DEPARTMENT OF LABOR AND INDUSTRY
CONSTRUCTION CODES AND LICENSING

Plumbing Plan Review in Single-Family Homes

Brad Williams

Plumbing Code Representative

Plumbing Plan Review

DEPARTMENT OF LABOR AND INDUSTRY

- Brad Williams
- Graduated from the University of Minnesota in 2011
- Started with the Department of Labor and Industry as a Public Health Engineer in 2012
- Licensed Professional Engineer since 2016

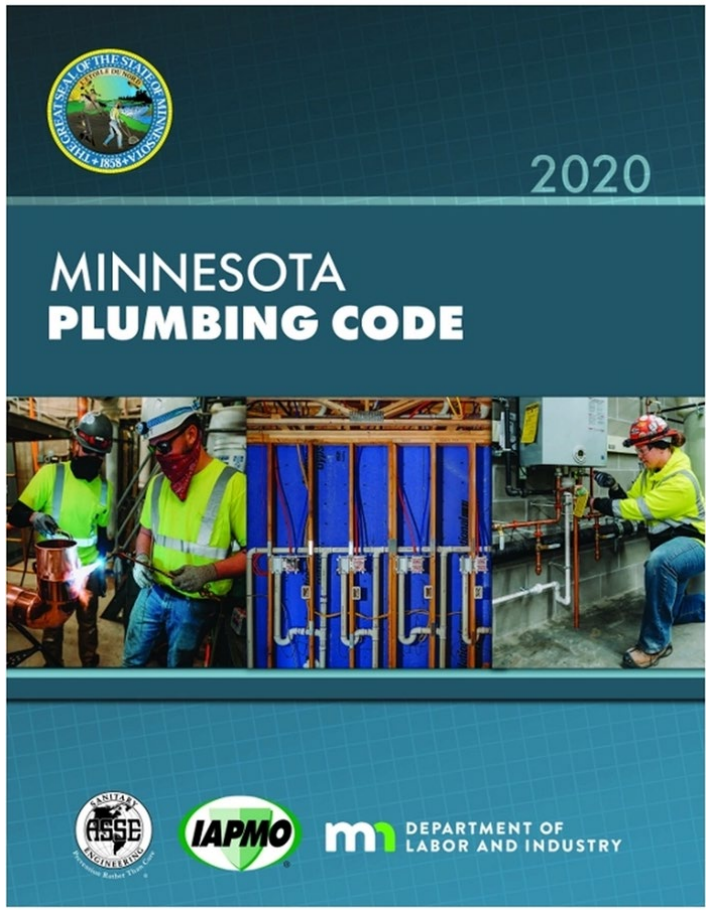
Goals

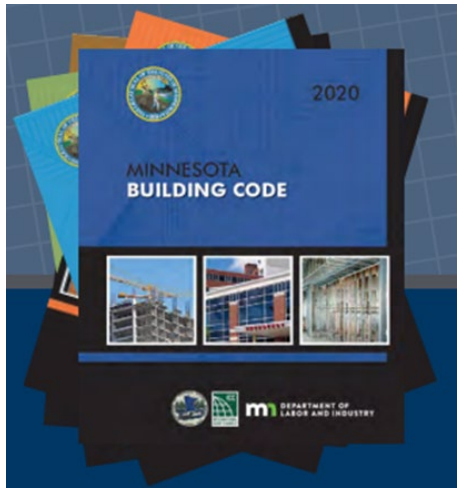
DEPARTMENT OF LABOR AND INDUSTRY

Plan Review Examples

- Material Requirements
- Water Sizing Examples
- Sanitary Drain Waste and Vent Sizing Example
- Horizontal Wet Venting

2020 Minnesota Plumbing Code
In Effect as of Dec. 17, 2021





- Administration
- Special Provisions
- Commercial Building
- Mechanical and Fuel Gas
- **Plumbing**
- Elevators and Related Devices
- Electrical
- Accessibility

- Residential Building
- Existing Buildings
- High Pressure Piping Systems
- Manufactured Homes
- Prefabricated Structures
- Industrialized/Modular Buildings
- Flood-proofing
- Energy Conservation
- Storm Shelters

Plumbing Home Page

https://www.dli.mn.gov/business/plumbing-and-mechanical-contractors

2020 Minnesota Plumbing Code

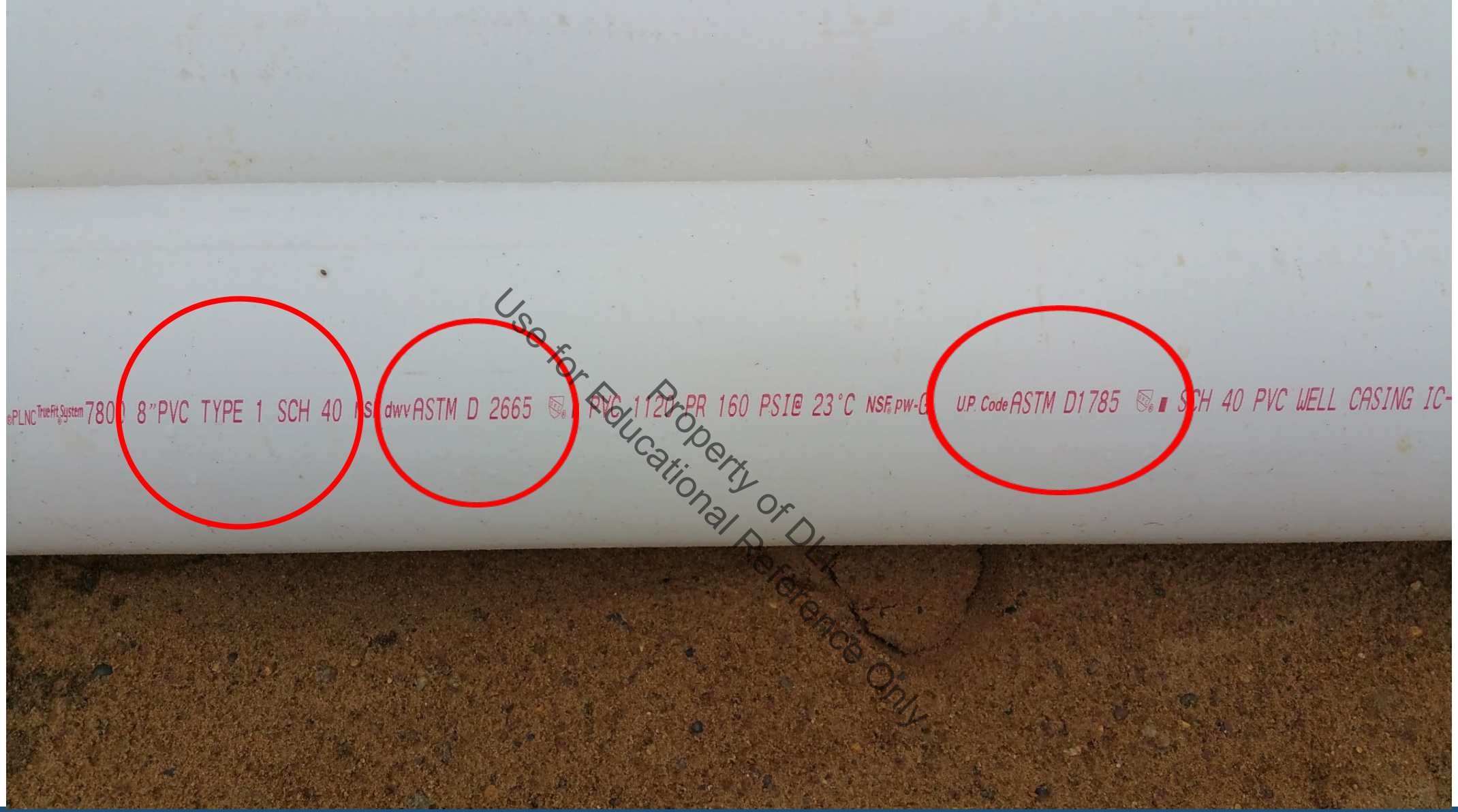
https://epubs.iapmo.org/2020/MPC/

301.2 Materials – Minimum Standards

- Pipe, pipe fittings, traps, fixtures, material, and devices used in a plumbing system shall be listed or labeled by a listing agency and shall comply with the approved applicable recognized standards referenced in this code and shall be free from defects.

301.2 Materials – Minimum Standards

- 301.2.1 Marking. Each pipe, fitting, trap, fixture, material, and device used in a plumbing system shall have cast, stamped, or be permanently marked with the manufacturer's mark or name, which shall readily identify the manufacturer to the end user of the product.



Marking

Table 701.2 Materials For Drain, Waste, Vent Pipe And Fittings

Materials for use within a building

TABLE 701.2
MATERIALS FOR DRAIN, WASTE, VENT PIPE AND FITTINGS

	UNDERGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS	ABOVEGROUND DRAIN, WASTE, VENT PIPE AND FITTINGS	BUILDING SEWER PIPE AND FITTINGS	REFERENCED STANDARD(S) PIPE	REFERENCED STANDARD(S) FITTINGS
ABS (Schedule 40)	X	X	X	ASTM D2661, ASTM D2680*	ASTM D2661, ASTM D2680*
Cast-Iron	X	X	X	ASTM A74, ASTM A888, CISPI 301	ASME B16.12, ASTM A74, ASTM A888, CISPI 301
Co-Extruded ABS (Schedule 40)	X	X	X	ASTM F628	ASTM D2661, ASTM D2680*
Co-Extruded Composite (Schedule 40)	X	X	X	ASTM F1488	ASTM D2661, ASTM D2665, ASTM F794*, ASTM F1866
Co-Extruded PVC (Schedule 40)	X	X	X	ASTM F891, ASTM F1760	ASTM D2665, ASTM F794*, ASTM F1336*, ASTM F1866
Copper and Copper Alloys (Type DWV)	X	X	X	ASTM B43, ASTM B75, ASTM B251, ASTM B302, ASTM B306	ASME B16.23, ASME B16.29
Galvanized Malleable Iron	—	X	—	—	ASME B16.3
Galvanized Steel	—	X	—	—	—
Polyethylene	—	—	X	—	—
PVC (Schedule 40)	X	X	X	—	—
PVC (Sewer and Drain)	—	—	X	ASTM D2729	ASTM D2729
PVC PSM	—	—	X	ASTM D3034	ASTM D3034
Stainless Steel 304	—	X	—	ASME A112.3.1	ASME A112.3.1
Stainless Steel 316L	X	X	X	ASME A112.3.1	ASME A112.3.1
Vitrified Clay (Extra strength)	—	—	X	ASTM C700	ASTM C700

* For building sewer applications.

Materials for building sewer

* For building sewer

Table 604.1 Materials For Building Supply and Water Distribution Piping and Fittings

Materials for water within a building

Materials for building supply

TABLE 604.1
MATERIALS FOR BUILDING SUPPLY AND WATER DISTRIBUTION PIPING AND FITTINGS

MATERIAL	BUILDING SUPPLY PIPE AND FITTINGS	WATER DISTRIBUTION PIPE AND FITTINGS	STANDARDS	
			PIPE	FITTINGS
Copper and Copper Alloys	X	X	ASTM B42, ASTM B43, ASTM B75, ASTM B88, ASTM B135, ASTM B251, ASTM B302, ASTM B447	ASME B16.15, ASME B16.18, ASME B16.22, ASME B16.26, ASME B16.50[2], ASME B16.51, ASSE 1061
CPVC	X	X	ASTM D2846, ASTM F441, ASTM F442, CSA B137.6	ASSE 1061, ASTM D2846, ASTM F437, ASTM F438, ASTM F439, ASTM F1970, CSA B137.6
CPVC-AL-CPVC	X	X	ASTM F2855	ASTM D2846
Ductile Iron	X	X	AWWA C151	ASME B16.4, AWWA C110, AWWA C153
Galvanized Steel	X	X	ASTM A53	—
Malleable Iron	X	X	—	ASME B16.3
PE	X	—	ASTM D2239, ASTM D2737, ASTM D3035, AWWA C901, CSA B137.1	ASTM D2609, ASTM D2683, ASTM D3261, ASTM F1055, CSA B137.1
PE-AL-PE	X	X	ASTM F1282, CSA B137.9	ASTM F1282, ASTM F1974, CSA B137.9
PE-AL-PEX	X	X	ASTM F1986	ASTM F1986
PE-RT	X	X	ASTM F2769, CSA B137.18	ASTM D3261, ASTM F1055, ASSE 1061, ASTM F1807, ASTM F2098, ASTM F2159, ASTM F2735, ASTM F2769, CSA B137.18
PEX	X	X	ASTM F876, ASTM F877, CSA B137.5, AWWA C904[1]	ASSE 1061, ASTM F877, ASTM F1807, ASTM F1960, ASTM F1961, ASTM F2080, ASTM F2159, ASTM F2735, CSA B137.5
	X	X	ASTM F1281, CSA B137.10, ASTM F2262	ASTM F1281, ASTM F1974, ASTM F2434, CSA B137.10
	X	X	ASTM F2389, CSA B137.11	ASTM F2389, CSA B137.11
	X[1]	—	ASTM D1785, ASTM D2241, AWWA C900	ASTM D2464, ASTM D2466, ASTM D2467, ASTM F1970, AWWA C907
Stainless Steel	X	X	ASTM A269, ASTM A312	—

Notes:
[1] For building supply or exterior cold-water applications, not for water distribution piping.
[2] For brazed fittings only.

301.0 Materials – Standards and Alternates

- Table 1701.1. – A list of accepted plumbing material standards with other types plumbing applications
- Listed by type and reference number of the quality standard (AWWA, ASME, ASTM, ASSE, ANSI, CSA, IAPMO, NSF, UL, etc.)

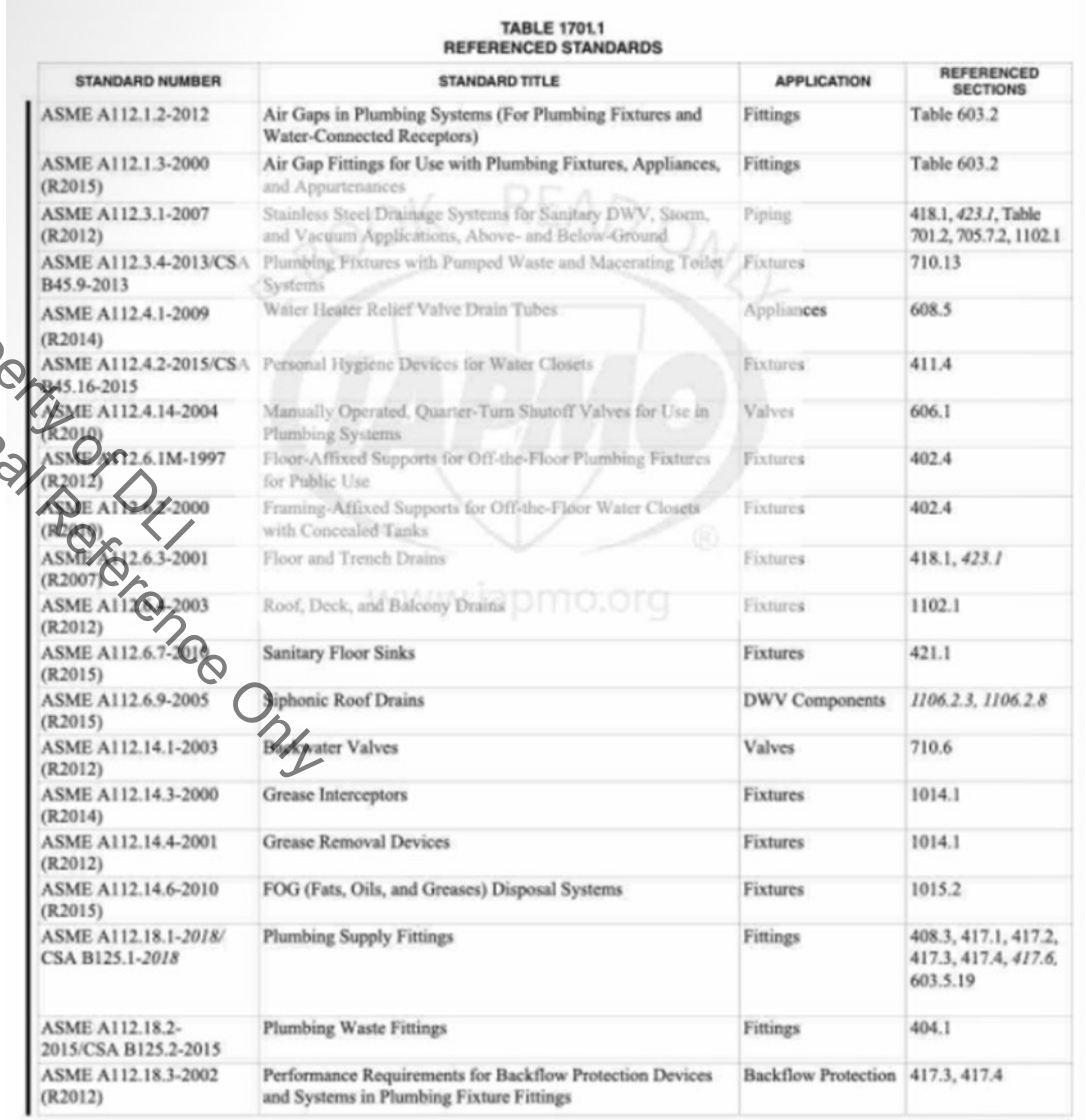


TABLE 1701.1
REFERENCED STANDARDS

STANDARD NUMBER	STANDARD TITLE	APPLICATION	REFERENCED SECTIONS
ASME A112.1.2-2012	Air Gaps in Plumbing Systems (For Plumbing Fixtures and Water-Connected Receptors)	Fittings	Table 603.2
ASME A112.1.3-2000 (R2015)	Air Gap Fittings for Use with Plumbing Fixtures, Appliances, and Appurtenances	Fittings	Table 603.2
ASME A112.3.1-2007 (R2012)	Stainless Steel Drainage Systems for Sanitary DWV, Storm, and Vacuum Applications, Above- and Below-Ground	Piping	418.1, *423.1*, Table 701.2, 705.7.2, 1102.1
ASME A112.3.4-2013/CSA B45.9-2013	Plumbing Fixtures with Pumped Waste and Macerating Toilet Systems	Fixtures	710.13
ASME A112.4.1-2009 (R2014)	Water Heater Relief Valve Drain Tubes	Appliances	608.5
ASME A112.4.2-2015/CSA B45.16-2015	Personal Hygiene Devices for Water Closets	Fixtures	411.4
ASME A112.4.14-2004 (R2010)	Manually Operated, Quarter-Turn Shutoff Valves for Use in Plumbing Systems	Valves	606.1
ASME A112.6.1M-1997 (R2012)	Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use	Fixtures	402.4
ASME A112.6.2-2000 (R2010)	Framing-Affixed Supports for Off-the-Floor Water Closets with Concealed Tanks	Fixtures	402.4
ASME A112.6.3-2001 (R2007)	Floor and Trench Drains	Fixtures	418.1, *423.1*
ASME A112.6.4-2003 (R2012)	Roof, Deck, and Balcony Drains	Fixtures	1102.1
ASME A112.6.7-2015 (R2015)	Sanitary Floor Sinks	Fixtures	421.1
ASME A112.6.9-2005 (R2015)	Siphonic Roof Drains	DWV Components	*1106.2.3, 1106.2.8*
ASME A112.14.1-2003 (R2012)	Backwater Valves	Valves	710.6
ASME A112.14.3-2000 (R2014)	Grease Interceptors	Fixtures	1014.1
ASME A112.14.4-2001 (R2012)	Grease Removal Devices	Fixtures	1014.1
ASME A112.14.6-2010 (R2015)	FOG (Fats, Oils, and Greases) Disposal Systems	Fixtures	1015.2
ASME A112.18.1-*2018*/ CSA B125.1-*2018*	Plumbing Supply Fittings	Fittings	408.3, 417.1, 417.2, 417.3, 417.4, *417.6*, 603.5.19
ASME A112.18.2-2015/CSA B125.2-2015	Plumbing Waste Fittings	Fittings	404.1
ASME A112.18.3-2002 (R2012)	Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings	Backflow Protection	417.3, 417.4

610.0 Size of Potable Water Piping

The size of each water meter and each potable water supply pipe from the meter or other source of supply to the fixture supply branches, risers, connections, and outlets shall be based on the total demand.

Two Primary Objectives:

- Maintaining flow velocities at a level that is appropriate for the type of pipe being installed.
- Matching pipe sizes to the residual pressure of the system.

Matching these two principles will allow for a system that delivers the appropriate amount of water volume at the appropriate pressures and allows fixtures or appliances to perform their functions without causing damage to the system, fixture, or appliance.

