

Michigan Department of Transportation

Infrastructure Protection and Rehabilitation Response to High Lake Levels

MDOT OR21-013

Appendix F: M-29 St. John's Marsh Expanded Documentation

March 2022 (Final)

Infrastructure Protection and Rehabilitation Response to High Lake Levels

MDOT OR21-031

Appendix F: M-29 St. John's Marsh Expanded Documentation

March 2022 (Final)

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Michigan Department of Transportation
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30080765

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As Arcadis does not have a complete control over the accuracy of the data used in the conceptual engineering and design completed in this report, it is recommended that the results shown not be used without first obtaining additional information and confirming all results. This includes, but is not limited to, the roadway survey data, the recommended bridge structures, the soils and geotechnical data, the erosion control calculations, the wave calculations, future high water and wave forecasts, and all other engineering design. The statements provided herein shall not be relied upon for any specific application without independent verification and assessment of suitability by the project's engineer of record, architect, or another party acting in similar capacity, as stipulated by the authority having jurisdiction or other applicable contractual regulations.

Therefore, while preliminary recommendations, calculations, and engineering design are based on sound and established principles, they shall not be deemed as instruction for any specific application or project without subsequent independent analysis, evaluation, verification and assessment of appropriateness for such an application by the engineer and/or architect of the project.

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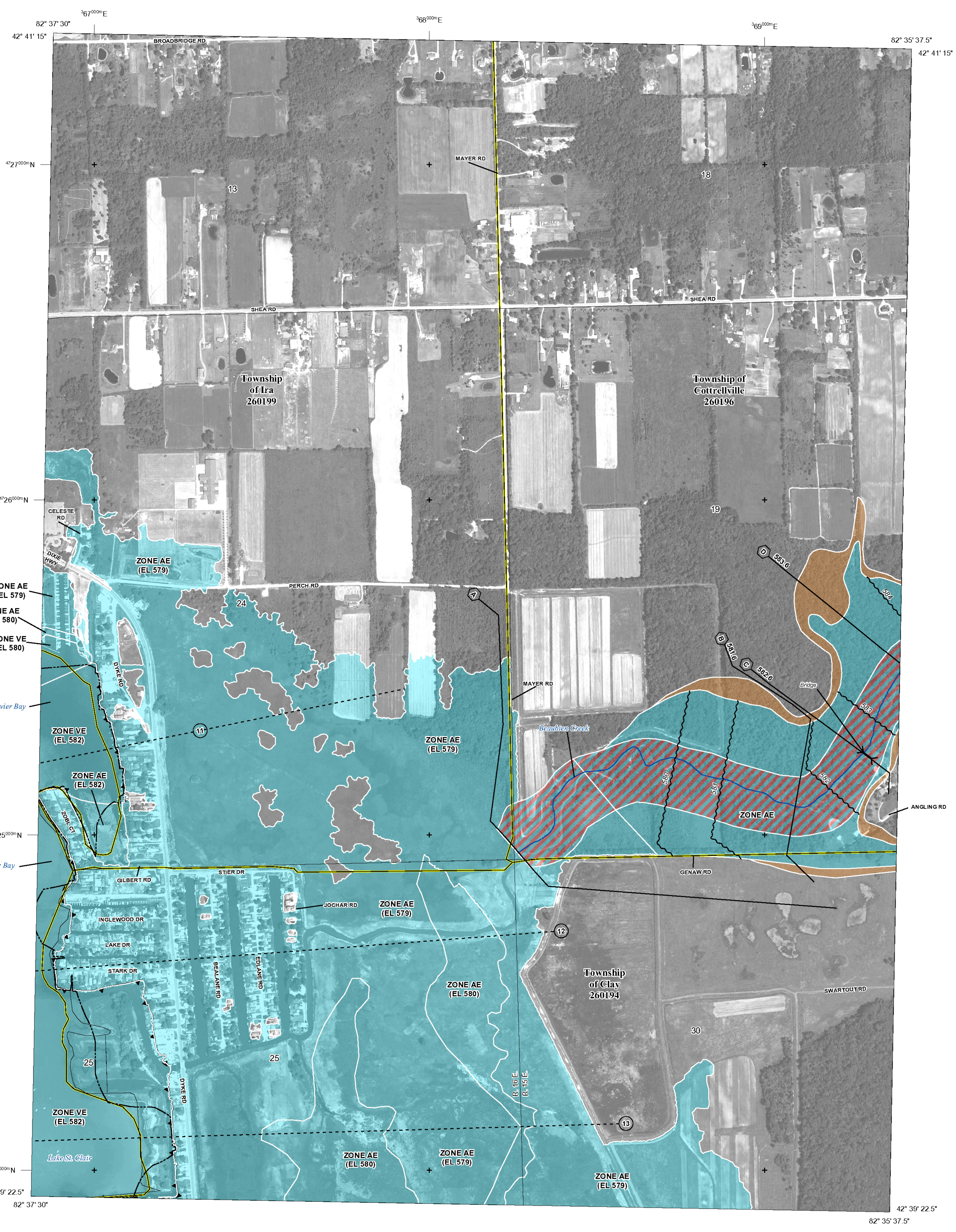
Historic Flooding Photographs for M-29 St. John's Marsh Expanded Documentation

**NO PHOTOS
AVAILABLE**

FEMA FIRM Map

26147CO511E & 26147CO513E

Effective Date December 14, 2018



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT
THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT [HTTPS://MSC.FEMA.GOV](https://msc.fema.gov)

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		Area of Minimal Flood Hazard Zone X
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
		Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
OTHER FEATURES		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-355-2627) or visit the FEMA Map Service Center website at <https://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

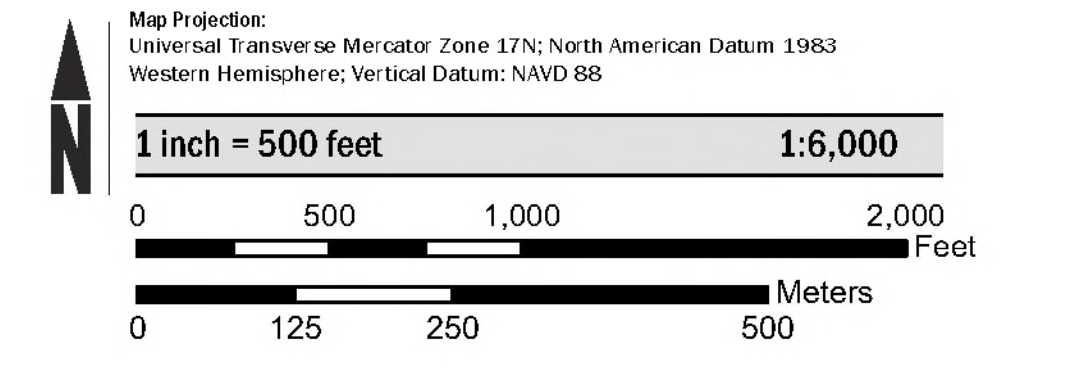
To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format by the National Agriculture Imagery Program (NAIP). This information was derived from digital orthophotography at a 2-foot resolution from photography dated 2012.

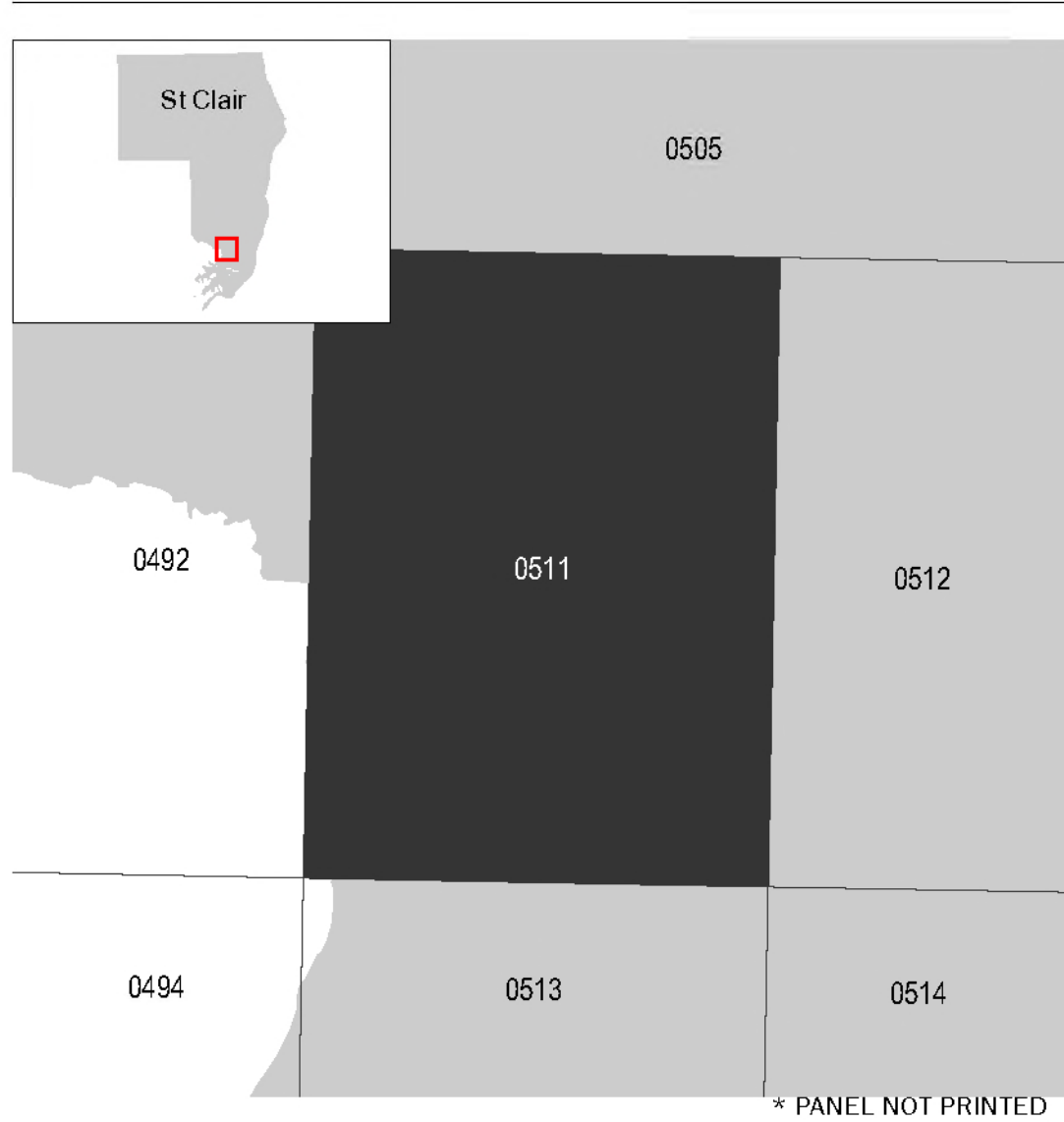
LIMIT OF MODERATE WAVE ACTION: Zone AE has been divided by a Limit of Moderate Wave Action (LMWA). The LMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the Zone VE and the LMWA (or between the shoreline and the LMWA for areas where Zone VE is not identified) will be similar to, but less severe than, those in the Zone VE.

