7.20 Cumulative Effects

7.20 CUMULATIVE EFFECTS

7.20.1 Introduction

This chapter identifies the resource areas of concern or sensitivity the Federal Railroad Administration (FRA) considered in determining cumulative impacts that would result from implementation of the Tier 1 Draft Environmental Impact Statement (Tier 1 Draft EIS) Action Alternatives.

7.20.1.1 Definition of Resources

Cumulative effects are defined as the combined incremental effects of the direct and indirect impacts of the Action Alternatives and other past, present, and future local, regional, and statewide projects on resource areas of concern or sensitivity (key resource areas).[1] This Tier 1 Draft EIS describes the cumulative effects of the following actions:

- **Action Alternatives**: Direct and indirect impacts of the Action Alternatives.
- **Other Transportation Projects**: Highway, transit, maritime, and aviation projects identified for future implementation.
- **Non-Transportation Projects**: Large-scale residential or commercial development or natural resource development activity.

Appendix E, Section 19, provides more detailed definitions of cumulative effects.

7.20.1.2 Effects-Assessment Methodology

The FRA developed a methodology for assessing cumulative effects (see Appendix E, Section E.19). The methodology and data sources explain how the FRA defined the Affected Environment and evaluated the effects on other environmental resources. Table 7.20-1 summarizes key factors associated with the methodology for cumulative effects.

7.20.2 Resource Overview

The analysis in this Tier 1 Draft EIS is a qualitative evaluation of the potential for the Action Alternatives to contribute to cumulative effects of development within the Study Area, which for the purposes of this analysis, includes connecting corridors.[2] This analysis does not provide a detailed quantitative analysis of past, present, and reasonably foreseeable future projects.

Connecticut has the greatest potential for the Action Alternatives to contribute to cumulative effects to transportation, land cover, hydrologic/water resources, and ecological resources from both other transportation projects and non-transportation projects. This finding regarding impacts in Connecticut is consistent across all Action Alternatives. However, among the Action Alternatives,

[1] Key resource areas noted in the cumulative effects analysis are those resource areas identified as having the greatest potential to contribute to cumulative effects in the Study Area based on the analysis presented in this Tier 1 Draft EIS. These are not necessarily the same "key resources" identified in this Tier 1 Draft EIS Summary, Chapter 7, or Chapter 9.

[2] Connecting corridors are passenger rail corridors that connect directly to another rail corridor (in this instance, the NEC) via a station transfer or through-train service.

the potential for cumulative effects is greatest in Alternative 3, where the Representative Route includes both improvements on the existing NEC and new right-of-way off the existing NEC. Other transportation projects would combine with the Action Alternatives to potentially improve the multimodal transportation network. However, undeveloped land covers would be developed, wetlands and coastal areas adjacent to the Long Island Sound would be negatively affected, and ecologically sensitive habitats would likely be subject to increased habitat fragmentation.

Table 7.20-1: Effect-Assessment Methodology Summary: Cumulative Effects

Data Source	Affected Environment	Type of Assessment	Outcome
Readily available information from federal documentation and websites	Study Area, expanded to include connecting corridors	Past trends that have resulted in the current condition of the resource and the potential for a resource's condition to improve or decline in the future	Identification of past, present, and future trends for resource areas
No Action Alternative Projects List	Study Area, expanded to include connecting corridors	Rail, highway, transit, and air travel improvement projects approved for future implementation	Identification of other transportation projects, present and future transportation actions, and the potential to affect key resource areas
Related Projects List	Study Area, expanded to include connecting corridors	Rail improvement projects approved for future implementation	Identification of other present and future transportation actions and the potential to affect key resource areas
Environmental Resource Chapters: ■ Transportation ■ Economic Effects (see Indirect Effects) ■ Land Cover ■ Hydrologic/Water Resources ■ Ecological Resources ■ Cultural Resources and Historic Properties ■ Environmental Justice ■ Air Quality ■ Climate Change	Environmental Consequences of the environmental resource	■ Existing condition of the environmental resource ■ Effects of the Action Alternatives on key resources areas	Identification of areas of key resources affected by the Action Alternatives
Federal and state regulatory and resource agencies	Study Area, expanded to include connecting corridors	Reasonably foreseeable non-transportation projects for future implementation	Identification of present and future non-transportation actions and the potential to affect key resource areas

Source: NEC FUTURE Cumulative Effects-Assessment Methodology, Appendix E., Section E.19, 2014

As described in Chapter 4, Alternatives Considered, the No Action Alternative assumes completion of planned and programmed improvements to highway, freight rail, transit, air, and maritime modes by 2040, consistent with the projects identified in the No Action Alternative Project List. The projects identified in the No Action Alternative Project List are inclusive of the other transportation projects. Therefore, the effect of the No Action Alternative on key resource areas is included in the consideration of effects of other transportation projects on key resource areas.

Cumulative effects from the Action Alternatives, other transportation projects, and non-transportation projects would likely combine to have a beneficial effect on air quality in Maryland. This finding is consistent and equivalent across all Action Alternatives. However, the cumulative effects of Alternative 3 and other transportation projects would convert undeveloped land covers to developed, and would likely negatively affect water resources associated with the Chesapeake Bay.

7.20.3 Cumulative Effects

7.20.3.1 Identification of Existing Conditions and Trends for Key Resources Potentially Affected by Action Alternatives

Key resources are those resources that have the greatest potential to be affected by the Action Alternatives thereby likely having the greatest potential to be affected by cumulative effects from other projects as well. The key resources discussed in this analysis include the following:

- Transportation
- Indirect Effects
- Land Cover
- Hydrologic/Water Resources
- Ecological Resources
- Cultural Resources and Historic Properties
- Environmental Justice
- Air Quality
- Climate Change

Table 7.20-2 presents the key resources and a summary of the existing conditions for each.

