




STRUCTURES

VALMONT MICROFLECT  
3575 25th STREET  
SALEM, OR 97302  
PHONE: 1-800-547-2151  
ENGINEER: Jeff Grassman  
Reviewed by: 

# COMMUNICATION TOWER DESIGN CALCULATIONS



EXPIRES: 6/30/23

City of Portland  
VALMONT ORDER# 541305  
SITE NAME: Bull Run Filtration Facility  
TOWER HEIGHT: 180  
MODEL: 72-S940-180

Jeffrey E  
Grassman  Digitally signed by  
Jeffrey E Grassman  
Date: 2022.03.16  
09:35:55 -07'00'

## STRUCTURES

3/15/22

### ENGINEERING DATA

for

City of Portland  
Bull Run Filtration Facility  
VALMONT ORDER 541305

- 1) STRUCTURE DESIGN CONFORMS TO BOTH TIA-222-G & H (DUAL RATED) FOR:  
Vasd = 76 MPH, Vult = 105 MPH  
30 MPH ICE WIND (50 YR. RETURN PERIOD)  
DESIGN ICE THICKNESS = 1.50 INCHES  
EXPOSURE CATEGORY C  
STRUCTURE CLASSIFICATION / RISK CATEGORY III  
TOPOGRAPHIC CATEGORY 2, (H = 584'), "z" = 723'  
60 MPH BASIC WIND SPEED WITH NO ICE FOR TWIST AND SWAY  
SEISMIC SITE CLASS D, Ss = 0.758 & S1 = 0.331
- 2) TOWER BASE WIDTH (FT): 20.00
- 3) ALL MICROWAVE ASSUMED TO BE 6 GHz UNLESS OTHERWISE NOTED.
- 4) LOADING AS FOLLOWS:  
180.0' TOWER  
4 - 6' HIGH PERFORMANCE (w/PM) @ 180.0  
2 - MEDIUM YAGI (w/PM) @ 170.0  
2 - MEDIUM YAGI (w/PM) @ 160.0  
2 - MEDIUM YAGI (w/PM) @ 150.0  
2 - MEDIUM YAGI (w/PM) @ 140.0  
2 - MEDIUM YAGI (w/PM) @ 130.0  
1 - WHIP (2.5" X 6') (w/PM) @ 170.0  
1 - WHIP (2.5" X 6') (w/PM) @ 160.0  
1 - WHIP (2.5" X 6') (w/PM) @ 150.0  
1 - WHIP (2.5" X 6') (w/PM) @ 140.0  
1 - WHIP (2.5" X 6') (w/PM) @ 130.0  
1 - 36" Standoff @ 170.0  
1 - 36" Standoff @ 160.0  
1 - 36" Standoff @ 150.0  
1 - 36" Standoff @ 140.0  
1 - 36" Standoff @ 130.0
- 5) TOWER MODEL: 72-S940-180
- 6) TIA-222-G CONTROLS THE DESIGN OF THIS TOWER OVER TIA-222-H

STRUCTURE HEIGHT(FT):	180
OVERTURNING M (FT-K):	4901
BASE SHEAR (K):	48.65
BASE WEIGHT (K):	249.23
MAX. LEG SHEAR (K):	26.55
MAX. LEG UPLIFT (K):	274.71
MAX. LEG DOWN (K):	292.11

## STRUCTURES

BY \_\_\_\_\_ DATE \_\_\_\_\_  
 CHKD. BY \_\_\_\_\_ DATE \_\_\_\_\_

SHEET NO. \_\_\_\_\_

3/15/22

### ENGINEERING DATA

for

**City of Portland**  
**Bull Run Filtration Facility**  
**VALMONT ORDER 541305**  
**EIA/TIA-222-G**

BASIC WIND:	85.0 MPH	DESIGN ICE THICKNESS:	1.5 IN.
WIND & ICE:	30.0 MPH	EXPOSURE CATEGORY:	C
TWIST & SWAY:	60.0 MPH	STRUCTURE CLASS.:	III
S <sub>s</sub> :	0.76	TOPOGRAPHIC CATEGORY:	1
S <sub>t</sub> :	0.33		

QTY DESCRIPTION	HEIGHT	DATA W.O. ICE		DATA W/ ICE	
		EPA	WT	EPA	WT
4 6' HIGH PERFORMANCE (w/PI @ 180.0'		150.20	1428	197.64	7140
2 MEDIUM YAGI (w/PM) @ 170.0'	@ 170.0'	9.36	76	29.52	346
2 MEDIUM YAGI (w/PM) @ 160.0'	@ 160.0'	9.36	76	29.40	344
2 MEDIUM YAGI (w/PM) @ 150.0'	@ 150.0'	9.36	76	29.28	342
2 MEDIUM YAGI (w/PM) @ 140.0'	@ 140.0'	9.36	76	29.14	338
2 MEDIUM YAGI (w/PM) @ 130.0'	@ 130.0'	9.36	76	28.98	336
1 WHIP (2.5" X 6') (w/PM) @ 170.0'	@ 170.0'	2.08	31	6.47	394
1 WHIP (2.5" X 6') (w/PM) @ 160.0'	@ 160.0'	2.08	31	6.44	390
1 WHIP (2.5" X 6') (w/PM) @ 150.0'	@ 150.0'	2.08	31	6.41	386
1 WHIP (2.5" X 6') (w/PM) @ 140.0'	@ 140.0'	2.08	31	6.39	383
1 WHIP (2.5" X 6') (w/PM) @ 130.0'	@ 130.0'	2.08	31	6.36	379
1 36" Standoff @ 170.0'	@ 170.0'	3.28	37	8.65	485
1 36" Standoff @ 160.0'	@ 160.0'	3.28	37	8.62	481
1 36" Standoff @ 150.0'	@ 150.0'	3.28	37	8.60	477
1 36" Standoff @ 140.0'	@ 140.0'	3.28	37	8.57	473
1 36" Standoff @ 130.0'	@ 130.0'	3.28	37	8.54	468





