Final Alternative Analysis Report | Version 7.00

Replacement of the Delaware River Bridge at Milepost H-43.4

Bucks County, Pennsylvania and Burlington County, New Jersey

February 2026

Prepared for the Pennsylvania Turnpike Commission (PTC) in coordination with the New Jersey Turnpike Authority (NJTA)

Executive Summary

This Alternatives Analysis Report for the replacement of the Delaware River Bridge (DRB) located at Milepost H-43.4 (NJTA Str. No. P0.00, NJDOT SI&A No. P000000) was prepared under contract with the Pennsylvania Turnpike Commission (PTC) in coordination with the New Jersey Turnpike Authority (NJTA).

The report documents the development and analyses associated with a range of alignment alternatives including the approach roadways and bridge options for both the main river span and the approach spans in Pennsylvania and New Jersey. A total of eleven (11) alternatives were studied, which included one (1) No build alternative, one (1) rehabilitation alternative, and nine (9) build alternatives. Each of the build alternatives that were studied included four (4) main river span options and three (3) approach span options. Note that the no build alternative does not meet the purpose and need of the project, however this alternative is being carried through the analysis to serve as a baseline for comparison. Additionally, as a result of the Historic Bridge Rehabilitation Analysis (HBRA), it was determined that the existing bridge cannot be rehabilitated to meet the purpose and need while still meeting the Secretary of the Interior's Standards for the Treatment of Historic Properties (SOI standards). Therefore, the rehabilitation alternative was dismissed from further evaluation.

An alternatives analysis typically uses readily available environmental desktop ("secondary source") data. However, due to the amount of information collected as part of the original 2003 Environmental Impact Statement (EIS) and subsequent Re-Evaluations, the analysis of alternatives for the DRB is based on more detailed project area and environmental information. During preliminary design, a Supplemental Environmental Impact Statement (SEIS) will be prepared to update environmental features and potential impacts and to verify areas that have changed since the original studies were conducted.

This report documents the various constraints associated with the project area, discusses the screening process and alternatives evaluated, details the evaluation process used to compare the alternatives, and provides a recommendation for the alternatives to be carried forward into the preliminary engineering phase of the project.

Based on the findings of this report, it is recommended that a Single Bridge, Bridge North alternative and a Single Bridge, North Staged alternative be advanced to preliminary engineering and further evaluated in the SEIS. Based on the comparison of alternatives, the following would result in the least impacts and greatest overall benefits and are recommended to be advanced:

- Alternative NPI (North Partial Impact)
- Alternative NSA (North Staged Alternate)

Main river span bridge options, as detailed in the Bridge Type Study Report, will be evaluated for each of the recommended alternatives, if applicable.

I. Introduction

A. Background and History

As part of a three stage project to connect the Pennsylvania Turnpike with Interstate 95 (I-95) via an interchange and facilitate the continuity of I-95 along the east coast, in 2018 the Pennsylvania Turnpike Commission (PTC) and New Jersey Turnpike Authority (NJTA), in cooperation with the Pennsylvania Department of Transportation (PennDOT), the New Jersey Department of Transportation (NJDOT), the Federal Highway Administration (FHWA), the Delaware River Joint Toll Bridge Commission (DRJTBC), and the Delaware Valley Regional Planning Commission (DVRPC), redesignated portions of I-276 in Bucks County, PA and Burlington County, NJ as I-95. The redesignation included portions of I-276 Eastbound having a designation of I-95 Northbound and portions of I-276 Westbound having a designation of I-95 Southbound. This decades long project to provide connectivity of I-95 is continuing with the reconstruction and widening of the Pennsylvania Turnpike within a nine-mile corridor to meet traffic demands. This project is the last phase of this on-going work and involves the evaluation of the Delaware River Bridge (DRB) at Milepost H-43.4 (NJTA Str. No. P0.00, NJDOT SI&A No. P000000) to meet the purpose and need of the project. The bridge opened to traffic in May 1956 and is jointly owned by the PTC and the NJTA. The existing bridge has an overall length of approximately 6,571-feet and a main span of 682-feet over the river channel and carries two travel lanes in each direction.

The original goal of the I-95 Program was to build a new bridge and rehabilitate the existing bridge to enhance capacity. An Environmental Impact Study (EIS) was completed in the 1990s and the 2003 Record of Decision indicated a selected alternative for the previously proposed dualization for construction of a new bridge to the south of the existing bridge and rehabilitation of the existing bridge. However, due to elapsed time and changes within the corridor FHWA required preparation of a Supplemental Environmental Impact Statement (SEIS). As part of this work, a revised purpose and need document was developed to capture the current conditions. As the DRB was determined eligible for listing in the National Register of Historic Places, a Historic Bridge Rehabilitation Analysis (HBRA) report was prepared to evaluate if the existing bridge could be rehabilitated to meet the revised purpose and need and meet the Secretary of the Interior's Standards for the Treatment of Historic Properties (SOI standards). The HBRA concluded that rehabilitation and/or reuse of the existing bridge does not meet the revised purpose and need associated with the project. Therefore, the existing bridge must be replaced in its entirety. The HBRA is included as **Appendix C**.

B. Study Area

The primary objective of this phase of the project is to address deficiencies with the crossing of the Delaware River, while minimizing environmental impacts and minimizing impacts to adjacent residential and commercial properties, as well as intersecting rail corridors. This requires consideration of alignments that are shifted from the existing alignment. For the purposes of this analysis, the project study area extends east from the SR 0013 (Bristol Pike) Interchange, which is also I-95 Exit #42, to the first horizontal curve in New Jersey for a total length of approximately 2½ miles (see **Appendix B**). All alternatives studied fall within the previously established environmental study area (completed as part of the 2003 EIS with supplemental studies completed in 2020 and 2021), which has a width of 1000-feet, centered on the existing alignment.

C. Alternatives Analysis

This report summarizes the evaluation of the alternatives studied for replacement of the DRB. This evaluation includes the impacts from each of the studied Roadway Alignment Alternatives, the Bridge Type Study Report, the Constructability Report, and the Geotechnical Baseline Reports.

II. Purpose and Need

The 2003 project purpose as documented in the Final Environmental Impact Statement (FEIS) included the following:

- Improved I-276 and I-95 linkage for system continuity;
- *Improved I-95 continuity through the Mid-Atlantic Region;*
- Additional capacity for the current I-276 and I-95 connections;
- Additional I-276 and I-95 capacity;
- Improved study area travel times and delay reduction.

The second, italicized project purpose was accomplished with the re-routing of I-95 in Pennsylvania over the new flyovers, east along the PA Turnpike, across the Delaware River Bridge of the NJ Turnpike Connector to New Jersey, east along the connector to NJ Turnpike Exit 6 and then north along the NJ Turnpike.

Upon re-evaluation of the project purpose, an additional purpose has been added to the project. This additional purpose is to:

- Secure a vital link in the regional and national interstate transportation network across the Delaware River.

The 2003 project needs as documented in the FEIS included the following:

- Inadequate I-276 and I-95 linkage for system continuity
- *Lack of I-95 continuity through the Mid-Atlantic Region*
- Inadequate capacity for the current I-276 and I-95 connections
- Inadequate capacity on I-276 and I-95
- Prolonged study area travel times and delays

Similar to the project purpose, *Improved I-95 continuity through the Mid-Atlantic Region*, the second project need, *Lack of I-95 continuity through the Mid-Atlantic Region*, has been satisfied with the completion of the flyovers that re-routed I-95 east along the PA Turnpike, across the Delaware River Bridge of the NJ Turnpike Connector to New Jersey, east along the connector to NJ Turnpike Exit 6 and then north along the NJ Turnpike.

Further evaluation of the project's purpose and need led the Project Team to consider the 2017 fracture of the existing Delaware River Bridge structure and the potential impact to traffic throughout the corridor. The Project Team has identified the following additional need:

- Lack of service reliability/redundancy of the existing Delaware River Bridge.

For additional information related to the purpose and need associated with the project, see the approved PA Turnpike Interchange Program – Stage 3 – DRB Updated Purpose and Need document dated October 2024.

III. Roadway Design Criteria

Roadway Design Criteria was developed based on the requirements defined in the following publications:

- Pennsylvania Turnpike Design Consistency Guidelines, April 2022 (Pennsylvania Approach)
- New Jersey Turnpike Authority Design Manual, September 2023 (New Jersey Approach)
- PennDOT Publication 13M, Design Manual Part 2, February 2023 Change 9
- AASHTO Policy of Geometric Design of Highways and Streets, 2018
- NJDOT Design Manual for Bridges and Structures Sixth Edition, 2016 (River Road)

The roadway corridor has a federal functional classification of Urban Interstate and has a design speed of 70 mph. Based on available traffic data, the opening year average daily traffic (ADT) is approximately 35,000 vehicles per day (vpd) in each direction. The design year ADT is approaching 50,000 vpd in each direction. The approved Roadway Design Criteria is included in **Appendix A**.

IV. Site Overview

A. Pennsylvania Approach

The Pennsylvania Approach is defined as the area extending from the SR 0013 (Bristol Pike) Interchange to the pier shared with the Main River Bridge. For graphical depictions of this area, see Figure IV.1 below and the preliminary drawings in **Appendix B**.

Figure IV.1 – *Aerial View of the Pennsylvania Approach (2022)*

The terrain of the Pennsylvania Approach is considered generally flat with approximately 10-feet of elevation drop between the base of the bridge abutment and the river. The existing approach roadway between the interchange and the bridge abutment is constructed on approximately 20-feet of fill and is elevated above the surrounding terrain. Near the river there is a defined bank

with an approximate height of 6-feet. The existing bridge is centered on and contained within a 200-foot-wide strip of right-of-way owned by the PTC. Along each side of the PTC's right-of-way are a mix of wooded areas, commercial buildings, single family houses, and residential streets. Several aerial and underground utilities are present throughout the corridor.

1. SR 0013 Interchange (I-95 Exit #42)

The western limit of the project is bounded by the SR 0013 (Bristol Pike) interchange. A previously completed (2017) I-95 Interchange project (Stage 1, Section D10) included the reconstruction of the eastbound exit ramp. The design and construction of the remaining interchange ramps is anticipated to be included in a future project. The radii for the existing loop ramps are substandard and only meet a design speed of 25 mph. The acceleration/deceleration lane lengths at this interchange are also substandard based on the design speed of the mainline roadway. There has been an increase in the mainline running speed due to the implementation of Open Road Tolling (ORT) and the removal of the existing mainline toll plaza immediately east of the interchange. Additional features in this area include mainline structures that cross the SR 0013 Interchange Ramps, Green Lane, and the East Penn Railroad. The SR 0013 Interchange Ramps are a two-lane barrier separated roadway that provides access to the existing loop ramps. Green Lane is a two-lane local road that crosses under the mainline at a skew of approximately 60 degrees. East Penn Railroad is a single railroad spur crossing under the mainline at approximately 60 degrees. Alternatives developed for the replacement of the DRB extend back to the SR 0013 interchange; however, impacts to the existing ramps have been minimized when feasible. See Figure IV.2 for an aerial view of this area.

Figure IV.2 – *Aerial View of SR 0013 Interchange (I-95 Exit #42) (2022)*

2. Former Toll Plaza

Immediately east of East Penn Railroad is the area of the former mainline toll plaza. The toll plaza has been removed and replaced by Automatic Toll Gantries for the westbound roadway. The existing widened pavement remains. See Figure IV.3 for an aerial view of this area.

Figure IV.3 – *Aerial View of Former Mainline Toll Plaza Area (2022)*

3. SR 0013 (Bristol Pike) & Delaware Canal

At the western limit of the DRB Pennsylvania Approach Span bridge, SR 0013 (Bristol Pike) crosses below the existing bridge at an angle of approximately 73 degrees. SR 0013 is a four-lane divided highway through this area having a curb-to-curb width of approximately 80-feet, a raised median, and a sidewalk adjacent to the western shoulder. The roadway is flanked by wooded areas and commercial properties in the vicinity of the existing bridge. The Delaware Canal (a designated National Historic Landmark) is located almost parallel to SR 0013 and crosses below this roadway just north of the existing bridge. It is contained in a pipe culvert from 100-feet south of the existing bridge, daylighting approximately 600-feet to the north. The canal is located in the Delaware Canal State Park. The Delaware Canal Towpath is located along the eastern bank of the canal and is not well defined where the canal is contained in the pipe culvert. See Figure IV.4 for an aerial view of this area.

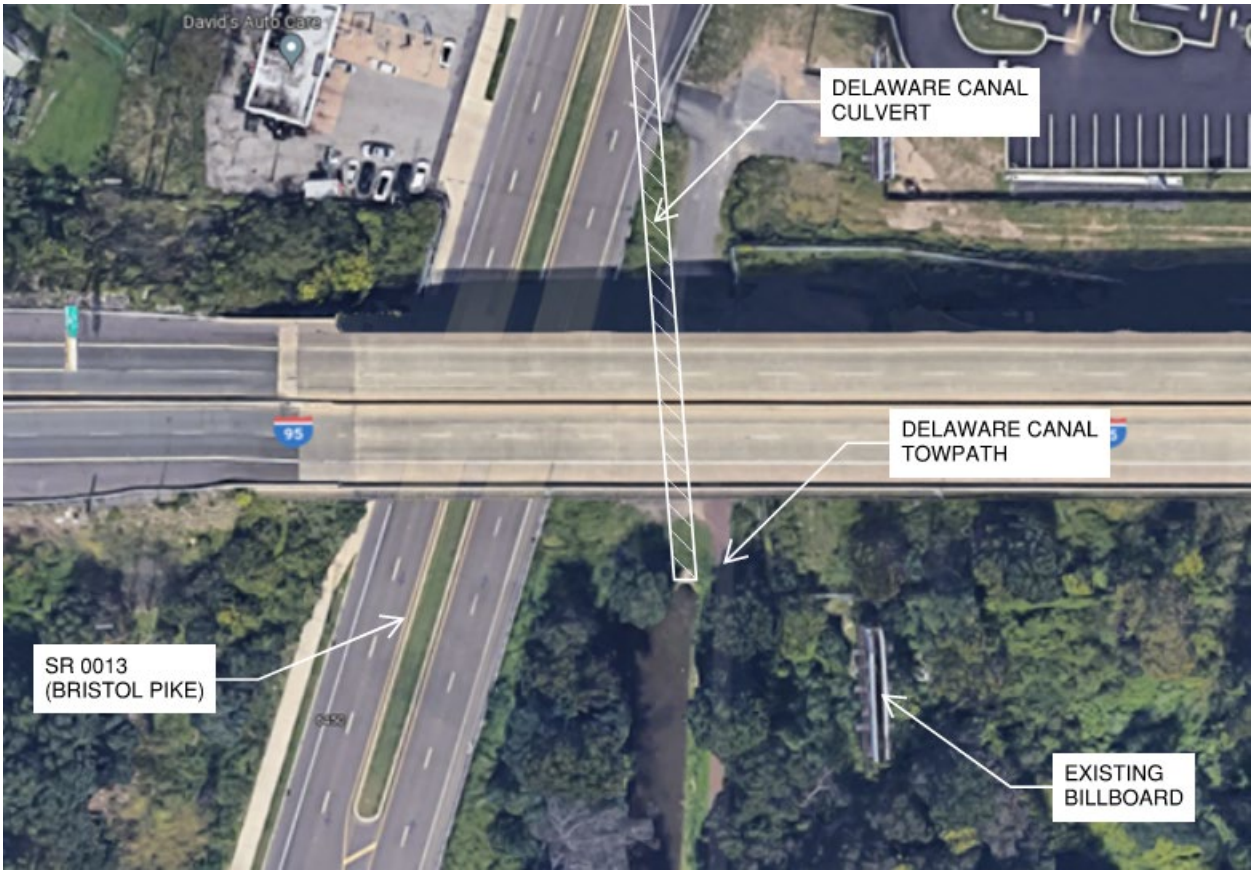

Figure IV.4 – *Aerial View of SR 0013 (Bristol Pike) and the Delaware Canal (2022)*

4. Amtrak – Northeast Corridor

Approximately mid-way along the western approach structure, the bridge crosses over Amtrak's Northeast Corridor (NEC) at milepost 65 with an angle of approximately 80 degrees. The NEC is a high-speed rail corridor and is approximately 160-feet in width to the north of the existing bridge and contains six (6) individual sets of railroad tracks. The NEC widens as it crosses below the existing bridge and is approximately 375-feet in width to the south. This portion of the NEC contains the Grundy Interlocking that allows trains to switch tracks. Note that numerous agencies/rail companies use the NEC tracks including the Southeastern Pennsylvania Transportation Authority (SEPTA), East Penn Railroad (ESPN), NJ Transit, Norfolk Southern, and Amtrak. See Figure IV.5 for an aerial view of this area.

Passenger trains along the NEC are electrified and therefore, numerous transmission and catenary lines are located along the tracks. At the existing bridge site, transmission lines are located above the deck of the bridge and catenary lines are located below the steel girders.

There are many Amtrak facilities located around the existing bridge. Directly to the south of the bridge on the west side of the tracks there is an electrical substation. Approximately 350-feet south of the bridge on the east side of the tracks there is a building associated with the Grundy Interlocking which is eligible for listing in the National Register of Historic Places. Directly north of the bridge along the western side of the tracks there are two signal bungalow structures.

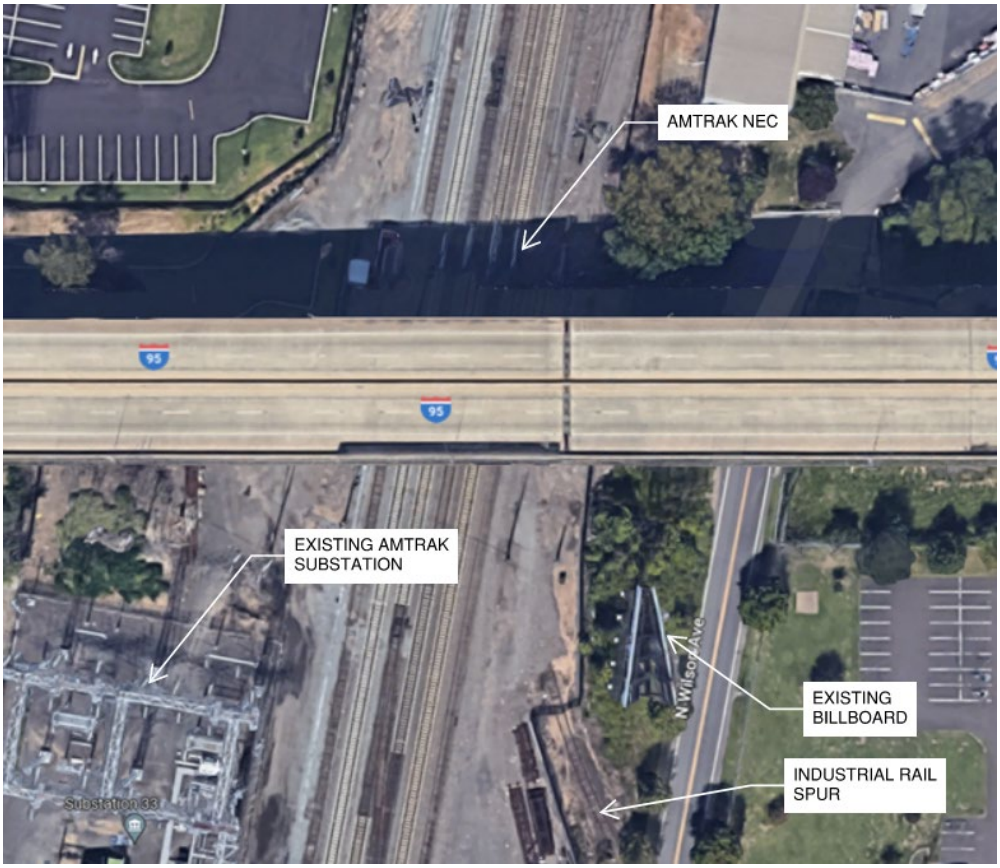

Figure IV.5 – *Aerial View of Amtrak's Northeast Corridor (2022)*

5. Residential Streets

North Wilson Avenue is located to the east of Amtrak's NEC and runs adjacent to the existing tracks. This road is one of many local roads located in the area of the western approach. The roadway contains single travel lanes in each direction with minimal shoulders and is approximately 30-feet in overall width. This road provides access to commercial properties and dead ends immediately north of the existing bridge at the entrance to an industrial park. Commercial properties are located along the eastern side of the roadway in the vicinity of the existing bridge. See Figure IV.5 for an aerial view of this area.

