MINNESOTA POWER
BISON 1 WIND PROJECT
NEW SALEM, NORTH DAKOTA

DRAWING LIST

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REGISTERED PROFESSIONAL ENGINEER
KENNETH J. BENOIT
R5006
DATE 1-24-12
REV.3
NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
.	.	.	.	.
.	.	.	.	.
3	12-8-11	CONSTRUCTION REVISIONS, W.O.#17480 NO CHANGES	NJG	KJB

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
2	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD
1	02-19-10	APPROVED FOR CONSTRUCTION	NEM	SJD
0	12-18-09	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCR DATE 02-19-10
B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA
SIGNED DENNIS NAGARAH
DATE 3/18/11 LICENSE NO. 6478

minnesota power

BISON WIND
GENERATING FACILITY
NEW SALEM, ND

MINNESOTA POWER/BISON 1 WIND PROJECT
BISON 1 WIND PROJECT
COVER SHEET

SHEET . REV. 3
165233-1-000-E0000

CADD DRAWING – FOR REPRODUCTION ONLY
SCALE: NONE
MICROFILMED / /
CODE BIS . .

ImageSite: WIND_PROJECTS

CIRCUIT # BISON 800 - 2.3 MW WTG						
REV	POWER CABLE NUMBER	SOURCE EQUIPMENT	DESTINATION EQUIPMENT	CABLE SIZE & TYPE	TRENCH LENGTH (FT)	NOTES
	PC-23-8	TURBINE 23	TURBINE 8	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	3370	
	PC-8-16	TURBINE 8	TURBINE 16	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	4150	
	PC-16-3	TURBINE 16	TURBINE 3	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	3958	
	PC-3-32	TURBINE 3	TURBINE 32	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	2740	
	PC-32-5	TURBINE 32	TURBINE 5	750 KCMIL AL 35KV URD, EPR, 100% INSULATION W/ 1/3 CONCENTRIC NEUTRAL	2054	
	PC-5-18	TURBINE 5	TURBINE 18	750 KCMIL AL 35KV URD, EPR, 100% INSULATION W/ 1/3 CONCENTRIC NEUTRAL	3271	
	PC-5-O&M	TURBINE 5	O&M BUILDING	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	1399	
	PC-18-SUB	TURBINE 18	SUBSTATION	750 KCMIL AL 35KV URD, EPR, 100% INSULATION W/ 1/3 CONCENTRIC NEUTRAL	1549	
CIRCUIT # BISON 801 - 3.0 MW WTG						
REV	POWER CABLE NUMBER	SOURCE EQUIPMENT	DESTINATION EQUIPMENT	CABLE SIZE & TYPE	TRENCH LENGTH (FT)	NOTES
	PC-26-801-GOLF	TURBINE 26	801 GOLF	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	2360	
	PC-20-801-GOLF	TURBINE 20	801 GOLF	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	1490	
	PC-801-GOLF -801 FOXTROT	801 GOLF	801 FOXTROT	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	2045	
	PC-7-801 FOXTROT	TURBINE 7	801 FOXTROT	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	205	
	PC-801 FOXTROT -801 ALPHA	801 FOXTROT	801 ALPHA	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	2165	
	PC-15-801 ALPHA	TURBINE 15	801 ALPHA	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	200	
	PC-25-801 DELTA	TURBINE 25	801 DELTA	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	2010	
	PC-17-801 DELTA	TURBINE 17	801 DELTA	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	175	
	PC-801 DELTA -801 CHARLIE	801 DELTA	801 CHARLIE	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	1965	
	PC-6-801 CHARLIE	TURBINE 6	801 CHARLIE	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	385	
	PC-801-CHARLIE -801 BRAVO	801 CHARLIE	801 BRAVO	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	2655	
	PC-28-801 BRAVO	TURBINE 28	801 BRAVO	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	210	
	PC-801 BRAVO -801 ALPHA	801 BRAVO	801 ALPHA	750 KCMIL AL 35KV URD, EPR, 100% INSULATION W/ 1/3 CONCENTRIC NEUTRAL	2555	
	PC-801 ECHO -SUBSTATION	801 ECHO	SUBSTATION	1000 KCMIL CU 35KV URD, EPR, 100% INSULATION W/ 1/3 CONCENTRIC NEUTRAL	6345	

CIRCUIT # BISON 802 - 3.0 MW WTG						
REV	POWER CABLE NUMBER	SOURCE EQUIPMENT	DESTINATION EQUIPMENT	CABLE SIZE & TYPE	TRENCH LENGTH (FT)	NOTES
	PC-30-802 KILO	TURBINE 30	802 KILO	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	835	
	PC-2-802 KILO	TURBINE 2	802 KILO	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	880	
	PC-802 KILO -802 JULIET	802 KILO	802 JULIET	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	2570	
	PC-10-802 JULIET	TURBINE 10	802 JULIET	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	115	
	PC-802 JULIET -802 INDIA	802 JULIET	802 INDIA	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	1885	
	PC-1-802 INDIA	TURBINE 1	802 INDIA	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	200	
	PC-11-802 LIMA	TURBINE 11	802 LIMA	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	5440	
	PC-9-802 LIMA	TURBINE 9	802 LIMA	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	215	
	PC-802 LIMA -802 INDIA	802 LIMA	802 INDIA	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	2555	
	PC-802 INDIA -802 HOTEL	802 INDIA	802 HOTEL	1000 KCMIL AL 35KV URD, EPR, 100% INSULATION W/ 1/3 CONCENTRIC NEUTRAL	1870	
	PC-27-802 HOTEL	TURBINE 27	802 HOTEL	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	190	
	PC-802 HOTEL -SUBSTATION	802 HOTEL	SUBSTATION	1000 KCMIL AL 35KV URD, EPR, 100% INSULATION W/ 1/3 CONCENTRIC NEUTRAL	3735	
CIRCUIT # BISON 806 - 2.3 MW WTG						
REV	POWER CABLE NUMBER	SOURCE EQUIPMENT	DESTINATION EQUIPMENT	CABLE SIZE & TYPE	TRENCH LENGTH (FT)	NOTES
	PC-22-33	TURBINE 22	TURBINE 33	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	3035	
	PC-33-806 ECHO	TURBINE 33	806 ECHO	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	1803	
	PC-4-13	TURBINE 4	TURBINE 13	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	1864	
	PC-13-806 ECHO	TURBINE 13	806 ECHO	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	905	
	PC-29-12	TURBINE 29	TURBINE 12	#1/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	2402	
	PC-12-31	TURBINE 12	TURBINE 31	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	2457	
	PC-31-806 ECHO	TURBINE 31	806 ECHO	#4/0 AWG AL 35KV URD, EPR, 100% INSULATION W/ FULL CONCENTRIC NEUTRAL	3112	
	PC-806 ECHO-19	806 ECHO	TURBINE 19	750 KCMIL AL 35KV URD, EPR, 100% INSULATION W/ 1/3 CONCENTRIC NEUTRAL	4038	
	PC-19-14	TURBINE 19	TURBINE 14	1000 KCMIL AL 35KV URD, EPR, 100% INSULATION W/ 1/3 CONCENTRIC NEUTRAL	2189	
	PC-14-SUB	TURBINE 14	SUBSTATION	1000 KCMIL AL 35KV URD, EPR, 100% INSULATION W/ 1/3 CONCENTRIC NEUTRAL	1667	

TYPICAL LOW VOLTAGE CABLE LENGTH AT A SINGLE WTG (2.3 MW WTG)						
REV	POWER CABLE NUMBER	SOURCE EQUIPMENT	DESTINATION EQUIPMENT	CABLE SIZE & TYPE	CABLE LENGTH (FT)	NOTES
	DLO-GSU-DS	GSU	DISCONNECT SWITCH	777 KCMIL CU, TYPE DLO, 2KV W/ OD < 1.45"	806	LENGTH IS FOR ALL (24) CABLES INCLUDES LENGTH FOR TERMINATION
	DLO-DS-WTG	DISCONNECT SWITCH	WTG	777 KCMIL CU, TYPE DLO, 2KV W/ OD < 1.45"	958	LENGTH IS FOR ALL (24) CABLES INCLUDES LENGTH FOR TERMINATION
	GRD-GSU-WTG	GSU	WTG	4/0 AWG, CU, TYPE THHN/THWN OD < 0.7	271	LENGTH IS FOR ALL (6) CABLES INCLUDES LENGTH FOR TERMINATION

TYPICAL LOW VOLTAGE CABLE LENGTH AT A SINGLE WTG - (3.0 MW WTG)						
REV	POWER CABLE NUMBER	SOURCE EQUIPMENT	DESTINATION EQUIPMENT	CABLE SIZE & TYPE	CABLE LENGTH (FT)	NOTES
	DLO-GSU-WTG	GSU	WTG	1000 KCMIL CU, TYPE EPR, 2KV W/ OD < 1.38"	1680	LENGTH IS FOR ALL (24) CABLES INCLUDES LENGTH FOR TERMINATION
	GRD-GSU-WTG	GSU	WTG	4/0 AWG CU, TYPE THHN/THWN, W/ OD < 0.7"	630	LENGTH IS FOR ALL (9) CABLES INCLUDES LENGTH FOR TERMINATION

NOTES:

1. CONTRACTOR IS TO DETERMINE ALL POWER CABLE AND COMMUNICATION CABLE LENGTHS INCLUDING SPLICING, TERMINATION AND ANY ADDITIONAL SLACK REQUIRED. LENGTHS SHOWN IN THE POWER CABLE AND FIBER OPTIC CABLE SCHEDULES ARE POINT TO POINT DISTANCES ONLY.
2. CONTRACTOR SHALL VERIFY ALL CABLE LENGTHS.

REGISTERED PROFESSIONAL ENGINEER
KENNETH J. BENOIT
6606
DATE 1-24-12
REV.5
NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
.	.	.	.	.
5	12-13-11	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KSB
4	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD
3	06-16-10	APPROVED FOR CONSTRUCTION	NEM	SJD
2	02-19-10	APPROVED FOR CONSTRUCTION	NEM	SJD
1	1-29-10	CABLE AND CONDUIT REVISION	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCR DATE 02-19-10
B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA.
SIGNED CHRIS NAGARAH
DATE 3/14/12 REG. NO. 6478

minnesota power

BISON WIND GENERATING FACILITY NEW SALEM, ND

MINNESOTA POWER
BISON 1 WIND PROJECT
POWER CABLE SCHEDULE

SHEET | REV. 5
165233-1-000-E0100

CADD DRAWING – FOR REPRODUCTION ONLY

SCALE: NONE

MICROFILMED		CODE		
/	/	BIS	.	.

ImageSite: WIND_PROJECTS

CIRCUIT # BISON 800						
REV	COMMUNICATION CABLE NUMBER	SOURCE EQUIPMENT	DESTINATION EQUIPMENT	CABLE SIZE & TYPE	TRENCH LENGTH (FT)	NOTES
	CC-23-8	TURBINE 23	TURBINE 8	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	3370	
	CC-8-HH	TURBINE 8	SPLICING HANDHOLE	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	1703	
	CC-HH-16	SPLICING HANDHOLE	TURBINE 16	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2447	
	CC-16-HH	TURBINE 16	SPLICING HANDHOLE	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2344	
	CC-HH-3	SPLICING HANDHOLE	TURBINE 3	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	1614	
	CC-3-32	TURBINE 3	TURBINE 32	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2740	
	CC-32-5	TURBINE 32	TURBINE 5	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2054	
	CC-5-MET TOWER	TURBINE 5	MET TOWER	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	1230	
	CC-5-18	TURBINE 5	TURBINE 18	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	3271	
	CC-18-SUB	TURBINE 18	SUBSTATION	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	1399	
	CC-SS-O&M	SUBSTATION	O&M BUILDING	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	3767	
	CC-TS-CH	TRANSITION STRUCTURE	CONTROL HOUSE	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	240	
	ADDITIONAL FIBER IN SUBSTATION			DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2600	

CIRCUIT # BISON 801						
REV	COMMUNICATION CABLE NUMBER	SOURCE EQUIPMENT	DESTINATION EQUIPMENT	CABLE SIZE & TYPE	TRENCH LENGTH (FT)	NOTES
	CC-26-801-GOLF	TURBINE 26	801 GOLF	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2360	
	CC-25-17	TURBINE 25	TURBINE 17	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2185	
	CC-17-6	TURBINE 17	TURBINE 6	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2525	
	CC-6-HH	TURBINE 6	SPLICING HANDHOLE	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	1970	
	CC-HH-28	SPLICING HANDHOLE	TURBINE 28	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	1280	
	CC-28-801 ALPHA	TURBINE 28	801 ALPHA	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2760	
	CC-20-801-GOLF	TURBINE 20	801 GOLF	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	1490	
	CC-801-GOLF-7	801 GOLF	TURBINE 7	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2245	
	CC-7-801 ALPHA	TURBINE 7	801 ALPHA	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2365	
	CC-15-801 ALPHA	TURBINE 15	801 ALPHA	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	200	
	801 ALPHA-HH	801 ALPHA	SPLICING HANDHOLE	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2320	
	HH-15-SUB	SPLICING HANDHOLE	SUBSTATION	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	4026	

CIRCUIT # BISON 802						
REV	COMMUNICATION CABLE NUMBER	SOURCE EQUIPMENT	DESTINATION EQUIPMENT	CABLE SIZE & TYPE	TRENCH LENGTH (FT)	NOTES
	CC-30-802 KILO	TURBINE 30	802 KILO	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	835	
	CC-2-802 KILO	TURBINE 2	802 KILO	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	880	
	CC-802 KILO-10	802 KILO	TURBINE 10	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2685	
	CC-10-802 INDIA	TURBINE 10	802 INDIA	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2000	
	CC-9-802 LIMA	TURBINE 9	802 LIMA	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	215	
	CC-11-HH	TURBINE 11	SPLICING HANDHOLE	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2975	
	CC-HH-802 LIMA	SPLICING HANDHOLE	802 LIMA	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2450	
	CC-802 LIMA-802 INDIA	802 LIMA	802 INDIA	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2555	
	CC-1-802 INDIA	TURBINE 1	802 INDIA	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	200	
	CC-802 INDIA-27	802 INDIA	TURBINE 27	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2055	
	CC-27-SUB	TURBINE 27	SUBSTATION	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	3735	

CIRCUIT # BISON 806						
REV	COMMUNICATION CABLE NUMBER	SOURCE EQUIPMENT	DESTINATION EQUIPMENT	CABLE SIZE & TYPE	TRENCH LENGTH (FT)	NOTES
	CC-22-33	TURBINE 23	TURBINE 33	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	3035	
	CC-33-806 ECHO	TURBINE 33	806 ECHO	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	1803	
	CC-4-13	TURBINE 4	TURBINE 13	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	1864	
	CC-13-806 ECHO	TURBINE 13	806 ECHO	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	905	
	CC-29-12	TURBINE 29	TURBINE 12	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2402	
	CC-12-31	TURBINE 12	TURBINE 31	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2457	
	CC-31-806 ECHO	TURBINE 31	806 ECHO	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	3112	
	CC-806 ECHO-HH	806 ECHO	SPLICING HANDHOLE	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	1806	
	CC-HH-19	SPLICING HANDHOLE	TURBINE 19	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2232	
	CC-19-14	TURBINE 19	TURBINE 14	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2189	
	CC-14-SUB	TURBINE 14	SUBSTATION	DX02 4DSL X9KR, 24 COUNT, LOOSE TUBE, FIBER OPTIC CABLE	2149	

NOTES:

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2. CONTRACTOR SHALL VERIFY ALL CABLE LENGTHS.

REGISTERED PROFESSIONAL ENGINEER
KENNETH J. LEVOIT
6506
DATE 1-24-12
REV.5
NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
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5	12-13-11	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KJB
4	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD
3	06-16-10	APPROVED FOR CONSTRUCTION	NEM	SJD
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BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCR DATE 02-19-10
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I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA.
SIGNED CHRIS HAGARAH
DATE 3/14/11 REG NO. 6478

minnesota power

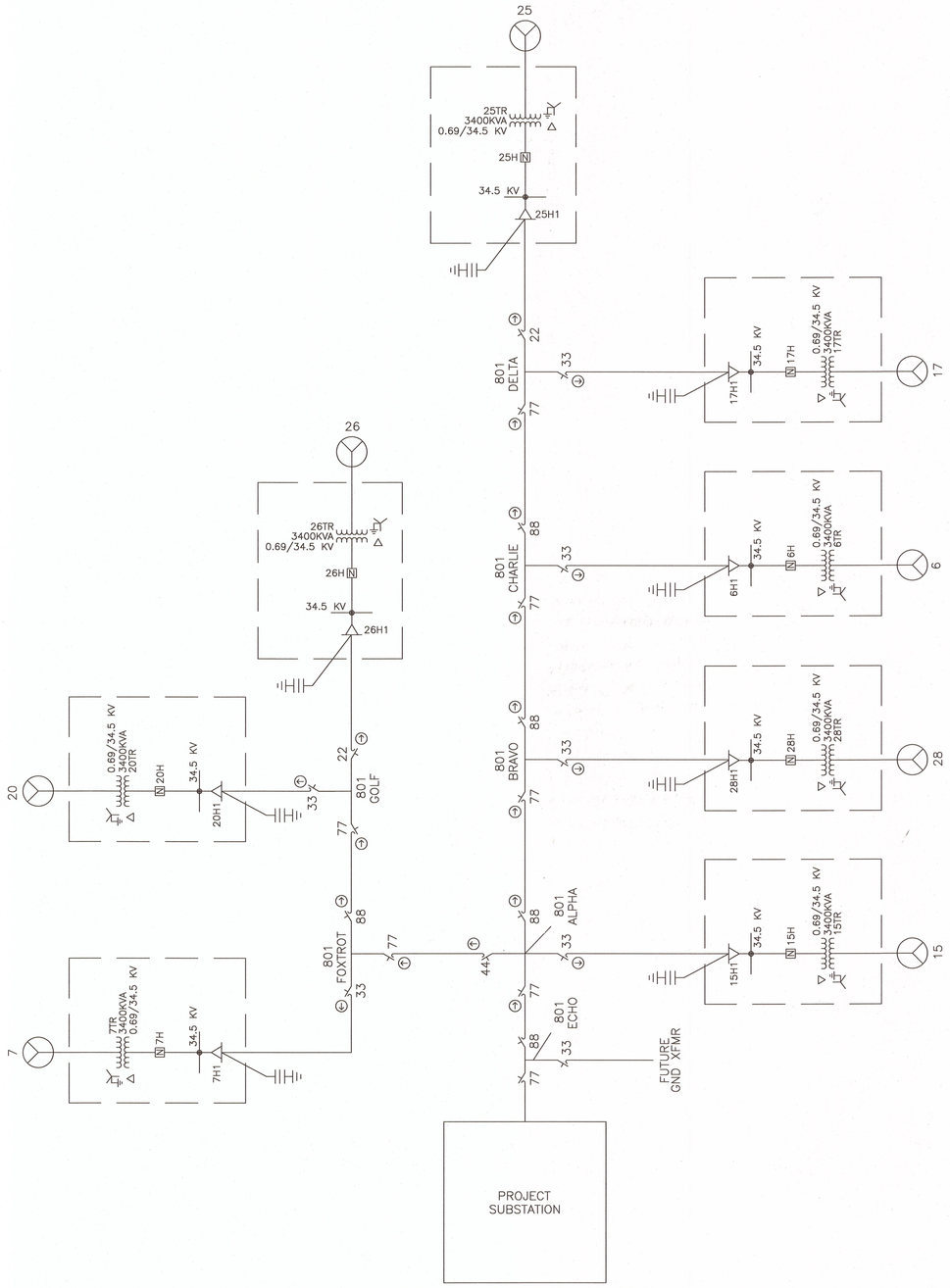
BISON WIND GENERATING FACILITY
NEW SALEM, ND

MINNESOTA POWER
BISON 1 WIND PROJECT
FIBER OPTIC CABLE SCHEDULE

SHEET . REV. 5
165233-1-000-E0101

CADD DRAWING – FOR REPRODUCTION ONLY
SCALE: NONE
MICROFILMED / /
CODE BIS . .

ImageSite: WIND_PROJECTS



ONE LINE – CIRCUIT 801 (8 WTG'S)

LEGEND:

- SIEMENS 3.0MW WTG (WIND TURBINE GENERATOR)
- 22KV MCOV ELBOW ARRESTERS
- FAULT INDICATORS LOCATED ON ELBOW
- [N] UNDER OIL SWITCH AND FUSE (NONVISABLE OPEN)
- UNDERGROUND FEEDER
- 600A DISCONNECTING ELBOW
- SECTIONAL PADMOUNT SWITCH

NOTES:

1. REFER TO DRAWING E0100 FOR POWER CABLE SCHEDULE.

REGISTERED PROFESSIONAL ENGINEER
KENNETH J. BENOIT
6506
DATE 1-25-12
REV.5
NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
.	.	-	.	.
5	1-25-12	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KGB
4	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD
3	06-16-10	APPROVED FOR CONSTRUCTION	NEM	SJD
2	02-19-10	APPROVED FOR CONSTRUCTION	NEM	SJD
1	1-29-10	GENERAL REVISIONS	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCR DATE 12-18-09
B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA
SIGNED CHRIS NADARSKI
DATE 3/19/11 REG NO. 6478

minnesota power

BISON WIND
GENERATING FACILITY
NEW SALEM, ND

MINNESOTA POWER
BISON 1 WIND PROJECT
ONE LINE DIAGRAM – CIRCUIT 801

SHEET . REV. 5
165233-1-000-E1001

CADD DRAWING – FOR REPRODUCTION ONLY
SCALE: NONE
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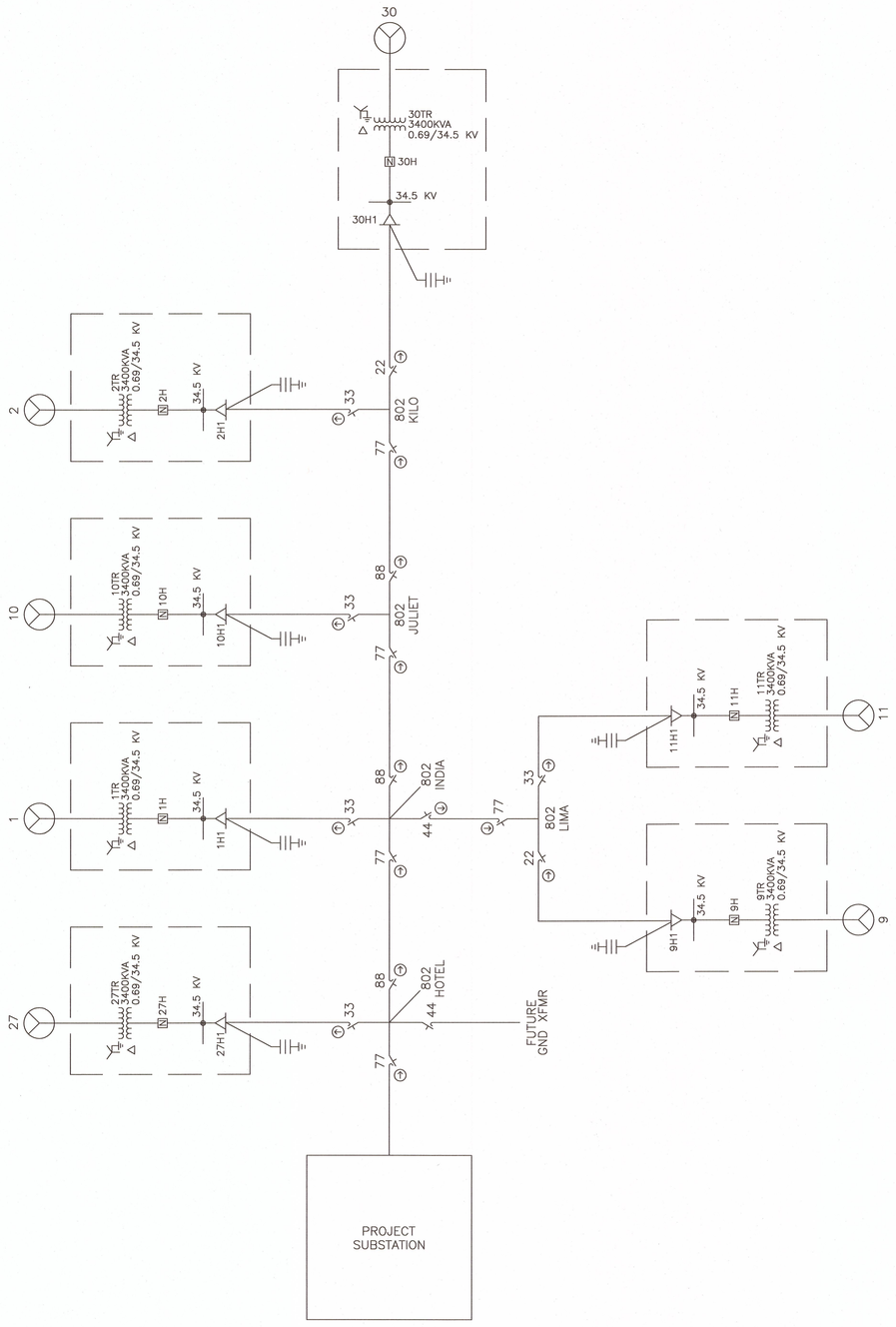
CODE BIS . .