TOWER POINT LOAD DATA ENTRY

LOAD DESCRIPTION	ATTACHMENT			-CENTROID-		-WITHOUT ICE-		--WITH ICE--	
	HT. (FT)	LEGS 1 2 3		HT. (FT)	ECC (FT)	EPA (FT**2)	WT. (LBS)	EPA (FT**2)	WT. (LBS)
4-6' HIGH PERFORMANC	180	X X X		180	0.00	150.20	1428	207.48	8376
2-MEDIUM YAGI	170	X X		170	0.00	9.36	76	33.58	434
2-MEDIUM YAGI	160	X X		160	0.00	9.36	76	33.50	434
2-MEDIUM YAGI	150	X X		150	0.00	9.36	76	33.44	432
2-MEDIUM YAGI	140	X X		140	0.00	9.36	76	33.36	430
2-MEDIUM YAGI	130	X X		130	0.00	9.36	76	33.26	428
1-WHIP (2.5" X 6')	170	X		173	0.00	2.08	31	7.32	529
1-WHIP (2.5" X 6')	160	X		163	0.00	2.08	31	7.31	528
1-WHIP (2.5" X 6')	150	X		153	0.00	2.08	31	7.29	525
1-WHIP (2.5" X 6')	140	X		143	0.00	2.08	31	7.28	522
1-WHIP (2.5" X 6')	130	X		133	0.00	2.08	31	7.26	519
1-36" Standoff	170	X		170	0.00	3.28	37	9.37	619
1-36" Standoff	160	X		160	0.00	3.28	37	9.36	617
1-36" Standoff	150	X		150	0.00	3.28	37	9.35	614
1-36" Standoff	140	X		140	0.00	3.28	37	9.34	612
1-36" Standoff	130	X		130	0.00	3.28	37	9.32	609

TOWER LINEAR LOAD DATA ENTRY

LOAD DESCRIPTION	APPLIED TO LEGS			HEIGHT (FT)		-WITHOUT ICE-		--WITH ICE--	
	1	2	3	START	END	EPA/FT (FT**2)	WT/FT (LBS)	EPA/FT (FT**2)	WT/FT (LBS)
(3) [0-20] SB's	X	X	X	0	20	0.18	3.0	0.27	4.5
(3) [20-40] SB's	X	X	X	20	40	0.18	3.0	0.27	4.5
(3) [40-60] SB's	X	X	X	40	60	0.18	3.0	0.27	4.5
(3) [60-80] SB's	X	X	X	60	80	0.18	3.0	0.27	4.5
(3) [80-100] SB's	X	X	X	80	100	0.18	3.0	0.27	4.5
(1) [0-20] 900 Climbin	X	X		0	20	0.40	6.8	1.37	86.1
(1) [20-40] 900 Climbi	X	X		20	40	0.40	6.8	1.42	99.2
(1) [40-60] 900 Climbi	X	X		40	60	0.40	6.8	1.45	105.2
(1) [60-80] 900 Climbi	X	X		60	80	0.40	6.8	1.46	108.9
(1) [80-100] 900 Climbi	X	X		80	100	0.40	6.8	1.47	111.7
(1) [100-120] 900 Clim	X	X		100	120	0.40	6.8	1.48	113.6
(1) [120-140] 900 Clim	X	X		120	140	0.40	6.8	1.49	115.1
(1) [140-160] 900 Clim	X	X		140	160	0.40	6.8	1.49	116.2
(1) [160-180] 900 Clim	X	X		160	180	0.40	6.8	1.49	117.1
(1) [0-20] Stack WG Ld	X	X		0	20	1.02	14.6	3.05	215.6
(1) [20-40] Stack WG L	X	X		20	40	1.02	14.6	3.11	234.6
(1) [40-60] Stack WG L	X	X		40	60	1.02	14.6	3.14	243.4
(1) [60-80] Stack WG L	X	X		60	80	1.02	14.6	3.16	248.9
(1) [80-100] Stack WG	X	X		80	100	1.02	14.6	3.18	252.8
(1) [100-120] Stack WG	X	X		100	120	1.02	14.6	3.19	255.6
(1) [120-140] Stack WG	X	X		120	140	1.02	14.6	3.19	257.7
(1) [140-160] Stack WG	X	X		140	160	1.02	14.6	3.20	259.4
(1) [160-180] Stack WG	X	X		160	180	1.02	14.6	3.20	260.6

