COVER SHEET

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Prepared by: Myrosia Dragan
Name
Date: 5/30/2016

Checked by: David Weiss
Name
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Additional Remarks:

WSP hereby submits the Final Facility Plan report for CAT-252.

The following supplemental information is also being submitted:

1) Comment tracking log with responses and implementation noted.
2) QA/QC review - Technical Document Checklists.

UNITED BY OUR DIFFERENCE

WSP

CITY OF NEW YORK

DEPARTMENT OF ENVIRONMENTAL PROTECTION (NYCDEP)

BUREAU OF ENGINEERING DESIGN AND CONSTRUCTION (BEDC)

Capital Project U-013
Contract: CAT 252-DES
PIN: 82613WM00273
Replacement of Esopus Creek and Rte. 28A Railroad Bridges

Final Facility Plan

Revision 2 –
5/10/2016

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1- Preliminary List of Permits
2- Detailed Cost Estimates
3- Initial Project EHS Profile

Section 1 Introduction

1.1 Project Overview

This project involves the complete removal and replacement of two structurally deficient and functionally obsolete bridges and a segment of NYS Route 28A roadway over the former Ulster and Delaware Railroad corridor and the Esopus Creek, just north of the Ashokan Reservoir. The bridges are located near the terminus of Route 28A at its intersection with NYS Route 28, just south of the Hamlet of Boiceville in the Town of Olive.

In addition to addressing the bridge deficiencies, the project also affords the opportunity to improve the existing non-standard approach roadway geometry of Route 28A by replacing the roadway within the project limits. This project will be coordinated with other local area projects. Three projects in the immediate area are a rail trail proposed by Ulster County for the former Ulster and Delaware Railroad corridor, a NYCDEP Route 28A roadway straightening project to improve alignment at a sharp “S”-curve just west of the bridges, and the Town of Olive’s Flood Mitigation Study which looks to develop flood mitigation measures to counter Esopus Creek flooding in the Boiceville area.

1.2 Overview Narrative Description of Area Scope

The two project bridges provide for continuity of Route 28A as it passes over the Esopus Creek and the former Ulster and Delaware Railroad corridor. NYS Route 28A is an approximately 20-mile long rural collector roadway owned by NYCDEP that connects communities south of the Ashokan Reservoir to NYS Route 28 and points along the north side of the reservoir. The terrain in the immediate vicinity of the project is generally rolling and vegetated. Much of the adjacent land is owned by New York City as part of the Ashokan Reservoir facility. The remaining adjacent land is residential.

The Esopus Creek flows from north to south through the project area, discharging into the Ashokan Reservoir approximately one mile south of Route 28A. The former Ulster and Delaware Railroad corridor also runs from north to south through the project area, to the west of the Esopus Creek. The portion of the RR corridor beneath Route 28A is not currently in use.

The hamlet of Boiceville is located approximately one-quarter of a mile northeast of the project area. Boiceville encompasses a commercial area along Route 28, as well as public services including a firehouse and the Onteora public schools.

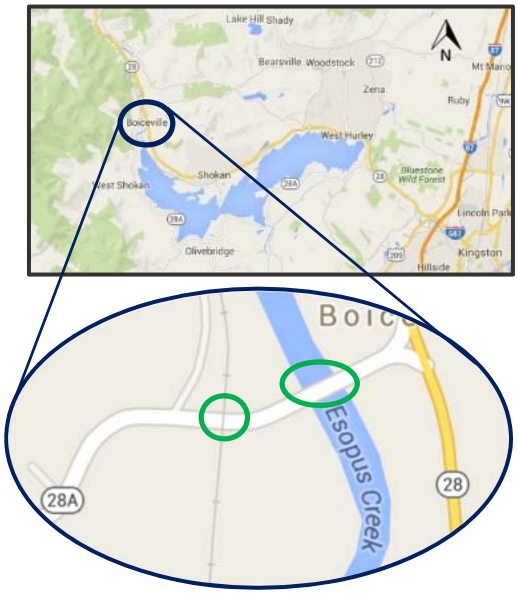


Figure 1 – Location Plan

Section 2 Executive Summary

Photo 1 - Esopus Creek Bridge

The two existing project bridges carry Route 28A and were constructed in 1913 as part of the original Catskill Water Project – Board of Water Supply Contract #49. They served to accommodate the realigned railroad and local roads displaced by the construction of the 8,300-acre Ashokan Reservoir. The bridges have remained intact to the present day, with major rehabilitation work limited to the concrete deck replacement and bridge railing replacement done in 1975 on the Esopus Creek Bridge.

The bridge carrying Route 28A over the Esopus Creek is a five-span, reinforced concrete arch structure. The total bridge length is 454'-6". The bridge carrying Route 28A over the former Ulster & Delaware Railroad corridor is a single span, reinforced concrete through-girder and floorbeam structure on reinforced concrete abutments. Route 28A is a two-lane rural collector with limited to no shoulders.

Both bridges are inspected biennially as part of the New York State Department of Transportation (NYSDOT) Biennial Inspection Program. The NYSDOT condition rating scale ranges from 1 to 7, with 7 being in new condition and a rating of 5 or greater considered as good condition. NYSDOT defines a deficient bridge as one with a condition rating less than 5.0. A deficient condition rating indicates deterioration at a level that requires corrective maintenance or rehabilitation to restore the bridge to its fully functional, non-deficient condition.

The condition rating reported in the November 2013 Biennial Inspection Report for the Esopus Creek Bridge is 3.984. The condition rating of the Railroad Bridge as reported in the October 2014 Biennial Inspection Report is 4.218.

Photo 2 - Railroad Bridge

Both bridges exhibit widespread deterioration throughout due to their long-term environmental exposure including repeated freeze-thaw cycles and the regular seasonal use of deicing agents. The concrete in the superstructures and the substructures of both project bridges is deteriorated. The deterioration is progressive and appears to be accelerating. Due to their relative age, the bridges are considered at the end of their useful lives.

This project is intended to address the structural deficiencies of the bridges. The project also affords the opportunity to improve the non-standard roadway geometry of Route 28A adjacent the bridges. A sharp crest curve over the RR Bridge limits driver sight distance, and a horizontal curve in the roadway between the two bridges also contributes to reduced sight distance.

The project will be coordinated with Ulster County's proposed repurposing of a portion of the former Ulster & Delaware Railroad corridor as a recreational rail trail. NYCDEP has signed an Intergovernmental Agreement with Ulster County regarding cooperative efforts for development of the rail trail. As part of the Agreement, the NYCDEP will provide for a pedestrian/bicycle path along Route 28A over the project bridges to connect to the proposed rail trail, as well as trail head parking and facilities.

Section 3 Statement of Project Need

This project is being undertaken to address the need to provide cost-effective, long-term solutions to the current structurally deficient and functionally obsolete condition of both the Rt. 28A bridge over the Esopus Creek (the 5-arches bridge) and the Rt. 28A bridge over the Railroad.

Section 4 Existing Conditions

4.1 Existing Land Use

The land within and immediately adjacent to the project limits is predominantly undeveloped rural property within the NYCDEP watershed. There are privately owned, residential properties situated to the north of Route 28A, west of the railroad corridor. Property to the south of Route 28A and to the east of the railroad corridor is owned and maintained by NYCDEP.

Beyond the immediate project limits, the land in the project area is also within the NYCDEP watershed. The Ashokan Reservoir and its adjacent NYCDEP-owned lands are located south of Route 28A. Land to the north and west of Route 28A is both undeveloped and developed private property. Land to the north and east of the project area includes the hamlet of Boiceville, which is the most densely developed locale in the project area.

In addition, four linear corridors exist within or near the project limits. The Esopus Creek flows north to south, through property owned by NYCDEP. The former Ulster & Delaware Railroad corridor is located west of the Esopus and runs roughly parallel to the creek. The railroad corridor is currently unused within the project area. The corridor is in use several miles north of the project area, where the Catskill Mountain Railroad operates sight-seeing rail service. NY State Route 28 is located east of and generally parallel to the Esopus Creek. Route 28A forms an east-west corridor that is situated approximately perpendicular to the creek and the railroad corridor, curving to the south at the west end of the project limits.

4.2 Existing System/Facilities Description

This project is located in the New York City West of Hudson Watershed approximately one mile north of the Ashokan Reservoir.

The facilities addressed by this project are two consecutive Route 28A roadway bridges, one crossing over the Esopus Creek and the other crossing over the former Ulster & Delaware Railroad corridor. These bridges were built as part of the original construction of Route 28A. Route 28A was constructed in 1913 as part of the original Catskill Water Project, to accommodate traffic around the newly-built Ashokan Reservoir.

The bridges are a link in the roadway system consisting of Routes 28A and 28 that provides a ring road around the reservoir. The project bridges are located near the terminus of Route 28A at Route 28, just south of the hamlet of Boiceville.

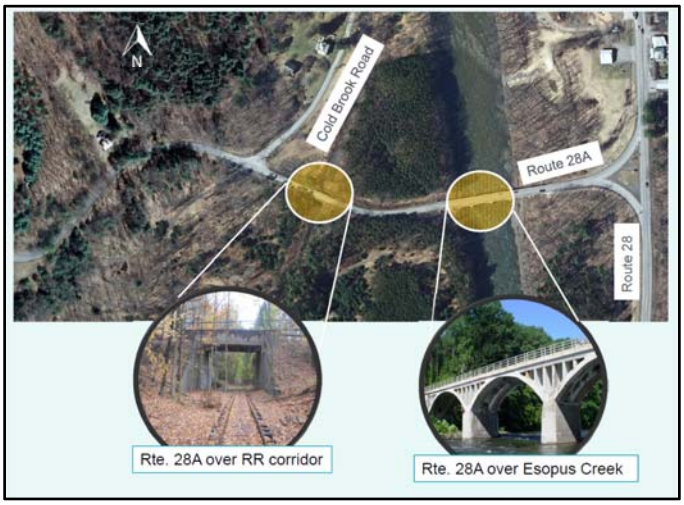


Figure 2 – Project bridges

The terrain immediately adjacent to both bridges is relatively low-lying and level on both the banks of the Esopus Creek. The general overall area terrain beyond the creek valley is mountainous and forested. The west approach of Route 28A to the bridges is relatively steep and winding as it approaches the area near the creek.

The Esopus Creek Bridge is a five-span reinforced concrete open-spandrel arch structure carrying two lanes of Route 28A traffic. The main spans are flanked at each end with four additional, enclosed abutment spans, for a total bridge length of 454’-6”. The bridge is oriented perpendicular to the creek, spanning both the creek and its banks, providing a series of bridge openings that accommodates heavy spring thaw and storm stream flows. Since the original construction of the bridge in 1913, some rehabilitation work has been done. In 1975, a new concrete bridge

deck and metal bridge railing were installed. In 1987, the entire bridge deck was overlaid with a new two-inch thick concrete overlay. In 2013, the City performed priority repairs to the bridge. These repairs included bridge deck joint replacement and localized concrete patching at various locations.

The Railroad Bridge is a 39-foot long single span structure carrying two lanes of Route 28A over a currently unused segment of the railroad corridor. It is located about 500 feet west of the Esopus Creek Bridge. The bridge is located on a sharp vertical crest curve. The west approach roadway to the bridge rises sharply on built-up embankments in order to provide vertical under clearance over the railroad corridor. Driver sight distance is limited at this location due to the vertical crest curve. There is a horizontal curve in the roadway east of the bridge that also limits sight distance. There has been no rehabilitation work done on the bridge since its original construction.

4.3 Conditions Assessment of Existing Facilities

Esopus Creek Bridge: The 2013 Biennial Inspection Report, performed on 11/11/13, assigned the bridge a General Recommendation Rating of 3.984. This rating is used to shade between minor and serious deterioration and indicates that the bridge condition is progressing to the point where it will no longer be functioning as originally designed in the near term. Widespread deterioration of the structure's primary load carrying members are evidenced by spalls in the concrete with exposed and rusted reinforcing steel on the arches, transverse floorbeams and spandrel walls. Additionally, cracking and spalling of concrete are evident on the piers as well. This condition is caused by long-term water infiltration resulting in the corrosion of rebar and subsequent delamination of the concrete.

During a previous biennial inspection performed in December 2012, a yellow structural flag was issued. The flag was located at one of the Span 5 floorbeams (see Photo 3) and was attributed to a full-length spall and fully exposed and debonded rebar along the bottom. The City undertook an interim repair contract that addressed this condition; the flag was subsequently removed by NYSDOT on 4/16/13. Although the bridge is not load posted, access is restricted to legal loads only. Vehicles operating with overweight permits ("R"-permits) are restricted from crossing the bridge. It should be noted that as the deterioration of this structure continues and accelerates, a load posting may be deemed necessary in the near future.

Photo 3 – Esopus Creek Bridge, yellow flag condition

An underwater diving inspection was performed in 2012. Hairline cracks and spalling of concrete were noted throughout at all pier locations. Scour holes were noted primarily at Pier 6, however no significant undermining was noted.

Route 28A Railroad Bridge: A General Recommendation Rating of 4.218 was assigned for this bridge in the 2014 Biennial Inspection Report, dated 10/8/14. Deterioration in the form of spalled and cracked concrete is evident on the primary load-carrying girders and floorbeam elements throughout. Additionally, the underside of deck and bridge seats and pedestals are spalled with loose concrete. At the north approach to the bridge, there is settlement of the roadway and the pavement is in poor condition. Numerous layers of asphalt paving over the life of the bridge have buried the bridge curbs. There have been no structural nor safety flags issued for the bridge. The bridge is not load posted. As the deterioration of this structure continues and accelerates, a load posting may be deemed necessary in the near future.

4.4 Existing System/Facilities Features and Deficiencies

4.4.1 Property and Right-of-Way

The two project bridges are located within the Route 28A roadway right-of-way. The bridges are owned and maintained by NYCDEP.

The former Ulster & Delaware Railroad corridor is owned by Ulster County. It is not currently in active use within the project area. Route 28 is a NY state-owned and maintained roadway. Cold Brook Road, which intersects with Route 28A west of the railroad corridor, is owned and maintained by the Town of Olive.

The property within and adjacent to the project is primarily rural, undeveloped land. Property south of Route 28A and west of Route 28 is owned by NYCDEP, shown shaded in green on the map in Figure 3. The green-shaded property north of Route 28A located between the RR corridor and Route 28 is also NYCDEP property. There are private residential properties north of Route 28A and west of the RR corridor, shaded in yellow on the map in Figure 3.

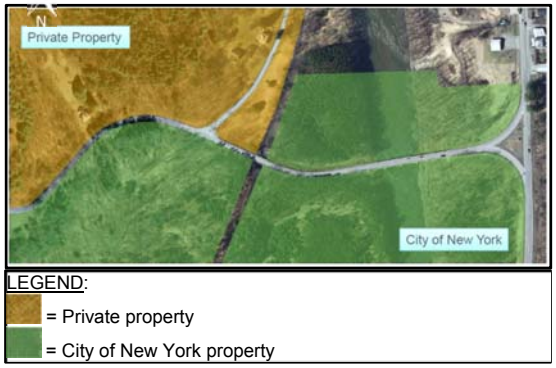


Figure 3 – Property Boundaries

4.4.2 Structures

The Esopus Creek Bridge is a five-span, reinforced concrete arch structure carrying two lanes of Route 28A traffic over the creek. The five main spans, each 75 feet long, are flanked at each end with approach spans. The west approach spans consist of four spans; there are also four east approach spans. Taken together, these thirteen spans comprise a total bridge length of 454’-6”.

The bridge is oriented perpendicular to the creek, spanning the creek itself and beyond its banks, resulting in a long bridge opening that accommodates heavy spring thaw and storm stream flows.

The existing bridge carries two, eleven-foot wide travel lanes between the curb lines. The center of the roadway is striped with a double yellow line. There are no shoulders on the bridges. Three-rail aluminum bridge railing set on safety curbs exists on both sides of the bridge for its full length.

Photo 4 – Esopus Creek Bridge

The structural configuration of the five main spans consists of two primary load-carrying arches and secondary transverse floorbeams. The arches are of an open spandrel type with intermediate arch columns. All of the structural members are made of reinforced concrete. There is a reinforced concrete deck on top of the structural framing.

The five main spans of the bridge are supported on four solid, unreinforced concrete piers on spread footings. These piers are located in the creek and on its banks. Each end of the five- span arch segment of the bridge, adjacent to the approach spans, is supported on a buried, mass concrete foundation. This foundation is also shared by the approach span support columns.

The structural configuration of the approach spans at either end of the bridge consists of reinforced concrete slabs and transverse floorbeams supported on reinforced concrete columns. The end spans are supported on buried, mass concrete foundations. Each of the approach spans is approximately eight feet long. These spans are enclosed vertical curtain walls, forming an enclosed, cellular-type abutment.

The Esopus Creek Bridge does not carry any utilities.

The Esopus Creek Bridge was built in 1913, under the City of New York's Board of Water Supply Contract No. 49, dated 1911 and titled "Ashokan Reservoir, Substituted New Highways, Bridges for West Basin, Located in the Town of Olive". Some bridge rehabilitation work has been done since the original construction. In 1975, a new concrete bridge deck was installed and concrete balustrades were replaced with aluminum bridge railing. In 1987, the bridge deck was overlaid with a new two-inch thick concrete overlay. In 2013, the City performed priority repairs to the bridge. These repairs included bridge deck joint replacement and localized concrete patching at various locations on the substructure and superstructure.

A 1996 historic resource evaluation resulted in a New York State Historic Preservation Office (SHPO) determination that the Esopus Creek Bridge is not eligible for listing in the New York State and National Registers of Historic Places.

Photo 5 – Railroad Bridge

The Railroad Bridge is a 39-foot long, single span reinforced concrete structure carrying two lanes of Route 28A over a currently unused segment of the former Ulster and Delaware Railroad corridor. It is located about 500 feet west of the Esopus Creek Bridge.

The bridge is oriented perpendicular to the railroad corridor and is located on a sharp vertical crest curve. The west approach roadway to the bridge is on a similar elevation as the railroad bed then rises sharply on built-up embankments in order to provide a minimum vertical clearance of 22 feet over the railroad corridor. Driver sight distance is limited at this location due to the vertical crest curve. There is also a horizontal curve in the roadway east of the bridge that also limits sight distance.

The existing bridge carries two, eleven-foot wide travel lanes between the curb lines. The center of the roadway is striped with a double yellow line. There are no shoulders on the bridge. The two main structural members of the bridge are through-girders which extend above the bridge deck and serve as concrete parapets along the full length of the bridge.

The structural configuration of the bridge consists of two primary load-carrying through-girders and secondary transverse floorbeams. All of the structural members are made of reinforced concrete. There is a reinforced concrete deck on top of the structural framing. The deck is paved with several layers of asphalt and the curbs are no longer visible.

The bridge framing is supported on unreinforced, mass concrete gravity abutments. Concrete wingwalls parallel to the railroad corridor extend both north and south of each abutment.

The Railroad Bridge does not carry any utilities.

The Railroad Bridge was built in 1913 under the same City of New York Board of Water Supply Contract No. 49 as the Esopus Creek Bridge. There has been no rehabilitation work other than roadway repaving done on the bridge since its original construction.

A 1996 historic resource evaluation resulted in a New York State Historic Preservation Office (SHPO) determination that the Railroad Bridge is not eligible for listing in the New York State and National Registers of Historic Places.

4.4.3 Roadway and Traffic Safety

The existing Route 28A roadway is a two-lane roadway with one lane in each direction. The roadway over each bridge is 22 feet wide, carrying two 11-foot wide lanes and no shoulders. There are no pedestrian accommodations on the bridges. The Esopus Creek Bridge has metal 3-rail bridge railing on either side of the bridge roadway. The RR Bridge has concrete parapets.

The bridge approach roadways are paved with asphalt and have minimal paved shoulders. There is a box-beam guiderail on both sides of the approach roadway between Route 28 and the Esopus Creek Bridge. There is a corrugated beam guiderail on both sides of the roadway between the two bridges and west of the RR Bridge to the intersection with Cold Brook Road.

Photo 6 – Crest curve over RR Bridge

The profile of Route 28A is at grade west of the RR corridor and rises on an embankment to a sharp vertical crest curve over the RR Bridge. East of the RR Bridge, the roadway is carried on embankments until it meets the Esopus Creek Bridge. The horizontal alignment of the roadway is curved at the west end of the project area, then tangent as it approaches and crosses the RR Bridge. East of the RR Bridge, there is a horizontal curve before the roadway straightens into a tangent run over the Esopus Creek Bridge and to the slip ramps at the intersection with Route 28.

Photo 7 – Horizontal curve, Route 28A looking east

The existing intersection between Route 28A and Route 28 has a Y-type configuration. A slip ramp extends from Route 28A to Route 28 south of the intersection, forming one leg of the "Y". The second slip ramp extends from Route 28A to Route 28 north of the intersection. These slip ramps are stop sign controlled.

Historic traffic volume data indicates that the traffic volumes in the project area are relatively low. This was confirmed by traffic volume counts and turning movement counts for Route 28A and Route 28 in the project area that were conducted in April 2015 as part of the traffic study performed for this project.

Photo 8 – Route 28A slip ramps to Route 28

Accident histories for Route 28A and Route 28 for a 36-month period between March 31, 2012 and April 1, 2015 were obtained via a Freedom of Information Law (FOIL) Request to the NYSDOT's Records Access Officer. A total of eight accidents occurred in the project area during this time, three of them in or near the Route 28A/Route 28 intersection. Analysis of the accident data indicates that the three intersection accidents all involved a vehicle making a left turn. Of the five remaining accidents, three involved loss of driver control, one was a head-on collision between opposing traffic, and one was a deer strike.

4.4.4 Bridge Crossing – Esopus Creek

The Esopus Creek is part of the New York City drinking water supply system. The waters of the creek discharge directly into the Ashokan Reservoir about one mile south of the Route 28A bridge. The Ashokan reservoir was created by damming the creek. The portion of the creek upstream of the reservoir is commonly referred to as the Upper Esopus Creek. From its source on Slide Mountain, the Esopus Creek flows approximately 26 miles to the Hudson River.

Many tributaries feed the Esopus along its length. Its flow is also supplemented by waters released from NYCDEP's Schoharie Reservoir via the Shandaken tunnel, which empties into the creek about ten miles north of the bridge.

