NEC FUTURE

7. Affected Environment, Environmental Consequences, and Mitigation Strategies

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INTRODUCTION AND GUIDE TO EFFECTS ASSESSMENT

Chapter 7 presents the environmental effects of the Preferred Alternative considered in the NEC FUTURE Tier 1 Final Environmental Impact Statement (Tier 1 Final EIS). The effect-assessment methodologies and analytical approaches are consistent with the Tier 1 Draft EIS (see Volume 2).

As explained in Chapter 4, Preferred Alternative, the Preferred Alternative comprises two elements—a Representative Route and representative Service Plan. Both elements are considered to be representational for analytical purposes in this Tier 1 Final EIS. Environmental analysis identifies either the physical impact to a resource as result of activities that take place within the Representative Route (e.g., conversion of land cover) or impacts that are a result of service (e.g., noise and vibration). Further explanation is provided in the **Calculation of Environmental Consequences** within this section. Throughout this chapter, the Preferred Alternative is compared to the No Action Alternative. To understand the effects of the No Action Alternative, the Federal Railroad Administration (FRA) developed a representational footprint for both the Existing NEC and Existing Hartford/Springfield Line to use as a point of reference for the physical impacts of the No Action Alternative (see **Approach to the Analysis of the No Action Alternative** within this section). Service components of the No Action Alternative consider existing and planned services through 2040.

Chapter 2, Readers' Guide, provides guidance on how to use this document and key concepts and terminologies applied in this Tier 1 Final EIS. Volume 1 of this Tier 1 Final EIS focuses on the Preferred Alternative for the NEC FUTURE investment program. Volume 2 of this Tier 1 Final EIS contains the full contents of the Tier 1 Draft EIS, with revisions such as data correction and text edits for clarification.

As described in Chapter 2, Readers' Guide, the Study Area includes a broad geographic area—extending 457 miles from Washington, D.C., in the south, to Boston, MA, in the north—covering over 50,000 square miles. The FRA developed an approach to defining the Preferred Alternative and its Representative Route in a way that allows for a meaningful programmatic assessment of potential Environmental Consequences. For each resource, the Affected Environment discussion describes existing conditions and sets the geographic boundaries where effects would occur; the Representative Route establishes a physical footprint for conducting Environmental Consequences assessments. The Context Area is a wider buffer around the Affected Environment that identifies adjacent or nearby environmental features potentially affected by the Preferred Alternative should the Representative Route shift. The FRA applied this approach throughout the environmental effects assessment of the Preferred Alternative presented in this chapter, as well as for the assessment of the Action Alternatives evaluated in the Tier 1 Draft EIS.

Analysis in this chapter reflects input from a variety of resource and regulatory agencies at the federal and state level. Agency coordination included regular multi-agency meetings and/or

webinars to communicate status of the program and updates on technical analyses and findings; discussions with smaller groups of relevant agencies about specific resource topics and regulatory compliance requirements; and Technical Working Groups focused on effects-assessment methodologies for specific resources. The various agencies have reviewed and commented on the effects-assessment methodologies, data, and preliminary Tier 1 Draft EIS findings as are relevant to their jurisdiction or specialty. The FRA used this input to develop this Tier 1 Final EIS. Input received during the comment period on the Tier 1 Draft EIS is reflected in this Tier 1 Final EIS.

BOUNDARIES FOR DEFINING ENVIRONMENTAL EFFECTS

The FRA uses the following concepts and terminology (first defined in Chapter 2, Readers' Guide) in the effects assessment for each resource:

