



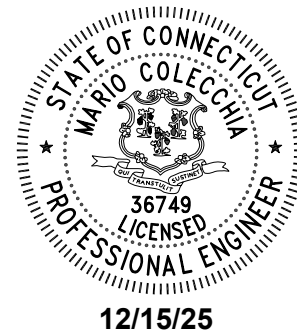
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Client Greenskies Project Woodbridge Soundview
Sheet No _____ Of _____
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Notes Pile Design Capacity

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Structural Calculations
For
Solar Array Posts and Foundations
7'-0" Torque Tube Height

Greenskies - Woodbridge Soundview
Woodbridge, CT



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Basis of Design:

Loads provided by Array Technologies, Inc.. Applied at center of torque tube.

OMNI v3 144HC-M10-SL540-52 -C Ground Force Analysis, 11 INT(SB) / 13 EXT (SB)Columns

Loading	Interior Rows	Exterior Rows
Horizontal Loading	2.15 kip	2.33 kip
Wind Up	2.17 kip	2.47 kip
Wind Downward	2.07 kip	2.44 kip
Snow	1.72 kip	1.47 kip
Moment	17.61 kip-ft	18.86 kip-ft
Dead Load	0.44 kip	0.38 kip

Load combinations for Allowable Stress Design per ASCE 7-16

	1.0D + 0.6W	1.0D + 0.45W + 0.75S
	0.6D + 0.6W	1.0D + 1.0S

Soil properties used in LPILE analysis provided by Down to Earth Consulting, LLC, Report #0255-016.00.

Layer	Type	p-y Curve	Depth (ft)	Unit Wt (pcf)	Friction Angle (deg)	Modulus (pci)	Cohesion (psf)	Strain Factor (e)	p-mult
1	Sand	Sand	0.0-8.0	135	36	150	NA	NA	
2	Sand	Sand	8.0-15.0	140	38	225	NA	NA	

Top 42" of soil neglected in vertical capacity.

Seismic analysis performed in the weak axis of gear rack posts and seismic posts. $S_{DS} = 0.174 g$

Loads about the weak axis of the piles consider a max N-S slope of 4 deg

Posts galvanized per ASTM A123 with an allowance for steel section loss due to corrosion.

Design life of 30 years.

Minimum pile size and embedment:

Type	Pile Size	Embedment	Deflection	Notes
Interior	W6x9	7'-6"	3"	
Exterior	W6x9	7'-6"	3.2"	

Lightweight equipment may be supported on the same pile as an interior tracker row pile.

Deflection of the pile head is within the 4" limit recommended by ATI.

Post size and embedment were designed with consideration of up to 12" of variation in ground surface.

Therefore, the torque tube may be 72" (min) to 84" (max) above ground surface.

4 bearing piles per row with set-screw bearings or translation clamps.



Determine post embedment and size to resist lateral and vertical loads due to wind, snow and dead load.

PV post reactions provided by Array Technologies, Inc..

OMNI v3 144HC-M10-SL540-52 -C Ground Force Analysis, 11 INT(SB) / 13 EXT (SB)Columns

Soils information provided by Down to Earth Consulting, LLC Report #0255-016.00 dated November 01 2024

Depth of soil neglected for vertical loads: $d_{neg,vert} = 42$ in

Depth of soil neglected for lateral bracing: $d_{neg,lat} = 12$ in

Soil Layer Properties:

Layer	Type	p-y Curve	Depth (ft)	Unit Wt (pcf)	Friction Angle (deg)	Modulus (pci)	Cohesion (psf)	Strain Factor (e)	p-mult
1	Sand	Sand	0.0-8.0	135	36	150	NA	NA	
2	Sand	Sand	8.0-15.0	140	38	225	NA	NA	

Layer	Layer Depth		End Bearing (psf)	Bearing Skin Friction		Uplift Skin Friction	
	Top (ft)	Bottom (ft)		Top (psf)	Bottom (psf)	Top (psf)	Bottom (psf)
1	0	3.5	0	0	0	0	0
2	3.5	8	6000	415	415	415	415
3	8	15	8000	500	500	500	500

Height of torque tube above ground: $H = 72" + 12" = 7.00$ ft

(from natural ground to center of torque tube with an allowance for fluctuation in grade)

Consider load combinations for Allowable Stress Design per ASCE 7, Section 2.4.1:

- 1) $1.0D + 0.6W$
- 2) $1.0D + 0.6(0.75)W + 0.75S$
- 3) $0.6D + 0.6W$
- 4) $1.0D + 1.0S$



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Interior Row Piles:

Horizontal wind load: 2.15 kip
 Wind load up: 2.17 kip
 Wind load down: 2.07 kip
 Snow load: 1.72 kip
 Ground-line Moment: 17.61 k-ft
 Dead load: 0.44 kip CAB Load: 0 lbs
 Moment at pile head: 2.56 kip-ft

Max horizontal load at pile head: $W_h = 1290$ lb
 Max moment at pile head: $M = 1.536$ kip-ft = 18432 lb-in
 Concurrent vertical load: $V = 1682$ lb
 Max vertical load: $V_{max} = 2662$ lb
 Min vertical load: $V_{min} = -1038$ lb

Embedment required to resist lateral loads:

See LPILE output for pile length required to minimize pile head deflection.

$$L_{lateral} = (13.1\text{ft} - H)1.10 = 6.71 \text{ ft}$$

Embedment required to resist vertical loads: assume W6x9 for surface area

$$P = 2(6\text{in}) + 2(4\text{in}) = 1.67 \text{ ft (perimeter)}$$

Layer Depth		$L_{bearing} = 7.5 \text{ ft}$			$L_{uplift} = 7.5 \text{ ft}$				
Top (ft)	Bottom (ft)	Top (psf)	Bottom (psf)	Capacity (lbs)	Top (ft)	Bottom (ft)	Top (psf)	Bottom (psf)	Capacity (lbs)
0	3.5	0	0	0	0	3.5	0	0	0
3.5	7.5	415	415	2767	3.5	7.5	415	415	2767
7.5	7.5	0	0	0	7.5	7.5	0	0	0
7.5	7.5	0	0	0	7.5	7.5	0	0	0
7.5	7.5	0	0	0	7.5	7.5	0	0	0

$$A = (6\text{in}) \times (4\text{in}) = 0.16667 \text{ sf (end bearing area)}$$

$$\text{End Bearing} = 1000 \text{ lbs}$$

$$\text{Bearing Friction} = 2767 \text{ lbs}$$

$$\text{Bearing Capacity} = 3767 \text{ lbs OK}$$

$$\text{Uplift Capacity} = 2767 \text{ lbs OK}$$



Exterior Row Piles:

Horizontal wind load: 2.33 kip
 Wind load up: 2.47 kip
 Wind load down: 2.44 kip
 Snow load: 1.47 kip
 Ground-line Moment: 18.86 kip-ft
 Dead load: 0.38 kip CAB Load: 0 lbs
 Moment at pile head: 2.55 kip-ft

Max horizontal load at pile head: $W_h = 1398$ lb
 Max moment at pile head: $M = 1.53$ kip-ft = 18360 lb-in
 Concurrent vertical load: $V = 1844$ lb
 Max vertical load: $V_{max} = 2581$ lb
 Min vertical load: $V_{min} = -1254$ lb

Embedment required to resist lateral loads:

See LPILE output for pile length required to minimize pile head deflection.

$$L_{lateral} = (13.3\text{ft} - H)1.10 = 6.93 \text{ ft}$$

Embedment required to resist vertical loads: assume W6x9 for surface area

$$P = 2(6\text{in}) + 2(4\text{in}) = 1.67 \text{ ft (perimeter)}$$

Layer Depth		$L_{bearing} = 7.5 \text{ ft}$			$L_{uplift} = 7.5 \text{ ft}$					
Top (ft)	Bottom (ft)	Top (psf)	Bottom (psf)	Capacity (lbs)	Top (ft)	Bottom (ft)	Top (psf)	Bottom (psf)	Capacity (lbs)	
0	3.5	0	0	0	0	3.5	0	0	0	
3.5	7.5	415	415	2767	3.5	7.5	415	415	2767	
7.5	7.5	0	0	0	7.5	7.5	0	0	0	
7.5	7.5	0	0	0	7.5	7.5	0	0	0	
7.5	7.5	0	0	0	7.5	7.5	0	0	0	

$$A = (6\text{in}) \times (4\text{in}) = 0.16667 \text{ sf (end bearing area)}$$

$$\text{End Bearing} = 1000 \text{ lbs}$$

$$\text{Bearing Friction} = 2767 \text{ lbs}$$

$$\text{Bearing Capacity} = 3767 \text{ lbs OK}$$

$$\text{Uplift Capacity} = 2767 \text{ lbs OK}$$



Gear Rack and Seismic Piles:

Each row contains one gear rack pile that can carry up to 500 lbs of lateral, seismic load in the weak direction. Remaining seismic load, if any, is carried by one or more seismic piles.

ATI calcs assume a design spectral response acceleration parameter, S_{DS}' , of 0.214

Site specific S_{DS} is 0.174 . Therefore, adjust the ATI seismic loads accordingly.

Seismic load, based on S_{DS}' : $V_s' = 0.54 \text{ kip}$ (from ATI calcs)

$$V_{\text{seismic}} = 0.7(V_s')(S_{DS})/S_{DS}' = 307 \text{ lb} \quad (\text{load factor of 0.7 per ASCE 7 ASD combinations})$$

Seismic load to gear rack pile: $V_{\text{gear.rack}} = 307 \text{ lb}$

Number of seismic piles required in order to keep the seismic load less than 500 lbs:

$$N_{\text{seismic}} = (V_{\text{seismic}} - V_{\text{gear.rack}})/500\text{lbs} = 0 \text{ seismic piles}$$

Load applied to each seismic pile if the number of seismic piles is set to 4 per row.

$$V_{\text{seismic.pile}} = V_{\text{seismic}}/(N_{\text{seismic}} + 1) = 61 \text{ lb}$$

The torque tube passing through the bearing housing provides rotational restraint at the pile head which is proportional to the bending stiffness of the torque tube.

$$M/\theta = 6EI/L = 2977945 \text{ lb-in/rad}$$

$$I = 4.33 \text{ in}^4 \quad (\text{moment of inertia of torque tube})$$

$$L = 253 \text{ in} \quad (\text{max spacing between piles})$$



For trackers installed on a north-south grade, vertical loads impart a horizontal reaction on the piles. For a bearing pile, the horizontal reaction is proportional to the vertical reaction at that pile. For gear rack and seismic piles, the sum of the horizontal reactions must equilibrate the sum of the horizontal reactions at all of the bearing piles.

Number of seismic piles: **4 (min of 2)** OK

Interior Rows:

Total number of piles per row, $N_t =$ 11 piles
 Number of seismic piles, $N_s =$ 5 piles (includes gear rack pile)
 Number of bearing piles, $N_b = N_t - N_s =$ 6 piles
 Max Row Slope, $\theta =$ 4 deg Max Bay Slope, $\beta =$ 5.4 deg
 Governing dead load reaction, $D =$ 440 lbs (worst-case dead load reaction among all piles)
 Total tracker dead load, $D_t =$ 4914 lbs

Horizontal dead load reaction at a bearing pile: $H_b = (D)\tan\beta =$ 42 lbs
 Concurrent vertical load on interior row piles: $V_{int} =$ 1682 lbs
 Horizontal dead load reaction at a seismic pile: $H_s = (N_b/N_t)(D_t)(\tan\theta)/(N_s) =$ 37 lbs
 Total Horizontal Load on a seismic pile: $H_s + V_{seismic.pile} =$ 98 lbs
 Concurrent dead load: $V_{dl} =$ 440 lbs
 Rotational Restraint at Pile Head: $6EI/L =$ 2977945 lb-in/rad
 $I =$ 4.33 in⁴
 $L =$ 253 in

Exterior Rows:

Total number of piles per row, $N_t =$ 13 piles
 Number of seismic piles, $N_s =$ 5 piles (includes gear rack pile)
 Number of bearing piles, $N_b = N_t - N_s =$ 8 piles
 Max Row Slope, $\theta =$ 4 deg Max Bay Slope, $\beta =$ 5.4 deg
 Governing dead load reaction, $D =$ 380 lbs (worst-case dead load reaction among all piles)
 Total tracker dead load, $D_t =$ 4914 lbs

Horizontal dead load reaction at a bearing pile: $H_b = (D)\tan\beta =$ 36 lbs
 Concurrent vertical load on exterior row piles: $V_{ext} =$ 1844 lbs
 Horizontal dead load reaction at a seismic pile: $H_s = (N_b/N_t)(D_t)(\tan\theta)/(N_s) =$ 42 lbs
 Total Horizontal Load on a seismic pile: $H_s + V_{seismic.pile} =$ 103 lbs
 Concurrent dead load: $V_{dl} =$ 380 lbs
 Rotational Restraint at Pile Head: $6EI/L =$ 3348533 lb-in/rad
 $I =$ 4.33 in⁴
 $L =$ 225 in



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Frost Heave

The pile uplift capacity required to address frost heave is a function of the ad-freeze bond stress, the frost depth, and the pile perimeter. For this analysis, the ad-freeze stress is assumed to act along the full pile perimeter.

Ad-freeze bond stress: 6.94 psi Factor of Safety Required: 1.00
 Frost depth: 42 in FS used for Allowable Skin Friction: 3.00

Interior Row Piles:

Pile section: W6x9 Pile perimeter: 28 in

Required uplift capacity: $(6.94 \text{ psi})(42 \text{ in})(28 \text{ in})(1 \text{ FS}) = 8161 \text{ lbs}$
 Ultimate uplift capacity provided: 8740 lbs FS provided: 1.07 OK

Exterior Row Piles:

Pile section: W6x9 Pile perimeter: 28 in

Required uplift capacity: $(6.94 \text{ psi})(42 \text{ in})(28 \text{ in})(1 \text{ FS}) = 8161 \text{ lbs}$
 Ultimate uplift capacity provided: 8680 lbs FS provided: 1.06 OK

Pile Isolation with: None to a depth of: 42 inches



Determine the flexural capacity of available pile sizes after an allowance for corrosion loss is considered in their section properties.

Consider the soil to be non corrosive.

Assume the total loss in the cross section steel due to corrosion, after galvanization loss (if galvanized), is approximately 0 inches to 0.000 inches on all flanges and webs.

Height of the post, above finished grade: 7.00 ft
 Depth of soil ignored in the calculation of unbraced length: 1 ft
 Unbraced length of pile: 8 ft = 96 in

Modulus of Elasticity, E: 29000 ksi
 Yield Strength, Fy: 50 ksi

$t_{corr} = 0.000$ in ($< 1/4$ " thick flange)
 $t_{corr} = 0.000$ in ($> 1/4$ " thick flange)

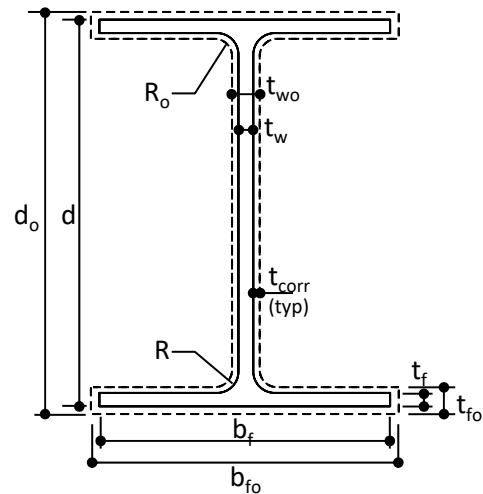
Moment gradient, for calculating C_b :

Moment at top of pile, $M_o = 18.432$ kip-in
 Max moment in pile, $M_{max} = 145.405$ kip-in (from LPILE)

$M_A = M_o + 0.25(M_{max} - M_o) = 50.1753$ kip-in
 $M_B = M_o + 0.5(M_{max} - M_o) = 81.9185$ kip-in
 $M_C = M_o + 0.75(M_{max} - M_o) = 113.662$ kip-in

$C_b = 12.5M_{max} / (2.5M_{max} + 3M_A + 4M_B + 3M_C) = 1.537$

For ASD $\Omega_b = 1.67$ For LRFD $\phi_b = 0.9$



Pile Size	b_{fo} (in)	t_{fo} (in)	d_o (in)	R_o (in)	t_{wo} (in)	Strong Axis		Weak Axis	
						M_p / Ω_b (kip-in)	M_r (kip-in)	M_p / Ω_b (kip-in)	M_r (kip-in)
W6x8.5	3.94	0.195	5.83	0.25	0.170	171.558	167.438	46.493	44.880
W6x9	3.94	0.215	5.90	0.25	0.170	186.561	186.509	51.147	51.126
W6x10.4	3.94	0.247	5.96	0.25	0.200	215.487	215.487	59.037	59.037
W6x12	4.00	0.280	6.03	0.25	0.230	248.628	248.628	69.232	69.232
W8x13	4.00	0.255	7.99	0.30	0.230	341.036	341.036	64.040	64.040
W6x15	5.99	0.260	5.99	0.25	0.230	322.997	304.077	141.819	129.672
W6x20	6.02	0.365	6.20	0.25	0.260	446.402	446.402	200.788	200.788
W6x25	6.08	0.455	6.38	0.25	0.320	566.716	566.716	255.985	255.985



Determine the compression capacity of available pile sizes. Since the majority of the unbraced length subject to instability is above ground and unaffected by corrosion, consider the full section properties. Reference AISC Section E and Appendix 7.

To account for loss of rigidity/fixity at grade due to corrosion loss in the pile:

For strong-axis flexural buckling, assume an effective length factor, $K = 2.5$ (AISC recommends 2.1)

For weak-axis flexural buckling, assume $G_A = 1.5$ (AISC recommends 1.0)

Unbraced length of pile: $L = 8 \text{ ft} = 96 \text{ in}$

(consider length from center of torque tube to effective grade)

Length of torque tube between piles, $L_{tt} = 253 \text{ in} = 21.0833 \text{ ft}$

Moment of Inertia of torque tube, $I_{tt} = 4.33 \text{ in}^4$

Modulus of Elasticity, $E: 29000 \text{ ksi}$

Yield Strength, $F_y: 50 \text{ ksi}$

For ASD $\Omega_c = 1.67$

For LRFD $\phi_c = 0.9$

Pile Size	A_g (in^2)	r_x (in)	I_y (in^4)	r_y (in)	Strong Axis		Weak Axis	
					$\phi_c P_n$ (kip)	P_n/Ω_c (kip)	$\phi_c P_n$ (kip)	P_n/Ω_c (kip)
W6x8.5	2.52	2.430	1.99	0.890	55.573	36.974	27.661	18.404
W6x9	2.68	2.470	2.20	0.905	60.471	40.233	29.965	19.937
W6x10.4	3.09	2.480	2.52	0.904	70.110	46.647	33.467	22.267
W6x12	3.55	2.490	2.99	0.918	80.991	53.886	38.508	25.621
W8x13	3.84	3.210	2.73	0.843	114.825	76.397	35.640	23.713
W6x15	4.43	2.560	9.32	1.450	104.839	69.753	85.965	57.196
W6x20	5.87	2.660	13.30	1.500	145.663	96.915	108.909	72.461
W6x25	7.34	2.700	17.10	1.520	185.357	123.325	128.303	85.364



Check the available pile sizes under the combined effects of axial compression and bending per AISC Section H1.

P_r = axial compression under ASD load combinations

$P_{r,dl}$ = axial compression due to dead load (for seismic analysis)

P_c = axial capacity, the lesser of strong-axis flexural buckling and weak-axis flexural buckling, ASD

M_{rx} = strong-axis bending moment under ASD load combinations (from LPile)

M_{ry} = weak-axis bending moment under ASD load combinations (from LPile)

M_{cx} = strong-axis flexural capacity

M_{cy} = weak-axis flexural capacity

At grade: P_r = 1.682 kip $P_{r,dl}$ = 0.440 kip
 M_{rx} = 145.405 kip-in M_{ry} = 4.545 kip-in (seismic)
 M_{ry} = 1.947 kip-in

Pile Size	P_c (kip)	P_r/P_c	M_{cx} (kip-in)	M_{rx}/M_{cx}	M_{ry}/M_{cy}	$P_{r,dl}/P_c$	M_{cy} (kip-in)	M_{ry}/M_{cy}	Unity Check
W6x8.5	18.404	0.09139	167.438	0.86841	0.04338	0.02391	44.88	0.10127	0.96
W6x9	19.937	0.08437	186.509	0.77962	0.03808	0.02207	51.1261	0.0889	0.86
W6x10.4	22.267	0.07554	215.487	0.67477	0.03298	0.01976	59.0367	0.07699	0.75
W6x12	25.621	0.06565	248.628	0.58483	0.02812	0.01717	69.2318	0.06565	0.65
W8x13	23.713	0.07093	341.036	0.42636	0.0304	0.01856	64.0396	0.07097	0.49
W6x15	57.196	0.02941	304.077	0.47818	0.01501	0.00769	129.672	0.03505	0.51
W6x20	72.461	0.02321	446.402	0.32573	0.0097	0.00607	200.788	0.02264	0.35
W6x25	85.364	0.0197	566.716	0.25657	0.00761	0.00515	255.985	0.01775	0.27

Below grade: P_r = 1.682 kip $P_{r,dl}$ = 0.440 kip
 M_{rx} = 154.933 kip-in M_{ry} = 4.545 kip-in (seismic)
 M_{ry} = 1.230 kip-in

Pile Size	P_c (kip)	P_r/P_c	M_{cx} (kip-in)	M_{rx}/M_{cx}	M_{ry}/M_{cy}	$P_{r,dl}/P_c$	M_{cy} (kip-in)	M_{ry}/M_{cy}	Unity Check
W6x8.5	18.404	0.09139	171.558	0.90309	0.02646	0.02391	46.4927	0.09776	0.98
W6x9	19.937	0.08437	186.561	0.83047	0.02405	0.02207	51.1469	0.08886	0.90
W6x10.4	22.267	0.07554	215.487	0.71899	0.02083	0.01976	59.0367	0.07699	0.78
W6x12	25.621	0.06565	248.628	0.62315	0.01777	0.01717	69.2318	0.06565	0.67
W8x13	23.713	0.07093	341.036	0.4543	0.01921	0.01856	64.0396	0.07097	0.51
W6x15	57.196	0.02941	322.997	0.47967	0.00867	0.00769	141.819	0.03205	0.50
W6x20	72.461	0.02321	446.402	0.34707	0.00613	0.00607	200.788	0.02264	0.36
W6x25	85.364	0.0197	566.716	0.27339	0.0048	0.00515	255.985	0.01775	0.29



Determine the flexural capacity of available pile sizes after an allowance for corrosion loss is considered in their section properties.

Consider the soil to be non corrosive.

Assume the total loss in the cross section steel due to corrosion, after galvanization loss (if galvanized), is approximately 0 inches to 0.000 inches on all flanges and webs.

Height of the post, above finished grade: 7.00 ft
 Depth of soil ignored in the calculation of unbraced length: 1 ft
 Unbraced length of pile: 8 ft = 96 in

Modulus of Elasticity, E: 29000 ksi
 Yield Strength, Fy: 50 ksi

$t_{corr} = 0.000$ in ($< 1/4$ " thick flange)
 $t_{corr} = 0.000$ in ($> 1/4$ " thick flange)

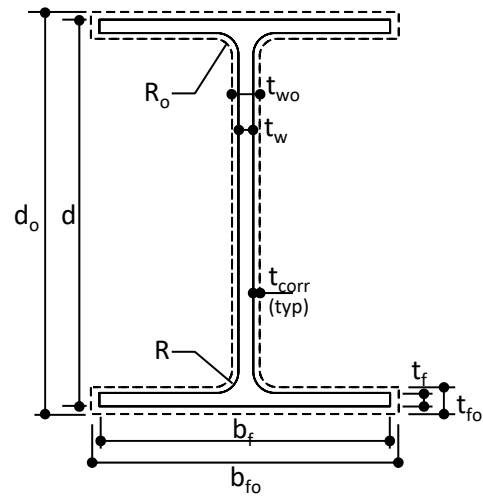
Moment gradient, for calculating C_b :

Moment at top of pile, $M_o = 18.36$ kip-in
 Max moment in pile, $M_{max} = 156.457$ kip-in (from LPILE)

$M_A = M_o + 0.25(M_{max} - M_o) = 52.8843$ kip-in
 $M_B = M_o + 0.5(M_{max} - M_o) = 87.4085$ kip-in
 $M_C = M_o + 0.75(M_{max} - M_o) = 121.933$ kip-in

$C_b = 12.5M_{max} / (2.5M_{max} + 3M_A + 4M_B + 3M_C) = 1.546$

For ASD $\Omega_b = 1.67$ For LRFD $\phi_b = 0.9$



Pile Size	b_{fo} (in)	t_{fo} (in)	d_o (in)	R_o (in)	t_{wo} (in)	Strong Axis		Weak Axis	
						M_p / Ω_b (kip-in)	M_r (kip-in)	M_p / Ω_b (kip-in)	M_r (kip-in)
W6x8.5	3.94	0.195	5.83	0.25	0.170	171.558	167.438	46.493	44.880
W6x9	3.94	0.215	5.90	0.25	0.170	186.561	186.509	51.147	51.126
W6x10.4	3.94	0.247	5.96	0.25	0.200	215.487	215.487	59.037	59.037
W6x12	4.00	0.280	6.03	0.25	0.230	248.628	248.628	69.232	69.232
W8x13	4.00	0.255	7.99	0.30	0.230	341.036	341.036	64.040	64.040
W6x15	5.99	0.260	5.99	0.25	0.230	322.997	304.077	141.819	129.672
W6x20	6.02	0.365	6.20	0.25	0.260	446.402	446.402	200.788	200.788
W6x25	6.08	0.455	6.38	0.25	0.320	566.716	566.716	255.985	255.985



Determine the compression capacity of available pile sizes. Since the majority of the unbraced length subject to instability is above ground and unaffected by corrosion, consider the full section properties. Reference AISC Section E and Appendix 7.

To account for loss of rigidity/fixity at grade due to corrosion loss in the pile:

For strong-axis flexural buckling, assume an effective length factor, $K = 2.5$ (AISC recommends 2.1)

For weak-axis flexural buckling, assume $G_A = 1.5$ (AISC recommends 1.0)

Unbraced length of pile: $L = 8 \text{ ft} = 96 \text{ in}$

(consider length from center of torque tube to effective grade)

Length of torque tube between piles, $L_{tt} = 225 \text{ in} = 18.75 \text{ ft}$

Moment of Inertia of torque tube, $I_{tt} = 4.33 \text{ in}^4$

Modulus of Elasticity, $E: 29000 \text{ ksi}$

Yield Strength, $F_y: 50 \text{ ksi}$

For ASD $\Omega_c = 1.67$

For LRFD $\phi_c = 0.9$

Pile Size	A_g (in^2)	r_x (in)	I_y (in^4)	r_y (in)	Strong Axis		Weak Axis	
					$\phi_c P_n$ (kip)	P_n/Ω_c (kip)	$\phi_c P_n$ (kip)	P_n/Ω_c (kip)
W6x8.5	2.52	2.430	1.99	0.890	55.573	36.974	28.082	18.684
W6x9	2.68	2.470	2.20	0.905	60.471	40.233	30.418	20.238
W6x10.4	3.09	2.480	2.52	0.904	70.110	46.647	34.473	22.936
W6x12	3.55	2.490	2.99	0.918	80.991	53.886	39.649	26.380
W8x13	3.84	3.210	2.73	0.843	114.825	76.397	36.704	24.421
W6x15	4.43	2.560	9.32	1.450	104.839	69.753	89.565	59.591
W6x20	5.87	2.660	13.30	1.500	145.663	96.915	112.297	74.715
W6x25	7.34	2.700	17.10	1.520	185.357	123.325	132.458	88.129



Check the available pile sizes under the combined effects of axial compression and bending per AISC Section H1.

