DiGioia Gray & Associates

Sept 17, 2014
Paul G. Cass, PE

EMF Calculation Process

New York State Public Service Commission Standards

The applicable electric field strength standards established by the NYSPSC are set forth in Opinion No. 78-13 (issued June 19, 1978). The magnetic field standards established by the NYSPSC are set forth in the NYSPSC's Interim Policy Statement on Magnetic Fields, issued September 11, 1990, (Interim Policy).

Opinion No. 78-13 established an electric field strength interim standard of 1.6 kV/m for ArticleVII electric transmission lines, at the edge of the right-of-way, one meter above ground level, with the line at the rated voltage. The Interim Policy establishes a magnetic field strength interim standard of 200 mG, measured at one meter above grade, at the edge of the right-of-way, at the point of lowest conductor sag. The measurement is based on the expected circuit phase currents being equal to the Winter Normal conductor rating.

Line Construction

The project consists of installing a new single circuit 345kV circuit on a shared right-of-way with existing 345kV circuit Feeder 398 also referred to as the L-Line.

The existing circuit is an interstate transmission line that connects Consolidated Edison's Pleasant Valley Substation with Connecticut. Feeder 398 consists of a single 2156 kcmil 84/19 ACSR conductor per phase and two 7#5 ALWD shield wires supported with steel lattice towers. Feeder 398 has a horizontal phase configuration with phase A identified as the northernmost phase and phase C as the southernmost phase. The normal winter feeder rating is 2260 Amps/conductor.

The EMF investigation for the proposed 345kV line to Cricket Valley Energy Center considered a steel pole with a delta phase configuration and a steel h-frame with a horizontal phase configuration. The conductor is a bundled 795kcmil 30/19 ACSS conductor with twin bundled phasing. From prior EMF studies the best phase configuration to minimize electric and magnetic fields at the edge of ROW is a B-C-A arrangement from top to bottom .

Design/EMF Analysis Process

The EMF calculations for the reconductored L-line between Cricket Valley and the Connecticut border were conducted using PLS-Cadd for the ROW with a single circuit. For the segment from Pleasant Valley to Cricket Valley an excel spreadsheet developed by DiGioia Gray to model multiple lines on a ROW both analyses. Both the spreadsheet and the PLS-Cadd analyses are based on the EPRI Red Book methodology (EPRI,1982). The excel program results were QA'd by using PLS-Cadd and modeling the two lines as a single double circuit line. While optimum phasing was determined from previous studies the phasing of the new line to CVEC

was varied to reflect all combinations. Two spans on the PV to CV segment and one span on the CV to CN border segment were selected for analysis based upon minimum conductor to ground clearance under winter normal conductor conditions.

All EMF calculations were made along a line perpendicular to the transmission line and at one (1) meter (3.28 feet) above ground level. EMF calculations were made at the low clearance point to ground with conductor temperatures of 203°F for the bundled Mallard ACSS conductor and 180°F for the single Bluebird ACSR. For the purpose of evaluating magnetic fields, phase A had a phase angle of 0 degrees, phase B had a phase angle of 120 degrees and phase C had a phase angle of 240 degrees. The existing line is a horizontal configuration modeled ABC from north to south. Balanced three phase loads were assumed.

Conductor Winter Normal Rating Information

All new and existing lines will be capable of transmitting their normal maximum ratings. Table 1 indicates the current ratings for the new and relocated lines included in the Project as well as the other lines in the transmission line corridors. The table also includes conductor and static wires used in the EMF analysis

Table 1 – Conductor Rating Information

Line	Voltage	T-Line status - configuration	Conductors used for modeling EMF	Static wires used for modeling EMF	Normal Winter Current (Amps)
L-Line PV to CV	345kV	Existing - Horizontal	(3) 1 x 2156 ACSR Bluebird 84/19	(2) 1 x 7 #5 ALWD	2260
L-Line CV to CN border	345kV	Proposed Horizontal	(3) 2 x 1351 ACSS Martin 54/19	(2) 1 x 7 #5 ALWD	2695
CV-Line	345kV	Proposed- Horizontal or Delta	(3) 2 x 1351 ACSS Martin 54/19	(2) 1 x 7 #5 ALWD	2695

Parameters for determining Conductor temperature

Line Rating values for the 795 ACSS Mallard conductor were determined as follows

- Determined line amperage based upon a 95°C conductor temperature. The 95°C conductor temperature is the normal summer conductor temperature for a 1323 MVA load.
- 0.5 Emissivity and Solar Absorptivity Coefficients
- 67.0 Watt/ft2 Winter solar radiation
- 3 ft/sec wind speed perpendicular to the wires

- Ground Elevation = 0
- 50°F Winter Ambient Temperature
- Material properties from Southwire (a manufacturer of the conductor)

EMF Calculation Results –

Table 2 – Calculated Magnetic Fields at Edge of Right of Way

Location	CV-Line structure configuration	Phasing L-line (north to south)	Phasing CV-Line (top to bottom or north to south)	Magnetic field (mG) @ north edge of ROW	Magnetic field (mG) @ south edge of ROW	Magnetic field (mG) @ 500' south of centerline
CV8 to CV9	Delta (Pole) (40ft clearance)	A-B-C	B-C-A	95	75	2.8
CV38-CV39	Delta (Pole) (40ft clearance)	A-B-C	B-C-A	93	77	2.8
L62-L63	NA	A-B-C		141	26	3.2
CV8 to CV9	Horizontal (H-Frame) (68ft clearance)	A-B-C	B-C-A	127	130	7.3
CV8 to CV9	Horizontal (H-Frame) (40ft clearance)	A-B-C	B-C-A	127	215 requires 17ft more ROW for 200mG	7.3

Table 3 – Calculated Electric Fields at Edge of Right of Way

Figure No	CV-Line Structure Configuration	Phasing L-line (north to south)	Phasing CV-Line (top to bottom or north to south)	Electric Field (kV/m) @ north edge of ROW	Electric Field (kV/m) @ south edge of ROW	Electric Field (kV/m) @ 500' south of centerline
CV8 to CV9	Delta (Pole)	A-B-C	B-C-A	1.13	1.02	0.02
CV38-CV39	Delta (Pole)	A-B-C	B-C-A	1.18	1.06	0.02
L62-L63	NA	A-B-C		1.42	.12	0.006
CV8 to CV9	Horizontal (H-Frame) (68ft	A-B-C	B-C-A	1.24	1.64	0.02

	clearance)					
CV8 to CV9	Horizontal (H-Frame) (40ft clearance)	A-B-C	B-C-A	1.23	1.61 requires 17ft more ROW for 200mG	0.02

See "CV8 to CV9 ABC-BCA winter normal 200 ft extents.pdf" and "CV8 to CV9 ABC-BCA winter normal 1500 ft distance" for combined CV and L-line EMF analyses for maximum values at edge of combined CV-line and L-line ROW.

See "CV38 to CV39 ABC-BCA winter normal 200' distance.pdf" and "CV38 to CV39 ABC-BCA winter normal 1500' distance" for combined CV and L-line EMF analyses for maximum values at edge of combined CV-line and L-line ROW.

See "L62 to L63 winter normal 500' distance.pdf" for reconductored L-line EMF analyses for maximum values at edge of ROW.

See "CV8 to CV9 ABC-BCA h-frame winter normal 200 ft extents.pdf" and "CV8 to CV9 ABC-BCA h-frame winter normal 1500 ft extents.pdf" for combined CV and L-line EMF analyses for maximum values at edge of combined CV-line and L-line ROW where H-frames are used for the CV line and the minimum clearance to ground at 95°C temperature is 68 feet.

Note: The proposed structure configuration for the Pleasant Valley to Cricket Valley 345kV line (CV-line) is a pole with conductors arranged in a delta configuration.

ELECTRICAL AND MAGNETIC FIELD CALCULATOR

Based on EPRI Transmission Line Reference Book (Red Book, 1982)

Version 1.3

Project/Site: *Effect of Clearance on EMF of typical 345kV double circuit line.*

Wire Data CV-8 to CV-9 ABC-BCA configuration

Number of Wires: 10

Wire Label	Description	Voltage (kV)	Current (amps)	Phase Angle (deg)	Bundle Spacing (in)	Conduc. Diam (in)	Number in Bundle	Location		Equivalent Diam	
								X (ft)	Y (ft)	(ft)	(in)
1		*0*	*0*	*0*	*0*	0.546	1	69.8	106.6	0.046	0.546
2		*0*	*0*	*0*	*0*	0.546	1	30.2	106.6	0.046	0.546
3-1		*345*	*2695*	*120*	*18*	1.14	2	69.8	73.6	0.534	6.406
3-2		*345*	*2695*	*240*	*18*	1.14	2	30.2	57.2	0.534	6.406
3-3		*345*	*2695*	*0*	*18*	1.14	2	69.8	41.4	0.534	6.406
6-1		*345*	*2260*	*0*	*0*	1.762	1	-75.6	32.4	0.147	1.762
6-2		*345*	*2260*	*120*	*0*	1.762	1	-50	32.4	0.147	1.762
6-3		*345*	*2260*	*240*	*0*	1.762	1	-24.4	32.4	0.147	1.762
4-1		*0*	*0*	*0*	*0*	0.546	1	-68	64.3	0.046	0.546
5-1		*0*	*0*	*0*	*0*	0.546	1	-32	64.3	0.046	0.546
										0.000	0.000
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Use GREEN text to copy/paste with PLS-CADD EMF Calculator

