ENVIRONMENTAL ASSESSMENT and

FINAL SECTION 4(f) EVALUATION

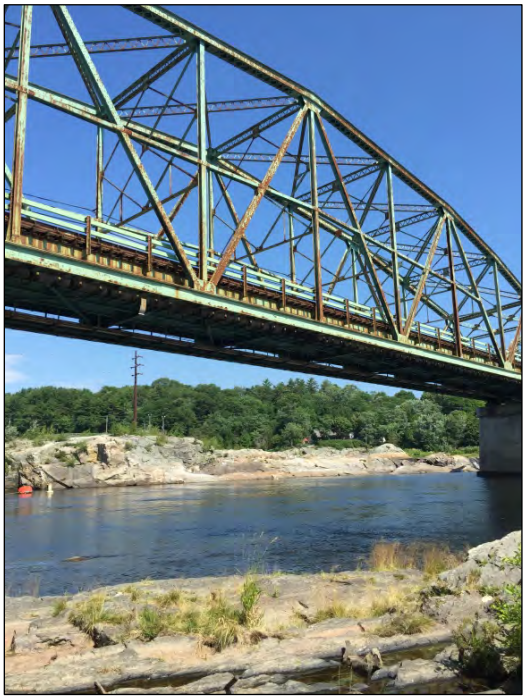
Brunswick-Topsham

Frank J. Wood Bridge

Cumberland and Sagadahoc County, Maine

Federal ID: STP-2260(300)

MaineDOT WIN: 22603.00



February 2019

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Submitted pursuant to 42 U.S.C. 4332
and 23 CFR 771
and 49 U.S.C. 303 and 23 CFR 774
By the

Federal Highway Administration
and
Maine Department of Transportation

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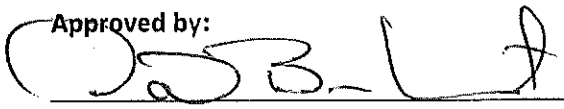

David Bernhardt, MaineDOT Commissioner — 2/22/18 Date

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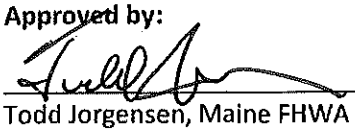

Todd Jorgensen, Maine FHWA Division Administrator — 2/27/18 Date

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A. Introduction

The National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] Part 1500 through 1508), and the Federal Highway Administration (FHWA) regulations implementing NEPA (23 CFR Part 771.101 through 771.139) direct FHWA to take into consideration the environmental consequences of proposed federal actions. In compliance with NEPA and its implementing regulations, this environmental assessment (EA) analyzes potential environmental impacts of the Preferred Alternative and other reasonable alternatives that would meet the purpose and need of the proposed project as well as a No Build Alternative. The No Build Alternative also serves as an environmental baseline against which all other alternatives can be compared. FHWA will use the findings in this EA to determine whether to prepare an Environmental Impact Statement (EIS).

B. Background

The Frank J. Wood Bridge carries US 201 / ME 24 over the Androscoggin River between the Towns of Brunswick and Topsham. The Brunswick Hydroelectric Dam is approximately 500 feet upriver of the bridge and is a power generation facility licensed to Brookfield White Pine Hydro, LLC. The Federal Energy Regulatory Commission (FERC) Boundary for the hydroelectric project is at elevation 17.35 (NAVD 88) which includes areas upstream and downstream of the existing bridge as well as portions of the existing bridge. Upstream fish passage at the dam also occurs via a vertical slot fishway adjacent to the powerhouse and on the western bank upstream. The Brunswick approach south of the bridge includes the 250th Anniversary Park east of US 201/ME 24 and the Fort Andross Mill Complex (originally the Cabot Mill) on the west. The Topsham approach includes the Bowdoin Mill Complex (originally the Pejepscot Paper Company) on the eastern side and a mixed use commercial building west of US 201/ME 24. Both Fort Andross and the Bowdoin Mill house a variety of shops, businesses, and restaurants. Figure 1 shows all of these properties in relationship to the Frank J. Wood Bridge. The Frank J. Wood Bridge is a key vehicular and pedestrian connection between the business districts and communities of Brunswick and Topsham.

Figure 1: Frank J. Wood Bridge Project Vicinity

The Frank J. Wood Bridge is one of three vehicular crossings of the Androscoggin River between Brunswick and Topsham. Approximately 19,000 vehicles a day travel across the bridge. About 2 miles upstream, I-295 crosses the river; it has interchanges with U.S. 1 on the Brunswick side and ME 196 on the Topsham side. Less than 1 mile downstream, ME 196 (also known as the Coastal Connector) crosses the river. In addition to these vehicular crossings, the Androscoggin Swinging Bridge is a pedestrian crossing of the river about ½ mile upstream of the Frank J. Wood Bridge. Figure 2 shows these crossings.

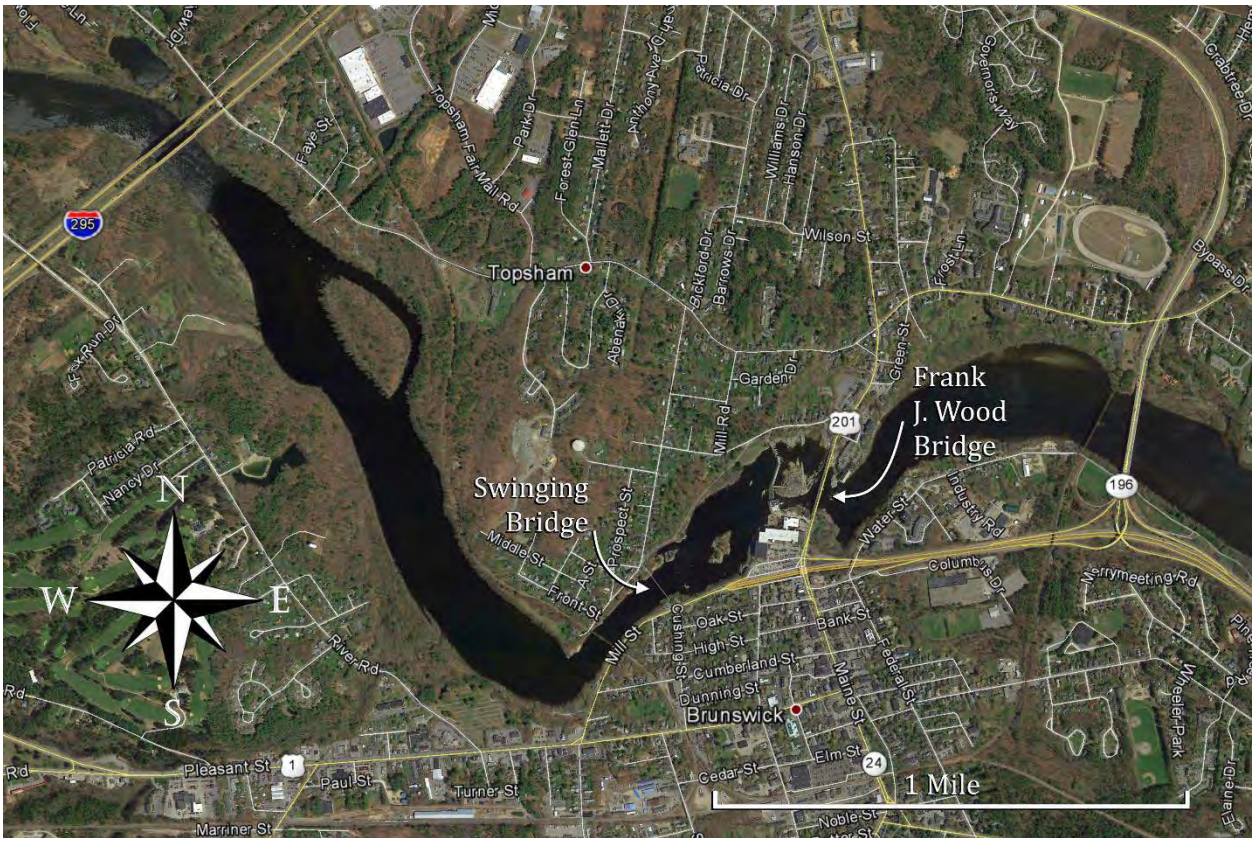

Figure 2: Existing Androscoggin River crossings between Brunswick and Topsham

The Frank J. Wood Bridge was constructed in 1932. It is an 805-foot-long, three span steel through-truss bridge supported by concrete abutments and two concrete piers. The travel way through the truss is 30 feet wide, with two 11-foot travel lanes and two 4-foot shoulders. The existing bridge carries a single sidewalk on the west side of the bridge. Because the outer 2 feet of the shoulders are made of an open steel grid, the usable shoulder width for bicycle travel is reduced to 2 feet on either side.

The Frank J. Wood Bridge was rehabilitated most recently in 2015, 2006, and 1985. It is a "fracture critical" structure, indicating it is vulnerable to sudden collapse if certain components fail. The truss diagonal and bottom chord members and their connections and the floor beams are the critical components (see Figure 3 for structure terminology). A "fracture critical" bridge is defined by the FHWA as a steel member in tension, or with a tension element, whose failure would probably cause a portion of or the entire bridge to collapse. Fracture critical bridges, of which there are a total of about 18,000 throughout the U.S., lack redundancy, which means that in the event of a steel member's failure there is no path for the transfer of the weight being supported by that member to hold up the bridge. Because of this designation, more detailed inspections are required and have been completed. Inspections by MaineDOT, most recently in August 2016, June 2016, and in 2012 found many deteriorated areas. There is corrosion and section loss in the steel floor system supporting the deck (the transverse cross beams, longitudinal stringers, and transverse floor beams). The floor system, bottom chords, and the concrete deck are currently in poor condition. Corrosion at the deteriorated areas is continuing and accelerating. Further, MaineDOT completed a load rating in 2013, updated it in August 2016, and found some floor system members are no longer adequate to support Maine's legal vehicle weights. The bridge is now posted for 25 tons.

MaineDOT initiated a Bridge Improvement Project for the Frank J. Wood Bridge in February 2015. The scope of the project was to assess the feasibility of a range of alternatives to address the bridge condition, from rehabilitation to full replacement. In April and May 2017, MaineDOT completed temporary repairs to address the most critical needs. Steel was added to the worst sections of the floor system beneath the deck, and missing and deteriorated rivets were repaired or replaced. These temporary repairs will maintain the current 25-ton load rating until 2022 when long-term capital improvements can be developed and completed.

FHWA and MaineDOT initially proposed to prepare a Categorical Exclusion for this project under 23 CFR 771.117(d)(3). However, due

to the presence of several environmental resources within the project area such as historic properties and districts, and threatened and endangered species and critical habitat, in addition to substantial public interest and controversy, FHWA and MaineDOT decided to prepare an Environmental Assessment (EA). The EA will help decide whether an Environmental Impact Statement would be needed and if there would be significant impacts resulting from the proposed action.

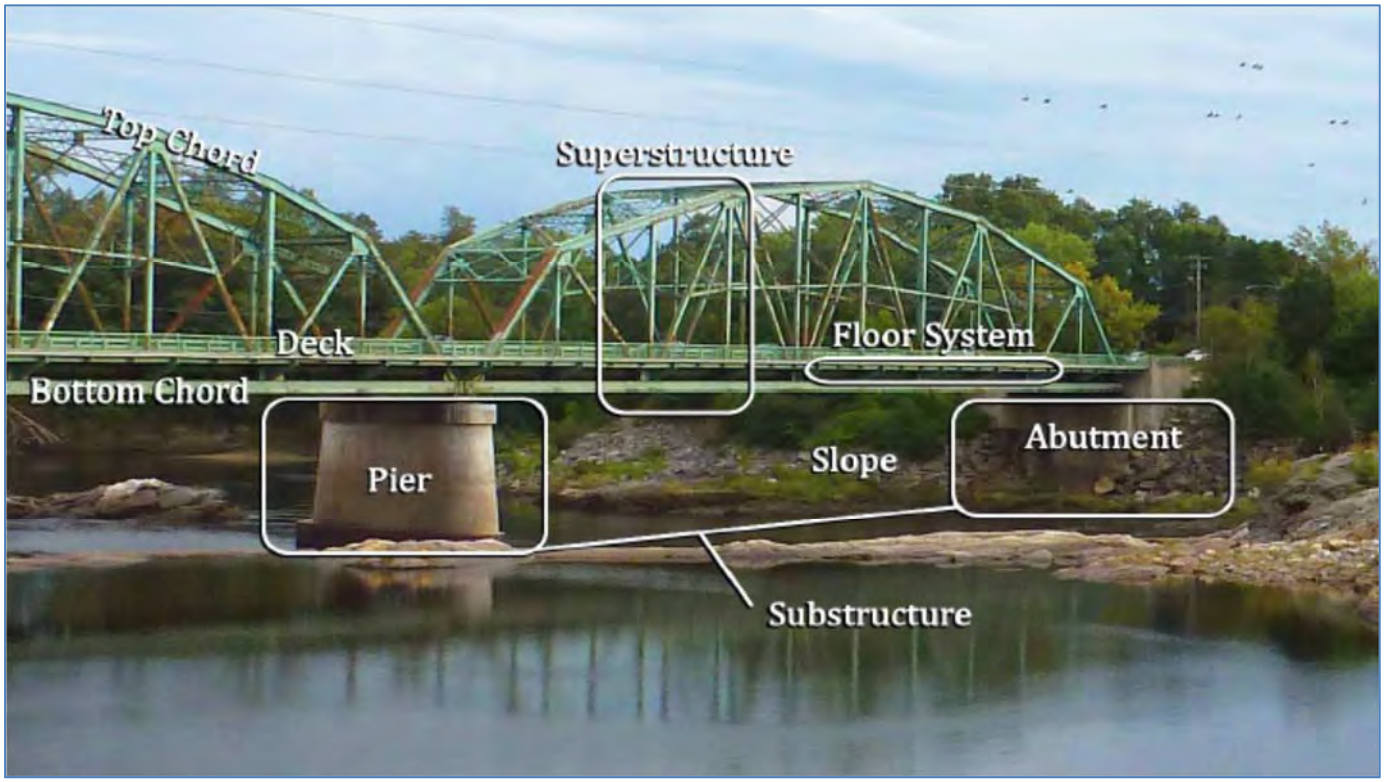

Figure 3: Steel Through-Truss Bridge Terms

C. Purpose and Need for Action

The purpose of the project is to address poor structural conditions and load capacity issues on the Frank J. Wood Bridge and to address mobility and safety concerns for pedestrians and bicycles.

Bridge improvements are needed to improve the condition ratings of the superstructure and deck from a rating of 4 (poor condition) to 7 (good condition). Because of the age of the bridge, 87 years old, and the considerable number of heavy loading cycles it has already experienced, steel fatigue concerns on critical tension members need to be addressed to continue to carry heavy truck traffic [1]on the existing truss. Additionally, the floor beams and stringers need improvements to bring their load rating factors to a 1.0[2] for all MaineDOT legal loads. The load rating ultimately results in the determination of what vehicle(s) can safely and repeatedly use the bridge.

This bridge is classified by FHWA as structurally deficient with superstructure and deck condition ratings of 4 (poor condition) out of 9. The three truss spans are fracture critical, meaning that failure of certain steel tension members could cause any of the three spans to collapse. Some of the steel truss bridge components are fatigue sensitive, susceptible to cracking and fracture because of heavy cyclic loading. The floor beams and stringers within the truss spans do not meet current design load or MaineDOT legal load standards.

The bridge supports foot traffic on the western side of the bridge only. Pedestrians crossing from Brunswick, on the east side of Routes 201/24 must cross the highway at existing mid-block pedestrian crossings before crossing the river. Bicycle traffic is limited by the 4-foot shoulder that consists of two feet of pavement and two feet of open steel grid. These conditions have been identified as safety

[1] Traffic data provided in Appendix G of the Preliminary Design Report states that traffic on the bridge is approximately 3% heavy trucks.
[2] The load rating is a measure of bridge live load capacity; it represents load that can safely use the bridge.

concerns that increase the likelihood of pedestrian/vehicle interactions, bicycle/vehicle interactions and vehicle/vehicle interactions.

D. Description of Alternative Alignments

MaineDOT identified and considered several alternatives to address the Purpose and Need during the planning phase of the project. The alternatives were refined and expanded based on input from the public and the Section 106 Consulting Parties. This section describes the alternatives and the discussion of impacts are in the sections that follow. A Matrix of Alternatives is provided in Appendix 1 that summarizes the alternatives and impacts.

MaineDOT evaluated five alternatives in addition to a No Build Alternative. Figure 4 shows the location of the alternatives relative to the existing bridge. Rehabilitation of the existing bridge would maintain the current alignment (shown in yellow below in Figure 4). The replacement options include on-alignment, upstream and downstream alignments.

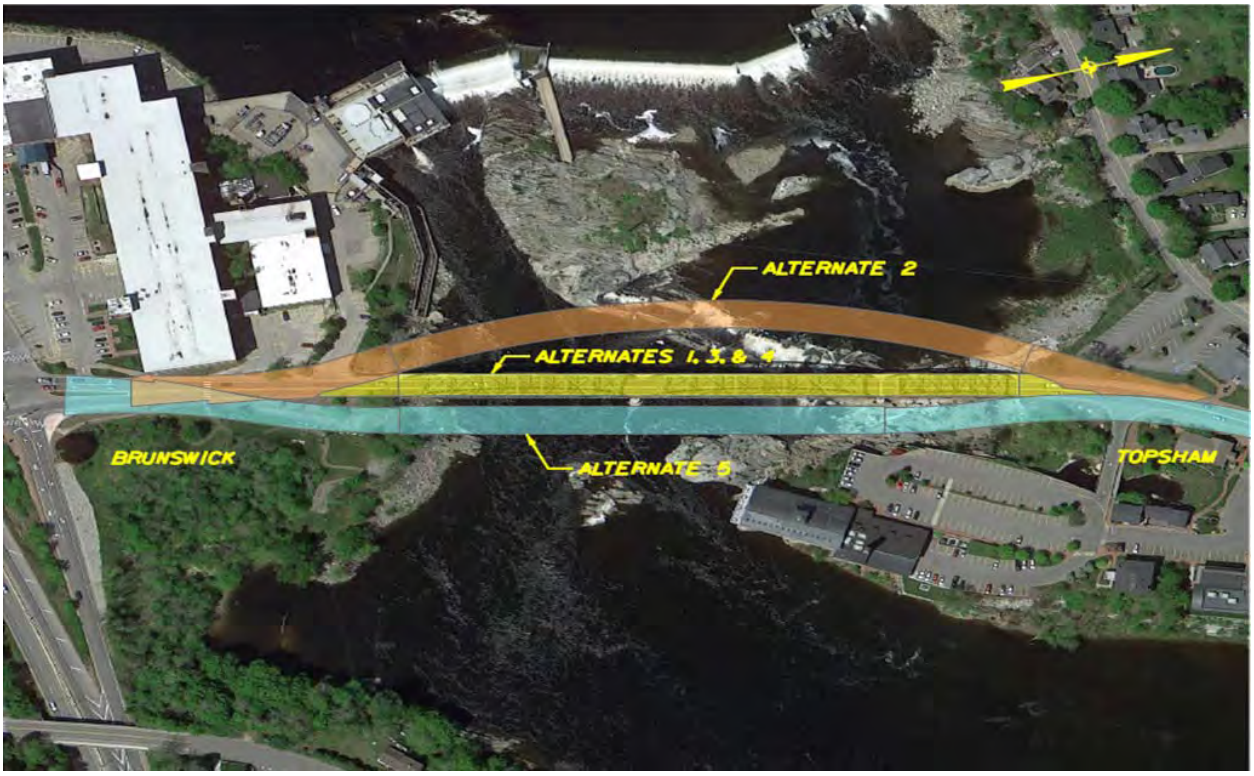

Figure 4: Alternative Alignments

No Build Alternative

The no build alternative presumes the existing structure remains unchanged except for required regular maintenance activities. The No Build Alternative serves as the baseline for which other alternatives can be compared. In August 2016, MaineDOT completed a detailed inspection of the bridge to summarize deterioration and target expected repairs over the next 5 years[3]. The inspection revealed rapid deterioration of structural steel and resulted in posting the bridge at a 25-ton load limit. The inspection identified repairs to the structural steel, particularly in the vicinity of floor beam ends and connection plates required to maintain the 25-ton load posting for approximately 5 years. The repairs, which costs $200,000, were completed in May 2017. A summary of the repairs completed can be found in the Preliminary Design Report[4] (Appendix 2).

Repair and maintenance, such as the repairs completed in May 2017, are included as part of the No-Build Alternative. With no additional capital improvements to the bridge components, the structural steel will continue to deteriorate. This will result in increased inspection frequency. Currently, the 25-ton maximum load posting precludes five axle trucks and other commercial vehicles

[3] Inspection Report, 8/1/16-8/2/16, Appendix C of Preliminary Design Report. See Appendix 2.
[4] Summary of Frank J. Wood Repair Contract, Appendix C of Preliminary Design Report. See Appendix 2.

from crossing the bridge and requires a bypass detour of one mile for these vehicles. Continued deterioration will likely result in further reductions in maximum loads on the bridge and eventual closure. The No Build Alternative will not improve the condition ratings of the bridge and will not address bicycle and pedestrian mobility and safety.

Alternative 1 – Replacement Bridge on Existing Alignment

Alternative 1 is a new 800-foot-long, multiple span, steel girder bridge on the existing alignment. The new bridge would have two 11-foot lanes, two 5-foot shoulders and two 5-foot sidewalks on both sides of the bridge. The bridge would be a multi-span steel girder structure supported by concrete piers and abutments on bedrock. The span arrangement and number of piers would be designed to minimize footprint impact within the channel of the Androscoggin River. MaineDOT would consider input from the Towns of Brunswick and Topsham, the Section 106 consulting parties, and the public for aesthetic components of the final design including railing and lighting. Construction of Alternative 1 would take approximately 3.5 years and would require a temporary bridge to maintain traffic during construction. The existing bridge would be demolished and removed prior to construction.

Alternative 2 – Replacement Bridge on Upstream Alignment (Preferred Alternative)

Alternative 2 is a new 835-foot-long bridge on a curved upstream alignment. The bridge would be a steel girder bridge supported by concrete abutments and piers on ledge. A curved bridge reduces the length of approach roadway construction and reduces right of way impacts to abutting properties when compared to a straight bridge in the same upstream location. The span arrangement and number of piers would be designed to minimize footprint impacts within the channel and within the FERC Boundary.

The new bridge would include two 11-foot lanes, two 5-foot shoulders, and two 5-foot sidewalks on both sides of the bridge. The bridge would be a multi-span steel girder structure supported by concrete piers and abutments on bedrock. MaineDOT would consider input from the Towns of Brunswick and Topsham, the Section 106 consulting parties, and the public for aesthetic components of the final design including railing and lighting. Construction of Alternative 2 would take approximately 2.5 years. Traffic would be maintained on the existing bridge during construction. The existing bridge would be demolished and removed when construction is complete.

Alternative 3 – Bridge Rehabilitation with Existing Westerly Sidewalk

Alternative 3 consists of rehabilitation of the existing truss bridge. The expected life of the rehabilitation work would be 75 years[5]. The work would consist of the following:

- Construct temporary bridge upstream of the existing bridge
- Replace existing bridge deck
- Repair the top of steel sidewalk support brackets
- Replace bridge joints
- Replace steel floor system
- Replace bottom flange angles of the bottom chord of the main trusses
- Replace lattice plates of the bottom chord
- Remove welded steel plates attached to truss vertical members; remediate with cover plates
- Paint entire steel superstructure including all above and below deck components
- Replace all existing utility brackets
- Replace abutment backwalls
- Repair stone masonry
- Replace concrete bearing pedestals at Pier 2

The rehabilitation work would be completed in accordance with the United States Secretary of the Interior's Standards for

[5] This alternative was examined and initially presented at the April 2016 public meeting as a 30-year rehabilitation. It included replacing the bridge deck, repairing the damaged and deteriorated steel bridge members, and painting the entire truss. The consideration of a 30-year solution eliminated the need for future painting of the bridge, one of the costliest components of extending the rehabilitation service life. Lane closures and bridge closures were assumed for maintenance of traffic. Later in 2016, it was determined that the user cost of lane closures and bridge closures were higher than installation of a temporary bridge. Once the construction cost of a temporary bridge was added to the 30-year alternative it was no longer a cost effective alternative and was not comparable to the other alternatives that offered a 75 to 100-year service life. It was not given further consideration. A 75-year bridge rehabilitation was then studied and considered.

Rehabilitation of Historic Properties[6]. Alternative 3 would maintain the existing two 11-foot lanes and two 4-foot shoulders[7] and one sidewalk on the west side of the bridge. The open grid decking along the outside of the existing shoulders would be replaced with a solid concrete deck. Even after rehabilitation, the Frank J. Wood Bridge would remain fracture critical.

Construction of Alternative 3 would take approximately 3 years and two-way traffic would be maintained with a temporary bridge.

Alternative 4 – Bridge Rehabilitation with Existing Westerly Sidewalk and a New Easterly Sidewalk

Alternative 4 consists of rehabilitation of the existing truss bridge. The expected life of the rehabilitation work would be 75-years. The work would consist of the following:

- Construct temporary bridge
- Replace existing bridge deck with a new lightweight concrete-filled Exodermic bridge deck
- Repair the top of steel sidewalk support brackets
- Replace bridge joints
- Replace steel floor system
- Replace bottom flange angles of the bottom chord of the main trusses
- Replace lattice plates of the bottom chord
- Remove welded steel plates attached to truss vertical members; remediate with cover plates
- Paint entire steel superstructure including all above and below deck components
- Replace all existing utility brackets
- Replace abutment backwalls
- Repair stone masonry
- Replace concrete bearing pedestals at Pier 2
- Construct a new 5’ easterly sidewalk with pedestrian rail

The rehabilitation work would be completed in accordance with the United States Secretary of the Interior’s Standards for Rehabilitation of Historic Properties[8]. Alternative 4 would maintain the existing two 11-foot lanes and two 4-foot shoulders[9] and a sidewalk on the west side of the bridge. Alternative 4 would add a 5-foot sidewalk on the east side of the bridge. The open grid decking along the outside of the existing shoulders would be replaced with a solid concrete deck. Even after rehabilitation, the Frank J. Wood Bridge would remain fracture critical.

To maintain the existing loading on the trusses while adding a new second sidewalk, weight would need to be taken off the truss elsewhere. Various lightweight concrete deck systems such as lightweight concrete, sandwich steel plate systems, and composite deck systems were considered, but a new lightweight concrete-filled Exodermic bridge deck would be recommended for this alternative. This alternative includes the addition of new structural steel framing, concrete deck, and pedestrian rail for the new 5-foot wide sidewalk on the east side of the bridge. Construction of Alternative 4 would take approximately 3 years and two-way traffic would be maintained with a temporary bridge.

Alternative 5 – Replacement Bridge on Downstream Alignment

Alternative 5 would be a new 800-foot, five span steel girder bridge located downstream of the existing bridge on a straight alignment, between the current bridge and the Bowdoin Mill Complex parking lot. The new bridge would include two 11-foot lanes, two 5-foot shoulders, and two 5-foot sidewalks. The bridge would be a multi-span steel girder structure supported by concrete piers and abutments on bedrock. Construction of Alternative 5 would take approximately 2.5 years. Traffic would be maintained on the existing bridge during construction. The existing bridge would be demolished and removed.

[6] 36 CFR 67

[7] In Appendix 1 (Matrix of Alternatives Investigated), two options for travel lane and shoulder widths were provided for this Alternative. The bridge could be restriped for two 10-foot lanes and two 5-foot shoulders. However, regardless of the travel lane and shoulder widths, impacts will remain the same.

[8] 36 CFR 67

[9] In Appendix 1 (Matrix of Alternatives Investigated), two options for travel lane and shoulder widths were provided for this Alternative. The bridge could be restriped for two 10-foot lanes and two 5-foot shoulders. However, regardless of the travel lane and shoulder widths, impacts will remain the same.

Preferred Alternative (Alternative 2)

MaineDOT and FHWA have evaluated the alternatives and their relative impacts considering: engineering feasibility, cost, constructability, and environmental impacts and have identified Alternative 2 as the Preferred Alternative. Figure 5 provides a conceptual rendering of the Preferred Alternative.

The effects relative to the following social, economic, natural, and cultural resources have been assessed for Alternatives 1, 2, 3 and 4. A hydraulic analysis showed that Alternative 5 would substantially increase the base flood elevation. The analysis showed that a downstream replacement bridge will raise water levels at the Bowdoin Mill Complex, particularly the end of the mill building where the Sea Dog Brewing Company is located. The hydraulic models suggested that during the design flood, floodwaters would rise more than 6 feet higher than existing conditions near the deck area of the Sea Dog Brewing Company.[10] Based on this, Alternative 5 was dismissed from further consideration and is not discussed further in this Environmental Assessment. A Matrix of Alternatives Investigated and a summary of the potential effects is located in Appendix 1. The environmental impacts of the Preferred Alternative (Alternative 2) and other alternatives considered are discussed in more detail in the sections that follow.

Figure 5: Preliminary Rendering of Preferred Alternative (Alternative 2)

Additional Alternatives Considered

MaineDOT and FHWA evaluated a design concept submitted by the Friends of the Frank J. Wood Bridge (Friends), including a rehabilitation concept titled "Option 3". This proposal was submitted as a comment to the EA and was further discussed at the June 27, 2018 Section 106 Consulting Parties meeting. "Option 3" proposes to replace the existing bridge deck with an independent steel girder system. [11] This option was presented at a conceptual level only. No engineering analysis or cost estimates were provided. MaineDOT conducted an examination of the Friends' bridge rehabilitation study and determined that the rehabilitation options already evaluated in the Environmental Assessment were appropriate and sufficient.

The alternative presented by the Friends proposed to replace the superstructure of the truss bridge save the bottom chords with a two or three span set of steel girders. MaineDOT commissioned review of the Friends' study by a consultant, who identified numerous

[10] See Memo dated August 22, 2017, Re: Brunswick-Topsham, Frank J. Wood Bridge, Downstream Alternative Hydraulics, Appendix 5
[11] See: *Historic Frank J. Wood Bridge Study*. Prepared for: Friends of the Frank J. Wood Bridge. Prepared by: JDB Consulting Engineers, Inc. April 9, 2018. This analysis was submitted as a comment to the Frank J Wood Bridge Project Environmental Assessment.

technical concerns.[12] At the end of construction, the truss would be non-functional. MaineDOT estimates the depth ratio of the girders may be as high as 8' to 10'. Additionally, this alternative does not meet the purpose and need because it does not address bicycle and pedestrian safety.

In response to continued Section 106 Consulting Party interest in expending agency time and resources exploring constructability, design details, and cost implications of the Friends' rehabilitation concept, FHWA conducted an additional internal review of both the Friends' report and MaineDOT's analysis in August 2018. FHWA's internal review found the following:

The Friends' Option 3 was presented at a conceptual level only. No engineering analysis or cost estimates were provided. Therefore, only general comments could be made.

- As a general rule, for simply supported steel I-girders, AASHTO Table 2.5.2.6.3-1 specifies the minimum ratio of the depth of steel girder portion to the span length to be 0.033. Based on the existing span length of 310', the girders would be around 10' deep. However, to maintain the existing structure depth as described in the report, the girders would have to be around 5' deep. This proposed depth to span ratio is significantly outside the range of standard engineering practice. Further development of this option would be needed to determine if the construction of this bridge type is possible. If construction of this type is possible, this option would look and act different from the existing bridge.

- This option also proposes the use of a "vertical slip connection" between the truss and the new girders. This is a complex detail and there is no information in the study to determine how the existing trusses are attached to the new superstructure. This is not a typical bolted connection so it would need further development and analysis to demonstrate its viability.

- In addition to improving the structural condition and load capacity, the Purpose and Need of this project includes pedestrian accommodations. The existing bridge has a sidewalk on the west side. Option 3 has no mention of a sidewalk or any other pedestrian accommodations.

Based on information presented in the technical reports outlined above, FHWA concluded per 23 CFR 774.17 that the additional design concept presented by the Friends of Frank J Wood Bridge during the EA comment period could not serve as a prudent and feasible avoidance alternative for this project under Section 4(f) of the Department of Transportation Act. This alternative was dismissed from further consideration (See Section M, *Frank J Wood Bridge Project Final Section 4(f) Evaluation*).

E. Environmental Impacts: Natural Resources

Compliance with federal environmental laws and regulations is required. Ensuring compliance includes identifying, assessing and documenting environmental resources in the project area and avoiding, minimizing or mitigating impacts on those environmental resources. The below sections list the environmental resources and impacts to those environmental resources that are anticipated to occur within the project area. Alternatives 1, 2, 3 and 4 would all have impacts to natural resources, but at varying degrees. Compliance with environmental laws and regulations for natural resources that are either not present in the project area or that will result in no effect from all the alternatives are documented in the Other Federal Environmental Laws section of this EA.

1. Endangered and Threatened Species - Fish

Section 7 of the Endangered Species Act requires each Federal agency to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat.

MaineDOT completed early coordination with the Maine Department of Marine Resources (MDMR) and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) about species present within the area of potential impact[13]. In a letter dated June 2, 2017, NMFS provided comments on Federally Endangered Species in the project area[14]. NMFS commented that federally listed species in the project area include the endangered Gulf of Maine distinct population segment (DPS) of Atlantic salmon, endangered shortnose sturgeon and Atlantic sturgeon. The project area is designated as critical habitat for Atlantic salmon

[12] Memorandum. WIN 22603.00 Frank J. Wood Bridge: Comments on JDB Bridge Rehab Study. TYLIN International. June 4, 2018.
[13] Gail Wippelhauser, Maine Department of Marine Resources, See Appendix 4: Agency Correspondence
[14] See Appendix 4: Agency Correspondence

and as critical habitat for Atlantic sturgeon. This project area is also used for spawning and rearing of shortnose and Atlantic sturgeon. Per NMFS, Atlantic salmon migrate upstream through the project area in May, June, and July. Shortnose sturgeon spawn in the project area in April and June. Atlantic sturgeon stage and spawn in the same area in June and July.

Based on proposed construction activities and known species presence, MaineDOT and FHWA made preliminary determinations that the Preferred Alternative (Alternative 2) was likely to have adverse effects to sturgeon and salmon and critical habitat. However, utilizing Avoidance and Minimization Measures (AMMs), many of the potential direct effects are related to temporary construction activities which will be conducted when species are less likely to be present. The schedules used to estimate the construction duration of each alternative assumed that in-water work activities most likely to affect endangered fish species would not occur between early April and late August.

Alternative 1 (on-alignment replacement) would require similar in-water activities and durations when compared to the Preferred Alternative (Alternative 2), except that Alternative 1 would also require an on-site temporary detour bridge and one additional year of construction duration. The rehabilitation alternatives (Alternatives 3 and 4) would not require new piers, rock removal or demolition of the existing bridge. However, they would require installation and removal of in-water supports for a temporary detour bridge. The overall duration of construction of the rehabilitation alternatives is estimated to be approximately six months longer than the Preferred Alternative (Alternative 2). Alternatives 1, 3, and 4 would have opportunities to minimize effects during design and construction like those for the Preferred Alternative (Alternative 2). Based on assessments completed to date, none of the alternatives considered would jeopardize the continued existence of these fish species or adversely modify the species' critical habitat.

MaineDOT (on behalf of FHWA) prepared a Biological Assessment and initiated Section 7 Consultation for effects to endangered and threatened species from the Preferred Alternative (Alternative 2) on November 2, 2017. The assessment identified potential effects to critical habitat and to fish species within NMFS jurisdiction. Potential effects to the species from the Preferred Alternative (Alternative 2) include underwater noise, increased sedimentation and turbidity, construction-related boat traffic and entrapment in cofferdams. The construction activities with potential to cause effects include installation of in-water supports for temporary work trestles, cofferdam installation and removal, possible rock removal to prepare for pier construction, and bridge pier demolition.

