

Concept Alignment Report

Replacement of US 701 Bridges

Over Great Pee Dee River,
Pee Dee Overflow & Lake Yauhannah

Horry/Georgetown Counties, SC



Submitted To:



The South Carolina Department of Transportation



Submitted By:

τβα Tuhin Basu & Associates, Inc.

July 19, 2005



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July 19, 2005

Mr. Rob Hamzy, PE
Program Manager
SC Department of Transportation
955 Park Street, Room 303
Columbia, SC 29202-0191

**RE: Replacement of US 701 Bridges over Great Pee Dee River,
Pee Dee Overflow and Lake Yauhannah
SC File No. 22.124B, Project No. BR-BR88(044), PIN No. 30688**

Dear Mr. Hamzy:

Attached please find six (6) copies of the **Conceptual Alignment Report** prepared for the subject project. Please review and provide your comments on these alignments and our recommendations for the preferred alignment.

Should you have any questions, please do not hesitate to call me at 703-918-9870 Ext. 106.

Sincerely,

TUHIN BASU & ASSOCIATES, INC.

Tuhin K. Basu, PE
Project Manager

Enclosures

Table of Contents

Table of Contents **i**

List of Tables **ii**

List of Figures..... **iii**

I. Introduction

 A. Project Description 1

 B. Site Description 1

 C. Existing and Proposed Facilities..... 2

II. Design Parameters

 A. Highway Design Criteria 4

 B. Survey/Topographic Controls..... 5

III. Conceptual Alignments

 A. Introduction..... 8

 B. Design Factors and Parameters..... 8

 C. Alignment Alternatives and Impacts 11

 1. Alignment Alternative 1 11

 2. Alignment Alternative 2 13

 3. Alignment Alternative 3 14

 4. Alignment Alternative 4 16

 D. Other Alignments Investigated 18

 E. Comments from Various Regulatory and Government Agencies 19

IV. Alignment Impact and Cost Comparison 20

V. Recommendations 23

VI. Roadway Drawings 24- 47

List of Tables

Table No.	Table Title	Page
1	Highway Design Parameters.....	4
2	Alignment Impact Data Summary	21
3	Alignment Alternatives Cost Comparison	22

List of Figures

Figure No.	Figure Title	Page
1	Site Location Map.....	3
2	Typical Roadway Section	6
3	Typical Bridge Section	7
4	Typical Roadway Section - Alignment Alternative 1	24
5	Alignment Alternative 1 – Plan & Profile (1 of 5)	25
6	Alignment Alternative 1 – Plan & Profile (2 of 5)	26
7	Alignment Alternative 1 – Plan & Profile (3 of 5)	27
8	Alignment Alternative 1 – Plan & Profile (4 of 5)	28
9	Alignment Alternative 1 – Plan & Profile (5 of 5)	29
10	Typical Roadway Section - Alignment Alternative 2.....	30
11	Alignment Alternative 2 – Plan & Profile (1 of 5)	31
12	Alignment Alternative 2 – Plan & Profile (2 of 5)	32
13	Alignment Alternative 2 – Plan & Profile (3 of 5)	33
14	Alignment Alternative 2 – Plan & Profile (4 of 5)	34
15	Alignment Alternative 2 – Plan & Profile (5 of 5)	35
16	Typical Roadway Section - Alignment Alternative 3.....	36
17	Alignment Alternative 3 – Plan & Profile (1 of 5)	37
18	Alignment Alternative 3 – Plan & Profile (2 of 5)	38
19	Alignment Alternative 3 – Plan & Profile (3 of 5)	39
20	Alignment Alternative 3 – Plan & Profile (4 of 5)	40
21	Alignment Alternative 3 – Plan & Profile (5 of 5)	41
22	Typical Roadway Section - Alignment Alternative 4.....	42
23	Alignment Alternative 4 – Plan & Profile (1 of 5)	43
24	Alignment Alternative 4 – Plan & Profile (2 of 5)	44
25	Alignment Alternative 4 – Plan & Profile (3 of 5)	45
26	Alignment Alternative 4 – Plan & Profile (4 of 5)	46
27	Alignment Alternative 4 – Plan & Profile (5 of 5)	47

I. Introduction

A. Project Description

US 701 Bridge Replacement project consists of the replacement and realignment of an approximately two-mile long section of US 701 located in Georgetown and Horry Counties. The project includes the replacement of the three existing bridges over the Great Pee Dee River, Pee Dee River Overflow and Lake Yauhannah. These existing bridges were built in early the 1950's replacing the older bridges constructed circa 1920. Existing US 701 within the project study limits is a two-lane rural undivided highway. The purpose of this project is to replace the structurally deteriorated and functionally obsolete existing US 701 bridges and maintain the principal direct rural connection between the larger towns of Conway and Georgetown, as well as smaller communities such as Bucksport and Yauhannah. During the construction of the replacement bridges and approaches, traffic will be maintained on the existing facilities. These existing bridges will be demolished upon completion of construction.

South Carolina Department of Transportation (SCDOT) has contracted with Tuhin Basu & Associates, Inc. (TBA) to provide engineering design services for this project. As a part of the project conceptual design phase, Tuhin Basu & Associates, Inc. has performed a study of conceptual alternative alignments. The study included the development and evaluation of various alternative new alignments for this project. This **Conceptual Alignment Report** summarizes the findings of the alignment study and provides recommendations for the preferred alignment. A separate conceptual bridge study report for alternative structure types will be submitted at a later date.

B. Site Description

The two-mile long project section of US 701 consists of a very rural corridor that is dominated by water bodies, wooded floodplain and forested wetlands. Several residences and a retail gas station are located at the northwestern end of the corridor. Several residences and two small restaurants are located at the southwestern end of the corridor. A public boat landing is located on the Horry County bank of the Great Pee Dee River, directly upstream of the existing bridge. Four abandoned concrete piers from a previous bridge are adjacent to the existing bridge over the Great Pee Dee River on the downstream side. Two of these piers are in the river and one is on each river bank. The Waccamaw National Wildlife Refuge occupies much of the project corridor.

On the Horry County side, most of the project corridor is zoned Commercial Forest/Agricultural (CFA). Small sections of land at the northeastern end are zoned Residential District (MR-4) and Highway Commercial District (HC). The residential portions of the corridor are zoned for single family homes. The project corridor area is not zoned on the Georgetown County side.

U.S. 701 Bridge Replacement Project

A cultural resources survey was performed for this project. The survey confirmed one previously identified site (38GE18). No significant historic structures were recorded and no significant underwater resources were identified.

Most of the corridor traverses the Waccamaw National Wildlife Refuge. In this corridor, the Wildlife Refuge is predominantly forested wetland. The 22-acre Yauhannah Bluff property near the Georgetown County end of the project has been recently acquired by the Waccamaw National Wildlife Refuge as the new site for a visitor center. There will be a direct access to the visitor center from US 701.

C. Existing and Proposed Facilities

The existing US 701 corridor in the proposed project area has three bridges connected by roadways on embankment fills. The bridge over Lake Yauhannah is located in Georgetown County and is 1,440 feet long. The bridge consists of 48 spans, each 30 feet long, comprised of concrete T-Beams supported on concrete bents. The bridge has a 26 feet wide roadway with a 2'-6" wide sidewalk on each side. The entire bridge is on a 0% grade. The bridge over the Great Pee Dee River is 1,603 feet long, and consists of both steel and concrete spans supported on concrete substructure units. The span lengths vary from 30 feet at the approaches on both sides of the river to 115 feet on the main river span. The bridge has a 26 feet wide roadway with a 2'-6" wide sidewalk on each side, and has a 3.5% grade. The bridge over the Pee Dee River Overflow in Horry County is 1,320 feet long and consists of concrete T-Beams with 30 feet spans supported on concrete bents. The bridge has a 26 feet wide roadway with a 2'-6" wide sidewalk on each side. The entire bridge is on a 0% grade. The roadway carrying US 701 between these bridges is supported on embankment fills with a maximum fill height of about 20 feet. The roadways are on 0% grades with normal cross slopes of 2.08% from the roadway crown.

In general, the existing facilities are narrow, structurally deficient and functionally inadequate for carrying the US 701 traffic under the current highway standards. The proposed replacement facilities will feature a cost-effective design with appropriate considerations to the environment, safety and ease of construction. The conceptual alignment study considered several alternative alignments on each side of the existing alignment, as well as one that crosses over the existing alignment. Four alternative alignments were included for an in-depth evaluation as part of this study. The design factors and parameters, as well as the descriptions of the alternative alignments investigated are included in Section III of this report.

U.S. 701 Bridge Replacement Project

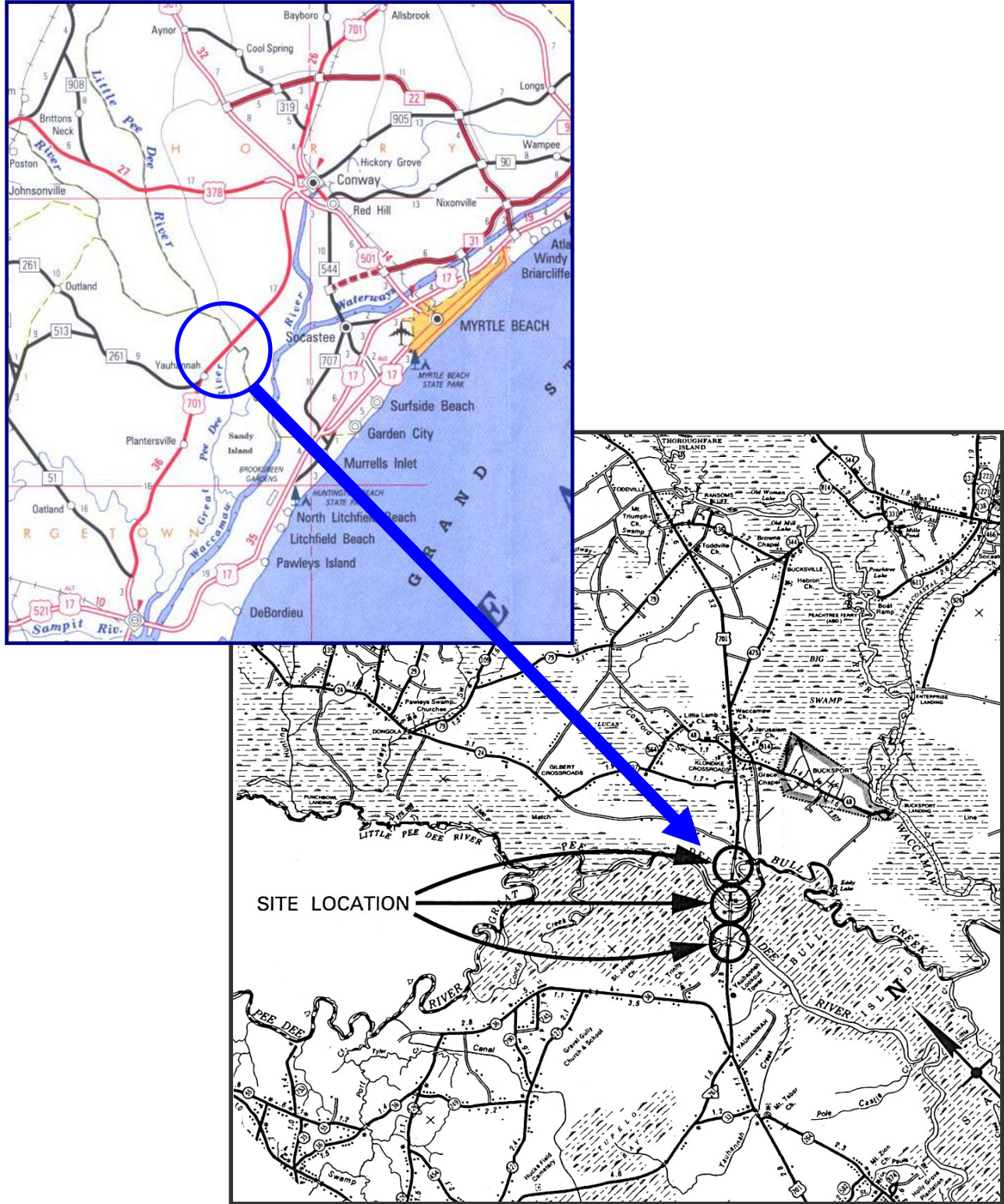


Figure 1. Site Location Map

II. Design Parameters

A. Highway Design Criteria

The design criteria used to develop the alignment alternatives for the proposed US 701 Bridge Replacement Project is presented in Table 1. Typical roadway and bridge cross sections are shown in Figures 1 and 2, respectively.

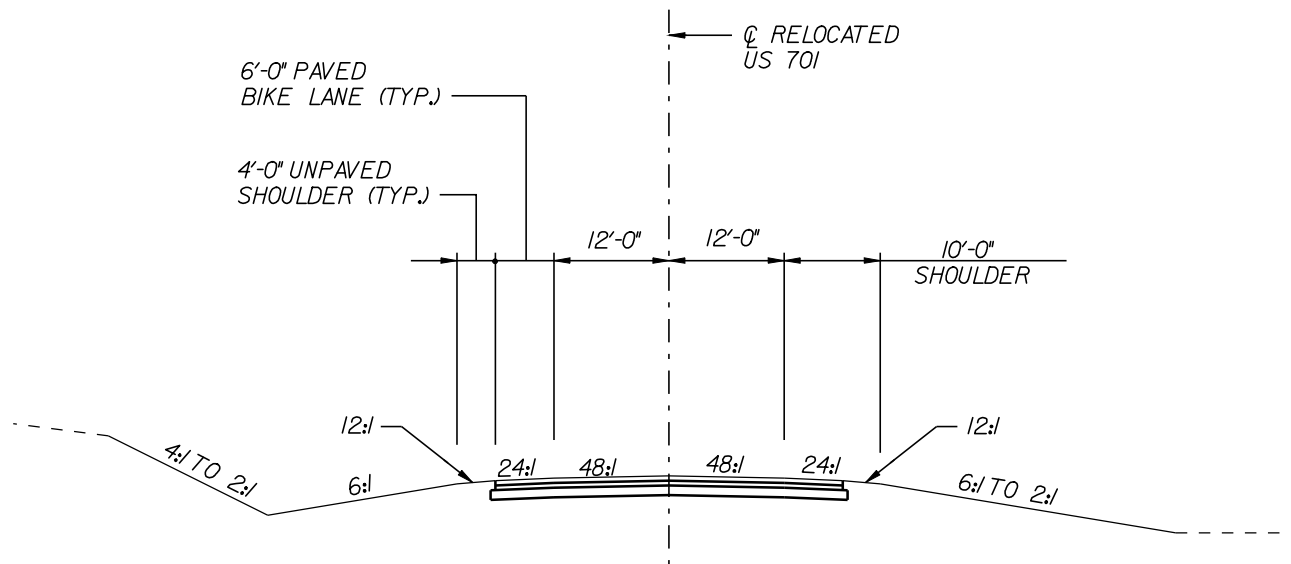
Table 1. Highway Design Parameters

Design Element		Design Criteria		
Design Controls	Classification		Rural Arterial	
	Design Speed		70 mph	
	Grades	Maximum	3.0%	
		Minimum	0.5%	
	Vertical Curves	"K" – Crest	247	
		"K" – Sag	181	
	Horizontal Curve	Minimum Radius	1820'	
Superelevation Rate		8.0%		
Cross Section Elements	Travel Lane Width		12'	
	Shoulder Width	Total Width	10'	
		Paved Bike Lane Width	6'	
		Unpaved Shoulder Width	4'	
Roadway Slopes	Cross Slope	Travel Lane	2.08%	
		Paved Bike Lane	4.17%	
		Unpaved Shoulder	8.33%	
	Side Slopes	Cut Section	Foreslope	6H:1V
			Ditch Type	V-Ditch
			Back Slope	4H:1V to 2H:1V
		Fill Section	0' – 5'	6H:1V
			5' – 10'	4H:1V
> 10'	2H:1V			
Bridges	New Bridges	Clear Roadway Width	44'	
		Out-to Out Bridge Width	47'	
		Structure Capacity	HL-93	

B. Survey/Topographic Controls

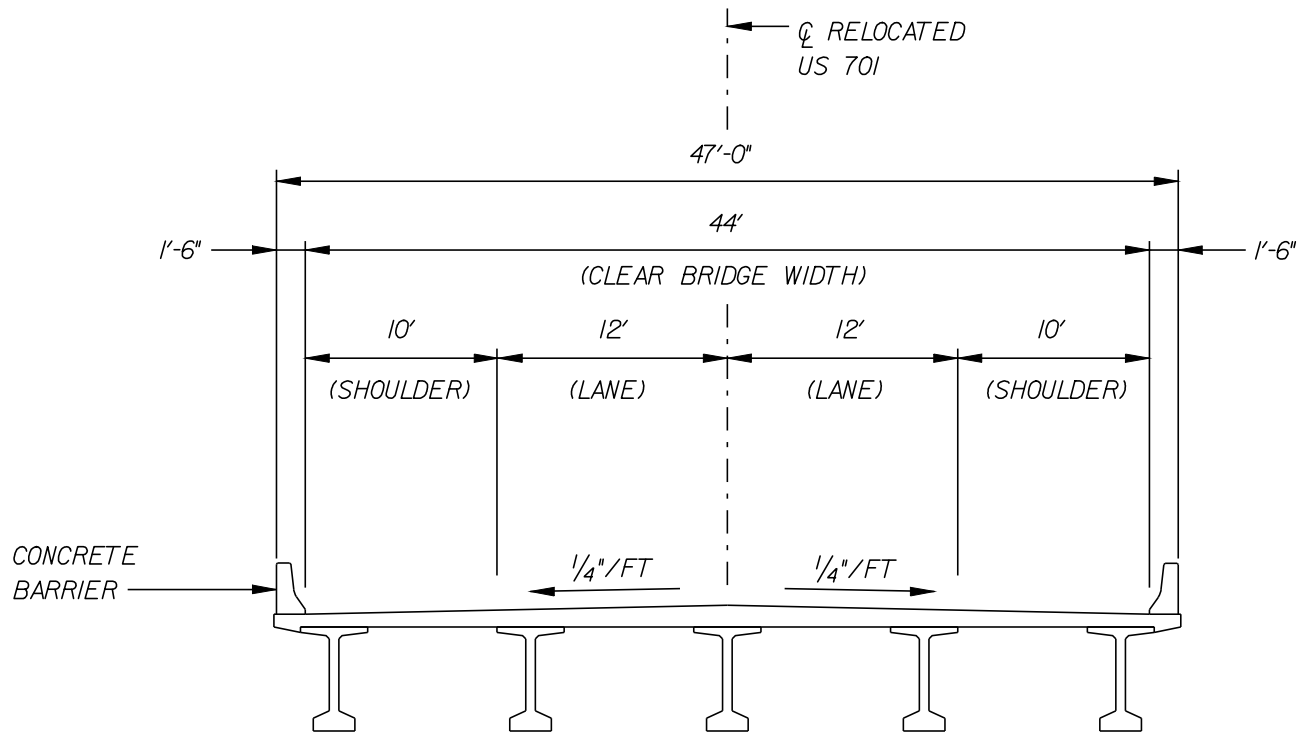
Survey of the existing site for the alignment study was prepared by B.P. Barber & Associates, Inc., under contract to Tuhin Basu & Associates, Inc. for the project. Aerial mapping and field survey was performed for a 300-foot width along the centerline of existing US 701 from Trinity Road at the south end of the project to Lucas Bay Road at the north end of the project. The survey and aerial mapping was based on the following controls:

- Horizontal Control: SC State Plane Coordinates NAD 83 (86 adjustment) Datum
- Vertical Control: National Geodetic Vertical Datum (NGVD) 1988



TYPICAL SECTION

SCALE: 1" = 20'-0"



TYPICAL SECTION

SCALE: 1" = 10'-0"

III. Conceptual Alignments

A. Introduction

The conceptual alignment study included the development of four feasible alignment alternatives, each providing the required horizontal and vertical geometrics for the relocated US 701. The alignment alternatives for US 701 were developed to arrive at the preferred alignment for the replacement of the existing US 701 bridges over the Great Pee Dee River, Pee Dee Overflow and Yauhannah Lake. Each of the feasible alternative alignments is located parallel to the existing bridges with a constant clear offset between the proposed and existing structures. The offset used for each alignment was based on the requirements to maintain traffic on the existing facility during construction, and/or future widening considerations for US 701.

