Final Language on Appendix P/Model Ordinance

The Residential Structures Board met on Wednesday, July 2, 2008 This was the final time the board would be able to make recommendations to Building Codes Division (BCD) on the adoption of "Appendix P"/Model Ordinance. Because of much contentious discussion, BCD offered four options on AP105 for the board's consideration. A board vote recommended adoption of AP105.2 with Option A amended. Amendments to the option are indicated by bold and strike-through language in the attached document.

The following paragraphs are excerpted from a narrative report to the Residential Structures Board by BCD on how the process will progress from here.

"The division will draft a final report on the 'Appendix P' process. The division's final report will be available on its web site by October 1, 2008, for review by stakeholders and local government. It will identify the division's position on matters included in the latest version of the 'Appendix P' document. The report will conclude the division's actions with regard to 'Appendix P'. No further action in 2008 by the board or division will occur once the Final Residential Sprinkler Report is issued."

"'Appendix P' will not be adopted as part of the Oregon Residential Specialty Code. The division will begin rulemaking to adopt administrative and application procedures for a jurisdiction to request authorization of a local ordinance under ORS 455.040. The proposed rules will clarify the necessary steps and requirements a jurisdiction must follow when seeking an ordinance approval for any matter from the division, including a fire sprinkler ordinance. The board will be informed of the rulemaking effort and its progress. The division intends the rules to become effective on January 1, 2009. Local jurisdictions could submit requests for a local ordinance after that date."

See the attached document for current language on "Appendix P"/Model Ordinance with AP105 language amended

SECTION AP 100
DEFINITIONS

AP100 Definitions. The following definitions apply unless a context requires otherwise.

(1) Final Plat means the final recorded plat with the standards of approval imposed upon the tentative plat.

(2) One- and two-family dwelling as defined in the Oregon Residential Specialty Code.

(3) Tentative Plat means the same as "preliminary plat" or a plat submitted to a planning office by a person wishing to create a new lot to which a jurisdiction will attach standards and conditions which must be incorporated into the final plat.

(3) Townhouse is as defined in the Oregon Residential Specialty Code.

SECTION AP101
SCOPE

AP101 Scope. These provisions apply to new one and two family dwellings and townhouses ~~provided that~~ in subdivisions where fire sprinklers are a condition or standard recorded on the final plat for the lot on which the dwelling or townhouse is to be located. The jurisdiction may apply these provisions to tentative plats submitted after July 1, 2009. Once the final plat for a lot has been approved it shall not be modified to require fire sprinklers, except that if there is an application for re-platting fire sprinklers may be added as a condition of the final re-plat.

Exception:

Where a parcel is divided into 3 lots or less, fire sprinklers shall not be required except as a trade-off under OAR 918-480-0120.

Manufactured dwellings are covered under these provisions.

SECTION AP102
FIRE SPRINKLER SYSTEMS

AP102.1 General. Fire sprinkler systems shall be permitted to be either a multipurpose system~~s~~ that serve both fire sprinklers and domestic cold water plumbing fixtures or a stand-alone system~~s~~ that serve only fire sprinklers.

AP102.2 Fire Sprinkler Systems.

Multipurpose Systems: Multipurpose fire sprinkler systems shall be designed and installed in accordance with this section.

Stand Alone Systems: Fire sprinkler systems designed and installed in accordance with NFPA 13D.

AP102.3 Locations where sprinklers are required. Sprinklers shall be provided to protect all areas of dwelling unit.

Exceptions:

1. Attics, crawl spaces, and normally unoccupied concealed spaces that do not contain fuel-fired appliances do not require sprinklers. In attics, crawl spaces, and normally unoccupied concealed spaces that contain fuel-fired equipment, a sprinkler shall be provided above the equipment; however, sprinklers shall not be required in the remainder of the space.

2. Clothes closets, linen closets and pantries not exceeding 24 square feet in area, with the smallest dimension not greater than 3 feet and having wall and ceiling surfaces of gypsum board or equivalent non-combustible material.

3. Bathrooms not greater than 55 square feet in area.

4. Garages; carports; exterior porches; unheated entry areas, such as mud rooms, that are adjacent to an exterior door; and similar areas.

AP102.4 Sprinklers. Sprinklers shall be listed residential sprinklers and shall be installed in accordance with the sprinkler manufacturer's installation instructions.

AP102.4.1 Temperature rating and separation from heat sources. Except as provided in AP102.4.2, sprinklers shall have a temperature rating of not less than 135°F and not more than 170°F. Sprinklers shall be separated from heat sources as required by the sprinkler manufacturer's installation instructions.

