28, Alternative B would have the same impacts described above for Alternative A. East of NH 28, the Alternative B footprint follows an existing powerline ROW, which would reduce the amount of shrubby habitat associated with the ROW and reduce the value of the remaining habitat. In New Hampshire, powerline ROWs provide habitat for shrubland bird species (e.g., field sparrow, eastern towhee, prairie warbler), snakes, and insects that require open habitats (e.g., pollinators, butterflies).

Alternative C

Alternatives C and D have the same footprint size, but Alternative C would consume a larger amount of natural habitat (Table 4.16-1). Less than half (14,250 of 33,010 linear feet) of Alternative C follows existing roadway as it passes through a mix of developed and undeveloped areas, including four areas mapped as Unfragmented Habitat Blocks, of which two are ranked as Supporting Landscapes in the 2015 Wildlife Action Plan (Figure 4.16-2). Alternative C would consume about 7.7 acres of non-vernal pool wetland; impact three vernal pools totaling about 0.3 acres; and have four stream crossings, none of which are new (Table 4.16-1). West of NH 28, Alternative B and C follow the same footprint and would have the same impacts. Between Alternative C's I-93 interchange and its juncture with the Alternative B footprint, Alternative C follows an existing powerline ROW, then follows the existing NH 28 footprint where it abuts a small section of wetland habitat that is mapped in the 2015 Wildlife Action Plan as Highest Ranked Habitat in Biological Region (Figure 4.16-2). Within the powerline ROW, this portion of Alternative C also could impact shrubland-associated bird, reptile, and insect species, and the wetland likely provides habitat for a wide variety of wildlife, including reptiles and amphibians. Additional pavement or traffic associated with construction of Alternative C would potentially increase road-related impacts on wildlife associated with this wetland.

Alternative D

Alternative D primarily follows existing roadways (20,231 of 29,525 linear feet) (Table 4.16-1), but it does pass through one unfragmented habitat block (Figure 4.16-2) and would impact about 3.6 acres of non-vernal pool wetland; impact four vernal pools totaling about 0.3 acre; and have a total of four stream crossings, none of which are new (Table 4.16-1). Because Alternative D follows the same footprint as Alternative C as it departs from I-93, it would have the same impacts as Alternative C in this section. After joining with the existing NH 28 footprint, Alternative D follows existing roadways where impacts from road improvements would be minimal.

4.16.3 Mitigation

Impact minimization and mitigation for plants and wildlife for all alternatives would be determined in consultation with NHFGD, New Hampshire Natural Heritage Bureau (NHNHB), NHDES, USFWS, USACE, and EPA to identify actions that reduce impacts associated with construction and operations.

4.17 Threatened and Endangered Species

The federal Endangered Species Act of 1973 (16 USC 1531-1543) (ESA) designates certain species throughout the United States as threatened or endangered, and as such protects them and the habitats in which they occur. The ESA defines two categories of species warranting protection: endangered and threatened. An endangered species is "in danger of extinction

throughout all or a significant portion of its range" (Sec. 3[4]). A threatened species is not immediately in danger of extinction but may become endangered due to overutilization or a habitat that will become vulnerable "within the foreseeable future" (Sec. 3[15]). The ESA protects only those species that are threatened or endangered on a federal level (i.e., throughout the United States) and does not include species of regional or statewide scarcity or those species at the limits of their range.

New Hampshire has also developed its own lists of plant and animal species that are considered to be threatened and endangered within the state. These species are protected by the NH Endangered Species Conservation Act of 1979 and the NH Native Plant Protection Act of 1987. Under the Endangered Species Conservation Act of 1979, NHFGD is authorized to designate and provide statutory protection for endangered and threatened wildlife (RSA 212A:1 et seq.). Endangered wildlife are defined as those native animal species whose prospects for survival in NH are in danger because of a loss of or change in habitat, overexploitation, predation, competition, disease, disturbance, or contamination. By definition, endangered species require assistance to ensure their continued existence as viable components of the state's wildlife community. Threatened wildlife are those species that may become endangered if conditions surrounding them begin, or continue, to decline. NH's Endangered Species Conservation Act makes it unlawful to export, take, possess, sell or offer for sale, deliver, carry, transport, or ship endangered and threatened wildlife species.

The NH Native Plant Protection Act of 1987 authorizes New Hampshire Division of Forests and Lands to protect rare, threatened, and endangered plants, as well as rare or noteworthy natural communities (i.e., exemplary natural areas). Within NHDRED, NHNHB locates, tracks, and provides information regarding rare (i.e., threatened or endangered) plant species and ecosystems across NH. NHNHB defines threatened species as those species with a record of 10 or fewer natural occurrences in the last 20 years, or those that are otherwise threatened by extinction due to habitat loss or other factors. Endangered species are native plants with a record of three or fewer natural occurrences in the state in the last 50 years, or plants with more than three occurrences that are especially vulnerable to extirpation. The rules promulgated pursuant to the Native Plant Protection Act require that NHNHB be consulted regarding the actual or potential presence of listed plant species within a study area for any state project or any plant species on state-owned land. NHNHB reviews the information, assesses any potential impacts on the listed species, and recommends how to protect the survival of the species at the particular site.