- The **Existing NEC** refers to a representational footprint of the NEC; it is the same footprint used in the Tier 1 Draft EIS. The FRA developed this representational footprint to characterize environmental conditions of the NEC. The FRA standardized the width of the NEC to 150 feet, conservatively accounting for a four-track right-of-way between Washington, D.C., and Boston. The 150-foot width includes tracks, ballast, signals, etc.
- The **Existing Hartford/Springfield Line** refers to a representational footprint of the existing rail line between New Haven and Hartford, CT, and Springfield, MA. For consistency, the FRA developed this footprint of the Existing Hartford/Springfield Line using the same standardized width (150 feet) as that used for defining the Existing NEC, accounting for a four-track right-of-way, and inclusive of tracks, ballast, signals, etc. and catenary wires and poles associated with electrification. (This Tier 1 Final EIS does not identify the specific locations of traction power substations. Additional right-of-way may be required.)
- The **Representative Route** is the route associated with an Action Alternative, including the Preferred Alternative. The dimensions of the Representative Route's footprint are meant to be inclusive of all physical improvements proposed by an Alternative and are thus based on cross sections identifying potential construction type (e.g., tunnel, viaduct, bridge, embankment, at-grade) for analytical purposes that are applied to topography or land use type, stations, supporting facilities, and right-of-way requirements. The footprints associated with the Representative Route range from 150 feet to 300 feet wide because improvements associated with stations and supporting facilities (i.e., tracks, platforms, parking) could flare out beyond the dimensions of the Representative Route.[1]

  The Representative Route for the Preferred Alternative includes the Existing NEC + Hartford/Springfield Line, and any new segment(s), where applicable, since the Preferred Alternative includes improvements along the Existing NEC + Hartford/Springfield Line.
- The **Affected Environment** is the geographic area for which the FRA identified existing conditions and Environmental Consequences for the Action Alternatives in the Tier 1 Draft EIS

[1] The FRA did not evaluate other ancillary facilities, such as maintenance and storage yards, traction power substations, etc. in either the Tier 1 Draft EIS or this Tier 1 Final EIS. The FRA did not identify specific locations of these facilities as part of the development of alternatives (see Volume 2, Chapter 4).

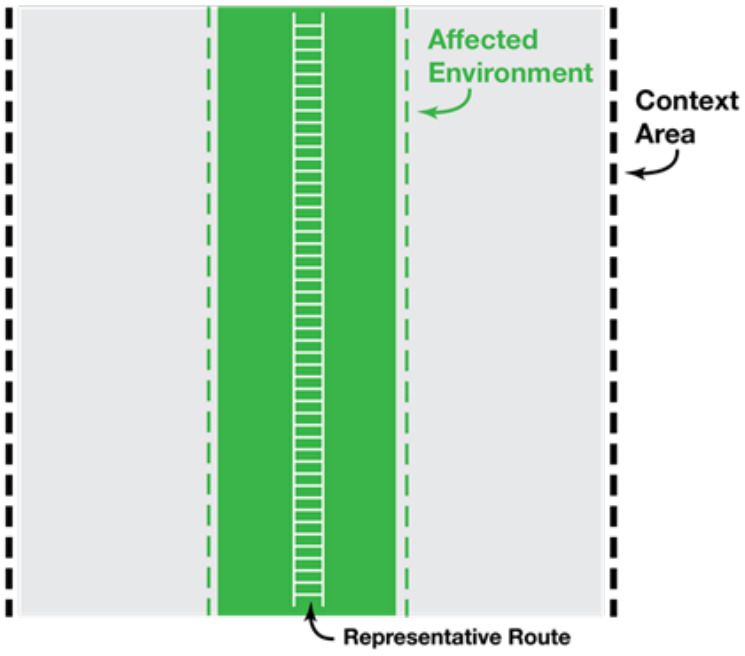
and Preferred Alternative in this Tier 1 Final EIS. The width of the Affected Environment varies based on the resource, but at a minimum is 2,000 feet wide, centered on the Representative Route. In some cases, where appropriate to accurately characterize the resource, the Affected Environment encompasses the entire Study Area.

Table 7-1 defines the Affected Environment widths used for each resource. The size of each Affected Environment reflects the nature of the resource itself and any relevant regulatory requirements that influence the area of effect the FRA considered in determining potential effects for each specific resource. Volume 2, Appendix E, provides the effects-assessment methodologies for each resource, in which the FRA provides the rationale used to determine the Affected Environment width for each resource.

- The **Context Area** is a broader geographic area that extends beyond the Affected Environment. This area allowed the FRA to qualitatively evaluate potential shifts in the Representative Route. The FRA defined the Context Area with a standardized 5-mile-wide uniform width, centered on the Representative Route, for all resources. For those resources where the Affected Environment encompasses the entire Study Area, the FRA did not perform Context Area analysis.

Figure 7-1 shows the relationships among the Representative Route, Affected Environment, and Context Area. These areas are all within the broader Study Area.

