

S-1 INTRODUCTION

This Environmental Impact Statement (EIS) examines the potential environmental effects of proposed alternatives for the Tappan Zee Hudson River Crossing Project, and where adverse impacts are identified, it discusses measures to mitigate them. The Federal Highway Administration (FHWA) is the federal lead agency for the project, and the New York State Department of Transportation (NYSDOT) and the New York State Thruway Authority (NYSTA) are joint lead agencies.

The purpose of the project is to maintain a vital link in the regional and national transportation network by providing a Hudson River crossing between Rockland and Westchester Counties, New York that addresses the limitations and shortcomings of the existing Governor Malcolm Wilson Tappan Zee Bridge (“Tappan Zee Bridge”). The project would address the structural, operational, safety, security, and mobility needs of the Tappan Zee Hudson River Crossing.

Compared to the prior Tappan Zee/I-287 Corridor Project (which has formally been rescinded by the project sponsors), the currently proposed Tappan Zee Hudson River Crossing Project is being advanced specifically to address the immediate structural and operational deficiencies of the Tappan Zee Bridge and is also based on an assessment of limited project funding opportunities for the foreseeable future. However, based on the new project’s much more limited scope and termini, the new Tappan Zee Hudson River Crossing Project will not preclude the planning, design, construction or consideration of future transit modes in the project area. Bridge design will not preclude future transit operations. Furthermore, a goal of the Tappan Zee Hudson River Crossing Project is to maximize the public investment in the new crossing. Given that the lifespan of a new crossing will extend over a century, it is prudent to design the new bridge to optimize the flexibility for future transportation modes that may not be foreseeable now, but may be over the lifespan of the new crossing. Certain transit provisions will be included in this project to maximize the public investment. These provisions could include added width, a gap between structures, providing certain grades and increased design loadings. Through the inclusion of design features that maximize the public investment, the bridge design will provide the flexibility to potentially allow for both Bus Rapid Transit (BRT) and Commuter Rail Transit (CRT), should a viable plan be developed and implemented in the future. Any BRT or CRT transit improvement project implemented in the region that uses the Tappan Zee Hudson River Crossing would still require its own future environmental review, studies, and permits. Please refer to **Appendix A** for more information.

Pursuant to New York State legislation passed in December 2011, NYSDOT and NYSTA anticipate that this project would be advanced under a Design-Build contract. With this approach, NYSDOT and NYSTA would select a single Design-Builder to both

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complete the design and construct the Replacement Bridge Alternative. The selection of the Design-Builder would be accomplished through a two-step approach—first a Request for Qualifications (RFQ) would be used to develop a short-list of qualified firms, followed by a Request for Proposals (RFP). The RFQ and RFP would specify basic design and planning guidelines, environmental performance commitments and any additional mitigation required based on the analysis in this Draft EIS (DEIS).

As specified in 23 CFR § 636.109, a Design-Build process must be coordinated with review under the National Environmental Policy Act of 1969 (NEPA; 42 USC §4321 et seq.). While preliminary designs are identified in this DEIS, the Design-Builder has the option to propose alternative design concepts so long as they meet the criteria of the RFP and the Contract Documents. The design options presented in this DEIS provide an envelope for the possible final design of the Replacement Bridge Alternative. The options presented in the DEIS represent the extent of work that is expected to be reflected in the proposals that are received out of the design build process, thereby enabling the team to identify and analyze the potential impacts and mitigation measures necessary relevant to the resources in the project area. While preliminary designs are identified, the Design-Builder has the option to propose alternative design concepts that are consistent with the Final EIS (FEIS), Record of Decision (ROD), and criteria of the RFP Contract Documents. The Design-Build process enables the Design-Builder to use innovation to further avoid, minimize and mitigate environmental effects and promote efficiency in cost and construction duration.

The options are intended to demonstrate the possible range of impacts of the Replacement Bridge Alternative and to identify potential mitigation measures. Should an alternative design concept be proposed and selected, FHWA, NYSDOT, and NYSTA would evaluate whether the new design would affect the conclusion of this NEPA process and whether additional documentation of its potential effects is necessary.

This EIS will serve as the basis for ROD under NEPA. This EIS will also satisfy review requirements of the New York State Environmental Quality Review Act (SEQRA; 6 NYCRR Part 617 and 17 NYCRR Part 15).

S-2 PURPOSE AND NEED

The Tappan Zee Bridge opened to traffic in 1955 as part of the New York State Thruway extension between Suffern, New York and Yonkers, New York. Over the years, the bridge and its highway connections have been the subject of numerous studies and subsequent transportation improvements. Despite these improvements, congestion has grown steadily over the years and the aging bridge structure has reached the point where major reconstruction and extensive measures are needed to sustain this vital link in the transportation system. The purpose of this project is to maintain this vital link in the regional and national transportation network by providing an improved Hudson River crossing between Rockland and Westchester Counties.

S-2-1 STRUCTURAL DEFICIENCIES

An extensive and costly maintenance and capital program has been required to keep the Tappan Zee Bridge's structural elements in a state of good repair. However, the existing Tappan Zee Bridge falls short of current engineering standards.

Based on criteria provided in the NYSDOT Load and Resistance Factor Design (LRFD) Bridge Design Specifications, the Tappan Zee Bridge is classified as a “critical bridge,” i.e., one required to be open to all traffic once inspected after a major event and be useable by emergency vehicles and for security, defense, economic or secondary life safety purposes immediately after the major event. However, the structure currently cannot sustain extreme natural or man-made events because it lacks the required structural redundancy to withstand them. Lacking this redundancy, the bridge is vulnerable to damage from such events, and as a consequence, traffic disruption or full closure could result while repairs are undertaken.

Between 2000 and 2010, NYSTA spent over \$500 million to maintain the bridge, and NYSTA will continue maintenance of the bridge and will invest capital funds to keep it in a state of good repair. NYSTA estimates that it would spend \$1.3 billion to maintain and repair the bridge over the next decade. Major work activities would include seismic upgrades to portions of the bridge, navigational safety improvements, steel and concrete repairs, and other miscellaneous work to continue to keep the bridge safe for the traveling public.

S-2-2 OPERATIONAL AND SAFETY DEFICIENCIES

The Tappan Zee Bridge does not meet current NYSDOT bridge and highway standards with respect to such essential characteristics as lane and shoulder widths. It currently operates with seven lanes that range in width from 11 feet, 2 inches to 12 feet, narrower than the standard 12-foot lane, and has no shoulders or emergency access; emergency vehicles must use general traffic lanes to attend to accidents or other incidents on the bridge. This adversely affects emergency calls and response times in the area. The bridge also has a median consisting of a movable barrier with only 1 foot of clearance on either side. This also falls short of NYSDOT’s minimum standard for bridges.

From 2001 to 2009, more than 2,700 accidents occurred between Interchange 9 (Route 9) in Tarrytown and Interchange 10 (Route 9W) in Nyack. During this same period, the accident rate on this 3.89-mile roadway segment was 2.15 accidents per million miles of vehicle travel (acc/MVM), more than twice NYSTA’s statewide average.

S-2-3 SECURITY DEFICIENCIES

The Tappan Zee Bridge is a critical infrastructure element within the corridor and region. If the Tappan Zee Bridge were to become inoperable, the consequences would be severe to the regional and national transportation networks and economies. Its structural deficiencies, in combination with the prominence of this crossing as a critical roadway link, highlight the need to incorporate redundancy and modern security infrastructure at this Hudson River crossing.

S-2-4 MOBILITY DEFICIENCIES

During a typical weekday, traffic volumes are higher in the eastbound direction during the morning and higher in the westbound direction in the evening. To better handle growing volumes, in 1992 NYSTA added a seventh (median) lane to the previously six-lane bridge, and uses a movable barrier system to assign this median lane to the peak traffic direction, providing four eastbound lanes in the morning and four westbound lanes in the evening. However, despite the additional travel lane, the bridge remains highly congested with frequent travel delays and a poor level of service.

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The bridge collects tolls in the eastbound direction at the toll plaza in Tarrytown. During peak weekday morning periods, the toll plaza generally handles the flow with minimum delay, since nearly 90 percent of the drivers have E-ZPass. The weekends are a different story, when the traffic volumes are lower, but E-ZPass usage is less than 60 percent. During this time, queues of cash-paying drivers block access to the E-ZPass lanes, spill back onto the bridge, and create traffic delays that reach well into Rockland County.

The bridge also does not allow for multi-modal travel. Buses do operate across the bridge, but are subject to the same difficulties as private vehicles and trucks. Cyclists and pedestrians are prohibited from crossing the bridge.

S-3 GOALS AND OBJECTIVES

Project development is being guided by three goals with supporting objectives that address the deficiencies of the existing bridge described above. These goals are as follows:

- Ensure the long-term vitality of this Hudson River crossing.
- Improve transportation operations and safety.
- Maximize the public investment in a new Hudson River crossing.

S-4 PROJECT ALTERNATIVES

This EIS considers two alternatives—No Build Alternative and Replacement Bridge Alternative. Rehabilitation, Tunnel, and Single Span Alternatives were previously considered and determined not to be prudent because they would not meet the project's goals and objectives, as discussed below. Therefore, this EIS does not assess the Rehabilitation, Tunnel, or Single Structure Alternatives for the Tappan Zee Hudson River Crossing Project.

S-4-1 NO BUILD ALTERNATIVE

NEPA requires that an EIS consider a No Build Alternative. The No Build Alternative reflects the continuation of the existing Tappan Zee Bridge and serves as the baseline condition against which the potential benefits and impacts of the Replacement Bridge Alternative are evaluated.

Under the No Build Alternative, the Tappan Zee Bridge would retain its current, seven-lane configuration. NYSTA would spend \$1.3 billion to maintain and repair the bridge over the next decade. Major work activities would include seismic upgrades to portions of the bridge, navigational safety improvements, steel and concrete repairs, and other miscellaneous work to continue to keep the bridge safe for the traveling public.

Extraordinary maintenance efforts and capital projects would ensure that the bridge continues to be safe to the traveling public, but these projects would not correct all of the structural, operational, safety, security, or mobility needs of the bridge. Therefore, given the age of the bridge and its vulnerabilities in extreme events, it is possible that under the No Build Alternative, the crossing could be closed altogether at some point in the future, resulting in the loss of a critical infrastructure element to an important transportation corridor.

In addition to the population and employment growth projections for Westchester and Rockland Counties over the next 30 years, there are certain projects that will be undertaken independent of the project alternatives for the Tappan Zee Hudson River Crossing. The assessment of the No Build Alternative in this EIS accounts for background growth, which includes the specific projects that would be developed independent of the Tappan Zee Hudson River Crossing Project.

S-4-2 REPLACEMENT BRIDGE ALTERNATIVE

The Replacement Bridge Alternative would result in a new bridge crossing of the Hudson River between Rockland and Westchester Counties. To conform to highway design standards, including widths and grades, the Replacement Bridge Alternative would result in new structures and modifications to Interstate 87/287 between approximately Interchange 10 (Route 9W) in Nyack and Interchange 9 (Route 9) in Tarrytown. The Replacement Bridge Alternative would consist of two parallel structures to the north of the existing bridge. The following sections describe the proposed landings, approach spans, main spans, and ancillary facilities of the Replacement Bridge Alternative.

The design options presented in this DEIS provide an envelope for the possible final design of the Replacement Bridge Alternative. The options presented in the DEIS represent the extent of work that is expected to be reflected in the proposals that are received out of the design-build process, thereby enabling the team to identify and analyze the potential impacts and mitigation measures necessary relevant to the resources in the project area. While preliminary designs are identified in this DEIS, the Design-Builder has the option to propose alternative design concepts that are consistent with the FEIS, ROD, and criteria of the RFP Contract Documents.