Information on the potential presence of threatened or endangered species and exemplary natural communities within the study area was provided by NHNHB (Amy Lamb, letters dated April 4, 2016) and USFWS (New England Ecological Services Field Office, letter dated June 20, 2018). A more inclusive study area, (encompassing 26 square miles, outlined in the NHNHB review) was used for these data requests to provide a broader context for rare plant, animal, and natural community occurrences. As NHNHB notes, the information provided is not based on a comprehensive field survey and is therefore not definitive. NHNHB provided supplemental data specific to the Project area in April, 2018 (NHNHB, 2018). Copies of the response letters from these agencies are included in Appendix A.

4.17.1 Affected Environment

Plants

Threatened and Endangered Plant Species (Federal)

No federally listed threatened or endangered plant species are known to occur within the study area.

Threatened and Endangered Plant Species (State)

NHNHB data provided for the Project in April 2018 identified occurrences for 11 plant species and one exemplary natural communities within the study area: a Medium Level Fen System identified in the vicinity of Scobie Pond. Low nutrient levels, high acidity, and accumulations of peat characterize this ecosystem. Threats to this natural community include changes in hydrology, increased nutrient input associated with stormwater runoff, and sedimentation from nearby disturbances. Rarity rankings are not applicable to natural community systems, which are typically assemblages of several community types. NHNHB has determined that, due to the quality of this system, it is to be considered exemplary and therefore of statewide significance. This system would not be encroached by any of the Build Alternatives considered for the Project, and, because it is upstream of all alternatives, it is unlikely to be affected.

Table 4.17-1 lists threatened and endangered plant species that have been documented within the study area. These species could be present near the alternatives if suitable habitat conditions exist. None of the recorded occurrences fall within the footprint of any alternatives. Based upon the natural communities present and the relevant life histories of these particular species, the Alternative footprints could support bird-foot violet (*Viola pedata*), hairy star-grass (*Hypoxis hirsuta*), licorice goldenrod (*Solidago odora*), and red threeawn in the more open areas on site, including forest edges and transmission line ROW. Additionally, other open-site rare species such as late purple American-aster (*Symphyotrichum patens*) are known from the vicinity but currently unidentified within the Project area by NHNHB. Dragon’s-mouth orchid, dwarf huckleberry (*Gaylussacia bigeloviana*), and northern tubercled bog-orchid (*Platanthera flava* var. *herbiola*), are unlikely to be found near the alternatives because of a lack of acidic peatland habitat that would be crossed.

Field surveys for all species and natural communities identified by NHNHB were performed within the proposed footprint of the alternatives between August and October 2016 and May 2017. The field surveys failed to locate any extant populations of rare plant species in the Project area. Element occurrences were reported by NHNHB for two species in April 2018, after the field surveys were performed. These species, Nuttall's reed grass (*Calamagrostis cinnoides*) and licorice goldenrod, were not included in the 2016 information request that the field efforts were based upon. The surveyors were aware that the goldenrod in particular is present in the area and were actively searching for it during the field work. Nuttall’s reed grass was not known from the area by the surveyors and may have gone undetected during the field surveys. Additional field work would be necessary to determine if this species is present within the Alternative footprints.

Table 4.17-1. Element Occurrences of Plants and Natural Communities in the Project Area

Scientific Name	Common Name	Preferred Habitat(s)	Survival Status[a]		Legal Status[b]	
			Global	State	Federal	State
Arethusa bulbosa[c]	Dragon's mouth	Acidic peatlands	G4	S1H	Unlisted	E
Aristida longespica var. *geniculata*	Red Threeawn	Moist, sandy pond shores	G5T5?	S1H	Not Listed	E
Asclepias tuberosa[c]	Butterfly weed	Dry fields, roadsides, sandy soils.	G5	S1H	Not Listed	E
Calamagrostis coarctata[d]	Nuttal's reedgrass	Wetlands—bogs, fens seeps and wet meadows	G5	S1	Not Listed	E
Gaylussacia bigeloviana	Dwarf huckleberry	Acidic peatlands	G5	S2	Not Listed	T
Gentianopsis crinita[c]	Fringed gentian	Low woods, wet meadows, stream banks	G5	S2	Not Listed	T
Hypoxis hirsuta[c]	Hairy star-grass	Dry, open, deciduous woods	G5	S2	Not Listed	T
Platanthera flava var. *herbiola*[c]	Pale green orchid	Boggy and swampy areas	G4T4	S1	Not Listed	E
Soldiago odora ssp. *odora*[d]	Licorice goldenrod	Dry forests, disturbed areas, sandplains	G5	S1	Not Listed	T
Viburnum rafinesquianum[c]	Downy arrowwood	Dry, calcareous woods	G5	S1H	Not Listed	E
Viola pedata[c]	Bird's foot violet	Dry fields, open woods	G5	S2	Not Listed	T
Exemplary Natural Community Description						
Medium Level Fen System: Stagnant wetland characterized by low-moderate nutrient levels and peat accumulation. More minerotrophic influence than Poor Level Fen Systems.						

Note: All data from NHNHB correspondence dated April 4, 2016, and data provided by NHNHB on April 27, 2018.

[a] Survival Status: Global level (G) and State level (S):
G1 S1 Critically imperiled (very rare and/or extremely prone to extinction)
G2 S2 Imperiled (rare and/or prone to extinction)
G3 S3 Rare and local, or of restricted range, or somewhat prone to extinction
G4 S4 Apparently secure
G5 S5 Demonstrably secure
T = subspecies or variety rank (e.g., G5T4 applies to a subspecies with a global species rank of G5, but with a subspecies rank of G4)
Survival Status Qualifiers: ? = Status ranking not final; H = Historical record, last documented occurrence at least 20 years prior to date of consultation (e.g., SH applies to a species that occurred historically in the state but has not been observed recently)

[b] Legal Status: E = Endangered, T = Threatened.