P_r = axial compression under ASD load combinations

$P_{r,dl}$ = axial compression due to dead load (for seismic analysis)

P_c = axial capacity, the lesser of strong-axis flexural buckling and weak-axis flexural buckling, ASD

M_{rx} = strong-axis bending moment under ASD load combinations (from LPile)

M_{ry} = weak-axis bending moment under ASD load combinations (from LPile)

M_{cx} = strong-axis flexural capacity

M_{cy} = weak-axis flexural capacity

At grade: P_r = 1.844 kip $P_{r,dl}$ = 0.380 kip
 M_{rx} = 156.457 kip-in M_{ry} = 4.858 kip-in (seismic)
 M_{ry} = 1.920 kip-in

Pile Size	P_c (kip)	P_r/P_c	M_{cx} (kip-in)	M_{rx}/M_{cx}	M_{ry}/M_{cy}	$P_{r,dl}/P_c$	M_{cy} (kip-in)	M_{ry}/M_{cy}	Unity Check
W6x8.5	18.684	0.09869	167.438	0.93442	0.04278	0.02034	44.88	0.10824	1.03
W6x9	20.238	0.09112	186.509	0.83887	0.03755	0.01878	51.1261	0.09502	0.92
W6x10.4	22.936	0.0804	215.487	0.72606	0.03252	0.01657	59.0367	0.08229	0.80
W6x12	26.380	0.0699	248.628	0.62928	0.02773	0.0144	69.2318	0.07017	0.69
W8x13	24.421	0.07551	341.036	0.45877	0.02998	0.01556	64.0396	0.07586	0.53
W6x15	59.591	0.03094	304.077	0.51453	0.01481	0.00638	129.672	0.03746	0.54
W6x20	74.715	0.02468	446.402	0.35048	0.00956	0.00509	200.788	0.02419	0.37
W6x25	88.129	0.02092	566.716	0.27608	0.0075	0.00431	255.985	0.01898	0.29

Below grade: P_r = 1.844 kip $P_{r,dl}$ = 0.380 kip
 M_{rx} = 167.599 kip-in M_{ry} = 4.858 kip-in (seismic)
 M_{ry} = 1.216 kip-in

Pile Size	P_c (kip)	P_r/P_c	M_{cx} (kip-in)	M_{rx}/M_{cx}	M_{ry}/M_{cy}	$P_{r,dl}/P_c$	M_{cy} (kip-in)	M_{ry}/M_{cy}	Unity Check
W6x8.5	18.684	0.09869	171.558	0.97692	0.02615	0.02034	46.4927	0.10449	1.05
W6x9	20.238	0.09112	186.561	0.89836	0.02377	0.01878	51.1469	0.09498	0.97
W6x10.4	22.936	0.0804	215.487	0.77777	0.0206	0.01657	59.0367	0.08229	0.84
W6x12	26.380	0.0699	248.628	0.67409	0.01756	0.0144	69.2318	0.07017	0.73
W8x13	24.421	0.07551	341.036	0.49144	0.01899	0.01556	64.0396	0.07586	0.55
W6x15	59.591	0.03094	322.997	0.51889	0.00857	0.00638	141.819	0.03425	0.54
W6x20	74.715	0.02468	446.402	0.37544	0.00606	0.00509	200.788	0.02419	0.39
W6x25	88.129	0.02092	566.716	0.29574	0.00475	0.00431	255.985	0.01898	0.31

Interior Strong.lp12o

LPIle Version 2022-12.013

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Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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This model was prepared by:
Dylan Donn

Files Used for Analysis

Path to file locations:
\\Users\dylan.donn\Documents\Design\Greenskies\woodbridge Soundview\LPile\7 FT TTH\

Name of input data file:
Interior Strong.lp12d

Name of output report file:
Interior Strong.lp12o

Name of plot output file:
Interior Strong.lp12p

Name of runtime message file:
Interior Strong.lp12r

Date and Time of Analysis

Date: December 15, 2025

Time: 12:04:09

Problem Title

Project Name: woodbridge Soundview

Job Number:

Client: Greenskies

Engineer: DD

Description: Interior Strong - W6X9

Program Options and Settings

Computational Options:
- Conventional Analysis
Engineering Units Used for Data Input and Computations:

- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed = 500
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:

- Static loading specified
- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:

- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

- Number of pile sections defined = 1
- Total length of pile = 20.000 ft
- Depth of ground surface below top of pile = 7.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	3.9400
2	20.000	3.9400

Input Structural Properties for Pile Sections:

Pile Section No. 1:

- Section 1 is an elastic pile
- Cross-sectional Shape = Strong AISC Section Pile
- Length of section = 20.000000 ft
- AISC Section Type = W
- AISC Section Name = W6X9
- Flange width = 3.940000 in
- Section Depth = 5.900000 in
- Flange Thickness = 0.215000 in
- Web Thickness = 0.170000 in
- Section Area = 2.680000 sq. in
- Moment of Inertia = 16.400000 in^4
- Elastic Modulus = 29000000. psi

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 7.000000 ft
 Distance from top of pile to bottom of layer = 15.000000 ft
 Effective unit weight at top of layer = 135.000000 pcf
 Effective unit weight at bottom of layer = 135.000000 pcf
 Friction angle at top of layer = 36.000000 deg.
 Friction angle at bottom of layer = 36.000000 deg.
 Subgrade k at top of layer = 150.000000 pci
 Subgrade k at bottom of layer = 150.000000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 15.000000 ft
 Distance from top of pile to bottom of layer = 20.000000 ft
 Effective unit weight at top of layer = 140.000000 pcf
 Effective unit weight at bottom of layer = 140.000000 pcf
 Friction angle at top of layer = 38.000000 deg.
 Friction angle at bottom of layer = 38.000000 deg.
 Subgrade k at top of layer = 225.000000 pci
 Subgrade k at bottom of layer = 225.000000 pci

(Depth of the lowest soil layer extends 0.000 ft below the pile tip)

**** Warning - Possible Input Data Error ****

Values entered for effective unit weights of soil were outside the limits of 20 pcf to 140 pcf.

The maximum input value, in layer 2, for effective unit weight = 140.00 pcf

This data may be erroneous. Please check your data.

 Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Angle of Friction deg.	kpy pci
1	Sand (Reese, et al.)	7.0000 15.0000	135.0000 135.0000	36.0000 36.0000	150.0000 150.0000
2	Sand (Reese, et al.)	15.0000 20.0000	140.0000 140.0000	38.0000 38.0000	225.0000 225.0000

 Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	7.000	0.7000	1.0000
2	9.500	0.7000	1.0000

 Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

 Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
		1	2			

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3.6000	1.4393	76283.	1290.	-0.02663	9791.	4.76E+08	0.00	0.00	0.00
3.8000	1.3759	79486.	1290.	-0.02623	10176.	4.76E+08	0.00	0.00	0.00
4.0000	1.3134	82687.	1290.	-0.02583	10560.	4.76E+08	0.00	0.00	0.00
4.2000	1.2519	85886.	1290.	-0.02540	10944.	4.76E+08	0.00	0.00	0.00
4.4000	1.1915	89084.	1290.	-0.02496	11329.	4.76E+08	0.00	0.00	0.00
4.6000	1.1321	92280.	1290.	-0.02450	11712.	4.76E+08	0.00	0.00	0.00
4.8000	1.0739	95474.	1290.	-0.02403	12096.	4.76E+08	0.00	0.00	0.00
5.0000	1.0168	98666.	1290.	-0.02354	12480.	4.76E+08	0.00	0.00	0.00
5.2000	0.9609	101856.	1290.	-0.02303	12863.	4.76E+08	0.00	0.00	0.00
5.4000	0.9062	105044.	1290.	-0.02251	13246.	4.76E+08	0.00	0.00	0.00
5.6000	0.8528	108230.	1290.	-0.02197	13628.	4.76E+08	0.00	0.00	0.00
5.8000	0.8008	111413.	1290.	-0.02142	14011.	4.76E+08	0.00	0.00	0.00
6.0000	0.7500	114595.	1290.	-0.02085	14393.	4.76E+08	0.00	0.00	0.00
6.2000	0.7007	117774.	1290.	-0.02026	14775.	4.76E+08	0.00	0.00	0.00
6.4000	0.6528	120950.	1290.	-0.01966	15156.	4.76E+08	0.00	0.00	0.00
6.6000	0.6063	124124.	1290.	-0.01904	15538.	4.76E+08	0.00	0.00	0.00
6.8000	0.5614	127296.	1290.	-0.01841	15919.	4.76E+08	0.00	0.00	0.00
7.0000	0.5180	130465.	1290.	-0.01775	16299.	4.76E+08	0.00	0.00	0.00
7.2000	0.4762	133631.	1282.	-0.01709	16680.	4.76E+08	-6.908	34.8195	0.00
7.4000	0.4360	136755.	1255.	-0.01641	17055.	4.76E+08	-15.271	84.0655	0.00
7.6000	0.3974	139788.	1209.	-0.01571	17419.	4.76E+08	-23.286	140.6182	0.00
7.8000	0.3606	142684.	1145.	-0.01500	17767.	4.76E+08	-30.003	199.7014	0.00
8.0000	0.3254	145405.	1065.	-0.01427	18094.	4.76E+08	-36.668	270.4104	0.00
8.2000	0.2921	147911.	965.9319	-0.01353	18395.	4.76E+08	-45.784	376.2062	0.00
8.4000	0.2605	150150.	843.2733	-0.01278	18664.	4.76E+08	-56.431	519.8898	0.00
8.6000	0.2308	152062.	690.5613	-0.01201	18894.	4.76E+08	-70.829	736.6767	0.00
8.8000	0.2028	153562.	500.5117	-0.01124	19074.	4.76E+08	-87.546	1036.	0.00
9.0000	0.1768	154555.	267.9387	-0.01047	19193.	4.76E+08	-106.265	1443.	0.00
9.2000	0.1526	154933.	-11.718	-0.00969	19238.	4.76E+08	-126.783	1994.	0.00
9.4000	0.1303	154577.	-326.345	-0.00890	19196.	4.76E+08	-135.407	2494.	0.00
9.6000	0.1099	153438.	-726.582	-0.00813	19059.	4.76E+08	-198.124	4328.	0.00
9.8000	0.09129	151155.	-1204.	-0.00736	18785.	4.76E+08	-199.966	5257.	0.00
10.0000	0.07454	147717.	-1683.	-0.00660	18372.	4.76E+08	-199.248	6415.	0.00
10.2000	0.05959	143128.	-2158.	-0.00587	17820.	4.76E+08	-196.134	7900.	0.00
10.4000	0.04636	137407.	-2620.	-0.00516	17133.	4.76E+08	-188.949	9781.	0.00
10.6000	0.03480	130594.	-3059.	-0.00449	16315.	4.76E+08	-176.985	12204.	0.00
10.8000	0.02483	122760.	-3463.	-0.00385	15374.	4.76E+08	-159.812	15448.	0.00
11.0000	0.01634	114002.	-3796.	-0.00325	14322.	4.76E+08	-117.635	17280.	0.00
11.2000	0.00923	104565.	-4021.	-0.00270	13188.	4.76E+08	-69.772	18144.	0.00
11.4000	0.00339	94723.	-4137.	-0.00220	12006.	4.76E+08	-26.819	19008.	0.00
11.6000	-0.00131	84725.	-4156.	-0.00174	10805.	4.76E+08	10.8420	19872.	0.00
11.8000	-0.00498	74788.	-4091.	-0.00134	9611.	4.76E+08	43.0181	20736.	0.00
12.0000	-0.00774	65097.	-3956.	-9.87E-04	8447.	4.76E+08	69.6844	21600.	0.00
12.2000	-0.00972	55806.	-3763.	-6.82E-04	7331.	4.76E+08	90.9614	22464.	0.00
12.4000	-0.01102	47038.	-3526.	-4.23E-04	6278.	4.76E+08	107.0911	23328.	0.00
12.6000	-0.01175	38886.	-3255.	-2.06E-04	5299.	4.76E+08	118.4142	24192.	0.00
12.8000	-0.01201	31415.	-2963.	-2.86E-05	4401.	4.76E+08	125.3460	25056.	0.00
13.0000	-0.01188	24665.	-2658.	-1.13E-04	3590.	4.76E+08	128.3553	25920.	0.00
13.2000	-0.01146	18654.	-2351.	2.22E-04	2868.	4.76E+08	127.9433	26784.	0.00
13.4000	-0.01082	13380.	-2048.	3.03E-04	2235.	4.76E+08	124.6260	27648.	0.00
13.6000	-0.01001	8824.	-1755.	3.59E-04	1688.	4.76E+08	118.9183	28512.	0.00
13.8000	-0.00909	4952.	-1479.	3.94E-04	1222.	4.76E+08	111.3206	29376.	0.00
14.0000	-0.00812	1721.	-1223.	4.11E-04	834.3592	4.76E+08	102.3084	30240.	0.00
14.2000	-0.00712	-920.308	-989.119	4.13E-04	738.1612	4.76E+08	92.3239	31104.	0.00
14.4000	-0.00614	-3030.	-780.205	4.03E-04	991.5762	4.76E+08	81.7708	31968.	0.00
14.6000	-0.00519	-4669.	-596.867	3.83E-04	1188.	4.76E+08	71.0107	32832.	0.00
14.8000	-0.00430	-5898.	-439.220	3.57E-04	1336.	4.76E+08	60.3617	33696.	0.00
15.0000	-0.00348	-6780.	-276.607	3.25E-04	1442.	4.76E+08	75.1492	51840.	0.00
15.2000	-0.00274	-7228.	-113.603	2.89E-04	1496.	4.76E+08	60.6880	53136.	0.00
15.4000	-0.00209	-7327.	16.1211	2.53E-04	1508.	4.76E+08	47.4151	54432.	0.00
15.6000	-0.00153	-7153.	115.6195	2.16E-04	1487.	4.76E+08	35.5003	55728.	0.00
15.8000	-0.00105	-6774.	188.2643	1.81E-04	1441.	4.76E+08	25.0371	57024.	0.00
16.0000	-6.61E-04	-6251.	237.5740	1.48E-04	1378.	4.76E+08	16.0544	58320.	0.00
16.2000	-3.43E-04	-5635.	267.0724	1.18E-04	1304.	4.76E+08	8.5276	59616.	0.00
16.4000	-9.42E-05	-4970.	280.1737	9.13E-05	1225.	4.76E+08	2.3901	60912.	0.00
16.6000	9.48E-05	-4291.	280.0943	6.79E-05	1143.	4.76E+08	-2.456	62208.	0.00
16.8000	2.32E-04	-3626.	269.7887	4.79E-05	1063.	4.76E+08	-6.132	63504.	0.00
17.0000	3.25E-04	-2996.	251.9073	3.12E-05	987.5239	4.76E+08	-8.769	64800.	0.00
17.2000	3.82E-04	-2417.	228.7739	1.76E-05	917.9462	4.76E+08	-10.508	66096.	0.00
17.4000	4.09E-04	-1898.	202.3801	6.67E-06	855.6332	4.76E+08	-11.487	67392.	0.00
17.6000	4.14E-04	-1446.	174.3925	-1.77E-06	801.2632	4.76E+08	-11.836	68688.	0.00
17.8000	4.01E-04	-1061.	146.1718	-8.09E-06	755.0794	4.76E+08	-11.681	69984.	0.00
18.0000	3.75E-04	-743.935	118.7996	-1.26E-05	716.9749	4.76E+08	-11.129	71280.	0.00
18.2000	3.40E-04	-490.810	93.1114	-1.58E-05	686.5690	4.76E+08	-10.278	72576.	0.00
18.4000	2.99E-04	-296.873	69.7323	-1.78E-05	663.2729	4.76E+08	-9.205	73872.	0.00
18.6000	2.55E-04	-155.951	49.1151	-1.89E-05	646.3451	4.76E+08	-7.976	75168.	0.00
18.8000	2.08E-04	-60.968	31.5774	-1.94E-05	634.9355	4.76E+08	-6.639	76464.	0.00
19.0000	1.61E-04	-4.223	17.3379	-1.96E-05	628.1192	4.76E+08	-5.228	77760.	0.00
19.2000	1.14E-04	22.4121	6.5480	-1.96E-05	630.3041	4.76E+08	-3.764	79056.	0.00
19.4000	6.75E-05	27.3659	-0.679	-1.94E-05	630.8992	4.76E+08	-2.259	80352.	0.00
19.6000	2.10E-05	19.3098	-4.246	-1.93E-05	629.9315	4.76E+08	-0.714	81648.	0.00
19.8000	-2.53E-05	7.1412	-4.055	-1.92E-05	628.4698	4.76E+08	0.8729	82944.	0.00
20.0000	-7.14E-05	0.00	0.00	-1.92E-05	627.6119	4.76E+08	2.5065	842120.	0.00

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* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

Pile-head deflection = 2.70162146 inches
 Computed slope at pile head = -0.0309314 radians
 Maximum bending moment = 154933. inch-lbs
 Maximum shear force = -4156. lbs
 Depth of maximum bending moment = 9.20000000 feet below pile head
 Depth of maximum shear force = 11.60000000 feet below pile head
 Number of iterations = 13
 Number of zero deflection points = 3
 Pile deflection at ground = 0.51799943 inches

 Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 1290. lbs
 Moment = 18432. in-lbs
 Axial Load = 1682. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
20.00000	2.70162146	154933.	-4156.
19.00000	2.70998292	154850.	-4164.
18.00000	2.69667387	154881.	-4160.
17.00000	2.69649720	154892.	-4161.
16.00000	2.70562039	154848.	-4149.
15.00000	2.70659768	154850.	-4149.
14.00000	2.72649719	154909.	-4465.
13.00000	3.00864553	155278.	-5765.

 Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
 Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
 Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
 Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
 Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	1290.	M, in-lb	18432.	1682.	2.7016	-0.03093	-4156.	154933.

Maximum pile-head deflection = 2.7016214571 inches
 Maximum pile-head rotation = -0.0309313955 radians = -1.772238 deg.

The analysis ended normally.

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Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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This model was prepared by:
Dylan Donn

Files Used for Analysis

Path to file locations:
\Users\dylan.donn\Documents\Design\Greenskies\woodbridge Soundview\LPile\7 FT TTH\
Name of input data file:
Interior weak.lp12d
Name of output report file:
Interior weak.lp12o
Name of plot output file:
Interior weak.lp12p
Name of runtime message file:
Interior weak.lp12r

Date and Time of Analysis

Date: December 15, 2025 Time: 12:04:53

Problem Title

Project Name: woodbridge Soundview

Job Number:

Client: Greenskies

Engineer: DD

Description: Interior Weak - W6X9

Program Options and Settings

Computational Options:
- Conventional Analysis
Engineering Units Used for Data Input and Computations:

- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed = 500
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:

- Static loading specified
- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:

- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

- Number of pile sections defined = 1
- Total length of pile = 20.000 ft
- Depth of ground surface below top of pile = 7.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	5.9000
2	20.000	5.9000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

- Section 1 is an elastic pile
- Cross-sectional Shape = weak AISC Section Pile
- Length of section = 20.000000 ft
- AISC Section Type = W

AISC Section Name = W6X9

- Flange width = 3.940000 in
- Section Depth = 5.900000 in
- Flange Thickness = 0.215000 in
- web Thickness = 0.170000 in
- Section Area = 2.680000 sq. in
- Moment of Inertia = 2.200000 in^4
- Elastic Modulus = 29000000. psi

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 7.000000 ft
 Distance from top of pile to bottom of layer = 15.000000 ft
 Effective unit weight at top of layer = 135.000000 pcf
 Effective unit weight at bottom of layer = 135.000000 pcf
 Friction angle at top of layer = 36.000000 deg.
 Friction angle at bottom of layer = 36.000000 deg.
 Subgrade k at top of layer = 150.000000 pci
 Subgrade k at bottom of layer = 150.000000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 15.000000 ft
 Distance from top of pile to bottom of layer = 20.000000 ft
 Effective unit weight at top of layer = 140.000000 pcf
 Effective unit weight at bottom of layer = 140.000000 pcf
 Friction angle at top of layer = 38.000000 deg.
 Friction angle at bottom of layer = 38.000000 deg.
 Subgrade k at top of layer = 225.000000 pci
 Subgrade k at bottom of layer = 225.000000 pci

(Depth of the lowest soil layer extends 0.000 ft below the pile tip)

**** Warning - Possible Input Data Error ****

Values entered for effective unit weights of soil were outside the limits of 20 pcf to 140 pcf.

The maximum input value, in layer 2, for effective unit weight = 140.00 pcf

This data may be erroneous. Please check your data.

 Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Angle of Friction deg.	kpy pci
1	Sand (Reese, et al.)	7.0000 15.0000	135.0000 135.0000	36.0000 36.0000	150.0000 150.0000
2	Sand (Reese, et al.)	15.0000 20.0000	140.0000 140.0000	38.0000 38.0000	225.0000 225.0000

 Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	7.000	0.7000	1.0000
2	9.500	0.7000	1.0000

 Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

 Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
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1	3	V =	42.000000 lbs	R =	2977945. in-lbs	1682.	No	Yes
2	3	V =	98.000000 lbs	R =	2977945. in-lbs	440.000000000	No	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	7.0000	0.00	N.A.	No	0.00	72983.
2	15.0000	7.5469	Yes	No	72983.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Rotational Stiffness (Loading Type 3)
Shear force at pile head = 42.0 lb
Rotational stiffness = 2977945.0 in-lb/rad
Axial load at pile head = 1682.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1135	-2007.	42.0000	-6.74E-04	3319.	6.38E+07	0.00	0.00	0.00
0.2000	0.1118	-1904.	42.0000	-7.48E-04	3180.	6.38E+07	0.00	0.00	0.00
0.4000	0.1099	-1800.	42.0000	-8.17E-04	3041.	6.38E+07	0.00	0.00	0.00
0.6000	0.1078	-1695.	42.0000	-8.83E-04	2901.	6.38E+07	0.00	0.00	0.00
0.8000	0.1056	-1591.	42.0000	-9.45E-04	2761.	6.38E+07	0.00	0.00	0.00
1.0000	0.1033	-1486.	42.0000	-0.00100	2620.	6.38E+07	0.00	0.00	0.00
1.2000	0.1008	-1381.	42.0000	-0.00106	2480.	6.38E+07	0.00	0.00	0.00
1.4000	0.09823	-1276.	42.0000	-0.00111	2339.	6.38E+07	0.00	0.00	0.00
1.6000	0.09552	-1171.	42.0000	-0.00115	2197.	6.38E+07	0.00	0.00	0.00
1.8000	0.09270	-1065.	42.0000	-0.00119	2056.	6.38E+07	0.00	0.00	0.00
2.0000	0.08978	-959.435	42.0000	-0.00123	1914.	6.38E+07	0.00	0.00	0.00
2.2000	0.08678	-853.586	42.0000	-0.00127	1772.	6.38E+07	0.00	0.00	0.00
2.4000	0.08370	-747.607	42.0000	-0.00130	1630.	6.38E+07	0.00	0.00	0.00
2.6000	0.08056	-641.515	42.0000	-0.00132	1488.	6.38E+07	0.00	0.00	0.00
2.8000	0.07735	-535.325	42.0000	-0.00135	1345.	6.38E+07	0.00	0.00	0.00
3.0000	0.07410	-429.054	42.0000	-0.00136	1203.	6.38E+07	0.00	0.00	0.00
3.2000	0.07081	-322.718	42.0000	-0.00138	1060.	6.38E+07	0.00	0.00	0.00
3.4000	0.06749	-216.333	42.0000	-0.00139	917.6946	6.38E+07	0.00	0.00	0.00

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3.6000	0.06415	-109.915	42.0000	-0.00139	774.9976	6.38E+07	0.00	0.00	0.00
3.8000	0.06080	-3.480	42.0000	-0.00140	632.2782	6.38E+07	0.00	0.00	0.00
4.0000	0.05745	102.9553	42.0000	-0.00139	765.6657	6.38E+07	0.00	0.00	0.00
4.2000	0.05411	209.3750	42.0000	-0.00139	908.3648	6.38E+07	0.00	0.00	0.00
4.4000	0.05078	315.7629	42.0000	-0.00138	1051.	6.38E+07	0.00	0.00	0.00
4.6000	0.04749	422.1028	42.0000	-0.00136	1194.	6.38E+07	0.00	0.00	0.00
4.8000	0.04424	528.3786	42.0000	-0.00135	1336.	6.38E+07	0.00	0.00	0.00
5.0000	0.04103	634.5742	42.0000	-0.00132	1479.	6.38E+07	0.00	0.00	0.00
5.2000	0.03788	740.6734	42.0000	-0.00130	1621.	6.38E+07	0.00	0.00	0.00
5.4000	0.03479	846.6602	42.0000	-0.00127	1763.	6.38E+07	0.00	0.00	0.00
5.6000	0.03179	952.5183	42.0000	-0.00124	1905.	6.38E+07	0.00	0.00	0.00
5.8000	0.02886	1058.	42.0000	-0.00120	2047.	6.38E+07	0.00	0.00	0.00
6.0000	0.02604	1164.	42.0000	-0.00116	2188.	6.38E+07	0.00	0.00	0.00
6.2000	0.02332	1269.	42.0000	-0.00111	2329.	6.38E+07	0.00	0.00	0.00
6.4000	0.02071	1374.	42.0000	-0.00106	2470.	6.38E+07	0.00	0.00	0.00
6.6000	0.01823	1479.	42.0000	-0.00101	2611.	6.38E+07	0.00	0.00	0.00
6.8000	0.01588	1584.	42.0000	-9.49E-04	2752.	6.38E+07	0.00	0.00	0.00
7.0000	0.01368	1689.	42.0000	-8.87E-04	2892.	6.38E+07	0.00	0.00	0.00
7.2000	0.01162	1793.	38.4850	-8.22E-04	3032.	6.38E+07	-2.929	604.8000	0.00
7.4000	0.00973	1880.	29.0836	-7.53E-04	3148.	6.38E+07	-4.905	1210.	0.00
7.6000	0.00801	1939.	15.9294	-6.81E-04	3227.	6.38E+07	-6.057	1814.	0.00
7.8000	0.00646	1962.	0.8415	-6.07E-04	3258.	6.38E+07	-6.517	2419.	0.00
8.0000	0.00510	1947.	-14.683	-5.34E-04	3239.	6.38E+07	-6.421	3024.	0.00
8.2000	0.00390	1896.	-29.468	-4.62E-04	3170.	6.38E+07	-5.900	3629.	0.00
8.4000	0.00288	1810.	-42.645	-3.92E-04	3054.	6.38E+07	-5.080	4234.	0.00
8.6000	0.00202	1694.	-53.631	-3.26E-04	2899.	6.38E+07	-4.075	4838.	0.00
8.8000	0.00132	1555.	-62.100	-2.65E-04	2713.	6.38E+07	-2.983	5443.	0.00
9.0000	7.50E-04	1398.	-67.947	-2.09E-04	2503.	6.38E+07	-1.889	6048.	0.00
9.2000	3.10E-04	1230.	-71.247	-1.60E-04	2278.	6.38E+07	-0.860	6653.	0.00
9.4000	-1.78E-05	1058.	-72.215	-1.17E-04	2046.	6.38E+07	0.05384	7258.	0.00
9.6000	-2.51E-04	884.7910	-70.743	-8.03E-05	1814.	6.38E+07	1.1725	11232.	0.00
9.8000	-4.03E-04	718.6417	-66.896	-5.02E-05	1591.	6.38E+07	2.0331	12096.	0.00
10.0000	-4.91E-04	564.0937	-61.273	-2.60E-05	1384.	6.38E+07	2.6533	12960.	0.00
10.2000	-5.28E-04	424.7433	-54.436	-7.45E-06	1197.	6.38E+07	3.0436	13824.	0.00
10.4000	-5.27E-04	302.8595	-46.913	6.24E-06	1034.	6.38E+07	3.2258	14688.	0.00
10.6000	-4.98E-04	199.5107	-39.166	1.57E-05	895.1376	6.38E+07	3.2300	15552.	0.00
10.8000	-4.52E-04	114.7362	-31.582	2.16E-05	781.4628	6.38E+07	3.0903	16416.	0.00
11.0000	-3.95E-04	47.7443	-24.462	2.47E-05	691.6327	6.38E+07	2.8424	17280.	0.00
11.2000	-3.33E-04	-2.883	-18.026	2.55E-05	631.4773	6.38E+07	2.5209	18144.	0.00
11.4000	-2.72E-04	-38.989	-12.413	2.47E-05	679.8923	6.38E+07	2.1573	19008.	0.00
11.6000	-2.15E-04	-62.663	-7.689	2.28E-05	711.6374	6.38E+07	1.7788	19872.	0.00
11.8000	-1.63E-04	-76.082	-3.865	2.02E-05	729.6306	6.38E+07	1.4079	20736.	0.00
12.0000	-1.18E-04	-81.380	-0.902	1.72E-05	736.7345	6.38E+07	1.0613	21600.	0.00
12.2000	-8.03E-05	-80.552	1.2727	1.42E-05	735.6245	6.38E+07	0.7512	22464.	0.00
12.4000	-4.99E-05	-75.385	2.7556	1.12E-05	728.6964	6.38E+07	0.4845	23328.	0.00
12.6000	-2.63E-05	-67.416	3.6546	8.56E-06	718.0105	6.38E+07	0.2646	24192.	0.00
12.8000	-8.75E-06	-57.912	4.0817	6.21E-06	705.2668	6.38E+07	0.09131	25056.	0.00
13.0000	3.53E-06	-47.874	4.1455	4.22E-06	691.8062	6.38E+07	-0.03818	25920.	0.00
13.2000	1.15E-05	-38.048	3.9458	2.60E-06	678.6306	6.38E+07	-0.128	26784.	0.00
13.4000	1.60E-05	-28.955	3.5704	1.34E-06	666.4380	6.38E+07	-0.185	27648.	0.00
13.6000	1.79E-05	-20.921	3.0934	4.02E-07	655.6647	6.38E+07	-0.213	28512.	0.00
13.8000	1.79E-05	-14.110	2.5743	-2.57E-07	646.5319	6.38E+07	-0.220	29376.	0.00
14.0000	1.67E-05	-8.562	2.0583	-6.83E-07	639.0930	6.38E+07	-0.210	30240.	0.00
14.2000	1.47E-05	-4.225	1.5777	-9.24E-07	633.2769	6.38E+07	-0.190	31104.	0.00
14.4000	1.23E-05	-0.982	1.1537	-1.02E-06	628.9281	6.38E+07	-0.163	31968.	0.00
14.6000	9.76E-06	1.3211	0.7974	-1.02E-06	629.3835	6.38E+07	-0.134	32832.	0.00
14.8000	7.39E-06	2.8543	0.5127	-9.37E-07	631.4392	6.38E+07	-0.104	33696.	0.00
15.0000	5.27E-06	3.7896	0.2517	-8.12E-07	632.6935	6.38E+07	-0.114	51840.	0.00
15.2000	3.49E-06	4.0690	0.02246	-6.64E-07	633.0682	6.38E+07	-0.07727	53136.	0.00
15.4000	2.08E-06	3.9028	-0.127	-5.14E-07	632.8452	6.38E+07	-0.04718	54432.	0.00
15.6000	1.02E-06	3.4642	-0.212	-3.75E-07	632.2571	6.38E+07	-0.02375	55728.	0.00
15.8000	2.78E-07	2.8883	-0.248	-2.56E-07	631.4848	6.38E+07	-0.00661	57024.	0.00
16.0000	-2.06E-07	2.2738	-0.250	-1.59E-07	630.6609	6.38E+07	0.00500	58320.	0.00
16.2000	-4.85E-07	1.6879	-0.230	-8.44E-08	629.8752	6.38E+07	0.01204	59616.	0.00
16.4000	-6.11E-07	1.1710	-0.197	-3.06E-08	629.1821	6.38E+07	0.01550	60912.	0.00
16.6000	-6.31E-07	0.7432	-0.159	5.41E-09	628.6086	6.38E+07	0.01637	62208.	0.00
16.8000	-5.85E-07	0.4096	-0.120	2.71E-08	628.1612	6.38E+07	0.01548	63504.	0.00
17.0000	-5.01E-07	0.1651	-0.08558	3.79E-08	627.8333	6.38E+07	0.01354	64800.	0.00
17.2000	-4.03E-07	-0.00146	-0.05602	4.10E-08	627.6139	6.38E+07	0.01110	66096.	0.00
17.4000	-3.05E-07	-0.104	-0.03244	3.90E-08	627.7516	6.38E+07	0.00855	67392.	0.00
17.6000	-2.16E-07	-0.157	-0.01477	3.41E-08	627.8231	6.38E+07	0.00617	68688.	0.00
17.8000	-1.41E-07	-0.175	-0.00242	2.78E-08	627.8470	6.38E+07	0.00411	69984.	0.00
18.0000	-8.22E-08	-0.169	0.00545	2.13E-08	627.8390	6.38E+07	0.00244	71280.	0.00
18.2000	-3.87E-08	-0.149	0.00978	1.53E-08	627.8121	6.38E+07	0.00117	72576.	0.00
18.4000	-8.57E-09	-0.122	0.01150	1.02E-08	627.7762	6.38E+07	2.64E-04	73872.	0.00
18.6000	1.05E-08	-0.09417	0.01142	6.16E-09	627.7382	6.38E+07	-3.27E-04	75168.	0.00
18.8000	2.10E-08	-0.06771	0.01023	3.11E-09	627.7027	6.38E+07	-6.68E-04	76464.	0.00
19.0000	2.54E-08	-0.04509	0.00844	9.90E-10	627.6724	6.38E+07	-8.23E-04	77760.	0.00
19.2000	2.57E-08	-0.02721	0.00644	-3.69E-10	627.6484	6.38E+07	-8.48E-04	79056.	0.00
19.4000	2.36E-08	-0.01420	0.00447	-1.15E-09	627.6310	6.38E+07	-7.91E-04	80352.	0.00
19.6000	2.02E-08	-0.00574	0.00270	-1.52E-09	627.6196	6.38E+07	-6.88E-04	81648.	0.00
19.8000	1.63E-08	-0.00125	0.00119	-1.65E-09	627.6136	6.38E+07	-5.64E-04	82944.	0.00
20.0000	1.23E-08	0.00	0.00	-1.68E-09	627.6119	6.38E+07	-4.31E-04	42120.	0.00