ImageSite: WIND_PROJECTS



ONE LINE – CIRCUIT 802 (9 WTG'S)

LEGEND:

- SIEMENS 3.0MW WTG (WIND TURBINE GENERATOR)
- 22KV MCOV ELBOW ARRESTERS
- FAULT INDICATORS LOCATED ON ELBOW
- [N] UNDER OIL SWITCH AND FUSE (NONVISABLE OPEN)
- UNDERGROUND FEEDER
- 600A DISCONNECTING ELBOW
- SECTIONAL PADMOUNT SWITCH

NOTES:

1. REFER TO DRAWING E0100 FOR POWER CABLE SCHEDULE.

REGISTERED PROFESSIONAL ENGINEER NORTH DAKOTA
KENNETH J. BENOIT 6506
DATE 1-24-12
REV.4

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
.	.	.	.	.
4	12-13-11	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KJB
3	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD
2	02-19-10	APPROVED FOR CONSTRUCTION	NEM	SJD
1	1-29-10	GENERAL REVISIONS	NEM	SJD
0	12-18-09	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCR DATE 02-19-10
B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA.
SIGNED CHRIS HAGARAH
DATE 3/16/11 REG. NO. 6478

minnesota power

BISON WIND
GENERATING FACILITY
NEW SALEM, ND

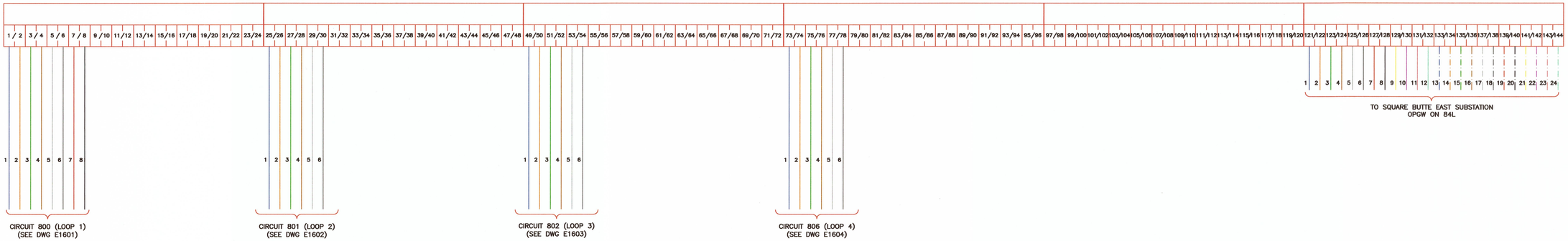
MINNESOTA POWER
BISON 1 WIND PROJECT
ONE LINE DIAGRAM – CIRCUIT 802

SHEET . REV. 4
165233-1-000-E1002

CADD DRAWING – FOR REPRODUCTION ONLY
SCALE: NONE
MICROFILMED / /
CODE BIS . .

ImageSite: WIND_PROJECTS

FIBER ACCESS PANEL
(SUBSTATION EEE)



LEGEND

- SINGLE MODE FIBER (1–12)
- SINGLE MODE FIBER (13–24)
- FUSION SPLICE

NOTES:

1. FIBER ACCESS PANEL (SUPPLIED BY CONTRACTOR) TO BE 19" RACK MOUNTABLE, WITH DUPLEX SC CONNECTORS.
2. ALL FIBER TO BE SINGLE MODE.
3. FIBER STRANDS TO BE LABELED PER THE TURBINE MANUFACTURER SPECIFICATIONS.
4. FIBER ACCESS PANEL TO BE LOCATED IN SUBSTATION COMMUNICATIONS PANEL IN THE CONTROL BUILDING.
4. CONTRACTOR TO SPECIFY MANUFACTURER AND PART NUMBERS FOR FIBER PATCH PANELS AND ASSOCIATED EQUIPMENT, UNLESS NOTED OTHERWISE. EQUIPMENT AND INSTALLATION SHALL COMPLY WITH THE TURBINE MANUFACTURER SPECIFICATIONS.

FIBER COLOR LEGEND

FIBER #	COLOR
1	BLUE
2	ORANGE
3	GREEN
4	BROWN
5	SLATE
6	WHITE (SHOWN AS DARK GRAY)
7	RED
8	BLACK
9	YELLOW
10	PURPLE
11	ROSE
12	AQUA

REGISTERED PROFESSIONAL ENGINEER NORTH DAKOTA
KENNETH J. BENOIT 6506
DATE 1-25-12
REV.2

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
.	.	.	.	.
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NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
2	1–25–12	CONSTRUCTION REVISIONS, W.O.#17480 NO CHANGES	NJG	KJB
1	03–09–11	APPROVED FOR CONSTRUCTION	NEM	SJD
0	12–18–09	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCN DATE 12–18–09
B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA
SIGNED CHRIS WAGMAN
DATE 3/14/11 REG'D NO. 6478

minnesota power

BISON WIND GENERATING FACILITY NEW SALEM, ND

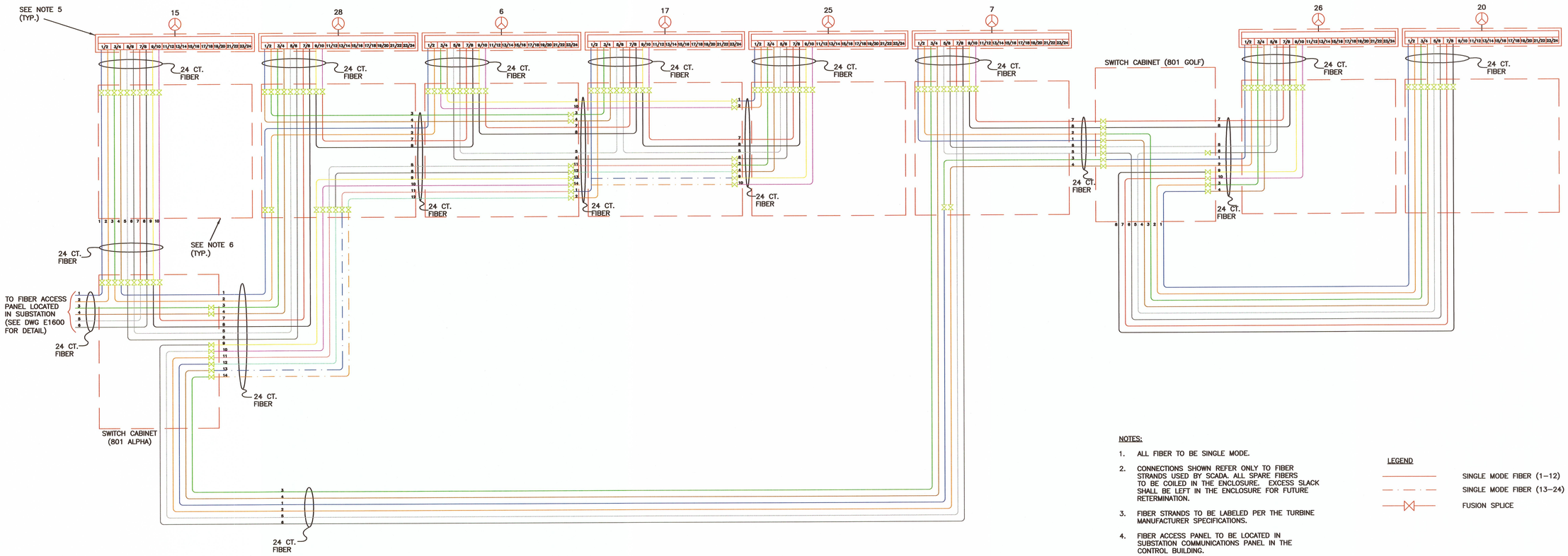
MINNESOTA POWER/BISON 1 WIND PROJECT
SUBSTATION FIBER ACCESS PANEL

SHEET . REV. 2
165233-1-000-E1600

CADD DRAWING – FOR REPRODUCTION ONLY
SCALE: NONE
MICROFILMED / /
CODE BIS . .

ImageSite: WIND_PROJECTS

CIRCUIT 801 – FIBER OPTIC CONNECTION DIAGRAM



NOTES:

1. ALL FIBER TO BE SINGLE MODE.
2. CONNECTIONS SHOWN REFER ONLY TO FIBER STRANDS USED BY SCADA. ALL SPARE FIBERS TO BE COILED IN THE ENCLOSURE. EXCESS SLACK SHALL BE LEFT IN THE ENCLOSURE FOR FUTURE RETERMINATION.
3. FIBER STRANDS TO BE LABELED PER THE TURBINE MANUFACTURER SPECIFICATIONS.
4. FIBER ACCESS PANEL TO BE LOCATED IN SUBSTATION COMMUNICATIONS PANEL IN THE CONTROL BUILDING.
5. FIBER PATCH PANEL TO BE INSTALLED AS SHOWN IN DRAWING E2602.
6. OUTDOOR FIBER SPLICE ENCLOSURE TO BE INSTALLED NEXT TO WIND TURBINE GSU AND AT SWITCH CABINET LOCATIONS PER DRAWING E2300.
7. A HANDHOLE SHALL BE LOCATED IN THE MIDDLE OF ANY PLAN EXCEEDING 4,000 FT./AND OR ANY TURN OVER 30°. A MINIMUM OF 100 FEET OF FIBER OPTIC CABLE MUST BE LEFT IN EACH HANDHOLE.
8. MINNESOTA POWER TO SPECIFY MANUFACTURER AND PART NUMBERS FOR FIBER PATCH PANELS AND ASSOCIATED EQUIPMENT, UNLESS NOTED OTHERWISE. EQUIPMENT AND INSTALLATION SHALL COMPLY WITH THE TURBINE MANUFACTURER SPECIFICATIONS.
9. REFER TO DRAWING E0101 FOR FIBER OPTIC CABLE SCHEDULE.
10. A TRACER WIRE SHOULD BE PULLED IN ALL RUNS. TRACER WIRE SHOULD BE BONDED TOGETHER AND GROUNDED IN THE OUTDOOR FIBER SOURCE ENCLOSURE. TRACER WIRES SHALL NOT ENTER WTG
11. ALL CONNECTORS ON PATCH PANEL SHALL BE LABELED 1/2, 3/4, TO 23/24 FROM LEFT TO RIGHT. INSTALLATION OF THE PATCH PANEL IN THE WTG WILL HAVE TO BE COORDINATED WITH SIEMENS TO BE DONE AFTER ERECTION OF THE WTG. (SEE FIBER COLOR LEGEND)
12. WHEN CABLE ATTACHES TO PATCH PANEL, CABLE ASSIGNMENTS ARE DETERMINED BY PATCH PANEL PORT NUMBERS.

LEGEND

- SINGLE MODE FIBER (1–12)
- SINGLE MODE FIBER (13–24)
- FUSION SPLICE

FIBER COLOR LEGEND

FIBER #	COLOR
1	BLUE
2	ORANGE
3	GREEN
4	BROWN
5	SLATE
6	WHITE (SHOWN AS DARK GRAY)
7	RED
8	BLACK
9	YELLOW
10	PURPLE
11	ROSE
12	AQUA

* FIBERS 13–24 SHALL FOLLOW THE SAME COLOR AS FIBERS 1–12.

REGISTERED PROFESSIONAL ENGINEER NORTH DAKOTA
KENNETH J. BENOIT 6506
DATE 1-25-12
REV.5

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
.	.	.	.	.
5	12–13–11	CONSTRUCTION REVISIONS, W.O.#17480 NO CHANGES	NJG	KJB
4	03–09–11	APPROVED FOR CONSTRUCTION	NEM	SJD
3	06–16–10	APPROVED FOR CONSTRUCTION	NEM	SJD
2	02–19–10	APPROVED FOR CONSTRUCTION	NEM	SJD
1	1–29–10	GENERAL REVISIONS	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCR DATE 02–19–10
B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA.
SIGNED CHRIS NAGARAH
DATE 3/14/11 REG NO. 6478

minnesota power

BISON WIND GENERATING FACILITY NEW SALEM, ND

MINNESOTA POWER/BISON 1 WIND PROJECT
FIBER OPTIC CONNECTION DIAGRAM
CIRCUIT 801

SHEET . REV. 5
165233-1-000-E1602

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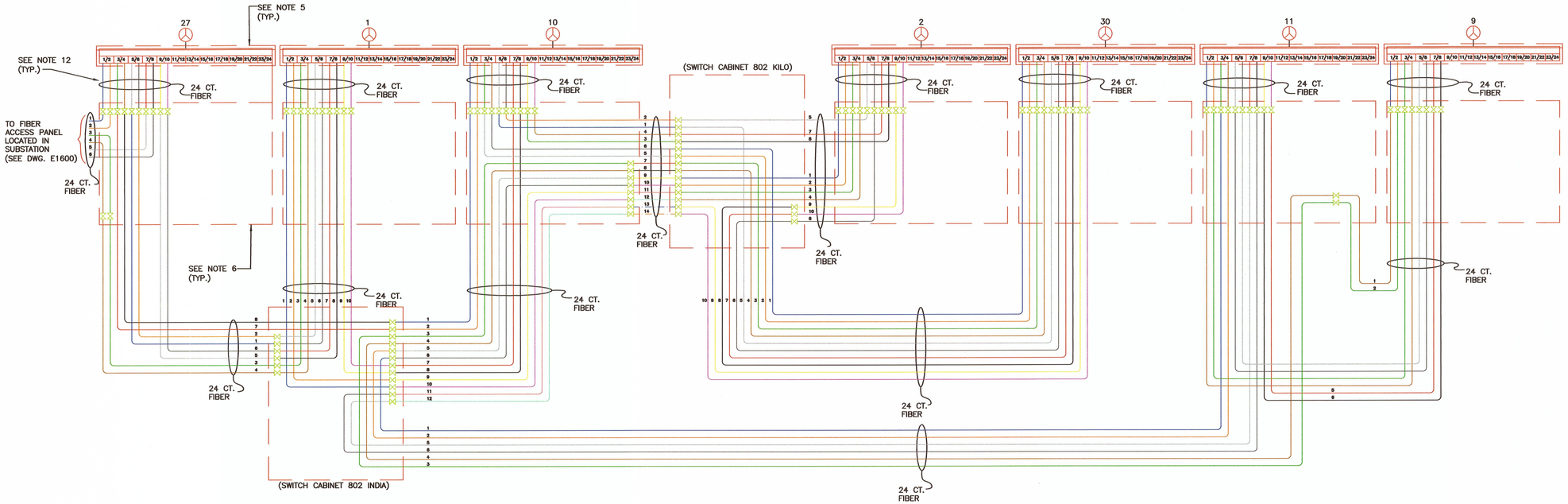
MICROFILMED / /
CODE BIS . .

ImageSite: WIND_PROJECTS

CIRCUIT 802 – FIBER OPTIC CONNECTION DIAGRAM



NOTES:

1. ALL FIBER TO BE SINGLE MODE.
2. CONNECTIONS SHOWN REFER ONLY TO FIBER STRANDS USED BY SCADA. ALL SPARE FIBERS TO BE COILED IN THE ENCLOSURE. EXCESS SLACK SHALL BE LEFT IN THE ENCLOSURE FOR FUTURE RETERMINATION.
3. FIBER STRANDS TO BE LABELED PER THE TURBINE MANUFACTURER SPECIFICATIONS.
4. FIBER ACCESS PANEL TO BE LOCATED IN SUBSTATION COMMUNICATIONS PANEL IN THE CONTROL BUILDING.
5. FIBER PATCH PANEL TO BE INSTALLED AS SHOWN IN DRAWING E2602.
6. OUTDOOR FIBER SPLICE ENCLOSURE TO BE INSTALLED NEXT TO WIND TURBINE GSU AND AT SWITCH CABINET LOCATIONS PER DRAWING E2300.
7. A HANDHOLE SHALL BE LOCATED IN THE MIDDLE OF ANY PLAN EXCEEDING 4,000 FT./AND OR ANY TURN OVER 30°. A MINIMUM OF 100 FEET OF FIBER OPTIC CABLE MUST BE LEFT IN EACH HANDHOLE.
8. MINNESOTA POWER TO SPECIFY MANUFACTURER AND PART NUMBERS FOR FIBER PATCH PANELS AND ASSOCIATED EQUIPMENT, UNLESS NOTED OTHERWISE. EQUIPMENT AND INSTALLATION SHALL COMPLY WITH THE TURBINE MANUFACTURER SPECIFICATIONS.
9. REFER TO DRAWING E0101 FOR FIBER OPTIC CABLE SCHEDULE.
10. A TRACER WIRE SHOULD BE PULLED IN ALL RUNS. TRACER WIRE SHOULD BE BONDED TOGETHER AND GROUNDED IN THE OUTDOOR FIBER SOURCE ENCLOSURE. TRACER WIRES SHALL NOT ENTER WTG.
11. ALL CONNECTORS ON PATCH PANEL SHALL BE LABELED 1/2, 3/4, TO 23/24 FROM LEFT TO RIGHT. INSTALLATION OF THE PATCH PANEL IN THE WTG WILL HAVE TO BE COORDINATED WITH SIEMENS TO BE DONE AFTER ERECTION OF THE WTG. (SEE FIBER COLOR LEGEND)
12. WHEN CABLE ATTACHES TO PATCH PANEL, CABLE ASSIGNMENTS ARE DETERMINED BY PATCH PANEL PORT NUMBER.

LEGEND

- SINGLE MODE FIBER (1–12)
- SINGLE MODE FIBER (13–24)
- FUSION SPLICE

FIBER COLOR LEGEND

FIBER #	COLOR
1	BLUE
2	ORANGE
3	GREEN
4	BROWN
5	SLATE
6	WHITE (SHOWN AS DARK GRAY)
7	RED
8	BLACK
9	YELLOW
10	PURPLE
11	ROSE
12	AQUA

* FIBERS 13–24 SHALL FOLLOW THE SAME COLOR AS FIBERS 1–12.

REGISTERED PROFESSIONAL ENGINEER — KENNETH J. BENOIT 6506 — DATE 1-25-12 — NORTH DAKOTA

REV. 4

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
.	.	.	.	.
4	12–14–11	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KJB
3	03–09–11	APPROVED FOR CONSTRUCTION	NEM	SJD
2	02–19–10	APPROVED FOR CONSTRUCTION	NEM	SJD
1	1–29–10	GENERAL REVISIONS	NEM	SJD
0	12–18–09	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCR DATE 02–19–10
B&V PROJECT DRAWING NUMBER

I, HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA.
SIGNED CHRIS NAGARAH
DATE 3/4/11 REG NO. 6478

minnesota power

BISON WIND GENERATING FACILITY NEW SALEM, ND

MINNESOTA POWER/BISON 1 WIND PROJECT
FIBER OPTIC CONNECTION DIAGRAM
CIRCUIT 802

SHEET . REV. 4
165233-1-000-E1603

CADD DRAWING – FOR REPRODUCTION ONLY
SCALE: NONE
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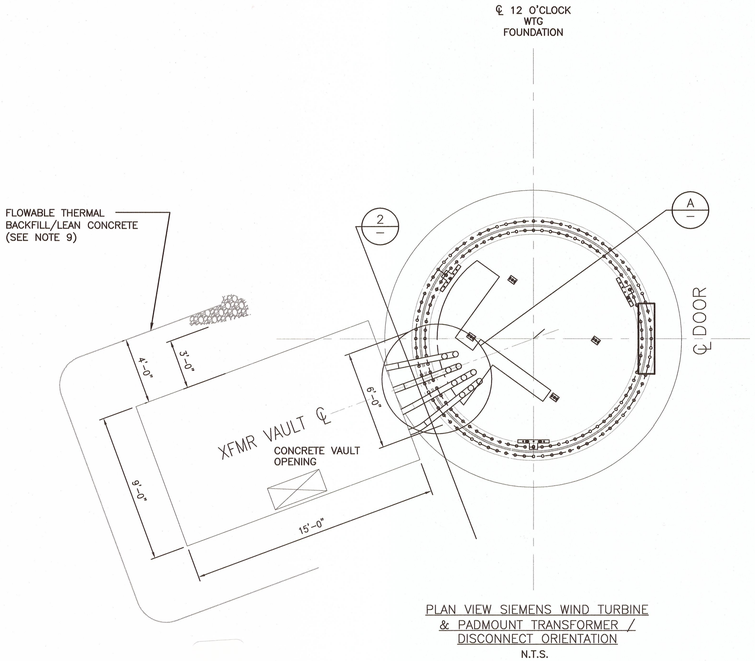
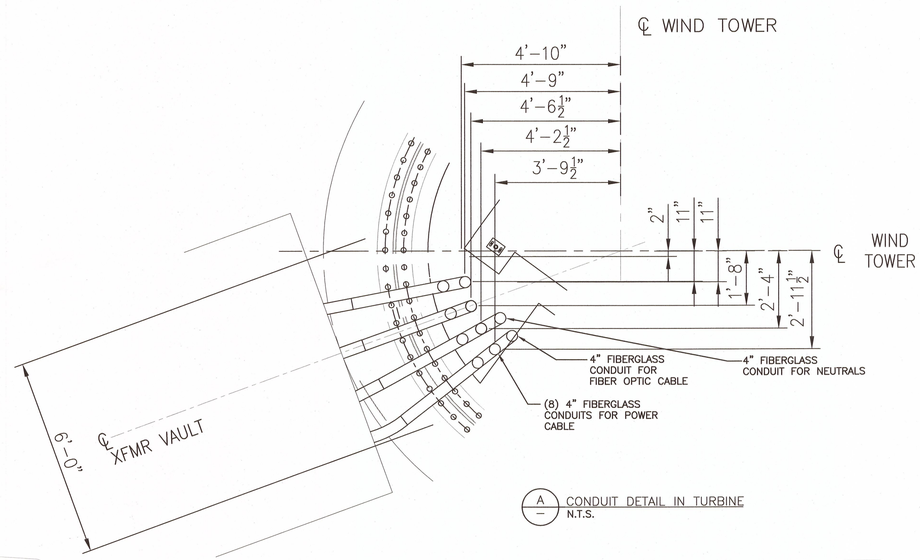
CODE BIS . .