[c] Species known but not found in study area during 2016-2017 field surveys.

[d] Species added by NHNHB after field surveys were performed for the 2016–2017 field season.

Animals

Four classes of listed special status species are considered in this section, consisting of federally listed threatened and endangered species, state-listed threatened and endangered species, Species of Special Concern, and Species in Greatest Conservation Need. The four classes are defined in the following section. NHNHB provided information on the potential special status species within the study area (NHNHB, 2016; 2018) and USFWS (USFWS, 2018). As NHNHB notes, the information provided is not based on a comprehensive field survey and is therefore not definitive. Appendix A contains copies of the response letters from these agencies.

The ESA designates certain species throughout the United States as threatened or endangered and grants protections to them and to their habitat if it is designated as Critical Habitat. An endangered species is "in danger of extinction throughout all or a significant portion of its range" (Sec. 3[4]). A threatened species is not immediately in danger of extinction but may become endangered "within the foreseeable future" (Sec. 3[15]). This vulnerability may be due to one or multiple factors, including habitat loss, overutilization, or disease.

New Hampshire also designates species as threatened or endangered within the state, granting them protection under the NH Endangered Species Conservation Act of 1979. Endangered wildlife are defined as those native animal species whose prospects for survival in New Hampshire are in danger because of a loss of or change in habitat, over-exploitation, predation, competition, disease, disturbance, or contamination. Threatened wildlife are those species that may become endangered if conditions surrounding them begin, or continue, to decline.

In addition to threatened and endangered species, New Hampshire also designates Species of Special Concern, which are species that are either "Near-threatened" or are "Responsibility Species." Near-threatened species include those that could become threatened in the foreseeable future if action is not taken as well as those which were recently down-listed (i.e., recovered) from the state endangered and threatened species list and where conservation action is prudent to ensure the species continues towards full recovery. Responsibility species are those species for which a large portion of their global or regional range (or population) occurs in New Hampshire and where actions to protect these species habitat will benefit the species' global population.

The 2015 New Hampshire Wildlife Action Plan also identifies 169 species as species of greatest conservation need (SGCN), which includes all Special Concern, Threatened, and Endangered species. Additional species are designated in the New Hampshire Wildlife Action Plan as SCGN for a variety of reasons, including a restricted distribution and/or abundance in New Hampshire and the Northeast, downward statewide, regional, or global population trends, known risks to the species, status and risk to species' habitat in New Hampshire, the species' vulnerability due to life-history traits, and the amount and quality of the information available to assess species status, trends, and threats.

Threatened and Endangered Animal Species (Federal)

As USFWS (2018) reports, the only federally listed species potentially present within the Project area is the federally listed as threatened northern long-eared bat (NLEB; *Myotis septentrionalis*). This species is also state-listed as threatened. This tree-roosting bat uses forested habitats during its active season from April 15–October 31. The Project has the potential to affect this species via tree clearing, which could reduce roosting habitat or cause direct mortality if an occupied roost tree is felled when bats are present. Therefore, a survey compliant with USFWS' 2016

Range-wide Indiana Bat Summer Survey Guidelines (Guidelines) (USFWS, 2016), which are also applicable to summer survey for NLEB, was conducted, and this species was determined not to be present. Appendix J contains a full description of the survey and results.

Threatened and Endangered Animal Species (State)

Based on NHNHB records, six state-listed animal species have been recorded within the study area. Consultation with NHNHB in 2018 provided the year and location of observations within the study area for Blanding's turtle, box turtle, spotted turtle, northern black racer, spotted turtle, grasshopper sparrow, and New England cottontail. Table 4.17-2 summarizes these records. Additionally, the state-listed little brown bat has the potential to be present. Although not included in NHNHB's known records for the Project area, prior to the advent of White-nose Syndrome, this species was known to have state-wide distribution and was New Hampshire's most common bat species. However, manual review of the acoustic data collected during the survey for the NLEB indicate this species was not detected.

Species of Special Concern (State)

Based on records held by NHNHB, four Species of Special Concern have been recorded within the study area. Consultation with NHNHB in 2018 provided the year and location of observations within the study area of smooth green snake, wood turtle, redfin pickerel, and banded sunfish. Table 4.17-2 summarizes these records. The two fish species fall within the footprint of Alternatives C and D.

Species of Greatest Conservation Need

A total of 169 species are identified as SGCN in the 2015 Wildlife Action Plan, of which NH lists 27 species as endangered, 14 as threatened, and 61 as special concern. The remaining 77 species received the SGCN for a variety of reasons, including a restricted distribution and/or abundance in NH and the Northeast; downward statewide, regional, or global population trends; known risks to the species; status and risk to species' habitat in NH; the species' vulnerability due to life-history traits; and the amount and quality of the information available to assess species status, trends, and threats. NHNHB does not track SGCNs. Of the SGCN species not previously discussed as state-endangered, threatened, or special concern species, there are 23 additional species that could occur within the study area, based on their known habitat preferences and distribution within the state. Table 4.17-3 lists these species.