TOWER INITIAL SECTION DATA ENTRY

TOP SECTION DATA

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STANDARD DESIGNATION: (N/A)                MEMBER ITYPE NUMBERS
TOP FACE WIDTH (IN) :72.00                LEGS      : 662
BRACING PATTERN      : TA                 DIAGONALS : 1
NUMBER OF BAYS       : 4                 HORIZONTALS: 7
TAPER RATE (IN/FT)  : 0.0              REDUNDANTS : 0
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TOWER MIDDLE AND BOTTOM SECTION DATA ENTRY

SECTION LOCATION FROM TOP	STD. DES.	LENGTH (FT)	TAPER	BRACING PATTERN NO.	NO. OF BAYS	MEMBER ITYPE NUMBERS			
						LEGS	DIAG	HORZ	RED.
2		20	CONT.	TA	4	664	3	0	0
3		20	1.200	TA	3	666	3	0	0
4		20	CONT.	TA	3	666	7	0	0
5		20	CONT.	TA	2	667	12	0	0
6		20	CONT.	TA	2	668	12	0	0
7		20	CONT.	TA	2	668	13	0	0
8		20	CONT.	TA	2	668	18	0	0
9		20	CONT.	TA	2	668	18	0	0

SUBJECT: 180.0 FT SELF-SUPPORTING TOWER, SITE: BULL RUN FILTRATION FACILITY  
 City of Portland

+-GROUP-+		+---MAXIMUM FORCES-----+				+---MEMBER DESCRIPTION--+			+-% OF CAPACITY-+		
NO.	DESC.	COMP.	LC	TENS.	LC	TYP	+-SIZE (IN)--+	FY	KL/R	MEMB.	CONN.
		(KIPS)		(KIPS)				(KSI)			
1	1 L	-32.06	W11	26.06	1C2	TPI	2.88 x 0.2030	50.0	63	63	
2	1 D	-5.06	W12	5.16	W12	A90	1.75 x 0.1875	36.0	123	56	67
3	2 L	-83.87	W11	69.38	1C2	TPI	4.00 x 0.2260	50.0	45	81	
4	2 D	-7.71	W12	7.82	W12	A90	2.00 x 0.1875	36.0	113	65	89
5	3 L	-114.65	W11	93.97	1B2	TPI	5.56 x 0.2580	50.0	43	68	
6	3 D	-8.20	1A1	8.00	1A2	A90	2.00 x 0.1875	36.0	126	81	
7	3 D	-6.89	1A2	7.09	W11	A90	2.00 x 0.1875	36.0	132	74	
8	3 D	-7.01	W11	6.68	1A2	A90	2.00 x 0.1875	36.0	138	82	94
9	4 L	-148.40	W11	120.91	1C2	TPI	5.56 x 0.2580	50.0	43	88	
10	4 D	-5.94	1A2	6.51	W11	A90	2.50 x 0.1875	36.0	121	44	
11	4 D	-6.40	W11	5.77	1A2	A90	2.50 x 0.1875	36.0	126	51	
12	4 D	-5.55	1C2	5.96	W11	A90	2.50 x 0.1875	36.0	131	47	66
13	5 L	-174.39	W11	141.01	1C2	TPI	6.62 x 0.2800	50.0	53	86	
14	5 D	-7.69	W11	6.96	1C2	A90	3.00 x 0.1875	36.0	138	60	
15	5 D	-6.78	1C2	6.96	W11	A90	3.00 x 0.1875	36.0	146	59	79
16	6 L	-201.96	W11	161.74	1C2	TPI	8.62 x 0.3220	50.0	41	60	
17	6 D	-7.83	W11	7.33	1C2	A90	3.00 x 0.1875	36.0	152	73	
18	6 D	-7.28	1C2	7.28	W11	A90	3.00 x 0.1875	36.0	160	76	80
19	7 L	-229.82	W11	182.44	1C2	TPI	8.62 x 0.3220	50.0	41	69	
20	7 D	-8.24	W11	7.90	1C2	A90	3.00 x 0.2500	36.0	170	73	
21	7 D	-7.89	1C2	7.78	W11	A90	3.00 x 0.2500	36.0	178	77	63
22	8 L	-258.00	W11	203.14	1C2	TPI	8.62 x 0.3220	50.0	41	77	
23	8 D	-8.76	W11	8.52	1C2	A90	3.50 x 0.2500	36.0	150	52	
24	8 D	-8.56	1C2	8.38	W11	A90	3.50 x 0.2500	36.0	156	55	67
25	9 L	-286.73	W11	224.12	1C2	TPI	8.62 x 0.3220	50.0	41	86	
26	9 D	-9.46	W11	9.27	1C2	A90	3.50 x 0.2500	36.0	162	65	
27	9 D	-9.39	1C2	9.17	W11	A90	3.50 x 0.2500	36.0	168	69	72

ROTATION (DEGREES) OF TOP OF TOWER CAUSED BY LOAD CASE 3

MAX. TWIST = 0.19 CORRESPONDING SWAY = 0.62 WIND DIRECTION = 120 DEG.\*  
 MAX. SWAY = 0.62 CORRESPONDING TWIST = 0.18 WIND DIRECTION = 90 DEG.\*