A capacity and traffic analysis for the US 701 Bridge Replacement project has been prepared and submitted under separate cover. Based on this analysis, the proposed replacement facility does not meet the Level of Service (LOS) required for the roadway classification; however, it does achieve the primary goal of the project which is to replace the significantly deteriorated and functionally obsolete existing bridges and improve traffic safety. See US 701 Bridge Replacement Capacity and Traffic Analysis Report for additional details.

B. Design Factors and Parameters

Several factors were considered in the development of the conceptual alignment alternatives for the replacement of the US 701 bridges. The following is a brief discussion of these factors.

- The US 701 roadway and the existing bridges over the Great Pee Dee River, Pee Dee Overflow and Yauhannah Lake within the project limits must remain open to traffic during construction. Replacing the existing bridges on the same alignment would result in an approximate detour length of 55 miles and create a major inconvenience for the traveling public. Therefore, all alternatives developed as part of this study have generally been positioned on new alignments parallel to the existing US 701 alignment. Additionally, given the limited clear roadway width on each of the existing bridges and adjoining roadways, it has been assumed that the new bridges or roadway can not be constructed from the existing facility.
- The new alignment must be located at a sufficient distance from the existing alignment to safely maintain traffic on the existing roadway during construction. Based on the anticipated structural depths for the replacement structures and the resulting increase in the new roadway fill height, we have established 55 feet as the minimum offset distance between the centerline of the existing alignment and the proposed alignment.

U.S. 701 Bridge Replacement Project

This minimum offset distance will permit the safe operation of the existing US 701 roadway and provide adequate space for drainage provisions during construction.

- An existing boat landing is present on the north bank of the Great Pee Dee River (i.e., in Horry County), directly upstream of the existing Great Pee Dee River Bridge. Although southbound US 701 traffic can safely access the existing roads leading to the boat landing, it is generally a challenge and unsafe for northbound US 701 traffic to enter or depart from the entrance roads leading to the boat landing. The existing boat ramp must be relocated if it is impacted by the new preferred alignment alternative. Additionally, improvements should be made to the entrances of the boat landing access road from US 701 to permit safe utilization by both northbound and southbound US 701 traffic. All alignments developed consider the presence of a boat landing and improvements to the tie-in of the landing access road to US 701.
- A cultural resources survey was conducted for the roadway improvements proposed as part of the US 701 project. One archaeological site, 38GE18, located on the Yauhannah bluff area in Georgetown County was identified. Although a large portion of the 38GE18 site has been severely damaged or destroyed, a 20-foot wide strip of this site on US Fish and Wildlife property is intact and contributes to the National Register eligibility. Based on the cultural resource survey performed for this project, it was recommended that the proposed alignments and resulting construction be limited to a distance of 130 feet downstream from the centerline of existing US 701 to avoid damaging the site. No alignment alternative considered as part of this study impacts the 38GE18 site.
- Existing utilities, consist of water, electric, telephone and cable lines, extend throughout the project length. The existing utilities have been designated both on the north and south approaches (i.e., Horry and Georgetown County). There are no utilities that cross or are attached to the existing Great Pee Dee River, Pee Dee Overflow or Yauhannah Lake bridges. Additionally to date, no prior rights of the utility companies have been identified. Specific impacts, if any, on these utilities at the north and south approach roadways are addressed in discussion of each specific alignment alternative.
- The majority of the project site from Yauhannah Lake to the north of the Pee Dee Overflow structure is located within the Waccamaw National Wildlife Refuge (NWR) and is comprised of wetlands. Attempts have been made to minimize impacts to the wetland areas by limiting the height of the new roadway embankments and the resulting embankment footprint. The impact of each alternative on the wetland sites has been quantified. Temporary impacts to the wetlands during construction have not been quantified as part of this study since the impact quantity will generally be the same for each alternative investigated.
- All alignment alternatives developed as part of this study take into consideration the potential future widening of US 701. Each alignment alternative investigated will accommodate the future widening of US 701, in accordance with SCDOT requirements, within the current SCDOT right-of-way through the Waccamaw NWR limits.

U.S. 701 Bridge Replacement Project

- The design criteria for the relocated US 701 mainline used to develop each alternative is based on a roadway functional classification for a Rural Principal Arterial with a design speed of 70 mph (see Section II, Highway Design Criteria). The typical section, based on the roadway classification, consists of a two-lane undivided highway with a paved bike lane and shoulders on each side of the roadway (see Figure 2). The north and south approaches and resulting roadway tie-ins to the existing US 701 alignment has been based on a design speed of 60 mph. This reduction in the design speed is considered acceptable since the existing US 701 roadway has a design speed of 60 mph. In the future, if US 701 is widened and becomes a divided highway, the reverse horizontal curves used for the approach roadway tie-ins will be eliminated to achieve an overall design speed of 70 mph.
- The horizontal alignment for each alternative has been developed such that there is no superelevation or superelevation transition on the proposed bridge structures. All bridges will have constant normal crown sections. This will help to facilitate the widening of US 701 in the future.
- The vertical profile for the majority of the existing US 701 from Yauhannah Lake to the north end of the Pee Dee Overflow Bridge is on a flat 0% grade. Additionally, the existing vertical profile over the Great Pee Dee River results in a design speed of less than 60 mph. In accordance with the Department's latest guidelines, new roadway facilities should be designed with minimum grades of 0.5%. The profile over the Great Pee Dee River also required improvement to achieve the desired 70 mph design speed.
- The proposed bridge structures will generally have deeper structural depths than the existing structures to accommodate longer span lengths, use of prestressed concrete girders and a reduction in the number of substructure units. Additionally, the replacement structures will provide the same vertical clearance as the existing structures. The vertical profiles developed for each alignment alternative have been based on these factors.
- The height of the roadway embankment fill in the wetland areas for each of the alignments has been limited to 22 feet. This limitation was established to minimize impacts on the wetland areas and facilitate roadway construction.
- The existing US 701 alignment has a section of superelevation transitioning that starts approximately 400 feet south of US 701/Trinity Road intersection. This point was established as a constraint for all alignment alternatives tying into the US 701 existing alignment at the south approach.
- Based on the property research performed as part of this project, there appears to be several right-of-way conflicts along the north approach roadway. For this study, it has been assumed that the Department's right-of-way is limited to a total width of 75 feet at the north approach.

The above design factors and parameters were utilized to develop the four alignment alternatives for the replacement of the US 701 bridges over the Great Pee Dee River, Pee Dee Overflow and Lake Yauhannah.

C. Alignment Alternatives and Impacts

The following is a brief discussion of the alignment alternatives investigated during the conceptual design phase of the US 701 Bridge Replacement Project. Conceptual roadway plans showing the proposed typical roadway section, alternative alignment and profile for each alternative can be found in Section VI.

1. Alignment Alternative 1

Description: Alternative 1 provides a proposed alignment parallel to and on the upstream side of existing US 701. The new alignment is offset from the existing alignment 72 feet, measured from the centerline of the existing roadway to the centerline of the new roadway. The 72-foot offset will result in a clear distance of 31'-9" between the existing bridges and the new bridges.

The proposed alignment ties into the existing south approach roadway with reverse curves having an approximate radius of 8,500 feet at the southern end and 5,000 feet at the northern end of the south approach. The two curves are separated by a tangent roadway section having a length of approximately 505 feet. The south approach tie-in to existing US 701 is approximately 375 feet south of the Trinity Road/US 701 intersection. At the north approach, the proposed alignment ties into the existing roadway with reverse curves each having an approximate radius of 4,000 feet. The two curves are separated by a tangent roadway section having a length of approximately 527 feet. The north approach tie-in is approximately 575 feet north of the Lucas Bay Road/US 701 intersection. The maximum roadway superelevation utilized in north and south approach tie-in is 3.9%.

The proposed vertical profile for Alignment Alternative 1 is generally comprised of a series of vertical curves to satisfy the tie-in requirements at each of the approaches, provide minimum grades of 0.5% and satisfy the clearance requirements over each of the bridges. The vertical profile over the Great Pee Dee River has a maximum grade of 3.0%.

At both approaches, only minimal provisions will be required to maintain traffic during construction since the horizontal and vertical tie-ins will generally provide a smooth transition from the existing pavement to the proposed grade. Additionally, the proposed alignment is far enough away from the existing roadway to facilitate construction.

Future widening of US 701 based on this alignment alternative would result in the future lanes being oriented along the centerline of the existing US 701 alignment.

U.S. 701 Bridge Replacement Project

Design Issues: The major design issues associated with this alternative include the impact on properties along the upstream side of the south approach, wetland impacts, relocation of the existing boat ramp and utility relocations.

At the south approach, the right-of-way width must be increased to accommodate the proposed alignment, limits for the fill height and anticipated side ditch. At the south approach, total acquisition would be required for five properties and partial takes would be required for three properties. At the north approach, total acquisition would be required for two properties and a partial take would be required for one properties.

Alignment Alternative 1 would result in approximately 5.29 acres of wetland impact. An additional 2.18 acres of wetlands would be impacted to accommodate the relocation of the boat landing and provisions for a new access road to the boat landing.

All utilities, including electric lines, telephone cable, and water lines located upstream from the existing bridge on both approach roadways would require relocation. Additionally, on the north approach, cable communication lines would require relocation.

Summary of Impacts:

Wetland Impacts:

Roadway:	5.29 Acres
Boat Landing Access Rd:	2.18 Acres

Number of Archeological Sites Impacted: None

Number of Properties Impacted:

Number of Properties Requiring Partial Takes:	4
Number of Properties Requiring Acquisition:	7
Number of Relocations:	5

Boat Ramp and Access: Relocation required

Utilities:

South Approach:	All utilities require relocation, except cable
North Approach:	All utilities require relocation

Approximate Bridge Lengths:

Yauhannah Lake:	1,530 ft
Great Pee Dee River	2,600 ft
Pee Dee Overflow	1,350 ft.

Earthwork Required:

Fill:	186,476 CY
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2. Alignment Alternative 2

Description: Alignment Alternative 2 is positioned 55 feet upstream of existing US 701, measured from the centerline of the existing roadway to the centerline of the new roadway. The new alignment is parallel to the existing alignment and provides a clear distance of 14'-9" between the existing bridges and the new bridges. This alternative was developed to help minimize impacts on wetlands.

The proposed alignment ties into the existing south approach roadway with reverse curves having an approximate radius of 13,500 feet at the southern end and 6,500 feet at the northern end of the south approach. The two curves are separated by a tangent roadway section having a length of approximately 520 feet. The south approach tie-in is approximately 375 feet south of the Trinity Road/US 701 intersection. At the north approach, the proposed alignment ties into the existing roadway with reverse curves each having an approximate radius of 4,800 feet. The two curves are separated by a tangent roadway section having a length of approximately 506 feet. The north approach tie-in is approximately 565 feet north of the Lucas Bay Road/US 701 intersection. The maximum roadway superelevation utilized in the north and south approach tie-in is 3.5%.

Similar to Alignment Alternative 1, the proposed vertical profile for Alignment Alternative 2 is generally comprised of a series of vertical curves to satisfy the tie-in requirements at each of the approaches, provide minimum grades of 0.5% and satisfy the clearance requirements over each of the bridges. The vertical profile over the Great Pee Dee River has a maximum grade of 3.0%.

At both approaches, only minimal provisions will be required to maintain traffic during construction since the horizontal and vertical tie-ins will generally provide a smooth transition from the existing pavement to the proposed grade. Additionally, the proposed alignment is far enough away from the existing roadway to facilitate construction.

Design Issues: The major design issues associated with Alignment Alternative 2 include the impact on properties along the upstream side of the south approach, wetland impacts, relocation of the existing boat landing and utility relocations.

At the south approach, the right-of-way width must be increased to accommodate the proposed alignment, limits for the fill height and anticipated side ditch. At the south approach, total acquisition would be required for four properties and partial takes would be for four properties. At the north approach, total acquisition would be required for one property and partial takes would be for two properties.

Alignment Alternative 2 would result in approximately 4.03 acres of wetland impact and an additional 1.79 acres of wetlands would be impacted to accommodate the relocation of the boat landing and provisions for a new access road to the boat landing.

U.S. 701 Bridge Replacement Project

All utilities, including electric lines, telephone cable, and water lines located upstream from the existing bridge on both approach roadways would require relocation. Additionally, on the north approach, cable communication lines would require relocation.

Summary of Impacts:

Wetland Impacts:

Roadway:	4.03 Acres
Boat Landing Access Rd:	1.79 Acres

Number of Archeological Sites Impacted: None

Number of Properties Impacted:

Number of Properties Requiring Partial Takes:	6
Number of Properties Requiring Acquisition:	5
Number of Relocations:	5

Boat Ramp and Access: Relocation required

Utilities:

South Approach:	All utilities require relocation, except cable
North Approach:	All utilities require relocation

Approximate Bridge Lengths:

Yauhannah Lake:	1,520 ft
Great Pee Dee River	2,600 ft
Pee Dee Overflow	1,350 ft.

Earthwork Required:

Fill:	155,050 CY
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3. Alignment Alternative 3

Description: Alignment Alternative 3 is positioned 55 feet downstream of existing US 701, measured from the centerline of the existing roadway to the centerline of the new roadway. This alignment provides a constant clear distance of 14'-9" between the existing bridges and the new bridges, and the alignment was developed to help minimize impacts on both properties and wetlands.

Alignment Alternative 3 generally positions proposed US 701 along the same alignment as the original US 701 bridge constructed circa 1920's. The proposed alignment ties into the existing south approach roadway with large reverse curves having an approximate radius of 17,000 feet at the southern end and 52,000 feet at the

northern end of the south approach. The two curves are separated by a tangent roadway section having a length of approximately 365 feet. The south approach tie-in is approximately 375 feet south of the Trinity Road/US 701 intersection. At the north approach, the proposed alignment has a 0.14-degree deflection angle before tying into the existing roadway approximately 525 feet north of the Lucas Bay Road/US 701 intersection.

Similar to the other alignments investigated, the proposed vertical profile for Alignment Alternative 3 is generally comprised of a series of vertical curves to satisfy the tie-in requirements at each of the approaches, provide minimum grades of 0.5% and satisfy the clearance requirements over each of the bridges. The vertical profile over the Great Pee Dee River has a maximum grade of 3.0%.

At both approaches, only minimal provisions will be required to maintain traffic during construction since the horizontal and vertical tie-ins will generally provide a smooth transition from the existing pavement to the proposed grade. Additionally, the proposed alignment is far enough away from the existing roadway to facilitate construction.

Design Issues: The major design issues associated with Alignment Alternative 3 include the impact on properties along the downstream side of the south approach, wetland impacts, utility relocations, and the distance between reverse curves.

At the south approach, the right-of-way width must be slightly increased to accommodate the proposed alignment, limits for the fill height and anticipated side ditch. However, there are no total property acquisitions or relocations required for this alternative. At the south approach, a partial right-of-way take would be required for one property. At the north approach, partial right-of-way takes would be required for two properties.

Alignment Alternative 3 would result in approximately 3.41 acres of wetland impact and an additional 1.04 acres of wetlands would be impacted to accommodate the improved access road to the boat landing. The boat landing would not have to be relocated for this alternative.

All utilities, including electric lines, telephone cable, water lines, and communication cable lines located downstream from the existing bridge on the north approach roadway would require relocation. At the south approach roadway, only the electrical lines would require relocation.

The SCDOT Highway Manual suggests that in rural areas, 500 feet should desirably be provided between the PT and PC of reverse curves for appearance. At the south approach, only 365 feet has been provided between the two curves. This value is considered to be an acceptable deviation from the manual given the large radii used in the reverse curves.

U.S. 701 Bridge Replacement Project

Summary of Impacts:

Wetland Impacts:

Roadway:	3.41 Acres
Boat Landing Access Rd:	1.04 Acres

Number of Archeological Sites Impacted: None

Number of Properties Impacted:

Number of Properties Requiring Partial Takes:	3
Number of Properties Requiring Acquisition:	0
Number of Relocations:	0

Boat Ramp and Access: Relocation not required (new access road required)

Utilities:

South Approach:	Only electric lines require relocation
North Approach:	All utilities require relocation

Approximate Bridge Lengths:

Yauhannah Lake:	1,530 ft
Great Pee Dee River	2,600 ft
Pee Dee Overflow	1,350 ft.

Earthwork Required:

Fill:	146,252 CY
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4. Alignment Alternative 4

Description: Alternative 4 provides a proposed alignment parallel to and on the downstream side of existing US 701. The new alignment is offset from the existing alignment 72 feet, measured from the centerline of the existing roadway to the centerline of the new roadway. The 72-foot offset will result in a clear distance of 31'-9" between the existing bridges and the new bridges. This alternative was developed to help minimize impacts on properties and future widening of US 701 would result in the future lanes being positioned along the centerline of the existing US 701 alignment.

The proposed alignment ties into the existing south approach roadway with large reverse curves having an approximate radius of 12,500 feet at the southern end and 27,000 feet at the northern end of the south approach. The two curves are separated by a tangent roadway section having a length of approximately 372 feet. The south approach tie-in is approximately 375 feet south of the Trinity Road/US 701 intersection. At the north approach, the proposed alignment ties directly into the existing roadway approximately 725 feet north of the Lucas Bay Road/US 701 intersection.

U.S. 701 Bridge Replacement Project

The proposed vertical profile for Alignment Alternative 3 is generally comprised of a series of vertical curves to satisfy the tie-in requirements at each of the approaches, provide minimum grades of 0.5% and satisfy the clearance requirements over each of the bridges. The vertical profile over the Great Pee Dee River has a maximum grade of 3.0%.

At both approaches, only minimal provisions will be required to maintain traffic during construction since the horizontal and vertical tie-ins will generally provide a smooth transition from the existing pavement to the proposed grade. Additionally, the proposed alignment is far enough away from the existing roadway to facilitate construction.