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* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

```

Pile-head deflection           = 0.11347073 inches
Computed slope at pile head   = -0.0006740 radians
Maximum bending moment        = -2007. inch-lbs
Maximum shear force           = -72.2146585 lbs
Depth of maximum bending moment = 0.000000 feet below pile head
Depth of maximum shear force  = 9.40000000 feet below pile head
Number of iterations          = 6
Number of zero deflection points = 4
Pile deflection at ground     = 0.01367674 inches
    
```

 Computed Values of Pile Loading and Deflection
 for Lateral Loading for Load Case Number 2

```

Pile-head conditions are Shear and Rotational Stiffness (Loading Type 3)
Shear force at pile head           = 98.0 lb
Rotational stiffness                = 2977945.0 in-lb/rad
Axial load at pile head            = 440.0 lbs
    
```

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in ²	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2578	-4545.	98.0000	-0.00153	6258.	6.38E+07	0.00	0.00	0.00
0.2000	0.2539	-4308.	98.0000	-0.00169	5941.	6.38E+07	0.00	0.00	0.00
0.4000	0.2497	-4071.	98.0000	-0.00185	5623.	6.38E+07	0.00	0.00	0.00
0.6000	0.2450	-3834.	98.0000	-0.00200	5305.	6.38E+07	0.00	0.00	0.00
0.8000	0.2401	-3596.	98.0000	-0.00214	4986.	6.38E+07	0.00	0.00	0.00
1.0000	0.2348	-3359.	98.0000	-0.00227	4668.	6.38E+07	0.00	0.00	0.00
1.2000	0.2292	-3121.	98.0000	-0.00239	4349.	6.38E+07	0.00	0.00	0.00
1.4000	0.2233	-2883.	98.0000	-0.00250	4030.	6.38E+07	0.00	0.00	0.00
1.6000	0.2172	-2645.	98.0000	-0.00261	3711.	6.38E+07	0.00	0.00	0.00
1.8000	0.2108	-2407.	98.0000	-0.00270	3392.	6.38E+07	0.00	0.00	0.00
2.0000	0.2042	-2169.	98.0000	-0.00279	3073.	6.38E+07	0.00	0.00	0.00
2.2000	0.1974	-1931.	98.0000	-0.00287	2754.	6.38E+07	0.00	0.00	0.00
2.4000	0.1904	-1693.	98.0000	-0.00293	2434.	6.38E+07	0.00	0.00	0.00
2.6000	0.1833	-1454.	98.0000	-0.00299	2115.	6.38E+07	0.00	0.00	0.00
2.8000	0.1761	-1216.	98.0000	-0.00304	1795.	6.38E+07	0.00	0.00	0.00
3.0000	0.1687	-977.651	98.0000	-0.00309	1475.	6.38E+07	0.00	0.00	0.00
3.2000	0.1612	-739.173	98.0000	-0.00312	1155.	6.38E+07	0.00	0.00	0.00
3.4000	0.1537	-500.666	98.0000	-0.00314	835.5268	6.38E+07	0.00	0.00	0.00
3.6000	0.1462	-262.139	98.0000	-0.00316	515.6840	6.38E+07	0.00	0.00	0.00
3.8000	0.1386	-23.602	98.0000	-0.00316	195.8272	6.38E+07	0.00	0.00	0.00
4.0000	0.1310	214.9362	98.0000	-0.00316	452.3891	6.38E+07	0.00	0.00	0.00
4.2000	0.1234	453.4659	98.0000	-0.00314	772.2357	6.38E+07	0.00	0.00	0.00
4.4000	0.1159	691.9776	98.0000	-0.00312	1092.	6.38E+07	0.00	0.00	0.00
4.6000	0.1084	930.4617	98.0000	-0.00309	1412.	6.38E+07	0.00	0.00	0.00
4.8000	0.1011	1169.	98.0000	-0.00305	1732.	6.38E+07	0.00	0.00	0.00
5.0000	0.09378	1407.	98.0000	-0.00300	2051.	6.38E+07	0.00	0.00	0.00
5.2000	0.08664	1646.	98.0000	-0.00295	2371.	6.38E+07	0.00	0.00	0.00
5.4000	0.07964	1884.	98.0000	-0.00288	2690.	6.38E+07	0.00	0.00	0.00
5.6000	0.07281	2122.	98.0000	-0.00281	3010.	6.38E+07	0.00	0.00	0.00
5.8000	0.06617	2360.	98.0000	-0.00272	3329.	6.38E+07	0.00	0.00	0.00
6.0000	0.05975	2598.	98.0000	-0.00263	3648.	6.38E+07	0.00	0.00	0.00
6.2000	0.05356	2836.	98.0000	-0.00253	3967.	6.38E+07	0.00	0.00	0.00
6.4000	0.04763	3074.	98.0000	-0.00241	4286.	6.38E+07	0.00	0.00	0.00
6.6000	0.04197	3312.	98.0000	-0.00229	4605.	6.38E+07	0.00	0.00	0.00
6.8000	0.03661	3549.	98.0000	-0.00217	4923.	6.38E+07	0.00	0.00	0.00
7.0000	0.03158	3787.	98.0000	-0.00203	5242.	6.38E+07	0.00	0.00	0.00
7.2000	0.02688	4024.	91.9966	-0.00188	5560.	6.38E+07	-5.003	446.6548	0.00
7.4000	0.02255	4232.	73.5619	-0.00173	5839.	6.38E+07	-10.360	1103.	0.00
7.6000	0.01860	4381.	44.2558	-0.00156	6038.	6.38E+07	-14.062	1814.	0.00
7.8000	0.01505	4448.	9.1801	-0.00140	6128.	6.38E+07	-15.167	2419.	0.00
8.0000	0.01189	4428.	-27.006	-0.00123	6101.	6.38E+07	-14.988	3024.	0.00
8.2000	0.00914	4321.	-61.579	-0.00107	5958.	6.38E+07	-13.824	3629.	0.00
8.4000	0.00678	4134.	-92.520	-9.07E-04	5708.	6.38E+07	-11.960	4234.	0.00
8.6000	0.00479	3879.	-118.463	-7.56E-04	5365.	6.38E+07	-9.659	4838.	0.00
8.8000	0.00315	3567.	-138.633	-6.16E-04	4948.	6.38E+07	-7.149	5443.	0.00
9.0000	0.00184	3215.	-152.763	-4.88E-04	4475.	6.38E+07	-4.625	6048.	0.00
9.2000	8.09E-04	2835.	-161.004	-3.74E-04	3966.	6.38E+07	-2.242	6653.	0.00
9.4000	3.82E-05	2443.	-163.833	-2.75E-04	3439.	6.38E+07	-0.116	7258.	0.00
9.6000	-5.12E-04	2049.	-161.097	-1.91E-04	2912.	6.38E+07	2.3955	11232.	0.00
9.8000	-8.77E-04	1670.	-152.919	-1.21E-04	2403.	6.38E+07	4.4199	12096.	0.00
10.0000	-0.00109	1316.	-140.543	-6.46E-05	1928.	6.38E+07	5.8930	12960.	0.00

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10.2000	-0.00119	995.2520	-125.268	-2.11E-05	1499.	6.38E+07	6.8364	13824.	0.00
10.4000	-0.00119	714.3004	-108.306	1.11E-05	1122.	6.38E+07	7.2987	14688.	0.00
10.6000	-0.00113	475.3610	-90.731	3.34E-05	801.5950	6.38E+07	7.3472	15552.	0.00
10.8000	-0.00103	278.7229	-73.442	4.76E-05	537.9212	6.38E+07	7.0599	16416.	0.00
11.0000	-9.05E-04	122.7389	-57.148	5.52E-05	328.7608	6.38E+07	6.5182	17280.	0.00
11.2000	-7.67E-04	4.2948	-42.365	5.76E-05	169.9381	6.38E+07	5.8014	18144.	0.00
11.4000	-6.29E-04	-80.734	-29.425	5.61E-05	272.4354	6.38E+07	4.9822	19008.	0.00
11.6000	-4.98E-04	-137.061	-18.497	5.20E-05	347.9660	6.38E+07	4.1237	19872.	0.00
11.8000	-3.79E-04	-169.631	-9.616	4.62E-05	391.6391	6.38E+07	3.2779	20736.	0.00
12.0000	-2.76E-04	-183.314	-2.701	3.96E-05	409.9862	6.38E+07	2.4844	21600.	0.00
12.2000	-1.89E-04	-182.679	2.4061	3.27E-05	409.1350	6.38E+07	1.7714	22464.	0.00
12.4000	-1.19E-04	-171.833	5.9194	2.61E-05	394.5921	6.38E+07	1.1563	23328.	0.00
12.6000	-6.42E-05	-154.321	8.0833	1.99E-05	371.1092	6.38E+07	0.6469	24192.	0.00
12.8000	-2.33E-05	-133.076	9.1519	1.45E-05	342.6215	6.38E+07	0.2436	25056.	0.00
13.0000	5.51E-06	-110.423	9.3728	9.94E-06	312.2457	6.38E+07	-0.05947	25920.	0.00
13.2000	2.44E-05	-88.107	8.9750	6.20E-06	282.3232	6.38E+07	-0.272	26784.	0.00
13.4000	3.53E-05	-67.356	8.1609	3.28E-06	254.4968	6.38E+07	-0.406	27648.	0.00
13.6000	4.01E-05	-48.942	7.1012	1.09E-06	229.8062	6.38E+07	-0.477	28512.	0.00
13.8000	4.05E-05	-33.272	5.9341	-4.54E-07	208.7937	6.38E+07	-0.496	29376.	0.00
14.0000	3.79E-05	-20.457	4.7653	-1.46E-06	191.6107	6.38E+07	-0.478	30240.	0.00
14.2000	3.35E-05	-10.395	3.6709	-2.05E-06	178.1181	6.38E+07	-0.434	31104.	0.00
14.4000	2.81E-05	-2.833	2.7005	-2.29E-06	167.9778	6.38E+07	-0.375	31968.	0.00
14.6000	2.25E-05	2.5722	1.8820	-2.30E-06	167.6282	6.38E+07	-0.308	32832.	0.00
14.8000	1.71E-05	6.2056	1.2251	-2.13E-06	172.5002	6.38E+07	-0.240	33696.	0.00
15.0000	1.22E-05	8.4572	0.6200	-1.86E-06	175.5195	6.38E+07	-0.264	34560.	0.00
15.2000	8.16E-06	9.1854	0.08573	-1.53E-06	176.4959	6.38E+07	-0.181	35424.	0.00
15.4000	4.92E-06	8.8720	-0.265	-1.19E-06	176.0756	6.38E+07	-0.112	36288.	0.00
15.6000	2.47E-06	7.9158	-0.468	-8.71E-07	174.7935	6.38E+07	-0.05735	37152.	0.00
15.8000	7.38E-07	6.6291	-0.558	-5.97E-07	173.0681	6.38E+07	-0.01753	38016.	0.00
16.0000	-3.96E-07	5.2411	-0.567	-3.74E-07	171.2069	6.38E+07	0.00963	38880.	0.00
16.2000	-1.06E-06	3.9084	-0.524	-2.02E-07	169.4198	6.38E+07	0.02625	39744.	0.00
16.4000	-1.36E-06	2.7267	-0.451	-7.70E-08	167.8353	6.38E+07	0.03464	40608.	0.00
16.6000	-1.43E-06	1.7444	-0.365	7.13E-09	166.5182	6.38E+07	0.03697	41472.	0.00
16.8000	-1.33E-06	0.9750	-0.278	5.83E-08	165.4865	6.38E+07	0.03520	42336.	0.00
17.0000	-1.15E-06	0.4083	-0.199	8.43E-08	164.7266	6.38E+07	0.03096	43200.	0.00
17.2000	-9.26E-07	0.01997	-0.131	9.24E-08	164.2059	6.38E+07	0.02550	44064.	0.00
17.4000	-7.03E-07	-0.222	-0.07688	8.86E-08	164.4761	6.38E+07	0.01975	44928.	0.00
17.6000	-5.01E-07	-0.349	-0.03598	7.78E-08	164.6474	6.38E+07	0.01433	45792.	0.00
17.8000	-3.30E-07	-0.394	-0.00725	6.38E-08	164.7080	6.38E+07	0.00962	46656.	0.00
18.0000	-1.94E-07	-0.384	0.01122	4.92E-08	164.6942	6.38E+07	0.00577	47520.	0.00
18.2000	-9.36E-08	-0.341	0.02154	3.56E-08	164.6359	6.38E+07	0.00283	48384.	0.00
18.4000	-2.37E-08	-0.281	0.02581	2.39E-08	164.5557	6.38E+07	7.29E-04	49248.	0.00
18.6000	2.09E-08	-0.217	0.02590	1.45E-08	164.4698	6.38E+07	-6.56E-04	50112.	0.00
18.8000	4.60E-08	-0.157	0.02336	7.49E-09	164.3890	6.38E+07	-0.00146	50976.	0.00
19.0000	5.69E-08	-0.105	0.01939	2.57E-09	164.3195	6.38E+07	-0.00184	51840.	0.00
19.2000	5.83E-08	-0.06348	0.01487	-5.91E-10	164.2642	6.38E+07	-0.00192	52704.	0.00
19.4000	5.40E-08	-0.03332	0.01040	-2.41E-09	164.2238	6.38E+07	-0.00181	53568.	0.00
19.6000	4.67E-08	-0.01357	0.00632	-3.29E-09	164.1973	6.38E+07	-0.00159	54432.	0.00
19.8000	3.82E-08	-0.00298	0.00283	-3.60E-09	164.1831	6.38E+07	-0.00132	55296.	0.00
20.0000	2.94E-08	0.00	0.00	-3.66E-09	164.1791	6.38E+07	-0.00103	56160.	0.00

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 2:

Pile-head deflection	=	0.25779590 inches
Computed slope at pile head	=	-0.0015262 radians
Maximum bending moment	=	-4545. inch-lbs
Maximum shear force	=	-163.8331327 lbs
Depth of maximum bending moment	=	0.000000 feet below pile head
Depth of maximum shear force	=	9.40000000 feet below pile head
Number of iterations	=	6
Number of zero deflection points	=	4
Pile deflection at ground	=	0.03157604 inches

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

- Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
- Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
- Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
- Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
- Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
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1	v, lb	42.0000	R, in-lb/r	2977945.	1682.	0.1135	-6.74E-04	-72.215	-2007.
2	v, lb	98.0000	R, in-lb/r	2977945.	440.0000	0.2578	-0.00153	-163.833	-4545.

Maximum pile-head deflection = 0.2577959008 inches

Maximum pile-head rotation = -0.0015261717 radians = -0.087443 deg.

The analysis ended normally.

Exterior Strong.lp12o

LPIle Version 2022-12.013

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License Type : (Single User License)

Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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This model was prepared by:
Dylan Donn

Files Used for Analysis

Path to file locations:
\\Users\dylan.donn\Documents\Design\Greenskies\woodbridge Soundview\LPile\7 FT TTH\

Name of input data file:
Exterior Strong.lp12d

Name of output report file:
Exterior Strong.lp12o

Name of plot output file:
Exterior Strong.lp12p

Name of runtime message file:
Exterior Strong.lp12r

Date and Time of Analysis

Date: December 15, 2025 Time: 12:05:25

Problem Title

Project Name: woodbridge Soundview

Job Number:

Client: Greenskies

Engineer: DD

Description: Interior Strong - W6X9

Program Options and Settings

Computational Options:
- Conventional Analysis
Engineering Units Used for Data Input and Computations:

- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed = 500
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:

- Static loading specified
- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:

- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

Pile Structural Properties and Geometry

- Number of pile sections defined = 1
- Total length of pile = 20.000 ft
- Depth of ground surface below top of pile = 7.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	3.9400
2	20.000	3.9400

Input Structural Properties for Pile Sections:

Pile Section No. 1:

- Section 1 is an elastic pile
- Cross-sectional Shape = Strong AISC Section Pile
- Length of section = 20.000000 ft
- AISC Section Type = W
- AISC Section Name = W6X9
- Flange width = 3.940000 in
- Section Depth = 5.900000 in
- Flange Thickness = 0.215000 in
- Web Thickness = 0.170000 in
- Section Area = 2.680000 sq. in
- Moment of Inertia = 16.400000 in^4
- Elastic Modulus = 29000000. psi

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 7.000000 ft
 Distance from top of pile to bottom of layer = 15.000000 ft
 Effective unit weight at top of layer = 135.000000 pcf
 Effective unit weight at bottom of layer = 135.000000 pcf
 Friction angle at top of layer = 36.000000 deg.
 Friction angle at bottom of layer = 36.000000 deg.
 Subgrade k at top of layer = 150.000000 pci
 Subgrade k at bottom of layer = 150.000000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 15.000000 ft
 Distance from top of pile to bottom of layer = 20.000000 ft
 Effective unit weight at top of layer = 140.000000 pcf
 Effective unit weight at bottom of layer = 140.000000 pcf
 Friction angle at top of layer = 38.000000 deg.
 Friction angle at bottom of layer = 38.000000 deg.
 Subgrade k at top of layer = 225.000000 pci
 Subgrade k at bottom of layer = 225.000000 pci

(Depth of the lowest soil layer extends 0.000 ft below the pile tip)

**** Warning - Possible Input Data Error ****

Values entered for effective unit weights of soil were outside the limits of 20 pcf to 140 pcf.

The maximum input value, in layer 2, for effective unit weight = 140.00 pcf

This data may be erroneous. Please check your data.

 Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Angle of Friction deg.	kpy pci
1	Sand (Reese, et al.)	7.0000	135.0000	36.0000	150.0000
2	Sand (Reese, et al.)	15.0000	135.0000	36.0000	150.0000
		20.0000	140.0000	38.0000	225.0000
			140.0000	38.0000	225.0000

 Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	7.000	0.7000	1.0000
2	9.500	0.7000	1.0000

 Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

 Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 1

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
----------	-----------	-------------	-------------	-------------------------	-------------------------------	--------------

Exterior Strong.lp12o

1 1 V = 1398. lbs M = 18360. in-lbs 1844. Yes Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile section No. 1:

Moment-curvature properties were derived from elastic section properties

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	7.0000	0.00	N.A.	No	0.00	63859.
2	15.0000	7.3429	Yes	No	63859.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Moment (Loading Type 1)

Shear force at pile head = 1398.0 lbs
Applied moment at pile head = 18360.0 in-lbs
Axial thrust load on pile head = 1844.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in ²	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	2.9381	18360.	1398.	-0.03340	2893.	4.76E+08	0.00	0.00	0.00
0.2000	2.8581	21863.	1398.	-0.03330	3314.	4.76E+08	0.00	0.00	0.00
0.4000	2.7783	25365.	1398.	-0.03318	3735.	4.76E+08	0.00	0.00	0.00
0.6000	2.6988	28867.	1398.	-0.03304	4156.	4.76E+08	0.00	0.00	0.00
0.8000	2.6197	32368.	1398.	-0.03289	4576.	4.76E+08	0.00	0.00	0.00
1.0000	2.5410	35868.	1398.	-0.03271	4997.	4.76E+08	0.00	0.00	0.00
1.2000	2.4627	39368.	1398.	-0.03252	5417.	4.76E+08	0.00	0.00	0.00
1.4000	2.3849	42867.	1398.	-0.03232	5837.	4.76E+08	0.00	0.00	0.00
1.6000	2.3076	46364.	1398.	-0.03209	6257.	4.76E+08	0.00	0.00	0.00
1.8000	2.2308	49861.	1398.	-0.03185	6677.	4.76E+08	0.00	0.00	0.00
2.0000	2.1547	53357.	1398.	-0.03159	7097.	4.76E+08	0.00	0.00	0.00
2.2000	2.0792	56851.	1398.	-0.03131	7517.	4.76E+08	0.00	0.00	0.00
2.4000	2.0044	60344.	1398.	-0.03101	7937.	4.76E+08	0.00	0.00	0.00
2.6000	1.9303	63836.	1398.	-0.03070	8356.	4.76E+08	0.00	0.00	0.00
2.8000	1.8571	67326.	1398.	-0.03037	8775.	4.76E+08	0.00	0.00	0.00
3.0000	1.7846	70815.	1398.	-0.03002	9195.	4.76E+08	0.00	0.00	0.00
3.2000	1.7129	74302.	1398.	-0.02966	9613.	4.76E+08	0.00	0.00	0.00
3.4000	1.6422	77788.	1398.	-0.02927	10032.	4.76E+08	0.00	0.00	0.00

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3.6000	1.5724	81272.	1398.	-0.02887	10451.	4.76E+08	0.00	0.00	0.00
3.8000	1.5037	84754.	1398.	-0.02845	10869.	4.76E+08	0.00	0.00	0.00
4.0000	1.4359	88234.	1398.	-0.02801	11287.	4.76E+08	0.00	0.00	0.00
4.2000	1.3692	91712.	1398.	-0.02756	11705.	4.76E+08	0.00	0.00	0.00
4.4000	1.3036	95188.	1398.	-0.02709	12122.	4.76E+08	0.00	0.00	0.00
4.6000	1.2392	98663.	1398.	-0.02660	12540.	4.76E+08	0.00	0.00	0.00
4.8000	1.1759	102134.	1398.	-0.02609	12957.	4.76E+08	0.00	0.00	0.00
5.0000	1.1139	105604.	1398.	-0.02557	13373.	4.76E+08	0.00	0.00	0.00
5.2000	1.0532	109071.	1398.	-0.02503	13790.	4.76E+08	0.00	0.00	0.00
5.4000	0.9938	112536.	1398.	-0.02447	14206.	4.76E+08	0.00	0.00	0.00
5.6000	0.9357	115998.	1398.	-0.02389	14622.	4.76E+08	0.00	0.00	0.00
5.8000	0.8791	119458.	1398.	-0.02330	15038.	4.76E+08	0.00	0.00	0.00
6.0000	0.8239	122915.	1398.	-0.02269	15453.	4.76E+08	0.00	0.00	0.00
6.2000	0.7702	126369.	1398.	-0.02206	15868.	4.76E+08	0.00	0.00	0.00
6.4000	0.7180	129820.	1398.	-0.02141	16282.	4.76E+08	0.00	0.00	0.00
6.6000	0.6674	133269.	1398.	-0.02075	16697.	4.76E+08	0.00	0.00	0.00
6.8000	0.6184	136714.	1398.	-0.02007	17110.	4.76E+08	0.00	0.00	0.00
7.0000	0.5711	140157.	1398.	-0.01937	17524.	4.76E+08	0.00	0.00	0.00
7.2000	0.5255	143596.	1390.	-0.01865	17937.	4.76E+08	-6.908	31.5527	0.00
7.4000	0.4816	146992.	1363.	-0.01792	18345.	4.76E+08	-15.271	76.1039	0.00
7.6000	0.4395	150298.	1317.	-0.01717	18742.	4.76E+08	-23.286	127.1655	0.00
7.8000	0.3992	153465.	1253.	-0.01640	19123.	4.76E+08	-30.003	180.3882	0.00
8.0000	0.3607	156457.	1173.	-0.01562	19482.	4.76E+08	-36.668	243.9524	0.00
8.2000	0.3242	159233.	1074.	-0.01482	19815.	4.76E+08	-45.784	338.9315	0.00
8.4000	0.2896	161743.	951.2738	-0.01401	20117.	4.76E+08	-56.431	467.6750	0.00
8.6000	0.2569	163923.	798.5621	-0.01319	20379.	4.76E+08	-70.829	661.5921	0.00
8.8000	0.2263	165693.	608.5128	-0.01236	20591.	4.76E+08	-87.546	928.5711	0.00
9.0000	0.1976	166954.	375.9402	-0.01152	20743.	4.76E+08	-106.265	1291.	0.00
9.2000	0.1710	167599.	96.2837	-0.01068	20820.	4.76E+08	-126.782	1780.	0.00
9.4000	0.1464	167510.	-233.468	-0.00983	20810.	4.76E+08	-148.011	2427.	0.00
9.6000	0.1238	166565.	-670.581	-0.00899	20696.	4.76E+08	-216.249	4193.	0.00
9.8000	0.1032	164371.	-1191.	-0.00815	20433.	4.76E+08	-217.829	5065.	0.00
10.0000	0.08465	160918.	-1713.	-0.00733	20018.	4.76E+08	-216.483	6138.	0.00
10.2000	0.06803	156215.	-2228.	-0.00653	19453.	4.76E+08	-212.621	7501.	0.00
10.4000	0.05330	150284.	-2730.	-0.00576	18740.	4.76E+08	-205.659	9261.	0.00
10.6000	0.04039	143165.	-3209.	-0.00502	17885.	4.76E+08	-193.736	11513.	0.00
10.8000	0.02921	134926.	-3653.	-0.00432	16896.	4.76E+08	-176.408	14495.	0.00
11.0000	0.01967	125669.	-4035.	-0.00366	15784.	4.76E+08	-141.598	17280.	0.00
11.2000	0.01165	115593.	-4310.	-0.00305	14573.	4.76E+08	-88.040	18144.	0.00
11.4000	0.00502	105007.	-4464.	-0.00249	13302.	4.76E+08	-39.794	19008.	0.00
11.6000	-3.25E-04	94190.	-4508.	-0.00199	12002.	4.76E+08	2.6887	19872.	0.00
11.8000	-0.00453	83386.	-4458.	-0.00154	10705.	4.76E+08	39.1672	20736.	0.00
12.0000	-0.00773	72806.	-4327.	-0.00115	9434.	4.76E+08	69.5868	21600.	0.00
12.2000	-0.01005	62625.	-4131.	-8.07E-04	8211.	4.76E+08	94.0562	22464.	0.00
12.4000	-0.01161	52984.	-3883.	-5.16E-04	7053.	4.76E+08	112.8216	23328.	0.00
12.6000	-0.01252	43993.	-3596.	-2.71E-04	5973.	4.76E+08	126.2407	24192.	0.00
12.8000	-0.01291	35727.	-3283.	-6.98E-05	4980.	4.76E+08	134.7575	25056.	0.00
13.0000	-0.01286	28237.	-2954.	-9.16E-05	4080.	4.76E+08	138.8778	25920.	0.00
13.2000	-0.01247	21546.	-2621.	2.17E-04	3276.	4.76E+08	139.1464	26784.	0.00
13.4000	-0.01182	15656.	-2290.	3.11E-04	2569.	4.76E+08	136.1277	27648.	0.00
13.6000	-0.01098	10549.	-1970.	3.77E-04	1955.	4.76E+08	130.3874	28512.	0.00
13.8000	-0.01001	6194.	-1667.	4.19E-04	1432.	4.76E+08	122.4774	29376.	0.00
14.0000	-0.00896	2544.	-1385.	4.41E-04	993.6273	4.76E+08	112.9246	30240.	0.00
14.2000	-0.00789	-455.913	-1126.	4.47E-04	742.8249	4.76E+08	102.2208	31104.	0.00
14.4000	-0.00682	-2867.	-894.750	4.38E-04	1032.	4.76E+08	90.8166	31968.	0.00
14.6000	-0.00578	-4755.	-690.829	4.19E-04	1259.	4.76E+08	79.1174	32832.	0.00
14.8000	-0.00481	-6187.	-514.910	3.91E-04	1431.	4.76E+08	67.4818	33696.	0.00
15.0000	-0.00390	-7230.	-332.733	3.58E-04	1556.	4.76E+08	84.3325	51840.	0.00
15.2000	-0.00309	-7787.	-149.446	3.20E-04	1623.	4.76E+08	68.4066	53136.	0.00
15.4000	-0.00237	-7950.	-2.870	2.80E-04	1643.	4.76E+08	53.7397	54432.	0.00
15.6000	-0.00175	-7803.	110.2541	2.40E-04	1625.	4.76E+08	40.5307	55728.	0.00
15.8000	-0.00122	-7423.	193.5625	2.02E-04	1580.	4.76E+08	28.8931	57024.	0.00
16.0000	-7.76E-04	-6876.	250.8761	1.66E-04	1514.	4.76E+08	18.8682	58320.	0.00
16.2000	-4.20E-04	-6220.	286.0423	1.33E-04	1435.	4.76E+08	10.4370	59616.	0.00
16.4000	-1.39E-04	-5504.	302.8062	1.03E-04	1349.	4.76E+08	3.5329	60912.	0.00
16.6000	7.51E-05	-4767.	304.7096	7.73E-05	1261.	4.76E+08	-1.947	62208.	0.00
16.8000	2.32E-04	-4042.	295.0171	5.50E-05	1174.	4.76E+08	-6.130	63504.	0.00
17.0000	3.39E-04	-3352.	276.6675	3.64E-05	1091.	4.76E+08	-9.161	64800.	0.00
17.2000	4.06E-04	-2714.	252.2460	2.11E-05	1014.	4.76E+08	-11.190	66096.	0.00
17.4000	4.40E-04	-2141.	223.9754	8.83E-06	945.2673	4.76E+08	-12.369	67392.	0.00
17.6000	4.49E-04	-1639.	193.7231	-7.11E-07	884.9776	4.76E+08	-12.842	68688.	0.00
17.8000	4.37E-04	-1211.	163.0194	-7.90E-06	833.5687	4.76E+08	-12.745	69984.	0.00
18.0000	4.11E-04	-856.753	133.0863	-1.31E-05	790.9746	4.76E+08	-12.200	71280.	0.00
18.2000	3.74E-04	-572.413	104.8724	-1.67E-05	756.8191	4.76E+08	-11.312	72576.	0.00
18.4000	3.30E-04	-353.218	79.0919	-1.91E-05	730.4889	4.76E+08	-10.172	73872.	0.00
18.6000	2.83E-04	-192.603	56.2657	-2.04E-05	711.1956	4.76E+08	-8.850	75168.	0.00
18.8000	2.32E-04	-82.962	36.7623	-2.11E-05	698.0252	4.76E+08	-7.403	76464.	0.00
19.0000	1.81E-04	-15.957	20.8372	-2.14E-05	689.9765	4.76E+08	-5.868	77760.	0.00
19.2000	1.30E-04	17.2462	8.6686	-2.14E-05	690.1313	4.76E+08	-4.272	79056.	0.00
19.4000	7.85E-05	25.8410	0.3886	-2.13E-05	691.1638	4.76E+08	-2.628	80352.	0.00
19.6000	2.76E-05	19.2998	-3.891	-2.12E-05	690.3780	4.76E+08	-0.938	81648.	0.00
19.8000	-2.31E-05	7.3527	-4.060	-2.11E-05	688.9429	4.76E+08	0.7977	82944.	0.00
20.0000	-7.37E-05	0.00	0.00	-2.11E-05	688.0597	4.76E+08	2.5854	42120.	0.00

