Howard P. Milstein
Chairman

New York State Thruway Authority
New York State Canal Corporation

200 Southern Boulevard, Post Office Box 189
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www.thruway.ny.gov
(518) 436-2700

Thomas J. Madison, Jr.
Executive Director

December 17, 2012

John Ferguson
New York State Department of
Environmental Conservation
625 Broadway
Albany, NY 12233

Re: New NY Bridge Project (formerly known as the Tappan Zee Hudson River Crossing Project) Supplement to the March 26, 2012 Joint Permit Application

Dear Mr. Ferguson:

On behalf of the New York State Thruway Authority (NYSTA), attached is a supplement to the March 26, 2012 Joint Permit Application for the New NY Bridge Project (formerly known as the Tappan Zee Hudson River Crossing Project). The attached enclosures supersede those included in the March 2012 Joint Permit Application submitted to you on March 26, 2012 and subsequent responses to NYSDEC comments. Although the drawings are still being refined for formatting, NYSDEC should now have all of the required information for preparation of the Public Notice.

The Final Environmental Impact Statement (FEIS) was approved in July 2012 and the Joint Record of Decision and State Environmental Quality Review Act Findings Statement were issued in September 2012. Since the issuance of these documents, a bridge design has been selected and a Reevaluation Statement and a supplement to the March 2012 Joint Permit Application have been prepared.
Primary differences between the selected design and the Replacement Bridge Alternative analyzed in the FEIS include:

- Cable-stayed tower height above Mean High Water level for the selected design would be 55 feet lower than that of Replacement Bridge Alternative.
- Span lengths would be 350 feet rather than 230 feet for the Short Span Option and 430 feet for the Long Span Option of the Replacement Bridge Alternative.
- The number of piles would be 931 rather than 1,326 for the Short Span Option and 836 for the Long Span Option of the Replacement Bridge Alternative. These include 916 permanent bridge piles and 15 piles to be installed as part of a pile installation demonstration plan (PIDP), which would be cut below the mud line after the conclusion of the PIDP.

- Pile sizes would be limited to 4 and 6 feet in diameter, rather than the 4, 6, 8, and 10 feet diameter piles evaluated for the Replacement Bridge Alternative.

- Dredging area would be reduced to 139 acres from the 164 acres of the Short Span Option and 173 acres of the Long Span Option of the Replacement Bridge Alternative.

- Dredging volume would be reduced to 951,000 cubic yards from the 1.9 million cubic yards of the Replacement Bridge Alternative.

- Dredging duration would be reduced from three, 3-month phases over a four year period to two, 3-month phases over a two year period relative.

- Overwater platform coverage for the permanent platform on the Rockland side would be slightly greater and a small amount of fill below mean higher high water in open water/benthic habitat would be required, but overall impacts to wetlands and open water/benthic habitats would be less than those of the Replacement Bridge Alternative.

- Hydroacoustic impacts to fish from pile driving would be less than what was originally estimated for the Replacement Bridge Alternative.

- Impacts to oyster beds would be less than what was originally estimated for the Replacement Bridge Alternative.

The selected design is within the scope of analysis (Long Span vs. Short Span Options) presented in the FEIS, and therefore, its effects on ecological resources would be generally the same or less. The selected design has less platform coverage during construction, less dredging and armoring, and reduced hydroacoustic impacts from pile driving. Further details of the selected design and associated impacts to ecological resources and coastal zones are provided in the attached re-evaluation statement, drawings, revised assessment of impacts to fish from pile driving, and revised coastal zone policy assessment.

The abovementioned attachments are also being submitted to the New York State Department of State (NYSDOS) for an updated consistency review under the New York State Coastal Management Act.

We hereby request NYSDEC's review of the supplemental documents and preparation of the Public Notice. Should you have any questions or require additional information, please do not hesitate to contact me at Elizabeth.Novak@thruway.ny.gov or (518) 436-3046.

Sincerely,

Elizabeth K. Novak

Elizabeth Novak, Director
Office of Transportation Planning and
Environmental Services

Attachments:

Attachment 1: Reevaluation Statement
- a) Appendix 1: "Methodology for estimating the spatial extent of underwater noise levels resulting from pile driving during construction of the Tappan Zee Hudson River Crossing and re-calculation of the incidental take of endangered sturgeon species associated with the recommended project design"

Attachment 2: Engineering Drawings
- a) Trestle Drawings
- b) Dredge Drawings
- c) JPA Drawings

Attachment 3: NYSDOS Coastal Zone Re-evaluation
Attachment 4: Figure 1- Impacts to Oyster Beds due to Dredging and Work Platforms

cc: M. Toni and J. Burns (FHWA)
P. Casper and M. Shamma (NYSTA)
M. Anderson and K. Edwards (NYSDOT)
J. Zappieri (NYSDOS)
E. McTiernan (NYSDEC)
R. Conway (AKRF)
D. Paget and A. Stolorow (SPR)

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Thomas J. Madison, Jr.
Executive Director

December 17, 2012

Jeff Zappieri
Supervisor of Consistency Review
New York State Department of State
99 Washington Avenue, Suite 1010
Albany, NY 12231-0001

Re: New NY Bridge Project (formerly known as the Tappan Zee Hudson River Crossing Project) Supplement to the March 26, 2012 Coastal Zone Consistency Documents

Dear Mr. Zappieri:

On behalf of the New York State Thruway Authority (NYSTA), enclosed are supplemental Coastal Zone consistency documents for the New NY Bridge Project (formerly known as the Tappan Zee Hudson River Crossing Project). The New York State Department of State (NYSDOS) granted consistency concurrence for the project on September 19, 2012. Since the issuance of the consistency concurrence letter, a bridge design has been selected and a Reevaluation Statement has been prepared. The enclosed re-evaluation of the project's consistency with relevant Coastal Management Program policies consider the selected design and other new information received following the approval of a Final Environmental Impact Statement (FEIS; July 2012) and the Joint Record of Decision and State Environmental Quality Review Act Findings Statement (September 2012).

The selected design is within the scope of analysis (Long Span vs. Short Span Options) presented in the FEIS, and therefore, environmental impacts would be generally the same. Similarly, the selected design is consistent with the New York State Coastal Management Program policies. As such, there are no changes to the forms submitted to NYSDOS in March 2012.

Although overwater platform coverage for the permanent platform on the Rockland side would be slightly greater than what was anticipated in the FEIS, and a small amount of fill below mean higher high water in open water/benthic habitat would be required to extend the bulkhead to support the permanent platform, the selected design has less overall platform coverage during construction, less dredging and armoring, and reduced hydroacoustic impacts from pile driving. Details of the selected design and associated impacts to ecological resources and coastal zones are provided in the attached re-evaluation statement, re-evaluation drawings, revised assessment of impacts to fish from pile driving, and revised coastal zone policy assessment.

The abovementioned attachments are also being submitted to the New York State Department of Environmental Conservation (NYSDEC) as a supplement to the Joint Permit Application of March 26, 2012.

We hereby request NYSDOS's review of the supplemental documents and consistency concurrence for the project. Should you have any questions or require additional information, please do not hesitate to contact me at Elizabeth.Novak@thruway.ny.gov or (518) 436-3046.

Sincerely,

Elizabeth Novak

Elizabeth Novak, Director
Office of Transportation Planning and
Environmental Services

Attachments:
Attachment 1: Reevaluation Statement
a) Appendix 1: "Methodology for estimating the spatial extent of underwater noise levels resulting from pile driving during construction of the Tappan Zee Hudson River Crossing and re-calculation of the incidental take of endangered sturgeon species associated with the recommended project design"
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New NY Bridge Project

(formerly known as the Tappan Zee Hudson River Crossing Project)

Supplement to the March 26, 2012 Joint Permit Application and Coastal Zone Consistency Documentation

December 2012

List of Attachments

Attachment 1: Tappan Zee Hudson River Crossing Project Reevaluation Statement

REEVALUATION STATEMENT

Tappan Zee Hudson River Crossing Project
Interstate 87/287
Rockland and Westchester Counties
PIN 8TZ1.00

As a result of the advancement of the Design-Build process, it became necessary to make design refinements to the Replacement Bridge Alternative described in the 2012 FEIS/Joint Record of Decision and Findings Statement (ROD). This reevaluation statement examined the proposed changes and their potential impacts.

This reevaluation has been done in close coordination between NYSTA, NYSDOT and FHWA and in accordance with FHWA 23 CFR 771.129 Reevaluation, SEQR 6 NYCRR Part 617 Regulations, SEQR 17 NYCRR Part 15 Regulations, and New York State Department of Transportation (NYSDOT) Project Development Manual (PDM), Appendix 11. Based on this reevaluation, it is concluded that the recommended design for Tappan Zee Hudson River Crossing Project would not be substantially different from the Replacement Bridge Alternative analyzed in the 2012 FEIS/ROD and that it would not result in any new significant adverse impacts requiring new mitigation measures. Furthermore, the environmental analysis in the FEIS is still valid, up-to-date and complete. Therefore, the 2012 FEIS and ROD are still valid.

FEIS Report Number - FHWA –NY-EIS-12-01-F
FEIS Approval Date – July 2012
ROD Issued on October 24, 2012

12/14/12
Date

Jonathan D. McDade, Division Administrator
Federal Highway Administration

12/14/12
Date

Michael A. Shamma
Michael A. Shamma, P.E., Acting Chief Engineer
New York State Thruway Authority

12/14/12
Date

Phillip Eng, P.E., Chief Engineer
New York State Department of Transportation

Tappan Zee Hudson River Crossing Project
Re-evaluation Statement
December 2012

1 INTRODUCTION

This re-evaluation statement considers the recommended design and other new information received subsequent to the approval of the Final Environmental Impact Statement (FEIS; July 2012) and the Joint Record of Decision and State Environmental Quality Review Act (SEQRA) Findings Statement (Joint ROD; September 2012) for the Tappan Zee Hudson River Crossing Project. This re-evaluation has been prepared in accordance with 23 CFR 771.129 as well as 6 NYCRR Part 617 and 17 NYCRR Part 15, and the purpose of this re-evaluation is to determine whether the conclusions of the FEIS and Joint ROD remain valid or whether a Supplemental EIS (SEIS) or any additional environmental analysis is needed.

As provided by Federal Highway Administration (FHWA) regulations, 23 CFR 771.129:

> After approval of the ROD, Finding of No Significant Impact (FONSI), or Categorical Exclusion (CE) designation, the applicant shall consult with the Administration prior to requesting any major approvals or grants to establish whether or not the approved environmental document or CE designation remains valid for the requested Administration action. These consultations will be documented when determined necessary by the Administration.

As provided by 23 CFR Part 771.130:

(a) A draft EIS, final EIS, or supplemental EIS may be supplemented at any time. An EIS shall be supplemented whenever the Administration determines that:

1. Changes to the proposed action would result in significant environmental impacts that were not evaluated in the EIS; or
2. New information or circumstances relevant to environmental concerns and bearings on the proposed action or its impacts would result in significant environmental impacts not evaluated in the EIS.

(b) However, a supplemental EIS will not be necessary where:

1. The changes to the proposed action, new information, or new circumstances result in a lessening of adverse environmental impacts evaluated in the EIS without causing other environmental impacts that are significant and were not evaluated in the EIS.

Specifically, this re-evaluation documents the potential effects of the following relative to the conclusions of the FEIS and Joint ROD:

- The recommendation of a design which includes
    - Reduction in the amount of dredge material;
    - Refinements in the pier locations, number of piles, and a reduction in pile sizes; and
    - Proposed changes in the temporary and permanent work platforms, including bulkhead treatments, in Rockland and Westchester Counties.
- Further archaeological investigation, which has led to a determination that a sunken coal vessel (Target 001) in the vicinity of the proposed north superstructure of the new bridge is eligible for listing on the National Register of Historic Places.

As demonstrated hereafter, because the information considered in this re-evaluation would not significantly impact the environment in a way not previously considered, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional environmental analysis.

2 PROJECT CHANGES AND NEW INFORMATION

2-1 RECOMMENDED DESIGN

To provide for flexibility in the design of the Replacement Bridge Alternative, the FEIS considered options for the approach spans and main spans of the Replacement Bridge Alternative.

- Approach Spans: The FEIS considers two options for the approach spans—Short Span and Long Span. These options differ in terms of the type of structure as well as the number of and distance between bridge piers. The Short Span Option would consist of two parallel bridge structures with a road deck supported by girders and piers. The average distance between piers would be 230 feet. The Long Span Option would have two parallel bridges structures with each supported by a truss and piers. The average distance between piers would be 430 feet.[1]
- Main Spans: The FEIS considers two options for the bridge's main spans over the navigable channel—Cable-stayed and Arch. These main span options represent potential designs for spanning the federal navigational channel. Both options would result in a horizontal clearance of at least 1,042 feet and a vertical clearance of 139 feet over the channel at mean high water

The recommended design would have a cable-stayed main span. As shown in **Table 1**, the recommended design has many of the same characteristics as the Short Span and Long Span options. In terms of span lengths and the resultant number of piers and piles, the recommended design is within the range identified for the Short Span and Long Span options; however, the recommended design would not include piles larger than 6 feet in diameter. The construction duration of the recommended design is approximately 5¼ years, which is within the 4½- to 5½-year duration identified in the FEIS. In terms of the quantity of dredge material, the recommended design would result in substantially less volume than either the Short Span or Long Span options.

[1] The FEIS provided these dimensions for illustrative purposes and noted that the piers may be located closer together near the abutments and shorelines but may be farther apart over water.

Table 1
Comparison of Cable-Stayed Replacement Bridge Alternative (Short and Long Span Options) and the Recommended Design

	Replacement Bridge Alternative		Recommended Design
	Short Span Option	Long Span Option	
Deck Widths			
North Structure	96 feet	96 feet	96 feet
South Structure	87 feet	87 feet	87 feet
Provides Gap for Potential Future Load	Yes	Yes	Yes
Cable-stayed tower height above Mean High Water level	495 feet	495 feet	440 feet
Number of Travel Lanes	8, 12 foot lanes (4 Eastbound and 4 Westbound)	8, 12 foot lanes (4 Eastbound and 4 Westbound)	8, 12 foot lanes (4 Eastbound and 4 Westbound)
Width of Inside Shoulders	20 and 25 feet	20 and 25 feet	20 and 25 feet
Width of Outside Shoulders	10 feet	10 feet	10 and 10.5 feet
Width of Shared-use Path	12 feet	12 feet	12 feet
Toll Plaza			
Highway-Speed EZ-Pass Lanes	3	3	3
Cash/EZ-Pass Lanes	7	7	7
Federal Navigational Clearance at Main Span			
Horizontal	600 feet	600 feet	600 feet
Vertical	139 feet	139 feet	139 feet
Minimum Maritime Clearance at Back Spans			
Horizontal	180 feet	180 feet	180 feet
Vertical	123 feet	123 feet	123 feet
Span Lengths (Typical)	230 feet	430 feet	350 feet
Number of Piles	1,326	836	916[2]
Pile Sizes	4, 6, 8, and 10-foot diameter piles	4, 6, 8, and 10-foot diameter piles	4 and 6-foot diameter piles
Quantity of Dredge Material	1.78 mcy	1.87 mcy	0.95 mcy
Area of Dredge	164 acres	173 acres	139 acres
Construction Duration	5½ years	4½ years	5¼ years

[2] In addition to the 916 permanent piles to be used in the construction of the bridge, 15 piles would be installed in the river before the start of construction as part of the contractor's geotechnical investigation and Pile Installation and Demonstration Project (PIDP 2).

The construction means and methods for the recommended design would be generally the same as those presented in the FEIS. As required by the Design-Build Contract Document, construction of the recommended design would comply with the Environmental Performance Commitments identified in the FEIS.[3]

2-1-1 REDUCTION IN THE QUANTITY OF DREDGE MATERIAL

The FEIS anticipated the need for large, deep-draft tugs, barges and lifting equipment to construct the replacement bridge. This resulted in the need to dredge an access channel to the depth of 16 feet below mean lower low water (MLLW) to provide sufficient clearance for the heavy equipment and operational maneuvers. (An additional one foot was assumed for over-dredging, bringing the total dredge depth to 17 feet below MLLW).

The dredge prism for the recommended design is within the same geographic area described in the FEIS, but the recommended design features smaller diameter piles and a lighter superstructure, which eliminates the need for the deep draft tugs and barges as anticipated in the FEIS. This would reduce the depth required for the access channel to approximately 13 feet below MLLW (assumed to be 14 feet below MLLW with one foot of over dredging), resulting in a reduction in the total volume of dredge material from approximately 1.9 million cubic yards (mcy) to 0.95 mcy. There would also be a reduction in the areal extent of dredging from approximately 164 to 173 acres (for the Short Span and Long Span Options for the Replacement Bridge Alternatives) to approximately 139 acres under the recommended design.

The benefits of the revised dredge program include:

- The reduction of in-water construction associated with this activity, requiring only six months of dredging over two years (versus potentially nine months of dredging during three phases as considered in the FEIS);
- The reduction of the amount of material to be dredged and its areal extent, thereby reducing potential impacts to water quality from the re-suspension of sediments during the dredging operation;
- A decrease in the amount of dredged material to be disposed; and
- The reduction of the operation of dredging equipment and dredged material transportation requirements, thereby reducing emissions of potential air pollutants from this aspect of the construction.

Table 2 shows the amount of material to be dredged during each stage of the dredging program. The channel width would measure approximately 613 feet, and it would extend approximately 7,000 feet from the Rockland County side into deeper waters and 2,000 feet from the Westchester platform into deeper waters.

[3] The Design-Build Contract requires the implementation of the Environmental Performance Commitments identified in the FEIS. It should be noted that because 8-foot and 10-foot piles are not proposed for the recommended design, the EPCs specific to 8-foot and 10-foot piles are not applicable.

Table 2
Dredging Quantities for the Replacement Bridge

Construction Stage	Quantity (million cubic yards)	Percent of Total
Stage 1	0.80 mcy	84%
Stage 2	0.15 mcy	16%
Total	0.95 mcy	100%

The EPCs identified in the FEIS, including seasonal restrictions, use of environmental buckets with no barge overflow, tugboat emissions reductions, and operational measures to prevent sediment re-suspension would be incorporated in the recommended design. It would also include the armoring specified in the FEIS in order to limit the re-suspension of sediments due to scour by tug propulsion wheels. Because the area of dredge would be reduced, the area of armoring (107 acres) would also be reduced from what was presented in the FEIS (167 acres for the Short Span Option and 160 acres for the Long Span Option).

2-1-2 CHANGES IN THE PIER LOCATIONS, NUMBER OF PILES, AND A REDUCTION IN PILE SIZES

The number of piles required by the recommended design is within the range estimated for the Short Span and Long Span Options presented in the FEIS. The recommended design would require a total of 916 in-water piles, as shown in **Table 3**. The 916 piles would consist solely of 4-foot and 6-foot piles. The greatest number of piles within a pier would be found in Piers 31 and 32, which would be the two piers supporting the main span of the bridge. There would be 56 6-foot piles in each of these piers. The back spans would be supported by piers made up of 24 piles. The remaining in-water piers would consist of 8 to 12 piles. For the upland piers, pier 1 and piers 43 through 45, the H-pile and 3½ foot drilled shaft would be used.

The greatest difference between the two options analyzed in the FEIS and the recommended design would be the elimination of the large diameter piles, defined as 8-foot and 10-foot diameter piles. The recommended design would need 724 4-foot piles and 192 6-foot piles. No large diameter piles would be required. As shown in **Table 4**, the recommended design would require 80 more piles than the Long Span Option but would use 410 fewer piles than the Short Span Option. In addition to the 916 piles required for the bridge construction, 15 piles would be installed in the river as part of the contractor's geotechnical investigation and Pile Installation Demonstration Project, which would occur prior to the start of construction and would inform the final design (PIDP 2; such investigation is to be distinguished from the geotechnical investigation and Pile Installation Demonstration Project undertaken in 2012 and referred to as the 2012 PIDP herein). These initial test piles would consist of 4- and 6-foot diameter piles consistent with the recommended design's foundations. The piles for the PIDP would be cut below the mud-line after testing is complete.

Table 3
In-Water Piles, Recommended Design

Pier No.	Foundation Zone	Pile Size (diameter in feet)	Number of Piles within each Pier	Total Number of Piles
2-5	1	4	10	80
6-10	2	4	9	90
11-21	3	4	10	220
22-28	4	4	11	154
29	4	6	8	16
30	4	6	24	24
31-32	5	6	56	112
33	6	6	24	24
34	6	6	8	16
35-37	6	4	11	66
38-39	7	4	11	44
40-41 WB	7	4	11	22
40-41 EB	7	4	12	24
42	7	4	12	24
Total Permanent Piles				**916**
PIDP 2				15
Total Piles (Permanent and PIDP)				**931**

Table 4
Number and Sizes of Permanent Piles for the Replacement Bridge Alternative (Short Span and Long Span Options) and the Recommended Design

Pile Size (diameter in feet)	Short Span Option	Long Span Option	Recommended Design
4	960	614	724
6	228	124	192
8	88	48	0
10	50	50	0
Total	**1,326**	**836**	**916**

2-2 CHANGES IN THE TEMPORARY AND PERMANENT WORK PLATFORMS

The FEIS reported that temporary work platforms would be constructed to the north of the bridge in the Westchester Bridge Staging Area (WBSA) and Rockland Bridge Staging Area (RBSA). In addition, the FEIS included an analysis of a temporary access roadway that would connect the WBSA to the Westchester Inland Staging Area (WISA). As shown in **Table 5**, a total of approximately 10.38 acres of temporary platform, including the access road and approximately 2.19 acres of permanent platform were analyzed in the FEIS.

The temporary access road at the WISA is not included in the recommended design. In the RBSA a steel bulkhead, pile-supported temporary platforms, and walkways, temporary NYSTA docks, and a permanent NYSTA dock (located to the north of the bridge) would replace the temporary and permanent work platforms described in the FEIS. As shown in **Table 5,** approximately 4.79 acres of temporary platforms, walkways, and docks, 3.56 acres of the permanent dock (North Dock), and 0.02 acres of fill (500 cubic yards) behind the steel bulkhead are included in the recommended design. The separate platforms, docks, and walkways are required to accommodate multiple construction and demolition activities.

Table 5
Overwater Coverage from Platforms

Status	Design Feature	Open Water/ Littoral Zone	FEIS Acreage	Recommended Design Acreage	Net Difference (In acres)
Temporary	WBSA North Platform	Open Water	5.58	1.84	-3.74
	WBSA South Platform	Open Water	N/A	0.29	+0.29
		Littoral Zone	N/A	0.45	+0.45
	WBSA Access Road	Open Water	1.00	N/A	-1.00
		Littoral Zone	0.13	N/A	-0.13
	RBSA Walkway	Open Water	N/A	0.13	+0.13
	RBSA South Platform	Open Water	3.67	0	-3.67
		Littoral Zone	0	0.70	+0.70
	RBSA NYSTA Dock	Open Water	N/A	0.80	+0.80
	Total	Open Water	10.25	3.06	-7.19
		Littoral Zone	0.13	1.15	+1.02
	Total Temporary Overwater Coverage		**10.38**	**4.21**	**--6.17**
Permanent	RBSA North Dock	Open Water	2.19	3.44	+1.25
	RBSA North Dock Bulkhead	Open Water	N/A	0.02	+0.02
	Total	Open Water	2.19	3.46	+1.27
		Littoral Zone	0	0	0
	Total Permanent Overwater Coverage		**2.19**	**3.46**	**+1.27**

Notes: WBSA = Westchester Bridge Staging Area
RBSA = Rockland Bridge Staging Area

2-3 RESULTS OF ADDITIONAL ARCHAEOLOGICAL INVESTIGATION

The FEIS identified the potential for archeological resources in the vicinity of the Replacement Bridge Alternative, including a Paleo-landform and submerged resources along the Hudson River bottom. Further investigation of these resources was undertaken to identify their presence and, if present, to determine their eligibility for listing on the National Register of Historic Places.

Previous surveys identified a sensitive Paleo-landform within the shoreline portion of the project's Area of Potential Effect (APE). The landform consists of deeply buried formerly exposed forest and river terrace sediments and tidal marsh deposits dating to the Middle Archaic period. The remains were identified in fifteen of the nineteen borings in Rockland County. The landform is considered archaeologically sensitive, but no archaeological resources were identified.

Initially, eight targets on the riverbed portion of the APE were selected for investigation as potential archaeological resources. Based on a magnetometry survey and diving surveys, and in consultation with the State Historic Preservation Officer (SHPO), four targets were considered to have archaeological potential. Targets 005 and 009 were subsequently identified as debris dumps and eliminated from further consideration as historic properties. Targets 001 and 003, tentatively identified as potential shipwrecks, were the subject of additional Phase I and Phase II archaeological investigations and evaluation, as documented in *Tappan Zee Hudson River Crossing Project Investigation and Evaluation of Submerged Archaeological Resources, Rockland and Westchester Counties, New York (*October 30, 2012).

Target 001, identified as an intact 19th century coal barge with a full load of lump coal, has been determined eligible for listing in the National Register of Historic Places. Target 003, identified as a portion of a modern deck or scaffold associated with the construction of the existing Tappan Zee Bridge, was determined not eligible for the National Register.

3 ENVIRONMENTAL EFFECTS

3-1 TRANSPORTATION

The recommended design would not change the operation (i.e., number of lanes) and projected traffic volumes of the Replacement Bridge Alternative described in the FEIS. The shared-use path and navigable channel would also be provided consistent with the descriptions provided in the FEIS. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to transportation.

3-2 COMMUNITY CHARACTER

The recommended design would not alter the right-of-way, acquisition of property interests, or operations of the replacement bridge as compared to analysis presented in the FEIS. The recommended design would also not result in adverse impacts not previously identified in the FEIS. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or other additional analysis with respect to community character.

3-3 LAND ACQUISITION, DISPLACEMENT, AND RELOCATION

The recommended design would require acquisition of the same property interests identified in the FEIS. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to land acquisition, displacement, and relocation.

3-4 PARKLANDS AND RECREATIONAL RESOURCES

Under the recommended design, there is no transportation “use” of public parks or recreational resources. The recommended design would also not adversely alter the public use of such resources. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to parklands and recreational resources.

3-5 SOCIOECONOMIC CONDITIONS

The recommended design would require acquisition of the same property interests identified in the FEIS and would not alter any other characteristics of housing and employment in the study area. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to socioeconomic conditions.

3-6 VISUAL AND AESTHETIC RESOURCES

The recommended design is consistent with the renderings and analysis presented in the FEIS for a cable-stayed main span; however, it would have a lower elevation at the highway approach to the Rockland landing. The result is a structure that is up to 23 feet lower at the point of greatest difference compared to the FEIS. The total length of the lower elevation is approximately 3,000 feet beginning at the Rockland landing abutment. This lower profile reduces costs as compared to the Replacement Bridge Alternative since it would result in shorter piers.

The lower elevation of the recommended design would lessen visual impacts from certain locations, but some views would continue to be obstructed or altered by the bridge and by new sound barriers if such barriers are supported by local residents. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to visual and aesthetic resources.

3-7 HISTORIC AND CULTURAL RESOURCES

The FEIS documented the evaluation of the project's effect on historic properties under Section 106 of the National Historic Preservation Act, concluding that the removal of the existing National Register-eligible Tappan Zee Bridge would result in an adverse effect, in accordance with 36 CFR Part 800.5(a)(1). The FEIS also identified the potential for adverse effects on submerged archaeological resources along the Rockland County shoreline and the Hudson River bottom, if further investigation and evaluation determined any such resources to be eligible for the National Register. A Memorandum of Agreement (MOA) was executed among FHWA, the New York State Department of Transportation (NYSDOT), the New York State Thruway Authority (NYSTA), SHPO, and the Advisory Council on Historic Preservation (ACHP) to resolve adverse effects. The MOA also stipulated the completion of ongoing investigations for potential archaeological resources in the Hudson River, and continuing consultation for the consideration of measures to avoid, minimize, or mitigate adverse effects on any submerged resources determined to be eligible for the National Register.

As described in Section 2-3, further archaeological investigation has identified a National Register-eligible shipwreck (Target 001) within the Hudson River, but other potential archaeological resources described in the FEIS are either not present or are not considered eligible for National Register listing. Construction of the recommended design would disturb the area associated with Target 001. In accordance with the MOA, FHWA, NYSDOT, and NYSTA are consulting with SHPO and ACHP to develop alternative mitigation measures, in lieu of data recovery, for the mitigation of adverse effects on the National Register-eligible shipwreck.

Since the MOA anticipated the presence of National Register-eligible submerged resources, considered the potential for adverse effects, and incorporated stipulations for consultation to mitigate those effects, the recommended design would not alter the conclusions of the FEIS with respect to historic and cultural resources.

3-8 AIR QUALITY

As described above, the recommended design would not change projected traffic volumes on the bridge or the operational characteristics (i.e., number of lanes and horizontal profile) of the bridge. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to air quality.

3-9 NOISE AND VIBRATION

The recommended design would not change traffic volumes on the bridge or operational characteristics of the bridge (i.e., number of lanes and horizontal profile) compared to the FEIS. Consistent with the analysis presented in the FEIS, the recommended design would include noise barriers, subject to approval by local residents. Consistent with the FEIS, an assessment of vibrations from the highway and bridge operations for the project is not warranted. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to noise and vibration.

3-10 ENERGY AND CLIMATE CHANGE

As described above, the recommended design would not alter the traffic operations or the projected traffic volumes on the replacement bridge as compared to analysis presented in the FEIS. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to energy and climate change.

3-11 TOPOGRAPHY, GEOLOGY, AND SOILS

The recommended design would include retaining walls and vegetation as outlined in the FEIS. The recommended design would also meet current seismic design standards. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to topography, geology, and soils.

3-12 WATER RESOURCES

The recommended design would include stormwater management to treat stormwater quality for the landing areas as outlined in the FEIS.

The recommended design would result in changes in the area of incursions into the 100- and 500-year floodplains in Rockland and Westchester Counties. The FEIS estimated that 0.3 acres of the bridge landing in Rockland County would be located within the 100-year floodplain and about 10 acres of the bridge landing would be located within the 500-year floodplain. The recommended design would increase by 0.1 acres the incursion into the 100-year floodplain to 0.4 acres and decrease incursion into the 500-year floodplain to 5.6 acres in Rockland County. In addition, the recommended design would affect 0.3 acres within the 100-year floodplain and 1.2 acres in the 500-year floodplain within Westchester County. Consistent with the FEIS, minimal portions of the piers for the replacement bridge would be located within the 500-year floodplain for the Hudson River within Westchester County. These incursions into portions of the 100-year and 500-year floodplain within Rockland and Westchester Counties would not result in adverse impacts to floodplain resources or result in increased flooding of adjacent areas. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to water resources.

3-13 ECOLOGY

The recommended design is within the scope of analysis (Long Span vs. Short Span Options) presented in the FEIS, and therefore, its effects on ecological resources would be generally the same. Overwater platform coverage for the Rockland permanent platform would be 1.27 acres more than what was anticipated in the FEIS, and a small amount of fill (500 cy) below mean higher high water (MHHW) in open water/benthic habitat would be required in order to extend the bulkhead to support the permanent platform. However, as described in Section 3-15 below, the new design has less platform coverage during construction, less dredging and armoring, and less hydroacoustic impacts due to pile driving.

Open water benthic habitats are considered deep water habitats and as such, are not included as wetland resources within the scope of Executive Order (EO) 11990. There would be no operational impacts to wetlands. Impacts to wetlands during construction are discussed in Section 3-15 below. Because the projected wetland impacts would be temporary and restored post-construction, and because remaining wetlands would retain their functions and values, the requirements of EO 11990 would be met.

The profile of the recommended design is approximately 23 feet lower at the Rockland landing than the Replacement Bridge Alternative. While the recommended design has a slightly lower profile on the Rockland landing, it also has a thinner deck than the Long Span Option described in the FEIS. The recommended design would still have a beneficial effect of less shading over the existing structure, similar to what was described under the Long Span Option in the FEIS. While there is an additional shading area (1.27 acres) due to the permanent platform, the shading associated with the recommended design would still be less than the shading from the extant bridge.