Design Issues: The major design issues associated with Alignment Alternative 4 include the impact on properties along the downstream side of the south approach, wetland impacts, utility relocations, and distance between reverse curves.

At the south approach, the right-of-way width must be slightly increased to accommodate the proposed alignment, limits for the fill height and anticipated side ditch. However, there are no total property acquisitions required for this alternative. At the south approach, a partial right-of-way take would be required for one property. At the north approach, partial right-of-way takes would be required for two properties.

Alignment Alternative 4 would result in approximately 4.67 acres of wetland impact and an additional 1.04 acres of wetlands would be impacted to accommodate the improved access road to the boat landing. The boat landing would not have to be relocated for this alternative.

All utilities, including electric lines, telephone cable, water lines, and communication cable lines located downstream from the existing bridge on the north approach roadway would require relocation. At the south approach roadway, only the electrical lines would require relocation.

Similar to Alternative 3, at the south approach only 372 feet has been provided between the reverse curves. This value is considered to be an acceptable deviation from the SCDOT Highway Design Manual given the large radii used in the reverse curves.

Summary of Impacts:

Wetland Impacts:

Roadway:	4.67 Acres
Boat Landing Access Rd:	1.04 Acres

Number of Archeological Sites Impacted: None

U.S. 701 Bridge Replacement Project

Number of Properties Impacted:

Number of Properties Requiring Partial Takes:	3
Number of Properties Requiring Acquisition:	1
Number of Relocations:	0

Boat Ramp and Access: Relocation not required (new access road required)

Utilities:

South Approach:	Only electric lines require relocation
North Approach:	All utilities require relocation

Approximate Bridge Lengths:

Yauhannah Lake:	1,480 ft
Great Pee Dee River	2,600 ft
Pee Dee Overflow	1,350 ft.

Earthwork Required:

Fill:	175,263 CY
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D. Other Alignments Investigated

Several other alignment alternatives were briefly investigated during the development of the four alignment alternatives for the US 701 project. The following is a brief discussion of the additional alternatives investigated:

- **Parallel Alignments with 45' Offset**

Parallel alignments positioned 45 feet upstream and downstream of existing US 701, measured from the centerline of the existing roadway to the centerline of the new roadway, were initially investigated as part of the concept study. These two alignments would provide a clear distance of 4'-9" between the existing and proposed bridges. Although both alignments would minimize the embankment fill footprint and consequently the wetland impacts, they would inherently increase project costs. A proposed embankment fill height higher than the existing fill height would result in the proposed fill material spilling over onto the existing roadway pavement unless extensive temporary retaining walls were used. Drainage during construction would also be a major safety concern for the existing roadway. Limiting the proposed fill heights would reduce the length of embankment fill between the proposed bridges, considerably increase the bridge lengths thus increasing the project construction cost. Both of these alignments were eliminated from further consideration due to the construction difficulties and cost implications.

- Cross-over Alignments

The concept study also investigated the viability of alignment alternatives that cross over the existing roadway alignment, either from downstream to upstream or upstream to downstream. The intent of this alignment was to utilize as much of the existing embankment fill as possible, thereby minimizing wetland impacts. It was determined that there was not a sufficient length of roadway embankment between the existing bridges to make this a viable alignment alternative.

E. Comments from Various Regulatory and Government Agencies

A field meeting was held at the US 701 Project site on April 28, 2005. The purpose of this meeting was to introduce and describe the proposed US 701 Bridge Replacement project to the various regulatory and government agencies, and also to obtain comments and concerns from the agencies. Representatives from the following agencies attended the field meeting:

- South Carolina DOT
- Federal Highway Admin.
- US Fish and Wildlife Service
- SC Dept. of Natural Resources
- SC Dept. of Health and Environment Control
- NOAA – National Marine Fisheries
- SC Dept. of Archives and History
- Horry County Dept. of Public Works

Representatives of SCDNR and FWS voiced their preference to have the new alignment positioned to the upstream side of the existing bridge. The forested wetland on the downstream side of the existing roadway is considered relatively undisturbed in contrast to the wetland area upstream of the existing roadway which has been cleared in the past to accommodate power lines.

Each of the four alignment alternatives developed for this study was evaluated against these comments and concerns from the various agencies. Each alternative utilizes new roadway fill adjacent to and overlapped with the existing roadway fill to minimize impacts on the wetlands. None of these alternatives utilizes an independent new roadway fill creating two separate causeways. Alignment Alternative 1 and Alignment Alternative 2 are positioned 72 feet upstream and 55 feet upstream, respectively, from the centerline of existing US 701 roadway. The power line is located a minimum of 250 feet upstream from the existing alignment, and is beyond the study corridor. It is not feasible to take advantage of the previously disturbed wetlands in the vicinity of the power line.

Similarly, Alternative Alignment 3 and Alternative Alignment 4 are positioned 55 feet downstream and 72 feet downstream, respectively, from the centerline of existing US 701 roadway. None of these two alignments negatively impact the recognized archaeological site or the proposed FWS Visitor Center. All four alternative alignments satisfy the questions raised by the various agencies at the field review meeting.

IV. Alignment Impact and Cost Comparison

A summary of the impacts related to each alignment alternative is presented in Table 2 for comparison purposes. Specifically, Table 2 summarizes the wetland impacts, property impacts and cultural resources associated with each alignment alternative.

Additionally, a summary of the relative construction costs associated with each alignment alternative has been provided in Table 3. The roadway cost for the various alternatives was based on actual embankment heights using the typical roadway cross section. Costs and quantities have been calculated for major roadway items such as pavement, earthwork, clearing and grubbing and geogrid. Costs for the various items were based on unit bid prices for contracts awarded within the past few years in the surrounding area. The remaining roadway construction items were estimated based on past projects and the proportion of costs for the major roadway items relative to the miscellaneous roadway items.

The bridge costs were based on the typical bridge cross section and the length of bridge. The cost of bridges was estimated to be approximately \$90.00 per square foot on average.

At this stage of the project, only a comparative, order-of-magnitude cost estimate was prepared for right-of-way acquisition.

Table 2. Alignment Impact Data Summary

Impacted Items	Alternative Alignments			
	Alternative 1 72' Offset Upstream	Alternative 2 55' Offset Upstream	Alternative 3 55' Offset Downstream	Alternative 4 72' Offset Downstream
<u>Wetland</u>				
Area of Wetland Impacted by Relocated US 701 (Acres)	5.29	4.03	3.41	4.67
Area of Wetland Impacted by Boat Ramp Access Roads (Acres)	2.18	1.79	1.04	1.04
Total Area of Wetland Impacted	7.47	5.82	4.45	5.71
<u>Cultural Resources</u>				
Number of Archaeological Sites Impacted	0	0	0	0
Number of Boat Landings Requiring Relocation	1	1	0	0
<u>Properties</u>				
Number of Properties Impacted				
North Approach (Horry Co.)	3	3	2	2
South Approach (Georgetown Co.)	8	8	1	1
Total	11	11	3	3
Number of Properties To Be Acquired				
North Approach (Horry Co.)	2	1	0	0
South Approach (Georgetown Co.)	5	4	0	0
Total	7	5	0	0
Number of Properties for Partial Take				
North Approach (Horry Co.)	1	2	2	2
South Approach (Georgetown Co.)	3	4	1	1
Total	4	6	3	3
Number of Relocations (Residences or Possible Buildings)				
North Approach (Horry Co.)	1	1	0	1
South Approach (Georgetown Co.)	4	4	0	0
Total	5	5	0	1

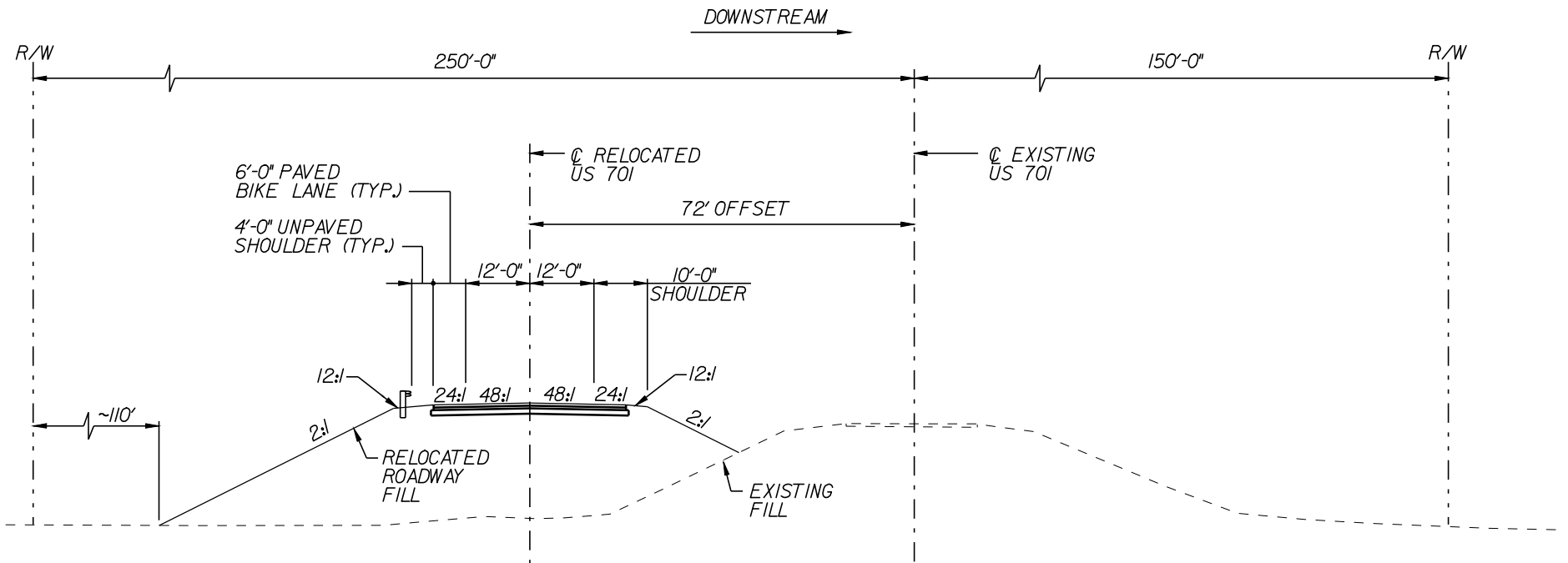
Table 3. Alignment Alternatives Cost Comparison

Description	Estimated Costs			
	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Roadway Costs	\$3,111,000	\$2,823,000	\$2,702,000	\$3,010,000
Bridge Costs	\$23,304,000	\$23,261,000	\$23,304,000	\$23,091,000
Right of Way Costs	\$157,000	\$150,000	\$21,000	\$50,000
Comparative Estimate (Sub-total)	\$26,572,000	\$26,234,000	\$26,027,000	\$26,151,000
Contingency @ 15%	\$3,986,000	\$3,935,000	\$3,904,000	\$3,923,000
Comparative Estimate	\$30,558,000	\$30,169,000	\$29,931,000	\$30,074,000

V. Recommendations

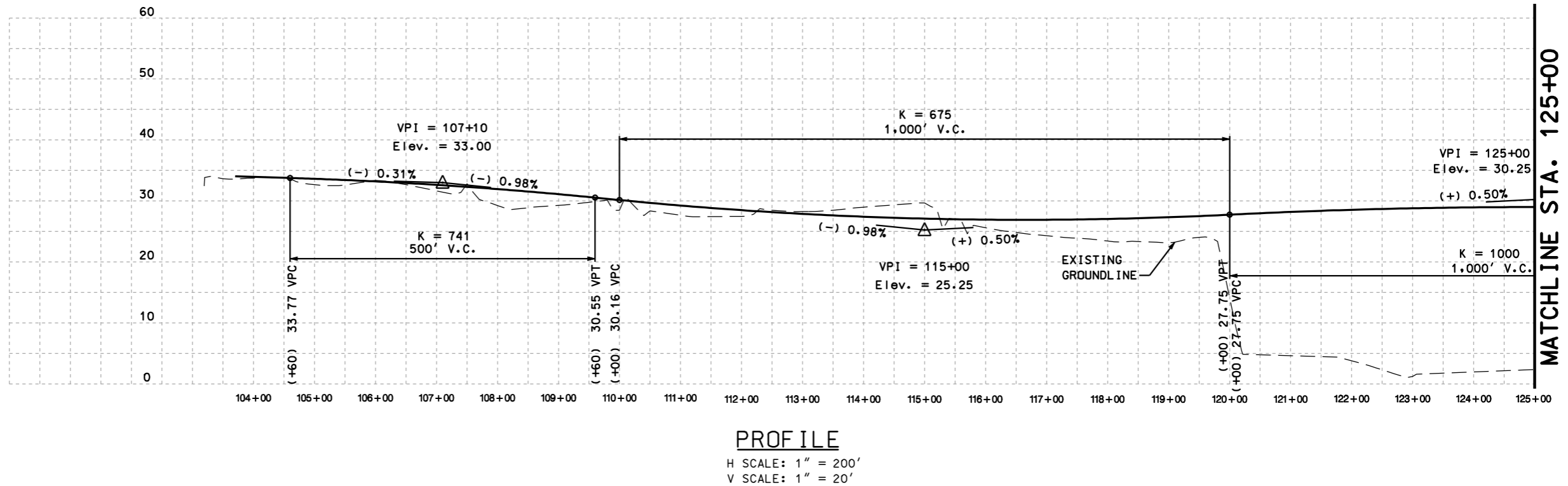
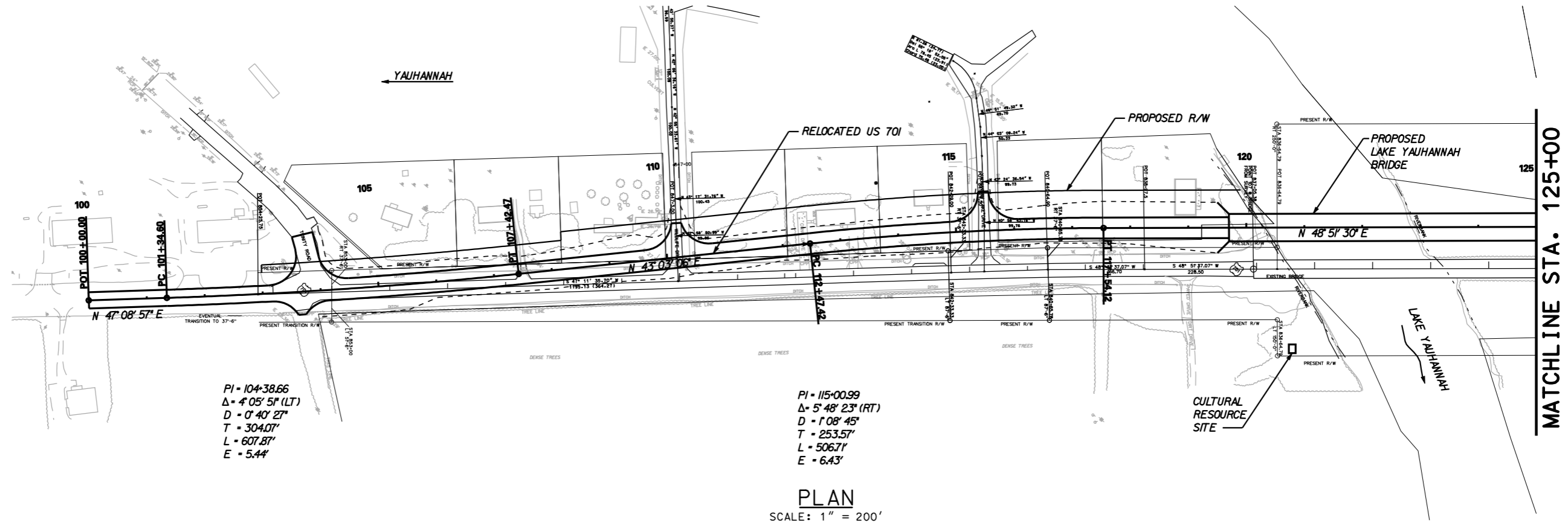
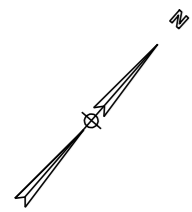
Considering the design issues, costs, impacts on properties, impacts on wetlands, utility relocations, ease of construction, relocation of the boat landing and other factors associated with each alignment alternative, it is recommended that the project proceed with the alignment prepared for Alternative 3.

All three alignments have comparable estimated construction costs. However, Alternative 3 has the least amount of wetland and property impacts. Alternative 3 also does not require the relocation of the existing boat landing. Additionally, Alignment Alternative 3 generally positions relocated US 701 along the same alignment as the original US 701 bridge constructed circa 1920's. Consequently, this alignment provides easier tie-ins to the existing US 701 alignment.



