7.7 Geologic Resources

7.7 GEOLOGIC RESOURCES

7.7.1 Introduction

Understanding geologic features can influence design and construction practices because certain geologic features are considered resources while others are considered potential hazards (see Section 7.7.1.1).

This chapter identifies geologic resources that are intersected by the Representative Routes of the Tier 1 Draft Environmental Impact Statement (Tier 1 Draft EIS) Action Alternatives. Appendix E, Section E.07, provides both the effects-assessment methodology that was used to evaluate geologic resources and hazards and the data supporting the analysis.

7.7.1.1 Definition of Resource

Geologic resources and hazards are defined below and include descriptions of the different types of geologic resources and hazards assessed in this Tier 1 Draft EIS:

- ***Geologic Resources*** include sole source aquifers, naturally occurring minerals, and active/inactive mines.[1]
  - ***Sole source aquifers:*** Sole source aquifers are aquifers that supply at least 50 percent of the drinking water consumed in the area overlying the aquifer. The U.S. Environmental Protection Agency (EPA) regulates disturbances to these sole source aquifers.
  - ***Mineral resources:*** Construction of tunnels in areas with known mineral resources may require additional studies to evaluate potentially unstable foundations in mined areas or potential subsurface constraints such as abandoned or filled mines or tunnels. There may also be impacts to active mining or mineral operations that could require compensation to the owner(s) of those operations.
- ***Geologic Hazards*** include seismic hazards (active geologic faults or fractures), karst terrain (characterized by sinkholes and caves), unstable soils (landslide susceptibility), naturally occurring asbestos, and acid producing soils.
  - ***Seismic hazards:*** Seismic hazards are typically associated with a geologic fault or fracture. Areas requiring tunnels or bridges may be especially susceptible to such hazards.
  - ***Karst terrain:*** Areas with karst terrain are susceptible to sinkholes, groundwater contamination, and erosion resulting from water drainage.
  - ***Landslide susceptibility:*** Construction and tunneling in areas that are susceptible to landslides may be challenging from an engineering perspective in order to incorporate design principles that minimize hazards to workers during construction and the future utilization of the corridor itself.

[1] Inactive mines were not included in the analysis because of the lack of complete and timely data. The Tier 2 process would perform additional analysis.

- ***Naturally occurring asbestos:*** Without the proper protection and engineering controls, excavating or tunneling in areas containing naturally occurring asbestos formations can be dangerous to the health and safety of site workers. Excavating in areas with naturally occurring asbestos is subject to U.S. Department of Labor–Occupational Safety and Health Administration (OSHA) regulations to minimize exposure to workers. Excavating in areas with naturally occurring asbestos typically requires engineering controls, site worker training and awareness, site monitoring, and regulatory interaction and reporting, which can increase the construction cost and duration in these areas.
- ***Acid producing soils:*** Certain unconsolidated soils and sediments in the Atlantic coastal plain could contain minerals that may produce enough acidity to degrade concrete and steel structures to the point of failure. Surface water run-off containing acidic discharges could also degrade the environment. Locating and identifying acid producing soils is necessary to properly design structures and to mitigate against any potential negative consequences during the construction process.

Appendix E, Section E.07, provides more-detailed definitions of geologic resources and hazards.

7.7.1.2 Effects-Assessment Methodology

The Federal Railroad Administration (FRA) developed an effects-assessment methodology for each of the resources examined in this Tier 1 Draft EIS. The effects-assessment methodology defines each resource and data source, and explains how the Affected Environment was defined and established and how the effects on each resource were evaluated and reported. Table 7.7-1 summarizes key factors associated with the effects-assessment methodology for examining effects on geologic resources and construction constraints caused by geologic hazards.