X location along ground: 50 ft

Y location above ground: 3.28084 ft

Graphing

Left Bound: -200 ft

Center for Mag: 0 ft

Center for Elec: 0 ft

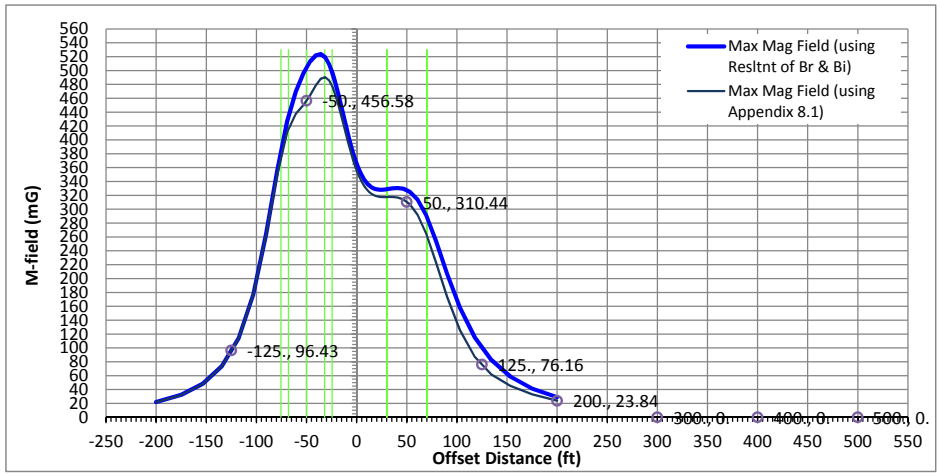
Right Round: 200 ft

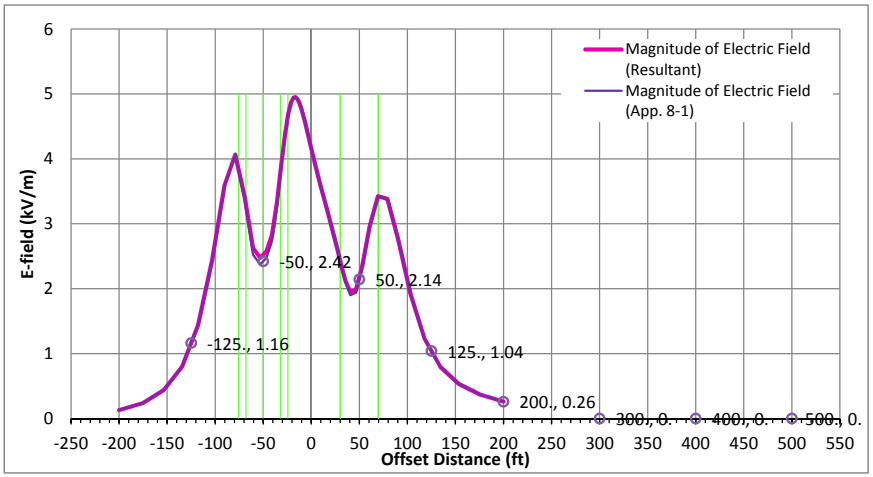
Values at Given Location (X=50.00, Y=3.28)

Magnitude of Magnetic Field (App. 8-1)	**311.1**	mG
Magnitude of Mag. Field (Resultant)	**327.8**	mG
Magnitude of Electric Field (App. 8-1)	**2.109**	kV/m
Magnitude of Electric Field (Resultant)	**2.146**	kV/m

Maximums over Given Range

Max Mag Field (using Appendix 8.1)	490.40	mG
Approx. Location	-31.31	ft
Max Mag Field (using Resltnt of B_r & B_i)	**523.70**	mG
Approx. Location	**-35.74**	ft
Max Elec Field (App. 8-1)	4.947	kV/m
Approx. Location	-16.15	ft
Max Elec Field (Resultant of E_r & E_i)	**4.950**	kV/m
Approx. Location	**-16.15**	ft





ELECTRICAL AND MAGNETIC FIELD CALCULATOR

Based on EPRI Transmission Line Reference Book (Red Book, 1982)

Version 1.3

Project/Site: *Effect of Clearance on EMF of typical 345kV double circuit line.*

Wire Data CV-8 to CV-9 ABC-BCA configuration

Number of Wires: 10

Wire Label	Description	Voltage (kV)	Current (amps)	Phase Angle (deg)	Bundle Spacing (in)	Conduc. Diam (in)	Number in Bundle	Location X (ft)	Location Y (ft)	Equivalent Diam (ft)	Equivalent Diam (in)
1		0	0	0	0	0.546	1	69.8	106.6	0.046	0.546
2		0	0	0	0	0.546	1	30.2	106.6	0.046	0.546
3-1		345	2695	120	18	1.14	2	69.8	73.6	0.534	6.406
3-2		345	2695	240	18	1.14	2	30.2	57.2	0.534	6.406
3-3		345	2695	0	18	1.14	2	69.8	41.4	0.534	6.406
6-1		345	2260	0	0	1.762	1	-75.6	32.4	0.147	1.762
6-2		345	2260	120	0	1.762	1	-50	32.4	0.147	1.762
6-3		345	2260	240	0	1.762	1	-24.4	32.4	0.147	1.762
4-1		0	0	0	0	0.546	1	-68	64.3	0.046	0.546
5-1		0	0	0	0	0.546	1	-32	64.3	0.046	0.546
										0.000	0.000
										0.000	0.000
										0.000	0.000
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Use GREEN text to copy/paste with PLS-CADD EMF Calculator

X location along ground: 50 ft

Y location above ground: 3.28084 ft

Graphing

Left Bound: -500 ft

Center for Mag: 0 ft

Center for Elec: 0 ft

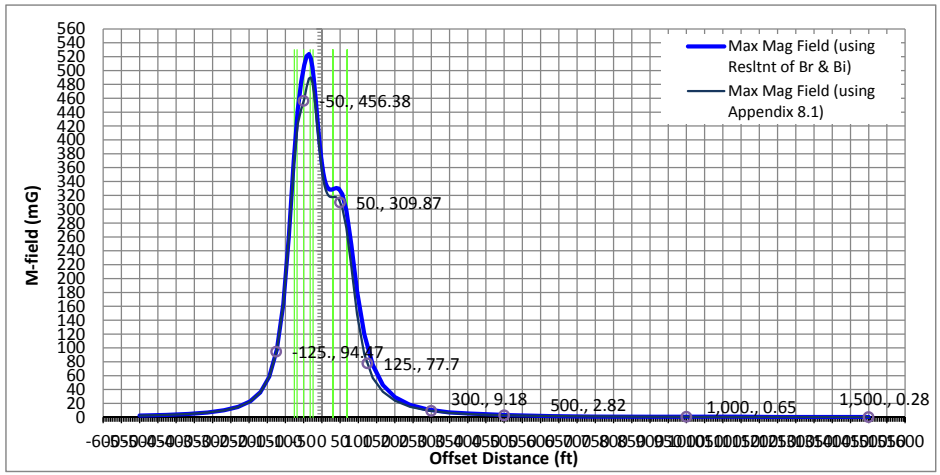
Right Round: 1500 ft

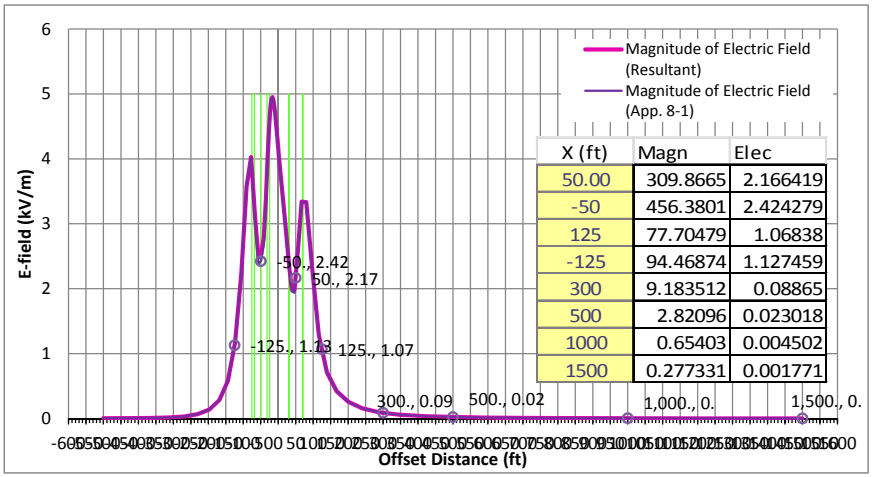
Values at Given Location (X=50.00, Y=3.28)

Magnitude of Magnetic Field (App. 8-1)	**311.1**	mG
Magnitude of Mag. Field (Resultant)	**327.8**	mG
Magnitude of Electric Field (App. 8-1)	**2.109**	kV/m
Magnitude of Electric Field (Resultant)	**2.146**	kV/m

Maximums over Given Range

Max Mag Field (using Appendix 8.1)	489.97	mG
Approx. Location	-30.51	ft
Max Mag Field (using Resltnt of B_r & B_i)	**523.66**	mG
Approx. Location	**-35.64**	ft
Max Elec Field (App. 8-1)	4.948	kV/m
Approx. Location	-16.39	ft
Max Elec Field (Resultant of E_r & E_i)	**4.951**	kV/m
Approx. Location	**-16.39**	ft





ELECTRICAL AND MAGNETIC FIELD CALCULATOR

Based on EPRI Transmission Line Reference Book (Red Book, 1982)

Version 1.3

Project/Site: *Effect of Clearance on EMF of typical 345kV double circuit line.*

Wire Data CV-38 to CV-39 ABC-BCA delta configuration

Number of Wires: 10

Wire Label	Description	Voltage (kV)	Current (amps)	Phase Angle (deg)	Bundle Spacing (in)	Conduc. Diam (in)	Number in Bundle	Location		Equivalent Diam	
								X (ft)	Y (ft)	(ft)	(in)
1		0	0	0	0	0.546	1	69.8	101.8	0.046	0.546
2		0	0	0	0	0.546	1	30.2	101.8	0.046	0.546
3-1		345	2695	120	18	1.14	2	69.8	72.4	0.534	6.406
3-2		345	2695	240	18	1.14	2	30.2	56.4	0.534	6.406
3-3		345	2695	0	18	1.14	2	69.8	40.5	0.534	6.406
6-1		345	2260	0	0	1.762	1	-75.6	34.5	0.147	1.762
6-2		345	2260	120	0	1.762	1	-50	34.5	0.147	1.762
6-3		345	2260	240	0	1.762	1	-24.4	34.5	0.147	1.762
4-1		0	0	0	0	0.546	1	-68	76.2	0.046	0.546
5-1		0	0	0	0	0.546	1	-32	76.2	0.046	0.546
										0.000	0.000
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Use GREEN text to copy/paste with PLS-CADD EMF Calculator