The Biological Assessment proposed AMMs to reduce potential effects. AMMs are project-specific measures that prevent or reduce the impact of a project on fish species or habitats. Proposed AMMs include minimizing permanent in-water structures; avoiding in-water work during known spawning and migration periods and other times when species are likely to be present; fish observation and evacuation if necessary; and using Best Management Practices (BMPs) for sedimentation and erosion control.

Replacement of the bridge will result in permanent conversion of habitat. MaineDOT and FHWA minimized permanent impacts by designing permanent features (piers, abutments, scour protection) to use the smallest footprint possible. Based on the proposed AMMs, the Biological Assessment states an overall effect determination that the Preferred Alternative (Alternative 2) "May Affect, is Likely to Adversely Affect"[15] shortnose sturgeon, Atlantic sturgeon, and Atlantic salmon. The Biological Assessment also concluded that the project "May Affect, is Likely to Adversely Affect"[14] the physical and biological features of Atlantic salmon Critical Habitat and Atlantic sturgeon Critical Habitat.

A Biological Opinion issued March 30th, 2018 by the National Marine Fisheries Service concluded that the proposed action is likely to adversely affect, but not likely to adversely modify or destroy critical habitat designated for the Gulf of Maine distinct population segment (DPS) of Atlantic sturgeon. It also concluded that the proposed action may affect, but is not likely to adversely affect, the Gulf of Maine DPS of Atlantic sturgeon, endangered shortnose sturgeon, endangered Gulf of Maine DPS of Atlantic salmon, or critical habitat designated for the Gulf of Maine DPS of Atlantic salmon.[16]

The Biological Opinion incorporates the AMMs described in the Biological Assessment. The following AMMs will be implemented:

- All elements of the project will be conducted in compliance with MaineDOT's Standard Specifications (MaineDOT 2014). The Standard Specifications is a textual compilation of provisions and requirements for the performance of any MaineDOT work and requires BMPs related to surface water quality protection and waste management. BMPs are methods, facilities, build elements, and techniques implemented or installed during project construction to prevent or reduce project impacts.

[15] This language is specific to and defined under 50 CFR 402
[16] See Appendix 10: Endangered Species Act Biological Opinion

- Contractors will submit a Soil and Erosion and Water Pollution Control Plan (SEWPCP) for review and approval by MaineDOT staff prior to the start of work. The plan includes the review of the implementation of any BMPs or AMMs proposed.
- Prior to soil disturbance, the erosion control portion of the SEWPCP will be reviewed and in place.
- In-water work window. MaineDOT and FHWA commit to avoiding all activities that could result in in-water noise that could result in fish disturbance (louder than 150 dB RMS) and turbidity producing activities between March 16 and July 31.
- No equipment, materials, or machinery shall be stored, cleaned, fueled, or repaired within any wetland or watercourse; dumping of oil or other deleterious materials on the ground will be forbidden; the contractor shall provide a means of catching, retaining, and properly disposing of drained oil, removed oil filters, or other deleterious material; and all oil spills shall be reported immediately to the appropriate regulatory body.
- Contractors are required to install turbidity curtains around areas planned for in-water fill associated with construction of the temporary trestle access point. All in-water trestle construction will occur between August 1 and March 15. In-river (i.e., not the ponded/bedrock falls habitat on the Topsham side) trestle construction and removal (~60 square feet footprint) will occur between September 1 and March 15.
- Maine DOT modified the preliminary design to eliminate a fourth in-water pier (leaving three in-water piers) to avoid impacts to critical habitat as well as potential effects to fishway function.
- All four cofferdams shall be constructed during the in-water work window, between August 1 and March 15, with the exception of the cofferdam for Pier 1, which will occur between September 1 and March 15.
- Bedrock leveling using hydraulic breakers (or hoe rams), blasting, or other methods resulting in potential injury to fish species present will occur between November 8 to March 15. All other in-water work activities resulting in potential noise levels over 150 dB RMS will be completed between August 1 and March 15.
- Plans for any project-related blasting will be submitted with 150 days for NOAA to review and will be designed to remain below potential fish injury limits (206 dB Peak (2.89 PSI)).
- Any blasting activities to occur from November 8 to November 30 will incorporate the following minimization measures to reduce potential impacts to adult Atlantic salmon which may still be present in the area:
    - Active acoustic monitoring of the action area for any tagged fish potentially present in the Androscoggin River.
    - Minimize charge sizes and the number of days of exposure to blasting.
    - Deploy scare charges prior to the main blast.
    - Conduct visual inspection of the action area post blast to document any impacts to fish.
- Fresh concrete will be poured inside of cofferdams and will not come into contact with flowing water.
- MaineDOT will deploy a diver into the cofferdams to visually search for endangered fish species. Should a salmon or sturgeon be observed within a cofferdam structure, MaineDOT will coordinate with the resource agencies for removal of those individuals prior to proceeding with construction.
- Water pumped out of the cofferdam will be within one pH unit of background (MaineDOT standard specifications). A representative of the MaineDOT Surface Water Quality Unit will periodically evaluate pH to determine whether the water is within the allowable tolerance to be pumped directly back into the river or whether it needs to be treated prior to discharge.
- Superstructure demolition debris will be contained using control devices and cannot enter the water.
- The existing pier structure will be removed down to the underlying bedrock and debris from the structure will be removed from the river to restore potential natural spawning substrate for sturgeon species.
- Construction crews will visually monitor for sturgeons in equipment and on barges and report any sturgeon to MaineDOT environmental staff.
- Vessels will travel at “slow speeds, typically less than 6 knots” (6.9 miles per hour) in the construction zone.

2. Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act requires projects that are funded, permitted, or implemented by federal action agencies to consult with NMFS regarding potential adverse impacts to Essential Fish Habitat (EFH).

MaineDOT and FHWA completed early coordination with NMFS that included an on-site meeting and other follow-up meetings to discuss EFH species and potential effects from the project. In a letter dated June 2, 2017[17], NMFS commented that the Androscoggin River and Merrymeeting Bay are identified as Essential Fish Habitat for Atlantic salmon. In addition, the area supports a number of other diadromous species including alewife, blueback herring, rainbow smelt, American shad, sea lamprey, American eel, and striped bass. American shad and blueback herring spawn in the project area. NMFS noted that because many of these species are prey for federally managed species, they are considered a component of EFH. Many of these species use the fishway adjacent to the dam to reach upstream spawning or rearing habitat. Spawning and migration occur in the spring and summer and are the most sensitive to impacts. The MDMR provided a summary of data from the fishway[18] to further define when species are using the project area.

In addition, NMFS stated that several other federally managed species occur within the tidal waters downstream of the dam and may occur within the proximity of the proposed project. These include winter flounder, windowpane flounder, bluefish, Atlantic mackerel, red hake, and white hake. EFH for these species are defined by temperature, depth, salinity, and velocity and these characteristics are addressed in the EFH Assessment Report.

The Preferred Alternative (Alternative 2) will have adverse effects on EFH. Approximate net loss of habitat from permanent structures is approximately 3,000 square feet. MaineDOT (on behalf of FHWA) initiated EFH Consultation with NMFS in May 2018. NMFS responded with conservation recommendations on July 27, 2018, (See Appendix 11). FHWA and MaineDOT accepted the following conservation recommendations via email on August 31, 2018:

- Debris and rubble from the demolition of the existing bridge should be prevented from entering the river below the Ordinary High Water (OHW) line, to the extent possible. Any debris or rubble that inadvertently falls below the OHW line should be removed using the least damaging methods available. This recommendation will be implemented with standard contract provisions.
- All bedrock leveling and substructure removal using hydraulic breakers, hoe rams, blasting, or other methods resulting in potential injury to fish species present should occur between November 8 to March 15. All other in-water work activities resulting in potential noise levels over 150 dB RMS will be completed between August 1- March 15. This measure minimizes impacts to migrating alewife, blueback herring, American shad, rainbow smelt, and striped bass.
- MaineDOT will review final impacts with the U.S. Army Corps of Engineers (USACE) and discuss any required mitigation via the permitting process during final design.

Alternative 1 (on-alignment replacement) would require similar in-water activities and durations when compared to the Preferred Alternative (Alternative 2), except that Alternative 1 would also require an on-site temporary detour bridge and one additional year of construction duration. The rehabilitation alternatives (Alternatives 3 and 4) would not require new piers, rock removal or demolition of the existing bridge. However, they would require installation of in-water supports for a temporary detour bridge. The overall duration of construction of the rehabilitation alternatives would be six months longer than the Preferred Alternative (Alternative 2). Alternatives 1, 3, and 4 would have adverse effects on EFH, and would have opportunities to minimize effects during design and construction similar to those for the Preferred Alternative (Alternative 2).

3. Endangered and Threatened Species - Wildlife

The project is located within the range of the Northern Long-Eared Bat (NLEB). The NLEB was listed as threatened under the Endangered Species Act on April 2, 2015. MaineDOT completed an assessment of potential NLEB habitat in the project area and did not observe any evidence of bat use[19].

The upland habitat at the project site consists primarily of developed space with ornamental vegetation and species that provide limited habitat value for wildlife. However, MaineDOT identified several trees on the north side of the bridge that may potentially provide summer roosting habitat for NLEB. Although the immediate surrounding upland habitat is mostly developed, at a landscape

[17] See Appendix 4: Agency Correspondence
[18] Gail Wippelhauser, Maine Department of Marine Resources, See Appendix 4: Agency Correspondence
[19] See Appendix 3

scale NLEB and other bats could use this area for summer roosting since available flight corridors (e.g. along the river) provide connectivity to contiguous areas of forested habitat in the area, several of which are protected from development. MaineDOT surveyed the existing bridge and did not observe any evidence of bat use.

The Preferred Alternative (Alternative 2) will result in removal of suitable roost trees (approximately 0.25 acres). MaineDOT (on behalf of FHWA) filed a Streamlined 4(d) Consultation Form with the U.S. Fish and Wildlife Service (USFWS) on May 5, 2016. Each alternative would have required similar extents of clearing to accommodate an off-alignment replacement or a temporary detour bridge to accommodate an on-alignment replacement or rehabilitation. The limited tree removal required for the Preferred Alternative (Alternative 2) results in a "May affect, but is Not Likely to Adversely Affect"[20] determination for the NLEB. The USFWS review period expired June 10, 2016, concurring with this determination. MaineDOT (on behalf of FHWA) re-filed a Streamlined 4(d) Consultation Form with the U.S. Fish and Wildlife Service (USFWS) on October 29, 2018 because the initial consultation expired. USFWS concurred with the determination on October 30, 2018. See Appendix 4.

4. U.S. Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act provides the basic authority for the USFWS and NMFS involvement in evaluating impacts to fish and wildlife from proposed water resource development projects. It requires that fish and wildlife resources receive equal consideration to other project features. It also requires Federal agencies that construct, license or permit water resource development projects to first consult with USFWS or National Marine Fisheries Service (NMFS, NMFS), as appropriate, and the State fish and wildlife agency regarding the impacts on fish and wildlife resources. Consultation regarding fish and wildlife species has occurred with NMFS and USFWS and will continue through project design. Conservation measures and opportunities to minimize effects during design and construction are expected to be similar for Alternatives 1, 2, 3 and 4.

5. Wetlands and Waterbodies

a. Clean Water Act

Section 401 of the Clean Water Act (CWA) prohibits Federal permitting or licensing agencies from issuing authorizations for construction activities having discharges into navigable waters, until the appropriate water quality certifying agency has issued a water quality certification (WQC) or waiver procedures have been satisfied.

Section 404 of the CWA establishes a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Activities in waters of the United States regulated under this program include fill for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports) and mining projects. Section 404 requires a permit before dredged or fill material may be discharged into waters of the United States, unless the activity is exempt from Section 404 regulation.

The Maine Department of Environmental Protection (DEP) has combined the decision concerning WQC with the review of an application for a state permit that already requires compliance with state water quality standards. Compliance with Section 401 is through the issuance of WQC with a state permit or by meeting an exemption.

Since all the alternatives will involve in-water work, all the alternatives would require coordination with the Maine DEP to discuss impacts and issuance of a Section 401 WQC with a state permit or by meeting an exemption. Final impacts and any required mitigation will be incorporated in an application and discussed with the U.S. Army Corps of Engineers to obtain a permit which will satisfy Section 404 of the Clean Water Act[21]. MaineDOT and FHWA anticipate that the Preferred Alternative (Alternative 2) will require an Individual Permit because of its potential adverse effects to endangered and threatened species and critical habitat.

b. Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act of 1899 requires authorization from the Secretary of the Army, acting through the USACE, for the construction of any structure in or over any navigable water of the United States. Structures or work outside the limits defined for navigable waters of the United States require a Section 10 permit if the structure or work affects the course, location, or condition of

[20] This language is specific to and defined under 50 CFR 402
[21] The Section 404 permit is typically obtained after the NEPA process.

the water body. The law applies to any dredging or disposal of dredged materials, excavation, filling, re-channelization, or any other modification of a navigable water of the United States, and applies to all structures.

Section 9 of the Rivers and Harbors Act of 1899 and the General Bridge Act of 1946 require authorization from the U.S. Coast Guard (USCG) to construct a new bridge or causeway or reconstruct or modify an existing bridge or causeway across navigable waters[22] of the United States. MaineDOT has requested an exemption under Title 23 U.S.C. Section 144(h) and Title 23 C.F.R. 650.805 "Bridges not requiring a USCG Permit".

For any of the alternatives, final impacts and any required mitigation will be incorporated in an application and continued coordination will occur with the USACE and/or the USCGto obtain a permit or confirm an exemption in accordance with Sections 9 and 10 of the Rivers and Harbors Act.

c. Wetland and Waterbody Impacts

MaineDOT completed a natural resources survey within the proposed project area. The survey results are provided in Appendix 3. MaineDOT will continue coordination with state and federal resources agencies during final design and permitting to further avoid and minimize impacts to wetlands and waterbodies.

The preferred alternative will incorporate best practices to minimize potential impacts to surface water in accordance with the "Memorandum of Agreement for Stormwater Management between the Maine Department of Transportation, Maine Turnpike Authority, and Maine Department of Environmental Protection, dated June 27, 2017 and the Maine Department of Environmental Protection "General Permit-Construction Activity, Maine Pollutant Discharge Elimination System with Basic Performance Standards Appendices"; and MaineDOT Standard Specification 656, "Temporary Soil Erosion and Water Pollution Control".

Permanent Wetland and Waterbody Impacts

There is one freshwater wetland in the project area that would be avoided by all of the alternatives. Each of the alternatives considered would impact the Androscoggin River. The pier and span arrangement of the Preferred Alternative (Alternative 2) will minimize the number of piers and maximize the use of bedrock outcrops above Highest Annual Tide/Ordinary High Water (HAT/OHW), but will result in new piers below the HAT/OHW of the Androscoggin River (approximately 3,400 square feet). The Preferred Alternative (Alternative 2) will also require placement of riprap in the river to provide scour protection at the new abutments and stabilize the bank (approximately 400 square feet). Removal of the existing in-water pier that supports the existing bridge on the Brunswick side will restore approximately 800 square feet of the Androscoggin River resulting in a net increase in permanent footprint of approximately 3,000 square feet. Based on this amount of impact, compensatory mitigation for wetland and waterbody impacts is not expected. Permanent impacts from the other replacement alternative (Alternative 1) would be similar. The rehabilitation alternatives (Alternatives 3 and 4) would likely not have any additional permanent impacts below the HAT/OHW. All alternatives would be in compliance with Executive Order 11990, Protection of Wetlands.

Temporary Wetland and Waterbody Impacts

The Preferred Alternative (Alternative 2) will include temporary fill and piles to construct a trestle for access to construct the cofferdams and piers, to erect the structural steel superstructure, to place deck concrete, and to remove the existing bridge. Temporary impacts estimated for Alternative 2 include approximately 2,000 square feet of temporary fill and approximately 800 square feet of temporary work trestle piles. Alternative 1 would have temporary impacts from fill and piles used to construct a trestle (approximately 2,800 square feet), in addition to requiring in-water fill and piles to support a temporary bridge (approximately 5,000 square feet). Temporary impacts from the rehabilitation alternatives (Alternatives 3 and 4) would include in-water piles to support a temporary bridge (approximately 5,000 square feet).

6. Coastal Zone Management

The Coastal Zone Management Act (CZM) requires all projects located within the designated coastal zone of a state be consistent with the State's federally approved CZM plan. The CZM grants Maine and other coastal states that have an approved coastal management program the authority to review federal activities, federal license or permit activities, and federally funded activities to ensure that

[22] For U.S. Coast Guard bridge permitting purposes, a navigable water is defined at 33 CFR, Subpart 2.05-25. It includes any waterway which is subject to the ebb and flow of the tide; or any waterway which is presently used and/or is susceptible to use in its natural condition, or by reasonable improvement, as a means to transport interstate or foreign commerce.

federal actions that may affect its coastal area meet the enforceable policies of the State's coastal program. The process by which a state decides whether a federal action meets its enforceable policies is called federal consistency review.

In Maine, standards and criteria of state environmental permitting and licensing laws and regulations serve as the enforceable policies of the Maine Coastal Program and are satisfied through the issuance of a Maine DEP permit or by meeting an exemption. All the alternatives would require coordination with the Maine DEP for a state permit. The evaluation of alternatives and measures to avoid and minimize impacts to wetlands, waterbodies, and fish and wildlife described in this EA are expected to meet state permit criteria.

7. Floodplains & Hydraulics

Executive Order 11988 requires Federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development whenever there is a practicable alternative.

A hydraulic analysis was performed to estimate how the river would behave with new piers added in the river. The results showed that water surface elevations upstream and downstream of the Preferred Alternative (Alternative 2) would closely match existing conditions due to the span arrangement and location of piers on existing ledge outcrops. Additionally, Alternative 1 being on existing alignment and Alternatives 3 and 4 being rehabilitation options, would also match the existing conditions. (See Hydraulic Analysis in Appendix 2).

8. Hazardous Materials (Contaminated Properties)

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) requires an environmental site assessment investigation which must address the liability of acquiring portions or all of a property. Initial site assessments have indicated that a property on the northwest Topsham approach was a former gas station. Review of available spill reports and uncontrolled sites data from the Maine Department of Environmental Protection suggests that the preferred Alternative (Alternative 2) will not directly impact the site with the initial limits of cuts, fills and property acquisition. However, MaineDOT will conduct additional borings and coordination during final design to ensure compliance with CERCLA. The data also suggests Alternatives 1, 3, and 4 do not directly impact the site with the initial limits of cuts, fills and property acquisition.

9. Brookfield Dam & Fishway

A hydropower dam operated by Brookfield Renewable Energy Partners (Brookfield) is located about 500 feet upstream of the existing Frank J. Wood Bridge. Brookfield owns and operates the dam under a license from FERC. No impacts to the Brookfield dam are anticipated for Alternatives 1, 2, 3 or 4. Upstream fish passage at the dam occurs via a vertical slot fishway, which provides passage for important anadromous species. All alternatives would have temporary effects to the fish species utilizing the fishway during construction due to installation of the temporary bridge or temporary trestles. Alternatives 1, 3 and 4 would not have permanent direct impacts to the fishway.

Alternative 2 (the Preferred Alternative) has the potential to affect the fishway permanently indirectly from shadowing and location of the southerly piers. Evaluation of potential effects to the fishway was conducted. The National Marine Fisheries Service and Brookfield provided input on the span arrangement of the preferred alternative. Based on this input, MaineDOT modified the preliminary design of Alternative #2 to remove the southernmost pier from the tailrace area. This modification was made to minimize physical impacts to critical habitat designated under the Endangered Species Act and to minimize potential impact to the upstream fishway associated with the Brunswick hydroelectric project by more closely simulating existing in-river flow patterns.

At present, Atlantic salmon passing upstream or downstream through the action area are subjected to vibrations associated with traffic crossing the existing Frank J. Wood Bridge. The preferred alternative would feature construction enhancements designed to reduce vibration in the form of rubberized pot bearings which would eliminate the current construction of steel on steel contact. Based on an assumed comparable traffic load across a new bridge it can be expected that the level of vibrations in the action area would be lower for a new structure than the current condition. Thus, an Endangered Species Act (ESA) determination of “not likely to adversely affect” was reached for impacts to upstream fish passage from bridge vibrations associated with future cross-bridge traffic for the preferred alternative.

Although it is understood that light can affect fish behavior, and discussions with Brookfield suggested that shadows and flicker can deter migrating fish, there is no published literature on shadow effects as related to successful passage via an upstream fishway.

MaineDOT evaluated the scope of static and dynamic shadowing from the existing Frank J. Wood Bridge as well as the proposed alignment of the preferred alternative. Under the existing conditions, anadromous fish species ascending the fishway are exposed to some level of dynamic and static shadowing. MaineDOT estimated the duration of shadowing from the existing structure at approximately 1 hour per day of static shadow (resulting from the bridge superstructure) and a few minutes per day of dynamic shadowing (resulting from passing traffic). Dependent on the model month, the shadows from the existing structure are present between the hours of approximately 0700 to 0945. MaineDOT predicted shadowing from the preferred alternative would increase the duration of static shadowing to 2.25 hours per day and of dynamic shadowing to 1.5-2 hours per day. The timing of shadowing predicted for the preferred alternative was between 0645 and 0945.

Man-made underwater noise has the potential to cause behavioral disturbances, hearing impairment or threshold shifts, physical injury, or mortality to fish species. Given the proximity of the preferred alternative of the new bridge structure to the existing upstream fishway in Brunswick, parties participating in the consultation process expressed concern over the potential impacts associated with the transference of traffic noise to the vicinity of the upstream fishway (i.e., underwater noise and vibrations).

Vibrations associated with traffic crossing the preferred alternative are expected to be at a more constant, low level (i.e., a "continuous" source) as opposed to a sudden and more intense burst associated with blasting or pile driving (i.e., an "impulsive" source). MaineDOT provided the following information about the potential for vibration from the new bridge:

- Vibration from traffic crossing the superstructure will need to travel through pot bearings, which the new superstructure will sit on. Each pot bearing has a rubberized elastomer designed to dampen the transfer of vibrations from superstructure to substructure. This is a substantial upgrade from the existing structure which is constructed with a steel on steel design which offers little to no vibration dampening.

- Any vibration energy that does transfer through the rubberized pot bearing will then need to travel through concrete, water, the walls of the fish ladder, and then water again before it can be detected by any fish within the fishway. Each change in medium will result in a continued dampening of the vibrations.

- In addition, the flowing water (river and fish ladder) is quite turbulent with its own 'white noise' and will help to further dampen vibrations related to the bridge structure.

MaineDOT coordinated with Brookfield Renewable Energy Partners (Brookfield) throughout the NEPA process. MaineDOT acknowledges that the existing facilities will require Federal Energy Regulatory Commission (FERC) re-licensing in 2029. MaineDOT has used best available information to understand and characterize the potential impacts to Brookfield and the fishway and will continue to coordinate and cooperate with Brookfield during final design upon completion of NEPA. In addition, MaineDOT will work with Brookfield and NOAA NMFS to identify baseline condition parameters at the fishway to measure pre- and post- construction conditions at the fishway.

NMFS Protected Resource Division also commented by separate letter that Alternative 2 would limit options for future improvements to the fishway. MaineDOT and FHWA acknowledge that at some point in the future relicensing proceedings could result in the modification of the structures at the fishway. However, the nature and type of modifications that are likely to occur have not been defined and are not reasonably foreseeable.

In addition, it is FHWA's assessment that any potential impacts from the project to Brookfield and the fishway in 2029 (change in fishway placement, etc.) at the time of FERC relicensing are speculative. MaineDOT will work with Brookfield and NOAA NMFS to identify baseline condition parameters (e.g., noise and vibration) at the fishway to measure pre- and post- construction conditions.

F. Environmental Impacts: Cultural Resources

1. Historic Architectural Resources

Section 106 of the National Historic Preservation Act requires that federal agencies take into account the effects of their undertakings on historic properties that are included on the National Register of Historic Places (National Register) or that meet the criteria for the National Register.

Historic resources within the project area include the following: Summer Street Historic District, Cabot Mill, Pejepscot Paper Company, the Frank J. Wood Bridge, and Brunswick Topsham Industrial Historic District. These resources are described below.

Summer Street Historic District

The Summer Street Historic District (SSHD), located northwest of the bridge in Topsham, is eligible for listing on the National Register for its local significance in Architecture (pictured in Figure 6). The district faces the bridge overlooking an eddy in the Androscoggin River, but has no direct physical connection to the bridge. The district is comprised of six residences and one associated former carriage house. The district contains one-story capes with fenestration patterns associated with the Federal era as well as Queen Anne-style and Stick-style residences. Its period of significance is ca. 1820 to ca. 1890.

Cabot Mill

The Cabot Mill, located southwest of the bridge in Brunswick, is individually eligible for listing on the National Register for its local significance in Architecture, Engineering, and Industry (pictured in Figure 6). The Cabot Mill site was home to an early textile mill in Brunswick and while its current buildings originate in the late 19th century, it still holds integrity under association (the direct link between an important historic event or person and a historic property). The buildings onsite embody characteristics of a period and type of construction including brick, rectangular massing, full-height, semi-arched windows, and two projecting Renaissance Revival-style towers. These features are the manifestation of the engineering required to design an efficient, functional textile mill in the late 19th century coupled with high architectural style details. Many of the complex's associated buildings, including tenement housing south of the mill, were lost when Route 1 was realigned to its current location. The mill's period of significance is ca. 1850 to ca.1950.

Figure 6. Left to Right: Summer Street Federal-era House and Cabot Mill

Pejepscot Paper Company

The Pejepscot Paper Company (PPC), northeast of the bridge in Topsham, was listed on the National Register for its local and statewide significance in Industry (as the earliest paper manufacturer in the state) and Architecture and Engineering (as an early example of the use of the Italianate style in an industrial context) in 1974 (pictured in Figure 7). The property, as listed on the National Register, includes all of Bowdoin Island. Since its listing, the island has lost a large building to fire. It sat between the mill and the bridge. The PPC's period of significance is 1868 to 1967.

Brunswick Topsham Industrial Historic District

The Brunswick Topsham Industrial Historic District (BTIHD) is eligible for listing on the National Register for its local significance in Architecture, Engineering, and Industry. Its contributing resources are the Cabot Mill, PPC, and the Frank J. Wood Bridge. The district was identified during MaineDOT's Historic Bridge Inventory circa 2001. It represents a localized, intact industrial area that utilized copious water power to produce goods and provide employment throughout its period significance. The district's period of significance is ca. 1850 to ca. 1966. The Frank J. Wood Bridge is considered a contributing resource because its date of construction coincides with the period of significance of the district and the bridge retains sufficient integrity (as defined by the National Park Service).

Frank J. Wood Bridge

The Frank J. Wood Bridge is eligible for listing in the National Register as an individual resource due to its association with the interurban lines connecting the Brunswick area with Lewiston (pictured in Figure 7). The bridge was constructed to carry a

single-track trolley down its center and accommodated a catenary system which powered the trolley line. The Maine State Highway Commission utilized standards published by the American Association of State Highway Officials (AASHO; now known as the American Association of State Highway and Transportation Officials (AASHTO)) to inform the bridge's design and construction. The unchanged standard width and height of the bridge, which allowed it to carry a line, was suitable to convey the trolley line's significance. The bridge's significance is under Criterion A for Transportation and has a period of significance from the bridge's construction in 1932 to the interurban trolley line's end of operations between Bath and Lisbon Falls in 1937. The bridge also is a contributing resource to the Brunswick Topsham Industrial Historic District.

Figure 7. From Left to Right: Pejepscot Paper Company and Frank J. Wood Bridge

a. Historic Resources Consultation

In November 2015, letters were sent to the towns of Brunswick and Topsham and the federally recognized tribes in Maine requesting information on historic resources in the project area. Responses were received in November and December of 2015 from the towns, the Passamaquoddy Tribe, and Penobscot Nation. The historic architectural survey was started shortly after and approved as complete by the Maine Historic Preservation Commission (MHPC) (Maine State Historic Preservation Officer, or SHPO) in May 2016. Properties determined eligible for listing on the National Register of Historic Places and the Area of Potential Effect were concurred with by the SHPO in June 2016. In June 2016, Section 106 consulting parties with demonstrated interests in the undertaking were established. Section 106 consulting party meetings were subsequently held on July 11, August 18 and October 27, 2016 to discuss and receive comments regarding the Section 106 area of potential effect, eligible historic properties, and evaluate the effects on historic properties for each of the proposed alternatives. In February 2017, the draft Section 106 determination of effect on historic properties for each alternative was developed and distributed to the Section 106 consulting parties, the SHPO, and posted for public review and comment. Comments were received and incorporated. In March 2017, the SHPO concurred with the determination of effect on historic properties for each alternative. A public meeting was held on April 5, 2017 utilizing an open house format and comments were received at the meeting and up to April 19, 2017. Responses to common questions were responded to on June 7, 2017 through posting on MaineDOT's public website and e-mail to interested parties.

In 2003, the Frank J. Wood Bridge was originally determined not individually eligible for the National Register of Historic Places as part of the MaineDOT Historic Bridge Survey, but was eligible as a contributing resource to the Brunswick Topsham Industrial Historic District. Based on comments received from the consulting parties and the SHPO, MaineDOT reevaluated the individual eligibility of the Frank J. Wood Bridge. MaineDOT conducted additional research on the 1936 flood, the interurban trolley, and the Boston Bridge Works Company. MaineDOT determined that the bridge was not individually eligible and sent the documentation to the SHPO on October 25, 2017 for concurrence. The SHPO responded on November 16, 2017 and did not concur. The SHPO stated that the bridge is individually eligible under Criteria A because the Bridge carried the A&K Railroad over a major river crossing and seems to have an important association with the interurban railway and that the Bridge possesses sufficient physical design characteristics to convey the fact that it was not designed simply to carry two lanes of highway traffic. Based on MaineDOT's additional research, the SHPO's November 16, 2017 memorandum, and a recommendation from FHWA's Federal Preservation Officer, FHWA determined the Frank J. Wood Bridge was individually eligible for listing on the National Register on December 11, 2017. MaineDOT responded back to the SHPO on December 13, 2017, indicating that FHWA had made the determination that the Frank J. Wood Bridge is individually eligible for listing on the National Register. On December 15, 2017, the Advisory Council on Historic Preservation (ACHP) was formally invited

to participate in the Section 106 consultation.

The Preferred Alternative (Alternative 2) was determined to have Adverse Effects on Cabot Mill, the PPC, the Frank J. Wood Bridge, and the BTIHD. The Preferred Alternative (Alternative 2) would result in No Adverse Effect on the SSHD. Alternative 1 would result in Adverse Effects on Cabot Mill, the PPC, the Frank J. Wood Bridge, and the BTIHD. Alternative 1 would have No Effect on the SSHD. Alternatives 3 and 4 would result in No adverse effects on Cabot Mill, the PPC, the Frank J. Wood Bridge, and the BTIHD. Alternatives 3 and 4 would have No Effect on the SSHD. The Section 106 determination of effects and SHPO concurrence is included in Appendix 6.

Avoidance and mitigation measures for the Adverse Effects to these resources were discussed in consultation among MaineDOT, FHWA, SHPO and the Consulting Parties. Measures to minimize harm for adverse effects were developed in consultation with SHPO, the consulting parties, and the public. (See "Section 106 Timeline", Revised EA and Final 4(f) Evaluation, Appendix 6). A Memorandum of Agreement (MOA) for adverse effects was developed in consultation with the Section 106 consulting parties and the public to document mitigation measures. ACHP served as a consulting party and provided substantive written edits to the MOA resolving adverse effects under Section 106.

MaineDOT and Federal Highway held two consulting party meetings specifically seeking mitigation input, and provided a thirty-day comment period seeking input on draft mitigation measures. The MOA was executed on December 21, 2018. (Appendix 6). Final mitigation measures are listed as Stipulations of the MOA and are summarized below:

- **New Bridge Design Review Process**: MaineDOT will consult with the Maine SHPO, Bridge Design Committee, and Section 106 consulting parties on the final design of the new bridge to ensure compatibility with existing historic features.
- **Historic American Engineering Recordation**: MaineDOT will provide recordation of the Frank J. Wood Bridge (Maine State Bridge No. 2016) in consultation with the National Park Service and in accordance with Historic American Engineering Record (HAER) Level 1 Standards.
- **National Register of Historic Places (NRHP) Nomination**: MaineDOT will prepare and submit to the Maine SHPO a NRHP nomination for the previously determined eligible Brunswick Topsham Industrial Historic District (including National Register-eligible tenement housing).
- **Outdoor Interpretive Panel**: MaineDOT will design and install two (2) permanent outdoor interpretive displays depicting the Frank J. Wood Bridge and earlier crossings, their history, and significance.
- **Conservation of Existing Bridge Plaques**: MaineDOT will be responsible for removing, storing, and conserving the four (4) historic plaques on the existing Frank J. Wood Bridge.
- **Adaptive Reuse or Reuse of Portions of the Structure**: Prior to dismantling, MaineDOT and FHWA shall offer the Frank J. Wood bridge to any group that could legally take possession of the bridge and maintain it at a new location, provided the group assumes all future legal and financial liability.
- **Illustrated Booklet on the History of the River Crossing**: MaineDOT, in consultation with the Maine SHPO, will commission an illustrated booklet on the history of the river crossing, as well as document the complete story of the Frank J. Wood Bridge and its relationship to the community and the cultural landscape, including indigenous use of the area.
- **Indoor Traveling Exhibit**: MaineDOT will develop a single indoor travelling exhibit consisting of three panels that share the story of the history of the Androscoggin River crossing, including the Frank J. Wood Bridge.
- **Post Review Discoveries**: If any unanticipated discoveries of historic properties or archaeological sites are encountered during the implementation of the project, MaineDOT shall suspend work in the area of the discovery in accordance with *MaineDOT Standard Specification 105.9: Historic and Archaeological Considerations,* and MaineDOT shall notify FHWA. FHWA shall notify the ACHP, the Maine SHPO, and if applicable, federally recognized tribal organizations that attach religious and/or cultural significance to the affected property.

2. Archaeological Resources

MaineDOT consulted with SHPO regarding potential archaeological resources within the project area. SHPO identified potential resources associated with all the alternatives and provided a general scope of the additional work that would be required to complete

Phase II and Phase III archaeological survey for each alternative. None of the potential resources were considered important for preservation in place. This meant that while impacts to these resources should be avoided and minimized, their presence did not preclude any alternative from being identified as the preferred. In accordance with the National Historic Preservation Act and Maine Statute 27 M.R.S.A 371-378, the information indicating potential locations of archaeological resources is protected from public disclosure. In cases where multiple alternatives may impact archaeological resources, SHPO and MaineDOT typically complete Phase II and Phase III surveys as required for only the preferred alternative to minimize unnecessary disturbance to resources.

The SHPO conducted a Phase I/II survey for the preferred alternative from September 10, 2018 to September 17, 2018. The SHPO concluded in a memo dated September 19, 2018 that no archaeological properties will be affected by the preferred alternative (Appendix 6). This information was provided to the Maine federally recognized tribes on October 22, 2018.

If any unanticipated discoveries of historic properties or archaeological sites are encountered during the implementation of the project, MaineDOT shall suspend work in the area of the discovery in accordance with *MaineDOT Standard Specification 105.9: Historic and Archaeological Considerations*, and MaineDOT shall notify FHWA. FHWA shall notify the ACHP, the Maine SHPO, and if applicable, federally recognized tribal organizations that attach religious and/or cultural significance to the affected property.