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* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

Pile-head deflection = 2.93813340 inches
 Computed slope at pile head = -0.0333977 radians
 Maximum bending moment = 167599. inch-lbs
 Maximum shear force = -4508. lbs
 Depth of maximum bending moment = 9.20000000 feet below pile head
 Depth of maximum shear force = 11.60000000 feet below pile head
 Number of iterations = 13
 Number of zero deflection points = 3
 Pile deflection at ground = 0.57110891 inches

 Pile-head Deflection vs. Pile Length for Load Case 1

Boundary Condition Type 1, Shear and Moment

Shear = 1398. lbs
 Moment = 18360. in-lbs
 Axial Load = 1844. lbs

Pile Length feet	Pile Head Deflection inches	Maximum Moment ln-lbs	Maximum Shear lbs
20.00000	2.93813340	167599.	-4508.
19.00000	2.94840869	167638.	-4515.
18.00000	2.93253160	167542.	-4504.
17.00000	2.93240980	167571.	-4509.
16.00000	2.94315977	167624.	-4491.
15.00000	2.94424081	167598.	-4502.
14.00000	2.96975990	167641.	-4875.
13.00000	3.33552085	168156.	-6411.

 Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
 Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
 Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
 Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
 Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
1	V, lb	1398.	M, in-lb	18360.	1844.	2.9381	-0.03340	-4508.	167599.

Maximum pile-head deflection = 2.9381334039 inches
 Maximum pile-head rotation = -0.0333977433 radians = -1.913550 deg.

The analysis ended normally.

Exterior Weak.lp12o

LPIle Version 2022-12.013

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Analysis of Individual Piles and Drilled Shafts
Subjected to Lateral Loading Using the p-y Method
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Files Used for Analysis

Path to file locations:
\Users\dylan.donn\Documents\Design\Greenskies\woodbridge Soundview\LPile\7 FT TTH\
Name of input data file:
Exterior Weak.lp12d
Name of output report file:
Exterior Weak.lp12o
Name of plot output file:
Exterior Weak.lp12p
Name of runtime message file:
Exterior Weak.lp12r

Date and Time of Analysis

Date: December 15, 2025 Time: 12:06:08

Problem Title

Project Name: woodbridge Soundview

Job Number:

Client: Greenskies

Engineer: DD

Description: Exterior Weak - W6X9

Program Options and Settings

Computational Options:
- Conventional Analysis
Engineering Units Used for Data Input and Computations:

- US Customary System Units (pounds, feet, inches)

Analysis Control Options:

- Maximum number of iterations allowed = 500
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in
- Number of pile increments = 100

Loading Type and Number of Cycles of Loading:

- Static loading specified
- Analysis uses p-y modification factors for p-y curves
- Analysis uses layering correction (Method of Georgiadis)
- No distributed lateral loads are entered
- Loading by lateral soil movements acting on pile not selected
- Input of shear resistance at the pile tip not selected
- Input of moment resistance at the pile tip not selected
- Computation of pile-head foundation stiffness matrix not selected
- Push-over analysis of pile not selected
- Buckling analysis of pile not selected

Output Options:

- Output files use decimal points to denote decimal symbols.
- Values of pile-head deflection, bending moment, shear force, and soil reaction are printed for full length of pile.
- Printing increment (nodal spacing of output points) = 1
- No p-y curves to be computed and reported for user-specified depths
- Print using wide report formats

 Pile Structural Properties and Geometry

- Number of pile sections defined = 1
- Total length of pile = 20.000 ft
- Depth of ground surface below top of pile = 7.0000 ft

Pile diameters used for p-y curve computations are defined using 2 points.

p-y curves are computed using pile diameter values interpolated with depth over the length of the pile. A summary of values of pile diameter vs. depth follows.

Point No.	Depth Below Pile Head feet	Pile Diameter inches
1	0.000	5.9000
2	20.000	5.9000

Input Structural Properties for Pile Sections:

Pile Section No. 1:

- Section 1 is an elastic pile
- Cross-sectional Shape = weak AISC Section Pile
- Length of section = 20.000000 ft
- AISC Section Type = W

AISC Section Name = W6X9

- Flange width = 3.940000 in
- Section Depth = 5.900000 in
- Flange Thickness = 0.215000 in
- Web Thickness = 0.170000 in
- Section Area = 2.680000 sq. in
- Moment of Inertia = 2.200000 in^4
- Elastic Modulus = 29000000. psi

 Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 7.000000 ft
 Distance from top of pile to bottom of layer = 15.000000 ft
 Effective unit weight at top of layer = 135.000000 pcf
 Effective unit weight at bottom of layer = 135.000000 pcf
 Friction angle at top of layer = 36.000000 deg.
 Friction angle at bottom of layer = 36.000000 deg.
 Subgrade k at top of layer = 150.000000 pci
 Subgrade k at bottom of layer = 150.000000 pci

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = 15.000000 ft
 Distance from top of pile to bottom of layer = 20.000000 ft
 Effective unit weight at top of layer = 140.000000 pcf
 Effective unit weight at bottom of layer = 140.000000 pcf
 Friction angle at top of layer = 38.000000 deg.
 Friction angle at bottom of layer = 38.000000 deg.
 Subgrade k at top of layer = 225.000000 pci
 Subgrade k at bottom of layer = 225.000000 pci

(Depth of the lowest soil layer extends 0.000 ft below the pile tip)

**** Warning - Possible Input Data Error ****

Values entered for effective unit weights of soil were outside the limits of 20 pcf to 140 pcf.

The maximum input value, in layer 2, for effective unit weight = 140.00 pcf

This data may be erroneous. Please check your data.

 Summary of Input Soil Properties

Layer Num.	Soil Type Name (p-y Curve Type)	Layer Depth ft	Effective Unit Wt. pcf	Angle of Friction deg.	kpy pci
1	Sand (Reese, et al.)	7.0000 15.0000	135.0000 135.0000	36.0000 36.0000	150.0000 150.0000
2	Sand (Reese, et al.)	15.0000 20.0000	140.0000 140.0000	38.0000 38.0000	225.0000 225.0000

 Modification Factors for p-y Curves

Distribution of p-y modifiers with depth defined using 2 points

Point No.	Depth X ft	p-mult	y-mult
1	7.000	0.7000	1.0000
2	9.500	0.7000	1.0000

 Static Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

 Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 2

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs	Compute Top y vs. Pile Length	Run Analysis
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1	3	V =	42.000000 lbs	R =	3348533. in-lbs	1844.	No	Yes
2	3	V =	103.000000 lbs	R =	3348533. in-lbs	380.000000000	No	Yes

V = shear force applied normal to pile axis
M = bending moment applied to pile head
y = lateral deflection normal to pile axis
S = pile slope relative to original pile batter angle
R = rotational stiffness applied to pile head
Values of top y vs. pile lengths can be computed only for load types with specified shear loading (Load Types 1, 2, and 3).
Thrust force is assumed to be acting axially for all pile batter angles.

Computations of Nominal Moment Capacity and Nonlinear Bending Stiffness

Axial thrust force values were determined from pile-head loading conditions

Number of Pile Sections Analyzed = 1

Pile Section No. 1:

Moment-curvature properties were derived from elastic section properties

Layering Correction Equivalent Depths of Soil & Rock Layers

Layer No.	Top of Layer Below Pile Head ft	Equivalent Top Depth Below Grnd Surf ft	Same Layer Type As Layer Above	Layer is Rock or is Below Rock Layer	F0 Integral for Layer lbs	F1 Integral for Layer lbs
1	7.0000	0.00	N.A.	No	0.00	72983.
2	15.0000	7.5469	Yes	No	72983.	N.A.

Notes: The F0 integral of Layer n+1 equals the sum of the F0 and F1 integrals for Layer n. Layering correction equivalent depths are computed only for soil types with both shallow-depth and deep-depth expressions for peak lateral load transfer. These soil types are soft and stiff clays, non-liquefied sands, and cemented c-phi soil.

Computed Values of Pile Loading and Deflection
for Lateral Loading for Load Case Number 1

Pile-head conditions are Shear and Rotational Stiffness (Loading Type 3)
Shear force at pile head = 42.0 lb
Rotational stiffness = 3348533.0 in-lb/rad
Axial load at pile head = 1844.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in^2	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.1103	-2050.	42.0000	-6.12E-04	3436.	6.38E+07	0.00	0.00	0.00
0.2000	0.1088	-1946.	42.0000	-6.87E-04	3297.	6.38E+07	0.00	0.00	0.00
0.4000	0.1070	-1842.	42.0000	-7.59E-04	3158.	6.38E+07	0.00	0.00	0.00
0.6000	0.1051	-1738.	42.0000	-8.26E-04	3018.	6.38E+07	0.00	0.00	0.00
0.8000	0.1031	-1633.	42.0000	-8.89E-04	2878.	6.38E+07	0.00	0.00	0.00
1.0000	0.1008	-1528.	42.0000	-9.49E-04	2737.	6.38E+07	0.00	0.00	0.00
1.2000	0.09850	-1423.	42.0000	-0.00100	2596.	6.38E+07	0.00	0.00	0.00
1.4000	0.09603	-1318.	42.0000	-0.00106	2455.	6.38E+07	0.00	0.00	0.00
1.6000	0.09343	-1212.	42.0000	-0.00110	2313.	6.38E+07	0.00	0.00	0.00
1.8000	0.09073	-1106.	42.0000	-0.00115	2172.	6.38E+07	0.00	0.00	0.00
2.0000	0.08793	-1000.	42.0000	-0.00119	2029.	6.38E+07	0.00	0.00	0.00
2.2000	0.08503	-894.234	42.0000	-0.00122	1887.	6.38E+07	0.00	0.00	0.00
2.4000	0.08206	-787.951	42.0000	-0.00125	1745.	6.38E+07	0.00	0.00	0.00
2.6000	0.07902	-681.536	42.0000	-0.00128	1602.	6.38E+07	0.00	0.00	0.00
2.8000	0.07591	-575.008	42.0000	-0.00131	1459.	6.38E+07	0.00	0.00	0.00
3.0000	0.07275	-468.384	42.0000	-0.00132	1316.	6.38E+07	0.00	0.00	0.00
3.2000	0.06955	-361.682	42.0000	-0.00134	1173.	6.38E+07	0.00	0.00	0.00
3.4000	0.06632	-254.920	42.0000	-0.00135	1030.	6.38E+07	0.00	0.00	0.00

Exterior weak.lp12o

3.6000	0.06306	-148.116	42.0000	-0.00136	886.6698	6.38E+07	0.00	0.00	0.00
3.8000	0.05979	-41.287	42.0000	-0.00136	743.4217	6.38E+07	0.00	0.00	0.00
4.0000	0.05652	65.5490	42.0000	-0.00136	775.9550	6.38E+07	0.00	0.00	0.00
4.2000	0.05325	172.3741	42.0000	-0.00136	919.1976	6.38E+07	0.00	0.00	0.00
4.4000	0.05000	279.1704	42.0000	-0.00135	1062.	6.38E+07	0.00	0.00	0.00
4.6000	0.04677	385.9202	42.0000	-0.00134	1206.	6.38E+07	0.00	0.00	0.00
4.8000	0.04358	492.6058	42.0000	-0.00132	1349.	6.38E+07	0.00	0.00	0.00
5.0000	0.04043	599.2094	42.0000	-0.00130	1492.	6.38E+07	0.00	0.00	0.00
5.2000	0.03734	705.7133	42.0000	-0.00128	1634.	6.38E+07	0.00	0.00	0.00
5.4000	0.03431	812.0996	42.0000	-0.00125	1777.	6.38E+07	0.00	0.00	0.00
5.6000	0.03136	918.3508	42.0000	-0.00121	1919.	6.38E+07	0.00	0.00	0.00
5.8000	0.02848	1024.	42.0000	-0.00118	2062.	6.38E+07	0.00	0.00	0.00
6.0000	0.02570	1130.	42.0000	-0.00114	2204.	6.38E+07	0.00	0.00	0.00
6.2000	0.02302	1236.	42.0000	-0.00109	2346.	6.38E+07	0.00	0.00	0.00
6.4000	0.02046	1342.	42.0000	-0.00104	2487.	6.38E+07	0.00	0.00	0.00
6.6000	0.01801	1447.	42.0000	-9.92E-04	2628.	6.38E+07	0.00	0.00	0.00
6.8000	0.01569	1552.	42.0000	-9.36E-04	2769.	6.38E+07	0.00	0.00	0.00
7.0000	0.01352	1657.	42.0000	-8.75E-04	2910.	6.38E+07	0.00	0.00	0.00
7.2000	0.01149	1761.	38.5245	-8.11E-04	3050.	6.38E+07	-2.896	604.8000	0.00
7.4000	0.00963	1849.	29.2268	-7.43E-04	3167.	6.38E+07	-4.852	1210.	0.00
7.6000	0.00793	1908.	16.2133	-6.72E-04	3247.	6.38E+07	-5.993	1814.	0.00
7.8000	0.00640	1933.	1.2813	-6.00E-04	3280.	6.38E+07	-6.451	2419.	0.00
8.0000	0.00505	1920.	-14.090	-5.28E-04	3262.	6.38E+07	-6.359	3024.	0.00
8.2000	0.00387	1870.	-28.736	-4.56E-04	3195.	6.38E+07	-5.847	3629.	0.00
8.4000	0.00286	1786.	-41.798	-3.88E-04	3083.	6.38E+07	-5.038	4234.	0.00
8.6000	0.00201	1673.	-52.699	-3.23E-04	2931.	6.38E+07	-4.045	4838.	0.00
8.8000	0.00131	1536.	-61.113	-2.62E-04	2747.	6.38E+07	-2.966	5443.	0.00
9.0000	7.48E-04	1382.	-66.934	-2.07E-04	2541.	6.38E+07	-1.885	6048.	0.00
9.2000	3.13E-04	1216.	-70.237	-1.58E-04	2319.	6.38E+07	-0.867	6653.	0.00
9.4000	-1.26E-05	1046.	-71.232	-1.16E-04	2090.	6.38E+07	0.03797	7258.	0.00
9.6000	-2.44E-04	875.3699	-69.819	-7.98E-05	1862.	6.38E+07	1.1397	11232.	0.00
9.8000	-3.95E-04	711.3671	-66.059	-4.99E-05	1642.	6.38E+07	1.9932	12096.	0.00
10.0000	-4.83E-04	558.7270	-60.536	-2.60E-05	1437.	6.38E+07	2.6093	12960.	0.00
10.2000	-5.20E-04	421.0237	-53.807	-7.62E-06	1253.	6.38E+07	2.9981	13824.	0.00
10.4000	-5.20E-04	300.5191	-46.393	5.96E-06	1091.	6.38E+07	3.1810	14688.	0.00
10.6000	-4.92E-04	198.2868	-38.750	1.53E-05	953.9443	6.38E+07	3.1876	15552.	0.00
10.8000	-4.46E-04	114.3820	-31.263	2.12E-05	841.4355	6.38E+07	3.0516	16416.	0.00
11.0000	-3.90E-04	48.0355	-24.231	2.43E-05	752.4710	6.38E+07	2.8084	17280.	0.00
11.2000	-3.30E-04	-2.142	-17.871	2.51E-05	690.9325	6.38E+07	2.4920	18144.	0.00
11.4000	-2.69E-04	-37.966	-12.320	2.44E-05	738.9685	6.38E+07	2.1337	19008.	0.00
11.6000	-2.13E-04	-61.493	-7.647	2.25E-05	770.5163	6.38E+07	1.7605	19872.	0.00
11.8000	-1.61E-04	-74.870	-3.862	1.99E-05	788.4542	6.38E+07	1.3940	20736.	0.00
12.0000	-1.17E-04	-80.206	-0.927	1.70E-05	795.6084	6.38E+07	1.0517	21600.	0.00
12.2000	-7.96E-05	-79.470	1.2293	1.40E-05	794.6216	6.38E+07	0.7451	22464.	0.00
12.4000	-4.95E-05	-74.429	2.7012	1.11E-05	787.8623	6.38E+07	0.4814	23328.	0.00
12.6000	-2.62E-05	-66.603	3.5954	8.48E-06	777.3682	6.38E+07	0.2638	24192.	0.00
12.8000	-8.83E-06	-57.246	4.0226	6.15E-06	764.8216	6.38E+07	0.09216	25056.	0.00
13.0000	3.35E-06	-47.349	4.0898	4.18E-06	751.5504	6.38E+07	-0.03616	25920.	0.00
13.2000	1.12E-05	-37.652	3.8957	2.58E-06	738.5480	6.38E+07	-0.126	26784.	0.00
13.4000	1.58E-05	-28.672	3.5274	1.34E-06	726.5068	6.38E+07	-0.181	27648.	0.00
13.6000	1.77E-05	-20.733	3.0578	4.07E-07	715.8605	6.38E+07	-0.210	28512.	0.00
13.8000	1.77E-05	-13.998	2.5460	-2.46E-07	706.8304	6.38E+07	-0.217	29376.	0.00
14.0000	1.65E-05	-8.510	2.0368	-6.70E-07	699.4708	6.38E+07	-0.208	30240.	0.00
14.2000	1.45E-05	-4.216	1.5622	-9.09E-07	693.7131	6.38E+07	-0.188	31104.	0.00
14.4000	1.21E-05	-1.003	1.1432	-1.01E-06	689.4050	6.38E+07	-0.161	31968.	0.00
14.6000	9.66E-06	1.2800	0.7910	-1.00E-06	689.7761	6.38E+07	-0.132	32832.	0.00
14.8000	7.31E-06	2.8022	0.5093	-9.25E-07	691.8172	6.38E+07	-0.103	33696.	0.00
15.0000	5.22E-06	3.7329	0.2510	-8.02E-07	693.0652	6.38E+07	-0.113	34560.	0.00
15.2000	3.46E-06	4.0141	0.02394	-6.56E-07	693.4422	6.38E+07	-0.07657	35424.	0.00
15.4000	2.06E-06	3.8536	-0.124	-5.09E-07	693.2270	6.38E+07	-0.04681	36288.	0.00
15.6000	1.02E-06	3.4228	-0.209	-3.72E-07	692.6494	6.38E+07	-0.02363	37152.	0.00
15.8000	2.80E-07	2.8554	-0.245	-2.54E-07	691.8886	6.38E+07	-0.00665	38016.	0.00
16.0000	-2.00E-07	2.2492	-0.247	-1.58E-07	691.0757	6.38E+07	0.00485	38880.	0.00
16.2000	-4.76E-07	1.6706	-0.227	-8.38E-08	690.2998	6.38E+07	0.01183	39744.	0.00
16.4000	-6.02E-07	1.1598	-0.195	-3.06E-08	689.6149	6.38E+07	0.01528	40608.	0.00
16.6000	-6.23E-07	0.7369	-0.157	5.08E-09	689.0478	6.38E+07	0.01615	41472.	0.00
16.8000	-5.78E-07	0.4068	-0.119	2.66E-08	688.6052	6.38E+07	0.01529	42336.	0.00
17.0000	-4.96E-07	0.1648	-0.08474	3.73E-08	688.2807	6.38E+07	0.01338	43200.	0.00
17.2000	-3.98E-07	-2.43E-04	-0.05552	4.04E-08	688.0600	6.38E+07	0.01097	44064.	0.00
17.4000	-3.01E-07	-0.102	-0.03219	3.85E-08	688.1965	6.38E+07	0.00846	44928.	0.00
17.6000	-2.14E-07	-0.155	-0.01470	3.37E-08	688.2677	6.38E+07	0.00611	45792.	0.00
17.8000	-1.40E-07	-0.173	-0.00247	2.75E-08	688.2916	6.38E+07	0.00408	46656.	0.00
18.0000	-8.16E-08	-0.167	0.00533	2.11E-08	688.2839	6.38E+07	0.00242	47520.	0.00
18.2000	-3.85E-08	-0.148	0.00963	1.52E-08	688.2575	6.38E+07	0.00116	48384.	0.00
18.4000	-8.66E-09	-0.121	0.01135	1.01E-08	688.2221	6.38E+07	2.67E-04	49248.	0.00
18.6000	1.02E-08	-0.09315	0.01128	6.11E-09	688.1846	6.38E+07	-3.19E-04	50112.	0.00
18.8000	2.06E-08	-0.06701	0.01011	3.09E-09	688.1496	6.38E+07	-6.58E-04	50976.	0.00
19.0000	2.50E-08	-0.04465	0.00835	9.93E-10	688.1196	6.38E+07	-8.11E-04	51840.	0.00
19.2000	2.54E-08	-0.02695	0.00637	-3.53E-10	688.0958	6.38E+07	-8.37E-04	52704.	0.00
19.4000	2.33E-08	-0.01408	0.00443	-1.13E-09	688.0786	6.38E+07	-7.82E-04	53568.	0.00
19.6000	2.00E-08	-0.00570	0.00267	-1.50E-09	688.0673	6.38E+07	-6.81E-04	54432.	0.00
19.8000	1.62E-08	-0.00124	0.00118	-1.63E-09	688.0614	6.38E+07	-5.59E-04	55296.	0.00
20.0000	1.22E-08	0.00	0.00	-1.65E-09	688.0597	6.38E+07	-4.28E-04	56160.	0.00

Exterior Weak.lpl2o

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 1:

Pile-head deflection = 0.11031697 inches
 Computed slope at pile head = -0.0006121 radians
 Maximum bending moment = -2050. inch-lbs
 Maximum shear force = -71.2322068 lbs
 Depth of maximum bending moment = 0.000000 feet below pile head
 Depth of maximum shear force = 9.40000000 feet below pile head
 Number of iterations = 6
 Number of zero deflection points = 4
 Pile deflection at ground = 0.01351883 inches

 Computed Values of Pile Loading and Deflection
 for Lateral Loading for Load Case Number 2

Pile-head conditions are Shear and Rotational Stiffness (Loading Type 3)
 Shear force at pile head = 103.0 lb
 Rotational stiffness = 3348533.0 in-lb/rad
 Axial load at pile head = 380.0 lbs

Depth X feet	Deflect. y inches	Bending Moment in-lbs	Shear Force lbs	Slope S radians	Total Stress psi*	Bending Stiffness lb-in ²	Soil Res. p lb/inch	Soil Spr. Es*H lb/inch	Distrib. Lat. Load lb/inch
0.00	0.2624	-4858.	103.0000	-0.00145	6655.	6.38E+07	0.00	0.00	0.00
0.2000	0.2587	-4609.	103.0000	-0.00163	6322.	6.38E+07	0.00	0.00	0.00
0.4000	0.2546	-4360.	103.0000	-0.00180	5988.	6.38E+07	0.00	0.00	0.00
0.6000	0.2501	-4111.	103.0000	-0.00196	5655.	6.38E+07	0.00	0.00	0.00
0.8000	0.2452	-3862.	103.0000	-0.00211	5321.	6.38E+07	0.00	0.00	0.00
1.0000	0.2400	-3613.	103.0000	-0.00225	4986.	6.38E+07	0.00	0.00	0.00
1.2000	0.2344	-3364.	103.0000	-0.00238	4652.	6.38E+07	0.00	0.00	0.00
1.4000	0.2285	-3114.	103.0000	-0.00250	4318.	6.38E+07	0.00	0.00	0.00
1.6000	0.2224	-2865.	103.0000	-0.00261	3983.	6.38E+07	0.00	0.00	0.00
1.8000	0.2160	-2615.	103.0000	-0.00272	3648.	6.38E+07	0.00	0.00	0.00
2.0000	0.2094	-2365.	103.0000	-0.00281	3314.	6.38E+07	0.00	0.00	0.00
2.2000	0.2025	-2116.	103.0000	-0.00289	2979.	6.38E+07	0.00	0.00	0.00
2.4000	0.1955	-1866.	103.0000	-0.00297	2644.	6.38E+07	0.00	0.00	0.00
2.6000	0.1883	-1616.	103.0000	-0.00303	2308.	6.38E+07	0.00	0.00	0.00
2.8000	0.1809	-1366.	103.0000	-0.00309	1973.	6.38E+07	0.00	0.00	0.00
3.0000	0.1734	-1116.	103.0000	-0.00314	1638.	6.38E+07	0.00	0.00	0.00
3.2000	0.1659	-865.626	103.0000	-0.00317	1303.	6.38E+07	0.00	0.00	0.00
3.4000	0.1582	-615.516	103.0000	-0.00320	967.1423	6.38E+07	0.00	0.00	0.00
3.6000	0.1505	-365.385	103.0000	-0.00322	631.7396	6.38E+07	0.00	0.00	0.00
3.8000	0.1427	-115.242	103.0000	-0.00323	296.3201	6.38E+07	0.00	0.00	0.00
4.0000	0.1350	134.9054	103.0000	-0.00323	322.6869	6.38E+07	0.00	0.00	0.00
4.2000	0.1272	385.0481	103.0000	-0.00322	658.1055	6.38E+07	0.00	0.00	0.00
4.4000	0.1195	635.1776	103.0000	-0.00320	993.5064	6.38E+07	0.00	0.00	0.00
4.6000	0.1119	885.2853	103.0000	-0.00317	1329.	6.38E+07	0.00	0.00	0.00
4.8000	0.1043	1135.	103.0000	-0.00313	1664.	6.38E+07	0.00	0.00	0.00
5.0000	0.09684	1385.	103.0000	-0.00309	1999.	6.38E+07	0.00	0.00	0.00
5.2000	0.08950	1635.	103.0000	-0.00303	2335.	6.38E+07	0.00	0.00	0.00
5.4000	0.08230	1885.	103.0000	-0.00296	2670.	6.38E+07	0.00	0.00	0.00
5.6000	0.07527	2135.	103.0000	-0.00289	3005.	6.38E+07	0.00	0.00	0.00
5.8000	0.06844	2385.	103.0000	-0.00280	3340.	6.38E+07	0.00	0.00	0.00
6.0000	0.06182	2635.	103.0000	-0.00271	3675.	6.38E+07	0.00	0.00	0.00
6.2000	0.05544	2884.	103.0000	-0.00260	4009.	6.38E+07	0.00	0.00	0.00
6.4000	0.04932	3134.	103.0000	-0.00249	4344.	6.38E+07	0.00	0.00	0.00
6.6000	0.04348	3383.	103.0000	-0.00237	4678.	6.38E+07	0.00	0.00	0.00
6.8000	0.03795	3633.	103.0000	-0.00224	5013.	6.38E+07	0.00	0.00	0.00
7.0000	0.03275	3882.	103.0000	-0.00210	5347.	6.38E+07	0.00	0.00	0.00
7.2000	0.02789	4131.	96.9344	-0.00194	5681.	6.38E+07	-5.055	434.8879	0.00
7.4000	0.02341	4351.	78.3005	-0.00179	5976.	6.38E+07	-10.474	1074.	0.00
7.6000	0.01933	4510.	48.1989	-0.00162	6189.	6.38E+07	-14.611	1814.	0.00
7.8000	0.01565	4585.	11.7397	-0.00145	6290.	6.38E+07	-15.772	2419.	0.00
8.0000	0.01238	4569.	-25.905	-0.00128	6268.	6.38E+07	-15.599	3024.	0.00
8.2000	0.00953	4463.	-61.906	-0.00111	6126.	6.38E+07	-14.403	3629.	0.00
8.4000	0.00707	4274.	-94.166	-9.41E-04	5873.	6.38E+07	-12.480	4234.	0.00
8.6000	0.00501	4013.	-121.260	-7.85E-04	5522.	6.38E+07	-10.099	4838.	0.00
8.8000	0.00331	3693.	-142.377	-6.40E-04	5094.	6.38E+07	-7.499	5443.	0.00
9.0000	0.00194	3330.	-157.232	-5.08E-04	4607.	6.38E+07	-4.881	6048.	0.00
9.2000	8.68E-04	2939.	-165.975	-3.90E-04	4083.	6.38E+07	-2.406	6653.	0.00
9.4000	6.42E-05	2534.	-169.095	-2.87E-04	3540.	6.38E+07	-0.194	7258.	0.00
9.6000	-5.11E-04	2128.	-166.461	-1.99E-04	2996.	6.38E+07	2.3893	11232.	0.00
9.8000	-8.93E-04	1736.	-158.192	-1.27E-04	2469.	6.38E+07	4.5014	12096.	0.00
10.0000	-0.00112	1369.	-145.539	-6.84E-05	1978.	6.38E+07	6.0428	12960.	0.00