Closer to the river there are two low volume residential streets, Wood Avenue and Palmer Avenue, that do not contain pavement markings. Wood Avenue measures approximately 26-feet wide while Palmer Avenue measures 30-feet. Typically, two lines of single-family houses are located between the two streets and to the east and west of Palmer Avenue.

The last crossing before the river is North Radcliffe Street. This street provides direct access to the other residential streets along the river. It has two striped travel lanes with shoulders and measures approximately 34-feet in overall width. A single line of single-family houses is located between the street and the riverbank; these houses have direct access to the river, and some have dock facilities. Crown Road runs parallel to the existing bridge just to the south of the structure and provides connectivity between Wood Avenue, Palmer Avenue and North Radcliffe Street as shown in Figure IV.6 below.

Figure IV.6 – *Aerial View Residential Streets in Pennsylvania (2022)*

B. Delaware River Crossing

The main river bridge is defined as the area extending from the pier shared with the Pennsylvania Bridge Approach and the pier shared with the New Jersey Bridge Approach. At the existing bridge, the river has a width of approximately 1,250-feet between the western bank and the eastern shoreline. The river is tidal and fluctuates approximately 8-feet between high and low tide. The river is navigable its full length south of the existing bridge to its outlet with the Delaware Bay and approximately 12 miles to the north. For graphical depictions of this area, see Figure IV.7 below.

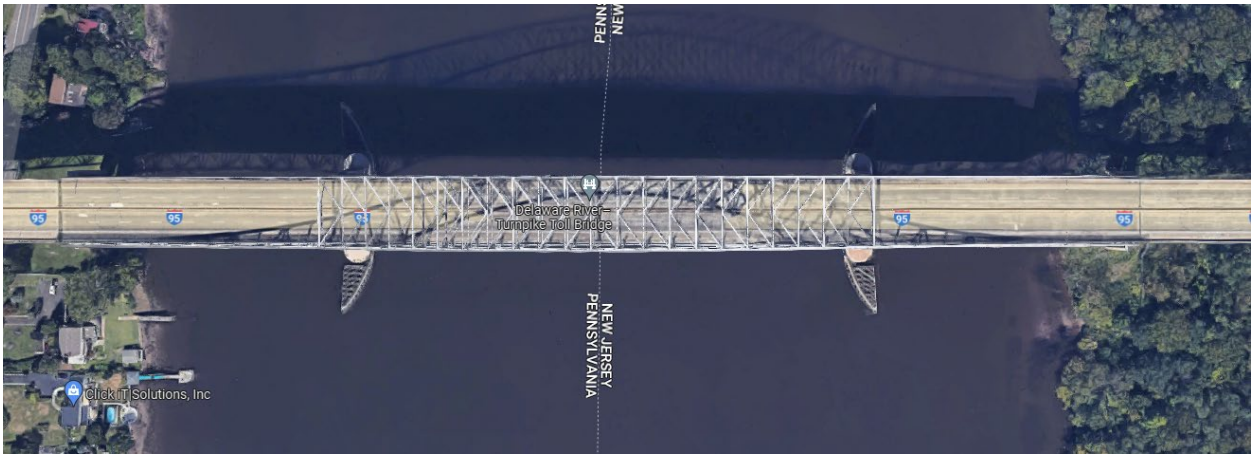

Figure IV.7 – *Aerial View of the Existing River Bridge (2022)*

In consideration of the various bridge types evaluated, the limits of the new main river bridge vary from a minimum of 680-feet to a maximum of 1,840-feet measured along the baseline of the proposed alignment. The main river bridge type alternatives are centered on the existing river/navigation channel.

1. River Navigation

Based on data depicted on the original existing bridge plans, information from the National Oceanic and Atmospheric Administration (NOAA), and the US Army Corps of Engineers (USACE); the existing bridge is in a portion of the Delaware River that has an actively maintained navigation channel. From this available information, the navigation channel is 400-feet in width and is located in approximately the center of the river. Dredging is performed by the USACE to maintain the width and depth of the channel. The navigation clearance shown on the current NOAA navigation chart dated 7/30/2021 are: Horizontal Clearance: 550-feet, Vertical Clearance: 135-feet.

A Navigation Study performed by Jacobs Engineering Group, Inc. (Jacobs) in 2022 found that ships regularly pass through this stretch of the river. Based on this study, the PTC and NJTA determined that the replacement structure(s) must maintain required navigational clearance equal to that of the existing bridge.

C. New Jersey Approach

The New Jersey Approach is defined as the area extending from the pier shared with the main river bridge to the first horizontal curve in New Jersey. For graphical depictions of this area, see Figure IV.8 below and preliminary drawings in **Appendix B**.

Figure IV.8 – *Aerial View of the New Jersey Approach (2022)*

The terrain of the New Jersey Approach is considered generally flat with approximately 20-feet of elevation gain between the river and the bridge abutment location. There is no defined bank near the river but rather a gradual slope. The existing bridge is centered on and contained within a 300-foot-wide strip of right-of-way owned by the NJTA. Along each side of the NJTA's right-of-way are wooded areas, commercial buildings, and parkland. Note that heavy commercial development has been taking place to the north and south of the NJTA right-of-way throughout the entire length of the anticipated project limits. All proposed alignments cross over River Road. There are no other crossings within the New Jersey Approach limits.

1. River Road and Adjacent Commercial Development

River Road (Burlington County Route 656) is the only DRB crossing in NJ and provides direct access to all the commercial buildings along the river. It has two striped travel lanes with shoulders and measures approximately 36-feet in overall width. An uninhabited wooded area is located between the river and the roadway in the vicinity of the existing bridge and commercial properties are located along the eastern side of River Road. See Figure IV.9 for an aerial view of this area.

Figure IV.9 – *Aerial View of River Road and Adjacent Commercial Development (2022)*

2. Eastern Extent

The eastern extent of the project includes the only horizontal curve within the limits of the project in New Jersey. Adjacent to the mainline roadway in this area are the Florence Recreation Field to the north and existing commercial development to the south. A railroad spur services the existing commercial property to the south and is located adjacent to the right-of-way. See Figure IV.10 for an aerial view of this area.

Figure IV.10 – *Aerial View of the Eastern Extent (2022)*

V. Environmental Considerations

Environmental considerations associated with both the Pennsylvania and New Jersey study areas include natural, cultural, and socioeconomic resources. Environmental Impact Maps are included in **Appendix D**.

A. Natural Resources

The natural resources that are located within the project area were identified during various field views, as well as review of secondary source information. The study area is depicted on the Environmental Impact Map in **Appendix D**. This study area for the purposes of this report is sufficient to assess the relative extent of natural resources potentially impacted by each proposed alternative.

The natural resources located within the project area include surface waters, wetlands, floodplains, submerged aquatic vegetation, local parks and recreation areas, forested areas, and threatened and endangered species.

1. Surface Waters

The Delaware River flows from northeast to southwest through the study area in-between PA and NJ. At the existing Delaware River Bridge, the river has a width of approximately 1,250 feet between the western bank and the eastern shoreline. According to the NJ Department of Environmental Protection (NJDEP) Fish & Wildlife Office website and the PA Fish and Boat Commission (PFBC), the river is not classified as Trout Production, Trout Maintenance, Class A, Stocked Trout, or Wild (Natural Reproduction) Trout Waters. However, according to the NJDEP, there are anadromous fish spawning habitats present in the Delaware River. The Delaware River Canal is also located in the study area, east of SR 0013 (Bristol Pike) in the study area.

The Delaware River is considered navigable by the USACE. The portion of the river that is navigable is the upper Delaware River from Delair, New Jersey to the head of the navigation on the Delaware River at Trenton, New Jersey. The existing Delaware River Bridge, located in this area, has 135 feet of vertical clearance and 550 feet of horizontal clearance. The navigation channel width under the existing bridge is 400 feet. The navigation channel is dredged to maintain the existing vertical clearance. A Navigation Impact Report will be completed to satisfy the permitting provisions found in the 2014 Memorandum of Understanding between the U.S. Coast Guard, the FHWA, the Federal Transit Administration, and the Federal Railroad Administration. The Delaware River is also a PFBC Water Trail and therefore subject to Section 4(f).

It is not anticipated that the proposed bridge project will affect the safe and efficient movement of any recreational fleet operation within the river. Nor will the proposed bridge prohibit the entry of any vessels to the local harbor of refuge. No permanent impacts to waterway users are anticipated. The proposed bridge will match or exceed the clearance of the existing structure. Temporary impacts to the navigation channel could originate during the location and construction of new bridge foundations, temporary falsework/shoring towers, trestles, and accommodation of large construction equipment (such as cranes), as well as the temporary closures of the navigation channel to accommodate construction and demolition activities.

Mill Creek is located on the western edge of the study area in PA. According to 25 Pa Code, Chapter 93, in the study area Mill Creek is classified as a Warm Water Fishes and Migratory Fishery (WWF, MF). According to the PFBC, Mill Creek is not classified as Class A, Stocked Trout, or Wild (Natural Reproduction) Trout Waters. It is not USACE navigable nor a PFBC Water Trail.

2. Wetlands

According to the U.S Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) Mapper, there are various mapped wetlands within the study area. There are mapped wetlands

on the northern and southern sides of I-95 surrounding the floodplains of Mill Creek and the Delaware River Canal in PA. Additionally, there are mapped wetlands on the NJ side of the study area. Mill Creek, Delaware Canal, and the Delaware River are mapped as riverine systems.

A field investigation was conducted to identify and delineate wetlands in 2000 and a re-evaluation was conducted in 2020. Four wetlands were identified and delineated in 2000. During the 2020 re-evaluation, two of the wetlands were removed as one was in a previously active construction site and was no longer present; while the other wetland was re-classified as a drainage swale and not a jurisdictional wetland as defined by the USACE. However, additional coordination will be conducted to confirm whether the swale is a wetland regulated by the PA Department of Environmental Protection.

Also, in 2020, three additional wetlands were delineated within the study area. According to the wetland delineations completed, there are five wetland systems within the study area. A follow-up field investigation is anticipated to identify, delineate, and re-evaluate the wetlands, especially in the easternmost portion of the study area. A Wetland Identification and Delineation Report will be completed.

3. Floodplains

According to the Federal Emergency Management Agency (FEMA), National Flood Hazard Layer, portions of the study area are located in a FEMA 100-year floodplain, Zone AE and FEMA Floodway. Zone AE refers to areas at high risk of flooding, with 1% or greater chance of flooding each year (known as the 100-year floodplain).

In PA, the western portion of the study area is located in the Zone AE 100-year floodplain of Mill Creek. On the eastern side of SR 0013 (Bristol Pike), the study area is located in the Zone AE 100-year floodplain of the Delaware River Canal. Along the state lines and immediately adjacent areas, the project is in the Zone AE 100-year floodplain and FEMA Floodway of the Delaware River.

Detailed Hydrologic and Hydraulic (H&H) Analyses will be completed during Preliminary Engineering to determine the discharge frequency relations along the flooding sources and the extent of the floodwaters and associated elevations.

4. Submerged Aquatic Vegetation

A Submerged Aquatic Vegetation (SAV) Survey Report will be completed. National Oceanic and Atmospheric Administration (NOAA) considers that all areas with any percent coverage of SAV or in areas that should otherwise be occupied by SAV are still considered potential SAV habitat.

5. Local Parks, Recreational Areas, and Green Acres

The parks and recreational areas in PA include the Black Ditch Park, Pacific Park, and the Delaware River Heritage Trail, known locally as the D&L Trail serving as a segment of the East Coast Greenway. Black Ditch Park is located on the western edge of the study area. Black Ditch Park is considered a Department of Conservation and Natural Resources (DCNR) Local Park. The total acreage of Black Ditch Park is 188.15 acres, however approximately 6.09 acres is in the study area. Pacific Park is approximately 1.41 acres within the study area.

In NJ, there are no state parks or local parks located within the study area. The Delaware River Heritage Trail is located in both PA and NJ. It is a 60-mile-long loop along the upper portion of the scenic Delaware River estuary. It travels from Trenton to Palmyra on the NJ side and from

Morrisville to Philadelphia's Tacony neighborhood in PA. Approximately 2,101 feet of the Delaware River Heritage Trail is within the study area.

A Green Acres funded property (Veterans Park) in Florence, NJ exists within the study area. The Green Acres Program is a land preservation program in NJ. The Green Acres Program can purchase lands directly, but also gives grant money to municipal and county governments, and conservation non-profits to purchase land for permanent protection. Further investigations will be completed during Preliminary Engineering to determine if the alternatives under consideration would result in impacts to this property and whether a Green Acres restriction exists.

Publicly owned parks and recreational areas are subject to Section 4(f). Additionally, parks may have received funding through the federal Land and Water Conservation Fund (LWCF) and/or other federal, state, or local recreation grants. Further analysis of the presence of these resources and the alternatives' potential effects will be conducted as part of the SEIS.

6. Forested Areas

Forested areas are present within the project study area primarily adjacent to the existing highway and interspersed with residential, commercial, and industrial land uses.

In PA, the area from the river to the western terminus of the study area is largely developed and, consequently, forested areas are primarily comprised of small pockets and relatively short tracts. Larger forested areas can be found west of the I-95/SR 0013 (Bristol Pike) interchange encompassing Mill Creek.

In NJ, forested areas are found both north and south of the DRB along the Delaware River between the river and River Road. To the south of I-95 and east of River Road there is a large tract of forested area that terminates with new development at which point a narrow tract of forest runs adjacent to the highway. To the north of I-95 and east of River Road, a narrow area of forest runs directly adjacent to the highway with occasional pockets of forested areas interspersed within residential and commercial land uses.

Due to the presence of forested areas adjacent to the existing highway and along the river itself, all build alternatives would likely result in potential impacts to forests. However, because the majority of the project area includes residential, commercial, industrial, and transportation land uses, it's anticipated that the amount of impacts would be relatively minimal. That said, additional analysis of impacts to forested areas, including any sensitive species associated with those areas, will be evaluated during the environmental review process.

7. Threatened and Endangered Species

The Pennsylvania Natural Diversity Inventory (PNDI) was reviewed on June 2024 which identified potential impacts to threatened and endangered species under the jurisdiction of the PA Game Commission (PGC), the PA DCNR, and the PFBC.

An active nesting pair of peregrine falcons is located on the eastern (PA) end of the bridge. Based on coordination with the PGC, no work can occur within 1,000 feet of the nest location during nesting season-February 15th through July 31st. The nine build alternatives under consideration all fall within the 1000-foot buffer; therefore, construction restrictions would be required for any of the build alternatives that are advanced for evaluation in Preliminary Design and the Supplemental Environmental Impact Statement (SEIS). While the peregrine falcon has been delisted, it is still considered a vulnerable species and annual coordination with the PGC is

required. Coordination should occur a minimum of 30 days prior to the start of falcon nesting season each year.

A Habitat Assessment Investigation and Report will be completed for species under the jurisdiction of the PFBC, including the Northern Red-bellied Cooter and three frog species: the Eastern Cricket Frog, New Jersey Chorus Frog, and the Coastal Plains Leopard Frog. Coordination with the PFBC will be completed to determine avoidance and/or mitigation measures, if necessary.

Fifteen plant species under jurisdiction of the DCNR were identified through PNDI. Initial plant surveys were conducted in 2020. Additional plant surveys - including a Plant Species of Special Concern Habitat Assessment – will be conducted. Coordination with DCNR will continue throughout project development, as appropriate.

The PA-endangered Willow Oak (*Quercus phellos*) is present south of the DRB. Coordination with the PA DCNR confirmed that the proposed alternatives would not impact these trees.

The New Jersey Natural Heritage Database and the Landscape Project was reviewed in June 2023, which identified a list of federally and state-listed species within the project area. Among the species identified are the state-listed bald eagle, blue heron, osprey, peregrine falcon and three mussel species. Additionally, the federally and state-listed shortnose sturgeon was identified as being present in the project study area. Coordination with the jurisdictional agencies will occur during the environmental review process.

The federally listed shortnose sturgeon and Atlantic Sturgeon are present within the project study area. Consultation with the NOAA Fisheries under Section 7 of the Endangered Species Act is anticipated. Potential effects will be determined and resulting mitigation will be developed during that process.

The PNDI and Natural Heritage Database and Landscape Project will be revisited during project development to confirm whether additional species are potentially present in the project area. Coordination with the respective jurisdictional agency or agencies would be conducted and any measures would be incorporated into the project, as appropriate.

B. Cultural Resources

1. Above Ground Historic Resources

There are five properties listed in or determined eligible for listing in the National Register of Historic Places (NRHP) in Pennsylvania. Additionally, five properties in New Jersey were reviewed for eligibility. The project will involve coordination with consulting parties during the Section 106 process. Separate Determination of Effects Reports for historic properties in Pennsylvania and New Jersey will be prepared for this project.

<u>Fleetwing Estates Historic District (Resource No. 2024RE00974)</u>

Located in Bristol Township, Bucks County, Fleetwing Estates Historic District is a small residential subdivision that was established in 1943 and contains approximately 20 acres and 100 detached dwellings. Fleetwing Estates was developed in response to the opening of an aircraft parts and manufacturing plant of the Fleetwings Corporation, which was located across Green Lane from the neighborhood.

Fleetwing Estates Historic District is eligible under Criterion A in the area of Planning and Development for its association with defense housing during World War II. The period of significance is 1943 to 1948, which covers the year of construction to the end of Fleetwings Corporation's operations in 1948. The National Register boundary includes the extent of the planned community and is bounded roughly by Fleetwing Drive on the south and west, Mustang Street on the north, and Bloomsdale Road on the east. The development is situated on the north side of the Pennsylvania Turnpike west of Green Lane.

Pennsylvania Railroad: Main Line (Philadelphia to New York) Historic District (Resource No. 1994RE01403)

The Pennsylvania Railroad: Main Line (Philadelphia to New York) Historic District was determined eligible for the National Register in 1994 as noted in in the PA SHPO's August 11, 1994, letter: "This important transportation resource is eligible for the National Register under Criterion A connecting two major cities which allowed the Pennsylvania Railroad to compete for rail traffic moving west out of New York. The line is also significant under Criterion C for engineering, because it provided an elevated route out of Philadelphia by circa 1910 and was completely electrified by 1935." The National Register boundary for the Pennsylvania Railroad for the portion from Philadelphia to New York is defined by the legal description of the current railroad corridor, including the tracks and roadbed, bridges, viaducts, signals, relay boxes, interlocking plants, catenary supports and association supply and transmission wires, stations, and any other related structures or equipment contained within the legal right-of-way. The period of significance begins in 1846 when the railroad obtained its charter from the Pennsylvania Legislature and ends in 1958 when the railroad ceased making a profit. The railroad extends along the eastern seaboard and connects Philadelphia with New York. Within the project area, the rail line runs under the western approach spans to the Delaware River Bridge.