Sizing Water Piping

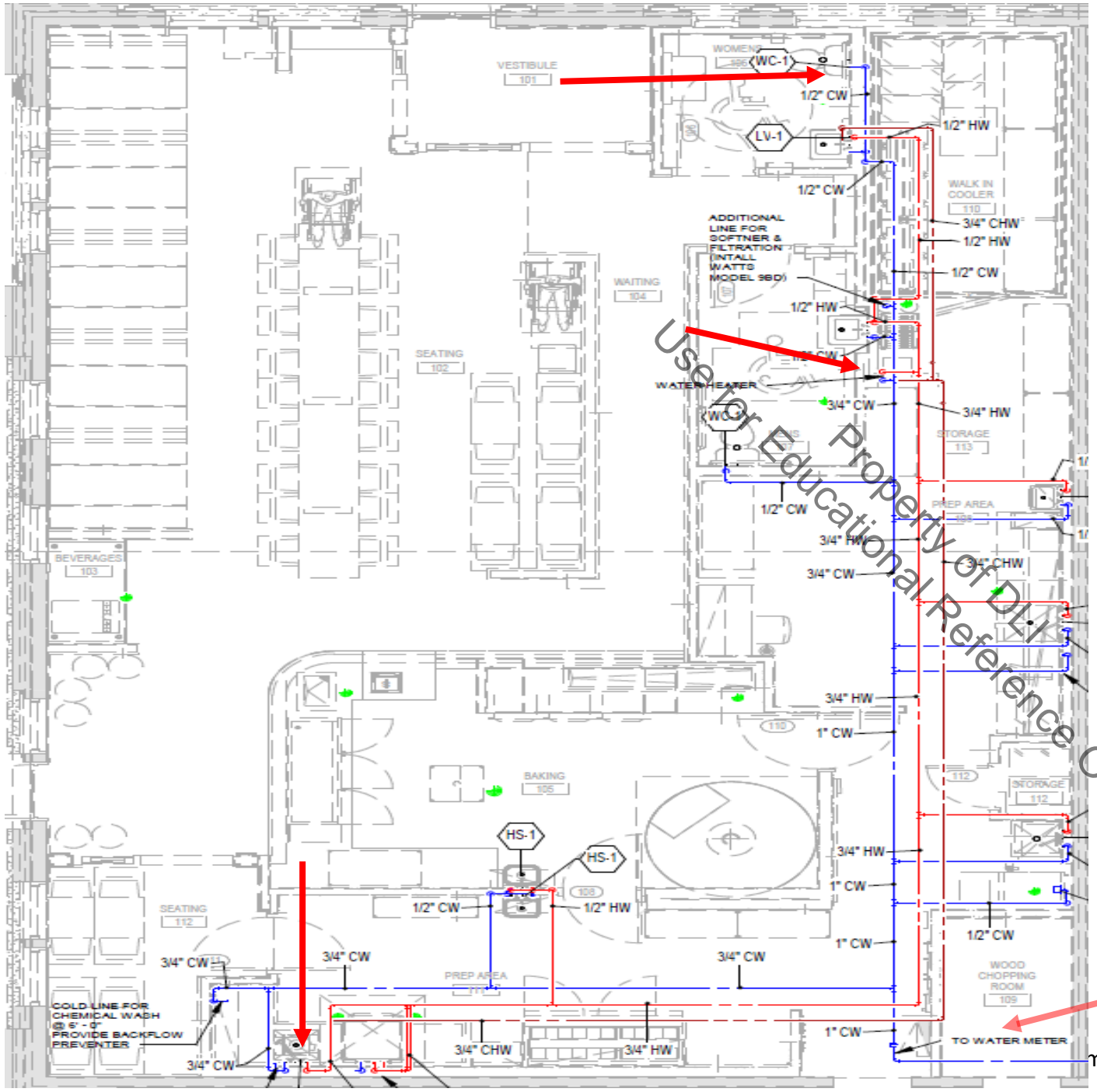
- Four things must be known before starting to size a water pipe system:
  - Total fixture units in building (using Table 610.3).
  - Distance from the meter to the most remote outlet in the system.
  - Elevation above the meter to the highest cold water outlet in the system (1/2 lb. per ft. rise)
  - Available pressure at peak demand: minimum pressure available.

Sizing Water Piping

Establishing Most Remote Outlet

- Section 610.7
  - Developed length of supply pipe from meter to the most remote outlet
  - Remote Outlet: It is the furthest outlet dimension, measuring from the meter, either the developed length of the cold-water piping or through the water heater to the furthest outlet on the hot water piping.

Which means the longest run is either the developed length of the cold water piping **or** the length through the water heater to the furthest outlet in the hot water piping.



Most Remote Outlet

Developed length of cold water piping: 57 feet

Developed length from the meter through the water heater to furthest hot water outlet: 103 feet

Sizing Water Piping

Water piping installation sized using Table 610.4, the following conditions must be determined:

- Total number of fixture units as determined from Table 610.3.
- Developed length of supply pipe from meter to most remote outlet.
- Difference in elevation between the meter or other source of supply and the highest fixture or outlet.
- Pressure in the street main or other source of supply at the locality where installation is to be made.

Sizing Water Piping

Determining Effective Pressure

- Take the minimum psi at the meter.
- Subtract ½ psi for each foot of elevation

Example:

- Minimum psi at water meter is 70
- Elevation of highest point above water meter is 30 feet
  - The Effective Pressure is 55

Table 610.3

TABLE 610.3
WATER SUPPLY FIXTURE UNITS (WSFU) AND MINIMUM FIXTURE BRANCH PIPE SIZES[3]

APPLIANCES, APPURTENANCES OR FIXTURES[2]	MINIMUM FIXTURE BRANCH PIPE SIZE[1,4] (inches)	PRIVATE	PUBLIC	ASSEMBLY[6]
Bathtub or Combination Bath/Shower (fill)	½	4.0	4.0	—
¾ inch Bathtub Fill Valve	¾	10.0	10.0	—
Bidet	½	1.0	—	—
Clothes Washer	½	4.0	4.0	—
Dental Unit, cuspidor	½	—	1.0	—
Dishwasher, domestic	½	1.5	1.5	—
Drinking Fountain or Water Cooler	½	0.5	0.5	0.75
Hose Bibb	½	2.5	2.5	—
Hose Bibb, each additional[8]	½	1.0	1.0	—
Lavatory (each basin), or hand sink	½	1.0	1.0	1.0
Lawn Sprinkler, each head[5]	—	1.0	1.0	—
Mobile Home, each (minimum)	—	12.0	—	—
Sinks	—	—	—	—
Bar	½	1.0	2.0	—
Clinical Faucet	½	—	3.0	—
Clinical Flushometer Valve with or without faucet	1	—	8.0	—
Kitchen, domestic with or without dishwasher	½	1.5	1.5	—
Laundry	½	1.5	1.5	—
Service or Mop Basin	½	1.5	3.0	—
Washup, each set of faucets	½	—	2.0	—
Shower, per head	½	2.0	2.0	—
Urinal, 1.0 GPF Flushometer Valve	¾	See Footnote[7]		—
Urinal, greater than 1.0 GPF Flushometer Valve	¾	See Footnote[7]		—
Urinal, flush tank	½	2.0	2.0	3.0
Wash Fountain, circular spray	¾	—	4.0	—
Water Closet, 1.6 GPF Gravity Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Valve	1	See Footnote[7]		—
Water Closet, greater than 1.6 GPF Gravity Tank	½	3.0	5.5	7.0
Water Closet, greater than 1.6 GPF Flushometer Valve	1	See Footnote[7]		—

For SI units: 1 inch = 25 mm

Notes:

1 Size of the cold branch pipe, or both the hot and cold branch pipes.

2 Appliances, appurtenances, or fixtures not referenced in this table shall be permitted to be sized by reference to fixtures having a similar flow rate and frequency of use.

3 The listed fixture unit values represent their load on the cold water building supply. The separate cold water and hot water fixture unit value for fixtures having both hot and cold water connections shall be permitted to be each taken as three-quarter of the listed total value of the fixture.

4 The listed minimum supply branch pipe sizes for individual fixtures are the nominal (I.D.) pipe size.

5 For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (gpm) (L/s), and add it separately to the demand in gpm (L/s) for the distribution system or portions thereof.

6 *Assembly (Public Use). See Minnesota Rules, chapter 1305, International Building Code.*

7 Where sizing flushometer systems, see Section 610.10.

8 Reduced fixture unit loading for additional hose bibbs is to be used where sizing total building demand and for pipe sizing where more than one hose bibb is supplied by a segment of water distribution pipe. The fixture branch to each hose bibb shall be sized on the basis of 2.5 fixture units.

610.0 Size of Potable Water Piping

- The water supply fixture unit valves shown in Table 610.3 represent the combined cold and hot water demand for each fixture.
- For example, the fixture unit value for a lavatory is one fixture unit. This value represents the combined hot and cold water usage for a lavatory.
- The fixture supplies are then typically connected to a fixture fitting or valve that will mix the cold and hot water and distribute to a common opening or port.
- It is for this reason that we will not add the separate hot and cold fixture unit values to determine the total demand for sizing the meter and water service or main.

Table 610.4

FIXTURE UNIT TABLE FOR DETERMINING WATER PIPE AND METER SIZES

METER AND STREET SERVICE (inches)	BUILDING SUPPLY AND BRANCHES (inches)	MAXIMUM ALLOWABLE LENGTH (feet)														
		40	60	80	100	150	200	250	300	400	500	600	700	800	900	1000
PRESSURE RANGE – 30 to 45 psi[1]																
¾	½[2]	6	5	4	3	2	1	1	1	0	0	0	0	0	0	0
¾	¾	16	16	14	12	9	6	5	5	4	4	3	2	2	2	1
¾	1	29	25	23	21	17	15	13	12	10	8	6	6	6	6	6
1	1	36	31	27	25	20	17	15	13	12	10	8	6	6	6	6
¾	1¼	36	33	31	28	24	23	21	19	17	16	13	12	12	11	11
1	1¼	54	47	42	38	32	28	25	23	19	17	14	12	12	11	11
1½	1¼	78	68	57	48	38	32	28	25	21	18	15	12	12	11	11
1	1½	85	84	79	65	56	48	43	38	32	28	26	22	21	20	20
1½	1½	150	124	105	91	70	57	49	45	36	31	26	23	21	20	20
2	1½	151	129	129	110	80	64	53	46	38	32	26	23	21	20	20
1	2	85	85	85	85	85	85	82	80	66	61	57	52	49	46	43
1½	2	220	205	190	176	155	138	127	120	104	85	70	61	57	54	51
2	2	370	327	292	265	217	185	164	147	124	96	70	61	57	54	51
2	2½	445	418	390	370	330	300	280	265	240	220	198	175	158	143	133
PRESSURE RANGE – 46 to 60 psi[1]																
¾	½[2]	7	7	6	5	4	3	2	2	1	1	1	0	0	0	0
¾	¾	20	20	19	17	14	11	9	8	6	5	4	4	3	3	3
¾	1	39	39	36	33	28	23	21	19	17	14	12	10	9	8	8
1	1	39	39	39	36	30	25	23	20	18	15	12	10	9	8	8
¾	1¼	39	39	39	39	39	39	34	32	27	25	22	19	19	17	16
1	1¼	78	78	76	67	52	44	39	36	30	27	24	20	19	17	16
1½	1¼	78	78	78	78	66	52	44	39	33	29	24	20	19	17	16
1	1½	85	85	85	85	85	85	80	67	55	49	41	37	34	32	30
1½	1½	151	151	151	151	128	105	90	78	62	52	42	38	35	32	30
2	1½	151	151	151	151	150	117	98	84	67	55	42	38	35	32	30
1	2	85	85	85	85	85	85	85	85	85	85	85	85	85	83	80
1½	2	370	370	340	318	272	240	220	198	170	150	135	123	110	102	94
2	2	370	370	370	370	368	318	280	250	205	165	142	123	110	102	94
2	2½	654	640	610	580	535	500	470	440	400	365	335	315	285	267	250
PRESSURE RANGE – Over 60 psi[1]																
¾	½[2]	7	7	7	6	5	4	3	3	2	1	1	1	1	1	0
¾	¾	20	20	20	20	17	13	11	10	8	7	6	6	5	4	4
¾	1	39	39	39	39	35	30	27	24	21	17	14	13	12	12	11
1	1	39	39	39	39	38	32	29	26	22	18	14	13	12	12	11
¾	1¼	39	39	39	39	39	39	39	39	34	28	26	25	23	22	21
1	1¼	78	78	78	78	74	62	53	47	39	31	26	25	23	22	21
1½	1¼	78	78	78	78	78	74	65	54	43	34	26	25	23	22	21
1	1½	85	85	85	85	85	85	85	85	81	64	51	48	46	43	40
1½	1½	151	151	151	151	151	151	130	113	88	73	51	51	46	43	40
2	1½	151	151	151	151	151	151	142	122	98	82	64	51	46	43	40
1	2	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85
1½	2	370	370	370	370	360	335	305	282	244	212	187	172	153	141	129
2	2	370	370	370	370	370	370	370	340	288	245	204	172	153	141	129
2	2½	654	654	654	654	654	650	610	570	510	460	430	404	380	356	329

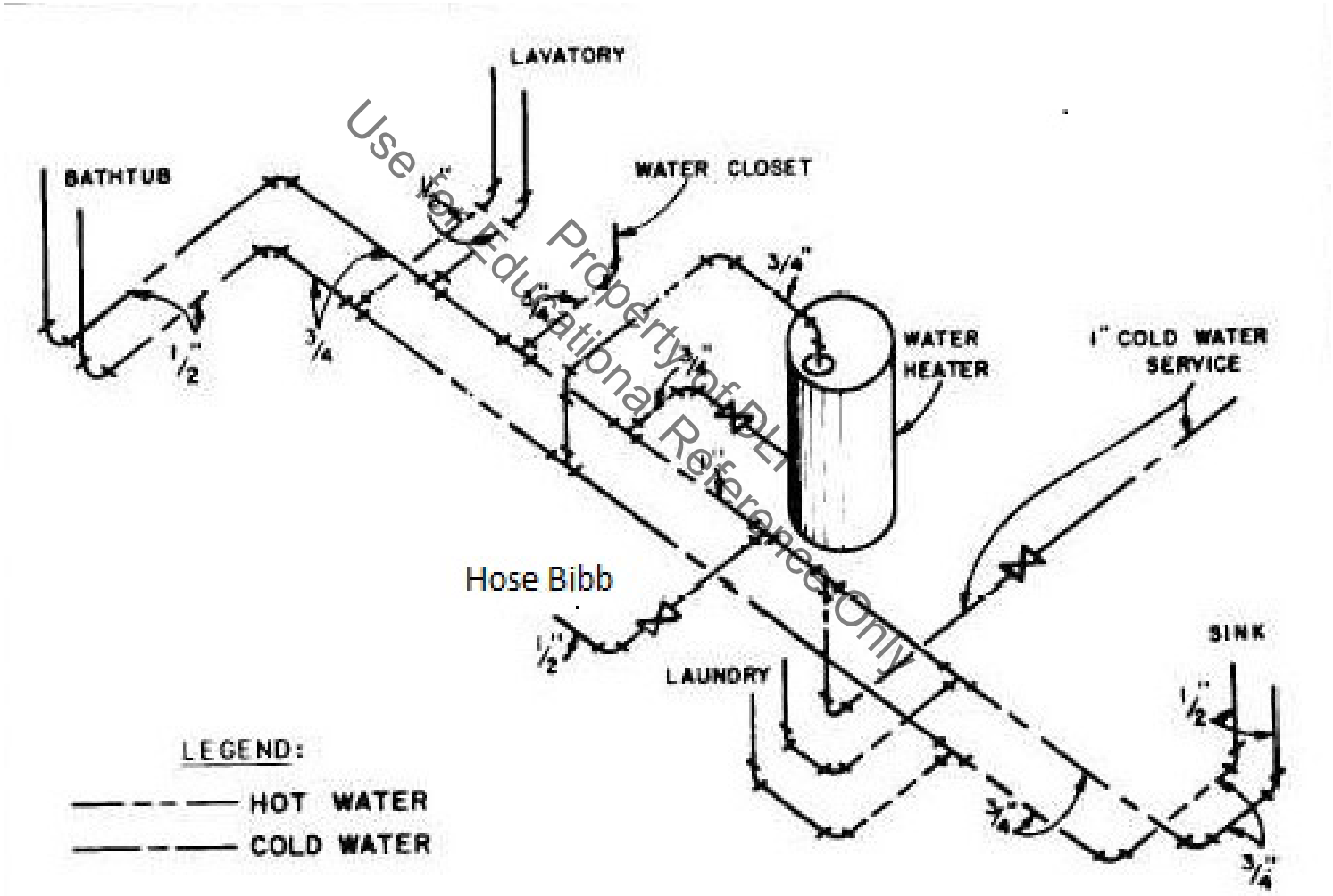
For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 pound-force per square inch = 6.8947 kPa

Notes:

1 Available static pressure after head loss.

2 Building supply, not less than ¾ of an inch (20 mm) nominal size.

Water Sizing Example



Water Sizing Example

TABLE 610.3
WATER SUPPLY FIXTURE UNITS (WSFU) AND MINIMUM FIXTURE BRANCH PIPE SIZES[3]

APPLIANCES, APPURTENANCES OR FIXTURES[2]	MINIMUM FIXTURE BRANCH PIPE SIZE[1,4] (inches)	PRIVATE	PUBLIC	ASSEMBLY[6]
Bathtub or Combination Bath/Shower (fill)	½	4.0	4.0	—
¾ inch Bathtub Fill Valve	¾	10.0	10.0	—
Bidet	½	1.0	—	—
Clothes Washer	½	4.0	4.0	—
Dental Unit, cuspidor	½	—	1.0	—
Dishwasher, domestic	½	1.5	1.5	—
Drinking Fountain or Water Cooler	½	0.5	0.5	0.75
Hose Bibb	½	2.5	2.5	—
Hose Bibb, each additional[8]	½	1.0	1.0	—
Lavatory (each basin), or hand sink	½	1.0	1.0	1.0
Lawn Sprinkler, each head[5]	—	1.0	1.0	—
Mobile Home, each (minimum)	—	12.0	—	—
Sinks	—	—	—	—
Bar	½	1.0	2.0	—
Clinical Faucet	½	—	3.0	—
Clinical Flushometer Valve with or without faucet	1	—	8.0	—
Kitchen, domestic with or without dishwasher	½	1.5	1.5	—
Laundry	½	1.5	1.5	—
Service or Mop Basin	½	1.5	3.0	—
Washup, each set of faucets	½	—	2.0	—
Shower, per head	½	2.0	2.0	—
Urinal, 1.0 GPF Flushometer Valve	¾	See Footnote[7]		—
Urinal, greater than 1.0 GPF Flushometer Valve	¾	See Footnote[7]		—
Urinal, flush tank	½	2.0	2.0	3.0
Wash Fountain, circular spray	¾	—	4.0	—
Water Closet, 1.6 GPF Gravity Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Valve	1	See Footnote[7]		—
Water Closet, greater than 1.6 GPF Gravity Tank	½	3.0	5.5	7.0
Water Closet, greater than 1.6 GPF Flushometer Valve	1	See Footnote[7]		—

Notes:

1 Size of the cold branch pipe, or both the hot and cold branch pipes.

2 Appliances, appurtenances, or fixtures not referenced in this table shall be permitted to be sized by reference to fixtures having a similar flow rate and frequency of use.

3 The listed fixture unit values represent their load on the cold water building supply. The separate cold water and hot water fixture unit value for fixtures having both hot and cold water connections shall be permitted to be each taken as three-quarter of the listed total value of the fixture.

4 The listed minimum supply branch pipe sizes for individual fixtures are the nominal (I.D.) pipe size.

5 For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (gpm) (L/s), and add it separately to the demand in gpm (L/s) for the distribution system or portions thereof.

6 *Assembly (Public Use). See Minnesota Rules, chapter 1305, International Building Code.*

7 Where sizing flushometer systems, see Section 610.10.

8 Reduced fixture unit loading for additional hose bibbs is to be used where sizing total building demand and for pipe sizing where more than one hose bibb is supplied by a segment of water distribution pipe. The fixture branch to each hose bibb shall be sized on the basis of 2.5 fixture units.

Notes from Table 610.3

Notes:

1 Size of the cold branch pipe, or both the hot and cold branch pipes.

2 Appliances, appurtenances, or fixtures not referenced in this table shall be permitted to be sized by reference to fixtures having a similar flow rate and frequency of use.

3 The listed fixture unit values represent their load on the cold water building supply. The separate cold water and hot water fixture unit value for fixtures having both hot and cold water connections shall be permitted to be each taken as three-quarter of the listed total value of the fixture.