The Esopus Creek in the vicinity of the project bridges is classified as a NY State Department of Conservation (NYSDEC) Class A (TS) stream. Classification of A is assigned to waters used as a source of drinking water. A standard of (TS) indicates that the waterway may support trout spawning (TS).

The Esopus is a relatively shallow creek approximately 150 feet wide in the immediate vicinity of the bridge. The level of water can rise and spread substantially during seasonal thaws and storm flows. In the vicinity of Route 28A, there is a fairly wide, level flood plain bordered by the hamlet of Boiceville to the east and a natural valley wall on the west.

The USGS stream gauge located just north of the bridge on the west bank of the creek has recorded a flood stage as high as 23 feet during Hurricane Irene in 2011. With the bridge roadway approximately 30 feet above the streambed at center span, the maximum recorded flood stage did not overtop the Esopus Creek Bridge during that storm event. Inundation of buildings in Boiceville did occur during Hurricane Irene and other, lesser magnitude flooding events. The Town of Olive recently conducted a Flood Mitigation Study, to consider potential measures that would reduce or eliminate future flood inundation in the Boiceville area.

4.4.5 Bridge Crossing – RR Corridor

The former Ulster & Delaware Railroad is situated west of and parallel to the Esopus Creek in the vicinity of Route 28A. There is an existing single track along the corridor below Route 28A, although it is not currently in use. The existing railroad bed is on a straight horizontal alignment and a fairly level vertical alignment near Route 28A.

Currently, the entire length of the railroad corridor within Ulster County is leased (until May 2016) from the County by the Catskill Mountain Railroad (CMRR). The CMRR operates a sight-seeing, tourist rail service from the Mt. Tremper Station, which is located approximately four miles north of Route 28A. The segment of the tourist rail service north of Mt. Tremper to Phoenicia has not resumed since track damage sustained during Hurricane Irene in 2011. The sight-seeing rail service is currently active only between Mt. Tremper and a point approximately 2.5 miles south of Mt. Tremper. The active rail service area ends about 1.5 miles north of Rt. 28A.

The railroad corridor also extends south from the project area through NYCDEP-owned property to the north end of the Ashokan Reservoir. A trestle bridge originally carried the railroad corridor over the Esopus Creek where it empties into the reservoir. This trestle bridge was damaged during Hurricane Irene and several spans collapsed. At this time it appears that Ulster County does intend to rebuild the bridge, however no work has been done to date. Further south, NYCDEP replaced the original Reservoir Road Bridge over the railroad corridor with a new bridge in 2009.

Based on the conditions encountered during replacement of the Reservior Road Bridge over the railroad corridor, there is the potential for the presence of contaminated materials in the soil of the railroad bed. Testing for contaminants was done at the railroad bed below Route 28A as part of CAT-177.

4.4.6 Bureau of Water Supply

The project bridges are adjacent to the north edge of the NYCDEP Ashokan Reservoir facility and property. There is a NYCDEP water quality sampling station located on the west bank of the Esopus Creek, north of the Route 28A bridge (see Figure 4, on next page). Access to the sampling station from NYCDEP property is via an unpaved access road that meets Route 28A in the vicinity of the Cold Brook Road intersection (see Figure 4). Bureau of Water Supply (BWS) personnel visit this sampling station on a daily basis.

Photo 9 – NYCDEP water sampling station

The access road is reached from the south side of Route 28A, west of the RR Bridge, where there is a parking area located approximately opposite of Cold Brook Road. The access road is gated. The access road runs south from Route 28A then turns east toward the Esopus Creek. The road then turns north and runs roughly parallel to the creek along its west bank, passing under the Route 28A bridge to the sampling station.

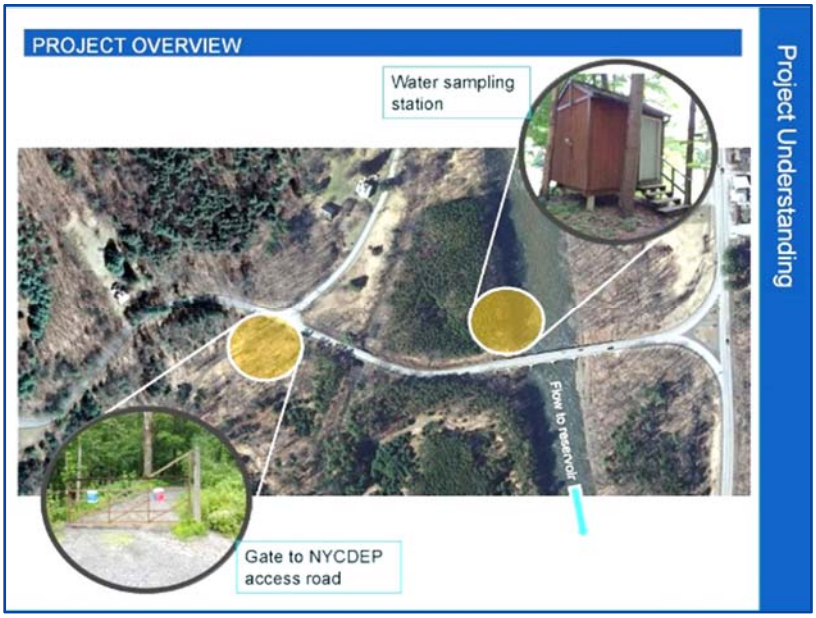


Figure 4 – Bureau of Water Supply facilities

4.5 Existing Site Environmental Health and Safety Concerns

The existing structures are in an advanced state of deterioration. They do not pose an immediate health and safety concern to the traveling public. However the condition of the bridges warrants corrective action to maintain structural capacity for long-term access to vehicular traffic. The existing facilities also do not meet current NYSDOT geometric and structural design standards.

An environmental and safety concern that exists currently is due to the potential for falling concrete from the deteriorated undersides of both bridges.

A hazardous materials survey of the existing Esopus Creek and RR Bridges was performed in 2014-2015. The results of the survey indicate that none of the sampled suspect materials were asbestos-containing. A potential for asbestos-containing materials is possible at the pier footings, which are buried and not accessible for sampling and testing. A small quantity of lead paint was found on the concrete parapet of the RR Bridge.

Testing for contaminants in the soil of the railroad bed below the RR Bridge was performed in 2004 as part of the CAT-177 Reservoir Road Bridge replacement over the railroad corridor. Trace amounts of contaminants were identified.

Section 5 Future Conditions

5.1 Land Use Planning

There are no known planned changes to land uses of adjacent properties near the project. The County of Ulster is in the process of designing a rail trail for a segment of the former Ulster & Delaware Railroad corridor that crosses NYCDEP property south of Route 28A. The rail trail will cross under the Route 28A Bridge.

Also, at this time there are no major developments or proposed land use changes for the wider Route 28 corridor area.

5.2 Demographic/Population Forecasts

Historic data from the US Census Bureau indicated a 3% population increase in all of Ulster County from 2010 to 2013. The Cornell University Program on Applied Demographics proposes a more modest or even negative population growth factor for Ulster County as a whole, depending on the forecast date.

Based on the nature of the current land use in the area of the project, no significant population increases are anticipated. The NYCDEP-owned lands adjacent to the Ashokan Reservoir will not be developed. Significant development of private properties in the project area is not anticipated, due to the rural, residential character of the area and current zoning rules.

5.3 Forecasted System/Facility Needs

5.3.1 Property and Right-of-Way

Public landowners in the project area include the Town of Olive, Ulster County, NYSDOT and NYCDEP. The project bridges and adjacent properties are located within the Town of Olive borders. The former Ulster and Delaware Railroad corridor is owned by Ulster County. Route 28 is within the NYSDOT highway right-of-way. No change is anticipated in the future ownership or right-of way boundaries of any of these public lands.

The privately owned parcels north of Route 28A and west of the RR Bridge may change ownership in the future. However, significant changes to boundaries are not anticipated.

The potential realignment of the bridge approach roadway as part of this project could require changes to the private driveways north of Route 28A at the west end of the project. Such changes may include the extension of driveways to a realigned Route 28A. Alternately, a reduction in driveway lengths with associated property acquisition could be required.

5.3.2 Structures

There will continue to be a need for a bridge to carry Route 28A over the Esopus Creek for the foreseeable future. The bridge crossing must have sufficient structural capacity to carry vehicular traffic and is necessary to provide for continuity of Route 28A across the creek.

There will also continue to be a need for a crossing at the railroad corridor to provide for continuity of Route 28A. The possible options for a crossing at the railroad corridor are a separated grade crossing or an at-grade crossing. A separated grade crossing would consist of a bridge or culvert with sufficient structural capacity to carry vehicular traffic and with sufficient clearance to accommodate the corridor below. An at-grade crossing would consist of the Route 28A roadway and railroad corridor intersecting at the same ground elevation. An at-grade crossing is technically possible and would require traffic controls appropriate to the current use of both corridors (e.g. roadway, recreational trail, railroad).

Design of new bridge structures must conform to the requirements of the current NYSDOT LRFD Bridge Design Specifications.

5.3.3 Roadway and Traffic Safety

Based on the modest demographic growth forecast for the project area, it is anticipated that traffic volume increases will be gradual and moderate. There is no expectation that the roadway capacities will need to be expanded to accommodate predicted future traffic volumes. Therefore roadway widening of Route 28A is not anticipated.

There is the potential for improvements to traffic safety, such as the provision of dedicated left-turn and/or right-turn lanes at the intersection of Routes 28A and Route 28.

Current NYSDOT Highway Design Manual roadway design criteria that apply to Route 28A are summarized in the table below:

Design Element	NYSDOT Standard Criteria
Design Speed	40 mph
Lane Width	11 ft. min.
Shoulder Width	3 ft. min. to 8 ft. max.
Lateral clearance	1.5 ft. (0 w/barrier)
Vertical clearance	22 ft. min. over RR 19 ft. min. (CMRR) 15 ft. min. over rail trail
Grade	8% max.
Horizontal Curvature	444 ft. min. w/super`e'
Superelevation	8% max.
Stopping Sight Distance	305 ft. min.

Table 1 – Highway Design Criteria

5.3.4 Bridge Crossing – Esopus Creek

It is anticipated that in the future the Esopus Creek will continue to flow into the Ashokan Reservoir as part of the New York City water supply system. Historically, the creek has flowed within its banks without any significant shifting of the creek or its banks. Therefore it is anticipated that the creek will remain in its current location within the project limits.

The Town of Olive recently conducted a Flood Mitigation Study to investigate potential mitigation strategies to alleviate the historic inundation of Esopus Creek flood waters experienced by the buildings and properties in the hamlet of Boiceville upstream of the bridge. As a result of this study, recommended potential future flood mitigation measures include changes to the floodplain in the form of construction of flood benches on the stream banks upstream of the existing bridge, as well as construction of earthen berms. The Town, however, does not intend to implement these flood mitigation measures at this time.

Increased frequency and intensity of recent storm events indicate that increases to the storm flows experienced historically at this location should be anticipated in the future.

5.3.5 Bridge Crossing – RR Corridor

It is anticipated that there will continue to be a need for a crossing at the RR corridor in the future. At the present time, the former Ulster and Delaware Railroad corridor in the project area is not in active use. Ulster County is currently planning to convert a segment of the corridor from Route 28A south to the reservoir to recreational trail use. NYCDEP signed an Intergovernmental Agreement (IGA) with Ulster County (June 2015) describing coordination efforts for the proposed rail trail, its facilities and access to Route 28A. In addition, Ulster County Resolution No. 488 (December 2015) states that the segment of the corridor from Basin Road to Route 28A in Boiceville, which includes all of the Ulster and Delaware Railroad corridor within NYCDEP lands, will be converted to a public recreational trail only with no provisions for future rail use.

5.3.6 Bureau of Water Supply

Future BWS operation of the Ashokan Reservoir facility is anticipated to continue. Currently there are no known facility expansion plans that would impact the project bridges or Route 28A.

In the project area, continued use of the existing water quality sampling station on the west bank of the creek north of the Esopus Creek Bridge is anticipated. The sampling station may require temporary or permanent relocation as part of this project to maintain daily access throughout construction activities. Continued future use of the existing access road through NYCDEP property south of Route 28A is also anticipated.

In addition, NYCDEP personnel will require access to the undersides of the Esopus Creek and RR Bridges for in-house bridge inspection and maintenance operations.

Section 6 Project Goals

6.1 Capacity

The overall objective of this project is to provide a system/facility with the stated capacity in each of the following categories:

- *Structural capacity*: Bridges that meet current NYSDOT standard bridge design criteria, including design live loads and seismic design requirements.
- *Roadway geometry*: Bridge and approach roadways that meet current NYSDOT standards for roadway widths, shoulders and other roadway design criteria for two lanes of vehicular traffic.
- *Bicycle and pedestrian accommodation*: Accommodation for bicycles and pedestrians on the bridges and Route 28A that meet NYCDEP obligations in its Intergovernmental Agreement (IGA) with Ulster County. Also includes provision of trailheads, as well as bicycle and pedestrian access from Route 28A to the proposed rail trail.

6.2 Performance

Project goals related to system/facility performance both during implementation of this project and after its completion, include the following:

- *Elimination of structural deficiencies*: Eliminate currently reported structural deficiencies of the two project bridges to improve their condition and condition ratings.
- *Low-Maintenance*: Incorporate low-maintenance features to reduce required future maintenance work on the bridges.

- *Service life*: Increase the service life of the crossings to a minimum of 75-years.
- *Environmental impacts*: Minimize impacts to existing natural resources and cultural resources:
  - Minimize impacts to ecology and wildlife.
  - Minimize impacts to water quality, water resources and Bureau of Water Supply.
  - Minimize impacts to stormwater management.
  - Minimize impacts to Esopus Creek floodplain.
  - Coordinate with the New York State Historic Preservation Office (SHPO) and the NYC Public Design Commission (PDC) to minimize historic and archaeological impacts.
- *Hydraulic performance*: Maintain or improve hydraulic performance of the crossing over the Esopus Creek.
- *Community impacts*: Minimize impacts to the surrounding community:
  - Provide adequate clearances for the former Ulster & Delaware Railroad corridor, as per NYCDEP commitments in the Intergovernmental Agreement (IGA) with Ulster County.
  - Maintain traffic along Route 28A during construction as opposed to utilizing an off-site detour or staged construction.
  - Minimize duration of any construction by use of Accelerated Bridge Construction (ABC) techniques where practical.
  - Provide a safe and effective intersection configuration where Route 28A intersects with Route 28 at the east end of the project.
  - Avoid encroaching on private property.
- *Cost*: Provide a cost-effective solution that considers both initial and future costs.

6.3 Sustainability

Preliminary sustainability goals for the project, based on key performance indicators (KPI) matrix include:

- *Emissions*: Reduce emissions during system/facility construction and operation.
- *Energy*: Reduce system/facility energy use during construction and operation.
- *Climate Change*: Address impact of increased future storms and flood levels on system/facility operations.
- *Waste Reduction*: Reduce generation and disposal of waste.
- *Water Conservation*: Conserve water during system/facility construction and during operation.
- *Recycled Material*: Consider use of recycled materials.
- *Stormwater Management*: Provide for stormwater management.
- *Landscaping*: Provide sustainable landscaping.

Section 7 Description and Assessment of Alternatives

7.1 Review of Evaluation Criteria

Feasible alternatives, described below, will be evaluated based on the following criteria:

Criteria	Commentary
Performance	Elimination of current structural deficiencies Improvement of non-standard roadway features Improvement of non-conforming intersection (Rt. 28/ Rt. 28A) 75-year service life (bridges)
Maintenance	Low-maintenance (bridges) High-durability (bridges)
Health and Safety	Current NYSDOT bridge standards Current NYSDOT roadway standards
Operations	Pedestrian/bicycle accommodation on bridges
Environmental	Impact to natural resources Historic/archaeological/aesthetic impact – PDC/SHPO approval
Community	Traffic impacts Backwater/flooding impacts Impacts to Private Property Construction Duration
Sustainability	Incorporation of sustainability measures
Cost	Initial cost Life cycle cost

Table 2 - Evaluation Criteria

7.2 Preliminary Description of Roadway Alignment Alternatives

Several options for the proposed alignment of Route 28A have been identified as part of the development of bridge replacement alternatives including replacement along the existing alignment (in-line) as well as a parallel alignment (off-line). Replacing the bridges in-line requires either full bridge closure with off-site detour or staged construction with temporary signals to maintain traffic. Bridge closure results in significant traffic impacts, while staged construction poses challenges due to the existing structure type. Replacing the bridges on an off-line alignment, parallel to the existing, is also an option.

Preliminary feasible alternatives for the Route 28A roadway alignment include the following:

- In-Line Roadway Alignment
- Off-Line, North Roadway Alignment

- Off-Line, South Roadway Alignment

***In-Line Roadway Alignment*:** Replacement of the bridges in place will maintain the current alignment of Route 28A. Construction may be done in one stage with a full roadway closure and off-site detour for the duration of the construction. However, an off-site detour will be approximately 20-miles in length posing a significant impact to the travelling public and local community.

Traditionally, bridge replacements can also be performed using staged construction techniques where traffic is maintained on half of the bridge while the other half is reconstructed. However, the existing structure type and configuration of these two bridges do not lend themselves to staged construction as an option. The Esopus Creek Bridge consists of two primary arched members, one at each fascia of the bridge, with transverse floorbeams spanning between the arches. The RR Bridge consists of two through-girders with transverse floorbeams. With only two primary load-carrying members, both of these structural systems are non-redundant and are not good candidates for staged construction. Removal of one primary member would render the bridge unstable thus requiring significant temporary support, including primary support systems and temporary foundations to be constructed for each stage, for each bridge. Additionally, the relatively poor condition of the concrete members makes them poor candidates for staged construction techniques.

***Off-Line, North Roadway Alignment*:** Alternately, the replacement bridges can be built on an off-line alignment, adjacent and parallel to the existing bridges and Route 28A roadway. Two lanes of traffic can be maintained on the existing bridges until it can be diverted onto the newly-built replacement bridges. Constructing the bridges off-line will require re-aligning the Route 28A approaches to the new bridges and the portion of roadway between the bridges. This allows for improvement of the vertical and horizontal geometry of the roadway to meet current NYSDOT standards. It will also require reconstruction of the intersections of Route 28A with Cold Brook Road and with Route 28.

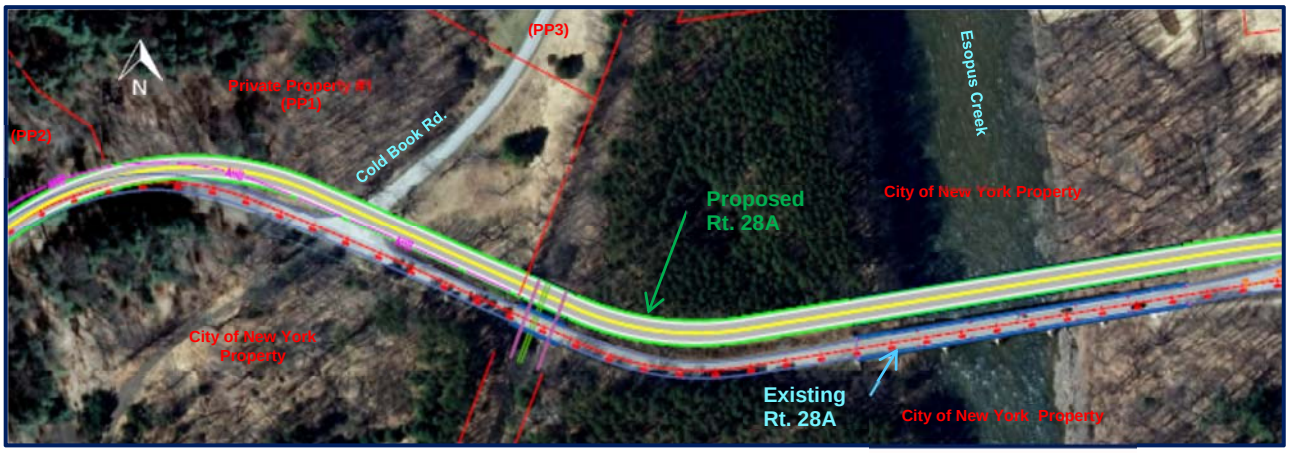


Figure 5 – Proposed Northern Alignment

In this alternative, the re-aligned roadway and replacement bridges will be located north of the existing Route 28A (see Figure 5). This alignment will require approximately 1,800 feet of approach roadway work. The land north of the existing roadway is primarily low-lying, vegetated and undeveloped. At the west end of the project, the topography is higher and the existing roadway curves to the south. In order to meet current standards for roadway geometry, the vertical profile of the re-aligned Route 28A roadway will require a combination of cut and fill sections.

The property north of the existing roadway consists of a large area of land owned by NYCDEP as well as several smaller plots near the west end of the project area that are privately owned. There are private driveways extending north from Route 28A at the west end of the project area. The proposed northern alignment will necessitate right-of-

way acquisitions in the form of a combination of fee takings, permanent and temporary easements from the private properties.

Under this alternative, the existing bridges and roadway will be demolished and removed. The land in the footprint of the existing roadway will be regraded and restored to a natural state.

***Off-Line, South Roadway Alignment*:** In this alternative, the re-aligned roadway and replacement bridges will be located south of the existing bridges and roadway. The land south of the existing roadway is primarily low-lying, vegetated and undeveloped. The property south of the existing roadway within the project area is owned entirely by NYCDEP. At the west end of the project, the existing roadway curves to the south. The former Ulster & Delaware Railroad corridor that passes below Route 28A is owned by Ulster County. There is a parking area and entrance to an unpaved NYCDEP access road located off of Route 28A just west of the RR Bridge. There are overhead utility lines located on the south side of the existing roadway extending from the west end of the project area to the RR Bridge. The utility lines include Time Warner communication lines and Central Hudson electric lines.

Under this alternative, the existing bridges and roadway will be demolished and removed. The land in the footprint of the existing roadway will be regraded and restored to a natural state.