Table 7.20-2: Affected Environment: Existing Conditions and Trends of Key Resource Areas

Key Resource Areas	Existing Conditions and Trends
Transportation	■ In the Study Area growth in non-highway travel outpaced highway travel between 2006 and 2012. Intercity rail had the highest percentage growth in travel volume during this period. As passenger volumes continue to grow, it places additional pressure on infrastructure and adds to congestion. ■ The percentage of the workforce driving to work declined in 11 of the 13 metropolitan areas in the Study Area; public transportation commutation increased in nine metropolitan areas and regional rail ridership rose in eight of the metropolitan areas. ■ Total and per-capita highway vehicle miles traveled (VMT) throughout the United States have declined in recent years, reversing a decades-long trend of increasing VMT. Overall, VMT has decreased 4.9 percent from the high of 489 million in 2006 to the current 465 million in 2012. ■ From 2006 to 2012, in the Study Area total passenger trips on the public transportation network increased approximately 18 percent from 4.39 billion to 5.17 billion. Growth in public transportation trips was led by heavy rail (subway) which grew 34 percent from 2.42 billion to 3.24 billion trips annually in six years. ■ Intercity rail ridership increased throughout the NEC by approximately 24 percent between 2006 and 2012. New York Penn Station was the busiest intercity passenger rail station in the country in both 2006 and 2012. Washington Union Station experienced the second highest intercity passenger volume in the country with 5.0 million riders in 2012, followed by Philadelphia with the third largest intercity passenger volume with over 4 million passengers annually. ■ From 2006 to 2012, regional rail ridership within the Study Area increased approximately 4 percent, with major increases in passenger travel on: the Shore Line East service, where passenger trips grew by 40 percent and annual passenger miles grew by 52 percent; on VRE service, where ridership grew by approximately 32 percent; and on MARC service, where ridership grew by approximately 17 percent.
Indirect Effects	■ There is a projected population increase of approximately 7.1 million (14 percent) and a rise in employment of approximately 3.1 million (13 percent) in the Study Area. ■ The south region will continue growing at a considerably faster rate than the rest of the Study Area. ■ The share of the Study Area's growth that will occur within its four largest cities—Boston, New York City, Philadelphia, and Washington, D.C.—will continue to be approximately 68 percent.
Land Cover	■ Land cover is continuous throughout the Study Area, with developed land cover concentrated around the major metropolitan areas along the existing NEC. Undeveloped land cover is generally concentrated in rural and natural locations outside the metropolitan areas and within waterbodies. ■ Connecticut and Maryland contain the greatest concentrations of undeveloped land cover. Connecticut has the most acreage of Open Water, Forest/Shrub, and Wetlands, while Maryland has the most acreage of Grassland/Cultivated land cover.

Table 7.20-2: Affected Environment: Existing Conditions and Trends of Key Resource Areas (continued)

Key Resource Areas	Existing Conditions and Trends
Hydrologic/Water Resources	■ Metropolitan areas include Washington, D.C., Baltimore, Philadelphia, New York City, and Boston—all of which are built on and around major waterbodies such as oceans and large rivers. ■ The Action Alternatives and the existing NEC cross the Lower White and Red Clay Creeks in New Castle, DE, which are federally designated Wild and Scenic Rivers. Both waterbodies have associated freshwater wetlands, Special Flood Hazard Areas (SFHA), and a coastal zone that may be affected by the Action Alternatives. Neither waterbody has special water quality considerations. ■ Connecticut contains the most acres of SFHA, which are associated with the Long Island Sound. ■ Saltwater wetlands are associated with Gunpowder River and Chesapeake Bay in Maryland; Christina River in Delaware; Hackensack River and Hudson River in New Jersey; and the East River and Long Island Sound in Connecticut.
Ecological Resources	■ Ecological resources are dispersed throughout the Study Area, but tend to have higher concentrations in Connecticut, New York, and Maryland. States with the most Ecologically Sensitive Habitat (ESH) tend to be composed of large, undeveloped ESH areas with comparably small, concentrated metropolitan centers. ■ Connecticut tends to have the most ecologically sensitive resources since it is a large state that contains substantial tracts of contiguous forested and undeveloped land and coastline that span the entire state.
Cultural Resources and Historic Properties	■ Cultural resources are concentrated primarily in urban areas such as Washington, D.C.; Philadelphia, PA; New York City, NY; Providence, RI; and Boston, MA. The FRA identified 900 resources* within the Affected Environment of the existing NEC, 71 of which are National Historic Landmarks (NHL). ■ Some of the NHLs include the L'Enfant Plan (Washington, D.C.), William Trent House (New Jersey), New York Public Library (New York), First Baptist Meeting House (Rhode Island), and New England Conservatory of Music (Massachusetts).
Environmental Justice	■ Eight states plus Washington, D.C., cover 124 counties in the Study Area. According to the 2010 census, there are approximately 51 million people living in the Study Area, which includes approximately 20 million minority (39 percent) and 5 million (11 percent) low-income persons. ■ Of the cities within the Affected Environment, the most low-income and minority populations include New York, NY; Philadelphia, PA; Hartford, CT; and Boston, MA.
Air Quality	■ The Clean Air Act Amendments of 1990 direct the U.S. Environmental Protection Agency (EPA) to implement environmental policies and regulations that will ensure acceptable levels of air quality. ■ All states and counties are considered non-attainment or maintenance areas for at least one criteria pollutant, with the exception of Putnam County, NY, counties in Connecticut along the Long Island Sound, counties in Rhode Island, and Bristol, Norfolk, and Suffolk counties in Massachusetts. ■ According to Federal Highway Administration analysis using the EPA's MOVES2010b model, even if vehicle activity (vehicle miles traveled) increases by 102 percent (as assumed it will from 2010 to 2050), the total annual emissions for the priority mobile-source air toxics would be reduced by 83 percent.

Table 7.20-2: Affected Environment: Existing Conditions and Trends of Key Resource Areas (continued)

Key Resource Areas	Existing Conditions and Trends
Climate Change	■ Greenhouse gas (GHG) emissions—naturally occurring and human-caused (i.e., anthropogenic)—contribute to changes in the global climate. The gas CO_2 makes up the largest anthropogenic component of GHG emissions. Continued increases in global GHG emissions are projected to lead to more significant changes in extreme weather events and their associated risks to rail assets and operations. ■ For current climate conditions, the existing NEC is most at risk of sea level rise flooding (e.g., tidal flooding), coastal storm surge flooding, and riverine flooding in Connecticut along the Long Island Sound, in Hudson County in New Jersey, and in New Castle County in Delaware.

Source: NEC FUTURE team, 2014

* Counts are NRHP-listed and NHLs combined.