Figure 7-1: Representative Route, Affected Environment, and Context Area



Source: NEC FUTURE team, 2016

Table 7-1: Limits of Affected Environment by Resource

Resource	Description of Resource	Affected Environment
Land Cover	Land cover within the Affected Environment	½-mile-wide swath centered on the Representative Route for the Preferred Alternative
Agricultural Lands (Prime Farmlands and Timberlands)	Prime farmland and timberlands	2,000-foot-wide swath centered along Representative Route for the Preferred Alternative
Parklands and Wild and Scenic Rivers	Publicly owned parklands; parklands receiving funding from the Land and Water Conservation Fund Act; Rivers identified as Wild and Scenic by the National Rivers Inventory within the Affected Environment	2,000-foot-wide swath centered along Representative Route for the Preferred Alternative
Hydrologic/Water Resources	Coastal zones and saltwater wetlands, freshwater resources (including wetlands), and floodplains	2,000-foot-wide swath centered on the Representative Route
Ecological Resources	Critical habitats and federally listed Threatened & Endangered Species	3,000-foot-wide swath centered along Representative Route for the Preferred Alternative
Geologic Resources	Soil, geological, groundwater, and topographic resources	3,000-foot-wide swath centered along Representative Route for the Preferred Alternative
Hazardous Waste and Contaminated Material Sites	Known sources and potential suspected sources of contaminated and hazardous materials	2-mile-wide swath centered along Representative Route for the Preferred Alternative
Cultural Resources and Historic Properties	Resources listed in or eligible for listing in the National Register of Historic Places within the Affected Environment or identified as significant by Indian Tribes	1-mile-wide swath centered along Representative Route for the Preferred Alternative
Visual and Aesthetic Resources	Prominent visual resources and aesthetic qualities within the Affected Environment	1-mile-wide swath centered along Representative Route for the Preferred Alternative
Environmental Justice	Minority and low-income populations within the Affected Environment	1-mile-wide swath centered along Representative Route for the Preferred Alternative
Noise and Vibration	Ambient noise and vibration conditions, and noise-sensitive land cover categories	5,000-foot-wide swath centered along Representative Route for the Preferred Alternative
Air Quality *(including greenhouse gas emissions)*	Current attainment status for criteria pollutants established by the U.S. Environmental Protection Agency for air-sheds within the Study Area	Determined by metropolitan planning organization by state within the Study Area
Energy	Energy consumed, particularly by the transportation sector	Entire Study Area

Note: Chapter 5 addresses transportation effects, and Chapter 6 addresses economic effects and growth.

Table 7-1: Limits of Affected Environment by Resource (continued)

Resource	Description of Resource	Affected Environment
Climate Change and Adaptation *(excluding greenhouse gas emissions)*	Identification of areas susceptible to the impacts of climate change (sea-level rise, storm surge and/or extreme heat and cold events)	For flood hazards: 2,000-foot-wide swath
		For extreme heat and cold events: Entire Study Area
Section 4(f) and Section 6(f) Resources	Parklands converted to transportation use, including publicly owned public parks, recreation areas, and wildlife/waterfowl refuges	2,000-foot-wide swath centered along Representative Route for the Preferred Alternative
	Converted lands or facilities that were acquired with Land and Water Conservation Fund Act funds	
	Historic resources converted to transportation use, including historic sites of local, state or national significance (eligible or listed)	1-mile-wide swath centered along Representative Route for the Preferred Alternative
Electromagnetic Fields and Electromagnetic Interference	Electromagnetic Fields (EMF) associated with electric conventional or high-speed train operations and electromagnetic interference that occurs when EMFs are produced	2,000-foot-wide swath centered on Representative Route for the Preferred Alternative
Safety	Operational, infrastructure and overall modal safety	Entire Study Area
Public Health	Potential public health-related effects for each of the relevant Tier 1 Final EIS resource areas	As per the resource areas
Cumulative Effects	Combined result of the incremental direct and indirect effects of this Tier 1 Final EIS Preferred Alternative as well as the effects of other past, present, and reasonably foreseeable future actions, regardless of agency, on key resources	Study Area, expanded to include connecting corridors