Pennsylvania Railroad: Grundy Tower (Resource No. 1999RE00833)

The Grundy Tower is located adjacent to the east side of the railroad tracks, approximately 300 feet south of the elevated approach span to the Delaware River Bridge. Constructed by the Pennsylvania Railroad ca. 1920, the Grundy Tower meets National Register Criteria A and C as a contributing resource to the National Register eligible Pennsylvania Railroad: Main Line (Philadelphia to New York) Historic District. The National Register boundary for the rail line is the current right-of-way, which includes the Grundy Tower.

Delaware Division of the Pennsylvania Canal (Resource No. 1974RE00084); National Register Listed and National Historic Landmark

Construction and operation of the Delaware Division of the Pennsylvania Canal, commonly known as the Delaware Canal, was authorized by the Pennsylvania Legislature in 1827. The canal parallels the west bank of the Delaware River and extends nearly 60 miles from Easton, Pennsylvania, to Bristol, Pennsylvania. The canal was constructed primarily as a connecting link with the Lehigh Canal to transport anthracite coal from the Lehigh Valley to Philadelphia and New York.

The Delaware Canal was listed in the National Register in 1974 and designated a National Historic Landmark in 1976. The canal is significant under Criterion A in the areas of transportation and commerce and the period of significance extends from 1827 to 1956. The National Register boundary is approximately 45 feet wide and 60 miles long and includes the canal, towpath, and

berm. The Delaware Canal runs under the Pennsylvania Turnpike and local roads at the western end of the Delaware River Bridge. The portion of the canal directly under the bridge was excavated to accommodate footings and regraded as part of construction of the Delaware River Bridge in the 1950s. The Keeper of the National Register of Historic Places determined that the section under the bridge does not contribute to the Delaware Canal.

DRB (Resource No. 2005RE00744)

The Pennsylvania Turnpike Delaware River Bridge carries I-95 over the Delaware River between Bristol Township, Bucks County, PA and Burlington Township, Burlington County, NJ. The bridge also spans SR 0013 (Bristol Pike), Amtrak, several local streets in Bristol Township, and River Road in Burlington Township.

The bridge consists of 31 spans and has a total length of approximately 6571′. The main river unit is a three-span continuous Warren through truss with a main river span and twin approach spans on either side. The PA and NJ approach spans both include a four-span continuous deck truss unit and a three-span continuous deck span unit. The PA approach also includes ten simple girder/floorbeam/stringer spans, while the NJ approach also includes four simple girder/floorbeam/stringer spans. The DRB was determined eligible for listing in the NRHP in 2005 and eligibility was reconfirmed by the PA SHPO in a letter dated February 23, 2023 and by the NJ HPO in a letter dated April 21, 2025. The bridge is significant under Criterion A in the area of Transportation and Planning as a critical connection between the New Jersey and Pennsylvania turnpike systems and Criterion C in the Area of Engineering as an example of a mid-twentieth century continuous Warren through truss. The period of significance begins in 1954, the year construction on the bridge began, and extends through 1974. The National Register Boundary of the resource is the bridge's footprint.

The following five properties located in NJ were determined not eligible for listing in the NRHP. The NJ HPO concurred with the determination on December 10, 2025.

1910 River Road, Burlington, NJ

The property at 1910 River Road is a one-and-one-half-story ranch dwelling with a side-gable roof covered in asphalt shingles. The original section, located at the northern end of the building, was built between 1950 and 1952, with an addition built between 1963 and 1965 on the southern end. The primary elevation (west) is clad in stone facing, synthetic stone, and vinyl siding.

The property at 1910 River Road was determined not eligible for the NRHP due to a lack of significance and integrity. The dwelling is a common example of a dwelling built in the 1950s. Since its construction, much of the farmland immediately surrounding the property has become forested and the farm buildings to the north were demolished. Also, much of the farmland to the east has been turned into a large industrial complex.

1922 River Road, Burlington, NJ

The building at 1922 River Road is a one-story commercial building constructed of concrete block covered in stucco with an asphalt shingle roof. The building was constructed between 1958 and 1963 and expanded between 1971 and 1984. The building is six bays wide with a rectangular footprint. The west elevation has a glass block window, a metal door, and four roll-up metal garage doors. The gable ends in the north and south elevations are both clad in vinyl siding.

The property at 1922 River Road was determined not eligible for the NRHP due to a lack of significance and integrity. It is an unremarkable example of a commercial building built in the mid-twentieth century and later expanded and altered.

Hays Riverview Cemetery, Burlington, NJ

The property contains a mostly empty, overgrown lot, with a small cemetery containing about 83 visible headstones set back approximately 400 feet from River Road. The 83 headstones have around 89 burials represented on them. The material of the headstones appears to include a mixture of marble, sandstone, and granite with the dates on the visible headstones ranging from 1783 to 1963. The cemetery itself is encircled by a chain link fence and several of the headstones have ornamental fences around them. The entire parcel also is surrounded by a chain link fence.

While the cemetery was active for almost 200 years, a majority of graves date from either 1850 or 1870, with 14 people buried in 1870 alone. Of those buried there, around 27% of them were under the age of 20, with 17% under the age of 10. Children under the age of 10 had more burials than any other age group, as the next closest age group is people in their 70s with 15 burials.

While many people from the surrounding area were buried in the cemetery, research did not find a connection to anyone of local, regional, or state importance. The county sheriff and later the county postmaster went by the name of Nathan W. C. Hays. However, he was not buried at the cemetery and there is no confirmed connection between him and any of the Hays buried there. There are no structures on the property and research did not yield an association with historic events. The area surrounding the cemetery would have been a small farming community for much of the time people were being buried there. Research has not linked the cemetery to any historic properties, people, or places of importance and therefore, it was determined as not eligible for the National Register.

New Jersey Turnpike Pennsylvania Extension, Burlington and Florence, NJ

The New Jersey Turnpike Pennsylvania Extension, which was renamed the Pearl Harbor Memorial Turnpike extension in 1997, meets the mainline of the New Jersey Turnpike at Interchange 6. The NJ HPO determined the mainline of the New Jersey Turnpike not eligible for the NRHP on September 14, 2006.

The 5.7 mile long, six lane New Jersey Turnpike Pennsylvania Extension started construction in 1954 and would link the Mainline New Jersey Turnpike to the Delaware River Extension of the Pennsylvania Turnpike, via the Delaware River Bridge (PhillyRoads n.d.). This connection was one of the final links in the turnpike system in the eastern United States, allowing drivers to take a single controlled access toll road from New York City to Chicago. The New Jersey Turnpike Pennsylvania Extension opened to traffic on May 25, 1956, along with the newly widened mainline of the New Jersey Turnpike, the Delaware River Bridge, and the Delaware River Extension of the Pennsylvania Turnpike.

Since its establishment, the New Jersey Turnpike Pennsylvania Extension has gone through multiple improvements to create and update its interchanges. Outside of interchange projects, the New Jersey Turnpike Pennsylvania Extension has underwent other alterations, including removal of the toll plaza from the western end of the extension before the Delaware River Bridge, placement of additional signage, the addition of guide rail and emergency turn arounds to the median, construction of the Florence Toll Plaza in February 2000 to accommodate E-ZPass

electronic tolling, and building two bridges to carry I-295 over the extension. The New Jersey Turnpike Pennsylvania Extension was determined not eligible for the National Register.

National Gypsum Company Railroad Spur, Florence, NJ

On June 7, 1955, B. Harold Wills, a civil engineer from Mount Holly, New Jersey, conducted a survey to construct a railroad spur from the westbound mainline of the Camden-Amboy Railroad (known as the Amboy Branch). On June 11, 1956, the last revisions were made, and the railroad spur was completed in 1956. The Camden and Amboy Railroad lasted until 1867 when the company merged with the New Jersey Railroad and Transportation Company to form the United New Jersey Railroad and Canal Company, which was a subsidiary of the Pennsylvania Railroad (Burns 2024). The railroad is now the New Jersey Transit River Line. Multiple spurs were constructed to connect industrial sites to the Camden and Amboy Railroad.

The National Gypsum Company Railroad Spur was determined not eligible for the NRHP due to a lack of significance and integrity. The spur was a privately built line serving individual businesses and is not associated with the Camden-Amboy Railroad and was one of dozens of private spurs connected to the railroad. The line does not represent any distinctive construction methods and materials. The railroad spur has been altered with new changes and additions.

2. Archaeological Resources

There are four recorded archaeological sites within the project study area; two sites in Pennsylvania and two sites in New Jersey. They are described from west (PA) to east (NJ), below:

Black Ditch Park Site (36BU0348)

The Black Ditch Park Site (36BU0348) is located in Bucks County at the western end of the study area in Pennsylvania. It was recorded in 2003 and was identified through the recovery of a high density of historic period artifacts and associated features. Phase II investigations were conducted to determine the NRHP eligibility of the site and resulted in the recovery of a large assemblage of historic period artifacts and associated structural features that indicated the site was occupied as early as the first quarter of the 19th century. The site was recommended eligible for listing in the NRHP and received SHPO concurrence in 2005.

Court Square Site (36BU0349)

The Court Square Site (36BU0349) is located in Bucks County, Pennsylvania and was recorded in 2003. The site was identified through the recovery of historic period artifacts and a Late Woodland Period, quartzite, Madison type projectile point during controlled Phase I and Phase II archaeological field investigations. The site was recommended not eligible for the NRHP and received PA SHPO concurrence in 2005.

Site 28BU0703

Site 28BU0703 is located in Burlington County, New Jersey at the eastern end of the study area. It was identified through the recovery of historic period domestic artifacts. It is described as a possible farmstead dwelling occupied from the mid-19th through mid-20th centuries. The site has not been evaluated for NRHP eligibility.

Site 28BU0702

Site 28BU0702 is located just east of Site 28BU0703 in Burlington County and was identified through the recordation of a historic house foundation. The foundation was recorded to be related to a mid-19th to mid-20th century farmhouse that was relocated to Florence, New Jersey in the 1950's. The site has not been evaluated for NRHP eligibility.

Project impacts to archaeological sites are unknown at this time. The project will involve coordination with consulting parties and Tribes and Nations throughout the Section 106 process. If it is determined that the project will have an Adverse Effect on NRHP eligible sites, mitigation of the adverse effects will be required.

Listed and eligible historic properties are subject to the requirements of Section 4(f). Further analysis of alternatives' potential 'use' of historic resources will be conducted as part of the SEIS.

C. Hazardous, Residual, and Industrial Areas

Studies of potentially sensitive or hazardous waste areas for the I-95 Interchange Project have been ongoing since 1995. The most recent comprehensive studies of the DRB Project study area include a Phase I Environmental Site Assessment (ESA), dated February 2006, completed for the I-95 Interchange Project (Interchange Segment) and a Phase I ESA Addendum of the Delaware River Bridge Alternatives, dated March 2021, completed for the I-95 Interchange Project. The Phase I ESA Addendum was conducted due to the amount of time that had elapsed since the 2006 Phase I ESA was completed and because work related to the DRB element of the I-95 Interchange Project was ongoing. Additionally, construction had been completed on portions of the I-95 Interchange Project, so the study area could be reduced. Both Phase I ESAs typically studied a 1,000- to 1,500-foot-wide corridor, centered on existing roadways. These Phase I ESAs cover the existing DRB Project area and would be used to identify properties of potential concern related to construction of the DRB project.

The 2006 Phase I ESA identified 23 properties of potential concern within or adjacent to the DRB Project area. The 2021 Phase I ESA Addendum identified 26 properties of potential concern within or adjacent to the DRB Project area, including 11 of the same properties identified in the 2006 Phase I ESA. Of these properties of concern, 10 were recommended for potential further action or study

However, since the 2021 Phase I ESA was completed, there have been significant land use changes pertaining to properties of potential concern. Some of the identified structures were demolished when the properties were converted into parking lots for an Amazon distribution center. While the structures have been demolished and the properties have been paved over, the status of potential contamination at the properties is unknown. Additionally, data from the New Jersey Department of Environmental Protection indicates that the area of historic fill east of the DRB is still present and the presence of contamination has not been determined. The railroads/spurs also remain within the DRB Project area, at five different locations.

Given the presence of hazardous waste and potential areas of concern throughout the project study area, it's anticipated that all build alternatives would result in potential impacts. However, regardless of the alternatives, appropriate measures would be implemented to ensure the proposed project would not present substantial risk to the public.

Future analysis through Phase II/III ESAs on likely impacted properties will be conducted as the project progresses through the SEIS and into Final Design.

D. Socioeconomic Resources

1. Demographics

A *Socioeconomic Existing Conditions Report* was prepared to investigate the existing socioeconomic resources within the study area to assess the potential impacts from the proposed bridge project to the surrounding communities. The project area was evaluated to understand the following community characteristics: income, racial and ethnic composition, limited English proficiency (LEP), age, people with a disability, female head of household with children and no spouse, and carless households.

According to the 2022 U.S. Census Bureau American Community Survey (ACS), the study area is within five census tracts which are comprised of six block groups: three census tracts and three block groups in PA, and two census tracts and three block groups in NJ. See Figure V.1 for an overview.

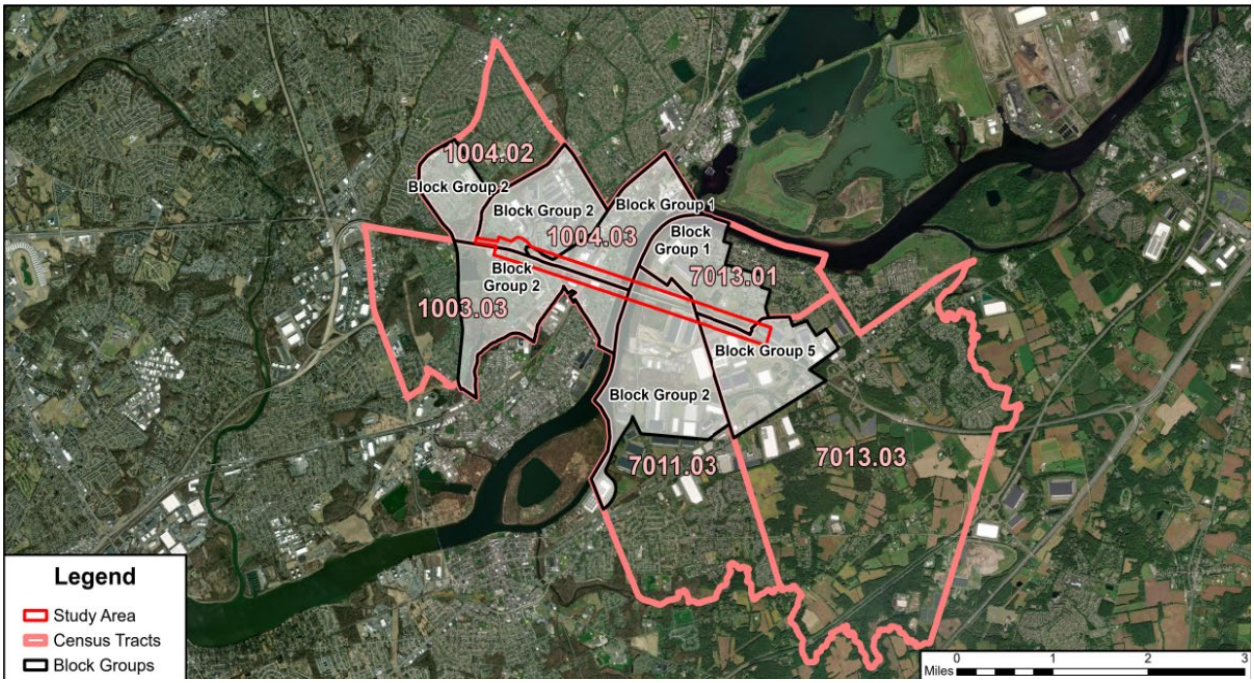

Figure V.1 - *American Census Survey (2022) Census Tracts and Block Groups*

Tables 1-7 present the demographic data of the areas surrounding the project area. Block groups not listed contained a population of zero according to the 2022 U.S Census Data.

Table *1*. Ethnic Composition									
Census Tract/ County	Block Group	Total Population	Black or African American	American Indian or Alaska Native	Asian	Native Hawaiian and Other Pacific Islander Alone	Some Other Race	Two or more races	Hispanic or Latino
Burlington County		461,853	73,251 (15.86%)	157 (0.03%)	24,967 (5.41%)	97 (0.02%)	2,993 (0.65%)	20,108 (4.35%)	41,114 (8.90%)
7013.01	1	1,567	159 (10.15%)	0 (0%)	51 (3.25%)	0 (0%)	0 (0%)	97 (6.19%)	236 (15.06%)
Bucks County		645,163	23,715 (3.68%)	262 (0.04%)	31,498 (4.88%)	62 (0.01%)	3,902 (0.60%)	20,478 (3.17%)	38,195 (5.92%)
1003.03	2	1,246	257 (20.63%)	0 (0%)	11 (0.88%)	0 (0%)	63 (5.06%)	130 (10.43%)	316 (25.36%)
1004.03	1	850	5 (0.59%)	0 (0%)	0 (0%)	0 (0%)	93 (10.94%)	34 (4.00%)	19 (2.24%)
	2	1,305	720 (55.17%)	0 (0%)	24 (1.84%)	0 (0%)	0 (0%)	54 (4.14%)	46 (3.52%)

Source: U.S. Census Bureau American Community Survey (ACS), 2022

Table 2. Income Averages					
County/ Census Tract	Block Group	Total Households[1]	Median Household Income[2]	Households Below Poverty Level Count[2]	Households Below Poverty Level (Percentage)[2]
Burlington County		174,545	$102,615	11,569	6.63%
7013.01	1	552	$68,333	70	12.68%
Bucks County		246,834	$107,826	15,009	6.08%
1003.03	2	487	$54,087	100	20.53%
1004.03	1	439	$87,540	11	2.51%
	2	466	$48,578	50	10.73%

Notes:

1. ***Source: U.S. Census Bureau American Community Survey (ACS), 2022***
2. ***Source: ACS Income Data – Percent of individuals, as identified in 2018-2022 5-Year ACS data, who are at or below the poverty level established through the Department of Health and Human Services Poverty Guidelines and the Census Bureau's annual income thresholds that vary by family size and composition.***

Table 3. Population 5+ who Speak English Less than "Very Well"							
County/ Census Tract	Block Group	Total Population 5+	Spanish	Indo-European	Asian and Pacific Island	Other Languages	Total
Burlington County		438,654	7,240 (1.65%)	6,500 (1.48%)	5,781 (1.32%)	1,238 (0.28%)	20,759 (4.73%)
7013.01	1	1,497	0 (0%)	13 (0.87%)	34 (2.27%)	0 (0%)	47 (3.14%)
Bucks County		614,917	7,965 (1.30%)	13,789 (2.24%)	5,509 (0.90%)	1,389 (0.23%)	28,652 (4.66%)
1003.03	2	1,201	57 (4.75%)	23 (1.92%)	0 (0%)	0 (0%)	80 (6.66%)
1004.03	1	838	9 (1.07%)	0 (0%)	0 (0%)	1 (0.12%)	10 (1.19%)
	2	1,169	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: U.S. Census Bureau American Community Survey (ACS), 2022

Table 4. Senior (65 +) Population				
County/Census Tract	Block Group	Total Population	Senior Population Count	Senior Population (Percentage)
Burlington County		461,853	81,197	17.58%
7013.01	1	1,567	177	11.30%
Bucks County		645,163	125,555	19.46%
1003.03	2	1,246	178	14.29%
1004.03	1	850	292	34.35%
	2	1,305	171	13.10%

Source: U.S. Census Bureau American Community Survey (ACS), 2022

Table 5. Population with a Disability			
County/Census Tract	Total Population	Population with a Disability Count	Population with a Disability (Percentage)
Burlington County	447,132	51,926	11.61%
7011.03	6,837	523	7.65%
7013.01	4,815	628	13.04%
7013.03	4,729	408	8.63%
Bucks County	639,266	68,290	10.68%
1003.03	4,860	807	16.60%
1004.03	2,155	361	16.75%

Source: U.S. Census Bureau American Community Survey (ACS), 2022

Table 6. Female Head of Household with Children and No Spouse				
Census Tract/County	Block Group	Total Households with Children	Female Head of Household Count	Female Head of Household (Percentage)
Burlington County		84,393	15,690	18.59%
7013.01	1	528	259	49.05%
Bucks County		116,322	16,567	14.24%
1003.03	2	310	185	59.68%
1004.03	1	48	0	0%
	2	349	162	46.42%

Source: U.S. Census Bureau American Community Survey (ACS), 2022

Table 7. Vehicle Ownership			
Census Tract/County	No. of Households	Households with No Vehicle Count	Households with No Vehicle (Percentage)
Burlington County	174,454	8,400	4.82%
7011.03	2,415	38	1.57%
7013.01	1,758	107	6.09%
7013.03	1,918	37	1.93%
Bucks County	246,834	11,697	4.74%
1003.03	1,869	267	14.29%
1004.03	905	58	6.41%

Source: U.S. Census Bureau American Community Survey (ACS), 2022

2. Communities

The project team evaluated the project study area for the presence of communities or neighborhoods that may or may not have a formal designation but may still exhibit cohesiveness, shared characteristics, and/or other features that reflect certain commonalities. This review included:

- Requesting input from the public whether they live in or are aware of neighborhoods within the study area
- Contacting Bristol Township Pennsylvania and Florence Township New Jersey to ask about neighborhood designations
- Reviewing aerial and GIS mapping, tax parcel data, street-level photos, and other secondary source information

The project team identified the following neighborhoods within the study area in Pennsylvania:

Fleetwing Estates

Located in Bristol Township, Bucks County, Fleetwing Estates Historic District is a small residential subdivision that was established in 1943 and contains approximately 20 acres and 100 detached dwellings. Fleetwing Estates was developed in response to the opening of an aircraft parts and manufacturing plant of the Fleetwings Corporation, which was located across Green Lane from the neighborhood.