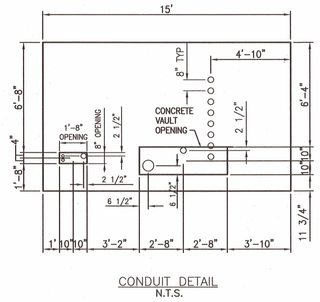
ImageSite: WIND_PROJECTS



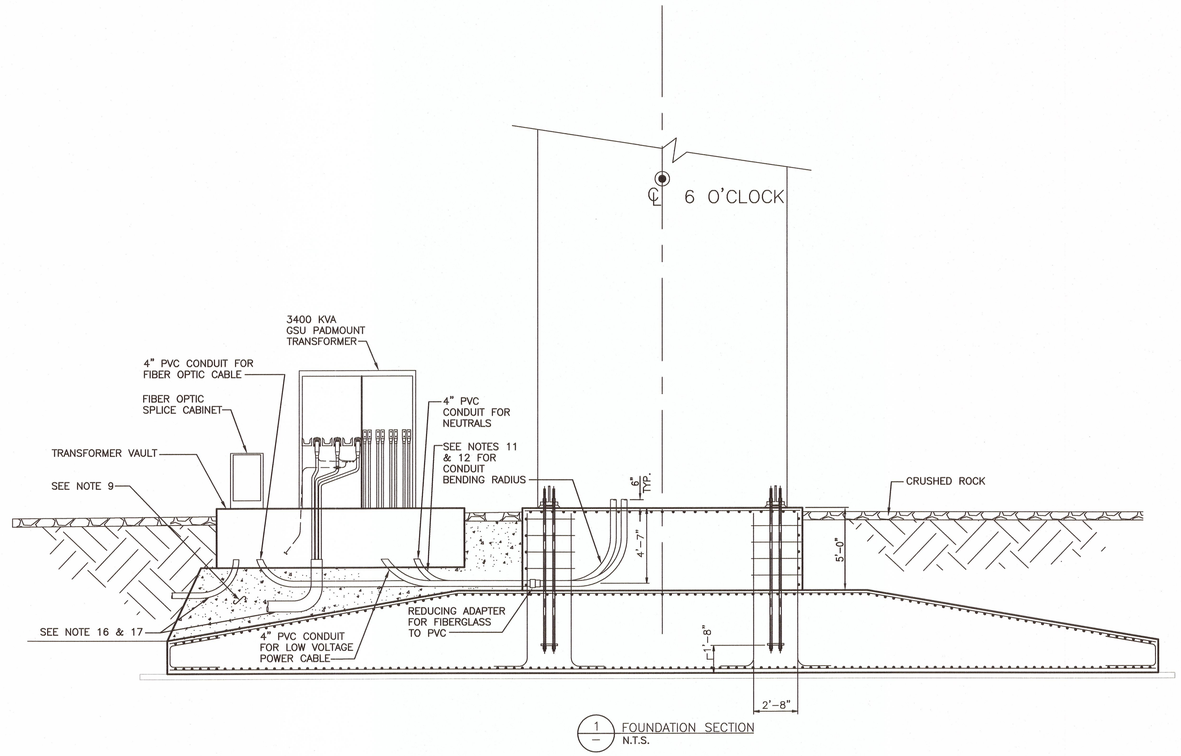
PLAN VIEW SIEMENS WIND TURBINE
& PADMOUNT TRANSFORMER /
DISCONNECT ORIENTATION
N.T.S.



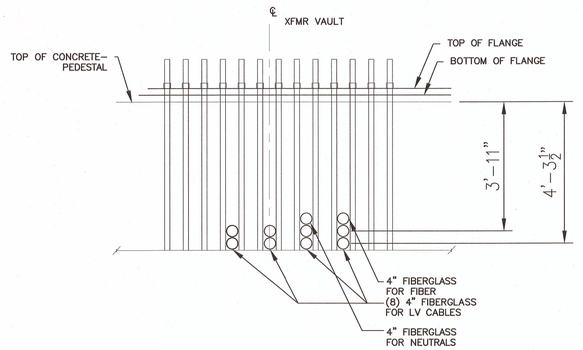
A CONDUIT DETAIL IN TURBINE
N.T.S.



CONDUIT DETAIL
N.T.S.



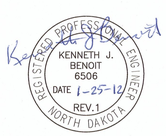
1 FOUNDATION SECTION
N.T.S.



2 CONDUIT SECTION
N.T.S.

NOTES:

1. THIS DRAWING ILLUSTRATES EQUIPMENT ORIENTATION AND CONDUIT DETAILS FROM THE TURBINE TO THE PAD MOUNT TRANSFORMER.
2. FOR UNDERGROUND TRENCH DETAILS REFER TO DRAWING S8000.
3. INSTALL END BELLS ON ALL PVC/FIBERGLASS CONDUITS. SEAL CONDUITS WITH OIL AND WATER RESISTANT SEALING COMPOUND TO PREVENT WATER ENTRY AND CONTAIN OIL IN THE EVENT OF LEAKAGE.
4. THE FOUNDATION CONTRACTOR SHALL SUPPLY AND INSTALL ALL CONDUITS EMBEDDED IN THE TOWER FOUNDATIONS.
5. NOT USED.
6. 24 – 1000 KCMIL 2000V EPR COPPER CONDUCTORS (8 – 1000 KCMIL PER PHASE) SHALL BE INSTALLED IN THE 4 INCH CONDUITS. CONTRACTOR SHALL PLACE ONE A, B & C PHASE CABLE IN EACH CONDUIT TO ENSURE REQUIRED AMPACITY IS REACHED.
7. 9–4/0 AWG CU TYPE THHN/THWN GROUNDS ARE TO BE INSTALLED IN THE 4" FIBERGLASS CONDUIT AND ROUTED FROM THE WTG DIRECTLY TO THE GSU.
8. LOW VOLTAGE AND 34.5KV CABLES SHALL BE INSTALLED WITH SUFFICIENT SLACK TO ALLOW RE–TERMINATION OF ELBOWS AND BE COILED, TIED AND LEFT INSIDE VAULT. CONTRACTOR SHALL VERIFY ALL CABLE LENGTHS.
9. LEAN CONCRETE SHALL BE PLACED UNDER THE GSU VAULT AND ENCOMPASS THE LOW VOLTAGE CONDUITS AS THEY EXIT THE TURBINE PEDESTAL AS SHOWN IN THE PLAN VIEW AND SECTION 1. THE LEAN CONCRETE MIX SHALL HAVE A MAXIMUM THERMAL RESISTIVITY OF 60 RHO. SEE DRAWING SERIES S5000 FOR FOUNDATION DETAILS.
10. CONTRACTOR SHALL MAINTAIN A MINIMUM 3" EDGE OF CONDUIT TO EDGE OF CONDUIT SEPARATION BETWEEN THE (8) LOW VOLTAGE CONDUITS. A 1X8 CONFIGURATION SHALL BE MAINTAINED FROM THE TURBINE PEDESTAL TO THE CONDUIT PENETRATIONS Φ THE GSU VAULT. IF AN ALTERNATIVE CONDUIT CONFIGURATION IS USED, THE CONTRACTOR SHALL GET OWNER APPROVAL PRIOR TO CONSTRUCTION.
11. MINIMUM BENDING RADIUS FOR 4" FIBERGLASS FOR FIBER OPTIC CABLE AND GROUND CONDUCTOR IS 2'–0".
12. MINIMUM BENDING RADIUS FOR 4" SCHEDULE 40 PVC/FIBERGLASS FOR 1000 KCMIL CU EPR LOW VOLTAGE CABLE IS 3'–0". CONTRACTOR TO VERIFY MINIMUM BENDING RADIUS OF THE LOW VOLTAGE CABLE.
13. MINIMUM BENDING RADIUS FOR 8" SCHEDULE 80 PVC FOR POWER CABLE IS 4'–0". CONTRACTOR TO VERIFY MINIMUM BENDING RADIUS OF THE POWER CABLE.
14. NOT USED.
15. CABLE MANUFACTURER TO PROVIDE 1000 KCMIL 2000V EPR CABLE IN A TRIPLEXED CONFIGURATION.
16. THE 2" FIBERDUCT FOR THE FIBER OPTIC CABLE AND THE 8" SCHEDULE 80 PVC CONDUIT FOR THE POWER CABLE SHALL EXTEND OUT FROM THE LEAN CONCRETE FOR LATER ACCESS BY THE ELECTRICAL CONTRACTOR. THE CONDUITS SHALL BE SEALED TO PREVENT ENTRY OF DIRT OR ROCK.
17. CONTRACTOR TO DETERMINE FINAL ROUTING OF THE 34.5 KV CIRCUIT INTO THE GSU TO AVOID INTERFERENCE WITH THE CRANE PAD. CONTRACTOR SHALL HOLD TO MINIMUM BENDING RADIUS PER CABLE MANUFACTURER.



NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
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NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
.	.	.	.	.
1	1–25–12	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KJB
0	03–09–11	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCR DATE 12–17–10
B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA
SIGNED CHRIS NAGARAH
DATE 3/14/11 REG. NO. 6478

minnesota power

BISON WIND
GENERATING FACILITY
NEW SALEM, ND

MINNESOTA POWER/BISON 1 WIND PROJECT
EQUIPMENT ORIENTATION
AND CONDUIT DETAILS – PHASE 1B

SHEET . REV. 1
165233-1-000-E2302

CADD DRAWING – FOR REPRODUCTION ONLY
SCALE: NONE
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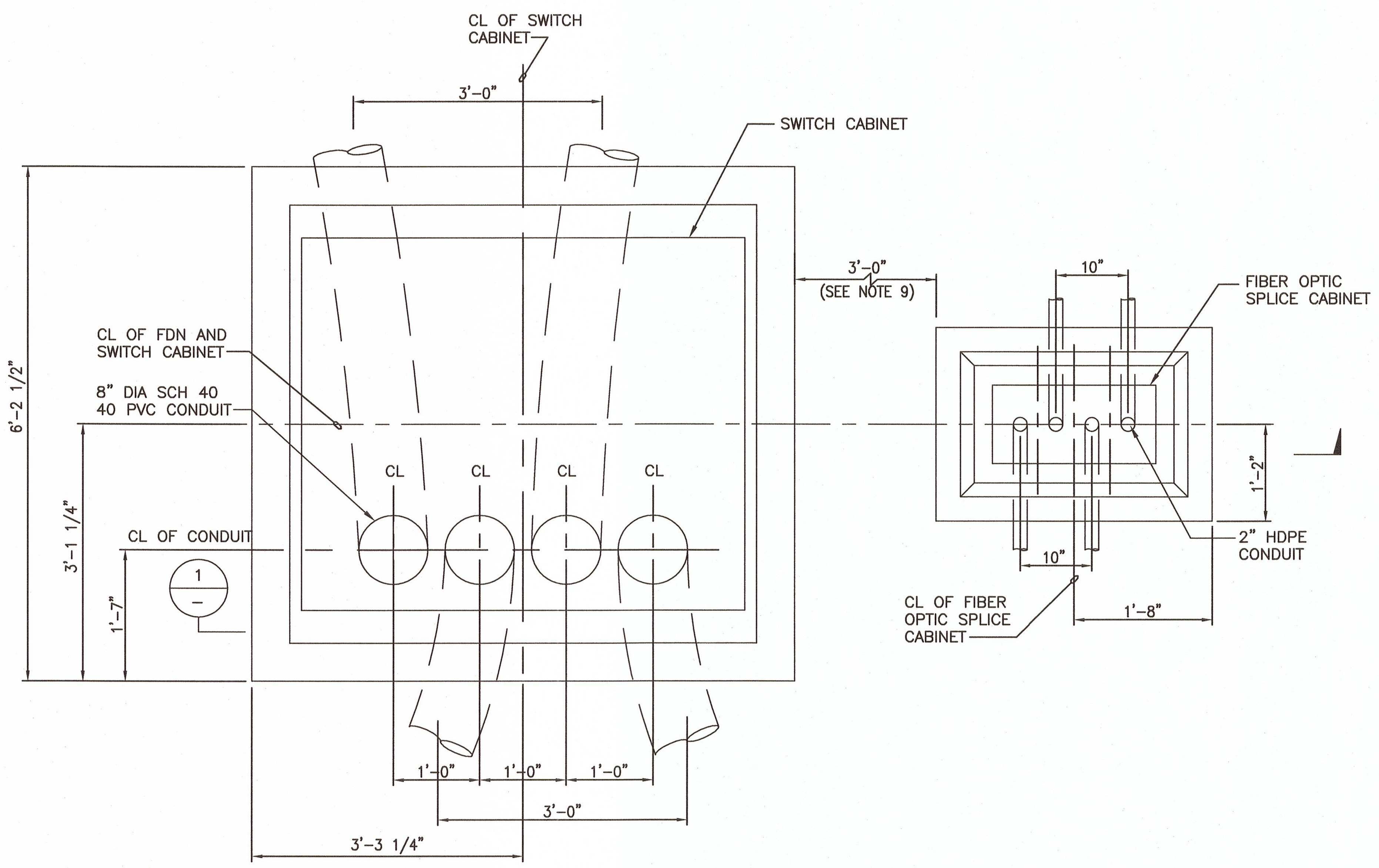
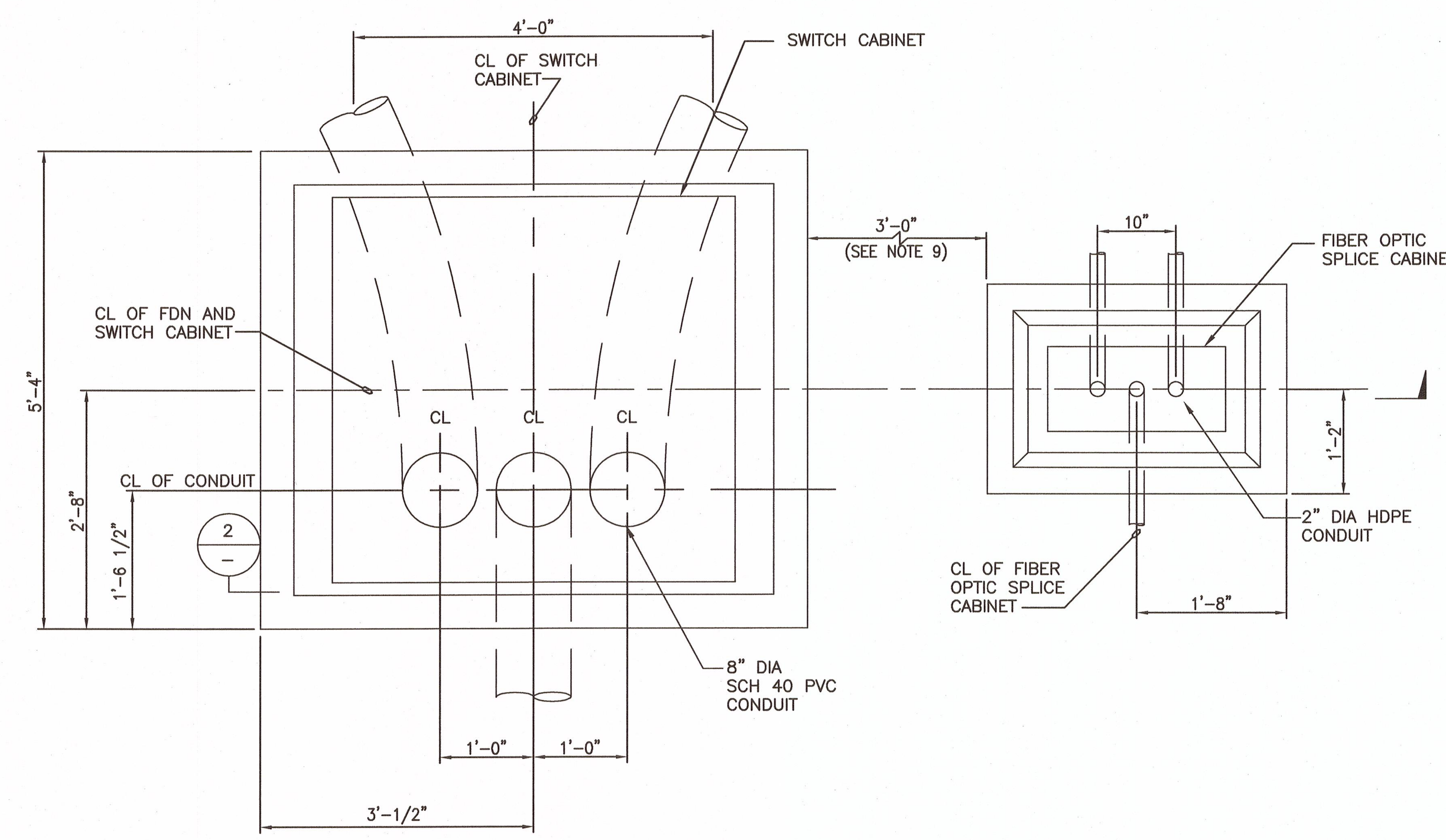
CODE BIS . .

ImageSite: WIND_PROJECTS



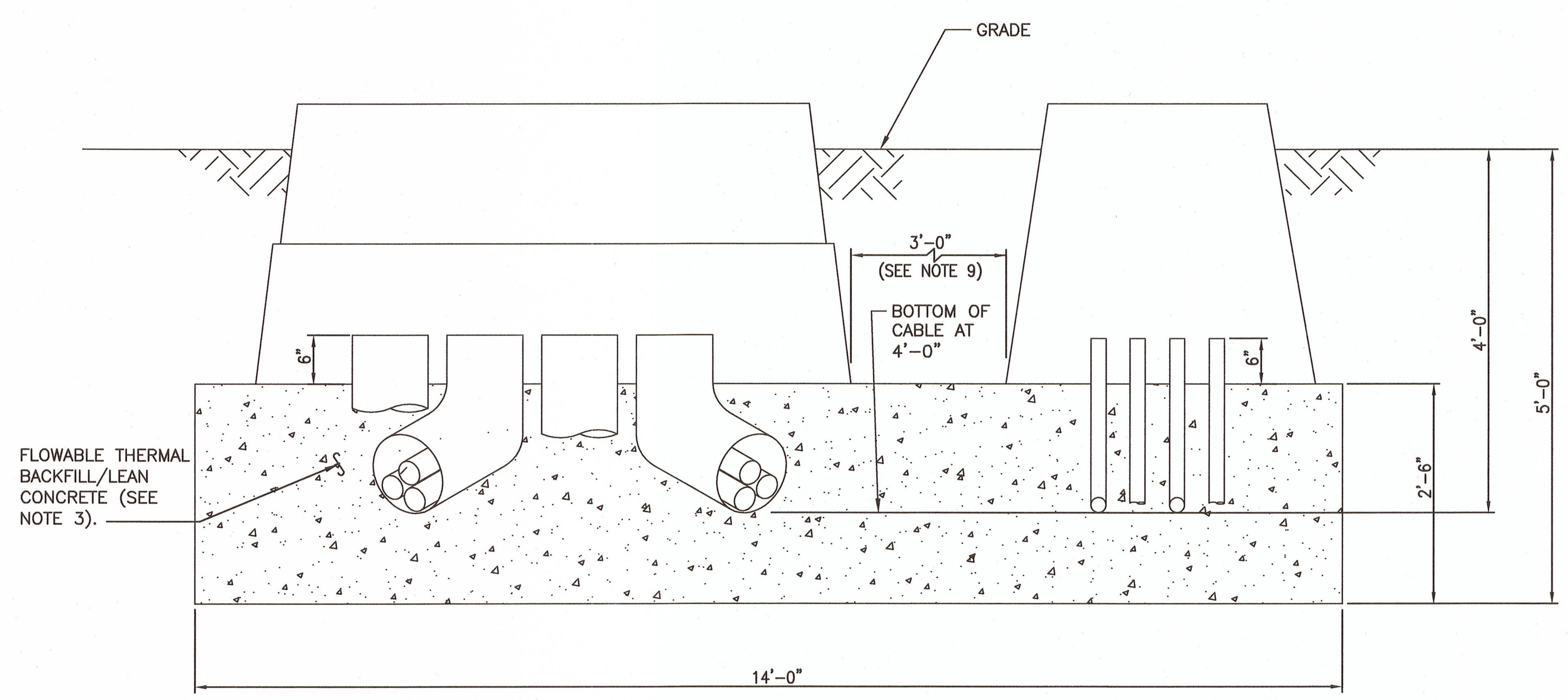
PLAN VIEW
4 WAY SWITCHCABINET PAD
N.T.S.



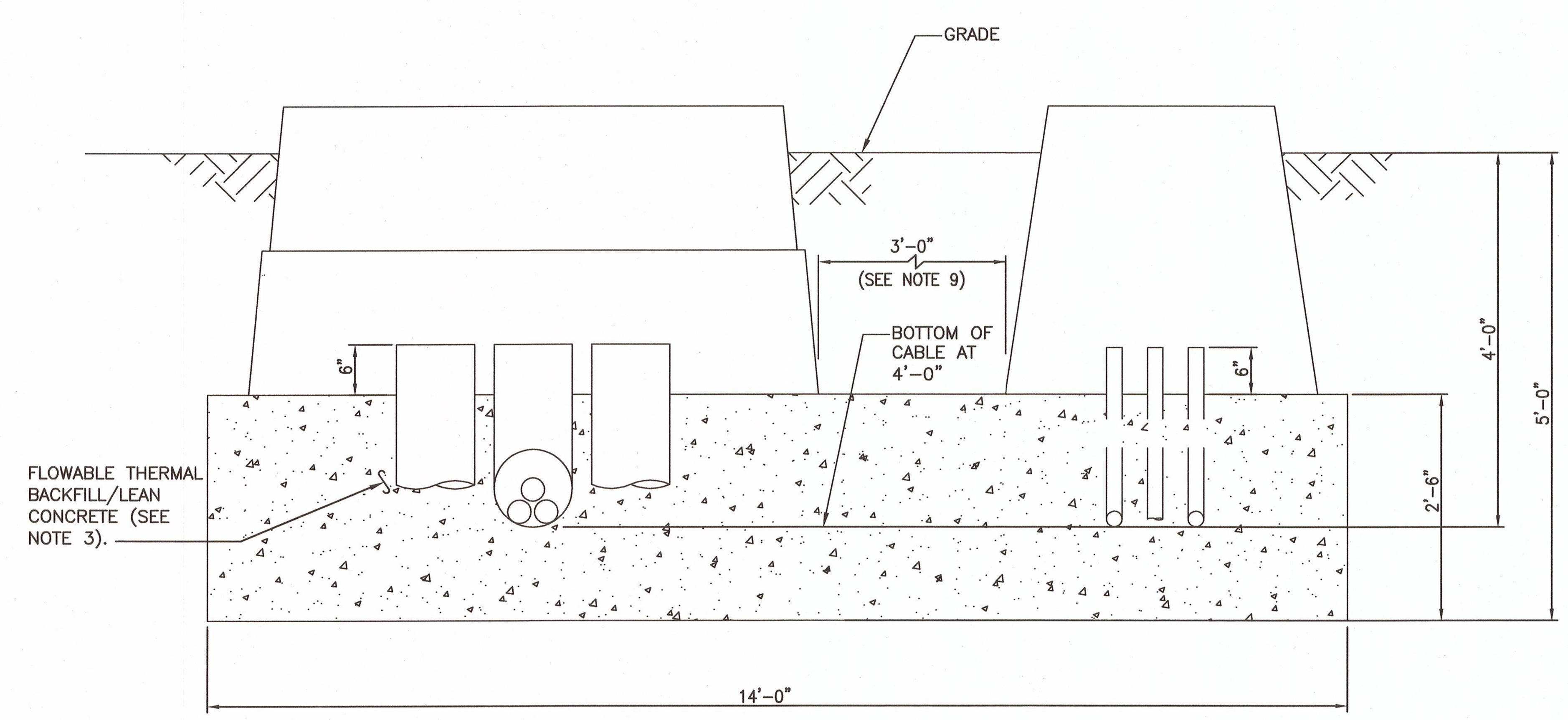
PLAN VIEW
3 WAY SWITCHCABINET PAD
N.T.S.