7.20.3.2 Identification of Effects of Action Alternatives on Key Resources

This section identifies the effects of the Action Alternatives within the Affected Environment on the key resource areas to identify areas of concern or sensitivity when determining cumulative impacts. Table 7.20-3 identifies the effects of Action Alternatives on key resources (listed below; see also Section 7.20.3.1 for trends in key resource areas affected by Action Alternatives) from Washington, D.C., to Boston, MA. Table 7.20-3 provides a qualitative summary of the potential locations of greatest effects on key resources as a result of the Action Alternatives. Appendix A, Mapping Atlas, identifies the locations of the environmental resources affected by the Action Alternatives. Key resource areas considered include:

- **Transportation:** The Action Alternatives would result in greater connectivity by expanding the reach of the Intercity rail network to serve new markets, increased frequency of service, and improved travel times between city-pairs. By providing more travel options, the Action Alternatives would generate significantly greater Intercity and Regional rail ridership compared to the No Action Alternative. Each of the Action Alternatives has the potential to change how people travel across the Study Area, reducing the share of trips by automobile, air, and intercity bus modes as travelers switch to passenger rail service. The Action Alternatives add new services to previously underserved or unserved metropolitan area markets with the potential to attract new rail trips. The Action Alternatives improve connectivity at Intercity stations by increasing the daily duration of rail service at many stations, making rail service available for longer periods of the day and hence more convenient to travelers. The Action Alternatives result in more convenient passenger rail with increased service frequency at many Regional rail and Intercity stations. As such, the Action Alternatives would have a beneficial effect on the transportation network.
- **Indirect:** Induced growth could encourage positive investment in resources or put a strain on resources within the Affected Environment. Induced growth would put a strain on resources within the Study Area. There is potential for induced growth, and thus indirect effects, to occur in certain areas. These areas include those that have potential for station area development and agglomeration effects, or are forecast to see high population and employment growth. In addition, areas that contain few or no environmental resources that could constrain development, contain other catalysts for development, and/or contain few to no development limitations have the potential for indirect effects. The potential to cause effects on the built and human environment is higher where induced growth occurs on developed land. Likewise, the potential to cause effects on the natural environment is higher where induced growth occurs on undeveloped land.
- **Land Cover:** Action Alternatives could result in conversions of undeveloped land cover (Open Water, Forest/Shrub, Grassland/Cultivated, and Wetlands) within the Representative Route to developed land cover. Potential conversions of land cover could result in acquisitions and/or displacements of private or public lands. Where there would be potential conversions of undeveloped land cover from non-transportation land use to a transportation land use, the Action Alternatives would have a negative effect on land cover.

Table 7.20-3: Environmental Consequences: Cumulative Effects – Impact of Action Alternatives on Key Resource Areas

Environmental Resources	Alternative 1	Alternative 2	Alternative 3
Transportation	■ Passenger rail travel between the Washington, D.C., and Boston metropolitan area pair would result in passenger rail trip making occurring more than five times the amount of the No Action Alternative instead of automobile travel. ■ Washington Union Station, Penn station New York, and Boston South Station have the greatest increase in daily boardings for Intercity and Regional rail service. ■ The largest reductions in travel times for Intercity trips occur between New Haven and Newark Penn Station. ■ Newark, DE has the greatest projected percentage growth in regional rail trips.	■ Passenger rail travel between the Washington, D.C., and Boston metropolitan area pair would result in passenger rail trip making occurring more than five times the amount of the No Action Alternative instead of automobile travel. ■ Washington Union Station, Penn station New York, and Boston South Station have the greatest increase in daily boardings for Intercity and Regional rail service. ■ The largest reductions in travel times for Intercity trips occur between New Haven and Newark Penn Station. ■ Newark, DE has the greatest projected percentage growth in regional rail trips.	■ Passenger rail travel between the Washington, D.C., and Boston metropolitan area pair would result in passenger rail trip making occurring more than five times the amount of the No Action Alternative instead of automobile travel. ■ Washington Union Station, Penn station New York, and Boston South Station have the greatest increase in daily boardings for Intercity and Regional rail service. ■ The largest reductions in travel time for Intercity trips occur between Boston South Station and Penn Station New York. ■ Newark, DE has the greatest projected percentage growth in regional rail trips.
Indirect Effects	■ Potential for induced growth spurred by improvements in rail capacity and accessibility is greatest in the Greater Boston Area. ■ Potential for induced growth spurred by improvements in travel time and rail capacity to New York City is greatest in the Greater Boston and Greater Providence areas.	■ Potential for induced growth spurred by improvements in rail capacity and accessibility is greatest in the Greater Hartford Area. ■ Potential for induced growth spurred by improvements in travel time and rail capacity to New York City is greatest in the New York-North Jersey Area and the Greater Hartford Area.	■ Potential for induced growth spurred by improvements in rail capacity and accessibility is greatest in the Greater Hartford area. ■ Potential for induced growth spurred by improvements in travel time and rail capacity to New York City is greatest in the New York-North Jersey Area, as well as to the north in the Greater Hartford, Providence, and Boston areas.

Table 7.20-3: Environmental Consequences: Cumulative Effects – Impact of Action Alternatives on Key Resource Areas (continued)

Environmental Resources	Alternative 1	Alternative 2	Alternative 3
Land Cover	■ Most of the potential conversions of undeveloped land cover within the Representative Route of this alternative would occur in Connecticut, where the addition of the Old Saybrook-Kenyon segment is proposed outside the existing NEC through New London County, CT.	■ Most of the potential conversions of undeveloped land cover within the Representative Route of this alternative would occur in Connecticut, where the addition of the New Haven-Hartford-Providence segment outside the existing NEC through New Haven, Hartford, Tolland, and Windham Counties, which include many acres of undeveloped land cover.	■ Most of the potential conversion of undeveloped land cover within the Representative Route of this alternative would occur in Connecticut and Maryland. ■ Maryland contains the most acres of potential conversion of undeveloped land cover for this alternative, where the Representative Route outside the existing NEC through Baltimore, Harford, and Cecil counties includes many acres of Forest/Shrub, Grassland/Cultivated, and Wetlands land cover.
Hydrologic/Water Resources	■ The most freshwater wetlands within the Representative Route of this alternative are present in Connecticut and Rhode Island. ■ Most saltwater wetlands and Coastal Zone Management Act (CZMA) boundaries are in Connecticut associated with the Long Island Sound.	■ The most freshwater wetlands within the Representative Route of this alternative are present in Connecticut and Rhode Island. ■ Most saltwater wetlands and CZMA boundaries are in Connecticut associated with the Long Island Sound.	■ The most freshwater wetlands within the Representative Route of this alternative are present in Maryland. ■ Most saltwater wetlands and CZMA boundaries are in Connecticut.