Table 4.17-2. Element Occurrences of Rare Wildlife Species

Species	Status	Town	Preferred Habitat	Observations within the last 25 Years
Blanding's Turtle (*Emydoidea blandingii*)	Endangered (State)	Derry	Wetlands with permanent shallow water and emergent vegetation, vernal pools, may use slow rivers and streams for travel and terrestrial habitats for nesting and travel among wetlands	Lower Shields Pond—1997, 2005, 2006, 2006, 2008, 2010 Scobie Pond—2005
		Londonderry	Described above	Nesenkeag Brook—2006, 2006, 2013, 2013 Little Cohas Brook—2004, 2009, 2012, 2014 Scobie Pond—2006, 2012, 2013
		Windham	Described above.	Mitchell Pond–2007, 2013
Eastern Box Turtle *(Terrapene Carolina)*	Endangered (State)	Londonderry	Terrestrial areas such as dry and moist woodlands, old fields, pastures, power-line corridors, and edges of marshes, bogs, and shallow streams.	Cohas Brook Headwaters 2016
New England Cottontail (*Sylvilagus transitionalis*)	Endangered (State)	Derry	Dense shrubs and regenerating clear cuts	2012
		Londonderry	Described above.	Little Cohas Brook—2002, 2013 South of Moose Hill—2002
Northern Black Racer (*Coluber constrictor constrictor*)	Threatened (State)	Londonderry	Dry brushy pastures, powerline corridors, rocky ledges, and woodlands	Scobie Pond—2013 I-93—2014, 2014
Spotted Turtle (*Clemmys guttata*)	Threatened (State)	Derry	Wetlands with shallow, permanent water bodies and emergent vegetation	Rainbow Pond—1997, 2006 Scobie Pond—2015 Beaver Lake—2014 Robert Frost Farm—2012
		Londonderry	Described above.	Old Derry Rd—2006

Species	Status	Town	Preferred Habitat	Observations within the last 25 Years
Grasshopper Sparrow (*Ammodramus savannarum*)	Threatened (State)	Derry	Sites at least 30 acres. Dry upland sites, with short native bunch grasses, minimal litter cover, patches of bare ground, scattered forbs, and short shrubs.	2003—Old Derry Landfill
Smooth Green Snake (*Opheodrys vernalis*)	Special Concern	Derry	Found in upland grassy fields, pastures, meadows, and forest openings	Vista Ave.—2008
		Londonderry	Described above.	Little Cohas Marsh—2003
Wood Turtle (*Glyptemys insculpta*)	Special Concern	Derry	Slow-moving streams and channels with sandy bottoms	South of Beaver Lake–2011
		Londonderry	Described above.	Old Nashua Rd—2006 Beaver Brook Tributary–2014 2015 (Beaver Brook)
Banded Sunfish *(Enneacanthus obesus)*	Special Concern	Londonderry	Acidic, heavily vegetated waters small and large rivers	Shields Brook–2005
Redfin Pickerel *(Esox americanus americanus)*	Special Concern	Londonderry	Streams with dense vegetation and/or decaying matter	Shields Brook–2005

Note: All data from NHNHB, 2016, 2018.

Table 4.17-3. Species of Greatest Conservation Need that may be Present within the Project Area

Species	Habitat Associations
Butterflies & Moths	
Monarch	Open habitats with milkweed
Bumblebees	
American Bumble Bee	Open farmland, hay, old fields
Yellowbanded Bumble Bee	Meadows, wetlands, woodlands, urban areas
Dragonflies & Damselflies	
Coppery Emerald	Breeds in sluggish forest streams, feeds in open habitats
Amphibians	
Northern Leopard Frog	Wetlands, wet meadows
Blue-Spotted/Jefferson Salamander	Palustrine wetlands including (but not limited to) vernal pools, forested uplands
Reptiles	
Eastern Ribbonsnake	Wetlands, wet meadows
Birds	
American Woodcock	Field edges, shrublands
Black-billed Cuckoo	
Brown Thrasher	Shrublands
Chimney Swift	Various, nests in chimneys
Eastern Towhee	Shrublands
Field Sparrow	Shrublands
Prairie Warbler	Shrublands
Purple Finch	Mixed and coniferous forest
Scarlet Tanager	Mixed and deciduous forest
Veery	Forested wetland and stream edges
Wood Thrush	Mixed and deciduous forest
Mammals	
Big Brown Bat	Fields, forest edges
Eastern Red Bat	Fields, forest edges
Hoary Bat	Fields, forest edges
Silver-haired Bat	Fields, forest edges
Tricolored Bat	Fields, forest edges

Source: NHFGD (2015a)

4.17.2 Environmental Consequences

State Threatened and Endangered Plant Species

No Build Alternative

The No Build Alternative would not require any new roadway construction. The No Build Alternative would, therefore, not result in any new impacts on state-listed threatened or endangered plant species.

Build Alternatives

As discussed in Section 4.17.1, several state-listed threatened and endangered plant species have been documented within or adjacent to the study area. None have been specifically documented within the potential area of impact for any of the proposed Build Alternatives. In addition, preliminary searches for threatened and endangered plant species along each proposed Build Alternative corridor did not identify extant populations. The greatest opportunity for any undocumented populations of rare plants to be affected by the Project is along portions of the Project that cross or are aligned with transmission line ROW. These areas pose the greatest potential to support populations of anise-scented goldenrod, bird-foot violet, and spiked needle-grass, although none of these were found during surveys. Table 4.17-4 provides a comparison of the likelihood of rare plants that are known to occur within the study area to be found within the existing habitat of the proposed Alternative footprints.

