Appendix A
Procedures for Calculating the Minimum Sizing of the Water Supply System

The following is a procedure that shall be used in calculating the minimum sizing of the water supply system:

Step 1. Compute the total number of fixture units from Table 18-29-604.10.1, Demand Weight of Fixtures in Fixture Units.

1. For supply outlets likely to impose continuous demands, estimate continuous supply separately and add to total demand for fixtures.

2. For fixtures not listed, weights may be assumed by comparing the fixture to a listed one using water in similar quantities and at similar rates.

3. The given weights are for total demand. For fixtures with both hot and cold water supplies, the weights for maximum separate demand may be taken as three-fourths the listed demand for supply.

Table 18-29-604.10.1
Demand Weight of Fixtures in Fixture Units

Fixture Type	Occupancy Use	Valve Type	Fixture Units
Water Closet	Public	Flush Valve	10
Water Closet	Public	Flush Tank	5
Urinal 1"	Public	Flush valve	10
Urinal 3/4"	Public	Flush valve	5
Urinal Tank	Public	Flush tank	3
Lavatory	Public	Faucet	2
Bathtub	Public	Faucet	4
Shower head	Public	Mixing valve	4
Service sink	Office, etc.	Faucet	3
Kitchen sink	Hotel or restaurant	Faucet	4
Water closet	Private	Flush valve	6
Water closet	Private	Flush tank	3
Lavatory	Private	Faucet	1
Bathtub	Private	Faucet	2
Shower head	Private	Mixing valve	2
Bathroom group	Private	Flush valve for closet	8
Bathroom group	Private	Flush tank for closet	4
Separate shower 109	Private	Mixing valve	2
Kitchen sink	Private	Faucet	2

Fixture Type	Occupancy Use	Valve Type	Fixture Units
Laundry trays (1 to 3)	Private	Faucet	2
Combination fixture	Private	Faucet	3
Laundry washer	Private	Faucet	2
Bidet	Private	Faucet	2
Dishwasher	–	–	2
Drinking fountain	–	–	1/2
Laundry washer	Public	8 lbs	3
Laundry washer	Public	15 lbs	4
Water closet	Public/Private	Flushometer tank	2

Step 2. Using Table 18-29-604.10.2, convert the total water demand from fixture units to gallons per minutes (gpm). Add any continuous supply demand in gpm such as lawn sprinklers, air conditioning, industrial uses, etc., to the sum of the total demand for fixtures. The result is the total required gpm demand. All distributing pipes, riser pipes and branch distributing pipes shall be sized in accordance with the demand indicated in Table 18-29-604.10.2 of this chapter.

Beyond the capacity listed in Table 18-29-604.10.2, the service pipe, main supply pipe, principal supply pipe and the branch supply pipe shall be sized to meet the velocity of water flow provisions of this chapter. Data shall be provided by the designer to substantiate this.

Table 18-29-604.10.2 – Part 1
Conversion of Total Water Demand

For Systems Predominantly Flush Tanks		For Systems Predominantly for Flush Valves	
Load	**Demand**	**Load**	**Demand**
1	1.5	1	–
2	2.5	2	–
3	3.3	3	–
4	4.0	4	–
5	4.8	5	15.0
6	5.5	6	17.5
7	5.7	7	19.7
8	6.9	8	22.2
9	7.5	9	24.5
10	8.2	10	27.0
11	8.8	11	27.8
12	9.5	12	28.5

For Systems Predominantly Flush Tanks		For Systems Predominantly for Flush Valves	
Load	**Demand**	**Load**	**Demand**
13	10.1	13	29.5
14	10.8	14	30.1
15	11.4	15	31.0
16	12.0	16	31.8
17	12.5	17	32.6
18	13.0	18	33.5
19	13.5	19	34.2
20	14.2	20	35.0
25	17.0	25	38.2
30	19.4	30	41.5
35	21.8	35	43.6
40	24.3	40	46.0
45	26.8	45	48.2
50	29.0	50	50.5

Table 18-29-604.10.2 – Part 2
Demand Weight of Fixtures

For Systems Predominantly for Flush Tanks		For Systems Predominantly for Flush Valves	
Load W.S.F.U.	**Demand GPM**	**Load W.S.F.U.**	**Demand GPM**
60	32.0	60	54.6
70	35.0	70	58.7
80	38.0	80	61.5
90	41.0	90	65.0
100	44.0	100	68.0
120	48.0	120	74.0
140	53.0	140	78.0
160	57.0	160	82.0
180	61.0	180	86.0
200	65.0	200	90.0
225	70.0	225	95.0
250	75.0	250	100.0

For Systems Predominantly for Flush Tanks		For Systems Predominantly for Flush Valves	
Load W.S.F.U.	**Demand GPM**	**Load W.S.F.U.**	**Demand GPM**
275	80.0	275	102.0
300	85.0	300	106.0
400	105.0	400	125.0
500	124.0	500	142.0
750	170.0	750	176.0
1000	208.0	1000	208.0
1250	237.0	1250	237.0
1500	262.0	1500	262.0
1750	283.0	1750	283.0
2000	302.0	2000	302.0
2500	337.0	2500	337.0
3000	362.0	3000	362.0
3500	387.0	3500	387.0
4000	412.0	4000	412.0

Step 3. Determine the elevation of the highest fixture or group of fixtures or water opening above the city water main or other source of pressure supply. Multiply this elevation in feet by 0.434. The result is the loss in static pressure in pounds per square inch (psi).