AP102.4.2 Intermediate temperature sprinklers. Sprinklers shall have an intermediated temperature rating of not less than 175°F and not more than 225°F where installed in the following locations:

1. Directly under skylights when exposed to direct sunlight.
2. In attics.
3. In concealed spaces located directly beneath a roof.
4. Within the distance to a heat source as specified in Table AP102.4

Table AP102.4
Locations where Intermediate Temperature Sprinklers are Required

Heat Source	Range of distance from heat source within which Intermediate Temperature Sprinklers are Required [a,b] (inches)
Fireplace, Side of Open or Recessed Fireplace	12 to 36
Fireplace, Front of Recessed Fireplace	36 to 60
Coal and Wood Burning Stove	12 to 42
Kitchen Range Top	9 to 18
Oven	9 to 18
Vent Connector or Chimney Connector	9 to 18
Heating Duct not Insulated	9 to 18

Hot Water Pipe not Insulated	6 to 12
Side of Ceiling or Wall Warm Air Register	12 to 24
Front of Wall Mounted Warm Air Register	18 to 36
Water Heater, Furnace or Boiler	3 to 6
Light Fixture up to 250 Watts	3 to 6
Light Fixture 250 Watts up to 499 Watts	6 to 12

a. Sprinklers shall not be located at distances less than the minimum table distance unless the sprinkler listing allows a lesser distance.
b. Distances shall be measured in a straight line from the nearest edge to the heat source to the nearest edge of the sprinkler.

AP102.4.3 Freezing areas. Piping shall be adequately protected from freezing. Where sprinklers are required in areas that are subject to freezing, dry-sidewall or dry-pendent sprinklers extending from a non-freezing area into a freezing area shall be installed.

AP102.4.4 Sprinkler coverage. Sprinkler coverage requirements and sprinkler obstruction requirements shall be in accordance with Sections AP102.4.4.1 and 102.4.4.2.

AP102.4.4.1 Coverage area limit. The area of coverage of a single sprinkler shall not exceed 400 square feet and shall be based on the sprinkler listing and the sprinkler manufacturer's installation instructions.

AP102.4.4.2 Obstructions to coverage. Sprinkler discharge shall not be blocked by obstructions unless additional sprinklers are installed to protect the obstructed area. Sprinkler separation from obstructions shall comply with the minimum distances specified in the sprinkler manufacturer's instructions.

AP102.4.4.2.1 Additional requirements for pendent sprinklers. Pendent sprinklers within 3 feet of the center of a ceiling fan, surface-mounted ceiling luminaire or similar object shall be considered to be obstructed, and additional sprinklers shall be provided.

AP102.4.4.2.2 Additional requirements for sidewall sprinklers. Sidewall sprinklers within 5 feet of the center of a ceiling fan, surface-mounted ceiling luminaire or similar object shall be considered to be obstructed, and additional sprinklers shall be provided.

AP102.4.6 Sprinkler modifications prohibited. Painting, caulking or modifying of sprinklers shall be prohibited. Sprinklers that have been painted, caulked, modified or damaged shall be replaced with new sprinklers.

AP102.5 Sprinkler Piping system. The sprinkler piping shall comply with all requirements for potable cold water distribution piping. Sprinkler pipe shall connect to and be part of the cold water piping system.

AP102.5.1 Nonmetallic pipe and tubing. Where nonmetallic pipe and tubing, such as CPVC and PEX, is used, it shall be listed for use in plumbing systems.

AP102.5.1.1 Nonmetallic Pipe protection. Nonmetallic pipe and tubing shall be protected from exposure to the living space by a layer of 3/8 inch gypsum wallboard, 1/2 inch plywood, or other material having a 15 minute fire barrier.

Exceptions:

1. Pipe protection shall not be required in areas that are not required to be protected with sprinklers as specified in Section AP102.3.
2. Pipe protection shall not be required where exposed piping is permitted by the pipe listing.

AP102.5.2 Shutoff valves prohibited. With the exception of shutoff valves for the entire water distribution system, valves shall not be installed in any location where the valve would isolate piping serving one or more sprinklers.

AP102.5.3 Single dwelling limit. Piping beyond the service valve located at the beginning of the water distribution system shall not serve more than one dwelling.

AP102.6 Determining system design flow. The flow for sizing the sprinkler piping system shall be based on the flow rating of each sprinkler in accordance with Section AP102.6.1 and calculated in accordance with Section AP102.6.2.

AP102.6.1 Determining required flow rate for each sprinkler. The minimum required flow for each sprinkler shall be determined using the sprinkler manufacturer's published data for the specific sprinkler model based on all of the following:

1. The area of coverage
2. The ceiling configuration
3. The temperature rating
4. Any additional conditions specified by the sprinkler manufacturer.

AP102.6.2 System design flow rate. The design flow rate for the system shall be based on the following:

1. The design flow rate for a room having only one sprinkler shall be the flow rate required for that sprinkler, as determined by Section AP102.6.1.

2. The design flow rate for a room having two or more sprinklers shall be determined by identifying the sprinkler in that room with the highest required flow rate, based on Section AP106.6.1, and multiplying that flow rate by 2.

3. Where the sprinkler manufacturer specifies different criteria for ceiling

configurations that are not smooth, flat and horizontal, the required flow rate for that room shall comply with the sprinkler manufacturer's instructions.

4. The design flow rate for the sprinkler system shall be the flow required by the room with the largest flow rate, based on Items 1, 2 and 3.

5. For the purpose of this section, it shall be permissible to reduce the design flow rate for a room by subdividing the space into two or more rooms, where each room is evaluated separately with respect to the required design flow rate. Each room shall be bounded by walls and a ceiling. Openings in walls shall have a lintel not less than 8 inches in depth and each lintel shall form a solid barrier between the ceiling and the top of the opening.

AP102.7 Water supply. The water supply shall provide not less than the required design flow rate for sprinklers in accordance with Section AP102.6.2 at a pressure not less than that used to comply with Section AP102.8.