Figure 6 – Proposed Southern Alignment

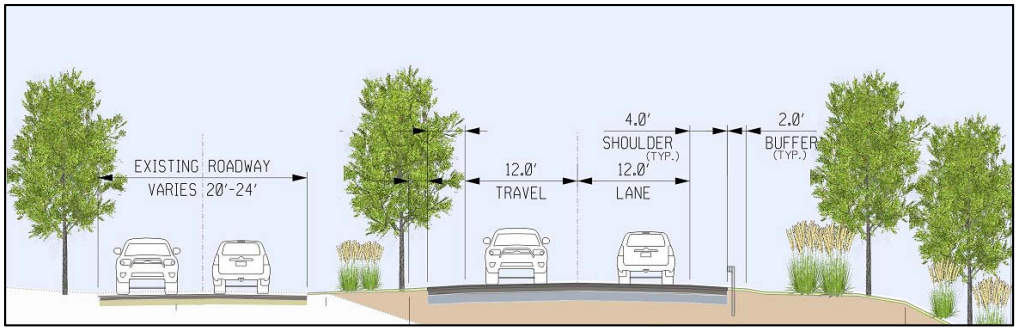


Figure 7 – Section View of Southern Alignment

7.3 Preliminary Description of Intersection Alternatives

The intersection of Route 28A with Route 28 is located about 400 feet east of the Route 28A bridge over the Esopus Creek. The existing 3-way intersection has a Y-type configuration, with two slip ramps extending from Route 28A to Route 28. The intersection is currently stop signed controlled on Route 28A, with uncontrolled through movement on Route 28. This Y-type configuration is considered an outdated intersection type and is no longer used by NYSDOT.

Given the proximity of this intersection to the east end of the Esopus Creek Bridge, it is likely that the bridge approach roadway work will necessitate the realignment of this intersection. As this realignment will require reconstruction of a majority of the existing intersection, the entire intersection will need to be updated to meet current NYSDOT roadway and intersection design standards. Intersection reconstruction will thus be a part of this project.

A traffic study was performed to evaluate the need for traffic control measures at the Route 28A/ Route 28 intersection. A determination on whether use of traffic signals or stop signs at an intersection are warranted is based on analyses of the volumes of traffic and the accident histories on the intersecting roadways. The historic traffic volumes on all three legs of this intersection are relatively low. A traffic counting program was undertaken in April 2015 to determine current traffic volumes and turning movement data. Accident data for the past three-year period were also obtained for the project corridor. A detailed traffic analysis was performed using current traffic volumes, projected future volumes and the accident history to evaluate the need for a traffic signal control, stop sign control, or installation of a traffic roundabout at this intersection to minimize future traffic delay.

The traffic study also addressed the possibility of providing dedicated left and right-turn lanes at the intersection, as requested by emergency services personnel at the Public Information Meeting held at the Town of Olive in December 2014. The study concluded that while turning volumes alone do not warrant exclusive turn lanes, providing such lanes would help to mitigate the high accident rate at this location and further increase safety.

The results of the traffic study were presented in a Traffic Report dated December 3, 2015. The Report indicated that neither traffic signalization nor a roundabout are warranted at this intersection. A T-type intersection, with stop sign control on Route 28A is recommended, as well as provision of dedicated turn lanes on all approaches. The DEP requested and received concurrence from NYSDOT Region 8 in February 2016 for a T-type, stop sign controlled intersection with dedicated turn lanes at the Route 28A/ Route 28 intersection.

7.4 Preliminary Description of Bikeway Alternatives

NYCDEP has made a commitment to accommodate pedestrians and bicyclists on and between the project bridges along Route 28A and to provide a connection from that shared-use path to the proposed rail trail along the former Ulster & Delaware Railroad corridor. These commitments are described in the Intergovernmental Agreement (IGA) between NYCDEP and Ulster County, the owner of the railroad corridor.

The eastern limit of the pedestrian and bicycle accommodations included in this project is at the east end of Route 28A where it meets Route 28. The western limit is near the RR Bridge, where a connection is to be provided from the path over the bridge to the rail trail below. The proposed rail trail will be constructed along the railroad corridor south of Route 28A under CAT-459. Its northern terminus is approximately at the north fascia of the RR Bridge.

Several options have been identified for pedestrian and bicycle accommodations on Route 28A within this project. Each of these options also includes a connection to the rail trail and provision of trailheads. Dedicated or shared-use accommodations are both feasible. Shared-use accommodations allow both pedestrians and bicyclists to use the same facility. Dedicated bicycle accommodations include bicycle lanes or bike paths and require that separate accommodation be made for pedestrians.

Preliminary feasible alternatives for the Route 28A bikeway include the following:

- Shared-Use Path on North Side of Route 28A
- Shared-Use Path on South Side of Route 28A
- Dedicated Bicycle Facility and Dedicated Pedestrian Facility

***Shared-use Path on North Side**:* In this alternative, a shared-use path is located on the north side of Route 28A and the project bridges. This path allows for bi-directional use by both pedestrians and bicycles, and a physical separation or distance offset from the roadway is required. On the bridges, a physical barrier is provided to separate the path from roadway traffic. Off of the bridges, the path can curve away from the roadway, providing the required distance offset without the need for a physical barrier.

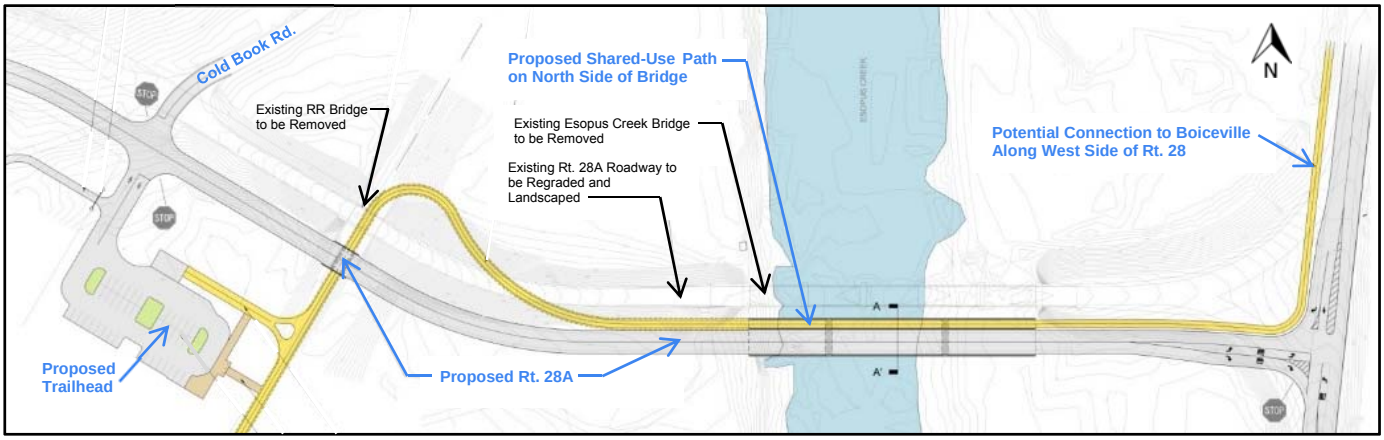


Figure 8 – Shared-Use Path on North Side

The eastern terminus of the path is near the intersection of Route 28A and Route 28. The location of the path on the north side of Route 28A allows for potential future extension of the path and connectivity into the hamlet of Boiceville without the need for any pedestrian/bicycle roadway crossings. NYSDOT generally requires a trailhead for paths that terminate at state roadways; therefore, although future extension of the path along Route 28 is possible, a trailhead may be included and would be located on the NYCDEP-owned property north of Route 28A and west of Route 28, near the intersection. This trailhead may be converted from the potential Contractor staging area at this location.

The west end of the path along Route 28A connects to and merges with the rail trail. The path does not continue along Route 28A west of the RR corridor. A curved alignment is used in order to make a smooth connection between the north-south oriented rail trail and the east-west oriented Route 28A path as well as to satisfy maximum allowable grades.

A trailhead for the rail trail will be required at the western terminus of the project. Two trailhead locations were evaluated, one to the north and another to the south of Route 28A (see Figure 9 on next page). The drawbacks of a trailhead location north of Route 28A include the very limited area of NYCDEP-owned property available and the significant grade change from top of the Route 28A roadway to the railroad bed. Due to the site constraints, designing for a trailhead within the NYCDEP property limits would result in a narrow lot with a limited number of angled parking spots. Additionally, the large grade change from Route 28A and the trailhead parking area to the rail trail would require constructing switchbacks or a long ramp for trail access. In order to provide an adequately-sized lot with suitable ingress, egress and rail trail access (as shown in Figure 9), the trailhead would need to be constructed on acquired property.

Locating the trailhead to the south of Route 28A, directly across from Cold Brook Road, is better suited for a proposed trailhead location for the following reasons: 1) access will be provided at an existing intersection along Route 28A; 2) there is already an existing parking area and entrance to an unpaved NYCDEP access road south of Route 28A at this location; 3) the land south of the existing roadway is primarily low-lying and is entirely owned by NYCDEP; and 4) the trailhead location would lend itself to the phasing of the Rail-Trail project as described below.

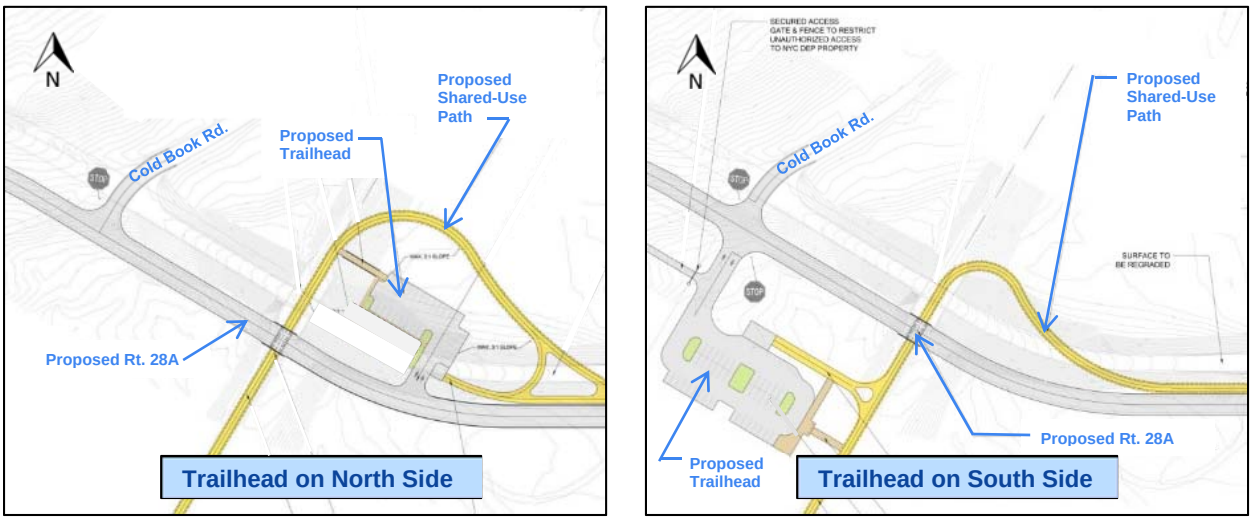


Figure 9 - Proposed Trailhead Options at Western Terminus of Project

The phasing of construction for the contract CAT-252 bridge work and Ulster County's rail trail is important to consider in the development of alternatives. At this time, it is assumed that the rail trail will be constructed under contract CAT-459 by 2018. The current schedule for CAT-252 anticipates start of construction in 2020. Assuming that current schedule expectations are met, the rail trail will be fully constructed and active prior to the start of CAT-252 construction.

It is anticipated that a project requirement will involve maintaining the rail trail operation during construction of CAT-252. Sequencing may require the trailhead be built during the early stages of construction to allow for continuous access to the trail. Relocation of the entrance to the trailhead may be required during certain stages of Route 28A roadway construction. Although the rail trail is planned to extend north to the RR Bridge, the trail will temporarily terminate to the south of the bridge, potentially at the southern trailhead in order to allow for anticipated bridge construction activities.

Shared-use Path on South Side: Alternately, the shared-use path can be located on the south side of Route 28A and the project bridges. The land south of the existing roadway is primarily low-lying, vegetated and unbuilt. The Route 28A roadway embankment will be built wider to accommodate the path. The property south of the existing roadway consists of land owned by NYCDEP.

The eastern terminus of the path could ultimately connect with a future path into the Hamlet of Boiceville. Therefore, a shared-use path situated on the south side of Route 28A would require installation of pedestrian/bicycle roadway crosswalks near the Route 28A/ Route 28

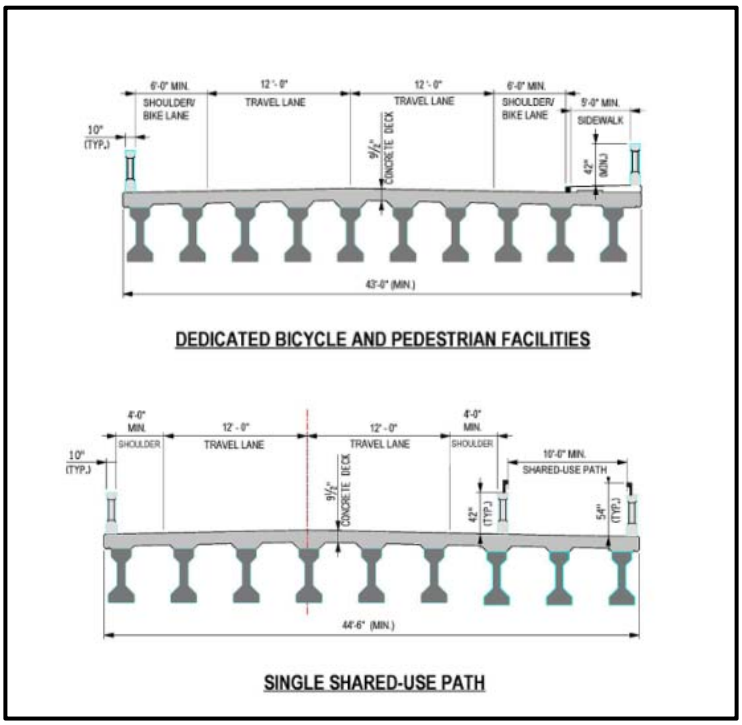


Figure 10 - Bikeway Alternatives at Proposed Bridge

intersection in order to continue north along Route 28. Addition of pedestrian/bicycle crosswalks in the project corridor under this alternative is considered less desirable.

The addition of trailhead locations at the western terminus and at the eastern end near Route 28 would be similar to that described in Shared-use Path on the North Side.

***Dedicated Bicycle and Pedestrian Facilities*:** This alternative assumes separate facilities for pedestrians and bicyclists; a dedicated sidewalk on the north side of the bridges for pedestrians and two dedicated bicycle lanes, one on each side of the roadway, occupying 6 to 8 foot wide shoulders.

Under this option, the pedestrian sidewalk would extend from a future proposed Route 28 trailhead or path from Boiceville, and continue along the north side of the bridges and the approach roadways to terminate at a trailhead located on the south side of Route 28A. A crosswalk would be required on Route 28A west of the RR Bridge to allow pedestrians to cross to the south side of Route 28A to access the trailhead and the rail trail. It should be noted that this crosswalk would exist at an uncontrolled intersection, which poses a safety concern.

Similarly, bicyclists in the westbound bike lane on the north side of Route 28A would have direct access to a trailhead at Route 28 and would use the crosswalk across Route 28A to reach the west trailhead and the rail trail.

Bicyclists on the rail trail would be able to directly access the eastbound bike lane on the south side of Route 28A via the west trailhead. However, another crosswalk across Route 28A is required at the east end of the project limits, to access points north into Boiceville.

This alternative introduces two pedestrian/bicycle crosswalks on Route 28A within the project limits, one at an uncontrolled intersection.

7.5 Preliminary Description of Bridge Alternatives

Preliminary feasible alternatives have been identified for the project bridges. The alternatives fall into three major categories: No-Build, Bridge Rehabilitation, and Bridge Replacement. The alternatives include the following:

- No-Build
  - Alternative 1: Do nothing (future maintenance).
- Bridge Rehabilitation
  - Alternative 2: Bridge superstructure and substructure rehabilitation and repair.
- Bridge Replacement

  Esopus Creek Bridge:
  - Alternative 3A: Replacement bridge with steel girders on conventional piers.
  - Alternative 3B: Replacement bridge with pre-stressed concrete beams on conventional piers.
  - Alternative 3C: Replacement bridge with superstructure on concrete V-piers.
  - Alternative 3D: Longer-span replacement bridge with superstructure on concrete V-piers.

  RR Bridge:
  - Alternative 4A: Replacement bridge with pre-stressed concrete beams on abutments.
  - Alternative 4B: Replacement with 3-sided precast concrete frame bridge.
  - Alternative 4C: Replacement with precast concrete box culvert and embankment fill.

7.5.1 No Build Alternative 1

Under the No-Build alternative the existing bridges will continue to be used in their current condition with no planned improvement. Any necessary maintenance, repair and rehabilitation work is deferred to some future date.

This alternative, designated as Alternative 1, will result in the need for ever-increasing extent and frequency of future maintenance and repair efforts. Continued deterioration without substantial remedial action will ultimately lead to loss of load-carrying capacity and restrictions to traffic and the eventual closure of the bridges.

7.5.2 Bridge Rehabilitation Alternative 2

This alternative proposes that both existing bridges remain in service while various bridge elements are rehabilitated or repaired, in order to improve the overall condition of the structures.

For the Esopus Creek Bridge, the proposed rehabilitation work includes:

- Repair of deteriorated substructure concrete (pier cap beams and stems; abutments, curtain walls and wingwalls)
- Repair of deteriorated superstructure concrete (arches and spandrel arch columns; transverse floorbeams)
- Concrete bridge deck replacement
- Bridge railing and transition rail replacement
- Repaving of bridge approach roadways

Based on the findings of the latest Biennial Inspection report, the major elements of the bridge exhibit some degree of concrete deterioration. The reported deterioration includes cracks, delaminated areas and spalls throughout. The concrete in this bridge is most probably not air-entrained, given its date of construction. Non air-entrained concrete is susceptible to damage under repeated freeze-thaw cycles. This, in combination with the many years of deicing salt use on the roadway above, is a good indication that concrete deterioration is pervasive throughout the structure. A robust concrete repair program will include the removal of all delaminated and hollow-sounding areas of concrete to sound material and subsequent patching with new concrete. It is anticipated that the depths and surface areas of concrete patching required will be extensive. Consideration must be given to the fact that concrete repair work of this nature has a tendency of resulting in significant quantity overruns during construction. This is due to the inherent difficulty in determining limits of concrete repair area and depth required during design compounded by the expansion of repair areas and depths typically seen during removal operations. Additionally, it should be noted that partial-depth concrete repairs typically fail after 7-10 years thus necessitating remedial repairs.

This alternative also includes replacement of the 40-year old concrete bridge deck. Drainage scuppers on the bridge will be repaired or replaced where necessary. Bridge railing and the transition from bridge rail to approach guide railing will be replaced to meet current standards.

The substandard features that will be retained under this alternative for the Esopus Creek Bridge include the posted structural load-carrying capacity of the structure and the nonstandard lane and shoulder widths on the bridge.

For the RR Bridge, the proposed rehabilitation work under this alternative includes:

- Repair of deteriorated substructure concrete (abutment pedestals, bridge seat and stem; wingwalls)
- Repair of deteriorated concrete superstructure (through girders; transverse floorbeams)
- Concrete deck repairs (underside of deck)
- Remove, repair and replace roadway wearing surface (Concrete deck repairs at top side of deck; Concrete curb repair; New asphalt wearing surface)
- Transition guide railing replacement

- Repaving of bridge approach roadways

Each of the concrete elements of the RR Bridge exhibits some degree of concrete deterioration, as noted in the latest Biennial Inspection report. The reported deterioration includes extensive cracking, spalling, crumbling and efflorescence. The concrete in this bridge is also most probably not air-entrained, given its date of construction. This, in combination with the many years of deicing salt use on the roadway above, is a good indication that concrete deterioration is pervasive throughout the structure. The proposed concrete repair program will include the removal of delaminated, spalled and hollow-sounding areas of concrete to sound material and subsequent patching with new concrete. It is anticipated that the depths and surface areas of concrete patching required will be extensive. As previously mentioned, concrete patching often result in quantity overruns and typically fail in 7-10 years.

Work under this alternative also includes removal of the bridge wearing surface, repair of the top of concrete deck and curbs, and placement of a new wearing surface. Eroded and settled areas at the bridge approaches will be filled and the approach roadways will be repaved.

Maintenance and protection of traffic will be required to perform the rehabilitation work proposed for both bridges. It may be feasible to stage the deck replacement work on the Esopus Creek Bridge and the deck repair/resurfacing work on the RR Bridge. Since the bridges are in line, the work on both bridges will be done concurrently to minimize the duration of traffic impacts. Staging the work will require closing one half of each bridge while maintaining a single lane of alternating directional traffic on the other half. The alternating traffic would be controlled by a temporary traffic signal.

It may be necessary to close the bridges to vehicular traffic during repair of the concrete superstructure members. If the concrete removal proves to be deep and extensive, the load-carrying capacity of the members may be compromised until the concrete patching work is complete. In this case, the bridges will have to be closed to traffic and a detour provided as required to complete the work. Alternately, temporary supportive measures may be installed for the affected structural members.

The substandard features that will be retained under this alternative for the RR Bridge are the nonstandard stopping sight distance due to the vertical crest curve at the bridge, as well as the nonstandard lane and shoulder widths over the bridge.

For the overall project, the bridge rehabilitation alternative designated as Alternative 2 improves some of the current structural deficiencies on both of the project bridges. However, given the age of the existing bridge components, continued concrete deterioration is anticipated. It is likely that continued future deterioration will require additional repairs of both bridges at increasingly frequent intervals as the bridge elements reach and exceed their presumed service lives.

7.5.3 Bridge Replacement Alternatives 3A–3D and 4A-4C

The bridge replacement alternative proposes full replacement of each of the project bridges, including the superstructure and substructure. This alternative eliminates all current structural, geometric and operational deficiencies and provides entirely new bridges with an anticipated 75-year service life. Under this alternative, the bridges will be designed to meet all current NYSDOT design standards, including those for seismic design.

