

reasonably foreseeable future actions (RFFAs), regardless of what agency or person undertakes such other actions (40 C.F.R. 1508.7). Examples of RFFAs that could interact with Proposed Project-related impacts to result in cumulative impacts are the Charleston Harbor Post 45 (the deepening of the Charleston Harbor to 50+ feet mean low water), construction of the HLT (formerly the Navy Base Marine Container Terminal at the Charleston Naval Complex), and expansion of commercial, institutional, and industrial facilities.

Direct and indirect impacts of Alternative 1 (Proposed Project) and alternatives are further evaluated for each resource in relation to context, duration, intensity, type, and potential to occur:

- Context (limited, local, or regional)
- Duration (temporary, short-term, long-term, or permanent)
- Intensity (negligible, minor, moderate, major, No Effect, No Adverse Effect, Adverse Effect)
- Type (beneficial or adverse)
- Potential to occur (unlikely, possible, or probable)

In the introduction for each resource section, the reader is provided a brief description of the methodology used for assessing and evaluating potential impacts, as well as definitions related to the intensity of potential impacts. With the exception of waters of the U.S., each resource section used the following definitions related to the duration of potential impacts:

- Temporary = Up to 1 week
- Short-Term = Up to 5 years
- Long-Term = Up to 10 years
- Permanent = Longer than 10 years

The definitions related to the duration of potential impacts associated with waters of the U.S are derived from the time limits associated with the Charleston District Regional Condition for the 2012 Nationwide Permits, which assigns an impact of less than 6 months as Temporary and an impact of greater than 6 months as Permanent.

Lastly, an impact summary, which takes into account the significance of impacts after mitigation implementation, is provided for each resource evaluated at the end of each resource section. When discussing impacts to action alternatives for any resource area, mitigation measures as presented for Alternative 1 (Proposed Project) would also be applicable to the action alternatives.

## 4.1 GEOLOGY AND SOILS

### 4.1.1 Methods and Impact Definitions

Impacts to geology and soils were evaluated through a review of site-specific geotechnical reports, conceptual development plans specific to the alternatives, and available literature on the regional

geology, as well as Geographic Information System (GIS) analysis and best professional judgment. The literature review was used to identify and assess potential alterations to topography; potential for soil erosion, soil compaction, and/or runoff; unique geologic features, such as paleontological resources, that could be disturbed or impacted; presence of a confining layer(s) above an aquifer; and sources/locations and volume of fill material that would be transported to meet fill requirements for Alternative 1 (Proposed Project) and alternatives.

Activities associated with the construction and operation of the ICTF that could impact the geology and soils within the study area include site preparation for the facility and roadway and rail improvements, and use of staging areas and buffers for construction. These activities can result in soil erosion and/or compaction, as well as modification to slopes and drainage patterns at the site. Long-term changes in soil type and cover across the study area resulting from changes in the landscape also could occur. Impact definitions for Geology and Soils are presented in Table 4.1-1.

Table 4.1-1  
Impact Definitions, Geology and Soils

	Negligible	Minor	Major
<b>Geology and Soils</b>	No effect to unique geologic features; no visible soil erosion and/or loss of topsoil; fill requirements can be met by regional sources of fill material; no effect to confining layers overlaying an aquifer.	Unique geologic features are encountered and preserved; localized, short-term soil erosion and loss of topsoil.	Unique geologic features are encountered and not preserved; increased soil erosion and runoff that extends beyond the Project/alternative sites; fill requirements exceed availability of fill material from regional sources; and breaching of a confining layer overlying an aquifer.

### 4.1.2 No-Action Alternative

Under the No-Action Alternative, the proposed site would continue to be used for mixed-use industrial activities, which could result in new soil impacts, such as erosion. Any future residential, commercial, and/or industrial development in the area may result in minor soil erosion and loss of topsoil; however, these impacts could be mitigated through appropriate use of Best Management Practices (BMPs). The surface soils within the study area have already been significantly disturbed by development within the CNC and region, and former native soils in the study area have been replaced with Urban Land soils. Construction of new buildings and roads in open areas may result in new soil compaction; however, existing mixed-use development and roadways account for at least 40 acres of pavement (and existing soil compaction) within the facility footprint. While naturally occurring seismic (earthquake) events have the potential to produce unstable conditions that could directly affect existing and future facilities, it is not expected that existing or future mixed-use

development would impact the frequency or magnitude of seismic events in the region. The No-Action Alternative would likely have no impact to geologic features within the study area.