Exterior weak.lpl2o

10.2000	-0.00122	1037.	-129.846	-2.31E-05	1533.	6.38E+07	7.0349	13824.	0.00
10.4000	-0.00123	745.9122	-112.371	1.04E-05	1142.	6.38E+07	7.5275	14688.	0.00
10.6000	-0.00117	497.8792	-94.230	3.38E-05	809.4018	6.38E+07	7.5900	15552.	0.00
10.8000	-0.00107	293.5474	-76.359	4.87E-05	535.4114	6.38E+07	7.3027	16416.	0.00
11.0000	-9.38E-04	131.2691	-59.495	5.67E-05	317.8110	6.38E+07	6.7500	17280.	0.00
11.2000	-7.96E-04	7.8665	-44.178	5.93E-05	152.3393	6.38E+07	6.0140	18144.	0.00
11.4000	-6.53E-04	-80.896	-30.757	5.79E-05	250.2646	6.38E+07	5.1702	19008.	0.00
11.6000	-5.17E-04	-139.875	-19.412	5.38E-05	329.3501	6.38E+07	4.2840	19872.	0.00
11.8000	-3.95E-04	-174.173	-10.180	4.79E-05	375.3409	6.38E+07	3.4095	20736.	0.00
12.0000	-2.88E-04	-188.826	-2.983	4.11E-05	394.9897	6.38E+07	2.5881	21600.	0.00
12.2000	-1.98E-04	-188.565	2.3420	3.40E-05	394.6401	6.38E+07	1.8492	22464.	0.00
12.4000	-1.25E-04	-177.647	6.0142	2.71E-05	379.9990	6.38E+07	1.2110	23328.	0.00
12.6000	-6.76E-05	-159.746	8.2857	2.07E-05	355.9964	6.38E+07	0.6819	24192.	0.00
12.8000	-2.51E-05	-137.913	9.4188	1.51E-05	326.7199	6.38E+07	0.2623	25056.	0.00
13.0000	4.94E-06	-114.564	9.6696	1.04E-05	295.4107	6.38E+07	-0.05334	25920.	0.00
13.2000	2.47E-05	-91.518	9.2753	6.50E-06	264.5083	6.38E+07	-0.275	26784.	0.00
13.4000	3.61E-05	-70.054	8.4456	3.46E-06	235.7274	6.38E+07	-0.416	27648.	0.00
13.6000	4.13E-05	-50.985	7.3580	1.18E-06	210.1576	6.38E+07	-0.490	28512.	0.00
13.8000	4.18E-05	-34.738	6.1559	-4.31E-07	188.3714	6.38E+07	-0.512	29376.	0.00
14.0000	3.92E-05	-21.436	4.9494	-1.49E-06	170.5349	6.38E+07	-0.494	30240.	0.00
14.2000	3.47E-05	-10.978	3.8178	-2.10E-06	156.5118	6.38E+07	-0.449	31104.	0.00
14.4000	2.91E-05	-3.107	2.8132	-2.36E-06	145.9571	6.38E+07	-0.388	31968.	0.00
14.6000	2.33E-05	2.5297	1.9648	-2.37E-06	145.1831	6.38E+07	-0.319	32832.	0.00
14.8000	1.77E-05	6.3287	1.2832	-2.21E-06	150.2772	6.38E+07	-0.249	33696.	0.00
15.0000	1.27E-05	8.6929	0.6544	-1.92E-06	153.4475	6.38E+07	-0.275	34560.	0.00
15.2000	8.50E-06	9.4732	0.09848	-1.58E-06	154.4937	6.38E+07	-0.188	35424.	0.00
15.4000	5.14E-06	9.1685	-0.267	-1.23E-06	154.0852	6.38E+07	-0.116	36288.	0.00
15.6000	2.59E-06	8.1926	-0.479	-9.05E-07	152.7766	6.38E+07	-0.06024	37152.	0.00
15.8000	7.92E-07	6.8695	-0.574	-6.22E-07	151.0024	6.38E+07	-0.01883	38016.	0.00
16.0000	-3.89E-07	5.4377	-0.585	-3.90E-07	149.0825	6.38E+07	0.00945	38880.	0.00
16.2000	-1.08E-06	4.0601	-0.542	-2.11E-07	147.2353	6.38E+07	0.02682	39744.	0.00
16.4000	-1.40E-06	2.8369	-0.467	-8.17E-08	145.5950	6.38E+07	0.03563	40608.	0.00
16.6000	-1.47E-06	1.8188	-0.378	5.89E-09	144.2299	6.38E+07	0.03815	41472.	0.00
16.8000	-1.38E-06	1.0204	-0.289	5.93E-08	143.1592	6.38E+07	0.03640	42336.	0.00
17.0000	-1.19E-06	0.4315	-0.207	8.66E-08	142.3697	6.38E+07	0.03205	43200.	0.00
17.2000	-9.60E-07	0.02731	-0.137	9.52E-08	141.8277	6.38E+07	0.02643	44064.	0.00
17.4000	-7.30E-07	-0.225	-0.08035	9.15E-08	142.0923	6.38E+07	0.02050	44928.	0.00
17.6000	-5.21E-07	-0.359	-0.03787	8.05E-08	142.2718	6.38E+07	0.01490	45792.	0.00
17.8000	-3.43E-07	-0.407	-0.00797	6.62E-08	142.3362	6.38E+07	0.01001	46656.	0.00
18.0000	-2.03E-07	-0.397	0.01128	5.10E-08	142.3233	6.38E+07	0.00603	47520.	0.00
18.2000	-9.84E-08	-0.353	0.02208	3.69E-08	142.2638	6.38E+07	0.00298	48384.	0.00
18.4000	-2.56E-08	-0.291	0.02660	2.48E-08	142.1812	6.38E+07	7.89E-04	49248.	0.00
18.6000	2.09E-08	-0.225	0.02676	1.51E-08	142.0926	6.38E+07	-6.53E-04	50112.	0.00
18.8000	4.71E-08	-0.163	0.02418	7.85E-09	142.0090	6.38E+07	-0.00150	50976.	0.00
19.0000	5.86E-08	-0.109	0.02010	2.75E-09	141.9370	6.38E+07	-0.00190	51840.	0.00
19.2000	6.02E-08	-0.06609	0.01544	-5.43E-10	141.8797	6.38E+07	-0.00198	52704.	0.00
19.4000	5.60E-08	-0.03474	0.01081	-2.44E-09	141.8376	6.38E+07	-0.00187	53568.	0.00
19.6000	4.85E-08	-0.01417	0.00658	-3.36E-09	141.8101	6.38E+07	-0.00165	54432.	0.00
19.8000	3.98E-08	-0.00312	0.00295	-3.68E-09	141.7952	6.38E+07	-0.00138	55296.	0.00
20.0000	3.09E-08	0.00	0.00	-3.74E-09	141.7910	6.38E+07	-0.00108	56160.	0.00

* The above values of total stress are combined axial and bending stresses.

Output Summary for Load Case No. 2:

Pile-head deflection	=	0.26240691 inches
Computed slope at pile head	=	-0.0014506 radians
Maximum bending moment	=	-4858. inch-lbs
Maximum shear force	=	-169.0949400 lbs
Depth of maximum bending moment	=	0.000000 feet below pile head
Depth of maximum shear force	=	9.40000000 feet below pile head
Number of iterations	=	6
Number of zero deflection points	=	4
Pile deflection at ground	=	0.03274829 inches

Summary of Pile-head Responses for Conventional Analyses

Definitions of Pile-head Loading Conditions:

- Load Type 1: Load 1 = Shear, V, lbs, and Load 2 = Moment, M, in-lbs
- Load Type 2: Load 1 = Shear, V, lbs, and Load 2 = Slope, S, radians
- Load Type 3: Load 1 = Shear, V, lbs, and Load 2 = Rot. Stiffness, R, in-lbs/rad.
- Load Type 4: Load 1 = Top Deflection, y, inches, and Load 2 = Moment, M, in-lbs
- Load Type 5: Load 1 = Top Deflection, y, inches, and Load 2 = Slope, S, radians

Load Case No.	Load Type 1	Pile-head Load 1	Load Type 2	Pile-head Load 2	Axial Loading lbs	Pile-head Deflection inches	Pile-head Rotation radians	Max Shear in Pile lbs	Max Moment in Pile in-lbs
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Exterior weak.lp12o

1	v, lb	42.0000	R, in-lb/r	3348533.	1844.	0.1103	-6.12E-04	-71.232	-2050.
2	v, lb	103.0000	R, in-lb/r	3348533.	380.0000	0.2624	-0.00145	-169.095	-4858.

Maximum pile-head deflection = 0.2624069092 inches

Maximum pile-head rotation = -0.0014506394 radians = -0.083116 deg.

The analysis ended normally.

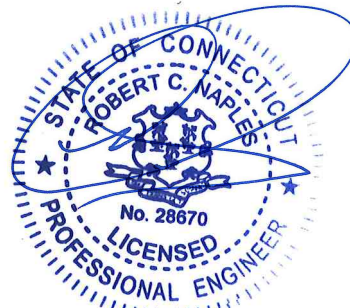
**OMNI v3 144HC-M10-SL540-52 -C Ground Force Analysis, 11 INT(SB) / 13 EXT (SB)Columns
52° Range of Motion – Category I - Low Risk – ASCE_7-16-SM**

PROJECT INFORMATION:

Project Name: Woodbridge Soundview
Client: Greenskies
Location: Woodbridge/CT
Size: 2.116 MWDC

DESIGN REQUIREMENTS:

Building Code: ASCE_7-16-SM
Wind Speed (mph): 110
Ground Snow (psf): 30
Seismic Sds: 0.214
Terrain/Exposure: C
Building Category: I - Low Risk
Topographic Factor: 1
Directional Factor: 0.85
Elevation (ft): 456
Undulation Angle: 1



Exp 01/31/2026

11/26/2025

MECHANICAL DESIGN:

Module dimensions 2279 x 1134 x 35 mm , Module weight = 64.39 lbs
Row: 52 module row with 26N/26S split for interior and exterior rows.
Foundations: 11 columns interior and 13 columns exterior
Bearings: Standard Bearing on both interior and exterior
Range of Motion: +/-52°
Center Structure Gap: 30" with 12" bracket and 10" hanger, 6" for construction tolerance
GCR=45.38%,
Max height of tracker = 7.00'

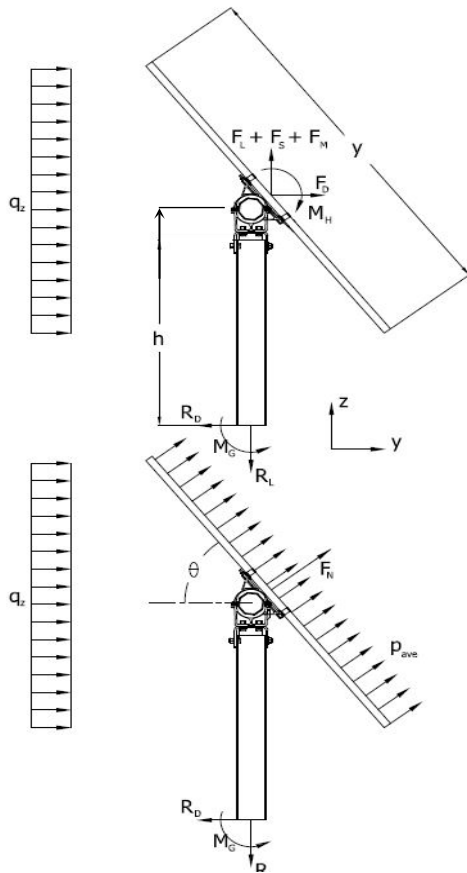
DESIGN BASIS:

Max +/- 5 degree motor block angle N/S in horizontal plane
Max +/- 4 degree N/S torque tube slope

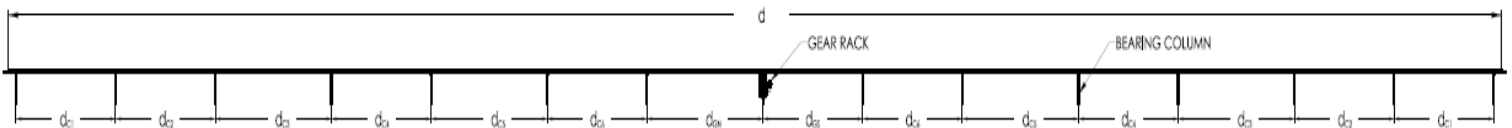
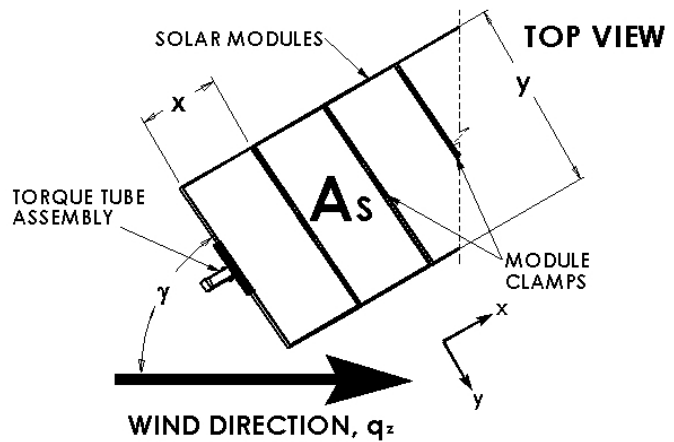
STOWING:

Passive wind stow @ 52°
Night Snow Mode

Symbols Conventions and Terminology



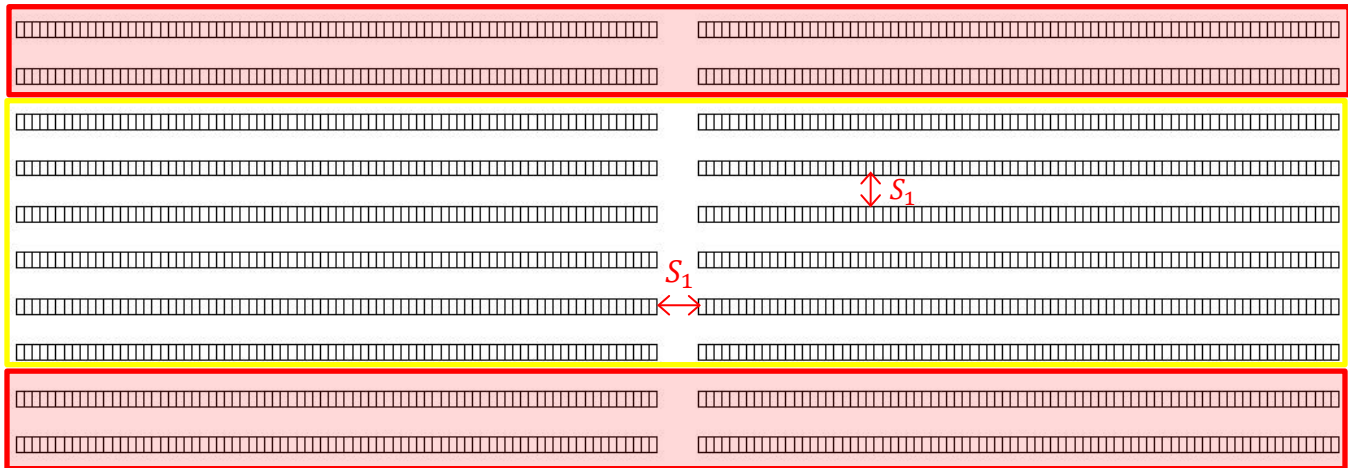
General Tracker Dimensions:	
d , Tracker Length	195.14'
x , Module Width	44.65" = 3.72'
y , Module Length	89.72" = 7.48'
X , Module Assembly Width	45.04" = 3.75'
Y , Module Assembly Length	89.72" = 7.48'
n , Total Number of Modules	52
h , Column Height	84" = 7.00'
Max. open area	4.41 × 7.48' = 32.99'; GCR=0.454



The diagram is for demonstrational purposes only. For actual individual column spacing dimensions, refer to the assembly drawing

Other Symbols	
As , Module Surface Tributary Area for Column	dc or dg , Column Spacing
MH , Hinge Moment due to wind loading	FD , Drag Force due to wind loading
MG , Total Ground Moment Reaction	FL , Lift Force due to wind loading
RD , Ground Drag Reaction	FS , Lift Force due to snow loading
RL , Ground Lift Reaction	qz , Dynamic Velocity Pressure of wind
θ , Tracker Angle from y-axis	γ , Yaw Angle of Wind from the y-axis

The figure below demonstrates that the entire site consists of two types of rows to optimize the structural design according to the loading contribution from RWDI wind loading report for Array Technologies, Inc.



- = Exterior Columns
- = Interior Columns

$$S_1 \leq 2 \times \text{Row Spacing}$$

Foundations are optimized for material costs since higher loads exist on the edges of the array. The controlling case from each designation in the field shall be used for all column designs. It is assumed that each column absorbs half of the load of the adjacent spans. Exterior columns are defined as any portion of the field where the max open area of 32.99' is exceeded in any direction.

Interior Column Spacing (from end, in inches)			
		North of Gear Rack	South of Gear Rack
Bearing Column Spacing 1	d _{c1}	231	231
Bearing Column Spacing 2	d _{c2}	225	225
Bearing Column Spacing 3	d _{c3}	225	225
Bearing Column Spacing 4	d _{c4}	225	225
Gear Rack North Spacing	d _{gn}	253	NA
Gear Rack South Spacing	d _{gs}	NA	253

Exterior Column Spacing (from end, in inches)			
		North of Gear Rack	South of Gear Rack
Bearing Column Spacing 1	d _{c1}	186	186
Bearing Column Spacing 2	d _{c2}	180	180
Bearing Column Spacing 3	d _{c3}	180	180
Bearing Column Spacing 4	d _{c4}	180	180
Bearing Column Spacing 5	d _{c5}	225	225
Gear Rack North Spacing	d _{gn}	208	NA
Gear Rack South Spacing	d _{gs}	NA	208

The **wind loads** are 110 mph 3 second gust, exposure C, evaluated using a combination of ASCE code and results obtained from RWDI wind loading testing done on the DuraTrack HZ system. All maxima were found at $\gamma = 0^\circ$. To properly determine design forces, a dynamic/velocity pressure, q_z , was determined to be:

$$q_z = 0.00256K_zK_{zt}K_dV^2K_e = 0.00256(0.85)(1.00)(0.85)(110)^2(0.98) = 21.93 \text{ PSF}$$

Design wind loads and moments are determined using the following equations. Diagrams showing how these loads are applied can be seen on page 1. GC_D , GC_L , and GC_M refer to the coefficients of drag and lift, and moment respectively. These coefficients were experimentally determined from RWDI wind loading tests, and the maxima recorded are conservatively assumed to be applied to each section simultaneously.

$$GC_D = C_HGC_P \sin \theta, \quad GC_L = C_HGC_P \cos \theta, \quad GC_T = C_HGC_M$$

C_H – Height correction factor, θ is the tilt angle.

Terrain undulation associated with Omni Tracker designs require the consideration of an additional vertical load, F_{Lud} . The calculated load is based on a maximum undulation angle of 1 degree, and is considered additive in magnitude to the direction of the resulting load due to wind. The undulation force is calculated using AISC beam equation, and post vertical offsets corresponding the maximum undulation angle.

$$F_D = q_zGC_D A_S, \quad F_L = q_zGC_L A_S \pm F_{Lud}, \quad M_H = q_zGC_T A_S y$$

There are two types of columns in this assembly: interior and exterior columns. At the design wind speed all columns will become fixed at the axis of rotation and set at the trackers designed range of motion, 52 degrees. This condition controls the design of the tracker and creates additional

moment at the top of the columns. The resultant forces and moments are due to the wind pressure on the frontal area of the modules supported by one column. The ground forces at the pile head (depth = 0) are found as follows.

Interior Row Columns – Max Unfactored Forces

Wind Horizontal Drag, When $\theta = 52^\circ$

$$GC_D = C_H GC_P \sin \theta = (1.03)(1.04) = 1.07$$

$$A_S = \bar{d}_b y = (147'' \div 12)(7.48') = 91.63 \text{ft}^2$$

$$R_D = F_D = q_z GC_D A_S = (21.93 \text{ PSF})(1.07)(91.63 \text{ft}^2) = 2.15 \text{ kips}$$

Wind Vertical Up, When $\theta = 52^\circ$

$$GC_L = C_H GC_P \cos \theta = (1.03)(0.85) = 0.88,$$

$$R_L = F_L = q_z GC_L A_S + F_{Lud} = (21.93 \text{ PSF})(0.88)(91.63 \text{ft}^2) + 0.40 \text{ kips} = 2.17 \text{ kips}$$

Wind Vertical Down, When $\theta = 52^\circ$

$$GC_L = C_H GC_P \cos \theta = (1.03)(-0.81) = -0.83$$

$$R_L = F_L = q_z GC_L A_S - F_{Lud} = (21.93 \text{ PSF})(-0.83)(91.63 \text{ft}^2) + -0.40 \text{ kips} = -2.07 \text{ kips}$$

Snow Vertical Down, When $\theta = 0^\circ$

The ground snow load is 30.00 PSF.

Thus, $p_S = 10.89 \text{ PSF}$

$$F_S = p_S A_S = (10.89 \text{ PSF})(157.70 \text{ft}^2) = -1.72 \text{ kips}$$

Ground-line Moments, When $\theta = 52^\circ$

$$M_G = F_D h + q_z GC_M A_S y = (2.15 \text{ k})(7.00') + (21.93 \text{ PSF})(0.17)(91.63 \text{ft}^2)(7.48') = 17.61 \text{ k-ft}$$

The estimated dead weight on each column = -0.44 kips.

Exterior Row Columns – Max Unfactored Forces

Wind Horizontal Drag, When $\theta = 52^\circ$

$$GC_D = C_H GC_P \sin \theta = (1.03)(0.80) = 0.82$$

$$A_S = \bar{d}_b Y = (208'' \div 12)(7.48') = 129.65 \text{ft}^2$$

$$R_D = F_D = q_z GC_D A_S = (21.93 \text{ PSF})(0.82)(129.65 \text{ft}^2) = 2.33 \text{ kips}$$

Wind Vertical Up, When $\theta = 52^\circ$

$$GC_L = C_H GC_P \cos \theta = (1.03)(0.63) = 0.65$$

$$R_L = F_L = q_z GC_L A_S + F_{Lud} = (21.93 \text{ PSF})(0.65)(129.65 \text{ft}^2) + 0.62 \text{ kips} = 2.47 \text{ kips}$$

Wind Vertical Down, When $\theta = 52^\circ$

$$GC_L = C_H GC_P \cos \theta = (1.03)(-0.62) = -0.64$$

$$R_L = F_L = q_z GC_L A_S - F_{Lud} = (21.93 \text{ PSF})(-0.64)(129.65 \text{ft}^2) + -0.62 \text{ kips} = -2.44 \text{ kips}$$

Snow Vertical Down, When $\theta = 0^\circ$

The ground snow load of 30.00 PSF.

Thus, $p_S = 10.89 \text{ PSF}$

$$F_S = p_S A_S = (10.89 \text{ PSF})(135.26 \text{ft}^2) = -1.47 \text{ kips}$$

Ground-line Moments, When $\theta = 52^\circ$

$$M_G = F_D h + q_z GC_M A_S y = (2.33 \text{ k})(7.00') + (21.93 \text{ PSF})(0.12)(129.65 \text{ft}^2)(7.48') = 18.86 \text{ k-ft}$$

The estimated dead weight on each column = -0.38 kips.

Snow Load Note: The snow load is the maximum of $0.7(C_e)(C_t)(I)(p_g)$ and either $p_g(I)$, if the ground snow (p_g) is greater than 20psf, or $20(I)$, if the ground snow is less than 20psf.

Max. Ground Force Summary Table

Loading Type	HEIGHT = 7.00'		HEIGHT = 6.00'		HEIGHT = 5.00'	
	Interior Column	Exterior Column	Interior Column	Exterior Column	Interior Column	Exterior Column
R_D (drag), kips	2.15	2.33	2.13	2.30	2.09	2.27
* R_L (wind vertical up), kips	2.17	2.47	2.13	2.44	2.11	2.41
* R_L (wind vertical down), kips	-2.07	-2.44	-2.05	-2.41	-2.03	-2.38
R_L (snow vertical down), kips	-1.72	-1.47	-1.72	-1.47	-1.72	-1.47
M_G (ground-line), k-ft	17.61	18.86	15.34	16.35	13.01	13.90
Estimated Dead-weight, kips	-0.44	-0.38	-0.44	-0.38	-0.44	-0.38

* Contains Terrain Undulation Induced Forces, for OMNI Designs

Note: Design forces summarized in the table are from ATI tracker components ONLY. Foundation engineer must include any additional component design forces that customer may attach to the array that are not ATI supplied. Example: CAB, cable trays etc.

The above loads are applied at each column. Interpolation of the forces is allowed for heights between 5.00' and 7.00'. Heights outside of these values will require an updated or additional ground force document from ATI.

ASCE 7 recommends the following **interaction equations** for **LRFD** design:

$$1. 1.2D + 1.6S + 0.5W \quad 2. 1.2D + 1.0W + 0.5S \quad 3. 0.9D + 1.0W \quad 4. 1.2D + 1.0E$$

ASCE 7 recommends the following **interaction equations** for **ASD** design:

$$1) 1.0D + 0.6W \quad 2) 1.0D + 0.6(0.75)W + 0.75S \quad 3) 0.6D + 0.6W$$

$$4) 1.0D + 1.0S \quad 5) 1.0D + 0.7E \quad 6) 1.0D + (0.75)(0.7)E + 0.75S$$

Note: the acceptable elastic deflections at the top of the column in E-W direction are approximately 3"~4" and are 3"~4" in N-S direction.

N-S Loading Due to Tracker Weight

N-S wind loading is negligible, and N-S loads on the tracker are mostly due to the weight of tracker and seismic loading. Seismic loading is described next on this document. N-S loading due to tracker weight is $W \sin$ (N-S slope in degrees) where W is the weight of tracker and N-S slope is assumed maximum as 4 degrees. For higher slopes, Array should be notified as loads may be affected.

N-S load due to tracker weight = 4914 lbs x $\sin(4^\circ) = 0.34$ kips.

N-S loads due to tracker weight is equally shared by gear rack column and seismic columns as described in seismic loading in the following section.

Seismic Loading – North / South Direction (Weak-Axis)

According to ASCE code, Considering tracker as an inverted pendulum. The equivalent lateral force is as follows:

$V_s = C_s W$, $C_s = \frac{S_{DS}}{I_e}$, Where $R=2.0$, for an inverted pendulum and

$I_e = 1.0$ for occupancy Category I - Low Risk in accordance with ASCE code.

$S_{DS} = 0.21g$ and $C_s = \frac{0.21g}{2.0} = 0.11g$

The effective seismic weight of one row, $W = 4914$ lbs excluding all the columns.