X location along ground: 50 ft

Y location above ground: 3.28084 ft

Graphing

Left Bound: -200 ft

Center for Mag: 0 ft

Center for Elec: 0 ft

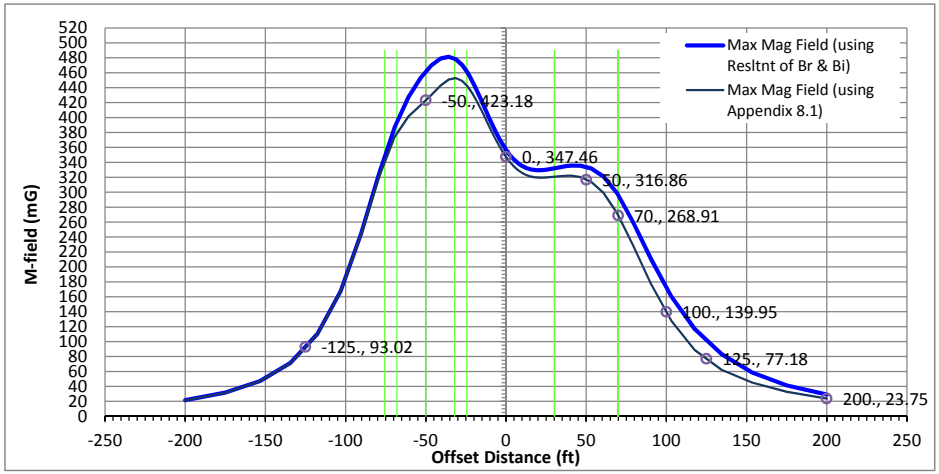
Right Round: 200 ft

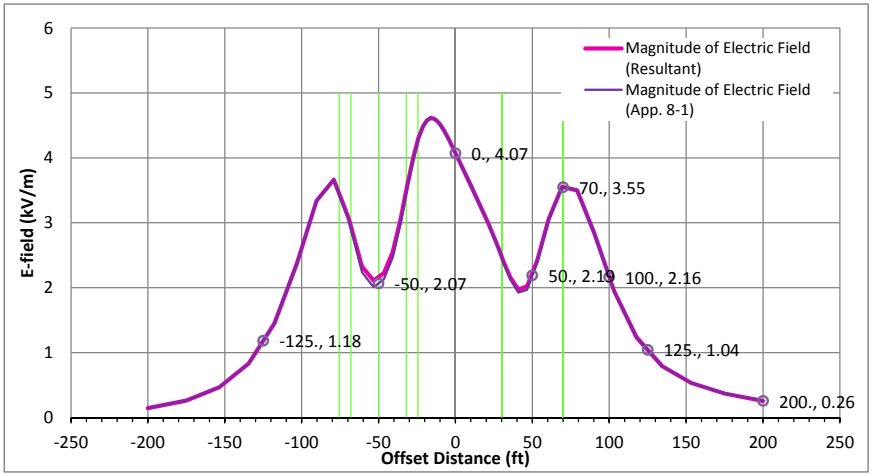
Values at Given Location (X=50.00, Y=3.28)

Magnitude of Magnetic Field (App. 8-1)	**317.5**	mG
Magnitude of Mag. Field (Resultant)	**334.1**	mG
Magnitude of Electric Field (App. 8-1)	**2.152**	kV/m
Magnitude of Electric Field (Resultant)	**2.191**	kV/m

Maximums over Given Range

Max Mag Field (using Appendix 8.1)	452.75	mG
Approx. Location	-31.31	ft
Max Mag Field (using Resltnt of B_r & B_i)	**481.36**	mG
Approx. Location	**-35.74**	ft
Max Elec Field (App. 8-1)	4.608	kV/m
Approx. Location	-16.15	ft
Max Elec Field (Resultant of E_r & E_i)	**4.611**	kV/m
Approx. Location	**-16.15**	ft





ELECTRICAL AND MAGNETIC FIELD CALCULATOR

Based on EPRI Transmission Line Reference Book (Red Book, 1982)

Version 1.3

Project/Site: *Effect of Clearance on EMF of typical 345kV double circuit line.*

Wire Data CV-38 to CV-39 ABC-BCA delta configuration — Number of Wires: 10

Wire Label	Description	Voltage (kV)	Current (amps)	Phase Angle (deg)	Bundle Spacing (in)	Conduc. Diam (in)	Number in Bundle	Location X (ft)	Location Y (ft)	Equivalent Diam (ft)	Equivalent Diam (in)
1		0	0	0	0	0.546	1	69.8	101.8	0.046	0.546
2		0	0	0	0	0.546	1	30.2	101.8	0.046	0.546
3-1		345	2695	120	18	1.14	2	69.8	72.4	0.534	6.406
3-2		345	2695	240	18	1.14	2	30.2	56.4	0.534	6.406
3-3		345	2695	0	18	1.14	2	69.8	40.5	0.534	6.406
6-1		345	2260	0	0	1.762	1	-75.6	34.5	0.147	1.762
6-2		345	2260	120	0	1.762	1	-50	34.5	0.147	1.762
6-3		345	2260	240	0	1.762	1	-24.4	34.5	0.147	1.762
4-1		0	0	0	0	0.546	1	-68	76.2	0.046	0.546
5-1		0	0	0	0	0.546	1	-32	76.2	0.046	0.546
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										0.000	0.000
										0.000	0.000

Use GREEN text to copy/paste with PLS-CADD EMF Calculator

X location along ground: 50 ft

Y location above ground: 3.28084 ft

Graphing

Left Bound: -500 ft

Center for Mag: 0 ft

Center for Elec: 0 ft

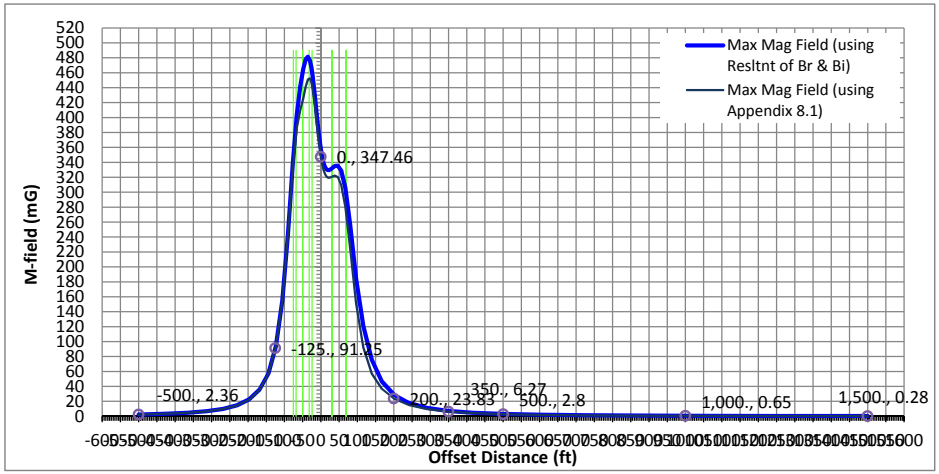
Right Round: 1500 ft

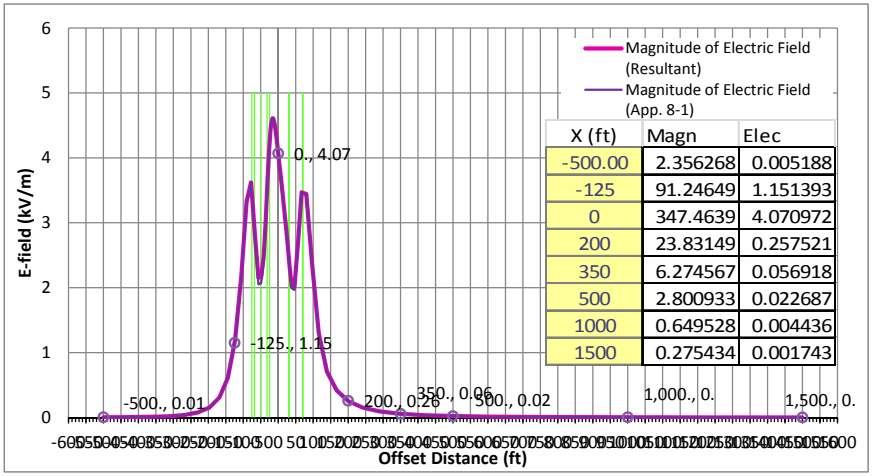
Values at Given Location (X=50.00, Y=3.28)

Magnitude of Magnetic Field (App. 8-1)	**317.5**	mG
Magnitude of Mag. Field (Resultant)	**334.1**	mG
Magnitude of Electric Field (App. 8-1)	**2.152**	kV/m
Magnitude of Electric Field (Resultant)	**2.191**	kV/m

Maximums over Given Range

Max Mag Field (using Appendix 8.1)	452.43	mG
Approx. Location	-30.51	ft
Max Mag Field (using Resltnt of B_r & B_i)	**481.34**	mG
Approx. Location	**-35.64**	ft
Max Elec Field (App. 8-1)	4.607	kV/m
Approx. Location	-16.39	ft
Max Elec Field (Resultant of E_r & E_i)	**4.610**	kV/m
Approx. Location	**-16.39**	ft





X (ft)	Magn	Elec
-500.00	2.356268	0.005188
-125	91.24649	1.151393
0	347.4639	4.070972
200	23.83149	0.257521
350	6.274567	0.056918
500	2.800933	0.022687
1000	0.649528	0.004436
1500	0.275434	0.001743