The in-water footprint of the recommended design (4.7 acres) is also less than the Replacement Bridge Alternative (6.5 to 8 acres). After demolition of the existing bridge, there would be a net gain of open water benthic habitat of 2.4 acres, as compare to a loss of open water benthic habitat under the Short Span Option of 0.92 acres and a net gain of 0.58 acres of open water benthic habitat under the Long Span Option.

Therefore, the FEIS, EO 11990 Findings Statement, and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to ecological resources.

3-14 HAZARDOUS WASTE AND CONTAMINATED MATERIALS

The FEIS identified any potential areas or sources of hazardous or contaminated materials in the project area and described the appropriate storage, handling, and transportation measures that would be followed, as required by law. No new areas of concern have been identified, and the project would continue to be subject to all applicable testing and handling requirements described in the FEIS. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to hazardous waste and contaminated materials.

3-15 CONSTRUCTION IMPACTS

The recommended design is within the envelope of the construction framework described and assessed in the FEIS, and the EPCs and other construction commitments of the FEIS have been incorporated into Design-Build Contract Documents. The Design-Build team has identified alternative concepts for temporary work platforms and dredging. These changes would not significantly change the conclusions of the FEIS with respect to construction-period impacts on community character, historic and cultural resources, transportation, air quality, noise, or energy and climate change. There is the potential, however, for a reduction in effects on water quality and aquatic resources, which is described below.

3-15-1 AQUATIC HABITATS

Benthic Macroinvertebrates

Similar to the Replacement Bridge Alternative described in the FEIS, the location of the sediment plume from dredging for the recommended design would move with the dredge, which would limit the time that a particular area would be exposed to re-suspended sediment. In addition, the duration of dredging and volume of dredging are reduced compared to the Replacement Bridge Alternative. Therefore, it is expected that there would be a reduction in the amount of suspended solids in the water column due to dredging under the recommended design.

The amount of dredging and armoring required for the recommended design would be 139 acres and 107 acres, respectively, which is less than what was presented in the FEIS. The duration of dredging would also be shorter—two, 3-month phases over a two year period compared with three, 3-month phases over a four year period, allowing the river's natural depositional process to occur sooner than what was predicted in the FEIS. In addition, the depth of the dredge channel for the recommended design (maximum of 14 feet including over dredge) is three feet less than what was predicted in the FEIS (maximum of 17 feet including over dredge). Because the duration of dredging would be reduced from four years to two years, and the depth and areal extent of dredging would be less than described in the FEIS (by three feet and 29 to 34 acres, respectively), the effects to benthic macroinvertebrates would be lessened.

Oyster beds

The FEIS identified the loss of 13 acres of oyster beds due to construction activities. As the dredge area and platform coverage for the recommended design are smaller, a smaller area of oyster beds would be affected (8.08 acres).

Fish

The recommended design would comply with all of the EPCs related to dredging as presented in the FEIS, and the mitigation plan would continue as detailed in the FEIS. Therefore, the recommended design would not alter the conclusions of the FEIS with respect to effects of dredging on fish.

The effects of pile driving are discussed below under "Threatened and Endangered Species." As described below, the hydroacoustic modeling analysis for this re-evaluation reflects the measured results from the 2012 PIDP, the elimination of large (8-foot and 10-foot diameter) piles, and the reduced number of hammer strikes required to drive many of the piles, and demonstrates a marked reduction in the area ensonified by pile-driving noise.

Threatened and Endangered Species

Dredging

As discussed in the FEIS, over time depositional processes would allow benthic habitat to return to its pre-construction state. Since the period of dredging for the recommended design would be shorter than previously predicted, it is expected that the river bottom would return to soft sediment more quickly than was described in the FEIS. As the bottom returns to soft sediment and is recolonized by benthic invertebrates, shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic sturgeon (*Acipenser oxyrinchus*) would regain any lost foraging habitat more quickly than predicted in the FEIS. With the shorter duration of dredging and corresponding decreased operation of construction vessels and related equipment, it is also anticipated that sturgeon would come into contact with construction vessels less frequently than predicted in the FEIS.

Pile Driving

Sturgeon take estimates provided in the FEIS ("FEIS take") relied upon pile-driving noise estimates derived from hydroacoustic modeling and a conceptual bridge design and construction schedule. Since these estimates were made, improved measurements of pile-driving noise were made (during the 2012 PIDP), and a recommended design was put forth. This new information was used to re-examine the spatial extent of pile-driving noise that may occur during bridge construction, which in turn allowed the re-calculation of potential sturgeon take (see **Attachment 1**).

The revised take estimates are lower than prior estimates due in large part to lower estimates of pile-driving noise. The smaller spatial extent of pile-driving noise is a result of several factors: 1) the recommended design eliminates the need to drive large (8-foot and 10-foot diameter) piles; 2) in addition to the planned noise attenuation provided by bubble curtains, there is likely to be attenuation from the construction barges that surround the piles, as observed during the 2012 PIDP; and 3) the number of hammer strikes required to drive many of the piles according to the recommended design would be less than was previously modeled (approximately 1,000 to 2,000 vs. 1,000 to 4,000 strikes) due to the increased use of a vibratory hammer during installation.

Tidal Wetlands

Westchester Bridge Staging Area

With the recommended design, approximately 0.10 acres of littoral zone tidal wetlands would be dredged on the Westchester side of the river. Like the Replacement Bridge Alternative, no dredging of littoral zone wetlands on the western shore of the river would be required.

In the recommended design, the WBSA temporary work platform has been modified to include two temporary platforms, each located on the north and south sides of the bridge (Westchester North and South Access Platforms). As shown in **Table 5**, the temporary Westchester South Access Platform would cover 0.45 acres of NYSDEC littoral zone tidal wetlands, more than the 0.13 acres described in the FEIS. Within this wetland area, 0.009 acres of NYSDEC littoral zone tidal wetlands would be impacted within the footprint of the temporary piles driven to support the pile-supported temporary south platform, as compared with 0.007 acres described in the FEIS. This platform would provide access for the demolition of the existing bridge and for construction of the upland portion of the new eastbound bridge. A temporary Westchester North Access Platform would be used to construct the new westbound bridge. This platform would be located outside of NYSDEC regulated tidal wetlands. Separate platforms to accommodate multiple construction and demolition activities in this area are critical to achieving the construction schedule. Furthermore, the speed and efficiency of construction equipment access and demolition/construction work via a work platform would be far greater than performing the same work by barge, and the wetland impacts of work platform support piles would result in less wetland impacts compared to dredging. Although there would be an increase in impacts to littoral zone tidal wetlands in the WBSA overall, the amount of platform coverage would be reduced by 4.14 acres from what was predicted in the FEIS. In the recommended design, the access roadway has been eliminated and no other temporary trestles or access roads would be constructed in the NYSDEC-regulated tidal wetland adjacent area in the WBSA. However, effects to littoral zone habitat for the temporary work platforms would be similar to what was described in the FEIS for the access roadway. After construction, the temporary platforms and pilings would be removed. Areas that were shaded by platform coverage would remain as littoral zone habitat during construction, although the value of such habitat would be diminished for some organisms during the 5¼ year construction period, which is within the 4½- to 5½-year duration identified in the FEIS. After construction, these areas would be re-exposed to sunlight and light-dependent organisms (e.g., algae, epifaunal benthic macroinvertebrates, fish) would be expected to quickly re-colonize the area. After pilings are removed, the natural sedimentation process of the river would occur and the areas occupied by pilings would be restored. Therefore, the recommended design would be similar to what was presented in the FEIS and the construction of the temporary access roadway for the WBSA would not result in adverse impacts to mapped NYSDEC tidal wetlands or adjacent area.

Therefore, the EO 11990 Findings Statement remains valid.

Rockland Bridge Staging Area

The FEIS determined that the temporary and permanent work platforms would not be constructed in NYSDEC-regulated tidal wetlands or in potential USACE wetlands. In the recommended design, a temporary trestle and temporary docks have been added to the south side of the bridge. Approximately 0.70 acres of the temporary trestle would occur over NYSDEC littoral zone tidal wetlands with 0.01 acres impacted as a result of the pile footprint. Approximately 0.005 acres of platform would occur over an NYSDEC-regulated adjacent area, with 0.001 acres impacted as a result of the pile footprint. This platform has been included in the recommended design for use in the construction of the inshore portion of the new eastbound bridge and for the demolition of the existing bridge. An alternative would be to dredge an access channel along the southern side of the existing bridge towards the shoreline. However, due to the shallow water depth in this area, a significant amount of dredging disturbance would be required and would result in a greater impact to NYSDEC littoral zone tidal wetlands than with the temporary trestle-support piles. Furthermore, the speed and efficiency of construction equipment access and construction and demolition work via a temporary platform was determined to be far greater than performing the same work by barge. As such, the most feasible and reasonable alternative that provides the least environmental impact and the best work efficiencies was determined to be the temporary platform. Although there would be an increase in impacts to littoral zone tidal wetlands in the RBSA, overall, the amount of platform coverage would be reduced by 0.33 acres from what was predicted in the FEIS. After construction, the temporary platforms and pilings would be removed. Areas that were shaded by platform coverage would remain as littoral zone habitat during construction, although the value of such habitat would be diminished for some organisms during the 5¼ year construction period, which is within the 4½- to 5½-year duration identified in the FEIS. After construction, these areas would be re-exposed to sunlight and light-dependent organisms (e.g., algae, epifaunal benthic macroinvertebrates, fish) would be expected to quickly re-colonize the area. After pilings are removed, the natural sedimentation process of the river would occur and the areas occupied by pilings would be restored. Therefore, the recommended design would be similar to what was presented in the FEIS and the construction of the temporary access roadway for the RBSA would not result in adverse impacts to mapped NYSDEC tidal wetlands or adjacent area.

Therefore, the EO 11990 Findings Statement remains valid.

Freshwater Wetlands

In the recommended design, the temporary platform and access road for the WBSA analyzed in the FEIS and are no longer included and have been replaced with temporary platforms over the Hudson River as described above. No portions of these temporary platforms would be constructed in freshwater wetlands and no other freshwater wetlands would be impacted as a result of the recommended design. The recommended design would be an improvement from that considered in the FEIS with respect to freshwater wetlands. Therefore, EO 11990 Findings Statement remains valid.

Benthic Habitat

Temporary Platforms, Walkways, and Docks in Bridge Staging Areas

In the recommended design, the temporary overwater coverage has been reduced by approximately 5.73 acres due to the replacement of the temporary platforms with temporary trestles in the WBSA and a combination of interconnected temporary trestles, walkways, and docks in the RBSA. In the recommended design, the total temporary overwater coverage would be 4.65 acres, with 2.57 acres and 2.08 acres in the WBSA and RBSA, respectively. This includes overwater coverage of 4.58 acres of open water habitat. Areas that would be shaded by the temporary trestles, walkways, and docks would remain as benthic habitat during construction, although the value of such habitat would be diminished for some organisms for the 5¼ year construction period, similar to that analyzed in the FEIS.

In the recommended design, a total of 0.04 acres of open water and littoral zone benthic habitat would be impacted within the footprint of the piles supporting the temporary platforms, walkways, and docks, less than what was presented in the FEIS (0.5 acres). Given that there would be fewer piles to be driven and all would be less than four feet, the zones of ensonification would be extremely small and would not be different from the platforms analyzed in the FEIS.

Permanent Dock and Bulkhead in Rockland Bridge Staging Area

Since the FEIS, this platform has been replaced with a permanent dock and the area for this permanent structure has been expanded to occupy 3.46 acres, as compared to the 2.19 acre permanent platform as described in the FEIS (see **Table 5**). Under the recommended design, the permanent dock would require additional piles for support of the dock structure. The permanent dock would have 291, 36-inch piles and 228, 30-inch piles for a total footprint area of 0.09 acres, as shown in **Table 6**. Although there would be more piles driven for the permanent dock, overall, there would be fewer piles to be driven during construction than the Replacement Bridge Alternative and all of the piles for the platforms would be less than four feet. The zones of ensonification for these piles would be extremely small and would be different from the platforms analyzed in the FEIS.

In addition, 0.10 acres of upland fill, which would have been returned to littoral zone tidal wetlands after project completion, would not be removed as described in the FEIS.

As discussed above, the permanent dock would be attached to the bridge and to land at a steel bulkhead. The area behind the 227-foot linear steel bulkhead would be backfilled with clean fill. This filled area would occupy 0.02 acres and require 500 cubic yards of fill below the MHHW elevation, as shown in **Table 6**. The steel bulkhead and associated fill at the NYSTA Permanent Maintenance Dock landing would function as an abutment for the permanent platform structure. The bulkhead and filled area provide a fixed connection and a transitional feature between the parking area near the shoreline and the marine dock structure. These features are essential to provide a stable transition area from the variable shoreline to the permanent dock that would accommodate heavy construction equipment during bridge construction and during future NYSTA maintenance operations.

Although there would be a 1.27-acre expansion of the permanent dock and 0.02 acres of filled area behind the steel bulkhead in the RBSA compared to the FEIS, it would not be significantly different from the environmental impacts previously considered. Any permanent loss in benthic habitat associated with the permanent dock and filled area would be minimal and would not result in an adverse impact, given the vast acreage of soft bottom habitat in the project region and in the Hudson River estuary. While there is an additional shading area (1.27 acres) due to the permanent platform, the reduction in shading from the new bridge structure as compared to the current bridge would more than compensate for the additional permanent platform coverage. Therefore, the conclusions of the FEIS with respect to benthic habitat would remain essentially unchanged.

3-15-2 CONCLUSION

Overall, the potential construction-period impacts of the recommended design would be the same as or lesser than described in the FEIS, and therefore, the FEIS, EO 11990 Findings Statement, and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional environmental analysis with respect to construction impacts.

Table 6
Potential Loss of River Bottom, Wetlands, and Adjacent Area Habitats due to Project Activities (Replacement Bridge Alternative and Recommended Design)

Status	Activity / Use	USACE Wetland Areas (acres)		NYSDEC Littoral Zone Tidal Wetlands (acres)		NYSDEC Tidal Wetland Adjacent Area (acres)		Open Water Benthic Habitat (acres)	
		RBA	RD	RBA	RD	RBA	RD	RBA	RD
Temporary	WBSA North Platform	-	-	-	-	-	-	0.28	0.03
	WBSA South Platform	N/A	-	N/A	0.01	N/A	-	N/A	0.003
	WBSA Access Road	0.004	N/A	0.01*	N/A	0.01*	N/A	0.05	N/A
	RBSA Walkway	N/A	-	N/A	-	N/A	-	N/A	0.002
	RBSA North Platform	-	N/A	-	N/A	-	N/A	0.18	N/A
	RBSA South Platform	N/A	-	N/A	0.01	N/A	-	N/A	0.001
	RBSA NYSTA Dock	N/A	-	N/A	-	N/A	-	N/A	0.001
	RBSA Adjacent Area	N/A	-	N/A	-	-	0.01	N/A	-
	Dredging / Armoring	-	-	0.10	-	-	-	164.4-172.4/ 160-167**	139/107
	Total	**0.004**	**0.0**	**0.11**	**0.02**	**0.01**	**0.01**	**164.9-172.9/160.5-167.5**	**139.04/ 107.04**
Permanent	RBSA North Dock (pile-supported)	-	-	-	-	-	-	0.11	0.09
	RBSA North Dock Bulkhead	-	-	-	-	-	-	(0.10)	0.02
	New Bridge	-	-	-	-	-	-	6.5-8.0	4.70
	Removal of Existing Structure	-	-	-	-	-	-	(7.1)	(7.10)
	Total	**0**	**0**	**0**	**0**	**0**	**0**	**(0.54)-0.91**	**(2.29)**

Notes:
RBA = Replacement Bridge Alternative; RD = Recommended Design
*Potential loss expressed as the area of the pile footprints supporting the overlying platform and access road for the FEIS Alternative; estimated as 5 percent of the platform area.
**Short Span/Long Span
Numbers in parentheses represent net gain.
WBSA Westchester Bridge Staging Area
RBSA Rockland Bridge Staging Area

3-16 ENVIRONMENTAL JUSTICE

The recommended design would not change the location of the project or the social and economic characteristics of the surrounding area from that identified in the FEIS nor would it result in new environmental impacts. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to environmental justice.

3-17 COASTAL AREA MANAGEMENT

The recommended design would result in a reduction in the size of piers and a smaller quantity of dredge material compared to the Replacement Bridge Alternative. The recommended design would implement the cable-stayed main span option and would result in approach spans and a quantity of piles that fall within the envelope of analysis (i.e., between the Short Span and Long Span options) presented in the FEIS. As described above, the recommended design would also not change the conclusions of the FEIS with respect to environmental impacts, and therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to consistency with the State's Coastal Management Program.

3-18 INDIRECT AND CUMULATIVE EFFECTS

As described in this re-evaluation, the recommended design would not change the conclusions of the FEIS, and new information has not been identified subsequent to the FEIS that would result in changes in the project area with the potential for additional indirect and cumulative effects. Therefore, the FEIS and Joint ROD remain valid, and it is not necessary to prepare an SEIS or any additional analysis with respect to indirect and cumulative effects.

3-19 SECTION 4(f) EVALUATION

As stated in 23 CFR 774.13(b), Section 4(f) of the U.S. Department of Transportation Act of 1966 applies to all archeological sites on or eligible for inclusion on the National Register, including those discovered during construction, except when:

- The Administration concludes that the archeological resource is important chiefly because of what can be learned by data recovery and has minimal value for preservation in place. This exception applies both to situations where data recovery is undertaken and where the Administration decides, with agreement of the official(s) with jurisdiction, not to recover the resource; and
- The official(s) with jurisdiction over the Section 4(f) resource have been consulted and have not objected to the Administration finding.

Target 001, an archaeological resource, has been determined eligible for the National Register. Based on a review of the report on archaeological investigations of submerged resources, FHWA finds that Target 001 is primarily important for its data potential and has minimal value for preservation in place. Given the inaccessibility and site conditions, the physical remains of Target 001 are not visible to the public and have no permanent in situ interpretive value. The site does not contain human remains. The site has no prehistoric component, and has no Native American affiliation or cultural materials.

The SHPO and ACHP, the officials with jurisdiction over the 4(f) resource, have been consulted and have no objections to this finding. The SHPO and ACHP also concur with the development of alternative mitigation measures in lieu of data recovery, due in part, to the difficulty of obtaining additional data. Therefore, in accordance with 23 CFR 774.13(b), Target 001 qualifies as an exception to Section 4(f) requirements.

4 CONCLUSION

The re-evaluation has been prepared in accordance with 23 CFR Part 771.129. Based on the above evaluation, it has been determined that the FEIS and Joint ROD remain valid, and the recommended design and new information received subsequent to the publication of the Joint ROD do not have the potential to result in significant environmental impacts that were not previously identified. The conditions of 23 CFR 771.130(a) have not been met; therefore, further evaluation of these changes through an SEIS or any additional environmental analysis is not necessary. In addition, the recommended design and new information would not require a supplemental analysis pursuant to SEQRA (6 NYCRR Part 617 and 17 NYCRR Part 15).

Attachment 1

Methodology for estimating the spatial extent of underwater noise levels resulting from pile driving during construction of the Tappan Zee Hudson River Crossing and re-calculation of the incidental take of endangered sturgeon species associated with the recommended project design

December 2012

Prepared by:

AKRF, Inc.
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1.1. Background and Purpose

The purpose of this document is to describe the methods used by AKRF and Dr. Arthur Popper to revise previous estimates of the spatial extent of underwater noise that may result from pile driving during construction of the Tappan Zee Hudson River Crossing ("the project"). These revised estimates have been prepared in order to re-calculate the potential "incidental take" of endangered shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic sturgeon (*Acipenser oxyrhinchus*) associated with the recommended design for the project.

Incidental take (or "take") from pile driving is estimated as the potential number of shortnose and Atlantic sturgeon that may be exposed to underwater pile-driving noise that exceeds pre-defined peak or cumulative sound levels that have been viewed by NMFS to result in the onset of physiological effects in sturgeon.

Take estimates were previously reported in the revised Biological Assessment (BA), the Final Environmental Impact Statement (FEIS) for the project, and in the National Marine Fisheries Service (NMFS) Biological Opinion (BO). However, these relied upon noise estimates derived from hydroacoustic modeling conducted for the project by JASCO Applied Sciences and were based on a construction plan developed for the FEIS in order to identify an envelope for the possible design of the replacement bridge. The purpose of this exercise was to identify and assess the potential environmental impacts from worst-case pile-driving conditions. The revised estimates of the spatial extent of pile-driving noise levels presented here are based on the empirical measurements of pile-driving noise provided by the Pile Installation Demonstration Project (PIDP) conducted at the project site in 2012, rather than modeled data (JASCO 2012). They also take into account the recommended bridge design that has been identified from among competing bridge designs. The recommended design would use fewer piles than the Short-Span Option analyzed in the revised BA/FEIS (but more than the Long-Span Option) and would only employ 4 ft and 6 ft piles, whereas the design options analyzed in the revised BA/FEIS used a combination of 4 ft, 6 ft, 8 ft, and 10 ft piles. The revised estimates of the spatial extent of pile-driving noise were then used to re-calculate potential sturgeon take resulting from the installation of 916 piles during bridge construction, as well as the 15 test piles, part of a geo-technical investigation (referred to hereafter as PIDP 2) in 2013, that will be driven and cut to the mudline prior to the start of construction.

1.2. Pile Driving Noise

During active pile driving, noise from each hammer striking the pile radiates into the water along the length of the pile (and into the substrate along the embedded part of the pile). The noise is loudest near the pile and then decreases (attenuates) in amplitude (or sound level) as the sound radiates away from the pile. At the same time, the more energy that is delivered to the pile (i.e., the harder the pile is struck), the louder the noise will be and the further the sound wave will travel before its level has decreased (attenuated) to where it can no longer be detected.

The distance from the pile at which the noise level decreases below a level that can result in the onset of physiological effects on fishes can be represented as the radius of a circle surrounding the pile. This radius can be used to calculate the area of the circle ("ensonified area") around the pile being driven within which sturgeon could potentially experience sound levels that could result in the onset of physiological effects. The circumference of the ensonified area is called the "isopleth." Beyond the isopleth, the pile-driving noise is below the sound level that can result in the onset of physiological effects to fishes of interest.

The methods presented here and in the accompanying Appendix refer to two criteria of impact from pile-driving noise: 1) peak sound pressure level (SPL_{peak}), and 2) cumulative sound exposure level (SEL_{cum}).

- SPL_{peak} is the maximum instantaneous noise level generated during a single pile strike. This peak level lasts for no more than a few milliseconds, whereas the whole pile strike may last for tens of milliseconds or more. The SPL_{peak} therefore represents only a small part of the total sound energy in the whole pile driving sound, but it is the loudest (most intense) part of that sound.
- The SEL_{cum} is a measure of the cumulative amount of sound energy received by a fish over the course of multiple pile strikes. It is thus the summation of the total amount of acoustic energy for all of the strikes, with the sound energy in a single strike being the SEL_{ss}.

The methodology described hereafter relates to the estimation of potential pile-driving impacts based on an SPL_{peak} level of 206 dB re 1μPa, which was the criterion indicated by NMFS in its BO for the project. The application of this criterion in the BO was predicated on the recognition by NMFS that sturgeon will avoid the location of pile driving and will therefore not remain near the pile, or in the area of the pile driving, long enough to accumulate enough sound energy to reach the SEL_{cum} criterion. That recognition was confirmed by the empirical data gained from the PIDP and the analysis of those data by AKRF and Dr. Arthur Popper based on the monitoring of acoustic-tagged Atlantic sturgeon during the PIDP (AKRF and Popper 2012a,b). That analysis demonstrates that Atlantic sturgeon will avoid areas proximate to impact pile-driving operations and that it is highly unlikely that sturgeon will remain in the vicinity of pile driving long enough to reach the cumulative threshold as they move through the area.

For the purpose of comparison, Appendix A to this document provides the methods used to determine the spatial extent of the SEL_{cum} ensonified area and presents the results of the re-calculation of the incidental take of sturgeon based on the application of the SEL_{cum} criterion.

1.3. Overview of Methodology

The following sections set forth the methods used to estimate the size of the ensonified area for the SPL_{peak} that may occur as a result of pile driving during bridge construction. The methods used to calculate the take of shortnose and Atlantic sturgeon are the same as those used for the prior take estimates presented in the revised BA/FEIS and are reiterated below. According to the proposed schedule, bridge construction will require pile driving of 4 ft and 6 ft diameter piles, 80 percent of which will be 4 ft piles driven in water less than 20 ft deep;

the remainder will be 6 ft piles which will be driven in deeper water (between 20 ft and 40 ft deep).

During the PIDP, seven piles (4 ft, 8 ft, and 10 ft diameter) were driven near the existing Tappan Zee Bridge in water depths of 9-16 ft to collect information on the sound levels and spatial extent of pile driving noise. In order to revise estimates of the ensonified areas associated with 4 ft piles to be driven during bridge construction, PIDP-measured SPL_{peak} data were used. Because 6 ft piles were not driven during the PIDP, and because piles were not driven at water depths greater than 20 ft, PIDP-measured noise data could not be used directly. Therefore, noise data collected during driving of the 8 ft PIDP pile were used to conservatively predict the size of the ensonified area for 6 ft piles. Moreover, measurements of pile-driving noise collected during several California Department of Transportation (Caltrans) construction projects were used to validate the predictions.

The specific methods used to calculate the radius of the ensonified area (i.e., distance from the pile to the circumference of the ensonified area), as well as the size of the ensonified area itself, are described in more detail for 4 ft and 6 ft piles in the following sections.

1.4. Peak Sound Pressure Level (SPL_{peak})

According to Stadler and Woodbury (2009), fish do not show the onset of physiological effects (i.e., take) until the SPL_{peak} reaches 206 dB re 1 µPa. This SPL_{peak} criterion was used by NMFS in its BO for this project.

1.4.1. 4-foot Diameter Piles

The maximum distance from the pile at which the 206 dB re 1 µPa SPL_{peak} was reported during the PIDP was used here to calculate the size of the ensonified area for 4 ft piles with BMP noise reduction in place.[1] An example of the regression relationship between SPL_{peak} and distance from the pile as calculated from SPL_{peak} levels measured during the PIDP is presented for a 4 ft pile in Figure 1. In this Figure, regression lines were drawn for the noise levels (y-axis) at different distances from the pile (x-axis). From the line for the SPL_{peak} (red line), it can be seen that as the distance from the pile increases, the SPL_{peak} decreases. If the measured regression line from this Figure is then extrapolated back towards the pile, it can be see that it intersects 206 dB re 1 µPa SPL_{peak} on the y-axis at a distance of approximately 20 ft from the pile (x-axis). Based on these data, noise levels of 206 dB re 1 µPa SPL_{peak} did not extend further than 20 ft from the 4 ft pile during the PIDP. Therefore, a radius of 20 ft was used to calculate the area ensonified at 206 dB re 1 µPa SPL_{peak} when estimating potential sturgeon take during pile driving of 4 ft piles.

[1] Best Management Practices (BMP) noise reduction during pile driving in the PIDP included the use of bubble curtains which surrounded the pile and absorbed/attenuated sound energy radiating from the pile. BMPs provided a reduction of 12 – 16 dB re 1µPa SPL_{peak} for 4 ft piles (JASCO 2012).

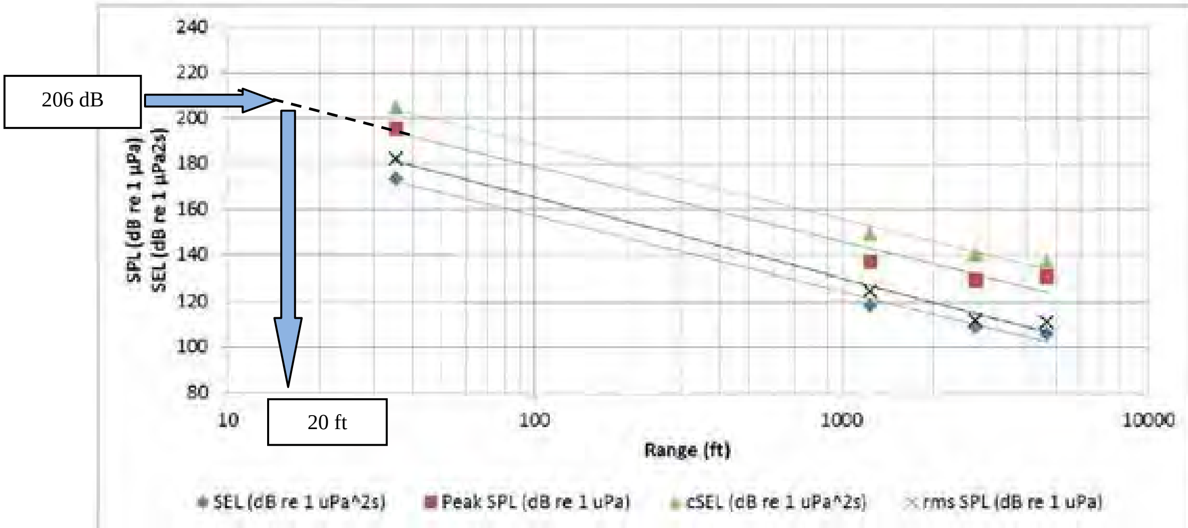

Figure 1. – Relationship between sound and distance from a 4 ft pile driven during the PIDP (taken from JASCO 2012). The sound data in this Figure were used to determine the distance from the pile to the 206 dB re 1 µPa SPL_{peak} (referred to as Peak SPL in the legend), which in this case was less than 20 ft (see text). The other sound data plotted in this Figure were not used in this discussion. The blue arrows, dashed regression line, and several data labels were added to the Figure for the purpose of illustrating how the JASCO regressions were used to estimate isopleth size for AKRF's estimation of take.

1.4.2. 6-foot Diameter Piles

Because 6 ft piles were not driven as part of the PIDP, the distance to the 206 dB re 1 µPa SPL_{peak} isopleth for the 6 ft piles was based on the distance observed during the PIDP for an 8 ft pile driven with BMP noise reduction in 16 ft of water. The use of the 8 ft PIDP pile as a proxy for the 6 ft piles was done with the understanding that the 8 ft pile's isopleth will be larger than that for the 6 ft piles. This is understood since the sound levels measured at different distances for various pile sizes during the PIDP showed that as piles get larger the sound levels close to the piles increase, meaning that larger piles produce greater sound levels than smaller piles (JASCO 2012). Indeed, as shown during the PIDP, the SPL_{peak} is greater for a larger pile at a given distance (Figure 2), meaning that the 206 dB re 1 µPa SPL_{peak} isopleth for the larger pile will be further from the pile as compared to a smaller pile. Thus, using an 8 ft pile as a proxy for all 6 ft piles results in a conservative estimate of the distance to the SPL_{peak} and, ultimately, a conservative estimate of take.