Limit of Moderate Wave Action (LMWA)

SCALE



PANEL LOCATOR



National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
 FLOOD INSURANCE RATE MAP

ST. CLAIR COUNTY, MI
 (All Jurisdictions)

PANEL 511 OF 595

Panel Contains:

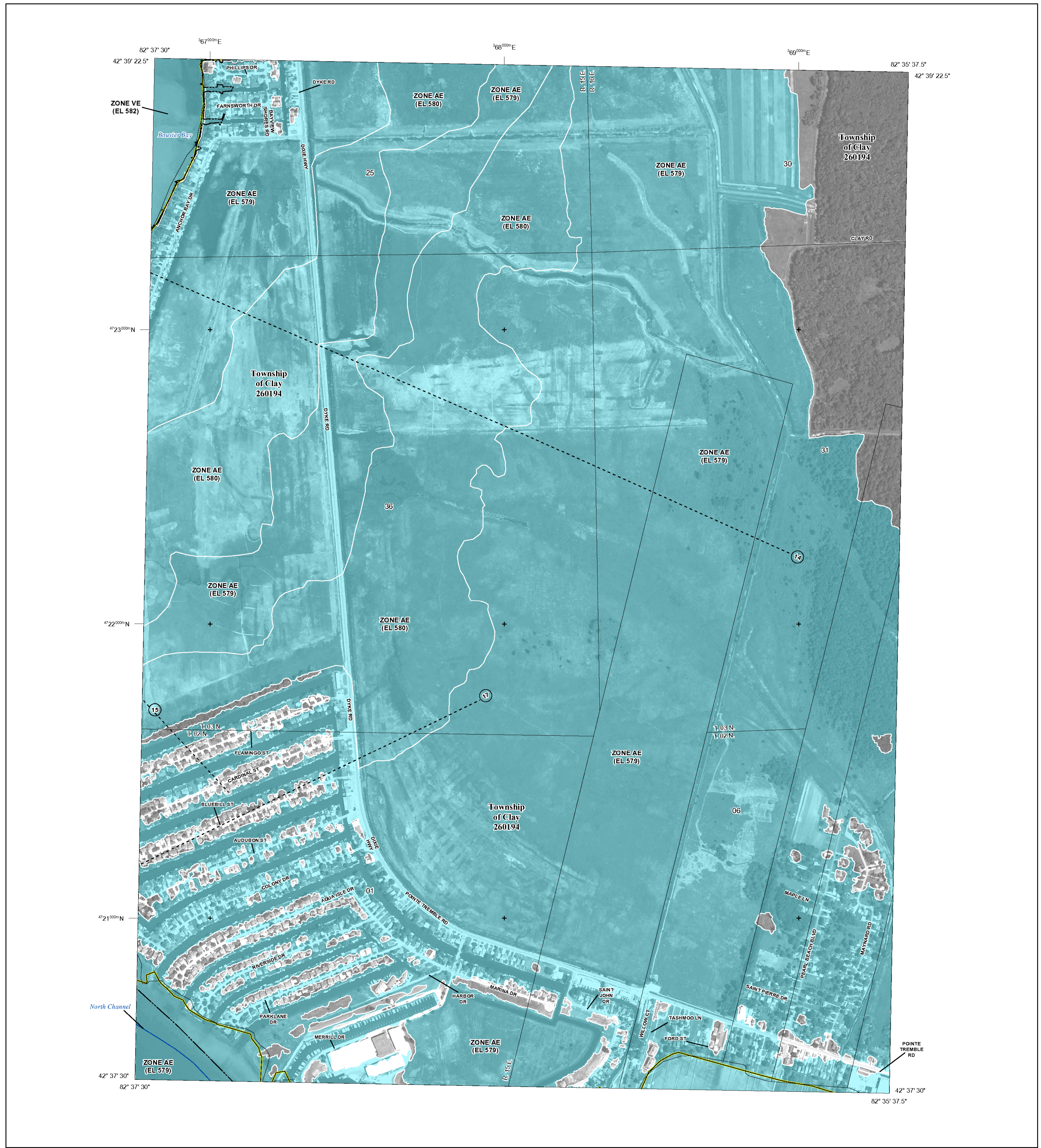
COMMUNITY	NUMBER	PANEL	SUFFIX
CLAY, TOWNSHIP OF	260194	0511	E
COTTRELLVILLE, TOWNSHIP OF	260196	0511	E
IRA, TOWNSHIP OF	260199	0511	E

PRELIMINARY
12/14/2018

VERSION NUMBER
2.4.3.5

MAP NUMBER
26147C0511E

MAP REVISED



FLOOD HAZARD INFORMATION

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		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
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		Levee, Dike, or Floodwall
		Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		Base Flood Elevation Line (BFE)
OTHER FEATURES		Limit of Study
		Jurisdiction Boundary

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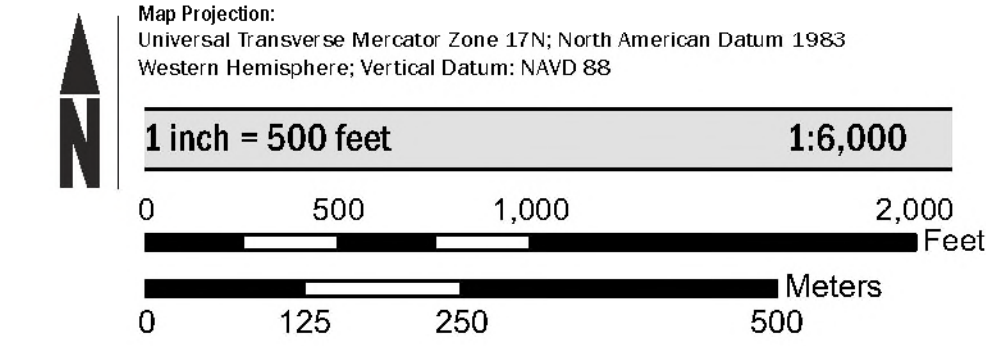
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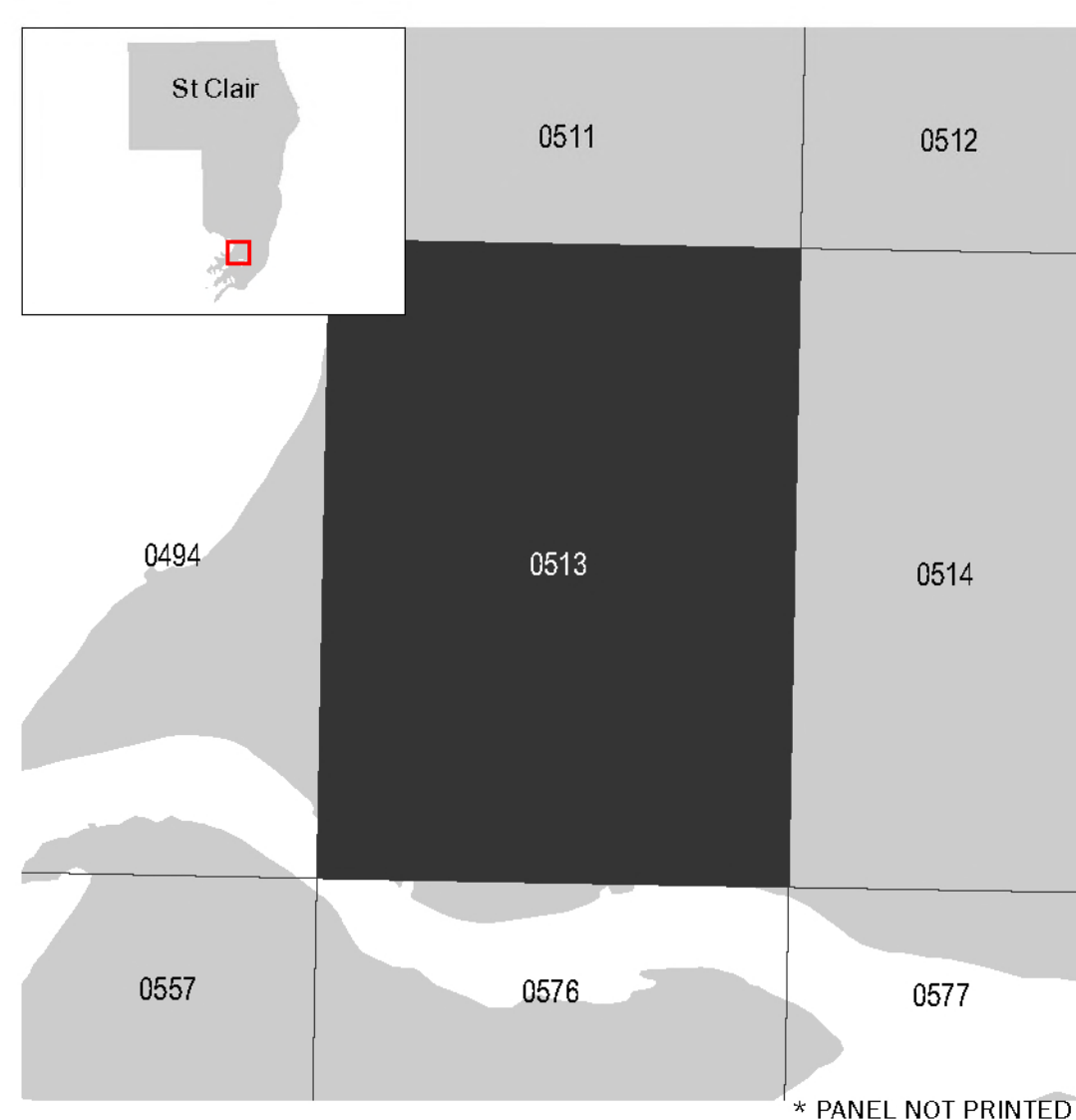
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Limit of Moderate Wave Action (LMWA)