3. Section 4(f)

A Section 4(f) evaluation is required when a Federally-funded transportation action proposes to use land from a historic site that is listed on or eligible for listing on the National Register of Historic Places, or a publicly owned park, recreational area, or wildlife or waterfowl refuge. Section 4(f) states that publicly owned parks, recreation lands, wildlife and waterfowl refuge areas, or historic sites of national, state, or local significance may not be used for US DOT funded projects unless there is no feasible and prudent alternative to the use of such property, and such projects include all possible planning to minimize harm to the property resulting from such use. Use is defined in 23 CFR 774.17: Except as set forth in 23 CFR 774.11 and 23 CFR 774.13, a "use" of Section 4(f) property occurs:

(1) When land is permanently incorporated into a transportation facility;
(2) When there is a temporary occupancy of land that is adverse in terms of the statute's preservation purpose as determined by the criteria in 23 CFR 774.13(d); or
(3) When there is a constructive use of a Section 4(f) property as determined by criteria in 23 CFR 774.15.

FHWA must determine whether there are feasible and prudent avoidance alternatives to the use of Section 4(f) properties necessitated by the proposed Federal action and that the proposed action includes all possible planning to minimize harm resulting from such use. A Final Section 4(f) Evaluation is provided as part of this Revised EA.

Section 4(f) resources within the project area include the five Section 106 resources described in Section 1 (Cabot Mill, the PPC, the BTIHD, Frank J. Wood Bridge, and the SSHD). In addition to the historic properties protected under Section 4(f), there is one Section 4(f) park in the project area. The 250th Anniversary Park is located southeast of the Brunswick approach with its frontage on the Androscoggin River. The Brunswick Parks and Recreation Department has been identified as the official with jurisdiction over this park.

The two rehabilitation alternatives (Alternative 3 and 4) would avoid the use of Section 4(f) resources. Because both rehabilitation alternatives would be rehabilitated in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties, they would not result in a Section 106 adverse effect nor a Section 4(f) use. However, the rehabilitation alternatives were determined to be not feasible and prudent because they would each result in additional construction, maintenance and operational costs of extraordinary magnitude (23 CFR 774.17(iv)) and a fracture critical bridge would still remain after rehabilitation. Additionally, Alternative 3 does not improve pedestrian and bicycle access. Other alternatives not previously considered were reviewed to determine if it was possible to avoid using Section 4(f) resources, but they were all determined to be not feasible and prudent.

After determining there were no feasible and prudent avoidance alternatives, Alternatives 1 and 2 were reviewed to determine the alternative that causes the least overall harm. Alternatives 1 and 2 would both result in demolition of the existing bridge.

Alternative 1 would use the Cabot Mill and the PPC. Temporary rights of approximately 0.1 acre would be required for the temporary bridge on the Cabot Mill property. Alternative 1 would permanently use the BTIHD and the Frank J. Wood Bridge due to the removal of the Frank J. Wood Bridge. Alternative 1 would not use the 250th Anniversary Park nor the SSHD. The estimated property rights are based on property lines from tax maps. Final right of way will not be determined until the plan impacts complete phase (final design) of the design process.

The Preferred Alternative (Alternative 2) would use the Cabot Mill. Permanent rights of approximately 0.1 acre for a new retaining wall between Cabot Mill and Brookfield would be required on the Cabot Mill property. Alternative 2 would use the PPC. Permanent rights of approximately 0.1 acre for the reconstruction of the driveway entrance to PPC would be required on the PPC property. Alternative 2 would permanently use the BTIHD due to the removal of the Frank J. Wood Bridge. Alternative 2 would not use the SSHD and would not use the 250th Anniversary Park. The estimated property rights are based on property lines from tax maps. Final right of way will not be determined until the plan impacts complete phase (final design) of the design process.

Although an individual Section 4(f) evaluation is included for the Frank J. Wood Bridge use, it does meet the criteria for the Programmatic Section 4(f) Evaluation and Approval for FHWA Projects that Necessitate the Use of Historic Bridges. The historic bridges covered by this programmatic Section 4(f) evaluation are unique because they are historic, yet also part of either a Federal-aid highway system or a state or local highway system that has continued to evolve over the years. Even though these structures are on or eligible for inclusion on the National Register, they must perform as an integral part of a modern transportation system. When they do not or cannot, they must be rehabilitated or replaced to ensure public safety while maintaining system continuity and integrity.

While the Frank J. Wood Bridge would be removed, MaineDOT has endeavored to reduce the amount of land permanently used at other Section 4(f) resources by limiting use to no more than 0.2 acres (combined) of the Cabot Mill and the PPC. Additionally, for the purposes of mitigation, in response to Section 106 consulting parties views and input, FHWA considered the Frank J. Wood Bridge eligible for listing under Criteria C on the National Register when developing formal mitigation measures for the Section 106 Memorandum of Agreement (MOA) to resolve adverse effects under this statute.[23]

Additional planning measures to minimize harm were developed in consultation with the SHPO, Section 106 Consulting Parties, the ACHP and the public. MaineDOT and FHWA held two consulting party meetings specifically seeking mitigation input, and provided a thirty-day comment period seeking input on draft mitigation measures. Final mitigation measures are described in detail under Section F (1)a: Historic Resources consultation.

G. Environmental Impacts: Social and Economic

Alternatives 1, 2, 3 and 4 would all have social and economic impacts, but at varying degrees. Compliance with environmental laws and regulations for social and economic resources that are either not present in the project area or that will result in no effect from all the alternatives are documented in the Other Federal Environmental Laws section of this Revised Environmental Assessment.

1. Residential and Business

The crossing of the Androscoggin River at this location is an important connection for businesses, residents and community services such as school buses and emergency response vehicles. Traffic will be maintained during construction, and access to businesses and residences will be maintained.

2. Bicycle and Pedestrian

The existing Frank J. Wood Bridge carries two 11-foot lanes and two 4-foot shoulders. The outer 2 feet of the shoulders is made of an open steel grid, which makes the usable shoulder width for bicycle travel 2 feet. There is one sidewalk on the west side of the bridge. The sidewalk on the west side of US 201/ME 24 extends from downtown Brunswick past Fort Andross and across the bridge to the intersection of US Route 201/24 and Elm Street in Topsham. The sidewalk on the east side of the bridge extends from downtown Brunswick and Federal Street and stops at the 250th Anniversary Park before the Frank J. Wood Bridge. The sidewalk begins again at the Bowdoin Mill Complex and continues north to Elm Street.

Improvements to bicycle and pedestrian mobility and safety is a necessary component of this bridge project per the purpose and need. Pedestrian activity is generated by the mix of business, commercial, residential uses and open spaces located at both ends of the bridge and on both sides of the road. Pedestrians include residents, business patrons, and commuters. Bicycle activity is generated by the same uses along with recreational bicycle through-traffic. There have been two pedestrian crashes in the project area over the past 15 years. Both occurred in 2011. Additionally, there were two bicycle crashes (one each in 2010 & 2013). Each of these incidents resulted in non-fatal injuries.

[23] See Section 106 MOA in **Appendix 6***: Section 106 Timeline, MOA, SHPO Concurrence, and Determination of Effects*.

The Brunswick/Topsham area has an active biking community. The Merrymeeting Wheelers Bicycle Club has advocated for better cycling conditions throughout this area for several years. One of the primary concerns this group has is that the Frank J. Wood Bridge is not friendly to bikers because of traffic speeds, lane widths, and the grating that eliminates a substantial portion of the area "allocated" for cycling. This group also purchased the earliest versions of the 3 ft. Passing Law Signs for the communities, and the town of Brunswick has updated these signs with the new FHWA approved format.

There is no bicycle/pedestrian usage data for the Frank J. Wood Bridge. However, MaineDOT does have data on bicycles and pedestrians on the Androscoggin River Path along the Coastal Connector. The path is a pedestrian and bicycle connection between in town Brunswick and the Cook's Corner area. The path can also be accessed from Topsham via bicycle/pedestrian lanes over the Merrymeeting Bridge.[24] May 2014 data for weekday use was nearly 850 people per day with that number more than doubling on the weekends. Bicycles represented approximately 20% of the total users on weekdays and 29% on weekends. These data also indicate, that the primary use for pedestrians is between 8am and 7pm with the peak being early afternoon. Bicycles have a similar time of use, but their peak use is the early evening.

Though there is no specific data to support the increased pedestrian activity at this specific river crossing, MaineDOT understands anecdotally that increased commercial and recreational development on both ends of the bridge has resulted in more pedestrian activity occurring between the two locations. Recent MaineDOT projects have confirmed that a bridge design that promotes access and safety helps generate additional use. MaineDOT also sees an increase in activity when interpretive information and improved viewsheds are included.

Currently, pedestrians approaching the bridge from either Topsham or Brunswick must cross the street to access the sidewalk on the west side of the bridge. One of the desirable outcomes of the project is to eliminate these "mid-block" crossings. Designers often assume that pedestrians will cross roadways at established intersections. Observation of pedestrian behavior clearly indicates that people routinely cross at mid-block locations. Pedestrians will rarely go out of their way to cross at an intersection unless they are rewarded with a much-improved crossing, and most will take the most direct route possible to get to their destination, even if this means crossing several lanes of high-speed traffic[25]. Drivers are more likely to anticipate pedestrian crossings at intersections. Midblock crossings inherently have increased risk because drivers do not traditionally expect there to be pedestrians crossing at that location. Locals will anticipate, but others may not even be aware that there is a crossing point at that location. Reducing the number of crossing points reduces the number of opportunities for pedestrian/vehicle conflicts and eliminates unnecessary impediments to traffic flow and movement.

Construction of two sidewalks promotes walkability and substantially improves access and accommodation for those with mobility concerns, impairments, and disabilities. Inclusion of sidewalks on both sides of the road is recommended by Safe Routes to School guidelines and supported by the National Association of City Transportation Officials (NACTO). BIKESAFE, the Bicycle Safety Guide and Countermeasure Selection System, supported by the FHWA to provide guidance to transportation professionals to improve pedestrian and bicycle conditions[26] states that "Sidewalks, provided on both sides of a street, are generally the preferred pedestrian facility. They provide the greatest degree of comfort for pedestrians and the presence of sidewalks has been associated with increased safety for pedestrians." BIKESAFE also recommends that sidewalks on both sides of the road should be required on all suburban highways, major arterials, urban collectors, minor arterials, local streets, and on all commercial urban streets. Sidewalks on both sides are "preferred" on urban local streets and on all streets in industrial areas.

The incorporation of strategically placed pedestrian crossings that include additional safety features (e.g., signage) can improve compliance with drivers stopping for pedestrians by upwards of 80%. This improved compliance directly relates to reduced pedestrian-vehicle incidents.

For the replacement alternatives (Alternatives 1 and 2), railings would meet standards for vehicle and pedestrian safety. Final design details would consider accommodations for visual enhancements, lighting and viewing points of the river upstream and downstream. Sidewalks on both sides of the bridge would connect the existing sidewalks on the approaches and would improve safety by reducing the need for pedestrians to cross the road. The 5-foot shoulders with no adjacent bridge railing or truss verticals would improve the

[24] http://www.brunswickme.org/wp-content/uploads/2012/01/A-Z-Guide-Brunswick-Parks-and-Recreation.pdf
https://mainebyfoot.com/androscoggin-river-path-brunswick/
[25] https://safety.fhwa.dot.gov/PED_BIKE/univcourse/pdf/swless16.pdf
[26] BIKESAFE, www.pedbikesafe.org

bridge for bicyclists. The proposed design would incorporate modern traffic calming techniques to slow traffic and provide additional dedicated space to both cyclists and pedestrians.

From a bicycle and pedestrian perspective, Alternative 3 (Rehabilitation with One Sidewalk) provides the least improvements. Pedestrian facilities under Alternative 3 would consist of the existing sidewalk on the west side of the bridge. The open grid decking along the outside of the existing shoulders would be replaced with solid concrete, providing a continuous 4-foot shoulder with adjacent traffic rails, which would provide an improvement for bicyclists using the shoulders. Alternative 4 (Rehabilitation with Two Sidewalks) would address pedestrian safety with the addition of a 5-foot sidewalk on the east side of the existing bridge. Like Alternative 3, a 4-foot shoulder with adjacent traffic rails would be provided for bicycle traffic. Therefore, Alternative 4 would provide improvements for bicyclists and pedestrians.

3. Construction and Traffic

Construction of this project will temporarily disrupt traffic patterns. Access to all residences and businesses will be maintained throughout construction. There will be noise from construction for the duration of the project. Best Management Practices for erosion and sedimentation control will be implemented and a Stormwater Pollution Prevention Plan detailing the pollutant prevention measures to be employed will be prepared by the contractor and approved by MaineDOT.

Four options were investigated to maintain traffic at this site during construction. They are not all feasible for all the bridge alternatives.

1. Complete road closure with a detour. Detour all traffic along U.S. Route 1 and State Route 196. The total detour distance is approximately 2.5 miles for through traffic and 3.7 miles end to end (see Appendix 2, Figure 20).

2. Single lane closure with staged construction. One way, southbound traffic would be carried across the bridge on a 12-foot travel-way and all northbound traffic would be detoured. This option can only work for certain construction activities, like painting. This traffic control method has been used successfully in the past on the Frank J. Wood Bridge for short-term projects.

3. On-site detour on temporary bridge. Construct a 2-lane temporary bridge parallel to the existing bridge and detour all traffic onto it. Traffic would only be disrupted during the construction of tie-ins to the existing roadway and to the new roadway upon conclusion of the project. These disruptions could be limited by requiring that work be done during off-peak hours. Construction and removal of the temporary bridge would likely extend the total construction duration by about 1½ years (1 construction season for construction of the temporary bridge and half a season for its removal). The cost for a temporary bridge is estimated to be $4 million.

4. Utilize existing bridge. If a new bridge is constructed on a new alignment, the existing bridge could be used to maintain traffic during construction. Traffic would primarily be disrupted during construction of the final tie-in, which is anticipated to include a two-month continuous single lane northbound road closure. Again, this could be mitigated by requiring work during off-peak hours. This option would result in the least traffic disruptions.

Traffic disruption results in indirect costs to the users of the bridge and to the surrounding businesses. A way to quantify the cost of delays to the traveling public is to calculate “user costs.” The average delay for vehicles is estimated and a fixed cost per hour is applied. The average delays for vehicles using an off-site temporary detour are between 3 and 4 minutes, with delays at peak times higher and at off times lower. Based on these delays, the added travel distance of 2.5 miles for thru traffic (and 3.7 miles end-to-end) and the average annual daily traffic of 19,000 vehicles per day, the daily user cost for a full bridge closure (i.e., using an off-site temporary detour) is approximately $22,000 per day, or over $13,000,000 for the estimated 20-month closure required for Alternatives 1, 3 & 4.

The daily user costs for implementing an off-site temporary detour include three components:

1. The cost of extra distance incurred by travelers using a detour
2. The cost of extra travel time incurred by travelers using a detour
3. The cost of extra travel time incurred by travelers due to increased delay at intersections

For this project, daily user costs 1 and 2 were determined with the aid of MaineDOT’s travel demand model, which can be used to test the impact of bridge closures on travel patterns on the highway network. With the expected changes in travel volumes at certain major intersections, user cost 3 can be derived by modeling the intersections under peak-hour conditions with traffic simulation software

and expanding the peak-hour results to a daily user cost. Added vehicle-miles and vehicle-hours are converted to dollar values by using unit costs of distance and time, respectively. These user costs do not reflect impacts to businesses in Topsham or Brunswick that may be affected by an off-site temporary detour, which is very difficult to quantify. The cost of an on-site temporary bridge detour (or temporary bridge) was estimated at $4,000,000. The user costs estimated for an off-site temporary detour exceed this figure by approximately $9,000,000. The onsite temporary bridge detour is included in Alternatives 1, 3, and 4 because the cost of a temporary bridge is less than the anticipated user cost of implementing an off-site temporary detour.

The Preferred Alternative (Alternative 2) has an estimated construction duration of 2.5 years. No temporary bridge is required since traffic could be maintained on the existing bridge during construction. A two-month continuous single lane northbound road closure and detour would be needed to construct approaches of the replacement bridge prior to shifting traffic onto the new bridge.

Alternative 1 would be constructed on the existing alignment; the existing truss bridge would have to be removed completely before new construction could begin. Duration of construction is estimated to be 3.5 years and includes the construction of a temporary on-site detour bridge to maintain two-way traffic during construction. A three-month total non-continuous single lane northbound road closure would be needed for the installation and removal of the temporary bridge approaches. As discussed above, the user costs and other economic impacts such a disruption warrants a temporary bridge for this alternative.

Alternatives 3 and 4 would both close the existing bridge and require a temporary on-site detour bridge[27] to maintain two-way traffic during construction. Construction is estimated to take 3 years. A three-month total non-continuous single lane northbound road closure would be needed for the installation and removal of the temporary bridge approaches.

4. Utilities

The existing Frank J. Wood Bridge carries the utilities of Topsham-Brunswick Water District, GWI Communication, Fairpoint Communication, and OTT Communication; Maine Natural Gas, CMP, Brunswick Sewer and Topsham Sewer are located on the approaches. For Alternatives 1 and 2, the utilities would need to be permanently relocated onto the new bridge. Alternatives 3 and 4 would require temporary support or temporary relocation during rehabilitation of the bridge. MaineDOT will work with affected utilities during final design to coordinate utility accommodations.

The hydropower dam operated by Brookfield Renewable Energy Partners (Brookfield), located about 500 feet upstream of the existing bridge crossing, would not be impacted by any of the alternatives.

5. Federal Energy Regulatory Commission (FERC) Boundary

The Brunswick Hydroelectric Project is a power generation facility located at river mile 6 of the Androscoggin River and approximately 500 feet upstream of the existing Frank J. Wood Bridge. The generation facility is licensed to Brookfield White Pine Hydro, LLC. The FERC Boundary for the hydroelectric project (FERC Project No. 2284) is at elevation 17.35 (NAVD 88) which includes areas upstream and downstream of the existing bridge as well as portions of the existing bridge (Brunswick abutment and the pier closest to Topsham). The FERC project boundary is shown in Figure 8. Bridge improvements within the FERC Boundary require coordination directly with the licensee (Brookfield).

Throughout the NEPA process, MaineDOT and FHWA have coordinated with Brookfield Renewable. Upstream fish passage at the dam occurs via a vertical slot fishway adjacent to the powerhouse and on the western bank upstream of the existing Frank J. Wood Bridge. The fishway provides passage for Atlantic salmon, as well as other important anadromous species including alewife and American shad. The fishway was commissioned in 1980 and construction was completed in the early 1980s. Through discussions with Brookfield Renewable, it is possible that at the time of FERC relicensing in 2029, changes to the fishway may be needed to improve fish passage at this site and within the Frank J. Wood Bridge project area.

[27] When a 75-year rehabilitation was carried forward, a temporary bridge was added to the scope of work. See Cost section for information on 75-year rehabilitation.

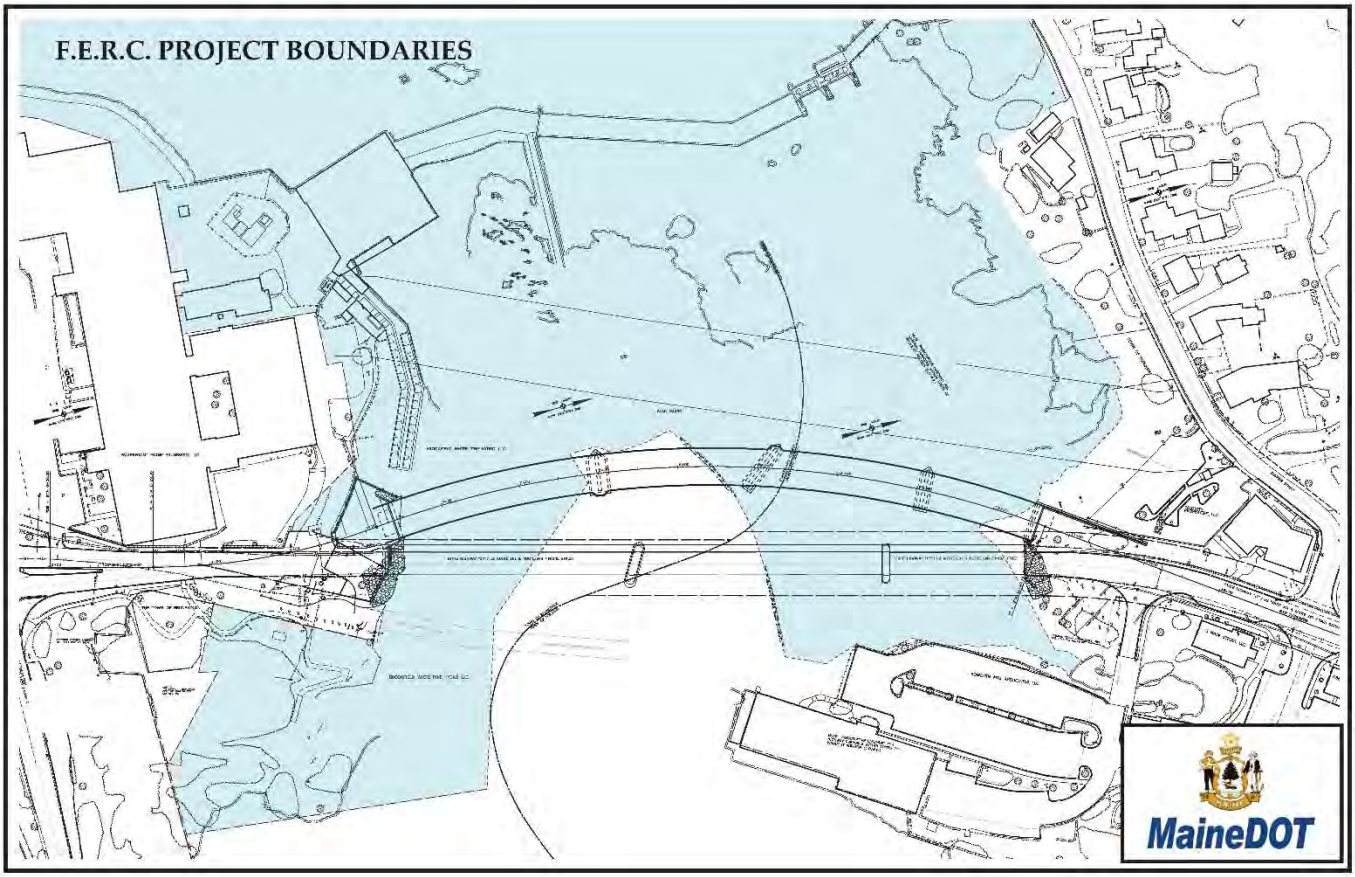

Figure 8. FERC Boundary

No impacts to the power generation facility are anticipated for any of the bridge improvement alternatives studied.
Alternative 2 would reconstruct one abutment and bridge piers within the limits of the FERC Boundary of the dam. Temporary property rights would be needed for construction access along the north side of both approaches (Topsham and Brunswick) within the FERC Boundary. Preliminary estimates suggest that Alternative 2 will require rights to permanently occupy approximately one acre of land and water area within the FERC boundary of the Brunswick Hydroelectric Project. This includes not only the direct footprint area of the abutments and piers, but also the area of bridge superstructure constructed over the Androscoggin River. An additional one half acre of land and water area is expected to be used during construction and will require temporary rights within the FERC Boundary. Alternative 1 would construct the Brunswick abutment and bridge piers within the FERC Boundary. Temporary property rights would be needed for construction access and a temporary detour bridge within the FERC Boundary. Alternatives 3 and 4 would rehabilitate the Brunswick abutment and the pier closest to Topsham that are within the FERC Boundary. No new permanent features within the FERC Boundary would be required. Temporary property rights would be needed for construction access and a temporary detour bridge within the FERC Boundary.

Upon completion of NEPA, MaineDOT will continue coordination with Brookfield to ensure that required temporary and permanent rights are obtained in accordance with FERC requirements.

6. Right of Way

Based on preliminary design, the Preferred Alternative (Alternative 2) will require permanent property rights from two Brunswick properties (Brookfield White Pine Hydro LLC and Waterfront, Maine Brunswick LLC) and two Topsham properties (Priority Properties, LLC and 3 Main Street, LLC) totaling approximately two acres of land and water area. This includes not only the direct footprint area of the abutments and piers, but also the area of bridge superstructure constructed over the Androscoggin River.

Construction of the Preferred Alternative (Alternative 2) would require permanent property acquisitions or easements of parts of two properties on the west side of the Brunswick (south) approach and one property on each side of the Topsham (north) approach. The south approach property impacts would include reconstruction of a retaining wall between the driveway entrances to the small Fort Andross parking lot and the Brookfield hydroelectric station at the dam. The 250th Anniversary Park located at the southeast corner of the bridge is a Brunswick town park constructed on land leased from Brookfield. At this location, permanent structures and fill slopes would be within the existing State-owned right-of-way. The north approach would have a new 130-foot-long retaining wall along the northwest approach to limit impacts to the property and parking area. Reconstruction of the driveway entrance to the Bowdoin Mill complex will require impacts beyond the existing MaineDOT right of way. Temporary property rights would be needed to construct work access platforms like work trestles. These rights would be similar to temporary rights needed for a temporary bridge. Additionally, temporary property rights would be needed for construction access along the north side of the approaches. The Uniform Relocation Assistance and Real Property Acquisition Policies Act for Federal and Federally Assisted Programs will be followed. There will be no residential or business displacements.

Alternatives 1, 3 and 4 (bridge rehabilitation or bridge replacement on the existing alignment) would not require permanent property impacts. However, temporary property rights would be needed for any temporary bridge. Temporary rights for the temporary bridge would be required during construction from the same properties as discussed above for the Preferred Alternative (Alternative 2).

7. Cost

Cost implications for this project are described for each alternative in both this Revised EA and the Individual Section 4(f) Evaluation. In response to the 2007 collapse of the I-35W Bridge in Minneapolis, Minnesota, the National Transportation Safety Board (NTSB) issued a series of recommendations to the FHWA and the American Association of State Highway and Transportation Officials (AASHTO). One of the three recommendations to the FHWA would require "bridge owners [to] assess the truss bridges in their inventories to identify locations where visual inspections may not detect gusset plate corrosion and where, therefore, appropriate nondestructive evaluation technologies should be used to assess gusset plate condition." In August 2007, then Maine Governor John Baldacci issued an executive order (EO) directing the MaineDOT to review Maine's Bridge Inspection and Programming. The substance of the order was, in part, to:

- Review Maine's bridge inspection program to assure it continues to meet or exceed all applicable federal standards;
- Utilize the available information on the cause of the Minneapolis bridge collapse to reassess the safety of Maine's bridges and take appropriate action to mitigate any safety concerns;
- Analyze MaineDOT's capital programming processes and levels for bridges and other critical transportation infrastructure, the failure of which would likely cause loss of life or other significant public safety impacts.

The result was a report titled *Keeping Our Bridges Safe* (KOBS), published on November 26, 2007. In 2014, the MaineDOT Commissioner directed the MaineDOT Chief Engineer to reconvene a team of bridge experts to examine the progress towards the goals outlined in this report. The team consisted of structural engineers from within MaineDOT as well as outside consultants, bridge maintenance engineers, bridge contractors, University of Maine engineering faculty, the FHWA Maine Division Bridge Engineer, and the MaineDOT Chief Engineer. The team was instructed to:

- Report on MaineDOT's progress on the 2007 report recommendations,
- Define the current status of bridges in Maine,
- Establish strategies to improve overall bridge conditions and safety,
- Find opportunities to impact costs, and
- Identify funding needs.

In the time between 2007 and 2014, MaineDOT endeavored to better organize and understand the condition of its infrastructure using the principles of asset management including prioritizing highway corridors and identifying customer service levels for Maine's transportation infrastructure. Highway Corridor Priorities are listed below in Table 1 for context.

Table 1: MaineDOT Highway Corridor Priorities				
Highway Corridor Priority	**Miles**	**% Miles**	**% Traffic**	**Definitions and Examples**
Priority 1	1760	7%	42%	These roads include the Maine Turnpike, the interstate system and key principal arterials like Route 1 in Aroostook County, the Airline (Route 9), Route 2 west of Newport, and Route 302. The 1,760 miles of Priority 1 roads represent only 7 percent of the miles but carry 42 percent of all vehicle miles traveled in Maine.
Priority 2	1350	6%	17%	These roads total about 1,350 miles. They are non-interstate, high value arterials that represent about 6 percent of the total miles of road but carry 17 percent of overall traffic in Maine.
Priority 3	2199	9%	16%	These roads generally are the remaining arterials and significant major collector highways. These 2,199 miles of Priority 3 represent only 9 percent of miles but carry 16 percent of the traffic in Maine.
Priority 4	3731	16%	9%	These roads generally are the remainder of the major collector highways, minor collector highways, and often also part of Maine's unique state aid system, in which road responsibilities are shared between the state and municipalities. These 3,731 miles represent about 16 percent of total miles and carry 9 percent of the traffic in Maine.
Priority 6	14,432	62%	13%	These roads are local roads and streets and are the year-round responsibility of our municipal partners. Though they carry just 13 percent of the statewide traffic, these 14,432 miles make up 62 percent of the total miles.
The miles and traffic percentages of the previous highway priority 5 have been incorporated into 4 and 6, as appropriate.				

Customer service levels (CSLs) are an established protocol used by MaineDOT to report priorities and capital goals. MaineDOT CSLs are based on reliability, condition, and service. The CSLs are communicated as letter grades A-F, with A representing excellent and F representing unacceptable. Bridge reliability grading is based on a pass/fail. An example of a fail is if one or more major members of a bridge is in serious condition or is scour critical. "Bridge Condition CSL" is based on the National Bridge Inventory (NBI) Condition (0-9), and "Service CSL" is created by the bridge's posting relative to its highway corridor priority. The Frank J. Wood Bridge has an overall "D" CSL due to its posting and congestion. The highway it carries, Route 201, is part of the National Highway System and is a MaineDOT HCP 3. US Route 201 has an overall "B" CSL rating. The D rating is in large part dictated by the fact that it is a fracture critical and structurally deficient structure.

The updated KOBS (2014) report (included in Appendix 8) is a comprehensive overview of the state of Maine's bridge infrastructure; placing bridges in context with highway corridor priority and CSLs. The KOBS (2007) report identified 44 fracture critical bridges.[28] The Frank J. Wood Bridge was identified as a fracture critical bridge within this report. Since 2007, 11 fracture critical bridges have been replaced. Both KOBS reports highlight that older bridges were not designed to carry current loads. Part of the initial KOBS report and goal was to initiate and use new bridge rating and bridge posting guides. The report states: "understanding what a bridge can safely carry is critical to public safety and mobility. At times, posting a re-rated bridge for less than legal loads may have minimal impacts. Other times it could pose hardships." These hardships include a long detour and/or no practical strengthening options.

The 2014 KOBS report found that MaineDOT's 2744 bridges and short spans are getting older – 776 bridges and 150 steel culverts are past their 50-year service life. Generally, older bridges require more maintenance and attention to keep them safe. In 2007, 65% of

[28] Fracture critical bridges are bridges with no redundancy – if a single member within the bridge fails it may ultimately lead to a catastrophic failure of the entire bridge.

MaineDOT's bridges and minor spans were in fair condition and 9% in poor condition. In 2014, while the percentage of bridges and minor spans in fair condition had decreased to 61%, the number of bridges in poor condition rose to 11%. Much attention is paid to bridges that are categorized as structurally deficient; however, that designation is only applicable to federal bridges with a 20' or longer span. The MaineDOT has found that this classification underestimates the population of smaller bridges in poor condition. Even so, the percentage of structurally deficient bridges in Maine rose from 14.99% in 2011 to 15.24% in 2013 (with peaks of 16.68% in 2001 and 16.26% in 2010). The Frank J. Wood Bridge was determined structurally deficient in June 2016 as part of its routine National Bridge Inspection (NBI). In August 2016, MaineDOT undertook a two-day field inspection of the bridge. The result of these efforts was that the Frank J. Wood Bridge was posted at 25 tons.

Another issue facing MaineDOT is the level of funding needed to maintain current condition of bridges compared to available funding. For the 2014 KOBS Report, MaineDOT used asset management software to assess bridge needs. This software generated conditions and service levels for 25 years for four funding levels (per year): $70 million, $105 million, $140 million, and $175 million. The results showed overall condition of bridges owned by MaineDOT throughout the state would deteriorate with funding less than $140 million. The 2014 KOBS Report concluded:

> *A long-term investment of $140 million per year will eliminate at least 90% of the structurally deficient and poor bridges on Highway Corridor Priorities 1-3. This funding level will improve the average condition of Maine's bridges over the next twenty-five years. It will also reduce the deterioration of bridges that are in good condition which presents the opportunity to save money in the future. It will not be enough to eliminate all bridges with CSLs of D's and F's. It does dramatically change the number of bridges with D and F ratings from 38% at the current funding levels to 15% over the next 25 years.*

In this context, elimination does not equate to absolute removal of all bridges of that rating, rather addressing the factors that result in the rating. Addressing these factors include repair, rehabilitation, or removal/replacement. MaineDOT would require $217 million per year to maintain the entire bridge system and substantially meet service, condition, and safety goals.

Another factor MaineDOT has to consider in bridge funding levels is the financial impact of Maine's thirty-six Forever Bridges.[29] Forever Bridges are considered "high value bridges which, when replaced, will create extraordinary impacts to customers or create significant funding needs that could severely impact bridge resources." These factors may include significant permitting and constructability issues in concert with providing critical access routes. These bridges must last 75-100 years or longer. Over a 15-year period (2002-2017), MaineDOT has spent approximately one-third of its annual bridge program budget on construction or heavy capital work on these bridges. This decreases the amount of resources that can be directed towards other bridges, even considering that Discretionary Grants, such as Transportation Investment Generating Economic Recovery (TIGER), have and may continue to offset the financial burden of Forever Bridges.

MaineDOT has a goal to eliminate 90% of the structurally deficient and poor bridges on highway corridor priorities 1-3. This goal can be accomplished with $140 million per year funding. However, MaineDOT is running at a deficit. The 2017-2018-2019 MaineDOT Work Plan and State Transportation Improvement Program (STIP) show an annual average of $121 million for bridge projects with an average 13% annual shortfall for bridge projects.

As illustrated by Table 2, MaineDOT does not anticipate adequate funding (State and Federal assistance) to maintain the current condition of the bridge network and certainly does not anticipate funding (State and Federal assistance) to improve overall condition. Therefore, MaineDOT must constantly evaluate which bridges to address knowing that it *will* result in the delay of addressing other bridges, some of which are structurally deficient, fracture critical, or in poor condition.

[29] A list of Maine's forever bridges including location is included as Appendix 8 within the updated KOBS document. Frank J. Wood Bridge is not considered a Forever Bridge.

Table 2: Core Highway and Bridge Programs CY 2017-2018-2019[30] Funding Need vs Anticipated State and Federal Funding (In millions of $)				
Work Group	**Average Annual $ from 2017-2018-2019 Work Plan**	**Annual $ Needed to Meet Basic Statutory Goals**	**Average Annual $ Shortfall**	**Dollar % Shortfall***
Bridge Projects	$121	$140	-$19	**-13%**
Highway Reconstruction/Rehab	$78	$100	-$22	**-22%**
Pavement Preservation	$90	$108	-$18	**-17%**
Light Capital Paving	$27	$27	$0	**0%**
Total – Core Programs	**$316**	**$375**	**-$59**	**-16%**

The MaineDOT makes these decisions knowing that some bridges on lower priority highway corridors may change from fair condition to poor while needing to increase the rating or improve the infrastructure condition on a Highway Corridor Priority 1, 2, or 3. This decision is made to improve the safety and reliability of the State's most utilized infrastructure. Each project alternative and cost (both construction and service life) is considered in concert with the needs of the entire bridge network, including Forever Bridges. MaineDOT used several tools to evaluate the cost of each of the alternatives considered for improvements to the Frank J. Wood Bridge. Each of the methods have advantages and limitations, and are described below.

a. Construction Costs

Construction cost estimates are generated based on recent bid histories for similar projects. These costs only include the initial cost to construct the project and do not consider future improvements or maintenance. Construction unit prices are generated from recent bid history for all items. Unit price multiplied by unit quantity produces total item cost. Factors affecting bid prices for individual components of a project include location, constructability, and market conditions. Construction estimates are adjusted based on professional engineering judgment. Early in the preliminary design process MaineDOT drafts a Preliminary Design Report (PDR) to document general project information, conceptual designs and corresponding cost estimates. This report also incorporates preliminary plans and other information gathered during the preliminary data gathering stage. Appendix H of the PDR for the Frank J Wood Bridge Project (Appendix 2, pages H-5 to H-18) contains detailed cost estimates (Structural Cost Estimates) that add up to a construction cost for each alternative.