During the PIDP, the measured distance from the 8 ft pile to the 206 dB re 1 µPa SPL_{peak} isopleth (without BMP noise reduction) was 84 ft. With the 17 dB BMP noise reduction measured for the 8 ft pile during the PIDP (JASCO, 2012, p. 41), the average distance to the 206 dB re 1 µPa SPL_{peak} isopleth was reduced to 32 ft. While a distance of 32 ft would seem to be a reasonable estimate for 6 ft piles, the 8 ft PIDP pile is not a perfect proxy as it was driven in shallow water (16 ft), while the 6 ft piles will be driven in deeper water (40 ft) during bridge construction. Because sound propagates further in deeper water (as demonstrated in Figure 3), one would expect the distance to the 206 dB re 1 µPa SPL_{peak}

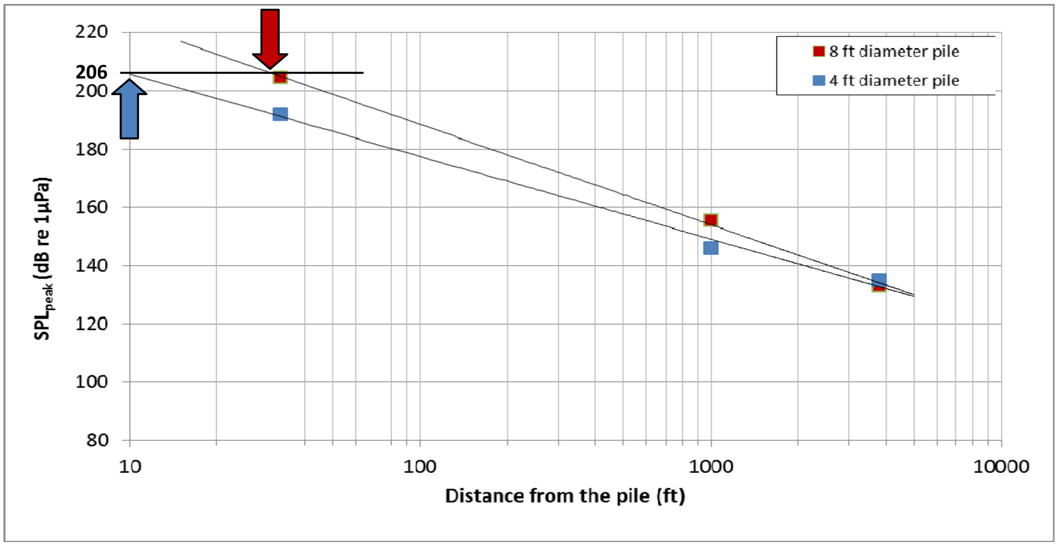

Figure 2. – Relationship between SPL_{peak} and distance from the pile for 4 ft and 8 ft piles driven in 16 ft of water during the PIDP (plotted from data presented in JASCO 2012). Notice the greater distance to an SPL_{peak} of 206 dB re 1 µPa for the 8 ft pile (32 ft as indicated by the red arrow) compared to the smaller distance for the 4 ft pile (10 ft as indicated by the blue arrow).

isopleth for the 6 ft piles to be greater than 32 ft when the piles are driven in deeper water. Nevertheless, the distance to the 206 dB re 1 µPa SPL_{peak} isopleth for the 6 ft piles would be on the order of tens of feet, rather than hundreds of feet, and is likely less than 84 ft as indicated by the 8 ft PIDP pile driven without BMP noise reduction.

It would be reasonable to expect the distance to the 206 dB re 1 µPa SPL_{peak} to be approximately 50 – 100 ft given the data reported here and in the JASCO report. Because these estimates represent a two-fold difference in distance, sturgeon take was calculated for both 50 and 100 ft, and the resulting take estimates were compared to determine if a two-fold difference in isopleth distance has a significant effect on the sturgeon take estimate (e.g., doubling of the take estimate?).

As a means of validating the predicted distance to the 206 dB re 1 µPa SPL_{peak} isopleth, the estimate of 50 – 100 ft for a 6 ft pile was compared to empirical data collected for an 8 ft pile driven in 40 ft of water during a Caltrans construction project (Benicia-Martinez Bridge) in the San Francisco Bay estuary (Caltrans 2009). Without BMP noise reduction, the distance to the 206 dB re 1 µPa SPL_{peak} isopleth was measured at 207 ft from the pile. Assuming a 10 dB BMP noise reduction, the distance to the 206 dB re 1 µPa SPL_{peak} was approximated by AKRF and Dr. Arthur Popper to be 61 ft based on SPL_{peak} data reported by Caltrans (2009). Since sound levels from a 6 ft pile are less intense than for an 8 ft pile, it follows that the distance to the 206 dB re 1 µPa SPL_{peak} isopleth for the 8 ft pile in the same depth of water is an overestimate of the distance for the 6 ft pile. Thus, if the distance in 40 ft of water for an 8 ft pile with BMP noise reduction is 61 ft, the distance for a 6 ft pile in the same depth will be less.

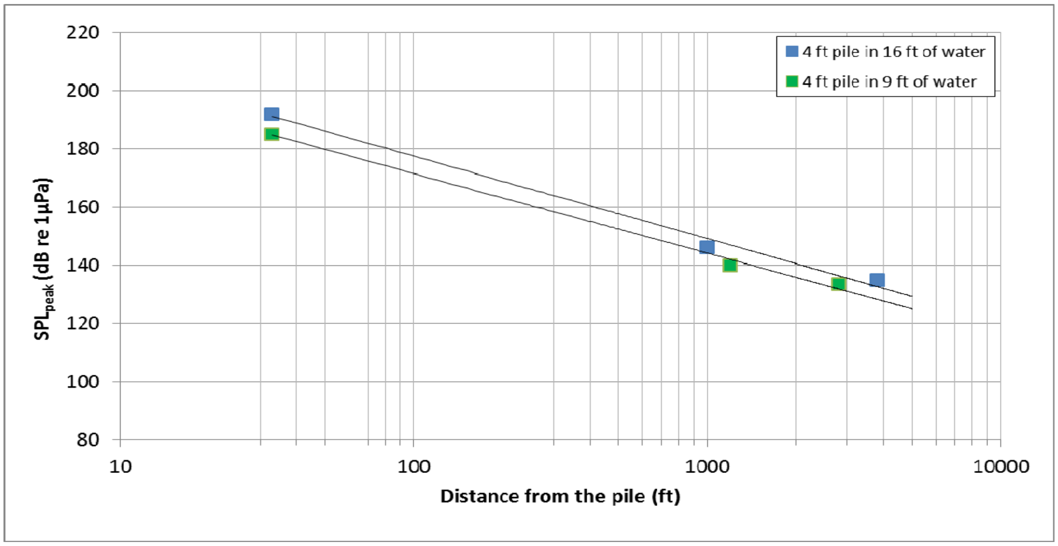

Figure 3. – Relationship between SPL_{peak} and distance from the pile for two 4 ft piles driven during the PIDP (plotted from data presented in JASCO 2012). This Figure illustrates the effect of water depth on sound as it travels away from the pile. Note that the SPL_{peak} at a given distance from the pile is greater for the pile driven in 16 ft of water (blue) compared to the pile driven in 9 ft of water (green) even though the piles are the same diameter.

1.4.3. Estimation of Sturgeon Abundance Used to Calculate Take

The same sturgeon abundance estimates used in the revised BA/FEIS and the NMFS BO were applied to re-calculate sturgeon take based on the estimated distances to the 206 dB re 1 µPa SPL_{peak} for 4 ft and 6 ft piles described above. For the prior take estimates for the 206 dB re 1 µPa SPL_{peak} criterion, NMFS reasoned that the take estimate for shortnose sturgeon should be applied to Atlantic sturgeon as well, on the basis that there are fewer Atlantic sturgeon than shortnose sturgeon in the Hudson River. Therefore, the recalculated take estimate for shortnose sturgeon was once again used here as the take estimate for both species. The method for estimating the abundance of shortnose sturgeon for the purposes of re-calculating take is described below, as adapted from the revised BA for the project.

Using fish abundance estimates from a 1-year comprehensive gill-net sampling study, the encounter rate of shortnose sturgeon in the study area was estimated as the number of shortnose sturgeon collected per gill net per hour. From June 2007 – May 2008, 476 gill nets were deployed just upstream of the existing Tappan Zee Bridge (and within the study area) for a total sampling time of 679 hours. Sampling was conducted approximately bimonthly from April 2007 to May 2008. During this time, 12 shortnose sturgeon were collected: 7 in September and October, 4 in May and June, 1 in August, and none in December or February. Based on the observed number of sturgeon collected over 679 gill-net hours, the encounter rate for shortnose sturgeon in the proposed bridge replacement area is 0.033 sturgeon encountered per hour of sampling. This encounter rate was calculated assuming that two of the five panels of the gill net (i.e., the one and two inch mesh sizes) were too small to effectively collect shortnose sturgeon.

To estimate the potential number of shortnose sturgeon that would potentially reach the onset of physiological effects as a result of pile-driving noise, it was necessary to scale gill-net encounter rates from a single gill-net sample (the gill net is 125 ft in length) to the diameter of the ensonified area for the SPL_{peak} of 206 dB re 1 µPa. The number of shortnose sturgeon was estimated as the number that would have been collected if multiple gill nets were deployed side-by-side across the diameter of the SPL_{peak} of 206 dB re 1 µPa ensonified area. For example, if the diameter of the isopleth for the 206 dB re 1 µPa SPL_{peak} created during 1 hr of pile driving for a 6 ft pile was 500 ft, then four gill nets would be required to span the isopleth. In each of these gill nets, 0.033 shortnose sturgeon would be collected for each hour of pile driving, according to the encounter rate described above. Therefore, the estimated take for this single 6 ft pile would be 0.13 sturgeon, calculated as:

$$0.033 \text{ sturgeon per ft per hour} * (500 \text{ ft}/125 \text{ ft per gill net}) * 1 \text{ hr}$$

This estimate would then be summed with those from the other piles driven during a specific time period and rounded to the nearest whole number, as done by NMFS in its BO. The sum of these partial takes over the entire time period required for pile driving during bridge construction equals the potential sturgeon take reported in Table 1.

1.4.4. Summary of the Spatial Extent of the 206 dB re 1 µPa SPL_{peak} Ensonified Area and Recalculated Sturgeon Take

To summarize, the distance from the pile to the 206 dB re 1 µPa SPL_{peak} isopleth was estimated to be 20 ft for 4 ft piles and between 50 ft and 100 ft for 6 ft piles. From these distances the diameter of the ensonified area was calculated as 40 ft for 4 ft piles and between 100 ft and 200 ft for 6 ft piles. Estimates of sturgeon take were calculated directly from these diameters and the encounter rate for shortnose sturgeon as described in the methods for sturgeon abundance.

Based on the calculated diameters of the ensonified area and the size, number and timing of piles to be driven, it is estimated that approximately 35 – 41 shortnose sturgeon and 35 – 41 Atlantic sturgeon could be exposed to noise levels high enough to cause the onset of recoverable physiological effects during the course of bridge construction. These recalculated take estimates are lower than those presented by NMFS in its BO for both the Long-Span and Short-Span Options (Table 1).

Table 1
Total numbers of sturgeon that may occur in ensonified areas exceeding the peak sound pressure level of 206 dB SPL_{peak} re 1μPa. Take estimates have been revised based on the new bridge construction schedule (including PIDP 2) and noise data collected during the Pile Installation Demonstration Project (PIDP). Revised estimates are compared to those presented in the NMFS Biological Opinion (BO).

Species	Life Stage	Potential for Onset of Physiological Effects (206 dB SPL_{peak} re 1μPa)		
		NMFS BO		
		Short Span	Long Span	Revised
Shortnose sturgeon	Juvenile/Adult	70	43	35-41*
Atlantic sturgeon	Juvenile/Subadult Adult	70	43	35-41*

Notes: *Represents the range of potential take depending on the size of the 206 dB SPLpeak isopleth, which was estimated as 100 - 200 ft wide. Lower take would result from a smaller isopleth.

2.1. Literature Cited

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Appendix A to Attachment 1

A1.1. Cumulative Sound Exposure Level (SEL_{cum})

As related in the principal memorandum (Attachment 1), the SPL_{peak} was the criterion used by the National Marine Fisheries Service (NMFS) in its Biological Opinion (BO) for the project. The application of this criterion in the BO was predicated on the recognition by NMFS that sturgeon will avoid the location of pile driving and will therefore not remain in the area of the pile driving long enough to accumulate enough sound energy to reach the criterion for cumulative sound exposure level (SEL_{cum}). In the event that there were to be any consideration of the application of the SEL_{cum}, this Appendix to Attachment 1 provides the methods used to determine the spatial extent of the SEL_{cum} ensonified area and presents the results of the re-calculation of the incidental take of sturgeon based on the application of the SEL_{cum} criterion.

The SEL_{cum} is a measure of the cumulative amount of sound energy received by a fish over the course of multiple pile strikes. It is thus the summation of the total amount of acoustic energy for all of the strikes, with the sound energy in a single strike being the SEL_{ss}. The cumulative sound energy experienced by a fish depends on the number of pile strikes and the SEL_{ss}. Thus, the SEL_{cum} increases with each strike as shown in Equation 1 (Popper and Hastings 2009).

$$SEL_{cum} = SEL_{ss} + 10 * \log_{10}(\text{number of strikes}) \quad \text{(Equation 1)}$$

Unlike SPL_{peak}, SEL_{cum} is a measure of prolonged exposure to pile driving sound over the duration of the pile driving operation, assuming the fish does not move away. Fish are considered by NMFS to reach the onset of physiological effects either by being exposed to a single strike that reaches a specific SPL_{peak} or by being exposed over time to a specific amount of accumulated sound energy, the SEL_{cum}.

In order to determine how close to the pile a sturgeon would have to be to accumulate enough sound energy to result in the onset of physiological effects, several steps were required. First, it was necessary to measure the SEL_{ss} of a single strike at different distances from the pile. Using the determined SEL_{ss} and the approximate number of strikes required to drive the pile, it was possible to determine the SEL_{cum} produced by that sound using the relationship shown in Equation 1.

Important levels of cumulative sound exposure were defined as the SEL_{cum} corresponding to the potential onset of physiological effects (187 dB re $1\mu Pa^2 \cdot s$), potential onset of recoverable physical injury (197 dB re $1\mu Pa^2 \cdot s$), and potential onset of mortal injury (207 dB re $1\mu Pa^2 \cdot s$). The approximate number of pile strikes required to drive each pile ranges from 230 – 2,380, as envisioned for the recommended bridge design. Clearly, both the SEL_{cum} levels of interest and the general number of pile strikes to drive a pile are known values. What needs to be determined (because it provides a means of calculating the distance to the SEL_{cum} isopleths) is the SEL_{ss}, that when accumulated for the known number of strikes results in the limiting SEL_{cum}. The SEL_{ss} can be determined by rearranging the standard formula to calculate SEL_{cum} (Equation 1, above) as:

$$SEL_{ss} = SEL_{cum} - 10 * \log_{10}(\text{number of strikes}) \quad \text{(Equation 2)}$$

In this equation, if the pile is struck only once, the SEL_{cum} and the SEL_{ss} will be the same (also as in Equation 1). As the number of pile strikes increases, and the amount of accumulated sound energy exposure increases, the SEL_{cum} increases. The SEL_{ss} does not change very much over all of the strikes during the driving of a single pile. Based on this relationship, any distance from a source can be selected to determine the maximum SEL_{ss} to which a fish could be exposed at that location in order not to exceed some SEL_{cum} criterion level (e.g., 187 dB) for the number of strikes needed to drive a pile.

For example, if the SEL_{cum} criterion is 187 dB, then for a sturgeon that is exposed to the 230 strikes required to drive a pile, it is necessary to know the maximum SEL_{ss} to which it can be exposed. Using Equation 2, this level is calculated to be 163 dB re 1µPa^2·s, as shown below.

$$163_{SELss} = 187_{SELcum} - 10 * \log_{10}(230\ \text{strikes})$$

Once the SEL_{ss} of 163 dB has been determined, it is possible to estimate, as discussed in several examples below, how close to the pile the sturgeon must be to be in order to be exposed to an SEL_{ss} of 163 dB re 1µPa^2·s each time the pile is struck. Beyond this distance, the cumulative sound energy from pile driving noise will not be loud enough to cause the onset of physiological effects to sturgeon, and sturgeon will not accumulate enough noise exposure during pile driving to reach the critical level of 187 dB re 1µPa^2·s SEL_{cum} after 230 pile strikes.

A1.1.1. 4-foot Diameter Piles

To determine the distance from the pile to the location where an SEL_{cum} of 187 dB re 1µPa^2·s occurs after 230 pile strikes, the noise measurements (in terms of SEL_{ss}) that were taken at different distances during pile driving of 4 ft piles during the PIDP and presented in the PIDP final report (JASCO 2012) were used (with BMP noise reduction unless otherwise noted[1]). During the PIDP, an SEL_{ss} of 163 dB re 1µPa^2·s for a single pile strike occurred at a distance of 63 ft from the pile, based on the regression line shown in Figure A-1. Therefore, AKRF and Dr. Popper conclude that a stationary sturgeon within 63 ft of pile driving for 4 ft piles would reach the onset of physiological effects (187 dB re 1µPa^2·s SEL_{cum}) after the 230 strikes required to drive the pile, but that fishes at a greater distance would not reach this effect level.

The same procedure was used to estimate the distance to the SEL_{cum} of 197 dB and 207 dB re 1µPa^2·s, effect levels: Equation 2 was again used to estimate the SEL_{ss} (173 dB and 183 dB re 1µPa^2·s, respectively) and the regression line for SEL_{ss} in Figure A-1 was then used to determine the distance to the SEL_{ss} (34 ft and 21 ft from the pile, respectively).

[1] Best Management Practices (BMP) noise reduction during pile driving in the PIDP included the use of bubble curtains which surrounded the pile and absorbed/attenuated sound energy radiating from the pile. BMPs provided a reduction of 10 – 12 dB re 1µPa^2·s SEL_{cum} for 4 ft piles (JASCO 2012).

Because some of the 4 ft piles will be driven deeper into the riverbed and will require a greater number of pile strikes than 230, this procedure was repeated using representative values for the approximate number of strikes required to drive piles during bridge construction (i.e., 750, 1,000, 2,000, and 2,380 pile strikes as specified in the recommended bridge design plan; Figure A-2).

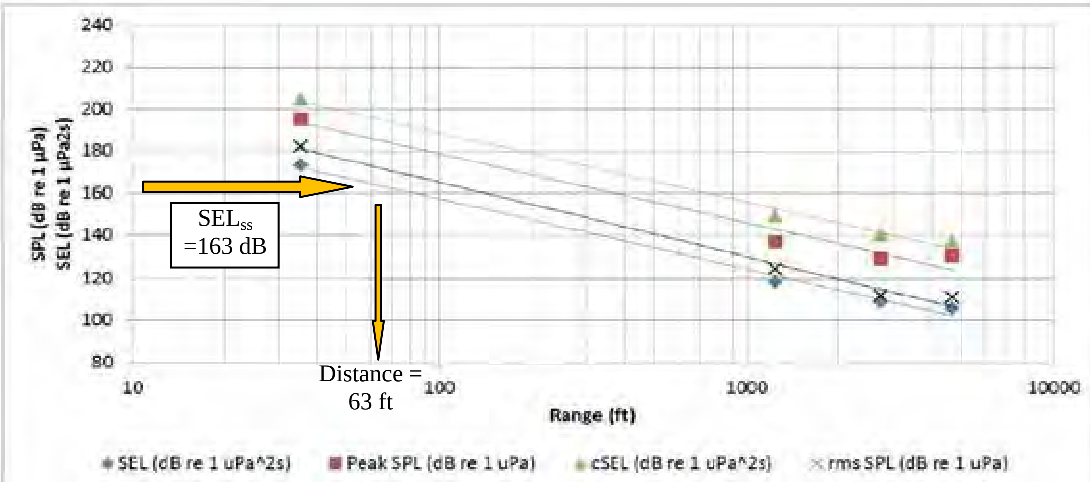

Figure A-1. – Relationship between sound and distance from a 4 ft pile driven during the PIDP (taken from JASCO 2012). The blue line representing SEL_{ss} in this Figure (referred to as SEL in the Figure legend) was used to determine the distance from the pile to the SEL_{ss} that corresponded to the 187, 197, and 207 dB SEL_{cum} for the number of strikes required to drive the pile. The other sound data plotted in this Figure were not used here. Using Equation 2, the SEL_{ss} required to produce a 187 dB re 1 $\mu Pa^2 \cdot s$ SEL_{cum} after 230 strikes would be 163 dB re 1 $\mu Pa^2 \cdot s$. Based on the Figure, this sound exposure level occurs at a distance of 63 ft from the pile. The yellow arrows and several data labels were added to the Figure for the purpose of illustrating how the JASCO regressions were used to estimate isopleth size.

Using the procedure just outlined and the PIDP regressions illustrated by Figure A-1, the distances to each SEL_{ss} representing the 187, 197 and 207 dB re $1\mu Pa^2 \cdot s$ SEL_{cum} were calculated for all of the 4 ft piles to be driven taking into consideration the various number of strikes necessary to drive each pile. The results of this iterative process (i.e., distances to the critical SEL_{cum} isopleths for each of the 4 ft piles) are summarized in Figure A-2. Following from the previous example for a 4 ft pile requiring 230 strikes, it is possible to determine from Figure A-2 that the distance from the pile to the SEL_{cum} of 183 dB re $1\mu Pa^2 \cdot s$ is 63 ft. This point is indicated by the yellow arrow that marks the intersection of the horizontal reference line for 187 dB re $1\mu Pa^2 \cdot s$ SEL_{cum} and the regression line (solid black) for 230 strikes. Moving up the same regression line to the intersection with the reference line for 197 dB re $1\mu Pa^2 \cdot s$ SEL_{cum}, it can be seen that the distance is approximately 35 ft for the same pile. To determine the distance to the 187 dB re $1\mu Pa^2 \cdot s$ SEL_{cum} for a greater number of strikes, one follows the horizontal reference line for 187 dB re $1\mu Pa^2 \cdot s$ SEL_{cum} to the right until it intersects the regression line corresponding to a given number of pile strikes. For example, for 1,000 strikes (blue line), the distance to the 187 dB re $1\mu Pa^2 \cdot s$ SEL_{cum} would be approximately 100 ft.

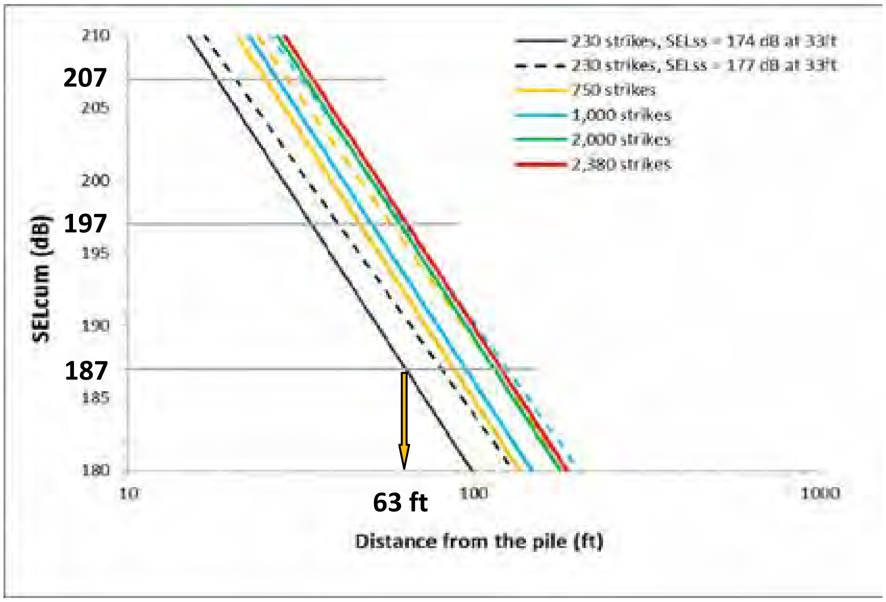

Figure A-2. – Distance from 4 ft piles to the 187, 197 and 207 dB re 1µPa^2·s SEL_{cum} (horizontal reference lines) for different numbers of strikes required to fully drive a 4 ft pile. Following the 230 pile strikes required to drive a 4 ft pile, a sturgeon present within 63 ft of the pile (yellow arrow) for the duration of the 230 strikes will have been exposed to a cumulative sound exposure level (SEL_{cum}) of 187 dB re 1 µPa^2·s or greater.

A1.1.2. 6-foot Diameter Piles

In addition to the 4 ft piles that will be driven at depths of 13 - 20 ft during bridge construction, larger 6 ft piles will be driven in deep water (20 – 40 ft). No piles were driven at these water depths during the PIDP; thus, a different approach was required to estimate the distance to the SEL_{cum} for 6 ft piles. As with the 4 ft piles, the distances from the 6 ft piles to the SEL_{cum} were calculated using empirical SEL_{ss} data collected during the PIDP for all pile sizes; however, unlike the 4 ft piles for which direct noise measurements were available, the distance to the SEL_{ss} for 6 ft piles had to be extrapolated (predicted) from the PIDP noise data.

To do this, the SEL_{ss} measured during the PIDP for all piles (regardless of pile diameter) were plotted according to the water depth at which the piles were driven, as shown in Figure A-3. Four curves were plotted for all SEL_{ss} measured at distances of 33 ft, 100 ft, 300 ft and 1,000 ft from the piles. From these curves, the SEL_{ss} at a water depth of 40 ft was extrapolated using regression as shown by the data point (triangle) at the end of each of the four curves in Figure A-3.

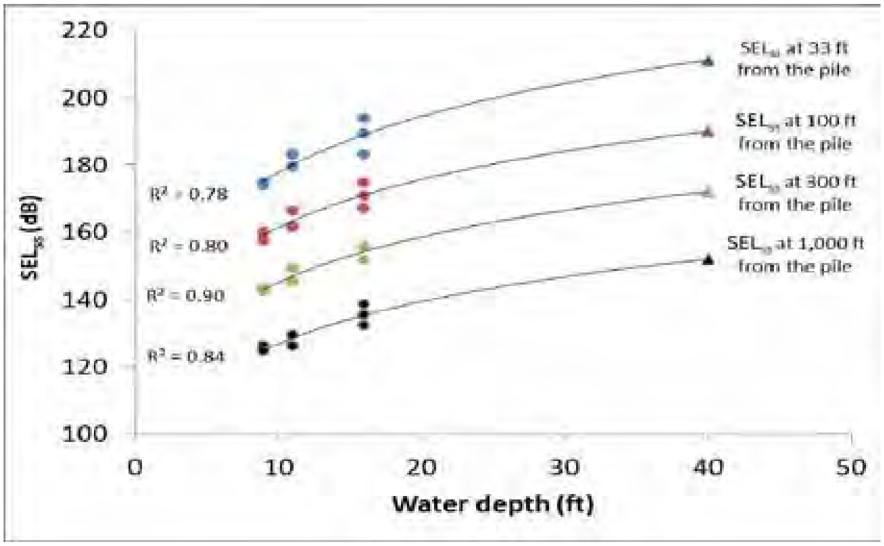

Figure A-3. – Single-strike sound exposure level (SEL_{ss}) (y-axis) was measured at a range of distances from 33 ft to 1,000 ft for piles driven in water depths of 9-16 ft (x-axis) during the PIDP. By plotting the SEL_{ss} in relation to water depth (circles), it was possible to extrapolate (predict) the SEL_{ss} for a pile driven at a water depth of 40 ft by fitting a curve to the data points. The outcome of this curve is the predicted sound levels (triangles) that would have been found at different distances from the piles driven during the PIDP if they had been driven at 40 ft depth. The R^2 value for each curve indicates how well the predicted noise values (the lines) approximate the measured noise values (circles) and range from 0 to 1 with higher values indicating better approximation. The high R^2 values for all curves indicate excellent fit in each case.

Put another way, and using one measured data point as an example, a sound level from a pile driven in 9 ft of water that has an SEL_{ss} of 177 dB re 1µPa^2·s at a distance of 33 ft from the pile (left-most blue circle) would have an SEL_{ss} of 211 dB re 1µPa^2·s at the same distance as if the pile was driven in water that was 40 ft deep (blue triangle). Thus, the four data points extrapolated at the right side of the plot (triangles) provide a means by which to predict the increase in sound levels at different distances from any pile that is driven in 40 ft of water. Because these regression relationships were created using SEL_{ss} data from a range of pile sizes (4 ft to 10 ft), and because the relationships have high predictive power (as indicated by the R^2 statistics in the Figure), the SEL_{ss} can be predicted for any of these pile sizes and across a range of water depths.

To predict the increase in SEL_{ss} level for a 6 ft pile driven in 40 ft of water, the difference in SEL_{ss} at a water depth of 16 ft vs. 40 ft was read from each of the four regression lines in Figure A-3. For example, at a distance of 33 ft from the pile (blue circles) the SEL_{ss} at water depth of 16 ft is 189 dB, while the SEL_{ss} at water depth of 40 ft is extrapolated in Figure A-3 to be 211 dB (blue triangle). Therefore, the increase in SEL_{ss} at a distance of 33 ft from a pile driven in 40 ft of water is predicted to be 22 dB greater than for the same pile driven in 16 ft of water (i.e., 211 dB – 189 dB = 22 dB).

Similarly, the SEL_{ss} was predicted to be 19 dB, 18 dB, and 16 dB at distances of 100 ft, 300 ft, and 1,000 ft, respectively.

The increased propagation of the SEL_{ss} as a result of pile driving in deeper water was approximated by adding the predicted increase of 16 – 22 dB to the SEL_{ss} levels reported by JASCO (2012) for the 8 ft PIDP pile driven in 16 ft of water as illustrated in Figure A-4. In this Figure, the original SEL_{ss} data are plotted for the 8 ft PIDP pile along with the predicted SEL_{ss} for the same 8 ft pile (with and without 10 dB BMP noise reduction) as if they had been driven at a water depth of 40 ft.

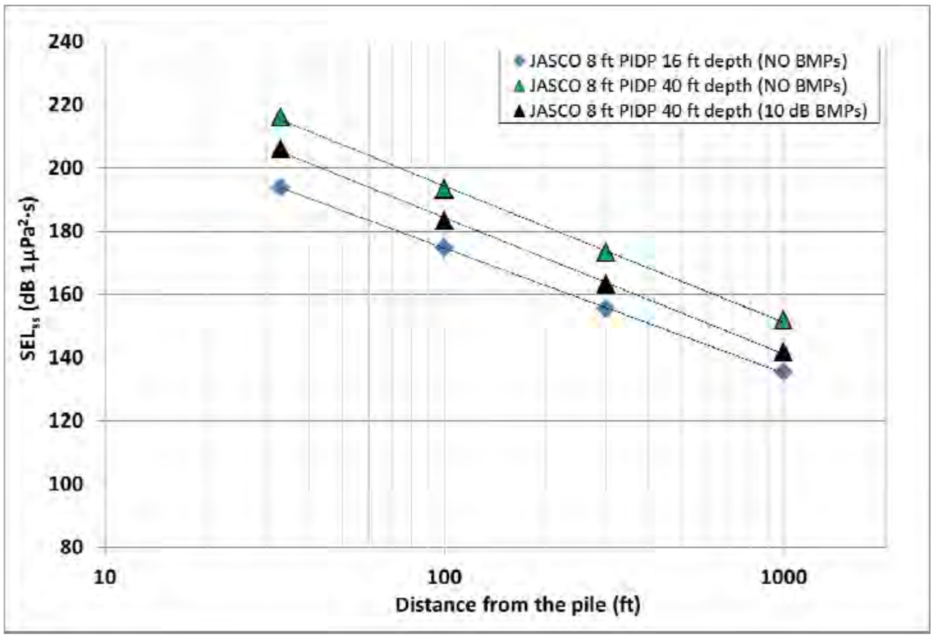

Figure A-4. – Relationship between SEL_{ss} and distance for 8 ft piles. The Figure includes the SEL_{ss} as actually measured by JASCO without BMPs at different distances from the pile in 16 ft of water. To get the SEL_{ss} at each distance for 40 ft of water the extrapolated values from Figure A-3 were added to the JASCO data to give the values without BMPs. The plot also shows the SEL_{ss} for an 8 ft pile in 40 ft of water with 10 dB BMP since all piles will be driven during construction with BMPs in place.

The predicted attenuation of SEL_{ss} for the 8 ft pile with 10 dB BMP noise reduction from Figure A-4 was then replotted in Figure A-5 to illustrate the distances to the SELss levels that would result in an SEL_{cum} of 187, 197, and 207 dB for a sturgeon that remained at that location for the 1,900 pile strikes necessary to drive the pile. These single strike levels were of 154, 164, and 174 dB respectively, as calculated using Equation 2. The curve plotted in Figure A-5 was used in the same manner as the curve plotted in Figure A-2 to estimate the distance to the SEL_{ss}.