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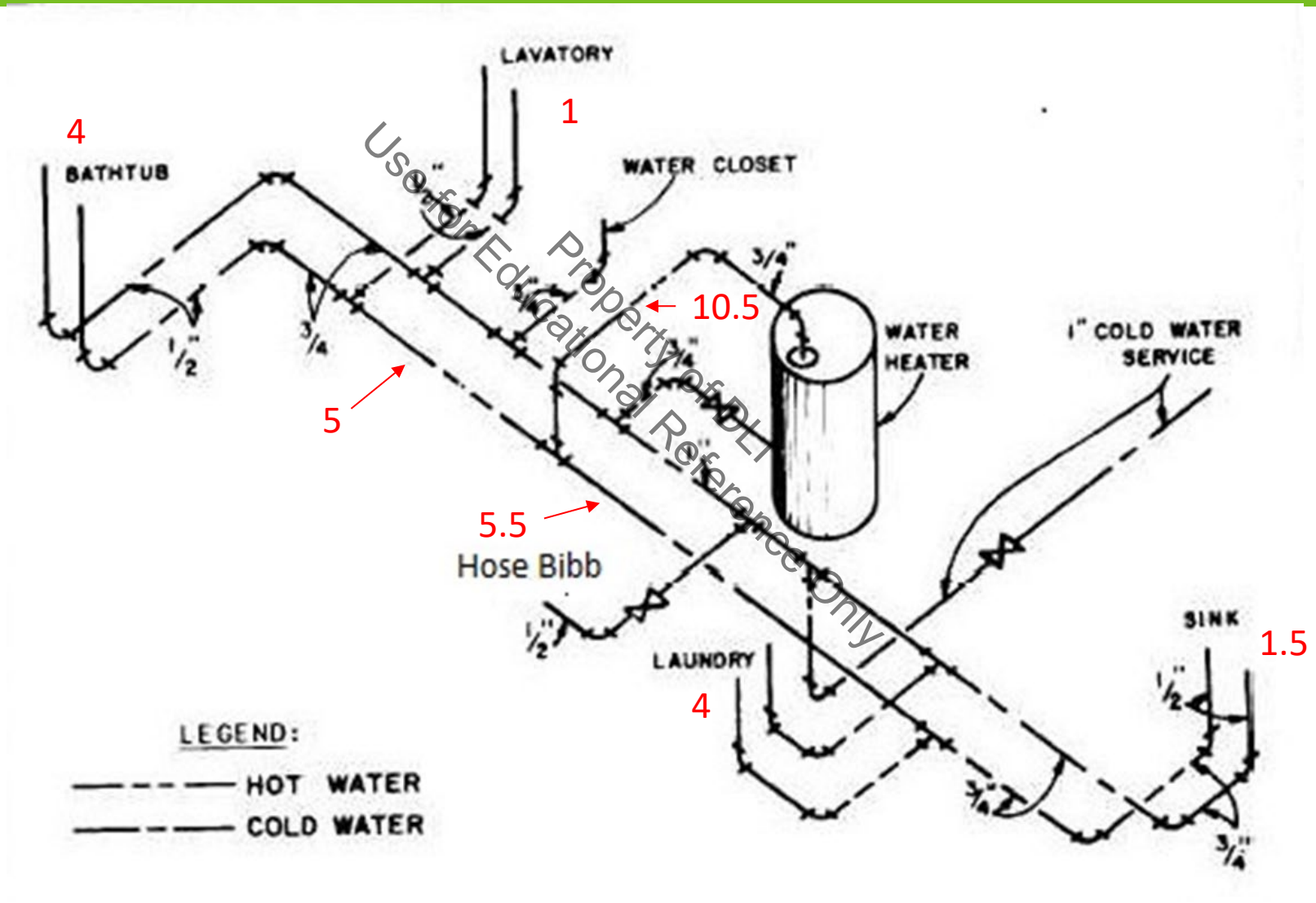
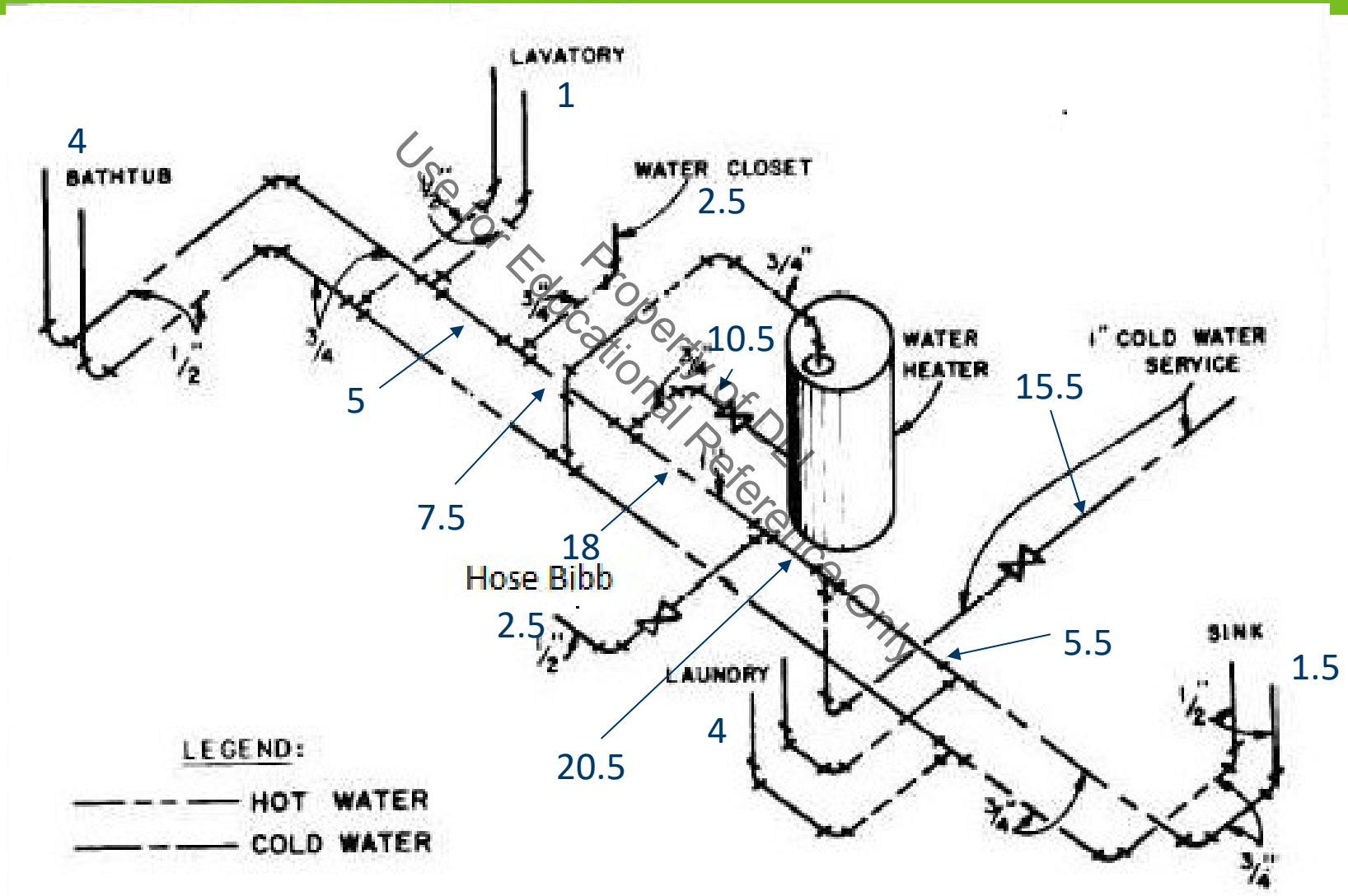
Water Sizing Example – Hot Water Piping



Water Sizing Example – Cold Water Piping



Water Sizing Example – Table 610.4

TABLE 610.4
FIXTURE UNIT TABLE FOR DETERMINING WATER PIPE AND METER SIZES

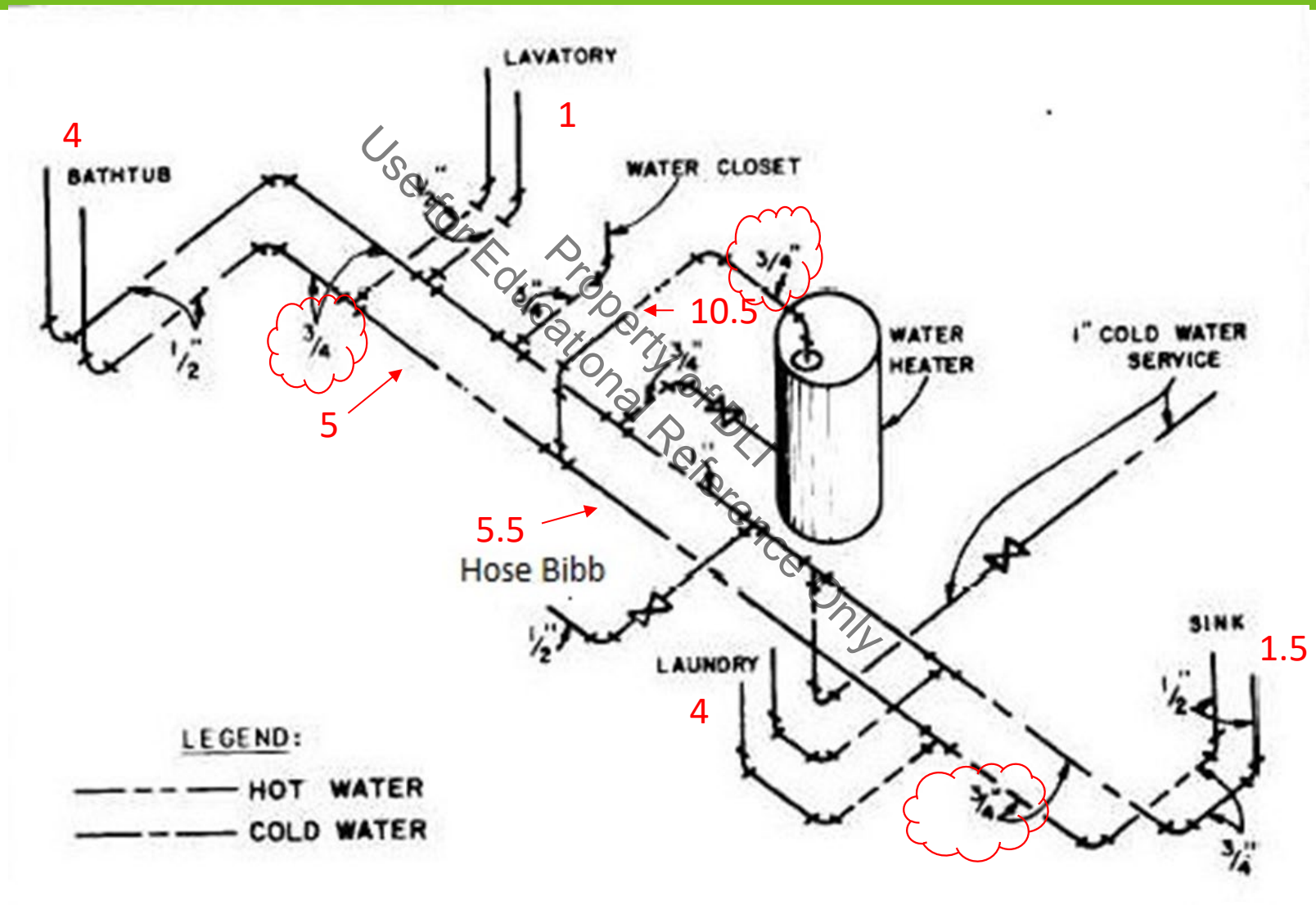
METER AND STREET SERVICE (inches)	BUILDING SUPPLY AND BRANCHES (inches)	MAXIMUM ALLOWABLE LENGTH (feet)														
		40	60	80	100	150	200	250	300	400	500	600	700	800	900	1000
PRESSURE RANGE – 30 to 45 psi[1]																
¾	½[2]	6	5	4	3	2	1	1	1	0	0	0	0	0	0	0
¾	¾	16	16	14	12	9	6	5	5	4	4	3	2	2	2	1
¾	1	29	25	23	21	17	15	13	12	10	8	6	6	6	6	6
1	1	36	31	27	25	20	17	15	13	12	10	8	6	6	6	6
¾	1¼	36	33	31	28	24	23	21	19	17	16	13	12	12	11	11
1	1¼	54	47	42	38	32	28	25	23	19	17	14	12	12	11	11
1½	1¼	78	68	57	48	38	32	28	25	21	18	15	12	12	11	11
1	1½	85	84	79	65	56	48	43	38	32	28	26	22	21	20	20
1½	1½	150	124	105	91	70	57	49	45	36	31	26	23	21	20	20
2	1½	151	129	129	110	80	64	53	46	38	32	27	23	21	20	20
1	2	85	85	85	85	85	85	82	80	66	61	57	52	49	46	43
1½	2	220	205	190	176	155	138	127	120	104	85	70	61	57	54	51
2	2	370	327	292	265	217	185	164	147	124	96	70	61	57	54	51
2	2½	445	418	390	370	330	300	280	265	240	220	198	175	158	143	133
PRESSURE RANGE – 46 to 60 psi[1]																
¾	½[2]	7	7	6	5	4	3	2	2	1	1	1	0	0	0	0
¾	¾	20	20	19	17	14	11	9	8	6	5	4	4	3	3	3
¾	1	39	39	36	33	28	23	21	19	17	14	12	10	9	8	8
1	1	39	39	39	36	30	25	23	20	18	15	12	10	9	8	8
¾	1¼	39	39	39	39	39	39	34	32	27	25	22	19	19	17	16
1	1¼	78	78	76	67	52	44	39	36	30	27	24	20	19	17	16
1½	1¼	78	78	78	78	66	52	44	39	33	29	24	20	19	17	16
1	1½	85	85	85	85	85	85	80	67	55	49	41	37	34	32	30
1½	1½	151	151	151	151	128	105	90	78	62	52	42	38	35	32	30
2	1½	151	151	151	151	150	117	98	84	67	55	42	38	35	32	30
1	2	85	85	85	85	85	85	85	85	85	85	85	85	85	83	80
1½	2	370	370	340	318	272	240	220	198	170	150	135	123	110	102	94
2	2	370	370	370	370	368	318	280	250	205	165	142	123	110	102	94
2	2½	654	640	610	580	535	500	470	440	400	365	335	315	285	267	250

Notes:

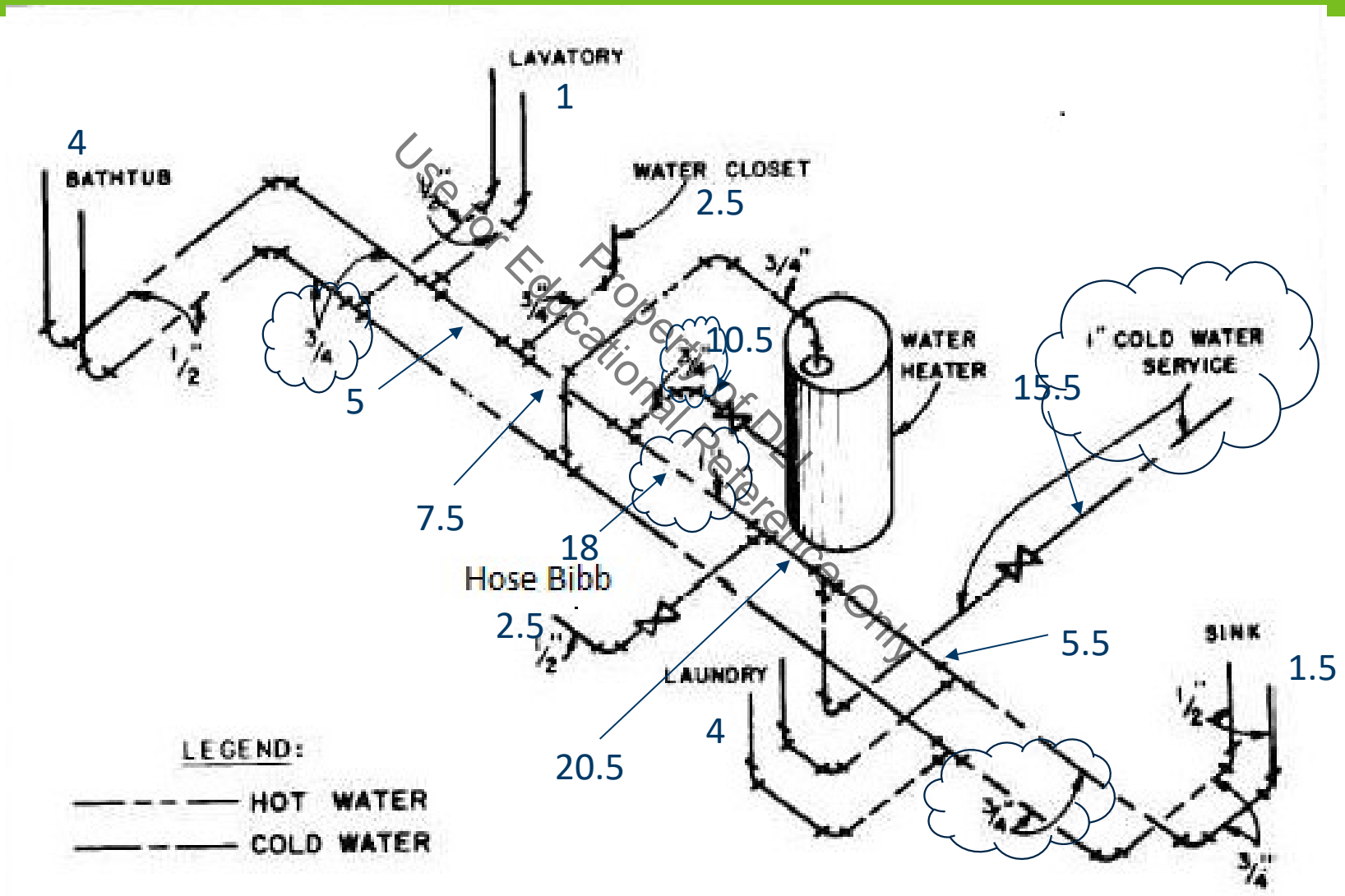
1 Available static pressure after head loss.

2 Building supply, not less than ¾ of an inch (20 mm) nominal size.

Water Sizing Example – Hot Water Piping



Water Sizing Example – Cold Water Piping



Water Sizing – Velocity Limitations

The water distribution system sizing must reflect the velocity limitations of the pipe material:

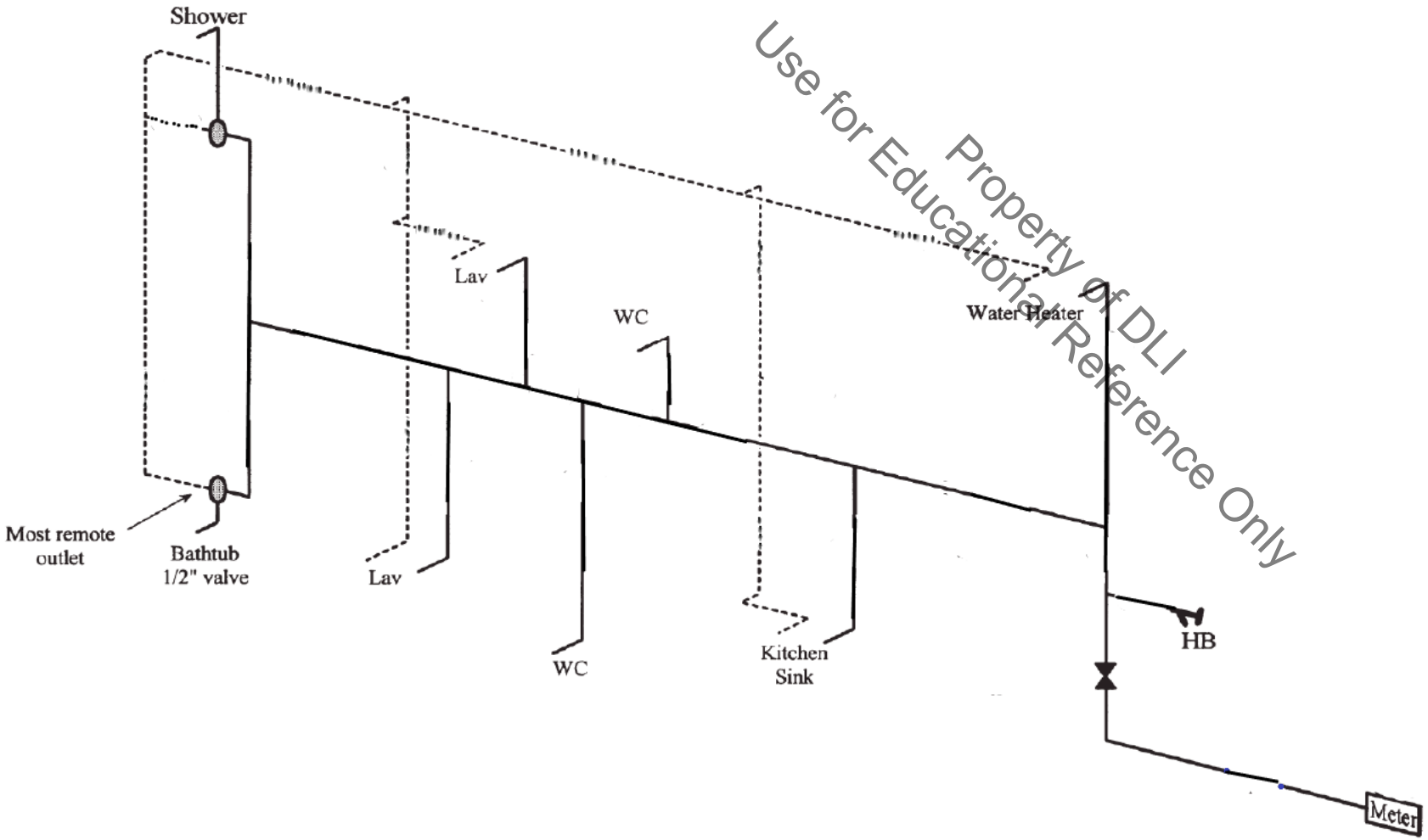
a. Copper systems or tubing systems using copper alloy fittings may not exceed 8 feet per second for cold water, or 5 feet per second for hot water (see Section 610.12).

b. PEX systems may not exceed 10 feet per second for cold water or 8 feet per second for hot water.

c. Other systems without copper alloy fittings may not exceed 10 feet per second (see Appendix A, 6.1).