MAXIMUM LEG REACTIONS (KIPS) AT BASE OF TOWER

RESULTANT HORIZONTAL SHEAR FORCE = 26.55  
 DOWNWARD FORCE = 292.11  
 UPWARD FORCE = 274.71

MAXIMUM TOWER REACTIONS AT BASE OF TOWER

MAXIMUM OVERTURNING MOMENT = 4901 FOOT-KIPS  
 MAXIMUM RESULTANT HORIZONTAL SHEAR FORCE = 48.65 KIPS  
 MAXIMUM RESULTANT VERTICAL SHEAR FORCE = 249.23 KIPS  
 TOWER WIDTH AT BOTTOM : 20.00 FEET  
 LEG & TOWER BASE REACTIONS- 90 DEGREE WIND

	CASE			
	I- G 1	I- G 2	II- G 3	SERVICE
HORIZONTAL LEG SHEAR(KIPS)	26.55	26.41	10.14	9.40
LEG DOWNWARD FORCE(KIPS)	292.11	289.87	136.13	104.84
LEG UPWARD FORCE(KIPS)	272.03	274.71	-30.02	88.01
TOWER OVERTURNING MOM. (FT-KIPS)	4901	4901	1130	1682
TOWER HORIZONTAL SHEAR(KIPS)	48.65	48.65	10.96	16.73
TOWER VERTICAL SHEAR(KIPS)	30.13	22.73	249.23	25.25

TOWER HORIZONTAL SHEAR FOR THE SEISMIC CASE(KIPS): 4.22

TOTAL STRUCTURE DEAD WEIGHT = 19196 LBS.

\* WIND DIRECTION IS THE DIRECTION TOWARD WHICH THE WIND IS BLOWING.  
 IT IS MEASURED FROM THE +X AXIS, WHICH IS PARALLEL TO THE FACE OF THE  
 STRUCTURE THAT CONTAINS LEGS 1 AND 2. LEG 3 IS ON THE Y AXIS (AT 90 DEG.).

CODE-RELATED DATA FOR  
 ##### EIA - G #####

COEFFICIENTS AND EXPONENTS, IN ORDER, FITTING THE EQUATION  
 $C2 * B^{E2} + C1 * B^{E1} + C0 * B^{E0}$

FORCE COEFFICIENT:	3.400	-4.700	3.400	2.000	1.000	0.000
RND. REDUC. FCTR.-SUBCRITICAL	-0.140	0.860	-0.240	1.000	2.000	3.000
THE ABOVE + CONSTANT	0.570					
RND. REDUC. FCTR.-CRITICAL	0.260	0.970	-0.063	1.000	2.000	3.000
THE ABOVE + CONSTANT	0.360					

In the above, B is Solidity Ratio.

MAXIMUM CONNECTION CSR VALUES

SECTION\ \MEMBER TYPE	DIAGONAL	HORIZONTAL	WIND BRACE	REDUNDANT
1	0.665	0.000	0.000	0.350
2	0.891	0.000	0.000	0.000
3	0.935	0.000	0.000	0.000
4	0.665	0.000	0.000	0.000
5	0.785	0.000	0.000	0.000
6	0.800	0.000	0.000	0.000
7	0.631	0.000	0.000	0.000
8	0.671	0.000	0.000	0.000
9	0.725	0.000	0.000	0.000

ANCHOR BOLT CLUSTER CALCULATIONS

NUMBER OF BOLTS = 6  
ECCENTRIC MOMENT ARM = 0.00  
BOLT TENSILE STRESS = 75.  
BOLT DIAMETER = 1.500  
BOLT CIRCLE = 13.25

CALCULATED STRESS / ALLOWABLE 0.636

SECTION	CHECK OF REDUNDANT MEMBERS		CSR
	REDUN. AXIAL STRENGTH	RQD. RESISTANCE LOAD	
1	17.885	0.576	0.03

DETAILED TOWER POINT LOAD DATA

NO ICE EPA AND WEIGHT DATA:

Description	Ka	ANTENNA/MOUNT		PIPE MOUNT		TOTAL	ICE Thick.	WIND Angle
		(EPA)n	(EPA)t	(EPA)n	(EPA)t	(EPA)a		
6' HIGH PERFORMANCE	1.00	35.67	35.67	1.88	1.88	37.55	0.00	0
MEDIUM YAGI	1.00	2.47	4.10	0.58	0.58	4.68	0.00	90
MEDIUM YAGI	1.00	2.47	4.10	0.58	0.58	4.68	0.00	90
MEDIUM YAGI	1.00	2.47	4.10	0.58	0.58	4.68	0.00	90
MEDIUM YAGI	1.00	2.47	4.10	0.58	0.58	4.68	0.00	90
MEDIUM YAGI	1.00	2.47	4.10	0.58	0.58	4.68	0.00	90
WHIP (2.5" X 6')	1.00	1.50	1.50	0.58	0.58	2.08	0.00	90
WHIP (2.5" X 6')	1.00	1.50	1.50	0.58	0.58	2.08	0.00	90
WHIP (2.5" X 6')	1.00	1.50	1.50	0.58	0.58	2.08	0.00	90
WHIP (2.5" X 6')	1.00	1.50	1.50	0.58	0.58	2.08	0.00	90
WHIP (2.5" X 6')	1.00	1.50	1.50	0.58	0.58	2.08	0.00	90
36" Standoff	1.00	0.62	3.28	0.00	0.00	3.28	0.00	90
36" Standoff	1.00	0.62	3.28	0.00	0.00	3.28	0.00	90
36" Standoff	1.00	0.62	3.28	0.00	0.00	3.28	0.00	90
36" Standoff	1.00	0.62	3.28	0.00	0.00	3.28	0.00	90
36" Standoff	1.00	0.62	3.28	0.00	0.00	3.28	0.00	90