AP102.7.1 Water supply from individual sources. Where a dwelling unit water supply is from a tank system, a private well system, or a combination of these, the available water supply shall be based on the minimum pressure control setting for the pump.

AP102.7.2. Required capacity. The water supply shall have the capacity to provide the required design flow rate for sprinklers for a period of time as follows:

1. 7 minutes for dwelling units less than 2,000 square feet in area
2. 10 minutes for dwelling units equal to or greater than 2,000 square feet in area.

Where a well system, a water supply tank system, or a combination thereof, is used, any combination of well capacity and tank storage shall be permitted to meet the capacity requirement.

AP102.8 Pipe sizing. The piping to sprinklers shall be sized for the flow required by Section AP102.6.2. The flow required to supply the plumbing fixtures shall not be required to be added to the sprinkler design flow.

AP102.8.1 Method of sizing pipe. Piping supplying sprinklers shall be sized using the prescriptive method in Sections AP102.8.2 or by hydraulic calculation in accordance with NFPA 13D. The minimum pipe size from the water supply source to any sprinkler shall be 3/4 inch nominal. Threaded adapter fittings at the point where sprinklers are attached to the piping shall be a minimum of ½ inch nominal. Exception: Listed network piping systems may use ½ inch nominal piping.

AP102.8.2 Prescriptive pipe sizing method. Pipe shall be sized by determining the available pressure to offset friction loss in piping and identifying a piping material, diameter and length using the equation in Section AP102.8.2.1 and the procedure in Section AP102.8.2.2.

AP102.8.2.1 Available pressure equation. The pressure available to offset friction loss in the interior piping system (P_t) shall be determined in accordance with the Equation 29-1.

(Equation 29-1)

$$\mathbf{P_t = P_{sup} - PL_{svc} - PL_m - PL_d - PL_e - P_{sp}}$$

Where:

P_t = Pressure used in applying Tables AP102.8(4) through AP102.8(9).

P_{sup} = Pressure available from the water supply source.

PL_{svc} = Pressure loss in the water-service pipe.

PL_m = Pressure loss in the water meter.

PL_d = Pressure loss from devices other than the water meter.

PL_e = Pressure loss associated with changes in elevation.

P_{sp} = Maximum pressure required by a sprinkler.

AP102.8.2.2 Calculation procedure. Determination of the required size for water distribution piping shall be in accordance with the following procedure:

Step 1 - Determine P_{sup}
Obtain the supply pressure that will be available from the water main from the water purveyor, or for an individual source, the available supply pressure shall be in accordance with Section AP102.7.1. The pressure shall be the residual pressure available at the flow rate used when applying Table AP102.8(1).

Step 2 – Determine PL_{svc}
Use Table AP102.8(1) to determine the pressure loss in the water service pipe based on the selected size of the water service.

Step 3 – Determine PL_m
Use Table AP102.8(2) to determine the pressure loss from the water meter. based on the selected water meter size.

Step 4 – Determine PL_d
Determine the pressure loss from devices, other than the water meter, installed in the piping system supplying sprinklers, such as pressure-reducing valves, backflow preventers, water softeners or water filters.
Device pressure losses shall be based on the device manufacturer's specifications. The flow rate used to determine pressure loss shall be the rate from Section AP102.6.2, except that 5 gpm shall be added where the device is installed in a water-service pipe that supplies more than one dwelling. As an alternative to deducting pressure loss for a device, an automatic bypass valve shall be installed to divert flow around the device when a sprinkler activates.

Step 5 – Determine PL_e
Use Table AP102.8(3) to determine the pressure loss associated with changes in elevation. The elevation used in applying the table shall be the difference between the elevation where the water source pressure was measured and the elevation of the highest sprinkler.

Step 6 – Determine P_{sp}
Determine the maximum pressure required by any individual sprinkler based on the flow rate from Section AP102.6.1. The required pressure is provided in the sprinkler manufacturer's published data for the specific sprinkler model based on the selected flow rate.

Step 7 – Calculate P_t
Using Equation 29-1, calculate the pressure available to offset friction loss in water-distribution piping between the service valve and the sprinklers.

Step 8 – Determine the maximum allowable pipe length
Use Tables AP102.8(4) through AP102.8(9) to select a material and size for water distribution piping. The piping material and size shall be acceptable if the developed length of pipe between the service valve and the most remote sprinkler does not exceed the maximum allowable length specified by the applicable table. Interpolation of P_t between the tabular values shall be permitted.

The maximum allowable length of piping in Tables AP102.8(4) through AP102.8(9) incorporates an adjustment for pipe fittings, and no additional consideration of friction losses associated with pipe fittings shall be required.

AP102.9 Instructions and signs. An owner's manual for the fire sprinkler system shall be provided to the owner. A sign or valve tag shall be installed at the main shutoff valve to the water distribution system stating the following: "Warning, the water system for this home supplies fire sprinklers that require certain flows and pressures to fight a fire.

Devices that restrict the flow or decreases the pressure or automatically shut off the water to the fire sprinkler system, such as water softeners, filtration systems, and automatic shutoff valves, shall not be added to this system without the issuance of a valid plumbing permit and review by the local jurisdiction's plumbing department. Do not remove this sign."

AP102.10 Inspections. The water distribution system shall be inspected in accordance with Sections AP102.10.1 and AP102.10.2.