Table 4.17-4. Potential for Rare Plants to Occur Within Exit 4A Alternative Footprints

Scientific Name	Common Name	Preferred Habitat(s)	Likelihood of Occurrence, by Alternative[a]				
			A	B	C	D	F
Arethusa bulbosa[b]	Dragon's mouth	Acidic peatlands	U	U	U	U	U
Aristida longespica var. *geniculata*	Spiked needle grass	Moist, sandy pond shores	U	P	P	U	U
Asclepias tuberos[b]	Butterfly weed	Dry fields, roadsides, sandy soils.	U	P	P	U	U
Calamagrostis coarctata[c]	Nuttall's reedgrass	Wetlands—bogs, fens seeps and wet meadows	P	P	P	P	U
Gaylussacia bigeloviana	Dwarf huckleberry	Acidic peatlands	U	U	U	U	U
Gentianopsis crinita[b]	Fringed gentian	Low woods, wet meadows, stream banks	P	P	P	P	U
Hypoxis hirsuta[b]	Hairy star-grass	Dry, open, deciduous woods	P	P	P	P	P

Scientific Name	Common Name	Preferred Habitat(s)	Likelihood of Occurrence, by Alternative[a]				
			A	B	C	D	F
Platanthera flava var. *herbiola*[b]	Pale green orchid	Boggy and swampy areas	P	P	P	P	U
Soldiago odora ssp. *odora*[c]	Licorice goldenrod	Dry forests, disturbed areas, sandplains	P	P	P	P	P
Viburnum rafinesquianum[b]	Downy arrowwood	Dry, calcareous woods	P	P	P	P	U
Viola pedat[b]	Bird's foot violet	Dry fields, open woods	P	P	P	P	U

[a] U = Unlikely, P = possible.
[b] Species known from Derry or Londonderry, but not found specifically within the study area. From NHNHB 2016.
[c] Species added by NH NHB after field surveys were performed for the 2016-2017 field season.

Similarly, although one exemplary natural community was identified within the study area limits, it is more than 0.5-mile upstream of Alternatives C and D. Therefore, direct impacts on this natural community are not anticipated as a result of implementing any of the Build Alternatives.

Wildlife

Federal Threatened and Endangered Wildlife Species

As discussed in Section 4.17.1, no federally endangered species are known to be present in the Project area. Therefore, no impacts on federally endangered species are expected as a result of the Project.

State-Listed Wildlife

Banding's, Spotted, and Wood Turtles:

As discussed in Section 4.17-1 (Table 4.17-3), four state-listed turtle species have been documented in or near the Project area: Blanding's turtle (state endangered), box turtle (state endangered), spotted turtle (state threatened), and wood turtle (Species of Special Concern). Box turtles are terrestrial and inhabit woodlands; pastures and fields; transmission line ROW; and edges of marshes, bogs, and streams. The other three species are more dependent on, and associated with, wetlands. Blanding's turtle habitat typically includes relatively still, shallow waters with soft muddy bottoms and abundant emergent and submergent aquatic vegetation. Ponds, lake margins, and river backwaters all potentially provide suitable habitat. Spotted turtle habitat consists of scrub-shrub and emergent wetlands, including vernal pools and shallow coves of small ponds, and this species is also known to estivate in upland fields and woodland edges during the summer. Wood turtle habitat consists of deep, slow moving streams with sandy, gravelly substrates in forested communities, and this species uses adjacent upland forests as well as emergent and scrub-shrub wetlands for foraging during the summer months. All four of these turtle species prefer sandy or gravelly upland areas with abundant sunshine to nest and will travel through upland areas to access suitable nest habitat. Additionally, the three wetland-dependent

species are known to travel across and/or forage in uplands during warmer months. Uplands within 300 meters of suitable wetlands should be considered as habitat for spotted, wood, and Blanding's turtles, and there is potential for these species to be present up to 1,000 meters from their preferred wetland habitats.

Wetlands, vernal pools, and ponds that provide preferred habitat for Blanding's and spotted turtles are present throughout the landscape surrounding the Project area, and within the footprint of the alternatives. Recent observation records for Blanding's and spotted turtles are found within the vicinity of Alternatives B, C, and D, or at locations connected to the alternatives by areas of suitable, undeveloped habitat. The upland habitats in and around the Project are suitable for box turtles, and there is a recent observation for this species in the approximately 1 mile west of the Alternative C and D access ramps. The Interstate likely forms an impermeable barrier for this species which would be unlikely to be able to successfully cross I-93 either at-grade or below grade. The likelihood of box turtles being present east of the highway, where the Alternative alignments are, is low. Deep, slow moving streams with sandy, gravelly substrates that provide preferred wood turtle habitat are not as widely distributed through the surrounding landscape, as compared to wetlands, and the recorded occurrences for this species are separated from the Alternative alignments by development, I-93, and other unsuitable habitats.

Snakes

As discussed in Section 4.17-1 (Table 4.17-3), based on available habitat and recent records in the Project area, two state-listed snake species have been documented in or near the Project area: the northern black racer (state threatened) and the smooth greensnake (Species of Special Concern). Black racers use a wide variety of forested and open habitat types, including uplands and wetlands. Smooth greensnakes prefer open, grassy habitats, but also use shrubby habitats. Recent records for northern black racer are located in the vicinity of Alternatives A, B, C, and D. Recent records for smooth greensnake are located in the vicinity of Alternatives B and C.