ICE EPA AND WEIGHT DATA:

Description	Ka	ANTENNA/MOUNT		PIPE MOUNT		TOTAL	ICE Thick.	WIND Angle
		(EPA)n	(EPA)t	(EPA)n	(EPA)t	(EPA)a		
6' HIGH PERFORMANCE	1.00	46.99	46.99	4.88	4.88	51.87	5.32	0
MEDIUM YAGI	1.00	5.22	14.49	2.29	2.29	16.79	5.31	90
MEDIUM YAGI	1.00	5.21	14.47	2.29	2.29	16.75	5.29	90
MEDIUM YAGI	1.00	5.21	14.44	2.28	2.28	16.72	5.28	90
MEDIUM YAGI	1.00	5.20	14.40	2.28	2.28	16.68	5.26	90
MEDIUM YAGI	1.00	5.19	14.36	2.27	2.27	16.63	5.24	90
WHIP (2.5" X 6')	1.00	5.03	5.03	2.29	2.29	7.32	5.31	90
WHIP (2.5" X 6')	1.00	5.02	5.02	2.29	2.29	7.31	5.30	90
WHIP (2.5" X 6')	1.00	5.01	5.01	2.28	2.28	7.29	5.28	90
WHIP (2.5" X 6')	1.00	5.00	5.00	2.28	2.28	7.28	5.26	90
WHIP (2.5" X 6')	1.00	4.99	4.99	2.27	2.27	7.26	5.25	90
36" Standoff	1.00	3.06	9.37	0.00	0.00	9.37	5.31	90
36" Standoff	1.00	3.06	9.36	0.00	0.00	9.36	5.29	90
36" Standoff	1.00	3.05	9.35	0.00	0.00	9.35	5.28	90
36" Standoff	1.00	3.05	9.34	0.00	0.00	9.34	5.26	90
36" Standoff	1.00	3.04	9.32	0.00	0.00	9.32	5.24	90

DETAILED TOWER LINEAR LOAD DATA

NO ICE EPA AND WEIGHT DATA:

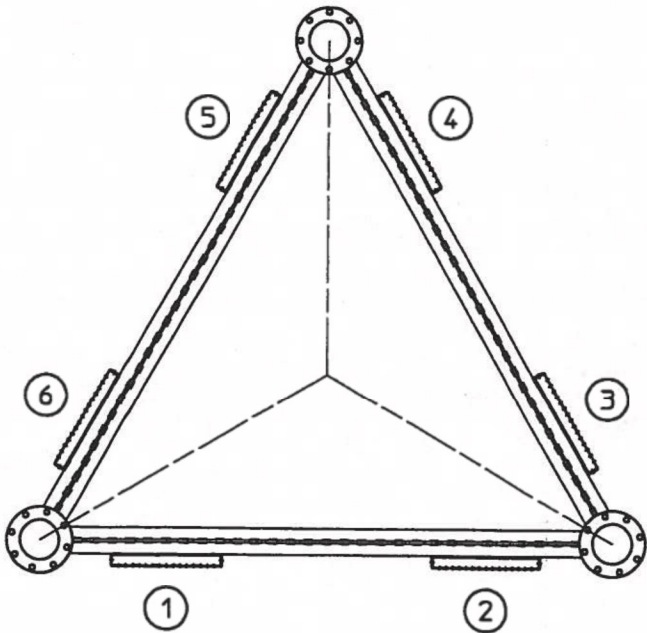
Description	Ka	(EPA)n	(EPA)t	(EPA)a	ICE Thick.	WIND Angle
[0-20] SB's	0.60	0.10	0.10	0.06	0.00	0
[20-40] SB's	0.60	0.10	0.10	0.06	0.00	0
[40-60] SB's	0.60	0.10	0.10	0.06	0.00	0
[60-80] SB's	0.60	0.10	0.10	0.06	0.00	0
[80-100] SB's	0.60	0.10	0.10	0.06	0.00	0
[0-20] 900 Climbing Ladder	0.60	0.18	0.67	0.40	0.00	90
[20-40] 900 Climbing Ladder	0.60	0.18	0.67	0.40	0.00	90
[40-60] 900 Climbing Ladder	0.60	0.18	0.67	0.40	0.00	90
[60-80] 900 Climbing Ladder	0.60	0.18	0.67	0.40	0.00	90
[80-100] 900 Climbing Ladder	0.60	0.18	0.67	0.40	0.00	90
[100-120] 900 Climbing Ladder	0.60	0.18	0.67	0.40	0.00	90
[120-140] 900 Climbing Ladder	0.60	0.18	0.67	0.40	0.00	90
[140-160] 900 Climbing Ladder	0.60	0.18	0.67	0.40	0.00	90
[160-180] 900 Climbing Ladder	0.60	0.18	0.67	0.40	0.00	90
[0-20] Stack WG Ldr, 14-hole (24-7/8")	0.60	1.70	0.81	1.02	0.00	0
[20-40] Stack WG Ldr, 14-hole (24-7/8"	0.60	1.70	0.81	1.02	0.00	0
[40-60] Stack WG Ldr, 14-hole (24-7/8"	0.60	1.70	0.81	1.02	0.00	0
[60-80] Stack WG Ldr, 14-hole (24-7/8"	0.60	1.70	0.81	1.02	0.00	0
[80-100] Stack WG Ldr, 14-hole (24-7/8"	0.60	1.70	0.81	1.02	0.00	0
[100-120] Stack WG Ldr, 14-hole (24-7/8"	0.60	1.70	0.81	1.02	0.00	0
[120-140] Stack WG Ldr, 14-hole (24-7/8"	0.60	1.70	0.81	1.02	0.00	0
[140-160] Stack WG Ldr, 14-hole (24-7/8"	0.60	1.70	0.81	1.02	0.00	0
[160-180] Stack WG Ldr, 14-hole (24-7/8"	0.60	1.70	0.81	1.02	0.00	0