Note: Velocity limitations are found using the charts in Appendix A and not Table 610.4

Water Sizing Example 2



Given:

Developed Length = 95 ft.
Pressure at meter = 50 psi minimum
= 78 psi maximum
Elevation of highest outlet above meter = 30 ft.
Water closets are 1.6 GPF gravity tank

——————— = Cold Water

- - - - - - - - - - - - - - - - = Hot Water

Table 610.3

TABLE 610.3
WATER SUPPLY FIXTURE UNITS (WSFU) AND MINIMUM FIXTURE BRANCH PIPE SIZES[3]

APPLIANCES, APPURTENANCES OR FIXTURES[2]	MINIMUM FIXTURE BRANCH PIPE SIZE[1,4] (inches)	PRIVATE	PUBLIC	ASSEMBLY[6]
Bathtub or Combination Bath/Shower (fill)	½	4.0	4.0	—
¾ inch Bathtub Fill Valve	¾	10.0	10.0	—
Bidet	½	1.0	—	—
Clothes Washer	½	4.0	4.0	—
Dental Unit, cuspidor	½	—	1.0	—
Dishwasher, domestic	½	1.5	1.5	—
Drinking Fountain or Water Cooler	½	0.5	0.5	0.75
Hose Bibb	½	2.5	2.5	—
Hose Bibb, each additional[8]	½	1.0	1.0	—
Lavatory (each basin), or hand sink	½	1.0	1.0	1.0
Lawn Sprinkler, each head[5]	—	1.0	1.0	—
Mobile Home, each (minimum)	—	12.0	—	—
Sinks	—	—	—	—
Bar	½	1.0	2.0	—
Clinical Faucet	½	—	3.0	—
Clinical Flushometer Valve with or without faucet	1	—	8.0	—
Kitchen, domestic with or without dishwasher	½	1.5	1.5	—
Laundry	½	1.5	1.5	—
Service or Mop Basin	½	1.5	3.0	—
Washup, each set of faucets	½	—	2.0	—
Shower, per head	½	2.0	2.0	—
Urinal, 1.0 GPF Flushometer Valve	¾	See Footnote[7]		—
Urinal, greater than 1.0 GPF Flushometer Valve	¾	See Footnote[7]		—
Urinal, flush tank	½	2.0	2.0	3.0
Wash Fountain, circular spray	¾	—	4.0	—
Water Closet, 1.6 GPF Gravity Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Valve	1	See Footnote[7]		—
Water Closet, greater than 1.6 GPF Gravity Tank	½	3.0	5.5	7.0
Water Closet, greater than 1.6 GPF Flushometer Valve	1	See Footnote[7]		—

For SI units: 1 inch = 25 mm

Notes:

1 Size of the cold branch pipe, or both the hot and cold branch pipes.

2 Appliances, appurtenances, or fixtures not referenced in this table shall be permitted to be sized by reference to fixtures having a similar flow rate and frequency of use.

3 The listed fixture unit values represent their load on the cold water building supply. The separate cold water and hot water fixture unit value for fixtures having both hot and cold water connections shall be permitted to be each taken as three-quarter of the listed total value of the fixture.

4 The listed minimum supply branch pipe sizes for individual fixtures are the nominal (I.D.) pipe size.

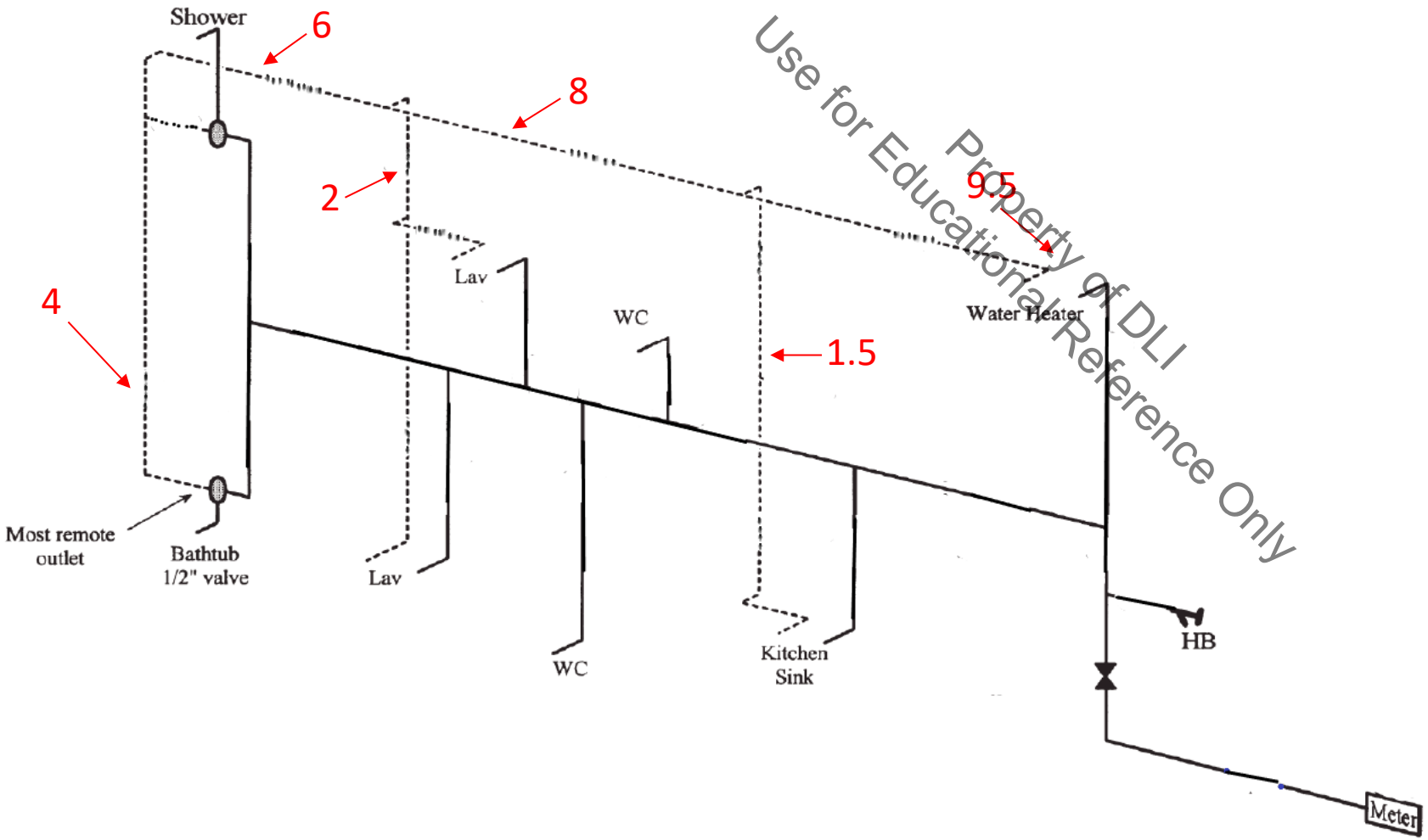
5 For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (gpm) (L/s), and add it separately to the demand in gpm (L/s) for the distribution system or portions thereof.

6 *Assembly (Public Use). See Minnesota Rules, chapter 1305, International Building Code.*

7 Where sizing flushometer systems, see Section 610.10.

8 Reduced fixture unit loading for additional hose bibbs is to be used where sizing total building demand and for pipe sizing where more than one hose bibb is supplied by a segment of water distribution pipe. The fixture branch to each hose bibb shall be sized on the basis of 2.5 fixture units.

Water Sizing Example 2 – Hot Water



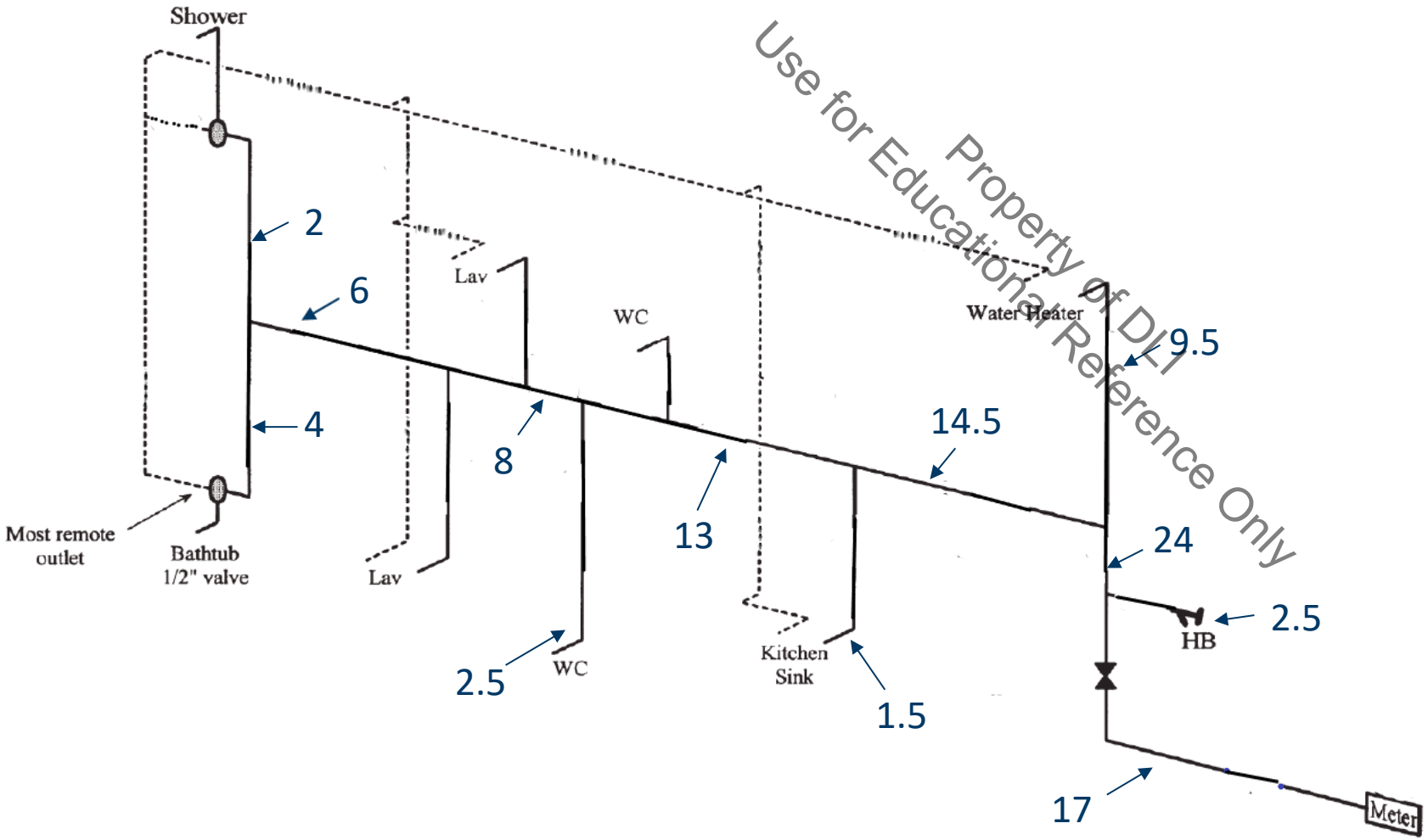
Given:

Developed Length = 95 ft.
Pressure at meter = 50 psi minimum
= 78 psi maximum
Elevation of highest outlet above meter = 30 ft.
Water closets are 1.6 GPF gravity tank

——————— = Cold Water

- - - - - - - - - - - - - - - - = Hot Water

Water Sizing Example 2 – Cold Water



Given:

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Pressure at meter = 50 psi minimum
= 78 psi maximum
Elevation of highest outlet above meter = 30 ft.
Water closets are 1.6 GPF gravity tank

——————— = Cold Water

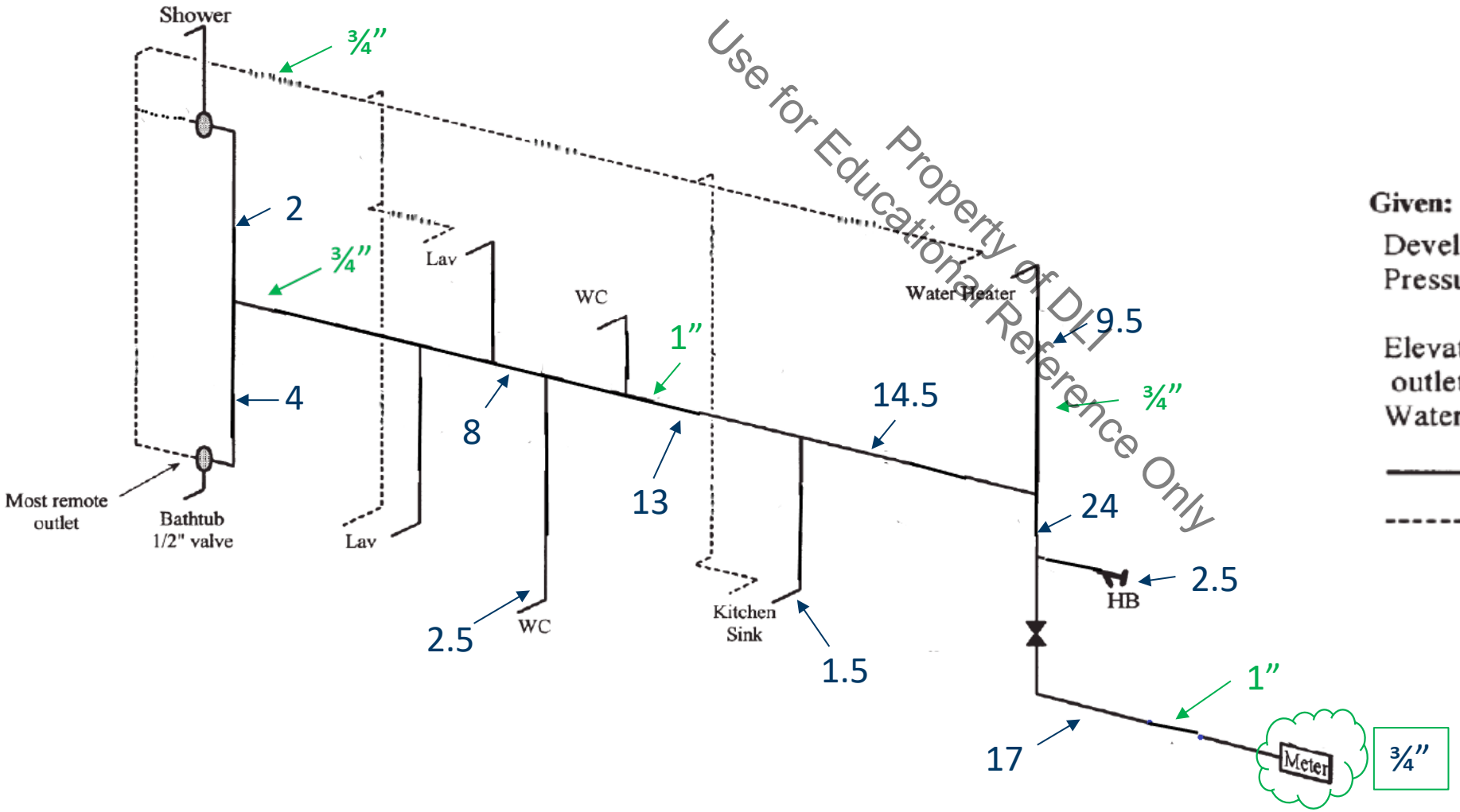
- - - - - - - - - - - - - - - - = Hot Water

Table 610.4

TABLE 610.4
FIXTURE UNIT TABLE FOR DETERMINING WATER PIPE AND METER SIZES

METER AND STREET SERVICE (inches)	BUILDING SUPPLY AND BRANCHES (inches)	MAXIMUM ALLOWABLE LENGTH (feet)														
		40	60	80	100	150	200	250	300	400	500	600	700	800	900	1000
PRESSURE RANGE – 30 to 45 psi[1]																
¾	½[2]	6	5	4	3	2	1	1	1	0	0	0	0	0	0	0
¾	¾	16	16	14	12	9	6	5	5	4	4	3	2	2	2	1
¾	1	29	25	23	21	17	15	13	12	10	8	6	6	6	6	6
1	1	36	31	27	25	20	17	15	13	12	10	8	6	6	6	6
¾	1¼	36	33	31	28	24	23	21	19	17	16	13	12	12	11	11
1	1¼	54	47	42	38	32	28	25	23	19	17	14	12	12	11	11
1½	1¼	78	68	57	48	38	32	28	25	21	18	15	12	12	11	11
1	1½	85	84	79	65	56	48	43	38	32	28	26	22	21	20	20
1½	1½	150	124	105	91	70	57	49	45	36	31	26	23	21	20	20
2	1½	151	129	129	110	80	64	53	46	38	32	27	23	21	20	20
1	2	85	85	85	85	85	85	82	80	66	61	57	52	49	46	43
1½	2	220	205	190	176	155	138	127	120	104	85	70	61	57	54	51
2	2	370	327	292	265	217	185	164	147	124	96	70	61	57	54	51
2	2½	445	418	390	370	330	300	280	265	240	220	198	175	158	143	133
PRESSURE RANGE – 46 to 60 psi[1]																
¾	½[2]	7	7	6	5	4	3	2	2	1	1	1	0	0	0	0
¾	¾	20	20	19	17	14	11	9	8	6	5	4	4	3	3	3
¾	1	39	39	36	33	28	23	21	19	17	14	12	10	9	8	8
1	1	39	39	39	36	30	25	23	20	18	15	12	10	9	8	8
¾	1¼	39	39	39	39	39	39	34	32	27	25	22	19	19	17	16
1	1¼	78	78	76	67	52	44	39	36	30	27	24	20	19	17	16
1½	1¼	78	78	78	78	66	52	44	39	33	29	24	20	19	17	16
1	1½	85	85	85	85	85	85	80	67	55	49	41	37	34	32	30
1½	1½	151	151	151	151	128	105	90	78	62	52	42	38	35	32	30
2	1½	151	151	151	151	150	117	98	84	67	55	42	38	35	32	30
1	2	85	85	85	85	85	85	85	85	85	85	85	85	85	83	80
1½	2	370	370	340	318	272	240	220	198	170	150	135	123	110	102	94
2	2	370	370	370	370	368	318	280	250	205	165	142	123	110	102	94
2	2½	654	640	610	580	535	500	470	440	400	365	335	315	285	267	250