As described earlier in this document, the bridges are proposed to be built using an off-line alignment, preferably to the south of their existing locations. Staged construction is not anticipated.

Preliminary design criteria include:

Design Element	Preliminary Design Criteria
Design Loading	AASHTO HL-93 Design Vehicle
Lane Width	12 ft.
Shoulder Width	4 ft. min.
Pedestrian/Bicycle Accommodations	Shared-use path, on one side of bridge
Vertical clearance	22 ft. min. over RR 15 ft. min. over rail trail

Table 3 – Bridge Design Criteria

At this preliminary stage, it is anticipated that the hydraulic bridge opening for the proposed Esopus Creek replacement bridge will match or improve the existing bridge opening. Preliminary hydraulic analyses were performed and coordinated with the concurrent hydraulic analyses done by Woidt Engineereing as part of the Town Of Olive's Flood Mitigation Study. Further hydraulic analyses will be performed to determine optimal bridge openings in terms of total span length, vertical clearance of the superstructure over the creek and optimal configuration/geometry of the bridge piers.

The total bridge width and girder spacing will be designed to accommodate future staged reconstruction of the bridge, to allow for rehabilitation and/or replacement work to be performed without closing the bridge to vehicular traffic.

For the RR Bridge, preliminary investigations considered both railroad clearances and recreational trail clearances below the bridge as feasible. However, in December 2015 Ulster County passed a resolution which states that the railroad corridor from Basin Road to Route 28A in Boiceville will be converted to a recreational trail only, with no provision for future railroad use. Therefore only recreational trail design clearances are currently considered in this report.

Several variations were investigated as part of the Bridge Replacement alternative. Each of the variations described provides for an entirely new bridge in place of the existing reinforced concrete structure.

For the Esopus Creek Bridge, alternatives include:

- Alternative 3A: Replacement bridge with steel girders on conventional piers.
- Alternative 3B: Replacement bridge with pre-stressed concrete beams on conventional piers.
- Alternative 3C: Replacement bridge with superstructure on concrete V-piers.
- Alternative 3D: Longer-span replacement bridge with superstructure on concrete V-piers.

Replacement of the bridge in-kind was considered and discarded, since it would result in a non-redundant structure type and would not provide any improvements for hydraulic flow.

For the RR Bridge, alternatives include:

- Alternative 4A: Replacement bridge with pre-stressed concrete beams on abutments.
- Alternative 4B: Replacement with 3-sided precast concrete frame bridge.
- Alternative 4C: Replacement with precast concrete box culvert and embankment fill.

Replacement of the bridge in-kind was considered and discarded, since it would result in a non-redundant structure type.

These alternatives are described in detail in the sections that follow.

7.5.3.1 Esopus Creek Bridge – Alternative 3A

Alternative 3A consists of a steel multi-girder superstructure with a reinforced concrete deck. The steel I-girders are installed parallel to each other and the roadway above and are supported on elastomeric bearings which rest on reinforced concrete abutments and piers.

The girders are constructed as continuous members over all three spans. This allows for increased structural capacity and efficiency as compared to using three sets of simply-supported girders. The capacity of the continuous steel I-beams allow for use of a 3-span configuration in place of the five existing, shorter spans. Each of the proposed three spans is within the range of 100 feet to 150 feet long, providing for a total bridge length similar to the existing bridge.

The vertical profile of the proposed bridge roadway is similar to the existing. Therefore the intent is to minimize superstructure depth so as to match or improve hydraulic performance under the bridge. This is achieved by optimizing girder size, spacing and grade of steel in the design phase. For this alternative, both rolled and welded plate girders are considered, in Grade 36, Grade 50 or HPS Grade 70 steel. Use of weathering steel is also an option, to reduce maintenance painting over the service life of the bridge.

See Figure 11 below:

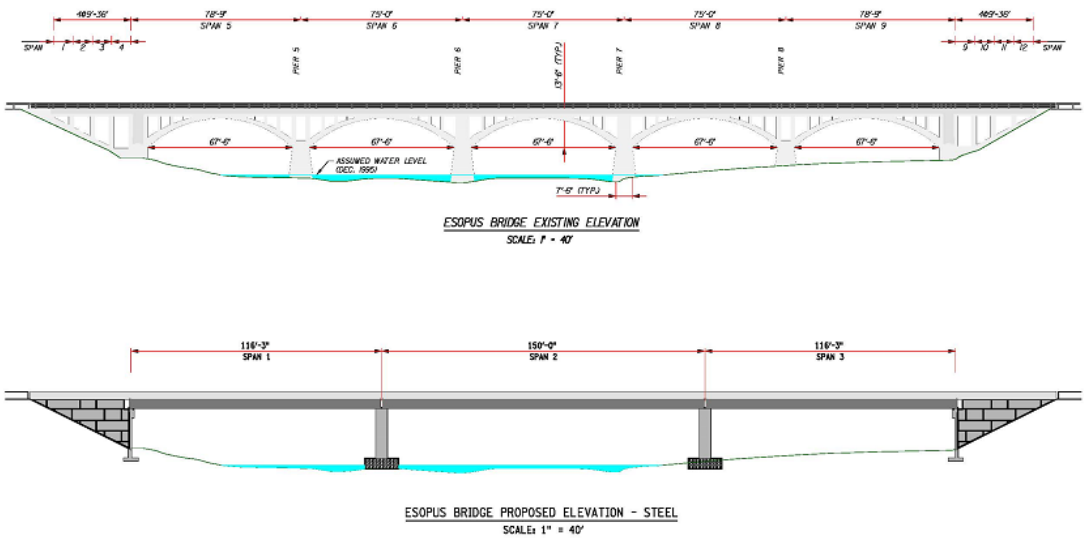


Figure 11 - Steel Superstructure Alternative (Elevation View)

Integral abutments are the favored option for bridge foundations, to eliminate the need for deck joints and bearings. Steel H-piles are required to support an integral abutment bridge. It is possible that the proposed subsurface and site soil investigations may reveal limitations on the use of integral abutments with driven piles. In this case, the use of semi-integral abutments or conventional abutments on drilled piles or on spread footings are additional options.

Solid wall reinforced concrete piers are proposed. Upstream edges of the piers are contoured to aid in deflecting ice floes and debris. Pier foundations are of the same type as abutment foundations, whether driven piles, drilled piles or spread footings. It should be noted that a reduction in the number of piers (from 4 to 2) in the waterway will improve overall hydraulic performance.

7.5.3.2 Esopus Creek Bridge – Alternative 3B

Alternative 3B proposes a similar three-span bridge configuration and similar foundations as in Alternative 3A. For this alternative, a different superstructure type is proposed. The Alternative 3B superstructure consists of Prestressed Concrete Economical Fabrication (PCEF) bulb tee beams with a reinforced concrete deck. The three superstructure spans are supported on elastomeric bearings resting on abutments and piers.

The selection of a specific bulb tee section and its optimal beam spacing will be determined in subsequent design phases. Concrete strength and prestressing strand location and orientation are additional variables that will be refined during design.

The use of bulb tees allows a customized beam shape – the bottom flange of the beams can be cast with a haunched profile, giving an aesthetically pleasing arched appearance without any appreciable increase in cost. No additional installation work or cost is needed - the decorative value is intrinsic to the structural girder.

7.5.3.3 Esopus Creek Bridge – Alternative 3C

Alternative 3C proposes an innovative structure configuration, with a total bridge length similar to the existing bridge. The proposed foundations consist of two abutments and two V-shaped piers. The piers diverge above their solid wall bases, forming two legs of a “V”. Each leg supports elastomeric bearings and girders. The “V”-shape of the piers provides a three-span footprint in the creek (116 ft., 150 ft., 116 ft.), while allowing for a shallower, five-span superstructure above (84 ft., 62 ft., 87 ft., 62 ft., 84 ft.). The five-span multi-girder superstructure is topped with a reinforced concrete deck.

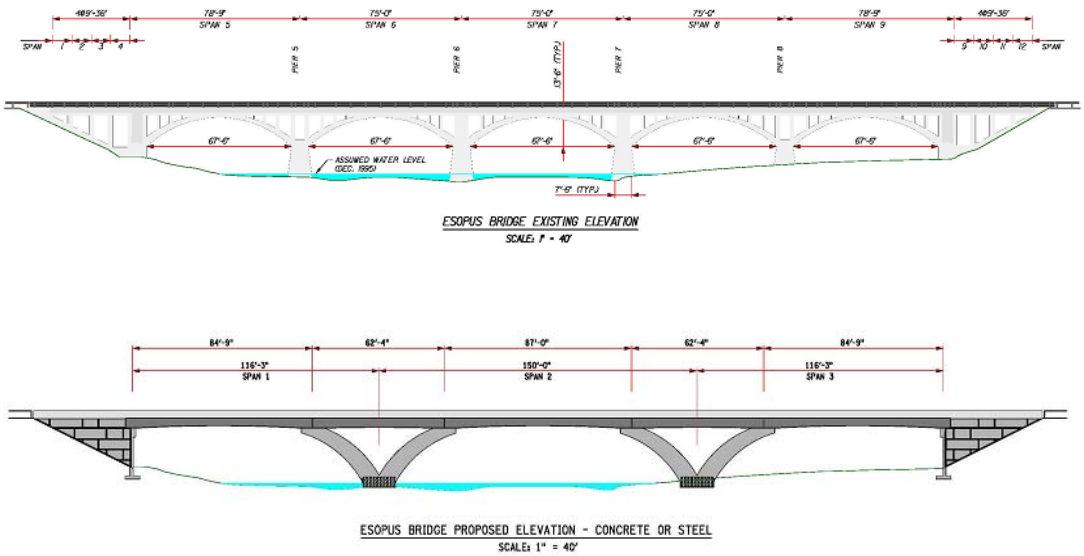


Figure 12 - V-Pier Alternative (Elevation View)

This alternative proposes use of precast concrete superstructure and substructure elements, in line with an accelerated bridge construction (ABC) approach. The V-shaped piers are proposed to be precast and erected on site. Precast concrete deck panels could also be utilized for the bridge deck. The modular nature of construction with precast elements allows for speedier bridge erection than with conventional bridge construction methods.

The abutments proposed under this alternative are similar to those described for alternatives 3A and 3B. Pier foundations are of the same type as abutment foundations, whether driven piles, drilled piles or spread footings.

The V-Pier alternative is an innovative, aesthetically pleasing design that replicates an arch-type structure similar in nature to the existing five-arch concrete bridge.

Figure 13 – Rendering of V-Pier

7.5.3.4 Esopus Creek Bridge – Alternative 3D

Alternative 3D proposes a bridge type similar to Alternative 3C, however with a longer total bridge length. For this alternative, the "V"-shaped piers provide a four-span footprint in the creek (125 ft., 150 ft., 150 ft., 125 ft.), while allowing for a shallow, seven-span superstructure above. This provides for a structure with a hydraulic bridge opening for the Esopus Creek that is approximately 150 ft. wider than exists there currently.

See Figure 14 below:

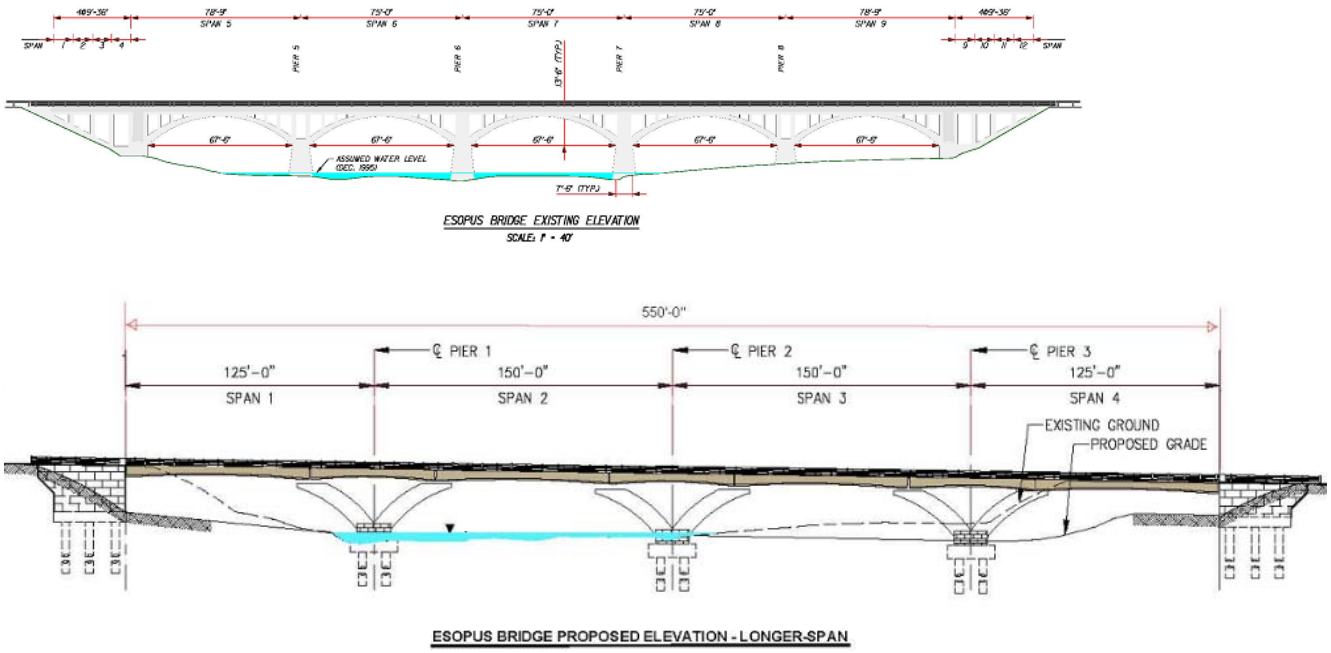


Figure 14 – Longer-Span V-Pier Alternative (Elevation View)

The longer-span alternative was developed as a potential means to alleviate local flooding concerns and was identified as an alternative in coordination with the Flood Mitigation Study recently performed by the Town of Olive to address a history of flooding in the hamlet of Boiceville. Several buildings in Boiceville, located on the eastern bank of the Esopus Creek upstream of the bridge, have experienced repeated flooding during past storm events.

The use of a longer-span structure could potentially complement flood mitigation measures that the Town may consider implementing in the area. Hydraulic analyses of a longer-span bridge alternative were performed to evaluate the structure's anticipated effect on the upstream flooding in Boiceville. The analyses considered the effects on flooding if the only action taken was to replace the existing bridge with a longer-span structure; they also considered the effects of implementing both the longer-span bridge replacement and the identified potential Town flood mitigation measures.

7.5.3.5 RR Bridge – Alternative 4A

Alternative 4A consists of a new single-span structure with pre-stressed concrete box beams on conventional reinforced concrete abutments or on mechanically stabilized earth (MSE) abutments. Under this alternative, the existing bridge is demolished in its entirety, including removal of the buried footings to at least two feet below grade.

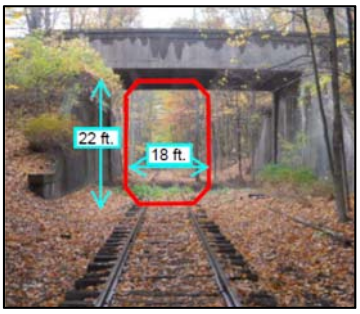


Figure 15 – Required Clearances for Rail

The RR corridor under this bridge will be converted to a recreational trail. Ulster County Resolution No. 488 states that the segment of former railroad corridor below and south of the existing Route 28A bridge to Basin Road is designated for recreational trail use only. Other segments of the corridor have been designated for both rail and trail use.

The existing bridge spans 39 feet over the RR corridor with a minimum vertical clearance of 22 feet. This meets the current NYSDOT standard for vertical and lateral clearances of bridges over railroads, as shown in Figure 15.

Based on the County's decision to convert the RR corridor at this location to trail use only, the applicable design clearances are those for bridges over shared use paths. The required minimum vertical clearance is 15 feet with minimum lateral clearance of 14 feet, as shown in Figure 16.

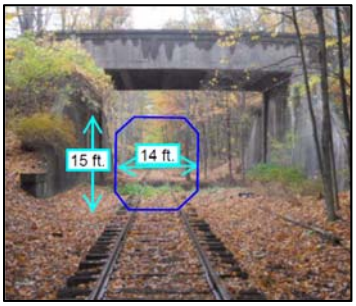


Figure 16 – Required Clearances for Recreational Trail

The bridge roadway elevation and corresponding quantity of fill at the bridge approaches are significantly lower for the proposed trail clearance requirements as compared to the existing railroad clearance. The roadway profile will be lowered by as much as 7 feet from its existing profile. This will flatten the vertical crest curve over the bridge, as shown in Figure 17, and will substantially improve the nonstandard stopping sight distance for drivers.

Shallow prestressed box beams with 24-inch, 27-inch or 30-inch depths are proposed (as compared to the existing superstructure depth of about 4 feet). A 6-inch thick HP concrete deck is placed on the box beams for rideability and to provide protection of the joints between box beam units.

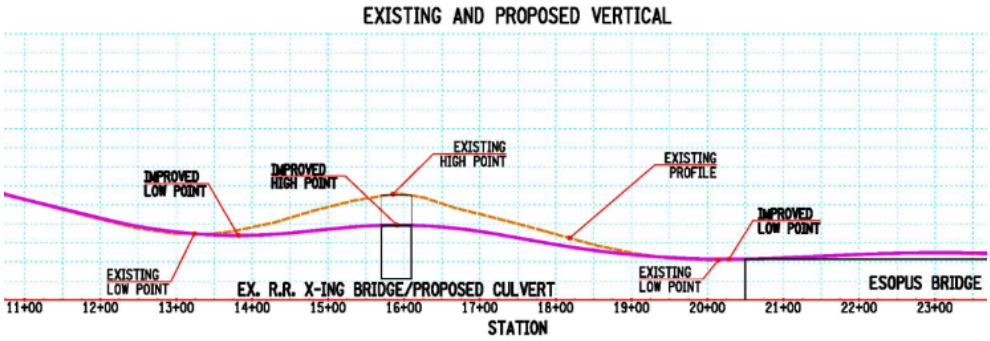


Figure 17 - Existing and Proposed Vertical Profiles

The box beams are supported on elastomeric bearings on the abutments. Abutment options include conventional reinforced concrete abutments on spread footings or MSE abutments. MSE abutments are short, stub-type reinforced concrete abutments that rest directly on embankment soil retained by mechanically-stabilized earth abutment walls and wingwalls. With this configuration, the concrete stub abutments are set back slightly from the face of the MSE abutment walls. The MSE abutment walls will extend north and south of the bridge to act as in-line wingwalls, tapering down as the embankment behind them slopes down to meet existing grade. Concrete bridge parapets are provided.

7.5.3.6 RR Bridge – Alternative 4B

Alternative 4B consists of a single span, precast 3-sided concrete arch-frame structure. The precast arch-frame is supported on cast-in-place concrete spread footings and completed with precast headwalls and wingwalls. The concrete headwalls are extended to created bridge parapets at each side of the bridge. The top of arch is waterproofed and the area between top of arch and headwalls is backfilled with earth fill. Asphalt pavement is placed on subbase material over the backfill to create the roadway surface.

The precast arch-frame system is a modular system. The precast modules are shop-fabricated, transported to the site and erected. The precast units will be founded on CIP concrete footings and potentially on short stem walls to provide sufficient vertical clearance.

Under this alternative, the existing bridge is demolished in its entirety, including removal of the abutments to at least two feet below grade.

7.5.3.7 RR Bridge – Alternative 4C

Alternative 4C consists of the installation of a buried precast four-sided box culvert. The precast box is placed on the existing RR corridor bed. Fill-type modular retaining walls are constructed adjacent to both sides of the culvert along the north fascia line and along the south fascia line (see photo 10). The top of the culvert is waterproofed and the area between the retaining walls is backfilled with earth to form the approach roadway embankments and to support the roadway over the culvert. Asphalt pavement is placed on subbase material over the backfill to create the roadway surface. Concrete barriers are installed over the retaining walls, tied to a moment slab system for stability.

Photo 10 - Example Project with Buried Box Culvert

Under this alternative, the existing bridge is partially demolished. The portions of abutments and wingwalls that will be below grade in the final condition may be abandoned in place.

7.6 Assessment of Alternatives against Evaluation Criteria

7.6.1 Roadway Alignment Alternatives

Roadway alignment alternatives were assessed against performance, health and safety, operations, environmental impact, community impact and cost criteria.

***In-Line Roadway Alignment*:** Under this alternative, most roadway-related performance criteria are met. The non-standard vertical stopping sight distance is improved and the non-conforming intersection at Route 28 is reconfigured. However the horizontal roadway curve between the two bridges can only be improved slightly and will not meet standards.

The stated health and safety criterion is partially achieved, as current NYSDOT roadway standards are met, with the exception of the radius of the horizontal roadway curve between the two bridges.

The operations criterion to provide pedestrian and bicycle accommodation along Route 28A within the project limits is not met under this alternative.

The footprint of disturbance of this alternative is similar to the existing condition. The proposed bridges and approach roadways are slightly wider than existing but in the same location. Therefore environmental impacts to natural resources are less than compared to off-line alignment alternatives.

The community impacts of this alternative in terms of traffic are significant. If the bridges are closed to traffic for the duration of construction, the public will have to use an almost 20-mile long detour. If the technical challenges and costs of staged construction of the non-redundant structures are overcome, then traffic will be limited to a single, alternating lane controlled by a temporary traffic signal. The construction duration includes time for demolition of the old bridges and construction of the replacement bridges. It is estimated that the staged construction scenario would be markedly longer than under the full bridge closure scenario and off-line alignment alternatives. There is limited opportunity for the incorporation of sustainability measures, due to the nature of the work.

The total initial construction cost of this alternative will be lower than the cost of an off-line alignment, since approach roadway and embankment work is limited. It is estimated, however, that the structural costs of the staged bridge construction scenario would be markedly higher than under the full bridge closure scenario, due to the need for extensive temporary structural supports to stabilize the bridges during staging. The choice of roadway alignment alternative does not have a significant effect on the life cycle costs of the project.