SCALE



PANEL LOCATOR



National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
 FLOOD INSURANCE RATE MAP

ST. CLAIR COUNTY, MI
 (All Jurisdictions)

PANEL 513 OF 595

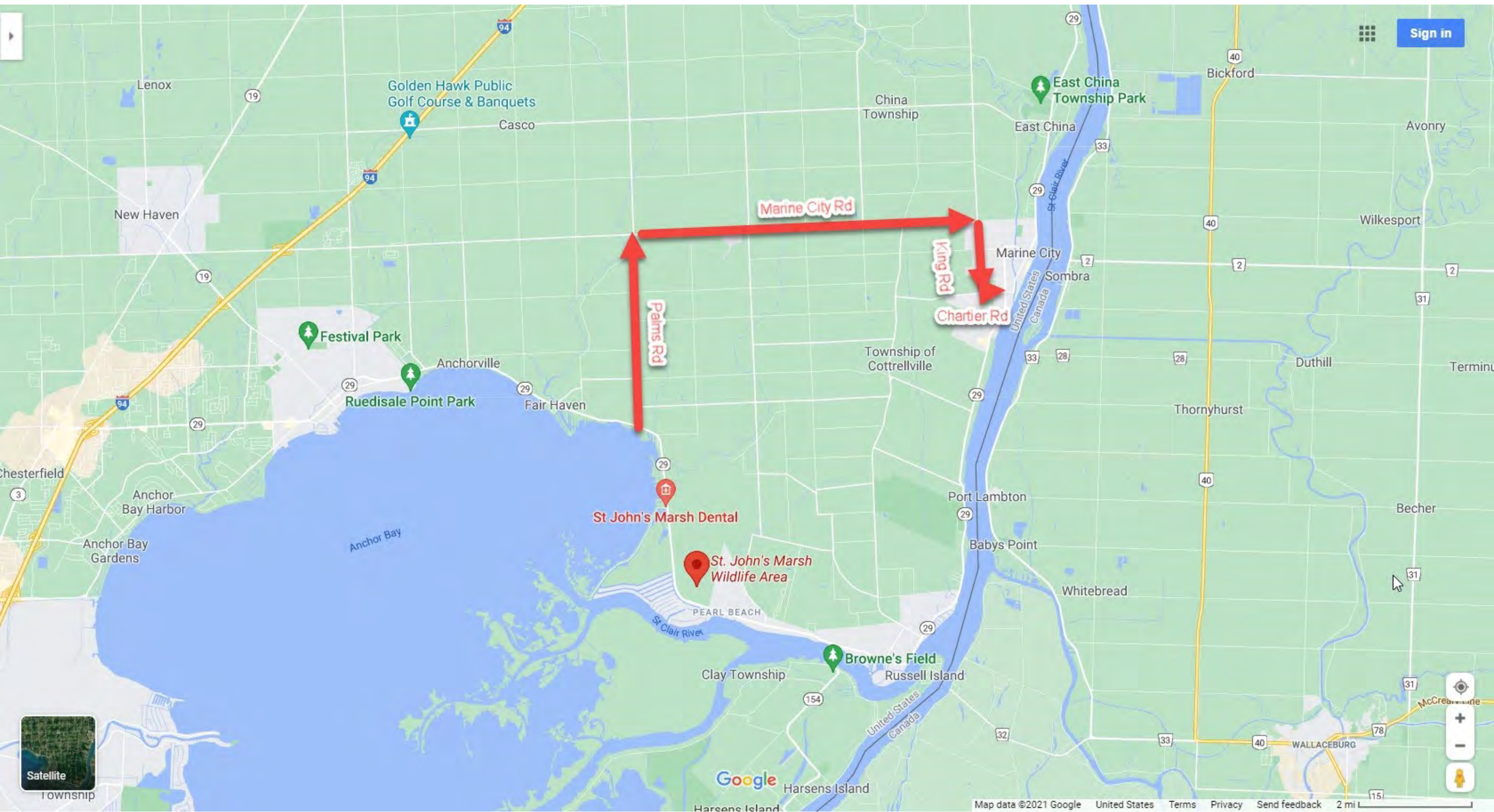
Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
CLAY TOWNSHIP OF	260194	0513	E

PRELIMINARY
12/14/2018

VERSION NUMBER
2.4.3.5
MAP NUMBER
26147C0513E
MAP REVISED

Detour Route for M-29 St. John's Marsh Expanded Documentation



Sign in



Cost Estimate for Preferred Mitigation Alternative for M-29 St. John's Marsh Expanded Documentation

**St. Johns Marsh (Algonac, Mi)
M-29 Design Criteria Matrix**

**Preparation Date: 6-30-2021
Consultant: ARCADIS**

Item	Engineering Design Feature	Criteria 55 MPH	Reference
Design Controls			
1	Highway Functional Classification	Arterial	TDMS
2	Design Functional Classification	Minor Rural Arterial	TDMS
3	AADT (2019)	10,463	TDMS
4	CAADT (2019)	271	TDMS
5	Terrain Type	Level	Topo Maps
6	Legal Speed Limit	50	Google Street Viewer
7	Design Speed	55	
8	Route on the National Highway System (NHS)?	No	NHS Michigan Map
Horizontal Alignment Design			
1	Stopping Sight Distance	495'	MDOT RDM, Sec. 3.03.01
2	Horizontal Sight Distance	495'	MDOT RDM, Sec. 3.03.01D
3	Passing Sight Distance	900 (K=289)	AASHTO Green Book
4	Intersection Sight Distance (Left Turn)	610 (K=133)	AASHTO Green Book
5	Intersection Sight Distance (Right turn)	530 (K=100)	AASHTO Green Book
6	Decision Sight Distance (DSD)	865'	AASHTO Green Book
7	Max. Centerline deflection w/o horiz. curve	1° 00'	AASHTO Green Book
8	Max. Degree of Curve w/ superelevation (Min. Radius)	6°00' (955)	AASHTO Green Book
9	Max. Degree of Curve w/o superelevation (Min. Radius)	0°38' (9047)	AASHTO Green Book
10	Design Superelevation Rate	0.070	Appendix 3A-4
11	Superelevation Transitions (equivalent max. relative slope)	213:1	AASHTO Green Book
12	Max. Curve w/o Spiral (Min. Radius)	N/A	AASHTO Green Book
Vertical Alignment Design			
1	Max. Grades - Roadway (Rolling Terrain)	5.00%	MDOT RDM, Sec. 3.03.02 and Appendix 3A-4
2	Critical Length of Grade	N/A	
3	Min. Grades- Roadway	0.00%	AASHTO Green Book
4	Max. Change in Vertical algnmt. w/o vert. curve	0.40%	AASHTO Green Book
5	Vertical Curve design SSD (crest)	495 (K=114)	AASHTO Green Book
6	Vertical Curve design SSD (sag)	495 (K=115)	AASHTO Green Book
Cross Section Design			
1	Travel Lane Width	12	MDOT RDM, Sec. 3.09.02
2	Cross Slopes (Roadway lanes)	2.00%	MDOT RDM, Sec. 3.09.02
3	Graded Shoulder Width (w/ barrier / w/o barrier)	8'+4' = 12'	MDOT RDM, Sec. 6.05.04D Shoulder Width Details
4	Treated Shoulder Width	8'	MDOT RDM, Sec. 3.09.02 and Appendix 3A-2
5	Treated Shoulder Composition	Paved	MDOT RDM, Sec. 3.09.02 and Appendix 3A-2
6	Cross Slopes (shoulders)	4.00%	MDOT RDM, Sec. 6.05.05
7	Guardrail offset from traveled way	10'	MDOT RDM, Sec. 6.05.04D Shoulder Width Details & 7.01.30B
8	Rounding	4'	

Item	Engineering Design Feature	Criteria 55 MPH	Reference
	Roadside Design		
1	Clear Zone Width	Varies 16' to 30'	MDOT RDM, Sec. 7.01.11
2	Safety Grading in Clear Zone	N/A	
3	Safety Grading outside of Clear Zone	N/A	
4	Barrier Grading	Yes, If Required	MDOT RDM, Sec. 7.01.30
5	Clear Zone Grading	Fill Slopes 1:4 Max Foreslopes.; Cut Slopes 1:3 Max. Backslopes	MDOT RDM, Sec. 2.03.01 and Sec. 7.01.11
6	Common Grading	N/A	
7	Roadside Barrier Warrants	Yes	MDOT RDM, Sec. 7.01.30
8	Median Barrier Warrants	N/A	
9	Lateral Clearence for bridge	Shoulder width + GR Offset = 12'	
10	Curve Widening	N/A	

**OPINION OF PROBABLE CONSTRUCTION COST
CITY OF ALGONAC, MI**

**M-29 RECONSTRUCTION
(FROM FLAMINGO ROAD TO ANCHOR BAY ROAD)**

REF NO.	ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT COST	ITEM TOTAL
1	1500001	Mobilization, Max \$100,000.00	LSUM	1	\$100,000.00	\$100,000.00
2	201001	Clearing	Acre	4	\$5,000.00	\$22,287.88
3	2030016	Sewer, Rem, 24 inch to 48 inch	Ft	150	\$30.00	\$4,500.00
4	2040035	Guardrail, Rem	Ft	125	\$3.00	\$375.00
5	2040050	Pavt, Rem	Syd	25,799	\$8.00	\$206,392.00
6	2050010	Embankment, CIP	Cyd	14,257	\$12.00	\$171,084.00
7	2050016	Excavation, Earth	Cyd	323	\$12.00	\$3,876.00
8	2080001	Sediment and Erosion Control	LSUM	1	\$10,000.00	\$10,000.00
9	3010002	Subbase, CIP	Cyd	28,377	\$25.00	\$709,419.44
10	3020001	Aggregate Base	Ton	8,814	\$40.00	\$352,579.26
11	3070001	Shoulder, CL II	Ton	859	\$30.00	\$25,777.78
12	4010908	Culv, Reinf Conc Ellip, HE Cl IV, 29 inch by 45 inch	Ft	150	\$450.00	\$67,500.00
13	4040063	Underdrain, Subbase, 6 inch	Ft	11,600	\$45.00	\$522,000.00
14	4040093	Underdrain Outlet, 6 inch	Ft	225	\$25.00	\$5,625.00
15	4040113	Underdrain Outlet Ending, 6 inch	Ea	9	\$200.00	\$1,800.00
16	5010046	HMA, 3E3	Ton	8,726	\$95.00	\$829,001.98
17	5010052	HMA, 4E3	Ton	2,128	\$90.00	\$191,557.58
18	5010058	HMA, 5E3	Ton	2,128	\$90.00	\$191,557.58
19	8070004	Guardrail, Type MGS-8	Ft	100	\$20.00	\$2,000.00
20	8070044	Guardrail Approach Terminal, Type 2M	Ea	1	\$3,000.00	\$3,000.00
21	8097043	Field Office, CL 3	Mo	18	\$2,000.00	\$36,000.00
22	8100001	Traffic Signs	LSUM	1	\$7,500.00	\$7,500.00
23	8110091	Pavt Mrkg, Polyurea, 4 inch, White	Ft	11,600	\$1.00	\$11,600.00
24	8110092	Pavt Mrkg, Polyurea, 4 inch, Yellow	Ft	1,515	\$1.00	\$1,515.00