Water Sizing Example 2



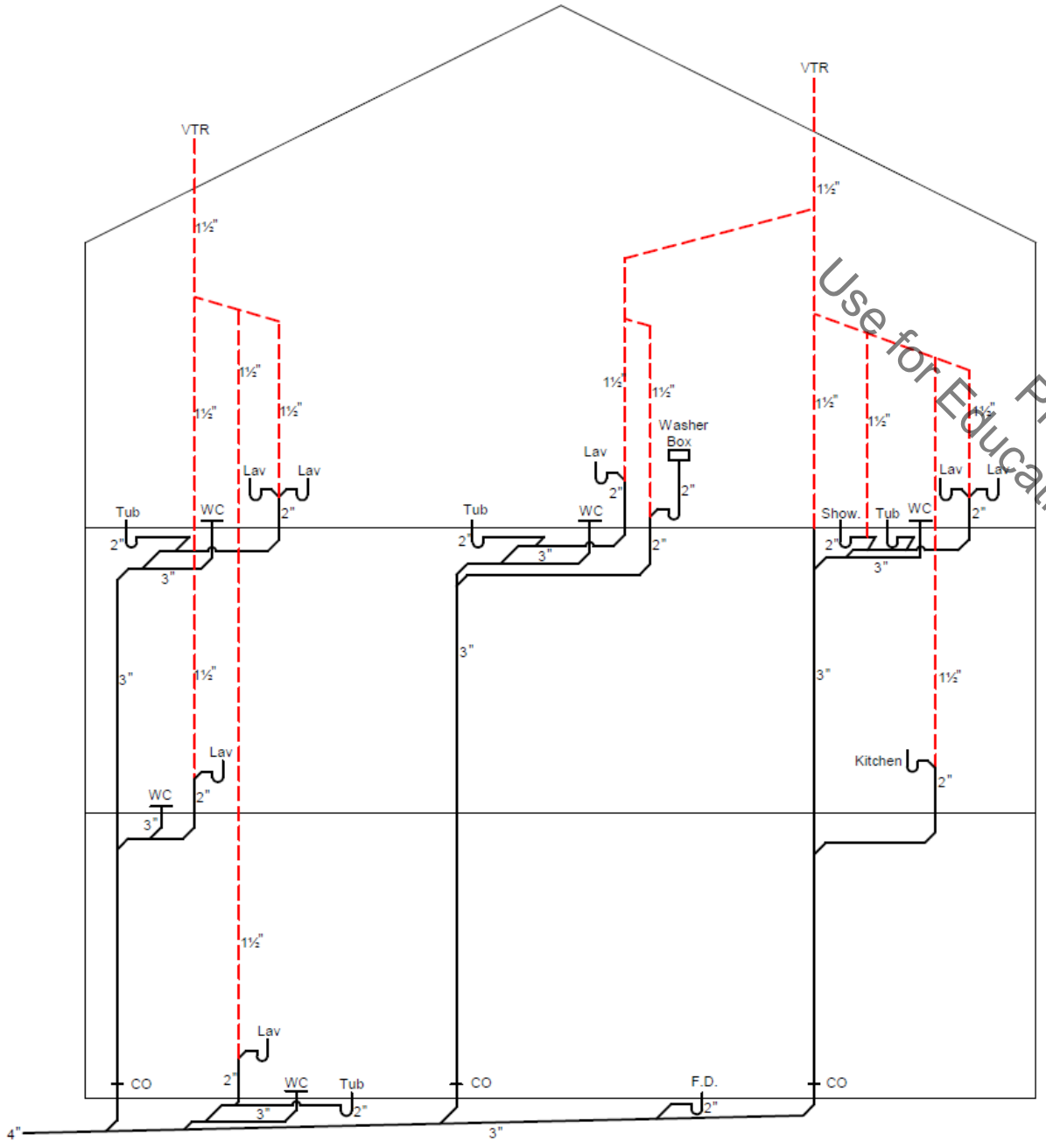
Given:

Developed Length = 95 ft.
Pressure at meter = 50 psi minimum
= 78 psi maximum
Elevation of highest outlet above meter = 30 ft.
Water closets are 1.6 GPF gravity tank

——————— = Cold Water

- - - - - - - - - - - - - - - - = Hot Water

Sanitary Sizing Example



Sanitary Sizing Example Table 702.1

TABLE 702.1
DRAINAGE FIXTURE UNIT VALUES (DFU)

PLUMBING APPLIANCES, APPURTENANCES, OR FIXTURES	MINIMUM SIZE TRAP AND TRAP ARM[6] (inches)	PRIVATE	PUBLIC	ASSEMBLY[7]
Bathtub or Combination Bath/Shower	1½	2.0	2.0	—
Bidet	1¼	1.0	—	—
Bidet	1½	2.0	—	—
Clothes Washer, domestic, standpipe[5]	2	3.0	3.0	3.0
Dental Unit, cuspidor	1¼	—	1.0	1.0
Dishwasher, domestic, with independent drain[2]	1½	2.0	2.0	2.0
Drinking Fountain or Water Cooler	1¼	0.5	0.5	1.0
Food Waste *Grinder*, commercial	2	—	3.0	5.0
Floor Drain, emergency	2	—	0.0	0.0
Floor Drain (for additional sizes see Section 702.0)	2	2.0	2.0	2.0
Shower, single-head trap	2	2.0	2.0	2.0
Multi-head, each additional	2	1.0	1.0	1.0
Lavatory, *single*	1¼	1.0	1.0	1.0
Lavatory, in sets *of two or three*	1½	2.0	2.0	2.0
Washfountain	1½	—	2.0	2.0
Washfountain	2	—	3.0	3.0
Mobile Home, trap	3	12.0	—	—
Receptor, indirect waste[1,3]	1½	See footnote[1,3]		
Receptor, indirect waste[1,4]	2	See footnote[1,4]		
Receptor, indirect waste[1]	3	See footnote[1]		
Sinks	—	—	—	—
Bar	1½	1.0	—	—
Bar[2]	1½	—	2.0	2.0
Clinical	3	—	6.0	6.0
Commercial with food waste[2]	1½	—	3.0	3.0
Commercial pot or scullery	2	—	4.0	4.0
Special Purpose[2]	1½	2.0	3.0	3.0
Special Purpose	2	3.0	4.0	4.0
Special Purpose	3	—	6.0	6.0
Kitchen, domestic[2] (with or without food waste *grinder*, dishwasher, or both)	1½	2.0	2.0	—
Laundry[2] (with or without discharge from a clothes washer)	1½	2.0	2.0	2.0
Service or Mop Basin	2	—	3.0	3.0
Service or Mop Basin	3	—	3.0	3.0
Service, flushing rim	3	—	6.0	6.0
Wash, each set of faucets	—	—	2.0	2.0
Urinal, integral trap 1.0 GPF[2]	2	2.0	2.0	5.0
Urinal, integral trap greater than 1.0 GPF	2	2.0	2.0	6.0
Urinal, exposed trap[2]	1½	2.0	2.0	5.0
Water Closet, 1.6 GPF Gravity Tank	3	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Tank	3	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Valve	3	3.0	4.0	6.0
Water Closet, greater than 1.6 GPF Gravity Tank[6]	3	4.0	6.0	8.0
Water Closet, greater than 1.6 GPF Flushometer Valve	3	4.0	6.0	8.0

For SI units: 1 inch = 25 mm

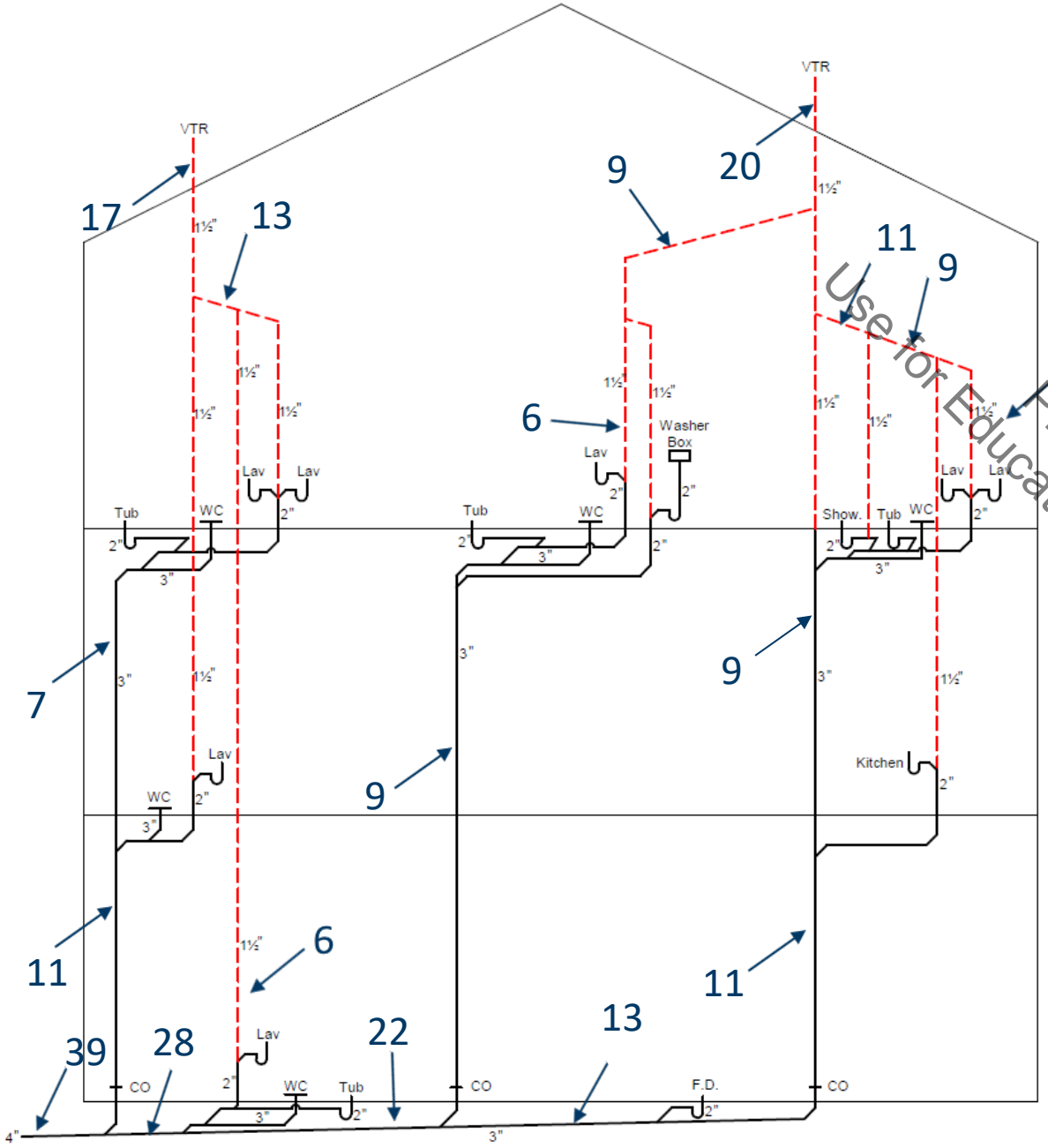
Notes:

1. Indirect waste receptors shall be sized based on the total drainage capacity of the fixtures that drain therein to, in accordance with Table 702.2(2).
2. Provide a 2 inch (50 mm) minimum drain.
3. For refrigerators, coffee urns, water stations, and similar low demands.
4. For commercial sinks, dishwashers, and similar moderate or heavy demands.
5. Buildings having a clothes-washing area with clothes washers in a battery of three or more clothes washers shall be rated at 6 fixture units each for purposes of sizing common horizontal and vertical drainage piping.
6. Trap sizes shall not be increased to the point where the fixture discharge is capable of being inadequate to maintain their self-scouring properties.
7. *Assembly [See Minnesota Rules, chapter 1305, International Building Code].*

Floor Drains

- For the purpose of drainage system sizing, emergency floor drains are limited to floor drains that do not serve as indirect waste receptors and are also located in restrooms, under emergency shower/eyewash equipment, or in laundry rooms
- Emergency floor drains, tell-tale floor drains, and floor drains not used as a receptor do not need to be individually vented. However, these floor drains must be installed within 25 feet of a vented branch or main.

Sanitary Sizing Example



PLUMBING APPLIANCES, APPURTENANCES, OR FIXTURES	MINIMUM SIZE TRAP AND TRAP ARM[6] (Inches)	PRIVATE
Bathtub or Combination Bath/Shower	1½	2.0
Bidet	1¼	1.0
Bidet	1½	2.0
Clothes Washer, domestic, standpipe[5]	2	3.0
Dental Unit, cuspidor	1¼	—
Dishwasher, domestic, with independent drain[2]	1½	2.0
Drinking Fountain or Water Cooler	1¼	0.5
Food Waste *Grinder*, commercial	2	—
Floor Drain, emergency	2	—
Floor Drain (for additional sizes see Section 702.0)	2	2.0
Shower, single-head trap	2	2.0
Multi-head, each additional	2	1.0
Lavatory, *single*	1¼	1.0
Lavatory, in sets *of two or three*	1½	2.0

Sanitary Sizing – Table703.2

TABLE 703.2
MAXIMUM UNIT LOADING AND MAXIMUM LENGTH OF DRAINAGE AND VENT PIPING

SIZE OF PIPE (inches)	1¼	1½	2	3	4	5	6	8	10	12
Maximum Units										
Drainage Piping[1]										
Vertical	1	2[2]	16[3]	48[4]	256	600	1380	3600	5600	8400
Horizontal	1	1	8[3]	35[4]	216[5]	428[5]	720[5]	2640[5]	4680[5]	8200[5]
Maximum Length										
Drainage Piping										
Vertical, (feet)	45	65	85	212	300	390	510	750	–	–
Horizontal (unlimited)										
Vent Piping										
Horizontal and Vertical[6]										
Maximum Units	1	8[3]	24	84	256	600	1380	3600	–	–
Maximum Lengths, (feet)	45	60	120	212	300	390	510	750		

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

Notes:

1 Excluding trap arm.

2 Except for sinks, urinals, and dishwashers – exceeding 1 fixture unit.

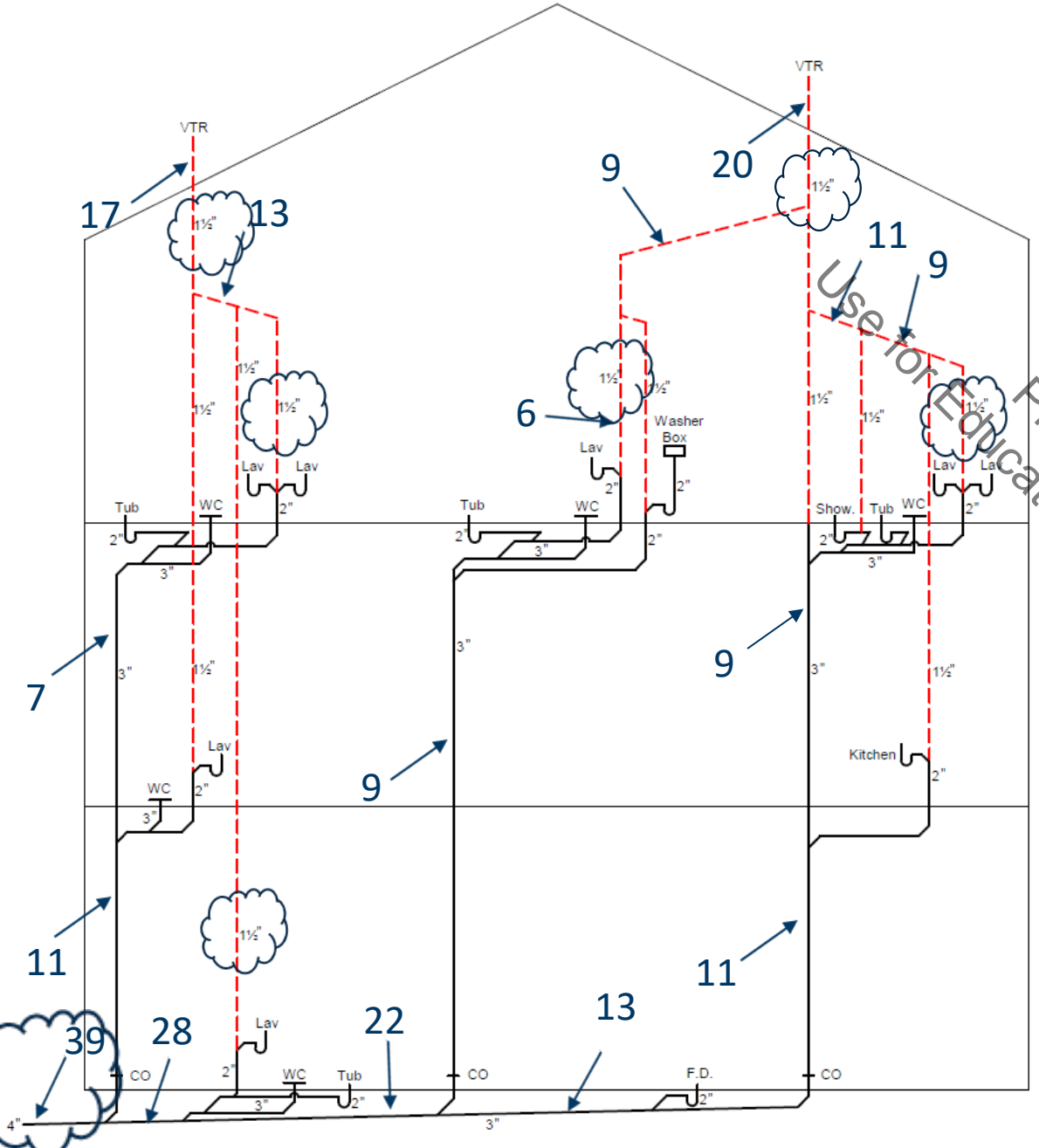
3 Except for six-unit traps or water closets.

4 Only four water closets or six-unit traps allowed on a vertical pipe or stack, and not to exceed three water closets or six-unit traps on a horizontal branch or drain.

5 Based on ¼ inch per foot (20.8 mm/m) slope. For ⅛ of an inch per foot (10.4 mm/m) slope, multiply horizontal fixture units by a factor of 0.8.

6 The diameter of an individual vent shall be not less than 1¼ inches (32 mm) nor less than one-half the diameter of the drain to which it is connected. Fixture unit load values for drainage and vent piping shall be computed from Table 702.1 and Table 702.2(2). Not to exceed one-third of the total permitted length of a vent shall be permitted to be installed in a horizontal position. Where vents are increased one pipe size for their entire length, the maximum length limitations specified in this table do not apply. This table is in accordance with the requirements of Section 901.3.

Sanitary Sizing Example



SIZE OF PIPE (inches)	1¼	1½	2	3	4
Maximum Units					
Drainage Piping[1]					
Vertical	1	2[2]	16[3]	48[4]	256
Horizontal	1	1	8[3]	35[4]	216[5]
Maximum Length					
Drainage Piping					
Vertical, (feet)	45	65	85	212	300
Horizontal (unlimited)					
Vent Piping					
Horizontal and Vertical[6]					
Maximum Units	1	8[3]	24	84	256
Maximum Lengths, (feet)	45	60	120	212	300

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

Notes:

1 Excluding trap arm.

2 Except for sinks, urinals, and dishwashers – exceeding 1 fixture unit.

3 Except for six-unit traps or water closets.

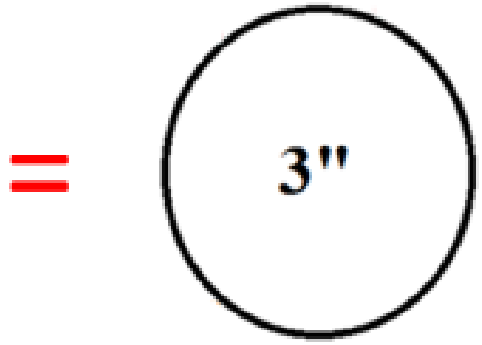
Vent Piping

- All drainage piping of each building and each connection to a public sewer or a private sewage disposal system shall be vented by means of one or more vent pipes.
- Section 906.7 - Vent pipes shall be at least 2 inches in diameter through a roof and the aggregate cross-sectional area of which shall be not less than that of the largest required building sewer, as determined from Table 703.2.

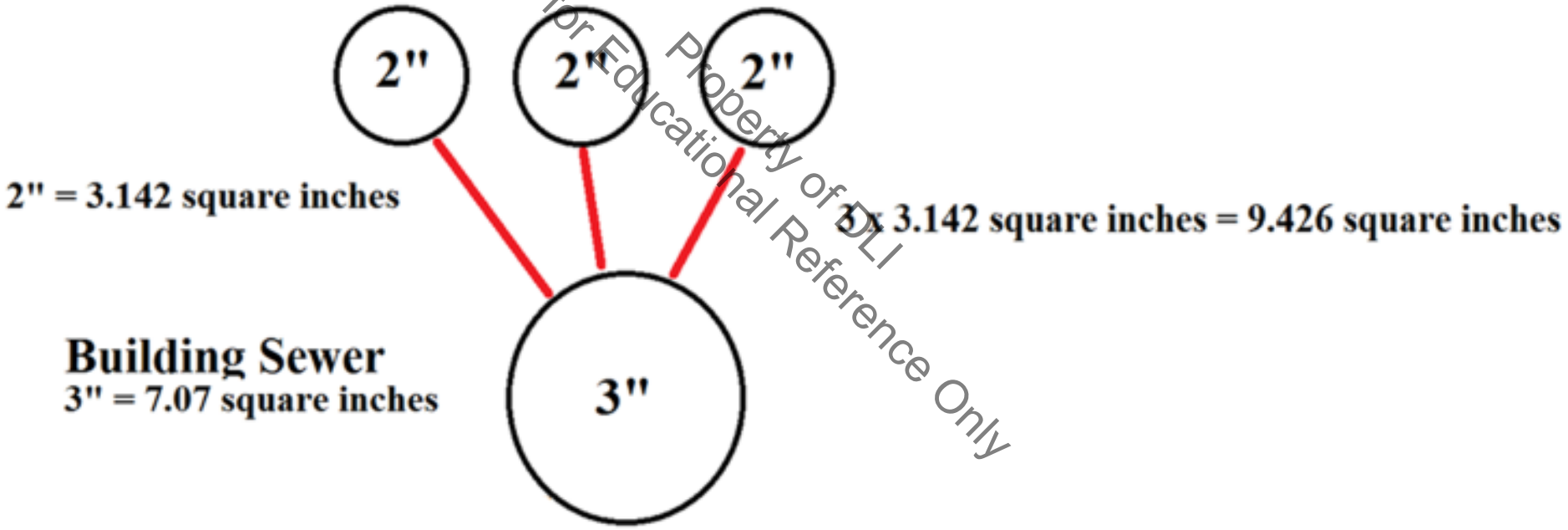
Venting – Cross Sectional Area

How many 2-inch vent pipes to have at least the equivalent area of a 3-inch pipe?