The total lateral seismic force acting on the array, in any horizontal direction, is:

$$V_s = (0.11g) \left(\frac{4914 \text{ lb}}{g} \right) = 0.54 \text{ k}$$

The gear rack center structure and the seismic columns with the set screw bearing housings restrains the tracker in N/S direction and share the loads equally. The moment on the north south seismic resisting system is as follows:

Seismic Shear Per Column:



$$V_{per\ column} = \frac{1}{3} [V_s] = \frac{1}{3} [0.54k] = 0.18 \text{ kips}$$

(Note: Seismic shear can be distributed to additional columns to lower shear per column)

$$M_{sc} = \frac{1}{3} [V_s] \times h$$

$$M_{sc} = \frac{1}{3} [0.54k](7.00') \times 12 \text{ in/ft} = 15.14 \text{ k-in}$$

Seismic Loading – East / West Direction (Strong-Axis)

In the east-west direction, the load is equally shared among all columns.

$$V_s = \frac{0.54 \text{ k}}{11} = 0.05 \text{ kips per column}$$

$$M_s = 0.05k (7.00') \times 12 \text{ in/ft} = 4.20 \text{ k-in}$$

When comparing the seismic load in the east-west direction to the wind load, the seismic load is substantially lower and can be deemed negligible. For more detailed information on structural loading, please contact Emily Omiotek.



**DOWN TO EARTH
CONSULTING, LLC**
GEOTECHNICAL AND ENVIRONMENTAL ENGINEERING

**GEOTECHNICAL ENGINEERING REPORT
PROPOSED SOLAR ARRAY
SOUNDVIEW DRIVE
WOODBIDGE, CONNECTICUT**

Prepared for:

Greenskies Clean Energy
127 Washington Avenue
North Haven, Connecticut 06473

Prepared by:

Down To Earth Consulting, LLC
27 Siemon Company Drive #363W
Watertown, Connecticut 06795

File No. 0255-016.00
November 2025

Down To Earth Consulting, LLC
27 Siemon Company Drive #363W, Watertown, CT 06795
(203) 683-4155



4.1.3 Weathered Rock

Weathered Rock was encountered at each boring location (except B-3) and at Test Pits TP-1 and TP-2 below the Glacial Till (or directly below the Topsoil/Subsoil at B-2) at depths ranging between about 4.5 and 10 feet below existing grade. The Weathered Rock was observed to extend to auger refusal at depths between 6.7 and 15.3 feet below existing grades (approximate El. 460 to 435). Retrieved samples and exposed weathered rock appeared to consist of gray, schist displaying varying degrees of weathering from decomposed rock to residual soil.

4.2 GROUNDWATER

Groundwater was not encountered within the limits of the subsurface investigation. Groundwater levels measured in the boreholes and test pits may not have had sufficient time to stabilize and should be considered approximate. Groundwater levels will vary depending on factors such as temperature, season, precipitation, construction activity, and other conditions, which may be different from those at the time of these measurements.

5.0 SOILS TESTING

5.1 LABORATORY TESTING

Soil samples were collected from 1 to 4 feet below grade from Test Pits TP-2 and TP-5 to evaluate the corrosivity potential of sampled soils. Samples were analyzed for pH (ASTM D4972), ORP (ASTM G200), Sulfates (ASTM D4327), Chlorides (ASTM D4327), and Electrical Resistivity (ASTM G57). Thermal resistivity testing (ASTM D5334) was also completed on bulk samples collected from these test pit locations. Based on the results of the laboratory tests, the soil samples are considered to be non- to slightly corrosive. We recommend that a corrosion specialist be consulted to determine the need for corrosion protective measures. The results of the laboratory testing are included in Appendix 3.

5.2 SOIL RESISTIVITY TESTING

On October 28, 2025, DTE field personnel conducted in-situ soil resistivity testing in accordance with accepted engineering practices using the Wenner electrode configuration. Electrodes were spaced at 5, 10, 20, 30, and 40 feet. A set of two approximately perpendicular resistivity lines was completed in the general vicinity of the proposed solar array area. The approximate location and orientation of the resistivity lines are shown on the attached Figure 2. The results of the resistivity tests are as follows:

Electrode Spacing (ft)	Resistivity (ohm-cm)	
	Line 1	Line 2
5	113,272	107,144
10	111,070	90,580
20	78,132	61,165
30	50,613	41,536
40	36,462	29,721

Field resistivity results may be influenced by shallow bedrock and boulders. Resistivity results will fluctuate depending on the degree of compaction, moisture content, constituent solubility, and

Resistivity: 100825 Ohm-cm



temperature. Field resistivity values may also vary depending upon season, precipitation, and other conditions that may differ from those at the time of testing.

6.0 ENGINEERING IMPLICATIONS OF SUBSURFACE CONDITIONS

Subsurface conditions generally consist of dense Glacial Till deposits (with cobbles and boulders) overlying relatively shallow bedrock. Due to the presence of obstructions (e.g., cobbles, boulders, and shallow bedrock), pile driving refusal should be expected throughout the limits of the proposed solar array. The presence of obstructions may also cause the piles to be driven out of tolerance as piles deflect off obstructions during driving.

In areas of pile driving difficulties, predrilling of pilot holes (up to 2/3 of the pile diameter) may be possible to accommodate pile installation. The pilot holes would then be backfilled with drill cuttings (absent any cobble-sized material) prior to driving piles. If piles still cannot penetrate soils and/or weathered bedrock sufficiently, drilling of oversized holes backfilled with grout may be required. Ground screws (e.g., Krinner) may also be used to support the racking systems, but similarly predrilling a pilot hole may be necessary to accommodate ground screw installation.

Foundations will need to be designed to resist compression, tension, and lateral loads. Preliminary geotechnical design parameters are provided below. The pile design capacities will need to be verified in the field based on the results of pile load testing completed at the Site.

7.0 GEOTECHNICAL ENGINEERING RECOMMENDATIONS

We offer the following preliminary geotechnical design recommendations based on the subsurface conditions encountered at the Site, available project information, and the proposed construction.

7.1 SEISMIC DESIGN

The site class is “C” per the Building Code. Based on the standard penetration test results, visual soil classification, and design peak ground acceleration at this locale, the site soils are not susceptible to liquefaction.

7.2 DRIVEN PILE FOUNDATIONS

The proposed racking systems may be supported on driven steel piles end bearing in Glacial Till Deposits and/or Weathered Rock. The steel piles should conform to ASTM A572, Grade 50 and have hardened pile tips (e.g., pile driving shoes) to minimize pile damage on potential obstructions (e.g., boulders and shallow bedrock). A minimum steel section corrosion loss of 1/16-inch all around the piles should be used. DTE recommends the following preliminary static design parameters for a driven pile foundation:



DESCRIPTION	VALUE
<u>Allowable End Bearing Capacity¹</u> Glacial Till Weathered Rock	6 kips per square foot (ksf) 8 ksf
<u>Ultimate Skin Friction Value²</u> Glacial Till (>3.5 fbg) Weathered Rock	1,250 pounds per square foot (psf) 1,500 psf
<u>Modulus of Lateral Subgrade Reaction³</u> Glacial Till (>2.5 fbg) – dry Weathered Rock	150 pounds per cubic inch (pci) 225 pci
<u>Angle of Internal Friction</u> Glacial Till Weathered Rock	36 degrees 38 degrees
<u>Total Soil Unit Weight</u> Glacial Till Weathered Rock	135 pounds per cubic foot (pcf) 140 pcf
<ol style="list-style-type: none"> 1. End-bearing should be neglected for uplift calculations. Provided value assumes a factor of safety of 3. 2. Contribution to pile capacity within the frost depth (i.e., above depths of 3.5 feet) should be ignored. The uplift capacity should be based on the dead weight of the pile and side resistance provided by the subsurface soils (i.e., end bearing should be neglected). 3. To analyze foundation under lateral loading (e.g., Ensoft LPILE). 4. All values provided in this table are preliminary and must be verified in the field by load testing. 	

7.2.1 Pre-Drilling Alternative

If pre-drilling is required to accommodate pile installation in areas of driven pile refusal, we recommend all pre-drilled holes be drilled no deeper than 6 inches short of target installation depths. Additional pre-drilling recommendations presented in Section 6.0 should also be adopted for the project. The following preliminary static design parameters for a pre-drilled pile foundation alternative are recommended:



DESCRIPTION	VALUE
<u>Allowable End Bearing Capacity¹</u> Glacial Till Weathered Rock	6 kips per square foot (ksf) 8 ksf
<u>Ultimate Skin Friction Value²</u> Cuttings (>3.5 fbg) Glacial Till Weathered Rock	500 pounds per square foot (psf) 1,000 psf 1,250 psf
<u>Modulus of Lateral Subgrade Reaction³</u> Cuttings (>2.5 fbg) – dry Glacial Till – dry Weathered Rock	50 pounds per cubic inch (pci) 150 pci 225 pci
<u>Angle of Internal Friction</u> Cuttings Glacial Till Weathered Rock	30 degrees 36 degrees 38 degrees
<u>Total Soil Unit Weight</u> Cuttings Glacial Till Weathered Rock	115 pounds per cubic foot (pcf) 135 pcf 140 pcf
1. End-bearing should be neglected for uplift calculations. Provided value assumes a factor of safety of 3. 2. Contribution to pile capacity within the frost depth (i.e., above depths of 3.5 feet) should be ignored. The uplift capacity should be based on the dead weight of the pile and side resistance provided by the subsurface soils (i.e., end bearing should be neglected). 3. To analyze foundation under lateral loading (e.g., Ensoft LPILE). 4. All values provided in this table are preliminary and must be verified in the field by load testing.	

7.2.2 Grout Encased Pile Alternative

Given the shallow depth to bedrock, driven pile refusal and possibly pre-drilling difficulties/refusal should be anticipated. DTE recommends the following preliminary design parameters for a grout-encased foundation alternative:



DESCRIPTION	VALUE
<u>Allowable End Bearing Capacity¹</u> Glacial Till Weathered Rock Sound Bedrock	6 kips per square foot (ksf) 8 ksf 10 ksf
<u>Allowable Bond Value²</u> Glacial Till/Weathered Rock (>3.5 fbg) Sound Bedrock	5 pounds per square inch (psi) 30 psi
<u>Modulus of Lateral Subgrade Reaction³</u> Glacial Till (>2.5 fbg – dry) - k_{py} Weathered Rock - k_{py} Sound Bedrock	150 pounds per cubic inch (pci) 225 pci 0.0005 (k_{rm}) $q_u = 3,000$ psi
<u>Angle of Internal Friction</u> Glacial Till Weathered Rock Sound Bedrock	36 degrees 38 degrees 42 degrees
<u>Total Soil Unit Weight</u> Glacial Till Weathered Rock Sound Bedrock	135 pounds per cubic foot (pcf) 140 pcf 160 pcf
1. End-bearing should be neglected for uplift calculations. Provided value assumes a factor of safety of 3. 2. Contribution to pile capacity within the frost depth (i.e., above depths of 3.5 feet) should be ignored. The uplift capacity should be based on the dead weight of the pile and side resistance provided by the subsurface soils (i.e., end bearing should be neglected). 3. To analyze foundation under lateral loading (e.g., Ensoft LPILE). 4. All values provided in this table are preliminary and must be verified in the field by load testing.	

7.2.3 Additional Pile Design Recommendations

Center-to-center pile spacing should not be less than 30 inches or 3 pile diameters. Final pile order lengths should be established based on the results of pile testing and the contractor should be prepared to increase anticipated pile lengths as conditions are exposed in the field.

Piles should be installed to a minimum ultimate geotechnical axial capacity of the structural load multiplied by 2 (assuming load testing is performed). Based on the recommended pile type, bearing material, and anticipated loads, we estimate negligible pile settlements. We recommend an adfreeze stress of 1,000 psf be considered when determining frost heave load on the piles. The box perimeter of the pile acting over the recommended frost depth of 3.5 feet should be considered when determining the frost heave load on a pile.

The lateral capacity of the upper 30 inches of soil should be neglected due to loss of strength from frost action and the presence of loose surficial soils. Appropriate lateral capacity reductions associated with group effects should be used for piles having a center-to-center spacing of less than 5 times their largest cross-sectional dimension.



Approximate the corrosion rates of zinc galvanization and bare steel based on the electrical resistivity of the soil.

Reference Publication No. FHWA-NHI-09-087, November 2009 from the Federal Highway Administration.

This publication references results from the Romanoff study of corrosion rates of zinc and steel in soil of varying electrical resistivity.

The corrosion rate of zinc and steel is proportional to the natural log of the electrical resistivity. A regression analysis of the results of the Ramonoff study produces the following relationships.

Electrical Resistivity of Soil:

$$R = 100825 \text{ ohm-cm}$$

Corrosion Rate of Zinc:

$$\rho_{\text{zinc}} = 1.0976 - 0.089\ln(R) = 0.072 \text{ mil/year}$$

Corrosion Rate of Steel:

$$\rho_{\text{steel}} = 3.4102 - 0.267\ln(R) = 0.334 \text{ mil/year}$$

Service Life of Project: $T_{\text{serv}} = 30 \text{ years}$

Zinc Coating Thickness: $t_{\text{zinc}} = 3 \text{ mil}$ (for sections with plate thickness < 1/4")

Longevity of zinc galvanization: $T_{\text{zinc}} = t_{\text{zinc}}/\rho_{\text{zinc}} = 41.7 \text{ years}$

Corrosion Loss of Steel = $(T_{\text{serv}} - T_{\text{zinc}}) \times \rho_{\text{steel}} = 0 \text{ mil (per side)}$
 $= 0 \text{ in (total)}$

Service Life of Project: $T_{\text{serv}} = 30 \text{ years}$

Zinc Coating Thickness: $t_{\text{zinc}} = 3.9 \text{ mil}$ (for sections with plate thickness $\geq 1/4$ ")

Longevity of zinc galvanization: $T_{\text{zinc}} = t_{\text{zinc}}/\rho_{\text{zinc}} = 54.2 \text{ years}$

Corrosion Loss of Steel = $(T_{\text{serv}} - T_{\text{zinc}}) \times \rho_{\text{steel}} = 0 \text{ mil (per side)}$
 $= 0 \text{ in (total)}$



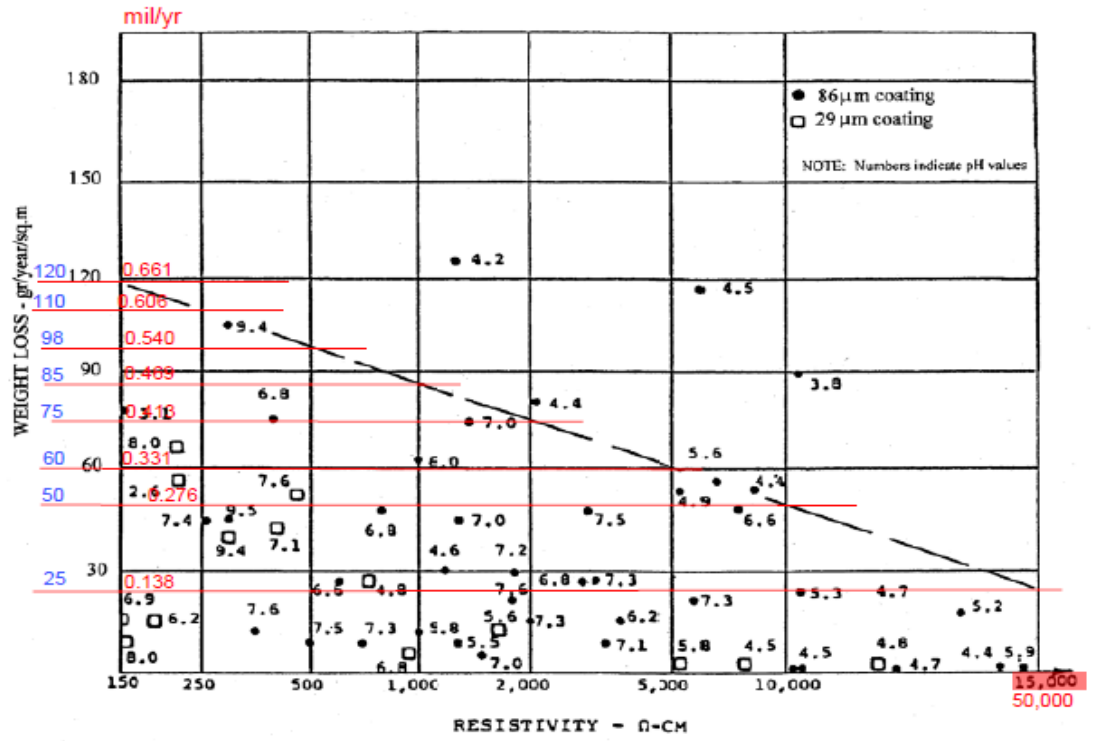
c:\users\dylan.donn\documents\design\greenskies\woodbridge soundview\pv pile design capacity_7_ft_tth.xlsm

FHWA NHI-09-087
Corrosion/Degradation

2-16

2 - Corrosion
November 2009

Figure 2-1. Metal loss as a function of resistivity (galvanized steel) (Fronistou-Yannis, 1985).
 $[1 \text{ gr/year/m}^2 = 0.14 \mu\text{m/year}] = 0.0055 \text{ mil/year}$

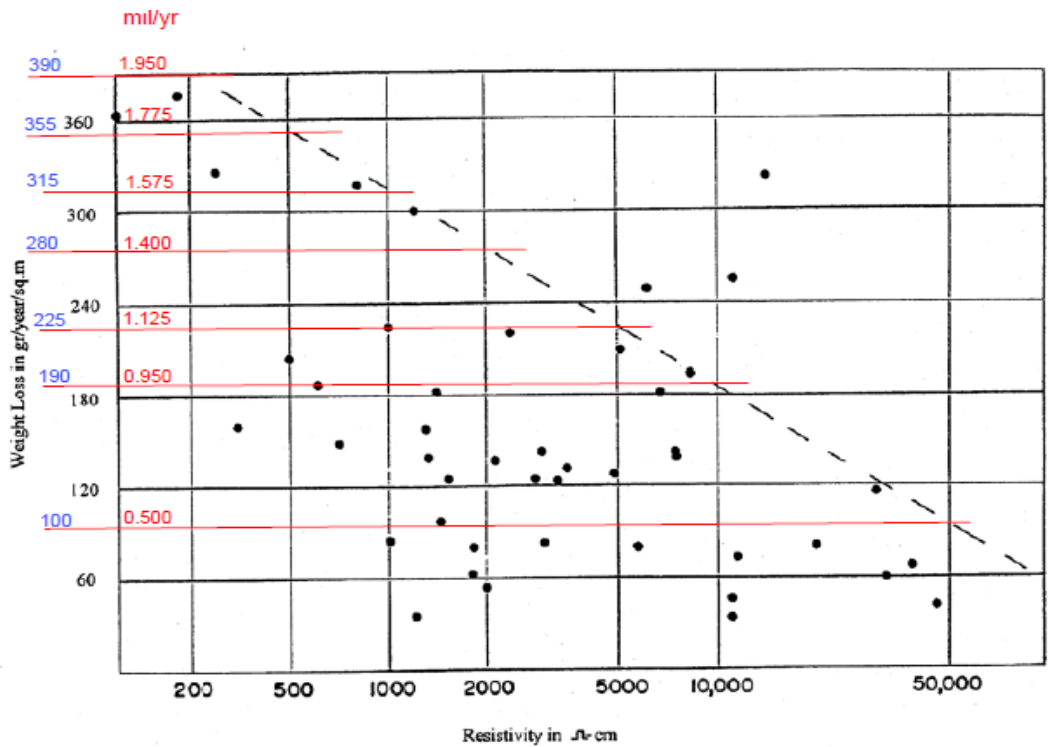


FHWA NHI-09-087
Corrosion/Degradation

2-17

2 - Corrosion
November 2009

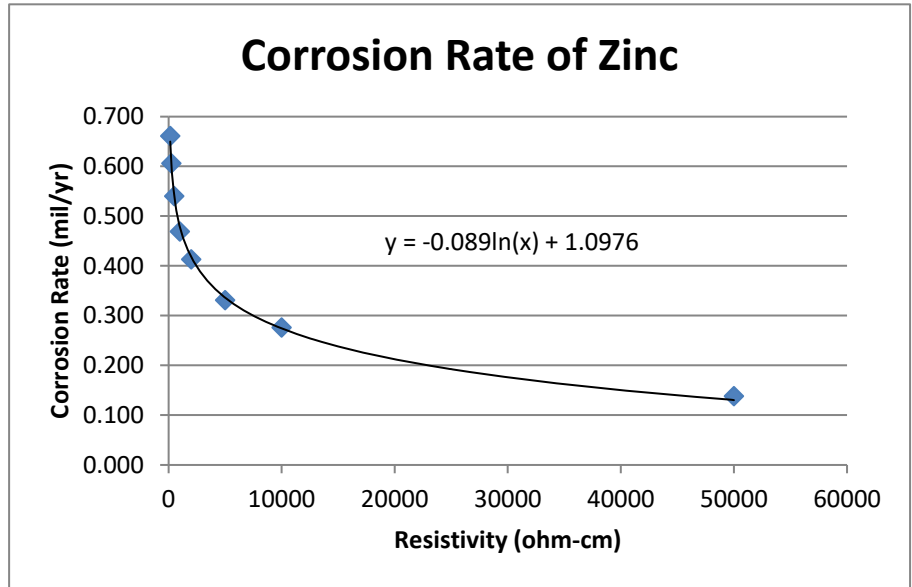
Figure 2-2. Metal loss as a function of resistivity (carbon steel) (Elias, 1990).
 $[1 \text{ gr/year/m}^2 = 0.127 \mu\text{m/year}] = 0.0050 \text{ mil/year}$





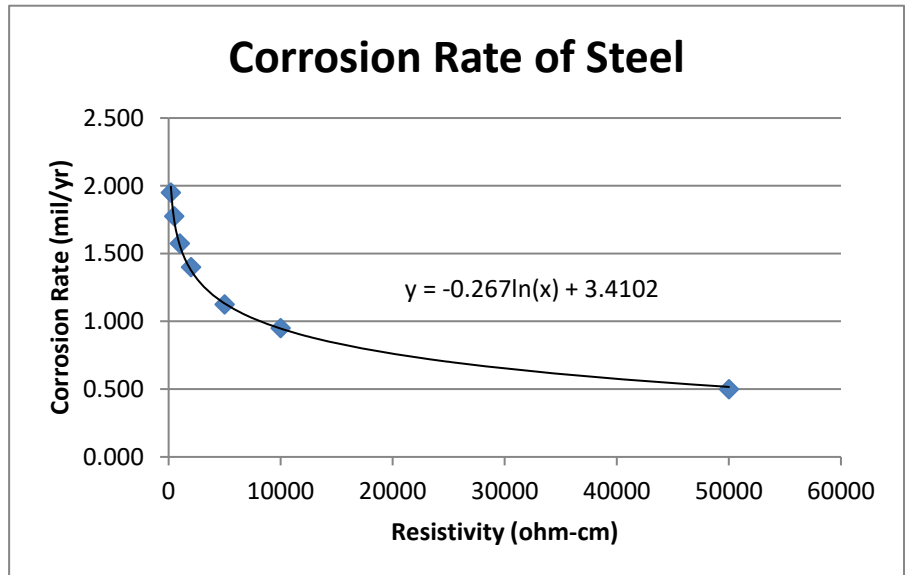
Zinc Corrosion Rate

Resistivity Rate	Rate	
ohm-cm	gr/yr/m2	mil
150	120	0.661
250	110	0.606
500	98	0.540
1000	85	0.469
2000	75	0.413
5000	60	0.331
10000	50	0.276
50000	25	0.138



Steel Corrosion rate

Resistivity Rate	Rate	
ohm-cm	gr/yr/m2	mil
200	390	1.950
500	355	1.775
1000	315	1.575
2000	280	1.400
5000	225	1.125
10000	190	0.950
50000	100	0.500



APPROVED ALTERNATE METHODS OF PILE INSTALLATIONS:

Alternative installation methods may be desirable or required where appropriate due to observed or unforeseen soil conditions. Depending on the nature of the installation difficulty or deviation, the following methods are acceptable. If none are appropriate, contact the EOR for redesign of the affected pile.

- A. **Cut-off Piles:** This method may be used if refusal is encountered during pile driving. Piles may be cut to a shorter length and load tested to show that the design strength is obtained. This method should only be used for piles driven directly into native soil that encounter refusal.
1. Install the pile to refusal depth. Refusal is defined as less than 2 inches of movement over 30 seconds of hammering.
 2. If the refusal depth is less than 4 feet, remove the pile and utilize a different remediation method. Do not cut off the pile, as 4 feet is the minimum depth required to utilize this method.
 3. Test the pile per the testing memorandum provided by the EOR. If the pile fails any of the tests, remove the pile and utilize an alternate remediation method.
 4. If the pile passes all the tests, cut the pile to the correct height, re-drill bracket mounting holes at the top of the pile, and apply spray galvanization to the cut end and drilled area.
- B. **Pre-Drill a Pilot Hole:** This method may be utilized for piles that encounter refusal or where refusal is anticipated.
1. Advance a 4-inch to 6-inch (for W6 piles) or 6-inch to 8-inch (for W8 piles) diameter auger or down-the-hole hammer at the pile location to the embedment depth shown on the Engineering Drawings.
 2. Backfill the hole with drill cuttings, native soil, or imported sand in 12-inch lifts and compact using hand tamping or mechanical means.
 3. Top the hole with sand or similar material to make up for material lost due to compaction.
 4. Drive the pile into the hole to the embedment depth shown on the Engineering Drawings utilizing the same methods as the standard installation method.
 5. Test the pile per the testing memorandum provided by the EOR. If the pile fails any of the tests, remove the pile and utilize an alternate remediation method.
- C. **Pre-Drill and Backfill with Engineered or Native Materials (sand, road base, native soil):** This method may be utilized for piles that encounter refusal, where refusal is anticipated, or where any load tests fail.
1. Drill an 8-inch (for W6 piles) or 10-inch (for W8 piles) diameter hole at the pile location to the embedment depth shown on the Engineering Drawings.
 2. Backfill the hole with drill cuttings, native soil, or road base. Do not use materials that have particle sizes large enough to leave voids larger than ¼”.
 3. Place the backfill in twelve-inch (12”) lifts and compact with the pile driver and a pile fitted with a 6” diameter (or larger) base plate.
 4. Drive the pile into the hole to the embedment depth shown on the Engineering Drawings utilizing the same methods as the standard installation method.
 5. Test the pile per the testing memorandum provided by the EOR. If the pile fails any of the tests, remove the pile and utilize an alternate remediation method.
- D. **Pre-Drill and Backfill with Engineered Materials (lean concrete or “CLSM”):** This method may

be utilized for piles that encounter refusal, where refusal is anticipated, or where any load tests fail.

1. Drill an 8-inch (for W6 piles) or 10-inch (for W8 piles) diameter hole at the pile location to the embedment depth shown on the Engineering Drawings.
2. Place the pile to the proper depth by hand. If the hole has been over-drilled, backfill with sand to bring the bottom of the hole to the proper height and replace the pile.
3. Backfill the hole with lean concrete or Controlled Low Strength Material (CLSM).
4. Support the pile so that it remains plumb until the backfill has hardened, at least 48 hours.

E. **Pre-Drill with Large Diameter Auger and Backfill with Engineered Materials (lean concrete, or CLSM):** This method may be utilized for piles that encounter refusal due to bedrock, boulders, large cobble, or other obstructions discovered underground during the installation, or where any load tests fail.

1. Drill a 12-inch diameter hole at the pile location to the embedment depth shown on the Engineering Drawings.
2. Place the pile to the proper depth by hand. If the hole has been over-drilled, backfill with sand to bring the bottom of the hole to the proper height and replace the pile.
3. Install a spacer near the top of the hole to hold the pile plumb.
4. Backfill the pile with lean concrete or CLSM up to the spacer.
5. Remove the spacer and backfill the remaining depth.

F. **Excavate to Remove Obstruction and Backfill with Native or Engineered Materials (native soil, sand, road base)** This method may be utilized for piles that encounter refusal due to boulders, large cobble, or other obstructions discovered underground during the installation, or where any load tests fail.

1. Excavate around the pile to the depth necessary to remove the obstruction and remove the obstruction.
2. Backfill the hole with excavated material, imported sand or road base in 12-inch lifts up to finished grade. Do not use materials that have particle sizes large enough to leave voids larger than ¼". Compact the backfill after each lift using hand tamping or other mechanical means. Backfill must be compacted to the same density as in-situ soil.
3. Drive the pile at the required location to the embedment depth shown on the Engineering Drawings utilizing the same methods as the standard installation method.
4. Test the pile per the testing memorandum provided by the EOR. If the pile fails any of the tests, remove the pile and utilize an alternate remediation method.

G. **Pile Isolation with Yellow Jacket Sleeve in Refusal Conditions** This method may be utilized for piles that require pile isolation for frost heave mitigation and shallow rock would prevent embedment.

1. Drill a 10-inch or 12-inch diameter hole at the pile location to the embedment depth shown on the Engineering Drawings.
2. Backfill the bottom of the hole up to the frost depth with drill cuttings, native soil, imported sand or road base. Do not use materials that have particle sizes large enough to leave voids larger than ¼".
3. Place the backfill in 12-inch lifts and compact with the pile driver and a pile fitted with an 8-inch diameter (or larger) base plate.
4. Place the pile in the hole, resting on the backfill at the bottom of the frost depth.
5. Install Yellow Jacket sleeve around the pile per manufacturer's instructions and slide down into the hole to the frost depth.