AP102.10.1 Pre-concealment Inspection. The following shall be verified prior to the concealment of any sprinkler system piping:

1. Sprinklers are installed in all areas as required by Section AP102.3.
2. Where sprinkler water spray patterns are obstructed by construction features, luminaires or ceiling fans, additional sprinklers are installed as required by Section AP102.4.4.2.
3. Sprinklers are the correct temperature rating and are installed at or beyond the required separation distances from heat sources as required by Sections AP102.4.1 and AP102.4.2.
4. The pipe size equals or exceeds the size used in applying Tables AP102.8(4) through AP102.8(9) or, if the piping system was hydraulically calculated in accordance with Section AP102.6.1, the size used in the hydraulic calculation.
5. The pipe length does not exceed the length permitted by Tables AP102.8(4) through AP102.8(9) or, if the piping system was hydraulically calculated in accordance with Section AP102.6.1, pipe lengths and fittings do not exceed those used in the hydraulic calculation.
6. Non-metallic piping that conveys water to sprinklers is listed for potable water use.
7. Piping is supported in accordance with the pipe manufacturer's and sprinkler manufacturer's installation instructions.
8. The piping system is tested in accordance with the plumbing code.

AP102.10.2 Final Inspection. The following shall be verified upon completion of the sprinkler system:

1. Sprinkler are not painted, damaged, obstructed, or otherwise hindered from operation.
2. Where a pump is required to provide water to the system, the pump starts automatically upon system water demand.
3. Pressure reducing valves, water softeners, water filters or other impairments to water flow that were not part of the original design have not been installed.
4. The sign or valve tag required by Section AP102.9 is installed and the owner's manual for the system is present.

NOTE: Tables AP102.8(1) through AP102.8(9) are attached at the end of this document.

SECTION AP103
FIRE APPARATUS ACCESS ROADS

AP103.1 Where required. Fire apparatus access roads shall be provided and maintained in accordance with Sections AP103.1.1 through AP103.1.5.

AP103.1.1 Residential developments. Access from two directions will not be required where there are more than 30 dwelling units on a single public or private fire apparatus access road and all the dwelling units are equipped with an automatic sprinkler system installed in accordance with Section AP102. The number of dwelling units on a single fire apparatus access road shall not be increased unless the fire apparatus road is connected to another development.

> **Exception:** Developments located within forestland-urban interface areas as determined using criteria established by the Oregon Department of Forestry for determining wildfire hazard zones and set out in OAR 629-044-200 through 629-044-1110 must be provided with access from two directions.

AP103.1.2 Road width. Fire apparatus access roads shall have an unobstructed width of not less than 20 feet when parking is allowed on one side and not less than 28 feet when parking is allowed on both sides. When parking is allowed along fire apparatus access roads, a queuing plan shall be submitted and approved and include a signage plan.

AP103.1.3 Dead ends. Dead-end fire apparatus access roads in excess of 300 feet in length shall be provided with an approved area for turning around fire apparatus.

AP103.1.4 Grade. The grade of fire apparatus access road shall not exceed 15% except where a jurisdiction allows a greater grade with the inclusion of a sprinkler system.

AP103.1.5 Security gates. The installation of security gates across a fire apparatus road shall be approved by the fire chief. Where the security gates are installed, they shall have an approved means of emergency operation. The security gate and the emergency operation shall be maintained operational at all times.

SECTION AP104
FIRE PROTECTION WATER SUPPLIES

AP104.1 Fire protection water supplies. An approved water supply capable of supplying a minimum fire flow of 500 gallons per minute at 20 psi for a duration of one hour shall be provided for one- and two-family dwellings having a fire-flow calculation area which does not exceed 3,600 square feet. Fire-flow and flow duration for dwellings having a fire-flow calculation area in excess of 3,600 square feet shall be as specified in Table AP104.

Exception: Attached garages shall not be included in the fire-flow calculation area when separated from adjoining spaces by 5/8" type X gypsum board or equivalent installed on the garage side.

Table AP104
Minimum Required Fire-Flow and Flow Duration

CALCULATION AREA (square feet)	FIRE-FLOW (gallons per minute)[a]	FLOW DURATION (hours)
3,601 – 4,800	500	2
4,801 – 6,200	500	2
6,201 – 7,700	562	2
7,701 – 9,400	625	2
9,401 – 11,300	687	2
11,301 – 13,400	750	3
Over 13,400	1,000	3

a. Measured at 20 psi.

AP104.2 Fire hydrant systems. Where all one-and two-family dwellings and townhouses in a developments are equipped with fire sprinkler systems meeting the requirements of Section AP102, the distance between fire hydrants shall be a maximum of 1,000 feet.

SECTION AP105
OTHER REQUIREMENTS

OPTION A.

AP105.~~2~~**1** System Development Charges. No additional ~~fees~~ **system development charges** shall be assessed beyond the ~~system development charges~~ costs for a "standard" ~~(i.e. ¾ inch)~~ meter when a larger meter ~~(i.e. 1 inch meter)~~ is installed only to meet the requirements of §102. Water purveyors may recoup the actual cost associated with ~~of~~ the larger meter, but where all other considerations remain the same, the standards required in this ordinance shall not result in system development fees greater than those assessed for a meter that would have been sufficient if no fire sprinkler system had been mandated. ~~Where a system development charge is assessed by fixture count, sprinkler heads count only as a single fixture~~.

