valmont STRUCTURES

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

COMMUNICATION TOWER DESIGN CALCULATIONS

REGISTERED PROFESSIONAL ENGINEER
16620PE
OREGON
JULY 20, 1993
JEFFREY E. GRASSMAN

EXPIRES: 6/30/23

Jeffrey E Grassman

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

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

valmont 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

valmont 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_S:	0.76	TOPOGRAPHIC CATEGORY:	1
S_1:	0.33		

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

TOWER INITIAL DATA ENTRY VERSION TOW-12-341

DATE 03/15/22

CURRENT FILE 541305

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

ANALYST'S INITIALS: JEG TOWER HEIGHT: 180 EXPOSURE: C

WIND LOAD = EIA-G ICE THICKNESS: 1.50 (IN. OR mm) BASE ELEVATION: 0. FT. OR M
STRUCTURE CLASS: 3 TOPO CATEGORY: 2

CLIMBING TYPE: 1
0 = CENTER MOUNT LADDER
1 = STEP BOLT
2 = LEG MOUNT LADDER

UNITS: 0
0 = U.S. CUSTOMARY
1 = SI UNITS

++

TOWER LOAD CASE DATA ENTRY

LOAD CASE	DESCRIPTION	BASIC WIND SPEED (MPH)	WIND DIRECT.	ICE? (YES OR NO)	OVER-LOAD FACTOR
1	WIND	76	ALL	NO	1.00
2	ICE + WIND	30	ALL	YES	1.00
3	T+S	60	ALL	NO	1.00

TOWER POINT LOAD DATA ENTRY

LOAD DESCRIPTION	ATTACHMENT HT. (FT)	LEGS 1	2	3	-CENTROID- HT. (FT)	ECC (FT)	-WITHOUT ICE- EPA (FT**2)	WT. (LBS)	--WITH ICE--- 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 1	2	3	HEIGHT (FT) START	END	-WITHOUT ICE- EPA/FT (FT**2)	WT/FT (LBS)	--WITH ICE-- 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 Climb	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

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

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. (KIPS)	LC	TENS. (KIPS)	LC	TYP	+-SIZE (IN)--+	FY (KSI)	KL/R	MEMB.	CONN.
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 ISON 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

\MEMBER TYPE SECTION\	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

CHECK OF REDUNDANT MEMBERS

SECTION	REDUN. AXIAL STRENGTH	RQD. RESISTANCE LOAD	CSR
1	17.885	0.576	0.03

DETAILED TOWER POINT LOAD DATA

NO ICE EPA AND WEIGHT DATA:

Description	Ka	ANTENNA/MOUNT (EPA)n	ANTENNA/MOUNT (EPA)t	PIPE MOUNT (EPA)n	PIPE MOUNT (EPA)t	TOTAL (EPA)a	ICE Thick.	WIND Angle
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 (EPA)n	ANTENNA/MOUNT (EPA)t	PIPE MOUNT (EPA)n	PIPE MOUNT (EPA)t	TOTAL (EPA)a	ICE Thick.	WIND Angle
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

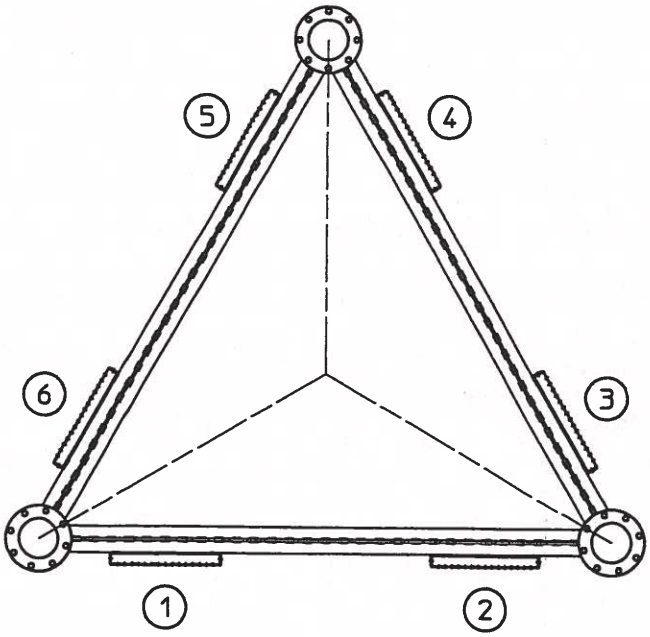
NO ICE EPA AND WEIGHT DATA:

