# nationalgrid

## Lockport-Batavia Line 112 Rebuild Project

Exhibit 5

**Design Drawings** 

### **TABLE OF CONTENTS**

<u>Section</u>		<b>Page</b>
EXHIB	IT 5: DESIGN DRAWINGS	5-1
5.1	INTRODUCTION	
5.2	STRUCTURE DESIGN STANDARDS	5-1

### LIST OF FIGURES

Figure 5-1	Proposed Right-of-Way Cross Section Drawings (Sheets 1-35)	5-4
Figure 5-2	Concrete Caisson Foundation (1 Sheet)	.5-40
Figure 5-3	Details for Direct Bury Steel Poles (1 Sheet)	.5-42
Figure 5-4	Line 112 Rebuild Proposed Transmission Structures / Material (9 Sheets)	.5-44
Figure 5-5	Centerline Elevation Profile (1 Sheet)	.5-54

### EXHIBIT 5: DESIGN DRAWINGS

### 5.1 INTRODUCTION

National Grid proposes to rebuild a portion of its 115kV Line 112 (Line 112) that presently extends approximately 20.5 miles between the Lockport Substation and Structure 211. The rebuilt Line 112 will include the relocation of its existing centerline in select locations which will add nearly 1.2 miles between the Lockport Substation and Structure 211, making the final length of the rebuilt route approximately 21.7 miles. A detailed description of the Project and its location is contained in Exhibit 2 of this Application (Location of Facilities).

The Project design standards and drawings are provided herein.

### 5.2 STRUCTURE DESIGN STANDARDS

National Grid will design the Project transmission facilities in accordance with applicable national and state codes and regulations, in addition to the Applicant's own standards. The primary governing code is the current National Electric Safety Code ("NESC 2017"), which specifies both the minimum structural loads for determining the required structural capacity and appropriate clearances to energized parts and wires. Typical clearance requirements defined by NESC include clearance to ground, adjacent transmission facilities, railroads, buildings, and other objects.

The current NESC, as well as other National Grid structure criteria, will determine the structural loading of the Project transmission line. The minimum structural load criteria will include:

- NESC
  - Heavy Loading:  $\frac{1}{2}$ -inch radial ice at 0° F with a 40 mph wind;
  - $\circ~$  Extreme Wind Loading: 90 mph wind at 60° F;
  - Extreme Ice with Concurrent Wind Loading: 1 inch radial ice at 15°F with a 40 mph wind; and
- National Grid Heavy Ice: 1<sup>1</sup>/<sub>2</sub> inches radial ice at 30°F with a 28 mph wind.

A detailed description of the proposed rebuilt transmission structures is included in Exhibit E-1 - Description of Proposed Transmission Facilities of the Application.

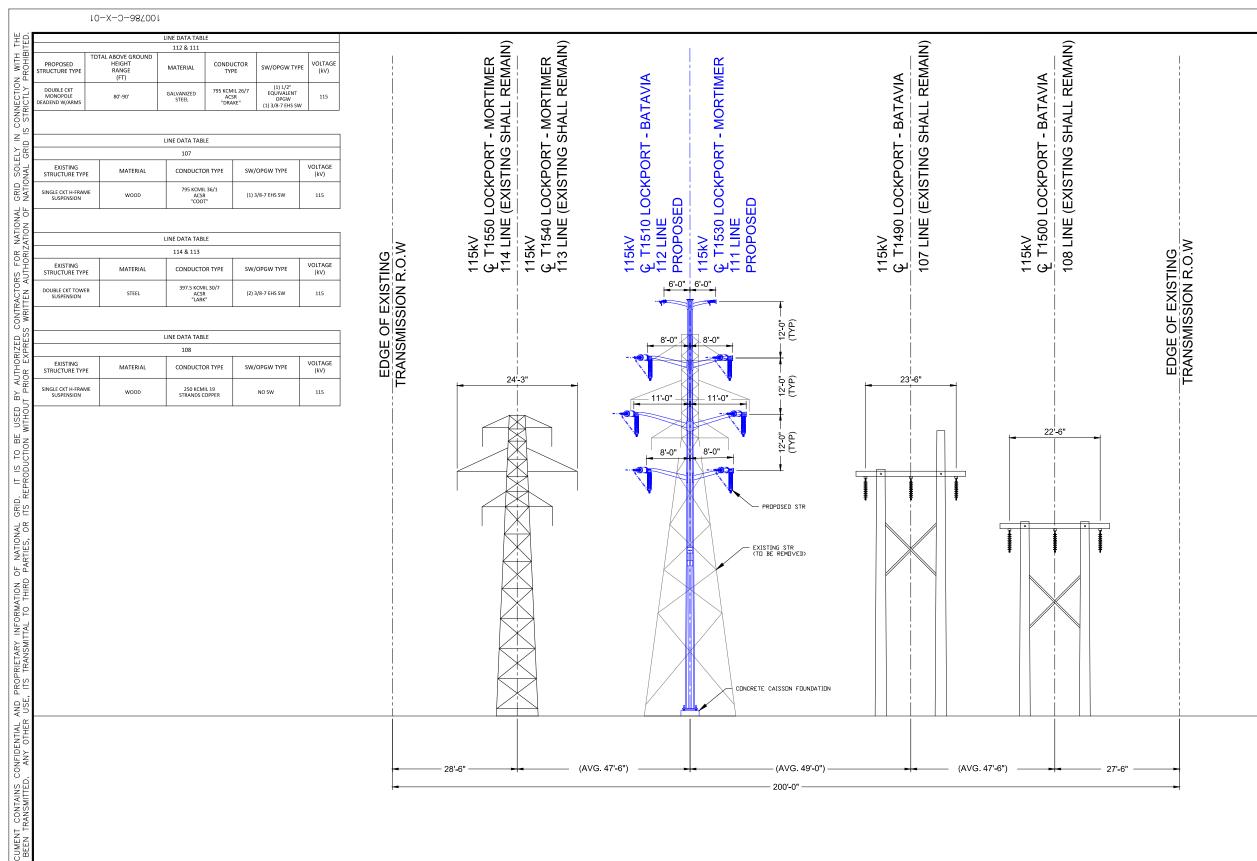
National Grid will use several types of structures for the Project. Figure 5-1, Sheets 1-35, is a set of cross-section diagrams of the Project ROW that show the typical configuration of the

structures (including width and height) in each segment. The material of construction, color and finish of the proposed structure types is steel with a galvanized finish for all steel pole structures. Figure 5-2 depicts a typical concrete foundation design. Figure 5-3 shows the details for direct-embedded steel poles structures. Figure 5-4 includes drawings for all typical transmission structures proposed, showing the structure type, material of construction, support arm configuration, insulators, and reference to wire type supported by the structures. Figure 5-5 depicts a profile of the centerline of the Project ROW at an exaggerated vertical scale.

### **EXHIBIT 5 - DESIGN DRAWINGS**

FIGURES

### Figure 5-1 Proposed Right-of-Way Cross Section Drawings (Sheets 1-35)



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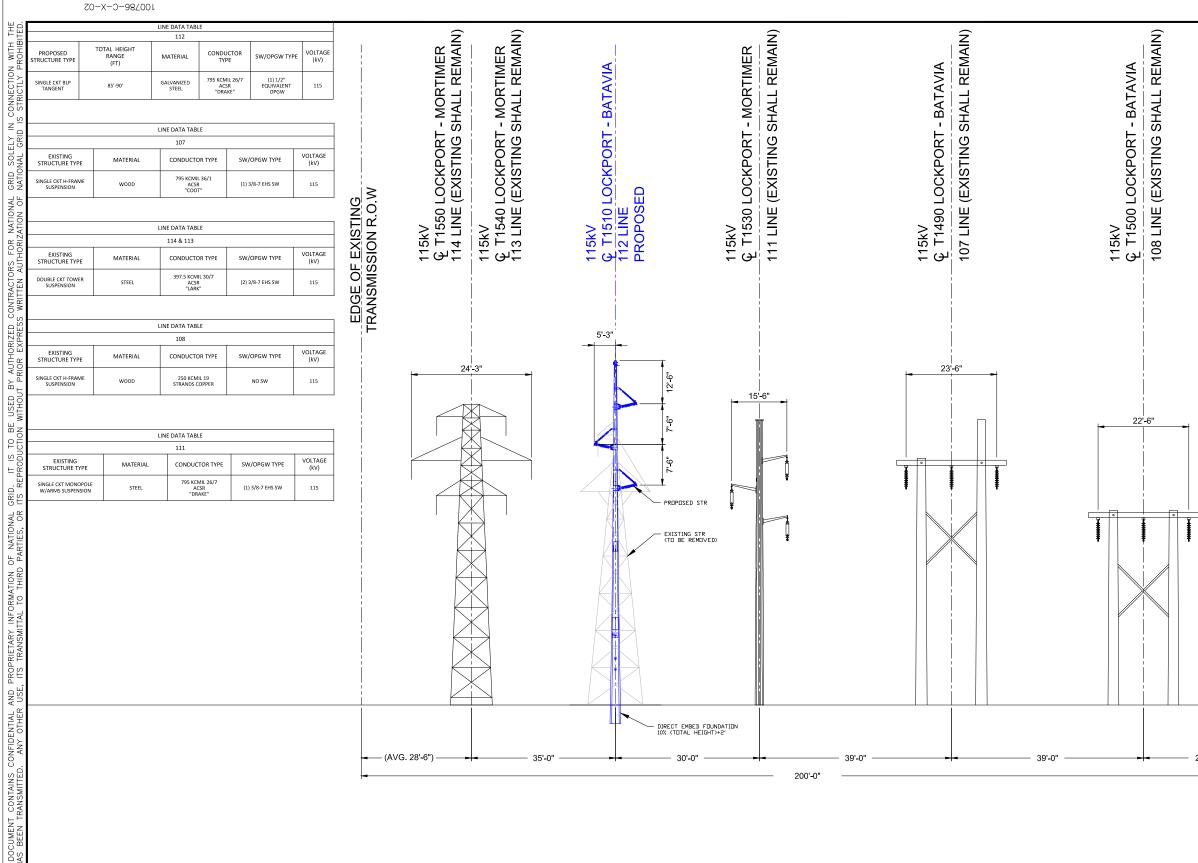
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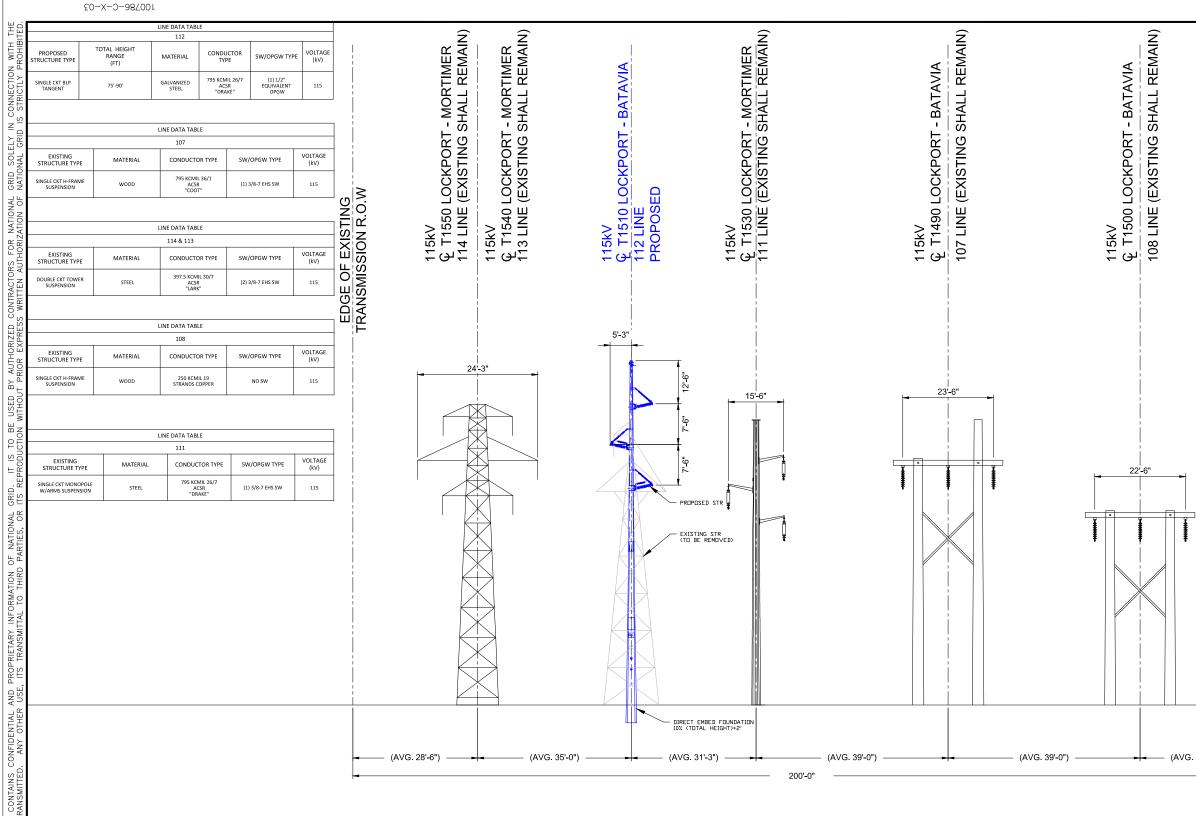
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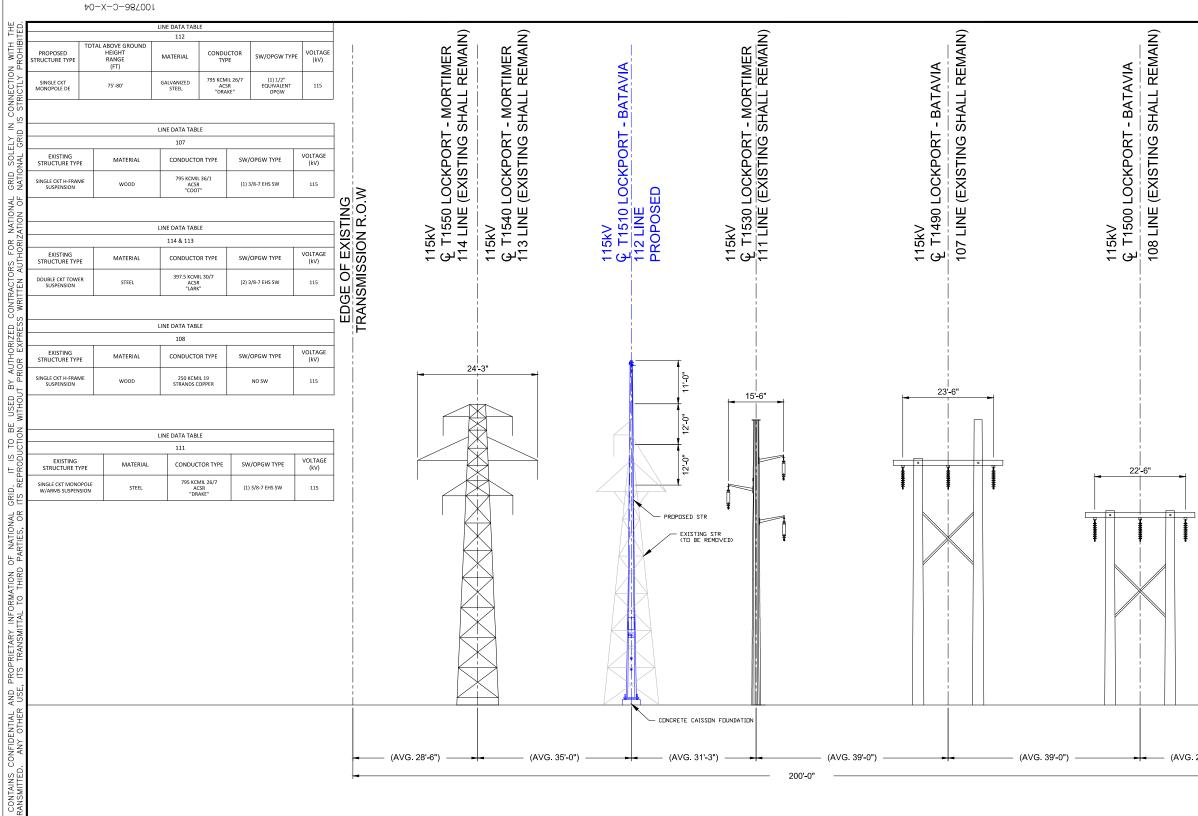


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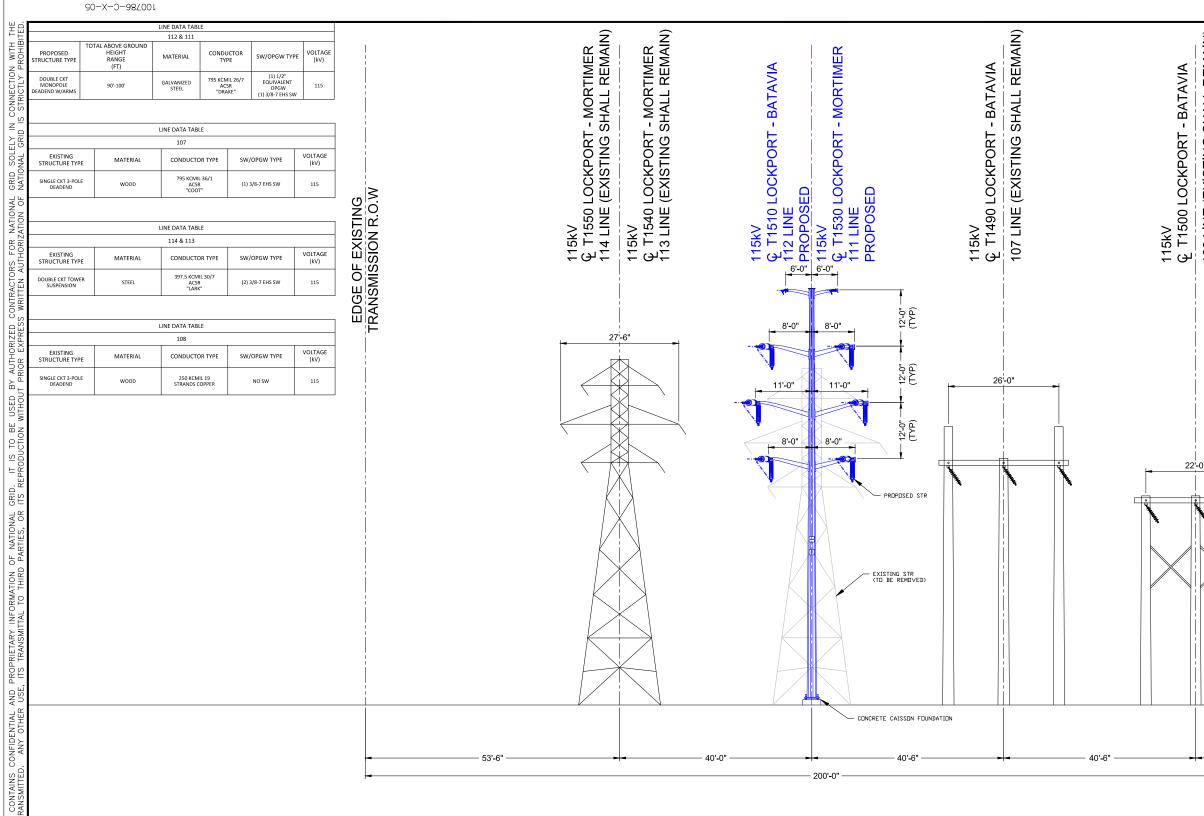