ELECTRICAL AND MAGNETIC FIELD CALCULATOR

Based on EPRI Transmission Line Reference Book (Red Book, 1982)

Version 1.3

Project/Site: *Effect of Clearance on EMF of typical 345kV double circuit line.*

Wire Data CV-8 to CV-9 ABC-BCA horizontal configuration

Number of Wires: 10

Wire Label	Description	Voltage (kV)	Current (amps)	Phase Angle (deg)	Bundle Spacing (in)	Conduc. Diam (in)	Number in Bundle	Location		Equivalent Diam	
								X (ft)	Y (ft)	(ft)	(in)
1		0	0	0	0	0.546	1	39	103	0.046	0.546
2		0	0	0	0	0.546	1	70	103	0.046	0.546
3-1	B	345	2695	240	18	1.14	2	11	68	0.534	6.406
3-2	C	345	2695	120	18	1.14	2	50	68	0.534	6.406
3-3	A	345	2695	0	18	1.14	2	89	68	0.534	6.406
6-1	A	345	2260	120	0	1.762	1	-75.6	33	0.147	1.762
6-2	B	345	2260	240	0	1.762	1	-50	33	0.147	1.762
6-3	C	345	2260	0	0	1.762	1	-24.4	33	0.147	1.762
4-1		0	0	0	0	0.546	1	-68	66	0.046	0.546
5-1		0	0	0	0	0.546	1	-32	66	0.046	0.546
										0.000	0.000
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Use GREEN text to copy/paste with PLS-CADD EMF Calculator

X location along ground	50	ft
Y location above ground	3.28084	ft

Graphing

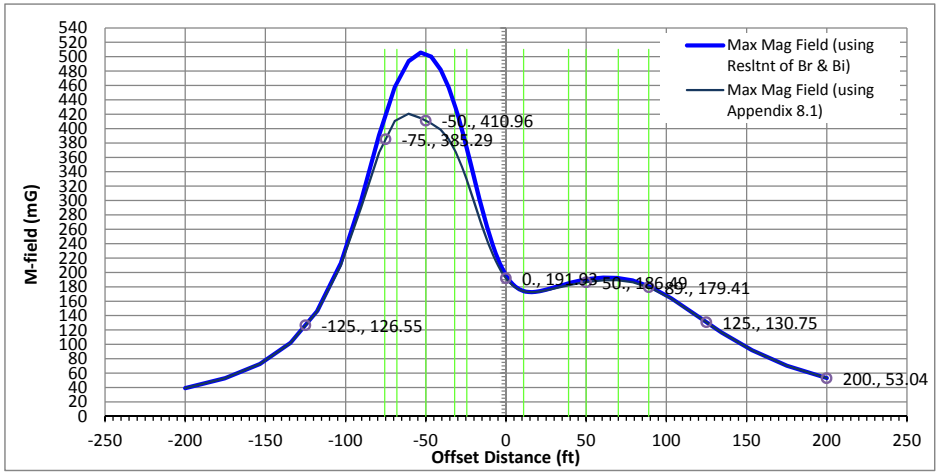
Left Bound	-200	ft
Center for Mag	0	ft
Center for Elec	0	ft
Right Round	200	ft

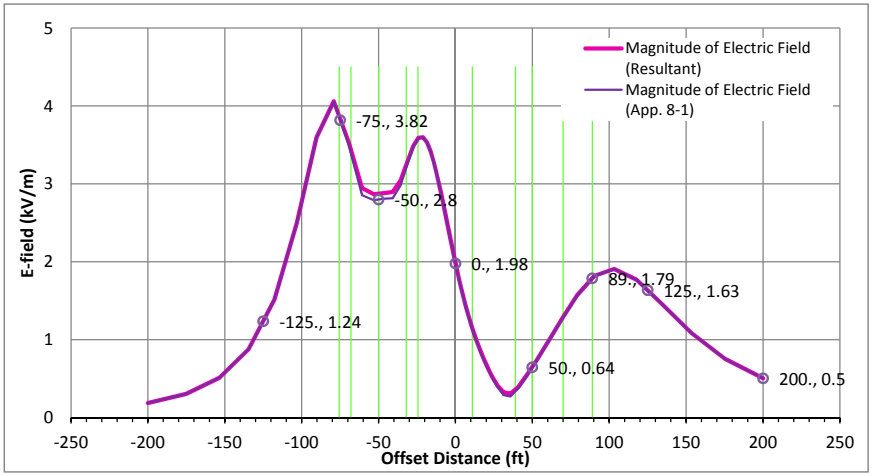
Values at Given Location (X=50.00, Y=3.28)

Magnitude of Magnetic Field (App. 8-1)	**186.6**	mG
Magnitude of Mag. Field (Resultant)	**190.2**	mG
Magnitude of Electric Field (App. 8-1)	**0.643**	kV/m
Magnitude of Electric Field (Resultant)	**0.651**	kV/m

Maximums over Given Range

Max Mag Field (using Appendix 8.1)	420.71	mG
Approx. Location	-60.72	ft
Max Mag Field (using Resltnt of B_r & B_i)	**505.60**	mG
Approx. Location	**-53.18**	ft
Max Elec Field (App. 8-1)	4.053	kV/m
Approx. Location	-79.13	ft
Max Elec Field (Resultant of E_r & E_i)	**4.059**	kV/m
Approx. Location	**-79.13**	ft





ELECTRICAL AND MAGNETIC FIELD CALCULATOR

Based on EPRI Transmission Line Reference Book (Red Book, 1982)

Version 1.3

Project/Site: *Effect of Clearance on EMF of typical 345kV double circuit line.*

Wire Data CV-8 to CV-9 ABC-BCA horizontal configuration — Number of Wires: 10

Wire Label	Description	Voltage (kV)	Current (amps)	Phase Angle (deg)	Bundle Spacing (in)	Conduc. Diam (in)	Number in Bundle	Location		Equivalent Diam	
								X (ft)	Y (ft)	(ft)	(in)
1		0	0	0	0	0.546	1	39	103	0.046	0.546
2		0	0	0	0	0.546	1	70	103	0.046	0.546
3-1	B	345	2695	240	18	1.14	2	11	68	0.534	6.406
3-2	C	345	2695	120	18	1.14	2	50	68	0.534	6.406
3-3	A	345	2695	0	18	1.14	2	89	68	0.534	6.406
6-1	A	345	2260	120	0	1.762	1	-75.6	33	0.147	1.762
6-2	B	345	2260	240	0	1.762	1	-50	33	0.147	1.762
6-3	C	345	2260	0	0	1.762	1	-24.4	33	0.147	1.762
4-1		0	0	0	0	0.546	1	-68	66	0.046	0.546
5-1		0	0	0	0	0.546	1	-32	66	0.046	0.546
										0.000	0.000
										0.000	0.000
										0.000	0.000
										0.000	0.000
										0.000	0.000
										0.000	0.000
										0.000	0.000
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										0.000	0.000
										0.000	0.000
										0.000	0.000
										0.000	0.000
										0.000	0.000
										0.000	0.000

Use GREEN text to copy/paste with PLS-CADD EMF Calculator

X location along ground: 50 ft

Y location above ground: 3.28084 ft

Graphing

Left Bound: -500 ft

Center for Mag: 0 ft

Center for Elec: 0 ft

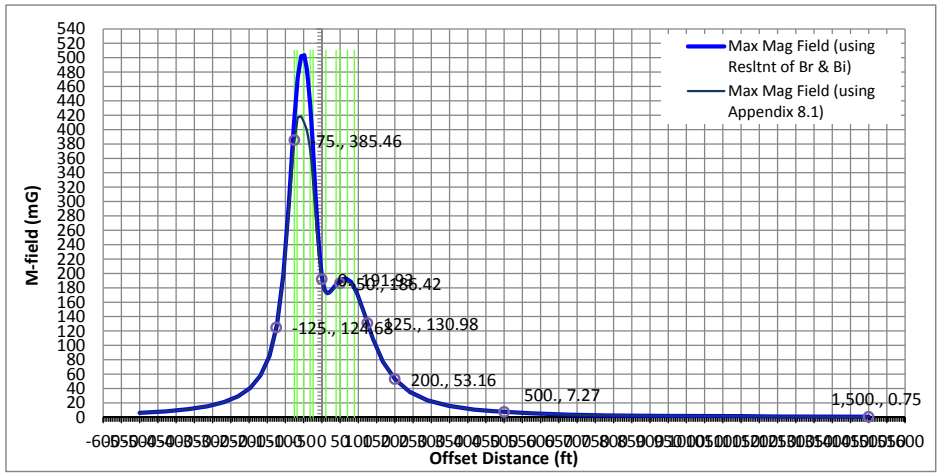
Right Round: 1500 ft

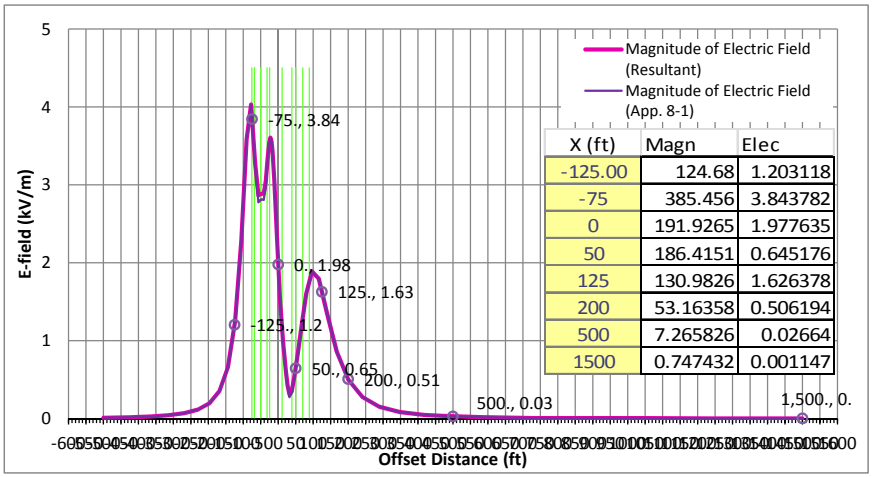
Values at Given Location (X=50.00, Y=3.28)