NOTES:

1. NOT USED.
2. FOR LOCATIONS AND SIZES OF ANCHORS, REFER TO SWITCH CABINET AND SPLICE CABINET MANUFACTURERS' DRAWINGS. ANCHORS SHALL BE HIT-TZ WITH HIT-ICE ADHESIVE ANCHORS (OR EQUAL).
3. SWITCH CABINET VAULT SHALL HAVE A FLOWABLE THERMAL BACKFILL / LEAN CONCRETE BASE BENEATH THE VAULT. LEAN CONCRETE MIX SHALL HAVE A MAXIMUM THERMAL RESISTIVITY OF 60 RHO.
4. NOT USED
5. NOT USED.
6. MINIMUM BENDING RADIUS FOR 2" HDPE CONDUIT IS 2'-0".
7. MINIMUM BENDING RADIUS FOR 8" SCH 40 PVC IS 4'-0". CONTRACTOR TO VERIFY RADIUS OF THE POWER CABLE.
8. FIBER CABINETS LOCATED ADJACENT TO SWITCH LOCATIONS 801 ALPHA (4-WAY), 801 GOLF (3-WAY), 802 INDIA (4-WAY), 802 KILO (3-WAY). ALL OTHER SWITCH CABINET LOCATIONS DISREGARD FIBER OPTIC SPLICE CABINET DETAILS.
9. CONTRACTOR TO ENSURE MINIMUM 3'-0" SEPARATION BETWEEN SWITCH CABINET AND FIBER OPTIC SPLICE ENCLOSURE ALLOW FOR 180 DEGREE OPENING OF BOTH THE FIBER SPLICE ENCLOSURE AND SWITCH CABINET DOORS.



1 SECTION
N.T.S.



2 SECTION
N.T.S.

KENNETH J. BENOIT 6506 DATE 1-24-12 REV.1 REGISTERED PROFESSIONAL ENGINEER NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED	NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
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.	.	.	.	.	1	12-14-11	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KJB
.	.	.	.	.	0	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION — ENGINEER NEM, DRAWN KDM, CHECKED JCR, DATE 12-17-10, B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA. SIGNED CHRIS NAGARAH DATE 3/14/11 REG NO. 6478

minnesota power

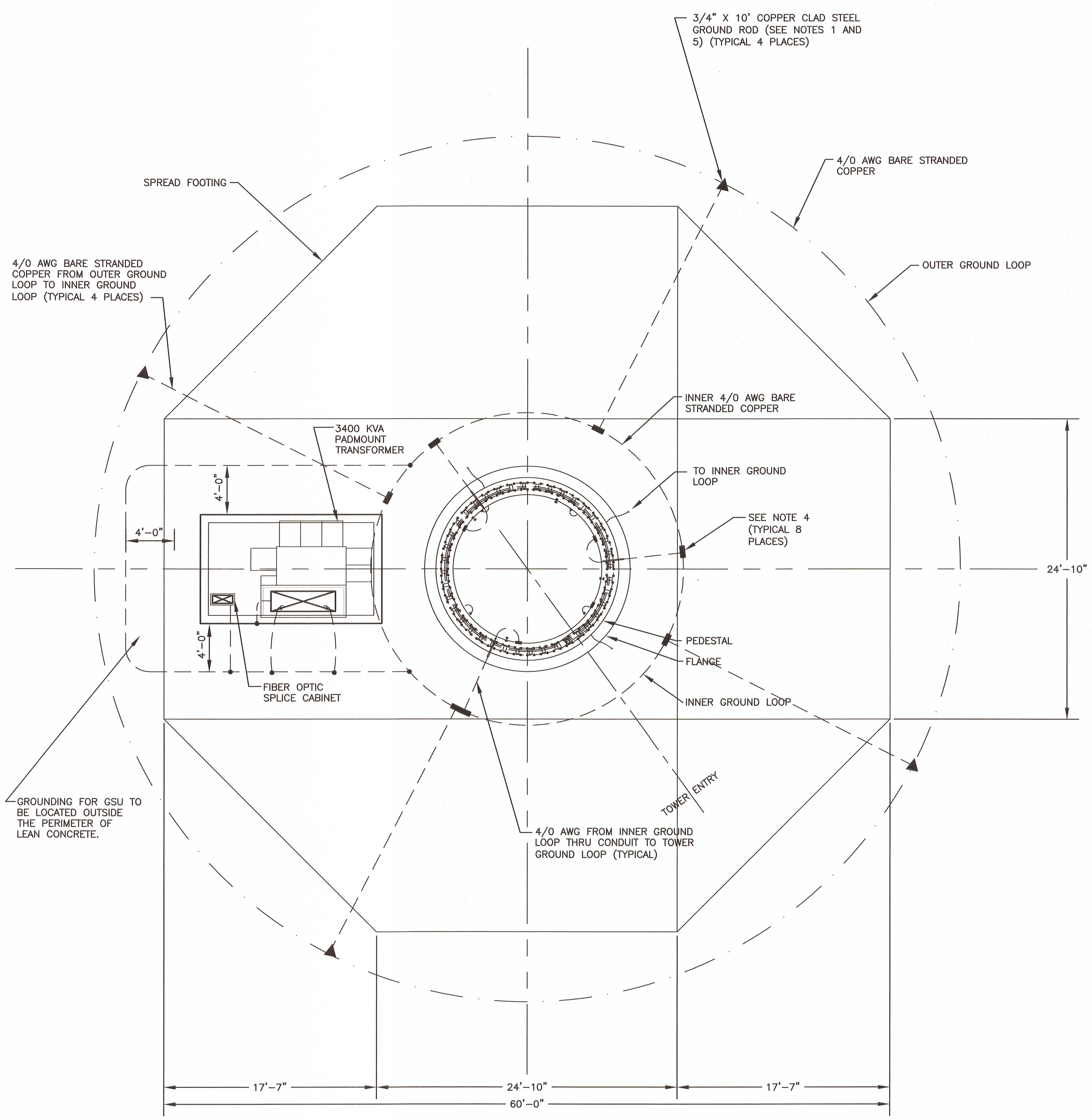
BISON WIND GENERATING FACILITY NEW SALEM, ND

MINNESOTA POWER/BISON 1 WIND PROJECT
SWITCH CABINET & F.O. SPLICE CABINET CONDUIT DETAILS – PHASE 1B

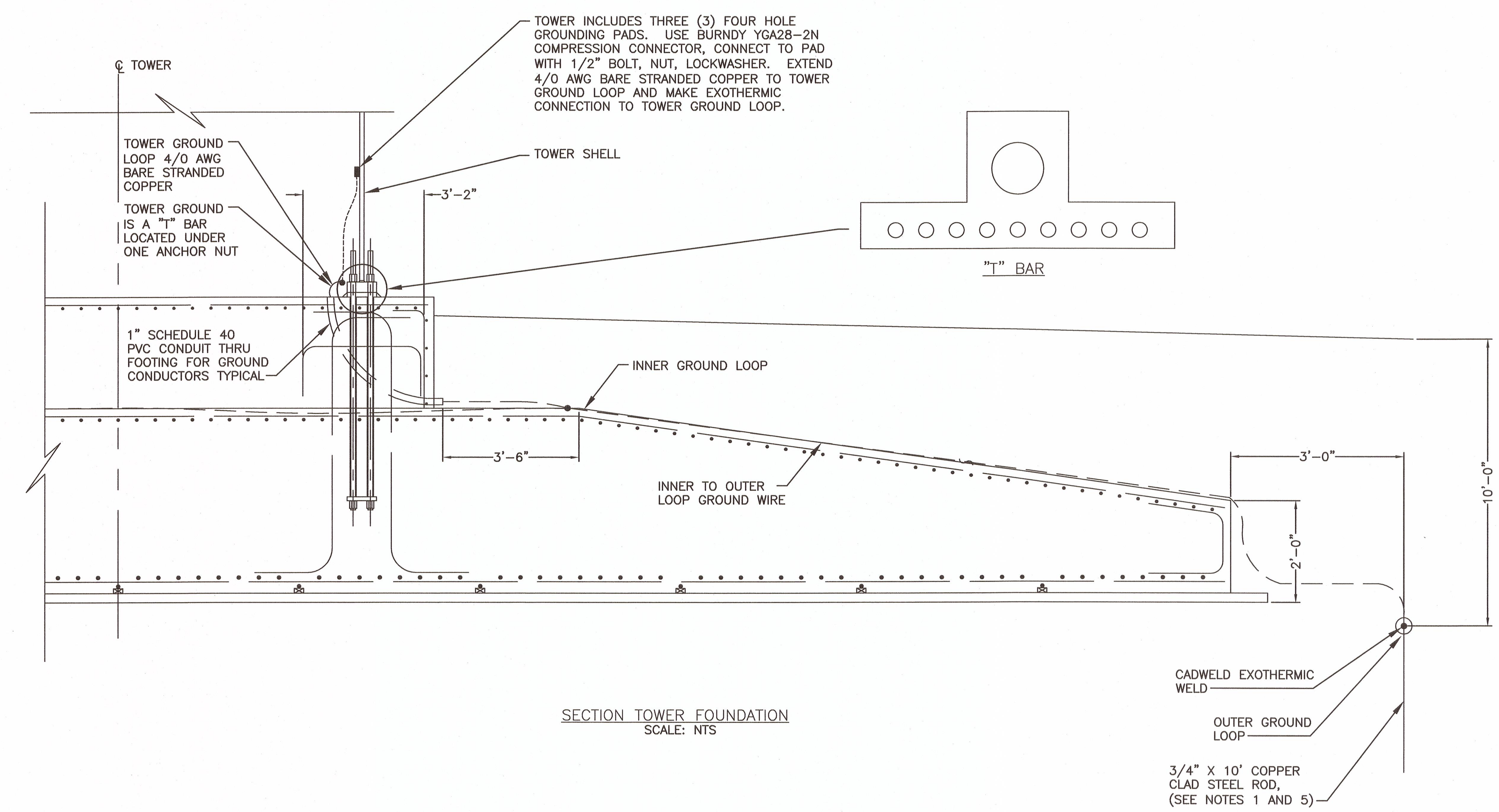
SHEET . REV. 1
165233-1-000-E2303

CADD DRAWING – FOR REPRODUCTION ONLY | SCALE: NONE | MICROFILMED / / | BIS | CODE .

ImageSite: WIND_PROJECTS



ELECTRICAL GROUND PLAN
SCALE: NTS



SECTION TOWER FOUNDATION
SCALE: NTS

NOTES:

1. 3/4" X 10' COPPER CLAD STEEL GROUND ROD. TOP OF ROD 6" ABOVE GROUND GRID. EXOTHERMIC WELD GROUND CONDUCTOR TO ROD WITH CADWELD GYE312Q. CONFIRM WITH ROD USE TYPICAL.
2. GROUND GRID CONDUCTORS. INNER AND OUTER LOOPS, ARE 4/0 AWG BARE STRANDED COPPER.
3. EXOTHERMIC "T" CONNECTION CADWELD TAC2Q2Q TYPICAL.
4. IN ADDITION TO EXOTHERMIC WELD ON SIDE OF GROUND ROD FOR THROUGH GROUND CONDUCTOR, PROVIDE CADWELD GRC-312Q ON TOP END OF ROD FOR CONNECTION TO INNER GROUND RING.
5. 4/0 AWG BARE STRANDED COPPER FROM SWITCHGEAR TO TOWER GROUND LOOP VIA 1" PVC CONDUIT MAKE CONNECTION TO TOWER GROUND LOOP WITH CADWELD TAC2Q2Q EXOTHERMIC WELD.
6. ALL BELOW GRADE GROUND CONNECTIONS SHALL BE EXOTHERMIC.
7. ONCE GROUND GRID IS INSTALLED CONTRACTOR IS RESPONSIBLE FOR VERIFYING THAT THE INSTALLATION IS COMPLIANT WITH THE TURBINE MANUFACTURER'S GROUNDING SPECIFICATIONS.

REGISTERED PROFESSIONAL ENGINEER
KENNETH J. BENOIT
6506
DATE 1-24-12
REV. 1
NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED	NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	1	12-14-11	CONSTRUCTION REVISIONS, W.O.#17480 NO CHANGES	NJG	KJB
.	.	.	.	.	0	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM | DRAWN KDM
CHECKED JCR | DATE 12/17/10
B&V PROJECT DRAWING NUMBER

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SIGNED SIGNATURE ON FILE CHRIS NAGARAH
DATE 3/14/11 REG NO. 6478

minnesota power

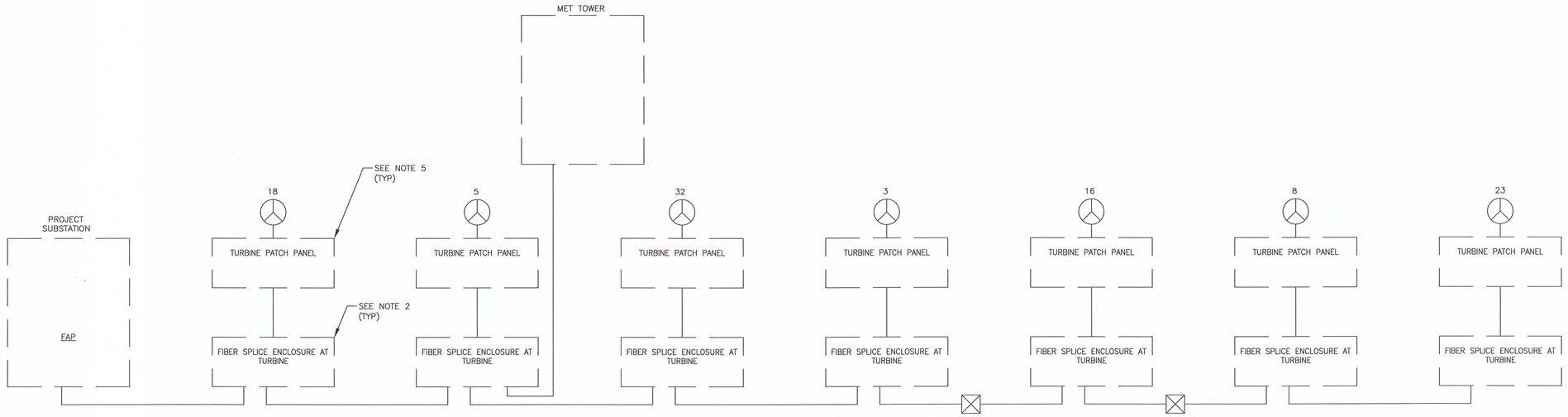
BISON WIND
GENERATING FACILITY
NEW SALEM, ND

MINNESOTA POWER
BISON 1 WIND PROJECT
GROUNDING DETAILS – PHASE 1B

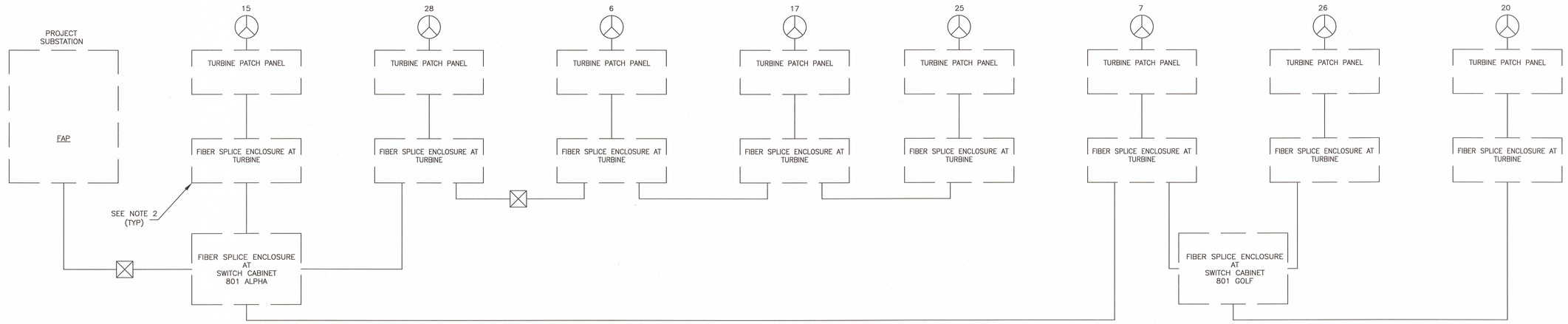
SHEET . REV. 1
165233-1-000-E2501

CADD DRAWING – FOR REPRODUCTION ONLY
SCALE: NONE
MICROFILMED / /
CODE BIS . .

ImageSite: WIND_PROJECTS



CIRCUIT 800



CIRCUIT 801

NOTES:

1. THIS DRAWING REPRESENTS THE INTENDED ROUTING AND TERMINATION OF THE FIBER OPTIC COMMUNICATION. CONTRACTOR INSTALLATION SHALL BE IN COMPLIANCE WITH THE TURBINE MANUFACTURER REQUIREMENTS.
2. FIBER SPLICE ENCLOSURES TO BE LOCATED NEXT TO TURBINE GSU. SEE DWGS E2300 AND 2301 FOR DETAILS.
3. ALL FIBER TO BE SINGLE MODE.
4. FIBER ACCESS PANEL TO BE LOCATED IN SUBSTATION COMMUNICATIONS PANEL IN THE CONTROL BUILDING.
5. FIBER PATCH PANEL TO BE INSTALLED IN THE RESERVED SPACE IN THE A2 CUBICLE LOCATED IN THE LOWER LEVEL OF THE TURBINE TOWER.
6. MINNESOTA POWER TO SPECIFY MANUFACTURER AND PART NUMBERS FOR FIBER PATCH PANELS AND ASSOCIATED EQUIPMENT UNLESS NOTED OTHERWISE. EQUIPMENT AND INSTALLATION SHALL COMPLY WITH THE TURBINE MANUFACTURER SPECIFICATIONS.
7. A HANDHOLE SHALL BE LOCATED IN THE MIDDLE OF ANY RUN EXCEEDING 4,000 FT. AND/OR ANY TURN OVER 30°. A MINIMUM OF 100 FEET OF FIBER OPTIC CABLE MUST BE LEFT IN EACH HANDHOLE.
8. REFER TO DRAWING E0101 FOR FIBER OPTIC CABLE SCHEDULE.
9. A MINIMUM OF 50 FEET OF EACH FIBER OPTIC CABLE SHOULD BE LEFT AT EXTERNAL SPLICE ENCLOSURE WHEN PULLING/BLOWING IN FIBER.
10. A MINIMUM OF 30 FEET OF EACH FIBER OPTIC CABLE MUST BE STORED IN THE OUTDOOR FIBER SPLICE ENCLOSURE AFTER TERMINATION.
11. TRACER WIRES TO TERMINATE IN OUTDOOR FIBER SPLICE ENCLOSURE.

LEGEND:

- WIND TURBINE GENERATOR
- FAP — FIBER ACCESS PANEL TO BE LOCATED IN SUBSTATION. (SEE DWG. E1600)
- UNDERGROUND FIBER CABLE, SINGLE MODE
- HANDHOLE

REGISTERED PROFESSIONAL ENGINEER
KENNETH J. BENOIT
6506
DATE 1-25-12
REV.3
NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
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3	1-25-12	CONSTRUCTION REVISIONS, W.O.#17480 NO CHANGES	NJG	KJB

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
2	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD
1	06-16-10	APPROVED FOR CONSTRUCTION	NEM	SJD
0	12-18-09	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION

ENGINEER	NEM	DRAWN	KDM
CHECKED	JCR	DATE	12-18-09

B&V PROJECT DRAWING NUMBER

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SIGNED CHRIS NAGARAH

DATE 3/16/11 REG. NO. 6478

minnesota power

BISON WIND GENERATING FACILITY NEW SALEM, ND

MINNESOTA POWER/BISON 1 WIND PROJECT
FIBER OPTIC COMMUNICATION SYSTEM
DIAGRAM – CIRCUIT 800 & 801

SHEET . REV. 3

165233-1-000-E2600

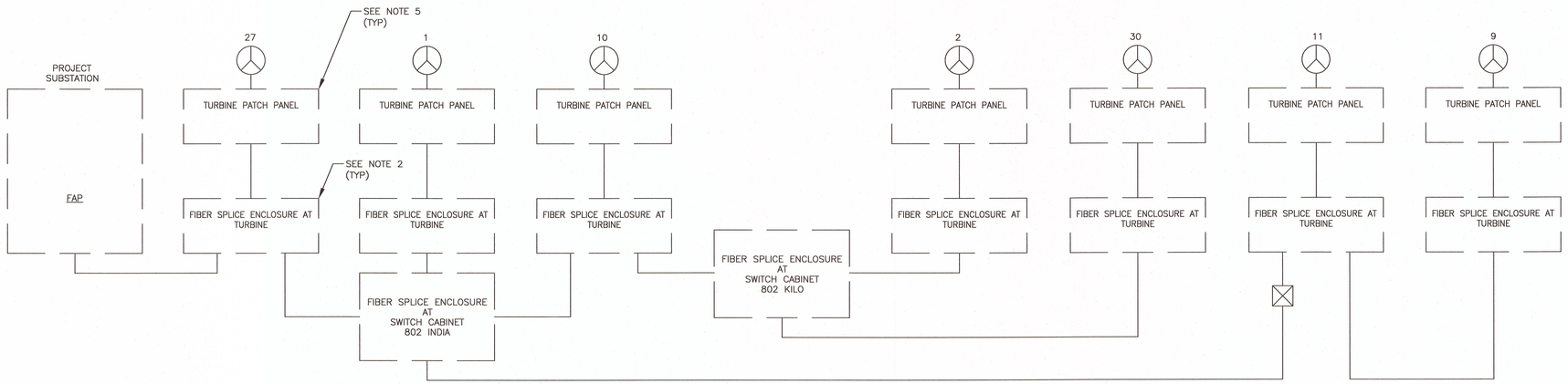
CADD DRAWING – FOR REPRODUCTION ONLY

SCALE: NONE

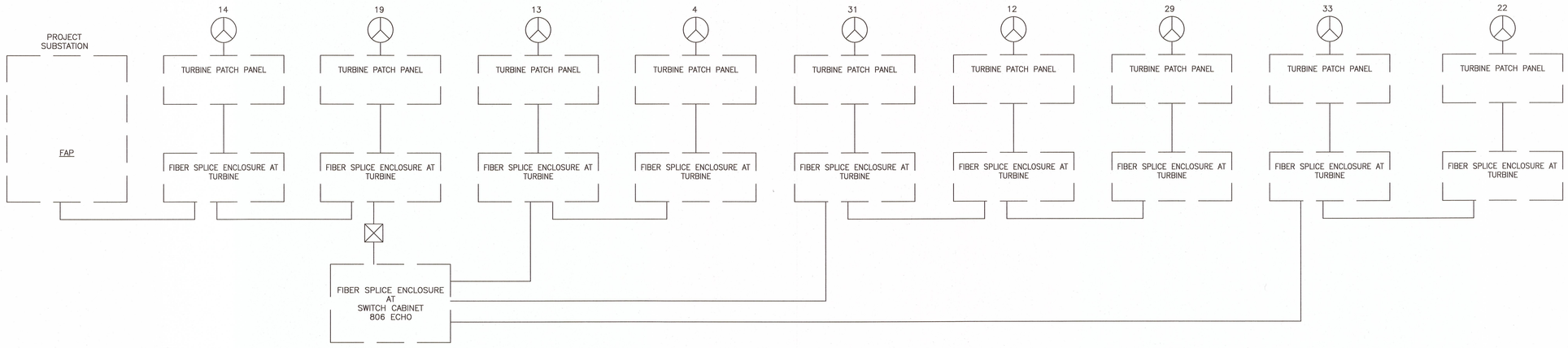
MICROFILMED / /

CODE BIS . .