Grasshopper Sparrow

The grasshopper sparrow is a habitat specialist, requiring relatively large (>30 acres) grassland habitats, composed primarily of short bunch grasses. It will not use dense, overly tall grasslands or grasslands with mixed with woody vegetation. This species was last observed in 2003 at the Old Derry Landfill, and no suitable habitats for this species appear to exist within or near any of the Alternative alignments. Previous Project-related surveys conducted for this species, when open habitats were more available in and around the Alternative footprints, did not detect this species. Grasshopper sparrow is not expected to be present within or in the vicinity of any of the alternatives. No impacts on it as a result of the Project are expected, and it is not discussed further in the alternatives review later in this section.

New England Cottontail

The state-endangered New England cottontail depends on early successional and shrubland habitats with a high density of woody stems to provide browse and cover from predators. Although individuals require only a small area of suitable habitat, these areas must be well interconnected by suitable cover to maintain a viable population. This species has been documented in Derry north of Beaver Lake in 2002; in Londonderry south of Moose Hill in 2002; and near little Cohas Brook in 2011, 2013 and 2015 (Table 4.17-3). The Londonderry locations are both over 2 miles from the Project area and separated from it by I-93. The Derry

location is separated from the Project footprint by a substantial area of unsuitable habitat (row crops and suburban development). Suitable habitat is insufficient within the footprint of Alternative A or D to support New England cottontail. The powerline ROW in Alternatives B and C does have suitable habitat during certain parts of its vegetation maintenance cycle, but this habitat is ephemeral, narrow, and fragmented by roads and residential developments and isolated from other suitable habitats and known populations. New England cottontail is not expected to be present within or in the Project area. No impacts on New England cottontail as a result of the Project are expected.

Fish

As discussed in Section 4.17-1 (Table 4.17-3), based on available habitat and recent records, two Species of Special Concern fish have been documented in the Project area: the banded sunfish and the redfin pickerel. Banded sunfish prefer stands of submerged aquatic vegetation along the margins of lakes, ponds, and slow flowing rivers. They are often found far upstream in beaver ponds and small wetlands in the headwaters streams of a watershed and are highly tolerant of acidic water. The redfin pickerel prefers shallow weedy backwaters in stands of aquatic vegetation or thick overhanging grasses and shrubs, and it is frequently found in streams flowing through abandoned beaver ponds in very small watersheds that may dry up in some years. Both of these species have been recently confirmed as present in Shield Brook, in the vicinity of Alternatives C and D.

Species of Greatest Conservation Need

Based on the habitat available in the Project area, 4 insects, 2 amphibians, 1 reptile, 11 birds, and 4 bat SGCNs could be present. Note that the acoustic survey conducted for the NLEB recorded probable calls of all the SGCN bat species. Broadly, three insect species use open meadow-type habitats, five bird species use shrublands, four bird species use forests, one bird species is associated with built environments, the bat species use field and forest edges, and the remaining four species are wetland associated (Table 4.17-5). Alternatives A through D affect all these types of habitats to varying degree, and the potential impact of each Alternative on SGCNs is briefly summarized below.

Table 4.17-5. Potential for Impacts on State Endangered, Threatened, Special Concern, and Greatest Conservation Need Species

Species	Preferred Habitat	Alternative				
		A	B	C	D	F
State Endangered						
Blanding's Turtle	Wetlands with permanent shallow water and emergent vegetation, vernal pools, may use slow rivers and streams for travel and terrestrial habitats for nesting and travel among wetlands	low	high	high	mod	low
New England Cottontail	Dense shrubs and regenerating clear cuts	low	low	low	low	low

Species	Preferred Habitat	Alternative				
		A	B	C	D	F
State Threatened						
Northern Black Racer	Dry brushy pastures, powerline corridors, rocky ledges, and woodlands	high	high	mod	mod	low
Spotted Turtle	Wetlands with shallow, permanent water bodies and emergent vegetation	low	low	low	low	low
Grasshopper Sparrow	Sites at least 30 acres. Dry upland sites, with short native bunch grasses, minimal litter cover, patches of bare ground, scattered forbs, and short shrubs.	low	low	low	low	low
Special Concern Species						
Smooth Greensnake	Found in upland grassy fields, pastures, meadows, and forest openings	low	mod	mod	mod	low
Wood Turtle	Slow-moving streams and channels with sandy bottoms	low	low	low	low	low
Banded Sunfish	Acidic, heavily vegetated waters small and large rivers	low	low	high	high	low
Redfin Pickerel	Streams with dense vegetation and/or decaying matter	low	low	high	high	low
Species of Greatest Conservation Need						
Monarch	Open habitats with milkweed	low	mod	mod	low	low
American Bumble Bee	Open farmland, hay, old fields	low	low	low	low	low
Yellowbanded Bumble Bee	Meadows, wetlands, woodlands, urban areas	low	mod	mod	low	low
Coppery Emerald	Breeds in sluggish forest streams, feeds in open habitats	low	low	low	low	low
Northern Leopard Frog	Wetlands, wet meadows	low	mod	mod	low	low
Blue-Spotted/Jefferson Salamander	Palustrine wetlands including (but not limited to) vernal pools, forested uplands	mod	mod	mod	mod	low
Eastern Ribbonsnake	Wetlands, wet meadows	low	mod	mod	low	low
American Woodcock	Field edges, shrublands	low	low	low	low	low
Black-billed Cuckoo	Deciduous and mixed forests	low	low	low	low	low
Brown Thrasher	Shrublands	low	low	low	low	low
Chimney Swift	Various, nests in chimneys	low	low	low	low	low
Eastern Towhee	Shrublands	low	mod	mod	low	low
Field Sparrow	Shrublands	low	mod	mod	low	low