ICE EPA AND WEIGHT DATA:

Description	Ka	(EPA)n	(EPA)t	(EPA)a	ICE Thick.	WIND Angle
[0-20] SB's	0.60	0.15	0.15	0.09	4.26	0
[20-40] SB's	0.60	0.15	0.15	0.09	4.71	0
[40-60] SB's	0.60	0.15	0.15	0.09	4.91	0
[60-80] SB's	0.60	0.15	0.15	0.09	5.04	0
[80-100] SB's	0.60	0.15	0.15	0.09	5.13	0
[0-20] 900 Climbing Ladder	0.60	2.12	2.28	1.37	4.26	90
[20-40] 900 Climbing Ladder	0.60	2.27	2.37	1.42	4.71	90
[40-60] 900 Climbing Ladder	0.60	2.32	2.41	1.45	4.91	90
[60-80] 900 Climbing Ladder	0.60	2.35	2.44	1.46	5.04	90
[80-100] 900 Climbing Ladder	0.60	2.36	2.46	1.47	5.13	90
[100-120] 900 Climbing Ladder	0.60	2.37	2.47	1.48	5.19	90
[120-140] 900 Climbing Ladder	0.60	2.37	2.48	1.49	5.24	90
[140-160] 900 Climbing Ladder	0.60	2.38	2.49	1.49	5.28	90
[160-180] 900 Climbing Ladder	0.60	2.38	2.49	1.49	5.31	90
[0-20] Stack WG Ldr, 14-hole (24-7/8")	0.60	5.08	2.68	3.05	4.26	0
[20-40] Stack WG Ldr, 14-hole (24-7/8"	0.60	5.19	2.83	3.11	4.71	0
[40-60] Stack WG Ldr, 14-hole (24-7/8"	0.60	5.24	2.90	3.14	4.91	0
[60-80] Stack WG Ldr, 14-hole (24-7/8"	0.60	5.27	2.94	3.16	5.04	0
[80-100] Stack WG Ldr, 14-hole (24-7/8"	0.60	5.29	2.97	3.18	5.13	0
[100-120] Stack WG Ldr, 14-hole (24-7/8"	0.60	5.31	2.99	3.19	5.19	0
[120-140] Stack WG Ldr, 14-hole (24-7/8"	0.60	5.32	3.01	3.19	5.24	0
[140-160] Stack WG Ldr, 14-hole (24-7/8"	0.60	5.33	3.02	3.20	5.28	0
[160-180] Stack WG Ldr, 14-hole (24-7/8"	0.60	5.34	3.03	3.20	5.31	0

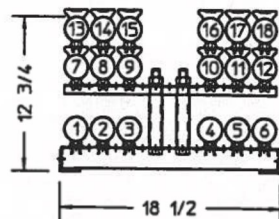
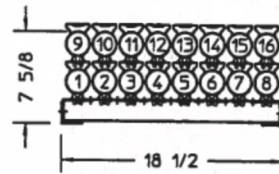
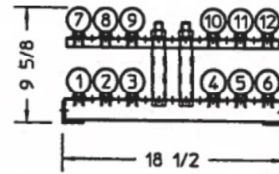
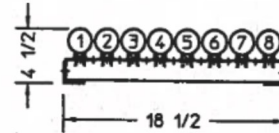
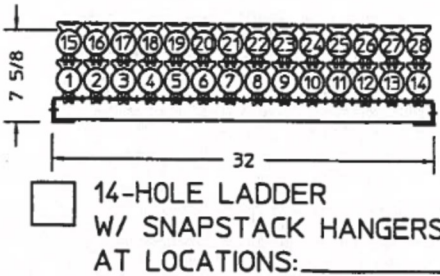
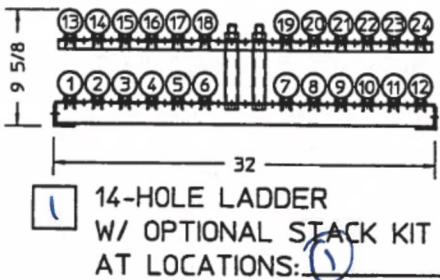
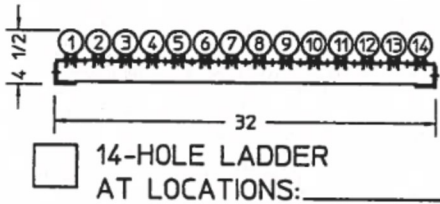