REF NO.	ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT COST	ITEM TOTAL
25	8120001	Maintenance of Traffic (Assume 2% of Construction Cost)	LSUM	1	\$100,000.00	\$100,000.00
26	8160027	Mulch Blanket	Syd	10,787	\$1.50	\$16,181.00
27	8160042	Turf Establishment - Seed	Lb	9,709	\$4.00	\$38,834.40
28	8160062	Topsoil Subsurface, Furn, 4 inch	Syd	21,575	\$5.00	\$107,873.33
29	8240001	Contractor Staking	LSUM	1	\$15,000.00	\$15,000.00
		CONSTRUCTION SUBTOTAL				\$3,754,837.23
		30% CONTINGENCY				\$1,126,451.17
		CONSTRUCTION TOTAL				\$4,881,288.40
		RIGHT-OF-WAY	Sf	0	\$1.00	\$0.00
		UTILITY RELOCATIONS	Ft	3,000	\$25.00	\$75,000.00
		ESTIMATED PROJECT TOTAL				\$4,956,288.40

**OPINION OF PROBABLE CONSTRUCTION COST
CITY OF ALGONAC, MI**

**M-29 MAINTENANCE RESURFACING
(FROM FLAMINGO ROAD TO ANCHOR BAY ROAD)**

REF NO.	ITEM NO.	DESCRIPTION	UNIT	TOTAL QUANTITY	UNIT COST	INFLATION ADJUSTED UNIT COST	ITEM TOTAL
1	1500001	Mobilization, Max \$100,000.00	LSUM	1	\$100,000.00	\$115,000.00	\$115,000.00
2	2040050	Cold Milling HMA Surface	Syd	25,799	\$1.50	\$1.73	\$44,503.28
3	3070001	Shoulder, CL II	Ton	859	\$30.00	\$34.50	\$29,644.44
4	5010058	HMA, 5E3	Ton	2,128	\$90.00	\$103.50	\$220,291.21
5	8240001	Contractor Staking	LSUM	1	\$10,000.00	\$11,500.00	\$11,500.00
		CONSTRUCTION TOTAL					\$420,938.93

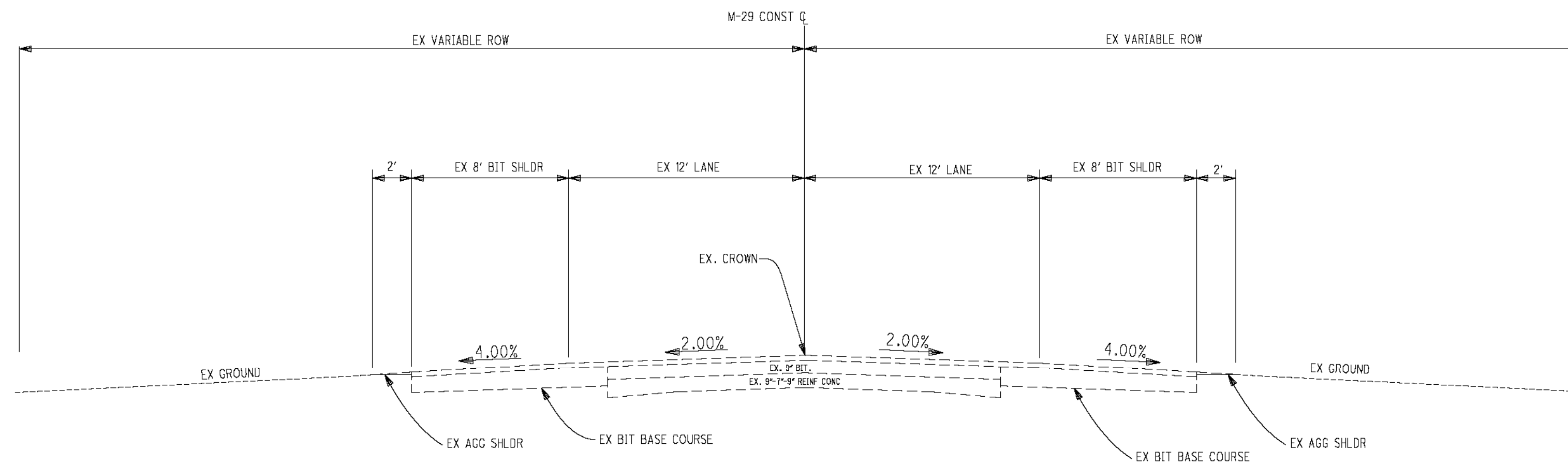
PID NO.: M-29
 JOB NO.:
 STRUCTURE:

ITEM/EXT.	PARTICIPATION		ESTIMATED QUANTITIES				CALC. BY: RJB		DATE: 11/17		AS PER PLAN	
	REHAB I	TRAC II	ITEM	ITEM EXT.	TOTAL	UNIT	DESCRIPTION	SUPER	ABUT'S	PIERS		GENERAL
505E11100			505	11100	75,000	\$	PILE DRIVING EQUIPMENT MOBILIZATION					
507E00200			507	00200	10,561,600	\$	STEEL PILES HP12X53, FURNISHED					
507E00250			507	00250	821,100	\$	STEEL PILES HP12X53, DRIVEN					
509E10000			509	10000	2,689,649	\$	EPOXY COATED REINFORCING STEEL					
511E34444			511	34444	3,132,813	\$	CLASS QC2 CONCRETE, BRIDGE DECK					
511E43210			511	43210	909,028	\$	CLASS QC1 CONCRETE, PIER					
511E43510			511	43510	112,153	\$	CLASS QC1 CONCRETE, ABUTMENT INCLUDING FOOTING					
515E12090			515	12090	23,386,467	\$	PRESTRESSED CONCRETE COMPOSITE BOX BEAM BRIDGE MEMBERS, LEVEL 1, CB33-48					
526E25000			526	25000	73,796	\$	REINFORCED CONCRETE APPROACH SLABS (T=15")					
622E10060			622	10060	1,530,000	\$	CONCRETE BARRIER, SINGLE SLOPE, TYPE B					

Subtotal = 43,291,606
 20 % Contingency = 8,658,321
 Total = 51,949,927

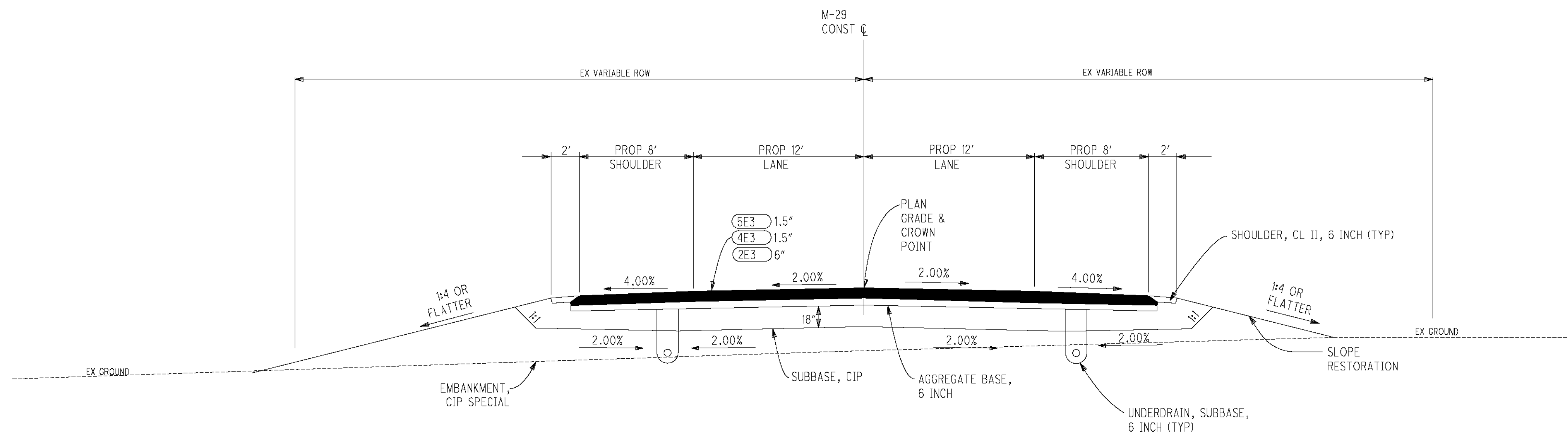
Deck Area = 225,563 SF
 Unit Cost = 230 /SF Superstructure Replacement & Raising

Engineering Drawings for Preferred Mitigation Alternative for M-29 St. John's Marsh Expanded Documentation