S-4-2-1 LANDINGS

In Rockland and Westchester Counties, Interstate 87/287 would be shifted northward to meet the new abutments of the Replacement Bridge Alternative.

Rockland County

There are two options for the Replacement Bridge Alternative's approach spans—the Short Span and Long Span Options. Each would result in different configurations of the Rockland County landing as described below.

Approximately 150 feet west of the South Broadway Bridge, the roadway would begin to shift northward from its existing centerline. The highway would continue to operate with 10 lanes: 8 general traffic lanes (4 eastbound and 4 westbound); 1 eastbound acceleration lane from Interchange 10 (Route 9W); and 1 westbound deceleration lane to Interchange 10 (Route 9W). Left and right shoulders would be provided in both directions. The eastbound acceleration lane and the westbound deceleration lane would end approximately 300 feet west of River Road, and as it approaches the bridge, the roadway would consist of 8 general traffic lanes with left and right shoulders.

The new bridge abutment would be located approximately 75 feet west of River Road. At the point where it meets the approach spans of the new bridge, the northern boundary of the highway would be approximately 100 feet north of its existing

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boundary. The highway would exit Rockland County at an elevation of between 16 and 23 feet above River Road.

Reconfiguration of the Rockland landing would require reconstruction of the South Broadway Bridge slightly east of its existing location. The reconfigured highway would also require that new eastbound and westbound maintenance ramps be constructed from Interstate 87/287 to River Road. For the Long Span Option, the eastbound maintenance ramp would extend about 100 feet further inland than in the Short Span Option. The longer maintenance ramp is required to meet the higher elevation of the highway in the Long Span Option.

Westchester County

The new bridge would enter Westchester County with 60 feet of clearance above Metro North Commuter Railroad's Hudson line. The new bridge structures would straddle the centerline of the existing bridge, and the new alignment would extend approximately 100 feet to the north and 100 feet to the south of the existing bridge. The new bridge abutments would be located approximately 200 feet inland of the Hudson line.

In the eastbound direction, Interstate 87/287 would widen from four to five lanes on the bridge as it nears the Westchester abutment. The three inner lanes would serve as highway-speed E-ZPass lanes through the Westchester County toll plaza. The right two lanes would serve cash/E-ZPass customers, and these two lanes would widen to seven cash/E-ZPass lanes through the toll plaza. In total, the highway would carry 10 lanes through the Westchester County toll plaza.

East of the toll plaza, the highway would narrow to six eastbound lanes, five general traffic lanes and one deceleration lane to Interchange 9 (Route 9). The highway-speed E-ZPass lanes would remain separated from the cash/E-ZPass to a point approximately 200 feet east of the Broadway Bridge (Route 9). Therefore, motorists that would exit at Interchange 9 (Route 9) would use the cash/E-ZPass lanes. Between the Broadway Bridge (Route 9) and a point approximately 400 feet to its east, the highway would narrow from five to four lanes and would resume its existing alignment.

In the westbound direction, the modified Westchester landing would extend from the Broadway Bridge (Route 9) to about 100 feet west of the shoreline. The westbound highway would consist of four lanes as it would pass beneath the Broadway Bridge (Route 9). West of the Broadway Bridge, the westbound Interchange 9 (Route 9) on-ramp would join the highway, and an acceleration lane would be provided for approximately 750 feet. The acceleration lane would end approximately 100 feet west of the shoreline, and the highway would continue as four westbound lanes as it crosses the Hudson River.

The modified Westchester landing would include 12-foot traffic lanes, a left shoulder, and a right shoulder in both the eastbound and westbound directions. There would be additional median space in the eastbound direction between the highway-speed E-ZPass lanes and the cash/E-ZPass lanes.

The modifications to the Westchester landing would require reconstruction of the toll plaza, the westbound on-ramp from Interchange 9 (Route 9), and the existing New York State Thruway maintenance facility at Interchange 9 (Route 9).

S-4-2-2 APPROACH SPANS

There are two options for the approach spans that provide a framework for the evaluation of impacts in the DEIS. The approach spans link the landings with the main spans over the navigable channel. These options—Short Span and Long Span—differ in terms of the type of structure as well as the number of and distance between bridge piers. Both approach span options would include eight travel lanes (four eastbound and four westbound) with inside and outside shoulders on both structures. The north structure of each approach span option would also include a shared-use path. The approach span options would maximize the public investment for and would not preclude future transit service across the Tappan Zee Hudson River Crossing.

Short Span Option

The Short Span Option would consist of two parallel bridge structures that would have a typical highway design with a road deck supported by girders and piers. The parallel structures would be separated by a gap that would vary in dimension across the approach spans. The following describes the general characteristics of the Rockland County and Westchester County approach spans for the Short Span Option:

- The Rockland County approach spans would extend 4,125 feet between the abutments and the main spans. Each approach span would consist of 43 sections with an average distance between the piers of about 230 feet. There would be no gap between the parallel highway decks at the abutments. The gap between the highway decks would widen to 70 feet at the main spans.
- The Westchester County approach spans would extend 1,800 feet between the main spans and the abutments, and each would consist of 16 sections with an average distance between the piers of approximately 230 feet. The gap between the parallel highway decks would range from 70 feet at the main spans to 40 feet at abutments.

As the approach spans meet the main span, the road deck would be at an elevation of 175 feet above the Hudson River's mean high-tide level.

Long Span Option

The Long Span Option would also consist of two parallel bridges structures. Each structure would have a truss supported by piers. The road deck would be located on top of the trusses. The parallel structures would be separated by a gap that would vary in dimension across the approach spans. The following describes the general characteristics of the Rockland County and Westchester County approach spans for the Long Span Option:

- The Rockland County approach spans would extend 4,125 feet between the abutments and the main spans. Each approach span would consist of 23 sections with an average distance between the piers of about 430 feet. There would be no gap between the parallel highway decks at the abutments. The gap between the highway decks would widen to 70 feet at the main spans.
- The Westchester County approach spans would extend 1,800 feet between the main spans and the abutments, and each would consist of 10 sections with an

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average distance between the piers of 430 feet. The gap between the parallel highway decks would range from 70 feet at the main spans to 40 feet at abutments.

As the approach spans meet the main span, the road deck would be at an elevation of 195 feet above the Hudson River's mean high-tide level.

S-4-2-3 MAIN SPANS

The main spans are the portions of the bridge that cross the navigable channel of the Hudson River, and would provide adequate vertical and horizontal clearance for marine transport. This DEIS 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 main span navigational channel. However, the Design-Builder may consider design options that are within the parameters of these designs. Both options would result in a horizontal clearance of at least 1,042 feet and a vertical clearance of 139 feet over the navigable channel at mean high water. Both main span options would include eight travel lanes (four eastbound and four westbound) with inside and outside shoulders on both structures. The north structure of each main span option would also include a shared-use path. The main span options will maximize the public investment for and would not preclude future transit service across the Tappan Zee Hudson River Crossing.

Cable-stayed Option

The Cable-stayed Option would result in two spans each supported by two towers and cables connected to towers. The four towers (two towers per span) would rise about 400 feet above the road deck and would be set approximately 300 feet outward from the limits of the navigable channel. Cables would extend from each of the towers to various points on the road deck, in effect holding it up from above. The cables would support the entirety of the main spans between the approach structures. The cables would extend both eastward and westward from each tower tying into the road deck as much as 300 feet away from the towers. The cables would be anchored to the ground through the tower foundations. Each section of the road deck would be connected to the towers by multiple cables.

Arch Option

This option would consist of two structures each supported by steel arches. Each structure would have two steel arches that would extend eastward and westward from the main spans' piers. The main spans' piers would be located about 500 feet outward from the limits of the navigable channel. The supports would curve upward and support the road deck from below. On either side of the navigable channel, the curved supports would extend above the road deck and meet in the middle forming the arch. The top of the arch would be about 200 to 300 feet above the road deck. Suspender cables would extend vertically from the arch structure to support the road deck.

S-4-2-4 OPERATIONS

Each deck would have four 12-foot traffic lanes, a left shoulder and emergency access, a right shoulder, and barriers along the decks' edges. The left and right shoulders would serve as disabled vehicle lanes. The left shoulder would also provide emergency

vehicle access. The extra-wide left shoulders would be provided only on the bridge itself and would narrow at the abutments to the Westchester or Rockland County landings.

A shared-use path would be provided along the northern edge of the Replacement Bridge Alternative's north superstructure. The path would serve cyclists and pedestrians and would be 12 feet wide with a 2-foot safety buffer between the path and the traffic lanes (14 feet total). In Rockland County, the shared-use path would connect to Esposito Trail via the South Broadway Bridge in South Nyack, following the westbound lanes of Interstate 87/287 from the abutment to the South Broadway Bridge. In Westchester County, the shared-use path would connect to Route 9 (South Broadway), following the westbound lanes of Interstate 87/287 from the abutment to the westbound on-ramp at Interchange 9, meeting Route 9 at the bottom of the westbound on-ramp.

S-4-2-5 ANCILLARY FACILITIES

The NYSTA maintenance facility and the New York State Police barracks on the north side of Interstate 87/287 at Interchange 9 (Route 9) would be relocated during construction to use this space for a contractor staging area. Upon completion of the Replacement Bridge Alternative, a new maintenance facility and New York State Police barracks would be constructed at approximately the same location within the existing NYSTA right-of-way.

The Replacement Bridge Alternative would relocate the bridge maintenance ramps in Rockland County to meet the new alignment of the Replacement Bridge Alternative. These ramps would begin at River Road and rise to the grade of Interstate 87/287 east of the South Broadway Bridge in South Nyack. Because the Long Span Option would be at a higher elevation than the Short Span Option, its maintenance ramps would extend further west of River Road.

Permanent stormwater controls will be designed and constructed in accordance with the New York State Department of Environmental Conservation's (NYSDEC's) *Stormwater Design Manual*, NYSDOT's *Highway Design Manual*, NYSDOT's *The Environmental Manual*, and NYSTA engineering guidance. The permanent controls would be developed as part of the Stormwater Pollution Prevention Plan (SWPPP) for the Replacement Bridge Alternative. Locations for the facilities would be determined as the final design for the Replacement Bridge Alternative is developed.

S-4-2-6 SECURITY

The Replacement Bridge would include design features and systems to protect the bridge from man-made events. Its design would incorporate offsets and clearances to limit access to key structure features. Surveillance and detection systems would be installed on the bridge, and a central command center would be located at NYSTA's maintenance facility to provide 24-hour monitoring of the bridge.

S-4-2-7 PROPERTY ACQUISITION

Construction of the Replacement Bridge Alternative would require both temporary (construction-period) and permanent property acquisitions and easements.

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S-4-2-8 CONSTRUCTION DURATION AND COST

Depending on the outcome of the Design Build process, the construction duration is anticipated to range from 3 to 5½ years, and the construction cost is anticipated to range from \$3.5 to \$5 billion. The Design Build project delivery method would introduce innovation and may reduce construction time, cost, and environmental impacts.

For purposes of analysis in this DEIS, a construction duration of 4½- to 5½ years was assumed, and the construction cost was assumed to \$4.64 billion (in 2012 dollars).

S-4-2-9 PILE INSTALLATION AND DEMONSTRATION PROGRAM

To assist in the preliminary engineering investigations, cost estimates, and development of potential environmental performance commitments during construction, NYSDOT and NYSTA will undertake a Pile Installation and Demonstration Program (PIDP) and geotechnical borings. NYSDOT and NYSTA have secured the necessary permits and approvals for the PIDP and geotechnical borings and work is expected to begin in the winter or early spring of 2012. As part of that program, NYSDOT and NYSTA will install and test the structural performance of a number of piles of varying diameters and monitor the efficacy of various noise attenuation measures. Any relevant data from these test programs will be incorporated into the Final EIS for the Tappan Zee Hudson River Crossing Project.