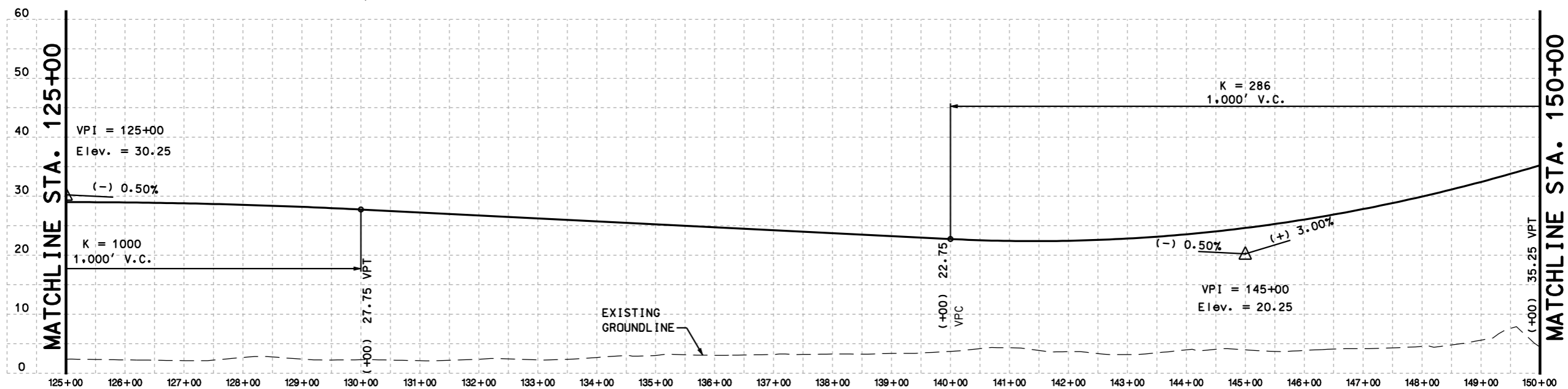
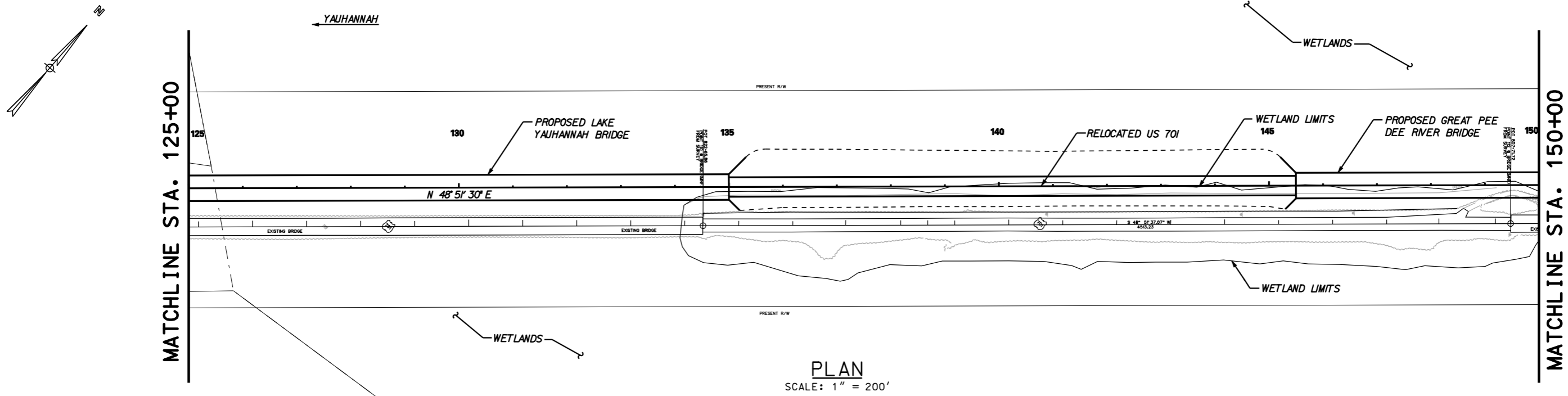
TYPICAL CROSS SECTION

SCALE: 1" = 30'



REPLACEMENT OF US 701 BRIDGES OVER
 GREAT PEE DEE RIVER, PEE DEE OVERFLOW
 & LAKE YAUHANNAH
 HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

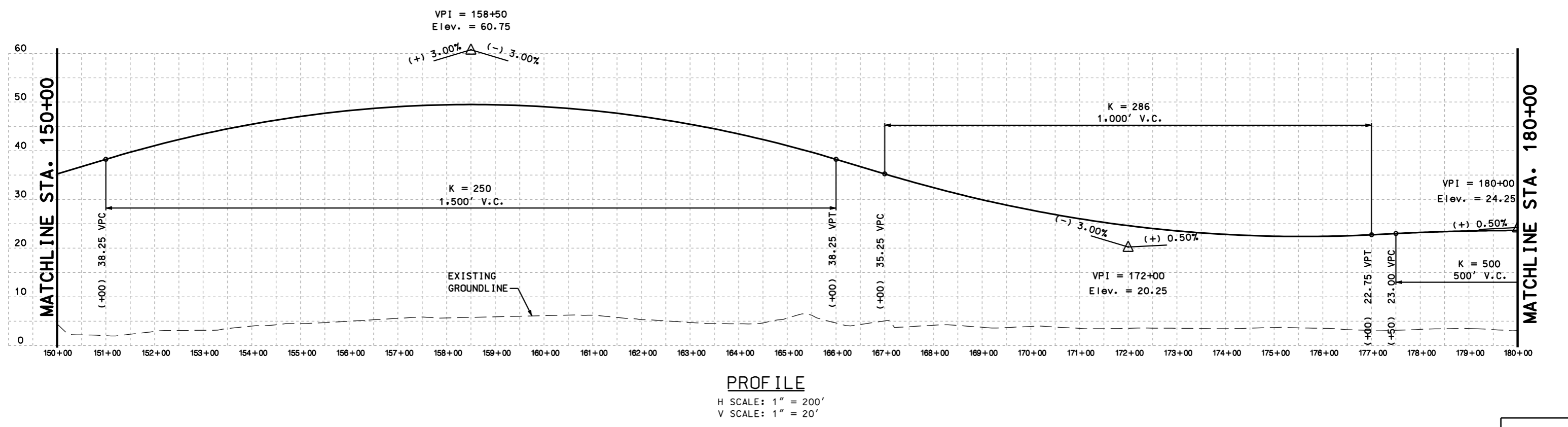
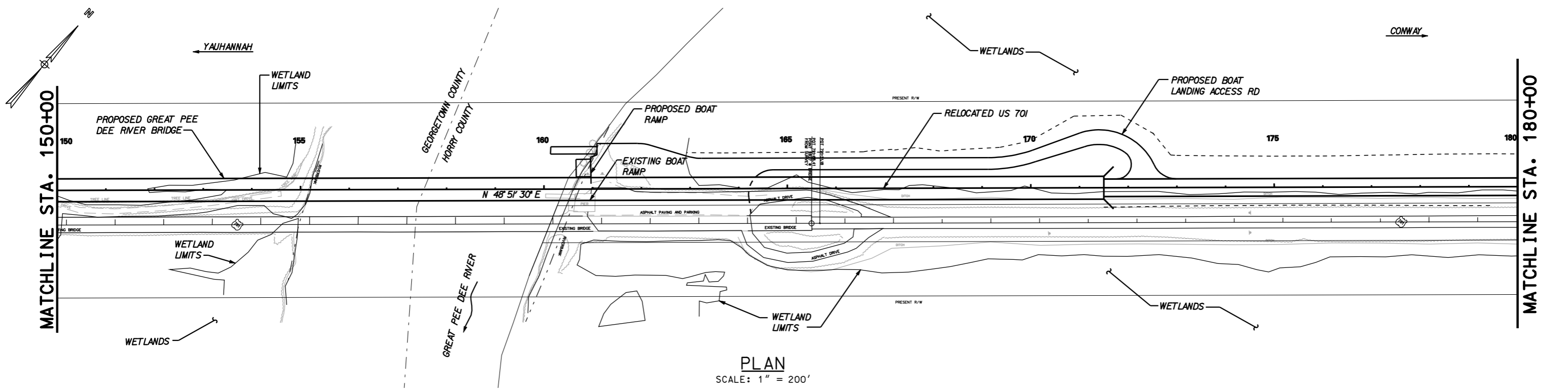
ALIGNMENT ALTERNATIVE 1
 PLAN & PROFILE (1 OF 5)
 FIGURE 5



PROFILE

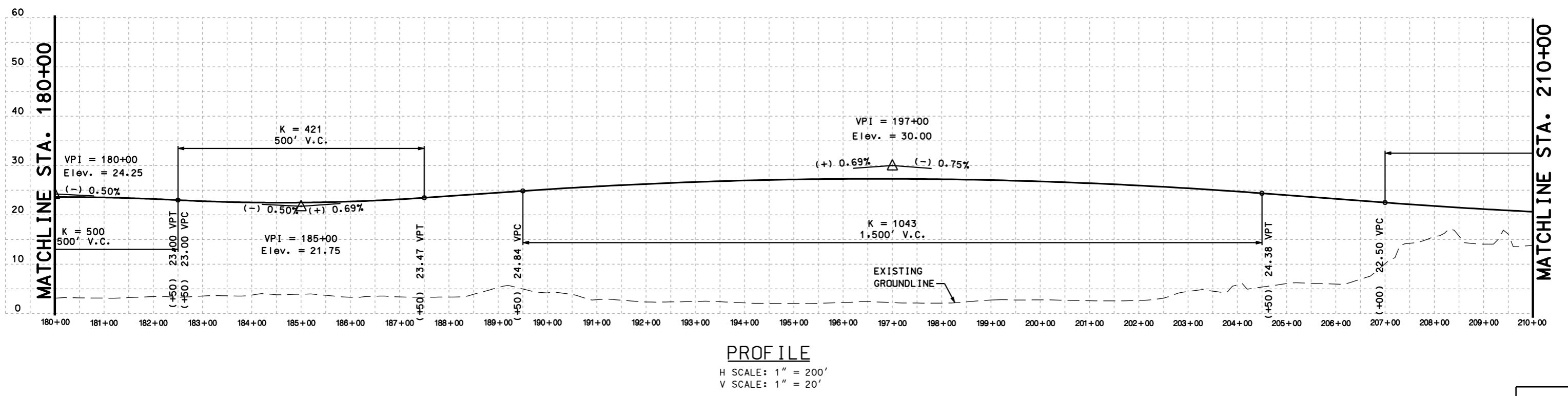
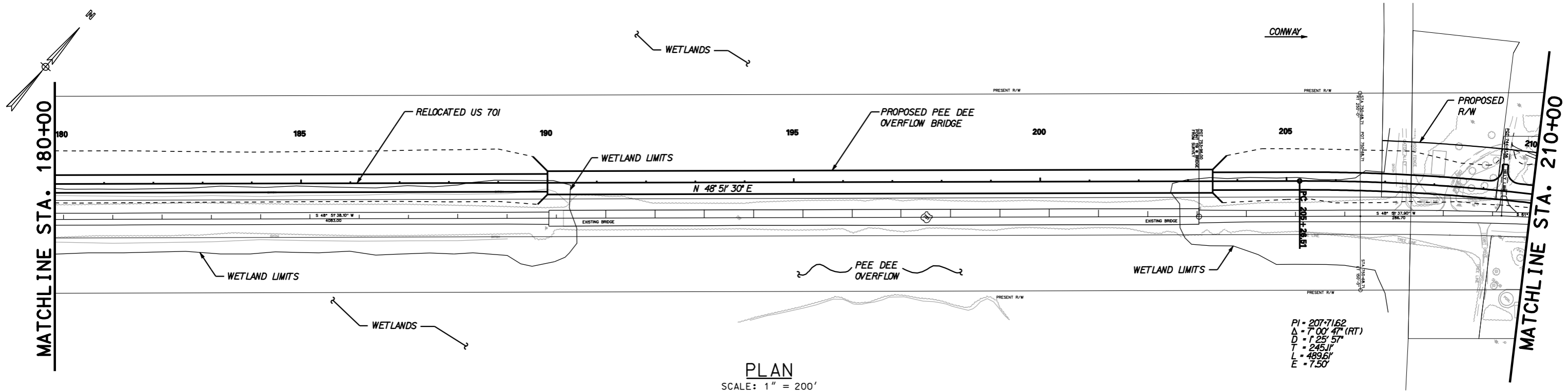
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V SCALE: 1" = 20'



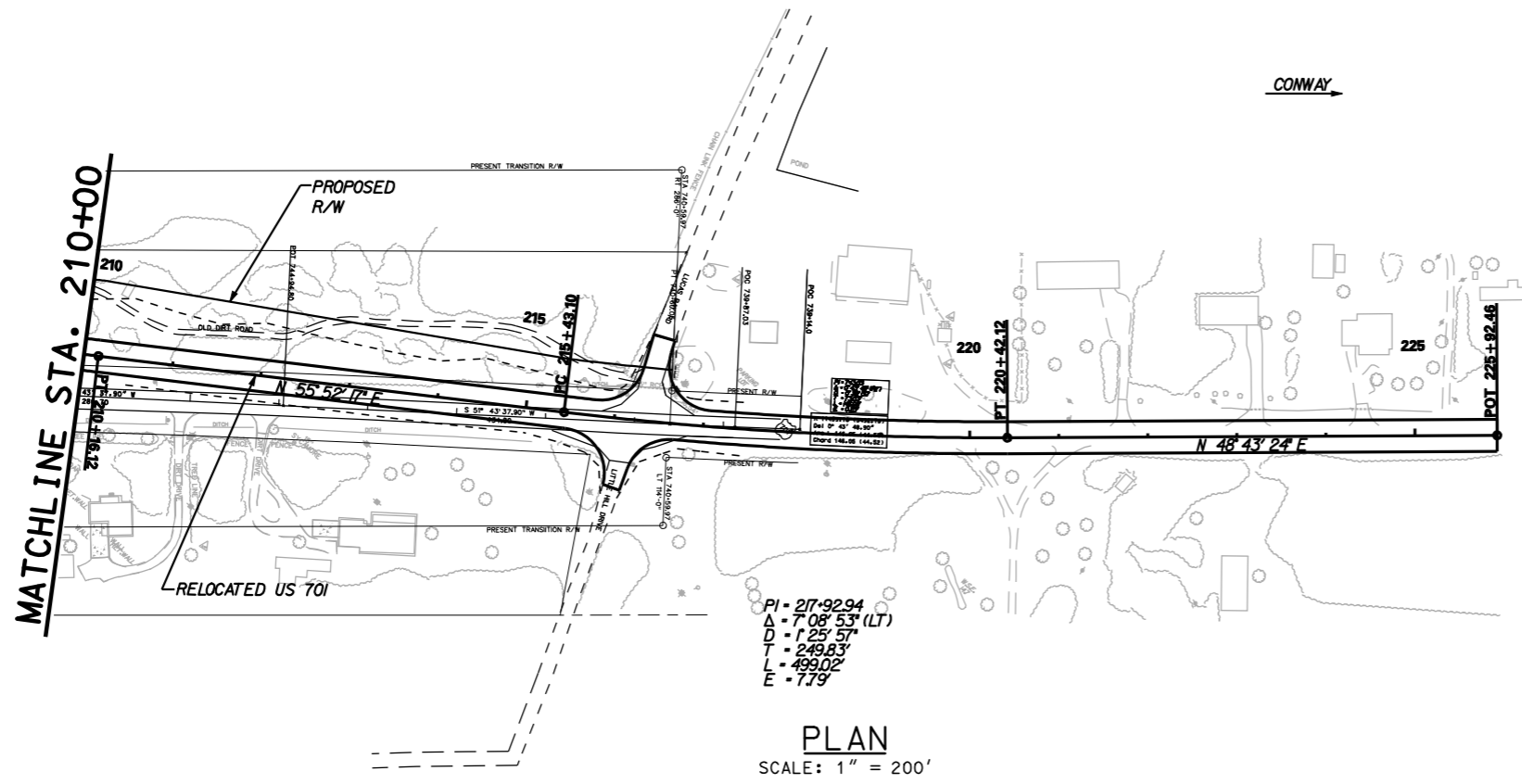
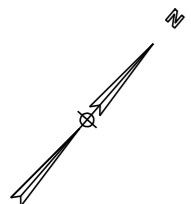
**REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& LAKE YAUHANNAH**
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

ALIGNMENT ALTERNATIVE 1
PLAN & PROFILE (3 OF 5)
FIGURE 7

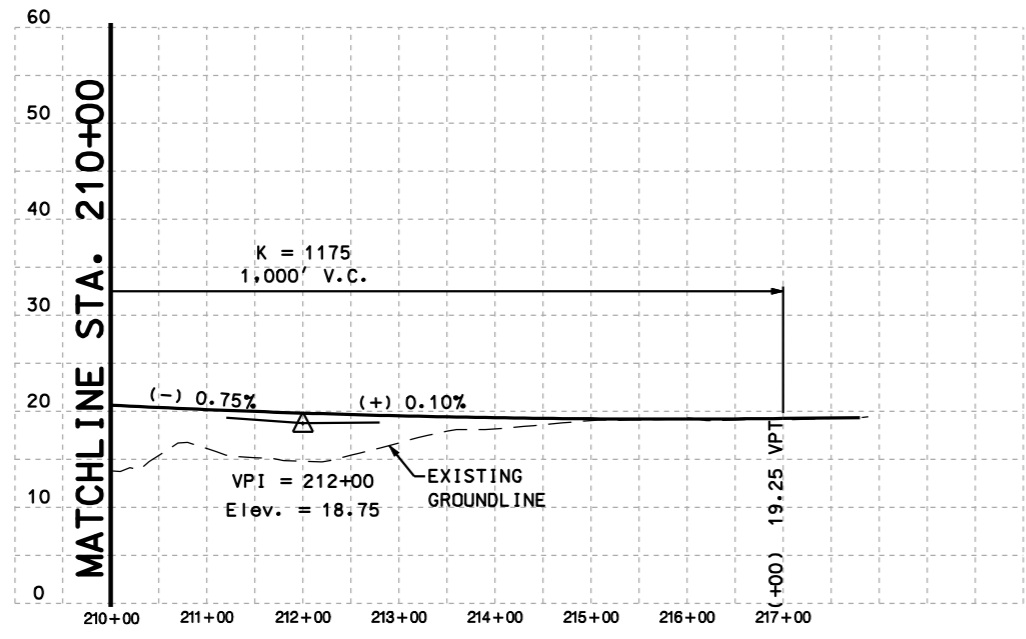


**REPLACEMENT OF US 701 BRIDGES OVER
 GREAT PEE DEE RIVER, PEE DEE OVERFLOW
 & LAKE YAUHANNAH**
 Horry/Georgetown Counties, South Carolina

**ALIGNMENT ALTERNATIVE 1
 PLAN & PROFILE (4 OF 5)
 FIGURE 8**



PLAN
SCALE: 1" = 200'

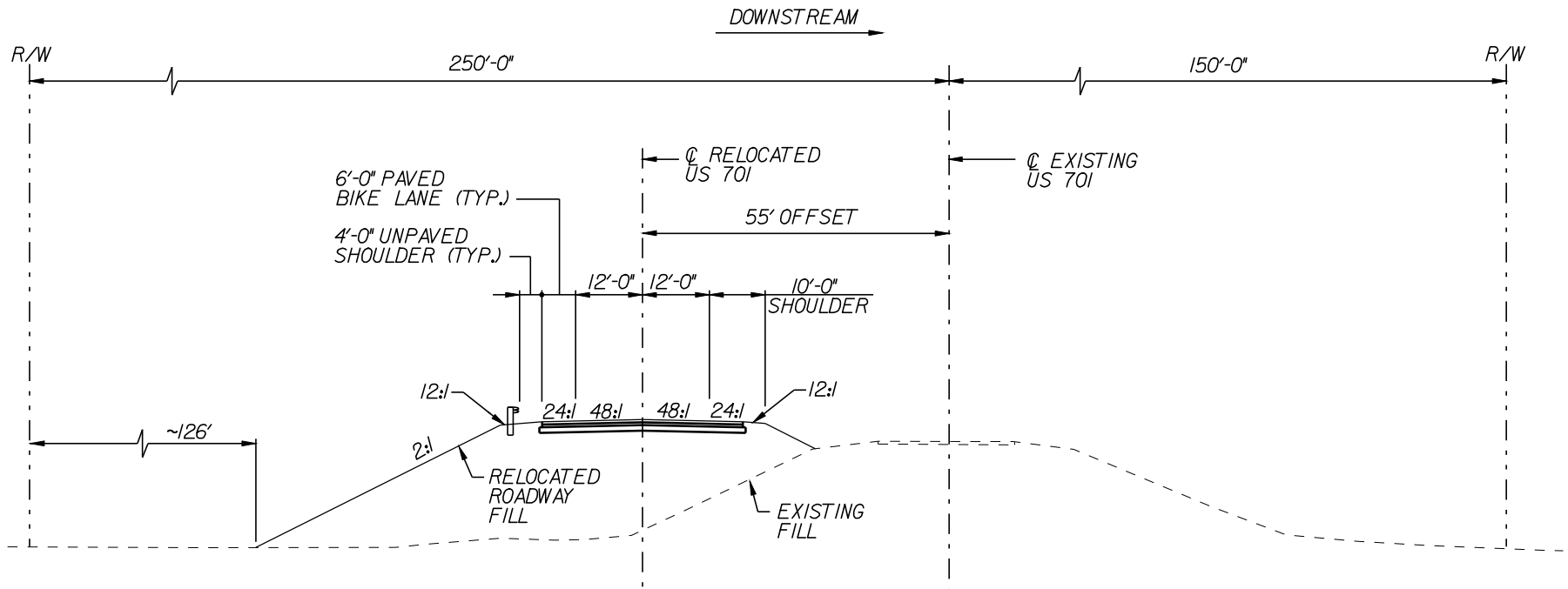


PROFILE
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V SCALE: 1" = 20'