OPTION B.

Jurisdictions shall not assess added costs unrelated to actual water usage.

OPTION C.

An application to the Director by a municipality for approval to apply the provisions of this Appendix shall be accompanied by findings and conclusions demonstrating compliance with the requirement of ORS 455.040(1) for cost-effectiveness, including a discussion of measures taken by the municipality to limit cost impacts of municipal fees and charges arising directly or indirectly from compliance with §102.

Findings – Jurisdictions proposing a local sprinkler ordinance must include the following information in the findings accompanying their proposed ordinance.

1. Identified construction cost of typical residential sprinkler system, including comparison of alternative sprinkler specifications [separate sprinkler systems, more heads served by standard size meter]
2. Identified total cost impacts/savings to home purchaser from other direct and indirect costs [examples: permit fees (building, planning, plumbing, etc.), meter cost, connection fees, water SDC, water rates, insurance premiums, property tax rates (reduce/eliminate need for increased levies), other costs]
3. Identified and assigned values to the costs and benefits to the community of sprinkler systems [examples: costs to build/expand water system capacity to serve larger meters, impacts on conservation programs and water supply of larger meter capacities, savings from greater hydrant spacing and/or fire station spacing
4. Adopted conclusion addressing fairness of the balance between increased costs and benefits flowing from the requirement of sprinklers

Process - The requesting jurisdiction's process for adopting the proposal must include at least the following steps.

- ✍ Solicited input from representatives of local home building industry, including local home builders association or other contractors association, on costs associated with addition of sprinklers and on opportunities for cost savings (demonstrate by copy of written notice or copy of written information submitted)
- ✍ Solicited input from fire service and water service providers (demonstrate by copy of written notice or copy of written information submitted)

- ✍ Held public information meeting to discuss residential sprinkler proposal, at which cost-effectiveness information was provided and solicited

After completion of previous steps, local governing body held public hearing on residential sprinkler proposal before authorizing action to request local option authority from Building Codes Division.

OPTION D.

No provision addressing system development charges or associated indirect costs.

AP105.3 Townhouse separation. The fire-resistive-rated wall assemblies required by Section R317.2 shall be permitted to be reduced to ½ hour in townhouse buildings that have fire sprinkler systems complying with AP102 installed in each townhouse unit within the building.

Table AP102.8(1)
Water Service Pressure Loss (PL_{svc})[a,b]

Flow Rate[c] (gpm)	3/4" Water Service Pressure Loss (psi)				1" Water Service Pressure Loss (psi)				1-1/4" Water Service Pressure Loss (psi)			
	40' or Less	41' to 75'	76' to 100'	101' to 150'	40' or Less	41' to 75'	76' to 100'	101' to 150'	40' or Less	41' to 75'	76' to 100'	101' to 150'
8	5.1	8.7	11.8	17.4	1.5	2.5	3.4	5.1	0.6	1.0	1.3	1.9
10	7.7	13.1	17.8	26.3	2.3	3.8	5.2	7.7	0.8	1.4	2.0	2.9
12	10.8	18.4	24.9	NP	3.2	5.4	7.3	10.7	1.2	2.0	2.7	4.0
14	14.4	24.5	NP	NP	4.2	7.1	9.6	14.3	1.6	2.7	3.6	5.4
16	18.4	NP	NP	NP	5.4	9.1	12.4	18.3	2.0	3.4	4.7	6.9
18	22.9	NP	NP	NP	6.7	11.4	15.4	22.7	2.5	4.3	5.8	8.6
20	27.8	NP	NP	NP	8.1	13.8	18.7	27.6	3.1	5.2	7.0	10.4
22	NP	NP	NP	NP	9.7	16.5	22.3	NP	3.7	6.2	8.4	12.4
24	NP	NP	NP	NP	11.4	19.3	26.2	NP	4.3	7.3	9.9	14.6
26	NP	NP	NP	NP	13.2	22.4	NP	NP	5.0	8.5	11.4	16.9
28	NP	NP	NP	NP	15.1	25.7	NP	NP	5.7	9.7	13.1	19.4
30	NP	NP	NP	NP	17.2	NP	NP	NP	6.5	11.0	14.9	22.0
32	NP	NP	NP	NP	19.4	NP	NP	NP	7.3	12.4	16.8	24.8
34	NP	NP	NP	NP	21.7	NP	NP	NP	8.2	13.9	18.8	NP
36	NP	NP	NP	NP	24.1	NP	NP	NP	9.1	15.4	20.9	NP

NP - Not Permitted. Pressure loss exceeds reasonable limits

a. Values are applicable for underground listed underground piping material and are based on an SDR of 11 and a Hazen Williams C Factor of 150.
b. Values include the following length allowances for fittings: 25% length increase for actual lengths up to 100 feet and 15% length increase for actual lengths over 100 feet.
c. Flow rate from Section AP….. Add 5 gpm to the flow rate where the water-service pipe supplies more than one dwelling.

