Name: _Solution_

1. For the project, Waste Management Hauling Facility and the drawing P1 Plumbing Plan provided, complete the following:

4 pts

A. Using a green, blue, and pink highlighter complete the following on the drawing provided:
   Cold Water Main – highlight green
   Cold Water Distribution – highlight blue
   Hot Water Distribution – highlight pink

15 pts

B. Use Table 382.40-2 Water Supply Fixture Units for Public Use (Wisconsin Plumbing Code) to complete the WSFU Table shown below. Water closets are Flushometer and urinals are Syphon Jet. The Mop Sink and Shop Sink are typical service sinks.

Water Supply Fixture Units							
Fixture	# of Fix.	HOT WSFU		COLD WSFU		TOTAL WSFU	
		EACH	THIS JOB	EACH	THIS JOB	EACH	THIS JOB
WC FM	5	—	—	6.5	32.5	6.5	32.5
LAV	6	0.5	3.0	0.5	3.0	1.0	6.0
SHO	2	2.0	4.0	2.0	4.0	3.0	6.0
KS	2	2.0	4.0	2.0	4.0	3.0	6.0
UR SJ	3	—	—	4.0	12.0	4.0	12.0
SS	1	2.0	2.0	2.0	2.0	3.0	3.0
MS	1	2.0	2.0	2.0	2.0	3.0	3.0
HB	8	—	—	3.0	24.0	3.0	24.0
TOTALS			15.0		83.5		92.5

3 pts

C. Use the Interpolation Method and the values from Using Table 382.40-3 Conversion of Water Supply Fixture Units to Gallons Per Minute to determine the Total GPM for the total building load. Show all work.

Total Building Load = ___92.5___ WSFU

$g_1 = 90$ $d_1 = 65$ $\left.\begin{array}{l} \end{array}\right\}$ Predominately Flushometer Type WC or Syphon Jet Urinals

$g_2 = 100$ $d_2 = 68$

$g = 92.5$ WSFU

$$d = d_1 + \frac{g - g_1}{g_2 - g_1}(d_2 - d_1)$$

$$= 65 + \frac{92.5 - 90}{100 - 90}(68 - 65) = 65.75 \text{ gpm}$$

1

8 pts D. Assign the load to the cold main immediately before the water heater
→ (total load downstream + hot load upstream)

Total Load Downstream

Fixture	Total WSFU
HB	3.0
LAV	1.0
LAV	1.0
UR	4.0
WC	6.5
WC	6.5
KS	3.0
TOTAL	25.0

Hot Load Upstream

Fixture	Hot WSFU
SS	2.0
LAV	0.5
LAV	0.5
LAV	0.5
LAV	0.5
KS	2.0
SHO	2.0
SHO	2.0
MS	2.0
TOTAL	12.0

Total Load Downstream __25.0__ + Hot Load Upstream __12.0__ = __37.0__ Total Cold Main

Before water heater

8 pts E. Assign the load to the cold main coming from the water meter.
→Total Load Upstream (all blue pipes from green main before water heater) – Hot Load (Same Fixtures)

Total Load Upstream

Fixture	Total WSFU
HB	3.0
HB	3.0
HB	3.0
HB	3.0
HB	3.0
SS	3.0
SHO	3.0
SHO	3.0
WC	6.5
WC	6.5
WC	6.5
UR	4.0
UR	4.0
LAV	1.0
LAV	1.0
LAV	1.0
LAV	1.0
KS	3.0
HB	3.0
HB	3.0
MS	3.0
TOTAL	67.5

Hot WSFU (Same Fixtures)

Fixture	Hot WSFU
SS	2.0
SHO	2.0
SHO	2.0
LAV	0.5
LAV	0.5
LAV	0.5
LAV	0.5
KS	2.0
MS	2.0
TOTAL	12.0

Total Load Upstream __67.5__ - Hot Load (Same Fixtures) __12.0__ = __55.5__

2 pts Total from D. __37.0__ + Total from E. __55.5__ = __92.5__ (Building Load)

1 pt. E F. Using a yellow and orange highlighter complete the following on the drawing provided:
Waste Pipe – highlight yellow
Waste Pipe Cleanouts – highlight orange

Using a blue pen circle the waste vent pipes

What size is the building's main waste pipe? ____4"____

What size are the main waste vent pipes? ____3"____

How many vents are shown? ____16____

What size are the waste pipes for the trench drains at the metal roll-up doors? ____3"____

G. What is the capacity of the water heater? ____60 gal____

H. How many floor drains are shown on the plan? ____2____

I. What size are the waste pipes for the floor drains? ____3"____

J. What type of pipe is specified on the drawing P1 for the hot and cold water piping?
Note 7. Hot and Cold water Piping shall be Type "L" Copper
P1 Plumbing Plan

K. What type of pipe is specified in the specifications (DIV15) for the hot and cold water piping?
Type "M" Copper or. PVC
15400 -2 , 2.3 A

L. What brands are specified for the fixtures, faucets, and drains in the specifications?
Crane, Eljer, Kohler, Speakman or Similar
15400 -2   2,1 D.