Table 7.7-1: Effects-Assessment Methodology Summary: Geologic Resources

Resource	Affected Environment	Type of Assessment	Outcome
Geologic Resources	3,000-foot-wide swath centered along Representative Route for each Action Alternative	▪ **Presence/Absence:** Seismic hazards; sole source aquifers; karst terrain; naturally occurring asbestos; acid producing soils; landslide susceptibility ▪ **Number of Resources:** mineral resources: producer, occurrence, plant, inactive producer;* active mines	Identification of the presence of geologic resources within the Affected Environment and intersected by the Representative Routes.

Source: NEC FUTURE Geologic Resources Effects-Assessment Methodology, Appendix E, Section E.07, 2014

* A plant is a facility that processes raw minerals. A producer, either past or present, is a location where a raw mineral is/was produced from (e.g., mine, ore bank, pit)

7.7.2 Resource Overview

The southern portion of the Study Area can be geographically characterized by a mix of low-lying areas and gentle changes in topography that transition to higher elevations and sharper changes in topography in the north. Notable geologic features in the Study Area include the Chesapeake Bay, Long Island Sound, and Appalachian Mountains.

With regard to Environmental Consequences, the Action Alternatives may affect geologic resources, but geologic hazards may also affect decisions about the location, design, and construction methods for any of the Action Alternatives. Effects would depend on the type of geologic resource or hazard present and construction method proposed. Depending on construction type, effects would be generally associated with earth-moving construction activities such as drilling, boring, and earth removal. For example, tunneling would have a higher likelihood of affecting a geologic feature (such as sole source aquifers) than at-grade construction activities. However, given the level of detail regarding construction activities and alignments being analyzed for this Tier 1 Draft EIS and generalized locations of the geologic resources and hazards, the FRA did not identify site-specific effects.

Although different types of geologic resources and hazards (as defined in Section 7.7.1.1) are present within the Affected Environment and within the footprint of the Action Alternatives, only certain resources and hazards are highlighted in this section. The resources and hazards highlighted may present significant regulatory challenges, potential associated safety issues, and engineering costs related to construction, or other potential geographic conflicts that would need to be assessed. Appendix E, Section E.07, includes an inventory of the larger set of geologic features (listed by state and county) within the Affected Environment and that are intersected by the existing NEC and Action Alternatives.

7.7.3 Affected Environment

The FRA analyzed the Affected Environment for the existing Northeast Corridor and each Action Alternative for the existence and/or occurrence of geologic resources and geologic hazards. Appendix E, Section E.07, notes these geologic features by state and county.

Notable resources within the Affected Environment include sole source aquifers, naturally occurring asbestos, karst terrain, and soils associated with moderate or high landslide susceptibility. The former two resources are notable to highlight within the Affected Environment because they may represent significant regulatory challenges. The latter two resources are notable to highlight within the Affected Environment due to potential associated safety issues and engineering costs related to construction. ***Sole source aquifers*** supply drinking water to many areas within the Affected Environment and occur in the following locations:

▸ States of Delaware and Pennsylvania ▸ Mercer and Middlesex Counties, NJ ▸ Queens and Kings Counties, NY ▸ New London County, CT ▸ Washington and Kent Counties, RI ▸ Bristol and Norfolk Counties, MA	Existing NEC and all Action Alternatives
▸ Nassau and Suffolk Counties, NY	Alternative 3 (New York City to Hartford via Long Island)

Naturally occurring asbestos exists in soils within the Affected Environments of the existing NEC and all Action Alternatives in Baltimore City, MD, and Hudson County, NJ.

Karst terrain occurs within the Affected Environment in Baltimore and Harford Counties, MD, within Alternative 3.

Soils associated with moderate or high landslide susceptibility occur within the Affected Environments of the existing NEC and all Action Alternatives in Baltimore, Baltimore City, Harford and Cecil Counties, MD; New Castle County, DE; Delaware, Philadelphia, and Bucks Counties, PA; and Suffolk County, MA. Additionally, these soils occur within the Affected Environment of Alternatives 2 and 3 in Hartford County, CT, and in Norfolk and Middlesex Counties, MA, in the Hartford to Boston via Worcester route option of Alternative 3.