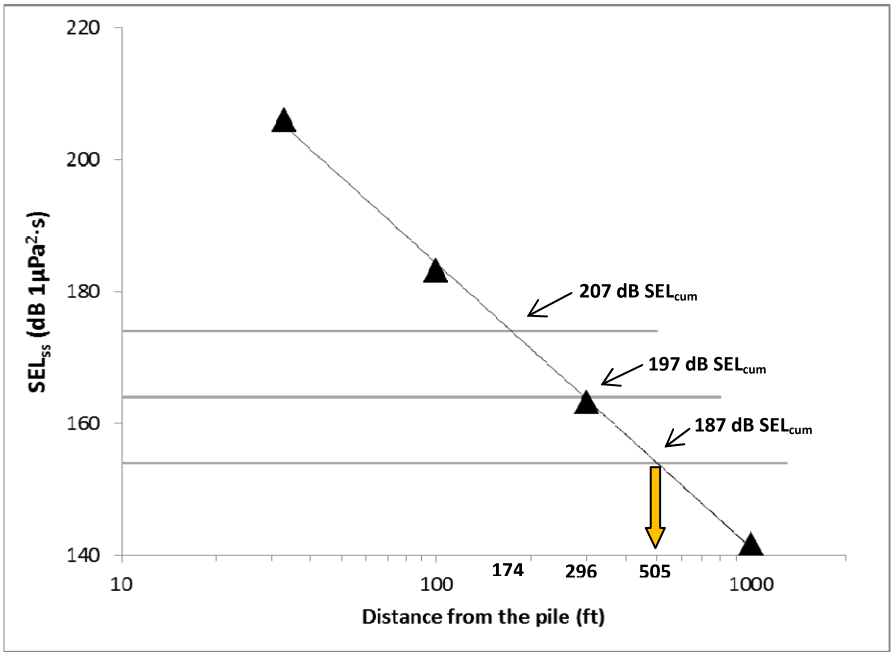

Figure A-5. – The predicted values of SEL_{ss} from an 8 ft pile driven in 40 ft of water from Figure A-4 re-plotted to illustrate a means for estimating the distance at which a stationary sturgeon would reach the onset of effects caused by cumulative sound exposure levels (SEL_{cum}) for 6 ft piles driven in 40 ft of water. A sturgeon exposed to 154, 164, and 174 dB re 1µPa^2·s SEL_{ss} (horizontal reference lines) for the 1,900 strikes required to drive the pile will experience an SEL_{cum} of 187, 197 and 207 dB re 1µPa^2·s at a distance of 505 ft, 296 ft (yellow arrow), and 174 ft, respectively.

For example, first the SEL_{ss} that would result in a 187 dB re 1µPa^2·s SEL_{cum} after 1,900 piles strikes was calculated using Equation 2, which would be 154 dB re 1µPa^2·s. The value of 154 dB re 1µPa^2·s SEL_{ss} was then located on the y-axis of Figure A-5. The horizontal reference line was followed to its intersection with the regression curve and then the value on the x-axis directly below the intersection was read as 505 ft. Similarly, an SEL_{ss} of 164 and 174 dB re 1µPa^2·s would result in 197 and 207 dB re 1µPa^2·s SEL_{cum} after 1,900 pile strikes and would occur at distances of 296 ft and 174 ft from the pile, respectively.

The predicted SEL_{ss} values for 6 ft piles were validated by comparing them to measured SEL_{ss} distances from other pile driving projects (Caltrans 2009). For example, the distance to the 154 dB re 1µPa^2·s SEL_{ss}[2] measured for 8 ft piles driven in approximately 40 ft of water during Caltrans construction of the Benicia-Martinez and San Francisco-Oakland Bay Bridges ranged from 1,400 ft to 1,640 ft. The distance to the same SEL_{ss} for a 10 ft pile driven in 49 ft of water during construction of the Richmond-San Rafael Bridge was 755 ft.[3]

[2] SEL_{ss} value reported in Caltrans (2009) was unattenuated. Therefore, the distance to 164 dB re 1µPa^2·s SEL_{ss} was used as the distance to 154 dB re 1µPa^2·s SEL_{ss} to estimate the distance to 154 dB with 10 dB BMP noise reduction in place.

[3] *Ibid.*

Given this range of measured values for SEL_{ss} and considering the larger size of the 8 ft and 10 ft piles driven during the Caltrans projects, as well as the increased BMP noise reduction observed during the PIDP (>10 dB), AKRF and Dr. Popper conclude that the estimate of 505 ft to an SEL_{ss} of 154 dB re $1\mu Pa^2 \cdot s$ was conservative for a 6 ft pile driven in 40 ft of water.

A1.2. Re-calculation of Sturgeon Take Estimates

In order to re-calculate sturgeon take, sturgeon abundance must first be estimated and then multiplied by the ensonified diameter, area or volume, depending on the dimension used to scale abundance (e.g., fish per m^3 would be multiplied with the ensonified volume to estimate take). The methods for estimating the abundance of shortnose sturgeon were identical to those outlined in Attachment 1 for the 206 dB SPL_{peak} criterion (see Attachment 1 for details). The methods used to estimate the abundance of juvenile, subadult, and adult Atlantic sturgeon are described here and are adapted from the descriptions provided in the revised BA/FEIS and the Incidental Take Permit (ITP) application for the project. Sturgeon abundance estimates used in the revised BA/FEIS and ITP are the same as those used to re-calculate sturgeon take.

A1.2.1. Atlantic Sturgeon Abundance

A1.2.1.1. Juveniles

Abundance for juvenile Atlantic sturgeon was estimated from the Utilities-sponsored Fall Shoals beam trawl survey. Because the 3-m beam trawl is not 100% efficient in collecting juvenile sturgeon, it was first necessary to develop a gear-efficiency correction factor to correct the abundance of juvenile sturgeon collected in the beam trawls. For example, if the gear efficiency is 50%, then only 50% of the sturgeon in the sampled water volume will be collected. Therefore, if 5 sturgeon are collected in the beam trawl, the gear-efficiency correction factor allows the abundance estimate to be “corrected” to account for the other 5 sturgeon (50%) that were not collected due to gear avoidance. The resulting abundance is then 10 sturgeon. The approach used to develop the gear-efficiency correction factor for juvenile Atlantic sturgeon in the beam trawl is described below.

Because of the lack of population-size estimates for juvenile Atlantic sturgeon, the population estimate developed by Bain et al. (1998, 2007) for shortnose sturgeon was used to develop a gear-efficiency correction factor for the beam trawl. The similarities in body size and overlapping habitat use between both sturgeon species during the riverine occupancy (Bain 1997) indicated that there should be no reason to expect differences in gear efficiency between species over the size range examined (<1,000-mm TL). The population estimate of 61,057 from Bain et al. (1998, 2007) is considered an accurate estimate for shortnose sturgeon as it is based on mark-recapture studies in which the size of the sample population (i.e., tagged fish) is known. The standing crop estimate for shortnose sturgeon using Fall Shoals data (unadjusted for gear efficiency) from the same time period (1994-1997) as the Bain studies were performed was 27,534 fish.

Because of differences in gear efficiency for smaller and larger sturgeon (i.e., larger sturgeon are better able to avoid collection in the trawl), juvenile sturgeon were divided into two size classes before estimating gear efficiency. The percentage of adult shortnose sturgeon (≥550-

mm TL) represented by Bain et al.'s (1998, 2007) estimate was 93%, with the remaining 7% represented by juveniles (<550-mm TL). Similarly, 90% of the shortnose sturgeon collected during the Fall Shoals survey between 1994-1997 were adults, with the remaining 10% in the size range of juveniles (<550 mm TL).

Using this information, gear efficiency was estimated for both size classes of shortnose sturgeon (<550-mm TL and ≥550-mm TL) by dividing the juvenile and adult proportions of the Fall Shoals standing crop estimate (2,753 and 24,781, respectively) by the same proportions of the Bain et al. (1997) population estimate (4,274 and 56,783, respectively). The resulting gear-efficiency correction factors were 64% for juvenile sturgeon <550-mm TL and 44% for juvenile sturgeon between 550-1,000-mm TL, meaning that juvenile Atlantic sturgeon abundances were corrected by adding the 36% and 56%, respectively, that were in the sampled volume but were not collected.

Abundance (uncorrected for gear efficiency) for riverine juvenile Atlantic sturgeon (<1,000-mm TL) was calculated using volume-corrected Atlantic sturgeon abundances from 1998-2007 Fall Shoals data stratified by sampling week, habitat (shoal, channel, bottom) and Utilities-survey river segment (e.g., Tappan Zee, Battery, Hyde Park, etc.). Abundances were interpolated for weeks that were not sampled. Weekly average abundance was then calculated for each of the 52 calendar weeks.

An examination of the Fall Shoals dataset revealed that 30% of the 233 Atlantic sturgeon collected in the Hudson River between 1998 and 2007 were ≥550-mm TL and the remaining 70% were <550-mm TL. These percentages were used to parse the weekly abundances of juvenile sturgeon into the two size classes which were then increased using the gear-efficiency correction factors of 64% for juvenile sturgeon <550-mm TL and 44% for juvenile sturgeon between 550-1,000-mm TL.

The estimated distances from the pile to the 187, 197 and 207 dB re $1\mu Pa^2\cdot s$ SEL_{cum} isopleths for the 4 ft and 6 ft piles (described above in an earlier section) were then used to estimate the area of these isopleths. These areas were combined with bathymetric data (i.e., depth) at each pile location to estimate ensonified water volumes. Knowing the ensonified volume for each week of pile driving and the corresponding mean weekly Atlantic sturgeon densities (number of sturgeon per unit-volume) it was possible to estimate the number of juvenile sturgeon expected to occur in the ensonified volume on a weekly basis over the course of bridge construction.

To estimate the total number of juvenile sturgeon within the ensonified volumes over the four years of planned bridge construction, the number of juvenile sturgeon within the ensonified area each week was summed across all weeks and divided by the number of weeks of pile driving. This average weekly number of sturgeon was then multiplied by 52 weeks in a year to determine the number of affected fish during an average construction year and multiplied by 4 years of planned pile driving to calculate the potential take for juvenile sturgeon.

A1.2.1.2. Subadults

Take for subadult Atlantic sturgeon was estimated using a similar approach to that used for shortnose sturgeon. However, instead of using the gill-net encounter rate as a measure of sturgeon abundance (as was done for shortnose sturgeon), abundance was estimated using monitoring data for acoustic-tagged Atlantic sturgeon detected by hydroacoustic receivers deployed near the Tappan Zee Bridge in April and May 2012 during the PIDP. The abundance of tagged subadult sturgeon collected near the Tappan Zee Bridge was compared to the total number of tagged Atlantic sturgeon released to estimate the additional number of untagged subadult sturgeon that may also have occurred near the Tappan Zee Bridge during the same April-May 2012 time period. The sum of tagged and untagged sturgeon per-unit-area per hr was then calculated, and this sum was the abundance used to estimate take for subadults.

To sample the abundance of tagged subadult sturgeon, three hydroacoustic receivers were deployed to detect and record the presence of acoustic-tagged sturgeon. Each receiver detected sturgeon within a range of 1,640 ft (500 m) and an area of 8,449,620 ft^2 (785,398 m^2). In total, 79 acoustic-tagged sub-adult sturgeon were detected during 636 hrs in an area of 25,348,860 ft^2 (i.e., area sampled by all three receivers).

To determine how many untagged subadult Atlantic sturgeon were in the same area during the same time period as the tagged sturgeon, it was assumed that the total number of tagged subadult sturgeon was 198 (based on tagging data from K. Dunton, State University of New York at Stony Brook). It was also assumed that the size of the Hudson River population of subadult sturgeon (tagged and untagged) was approximately 6,000 (based on the abundance of juvenile Atlantic sturgeon collected by the Utilities Fall Shoals trawl survey, and growth and mortality data reported by Kahnle et al. 2007).

If 79 of the 198 tagged sturgeon were detected during the PIDP (40% of the tagged population) and it is assumed that the ratio of tagged to untagged sturgeon was the same throughout the Hudson River, then the same percentage of the untagged population would have occurred with the tagged subadults detected during the PIDP (i.e., (6,000 subadults – 189 tagged subadults) * 40% = 2,324 untagged subadults). Summing the number of tagged and untagged sturgeon results in a total of 2,403 subadults in the area sampled by the hydroacoustic receivers. The total abundance of subadult Atlantic sturgeon per-unit-area would then equal 2,403 subadults / 25,348,860 ft^2 / 636 hrs or 1.5×10^{-7} sturgeon per ft^2 per hr.

Potential take for subadult Atlantic sturgeon was calculated by multiplying this abundance estimate by the area ensonified during pile driving and the duration of pile driving in hours. Because subadults are only present in the Hudson River from April through September (Bain 1997), take was calculated only for this time period; subadults would not be exposed to pile driving noise from October through March when they would be expected to occur in nearshore habitats of the Atlantic Ocean (Bain 1997).

A1.2.1.3. Adults

Adult population estimates for Atlantic sturgeon have been reported to be 863 spawning sturgeon (ASSRT 2007). Adults (>1,500-mm TL) migrate into the Hudson River from coastal waters to spawn beginning in April and most leave the river by August (Bain 1997, NYSDEC personal communication). Males, representing 69% of the spawning population (ASSRT 2007), enter the river during April and migrate to the spawning grounds near Hyde

Park (RM 81) and Catskill (RM 113). Female Atlantic sturgeon (31% of the spawning population) follow the migration during May and move directly to the spawning grounds. The inter-spawning interval is thought to be 3-5 years depending on the sex (Bain 1997) meaning that the estimate of 863 adult Atlantic sturgeon is likely three times the spawning population during a given year (i.e., 288 per year). The non-spawning adult population remains outside of the Hudson River in nearshore coastal habitats and would therefore not be exposed to pile driving noise within the River.

Because of their large size, spawning adult sturgeon are able to avoid collection by the beam trawl during Fall Shoals sampling. Therefore, the number of spawning adults potentially affected by pile driving noise was estimated as a function of the probability of their exposure to noise. The probability of a migrating adult Atlantic sturgeon encountering the ensonified area becomes greater as the size and duration of the ensonifed area increases. To calculate this probability, time-weighted ensonified river widths were determined by multiplying the percentage of the river width occupied by the 187, 197 and 207 dB re 1μPa^2·s SEL_{cum} isopleths by the number of pile driving hours during which the isopleths would occur in the river. For example, driving a 6 ft pile would create a 187 dB isopleth that is approximately 7% of the river width. The time required to drive all 112 of the 6 ft piles in the tower piers would be approximately 103 hours or 2.6% of the time in which spawning adults occupy the river (i.e., April 1- September 30). The product of the driving time and river width metrics equals the time-weighted ensonified river width, which accounts for both the spatial and temporal aspects of construction-related noise and thus the likelihood that adult Atlantic sturgeon would encounter the ensonifed areas. Ensonified river widths were binned into 1% width classes (from 0-7%) to calculate the total number of hours each width is expected to occur, based on the proposed construction schedule. The sum of these weighted river widths divided by the total number of hours in the spawning season for the construction period was used as the probability that a migrating adult Atlantic sturgeon would encounter the ensonified areas. This probability, expressed as a percentage, was multiplied by the number of spawning adults per year (i.e., 288) to estimate the number of adults that would encounter the ensonified area as they pass through the project area. A construction start date of September 4 was assumed based on the construction schedule for the recommended bridge design, which would coincide with the end of the spawning emigration from the river. It was also assumed that migrating adult Atlantic sturgeon could potentially encounter the ensonified area twice (i.e., once during immigration to the spawning grounds and again during emigration from the river).

A1.3. Summary of the spatial extent of the 187, 197, and 207 dB re 1 μPa^2·s SEL_{cum} ensonified areas and recalculated sturgeon take

To summarize, the distances from the pile to the 187, 197, and 207 dB re 1 μPa^2·s SEL_{cum} isopleths estimated using PIDP-measured SEL_{ss} were substantially smaller than the modeled isopleths used to develop prior sturgeon take estimates presented in the revised BA/FEIS and ITP application (Table A-1). As a result of the reduction in the size of the SEL_{cum} ensonified areas, the recalculated take estimates reported here are also lower than, or in a few cases comparable to, those presented in the revised BA/FEIS and ITP application for both the Long-Span and Short-Span Options (Table A-2).

Based on the calculated diameters of the ensonified area and the size, number and timing of piles to be driven, it is estimated that approximately 111 shortnose sturgeon and 25 Atlantic sturgeon (21 juveniles/subadults and 4 adults) could be exposed to an SEL_{cum} of 187 dB re 1μPa^2·s during the course of construction for the recommended bridge design (Table A-2). These sturgeon would be susceptible to the physiological effects associated with exposure to this level of accumulated sound but would be expected to recover fully from any stress. Because of the smaller extent of the 197 dB re 1μPa^2·s SEL_{cum} isopleths, approximately 71 shortnose sturgeon and 10 Atlantic sturgeon (7 juveniles/subadults and 3 adults) could be exposed to accumulated sound levels that may cause the onset of recoverable physical injury (e.g., auditory tissue damage, hemorrhaging).

Even fewer sturgeon would be susceptible to cumulative sound exposure levels considered by NMFS to be a very conservative level for the potential onset of mortal injury (i.e., 207 dB re 1μPa^2·s). In this case, approximately 45 shortnose sturgeon and 5 Atlantic sturgeon (3 juveniles/subadults and 2 adults) would exceed the criterion.

However, it is important to note that recently peer-reviewed experimental studies on effects of pile driving on small juvenile lake sturgeon (66 mm standard length) showed that the actual onset of physiological effects only occurs with sounds with an SEL_{cum} of 207 dB re 1μPa^2·s (Halvorsen et al. 2012b). Therefore, the criterion of SEL_{cum} used in this Appendix provides an exceptionally conservative estimate of sturgeon take compared to the take that would be estimated if the more scientifically accurate SEL_{cum} of 207 dB were used.

Moreover, at sound levels which exceed the current SEL_{cum} criterion, it is expected that sturgeon will avoid the location of pile driving and would therefore not remain long enough to reach an SEL_{cum} (criterion-level or otherwise) that would cause the potential onset of recoverable physical injury or mortal injury. The results of a previous analysis conducted by AKRF and Dr. Arthur Popper (AKRF and Popper 2012a,b) supports this view. Accordingly, the SPL_{peak} criterion should be considered the appropriate metric for assessing the potential impacts of pile driving noise on sturgeon.

Table A-1
Estimated distances from the pile to the cumulative sound exposure level (SEL_{cum}) corresponding to the potential onset of pile driving effects for sturgeon. Incidental take for sturgeon was calculated based on these distances and the resulting size of the ensonified areas.

	Potential for Onset of Physiological Effects	**Potential for Onset of Recoverable Injury**	**Potential for Onset of Mortal Injury**
	(187 dB SEL_{cum} re $1\mu Pa^2 \cdot s$)	(197 dB SEL_{cum} re $1\mu Pa^2 \cdot s$)	(207 dB SEL_{cum} re $1\mu Pa^2 \cdot s$)
Pile size	Distance from the pile to the SEL_{cum} isopleth (ft)		
4 ft piles*	63 - 132	34 - 66	18 - 34
6 ft piles**	505	296	174

Notes: *Distance for 4 ft piles was calculated using the equation: SELss = SELcum – 10 * log10(number of strikes). Values for single-strike SELss was reported by JASCO for 4 ft piles driven during the Pile Installation Demonstration Project (PIDP). Number of strikes required to drive the pile were given in the recommended bridge design plan and varied by pile location.
**Distance for 6 ft piles was extrapolated from regressions of SELss and water depth data collected during the PIDP to predict distance to the appropriate SELss for piles driven in deep water (20-40 ft), which was not conducted during the PIDP. Distance to the SELcum was then calculated as for 4 ft piles.

Table A-2
Total numbers of sturgeon that may occur in ensonified areas exceeding the cumulative sound exposure level of 187, 197, or 207 dB SEL_{cum} re 1μPa^2·s. Take estimates have been revised based on the new bridge construction schedule (including PIDP 2) and noise data collected during the Pile Installation Demonstration Project (PIDP). Revised estimates are compared to those presented in the revised Biological Assessment and FEIS.

Species	**Life Stage**	**Potential for Onset of Physiological Effects (187 dB SEL_{cum} re 1μPa^2·s)**			**Potential for Onset of Recoverable Injury (197 dB SEL_{cum} re 1μPa^2·s)**			**Potential for Onset of Mortal Injury (207 dB SEL_{cum} re 1μPa^2·s)**		
		BA/FEIS		Revised	BA/FEIS		Revised	BA/FEIS		Revised
		Short Span	Long Span		Short Span	Long Span		Short Span	Long Span	
Shortnose sturgeon	Juvenile/Adult	796	603	**111**	298	218	**71**	89	67	**45**
Atlantic sturgeon	Juvenile/Subadult	193-252	158-303	**21**	113-116	93-141	**7**	49-50	40-57	**3**
	Adult	10-27	4-10	**4**	4-13	2-5	**3**	0-5	0-3	**2**

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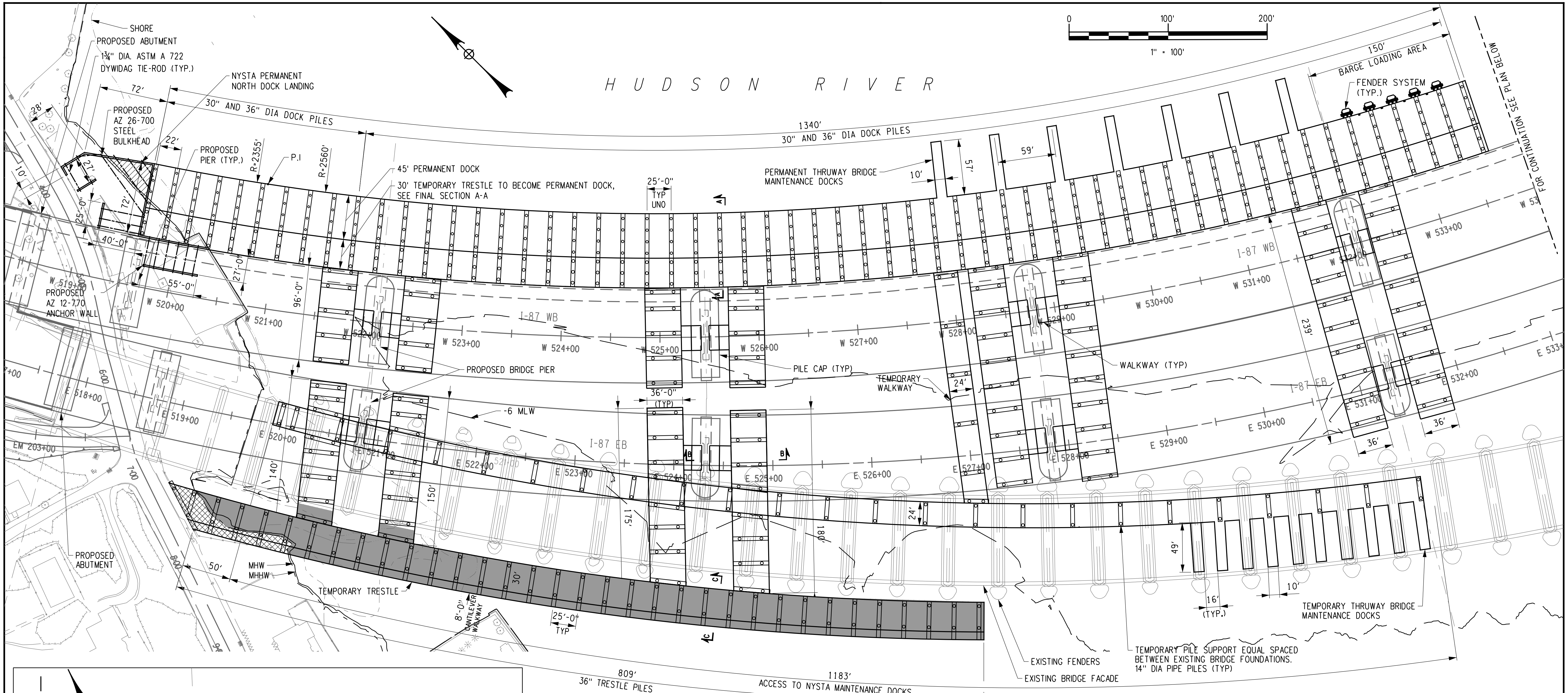
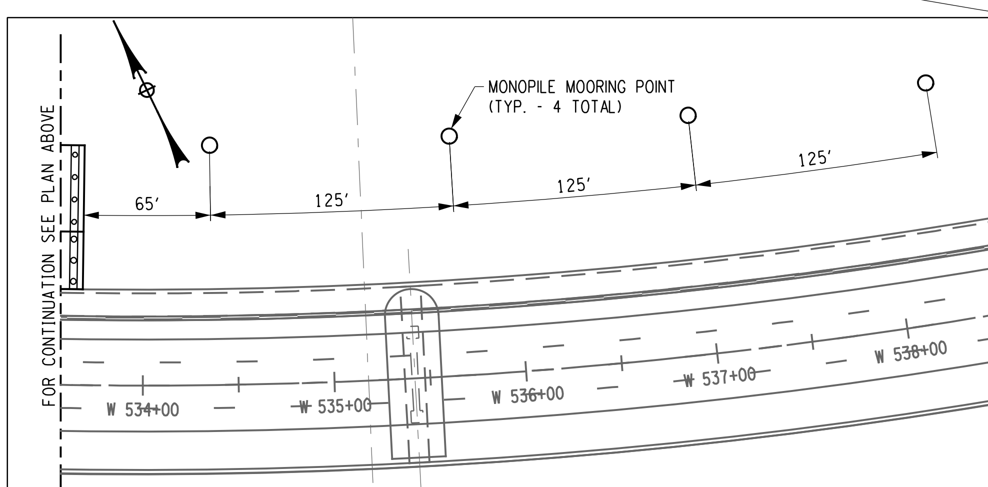
Attachment 2: Engineering Drawings

a) Trestle Drawings

b) Dredge Drawings

c) JPA Drawings





LEGEND:

- MHHW = EL. +2.02' (NAVD88)
- MHW = EL. +1.76' (NAVD88)
- -6 MLW = EL. -7.69' (NAVD88)
- AREA IN NYSDEC TIDAL WETLANDS
- NYSDEC TIDAL WETLANDS ADJACENT AREA
- AREA IN NYSDEC OPEN WATERS

REFERENCE LEGEND:

FOR SECTION A-A SEE TYPICAL PILE BENT DRAWING
FOR SECTION B-B SEE TYPICAL PILE BENT DRAWING
FOR SECTION C-C SEE TYPICAL PILE BENT DRAWING

ESTIMATED PERMANENT FILL IN NYSDEC OPEN WATERS

	FILL AREA (SQ. FT.)	FILL VOLUME (CU. YD.)
NYSTA PERMANENT MAINTENANCE DOCK LANDING	1,000	500

DRAWING FOR PERMIT ONLY
NOT FOR CONSTRUCTION

ESTIMATED QUANITY INFORMATION TABLE

	DIAMETER PILES			PILE AREA (SQ. FT.)	DECK AREA (SQ. FT.)
	36"	30"	14"		
NYSTA PERMANENT NORTH DOCK	291	228		4,136	150,000
TEMPORARY WALKWAY	12			85	5,700
TEMPORARY SOUTH TRESTLE	131			926	50,000
NYSTA TEMPORARY DOCK			50	53	35,000

ESTIMATED QUANTITY IN NYSDEC TIDAL WETLANDS

	DIAMETER PILES			PILE AREA (SQ. FT.)	DECK AREA (SQ. FT.)
	36"	30"	14"		
TEMPORARY SOUTH TRESTLE	64			452	30,500

ESTIMATED QUANTITY IN NYSDEC TIDAL WETLANDS ADJACENT AREA

	DIAMETER PILES			PILE AREA (SQ. FT.)	DECK AREA (SQ. FT.)
	36"	30"	14"		
TEMPORARY SOUTH TRESTLE	7			49	220

PROJECT MANAGER / CHECK / DRAFTING / CHECK / DESIGN / JOB MANAGER / DESIGN SUPERVISOR

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NEW YORK STATE THRUWAY AUTHORITY

TAPPAN ZEE CONSTRUCTORS
A Consortium of Fluor, American Bridge, Granite, and Traylor Bros.

REVISIONS
DESCRIPTION OF ALTERATIONS:
0 PERMIT SUBMISSION 11/21/12

TAPPAN ZEE
HUDSON RIVER CROSSING
COUNTY: ROCKLAND/WESTCHESTER

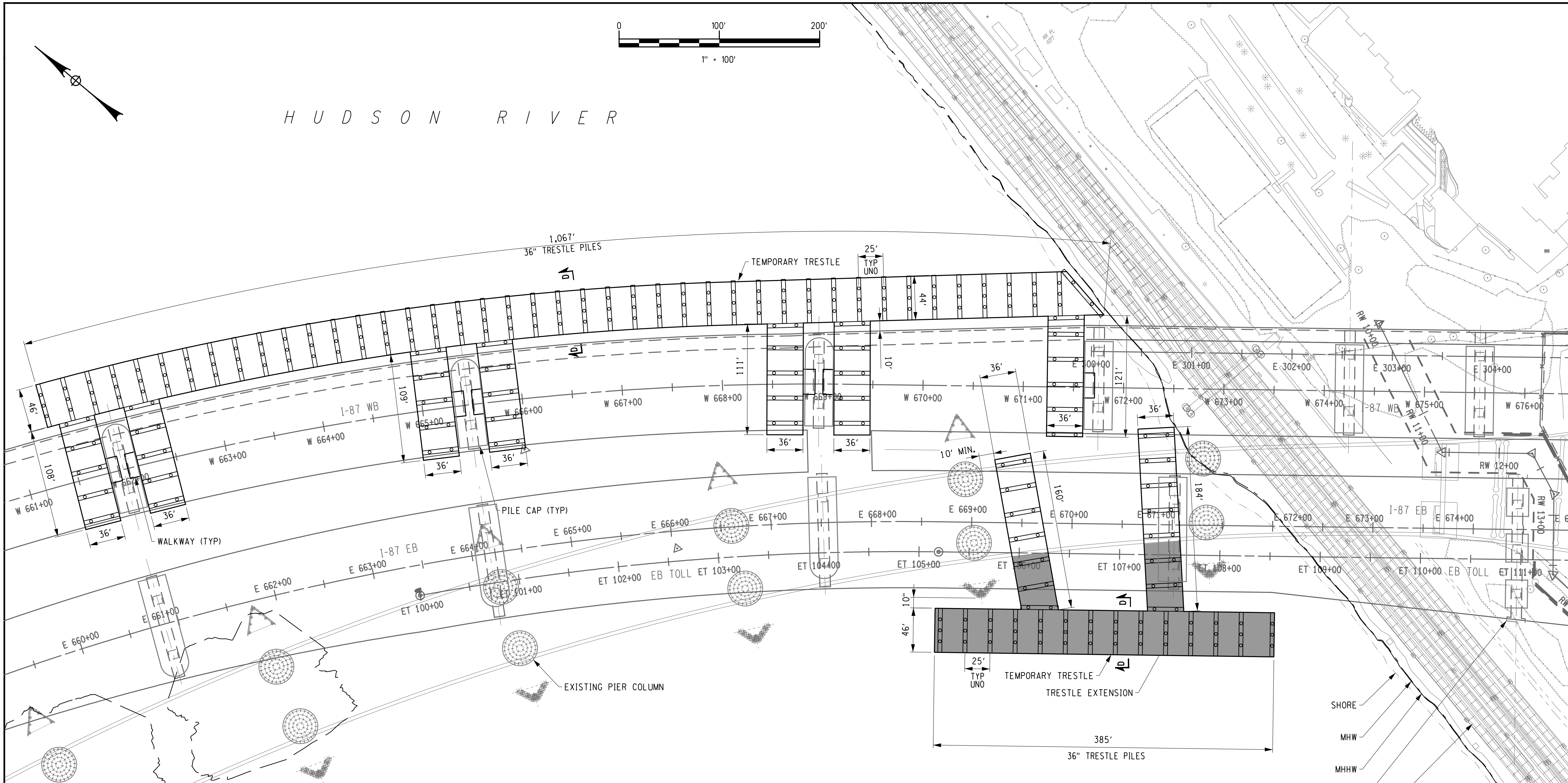
PIN 8TZ100
BRIDGES
CULVERTS

ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED

TAPPAN ZEE DOCK FACILITY
PERMANENT DOCK PRELIMINARY DESIGN
PARTIAL GENERAL PLAN - SHEET 1 OF 2

CONTRACT NUMBER D214134
DRAWING NO. MFA-RL-001
SHEET NO. 1 OF 9

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 08
DOCUMENT NAME: MFA-RL-001.dgn



LEGEND:

- MHHW = EL. +2.02' (NAVD88)
- MHW = EL. +1.76' (NAVD88)
- -6 MLW = EL. -7.69' (NAVD88)
- AREA IN NYSDEC TIDAL WETLANDS

DRAWING FOR PERMIT ONLY
NOT FOR CONSTRUCTION

ESTIMATED QUANITY INFORMATION TABLE			
	DIAMETER PILES 36"	PILE AREA (SQ. FT.)	DECK AREA (SQ. FT.)
TEMPORARY NORTH TRESTLE	200	1,414	80,000
TEMPORARY SOUTH TRESTLE	72	509	32,000

ESTIMATED AREA IN NYSDEC TIDAL WETLANDS			
	36" DIAMETER PILES	PILE AREA (SQ. FT.)	DECK AREA (SQ. FT.)
TEMPORARY SOUTH TRESTLE	54	382	19,400

REFERENCE LEGEND:

FOR SECTION D-D SEE TYPICAL PILE BENT DRAWING

PROJECT MANAGER
CHECK
DRAFTING
CHECK
DESIGN
JOB MANAGER
DESIGN SUPERVISOR

FILE NAME = c:\pwworking\pitt\d0694047\MFA-RL-002.dgn
DATE/TIME = 12-12-2012 11:18:09 AM
USER = hshn

NEW YORK STATE THRUWAY AUTHORITY

TAPPAN ZEE CONSTRUCTORS
A Consortium of Fluor, American Bridge, Granite, and Traylor Bros.