Magnitude of Magnetic Field (App. 8-1)	**186.6**	mG
Magnitude of Mag. Field (Resultant)	**190.2**	mG
Magnitude of Electric Field (App. 8-1)	**0.643**	kV/m
Magnitude of Electric Field (Resultant)	**0.651**	kV/m

Maximums over Given Range

Max Mag Field (using Appendix 8.1)	418.48	mG
Approx. Location	-56.80	ft
Max Mag Field (using Resltnt of B_r & B_i)	**503.47**	mG
Approx. Location	**-48.62**	ft
Max Elec Field (App. 8-1)	4.022	kV/m
Approx. Location	-77.50	ft
Max Elec Field (Resultant of E_r & E_i)	**4.030**	kV/m
Approx. Location	**-77.50**	ft





PLS-CADD Version 13.09x64 7:40:47 AM Wednesday, September 17, 2014
DiGioia Gray & Assoc.
Project Name: 'p:\pls\pls_cadd\overhead transmission lines\l-line\l56-l76 cv-cn border (345kv)\l56_l76_pls_cadd_230106_v2a_ms.DON'
Line Title: ' L, 345kV, 'Pleasant Valley - NY / CT State Line'Mallard ACSS 2-Bundled'

Criteria Notes:
NESC Heavy per Rule 250B, Page 161
Extreme Wind Loading per Rule 250C, Page 161, Coefficients and Gust Response Factors per Equations in Tables 250-2, 250-3
90 MPH Basic Wind Speed, 3 second Gust Wind Speed, Figure 250-2 Beginning on Page 166
Grade B Construction "Method A" per Table 253-1, Page 173 and Table 261-1A, Page 182
Tension Limits per Rule 261H1, Page 179
Insulator Strength Reduction per Rule 277, Page 188 Should be applied to Insulator Strengths when Modeling Insulators
2002 NESC C2-2002 Criteria File for PLS-CADD Created December 21, 2001
POWER LINE SYSTEMS, INC. IS NOT RESPONSIBLE FOR THE ACCURACY OF THE CONTENT HEREIN. THIS FILE IS BEING PROVIDED
AS A REFERENCE. CRITERIA SHOULD BE CHECKED AND MODIFIED AS NECESSARY BY A QUALIFIED ENGINEER FAMILIAR WITH THE
NESC REQUIREMENTS OF THE AREA WHICH THE PROJECT IS IN AND ITS APPLICATION.

The following update reflects the use of NESC 2007
NESC Heavy per Rule 250B, Page 177
Extreme Wind Loading per Rule 250C, Page 177, Coefficients and Gust Response Factors per Equations in Tables 250-2, 250-3
90 MPH Basic Wind Speed, 3 second Gust Wind Speed, Figure 250-2 Beginning on Page 180
Grade B Construction "Method A" per Table 253-1, Page 197 and Table 261-1A, Page 207
Tension Limits per Rule 261H1, Page 204
Insulator Strength Reduction per Rule 277, Page 214 Should be applied to Insulator Strengths when Modeling Insulators
2007 NESC C2-2007 Criteria File for PLS-CADD Created April, 2009

EMF Calculation Notes:
1) All calculations based on the EPRI Red Book methods (2nd Edition, 1982 - infinite straight wire with flat earth approximation).
2) These approximations are only valid for low frequency (50-60Hz) AC transmission lines.
3) Bundles are modeled with an equivalent conductor as per EPRI Red Book 8.3.1.
4) The effects of earth return currents (earth resistivity) are ignored when calculating the magnetic field.
5) Wire position is determined by the currently displayed weather case.
6) Wire height used is the height of the wire where the target point is projected upon it.
7) All calculations assume ground is flat with same elevation as that of centerline.

Meter height above centerline ground: 3.28 (ft)
Cross section offset for graph +/-: 500.00 (ft)
Result interval for graph: 5.00 (ft)
Electric field limit: 0.00 (kV/m)
Magnetic field limit: 0.00 (mG)

EMF calculation includes only wires going from structure L-62 to structure L-63

EMF Circuit Data:

Set #	Phase #	Conductors Per Phase	Voltage Ph-Ph (kV)	Current (Amps)	Phase Angle (deg)	Bundle Diameter (in)
1	1	2	345	2695.000	0	18.000
2	1	2	345	2695.000	120	18.000
3	1	2	345	2695.000	240	18.000
7	1	1	0	0.000	0	0.000
8	1	1	0	0.000	0	0.000

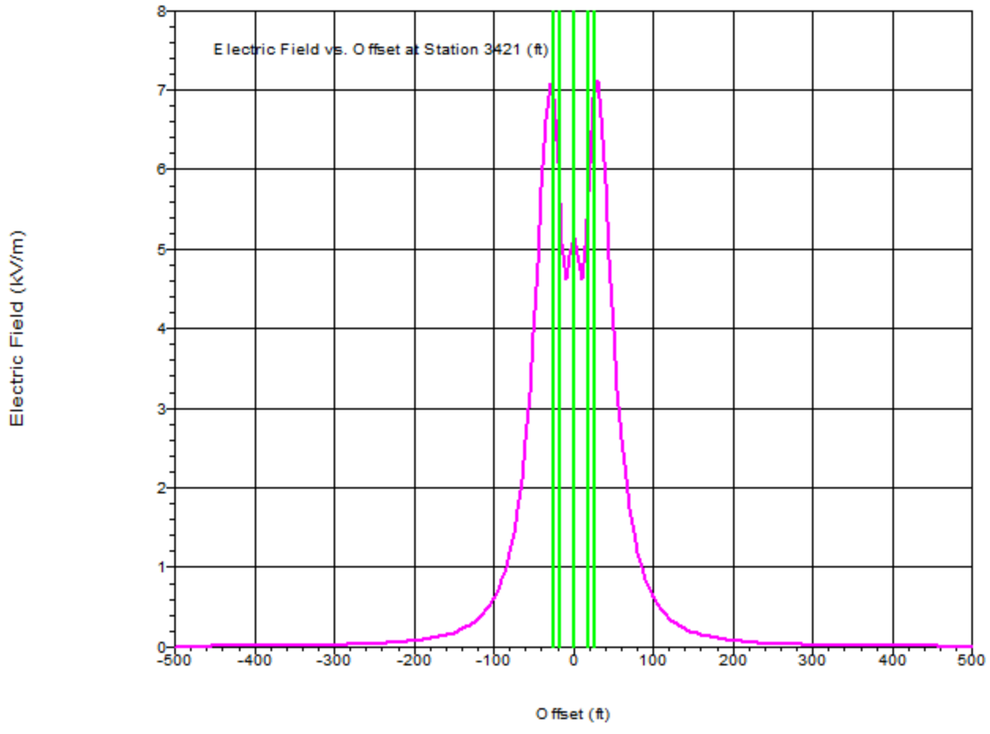
Calculated EMF Circuit Data For Last Point:

Wire station and offset are based on alignment closest to point on wire.
In the case of wires that are not parallel, this may result in different stations for the wires and centerline.

Set #	Phase #	Weather Case	Cable Condition	Wind From	Wire X (ft)	Wire Y (ft)	Wire Z (ft)	Station (ft)	Offset (ft)	Eqv. Wire Diameter (in)	Voltage To Gnd. (kV)
1	1	203 Deg F Winter Normal Max Sag	FE	Left	746508.41	1037246.86	520.99	3421.00	-25.61	6.406	199.2
2	1	203 Deg F Winter Normal Max Sag	FE	Left	746503.13	1037221.69	520.80	3421.00	0.12	6.406	199.2
3	1	203 Deg F Winter Normal Max Sag	FE	Left	746497.85	1037196.49	520.94	3421.00	25.86	6.406	199.2
7	1	203 Deg F Winter Normal Max Sag	FE	Left	746506.84	1037239.40	548.46	3421.00	-17.98	0.546	0
8	1	203 Deg F Winter Normal Max Sag	FE	Left	746499.41	1037203.97	548.69	3421.00	18.22	0.546	0

Maximum magnetic field of 768.40 (mG) found at station 3421.00, offset 0.00 (ft)

Maximum electric field of 7.111 (kV/m) found at station 3421.00, offset 30.00 (ft)



EMF Calculation Results:

Station (ft)	Offset (ft)	X (ft)	Y (ft)	Z (ft)	B Real (mG)	B Img. (mG)	B Phase Angle (deg)	B rms Res. (mG)	E Real (kV/m)	E Img. (kV/m)	E Phase Angle (deg)	E Axis Angle (deg)	E rms Res. (kV/m)
3421.08	-500.00	746605.77	1037711.16	494.11	2.777	1.49601	28.3	3.154	0.006	0.00052	5.3	89.0	0.006
3421.08	-495.00	746604.74	1037706.26	494.11	2.834	1.52556	28.3	3.218	0.006	0.00051	5.0	89.0	0.006
3421.08	-490.00	746603.72	1037701.37	494.11	2.892	1.55599	28.3	3.284	0.006	0.00050	4.8	89.0	0.006
3421.08	-485.00	746602.69	1037696.48	494.11	2.953	1.58734	28.3	3.352	0.006	0.00049	4.6	88.9	0.006
3421.08	-480.00	746601.66	1037691.58	494.11	3.015	1.61965	28.2	3.423	0.006	0.00048	4.3	88.9	0.006
3421.07	-475.00	746600.64	1037686.69	494.11	3.080	1.65296	28.2	3.495	0.007	0.00047	4.1	88.9	0.007
3421.07	-470.00	746599.61	1037681.80	494.11	3.146	1.68730	28.2	3.570	0.007	0.00046	3.9	88.9	0.007
3421.07	-465.00	746598.59	1037676.90	494.11	3.215	1.72273	28.2	3.647	0.007	0.00044	3.6	88.9	0.007
3421.07	-460.00	746597.56	1037672.01	494.11	3.286	1.75928	28.2	3.727	0.007	0.00043	3.4	88.9	0.007
3421.07	-455.00	746596.53	1037667.11	494.11	3.359	1.79701	28.1	3.809	0.007	0.00041	3.2	88.9	0.007
3421.07	-450.00	746595.51	1037662.22	494.11	3.435	1.83596	28.1	3.895	0.008	0.00039	2.9	88.8	0.008
3421.07	-445.00	746594.48	1037657.33	494.11	3.513	1.87619	28.1	3.983	0.008	0.00037	2.7	88.8	0.008
3421.07	-440.00	746593.45	1037652.43	494.11	3.594	1.91776	28.1	4.074	0.008	0.00035	2.5	88.8	0.008
3421.07	-435.00	746592.43	1037647.54	494.11	3.678	1.96072	28.1	4.168	0.008	0.00033	2.2	88.8	0.008
3421.07	-430.00	746591.40	1037642.65	494.11	3.765	2.00514	28.0	4.266	0.009	0.00030	2.0	88.8	0.009
3421.07	-425.00	746590.38	1037637.75	494.11	3.855	2.05109	28.0	4.367	0.009	0.00027	1.8	88.8	0.009
3421.07	-420.00	746589.35	1037632.86	494.11	3.948	2.09864	28.0	4.471	0.009	0.00024	1.5	88.8	0.009
3421.07	-415.00	746588.32	1037627.97	494.11	4.045	2.14786	28.0	4.580	0.010	0.00021	1.3	88.7	0.010
3421.06	-410.00	746587.30	1037623.07	494.11	4.145	2.19882	27.9	4.692	0.010	0.00018	1.0	88.7	0.010
3421.06	-405.00	746586.27	1037618.18	494.11	4.249	2.25163	27.9	4.809	0.010	0.00014	0.8	88.7	0.010
3421.06	-400.00	746585.25	1037613.29	494.11	4.357	2.30635	27.9	4.930	0.011	0.00010	0.6	88.7	0.011
3421.06	-395.00	746584.22	1037608.39	494.11	4.469	2.36310	27.9	5.056	0.011	0.00007	0.3	88.7	0.011
3421.06	-390.00	746583.19	1037603.50	494.11	4.586	2.42196	27.8	5.186	0.011	0.00003	0.2	88.6	0.011
3421.06	-385.00	746582.17	1037598.60	494.11	4.707	2.48305	27.8	5.322	0.012	0.00005	0.2	88.6	0.012
3421.06	-380.00	746581.14	1037593.71	494.11	4.833	2.54647	27.8	5.463	0.012	0.00010	0.5	88.6	0.012
3421.06	-375.00	746580.11	1037588.82	494.11	4.965	2.61236	27.8	5.610	0.013	0.00015	0.7	88.6	0.013
3421.06	-370.00	746579.09	1037583.92	494.11	5.101	2.68083	27.7	5.763	0.013	0.00021	0.9	88.6	0.013
3421.06	-365.00	746578.06	1037579.03	494.11	5.244	2.75203	27.7	5.922	0.014	0.00028	1.2	88.5	0.014

3421.06	-360.00	746577.04	1037574.14	494.11	5.392	2.82610	27.7	6.088	0.014	0.00035	1.4	88.5	0.014
3421.06	-355.00	746576.01	1037569.24	494.11	5.547	2.90320	27.6	6.261	0.015	0.00042	1.6	88.5	0.015
3421.06	-350.00	746574.98	1037564.35	494.11	5.709	2.98349	27.6	6.441	0.015	0.00051	1.9	88.5	0.015
3421.05	-345.00	746573.96	1037559.46	494.11	5.877	3.06716	27.6	6.629	0.016	0.00060	2.1	88.4	0.016
3421.05	-340.00	746572.93	1037554.56	494.11	6.054	3.15440	27.5	6.826	0.017	0.00069	2.4	88.4	0.017
3421.05	-335.00	746571.91	1037549.67	494.11	6.238	3.24540	27.5	7.032	0.017	0.00080	2.6	88.4	0.017
3421.05	-330.00	746570.88	1037544.78	494.11	6.431	3.34040	27.4	7.247	0.018	0.00091	2.9	88.4	0.018
3421.05	-325.00	746569.85	1037539.88	494.11	6.633	3.43962	27.4	7.472	0.019	0.00103	3.1	88.3	0.019
3421.05	-320.00	746568.83	1037534.99	494.11	6.845	3.54333	27.4	7.707	0.020	0.00116	3.3	88.3	0.020
3421.05	-315.00	746567.80	1037530.09	494.11	7.067	3.65179	27.3	7.954	0.021	0.00130	3.6	88.3	0.021
3421.05	-310.00	746566.77	1037525.20	494.11	7.300	3.76531	27.3	8.214	0.022	0.00145	3.8	88.3	0.022
3421.05	-305.00	746565.75	1037520.31	494.11	7.544	3.88419	27.2	8.486	0.023	0.00161	4.1	88.2	0.023
3421.05	-300.00	746564.72	1037515.41	494.11	7.802	4.00879	27.2	8.771	0.024	0.00179	4.3	88.2	0.024
3421.05	-295.00	746563.70	1037510.52	494.11	8.072	4.13947	27.1	9.072	0.025	0.00198	4.5	88.2	0.025
3421.05	-290.00	746562.67	1037505.63	494.11	8.357	4.27663	27.1	9.388	0.026	0.00219	4.8	88.1	0.026
3421.04	-285.00	746561.64	1037500.73	494.11	8.657	4.42072	27.1	9.721	0.028	0.00242	5.0	88.1	0.028
3421.04	-280.00	746560.62	1037495.84	494.11	8.974	4.57220	27.0	10.072	0.029	0.00266	5.2	88.1	0.029
3421.04	-275.00	746559.59	1037490.95	494.11	9.309	4.73160	26.9	10.442	0.031	0.00293	5.5	88.0	0.031
3421.04	-270.00	746558.57	1037486.05	494.11	9.662	4.89945	26.9	10.833	0.032	0.00321	5.7	88.0	0.032
3421.04	-265.00	746557.54	1037481.16	494.11	10.036	5.07639	26.8	11.247	0.034	0.00353	5.9	87.9	0.034
3421.04	-260.00	746556.51	1037476.27	494.11	10.432	5.26307	26.8	11.685	0.036	0.00387	6.1	87.9	0.036
3421.04	-255.00	746555.49	1037471.37	494.11	10.852	5.46022	26.7	12.148	0.038	0.00424	6.4	87.8	0.038
3421.04	-250.00	746554.46	1037466.48	494.11	11.298	5.66864	26.6	12.641	0.040	0.00465	6.6	87.8	0.041
3421.04	-245.00	746553.43	1037461.59	494.11	11.772	5.88920	26.6	13.163	0.043	0.00509	6.8	87.8	0.043
3421.04	-240.00	746552.41	1037456.69	494.11	12.277	6.12286	26.5	13.719	0.045	0.00558	7.0	87.7	0.046
3421.04	-235.00	746551.38	1037451.80	494.11	12.814	6.37067	26.4	14.310	0.048	0.00611	7.2	87.7	0.049
3421.04	-230.00	746550.36	1037446.90	494.11	13.388	6.63380	26.4	14.941	0.051	0.00670	7.4	87.6	0.052
3421.04	-225.00	746549.33	1037442.01	494.11	14.001	6.91353	26.3	15.615	0.055	0.00734	7.6	87.5	0.055
3421.03	-220.00	746548.30	1037437.12	494.11	14.657	7.21130	26.2	16.335	0.059	0.00804	7.8	87.5	0.059
3421.03	-215.00	746547.28	1037432.22	494.11	15.360	7.52867	26.1	17.106	0.063	0.00881	8.0	87.4	0.063
3421.03	-210.00	746546.25	1037427.33	494.11	16.115	7.86741	26.0	17.933	0.067	0.00967	8.2	87.4	0.068
3421.03	-205.00	746545.23	1037422.44	494.11	16.928	8.22946	25.9	18.822	0.072	0.01061	8.4	87.3	0.073
3421.03	-200.00	746544.20	1037417.54	494.11	17.803	8.61701	25.8	19.779	0.077	0.01165	8.6	87.2	0.078
3421.03	-195.00	746543.17	1037412.65	494.11	18.747	9.03251	25.7	20.810	0.083	0.01281	8.7	87.1	0.084
3421.03	-190.00	746542.15	1037407.76	494.11	19.769	9.47870	25.6	21.924	0.090	0.01409	8.9	87.1	0.091
3421.03	-185.00	746541.12	1037402.86	494.11	20.877	9.95866	25.5	23.130	0.097	0.01552	9.1	87.0	0.099
3421.03	-180.00	746540.09	1037397.97	494.11	22.080	10.47588	25.4	24.439	0.106	0.01711	9.2	86.9	0.107
3421.03	-175.00	746539.07	1037393.08	494.11	23.390	11.03430	25.3	25.862	0.115	0.01889	9.3	86.8	0.116
3421.03	-170.00	746538.04	1037388.18	494.11	24.820	11.63840	25.1	27.413	0.125	0.02088	9.5	86.7	0.127
3421.03	-165.00	746537.02	1037383.29	494.11	26.385	12.29327	25.0	29.108	0.137	0.02311	9.6	86.6	0.139
3421.03	-160.00	746535.99	1037378.39	494.11	28.103	13.00474	24.8	30.966	0.150	0.02562	9.7	86.5	0.152
3421.02	-155.00	746534.96	1037373.50	494.11	29.993	13.77948	24.7	33.007	0.165	0.02845	9.8	86.4	0.167
3421.02	-150.00	746533.94	1037368.61	494.11	32.080	14.62518	24.5	35.257	0.182	0.03166	9.9	86.3	0.184
3421.02	-145.00	746532.91	1037363.71	494.11	34.393	15.55073	24.3	37.745	0.201	0.03529	10.0	86.1	0.204
3421.02	-140.00	746531.89	1037358.82	494.11	36.963	16.56644	24.1	40.506	0.223	0.03943	10.0	86.0	0.226
3421.02	-135.00	746530.86	1037353.93	494.11	39.832	17.68431	23.9	43.581	0.249	0.04415	10.1	85.8	0.253
3421.02	-130.00	746529.83	1037349.03	494.11	43.046	18.91841	23.7	47.020	0.278	0.04956	10.1	85.7	0.283
3421.02	-125.00	746528.81	1037344.14	494.11	46.663	20.28530	23.5	50.881	0.313	0.05579	10.1	85.5	0.318
3421.02	-120.00	746527.78	1037339.25	494.11	50.752	21.80455	23.2	55.238	0.354	0.06297	10.1	85.3	0.359
3421.02	-115.00	746526.75	1037334.35	494.11	55.399	23.49943	23.0	60.177	0.402	0.07129	10.1	85.1	0.408
3421.02	-110.00	746525.73	1037329.46	494.11	60.708	25.39778	22.7	65.806	0.458	0.08099	10.0	84.9	0.466
3421.02	-105.00	746524.70	1037324.57	494.11	66.808	27.53312	22.4	72.259	0.527	0.09233	9.9	84.7	0.535
3421.02	-100.00	746523.68	1037319.67	494.11	73.863	29.94603	22.1	79.703	0.609	0.10565	9.8	84.4	0.618
3421.01	-95.00	746522.65	1037314.78	494.11	82.077	32.68602	21.7	88.346	0.709	0.12140	9.7	84.2	0.719
3421.01	-90.00	746521.62	1037309.88	494.11	91.710	35.81393	21.3	98.455	0.831	0.14012	9.6	83.9	0.843
3421.01	-85.00	746520.60	1037304.99	494.11	103.096	39.40509	20.9	110.370	0.982	0.16250	9.4	83.6	0.995
3421.01	-80.00	746519.57	1037300.10	494.11	116.667	43.55357	20.5	124.531	1.170	0.18943	9.2	83.3	1.185
3421.01	-75.00	746518.55	1037295.20	494.11	132.980	48.37781	20.0	141.507	1.406	0.22210	9.0	83.0	1.423
3421.01	-70.00	746517.52	1037290.31	494.11	152.766	54.02830	19.5	162.038	1.704	0.26207	8.7	82.6	1.724
3421.01	-65.00	746516.49	1037285.42	494.11	176.965	60.69797	18.9	187.086	2.082	0.31147	8.5	82.4	2.105
3421.01	-60.00	746515.47	1037280.52	494.11	206.780	68.63643	18.4	217.874	2.561	0.37334	8.3	82.2	2.588
3421.01	-55.00	746514.44	1037275.63	494.11	243.676	78.16938	17.8	255.907	3.163	0.45224	8.1	82.1	3.195
3421.01	-50.00	746513.41	1037270.74	494.11	289.275	89.72497	17.2	302.871	3.905	0.55532	8.1	82.2	3.944
3421.01	-45.00	746512.39	1037265.84	494.11	344.946	103.86874	16.8	360.245	4.775	0.69443	8.3	82.8	4.826
3421.01	-40.00	746511.36	1037260.95	494.11	410.800	121.34767	16.5	428.348	5.704	0.88951	8.9	84.1	5.773
3421.01	-35.00	746510.34	1037256.06	494.11	483.899	143.13911	16.5	504.626	6.513	1.17224	10.2	86.1	6.616
3421.00	-30.00	746509.31	1037251.16	494.11	556.492	170.48654	17.0	582.022	6.909	1.58473	12.9	89.2	7.082
3421.00	-25.00	746508.28	1037246.27	494.11	617.011	204.86913	18.4	650.133	6.586	2.16326	18.2	93.0	6.909
3421.00	-20.00	746507.26	1037241.37	494.11	655.621	247.77656	20.7	700.879	5.441	2.90543	28.1	96.4	6.096
3421.00	-15.00	746506.23	1037236.48	494.11	669.471	300.04260	24.1	733.633	3.693	3.73462	45.3	276.5	5.078
3421.00	-10.00	746505.21	1037231.59	494.11	661.464	360.47138	28.6	753.309	1.879	4.47146	67.2	270.2	4.625
3421.00	-5.00	746504.18	1037226.69	494.11	636.026	424.08332	33.7	764.444	1.508	4.83005	72.7	267.1	4.910
3421.00	0.00	746503.15	1037221.80	494.11	598.496	481.92046	38.8	768.404	2.710	4.50754	59.0	269.9	5.148