Each of the construction cost estimates for the Frank J. Wood Bridge carry a contingency cost. This is to recognize variation in estimates and changes during construction. Contingencies are estimated based on past project history for similar type bridge projects. This project site is unique due to the exposed and highly variable bedrock, exposure to high velocity flows, and proximity to the upstream dam. Due to the uncertainties associated with rehabilitating an existing deteriorated truss bridge, a higher amount of contingency cost is typically carried for rehabilitation options. It is difficult to know the precise condition of all the bridge elements until work is underway. As components of the bridge are exposed, additional section loss and discovering more deterioration than anticipated is common. Uncertainty regarding condition can cause prices to inflate. Replacement of the entire deck system reduces this uncertainty.

[30] The 2018-2019-2020 MaineDOT work plan and the 2019-2020-2021 MaineDOT Draft Work Plan show comparable or increased dollar % shortfalls for bridge projects.

However, there are additional areas of concern that may have not been specifically identified, but may require additional repair, replacement, or strengthening. Repair needs become more evident when preparing the truss for painting. The need to remove all deterioration, rust, and old paint will often uncover additional steel areas that need strengthening, repair, or replacement. Replacement or repair of deteriorated rivets and strengthening or replacement of gusset plates are examples of these needs. A 15% rehabilitation contingency was used for Alternatives 3 & 4. All alternatives carry a 7% contingency cost for items such as traffic control plans and field offices.

The cost of materials can also fluctuate over time which can affect the accuracy of estimates. For example, the cost of steel included in the current estimates is $7.80/lb. The price has more than doubled since the original estimate; recent low bids for steel repairs on steel girder and steel arch style bridges range from $11/lb. to $24.50/lb., making the 15% for rehabilitation contingencies a conservative estimate.

The construction cost of Alternative 1 is estimated at $16,000,000. This cost includes the construction of a temporary bridge needed during construction for vehicular traffic.

The construction cost of Alternative 2 is estimated at $13,000,000. A work trestle would be needed during construction for access to construct the cofferdams and piers, to erect the structural steel superstructure, to place deck concrete, and to remove the existing bridge. A cost premium of $1 million is included in the estimate to account for the added expense of a work trestle.

The construction costs of Alternative 3 and Alternative 4 are estimated at $15,000,000[31] and $17,000,000, respectively. These costs include the construction of a temporary bridge needed during construction for vehicular traffic. These costs also include a 15 percent contingency above the repair work identified. Rehabilitation projects nearly always discover issues not previously found in inspections, causing budget overruns. This contingency is based on MaineDOT bid history data. Alternative 4 is estimated at $2,000,000 more than Alternative 3 because Alternative 4 includes a more expensive lightweight deck and a new sidewalk.

b. Life Cycle Costs

Life cycle costs analysis (LCCA) is a standard engineering economic analysis tool useful in comparing the relative merit of competing bridge improvement alternatives. This evaluation technique converts all estimated bridge costs throughout the life of each bridge improvement alternative into current dollar equivalents, termed present value. The LCCA accounts for estimated construction cost on the current project and the translated present value of anticipated future inspection, maintenance, and rehabilitation costs. It also accounts for anticipated future bridge replacement dates for each alternative. The LCCA assumes money could be set aside today for future work and incorporates economic concepts and techniques such as earned interest on investments, inflation factors, and discounting the opportunity value of time. While LCCA is a tool that can identify the most cost effective alternative, it is not an indicator of the actual costs a transportation agency will expend on an alternative over the timeframe used for the analysis. State transportation agencies are not often able to set money aside today, and make interest earning investments, to pay for future work. For these reasons, life cycle cost was considered[32] but was not the primary basis for a decision on this project.

c. Service Life Cost

Service life cost provides a more accurate comparison of the expected real costs to an agency when examining bridge improvement alternatives. Service life is defined as the number of years a bridge can be part of the transportation system with maintenance, repair, and/or rehabilitation before its eventual replacement. The Service Life Cost is the total cost to maintain a structure over its design service life. It includes the cost of initial construction (construction cost), maintenance costs, inspections, and the cost of expected future improvements. Costs are broken down into required annual costs (such as inspections and anticipated maintenance) as well as periodic items (such as bridge painting, deck replacements, and structural rehabilitation). These costs are generated based on the historical maintenance needs of similar bridge types and historical data on costs. A service life cost estimate is not translated or discounted to current dollar equivalents. Service life cost of each alternative is summarized in Table 3.

[31] The cost of Alternative 3 at a 30-year rehabilitation was estimated at $8 million. See Cost section for information on 75-year rehabilitation.
[32] Appendix H of the Preliminary Design Report (Appendix 2, page H-19)

Table 3. Service Life Cost

Brunswick-Topsham, Frank J. Wood Bridge: Service Life Cost								
	Alternate 1: Replacement on Existing Alignment		Alternate 2: Replacement on Upstream Curved Alignment		Alternate 3: Rehabilitation		Alternate 4: Rehabilitation with Added Sidewalk	
Cost Items	Year	Cost	Year	Cost	Year	Cost	Year	Cost
Construction Cost	2019	$ 16,000,000	2019	$ 13,000,000	2019	$ 15,000,000	2019	$ 17,000,000
Inspections	Annual	$ 600	Annual	$ 600	Annual	$ 30,000	Annual	$ 30,000
Maintenance	Annual	$ 1,000	Annual	$ 1,000	Annual	$ 40,000	Annual	$ 40,000
Paint	35	$ 1,750,000	35	$ 1,750,000	20	$ 4,000,000	20	$ 4,000,000
	70	$ 1,750,000	70	$ 1,750,000	40	$ 4,000,000	40	$ 4,000,000
					60	$ 4,000,000	60	$ 4,000,000
Deck Replacement	None		None		40	$ 1,000,000	40	$ 2,000,000
Substructure Rehab	None		None		20	$ 1,000,000	20	$ 1,000,000
					50	$ 1,000,000	50	$ 1,000,000
Wearing Surface	15	$ 100,000	15	$ 100,000	None		None	
	30	$ 100,000	30	$ 100,000				
	45	$ 100,000	45	$ 100,000				
	60	$ 100,000	60	$ 100,000				
	75	$ 100,000	75	$ 100,000				
	90	$ 100,000	90	$ 100,000				
Service Life	100 years		100 years		75 years		75 years	
Total Cost over Life (Service Life Cost)	$20,300,000		$17,300,000		$35,200,000		$38,200,000	

Replacement (Alternatives 1 and 2)

FHWA requires that states inspect bridges every twenty-four months. Estimates for inspection are broken down into annual costs even though inspections would be completed every two years. The biennial inspection of a new bridge typically requires an inspection team spending a day or two looking at all bridge elements. The inspection would be followed by the preparation of a report detailing findings. Routine annual maintenance for a new bridge would include washing of the drains, curb lines, and joints as well as washing of any debris that might have built up on the structure.

Required periodic improvements include milling and resurfacing the asphalt wearing surface every 15 years and painting the girders at year 35 and year 70.

For both replacement alternatives (Alternative 1 and Alternative 2), the cost of inspection, maintenance, and periodic improvements are estimated at $4,260,000 over 100 years. When added to the Construction Cost of each alternative the total cost over service life for Alternative 1 is estimated to be $20,300,000. For Alternative 2, the total cost over service life is estimated to be $17,300,000.

Rehabilitation (Alternatives 3 and 4)

Estimates for inspection of the rehabilitation alternatives include the routine biennial inspection as well as additional effort for fracture critical bridges. Inspection of a fracture critical bridge requires a minimum of two inspectors, at least one of whom needs to be a qualified fracture critical bridge inspector, completing hands on inspection of every fracture critical member of the bridge. This type of inspection often requires bridge lane closures and the lease of specialized equipment for access and traffic control. Fracture critical inspection can take up to two weeks onsite versus one or two days for other non-fracture critical bridges as well as one to two additional weeks of effort to produce required reporting.

Maintenance for a rehabilitated bridge would include annual washing of the drains, curb lines, and joints as wells as washing of any debris that might have built up on the structure. Because of the age of the bridge, it is very likely that cracks in fatigue sensitive or fracture critical members would be found during inspection and immediate repairs would be required. A value of $40,000 per year to repair fatigue cracks was used in the maintenance service life cost estimate for this work.

Required periodic improvements for a rehabilitation include paint every 20 years, and a deck replacement at year 40. Based on the performance of similar aged bridges and the age of the most recent major substructure rehabilitation at the Frank J. Wood Bridge, additional substructure rehabilitations would be expected at years 20 and 50 following the initial construction of the rehabilitation alternatives.

The cost of maintenance, inspections, and required periodic improvements for Alternative 3 is $20,250,000 estimated over 75 years. When the Construction Cost is added, the total Service Life Cost of Alternative 3 is estimated to be $35,200,000. The cost of maintenance, inspections, and required periodic improvements for Alternative 4 is estimated at $21,250,000 over 75 years. The difference between Alternative 3 and 4 is that Alternative 4 includes an exodermic deck, which has a higher cost of replacement than the deck for Alternative 3. When added to the Construction Cost, the total Service Life Cost for Alternative 4 is estimated to be $38,200,000.

d. Annual Cost over Service Life

The Estimated Annual Cost of Service Life of each alternative is calculated by excluding the Construction Cost from the Total Service Life Cost and dividing by the Service Life [*Service Life Cost– Construction Cost)/Number of Service Life Years]*. This provides an average of expenditures from maintenance, inspections and required periodic improvements over the service life of the structure. The comparison of alternatives is shown in Table 4.

Table 4: Preliminary Cost & Annual Cost over Service Life

	Service Life (years)	**Preliminary Construction Estimate (Construction Cost)**	**Estimated Service Life Cost**	**Estimated Annual Average Cost of Service Life (Maintenance, Inspection, Periodic Improvements)**	**Increased Percentage Average Annual Cost Per Service Life Year (Maintenance, Inspection, Periodic Improvements)**
Alternative 1 Replacement on Alternative Alignment	100	$16 M	$20.3M	$43,000	0%
Alternative 2 Replacement on Upstream Alignment	100	$13M	$17.3M	$43,000	0%
Alternative 3 Rehabilitation with one Sidewalk; No posting	75	$15M	$35.2M	$269,333	626%
Alternative 4 Rehabilitation with 2 Sidewalks; no posting	75	$17M	$38.2M	$282,667	657%

When compared with the replacement alternatives, Alternative 3 would have increased annual cost over service life of 626%, and Alternative 4 would have a 657% increase in annual cost over service life. Additional details regarding cost estimates and program-wide needs may be found in Appendix 2: Preliminary Design Report (PDR) and Appendix 8: Keeping our Bridges Safe Report (2014).

In summary, the preliminary construction cost estimates of the rehabilitation alternatives (Alternatives 3 and 4) represent a 14% and 24% increase over the lowest estimated preliminary construction cost of any alternative. The rehabilitation alternatives (Alternatives 3 and 4) represent a 626% and 657% increase in annual cost over service life. Alternatives 3 and 4 would avoid the use of Section 4(f) properties. However, when they were considered with the cost and funding information described above, Alternatives 3 and 4 were found not prudent due to Service Life Costs of extraordinary magnitude (Section 774.17(iv)).

H. Secondary or Indirect Impacts

Secondary, or indirect, impacts[33] are defined as effects which are caused by the action and are later in time or father removed in distance, but are still reasonably foreseeable. Secondary, or indirect, effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR Part 1508.8, CEQ Regulations). The baseline for evaluating potential secondary impacts is the existing environment.

Alternatives 1, 2, 3 and 4 would not induce development and would not result in adverse secondary impacts to economic development. The rehabilitation alternatives and the replacement alternatives would have similar, if not the same, approach tie-ins as the existing Frank J. Wood Bridge. At varying degrees, Alternatives 1, 2 and 4 would improve and accommodate pedestrian and bicycle mobility between Brunswick and Topsham along Route 201. Alternatives 1 and 2 would have two 5-foot shoulders and two 5-foot sidewalks, which may attract more bicycle and pedestrian traffic to the area. Alternative 4 would have two 4-foot shoulders and two 5-foot sidewalks, which also may attract more bicycle and pedestrian traffic to the area. However, substantial changes to the pattern of land use within the project area are not expected. All alternatives would result in expenditures on construction manufacturing labor and materials, which would be a beneficial short-term impact to segments of the local economy.

I. Cumulative Impacts

Cumulative impacts are defined as the impacts on the environment which result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR Part 1508.7, CEQ Regulations). The geographic areas considered are those areas directly adjacent to and near the Frank J. Wood Bridge. The project impacts described in this document for the Frank J. Wood Bridge include impacts to cultural and natural resources, in addition to beneficial impacts to bicyclists and pedestrians. This section will first describe the identified past, present, and reasonably foreseeable future actions, followed by a discussion on the impacts of those actions on the cultural resources, natural resources, and bicyclists and pedestrians in the area.

Past, Present, and Reasonably Foreseeable Future Actions

For purposes of analysis, the year 1966 was chosen as the past reference year. This year marks the end of the period of significance for the PPC and the BTIHD. Past actions in the project vicinity include years of residential and commercial development and transportation infrastructure improvements. These past actions have resulted in the current built environment surrounding the Frank J. Wood Bridge, which is generally urbanized. The PPC was listed in the National Register in 1974, the Brookfield dam was constructed in ca. 1985, and the 250th Anniversary Park was dedicated in the early 1990s. Year 2122 was selected as the future conditions analysis year. Since MaineDOT now typically designs bridge projects with a design year of 100, and it is reasonable to assume construction will be complete by 2022, year 2122 would appropriately represent future actions. Since the majority of the Frank J. Wood Bridge project area is already developed, no redevelopment activities are anticipated to occur. No future residential or commercial development opportunities in the project area have been identified.

Planning documents utilized to identify applicable future projects in the project area include the *Maine Department of Transportation's 2017-2018-2019-2020 Statewide Transportation Improvement Program (STIP)*, the *Maine Department of Transportation's Workplan for Calendar Years 2017-2018-2019* and existing town comprehensive plans and studies, which are specifically called out below.

[33] Effects and impacts used in this section are synonymous.

The following projects are listed in *MaineDOT's 2017-2018-2019-2020 STIP* and *Workplan for Calendar Years 2017-2018-2019* within the study area of the Frank J. Wood Bridge project:

- MaineDOT WIN 22212.00 – new bicycle and pedestrian trail between Brunswick and Topsham, beginning at the Swinging Bridge, to Mill Street, Bow Street and Cabot Street, and ending at the Frank J. Wood Bridge. This project may also be known as part of the Androscoggin Riverwalk. MaineDOT is currently completing a feasibility study on this project jointly with the Towns of Brunswick and Topsham. This project is currently only funded for preliminary engineering.
- MaineDOT WIN 21714.10- Study of Traffic Patterns in and around the Maine Street Bridge (# 5884) which carries Route 24B over Route 1

The Town of Brunswick and the Town of Topsham were both contacted on July 26, 2017 and asked about any future work planned within the project area of the Frank J. Wood Bridge. Existing town plans were discussed and utilized to identify applicable projects within the project area. Identified projects include:

- Brunswick Mill Street Streetscape Project – This project includes a portion of the planned Androscoggin Riverwalk corridor but extends those improvements further south on Mill Street to Pleasant Street. The proposed plan calls for a redesign of the right-of-way corridor along Mill Street and further allows the addition of pedestrian and bicycle facilities adjacent to the river where no such facilities exist today. The improvements to Mill Street will be phased over several years. The actual schedule will be based upon the Town's desire to see the pathway extended, available funding sources, the towns' success at securing these funds, and the towns' willingness to raise the necessary matching funds.
- From the *2002 Brunswick Parks, Recreation and Open Space Plan*[34], which features over one hundred prioritized action items:
    - Item 35 – Prepare gateway landscape/cleanup plans at Outer Pleasant Street and Mill Street and make improvements to grass esplanades on Inner Pleasant Street
    - Item 67 – Acquire riverfront property north of the Brookfield dam to the Durham town line
    - Item 86 – Open up views of the Androscoggin River by selective cutting along Mill Street
    - Item 111 – Develop a pedestrian underpass at the Frank J. Wood bridge between the 250th Anniversary Park and the Fish Ladder.
    - Item 112 – Create an Androscoggin Riverside Trail to Pejepscot Dam. This would connect with the Androscoggin Riverwalk and the Frank J. Wood Bridge.

Additionally, through online research, other town plans and studies were identified and include:

- The *2005 Topsham Comprehensive Plan*[35] highlights current and future improvements and identifies goals, visions and needs for the community. The plan recognizes resources of importance in the area which include, but are not limited to, historic and archaeological resources; parks and recreation; open space, agriculture and forestry; and marine resources. Many future actions are recommended in the plan related to bicycle and pedestrian improvements throughout the community.
- The *2004 Brunswick Bicycle and Pedestrian Improvement Plan*[36] highlights the need to make further improvements to Maine Street from Bath Road to the Frank J. Wood Bridge and the Topsham town line, making for safer bicycle and pedestrian facilities. The plan calls for the Town of Brunswick and MaineDOT to work closely together to improve pedestrian and bicycle access.
- The *Master Plan for Downtown Brunswick and the Outer Pleasant Street Corridor*[37] – This plan articulates a number of future improvements in the vicinity of the Frank J. Wood Bridge including, but not limited to, establishing an interpretive lookout point, photo opportunity, and potential amphitheater at the 250th Anniversary Park overlooking the Androscoggin River.

Throughout the NEPA process, MaineDOT and FHWA have also been coordinating with Brookfield Renewable. As mentioned previously, the power generation facility is located at river mile 6 of the Androscoggin River and approximately 500 feet upstream of the existing Frank J. Wood Bridge. The generation facility is licensed to Brookfield White Pine Hydro, LLC. The Brunswick Hydroelectric project currently operates under a FERC license which will expire on February 28, 2029. Upstream fish passage at the dam occurs via a vertical slot fishway adjacent to the powerhouse and on the western bank upstream of the existing Frank J. Wood Bridge. The fishway provides passage for Atlantic salmon, as well as other important anadromous species including alewife and American shad. The fishway

[34] http://www.brunswickme.org/wp-content/uploads/2012/01/Parks-Recreation-and-Open-Space-Plan.pdf
[35] http://www.topshammaine.com/vertical/sites/%7B95A28B10-4485-4BEC-B8FC-5E8BF056A147%7D/uploads/2007_Amenedments_Topsham_Comp_Plan_Parts_1-3_Final.pdf
[36] http://www.brunswickme.org/wp-content/uploads/2011/12/BBPAC-2004-Updated-Plan.pdf
[37] http://www.brunswickme.org/wp-content/uploads/2012/04/adopted.downtown.master.plan_.pdf

was commissioned in 1980 and construction was completed in the early 1980s. Through discussions with Brookfield Renewable, it is possible that at the time of FERC relicensing, changes to the fishway may be needed to improve fish passage at this site and within the Frank J. Wood Bridge project area.

Impacts of Past, Present, and Reasonably Foreseeable Future Actions

The main project impacts for Alternatives 1, 2, 3 and 4 are cultural resources (i.e., historic architectural properties and public parks), natural resources (i.e., endangered species and their habitats), and impacts to bicyclists and pedestrians.

Alternatives 1 and 2 would result in demolition of the Frank J. Wood Bridge and would result in an adverse effect under Section 106 to the Cabot Mill, PPC, Frank J. Wood Bridge, and BTIHD. Alternative 1 would not have an effect on the SSHD, but would have a Section 4(f) use on Cabot Mill, PPC, and Frank J. Wood Bridge and the BTIHD. Alternative 2 would have a Section 4(f) use on the Cabot Mill, PPC, Frank J. Wood Bridge and BTIHD. Alternatives 3 and 4 would not result in the demolition of the Frank J. Wood Bridge and therefore, would not result in adverse effects under Section 106 but would result in Section 4(f) use on Cabot Mill and BTHID. Foreseeable future actions identified above within the project area, such as bicycle and pedestrian improvements, new trails, and esplanade enhancements, could have visual effects on the surrounding historic properties and districts. However, with the establishment of the Topsham Historic District Commission and a large presence of historical advocacy groups in the area, it is likely these future improvements would go through a local historic review, which would result in avoidance, minimization or mitigation of impacts to historic properties. If these actions require federal funds, licenses, permits or approvals, the Section 106 process and associated federal requirements would apply and impacts to historic properties must be identified and avoided, minimized or mitigated. The proposed action, in combination with past and future actions, is not expected to result in substantial cumulative impacts to cultural resources.

All alternatives would result in temporary adverse construction impacts to the endangered Atlantic salmon and its designated critical habitat, the threatened Atlantic sturgeon and its designated critical habitat, the endangered Shortnose sturgeon, and essential fish habitat. Alternatives 1 and 2 would also result in permanent adverse construction impacts. Measures to avoid and minimize impacts to species and critical habitats in the project area were identified in the Section 7 and Essential Fish Habitat consultations. Foreseeable future actions identified above within the project area are not anticipated to result in in-water work and therefore, are not expected to impact fish or their habitats. Therefore, the proposed action, in combination with past and future actions, is not expected to result in substantial cumulative impacts to endangered or threatened species and their protected habitats.

Lastly, the Preferred Alternative (Alternative 2) would result in beneficial impacts to bicycle and pedestrian movement along the Route 201 corridor between Brunswick and Topsham. Several future actions within State and town planning documents show that there is an emphasis on bicycle and pedestrian improvements within Brunswick and Topsham and between the communities, as indicated above. The Preferred Alternative (Alternative 2) improves bicycle and pedestrian connectivity between the two towns along Route 201 by providing shoulders of additional width and a new easterly sidewalk; and is consistent with the goals and objectives mentioned in overall State and local planning documents.

In conclusion, after a review of the impacts of past, present and reasonably foreseeable future actions in the project area, when added to the potential impacts of Alternatives 1, 2, 3 or 4, substantial cumulative effects to cultural resources, natural resources, and bicyclists and pedestrians are not anticipated to occur.

J. Other Federal Environmental Laws

Alternatives 1, 2, 3 and 4 were reviewed and analyzed for effects to natural, cultural, social and economic resources protected under Federal environmental laws. For all alternatives, either no resources were found in the project area, or the alternatives were determined to have no effect on the below-mentioned resources.

1. Bald and Golden Eagle Protection Act

In accordance with the Bald and Golden Eagle Protection Act, transportation projects are prohibited, except under certain specified conditions, from taking of such birds. There are no known mapped bald or golden eagles' nests within the project limits. None of the alternatives considered would result in a take of Bald or Golden Eagles.

2. Wild and Scenic Rivers Act

The Wild and Scenic Rivers Act prohibits the issuance of any federal permit for construction of projects having adverse impacts on a river with values qualifying it for protection under this act. The project location is not within a Wild and Scenic River.

3. Coastal Barrier Resources Act

The Coastal Barrier Resources Act established the Coastal Barrier Resources System (CBRS) and was enacted to minimize the loss of human life, wasteful expenditure of federal revenues, and the damage to fish, wildlife and other natural resources associated with coastal barriers. Projects within the CBRS may not receive federal funding unless they are in compliance and meet an exception to the Coastal Barrier Resources Act. The project area is not within a Coastal Barrier Resource.

4. Environmental Justice

Executive Order 12898 requires all Federal agencies to ensure that environmental justice consideration is part of their missions by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations in the United States and its territories and possessions.
The definition of an adverse effect under environmental justice is the totality of significant individual or cumulative human health or environmental effects and the definition of disproportionately high and adverse as predominately borne by minority and/or low-income populations that is appreciably more severe or greater in magnitude than adverse effects that will be suffered by non-minority and/or low-income populations.

As evaluated in accordance with Executive Order 12898, the direct and indirect effects of the replacement of the Frank J. Wood Bridge in Topsham and Brunswick, Maine are not expected to cause disproportionately high and adverse human health or environmental effects that will occur on minority populations and low-income populations.

5. Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions between the U.S., Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Under the MBTA, taking, killing, or possessing migratory birds (other than game birds during valid hunting seasons) is unlawful. Protections extend to migratory bird nests determined to contain eggs or young. In a December 22, 2017 legal memo issued by the Interior Department, the Migratory Bird Treaty Act applies only to direct and affirmative purposeful actions that reduce migratory birds, their eggs, or their nests, by killing or capturing.

MaineDOT completed a migratory bird survey and no migratory bird nests were detected within the project limits. None of the alternatives will have direct and affirmative purposeful actions that reduce migratory birds, their eggs, or their nests, by killing or capturing.

6. Marine Mammal Protection Act

The Marine Mammal Protection Act of 1972, as amended, protects populations of marine mammals and prohibits Federal agencies from harassment and take without authorization. There is the potential for seals to be present in the project area. However, no seal haul-outs have been identified or mapped in the project vicinity. MaineDOT consulted GIS data layers maintained by the MDMR and consultation documents from the upstream hydroelectric facility. MaineDOT completed a review of available data and concluded that the presence of an occasional transient harbor seal is possible, particularly during fish migration periods. However, based on the frequency of occurrence and the limits of the timing of in-water work to avoid migration periods for key fish species it is unlikely that marine mammal presence will coincide with construction activity. If necessary, contract language may be included to require the contractor to stop in-water activities to avoid harassment or take of seals. No other marine mammals are expected within the project area. None of the alternatives considered are likely to harass or take marine mammals.

7. Farmland Protection Policy Act

The Farmland Protection Policy Act requires the consideration of adverse effects of all federally funded transportation projects on farmland preservation and to consider alternative actions that could lessen those impacts. The review did not indicate any prime or unique farmland within the project area.

8. Section 6(f) of the Land and Water Conservation Fund Act

Section 6(f) ensures that once an area has been funded with LWCFA assistance, it is continually maintained in public recreation use unless the National Park Service (NPS) approves substitution property of reasonably equivalent usefulness and location and of at least equal fair market value. The Secretary must approve all conversions of property acquired or developed with LWCFA assistance under this section to other than public outdoor recreation uses. On June 9, 2017, the Maine Department of Agriculture, Conservation and Forestry confirmed there are no Section 6(f) properties within the project area.

9. Clean Air Act

The Clean Air Act established National Ambient Air Quality Standards (NAAQS) for six priority pollutants to protect public health and the environment. Areas that do not meet the NAAQS are designated as nonattainment areas and, thus, are subject to transportation conformity. Maintenance areas are geographic regions that were previously designated as nonattainment but are now consistently meeting NAAQS. Transportation conformity requires nonattainment and maintenance areas to demonstrate that all future transportation projects will not hinder the area from reaching and maintaining its attainment goals. The project is located between Cumberland and Sagadahoc Counties, areas that have been identified as being in nonattainment for the 1997 ozone NAAQS. In accordance with the U.S. Department of Transportation Interim Guidance on Conformity Requirements for the 1997 Ozone NAAQS, dated April 23, 2018, the Frank J. Wood project was published in an approved State Transportation Improvement Plan (STIP) prior to 2018 and therefore NEPA can be approved.

10. Noise

The MaineDOT Noise Policy requires highway agencies proposing to use Federal-aid highway funds for Type I projects perform a noise analysis of sufficient scope to provide information needed to make the determination if abatement is required based on it being reasonable and feasible. A traffic noise analysis is not required for this action because it does not involve a Type I project (none of the alternatives would significantly alter the horizontal or vertical alignment of the bridge- move more than ½ the distance closer to a receptor). No further analysis or abatement measures are required.

K. Coordination

Coordination with state and federal agencies has occurred throughout the project since the February 2015 initial MaineDOT team meeting. Coordination efforts are summarized in Table 5.

Table 5. Coordination with Agencies, Public and Section 106 consulting Parties

Date	Contact	Topic
2/5/15	Initial Team Meeting/Project Kickoff	Share baseline information
2/25/2015	Public	Preliminary Public Meeting
11/3/2015	Houlton Band of Maliseet Indians, Aroostook Band of Micmacs, Passamaquoddy Tribe, Penobscot Nation and Maine Historic Preservation Commission Archaeology staff	Notification of project and request for information
11/5/2015	Brunswick and Topsham Town Officials	Letters sent to towns requesting information of historic properties or concerns with historic properties
11/10/2015	Topsham Town Officials	Response from town regarding information on contributing buildings within the historic district
11/12/2015	Brunswick Town Officials	Response from town regarding information on contributing buildings within the historic district
11/19/2015	Penobscot Nation	Response regarding cultural resources received
12/8/2015	Passamaquoddy Tribe	Response regarding cultural resources received
4/25/2016	Public	Public Meeting- introduced alternatives from a cost and engineering perspective
5/12/2016	Department of Marine Resources, National Marine Fisheries Service,	Natural resources coordination meeting (on-site)
6/15/2016	Section 106 Consulting Parties	Consulting parties were established and notified.
6/16/2016	Maine Historic Preservation Commission	State Historic Preservation Officer concurs with National Register eligibility within the Area of Potential Effect.
7/11/2016	Section 106 Consulting Parties	Consulting parties meeting
8/18/2016	Section 106 Consulting Parties	Consulting parties meeting
9/16/2016	National Marine Fisheries Service, U.S. Army Corps of Engineers, Brookfield	Coordination meeting to discuss impacts to Brookfield dam, fishway, and natural resources
10/27/2016	Section 106 Consulting Parties	Consulting parties meeting
2/6/2017	Public	Public notice published providing the public an opportunity to review and comment on the various alternatives and the effects on historic properties.
2/6/2017	Maine Historic Preservation Commission	MaineDOT sent effects of the alternatives on historic properties to the State Historic Preservation Officer for review and concurrence.
3/6/2017	Maine Historic Preservation Officer, Section 106 consulting parties, Public	Concurrence memo on effects received from the State Historic Preservation Officer and comments received from Section 106 consulting parties and the Public.
3/17/2017	Maine Historic Preservation Commission	MaineDOT submitted additional requested information regarding the Summer Street Historic District to the State Historic Preservation Officer.
3/29/2017	Maine Historic Preservation Commission	MaineDOT received a concurrence memo regarding the Summer Street Historic District from the State Historic Preservation Officer.
4/3/2017	Army Corps of Engineers	Coordination
4/5/2017	Public	Public Open House on four all alternatives
6/1/2017	National Marine Fisheries Service, Brookfield	Coordination meeting

Date	Contact	Topic
6/5/2017	Public	Questions and Responses document was posted regarding the common questions received from the public between October 2016 and April 19, 2017
7/31/2017	National Marine Fisheries Service, Brookfield, FHWA	Section 7 Endangered Species Act Coordination
8/23/17 8/29/17 10/5/17	National Marine Fisheries Service, Brookfield, FHWA	Section 7 Endangered Species Act Coordination
6/2017 - 12/2017	Section 106 consulting parties	Continued correspondence between the consulting parties, State Historic Preservation Officer and FHWA.
10/25/2017	State Historic Preservation Officer	MaineDOT/FHWA sent determination of individual eligibility for the National Register to the SHPO for review and concurrence
11/2/2017	National Marine Fisheries Service	Formal Section 7 Endangered Species Act Consultation Initiated
11/16/2017	State Historic Preservation Officer	State Historic Preservation Officer does not concur with the Frank J Wood not being individually eligible (states the bridge is eligible under Criteria A).
12/15/2017	State Historic Preservation Officer and consulting parties	Federal Highway Administration updated the consulting parties on the individual eligibility of Frank J. Wood Bridge.
12/28/2017	Advisory Council on Historic Preservation	Federal Highway Administration invited the advisory Council to participate.
2/16/18	Friends of Frank J. Wood Bridge	Comments received on Individual Eligibility and process.
2/27/2018	Public & State & Federal Agencies	Environmental Assessment & Draft Section 4(f) Evaluation circulated and posted for public comment until April 11, 2018
3/15/18	Brookfield	Meeting to discuss FERC Boundary requirements and process.
3/28/2018	Public	Public Meeting on the Environmental Assessment
3/30/18	National Marine Fisheries Service	Section 7 Endangered Species Act Consultation Concluded
5/14/18	National Marine Fisheries Service	FHWA Initiates EFH Consultation.
5/30/18	Public	Public comments received posted on MaineDOT project website.
6/27/18	Section 106 Consulting Parties	Meeting to receive comments on potential mitigation for adverse effects. Comments on mitigation accepted until July 11, 2018.
7/17/18	State Historic Preservation Officer	MaineDOT/FHWA meeting with SHPO to update and obtain input on potential mitigation measures.
7/27/18	National Marine Fisheries Service	NMFS concludes EFH Consultation and provides Conservation Recommendations
8/22/18	Section 106 Consulting Parties	FHWA provides meeting minutes and information in response to comments and questions at 6/27/18 meeting. Information posted to MaineDOT website.
9/18/18	Maine Historic Preservation Commission	MHPC completes archaeological investigation for preferred alternative. MHPC did not find archaeological resources in areas to be disturbed.
10/3/2018	Section 106 Consulting Parties	Consulting Parties meeting gather input and views on the DRAFT MOA mitigation measures. Comments accepted until October 20, 2018.
10/15/18	State Historic Preservation Officer	MaineDOT/FHWA meeting with SHPO to update and obtain input on potential mitigation measures.
10/22/18	Section 106 and Public	Section 106 MOA comment period closes
10/24/18	Section 106 and Public	Final draft MOA posted on MaineDOT website for public comment until November 7, 2018.
10/22/18	Houlton Band of Maliseet Indians, Aroostook Band of Micmacs, Passamaquoddy Tribe, Penobscot Nation	Update sent to Tribes with request for comment.
10/22/18	Houlton Band of Maliseet Indians	Response received. No concerns.
10/29/18	United States Fish and Wildlife Service	Streamlined 4(d) Endangered Species Act Consultation Initiated
10/30/18	United Fish and Wildlife Service	Streamlined 4(d) Endangered Species Act Consultation concluded.
11/7/18	Section 106 and Public	Section 106 MOA final comment period closes
12/22/2018	Section 106	Section 106 MOA signed and Section 106 concluded.

L. Public Involvement

MaineDOT initiated a Bridge Improvement Project for the Frank J. Wood Bridge in February 2015. The scope of the project was to assess the feasibility of a range of alternatives to address the bridge condition, from rehabilitation to full replacement. Baseline information regarding project constraints and existing conditions relative to right-of-way, traffic, utilities, environment, maintenance, and community needs was collected. A preliminary public meeting was held on February 5, 2015 to obtain feedback and understand concerns as preliminary engineering was begun to examine improvement alternatives for the bridge. MaineDOT had anticipated that the improvement analysis could show that cost effective repairs could be made to the bridge to extend the service life for several years. MaineDOT proceeded with the engineering feasibility study over the following year.

In March 2016, MaineDOT reviewed the preliminary results of the feasibility study. In April 2016, MaineDOT presented the public with the range of alternatives considered and the results of the feasibility study. The purpose of the meeting was to inform the public that the in-depth engineering examination of the extent of repair of the bridge, and associated costs, revealed that a rehabilitation alternative would not be as cost effective as a bridge replacement. While replacement was the preliminary recommendation due to the cost findings, it was recognized at that time that many additional environmental analyses would have to occur, including the Section 106 review process before final decisions were made.