6. Backfill the top of the hole around the pile and sleeve with drill cuttings, native soil, imported sand or road base. Tamp the backfill as best as possible with hand tamping or other mechanical means. Alternatively, backfill the top of the hole with lean concrete or CLSM. Compaction of lean concrete or CLSM is not required.
 7. Drive the pile into the hole to the embedment depth shown on the Engineering Drawings utilizing the same methods as the standard installation method.
- *Note: Alternative means and methods for installing the Yellow Jacket sleeve are acceptable so long as the sleeve encloses the pile through the entire frost depth.
8. Test the pile per the testing memorandum provided by the EOR. If lean concrete or CLSM is used as backfill, do not load test until the backfill has hardened, at least 48 hours.

H. **Pile Isolation with Yellow Jacket Sleeve** This method may be utilized for piles that require pile isolation for frost heave mitigation and piles can be driven to design embedment.

1. Drill an 8-inch to 12-inch diameter hole at the pile location to the design frost depth.
2. Place the pile in the hole, supporting it plumb.
3. Install Yellow Jacket sleeve around the pile per manufacturer's instructions and slide down into the hole to the frost depth.
4. Backfill the hole around the pile and sleeve with drill cuttings, native soil, imported sand or road base. Tamp the backfill as best as possible with hand tamping or other mechanical means. Alternatively, backfill the top of the hole with lean concrete or CLSM. Compaction of lean concrete or CLSM is not required.
5. Drive the pile to the embedment depth shown on the Engineering Drawings utilizing the same methods as the standard installation method.
6. If design embedment is achieved without refusal, load testing is not needed.

*Note: Alternative means and methods for installing the Yellow Jacket sleeve are acceptable so long as the sleeve encloses the pile through the entire frost depth.

PRODUCTION PILE VERIFICATION LOAD TESTING:

The equipment, setup, sequence of operations, test loads, measurement and reporting requirements will be provided by the EOR in a site-specific testing memorandum. This memorandum is to be followed if required due to pile driving refusal, or abnormal driving, and remediated through corrective actions described above.

The number of piles to be load tested depends on the number of piles that encountered refusal and were remediated with one of the approved methods detailed above. See Table below. The piles to be tested shall be chosen at random and distributed evenly among all the refused piles. Due to the nature of the gear rack piles, only bearing piles can be load tested. If any of the tested piles fails a load test, the failed piles shall be replaced, and an additional set of refused piles shall be load tested.

Number of Refused Piles	Number of Test Piles
1 – 10	All
50	15
100	20
400	40
1000	60
2000	75
3000	85
4000	90
> 4000	2% of refused piles

Linear interpolation may be used to determine the number of test piles for number of refused piles not shown in the table above.

PHOTOVOLTAIC ARRAY PROJECT: 19091
 MODULE: Heliene 144-HC-M10-SL (530W & 540W)
 POWER: APPROX. 2.116 MW DC
 UP TO 32 LINKED ROWS

PROJECT NOTES:

1. DESIGN CRITERIA:

- A. 110 MPH WIND SPEED, ASCE 7-16, CAT I
- B. 30 PSF GROUND SNOW
- C. EXPOSURE C
- D. ISO 9223 C2 CORROSION CONDITIONS
- E. SEISMIC: $S_{DS} = 0.214$

2. MODULE SPECIFICATIONS:

- A. Heliene 144-HC-M10-SL (530W & 540W)
- B. 26 IN SERIES
- C. MOUNTED WITH 1400mm Thru-Bolt & 400mm Thru-Bolt CLAMPS

3. TRACKER SPECIFICATIONS:

- A. 4.0° MAX N-S TILT FROM HORIZONTAL WITHOUT MODIFICATION
- B. ±52° TRACKER RANGE OF MOTION
- C. 10.0° MAX E/W SLOPE
- D. 480V MOTORS

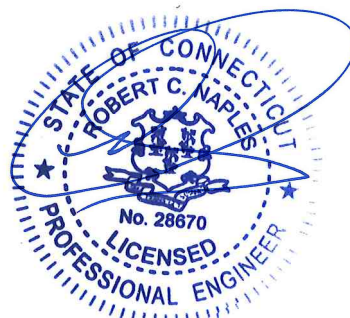
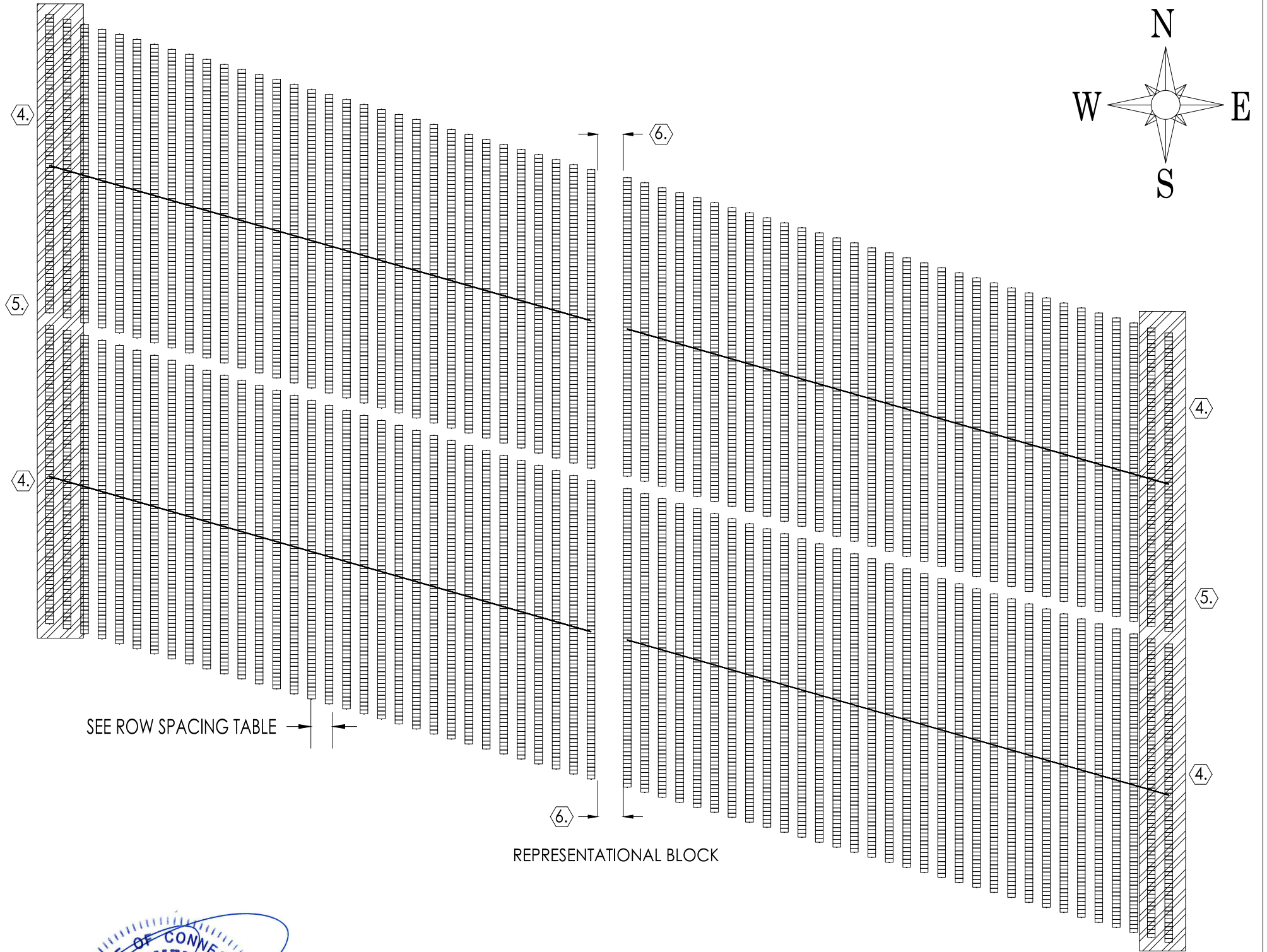
④ MOTOR IS INSTALLED AT THE WEST OR EAST SIDE OF THE BLOCK.

⑤  INDICATES E/W EXTERIOR ROW UNLESS ADJACENT TO ANOTHER BLOCK.

⑥ IF THE CLEAR DISTANCE BETWEEN BLOCKS EXCEEDS 2 TIMES THE ROW SPACING, THE FIRST TWO EXPOSED ROWS ARE EXTERIOR.

7. SEE DETAIL A ON SHEET 5 FOR EXTERIOR ROW DESIGNATION DUE TO ELEVATION DIFFERENCES BETWEEN ROWS.

8. MINIMUM SITE DESIGN TEMPERATURE: -14.6°C







Exp 01/31/2026
 11/26/2025

ROW SPACING TABLE		
SPACING	BLOCK ANGLE	ROWS/MOTOR
5.02M [16.477']	9.31°	32

19091 Greenskies: Woodbridge
 Soundview
 Approx. 2.116 MWDC
 Woodbridge, CT 06525
 Greenskies

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  	DRAWING STATUS Final	
	PRODUCT STATUS Final	
	NAME	DATE
	DRAWN	EO 11/24/2025
CHECKED	Ampacity	11/24/2025
APPROVED	---	---

A	INITIAL RELEASE	11/24/2025
REV	DESCRIPTION	DATE
ARRAY TECHNOLOGIES 		
3901 Midway Place NE, Albuquerque, NM 87109 (505) 881-7567		
TITLE OmniTrack® HZ Project: 19091 Greenskies: Woodbridge Soundview		
SIZE B	PRODUCT NUMBER 19091	REVISION A
SCALE NTS	DWG NO. 19091-901	U.S. PATENT NO. #8,459,249; # 9,281,778
		1 OF 7

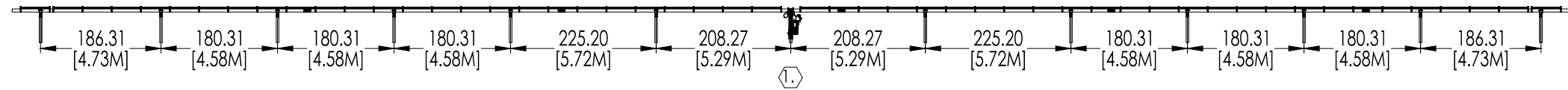
NOTES:

① GEAR RACK COLUMN

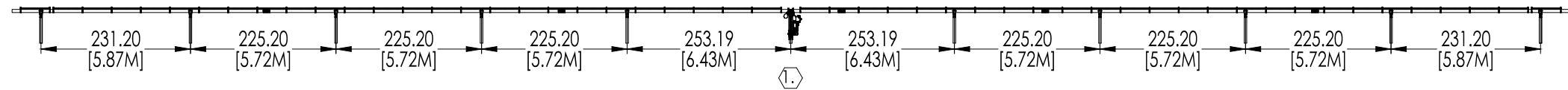
2. ALL COLUMNS NOT IDENTIFIED AS "GEAR RACK COLUMN" ARE BEARING COLUMNS.
3. ALL BEAMS SHOULD BE CONSTRUCTED WITH ASTM A992 GRADE 50 STEEL WITH CONSIDERATION FOR CORROSION. REFER TO FOUNDATION DESIGN, BY OTHERS, FOR DETAILS.
4. FOR COLUMN LENGTH, REFERENCE CUSTOMER PROVIDED FOUNDATION DESIGNS.
5. COLUMN TOLERANCES
 - A. PILE HEIGHT TOLERANCE $\pm 1.18"$ (30mm) FROM NOMINAL Z COORDINATE.
 - B. PLAN LOCATION (NSEW)
 1. E/W: $\pm 0.625"$ (16mm)
 2. N/S: $\pm 1.375"$ (35mm)
 - C. ROTATIONAL TWIST GEAR RACK: $\pm 1.5^\circ$ FROM AXIS BEARING
COLUMN: $\pm 5^\circ$ FROM AXIS
 - D. PLUMB:
 1. E/W: $\pm 1.0^\circ$
 2. N/S: $\pm 3.0^\circ$

NOTE: THESE TOLERANCES ARE NOT CUMULATIVE AND ARE DEFINED AT THE TOP OF THE COLUMN RELATIVE TO THE COLUMN PLANE AND PLAN LOCATION.

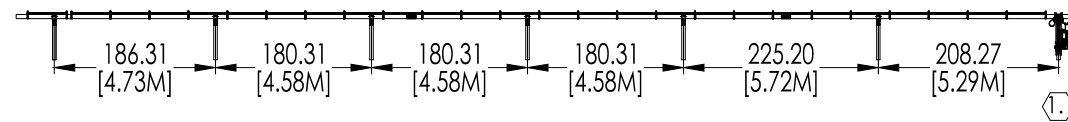
6. SEE DETAIL B ON SHEET 5 FOR MINIMUM COLUMN HEIGHTS
7. ARRAY BRACKETS ARE COMPATIBLE WITH (TBD) I-BEAMS FOR BEARING COLUMNS. IF A DIFFERENT COLUMN SIZE IS REQUIRED, CONTACT ARRAY.
8. SEE FIELD ASSEMBLY DRAWINGS FOR GEAR RACK COLUMN AND BEARING COLUMN HOLE REQUIREMENTS.
9. COLUMN SPACINGS SHOWN ARE BEARING TO BEARING ALONG TRACKER AXIS, WHICH MATCHES PILE SPACING ON A FLAT PLANE. FOR HIGH-SLOPE TRACKER INSTALLATION, REFER TO CONSTRUCTION SUPPLEMENT 90110-000.



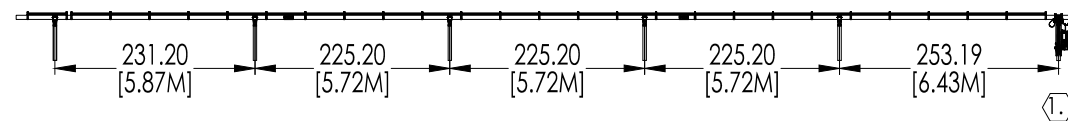
19091-001 52 (26/26) MODULE FULL EXTERIOR ROW



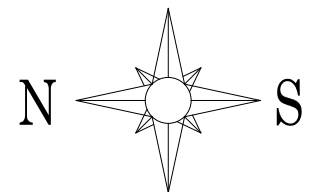
19091-002 52 (26/26) MODULE FULL INTERIOR ROW



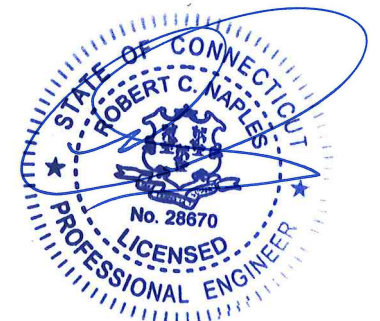
19091-003 26 (26/0) MODULE PARTIAL EXTERIOR ROW



19091-004 26 (26/0) MODULE PARTIAL INTERIOR ROW



BEARING STRENGTH	HOLE DIAMETER	BEARING TYPE
STANDARD	[0.688] 17.5	ALUMINUM



Exp 01/31/2026
11/26/2025

19091 Greenskies: Woodbridge
Soundview
Approx. 2.116 MWDC
Woodbridge, CT 06525
Greenskies



DRAWING STATUS		PRODUCT STATUS	
Final		Final	
NAME	DATE	NAME	DATE
EO	11/24/2025	EO	11/24/2025
Ampacity	11/24/2025	---	---

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REV	DESCRIPTION	DATE
A	INITIAL RELEASE	11/24/2025

ARRAY TECHNOLOGIES
3901 Midway Place NE, Albuquerque, NM 87109
(505) 881-7567

ARRAY TECHNOLOGIES

TITLE: **OmniTrack® HZ Project: 19091 Greenskies: Woodbridge Soundview Foundation Layout**

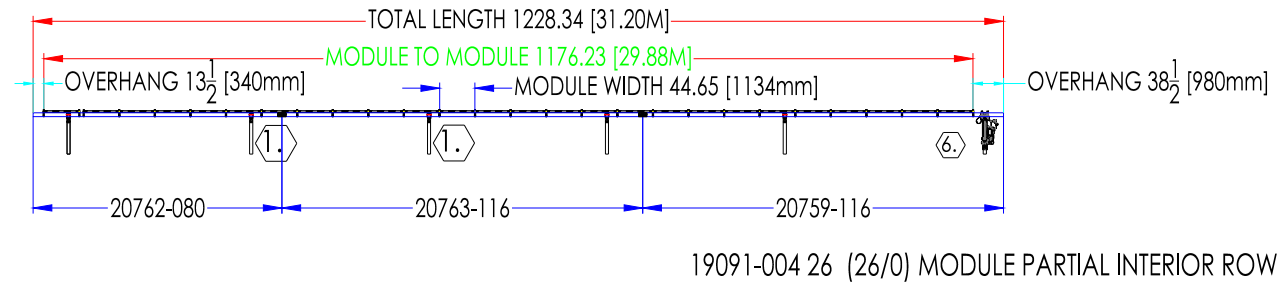
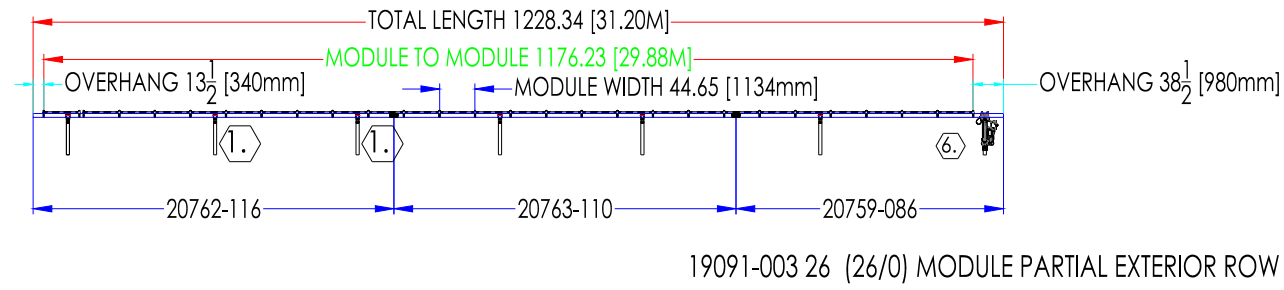
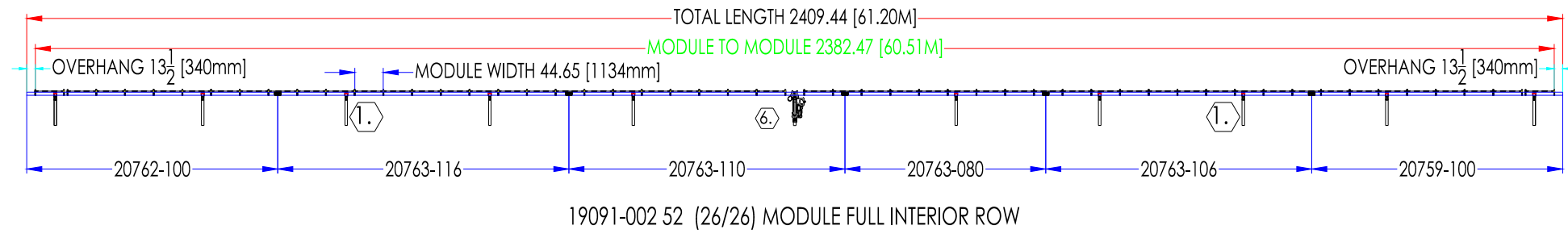
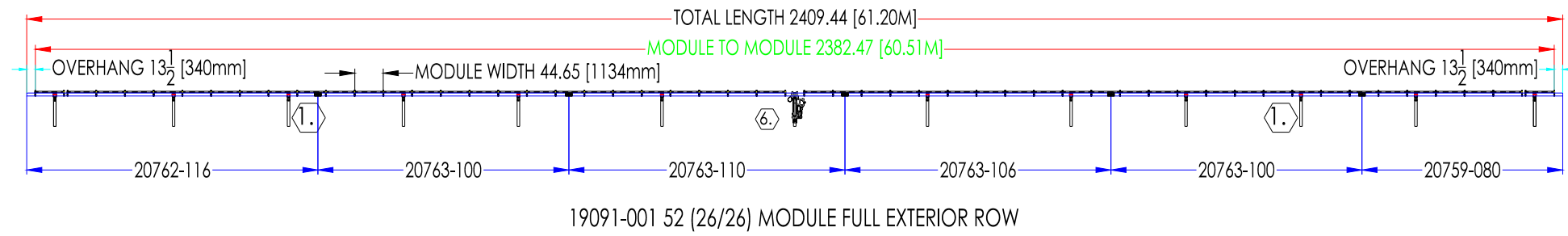
SIZE	PRODUCT NUMBER	REVISION
B	19091	A

SCALE: DWG NO. 19091-901, U.S. PATENT NO. #8,459,249; # 9,281,778

2 OF 7

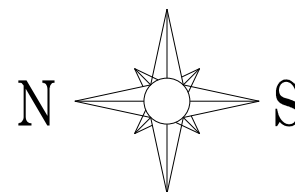
NOTES:

- 1. LOCATION OF DAMPER
- 2. THERE IS 0.394" (10mm) OF SPACE BETWEEN MODULES WITH 400mm TB AND 0.021" (5.4mm) OF SPACE BETWEEN MODULES WITH 1400mm TB CLAMPS.
- 3. DO NOT ATTACH NON- ARRAY SUPPLIED MATERIALS WITHOUT ARRAY APPROVAL.
- 4. PREGALVANIZED TUBE, PN 30811, MAY BE SUBSTITUTED WITH STRUCTURAL EQUIVALENT HDG, PN 30662/30810
- 5. OVERHANG IS MEASURED FROM MODULE EDGE. THE DISTANCE BETWEEN MODULE EDGE AND CLAMP EDGE IS APPROX. 0.75".
- 6. MODULE GAP: BEGIN MODULE INSTALLATION AT CENTER STRUCTURE. FOR CENTER GAP DIMENSIONS SEE DETAIL F ON SHEET 6.



12ga TORQUE TUBE PART NOS. (L CONDITION)					
FT	M	BEAM/ COUPLER	BEAM/ CAP	BEAM/ COUPLER+ CAP	TUBE
19.68	6	20763-060	20762-060	20759-060	30811-060
20.67	6.3	20763-063	20762-063	20759-063	30811-063
21.65	6.6	20763-066	20762-066	20759-066	30811-066
26.25	8	20763-080	20762-080	20759-080	30811-080
27.23	8.3	20763-083	20762-083	20759-083	30811-083
28.21	8.6	20763-086	20762-086	20759-086	30811-086
32.81	10	20763-100	20762-100	20759-100	30811-100
34.78	10.6	20763-106	20762-106	20759-106	30811-106
36.09	11.0	20763-110	20762-110	20759-110	30811-110
38.06	11.6	20763-116	20762-116	20759-116	30811-116
39.37	12.0	20763-120	20762-120	20759-120	30811-120

NOTE: TORQUE TUBE/BEAM ASSEMBLY TABLE FOR INFORMATION PURPOSES ONLY. NOT ALL BEAM CONFIGURATIONS MAY BE REPRESENTED IN ROW LAYOUTS.



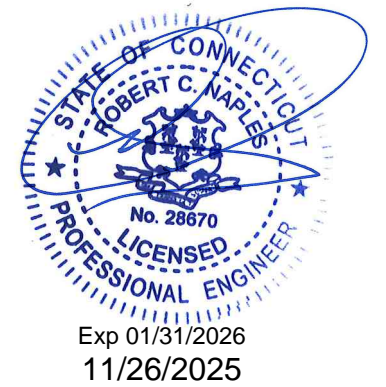
19091 Greenskies: Woodbridge Soundview
Approx. 2.116 MWDC
Woodbridge, CT 06525
Greenskies

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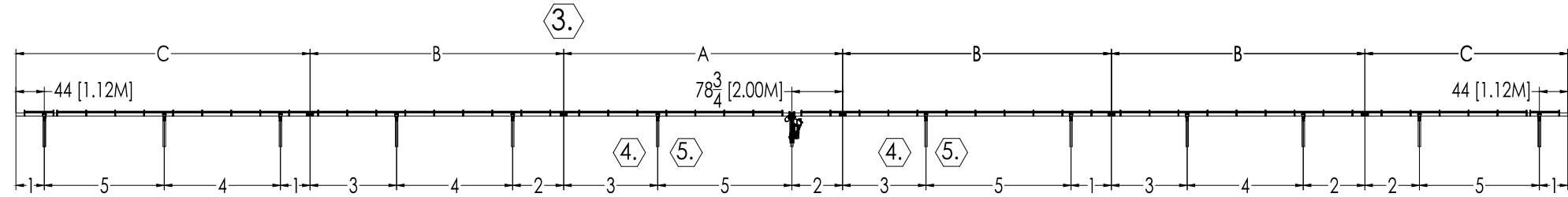
DRAWING STATUS		
Final		
PRODUCT STATUS		
Final		
NAME	DATE	
DRAWN	EO	11/24/2025
CHECKED	Ampacity	11/24/2025
APPROVED	---	---

A	INITIAL RELEASE	11/24/2025
REV	DESCRIPTION	DATE
ARRAY TECHNOLOGIES 3901 Midway Place NE, Albuquerque, NM 87109 (505) 881-7567		
TITLE OmniTrack® HZ Project: 19091 Greenskies: Woodbridge Soundview Torque Tube Configurations		
SIZE	PRODUCT NUMBER	REVISION
B	19091	A
SCALE	DWG NO.	U.S. PATENT NO.
NTS	19091-901	#8,459,249; # 9,281,778
		3 OF 7

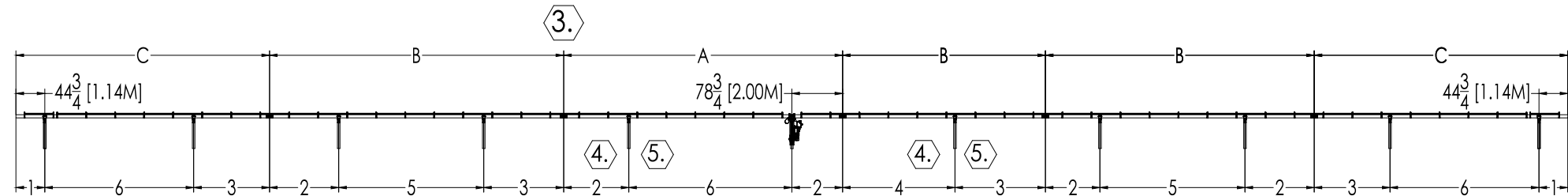


NOTES:

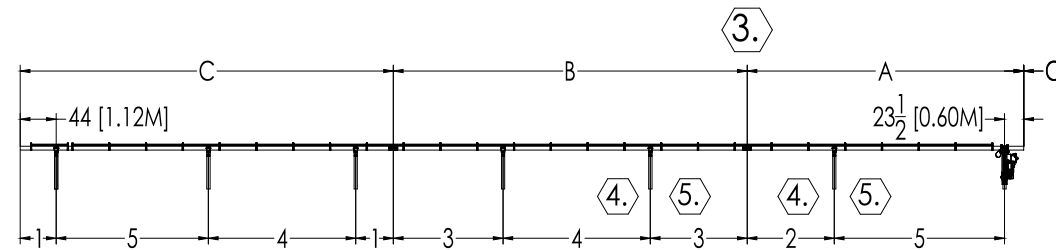
1. LOWER NUMBER INDICATES NUMBER OF CLAMPS BETWEEN TWO POINTS(COLUMN TO COLUMN OR COLUMN TO TORQUE BEAM/TUBE END)
2. FOR EASE OF ASSEMBLY, ARRAY RECOMMENDS, BUT DOES NOT REQUIRE, THE FOLLOWING INSTALLATION SEQUENCE:
 A: INSTALLED FIRST
 B : INSTALLED SECOND
 C: INSTALLED LAST
3. COUPLER IS LOCATED BETWEEN ALL TORQUE BEAM/TUBES
4. LOCATION OF BEARING HOUSING WITH SET SCREWS. REFER 21000-901 FIELD ASSEMBLY DRAWING FOR DETAILS.
5. TRANSLATION CLAMP PAIR LOCATION. CLAMPS TO BE INSTALLED ON NORTH AND SOUTH SIDES OF BEARING POST. REFER 25096-000 FIELD ASSEMBLY DRAWING FOR DETAILS.
6. 1400mm Thru-Bolt CLAMPS INSTALLED ON FIRST FOUR MODULES ON NORTH AND/OR SOUTH ENDS OF ROWS. USE MOUNTING METHOD "A". REFER TO 20895-901 FIELD ASSEMBLY DRAWING FOR DETAILS. ALL OTHER CLAMPS 400MM TB.
7. NIGHT SNOW STOW SYSTEM SETTING MUST BE TURNED ON UPON COMMISSIONING.