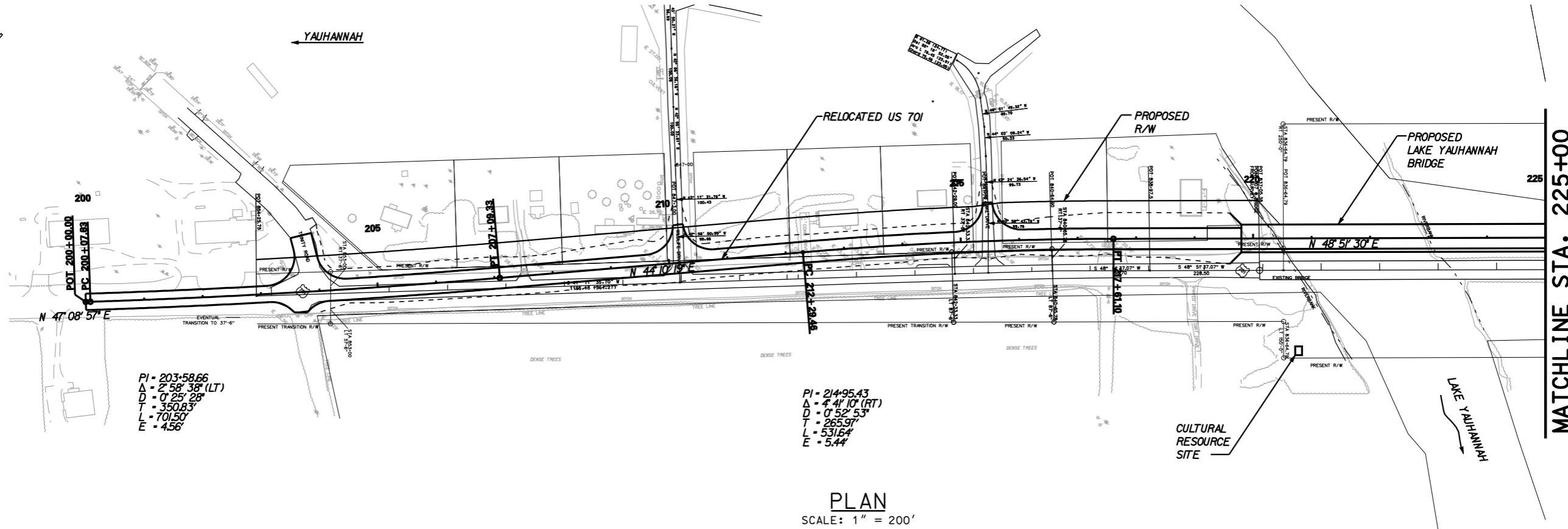
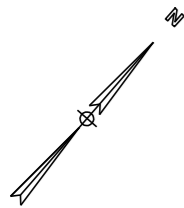
**REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& LAKE YAUHANNAH**
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

**ALIGNMENT ALTERNATIVE 1
PLAN & PROFILE (5 OF 5)
FIGURE 9**



TYPICAL CROSS SECTION

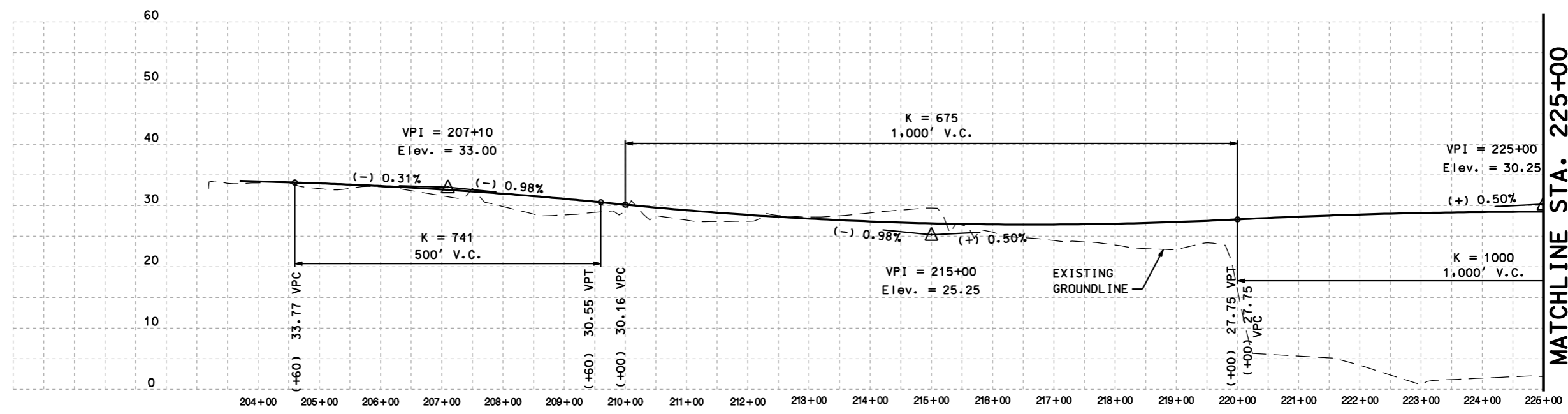
SCALE: 1" = 30'



PI = 203+58.66
 Δ = 2° 58' 38" (LT)
 D = 0' 25" 28"
 T = 350.83'
 L = 701.50'
 E = 4.56'

PI = 214+95.43
 Δ = 4° 41' 10" (RT)
 D = 0' 52' 53"
 T = 265.97'
 L = 531.64'
 E = 5.44'

PLAN
 SCALE: 1" = 200'

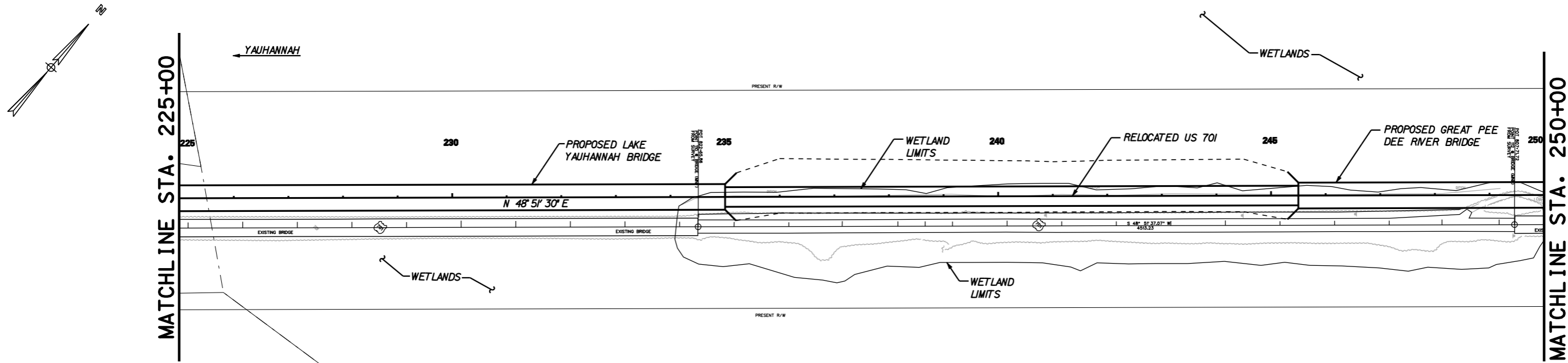


PROFILE
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 V SCALE: 1" = 20'

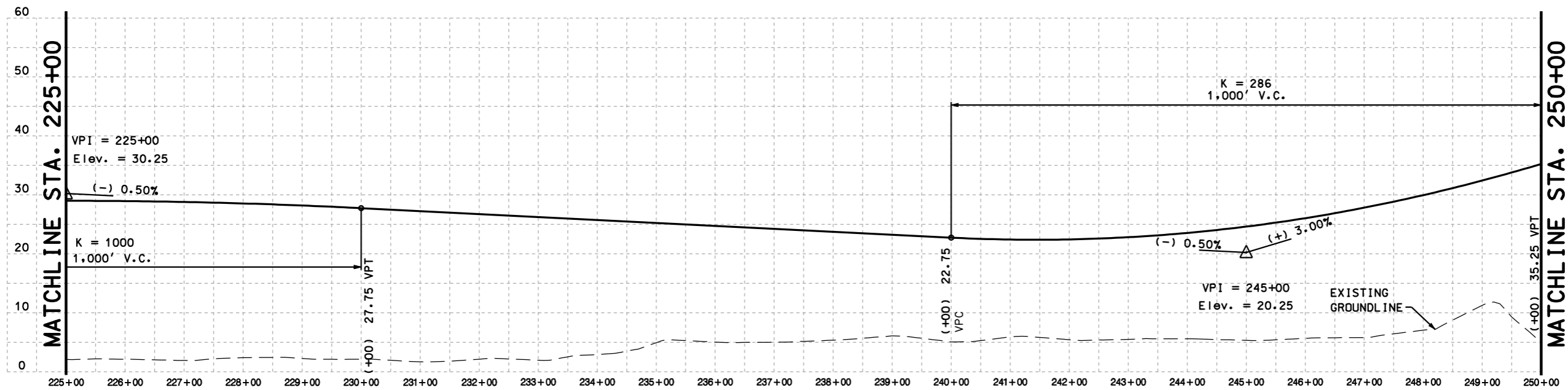


**REPLACEMENT OF US 701 BRIDGES OVER
 GREAT PEE DEE RIVER, PEE DEE OVERFLOW
 & LAKE YAUHANNAH**
 HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

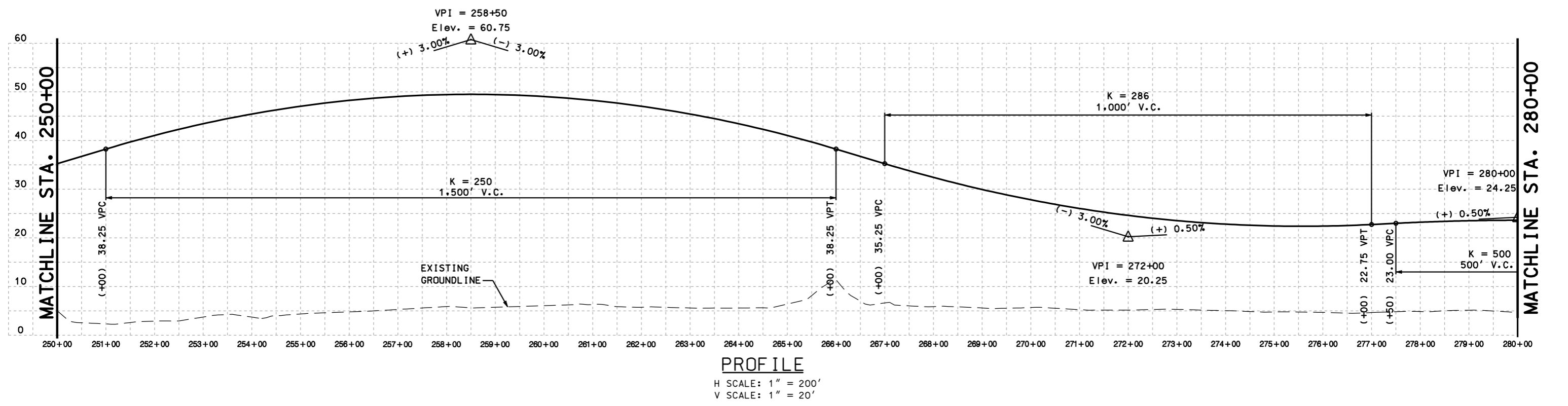
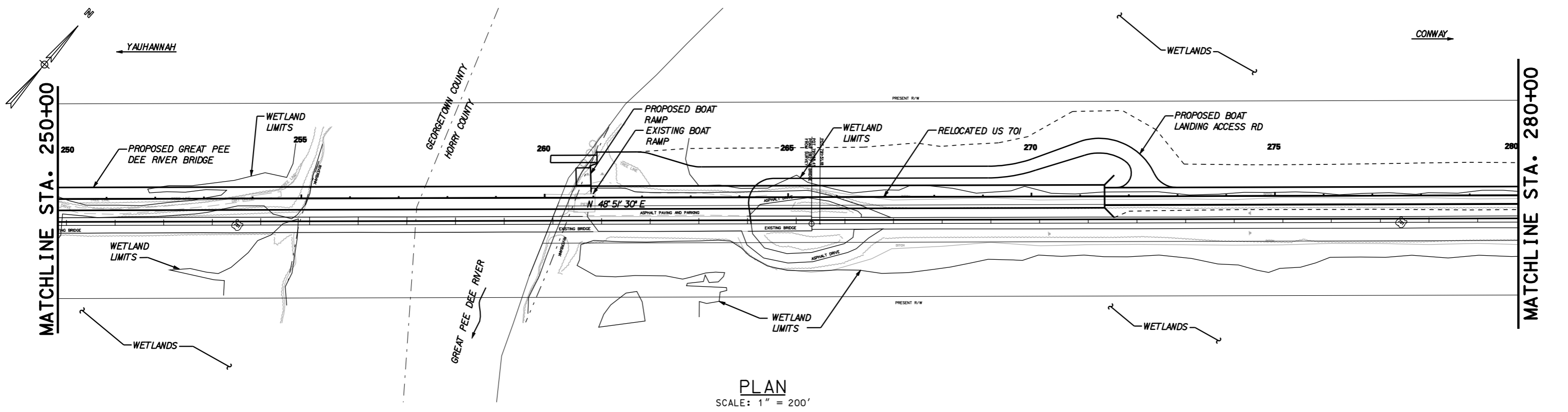
ALIGNMENT ALTERNATIVE 2
 PLAN & PROFILE (1 OF 5)
 FIGURE 11



PLAN
SCALE: 1" = 200'

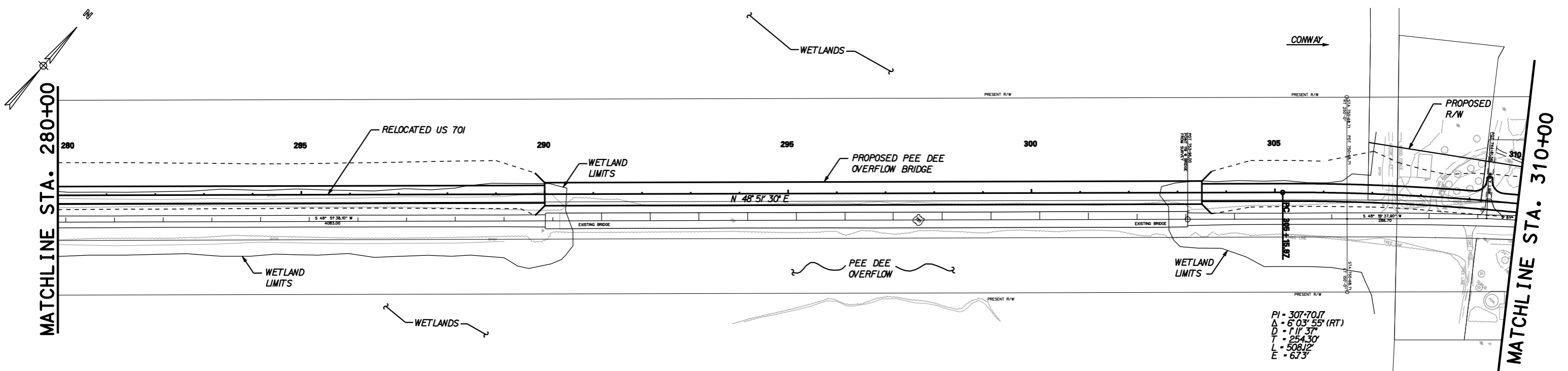


PROFILE
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V SCALE: 1" = 20'

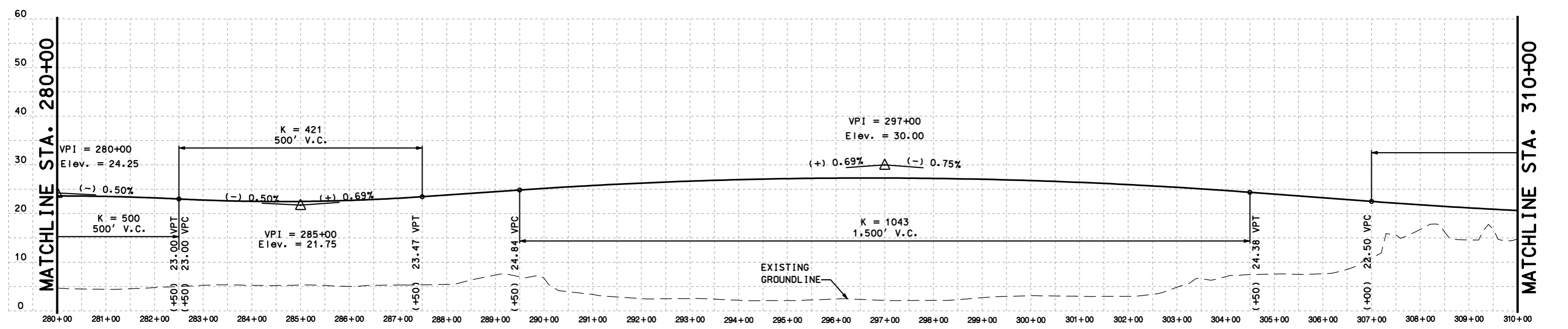


**REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& LAKE YAUHANNAH**
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

ALIGNMENT ALTERNATIVE 2
PLAN & PROFILE (3 OF 5)
FIGURE 13



PLAN
 SCALE: 1" = 200'

