PSC REF#:146637

Public Service Commission of Wisconsin
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CapX2020
Hampton – Rochester – La Crosse
345 kV Transmission Project
Docket 5-CE-136
Completeness Response: Item 01-76

Date of PSCW Request: February 1, 2011
Date of Response: March 2011

Item 01-76 / Appendix U / AFR Section 2.7.1.4.1
Amperage reported on EMF tables for proposed structures report only one current value for each double-circuit configuration. Include amperage for both circuits on each table (e.g. Tables 11 and 11c, the amperage reported for these two tables is identical but the magnetic fields suggest that at least one circuit has a much different amperage value).

Response:
The EMF tables included in Appendix U have been revised to include amperage for both circuits. This revised Appendix U replaces the original Appendix U.

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REVISED March 2011

Appendix U:
Electric and Magnetic Fields (EMF) Information

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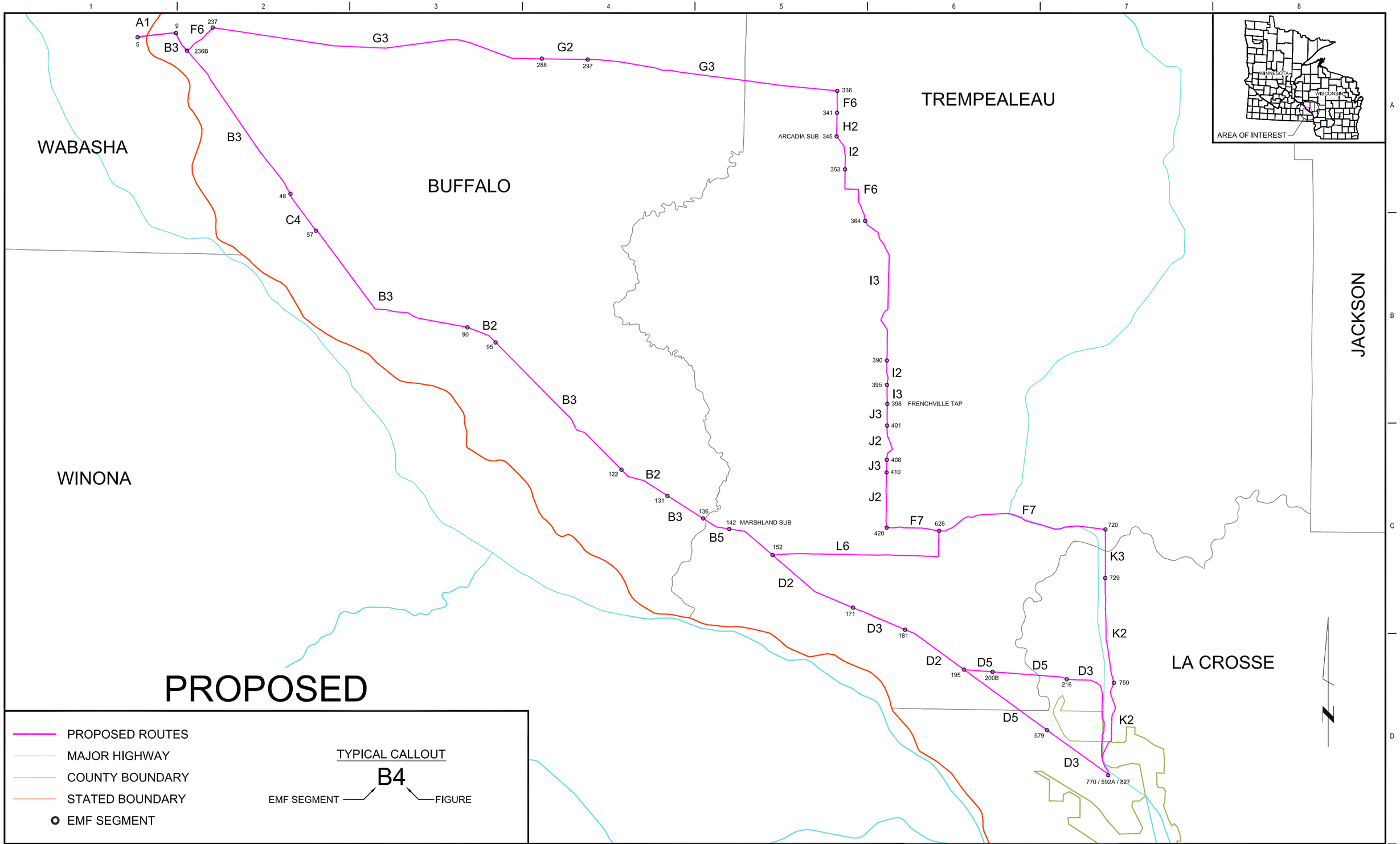

REV	REVISIONS	DATE	DRN	DSGN	CKD	APPD
C	MISC. COMMENTS	11-1-10	PEI	PEI	PEI	
B	MISC. COMMENTS	10-14-10	PEI	PEI	PEI	
A	MISC. COMMENTS	8-19-10	PEI	PEI	PEI	

REFERENCE DRAWINGS

DSGN	PEI	7/14/10
DRN	PEI	7/14/10
CKD	PEI	7/14/10

SCALE: NTS
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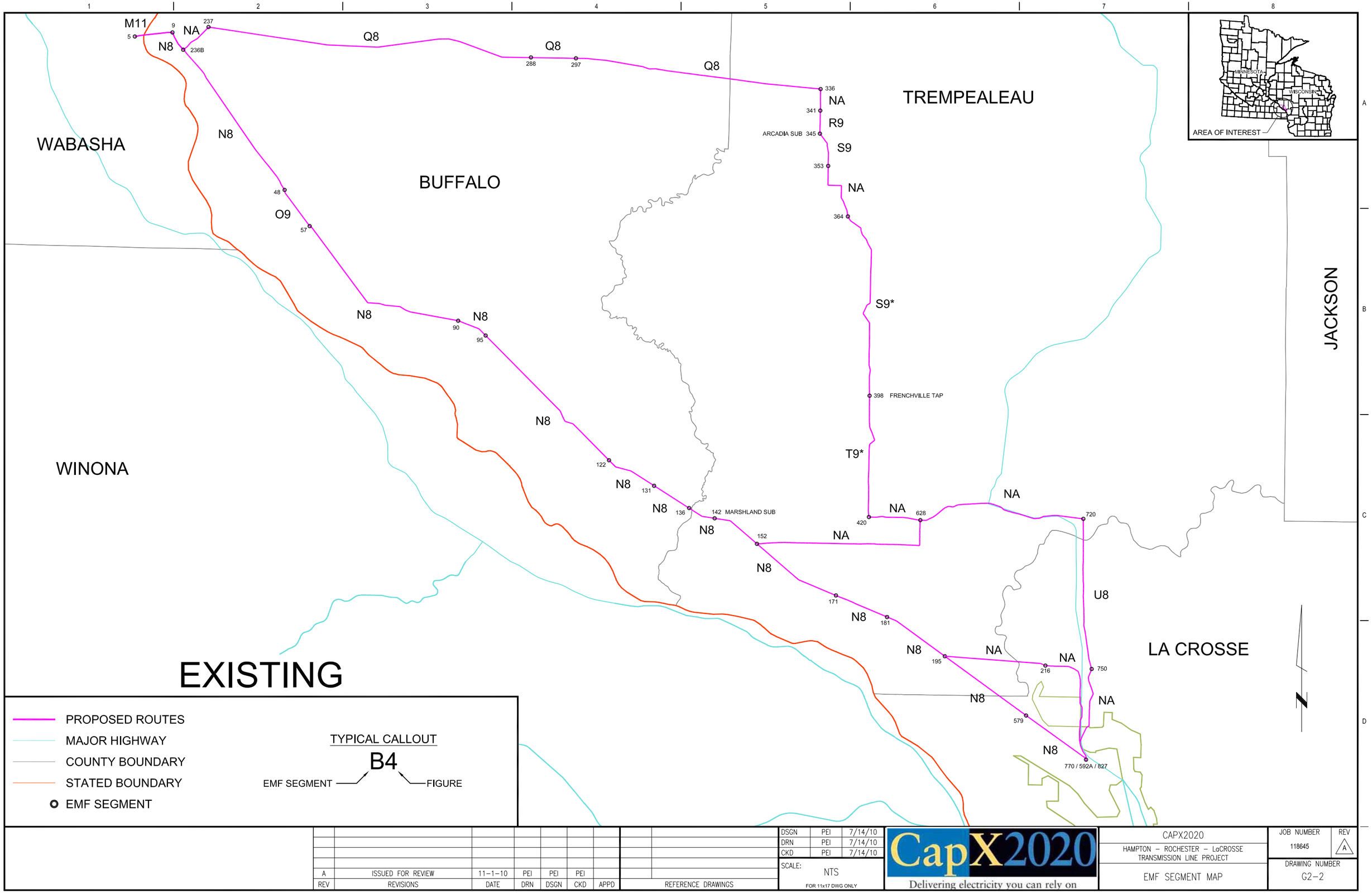
HAMPTON – ROCHESTER – LaCROSSE TRANSMISSION LINE PROJECT
EMF SEGMENT MAP