S-4-2-10 ALTERNATIVES CONSIDERED AND ELIMINATED

Rehabilitation Alternative

The *Alternatives Analysis for Rehabilitation and Replacement of the Tappan Zee Bridge Report* (March 2009) identified four rehabilitation options to enhance the structural integrity and operation of the existing Tappan Zee Bridge. Four rehabilitation options were considered:

- 1) Replacement Causeway and Rehabilitated Main Span;
- 2) Replacement Causeway and Widened Main Span;
- 3) Replacement Causeway, Rehabilitated Main Span, and Single Level Supplemental Bridge; and
- 4) Replacement Causeway, Rehabilitated Main Span, and Dual Level Supplemental Bridge.

The Alternatives Analysis for Rehabilitation and Replacement of the Tappan Zee Bridge Report was part of the Scoping Summary Report for the Tappan Zee Bridge/I-287 Corridor Project. It was widely distributed and the subject of intensive public and agency review and comment. The report concluded that the Rehabilitation Alternative is not prudent for the reasons described below. The findings of the report were reviewed in the context of the goals and objectives for the current project, and the conclusion was confirmed.

The Rehabilitation Alternative would fail to meet the project goal of ensuring the long-term vitality of the Tappan Zee Hudson River crossing for the following reasons:

- The Rehabilitation Alternative would be designed to comply with seismic criteria, which are based on strength, but would lack ductility, which allows bridge members

to endure changes in shape without breaking. Therefore, the Rehabilitation Alternative would be vulnerable during an extremely long or intensive earthquake.

- The Rehabilitation Alternative options that have a single structure (Options 1 and 2) would lack service redundancy. If the bridge were heavily damaged by a natural or man-made event, it could be closed for repairs. If the bridge were closed, there would be no alternative routing for traffic at this location along the Hudson River.

The Rehabilitation Alternative would fail to meet the project goal of improving transportation operations and safety on the crossing for the following reasons:

- The Rehabilitation Alternative would lack alternative load path redundancy (i.e., the ability of bridge members to be supported by multiple means, such as a deck supported both by a deck truss and by a bridge cable). As such, the Rehabilitation Alternative would not adequately address security or operational concerns, since a fire, vessel collision, or other man-made event could more easily cause severe damage to the structure and require its closure. Its closure would severely affect traffic operations, freight movement, and economic conditions across the region.

The Rehabilitation Alternative would fail to meet the project goal of maximizing the public investment in a new Hudson River crossing for the following reasons:

- The life span of bridge components retained in the Rehabilitation Alternative would be shorter than those of a new bridge. To maximize the public investment in a new Tappan Zee Hudson River Crossing, the desired life span of the new structure is at least 100 years before major maintenance or rehabilitation is needed. However, components of the Rehabilitation Alternative would need major maintenance or replacement in as few as 50 years.
- The construction duration for the Rehabilitation Alternative would be one year longer than for a replacement bridge.
- There is much uncertainty associated with rehabilitation projects in that the extent of damage to certain bridge components may not be fully known until they are actually replaced. This uncertainty would have the potential to substantially increase the construction cost and duration of the Rehabilitation Alternative.
- The Rehabilitation Alternative would involve both upland and in-water construction activities and would be expected to result in many of the same environmental impacts of a replacement bridge.
- The Rehabilitation Alternative with two bridges would cost \$2.5 to \$2.7 billion more than the Replacement Bridge Alternative. It would also result in more in-water work and would have the same deficiencies described above in terms of life cycle and vulnerabilities.

Given these considerations, the Rehabilitation Alternative would not meet the project's purpose and need and was eliminated from further consideration in this EIS.

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Tunnel Alternative

A newly bored or immersed tunnel between Rockland and Westchester Counties was previously studied (*Alternatives Analysis for Hudson River Highway Crossing*, July 2007) and was concluded not to be prudent for the following reasons.

The Tunnel Alternative would consist of five separate bored tubes with two lanes each or an immersed tunnel with two chambers. To provide for a maximum desired highway grade and to accommodate the topography of the affected area, the bored tunnel would stretch seven miles from Interchange 12 (NY 303/Palisades Center Drive) in Rockland County to east of Interchange 10 (Route 9) in Westchester County. In contrast, the immersed tunnel would be shallower and would come to the surface closer to the shoreline. However, it would require extensive shoreline and in-water work.

Compared with the Replacement Bridge Alternative, the Tunnel Alternative would take longer to construct and would entail a higher cost (\$8 billion as compared with \$4.6 billion). The Tunnel Alternative would require acquisition of substantial rights-of-way for its approach structures, portals, and ventilation structures. The tunnel's construction would substantially impact the Talleyrand Swamp and the Rockland and Westchester County shoreline of the Hudson River where its ventilation structures would be sited.

The Tunnel Alternative would offer less operational flexibility than a bridge. Traffic would be separated into two or five tubes, resulting in less flexibility to maintain traffic flow through the tunnel and difficult traffic control at the portals. The tunnel would have a 3 percent grade over a long distance, making speed control difficult for trucks. The separation of highway operations into separated tubes or chambers over a long distance would make emergency response more challenging than for a bridge. Furthermore, a bored tunnel would result in the removal of Interchanges 9 (Route 9), 10 (Route 9W), and 11 (Route 9W), and connectivity to Interstate 87/287 from local roads in eastern Rockland County would be lost.

While the Tunnel Alternative would meet some of the goals and objectives of the project, it would fail to meet the goal of "maximizing the public investment in a new Hudson River crossing" for the following reasons:

- The Tunnel Alternative would require higher construction costs and a longer duration of construction activities than a replacement bridge. As such, this alternative would not be cost-effective or yield maximum benefit in relation to its financial investment.
- The Tunnel Alternative would result in greater disruption to surrounding land uses than a replacement bridge, as extensive construction would be required outside of the existing New York State Thruway right-of-way, thereby requiring greater land acquisition.
- The Tunnel Alternative would not provide an opportunity to implement a shared-use pathway for cyclists and pedestrians.

Given these considerations, the Tunnel Alternative would not meet the project's goal to maximize the public investment in this Hudson River crossing. Thus, the Tunnel Alternative was eliminated from further consideration in this EIS.

Single Structure Alternative

Comments received during the scoping process for the Tappan Zee Bridge Hudson River Crossing Project called for examination of a Single Structural Alternative. The Single Span Alternative would involve the replacement of the existing Tappan Zee Bridge with a new eight-lane crossing on a single structure, whereas the Replacement Bridge Alternative would include two structures.

As noted above, this critical crossing requires service redundancy. In the event that a man-made or natural event would severely damage the bridge, the entire crossing would be subject to closure. Also, NYSTA would be more limited in its ability to maintain a single structure since it must remain open to traffic during repairs.

The constructability of the Single Structure Alternative is more difficult than for the Replacement Bridge Alternative. The Single Span Alternative would be a wide structure, which would likely need to be constructed in multiple phases to maintain a proper transition between the bridge and landings without impeding traffic flow. Furthermore, construction of the second or third phase of a single structure would be difficult if traffic were operating across the first phase, and it is likely that the Single Span Alternative would require that the existing bridge remain in use for a longer period. There would also be more property needed at the landings, and there would be piers in the river during construction.

Given these considerations, the Single Structure Alternative would not meet the project's goals to improve transportation operations and safety on the crossing and to maximize the public investment in this Hudson River crossing. Thus, the Single Span Alternative was eliminated from further consideration in this EIS.

S-5 PROCESS, AGENCY COORDINATION, AND PUBLIC PARTICIPATION

NYSDOT and NYSTA are requesting approvals from FHWA and other federal agencies for implementation of the Tappan Zee Hudson River Crossing Project. These federal approvals are subject to environmental review NEPA.

The project is classified as a NEPA Class I project in accordance with 23 CFR § 771.115, which requires an EIS to determine the likely impacts the project will have on the environment. The steps in the NEPA EIS process are (1) issuance of a Notice of Intent (NOI); (2) issuance of a Notice of Scoping (initiating the public comment period on the scope of the project); (3) publication of a DEIS consistent with NEPA and other applicable regulations and requirements; (4) public review of the DEIS, including a public hearing and period for public comments on the document; (5) publication of a FEIS that include the comments and responses on the DEIS and any necessary revisions to address the comments; and (6) approval of a ROD.

In accordance with SAFETEA-LU Section 6002, this environmental document may be adopted or used by any Federal agency making any approval associated with the Tappan Zee Hudson River Crossing Project.

S-5-1 STATE ENVIRONMENTAL QUALITY REVIEW ACT (SEQRA)

SEQRA requires New York governmental agencies to identify potential environmental effects that would result from their discretionary actions, and to the extent that significant adverse impacts are identified, avoid, minimize or mitigate those impacts to the maximum extent practicable, consistent with social, economic, environmental, and other considerations. For all actions under SEQRA, no involved New York State agency may undertake, fund, or approve the action until review under SEQRA is complete and SEQRA findings have been issued, unless such actions fall within certain statutory or regulatory exemptions.

The project is classified as a SEQRA Type I action (6 NYCRR § 617.4 and 17 NYCRR Part 15), indicating that it has the potential for environmental impacts that should be evaluated under SEQRA. In accordance with 6 NYCRR § 617.15 and 17 NYCRR Part 15, the NEPA and SEQRA processes for the Tappan Zee Hudson River Crossing Project are being coordinated, and therefore, NYSDOT, NYSTA, and other New York State agencies undertaking a discretionary action for this project have no obligation to prepare an additional EIS under SEQRA. Rather, NYSDOT, NYSTA, and other New York State agencies will make SEQRA findings based on the Federal FEIS.

S-5-2 OTHER FEDERAL AND STATE REGULATORY REQUIREMENTS, PERMITS, AND APPROVALS

Implementation and construction of the Tappan Zee Hudson River Crossing Project is subject to a number of state and federal permits and approvals in addition to NEPA and SEQRA. The list below is a summary of the regulatory requirements identified thus far as applicable to this project.

- Clean Air Act (42 USC § 7506(c); 40 CFR Part 93).
- Clean Water Act (33 USC §§ 1251-1387).
- Coastal Zone Management Act (16 USC §§ 1451, et seq.; 15 CFR Part 930; New York Executive Law Article 42; 19 NYCRR Part 600).
- Eminent Domain Procedures Law.
- Endangered Species Act (16 USC §§ 1531-1544; 50 CFR Part 402).
- Environmental Justice (Executive Order 12898 of 1994, 59 CFR Page 7629, February 16, 1994; 1997 U.S. Department of Transportation [USDOT] "Order to Address Environmental Justice in Minority Populations and Low-Income Populations," 62 CFR Page 18377, April 15, 1997).
- Floodplains (Executive Order 11988 of 1977; USDOT Order 5650-2, "Floodplain Management and Protection," April 23, 1979).
- General Bridge Act of 1946 (22 USC § 403).
- Grant or License of Land Underwater (New York State Public Lands Law § 6-75.7b).
- Incidental Take Permit (6 NYCRR Part 182.11).
- Magnuson-Stevens Fishery Conservation and Management Act (16 USC §§ 1801-1884).

- Marine Protection, Research and Sanctuaries Act (16 USC §§ 1431, et seq., and 33 USC §§ 1401, et seq.).
- National Historic Preservation Act (16 USC § 470, et seq.; 36 CFR Part 800).
- Rivers and Harbors Act of 1899 (33 U.S.C. 403).
- Smart Growth Public Infrastructure Policy Act (ECL § 6-0101, et seq.).
- State Pollutant Discharge Elimination System (6 NYCRR Part 750).
- Tidal Wetlands Law (ECL Article 25).
- Uniform Relocation and Assistance and Real Property Acquisition Policies Act of 1970 (42 USC § 4601, et seq.).
- U.S. Department of Transportation Act—Section 4(f) (49 USC § 303; 23 CFR §774).
- Wetlands (Executive Order 11990 of 1977; USDOT Order 5660.1A, “Preservation of the Nation’s Wetlands,” August 24, 1978).