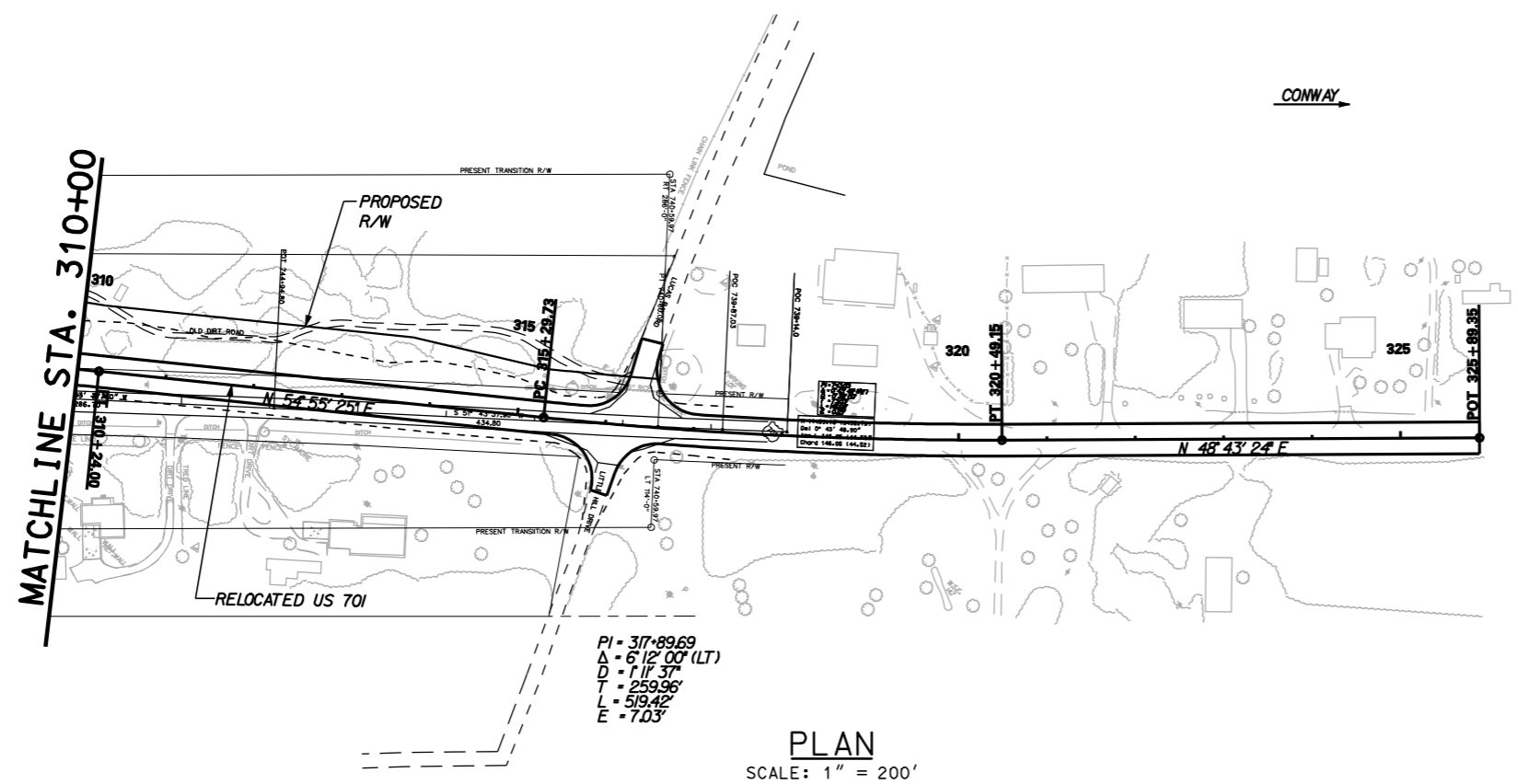
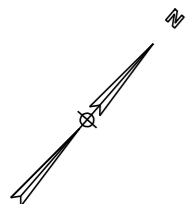


PROFILE
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 V SCALE: 1" = 20'

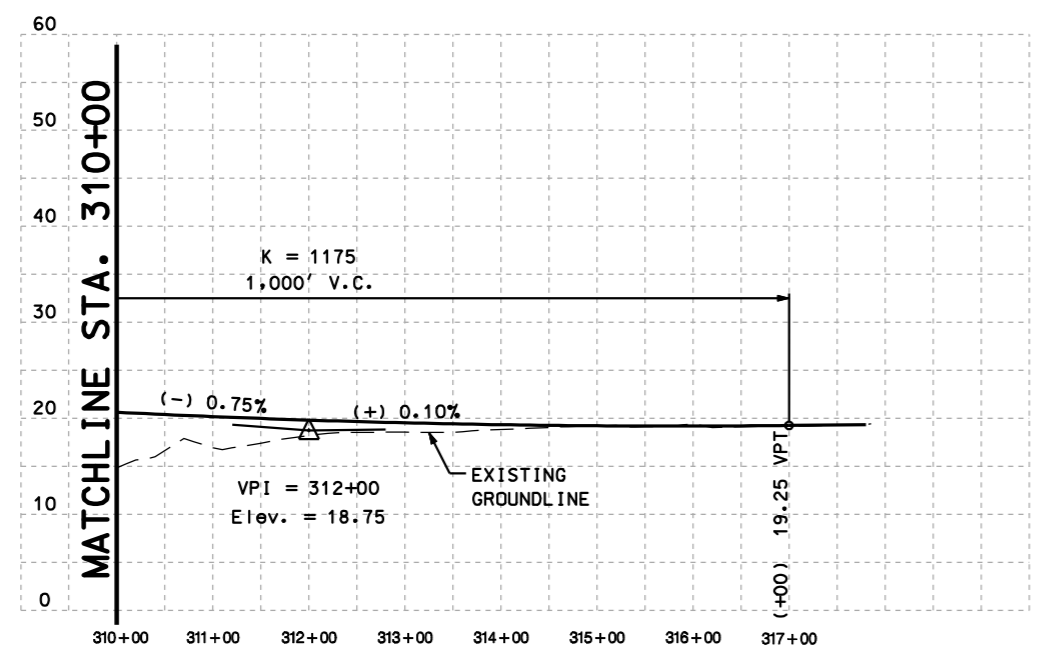


**REPLACEMENT OF US 701 BRIDGES OVER
 GREAT PEE DEE RIVER, PEE DEE OVERFLOW
 & LAKE YAUHANNAH**
 Horry/Georgetown Counties, South Carolina

ALIGNMENT ALTERNATIVE 2
 PLAN & PROFILE (4 OF 5)
FIGURE 14



PLAN
SCALE: 1" = 200'

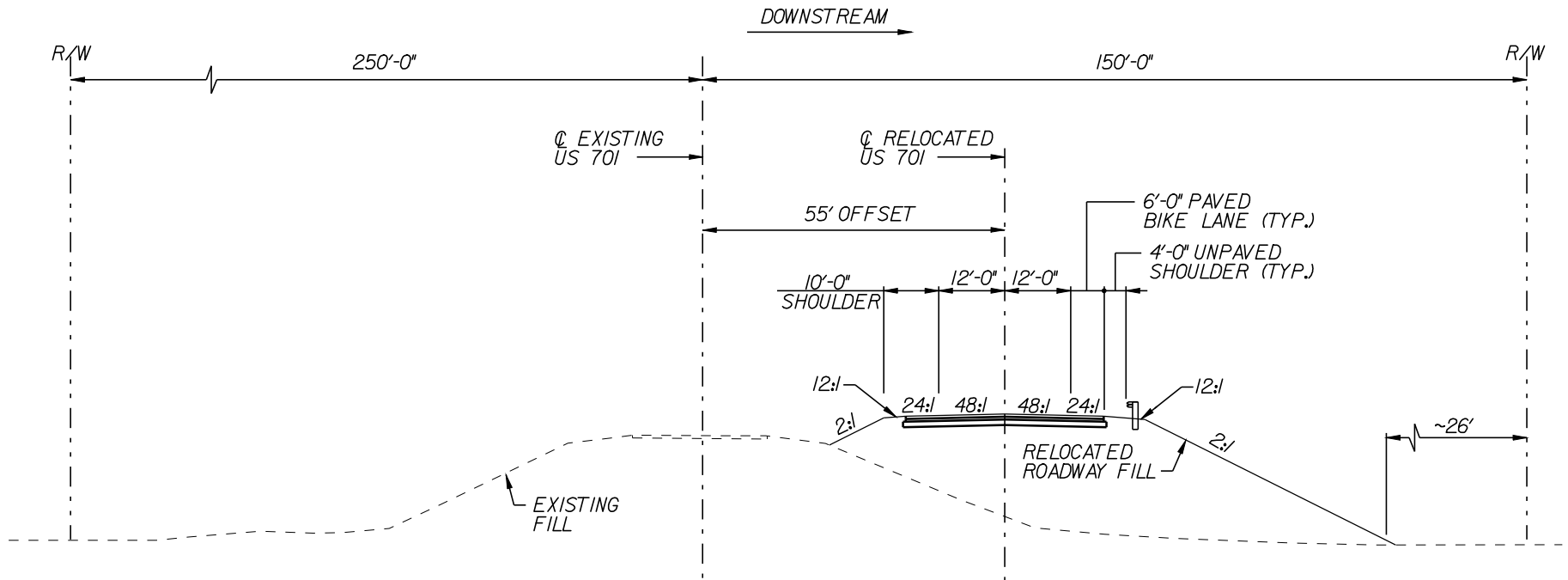


PROFILE
H SCALE: 1" = 200'
V SCALE: 1" = 20'



**REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& LAKE YAUHANNAH**
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

**ALIGNMENT ALTERNATIVE 2
PLAN & PROFILE (5 OF 5)
FIGURE 15**



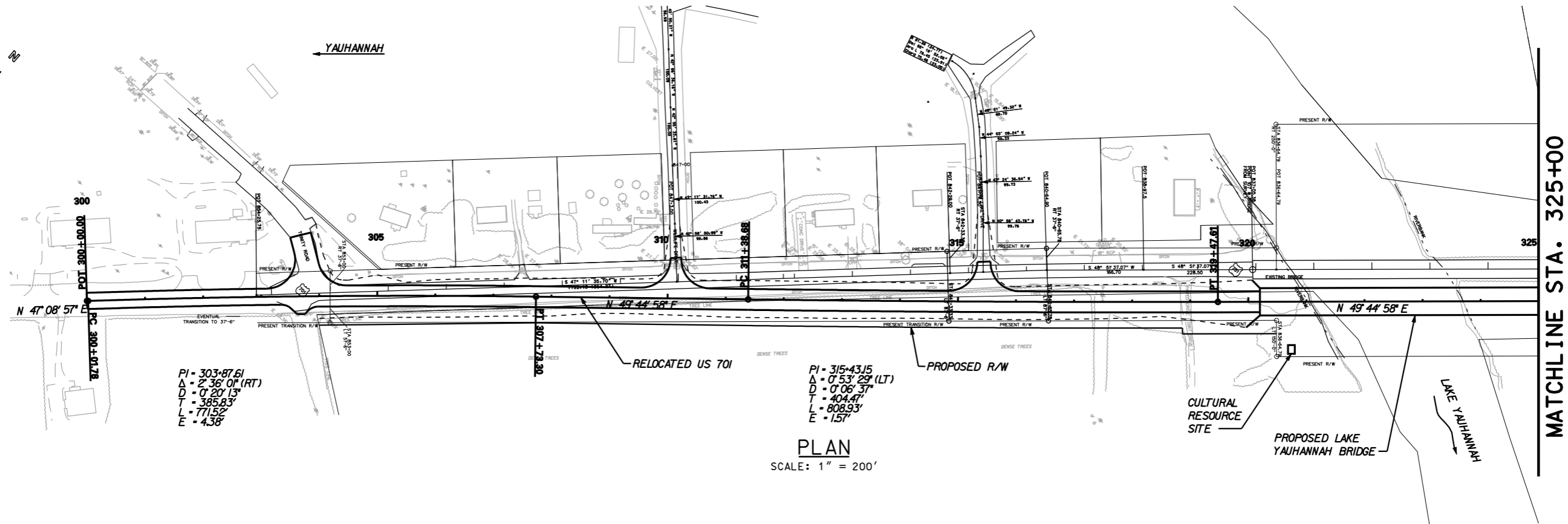
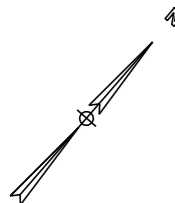
TYPICAL CROSS SECTION

SCALE: 1" = 30'



REPLACEMENT OF US 701 BRIDGES OVER
 GREAT PEE DEE RIVER, PEE DEE OVERFLOW
 & YAUHANNAH LAKE
 HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

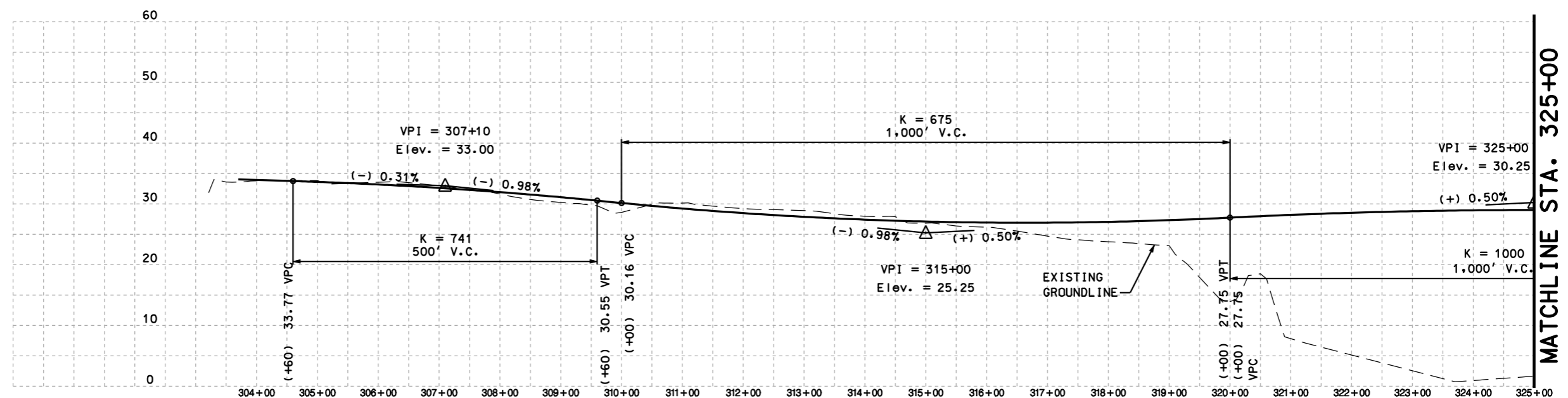
TYPICAL ROADWAY SECTION
 ALTERNATIVE 3
 FIGURE 16



PI = 303+87.61
 Δ = 2° 36' 01" (RT)
 D = 0' 20' 13"
 T = 386.83'
 L = 771.52'
 E = 4.38'

PI = 315+43.15
 Δ = 0° 53' 29" (LT)
 D = 0' 06' 37"
 T = 404.47'
 L = 808.93'
 E = 1.57'

PLAN
 SCALE: 1" = 200'



PROFILE
 H SCALE: 1" = 200'
 V SCALE: 1" = 20'

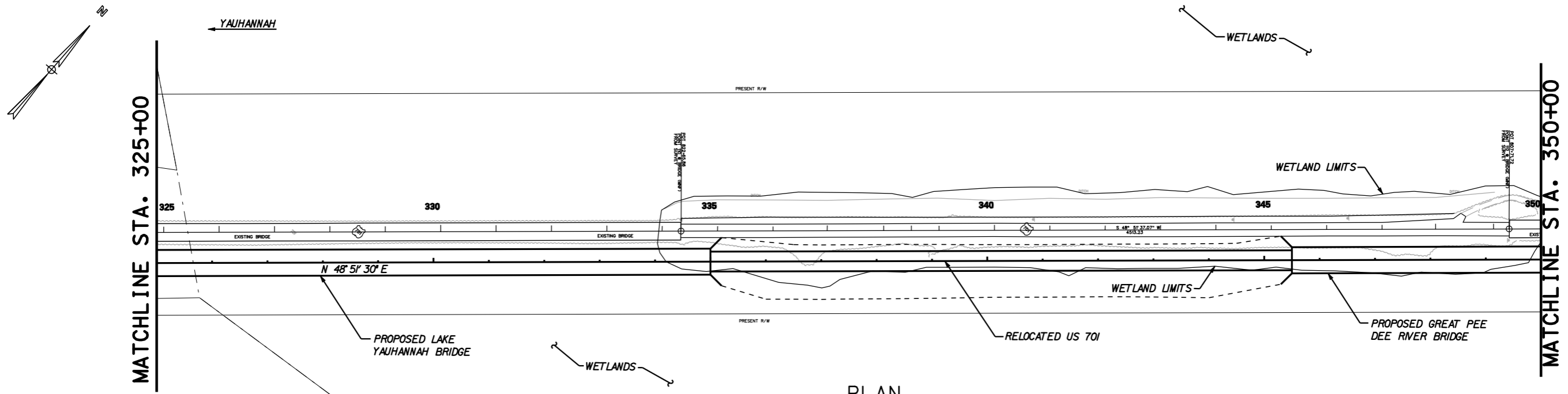
MATCHLINE STA. 325+00

MATCHLINE STA. 325+00

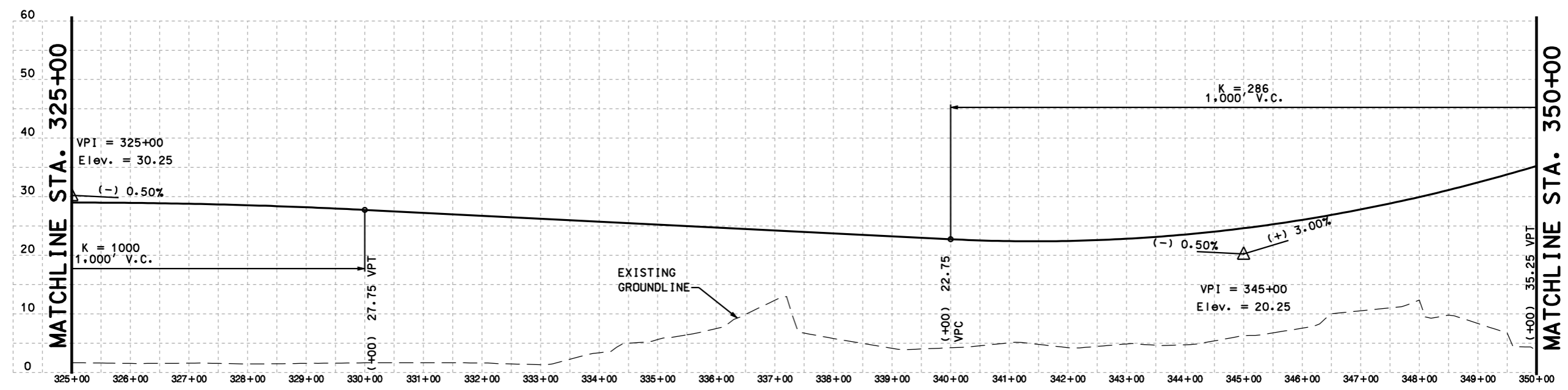


**REPLACEMENT OF US 701 BRIDGES OVER
 GREAT PEE DEE RIVER, PEE DEE OVERFLOW
 & LAKE YAUHANNAH**
 HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

ALIGNMENT ALTERNATIVE 3
 PLAN & PROFILE (1 OF 5)
 FIGURE 17



PLAN
SCALE: 1" = 200'