EXISTING M-29 NORMAL CROWN SECTION

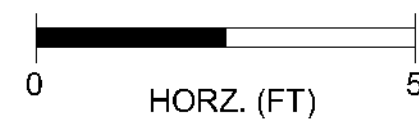
TO APPLY:
STA 56+00 TO STA 114+00



PROPOSED M-29 NORMAL CROWN SECTION

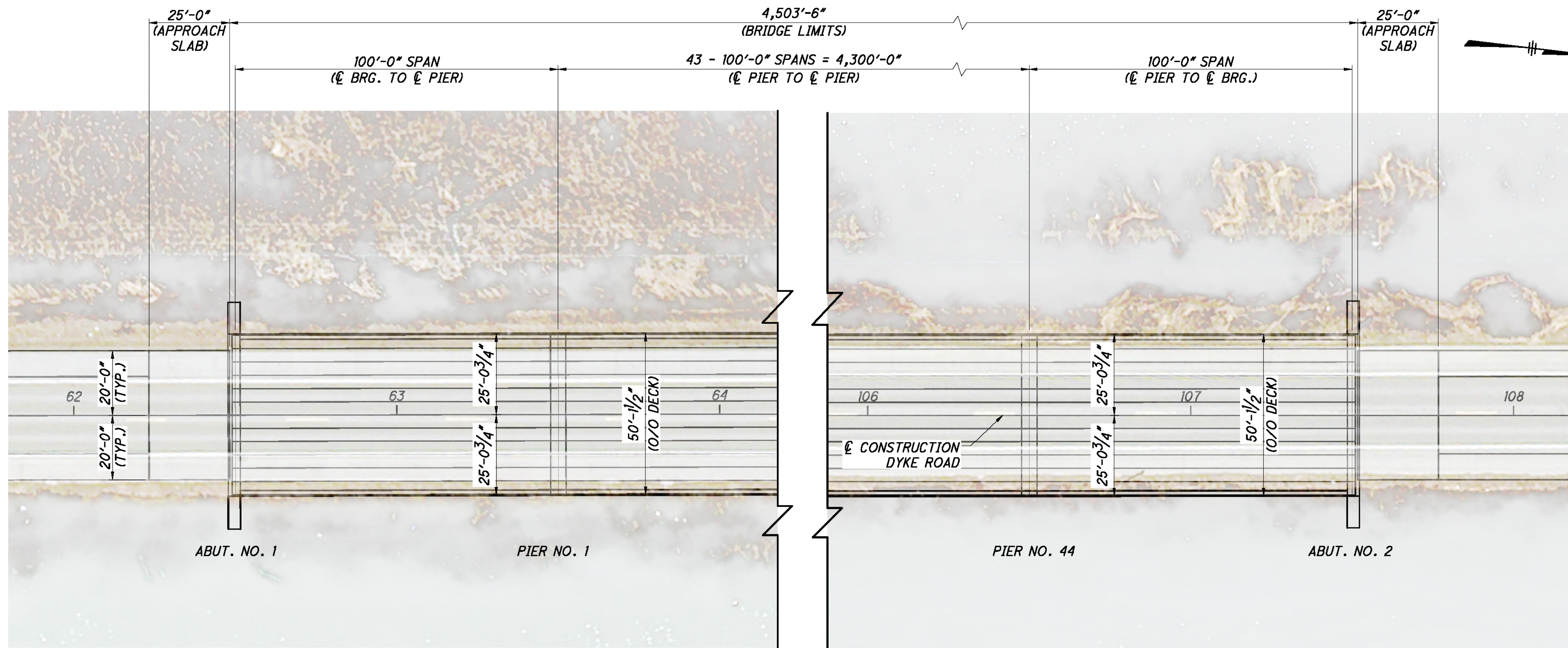
TO APPLY:
STA 56+00 TO STA 114+00

FINAL ROW PLAN REVISIONS				SUBMITTAL DATE:			
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

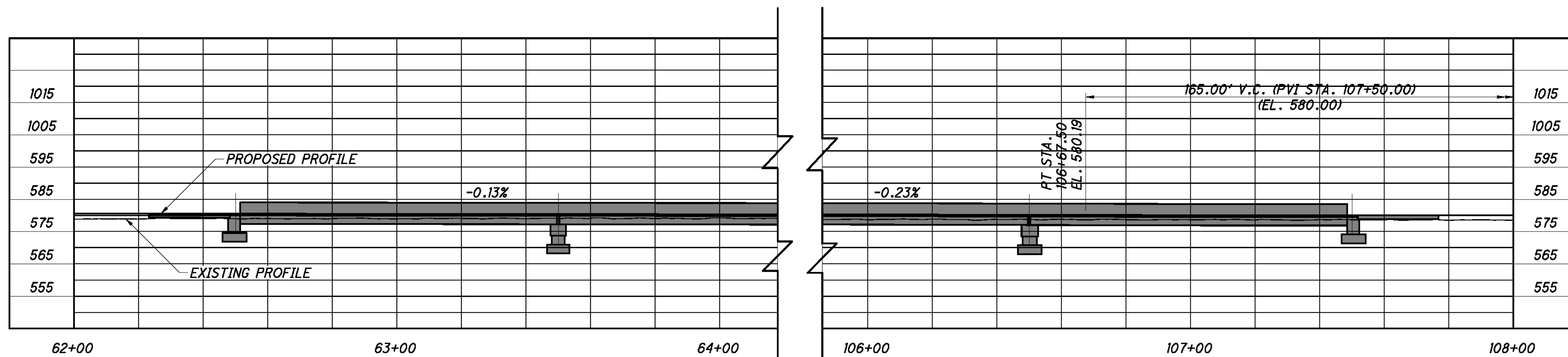


DATE:	CS:
DESIGN UNIT:	JN:
TSC:	
FILE:	

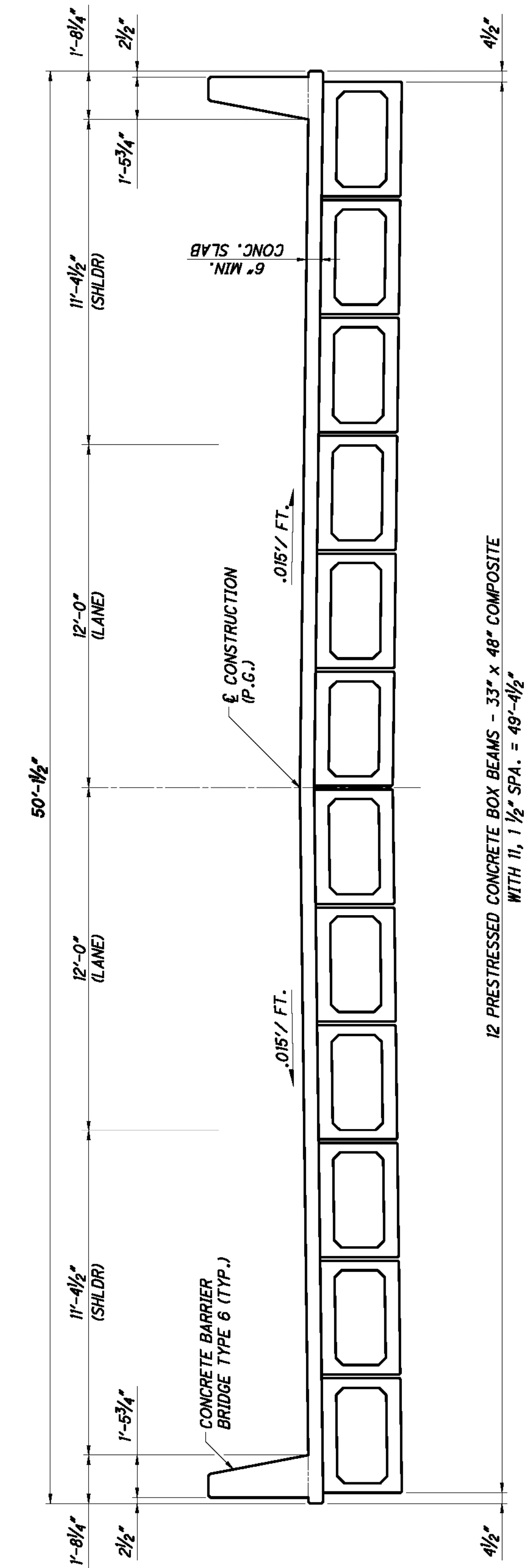
TYPICAL CROSS SECTION		DRAWING	SHEET
M-29 (POINTE TREMBLE ROAD)			