M. What brand in specified for the fixtures in Addendum #2?
American Standard

N. What is a hub drain?
A drain set into the floor that is connected to the drain pipe by means of a hub coupling. The end of the drain flares out like a funnel.

O. What type pipe is specified for sanitary, waste, and vent piping?
PVC, DWV schedule 40 or heavier with solvent Joints
15400 -2, 2.2 A.

2. Determine the Meter and Street Service size and the Building Supply size for the Dwelling shown. MDSSPA = 80 psi. The highest water outlet in the building is 12 feet above the source of supply. Pressure loss due to the meter is 5 psi. The water softener has a pressure loss of 9 psi. The maximum developed length of the piping between the source of supply and the furthest fixture is 140 feet. Each side of the house has a ½" hose bibb. The owner selected all the options as shown on the plan. Use 2016 California Plumbing Code.
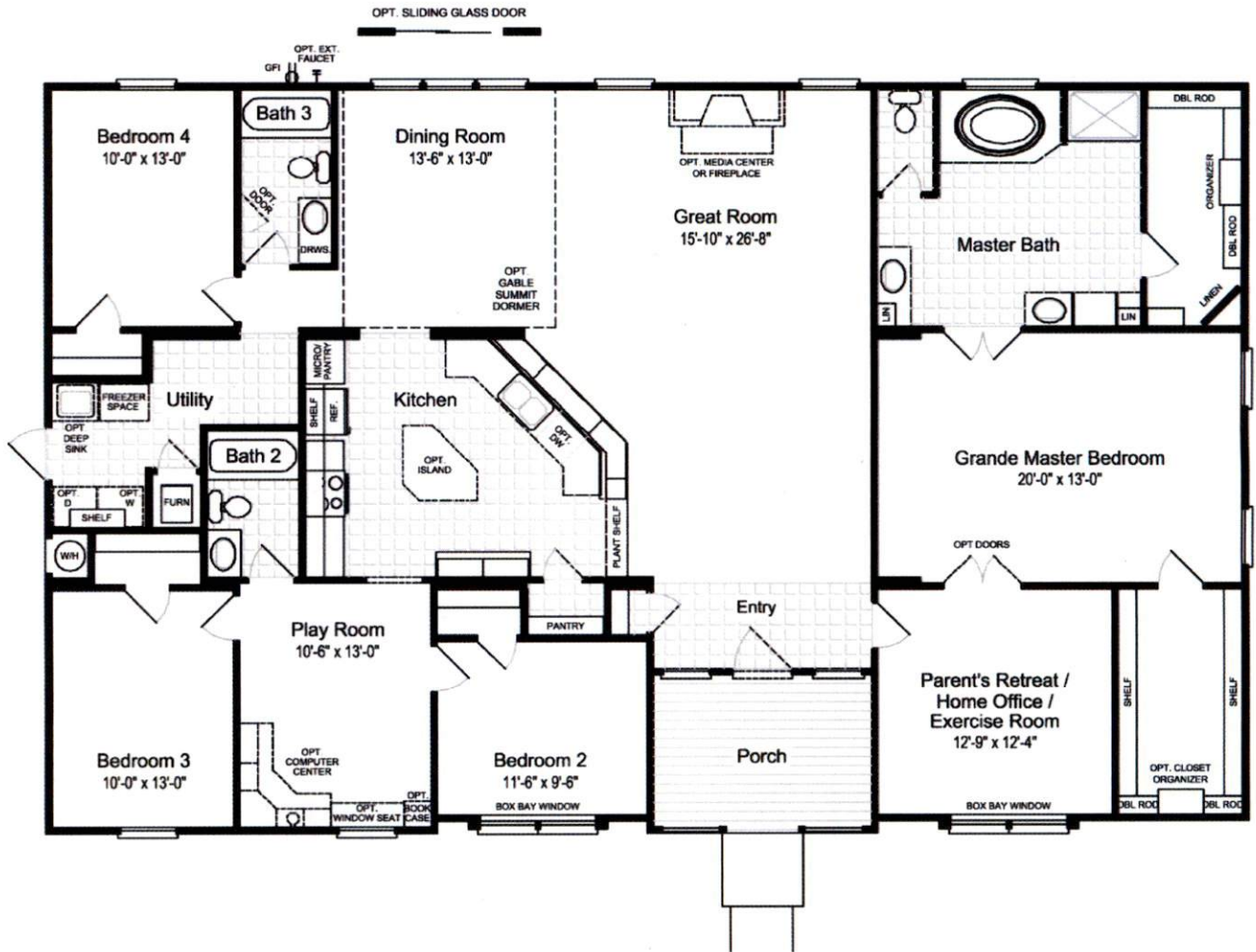
Step 1. Calculate the Available Water Pressure