S-5-3 AGENCY COORDINATION

Section 6002 of SAFETEA-LU increased opportunities for federal, state, and local agencies to have active and early involvement in the NEPA process and to provide comments on the project’s purpose and need, environmental study methodology, and alternatives under consideration. It requires the development of a coordination plan for all highway and transit projects for which an EIS is prepared under NEPA. FHWA, NYSDOT, and NYSTA outlined a coordination plan in the Scoping Information Package, as well as a Cooperating Agencies’ agreement. The plan described the process and communication methods that have been and will be followed to disseminate information about the project, as well as to solicit and consider input from the agencies. The coordination plan will be in effect throughout the EIS process. The coordination plan is a flexible, “living” document that can be amended as needed.

FHWA identified and invited federal agencies and NYSDOT and NYSTA identified and invited New York State agencies to participate in the Section 6002 coordinated review by serving as cooperating or participating agencies. According to Council on Environmental Quality (CEQ) regulations (40 CFR § 1508.5), “cooperating agency” means any federal agency, other than a lead agency, that has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposed project or project alternative. “Participating agencies” are those federal, state, or local agencies or federally recognized Native American tribes with an interest in the project.

The following agencies have been identified as cooperating agencies:

- Advisory Council on Historic Preservation (ACHP);
- National Marine Fisheries Service (NMFS);
- U.S. Army Corps of Engineers (USACE);
- U.S. Coast Guard (USCG);
- U.S. Environmental Protection Agency (USEPA);
- U.S. Fish and Wildlife Service (USFWS);
- New York State Department of Environmental Conservation (NYSDEC);
- New York State Department of State (NYSDOS);

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- New York State Office of General Services (NYSOGS); and
- State Historic Preservation Officer (SHPO) of the New York State Office of Parks, Recreation and Historic Preservation (OPRHP).

S-5-4 PUBLIC OUTREACH PROGRAM

Continuing the commitment to an open, participatory process, the project has solicited early and continued feedback from the public and from agencies; encouraged open discussion of project details and issues; and has provided opportunities for comments and questions. These efforts will continue throughout the environmental review of the Tappan Zee Hudson River Crossing Project. Tools that have been and will continue to be used in the public involvement program include:

- Public meetings and open houses;
- Project hot line;
- Project website (www.tzbsite.com);
- Mailing list;
- Informational materials at key points during the project development process;
- Media outreach; and
- Repositories.

S-6 ENVIRONMENTAL EFFECTS

Summarized in this section in tabular form are the findings of the environmental analyses performed for this EIS. Analyses were performed to determine the potential for adverse and/or beneficial impacts in the following categories: transportation; community character; land acquisition, displacement, and relocation; parklands and recreational resources; socioeconomic conditions; visual and aesthetic resources; historic and cultural resources; air quality; noise and vibration; energy and climate change; topography, geology, and soils; water resources; ecology; hazardous waste and contaminated materials; and construction impacts.

Table S-1 provides a summary of the long-term (operational) environmental effects of the No Build and Replacement Bridge Alternatives. The implementation and operation of the Replacement Bridge Alternative has the potential to result in adverse impacts on visual and aesthetic resources; historic and cultural resources; noise; and ecological resources. Mitigation measures to avoid or minimize these adverse impacts are shown in **Table S-2**.

The design and construction of the Replacement Bridge Alternative would incorporate Environmental Performance Commitments (EPCs) to minimize the environmental impacts from construction (see **Table S-3**). **Table S-4** identifies the potential construction-period effects of the Replacement Bridge Alternative accounting for the EPCs identified in **Table S-3** and included in the project's design and construction. Where adverse construction-period impacts have been identified, mitigation measures are proposed as shown in **Table S-5**.

**Table S-1
Summary of Environmental Effects—Operational Period**

Environmental Resource Area	No Build Alternative	Replacement Bridge Alternative
Transportation	The No Build Alternative would not correct existing non-standard highway features of the Tappan Zee Bridge, which include a lack of shoulders, limited site distances, and steep grades. These elements create operational difficulties and reduced throughput on the bridge. Additionally, the lack of a full shoulder or breakdown lane contributes to an increase in vehicle delays due to traffic incidents and accidents and limits the ability of accident management and emergency response services.	Overall, the Replacement Bridge Alternative would not adversely impact transportation. Future traffic volumes on the bridge would be the same in the future with or without the Replacement Bridge Alternative. The Replacement Bridge Alternative would have a beneficial direct effect by enhancing operational efficiency, improving safety and emergency access, and providing for pedestrian/cycling access. The Replacement Bridge Alternative would provide for left and right shoulders, 12-foot travel lanes, reductions in grade, and highway speed E-ZPass lanes. These measures, along with pavement, signage, and lighting improvements, would reduce the accident rates, as well as the time to respond to and address accidents and incidents. In turn, these improvements would reduce delays experienced by motorists. The improvements in vehicle operations across the bridge would also benefit existing transit services that operate across the Tappan Zee Hudson River crossing. The Replacement Bridge Alternative would not alter the horizontal and vertical clearances of the navigable channel, and therefore, would not impact marine transport. The Replacement Bridge Alternative's shared-use (bicycle and pedestrian) path would increase the public's access to trail systems and bicycle routes on both sides of the Hudson River and would substantially enhance mobility of cyclists and pedestrians.
Community Character	The No Build Alternative would not change land use and planning in the study area, and no land would be acquired for right-of-way purposes. Under this alternative, no impacts to community facilities would result, and the improvements associated with the Replacement Bridge Alternative would not occur. Other existing trends and economic forces may influence changes within the study area in the No Build Alternative. For example, projected traffic growth on Interstate 87/287 and other highways would cause increased congestion throughout the transportation system. The majority of the policy documents and comprehensive plans of jurisdictions within the study area acknowledge the importance of replacing the Tappan Zee Bridge in a cost- and time-efficient manner. As such, the No Build Alternative would be inconsistent with these policies.	The project would be expected to preserve and enhance the quality of life and character of the communities and neighborhoods in the study area as a result of the improvements to access, mobility, and safety, as well as fewer instances of travel delays because of the addition of shoulder and emergency access. The project was found to have no adverse impacts on land use patterns, zoning, and other planning policies, community facilities, or overall community character in the affected communities.
Land Acquisition, Displacement, and Relocation	In the No Build Alternative, there would be no land acquisition and there would be no impacts resulting from the displacement of property owners, residents, or businesses.	Twelve parcels have been identified for full or partial acquisition or temporary easements along the Interstate 87/287 right-of-way in Rockland County. One small permanent easement would be required in Westchester County. The property acquisitions and relocation of nine households in the Village of South Nyack, Town of Orangetown would be undertaken pursuant to the federal <i>Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970</i> and the <i>New York State Eminent Domain Procedures Law</i> . The analysis of potential reduction in property tax revenues associated with the full and partial acquisitions (including all temporary easements) indicates that the amount would be less than 1 percent of current total tax levies for all the affected jurisdictions. Therefore, there would not be any adverse impacts and no mitigation is required.
Parklands and Recreational Resources	The No Build Alternative would not change horizontal or vertical clearances of the navigable channel through the Hudson River, and therefore, it would have no effect on recreational boating in the study area. The No Build Alternative would not alter any existing or planned parklands or recreational areas within the study area. However, the No Build Alternative would not provide for a shared-use path across the Hudson River, and pedestrians and cyclists would continue to be prohibited on the Tappan Zee Bridge. Thus, the No Build Alternative would not enhance or improve recreational opportunities in Rockland or Westchester Counties.	The project's shared-use path would be a benefit to parklands and recreational resources by providing a pedestrian and bicycle crossing over the Hudson River and linking established trailway systems in Rockland and Westchester Counties. The temporary acquisition of 0.03 acres (3.7 percent) of Elizabeth Place Park for construction purposes would not result in adverse impacts on parklands and recreational resources since the park would be returned to public use upon the completion of construction. The Replacement Bridge Alternative would result in a 0.04-acre temporary easement (during construction) and a 0.01-acre partial acquisition (permanent) of the 0.05-acre green space located southeast of Elizabeth Place Park. Following construction, 0.04 acres of this property would be returned to green space. The 0.01 acres would be permanently incorporated into the right-of-way of the South Broadway Bridge. Since the partial acquisition of this small area (0.01 acres) of green space would avoid adverse traffic and economic impacts, and the partial loss of this green space would be fully compensated by the construction of an approximately 4-acre shared-use path over the replacement bridge, its permanent incorporation into the project is not considered an adverse impact.
Socioeconomic Conditions	Given its age and vulnerabilities, the existing Tappan Zee Bridge is susceptible to extreme events and potential closure. If the bridge were closed, this vital link between the population and employment centers of Rockland and Westchester Counties would be removed, causing a break in the regional and national transportation network. As a result, the local and regional population and workforce would be adversely affected by the No Build Alternative. Given that the regional population could be adversely affected by the No Build Alternative, there could be socioeconomic impacts on specific populations of the elderly, disabled, and low-income and minority populations.	The Replacement Bridge Alternative would ensure the long-term viability of the Hudson River crossing between Rockland and Westchester Counties, and would provide benefits to local and regional populations and workforce in terms of improved operational mobility and safety. There is no anticipated project-related effect on long-term population or workforce characteristics in Rockland or Westchester County and the long-term forecasts by NYMTC for all the counties in the region would remain unchanged. Thus, the Replacement Bridge Alternative would not alter the demographic profile in the study area and would not result in adverse impacts on socioeconomic conditions.
Visual and Aesthetic Resources	Under the No Build Alternative, there would be no substantial changes to visual quality or views associated with the project. Other projects may be developed within jurisdictions located in the study area that could alter existing conditions, and these may result in additional locations where residents would have views of the Tappan Zee Bridge, including the General Motors site adjacent to the Tarrytown Lighthouse and a mixed-use development one mile north of Interstate 87/287 on the Hudson River waterfront.	A new noise wall along the south side of Interstate 87/287 in Rockland County and greater height and depth of the western approach in the Hudson River under the Short Span Option would obstruct views to the Hudson River and Westchester land mass from a limited number of residences on Ferris Lane, Bight Lane, and River Road, resulting in adverse visual impacts. The greater height and depth of the Long Span Option's superstructure would result in adverse visual impacts in locations where residents located south of Interstate 87/287 in Rockland County (i.e., residents on Ferris Lane, Bight Lane, and River Road) would have views of the Palisades Ridge, Hudson River and opposite Westchester shoreline obstructed.