JOB NUMBER 118645
REV C
DRAWING NUMBER G2-1



REV	REVISIONS	DATE	DRN	DSGN	CKD	APPD
A	ISSUED FOR REVIEW	11-1-10	PEI	PEI	PEI	

REFERENCE DRAWINGS

DSGN	PEI	7/14/10
DRN	PEI	7/14/10
CKD	PEI	7/14/10

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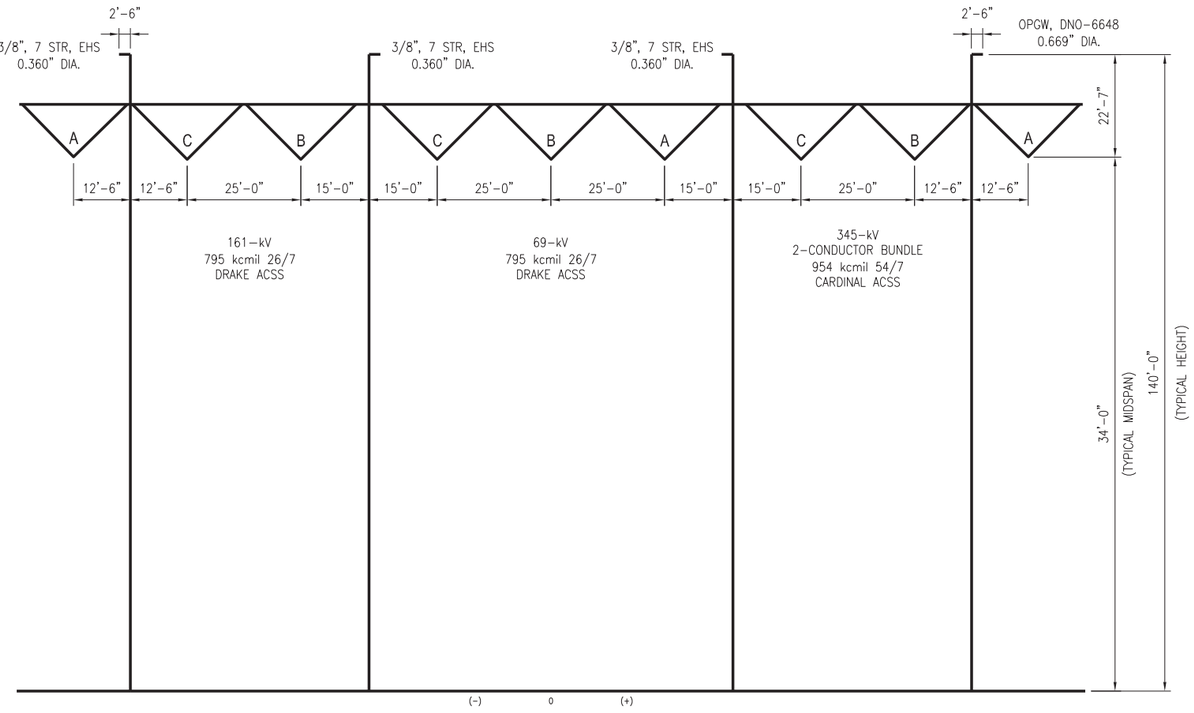
EMF SEGMENT MAP

JOB NUMBER 118645

REV A

DRAWING NUMBER G2-2



LOOKING TOWARDS NORTH La CROSSE

FIGURE 1

Table 1 - Calculated Electric Fields Table

Calculated Electric Field Data[3]	
Transmission Line Segments: A1	
Facility Description:[4] Proposed Tangent Triple Circuit[5] Triple Circuit 345kV/161kV/69kV Mississippi River Crossing	
Distance from Centerline (feet)	**Electric Field (kV/m)**
Centerline	0
25	1.76
50	4.48
100	4.37
150	1.82
200	0.44
300	0.08

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6 A
[1]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[2]Describe facility - Structure type, configuration, location
[3]Figure 1

Table 8 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]							
Transmission Line Segments: A1							
Facility Description:[4] Proposed Tangent Triple Circuit[5] Triple Circuit 345kV/161kV/69kV Proposed Mississippi River Crossing							
(2015)[1] **Normal Load**		*(2015)* **Normal Peak**		*(2025)*[2] **Normal Load**		*(2025)* **Normal Peak**	
Distance from Centerline (feet)	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**
Centerline	26.59	Centerline	33.23	Centerline	30.57	Centerline	38.15
25	18.27	25	22.84	25	21.52	25	26.95
50	33.99	50	42.49	50	39.91	50	49.96
100	45.78	100	57.22	100	53.33	100	66.68
150	12.35	150	15.44	150	14.34	150	17.92
200	4.31	200	5.39	200	4.99	200	6.24
300	1.37	300	1.71	300	1.58	300	1.97

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 652.7A (161kV), 58.6A (69kV) for 2015 and 354.8A (345kV), 760.3A (161kV), 62.8A (69kV) for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
161 and 69 kV Circuit Phase Angles: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 1

PROPOSED
SEGMENT: A

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REVISED March 2011

REFERENCE DRAWINGS

DSGN	PEI	7/14/10
DRN	PEI	7/14/10
CKD	PEI	7/14/10

SCALE: NTS
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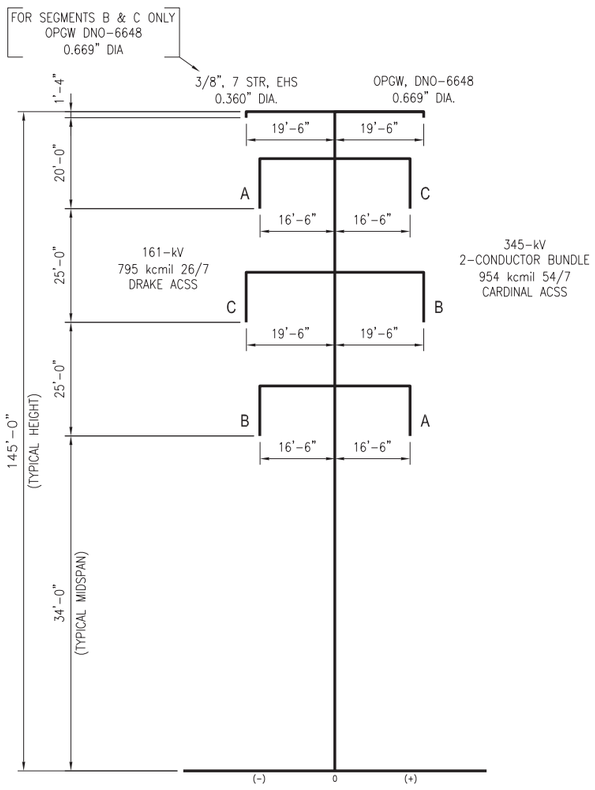
EMF FIGURES
GENERAL DRAWING
345/345/161-kV TANGENT TRIPLE CIRCUIT

JOB NUMBER 118645
REV B
DRAWING NUMBER S5-1



LOOKING TOWARDS NORTH La CROSSE

FIGURE 2

PROPOSED

SEGMENTS: B,D,G,K - OPERATES 345/161kV

SEGMENTS: H,I,J - OPERATES 345/69kV

Table 2 - Calculated Electric Fields Table

Calculated Electric Field Data[3]