Public comment was mixed between support of replacement and support of rehabilitation alternatives. Several individuals and groups raised concerns regarding consideration of historic resources in evaluating the alternatives. In response to public comment, the five alternatives presented in the EA include additional alternatives that were not initially considered by the project team. MaineDOT refined the alternatives, added alternatives not previously considered and evaluated all the alternatives for engineering, cost, and environmental impacts, including impacts to historic resources. From April 2016 to April 2017, MaineDOT continued to evaluate each alternative. MaineDOT and FHWA solicited, received, and considered input from the public, the Section 106 Consulting Parties and other state and federal resource agencies

Some of the key issues raised during the public meetings, Section 106 consulting party meetings, meetings with town officials and agencies are as follows:

- Historic nature of existing bridge and area
- Bicycle and pedestrian connectivity
- Aesthetics
- Importance of detour route/business access
- Costs and community interests

All of the comments received are posted to the MaineDOT project website: http://www.maine.gov/mdot/env/frankjwood/

Public involvement continued through the Section 106 Process as described in the Environmental Impacts: Cultural Resources section of this document. Public involvement continued through publication of this EA. A public meeting was held on March 28, 2018 and public comment on the EA was accepted through April 19, 1018.

The public was requested to comment on mitigation for the adverse effects under Section 106 and the Draft Section 106 MOA. The public was notified on September 26, 2018 and allowed to comment through October 22, 2018. The public was also notified on October 26, 2018 that public comments on the Final Section 106 MOA would be accepted through November 7, 2018.

M. Responses to EA Comments

All comments received on the EA are available for review in Appendix 12 and 13, and summarized below. FHWA and MaineDOT reviewed and considered all comments, and have provided responses to substantive comments in the following section.

What is a Substantive Comment?

A substantive comment is one which suggests the modifications of an alternative, suggests the development and evaluation of an alternative not previously considered, supplements, improves or modifies analyses, or corrects a factual error. A statement of preference for a particular alternative is not considered a substantive comment.

a. Matrix

Comment #	Name	Affiliation	Topic	Topic of Substantive Comment	EA Response to Comment #
1	Joseph Feely		Life cycle costs	NEPA	EA Response #10
2	Jerome Brannigan	Topsham resident	Supports new bridge		
3	Paul Womer	Brunswick resident	Bicycle, aesthetics of new bridge, endorses new bridge		
4	Leslie Mortimer	Topsham resident	Supports new bridge		
5	Thomas Connelie	Topsham resident and business owner	Endorses new bridge. Questions: Will the depth of the structural steel beams for Alternate 2 and projected water levels necessitate raising the road height above the existing road height of the existing bridge? If so, how much? When viewed from the side what will be the depth of the bridge structure (steel beams plus road deck plus railing? How does this compare with the visual depth of the existing truss structure?	NEPA-Visual/Design	EA Response #1 and 13
6	Jim Hamilton	Brunswick resident	Supports new bridge		
7	Richard Roedner	Topsham Town Manager	Vehicle lanes should be limited to 10'	NEPA-Design	EA Response #2

Comment #	Name	Affiliation	Topic	Topic of Substantive Comment	EA Response to Comment #
8	Mike Dumais	Topsham resident	Supports new bridge		
9	Cory King	Durham resident	Supports new bridge		
10	Tom Rumpf	resident	Bike and pedestrian traffic safety, supports new bridge		
11	Arlene Morris	Topsham resident, commercial building owner	Supports rehabilitation. Questions: Why did MaineDOT fail to be objective in the Section 106 process? Questions about speed, elevation, and position of the new bridge as it hits the abutments. Economic development concerns.	Section 106, NEPA-Design	EA Response # 1, 3, 11, and 13
12	Georgia Bancroft	Brunswick resident	Supports new bridge. Safety concerns with existing truss.		
13	Jim Byrne	Topsham resident	Supports replacement, safety, cost		
14	Mark Pavitt		Supports Alternative 2/replacement		
15	James Mixon	Topsham resident	Supports rehabilitation, aesthetics, preserve some of the only remaining history and charm in town.		EA Response # 4 and 10
16	Richard Bryant	Brunswick resident	Supports new bridge		
17	Joan Sheldon	Topsham resident	Supports new bridge		
18	Michael Gray	Topsham resident	Supports new bridge, part of FJW truss should be left as memorial to its construction		mitigation suggestion
19	Loyd Van Lunen		Supports new bridge		
20	William Sadler		Question: Can hand rails be added to the new bridge between the road and sidewalk?	Final design	EA Response # 5
21	Jeff Runyon	Brunswick resident	Supports new bridge. Safety concerns		
22	Mechelle Given	user of bridge, works in Brunswick	Supports new bridge. Safety concerns		

Comment #	Name	Affiliation	Topic	Topic of Substantive Comment	EA Response to Comment #
23	Margaret Schick	Topsham resident	Supports bridge replacement. Safety concerns, aesthetics, costs.		
24	Margaret Wilson		Supports bridge replacement. Safety concerns, aesthetics, costs.		
25	Richard Moll	Brunswick resident	Supports new bridge. Costs		
26	Faith Moll	Brunswick resident	Supports new bridge. Costs		
27	Robert Pickel		Supports new bridge. Safety, costs		
28	Richard Mersereau	Brunswick resident	Supports new bridge		
29	John Briley	Topsham resident	Supports new bridge, would like at least 2 overlooks on up and downstream sides. Historical markers at overlooks		mitigation suggestion
30	Adair Delamater		Supports new bridge		
31	Richard Winter		Supports new bridge, concerns with maintaining fish ladder	NEPA-Design	EA Response #6
32	Brian Thibeault		Supports new bridge. Safety, costs		
33	Phinney White	Friends of FJW	Wanted to ensure comment website was working properly		
34	FC Vitolo		Supports replacement, preservation through artwork, sculpture and photography		mitigation suggestion
35	Stephen Bowman	Brunswick resident	Supports replacement, pedestrian friendly		
36	Debra Wigand	Brunswick resident	Supports alternative 2-replacement, traffic, bike paths incorporated into new bridge		
37	Jerry Lamarre	Topsham resident	Supports new bridge		
38	Cheryl King	Topsham resident	Supports rehabilitation, loss of quaintness		

Comment #	Name	Affiliation	Topic	Topic of Substantive Comment	EA Response to Comment #
39	Magaret Fischer	Topsham resident	Supports replacement, Questions: How approaches at either end will be constructed, How they will look, How traffic will be affected, fish ladder affected, Entrance to Frontier Restaurant and parking, other businesses parking, and height of new bridge.	NEPA-Design	EA Response #1, 6, and 13
40	Susan Williams	Harpswell resident	Supports rehabilitation with an added sidewalk. Lower water falls very important, keep metal barrier between pedestrians and traffic.	NEPA-Design	EA Response #5 and 7
41	David Colt	Harpswell resident	Supports rehabilitation		
42	Thomas Bartes	Brunswick resident	Supports replacement, alternative 2.		
43	James Hamilton	Brunswick resident	Supports replacement, alternative 2. Bicyclist, cost concerns		
44	Mark Grandonico	Midcoast Triathlon Club	The triathlon club supports replacement		
45	Richard Bernasconi	Brunswick resident	Supports replacement		
46	Cynthia Howland		Supports rehabilitation. Cultural history, fishway, marine/waterfowl.		
47	Cornelius+Donna Walsh	Topsham resident	Supports rehabilitation		
48	Linda Baker	Topsham resident	Supports Replacement. Fiscally responsible.		
49	Hannah Judson		Supports Rehabilitation. History, joins towns.		
50	Hedda Scribner	Topsham resident	Supports upstream replacement. Guardrail. Bike/pedestrian friendly.	Final Design	EA Response #5
51	Katharine Watson	Brunswick resident	Supports rehabilitation. Human and vehicular safety, Urban vistas. Waterfalls, hydraulics.	NEPA	EA Response #7

Comment #	Name	Affiliation	Topic	Topic of Substantive Comment	EA Response to Comment #
52	John Mckee	Brunswick resident	Supports rehabilitation. Historic preservation. Traffic flow and safety must be discounted because of approach traffic patterns.		
53	Stephen + Jo-Ann Turner	Brunswick resident	Supports replacement. Repairs problematic and costly.		
54	Amanda Hughes		Supports replacement, Alternative 2. Daily driver and pedestrian user. Safety.		
55	Wallace Pinfold	Brunswick resident	Supports rehabilitation. Does not trust costs figures.	NEPA	EA Response # 10
56	Peter Huntsman		Supports safest, cost effective bridge.		
57	Noyes Lawrence	Lisbon Falls resident	Supports replacement. Costs. Erect a plaque dedicated to the memory of Frank J. Wood or name the new bridge Frank J Wood.		mitigation suggestion
58	Jane Crichton	Brunswick resident	Made following points: safety of pedestrians - appreciate the steel barriers on truss. Collisions- seen no evidence of accidents on bridge. History - reason for green bridge being on cover of Mills and Factories of New England.		
59	Sarah Boyd Williams	Harpswell resident	Supports rehabilitation with added sidewalk. Conserve character of Topsham and Brunswick. Concerns for pedestrian protection and view of waterfalls.	Design	EA Response #5 and 7
60	P. Asher	Topsham resident	Supports rehabilitation. Questions: Is there research on pedestrian traffic numbers? 10' lane widths wanted. Difference in 2003 Historic Bridge statement and 2018 4(f) statement.	NEPA	EA Response #2, EA Section G 2, Section 4(f) document
61	Susan White	Topsham resident	Supports rehabilitation		

Comment #	Name	Affiliation	Topic	Topic of Substantive Comment	EA Response to Comment #
62	James Phinney Baxter White	Topsham resident	Supports rehabilitation. Suggests bridge is eligible under criterion C for construction type. States it may be a National Historic Landmark. States it is already a landmark.	Section 106	EA Response #8
63-86	Summer Street Residents and Others: Charles Carroll, Ann Caroll, Josie Seymour, Allison Brigham, Maynard McCorkle, Paul Seaquist, James Mason, Steve Stern, Arlene, Morris, James White, Eleanor Brown, Bronda Niese, Mariyln Hardy, John McKee, Cynthia Howland, Hannah Judson, Katherine Watson, Mary O'Brien, Ann Nemrow, Evan Duda, Frank Duda, Wallace Pinfold, Susan White.		Supports rehabilitation. Comments submitted as Summer Street residents and others. Comments: What is elevation of the proposed Alternative #2? How would the replacement bridge tie into the approaches? Increased noise/ head lights shining in Summer Street residents. Claims Summer Street HD ties to bridge and mill. Rendering of the Alternative 2 replacement. Pedestrian safety concerns with the new bridge. Concerns with environmental impacts. Safety concerns with the new alignment at the Summer Street intersection. Question cost estimates. Concerns with fish ladder and wildlife. Comments on the bridge meeting Criteria C. Why did MaineDOT fail to be objective in the Section 106 process?	NEPA, Section 106	EA Response # 1, 3, 6, 8, 10, 12, and 13, Section 106 documentation (Appendix 6 of EA), and EA Section E.
87	Margo Knight	Brunswick Resident, Brunswick Downtown master plan chair	Supports replacement. Bike, pedestrian and driver safety. Interpretive and commemorative plaque mitigation comment.	Final Design.	EA Response # 5. Mitigation suggestion
88	Barbara Proko	Bath Resident	Supports rehabilitation		
89	Beau Gros		Supports rehabilitation		

Comment #	Name	Affiliation	Topic	Topic of Substantive Comment	EA Response to Comment #
90	David Israel	Brunswick resident	Supports rehabilitation		
91	Bonnie Biedrzycki		Supports rehabilitation. Viewing of the falls.	NEPA	EA Response # 5.
92	Melissa Jones		Supports rehabilitation		
93	Scott Hanson	Topsham resident. Friends of FJW Bridge	Supports rehabilitation. States that Friends independent engineering bridge study shows vastly lower costs for maintaining the bridge than MaineDOT's projected costs.	NEPA	EA Response #4 and 9. Section 4(f) document.
94	Alexis Sullivan	Topsham resident	Supports rehabilitation		
95	William Carr Jr.		Supports rehabilitation		
96	Greg Paxton	Maine Preservation	Supports rehabilitation. Tourism, economic development, 10' lane widths	NEPA	EA Response #2 and 11
97	Susan Cooney		Supports rehabilitation		
98	Amy Robinson	Topsham resident	Supports rehabilitation		
99	Julia Crocker	National Marine Fisheries Service	Concerns with Alternative 2 and the possible limitation on future improvements to the fishway at Brookfield and overall fish passage.	NEPA	EA Response #6
100	Edda Thiele		Supports rehabilitation		
101	Nicole Lepera	Topsham resident	Supports rehabilitation		
102	Lynzie Millard	Topsham resident	Supports rehabilitation		
103	Jill, Bailey and Ben	Topsham resident	Supports rehabilitation. How would the new bridge impact fish migration?	NEPA	EA Response #6
104	Cathy Hanscom	Topsham resident	Supports rehabilitation		
105	Dale Dorr		Supports replacement		
106	Douglass Bennett	Topsham resident	Supports replacement		
107	Renee Badershall		Supports rehabilitation		
108	Kelly Maloney	Brookfield Renewable	concerns with noise, vibration and shadowing on the fishway and migration from Alternative 2.	NEPA	EA Response #6. EFH (EA Appendix 11)

Comment #	Name	Affiliation	Topic	Topic of Substantive Comment	EA Response to Comment #
109	John Merryman		Supports replacement		
110	Linsa and Harold Christensen	Brunswick resident	Supports replacement		
111	A Weymouth		Supports rehabilitation		
112	Louise Rosen	Brunswick resident	Supports rehabilitation		
113	Donnalee LaRoce	Brunswick resident	Supports replacement		
114	John Graham	Friends of Frank J Wood Bridge	Supports rehabilitation. Questions: elevation of the preferred Alternative 2 has not been made public and renderings of alternative 2 from adjoining historic neighborhoods have not been made public. Approach renderings? Methodology of arriving at estimated costs is a concern. Other reasonable alternatives were not studied (Friends Independent engineering report included in submittal). States EA is premature. Friends content that the process has been biased. Questions feasible and prudent under Section 4(f). Fish ladder concerns. Cost comparison related to extraordinary magnitude. Questions life cycle costs.	NEPA, Section 106, Section 4(f)	EA Response #1, 4, 6, 9, 10 and 13

Comment #	Name	Affiliation	Topic	Topic of Substantive Comment	EA Response to Comment #
115	Penninah Graham	Topsham resident	Supports rehabilitation. States there is no problem with pedestrian traffic, 10' traffic lanes. Questions 2003 Historic Bridge Plan language.	NEPA	EA Response #2, Section 4(f) document
116	Stephen Hinchman	Friends of Frank J Wood Bridge	Concerned that FHWA and MaineDOT are not meeting requirements of NEPA by segmenting Section 106 and Section 4(f) and impacts based on final design. Discusses how the EA violates NEPA provisions. Explains how NPEA works and some of the failures in the FJW EA. States that the EA must be withdrawn and done correctly.	NEPA	EA Response 1, 6 and 13, EA, EA Appendices, Section 4(f)
117	Richard Nemrow	Brunswick Resident	Supports rehabilitation		

EA Public Meeting (March 28, 2018)					
Comment #	**Name**	**Affiliation**	**Topic**	**Topic of Substantive Comment**	**EA Response to Comment #**
1	John Graham	Friends of Frank J Wood Bridge	Question on height of new bridge	NEPA	EA Response #1 and 13
2	Ann Carroll	Friends of Frank J Wood Bridge	Impacts to Sumer Street Neighborhood	NEPA/Section 106	EA Response #12
3	Chick Carroll	Friends of Frank J Wood Bridge	Questions regarding fishway	NEPA	EA Response #6
4	Susan Williams	Friends of Frank J Wood Bridge	Alternative 2 covering up natural falls	NEPA	EA Response #5
5	Steve Sterns	Friends of Frank J Wood Bridge	Questioned why 10' lanes can not be used.	NEPA	EA Response #2

b. Responses to EA Comments

1. How did MaineDOT consider visual impacts of a new bridge? (For example, depth of beam and view from the Summer Street Historic District.)

MaineDOT and FHWA reviewed and considered extensive public comments regarding visual impacts and aesthetic considerations. Visual elements of the bridge and aesthetic considerations will continue to be refined during final design of the project.

In response to questions specific to visual impacts on the Summer Street Historic District, MaineDOT developed two renderings, provided below in response to comment #13, of both the existing and preferred bridge alternative from Summer Street. The comparison between Alternative 2 (Sheet 2) and the existing bridge (Sheet 1) were generated based on variable components that relate beam depth to structure depth from a single vantage point (Sheet 3 "Summer Street Viewpoint"). The images are to scale and are based on existing information and preliminary engineering.

To provide as much detail as possible to consulting parties and to be responsive to questions asked at previous meetings, the following preliminary design details have been summarized, below.

<u>Preliminary design details for Alternative 2 height/span length are as follows:</u>

- The preferred Alternative 2 bridge will be comprised of four variable length spans. The first span, at the Brunswick end is the longest, the next two spans are the same length and the last span, at the Topsham end, is the shortest. Generally, structural efficiency is gained through a positive relationship between span length and girder depth. As the span length increases, the girder depth should also increase to maintain structural efficiency. Because of this relationship, the girder depths vary with the span lengths, deeper girders are used for the longer spans and more shallow sections are used for the shorter span lengths. Additional structural efficiency is gained by using "haunched" girders, which have a shallower depth at the mid-span and then curve down to become a deeper section over the piers where load demand is highest.

- Preliminary design has resulted in initial approximate sizing for these girders. These sizes will be refined during the final design phase to optimize economy and aesthetics. The "bridge structure depth" is made up of the depth of the steel beam girders plus the thickness of the concrete and asphalt deck, sidewalk, and the 3'-6" high combination concrete / metal railing. Due to the variability in the girder depth, the bridge structure depth varies from the Brunswick end to the Topsham end of the bridge. At the Brunswick end, the bridge structure depth for the first span varied from approximately 15'-8" in the center of the span to approximately 17'-8" at the pier. At the Topsham end, the bridge structure depth for the last span is approximately 11'-0" at the center of the span and 12'-8" at the pier.

- When looking at the existing bridge from the side there are two visual components to the bridge depth. The first is the "bridge structure depth" referenced in the question, which is made up of the depth from the bottom chord to the top of the sidewalk railing. The second is the overall depth of the bridge including both the "bridge structure depth" and the truss elements above the railing.
- Regarding the existing "bridge structure depth", when looking at the side of the bridge this is seen as mostly solid. It includes the depth of the truss bottom cord, height of the sidewalk bracket, the thickness of the sidewalk concrete, and height of the metal pedestrian railing. The structure depth varies with span length but the difference is less pronounced than for the proposed bridge. The structure depth, for the existing bridge, is approximately 9'-6" for the shortest span and 10'- 6" for the other two spans.
- The second visual component of the existing bridge is the portion of the truss above the sidewalk railing. When looking at the side of the bridge, the view above the pedestrian railing is partially to mostly obstructed by the truss elements depending on the view perspective. The total maximum height from bottom chord to highest point on the truss is about 36'-6" for the span closest to Topsham, and about 54 '-0" for the other two spans.

In summary, the "bridge structure depth" that completely obscures the view when looking at the side of the bridge goes from an existing depth of between 9'-6" and 10'-6" to a proposed Alternative 2 depth varying between 11'-0" and 17'-8". The total structure depth (contributing to both completely and partially to mostly obscured views) reduces from between 36'-6" and 54'-0" for the existing bridge to between 11'-0" and 17'-8" for proposed Alternative 2.

The public can continue to comment and provide input on visual features of the project during final design. Because NEPA asks agencies to consider multiple alternatives, MaineDOT/FHWA cannot commit to final design details before issuing a NEPA decision.[38] As is the case with other projects that have a high level of public interest, MaineDOT regularly receives public comment on final design elements (e.g., bridge height, curb materials, lamp posts, lighting style, etc.) throughout the NEPA process. MaineDOT cannot make any final design commitments at this early stage. However, the Memorandum of Agreement (MOA) containing mitigation measures to resolve adverse effects to Historic Resources (Appendix 6) includes the following stipulation:

"*MaineDOT will consult with the Maine SHPO, the Bridge Design Committee, and the consulting parties on the final design of the new bridge. MaineDOT will provide the SHPO, Bridge Design Committee, and the consulting parties, for their review and comments, details on aesthetic bridge design features, including public space, viewing, railing and lighting options to ensure compatibility with existing historic features. The information will be provided at 60% and 90% relevant design documents via email and posted on the*

[38] 40 CFR 1500-1508

MaineDOT Frank J Wood web page. The Design Advisory Committee and consulting parties will have 30 calendar days to review and provide any comments to MaineDOT."

Renderings are provided as part of response 13.

2. Can 10' travel lanes be used instead of 11'?

Travel lanes are usually 11 to 12 feet. Only in extremely low volume situations would MaineDOT go down to 10 feet. Frank J. Wood/Route 201 is not a low volume highway. The average daily traffic volume is around 19,000 vehicles and truck traffic that travels over this bridge. Two 10' travel lanes are not appropriate for this location.

3. Can FHWA/MaineDOT please respond to comments that the Section 106 process for this project was flawed?

In November 2015, letters were sent to the towns of Brunswick and Topsham and the federally recognized tribes in Maine requesting information on historic resources in the project area. Responses were received in November and December of 2015 from the towns, the Passamaquoddy Tribe, and Penobscot Nation. The historic architectural survey was started shortly after and approved as complete by the Maine Historic Preservation Commission (MHPC) (Maine State Historic Preservation Officer, or SHPO) in May 2016. Properties determined eligible for listing on the National Register of Historic Places and the Area of Potential Effect were concurred with by the SHPO in June 2016. In June 2016, Section 106 consulting parties with demonstrated interests in the undertaking were established. Section 106 consulting party meetings were subsequently held on July 11, August 18 and October 27, 2016 to discuss and receive comments regarding the Section 106 area of potential effect, eligible historic properties, and evaluate the effects on historic properties for each of the proposed alternatives. In February 2017, the draft Section 106 determination of effect on historic properties for each alternative was developed and distributed to the Section 106 consulting parties, the SHPO, and posted for public review and comment. Comments were received and incorporated. In March 2017, the SHPO concurred with the determination of effect on historic properties for each alternative. A public meeting was held on April 5, 2017 utilizing an open house format and comments were received at the meeting and up to April 19, 2017. Responses to common questions were responded to on June 7, 2017 through posting on MaineDOT's public website and e-mail to interested parties.

In 2003, the Frank J. Wood Bridge was originally determined not individually eligible for the National Register of Historic Places as part of the MaineDOT Historic Bridge Survey, but was eligible as a contributing resource to the Brunswick Topsham Industrial Historic District. Based on comments received from the consulting parties and the SHPO, MaineDOT reevaluated the individual eligibility of the Frank J. Wood Bridge. MaineDOT conducted additional research on the 1936 flood, the interurban trolley, and the Boston Bridge Works Company. MaineDOT determined that the bridge was not individually eligible and sent the documentation to the SHPO on October 25, 2017 for concurrence. The SHPO responded on

November 16, 2017 and did not concur. The SHPO stated that the bridge is individually eligible under Criteria A because the Bridge carried the A&K Railroad over a major river crossing and seems to have an important association with the interurban railway and that the Bridge possesses sufficient physical design characteristics to convey the fact that it was not designed simply to carry two lanes of highway traffic. Based on MaineDOT's additional research, the SHPO's November 16, 2017 memorandum, and a recommendation from FHWA's Federal Preservation Officer, FHWA determined the Frank J. Wood Bridge was individually eligible for listing on the National Register on December 11, 2017. MaineDOT responded back to the SHPO on December 13, 2017, indicating that FHWA had made the determination that the Frank J. Wood Bridge is individually eligible for listing on the National Register. On December 15, 2017, the Advisory Council on Historic Preservation (ACHP) was formally invited to participate in the Section 106 consultation.

The Preferred Alternative (Alternative 2) was determined to have Adverse Effects on Cabot Mill, the PPC, the Frank J. Wood Bridge, and the BTIHD. The Preferred Alternative (Alternative 2) would result in No Adverse Effect on the SSHD. Alternative 1 would result in Adverse Effects on Cabot Mill, the PPC, the Frank J. Wood Bridge, and the BTIHD. Alternative 1 would have No Effect on the SSHD. Alternatives 3 and 4 would result in No adverse effects on Cabot Mill, the PPC, the Frank J. Wood Bridge, and the BTIHD. Alternatives 3 and 4 would have No Effect on the SSHD. The Section 106 determination of effects and SHPO concurrence is included in Appendix 6.

Avoidance and mitigation measures for the Adverse Effects to these resources were discussed in consultation among MaineDOT, FHWA, SHPO and the Consulting Parties. Measures to minimize harm for adverse effects were developed in consultation with SHPO, the consulting parties, and the public. (See "Section 106 Timeline", Revised EA and Final 4(f) Evaluation, Appendix 6). A Memorandum of Agreement (MOA) for adverse effects was developed in consultation with the Section 106 consulting parties and the public to document mitigation measures. ACHP served as a consulting party and provided substantive written edits to the MOA resolving adverse effects under Section 106.

MaineDOT and Federal Highway held two consulting party meetings specifically seeking mitigation input, and provided a thirty-day comment period seeking input on draft mitigation measures. The MOA was executed on December 21, 2018. (Appendix 6). Final mitigation measures are listed as Stipulations of the MOA and are summarized below:

- **New Bridge Design Review Process**: MaineDOT will consult with the Maine SHPO, Bridge Design Committee, and Section 106 consulting parties on the final design of the new bridge to ensure compatibility with existing historic features.
- **Historic American Engineering Recordation**: MaineDOT will provide recordation of the Frank J. Wood Bridge (Maine State Bridge No. 2016) in consultation with the National Park Service and in accordance with Historic American Engineering Record (HAER) Level 1 Standards.

- **National Register of Historic Places (NRHP) Nomination**: MaineDOT will prepare and submit to the Maine SHPO a NRHP nomination for the previously determined eligible Brunswick Topsham Industrial Historic District (including National Register-eligible tenement housing).
- **Outdoor Interpretive Panel**: MaineDOT will design and install two (2) permanent outdoor interpretive displays depicting the Frank J. Wood Bridge and earlier crossings, their history, and significance.
- **Conservation of Existing Bridge Plaques**: MaineDOT will be responsible for removing, storing, and conserving the four (4) historic plaques on the existing Frank J. Wood Bridge.
- **Adaptive Reuse or Reuse of Portions of the Structure**: Prior to dismantling, MaineDOT and FHWA shall offer the Frank J. Wood bridge to any group that could legally take possession of the bridge and maintain it at a new location, provided the group assumes all future legal and financial liability.
- **Illustrated Booklet on the History of the River Crossing**: MaineDOT, in consultation with the Maine SHPO, will commission an illustrated booklet on the history of the river crossing, as well as document the complete story of the Frank J. Wood Bridge and its relationship to the community and the cultural landscape, including indigenous use of the area.
- **Indoor Traveling Exhibit**: MaineDOT will develop a single indoor travelling exhibit consisting of three panels that share the story of the history of the Androscoggin River crossing, including the Frank J. Wood Bridge.
- **Post Review Discoveries**: If any unanticipated discoveries of historic properties or archaeological sites are encountered during the implementation of the project, MaineDOT shall suspend work in the area of the discovery in accordance with *MaineDOT Standard Specification 105.9: Historic and Archaeological Considerations,* and MaineDOT shall notify FHWA. FHWA shall notify the ACHP, the Maine SHPO, and if applicable, federally recognized tribal organizations that attach religious and/or cultural significance to the affected property.

The timeline in Appendix 6 of the Revised EA details the Section 106 process and relevant regulatory requirements. It identifies multiple consulting party and public comment periods as well as project components that were revised or revisited to respond to and incorporate consulting party input. Comments from consulting parties and the Maine SHPO were also made available to the public via MaineDOT's project website.

4. How did MaineDOT/FHWA develop estimates for future cost of bridge maintenance and inspections?

MaineDOT and FHWA provided the following response to questions regarding the estimation of annual inspection and maintenance costs. The response, including cost estimates, were posted to the MaineDOT website on June 7, 2017:

"Alternatives 1 and 2 (replacement) estimate an annual inspection cost and annual routine maintenance cost. These costs are broken down into annual costs even though inspections would be conducted every two years. The biannual inspection of a new bridge typically requires an inspection team spending a couple of hours looking at major items that may have changed in the two-year span between inspections. The

inspection would be followed by the preparation of a report detailing any findings. Routine maintenance for a new bridge would include annual washing of the drains, curb lines, and joints as well as washing of any debris that might have built up on the structure.

Alternatives 3 and 4 (rehabilitation) also estimate an annual inspection cost and annual routine maintenance cost. The annual inspection of an older, fracture critical bridge requires an inspection team gaining hands-on inspection of all fracture critical members. This hands-on inspection can only be done with the use of expensive equipment (under bridge crane, bucket truck, etc.) and temporary traffic control. This work would generally take one to two weeks of on-site work preceded with several days of preparation work and followed by one to two weeks of report preparation. Routine maintenance for an older structure would include all the maintenance mentioned above for a new structure and repairs to failed steel members. This is difficult to quantify but very likely anticipated because of the age of the bridge. Even after rehabilitation, this bridge would remain fracture critical."

Additional information on cost is provided in response #10 and Section G.7 of the Revised EA.

5. Final design

The bridge type has been established as a steel girder bridge supported by concrete abutments and piers. MaineDOT will begin final design of the preferred alternative after NEPA is complete.

6. Did MaineDOT/FHWA consider potential impacts to the upstream fishway?

MaineDOT and FHWA reviewed and considered comment letters received from the public, Brookfield, and the National Marine Fisheries Service (NMFS) regarding potential impacts to the function of the fish ladder upstream of the existing bridge. The information provided below is in direct response to these comments.

A hydropower dam operated by Brookfield Renewable Energy Partners (Brookfield) is located about 500 feet upstream of the existing Frank J. Wood Bridge. Brookfield owns and operates the dam under a license from FERC. No impacts to the Brookfield dam are anticipated for Alternatives 1, 2, 3 or 4. Upstream fish passage at the dam occurs via a vertical slot fishway, which provides passage for important anadromous species. All alternatives would have temporary effects to the fish species utilizing the fishway during construction due to installation of the temporary bridge or temporary trestles. Alternatives 1, 3 and 4 would not have permanent direct impacts to the fishway.

Alternative 2 (the Preferred Alternative) has the potential to affect the fishway permanently indirectly from shadowing and location of the southerly piers. Evaluation of potential effects to the fishway was conducted. The National Marine Fisheries Service and Brookfield provided input on the span arrangement of the preferred alternative. Based on this input, MaineDOT modified the preliminary design of Alternative #2 to remove the southernmost pier from the tailrace area. This modification was made to minimize physical impacts to critical habitat designated under the Endangered Species Act and to minimize potential impact to the upstream fishway associated with the Brunswick hydroelectric project by more closely simulating existing in-river flow patterns.

At present, Atlantic salmon passing upstream or downstream through the action area are subjected to vibrations associated with traffic crossing the existing Frank J. Wood Bridge. The preferred alternative would feature construction enhancements designed to reduce vibration in the form of rubberized pot bearings which would eliminate the current construction of steel on steel contact. Based on an assumed comparable traffic load across a new bridge it can be expected that the level of vibrations in the action area would be lower for a new structure than the current condition. Thus, an Endangered Species Act (ESA) determination of "not likely to adversely affect" was reached for impacts to upstream fish passage from bridge vibrations associated with future cross-bridge traffic for the preferred alternative.

Although it is understood that light can affect fish behavior[39], and discussions with Brookfield suggested that shadows and flicker can deter migrating fish, there is no published literature on shadow effects as related to successful passage via an upstream fishway. MaineDOT's design consultant evaluated the scope of static and dynamic shadowing from the existing Frank J. Wood Bridge as well as the proposed alignment of the preferred alternative. Under the existing conditions, anadromous fish species ascending the fishway are exposed to some level of dynamic and static shadowing. MaineDOT's design consultant estimated the duration of shadowing from the existing structure at approximately 1 hour per day of static shadow (resulting from the bridge superstructure) and a few minutes per day of dynamic shadowing (resulting from passing traffic). Dependent on the model month, the shadows from the existing structure are present between the hours of approximately 0700 to 0945. MaineDOT's design consultant predicted shadowing from the preferred alternative would increase the duration of static shadowing to 2.25 hours per day and of dynamic shadowing to 1.5-2 hours per day. The timing of shadowing predicted for the preferred alternative was between 0645 and 0945.

Man-made underwater noise has the potential to cause behavioral disturbances, hearing impairment or threshold shifts, physical injury, or mortality to fish species. Given the proximity of the preferred alternative of the new bridge structure to the existing upstream fishway in Brunswick, parties participating in the consultation process expressed concern over the potential impacts associated with the transference of traffic noise to the vicinity of the upstream fishway (i.e., underwater noise and vibrations).

Vibrations associated with traffic crossing the preferred alternative are expected to be at a more constant, low level (i.e., a "continuous" source) as opposed to a sudden and more intense burst associated with blasting or pile driving (i.e., an "impulsive" source). The bridge design consultant provided the following information about the potential for vibration from the new bridge:

- Vibration from traffic crossing the superstructure will need to travel through pot bearings, which the new superstructure will sit on. Each pot bearing has a rubberized elastomer designed to significantly

[39] Schilt, C.R. 2007. Developing fish passage and protection at hydropower dams. Applied Animal Behaviour Science 104: 295-325.

dampen the transfer of vibrations from superstructure to substructure. This is a substantial upgrade from the existing structure which is constructed with a steel on steel design which offers little to no vibration dampening.

- Any vibration energy that does transfer through the rubberized pot bearing will then need to travel through concrete, water, the walls of the fish ladder, and then water again before it can be detected by any fish within the fishway. Each change in medium will result in a continued dampening of the vibrations.
- In addition, the flowing water (river and fish ladder) is quite turbulent with its own 'white noise' and will help to further dampen vibrations related to the bridge structure.

MaineDOT/FHWA initiated Essential Fish Habitat Consultation with the NMFS in 2018. NMFS Habitat Conservation Division concluded that the project will have minimal adverse effects to Essential Fish Habitat and provided Conservation Recommendations. FHWA and MaineDOT accepted the following conservation recommendations via email on August 31, 2018:

- Debris and rubble from the demolition of the existing bridge should be prevented from entering the river below the OHW line, to the extent possible. Any debris or rubble that inadvertently falls below the OHW line should be removed using the least damaging methods available. This recommendation will be implemented with standard contract provisions.
- All bedrock leveling and substructure removal using hydraulic breakers, hoe rams, blasting, or other methods resulting in potential injury to fish species present should occur between November 8 to March 15. All other in water work activities resulting in potential noise levels over 150 dB RMS will be completed between August 1- March 15. This measure minimizes impacts to migrating alewife, blueback herring, American shad, rainbow smelt, and striped bass.
- MaineDOT will review final impacts with the USACE and discuss required mitigation via the permitting process during final design.

MaineDOT/FHWA have completed Section 7 ESA consultation with NMFS. Consultation considered the effects of the action on the fishway upstream of the bridge. In a Biological Opinion dated March 30, 2018, NMFS concluded that Alternative 2 (the preferred alternative) is likely to adversely affect, but not likely to adversely modify or destroy critical habitat designated for the Gulf of Maine distinct population segment (DPS) of Atlantic sturgeon.[40] The project may affect, but is not likely to adversely affect, the Gulf of Maine DPS of Atlantic sturgeon, endangered shortnose sturgeon, endangered Gulf of Maine DPS of Atlantic salmon, or critical habitat designated for the Gulf of Maine DPS of Atlantic salmon.