Bristol Defense

Bristol Defense is a small neighborhood between the PA Turnpike (I-95) to the north, Bristol Pike (SR0013) to the east, and Green Lane to the south and west. The neighborhood is made up of homes built in the early 1940s. A park (Pacific Park) is located to the north of the neighborhood adjacent to the PA Turnpike. A local railroad line, which extends from the Amtrak line, is immediately to the south. Further evaluation will be conducted to determine whether any aspects of the proposed project would result in direct or reasonably foreseeable effects.

Bloomsdale

Bloomsdale is a neighborhood located in Bristol Township immediately to the north and south of the PA Turnpike (I-95) and adjacent to the Delaware River. Due to its proximity to the existing DRB and its location within the project study area, potential effects to the neighborhood resulting from right-of-way acquisitions and/or relocations are anticipated. Further evaluation of the effects of the proposed project will be conducted as part of detailed studies.

The project team identified the following neighborhoods within the study area in New Jersey.

The Estates at Oak Mill

The Estates at Oak Mill, located in Florence, NJ, is a relatively new neighborhood with homes constructed between 2012 and 2015. The neighborhood is situated south of W 5th Street between Seaman Drive and Summer Street. Immediately to the east is the Florence Township Recreation Complex.

Brookdale Florence Assisted Living Community

The Brookdale Florence Assisted Living Community is located in Florence, NJ approximately 500' to the north of the NJ Turnpike Extension (I-95). The community provides housing and assisted living for seniors. Direct effects on the Brookdale Florence Assisted Living Community are not anticipated; however, further evaluation will be conducted as part of detailed studies.

Other Neighborhood

To the east of the Brookdale Florence Assisted Living Community is an unnamed cul-de-sac residential neighborhood with houses constructed in the 1980s. The neighborhood is located at the eastern extent of the project area where the proposed alignments would tie into the existing alignment of the NJ Turnpike (I-95). As such, direct effects to the neighborhood are not anticipated.

As part of the scoping phase of the project, a public survey will be conducted to help the project team gain a greater understanding of the existing conditions within the study area, including the presence of communities and environmental resources.

The project team will conduct meaningful engagement with the local community and stakeholders in the study area by the following measures:

- Hosting elected official and community leader briefings
- Special stakeholder meetings
- Virtual public meetings
- In-Person public meetings
- Public hearings
- Scoping meetings
- Pop-up meetings

Outreach tools to be utilized include the following:

- Project website
- Interactive surveys

- Comment forms
- Social media
- Digital and print media
- Direct mail
- Public meeting notifications via email
- Translation services for all products and meetings

Potential impacts to communities and environmental resources and associated mitigation will be discussed in the SEIS.

VI. Alternatives Studied

A total of nine (9) build alternative alignments were studied, one (1) no build alternative, and one (1) rehabilitation alternative. The following general build alternatives were considered:

- Single Bridge, Bridge South Alternatives (SNI: South No Impact to existing approach spans, SPI: South Partial Impact to existing approach spans)
- Single Bridge, Bridge North Alternatives (NNI: North No Impact to existing approach spans, NPI: North Partial Impact to existing approach spans)
- Dual Bridges, Bridges North and South Alternatives (DNI: Dual No Impact to existing approach spans, DPI: Dual Partial Impact to existing approach spans)
- Single Bridge, Staged Alternatives (NS: North Staged, NSA: North Staged Alternate)
- Dual Bridges, Staged Alternative (DS: Dual Staged)

To establish the horizontal and vertical geometry for each of the alternatives, the following design parameters were considered.

- A design speed of 70 mph was utilized for the corridor.
- The horizontal tangent for the main river span was established for each alternative based on the constructability of the proposed river piers and the proximity to the existing river piers.
- A minimum navigational opening of 550-feet horizontal and 135-feet vertical was provided for all alternatives.
- Alignments were developed to maintain two-lanes of traffic in each direction at all times (during construction), while maintaining tolling operations.

Due to the type of existing approach span bridge (two-girder system and deck truss) and main span bridge (truss), half width/staged construction is not feasible. Therefore, replacement of the structure requires a shift in the roadway alignment. This shift is achieved by introducing flat, normal crown horizontal curves at the eastern and western extents of the project. The use of normal crown curves increases the drivability of the roadway as drivers approach this major river crossing.

The proposed vertical geometry for each alternative was developed based on the required navigational clearance for the main river span. Since the main span bridge options have varying depths, a minimum profile and maximum profile were developed for each alternative. The minimum profile was utilized for the network tied-arch structure and the cable-stayed structures. An extradosed structure, combining the main elements of both a prestressed box girder bridge and a cable-stayed bridge, was also studied. The increased depth of the extradosed structure (~18-feet) required the application of the maximum profile.

The proposed typical section for the Pennsylvania Approach roadway includes three (3) 12-foot lanes in each direction with 12-foot inside and outside shoulders. The approaches are barrier separated, resulting in a total median width of 26-feet. Similarly, the proposed typical section for the New Jersey Approach roadway includes three (3) 12-foot lanes in each direction with 12-foot inside and outside shoulders. The eastbound and westbound lanes are barrier separated with a resultant median width of 26 feet; however, the median width will vary at the eastern extent to meet the existing variable width grass median.

A. No Build

A No Build alternative does not meet the purpose and need of the project, however this alternative is being carried through the analysis to serve as a baseline for comparison.

B. Rehabilitation

A Historic Bridge Rehabilitation Analysis (HBRA) was conducted to determine if there is a rehabilitation alternative that would address the purpose and need while meeting the SOI standards. The report concludes that rehabilitation of the bridge cannot meet the project's Updated Purpose and Need (October 2024). The HBRA was reviewed by the PA SHPO and NJ HPO who concurred with the conclusion of the assessment on April 3, 2025 and December 10, 2025 respectively. See Appendix C for a copy of the HBRA, as well as the concurrence letters from the SHPOs. The following is a brief summary of the report and the conclusions.

Three rehabilitation options were evaluated:

- Member Repair
- Widespread Structure Strengthening
- Member Strengthening

It was determined that these three rehabilitation options would not address the following project needs:

- Inadequate (traffic) capacity on I-276 and I-95
- Lack of service reliability/redundancy of the existing Delaware River Bridge

The three rehabilitation options did not meet the project needs as described below.

Member Repair

Repair to the deteriorated structural members consistent with SOI standards typically involves either bolting additional steel plates to existing members or in-kind member replacement.

Such repairs would not meet the project need for traffic capacity as the existing bridge deck width would remain, nor the need for redundancy as the Nonredundant Steel Tension Members (NSTMs) would remain.

Member repair would also not meet the project need for service reliability, as it would not eliminate fatigue sensitive details and would not sufficiently improve the low load ratings. The current design live load is heavier than the live load the bridge was designed for in the 1950's. As discussed in Section 2.2 of the HBRA, the as-built live load ratings for AASHTO's current design live load (HL-93) are less than 1.0 and therefore do not meet current design standards. Repairs that restore

the members to their original structural capacity are not adequate; strengthening is required to sufficiently address the low load ratings.

Member repairs would not meet the project needs for traffic capacity or service reliability/redundancy of the bridge.

Widespread Structure Strengthening

Several techniques were considered for increasing the load capacity of existing members, which include adding supplemental members, providing additional supports, and post-tensioning. Adding a third truss/girder line throughout the existing DRB is not practical, especially for the Warren through truss, where providing an additional truss line will significantly alter load paths, structural behavior, and bridge appearance. Even if the third truss/girder line was provided, NSTMs would remain throughout the bridge, as load path redundancy cannot be achieved because the significant bridge width and spacing between truss/girder lines could result in collapse of the bridge if either exterior truss/girder line were to fail.

One concept for improving the bridge load ratings and removing the NSTM designation of select members is to construct external post-tensioning. Post-tensioning was considered for individual members or for application on a much larger scale (entire span). Post-tensioning for a structure of such a large scale is not practical as this technique is typically used for short span bridges. Given the span lengths and significant forces in the DRB truss members, use of post tensioning will induce extremely high local stresses, which will trigger the need for strengthening of additional members and the truss joints. There are no known examples of widespread strengthening of similar large truss bridges using post-tensioning (PT) tendons. PT will alter load paths and truss geometry and will also change member and overall bridge appearance (character defining features). For a graphical representation of typical techniques for PT of trusses, please see Figure 3-1 in the HBRA.

This option would not meet project need for traffic capacity as the existing bridge width would remain. PT of the entire span, even if successful, could improve the bridge capacity and load ratings. However, this would not adequately meet the project need for service reliability/redundancy as fatigue sensitive details and some NSTMs would remain.

Member Strengthening

As can be seen from Figure 2-2 in the HBRA report, over 40% of the approach deck truss members and majority of the Warren through truss members are NSTM members. To remove NSTM members using PT tendons would require PT forces in the magnitude of millions of pounds, induce extremely high local stresses due to the attachment of PT tendons at truss connections, and require strengthening of truss connections. Post-tensioning of this magnitude would severely alter the appearance of the truss members and the overall bridge elevation; see Figure 3-2 in the HBRA report for a typical technique for post-tensioning a truss member.

Figure 3-3 in the HBRA report shows the elevation view of the 4-span approach deck truss after post- tensioning. The shapes of over 40% of members would be altered after post-tensioning. The majority of the members would likely require strengthening to carry the redistribution of force that would occur as a result of the post-tensioning. This would further impact visual aesthetics and change the structural behavior of the bridge. Gusset plate connections joining these members would also be modified; these changes would be clearly visible in both elevation view and view

from the underside of the bridge. The change in appearance would be even more evident in the Warren through truss where the majority of the truss members would require post-tensioning.

Member strengthening, if successful, could improve the bridge capacity and load ratings. However, it would not meet project need for traffic capacity as the existing bridge width would remain. It would also not meet the project need for service reliability/redundancy as fatigue sensitive details and some NSTMs would remain. As previously noted, widespread PT of a truss bridge of the magnitude and complexity of the DRB is not known to exist.

C. Alternative SNI: South No Impact to existing approach spans

Alternative SNI consists of constructing a single bridge to the south of the existing bridge. The proposed structure will be offset from the existing structure to allow for the existing main river bridge and approach roadway to remain in service during construction. A maximum offset of 195-feet between the centerline of the existing and proposed main river span bridges would be utilized to develop the horizontal geometry for this alternative. The horizontal offset would be established to allow the proposed river piers to be constructed adjacent (in-line) with the existing river piers. This alternative shifts the outside barrier of the proposed structure 230-feet south of the existing barrier and provides a clearance of 70-feet between the northmost proposed barrier and the existing bridge. A graphical representation of Alternative SNI is included in **Appendix B**.

Figure V.1 – *Alternative SNI*

At the western extent, the horizontal geometry would be established by extending the existing horizontal curve through the SR 0013 (Bristol Pike) Interchange and establishing a new tangent that shifts the alignment off the existing. A normal crown curve would then be introduced near the Amtrak Rail lines to establish a tangent paralleling the existing main span over the river. A similar approach would be utilized in New Jersey at the eastern extent of the project. Reverse curves, separated by over 1,000-feet of tangent, are utilized to shift the horizontal alignment to the north and tie the proposed alignment to the existing horizontal curve. Additionally, the proposed approach span structures can be constructed without impacting the existing approach span structures in both Pennsylvania and New Jersey.

The proposed alignment impacts the existing structures carrying I-95/I-276 over Green Lane and the East Penn Railroad. Additionally, the proposed widening will impact the existing eastbound entrance ramp and westbound exit ramp at the SR 0013 (Bristol Pike) Interchange. The proposed design includes add/drop lanes at the entrance and exit ramps to accommodate the proposed widening, allowing for adequate acceleration and deceleration lane lengths. It is anticipated that the future final configuration of the corridor will include three lanes in each direction through the interchange with acceleration and deceleration lanes extending through the proposed structures over Green Lane and the East Penn Railroad. The proposed structures have been designed to accommodate the future configuration (three through lanes and an auxiliary lane in each direction).

The proposed alignment for Alternative SNI begins to shift to the south immediately east of the SR 0013 (Bristol Pike) Interchange, resulting in impacts to the Pacific Avenue Park, a 4(f) resource. As the alignment continues to the east, there are multiple impacts to residential, industrial, and commercial properties in Pennsylvania. The alternative will also require the

relocation of the Amtrak electrical substation and aerial transmission lines. Crown Road, which parallels the existing mainline roadway, is completely encumbered due to the pier locations required by this alternative. Existing aerial and underground utilities within the Crown Road corridor will require relocation.

Foreign borrow will be required to construct the New Jersey roadway approaches. A retaining wall is proposed after the eastern abutment, along the southern side of the Turnpike to limit the volume of foreign borrow that will be required. Installation of the retaining wall will also reduce right-of-way and potential environmental impacts. Several commercial properties in New Jersey will be impacted by this alternative, including a recently constructed 1.5 million square foot warehouse complex.

This alternative allows for the approach span structures and main river span structure to be constructed in a single stage. The SR 0013 Interchange structure is not impacted by this alternative. Since this structure is not anticipated to be replaced for this alternative, multiple work zones are anticipated to maintain traffic during construction due to the existing interchange structure becoming a pinch point within the temporary lane shift tapers entering and exiting the work zone. The work zone will need to be divided into more, smaller areas as active traffic is shifted. Additionally, the eastbound entrance ramp of the interchange is anticipated to be temporarily split from the eastbound lanes, utilizing the proposed structure, with the merge point in New Jersey. Impacts associated with Alternative SNI are detailed in the Alignment Alternatives Evaluation Matrix in **Section IX Recommendations**.

This alternative will impact Pacific Avenue Park. Due to the potential change in use of the park an individual Section 4(f) will likely be required. This alternative may also require coordination with the township to relocate an observed encampment of people experiencing homelessness currently located just south of the Turnpike right-of-way near the Delaware Canal.

D. Alternative SPI: South Partial Impact to existing approach spans

Alternative SPI consists of constructing a single bridge to the south of the existing bridge. The proposed structure will be offset from the existing structure to allow for the existing main river bridge and approach to remain in service during construction and includes a partial impact to the cantilevered overhang on the existing approach span structure. The partial impact includes the removal of the Pennsylvania approach existing bridge deck that is outside of the limits of the girder. Two lanes of traffic will still be maintained in both directions and the removal only impacts the first span in Pennsylvania. A maximum offset of 195-feet between the centerline of the existing and proposed main river span bridges would be utilized to develop the horizontal geometry for this alternative. The horizontal offset would be established to allow the proposed river piers to be constructed adjacent (in-line) with the existing river piers. This alternative shifts the outside barrier of the proposed structure 230-feet south of the existing barrier and provides a clearance of 70-feet between the northmost proposed barrier and the existing bridge. A graphical representation of Alternative SPI is included in **Appendix B**.

Figure V.2 – *Alternative SPI*

At the western extent, the horizontal geometry would be established by extending the existing horizontal curve through the SR 0013 (Bristol Pike) Interchange and establishing a new tangent

that shifts the alignment off the existing. A normal crown curve would then be introduced near the Amtrak Rail lines to establish a tangent paralleling the existing main span over the river.

A similar approach would be utilized in New Jersey at the eastern extent of the project. Reverse curves, separated by over 1,000-feet of tangent, are utilized to shift the horizontal alignment to the north and tie the proposed alignment to the existing horizontal curve. It is anticipated that the first span of the proposed westbound (WB) approach span structure in PA will require staged construction due to the impact to the existing eastbound (EB) travel lanes. The proposed approach span structure can be constructed without impacting the existing approach span structure in New Jersey.

The proposed alignment impacts the existing structures carrying I-95/I-276 over Green Lane and the East Penn Railroad. Additionally, the proposed widening will impact the existing eastbound entrance ramp and westbound exit ramp at the SR 0013 (Bristol Pike) Interchange. The proposed design includes add/drop lanes at the entrance and exit ramps to accommodate the proposed widening, allowing for adequate acceleration and deceleration lane lengths. It is anticipated that the future configuration of the corridor will include three lanes in each direction through the interchange with acceleration and deceleration lanes extending through the proposed structures over Green Lane and the East Penn Railroad. The proposed structures have been designed to accommodate the future configuration (three through lanes and an auxiliary lane in each direction).

The proposed alignment for Alternative SPI begins to shift to the south immediately east of the SR 0013 (Bristol Pike) Interchange, resulting in impacts to the Pacific Avenue Park, a 4(f) resource. As the alignment continues to the east, there are multiple impacts to residential, industrial, and commercial properties in Pennsylvania. The alternative will also require the relocation of the Amtrak electrical substation and aerial transmission lines. Crown Road, which parallels the existing mainline roadway, is completely encumbered due to the pier locations required by this alternative. Existing aerial and underground utilities within the Crown Road corridor will require relocation.