***Off-Line, North Roadway Alignment*:** Under both off-line alternatives, roadway-related performance criteria are met. The non-standard vertical stopping sight distance and horizontal roadway curve are improved. The non-conforming intersection at Route 28 is reconfigured to meet current standards.

The health and safety criterion is achieved, as current NYSDOT roadway standards are met.

The operations criterion to provide pedestrian and bicycle accommodation along Route 28A within the project limits is met under this alternative.

The footprint of disturbance of this alternative is greater than the existing condition, in part because the proposed roadway is built along a previously undisturbed alignment. The proposed roadway footprint is also wider than the existing, with increased shoulders and new pedestrian/bicycle accommodations, resulting in a larger impervious area. Environmental impacts to natural resources are therefore greater than for the in-line alignment alternative. These impacts will be mitigated during construction using best management practices and post-construction by restoring the existing roadway footprint to a natural state, in effect partially exchanging the new roadway footprint for the existing.

The community impacts of this alternative in terms of traffic are relatively minor. Two lanes of traffic are maintained on the existing bridges and roadway while the replacement bridges are built and then both lanes are shifted to the new bridges. Short-term single lane closures will be needed to construct the transition roadway and to complete the traffic shift. This alternative requires permanent acquisition of private property north of Route 28A to accommodate

the new alignment. There is limited opportunity for the incorporation of sustainability measures, due to the nature of the work.

The total initial construction cost of this alternative will be higher than the cost of an in-line alignment, due to the additional proposed roadway embankment work and existing roadway embankment restoration work. However, there will be cost savings in construction means, methods and operations as compared to the in-line, staged construction alternative. The choice of roadway alignment alternative does not have a significant effect on the life cycle costs of the project.

***Off-Line, South Roadway Alignment*:** Performance, health and safety, and operations criteria are met, as described for the northern off-line alignment alternative above.

Environmental impacts and their mitigation are similar to the northern off-line alignment alternative described above.

The community impacts in terms of traffic and incorporation of sustainability measures are similar to the northern off-line alignment alternative described above. However this southern alignment alternative can be constructed entirely on NYCDEP property thus eliminating the need for private property acquisitions.

The costs for this alternative are similar to those described above for the northern off-line alignment.

7.6.2 Intersection alternatives:

The selection of a preferred alternative from among the three preliminary alternatives presented depended in large part on whether use of a traffic signal was warranted. The results of the traffic analyses performed indicated that traffic signals are not warranted. Therefore a T-type, stop-sign controlled intersection alternative is the preferred alternative.

Had the analyses indicated that a traffic signal was warranted, then the signalized intersection and roundabout alternatives would have been considered. It should be noted that BEDC coordinated with NYSDOT Region 8 regarding this intersection. In correspondence dated February 11, 2016 NYSDOT indicated their concurrence with the proposed replacement of the outdated Y-legged intersection with a standard T-type intersection.

7.6.3 Bikeway alternatives:

The three bikeway alternatives presented above all meet the evaluation criteria listed in Section 7.1, by providing for bicycle and pedestrian accommodation on the Route 28A bridges. All three of the alternatives have similar low levels of impact on natural resources and contribute comparable increases to the overall project construction cost.

There is an operational benefit to locating the shared-use path on the north side of Route 28A. This alternative eliminates the need for any pedestrian/bicyclist crosswalks across Route 28A.

7.6.4 Bridge alternatives:

Bridge Alternatives 1 through 4C as identified above have been assessed against the evaluation criteria identified in Section 7.1. The table on the following page provides a summary of the assessments:

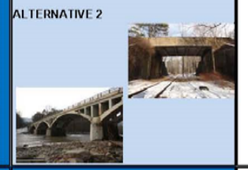
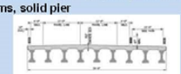
		EVALUATION CRITERIA																	
		PERFORMANCE				MAINTENANCE		HEALTH & SAFETY		OPERATIONS	ENVIRONMENTAL		COMMUNITY				SUSTAINABILITY	COST	
	ALTERNATIVES	ELIMINATE CURRENT STRUCTURALDEFICIENCIES	ELIMINATE NON-STANDARD ROADWAY FEATURES	IMPROVE NON-CONFORMING INTERSECTION	PROVIDE 75 YEAR SERVICE LIFE	PROVIDE LOW MAINTENANCE STRUCTURE	PROVIDE DURABLE STRUCTURE	MEET CURRENT NYSDOT BRIDGE STANDARDS	MEET CURRENT NYSDOT ROADWAY STANDARDS	PROVIDE PEDESTRIAN/ BICYCLE ACCOMMODATION OVER BRIDGES	IMPACT TO NATURAL RESOURCES	IMPACT TO CULTURAL RESOURCES (PDC Approval)	IMPACT TO COMMUNITY (TRAFFIC)	IMPACT TO BACKWATER/FLOODING	IMPACT TO PRIVATE PROPERTY	CONSTRUCTION DURATION	INCORPORATE SUSTAINABILITY MEASURES	INITIAL COST	LIFE CYCLE COST
NO BUILD	ALTERNATIVE 1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	N/A	N/A	LOW	HIGH
REHABILITATION	ALTERNATIVE 2 	X	X	X	X	LOW	LOW	X	X	X	LOW	N/A	HIGH	X	X	HIGH	MID	MID	HIGH
REPLACEMENT	ESOPUS BRIDGE																		
	ALTERNATIVE 3A - 3-span, steel girders, solid pier	✓	✓	✓	✓	MID	HIGH	✓	✓	✓	HIGH	LOW	LOW	LOW	X	MID	HIGH	HIGH	MID
	ALTERNATIVE 3B - 3-span, prestressed beams, solid pier 	✓	✓	✓	✓	HIGH	HIGH	✓	✓	✓	HIGH	MID	LOW	LOW	X	MID	HIGH	HIGH	MID
	ALTERNATIVE 3C - V-pier	✓	✓	✓	✓	HIGH	HIGH	✓	✓	✓	MID-HIGH	HIGH	LOW	LOW-MID	X	HIGH	HIGH	HIGH	MID
	ALTERNATIVE 3D - Longer-span V-pier	✓	✓	✓	✓	HIGH	HIGH	✓	✓	✓	MID-HIGH	HIGH	LOW	LOW-MID	X	HIGH	HIGH	HIGH	MID
	RR BRIDGE																		
	ALTERNATIVE 4A - prestressed box beams	✓	✓	✓	✓	MID	MID	✓	✓	✓	HIGH	MID	LOW	N/A	X	LOW	HIGH	HIGH	MID
	ALTERNATIVE 4B - 3-sided precast arch- frame	✓	✓	✓	✓	HIGH	HIGH	✓	✓	✓	HIGH	MID	LOW	N/A	X	MID	HIGH	HIGH	MID
	ALTERNATIVE 4C - precast box culvert	✓	✓	✓	✓	HIGH	HIGH	✓	✓	✓	MID-HIGH	MID	LOW	N/A	X	HIGH	HIGH	MID	MID

Table 4 – Assessment of Alternatives against Evaluation Criteria

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7.7 Pre-Screening of Alternatives (Fatal Flaws)

7.7.1 Roadway Alignment Alternatives

The in-line alignment alternative meets the capacity goals and many of the performance criteria identified for the project (as described in Section 7.6). However a major performance criterion that it does not meet is to minimize community and traffic impacts. Under this alternative, traffic will have to use an almost 20-mile long detour for the duration of construction. The option of maintaining traffic by using staged bridge construction is not technically feasible in a cost effective manner. This is a fatal flaw and therefore this alternative will not be considered further.

The off-line north alignment alternative meets the stated evaluation criteria. However its footprint encroaches on several privately-owned properties at the northwest quadrant of the project area. Since there is another feasible off-line alignment alternative that does not affect private property, this is identified as a fatal flaw of this alternative and therefore it will not be considered further.

The off-line, south alignment alternative contains no fatal flaws and will be considered further.

7.7.2 Intersection Alternatives

None of the three preliminary intersection alternatives contain fatal flaws. Therefore all three alternatives will be considered further.

7.7.3 Bikeway Alternatives

Both of the shared-use path alternatives contain no fatal flaws and will be considered further.

The alternative that calls for separate dedicated pedestrian and dedicated bicycle facilities meets the stated evaluation criteria. However as compared to the shared-use path alternatives, this alternative poses public safety risks since it requires bicyclists to cross Route 28A to access the rail trail or the trail heads. This is a fatal flaw and therefore this alternative will not be considered further.

7.7.4 Bridge Alternatives

The No Build Alternative 1 does not meet the stated capacity and performance goals identified for the project (see Sections 6 and 7.6). It does not provide bridges that meet current NYSDOT bridge and roadway standards, and it does not provide for pedestrian and bicycle accommodations on the bridges. This is considered a fatal flaw. However, for purposes of comparison, this alternative will be addressed in the upcoming Basis of Design Report for the project.

The Bridge Rehabilitation Alternative 2 does not meet the stated capacity and performance goals identified for the project. Although this alternative improves the condition of the existing bridges, the rehabilitated bridges do not meet all current NYSDOT bridge standards. Also, roadway geometry does not meet current standards, and no accommodation is provided for pedestrians and bicyclists. This is considered a fatal flaw. However, for purposes of comparison, this alternative will be addressed in the upcoming Basis of Design Report for the project.

Esopus Creek Bridge Replacement Alternatives 3A through 3D contain no fatal flaws and will be considered further.

RR Bridge Replacement Alternatives 4A through 4C contain no fatal flaws and will be considered further.

7.8 Detailed Analysis of Screened Alternatives

7.8.1 Roadway Alignment Alternatives

The key issues for the evaluation of a roadway alignment alternative are traffic and community impacts, constructability, and cost. Maintenance of traffic is a key local concern, since closure of the bridges requires an almost 20-mile long detour. The issue of constructability centers on the feasibility of staging demolition of the existing structures. In addition to traffic, community impacts include potential private property takings or easements, modifications to Cold Brook Road, public access to the proposed rail trail and maintaining the NYCDEP access road south of Route 28A during construction.

The preliminary alternatives developed for the Route 28A roadway and bridge alignment and presented in Section 7.2 above are: in-line alignment, off-line alignment to the north, and off-line alignment to the south.

- In-Line Roadway Alignment Alternative

  Traffic: It is not possible to maintain two lanes of traffic during construction of in-line replacement bridges due to the narrow width of the existing 22-ft wide bridge roadways. A single lane of alternating-direction traffic could potentially be accommodated using staged construction, with some structural modifications. The single alternating lane of traffic would be controlled by temporary traffic signals. Alternately, closure of the bridges would require an almost 20-mile long detour via Reservoir Road.

  As a result of municipal and community input at the Public Information Meeting conducted by NYCDEP at the Town of Olive on December 16, 2014, it is clear that the community considers roadway closure and detour unacceptable and desires that a minimum of one lane of alternating traffic be maintained.

  Constructability: The use of staged construction to demolish half of each bridge and carry traffic on the remaining half is limited by the non-redundant nature of the existing bridges. The main load-carrying members of the Esopus Creek Bridge are the two arches, one located at each fascia. The main load-carrying members of the RR Bridge are two through-girders, one at each fascia. The staging of such non-redundant bridges is not possible without the construction of substantial temporary structural supports to provide structural stability to the half of bridge that is to remain and carry traffic. Additionally, due to their condition, the existing bridges do not lend themselves to staged construction techniques where half of the bridge must be carefully removed while the other half remains in service. Therefore, staged construction is not considered feasible for the replacement of these bridges.

  Community impacts: Replacement of the project bridges on the same alignment as existing allows for the project to be built within the boundaries of NYCDEP-owned property. Property takings or easements are not anticipated. The modifications proposed to the vertical and horizontal alignment to improve the Route 28A roadway geometry will result in the need for some modifications to Cold Brook Road at its intersection with Route 28A. Cold Brook Road is a Town road.

  The project will provide for a bike path along Route 28A over the bridges. Under this alternative, the bike path will be accommodated within a slightly wider roadway corridor footprint as compared to the existing. Access to the rail trail below the roadway will be provided by connecting a path from the bike path along Route 28A. The proposed alignment of Route 28A does not have a marked effect on rail trail access – at most, the alignment of the connecting path may shift based on the location of the proposed roadway relative to the existing. The proposed alignment of Route 28A also does not have a marked effect on the rail trail itself. Under this on-line alignment alternative, users of the rail trail will be diverted to the proposed trail head at Route 28A south of the construction area during construction of this project.

  There is an existing NYCDEP operations access road located on NYCDEP-owned land south of the project area. The entrance to this access road is on the south side of Route 28A, opposite Cold Brook Road. This access road is used by NYCDEP on a daily basis and access to it will be maintained during construction.

Temporary staging or relocation of the entrance to the access road will be required during construction of this alternative.

Cost: This alternative provides cost savings related to highway work and additional costs related to bridge work and user delay as compared to the off-line alternatives. The savings are due to the fact that improvements to the existing alignment are limited to relatively small amounts of earthwork in the form of placement of roadway embankment fill, with minor if any excavation. The cost savings are offset by substantial additional costs associated with premiums due to staged construction and with driver user delays. The overall duration of construction for this alternative is estimated to be longer than for the off-line roadway alignment alternatives.

The major advantage of this alternative is that it can be built in the same approximate footprint as the existing roadway and structures. Improvements to existing non-standard roadway stopping sight distance are possible, although potential for improvements to horizontal alignment are limited. The major disadvantage of this alternative is its impact to the travelling public. Full roadway and bridge closure during construction will result in an unacceptably long detour route. It is not feasible to cost-effectively stage construction to maintain at least one lane of traffic, given the structural configuration of the existing bridges.

- Off-Line, North Roadway Alignment

Traffic: The off-line alternatives afford the opportunity to maintain two lanes of traffic on the existing bridges and roadway during construction of the new replacement bridges and roadway parallel to the existing bridges. Once the replacement bridges are built, both lanes of traffic will be shifted to the new bridges and roadway. Short-term, single lane closures are required to complete the transition of traffic from the old alignment to the new. The single lane, alternating-direction traffic will be maintained with the use of daily lane closures using flaggers and can be limited to off-peak daytime or overnight hours.

With the proposed alignment to the north of the existing roadway, construction access at the east end of the project will be from the westbound lane of Route 28A and/or the southbound lane of Route 28. Construction access at the west end of the project will be from the westbound lane of Route 28A and from Cold Brook Road.

As mentioned previously, the feedback from the Public Information Meeting conducted by NYCDEP at the Town of Olive on December 16, 2014 indicates that the community considers bridge closure and detour unacceptable and desires that a minimum of one lane of alternating traffic be maintained during construction.

Constructability: The use of an off-line alternative separates traffic from construction operations. Construction of the new bridges is at an offset distance from the existing bridges, and construction operations will not directly affect the existing bridges carrying traffic. Similarly, once traffic is shifted to the new replacement bridges, demolition of the existing structures will be done at a distance from the new structures carrying traffic and demolition operations will not directly affect the new bridges and traffic. Building the replacement bridges adjacent to the existing ones eliminates the need for the extensive temporary supports that would be required to stage construction of the existing non-redundant structures. Providing distance between active operations and the structure carrying traffic provides additional space and easier access for the contractor, which translates into smoother, faster completion of work.

The existing topography includes steeper terrain at the west end of the project, north of Route 28A. The land south of Route 28A is relatively low-lying and level, but at this location it slopes upward from the area south of the roadway to the area north of the roadway. Under this alternative, cuts into the rock and slopes will be required to accommodate the re-aligned roadway. The balance of the re-aligned roadway will be built on new embankment fill.

During construction, temporary Geosynthetic Reinforced Earth System (GRES) walls will be utilized to support portions of the raised Route 28A profile in close proximity to the existing roadway.

Community impacts: Replacement of the project bridges on an alignment north of the existing involves construction of the new roadway on both NYCDEP-owned property and private property. Property acquisition in the form of fee takings will be needed at the northwest quadrant of the project, between the west end of the project and the RR corridor, north of Route 28A. Depending on the limits of the project, there are potentially two to four private properties that are affected. A private driveway at the west end of the project will also need to be

modified. Modifications to the profile of Cold Brook Road are required to provide a smooth transition to the new intersection with the re-aligned Route 28A. Cold Brook Road is a Town road.

The proposed alignment of Route 28A does not have a marked effect on rail trail access from Route 28A – at most, the alignment of the connecting path may shift based on the location of the proposed roadway relative to the existing. Under this alternative, the connecting path encroaches on private property to a greater extent than for the in-line or southern off-line alternatives. The proposed alignment of Route 28A also does not have a marked effect on the rail trail itself. Under this northern off-line alignment alternative, users of the rail trail will be diverted to the proposed trail head at Route 28A south of the construction area during construction of this project.

The entrance to the existing NYCDEP access road will continue to be accessed from the existing Route 28A during construction. Once construction of the re-aligned roadway and bridges is complete, and restoration of the old roadway begins, there will be a need for temporary staging or relocation of the entrance. At the conclusion of the project, the entrance will be extended to meet the new Route 28A alignment.

Cost: This alternative results in additional construction costs as compared to the on-line alternative. These costs include placement of embankment fill for the re-aligned roadway and removal/restoration of the old roadway embankment. The overall duration of construction for this alternative is estimated to be shorter than for the on-line roadway alignment alternative.

The major advantages of this alternative are that it minimizes impacts to the travelling public and provides for simplified construction access and operations by separating the new construction work zone from the existing bridges and roadway. Improvements to all existing non-standard roadway geometry are achieved. The main disadvantages of this alternative are the need for private property acquisition, the need to cut into existing rock and slopes to provide the required roadway grades at the west end of the project and a larger footprint as compared to the in-line alternative.

- Off-Line, South Roadway Alignment

  Traffic: As mentioned previously, both off-line alternatives afford the opportunity to maintain two lanes of traffic on the existing bridges and roadway during construction of the new replacement bridges. Once the replacement bridges are built, both lanes of traffic will be shifted to the new bridges and roadway. Short-term, single lane closures are required to complete the transition of traffic from the old alignment to the new. The single lane, alternating-direction traffic will be maintained with the use of daily lane closure using flaggers and can be limited to off-peak daytime or overnight hours.

  With the proposed alignment to the south of the existing roadway, construction access at the east end of the project will be from the eastbound lane of Route 28A and/or the southbound lane of Route 28. Construction access at the west end of the project will be from the eastbound lane of Route 28A.

  Constructability: The use of an off-line alternative separates traffic from construction operations. Construction of the new bridges is at an offset distance from the existing bridges, and construction operations will not directly affect the existing bridges carrying traffic. Similarly, once traffic is shifted to the new replacement bridges, demolition of the existing structures will be done at a distance from the new structures carrying traffic and demolition operations will not directly affect the new bridges and traffic. Building the replacement bridges adjacent to the existing ones eliminates the need for the extensive temporary supports that would be required to stage construction of the existing non-redundant structures. Providing distance between active operations and the structure carrying traffic provides additional space and easier access for the contractor, which translates into smoother, faster completion of work.

  The existing topography includes steeper terrain at the west end of the project, north of Route 28A. The land south of Route 28A is relatively low-lying and level. Locating the new roadway south of the existing eliminates the need for cuts into the rock and slopes that exist north of the existing roadway. The re-aligned roadway will be built on new embankment fill.

During construction, temporary GRES walls will be utilized to support portions of the raised Route 28A profile in close proximity to the existing roadway.

Community impacts: Replacement of the project bridges on an alignment south of the existing allows for all construction to be within the boundaries of NYCDEP-owned property. No private property acquisition will be needed. Cold Brook Road will be extended to meet the re-aligned Route 28A. Cold Brook Road is a Town road.

The proposed alignment of Route 28A does not have a marked effect on rail trail access from Route 28A – at most, the alignment of the connecting path may shift based on the location of the proposed roadway relative to the existing. Under this alternative, the connecting path will likely be contained within the footprint of the existing roadway bed. The proposed alignment of Route 28A does have some effect on the rail trail itself, during construction. Under this alternative, users of the rail trail will be diverted to the proposed trail head at Route 28A south of the construction area. Accessing the proposed trail head from Route 28A will require crossing the work zone. Accommodations will be made to separate the public from the construction zone and temporary staged relocation of the entrance to the trail head will be required.

The entrance to the existing NYCDEP access road will continue to be from the existing Route 28A during construction. There will, however, be a need for temporary staging or relocation of the entrance as construction progresses, since the entrance crosses the work zone for construction of the re-aligned roadway. The entrance will also likely be used by or crossed by the contractor to access the larger bridge and roadway work zone south of Route 28A.

Cost: This alternative has additional construction costs as compared to the in-line alternative. The magnitude of cost and construction duration is estimated to be comparable to those for the northern off-line alternative.

The major advantages of this alternative are that it minimizes impacts to the travelling public, does not encroach on private property and provides for simplified construction access and operations by separating the new construction work zone from the existing bridges and roadway. Improvements to all existing non-standard roadway geometry are achieved. The main disadvantages of this alternative are its larger footprint as compared to the in-line alternative and the construction crossing required to access the NYCDEP access road and proposed trail head.

7.8.2 Intersection Alternatives

The preliminary alternatives developed for the intersection of Routes 28 and 28A and presented in Section 7.3 above are: a stop-sign controlled T-type intersection, a signal-controlled T-type intersection and a roundabout.

Current NYSDOT standard intersection configurations applicable for a 3-way intersection include a T-type intersection and a roundabout. NYSDOT policy is to consider roundabouts as an option in cases where traffic volumes warrant use of a signal-controlled intersection.

The key issue in determining a preferred intersection alternative is whether use of a traffic signal is warranted at the intersection. If no traffic signal is warranted, as is the preliminary expectation, then the T-type, stop-sign controlled intersection alternative will be selected.

The determination of whether use of a traffic signal is warranted at a particular intersection is based on the volumes of traffic and accident histories on the intersecting roadway legs. A traffic analysis was performed using current traffic volumes, projected future volumes and the intersection accident history in order to analyze the need for a traffic signal at this intersection. The results of the analysis indicated that a traffic signal is not warranted.

The traffic analysis was also used to determine the need for additional, dedicated left and right-turn lanes at the intersection. The installation of dedicated right-turn lanes was raised by local emergency services personnel at the Public Information Meeting held by NYCDEP at the Town of Olive in December 2014.

- T-type Intersection, stop-sign controlled

  This is the default alternative, since the traffic analysis indicated that use of traffic signal is not warranted.