PLAN

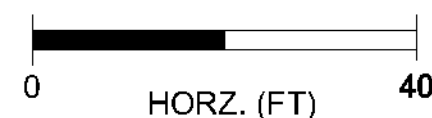


ELEVATION



TYPICAL SECTION

FINAL ROW PLAN REVISIONS		SUBMITTAL DATE:	
NO.	DATE	AUTH	DESCRIPTION

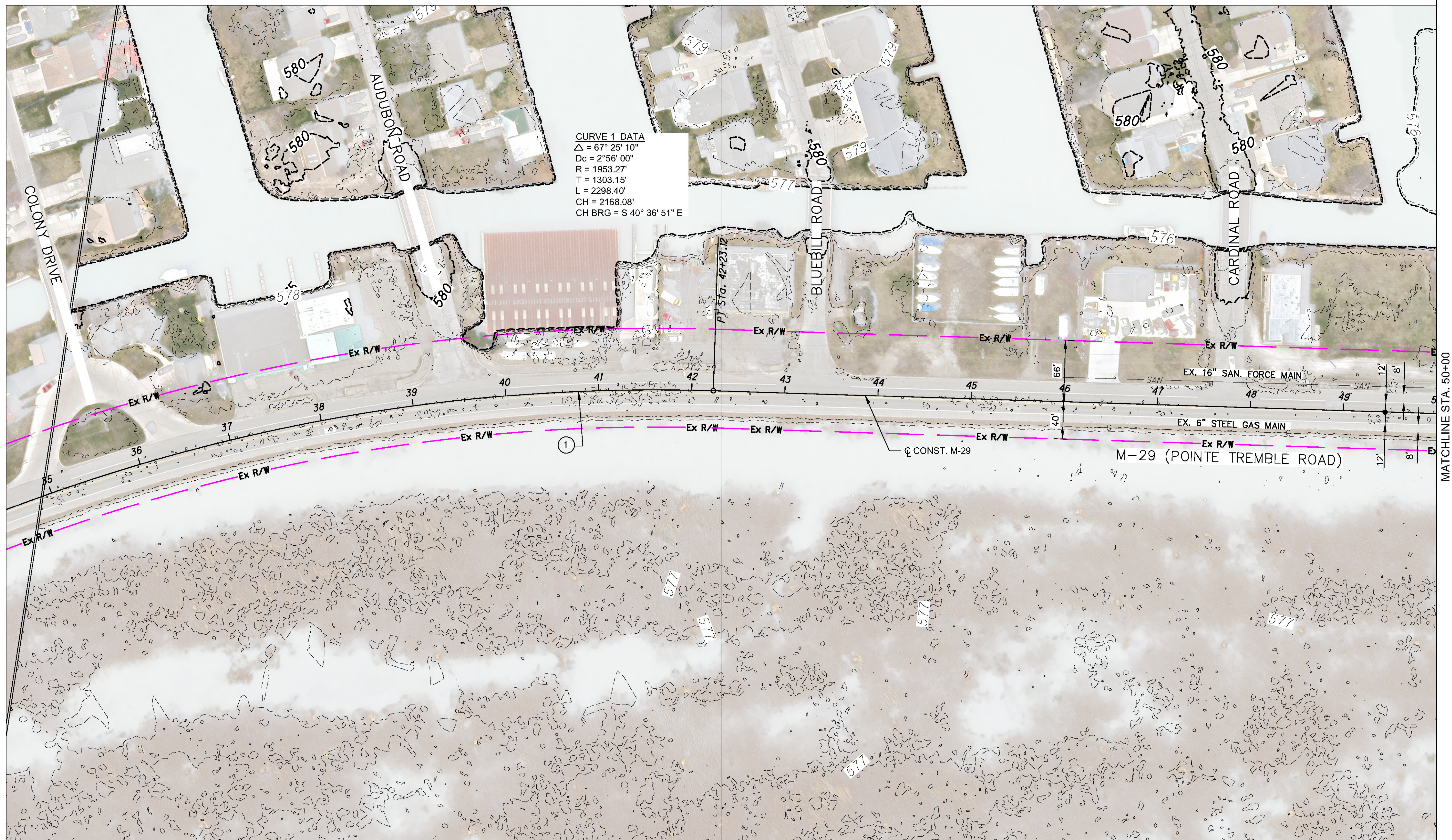


FILE: _____

DATE: _____
 DESIGN UNIT: _____
 TSC: _____

CS: _____
 JN: _____

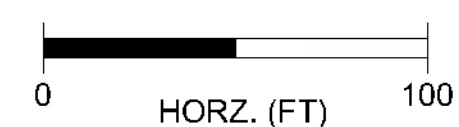
PLAN SHEET		DRAWING SHEET
M-29		SECT
STA. 50+00 TO STA. 65+00		



CURVE 1 DATA
 $\Delta = 67^\circ 25' 10''$
 $Dc = 2^\circ 56' 00''$
 $R = 1953.27'$
 $T = 1303.15'$
 $L = 2298.40'$
 $CH = 2168.08'$
 $CH BRG = S 40^\circ 36' 51'' E$

MATCHLINE STA. 50+00

FINAL ROW PLAN REVISIONS			SUBMITTAL DATE:				
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



DATE: _____
 DESIGN UNIT: _____
 TSC: _____
 FILE: _____

CS: _____
 JN: _____

PLAN SHEET
M-29 (POINTE TREMBLE ROAD)
STA. 35+00 TO STA. 50+00

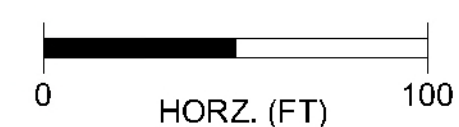
DRAWING SHEET
 SECT



MATCHLINE STA. 50+00

MATCHLINE STA. 65+00

FINAL ROW PLAN REVISIONS			SUBMITTAL DATE:		
NO.	DATE	AUTH	NO.	DATE	AUTH



DATE: _____
 DESIGN UNIT: _____
 TSC: _____
 FILE: _____

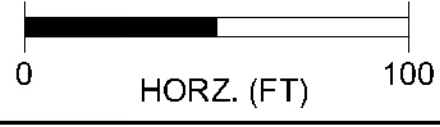
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PLAN SHEET
 M-29 (POINTE TREMBLE ROAD)
 STA. 50+00 TO STA. 65+00

DRAWING SHEET
 SECT



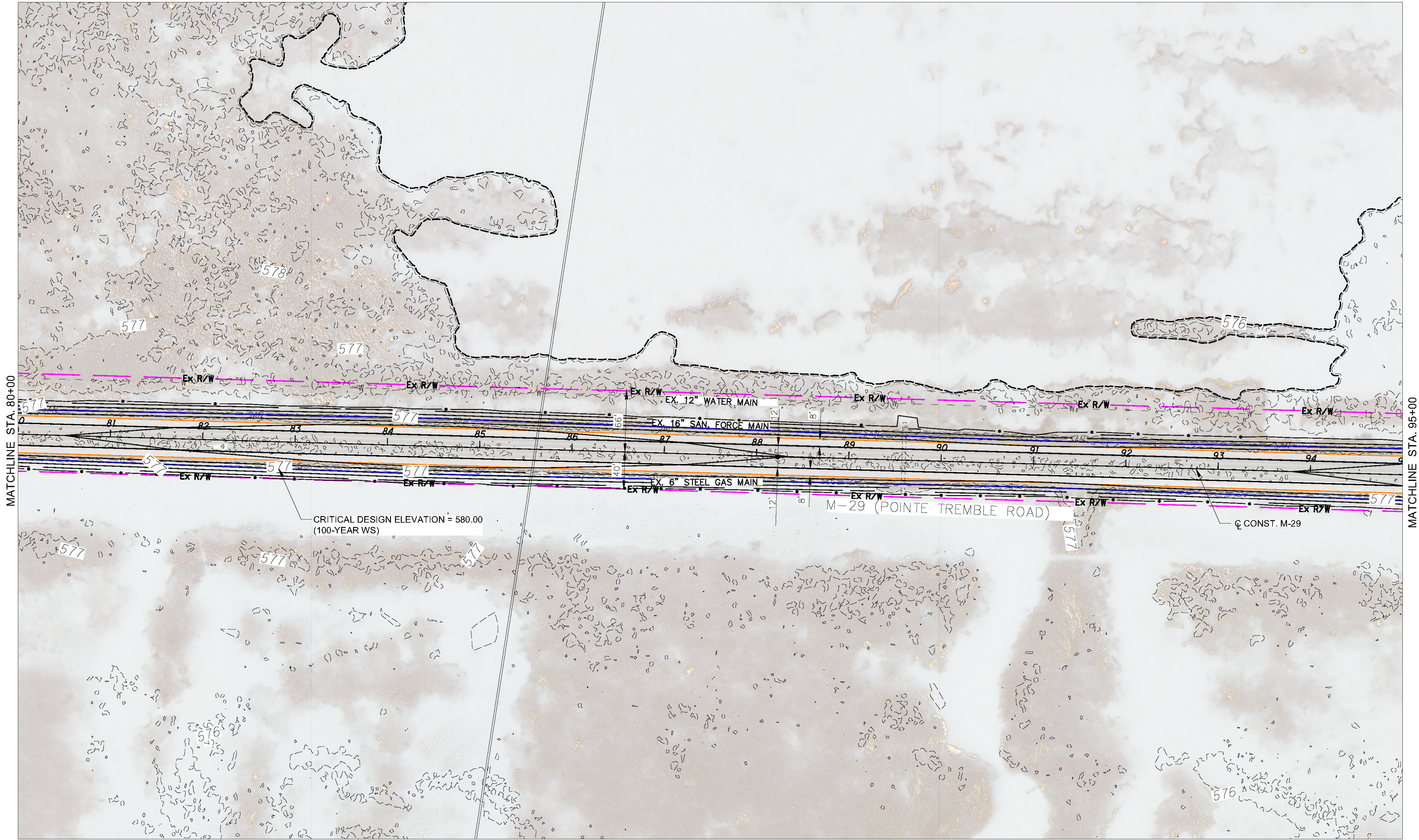
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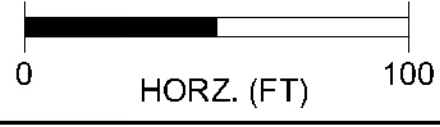
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PLAN SHEET	DRAWING SHEET
M-29 (POINTE TREMBLE ROAD)	
STA. 65+00 TO STA. 80+00	SECT



FINAL ROW PLAN REVISIONS						SUBMITTAL DATE:					
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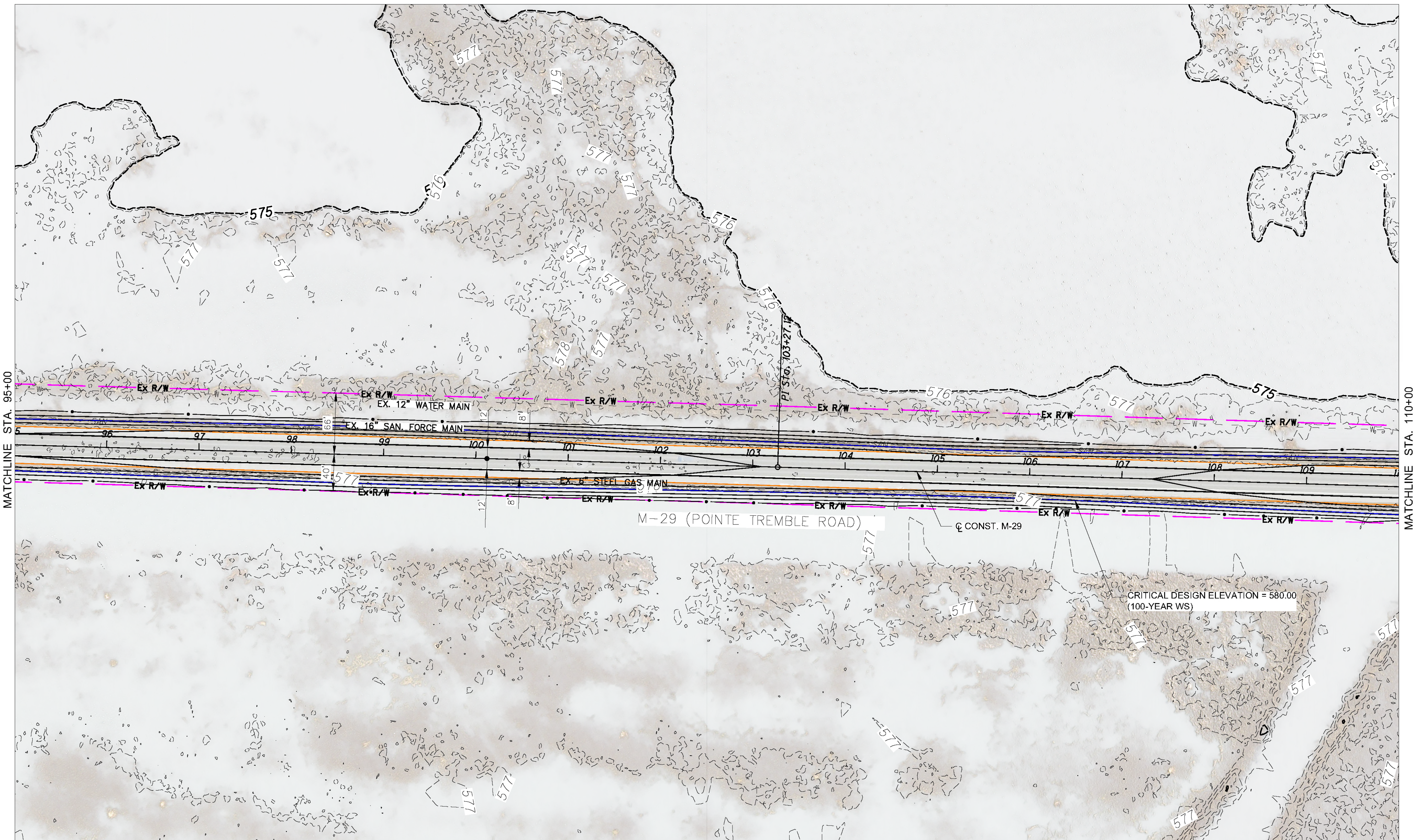