REV	DESCRIPTION	DATE	BY
A	ADDED COAX TO VACANT W/G LADDER HOLES.	20DEC12	PDC MF



### POSSIBLE COAX LADDER POSITIONS

WAVEGUIDE FROM MICROWAVE ANTENNAS MAY BE ATTACHED USING OPEN HOLES IN LADDER OR VIA LEG CLAMP BRACKETS DOWN TOWER LEGS.



**valmont**  
STRUCTURES  
1-877-467-4763 Plymouth, IN  
1-800-547-2151 Salem, OR

900 SERIES  
COAX LADDER  
CONFIGURATION  
OPTIONS

BY PDC CK MF  
DATE 20MAR07  
S.O. 541305

DWG. A-123417  
SHT. 1 OF 1

**Anchor Bolt Layout Drawing for 3-Leg Towers -  
(6) Bolts per Leg**

Date: 15-Mar-22  
 SO#: 541305  
 Customer: City of Portland  
 Site: Bull Run Filtration Facility  
 Twr. Ht.: 180 ft. (54.864 M)

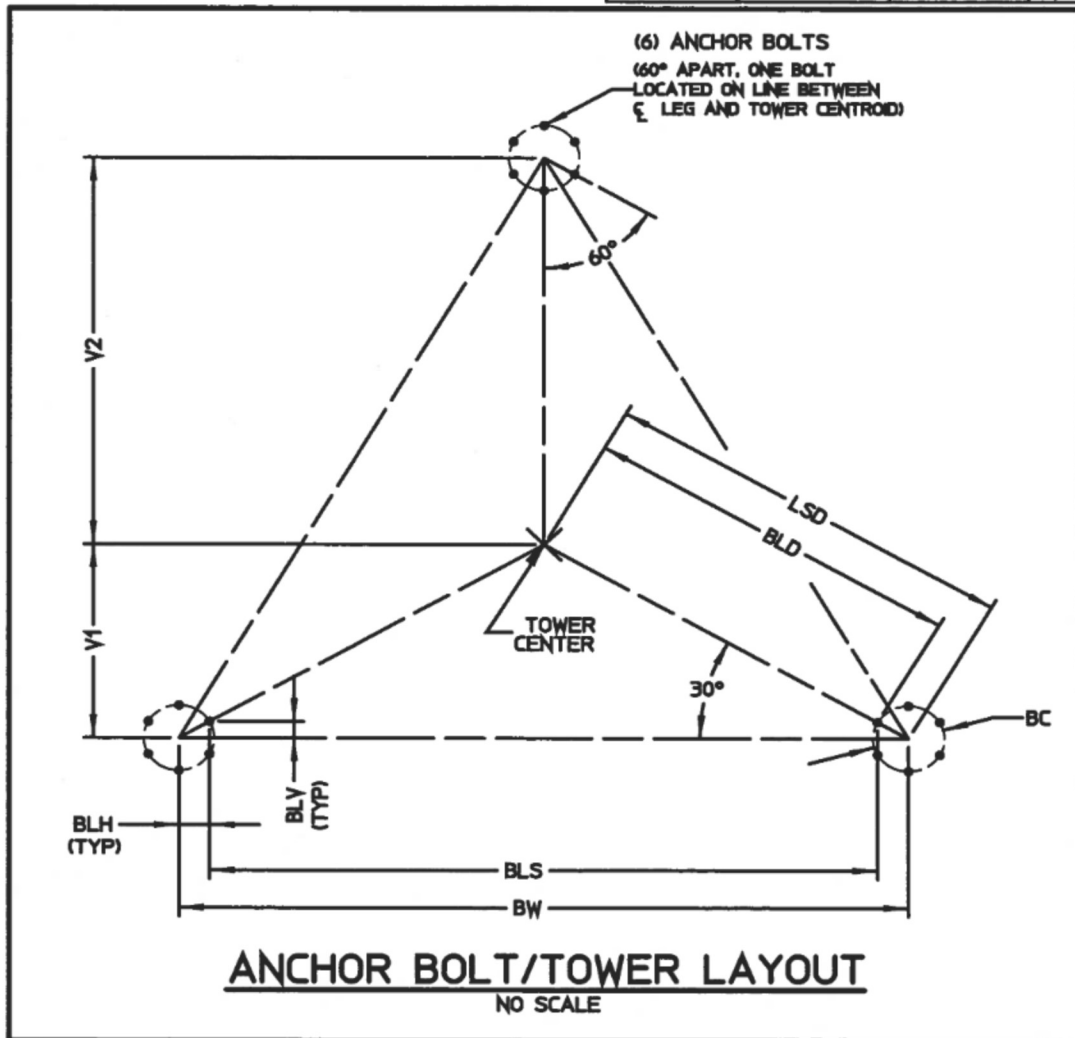
By: JG  
 Check: MF 

**INPUT DIMENSIONS**

Base Wd (BW):	20	ft.
Bolt Circle (BC):	13.25	in.
AB Dia:	1.5	in.
AB Length:	60	in.
AB Projection:	9	in.
AB Cluster P/N:	31-95027	