Table AP102.8(2)
Minimum Water Meter Pressure Loss (PL_m)[a]

Flow Rate (gpm)	5/8" Meter Pressure Loss (psi)	3/4" Meter Pressure Loss (psi)
8	2	1
10	3	1
12	4	1
14	5	2
16	7	3
18	9	4
20	11	4
22	NP	5
24	NP	5
26	NP	6
28	NP	6
30	NP	7
32	NP	7
34	NP	8
36	NP	8

NP – Not permitted unless the actual water meter pressure loss is known.
a. This table establishes conservative values for water meter pressure loss for installations where the meter loss is unknown. Where the actual water pressure loss is known, P_m shall be the actual loss.

Table AP102.8(3)
Elevation Loss (PL_e)

Elevation (feet)	Pressure Loss (psi)
5	2.2
10	4.4
15	6.5
20	8.7
25	10.9
30	13
35	15.2
40	17.4

Table AP102.8(4)
Allowable Pipe Length for ¾ inch Type M Copper Water Tubing

Sprinkler Flow Rate[a] (gpm)	Water Distribution Size (inch)	Available Pressure – P_t (psi)									
		15	20	25	30	35	40	45	50	55	60
		Allowable Length of Pipe from Service Valve to Farthest Sprinkler (feet)									
8	3/4	217	289	361	434	506	578	650	723	795	867
9	3/4	174	232	291	349	407	465	523	581	639	697
10	3/4	143	191	239	287	335	383	430	478	526	574
11	3/4	120	160	200	241	281	321	361	401	441	481
12	3/4	102	137	171	205	239	273	307	341	375	410
13	3/4	88	118	147	177	206	235	265	294	324	353
14	3/4	77	103	128	154	180	205	231	257	282	308
15	3/4	68	90	113	136	158	181	203	226	248	271
16	3/4	60	80	100	120	140	160	180	200	220	241
17	3/4	54	72	90	108	125	143	161	179	197	215
18	3/4	48	64	81	97	113	129	145	161	177	193
19	3/4	44	58	73	88	102	117	131	146	160	175
20	3/4	40	53	66	80	93	106	119	133	146	159
21	3/4	36	48	61	73	85	97	109	121	133	145
22	3/4	33	44	56	67	78	89	100	111	122	133
23	3/4	31	41	51	61	72	82	92	102	113	123
24	3/4	28	38	47	57	66	76	85	95	104	114
25	3/4	26	35	44	53	61	70	79	88	97	105
26	3/4	24	33	41	49	57	65	73	82	90	98
27	3/4	23	30	38	46	53	61	69	76	84	91
28	3/4	21	28	36	43	50	57	64	71	78	85
29	3/4	20	27	33	40	47	53	60	67	73	80
30	3/4	19	25	31	38	44	50	56	63	69	75
31	3/4	18	24	29	35	41	47	53	59	65	71
32	3/4	17	22	28	33	39	44	50	56	61	67
33	3/4	16	21	26	32	37	42	47	53	58	63
34	3/4	NP	20	25	30	35	40	45	50	55	60
35	3/4	NP	19	24	28	33	38	42	47	52	57
36	3/4	NP	18	22	27	31	36	40	45	49	54
37	3/4	NP	17	21	26	30	34	38	43	47	51
38	3/4	NP	16	20	24	28	32	36	40	45	49
39	3/4	NP	15	19	23	27	31	35	39	42	46
40	3/4	NP	NP	18	22	26	29	33	37	40	44

NP – Not Permitted

a. Flow rate from Section

Table AP102.8(5)

Allowable Pipe Length for 1 inch Type M Copper Water Tubing

Sprinkler Flow Rate[a] (gpm)	Water Distribution Size (inch)	Available Pressure – P_t (psi)									
		15	20	25	30	35	40	45	50	55	60
		Allowable Length of Pipe from Service Valve to Farthest Sprinkler (feet)									
8	1	806	1075	1343	1612	1881	2149	2418	2687	2955	3224
9	1	648	864	1080	1296	1512	1728	1945	2161	2377	2593
10	1	533	711	889	1067	1245	1422	1600	1778	1956	2134
11	1	447	596	745	894	1043	1192	1341	1491	1640	1789
12	1	381	508	634	761	888	1015	1142	1269	1396	1523
13	1	328	438	547	657	766	875	985	1094	1204	1313
14	1	286	382	477	572	668	763	859	954	1049	1145
15	1	252	336	420	504	588	672	756	840	924	1008
16	1	224	298	373	447	522	596	671	745	820	894
17	1	200	266	333	400	466	533	600	666	733	799
18	1	180	240	300	360	420	479	539	599	659	719
19	1	163	217	271	235	380	434	488	542	597	651
20	1	148	197	247	296	345	395	444	493	543	592
21	1	135	180	225	270	315	360	406	451	496	541
22	1	124	165	207	248	289	331	372	413	455	496
23	1	114	152	190	228	267	305	343	381	419	457
24	1	106	141	176	211	246	282	317	352	387	422
25	1	98	131	163	196	228	261	294	326	359	392
26	1	91	121	152	182	212	243	273	304	334	364
27	1	85	113	142	170	198	226	255	283	311	340
28	1	79	106	132	159	185	212	238	265	291	318
29	1	74	99	124	149	174	198	223	248	273	298
30	1	70	93	116	140	163	186	210	233	256	280
31	1	66	88	110	132	153	175	197	219	241	263
32	1	62	83	103	124	145	165	186	207	227	248
33	1	59	78	89	117	137	156	176	195	215	234
34	1	55	74	92	111	129	148	166	185	203	222
35	1	53	70	88	105	123	140	158	175	193	210
36	1	50	66	83	100	116	133	150	166	183	199
37	1	47	63	79	95	111	126	142	158	174	190
38	1	45	60	75	90	105	120	135	150	165	181
39	1	43	57	72	86	100	115	129	143	158	172
40	1	41	55	68	82	96	109	123	137	150	164