$$\text{Available Pressure} = 80\,psi - (12\,ft \times 0.433\,\frac{psi}{ft}) - 5\,psi - 9\,psi$$

$$= 60.8\,psi$$

Step 2. Find the Effective Maximum Developed Length (DL) of Pipe

$$DL = 140\,ft \times 1.5 = 210\,ft$$

Step 3. Calculate the total WSFU

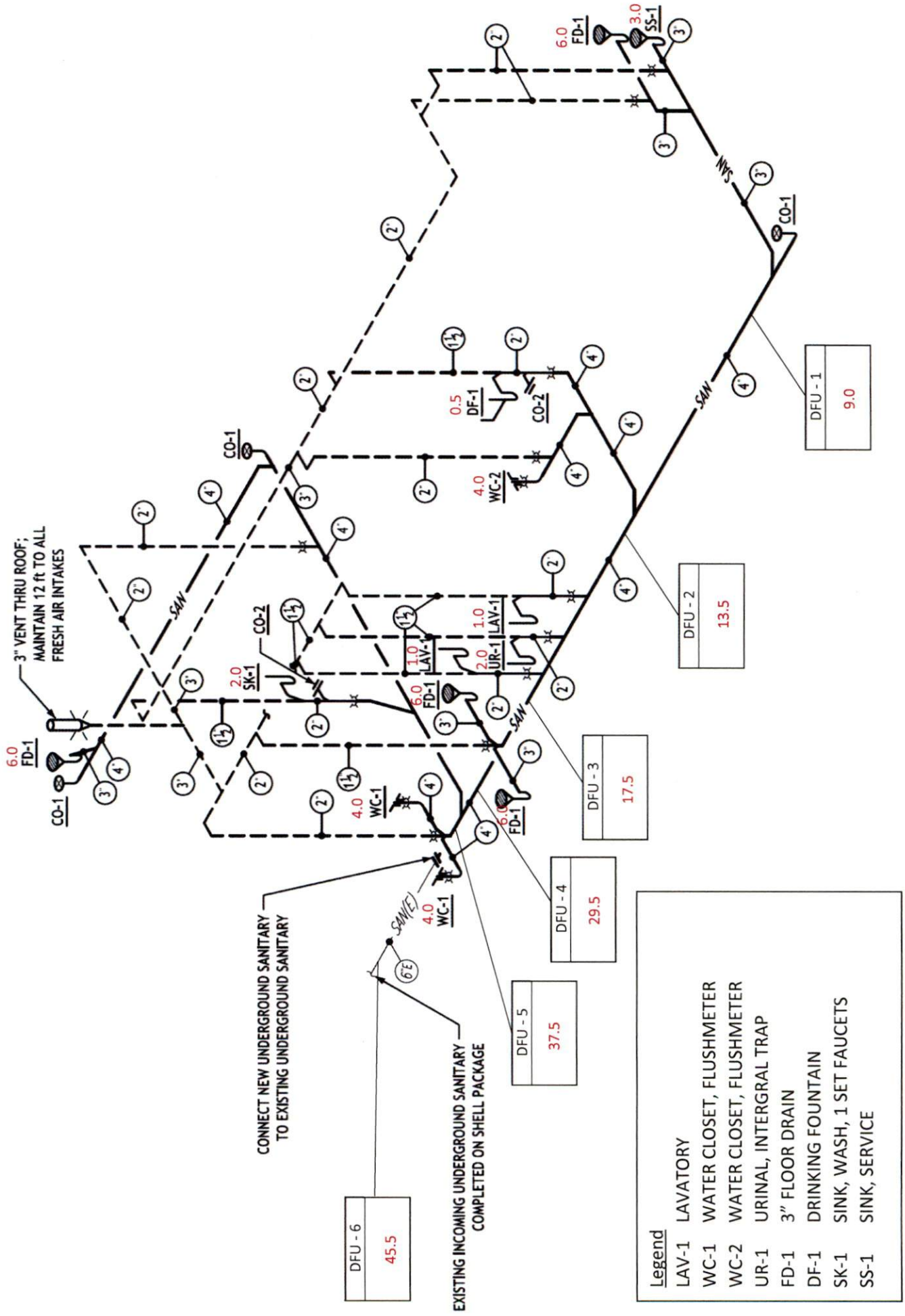| QTY	FIXTURE	WSFU	TOTAL WSFU
3	WC	2.5	7.5
2	BT/SHO	4.0	8.0
4	LAV	1.0	4.0
1	BT	4.0	4.0
1	SHO	2.0	2.0
1	KS	1.5	1.5
1	DW	1.5	1.5
1	LT	1.5	1.5
1	CW	4.0	4.0
4	HB	5.5	5.5
TOTAL WSFU			39.5