The Biological Opinion incorporates the avoidance and minimization measures described in the Biological Assessment. The following AMMs will be implemented:

[40] National Marine Fisheries Service. Biological Opinion for Maine Department of Transportation Replacement of Frank J Wood Bridge. March 30, 2018

- All elements of the project will be conducted in compliance with MaineDOT's Standard Specifications (MaineDOT 2014). The Standard Specifications is a textual compilation of provisions and requirements for the performance of any MaineDOT work and requires best management practices (BMPs) related to surface water quality protection and waste management. BMPs are methods, facilities, build elements, and techniques implemented or installed during project construction to prevent or reduce project impacts.

- Contractors will submit a SEWPCP for review and approval of MaineDOT staff prior to the start of work. The plan includes the review of the implementation of any BMPs or AMMs proposed.
- Prior to soil disturbance, the erosion control portion of the SEWPCP will be reviewed and in place.
- In-water work window. MaineDOT and FHWA commit to avoiding all activities that could result in in-water noise that could result in fish disturbance (louder than 150 dB RMS) and turbidity producing activities between March 16 and July 31.
- No equipment, materials, or machinery shall be stored, cleaned, fueled, or repaired within any wetland or watercourse; dumping of oil or other deleterious materials on the ground will be forbidden; the contractor shall provide a means of catching, retaining, and properly disposing of drained oil, removed oil filters, or other deleterious material; and all oil spills shall be reported immediately to the appropriate regulatory body.
- Contractors are required to install turbidity curtains around areas planned for in-water fill associated with construction of the temporary trestle access point. All in-water trestle construction will occur between August 1 and March 15. In-river (i.e., not the ponded/bedrock falls habitat on the Topsham side) trestle construction and removal (~60 square feet footprint) will occur between September 1 and March 15.
- Removal of the fourth pier (leaving three in-water piers) from preliminary design to avoid impacts to critical habitat as well as potential effects to fishway function.
- All four cofferdams shall be constructed during the in-water work window, between August 1 and March 15, with the exception of the cofferdam for Pier 1, which will occur between September 1 and March 15.
- Bedrock leveling using hydraulic breakers (or hoe rams), blasting, or other methods resulting in potential injury to fish species present will occur between November 8 to March 15. All other in-water work activities resulting in potential noise levels over 150 dB RMS will be completed between August 1 and march 15.
- Plans for any project-related blasting will be submitted with 150 days for NOAA to review and will be designed to remain below potential fish injury limits (206 dB Peak (2.89 PSI)).
- Any blasting activities to occur from November 8 to November 30 will incorporate the following minimization measures to reduce potential impacts to adult Atlantic salmon which may still be present in the area:
    - Active acoustic monitoring of the action area for any tagged fish potentially present in the Androscoggin River.

- Minimize charge sizes and the number of days of exposure to blasting.
- Deploy scare charges prior to the main blast.
- Conduct visual inspection of the action area post blast to document any impacts to fish.

- Fresh concrete will be poured inside of cofferdams and will not come into contact with flowing water.
- MaineDOT will deploy a diver into the cofferdams to visually search for endangered fish species.

Should a salmon or sturgeon be observed within a cofferdam structure, MaineDOT will coordinate with the resource agencies for removal of those individuals prior to proceeding with construction.

- Water pumped out of the cofferdam will be within one pH unit of background (MaineDOT standard specifications). A representative of the MaineDOT Surface Water Quality Unit will periodically evaluate pH to determine whether the water is within the allowable tolerance to be pumped directly back into the river or whether it needs to be treated prior to discharge.
- Superstructure demolition debris will be contained using control devices and cannot enter the water.
- The existing pier structure will be removed down to the underlying bedrock and debris from the structure will be removed from the river to restore potential natural spawning substrate for sturgeon species.
- Construction crews will visually monitor for sturgeons in equipment and on barges and report any sturgeon to MaineDOT environmental staff.
- Vessels will travel at "slow speeds, typically less than 6 knots" (6.9 miles per hour) in the construction zone.

MaineDOT coordinated with Brookfield Renewable Energy Partners (Brookfield) throughout project development. MaineDOT acknowledges that the existing facilities will require Federal Energy Regulatory Commission (FERC) re-licensing in 2029. MaineDOT has used best available information to understand and characterize the potential impacts to Brookfield and the Fishway and will continue to coordinate and cooperate with Brookfield during final design upon completion of NEPA. MaineDOT will work with Brookfield and NOAA NMFS to identify baseline condition parameters (e.g. noise and vibration) at the fishway to measure pre- and post- construction conditions.

NMFS Protected Resource Division also commented by separate letter, dated April 11, 2018, that Alternative 2 would limit options for future improvements to the fishway. MaineDOT and FHWA acknowledge that at some point in the future relicensing proceedings could result in the modification of the structures at the Brunswick fishway. However, the nature and type of modifications that are reasonably likely to occur have not been defined and are not reasonably foreseeable.

It is FHWA's assessment that any potential impacts from the project to Brookfield and the fishway in 2029 (change in fishway placement, etc.) at the time of FERC relicensing are speculative.

The April 22, 2018 letter also requests that MaineDOT include provisions "*to monitor pre-and post project passage effectiveness in order to determine the magnitude of the proposed project's effects on the diadromous fish community and the ecosystems to which they are associated and develop a plan to*

mitigate any documented impacts." In response to this comment, MaineDOT will work with Brookfield and NOAA NMFS to identify baseline condition parameters (e.g. noise and vibration) at the fishway to measure pre- and post- construction conditions.

7. Will part of the water falls be covered by the preferred alternative?

Yes. The preferred alternative would shift upstream and it would span over portions of the lower falls. It would also open the view of other portions of the falls. The very lowest falls are under the existing bridge.

8. What is the significance of rolled steel beam technology found on the Frank J. Wood Bridge under Criteria C?

At the project kick-off in February 2014, MaineDOT understood that the Frank J. Wood Bridge was eligible for the National Register a contributing resource to the Brunswick – Topsham Industrial Historic District. The assessment of project alternatives has always considered impacts to the bridge. It was recognized early in the Section 106 process that the Frank J. Wood is a contributing element to the BTIHD. During the Section 106 consultation process, at the request of consulting parties, MaineDOT/FHWA reevaluated the *individual* eligibility of the Frank J Wood Bridge. It was ultimately determined that the bridge was individually eligible under Criteria A, but there was not enough information for MHPC to conclude that the bridge was eligible under criteria C. It was originally determined not eligible under Criteria C in the 2003 Maine Historic Bridge Survey.

In the spring of 2018, MaineDOT began a reevaluation of MaineDOT's remaining truss bridges that were originally not determined eligible for NRHP listing during the 2003 Maine Historic Bridge Survey. This was a separate process from the Frank J. Wood Bridge Section 106 process. The truss survey reevaluation is ongoing, but MaineDOT research indicates that the use of rolled steel sections became widespread and common in late 1929 and onward. Therefore, the bridges constructed after 1929 are not considered significant for the use of rolled steel sections. This technology became common place within a year. The period of significance for the innovative use of rolled sections is comparatively miniscule to the period of significance for metal trusses in the context of bridge technology. The period of significance of an eligible metal truss bridge that is eligible for its use of rolled steel members in Maine is 1929. Therefore, there are no remaining significant examples.

The period of significance for the Frank J. Wood Bridge has been determined to be 1932-1937. This is documented in the Section 106 eligibility determination for this project and has been concurred upon by the Maine SHPO.

9. Have MaineDOT/FHWA considered the Friends of the Frank J. Wood Bridge (Friends) Engineering study, specifically the additional rehabilitation concept titled "Option 3"?

MaineDOT and FHWA evaluated a design concept submitted by the Friends of the Frank J. Wood Bridge (Friends), including a rehabilitation concept titled "Option 3". This proposal was submitted as a comment to the EA and was further discussed at the June 27, 2018 Section 106 Consulting Parties meeting. "Option

3" proposes to replace the existing bridge deck with an independent steel girder system.[41] This option was presented at a conceptual level only. No engineering analysis or cost estimates were provided. MaineDOT conducted an examination of the Friends' bridge rehabilitation study and determined that the rehabilitation options already evaluated in the Environmental Assessment were appropriate and sufficient.

The alternative presented by the Friends proposed to replace the superstructure of the truss bridge save the bottom chords with a two or three span set of steel girders. MaineDOT commissioned review of the Friends' study by a consultant, who identified numerous technical concerns.[42] At the end of construction, the truss would be non-functional. MaineDOT estimates the depth ratio of the girders may be as high as 8' to 10'. Additionally, this alternative does not meet the purpose and need because it does not address bicycle and pedestrian safety.

In response to continued Section 106 Consulting Party interest in expending agency time and resources exploring constructability, design details, and cost implications of the Friends' rehabilitation concept, FHWA conducted an additional internal review of both the Friends' report and MaineDOT's analysis in August 2018. FHWA's internal review found the following:

The Friends' Option 3 was presented at a conceptual level only. No engineering analysis or cost estimates were provided. Therefore, only general comments could be made.

- As a general rule, for simply supported steel I-girders, AASHTO Table 2.5.2.6.3-1 specifies the minimum ratio of the depth of steel girder portion to the span length to be 0.033. Based on the existing span length of 310', the girders would be around 10' deep. However, to maintain the existing structure depth as described in the report, the girders would have to be around 5' deep. This proposed depth to span ratio is significantly outside the range of standard engineering practice. Further development of this option would be needed to determine if the construction of this bridge type is possible. If construction of this type is possible, this option would look and act different from the existing bridge.

- This option also proposes the use of a "vertical slip connection" between the truss and the new girders. This is a complex detail and there is no information in the study to determine how the existing trusses are attached to the new superstructure. This is not a typical bolted connection so it would need further development and analysis to demonstrate its viability.

- In addition to improving the structural condition and load capacity, the Purpose and Need of this project includes pedestrian accommodations. The existing bridge has a sidewalk on the west side. Option 3 has no mention of a sidewalk or any other pedestrian accommodations.

Based on information presented in the technical reports outlined above, FHWA concluded per 23 CFR 774.17 that the additional design concept presented by the Friends of Frank J Wood Bridge during the EA comment period could not serve as a prudent and feasible avoidance alternative for this project under

[41] See: *Historic Frank J. Wood Bridge Study*. Prepared for: Friends of the Frank J. Wood Bridge. Prepared by: JDB Consulting Engineers, Inc. April 9, 2018. This analysis was submitted as a comment to the Frank J Wood Bridge Project Environmental Assessment.
[42] Memorandum. WIN 22603.00 Frank J. Wood Bridge: Comments on JDB Bridge Rehab Study. TYLIN International. June 4, 2018.

Section 4(f) of the Department of Transportation Act. This alternative was dismissed from further consideration (See Section M, *Frank J Wood Bridge Project Final Section 4(f) Evaluation*).

10. How were construction, contingency, long term maintenance costs assessed?

Construction cost estimates are generated based on recent bid histories for similar projects. These costs only include the initial cost to construct the project and do not consider future improvements or maintenance. Construction unit prices are generated from recent bid history for all items. Unit price multiplied by unit quantity produces total item cost. Factors affecting bid prices for individual components of a project include location, constructability, and market conditions. Construction estimates are adjusted based on professional engineering judgment. Early in the preliminary design process MaineDOT drafts a Preliminary Design Report (PDR) to document general project information, conceptual designs and corresponding cost estimates. This report also incorporates preliminary plans and other information gathered during the preliminary data gathering stage. Appendix H of the PDR for the Frank J Wood Bridge Project (Appendix 2, pages H-5 to H-18) contains detailed cost estimates (Structural Cost Estimates) that add up to a construction cost for each alternative.

Each of the construction cost estimates for the Frank J. Wood Bridge carry a contingency cost. This is to recognize variation in estimates and changes during construction. Contingencies are estimated based on past project history for similar type bridge projects. This project site is unique due to the exposed and highly variable bedrock, exposure to high velocity flows, and proximity to the upstream dam. Due to the uncertainties associated with rehabilitating an existing deteriorated truss bridge, a higher amount of contingency cost is typically carried for rehabilitation options. It is difficult to know the precise condition of all the bridge elements until work is underway. As components of the bridge are exposed, additional section loss and discovering more deterioration than anticipated is common. Uncertainty regarding condition can cause prices to inflate. Replacement of the entire deck system reduces this uncertainty. However, there are additional areas of concern that may have not been specifically identified, but may require additional repair, replacement, or strengthening. Repair needs become more evident when preparing the truss for painting. The need to remove all deterioration, rust, and old paint will often uncover additional steel areas that need strengthening, repair, or replacement. Replacement or repair of deteriorated rivets and strengthening or replacement of gusset plates are examples of these needs. A 15% rehabilitation contingency was used for Alternatives 3 & 4. All alternatives carry a 7% contingency cost for items such as traffic control plans and field offices.

The cost of materials can also fluctuate over time which can affect the accuracy of estimates. For example, the cost of steel included in the current estimates is $7.80/lb. The price has more than doubled since the original estimate; recent low bids for steel repairs on steel girder and steel arch style bridges range from $11/lb. to $24.50/lb., making the 15% for rehabilitation contingencies a conservative estimate.

The construction cost of Alternative 1 is estimated at $16,000,000. This cost includes the construction of a temporary bridge needed during construction for vehicular traffic.

The construction cost of Alternative 2 is estimated at $13,000,000. A work trestle would be needed during construction for access to construct the cofferdams and piers, to erect the structural steel superstructure, to place deck concrete, and to remove the existing bridge. A cost premium of $1 million is included in the estimate to account for the added expense of a work trestle.

The construction costs of Alternative 3 and Alternative 4 are estimated at $15,000,000[43] and $17,000,000, respectively. These costs include the construction of a temporary bridge needed during construction for vehicular traffic. These costs also include a 15 percent contingency above the repair work identified. Rehabilitation projects nearly always discover issues not previously found in inspections, causing budget overruns. This contingency is based on MaineDOT bid history data. Alternative 4 is estimated at $2,000,000 more than Alternative 3 because Alternative 4 includes a more expensive lightweight deck and a new sidewalk.

Life cycle costs analysis (LCCA) is a standard engineering economic analysis tool useful in comparing the relative merit of competing bridge improvement alternatives. This evaluation technique converts all estimated bridge costs throughout the life of each bridge improvement alternative into current dollar equivalents, termed present value. The LCCA accounts for estimated construction cost on the current project and the translated present value of anticipated future inspection, maintenance, and rehabilitation costs. It also accounts for anticipated future bridge replacement dates for each alternative. The LCCA assumes money could be set aside today for future work and incorporates economic concepts and techniques such as earned interest on investments, inflation factors, and discounting the opportunity value of time. While LCCA is a tool that can identify the most cost effective alternative, it is not an indicator of the actual costs a transportation agency will expend on an alternative over the timeframe used for the analysis. State transportation agencies are not often able to set money aside today, and make interest earning investments, to pay for future work. For these reasons, life cycle cost was considered[44] but was not the primary basis for a decision on this project.

Service life cost provides a more accurate comparison of the expected real costs to an agency when examining bridge improvement alternatives. Service life is defined as the number of years a bridge can be part of the transportation system with maintenance, repair, and/or rehabilitation before its eventual replacement. The Service Life Cost is the total cost to maintain a structure over its design service life. It includes the cost of initial construction (construction cost), maintenance costs, inspections, and the cost of expected future improvements. Costs are broken down into required annual costs (such as inspections and anticipated maintenance) as well as periodic items (such as bridge painting, deck replacements, and structural rehabilitation). These costs are generated based on the historical maintenance needs of similar bridge types and historical data on costs. A service life cost estimate is not translated or discounted to current dollar equivalents. Service life cost of each alternative is summarized in Table 3.

Replacement (Alternatives 1 and 2)

FHWA requires that states inspect bridges every twenty-four months. Estimates for inspection are broken down into annual costs even though inspections would be completed every two years. The biennial inspection of a new bridge typically requires an inspection team spending a day or two looking at all bridge elements. The inspection would be followed by the preparation of a report detailing findings. Routine annual maintenance for a new bridge would include washing of the drains, curb lines, and joints as well as washing of any debris that might have built up on the structure.

[43] The cost of Alternative 3 at a 30-year rehabilitation was estimated at $8 million. See Cost section for information on 75-year rehabilitation.

[44] Appendix H of the Preliminary Design Report (Appendix 2, page H-19)

Required periodic improvements include milling and resurfacing the asphalt wearing surface every 15 years and painting the girders at year 35 and year 70.

For both replacement alternatives (Alternative 1 and Alternative 2), the cost of inspection, maintenance, and periodic improvements are estimated at $4,260,000 over 100 years. When added to the Construction Cost of each alternative the total cost over service life for Alternative 1 is estimated to be $20,300,000. For Alternative 2, the total cost over service life is estimated to be $17,300,000.

Rehabilitation (Alternatives 3 and 4)

Estimates for inspection of the rehabilitation alternatives include the routine biennial inspection as well as additional effort for fracture critical bridges. Inspection of a fracture critical bridge requires a minimum of two inspectors, at least one of whom needs to be a qualified fracture critical bridge inspector, completing hands on inspection of every fracture critical member of the bridge. This type of inspection often requires bridge lane closures and the lease of specialized equipment for access and traffic control. Fracture critical inspection can take up to two weeks onsite versus one or two days for other non-fracture critical bridges as well as one to two additional weeks of effort to produce required reporting.

Maintenance for a rehabilitated bridge would include annual washing of the drains, curb lines, and joints as wells as washing of any debris that might have built up on the structure. Because of the age of the bridge, it is very likely that cracks in fatigue sensitive or fracture critical members would be found during inspection and immediate repairs would be required. A value of $40,000 per year to repair fatigue cracks was used in the maintenance service life cost estimate for this work.

Required periodic improvements for a rehabilitation include paint every 20 years, and a deck replacement at year 40. Based on the performance of similar aged bridges and the age of the most recent major substructure rehabilitation at the Frank J. Wood Bridge, additional substructure rehabilitations would be expected at years 20 and 50 following the initial construction of the rehabilitation alternatives.

The cost of maintenance, inspections, and required periodic improvements for Alternative 3 is $20,250,000 estimated over 75 years. When the Construction Cost is added, the total Service Life Cost of Alternative 3 is estimated to be $35,200,000. The cost of maintenance, inspections, and required periodic improvements for Alternative 4 is estimated at $21,250,000 over 75 years. The difference between Alternative 3 and 4 is that Alternative 4 includes an exodermic deck, which has a higher cost of replacement than the deck for Alternative 3. When added to the Construction Cost, the total Service Life Cost for Alternative 4 is estimated to be $38,200,000.

The Estimated Annual Cost of Service Life of each alternative is calculated by excluding the Construction Cost from the Total Service Life Cost and dividing by the Service Life [*Service Life Cost– Construction Cost)/Number of Service Life Years]*. This provides an average of expenditures from maintenance, inspections and required periodic improvements over the service life of the structure. The comparison of alternatives is shown in Table 4.

When compared with the replacement alternatives, Alternative 3 would have increased annual cost over service life of 626%, and Alternative 4 would have a 657% increase in annual cost over service life. Additional details regarding cost estimates and program-wide needs may be found in Appendix 2:

Preliminary Design Report (PDR) and Appendix 8: Keeping our Bridges Safe Report (2014).

In summary, the preliminary construction cost estimates of the rehabilitation alternatives (Alternatives 3 and 4) represent a 14% and 24% increase over the lowest estimated preliminary construction cost of any alternative. The rehabilitation alternatives (Alternatives 3 and 4) represent a 626% and 657% increase in annual cost over service life. Alternatives 3 and 4 would avoid the use of Section 4(f) properties. However, when they were considered with the cost and funding information described above, Alternatives 3 and 4 were found not prudent due to Service Life Costs of extraordinary magnitude (Section 774.17(iv)).

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11. Has MaineDOT/FHWA considered the impacts of the project on local heritage tourism?

MaineDOT and FHWA recognize that Brunswick and Topsham have cultural resources and history that are an important part of the local economy and tourism industry. MaineDOT has requested and received comments from residents, business owners, Town governments, and Section 106 consulting parties to understand the direct and indirect impacts of the project on cultural resources.

12. How did FHWA determine effects to the Summer Street Historic District under Section 106? How did MaineDOT/FHWA determine there would be No Adverse Effects to Summer Street?

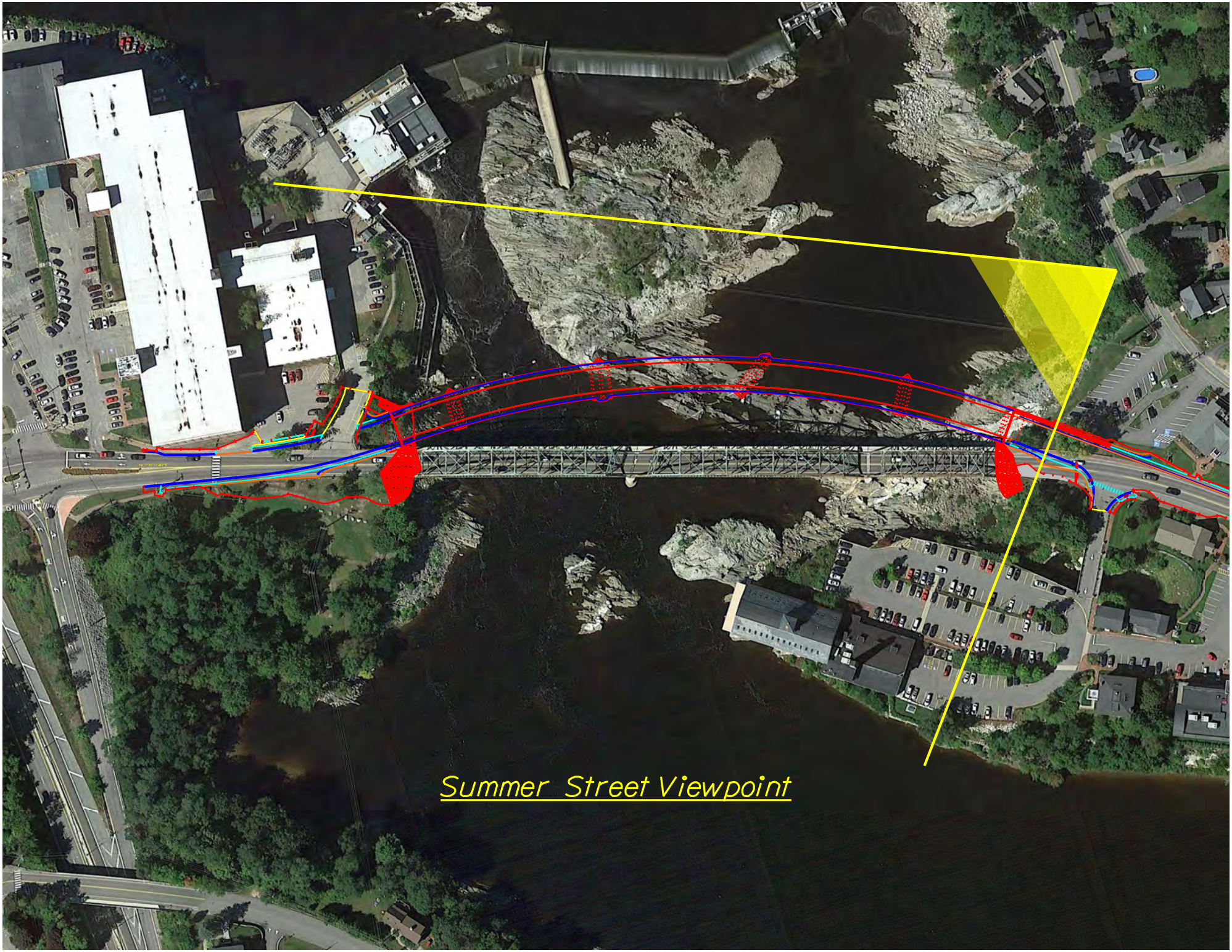
MaineDOT and FHWA provided a Determination of Effect, dated February 6, 2017 stating that all alternatives, including Alternative 2 would have no adverse effect on the Summer Street Historic District. This Determination of Effect was published via the MaineDOT website and distributed to consulting parties. During the subsequent comment period, the SHPO and the public requested additional information regarding the Summer Street Historic District. MaineDOT completed additional research and provided supplemental information regarding the Summer Street Historic District on March 17, 2018. Based on this information, in a memo dated March 29, 2017, the SHPO concurred with MaineDOT's findings that the conceptual design of Alternative 2 will have no adverse effect on the Summer Street Historic District.

13. Renderings

MaineDOT and FHWA reviewed and considered comments regarding aesthetic impacts from a new bridge, as well as impacts to views to and from historic resources. MaineDOT provided the following renderings to help visualize possible bridge height near surrounding historic and cultural resources. However, final bridge height will not be determined until final design.


7′-0" Bottom chord
to top of sidewalk
10′-6" Bottom chord
to top of bridge railing
54′-0" Bottom chord
to top of truss
Existng Truss from Summer Street


11'-4" Bottom of girder
to top of sidewalk
15'-10" Bottom of girder
to top of bridge railing
Proposed Bridge from Summer Street


Summer Street Viewpoint

N. Final Section 4(f) Evaluation

U.S. Department of Transportation
Federal Highway Administration

Maine Division

40 Western Ave, Rm 614
Augusta, ME 04330
207-622-8350

February 21, 2019

In Reply Refer To: HDA-ME

SECTION 4(f) DETERMINATION

PROJECT NO. 22603.00
Brunswick-Topsham – Frank J Wood Bridge Project

There is no feasible and prudent alternative to the Section 4(f) use of the following properties to accommodate transportation improvements for the Frank J Wood Bridge Project in Brunswick and Topsham, Cumberland and Sagadahoc Counties, Maine:

- **Cabot Mill**, *(National Register of Historic Places (NRHP) Eligible);*
- **Frank J. Wood Bridge** *(NRHP Eligible);*
- **Brunswick Topsham Industrial Historic District** *(NRHP Eligible); and*
- **Pejepscot Paper Company** *(NRHP Listed).*

This project has been determined to have a Section 106 Adverse Effect to these resources due to permanent impacts associated with the removal and replacement of the Frank J Wood Bridge. The proposed action includes all possible planning to minimize harm resulting from this action.

This determination follows consideration of all information contained in the *Frank J. Wood Bridge Project Final Section 4(f) Evaluation*, concluded February 2019. This evaluation provides detailed information about the project, the use of Section 4(f) resources, and proposed plans to minimize harm including a signed Section 106 Memorandum of Agreement (MOA). This evaluation incorporates comments received from the Department of the Interior, the Advisory Council on Historic Preservation, Section 106 Consulting Parties and the public. The information contained in this evaluation is hereby incorporated into this determination.

Approved by: Todd D. Jorgensen

Todd D. Jorgensen
Division Administrator

Date: 2/21/19

BRUNSWICK-TOPSHAM

FRANK J. WOOD BRIDGE

WIN 22603.00

CUMBERLAND AND SAGADAHOC COUNTIES, MAINE

FINAL SECTION 4(f) EVALUATION

PURSUANT TO 49 USC 303 DEPARTMENT OF TRANSPORTATION ACT OF 1966

FEDERAL HIGHWAY ADMINISTRATION AND MAINE DEPARTMENT OF TRANSPORTATION

FEBRUARY 2019

Introduction

The Federal Highway Administration (FHWA) and the Maine Department of Transportation (MaineDOT) have prepared this evaluation to meet the requirements set forth in Section 4(f) of the United States Department of Transportation Act of 1966 (49 USC 303) and 23 Code of Federal Regulations Part 774 (23 CFR 774).

FHWA must conduct a Section 4(f) evaluation when any Federally-funded transportation action proposes to use land from historic sites listed in or eligible for listing in the National Register of Historic Places, publicly owned parks, recreational areas, or wildlife refuges. Section 4(f) states that these properties may not be used for US DOT funded projects if there is a feasible and prudent avoidance alternative to the use of such property. If a Section 4(f) property is used, the project must include all possible planning to minimize harm.

Use is defined in FHWA's regulations at 23 CFR 774.17**.** Except as set forth in 23 CFR 774.11 and 23 CFR 774.13, a "use'' of Section 4(f) property occurs:

- When land is permanently incorporated into a transportation facility;
- When there is a temporary occupancy of land that is adverse in terms of the statute's preservation purpose as determined by the criteria in 23 CFR 774.13(d); or
- When there is a constructive use of a Section 4(f) property as determined by criteria in 23 CFR 774.15.

This evaluation provides the necessary information for the Secretary of Transportation to render a Section 4(f) finding. FHWA Maine Division has elected to forgo the use of FHWA's *Programmatic Section 4(f) Evaluation and Approval for FHWA Projects that Necessitate the Use of Historic Bridges* for this project. Instead, this evaluation follows FHWA's Individual Evaluation format, and incorporates guidance from FHWA's 2012 *Section 4(f) Policy Paper*. [1]

Purpose and Need

The purpose of this project is twofold:

1. Address poor structural conditions and load capacity issues on the Frank J. Wood Bridge, and
2. Address pedestrian and bicycle mobility and safety concerns.

Improvements are needed to raise the condition rating of the both the bridge superstructure and deck from 4 (poor condition) to 7 (good condition). Because of the age of the bridge, (87 years old), and the considerable number of heavy loading cycles it has already experienced, steel fatigue concerns regarding critical tension members need to be addressed to continue to carry heavy truck traffic on the existing truss structure[2]. Additional needs associated with the condition of the bridge include, but are not limited to:

[1] FHWA. Section 4(f) Policy Paper. Office of Planning, Environment and Realty Project Development and Environmental Review. Washington, DC. July 20, 2012

[2] Heavy loading cycles are fatigue loads applied to the bridge in accordance with the American Association of State Highway and Transportation Officials (AASHTO) design specifications to determine the remaining service life of fatigue-prone bridge details. These heavy load cycles, or fatigue loads, gradually wear out these fatigue-prone elements on the structure. The AASHTO Manual for Bridge Evaluation specifies how to calculate the remaining fatigue life (in years) of a fatigue-prone detail.

- Floor beams and stringers need improvements to bring their load rating factors to a 1.0 for all legal loads.
- The bridge is currently posted at 25 tons.
- The bridge has an overall D Customer Service Level (CSL) due to the load posting and existing congestion levels.
- The three truss spans are fracture critical, meaning that failure of certain steel tension members could cause any of the three spans to collapse.

Some of the steel truss bridge components are fatigue sensitive, meaning they are susceptible to cracking and fracture because of heavy load cycles. The floor beams and stringers within the truss spans do not meet current design load or MaineDOT legal load standards.

Additional details regarding the condition of the Frank J. Wood Bridge may be found in **Appendix 2**: *Preliminary Design Report (PDR).* The PDR includes MaineDOT's Inspection Report published in 2016, as well as an August 15, 2016 MaineDOT Load Rating/Posting memo.

Pedestrian and bicycle mobility and safety needs in the project area include, but are not limited to:

- Pedestrians on the east side of Routes 201/24 cannot cross the river without crossing the highway at existing mid-block pedestrian crossings.
- Bicycle traffic is limited by the 4-foot shoulder that consists of two feet of pavement and two feet of open steel grid.

Additional explanation on pedestrian and bicycle mobility and safety needs is provided later in this Evaluation, as well as within the *Frank J Wood Bridge Project Revised Environmental Assessment: Section G(2) Environmental Impacts – Social and Economic – Bicycle and Pedestrian*.

Proposed Action & Alternatives Description

The Frank J. Wood Bridge (Bridge #2016) connects US Route 201 (Highway Corridor Priority 3 road) over the Androscoggin River, connecting the town of Brunswick in Cumberland County, and the town of Topsham in Sagadahoc County, Maine. Although rehabilitation options outlined in the following sections would address structural deficiency and poor condition of the current bridge, the structure itself would remain fracture critical.

MaineDOT proposes to replace the Frank J. Wood Bridge. The proposed action *Alternative 2: Replacement on Curved Upstream Alignment*, would include a new 835' long, multi-span, steel girder replacement structure. A curved design reduces length of roadway approach construction, as well as right of way impacts to abutting properties, including several historic properties and a public park. Span arrangement and number of piers would be designed to minimize footprint impacts within the existing river channel, as well as impacts within the Federal Emergency Regulatory Commission (FERC) Boundary. The proposed alternative will also maximize engineering efficiency of the bridge's superstructure (e.g., amount of material used, weight on each pier, and constructability). The new bridge design would maintain existing hydraulic clearance over the river.

The estimated construction duration for the proposed action is approximately 2½ years. No temporary bridge would be required since traffic would be maintained on the existing bridge during construction.

A short term (approximately 2 months) a single lane northbound road closure and detour would be needed during the final tie-in of the approaches. The existing bridge would be removed.

Figure 1. Aerial view of the Project Area.[3] Each number denotes a Section 4(f) property, which are all discussed later in this document.

Section 4(f) properties within the Project Area

There are six (6) Section 4(f) resources within the project area, including five (5) resources either listed or eligible for listing on the National Register of Historic Places (National Register or "NR"). Each is described in the following subsection. The Section 4(f) properties within the project area are:

1. **Summer Street Historic District**
    a. NR-eligible, Criterion C; Architecture, ca. 1820-ca.1890
2. **Cabot Mill**
    a. NR-eligible, Criterion A & C; Architecture, Engineering, and Industry, ca. 1850-ca.1950
3. **Pejepscot Paper Company (Bowdoin Mill Complex)**
    a. NR-listed, Criterion A&C; Architecture, Engineering, and Industry, 1868 to 1967
4. **Brunswick-Topsham Industrial Historic District**
    a. NR-eligible, Criterion A&C; Architecture, Engineering, and Industry, ca. 1850 to 1967
5. **Frank J. Wood Bridge**
    a. NR-eligible, Criterion A; Transportation, 1932-1937
6. **250th Anniversary Park**
    a. A public park used for fishing access and canoe portage.

[3] This view refers to some Section 4(f) properties with modern names. The Bowdoin Mill Complex was historically the Pejepscot Paper Company and the Fort Andross Mill Complex was historically the Cabot Mill.

Historic Resources

The **Summer Street Historic District** (SSHD) (#1 on Figure 1) faces the bridge overlooking an eddy in the Androscoggin River. The district is comprised of six residences and one associated former carriage house. The district contains one-story capes with fenestration patterns associated with the Federal era as well as Queen Anne and Stick-styles residences. The district was found to be eligible for listing under Criterion C for Architecture and its suggested period of significance ends prior to the construction of the Frank J. Wood Bridge. During the start of the 106 process, the Maine SHPO requested detailed information to address the nature and duration of any association its [SSHD] residents may have had with the mills.[4] The research which followed did not reveal a significant connection between SSHD and the mills, which make up the Brunswick Topsham Industrial Historic District (BTIHD).

The **Cabot Mill** (#2 on Figure 1), located southwest of the bridge in Brunswick, was home to an early textile mill. While its current buildings originate in the late 19th century, it still holds its integrity of association. The buildings onsite embody characteristics of a period and type of construction including brick, rectangular massing, full-height, semi-arched windows, and two projecting Renaissance Revival-style towers. These features are the manifestation of the engineering required to design an efficient, functional textile mill in the late 19th century coupled with high architectural style details. Many of the complex's associated buildings, including tenement housing south of the mill, were lost when Route 1 was realigned to its current location.

The **Pejepscot Paper Company** (PPC), also known as the Bowdoin Mill Complex (#3 on Figure 1), was listed in the National Register for its local and statewide significance in Industry (as the earliest paper manufacturer in the state) and Architecture and Engineering (as an early example of the use of the Italianate style in an industrial context) in 1974. The property, as listed in the National Register, includes all of Bowdoin Island. Since its listing, the island has lost a large building to fire. It sat between the extant mill and the bridge. Additionally, the predecessor to the Frank J. Wood Bridge was aligned directly between those buildings. The construction of the Frank J. Wood Bridge on the existing alignment west of the PPC occurred during its period of significance.