Transmission Line Segments: B2, D2, G2, K2

Facility Description:[4] Proposed Single Pole, 1 String Tangent[5]
Double Circuit 345kV/161kV

Applies to all proposed 345/161 kV I String type segments

Distance from Centerline (feet)	Electric Field (kV/m)
Centerline	2.95
25	4.63
50	1.74
100	0.14
150	0.13
200	0.09
300	0.05

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6 A
[1]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[2]Describe facility - Structure type, configuration, location
[3]Figure 2

Table 2a - Calculated Electric Fields Table

Calculated Electric Field Data[3]

Transmission Line Segments: H2, I2, J2

Facility Description:[4] Proposed Single Pole, 1 String Tangent[5]
Double Circuit 345kV/161kV Operated at 345kV/69kV

Applies to all proposed segments energized as 345/69 kV with I string insulators

Distance from Centerline (feet)	Electric Field (kV/m)
Centerline	3.39
25	4.72
50	1.73
100	0.16
150	0.15
200	0.11
300	0.06

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6 A
[1]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[2]Describe facility - Structure type, configuration, location
[3]Figure 2

Table 9 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: B2

Facility Description:[4] Proposed Single Pole, 1 String Tangent[5]
Double Circuit 345kV/161kV

Circuit 1: Capx North Rochester -- Briggs Road 345 kV | Circuit 2: Dairyland Alma -- Marshland 161 kV

(2015)[1] Normal Load		(2015) Normal Peak		(2025)[2] Normal Load		(2025) Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	38.84	Centerline	48.54	Centerline	45.45	Centerline	56.81
25	25.58	25	31.97	25	29.83	25	37.29
50	11.93	50	14.92	50	13.88	50	17.35
100	3.76	100	4.7	100	7.23	100	5.47
150	1.8	150	2.25	150	2.1	150	2.62
200	1.06	200	1.32	200	1.23	200	1.54
300	0.5	300	0.62	300	0.58	300	0.73

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 351.4A (161kV) for 2015 and 354.8A (345kV), 412.4A (161kV) for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
161 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 2

Table 10 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: D2

Facility Description:[4] Proposed Single Pole, 1 String Tangent[5]
Double Circuit 345kV/161kV

Circuit 1: Capx North Rochester -- Briggs Road 345 kV | Circuit 2: Dairyland Marshland -- La Crosser tap 161 kV

(2015)[1] Normal Load		(2015) Normal Peak		(2025)[2] Normal Load		(2025) Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	26.17	Centerline	32.71	Centerline	30.13	Centerline	37.62
25	25.76	25	32.2	25	30.21	25	37.79
50	15.51	50	19.38	50	18.36	50	22.99
100	5.5	100	6.87	100	6.56	100	8.21
150	2.54	150	3.17	150	3.04	150	3.81
200	1.41	200	1.76	200	1.69	200	2.12
300	0.6	300	0.75	300	0.72	300	0.9

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 111.2A (161kV) for 2015 and 354.8A (345kV), 114.8A (161kV) for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
161 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 2

Table 11 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: K2

Facility Description:[4] Proposed Single Pole, 1 String Tangent[5]
Double Circuit 345kV/161kV

Circuit 1: Capx North Rochester -- Briggs Road 345 kV | Circuit 2: Xcel Energy Tremval -- Mayfair 161 kV

(2015)[1] Normal Load		(2015) Normal Peak		(2025)[2] Normal Load		(2025) Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	29.16	Centerline	36.46	Centerline	30.67	Centerline	38.35
25	24.93	25	31.16	25	29.9	25	37.38
50	13.92	50	17.39	50	17.91	50	22.39
100	4.69	100	5.86	100	6.33	100	7.91
150	2.12	150	2.65	150	2.92	150	3.65
200	1.16	200	1.46	200	1.62	200	2.02
300	0.49	300	0.61	300	0.68	300	0.86

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 190.1A (161kV) for 2015 and 354.8A (345kV), 136.3A (161kV) for 2025
345 and 161 kV Circuit Phase Angles: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 2

Table 11a - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: H2, I2[6]

Facility Description:[4] Proposed Single Pole, 1 String Tangent[5]
Double Circuit 345kV/161kV; Operated at 345kV/69kV

Circuit 1: Capx North Rochester -- Briggs Road 345 kV | Circuit 2: North Creek -- Arcadia 69 kV or Arcadia -- Frenchville Tap 69 kV

(2015)[1] Normal Load		(2015) Normal Peak		(2025)[2] Normal Load		(2025) Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	25.69	Centerline	32.11	Centerline	30.24	Centerline	37.8
25	26.07	25	32.58	25	30.14	25	37.68
50	15.94	50	19.92	50	18.26	50	22.83
100	5.72	100	7.15	100	6.51	100	8.13
150	2.65	150	3.32	150	3.01	150	3.76
200	1.48	200	1.85	200	1.67	200	2.09
300	0.63	300	0.79	300	0.71	300	0.89

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 92A (69kV) for 2015 and 354.8A (345kV), 120.49A (69kV) for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
69 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 2
[6]Because of the very small load at Arcadia substation, current flows at each side of the substation are very similar in value. Therefore, calculations for H and I were made using the higher of the two values (Segment H).

Table 11b - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: J2

Facility Description:[4] Proposed Single Pole, 1 String Tangent[5]
Double Circuit 345kV/161kV; Operated at 345kV/69kV

Circuit 1: Capx North Rochester -- Briggs Road 345 kV | Circuit 2: Frenchville Tap -- Galesville 69 kV

(2015)[1] Normal Load		(2015) Normal Peak		(2025)[2] Normal Load		(2025) Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	29.69	Centerline	37.1	Centerline	34.59	Centerline	43.24
25	24.88	25	31.09	25	28.97	25	36.21
50	13.73	50	17.15	50	15.98	50	19.97
100	4.59	100	5.74	100	5.34	100	6.68
150	207	150	2.59	150	2.41	150	3.02
200	1.14	200	1.42	200	1.32	200	1.66
300	0.48	300	0.6	300	0.56	300	0.7

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 200.82A (69kV) for 2015 and 354.8A (345kV), 234.29A (69kV) for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
69 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 2

Table 11c - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: G2

Facility Description:[4] Proposed Single Pole, 1 String Tangent[5]
Double Circuit 345kV/161kV

Circuit 1: Capx North Rochester -- Briggs Road 345 kV | Circuit 2: Alma -- Tremval 161 kV

(2015)[1] Normal Load		(2015) Normal Peak		(2025)[2] Normal Load		(2025) Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	80.03	Centerline	100.03	Centerline	98.29	Centerline	122.87
25	42.5	25	53.13	25	52.18	25	65.23
50	19.36	50	24.2	50	24.17	50	30.21
100	8.34	100	10.42	100	10.52	100	13.15
150	4.81	150	6.02	150	6.07	150	7.58
200	3.09	200	3.87	200	3.89	200	4.87
300	1.56	300	1.95	300	1.96	300	2.45

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 861.84A (161kV) for 2015 and 354.8A (345kV), 1062.66A (161kV) for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
161 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 2

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DSGN	PEI	7/14/10	
DRN	PEI	7/14/10	
CKD	PEI	7/14/10	
SCALE: NTS			FOR 11x17 DWG ONLY

REFERENCE DRAWINGS

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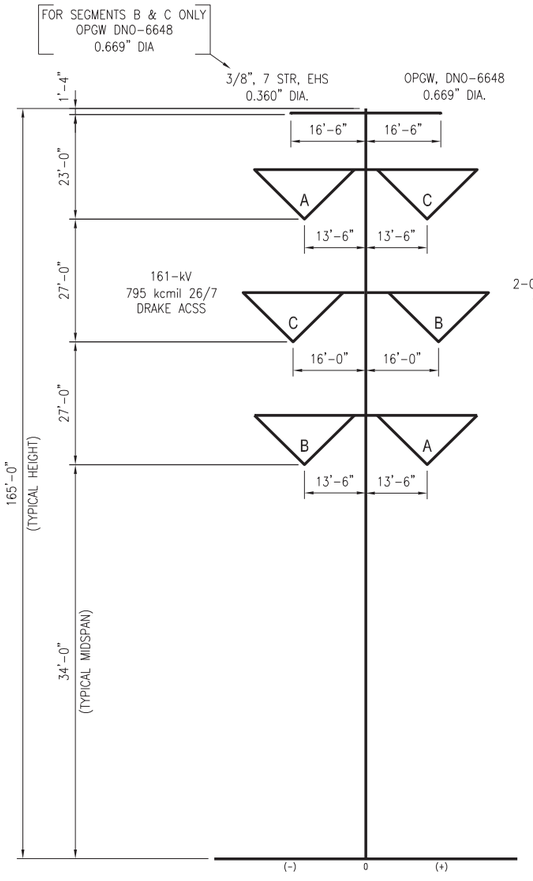
EMF FIGURES
GENERAL DRAWING