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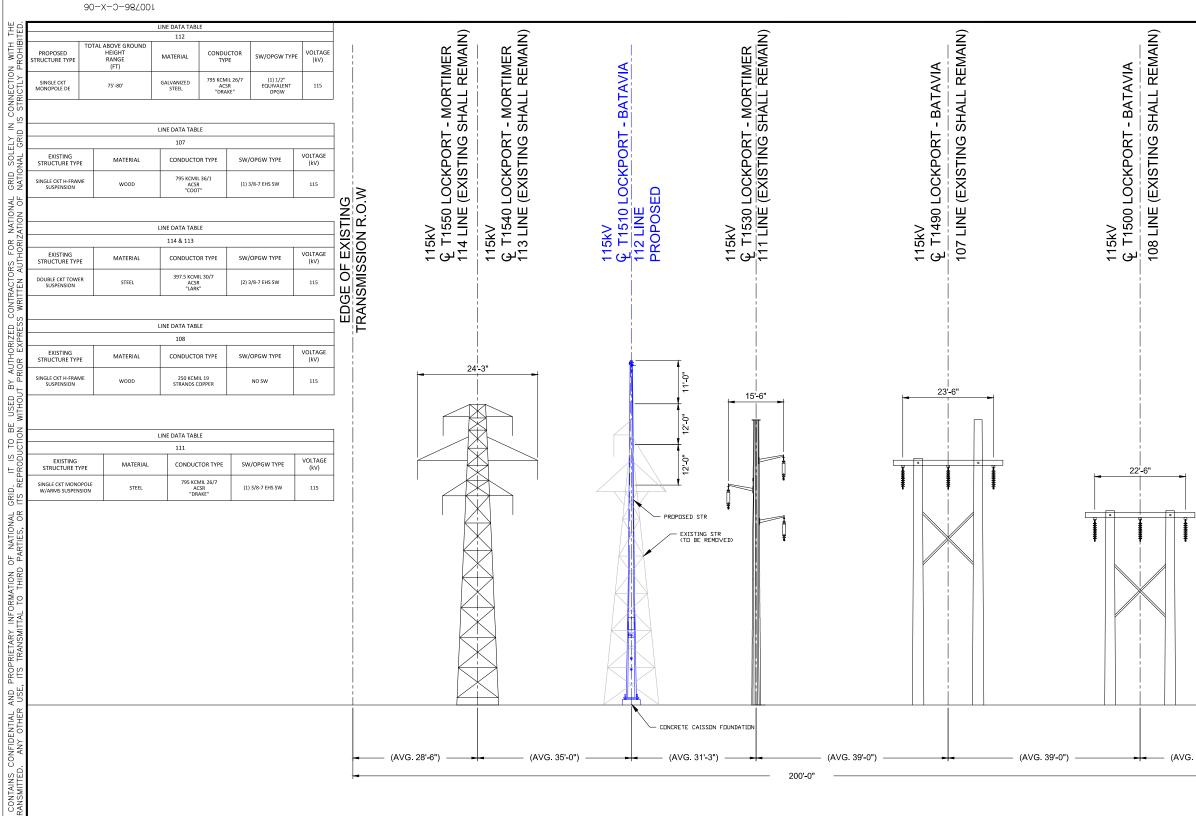
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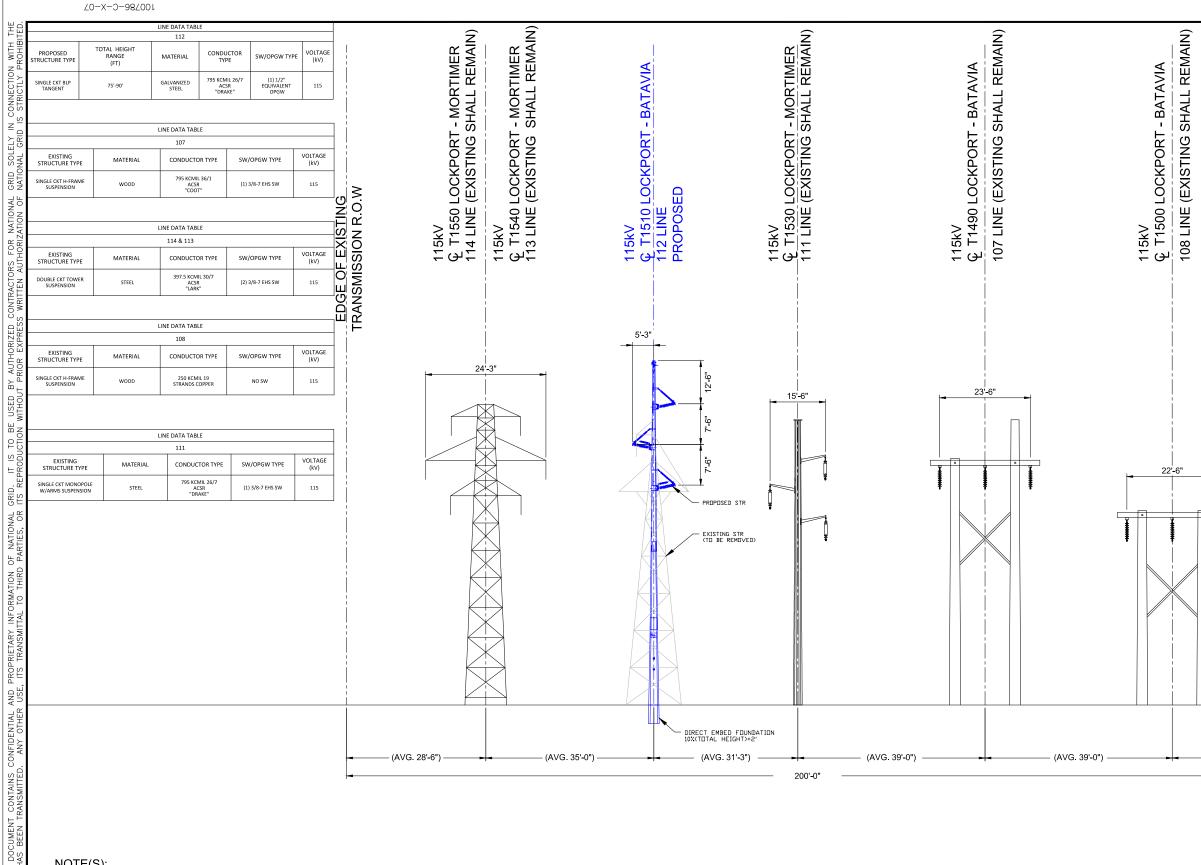
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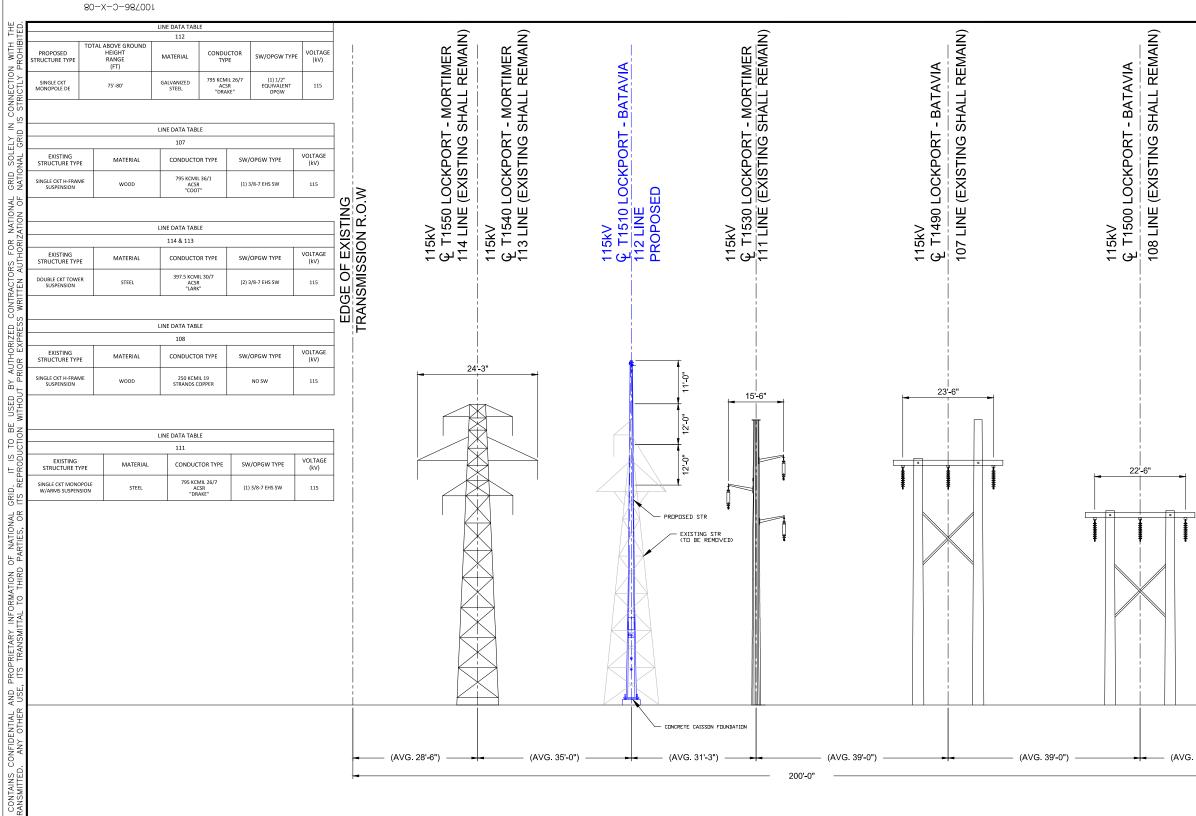
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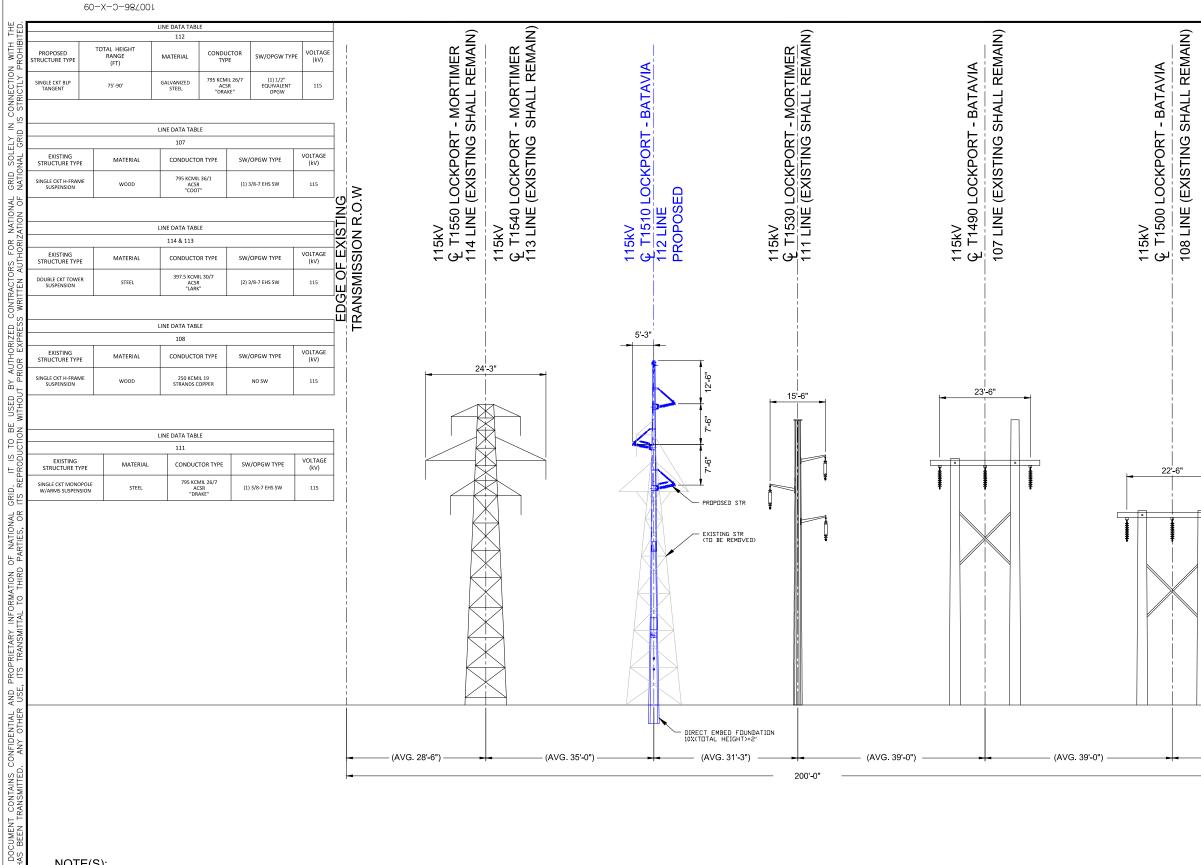
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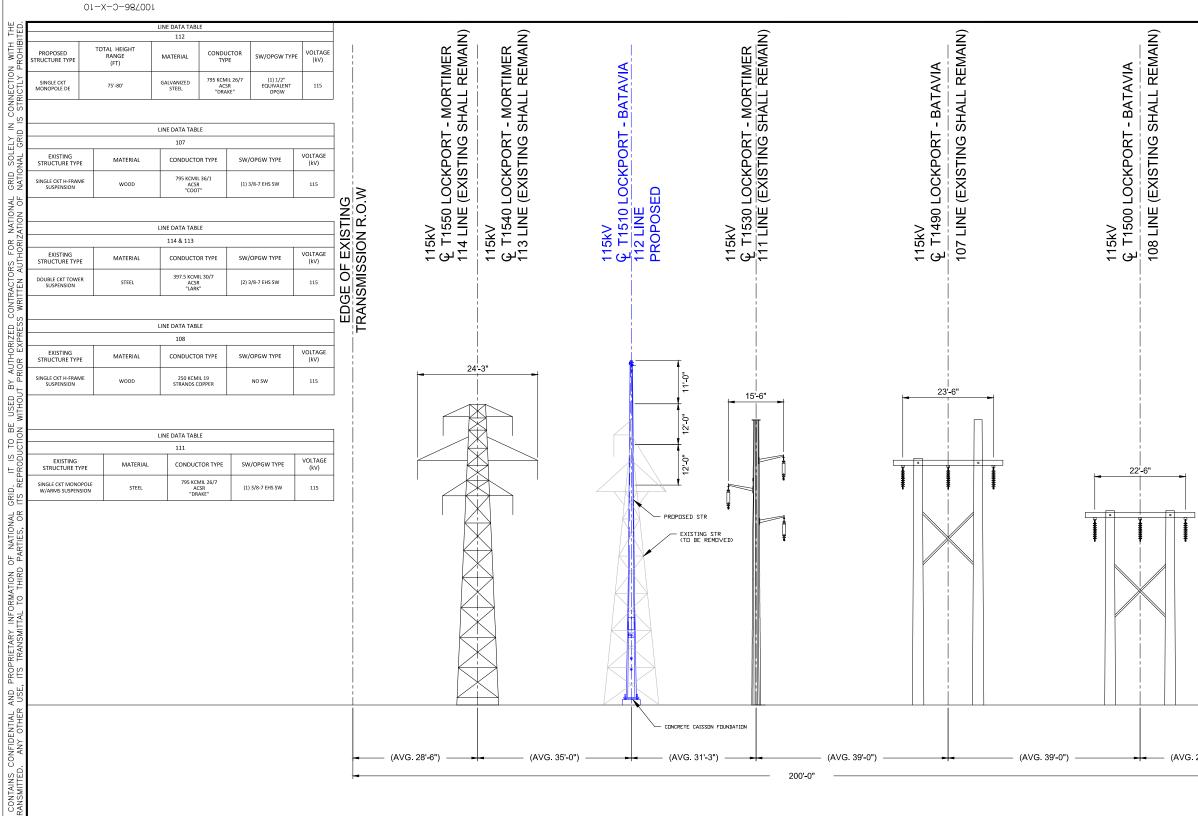
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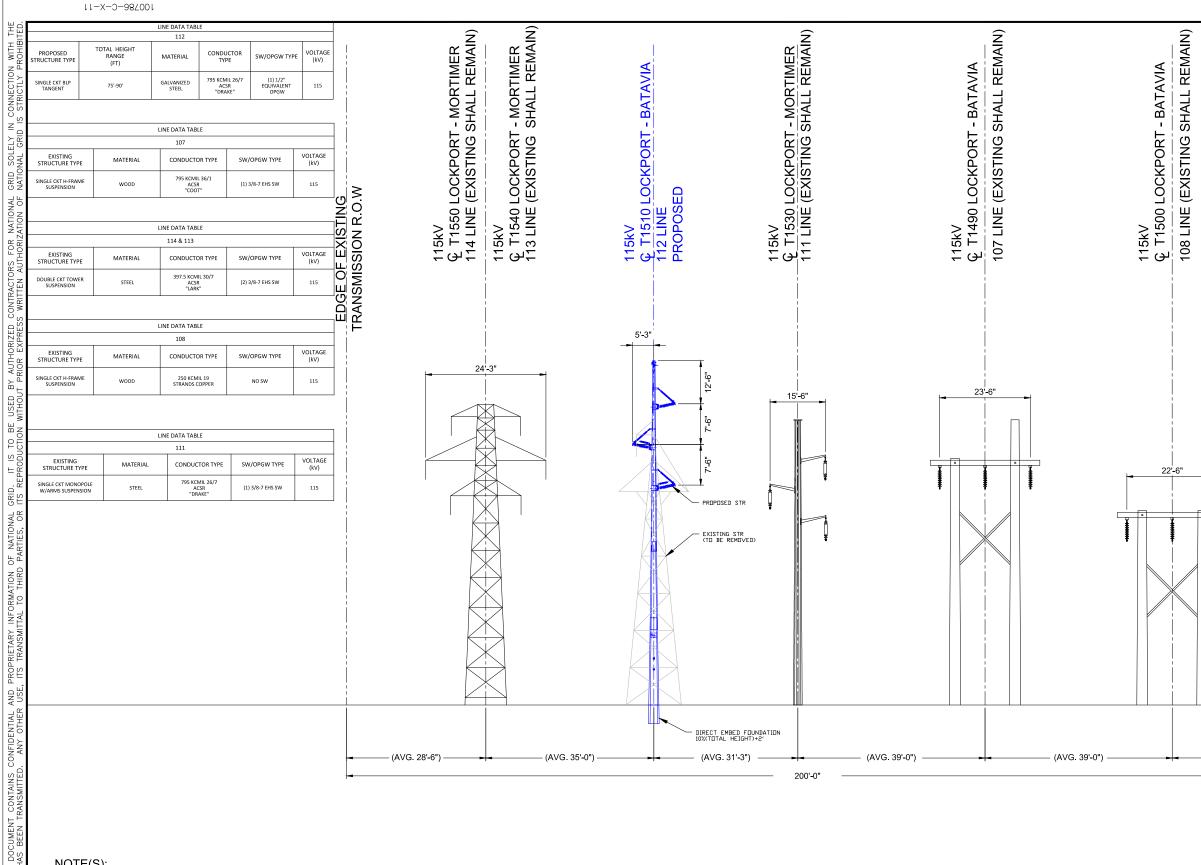


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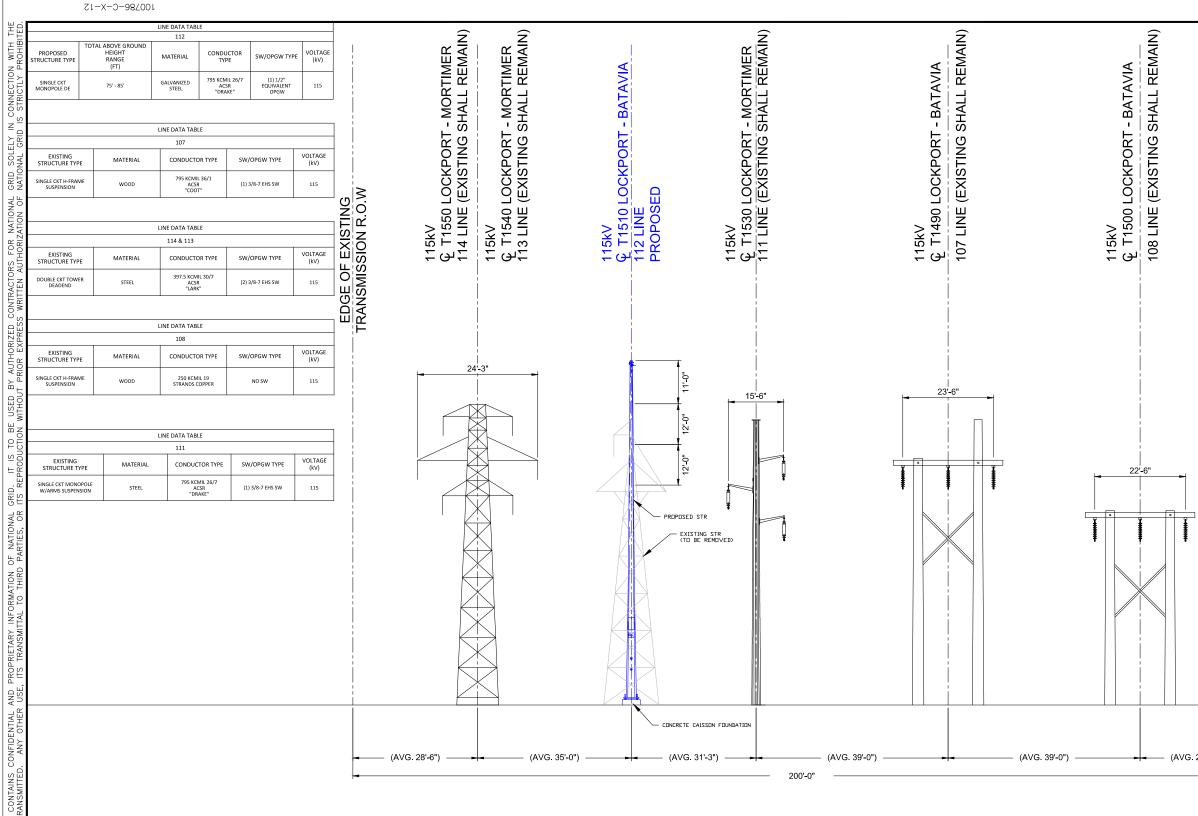
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NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION STRUCTURES 57 TO 66 MILE 5.39 TO 6.32 **SEGMENT 2** 

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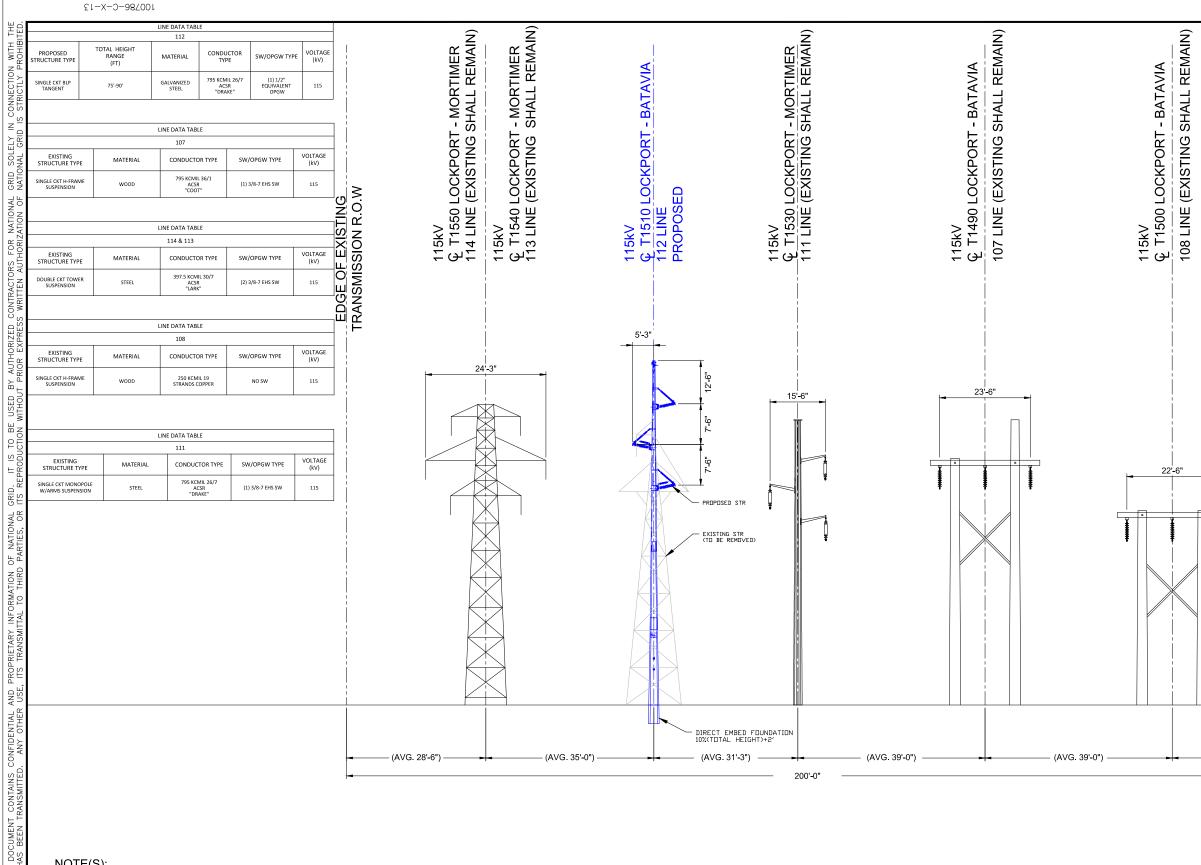
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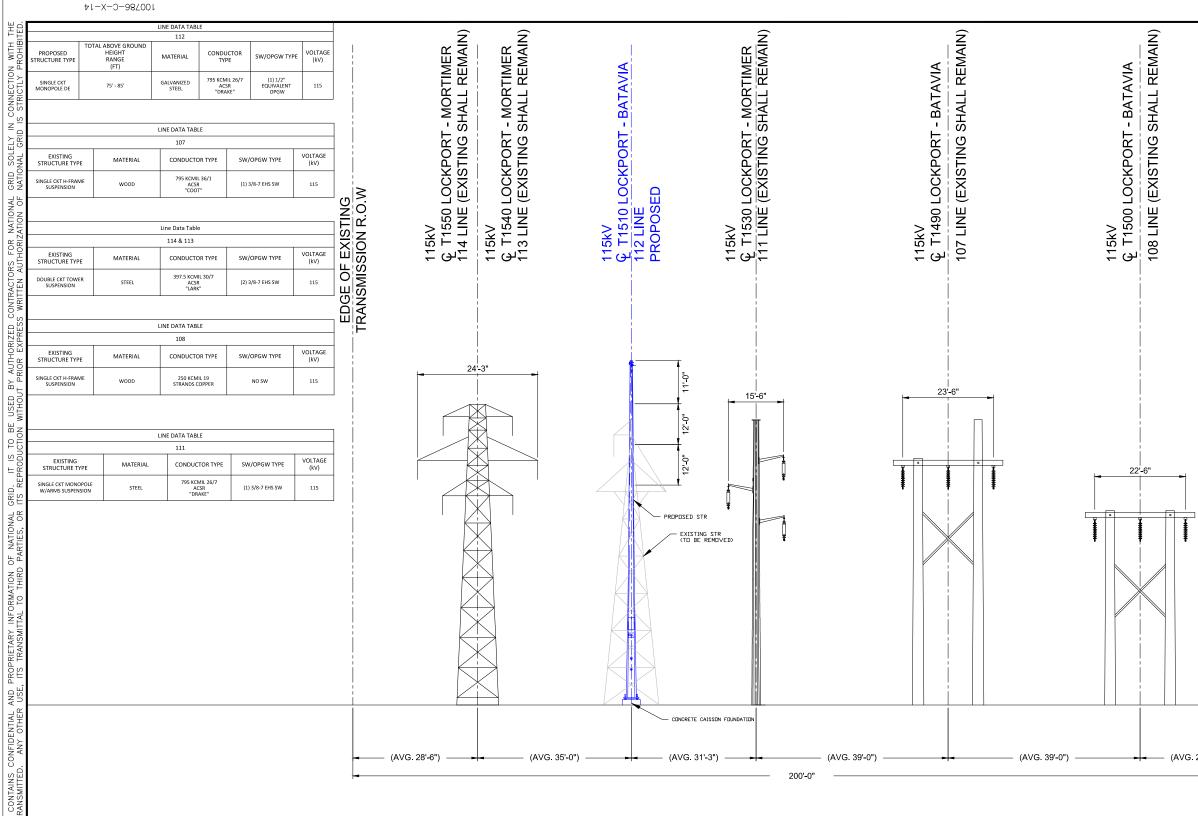
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NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION STRUCTURES 68 TO 80 MILE 6.53 TO 7.77 SEGMENT 2