- T-type Intersection, signalized

This alternative would have been considered further if analyses indicated that a traffic signal is warranted.

- Roundabout

  The roundabout alternative would have been considered if analyses indicated that a traffic signal is warranted for the intersection. It is NYSDOT policy to include a roundabout in an intersection alternatives study for those intersections warranting signalization.

7.8.3 Bikeway Alternatives

The key issues for the evaluation of a bikeway alternative are safety, connectivity, and cost. Public safety is a key concern. The issue of connectivity centers on providing bikeway users with access from the bikeway to the rail trail below. In addition to connectivity, the location of trail heads impact bikeway and rail trail users.

The preliminary alternatives developed for the bikeway over the Route 28A bridges and presented in Section 7.3 above are: shared-use path on the north side of Route 28A, shared-use path on the south side of Route 28A, and dedicated bicycle facility with dedicated pedestrian facility.

- Shared-Use Path on North Side of Route 28A

  Safety: The shared-use path accommodates both pedestrian and bicycle traffic in both directions. A physical barrier or a minimum offset distance separates the path from roadway traffic. Under this alternative, it is proposed that a physical barrier be used to separate vehicular and pedestrian/bicycle traffic on the bridges while an offset distance is used to separate them off the structures. This scenario will require separate snow clearing operations on the path and on the roadway.

  The proposed trail head locations include one at the east end of the project and another at the west end, adjacent to the rail trail. The preferred locations identified for the trail heads are north of Route 28A near the intersection with Route 28, and south of Route 28A west of the RR corridor. Locating the bikeway north of Route 28A allows for direct access for users from the path to the east trail head. Likewise, since the bikeway connects to the rail trail below, direct access to the west trail head is also provided. Roadway crossings are not required.

  Connectivity: Locating the path on the north side of the roadway allows for direct access from the bikeway to the trail head at the east end of the project. It also allows for direct access to the hamlet of Boiceville via the shoulder of Route 28 and offers the potential for a more clearly designated bicycle path along Route 28 in the future. Direct access to the trail head adjacent to the rail trail is provided by the connecting path between the bikeway and the rail trail.

  Cost: The construction costs for both shared-use path alternatives are comparable. The major items include widening the bridges and roadway embankments to accommodate the bikeway, building trail heads and installing a connecting path to link the bikeway to the rail trail.

- Shared-Use Path on South Side of Route 28A

  Safety: This alternative is similar to the previous one, except that the shared-use path is located on the south side of Route 28A rather than on the north side. Locating the bikeway south of Route 28A allows for a more immediate connection to the rail trail, without passing under the Route 28A RR Bridge. Access to the west trail head is provided via the rail trail. To access the east trail head, bikeway users must cross Route 28A. To mitigate the safety risk of the roadway crossing, a crosswalk is proposed just west of the intersection with Route 28. Traffic control at the intersection, whether by stop sign or traffic signal, provides those using the sidewalk a measure of safety.

  Connectivity: Locating the path on the south side of the roadway does not allow for direct access from the bikeway to the east trail head, nor to the hamlet of Boiceville. Direct access to the trail head adjacent to the rail trail is provided by the connecting path between the bikeway and the rail trail.

  Cost: The construction costs for both shared-use path alternatives are comparable.

- Dedicated Bicycle Facility/Dedicated Pedestrian Facility

  Safety: The dedicated facility alternative includes one-way bike lanes on each side of the roadway and a sidewalk on one side of the bridge. There is no need for a physical barrier to separate the bike lanes or sidewalk from vehicular traffic. Since there is no barrier, this scenario allows for combined roadway/bike lane/sidewalk snow clearing operations.

  Direct access is provided from the eastbound bike lane to and from the rail trail via the west trail head. In this case, there will be two connecting paths, one on each side of the roadway. Access to the west trail head is provided via the rail trail. To access the east trail head, eastbound bike lane users and pedestrians on the south sidewalk must cross Route 28A. To mitigate the safety risk of the roadway crossing, a crosswalk is proposed just west of the intersection with Route 28. Traffic control at the intersection, whether by stop sign or traffic signal, provides those using the crosswalk an added measure of safety.

  Connectivity: Locating the sidewalk on the north side of the roadway allows for direct access from the sidewalk to the trail head at the east end of the project. It also allows for direct access to the hamlet of Boiceville via the shoulder of Route 28. Access to the trail head adjacent to the rail trail requires crossing Route 28A at a crosswalk located west of the RR Bridge. Connectivity of the westbound bike lane to the trail heads and rail trail is similar to that described for the north sidewalk. The eastbound bike lane connects directly to the west trail head and through the trail head to the rail trail. Access to the east trail head requires crossing Route 28A at a crosswalk located west of the Route 28 intersection.

  Cost: The construction cost for the dedicated use facilities is higher than for the shared-use path alternatives, since bike lanes and sidewalks are constructed on both sides of the roadway.

7.8.4 Esopus Creek Bridge Alternatives

The key issues for the evaluation of the bridge alternatives are capacity, durability, constructability and cost. Structural capacity to support traffic loads is a major issue, as is the geometric capacity of the bridges to carry pedestrian and bicycle traffic in addition to vehicular traffic. Hydraulic capacity is a critical issue in reducing the potential for backwater flooding effects upstream of the bridge. The issue of durability centers on the structural condition of the bridges over the long term. Ease of constructability has a direct impact on quality, cost and schedule of construction.

The three broad alternatives considered include a no-build alternative, bridge rehabilitation and bridge replacement.

The No-Build Alternative 1 does not meet any of the project goals stated in Section 6. Under this alternative, the bridge will continue to deteriorate. The deteriorating condition of the bridge elements will eventually lead to structural flags, requiring emergency attention. The worsening condition will also eventually lead to diminished structural capacity with the need to restrict traffic on the bridge. Frequent and increasingly extensive maintenance and repair will be required in the future. The condition of the structural concrete may eventually reach a state where repair becomes technically infeasible. There is no initial cost for this alternative; the life cycle costs, given the need for extensive future work, are high.

The Bridge Rehabilitation Alternative 2 does not meet most of the project goals. Due to the age of the concrete structure, it is likely that concrete repair work will be extensive. Generally, on older concrete structures, removal of deteriorated concrete to reach sound material is far more extensive than is first estimated on the basis of surface soundings. There is the potential for very large quantities of concrete repair under this rehabilitation alternative, resulting in a costly and long-duration effort. Additionally, the quantities of concrete repair have a tendency to expand during construction resulting in cost overruns. The rehabilitation work will improve the structural condition of the bridge in the short-term. However in the long-term, it will only delay the further deterioration, not stop it. Concrete repairs have a life span of only 7-10 years. The frequent and increasingly extensive maintenance and repair work anticipated for the no-build alternative is merely delayed under the rehabilitation alternative. The initial cost of this alternative is moderate; when combined with the anticipated extensive future work, the life cycle costs are high.

Neither of these two alternatives, no-build and rehabilitation, will accommodate pedestrian and bicycle traffic. There are no issues with constructability for the no-build alternative. The rehabilitation alternative will use conventional concrete repair methods, with no unusual constructability issues.

The Bridge Replacement alternatives developed for the Esopus Creek Bridge as described in Section 7.5 above are: steel girder superstructure on conventional piers, prestressed concrete beam superstructure on conventional piers, and five-span superstructure on two V-shaped concrete piers.

- Alternative 3A: Replacement bridge with steel girders on conventional piers.

Capacity: Alternative 3A meets current standards for structural capacity and accommodates pedestrian and bicycle traffic. The proposed span configuration eliminates two piers, a great advantage in terms of reduction of obstructions to stream flow and a reduction in the required extent of construction in the waterway. The hydraulic capacity of the bridge under this alternative is improved over the existing condition due to the reduction in the number of piers from four to two. The constant-depth superstructure also increases the hydraulic opening below the bridge as compared with the existing variable-depth arches. An advantage of steel girders is that plate girders may be fabricated to the specific depth requirement, to the nearest inch.

Durability: New reinforced concrete abutments and piers are more durable than the existing by virtue of their age, alone. However current concrete materials, placement methods and quality control also provide an advantage. The use of air-entrained concrete adds freeze-thaw cycle durability. The reduction or elimination of deck joints also contributes to the durability of the replacement bridge. Generally speaking, the worst deterioration on the existing concrete bridge can be traced to water and deicing salt infiltration through the deck joints onto the structure below. Therefore, elimination of deck joints is a key design issue for the replacement structure.

The reduction in the number of spans and the corresponding reduction in the number of bridge deck joints is an advantage in terms of reducing the extent of steel girder and bearing deterioration. The ends of steel girders and their supporting bearings often deteriorate as a result of leaking from deck joints above. Reducing the number of girder ends and bearings exposed to leakage offers a reduction in the quantity of elements prone to potential deterioration.

Anticipated future maintenance for this alternative consists of periodic cleaning of bridge deck; repainting of the steel girders to protect them from rusting and corrosion; lubricate bearing devices; seal concrete decks with waterproofing penetrating sealant. It should be noted that bridge painting is almost eliminated if weathering steel is used. In the long-term, installation of thin deck overlays and/or replacement of the concrete deck may be required. Other potential future repairs that may be required near the end of the proposed bridge's service life include bearing replacement, localized steel girder repair and localized deteriorated concrete repair.

Constructability: Conventional construction methods may be used for this alternative. The long span lengths present a minor erection challenge. Transportation of the girders to the site will be in segments that will then be field-spliced on site. Foundation construction requires excavation for footings or pile caps. Given the nature of the rocky creek bed, excavation will take more effort than would be required at a soft soil site. Cofferdams are required to provide a dry work area for the pier construction within the creek. However, due to the reduction in the number of piers to two over the existing four, the number of required cofferdams and pier foundation excavations are reduced.

Cost: This alternative proposes the use of conventional bridge elements and construction methods. The use of a three-span, continuous girder configuration allows for elimination of two piers and the elimination of several bearing lines as compared to the existing structure, resulting in cost efficiencies. The initial construction cost of this alternative is high, while its life cycle cost is moderate.

- Alternative 3B: Replacement bridge with pre-stressed concrete beams on conventional piers.

Capacity: The structural, geometric and hydraulic capacity of Alternative 3B is similar to that of Alternative 3A. The required beam depth for a 130-foot span will generally be 63 inches or deeper. In contrast to welded steel plate girders whose depth can be set, prestressed concrete PCEF bulb tee beams are fabricated in standard depths of 55 inches, 63 inches, 71 inches and 79 inches.

Durability: The advantage of this alternative over the steel girder alternative is the use of plant-fabricated and plant-cured prestressed concrete, which combines a high quality, durable structural member with low maintenance needs over the life of the bridge. No periodic repainting is required, as is the case with non-weathering steel.

The durability of the proposed reinforced concrete substructures is the same as for alternative 3A, above. The advantages of the reduction in the number of deck joints due to the proposed three-span configuration, is similar to that described for Alternative 3A.

Regular maintenance for this alternative is less, only requiring periodic cleaning. In the long-term, installation of thin deck overlays and/or replacement of the concrete deck may be required. Other potential future repairs that may be required near the end of the proposed bridge's service life include bearing replacement and localized deteriorated concrete repairs.

Constructability: Conventional construction methods may be used for this alternative. The long beam lengths present transportation and handling challenge. Oversize hauling roadway permits (Special Hauling Permit in New York State) and specialized trailers are required to transport the 130-foot long beams. The existence of feasible transport routes to accommodate the over-length loads must be identified during the design phase.

Foundation construction requires excavation for footings or pile caps. Given the nature of the rocky creek bed, excavation will take more effort than would be required at a soft soil site. Cofferdams are required to provide a dry work area for the pier construction within the creek. However due to the reduction in the number of piers to two over the existing four, the number of required cofferdams and pier foundation excavations are reduced.

Cost: The bridge elements and bridge construction methods for this alternative are conventional. The use of the three-span configuration allows for elimination of two piers and the elimination of several bearing lines, resulting in cost efficiencies. A life cycle cost savings over Alternative 3A is realized since future repainting of girders is not required. The initial construction cost of this alternative is high, while its life cycle cost is moderate.

- Alternative 3C: Replacement bridge with superstructure on concrete V-piers.

Capacity: The structural and geometric capacity of Alternative 3C is similar to that of Alternatives 3A and 3B. The hydraulic capacity is somewhat less as compared to a conventional solid wall pier, as the two legs of each V-pier create obstructions to stream flow. The impact of the V-pier geometry will be analyzed as part of the detailed hydraulic analysis. Preliminary hydraulic analysis suggests that the existing bridge opening is adequate; the proposed pier size, bridge underclearance and total bridge span length will be optimized to meet the required hydraulic capacity.

Durability: The advantage of this alternative over the steel girder alternative is the use of plant-fabricated and plant-cured precast concrete, which combines a high quality, durable structural member with low maintenance needs over the life of the bridge. No periodic repainting is required, as is the case with steel.

The pier will be constructed using modular precast concrete segments which have higher durability as compared to cast-in-place concrete piers.

There are no regular future maintenance tasks anticipated for this alternative other than periodic bridge cleaning. In the long-term, installation of thin deck overlays and/or replacement of the concrete deck may be required. Other potential future repairs that may be required near the end of the proposed bridge's service life include bearing replacement and localized deteriorated concrete repair.

Constructability: Precast modular construction is an advantage of this alternative. Although abutments are constructed conventionally, the piers are precast in segments which are hauled to the site and erected thus minimizing work in the stream. Concrete forming, rebar placement and curing take place in a controlled, shop environment. Beams are conventionally erected. Precast deck panels, if selected, are hauled to the site and erected.

Foundation construction requires excavation for footings or pile caps. Given the nature of the rocky creek bed, excavation will take more effort than would be required at a soft soil site. Cofferdams are required to provide a dry work area for the pier construction within the creek. However due to the reduction in the number of piers to two over the existing four, the number of required cofferdams and pier foundation excavations are reduced.

Accelerated Bridge Construction (ABC) is an approach that emphasizes reducing field construction time. By using ABC techniques and procedures, it is possible to reduce traffic impacts, onsite construction time and weather-related time delays. Under this alternative, the use of precast pier elements allows for erection of the piers without the need for field formwork installation, rebar placement, concrete placement and field-curing time.

Cost: There is a slight materials cost premium in using precast bridge elements. Bridge construction methods, however, are straightforward and are of a shorter duration than for an alternative that relies heavily on cast in place concrete. The reduction in construction time provides for cost-efficient operations. The initial construction cost of this alternative is high, while its life cycle cost is moderate.

The construction duration for this alternative is less than for Alternatives 3A and 3B, due to the use of precast elements for the pier, superstructure and bridge deck.

- Alternative 3D: Longer-span replacement bridge with superstructure on concrete V-piers.

Capacity: The structural and geometric capacity of Alternative 3D is similar to that of Alternative 3C. The hydraulic capacity is potentially greater for the four-span Alternative 3D as compared to the three-span Alternative 3C, due to the greater total structure length which affords a wider bridge opening for the creek. The effect of the longer bridge length will be evaluated as part of the detailed hydraulic analysis, to determine if there is a benefit in terms of hydraulic capacity.

Durability: The durability of this alternative is the same as for Alternative 3C.

Constructability: The constructability of this alternative is similar to that of Alternative 3C, however there is an increase in the number of foundations to be constructed. In addition, a greater quantity of excavation and soil removal is required at the east bank of the creek, in order to accommodate the additional span at the east end of the structure.

Cost: The unit costs of the longer-span alternative are similar to Alternative 3C, while due to the longer length of the Alternative 3D bridge, the total cost is higher. The initial construction cost of this alternative is high, while its life cycle cost is moderate.

The construction duration for this alternative is less than for Alternatives 3A and 3B, due to the use of precast elements for the pier, superstructure and bridge deck. The duration is greater for this alternative than for Alternative 3C.

7.8.5 RR Bridge Alternatives

The key issues for the evaluation of the bridge alternatives are capacity, durability, constructability and cost. Structural capacity to support traffic loads is a major issue, as is the geometric capacity of the bridges to carry pedestrian and bicycle traffic in addition to vehicular traffic. The issue of durability centers on the structural condition of the bridges over the long term. Ease of constructability has a direct impact on quality and cost of construction.

The three broad alternatives considered include a no-build alternative, bridge rehabilitation and bridge replacement.

The no-build alternative does not meet any of the project goals. Under this alternative, the bridge will continue to deteriorate. The deteriorating condition of the bridge elements will eventually lead to structural flags, requiring emergency attention. The worsening condition will also eventually lead to diminished structural capacity with the need to restrict traffic on the bridge. Frequent and increasingly extensive maintenance and repair will be required in the future. The condition of the structural concrete may eventually reach a state where repair becomes technically infeasible. There is no initial cost for this alternative; the life cycle costs, given the need for extensive future work, are high.

The bridge rehabilitation alternative does not meet most of the project goals. Due to the age of the concrete structure, it is likely that concrete repair work will be extensive. Generally, on older concrete structures, removal of deteriorated concrete to reach sound material is far more extensive than is first estimated on the basis of surface soundings. There is the potential for very large quantities of concrete repair under this rehabilitation alternative,

resulting in a costly and long-duration effort. Additionally, the quantities of concrete repair have a tendency to expand during construction resulting in cost overruns. The rehabilitation work will improve the structural condition of the bridge in the short-term. However in the long-term, it will only delay the further deterioration, not stop it. Concrete repairs have a life span of only 7-10 years. The frequent and increasingly extensive maintenance and repair work anticipated for the no-build alternative is merely delayed under the rehabilitation alternative. The initial cost of this alternative is moderate; when combined with the anticipated extensive future work, the life cycle costs are high.

Neither of these two alternatives, no-build and rehabilitation, will accommodate pedestrian and bicycle traffic. There are no issues with constructability for the no-build alternative. The rehabilitation alternative will use conventional concrete repair methods, with no unusual constructability issues.

The preliminary bridge replacement alternatives developed for the Route 28A bridge over the railroad corridor as described in Section 7.5 above are: single-span prestressed concrete box beam bridge, 3-sided precast concrete arch, and buried precast concrete box culvert.

- Alternative 4A - Single-span prestressed concrete box beam bridge

Capacity: Alternative 4A meets current standards for structural and geometric capacity.

Durability: The advantage of prestressed concrete over cast-in-place concrete is its durability. Prestressed concrete box beams are fabricated using High Performance (HP) concrete, resulting in high-strength structural beams with a consistently high durability. They are shop fabricated, under controlled conditions, with greater uniformity of material and quality control than field-placed concrete. The HP concrete wearing surface placed over the adjacent box beams adds a layer of protection from roadway run-off, including de-icing salts.

Constructability: Adjacent box beams are erected using a crane and placed on elastomeric bearings. This is conventional bridge construction that does not create any unusual constructability issues. Conventional concrete abutment construction requires some excavation to place the spread footings, followed by forming, rebar placement and placement of concrete for the abutment stems.

The Mechanically stabilized earth (MSE) abutment option is ideally suited for construction on fill, such as for this bridge. The horizontal geotextiles, vertical facing and lifts of backfill that constitute the MSE system are installed over the existing grade, requiring no excavation. Conventional cast-in-place concrete construction is limited to the short height, stub abutments. Since the proposed Route 28A alignment requires placement of embankment fill to support the new approach roadways, MSE abutments satisfy two needs: for embankment fill and for structural support of the bridge.

Cost: To balance the need to meet vertical underclearance requirements with the desire to keep the height and cost of approach roadway embankments low, the superstructure depth is minimized. Prestressed box beams were selected over other prestressed members to take advantage of their shallow depths. MSE abutments satisfy two roles with one cost: for embankment fill and for structural support of the bridge. The initial cost of this alternative is the highest of the three RR bridge replacement alternatives. Its life cycle cost is moderate.

- Alternative 4B – 3-sided precast concrete arch

Capacity: Alternative 4B meets current standards for structural and geometric capacity.

Durability: The precast concrete arch units are shop fabricated under controlled conditions, with greater uniformity of material and quality control than field-placed concrete, resulting in higher durability. Under this alternative the top of arch is backfilled and the asphalt pavement is placed on the fill. The elimination of conventional bridge deck joints means that little if any water and de-icing salts from the roadway reach the structure. Since water and de-icing salts are major contributors to concrete bridge deterioration, burying the arch effectively increases its durability. A great advantage of a buried precast arch option is that no future bridge maintenance is anticipated over the life of the bridge.

Constructability: Precast arch modules are transported to the bridge site on flat-bed trailers and installed with minimal site disturbance, minimal labor and no wait for concrete cure time. For this bridge, it is proposed that the precast arch units be placed on cast-in place footings/stem walls. Installation of precast headwalls and wingwalls is also modular and can be immediately followed by placement of fill in the area above the arch and behind the

wingwalls. Conventional roadway construction on the fill and installation of concrete traffic barriers completes the bridge installation.

Cost: This alternative eliminates the need for conventional abutments. The elimination of material and labor costs and concrete curing time for conventional abutment construction results in cost savings. The initial cost of this alternative is high, although it is lower than for the Alternative 4A. The life cycle cost is moderate. Construction duration is reduced as compared to Alternative 4A.

- Alternative 4C – Precast concrete box culvert

Capacity: Alternative 4C meets current standards for structural and geometric capacity. This alternative meets vertical clearance requirements for a recreational trail only and would not meet RR vertical clearance requirements due to limited precast culvert height availability.

Durability: The precast concrete box culvert is shop fabricated under controlled conditions, with greater uniformity of material and quality control than field-placed concrete, resulting in higher durability. Under this alternative the box culvert is buried in the roadway embankment, protecting it from water and de-icing salts from the roadway above. No future structural maintenance is anticipated over the life of the bridge.

Constructability: The precast box culvert is transported to the bridge site on flat-bed trailers and installed with minimal site disturbance, minimal labor and no wait for concrete cure time. No separate foundations are required. The fill-type retaining walls proposed to contain the roadway embankment adjacent to the culvert are also placed with minimal site disturbance, in a modular fashion. The area between the walls and the area over the culvert are backfilled and a conventional roadway is built on the fill.

Cost: This option eliminates the need for a conventional bridge structure. The elimination of material and labor costs and concrete curing time for footings results in cost savings. The cost of this alternative is moderate; it is the lowest of the RR bridge replacement alternatives. The life cycle cost is also moderate. Construction duration is less than that for Alternatives 4A and 4B.