345/161-kV I-STRING TANGENT

JOB NUMBER 118645

REV B

DRAWING NUMBER S5-2



LOOKING TOWARDS NORTH La CROSSE

FIGURE 3

Table 3 - Calculated Electric Fields Table

Calculated Electric Field Data[3]

Transmission Line Segments: B3, D3, G3, K3

Facility Description:[4] Proposed Single Pole, V String Tangent[5]
Double Circuit 345kV/161kV

Applies to all proposed 345/161 kV segments with V string insulators

Distance from Centerline (feet)	Electric Field (kV/m)
Centerline	3.68
25	4.35
50	1.51
100	0.18
150	0.02
200	0.01
300	0

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6 A
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 3

Table 3a - Calculated Electric Fields Table

Calculated Electric Field Data[3]

Transmission Line Segments: I3, J3

Facility Description:[4] Proposed Single Pole, V String Tangent[5]
Double Circuit 345kV/161kV; Operated at 345kV/69kV

Applies to all proposed segments energized as 345/69 kV with I string insulators

Distance from Centerline (feet)	Electric Field (kV/m)
Centerline	3.93
25	4.4.5
50	1.52
100	0.15
150	0.15
200	0.11
300	0.06

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6 A
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 3

Table 12 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: B3

Facility Description:[4] Proposed Single Pole, V String Tangent[5]
Double Circuit 345kV/161kV

Circuit 1: Capx North Rochester -- Briggs Road 345 kV | Circuit 2: Alma -- Marshland 161 kV

(2015)[1] Normal Load		(2015) Normal Peak		(2025)[2] Normal Load		(2025) Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	36.81	Centerline	46	Centerline	43.05	Centerline	53.82
25	25.31	25	31.64	25	29.52	25	36.9
50	14.4	50	17.99	50	16.78	50	20.97
100	5.97	100	7.46	100	6.96	100	8.7
150	3.09	150	3.86	150	3.61	150	4.51
200	1.85	200	2.31	200	2.16	200	2.7
300	0.86	300	1.07	300	1	300	1.25

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 351.4A (161kV) for 2015 and 354.8A (345kV), 412.4A (161kV) for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
161 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 3

Table 13 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: D3

Facility Description:[4] Proposed Single Pole, V String Tangent[5]
Double Circuit 345kV/161kV

Circuit 1: Capx North Rochester -- Briggs Road 345 kV | Circuit 2: Marshland -- La Crosse tap 161 kV

(2015)[1] Normal Load		(2015) Normal Peak		(2025)[2] Normal Load		(2025) Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	26.8	Centerline	33.5	Centerline	31.03	Centerline	38.79
25	25.64	25	32.05	25	30.1	25	37.63
50	15.82	50	19.77	50	18.63	50	23.29
100	6.13	100	7.66	100	7.21	100	9.02
150	2.99	150	3.74	150	3.52	150	4.4
200	1.72	200	2.15	200	2.02	200	2.53
300	0.76	300	0.95	300	0.89	300	1.12

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 111.2A (161kV) for 2015 and 354.8A (345kV), 114.8A (161kV) for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
161 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 3

Table 14 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: K3

Facility Description:[4] Proposed Single Pole, I String Tangent[5]
Double Circuit 345kV/161kV

Circuit 1: Capx North Rochester -- Briggs Road 345 kV | Circuit 2: Tremval -- Mayfair 161 kV

(2015)[1] Normal Load		(2015) Normal Peak		(2025)[2] Normal Load		(2025) Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	28.75	Centerline	35.94	Centerline	31.31	Centerline	39.15
25	24.77	25	30.96	25	29.76	25	37.2
50	14.9	50	18.62	50	18.33	50	22.91
100	5.84	100	7.3	100	7.11	100	8.88
150	2.89	150	3.61	150	3.47	150	4.34
200	1.67	200	2.09	200	2	200	2.5
300	0.75	300	0.93	300	0.88	300	1.1

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 190.1A (161kV) for 2015 and 354.8A (345kV), 136.3A (161kV) for 2025
345 and 161 kV Circuit Phase Angles: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 3

Table 14a - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: I3, J3

Facility Description:[4] Proposed Single Pole, V String Tangent[5]
Double Circuit 345kV/161kV; operated at 345kV/69kV

Circuit 1: Capx North Rochester -- Briggs Road 345 kV | Circuit 2: North Creek -- Arcadia 69 kV or Arcadia -- Frenchville Tap 69 kV

(2015)[1] Normal Load		(2015) Normal Peak		(2025)[2] Normal Load		(2025) Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	29.14	Centerline	36.42	Centerline	33.94	Centerline	42.44
25	24.71	25	30.88	25	28.77	25	35.97
50	14.81	50	18.51	50	17.24	50	21.55
100	5.82	100	7.28	100	6.78	100	8.47
150	2.89	150	3.61	150	3.36	150	4.2
200	1.67	200	2.09	200	1.95	200	2.44
300	0.75	300	0.94	300	0.87	300	1.09

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 92A (69kV) for 2015 and 354.8A (345kV), 120.49A (69kV) for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
69 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 3

Table 14b - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: G3

Facility Description:[4] Proposed Single Pole, V String Tangent[5]
Double Circuit 345kV/161kV

Circuit 1: Capx North Rochester -- Briggs Road 345 kV | Circuit 2: Alma -- Tremval 161 kV

(2015)[1] Normal Load		(2015) Normal Peak		(2025)[2] Normal Load		(2025) Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	75.69	Centerline	94.61	Centerline	93.07	Centerline	116.34
25	41.96	25	52.45	25	51.53	25	64.41
50	23.26	50	29.08	50	28.66	50	35.83
100	10.72	100	13.4	100	13.23	100	16.53
150	5.94	150	7.43	150	7.33	150	9.17
200	3.7	200	4.62	200	4.57	200	5.71
300	1.8	300	2.24	300	2.22	300	2.77

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 861.84A (161kV) for 2015 and 354.8A (345kV), 1062.66A (161kV) for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
161 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 3

PROPOSED
SEGMENTS: B,D,G,K - OPERATES 345/161kV
SEGMENTS: I,J - OPERATES 345/69kV

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GENERAL DRAWING
345/161-kV V-STRING TANGENT

JOB NUMBER 118645
REV B
DRAWING NUMBER S5-3

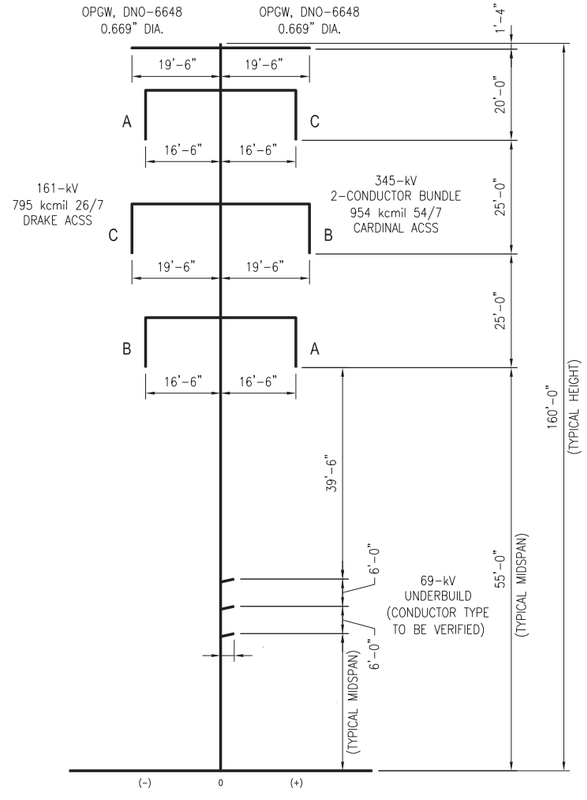

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FIGURE 4

Table 4 - Calculated Electric Fields Table

Calculated Electric Field Data[3]	
Transmission Line Segments: C4	
Facility Description:[4] Proposed Single Pole, 1 String Tangent with underbuild[5] Double Circuit 345kV/161kV with 69kV underbuild	
Applies to proposed 345/161/69 kV triple circuit south of Cochrane, WI	
Distance from Centerline (feet)	**Electric Field (kV/m)**
Centerline	1.35
25	1.28
50	0.95
100	0.22
150	0.02
200	0.06
300	0.04