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/	0.60	1.70	0.81	1.02	0.00	0
[120-140] Stack WG Ldr, 14-hole (24-7/	0.60	1.70	0.81	1.02	0.00	0
[140-160] Stack WG Ldr, 14-hole (24-7/	0.60	1.70	0.81	1.02	0.00	0
[160-180] Stack WG Ldr, 14-hole (24-7/	0.60	1.70	0.81	1.02	0.00	0

ICE EPA AND WEIGHT DATA:

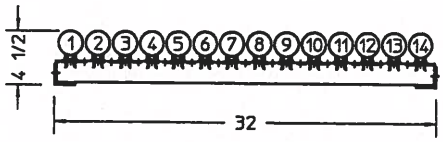
Description	Ka	(EPA)n	(EPA)t	(EPA)a	ICE Thick.	WIND Angle
[0-20] SB's	0.60	0.15	0.15	0.09	4.26	0
[20-40] SB's	0.60	0.15	0.15	0.09	4.71	0
[40-60] SB's	0.60	0.15	0.15	0.09	4.91	0
[60-80] SB's	0.60	0.15	0.15	0.09	5.04	0
[80-100] SB's	0.60	0.15	0.15	0.09	5.13	0
[0-20] 900 Climbing Ladder	0.60	2.12	2.28	1.37	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/	0.60	5.31	2.99	3.19	5.19	0
[120-140] Stack WG Ldr, 14-hole (24-7/	0.60	5.32	3.01	3.19	5.24	0
[140-160] Stack WG Ldr, 14-hole (24-7/	0.60	5.33	3.02	3.20	5.28	0
[160-180] Stack WG Ldr, 14-hole (24-7/	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

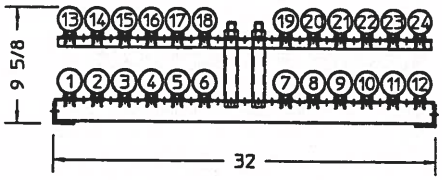


POSSIBLE COAX LADDER POSITIONS

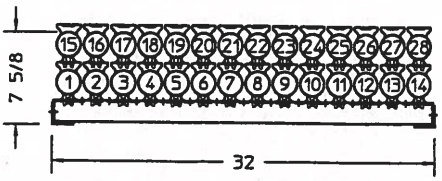
WAVEGUIDE FROM MICROWAVE ANTENNAS MAY BE ATTACHED USING OPEN HOLES IN LADDER OR VIA LEG CLAMP BRACKETS DOWN TOWER LEGS.



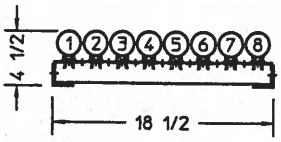
☐ 14-HOLE LADDER
AT LOCATIONS:_____



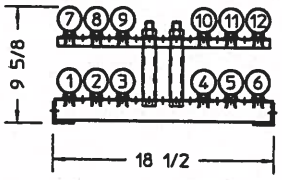
☐ 14-HOLE LADDER
W/ OPTIONAL STACK KIT
AT LOCATIONS:_____



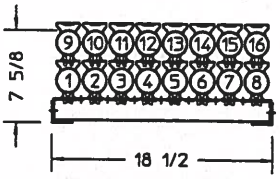
☐ 14-HOLE LADDER
W/ SNAPSTACK HANGERS
AT LOCATIONS:_____



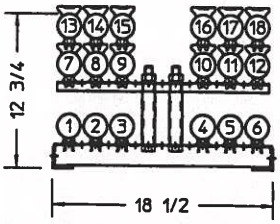
☐ 8-HOLE LADDER
AT LOCATIONS:_____



☐ 8-HOLE LADDER
W/ OPTIONAL STACK KIT
AT LOCATIONS:_____



☐ 8-HOLE LADDER
W/ SNAPSTACK HANGERS
AT LOCATIONS:_____



☐ 8-HOLE LADDER
W/ OPTIONAL STACK KIT
& SNAPSTACK HANGERS
AT LOCATIONS:_____

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	DWG. A-123417
		S.O. 541305	SHT. 1 OF 1

valmont MICROFLECT

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)