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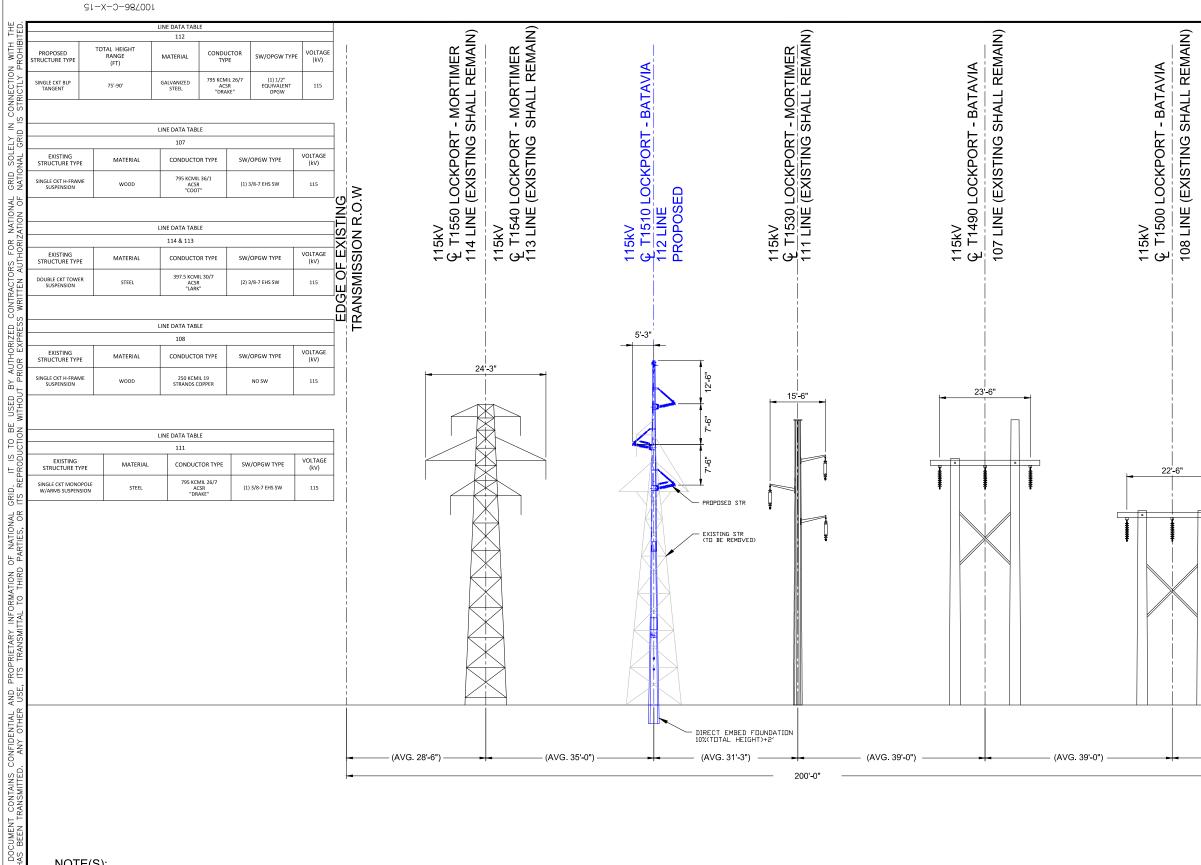
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- 3. TWO NYSEG 345kV LINES CROSS OVER PERPENDICULAR TO THE 112 LINE BETWEEN STRUCTURE 81 TO 81-1

NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION STRUCTURES 81 TO 81-1 MILE 7.85 TO 7.92 SEGMENT 2

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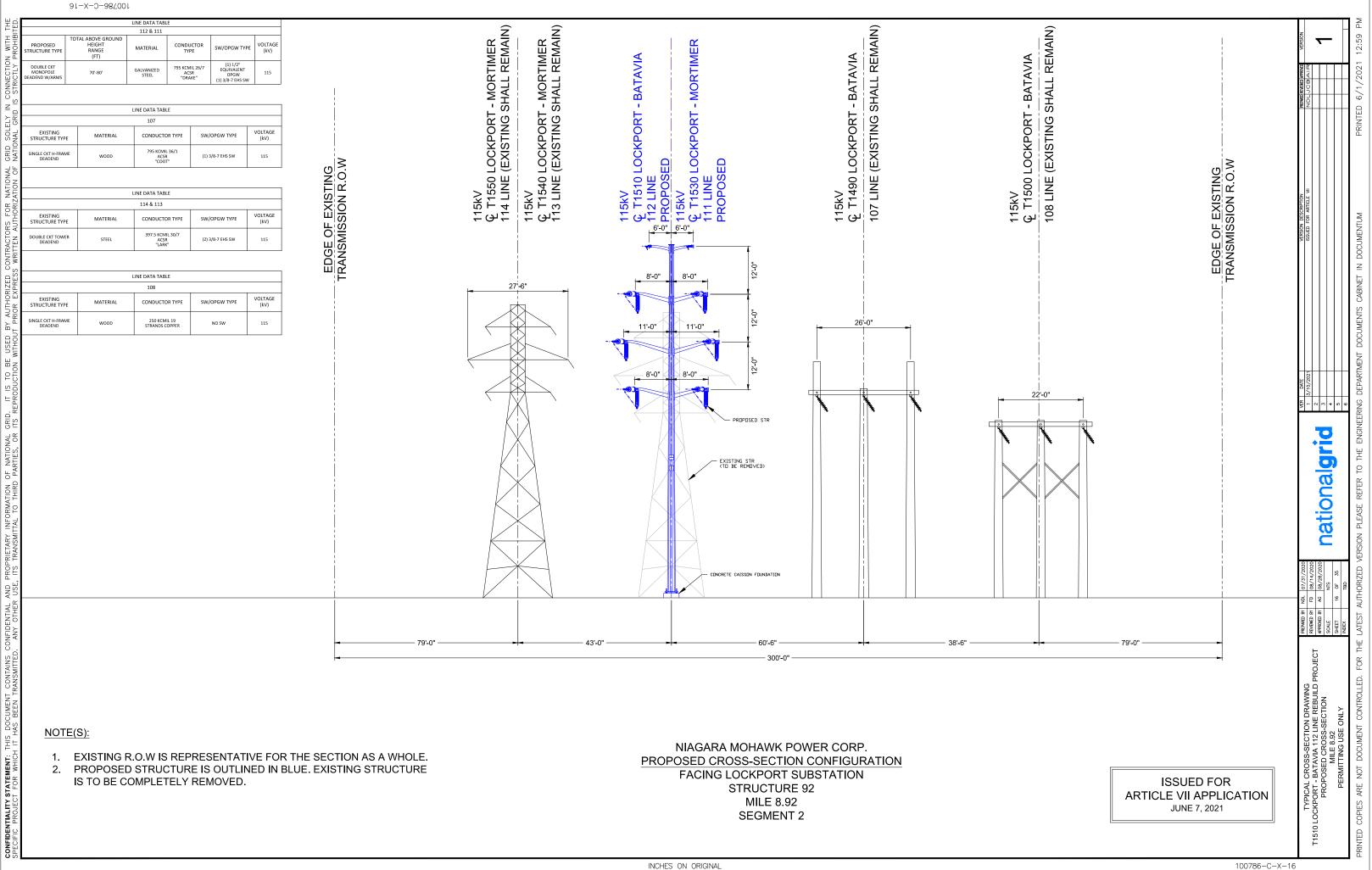
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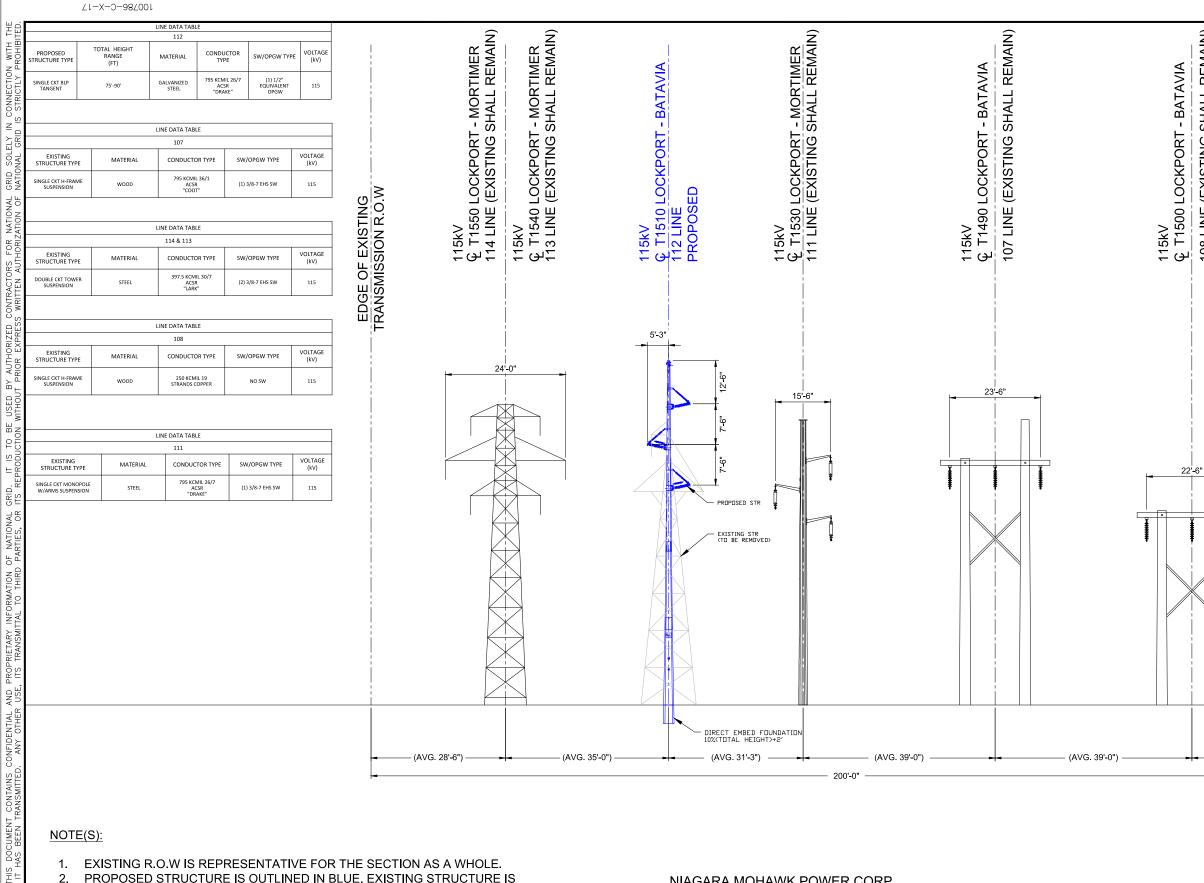
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NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION STRUCTURES 82 TO 91 MILE 7.98 TO 8.86 SEGMENT 2

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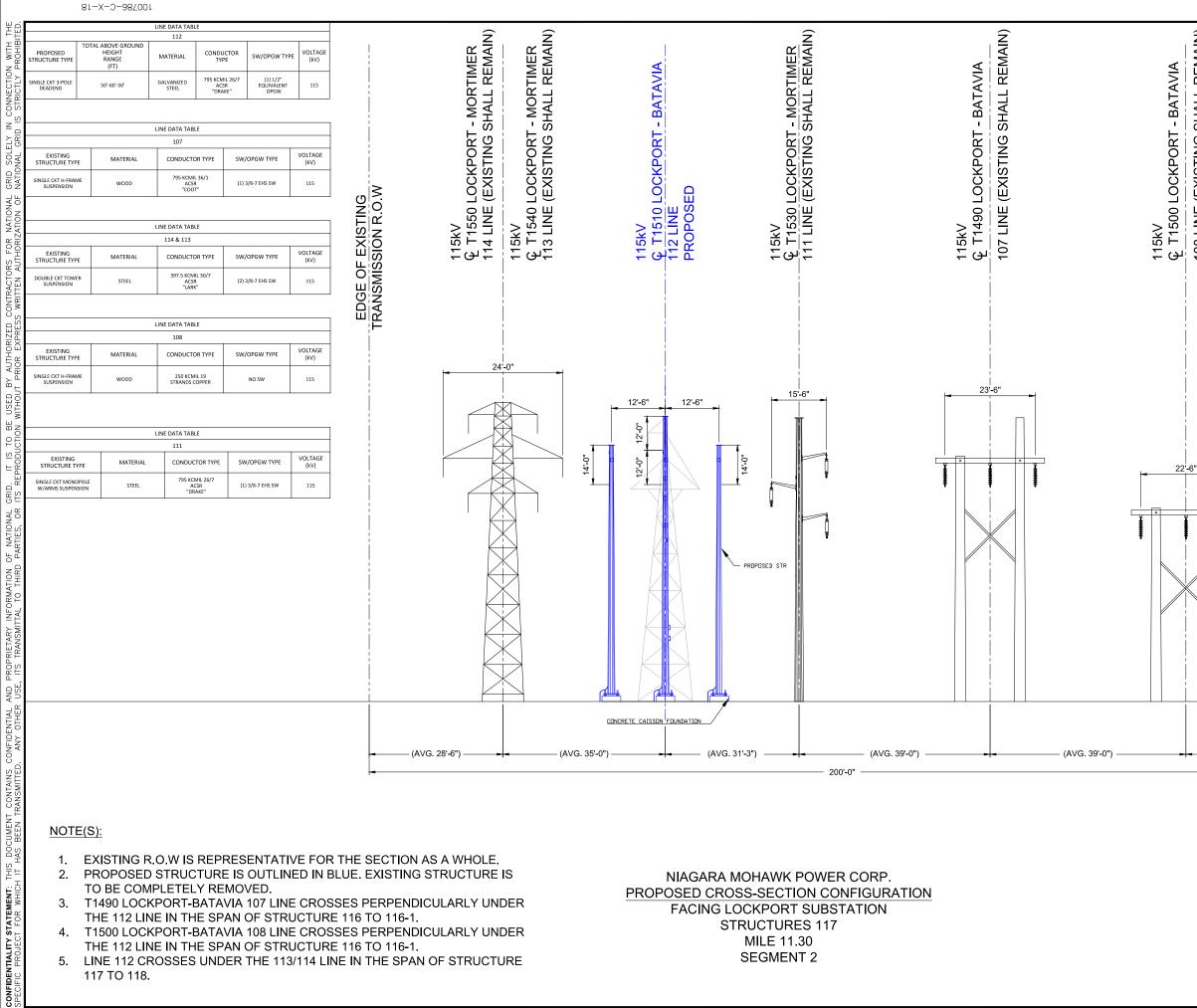
- PROPOSED STRUCTURE IS OUTLINED IN BLUE. EXISTING STRUCTURE IS TO BE COMPLETELY REMOVED.
- 3. T1490 LOCKPORT-BATAVIA 107 LINE CROSSES PERPENDICULARLY UNDER THE 112 LINE IN THE SPAN OF STRUCTURE 116 TO 116-1.
- 4. T1500 LOCKPORT-BATAVIA 108 LINE CROSSES PERPENDICULARLY UNDER THE 112 LINE IN THE SPAN OF STRUCTURE 116 TO 116-1.

CONFIDENTIALITY STATEMENT:

5. LINE 112 CROSSES UNDER THE 113/114 LINE IN THE SPAN OF STRUCTURE 117 TO 118.

NIAGARA MOHAWK POWER CORP. <u>PROPOSED CROSS-SECTION CONFIGURATION</u> FACING LOCKPORT SUBSTATION STRUCTURES 93 TO 116-1 MILE 8.97 TO 11.23 SEGMENT 2

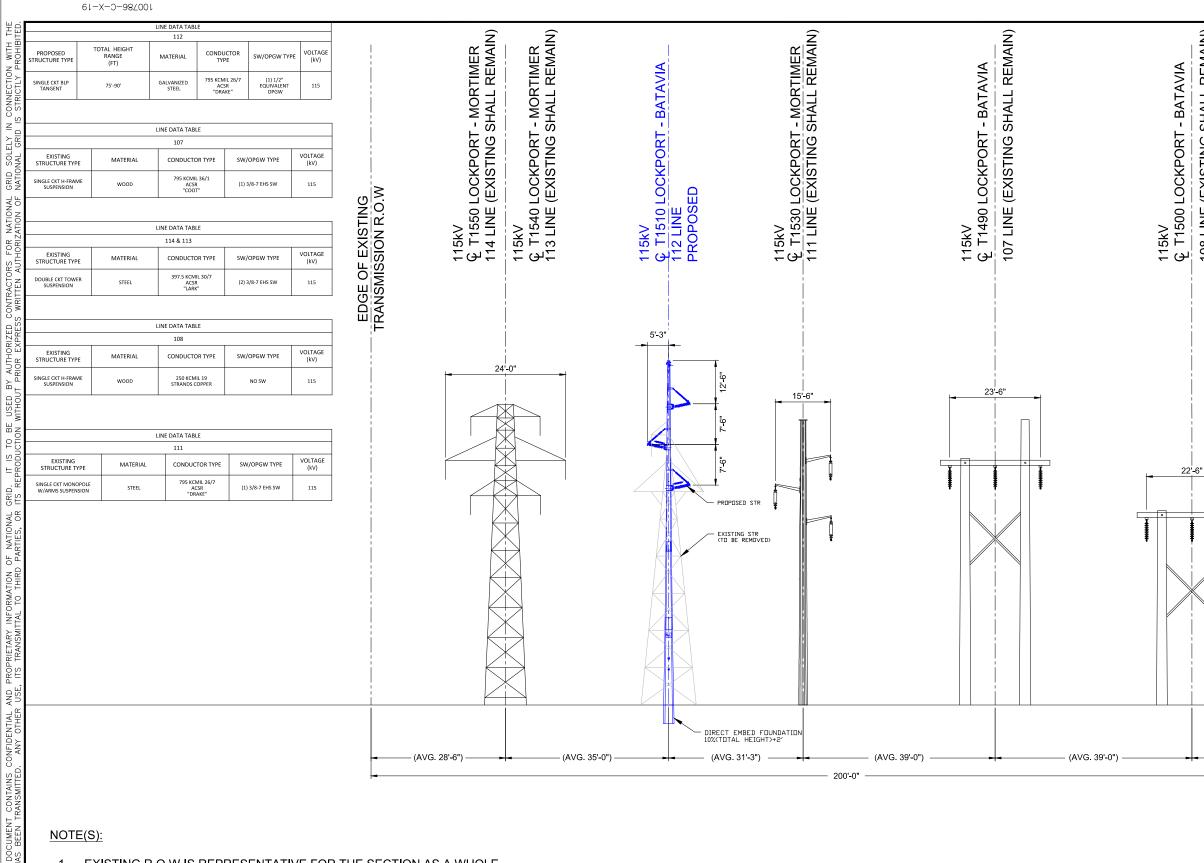
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- T1490 LOCKPORT-BATAVIA 107 LINE CROSSES PERPENDICULARLY UNDER 3. THE 112 LINE IN THE SPAN OF STRUCTURE 116 TO 116-1.
- T1500 LOCKPORT-BATAVIA 108 LINE CROSSES PERPENDICULARLY UNDER 4. THE 112 LINE IN THE SPAN OF STRUCTURE 116 TO 116-1.
- 5. LINE 112 CROSSES UNDER THE 113/114 LINE IN THE SPAN OF STRUCTURE 117 TO 118.

PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION **STRUCTURES 117** MILE 11.30 **SEGMENT 2** 

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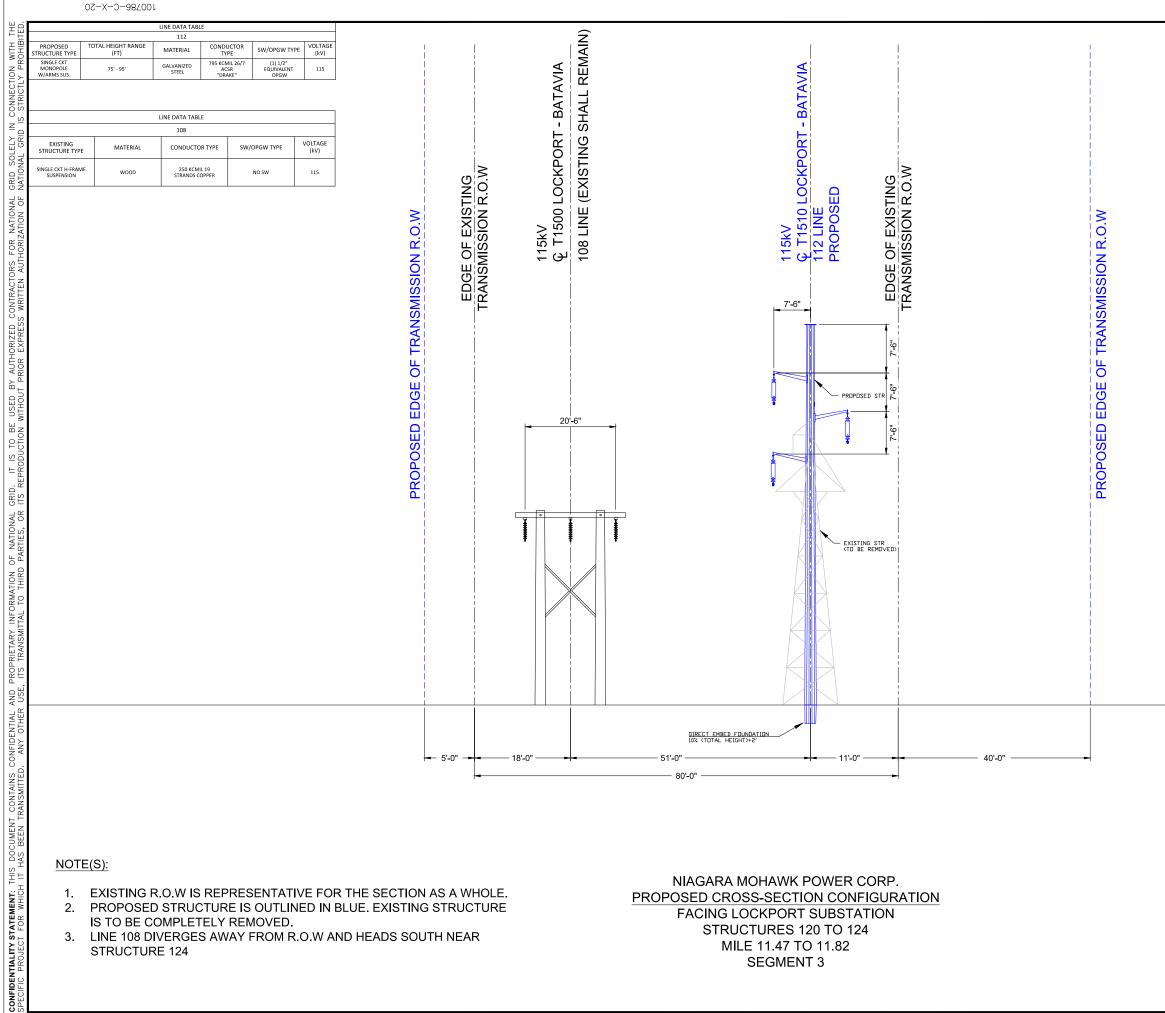
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- 2. PROPOSED STRUCTURE IS OUTLINED IN BLUE. EXISTING STRUCTURE IS TO BE COMPLETELY REMOVED.
- 3. T1490 LOCKPORT-BATAVIA 107 LINE CROSSES PERPENDICULARLY UNDER THE 112 LINE IN THE SPAN OF STRUCTURE 116 TO 116-1.
- 4. T1500 LOCKPORT-BATAVIA 108 LINE CROSSES PERPENDICULARLY UNDER THE 112 LINE IN THE SPAN OF STRUCTURE 116 TO 116-1.
- 5. LINE 112 CROSSES UNDER THE 113/114 LINE IN THE SPAN OF STRUCTURE 117 TO 118.

NIAGARA MOHAWK POWER CORP. <u>PROPOSED CROSS-SECTION CONFIGURATION</u> FACING LOCKPORT SUBSTATION STRUCTURES 118 TO 119 MILE 11.34 TO 11.39 SEGMENT 2

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3. LINE 108 DIVERGES AWAY FROM R.O.W AND HEADS SOUTH NEAR STRUCTURE 124

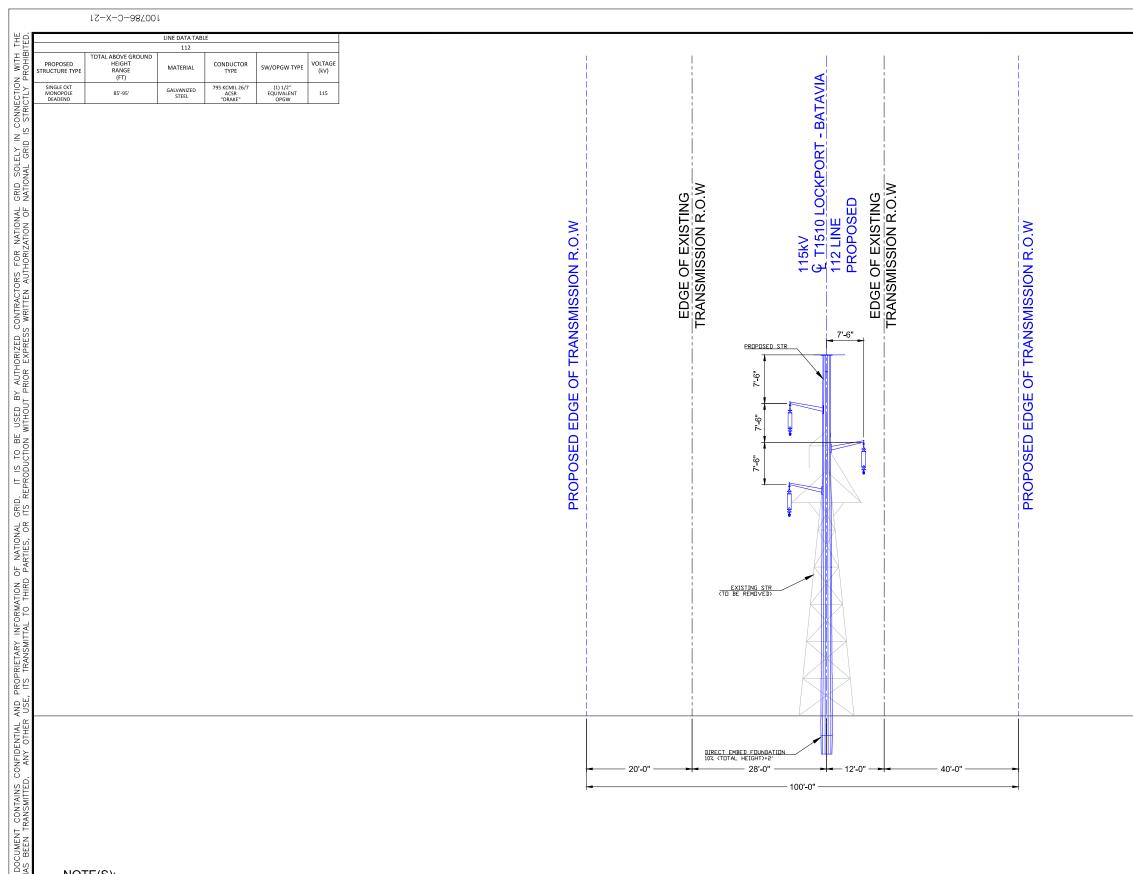
FACING LOCKPORT SUBSTATION STRUCTURES 120 TO 124 MILE 11.47 TO 11.82 **SEGMENT 3** 

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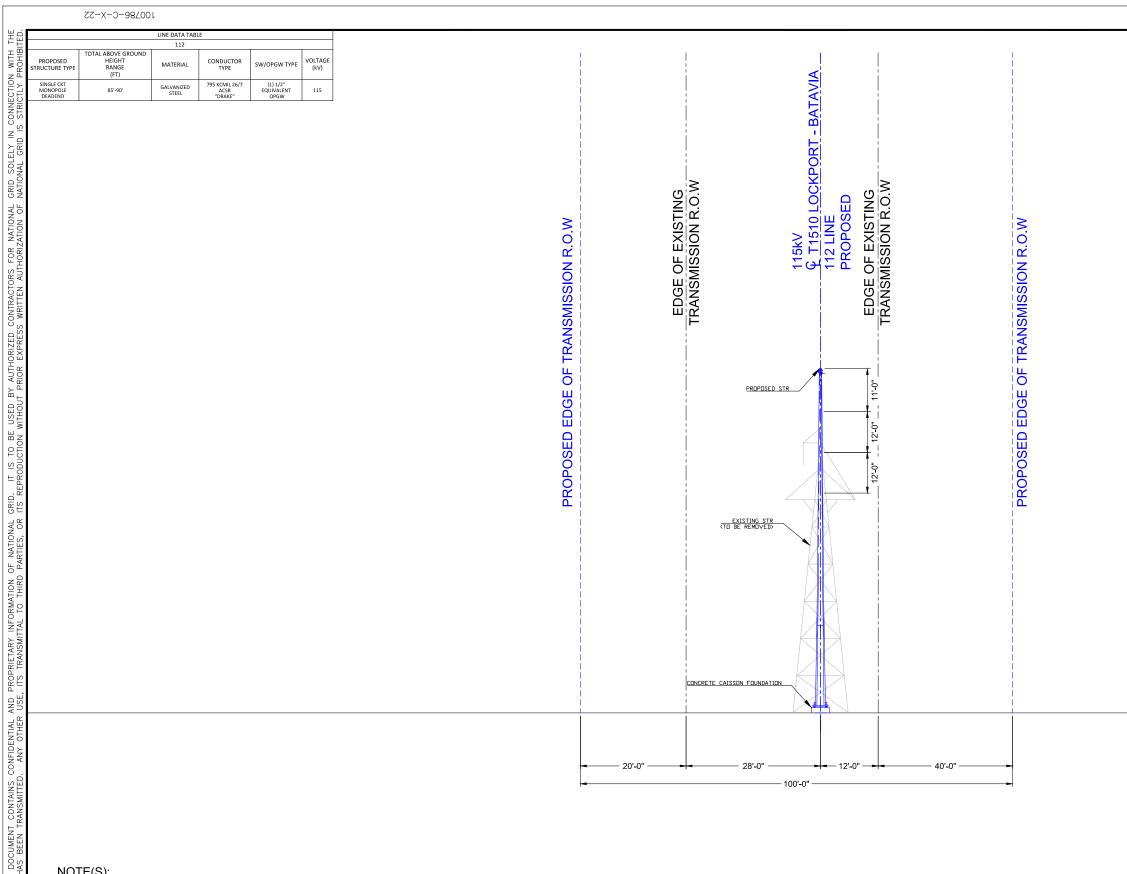
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- 2. PROPOSED STRUCTURE IS OUTLINED IN BLUE. EXISTING STRUCTURE IS TO BE COMPLETELY REMOVED.
- 3. LINE 108 DIVERGES AWAY FROM R.O.W AND HEADS SOUTH NEAR STRUCTURE 124

NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION STRUCTURE 125 TO 140 MILE 11.93 TO 13.49 SEGMENT 3

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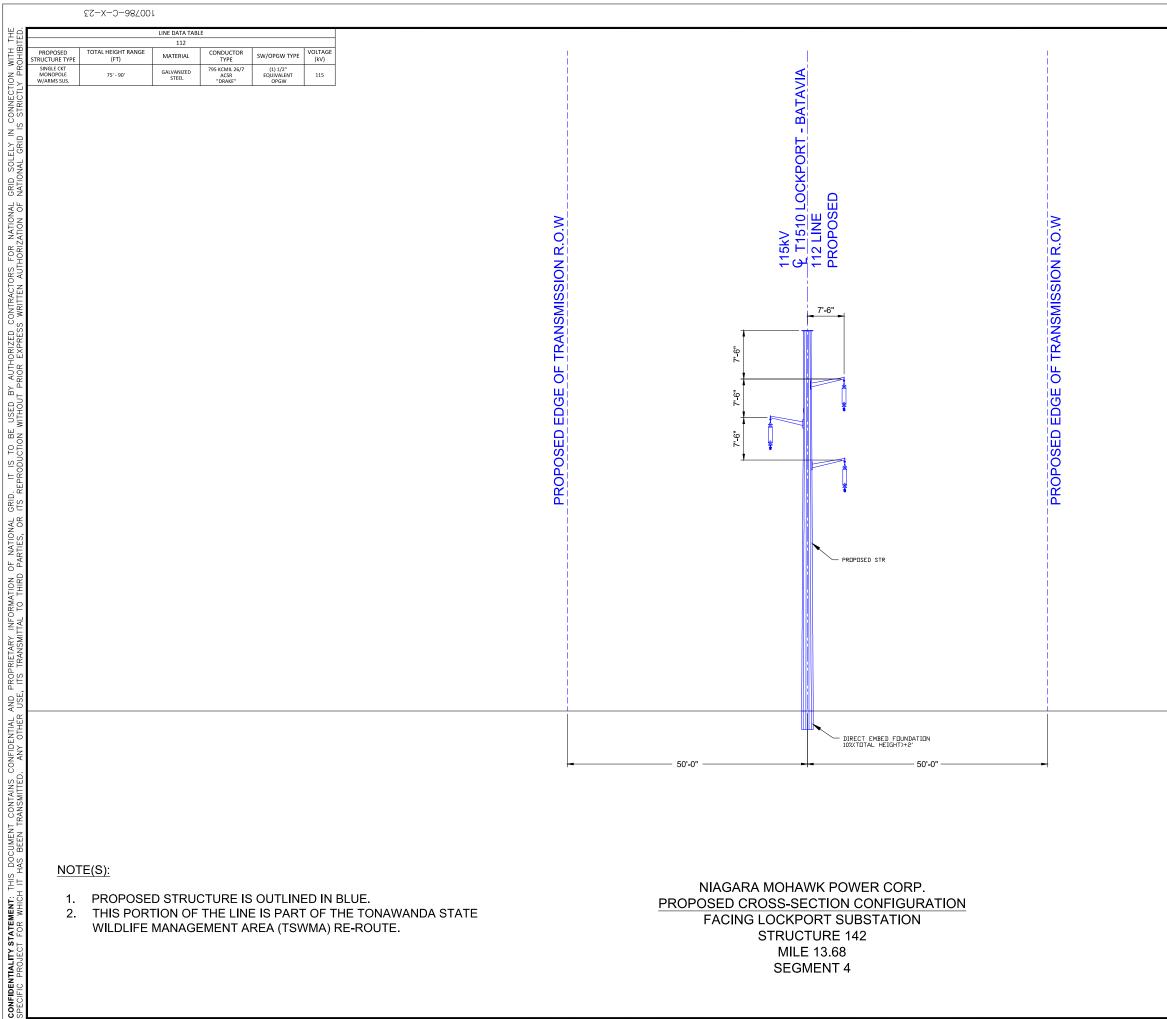
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NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION STRUCTURE 141 MILE 13.58 **SEGMENT 3** 

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- 2. THIS PORTION OF THE LINE IS PART OF THE TONAWANDA STATE WILDLIFE MANAGEMENT AREA (TSWMA) RE-ROUTE.

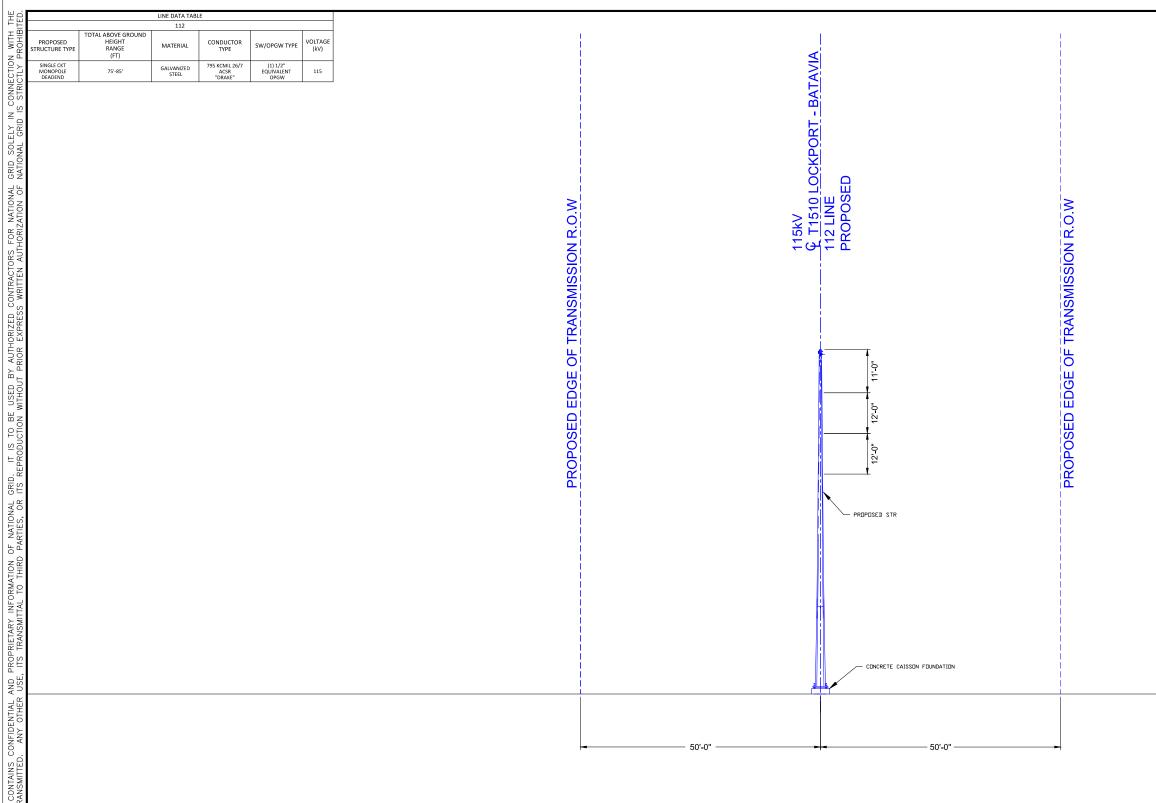
NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION STRUCTURE 142 MILE 13.68 **SEGMENT 4** 

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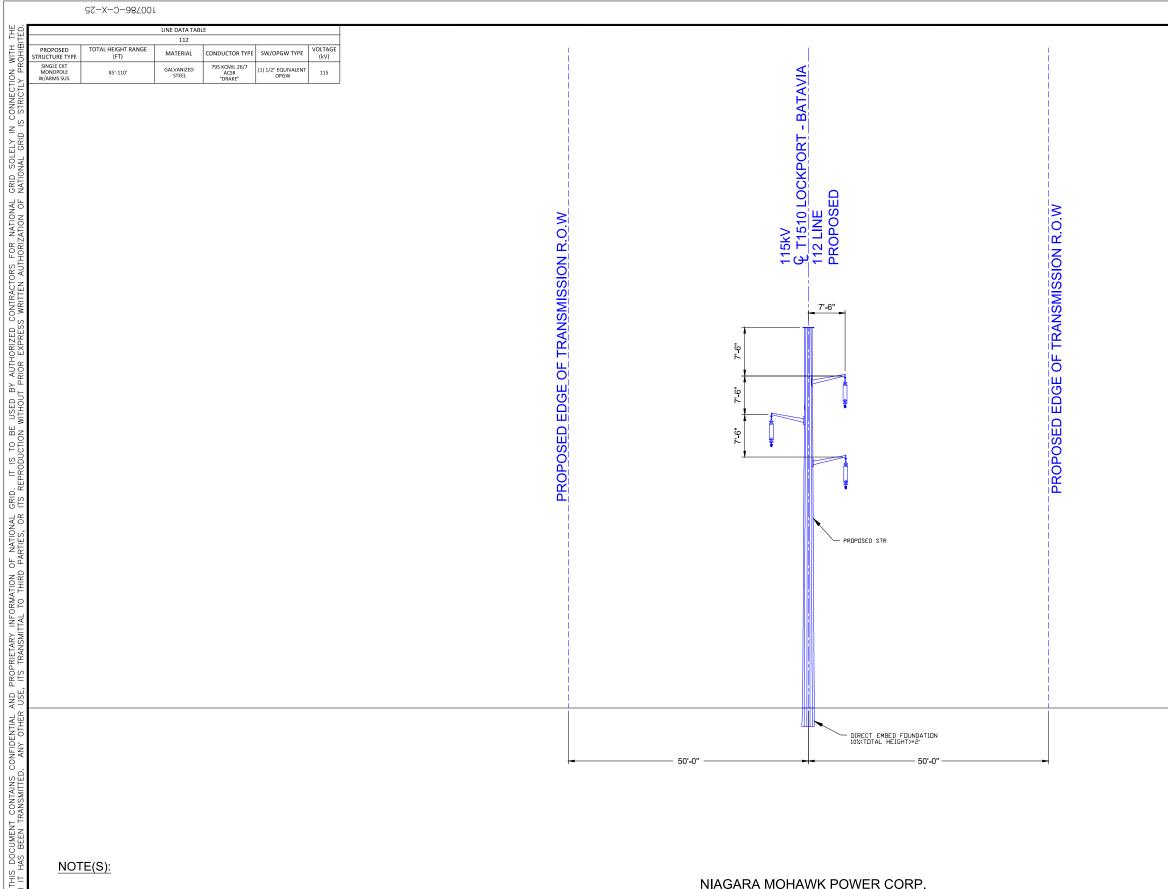
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NIAGARA MOHAWK POWER CORP. <u>PROPOSED CROSS-SECTION CONFIGURATION</u> FACING LOCKPORT SUBSTATION STRUCTURE 143 MILE 13.78 SEGMENT 4