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6 A
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 4

Table 15 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]							
Transmission Line Segments: C4							
Facility Description:[4] Proposed Single Pole, 1 String Tangent with underbuild[5] Double Circuit 345kV/161kV with 69kV underbuild							
Circuit 1: Capx North Rochester -- Briggs Road 345 kV Circuit 2: Alma -- Marshland 161 kV							
Circuit 3: Dairyland's Xcel Cochrane -- DPC Conchrane 69 kV							
(2015)[1] **Normal Load**		*(2015)* **Normal Peak**		*(2025)*[2] **Normal Load**		*(2025)* **Normal Peak**	
Distance from Centerline (feet)	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**
Centerline	14.48	Centerline	18.09	Centerline	16.56	Centerline	20.7
25	10.23	25	12.79	25	11.88	25	14.85
50	7.71	50	9.63	50	8.98	50	11.23
100	4.36	100	5.45	100	5.08	100	6.35
150	2.56	150	3.2	150	2.98	150	3.73
200	1.62	200	2.03	200	1.89	200	2.36
300	0.79	300	0.98	300	0.92	300	1.15

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 351.4A (161kV), 58.6A (69kV) for 2015 and 354.8A (345kV), 412.4A (161kV), 62.8A (69kV) for 2025
345 and 69 kV Circuit Phase Angles: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
161 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 4

PROPOSED
SEGMENT: C

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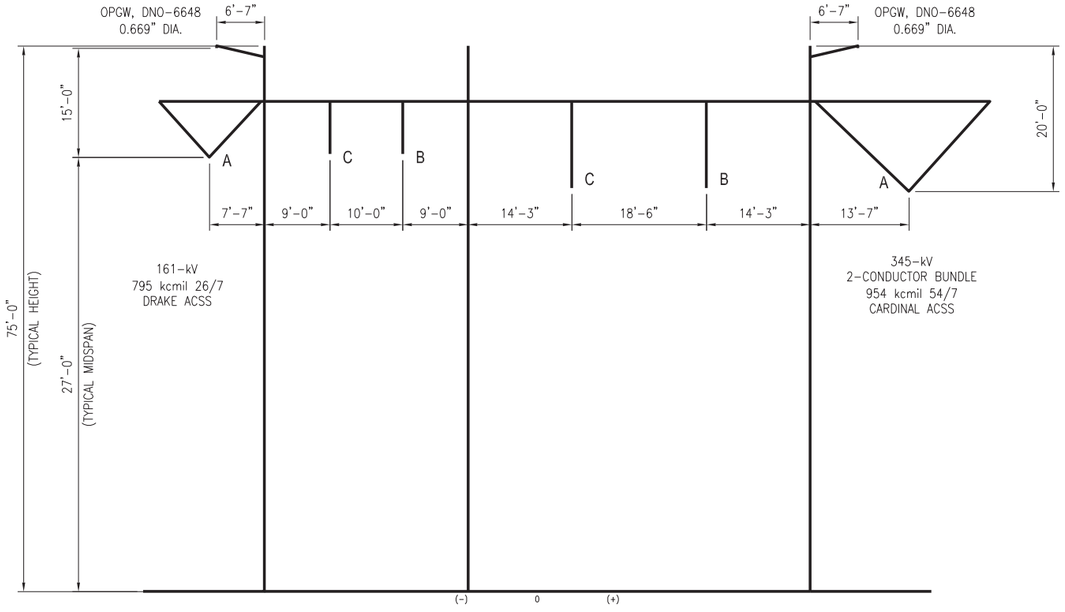
345/161-kV I-STRING TANGENT W/ 69-kV UB

JOB NUMBER 118645
REV B
DRAWING NUMBER S5-4



LOOKING TOWARDS NORTH La CROSSE

FIGURE 5

Table 5 - Calculated Electric Fields Table

Calculated Electric Field Data[3]

Transmission Line Segments: B5, D5

Facility Description:[1] Proposed H Frame Tangent[5]
Double Circuit 345kV/161kV

Applies to all proposed 345/161 kV H-frame segments

Distance from Centerline (feet)	Electric Field (kV/m)
Centerline	5.35
25	5.39
50	4.96
100	2.17
150	0.42
200	0.14
300	0.04

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6 A

[1]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[2]Describe facility - Structure type, configuration, location
[3]Figure 5

Table 16a - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: B5

Facility Description:[4] Proposed H Frame Tangent[5]
Double Circuit 345kV/161kV

Circuit 1: Capx North Rochester -- Briggs Road 345 kV				Circuit 2: Alma -- Marshland 161 kV			
(2015)[1] **Normal Load**		*(2015)* **Normal Peak**		*(2025)*[2] **Normal Load**		*(2025)* **Normal Peak**	
Distance from Centerline (feet)	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**
Centerline	63.66	Centerline	79.56	Centerline	74.43	Centerline	93.05
25	74.28	25	92.84	25	58.22	25	108.26
50	68.76	50	85.94	50	80.11	50	100.15
100	14.41	100	18.02	100	12.85	100	20.97
150	4.19	150	5.23	150	2.17	150	6.09
200	1.92	200	2.4	200	0.69	200	2.8
300	0.71	300	0.89	300	0.16	300	1.04

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 351.4A (161kV) for 2015 and 354.8A (345kV), 412.4A (161kV) for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
161 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 5

Table 16 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: D5

Facility Description:[4] Proposed H Frame Tangent[2]
Double Circuit 345kV/161kV

Circuit 1: Capx North Rochester -- Briggs Road 345 kV				Circuit 2: Marshland -- La Crosse tap 161 kV			
(2015)[1] **Normal Load**		*(2015)* **Normal Peak**		*(2025)*[2] **Normal Load**		*(2025)* **Normal Peak**	
Distance from Centerline (feet)	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**
Centerline	43.12	Centerline	53.91	Centerline	49.21	Centerline	61.52
25	67.18	25	83.97	25	77.83	25	97.31
50	65.81	50	82.26	50	76.47	50	95.6
100	15.57	100	19.47	100	18.21	100	22.77
150	4.78	150	5.97	150	5.6	150	7
200	2.25	200	2.81	200	2.64	200	3.3
300	0.84	300	1.05	300	0.99	300	1.24

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6A (345kV), 111.2A (161kV) for 2015 and 354.8A (345kV), 114.8A (161kV) for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
161 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 5

PROPOSED
SEGMENTS: C,D

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GENERAL DRAWING
345/161-kV H-FRAME TANGENT

JOB NUMBER 118645
REV B
DRAWING NUMBER S5-5

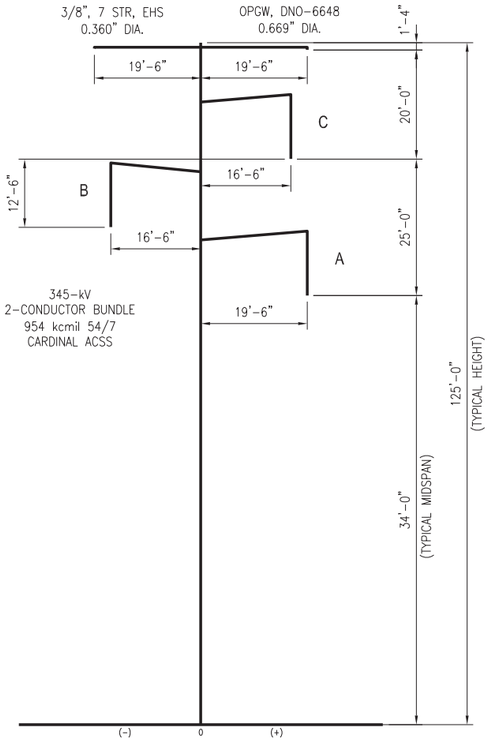

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FIGURE 6

Table 6 - Calculated Electric Fields Table

Calculated Electric Field Data[3]