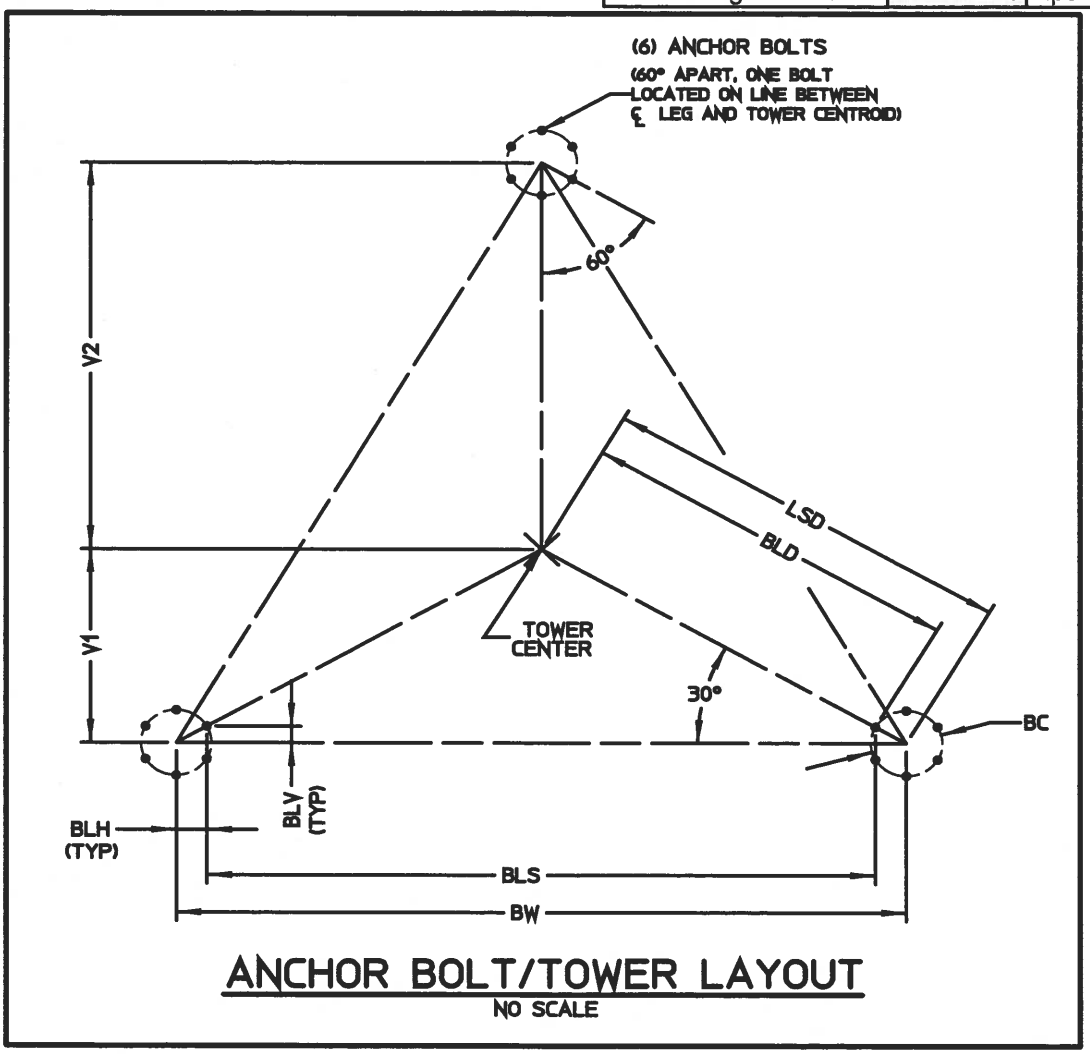
By:	JG
Check:	MF

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



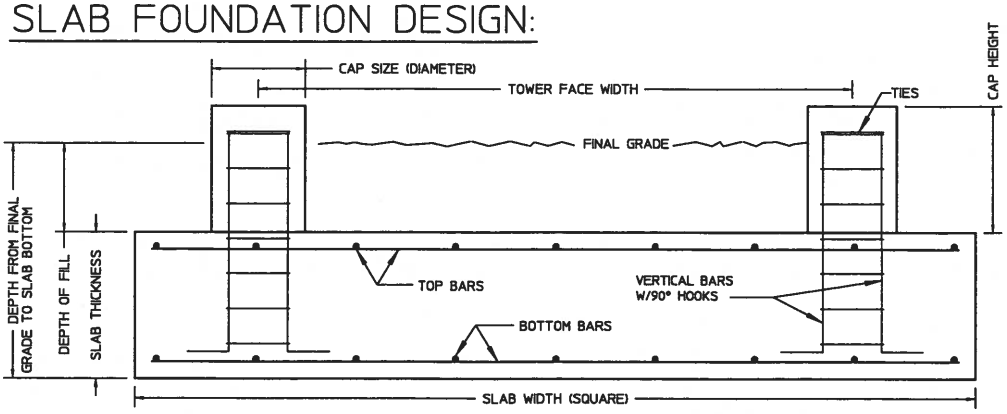
ANCHOR BOLT/TOWER LAYOUT
NO SCALE

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).