**Table S-1 (cont'd)
Summary of Environmental Effects—Operational Period**

Environmental Resource Area	No Build Alternative	Replacement Bridge Alternative
Historic and Cultural Resources	<p>The No Build Alternative would have no adverse effects on the Tappan Zee Bridge or other architectural resources in the Area of Potential Effect (APE). Any archaeological resources located in the Direct APE would most likely remain in place, though disturbance could occur from activities not related to the project.</p> <p>Changes to the architectural resources or to their settings may occur irrespective of the project. It is possible that some architectural resources in the APE may be removed or deteriorate, while others may be restored. Other projects may be developed within jurisdictions located in the study area. Depending on proximity to architectural resources, these future projects could have the potential to affect architectural resources.</p>	<p>The Replacement Bridge Alternative would have direct effects on historic resources in the APE, including the Tappan Zee Bridge and two contributing properties (21 Cornelison Avenue and 78 Smith Avenue) in the South Nyack Historic District.</p> <p>There is a possibility for direct effects on archaeological resources in the Hudson River portion of the APE, including deeply buried, in situ marsh deposits that may contain evidence of prehistoric activity dating to the Early Archaic Period or the Paleo-Indian Period; and potential submerged shipwrecks and other historic resources such as remains of docks and piers.</p> <p>While the Replacement Bridge Alternative would alter view corridors in the APE by replacing the existing Tappan Zee Bridge with two new structures a bit further north, it would not result in indirect adverse effects on historic resources.</p>
Air Quality	<p>Air quality in the general area of the project would be similar to the existing conditions under the No Build Alternative, with some improvements resulting from statewide efforts to reduce pollution and improved vehicular technology as older vehicles are replaced with newer, cleaner engines. Under the No Build Alternative, heavy congestion and delays resulting from accidents and vehicle breakdowns on the bridge would persist as there would be no shoulders or emergency access to clear the roadway. These delays would result in avoidable emissions (as is the case in the existing condition). Additionally, ongoing maintenance would be more intense under the No Build Alternative, resulting in some additional emissions.</p>	<p>No changes in overall traffic patterns, volume, or speed would occur, so there would be no adverse impact on mesoscale air quality. The analysis of limited right-of-way changes shows no adverse impact on microscale air quality, including for analysis locations on the Replacement Bridge Alternative's shared-use path. In general, air quality would be similar to the No Build Alternative, with some improvement associated with some avoided local congestion on the bridge and at the toll plaza. The Replacement Bridge Alternative would not result in adverse impacts on air quality.</p>
Noise and Vibration	<p>The maximum increase in $L_{eq(1)}$ noise levels in the study area, comparing the No Build Alternative with existing conditions, would be less than 2 dBA, a barely perceptible change. No changes in noise levels would be abated under the No Build Alternative.</p>	<p>While the predicted noise levels for the Replacement Bridge Alternative would not exceed the FHWA/NYS DOT substantial increase criteria, they would exceed FHWA's Noise Abatement Criteria resulting in adverse noise impacts.</p>
Energy and Climate Change	<p>Under the No Action Alternative, bridge maintenance would require energy use and ensuing greenhouse gas emissions that would exceed the maintenance requirements for the Replacement Bridge Alternative. Furthermore, heavy congestion occurring due to vehicle accidents and breakdowns on the bridge, where no shoulder is available to clear the roadway, would persist, resulting in avoidable fuel consumption and greenhouse gas emissions.</p>	<p>Operational fuel consumption and greenhouse gas emissions would be largely unaffected by the Replacement Bridge Alternative. Some benefit may accrue from improved operations (less local congestion). Furthermore, some energy conservation measures would be included to reduce operational emissions associated with energy consumption at the toll plaza facility and for bridge lighting, and additional measures such as renewable power generation are under consideration. Thus, the Replacement Bridge Alternative would not result in adverse impacts on energy or climate change.</p>
Topography, Geology, and Soils	<p>Under the No Build Alternative, the existing Tappan Zee Bridge and its approaches would continue to function and operate under existing conditions. Although some seismic retrofits would be undertaken, the bridge would be more susceptible to earthquakes than a new bridge would be.</p>	<p>The Replacement Bridge Alternative would not adversely impact topography, geology, or soils. Retaining walls would be used to support and stabilize any regraded areas, as needed. Erosion and sediment control measures from the project's Stormwater Pollution Prevention Plan would be implemented to minimize soil erosion. Disturbed areas would be revegetated following construction to limit any potential erosion. The Replacement Bridge Alternative would meet current seismic design standards, providing a substantial improvement over the existing Tappan Zee Bridge which pre-dates these standards and is more vulnerable to earthquakes.</p>
Water Resources	<p>Under the No Build Alternative, the primary source of groundwater resources within the study area would continue to be contributed by the Hudson River with minor contributions from recharge areas. Land use changes within a small portion of the recharge area would not adversely affect local groundwater resources.</p> <p>The No Build Alternative would also not result in changes that would affect surface water resources and floodplains of Sheldon Brook and the Hudson River. As with existing conditions, no treatment of stormwater would take place on the bridge, and maintenance of existing drainage systems along Interstate 87/287 would continue according to current practices. Pollutant loadings to the Hudson River and Sheldon Brook from stormwater discharge would remain unchanged. Estimated current pollutant loadings to the Hudson River from the existing bridge and landing areas are about 48 pounds per year of total phosphorus and 69,851 pounds per year of total suspended solids.</p> <p>The patterns of pier scour and deposition would remain largely the same as existing conditions, although they may vary somewhat with changing water column conditions. Under this condition, a large area near the existing bridge is subject to scour due to the narrow column spacing.</p>	<p>With the proposed stormwater management to treat stormwater quality for the landing areas, the discharge of stormwater from the Replacement Bridge Alternative would not produce a net increase in pollutant loading to the Hudson River for total suspended solids. It would increase pollutant loading for total phosphorus, but the increase would not be substantial and would not result in long-term, adverse changes to the River's water quality. The proposed collection and treatment of stormwater prior to discharge also minimize the potential for adverse environmental impacts to groundwater resources.</p> <p>Small incremental incursions into the 100- and 500-year floodplain in Rockland County (0.3 and 10 acres, respectively), the 500-year floodplain of the Hudson River within Westchester County, and the 100-year floodplain of the Hudson River would not result in adverse impacts to floodplain resources or result in increased flooding of adjacent areas. The Hudson River is tidally influenced and affected by coastal flooding, and therefore, would not be affected by the project.</p> <p>The reduction in the number of piers and subsequent increase in interpier area would result in lower water velocities at the replacement bridge compared to the existing bridge. It would also result in less scour (from 62 acres currently to 26 to 41 acres with the replacement bridge) and subsequently less sediment resuspension and movement and habitat disturbance.</p>
Ecology	<p>In the future without the project, terrestrial and aquatic ecosystems within the project site would remain unchanged and would continue to support the same communities of fish, wildlife, and other organisms as at present. The No Build Alternative would continue operation of the existing Tappan Zee Bridge, and therefore, would not introduce any new disturbances to ecological resources of the area.</p>	<p>Operation of the replacement bridge would not adversely impact ecological resources. The state-endangered plant species in areas of disturbance may require relocation of the plants or other protection measures, unless the state's impending review of the species' status results in its delisting. Project operation would have minimal impacts on aquatic biota and their habitat, and in some cases, may benefit these resources by reducing pier areas, diminishing scouring, and reducing pollutant loadings.</p> <p>Operation of the replacement bridge would not increase noise or other disturbances to wildlife above levels that are attributable to the existing bridge, and thus, any species currently inhabiting the area would continue to occur with the same likelihood. This includes the state-endangered peregrine falcon, which is expected to transition to new nest boxes on the replacement bridge.</p> <p>With the selection of appropriate lighting schemes, collisions of night-migrating birds would likely be a rare occurrence and have no substantial impact on their populations.</p>
Hazardous Materials	<p>Under the No Build Alternative, the existing bridge and the remainder of the study area would continue in their current uses. No new bridge or associated new maintenance facilities would be constructed for the project. As with the current conditions, all applicable regulatory requirements would be followed in accordance with existing NYSTA/NYS DOT procedures.</p>	<p>With adherence to applicable laws and regulations, there would be no impacts on hazardous materials.</p>

Table S-2
Summary of Mitigation Measures—Operational Period

Environmental Resource Area	Proposed Mitigation
Transportation	No mitigation measures required.
Community Character	No mitigation measures required.
Land Acquisition, Displacement, and Relocation	No mitigation measures required.
Parklands and Recreational Resources	No mitigation measures required.
Socioeconomic Conditions	No mitigation measures required.
Visual and Aesthetic Resources	The project would result in adverse visual impacts to a limited number of residences along Bight Lane, River Road, and Ferris Lane in the Village of South Nyack (Rockland County). The greater height and depth of the replacement bridge superstructure, as well as any potential noise barriers, would obstruct existing scenic views from these properties. While loss of these views cannot be mitigated, the project sponsors will work with affected property owners to develop a plan to help offset adverse visual impacts, such as landscaping to screen the bridge structure and any noise barriers.
Historic and Cultural Resources	To mitigate removal of the existing S/NR-eligible Tappan Zee Bridge, the following measures would be taken: Historic American Engineering Record (HAER) documentation of the bridge; produce educational materials for use by local libraries, historical societies, and educational institutions; and possible interpretive signage along the shared-use path. To mitigate acquisition and demolition of two contributing properties in the South Nyack Historic District, the following measures would be taken: plant vegetation along any proposed noise barriers; Historic American Building Survey (HABS) recordation to document removed resources; and consider posting signage interpreting the history and architecture of the South Nyack Historic District.
Air Quality	No mitigation measures required.
Noise and Vibration	To mitigate potential NAC exceedances at several properties, abatement measures (such as noise barriers) would be included where feasible and practicable, and based on community input.
Energy and Climate Change	No mitigation measures required.
Topography, Geology, and Soils	No mitigation measures required.
Water Resources	No mitigation measures required.
Ecology	No mitigation measures required.
Hazardous Materials	No mitigation measures required.

Table S-3
Summary of Environmental Performance Commitments (EPCs)—Construction Period

Environmental Resource Area	Environmental Performance Commitment
Transportation	Implement and follow a Work Zone Traffic Control Management Plan, following a strict schedule; minimizing detours through residential areas; utilizing Intelligent Transportation System measures, such as variable message signs and notifying the local news of road closures, detours, and other construction activities. Project sponsors would coordinate with local agencies regarding the hauling of any construction materials to identify acceptable routes, roadways, and times. The contractor would coordinate with potentially affected public services in planning traffic control measures. Access to all businesses and residences would be maintained. The ability for boats to travel along the Hudson River would be maintained throughout the construction period. Signage and markers would be utilized (in coordination with the U.S. Coast Guard) to advise recreational boaters of preferred routes and/or dangers.
Community Character	A construction contract stipulating that the contractor must maintain a clean and orderly worksite, with metrics included for determining compliance, provisions for enforcement, and penalties for non-compliance, would be developed to minimize potential impacts on community character during construction.
Land Acquisition, Displacement, and Relocation	All temporary easements during construction would be returned to the original property owner for its original use after construction.
Parklands and Recreational Resources	The 0.03-acre temporary easement of Elizabeth Place Park and the 0.04-acre temporary easement of the adjacent green space area would be returned to their original use after construction.
Historic and Cultural Resources	Implement a Construction Protection Plan to avoid inadvertent damage to architectural resources within 100 feet of the construction limits. If any submerged archaeological resources are identified (pending further geo-archaeological investigation), appropriate mitigation measures will be developed, as needed.