Table 7.20-3: Environmental Consequences: Cumulative Effects – Impact of Action Alternatives on Key Resource Areas (continued)

Environmental Resources	Alternative 1	Alternative 2	Alternative 3
Ecological Resources	■ Ecologically Sensitive Habitat (ESH) impacts within the Representative Route of this alternative are concentrated in Connecticut, which would have the most terrestrial and saltwater ESH impacts. Maryland would have the most freshwater ESH impacts. ■ Threatened and Endangered (T&E) species and their critical habitats are of particular concern in Connecticut and Maryland. ■ Essential Fish Habitat (EFH) crossings are concentrated in New York and Connecticut.	■ ESH impacts within the Representative Route of this alternative are concentrated in Connecticut, which would have the most terrestrial and saltwater ESH impacts. Maryland would have the most freshwater ESH impacts. ■ T&E species and their critical habitats are of particular concern in Connecticut and Maryland. ■ EFH crossings are concentrated in New York and Connecticut.	■ ESH impacts within the Representative Route of this alternative are concentrated in Connecticut, which would have the most terrestrial and saltwater ESH impacts. Maryland would have the most freshwater ESH impacts. ■ T&E species and their critical habitats are of particular concern in Connecticut and Maryland. ■ EFH crossings are concentrated in New York and Connecticut.
Cultural Resources and Historic Properties	■ The most cultural resources and historic properties within the Representative Route are concentrated in Connecticut.	■ The most cultural resources and historic properties within the Representative Route are concentrated in Connecticut.	■ The most cultural resources and historic properties within the Representative Route are concentrated in Connecticut.
Environmental Justice (EJ)	■ Greatest potential for negative environmental effects in EJ census tracts in Maryland and Connecticut. ■ Benefits of decrease travel time and increase service reliability and improved access, frequency, and mobility for the entire population, including EJ populations, throughout the Study Area.	■ Greatest potential for negative environmental effects in EJ census tracts in Pennsylvania, New Jersey, New York, and Connecticut. ■ Benefits of decrease travel time and increase service reliability and improved access, frequency, and mobility for the entire population, including EJ populations, throughout the Study Area.	■ Greatest potential for negative environmental effects in EJ census tracts in Maryland, Pennsylvania, New York, Connecticut, Rhode Island, and Massachusetts. ■ Benefits of decrease travel time and increase service reliability and improved access, frequency, and mobility for the entire population, including EJ populations, throughout the Study Area.

Table 7.20-3: Environmental Consequences: Cumulative Effects – Impact of Action Alternatives on Key Resource Areas (continued)

Environmental Resources	Alternative 1	Alternative 2	Alternative 3
Air Quality	■ Reduction in criteria pollutants in all states. ■ Reduction in mobile source air toxics (MSATs) in all states. ■ The net total CO_2 emissions decrease in all states.	■ Reduction in criteria pollutants in all states. ■ Reduction in MSATs in all states. ■ The net total CO_2 emissions decrease in all states.	■ Reduction in criteria pollutants in all states. ■ Reduction in MSATs in all states. ■ The net total CO_2 emissions decrease in all states.
Climate Change	■ The projected increase in the number of days per year above 95°F is most dramatic in Maryland, Washington, D.C., Delaware, Pennsylvania, and New Jersey. ■ Inundation risk is greatest in four counties in Connecticut (Fairfield, New Haven, Middlesex, and New London Counties).	■ The projected increase in the number of days per year above 95°F is most dramatic in Maryland, Washington, D.C., Delaware, Pennsylvania, and New Jersey. ■ Inundation risk is greatest in four counties in Connecticut (Fairfield, New Haven, Middlesex, and New London Counties).	■ The projected increase in the number of days per year above 95°F is most dramatic in Maryland, Washington, D.C., Delaware, Pennsylvania, and New Jersey. ■ Inundation risk is greatest in four counties in Connecticut (Fairfield, New Haven, Middlesex, and New London Counties).

Source: NEC FUTURE team, 2015

- **Hydrologic/Water Resources:** Action Alternatives potentially affect water resources including surface waters and hydrologic systems such as wetlands, coastal zones, and floodplains. Potential impacts on floodplains may involve the placement of fill that can divert flow and increase the base flood elevation. Changes to land use that increase impervious surface area and remove vegetation can increase stormwater runoff and degrade water quality. Overall, these changes would negatively affect wetlands and coastal areas by increasing erosion and sedimentation. Activities that involve crossing a water body or wetland are expected to have the most direct and significant impacts on hydrology and water resources.
- **Ecological Resources:** The Action Alternatives would have a negative effect on ecological resources, which include Threatened and Endangered (T&E) species, Ecologically Sensitive Habitats (ESH), and Essential Fish Habitats (EFH). Impacts to these sensitive habitats and the species that occur in these habitats would result from the construction and operation of the Action Alternatives. Those ESH and EFH within the Representative Route would be vulnerable to habitat fragmentation.
- **Cultural Resources and Historic Properties**: The Action Alternatives would have the potential to disturb cultural resources and historic properties within the Representative Route, or could have indirect effects on cultural resources and historic properties outside the Representative Route. Resources within the Representative Route are expected to have a higher likelihood of being directly affected by the implementation of an Action Alternative during construction or through operations. Direct physical and/or contextual disturbance to existing historic structures and/or districts sites may physically compromise existing historic sites, structures, districts, and known and unknown terrestrial and underwater archaeological sites. Indirect effects to these same resources occur outside the Representative Route and could include increased noise levels, increased vibration, changes to the visual setting, or changes to access. The sensitivity of cultural resources includes integrity of the surrounding landscape. Impacting the viewshed or site lines of historic properties could adversely affect these resources. As such, the Action Alternatives would have a negative effect on cultural resources and historic properties.
- **Environmental Justice:** The Action Alternatives would have the potential to affect Environmental Justice (EJ) census tracts. Unlike other key resource areas, the intensity of impacts to EJ census tracts are correlated to the cumulative effects of the Action Alternatives to land cover, parklands, cultural resources, visual and aesthetic resources, noise and vibration, hazardous materials, transportation, economic effects, air quality, and safety impacts within EJ census tracts. A benefit of the additional capacity, mobility and connectivity associated with the Action Alternatives is improved access to EJ communities along the NEC. Increased train frequencies, more connections, new locations and pricing available to travelers would provide more choices enabling people to have a greater selection and availability of jobs and services. The potential for negative impacts of the Action Alternatives in EJ census tracts occur where the Action Alternatives affect land cover, parklands, hazardous wastes and contaminated material sites, cultural resources, visual and aesthetic resources, and noise and vibration. Specific effects to EJ populations would be documented in subsequent Tier 2 analysis.
- **Air Quality:** The Action Alternatives would have a beneficial effect on emissions of criteria pollutants and GHGs from roadway vehicles since they would decrease vehicle miles traveled (VMT) and associated vehicle emissions. Changes in emissions of criteria pollutants and GHGs