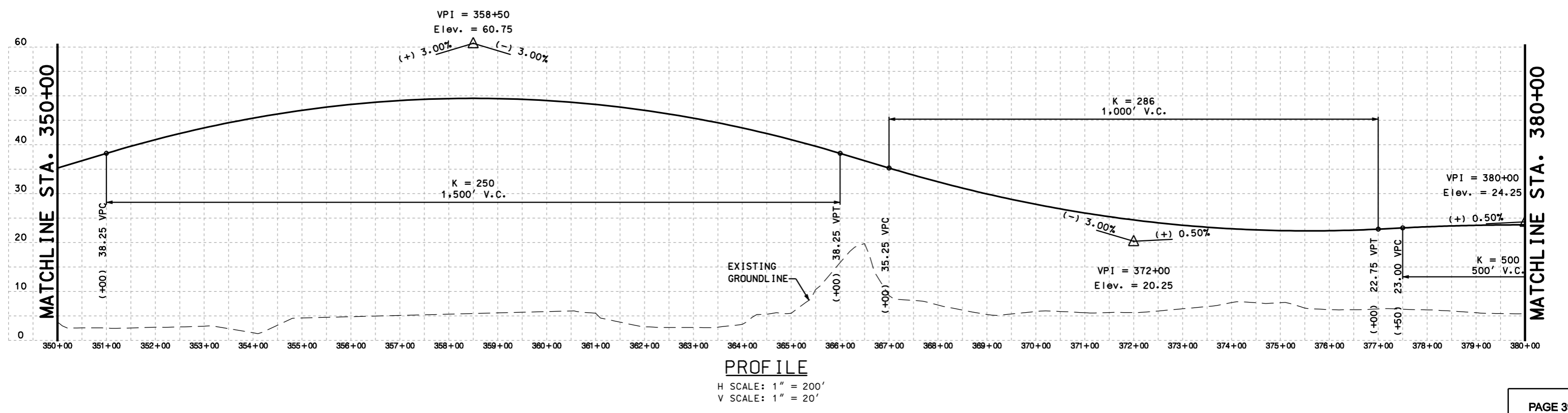
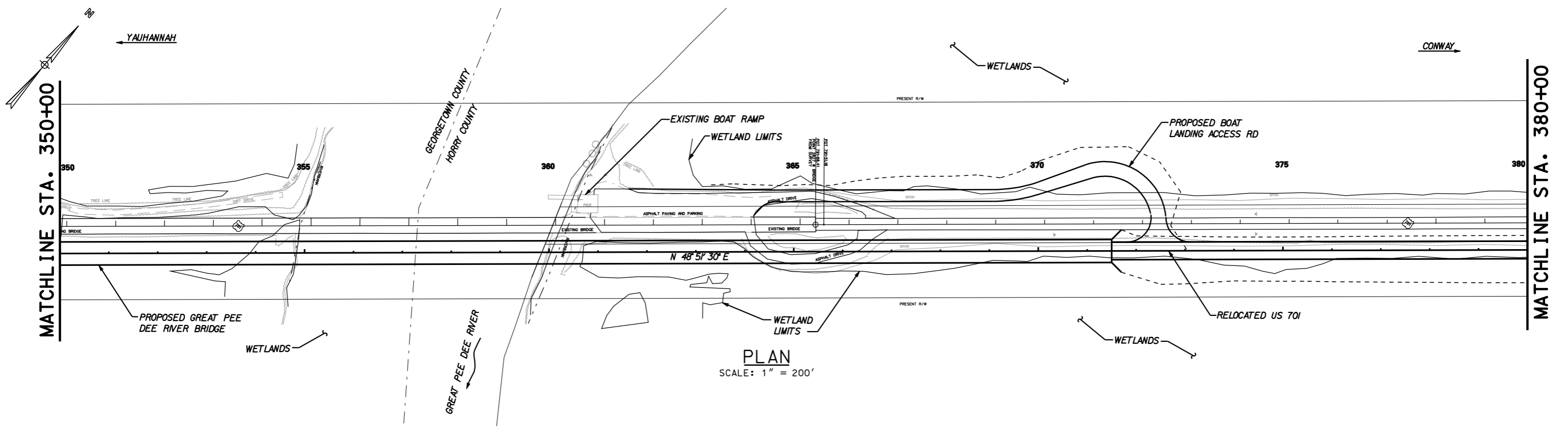


PROFILE
H SCALE: 1" = 200'
V SCALE: 1" = 20'



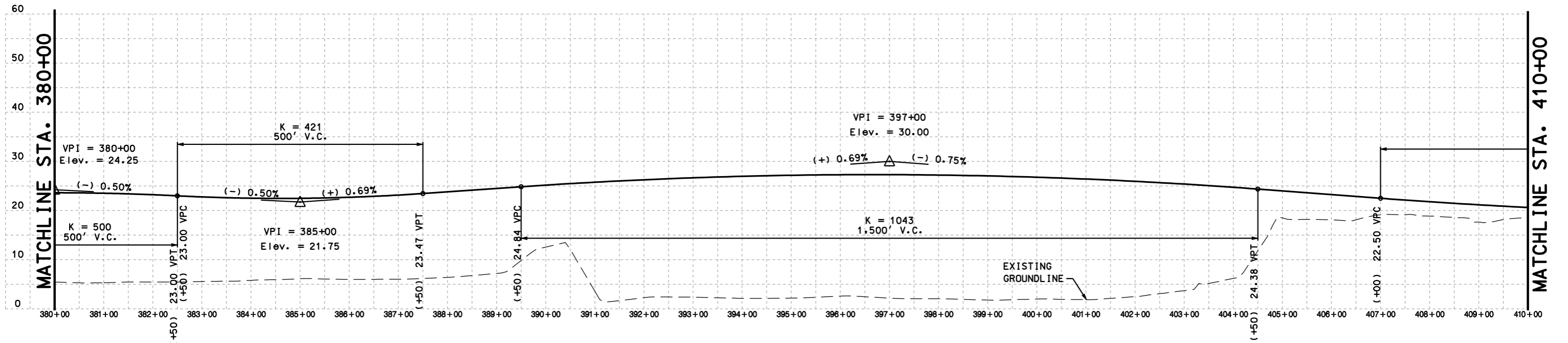
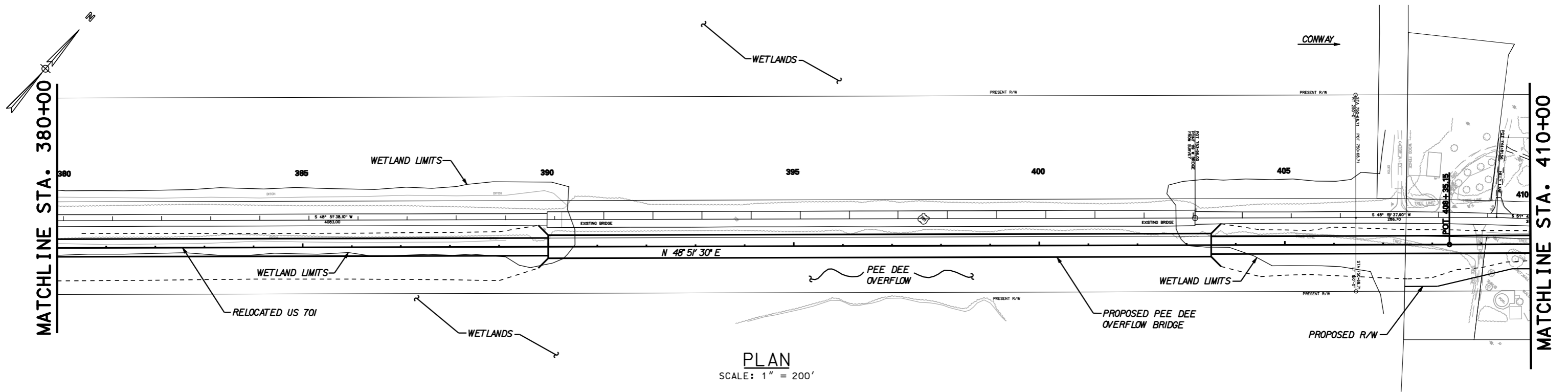
**REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& LAKE YAUHANNAH**
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

**ALIGNMENT ALTERNATIVE 3
PLAN & PROFILE (2 OF 5)
FIGURE 18**



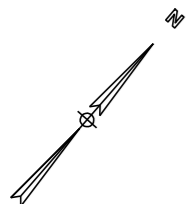
**REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& LAKE YAUHANNAH**
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

**ALIGNMENT ALTERNATIVE 3
PLAN & PROFILE (3 OF 5)
FIGURE 19**

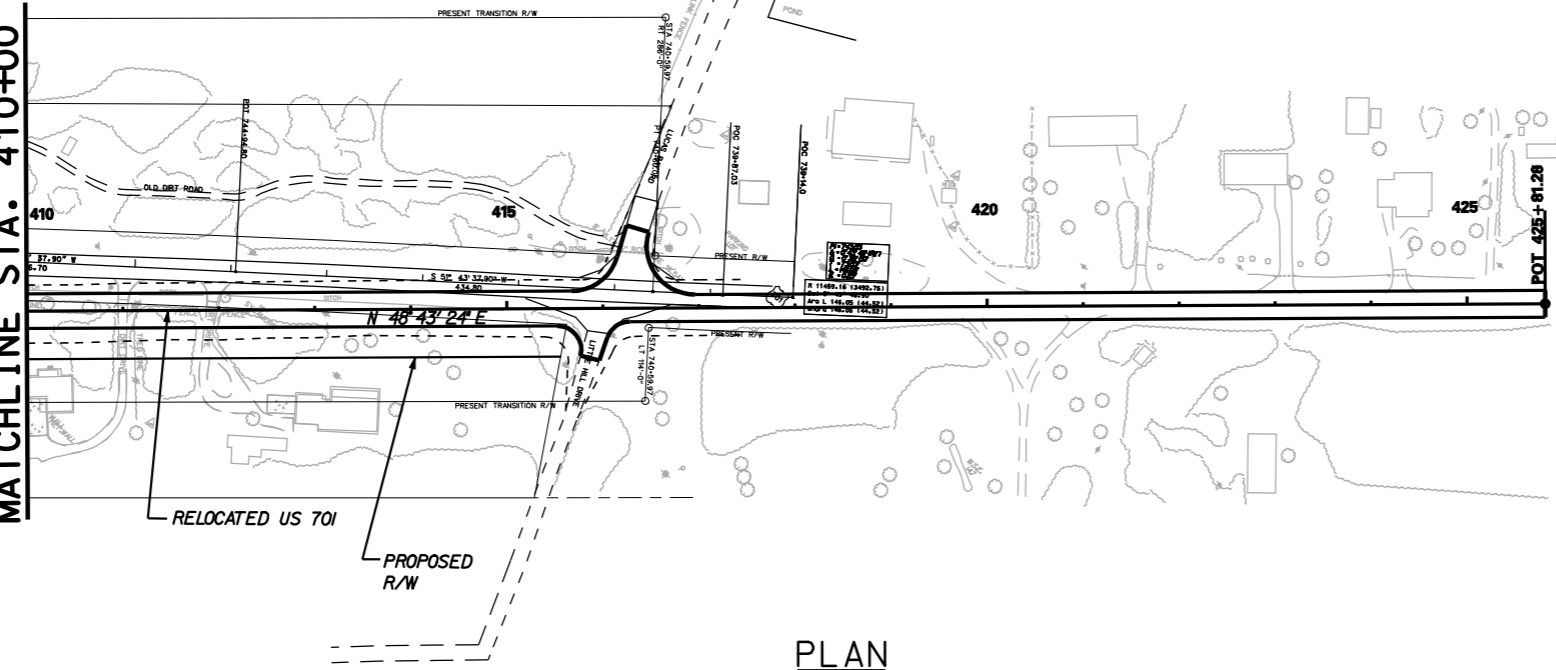


REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& LAKE YAUHANNAH
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

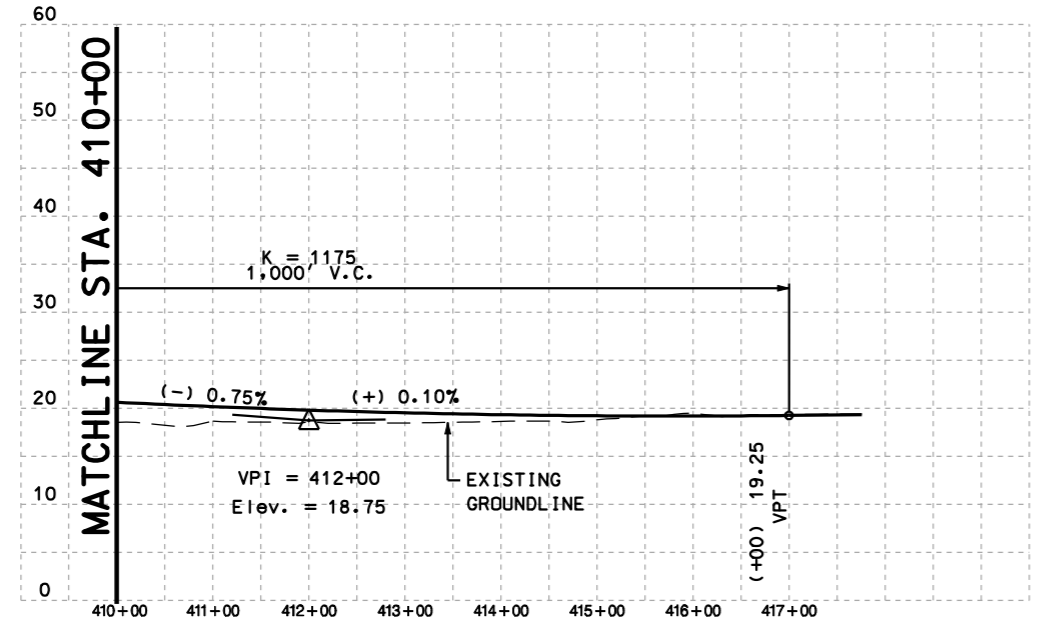
ALIGNMENT ALTERNATIVE 3
PLAN & PROFILE (4 OF 5)
FIGURE 20



MATCHLINE STA. 410+00



PLAN
SCALE: 1" = 200'

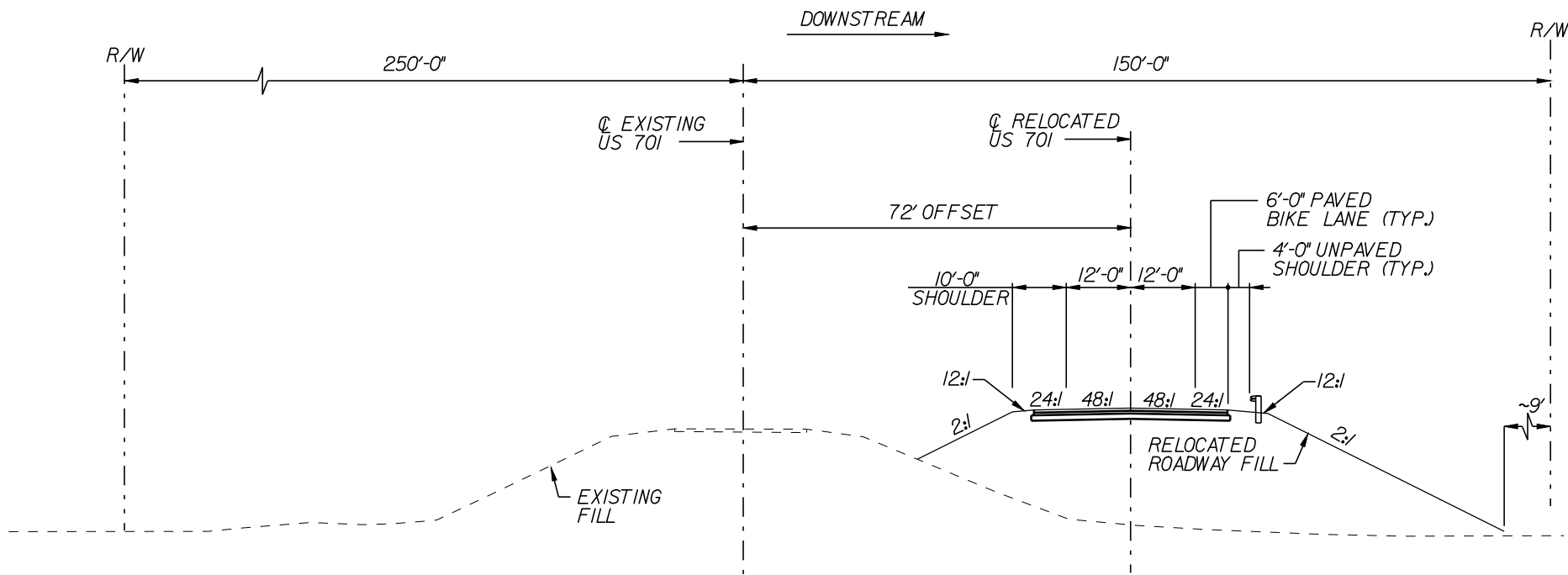


PROFILE
H SCALE: 1" = 200'
V SCALE: 1" = 20'



REPLACEMENT OF US 701 BRIDGES OVER
 GREAT PEE DEE RIVER, PEE DEE OVERFLOW
 & LAKE YAUHANNAH
 HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