Table S-3 (cont'd)
Summary of Environmental Performance Commitments (EPCs)—Construction Period

Environmental Resource Area	Environmental Performance Commitment
Air Quality	<p>In order to minimize, avoid, or otherwise mitigate potential air quality impacts, the following measures, practices, and EPCs would be used or implemented during construction:</p> <ul style="list-style-type: none"> - Clean Fuel - Best Available Tailpipe Reduction Technologies - Utilization Of Newer Equipment: All non-road construction equipment would meet USEPA Tier 3 emissions standards or better. - Tug Boat Emissions Reduction: The total combined PM emission rate from all tug boats used for the project would be limited to 3,700 grams per hour at peak power, including auxillary engine emissions - Concrete Batch Plant Controls: The concrete batch plant would vent the cement weigh hopper, gathering hopper, and mix loading operations to a baghouse or filter sock. Storage silo chutes would be vented to a baghouse. Roadways at the concrete batch plant, and all unloading and loading material handling operations, would have a dust control plan providing at least a 50 percent reduction in PM₁₀ and PM_{2.5} emissions from fugitive dust through wet suppression. - All reasonable efforts would be made to address heavy duty vehicle idling at the project site in order to reduce fuel usage (and associated costs) and emissions. On-road diesel fueled trucks may not idle for more than five consecutive minutes except under certain specific conditions. In addition to enforcing the on-road idling prohibition, all reasonable efforts will be made to reduce non-productive idling of non-road diesel powered equipment.
Noise	<p>In order to minimize, avoid, or otherwise mitigate potential noise impacts during construction, the following measures or practices would be implemented:</p> <ul style="list-style-type: none"> - As practicable, noise abatement measures would include shrouds to reduce pile driver noise, quiet compressors and generators, and use of portable or other noise barriers and/or enclosures. - As practicable, electric powered equipment rather than diesel would be utilized. - Use of impact devices such as jackhammer, pavement breakers, and pneumatic tools would be limited and shrouds would be utilized. - Construction staging areas would have appropriate noise attenuation installed. - Contractors and subcontractors would be required to properly maintain equipment. - Attenuating curtains or shrouds would be used on pile drivers when in close proximity to residential areas. - Moveable noise attenuation measures would be erected around pumps, trucks, etc. when close to residential areas.
Energy and Climate Change	Construction contracts would, as practicable, require the use of recycled materials, locally sourced materials, and renewable fuels.
Topography, Geology, and Soils	An erosion and sediment control plan, developed as part of a SWPPP for the project, would be implemented to minimize soil erosion and sedimentation of surrounding waterways.
Water Resources	<p>The following measures and EPCs would be implemented to minimize or avoid potential adverse water quality impacts during construction:</p> <ul style="list-style-type: none"> - A SWPPP would be developed pursuant to a SPDES General Permit (GP-0-10-001) to avoid adverse impacts to water quality. Further, activities within any floodplains and dredging and disposal of dredge material would comply with all applicable federal and state legislation and regulatory programs. - Construction Staging Sites: Contractor would be required to obtain all necessary permits and approvals. - Dredged Material Transport and Disposal: Truck transport of dredged material would not be allowed. - Dredged Depth: 14 feet at mean lower low water (MLLW) after armoring (16 feet total plus 1 foot overdredge) - Channel Armor: 2 feet of sand and gravel placed to line channel as soon as dredging for section is complete; sand and gravel not to be removed; and methods of placement would include either mechanical [dry sand capping material with bottom-dump barge, side-casting, bucket/clamshell, tremie (gravity-fed downpipe)] or hydraulic (wet/slurry of sand placed from a pipe, tremie, or spreader barge) to minimize disturbance of sediment bed. - Dredging: Adherence to a 3-month fall window (August 1 to November 1) when dredging would be required; use of an environmental bucket with no barge overflow; and armoring of the channel to prevent re-suspension of sediment during the movement of construction vessels, installation and removal of cofferdams, and pile driving - Pile Installation: The driving of the largest (8 and 10 ft. piles) would only occur for a few months in the first year of construction; use of cofferdams and silt curtains, where feasible, to minimize discharge of sediment into the water; use of vibratory pile driver to the extent feasible particularly for the initial pile segment; use of bubble curtain, cofferdams, isolation casings, Gunderboom or other technologies and operational measures to achieve the best available reduction which will provide at least 10 dB of noise attenuation; use the results of the Hudson River site specific PIDP to inform the project on the effectiveness of BMP technologies for reducing sound levels, and implementing BMPs to achieve maximum sound reduction; Limiting the periods of pile driving to no more than 12-hours/day (in rare circumstances, it is possible that piling may extend further than 12 hours depending on the practicality of driving); Limiting driving of piles with an impact hammer within Zone C [water depths 5.5-13.7 m (18-45 feet)] to 5 hours per day during the period of spawning migration for shortnose and Atlantic sturgeon (April 1 to August 1); pile tapping (series of minimal strikes) for an initial period to frighten fish; coordinating pile driving activities to maintain an appropriate corridor to allow fish to pass and avoid intensive construction activities; development of a comprehensive monitoring plan with elements to include: 1) monitor locations to characterize the hydroacoustic field, 2) surround pile driving operations with locations and distances from pile driving established on the basis of sound levels established by NMFS as potential for impact, 3) monitor fish locations and movements before and during pile driving, and 4) monitor fish mortality and predation levels by gulls and other piscivorous birds, develop criteria to be included in incidental take permits for re-initiating consultation with NMFS and NYSDEC if Shortnose or Atlantic Sturgeon come to the surface wounded or dead; use of a quick, low-noise, moderate-energy vibratory hammer to install much of the length of the pile; feasibility of deep vibratory techniques will be tested in the PIDP. From these tests, it is anticipated that the initial set for these deep piles cannot be overcome after pile sections are spliced; upon completion of pile installation, the soil within each pile would be excavated and transported to an off-site disposal facility. - Existing Bridge Demolition: No blasting would occur; columns and footings cut with diamond wire or broken by pneumatic hammers, timber piles will be cut off just below the mudline; materials not re-used or recycled would be transported to an appropriate, permitted off-site disposal facility; turbidity curtain utilized to ensure demolition debris will not be dispersed; side-scan sonar surveys would be performed in order to verify that all generated debris would be removed from river
Ecology	See "Water Resources" above for EPCs to protect aquatic habitat during construction.
Hazardous Materials	Phase II subsurface investigations would be performed in areas of potential soil disturbance. A site-specific Remedial Action Plan (RAP) and Construction Health and Safety Plan (CHASP) would be developed based on results of the Phase II investigation to outline appropriate handling and disposal methods of any identified hazardous or contaminated materials.

Table S-4
Summary of Environmental Effects—Construction Period

Environmental Resource Area	Environmental Effect
Transportation	<p>The construction effort would require temporary localized changes in traffic operations with detours and potential road closures. Primary truck movements to and from potential off-site staging areas near Exit 12 would be on the highway with new or enhanced entrance/exit ramps in Nyack and Tarrytown, New York. Traffic and transportation issues would be managed by a comprehensive and detailed Work Zone Traffic Control management plan. The contract specifications would require road closures and detours to be strictly coordinated so that traffic can take safe, practical and short detour routes. This coordination would serve to avoid or minimize, to the extent feasible, traffic diversions through residential neighborhoods. Further, the construction would be staged to maintain through traffic, perhaps with only one direction being detoured at a time.</p> <p>While much of the material needed for construction of the project is anticipated to arrive by barge, the project sponsors would also coordinate with local agencies regarding the hauling of any construction materials to identify acceptable routes and times of operation, and roadways to be used. The contractor, in coordination with NYSDOT and NYSTA, would coordinate with potentially affected public services in planning traffic control measures. Construction activities that might substantially disrupt traffic would not be performed during peak travel periods to the maximum extent practicable. Access to all businesses and residences would be maintained.</p> <p>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. Some boaters, due to water craft size or power source, may experience difficulty navigating through the construction zone during this time period. Waterborne supply deliveries could increase the use of navigation channel while barge/pile driving and demolition of the existing bridge could restrict use of the river for navigation. Any restricted navigation during construction would be coordinated with the U.S. Coast Guard with ample prior notice to marine traffic.</p>
Community Character	<p>The project has the potential to result in temporary changes in traffic, access to residences and businesses, on-street parking, dust, noise, vibrations, and visual quality.</p> <p>Areas surrounding the construction staging area in the vicinity of the Rockland landing would have the greatest visual quality change; residents near the river to the north would have direct views of the platform construction to facilitate in-water construction. At staging areas near Interchange 12, proposed temporary uses are compatible with the existing industrial character.</p>
Land Acquisition, Displacement, and Relocation	<p>In addition to the permanent acquisitions described in Table S-1, the project's construction would require temporary easements. The project would result in several temporary easements on parcels in Rockland County during construction. In the Village of South Nyack, a 0.03-acre temporary easement on a portion of Elizabeth Place Park and a 0.04-acre temporary easement on a nearby green space would be required for the purposes of reconstructing and realigning the South Broadway bridge over Interstate 87/287. These temporary easements would be returned to the Village of South Nyack after construction for continued use.</p> <p>North of the existing highway, a temporary easement on a portion of a multi-family residential parcel in Rockland County would be required for purposes of realigning Interstate 87/287 with the replacement bridge. The temporary easement on this parcel would be substantially similar under both the Short and Long Span Options (slightly less than 0.05 acres for the Short Span Option and slightly greater than 0.05 acres for the Long Span Option). This temporary easement would displace existing parking spaces. In addition, a 0.01-acre temporary easement of an adjacent single-family residential property would be required during construction. This temporary easement would not be expected to affect the use of the parcel.</p>
Parklands and Recreational Resources	<p>During construction, access to Elizabeth Place Park would be limited to only one point (from the Esposito Trailway). The green space area across South Broadway from Elizabeth Place Park would not be accessible during the construction period. Recreational boating on the Hudson may be restricted in an area around the construction sites or by limited uses (i.e., "no sails up" zones). However, due to the temporary nature of the impacts of construction, the project as built would not result in adverse impacts to parklands and recreational resources.</p>
Socioeconomic Conditions	<p>The project has a preliminary estimated cost of \$4.6 billion, which will have a significant direct effect on the local and regional economy. Over the five-year construction period, it is expected to generate the direct demand for about 2,800 workers per year, with wages and salaries of \$228 million.</p> <p>In addition to the direct employment, construction would also result in an estimated 2,150 indirect and induced workers in New York State, with employee compensation of \$168 million.</p>
Visual and Aesthetic	<p>The character and quality of views of the Hudson River during construction of the project would be impaired for residents and visitors who have views of this visual resource. Therefore, the construction of the Replacement Bridge Alternative would result in adverse impacts to visual and aesthetic resources.</p>
Historic and Cultural	<p>Two classes of potential archaeological resources have been identified within the river portion of the APE that could potentially be affected by the project: a submerged landform that may have been occupied during the Archaic Period or the Paleo-Indian Period; and possible submerged historic resources including potential shipwrecks lying on the river bottom. Further analysis will be undertaken to determine whether submerged S/NR eligible resources are present in the river portion of the APE for direct effects. If submerged resources are identified and determined to be S/NR eligible, the project would have an adverse effect on those resources as a result of dredging and construction of the replacement bridge. The FEIS will provide the results of this further analysis. Consultation with SHPO and any appropriate tribal nations and consulting parties would be undertaken to identify measures to avoid, minimize or mitigate any potential S/NR-eligible resources that may be adversely affected by the project.</p> <p>To avoid inadvertent damage to architectural resources within the APE during construction, a Construction Protection Plan would be implemented. In addition, the project would include mitigation for the removal of two residences within the South Nyack Historic District and the Tappan Zee Bridge as part of project construction (see Table S-3).</p>
Air Quality	<p>Diesel emissions from construction equipment and tugboats would not result in microscale adverse impacts on particulate matter, carbon monoxide, or annual-average nitrogen dioxide concentrations. This would be ensured by a robust set of environmental performance commitments aimed at diesel emissions reduction, including the use of Tier 3 engines and diesel particle filters (DPF) for all land-based engines with a power output rating of 50 horsepower or greater that would reduce particulate emissions from these sources by 90 percent on average; emission controls for tug boats limiting diesel particulate matter emissions; baghouse filters for the concrete batching plant (which would reduce particulate matter emissions from cement silos by over 99 percent); and a strict dust control program aimed at reducing fugitive dust emissions by at least 50 percent at land based construction sites and concrete batching plants.</p> <p>Levels exceeding the 1-hour NO₂ NAAQS cannot be ruled out. Therefore, construction contracts would require that all land-based non-road diesel-powered construction engines with a power output rating of 50 horsepower or greater be rated Tier 3 or higher where the use of such equipment is practicable.</p>
Noise and Vibration	<p>Eleven noise receptor sites were analyzed to identify potential noise impacts from construction of the Replacement Bridge Alternative. Noise abatement measures identified in Table S-3 would reduce project increases in noise levels as compared to conditions without abatement measures. Nevertheless, predicted increases in noise would be perceptible, and further abatement measures to reduce are not practicable. Therefore, construction of the Replacement Bridge Alternative would result in unmitigated noise impacts, and construction activities would be intrusive and noisy.</p> <p>No adverse impacts from vibration due to construction activities are anticipated.</p>
Energy and Climate Change	<p>The construction of the project would require substantial energy and materials use resulting in greenhouse gas emissions. Consistent with state policies aimed at reducing greenhouse gas emissions and energy use, the project would implement several measures during construction: supplementary cementitious materials (SCM); reducing concrete waste; and optimize cement content. In addition, the following measures would be implemented, where practicable: biodiesel fuel, recycled steel, and local materials sourcing.</p>
Topography, Geology, and Soils	<p>Soil erosion is primarily a concern during construction when soils are exposed to wind, rain, and other erosive forces. Construction activities would comply with any NYSDEC-approved SWPPP and erosion and sediment control measures to minimize soil erosion. In addition, the project would not require substantial regrading of any steep slopes (i.e., greater than 15 percent). Therefore, construction of the project would not adversely affect topography, geology, and soils.</p>