REVISIONS
DESCRIPTION OF ALTERATIONS:
0 PERMIT SUBMISSION 11/21/12

TAPPAN ZEE
HUDSON RIVER CROSSING
COUNTY: ROCKLAND/WESTCHESTER

PIN 8TZ100
BRIDGES
CULVERTS

ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED

TAPPAN ZEE DOCK FACILITY
PERMANENT DOCK PRELIMINARY DESIGN
PARTIAL GENERAL PLAN - SHEET 2 OF 2

CONTRACT NUMBER D214134
DRAWING NO. MFA-RL-002
SHEET NO. 2 OF 9

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 08
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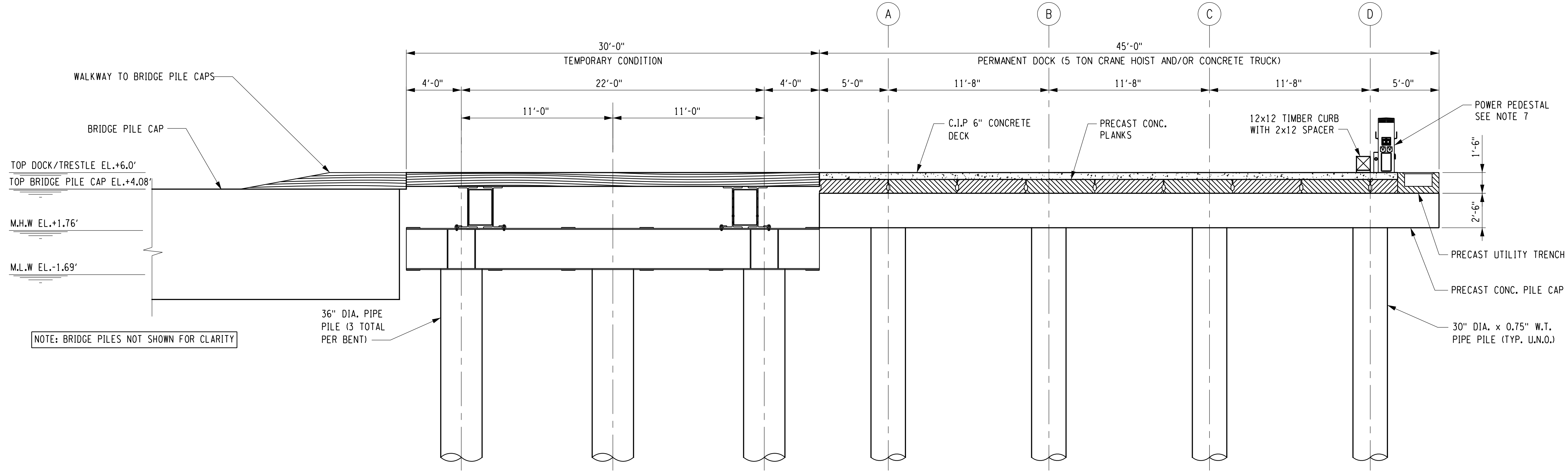
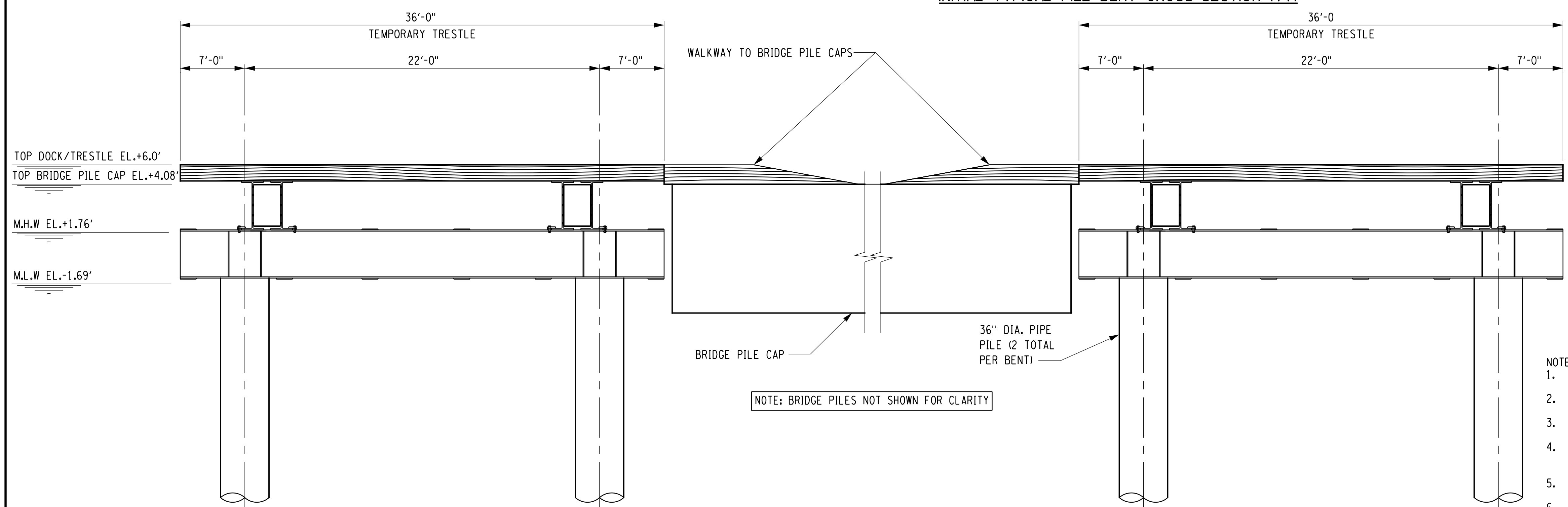


INITIAL TYPICAL PILE BENT CROSS-SECTION A-A



TYPICAL PILE BENT CROSS-SECTION B-B

DRAWING FOR PERMIT ONLY
NOT FOR CONSTRUCTION

NOTES:
1. ELEVATIONS REFERENCE NAVD88.
2. PILE CAP TO BE PRECAST 30"x48" PRECAST CONCRETE.
3. PRECAST PLANKS TO BE 12" THICK WITH 6" STRUCTURAL TOPPING FOR DECK.
4. PILE CAPACITY: ALLOWABLE = 235 TONS
   ULTIMATE = 705 TONS SF=3
5. SECTION FOR PIER BETWEEN STATIONS 525+0 TO 540+0.
6. LENGTH OF PILE 180' LONG.
7. 25' BENT SPACING.
8. POWER PEDESTALS SHALL BE ADMIRAL-SS 14 INCH MODEL AS MANUFACTURED BY MARINA PC (800-723-8009). POWER PEDESTALS SHALL BE INSTALLED AT 100 FOOT SPACING ALONG T HEAD OF EACH VESSEL SLIP. 18 PEDESTALS ARE ESTIMATED.

PROJECT MANAGER
CHECK A. D. SLEICHER
DRAFTING R. BUZETA
CHECK A. D. SLEICHER
DESIGN A. MORA
JOB MANAGER
DESIGN SUPERVISOR

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USER = hshn

TAPPAN ZEE CONSTRUCTORS
A Consortium of Fluor, American Bridge, Granite, and Traylor Bros.

REVISIONS DESCRIPTION OF ALTERATIONS:	
0 PERMIT SUBMISSION	11/21/12

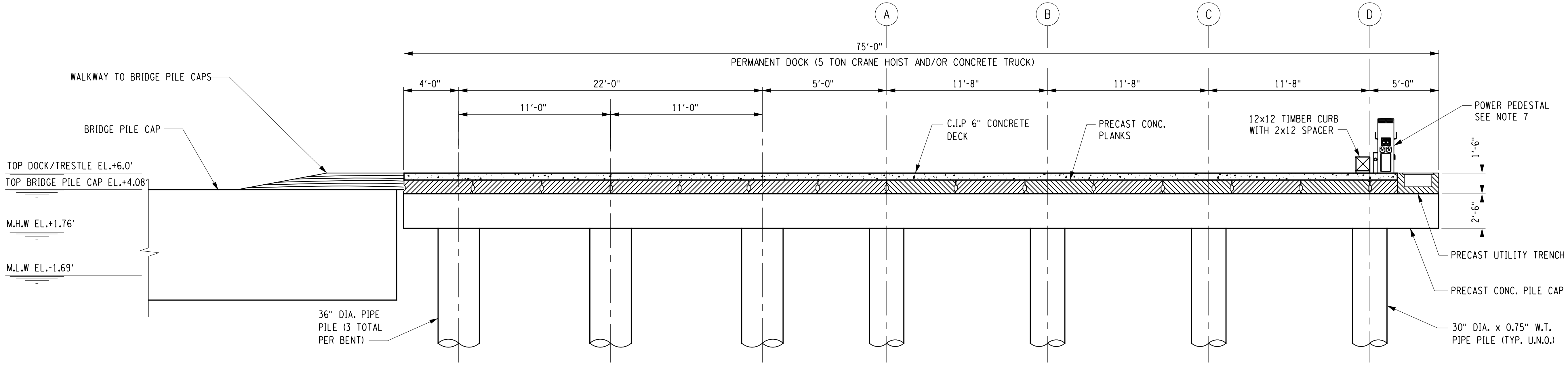
TAPPAN ZEE
HUDSON RIVER CROSSING
COUNTY: ROCKLAND/WESTCHESTER

PIN: 8TZ100
BRIDGES
CULVERTS

ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED
TAPPEN ZEE DOCK FACILITY
PERMANENT DOCK PRELIMINARY DESIGN
TYPICAL PILE BENT

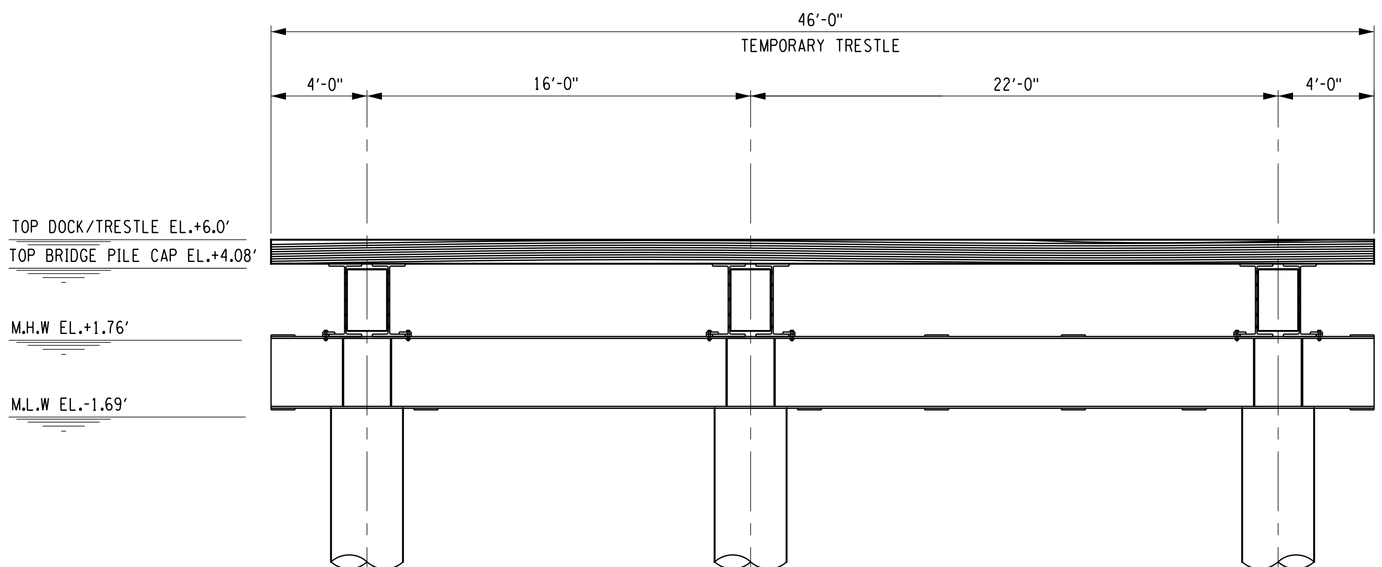
CONTRACT NUMBER D214134
DRAWING NO. MFA-RL-003
SHEET NO. 3 OF 9

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 08
DOCUMENT NAME: MFA-RL-003.dgn



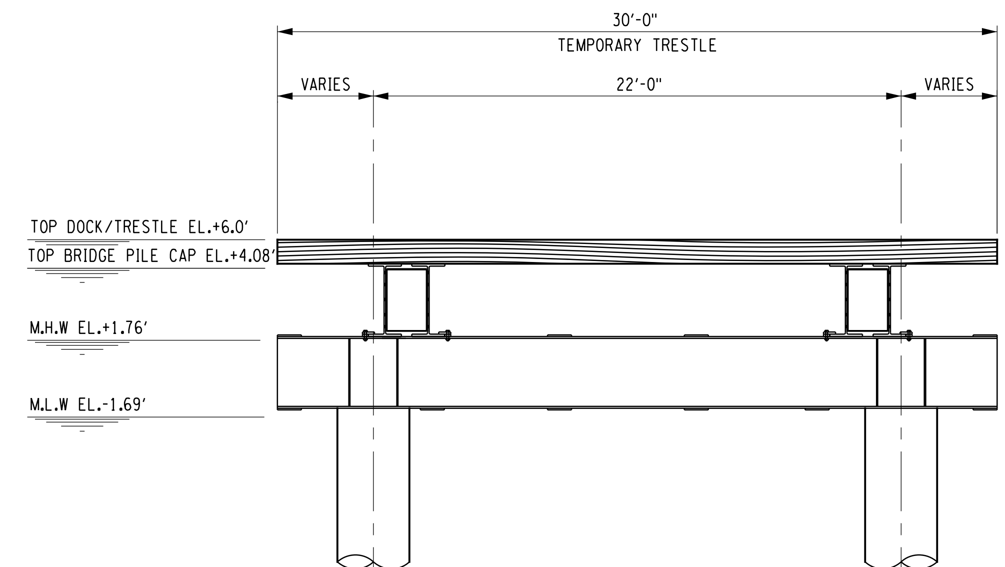
NOTE: BRIDGE PILES NOT SHOWN FOR CLARITY

FINAL TYPICAL PILE BENT CROSS-SECTION A-A



TYPICAL TEMPORARY TRESTLE CROSS-SECTION D-D

1/8"=1'-0"



TYPICAL TEMPORARY TRESTLE CROSS-SECTION C-C

1/8"=1'-0"

DRAWING FOR PERMIT ONLY
NOT FOR CONSTRUCTION

NOTES:
1. ELEVATIONS REFERENCE NAVD88.
2. PILE CAP TO BE PRECAST 30"x48" PRECAST CONCRETE.
3. PRECAST PLANKS TO BE 12" THICK WITH 6" STRUCTURAL TOPPING FOR DECK.
4. PILE CAPACITY: ALLOWABLE = 235 TONS
   ULTIMATE = 705 TONS SF=3
5. SECTION FOR TRESTLE AND PIER BETWEEN STATIONS 520+0 TO 525+0.
6. LENGTH OF PILE VARIES BETWEEN 30' LONG TO 120' LONG.
7. 25' BENT SPACING.
8. POWER PEDESTALS SHALL BE ADMIRAL-SS 14 INCH MODEL AS MANUFACTURED BY MARINA POWER AND LIGHTING, INC. (800-723-8009). POWER PEDESTALS SHALL BE INSTALLED AT 100 FOOT SPACING ALONG THE PIER AND AT THE HEAD OF EACH VESSEL SLIP. 18 PEDESTALS ARE ESTIMATED.

REVISIONS DESCRIPTION OF ALTERATIONS: 0 PERMIT SUBMISSION 11/21/12	TAPPAN ZEE HUDSON RIVER CROSSING COUNTY: ROCKLAND/WESTCHESTER	PIN 8TZ100	BRIDGES	CULVERTS	ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED TAPPEN ZEE DOCK FACILITY PERMANENT DOCK PRELIMINARY DESIGN TYPICAL PILE BENT	CONTRACT NUMBER D214134 DRAWING NO. MFA-RL-004 SHEET NO. 4 OF 9

NEW YORK STATE THRUWAY AUTHORITY

TAPPAN ZEE CONSTRUCTORS
A Consortium of Fluor, American Bridge, Granite, and Traylor Bros.

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 08
DOCUMENT NAME: MFA-RL-004.dgn

PROJECT MANAGER
CHECK A. D. SLEICHER
DRAFTING R. BUZETA
CHECK A. D. SLEICHER
DESIGN A. MORA
JOB MANAGER
DESIGN SUPERVISOR

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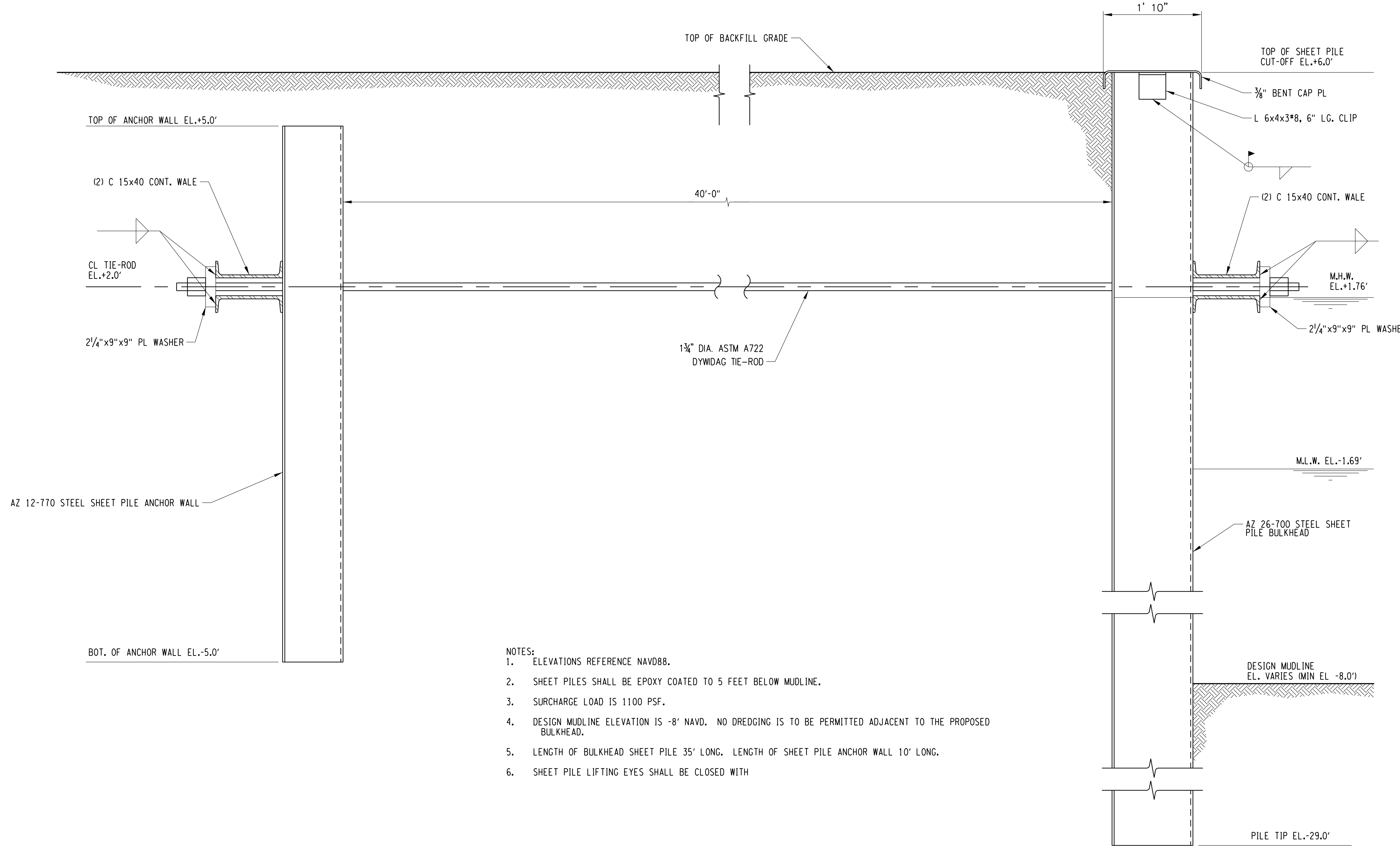

NOTES:
1. ELEVATIONS REFERENCE NAVD88.
2. SHEET PILES SHALL BE EPOXY COATED TO 5 FEET BELOW MUDLINE.
3. SURCHARGE LOAD IS 1100 PSF.
4. DESIGN MUDLINE ELEVATION IS -8' NAVD. NO DREDGING IS TO BE PERMITTED ADJACENT TO THE PROPOSED BULKHEAD.
5. LENGTH OF BULKHEAD SHEET PILE 35' LONG. LENGTH OF SHEET PILE ANCHOR WALL 10' LONG.
6. SHEET PILE LIFTING EYES SHALL BE CLOSED WITH

TYPICAL BULKHEAD SECTION
1/2"=1'-0"

DRAWING FOR PERMIT ONLY
NOT FOR CONSTRUCTION

PROJECT MANAGER: A. D. SLEICHER
CHECK: R. BUZETA
DRAFTING: A. D. SLEICHER
CHECK: A. MORA
DESIGN
JOB MANAGER
DESIGN SUPERVISOR

FILE NAME : c:\pwworking\pitt\d0694047\MFA-RL-005.dgn
DATE/TIME : 12-12-2012 11:18:29 AM
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NEW YORK STATE THRUWAY AUTHORITY

TAPPAN ZEE CONSTRUCTORS
A Consortium of Fluor, American Bridge, Granite, and Traylor Bros.

REVISIONS
DESCRIPTION OF ALTERATIONS:
0 PERMIT SUBMISSION 11/21/12

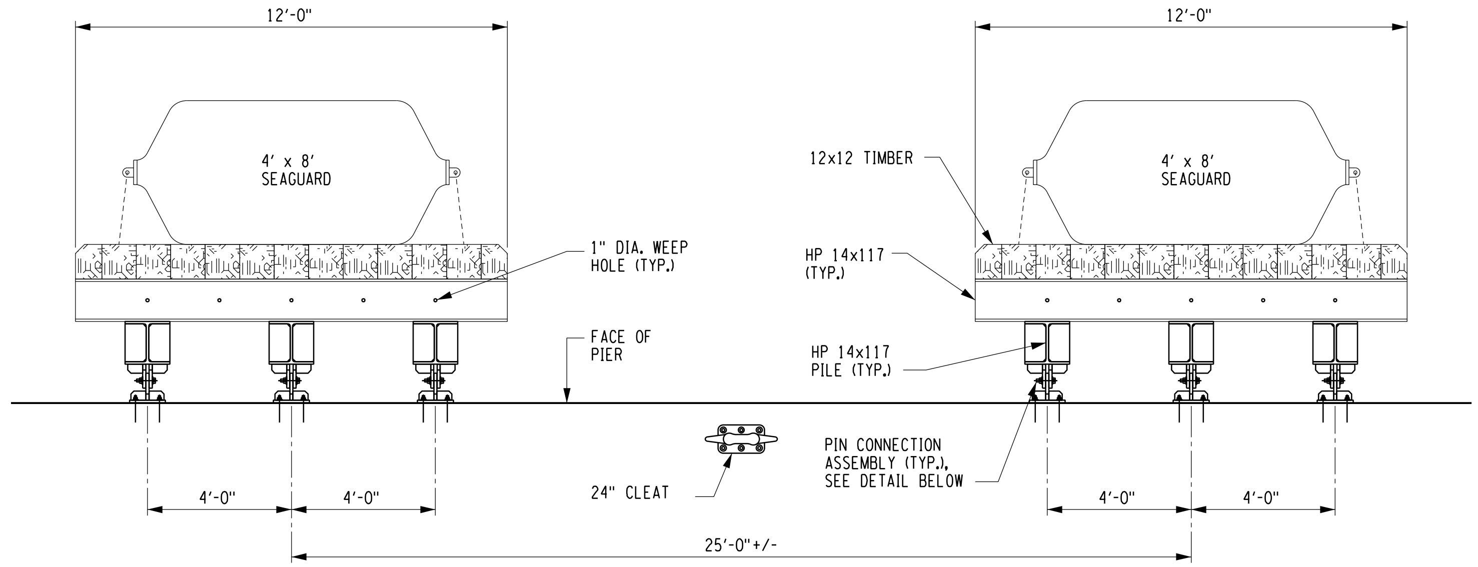
TAPPAN ZEE
HUDSON RIVER CROSSING
COUNTY: ROCKLAND/WESTCHESTER

PIN 8TX100
BRIDGES
CULVERTS

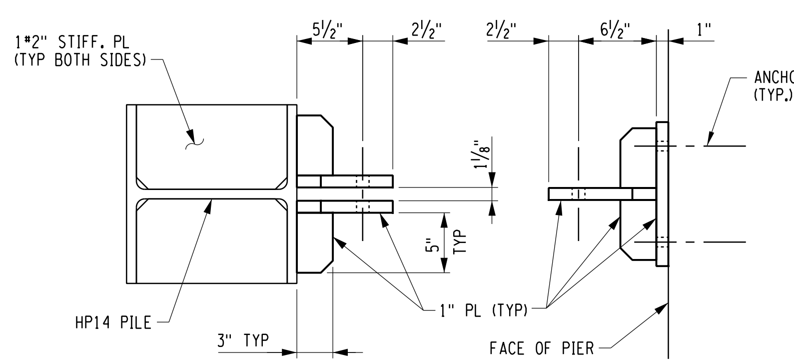
ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED
TAPPAN ZEE DOCK FACILITY
PERMANENT DOCK PRELIMINARY DESIGN
TYPICAL STEEL BULKHEAD SECTION

CONTRACT NUMBER D214134
DRAWING NO. MFA-RL-005
SHEET NO. 5 OF 9

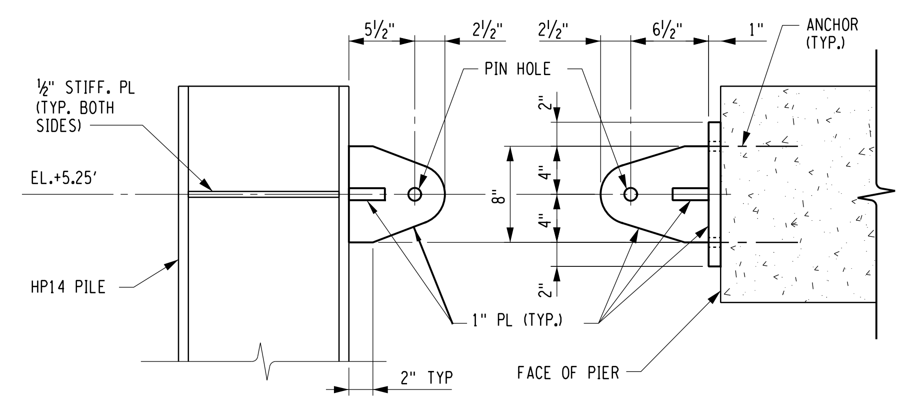
NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 08
DOCUMENT NAME: MFA-RL-005.dgn



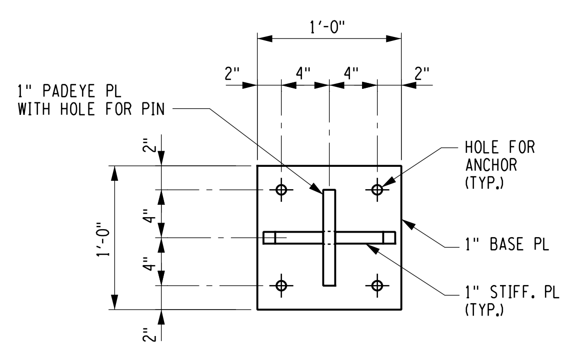
PARTIAL PLAN - FENDER ARRANGEMENT
3/16"=1'-0"



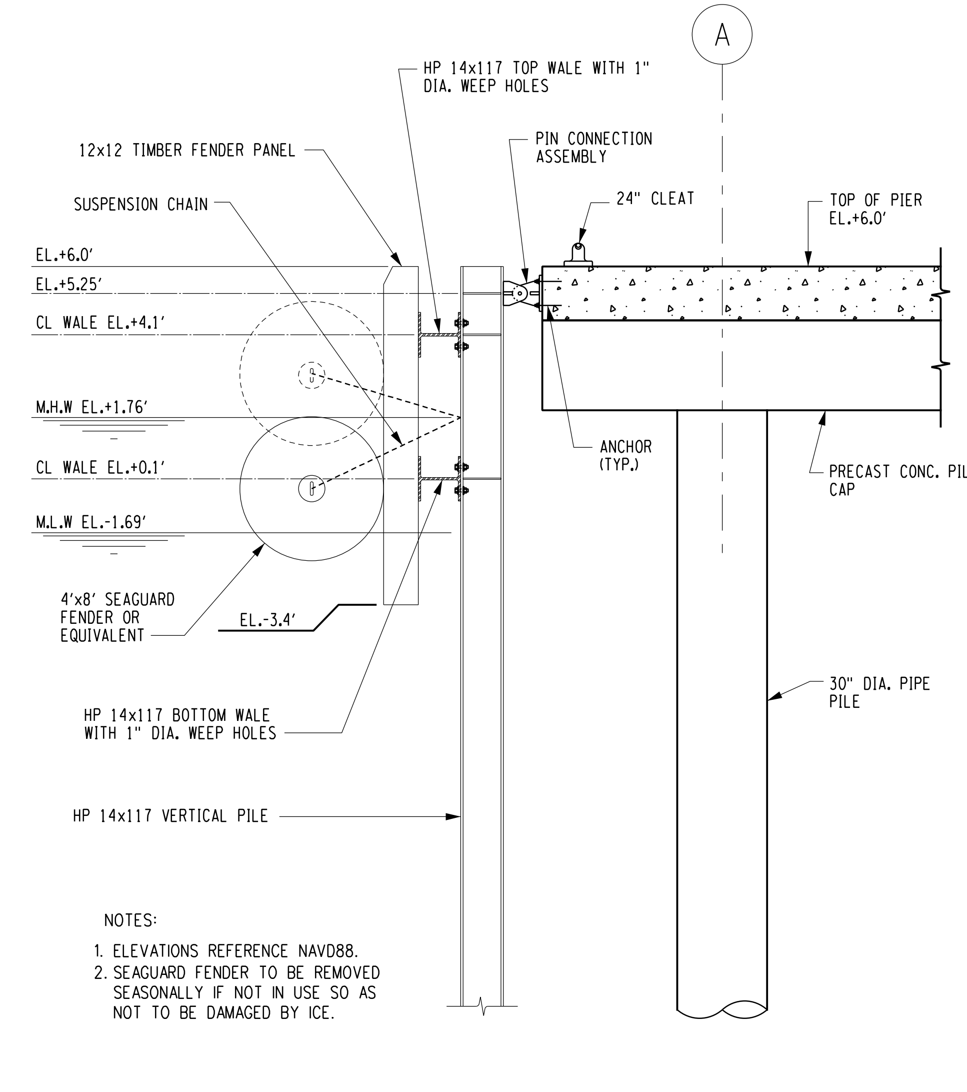
PLAN - FENDER PILE PIN CONNECTION ASSEMBLY
3/4"=1'-0"



ELEVATION - FENDER PILE PIN CONNECTION ASSEMBLY
3/4"=1'-0"



ELEVATION - PADEYE BASE PL
3/4"=1'-0"



NOTES:
1. ELEVATIONS REFERENCE NAVD88.
2. SEAGUARD FENDER TO BE REMOVED SEASONALLY IF NOT IN USE SO AS NOT TO BE DAMAGED BY ICE.