Left to Right: Pejepscot Paper Company and Cabot Mill

The **Brunswick Topsham Industrial Historic District** (BTIHD) (#4 on Figure 1; comprised of #2, #3, and #5) consists of the Cabot Mill, PPC, and the Frank J. Wood Bridge. The district was identified during

[4] Memorandum. Kirk Mohney, State Historic Preservation Officer. 22603; Bridge Improvements/Replacement, Brunswick; MHCP #1595-15. June 16, 2016. See: **Appendix 6** of this document for full text.

MaineDOT's Historic Bridge Inventory circa 2001. It represents a localized, intact industrial area that utilized copious water power to produce goods and provide employment throughout its period of significance. The district's period of significance is ca. 1850 to ca. 1967. The Frank J. Wood Bridge is considered a contributing resource because its date of construction coincides with the period of significance of the district and the bridge retains sufficient integrity (as defined by the National Park Service).

Determination of Eligibility for Frank J Wood Bridge

Based on input from Section 106 Consulting Parties and SHPO, MaineDOT reevaluated the individual eligibility of the Frank J. Wood Bridge in 2017. MaineDOT conducted additional research on the 1936 flood, the interurban trolley, and the Boston Bridge Works Company. At that time MaineDOT determined that the bridge was not individually eligible and sent the documentation to the SHPO on October 25, 2017 for concurrence. The SHPO responded on November 16, 2017 and did not concur. The SHPO stated that the bridge is individually eligible for listing in the National Register of Historic Places under Criterion A for its local significance in Transportation due to its significant association with regional interurban trolley lines. While most of the features associated with the interurban line are gone, MHPC noted that the standard width and height of the bridge, set specifically to accommodate the interurban line was adequate integrity to convey significance.

MaineDOT informed the SHPO on December 13, 2017 that FHWA agreed with their comments, and changed their determination of effects to reflect that the Frank J. Wood Bridge is individually eligible for the National Register. The Bridge (#5 on Figure 1) is now assumed eligible for listing as an individual resource due to its association with the interurban lines connecting the Brunswick area with Lewiston. The bridge was constructed to carry a single track down its center and accommodated a catenary system which powered the line. The Maine State Highway Commission utilized standards published by the American Association of State Highway Officials (AASHO); now known as the American Association of State Highway and Transportation Officials (AASHTO) to inform the bridge's design and construction.

Upon conclusion of all historic eligibility determinations, on December 15, 2017, the Advisory Council on Historic Preservation was invited to participate in the Section 106 consultation process.

Left to Right: Frank J. Wood Bridge and Summer Street Federal-era house

Parks, Recreation Areas, and Refuges

There is one (1) Section 4(f) park resource in the project area. The **250th Anniversary Park** (#6 on Figure 1) is approximately 2.75 acres and is located southeast of the Brunswick approach with its frontage on

the Androscoggin River. Access to the park is via an at-grade crossing near the Cabot Mill and the sidewalk along the eastern side of US Route 201. Per the Brunswick Parks and Recreation department, the park includes scenic overlooks, a fishing area, and a canoe/kayak put in to facilitate portage around the Brookfield hydroelectric dam. As depicted on tax maps, the park consists of three parcels east of US Route 201. The northwestern parcel, situated on the bank of the Androscoggin River, is owned by Brookfield; however, it is leased to the Town of Brunswick. The Town owns the southwestern parcel. MaineDOT owns the eastern parcel.

The first distinct area of the park, located adjacent to US Route 201 slopes downhill to a sharp drop off at the location of the abutment for the previous crossing. This area holds a metal pipe railing to assist pedestrians, a granite monolith with the name of the park inscribed, and the slab foundation of an unknown structure. Interestingly, the configuration of the railing may be to keep pedestrians away from the foundation.

The second area utilizes a plateau below an easterly slope from the first and is connected by a wide wood and brick staircase. This area includes benches, a monument installed by the Brunswick Rotary, and provides access to traversable rocks along the bank. The monument is a granite bolder with a bronze plaque. The inscription reads “When the Abakanaki were the sole inhabitants of this land, the water here was called Ammoscoggin. The word means ‘fish come in spring’. – Brunswick Rotary Club, 2001”. The third area is connected to the second by a primitive path leading to a wide wood and brick staircase that opens up to a flat area at the river’s shore. This area is used as a portage point.

The third area directly adjacent to the river is used regularly for fishing, likely due to the prolific activity of many different species. The pools accessed from this area are the first pools open to recreational fishing downstream of the bridge. The southern Frank J. Wood Bridge abutment marks a limit of the park as access to areas upstream are prohibited, as illustrated by numerous signs on the property.

Left to Right: Steps leading to portage point at shoreline; installed monument

There are no other historic resources, public recreation areas, or wildlife or waterfowl refuges in the project area protected under Section 4(f).

Project Analysis and Impacts to Section 4(f) Properties

This section provides a brief explanation of how project alternatives will use each Section 4(f) property. Table 1, below, presents each alternative and associated uses. Uses (defined in 23 CFR 774.17) shown here are the result of permanently incorporating land into a transportation facility.

Table 1: Section 4(f) Use by Alternate

	Summer Street Historic District	Cabot Mill	Pejepscot Paper Company	Brunswick Topsham Industrial Historic District	Frank J. Wood Bridge #2016	250th Anniversary Park
No Build	No Use No Effect	No Use No Effect	No Use No Effect	No Use No Effect	No Use No Effect	No Use
Replacement on Alignment (Alternative 1)	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	Use Adverse Effect	Use Adverse Effect	No Use
Replacement on Curved Upstream Alignment (Alternative 2)	No Use No Adverse Effect	Use 0.1 acre Adverse Effect	Use 0.1 acre Adverse Effect	Use 0. 2 acre Adverse Effect	Use Adverse Effect	No Use
Rehabilitation with one Sidewalk; No posting (Alternative 3)	No Use No Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use
Rehabilitation with 2 sidewalks; no posting (Alternative 4)	No Use No Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use
Replacement on Downstream Alignment (Alternative 5)	No Use No Adverse Effect	No Use No Adverse Effect	Use 0.2 acre Adverse Effect	Use 0.2 acre Adverse Effect	Use Adverse Effect	Use 3 acres
Conversion to Bike/Ped Facility; Construction of New Vehicular Bridge Offsite	No Use No Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use
Conversation to Bike/Ped Facility; Detour using Existing Infrastructure	No Use No Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use
Bridge Rehabilitation (1 sidewalk) without Secretary of the Interior's Standards	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use
Minor Bridge Rehabilitation; Posted to Remove Heavy Vehicular Traffic	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use
Bridge Rehabilitation with Reduction to One-Travel Lane and Posting	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	No Use
Bridge Rehabilitation (2 sidewalks) without Secretary of the Interior's Standards & Guidelines	No Use No Adverse Effect	No Use No Adverse Effect	No Use No Adverse Effect	Use Adverse Effect	Use Adverse Effect	No Use

Estimated permanent property rights/easements required on Section 4(f) properties are indicated in acres. The immediate adjacency of Section 4(f) resources (legal parcels are considered the boundaries)

to MaineDOT right-of-way would result in the amount shown in the cell for driveway and/or roadway realignment. Additionally, the removal of the Frank J. Wood Bridge also constitutes "use" as established by FHWA regulations. The alternates that have no shading are considered avoidance alternates and will be further examined in an avoidance alternatives analysis to determine whether they are prudent and feasible.

Explanation of How Section 4(f) Uses were Determined

No alternative except Alternative 5 is predicted to use the only public park resource, 250th Anniversary Park. Since there are no other park or wildlife refuge resources present in the project are, the remaining analysis below is limited to use of historic resources.

To aid the reader, Table 1 cross references language associated with Section 106 findings of effect for this project. Section 106 of the National Historic Preservation Act regulations defines "adverse effect" in 36 CFR Part 800.5(1) as follows: "An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting materials, workmanship, feeling, or association." Detailed supporting information and SHPO correspondence on Section 106 effect determinations for each property are provided in **Appendix 6**: *Section 106 Timeline, MOA, SHPO Concurrence, and Determination of Effects*.

Temporary Occupancies of Section 4(f) Resources

For several alternatives, Section 4(f) properties would be occupied temporarily during the construction process. MaineDOT has committed to re-seeding and restoring to prior condition any land used for temporary construction staging, and the official with jurisdiction has been notified in writing of the nature and expected duration of temporary impacts. Due to the minor nature of these occupancies and the efforts that will be made to restore properties to their current condition, each temporary occupancy described below meets all Section 4(f) exemption requirements outlined in 23 CFR 774.13(d)1-5:

- The land use is of short duration (less than the time needed for the construction);
- There is no change in ownership of the land;
- The scope of the work is minor;
- There are no temporary or permanent adverse changes to the activities, features, or attributes of the property;
- The land will be fully restored to a condition at least as good as prior to the project; and
- There is a documented agreement from the official with jurisdiction (e.g., SHPO) over the property with the above conditions.

In other words, all temporary impacts to Section 4(f) properties described below are so negligible as to not constitute a "use" under Section 4(f). Exact acreages of temporary impacts may change during the construction process; numbers below are based on best current estimates. Supporting information and SHPO correspondence on temporary occupancies for each property are provided in **Appendix 14**: *Additional Section 4(f) Supporting Information*.

Breakdown of Section 4(f) Use by Alternative

No Build

The no build alternative would not use any Section 4(f) resources. It includes no temporary or permanent impacts from construction and causes no adverse effects to historic properties under Section 106.

Replacement on Alignment (Alternative 1)

This alternative would remove the Frank J. Wood Bridge and would include a finding of adverse effect on Frank J. Wood Bridge and the BTIHD, resulting in Section 4(f) uses for these resources. This alternative would include a temporary occupancy of 0.1 acres during construction for placement of a temporary bridge on the Cabot Mill property, a contributing resource to the BTIHD.

Replacement on Curved Upstream Alignment (Alternative 2)

This alternative would also remove the Frank J. Wood Bridge, resulting in an adverse effect under Section 106 and use of this resource. Additionally, the integrity of setting of the Cabot Mill and PPC would be diminished because the bridge represents one of the last remaining pieces of transportation infrastructure that originated during the mills' period of significance. This alternative would also require a minor (0.1 acre) permanent right-of-way easement for a retaining wall on the Cabot Mill property, and 0.1 acres of permanent impacts to the Pejepscot Paper Company for a new driveway, resulting in transportation use of both resources. FHWA determined that a replacement on upstream alignment would result in no adverse effect to the SSHD because it would not alter the features of the district in a way that would diminish the integrity of the district.

Rehabilitation with one Sidewalk; no posting (Alternative 3)

This alternative avoids use of all Section 4(f) resources. Rehabilitation would retain the Frank J. Wood Bridge and constitutes no adverse effects to surrounding historic properties. Rehabilitation would follow the Secretary of the Interior's standards for the Treatment of Historic Properties and include the replacement in kind of materials in the deck, super, and sub structures to reflect the original design of the bridge, while keeping original materials in the trusses. This alternative would include a temporary occupancy of 0.1 acres at the Cabot Mill for construction rights.

Rehabilitation with 2 sidewalks; no posting (Alternative 4)

This alternative also avoids use of all Section 4(f) resources. It would result in a finding of no adverse effect for the Frank J. Wood bridge because the sidewalk would be designed following Secretary of the Interior's standards for the Treatment of Historic Properties. This alternative would include a temporary occupancy of 0.1 acres at the Cabot Mill for construction rights.

Replacement on Downstream Alignment (Alternative 5)

This alternate would result in use of several Section 4(f) properties including removal of the Frank J. Wood Bridge. This alternate would require permanent use and property acquisition of 0.2 acres of the PPC property for placement of a new bridge. It would also require complete and total use (3 acres) of 250th Anniversary Park for placement of a new bridge.

Conversion to Bike/Ped Facility; Construction of New Vehicular Bridge Offsite; Conversion to Bike/Ped Facility; Detour using Existing Infrastructure; Bridge Rehabilitation (1 sidewalk) without Secretary of the Interior's Standards; Minor Bridge Rehabilitation; Posted to Remove Heavy Vehicular Traffic; Bridge Rehabilitation with Reduction to One-Travel Lane and Posting

These alternatives completely avoid use of any Section 4(f) resources, also known as "avoidance alternatives". No historic properties were found to be adversely affected under 106, and there would be no additional effects constituting a use under Section 4(f). For Bridge Rehabilitation with 1 Sidewalk without Secretary of Interior (SOI) standards, FHWA assumed that rehabilitation would be completed in the deck system only and would not change the integrity of design and materials of the BTIHD and the Frank J. Wood Bridge. The integrity of the BTIHD and the Frank J. Wood Bridge could be similarly unaffected if the rehabilitation did not include painting of the bridge elements.

Bridge Rehabilitation (2 sidewalks) without Secretary of the Interior's Standards & Guidelines

Since this alternative proposes rehabilitating the Frank J Wood Bridge in a manner not consistent with the Secretary of Interior's Standards and Guidelines and adds an additional sidewalk, rehabilitation would change the integrity of design and materials of the BTIHD and the Frank J. Wood Bridge, thus representing an adverse effect and Section 4(f) use for both these resources.

Can a Prudent and Feasible Avoidance Alternative be Identified?

A federal transportation agency must show that there are no prudent and feasible avoidance alternatives to using a Section 4(f) resource before a project can proceed. FHWA Regulations at 23 CFR 774.17 provide guidance on the definition of whether an alternative is feasible and prudent. An alternative is not feasible if it cannot be built as a matter of sound engineering judgement. An alternative is not prudent if:

i. It compromises the project to a degree that is unreasonable to proceed with the project in light of its stated purpose and need
ii. It results in unacceptable safety or operational problems
iii. After reasonable mitigation, it still causes:
    a. Severe social, economic, or environmental impacts
    b. Severe disruptions to established communities
    c. Severe disproportionate impacts to minority or low-income populations
    d. Severe impacts to environmental resources protected by other Federal Statutes
iv. It results in additional construction, maintenance, or operational costs of an extraordinary magnitude
v. It causes other unique problems or other unusual factors
vi. It involves multiple factors in paragraph (i-v) of this definition, that while individually minor cumulatively cause unique problems or impacts of extraordinary magnitude.

Table 2 shows the six factors of prudency applied to each avoidance alternative. If an alternative affirms one of the six factors, it must be removed from consideration. This summary table is followed by a narrative description of how each avoidance alternative was found not feasible and prudent.

Table 2: Analysis – Are There Any Prudent and Feasible Avoidance Alternatives?

	No Build	Conversion to Bike/Ped Facility; New Vehicular Bridge Offsite	Conversion to Bike/Ped Facility; Detour Traffic	Rehabilitation with Existing Westerly Sidewalk (Alternative 3)	Rehabilitation with Existing Westerly Sidewalk and New Easterly Sidewalk (Alternative 4)	Minor Bridge Rehabilitation Resulting in Removal of Heavy Traffic & Posting the Bridge	Bridge Rehabilitation w/ One-Travel Lane and Load Posting	Bridge Rehabilitation (1 sidewalk) w/o Consideration of Secretary of the Interior Standards
Is this Alternative Prudent & Feasible per per 23 CFR 774.17? ➔	No	No	No	No	No	No	No	No
(i) Compromises Purpose and Need?	Yes	Yes	No	No	No	Yes	Yes	No
(ii) Unacceptable Safety & Operations Problems?	Yes	No	No	No	No	No	No	No
(iii) Severe social, economic, or environmental impacts?	No	Yes	Yes	No	No	Yes	Yes	No
(iv) Costs of an extraordinary magnitude?	Yes	No	No	Yes	Yes	Yes	Yes	Yes
(v) Other problems or unique factors?	No	Yes	Yes	No	No	Yes	Yes	No
(vi) Cumulative factors present?	Yes	Yes	Yes	No	No	Yes	No	No

No Build

The No Build alternative would take no action to repair, rehabilitate, or correct any deficiencies of the bridge. This alternative would not meet the purpose and need. It would not correct the poor structural condition and deficiency of the bridge. This option would result in the bridge remaining under current MaineDOT and legal load ratings. Additionally, bicycle and pedestrian mobility and safety deficiencies would not be addressed. Therefore, this alternative was not considered prudent and was dismissed

from further consideration. This alternative was found to meet the definition of not prudent at 23 CFR 774.17(i), (ii), (iv) and (vi).

Conversion to Bike/Pedestrian Facility; Construction of New Bridge Offsite

This alternative is similar to the *Conversion to Bike/Pedestrian Facility; Detour Traffic to Existing Infrastructure* alternative discussed below. However, it would introduce a new bridge somewhere between the existing alignment and the current State Route 196 Bypass downstream. An upstream alignment would require a new spur off the congested US Route 1 connecting to a residential neighborhood. Similarly, the connection for a downstream alignment (but upstream of the bridge that serves as the crossing as part of the approximate 4-mile detour) would need to be tied into two neighborhood streets – Water Street in Brunswick and State Route 24 (Elm Street) in Topsham. It would also likely require the removal of several houses on each street. Elm Street is part of the National Register-listed Topsham Historic District. This would lead to additional adverse effects under Section 106. Additionally, the crossing would likely require a multi-span bridge situated on new piers placed in critical habitat for threatened and endangered fish species. This alternative was found to meet the definition of not prudent at 23 CFR 774.17(i), (iii), (v)and (vi).

Conversion to Bike/Pedestrian Facility; Detour Traffic to Existing Infrastructure

MaineDOT calculated user costs of approximately $22,000 per day if traffic is removed from this route. Traditionally, if MaineDOT removes automobile traffic from its infrastructure, it seeks to transition ownership as well. If the bridge leaves MaineDOT ownership as a result of a project that uses federal funds, the federal agency is still required to examine the potential effects that transferred ownership may have on the integrity of a historic structure under Section 106. MaineDOT would offer this bridge for adaptive reuse at the conclusion of NEPA. Moving vehicular traffic off a bridge constructed for that purpose represents a change of use under Section 106. Additionally, MaineDOT anticipates that traffic will increase on State Route 24 (Elm Street) by those seeking to shorten the approximate 4-mile detour. This alternative was found to meet the definition of not prudent at 23 CFR 774.17(iii), (v), and (vi)).

Alternative 3: Bridge Rehabilitation with Existing Westerly Sidewalk[5]

Alternative 3 would rehabilitate the Frank J. Wood Bridge using the Secretary of the Interior's Standards and Guidelines for the Treatment of Historic Properties. This alternative would not result in a finding of adverse effect under Section 106 and would not result in a Section 4(f) use. The rehabilitated bridge would remain fracture critical. This alternative would increase the roadway width to two 11-foot lanes with two 4-foot shoulders and one 5-foot sidewalk. Construction duration is estimated to be three years, only shorter than Alternative 1 (Replacement on Alignment) in the Environmental Assessment. This alternative would require a temporary bridge during construction.

The rehabilitation would extend the bridge's service life by 75 years at an estimated construction cost of $15 million, including a 15% rehabilitation contingency cost. Contingency for rehabilitations are typically carried due to the high likelihood additional problem areas of the fracture critical bridge, currently unseen, would be revealed during rehabilitation. Based on previous experience with rehabilitation of bridges, including of this age, type, and material, MaineDOT initially used a 15% contingency estimate for this rehabilitation; however, "after additional conversations, this number may

[5] The *Funding and Costs of Extraordinary Magnitude* section within this evaluation includes information regarding financial constraints MaineDOT faces regarding overall infrastructure improvement.

be conservatively estimated."[6] While the condition would improve after rehabilitation; the bridge would remain fracture critical.

MaineDOT estimates that the cost over service life for this rehabilitation alternative would be approximately $35.2 million, which is almost twice the amount of a replacement bridge (with a 100-year service life). The high cost over service life is due to the cost of maintenance, inspections and required periodic improvements, and anticipated rehabilitation cost.

In summary, the preliminary construction cost estimate of this alternative represents a 13% increase over the lowest preliminary cost of any alternative and a 626% increase in annual cost over service life. Alternative 3 would avoid the use of Section 4(f) properties. However, this alternative was found not prudent due to Service Life Cost of extraordinary magnitude (23 CFR 774.17(iv)), outlined in the following subsection, *Funding and Costs of Extraordinary Magnitude.*

Alternative 4: Bridge Rehabilitation with Existing Westerly Sidewalk and a New Easterly Sidewalk

Alternative 4 would rehabilitate the Frank J. Wood Bridge using the Secretary of the Interior's Standards and Guidelines for the Treatment of Historic Properties. This alternative would likely not result in a finding of adverse effect under Section 106 nor would this alternative result in a Section 4(f) use. The rehabilitated alternative would remain fracture critical. This alternative would increase the roadway width to two 11' lanes with two 4' shoulders and two 5' sidewalks. The existing bridge deck would be replaced by a light weight exodermic deck with concrete wearing surface to accommodate the extra weight of a second sidewalk. This alternative does not support the weight of a bituminous surface. This alternative would require a temporary bridge during construction.

The rehabilitation would extend the bridge's service life by 75 years at an estimated construction cost of $17 million dollars, including a 15% rehabilitation contingency cost. Contingency for rehabilitations are typically carried due to the high likelihood of additional problem areas of the fracture critical bridge, currently unseen, and revealed during rehabilitation. As noted above, based upon previous experience with rehabilitation of bridges, including age, type, and material, MaineDOT initially used a 15% contingency estimate for this rehabilitation; however, "after additional conversations, this number may be conservatively estimated."[7] While the condition would improve after rehabilitation, the bridge would remain fracture critical.

MaineDOT estimated the cost over service life for this rehabilitation alternative at approximately $38.2 million – over twice the amount of a replacement bridge (with a 100-year service life). As stated in Alternative 3, the high cost over service life is due to the cost of maintenance, inspections and required periodic improvements anticipated for a rehabilitation.

In summary, the preliminary construction cost estimate of this alternative represents a 24% increase over the lowest estimated preliminary construction cost of any alternative and a 657% increase in annual cost over service life. Alternative 4 would avoid the use of Section 4(f) properties. However, this

[6] **Appendix 7 -** MaineDOT, "Frank J Wood Questions and Responses," Frank J Wood Public Comment Period Materials, 2017.
[7] Ibid.

alternative was found not prudent due to Service Life Cost of extraordinary magnitude (23 CFR 774.17(iv)), outlined in the following subsection, *Funding and Costs of Extraordinary Magnitude*.

Minor Bridge Rehabilitation Resulting in Removal of Heavy Traffic and Posting the Bridge

In 2016, MaineDOT completed a National Bridge Inspection Standards (NBIS) Fracture Critical inspection of the Frank J. Wood Bridge (Inspection Report is located in the Preliminary Design Report in **Appendix 2**: *Preliminary Design Report (PDR)*). As a result of that inspection, the bridge was posted at 25 Tons. The posting removed heavy traffic and detoured it 4 miles in either direction and partially on heavily congested US Route 1. At the time of posting, MaineDOT determined the bridge would require a $200,000 rehabilitation or repair in the next 12 months in order to retain a posted crossing for approximately 5 years. This effort was completed in 2017. If no additional action is taken, MaineDOT anticipates posting a further reduction of load and diverting even more traffic to US Route 1 within the 5-year window. Additionally, this alternative does not address the need for improved bicycle and pedestrian safety and would retain a fracture critical bridge within the transportation network. While this alternative would avoid the use of Section 4(f) resources, it was found to meet the definition of not prudent at 23 CFR 774.17(i) and (iii-vi).

Bridge Rehabilitation with Reduction to One-Travel Lane and Load Posting

This alternative would retain one direction of traffic. User costs would be approximately $10,000 per day or more by diverting all heavy traffic and one direction of traffic off the bridge. The alternate travel way (utilizing existing infrastructure) is a near 4-mile detour along US Route 1 (a heavily congested Highway Corridor Priority 1 road within the National Highway System) and the State Route 196 Bypass. A shorter route exists; however, it is along State Route 24 (Elm Street) in Topsham, which is located in the heart of the large Topsham Historic District, listed in the National Register. The Town of Topsham does not support the introduction of additional traffic through this local community. This alternative would result in additional findings of adverse effects under Section 106. This alternative was found to meet the definition of not prudent at 23 CFR 774.17(i), (iii-v).

Bridge Rehabilitation (w/ One Sidewalk) without Consideration of the Secretary of the Interior (SOI) Standard and Guidelines for the Treatment of Historic Properties

This alternative would consist of much of the undertaking as described in the two rehabilitation avoidance alternatives; however, it would not include the construction of a second sidewalk. The cost of construction and cost over service life for the two rehabilitation alternatives found in the following section were initially calculated without incorporating the costs of the use of the SOI standards. This was done because rehabilitation would be completed in the deck system and would not change the integrity of design and materials of the BTIHD and the Frank J. Wood Bridge. The integrity of the BTIHD and the Frank J. Wood Bridge may be similarly unaffected if the rehabilitation did not include painting of the bridge elements. This alternative was found not prudent due to Service Life Cost of extraordinary magnitude (23 CFR 774.17(iv)), outlined in the following subsection, *Funding and Costs of Extraordinary Magnitude.*

Are there any additional prudent and feasible alternatives?

Maine DOT and FHWA examined three additional alternatives to see if there were any other feasible and prudent avoidance alternatives, and found that there were not. Supporting information is provided below.

Alternative 5: Replacement on Parallel Downstream Alignment

This alternative was found to have some of the most severe impacts due to the potential use of all five (5) Section 4(f) properties, including the elimination of the 250th Anniversary Park via flooding and the relocation of US Route 201. This flooding would be unmitigable and would introduce rather than ameliorate safety concerns at the crossing. Because this alternative does not meet this core purpose and need of the project (increasing pedestrian and bicycle safety), this alternative is not prudent per 23 CFR 774.17(i). Additionally, the constructability for a downstream alignment was quickly identified as more complicated due to topography and hydraulics/hydrology resulting in substantial increased costs over other alternatives.

Bridge Rehabilitation with 2 Sidewalks without Consideration of the Secretary of the Interior (SOI) Standard and Guidelines for the Treatment of Historic Properties

This alternative would result in similar or the same adverse impacts as other rehabilitation options and would also require a temporary bridge. To rehabilitate a historic structure without the use of the Secretary of the Interior's Standards and Guidelines would not represent a measure to minimize harm, and the severity of harm would be higher than others after reasonable mitigation. Additionally, the high service life costs represent a substantial cost difference among the alternatives. This alternative was found to meet the definition of not prudent at 23 CFR 774.17(iv) due to the maintenance and operation costs outlined in Alternative 3 and Alternative 4, as well as the information presented in a following subsection *Funding and Costs of Extraordinary Magnitude*.

Independent Plate Girder Superstructure w/ Decorative Truss

This alternative was not considered in the draft Section 4(f) analysis. A citizens group, The Friends' of the Frank J. Wood Bridge (Friends), presented this rehabilitation option to MaineDOT and FHWA at a June 27 Section 106 consulting parties meeting as well as within comments on the Draft Environmental Assessment. The Friends' design concept proposes to replace the existing bridge deck with an independent steel girder system.[8] This option was presented at a conceptual level only. No engineering analysis or cost estimates were provided.

This alternative would replace the superstructure of the truss bridge save the bottom chords with a two or three span set of steel girders. At the end of the construction the truss would be non-functional. MaineDOT estimates the depth ratio of the girders may be as high as 8' to 10'. Additionally, this alternative does not currently meet the purpose and need because it does not address bicycle and pedestrian safety.

MaineDOT commissioned review of the Friends' proposal by a consultant, who identified numerous technical concerns.[9] MaineDOT concluded that this additional option would not surface as a viable preferred alternative if further engineering analysis was performed. In response to continued Section 106 Consulting Party interest in expending further agency time and effort exploring constructability, design details and cost implications of the Friends' additional rehabilitation concept, FHWA conducted an additional internal review of both the Friends' report and MaineDOT's analysis in August 2018.

[8] See: *Historic Frank J. Wood Bridge Study*. Prepared for: Friends of the Frank J. Wood Bridge. Prepared by: JDB Consulting Engineers, Inc. April 9, 2018. This analysis was submitted as comment to the Frank J Wood Bridge project Environmental Assessment.

[9] Memorandum. WIN 22603.00 Frank J. Wood Bridge: Comments on JDB Bridge Rehab Study. TYLIN International. June 4, 2018.

FHWA's internal review found that the proposed depth to span ratio described in this design concept was substantially outside the range of standard engineering practice. As a general rule, for simply supported steel I-girders, AASHTO Table 2.5.2.6.3-1 specifies the minimum ratio of the depth of steel girder portion to the span length to be 0.033. Based on the existing span length of 310', the girders would be around 10' deep. However, to maintain the existing structure depth as described in the report, the girders would have to be around 5' deep.

Further development of this option would be needed to determine if the construction of this bridge type is possible. If construction of this type is possible, this option would look and act differently from the existing bridge. This option also proposes the use of a "vertical slip connection" between the truss and the new girders. This is a complex detail and there is no information in the study to determine how the existing trusses are attached to the new superstructure. This is not a typical bolted connection so it would need further development and analysis to demonstrate its viability.

Finally, in addition to improving the structural condition and load capacity, FHWA noted that the Purpose and Need of this project includes pedestrian accommodations. The existing bridge has a sidewalk on the west side. The option presented by the Friends' has no mention of a sidewalk or any other pedestrian accommodations. In summary, due to multiple analyses concluding this alternative would not meet the purpose and need for this project, per 23 CFR 774.17(3)(i) this option could not be found prudent as defined in FHWA's regulations.

Funding and Costs of Extraordinary Magnitude

This section summarizes supporting data used to develop the cost estimates referenced above, and provides further detail on procedures MaineDOT and FHWA use to evaluate and manage the costs associated with maintaining specific levels of service on aging infrastructure within the State of Maine. This context is important for understanding substantial differences in cost among the alternatives considered for the project.

In response to the 2007 collapse of the I-35W Bridge in Minneapolis, Minnesota, the National Transportation Safety Board (NTSB) issued a series of recommendations to the FHWA and the American Association of State Highway and Transportation Officials (AASHTO). One of the three recommendations to the FHWA would require "bridge owners [to] assess the truss bridges in their inventories to identify locations where visual inspections may not detect gusset plate corrosion and where, therefore, appropriate nondestructive evaluation technologies should be used to assess gusset plate condition." In August 2007, then Maine Governor John Baldacci issued an executive order (EO) directing the MaineDOT to review Maine's Bridge Inspection and Programming. The substance of the order was, in part, to:

1. Review Maine's bridge inspection program to assure it continues to meet or exceed all applicable federal standards;
2. Utilize the available information on the cause of the Minneapolis bridge collapse to reassess the safety of Maine's bridges and take appropriate action to mitigate any safety concerns;
3. Analyze MaineDOT's capital programming processes and levels for bridges and other critical transportation infrastructure, the failure of which would likely cause loss of life or other significant public safety impacts.

The result was a report titled *Keeping Our Bridges Safe* (KOBS), published on November 26, 2007. In 2014, the MaineDOT Commissioner directed the MaineDOT Chief Engineer to reconvene a team of bridge experts to examine the progress towards the goals outlined in this report. The team consisted of structural engineers from within MaineDOT as well as outside consultants, bridge maintenance engineers, bridge contractors, University of Maine engineering faculty, the FHWA Maine Division Bridge Engineer, and the MaineDOT Chief Engineer. The team was instructed to:

- Report on MaineDOT's progress on the 2007 report recommendations,
- Define the current status of bridges in Maine,
- Establish strategies to improve overall bridge conditions and safety,
- Find opportunities to impact costs, and
- Identify funding needs.

In the time between 2007 and 2014, MaineDOT has endeavored to better organize and understand the condition of its infrastructure using the principles of asset management including prioritizing highway corridors and identifying customer service levels for Maine's transportation infrastructure. Highway Corridor Priorities are listed below in Table 3 for context.

Table 3: MaineDOT Highway Corridor Priorities

Highway Corridor Priority	Miles	% Miles	% Traffic	Definitions and Examples
Priority 1	1760	7%	42%	These roads include the Maine Turnpike, the interstate system and key principal arterials like Route 1 in Aroostook County, the Airline (Route 9), Route 2 west of Newport, and Route 302. The 1,760 miles of Priority 1 roads represent only 7 percent of the miles but carry 42 percent of all vehicle miles traveled in Maine.
Priority 2	1350	6%	17%	These roads total about 1,350 miles. They are non-interstate, high value arterials that represent about 6 percent of the total miles of road but carry 17 percent of overall traffic in Maine.
Priority 3	2199	9%	16%	These roads generally are the remaining arterials and significant major collector highways. These 2,199 miles of Priority 3 represent only 9 percent of miles but carry 16 percent of the traffic in Maine.
Priority 4	3731	16%	9%	These roads generally are the remainder of the major collector highways, minor collector highways, and often also part of Maine's unique state aid system, in which road responsibilities are shared between the state and municipalities. These 3,731 miles represent about 16 percent of total miles and carry 9 percent of the traffic in Maine.
Priority 6	14,432	62%	13%	These roads are local roads and streets and are the year-round responsibility of our municipal partners. Though they carry just 13 percent of the statewide traffic, these 14,432 miles make up 62 percent of the total miles.
The miles and traffic percentages of the previous highway priority 5 have been incorporated into 4 and 6, as appropriate.				

Customer service levels (CSLs) are an established protocol used by MaineDOT to report priorities and capital goals. MaineDOT CSLs are based on reliability, condition, and service. The CSLs are communicated as letter grades A-F, with A representing excellent and F representing unacceptable.

Bridge reliability grading is based on a pass/fail. An example of a fail is if one or more major members of a bridge is in serious condition or is scour critical. "Bridge Condition CSL" is based on the National Bridge Inventory (NBI) Condition (0-9), and "Service CSL" is created by the bridge's posting relative to its highway corridor priority. The Frank J. Wood Bridge has an overall "D" Customer Service Level (CSL) due to its posting and congestion. The highway it carries, Route 201, is part of the National Highway System and is a MaineDOT HCP 3. US Route 201 has an overall "B" CSL rating. The D rating is in large part dictated by the fact that it is a fracture critical and structurally deficient structure.

The updated KOBS (2014) report (included in Appendix 8 of the PDR) is a comprehensive overview of the state of Maine's bridge infrastructure; placing bridges in context with highway corridor priority and CSLs. The KOBS (2007) report identified 44 fracture critical bridges.[10] The Frank J. Wood Bridge was identified as a fracture critical bridge within this report. Since 2007, 11 fracture critical bridges have been replaced. Both KOBS reports highlight that older bridges were not designed to carry current loads. Part of the initial KOBS report and goal was to initiate and use new bridge rating and bridge posting guides. The report states: "understanding what a bridge can safely carry is critical to public safety and mobility. At times, posting a re-rated bridge for less than legal loads may have minimal impacts. Other times it could pose hardships." These hardships include a long detour and/or no practical strengthening options.

The 2014 KOBS report found MaineDOT's 2744 bridges and short spans are getting older – 776 bridges and 150 steel culverts are past their 50-year service life. Generally, older bridges require more maintenance and attention to keep them safe. In 2007, 65% of MaineDOT's bridges and minor spans were in fair condition and 9% in poor condition. In 2014, while the percentage of bridges and minor spans in fair condition had decreased to 61%, the number of bridges in poor condition rose to 11%. Much attention is paid to bridges that are categorized as structurally deficient; however, that designation is only applicable to federal bridges with a 20' or longer span. The MaineDOT has found that this classification underestimates the population of smaller bridges in poor condition. Even so, the percentage of structurally deficient bridges in Maine rose from 14.99% in 2011 to 15.24% in 2013 (with peaks of 16.68% in 2001 and 16.26% in 2010). The Frank J. Wood Bridge was determined structurally deficient in June 2016 as part of its routine National Bridge Inspection (NBI). In August 2016, MaineDOT undertook a two-day field inspection of the bridge with representatives from the Bureaus of Project Development and Maintenance and Operations. The result of these efforts was that the Frank J. Wood Bridge was posted at 25 tons.