Foreign borrow will be required to construct the New Jersey roadway approaches. A retaining wall is proposed after the eastern abutment, along the southern side of the Turnpike to limit the volume of foreign borrow that will be required. Installation of the retaining wall will also reduce right-of-way and potential environmental impacts. Several commercial properties in New Jersey will be impacted by this alternative, including a recently constructed 1.5 million square foot warehouse complex.

This alternative allows for the main river span structure to be constructed in a single stage. The approach span structures in Pennsylvania will require multiple stages to construct. The SR 0013 Interchange structure is not impacted by this alternative. Since this structure is not anticipated to be replaced, multiple work zones are anticipated to maintain traffic during construction. Additionally, the eastbound entrance ramp for the interchange is anticipated to be temporarily split from the eastbound lanes, utilizing the proposed structure, with the merge point in New Jersey. Impacts associated with Alternative SPI are detailed in the Alignment Alternatives Evaluation Matrix in **Section XI Recommendations**.

This alternative will impact Pacific Avenue Park. Due to the potential change in use of the park an individual Section 4(f) will likely be required. This alternative may also require coordination with the township to relocate an observed encampment of people experiencing homelessness currently located just south of the Turnpike right-of-way near the Delaware Canal.

E. Alternative NNI: North No Impact to existing approach spans

Alternative NNI consists of constructing a single bridge to the north of the existing bridge. The proposed structure will be offset from the existing structure to allow for the existing main river bridge and approach to remain in service during construction. A maximum offset of 195-feet between the centerline of the existing and proposed main river span bridges would be utilized to develop the horizontal geometry for this alternative. The horizontal offset would be established to allow the proposed river piers to be constructed adjacent (in-line) with the existing river piers. This alternative shifts the outside barrier of the proposed structure 230-feet north of the existing barrier and provides a clearance of 70-feet between the southernmost proposed barrier and the existing bridge. Approach span structures and the main river span structure are located entirely on horizontal tangents for this alternative. A graphical representation of Alternative NNI is included in **Appendix B**.

Figure V.3 – *Alternative NNI*

At the western extent, the horizontal geometry would be established by shortening the existing horizontal curve near the SR 0013 (Bristol Pike) Interchange and establishing a new tangent that shifts off the existing alignment. A normal crown curve would then be introduced to establish a tangent paralleling the existing main span. At the project's eastern extent, a new normal crown curve is introduced separated by over 2,500-feet of tangent between the broken back (back to back curves in the same direction) normal crown curve which replaces the existing horizontal curve at the eastern project limit. Additionally, the proposed approach span structures can be constructed without impacting the existing approach span structures in both Pennsylvania and New Jersey.

The proposed alignment impacts the existing structures carrying I-95/I-276 over the interchange ramps, Green Lane, and the East Penn Railroad. Additionally, the proposed widening will impact the existing eastbound entrance ramp and both the westbound entrance and exit ramps at the interchange. The proposed design includes add/drop lanes at the entrance and exit ramps to accommodate the proposed widening, allowing for adequate acceleration and deceleration lane lengths. It is anticipated that the future configuration of the corridor will include three lanes in each direction through the SR 0013 (Bristol Pike) Interchange with acceleration and deceleration lanes extending through the proposed structures over Green Lane and the East Penn Railroad. The proposed structures have been designed to accommodate the future configuration (three through lanes and an auxiliary lane in each direction). The Ramp B entrance ramp will also be extended to provide adequate acceleration lane length.

The proposed alignment for Alternative NNI begins to shift to the north immediately west of the SR 0013 (Bristol Pike) Interchange, resulting in impacts to Airport Road as well as impacts to several residential, industrial, and commercial properties in Pennsylvania. The impacts to Airport Road will either require the relocation of Airport Road or the installation of a retaining wall to eliminate the impact. The alternative does not impact the Amtrak electrical substation; however, relocation of the aerial transmission lines would still be required. In addition to the impacts to the aerial transmission lines, existing aerial and underground utilities on the local roadway network will require relocation. Foreign borrow will be required to construct the Pennsylvania roadway approaches.

Foreign borrow will also be required to construct the New Jersey roadway approaches. A retaining wall is proposed along the northern side of the turnpike to limit the volume of foreign borrow that will be required. Installation of the retaining wall will also reduce right-of-way and potential environmental impacts. A recently constructed warehouse located to the north of the existing Turnpike near River Road will be impacted by this alternative. The approach structure falls within the tractor trailer parking/staging area of this warehouse and a proposed easement (50 feet from the proposed bridge fascia) would encumber the access road around the facility. In addition, the Florence Recreation Field will be impacted by this alternative. This alternative extends beyond the mapping and environmental screening limits. Additional mapping and environmental studies may be required to assess this alternative's impacts. This work would be completed during preliminary engineering should this alternative be selected for advancement.

This alternative allows for the approach span structures and main river span structure to be constructed in a single stage. Impacts associated with Alternative NNI are detailed in the Alignment Alternatives Evaluation Matrix in **Section XI Recommendations**.

F. Alternative NPI: North Partial Impact to existing approach spans

Alternative NPI consists of constructing a single bridge to the north of the existing bridge. The proposed structure will be offset from the existing structure to allow for the existing main river bridge and approaches to remain in service during construction. This alignment could include a partial impact to the cantilevered overhang on the existing approach span structure, though ultimately the two structures do not overlap. The two structures remain separated by a small margin (approximately 3-feet) for this alternative. Minor impacts may still be required to the existing bridge for construction activities to build the new bridge. A maximum offset of 195-feet between the centerline of the existing and proposed main river span bridges would be utilized to develop the horizontal geometry for this alternative. The horizontal offset would be established to allow the proposed river piers to be constructed adjacent (in-line) with the existing river piers. This alternative shifts the outside barrier of the proposed structure 230-feet north of the existing barrier and provides a clearance of 70-feet between the southernmost proposed barrier and the existing bridge. A graphical representation of Alternative NPI is included in **Appendix B**.

Figure V.4 – *Alternative NPI*

At the western extent, the horizontal geometry would be established by shortening the existing horizontal curve near the SR 0013 Interchange and establishing a new tangent. A normal crown curve would then be introduced to establish a tangent paralleling the existing main span. At the eastern extent of the project, the easternmost existing horizontal curve would be shortened, and a large radius broken back curve utilized to shift the alignment to the north. The proposed tangent between the broken back curves exceeds 4,000-feet. It is anticipated that the first span of the EB approach span structure in PA will require staged construction due to the impact to the existing WB travel lanes. The proposed approach span structure can be constructed without impacting the existing approach span structure in New Jersey.

The proposed alignment impacts the existing structures carrying I-95/I-276 over the interchange ramps, Green Lane, and the East Penn Railroad. Additionally, the proposed widening will impact the existing eastbound entrance ramp and both the westbound entrance and exit ramps at the

SR 0013 (Bristol Pike) Interchange. The proposed design includes add/drop lanes at the entrance and exit ramps to accommodate the proposed widening, allowing for adequate acceleration and deceleration lane lengths. It is anticipated that the future configuration of the corridor will include three lanes in each direction through the SR 0013 Interchange with acceleration and deceleration lanes extending through the proposed structures over Green Lane and the East Penn Railroad. The proposed structures have been designed to accommodate the future configuration (three through lanes and an auxiliary lane in each direction). The Ramp B entrance ramp will also be extended to provide adequate acceleration lane length.

The proposed alignment for Alternative NPI begins to shift to the north immediately east of the SR 0013 (Bristol Pike) Interchange structure, resulting in impacts to multiple residential, industrial, and commercial properties in Pennsylvania. The alternative does not impact the Amtrak substation; however, relocation of the aerial transmission lines would still be required. In addition to the impacts to the aerial transmission lines, existing aerial and underground utilities on the local roadway network will require relocation. Foreign borrow will be required to construct the Pennsylvania roadway approaches.

Foreign borrow will also be required to construct the New Jersey roadway approaches. A retaining wall is proposed after the eastern abutment on the north side of the Turnpike to limit the volume of foreign borrow that will be required. Installation of the retaining wall will also reduce right-of-way and potential environmental impacts. A recently constructed warehouse will be impacted by this alternative. The approach structure falls within the tractor trailer parking/staging area and an easement (50 feet from the fascia) would encumber the access road around the facility.

This alternative allows for the New Jersey Approach span structures and main river span structure to be constructed in a single stage. It is anticipated that the Pennsylvania Approach span structures will require staged construction due to the impact to the existing WB travel lanes. Impacts associated with Alternative NPI are detailed in the Alignment Alternatives Evaluation Matrix in **Section XI Recommendations**.

G. Alternative DNI: Dual No Impact to existing approach spans

Alternative DNI consists of dual bridges, one to the north and one to the south of the existing bridge. The proposed structures will be offset from the existing structure to allow for the existing main river bridge and approach to remain in service during construction. A maximum offset of 149-feet between the centerline of the existing bridge and baselines of the proposed bridges would be utilized to develop the horizontal geometry for this alternative. The horizontal offset would be established to allow the proposed river piers to be constructed adjacent (in-line) with the existing river piers. This alternative shifts the outside barrier of the proposed structures 150-feet north and south of the existing barrier and provides a clearance of 70-feet between the proposed barriers and the existing bridge. A graphical representation of Alternative DNI is included in **Appendix B**.

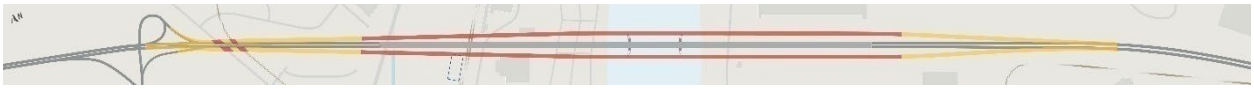

Figure V.5 – *Alternative DNI*

At the western extent, the EB horizontal geometry would be established by extending the existing horizontal curve near the SR 0013 (Bristol Pike) Interchange and establishing a new tangent. A normal crown curve is then introduced to establish a tangent paralleling the existing main span.

The WB horizontal geometry would be established by shortening the existing horizontal curve near the interchange and establishing a new tangent. A normal crown curve is then introduced to establish a tangent paralleling the existing main span. At the eastern extent of the project, the EB geometry would be established by introducing reverse curves (separated by a tangent exceeding 1,000-feet) to shift the alignment to the north. The WB geometry would be established by introducing broken back curves (separated by a tangent exceeding 2,500-feet) to shift the alignment to the south. Additionally, the proposed approach span structures can be constructed without impacting the existing approach span structures in both Pennsylvania and New Jersey.

The proposed alignment impacts the existing structures carrying I-95/I-276 over Green Lane and the East Penn Railroad. Additionally, the proposed widening will impact the existing eastbound entrance ramp and both the westbound entrance and exit ramps at the interchange. The proposed design includes add/drop lanes at the entrance and exit ramps to accommodate the proposed widening, allowing for adequate acceleration and deceleration lane lengths. It is anticipated that the future configuration of the corridor will include three lanes in each direction through the interchange with acceleration and deceleration lanes extending through the proposed structures over Green Lane and the East Penn Railroad. The proposed structures have been designed to accommodate the future configuration (three through lanes and an auxiliary lane in each direction).

The proposed alignment for Alternative DNI begins to shift to the north and south immediately east of the SR 0013 (Bristol Pike) Interchange structure, resulting in impacts to multiple residential, industrial, and commercial properties in Pennsylvania. The eastbound alignment will be shifted to the south, requiring the relocation of the Amtrak electrical substation and aerial transmission lines. Crown Road, which parallels the existing mainline roadway, is completely encumbered due to the pier locations required by this alternative. Existing aerial and underground utilities within the Crown Road corridor will require relocation.

Foreign borrow will be required to construct the New Jersey roadway approaches. Retaining walls are proposed after the eastern abutment on the north side of the WB lanes and on the south side of the EB lanes to limit the volume of foreign borrow that will be required. Installation of the retaining wall will also reduce right-of-way and potential environmental impacts. Commercial properties, including the parking areas of the two new warehouses in New Jersey will be impacted by this alternative.

This alternative allows for the approach span structures and main river span structures to be constructed in a single stage. The SR 0013 Interchange structure is not impacted by this alternative. Since the structure is not anticipated to be replaced, multiple work zones are anticipated to maintain traffic during construction due to the existing interchange structure becoming a pinch point within the temporary lane shift tapers entering and exiting the work zone. The work zone will need to be divided into more, smaller areas as active traffic is shifted. Additionally, concurrent construction of the dual structures is anticipated to require multiple traffic control set ups and crews to complete the work. It is assumed that multiple crews will be required in order to meet the construction schedule and have both structures completed at the same time. Impacts associated with Alternative DNI are detailed in the Alignment Alternatives Evaluation Matrix in **Section XI Recommendations**.

H. Alternative DPI: Dual Partial Impact to existing approach spans

Alternative DPI consists of dual bridges, one to the north and one south of the existing bridge. The proposed structures will be offset from the existing structure to allow for the existing main

river bridge and approach to remain in service during construction. This alignment could include a partial impact to the cantilevered overhang on the existing approach span structure, though ultimately the two structures do not overlap. The two structures remain separated by a small margin (approximately 3-feet) for this alternative. Minor impacts may still be required to the existing approach span bridge for construction activities to build the new bridge. A maximum offset of 149-feet between the centerline of the existing bridge and the baselines of the proposed bridges would be utilized to develop the horizontal geometry for this alternative. The horizontal offset would be established to allow the proposed river piers to be constructed adjacent (in-line) with the existing river piers. This alternative shifts the outside barrier of the proposed structures 150-feet north and south of the existing barrier and provides a clearance of 70-feet between the proposed barriers and the existing bridge. A graphical representation of Alternative DPI is included in **Appendix B**.

Figure V.6 – *Alternative DPI*

At the western extent, the EB horizontal geometry would be established by extending the existing horizontal curve near the SR 0013 (Bristol Pike) Interchange and establishing a new tangent. A normal crown curve would then be introduced to establish a tangent paralleling the existing main span. The WB horizontal geometry would be established by shortening the existing horizontal curve near the interchange and establishing a new tangent. A normal crown curve would then be introduced to establish a tangent paralleling the existing main span. At the eastern extent of the project, the EB geometry would be established by introducing reverse curves (separated by a tangent exceeding 3,000-feet) to shift the alignment to the north. The WB geometry would be established by introducing broken back curves (separated by a tangent exceeding 4000-feet) to shift the alignment to the south. It is anticipated that the first span of both approach span structures in PA will require staged construction due to the impact to the existing travel lanes. The proposed approach span structures can be constructed without impacting the existing approach span structure in New Jersey.

The proposed alignment impacts the existing structures carrying I-95/I-276 over Green Lane and the East Penn Railroad. Additionally, the proposed widening will impact the existing eastbound entrance ramp and both the westbound entrance and exit ramps at the SR 0013 (Bristol Pike) Interchange. The proposed design includes add/drop lanes at the entrance and exit ramps to accommodate the proposed widening, allowing for adequate acceleration and deceleration lane lengths. It is anticipated that the future configuration of the corridor will include three lanes in each direction through the interchange with acceleration and deceleration lanes extending through the proposed structures over Green Lane and the East Penn Railroad. The proposed structures have been designed to accommodate the future configuration (three through lanes and an auxiliary lane in each direction).

The proposed alignment for Alternative DPI begins to shift to the north and south immediately east of the East Penn Railroad structure, resulting in impacts to multiple residential, industrial, and commercial properties in Pennsylvania. The eastbound alignment will be shifted to the south, requiring the relocation of the Amtrak electrical substation and aerial transmission lines. Crown Road, which parallels the existing mainline roadway, is completely encumbered due to the pier locations required by this alternative. Existing aerial and underground utilities within the Crown Road corridor will require relocation.

Foreign borrow will be required to construct the New Jersey roadway approaches. Retaining walls are proposed after the eastern abutment on the north side of the WB lanes and on the south side of the EB lanes to limit the volume of foreign borrow that will be required. Installation of the retaining wall will also reduce right-of-way and potential environmental impacts. Commercial properties, including the parking areas of the two new warehouses in New Jersey will be impacted by this alternative.

This alternative allows for the main river span structures to be constructed in a single stage. The approach span structures in Pennsylvania will require multiple stages to construct. The interchange structure is not impacted by this alternative. Since this structure is not anticipated to be replaced, multiple work zones are anticipated to maintain traffic during construction. Additionally, concurrent construction of the dual structures is anticipated to require multiple traffic control set ups and crews to complete the work. It is assumed that multiple crews will be required in order to meet the construction schedule and have both structures completed at the same time. Impacts associated with Alternative DPI are detailed in the Alignment Alternatives Evaluation Matrix in **Section XI Recommendations**.

I. Alternative NS: North Staged.

Alternative NS consists of constructing a single bridge, in stages, to the north of the existing bridge. The proposed structure will be offset from the existing structure to allow for the existing main river bridge and approach to remain in service during the first phase of construction. A maximum offset of 113-feet between the centerline of the existing and proposed bridges would be utilized to develop the horizontal geometry for this alternative. The horizontal offset would be established to allow the proposed river piers to be constructed adjacent (in-line) with the existing river piers. This alternative shifts the outside barrier of the proposed structure 150-feet north of the existing barrier and provides a clearance of 70-feet between the southernmost proposed Stage 1 barrier and the existing bridge. A graphical representation of Alternative NS is included in **Appendix B**.

Figure V.7 – *Alternative NS*

At the western extent, the horizontal geometry would be established with a new horizontal curve through the SR 0013 (Bristol Pike) Interchange. A normal crown curve is introduced to establish a tangent paralleling the existing main span. At the eastern extent of the project, the existing horizontal curves would be shortened, and a large radius broken back curve utilized to shift the alignment to the north. The proposed tangents between each of the broken back curves exceed 3,700-feet. Due to the proximity of the proposed EB structures to the existing structures, the proposed structures for this alternative will be required to be constructed in stages. The proposed WB structures and approach roadways will be constructed in the first stage. The second stage will require all traffic to be shifted to the newly constructed WB structure and roadway approaches while the existing structures are demolished, and the new EB structures are constructed.

The proposed alignment impacts the existing structures carrying I-95/I-276 over the interchange ramps, Green Lane, and the East Penn Railroad. Additionally, the proposed widening will impact the existing eastbound entrance ramp and both the westbound entrance and exit ramps at the

SR 0013 (Bristol Pike) Interchange. The proposed design includes add/drop lanes at the entrance and exit ramps to accommodate the proposed widening, allowing for adequate acceleration and deceleration lane lengths. It is anticipated that the future configuration of the corridor will include three lanes in each direction through the interchange with acceleration and deceleration lanes extending through the proposed structures over Green Lane and the East Penn Railroad. The proposed structures have been designed to accommodate the future configuration (three through lanes and an auxiliary lane in each direction).

The proposed alignment for Alternative NS begins to shift to the north immediately east of the interchange structure, resulting in impacts to multiple residential, industrial, and commercial properties in Pennsylvania. The alternative does not impact the Amtrak electrical substation; however, relocation of the aerial transmission lines would still be required. In addition to the impacts to the aerial transmission lines, existing aerial and underground utilities on the local roadway network will require relocation. Minor foreign borrow will be required to construct the Pennsylvania roadway approaches.

Foreign borrow will also be required to construct the New Jersey roadway approaches. A retaining wall is proposed after the eastern abutment on the north side of the Turnpike to limit the volume of foreign borrow that will be required. Installation of the retaining wall will also reduce right-of-way and potential environmental impacts. Although the proposed approach structure does not have direct impacts on the recently constructed warehouse to the north, an easement (50 feet from the proposed bridge fascia) will encumber a portion of the tractor trailer parking/staging area.

This alternative requires staged construction for the approach span structures and main river span. Temporary pavement will be required to accommodate staged construction. Impacts associated with Alternative NS are detailed in the Alignment Alternatives Evaluation Matrix in **Section XI Recommendations**.