due to aircraft travel are expected to decrease under the Action Alternatives, because of the potential mode shift from auto and aircraft travel to passenger rail. However, the Action Alternatives would increase emissions of criteria pollutants and GHGs from power plants because of the increased electrical requirements of the trains under the Action Alternatives. Nonetheless, the net result is a decrease in emissions of criteria pollutants and GHGs under the Action Alternatives.

- **Climate Change:** Inundation from flooding presents significant risks to rail assets by restricting access, undermining foundations, damaging assets, and increasing maintenance and repair requirements. Inundation may be permanent as a result of sea level rise or temporary due to storm surge or riverine flooding. Extreme heat events increase the risk of tracks buckling and potential electrical failures from sagging catenary wires and overheating power supplies. The Action Alternatives would have a beneficial effect on rail assets at risk of inundation by providing alternate routes that could assist in maintaining services if inundation issues (or other hazards) affect assets or services.

7.20.3.3 Identification of Effects of Past, Present, and Reasonably Foreseeable Future Actions

To fully understand the ramifications of multiple projects on key resource areas, trends affecting each of those key resources must be identified and considered. Consideration of these key resources includes review of implications from other transportation projects and non-transportation projects that have recently occurred, are under development, or have been proposed.

Other Transportation Projects

Other non-NEC FUTURE related transportation projects are rail, highway, transit, aviation, and maritime projects that are assumed to be built by the horizon year of 2040. Table 7.20-4 includes descriptions of the following transportation-related actions of other transportation projects that would affect the key resource areas:

- Planned and programmed improvements to highway, freight rail, transit, air, and maritime modes using current information compiled from federal, state, and regional transportation planning documents and from interviews with federal and state regulatory and resource agencies
- Actions throughout the Study Area expanded to include the connecting corridors
- Funded projects or projects with approved funding plans (e.g., federal or state committed funding)
- Funded or unfunded mandates
- Unfunded projects necessary to keep the railroad running

Table 7.20-4: Environmental Consequences: Qualitative Assessment of Resources Affected by Other Transportation Projects

State	Mode	Project Name	Description	Potential Key Resource Areas Most Affected
VA	Transit	Crystal City/Potomac Yard Transitway	■ Bus rapid transit and possible streetcar in a later phase connecting the blue and yellow lines of the D.C. Metrorail. ■ 21 station stops located in the Route 1 corridor in the city of Alexandria and Arlington County, VA.	■ Transportation
	Aviation	Dulles International Airport Fifth Runway (Runway 12R-30L)	■ Construct fifth runway parallel to existing runway 12–30 along the south side of Dulles Airport property roughly parallel to U.S. 50, west of Chantilly ~10,500 feet long and 150 feet wide named Runway 12R-30L (existing parallel runway will be renamed 12L-30R).	■ Transportation ■ Land Cover ■ Hydrologic/Water Resources
D.C.	Rail	Washington Union Station Master Plan	■ The Union Station Master Plan sets out a framework for rebuilding and expanding the station over the next 20 years. It provides a long-term, multi-phased vision for increased capacity with additional tracks and wider all high-level platforms; new amenities for passengers including sweeping modern concourses and retail spaces; and large-scale real estate development above the station's tracks.	■ Transportation ■ Cultural Resources and Historic Properties
MD	Rail	B&P Tunnels Repairs	■ Critical repairs necessary to maintain tunnels in operating condition.	■ Transportation
	Freight	National Gateway Freight Rail Corridor	■ Package of rail infrastructure and intermodal terminal projects that will enhance transportation service options along three major freight rail corridors owned and operated by CSX through the Midwest and along the Atlantic coast. ■ Improvements will allow trains to carry double-stacked containers, increase freight capacity and make the corridor more marketable to major East Coast ports and shippers.	■ Transportation ■ Hydrologic/Water Resources
	Maritime	Masonville Berth Construction	■ Construct new structure to replace Fairfield Marine Terminal Pier 4, a deficient pier of World War II vintage that is currently at the end of its useful life and the sole MPA berth for two large auto terminals (146 acres). ■ Convert Masonville Dredged Material Containment Facility into a marine terminal.	■ Land Cover ■ Hydrologic/Water Resources

Table 7.20-4: Environmental Consequences: Qualitative Assessment of Resources Affected by Other Transportation Projects (continued)

State	Mode	Project Name	Description	Potential Key Resource Areas Most Affected
MD (cont'd)	Rail	Susquehanna Bridge Rehabilitation/ Replacement	■ Replacement and/or rehabilitation of the Susquehanna River Bridge in Maryland, a chokepoint that precludes capacity increases on the Northeast Corridor. Engineering and environmental analysis is currently funded.	■ Transportation
PA	Rail	Keystone Corridor-Interlocking Design	■ The replacement and reconfiguration of tracks and improvements to signal and train control along the Philadelphia-Harrisburg Keystone Corridor to improve speed, reliability, and on-time performance. Engineering and environmental analysis is currently funded.	■ Transportation
NJ	Rail	Elizabeth Intermodal Station Reconstruction	■ The reconstruction of the passenger platforms and station building at Elizabeth Rail Station, including new elevators and stairs, ticket and operational office space, and retail space.	■ Transportation ■ Indirect
	Maritime	Delaware River Deepening	■ Deepen river to allow larger ships to access ports in PA and NJ.	■ Hydrologic/Water Resources
	Rail	Hunter Flyover	■ Construction of a grade-separated crossing of the Raritan Valley Line trains that would allow RVL to cross NEC tracks without interfering with any trains on Tracks 4, 3 and 2. It would permit trains to operate at faster speeds and provide substantial additional capacity, which could be used to support increased train volumes when required.	■ Transportation
NY	Rail	MTA-Long Island Rail Road (LIRR) – Penn Station New York (PSNY) Improvements	■ Investments in support of PSNY, focus on customer improvements, including the replacement of two-decade old elevators and escalators in the MTA-LIRR area of the station, along with rehabilitation of stairs, platform lighting and other station components. ■ The PSNY Complex Improvements project will advance early initiatives identified as part of the PSNY Visioning effort. The Vision project recommended enhancements to corridors, access points, lighting, signage and wayfinding and a general improving of the space available for passenger circulation.	■ Land Cover ■ Transportation