(TIA-G/H LRFD VALUES)

TOWER REACTIONS		
Max Uplift per Leg:	275	kips
Max Dnload per Leg:	292	kips
Max Shear per Leg:	26.6	kips
Overturning moment	4901	ft -kips
Base shear	48.7	kips
Tower weight (1.0D)	25.3	kips
Tower weight w/ ice	249	kips

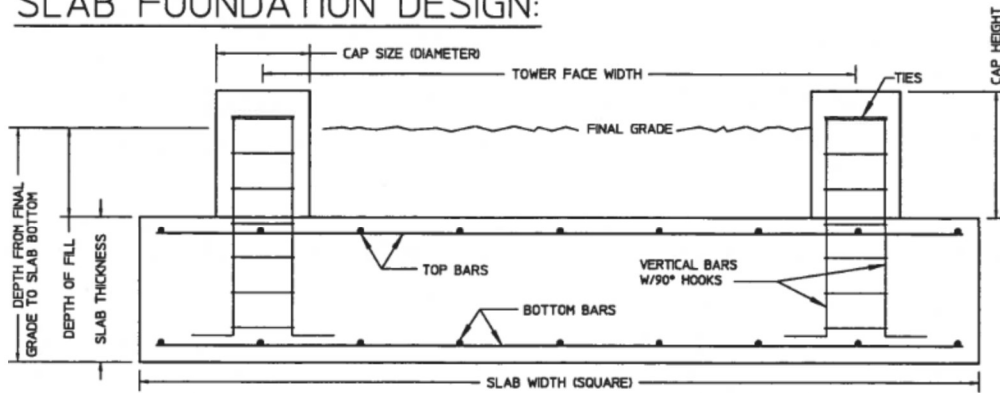


**OUTPUT DIMENSIONS:**

	FT-INCH	METRIC
BW:	20'-0"	6.096 M
BLH:	0'-5.75"	145.7 mm
BLV:	0'-3.3125"	84.1 mm
BLS:	19'-0.5"	5.805 M
BC:	1'-1.25"	336.6 mm

	FT-INCH	METRIC	
LSD:	11'-6.5625"	3.52 M	(+/- 1/8")
BLD:	10'-11.9375"	3.351 M	(+/- 1/8")
V1:	5'-9.3125"	1.76 M	
V2:	11'-6.5625"	3.52 M	

# SLAB FOUNDATION DESIGN:



## DIMENSIONS:

Slab width = 30.0 feet  
 Slab thickness = 30.0 inches  
 Cap height = 30.0 inches  
 Cap size = 30.0 inches  
 Tower face width = 20.0 feet  
 Number of tower legs = 3  
 Depth of fill = 24.0 inches  
 Depth from final grade = 4.5 feet to slab bottom

## MATERIAL PARAMETERS:

Allowable net soil bearing pressure = 2.44 ksf  
 Ultimate net soil bearing pressure = 4.88 ksf  
 Concrete compressive strength = 4500 psi  
 Rebar yield strength = 60000 psi  
 Density of concrete = 0.150 kcf  
 Density of soil = 0.110 kcf  
 Density of fill = 0.090 kcf  
 Allowable stress increase factor = 1.00

## TOWER BASE REACTIONS:

Overturning moment = 5570 ft-kips  
 Total tower shear = 55.0 kips  
 Maximum leg shear = 30.0 kips  
 Tower weight = 25.3 kips

## NOTES:

1. This foundation was designed to better match the ultimate capacity of the tower.
2. This design methodology assumes a rigid slab (Ref. ACI 336.2 R-88).

## OUTPUT SUMMARY:

Stability ratio = 1.22 OK  
 Net soil bearing pressure = 1.97 ksf OK  
 Volume of concrete = 85.1 cu. yds.  
 Slab two-way shear: OK  
 Slab beam shear: OK

## REINFORCEMENT REQUIREMENTS: (ASTM A615 Gr. 60)

Minimum reinforcement areas: Top bars = 16.23 sq. inches, Bottom bars = 23.98 sq. inches.  
 Top bars: Use 28-#7 (each way) @ 13.11 inch spacing, length = 29.50 ft., total weight = 3377 lbs.  
 Bottom bars: Use 31-#8 (each way) @ 11.80 inch spacing, length = 29.50 ft., total weight = 4883 lbs.  
 Circular hoops: Use 7-#4 Hoops, 24 in. diam. @ 12 in. spc. (per pier), double @ top.  
 Vertical bars: Use 15 -#6 Vertical bars w/90 degree hooks (per pier).

SHEET 1 OF 1 DWG. NO. B-152119	<b>STRESS ANALYSIS</b> CITY OF PORTLAND SITE: BULL RUN FILTRATION FACILITY		REVISIONS REV   DESCRIPTION   DATE   BY/CK
	BY JG	CK MF	
	DATE 16MAR22	S.O. 541305	