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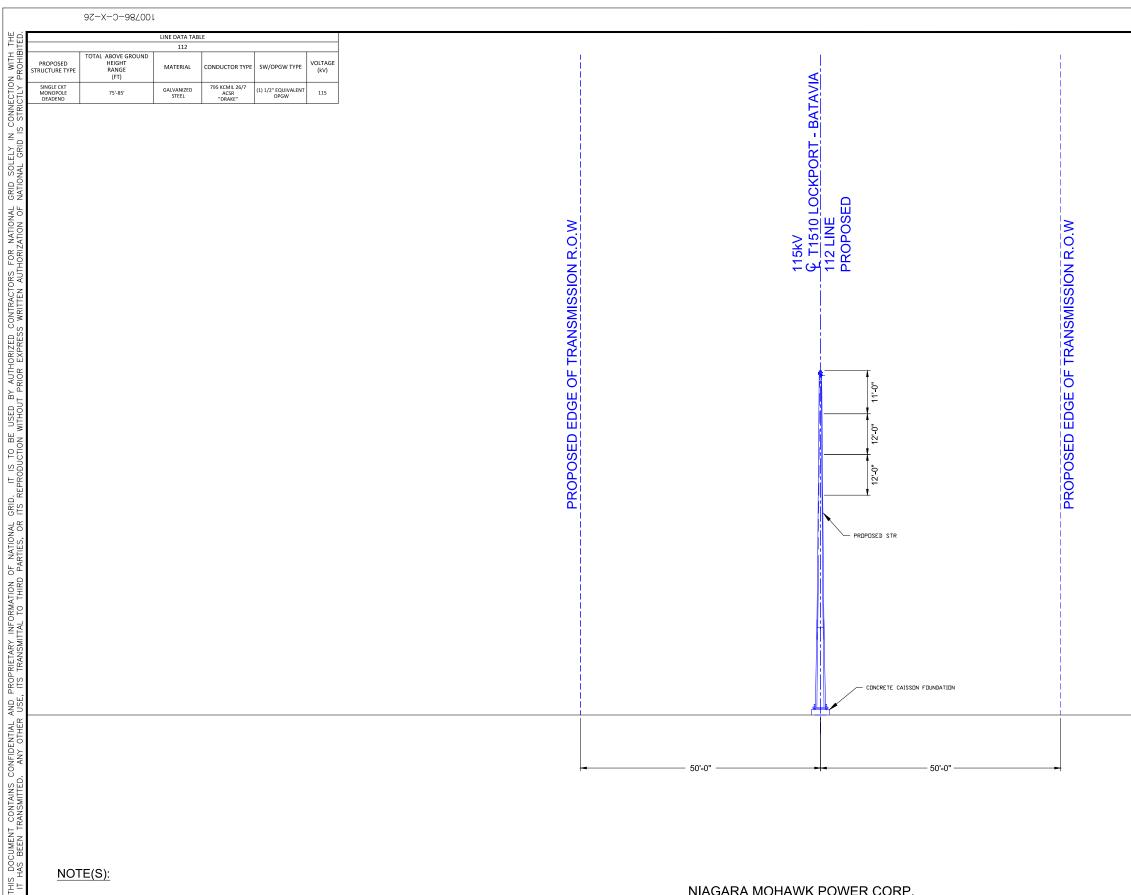


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NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION STRUCTURES 144 TO 152 MILE 13.90 TO 14.85 SEGMENT 4

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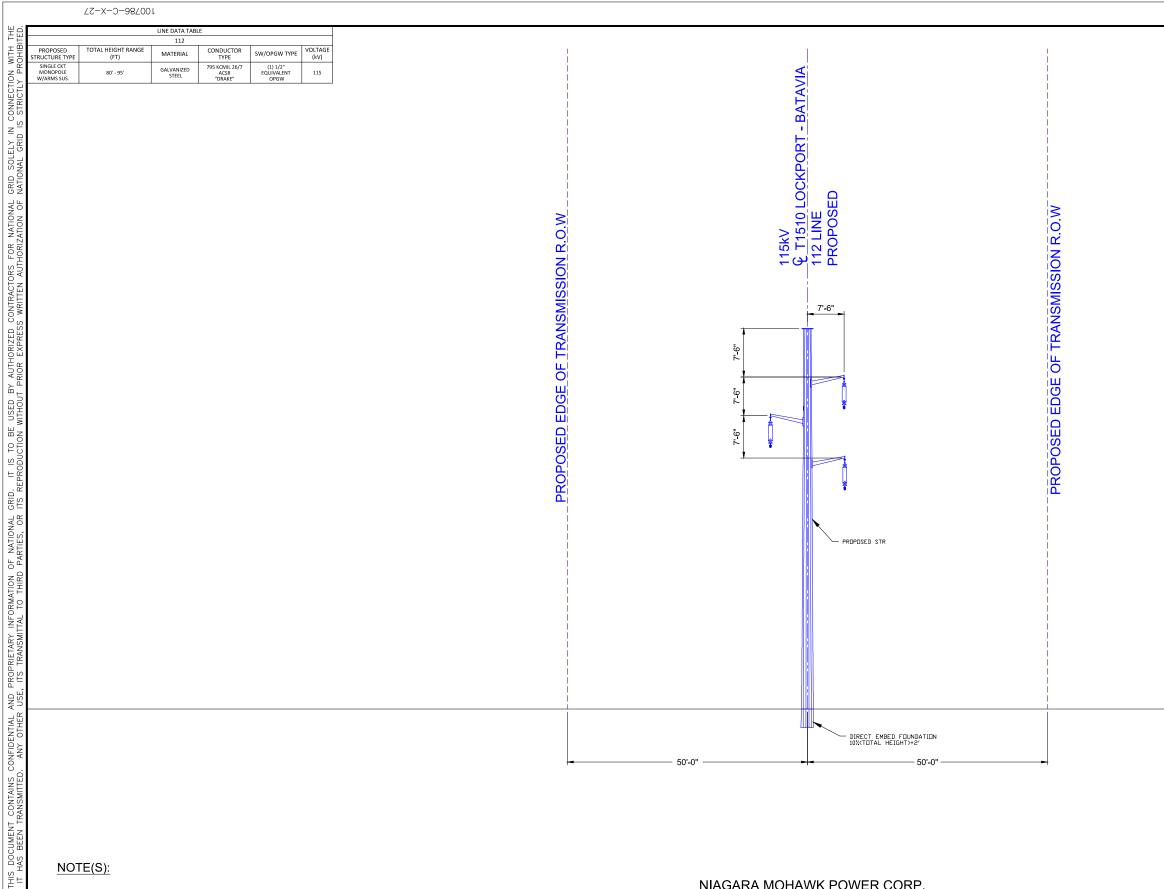
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NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION **STRUCTURE 153** MILE 14.94 SEGMENT 4

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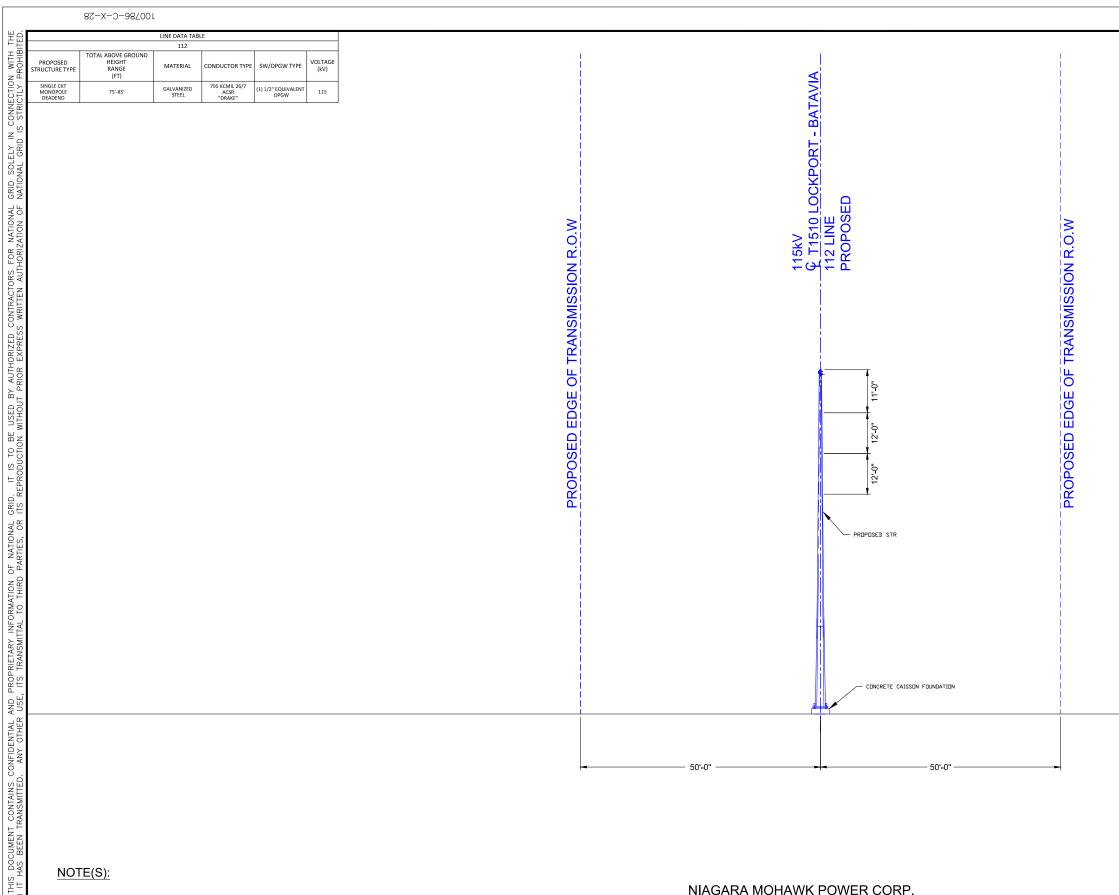
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NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION STRUCTURES 154 TO 155 MILE 15.07 TO 15.20 SEGMENT 4

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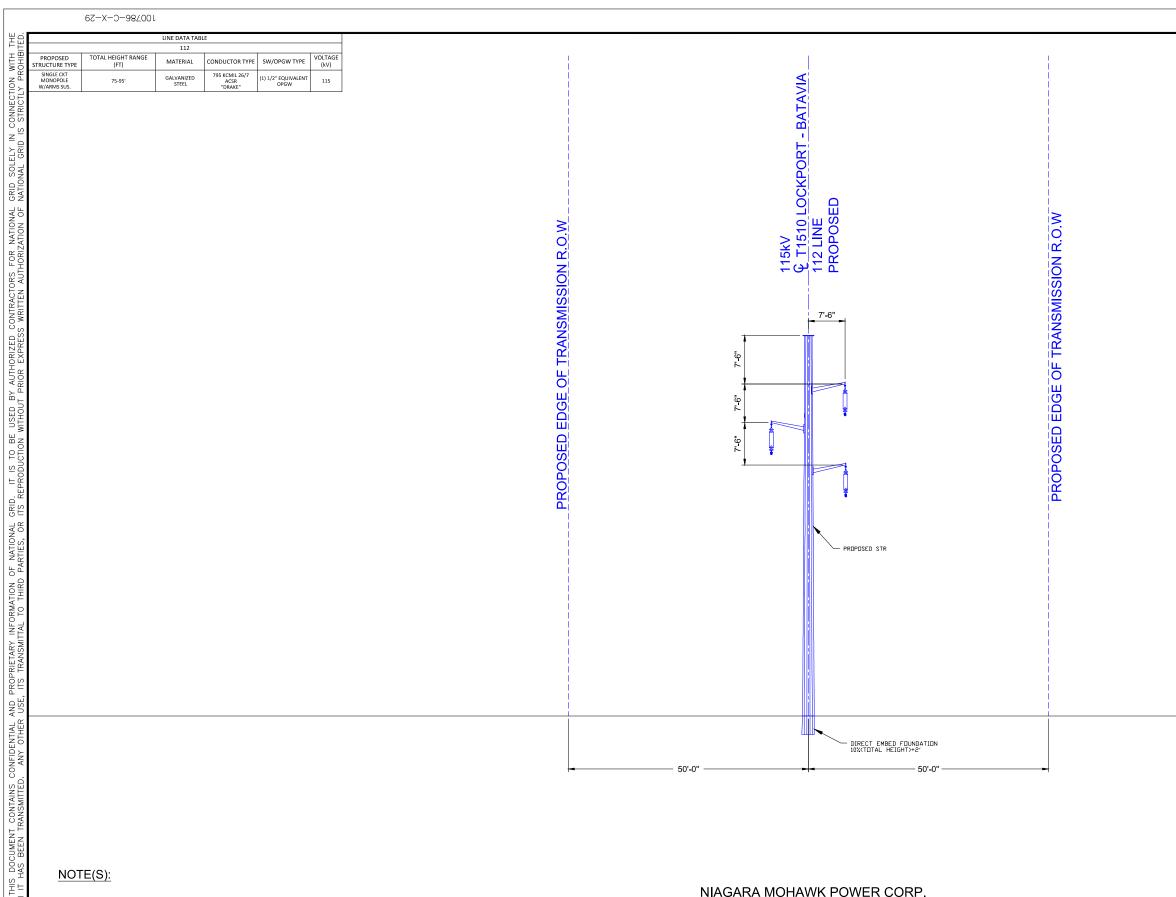
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NIAGARA MOHAWK POWER CORP. <u>PROPOSED CROSS-SECTION CONFIGURATION</u> FACING LOCKPORT SUBSTATION STRUCTURE 156 MILE 15.32 SEGMENT 4

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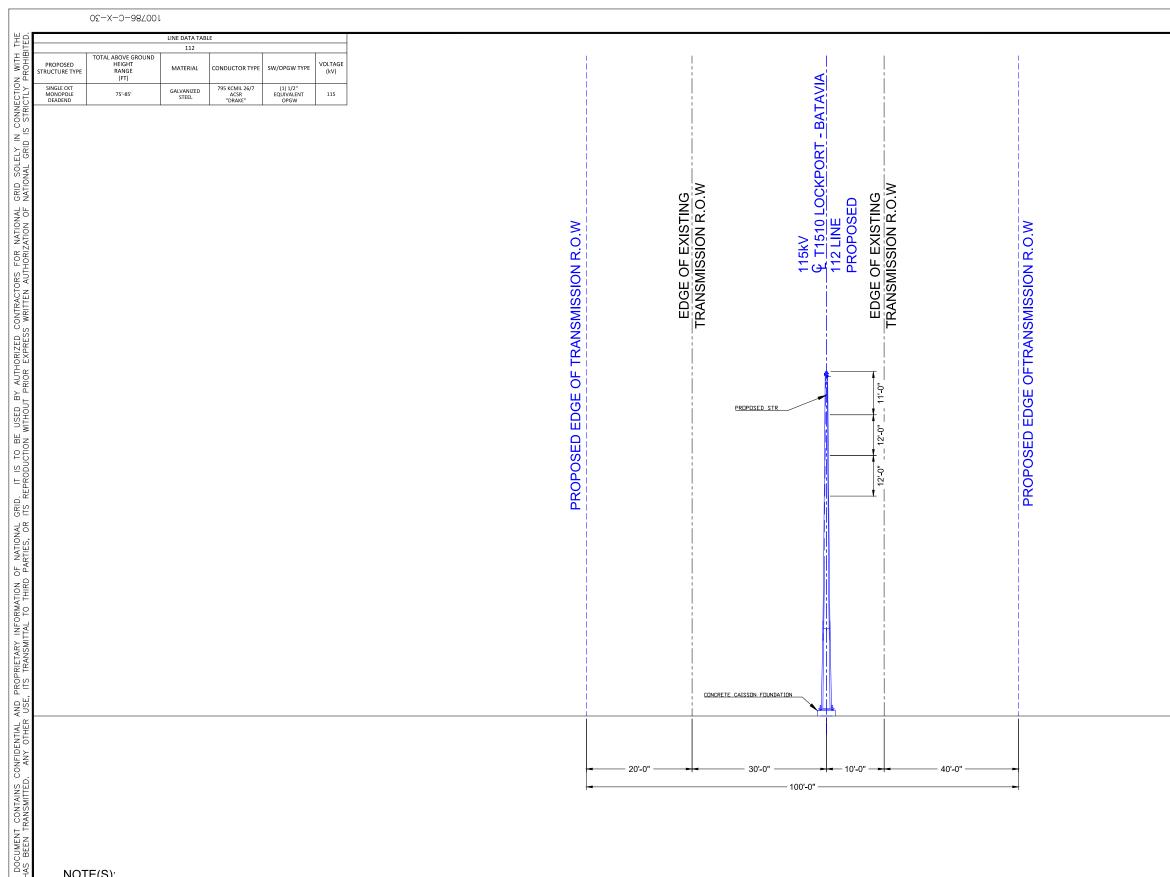
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NIAGARA MOHAWK POWER CORP. <u>PROPOSED CROSS-SECTION CONFIGURATION</u> FACING LOCKPORT SUBSTATION STRUCTURES 157 TO 159 MILE 15.43 TO 15.67 SEGMENT 4

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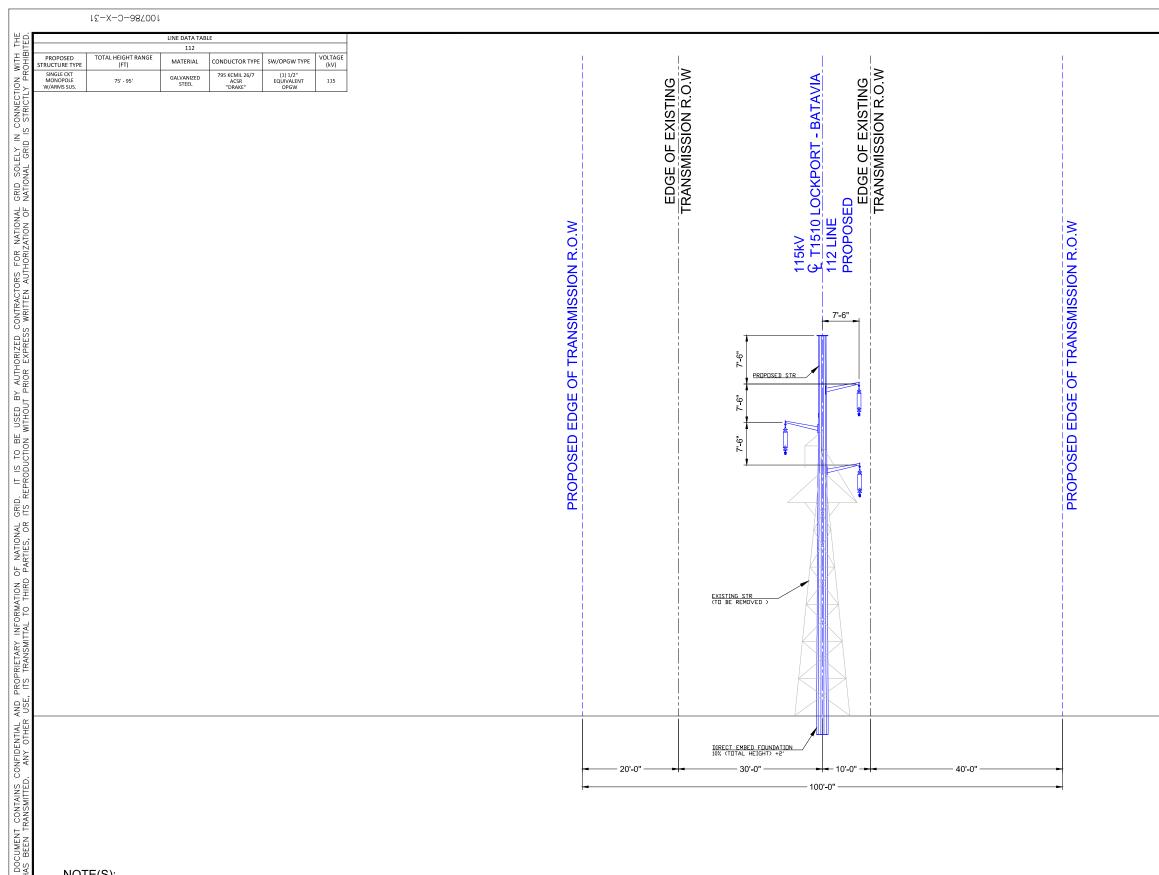
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NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION STRUCTURE 159-1 MILE 15.78 **SEGMENT 4** 

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- 2. PROPOSED STRUCTURE IS OUTLINED IN BLUE. EXISTING STRUCTURE IS TO BE COMPLETELY REMOVED.