ImageSite: WIND_PROJECTS



CIRCUIT 802 (1B)



CIRCUIT 806 (1A)

NOTES:

1. THIS DRAWING REPRESENTS THE INTENDED ROUTING AND TERMINATION OF THE FIBER OPTIC COMMUNICATION. CONTRACTOR INSTALLATION SHALL BE IN COMPLIANCE WITH THE TURBINE MANUFACTURER REQUIREMENTS.
2. FIBER SPLICE ENCLOSURES TO BE LOCATED NEXT TO THE TURBINE GSU. SEE DWGS E2300 AND 2301 FOR DETAILS.
3. ALL FIBER TO BE SINGLE MODE.
4. FIBER ACCESS PANEL TO BE LOCATED IN SUBSTATION COMMUNICATIONS PANEL IN THE CONTROL BUILDING.
5. FIBER PATCH PANEL TO BE INSTALLED IN THE RESERVED SPACE IN THE A2 CUBICLE LOCATED IN THE LOWER LEVEL OF THE TURBINE TOWER.
6. MINNESOTA POWER TO SPECIFY MANUFACTURER AND PART NUMBERS FOR FIBER PATCH PANELS AND ASSOCIATED EQUIPMENT UNLESS NOTED OTHERWISE. EQUIPMENT AND INSTALLATION SHALL COMPLY WITH THE TURBINE MANUFACTURER SPECIFICATIONS.
7. A HANDHOLE SHALL BE LOCATED IN THE MIDDLE OF ANY RUN EXCEEDING 4,000 FT. AND/OR ANY TURN OVER 30°. A MINIMUM OF 100 FEET OF FIBER OPTIC CABLE MUST BE LEFT IN EACH HANDHOLE.
8. REFER TO DRAWING E0101 FOR FIBER OPTIC CABLE SCHEDULE.
9. A MINIMUM OF 50 FEET OF EACH FIBER OPTIC CABLE SHOULD BE LEFT AT EXTERNAL SPLICE ENCLOSURE WHEN PULLING/BLOWING IN FIBER.
10. A MINIMUM OF 30 FEET OF EACH FIBER OPTIC CABLE MUST BE STORED IN THE OUTDOOR FIBER SPLICE ENCLOSURE AFTER TERMINATION.
11. TRACER WIRES TO TERMINATE IN OUTDOOR FIBER SPLICE ENCLOSURE.
12. FOR FIBER PANEL INSTALLATION INSIDE WTG REFER TO DWG E2602 FOR DETAILS.

LEGEND:

- WIND TURBINE GENERATOR
- FAP — FIBER ACCESS PANEL TO BE LOCATED IN SUBSTATION. (SEE DWG. E1600)
- UNDERGROUND FIBER CABLE, SINGLE MODE
- HANDHOLE

REGISTERED PROFESSIONAL ENGINEER — KENNETH J. BENOIT 6506 — DATE 1-25-12 — REV.2 — NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
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NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
2	1-15-12	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KJB
1	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD
0	12-18-09	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM | DRAWN KDM
CHECKED JOR | DATE 12-18-09
B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA
SIGNED — CHRIS INGRAHAM
DATE 3/19/11 — REG NO. 6478

minnesota power

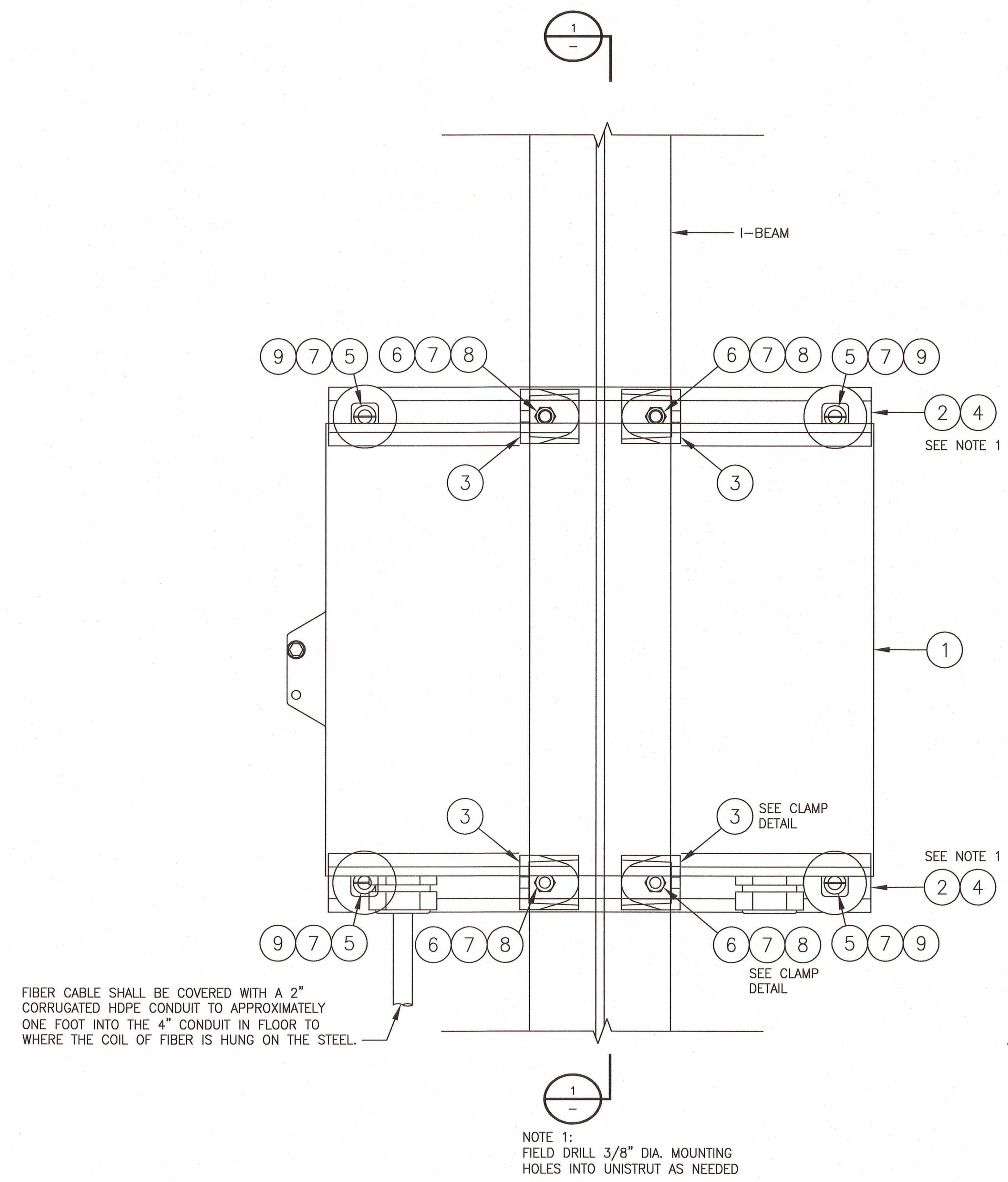
BISON WIND GENERATING FACILITY NEW SALEM, ND

MINNESOTA POWER/BISON 1 WIND PROJECT
FIBER OPTIC COMMUNICATION SYSTEM
DIAGRAM – CIRCUITS 802 & 806

SHEET . | REV. 2
165233-1-000-E2601

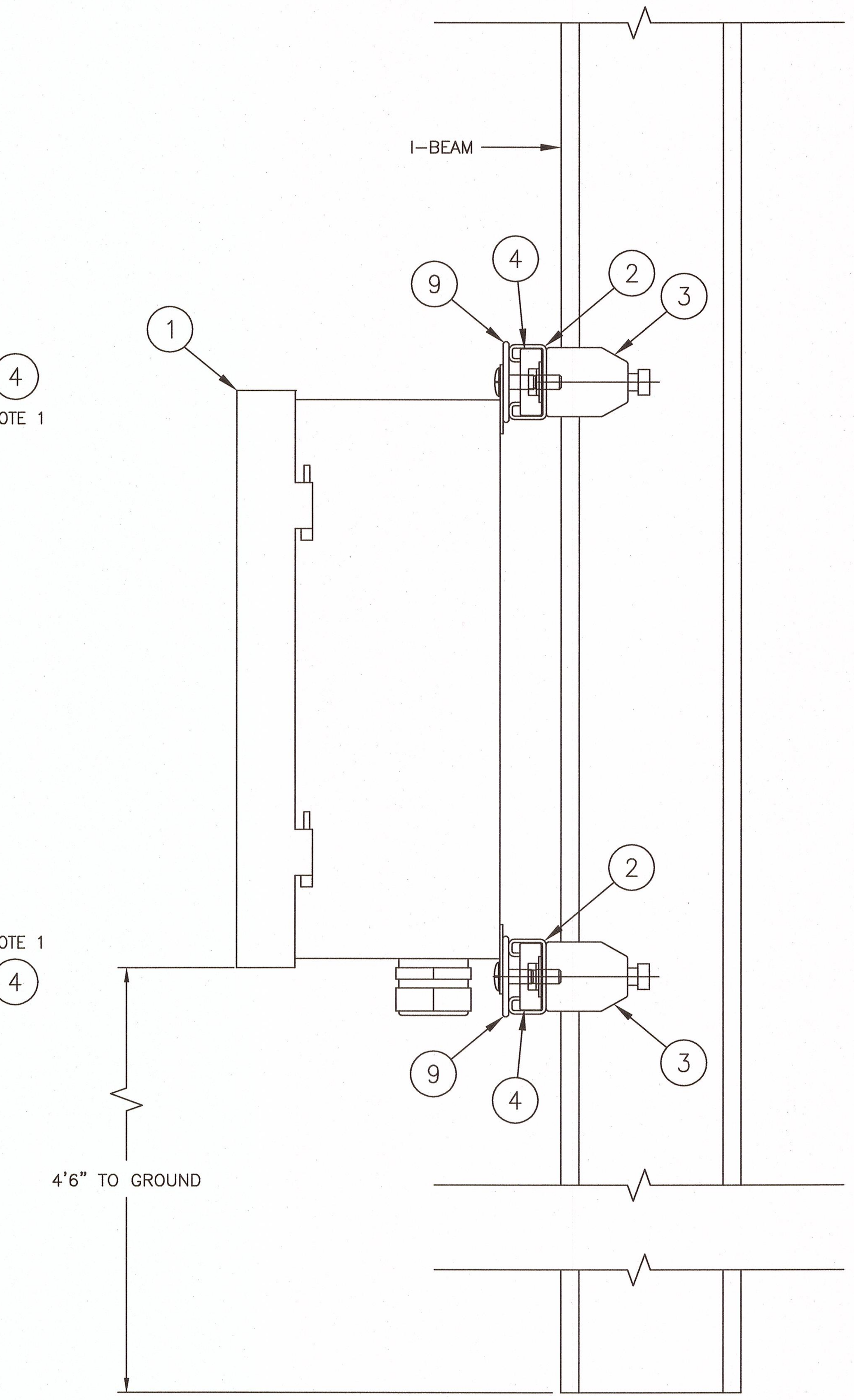
CADD DRAWING – FOR REPRODUCTION ONLY | SCALE: NONE | MICROFILMED / / | CODE BIS . .

ImageSite: WIND_PROJECTS



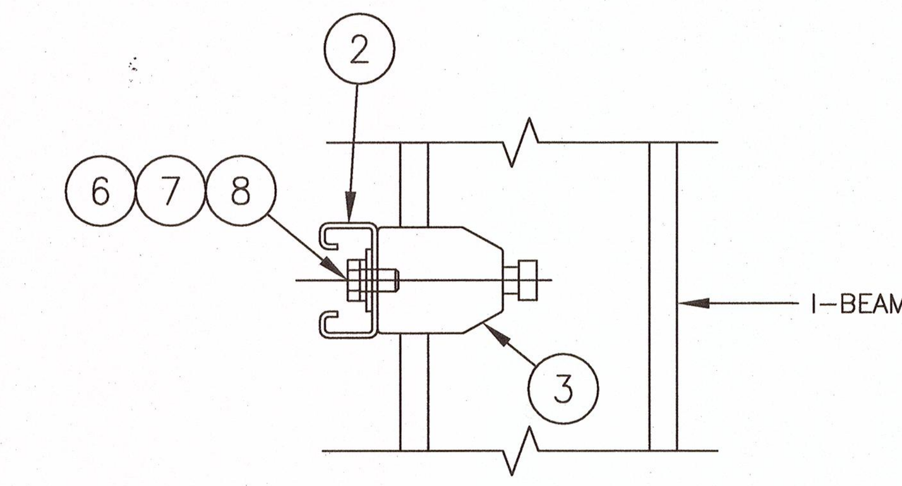
NOTE 1:
FIELD DRILL 3/8" DIA. MOUNTING HOLES INTO UNISTRUT AS NEEDED

ELEVATION
SCALE: NTS



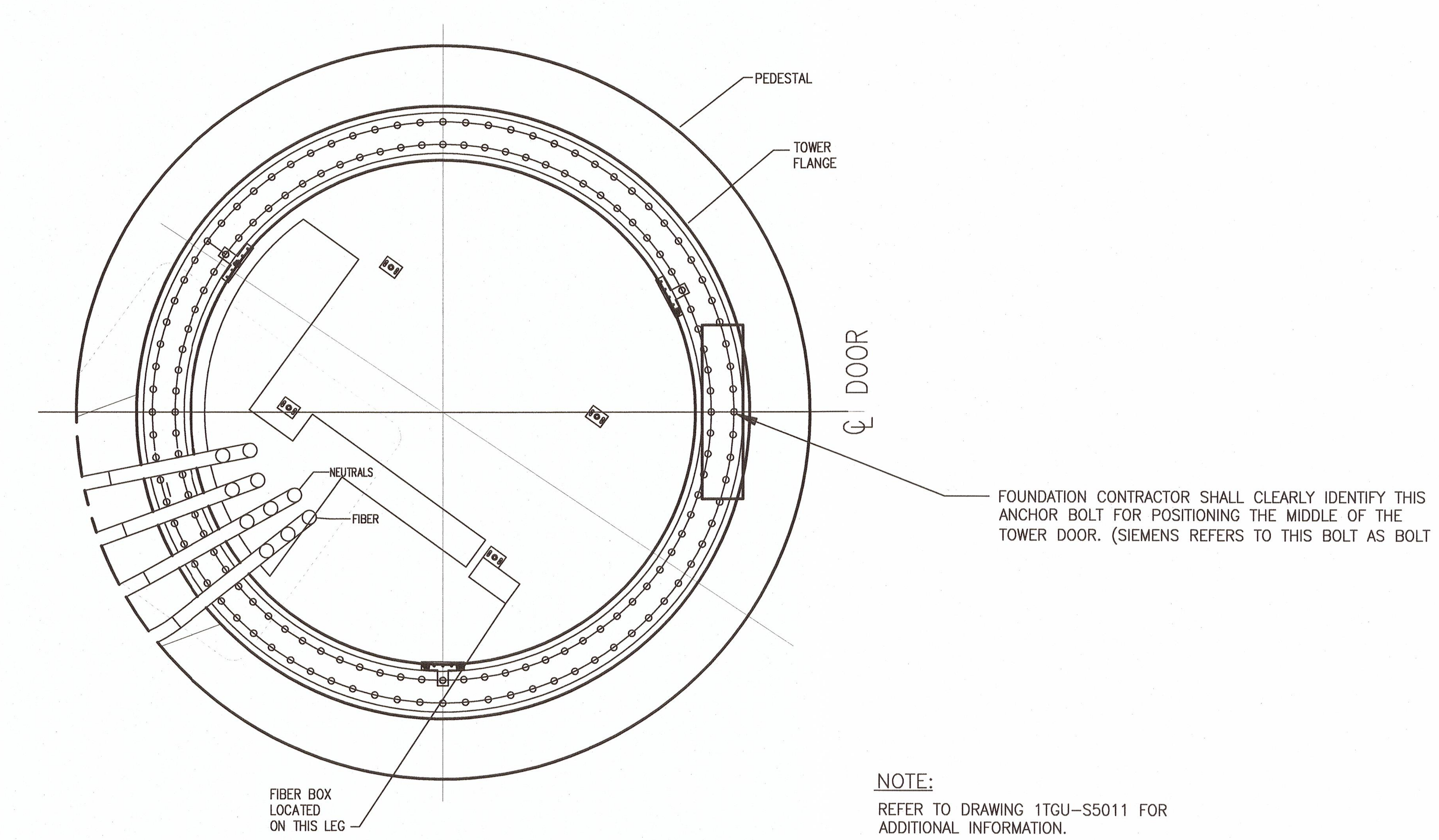
SECTION 1
SCALE: NTS

FIBER PANEL INSTALLATION
(LOCATED IN THE BASE OF WTG)



CLAMP DETAIL

FIBER PANEL BOM					
NO.	QTY	DEVICE	MFGR.	TYPE	PART NO.
1	1	OUTDOOR WALLBOX ASSY	CLEARFIELD	FDS 24	WCZ-024-A1E -ZZ6 150F
2	2	UNISTRUT x 15" LONG	POWERSTRUT		PS 500
3	4	BEAM CLAMP	WESCO	501	78599150954
4	4	UNISTRUT CLAMPING NUT	POWERSTRUT		PS SS
5	4	5/16" x 3/4" ROUNDHEAD MACHINE SCREW	FASTENAL	31161504	27737
6	4	5/16" x 1/2" HEX HEAD BOLTS	FASTENAL	31161561	13051
7	8	5/16" LOCK WASHERS	FASTENAL	31161801	33620
8	4	5/16" FLAT WASHERS	FASTENAL	31161800	33216
9	4	5/16" x 1 3/4"x 1/8" FENDER WASHERS	FASTENAL	31161807	33006



NOTE:
REFER TO DRAWING 1TGU-S5011 FOR ADDITIONAL INFORMATION.

DETAIL 1
SCALE: NTS

KENNETH J. BENOIT 6506 DATE 1-25-12 REV.1 REGISTERED PROFESSIONAL ENGINEER NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED	NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
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					1	1-25-12	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KJB
					0	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM | DRAWN KDM | CHECKED JCR | DATE 02-19-10
B&V PROJECT DRAWING NUMBER

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SIGNED CHRIS NAGARAH (SIGNATURE ON FILE)
DATE 3/14/11 REG NO. 6478

minnesota power

BISON WIND GENERATING FACILITY
NEW SALEM, ND

MINNESOTA POWER
BISON 1B WIND PROJECT
FIBER PANEL INSTALLATION DETAIL

SHEET . | REV. 1
165233-1-000-E2602

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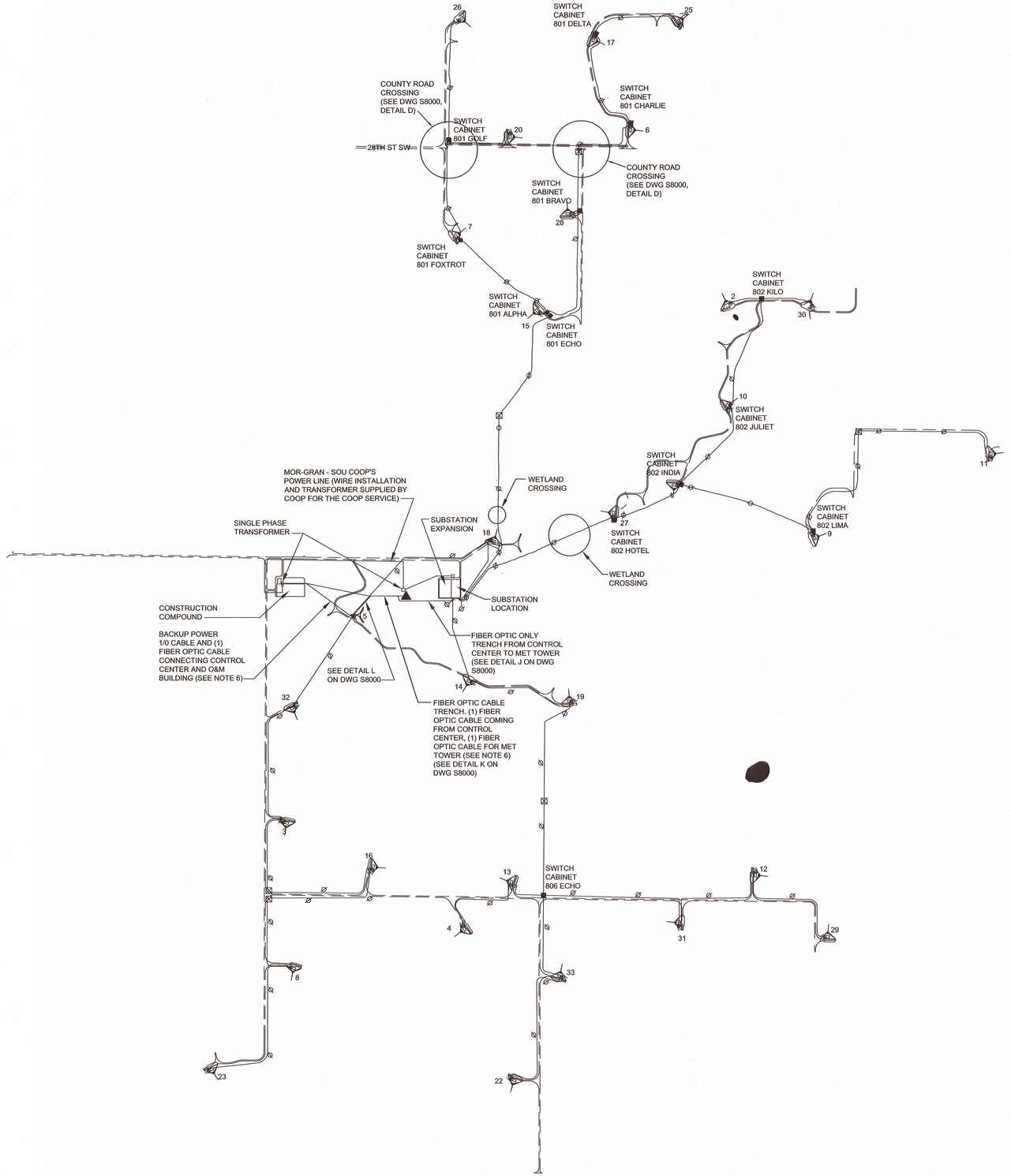
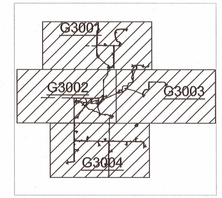
ImageSite: PROJECT_NAME





KEY MAP

LEGEND:

- WIND TURBINE GENERATOR (WTG)
- METEOROLOGICAL TOWER
- GENERATION STEP UP TRANSFORMER (GSU)
- SWITCH CABINET
- WETLANDS
- POWER AND COMMUNICATION CABLES
- ACCESS ROADS
- GROUNDING LOCATION (DISTANCE BETWEEN GROUNDING POINTS SHALL NOT EXCEED 1250 FEET)
- HANDHOLE

NOTES:

1. REFER TO DRAWING S8000 FOR TRENCH DETAILS AND ROAD CROSSINGS.
2. REFER TO DRAWING K3000 FOR PHASE 1A SWITCH CABINET DETAILS AND K3005 FOR PHASE 1B SWITCH CABINET DETAILS.
3. REFER TO DRAWING E2300 FOR PHASE 1A TURBINE & GSU LAYOUT AND E2302 FOR PHASE 1B TURBINE & CABLE LAYOUT.
4. CONTRACTOR TO DETERMINE ALL POWER CABLE AND COMMUNICATION CABLE LENGTHS INCLUDING SPLICING, TERMINATION AND ANY ADDITIONAL SLACK REQUIRED.
5. SEE DRAWING E0100 FOR POWER CABLE SCHEDULE AND E0101 FOR FIBER OPTIC CABLE SCHEDULE.
6. CONTRACTOR SHALL MINIMIZE ADDITIONAL TRENCHING FOR THE FIBER OPTIC CABLE, CONNECTING THE CONTROL CENTER TO THE O&M BUILDING, BY UTILIZING THE EXISTING FIBER ONLY TRENCH BETWEEN WTG 5 & THE MET TOWER AND THE BACK UP POWER TRENCH FROM WTG 5 TO THE O&M BUILDING.