Table 7.20-4: Environmental Consequences: Qualitative Assessment of Resources Affected by Other Transportation Projects (continued)

State	Mode	Project Name	Description	Potential Key Resource Areas Most Affected
NY (cont'd)	Rail	East Side Access	■ Construction of new tunnels, rail system elements and a new station on Manhattan's East Side for Long Island Rail Road.	■ Transportation ■ Land Cover ■ Cultural and Historic
	Rail	Moynihan Station Phase 1	■ Construct Phase 1 of the Moynihan Station project, which includes below-grade transportation improvements, providing increased access points to the western portions of the Penn Station platforms, above- and below grade, expanded concourses and a new emergency ventilation system.	■ Transportation ■ Cultural and Historic ■ Climate Change
	Transit	Second Avenue Subway Phase I	■ Construct 2.3 miles of new subway on Manhattan's East Side from 96th Street to 63rd Street, connecting with the existing Broadway Line at the 63rd Street Station. ■ Construction of three new stations at 96th, 86th, and 72nd Streets. ■ Modification of the existing 63rd Street station. ■ New tunnels from 92nd to 63rd Streets Stations/ancillary facilities. ■ Track, signal, and power systems. ■ Procurement of 68 rail cars.	■ Transportation ■ Land Cover
	Freight	Hunts Point Freight Rail Improvement Project	■ Freight rail improvements at the Hunts Point Terminal Produce Market to modernize current infrastructure and create new circulation areas, reduce truck traffic and congestion, and improve air quality in the community.	■ Transportation ■ Air Quality ■ Climate Change
CT	Transit	Hartford-New Britain Busway	■ Construct New Britain - Hartford Busway (Busway), a priority project designed to allow for connections to some rail stations. ■ Provide direct linkage shuttle bus to Bradley Airport and over the long term, the feasibility of creating a rail connection to the terminal will be assessed.	■ Transportation ■ Air Quality
	Rail	New England Central Railroad Freight Rail Project	■ The project will complete state-of-good-repair improvements and the upgrade of rail and track infrastructure to accommodate national standard 286,000-pound (286K) gross-weight rail freight cars on the 55 miles of track running through the municipalities of New London, Waterford, Montville, Norwich, Franklin, Lebanon, Windham, Mansfield, Willington, and Stafford in eastern Connecticut.	■ Transportation

Table 7.20-4: Environmental Consequences: Qualitative Assessment of Resources Affected by Other Transportation Projects (continued)

State	Mode	Project Name	Description	Potential Key Resource Areas Most Affected
RI	Aviation	T.F. Green Airport	■ Extend Runway 5-23. ■ Expand Runway 16-34 Runway Safety Area. ■ Relocate Taxiway C farther from Runway 16-34. ■ Construct up to seven new gates.	■ Transportation ■ Land Cover ■ Hydrologic/Water Resources
MA	Maritime	New Russia Wharf Ferry Terminal and Route in Boston	■ Implement new ferry route in Boston Inner Harbor, from the existing terminal at the Charlestown Navy Yard to a new terminal at Russia Wharf, which is located in Fort Point Channel at Congress Street.	■ Transportation ■ Hydrologic/Water Resources ■ Cultural and Historic
	Rail	Springfield MA Union Station Project	■ Integrate multiple transit modes (bus, Amtrak, commuter rail, taxi, bicycle, and pedestrian). ■ Restore Terminal Building and its central concourse. Remove Baggage Building and construct a 24-bay bus terminal and a 146-space parking garage, with 4 additional bus bays on adjacent site. ■ Reopen and restore passenger tunnel linking the terminal building to rail boarding platforms and pedestrian access to the downtown. ■ Provide new stair and elevator access from re-opened passenger tunnel leading to passenger rail boarding platforms.	■ Transportation ■ Cultural and Historic
	Rail	MBTA Worcester Line Improvements/ Service Expansion	■ Increase commuter rail service on the Framingham/Worcester line between Boston and Worcester with the addition of three new inbound and three new outbound trains between the two cities for 31 stops arriving or departing Worcester station. ■ Agreement between CSX and the Commonwealth provides the Commonwealth ownership of the rail tracks and control of operations along the Framingham/Worcester line, allowing greater opportunities for MassDOT to not only improve service but also increase service between Boston and Worcester.	■ Transportation ■ Land Cover

Source: NEC FUTURE team, 2015

Table 7.20-4 is a representative list of present and future transportation projects that would occur in the Study Area by 2040. Many of these projects, such as the New Jersey High-Speed Rail Improvement Project known as Raceway, are transportation projects included in transportation planning documents spanning the current fiscal year. Other projects, such as the Atlantic City Expressway Widening, are included in long range planning documents. For a complete list of other transportation projects identified in the Study Area, see Appendix E, Section E.19.

The greatest numbers of other transportation-related projects are planned in Pennsylvania, New Jersey, and New York. As such, the implementation of the Action Alternatives in these states has the greatest potential for cumulative effects. The resources with the greatest potential effects are the transportation network itself, hydrologic/water resources, and land cover.

Non-Transportation Projects

Non-transportation projects include large-scale residential or commercial development projects, or natural resource development projects that are assumed to be built by the horizon year of 2040. Table 7.20-5 includes description of non-transportation actions that would affect the key resource areas. These actions include the following:

- Non-transportation infrastructure improvements that would occur near the Representative Route of the Action Alternatives
- Larger-scale development projects near stations of the Action Alternatives
- State efforts, plans, or publications related to land cover, air quality, or any other environmental resources that relate to key resource areas

Delaware and Massachusetts include the greatest number of non-transportation-related projects. As such, the implementation of the Action Alternatives in these states has the greatest potential for cumulative effects. The resources subject to the greatest potential effects are the transportation network itself, cultural resources, hydrologic/water resources, air quality, and land cover.