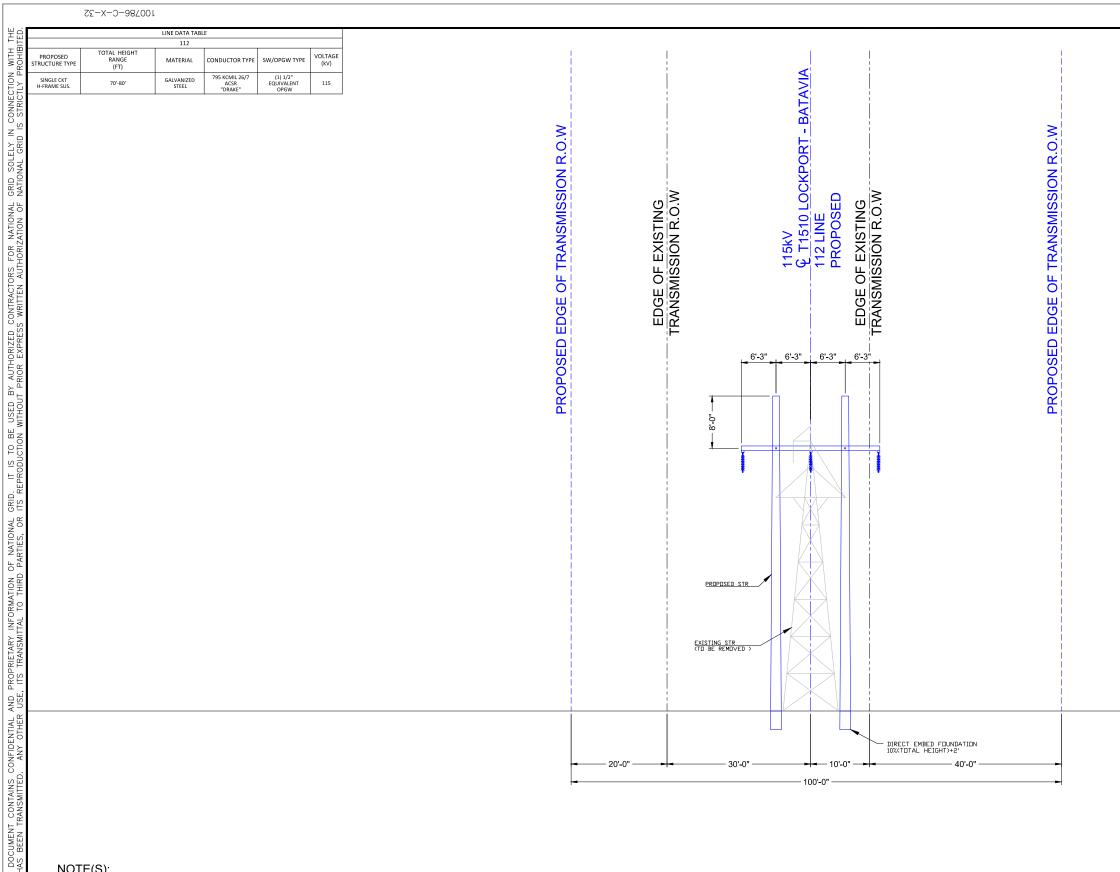
NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION STRUCTURES 160 TO 170 MILE 15.84 TO 16.87 SEGMENT 5

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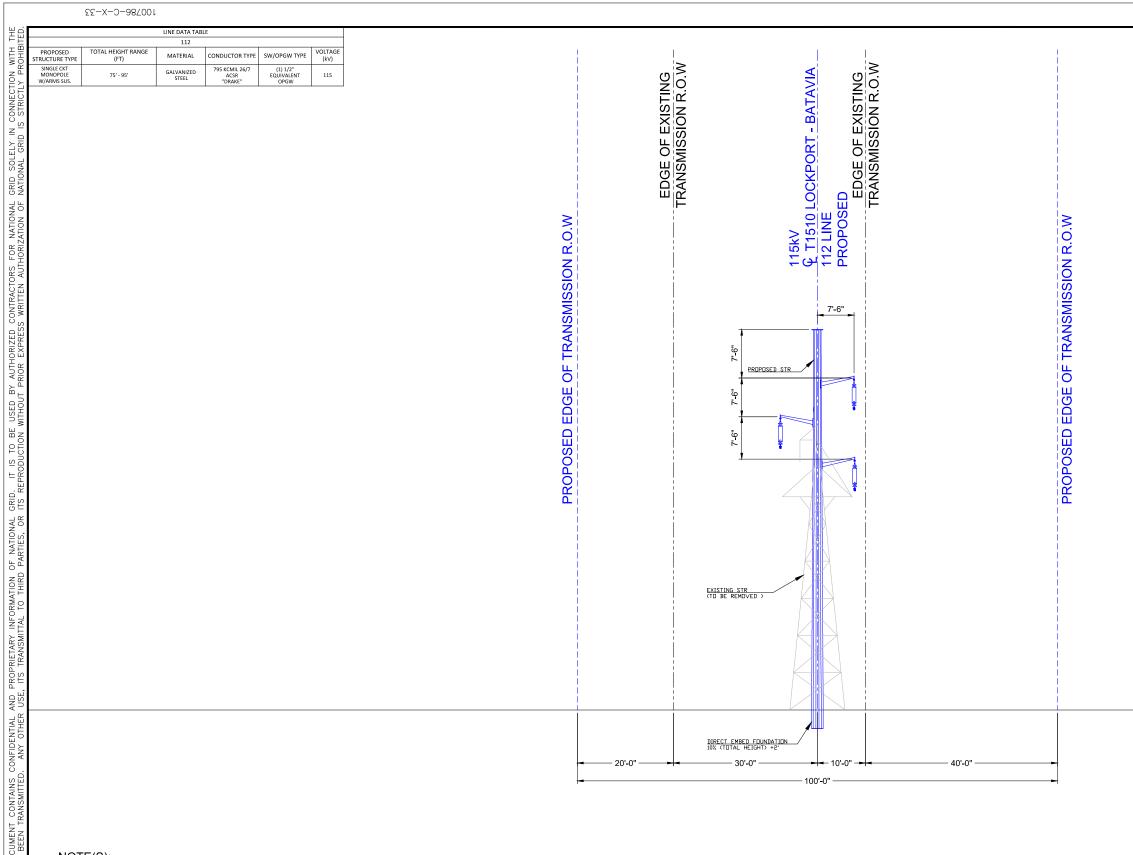
NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION STRUCTURES 171 TO 172 MILE 16.97 TO 17.07 **SEGMENT 5** 

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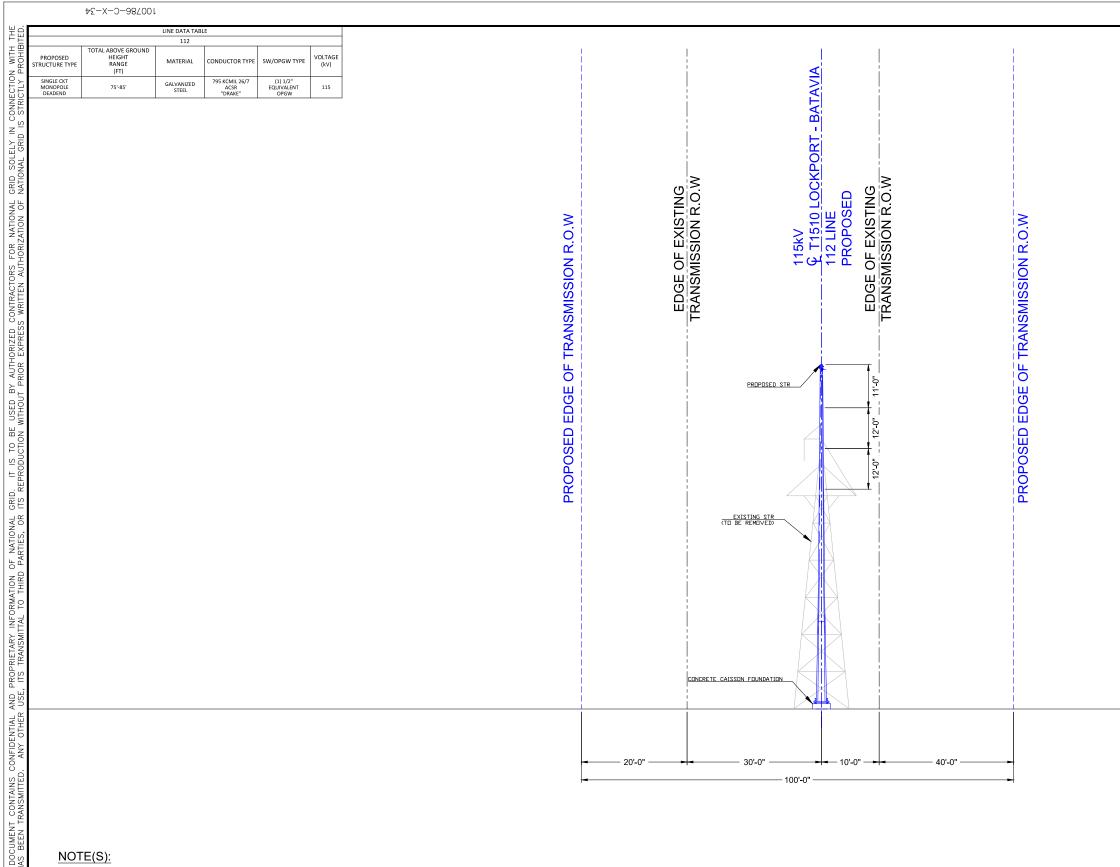
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- 3. THE EXISTING TRANSMISSION R.O.W EDGE INCREASES TO 70 FEET AT STRUCTURE 200.
- 4. SEGMENT 6 (STRUCTURES 173-1/2 TO 184-1/2) IS PART OF THE GENESEE COUNTY ECONOMIC DEVELOPMENT CORPORATION (GCEDC) STAMP PROJECT AND WILL NOT BE INCLUDED IN THIS ARTICLE VII APPLICATION.

NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION SEGMENT 5 (STRUCTURE 173) MILE 17.15 SEGMENT 7 (STRUCTURE 185 TO 199) MILE 19.19 TO 20.49

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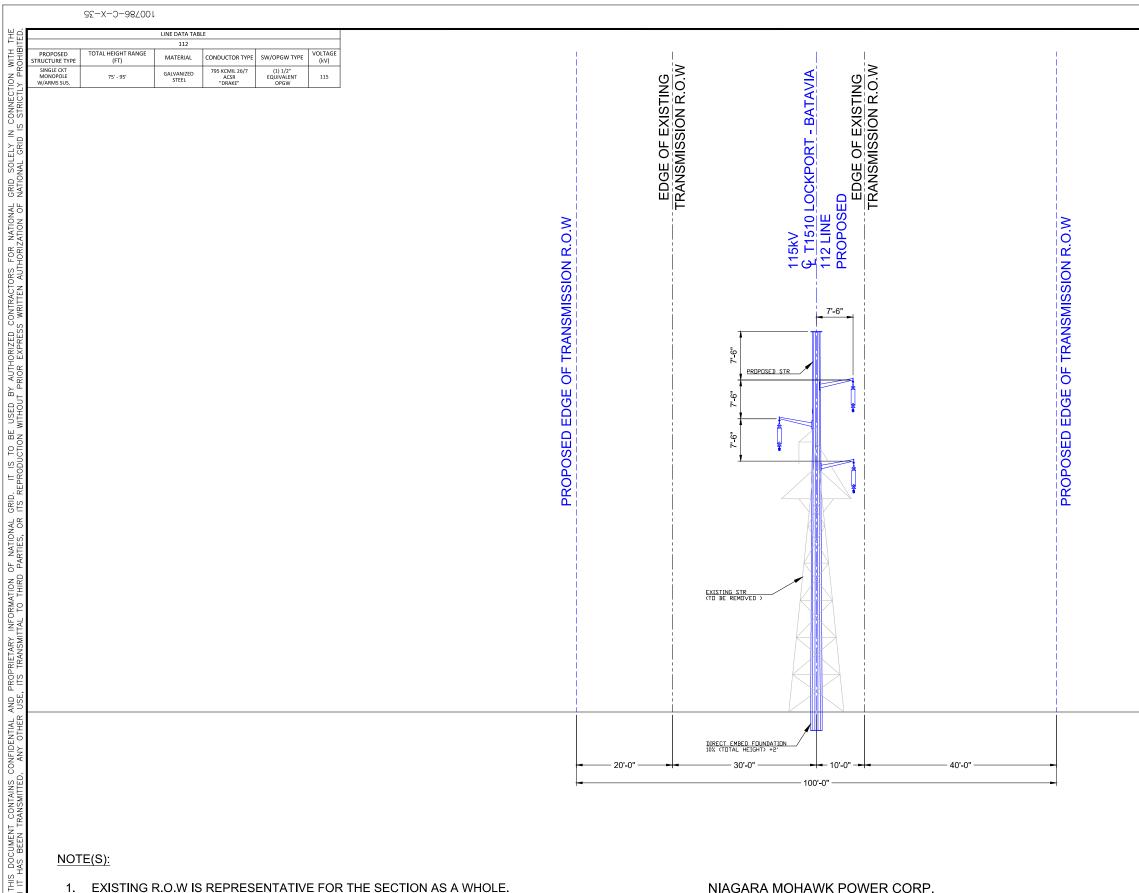
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- THE EXISTING TRANSMISSION R.O.W EDGE INCREASE TO 70 FEET AT 3. STRUCTURE 200.
- SEGMENT 6 (STRUCTURES 173-1/2 TO 184-1/2) IS PART OF THE 4. GENESEE COUNTY ECONOMIC DEVELOPMENT CORPORATION (GCEDC) STAMP PROJECT AND WILL NOT BE INCLUDED IN THIS ARTICLE VII APPLICATION.

NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION **STRUCTURE 200** MILE 20.56 **SEGMENT 7** 

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NIAGARA MOHAWK POWER CORP. PROPOSED CROSS-SECTION CONFIGURATION FACING LOCKPORT SUBSTATION STRUCTURES 201 TO 211 MILE 20.67 TO 21.68 **SEGMENT 7** 

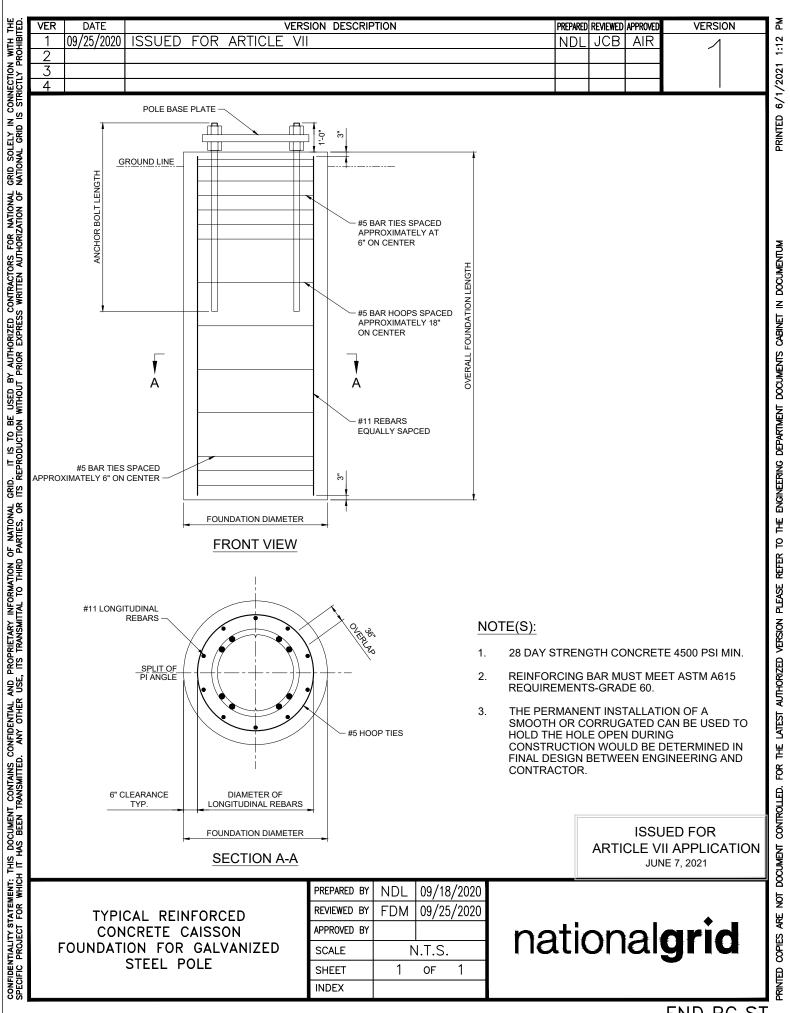
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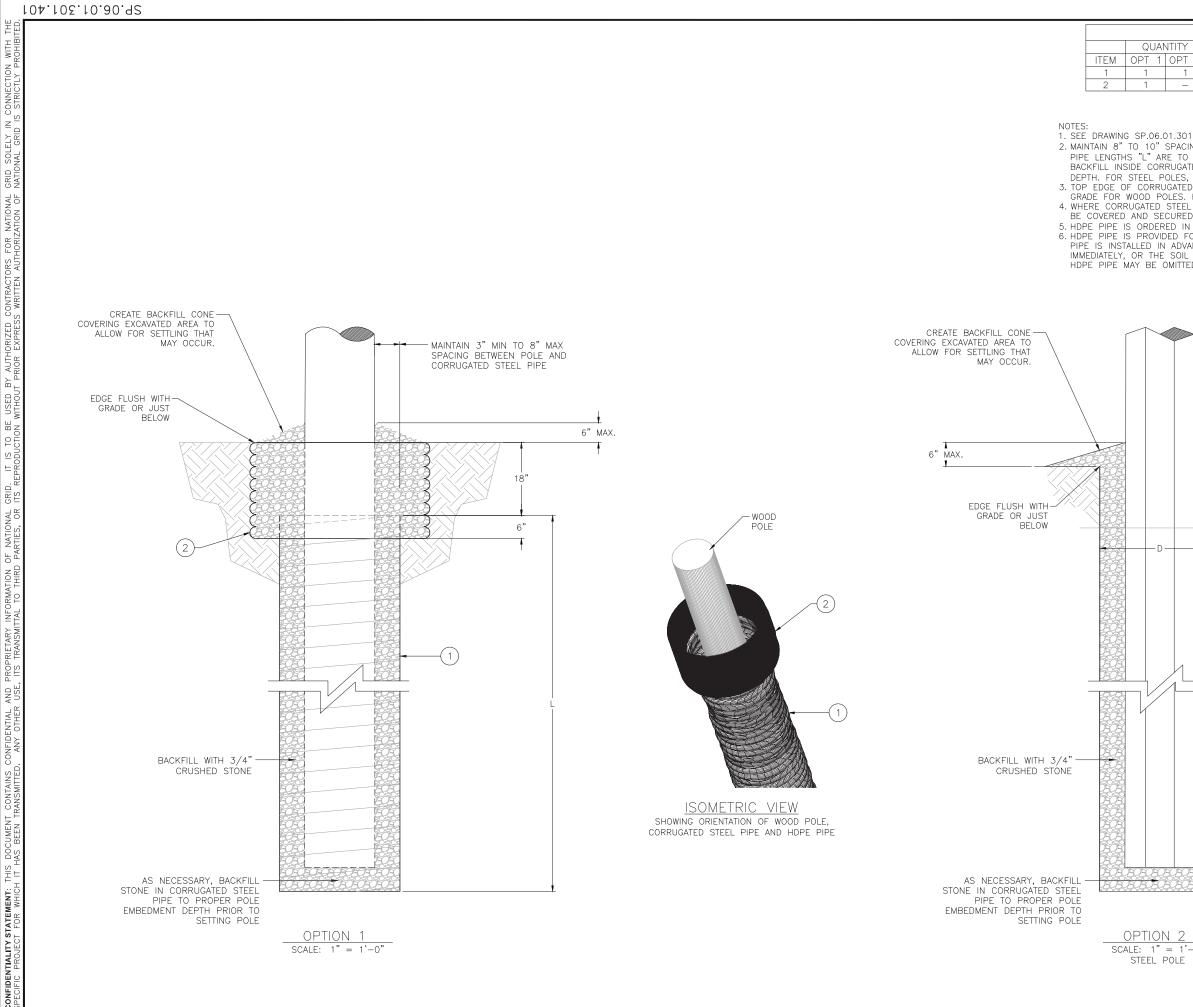
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# Figure 5-2 Concrete Caisson Foundation (1 Sheet)



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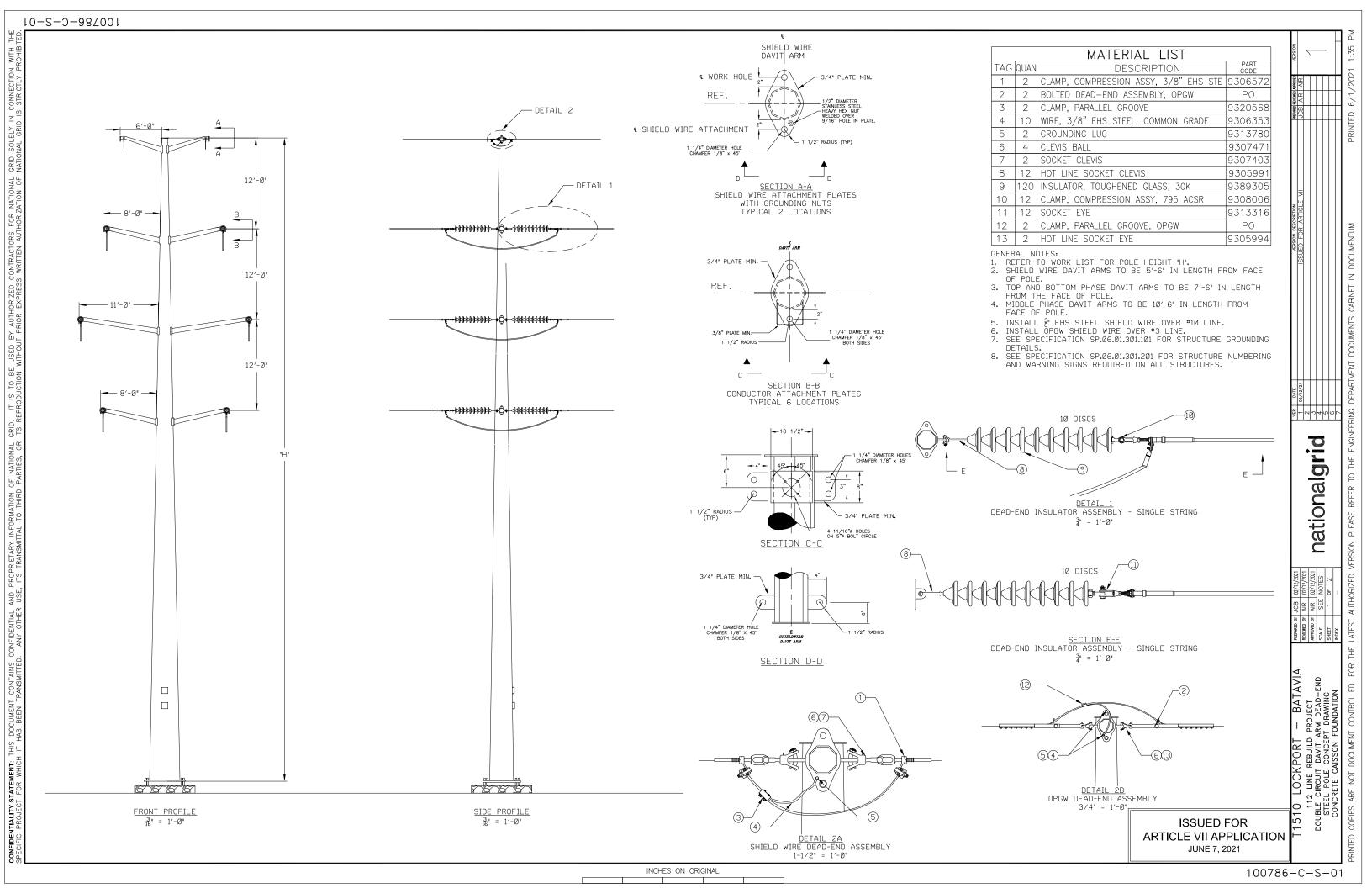
# Figure 5-3 Details for Direct Bury Steel Poles (1 Sheet)