Transmission Line Segments: F6, L6,

Facility Description:[4] Proposed Single Pole, 1 String Delta Tangent[5]
Single Circuit 345kV

Applies to proposed 345 kV single circuit delta segments

Distance from Centerline (feet)	Electric Field (kV/m)
Centerline	2.46
25	4.86
50	2.41
100	0.5
150	0.2
200	0.1
300	0.04

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6 A

[2]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 6

Table 17 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: F6, L6

Facility Description:[4] Proposed Single Pole, 1 String Delta Tangent[5]
Single Circuit 345kV

Circuit: Capx North Rochester -- Briggs Road 345 kV

(2015)[1] **Normal Load**		*(2015)* **Normal Peak**		*(2025)*[2] **Normal Load**		*(2025)* **Normal Peak**	
Distance from Centerline (feet)	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**
Centerline	32.67	Centerline	40.83	Centerline	38.04	Centerline	47.56
25	30.94	25	38.67	25	36.03	25	45.05
50	18.24	50	22.79	50	21.24	50	26.55
100	6.33	100	7.91	100	7.37	100	9.21
150	3.03	150	3.78	150	3.53	150	4.41
200	1.76	200	2.2	200	2.05	200	2.56
300	0.86	300	1.02	300	0.95	300	1.19

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6 A for 2015 and 354.8 A for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg

[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 6

PROPOSED
SEGMENT: F,L

* SEE NOTE ON TABLE 20.

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345-kV I-STRING DELTA TANGENT

JOB NUMBER 118645
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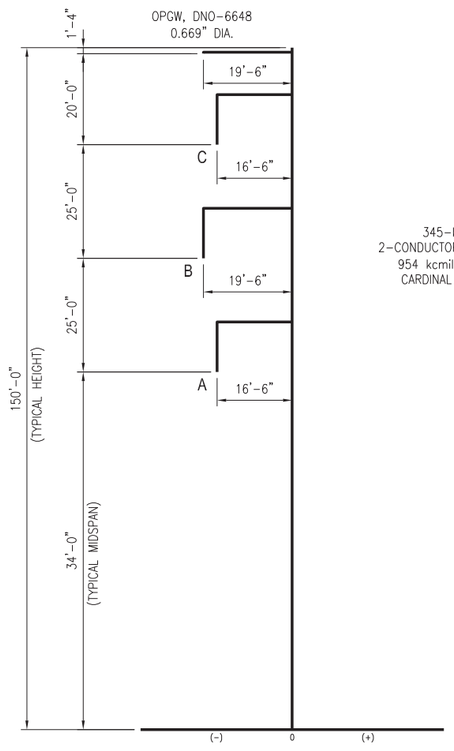

345-kV
2-CONDUCTOR BUNDLE
954 kcmil 54/7
CARDINAL ACSS

LOOKING TOWARDS NORTH La CROSSE

FIGURE 7

Table 7 - Calculated Electric Fields Table

Calculated Electric Field Data[3]

Transmission Line Segments: F7

Facility Description:[4] Proposed Single Pole, 1 String Vertical Tangent[5]
Single Circuit 345kV

Applies to proposed single circuit 345 kV vertical segments along WI Hwy 93 near Galesville.

Distance from Centerline (feet)	Electric Field (kV/m)
Centerline	3.85
25	1.07
50	0.1
100	0.21
150	0.17
200	0.12
300	0.06

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6 A

[1]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 7

Table 18 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: F7

Facility Description:[4] Proposed Single Pole, 1 String Vertical Tangent[5]
Single Circuit 345kV
Circuit: Capx North Rochester -- Briggs Road 345 kV

(2015)[1] **Normal Load**		*(2015)* **Normal Peak**		*(2025)*[2] **Normal Load**		*(2025)* **Normal Peak**	
Distance from Centerline (feet)	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**
Centerline	24.93	Centerline	31.16	Centerline	29.04	Centerline	36.3
25	15.07	25	18.83	25	17.55	25	21.94
50	9.13	50	11.41	50	10.63	50	13.29
100	4.06	100	5.07	100	4.73	100	5.91
150	2.2	150	2.75	150	2.56	150	3.21
200	1.36	200	1.7	200	1.58	200	1.98
300	0.65	300	0.82	300	0.76	300	0.95

Assumptions:
Typical Midspan Sag = 35 to 50 feet
Amperage = 304.6 A for 2015 and 354.8 A for 2025
345 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg

[1]Expected in-service date of new facility
[2]Calculated MF based on expected loads 10 years in the future after in-service date
[1]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 7

PROPOSED
SEGMENT: F

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345-kV I-STRING VERTICAL TANGENT

JOB NUMBER 118645
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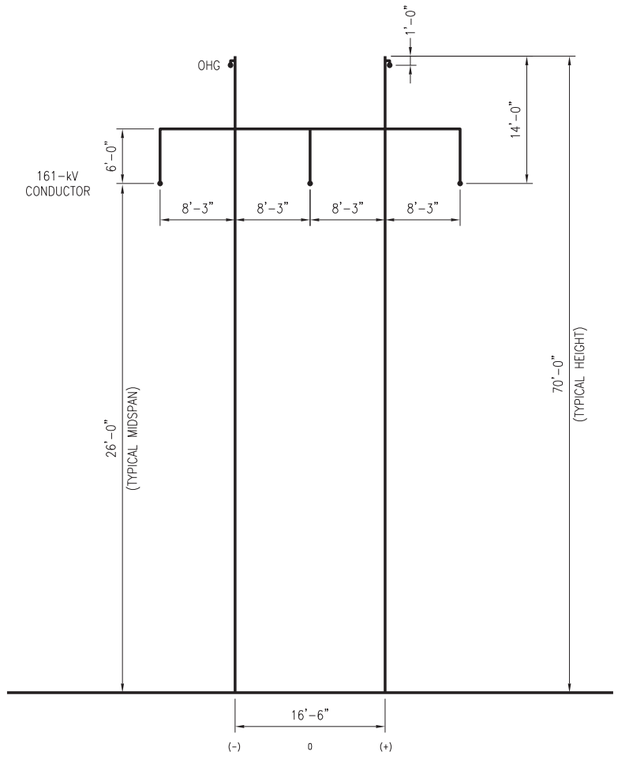

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FIGURE 8

Table 19 - Calculated Electric Fields Table

Calculated Electric Field Data[3]

Transmission Line Segments: N8, Q8, U8

Facility Description:[4] Existing Single Pole, H-Frame
Single Circuit 161kV

Applies to all existing 161 kV H-

Distance from Centerline (feet)	Electric Field (kV/m)
Centerline	0.68
25	1.72
50	0.82
100	0.15
150	0.05
200	0.02
300	0.01

Assumptions:
Typical Midspan Sag = 26 to 30 feet
Amperage = 427 A

[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 8

Table 22 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: U8

Facility Description:[4] Existing H-Frame[5]
Single Circuit 161kV
Circuit: Dairyland Marshland -- La Crosse tap 161 kV and Xcel Energy's Tremval -- Mayfair 161 kV

Existing Normal Load		*Existing* Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	14.46	Centerline	18.06
25	10.1	25	12.61
50	4.5	50	5.62
100	1.32	100	1.66
150	0.61	150	0.76
200	0.35	200	0.44
300	0.16	300	0.2

Assumptions:
Typical Midspan Sag = 26 to 30 feet
Amperage = 89.6 A
Amperage on these two lines were essentially the same, so the highest of the two values was used for magnetic field calculations.
The calculation used Xcel Energy's phase angles of A = 0, B = 240 and C = 120. Using Dairyland's phase angles changes the values by only 0.1%.