Source: NEC FUTURE team, 2016

Calculation of Environmental Consequences

The FRA used the same effects-assessment methodologies and data sources for this Tier 1 Final EIS as was used in the Tier 1 Draft EIS. However, input during the public comment period did influence some minor changes to the presentation, review, or additional analysis of resources for this Tier 1 Final EIS. For example, the U.S. Department of the Interior (U.S. DOI), National Park Service division requested analysis of historic and scenic trails be included in this Tier 1 Final EIS. The FRA complied and has included analysis of these trails in this Tier 1 Final EIS. Wherever the analysis or data sources have changed since the Tier 1 Draft EIS, it has been noted in the appropriate sections of relevant chapters.

The FRA describes the Environmental Consequences of the Preferred Alternative either quantitatively or qualitatively, depending on the resource. Quantitative analyses rely on geographic information system data and mapping to calculate the effects of the footprint of the Preferred Alternative, or rely on service data to calculate the effects of the service proposed by the Preferred Alternative. Qualitative analysis may consider information from other sources, such as existing reports and studies, to assess potential effects. The FRA attributes Environmental Consequences to one or both of the following:

- **Physical footprint of the Preferred Alternative –** Environmental Consequences are based on either estimates of specific quantities of the resource (e.g., number of resources or resource-specific units of measurement such as acreage or linear feet) or the presence/absence of resources within the footprints of new or upgraded stations and within the Representative Route.

  Chapter 7 provides information regarding the presence/absence of resources within the footprints of new or upgraded stations. Appendix EE provides specific quantities of resources that could be affected within the footprints of stations.[2] (See Chapter 4, Section 4.5.5, for more information on station area planning.)

  The calculation of footprint-related effects within the Representative Route for each resource in Chapter 7 assumes the use of six construction types: tunnel, trench, at-grade, embankment, aerial structure (viaduct), and major bridge. The analysis also uses these construction types to identify areas where impacts could be effectively mitigated (i.e., as described below, certain construction types were excluded from the calculation of impacts because they inherently would not cause impact). The construction types used in this analysis are representative, and as such, will be revisited during subsequent planning and environmental analysis at the (Tier 2) project level, where changes to construction type may result in additional or different impacts. *Every resource in Chapter 7 assumes that potential impacts would occur under all six construction types, with the exception of the following resources*:

  – **Land Cover:** The FRA excluded tunnels and major bridges in the analysis of potential land conversions because of the grade separation and resulting negligible conversion of land cover type at the surface. The FRA considered all construction types in the acquisitions and displacements analysis.

[2] Stations are listed by state, county, and identification number in Chapter 4, Preferred Alternative (Table 4-7).

  - **Hydrologic/Water Resources:** The FRA excluded tunnels in the analysis of wetlands (both freshwater and saltwater) and floodplains because tunnels typically go beneath the resources and therefore avoid or greatly minimize the impact to a resource. The FRA recognizes that construction of tunnels can result in effects on hydrologic/water resources. However, site-specific construction methods and associated impacts have not been evaluated for this Tier 1 EIS. Confirmation of construction types, identification of site-specific impacts, and development of appropriate mitigation to minimize impacts will be conducted during Tier 2 project studies based on site conditions and construction methods used.
  - **Noise:** The FRA excluded tunnels from the noise propagation effects analysis because tunnels would create a barrier between the noise source and a potentially sensitive receptor. While tunnels are excluded from the noise analysis, they are included in the calculation of vibration velocity levels (VdB) in the vibration analysis. Tier 2 project studies will include refinement of all construction types, full identification of noise as well as vibration effects, and development of mitigation measures and designs to address site-specific impacts that will minimize noise and vibration effects.

- **Service characteristics of the Preferred Alternative –** Environmental Consequences are based on end-to-end estimates of service characteristics, including metropolitan areas and city-pairs served, type of service (e.g., Intercity or Regional, frequency, travel times), type of equipment (e.g., diesel or electric, speed profiles), user benefits (e.g., passenger trips, passenger miles, train miles, vehicle miles traveled), costs (i.e., capital, operation and maintenance), and revenues. These end-to-end statistics inform the environmental effects assessment for resource areas such as transportation, economic effects, environmental justice, noise and vibration, and air quality.