Section 8 Recommended Plan

8.1 Ranking of Screened Alternatives

8.1.1 Roadway Alignment Alternatives

Of the three roadway alignment alternatives presented, the off-line alignment to the south is the preferred alternative. It is the only alternative without any fatal flaws. The major advantages of this alternative are that two lanes of traffic are maintained during construction and that no private properties are impacted.

The preliminary alternatives are ranked in order of preference as follows:

1. Off-Line, South Roadway Alignment
2. Off-Line, North Roadway Alignment (fatal flaw)
3. In-Line Roadway Alignment (fatal flaw)

8.1.2 Intersection Alternatives

The three preliminary intersection alternatives will continue to be studied. Evaluation and selection of a preferred alternative will be based on the results of the traffic analysis currently being performed. Selection of an intersection

alternative is independent of the rest of the project and will be applicable to any of the proposed bridge replacement alternatives.

8.1.3 Bikeway Alternatives

Of the three bikeway alternatives presented, the shared-use path on the north side of Route 28A is considered the preferred alternative. The major advantages of this alternative over the alternative that located the shared-use path on the south side of Route 28A is that it provides connectivity to the hamlet of Boiceville and allows users direct access to both trail heads without any roadway crossings.

The preliminary alternatives are ranked in order of preference as follows:

1. Shared-Use Path on North Side of Route 28A
2. Shared-Use Path on South Side of Route 28A
3. Dedicated Bicycle Facility/Dedicated Pedestrian Facility (fatal flaw)

8.1.4 Bridge Alternatives

Of the three bridge alternatives presented, bridge replacement is the preferred alternative. It is the only alternative without any fatal flaws. The major advantages of this alternative are that current design standards are met, 75-year bridge service life is provided and pedestrian/bicycle traffic is accommodated.

The preliminary alternatives are ranked in order of preference as follows:

1. Bridge Replacement
2. Bridge Rehabilitation (fatal flaw)
3. No-Build (fatal flaw)

8.2 Description of Recommendation(s)

It is recommended that the feasible bridge replacement alternatives be developed and investigated further in a Basis of Design Report. Each of these alternatives includes an off-line alignment of the bridges and roadway, located to the south of existing. Reconstruction of the Route 28A and Cold Brook Road intersections with Route 28A are also included in each recommended alternative. The proposed shared-use path (bikeway) is located on the north side of the re-aligned Route 28A roadway and two trail heads are included. The trail heads will be located with one at the east end of the project, north of Route 28A, and the one located west of the RR corridor, south of Route 28A.

The alternatives recommended for further study also include the No-Build and Bridge Rehabilitation Alternatives, to allow for comparison of costs.

As design progresses, NYCDEP will initiate and/or continue contact with external stakeholders whose input or approvals are necessary to implement the proposed alternatives.

For bridge work, stakeholders include the Town of Olive, NYSDOT and NYC Public Design Commission (PDC). The span configuration and approximate location of bridge piers in the Esopus Creek have been determined in coordination with the Town of Olive's Flood Mitigation Study. NYSDOT bridge design standards and procedures will be followed. The PDC review process will be initiated early in the design phase.

For roadway and intersection work, stakeholders include the Town of Olive, NYSDOT and utility companies. Work that involves modifications to Cold Brook Road at the intersection with Route 28A will continue to be coordinated with the Town of Olive. Work that effects the intersection of Route 28A with Route 28 will continue to be coordinated with NYSDOT. Any required relocation of the existing overhead utility lines and poles will be coordinated with the effected utility companies.

For pedestrian and bicycle accommodations, stakeholders include Ulster County and the Town of Olive. Coordination of trail head design and rail trail access from Route 28A will continue to be coordinated with Ulster County. Coordination of bikeway accommodations along Route 28A will continue to be coordinated with the Town of Olive.

Section 9 Project Implementation

9.1 Project Cost Estimate

Preliminary construction costs have been estimated for Alternatives 1 through 4C. The costs are for the alternatives that are at a conceptual level of design and for which many design features have not yet been specifically determined. Therefore the costs shown below represent an order of magnitude and are best suited for use as a basis of comparison between alternatives. These costs do not include administrative construction-related costs, such as construction inspection. They are intended to reflect the estimated construction contract cost, escalated to the anticipated mid-point of construction.

	Cost Estimates			
Alternatives	ESOPUS BRIDGE	RR BRIDGE	HIGHWAY/ CIVIL	TOTAL
Alternative 1 - No Build	N/A	N/A	N/A	$ 0
Alternative 2 - Bridge Rehabilitation	$ 24M	$ 1.5M	N/A	$ 26M
Alternatives 3A & 4A - Bridge Replacement	$ 44M	$ 7.5M	$ 14.2M	$ 66M
Alternatives 3B & 4B – Bridge Replacement	$ 39M	$ 7M	$ 14M	$ 60M
Alternatives 3C & 4C – Bridge Replacement	$ 41M	$ 7M	$ 14M	$ 62M
Alternatives 3D & 4C – Bridge Replacement	$ 49.5M	$ 7M	$ 14M	$ 71M

Table 5 – Cost Estimates

9.2 Implementation Schedule

The project is currently in the Facility Planning Phase. Completion of this phase, with approval of the Final BODR, is slated for May 2016. The anticipated project schedule is as follows:

- Facility Planning Phase: June 2014 through May 2016
- Design Phase: May 2016 through summer 2019
- Construction Phase: Spring 2020 through spring 2023
- Construction Close-out: Spring 2025

9.3 Staffing Plan

The NYCDEP Bureau of Engineering, Design and Construction is taking the lead for this project. The Portfolio Manager is Paul Costa, P.E. and the Accountable Manager is Ray G. Girgis, P.E.. WSP USA Corp. is providing engineering design services as a consultant to BEDC.

9.4 Contracting Strategy

Contracting strategy for this project is anticipated to be for a conventional design-bid-build project delivery. Alternative delivery methods such as design-build are not being considered. In the interest of achieving a quality constructed product with reduced construction duration impacts, the use of incentive/disincentive clauses for the contractor will be considered. For the same reasons, implementation of accelerated bridge construction (ABC) methods is also an objective.

9.5 Public Outreach Plan

The public outreach plan for the project includes several methods for communication and feedback. Both Public Information Meetings and a project website are planned for outreach to local residents and the general public. Two Public Information Meetings have been held to date. BEDC has initiated and intends to continue contact with project stakeholders including Town of Olive and Ulster County officials and the NYSDOT. In addition, the project will be submitted for the three-stage NYC Public Design Commission (PDC) review process.

A Public Information Meeting was held on December 16, 2014 at the Town of Olive Town Meeting Hall. Town officials, Ulster County officials, local residents and local groups were represented at the meeting. BEDC presented an overview of the project and noted that public feedback and involvement was being sought in the early stages of design.

A subsequent Public Information Meeting was held on October 27, 2015. It is anticipated that additional Public Information Meetings will be held following completion of the Facility Planning Phase and into the Design Phase of the project.

An additional method for outreach includes the plan to develop a project-specific page for public information, within the framework of the NYCDEP website.

The project was submitted for PDC Conceptual Review in February 2016, during the Facility Planning Phase of the project. As a result of the Conceptual Review, modifications to the shape of proposed Esopus Creek piers and girders, as well as the shape of the RR Bridge opening, are anticipated.

9.6 Permitting Requirements

It is anticipated that the following permits will be required during the facility planning, design and construction phases of this project:

- US Army Corps of Engineers Section 404 Permit (Nationwide)
- NYS Department of Environmental Conservation (NYSDEC) Section 401 Water Quality Certification
- NYSDEC Protection of Waters Permit

- NYSDEC State Pollutant Discharge Elimination System (SPDES) Permit
- NYS Department of Transportation Highway Work Permit
- NYCDEP Variance for Increase to Impervious Surface

In addition to the permitting requirements, the required approval processes include:

- State Environmental Quality Review (SEQR)
- City Environmental Quality Review (CEQR)
- US Fish & Wildlife Service (USFWS) approval
- NY State Historic Preservation Office (SHPO) review
- NYC Public Design Commission (PDC) review
- NYCDEP Value Engineering
- Town of Olive Public Information meetings

9.7 Environmental Health and Safety Requirements

Critical EHS project risks will continue to be addressed throughout the design of this project. To date, all design team members have familiarized themselves with the approved Health and Safety Plan (HASP) for the project with the understanding that accidents are preventable through the implementation of effective Environmental Health and Safety (EHS) policies and programs.

During the Facility Planning and Design phases, EHS procedures related to any field work, or oversight of field work that is occurring to support design efforts, will continue to be followed. As development of the project design progresses, mitigation of potential EHS project risks of the completed project will be identified and incorporated into the design.

9.8 Project Risks

Preliminary project risks have been identified for the project. The risk of project delays and cost increases is real in both the design and the construction phases of the project. The major risks identified are listed below.

Identified risks of project delays and/or cost increases include those due to:

- Design changes to address local stakeholder concerns (Town of Olive, Ulster County, NYSDOT, local residents).
- Design changes to secure PDC and SHPO approval.
- Delays in permit approval processes.
- Delays in environmental review and permitting process.
- Delays and/or design changes due to presence of endangered species.
- Delays in property acquisition process (if required).
- Unanticipated subsurface conditions.

Risks associated with the poor condition of the existing bridges include:

- The risk for the need for remedial or emergency repair work to maintain bridge capacity and safety for traffic use.
- The risk of traffic impacts during remedial repair construction work.
- The risk of traffic impacts due to closure of existing bridges due to condition.

WSP USA
555 Pleasantville Road
South Building
Briarcliff Manor, NY 10510
Main: 914-747-1120 914-747-1956

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ATTACHMENT 1 –

Preliminary List of Permits

Preliminary List of Permits

Anticipated for CAT-252

US Army Corps of Engineers Section 404 Permit (Nationwide)

NYSDEC Section 401 Water Quality Certification
NYSDEC Protection of Waters Permit
NYSDEC State Pollutant Discharge Elimination System (SPDES) Permit

NYS Department of Transportation Highway Work Permit

NYCDEP Variance for Increase to Impervious Surface

In addition to the permits listed above, the following reviews are anticipated:

- State Environmental Quality Review (SEQR)
- City Environmental Quality Review (CEQR)
- US Fish & Wildlife Service (USFWS) review
- NYS Historic Preservation Office (SHPO) review
- NYC Public Design Commission (PDC) review
- NYCDEP Value Engineering
- Town of Olive Public Information Meetings

ATTACHMENT 2 –

Detailed Cost Estimates

CAT-252
ALTERNATIVE 2
PRELIMINARY CONSTRUCTION COST ESTIMATE

FACILITY PLAN
MARCH 2016

WORK CLASSIFICATION	UNIT	Esopus Creek Bridge	RR Bridge	TOTAL	UNIT PRICE	TOTAL PRICE
		QUANTITY				
CLEARING AND GRUBBING	LS	1		1	$ 100,000.00	$ 100,000.00
CONCRETE REPAIR - SUBSTRUCTURE	SF	3840	1500	5340	$ 250.00	$ 1,335,000.00
CONCRETE REPAIR - SUPERSTRUCTURE	SF	13800	585	14385	$ 300.00	$ 4,315,500.00
REMOVAL AND DISPOSAL OF CONCRETE DECK	CY	5750	0	5750	$ 500.00	$ 2,875,000.00
CONCRETE DECK REPLACEMENT	SY	11500	0	11500	$ 600.00	$ 6,900,000.00
REMOVAL AND DISPOSAL OF EXISTING BRIDGE RAIL AND TRANSITION RAIL	LF	900	0	900	$ 25.00	$ 22,500.00
BRIDGE RAIL	LF	900	0	900	$ 200.00	$ 180,000.00
TRANSITION RAILING	LF	200	200	400	$ 150.00	$ 60,000.00
MILLING	SF	100	140	240	$ 5.00	$ 1,200.00
REPAVING	TON	2	7	9	$ 1,000.00	$ 9,100.00
WORK ZONE TRAFFIC CONTROL	LS	0.85	0.15	1	$ 750,000.00	$ 750,000.00
ENGINEER'S OFFICE	MNTH	20	4	24	$ 2,000.00	$ 48,000.00
CONTINGENCY FOR INSPECTION AND TESTING	LS	0.85	0.15	1	$ 75,000.00	$ 75,000.00
CONTINGENCY FOR WITNESSING INSPECTION AND TESTING	LS	0.85	0.15	1	$ 75,000.00	$ 75,000.00
FIELD CHANGE PAYMENT (10%)	LS	0.85	0.15	1	$ 1,674,630.00	$ 1,674,630.00
MOBILIZATION (5%)	LS	0.85	0.15	1	$ 837,315.00	$ 837,315.00
SUBTOTALS:		**$ 18,150,703**	**$ 1,107,542**			**$ 19,259,000.00**
CONTINGENCY (30%)	LS			1	$ 5,780,000.00	$ 5,780,000.00
SUBTOTALS:		**$ 23,600,000**	**$ 1,440,000**		**TOTAL:**	**$ 25,039,000**

CAT-252
ALTERNATIVES 3A & 4A
PRELIMINARY CONSTRUCTION COST ESTIMATE

FACILITY PLAN
MARCH 2016

WORK CLASSIFICATION	UNIT	Esopus Creek Bridge - Alt. 3A	RR Bridge - Alt. 4A	Highway/Civil	TOTAL	UNIT PRICE	TOTAL PRICE
		QUANTITY					
CLEARING AND GRUBBING	LS			1	1	$ 300,000.00	$ 300,000.00
TREE CLEARING	EA			1200	1200	$ 1,500.00	$ 1,800,000.00
EXCAVATION	CY			8100	8100	$ 45.00	$ 364,500.00
BACKFILL	CY			36400	36400	$ 30.00	$ 1,092,000.00
SUBGRADE IMPROVEMENTS	CY			3900	3900	$ 75.00	$ 292,500.00
PAVING	TON			6600	6600	$ 120.00	$ 792,000.00
ROADSIDE APPURTENANCES	LF			6600	6600	$ 50.00	$ 330,000.00
INTERSECTION IMPROVEMENTS	LS			1	1	$ 150,000.00	$ 150,000.00
REMOVAL AND DISPOSAL OF EXISTING BRIDGE SUPERSTRUCTURE	LS	1			1	$ 2,500,000.00	$ 2,500,000.00
" " " "	LS		1		1	$ 300,000.00	$ 300,000.00
REMOVAL AND DISPOSAL OF EXISTING BRIDGE SUBSTRUCTURE	CY	3100	1500		4600	$ 100.00	$ 460,000.00
SELECT STRUCTURAL FILL	CY	2400	0		2400	$ 75.00	$ 180,000.00
STRUCTURE EXCAVATION	CY	3400	90		3490	$ 75.00	$ 261,750.00
SOIL EROSION AND SEDIMENT CONTROL	LF	2000	1000		3000	$ 30.00	$ 90,000.00
HAZARDOUS MATERIAL ABATEMENT	SF	400	400		800	$ 200.00	$ 160,000.00
ENVIRONMENTAL GROUND PROTECTION	LS	1			1	$ 10,000.00	$ 10,000.00
" " " "	LS		1		1	$ 3,000.00	$ 3,000.00
ENVIRONMENTAL WATERWAY PROTECTION	LS	1			1	$ 250,000.00	$ 250,000.00
" " " "	LS		0		0	$	$
DRILLED SHAFTS	LF	3000	0		3000	$ 2,000.00	$ 6,000,000.00
TEMPORARY EXCAVATION SUPPORT	SF	8200	4000		12200	$ 20.00	$ 244,000.00
COFFERDAMS	EA	10	0		10	$ 100,000.00	$ 1,000,000.00
TEMPORARY GRSS WALL	SY	0	0	6000	6000	$ 30.00	$ 180,000.00
FILL-TYPE RETAINING WALLS	SF	0	3400		3400	$ 80.00	$ 272,000.00
FOOTING CONCRETE, CLASS HP	CY	3000	100		3100	$ 650.00	$ 2,015,000.00
CONCRETE FOR STRUCTURES, CLASS HP	CY	1400	100		1500	$ 1,250.00	$ 1,875,000.00
EPOXY-COATED BAR REINFORCEMENT	LBS	230000	10000		240000	$ 3.00	$ 720,000.00
SUPERSTRUCTURE SLAB	SY	1800	300		2100	$ 750.00	$ 1,575,000.00
STRUCTURAL APPROACH SLAB	SY	200	200		400	$ 300.00	$ 120,000.00
PRESTRESSED CONCRETE BOX BEAMS	SF	0	2100		2100	$ 200.00	$ 420,000.00
STRUCTURAL STEEL	LBS	875000	0		875000	$ 7.00	$ 6,125,000.00
TYPE E.B. BEARINGS	EA	24	16		40	$ 5,000.00	$ 200,000.00
ARMORLESS BRIDGE JOINT SYSTEM	LF	300	70		370	$ 300.00	$ 111,000.00
TEXAS AESTHETIC CONCRETE BRIDGE BARRIER	LF	900	100		1000	$ 600.00	$ 600,000.00
TEMPORARY WORKS	LS	1	0		1	$ 750,000.00	$ 750,000.00
TRANSITION RAILING	EA	4	4		8	$ 8,000.00	$ 64,000.00
BRIDGE CURB	LF	900	80		980	$ 150.00	$ 147,000.00
DRAINAGE - BRIDGE	LS	1	0		1	$ 400,000.00	$ 400,000.00
DRAINAGE - HIGHWAY	LF	0	0	2800	2800	$ 75.00	$ 210,000.00
STORMWATER TREATMENT	SY	0	0	3500	3500	$ 100.00	$ 350,000.00
LANDSCAPING	LS	0	0	1	1	$ 450,000.00	$ 450,000.00
WORK ZONE TRAFFIC CONTROL	LS	0.33	0.33	0.33	1	$ 2,000,000.00	$ 1,980,000.00
PROTECTIVE SHIELDING	SF	30000	0		30000	$ 25.00	$ 750,000.00
SURVEY OPERATIONS	LS	0.33	0.33	0.33	1	$ 250,000.00	$ 247,500.00
CONSTRUCTION ACCESS	SY	0	0	2300	2300	$ 50.00	$ 115,000.00
UTILITY RELOCATION	LS	0.33	0.33	0.33	1	$ 250,000.00	$ 247,500.00
ENGINEER'S OFFICE	MNTH	12	12	12	36	$ 3,000.00	$ 106,920.00
CONTINGENCY FOR INSPECTION AND TESTING	LS	0.33	0.33	0.33	1	$ 50,000.00	$ 49,500.00
CONTINGENCY FOR WITNESSING INSPECTION AND TESTING	LS	0.33	0.33	0.33	1	$ 50,000.00	$ 49,500.00
FIELD CHANGE PAYMENT (10%)	LS	0.33	0.33	0.33	1	$ 3,680,000.00	$ 3,643,200.00
MOBILIZATION (5%)	LS	0.33	0.33	0.33	1	$ 1,840,000.00	$ 1,821,600.00
SUBTOTALS:		**$ 28,266,240**	**$ 4,766,990**	**$ 9,141,240**			**$ 42,175,000.00**
CONTINGENCY (30%)	LS				1	$ 12,660,000.00	$ 12,660,000.00
ESCALATION TO MIDPOINT OF CONSTRUCTION (2021)	LS				1	$ 10,650,000.00	$ 10,650,000.00
SUBTOTALS:		**$ 43,890,000**	**$ 7,410,000**	**$ 14,200,000**		**TOTAL:**	**$ 65,485,000**