### 4.1.3 Alternative 1: Applicant's Proposed Project (South via Milford / North via Hospital District)

Alternative 1 (Proposed Project) would have no significant adverse impacts to the geology and soils in the study area. It is extremely unlikely that unique geologic features, such as paleontological resources, would be encountered during construction of Alternative 1 (Proposed Project) based on the descriptions of the fossils associated with the native soils, and the presence of substantial fill material throughout the CNC. The likelihood of encountering a unique geologic feature would be greater during the construction of portions of the drayage road near existing waters of the U.S. and bridge improvements areas that are less disturbed than other locations within the study area; however, recent investigations did not identify any archaeological sites within the Project site. Two archaeological sites were identified outside the study area (see Section 3.10 for additional information).

The depth to the top of the Ashley formation, which is part of a substantial confining unit that separates the unconfined aquifer from underlying aquifers, is located at 35 to 50 feet bls. This depth is greater than the expected excavation depth required during construction of Alternative 1 (Proposed Project), and as a result, the confining layer would not be expected to be intercepted or breached.

While naturally occurring seismic (earthquake) events have the potential to produce unstable conditions that could directly affect the proposed facilities, it is not expected that construction and/or operation of the Navy Base ICTF would impact the frequency or magnitude of seismic events in the region.

Excavation and construction activities associated with Alternative 1 (Proposed Project) would result in minor, short-term soil erosion; however, the use of BMPs, such as silt fencing, placement of hay, and other common soil retention practices would minimize this adverse impact. Topographical changes that result from construction activities, such as a change in elevation associated with the construction of the drayage road, may result in increased, short-term soil erosion and loss of topsoil, but the use of BMPs would minimize these adverse impacts to be minor. There would be a permanent increase in stormwater runoff resulting from topographical changes and new pavement within the study area (approximately 100 total acres would be paved after construction activities, including the more than 40 acres of existing impervious surface in the facility footprint), which would result in reduced infiltration of surface water through the soil; however, this adverse impact would be minor, and would be minimized by the proposed detention ponds associated with Alternative 1 (Proposed Project). Soil erosion and loss of topsoil would be localized near construction activities, and increased erosion would occur within the confines of the study area.

Short-term compaction of soil would occur within the staging locations of the study area, while permanent compaction would occur in open, pervious areas of the facility site, the drayage road, and new rail track where pavement and structures are built, and where fill material (surcharge) would be placed. Soil compaction resulting from construction activities would result in a minor adverse impact because the soil in the Project site is classified as Urban Land and there are no native soils present.

There are three local borrow sources within 28 miles of the Project site that can supply fill material requirements for the construction of the Navy Base ICTF (~105,000 cy). Given the large number of active sand and dirt mines in the region, Alternative 1 (Proposed Project) is expected to cause a relatively small demand in comparison to available resources, resulting in a negligible impact.

#### **4.1.4 Alternative 2: Proposed Project Site (South via Milford / North via S-Line)**

Impacts to geology and soils resulting from Alternative 2 would be the same as those described for Alternative 1 (Proposed Project) with the exception that adverse soil impacts related to the northern rail connection would shift from the Hospital District to those areas that connect to the existing CSX ROW along Spruill Avenue.

#### **4.1.5 Alternative 3: Proposed Project Site (South via Kingsworth / North via Hospital District)**

Impacts to geology and soils resulting from Alternative 3 would be the same as those described for Alternative 1 (Proposed Project) with the exception that adverse soil impacts related to the southern rail connection would shift from the areas associated with the Milford Street connection to areas associated with the Kingsworth Avenue connection.

#### **4.1.6 Alternative 4: Proposed Project Site (South via Milford)**

Impacts to geology and soils resulting from Alternative 4 would be the same as those described for Alternative 1 (Proposed Project) with the exception that adverse soil impacts related to the northern rail connection would stop short of the Noisette Creek bridge.

#### **4.1.7 Alternative 5: River Center Project Site (South via Milford / North via Hospital District)**

Under Alternative 5, impacts to the geology and soils would be similar to those described for Alternative 1 (Proposed Project). The majority of adverse soil impacts would occur at the River Center project site, and new soil disturbance would be minimal as approximately 85 percent of the River Center project site is already paved and/or contains an impervious surface.

#### **4.1.8 Alternative 6: River Center Project Site (South via Kingsworth / North via Hospital District)**

Impacts to geology and soils resulting from Alternative 6 would be the same as those described for Alternative 5 with the exception that soil impacts related to the southern rail connection would shift from the areas associated with the Milford Street connection to areas associated with the Kingsworth Avenue connection.