Each of the resource-specific sections presents direct effects. Direct effects include effects related to encroachment (even if separated by space or time) or specific impacts that result from an action affecting a particular resource. Chapter 6 presents indirect effects, defined as those effects related to induced growth and development resulting from construction and operation of the Preferred Alternative.

Appendix AA, Mapping Atlas of the Preferred Alternative, illustrates the Representative Route (part 1) and construction types (part 2) used in the analysis. Appendix EE provides quantitative data by county for environmental resources identified within the Affected Environment, Representative Route, and Context Area.

Analysis of the No Action Alternative

- Physical limits of the No Action Alternative are unknown; therefore, quantitative analysis for a footprint of the No Action Alternative is not presented.
- Data for the Existing NEC + Hartford/Springfield Line are presented as a point of reference for the footprint of the majority of passenger rail investments included in the No Action Alternative.

Approach to the Analysis of the No Action Alternative

The No Action Alternative incorporates improvements such as track and signal upgrades within the Existing NEC right-of-way and planned improvements to the Existing Hartford/Springfield Line (see Volume 2, Appendix B.1, *No Action Alternative Report*). It also includes projects

that may extend beyond the existing right-of-way, such as bridge and station rehabilitation or expansion projects, and other non-rail transportation projects. Because some of the projects included within the No Action Alternative are still in the planning stages of development, the physical limits of the No Action Alternative are not well defined. As a result, calculating the footprint-related Environmental Consequences for the No Action Alternative was not possible. However, ***for the purposes of comparison against the Action Alternatives and Preferred Alternative, the FRA used the Existing NEC + Hartford/Springfield Line as a point of reference for understanding potential footprint-related effects of the rail projects included in the No Action Alternative*** because the physical footprint of improvements associated with rail projects included in the No Action Alternative will occur primarily within the physical footprint of the Existing NEC and Hartford/Springfield Line.[3] As stated earlier in this section, the FRA assumed the footprint associated with the Existing NEC + Hartford/Springfield Line to be 150 feet wide, which conservatively covers the width of a four-track railroad. The Preferred Alternative also includes the improvements that are assumed to occur as part of the No Action Alternative.

Therefore, in Chapter 7 of this Tier 1 Final EIS:

- The FRA considered resources within the Existing NEC + Hartford/Springfield Line as a point of reference for the resources that may be affected by the No Action Alternative. The Existing NEC and Hartford/Springfield Line is referenced in both the Affected Environment and Environmental Consequences sections of this Tier 1 Final EIS.
- The FRA developed an "Affected Environment" for each resource. Existing conditions within this Affected Environment of the Existing NEC + Hartford/Springfield Line are shown for each resource in order for the FRA to make valid comparisons between the Affected Environment of the No Action Alternative (as represented by the Existing NEC + Hartford/Springfield Line) and the Affected Environment of the Preferred Alternative.
- There is a qualitative discussion of potential effects of the No Action Alternative for all resources. The FRA used this qualitative assessment to further understand and assess NEC FUTURE's potential contributions to cumulative effects on identified resources.
- In presenting footprint-related Environmental Consequences for the Preferred Alternative, the numerical quantities of impacts include the quantities that occur within the Existing NEC + Hartford/Springfield Line (i.e., as part of the No Action Alternative). This inclusion of impacts of the No Action Alternative is appropriate because improvements on the Existing NEC + Hartford/Springfield Line included in the No Action Alternative are also part of the Preferred Alternative.
- The FRA did quantify service-related effects of the No Action Alternative. Service data for the No Action Alternative established a baseline of service against which the FRA compared and evaluated the Preferred Alternative. These service data included quantifiable timetable-related data such as scheduled trains by time of day, stopping patterns, and travel times, as well as equipment types.

[3] Most rail improvement projects included in the No Action Alternative will take place within the Existing NEC and Hartford/Springfield right-of-way, except for some projects underway such as East Side Access in New York City.

This approach to the analysis of the No Action Alternative is consistent with the following:

- The programmatic level of detail across both the No Action Alternative and the Preferred Alternative, and inclusion of improvements to the Existing NEC + Hartford/Springfield Line in the Preferred Alternative.
- National Environmental Policy Act (NEPA) practice, particularly where the projects included as part of the No Action Alternative are an integral component of the Preferred Alternative.