a. Flow rate from Section

Table AP102.8(6)
Allowable Pipe Length for 3/4 inch CPVC Pipe

Sprinkler Flow Rate[a] (gpm)	Water Distribution Size (inch)	Available Pressure – P_t (psi)									
		15	20	25	30	35	40	45	50	55	60
		Allowable Length of Pipe from Service Valve to Farthest Sprinkler (feet)									
8	3/4	348	465	581	697	813	929	1045	1161	1278	1394
9	3/4	280	374	467	560	654	747	841	934	1027	1121
10	3/4	231	307	384	461	538	615	692	769	845	922
11	3/4	193	258	322	387	451	515	580	644	709	773
12	3/4	165	219	274	329	384	439	494	549	603	658
13	3/4	142	189	237	284	331	378	426	473	520	568
14	3/4	124	165	206	247	289	330	371	412	454	495
15	3/4	109	145	182	218	254	290	327	363	399	436
16	3/4	97	129	161	193	226	258	290	322	354	387
17	3/4	86	115	144	173	202	230	259	288	317	346
18	3/4	78	104	130	155	181	207	233	259	285	311
19	3/4	70	94	117	141	164	188	211	234	258	281
20	3/4	64	85	107	128	149	171	192	213	235	256
21	3/4	58	78	97	117	136	156	175	195	214	234
22	3/4	54	71	89	107	125	143	161	179	197	214
23	3/4	49	66	82	99	115	132	148	165	181	198
24	3/4	46	61	76	91	107	122	137	152	167	183
25	3/4	42	56	71	85	99	113	127	141	155	169
26	3/4	39	52	66	79	92	105	118	131	144	157
27	3/4	37	49	61	73	86	98	110	122	135	147
28	3/4	34	46	57	69	80	92	103	114	126	137
29	3/4	32	43	54	64	75	86	96	107	118	129
30	3/4	30	40	50	60	70	81	91	101	111	121
31	3/4	28	38	47	57	66	76	85	95	104	114
32	3/4	27	36	45	54	63	71	80	89	98	107
33	3/4	25	34	42	51	59	68	76	84	93	101
34	3/4	24	32	40	48	56	64	72	80	88	96
35	3/4	23	30	38	45	53	61	68	76	83	91
36	3/4	22	29	36	43	50	57	65	72	79	86
37	3/4	20	27	34	41	48	55	61	68	75	82
38	3/4	20	26	33	39	46	52	59	65	72	78
39	3/4	19	25	31	37	43	50	56	62	68	74
40	3/4	18	24	30	35	41	47	53	59	65	71

a. Flow rate from Section

Table AP102.8(7)
Allowable Pipe Length for 1 inch CPVC Pipe

Sprinkler Flow Rate[a] (gpm)	Water Distribution Size (inch)	Available Pressure – P_t (psi)									
		15	20	25	30	35	40	45	50	55	60
		Allowable Length of Pipe from Service Valve to Farthest Sprinkler (feet)									
8	1	1049	1398	1748	2098	2447	2797	3146	3496	3845	4195
9	1	843	1125	1406	1687	1968	2249	2530	2811	3093	3374
10	1	694	925	1157	1388	1619	1851	2082	2314	2545	2776
11	1	582	776	970	1164	1358	1552	1746	1940	2133	2327
12	1	495	660	826	991	1156	1321	1486	1651	1816	1981
13	1	427	570	712	854	997	1139	1261	1424	1566	1709
14	1	372	497	621	745	869	993	1117	1241	1366	1490
15	1	328	427	546	656	765	874	983	1093	1202	1311
16	1	291	388	485	582	679	776	873	970	1067	1164
17	1	260	347	433	520	607	693	780	867	954	1040
18	1	234	312	390	468	546	624	702	780	858	936
19	1	212	282	353	423	494	565	635	706	776	847
20	1	193	257	321	385	449	513	578	642	706	770
21	1	176	235	293	352	410	469	528	586	645	704
22	1	161	215	269	323	377	430	484	538	592	646
23	1	149	198	248	297	347	396	446	496	545	595
24	1	137	183	229	275	321	366	412	458	504	550
25	1	127	170	212	255	297	340	382	425	467	510
26	1	118	158	197	237	276	316	355	395	434	474
27	1	111	147	184	221	258	295	332	368	405	442
28	1	103	138	172	207	241	275	310	344	379	413
29	1	97	129	161	194	226	258	290	323	355	387
30	1	91	121	152	182	212	242	273	303	333	364
31	1	86	114	143	171	200	228	257	285	314	342
32	1	81	108	134	161	188	215	242	269	296	323
33	1	76	102	127	152	178	203	229	254	280	305
34	1	72	96	120	144	168	192	216	240	265	289
35	1	68	91	114	137	160	182	205	228	251	273
36	1	65	87	108	130	151	173	195	216	238	260
37	1	62	82	103	123	144	165	185	206	226	247
38	1	59	78	98	117	137	157	176	196	215	235
39	1	56	75	93	112	131	149	168	187	205	224
40	1	53	71	89	107	125	142	160	178	196	214