TYPICAL FENDER SYSTEM CROSS-SECTION
3/16"=1'-0"

DRAWING FOR PERMIT ONLY
NOT FOR CONSTRUCTION

PROJECT MANAGER
CHECK A. D. SLEICHER
DRAFTING R. BUZETA
CHECK A. D. SLEICHER
DESIGN A. MORA
JOB MANAGER
DESIGN SUPERVISOR

FILE NAME = c:\pwworking\ptti\d0594047\MFA-RL-006.dgn
DATE/TIME = 12-12-2012 11:18:37 AM
USER = hshin

NEW YORK STATE THRUWAY AUTHORITY

TAPPAN ZEE CONSTRUCTORS
A Consortium of Fluor, American Bridge, Granite, and Traylor Bros.

REVISIONS
DESCRIPTION OF ALTERATIONS:
0 PERMIT SUBMISSION 11/21/12

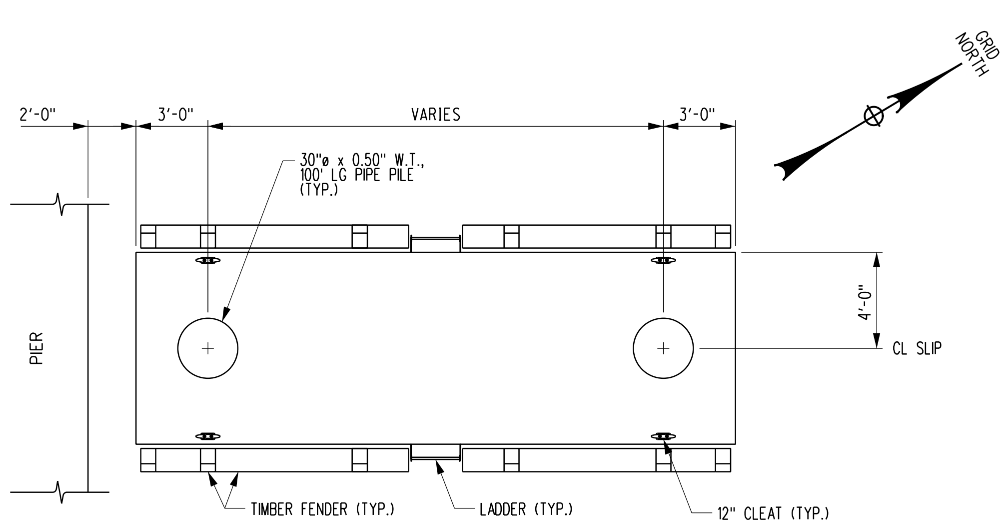
TAPPAN ZEE
HUDSON RIVER CROSSING
COUNTY: ROCKLAND/WESTCHESTER

PIN 8TZ100
BRIDGES
CULVERTS

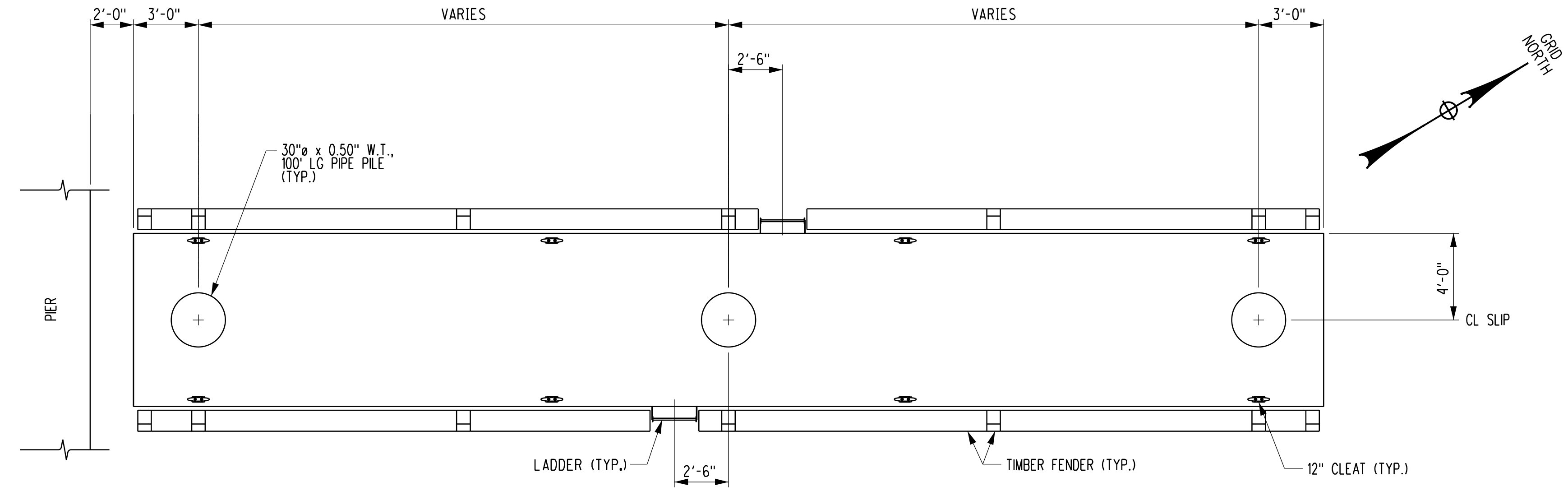
ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED
TAPPAN ZEE DOCK FACILITY
PERMANENT DOCK PRELIMINARY DESIGN
TYPICAL BARGE BERTH FENDER SYSTEM

CONTRACT NUMBER D214134
DRAWING NO. MFA-RL-006
SHEET NO. 6 OF 9

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 08
DOCUMENT NAME: MFA-RL-006.dgn



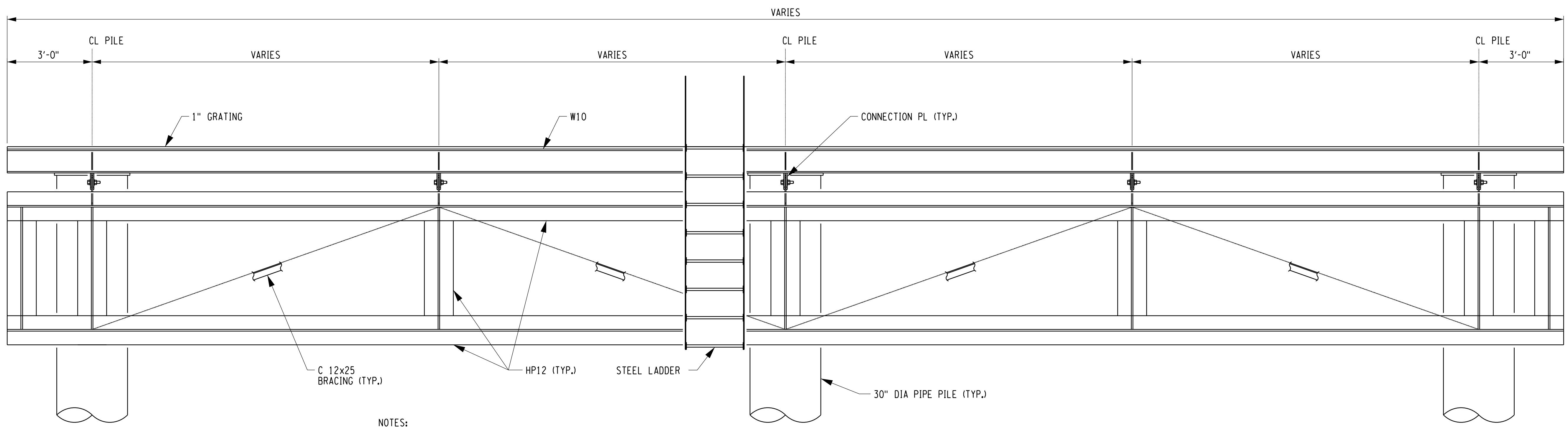
SHORT SLIP



LONG SLIP

TYPICAL SLIP PILE PLANS

1/8"=1'-0"



NOTES:

1. STEEL ASSEMBLY SHALL BE EPOXY COATED.
2. MOUNT TIMBER (NOT SHOWN) ON STEEL MEMBERS.
3. CUT TIMBERS AT LADDER LOCATIONS.
4. PROVIDE TWO STEEL LADDERS PER SLIP.

TYPICAL FRAMING ELEVATION

1/4"=1'-0"

DRAWING FOR PERMIT ONLY
NOT FOR CONSTRUCTION

PROJECT MANAGER
CHECK A. D. SLEICHER
DRAFTING R. BUZETA
CHECK A. D. SLEICHER
DESIGN A. MORA
JOB MANAGER
DESIGN SUPERVISOR

FILE NAME : c:\pwworking\ptt\d0694047\MFA-RL-007.dgn
DATE/TIME : 12-12-2012 11:18:43 AM
USER : hshin

NEW YORK STATE THRUWAY AUTHORITY

TAPPAN ZEE CONSTRUCTORS
A Consortium of Fluor, American Bridge, Granite, and Traylor Bros.

REVISIONS
DESCRIPTION OF ALTERATIONS:
0 PERMIT SUBMISSION 11/21/12

TAPPAN ZEE
HUDSON RIVER CROSSING
COUNTY: ROCKLAND/WESTCHESTER

PIN 8TZ100

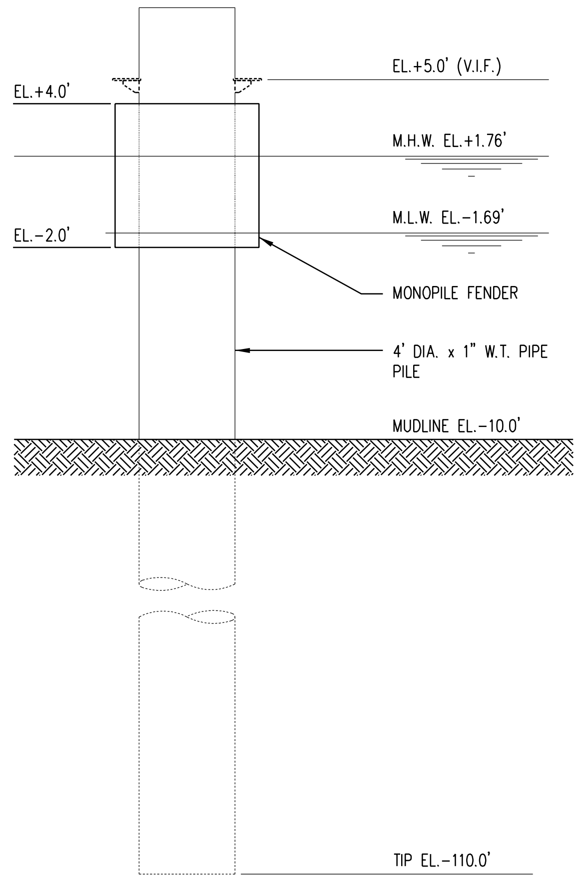
BRIDGES

CULVERTS

ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED
TAPPAN ZEE DOCK FACILITY
PERMANENT DOCK PRELIMINARY DESIGN
SLIP - TYPICAL PLANS AND FRAMING ELEVATION

CONTRACT NUMBER D214134
DRAWING NO. MFA-RL-007
SHEET NO. 7 OF 9

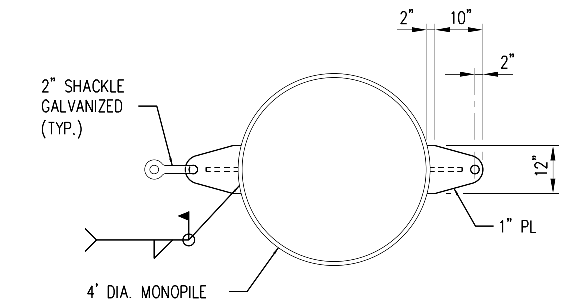
NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 08
DOCUMENT NAME: MFA-RL-007.dgn



NOTES:
1.ELEVATIONS REFERENCE NAVD88.
2. MONOPILE SHALL BE COATED TOP 40 FEET.
3.PROVIDE OPEN END CUTTING SHOE.
4.PROVIDE A MIN. PILE EMBEDMENT OF 100 FEET.

MOORING POINTS - MONOPILES

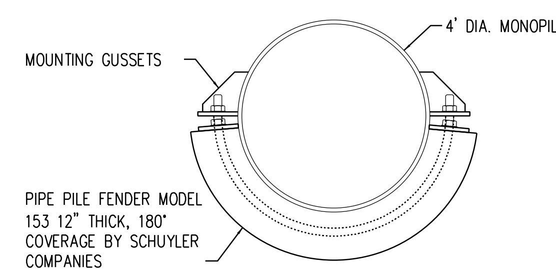
1/8"=1'-0"



NOTE: LOCATE MOORING ASSEMBLIES AT REQUIRED ELEVATIONS.

MOORING ASSEMBLY

1/4"=1'-0"



NOTE: MOUNT FENDER FROM EL.+4.0' TO EL.-2.0'

MONOPILE FENDER DETAIL

1/4"=1'-0"

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PROJECT MANAGER
CHECK A. D. SLEICHER
DRAFTING R. BUZETA
CHECK A. D. SLEICHER
DESIGN A. MORA
JOB MANAGER
DESIGN SUPERVISOR

FILE NAME : c:\pwworking\pitt\d0594047\MFA-RL-008.dgn
DATE/TIME : 12-12-2012 11:18:52 AM
USER : hshin

NEW YORK STATE THRUWAY AUTHORITY

TAPPAN ZEE CONSTRUCTORS
A Consortium of Fluor, American Bridge, Granite, and Traylor Bros.

REVISIONS
DESCRIPTION OF ALTERATIONS:
0 PERMIT SUBMISSION 11/21/12

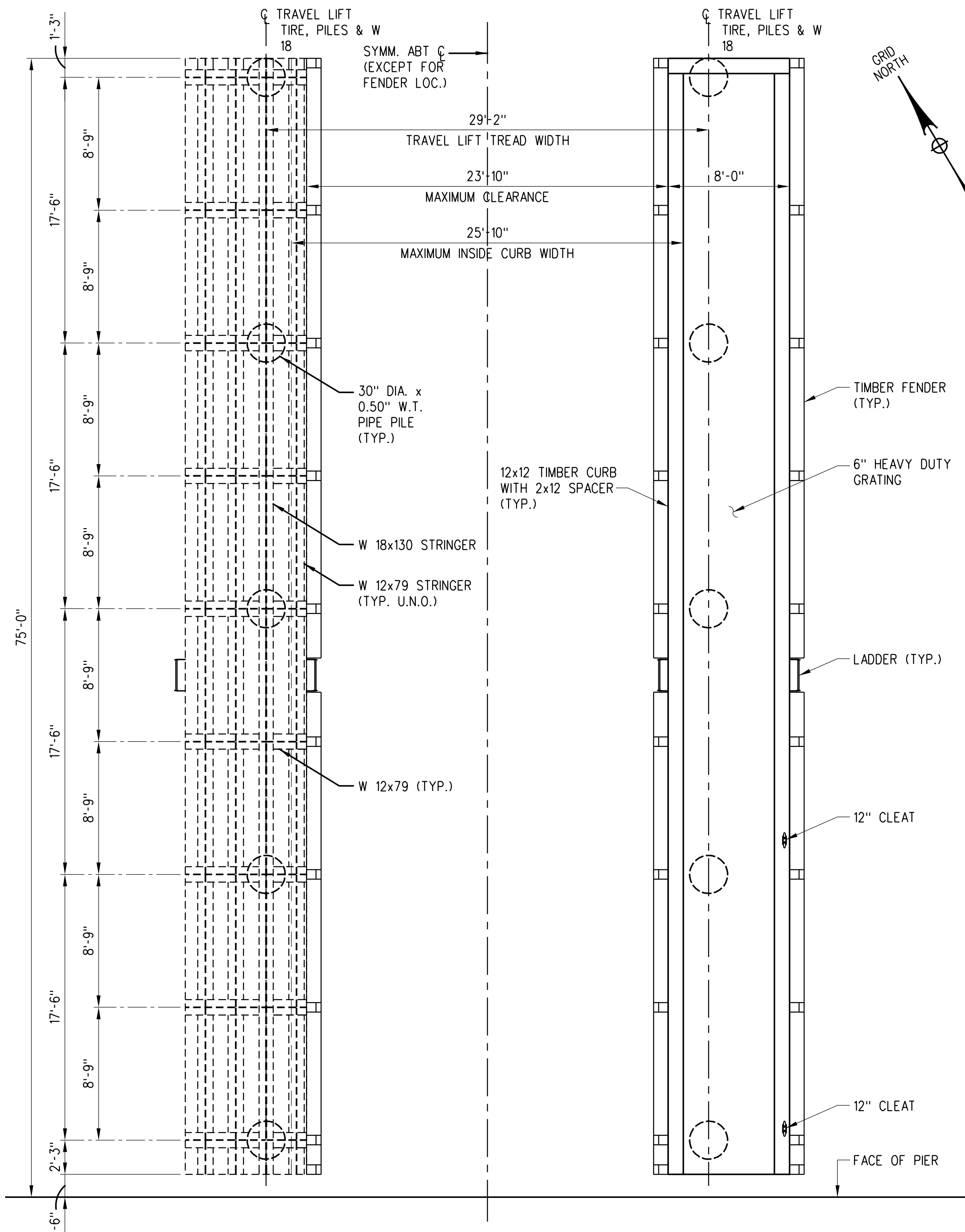
TAPPAN ZEE
HUDSON RIVER CROSSING
COUNTY: ROCKLAND/WESTCHESTER

PIN	BRIDGES	CULVERTS
8TZ100		

ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED
TAPPAN ZEE DOCK FACILITY
PERMANENT DOCK PRELIMINARY DESIGN
MOORING POINTS - MONOPILE

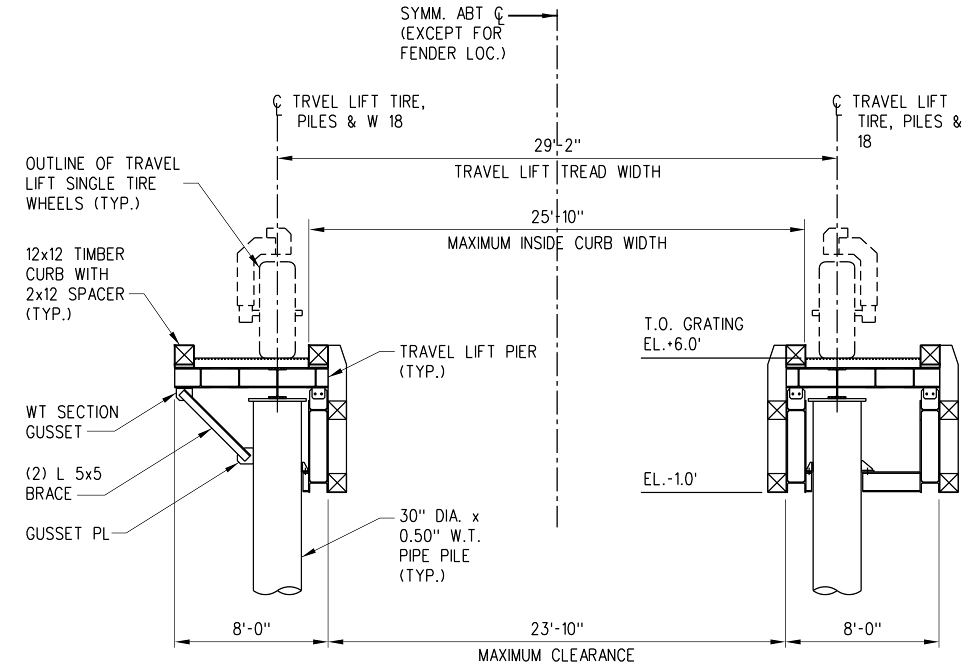
CONTRACT NUMBER D214134
DRAWING NO. MFA-RL-008
SHEET NO. 8 OF 9

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 08
DOCUMENT NAME: MFA-RL-008.dgn



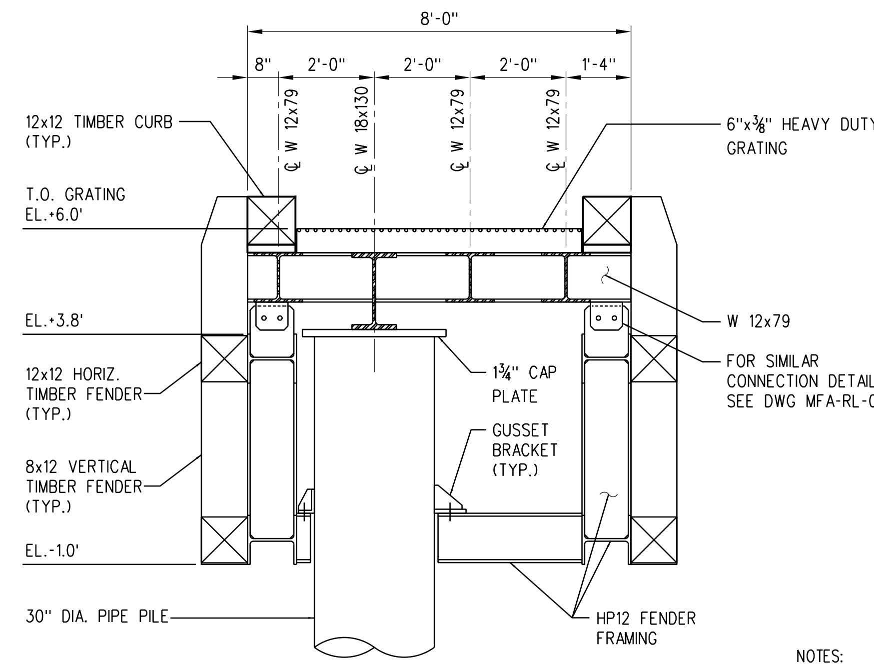
PLAN - TRAVEL LIFT PIER

1"=10'-0"



CROSS-SECTION LOOKING NORTH

1"=10'-0"



TRAVEL LIFT STRUCTURE CROSS-SECTION

1/4"=1'-0"

DRAWING FOR PERMIT ONLY
NOT FOR CONSTRUCTION

NOTES:

1. STEEL GRATING NOT SHOWN FOR CLARITY.
2. STEEL ASSEMBLY SGALL BE EPOXY COATED.
3. TRAVEL LIFT SHALL BE MODEL BFMII (100 TON CAPACITY) AS MANUFACTURED BY MARINE TRAVELLIFT, STURGEON BAY, WI, (920-743-6202).
4. STEEL PLATES (NOT SHOWN) REQUIRED TO SPAN CLEARANCE BETWEEN PERMANENT PIER AND TRAVEL LIFT AND VESSEL SLIP PIERS.
5. SEE DWG MFA-RL-010 FOR SIMILAR FENDER SYSTEM DETAILS.

PROJECT MANAGER
CHECK A. D. SLEICHER
DRAFTING R. BUZETA
CHECK A. D. SLEICHER
DESIGN A. MORA
JOB MANAGER
DESIGN SUPERVISOR

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NEW YORK STATE THRUWAY AUTHORITY

TAPPAN ZEE CONSTRUCTORS
A Consortium of Fluor, American Bridge, Granite, and Traylor Bros.

REVISIONS DESCRIPTION OF ALTERATIONS:	
0 PERMIT SUBMISSION	11/21/12

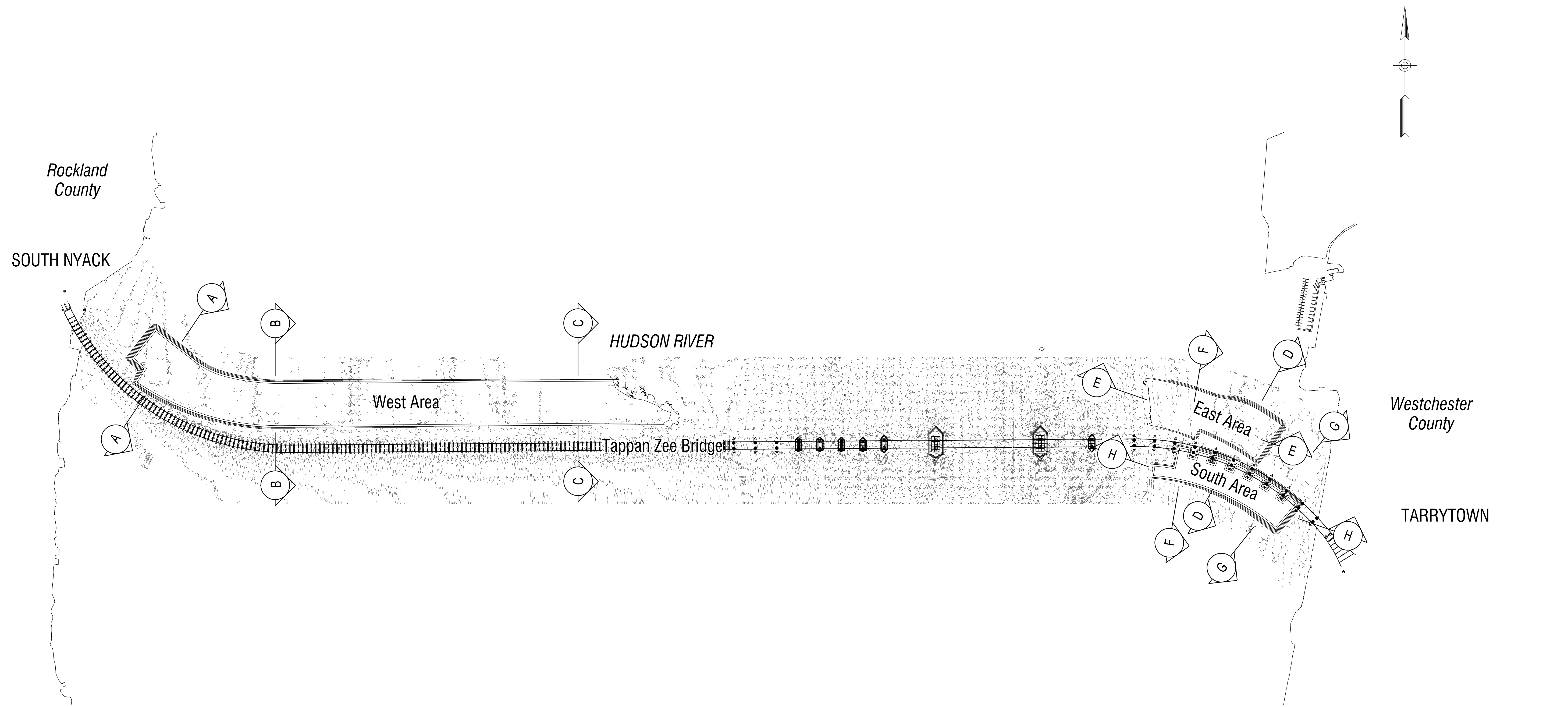
TAPPAN ZEE
HUDSON RIVER CROSSING
COUNTY: ROCKLAND/WESTCHESTER

PIN	BRIDGES	CULVERTS
8TZ100		

ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED
TAPPAN ZEE DOCK FACILITY
PERMANENT DOCK PRELIMINARY DESIGN
TRAVEL LIFT PIER

CONTRACT NUMBER D214134
DRAWING NO. MFA-RL-009
SHEET NO. 9 OF 9

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 08
DOCUMENT NAME: MFA-RL-009.dgn



NOTES:

1. DIMENSIONS AND LOCATION OF TEMPORARY ACCESS CHANNEL BOTTOM BASED ON THAT PROVIDED BY NYSTA DRAWING NO. DIR-001 THRU 004.

2. BASED UPON S.T. HUDSON ENGINEERS, INC. HYDROGRAPHIC SURVEY DATED JANUARY 26, 2012, SIGNED BY MR. MARK KLEIN #182 AND SIGNED AND SEALED BY MR. MICHAEL FASNACHT, NYSPE #57352.

3. AREAS IN TABLE BASED ON TOP OF SLOPE OF ACCESS CHANNEL AND ARMORING ELEVATION.

		WEST			EAST			SOUTH			TOTAL	TOTAL
DREDGING	DEPTH AT MEAN LOWER LOW WATER (MLLW)	TOE SLOPE AREA (AC.)	VOLUME (MCY)	SCHEDULED DATES	TOE SLOPE AREA (AC.)	VOLUME (MCY)	SCHEDULED DATES	TOE SLOPE AREA (AC.)	VOLUME (MCY)	SCHEDULED DATES	VOLUME (MCY)	AREA (AC.)
ACCESS CHANNEL	-13.0	95.3	0.52	AUG - OCT 2013	24.1	0.16	AUG - OCT 2013	19.1	0.13	AUG - OCT 2014	0.81	138.5
OVERDEPTH ALLOWANCE (1FT)	-14.0		0.10			0.02			0.02		0.14	
DREDGING TOTAL	-14.0		0.62			0.18			0.15		0.95	
ARMORING	-11.0	76.1	0.46	AUG - OCT 2013	17.1	0.11	AUG - OCT 2013	13.3	0.08	AUG - OCT 2014	0.65	106.5

0 600' 1200' 1800' 2400'
1" = 1200'

NEW YORK STATE THRUWAY AUTHORITY

TAPPAN ZEE CONSTRUCTORS
A Consortium of Fluor, American Bridge, Granite, and Traylor Bros.

REVISIONS
DESCRIPTION OF ALTERATIONS:

TAPPAN ZEE
HUDSON RIVER CROSSING

COUNTY: ROCKLAND/WESTCHESTER

PIN

BRIDGES

CULVERTS

ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED

PROPOSED TEMPORARY ACCESS CHANNEL DREDGING PLAN TO -13'

CONTRACT NUMBER
D214134

DRAWING NO.