3421.00	5.00	746502.13	1037216.91	494.11	556.868	524.62304	43.3	765.070	3.769	3.39927	42.0	272.8	4.929
3421.00	10.00	746501.10	1037212.01	494.11	519.638	547.12728	46.5	754.568	4.472	1.88303	22.8	270.1	4.628
3421.00	15.00	746500.07	1037207.12	494.11	490.025	548.69044	48.2	735.653	4.915	1.77448	19.9	263.6	5.045
3421.00	20.00	746499.05	1037202.23	494.11	463.771	529.48826	48.8	703.876	5.150	3.33963	33.0	263.4	6.063
3421.00	25.00	746498.02	1037197.33	494.11	433.260	490.08382	48.5	654.138	5.138	4.64681	42.1	266.8	6.904
3421.00	30.00	746497.00	1037192.44	494.11	394.100	434.57537	47.8	586.661	4.839	5.21959	47.2	90.6	7.111
3420.99	35.00	746495.97	1037187.55	494.11	348.255	371.60755	46.9	509.287	4.304	5.09531	49.8	93.7	6.668
3420.99	40.00	746494.94	1037182.65	494.11	301.255	310.39239	45.9	432.548	3.659	4.54076	51.1	95.9	5.831
3420.99	45.00	746493.92	1037177.76	494.11	257.817	256.64597	44.9	363.781	3.023	3.83139	51.7	97.1	4.880
3420.99	50.00	746492.89	1037172.86	494.11	220.166	212.14886	43.9	305.745	2.461	3.14052	51.9	97.8	3.990
3420.99	55.00	746491.87	1037167.97	494.11	188.612	176.34888	43.1	258.212	1.996	2.54261	51.9	97.9	3.232
3420.99	60.00	746490.84	1037163.08	494.11	162.544	147.83640	42.3	219.719	1.621	2.05380	51.7	97.9	2.616
3420.99	65.00	746489.81	1037158.18	494.11	141.079	125.12129	41.6	188.570	1.324	1.66472	51.5	97.7	2.127
3420.99	70.00	746488.79	1037153.29	494.11	123.354	106.92019	40.9	163.243	1.090	1.35823	51.3	97.4	1.741
3420.99	75.00	746487.76	1037148.40	494.11	108.633	92.21314	40.3	142.493	0.904	1.11715	51.0	97.1	1.437
3420.99	80.00	746486.73	1037143.50	494.11	96.318	80.21660	39.8	125.347	0.756	0.92685	50.8	96.7	1.196
3420.99	85.00	746485.71	1037138.61	494.11	85.937	70.33616	39.3	111.051	0.637	0.77571	50.6	96.4	1.004
3420.99	90.00	746484.68	1037133.72	494.11	77.121	62.12162	38.9	99.029	0.541	0.65475	50.4	96.1	0.849
3420.99	95.00	746483.66	1037128.82	494.11	69.577	55.23067	38.4	88.833	0.463	0.55714	50.3	95.8	0.724
3420.98	100.00	746482.63	1037123.93	494.11	63.077	49.40126	38.1	80.120	0.399	0.47773	50.1	95.6	0.622
3420.98	105.00	746481.60	1037119.04	494.11	57.441	44.43109	37.7	72.619	0.346	0.41258	50.0	95.3	0.538
3420.98	110.00	746480.58	1037114.14	494.11	52.523	40.16260	37.4	66.119	0.301	0.35871	50.0	95.1	0.468
3420.98	115.00	746479.55	1037109.25	494.11	48.208	36.47197	37.1	60.450	0.264	0.31383	49.9	94.9	0.410
3420.98	120.00	746478.53	1037104.35	494.11	44.401	33.26101	36.8	55.478	0.233	0.27616	49.9	94.7	0.361
3420.98	125.00	746477.50	1037099.46	494.11	41.027	30.45118	36.6	51.093	0.206	0.24432	49.9	94.5	0.320
3420.98	130.00	746476.47	1037094.57	494.11	38.023	27.97916	36.3	47.208	0.183	0.21725	49.9	94.3	0.284
3420.98	135.00	746475.45	1037089.67	494.11	35.336	25.79348	36.1	43.749	0.163	0.19409	49.9	94.2	0.254
3420.98	140.00	746474.42	1037084.78	494.11	32.924	23.85200	35.9	40.656	0.146	0.17415	50.0	94.0	0.227
3420.98	145.00	746473.39	1037079.89	494.11	30.751	22.11999	35.7	37.880	0.132	0.15691	50.0	93.9	0.205
3420.98	150.00	746472.37	1037074.99	494.11	28.785	20.56860	35.5	35.379	0.119	0.14191	50.1	93.8	0.185
3420.98	155.00	746471.34	1037070.10	494.11	27.002	19.17376	35.4	33.117	0.107	0.12881	50.2	93.6	0.168
3420.97	160.00	746470.32	1037065.21	494.11	25.380	17.91523	35.2	31.066	0.097	0.11731	50.3	93.5	0.153
3420.97	165.00	746469.29	1037060.31	494.11	23.900	16.77594	35.1	29.200	0.089	0.10718	50.4	93.4	0.139
3420.97	170.00	746468.26	1037055.42	494.11	22.545	15.74137	34.9	27.497	0.081	0.09821	50.5	93.3	0.127
3420.97	175.00	746467.24	1037050.53	494.11	21.302	14.79913	34.8	25.939	0.074	0.09025	50.6	93.2	0.117
3420.97	180.00	746466.21	1037045.63	494.11	20.160	13.93863	34.7	24.509	0.068	0.08315	50.8	93.1	0.107
3420.97	185.00	746465.19	1037040.74	494.11	19.107	13.15071	34.5	23.195	0.062	0.07680	50.9	93.0	0.099
3420.97	190.00	746464.16	1037035.84	494.11	18.134	12.42747	34.4	21.984	0.057	0.07110	51.1	92.9	0.091
3420.97	195.00	746463.13	1037030.95	494.11	17.234	11.76206	34.3	20.865	0.053	0.06597	51.3	92.9	0.085
3420.97	200.00	746462.11	1037026.06	494.11	16.399	11.14849	34.2	19.829	0.049	0.06135	51.4	92.8	0.078
3420.97	205.00	746461.08	1037021.16	494.11	15.623	10.58153	34.1	18.869	0.045	0.05716	51.6	92.7	0.073
3420.97	210.00	746460.05	1037016.27	494.11	14.901	10.05661	34.0	17.977	0.042	0.05336	51.8	92.6	0.068
3420.97	215.00	746459.03	1037011.38	494.11	14.228	9.56967	33.9	17.147	0.039	0.04990	52.0	92.6	0.063
3420.97	220.00	746458.00	1037006.48	494.11	13.600	9.11715	33.8	16.373	0.036	0.04675	52.2	92.5	0.059
3420.96	225.00	746456.98	1037001.59	494.11	13.012	8.69589	33.8	15.651	0.034	0.04387	52.4	92.5	0.055
3420.96	230.00	746455.95	1036996.70	494.11	12.462	8.30308	33.7	14.975	0.032	0.04123	52.6	92.4	0.052
3420.96	235.00	746454.92	1036991.80	494.11	11.946	7.93623	33.6	14.342	0.029	0.03881	52.8	92.4	0.049
3420.96	240.00	746453.90	1036986.91	494.11	11.461	7.59311	33.5	13.748	0.028	0.03658	53.0	92.3	0.046
3420.96	245.00	746452.87	1036982.02	494.11	11.005	7.27171	33.5	13.191	0.026	0.03453	53.2	92.2	0.043
3420.96	250.00	746451.85	1036977.12	494.11	10.576	6.97025	33.4	12.666	0.024	0.03264	53.4	92.2	0.041
3420.96	255.00	746450.82	1036972.23	494.11	10.172	6.68711	33.3	12.173	0.023	0.03089	53.6	92.2	0.038
3420.96	260.00	746449.79	1036967.33	494.11	9.790	6.42084	33.3	11.708	0.021	0.02927	53.9	92.1	0.036
3420.96	265.00	746448.77	1036962.44	494.11	9.429	6.17014	33.2	11.269	0.020	0.02777	54.1	92.1	0.034
3420.96	270.00	746447.74	1036957.55	494.11	9.088	5.93380	33.1	10.854	0.019	0.02637	54.3	92.0	0.032
3420.96	275.00	746446.71	1036952.65	494.11	8.765	5.71077	33.1	10.462	0.018	0.02507	54.6	92.0	0.031
3420.96	280.00	746445.69	1036947.76	494.11	8.459	5.50005	33.0	10.090	0.017	0.02386	54.8	92.0	0.029
3420.96	285.00	746444.66	1036942.87	494.11	8.169	5.30076	33.0	9.738	0.016	0.02273	55.0	91.9	0.028
3420.95	290.00	746443.64	1036937.97	494.11	7.894	5.11210	32.9	9.404	0.015	0.02167	55.3	91.9	0.026
3420.95	295.00	746442.61	1036933.08	494.11	7.632	4.93331	32.9	9.087	0.014	0.02068	55.5	91.8	0.025
3420.95	300.00	746441.58	1036928.19	494.11	7.383	4.76373	32.8	8.786	0.013	0.01976	55.7	91.8	0.024
3420.95	305.00	746440.56	1036923.29	494.11	7.146	4.60273	32.8	8.500	0.013	0.01889	56.0	91.8	0.023
3420.95	310.00	746439.53	1036918.40	494.11	6.920	4.44974	32.7	8.227	0.012	0.01808	56.2	91.7	0.022
3420.95	315.00	746438.51	1036913.51	494.11	6.705	4.30425	32.7	7.967	0.011	0.01731	56.4	91.7	0.021
3420.95	320.00	746437.48	1036908.61	494.11	6.499	4.16576	32.7	7.720	0.011	0.01659	56.7	91.7	0.020
3420.95	325.00	746436.45	1036903.72	494.11	6.303	4.03385	32.6	7.484	0.010	0.01591	56.9	91.7	0.019
3420.95	330.00	746435.43	1036898.82	494.11	6.116	3.90809	32.6	7.258	0.010	0.01527	57.2	91.6	0.018
3420.95	335.00	746434.40	1036893.93	494.11	5.937	3.78812	32.5	7.042	0.009	0.01467	57.4	91.6	0.017
3420.95	340.00	746433.37	1036889.04	494.11	5.766	3.67358	32.5	6.836	0.009	0.01410	57.7	91.6	0.017
3420.95	345.00	746432.35	1036884.14	494.11	5.602	3.56416	32.5	6.639	0.009	0.01356	57.9	91.6	0.016
3420.94	350.00	746431.32	1036879.25	494.11	5.444	3.45954	32.4	6.451	0.008	0.01305	58.1	91.5	0.015
3420.94	355.00	746430.30	1036874.36	494.11	5.294	3.35946	32.4	6.270	0.008	0.01257	58.4	91.5	0.015
3420.94	360.00	746429.27	1036869.46	494.11	5.149	3.26366	32.4	6.096	0.007	0.01211	58.6	91.5	0.014
3420.94	365.00	746428.24	1036864.57	494.11	5.011	3.17189	32.3	5.930	0.007	0.01167	58.9	91.5	0.014