Table 7.20-5: Environmental Consequences: Qualitative Assessment of Resources Affected by Non-Transportation Projects

State	Project Name	Description	Potential Key Resource Areas Most Affected
VA	Potomac Shores Development	A public private partnership to spur new development, which includes the Potomac Shores VRE Station.	■ Transportation ■ Land Cover ■ Hydrologic/Water Resources
D.C.	Navy Yard Master Plan	The National Capital Planning Commission approved a modified final master plan for the Washington Navy Yard, which includes an addition of a 100-foot green buffer along the Potomac River riverfront.	■ Land Cover ■ Cultural Resources and Historic Properties
MD	Executive Order 01.01.2014.14 Strengthening Climate Action in Maryland	Executive Order expanding and modifying the Maryland Commission on Climate Change requiring state agencies to integrate GHG Reduction Act, consider climate change impacts. The Commission will report every year, on status of the state's efforts to address the causes and consequences of climate change, including future plans and recommendations for legislation, if any, for consideration by the General Assembly.	■ Air Quality ■ Climate Change
DE	Brownfield Redevelopment	Brownfield redevelopment plan to reuse 29 acres of mostly vacant and idle land east of the city's most-active riverfront redevelopment area, near the Southbridge community. Christina River LLC, led by owners of an export company off Pyles Lane in New Castle, secured the 10-year, 1 percent interest loan from the Department of Natural Resources and Environmental Control for the former New Arc Welding property. The site lies off Commerce Street partly along the Christina River, roughly opposite the 7th Street Peninsula.	■ Land Cover
	First State National Monument	First State National Monument's boundary encompasses a little over 1,000 acres of federal, state, and city lands in Kent and New Castle Counties in Delaware. This is a new national park, which consists of the Woodlawn Tract, New Castle Court House, New Castle Green, and Dover Green.	■ Cultural Resources and Historic Properties
	Division of Air Quality's (DAQ) 2015 Air Toxics Strategic Plan (2015 - 2019)	The DAQ's Air Toxics Strategic Plan is a five-year plan of activities to be undertaken by DAQ and its partners to reduce the risk of adverse health effects caused by the inhalation of air toxics.	■ Air Quality

Table 7.20-5: Environmental Consequences: Qualitative Assessment of Resources Affected by Non-Transportation Projects (continued)

State	Project Name	Description	Potential Key Resource Areas Most Affected
PA	Ardmore Redevelopment Project	A redevelopment in downtown Ardmore which includes a high-rise apartment and retail complex across from the Ardmore train station.	■ Transportation ■ Land Cover
CT	Stamford Transportation Center Transit-Oriented Development (TOD)	The TOD project will include approximately 600,000 square feet of commercial office space, 60,000 SF of street-level retail space, a hotel with approximately 150 rooms and approximately 150 residential units. The purpose of the proposed project is to: ■ Replace the aging 727-space original parking garage that services the Stamford Transportation Center with low maintenance, long service life facilities that accommodated a minimum of 1,000 spaces. ■ Expand the availability of parking and improve multimodal traffic, bicycle, and pedestrian flow around the Stamford Transportation Center and Station Place. ■ Minimize the public costs for construction and ongoing operations and maintenance of the parking facilities serving the Stamford Transportation Center by promoting TOD, which leverages and enhances the multimodal public transportation services provided by the Stamford Transportation Center.	■ Transportation ■ Land Cover
MA	Assembly Station	The MBTA opens Assembly Station. Assembly provides a link from Somerville's Assembly Row to Boston and is key to creating transit-oriented development in the area, MBTA officials said. Those plans call for more than 2.8 million square feet of office space; 635,000 square feet of retail shops, restaurants, and other entertainment outlets; and 1,813 homes at the site.	■ Transportation ■ Land Cover ■ Hydrologic/Water Resources
	Rehabilitation of Springfield Union Station	In December 2014, the Springfield City Council authorized spending $3.2 million toward the long-awaited, $75.6 million Union Station intermodal transportation project.	■ Transportation ■ Land Cover ■ Cultural and Historic

Source: NEC FUTURE team, 2014

7.20.3.4 Assessment of Cumulative Effects by Key Resource

To determine cumulative effects, this analysis focused on identifying locations within the Affected Environment of the key resource areas to identify areas of concern or sensitivity to cumulative impacts. This section broadly identifies and discloses the potential for incremental effects of the Action Alternatives to cause cumulative effects on key resource areas where other transportation projects or non-transportation projects also have the potential to affect those resource areas. The cumulative effects of the Action Alternatives, other transportation projects, and non-transportation projects have the potential to have beneficial or adverse effects on key resources. Areas of concern or sensitivity to cumulative effects are highlighted.

Table 7.20-6 through Table 7.20-8 identify the states containing key resources areas affected by the Action Alternatives, and the combined actions of other transportation projects, or non-transportation projects. See Appendix E, Section E.19 for the number of other transportation projects and non-transportation projects that affect key resources. A full list of other transportation projects and non-transportation projects identified in the Study Area by state is included in supporting documentation.

Alternative 1

Table 7.20-6: Environmental Consequences: Greatest Potential for Cumulative Effects on Key Resources – Alternative 1

State	Transportation	Indirect	Land Cover	Hydrologic/Water Resources	Ecological Resources	Cultural Resources and Historic Properties	Environmental Justice	Air Quality	Climate Change
VA	TN	T	TN	TN				AT	
D.C.	AT		TN	T		TN		A	A
MD	T	T	T	T	A		A	ATN	AN
DE	AT	T	N	T		N		AN	A
PA	TN		TN	T		T		A	A
NJ	AT	T	T	T				A	A
NY	AT	T	T	T	A	T		AT	T
CT	ATN		ATN	AT	AT	A	A	AT	A
RI	T	AT	T	AT				A	
MA	ATN	AT	TN	TN		TN		AT	
NH								A	

Source: NEC FUTURE team, 2015
A = Potential for Cumulative Effects due to the Action Alternatives
T = Potential for Cumulative Effects due to one or more other transportation projects
N = Potential for Cumulative Effects due to one or more non-transportation projects
Blank Cell = Minimal potential for cumulative effects identified for key resource area in the listed state.