J. Alternative NSA: North Staged Alternate

Alternative NSA consists of constructing a single bridge, in stages, to the north of the existing bridge. Due to the increased span length, this alternative precludes the use of two (2) of the main river span bridge options since the maximum span length for the 2-span cable-stayed structure and the extradosed structure is exceeded for this alternative. The proposed structure will be offset from the existing structure to allow for the existing main river bridge and approach to remain in service during the first phase of construction. A maximum offset of 74-feet between the centerline of the existing and proposed bridges would be utilized to develop the horizontal geometry for this alternative. The horizontal offset requires the proposed river piers to be constructed offset from the existing river piers, resulting in an increased span length. Alternative NSA shifts the outside barrier of the proposed structure 130-feet north of the existing barrier and provides a clearance of 30-feet between the southernmost proposed Stage 1 barrier and the existing bridge. A graphical representation of Alternative NSA is included in **Appendix B**.

Figure V.8 – *Alternative NSA*

At the western extent, the horizontal geometry would be established by shortening the existing horizontal curve near the SR 0013 (Bristol Pike) Interchange and establishing a new tangent. A normal crown curve would then be introduced to establish a tangent paralleling the existing main

span. At the eastern extent of the project, the existing horizontal curves would be shortened, and a large radius broken back curve utilized to shift the alignment to the north. The proposed tangents between each of the broken back curves exceed 2,600-feet. Due to the proximity of the proposed EB structures to the existing structures, the proposed structures for this alternative will be required to be constructed in stages. The proposed WB structures and approach roadways will be constructed in the first stage. The second stage will require all traffic to be shifted to the newly constructed WB structure and roadway approaches while the existing structures are demolished, and the new EB structures are constructed.

The proposed alignment impacts the existing structures carrying I-95/I-276 over Green Lane and the East Penn Railroad. Additionally, the proposed widening will impact the existing eastbound entrance ramp and both the westbound entrance and exit ramps at the SR 0013 (Bristol Pike) Interchange. The proposed design includes add/drop lanes at the entrance and exit ramps to accommodate the proposed widening, allowing for adequate acceleration and deceleration lane lengths. It is anticipated that the future configuration of the corridor will include three lanes in each direction through the interchange with acceleration and deceleration lanes extending through the proposed structures over Green Lane and the East Penn Railroad. The proposed structures have been designed to accommodate the future configuration (three through lanes and an auxiliary lane in each direction).

The proposed alignment for Alternative NSA begins to shift to the north immediately east of the interchange structure, resulting in impacts to multiple residential, industrial, and commercial properties in Pennsylvania. The alternative does not impact the Amtrak electrical substation; however, relocation of the aerial transmission lines would still be required. In addition to the impacts to the aerial transmission lines, existing aerial and underground utilities on the local roadway network will require relocation. Minor foreign borrow will be required to construct the Pennsylvania roadway approaches.

Foreign borrow will also be required to construct the New Jersey roadway approaches. A retaining wall is proposed after the eastern abutment on the north side of the Turnpike to limit the volume of required foreign borrow. Installation of the retaining wall will also reduce right-of-way and potential environmental impacts. This alternative reduces impacts to the warehouse facility and eliminates nearly all right-of-way impacts.

This alternative requires staged construction for the approach span structures and main river span. Temporary pavement will be required to accommodate staged construction. The interchange structure is not impacted by this alternative. Since this structure is not anticipated to be replaced, multiple work zones are anticipated to maintain traffic during construction. Impacts associated with Alternative NSA are detailed in the Alignment Alternatives Evaluation Matrix in **Section XI Recommendations**.

K. Alternative DS: Dual Staged

Alternative DS consists of constructing dual bridges, in stages. The proposed WB bridge will be constructed north of the existing bridge. The proposed EB bridge will be constructed on the existing alignment. The proposed WB structure will be offset from the existing structure to allow for the existing main river bridge and approach to remain in service during construction. A maximum offset of 106-feet between the centerline of the existing bridge and proposed WB bridge would be utilized to develop the horizontal geometry for this alternative. This alternative shifts the outside barrier of the proposed structure 130-feet north of the existing barrier and provides a clearance of 30-feet between the southernmost proposed Stage 1 barrier and the existing bridge.

The horizontal offset requires the proposed river piers to be constructed offset from the existing river piers, resulting in an increased span length. Due to the increased span length, this alternative precludes the use of two (2) of the main river span bridge options, which include the 2-span cable-stayed structure and the extradosed structure. A graphical representation of Alternative DS is included in **Appendix B**.

Figure V.9 – *Alternative DS*

At the western extent, the WB horizontal geometry would be established by shortening the existing horizontal curve near the SR 0013 (Bristol Pike) Interchange and establishing a new tangent. A normal crown curve would then be introduced to establish a tangent paralleling the existing main span. At the eastern extent of the project, the existing horizontal curve would be shortened, and a large radius broken back curve utilized to shift the alignment to the north. The proposed tangent between each of the broken back curves exceeds 4,000-feet. The proposed EB geometry matches the existing geometry for this alternative. Since the proposed EB structures will be reconstructed in their existing location, the proposed structures for this alternative will be required to be constructed in stages. The proposed WB structures and approach roadways will be constructed in the first stage. The second stage will require all traffic to be shifted to the newly constructed WB structure and roadway approaches while the existing structures are demolished, and the new EB structures are constructed.

The proposed alignment impacts the existing structures carrying I-95/I-276 over Green Lane and the East Penn Railroad. Additionally, the proposed widening will impact the existing eastbound entrance ramp and both the westbound entrance and exit ramps at the SR 0013 (Bristol Pike) Interchange. The proposed design includes add/drop lanes at the entrance and exit ramps to accommodate the proposed widening. It is anticipated that the future configuration of the corridor will include three lanes in each direction through the interchange with acceleration and deceleration lanes extending through the proposed structures over Green Lane and the East Penn Railroad. The proposed structures have been designed to accommodate the future configuration (three through lanes and an auxiliary lane in each direction).

The proposed westbound alignment for Alternative DS begins to shift to the north immediately east of the interchange structure, resulting in impacts to multiple residential, industrial, and commercial properties in Pennsylvania. The alternative does not impact the Amtrak electrical substation; however, relocation of the aerial transmission lines would still be required. In addition to the impacts to the aerial transmission lines, existing aerial and underground utilities on the local roadway network will require relocation. Minor foreign borrow will be required to construct the Pennsylvania roadway approaches.

Foreign borrow will also be required to construct the New Jersey roadway approaches. Retaining walls are proposed after the eastern abutment on the north side of the WB lanes and on the south side of the EB lanes to limit the volume of required foreign borrow. Installation of the retaining wall will also reduce right-of-way and potential environmental impacts. This alternative reduces impacts to the warehouse facility and eliminates nearly all right-of-way impacts.

This alternative requires staged construction for the approach span structures and main river span. Temporary pavement will be required to accommodate staged construction. The

interchange structure is not impacted by this alternative. Since this structure is not anticipated to be replaced, multiple work zones are anticipated to maintain traffic during construction. Impacts associated with Alternative DS are detailed in the Alignment Alternatives Evaluation Matrix in **Section XI Recommendations**.

L. Environmental Site Assessment

Previous studies identified two (2) properties requiring Phase II/Phase III hazardous waste studies. For the alternatives studied, Alternatives NNI, NPI, DNI, DPI, NS, and NSA will impact these properties (Parcels 87 and 149). Alternative DS will impact one property (Parcel 87). Alternatives SNI and SPI do not impact these properties. Note that ownership of the properties has changed since the Phase I Environmental Site Assessment was prepared. Commercial real estate transactions typically include environmental due diligence and remediation prior to transfer of ownership. During preliminary engineering, the project team will verify that this has occurred. Environmental Impact Maps are included in **Appendix D**.

VII. Evaluation Methodology

When numerous alternatives are evaluated at a particular site, they must be compared to each other using a process that systematically evaluates the impacts associated with each alternative to arrive at a preferred solution. A method developed to perform this comparison is through the use of evaluation matrices. Each matrix is developed to evaluate the proposed options against each other using site-specific categories. Each category is used to evaluate the different options against each other based on impacts and/or advantages of one option over another. The Alignment Alternatives Evaluation Matrix (see **Section XI Recommendations**) was developed to rate each option using the following categories:

A. Roadway

Development of the alternatives analysis includes the evaluation of the roadway geometry. For the purposes of this analysis, the category was separated into three (3) subcategories: Mainline Roadway Geometry, Impacts to the SR 0013 (Bristol Pike) interchange, and Local Road Impacts.

Mainline roadway geometry was evaluated for conformance with the design criteria as well as driver expectancy. For example, alignments with reverse curves were considered less desirable than more traditional tangent-curve-tangent alignments. Alternatives SNI, SPI, DNI, and DPI all require reverse curves and were therefore assigned a greater impact.

Ultimately, the SR 0013 (Bristol Pike) Interchange adjacent to the project will need to be reconstructed. However, it is not intended to be included in this stage of the project. Impacts to the interchange were minimized when possible, and alternatives with a greater impact to the interchange were less desirable. The proposed geometries for Alternatives NNI, NPI, and NS extend through the interchange and require the replacement of the interchange bridge. These alternatives may also result in reconfiguration of the interchange. As such, these alternatives were less desirable.

Impacts to local roads were also considered in the roadway analysis. Impact areas were calculated based on the proposed roadway and bridge footprint. Alternatives with greater impacts to the local road network, particularly roads paralleling the mainline, were less desirable. Alternatives SNI, SPI, DNI, and DPI have substantial impacts to Crown Road, which parallels the mainline. Additionally, Alternatives NNI and NS impact Airport Road at the western extent of the

project. These alternatives were less desirable due to the increased impacts to the local road network.

Accident history review and crash analysis is not included in the Alternative Analysis. A crash analysis will be performed in Preliminary Engineering.

B. Structures

Structure evaluations were separated into four (4) subcategories. Subcategories include Main Span, Pennsylvania Approach Spans, New Jersey Approach Spans, and Ancillary Structures. Evaluations of the Main Span, Pennsylvania Approach Spans, and New Jersey Approach Spans categories are taken from the Bridge Type Study Report. The evaluations were normalized from those found in the Bridge Type Study matrix to align with the Alignment Alternatives Evaluation Matrix. The Bridge Type Study Report evaluated the various bridge options, recommending two (2) main span options and one (1) option for the approach spans. Recommended main river span bridge options include an extradosed structure and a network tied arch structure. The recommended approach span bridge option is a steel girder bridge. The complexity associated with building the main span bridges in stages (staged alternatives) was accounted for in the determination of the impacts for those options. There is an increase in risk to build the second half of the new structure adjacent to the first half while traffic is maintained on the new bridge. There are also additional construction phases to control the geometry for some of the bridge types that was considered in development of the construction cost estimates.

Ancillary Structures include mainline structures crossing the interchange ramps, Green Lane, and the East Penn Railroad, sign structures, and retaining walls. Alternatives NNI, NPI, and NS require the replacement of the mainline structure over the interchange ramps, resulting in a greater impact. Retaining walls are proposed for the New Jersey Approach to limit the required foreign borrow. Alternatives DNI, DPI, and DS have the largest anticipated retaining wall areas, resulting in an increased impact.

C. Right-of-Way Impacts

Right-of-Way impacts were separated into four (4) subcategories. Subcategories include Commercial Impacts, Industrial Impacts, Residential Impacts, and impacts to Billboards/Cell Towers. Displacements were tabulated for each of the subcategories. Partial acquisitions were tabulated for each of the subcategories with the exception of Billboards/Cell Towers since all impacts to Billboards/Cell Towers were considered to be total acquisitions. Temporary impacts were not considered in the analysis.

Proposed Right-of-Way limits in Pennsylvania were established using drainage requirements set forth in the PA Turnpike Design Consistency Guidelines and engineering judgement. The following general criteria were utilized:

- The ROW line shall be a minimum of 20 feet from toe of fill, where no drainage ditch at the toe of slope is present (Drainage design was not completed for the alternatives analysis and therefore the ROW limits will change).
- The ROW line shall be a minimum of 20 feet from the top of cut.
- Along long bridges and viaducts, the ROW lines are to be established at a minimum of 50 feet outside the fascia lines of structure. It is anticipated that aerial easements will be required at the existing railroad crossings. Temporary impacts were not considered.

Proposed Right-of-Way limits in New Jersey were established using the criteria provided in Section 9 of the New Jersey Turnpike Authority Procedures Manual. The criteria include the following:

- The ROW line shall be a minimum of 70 feet from the outside edge of through travel pavement, where practical.
- The ROW line shall be a minimum of 25 feet from toe of slope, where no drainage ditch at the toe of slope is present (Drainage design was not completed for the alternatives analysis and therefore the ROW limits will change).
- The ROW line shall be a minimum of 10 feet from the top of ditch back slope where a drainage ditch at the toe of slope is required.
- The ROW line shall be a minimum of 10 feet outside the top of slope where no top of cut ditch is required.
- The ROW line shall be a minimum of 10 feet from the top of ditch backslope where a top of cut ditch is required.
- Along long bridges and viaducts, the ROW lines are to be established at a minimum of 50 feet outside the fascia lines of structure. Easements will be acceptable for those cases where fee acquisition is not feasible, i.e. railroads, certain utilities, etc.
- The ROW line within the limits of retaining walls will follow the criteria provided for toe of slope and ditches as appropriate.
- Temporary impacts were not considered.

D. Environmental Impacts

Environmental constraints were evaluated and mapped, with the assumption that impacts to these resources would occur for the entire area within the proposed Right-of-Way.

Environmental impacts were separated into subcategories, including:

- Natural Resources such as Surface waters, Wetlands, Floodplains, Submerged aquatic vegetation, Forested Areas, and Threatened and Endangered Species,
- Cultural Resources including above ground historic properties and archaeological sites,
- Parks and Recreational Areas,
- Potential Hazardous, Residual, and Industrial Waste Areas, and
- Socioeconomic Impacts.

Impacts to each subcategory were tabulated based on the type of feature. For example, wetland areas were tabulated in acres and stream impacts were tabulated in linear feet.

E. Constructability

Constructability evaluated the overall complexity of the traffic control staging, including the total number of different phases of traffic control and access to the work areas, and how that would impact the overall construction duration of the project. This section focused more on the effects of the traffic control design on the contractor's ability to efficiently construct the project. Material delivery and quantity was also considered in this subcategory. Ancillary structures were included in this category since they were not included with the Bridge Type Study Report. Constructability of the approach span and main river span structures was included in the Bridge Type Study Report evaluation and therefore omitted from this analysis.

Several alternatives (SNI, SPI, DNI, DPI, NSA, DS) will not require the replacement of the structure over the SR 0013 (Bristol Pike) interchange ramps. Since the existing structure will remain in place for these alternatives, multiple, small work zones will be required to maintain traffic during construction. Due to the increased complexity in the staging, these alternatives were assigned a greater impact. In addition to the complex phasing, alternatives with center work zones were also assigned a greater impact.

F. Railroad Impacts

Impacts to the East Penn Railroad crossing and Amtrak's Northeast Corridor Railroad crossing were considered. Impacts to existing railroad right-of-way as well as potential impacts to tracks were considered. Impacts to the existing Amtrak electrical substation were also included in the category. Impacts to the railroads can have a substantial influence on the project cost and schedule. Note that the costs associated with railroad impacts are not included in the cost contained in this report.

All of the alternatives that include proposed bridges south of the existing bridge impact the existing Amtrak electrical substation. Relocation of the substation will have a substantial impact on the project schedule and overall project cost. Greater impacts were assigned for all alternatives impacting the substation.

G. Public Utility Impacts

Public utility impacts were categorized as either major or minor. Major utilities primarily included the aerial transmission line that crosses I-95/I-276 and runs along the NEC. Minor utilities include the utilities along the local roadway network such as aerial electric, communication, and cable television as well as various underground utilities including water, sanitary sewer, gas, etc.

All of the alternatives that include proposed bridges south of the existing bridge impact Crown Road, which parallels the mainline. Crown Road carries utilities to the local roadway network located in Pennsylvania. Alternatives that impact Crown Road were assigned a greater impact due to increased utility impacts.

H. Traffic Control

Maintenance and protection of traffic impacts for the project were evaluated based on the overall complexity of each alternative in terms of how and where traffic would be maintained and the number of stages that would be required to complete the work. This section focused more on the vehicular road users and how the traffic control design would impact their travel through the work zone. Increased construction costs from additional temporary measures (pavement, guide rail, barrier, impact attenuators, etc.) stemming from numerous setups of smaller work zones resulted in greater impacts. Impacts to existing structures immediately adjacent to the western terminus of the work zone also resulted in a greater impact. It was assumed that the existing number of mainline travel lanes and ramp entrance and exit ramps would be maintained to the greatest extent possible.

Alternative DPI was assigned the greatest impact for this category. This is due to the restricted work area within the work zone, multiple stages of construction, and potential over-widening required to accommodate traffic. Alternative DS was assigned a similar impact and has similar restrictions and complexity within the anticipated traffic control staging.

I. Tolling

The existing Westbound/I-95 Southbound toll gantry owned by the PTC will be impacted by all alternatives. This category evaluated the number of relocations of the toll gantry that would be required to maintain revenue collection throughout construction. For some alternatives, additional temporary or permanent relocations are anticipated. For example, the split alignment and staged alignment alternatives all require multiple toll gantry relocations. For this reason, these alternatives have a slightly greater impact than the north and south alignments. Overall, the impacts associated with tolling are considered low.

J. Comparative Cost Analysis

A comparative cost analysis was performed and separated into six (6) subcategories. The categories include Pennsylvania Approach Roadway, Pennsylvania Approach Structure, Main Span, New Jersey Approach Structure, New Jersey Approach Roadway, and Miscellaneous Structures. Discussion of the comparative cost analysis is included in **Section X**. Costs for known quantities were developed based on historic price data.

VIII. Bridge Type Evaluation

The Bridge Type Evaluation is included in the Bridge Type Study Report. The report documents the various constraints associated with the project site, discusses the screening process and bridge types evaluated for the main river bridge, and details the evaluation process used to assess the main river bridge structures. The report also discusses the screening process and bridge types evaluated for the approach structures leading to the main river bridge and details the evaluation process used to assess the approach bridge structures. Ultimately, the Bridge Type Study report provides a recommendation for options to be carried forward into the preliminary engineering phase of the project.

A. Main River Crossing

As part of the main river crossing analysis, and as detailed in the Bridge Type Study Report, the following general considerations were included in the initial evaluation:

- **Navigation requirements of the Delaware River**. The Delaware River Navigation Channel is a federally authorized navigation channel in the vicinity of the proposed river crossing, therefore, all feasible alternatives for construction of the new main river bridge will require coordination with the USCG because the project involves placement of a structure over navigable waters of the United States.
- **Resiliency**. The ability to sustain higher intensity rainfall events, superfloods, and sea level rise while maintaining navigable clearance was considered. HDR assumed that maintaining the existing navigation vertical clearance (135-feet minimum) from the mean high water (MHW) and horizontal normal clear span opening (550-feet minimum) is satisfactory. However, to account for future sea level rise the low chord of the proposed structures was set to accommodate an additional 3-feet of vertical under clearance.
- **Temporary Impacts**. Temporary impacts to the navigation channel during construction are also an important consideration. To minimize impacts, all alternatives were evaluated for their constructability and their ability to be constructed with means and methods that would eliminate or minimize impacts to the channel during construction. All options considered were evaluated with respect to their erection schemes and potential impacts to the project study area. Impacts to the project study area include impacts to the environment, adjacent land uses, and the navigation channel and are generally created

by the construction and location of new bridge foundations, any temporary falsework/ shoring towers, trestles, large construction equipment such as cranes, and temporary closures of the navigation channel to accommodate construction activities. Waterline foundations are used in the river to improve constructability by allowing the use of "lost forms" or floating cofferdams without the need for deep cofferdams.