[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 8

Table 22a - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: N8, Q8

Facility Description:[4] Existing H-Frame[5]
Single Circuit 161kV
Circuit 1: Alma - Marshland 161 kV or Alma -- Tremval 161 kV[6]

Existing Normal Load		*Existing* Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	68.74	Centerline	86.07
25	48	25	60.11
50	21.39	50	26.78
100	6.3	100	7.89
150	2.91	150	3.64
200	1.67	200	2.09
300	0.77	300	0.96

Assumptions:
Typical Midspan Sag = 26 to 30 feet
Amperage = 427 A
161 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg

[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 8
[6]Flows on Alma - Marshland and Alma - Tremval are essentially identical

EXISTING
SEGMENTS: N,P,Q,U

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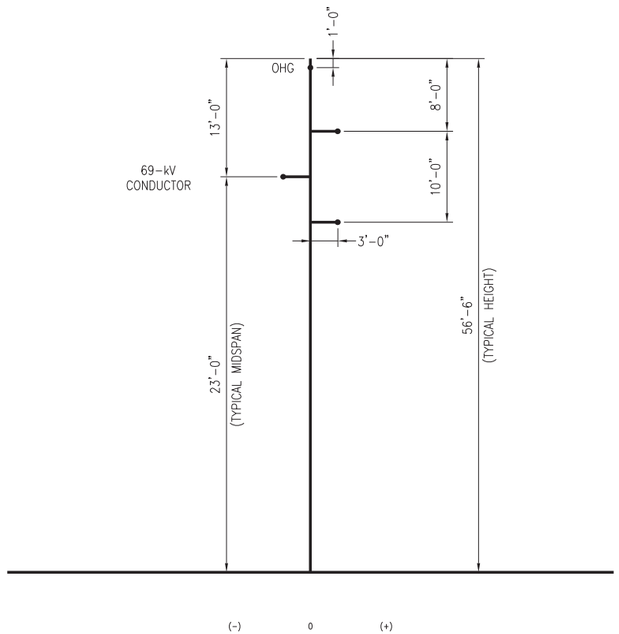
161-kV H-FRAME

JOB NUMBER 118645
REV B
DRAWING NUMBER S5-8



LOOKING TOWARDS NORTH La CROSSE

FIGURE 9

Table 20 - Calculated Electric Fields Table

Calculated Electric Field Data[3]	
Transmission Line Segments: R9, S9, T9 (majority of existing poles);* O9 (all poles)	
Facility Description:[4] Existing Single Pole, Horizontal Post[5] Single Circuit 69kV	
Applies to all existing 69 kV	
Distance from Centerline (feet)	**Electric Field (kV/m)**
Centerline	0.69
25	0.28
50	0.08
100	0.03
150	0.01
200	0.01
300	0

Assumptions:
Typical Midspan Sag = 23 to 25 feet
Amperage = 200.8 A
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 9
[6]Segments R, S, and T: The majority of the poles on these segments are horizontal post. Although a few wishbone and vertical configured structures exist they were modeled as horizontal post because 1) there are very few of them and 2) horizontal posts h

Table 23 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]			
Transmission Line Segments: R9, S9 (majority of spans)[6]			
Facility Description:[4] Existing Single Pole, Horizontal Post[5] Single Circuit 69kV			
Circuit: Dairyland North Creek -- Arcadia 69 kV and Dairyland Arcadia -- Frenchville tap 69 kV			
***Existing* Normal Load**		***Existing* Normal Peak**	
Distance from Centerline (feet)	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**
Centerline	13.05	Centerline	16.32
25	6.59	25	8.23
50	2.53	50	3.16
100	0.71	100	0.89
150	0.31	150	0.39
200	0.17	200	0.22
300	0.07	300	0.09

Assumptions:
Typical Midspan Sag = 23 to 25 feet
Amperage = 138.9 A
69 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 9
[6]Because of the very small load at Arcadia substation, current flows at each side of the substation are very similar in value. Therefore, calculations for H and I were made using the higher of the two values (Segment H).

Table 23a - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]			
Transmission Line Segments: T9 (majority of spans)			
Facility Description:[4] Existing Single Pole, Horizontal Post Single Circuit 69kV			
Circuit: Dairyland Frenchville tap -- Galesville 69 kV			
***Existing* Normal Load**		***Existing* Normal Peak**	
Distance from Centerline (feet)	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**
Centerline	18.88	Centerline	23.59
25	9.53	25	11.9
50	3.66	50	4.57
100	1.02	100	1.28
150	0.45	150	0.57
200	0.25	200	0.31
300	0.11	300	0.13

Assumptions:
Typical Midspan Sag = 23 to 25 feet
Amperage = 200.8 A
69 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 9

Table 23b - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]			
Transmission Line Segments: O9			
Facility Description:[4] Existing Single Pole, Horizontal Post[5] Single Circuit 69kV			
Circuit: Xcel Cochrane -- Dairyland Cochrane 69 kV			
***Existing* Normal Load**		***Existing* Normal Peak**	
Distance from Centerline (feet)	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**
Centerline	3.77	Centerline	4.72
25	1.9	25	2.38
50	0.73	50	0.92
100	0.2	100	0.26
150	0.09	150	0.11
200	0.05	200	0.06
300	0.02	300	0.03

Assumptions:
Typical Midspan Sag = 23 to 25 feet
Amperage = 40.2 A
69 kV Circuit Phase Angle: A phase = 0 Deg, B phase = 240 Deg, C phase = 120 Deg
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 9

EXISTING
SEGMENTS: R,S,T,O

* SEE NOTE ON TABLE 20.

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69-kV MONO-POLE

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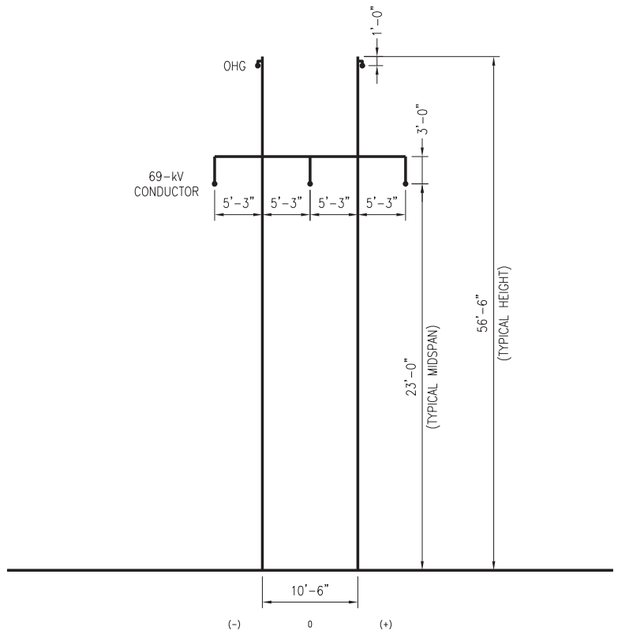

LOOKING TOWARDS NORTH La CROSSE

FIGURE 10

Table 21 - Calculated Electric Fields Table

Calculated Electric Field Data[3]	
Transmission Line Segments: R10, S10, T10	
Facility Description:[4] Existing Single Pole, H Frame (used on large angles and long spans)[5] Single Circuit 69kV	
Applies to all existing 69 kV H-	
Distance from Centerline (feet)	**Electric Field (kV/m)**
Centerline	0.3
25	0.72
50	0.22
100	0.04
150	0.01
200	0.01
300	0

Assumptions:
Typical Midspan Sag = 23 to 25 feet
Amperage = 200.8 A
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 10

Table 24 - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]			
Transmission Line Segments: S10 (certain long spans)			
Facility Description:[4] Existing Single Pole, H Frame[5] Single Circuit 69kV			
Circuit: Dairyland North Creek -- Arcadia 69 kV and Dairyland Arcadia -- Frenchville tap 69 kV			
***Existing* Normal Load**		***Existing* Normal Peak**	
Distance from Centerline (feet)	**Magnetic Field (mG)**	**Distance from Centerline (feet)**	**Magnetic Field (mG)**
Centerline	27.79	Centerline	34.74
25	13.56	25	16.96
50	4.74	50	5.92
100	1.28	100	1.6
150	0.58	150	0.72
200	0.32	200	0.41
300	0.14	300	0.18

Assumptions:
Typical Midspan Sag = 23 to 25 feet
Amperage = 138.9 A
69 kV Circuit Phase Angle: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 10