0 1' 2'
1" = 1000'

REGISTERED PROFESSIONAL ENGINEER
KENNETH J. BENOIT
6506
DATE 1-24-12
REV.3
NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
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3	12-14-11	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KJB

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
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1	06-16-10	APPROVED FOR CONSTRUCTION	NEM	SJD
0	12-18-09	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCH DATE 12-18-09
B&V PROJECT DRAWING NUMBER

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SIGNED CHRIS NAGABAH
DATE 3/14/11 REGISTRATION NO. 6478

minnesota power

BISON WIND GENERATING FACILITY
NEW SALEM, ND

MINNESOTA POWER
BISON 1 WIND PROJECT
SITE LAYOUT

SHEET 1 REV. 3
165233-1-000-G3000

CADD DRAWING – FOR REPRODUCTION ONLY

SCALE: AS NOTED

MICROFILMED		CODE		
/	/	BIS	.	.

ImageSite: WIND_PROJECTS

26 TO 801 GOLF							
CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	15.00	491427.73	1708729.36	491455.02	1708690.39	491427.73	1708681.78
2	40.00	491427.73	1708622.02	491427.73	1708643.97	491409.23	1708610.23
3	200.00	491292.68	1708536.47	491339.76	1708565.96	491237.14	1708535.48

20 TO 801 GOLF							
CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	25.00	489317.22	1709551.14	489317.22	1709576.14	489292.22	1709551.14
2	40.00	489117.26	1709532.43	489131.68	1709536.67	489117.50	1709516.08
3	25.00	489128.57	1708482.62	489126.59	1708536.75	489155.75	1708492.07

801 GOLF TO 801 FOXTROT							
CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	200.00	489125.04	1708468.88	489166.53	1708490.12	489078.44	1708468.16
2	300.00	487919.38	1708450.39	487999.78	1708451.62	487849.15	1708489.53
3	300.00	487398.07	1708755.56	487456.48	1708713.47	487348.81	1708720.42
4	--	--	--	--	--	--	--

801 FOXTROT TO 801 ALPHA							
CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	--	--	--	487202.50	1708807.17	487169.76	1708844.96
2	--	--	--	486810.42	1709215.64	486775.13	1709251.30
3	200.00	486314.24	1709752.90	486331.46	1709733.71	486302.46	1709775.82
4	200.00	486104.45	1710160.93	486119.47	1710131.72	486080.88	1710183.81

801 ECHO TO SUBSTATION							
CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	100.00	485599.62	1710096.72	485628.83	1710126.82	485557.67	1710096.46
2	25.00	484699.25	1710091.29	484707.75	1710091.34	484692.55	1710086.08
3	25.00	483891.56	1709463.09	483898.17	1709468.23	483883.20	1709462.96
4	250.00	481297.62	1709489.94	481760.73	1709442.67	481238.26	1709436.60
5	15.00	480357.89	1708772.64	480365.99	1708779.42	480357.89	1708757.15
6	15.00	480357.94	1708703.46	480357.71	1708729.51	480375.74	1708703.46

25 TO 801 DELTA							
CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	--	--	--	--	--	--	--
2	--	--	--	--	--	--	--
3	27.66	491372.90	1713010.83	491400.84	1712974.55	491352.78	1712958.50
4	60.00	491311.45	1712869.60	491336.76	1712912.72	491354.57	1712844.29
5	100.00	491560.74	1712723.27	491509.43	1712753.39	491558.75	1712663.81
6	350.00	491517.80	1711438.37	491524.78	1711647.36	491330.46	1711345.48

801 DELTA TO 801 CHARLIE							
CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	--	--	--	--	--	--	--
2	80.00	491100.92	1711522.90	491160.62	1711339.38	490990.52	1711324.97
3	50.00	490934.56	1711224.65	490944.51	1711242.49	490911.15	1711224.83
4	100.00	490021.27	1711370.60	490038.18	1711367.26	490006.45	1711379.40
5	104.00	489713.54	1711553.42	489755.61	1711528.43	489705.98	1711601.77
6	100.00	489673.16	1711892.85	489681.96	1711833.32	489636.41	1711911.24

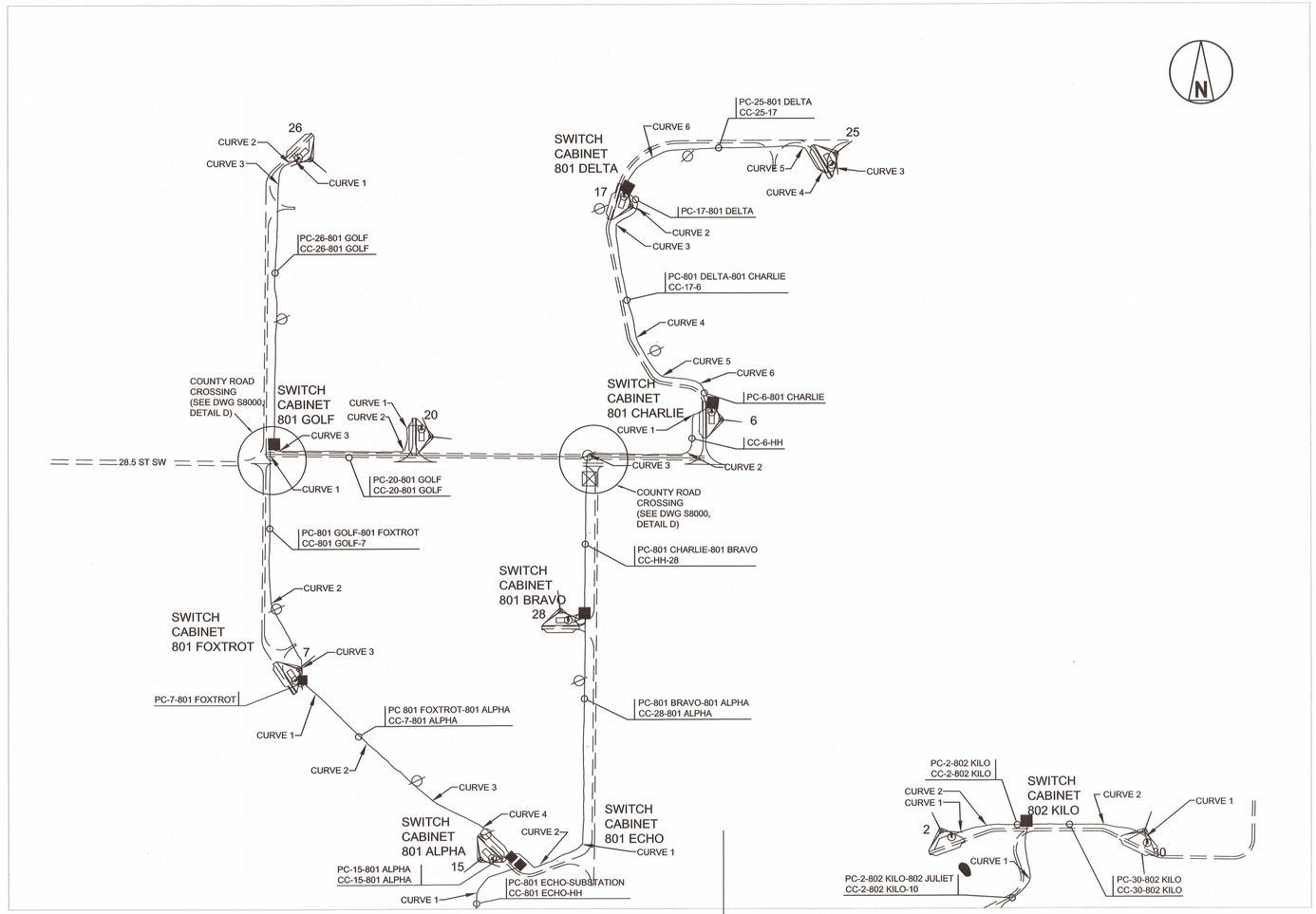
801 CHARLIE TO 801 BRAVO							
CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	40.00	489399.77	1711833.58	489426.42	1711886.34	489370.26	1711833.09
2	100.00	489089.57	1711822.19	489105.95	1711826.63	489089.57	1711708.71
3	50.00	489099.48	1710997.62	489099.72	1711010.02	489065.66	1710992.58

801 BRAVO TO 801 ALPHA							
CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	83.00	485960.87	1710950.60	486008.50	1710950.93	485934.64	1710897.18
2	100.00	4855794.45	1710581.02	485822.99	1710654.99	485840.84	1710510.87

30 TO 802 KILO							
CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	25.00	485996.16	1715418.91	485996.16	1715443.91	486021.16	1715418.91
2	50.00	486122.42	1715122.64	486103.18	1715217.11	486126.71	1715020.40

2 TO 802 KILO							
CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	--	--	--	486061.16	1713942.97	486077.51	1713990.37
2	300.00	486110.81	1714193.19	486109.97	1714182.03	486110.82	1714204.37

802 KILO TO 802 JULIET							
CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	150.00	485624.55	1714491.78	485878.12	1714491.78	485586.86	1714441.36
2	--	--	--	485354.10	1714238.96	485304.10	1714216.92
3	121.00	484770.26	1713979.49	484862.18	1714022.28	484625.49	1713966.82
4	--	--	--	484213.21	1713914.25	484171.16	1713941.54
5	--	--	--	484171.16	1713941.54	484142.85	1713966.18
6	25.00	484118.16	1713974.67	484128.48	1713971.12	484108.54	1713969.52



NOTES:

1. REFER TO DRAWING S8000 FOR TRENCH DETAILS AND ROAD CROSSINGS.
2. REFER TO DRAWING K3000 FOR PHASE 1A SWITCH CABINET DETAILS AND K3005 FOR PHASE 1B SWITCH CABINET DETAILS.
3. REFER TO DRAWING E2300 FOR PHASE 1A TURBINE & GSU LAYOUT AND E2302 FOR PHASE 1B TURBINE & GSU LAYOUT.
4. CONTRACTOR TO DETERMINE ALL POWER CABLE AND COMMUNICATION CABLE LENGTHS INCLUDING SPLICING, TERMINATION AND ANY ADDITIONAL SLACK REQUIRED.
5. SEE DRAWING E0100 FOR POWER CABLE SCHEDULE AND E0101 FOR FIBER OPTIC CABLE SCHEDULE.

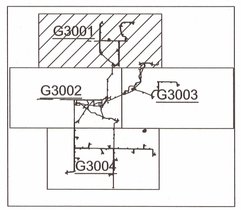
LEGEND:

- WIND TURBINE GENERATOR (WTG)
- METEOROLOGICAL TOWER
- GENERATION STEP UP TRANSFORMER (GSU)
- SWITCH CABINET
- WETLANDS
- POWER AND COMMUNICATION CABLES
- ACCESS ROADS
- GROUNDING LOCATION (CABLE FOOTAGE BETWEEN GROUND POINTS SHALL NOT EXCEED 1250 FEET)
- HANDHOLE

ABBREVIATIONS:

PC POWER CABLE

CC COMMUNICATION CABLE



KEY MAP

0 1" 2"

1" = 500'

POWER CABLE DATA			
CABLE NUMBER	SOURCE EQUIPMENT	DESTINATION EQUIPMENT	CABLE SIZE
PC-26-801 GOLF	26	801 GOLF	1/0
PC-20-801 GOLF	20	801 GOLF	1/0
801 GOLF-801 FOXTROT	801 GOLF	801 FOXTROT	4/0
PC-7-801 FOXTROT	7	801 FOXTROT	1/0
801 FOXTROT-801 ALPHA	801 FOXTROT	801 ALPHA	4/0
PC-15-801 ALPHA	15	801 ALPHA	1/0
PC-25-801 DELTA	25	801 DELTA	1/0
PC-17-801 DELTA	17	801 DELTA	1/0
801 DELTA-801 CHARLIE	801 DELTA	801 CHARLIE	4/0
PC-6-801 CHARLIE	6	801 CHARLIE	1/0
801 CHARLIE-801 BRAVO	801 CHARLIE	801 BRAVO	4/0
PC-28-801 BRAVO	28	801 BRAVO	1/0
801 BRAVO-801 ALPHA	801 BRAVO	801 ALPHA	750 KCMIL
801 ECHO-SUBSTATION	801 ECHO	SUBSTATION	1000 KCMIL CU
PC-30-802 KILO	30	802 KILO	1/0
PC-2-802 KILO	2	802 KILO	1/0

TURBINE	NORTHING	EASTING	LATITUDE	LONGITUDE
2	486030	1713893.72	46.99	-101.52
6	489429	1711987.92	47.00	-101.53
7	487292	1708665.87	47.00	-101.54
15	485865	1710232.06	46.99	-101.54
17	491152	1711288.80	47.01	-101.53
20	489300	1709673.98	47.00	-101.54
25	491402	1712945.55	47.01	-101.52
26	491469	1708697.23	47.01	-101.54
28	487767	1710838.65	47.00	-101.53
30	485979	1715453.34	47.00	-101.51

KENNETH J. BENOIT 6506 DATE 1-25-12 REV.5 REGISTERED PROFESSIONAL ENGINEER NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
.	.	.	.	.
5	1-25-12	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KJB
4	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD
3	06-16-10	APPROVED FOR CONSTRUCTION	NEM	SJD
2	02-19-10	APPROVED FOR CONSTRUCTION	NEM	SJD
1	1-29-10	GENERAL REVISIONS	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCR DATE 02-19-10
B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA.
SIGNED CHRIS NADARAH
DATE 3/14/11 REG. NO. 6478

minnesota power

BISON WIND
GENERATING FACILITY
NEW SALEM, ND

MINNESOTA POWER
BISON 1 WIND PROJECT
FEEDER LAYOUT

SHEET 1 REV. 5
165233-1-000-G3001

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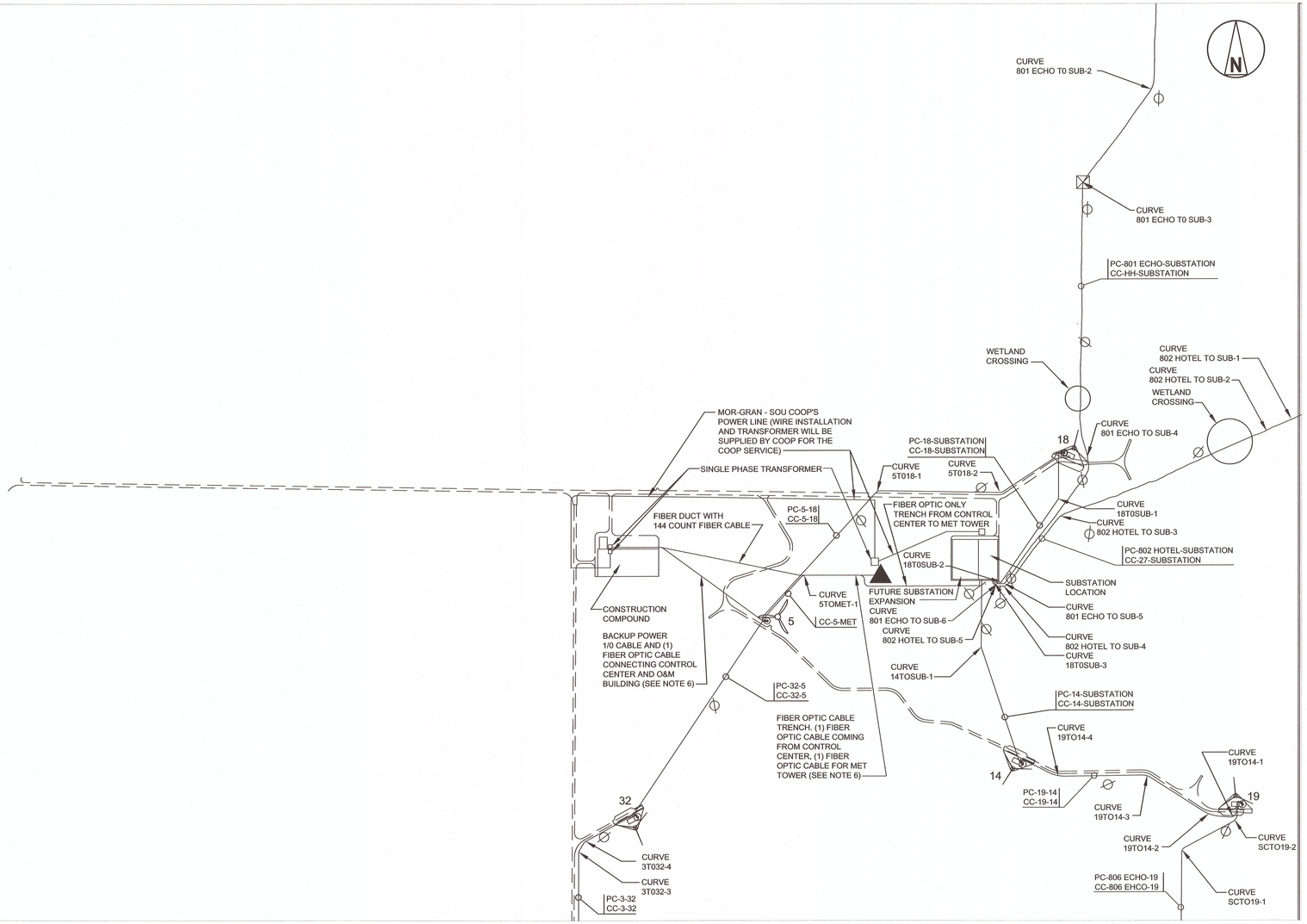
MICROFILMED / /
CODE BIS . .

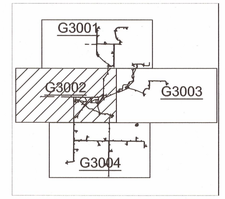
ImageSite: WIND_PROJECTS

G3001



G3003

G3004



KEY MAP

LEGEND:

- WIND TURBINE GENERATOR (WTG)
- METEOROLOGICAL TOWER
- GENERATION STEP UP TRANSFORMER (GSU)
- SWITCH CABINET
- WETLANDS
- POWER AND COMMUNICATION CABLES
- ACCESS ROADS
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ABBREVIATIONS:

PC	POWER CABLE
CC	COMMUNICATION CABLE

NOTES:

1. REFER TO DRAWING S8000 FOR TRENCH DETAILS AND ROAD CROSSINGS.
2. REFER TO DRAWING K3000 FOR PHASE 1A SWITCH CABINET DETAILS AND K3005 FOR PHASE 1B SWITCH CABINET DETAILS.
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4. CONTRACTOR TO DETERMINE ALL POWER CABLE AND COMMUNICATION CABLE LENGTHS INCLUDING SPLICING, TERMINATION AND ANY ADDITIONAL SLACK REQUIRED.
5. SEE DRAWING E0100 FOR POWER CABLE SCHEDULE AND E0101 FOR FIBER OPTIC CABLE SCHEDULE.
6. CONTRACTOR SHALL MINIMIZE ADDITIONAL TRENCHING FOR THE FIBER OPTIC CABLE, CONNECTING THE CONTROL CENTER TO THE O&M BUILDING, BY UTILIZING THE EXISTING FIBER ONLY TRENCH BETWEEN WTG 5 & THE MET TOWER AND THE BACK UP POWER TRENCH FROM WTG 5 TO THE O&M BUILDING

0 1" 2"

1" = 500'

TURBINE	NORTHING	EASTING	LATITUDE	LONGITUDE
5	480029	1706688.96	46.98	-101.55
14	478770	1708934.38	46.97	-101.54
18	481511	1709298.06	46.98	-101.54
19	478413	1710867.20	46.97	-101.53
32	478308	1705550.65	46.97	-101.55

POWER CABLE DATA

CABLE NUMBER	SOURCE EQUIPMENT	DESTINATION EQUIPMENT	CABLE SIZE
801 ECHO-SUBSTATION	801 ECHO	SUBSTATION	1000 KCMIL CU
802 HOTEL-SUBSTATION	802 HOTEL	SUBSTATION	1000 KCMIL
PC-3-32	3	32	4/0
PC-32-5	32	5	750 KCMIL
PC-5-18	5	18	750 KCMIL
PC-18-SUBSTATION	18	SUBSTATION	750 KCMIL
PC-806 ECHO-19	806 ECHO	19	750 KCMIL
PC-19-14	19	14	1000 KCMIL
PC-14-SUBSTATION	14	SUBSTATION	1000 KCMIL

CURVE 5 TO MET TOWER

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
5TOMET-1	50.0000	480435.8134	1707002.6205	480419.2303	1706987.7140	480435.8048	1707024.9185

CURVE SWITCH CABINET TO 19

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
SCTO19-1	50.0000	478021.5049	1710333.8481	477991.7081	1710333.6481	478035.5077	1710360.1505
SCTO19-2	75.0000	478278.5856	1710816.7427	478259.4319	1710780.7650	478319.1935	1710820.2432

CURVE 19 TO 14

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
19TO14-1	50.0000	478297.1483	1710808.3058	478346.9636	1710812.5999	478301.4425	1710758.4905
19TO14-2	300.0000	478316.6573	1710581.9883	478310.2900	1710655.8533	478356.6987	1710519.5923
19TO14-3	125.0000	478673.4012	1710026.0794	478653.1112	1710057.6970	478672.8989	1709988.5148
19TO14-4	300.0000	478662.7973	1709233.0777	478663.7651	1709305.4576	478694.9430	1709168.2207
19TO14-5	20.0000	478814.2194	1708927.5694	478807.8414	1708940.4377	478804.0638	1708917.4138

CURVE 14 TO SUBSTATION

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
14TOSUB-1	25.0000	479798.1887	1708570.1628	479794.2531	1708571.4775	479802.3381	1708570.1899

CURVE 3 TO 32

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
3TO32-1	25.0000	476204.4460	1705290.1500	476179.8026	1705290.1500	476204.8001	1705265.5092
3TO32-2	73.0000	476208.1281	1705033.9221	476207.0941	1705105.8732	476280.0866	1705033.9221
3TO32-3	25.0000	478002.5638	1705033.9221	477995.7341	1705033.9221	478008.4448	1705037.3945
3TO32-4	25.0000	478088.2712	1705084.5272	478082.3896	1705081.0545	478091.5699	1705090.5081

CURVE 5 TO 18

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
5TO18-1	50.0000	481177.1722	1707655.6819	481160.4023	1707640.5105	481176.8534	1707678.2938
5TO18-2	50.0000	481161.7380	1708750.3318	481161.9546	1708734.9644	481170.1904	1708763.1678

CURVE 18 TO SUBSTATION

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
18TOSUB-1	15.0000	481108.9333	1709249.8800	481113.5733	1709249.8800	481105.1038	1709247.2601
18TOSUB-2	15.0000	480366.5479	1708741.9971	480373.0784	1708746.4647	480366.5479	1708734.0846
18TOSUB-3	10.0000	480366.5479	1708680.1246	480366.5479	1708689.7857	480376.2033	1708679.7917

801 ECHO TO SUBSTATION

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	100.00	485599.62	1710096.72	485628.83	1710126.82	485557.67	1710096.46
2	25.00	484699.25	1710091.29	484707.75	1710091.34	484692.55	1710086.08
3	25.00	483891.56	1709463.09	483898.17	1709468.23	483883.20	1709462.96
4	250.00	481297.62	1709489.94	481760.73	1709442.67	481238.26	1709436.60
5	15.00	480357.89	1708772.64	480365.99	1708779.42	480357.89	1708757.15
6	15.00	480357.94	1708703.46	480357.71	1708729.51	480375.74	1708709.46

802 HOTEL TO SUBSTATION

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	250.00	481816.53	1711297.96	481816.53	1711358.73	481788.63	1711243.97
2	50.00	481702.54	1711077.36	481703.34	1711078.89	481701.86	1711075.77
3	15.00	480954.52	1709262.76	480987.15	1709337.96	480925.28	1709238.19
4	15.00	480335.20	1708789.87	480357.41	1708807.97	480335.20	1708755.34
5	15.00	480335.20	1708670.06	480335.20	1708711.30	480365.81	1708670.90

REGISTERED PROFESSIONAL ENGINEER
KENNETH J. BENOIT
6506
DATE 1-24-12
REV.2
NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
2	1-11-12	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KJB
1	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD
0	12-18-09	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCR DATE 02-19-10
B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA.
SIGNED CHRIS NAGARAH
DATE 3/14/11 REG. NO. 6478

minnesota power

BISON WIND
GENERATING FACILITY
NEW SALEM, ND

MINNESOTA POWER
BISON 1 WIND PROJECT
FEEDER LAYOUT

SHEET 1 REV. 2
165233-1-000-G3002

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CODE BIS . .