The greatest potential to contribute to cumulative effects on key resource areas would occur in Maryland, Connecticut, and Massachusetts where the incremental effects of the Action

Alternatives, other transportation projects, and non-transportation projects have the potential to affect key resources. In Connecticut there would be potential for adverse effects to land cover due to potential conversion of undeveloped land cover, or potential acquisition or displacement of developed land cover. In both Connecticut and Massachusetts, there is the potential for a beneficial effect on transportation. In addition, the combined effect of the Action Alternatives and other transportation projects has the potential to negatively affect ecological resources and hydrological/water resources in Connecticut. Cumulative effects from the Action Alternatives and other transportation projects would likely have a beneficial effect on air quality in Virginia, Washington, D.C., Maryland, Delaware, New York, Connecticut, and Massachusetts.

Alternative 2

Table 7.20-7: Environmental Consequences: Greatest Potential for Cumulative Effects on Key Resources – Alternative 2

State	Transportation	Indirect	Land Cover	Hydrologic/Water Resources	Ecological Resources	Cultural Resources and Historic Properties	Environmental Justice	Air Quality	Climate Change
VA	TN	T	TN	TN				AT	
D.C.	AT		TN	T		TN		A	A
MD	T	T	T	T	A			ATN	AN
DE	AT	T	N	T		N		AN	A
PA	TN		TN	T		T	A	A	A
NJ	AT	AT	T	T			A	A	A
NY	AT	AT	T	T	A	T	A	AT	T
CT	ATN	A	ATN	AT	AT	A	A	AT	A
RI	T	T	T	AT				A	
MA	ATN	AT	TN	TN		TN		AT	
NH								A	

Source: NEC FUTURE team, 2015

A = Potential for Cumulative Effects due to the Action Alternatives

T = Potential for Cumulative Effects due to one or more other transportation projects

N = Potential for Cumulative Effects due to one or more non-transportation projects

Blank Cell = Minimal potential for cumulative effects identified for key resource area in the listed state.

The greatest potential to contribute to cumulative effects on key resource areas would occur in Maryland, Connecticut, and Massachusetts consistent with the findings of the cumulative effects analysis for Alternative 1. The combined effects of the Action Alternatives and other transportation projects have the potential to exacerbate indirect effects in New Jersey, New York, and Massachusetts, but would likely have a beneficial effect on air quality.

Alternative 3

The effects of Alternative 3 on the key resource areas identified in Table 7.20-8 consider the effects from Washington, D.C., to Boston for all possible route options.

Table 7.20-8: Environmental Consequences: Greatest Potential for Cumulative Effects on Key Resources – Alternative 3

State	Transportation	Indirect	Land Cover	Hydrologic/Water Resources	Ecological Resources	Cultural Resources and Historic Properties	Environmental Justice	Air Quality	Climate Change
VA	TN	T	TN	TN				AT	
D.C.	AT		TN	T		TN		A	A
MD	T	T	AT	AT			A	ATN	AN
DE	AT	T	N	T		N		AN	A
PA	TN		TN	T		T	A	A	A
NJ	T	AT	T	T				A	A
NY	AT	AT	T	T	A	T	A	AT	T
CT	TN	A	ATN	AT	AT	A	A	AT	A
RI	T	AT	T	T			A	A	
MA	ATN	AT	TN	TN		TN	A	AT	
NH								A	

Source: NEC FUTURE team, 2015
A = Potential for Cumulative Effects due to the Action Alternatives
T = Potential for Cumulative Effects due to one or more other transportation projects
N = Potential for Cumulative Effects due to one or more non-transportation projects
Blank Cell = Minimal potential for cumulative effects identified for key resource area in the listed state.

The greatest potential for cumulative effects on key resource areas would occur in Maryland, Connecticut, and Massachusetts, consistent with the findings of the cumulative effects analysis for Alternatives 1 and 2. The combined effects of the Action Alternatives and other transportation projects would likely have an adverse effect on land cover and hydrological/water resources in Maryland, as well as experience an increase the number of days per year above 95°F. There is potential for cumulative effects on key resources in Massachusetts, where the combined effects of the Action Alternatives, other transportation, and non-transportation projects together have the potential to affect transportation.

7.20.4 Summary

Implementation of all Action Alternatives, when considered in the context of implementation of other transportation and non-transportation projects, would have notable effects on air quality, cultural resources and historic properties, land cover, and transportation.

Many projects during development would convert undeveloped land to developed land, resulting in various effects such as increased impervious surfaces, runoff, and loss or fragmentation of ecological resources. These conversions of land cover can also result in the removal or demolition of cultural and historic properties. Unlike some resources, loss of cultural and historic properties is irreplaceable. For many of the negative effects identified, mitigation measures can be employed to minimize the overall cumulative effects. However, multiple effects on like resources within the same Study Area can result in much larger and more significant effects that may not be able to be mitigated. Examples of this are multiple areas of dredging and filling of wetlands within the same watershed, as site-specific effects of dredging and filling wetlands can have effects that span a watershed.

Air quality, EJ communities, and the transportation network would likely benefit, as the Action Alternatives, other transportation projects, and non-transportation projects coincide to improve the overall transportation network. The transportation improvements would increase the role of rail as part of the total travel market; provide a better overall transportation network that functions to more effectively and efficiently meet the needs of commuters, travelers, freight movers, residents, and businesses within the Study Area; reduce emissions of criteria pollutants and GHGs from roadway vehicles; and provide more travel choices enabling people to have a greater selection and availability of jobs and services.

A specific geographic area of note is Connecticut. As indicated in this analysis, Connecticut has many transportation and non-transportation initiatives ongoing or proposed. Implementation of these initiatives, in conjunction with the Action Alternatives, has the opportunity to provide numerous benefits to Connecticut but could also negatively affect numerous resources within this one state.

7.20.5 Subsequent Tier 2 Analysis

During subsequent Tier 2 planning efforts, the analyses would further define the specific cumulative impacts a project may have on key resources when considered with other past, present, and future actions. Coordination with state and federal resource agencies and metropolitan planning organizations would provide more specific information about local projects for consideration.