#### **4.1.9 Alternative 7: River Center Project Site (South via Milford)**

Impacts to geology and soils resulting from Alternative 7 would be the same as those described for Alternative 5 with the exception that soil impacts related to northern rail connection would stop short of the Noisette Creek bridge.

#### **4.1.10 Related Activities**

Geology and soils impacts associated with the Related Activities would result in minor adverse impacts to soils, because these activities would occur within existing CSX and NS ROWs where the Urban Land soil type has already been compacted and disturbed. Use of BMPs, such as silt fencing, would minimize the potential for soil erosion and loss of topsoil.

#### **4.1.11 Summary of Impacts Table**

Table 4.1-2 summarizes the environmental consequences to geology and soils from Alternative 1 (Proposed Project) and all the alternatives.

Table 4.1-2  
Summary of Impacts, Geology and Soils

Alternative	Geology	Soils
<b>No-Action</b>	Negligible	Negligible effects to unique geologic features. Potential minor adverse impact resulting from a short-term increase in soil erosion, a loss of topsoil, soil compaction, and runoff
<b>1: Proposed Project: South via Milford / North via Hospital District</b>	Negligible	Negligible effects to unique geologic features. Potential minor adverse impact resulting from a short-term increase in soil erosion, a loss of topsoil, soil compaction, and runoff
<b>2: South via Milford / North via S-line</b>	Negligible	Similar to Alternative 1 (Proposed Project)
<b>3: South via Kingsworth / North via Hospital District</b>	Negligible	Similar to Alternative 1 (Proposed Project)
<b>4: South via Milford</b>	Negligible	Similar to Alternative 1 (Proposed Project)
<b>5: River Center Project Site: South via Milford / North via Hospital District</b>	Negligible	Negligible effects to unique geologic features. Potential minor adverse impact resulting from a short-term increase in soil erosion, a loss of topsoil, soil compaction, and runoff
<b>6: River Center Project Site: South via Kingsworth / North via Hospital</b>	Negligible	Similar to Alternative 5
<b>7: River Center Project Site: South via Milford</b>	Negligible	Similar to Alternative 5

#### Geology and Soils Impact Definitions

**Negligible** = No effect to unique geologic features; no visible soil erosion and/or loss of topsoil; fill requirements can be met by regional sources of fill material; no effect to confining layers overlaying an aquifer.

**Minor** = Unique geologic features are encountered and preserved; localized, short-term soil erosion and loss of topsoil.

**Major** = Unique geologic features are encountered and not preserved; increased soil erosion and runoff that extends beyond the Project/alternative sites; fill requirements exceed availability of fill material from regional sources; and breaching of a confining layer overlaying an aquifer.

## 4.1.12 Mitigation

### 4.1.12.1 Applicant's Proposed Avoidance and Minimization Measures

The Applicant has committed to several measures that avoid and/or minimize potential impacts of Alternative 1 (Proposed Project). These measures are taken from Palmetto Railways Mitigation Plan provided in Appendix N. Some of these measures are required under federal, state, and local permits; others are measures that Palmetto Railways has incorporated into the design and operations of

Alternative 1 (Proposed Project). Each mitigation measure is also designated as one that either helps to avoid an impact or one that minimizes an impact.

- Implement an SWPPP as required by the National Pollutant Discharge Elimination System (NPDES) permit, including management of sediment and erosion control. (Minimization)
- Implement an SPCC plan for petroleum products. (Minimization)
- Use Best Management Practices (BMPs) and/or methods of managing sediment and erosion control during construction pursuant to the *South Carolina Stormwater Management Handbook* (South Carolina Department of Health and Environmental Control [SCDHEC] 2005). (Minimization)
- Capping contaminated sites within the ICTF to “seal” existing soil and groundwater contamination. (Minimization)
- Perform all land disturbance activities in compliance with the U.S. Navy Construction Process Document (Navy “Dig” Permit) which identifies the permit process and requirements for conducting construction or other land disturbing activities in Land Use Control (LUC) areas at the former Navy Base (Charleston Naval Complex). (Minimization)
- Develop a soil management plan during design to be implemented during construction. (Minimization)
- Use clean fill material. (Minimization)

These avoidance and minimization measures, except the items noted with an asterisk (\*), have been considered in the preceding impact analysis. The complete list of Applicant-proposed avoidance and minimization measures for the Navy Base ICTF is provided in Chapter 6, Table 6.1.

#### 4.1.12.2 Additional Potential Mitigation Measures

No additional mitigation measures are proposed for Geology and Soils by the Corps. Additional avoidance, minimization, and mitigation may be considered by the Corps in its decision-making process. Final mitigation measures may be adopted as conditions of the DA permit and documented in the Record of Decision (ROD).