Species	Preferred Habitat	Alternative				
		A	B	C	D	F
Prairie Warbler	Shrublands	low	mod	mod	low	low
Purple Finch	Mixed and coniferous forest	mod	mod	mod	low	low
Scarlet Tanager	Mixed and deciduous forest	mod	mod	mod	low	low
Veery	Forested wetland and stream edges	mod	mod	mod	low	low
Wood Thrush	Mixed and deciduous forest	mod	mod	low	low	low
Big Brown Bat	Fields, forest edges	low	low	low	low	low
Eastern Red Bat	Fields, forest edges	low	low	low	low	low
Hoary Bat	Fields, forest edges	low	low	low	low	low
Silver-haired Bat	Fields, forest edges	low	low	low	low	low
Tricolored Bat	Fields, forest edges	low	low	low	low	low

Alternative A

Although Alternative A primarily follows an existing roadway in highly developed residential and commercial areas, it also crosses an undeveloped parcel that supports the largest unfragmented habitat block potentially affected by any of the alternatives. Alternative A would impact a total 4.34 acres of wetlands, including 1.15 acres of vernal pool habitat. No nearby records for any listed turtle species were found in the vicinity of Alternative A, but there are recent records for northern black racer within the footprint of Alternative A. Because racers use a wide variety of habitats, the entire undeveloped parcel potentially provides suitable habitat, and the section of Alternative A that would cross it would result in habitat loss, habitat fragmentation, and increased potential for road mortality.

Because the majority of the natural habitat that would be impacted by Alternative A is forested, the forest-dependent avian SGCNs (Table 4.17-5) are also likely to be affected by this alignment. This impact would be magnified because the alignment bisects a large Unfragmented Habitat Block, and forest-dependent species are typically sensitive to fragmentation effects. However, this Alternative would impact the least amount of forest cover type of Alternatives A through D, would have the smallest wetland impact, and would affect only a small amount of shrubby habitat, minimizing its impacts on SGCNs that depend on these habitat types.

Alternative B

Alternative B would create the most new roadway footprint of all the alternatives, with only 7,716 of 29,536 linear feet (26 percent) following existing roadway, and would affect a total of about 10.0 acres of wetlands, including 1.09 acres of vernal pool habitat directly, the most of any Alternative. West of NH 28, Alternative B shares the same footprint as Alternative A across the large, unfragmented habitat block and would have the same potential impacts on the northern black racer and forest-dependent birds. East of NH 28, Alternative B would impact three smaller Unfragmented Habitat Blocks as well as shrubby habitats associated with a powerline ROW. There are recent records for Blanding's turtle within the Alternative B footprint, and recent

spotted turtle and smooth greensnake records in the vicinity, that are connected to the roadway footprint by undeveloped habitats areas.

In addition to consuming and fragmenting habitat, Alternative B would increase the potential of road mortality for Blanding's turtle, spotted turtle, and smooth greensnake. Indirect impacts on listed reptiles also include increased exposure to collection and entrapment in catch basins and other roadway drainage structures. Impacts on shrubby habitats potentially affect shrubland bird SGCNs (Table 4.17-5). Additionally, this Alternative would also affect the greatest amount of wetland habitat of all the alternatives. Because it would affect the shrubby habitat of a powerline ROW east of NH 28, it could affect wetland- and shrubland-dependent SGCNs as well (Table 4.17-5).

Alternative C

Moving eastwards from I-93, Alternative C bisects a small Unfragmented Habitat Block, than follows NH 28 until it turns to the northeast and follows the same footprint as Alternative B. Alternative C would impact a total of about 8.73 acres of wetlands, including about 0.27 acre of vernal pool habitat directly, and there are records for Blanding's turtle, spotted turtle, and northern black racer in the vicinity of the initial portion of Alternative C, as well as the listed species records described above for the portion of the footprint that Alternative C shares with Alternative B. Suitable, undeveloped habitats provide a connection between all the recorded locations and Alternative C. Therefore, Alternative C would have the same type of impacts as Alternative B on listed turtles and snakes, including habitat loss and increasing the potential for road mortality, collection, and entrapment in drainage structures. Additionally, the interchange footprint of Alternative C west of I-93 is in the vicinity of a recent record for box turtle, and the new interchange could have all the same impacts on this species west of I-93.

Alternative C also crosses Shields Brook in the vicinity of recent records for banded sunfish and redfin pickerel. If changes to this stream crossing decrease water quality or impede fish passage, these species could be affected by the Project.

Because the majority of the natural habitat that would be affected by Alternative C is forested, forest-dependent avian SGCNs have the greatest potential to be affected by it. Some of the impacts on forest species would be minimized because this Alternative crosses the Unfragmented Habitat Blocks through existing powerline ROWs. However, this in turn increases impacts on shrubland habitats and shrubland-dependent SGCNs. This Alternative also would affect nearly as much wetland habitat as Alternative B and would therefore potentially impact wetland-dependent SGCNs (Table 4.17-5).