Another issue facing MaineDOT is the level of funding needed to maintain current condition of bridges compared to available funding. For the 2014 KOBS Report, MaineDOT used asset management software to assess bridge needs. This software generated conditions and service levels for 25 years for four funding levels (per year): $70 million, $105 million, $140 million, and $175 million. The results showed overall condition of bridges owned by MaineDOT throughout the state would deteriorate with funding less than $140 million. The 2014 KOBS Report concluded:

> A long-term investment of $140 million per year will eliminate at least 90% of the structurally deficient and poor bridges on Highway Corridor Priorities 1-3. This funding level will improve the average condition of Maine's bridges over the next twenty-five years. It will also reduce the deterioration of bridges that are in good condition which presents the opportunity to save money in the future. It will not be

[10] Fracture critical bridges are bridges with no redundancy – if a single member within the bridge fails it may ultimately lead to a catastrophic failure of the entire bridge.

enough to eliminate all bridges with CSLs of D's and F's. It does dramatically change the number of bridges with D and F ratings from 38% at the current funding levels to 15% over the next 25 years.

In this context, elimination does not equate to absolute removal of all bridges of that rating, rather addressing the factors that result in the rating. Addressing these factors include repair, rehabilitation, or removal/replacement. MaineDOT would require $217 million per year to maintain the entire bridge system and substantially meet service, condition, and safety goals.

Another factor MaineDOT has to consider in bridge funding levels is the financial impact of Maine's thirty-six Forever Bridges.[11] Forever Bridges are considered "high value bridges which, when replaced, will create extraordinary impacts to customers or create significant funding needs that could severely impact bridge resources." These factors may include significant permitting and constructability issues in concert with providing critical access routes. These bridges must last 75-100 years or longer. Over a 15-year period (2002-2017), MaineDOT has spent approximately one-third of its annual bridge program budget on construction or heavy capital work on these bridges. This decreases the amount of resources that can be directed towards other bridges, even considering that Discretionary Grants, such as Transportation Investment Generating Economic Recovery (TIGER), have and may continue to offset the financial burden of Forever Bridges.

Table 4: Core Highway and Bridge Programs
CY 2017-2018-2019[12] Funding Need vs Anticipated State and Federal Funding
(In millions of $)

Work Group	Average Annual $ from 2017-2018-2019 Work Plan	Annual $ Needed to Meet Basic Statutory Goals	Average Annual $ Shortfall	Dollar % Shortfall*
Bridge Projects	$121	$140	-$19	**-13%**
Highway Reconstruction/Rehab	$78	$100	-$22	**-22%**
Pavement Preservation	$90	$108	-$18	**-17%**
Light Capital Paving	$27	$27	$0	**0%**
Total – Core Programs	**$316**	**$375**	**-$59**	**-16%**

MaineDOT has a goal to eliminate 90% of the structurally deficient and poor bridges on highway corridor priorities 1-3. This goal can be accomplished with $140 million per year funding. However, MaineDOT is running at a deficit. The 2017-2018-2019 MaineDOT Work Plan and State Transportation

[11] A list of Maine's forever bridges including location is included as an appendix within the updated KOBS document. Frank J. Wood Bridge is not considered a Forever Bridge.
[12] The 2018-2019-2020 MaineDOT work plan and the 2019-2020-2021 MaineDOT Draft Work Plan show comparable or increased dollar % shortfalls for bridge projects.

Improvement Program (STIP) show an annual average of $121 million for bridge projects with an average 13% annual shortfall for bridge projects.

As illustrated by Table 4, MaineDOT does not anticipate adequate funding (State and Federal assistance) to maintain the current condition of the bridge network and certainly does not anticipate funding (State and Federal assistance) to improve overall condition. Therefore, MaineDOT must constantly evaluate which bridges to address knowing that it *will* result in the delay of addressing other bridges, some of which are structurally deficient, fracture critical, or in poor condition.

The MaineDOT makes these decisions knowing that some bridges on lower priority highway corridors may change from fair condition to poor while needing to increase the rating or improve the infrastructure condition on a Highway Corridor Priority 1, 2, or 3. This decision is made to improve the safety and reliability of the State's most utilized infrastructure. Each project alternative and cost (both construction and service life) is considered in concert with the needs of the entire bridge network, including Forever Bridges.

MaineDOT used several tools to evaluate the cost of each of the alternatives considered for improvements to the Frank J. Wood Bridge. Each of the methods have advantages and limitations, described r below.

Construction Costs

Construction cost estimates are generated based on recent bid histories for similar projects. These costs only include the initial cost to construct the project and do not consider future improvements or maintenance. Construction unit prices are generated from recent bid history for all items. Unit price multiplied by unit quantity produces total item cost. Factors affecting bid prices for individual components of a project include location, constructability, and market conditions. Construction estimates are adjusted based on professional engineering judgment. Early in the preliminary design process MaineDOT drafts a Preliminary Design Report (PDR) to document general project information, conceptual designs and corresponding cost estimates. This report also incorporates preliminary plans and other information gathered during the preliminary data gathering stage. Appendix H of the PDR for the Frank J Wood Bridge Project (Appendix 2, pages H-5 to H-18) contains detailed cost estimates (Structural Cost Estimates) that add up to a construction cost for each alternative.

Each of the construction cost estimates for the Frank J. Wood Bridge carry a contingency cost. This is to recognize variation in estimates and changes during construction. Contingencies are estimated based on past project history for similar type bridge projects. This project site is unique due to the exposed and highly variable bedrock, exposure to high velocity flows, and proximity to the upstream dam. Due to the uncertainties associated with rehabilitating an existing deteriorated truss bridge, a higher amount of contingency cost is typically carried for rehabilitation options. It is difficult to know the precise condition of all the bridge elements until work is underway. As components of the bridge are exposed, additional section loss and discovering more deterioration than anticipated is common. Uncertainty regarding condition can cause prices to inflate. Replacement of the entire deck system reduces this uncertainty. However, there are additional areas of concern that may have not been specifically identified, but may require additional repair, replacement, or strengthening. Repair needs become more evident when preparing the truss for painting. The need to remove all deterioration, rust, and old paint will often uncover additional steel areas that need strengthening, repair, or replacement. Replacement or repair of deteriorated rivets and strengthening or replacement of gusset plates are examples of these needs. A 15% rehabilitation contingency was used for Alternatives 3 & 4. All alternatives carry a 7% contingency cost for items such as traffic control plans and field offices.

The cost of materials can also fluctuate over time which can affect the accuracy of estimates. For example, the cost of steel included in the current estimates is $7.80/lb. The price has more than doubled since the original estimate; recent low bids for steel repairs on steel girder and steel arch style bridges range from $11/lb. to $24.50/lb., making the 15% for rehabilitation contingencies a conservative estimate.

The construction cost of Alternative 1 is estimated at $16,000,000. This cost includes the construction of a temporary bridge needed during construction for vehicular traffic.

The construction cost of Alternative 2 is estimated at $13,000,000. A work trestle would be needed during construction for access to construct the cofferdams and piers, to erect the structural steel superstructure, to place deck concrete, and to remove the existing bridge. A cost premium of $1 million is included in the estimate to account for the added expense of a work trestle.

The construction costs of Alternative 3 and Alternative 4 are estimated at $15,000,000[13] and $17,000,000, respectively. These costs include the construction of a temporary bridge needed during construction for vehicular traffic. These costs also include a 15 percent contingency above the repair work identified. Rehabilitation projects nearly always discover issues not previously found in inspections, causing budget overruns. This contingency is based on MaineDOT bid history data. Alternative 4 is estimated at $2,000,000 more than Alternative 3 because Alternative 4 includes a more expensive lightweight deck and a new sidewalk.

Life Cycle Cost

Life cycle costs analysis (LCCA) is a standard engineering economic analysis tool useful in comparing the relative merit of competing bridge improvement alternatives. This evaluation technique converts all estimated bridge costs throughout the life of each bridge improvement alternative into current dollar equivalents, termed present value. The LCCA accounts for estimated construction cost on the current project and the translated present value of anticipated future inspection, maintenance, and rehabilitation costs. It also accounts for anticipated future bridge replacement dates for each alternative. The LCCA assumes money could be set aside today for future work and incorporates economic concepts and techniques such as earned interest on investments, inflation factors, and discounting the opportunity value of time. While LCCA is a tool that can identify the most cost effective alternative, it is not an indicator of the actual costs a transportation agency will expend on an alternative over the timeframe used for the analysis. State transportation agencies are not often able to set money aside today, and make interest earning investments, to pay for future work. For these reasons, life cycle cost was considered[14] but was not the primary basis for a decision on this project.

Service Life Cost

Service life cost provides a more accurate comparison of the expected real costs to an agency when examining bridge improvement alternatives. Service life is defined as the number of years a bridge can be part of the transportation system with maintenance, repair, and/or rehabilitation before its eventual replacement. The Service Life Cost is the total cost to maintain a structure over its design service life. It includes the cost of initial construction (construction cost), maintenance costs, inspections, and the cost of expected future improvements. Costs are broken down into required

[13] The cost of Alternative 3 at a 30-year rehabilitation was estimated at $8 million. See Cost section for information on 75-year rehabilitation.
[14] Appendix H of the Preliminary Design Report (Appendix 2, page H-19)

annual costs (such as inspections and anticipated maintenance) as well as periodic items (such as bridge painting, deck replacements, and structural rehabilitation). These costs are generated based on the historical maintenance needs of similar bridge types and historical data on costs. A service life cost estimate is not translated or discounted to current dollar equivalents.
Service life cost of each alternative is summarized in Table 5.

Replacement (Alternatives 1 and 2)
FHWA requires that states inspect bridges every twenty-four months. Estimates for inspection are broken down into annual costs even though inspections would be completed every two years. The biennial inspection of a new bridge typically requires an inspection team spending a day or two looking at all bridge elements. The inspection would be followed by the preparation of a report detailing findings. Routine annual maintenance for a new bridge would include washing of the drains, curb lines, and joints as well as washing of any debris that might have built up on the structure.

Required periodic improvements include milling and resurfacing the asphalt wearing surface every 15 years and painting the girders at year 35 and year 70.

For both replacement alternatives (Alternative 1 and Alternative 2), the cost of inspection, maintenance, and periodic improvements are estimated at $4,260,000 over 100 years. When added to the Construction Cost of each alternative the total cost over service life for Alternative 1 is estimated to be $20,300,000. For Alternative 2, the total cost over service life is estimated to be $17,300,000.

Rehabilitation (Alternatives 3 and 4)
Estimates for inspection of the rehabilitation alternatives include the routine biennial inspection as well as additional effort for fracture critical bridges. Inspection of a fracture critical bridge requires a minimum of two inspectors, at least one of whom needs to be a qualified fracture critical bridge inspector, completing hands on inspection of every fracture critical member of the bridge. This type of inspection often requires bridge lane closures and the lease of specialized equipment for access and traffic control. Fracture critical inspection can take up to two weeks onsite versus one or two days for other non-fracture critical bridges as well as one to two additional weeks of effort to produce required reporting.

Maintenance for a rehabilitated bridge would include annual washing of the drains, curb lines, and joints as wells as washing of any debris that might have built up on the structure. Because of the age of the bridge, it is very likely that cracks in fatigue sensitive or fracture critical members would be found during inspection and immediate repairs would be required. A value of $40,000 per year to repair fatigue cracks was used in the maintenance service life cost estimate for this work.

Required periodic improvements for a rehabilitation include paint every 20 years, and a deck replacement at year 40. Based on the performance of similar aged bridges and the age of the most recent major substructure rehabilitation at the Frank J. Wood Bridge, additional substructure rehabilitations would be expected at years 20 and 50 following the initial construction of the rehabilitation alternatives.

The cost of maintenance, inspections, and required periodic improvements for Alternative 3 is $20,250,000 estimated over 75 years. When the Construction Cost is added, the total Service Life Cost of Alternative 3 is estimated to be $35,200,000. The cost of maintenance, inspections, and required periodic improvements for Alternative 4 is estimated at $21,250,000 over 75 years. The difference

between Alternative 3 and 4 is that Alternative 4 includes an exodermic deck, which has a higher cost of replacement than the deck for Alternative 3. When added to the Construction Cost, the total Service Life Cost for Alternative 4 is estimated to be $38,200,000.

Table 5. Service Life Cost

Brunswick-Topsham, Frank J. Wood Bridge: Service Life Cost								
	Alternate 1: Replacement on Existing Alignment		**Alternate 2:** Replacement on Upstream Curved Alignment		**Alternate 3:** Rehabilitation		**Alternate 4:** Rehabilitation with Added Sidewalk	
Cost Items	**Year**	**Cost**	**Year**	**Cost**	**Year**	**Cost**	**Year**	**Cost**
Construction Cost	2019	$ 16,000,000	2019	$ 13,000,000	2019	$ 15,000,000	2019	$ 17,000,000
Inspections	Annual	$ 600	Annual	$ 600	Annual	$ 30,000	Annual	$ 30,000
Maintenance	Annual	$ 1,000	Annual	$ 1,000	Annual	$ 40,000	Annual	$ 40,000
Paint	35	$ 1,750,000	35	$ 1,750,000	20	$ 4,000,000	20	$ 4,000,000
	70	$ 1,750,000	70	$ 1,750,000	40	$ 4,000,000	40	$ 4,000,000
					60	$ 4,000,000	60	$ 4,000,000
Deck Replacement	None		None		40	$ 1,000,000	40	$ 2,000,000
Substructure Rehab	None		None		20	$ 1,000,000	20	$ 1,000,000
					50	$ 1,000,000	50	$ 1,000,000
Wearing Surface	15	$ 100,000	15	$ 100,000	None		None	
	30	$ 100,000	30	$ 100,000				
	45	$ 100,000	45	$ 100,000				
	60	$ 100,000	60	$ 100,000				
	75	$ 100,000	75	$ 100,000				
	90	$ 100,000	90	$ 100,000				
Service Life	100 years		100 years		75 years		75 years	
Total Cost over Life (Service Life Cost)	$20,300,000		$17,300,000		$35,200,000		$38,200,000	

Annual Cost over Service Life

The Estimated Annual Cost of Service Life of each alternative is calculated by excluding the Construction Cost from the Total Service Life Cost and dividing by the Service Life [*Service Life Cost–Construction Cost)/Number of Service Life Years]*. This provides an average of expenditures from maintenance, inspections and required periodic improvements over the service life of the structure. The comparison of alternatives is shown in Table 6.

When compared with the replacement alternatives, Alternative 3 would have increased annual cost over service life of 626%, and Alternative 4 would have a 657% increase in annual cost over service life. Additional details regarding cost estimates and program-wide needs may be found in **Appendix 2**: *Preliminary Design Report (PDR)* and **Appendix 8**: *Keeping our Bridges Safe Report (2014).*

In summary, the preliminary construction cost estimates of the rehabilitation alternatives (Alternatives 3 and 4) represent a 14% and 24% increase over the lowest estimated preliminary construction cost of any alternative. The rehabilitation alternatives (Alternatives 3 and 4) represent a 626% and 657% increase in annual cost over service life. Alternatives 3 and 4 would avoid the use of Section 4(f)

properties. However, when they were considered with the cost and funding information described above, Alternatives 3 and 4 were found not prudent due to Service Life Costs of extraordinary magnitude (Section 774.17(iv)).

Table 6: Preliminary Cost & Annual Cost over Service Life

	Service Life (years)	Preliminary Construction Estimate (Construction Cost)	Estimated Service Life Cost	Estimated Annual Average Cost of Service Life (Maintenance, Inspection, Periodic Improvements)	Increased Percentage Average Annual Cost Per Service Life Year (Maintenance, Inspection, Periodic Improvements)
Alternative 1 Replacement on Alternative Alignment	100	$16 M	$20.3M	$43,000	0%
Alternative 2 Replacement on Upstream Alignment	100	$13M	$17.3M	$43,000	0%
Alternative 3 Rehabilitation with one Sidewalk; No posting	75	$15M	$35.2M	$269,333	626%
Alternative 4 Rehabilitation with 2 Sidewalks; no posting	75	$17M	$38.2M	$282,667	657%

Bicycle and Pedestrian Safety

In addition to addressing poor structural conditions and load capacity issues at the current bridge, improvements to bicycle and pedestrian safety and mobility are the second necessary component to satisfy the purpose and need of this transportation project. This section provides context regarding the scope of safety and mobility needs at the existing bridge crossing, as well as analysis of how different project alternatives address this need.

The existing Frank J. Wood Bridge carries two 11-foot lanes and two 4-foot shoulders. The outer 2 feet of shoulder is made of an open steel grid, which makes the usable shoulder width for bicycle travel 2 feet. There is one sidewalk on the west side of the bridge. The sidewalk on the west side of US 201/ME 24 extends from downtown Brunswick past Fort Andross and across the bridge to the intersection of US Route 201/24 and Elm Street in Topsham. The sidewalk on the east side of the bridge extends from downtown Brunswick and Federal Street and stops at the 250th Anniversary Park before the Frank J. Wood Bridge. The sidewalk begins again at the Bowdoin Mill Complex and continues north to Elm Street.

Pedestrian activity is generated by the mix of business, commercial, residential uses and open spaces located at both ends of the bridge and on both sides of the road. Pedestrians include residents, business patrons, and commuters. Bicycle activity is generated by the same uses along with recreational bicycle through-traffic. There have been two pedestrian crashes in the project area over the past 15 years. Both occurred in 2011. Additionally, there were two bicycle crashes (one each in 2010 & 2013). Each of these incidents resulted in non-fatal injuries.

The towns of Brunswick and Topsham have an active biking community. One specific group, the *Merrymeeting Wheelers Bicycle Club*, identified specific safety and mobility deficiencies in the current Frank J Wood bridge design. Primary concerns of this group include high traffic speeds, limited lane widths, and existing grating eliminates a substantial portion of the area "allocated" for cycling on the bridge. This group also purchased 3 ft. passing signs for use in the towns of Brunswick and Topsham.

There is no regularly collected bicycle/pedestrian usage data for the Frank J. Wood Bridge. However, MaineDOT does collect data on bicycles and pedestrians on the Androscoggin River Path. May 2014 data for weekday use was nearly 850 people per day with that number more than doubling on the weekends. Bicycles represented approximately 20% of the total users on weekdays and 29% on weekends. These data also indicate that the primary use for pedestrians is between 8am and 7pm with the peak being early afternoon. Bicycles have a similar time of use, but their peak use is the early evening.

Currently, pedestrians approaching the bridge from either Topsham or Brunswick must cross the street to access the sidewalk on the west side of the bridge. One of the desirable safety outcomes of the bridge improvements is to eliminate these "mid-block" crossings. Designers often assume that pedestrians will cross roadways at established intersections. FHWA training materials direct designers to consider the reality that people routinely cross at mid-block locations. Pedestrians will rarely go out of their way to cross at an intersection unless they are rewarded with a much-improved crossing, and most will take the most direct route possible to get to their destination, even if this means crossing several lanes of high-speed traffic[15]. Drivers are more likely to anticipate pedestrian crossings at intersections. Midblock crossings inherently have increased risk because drivers do not traditionally expect there to be pedestrians crossing at that location. Reducing the number of crossing points reduces the number of opportunities for pedestrian/vehicle conflicts and eliminates unnecessary impediments to traffic flow and movement.

Construction of two sidewalks, one on both sides of a bridge therefore promotes walkability and substantially improves access and accommodation for those with mobility concerns, impairments, and disabilities. Inclusion of sidewalks on both sides of the road is also recommended by Safe Routes to School guidelines and supported by the National Association of City Transportation Officials (NACTO).

BIKESAFE, the Bicycle Safety Guide and Countermeasure Selection System, supported by the FHWA to provide guidance to transportation professionals to improve pedestrian and bicycle conditions states that "Sidewalks, provided on both sides of a street, are generally the preferred pedestrian facility. They provide the greatest degree of comfort for pedestrians and the presence of sidewalks has been

[15]FHWA Course on Pedestrian and Bike Safety - Chapter 16: Mid-Block Crossings. Online Resource. Available: https://safety.fhwa.dot.gov/PED_BIKE/univcourse/pdf/swless16.pdf

associated with increased safety for pedestrians." [16] BIKESAFE also recommends that sidewalks on both sides of the road be required on all suburban highways, major arterials, urban collectors, minor arterials, local streets, and on all commercial urban streets. Sidewalks on both sides are "preferred" on urban local streets and on all streets in industrial areas.

The incorporation of strategically placed pedestrian crossings that include additional safety features (e.g., signage) can improve compliance with drivers stopping for pedestrians by upwards of 80%. This improved compliance directly relates to reduced pedestrian-vehicle incidents.

From a bicycle and pedestrian safety perspective, *Alternative 3*: *Rehabilitation with One Sidewalk; No Posting* provides the least improvements. Pedestrian facilities under this alternative would consist of the existing sidewalk on the west side of the bridge. The open grid decking along the outside of the existing shoulders would be replaced with solid concrete, providing a continuous 4-foot shoulder with adjacent traffic rails, which would provide an improvement for bicyclists using the shoulders.

Alternative 4: Rehabilitation with 2 Sidewalks; No Posting would address pedestrian safety with the addition of a 5-foot sidewalk on the east side of the existing bridge. Like Alternative 3, a 4-foot shoulder with adjacent traffic rails would be provided for bicycle traffic. Alternative 4 would provide improvements for bicyclists and pedestrians.

Alternative 1: Replacement on Alignment and Alternative #2: Replacement on Curved Upstream Alignment would include the most accommodations for bicycle and pedestrian safety. For these alternatives, railings would meet standards for vehicle and pedestrian safety, and final design details would consider accommodations for visual enhancements, lighting and viewing points of the river upstream and downstream. Sidewalks on both sides of the bridge would connect to existing sidewalks on the approaches and would improve safety by reducing the need for pedestrians to cross the road. The addition of 5-foot shoulders with no adjacent bridge railing or truss verticals would improve the bridge for bicyclists. The proposed design would incorporate modern traffic calming techniques to slow traffic and provide additional dedicated space to both cyclists and pedestrians.

Least Overall Harm Analysis

Since FHWA found no prudent and feasible avoidance alternatives to use of Section 4(f) properties, before moving forward with a selected alternative the agency must conduct a Least Overall Harm or LOH analysis per 23 CFR 774.3(c). Language at 23 CFR 774.3(c)(1) provides seven factors that must be balanced when conducting an LOH analysis:

i. the ability to mitigate adverse impacts to Section 4(f) resources
ii. the relative severity of remaining harm, after mitigation, to the protected activities, attributes, or features that qualify each Section 4(f) property for protection
iii. the relative significance of each Section 4(f) property
iv. the views of the officials with jurisdiction over each Section 4(f) property
v. the degree to which each alternative meets the purpose and need
vi. after reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f)

[16] BIKESAFE, www.pedbikesafe.org

vii. substantial differences in costs among the alternatives

Table 7 provides an overview of how each factor was applied to the remaining two alternatives. Please note these remaining alternatives both "use" Section 4(f) resources – agency rules require FHWA to balance the seven factors above considering the Statute's preservation purpose for remaining Section 4(f) resources, as well as mitigation of adverse effects to Section 4(f) properties that will occur as a result of the project. In some cases, there is no reasonable difference between the two options. A narrative description of this analysis follows.

Table 7: Least Overall Harm Analysis

	i. Ability to mitigate adverse impacts to each Section 4(f) property (including any measures that results in benefits to the property)	ii. Relative severity of remaining harm after mitigation to the protected activities, attributes, or features that qualify each Section 4(f) property	iii. The relative significance of each Section 4(f) property	iv. Views of the officials(s) with jurisdiction over each Section 4(f) property	v. The degree to which each alternative meets purpose and need for the project	vi. After reasonable mitigation, the magnitude of any adverse impacts to resources not protected by Section 4(f)	vii. Substantial differences in costs among the alternatives
Replacement on Alignment (Alternative 1)	Same	Less than Alternate 2	Same	Same	Same	More than Alternate 2	$3 million (construction) and $3 million (service life) more than Alternative 2
Replacement on Curved Upstream Alignment (Alternative 2)	Same	More than Alternate 1	Same	Same	Same	Less than Alternate 1	$3 million (construction) and 3 million (service life) less than Alternative 1

Alternative 1: Replacement on Existing Alignment

Alternative 1 would require an 800-foot, multi-span, steel girder bridge on the existing alignment. This alternative would require the complete removal of the Frank J. Wood Bridge prior to any new construction as well as a temporary bridge. A detour was considered; however, it would result in traffic disruption for two years. This alternative would require a work trestle. It would require temporary occupancy of the Cabot Mill as approximately 0.1 acre would be temporarily required for the temporary bridge used during the replacement effort. This alternative would also require removal of the Frank J. Wood Bridge, resulting in a permanent Section 4(f) use of that resource and the BTIHD. This alternative would not use the SSHD nor the 250th Anniversary Park.

i. Replacement Alternatives 1 and 2 would result in the same or similar ability to mitigate adverse impacts to Section 4(f) resources because they would either result in less harm to said resources or show the best avoidance and minimization of harm under Section 106. The land needed for each alternative is relatively minimal when compared to the overall size of the Cabot Mill and PPC sites (5 and 16 acres respectively).

ii. This alternative would result in less harm than Alternative 2 because it would retain the current alignment.

iii. Both alternatives would remove Frank J. Wood Bridge and completely avoid use of the 250th Anniversary Park and SSHD. Alternative 2 may have additional minor impacts (.1 acres each) to Cabot Mill and the PCP due to the new alignment, however total impact to Section 4(f) resources is substantially equal.

iv. Both alternatives are viewed the same by the official with jurisdiction.

v. This alternative meets the purpose and need in a similar way to Alternative 2.

vi. This alternative was found to have more harm to resources protected under the Endangered Species Act and Magnuson-Stevens Act (MSA; with regard to Essential Fish Habitat) than Alternative 2 because construction would be 3½ years due to the limitations on in-water work and to accommodate the time required to construct a temporary bridge to carry traffic during construction. [17]

vii. With construction estimated at $3M more than Alternative 2 and service life costs estimated at $3M more, this alignment was also found to have more harm due to substantial cost differences between the alternatives.

Alternative 2: Replacement on Curved Upstream Alignment

Alternative 2 would require an 835-foot, multi-span, steel girder bridge on a curved upstream alignment. The estimated time of construction would be 2½ years, a reduction from Alternative 1 as traffic would be carried on the existing bridge for most of the construction duration - eliminating the length of time, money, and in-water work impacts associated with a temporary bridge. This alternative would present minor permanent uses at the Cabot Mill, the PPC as approximately 0.1 acres would be permanently used at the Cabot Mill for a retaining wall and approximately 0.1 acre would be permanently used at the PPC to tie in the island access to the new bridge. This alternative would require the removal of the Frank J. Wood Bridge, resulting in a permanent Section 4(f) use of that resource and the BTIHD. This alternative would not use the SSHD nor the 250th Anniversary Park.

i. Replacement Alternatives 1 and 2 would result in the same or similar ability to mitigate adverse impacts to Section 4(f) resources because they would either result in less harm to said resources or show the best avoidance and minimization of harm under Section 106. The land needed for each alternative is relatively minimal when compared to the overall size of the Cabot Mill and PPC sites (5 and 16 acres respectively).

ii. This alternative would result in more harm to historic resources than Alternative 1 because it would introduce a new alignment to the BITHD and change the setting of the historic resources in the area.

iii. Both alternatives would remove the Frank J. Wood Bridge and completely avoid use of the 250th Anniversary Park and SSHD. Alternative 2 may have additional minor impacts (.1 acres each) to

[17] Impacts under the ESA are quantified in part by frequency, impact, and duration of the stressor to which the species may be exposed. Typically, time of year restrictions for in-water work are placed on projects to minimize, but not fully avoid, stress to and harassment of fish and wildlife by reducing exposure during their most active periods. The time of year restrictions would be considered ways to mitigate adverse effects. However, preliminary analyses show that both alternatives would result in adverse effects under the ESA, even considering the reasonable mitigation of limiting in-water work to avoid sensitive time periods.

Cabot Mill and the PCP due to the new alignment, however total impact to Section 4(f) resources is substantially equal.

iv. *Both alternatives are viewed the same by the official with jurisdiction.*

v. *This alternative meets the purpose and need in a similar way as Alternative 1.*

vi. *The decreased magnitude of Alternative 2 is because its construction duration would be 2½ years. Additionally, Alternative 2 would only require a work trestle rather than both a trestle and temporary bridge as with Alternative 1. Only having a work trestle, instead of having a work trestle and a temporary on-site bridge, reduces the magnitude of in-water work. Decreased adverse effects under the ESA because of a shorter construction duration for the preferred alternative is considered the least harm.*

vii. *The Preliminary Construction Cost Estimate for Alternative 2 is $13 million, or an estimated $3 million (20%) less than Alternative 1. The Preliminary Service Life Estimate for Alternative 2 is $17.3 million, or an estimated $3 million (15%) less than Alternative 1. Based on historic cost expenditures for similar bridge construction projects (number of spans, physical conditions, location), this constitutes a substantial difference over Alternative 1. More information regarding cost estimates can be found in the PDR Appendix 2.*

In conclusion, FHWA has determined that Alternative 2 results in the least overall harm because:

- It is the alternative that requires the least amount of time for in-water work in areas with endangered species and their habitats; per 23 CFR 774.3(c)(1)(vi), resulting in less harm to endangered and threatened fish species and their habitats.
- At $13M in construction costs, it is $3M less than Alternative 1. At $17.3M in service life costs, it is $3M less than Alternative 1. This represents a substantial difference among the two alternatives[18]; per 23 CFR 774.3(c)(1)(vii).

Measures to Minimize Harm

The preferred alternative, Alternative 2 (Replacement on Upstream Alignment), would use four Section 4(f) resources: Cabot Mill, PPC, Frank J. Wood Bridge, and BTIHD as the result of permanent incorporation of land into transportation use. Measures to minimize harm to Section 4(f) resources normally serve to preserve the historic activities, features, or attributes of the site as agreed to within the Section 106 consultation process. This section outlines the series of measures MaineDOT and FHWA have taken to minimize and reduce harm to these properties.

While the Frank J. Wood Bridge would be removed, MaineDOT has endeavored to reduce the amount of land permanently used at other Section 4(f) resources by limiting use to no more than 0.2 acres (combined) of the Cabot Mill and the PPC. Additionally, for the purposes of mitigation, in response to Section 106 Consulting Parties views and input, FHWA considered the Frank J. Wood Bridge eligible for listing under Criteria C on the National Register when developing formal mitigation measures for the Section 106 Memorandum of Agreement (MOA) to resolve adverse effects under this statute.[19]

Additional planning measures to minimize harm were developed in consultation with the SHPO, Section 106 Consulting Parties, the Advisory Council on Historic Preservation (ACHP) and the public. MaineDOT and FHWA held two consulting parties meetings specifically seeking mitigation input, and opened a

[18] "Substantial" is informed by data presented in the Funding and Costs of Extraordinary Magnitude section of this Section 4(f) Evaluation, and **Appendix 8**: *Keeping our Bridges Safe Report*.

[19] See Section 106 MOA in **Appendix 6***: Section 106 Timeline, MOA, SHPO Concurrence, and Determination of Effects*.

thirty-day comment period seeking input on draft mitigation measures. Final mitigation measures include:

- *Opportunity for the Bridge Design Committee, Maine SHPO and Section 106 consulting parties to comment and review final design details of aesthetic aspects of the bridge, including public space, viewing, railing and lighting options to ensure compatibility with existing historic features,*
- *Historic American Engineering Recordation (HABS/HAER),*
- *Commitment to prepare and submit a National Register nomination for the previously determined eligible Brunswick Topsham Industrial Historic District,*
- *Outdoor interpretive panels depicting the Frank J. Wood Bridge history and significance,*
- *Conservation of existing bridge plaques,*
- *An illustrated booklet on the history of the river crossing,*
- *An indoor traveling exhibit sharing the story of the history of the river crossing, and*
- *Adaptive reuse or reuse of portions of the structure.*

ACHP served as a consulting party on this project and provided substantive written edits to the above measures before finalization. This agreement was executed on December 22nd, 2018.

Coordination

In November 2015, letters were sent to the towns of Brunswick and Topsham and all federally recognized tribes in Maine requesting information on historic resources in the project area. Responses were received in November and December of 2015 from the towns, Passamaquoddy Tribe, and Penobscot Nation. The historic architectural survey was started shortly after and approved as complete by the SHPO in May 2016. The SHPO concurred with the Area of Potential Effect (APE) and properties determined eligible for listing on the National Register by the MaineDOT in June 2016.

In June 2016, Section 106 consulting parties with demonstrated interests in the undertaking were established. Section 106 consulting parties meetings were subsequently held in 2016 on July 11, August 18, and October 27 to discuss and receive comments regarding the Section 106 APE, eligible historic properties, and to evaluate the effects on historic properties for each of the proposed alternatives. The ACHP participated in these meetings. In February 2017, the draft Section 106 determination of effect on historic properties for each alternative was developed and distributed to the Section 106 consulting parties, SHPO, and posted for public review and comment. Comments were received and incorporated.

In March 2017, the SHPO concurred with the determination of effect on historic properties for each alternative. A public meeting was held on April 5, 2017 utilizing an open house format and comments were received both at the meeting and during a comment period which closed on April 19, 2017. FHWA and MaineDOT responded to common questions on June 5, 2017 by posting to MaineDOT's public website and e-mailing to interested parties. MaineDOT and FHWA continued to consult under Section 106 and additional comments and concerns were received and considered through December 2017. A public meeting for the EA/Draft Section 4(f) Evaluation was held on March 28, 2018.

Based on input from the Section 106 Consulting Parties and SHPO, MaineDOT reevaluated the individual eligibility of the Frank J. Wood Bridge, ultimately finding that this resource was eligible for listing on the National Register.

Section 106 consulting parties meetings were held on June 27, 2018, and October 3, 2018 to discuss mitigation measures for adverse effects to historic properties.

Throughout Section 106 consultation FHWA addressed multiple comments regarding the SSHD, its historic connection to other resources in the APE, and potential Section 106 effects to the Summer Street Historic District (SSHD). As noted earlier, During the start of the Section 106 process, the Maine SHPO requested further information on the nature and duration of any association previous district residents may have had with the mills. The SHPO requested this, in part, due to views expressed by consulting parties. The research which followed did not reveal a significant connection between the remaining district and the mills (which make up the BTIHD). FHWA determined that a replacement option on upstream alignment would result in no adverse effect to the SSHD because it would not alter its features and attributes in a way that would diminish the integrity of the district. MHPC concurred with all FHWA final determinations and those concurrences are found in **Appendix 6***: Section 106 Timeline, MOA, SHPO Concurrence, and Determination of Effects*.

In addition to Section 106 Consulting Party forums, MaineDOT has held three general public meetings. In a February 2015 meeting, the public noted the following aspects as important to residents and interested parties: need for bicycle/pedestrian connectivity, aesthetics, importance of detour routes, costs and life cycle expectations, and historic resources. Two additional public meetings were held in April 2016 and April 2017.

Over a hundred public comments were received on the combined Environmental Assessment/Draft 4(f) Evaluation for this project. Responses to all substantive comments and questions on this document will be posted on MaineDOT's website with the final NEPA decision. Comments were evenly divided between residents and stakeholders whom advocated for replacement and those advocating for various rehabilitation alternatives (See **Appendix 12**: *EA Public Comments*).

The Department of Interior (DOI) submitted a formal comment concurring that there are no prudent and feasible alternatives to use of land from Section 4(f) properties, and that the proposed action includes all possible planning to minimize harm to Section 4(f) resources. As mentioned above, ACHP participated in the Section 106 consultation for this project and provided substantive comment and input.

Conclusion

Based upon the above considerations there is no feasible and prudent alternative to the use of land from the National Register Eligible *Cabot Mill*, National Register Eligible *Brunswick Topsham Industrial Historic District*, National Register Eligible *Frank J. Wood Bridge,* and the National Register Listed *Pejepscot Paper Company*. This proposed action includes all possible planning to minimize harm to these properties resulting from such use.