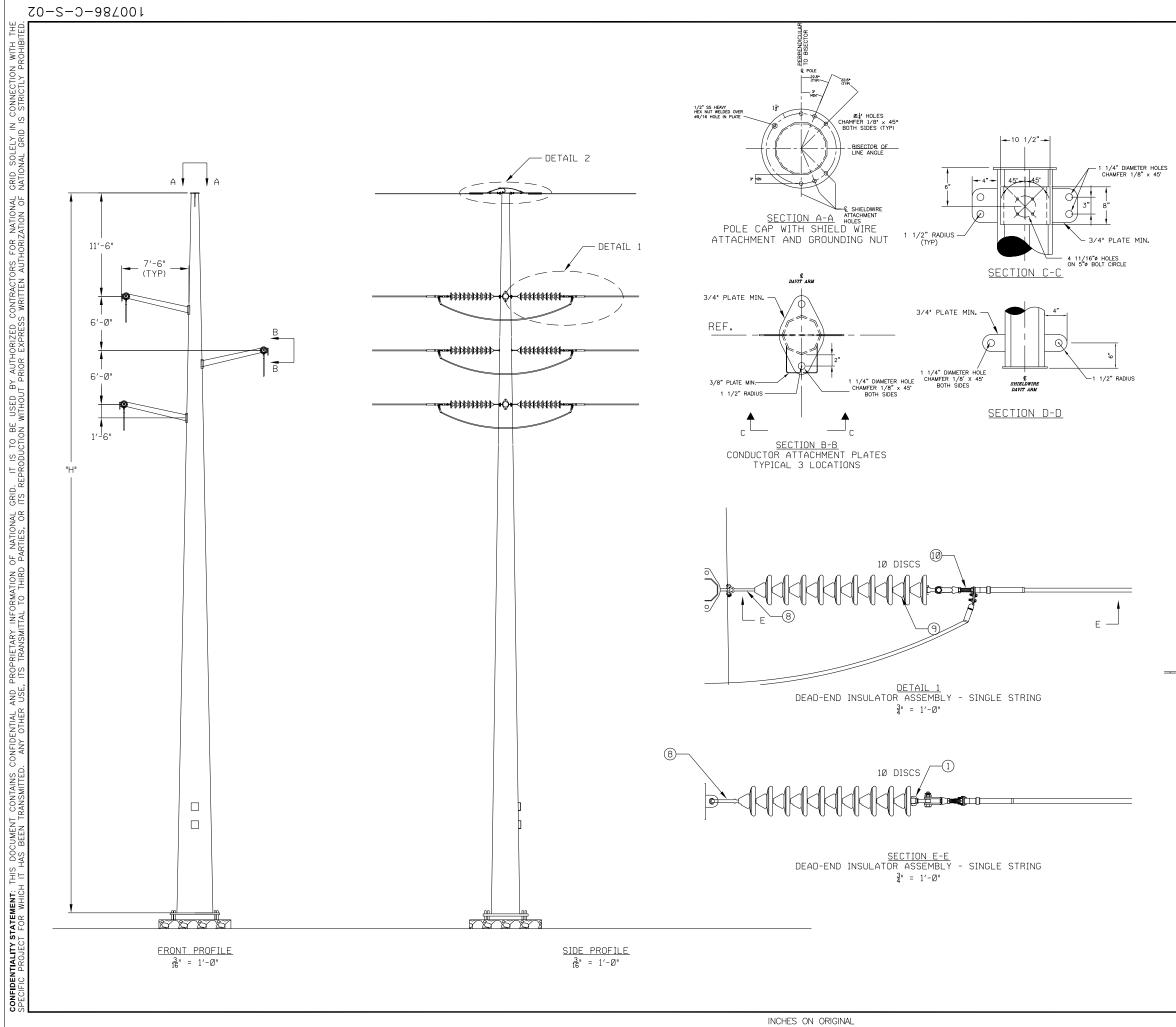


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Figure 5-4 Line 112 Rebuild Proposed Transmission Structures / Material (9 Sheets)





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QUAN	DESCRIPTION	PART CODE
6	SOCKET EYE	9313316
2	BOLTED DEAD-END ASSEMBLY, OPGW	PO
2	CLAMP, PARALLEL GROOVE, OPGW	PO
10	WIRE, 3/8" EHS STEEL, COMMON GRADE	9306353
1	GROUNDING LUG	9313780
2	CLEVIS BALL	9307471
2	HOT LINE SOCKET EYE	9305994
6	HOT LINE SOCKET CLEVIS	9305991
60	INSULATOR, TOUGHENED GLASS, 30K	9389305
6	CLAMP, COMPRESSION ASSY, 795 ACSR	9308006
	6 2 2 10 1 2 2 6 60	QUANDESCRIPTION6SOCKET EYE2BOLTED DEAD-END ASSEMBLY, OPGW2CLAMP, PARALLEL GROOVE, OPGW10WIRE, 3/8" EHS STEEL, COMMON GRADE1GROUNDING LUG2CLEVIS BALL2HOT LINE SOCKET EYE6HOT LINE SOCKET CLEVIS60INSULATOR, TOUGHENED GLASS, 30K

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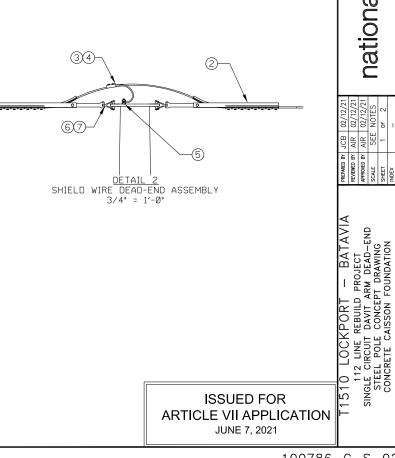
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GENERAL NOTES:
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3. SEE SPECIFICATION SP.06.01.301.101 FOR STRUCTURE GROUNDING DETAILS

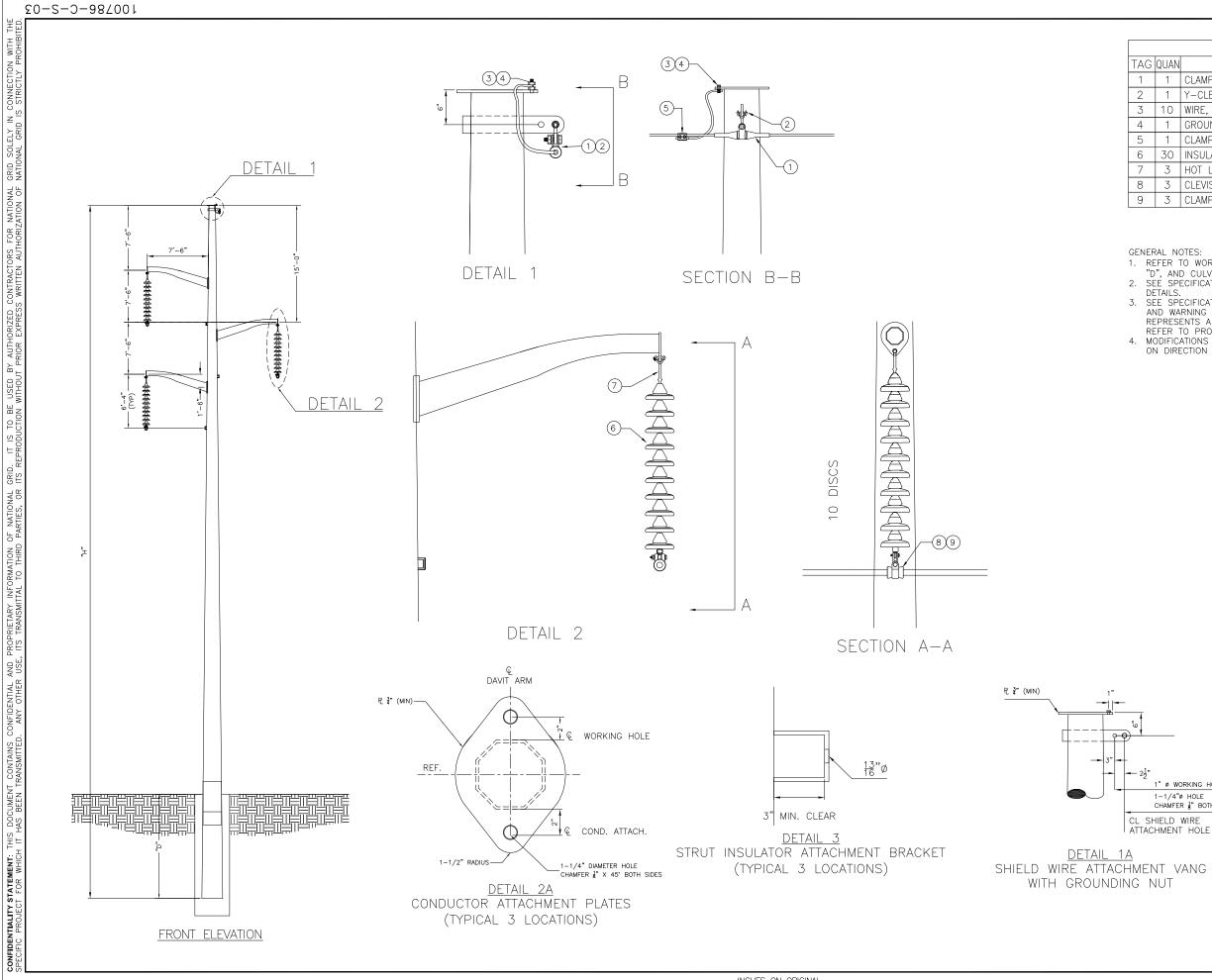
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1	Y-CLEVIS 90°	9312422
10	WIRE, 3/8" COMMON GRADE STEEL	9306353
1	GROUNDING LUG	9313780
1	CLAMP, PARALLEL GROOVE	PO
30	INSULATOR, TOUGHENED GLASS, 30K	9389305
3	HOT LINE Y CLEVIS BALL	9312243
3	CLEVIS EYE 90° FOR 795 ACSR	9320427
3	CLAMP, CGS UNIT FOR 795 ACSR	9306305

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 SEE SPECIFICATION SP.06.01.301.101 FOR STRUCTURE GROUNDING

DETAILS.

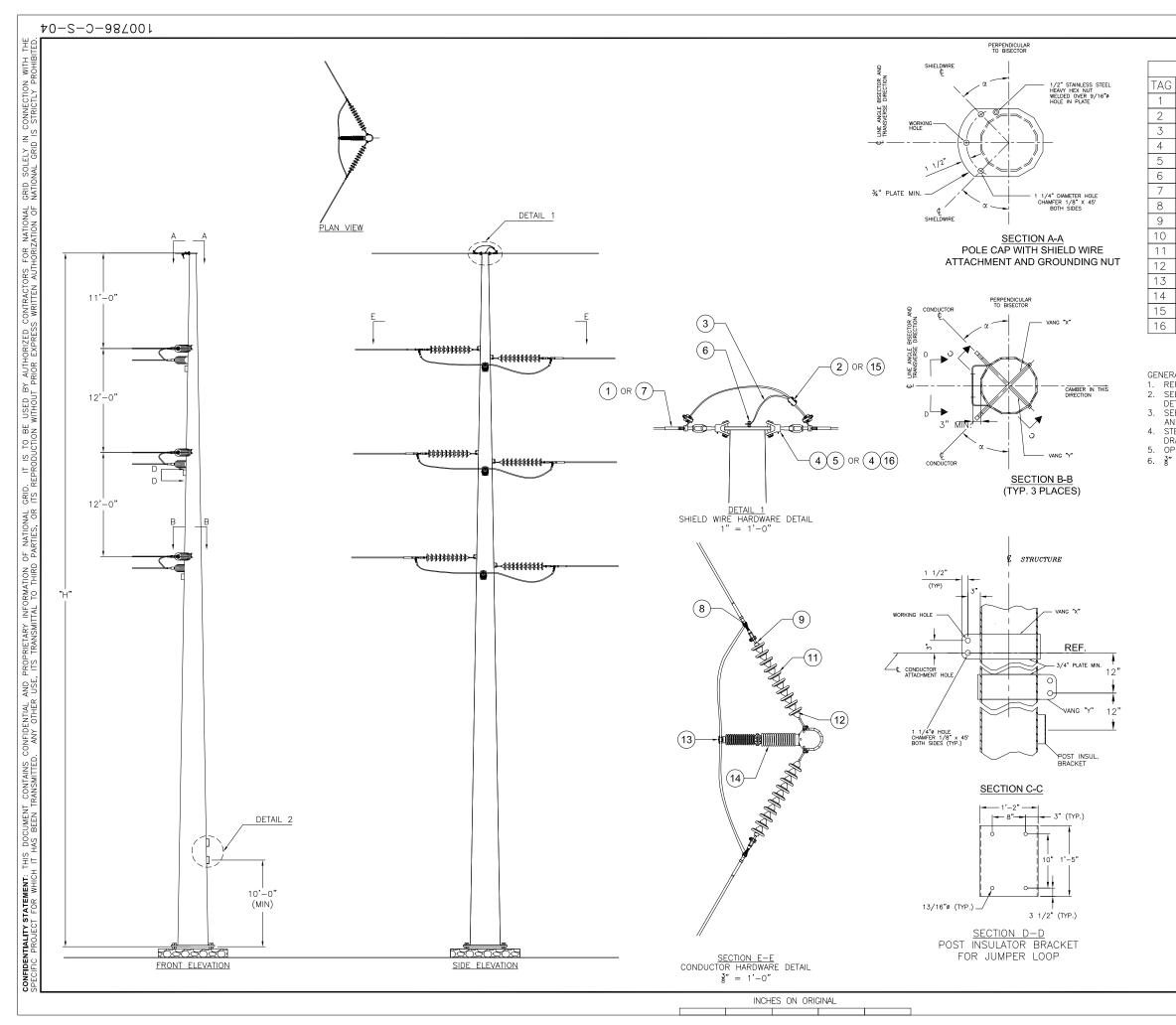
DETAILS.
SEE SPECIFICATION SP.06.01.301.201 FOR STRUCTURE NUMBERING AND WARNING SIGNS REQUIRED FOR ALL STRUCTURES. DRAWING REPRESENTS A TYPICAL STRUCTURE. FOR ARM ORIENTATION PLEASE REFER TO PROJECT CROSS-SECTIONS.
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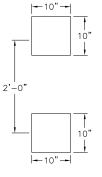


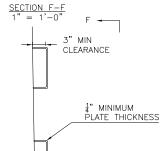
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	1	CLAMP, PARALLEL GROOVE, OPGW	PO
	15	WIRE, 3/8" STEEL, COMMON GRADE	9306353
	4	CLEVIS BALL	9307471
	2	SOCKET CLEVIS	9307403
	1	GROUNDING LUG	9313780
	2	CLAMP, BOLTED DEAD-END, OPGW	PO
	6	CLAMP, COMPRESSION ASSY, 795 ACSR	9308006
	6	SOCKET EYE	9313316
	12	HOT LINE Y-CLEVIS BALL	9312243
	60	INSULATOR, TOUGHENED GLASS, 30K	9389305
	6	HOT LINE SOCKET CLEVIS	9305991
	3	CLAMP, TRUNION FOR 1.00" TO 1.50" ALUM	9312462
	3	INSULATOR, PORCELAIN LINE POST, TWO PIE	9386601
	1	CLAMP, PARALLEL GROOVE	9320568
	2	HOT LINE SOCKET EYE	9305994

GENERAL NOTES: 1. REFER TO WORK LIST FOR POLE HEIGHT "H". 2. SEE SPECIFICATION SP.06.01.301.101 FOR STRUCTURE GROUNDING DETAILS. SEE SPECIFICATION SP.06.01.301.201 FOR STRUCTURE NUMBERING AND WARNING SIGNS REQUIRED FOR ALL STRUCTURES.
 STEEL POLE MANUFACTURER DRAWINGS TO SUPERCEDE CONCEPT

DRAWINGS AS SOON AS PRACTICAL. 5. OPGW ASSEMBLY INCLUDES ITEMS 2, 4, 7 & 16

6. <sup>3</sup>/<sub>8</sub>" EHS STEEL ASSEMBLY INCLUDES ITEMS 1, 4, 5, & 15





DETAIL 2 OPGW SPLICE BRACKET 1" = 1'-0"

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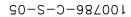
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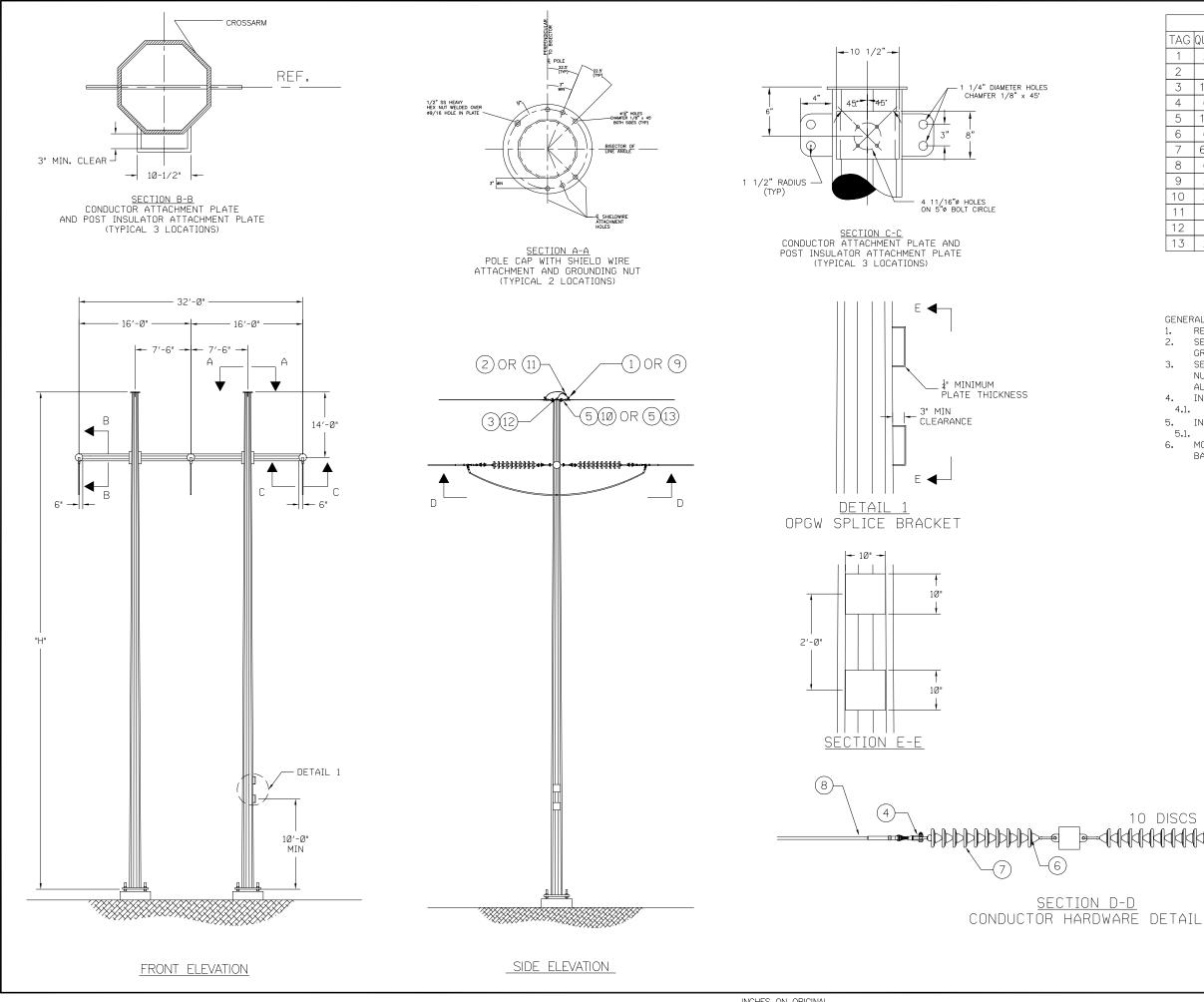
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CONFIDENTIAL . ANY OTHER

CONTAINS FRANSMITTED

DOCUMENT HAS BEEN TF

CONFIDENTIALITY STATEMENT: THIS SPECIFIC PROJECT FOR WHICH IT H



INCHES ON ORIGINAL

		MATERIAL LIST	
TAG	QUAN	DESCRIPTION	PART CODE
1	2	CLAMP, COMPRESSION ASSY, 3/8" EHS STE	9306572
2	1	CLAMP, PARALLEL GROOVE	9320568
3	15	WIRE, 3/8" STEEL, COMMON GRADE	9306353
4	6	CLAMP, COMPRESSION ASSY, 795 ACSR	9308006
5	16	CLEVIS BALL	9307471
6	6	HOT LINE SOCKET CLEVIS	9305991
7	60	INSULATOR, TOUGHENED GLASS, 30K	9389305
8	6	SOCKET EYE	9313316
9	2	BOLTED DEAD-END ASSEMBLY, OPGW	PO
10	2	SOCKET CLEVIS	9307403
11	1	CLAMP, PARALLEL GROOVE, OPGW	PO
12	1	GROUNDING LUG	9313780
13	2	HOT LINE SOCKET EYE	9305994

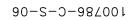
GENERAL NOTES:

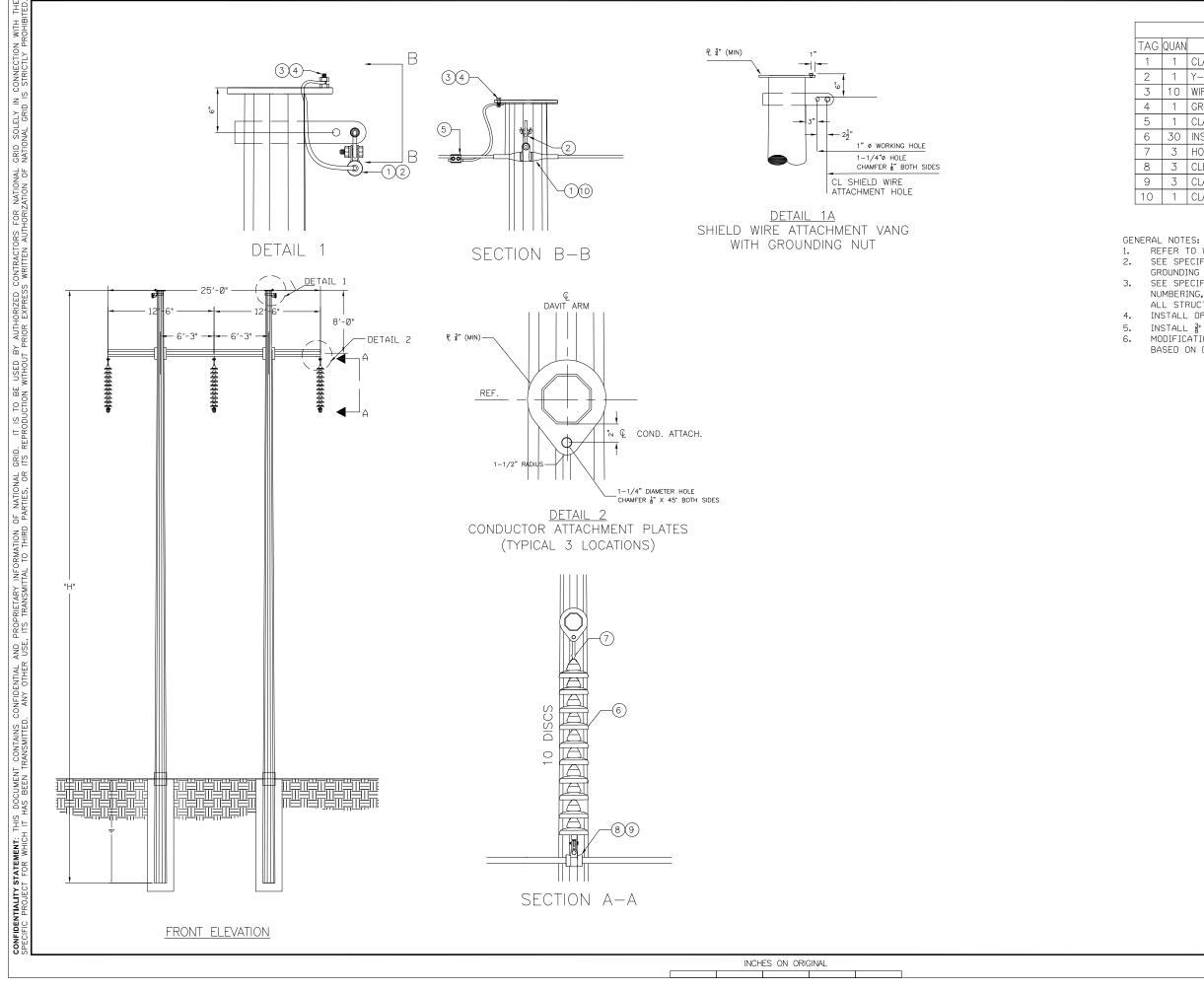
- REFER TO WORK LIST FOR POLE HEIGHT "H" 1. SEE SPECIFICATION SP.06.01.301.101 FOR STRUCTURE 2. GROUNDING DETAILS.
- SEE SPECIFICATION SP.06.01.301.201 FOR STRUCTURE NUMBERING, WARNING SIGNS, AND MARKINGS ROUIRED FOR З. ALL STRUCTURES.
- INSTALL OPGW ON RIGHT POLE OF STRUCTURE. . ITEMS 5, 11, 13, & 15 4. 4.1.
- 5. 5.1.
- INSTALL & EHS ON LEFT POLE OF STRUCTURE. I. ITEMS 1, 2, 5, & 12. MODIFICATIONS TO STANDARD INSTALLATION MAY PROCEED BASED ON DIRECTION FROM PROJECT ENGINEER. 6.