SHEET NO. 1

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION

DOCUMENT NAME:

PROJECT MANAGER
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DRAFTING
CHECK
DESIGN
JOB MANAGER
DESIGN SUPERVISOR

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USER = erydell

TAPPAN ZEE BRIDGE
THE NEW NY BRIDGE PROJECT
(FORMERLY TAPPAN ZEE HUDSON RIVER CROSSING)

JOINT APPLICATION PERMIT DRAWINGS
JANUARY 2013

INDEX OF DRAWINGS

SIGNATURE

DATE

TAPPAN ZEE BRIDGE
THE NEW NY BRIDGE PROJECT
(FORMERLY TAPPAN ZEE HUDSON RIVER CROSSING)

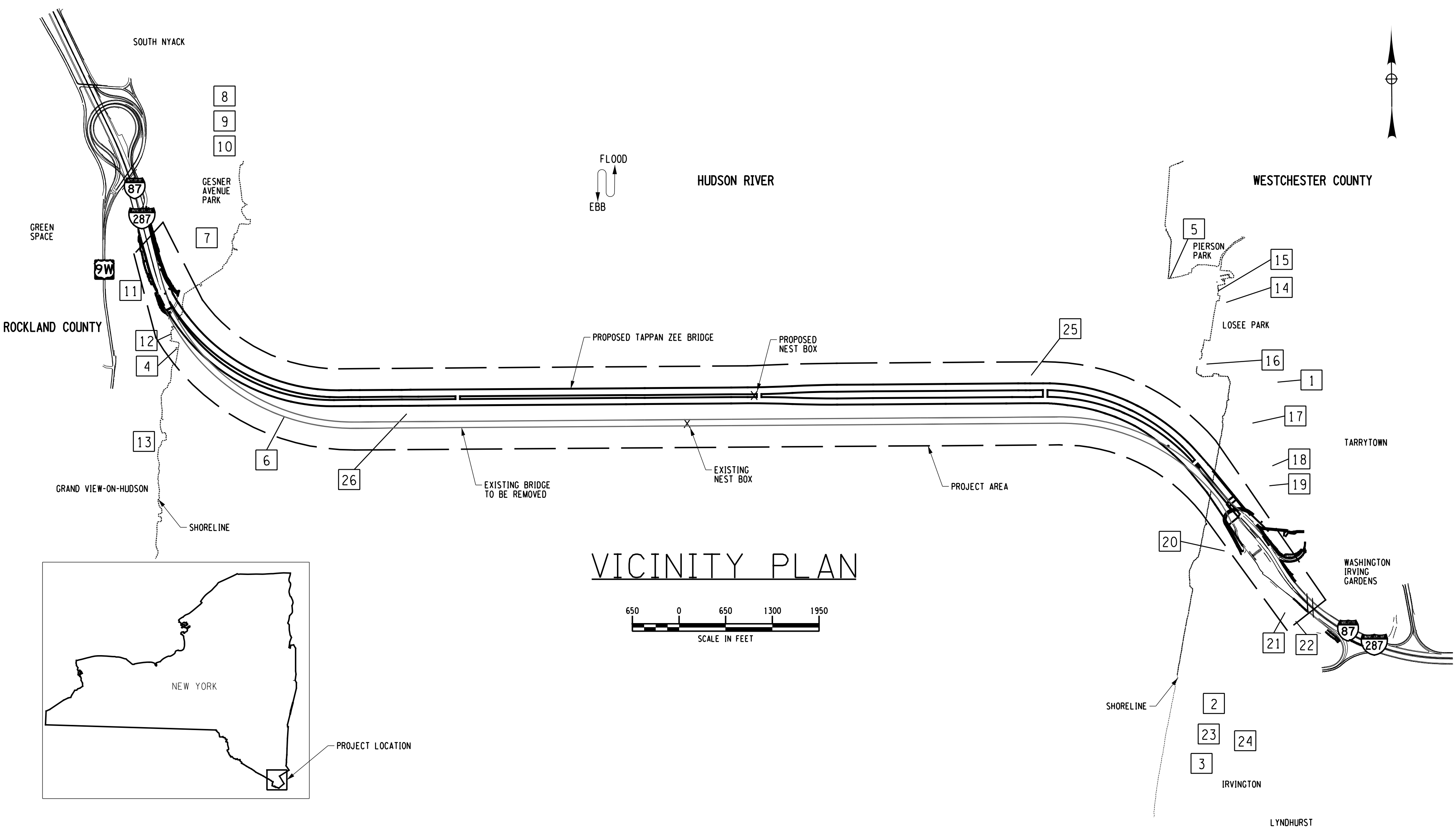
HUDSON RIVER
MILEPOINT 27

SOUTH NYACK - TARRYTOWN, NEW YORK
ROCKLAND AND WESTCHESTER COUNTIES

APPLICANT/OWNER:
NEW YORK STATE THRUWAY AUTHORITY
CONSULTANT:
TAPPAN ZEE CONSTRUCTORS

12/13/2012
DATE

SHEET NUMBER
1 OF 7



HISTORICAL STRUCTURES

NATIONAL HISTORICAL LANDMARK

1 OLD CROTON AQUEDUCT
2 LYNDHURST
3 SUNNYSIDE

S/NRHP LISTED

4 WAYSIDE CHAPEL
5 TARRYTOWN LIGHTHOUSE

POTENTIAL S/NRHP ELIGIBLE

6 TAPPAN ZEE BRIDGE
7 SOUTH NYACK HISTORIC DISTRICT
8 129 PIEMONT AVENUE
9 135 PIEMONT AVENUE
10 147 PIEMONT AVENUE
11 2 SHADYSIDE AVENUE
12 10 FERRIS LANE
13 RIVER ROAD HISTORIC DISTRICT
14 TARRYTOWN SEWAGE TREATMENT PLANT
15 TARRYTOWN RAILROAD STATION
16 TAPPAN LANDING HISTORIC DISTRICT
17 WASHINGTON IRVING GARDENS
18 99 WHITE PLAINS ROAD
19 100 WHITE PLAINS ROAD
20 IRVING HISTORIC DISTRICT
21 HOPE UNITED PRESBYTERIAN CHURCH
22 GLENWOLDE PARK HISTORIC DISTRICT
23 NEW COUNTY PARK
24 SOUTH END HISTORIC DISTRICT
25 SHIPWRECK TARGET 001
26 SHIPWRECK TARGET 003

SIGNATURE

DATE

TAPPAN ZEE BRIDGE
THE NEW NY BRIDGE PROJECT
(FORMERLY TAPPAN ZEE HUDSON RIVER CROSSING)

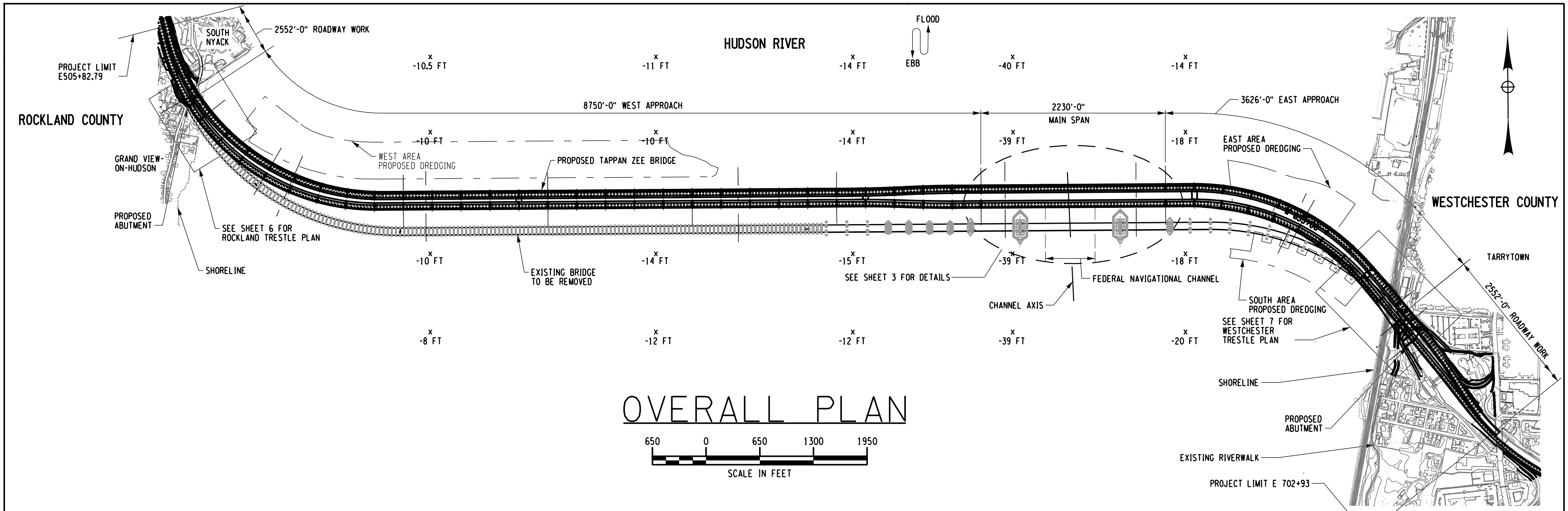
HUDSON RIVER
MILEPOINT 27

SOUTH NYACK - TARRYTOWN, NEW YORK
ROCKLAND AND WESTCHESTER COUNTIES

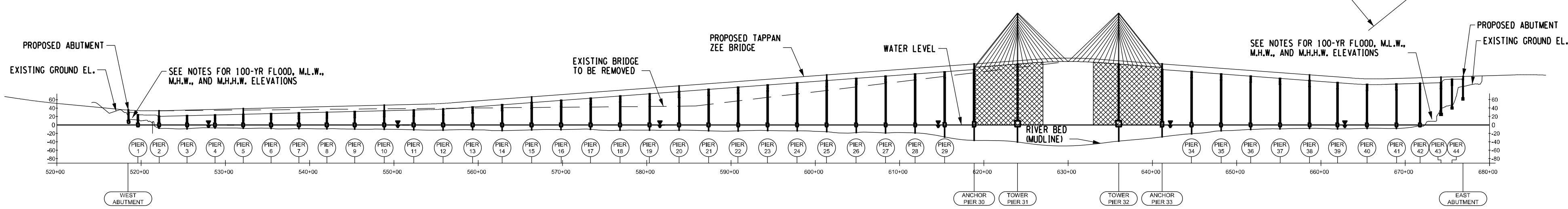
APPLICANT/OWNER:
NEW YORK STATE THRUWAY AUTHORITY
CONSULTANT:
TAPPAN ZEE CONSTRUCTORS

12/13/2012
DATE

SHEET NUMBER
2 OF 7



OVERALL PLAN



OVERALL ELEVATION

650 0 650 1300 1950
SCALE IN FEET

NOTES:

1. HORIZOTAL DATUM: NAD83
2. VERTICAL DATUM: NAVD88
3. TIDAL DATUM:
   M.L.W. = EL. -1.69'
   M.H.W. = EL. +1.76'
   M.H.H.W. = EL. +2.02'
4. WIDTH OF APPROACH STRUCTURE: VARIES (223'-0" TO 277'-0")
5. WIDTH OF MAIN SPAN STRUCTURE 277'-0"
6. FEMA MAP 100-YEAR FLOOD ELEVATION-WESTCHESTER CO: EL. 7' NAVD88
7. FEMA MAP 100-YEAR FLOOD ELEVATION-ROCKLAND CO: EL. 7' NAVD88
8. REMOVE TO 2 FEET BELOW MUDLINE: ALL WOOD PILE-SUPPORTED PIERS
9. REMOVE TO 2 FEET BELOW MUDLINE: ALL CAISSON-SUPPORTED PIERS
10. REMOVE TO 2 FEET BELOW GRADE: ALL LAND-BASED PIERS
11. REMOVE TO 2 FEET BELOW GRADE: ABUTMENTS
12. SPOT SOUNDINGS ARE BASED ON HYDROGRAPHIC SURVEY DATED JANUARY 2012, PREPARED BY S.T. HUDSON ENGINEERING. ELEVATIONS ARE NAVD88.

DREDGING	DEPTH AT MEAN LOWER LOW WATER (MLLW)	WEST		EAST		SOUTH		TOTAL	TOTAL
		SURFACE AREA (AC.)	VOLUME (MCY)	SURFACE AREA (AC.)	VOLUME (MCY)	SURFACE AREA (AC.)	VOLUME (MCY)	VOLUME (MCY)	AREA (AC.)
ACCESS CHANNEL	-13.0	95.30	0.52	24.10	0.16	19.10	0.13	0.81	138.50
OVERDEPTH ALLOWANCE (1FT)	-14.0		0.10		0.02		0.02	0.14	
DREDGING TOTAL	-14.0		0.62		0.18		0.15	0.95	
ARMORING	-11.0	76.1	0.46	17.1	0.11	13.3	0.08	0.65	106.50

TAPPAN ZEE BRIDGE
THE NEW NY BRIDGE PROJECT
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SOUTH NYACK - TARRYTOWN, NEW YORK
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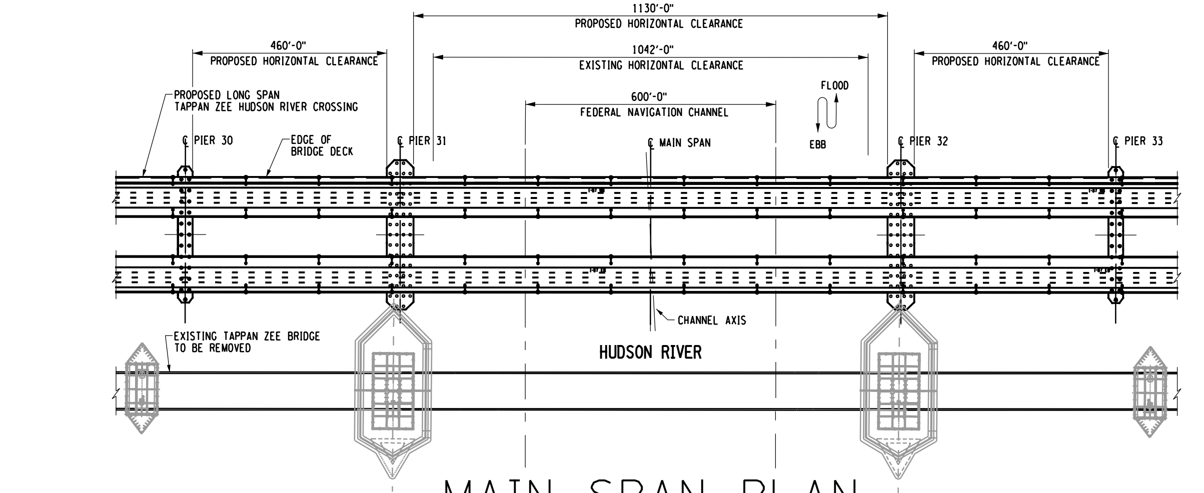
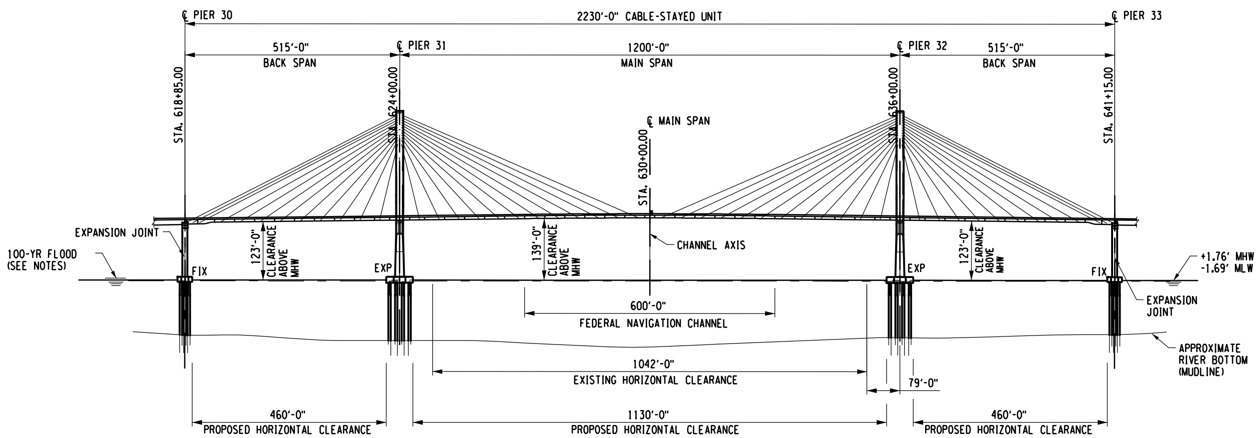
3 OF 7



MAIN SPAN PLAN

150 0 150 300 450

SCALE IN FEET



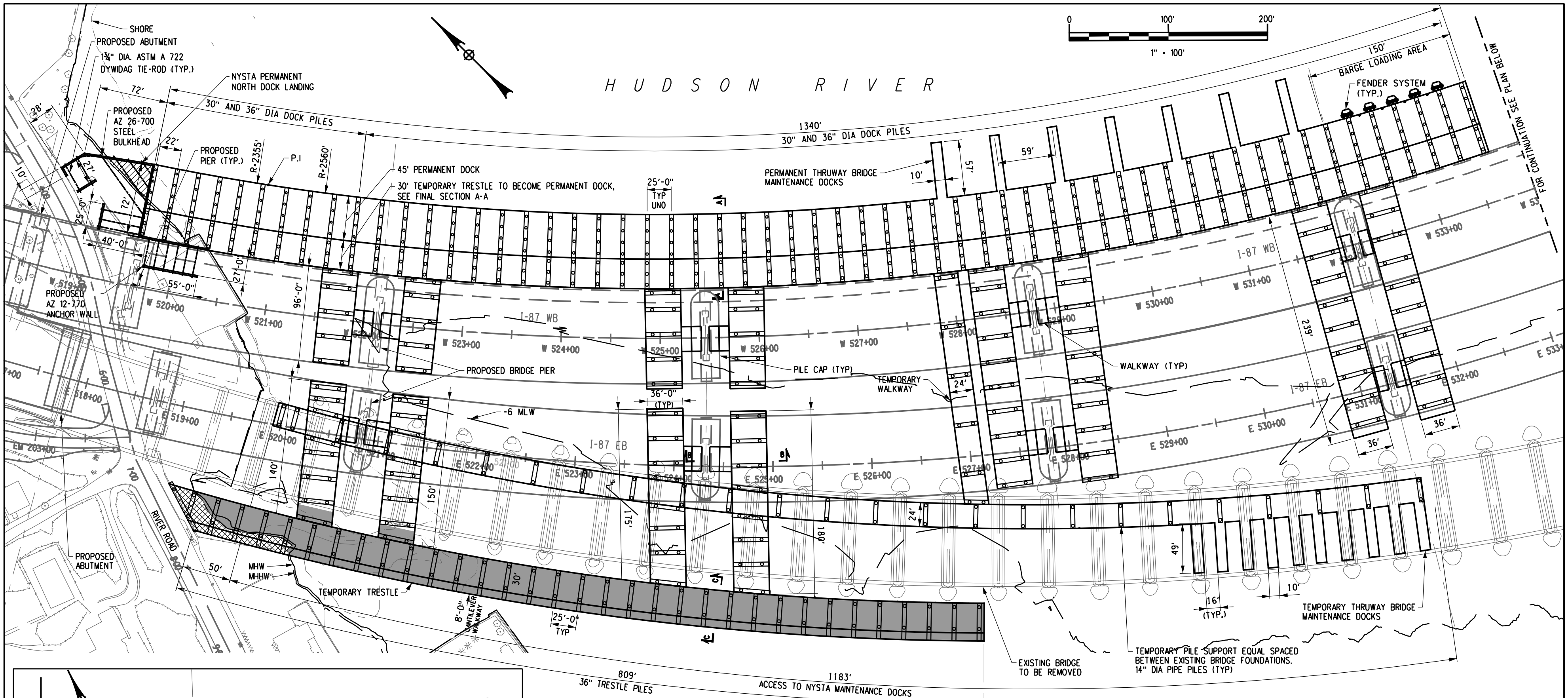
MAIN SPAN ELEVATION

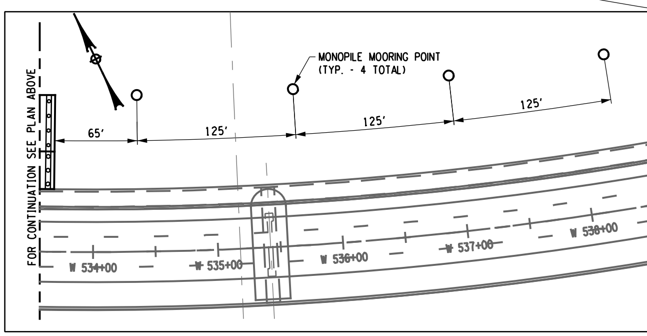
150 0 150 300 450

SCALE IN FEET

NOTES:
1. FEMA MAP 100-YEAR FLOOD ELEVATION-WESTCHESTER CO: EL. 7' NAVD88

SIGNATURE	TAPPAN ZEE BRIDGE THE NEW NY BRIDGE PROJECT (FORMERLY TAPPAN ZEE HUDSON RIVER CROSSING)	
	HUDSON RIVER MILEPOINT 27 SOUTH NYACK - TARRYTOWN, NEW YORK ROCKLAND AND WESTCHESTER COUNTIES APPLICANT/OWNER: NEW YORK STATE THRUWAY AUTHORITY CONSULTANT: TAPPAN ZEE CONSTRUCTORS	12/13/2012 DATE
DATE		SHEET NUMBER 4 OF 7





LEGEND:

MHHW = EL. +2.02' (NAVD88)
MHW = EL. +1.76' (NAVD88)
-6 MLW = EL. -7.69' (NAVD88)
AREA IN NYSDEC TIDAL WETLANDS
NYSDEC TIDAL WETLANDS ADJACENT AREA
AREA IN NYSDEC OPEN WATERS

REFERENCE LEGEND:

FOR SECTION A-A SEE TYPICAL PILE BENT DRAWING
FOR SECTION B-B SEE TYPICAL PILE BENT DRAWING
FOR SECTION C-C SEE TYPICAL PILE BENT DRAWING

ESTIMATED PERMANENT FILL IN NYSDEC OPEN WATERS

	FILL AREA (SQ. FT.)	FILL VOLUME (CU. YD.)
NYSTA PERMANENT MAINTENANCE DOCK LANDING	1,000	500

DRAWING FOR PERMIT ONLY
NOT FOR CONSTRUCTION

ESTIMATED QUANITY INFORMATION TABLE

	DIAMETER PILES			PILE AREA (SQ. FT.)	DECK AREA (SQ. FT.)
	36"	30"	14"		
NYSTA PERMANENT NORTH DOCK	291	228		4,136	150,000
TEMPORARY WALKWAY	12			85	5,700
TEMPORARY SOUTH TRESTLE	131			926	50,000
NYSTA TEMPORARY DOCK			50	53	35,000

ESTIMATED QUANTITY IN NYSDEC TIDAL WETLANDS

	DIAMETER PILES			PILE AREA (SQ. FT.)	DECK AREA (SQ. FT.)
	36"	30"	14"		
TEMPORARY SOUTH TRESTLE	64			452	30,500

ESTIMATED QUANTITY IN NYSDEC TIDAL WETLANDS ADJACENT AREA

	DIAMETER PILES			PILE AREA (SQ. FT.)	DECK AREA (SQ. FT.)
	36"	30"	14"		
TEMPORARY SOUTH TRESTLE	7			49	220

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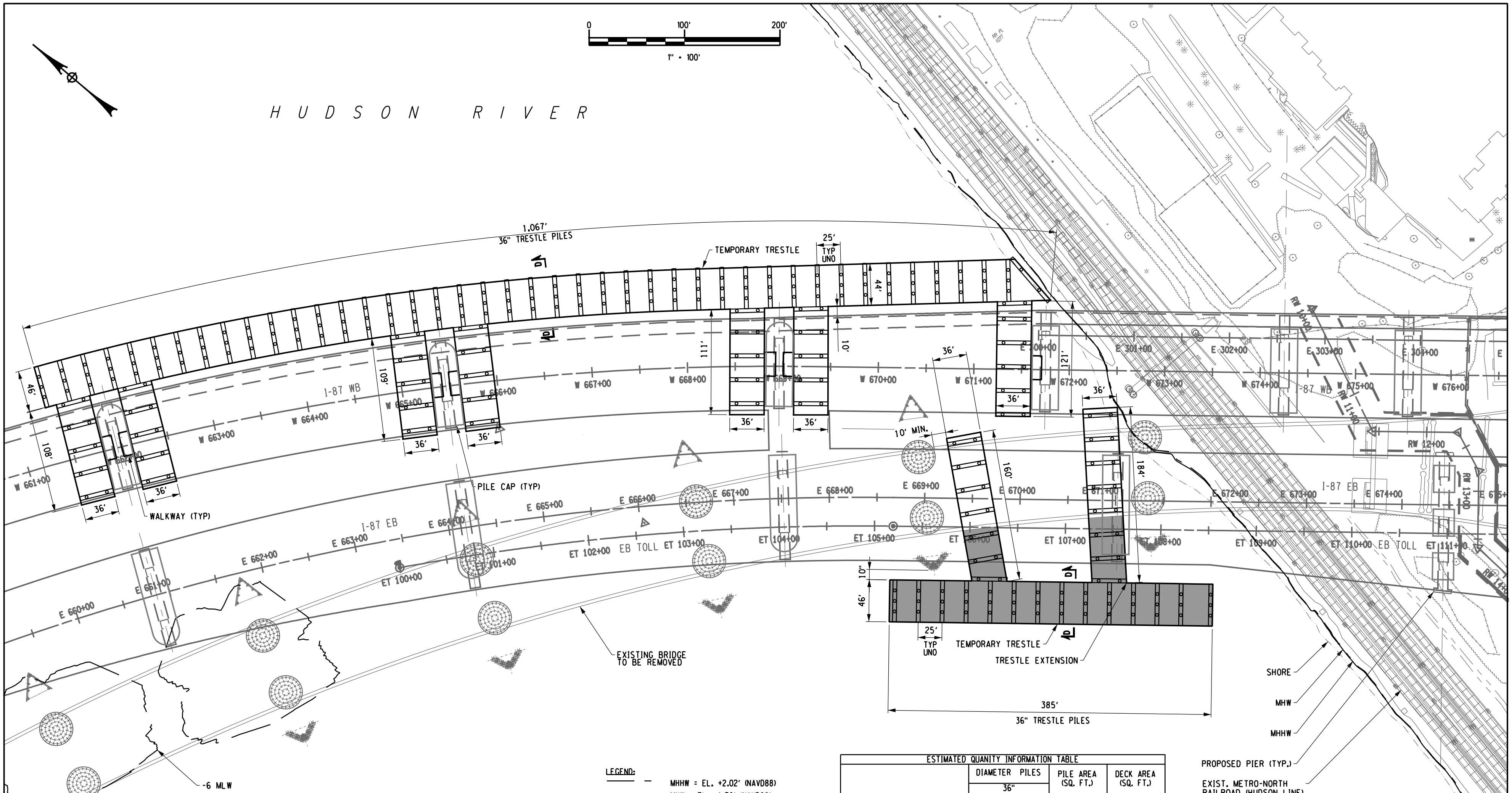

LEGEND:

MHHW = EL. +2.02' (NAVD88)
MHW = EL. +1.76' (NAVD88)
-6 MLW = EL. -7.69' (NAVD88)
AREA IN NYSDEC TIDAL WETLANDS

DRAWING FOR PERMIT ONLY
NOT FOR CONSTRUCTION

ESTIMATED QUANITY INFORMATION TABLE			
	DIAMETER PILES 36"	PILE AREA (SQ. FT.)	DECK AREA (SQ. FT.)
TEMPORARY NORTH TRESTLE	200	1,414	80,000
TEMPORARY SOUTH TRESTLE	72	509	32,000
ESTIMATED AREA IN NYSDEC TIDAL WETLANDS			
	36" DIAMETER PILES	PILE AREA (SQ. FT.)	DECK AREA (SQ. FT.)
TEMPORARY SOUTH TRESTLE	54	382	19,400

REFERENCE LEGEND:

FOR SECTION D-D SEE TYPICAL PILE BENT DRAWING

ESTIMATED QUANITY INFORMATION TABLE		
TEMPORARY NORTH TRESTLE AREA	80,000	SQUARE FEET
TEMPORARY SOUTH TRESTLE AREA	32,000	SQUARE FEET
SOUTH TRESTLE 36" DIA. PILES	80	PILES
NORTH TRESTLE 36" DIA. PILES	210	PILES

SIGNATURE

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SOUTH NYACK - TARRYTOWN, NEW YORK
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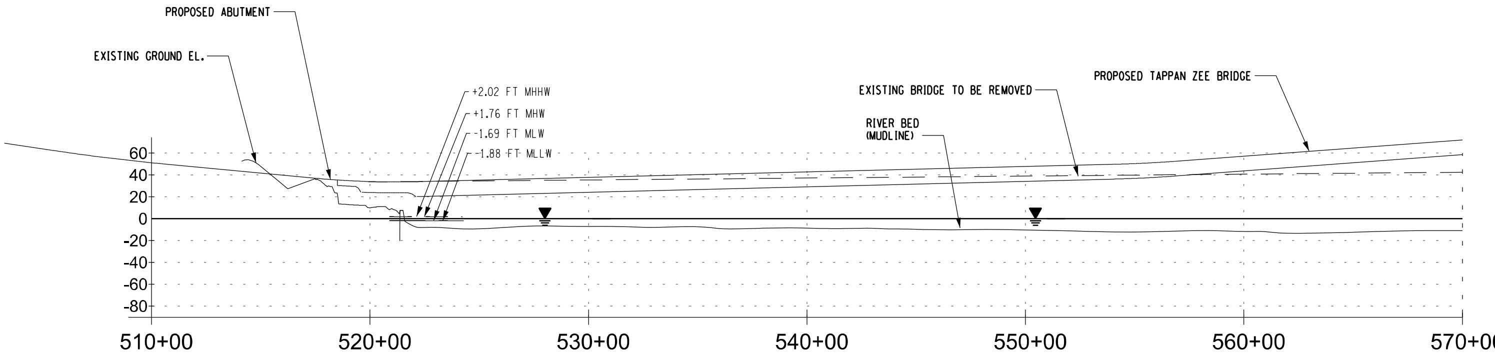
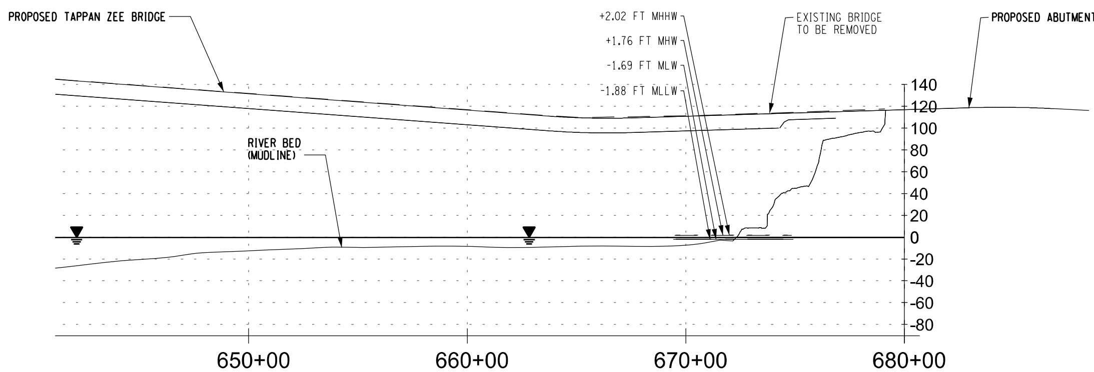


WESTBOUND SECTION
ROCKLAND COUNTY



EASTBOUND SECTION
WESTCHESTER COUNTY

TAPPAN ZEE BRIDGE
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Attachment 3: NYSDOS Coastal Zone Re-evaluation

COASTAL ZONE POLICIES

Policy 1: *Restore, revitalize, and redevelop deteriorated and underutilized waterfront areas for commercial, industrial, cultural, recreational, and other compatible uses.*

The original assessment of the project's consistency with this policy is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS.

The project is not intended to directly revitalize and restore underutilized waterfront areas, but the replacement bridge would not be a detriment to such revitalization efforts because it would not use any waterfront lands that have the potential for redevelopment as part of a larger economic development initiative. By replacing the existing bridge, the project would ensure that the potential for economic revitalization of the waterfront continues unimpeded by avoiding potential closure of the bridge and detrimental effects to local and regional transportation patterns. A closed bridge, or one with reduced capacity, would have the potential to limit private and public investment in the area and along the waterfront.

As discussed in Chapter 7, "Parklands and Recreational Resources", and Chapter 8, "Socioeconomic Conditions", of the FEIS, no adverse impacts would occur to the commercial and recreational uses adjacent to the bridge in Tarrytown, South Nyack, and neighboring municipalities. This conclusion is unchanged by the selected design and new information received since the approval of the FEIS and the Joint Record of Decision and State Environmental Quality Review Act Findings (Joint ROD) in September 2012. The federal channel which conveys shipping north/south beneath the Tappan Zee Bridge would remain unimpeded during construction. In addition, waterfront parks, marinas, mooring fields, and commercial/industrial businesses that currently operate in the study area would remain largely unaffected by the proposed bridge.

Therefore, the project remains consistent with Policy 1.

Policy 2: *Facilitate the siting of water-dependent uses and facilities on or adjacent to coastal waters.*

Nyack Policy 2A: *Preserve and retain existing water dependent uses in the coastal area.*

The original assessment that Policy 2 is not applicable to the project still stands in light of the selected design and other new information received since coastal consistency was granted by NYSDOS. The project is not related to the siting of water-dependent uses. The purpose of the project is to maintain a vital link in the regional and national transportation network. This will improve traffic congestion on the bridge and address the structural, safety, and security needs of the Hudson River crossing. Therefore, Policy 2 is not applicable to the project.

The original assessment of the project's consistency with Policy 2A is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. Water dependent uses in the Village of Nyack, including the Memorial Park boat launch and additional marinas and boat facilities listed in the Village's LWRP, are located ½ mile or more from the project and would not be directly adversely affected during or after construction. However, disruptions to small craft navigation through the construction zone can be expected during construction. The ability for boats to travel along the Hudson River would be maintained throughout the construction period. Signage and channel markers would be utilized to advise recreational boaters of preferred routes and potential dangers within the construction zone. This would be done in coordination with the U.S. Coast Guard. Upon completion of the project, navigation would be restored. The vertical and horizontal clearances of the new bridge would accommodate the same dimensions of vessels that cross beneath the existing Tappan Zee Bridge, and the project would not adversely impact vessel navigation. Therefore, the project is consistent with Nyack Policy 2A.