- **Inspection Access**. The specific inspection/maintenance access provisions will vary with superstructure type and pier/tower shape; however, for all alternatives under consideration inspection/maintenance access provisions are feasible and detailed in the Bridge Type Study Report.
- **Federal Aviation Administration (FAA) Requirements**. Due to the potential height of some of the structure types being considered, impacts to local airports must be evaluated to make sure the Federal Aviation Administration's (FAA) interest in protecting airspace from hazardous objects is considered.
- **Foundations**. The process of developing feasible deep foundation concepts for the main river bridge involved developing preliminary foundation demands for the bridge types under consideration that include gravity loads, wind loads, and vessel collision loads. To establish initial loadings that could be used to prepare foundation options, HDR commissioned RWDI to prepare a project specific wind study report that includes initial recommendations for wind loading to be used for preliminary purposes. HDR also determined the magnitude of the vessel collision loading on the main span foundations for the various options developed.

Based on the considerations described above, an initial span range was established. Appropriate structure types for the span range were selected to be advanced as part of the Bridge Type Study. Bridge types/spans included:

- Concrete Segmental Girder – 682-foot channel span
- 3-Span Concrete Box Girder Extradosed Bridge – 682-foot channel span
- Steel Box Girder – 680-foot channel span
- Steel Tied-Arch – 680-foot to 840-foot channel span
- 2-Span Cable-Stayed Bridge – 720-foot channel span
- 3-Span Cable-Stayed Bridge – 990-foot channel span

Ultimately, the Concrete Segmental Girder and Steel Box Girder structure types were found to be cost prohibitive and were eliminated from consideration. The remaining four (4) bridge types were selected to be advanced as part of the Bridge Type Study Report.

A Bridge Option Evaluation was performed for each of the four (4) bridge types. When numerous bridge types are evaluated at a particular site, they must be compared to each other using a process that systematically evaluates the impacts associated with each option to arrive at a preferred solution. A method developed to perform this comparison is through the use of evaluation matrices. Each matrix is developed to evaluate the proposed options against each other through the use of site-specific criterion. The main river bridge comparison matrix was developed to rate each option using the following criterion:

- Aesthetics
- Constructability
- Construction Duration
- Inspection and Maintenance.
- Maintenance and Durability

- Comparative Life Cycle Costs
- Comparative Initial Construction Costs

Based on the proposed assessment and weighting of criteria shown in the main river bridge comparison matrix, leading bridge options were evaluated using weighted impacts. Based on this evaluation and their versatility for alignment alternates, the extradosed and tied arch options are recommended to be carried forward into the next phase.

B. Approach Spans

As part of the approach span analysis, and as detailed in the Bridge Type Study Report, the following general considerations were included in the initial evaluation:

- **Span flexibility and length**. The Pennsylvania Approach includes numerous constraints such as utilities, roadways, railroad lines and facilities, and the Delaware Canal. As a result, flexible span arrangements and a few long spans are required. Initial assessments indicate that long spans could also be economical for the tall piers near the main river bridge, to reduce the number of substructure units.
- **Substructure**. The tallest approach span piers are expected to exceed 130-feet in height, with height reducing away from the main river bridge due to the 3% roadway grade. Preliminary geotechnical evaluation indicates rock is deep at the site. Review of a representative boring and the geological section from 1953 along the existing Pennsylvania Approach structure shows an expected depth to rock of 110-feet to 140-feet, requiring significant deep foundation elements.

The need for long spans, tall piers, and deep foundations led to the selection of three long-span approach structure types for evaluation in this alternatives analysis phase:

- Steel Plate Girders,
- Precast Spliced Concrete Girders
- Precast Concrete Segmental Structures

As with the main river bridge structures, evaluation matrices have been developed to compare structure options for both the PA and NJ replacement approach structures. Due to the varied constraints on each side of the river, unique matrices were developed for each approach. Structure options were grouped by similar alignment to limit repeated columns. Each matrix is a tool to help evaluate the proposed options against each other through the use of site-specific criterion. The approach span bridge matrices rate each option using the following criterion:

- Aesthetics
- Railroad Impacts
- Waterway Impacts
- Environmental Impacts
- Constructability
- Construction Duration
- Inspection and Maintenance Access
- Maintenance and Durability
- Comparative Life Cycle Costs
- Comparative Initial Construction Costs

Based on the proposed assessment and weighting of criteria shown in the approach span bridge matrices, steel plate girder structures are recommended to be advanced in the next phase for both the PA and NJ Approach spans.

IX. Geotechnical Investigations

Geotechnical baseline reports were prepared for the Pennsylvania Approach, the main span of the bridge, and for the New Jersey Approach. Subsurface exploration programs were not conducted as part of the Geotechnical Investigations performed during this phase of the project. The geotechnical baseline reports were developed based on readily available published information.

Based on the published geology and available subsurface information, the project site is located within the Lowland and Intermediate Upland Section of the Atlantic Coastal Plain Province. The geomorphology of the area has been influenced by fluvial erosion, re-deposition of transported sediments and low relief of the Delaware River Floodplain. This region largely consists of unconsolidated to poorly consolidated coastal plain sediments that overlie metamorphic basement rock, primarily schist and gneiss.

The site is underlain by stratified glacial drift. According to PAGEODE and NJ-GeoWeb, the glacial deposits consist of Quaternary-aged Trenton Gravel (Qt), Potomac Formation (Kp), and Magothy (Kmg). These formations are known to include glaciofluvial, interglacial estuarine and postglacial alluvial deposits. They have been previously mapped by Owen and Minard (1975) as Graywacke 2 and by Stanford (2008) as glaciofluvial deposits (Qwf). The Trenton Gravel consists of gray to pale-reddish-brown, interbedded sand and gravel with local clay and silt layers. According to the Engineering Characteristics of Rocks in Pennsylvania, this formation is well bedded with common cross-bedding. Excavation of this formation is reported to be easy; however, cut slope and foundation stability is poor without replacement or densification. The Potomac Formation consists of fine to coarse grained sand, interbedded with white, red, or yellow clay. Similarly, the Magothy Formation consists of quartz sand interbedded with clay or clay-silt.

The bedrock is not well mapped in this area due to the thickness of glacial deposits. However, a review of subsurface information from the original bridge construction drawings indicates the site is underlain by gneiss and mica schist associated with the Wissahickon Formation. The Wissahickon Formation is described as dark gray to tan, fine to coarse-grained oligoclase mica schist with interlayers of granofels, amphibolite, quartzite, and pegmatite. There are instances where hornblende gneiss, augen gneiss, and quartz-rich and feldspar-rich members are present due to various degrees of granitization. The foliations within the rock are noted to be shallow to moderately dipping to the north and contain multiple generations of folds as a result of the past compression and deformation that occurred in the region. The upper surface of the Wissahickon Formation is commonly chemically weathered to saprolite consisting of soft decomposed clayey, silty, and sandy material that preserves the fabric of the rock. The upper 10 to 150 feet of this formation commonly consists of this weathered micaceous clayey saprolite.

Accordingly, depth to competent bedrock is expected to be encountered at a considerable depth for all of the upstream and downstream alternatives. For the Main Span, the piers will be supported by deep foundations based on the anticipated loading conditions; it is anticipated that the foundation conditions would be similar for all of the proposed alternatives under consideration. The existing piers are supported by piles driven to capacity in the dense glaciofluvial deposits and saprolite zone above bedrock which is consistent with our understanding of the published geologic setting. Preliminary analyses for feasibility and to develop costs included drilled shafts, micropiles,

and driven piles for the Main Span piers. Drilled shafts are preferred to support the high axial and lateral loads for piers of large structures, however, the depth to competent bedrock for the Main Span increases their cost and poses difficulty for construction. Alternatively, driven piles and micropiles will be considered as foundations. Disturbance of the existing foundations caused by the installation of proposed foundations, particularly driven piles, is a criteria for the selection of the recommended foundations. The dense sands and gravels comprising the overburden soils are generally capable of supporting spread footings for approach substructures. The available plans suggest the approach substructures to the existing bridge are supported by spread footings bearing on soil. As in-depth geotechnical evaluations are to be performed in the next phase of the project, the cost analyses assume deep foundations utilizing micropiles or drilled shafts for the new approach structures.

X. Cost Analysis

A comparative cost analysis was performed and separated into six (6) categories, including Pennsylvania Approach Roadway, Pennsylvania Approach Structure, Main Span, New Jersey Approach Structure, New Jersey Approach Roadway, and Miscellaneous Structures. Costs from the six (6) categories were totaled to determine the impact. Impacts for this criterion are directly related to the cost, with the lowest cost option considered the least impact. All costs are based on 2023 dollars. Based on past practice, a 20 percent contingency was included on the total cost of the items included in the estimate to reflect the level of design performed during this phase of the project and to account for items not included in the estimate. The 20% contingency is appropriate based on the level of design completed for the bridge structures including the approach spans and the main span and those items being the major drivers of the project cost.

A. Pennsylvania Approach Roadway/New Jersey Approach Roadway

For each alignment alternative, comparative initial cost estimates using major roadway items only were computed. Items include, but are not limited to:

- Excavation (Class 1, Foreign Borrow, Rock, Type A)
- Pavement
- Guide Rail and Median Barrier
- Rock Armor

Percentages of roadway costs were applied to determine comparative costs for maintenance and protection of traffic, erosion control, and post construction stormwater management.

B. Pennsylvania Approach Structures/New Jersey Approach Structures

For each approach span option, comparative initial cost estimates using major items only were computed for the three different construction scenarios of full off-line construction, phased construction, and dual bridge construction. Due to the multitude of possible alignment options and variation in start/end station for main river span options, four representative alignment options were selected for this evaluation, as shown below.

- South Partial Impact (SPI): Cable-Stayed (2-Span)
- North No Impact (NNI): Tied-arch
- Dual Partial Impact (DPI): Cable-Stayed (3-Span)
- North Staged (NS): Extradosed

Detailed cost estimates were generated for these representative alignment options. From these detailed cost estimates, approach span combinations were converted into an average cost per square foot of deck area (one average cost per approach span bridge type). The square foot costs were then used to generate the cost associated with each approach span scenario.

C. Main Span

For each main river span bridge option, comparative initial cost estimates using major items only were computed for all alignment alternatives (full off-line construction, phased construction, and dual bridge construction).

D. Miscellaneous Structures

For each alignment alternative, comparative initial cost estimates for the miscellaneous structures such as retaining walls were computed by estimating square foot costs. Sign structures were included as a lump sum cost per structure. An increased square foot cost was utilized for Alternative DNI since independent substructures are proposed.

E. Comparative Cost Summary

Alt	PA Roadway Construction	NJ Roadway Construction	PA Approach Spans	NJ Approach Spans	River Span	Miscellaneous Structures	Total
SNI-Max	$17,340,000	$23,280,000	$197,470,000	$154,448,000	$166,478,000	$30,272,000	$589,288,000
SPI-Max	$14,370,000	$19,850,000	$197,470,000	$157,521,000	$166,478,000	$29,072,000	$584,761,000
NNI-Max	$32,890,000	$33,100,000	$197,470,000	$154,448,000	$166,478,000	$26,691,000	$611,077,000
NPI-Max	$22,370,000	$23,170,000	$197,470,000	$151,375,000	$166,478,000	$30,254,000	$591,117,000
DNI-Max	$15,400,000	$30,780,000	$197,470,000	$157,521,000	$172,440,000	$33,668,000	$607,279,000
DPI-Max	$12,440,000	$27,320,000	$197,470,000	$151,375,000	$172,440,000	$31,170,000	$592,215,000
NS-Max	$27,860,000	$21,060,000	$197,470,000	$151,375,000	$173,414,000	$27,810,000	$598,989,000
NSA-Min	$12,590,000	$18,060,000	$216,953,000	$158,566,000	$165,239,000	$24,971,000	$596,379,000
DS-Min	$11,570,000	$23,360,000	$216,953,000	$158,566,000	$174,272,000	$30,116,000	$614,837,000

Note that the values provided in the table are comparative costs.

Comparative construction costs from the six (6) categories above were tabulated and compared for each of the build alternatives. Costs were based on known quantities, with a 20% contingency applied for unknown items. Comparative cost values ranged from $584,761,000 to $614,837,000, resulting in a delta of $30,076,000. Cost values were ranked and assigned an impact, with the most expensive alternatives (DS and NNI) having the highest impact. Alternative SPI had the lowest comparative cost and therefore the lowest impact.

XI. Recommendations

The primary goal for this Alternatives Analysis Report is to summarize the studies completed to date and recommend alternatives for advancement into preliminary engineering and the SEIS. The results of the studies that were described in this report are summarized in the following Alignment Alternatives Evaluation Matrix.

DELAWARE RIVER BRIDGE
REPLACEMENT AT MP H-43.4
ALIGNMENT ALTERNATIVES EVALUATION MATRIX

Legend:

No/Low Impact	Moderate Impact	Medium Impact
High Impact	Substantial Impact	

	SOUTH ALIGNMENTS		NORTH ALIGNMENTS		SPLIT ALIGNMENTS		STAGED ALIGNMENTS		
	Alternative South No Impact (SNI)	Alternative South Partial Impact (SPI)	Alternative North No Impact (NNI)	Alternative North Partial Impact (NPI)	Alternative Dual No Impact (DNI)	Alternative Dual Partial Impact (DPI)	Alternative North Staged (NS)	Alternative North Staged Alternate (NSA)	Alternative Dual Staged (DS)
ROADWAY - evaluates geometry of the proposed turnpike and impacts to the interchange ramps/roadways below the turnpike.									
GEOMETRY (HORIZONTAL AND VERTICAL)	Reverse Curves Required	Reverse Curves Required	Typical Geometry	Typical Geometry	Reverse Curves Required	Reverse Curves Required	Typical Geometry	Typical Geometry	Typical Geometry
INTERCHANGE IMPACTS - SR 0013 Ramps (SF/LF)	35,960 / 1,010	28,460 / 810	43,645 / 1,180	45,515 / 1,260	28,560 / 815	30,070 / 860	46,040 / 1,275	31,660 / 900	31,405 / 895
LOCAL ROAD IMPACTS (SF/LF)	89,655 / 2,490	83,305 / 2,360	140,725 / 3,440	79,860 / 2,075	102,570 / 2,770	96,340 / 2,655	110,415 / 2,705	56,675 / 1,395	53,080 / 1,275
STRUCTURES - evaluates merits of the proposed Delaware River Bridge, roadway approach bridges, required retaining walls, and sign structures.									
MAIN SPAN	Single Bridge Built in Single Phase	Single Bridge Built in Single Phase	Single Bridge Built in Single Phase	Single Bridge Built in Single Phase	Dual Bridge Built in Single Phase	Dual Bridge Built in Single Phase	Single Bridge Built in Two Phases	Single Bridge Built in Two Phases	Dual Bridge Built in Two Phases
PA APPROACH SPANS	Steel I-Girder	Steel I-Girder	Steel I-Girder	Steel I-Girder	Steel I-Girder	Steel I-Girder	Steel I-Girder	Steel I-Girder	Steel I-Girder
NJ APPROACH SPANS	Steel I-Girder	Steel I-Girder	Steel I-Girder	Steel I-Girder	Steel I-Girder	Steel I-Girder	Steel I-Girder	Steel I-Girder	Steel I-Girder
ANCILLARY STRUCTURES - Bridges, Walls and Signs (#/SF/#)	2 / 22,400 / 5	2 / 21,400 / 5	3 / 22,400 / 8	3 / 31,050 / 5	2 / 51,150 / 5	2 / 40,499 / 5	3 / 27,600 / 5	2 / 22,400 / 5	2 / 39,036 / 5
RIGHT-OF-WAY - Evaluates the impacts on commercial, industrial, and residential properties.									
COMMERCIAL IMPACTS	Medium Impact	Medium Impact	High Impact	Medium Impact	High Impact	High Impact	Medium Impact	Low Impact	Low Impact
INDUSTRIAL IMPACTS	Moderate impact	Moderate impact	Medium Impact	Moderate impact	Medium Impact	Medium Impact	Medium Impact	Moderate impact	Moderate impact
RESIDENTIAL IMPACTS	Moderate impact	Moderate impact	Medium Impact	Medium Impact	Medium Impact	Medium Impact	Medium Impact	Moderate impact	Moderate impact
BILLBOARDS/CELL TOWERS	Low Impact	Low Impact	Low Impact	Low Impact	Moderate impact	Moderate impact	Low Impact	Low Impact	Low Impact
CONSTRUCTABILITY - Evaluates the complexity associated with the construction of the roadway approaches.									
ROADWAY	Moderately Complex Phasing, Substantial Fill	Moderately Complex Phasing, Center Work Zone, Substantial Fill	Moderately Complex Phasing, Substantial Fill	Moderately Complex Phasing, Center Work Zone, Substantial Fill	Complex Phasing, Substantial Fill	Complex Phasing, Center Work Zone, Substantial Fill	Complex Phasing, Substantial Fill	Complex Phasing, Substantial Fill	Complex Phasing, Substantial Fill
RAILROAD - Evaluates the impacts to the East Penn Railroad crossing below the turnpike and the Amtrak Northeast Corridor facilities.									
East Penn Railroad	Low Impact	Low Impact	Low Impact	Low Impact	Low Impact	Low Impact	Low Impact	Low Impact	Low Impact
Amtrak (NEC)	Substation Relocation Required	Substation Relocation Required	Moderate Impact	Moderate Impact	Substation Relocation Required	Substation Relocation Required	Moderate Impact	Moderate Impact	Moderate Impact
PUBLIC UTILITIES - Evaluates the impacts to the Amtrak power transmission lines above the Delaware River Bridge and other utility facilities below									
Amtrak Transmission Lines	Transmission Line Relocation Required	Transmission Line Relocation Required	Transmission Line Relocation Required	Transmission Line Relocation Required	Transmission Line Relocation Required	Transmission Line Relocation Required	Transmission Line Relocation Required	Transmission Line Relocation Required	Transmission Line Relocation Required
Minor Facilities Below Bridge	Low Impact to Minor Utilities	Low Impact to Minor Utilities	Low Impact to Minor Utilities	Low Impact to Minor Utilities	Low Impact to Minor Utilities	Low Impact to Minor Utilities	Low Impact to Minor Utilities	Low Impact to Minor Utilities	Low Impact to Minor Utilities
TRAFFIC CONTROL - Evaluates the complexity associated with maintaining traffic on the turnpike during construction.									
	4 Phases	4 Phases	3 Phases	3 Phases with Temporary Widening	4 Phases	4 Phases with Temporary Widening	3 Phases with Temporary Crossover	3 Phases with Temporary Crossover	4 Phases with Temporary Widening
TOLLING - Evaluates the impacts to the turnpikes tolling facilities during construction.									
	Low Impact to Tolling Facilities	Low Impact to Tolling Facilities	Low Impact to Tolling Facilities	Low Impact to Tolling Facilities	Low Impact to Tolling Facilities	Low Impact to Tolling Facilities	Low Impact to Tolling Facilities	Low Impact to Tolling Facilities	Low Impact to Tolling Facilities
INITIAL COMPARATIVE COSTS - Compares the relative construction cost.									
	Moderate Comparative Cost	Low Comparative Cost	High Comparative Cost	Moderate Comparative Cost	Medium Comparative Cost	Moderate Comparative Cost	Moderate Comparative Cost	Moderate Comparative Cost	High Comparative Cost