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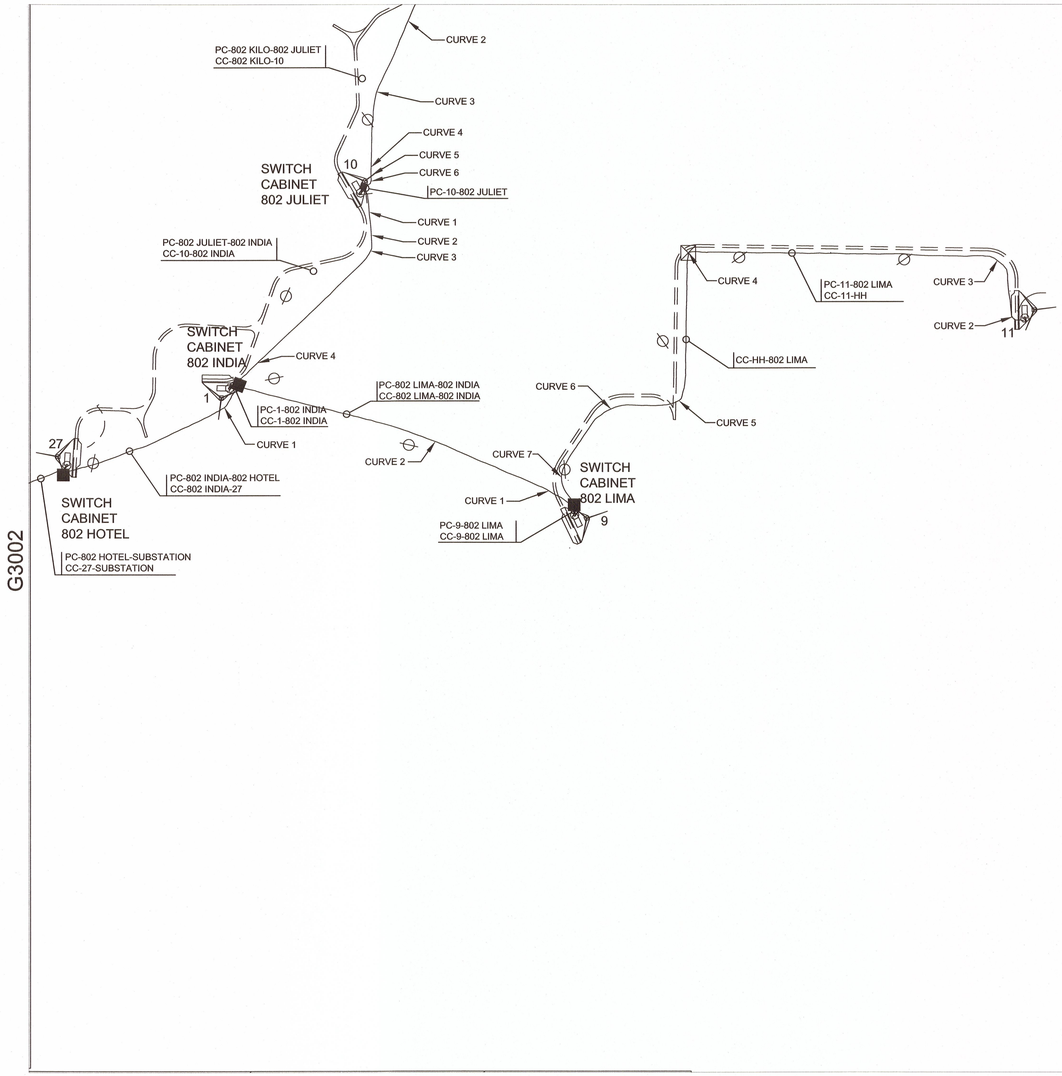

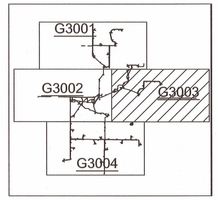

KEY MAP

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- WIND TURBINE GENERATOR (WTG)
- METEOROLOGICAL TOWER
- GENERATION STEP UP TRANSFORMER (GSU)
- SWITCH CABINET
- WETLANDS
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0 1" 2"
1" = 500'

G3004

TURBINE	NORTHING	EASTING	LATITUDE	LONGITUDE
1	482550	1712877.88	46.99	-101.52
9	481586	1715488.41	46.98	-101.51
10	484029	1713869.91	46.99	-101.52
11	483079	1718898.35	46.99	-101.50
21	478897	1720310.17	46.98	-101.49
24	479057	1717426.82	46.98	-101.51
27	481965	1711645.57	46.98	-101.53

POWER CABLE DATA			
CABLE NUMBER	SOURCE EQUIPMENT	DESTINATION EQUIPMENT	CABLE SIZE
802 KILO-802 JULIET	802 KILO	802 JULIET	4/0
PC-10-802 JULIET	10	802 JULIET	1/0
802 KILO-802 JULIET	802 KILO	802 JULIET	1/0
802 JULIET-802 INDIA	802 JULIET	802 INDIA	4/0
PC-1-802 INDIA	1	802 INDIA	1/0
PC-11-802 LIMA	11	802 LIMA	1/0
PC-9-802 LIMA	9	802 LIMA	1/0
802 LIMA-802 INDIA	802 LIMA	802 INDIA	4/0
802 INDIA-802 HOTEL	802 INDIA	802 HOTEL	1000 KCMIL
PC-27-802 HOTEL	27	802 HOTEL	1/0
802 HOTEL-SUBSTATION	802 HOTEL	SUBSTATION	1000 KCMIL

802 KILO TO 802 JULIET

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	150.00	485624.55	1714491.78	485878.12	1714491.78	485586.86	1714441.36
2	--	--	--	485354.10	1714238.96	485304.10	1714216.92
3	121.00	484770.26	1713979.49	484862.18	1714022.28	484625.49	1713966.82
4	--	--	--	484213.21	1713914.25	484171.16	1713941.54
5	--	--	--	484171.16	1713941.54	484142.85	1713966.18
6	25.00	484118.16	1713974.67	484128.48	1713971.12	484108.54	1713969.52

802 JULIET TO 802 INDIA

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	100.00	483901.57	1713946.53	483924.23	1713912.77	483861.79	1713954.90
2	280.00	483551.15	1714020.25	483818.77	1713963.95	483488.56	1713754.04
3	66.00	483579.34	1713958.86	483695.33	1713952.48	483515.76	1713896.15
4	50.00	482739.68	1713070.02	482747.98	1713072.96	482732.88	1713064.42

11 TO 802 LIMA

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	--	--	--	--	--	--	--
2	65.00	483063.25	1718801.55	483063.53	1718832.12	483096.65	1718798.57
3	200.00	483553.07	1718778.01	483362.91	1718784.35	483556.21	1718587.77
4	100.00	483594.12	1716298.11	483592.44	1716399.76	483492.45	1716298.11
5	75.00	482424.44	1716298.11	482499.44	1716298.11	482424.44	1716223.11
6	210.00	482424.44	1715706.12	482424.44	1715818.05	482331.51	1715643.71
7	150.00	481891.17	1715348.03	481949.71	1715387.34	481823.55	1715368.02

802 LIMA TO 802 INDIA

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	100.00	481763.22	1715295.65	481763.22	1715315.95	481771.13	1715276.97
2	150.00	482137.67	1714411.05	482136.32	1714414.23	482138.86	1714407.81

802 INDIA TO 802 HOTEL

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	25.00	482416.50	1712853.52	482430.00	1712861.20	482398.50	1712826.49

802 HOTEL TO SUBSTATION

CURVE	RADIUS	P.I. NORTHING	P.I. EASTING	B.C. NORTHING	B.C. EASTING	E.C. NORTHING	E.C. EASTING
1	250.00	481816.53	1711297.96	481816.53	1711358.73	481788.63	1711243.97
2	50.00	481702.54	1711077.36	481703.34	1711078.89	481701.86	1711075.77
3	15.00	480954.52	1709262.76	480987.15	1709337.96	480925.28	1709238.19
4	15.00	480335.20	1708789.87	480357.41	1708807.97	480335.20	1708755.34
5	15.00	480335.20	1708670.06	480335.20	1708711.30	480365.81	1708670.90

KENNETH J. BENOIT 6506 REGISTERED PROFESSIONAL ENGINEER NORTH DAKOTA
DATE 1-25-12
REV.5

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
.	.	.	.	.
5	1-25-11	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KJB
4	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD
3	06-16-10	APPROVED FOR CONSTRUCTION	NEM	SJD
2	02-19-10	APPROVED FOR CONSTRUCTION	NEM	SJD
1	1-29-10	GENERAL REVISIONS	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCR DATE 02-19-10
B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA.
SIGNED CHRIS NAGARAH
DATE 3/14/11 REGISTRATION NO. 6478

minnesota power

BISON WIND GENERATING FACILITY NEW SALEM, ND

MINNESOTA POWER BISON 1 WIND PROJECT FEEDER LAYOUT

SHEET 1 REV. 5
165233-1-000-G3003

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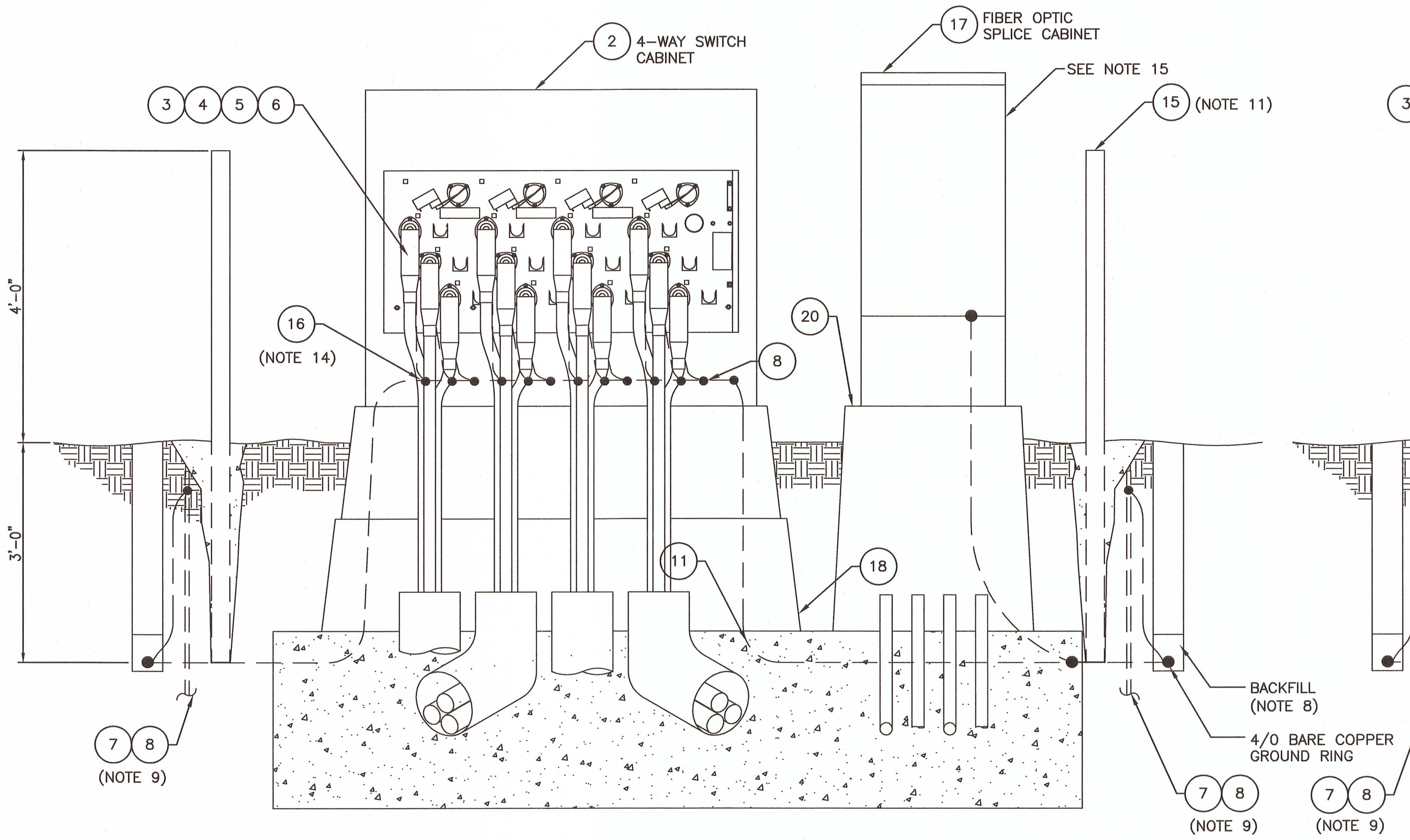
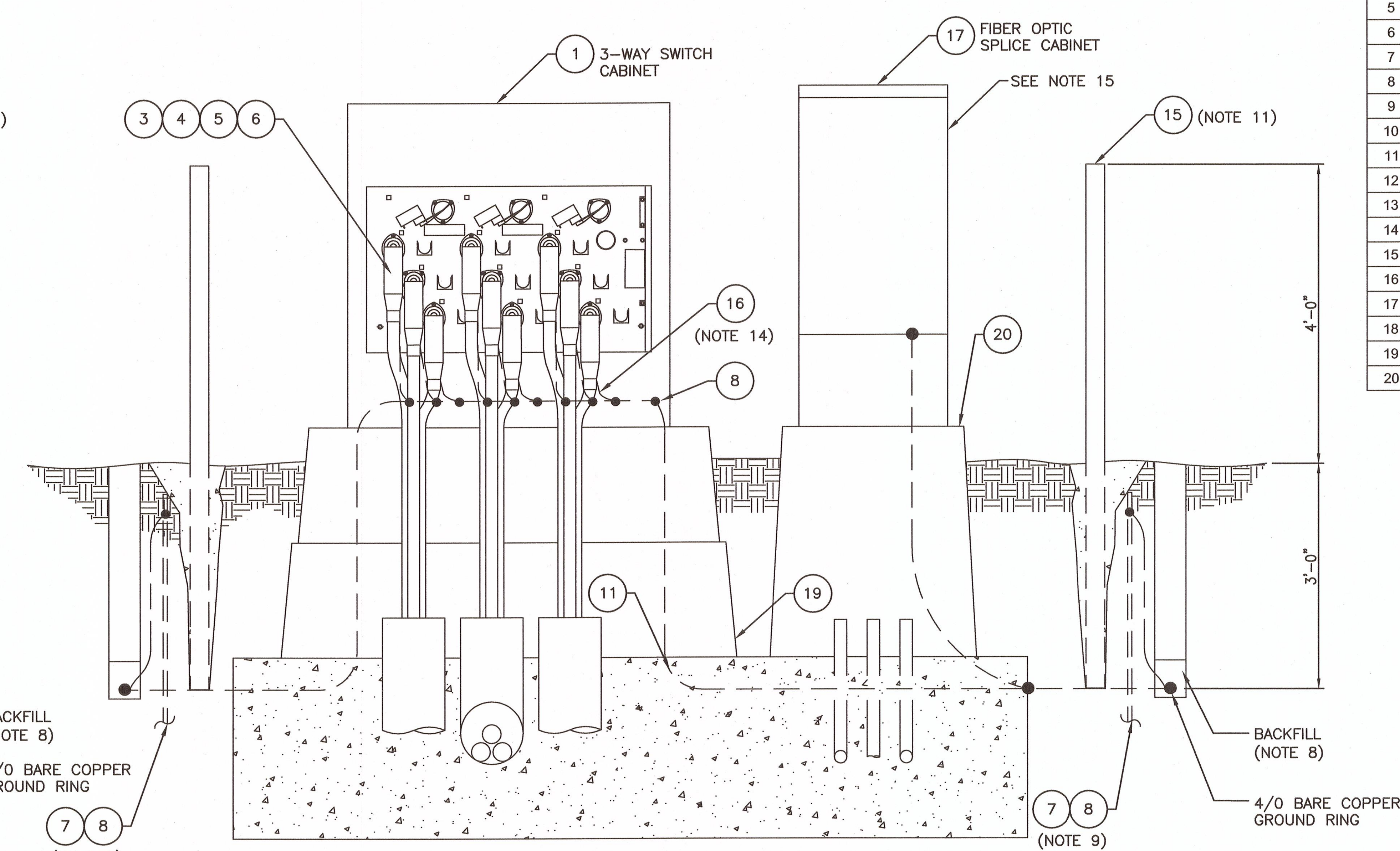
ImageSite: WIND_PROJECTS