- 0 M 4 K

national**grid** 

AIR \$ \$ PREPARED REVIEWED APPROVED SCALE SCALE SHEET INDEX **AVIA** UILD PROJECT IMENT 12 LINE REBUILD E CIRCUIT H-FRA EL POLE CONCEFICEL POLE CONCEFICE Not SINGLE CIRCUI STEEL POLE CONCRETE ( ARE 510 ß **ISSUED FOR** ARTICLE VII APPLICATION ED JUNE 7, 2021 100786-C-S-05

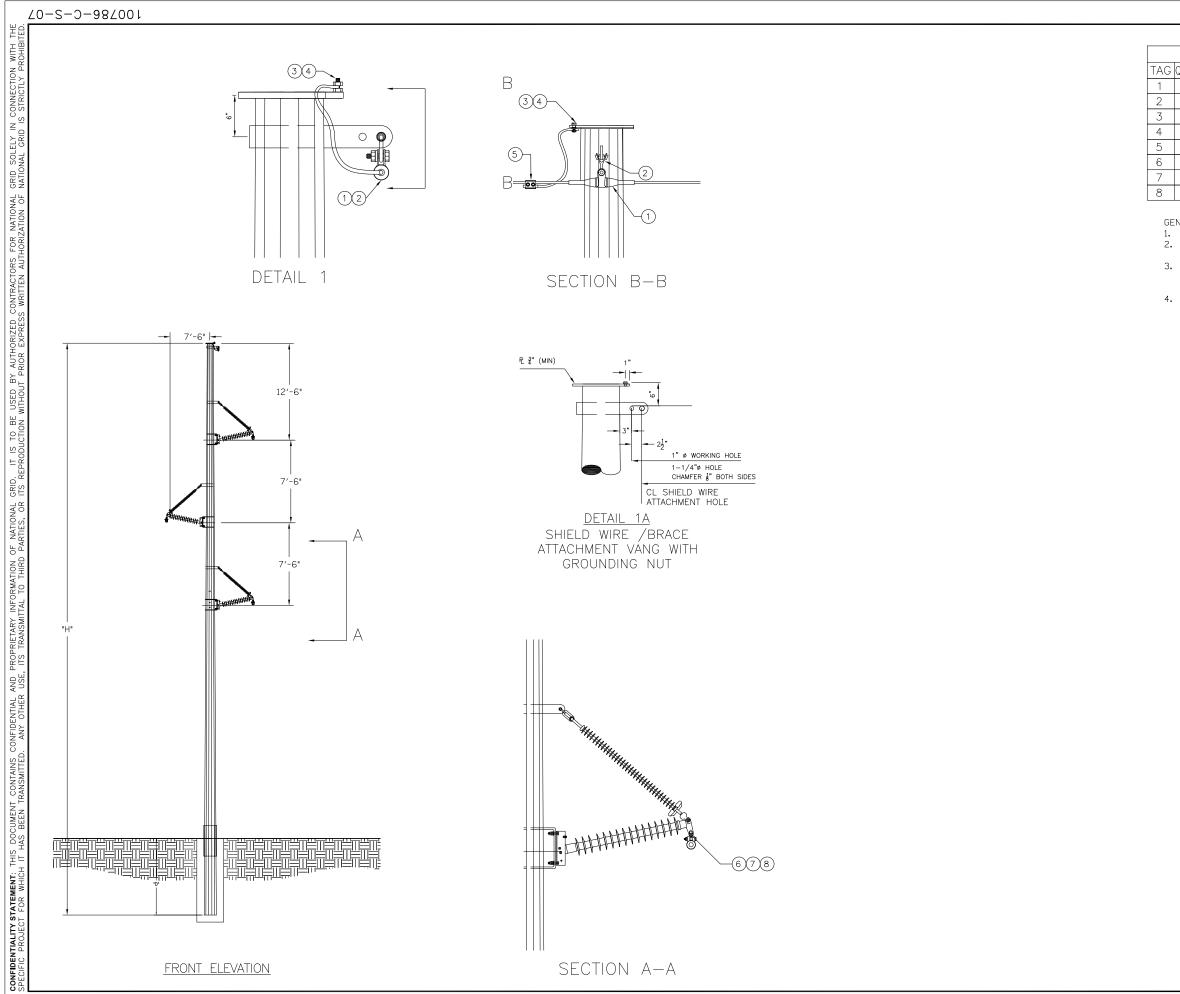




	MATERIAL LIST	
QUAN	DESCRIPTION	PART CODE
1	CLAMP, AGS UNIT FOR OPGW	PO
1	Y-CLEVIS 90°	9312422
10	WIRE, 3/8" COMMON GRADE STEEL	9306353
1	GROUNDING LUG	9313780
1	CLAMP, PARALLEL GROOVE	PO
30	INSULATOR, TOUGHENED GLASS, 30K	9389305
3	HOT LINE Y CLEVIS BALL	9312243
3	CLEVIS EYE 90° FOR 795 ACSR	9320427
3	CLAMP, CGS UNIT FOR 795 ACSR	9306305
1	CLAMP, AGS W/ROD FOR 3/8" EHS STEEL	9306625

- REFER TO WORK LIST FOR POLE HEIGHT "H" SEE SPECIFICATION SP.06.01.301.101 FOR STRUCTURE GROUNDING DETAILS.
- SEE SPECIFICATION SP.06.01.301.201 FOR STRUCTURE NUMBERING, WARNING SIGNS, AND MARKINGS REQUIRED FOR ALL STRUCTURES.
- INSTALL OPGW ON RIGHT POLE OF STRUCTURE. INSTALL & EHS ON LEFT POLE OF STRUCTURE. MODIFICATIONS TO STANDARD INSTALLATION MAY PROCEED BASED ON DIRECTION FROM PROJECT ENGINEER.

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ADE STEEL	9306353	PREPARED REVIEWED APPROVE			9
	9313780	EBH CI-	}		TED
Έ	P0				RIN
GLASS, 30K	9389305				٩
0LA33, 30N	9312243	Ш			
5 ACSR		Ш			
	9320427	Ш			
95 ACSR	9306305				
3/8" EHS STEEL	9306625	N			
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		BY JCB	D BY AIR	SCALE SEE NOIES SHEET 1 OF 1 INDEX –	E LATEST AUTHORIZED VE
ISSUED ARTICLE VII AF JUNE 7,	PPLICATION	T1510 LOCKPORT - BATAVIA	112 LINE REBUILD PROJECT SINGLE CIRCUIT H-FRAME SUSPENSION	STEEL POLE CONCEPT DRAWING DIRECT EMBEDDED FOUNDATION	INTED COPIES ARE NOT DOCUMENT CONTROLLED. FOR THE LATEST AUTHORIZED VERSION



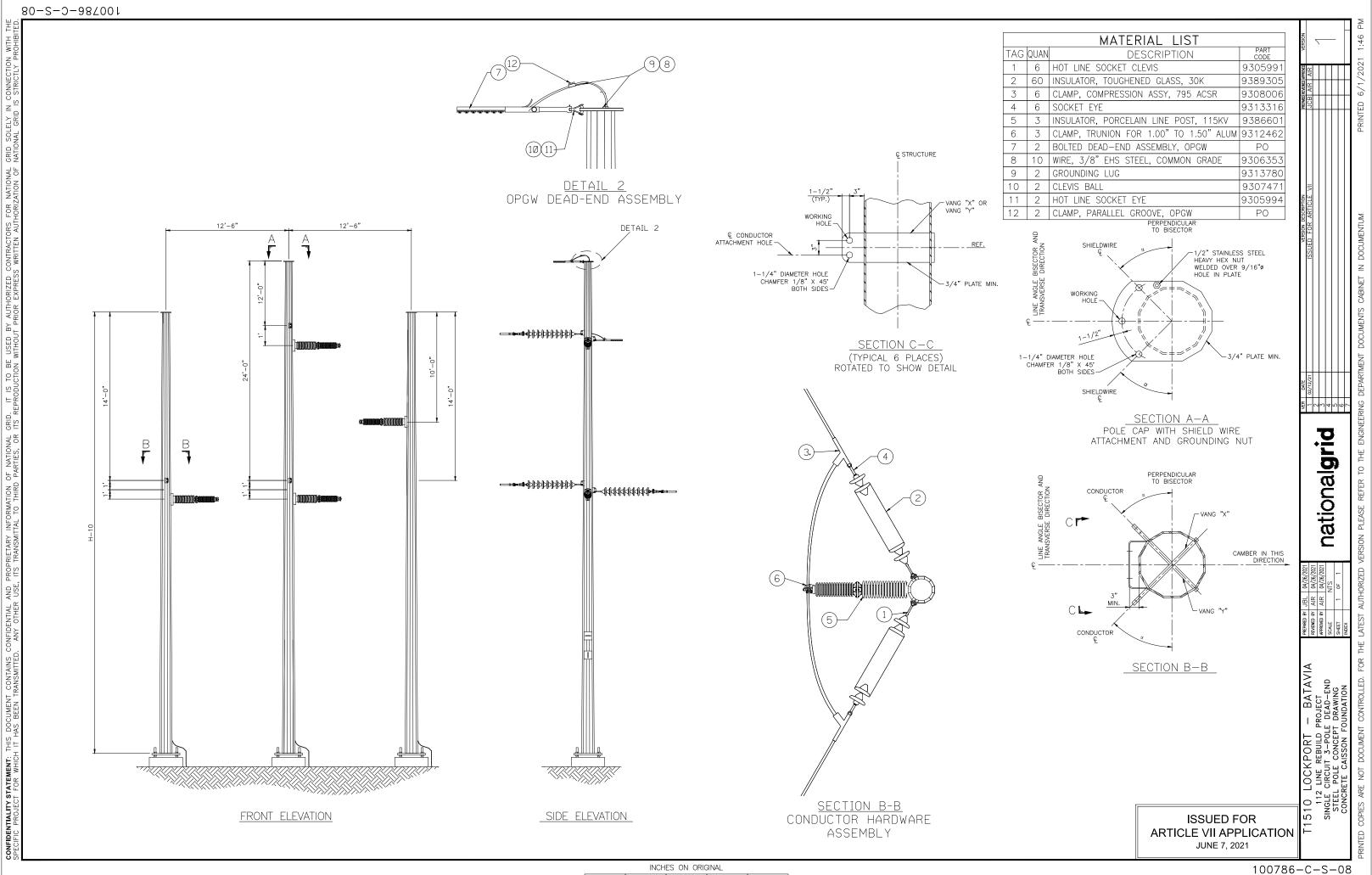
INCHES ON ORIGINAL

	MATERIAL LIST	
QUAN	DESCRIPTION	PART CODE
1	CLAMP, AGS UNIT FOR OPGW	PO
1	Y-CLEVIS 90°	9312422
10	WIRE, 3/8" COMMON GRADE STEEL	9306353
1	GROUNDING LUG	9313780
1	CLAMP, PARALLEL GROOVE	PO
3	BRACED POST ASSEMBLY	PO
3	CLEVIS EYE 90° FOR 795 ACSR	9320427
3	CLAMP, CGS UNIT FOR 795 ACSR	9306305

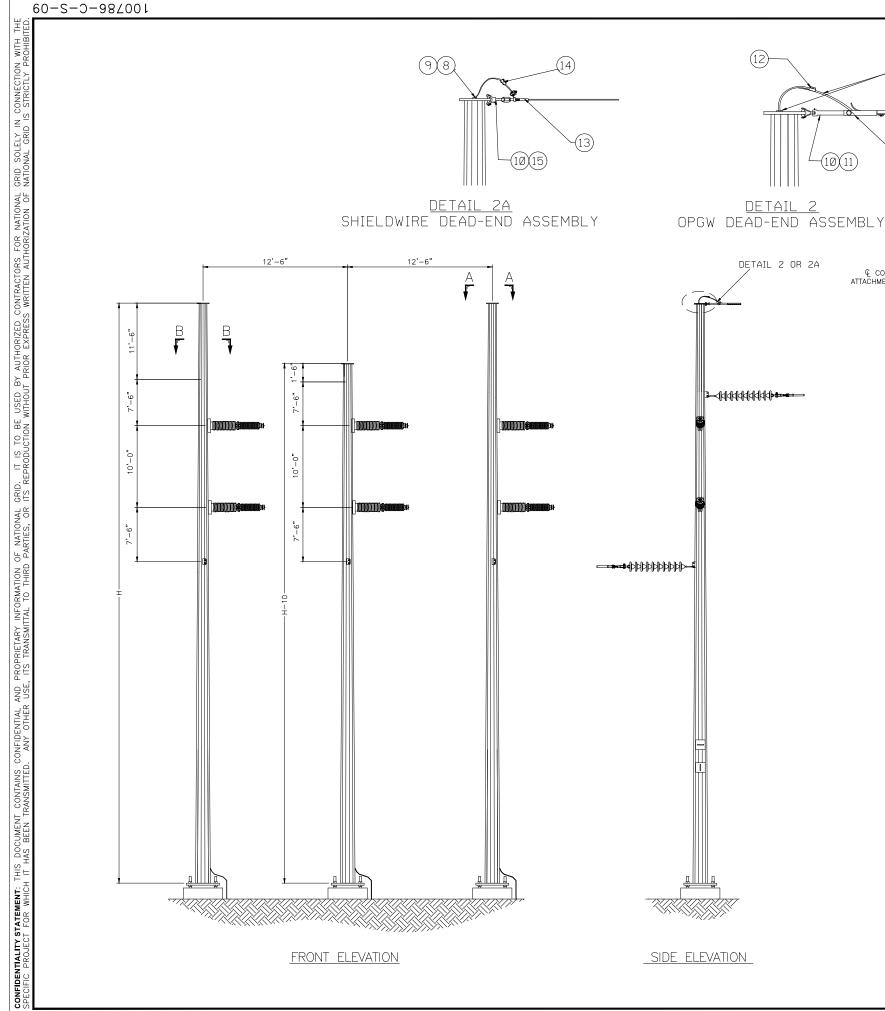
GENERAL NOTES: 1. REFER TO WORK LIST FOR POLE HEIGHT "H" 2. SEE SPECIFICATION SP.06.01.301.101 FOR STRUCTURE GROUNDING DETAILS. SEE SPECIFICATION SP.06.01.301.201 FOR STRUCTURE NUMBERING, WARNING SIGNS, AND MARKINGS RQUIRED FOR ALL STRUCTURES.

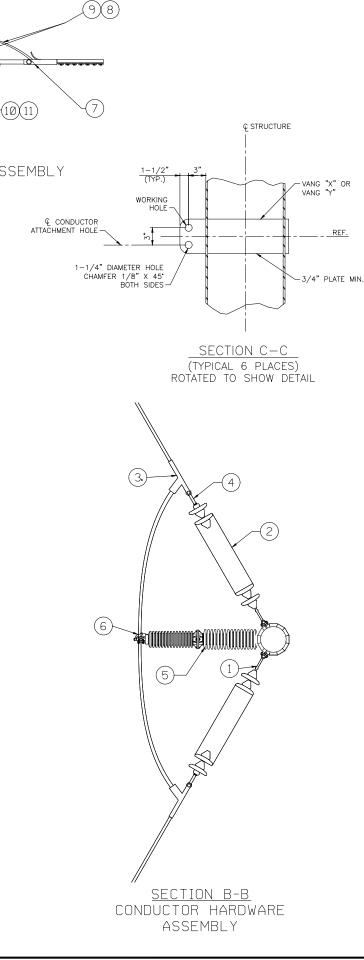
4. MODIFICATIONS TO STANDARD INSTALLATION MAY PROCEED BASED ON DIRECTION FROM PROJECT ENGINEER.

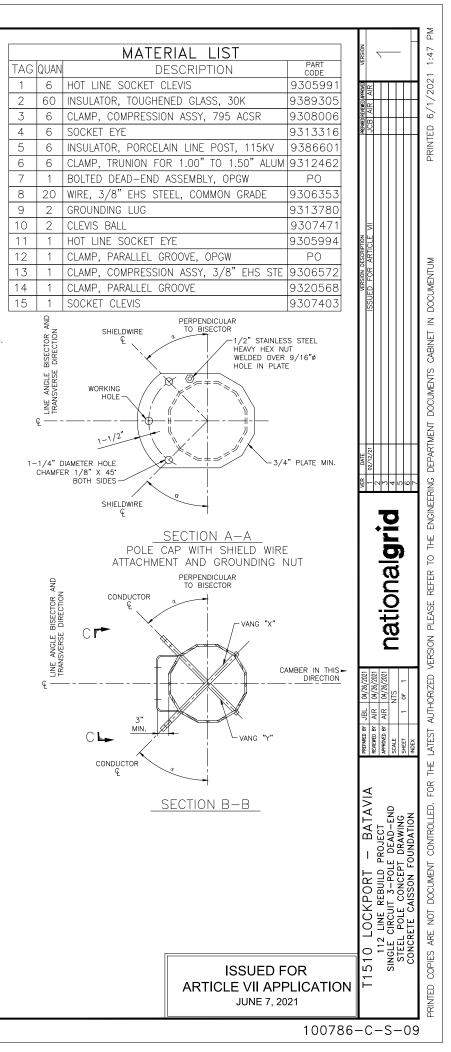
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5 ACSR	9320427	Ш			
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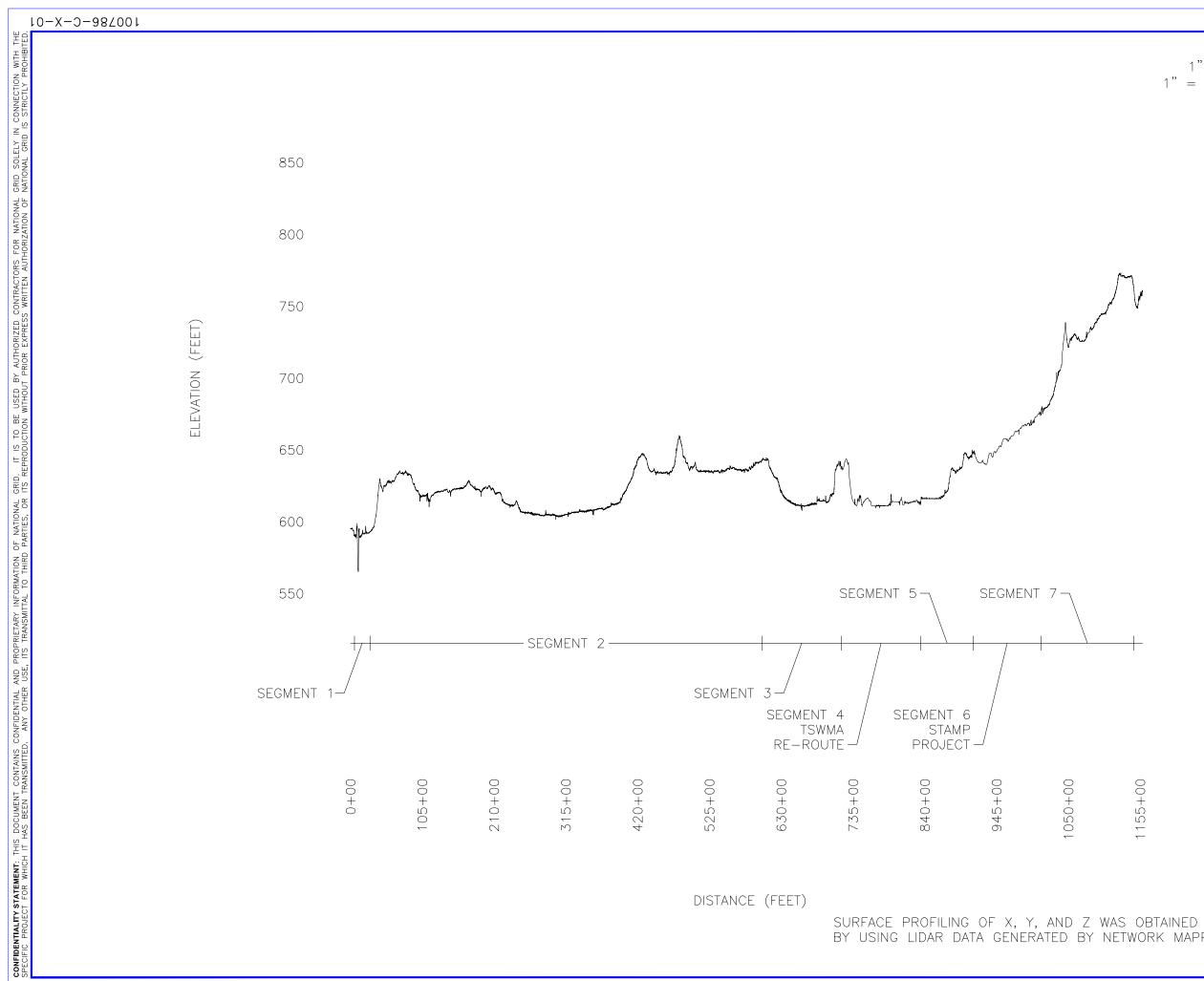
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# Figure 5-5 Centerline Elevation Profile (1 Sheet)



	INCH	ES ON (	ORIGINAL		

1" = 50' VER	RTICAL	VERSION	<u></u>	1.12 PM
= 10,500' Ho	ORIZONTAL	REPARED REVIEMED APPROVED NDL AIR AIR		DRINTED 6/1/2021 1:12
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		PREPARED BY NDL 10/09/20 REVIEWED BY FDM -	APRONED BY SCALE SEE NOTES SHEET 1 OF 1 INDEX TBD	
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