Policy 3: *Further develop the state's major ports of Albany, Buffalo, New York, Ogdensburg, and Oswego as centers of commerce and industry, and encourage the siting, in these port areas, including those under the jurisdiction of state public authorities, of land use and development which is essential to or in support of the waterborne transportation of cargo and people.*

The project is not located near any of the state's major ports and would not affect the waterborne transportation of cargo and people to or from the port of Albany, Buffalo, New York, Ogdensburg, or Oswego. Therefore, it remains that this policy is not applicable to the proposed project.

Policy 4: *Strengthen the economic base of smaller harbor areas by encouraging the development and enhancement of those traditional uses and activities which have provided such areas with their unique maritime identity.*

The applicability of this policy to the proposed project is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. The project is not related to, and would have no impact upon, traditional uses and activities of small harbors. Therefore, it remains that Policy 4 is not applicable to the proposed project.

Policy 5: *Encourage the location of development in areas where public services and facilities essential to such development are adequate.*

Sleepy Hollow Policy 5A: *Discourage the development of uses which, by reason of their demand for new community services and facilities or their imposition of burdens on existing services and facilities, would require disproportionate public cost in comparison to public benefits.*

The original assessment that Policy 5 and 5A are not applicable to the proposed project is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. The project would not extend new services into unserved areas, nor would it introduce any new residents or permanent workers to the surrounding area. Instead, it would provide benefits to local and regional populations and workforce in the form of improved operational mobility and safety. As such, the project is not related to the encouragement of development in the coastal area. Therefore, neither Policy 5 nor Sleepy Hollow Policy 5A is applicable to the proposed project.

Policy 6: *Expedite permit procedures in order to facilitate the siting of development activities at suitable locations*.

The responsibility for implementing Policy 6 rests with the various agencies issuing the requisite permits and/or approvals. Therefore, it remains that Policy 6 is not applicable to the proposed project.

FISH AND WILDLIFE POLICIES

Policy 7: *Significant coastal fish and wildlife habitats will be protected, preserved, and, where practical, restored so as to maintain their viability as habitats.*

Nyack Policy 7A: *Protect the physical characteristics of the Hudson River along Nyack that support the varied fish populations found there.*

Sleepy Hollow Policy 7D: *The Hudson River immediately adjacent and within 1,000 feet of the Village's shoreline shall be protected, preserved, and where practical, restored so as to maintain its viability as a locally significant habitat.*

The project is not located in close proximity to any Significant Coastal Fish and Wildlife Habitats (SCFWH) and would not result in adverse impacts to SCFWH designated by the NYSDOS. The original conclusion that sediment plumes and sound levels capable of causing physical effects to fish (≥187 dB re 1μPa2-s) would not enter SFWH is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS.

Project construction would have lesser potential impact to fish and fish habitat than what was originally estimated in the FEIS and Biological Assessment (BA) due to less dredging volume and duration and less impact hammering under the selected design.

Therefore, it remains that the project is consistent with Policy 7, Nyack Policy 7A, and Sleepy Hollow Policy 7D.

Policy 8: *Protect fish and wildlife resources in the coastal area from the introduction of hazardous wastes and other pollutants which bioaccumulate in the food chain or which cause significant sublethal or lethal effects on those resources.*

The original conclusion that, with the implementation of stormwater management practices to treat stormwater for the landing areas, the discharge of stormwater runoff from the proposed project would not result in a net increase in pollutant loading to the Hudson River, is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS.

Under the selected design, there would be a lower volume and duration of dredging and fewer and smaller piles driven into the riverbed, and thus less sediment suspension during construction than what was considered in the FEIS and original Coastal Assessment Form. The amount of dredging and armoring required for the recommended design would be 951,000 cubic yards, which is less than what was presented in the FEIS (approximately 1.9 million cubic yards). The duration of dredging would also be shorter—two, 3-month phases over a two year period compared with three, 3-month phases over a four year period. Increases in suspended sediment would be minimal for the construction of the selected design and within the natural range of variation of suspended sediment concentration within this portion of the river. Sediment resuspension resulting from dredging and other sediment disturbing activities would be expected to meet the Class SB turbidity standard at the edge of the mixing zone. Resuspended sediment would dissipate shortly after the completion of the dredging activities, and would not result in adverse impacts to water quality. During the periods of in-water construction when no dredging is occurring, the limited sediment resuspension during pile driving, cofferdam installation and removal, and vessel movement would be localized, would be expected to dissipate shortly after the completion of in-water construction activity and would not result in adverse water quality impacts. For these reasons the increase in suspended sediment projected to result from dredging and other in-water sediment-disturbing construction activities, even under the worst case scenarios, and the placement of armoring within the dredged channel, would not result in adverse impacts to water quality or aquatic biota of the Hudson River.

Therefore, it remains that the project would be consistent with Policy 8.

Policy 9: *Expand recreational use of fish and wildlife resources in coastal areas by increasing access to existing resources, supplementing existing stocks, and developing new resources*.

The original assessment of the project's consistency with this policy is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS.

Increasing access to recreational fish and wildlife resources; increasing existing stocks; or developing new resources are not components of this project. The ability for boats to travel along the Hudson River would be maintained throughout the construction period. Signage and channel markers would be utilized to advise recreational boaters of preferred routes and potential dangers within the construction zone. While some boaters, due to water craft size or power source, may experience difficulty navigating through the construction zone during this time period, this temporary disruption is not considered an adverse impact.

Therefore, it remains that the project is consistent with Policy 9.

Policy 10: *Further develop commercial finfish, shellfish and crustacean resources in the coastal area by: (i) encouraging the construction of new, or improvement of existing on shore commercial fishing facilities; (ii) increasing marketing of the state's seafood products; and (iii) maintaining adequate stocks and expanding aquaculture facilities.*

The original assessment of the project's consistency with this policy is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. Development, maintenance, or marketing of commercial fisheries are not components of the project. The loss of oyster beds is identified as an adverse impact in the FEIS, and although this impact would be reduced under the selected design, there would still be 8.08 acres of oyster beds lost. However, these oysters are not part of a commercial fishery. The project sponsor remains committed to mitigating the loss of oyster beds in coordination with NYSDEC.

Therefore, the project would be consistent with Policy 10.

FLOODING AND EROSION POLICIES

Policy 11: *Buildings and other structures will be sited in the coastal area so as to minimize damage to property and the endangering of human lives caused by flooding and erosion.*

The acreage of affected floodplain on the Rockland and Westchester County sides of the project site would be slightly different under the selected design than what was analyzed in the FEIS and original Coastal Assessment Form, but the project would remain consistent with this policy.

On the Rockland County side, the selected design would increase the incursion into the 100-year floodplain from 0.3 to 0.4 acres, and decrease incursion into the 500-year floodplain from 10 to 5.6 acres. No floodplains within Westchester County would be within the project site under the original design alternative, whereas the selected design would affect 0.3 acres of 100-year floodplain and 1.2 acres of 500-year floodplain. However, these incursions into portions of the 100-year and 500-year floodplain within Rockland and Westchester Counties would not result in adverse impacts to floodplain resources or result in increased flooding of adjacent areas. Flooding in these areas is caused by coastal flooding, which is influenced by astronomic tide and meteorological forces.

Therefore, under the selected design, the project would be consistent with Policy 11.

Policy 12: *Activities or development in the coastal area will be undertaken so as to minimize damage to natural resources and property from flooding and erosion by protecting natural protective features including beaches, dunes, barrier islands and bluffs.*

The original assessment that Policy 12 is not applicable to the proposed project is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. The project would be constructed on land areas that do not include natural protective features such as beaches, dunes, barrier islands, and bluffs. Therefore, it remains that Policy 12 is not applicable.

Policy 13: *The construction or reconstruction of erosion protection structures shall be undertaken only if they have a reasonable probability of controlling erosion for at least 30 years as demonstrated in design and construction standards and/or assured maintenance or replacement programs.*

This policy is not applicable to the project under the selected design.

Policy 14: *Activities and development including the construction or reconstruction of erosion protection structures, shall be undertaken so that there will be no measurable increase in erosion or flooding at the site of such activities or development, or at other locations.*

This policy is not applicable to the project under the selected design.

Policy 15: *Mining, excavation, or dredging in coastal waters shall not significantly interfere with the natural coastal processes which supply beach materials to land adjacent to such waters and shall be undertaken in a manner which will not cause an increase in erosion of such lands.*

Under the selected design, there would be a lower volume and duration of dredging that what was considered in the FEIS and original Coastal Assessment Form. As such, the original conclusion that dredging activities for the project would not interfere with natural coastal processes and would not increase erosion of coastal land is unchanged, and it remains that the project would be consistent with Policy 15.

Policy 16: *Public funds shall only be used for erosion protective structures where necessary to protect human life, and new development which requires a location within or adjacent to an erosion hazard area to be able to function, or existing development;*

and only where the public benefits outweigh the long-term monetary and other costs including the potential for increasing erosion and adverse effects on natural protective features.

Coastal erosion protective structures are not a component of the project under the selected design. Therefore, Policy 16 is not applicable.

Policy 17: *Non-structural measures to minimize damage to natural resources and property from flooding and erosion shall be used whenever possible.*

Non-structural measures, such as the set-back of buildings, use of vegetation, etc. are not applicable to the project under the selected design, and the project would not cause shoreline erosion or increases in area flooding. Therefore, it remains that the project would be consistent with Policy 17.

GENERAL SAFEGUARDS POLICY

Policy 18: *To safeguard the vital economic, social and environmental interests of the state and its citizens, proposed major actions in the coastal area must give full consideration to those interests, and to the safeguards which the state has established to protect valuable coastal resource areas.*

Sleepy Hollow Policy 18A: *Protect the vital economic, social, cultural, and environmental interests of the Village in the Evaluation of any proposal for new roads, road widening or infrastructure.*

The original assessment of the project's consistency with this policy is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. The project would ensure that there is a reliable transportation corridor across the Hudson River, linking I-287 and I-87, which would support both the economic and social interests of the state, the region, and adjacent communities. By maintaining this vital transportation link, the project would safeguard and promote New York State's economic, social, and environmental interests.

Under the selected design, the project would not interrupt traffic patterns in the Village of Sleepy Hollow nor adversely impact established residential or commercial character with new roadways or infrastructure.

Therefore, it remains that the project would be consistent with Policy 18 and Sleepy Hollow Policy 18A.

PUBLIC ACCESS POLICIES

Policy 19: *Protect, maintain, and increase the level and types of access to public water-related recreation resources and facilities.*

The original assessment of the project's consistency with this policy is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS.

The Hudson River is used by sail-boaters, power-boaters, and other personal watercraft users for recreational purposes. Temporary disruptions to recreational boating through the study area can be expected during the construction period for the proposed project under the selected design, and sail boaters may be precluded from using sails while traversing through the construction zone. However, no long-term impacts to recreational boating on the Hudson River are anticipated once the proposed project is operational.

The ability for boats to travel along the Hudson River would be maintained throughout the construction period. Signage and channel markers would be utilized to advise recreational boaters of preferred routes and potential dangers within the construction zone. This would be done in coordination with the U.S. Coast Guard.

Under the selected design, the replacement bridge would include a shared-use bike and pedestrian path, thereby improving the connectivity between trailways and recreational resources on either side of the Hudson River. The project would have no detrimental effect on any existing waterfront park or recreational resource.

Therefore, the project would be consistent with Policy 19.

Policy 20: *Access to publicly owned foreshore and to lands immediately adjacent to the foreshore or the water's edge that are publicly owned shall be provided, and it should be provided in a manner compatible with adjoining uses.*

The original assessment of the project's consistency with this policy is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. Under the selected design, the project would still provide public access on the replacement bridge by means of a bicycle/pedestrian path that would connect to existing trails and walkways along the waterfront in both counties. This path would consist of a 4-acre, shared-use public space for pedestrians and bicyclists to cross the Hudson River. This shared-use path would increase the public's access to trail systems and bicycle routes on both sides of the Hudson River, offering new direct and on-street connections to existing systems.

New access points to the foreshore are not provided by the project, nor are they precluded from occurring in the future.

Therefore, the project would be consistent with Policy 20.

RECREATION POLICIES

Policy 21: *Water dependent and water enhanced recreation will be encouraged and facilitated, and will be given priority over non-water related uses along the coast.*

The original assessment of the project's consistency with this policy is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. Under the selected design, the project would be consistent with the preservation and enhancement of other coastal resources because it would allow for the continued use of existing recreational facilities in the area. It would not diminish any existing water-dependent use or water-enhanced recreational use of the Hudson River.

The extension of RiverWalk - the shared-use path along the eastern shore of the Hudson River - would not be adversely affected by the project under the selected design. Future connections of RiverWalk beneath the bridge to segments north and south would not be precluded. The replacement bridge would also include a shared-use (bicycle and pedestrian) path across its north bridge span which would connect the Esposito Trail in Rockland County with Route 9 in Westchester County. This shared-use path would be approximately 4 acres in footprint.

Therefore, the project would be consistent with Policy 21.

Policy 22: *Development, when located adjacent to the shore, will provide for water-related recreation whenever such use is compatible with reasonably anticipated* *demand for such activities, and is compatible with the primary purpose of the development.*

The original assessment that Policy 22 is not applicable to the proposed project is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. The project would not generate new demand for water related recreation as might be the case for a residential or commercial development.

Therefore, Policy 22 is not applicable to the proposed project.

HISTORIC RESOURCES AND VISUAL QUALITY POLICIES

Policy 23: *Protect, enhance, and restore structures, districts, areas or sites that are of significance in the history, architecture, archeology or culture of the state, its communities, or the nation.*

The FEIS concluded that the removal of the existing National Register-eligible (NR-eligible) Tappan Zee Bridge would result in an adverse effect to historic properties. This remains an unavoidable impact under the selected design. The FEIS also identified the potential for adverse effects on submerged archaeological resources along the Rockland County shoreline and the Hudson River bottom, in the event that further investigation determined any such resources to be eligible for the National Register. A Memorandum of Agreement (MOA) was executed among the FHWA, New York State Department of Transportation (NYSDOT), New York State Thruway Authority (NYSTA), State Historic Preservation Office (SHPO), and Advisory Council on Historic Preservation (ACHP) to resolve adverse effects. The MOA also stipulated the completion of ongoing investigations for potential archaeological resources in the Hudson River and continuing consultation for the consideration of measures to avoid, minimize, or mitigate adverse effects on any submerged resources eligible for the National Register. Further archaeological investigation that has since occurred identified a National Register-eligible shipwreck, but other potential archaeological resources described in the FEIS were not present or were not considered eligible for National Register listing. Construction of the selected design would disturb the area associated with the shipwreck. In accordance with the MOA, FHWA, NYSDOT, and NYSTA are consulting with SHPO and ACHP to develop alternative mitigation measures, in lieu of data recovery, for the mitigation of adverse effects on the NR-eligible shipwreck.

Since the MOA anticipated the presence of National Register-eligible submerged resources, considered the potential for adverse effects, and incorporated stipulations for consultation to mitigate those effects, the selected design would not alter the conclusions of the FEIS with respect to historic and cultural resources. The original assessment of the project’s consistency with Policy 23 is also unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. Under the selected design, it remains that the project is inconsistent with this policy, but the need to maintain a regionally important transportation link necessitates impacts to historic structures.

Policy 24: *Prevent impairment of scenic resources of statewide significance.*

The original assessment of the project’s consistency with this policy is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. The project site is approximately 15 miles from the nearest NYSDOS-mapped Scenic Area of Statewide Significance (SASS) and no designated scenic resources of statewide significance would be impaired by the project.

Therefore, the project remains consistent with Policy 24 under the selected design.

Policy 25: *Protect, restore, or enhance natural and manmade resources which are not identified as being of statewide significance, but which contribute to the overall scenic quality of the coastal area.*

Nyack policy 25A: *Protect and enhance views from Route 9W, Tallman Place, Fourth Avenue, Second Avenue, First Avenue and Memorial Park.*

Sleepy Hollow policy 25A: *Protect or enhance views of the Hudson River, the Hudson River valley, and the opposite shore from the immediate riverfront as viewed from publically owned properties.*

The original assessment of the project's consistency with these policies is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. The selected design is consistent with the renderings and analysis presented in the FEIS for a cable-stayed main span; however, it would have a lower elevation at the highway approach to the Rockland landing, and thus have lesser visual impact from certain locations compared to the Replacement Bridge Alternative. Under the selected design, the replacement bridge would not affect the overall scenic quality of the Tappan Zee region or the surrounding Hudson River communities.

Therefore, the project remains consistent with Policy 25, Nyack policy 25A, and Sleepy Hollow policy 25A.

AGRICULTURAL LANDS POLICY

Policy 26: *Conserve and protect agricultural lands in the state's coastal area.*

The original assessment that Policy 26 is not applicable to the proposed project is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. The project site is not located on or adjacent to lands meeting NYSDOS criteria for important agricultural lands.

Therefore, Policy 26 is not applicable.

ENERGY AND ICE MANAGEMENT POLICIES

Policy 27: *Decisions on the siting and construction of major energy facilities in the coastal area will be based on public energy needs, compatibility of such facilities with the environment, and the facility's need for a shorefront location.*

The original assessment that Policy 27 is not applicable to the proposed project is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS.

Policy 28: *Ice management practices shall not interfere with production of hydroelectric power, damage significant fish and wildlife and their habitats, or increase shoreline.*

The original assessment that Policy 28 is not applicable to the proposed project is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS.

Policy 29: *Encourage the development of energy resources on the Outer Continental Shelf, in Lake Erie and in other water bodies, and ensure the environmental safety of such activities.*

The original assessment that Policy 29 is not applicable to the proposed project is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS.

WATER AND AIR RESOURCES POLICIES

Policy 30: *Municipal, industrial, and commercial discharge of pollutants, including, but not limited to, toxic and hazardous substances, into coastal waters will conform to state and national water quality standards.*

Under the selected design, no municipal, industrial, or commercial discharges of pollutants or hazardous substances would occur as part of the project. With regard to non-point source pollution, the original conclusion that, with the implementation of stormwater management practices to treat stormwater for the landing areas, the discharge of stormwater runoff from the proposed project would not result in a net increase in pollutant loading to the Hudson River, is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. No significant adverse impacts to the water quality of the Hudson River would result from the selected design.

Therefore, the project remains consistent with Policy 30.

Policy 31: *State coastal area policies and management objectives of approved Local Waterfront Revitalization Programs will be considered while reviewing coastal water classifications and while modifying water quality standards; however, those waters already over-burdened with contaminants will be recognized as being a development constraint.*

The original assessment that Policy 31 is not applicable to the proposed project is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. Policy 31 requires that NYSDEC consider the CMP and the purposes of any approved LWRP when reviewing coastal water classifications and while modifying surface water quality standards. Policy 31 is not applicable to the project.

Policy 32: *Encourage the use of alternative or innovative sanitary waste systems in small communities where the costs of conventional facilities are unreasonably high, given the size of the existing tax base of these communities.*

This policy is not applicable.

Policy 33: *Best management practices will be used to ensure the control of storm water runoff and combined sewer overflows draining into coastal waters.*

The original conclusion that, with the implementation of stormwater management practices to treat stormwater for the landing areas, the discharge of stormwater runoff from the proposed project would not result in a net increase in pollutant loading to the Hudson River, is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. Under the selected design, the project would not result in a net increase in pollutant loading to the Hudson River for total suspended sediments and would result in just a small increase in pollutant loading for total phosphorus, thereby minimizing the potential for adverse changes to Hudson River water quality from the discharge of stormwater from the proposed project.

Therefore, it remains that the project would be consistent with Policy 33.

Policy 34: *Discharge of waste materials into coastal waters from vessels will be limited so as to protect significant fish and wildlife habitats, recreational areas and water supply areas.*

The original assessment of the project's consistency with these policies is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. The project would not involve the discharge of waste materials to the Hudson River, as the Hudson River is a no-discharge zone. Wastewater from sanitary facilities and from vessels used during construction would be disposed in accordance with all applicable health regulations.

Therefore, the project would be consistent with Policy 34.

Policy 35: *Dredging and dredge spoil disposal in coastal waters will be undertaken in a manner that meets existing state dredging permit requirements, and protects significant fish and wildlife habitats, scenic resources, natural protective features, important agricultural lands, and wetlands*.

Sleepy Hollow policy 35A: *Dredging shall not occur during fish spawning seasons and must be authorized by an appropriate permit from the NYSDEC and USACE.*

The original assessment of the project's consistency with these policies is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. The selected design would comply with all of the EPCs related to dredging as presented in the FEIS, and the mitigation plan would continue as detailed in the FEIS. Therefore, the selected design would not alter the conclusions of the FEIS with respect to effects of dredging on fish. Under the selected design, dredging would be undertaken outside the spawning season and in accordance with permits to be issued by USACE and NYSDEC. Any disposal of dredging material in ocean waters would be undertaken in accordance with a Section 103 permit pursuant to the Marine Protection, Research and Sanctuaries Act (16 USC §§ 1431, et seq., and 33 USC §§ 1401, et seq.).

Under the selected design, the spatial extent of the dredging would be reduced by approximately 25 to 34 acres and its duration would be reduced from three, 3-month phases over a four year period to two, 3-month phases over a two year period relative to the Replacement Bridge Alternative evaluated in the FEIS. This would allow the river's natural depositional process to occur sooner than what was estimated in the FEIS. In addition, the depth of the dredge channel for the selected design (maximum of 14 feet including over dredge) is three feet less than what was predicted in the FEIS (maximum of 17 feet including over dredge).

Therefore, the project would be consistent with Policy 35 and Sleepy Hollow Policy 35A.

Policy 36: *Activities related to the shipment and storage of petroleum and other hazardous materials will be conducted in a manner that will prevent or at least minimize spills into coastal waters; all practicable efforts will be undertaken to expedite the cleanup of such discharges; and restitution for damages will be required when these spills occur.*

The original assessment of the project's consistency with Policy 36 is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. No new potential areas or sources of hazardous or contaminated materials have been identified, and the project would continue to be subject to all applicable testing and handling requirements described in the FEIS.

Therefore, the project would be consistent with Policy 36.

Policy 37: *Best management practices will be utilized to minimize the non-point discharge of excess nutrients, organics and eroded soils into coastal waters.*

The original assessment of the project's consistency with Policy 37 is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. With the implementation of stormwater management practices to treat stormwater for the landing areas, the discharge of stormwater runoff would not result in a net increase in pollutant loading to the Hudson River. Additionally, there would be no net increase in total suspended sediments under the selected design (see response to Policy 33).

Therefore, the project would be consistent with Policy 37.

Policy 38: *The quality and quantity of surface water and groundwater supplies will be conserved and protected, particularly where such waters constitute the primary or sole source of water supply.*

The original assessment of the project's consistency with this policy is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. With the selected design, the project would not impact the quality and quantity of surface water or groundwater supplies, and no significant adverse impacts to water quality would result from the discharge of stormwater (see response to Policy 33).

Therefore, the project would be consistent with Policy 38.

Policy 39: *The transport, storage, treatment and disposal of solid wastes, particularly hazardous wastes, within coastal areas will be conducted in such a manner so as to protect groundwater and surface water supplies, significant fish and wildlife habitats, recreation areas, important agricultural lands and scenic resources.*

See response to Policy 35, above. Any disposal to upland sites would be the responsibility of the contractor and would comply with relevant laws and regulations.

Policy 40: *Effluent discharged from major steam electric generating and industrial facilities into coastal waters will not be unduly injurious to fish and wildlife and shall conform to state water quality standards.*

This policy is not applicable.

Policy 41: *Land use or development in the coastal area will not cause national or state air quality standards to be violated.*

The proposed project is not a land use or development project. Therefore, Policy 41 does not apply.

Policy 42: *Coastal management policies will be considered if the state reclassifies land areas pursuant to the prevention of significant deterioration regulations of the Federal Clean Air Act.*

Policy 42 relates to NYSDEC's obligations under the federal Clean Air Act's prevention of significant deterioration program and, therefore, is not applicable to the project.

Policy 43: *Land use or development in the coastal area must not cause the generation of significant amounts of the acid rain precursors: nitrates and sulfates.*

The original assessment of the project's consistency with this policy is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS. The project would not generate significant amounts of acid rain precursors (NO_x, SO_2). Therefore, the project would be consistent with Policy 43.

WETLANDS POLICY

Policy 44: *Preserve and protect tidal and freshwater wetlands and preserve the benefits derived from these areas.*

Although acreage of wetland disturbance under the selected design differs slightly than that which was analyzed for the Replacement Bridge Alternative, the original assessment of the project's consistency with this policy is unaffected by the selected design and other new information received since coastal consistency was granted by NYSDOS.

With the selected design, approximately 0.10 acres of littoral zone tidal wetlands would be dredged on the Westchester side of the river, similar to the Replacement Bridge Alternative. Like the Replacement Bridge Alternative, no dredging of littoral zone wetlands on the western shore of the river would be required under the selected design.

With the selected design, the Westchester Bridge Staging Area (WBSA) temporary work platform would include two temporary platforms and occupy 0.32 additional acres of NYSDEC littoral zone tidal wetlands than what was analyzed for the Replacement Bridge Alternative. Within this wetland area, 0.009 acres of NYSDEC littoral zone tidal wetlands would be impacted within the footprint of the temporary piles driven to support the pile-supported temporary south platform, as compared with 0.007 acres described in the FEIS. This platform would provide access for the demolition of the existing bridge and for construction of the upland portion of the new eastbound bridge. A temporary Westchester North Access Platform would be used to construct the new west bound bridge. This platform would be located outside of NYSDEC regulated tidal wetlands. Separate platforms to accommodate multiple construction and demolition activities in this area are critical to achieving the construction schedule. Furthermore, the speed and efficiency of construction equipment access and demolition/construction work via a work platform would be far greater than performing the same work by barge, and the wetland impacts of work platform support piles would result in less wetland impacts compared to dredging. Although there would be an increase in impacts to littoral zone tidal wetlands in the WBSA, overall, the amount of platform coverage would be reduced by 4.14 acres from what was predicted in the FEIS.

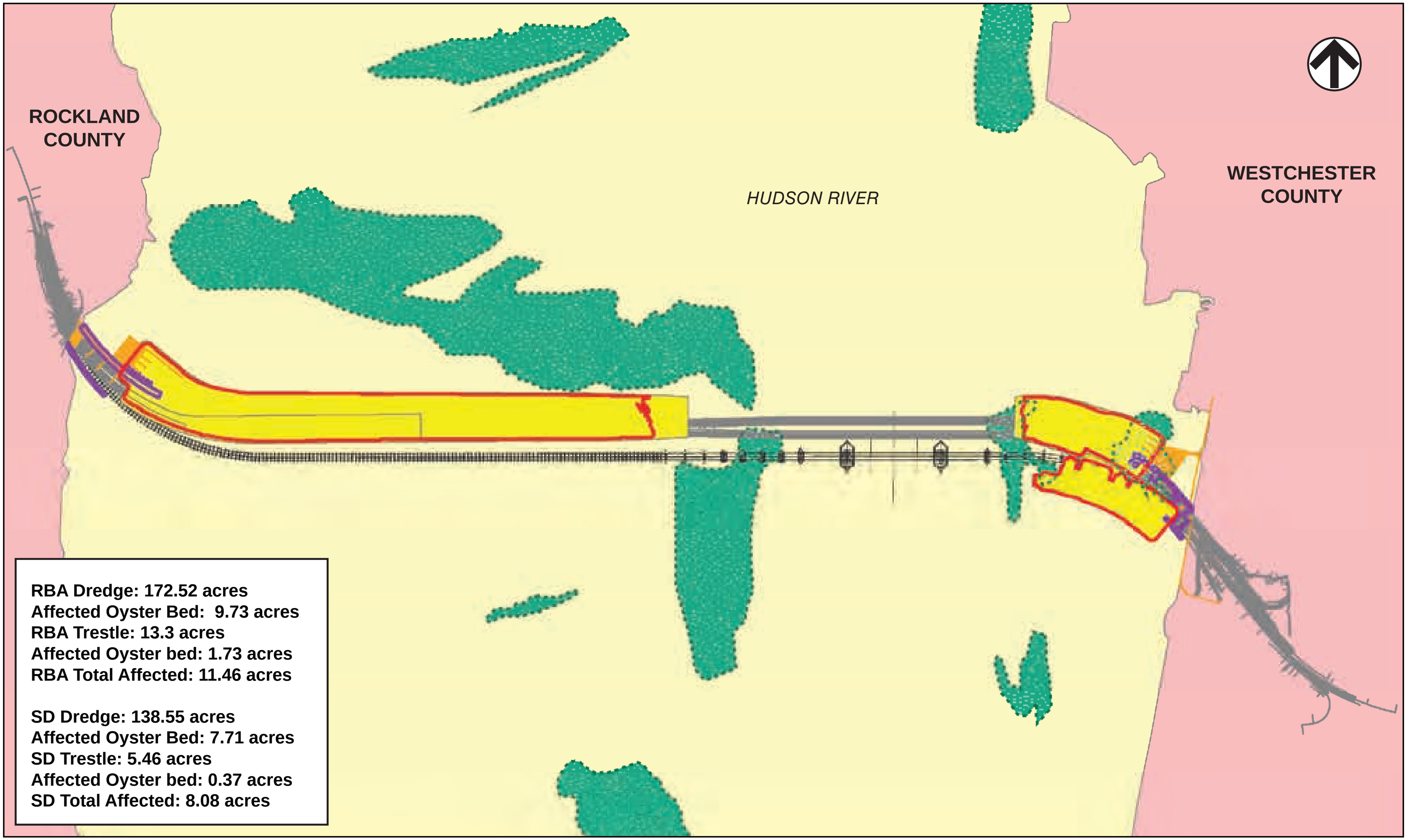
The FEIS determined that the temporary and permanent work platforms would not be constructed in NYSDEC-regulated tidal wetlands or in potential USACE wetlands on the Rockland County side of the river. With the selected design, a temporary trestle and temporary docks would be added to the south side of the bridge. Approximately 0.70 acres of the temporary trestle would occur over NYSDEC littoral zone tidal wetlands, with 0.01 acres impacted as a result of the pile footprint. Approximately 0.005 acres of platform would occur over NYSDEC-regulated adjacent area, with 0.001 acres impacted as a result of the pile footprint. An alternative would be to dredge an access channel along the southern side of the existing bridge towards the shoreline. However, due to the shallow water depth in this area, a significant amount of dredging disturbance would be required and would result in a greater impact to NYSDEC littoral zone tidal wetlands than with the temporary trestle-support piles. Furthermore, the speed and efficiency of construction equipment access and construction and demolition work via a temporary platform was determined to be far greater than performing the same work by barge. As such, the most feasible and reasonable alternative that provides the least environmental impact and the best work efficiencies was determined to be the temporary platform. Although there would be an increase in impacts to littoral zone tidal wetlands in the RBSA, overall, the amount of platform coverage would be reduced by 0.33 acres from what was predicted in the FEIS.

Regarding freshwater wetlands, the selected design would be an improvement from that considered in the FEIS. In the selected design, the temporary platform and access road for the WBSA analyzed in the FEIS are no longer included and have been replaced with temporary trestles over the Hudson River, as described above. No portions of these temporary trestles would be constructed in freshwater wetlands and no other freshwater wetlands would be impacted as a result of the selected design.

Although the selected design would affect wetlands, the need for the project necessitates these impacts, and overall impacts to wetlands would be less than those of the Replacement Bridge Alternative evaluated in the FEIS. Furthermore, there remains no prudent and feasible alternative to the impact on these resources. Notwithstanding the decreased wetland impacts of the selected design, the project sponsors remain committed to the mitigation plan, which was developed in coordination with NYSDEC and was described in the FEIS. With the implementation of these mitigation measures in place, the project would be consistent with Policy 44.

Attachment 4: Figure 1: Impacts to Oyster Beds due to Dredging and Work Platforms

12.17.12



NOTE:
RBA = Replacement Bridge Alternative
SD = Selected Design

SD Dredge
SD Trestle
RBA Trestle
RBA Dredge
SD Bridge
Existing Bridge
County
Oyster Beds

Figure 1

Dredging and Trestle Impacts to Oyster Beds