7.7.4 Environmental Consequences

This analysis highlights where certain geologic resources and hazards—including sole source aquifers, soils associated with moderate and high landslide susceptibility, naturally occurring asbestos, and karst terrain—intersect with the existing NEC and the Representative Route for each Action Alternative. These four geologic resources and hazards may present significant regulatory challenges or potential associated safety issues and engineering costs related to construction. Appendix E, Section E.07, includes an inventory of a larger set of geologic features (listed by state and county) that are intersected by the existing NEC and Action Alternatives.

Table 7.7-2 and Table 7.7-3 present areas where the Representative Routes intersect sole source aquifers and soils associated with moderate or high landslide susceptibility. The potential exists for the existing NEC and all the Action Alternatives to encounter these geologic resources and hazards. In addition, karst terrain exists only in Harford County, MD, within the Representative Route of Alternative 3, and no soils that contain naturally occurring asbestos exist within the existing NEC or Representative Routes of any of the Action Alternatives.

Table 7.7-2: Environmental Consequences: Representative Route – Geologic Resources

State	Geologic Resource/Hazard	Existing NEC	Alternative 1*	Alternative 2*	Alternative 3*
MD	Landslide Susceptibility	X	X	X	X
DE	Sole Source Aquifer	X	X	X	X
PA	Sole Source Aquifer	X	X	X	X
NJ	Sole Source Aquifer	X	X	X	X
NY	Sole Source Aquifer	X	X	X	X
CT	Sole Source Aquifer	X	X	X	X
	Landslide Susceptibility			X	X
RI	Sole Source Aquifer	X	X	X	X
MA	Sole Source Aquifer	X	X	X	X
	Landslide Susceptibility	X	X	X	X

Source: NEC FUTURE team, 2015

X = Presence of resource and potential effects within the Representative Route; effects would be subject to Tier 2 analysis.
Blank cell = No presence and no effects identified for listed geologic resource or hazard for specified alternative.
* All Action Alternatives assume improvements to the existing NEC; therefore, the data presented include the Environmental Consequences inclusive of improvements to the existing NEC and any new route option or off-corridor route associated with each Action Alternative.

Table 7.7-3: Environmental Consequences: Representative Route of Alternative 3 Route Options – Geologic Resources

Geography	Geologic Resource/Hazard	Existing NEC	Alternative 3				
			D.C. to NYC	New York City to Hartford via Central Connecticut	New York City to Hartford via Long Island	Hartford to Boston via Providence	Hartford to Boston via Worcester
D.C.	Landslide Susceptibility	—	—	—	—	—	—
MD	Landslide Susceptibility	X	X	—	—	—	—
DE	Sole Source Aquifer	X	X	—	—	—	—
PA	Sole Source Aquifer	X	X	—	—	—	—
NJ	Sole Source Aquifer	X	X	—	—	—	—
NY	Sole Source Aquifer	X	—	X	X	—	—
CT	Sole Source Aquifer	X	—	X	X	X	X
	Landslide Susceptibility	X	—	X	X	X	X
RI	Sole Source Aquifer	X	—	—	—	X	X
MA	Sole Source Aquifer	X	—	—	—	X	X
	Landslide Susceptibility	X	—	X	X	X	X

Source: NEC FUTURE team, 2015
X = Presence of resource and potential effects within the Representative Route; effects would be subject to Tier 2 analysis.
— = Not applicable within that alternative/route option.

7.7.4.1 Stations

New stations would likely affect geologic resources or encounter geologic hazards more than modified stations. Table 7.7-4 presents proposed new stations or modified existing stations that geographically coincide with resources and hazards that may present significant regulatory challenges, potential associated safety issues, and engineering costs related to construction, or other potential geographic conflicts that would need to be assessed. The resources include sole source aquifers and mineral resources. The hazards include soils associated with moderate or high incidence of landslide occurrences, naturally occurring asbestos, and karst terrain. As shown in Table 7.7-4, no effects associated with naturally occurring asbestos or karst terrain would occur as a result of new stations or modifications to existing stations.