EXISTING
SEGMENTS: R,S,T

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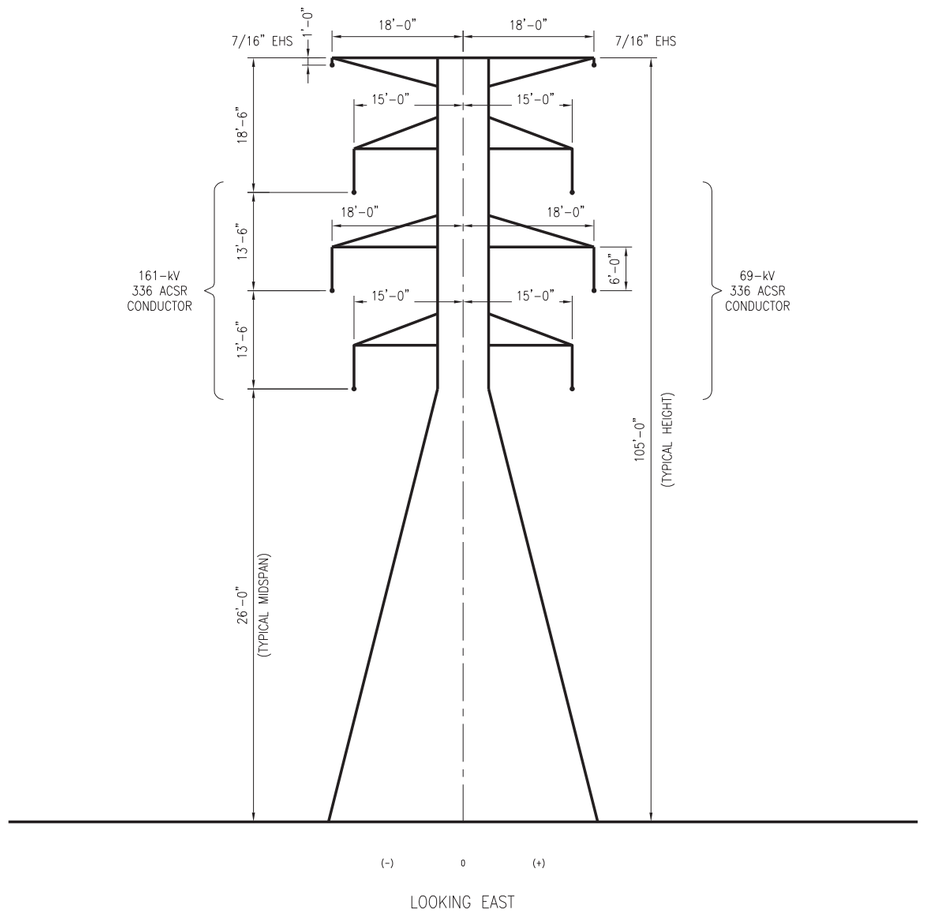

FIGURE 11

Table 21a - Calculated Electric Fields Table

Calculated Electric Field Data[3]

Transmission Line Segments: M11

Facility Description:[4] Existing Single Pole, Double Circuit (River Crossing)[5]
Double Circuit 161kV/69kV

Applies to existing Mississippi

Distance from Centerline (feet)	Electric Field (kV/m)
Centerline	1.83
25	0.82
50	0.16
100	0.06
150	0.05
200	0.04
300	0.02

Assumptions:
Typical Midspan Sag = 23 to 25 feet
Amperage = 167.4 A
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 11

Table 24a - Calculated Magnetic Fields Table

Calculated Magnetic Field Data[3]

Transmission Line Segments: M11

Facility Description:[4] Existing Single Pole, Lattice Tower (River Crossing)[5]
Double Circuit 161kV/69kV

Applies to existing Mississippi River crossing

Existing Normal Load		*Existing* Normal Peak	
Distance from Centerline (feet)	Magnetic Field (mG)	Distance from Centerline (feet)	Magnetic Field (mG)
Centerline	14.3	Centerline	17.88
25	14.32	25	17.9
50	9.05	50	11.31
100	3.27	100	4.09
150	1.56	150	1.95
200	0.9	200	1.13
300	0.41	300	0.51

Assumptions:
Typical Midspan Sag = 23 to 25 feet
Amperage = 167.4 A
161 and 69 kV Circuit Phase Angles: A phase = 240 Deg, B Phase = 120 Deg, C phase = 0 Deg
[3]Provide a measured diagram of structures showing the height of conductors from the ground at the structure.
[4]Describe facility - Structure type, configuration, location
[5]Figure 11

EXISITING
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161-kV TOWER

JOB NUMBER 118645
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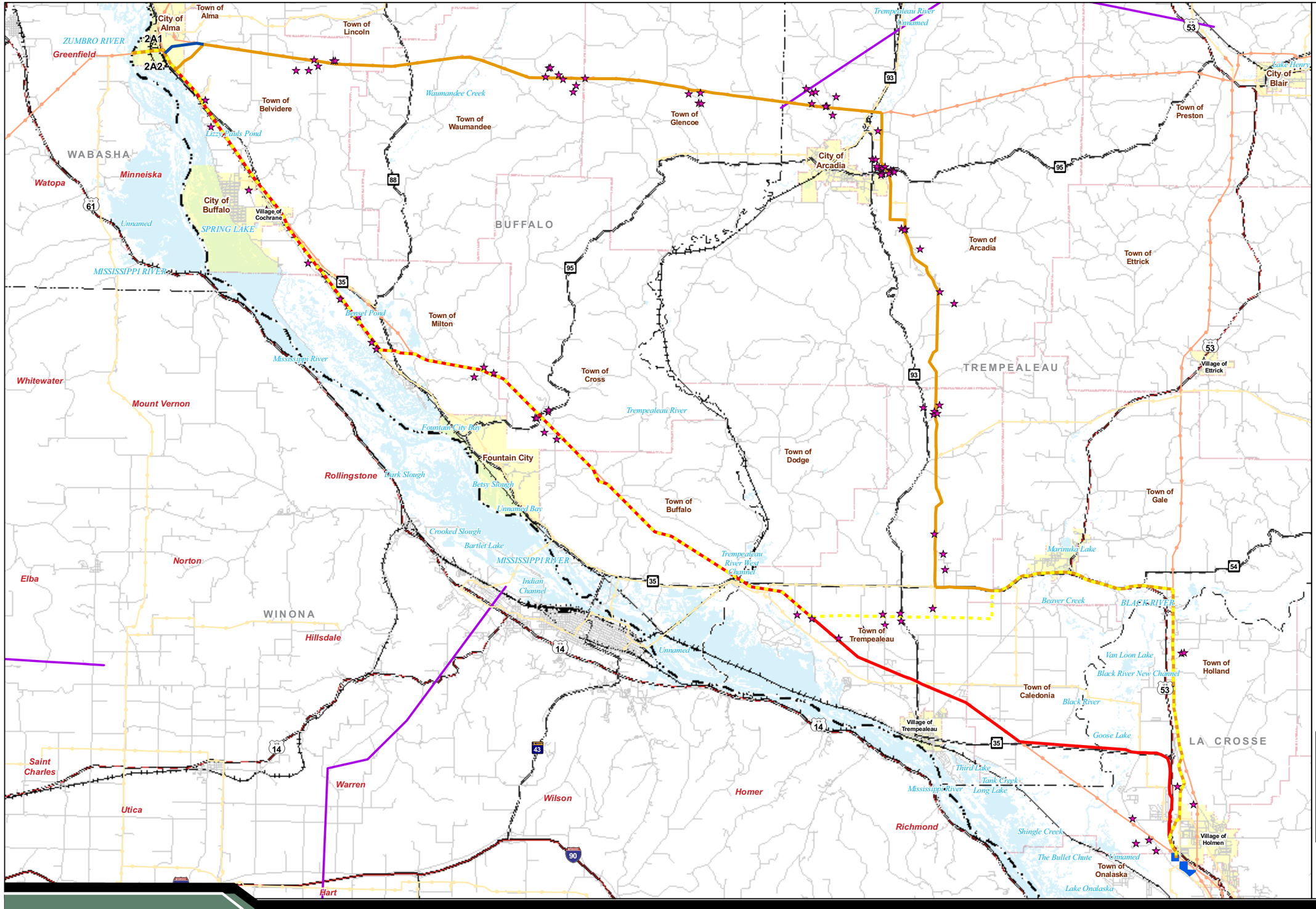

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Figure 12
Confined Animal Operation Map
January 2011