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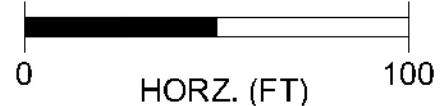
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PLAN SHEET
 M-29 (POINTE TREMBLE ROAD)
 STA. 80+00 TO STA. 95+00

DRAWING SHEET
 SECT

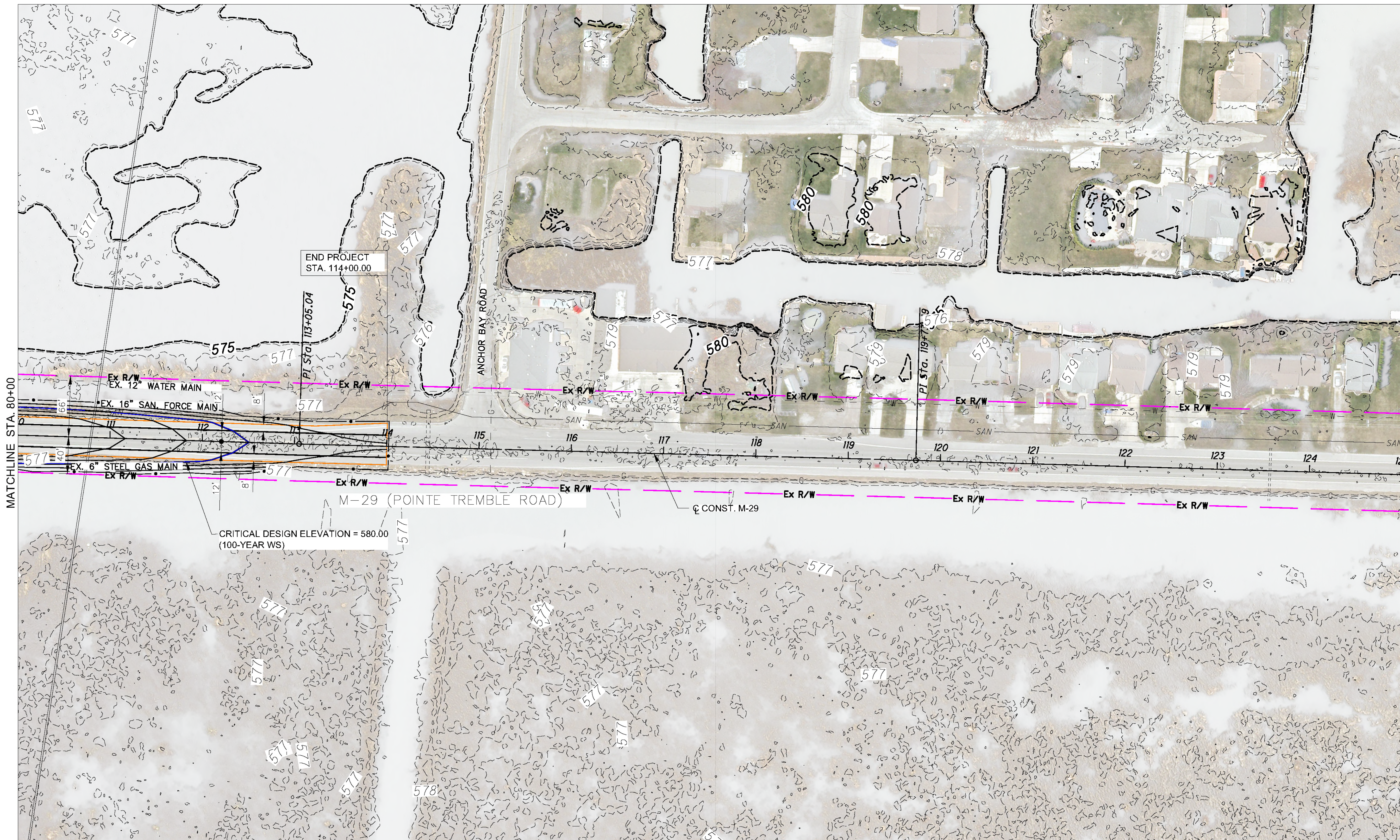


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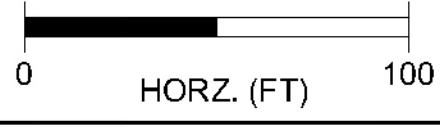


DATE:	CS:
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PLAN SHEET		DRAWING	SHEET
M-29 (POINTE TREMBLE ROAD)			
STA. 95+00 TO STA. 110+00			



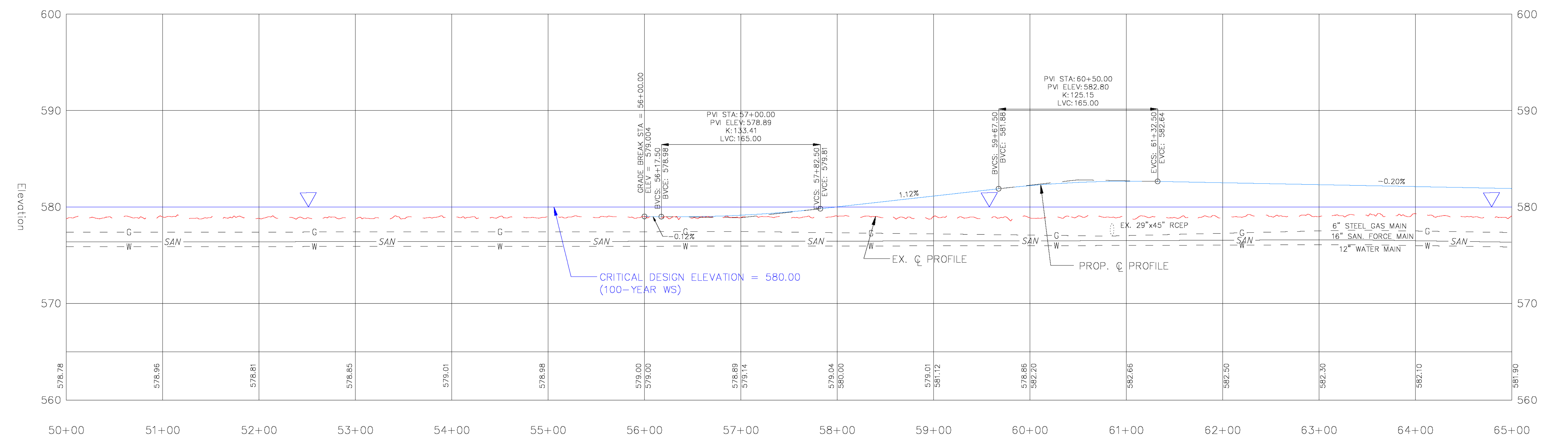
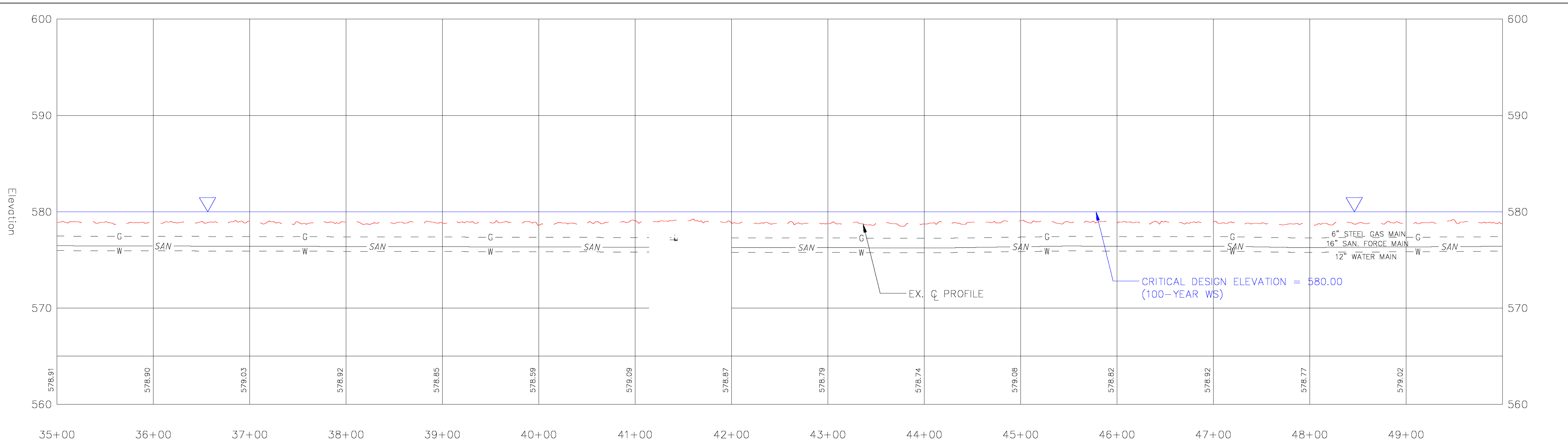
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NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



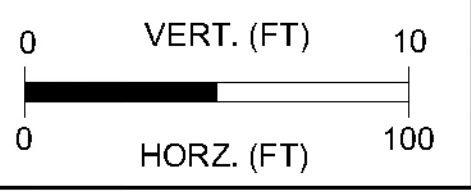
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PLAN SHEET
M-29 (POINTE TREMBLE ROAD)
STA. 110+00 TO STA. 125+00