7.7.5 Context Area

Conditions within the Context Area are similar to those described for the Affected Environment. In addition to the geologic resources and hazards described in Section 7.7.3, a sole source aquifer exists in Fairfield County, CT, only in the Context Area of Alternative 3 (New York City to Hartford via Central Connecticut route option). Soils potentially containing naturally occurring asbestos also exist within the Context Area in Delaware, Philadelphia, and Bucks Counties in Pennsylvania.

Table 7.7-4: Environmental Consequences: Stations – Geologic Resources

State	County	Station ID/Type	Station Name	Geologic Resource/Hazard	Alt. 1	Alt. 2	Alt. 3
MD	Anne Arundel	6/New	BWI Airport	Mineral Resources			X
	Baltimore City	11/New	Baltimore Downtown	Mineral Resources			X
		12/New	Broadway	Landslide Susceptibility	X	X	X
		13/New	Bayview	Landslide Susceptibility	X	X	X
		14/New	Bayview H.S.	Landslide Susceptibility			X
	Cecil	23/New	Elkton	Landslide Susceptibility	X	X	X
DE	New Castle	24/Existing	Newark, DE	Landslide Susceptibility	X	X	X
		26/New	Newport	Landslide Susceptibility	X	X	X
		28/New	Edgemoor	Sole Source Aquifer	X	X	X
				Landslide Susceptibility	X	X	X
PA	Delaware	34/New	Baldwin	Sole Source Aquifer	X	X	X
	Philadelphia	44/New	Philadelphia Airport			X	X
		46/New	Philadelphia Market East				X
	Bucks	53/Existing	Cornwells Heights	Sole Source Aquifer	X	X	X
				Landslide Susceptibility	X	X	X
NJ	Mercer	61/Existing	Princeton Junction	Sole Source Aquifer	X	X	X
NY	Queens	144/Existing	Jamaica	Sole Source Aquifer			X
		145/New	Jamaica H.S.				X
	Nassau	146/New	Nassau Hub				X
	Suffolk	148/New	Suffolk Hub				X
		149/Existing	Ronkonkoma				X
CT	Hartford	160/New	Berlin	Landslide Susceptibility		X	
		164/New	Hartford (New)	Landslide Susceptibility		X	X
RI	Washington	123/Existing	Westerly	Sole Source Aquifer	X	X	X
MA	Suffolk	142/New	Back Bay H.S.	Landslide Susceptibility			X

Source: NEC FUTURE team, 2015
X = Presence of resource and potential effects within the Representative Route; potential effects subject to Tier 2 analysis.
Blank cell = No presence and no effects identified for listed geologic resource or hazard for specified alternative.
H.S. = high speed

7.7.6 Potential Mitigation Strategies

Programmatic mitigation measures could include design considerations, alternative construction methods, and slope/soil stabilization measures. Depending on the affected geologic resource, specific mitigation measures could include the following:

- ***Sole Source Aquifers*** – Develop Stormwater Pollution Prevention Plan and/or Spill Pollution Prevention Plan.
- ***Landslide Susceptibility*** – Use engineered slopes and fill material.
- ***Seismic hazards*** – Mitigate seismic motion through design consideration and enforcement of seismic building codes during construction.
- ***Acid Producing Soils*** – Use engineered fill material, add soil amendments to correct acidity of soil.
- ***Naturally Occurring Asbestos*** – Follow OSHA regulations to minimize exposure to workers; engineering controls, site worker training and awareness, site monitoring, and regulatory interaction and reporting.
- ***Karst terrain*** – Karst terrain assessment, design consideration, construction engineering.
- ***Mineral resources*** – Provide/construct alternative access to physically avoid the mineral resource.

7.7.7 Subsequent Tier 2 Analysis

Tier 2 analyses would determine the presence and type of geologic resources to a higher level of detail, as well as assess the need for and identify mitigation measures and design and construction methods that would avoid or minimize effects. Coordination with the EPA and the U.S. Geological Survey may be warranted when more site-specific effects are known.