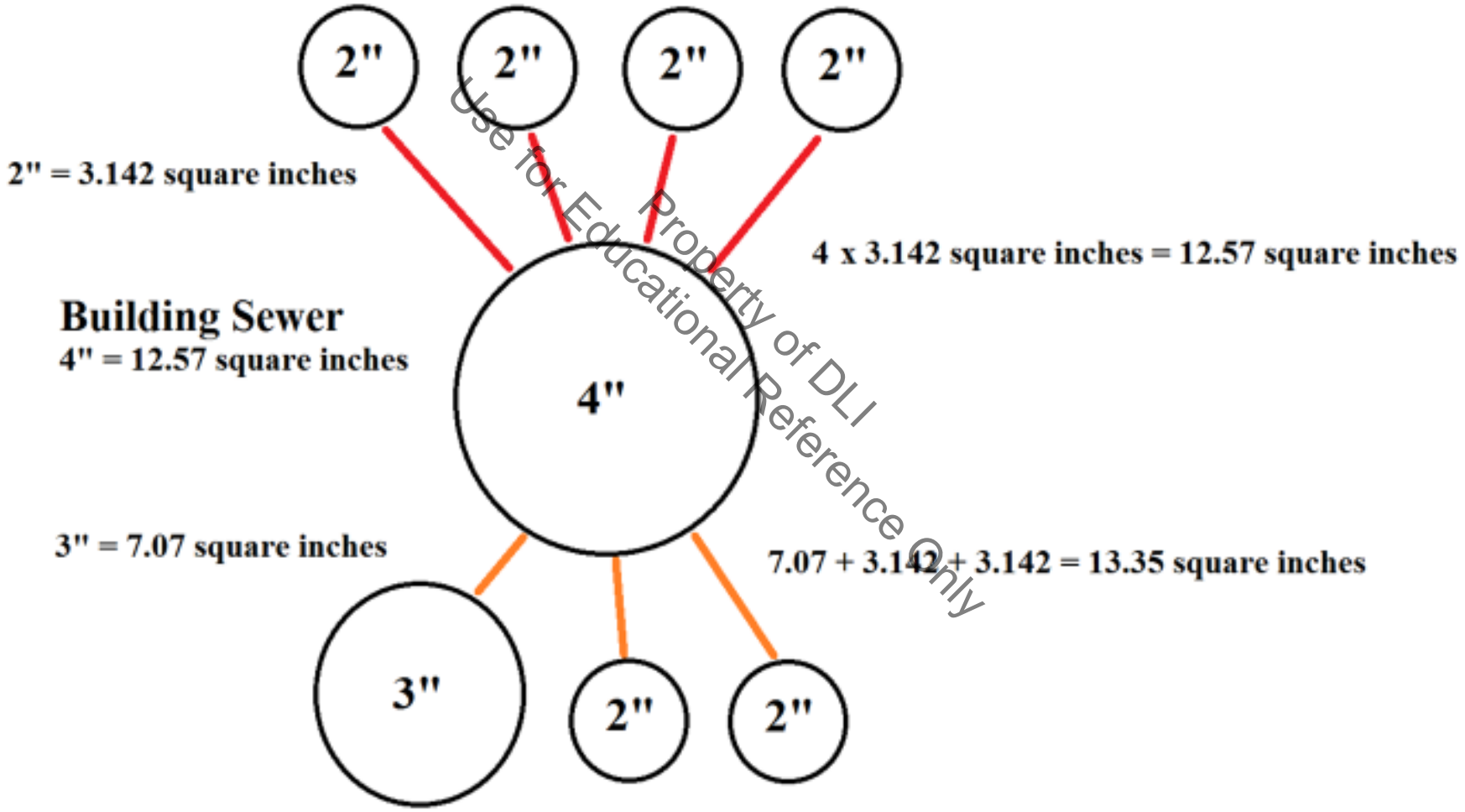
Area of a circle = πr^2



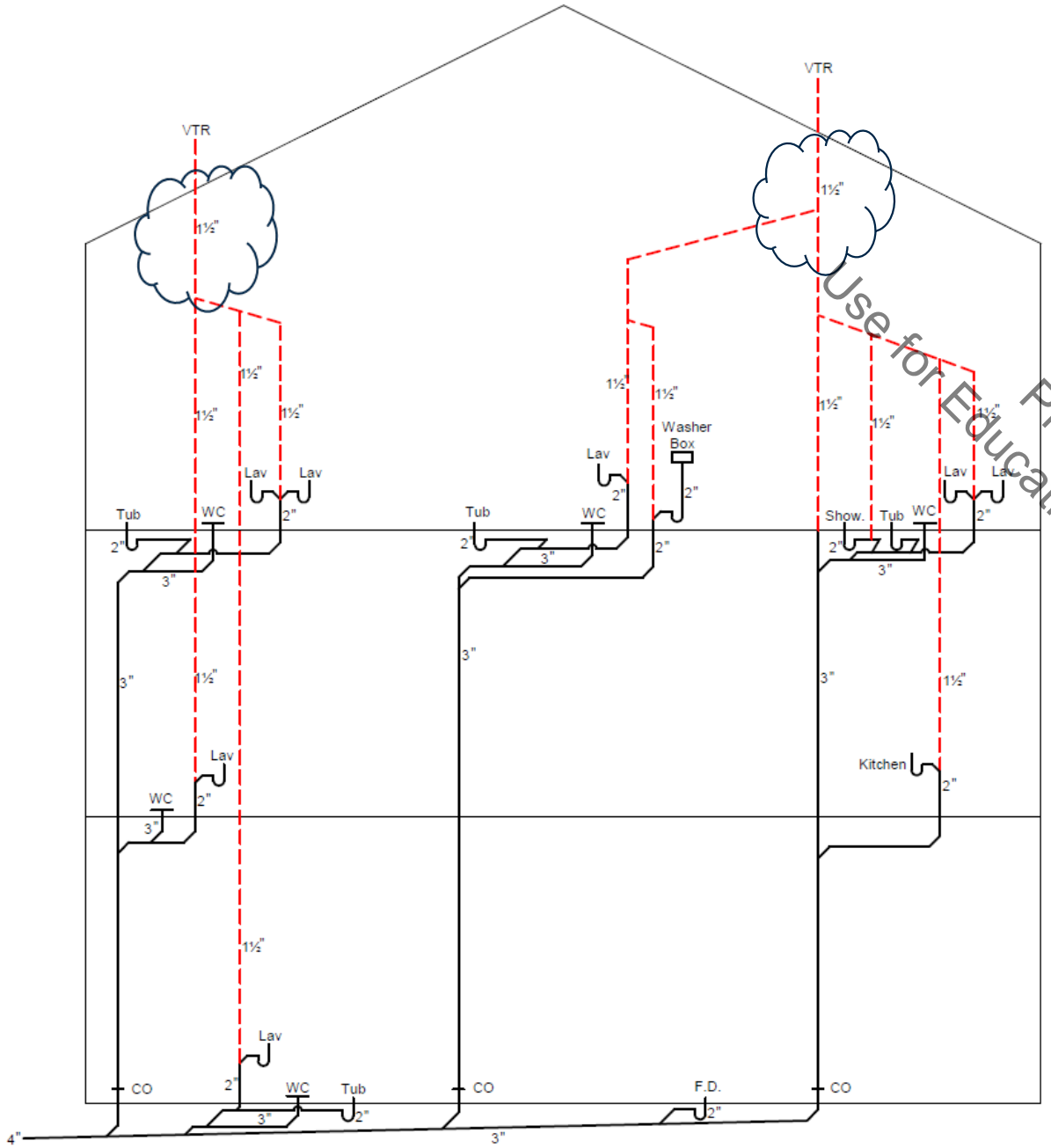
Venting – Cross Sectional Area



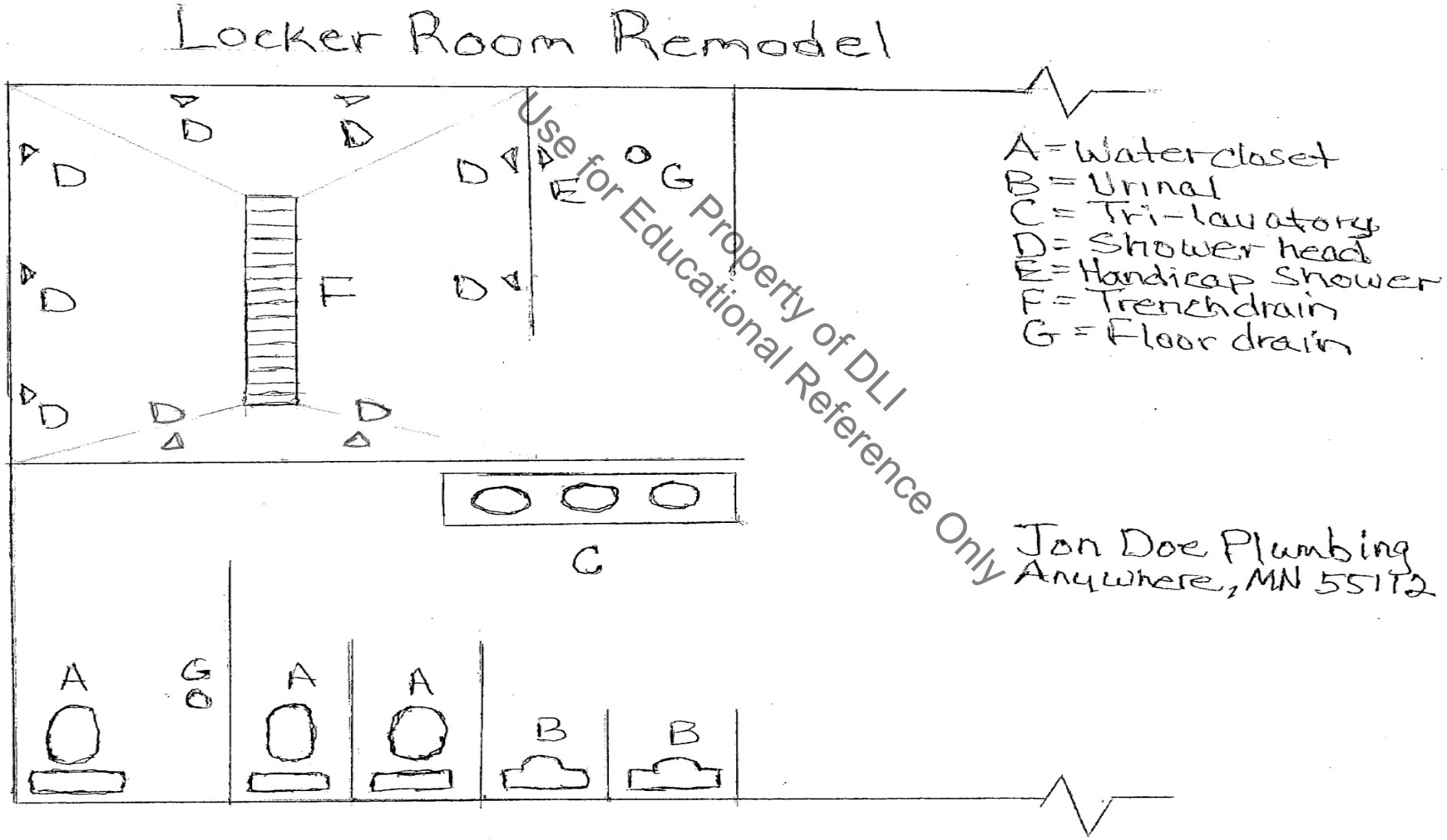
Venting – Cross Sectional Area



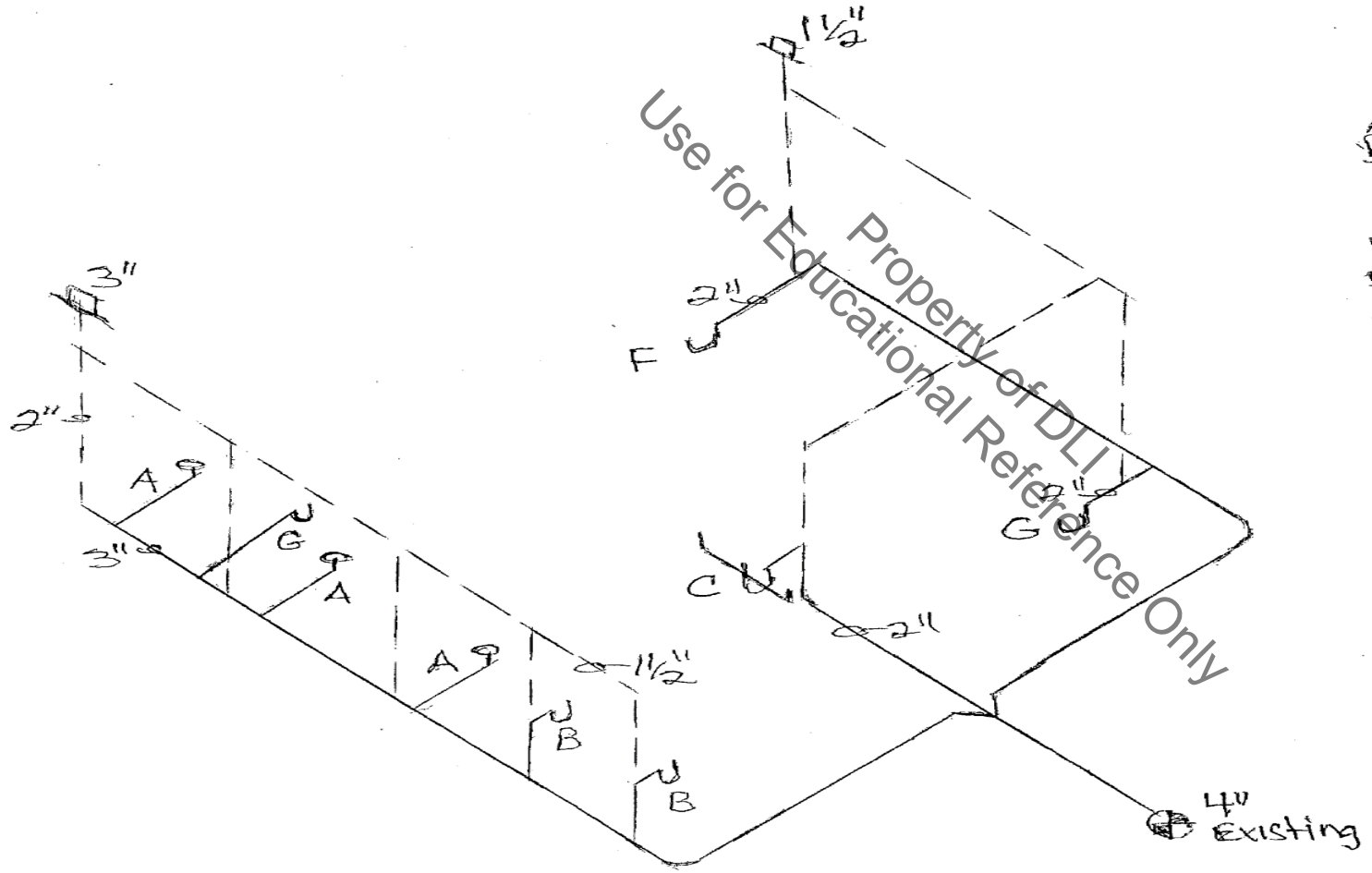
Venting – Cross Sectional Area



Floor Plan



DWV Riser Diagram



A = Water closet
B = Urinal
C = Tri-lavatory
D = Shower head
E = Handicap shower
F = Trench drain
G = Floor drain

Jon Doe Plumbing
Anywhere, MN 55112

ABS plastic pipe

Table 702.1

TABLE 702.1
DRAINAGE FIXTURE UNIT VALUES (DFU)

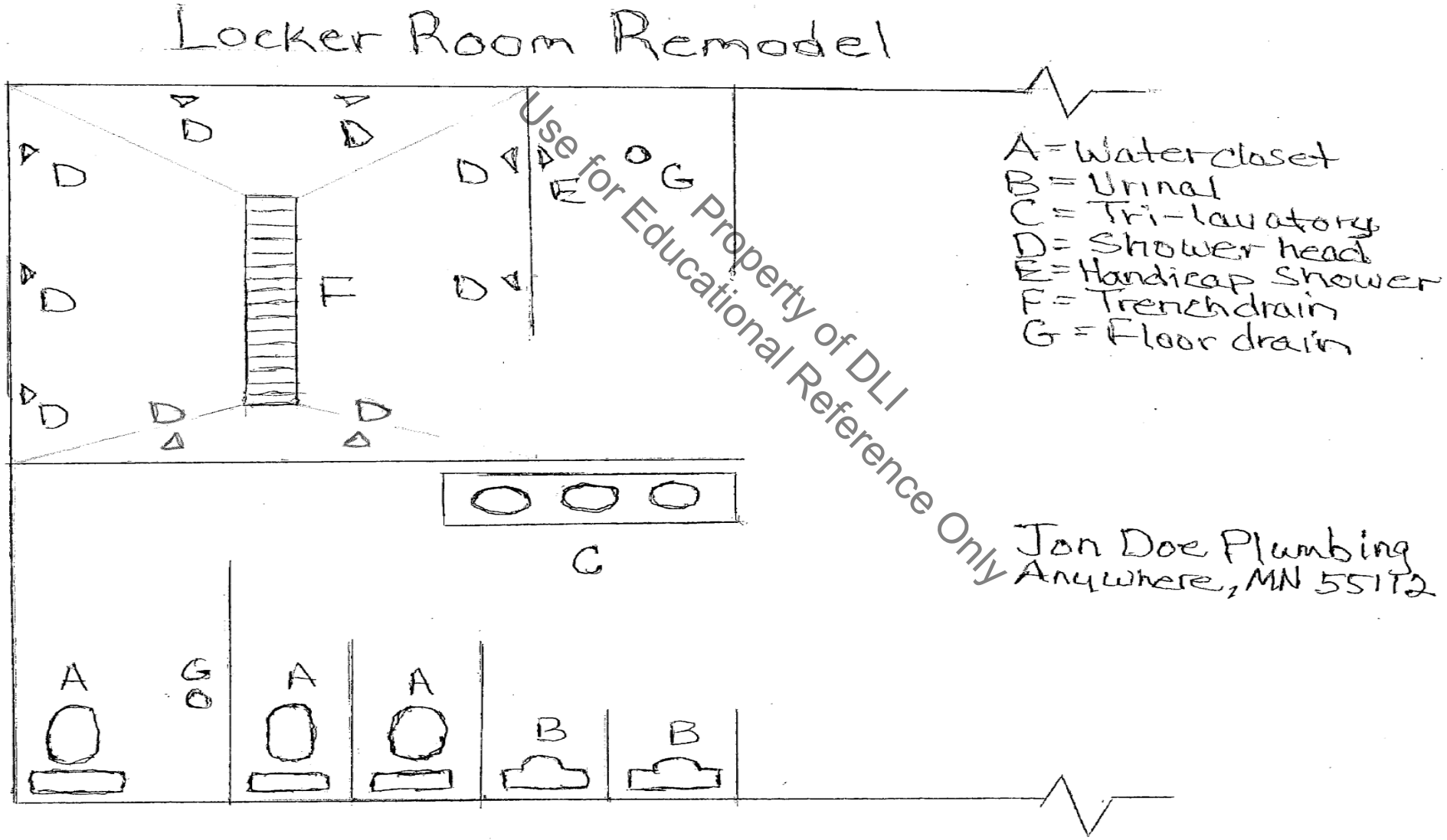
PLUMBING APPLIANCES, APPURTENANCES, OR FIXTURES	MINIMUM SIZE TRAP AND TRAP ARM[7] (inches)	PRIVATE	PUBLIC	ASSEMBLY[8]
Bathtub or Combination Bath/Shower	1½	2.0	2.0	—
Bidet	1¼	1.0	—	—
Bidet	1½	2.0	—	—
Clothes Washer, domestic, standpipe[5]	2	3.0	3.0	3.0
Dental Unit, cuspidor	1¼	—	1.0	1.0
Dishwasher, domestic, with independent drain[2]	1½	2.0	2.0	2.0
Drinking Fountain or Water Cooler	1¼	0.5	0.5	0.5
Food Waste Grinder, commercial	2	—	3.0	3.0
Floor Drain, emergency	2	—	0.0	0.0
Floor Drain (for additional sizes see Section 702.0)	2	2.0	2.0	2.0
Shower, single-head trap	2	2.0	2.0	2.0
Shower multi-head, each additional	2	1.0	1.0	1.0
Lavatory, single	1¼	1.0	1.0	1.0
Lavatory, in sets of two or three	1½	2.0	2.0	2.0
Washfountain	1½	—	2.0	2.0
Washfountain	2	—	3.0	3.0
Mobile Home, trap	3	12.0	—	—
Receptor, indirect waste[1,3]	1½	See footnote[1,3]		
Receptor, indirect waste[1,4]	2	See footnote[1,4]		
Receptor, indirect waste[1]	3	See footnote[1]		
Sinks	—	—	—	—
Bar	1½	1.0	—	—
Bar[2]	1½	—	2.0	2.0
Clinical	3	—	6.0	6.0
Commercial with food waste[2]	1½	—	3.0	3.0
Commercial pot or scullery	2	—	4.0	4.0
Special Purpose[2]	1½	2.0	3.0	3.0
Special Purpose	2	3.0	4.0	4.0
Special Purpose	3	—	6.0	6.0
Kitchen, domestic[2] (with or without food waste grinder, dishwasher, or both)	1½	2.0	2.0	—
Laundry[2] (with or without discharge from a clothes washer)	1½	2.0	2.0	2.0
Service or Mop Basin	2	—	3.0	3.0
Service or Mop Basin	3	—	3.0	3.0
Service, flushing rim	3	—	6.0	6.0
Wash, each set of faucets	—	—	2.0	2.0
Urinal, integral trap 1.0 GPF[2]	2	2.0	2.0	5.0
Urinal, integral trap greater than 1.0 GPF	2	2.0	2.0	6.0
Urinal, exposed trap[2]	1½	2.0	2.0	5.0
Water Closet, 1.6 GPF Gravity Tank[6]	3	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Tank[6]	3	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Valve[6]	3	3.0	4.0	6.0
Water Closet, greater than 1.6 GPF Gravity Tank[6]	3	4.0	6.0	8.0
Water Closet, greater than 1.6 GPF Flushometer Valve[6]	3	4.0	6.0	8.0