Alternative D

Alternative D initially follows the same footprint as Alternative C, with part of the interchange footprint located west of I-93, bisecting a small unfragmented habitat block as it departs from I-93, then following NH 28. Unlike Alternative C, the remainder of Alternative D continues to follow existing roadways. However, the portion of Alternative D that follows the Alternative C footprint would impact a total of about 3.89 acres of wetland including about 0.3 acre of vernal pool habitat directly, and would have the same potential impacts on Blanding's, spotted, and box turtles; northern black racers; banded sunfish; and redfin pickerel as described above for Alternative C.

Although the majority of the natural habitat that would be affected by this Alternative is forested, impacts on forest-dependent SGCNs would be minimized because the route of this Alternative primarily follows existing roadways and would create a minimal amount of new forest habitat fragmentation. This Alternative also affects wetland habitat and would therefore result in impacts on wetland-dependent SGCNs (Table 4.17-5).

Alternative F

Alternative F would upgrade an existing roadway surrounded entirely by developed cover types. Alternative F is separated from existing records of listed wildlife species in the vicinity by unsuitable, developed cover types, and impacts on listed species as a result of this Alternative are unlikely. There is a small possibility that species associated with waterways could be affected by the stream crossings (Table 4.17-5).

4.17.3 Mitigation

Impact minimization and mitigation for all species and all alternatives would be determined in consultation with NHFGD, NHNHB, NHDES, USFWS, USACE, and EPA to identify actions that reduce impacts associated with construction and operations. Potential actions include, but are not limited to, conducting surveys within the construction limit of work for listed animals and relocating them to safe, appropriate locations prior to initiating construction activities; fencing work areas to prevent re-entry by listed species during construction; and time of year restrictions on construction activities. It is anticipated all stream crossings would be designed to protect water quality, maintain or improve stream habitat quality, and promote passage by aquatic and terrestrial wildlife. Unavoidable impacts would be mitigated as part of the wetlands mitigation for the Project, further discussed in Section 4.12.2.

To reduce the potential for black racer mortality in the portion of the Project area from I-93 to Folsom Road due to Project construction, searches for reptiles would be conducted in the Project footprint, and all materials storage areas would be fenced to exclude reptiles. All fencing would be in place by September 15 to exclude snakes returning to potential hibernacula within the project site. The searches would be conducted in the Project footprint prior to initial ground-disturbing activities, because racers have the highest potential to be present when undisturbed habitat is still present. Once the new roadway alignment has been graded and compacted, the potential for racers to shelter in the work zone would be significantly reduced, and the potential to crush a hidden racer would be likewise reduced.

Searches for black racers would occur immediately before any heavy machinery enters the work zone or soil alteration begins. Searches would be supervised by a qualified biologist, during appropriate weather conditions, and the effort would be sufficient to ensure that work area is completely searched. All non-state-listed threatened or endangered reptile species, including listed species, encountered during these searches would be captured and released in appropriate habitat on site, but outside the construction areas. NHFGD would be contacted immediately if any threatened or endangered species are encountered or captured, and species would not be released until after consultation with NHFGD. Depending on the sequence and timing of ground-disturbing activities, some or all of the Project area may require repeated sweeps.

Materials storage areas would be fenced to exclude reptiles, because materials being stored have a high potential to provide suitable shelter for snakes even after natural habitats have been

removed from the area. Reptile-proof fencing would be used and maintained for the duration of the Project, and the fencing would be removed when the Project is complete.

In addition to the sweeps and fencing of materials storage areas, all erosion control materials used for slope and winter stabilization would be wildlife-friendly, made from natural woven fibers (no plastic mesh products) without fixed knots and without welded plastic components. Additionally, construction personnel would receive training for recognizing black racers and to take the appropriate actions to protect them. All project personnel would understand and implement the appropriate protective actions and notifications to protect listed species.

Coordination would continue with NHFGD during the permitting process to ensure that there are no additional concerns about records of listed wildlife species.

4.18 Cultural Resources

4.18.1 Regulatory Overview

Federal Regulations

Archaeological and historic architectural resources are protected by federal laws, including Section 106 of the NHPA of 1966, as amended, and Section 4(f) of the Department of Transportation Act. The requirements of Section 4(f) are discussed in detail in Chapter 7, *Section 4(f) Evaluation*.

Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on historic properties and allow the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. Before the ACHP comments on a project, the resources and effects on those resources are evaluated by the State Historic Preservation Officer (SHPO). In NH, the Director of the New Hampshire Division of Historical Resources (NHDHR) is the SHPO. A review by the SHPO is required by 36 CFR 800 (Section 106 process) and 23 CFR 771 (Section 4(f) process). Under Section 106, provisions are made by ACHP regulations (36 CFR 800) for review and input from interested consulting parties (e.g., historical societies or advocacy groups), including local governments, Native American tribes, the public, and adjacent and affected landowners.

Section 110(f) of the NHPA requires federal agencies to account for and minimize harm to any National Historic Landmark that may be directly and adversely affected by a project.

In addition to the federal requirements, state and local cultural resources regulations are relevant to the Project.

State Requirements

With the implementation of RSA 227-C:9, Directive for Cooperation in the Protection of Historic Resources, the SHPO is responsible for overseeing the identification and evaluation of cultural resources within the state relative to the work of other state agencies.

Local Requirements

The National Historic Preservation Program operates as a partnership between the federal government, states, and local communities. Program participation by local governments is