ALIGNMENT ALTERNATIVE 3
 PLAN & PROFILE (5 OF 5)
 FIGURE 21



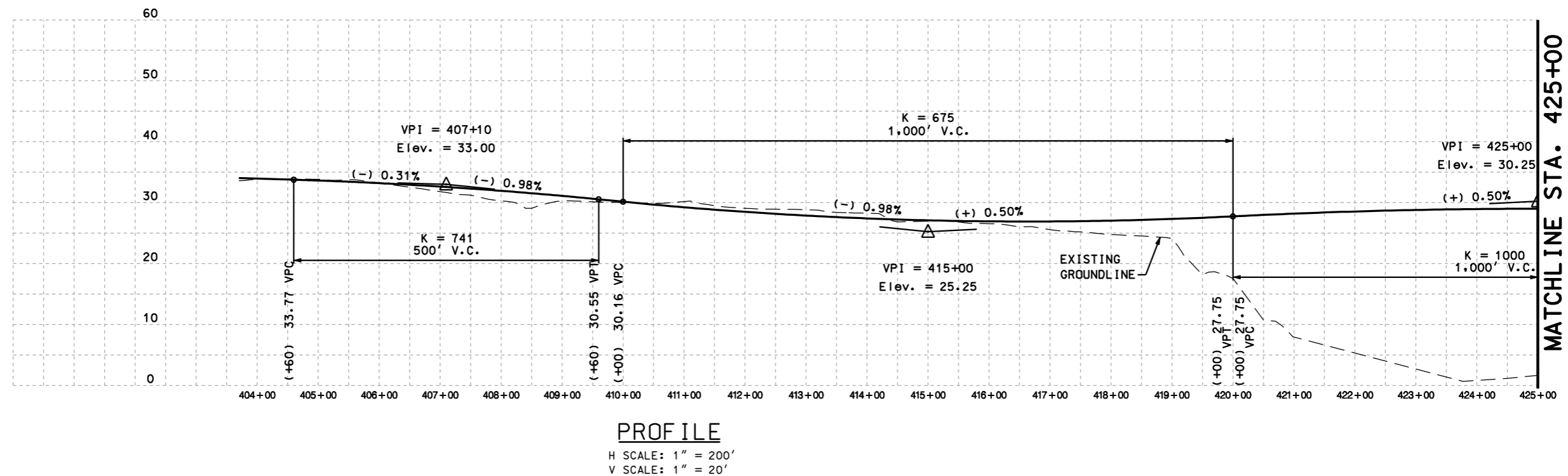
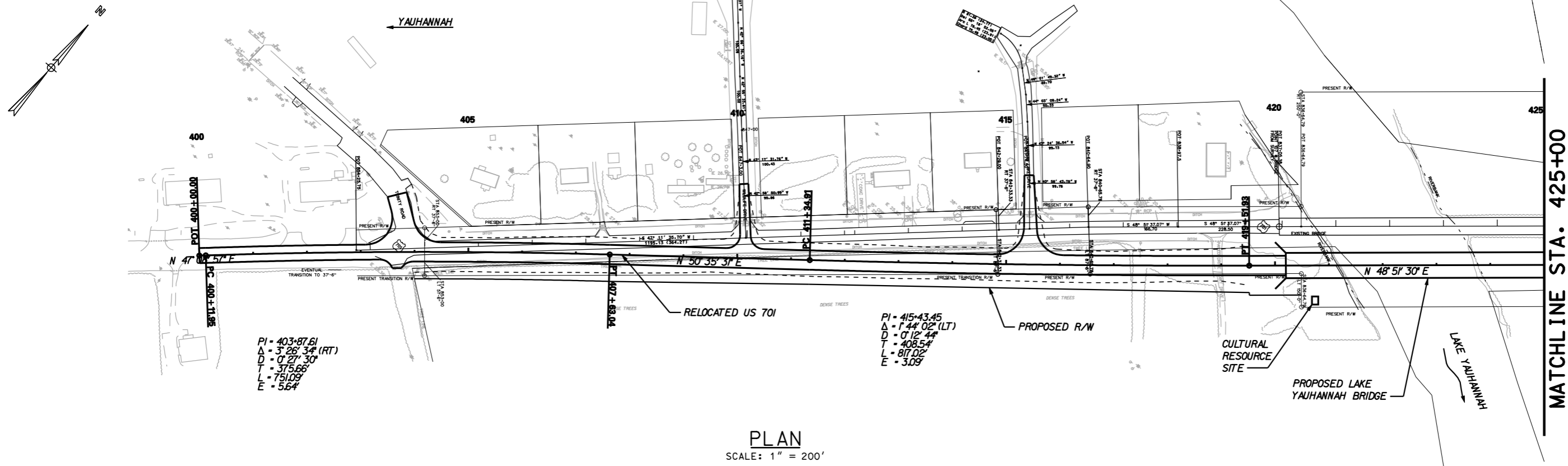
TYPICAL CROSS SECTION

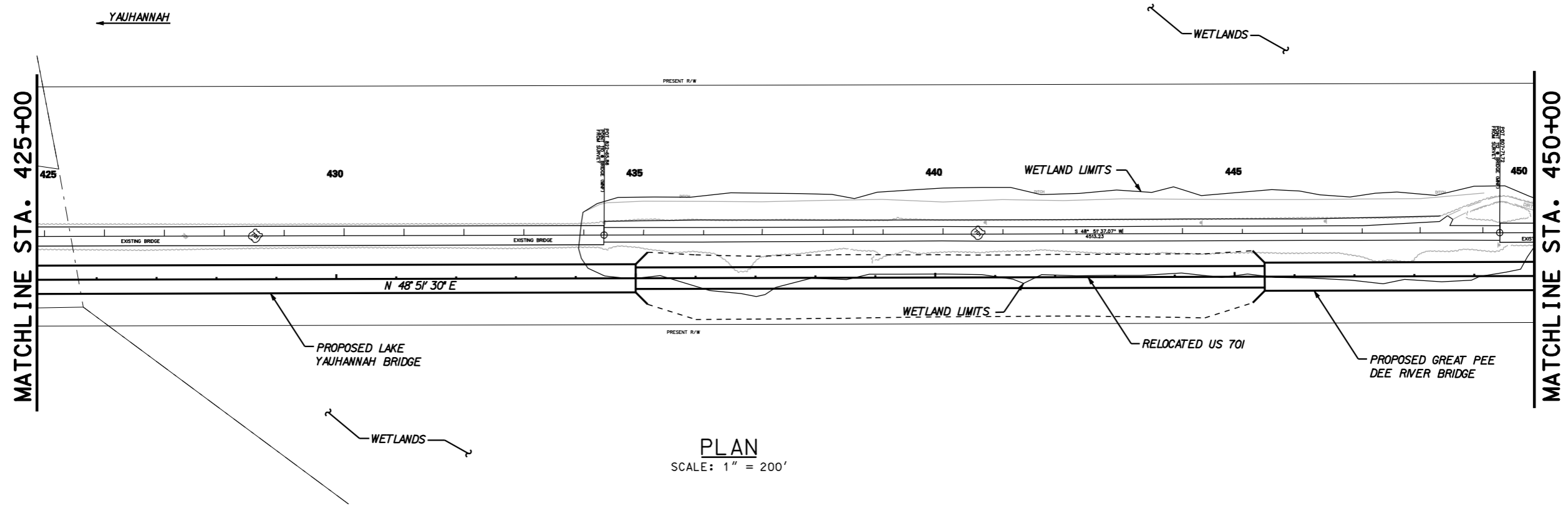
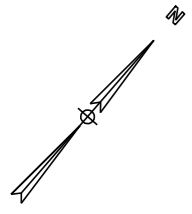
SCALE: 1" = 30'



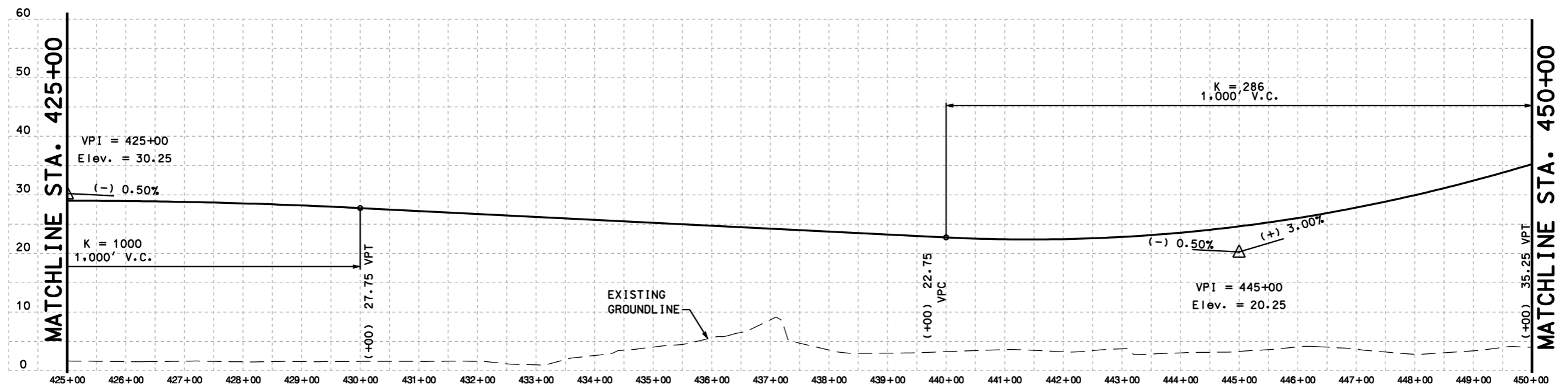
REPLACEMENT OF US 701 BRIDGES OVER
 GREAT PEE DEE RIVER, PEE DEE OVERFLOW
 & YAUHANNAH LAKE
 HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

TYPICAL ROADWAY SECTION
 ALTERNATIVE 4
 FIGURE 22





PLAN
SCALE: 1" = 200'

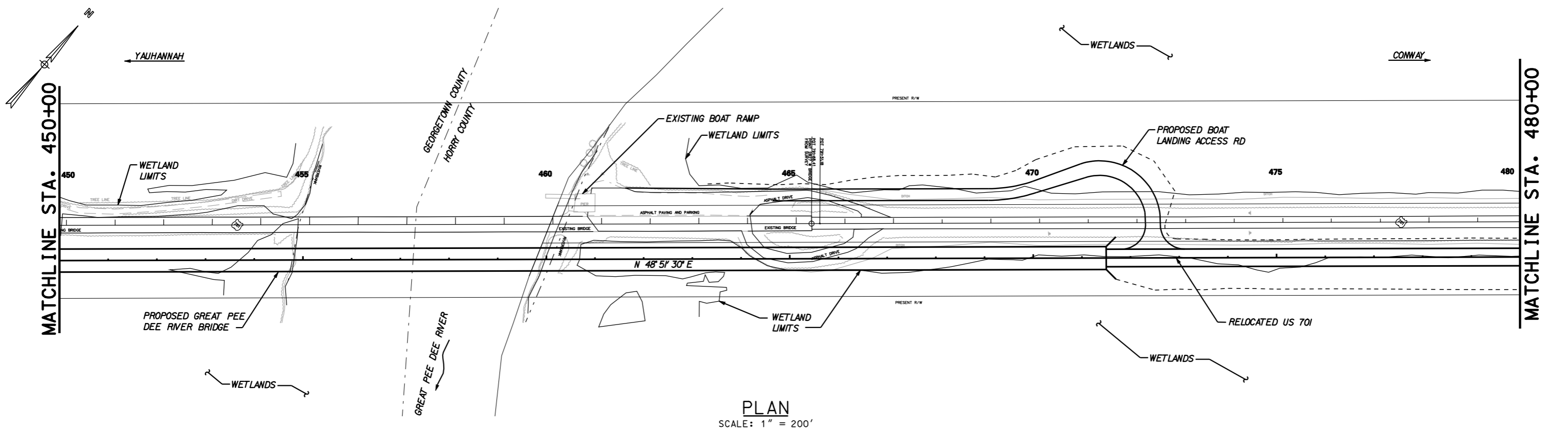


PROFILE
H SCALE: 1" = 200'
V SCALE: 1" = 20'

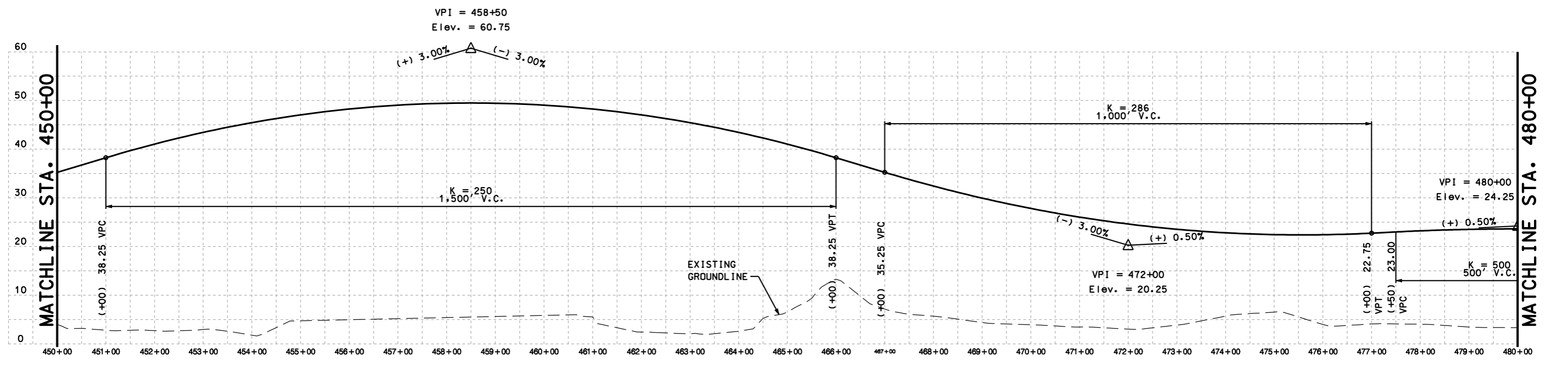


**REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& LAKE YAUHANNAH**
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

**ALIGNMENT ALTERNATIVE 4
PLAN & PROFILE (2 OF 5)
FIGURE 24**



PLAN
SCALE: 1" = 200'



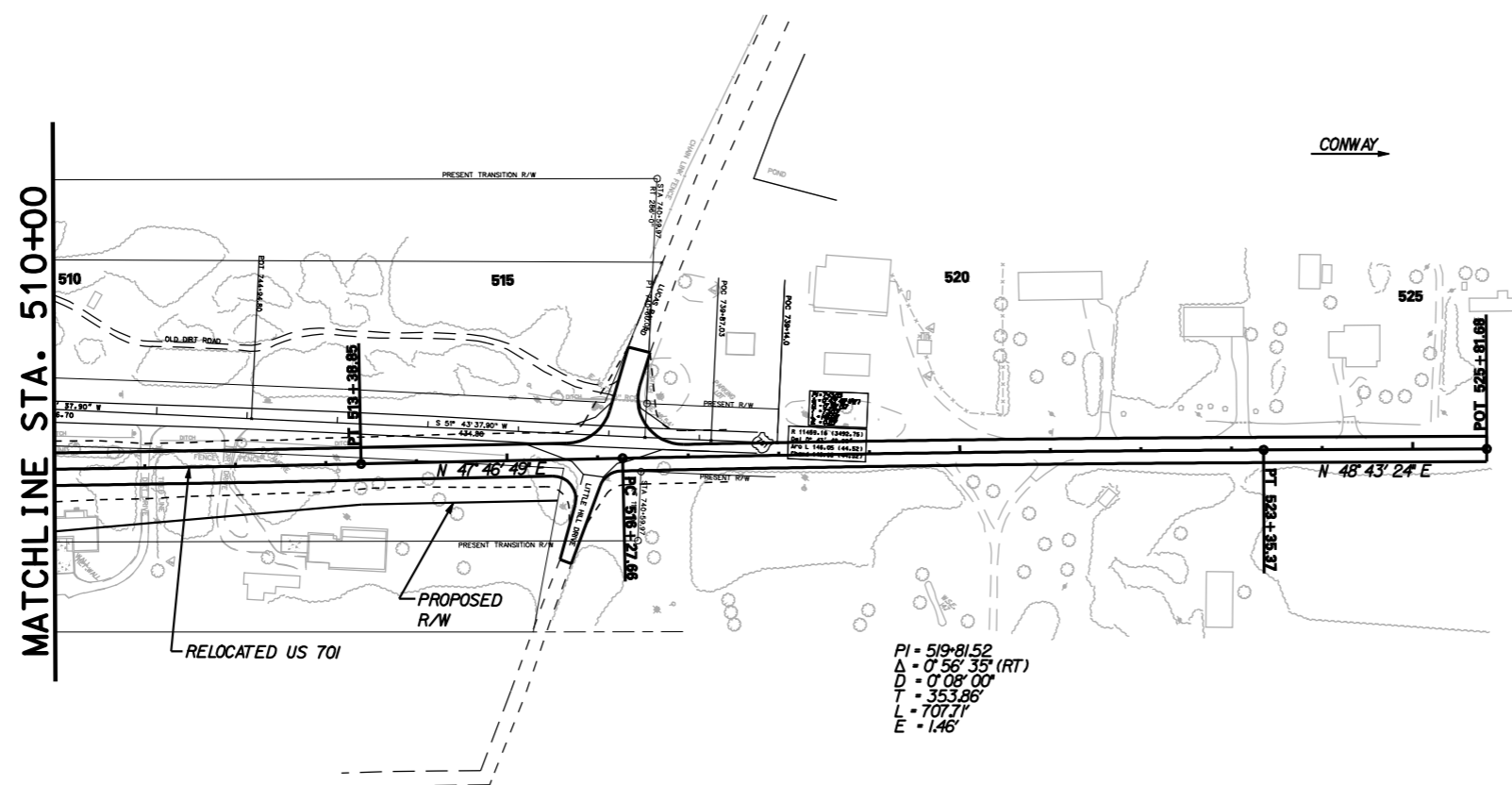
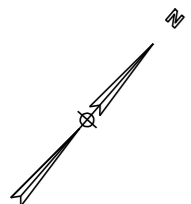
PROFILE

H SCALE: 1" = 200'
V SCALE: 1" = 20'

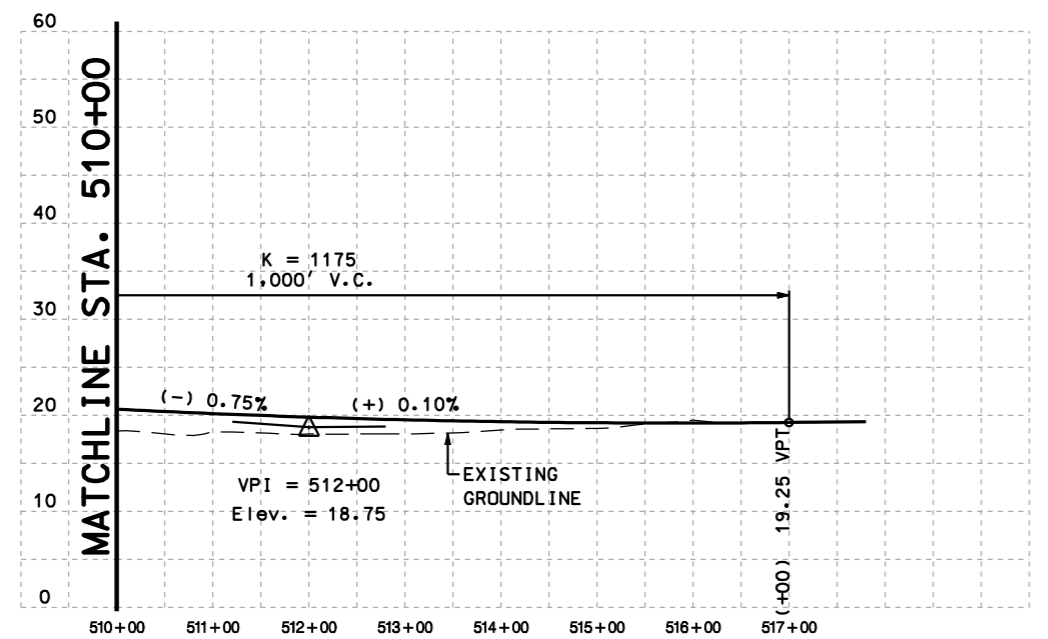


REPLACEMENT OF US 701 BRIDGES OVER
GREAT PEE DEE RIVER, PEE DEE OVERFLOW
& LAKE YAUHANNAH
HORRY/GEORGETOWN COUNTIES, SOUTH CAROLINA

ALIGNMENT ALTERNATIVE 4
PLAN & PROFILE (3 OF 5)
FIGURE 25



PLAN
 SCALE: 1" = 200'



PROFILE
 H SCALE: 1" = 200'
 V SCALE: 1" = 20'



**REPLACEMENT OF US 701 BRIDGES OVER
 GREAT PEE DEE RIVER, PEE DEE OVERFLOW
 & LAKE YAUHANNAH**
 Horry/Georgetown Counties, South Carolina

ALIGNMENT ALTERNATIVE 4
 PLAN & PROFILE (5 OF 5)
 FIGURE 27