CAT-252
ALTERNATIVES 3B & 4B
PRELIMINARY CONSTRUCTION COST ESTIMATE

FACILITY PLAN
MARCH 2016

WORK CLASSIFICATION	UNIT	Esopus Creek Bridge - Alt. 3B	RR Bridge - Alt. 4B	Highway/Civil	TOTAL	UNIT PRICE	TOTAL PRICE
		QUANTITY					
CLEARING AND GRUBBING	LS			1	1	$ 300,000.00	$ 300,000.00
TREE CLEARING	EA			1200	1200	$ 1,500.00	$ 1,800,000.00
EXCAVATION	CY			8100	8100	$ 45.00	$ 364,500.00
BACKFILL	CY			36400	36400	$ 30.00	$ 1,092,000.00
SUBGRADE IMPROVEMENTS	CY			3900	3900	$ 75.00	$ 292,500.00
PAVING	TON			6600	6600	$ 120.00	$ 792,000.00
ROADSIDE APPURTENANCES	LF			6600	6600	$ 50.00	$ 330,000.00
INTERSECTION IMPROVEMENTS	LS			1	1	$ 150,000.00	$ 150,000.00
REMOVAL AND DISPOSAL OF EXISTING BRIDGE SUPERSTRUCTURE	LS	1			1	$ 2,500,000.00	$ 2,500,000.00
" " " "	LS		1		1	$ 300,000.00	$ 300,000.00
REMOVAL AND DISPOSAL OF EXISTING BRIDGE SUBSTRUCTURE	CY	3100	1500		4600	$ 100.00	$ 460,000.00
SELECT STRUCTURAL FILL	CY	2400	0		2400	$ 75.00	$ 180,000.00
STRUCTURE EXCAVATION	CY	3400	90		3490	$ 75.00	$ 261,750.00
SOIL EROSION AND SEDIMENT CONTROL	LF	2000	1000		3000	$ 30.00	$ 90,000.00
HAZARDOUS MATERIAL ABATEMENT	SF	400	400		800	$ 200.00	$ 160,000.00
PRECAST CONCRETE ARCH-FRAME UNITS	LS		1		1	$ 250,000.00	$ 250,000.00
ENVIRONMENTAL GROUND PROTECTION	LS	1			1	$ 10,000.00	$ 10,000.00
" " " "	LS		1		1	$ 3,000.00	$ 3,000.00
ENVIRONMENTAL WATERWAY PROTECTION	LS	1			1	$ 250,000.00	$ 250,000.00
" " " "	LS		0		0	$ -	$ -
DRILLED SHAFTS	LF	3000	0		3000	$ 2,000.00	$ 6,000,000.00
TEMPORARY EXCAVATION SUPPORT	SF	8200	4000		12200	$ 20.00	$ 244,000.00
COFFERDAMS	EA	10	0		10	$ 100,000.00	$ 1,000,000.00
TEMPORARY GRSS WALL	SY	0	0	6000	6000	$ 30.00	$ 180,000.00
FILL-TYPE RETAINING WALLS	SF	0	3400		3400	$ 80.00	$ 272,000.00
FOOTING CONCRETE, CLASS HP	CY	3000	100		3100	$ 650.00	$ 2,015,000.00
CONCRETE FOR STRUCTURES, CLASS HP	CY	1400	100		1500	$ 1,250.00	$ 1,875,000.00
EPOXY-COATED BAR REINFORCEMENT	LBS	230000	10000		240000	$ 3.00	$ 720,000.00
SUPERSTRUCTURE SLAB	SY	1800	300		2100	$ 750.00	$ 1,575,000.00
STRUCTURAL APPROACH SLAB	SY	200	200		400	$ 300.00	$ 120,000.00
PRESTRESSED CONCRETE PECF BULB TEE BEAMS	LF	3200	0		3200	$ 1,000.00	$ 3,200,000.00
TYPE E.B. BEARINGS	EA	24	16		40	$ 5,000.00	$ 200,000.00
ARMORLESS BRIDGE JOINT SYSTEM	LF	300	70		370	$ 300.00	$ 111,000.00
TEXAS AESTHETIC CONCRETE BRIDGE BARRIER	LF	900	100		1000	$ 600.00	$ 600,000.00
TEMPORARY WORKS	LS	1	0.00		1	$ 750,000.00	$ 750,000.00
TRANSITION RAILING	EA	4	4		8	$ 8,000.00	$ 64,000.00
BRIDGE CURB	LF	900	80		980	$ 150.00	$ 147,000.00
DRAINAGE - BRIDGE	LS	1	0		1	$ 400,000.00	$ 400,000.00
DRAINAGE - HIGHWAY	LF	0	0	2800	2800	$ 75.00	$ 210,000.00
STORMWATER TREATMENT	SY	0	0	3500	3500	$ 100.00	$ 350,000.00
LANDSCAPING	LS	0	0	1	1	$ 450,000.00	$ 450,000.00
WORK ZONE TRAFFIC CONTROL	LS	0.33	0.33	0.33	1	$ 2,000,000.00	$ 1,980,000.00
PROTECTIVE SHIELDING	SF	30000	0		30000	$ 25.00	$ 750,000.00
SURVEY OPERATIONS	LS	0.33	0.33	0.33	1	$ 250,000.00	$ 247,500.00
CONSTRUCTION ACCESS	SY	0	0	2300	2300	$ 50.00	$ 115,000.00
UTILITY RELOCATION	LS	0.33	0.33	0.33	1	$ 250,000.00	$ 247,500.00
ENGINEER'S OFFICE	MNTH	12	12	12	36	$ 3,000.00	$ 106,920.00
CONTINGENCY FOR INSPECTION AND TESTING	LS	0.33	0.33	0.33	1	$ 50,000.00	$ 49,500.00
CONTINGENCY FOR WITNESSING INSPECTION AND TESTING	LS	0.33	0.33	0.33	1	$ 50,000.00	$ 49,500.00
FIELD CHANGE PAYMENT (10%)	LS	0.33	0.33	0.33	1	$ 3,370,000.00	$ 3,336,300.00
MOBILIZATION (5%)	LS	0.33	0.33	0.33	1	$ 1,690,000.00	$ 1,673,100.00
SUBTOTALS:		**$ 25,189,440**	**$ 4,445,190**	**$ 8,989,440**			**$ 38,625,000.00**
CONTINGENCY (30%)	LS				1	$ 11,590,000.00	$ 11,590,000.00
ESCALATION TO MIDPOINT OF CONSTRUCTION (2021)	LS				1	$ 9,750,000.00	$ 9,750,000.00
SUBTOTALS:		**$ 39,110,000**	**$ 6,910,000**	**$ 13,960,000**		**TOTAL:**	**$ 59,965,000**

CAT-252
ALTERNATIVES 3C & 4C
PRELIMINARY CONSTRUCTION COST ESTIMATE

FACILITY PLAN
MARCH 2016

WORK CLASSIFICATION	UNIT	Esopus Creek Bridge - Alt. 3C	RR Bridge - Alt. 4C	Highway/Civil	TOTAL	UNIT PRICE	TOTAL PRICE
		QUANTITY					
CLEARING AND GRUBBING	LS			1	1	$ 300,000.00	$ 300,000.00
TREE CLEARING	EA			1200	1200	$ 1,500.00	$ 1,800,000.00
EXCAVATION	CY			8100	8100	$ 45.00	$ 364,500.00
BACKFILL	CY			36400	36400	$ 30.00	$ 1,092,000.00
SUBGRADE IMPROVEMENTS	CY			3900	3900	$ 75.00	$ 292,500.00
PAVING	TON			6600	6600	$ 120.00	$ 792,000.00
ROADSIDE APPURTENANCES	LF			6600	6600	$ 50.00	$ 330,000.00
INTERSECTION IMPROVEMENTS	LS			1	1	$ 150,000.00	$ 150,000.00
REMOVAL AND DISPOSAL OF EXISTING BRIDGE SUPERSTRUCTURE	LS	1			1	$ 2,500,000.00	$ 2,500,000.00
" " " "	LS		1		1	$ 300,000.00	$ 300,000.00
REMOVAL AND DISPOSAL OF EXISTING BRIDGE SUBSTRUCTURE	CY	3100	1500		4600	$ 100.00	$ 460,000.00
SELECT STRUCTURAL FILL	CY	2400	0		2400	$ 75.00	$ 180,000.00
STRUCTURE EXCAVATION	CY	3400	90		3490	$ 75.00	$ 261,750.00
SOIL EROSION AND SEDIMENT CONTROL	LF	2000	1000		3000	$ 30.00	$ 90,000.00
HAZARDOUS MATERIAL ABATEMENT	SF	400	400		800	$ 200.00	$ 160,000.00
ENVIRONMENTAL GROUND PROTECTION	LS	1			1	$ 10,000.00	$ 10,000.00
" " " "	LS		1		1	$ 3,000.00	$ 3,000.00
ENVIRONMENTAL WATERWAY PROTECTION	LS	1			1	$ 250,000.00	$ 250,000.00
" " " "	LS		0		0	$ -	$ -
DRILLED SHAFTS	LF	3000	0		3000	$ 2,000.00	$ 6,000,000.00
TEMPORARY EXCAVATION SUPPORT	SF	8200	4000		12200	$ 20.00	$ 244,000.00
COFFERDAMS	EA	10	0		10	$ 100,000.00	$ 1,000,000.00
TEMPORARY GRSS WALL	SY	0	0	6000	6000	$ 30.00	$ 180,000.00
FILL-TYPE RETAINING WALLS	SF	0	3400		3400	$ 80.00	$ 272,000.00
FOOTING CONCRETE, CLASS HP	CY	3000	100		3100	$ 650.00	$ 2,015,000.00
CONCRETE FOR STRUCTURES, CLASS HP	CY	1400	100		1500	$ 2,000.00	$ 3,000,000.00
EPOXY-COATED BAR REINFORCEMENT	LBS	230000	10000		240000	$ 3.00	$ 720,000.00
SUPERSTRUCTURE SLAB	SY	1800	300		2100	$ 750.00	$ 1,575,000.00
STRUCTURAL APPROACH SLAB	SY	200	200		400	$ 300.00	$ 120,000.00
PRESTRESSED CONCRETE PECF BULB TEE BEAMS	LF	3200	0		3200	$ 1,000.00	$ 3,200,000.00
TYPE E.B. BEARINGS	EA	48	16		64	$ 5,000.00	$ 320,000.00
ARMORLESS BRIDGE JOINT SYSTEM	LF	300	70		370	$ 300.00	$ 111,000.00
TEXAS AESTHETIC CONCRETE BRIDGE BARRIER	LF	900	100		1000	$ 600.00	$ 600,000.00
TEMPORARY WORKS	LS	1	0.00		1	$ 750,000.00	$ 750,000.00
PRECAST CONCRETE BOX CULVERT	LF	0	40		40	$ 3,000.00	$ 120,000.00
TRANSITION RAILING	EA	4	4		8	$ 8,000.00	$ 64,000.00
BRIDGE CURB	LF	900	80		980	$ 150.00	$ 147,000.00
DRAINAGE - BRIDGE	LS	1	0		1	$ 400,000.00	$ 400,000.00
DRAINAGE - HIGHWAY	LF	0	0	2800	2800	$ 75.00	$ 210,000.00
STORMWATER TREATMENT	SY	0	0	3500	3500	$ 100.00	$ 350,000.00
LANDSCAPING	LS	0	0	1	1	$ 450,000.00	$ 450,000.00
WORK ZONE TRAFFIC CONTROL	LS	0.33	0.33	0.33	1	$ 2,000,000.00	$ 1,980,000.00
PROTECTIVE SHIELDING	SF	30000	0		30000	$ 25.00	$ 750,000.00
SURVEY OPERATIONS	LS	0.33	0.33	0.33	1	$ 250,000.00	$ 247,500.00
CONSTRUCTION ACCESS	SY	0	0	2300	2300	$ 50.00	$ 115,000.00
UTILITY RELOCATION	LS	0.33	0.33	0.33	1	$ 250,000.00	$ 247,500.00
ENGINEER'S OFFICE	MNTH	12	12	12	36	$ 3,000.00	$ 106,920.00
CONTINGENCY FOR INSPECTION AND TESTING	LS	0.33	0.33	0.33	1	$ 50,000.00	$ 49,500.00
CONTINGENCY FOR WITNESSING INSPECTION AND TESTING	LS	0.33	0.33	0.33	1	$ 50,000.00	$ 49,500.00
FIELD CHANGE PAYMENT (10%)	LS	0.33	0.33	0.33	1	$ 3,480,000.00	$ 3,445,200.00
MOBILIZATION (5%)	LS	0.33	0.33	0.33	1	$ 1,740,000.00	$ 1,722,600.00
SUBTOTALS:		**$ 26,412,240**	**$ 4,442,990**	**$ 9,042,240**			**$ 39,898,000.00**
CONTINGENCY (30%)	LS				1	$ 11,970,000.00	$ 11,970,000.00
ESCALATION TO MIDPOINT OF CONSTRUCTION (2021)	LS				1	$ 10,070,000.00	$ 10,070,000.00
SUBTOTALS:		**$ 41,010,000**	**$ 6,900,000**	**$ 14,040,000**		**TOTAL:**	**$ 61,938,000**

CAT-252
ALTERNATIVES 3D & 4C
PRELIMINARY CONSTRUCTION COST ESTIMATE

FACILITY PLAN
MARCH 2016

WORK CLASSIFICATION	UNIT	Esopus Creek Bridge - Alt. 3D	RR Bridge - Alt. 4C	Highway/Civil	TOTAL	UNIT PRICE	TOTAL PRICE
		QUANTITY					
CLEARING AND GRUBBING	LS			1	1	$ 300,000.00	$ 300,000.00
TREE CLEARING	EA			1200	1200	$ 1,500.00	$ 1,800,000.00
EXCAVATION	CY	18000		8100	26100	$ 45.00	$ 1,174,500.00
BACKFILL	CY			36400	36400	$ 30.00	$ 1,092,000.00
SUBGRADE IMPROVEMENTS	CY			3900	3900	$ 75.00	$ 292,500.00
PAVING	TON			6600	6600	$ 120.00	$ 792,000.00
ROADSIDE APPURTENANCES	LF			6600	6600	$ 50.00	$ 330,000.00
INTERSECTION IMPROVEMENTS	LS			1	1	$ 150,000.00	$ 150,000.00
REMOVAL AND DISPOSAL OF EXISTING BRIDGE SUPERSTRUCTURE	LS	1			1	$ 2,500,000.00	$ 2,500,000.00
" " " "	LS		1		1	$ 300,000.00	$ 300,000.00
REMOVAL AND DISPOSAL OF EXISTING BRIDGE SUBSTRUCTURE	CY	3100	1500		4600	$ 100.00	$ 460,000.00
SELECT STRUCTURAL FILL	CY	2400	0		2400	$ 75.00	$ 180,000.00
STRUCTURE EXCAVATION	CY	3400	90		3490	$ 75.00	$ 261,750.00
SOIL EROSION AND SEDIMENT CONTROL	LF	2000	1000		3000	$ 30.00	$ 90,000.00
HAZARDOUS MATERIAL ABATEMENT	SF	400	400		800	$ 200.00	$ 160,000.00
ENVIRONMENTAL GROUND PROTECTION	LS	1			1	$ 10,000.00	$ 10,000.00
" " " "	LS		1		1	$ 3,000.00	$ 3,000.00
ENVIRONMENTAL WATERWAY PROTECTION	LS	1			1	$ 250,000.00	$ 250,000.00
" " " "	LS		0		0	$ -	$ -
DRILLED SHAFTS	LF	4000	0		4000	$ 2,000.00	$ 8,000,000.00
TEMPORARY EXCAVATION SUPPORT	SF	14000	4000		18000	$ 20.00	$ 360,000.00
COFFERDAMS	EA	10	0		10	$ 100,000.00	$ 1,000,000.00
TEMPORARY GRSS WALL	SY	0	0	6000	6000	$ 30.00	$ 180,000.00
FILL-TYPE RETAINING WALLS	SF	0	3400		3400	$ 80.00	$ 272,000.00
FOOTING CONCRETE, CLASS HP	CY	1300	100		1400	$ 650.00	$ 910,000.00
CONCRETE FOR STRUCTURES, CLASS HP	CY	1800	100		1900	$ 2,000.00	$ 3,800,000.00
EPOXY-COATED BAR REINFORCEMENT	LBS	219000	10000		229000	$ 3.00	$ 687,000.00
SUPERSTRUCTURE SLAB	SY	2500	300		2800	$ 750.00	$ 2,100,000.00
STRUCTURAL APPROACH SLAB	SY	200	200		400	$ 300.00	$ 120,000.00
PRESTRESSED CONCRETE PECF BULB TEE BEAMS	LF	4400	0		4400	$ 1,000.00	$ 4,400,000.00
TYPE E.B. BEARINGS	EA	64	16		80	$ 5,000.00	$ 400,000.00
ARMORLESS BRIDGE JOINT SYSTEM	LF	300	70		370	$ 300.00	$ 111,000.00
TEXAS AESTHETIC CONCRETE BRIDGE BARRIER	LF	1200	100		1300	$ 600.00	$ 780,000.00
TEMPORARY WORKS	LS	1	0.00		1	$ 750,000.00	$ 750,000.00
PRECAST CONCRETE BOX CULVERT	LF	0	40		40	$ 3,000.00	$ 120,000.00
TRANSITION RAILING	EA	4	4		8	$ 8,000.00	$ 64,000.00
BRIDGE CURB	LF	1200	80		1280	$ 150.00	$ 192,000.00
DRAINAGE - BRIDGE	LS	1	0		1	$ 400,000.00	$ 400,000.00
DRAINAGE - HIGHWAY	LF	0	0	2800	2800	$ 75.00	$ 210,000.00
STORMWATER TREATMENT	SY	0	0	3500	3500	$ 100.00	$ 350,000.00
LANDSCAPING	LS	0	0	1	1	$ 450,000.00	$ 450,000.00
WORK ZONE TRAFFIC CONTROL	LS	0.33	0.33	0.33	1	$ 2,000,000.00	$ 1,980,000.00
PROTECTIVE SHIELDING	SF	30000	0		30000	$ 25.00	$ 750,000.00
SURVEY OPERATIONS	LS	0.33	0.33	0.33	1	$ 250,000.00	$ 247,500.00
CONSTRUCTION ACCESS	SY	0	0	2300	2300	$ 50.00	$ 115,000.00
UTILITY RELOCATION	LS	0.33	0.33	0.33	1	$ 250,000.00	$ 247,500.00
ENGINEER'S OFFICE	MNTH	12	12	12	36	$ 3,000.00	$ 106,920.00
CONTINGENCY FOR INSPECTION AND TESTING	LS	0.33	0.33	0.33	1	$ 50,000.00	$ 49,500.00
CONTINGENCY FOR WITNESSING INSPECTION AND TESTING	LS	0.33	0.33	0.33	1	$ 50,000.00	$ 49,500.00
FIELD CHANGE PAYMENT (10%)	LS	0.42	0.29	0.30	1	$ 3,940,000.00	$ 3,979,400.00
MOBILIZATION (5%)	LS	0.42	0.29	0.30	1	$ 1,970,000.00	$ 1,989,700.00
SUBTOTALS:		**$ 31,789,840**	**$ 4,434,290**	**$ 9,092,640**			**$ 45,317,000.00**
CONTINGENCY (30%)	LS				1	$ 13,600,000.00	$ 13,600,000.00
ESCALATION TO MIDPOINT OF CONSTRUCTION (2021)	LS				1	$ 11,440,000.00	$ 11,440,000.00
SUBTOTALS:		**$ 49,360,000**	**$ 6,890,000**	**$ 14,120,000**		**TOTAL:**	**$ 70,357,000**

ATTACHMENT 3 –

Initial Project EHS Profile

INITIAL PROJECT EHS PROFILE

This profile is to be utilized by the Design Engineer to determine if the project includes any significant environmental, health, or safety (EHS) issues that must be considered in the initial facility planning phase of the project. This is not an all-inclusive checklist and it shall be supplemented with additional documentation that describes the EHS issues that currently exist at the facility or may be encountered during the design and through construction.

The Design Engineer is to review the information received from the Operating Bureau, complete and submit this profile to the BEDC Accountable Manager (AM) for review. The BEDC AM is responsible for distributing the draft Initial Project EHS Profile to all participants prior to the actual site visit. Upon completion of the site meeting and walkthrough, a final Project EHS Profile shall be completed by the EOR and submitted to the BEDC AM for review (reference SOP 024).

Basic Project Information			
Project Title:	Replacement of Rte. 28A Bridges	DEP Project ID No.	CAT-252
Accountable Manager:	Ray G. Girgis, PE	In-House or external EOR:	WSP
Portfolio Manager (PM):	Paul Costa, PE	Completed by:	Myrosia Dragan (WSP)
Brief Description of scope of work:	Replacement of the Route 28A bridges over the Esopus Creek and former Ulster and Delaware Railroad corridor in the Town of Olive.		

No.	Existing Conditions Assessment Survey- EHS	Requested	Received	Evaluated	Comments (documenting the EOR's assessment / conclusion)
	HAZARDOUS MATERIALS INVENTORY AND REMEDIATION				
1	Provide any legacy database information for known or potential hazardous materials by type, location and condition that could be encountered during construction, demolition, repair, renovation, or replacement that could disturb materials or equipment based of the proposed scope of work to include but not limited to: a) Asbestos (boilers, piping insulation, walls and acoustic ceilings, floor tile, mastic, caulking, roofing material, siding shingles, etc.) b) Lead (paints, lead pipe, lead solder, brass pipe/equipment, lead-coated electrical cable, lead-coated mortar/grout, leaded glass, baluster repair, etc.) c) Mercury (paints, lighting, laboratory equipment, valve operators, manometers/flow meters, electrical switches/rectifiers/relays/thermostats) d) PCBs (PCB Coated Concrete, PCB piping, PCB Containing Electrical Transformers, etc.) e) Other hazardous material (i.e. radioactive, chlorine, creosoted treated wood, etc.)	☒	☐	☒	There is no available legacy database information for known hazardous materials on the bridges. A hazardous materials screening is being conducted as part ofthis project.

Environmental Protection

No.	Existing Conditions Assessment Survey- EHS	Requested	Received	Evaluated	Comments (documenting the EOR's assessment / conclusion)
2	Provide all data and reports related to the completion of a any Phase I or II site assessment(s) conducted at the facility	☒	☐	☒	A hazardous materials screening is being conducted as part of this project.
3	Provide all data and reports of any contaminated soil hazardous remediation projects previously completed within the proposed scope of work.	☒	☐	☒	Not applicable.
	SPILLS/RELEASES OF HAZARDOUS SUBSTANCES				
4	Provide a list of spills/releases of hazardous chemical substances that have previously occurred within the scope of work and the status of the remediation (i.e. hydraulic oils, chemicals/solvents/acids, etc. caused by equipment failure or human error)	☒	☐	☒	Not applicable.
	UTILITY OVERHEAD AND UNDERGROUND SUBSTRUCTURES				
5	Provide plant as-builts which identify the location, type and condition of all underground and above ground utility substructures to include electrical, telephone, cable, water, sewer lines and vaults and accompanied by any other documentation provided by the responsibility utility or owner (i.e. Con Edison, National Grid, Verizon, etc.)	☐	☐	☐	Not applicable.
	CHEMICAL/ PETROLEUM BULK STORAGE AND HIGHLY HAZARDOUS CHEMICALS				
6	Provide all relevant information of any regulated processes using highly hazardous chemicals	☐	☐	☐	Not applicable.
7	Provide the location, type, age and condition of any underground or above ground chemical or petroleum bulk storage tanks that may be encountered within the proposed scope of work. This includes storage tanks that have been abandoned or decommissioned	☐	☐	☐	Not applicable.
	HAZARDOUS (CLASSIFIED) LOCATIONS				
8	Please provide a list and description of all hazardous (classified) locations that will be impacted by the proposed scope of work	☐	☐	☐	Not applicable.
	STORMWATER MANAGEMENT/ENVIRONMENTALLY SENSISTIVE AREAS				
9	Provide the location and description of any environmentally sensitive areas that could be impacted by on or adjacent to the proposed scope of work (i.e. wetlands, streams, etc.)	☒	☐	☒	Wetland delineation has been performed.

	SURROUNDING COMMUNITY IMPACTS				
10	Provide a description and location of all community sensitive structures that could be impacted by the proposed scope of work that includes: schools, churches, community centers, hospitals, airports, etc. related to the air emissions (airborne separation), noise, construction traffic, etc.	☒	☒	☒	Community sensitive structures in the vicinity of the project have been identified.

Preparer : MYROSIA DRAGAN (Printed name)

(Signature)

Date: 5/20/15

Design Engineer review: DAVID WEISS (Print name)

(Signature)

Date: 5/21/15