For SI units: 1 inch = 25 mm

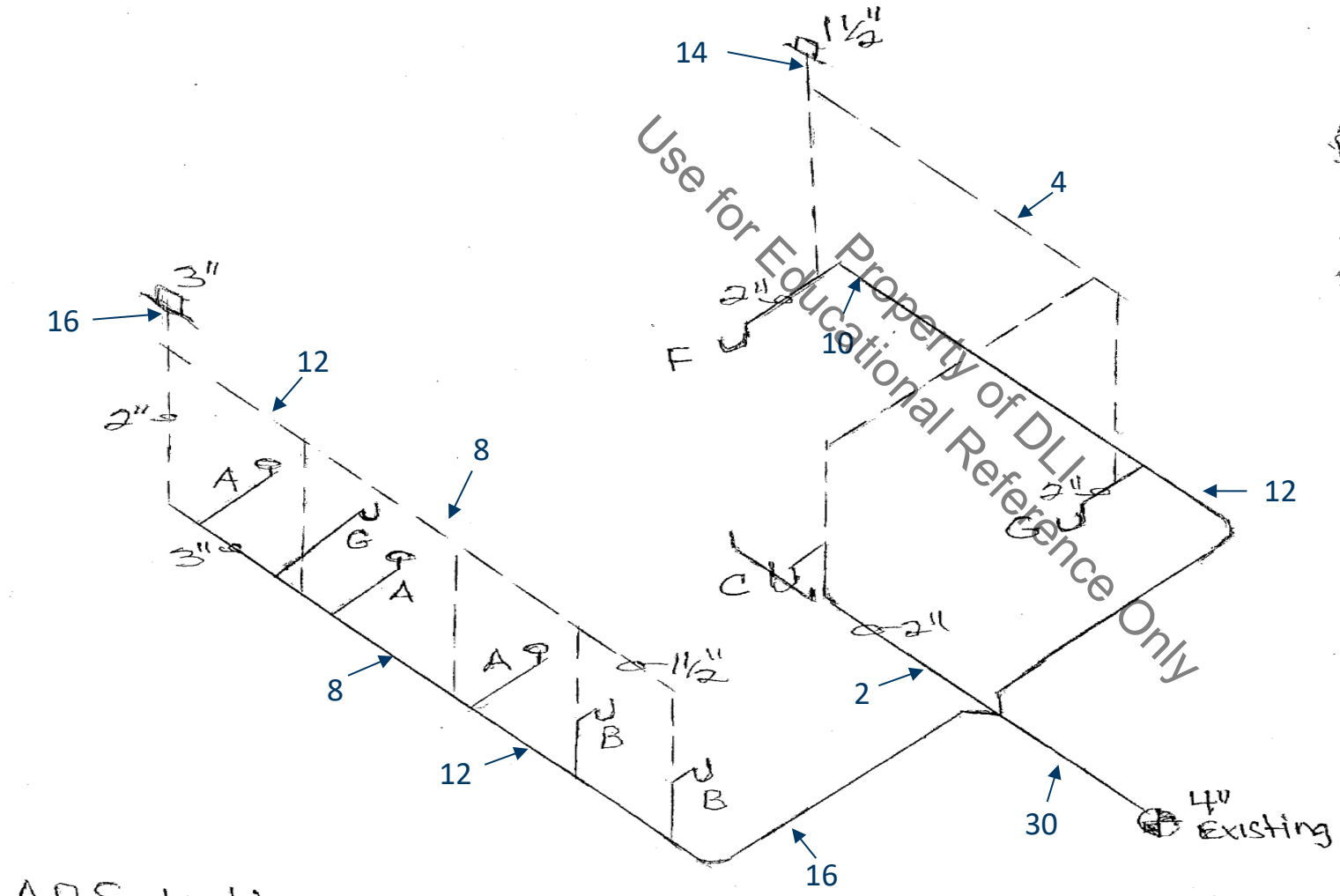
Notes:

1. Indirect waste receptors shall be sized based on the total drainage capacity of the fixtures that drain therein to, in accordance with Table 702.2(b).
2. Provide a 2 inch (50 mm) minimum drain.
3. For refrigerators, coffee urns, water stations, and similar low demands.
4. For commercial sinks, dishwashers, and similar moderate or heavy demands.
5. Buildings having a clothes-washing area with clothes washers in a battery of three or more clothes washers shall be rated at 6 fixture units each for purposes of sizing common horizontal and vertical drainage piping.
6. Trap sizes shall not be increased to the point where the fixture discharge is capable of being inadequate to maintain their self-scouring properties.
7. Assembly [Public Use (see Table 422.1)].

Floor Plan



DWV Sizing



A = Water closet
B = Urinal
C = Tri-lavatory
D = Shower head
E = Handicap shower
F = Trench drain
G = Floor drain

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DWV Sizing

TABLE 703.2
MAXIMUM UNIT LOADING AND MAXIMUM LENGTH OF DRAINAGE AND VENT PIPING

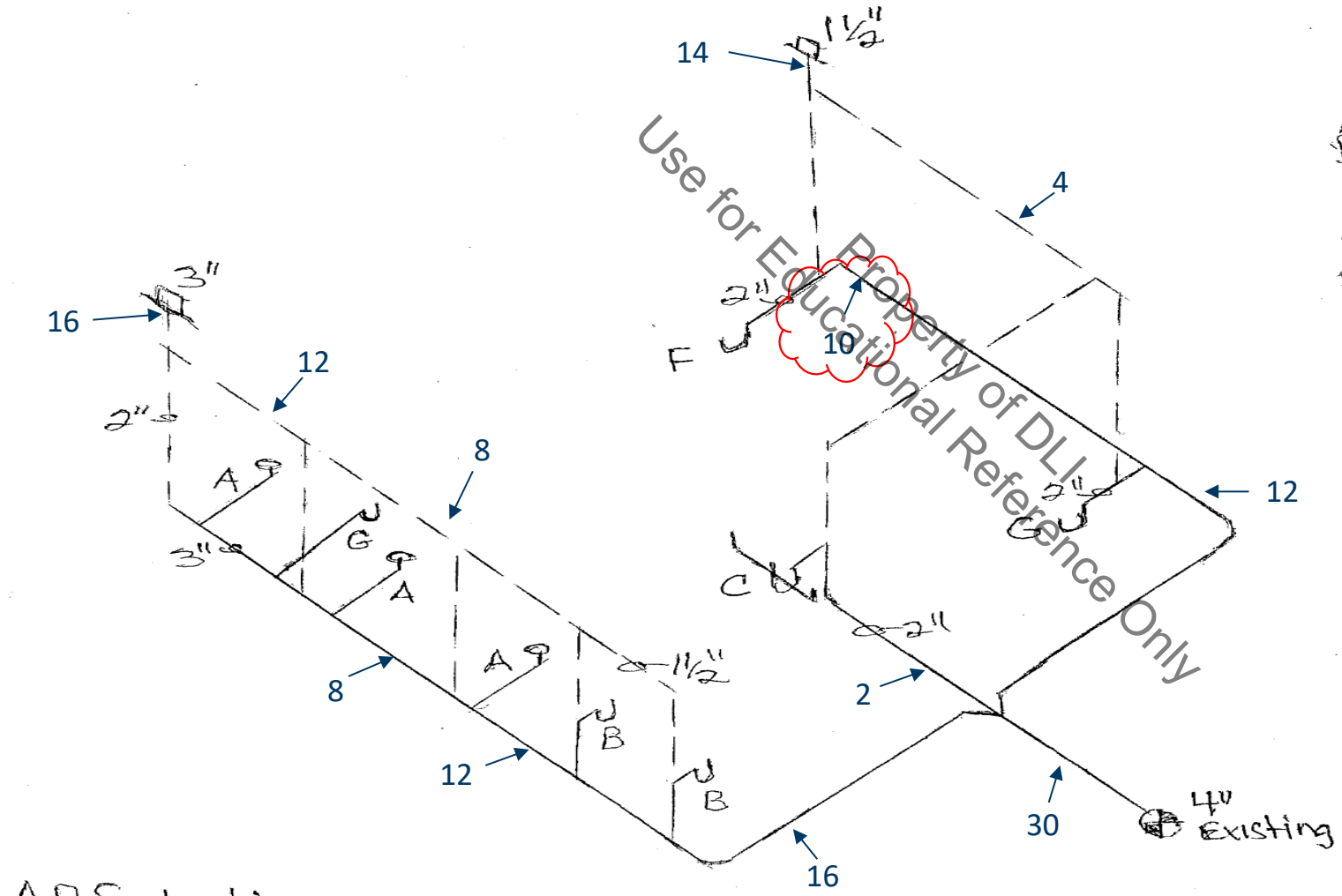
SIZE OF PIPE (inches)	1¼	1½	2	2½	3	4	5	6	8	10	12
Maximum Units											
Drainage Piping[1]											
Vertical	1	2[2]	16[3]	32[3]	48[4]	256	600	1380	3600	5600	8400
Horizontal	1	1	8[3]	14[3]	35[4]	216[5]	428[5]	720[5]	2640[5]	4680[5]	8200[5]
Maximum Length											
Drainage Piping											
Vertical, (feet)	45	65	85	148	212	300	390	510	750	–	–
Horizontal (unlimited)											
Vent Piping											
Horizontal and Vertical[6]											
Maximum Units	1	8[3]	24	48	84	256	600	1380	3600	–	–
Maximum Lengths, (feet)	45(15)	60(20)	120(40)	180(60)	212(70)	300(100)	390(130)	510(170)	750(250)		

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

Notes:

1. Excluding trap arm.
2. Except sinks, urinals, and dishwashers – exceeding 1 fixture unit.
3. Except six-unit traps or water closets.
4. Only four water closets or six-unit traps allowed on a vertical pipe or stack; and not to exceed three water closets or six-unit traps on a horizontal branch or drain.
5. Based on ¼ inch per foot (20.8 mm/m) slope. For ⅛ of an inch per foot (10.4 mm/m) slope, multiply horizontal fixture units by a factor of 0.8.
6. The diameter of an individual vent shall be not less than 1¼ inches (32 mm) nor less than one-half the diameter of the drain to which it is connected. Fixture unit load values for drainage and vent piping shall be computed from Table 702.1 and Table 702.2(b). Not to exceed one-third of the total permitted length of a vent shall be permitted to be installed in a horizontal position. Where vents are increased one pipe size for their entire length, the maximum length limitations specified in this table do not apply. This table is in accordance with the requirements of Section 901.2.

DWV Sizing



DWV Sizing

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Maximum Length											
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Vertical, (feet)	45	65	85	148	212	300	390	510	750	–	–
Horizontal (unlimited)											
Vent Piping											
Horizontal and Vertical[6]											
Maximum Units	1	8[3]	24	48	84	256	600	1380	3600	–	–
Maximum Lengths, (feet)	45(15)	60(20)	120(40)	180(60)	212(70)	300(100)	390(130)	510(170)	750(250)		

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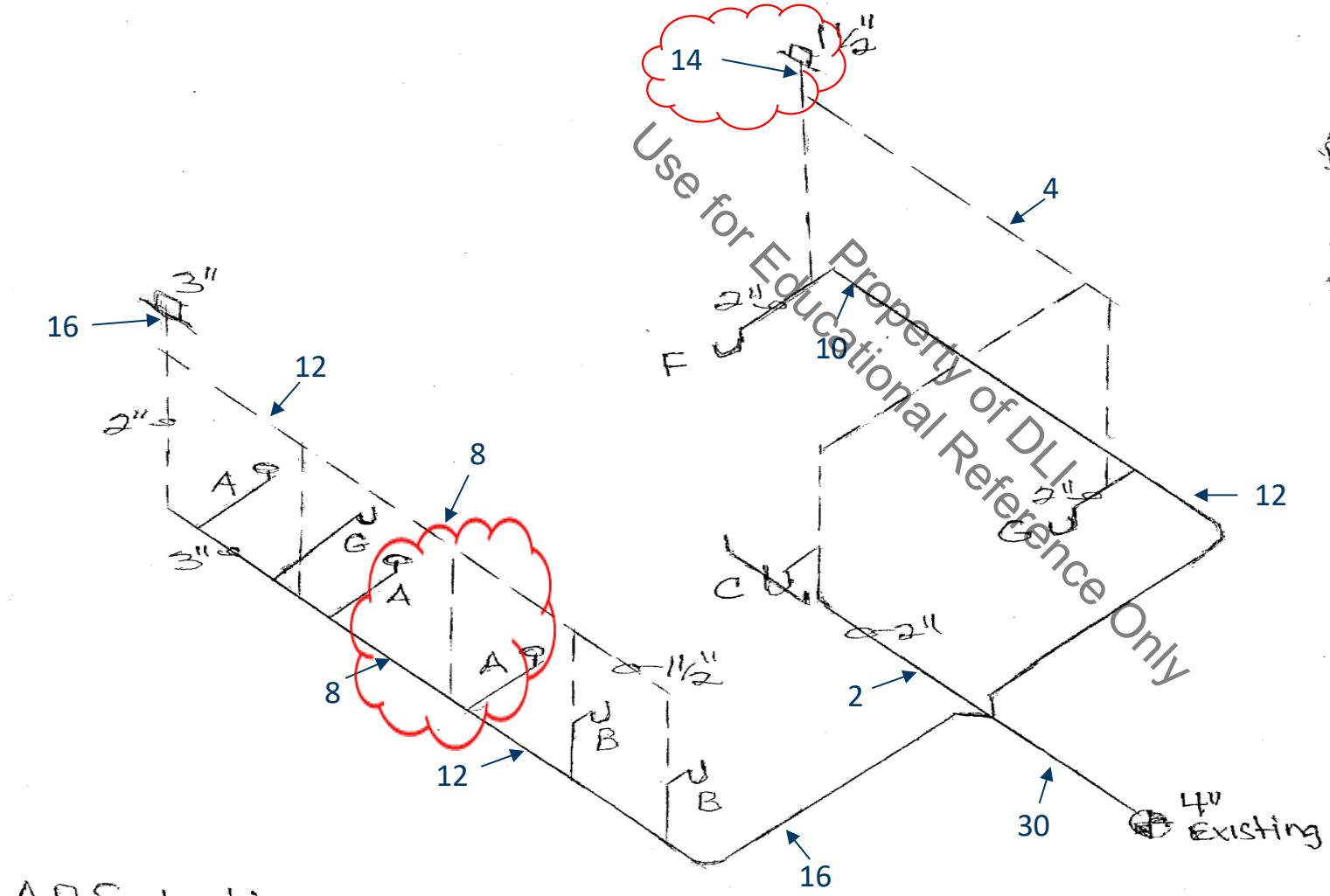
Notes:

1. Excluding trap arm.
2. Except sinks, urinals, and dishwashers – exceeding 1 fixture unit.
3. Except six-unit traps or water closets.
4. Only four water closets or six-unit traps allowed on a vertical pipe or stack; and not to exceed three water closets or six-unit traps on a horizontal branch or drain.
5. Based on ¼ inch per foot (20.8 mm/m) slope. For ⅛ of an inch per foot (10.4 mm/m) slope, multiply horizontal fixture units by a factor of 0.8.
6. The diameter of an individual vent shall be not less than 1¼ inches (32 mm) nor less than one-half the diameter of the drain to which it is connected. Fixture unit load values for drainage and vent piping shall be computed from Table 702.1 and Table 702.2(b). Not to exceed one-third of the total permitted length of a vent shall be permitted to be installed in a horizontal position. Where vents are increased one pipe size for their entire length, the maximum length limitations specified in this table do not apply. This table is in accordance with the requirements of Section 901.2.