a. Flow rate from Section

Table AP102.8(8)
Allowable Pipe Length for 3/4 inch PEX Tubing

Sprinkler Flow Rate[a] (gpm)	Water Distribution Size (inch)	Available Pressure – P_t (psi)									
		15	20	25	30	35	40	45	50	55	60
		Allowable Length of Pipe from Service Valve to Farthest Sprinkler (feet)									
8	3/4	93	123	154	185	216	247	278	309	339	370
9	3/4	74	99	124	149	174	199	223	248	273	298
10	3/4	61	82	102	123	143	163	184	204	225	245
11	3/4	51	68	86	103	120	137	154	171	188	205
12	3/4	44	58	73	87	102	117	131	146	160	175
13	3/4	38	50	63	75	88	101	113	126	138	151
14	3/4	33	44	55	66	77	88	99	110	121	132
15	3/4	29	39	48	58	68	77	87	96	106	116
16	3/4	26	34	43	51	60	68	77	86	94	103
17	3/4	23	31	38	46	54	61	69	77	84	92
18	3/4	21	28	34	41	48	55	62	69	76	83
19	3/4	19	25	31	37	44	50	56	62	69	75
20	3/4	17	23	28	34	40	45	51	57	62	68
21	3/4	16	21	26	31	36	41	47	52	57	62
22	3/4	NP	19	24	28	33	38	43	47	52	57
23	3/4	NP	17	22	26	31	35	39	44	48	52
24	3/4	NP	16	20	24	28	32	36	40	44	49
25	3/4	NP	NP	19	22	26	30	34	37	41	45
26	3/4	NP	NP	17	21	24	28	31	35	38	42
27	3/4	NP	NP	16	20	23	26	29	33	36	39
28	3/4	NP	NP	15	18	21	24	27	30	33	36
29	3/4	NP	NP	NP	17	20	23	26	28	31	34
30	3/4	NP	NP	NP	16	19	21	24	27	29	32
31	3/4	NP	NP	NP	15	18	20	23	22	28	30
32	3/4	NP	NP	NP	NP	17	19	21	24	26	28
33	3/4	NP	NP	NP	NP	16	18	20	22	25	27
34	3/4	NP	NP	NP	NP	NP	17	19	21	23	25
35	3/4	NP	NP	NP	NP	NP	16	18	20	22	24
36	3/4	NP	NP	NP	NP	NP	15	17	19	21	23
37	3/4	NP	NP	NP	NP	NP	NP	16	18	20	22
38	3/4	NP	NP	NP	NP	NP	NP	16	17	19	21
39	3/4	NP	NP	NP	NP	NP	NP	NP	16	18	20
40	3/4	NP	NP	NP	NP	NP	NP	NP	16	17	19

NP – Not Permitted

a. Flow rate from Section

Table AP102.8(9)
Allowable Pipe Length for 1 inch PEX Tubing

Sprinkler Flow Rate[a] (gpm)	Water Distribution Size (inch)	Available Pressure – P_t (psi)									
		15	20	25	30	35	40	45	50	55	60
		Allowable Length of Pipe from Service Valve to Farthest Sprinkler (feet)									
8	1	314	418	523	628	732	837	941	1046	1151	1255
9	1	252	336	421	505	589	673	757	841	925	1009
10	1	208	277	346	415	485	554	623	692	761	831
11	1	174	232	290	348	406	464	522	580	638	696
12	1	148	198	247	296	346	395	445	494	543	593
13	1	128	170	213	256	298	341	383	426	469	511
14	1	111	149	186	223	260	297	334	371	409	446
15	1	98	131	163	196	229	262	294	327	360	392
16	1	87	116	145	174	203	232	261	290	319	348
17	1	78	104	130	156	182	208	233	259	285	311
18	1	70	93	117	140	163	187	210	233	257	280
19	1	63	84	106	127	148	169	190	211	232	253
20	1	58	77	96	115	134	154	173	192	211	230
21	1	53	70	88	105	123	140	158	175	193	211
22	1	48	64	80	97	113	129	145	161	177	193
23	1	44	59	74	89	104	119	133	148	163	178
24	1	41	55	69	82	96	110	123	137	151	164
25	1	38	51	64	76	89	102	114	127	140	152
26	1	35	47	59	71	83	95	106	118	130	142
27	1	33	44	55	66	77	88	99	110	121	132
28	1	31	41	52	62	72	82	93	103	113	124
29	1	29	39	48	58	68	77	87	97	106	116
30	1	27	36	45	54	63	73	82	91	100	109
31	1	26	34	43	51	60	68	77	85	94	102
32	1	24	32	40	48	56	64	72	80	89	97
33	1	23	30	38	46	53	61	68	76	84	91
34	1	22	29	36	43	50	58	65	72	79	86
35	1	20	27	34	41	48	55	61	68	75	82
36	1	19	26	32	39	45	52	58	65	71	78
37	1	18	25	31	37	43	49	55	62	68	74
38	1	18	23	29	35	41	47	53	59	64	70
39	1	17	22	28	33	39	45	50	56	61	67
40	1	16	21	27	32	37	43	48	53	59	64

a. Flow rate from Section