ENVIRONMENTAL - Evaluates the impacts to the various environmental features and wildlife.									
NATURAL RESOURCES									
Surface Waters/ Wetlands (LF/Acres)	1,650 / 0.5	1,650 / 0.5	3,456 / 0.7	3,470 / 0.2	1,696 / 0.5	1,679 / 0.7	3,390 / 0.3	1,543 / 0.2	1,305 / 0.3
Floodplains (Acres)	0.6	0.6	0.6	0.6	0.7	0.7	0.6	0.6	0.7
Submerged Aquatic Vegetation	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact
Forested Areas (Acres)	33	31	27	24	29	28	23	21	21
CULTURAL RESOURCES - Above Ground Historic									
Fleetwing Estates Historic District (Resource No. 2024RE00974)	No Impact	No Impact	Potential Impact	Potential Impact	No Impact	No Impact	Potential Impact	No Impact	No Impact
Pennsylvania Railroad: Main Line (Philadelphia to New York) Historic District (Resource No. 1994RE01403)	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact
Pennsylvania Railroad: Grundy Tower (Resource No. 1999RE00833)	Potential Impact	Potential Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
Delaware Division of the Pennsylvania Canal Historic District (Resource No. 1974RE00074)	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact
Delaware River Bridge (Resource No. 2005RE00744)	Impacted	Impacted	Impacted	Impacted	Impacted	Impacted	Impacted	Impacted	Impacted
CULTURAL RESOURCES - Archaeological									
Black Ditch Park Site (36BU0348)	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
Court Square Site (36BU0349)	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
Site 28BU0703	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
Site 28BU0702	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
THREATENED and ENDANGERED SPECIES									
Atlantic Sturgeon	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact
Peregrine falcon [2]	Impacted	Impacted	Impacted	Impacted	Impacted	Impacted	Impacted	Impacted	Impacted
Other Species	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact
PARKS and RECREATIONAL AREAS									
Black Ditch Park Site	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact
Pacific Park	Potential Impact	Potential Impact	No Impact	No Impact	Potential Impact	Potential Impact	No Impact	No Impact	No Impact
Delaware River Heritage Trail	Temporary Impact	Temporary Impact	Temporary Impact	Temporary Impact	Temporary Impact	Temporary Impact	Temporary Impact	Temporary Impact	Temporary Impact
Green Acres funded property (Veterans Park)	No Impact	No Impact	Potential Impact	Potential Impact	No Impact	No Impact	Potential Impact	Potential Impact	Potential Impact
HAZARDOUS, RESIDUAL, and INDUSTRIAL AREAS (Acres)	Potential Hazardous Waste: 4.3 Potential Area of Concern: 8.7	Potential Hazardous Waste: 4.8 Potential Area of Concern: 6.7	Potential Hazardous Waste: 18.9	Potential Hazardous Waste: 9.0	Potential Hazardous Waste: 7.2 Potential Area of Concern: 5.9	Potential Hazardous Waste: 5.9 Potential Area of Concern: 4.6	Potential Hazardous Waste: 4.9	Potential Hazardous Waste: 2.9	Potential Hazardous Waste: 2.8
SOCIOECONOMIC IMPACTS	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact	Potential Impact
Alternatives Matrix Summary	Alternative South No Impact (SNI)	Alternative South Partial Impact (SPI)	Alternative North No Impact (NNI)	Alternative North Partial Impact (NPI)[1]	Alternative Dual No Impact (DNI)	Alternative Dual Partial Impact (DPI)	Alternative North Staged (NS)	Alternative North Staged Alternate (NSA)[1]	Alternative Dual Staged (DS)

(1) Alternative recommended for advancement and further study.
(2) Impact to the peregrine falcon is the removal of the existing bridge.

Based on the findings of this report, it is recommended that a Single Bridge, Bridge North alternative and a Single Bridge, Staged alternative be advanced to preliminary engineering. Based on the least impact, the following alternatives are recommended to be advanced:

- Alternative NPI (North Partial Impact)
- Alternative NSA (North Staged Alternate)

It should be noted that all Bridge South and all offline Dual Bridge alternatives (Alternatives SNI, SPI, DNI and DPI) impact the existing Amtrak substation. Impacts to this facility are anticipated to have substantial costs and schedule delays. As shown in the matrix, impacts associated with these four alternatives are greater than those associated with the other alternatives, therefore

they were dropped from further consideration. A Bridge North alternative is shown to be least impactful in the matrix.

Alternative NPI (North Partial Impact) was selected to be advanced as the least impactful offline alternative. When comparing Alternatives NPI and NNI, alternative NNI increases the impacts with no benefit and was therefore dropped from further consideration.

Alternative NSA (North Staged Alternate) was selected to be advanced as the least impactful staged alternative. When comparing Alternatives NS, NSA and DS, alternatives NS and DS increase impacts with no benefit and were therefore dropped from further consideration.

The next step in project development will be preliminary engineering (PE) and environmental review under NEPA for the recommended replacement bridge types, and on the recommended alignments. PE will include further refinement of the preferred alignments and structures, including span lengths and structure details for economy, as well as geotechnical investigation and foundation design. In accordance with NEPA, environmental review will include consideration of the alternatives' potential effects on resources and communities, mitigation for those effects, public involvement, and agency coordination.

Appendices

Appendix A – Roadway Design Criteria

Appendix B – Roadway Drawings and Representative Cross Sections

Appendix C – Historic Bridge Rehabilitation Analysis (HBRA) Report

Appendix D – Environmental Impacts Maps

Appendix A – Roadway Design Criteria

Project:	DRB Replacement at MP H-43.4	Computed:	SJG	Date:	7/12/2022
Subject:	Design Criteria	Checked:	BEM/JB	Date:	9/30/2022
Task:	Alternatives Analysis	Page:	1	of:	1
HDR Job #:	10330375	No.:			

REPLACEMENT OF THE DELAWARE RIVER BRIDGE AT MILEPOST H-43.4

PA & NJ TURNPIKE MAINLINE - DESIGN CRITERIA

Highway Classification	Urban Interstate
Opening Year ADT (2030)	36,920 (EB) 32,399 (WB)
Design Year ADT (2050)	48,277 (EB) 42,365 (WB)
Truck Percentage	23% (EB) 17% (WB)

DESCRIPTION	EXISTING CONDITIONS	PA TURNPIKE DESIGN CONSISTENCY GUIDELINES	NJ TURNPIKE AUTHORITY DESIGN GUIDELINES [3]	PROPOSED CONDITIONS
Lane Width	12'	12'	12'	12'
Outside Shoulder Width	11'-3"	12'	12'	12'
Inside Shoulder Width	7' (Approach Roadway) 2' (Structure)	12'	5'	12'
Median Width	16' (Approach Roadway) 6' (Structure)	26'	26'	26'
Travel Lanes	4	4 or More [1]	4 or More	6
Cross Slope (Min)	1.04%	2.00% [1]	1.50%	2.00% (PA) 1.50% (NJ)
Cross Slope (Max)	1.04%	6.00% (SE) [1] 2.00% (NC)	5.00% (SE) 1.50% (NC)	6.00% or Less (SE - PA) 5.00% or Less (SE - NJ) 2.00% (NC - PA) 1.50% (NC - NJ)
Vertical Grade (Min)	0.5%	0.50% [1]	0.50% Desirable 0.30% Absolute Minimum	0.50% or Greater
Vertical Grade (Max)	3.00%	3.00%	3.00% Desirable 5.00% Absolute Maximum	3.00%
Vertical Clearance (Min)	N/A	16'-0" [6]	16'-0" [4] [6]	16'-0" or Greater
Radius (Min)	5,729.65' (PA) 11,459.16' (NJ)	1909.86' [5]	3,500'	1,909.86' or Greater (PA) 3,500' or Greater (NJ)
Design Speed	55 mph	70 mph	70 mph	70 mph
Stopping Sight Distance (Min)	700'	730' [2]	730' [2] (2' Object Height)	Exceeds 730'

[1] From PennDOT Publication 13M, DM-2, Chapter 1, Table 1.8 (Limited Access Freeway)

[2] From AASHTO's "A Policy on Geometric Design of Highways and Streets", Chapter 3, Table 3-34

[3] From New Jersey Turnpike Authority Design Manual, Section 1.2 Mainline Roadways

[4] From New Jersey Turnpike Authority Design Manual, Section 3.2.2

[5] Calculated from the Maximum Degree of Curvature (D): R = 5729.578 / D, where D equals 3°00'00"

[6] See Table Below for Vertical Clearance Requirements for Additional Crossing Features:

Crossing Feature	(Min)	Source
Railroads	22'-0"	PA Code, Title 52, Chapter 33, Subchapter C, Clearances
Bristol Pike	16'-6"	PennDOT Publication 13M, DM-2, Chapter 1, Table 1.3 (Regional Arterial)
N. Radcliffe Street	16'-6"	PennDOT Publication 13M, DM-2, Chapter 1, Table 1.4 (Community Arterial)
Green Lane	14'-6"	PennDOT Publication 13M, DM-2, Chapter 1, Table 1.5 (Community Collector)
Wood Avenue	14'-6"	PennDOT Publication 13M, DM-2, Chapter 1, Table 1.7 (Local Road)
N. Wilson Avenue	14'-6"	PennDOT Publication 13M, DM-2, Chapter 1, Table 1.7 (Local Road)
Palmer Avenue	14'-6"	PennDOT Publication 13M, DM-2, Chapter 1, Table 1.7 (Local Road)
River Road	14'-6"	NJDOT Design Manual for Bridges and Structures, Table 2.3.3.2 (Major Collector)

Appendix B – Roadway Drawings and Representative Cross Sections

Appendix C – Historic Bridge Rehabilitation Analysis (HBRA) Report

HPO Project #24-1757-16
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OS-2C (2-22)

pennsylvania
DEPARTMENT OF TRANSPORTATION

Cultural Resources Submission

DATE: November 18, 2025

SUBJECT:

District: 6-0
County: Bucks Co., PA/Burlington Co., NJ Municipality: Various
SR: 0095 Section: TPK
Project Name: I-95 PA Turnpike Interchange – Delaware River Bridge
PennDOT MPMS Number: 13347
NJ HPO Review No.: 24-1757 Funding: Federal Lead Agency: FHWA
Re: Project Summary; APE, Historic Bridge Rehabilitation Analysis Report, Survey Forms
NJ HPO Concurrence Requested

TO: Katherine J. Marcopul, Ph.D., Administrator and Deputy State Historic Preservation Officer
New Jersey Historic Preservation Office
NJ Department of Environmental Protection

FROM: Monica Harrower
PennDOT District 6-0 Cultural Resources Professional
PennDOT Bureau of Design and Delivery

Monica P. Harrower
Digitally signed by Monica Harrower
Date: 2025.11.18 13:40:45 -05'00'

As a follow up to the October 17, 2025 call with the Federal Highway Administration (FHWA), the New Jersey Historic Preservation Office (NJ HPO), the New Jersey Turnpike Authority (NJTA), and the Pennsylvania Turnpike Commission (PA Turnpike Commission), the Pennsylvania Department of Transportation (PennDOT) is submitting a consultation letter to request the NJ HPO's review of documents previously submitted to your office. These documents were prepared for compliance with Section 106 of the National Historic Preservation Act (NHPA). All submissions from the PennDOT Cultural Resources Professionals to the NJ HPO have been made on behalf of the FHWA.

Project Description

The Pennsylvania Turnpike Commission (PA Turnpike) and the New Jersey Turnpike Authority (NJTA), with oversight from the Federal Highway Administration (FHWA), are currently re-evaluating rehabilitation and replacement options for the existing Delaware River Bridge (DRB).

The FHWA issued the Record of Decision (ROD) in 2003. In 2017, a fracture of one of the existing bridge approach trusses required a full closure of more than six weeks while the bridge was fully inspected and repaired. The PA Turnpike Commission and NJTA are now considering a range of alternatives for rehabilitation or replacement of the DRB.

Identification of Consulting Parties and Public Involvement (36 CFR 800.2)

PennDOT, on behalf of the FHWA, consulted with the NJ HPO prior to soliciting potential Section 106 consulting parties. The following organizations responded that they would like to be Section 106 consulting parties for the DRB project:

- Florence Township Planning Board
- County of Burlington
- The New Jersey Historic Trust
- Christal Properties, LLC

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- The Roebling Museum
- Florence Township

Two public meetings were held on March 19 and 20, 2025 in PA and NJ and two public meetings were held on October 15 and 16, 2025 in PA and NJ. Additional public meetings will be scheduled as the project progresses.

Delineation of the Area of Potential Effects (36 CFR 800.3)

The Area of Potential Effect (APE) is based on the bridge rehabilitation alternative shown on an aerial map that was provided to FHWA, PennDOT, NJTA, PA Turnpike Commission, PA SHPO, and NJ HPO during field views held on May 21, 2024 and July 1, 2024. The APE includes the 1000-foot-wide corridor (project study area) and encompasses a total area of 291.81 acres (118.09 hectares) in both Pennsylvania and New Jersey. The New Jersey portion of the APE includes 141.77 acres (57.37 hectares). Since a preferred alternative has not yet been identified, the APE may be revised as the project progresses. PennDOT and FHWA will identify any properties in the revised APE which will be directly and/or indirectly affected by the project.

Identification of Historic Properties (36 CFR 800.4)

- NJ Turnpike (I-95) Bridge over Delaware River (aka Delaware River Bridge)
- 1910 River Road property
- 1922 River Road property
- Hays Riverview Cemetery
- National Gypsum Company Railroad Spur
- New Jersey Turnpike Pennsylvania Extension

Other Documentation

PennDOT and FHWA use Historic Bridge Rehabilitation Analysis (HBRA) Reports in Pennsylvania to ensure that a good faith effort is made to analyze rehabilitation of historic bridges. PennDOT undertakes this analysis as part of the Section 106 review to investigate if an adverse effect to a historic bridge can be avoided and still meet project purpose and need. If a bridge cannot be rehabilitated to meet project purpose and need and avoid an adverse effect, then PennDOT and FHWA will prepare an Alternatives Analysis for the bridge.

Section 106 Submissions to Date

Below is the list of PennDOT/FHWA submissions and date of submissions to NJ HPO:

New Jersey Historic Preservation Office Email Submittal Form, including the Description of the APE
Submitted: December 18, 2024

New Jersey Historic Preservation Office Email Submittal Form and an Architectural Survey Form for the NJ Turnpike (I-95) Bridge over Delaware River (aka Delaware River Bridge)
Submitted: February 27, 2025 (*NJ HPO response received*)

Draft List of Section 106 Consulting Parties;
Submitted: May 12, 2025 (*NJ HPO response received*)

Historic Bridge Rehabilitation Analysis (HBRA) Report
Submitted: July 30, 2025

New Jersey Historic Preservation Office Email Submittal Form and an Architectural Survey Form
Property: **1910 River Road**
Submitted: August 12, 2025

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New Jersey Historic Preservation Office Email Submittal Form and an Architectural Survey Form
Property: **1922 River Road**
Submitted: August 12, 2025

New Jersey Historic Preservation Office Email Submittal Form and an Architectural Survey Form
Property: **Hays Riverview Cemetery**
Submitted: August 21, 2025

New Jersey Historic Preservation Office Email Submittal Form and an Architectural Survey Form
Property: **National Gypsum Company Railroad Spur**
Submitted: August 21, 2025

New Jersey Historic Preservation Office Email Submittal Form and an Architectural Survey Form
Property: **New Jersey Turnpike Pennsylvania Extension**
Submitted: August 29, 2025

Status of Archaeology

PennDOT, on behalf of FHWA, submitted the Phase 1A Archaeological Sensitivity Assessment on November 6, 2025 for NJ HPO review and comment.

Request for Concurrence

PennDOT, on behalf of the FHWA, is requesting your review of the Historic Bridge Rehabilitation Analysis (HBRA) Report and the five Architectural Survey Forms for the properties listed in bold above.

Further, we are requesting your concurrence with the following:

- The Area of Potential Effect (APE) as described above.
- The Delaware River Bridge cannot be rehabilitated to meet the purpose and need of the project.
- The following properties are not eligible for listing in the National Register of Historic Places due to a lack of significance and integrity:

  1910 River Road property
  1922 River Road property
  Hays Riverview Cemetery
  National Gypsum Company Railroad Spur
  New Jersey Turnpike Pennsylvania Extension

Enclosed is a concurrence request form which can be signed in lieu of a concurrence letter if you prefer.

PennDOT, on behalf of the FHWA, looks forward to our continued coordination with your office. Should you have any questions, please contact me at mharrower@pa.gov or (610) 205-6709.

Enclosure

4340/MPH/mph

cc: Michelle Goddard, FHWA PA Division Office
Sutapa Bandyopadhyay, Ph.D., FHWA NJ Division Office
Luke Larson, PA Turnpike Commission
Mark Bernard, NJTA
Judy Arena, PennDOT, Project Manager

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PA Turnpike/I-95 Interchange Stage 3 Delaware River Bridge Project
Bucks County, Pennsylvania and Burlington County, New Jersey

Request for Concurrence

☑ I concur with the APE as described in the accompanying letter.

☐ I do not concur for the following reason(s):

_____

_____

☑ I concur with the conclusion of the Historic Bridge Rehabilitation Analysis (HBRA) that the existing Delaware River Bridge cannot be rehabilitated to meet the project's Purpose and Need.

☐ I do not concur for the following reason(s):

_____

_____

☑ I concur with the determination that the five (5) properties evaluated for eligibility on the National Register of Historic Places are <u>not</u> eligible.

☐ I do not concur for the following reason(s):

_____

_____

Signed: Katherine J. Marcopul Date: 12/10/2025

Dr. Katherine J. Marcopul, Ph.D.
Administrator and Deputy State Historic Preservation Officer
New Jersey Historic Preservation Office

Pennsylvania State Historic Preservation Office
PENNSYLVANIA HISTORICAL AND MUSEUM COMMISSION

April 3, 2025

Sent Via PA-SHARE

RE: ER Project # 1984PR09230.069, I-276/I-95 (PA Turnpike) Interchange Project [PennDOT/FHWA Project], Federal Highway Administration, Multi-Municips, Montgomery County

Dear Submitter,

Thank you for submitting information concerning the above referenced project. The Pennsylvania State Historic Preservation Office (PA SHPO) reviews projects in accordance with state and federal laws. Section 106 of the National Historic Preservation Act of 1966, and the implementing regulations (36 CFR Part 800) of the Advisory Council on Historic Preservation, is the primary federal legislation. The Environmental Rights amendment, Article 1, Section 27 of the Pennsylvania Constitution and the Pennsylvania History Code, 37 Pa. Cons. Stat. Section 500 et seq. (1988) is the primary state legislation. These laws include consideration of the project's potential effects on both historic and archaeological resources.

Above Ground Resources
No Above Ground Concerns - Environmental Review - SHPO Sends Above Ground Comments

Based on the information available within our files, the PA SHPO concurs with the agency that rehabilitating the Delaware River Bridge does not meet the poject pupose and need.

For questions concerning above ground resources, please contact Tyra Guyton at tyguyton@pa.gov.

Archaeological Resources

For questions concerning archaeological resources, please contact Sara-Ladd Manley at samanley@pa.gov.

Sincerely,

Barbara Frederick
Environmental Review Division Manager

Appendix D – Environmental Impacts Maps