Table S-4 (cont'd)
Summary of Environmental Effects—Construction Period

Environmental Resource Area	Environmental Effect
Water Resources	<p>In-water construction activities for the Replacement Bridge Alternative have the potential to affect water quality due to sediment resuspension. These activities include dredging and placement of armoring, installation of cofferdams, driving of piles, vessel movement, and the demolition of the existing bridge. Results of hydrodynamic modeling conducted to project the plume of resuspended sediment resulting from construction of the project indicate that, with the exception of the portion of the water column within the immediate area of the dredge, increases in sediment suspension would be minimal and within the natural range of variation of expected concentrations. Sediment resuspension resulting from dredging and other in-water construction activities would be expected to meet the Class SB turbidity standard at the edge of the NYSDEC-designated mixing zone for the project. Localized higher concentrations of suspended sediment would dissipate shortly after construction and demolition activities would not result in adverse effects on water quality. Considering the limited area and depth of sediments with low to moderate levels of contamination within the area to be dredged, the release of any contaminants would not result in adverse impacts to water quality. Use of turbidity curtains and other measures to be specified in the permits to be issued by NYSDEC during removal of the in-water components of the existing bridge would minimize the potential for sediment resuspended during bridge removal. Therefore, demolition of the bridge would not result in adverse impacts to water quality. Following removal of the piers for the existing bridge, the gradual erosion over time of sediment that has been deposited in proximity to the piers, some of which has elevated concentrations of certain contaminants, would not result in adverse impacts to water quality of the Hudson River.</p> <p>With the implementation of Spill, Prevention, Control, and Counter measures requirements, and state petroleum bulk storage, chemical bulk storage, and spill requirements, potential upland staging areas have limited potential to impact groundwater or surface water. Additionally, environmental site investigations would be conducted to identify potential areas of subsurface contamination prior to any soil disturbing activities. Therefore, the project would not result in adverse impacts to groundwater resources. Implementation of erosion and sediment control measures and stormwater management measures in accordance with the Stormwater Pollution Prevention Plan (SWPPP) developed for the upland staging areas and for development of construction access to the waterfront staging areas would minimize potential impacts to water quality of surface waters receiving stormwater runoff from these areas.</p> <p>Use of the upland staging areas, and temporary platforms within the bridge staging areas would not result in adverse impacts to floodplain resources.</p> <p>With sediment resuspension and deposition largely limited to short-term effects in the immediate areas of construction and demolition activities, there are no anticipated indirect effects from construction activities.</p>
Ecology	<p>The project would affect 0.15 acres of forested wetlands due to installation of a temporary pile-supported access roadway in Westchester County. As the roadway would consist of a platform over the wetland areas, it is not expected that wetland hydrology would be altered or indirectly effect wetlands downstream. With restoration of these wetlands following the completion of construction, these wetland impacts would not be adverse. The project would also affect benthic macroinvertebrate habitat, oyster beds, and fish habitat due to dredging and construction of in-water components of the Replacement Bridge Alternative. However, the loss of soft bottom habitat would be temporary, and recolonization by benthic invertebrates would begin following completion of in-water activities in a given area. While the permanent loss of oyster habitat would result in an unavoidable adverse impact, potential for implementation of oyster enhancement, relocation, or restoration projects will be explored, and other mitigation strategies developed, in consultation with NYSDEC, USACE, USFWS, and NMFS. Sounds from pile driving and other in-water construction activities would be temporary, and would not be expected to represent a barrier to movement of individuals within the Hudson River. Potential hydroacoustic impacts to fish using the deep water portions of the Hudson River due to pile driving with an impact hammer would only occur during the initial few months of in-water construction activities, and from April 1 to August 1 would be restricted to 5 hours per day for the 8- or 10-foot diameter piles in the vicinity of the navigation channel (i.e., Zone C— waters 18 feet or deeper at MLLW). Pile driving would not occur at night and would not be continuous during the day (i.e., when piles are being put in place or being welded, or when the pile driver is being relocated). For most of the pile driving scenarios modeled, including those in which the maximum number of simultaneous piles are being driven and/or for the largest piles, a substantial portion of the Hudson River's width would never reach the SEL_{cum} criterion established for onset of physiological injury, and portions of the river would also be below the 150 dB re 1 μPa rms guidance for behavioral effects. Fish would not be expected to remain in an area at which noise would cause discomfort. The hydroacoustic environment resulting from pile driving with an impact hammer would result in a temporary loss of a small area of fish habitat, including EFH and would not be expected to affect movement of EFH or other migratory fish species within the river. The project's suspended sediments would be below the physiological impact thresholds for adult and larval fish and would not affect survival or migration.</p> <p>Detailed acoustic modeling and research indicates that while some individual fish in the immediate vicinity of the piles would be at risk of mortality or other physiological effects, the potential affected area is limited and pile driving would not be expected to result in an adverse impact to populations of fish species in the Hudson River. Similarly, for individual shortnose and Atlantic sturgeon, there is potential for injury within the immediate vicinity of the pile driving and other in-water construction activities. However, pile driving and dredging would have minimal effects on sturgeon migratory activities as there would always be large portions of the river that are not ensounded and dredging would be restricted to three month windows between August 1 and November 1. Incidental vessel strikes and indirect effects from resuspended sediments would be insignificant. Because marine mammals are rare, transients to study area, the project would not jeopardize the populations of any of the species reported in the area.</p>
Hazardous and Contaminated Materials	<p>The project would be conducted in accordance with the following:</p> <ul style="list-style-type: none"> - Prior to soil disturbance activities, Phase II investigations of the areas to be disturbed would be conducted. - Based on the findings of the subsurface investigations, site-specific Remedial Action Plans and Construction Health and Safety Plans would be prepared and implemented during construction. - Any petroleum storage tanks within the project limits that would not be used following the proposed action would be properly closed and removed, along with any contaminated soil, prior to disturbance in accordance with NYSDEC requirements and NYSDOT procedures. - Any chemicals requiring disposal would be properly disposed of in accordance with regulatory requirements and standard NYSDOT procedures. <p>Accordingly, there would be no adverse impacts associated with hazardous or contaminated materials.</p>

Table S-5
Summary of Mitigation Measures—Construction Period

Environmental Resource Area	Proposed Mitigation
Ecology	<p>Measures to mitigate adverse impacts on ecology during construction would include:</p> <ul style="list-style-type: none"> - Oyster Reefs: Opportunities for oyster bed enhancement, relocation, and/or restoration will be evaluated under consideration with NYSDEC, USACE, USFWS, and NMFS as possible mitigation for loss of oyster reefs. - Wetland Enhancement: The 0.15-acre area of wetland disturbance in the area of the Westchester bridge landing would be restored in coordination with USACE after construction.

S-6-1 ENVIRONMENTAL JUSTICE

Based on a review of the likely potential impacts of the project, minority and low-income populations areas would not bear a disproportionately high or adverse share of operational impacts resulting from the project.

S-6-2 COASTAL AREA MANAGEMENT

The project would be located in the Coastal Area as designated by the New York State Waterfront Revitalization of Coastal Areas and Inland Waterways Act. This act implements New York State's Coastal Management Program (CMP). New York State's CMP consists of 44 policies. The 44 policies address various potential effects of projects in the coastal zone including land use and coastal character, fish and wildlife, flooding and erosion, general safeguards, public access, recreation, historic resources and visual quality, agricultural lands, energy and ice management, water and air quality, and wetlands. A number of policies would not apply to the project as it would not involve lands or activities that are stipulated in these policies. For the policies that are applicable to the project, the Replacement Bridge Alternative would be consistent with the CMP.

S-6-3 INDIRECT AND CUMULATIVE IMPACTS

Since the project is not expected to alter regional mobility or capacity, and is in an area with well-established land use patterns, it is not expected to result in new induced or indirect effects. And since the proposed replacement bridge has been determined to have no direct or indirect effect on regional traffic capacity or vehicle miles traveled, it would have no cumulative effect in combination with other projects.

Potential indirect effects are generally defined as those impacts that are induced or "caused by an action and are later in time or farther removed in distance, but are still reasonably foreseeable." Therefore, there is no potential for indirect effects to be generated by construction activities. However, construction activities could have the potential to result in cumulative effects with other concurrent projects. Terrestrial construction-related impacts are specific to localized effects at staging sites and along the existing highway. Since no other major construction projects (public or private) were identified within these areas of potential terrestrial construction-related impacts, there is no cumulative effect. The greatest potential for cumulative impacts would result from proposed in-water construction activities associated with dredging, bottom stabilization, demolition, and pile-driving activities, which are summarized below.

S-6-3-1 AQUATIC ECOLOGY

The assessment of cumulative effects addresses the potential impacts from the project and other projects proposed within, or in the vicinity of, the study area that may affect aquatic resources. The proposed Champlain Hudson Power Express Inc. cable project and the American Sugar Refining, Inc. maintenance dredging project are the projects identified for evaluation of cumulative effects with the Tappan Zee Replacement Bridge Alternative. At the present time, US Gypsum, located upriver within Haverstraw Bay, is not expected to dredge its Stony Point facility and is not, therefore, evaluated with respect to cumulative impacts for the Replacement Bridge Alternative.

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The Champlain-Hudson Power Express (CHPE) may be active in the area of the Tappan Zee in 2014 or 2015 and would therefore potentially be active at the same time as the bridge effort. Within the study area, the cables would be buried through the use of water jetting, where possible, and by hydroplow or dredging where water jetting is not feasible (i.e., within Haverstraw Bay). The CHPE is expected to be active in the immediate area of the Tappan Zee construction area for less than one week and laying of the cable would occur in a narrow band immediately west of the navigation channel. Therefore, other than coordination of activities (which has already been initiated) to ensure no direct disruption to either project, the cumulative effect of the projects would be minimal.

Maintenance dredging by American Sugar Refining, should it occur concurrently with dredging for the project, would be at least 14 miles downriver. This distance is far beyond the 1,000 to 2,000 feet over which the incremental increase in suspended sediment of 10 mg/L due to the Replacement Bridge Alternative has been projected by the hydrodynamic modeling and beyond the 5 mg/L incremental increase in projected suspended sediment. The area of maintenance dredging for American Sugar Refining extends only 300 feet into the river from the east bank and does not extend into the navigation channel. Therefore, the three projects would not be expected to result in cumulative adverse impacts to migration of anadromous fish species or adversely affect other aquatic resources.