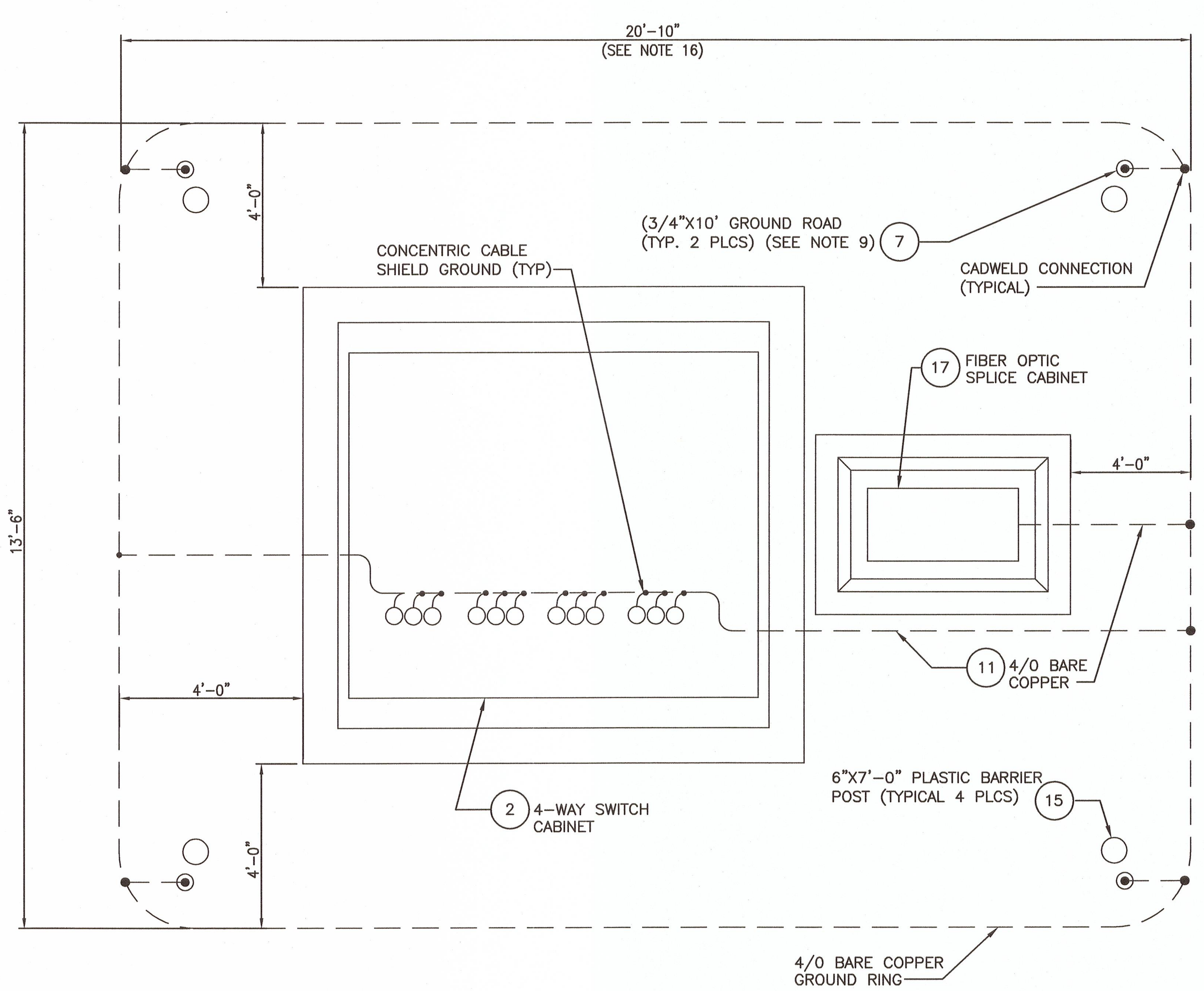


ELEVATION
4-WAY SWITCH CABINET

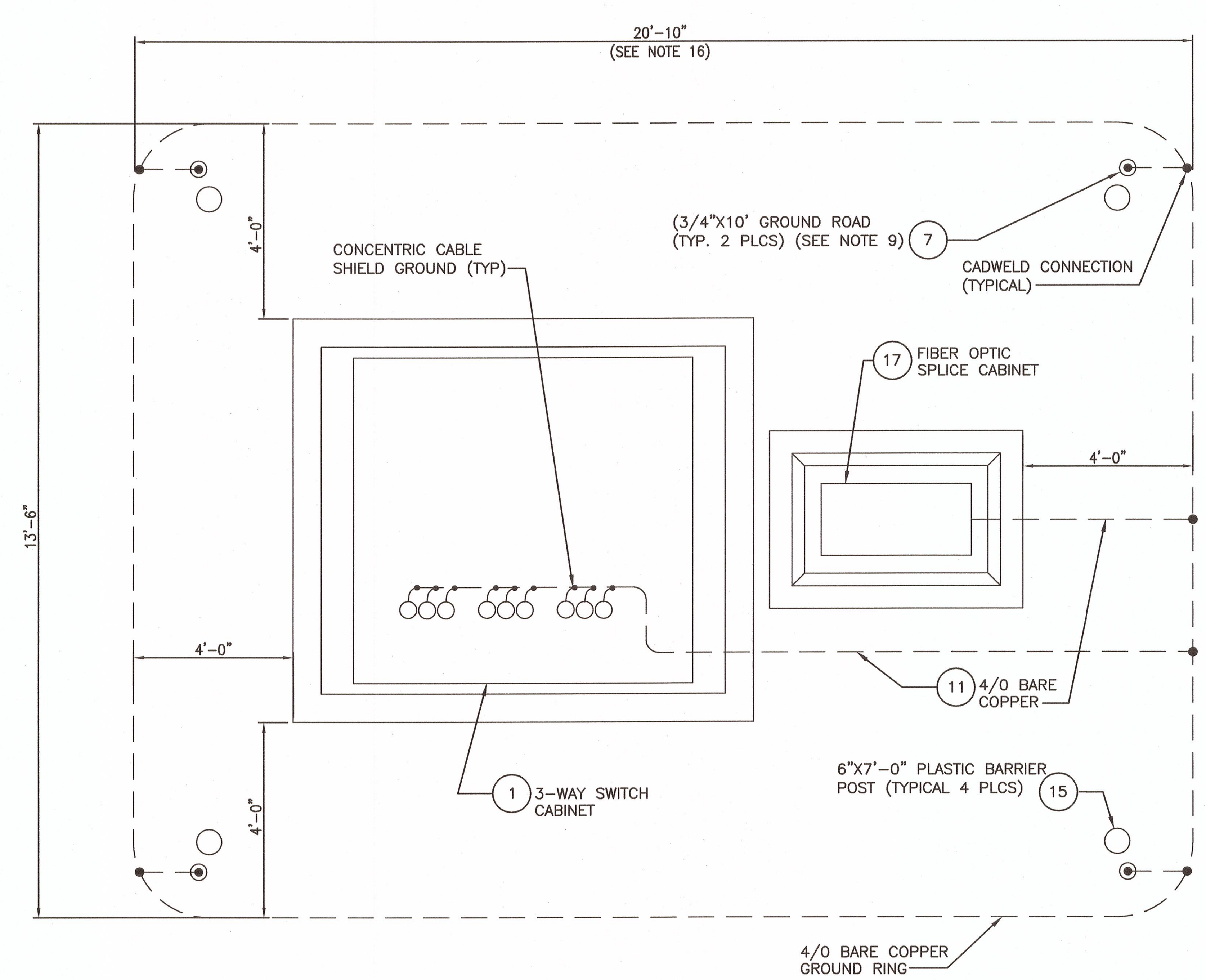


ELEVATION
3-WAY SWITCH CABINET

BILL OF MATERIAL					
ITEM	QTY. PER BOX	EA/FT	MANUFACTURER	CATALOG #	DESCRIPTION
1	1	EA	G & W ELECTRIC CO.	SPRAM 33-396F-40P1	38KV PADMOUNT PUFFER GAS 3-WAY SWITCH W/ 20" CABLE COMPARTMENT
2	1	EA	G & W ELECTRIC CO.	SPRAM 44-396F-40P1	38KV PADMOUNT PUFFER GAS 4-WAY SWITCH W/ 27" CABLE COMPARTMENT
3	1	EA	COOPER POWER SYSTEMS	TP635H13C	600A, 35KV, DEADBREAK CONNECTOR FOR 1/0 AL.
4	1	EA	COOPER POWER SYSTEMS	TP635L16C	600A, 35KV, DEADBREAK CONNECTOR FOR 4/0 AL.
5	1	EA	COOPER POWER SYSTEMS	TP635S25C	600A, 35KV, DEADBREAK CONNECTOR FOR 750 AL.
6	1	EA	COOPER POWER SYSTEMS	TP635U27C	600A, 35KV, DEADBREAK CONNECTOR FOR 1000 AL.
7	4	EA	BLACKBURN-DE*		GROUND ROD, 3/4" X 10'
8	4	EA	ANDERSON-DE	GC-103-01	GROUND ROD CLAMP FOR CADWELD
9	AS REQ'D.	EA			SPLIT BOLT
10	AS REQ'D.	EA		YA28-2N	4/0 AWG COPPER TO 2 HOLE COMPRESSION LUG
11	AS REQ'D.	FT			4/0 AWG BARE COPPER GROUND WIRE
12	1	LOT			PHASE AND DESIG. TAGS
13	1	EA			SEALANT, FOAM TYPE
14		EA			NOT USED
15	4	EA			PLASTIC POST 6" X 7"
16	AS REQ'D.	EA	POWER DELIVERY PRODUCTS	40-3115-00 0-08	DIRECTIONAL FAULT INDICATOR (SEE NOTE 14)
17	1	EA	EMERSON	OPFOBD7	FIBER OPTIC SPLICE CABINET
18	AS REQ'D	EA	NORDIC FIBERGLASS	GS696536RTEBMG	FIBERGLASS SPLICE CABINET VAULT
19	AS REQ'D	EA	NORDIC FIBERGLASS	GS695636RTEBMG	FIBERGLASS SPLICE CABINET VAULT
20	AS REQ'D	EA	NORDIC FIBERGLASS	GS301830MG	FIBERGLASS SPLICE CABINET VAULT



PLAN
4-WAY SWITCH CABINET



PLAN
3-WAY SWITCH CABINET

NOTES:

1. ALL SWITCHED WAYS EQUIPPED WITH INTERNAL SPRING OPERATORS AND WITH EXTERNAL PROVISIONS FOR PADLOCKING IN ALL POSITIONS.
2. 1/4" STAINLESS STEEL TANK, PAINTED ASA 70 LIGHT GRAY. MILD STEEL ENCLOSURE FINISHED ANSI 70 LIGHT GRAY.
3. SWITCH ELECTRICAL RATINGS MAY BE REDUCED BY THE CHOICE OF ENTRANCES.
4. ENCLOSURE IS DESIGNED PER APPLICABLE SECTIONS OF ANSI/IEEE C37.72 AND C57.12.28 DRAWING IS TYPICAL AND SHOWS OVERALL DIMENSIONS ONLY. CONSTRUCTION DETAILS MAY VARY FROM THOSE DEPICTED.
5. SEE DRAWING E2303 FOR FOUNDATION DETAILS.
6. AREA UNDER THE PAD SHALL BE EXCAVATED TO BELOW THE FROST LINE OR TO A DEPTH NECESSARY TO REACH FIRM, UNDISTURBED MATERIAL, WHICHEVER IS DEEPER.
7. IF FIRM MATERIAL HAS NOT BEEN REACHED WITHIN A DEPTH OF FIVE FEET, EXCAVATE ONE FOOT BEYOND THE PERIMETER OF THE PAD AND BACKFILL THE ENTIRE EXCAVATED AREA WITH CLEAN, NON-EXPANSIVE SOIL, COMPACTED TO 90% OF MAXIMUM DENSITY. SOIL SHALL BE PLACED IN LAYERS NOT MORE THAN 6" THICK BEFORE COMPACTION. MAXIMUM DENSITY AND IN PLACE DENSITY TO BE DETERMINED BY ASTM D-1556 AND D-1557.
8. BACKFILL AROUND GROUND CONDUCTOR WITH 4 INCHES OF WELL COMPACTED SELECT NATIVE FILL WITH NO ROCKS LARGER THAN WHAT WOULD PASS THROUGH A NUMBER 4 SCREEN.
9. A MINIMUM DISTANCE OF TEN FEET SHALL BE MAINTAINED BETWEEN GROUND RODS.
10. DIRECTION OF EXIT FROM BOX IS TO BE DETERMINED BY BOX PLACEMENT AND FIELD REQUIREMENTS FOR EACH.
11. PLASTIC BARRIER POSTS ARE TO BE SET IN A THREE FOOT DEEP, 12 INCH DIAMETER HOLE. THE HOLE SHALL BE FILLED WITH CONCRETE. THE ENTIRE BARRIER POST SHALL BE PLASTIC.
12. NOT USED.
13. SEAL BUSHING AFTER CABLE INSTALLATION TO PREVENT RODENT ENTRY.
14. DIRECTIONAL FAULT INDICATORS TO BE LOCATED AT BASE OF EACH DEAD BREAK CONNECTOR ELBOW.
15. FIBER OPTIC SPLICE ENCLOSURES LOCATED AT SWITCH CABINETS 801 ALPHA, 801 GOLF, 802 INDIA, 802 KILO AND 802 LIMA.
16. CONTRACTOR TO ENSURE MINIMUM 3'-0" SEPARATION BETWEEN SWITCH CABINET & FIBER OPTIC SPLICE ENCLOSURE ALLOW FOR 180 DEGREE OPENING OF BOTH THE FIBER SPLICE ENCLOSURE AND SWITCH CABINET DOORS.

REGISTERED PROFESSIONAL ENGINEER — KENNETH J. BENOIT — 6506 — DATE 1-24-12 — REV.1 — NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
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NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
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1	1-11-12	CONSTRUCTION REVISIONS, W.O.#17480 NO CHANGES	NJG	.
0	03-09-11	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION — ENGINEER NEM — DRAWN KDM — CHECKED JCR — DATE 02-19-10 — B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA.
SIGNED CHRIS NAGARAH
DATE 3/14/11 REG NO. 6478

minnesota power

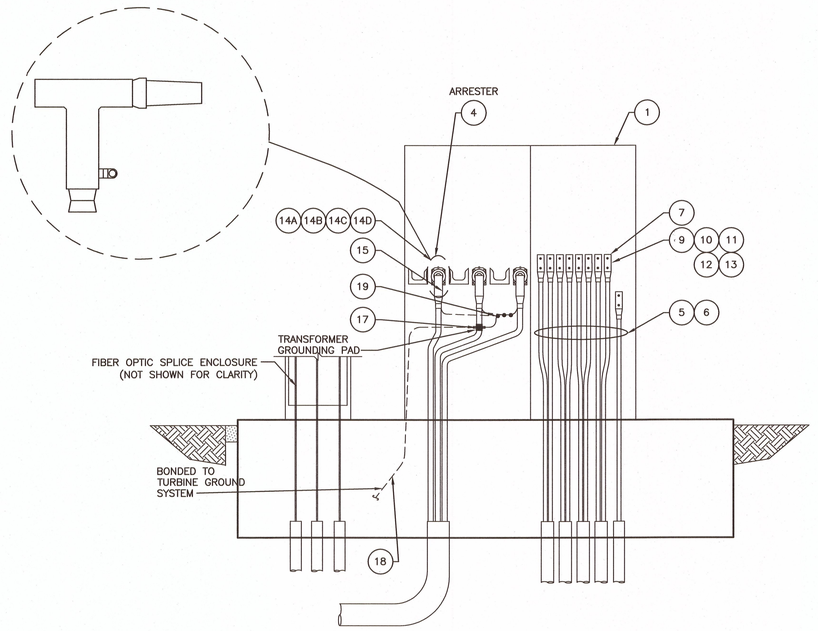
BISON WIND GENERATING FACILITY
NEW SALEM, ND

MINNESOTA POWER/BISON 1 WIND PROJECT
ELECTRICAL COMPONENT & GROUNDING DIAGRAM-SWITCH & F.O. CABINET-PHASE 1B

SHEET 1 — REV. 1
165233-1-000-K3005

CADD DRAWING - FOR REPRODUCTION ONLY — SCALE: NONE — MICROFILMED / / — CODE BIS . .

ImageSite: WIND_PROJECTS



STEP–UP TRANSFORMER – RADIAL LEVEL
N.T.S.

3400KVA RADIAL FEED TRANSFORMER, BOM					
ITEM	QTY. PER BOX	EA/FT	MANUFACTURER	CATALOG #	DESCRIPTION
1	1	EA	SUPPLIED BY MP		3400KVA TRANSFORMER, PAD MOUNT, 34.5KV
2	3	EA			NOT USED
3	3	EA			NOT USED
4	3	EA			ARRESTER, SURGE, 22KV MCOV, ELBOW
5	AS REQ'D.	FT			WIRE, 1000 KCMIL CU, TYPE EPR, 2KV W/ OD < 1.38"
6	AS REQ'D.	FT			WIRE, #4/0 AWG CU, TYPE THHN/THWN (NOT SHOWN) OD < 0.7"
7	60	EA			LUG COMPRESSION, COPPER, 2 HOLE, 1000KCMIL, 8 PER PHASE
8	6	EA			LUG COMPRESSION, COPPER, 2 HOLE, #4/0 AWG (NOT SHOWN)
9	AS REQ'D.	EA			BOLT, 302 OR 316 STAINLESS, 1/2"
10	AS REQ'D.	EA			WASHER, LOCK, STAINLESS STEEL, 1/2"
11	AS REQ'D.	EA			WASHER, STAINLESS, FLAT, ROUND, 1/2"
12	AS REQ'D.	EA			WASHER, BELLEVILLE, 302 OR 316 STAINLESS, 1/2"
13	AS REQ'D.	EA			NUT, ALLOY 650 SILICONE BRONZE, 1/2"
14A	3	EA	COOPER POWER SYSTEMS	TP63513C	600 AMP, 35KV, DEADBREAK CONNECTOR FOR 1/0 AL
14B	3	EA	COOPER POWER SYSTEMS	TP635L16C	600 AMP, 35KV, DEADBREAK CONNECTOR FOR 1/0 AL
14C	3	EA	COOPER POWER SYSTEMS	TP635S25C	600 AMP, 35KV, DEADBREAK CONNECTOR FOR 1/0 AL
14D	3	EA	COOPER POWER SYSTEMS	TP635U27C	600 AMP, 35KV, DEADBREAK CONNECTOR FOR 1/0 AL
15	3	EA			SEAL, CABLE JACKET, COLD SHRINK, SIZED FOR CABLE DIAMETER
16	AS REQ'D.	EA			CABLE CLEANING KIT (NOT SHOWN)
17	4	EA			LUG COMPRESSION, COPPER, 2 HOLE, #2/0 AWG
18	AS REQ'D.	EA			WIRE #2/0 AWG, STRANDED, SOFT DRAWN, BARE CU
19	6	EA			CONNECTOR, 2/0-1/0 TO (SIZE FOR CONCENTRIC NEUTRAL) COMPRESSION TYPE

NOTES:

1. CAULK INTERFACE OF PAD AND BASE OF TRANSFORMER OR INSIDE OF CABINET. ALL CONDUIT ENDS SHALL BE SEALED WITH FOAM AFTER CABLE INSTALLATION.
2. 34.5KV CABLES SHALL BE INSTALLED WITH SUFFICENT SLACK TO ALLOW FOR FUTURE RE–TERMINATION AND BE COILED INSIDE THE GSU VAULT. CONTRACTOR SHALL ENSURE COILED CABLE WILL MEET THE CABLES MINIMUM BENDING RADIUS.

REGISTERED PROFESSIONAL ENGINEER
KENNETH J. BENOIT
6506
NORTH DAKOTA
DATE 1-25-12
REV.1

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
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1	1–11–12	CONSTRUCTION REVISIONS, W.O.#17480	NJG	KJB
0	03–09–11	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM | DRAWN KDM
CHECKED JCR | DATE 02–19–10
B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA
SIGNED CHARLES NAGARAH
DATE 3/14/11 REG NO. 6478

minnesota power

BISON WIND
GENERATING FACILITY
NEW SALEM, ND

MINNESOTA POWER/BISON 1 WIND PROJECT
ELECTRICAL COMPONENT DIAGRAM–
GSU – PHASE 1B

SHEET 1 | REV. 1
165233-1-000-K3006

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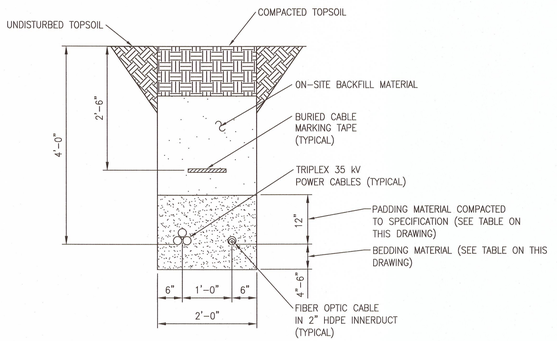
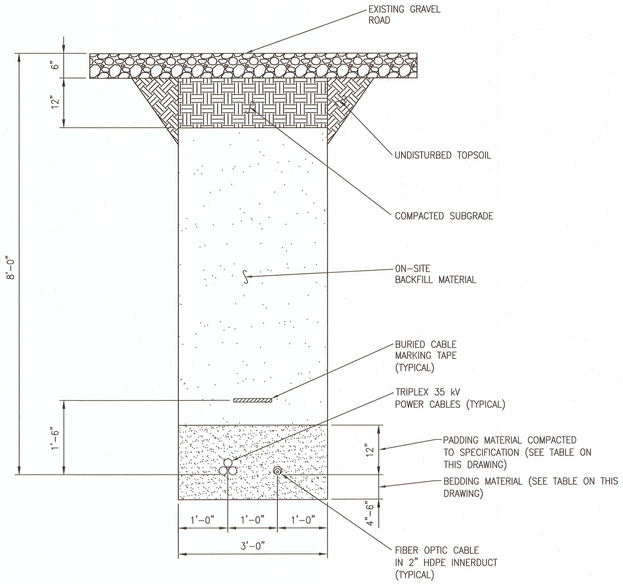
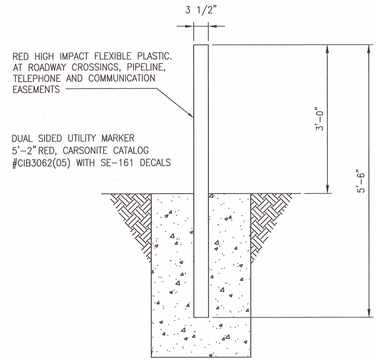


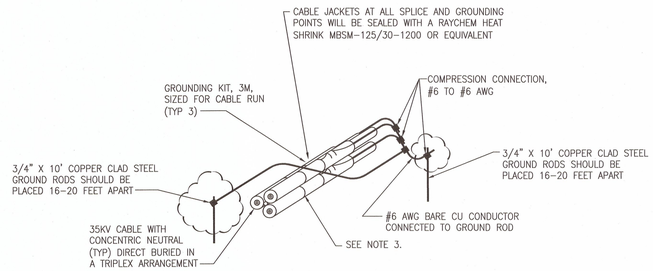
C — TYP. UNDERGROUND TRENCH
SCALE: 1/2" = 1'-0"



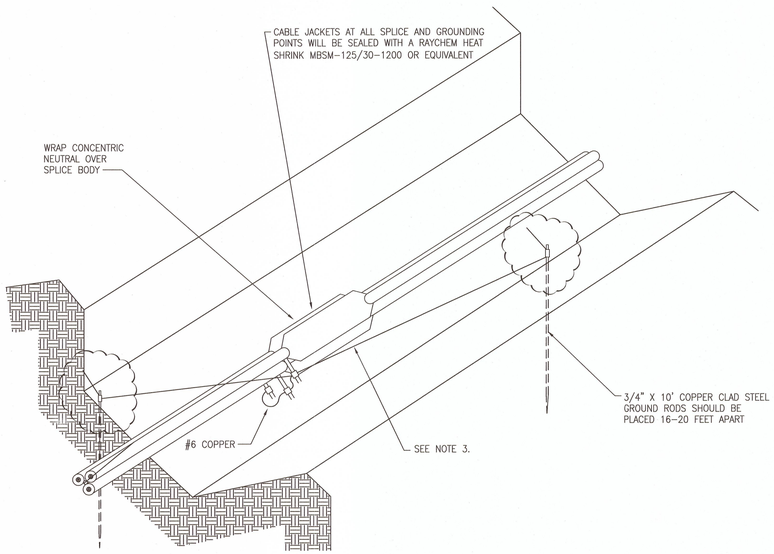
D — GRAVEL ROAD CROSSING
SCALE: 1/2" = 1'-0"



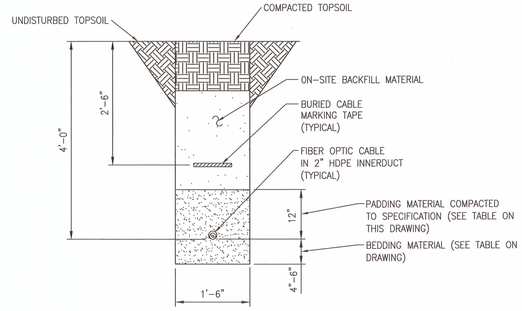
F — UNDERGROUND CABLE MARKER
SCALE: 1/2" = 1'-0"



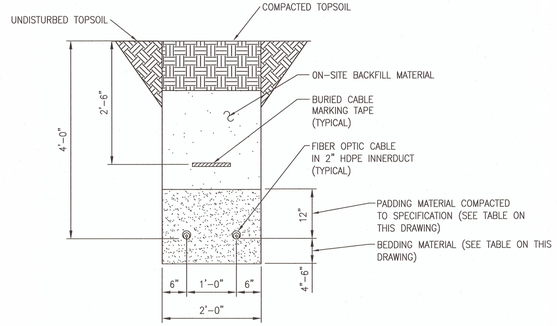
G — TYPICAL CONCENTRIC NEUTRAL GROUNDING NOT AT A SPLICE
N.T.S.



H — TYPICAL CONCENTRIC NEUTRAL GROUNDING AT A SPLICE
SCALE: N.T.S.

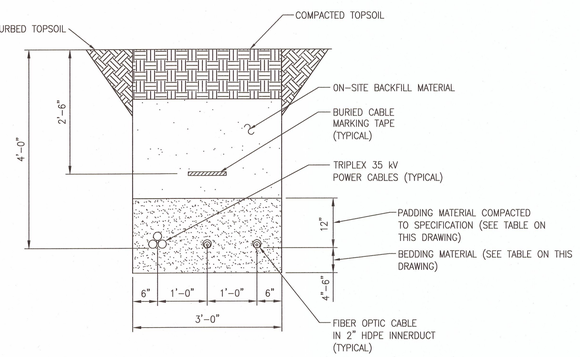


J — FIBER ONLY TRENCH
SCALE: 1/2" = 1'-0"



K — DOUBLE FIBER TRENCH
SCALE: 1/2" = 1'-0"

STRUCTURAL BEDDING, PADDING AND SELECT BACKFILL REQUIREMENTS		
WEIGHT, PASSING PERCENT	SCREEN SIZE	SIZE OF MESH (INCHES)
100	3/8 INCH	0.375
85 TO 100	NO. 4	0.187
10 TO 40	NO. 8	0.094
0 TO 10	NO. 16	0.047
0 TO 5	NO. 50	0.012



L — POWER CABLE AND DOUBLE FIBER TRENCH
SCALE: 1/2" = 1'-0"

NOTES:

1. VIBRATE BEDDING AND SELECT BACKFILL MATERIAL CONTINUOUSLY AND THOROUGHLY THROUGHOUT ITS DEPTH USING VIBRATORY PLATES. DO NOT USE MANUAL TAMPS.
2. TRENCH DEPTH TO BE MAINTAINED AT A MAXIMUM DEPTH OF 4'-4" TO ACHIEVE REQUIRED AMPACITY. IF THE CONTRACTOR DETERMINES THAT A DEPTH OF 4'-4" WILL BE EXCEEDED A THERMAL BACKFILL WILL BE REQUIRED. CONSULT WITH ENGINEER PRIOR TO INSTALL.
3. CABLES SHALL BE GROUNDED AT PADMOUNT TRANSFORMERS, SWITCH CABINETS, SPLICING LOCATIONS AS WELL AS EVERY 1,250 FEET.
4. REFER TO DRAWING E0100 FOR POWER CABLE SCHEDULE AND E0101 FOR FIBER OPTIC CABLE SCHEDULE.

REGISTERED PROFESSIONAL ENGINEER
KENNETH J. BENOIT
6506
DATE 1-24-12
REV.2
NORTH DAKOTA

NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
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NO.	DATE	REVISION DESCRIPTION	BY	APPROVED
2	1-11-12	CONSTRUCTION REVISIONS, W.O.#17480 NO CHANGES	NJG	KQB
1	3-9-11	APPROVED FOR CONSTRUCTION	NEM	SJD
0	12-18-09	APPROVED FOR CONSTRUCTION	NEM	SJD

BLACK & VEATCH CORPORATION
ENGINEER NEM DRAWN KDM
CHECKED JCR DATE 12-18-09
B&V PROJECT DRAWING NUMBER

I HEREBY CERTIFY THAT THIS DOCUMENT WAS PREPARED BY ME, OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF NORTH DAKOTA
SIGNED CHRIS NAGARAH
DATE 3/14/11 REG. NO. 6478

minnesota power

BISON WIND GENERATING FACILITY NEW SALEM, ND

MINNESOTA POWER
BISON 1 WIND PROJECT
TRENCH DETAILS

SHEET 1 REV. 2
165233-1-000-S8000

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