3420.94	370.00	746427.22	1036859.68	494.11	4.878	3.08394	32.3	5.771	0.007	0.01126	59.1	91.4	0.013
3420.94	375.00	746426.19	1036854.78	494.11	4.750	2.99959	32.3	5.618	0.006	0.01087	59.4	91.4	0.013
3420.94	380.00	746425.17	1036849.89	494.11	4.627	2.91865	32.2	5.471	0.006	0.01050	59.6	91.4	0.012
3420.94	385.00	746424.14	1036845.00	494.11	4.509	2.84094	32.2	5.329	0.006	0.01014	59.9	91.4	0.012
3420.94	390.00	746423.11	1036840.10	494.11	4.395	2.76629	32.2	5.193	0.006	0.00980	60.1	91.4	0.011
3420.94	395.00	746422.09	1036835.21	494.11	4.286	2.69454	32.2	5.062	0.005	0.00948	60.3	91.3	0.011
3420.94	400.00	746421.06	1036830.31	494.11	4.180	2.62554	32.1	4.936	0.005	0.00918	60.6	91.3	0.011
3420.94	405.00	746420.03	1036825.42	494.11	4.079	2.55916	32.1	4.815	0.005	0.00888	60.8	91.3	0.010
3420.94	410.00	746419.01	1036820.53	494.11	3.981	2.49526	32.1	4.698	0.005	0.00860	61.1	91.3	0.010
3420.93	415.00	746417.98	1036815.63	494.11	3.886	2.43373	32.1	4.585	0.005	0.00834	61.3	91.3	0.010
3420.93	420.00	746416.96	1036810.74	494.11	3.795	2.37444	32.0	4.477	0.004	0.00808	61.6	91.2	0.009
3420.93	425.00	746415.93	1036805.85	494.11	3.707	2.31729	32.0	4.372	0.004	0.00784	61.8	91.2	0.009
3420.93	430.00	746414.90	1036800.95	494.11	3.622	2.26218	32.0	4.271	0.004	0.00760	62.0	91.2	0.009
3420.93	435.00	746413.88	1036796.06	494.11	3.540	2.20901	32.0	4.173	0.004	0.00738	62.3	91.2	0.008
3420.93	440.00	746412.85	1036791.17	494.11	3.461	2.15769	31.9	4.078	0.004	0.00716	62.5	91.2	0.008
3420.93	445.00	746411.83	1036786.27	494.11	3.384	2.10813	31.9	3.987	0.004	0.00696	62.8	91.2	0.008
3420.93	450.00	746410.80	1036781.38	494.11	3.310	2.06027	31.9	3.899	0.003	0.00676	63.0	91.2	0.008
3420.93	455.00	746409.77	1036776.49	494.11	3.238	2.01401	31.9	3.814	0.003	0.00657	63.2	91.1	0.007
3420.93	460.00	746408.75	1036771.59	494.11	3.169	1.96929	31.9	3.731	0.003	0.00639	63.5	91.1	0.007
3420.93	465.00	746407.72	1036766.70	494.11	3.102	1.92605	31.8	3.651	0.003	0.00621	63.7	91.1	0.007
3420.93	470.00	746406.69	1036761.80	494.11	3.037	1.88421	31.8	3.574	0.003	0.00605	64.0	91.1	0.007
3420.93	475.00	746405.67	1036756.91	494.11	2.974	1.84373	31.8	3.499	0.003	0.00589	64.2	91.1	0.007
3420.92	480.00	746404.64	1036752.02	494.11	2.913	1.80453	31.8	3.426	0.003	0.00573	64.4	91.1	0.006
3420.92	485.00	746403.62	1036747.12	494.11	2.853	1.76657	31.8	3.356	0.003	0.00558	64.7	91.1	0.006
3420.92	490.00	746402.59	1036742.23	494.11	2.796	1.72979	31.7	3.288	0.003	0.00544	64.9	91.0	0.006
3420.92	495.00	746401.56	1036737.34	494.11	2.740	1.69415	31.7	3.222	0.002	0.00530	65.1	91.0	0.006
3420.92	500.00	746400.54	1036732.44	494.11	2.686	1.65960	31.7	3.157	0.002	0.00517	65.3	91.0	0.006