Other regional projects up- or down-stream of the Tappan Zee Hudson River crossing would have no cumulative effect on activities at the project site. With no noticeable changes beyond a limited area around the construction site, the project would not create any foreseeable changes at other project locations. Similarly, since habitat losses resulting from bridge construction are expected to be localized and would not extend beyond the defined areas of impact, any temporary or permanent changes to aquatic habitats would not affect the larger habitat value of the Hudson River and no cumulative habitat fragmentation would be expected. The analysis of potential impacts on benthic and fish populations affected by the pile driving would potentially affect a small proportion of any given species and would not cumulatively affect overall populations. It is noted that the CPHE project has been delineated to avoid important habitat locations and such conditions have been established in the New York State Department of State's Conditional Concurrence with the CPHE Coastal Zone Consistency Certification.

S-6-3-2 DREDGING

In terms of dredging, there is little or no other dredging proposed for the Hudson River navigation channel in the vicinity of the Tappan Zee Bridge so this would also not be expected to result in any cumulative impacts in combination with the project. Dredge disposal is anticipated to use the New York Historic Area of Remediation Site (HARS), in which disposal is controlled by USACE and USEPA. The total material dredged as part of the Tappan Zee project (up to an estimated 1.74 million cubic yards), should it be deemed eligible for HARS disposal, would be a small proportion of the overall fill necessary to remediate the site—an activity expected to occur over several decades—and would be disposed of within HARS specific to the characteristics of the dredged material based on extensive prior testing.

The primary cumulative impact from the placement of the dredged material from the project at the HARS would be the eventual remediation of the HARS which would result in an improved benthic community and improved habitat for fish and shellfish. The placement of the dredged material from the project at the HARS in three stages would minimize the area of disturbance within the cells designated for the project by the USACE during each dredging season for the project. Because changes to water quality during placement of Remediation Material would be expected to be limited temporally and spatially, placement of the dredged material with material from other projects would not be expected to result in adverse impacts to water quality or Essential Fish Habitat (EFH). Given the large area of the HARS yet to be remediated, placement of the dredged material from the project concurrent with placement of material from other projects, sufficient EFH would still be available within the HARS that placement of the dredged material concurrent with placement of Remediation Material from other projects would not be expected to result in adverse impacts to EFH.

S-6-4 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The project would result in the irretrievable and/or irreversible commitment of land, building materials, energy, and human effort (time and labor). It would be developed within the existing right-of-way to the extent possible, thereby limiting the use of land resources. Further, the project would improve incident management and emergency access, thereby reducing wasteful energy consumption associated with vehicle delays. As resources required for the project are not expected to be in short supply, the project would not result in any adverse effects related to the irreversible and irretrievable commitment of resources. While the No Build Alternative would not require land typical of a construction project, it would require an irreversible and irretrievable commitment of human effort, materials, energy, and financial resources in order to maintain, repair, and upgrade the existing bridge.

S-6-5 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Short-term impacts are often a necessary component of construction projects in order to achieve the long-term goals and productivity of the project. The project would result in short-term, construction impacts related to traffic, noise, air quality, community character, visual resources, cultural resources, ecological resources, green space, and parklands. Measures to avoid short-term construction impacts would be conducted to the extent possible, but where avoidance is not prudent or feasible, measures to minimize impacts would be implemented. Such measures would include limiting the duration of construction activities to the extent feasible and employing modern methods of construction that would minimize adverse effects on ecological resources and the surrounding community.

These short-term impacts are necessary to realize the long-term local and regional benefits of the Replacement Bridge Alternative, including enhanced safety and emergency response, improved energy efficiency, reduced emissions as a result of reduced delays, and seismic upgrades. In addition, the project would provide a shared-use bike and pedestrian path, linking trailways in Westchester and Rockland Counties. The proposed facility would foster future economic development, which in turn would serve to create jobs and generate increases in property tax revenues. The beneficial

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long-term effects of implementing the project would offset the localized short-term impacts associated with construction.

**S-6-6 NEW YORK STATE SMART GROWTH PUBLIC INFRASTRUCTURE
POLICY ACT**

Under the New York State Smart Growth Public Infrastructure Policy Act, no state infrastructure agency shall approve, undertake, support, or finance a public infrastructure project, unless, to the extent practicable, the public infrastructure project is consistent with its ten smart growth infrastructure criteria. The smart growth criteria are intended to limit sprawl, maximize efficiency, and promote environmentally- and socially-conscious development. The Replacement Bridge Alternative would improve an existing transportation infrastructure facility and minimize impacts on environmental resources to the extent practicable. Therefore, the project would be consistent with each of the applicable smart growth criteria.

S-6-7 UNAVOIDABLE IMPACTS

Unavoidable impacts may occur if there are no feasible or practicable mitigation measures to eliminate the impacts of a project and if there are no reasonable alternatives to the project that would meet the purpose and need of the action, eliminate the impact, and not cause other or similar adverse impacts. The following unavoidable impacts of the Replacement Bridge Alternative have been identified:

- Acquisition of several properties, thereby displacing current residents;
- Obstruction of existing scenic views from several residences in Rockland County;
- Acquisition and demolition of two historic structures in the South Nyack Historic District;
- Removal of the existing Tappan Zee Bridge, which is eligible for listing on the State and National Register of Historic Places (S/NR); and
- Disturbance to river bottom habitat, particularly oyster habitat.

S-7 DRAFT SECTION 4(f) EVALUATION

Section 4(f) of the USDOT Act of 1966 (49 USC § 303; 23 CFR § 774) prohibits the Secretary of Transportation from approving any program or project that requires the “use” of (1) any publicly owned parkland, recreation area, or wildlife and waterfowl refuge of national, state, or local significance; or (2) any land from a historic site of national, state, or local significance (collectively, “Section 4(f) properties”), unless there is no feasible and prudent alternative to the use of such land and such program or project includes all possible planning to minimize harm to the park, recreation area, wildlife refuge, or historic site.

Three Section 4(f) properties—Tappan Zee Bridge, Elizabeth Place Park, and the South Nyack Historic District—would be temporarily and/or permanently used by the Replacement Bridge Alternative. The effects of the Short Span and Long Span Options for the Replacement Bridge Alternative would be the same with respect to these Section 4(f) properties.

S-7-1 TAPPAN ZEE BRIDGE

The reuse of the existing Tappan Zee Bridge in place is not considered prudent or feasible, and moving the bridge intact would be infeasible, if not impossible as the Tappan Zee Bridge is more than 3.1 miles long with 198 piers. Disassembly and reassembly of the structure would also be extremely difficult given the location, length, and age of the Tappan Zee Bridge. Furthermore, the removal of the bridge would likely alter or demolish its causeway foundations, buoyant foundations, and cofferdams, which are contributing elements to the historic integrity of the bridge.

Since preservation in place or relocation is not a viable option, FHWA, NYSDOT, and NYSTA, in consultation with SHPO, have explored measures to mitigate the adverse effect on the Tappan Zee Bridge. These measures are identified in the draft Section 106 Memorandum of Agreement and include Historic American Engineering Record (HAER) documentation and the preparation of educational materials documenting the history and construction of the bridge.

S-7-2 ELIZABETH PLACE PARK

The South Broadway Bridge over Interstate 87/287 must be lengthened to allow for a northward shift in the highway alignment to meet the new abutments of the Replacement Bridge Alternative. To construct the new South Broadway Bridge, NYSDOT and NYSTA would seek a temporary, 3-year easement for 0.03 acres of Elizabeth Place Park. The easement would consist of a sloped area at the western edge of the park, which has limited use by park patrons. FHWA proposes a *de minimis* impact finding for the use of Elizabeth Place Park, as it would be temporary and would impact less than 5 percent of the park's area. The use would involve areas of the park with limited public utility and would not affect the other attributes of the park. Furthermore, upon completion of construction, the 0.03 acres would be regraded to better serve park users. FHWA will seek the concurrence from the Village of South Nyack for its proposed *de minimis* impact finding.

S-7-3 SOUTH NYACK HISTORIC DISTRICT

The residences at 21 Cornelison and 78 Smith Avenues are contributing resources to the South Nyack Historic District. The 21 Cornelison Avenue and 78 Smith Avenue properties would be acquired for the Replacement Bridge Alternative. The structures would be removed, and the properties would be permanently incorporated into the Interstate 87/287 and future South Broadway right-of-way.

Three Alternatives for the South Broadway Bridge reconstruction—No Build Alternative, Southerly Alignment in Rockland County, and Replacement of the South Broadway Bridge at the Same Location—would avoid a use of the South Nyack Historic District, but these alternatives are not prudent, as they would not meet the project's purpose and need.

Reconstruction of the South Broadway Bridge to the west would avoid use of the 21 Cornelison Avenue property, but the 78 Smith Avenue property would still be incorporated into NYSTA right-of-way. While reconstruction of the South Broadway Bridge to the west would partially avoid a use of the South Nyack Historic District, it would result in a permanent use of Elizabeth Place Park, may require a permanent closure of the eastbound ramp at Interchange 10, and would divert local traffic in South

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Nyack for a year during construction. Therefore, reconstruction of the South Broadway Bridge to the west is also not considered prudent.

As there is no alternative to avoid a use of the South Nyack Historic District, NYSDOT and NYSTA would implement the following measures to minimize harm: plantings along noise walls on the western edge of the district to provide screening; historic American Building Survey recordation of 21 Cornelison Avenue and 79 Smith Avenue; and signage interpreting the history and architecture of the South Nyack Historic District along the Replacement Bridge Alternative's shared-use path.

S-7-4 COORDINATION

Review of the Draft Section 4(f) Evaluation includes FHWA, NYSDOT, NYSTA, the U.S. Department of Interior (DOI), and SHPO. FHWA, NYSDOT, and NYSTA have initiated a public outreach program. As part of these efforts, a formal consultation process under Section 106 of the NHPA was initiated. FHWA contacted Native American Tribal Nations and groups who may attach religious and cultural interest in sites within the Tappan Zee Hudson River crossing's area of potential effect. NYSDOT and NYSTA have contacted municipalities, preservation groups, and individuals with an interest in the project and the Section 106 process as well as property owners of historic sites within the area of potential effect. Through consultation with these groups, FHWA, NYSDOT, and NYSTA have developed measures to minimize harm to the Section 4(f) properties to be used for implementation of the Replacement Bridge Alternative. These measures are described in the project's draft Section 106 Memorandum of Agreement (see **Appendix C**).

During the public review of the Draft Section 4(f) Evaluation, FHWA, NYSDOT, and NYSTA will meet with the Village of South Nyack to discuss the project's temporary impacts on Elizabeth Place Park. FHWA will provide the Village with any public comments on the proposed use of Elizabeth Place Park and will seek the Village's concurrence with its proposed *de minimis* impact finding.

S-8 ADDITIONAL PROJECT INFORMATION

To assist in the preliminary engineering investigations, cost estimates, and development of potential environmental performance commitments during construction, NYSDOT and NYSTA will undertake a Pile Installation and Demonstration Program (PIDP), geotechnical borings, and general survey work. NYSDOT and NYSTA have secured the necessary permits and approvals for the PIDP, geotechnical borings and survey work. The work is expected to begin in the winter or early spring of 2012. As part of the PIDP, NYSDOT and NYSTA will test the structural performance of a number of temporary piles of varying diameters and monitor the efficacy of various noise attenuation measures. All test piles will be removed, in compliance with regulatory requirements, at the conclusion of the demonstration program. Any relevant data from these test programs will be incorporated into the FEIS and Final Design for the Tappan Zee Hudson River Crossing Project.

S-9 CONTACT INFORMATION

For further information on the project, please visit the project website at www.tzbsite.com or please contact:

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Written comments on this EIS should be submitted to Michael Anderson at NYSDOT.