Level of Detail and Data Considerations

Level of Detail

- Broad environmental review
- Analysis based on "readily available" data and information
- No field work or subsurface testing
- Detailed analysis will be carried out during Tier 2 actions

The interaction of resource-specific data (e.g., land cover, demographics, and ecological resources), service data, and information about the Preferred Alternative drives the Affected Environment and Environmental Consequences analyses of resources evaluated in Chapter 7. As described in Chapter 2, Readers' Guide, the FRA analyzed readily available secondary source data (e.g., geographic information system [GIS]-based, published reports, technical analyses), and did not conduct fieldwork or subsurface testing of any kind as part of this Tier 1 Final EIS. The FRA reviewed the data carefully to ensure a uniform level of detail since the data were collected from a variety of sources. For the resources assessed in Chapter 7 of this Tier 1 Final EIS, the FRA collected data for each resource in 2012; data were collected at that time for the latest year in which a complete year of data was available, depending on the resource and availability of data. For a list of data sources used for each resource, refer to Volume 2, Appendix E, for the individual resource methodologies. For this Tier 1 Final EIS, the FRA updated information for the Preferred Alternative as available and as appropriate to inform the decision made. For example, the FRA updated the threatened and endangered species list for this Tier 1 Final EIS as requested by the USFWS during the public comment period. Information is provided within the appropriate sections of this chapter and other chapters wherever data sources were updated.

Data Considerations

- Quantities associated with "footprint" calculations are based on GIS mapping overlays.
- Data are tallied by state.
- Highest level of detail is the county level and is presented in Appendix EE.

Chapter 7 presents data as totals for each of the affected states and Washington, D.C. Areas of interest and corresponding data are called out by county as needed in each resource section of Chapter 7. The highest level of detail collected and presented is at the county level; data were collected for each county for each resource and is presented in Appendix EE.

HOW TO READ CHAPTER 7

Chapter 7 analyzes impacts to the resources listed in Table 7-2 in accordance with NEPA and FRA's Procedures for Considering Environmental Impacts (64 Fed. Reg. 28545). Within Chapter 7, each resource is evaluated within its own chapter as noted in Table 7-2. Other resources evaluated in this Tier 1 Final EIS, including transportation effects, economic effects and growth and indirect effects, and construction effects are addressed in Chapters 5, 6, and 8, respectively.

Table 7-2: Chapter Number/Resource Area Considered

Chapter	Resource
7.2	Land Cover
7.3	Agricultural Lands (Prime Farmland and Timberlands)
7.4	Parklands and Wild and Scenic Rivers
7.5	Hydrologic/Water Resources
7.6	Ecological Resources
7.7	Geologic Resources
7.8	Hazardous Waste and Contaminated Material
7.9	Cultural Resources and Historic Properties
7.10	Visual and Aesthetic Resources
7.11	Environmental Justice
7.12	Noise and Vibration
7.13	Air Quality
7.14	Energy
7.15	Climate Change and Adaptation
7.16	Section 4(f) and Section 6(f) Resources
7.17	Electromagnetic Fields and Electromagnetic Interference
7.18	Safety
7.19	Public Health
7.20	Cumulative Effects
7.21	Irreversible and Irretrievable Commitment of Resources

ORGANIZATION OF CHAPTER 7 RESOURCE AREAS

This Tier 1 Final EIS presents a summary of findings by state; Appendix EE provides details for each state by county. Appendix AA, Mapping Atlas of the Preferred Alternative, presents the Preferred Alternative in relation to mapped resources (Part 1) and presents the Representative Route of the Preferred Alternative, highlighting construction types used for analysis (Part 2). Each resource chapter provides a summary of the Affected Environment and the Environmental Consequences identified for the Preferred Alternative and Context Area, as well as a description of the effects of the No Action Alternative. Analysis is also presented for specific elements of the Preferred Alternative, such as new or upgraded segments (described in Chapter 4). In addition, a comparison of the Preferred Alternative to Action Alternatives evaluated in the Tier 1 Draft EIS is provided. Each chapter provides potential mitigation and strategies and discusses the needs for subsequent Tier 2 analysis. To review the detailed effects-assessment methodology for each resource, refer to Volume 2, Appendix E.