DWV Sizing



A = Water closet
B = Urinal
C = Tri-lavatory
D = Shower head
E = Handicap shower
F = Trench drain
G = Floor drain

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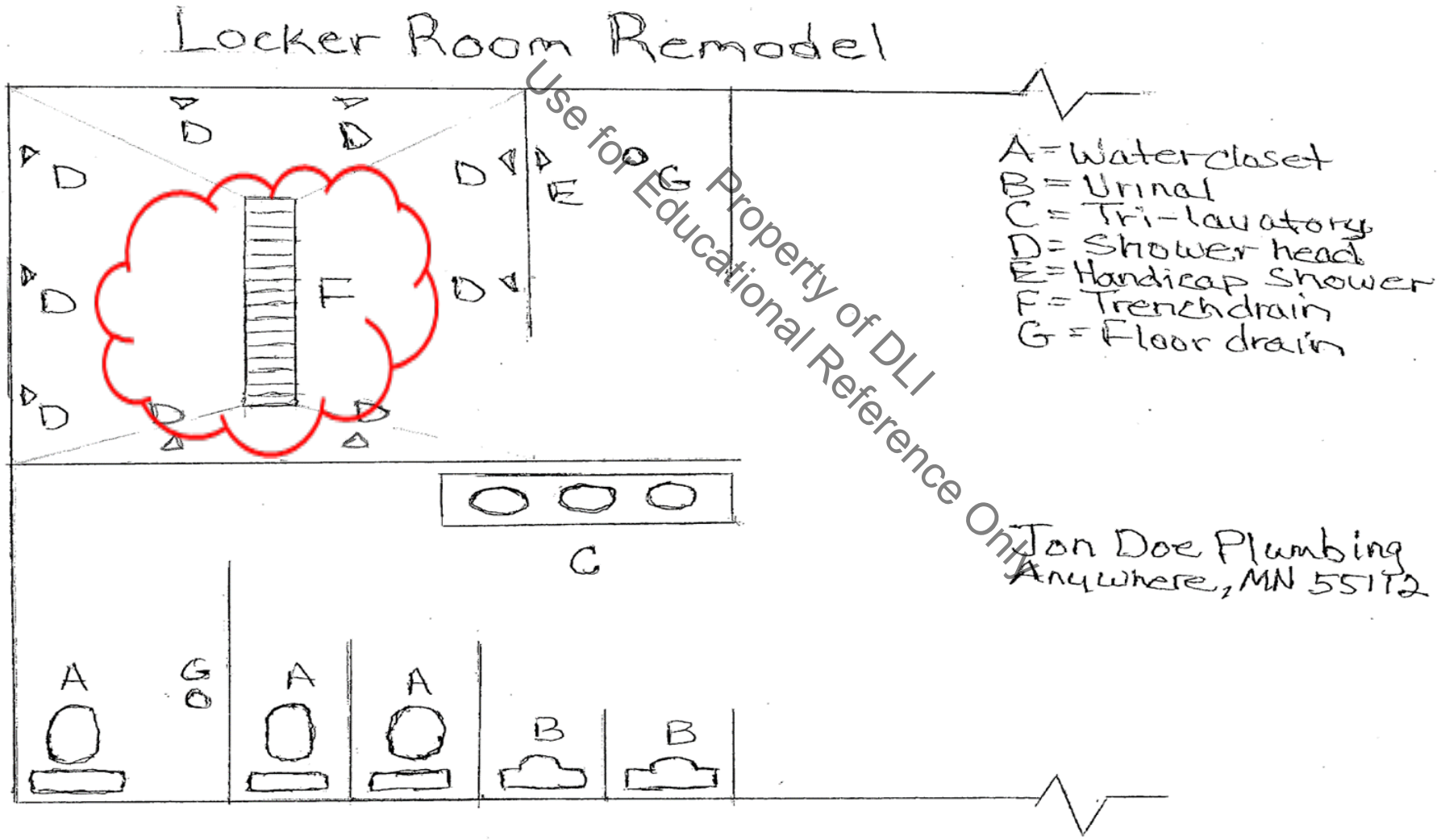
DWV Sizing Errors

- Based on the number of showers and lavatories being installed, a 1-1/2 inch vent is serving a total of 14 drainage fixture units. Since a 1-1/2 inch vent can only accommodate a maximum of 8 fixture units, this portion of the system is undersized (see Minnesota Rules, Chapter 4714, Table 703.2).
- There is a 1-1/2 inch vent through the roof serving the shower drains. Vent pipes shall be at least 2 inches in diameter through the roof and must terminate not less than 12 inches above the roof (see Minnesota Rules, Chapter 4714, Section 906.7).
- Nine shower heads total 10 drainage fixture units and are shown discharging through a 2-inch pipe. Since a 2-inch horizontal drain can only accommodate 8 fixture units at a slope of 1/4 inch per foot, this portion of the system is undersized (see Minnesota Rules, Chapter 4714, Table 703.2).
- The minimum water closet vent shall be two inches in size (see Minnesota Rules, part Chapter 4714, Table 703.2, Note 3).

DWV Errors



DWV Errors

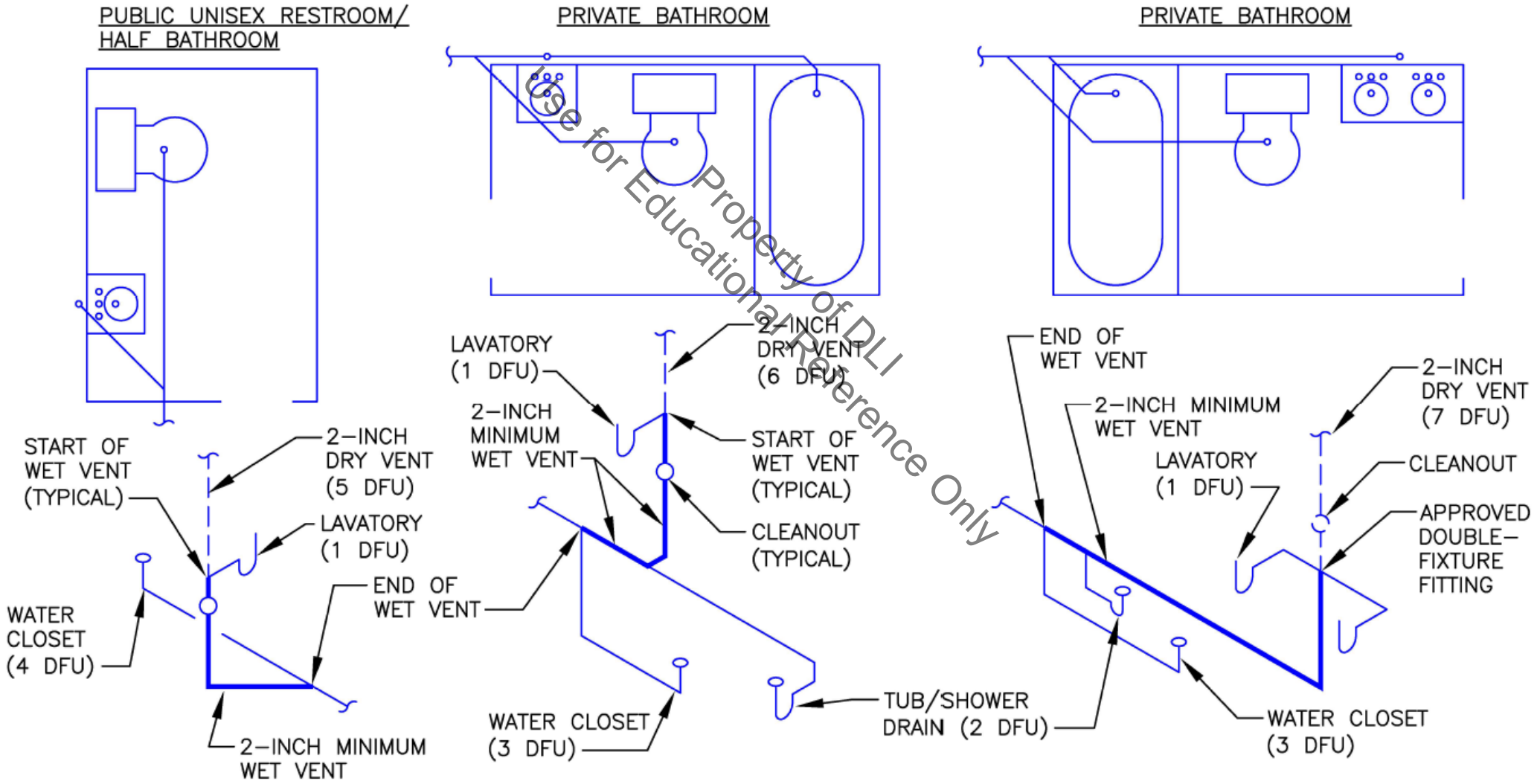
- For shower spaces not provided with individual waste outlets, the waste outlet must be located, and the floor pitched, so that wastewater from one bather does not pass over areas occupied by other bathers (see Minnesota Rules, Chapter 4714, Section 408.8).

Horizontal Wet Venting

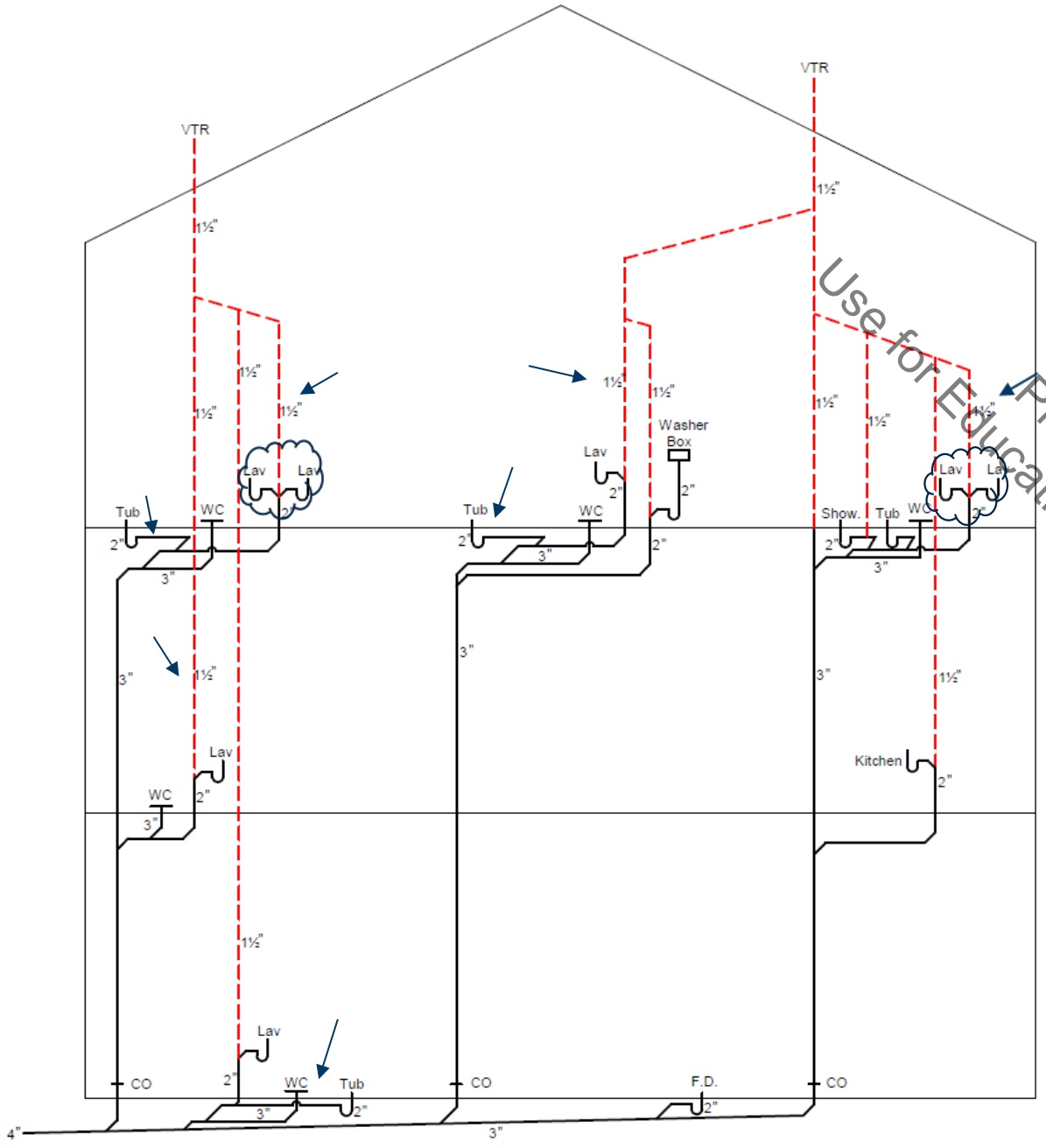
Horizontal wet venting is limited to a bathroom group located on the same floor level. A bathroom group includes any combination of the following fixtures: one water closet, two lavatories, one bathtub or bath/shower, one shower, a bidet, and emergency floor drain.

- The length of the trap arm must not exceed the limits of Table 1002.2
- The water closet connection must be downstream of all fixture connections to the horizontal wet vent
- Only one wet-vented fixture drain shall discharge upstream of the dry-vented fixture drain connection
- The dry vent must be sized based on the total fixture units discharging into the wet vent
- The wet vent must be sized based on the fixture unit discharge into the wet vent. The wet vent must be at least 2 inches in size for 4 DFU or less, and not less than 3 inches in size for 5 DFU or more.
- One or two vented lavatory(s) shall be permitted to serve as a wet vent.

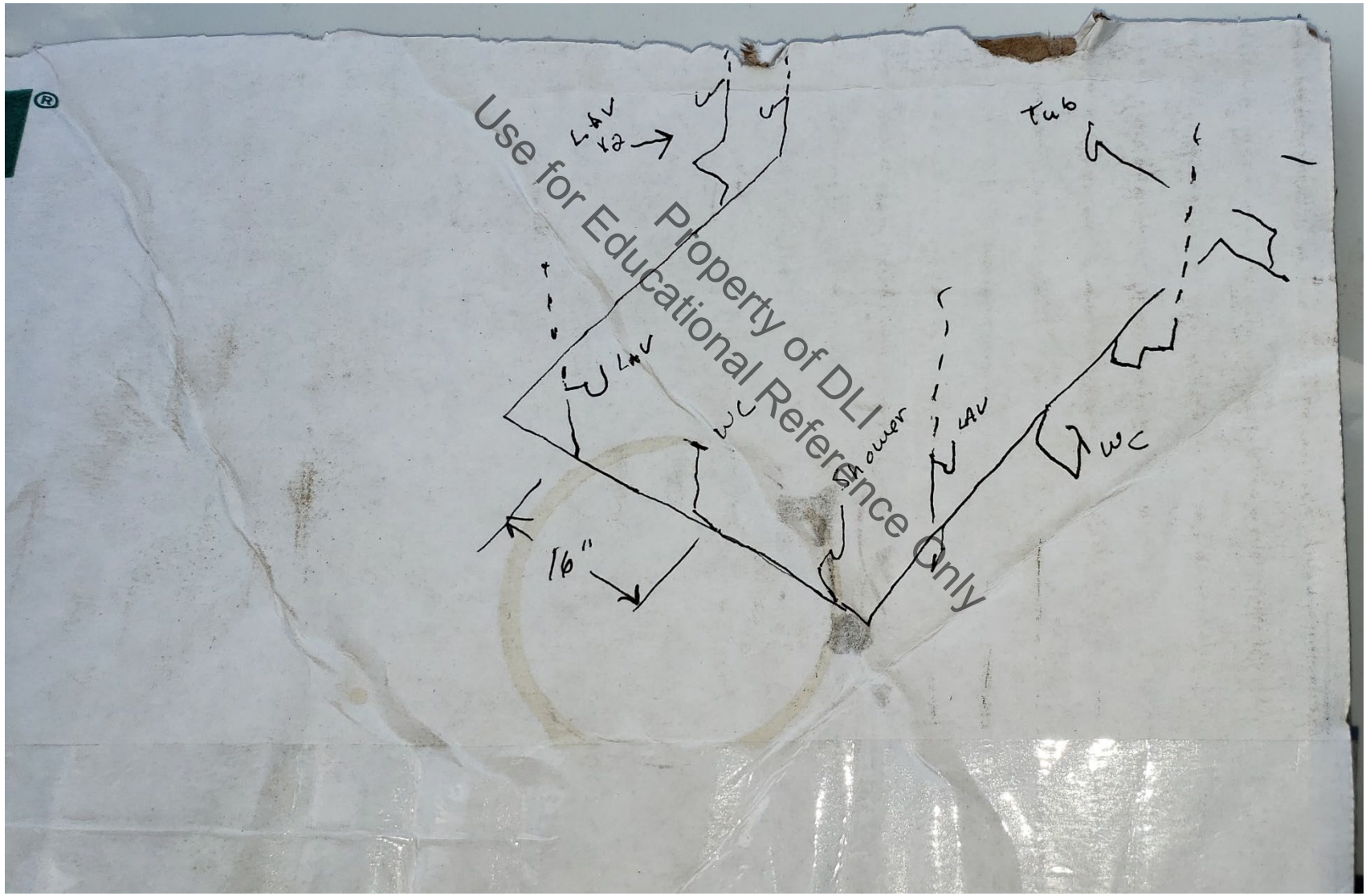
Horizontal Wet Venting



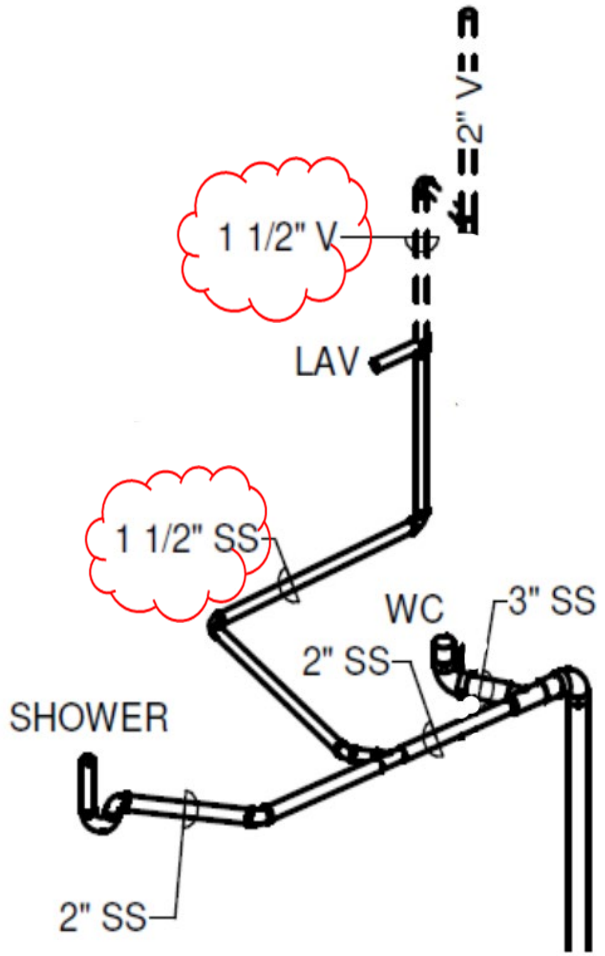
Horizontal Wet Venting

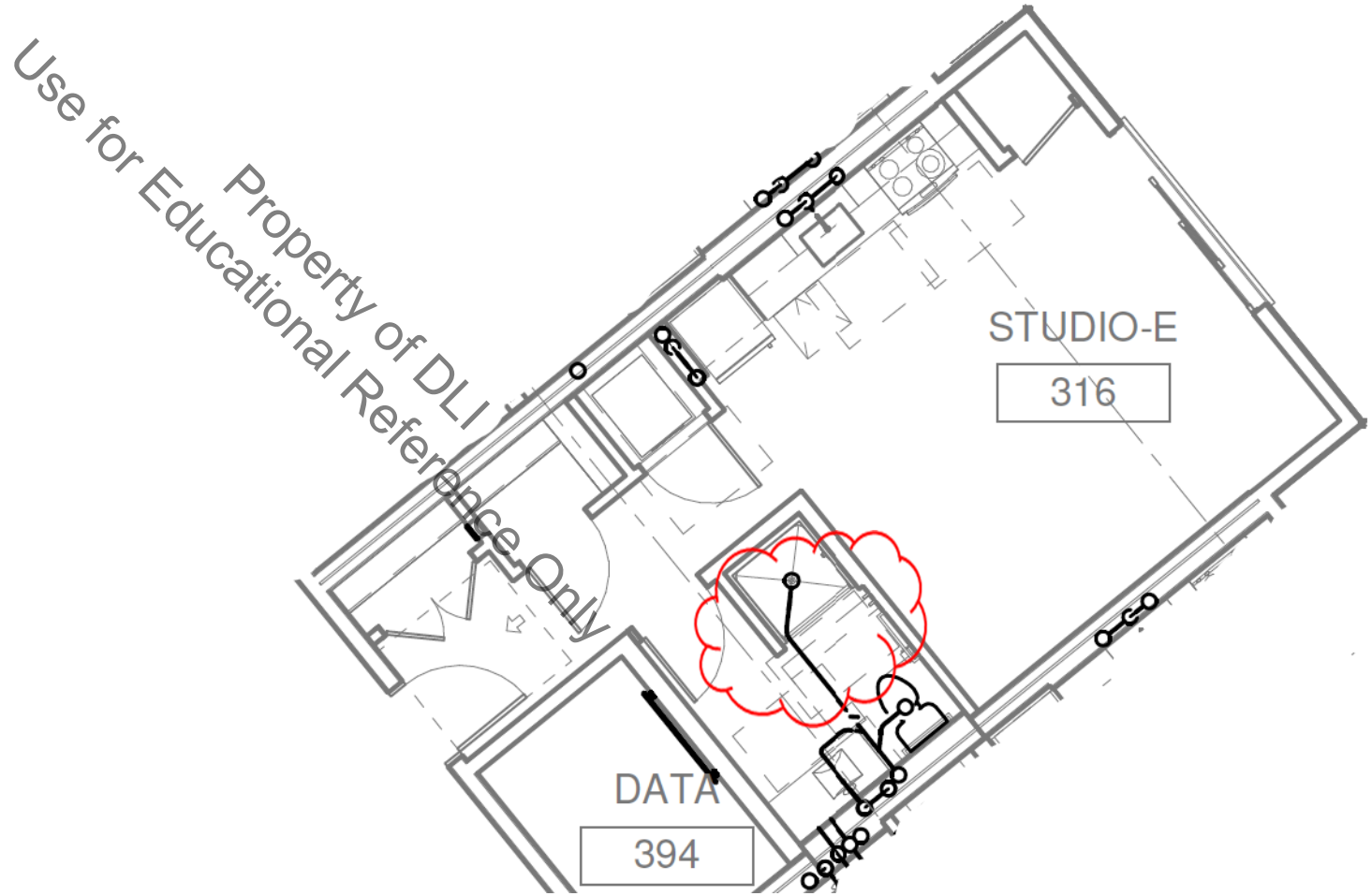


Horizontal Wet Venting



Horizontal Wet Venting





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CONSTRUCTION CODES AND LICENSING

Thank You!

Brad Williams

Bradley.Williams@state.mn.us