Step 4. Compute the size of meter necessary for a total water demand.

Step 5. Compute the pressure loss through the meter. For pressure losses, consult manufacturer's data.

Step 6. Compute the available pressure to overcome friction in the piping system. First compute all losses (see below):

1) Subtract the above losses from the minimum service pressure in the water main or other source of supply. The remaining is the available pressure to overcome friction within an upfeed piping system.

2) For gravity water tanks, determine the vertical distance between the incoming water service, the minimum tank water line, and the highest fixture or group of fixtures or water opening. To find the available pressure to overcome friction in the downfeed piping system, multiply the distance defined above by 0.434, then subtract the above losses from this pressure. The remaining is the available pressure to overcome friction within the downfeed piping system.

Step 7. Compute the developed length of the basic circuit of piping from the main in the street, the house pump, the outlet side of the pressure-reducing valve or other source of supply pressure to the highest and farthest outlet.

For a gravity water tank, compute the developed length of the basic circuit of the piping from the tank connection to the highest and most remote outlet. Developed length plus 50 percent will approximate the equivalent length run (ELR).

Step 8. Compute the pressure factor per 100 feet of developed length. From the above calculations, take the pressure available for friction loss in psi, (Step 6) divide by the equivalent length run (ELR) (Step 7) and multiply by 100 to ascertain the maximum uniform pressure loss for friction in the piping of the basic circuit. (See Table 18-29-604.10.3)

Step 9. Knowing the permissible uniform friction loss per 100 feet of pipe and the fixture gpm and all continuous demands in gpm, the diameter of the building service and main supply pipe to the cold and hot water branch or the first branch may be obtained from Table 18-29-604.10.2.

The diameter of pipe on the coordinate point corresponding to the estimated demand and the permissible uniform friction loss shall be the size of the service and main supply pipe to cold and hot water branch or the first branch.

All other piping in the water supply system shall be sized according to the full-listed demand weight, with the exception of piping that supplies fixtures with both cold and hot water, which may be sized at three-fourths of the listed demand weight for cold or hot water piping. All continuous demands on the piping system shall be included in the fixture gpm demand.

For fixtures not listed, demand weights may be assumed by comparing the fixture to a listed one using water in similar quantities and at similar rates.

The cold and hot water principal supply pipe, branches and risers may be obtained from either Table 18-29-604.10.3 or 18-29-604.10.4, whichever is applicable. The diameter of pipe on or directly above the coordinate point corresponding to the estimates* demand and the permissible uniform friction loss shall be the size of the pipe.

*** Editor's note –** As set forth in Coun. J. 3-28-01, p. 55444, § 1; correct language appears to be "estimated".

No service shall be less than 1 inch nominal pipe size. Where 1 inch flushometer valves are used, the minimum size of water service shall be a 1 1/2 inch nominal pipe size and the minimum size of the riser shall be a 1 1/4 inch nominal pipe size. No riser shall be less than 3/4 inch nominal pipe size.

Table 18-29-604.10.3
Allowance in Equivalent Length of Pipe for Friction Loss in Valves and Threaded Fittings

Diameter of Fitting (Inches)	90-DEG Standard ELL (Feet)	45-DEG Standard ELL (Feet)	90-DEG Side Tee (Feet)	Coupling or Straight Run of Tee (Feet)	Gate Valve (Feet)	Globe Valve (Feet)	Angle Valve (feet)
3/8	1	0.6	1.5	0.3	0.2	8	4
1/2	2	1.2	3	0.6	0.4	15	8
3/4	2.5	1.5	4	0.8	0.5	20	12
1	3	1.8	5	0.9	0.6	25	15
1 1/4	4	2.4	6	1.2	0.8	35	18

Diameter of Fitting (Inches)	90-DEG Standard ELL (Feet)	45-DEG Standard ELL (Feet)	90-DEG Side Tee (Feet)	Coupling or Straight Run of Tee (Feet)	Gate Valve (Feet)	Globe Valve (Feet)	Angle Valve (feet)
1 1/2	5	3	7	1.5	1.0	45	22
2	7	4	10	2	1.3	55	28
2 1/2	8	5	12	2.5	1.6	65	34
3	10	6	15	3	2	80	40
3 1/2	12	7	18	3.6	2.4	100	50
4	14	8	21	4.0	2.7	125	55
5	17	10	25	5	3.3	140	70
6	20	12	30	6	4	165	80

(Amend Coun. J. 3-27-02, p. 82090, § 3)