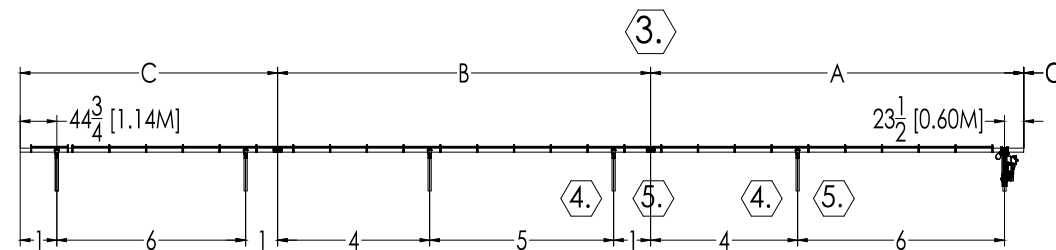
19091-001 52 (26/26) MODULE FULL EXTERIOR ROW
56 CLAMPS



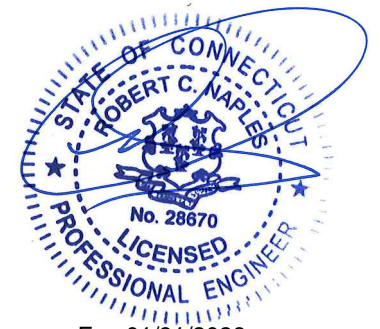
19091-002 52 (26/26) MODULE FULL INTERIOR ROW
56 CLAMPS



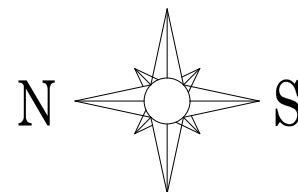
19091-003 26 (26/0) MODULE PARTIAL EXTERIOR ROW
28 CLAMPS



19091-004 26 (26/0) MODULE PARTIAL INTERIOR ROW
28 CLAMPS



Exp 01/31/2026
11/26/2025



19091 Greenskies: Woodbridge
Soundview
Approx. 2.116 MWDC
Woodbridge, CT 06525
Greenskies

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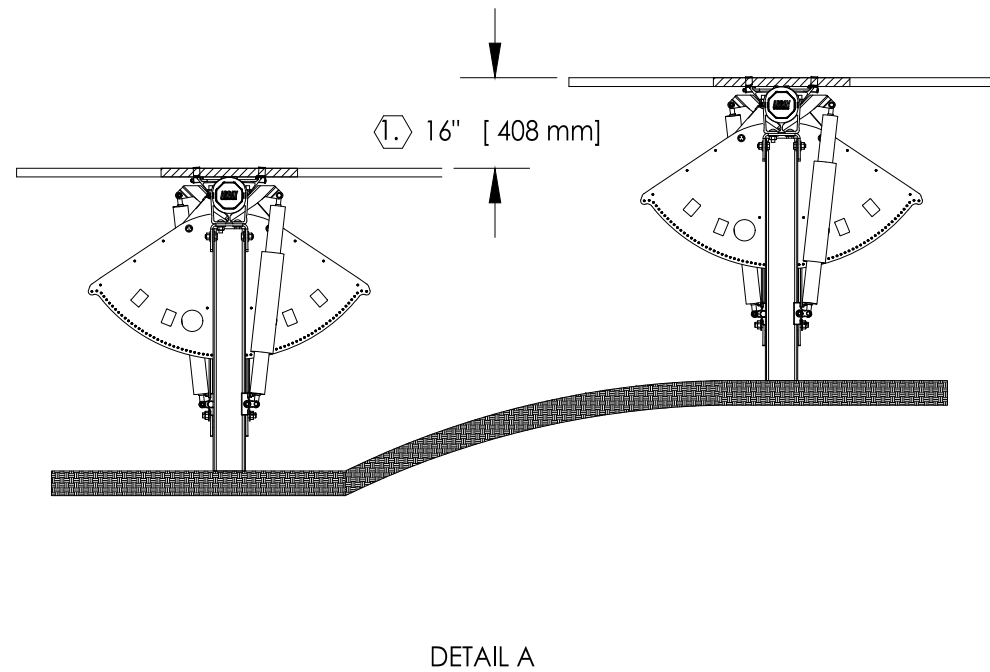
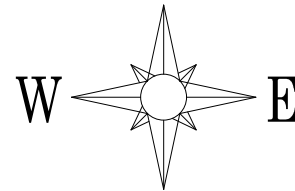
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PRODUCT STATUS Final		
NAME	DATE	
DRAWN EO	11/24/2025	
CHECKED Ampacity	11/24/2025	
APPROVED ---	---	

A	INITIAL RELEASE	11/24/2025
REV	DESCRIPTION	DATE
ARRAY TECHNOLOGIES 3901 Midway Place NE, Albuquerque, NM 87109 (505) 881-7567		
TITLE OmniTrack® HZ Project: 19091 Greenskies: Woodbridge Soundview Assembly Sequence		
SIZE B	PRODUCT NUMBER 19091	REVISION A
SCALE NTS	DWG NO. 19091-901	U.S. PATENT NO. #8,459,249; # 9,281,778
		4 OF 7

NOTE:

- IF THE HEIGHT DIFFERENCE AVERAGED AT ROW EXTREMITIES EXCEEDS THE DISTANCE NOTED, ROW ON HIGHER PLANE IS AN EXTERIOR ROW.

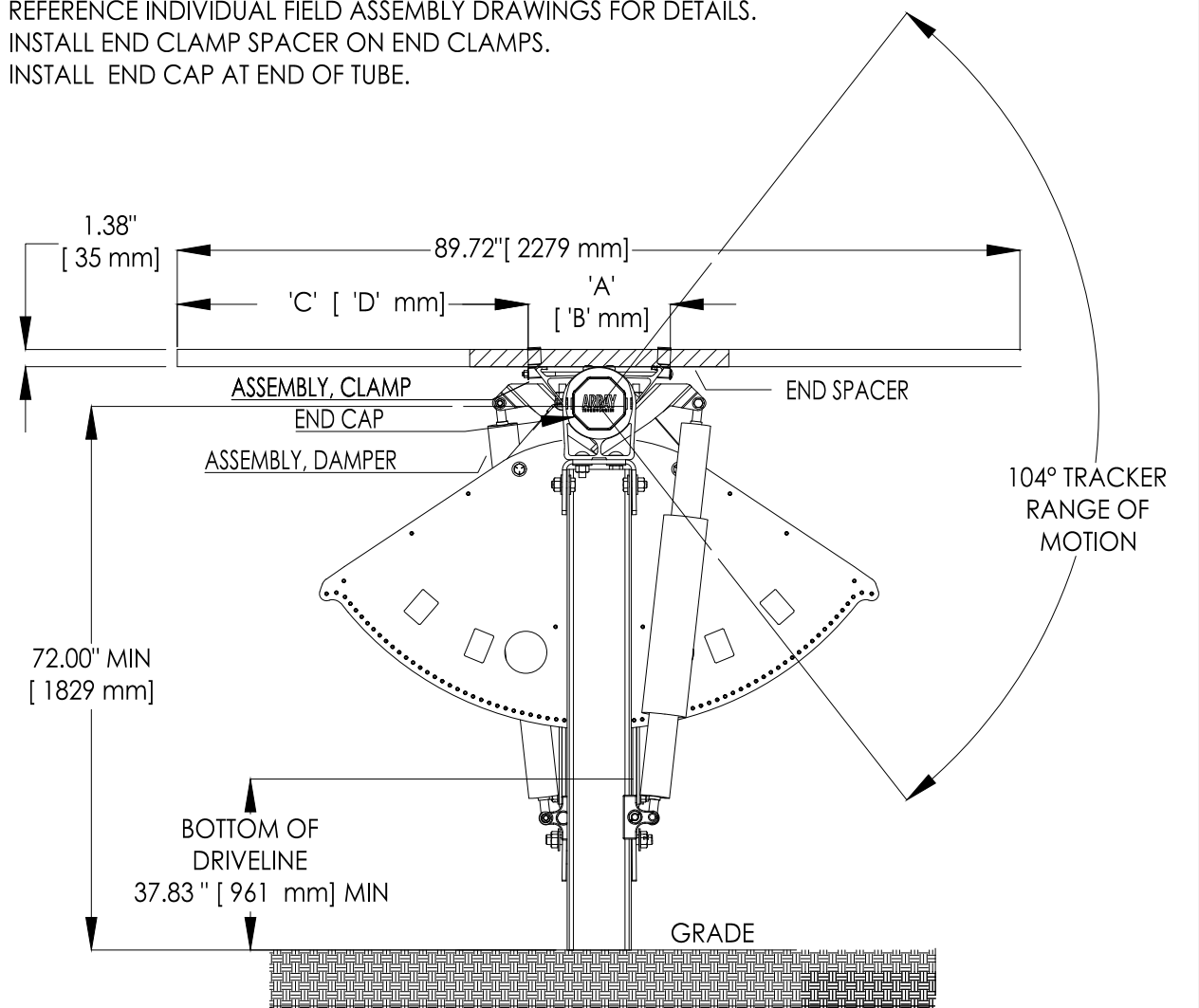
EXTERIOR ROW HEIGHT PARAMETER



NOTE:

- REFERENCE INDIVIDUAL FIELD ASSEMBLY DRAWINGS FOR DETAILS.
INSTALL END CLAMP SPACER ON END CLAMPS.
INSTALL END CAP AT END OF TUBE.

MINIMUM DISTANCES AND MODULE DATA



MODULE WIDTH = 44.65" [1134 mm]

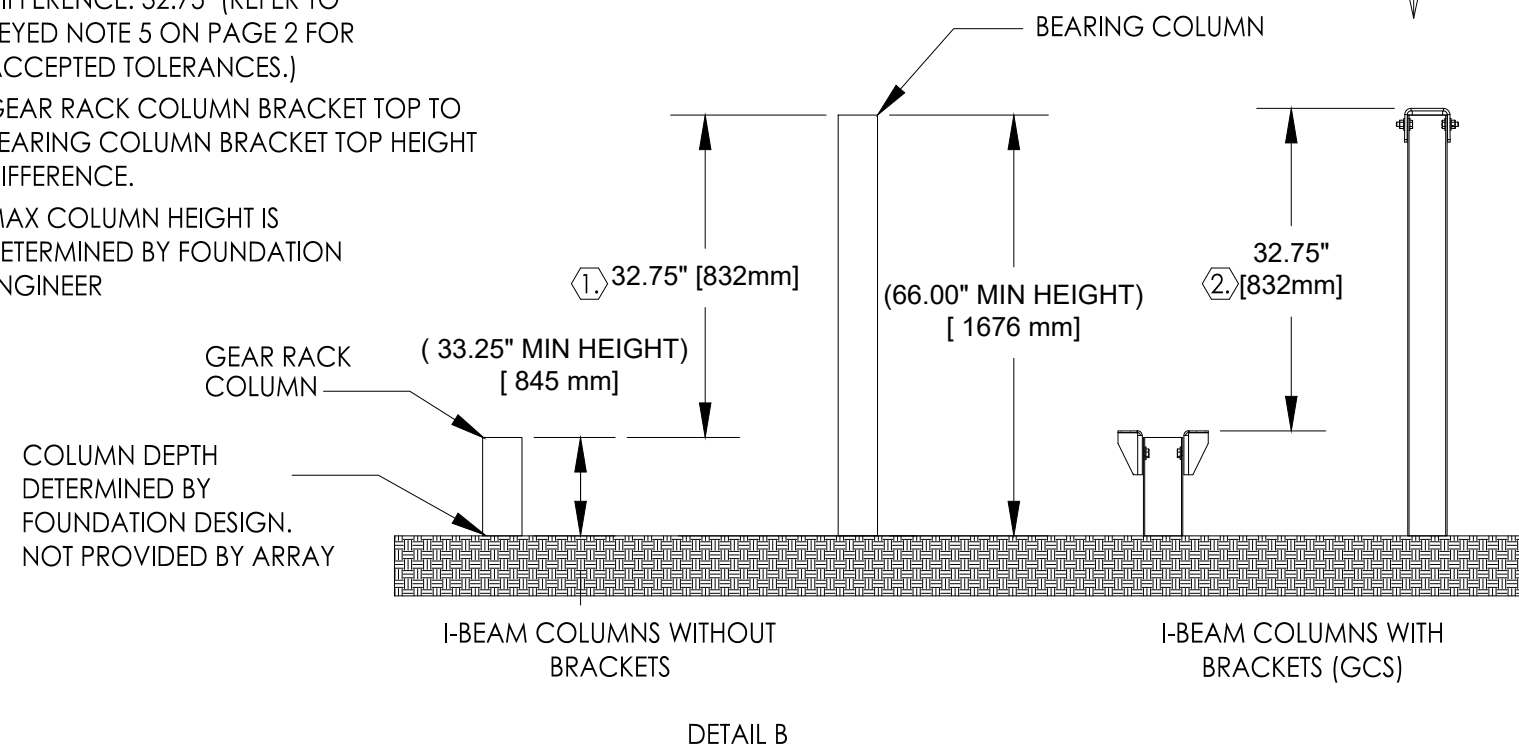
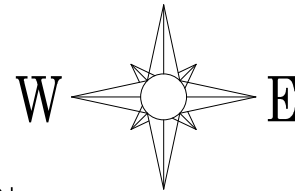
DETAIL C

CLAMP TYPE	DIM 'A' [IN]	DIM 'B' [mm]	DIM 'C' [IN]	DIM 'D' [mm]
400mm THRU BOLT	17.02	432.3	36.33	922.8
1400mm THRU BOLT	56.97	1447.0	16.36	415.5

NOTES:

- GEAR RACK COLUMN TOP TO BEARING COLUMN TOP HEIGHT DIFFERENCE: 32.75" (REFER TO KEYED NOTE 5 ON PAGE 2 FOR ACCEPTED TOLERANCES.)
- GEAR RACK COLUMN BRACKET TOP TO BEARING COLUMN BRACKET TOP HEIGHT DIFFERENCE.
- MAX COLUMN HEIGHT IS DETERMINED BY FOUNDATION ENGINEER

COLUMN HEIGHT REQUIREMENTS



19091 Greenskies: Woodbridge Soundview
Approx. 2.116 MWDC
Woodbridge, CT 06525
Greenskies



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PRODUCT STATUS: Final

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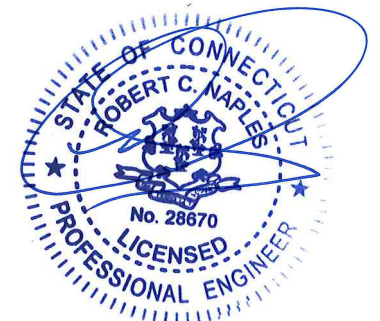
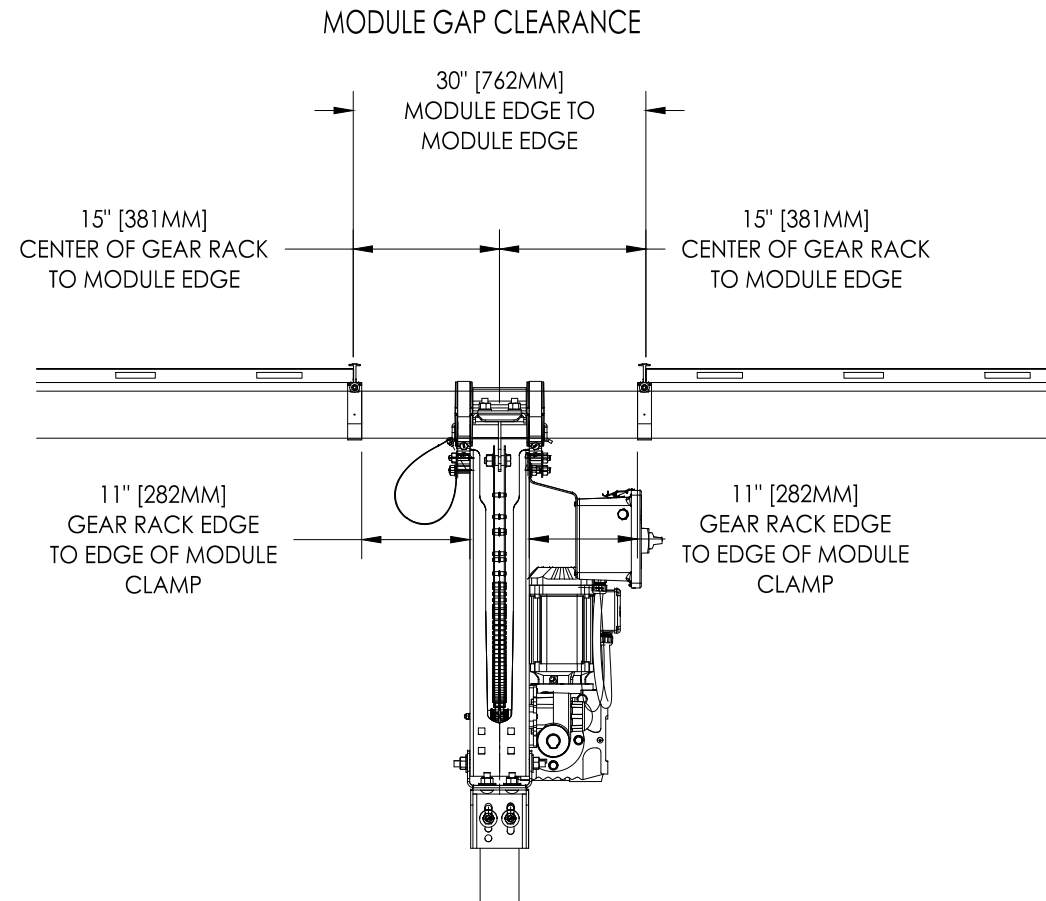


	NAME	DATE
DRAWN	EO	11/24/2025
CHECKED	Ampacity	11/24/2025
APPROVED	---	---

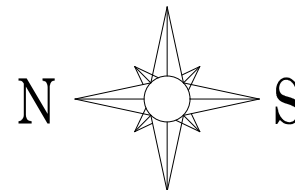
REV	INITIAL RELEASE	11/24/2025
REV	DESCRIPTION	DATE
ARRAY TECHNOLOGIES 3901 Midway Place NE, Albuquerque, NM 87109 (505) 881-7567		
TITLE OmniTrack® HZ Project: 19091 Greenskies: Woodbridge Soundview Detail Views		
SIZE B	PRODUCT NUMBER 19091	REVISION A
SCALE NTS	DWG NO. 19091-901	U.S. PATENT NO. #8,459,249; # 9,281,778

NOTES:

1. THE GLOBAL CENTER STRUCTURE MOTOR IS MOUNTED OPPOSITE OF CAB SYSTEM.
2. THE GLOBAL CENTER STRUCTURE MOTOR CAN BE MOUNTED ON EITHER WEST SIDE OR EAST SIDE OF GEAR RACK.



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11/26/2025



19091 Greenskies: Woodbridge
Soundview
Approx. 2.116 MWDC
Woodbridge, CT 06525
Greenskies

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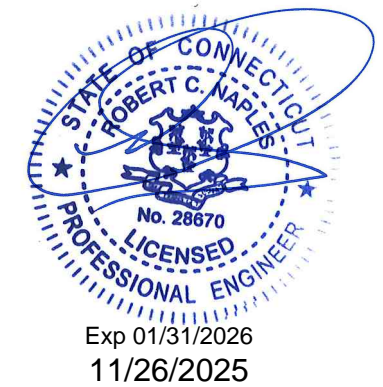
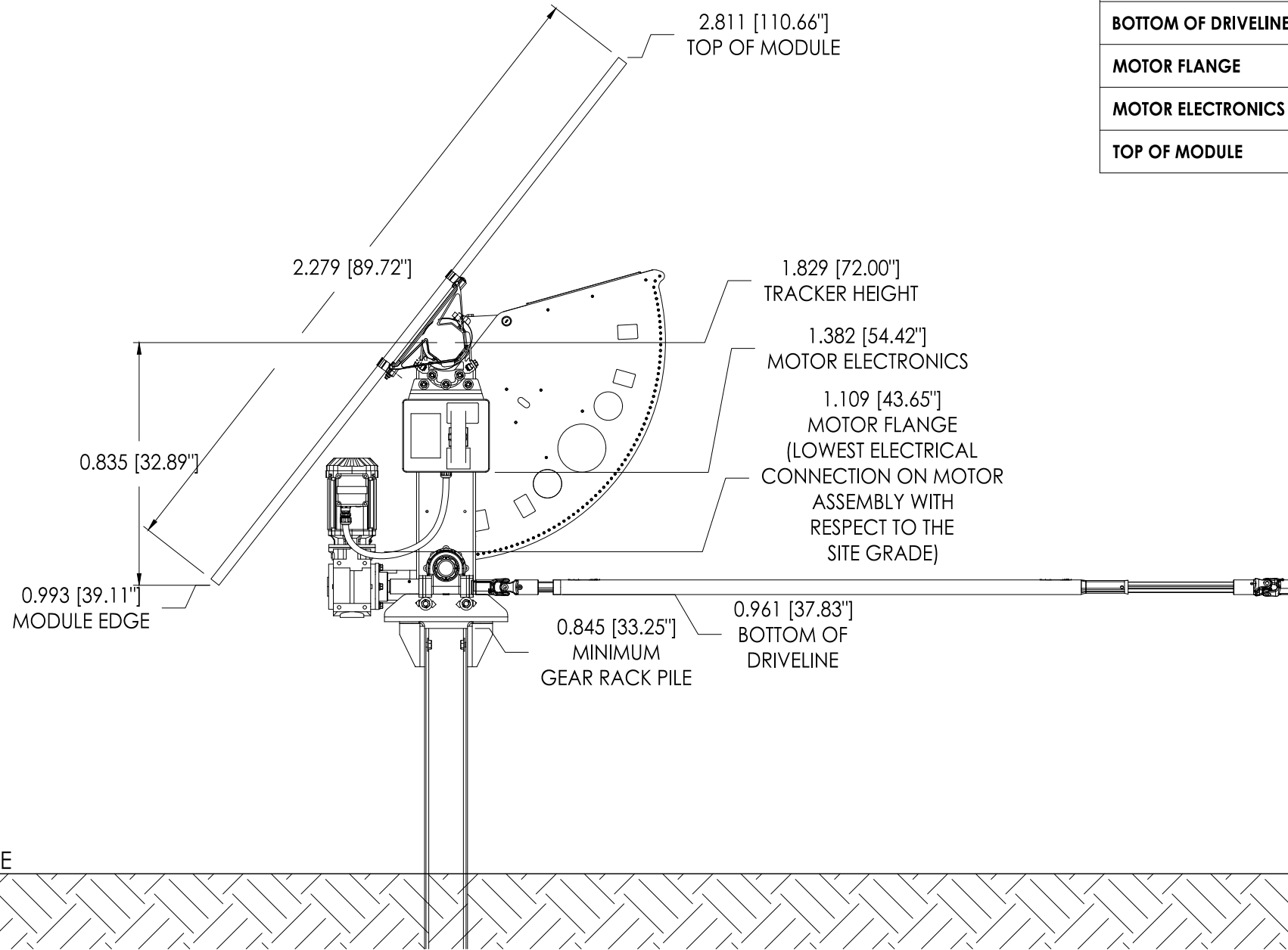
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PRODUCT STATUS Final		
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DRAWN	EO	11/24/2025
CHECKED	Ampacity	11/24/2025
APPROVED	---	---

A	INITIAL RELEASE	11/24/2025
REV	DESCRIPTION	DATE
ARRAY TECHNOLOGIES		
3901 Midway Place NE, Albuquerque, NM 87109 (505) 881-7567		
TITLE OmniTrack® HZ Project: 19091 Greenskies: Woodbridge Soundview Detail Views		
SIZE B	PRODUCT NUMBER 19091	REVISION A
SCALE NTS	DWG NO. 19091-901	U.S. PATENT NO. #8,459,249; # 9,281,778
		6 OF 7

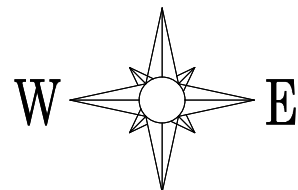
1. DIMENSIONS PROVIDED IN TABLE ARE FOR REFERENCE ONLY. REFER TO DETAILS A, B AND C ON SHEET 5 FOR PILE REVEAL MINIMA.

GCS DIMENSIONS FROM GRADE - 2279mm

TRACKER HEIGHT	72.00" [1.829 m]		84.00" [2.134 m]		96.00" [2.438 m]		108.00" [2.743 m]		120.00" [3.048 m]	
MODULE EDGE TO GRADE	39.11	0.993m	51.11"	1.298m	63.11"	1.603m	75.11"	1.908m	87.11"	2.212m
GEAR RACK PILE	33.25"	0.845m	45.25"	1.149m	57.25"	1.454m	69.25"	1.759m	81.25"	2.064m
BOTTOM OF DRIVELINE	37.83"	0.961m	49.83"	1.266m	61.83"	1.570m	73.83"	1.875m	85.83"	2.180m
MOTOR FLANGE	43.57"	1.107m	55.57"	1.411m	67.57"	1.716m	79.57"	2.021m	91.57"	2.326m
MOTOR ELECTRONICS	54.42"	1.382m	66.42"	1.687m	78.42"	1.992m	90.4"	2.297m	102.42"	2.601m
TOP OF MODULE	110.66	2.811	122.66"	3.115m	134.66"	3.420m	146.66"	3.725m	158.66"	4.030m



DETAIL F
72.00" TRACKER HEIGHT



19091 Greenskies: Woodbridge Soundview
Approx. 2.116 MWDC
Woodbridge, CT 06525
Greenskies

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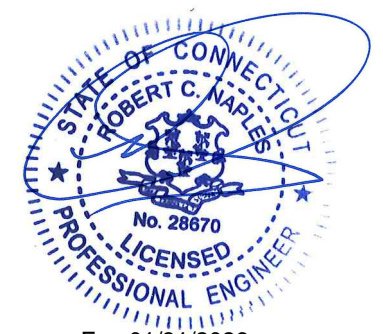
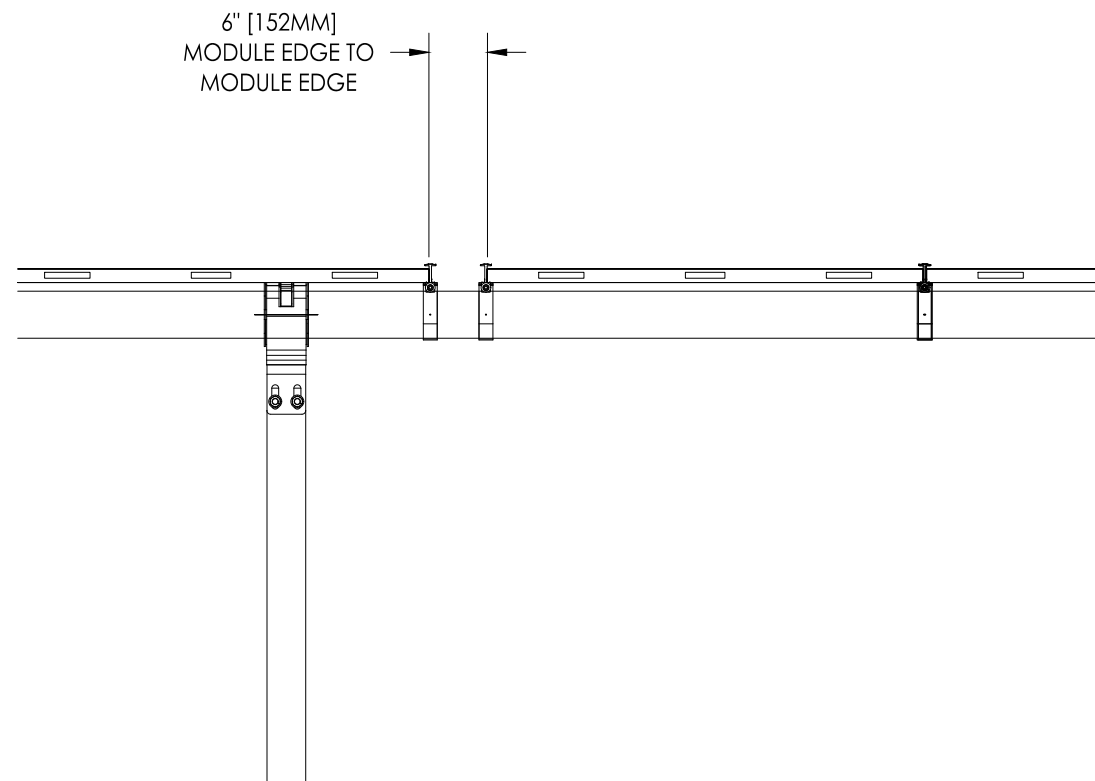
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PRODUCT STATUS		Final	
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DRAWN	EO	11/24/2025	
CHECKED	Ampacity	11/24/2025	
APPROVED	---	---	

REV	INITIAL RELEASE	11/24/2025
REV	DESCRIPTION	DATE
A	INITIAL RELEASE	11/24/2025
REV	DESCRIPTION	DATE
ARRAY TECHNOLOGIES 3901 Midway Place NE, Albuquerque, NM 87109 (505) 881-7567		
OmniTrack® HZ Project: 19091 Greenskies: Woodbridge Soundview Detail Views		
SIZE	PRODUCT NUMBER	REVISION
B	19091	A
SCALE	DWG NO.	U.S. PATENT NO.
NTS	19091-901	#8,459,249; # 9,281,778
		7 OF 7

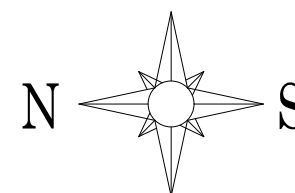
NOTES:

1. THE NOMINAL GAP SHOWN MAY BE ALTERED +/- 6IN.

OMNITRACK NOMINAL
MODULE GAP CLEARANCE



Exp 01/31/2026
11/26/2025



19091 Greenskies: Woodbridge
Soundview
Approx. 2.116 MWDC
Woodbridge, CT 06525
Greenskies

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DRAWING STATUS Final		
PRODUCT STATUS Final		
	NAME	DATE
DRAWN	EO	11/24/2025
CHECKED	Ampacity	11/24/2025
APPROVED	---	---

A	INITIAL RELEASE	11/24/2025
REV	DESCRIPTION	DATE
ARRAY TECHNOLOGIES 3901 Midway Place NE, Albuquerque, NM 87109 (505) 881-7567		
TITLE OmniTrack® HZ Project: 19091 Greenskies: Woodbridge Soundview Detail Views		
SIZE B	PRODUCT NUMBER 19091	REVISION A
SCALE NTS	DWG NO. 19091-901	U.S. PATENT NO. #8,459,249; # 9,281,778
		7B OF 7