Step 4. Use the 2016 CPC Table 610.4 complete the table below for your results:

Pressure Range	Over 60 psi
Maximum Allowable Length	250 ft
Distribution Piping	Pipe Size (inches)
Meter and Street Service	1"
Building Supply	1 ¼"

46 to 60 psi
250 ft

1 ½"
1 ¼"

3. For the commercial building sanitary isometric shown place the DFU value next to each fixture. Place the DFU totals at the locations shown.

3" VENT THRU ROOF;
MAINTAIN 12 ft TO ALL
FRESH AIR INTAKES

6.0
FD-1

CO-1

3.0
SS-1

6.0
FD-1

0.5
DF-1

CO-2

4.0
WC-2

CO-1

2.0
SK-1

CO-2

1.0
LAV-1

1.0
LAV-1

2.0
UR-1

6.0
FD-1

4.0
WC-1

6.0
FD-1

4.0
WC-1

SAN(E)

| DFU - 1 | 9.0 |

| DFU - 2 | 13.5 |

| DFU - 3 | 17.5 |

| DFU - 4 | 29.5 |

| DFU - 5 | 37.5 |

| DFU - 6 | 45.5 |

CONNECT NEW UNDERGROUND SANITARY
TO EXISTING UNDERGROUND SANITARY

EXISTING INCOMING UNDERGROUND SANITARY
COMPLETED ON SHELL PACKAGE

Legend
LAV-1	LAVATORY
WC-1	WATER CLOSET, FLUSHMETER
WC-2	WATER CLOSET, FLUSHMETER
UR-1	URINAL, INTERGRAL TRAP
FD-1	3" FLOOR DRAIN
DF-1	DRINKING FOUNTAIN
SK-1	SINK, WASH, 1 SET FAUCETS
SS-1	SINK, SERVICE

10 pts 4. Determine the vertical and horizontal drain sizes for a building located in Wilmington, NC for the roof drain design shown. Use the 2016 CPC Appendix D rainfall rate with no amendments.
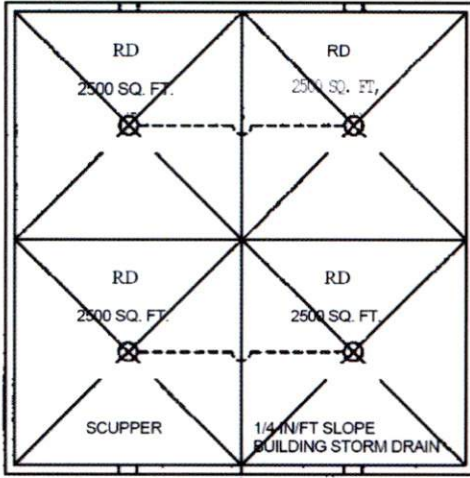
Rainfall Rate Wilmington, NC = 4.4 inches/hr

2500 sf per drain

Roof area = 10,000 sf

Table 1101.12

Drain	I(in/h)	
2"	2880 /4.4	= 636 sf
3"	8800 /4.4	= 2000 sf
4"	18400 /4.4	= 4182 sf ✓

Table 1101.8 - 1/4 in/ft slope

Horiz	I(in/h)	
3"	4640 /4.4	
4"	10,600 /4.4	= 2409 sf
5"	18 880 /4.4	= 4290 sf ✓
6"	30,200 /4.4	= 6864 sf
8"	65,200 /4.4	= 14818 sf

Show all calculations

A. Minimum Drain Size for the roof drainage design shown.

4" minimum drain

B. Minimum Horizontal Drain Size
Roof Area = 2500 sq. ft.

5" minimum horizontal drain pipe

Roof Area = 5000 sq. ft.

6" minimum

Roof Area = 10,000 sq. ft.

8" minimum

C. If one leader serves the entire roof area what is the minimum size pipe required?

Table 1101.12

6" $\frac{54000}{4.4}$ = 12,272 , but must be 8"
can't reduce in direction of flow

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