DRAWING SHEET
SECT



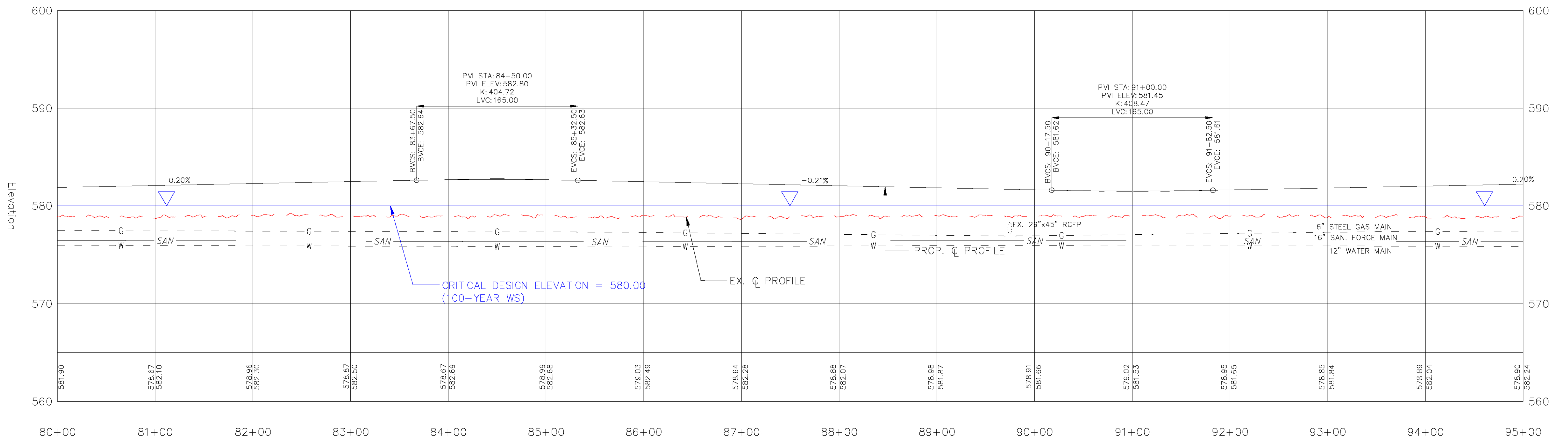
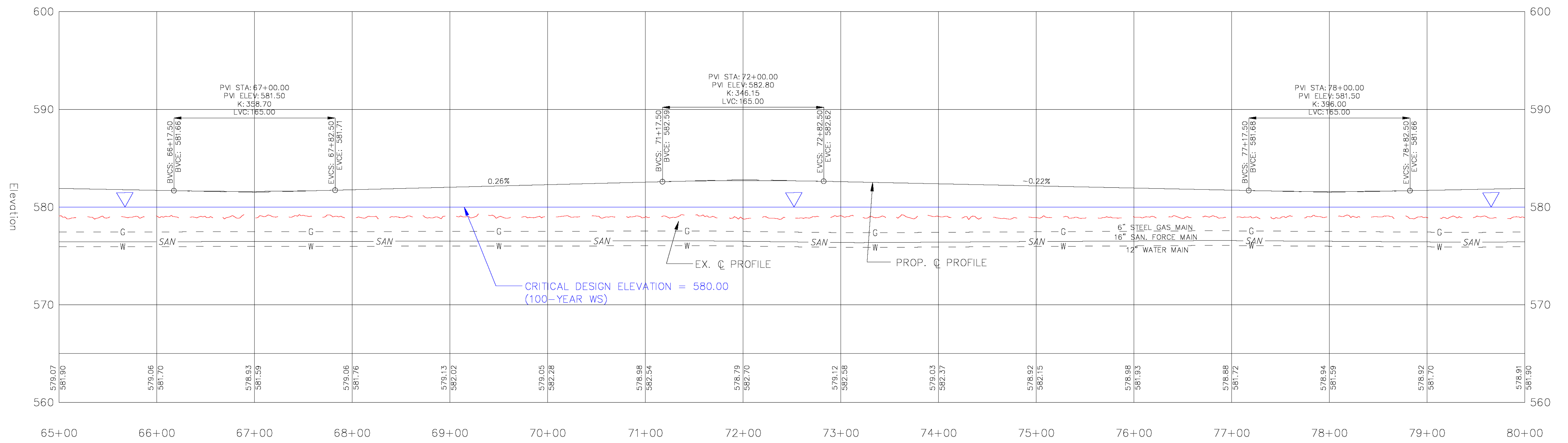
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NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



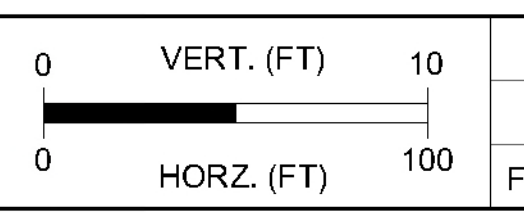
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PROFILE SHEET		DRAWING SHEET
M-29 (POINTE TREMBLE ROAD)		
STA. 35+00 TO STA. 65+00		SECT



FINAL ROW PLAN REVISIONS			SUBMITTAL DATE:		
NO.	DATE	AUTH	NO.	DATE	AUTH

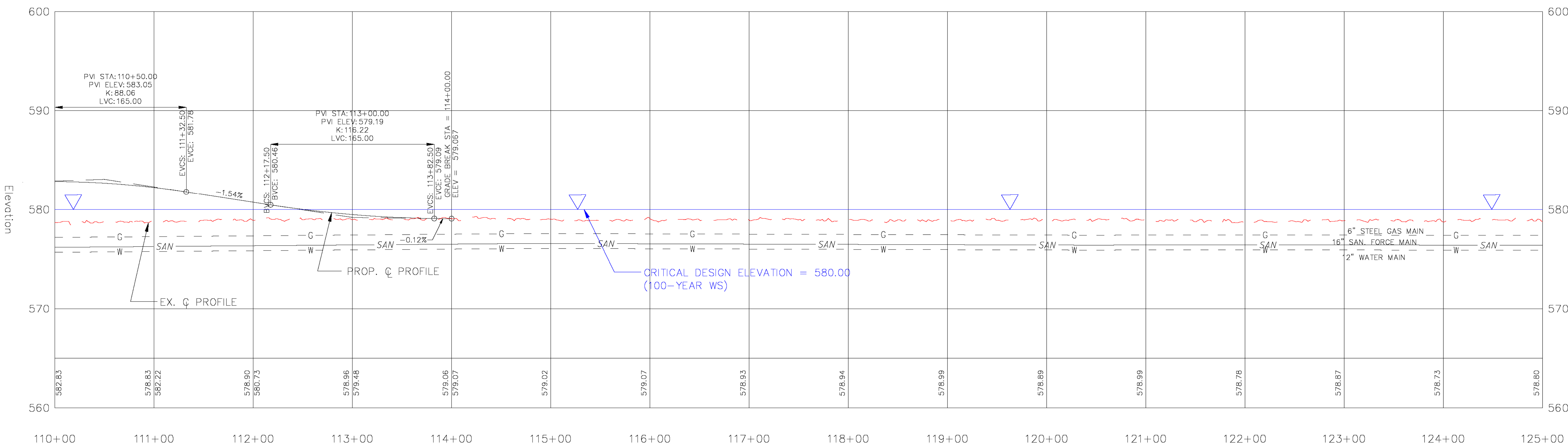
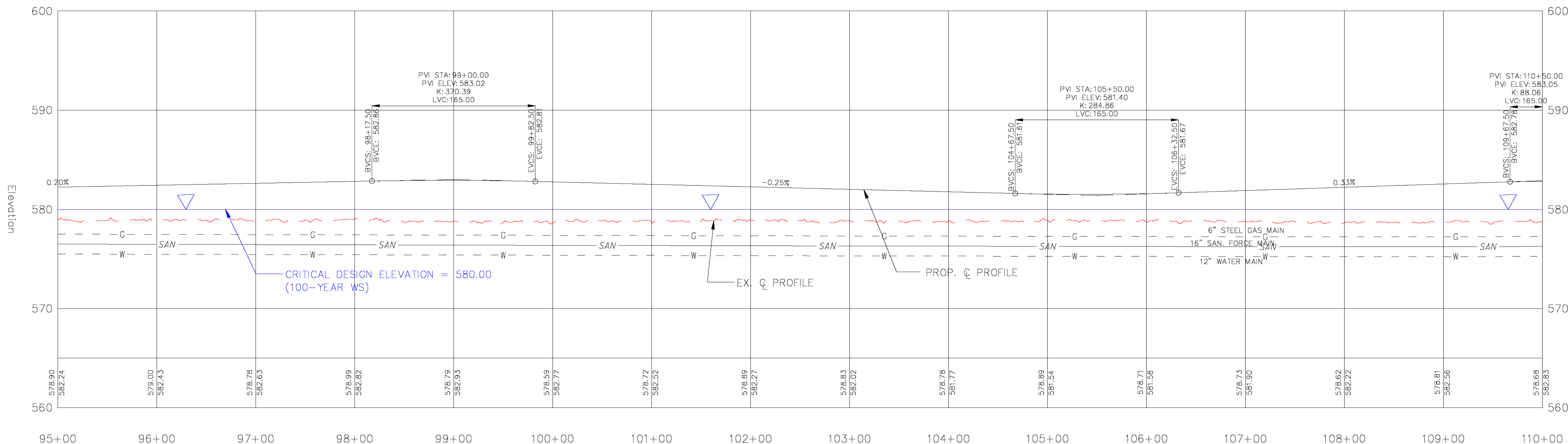


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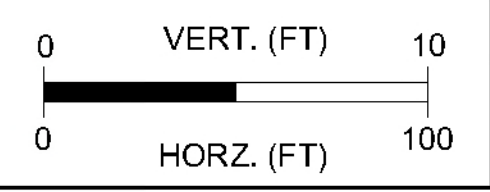
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PROFILE SHEET
M-29 (POINTE TREMBLE ROAD)
STA. 65+00 TO STA. 95+00

DRAWING SHEET
 SECT



FINAL ROW PLAN REVISIONS			SUBMITTAL DATE:		
NO.	DATE	AUTH	NO.	DATE	AUTH



DATE:	CS:
DESIGN UNIT:	JN:
TSC:	

PROFILE SHEET		DRAWING SHEET
M-29 (POINTE TREMBLE ROAD)		SECT
STA. 95+00 TO STA. 125+00		

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