for mitigation. It is anticipated that wetland restoration and enhancement would be evaluated for any proposed landscape scale mitigation site and the SOP would be used to calculate potential mitigation credits provided by large tracts to insure that the USACE required ratio of restoration/ enhancement credits to preservation credits is met.

Discussions are currently ongoing concerning the type of mitigation and the means of acquiring mitigation.

Once the impacts to streams and wetlands have been determined for the I-73 North Preferred Alternative, coordination with the ACT concerning mitigation will continue and a suitable mitigation will be identified. At that point, a final mitigation plan would be prepared, included in the FEIS, and submitted along with the Section 404 permit application.

C.13 Invasive Species

C.13.1 How do invasive plants negatively impact the land?

Invasive species can dominate a habitat by out-competing native species, leading to degradation of habitat diversity, and reduction of available wildlife habitat. The human-built environment and economy can also suffer great damage. Invasive species can hinder access and diminish the productivity of croplands and timberlands, as well as dominate recreational areas such as parks, golf courses, and waterfronts.

C.13.2 How would actions from the proposed project create impacts from invasive plant species?

Highway corridors provide opportunities for the movement of invasive plant species through the landscape. Once these plants become established at one location along a roadway, they can spread into surrounding woodlands and along the length of the roadway, and the plants continue to spread long after the road construction is complete. Ways invasive plant species seeds can spread is by attaching to vehicles and from mowing operations. Construction equipment that has not been properly washed-off to remove seeds and plant material before leaving a previous construction site is also a potential invasive plant vector. Additionally, the spread of invasive plants is possible when topsoil is stripped from one site where invasive species, such as Chinese privet, were used as ornamental plants, and moved to another site. The top soil is generally used as top-dressing for shoulders and medians. Dormant seeds, roots, and tubers in the soil could then be spread along the new roadway. In addition, grading and grubbing the soil can spread and intensify infestations of woody invasive species by chopping the roots and stems into thousands of segments that can then

resprout.[13] Some invasive plant species might be deliberately planted in erosion control, landscape, or wildflower projects.[14]

C.13.3 What measures have been successful in preventing and/or controlling the spread of invasive plant species?

Measures to prevent the spread of invasive species include the inspection and cleaning of construction equipment, reducing opportunities for invasive species by reducing disturbance of soils in either time or space,[15] and the use of invasive-free mulches, topsoils and seed mixes. Planting disturbed areas rather than allowing them to revegetate naturally could reduce the likelihood of unwanted species colonizing in the road corridor. Control measures involve eradication, including mechanical removal of the plant material, or the application of herbicides.[16] During the construction of I-73, the aforementioned control measures would be implemented to reduce the likelihood of the spread of non-native invasive plant species along the Preferred Alternative.

C.14 Federally Protected Species

C.14.1 How could federally protected species be affected by the proposed project?

Typically, federally protected species require specific, well-documented habitat conditions to sustain them. A literature search was performed to determine habitat requirements and to find descriptions of the federally protected species, which will aid in identification of suitable habitat and the presence of species during field surveys. Important sources of reference information included natural resource agency data and published reports, various botanical and faunal literature, along with available USFWS Recovery Plans.

The Build Alternatives were designed to avoid all known locations of federally protected species and based on preliminary site visits, it is not anticipated that any of the Build Alternatives would impact federally listed species. However, intensive field surveys for all listed federally protected species will be performed for the Preferred Alternative in the identified potentially suitable habitats. If federally protected species are found during the field surveys, informal consultation with the USFWS would occur and design modifications would be made to avoid impacts to the extent practicable. If it is determined that unavoidable impacts would occur to a federally protected species, formal consultation with the USFWS would occur.

[13] James H. Miller, *Nonnative Invasive Plants of Southern Forest: A Field Guide for Identification and Control*, General Technical Report SRS-62, Asheville, N.C.: (USDA Forest Service Southern Research Station, 2003).
[14] Federal Highway Administration Guidance on Invasive Species webpage, http://www.fhwa.dot.gov/environment/inv_guid.htm.
[15] R.T.T. Forman et al., *Road Ecology: Science and Solutions, (* Washington D.C., Island Press: 2003).
[16] Federal Highway Administration Guidance on Invasive Species webpage, http://www.fhwa.dot.gov/environment/inv_guid.htm.

The following are descriptions of the federally protected species known to occur, or that could possibly occur, within the project study area, their habitat requirements, and the potential direct impacts to each from the Build Alternatives.

C.14.1.1 Rough-leaved loosestrife

Based on information from the USFWS, rough-leaved loosestrife is known to occur in Richmond and Scotland Counties. However, according to the SCDNR and NCDENR databases, rough-leaved loosestrife has not been documented in the project study area. Fire has been suppressed in most of the project study area, which has resulted in the herbaceous and shrubby vegetation being too dense in areas that may otherwise be suitable for this species. Based on a review of the NWI maps, there are small areas of pocosin wetlands indicated in close proximity to the Build Alternatives in Richmond, Scotland, and northern Marlboro Counties that could be suitable habitat for rough-leaved loosestrife. However, potentially suitable habitat for rough-leaved loosestrife was not observed within the 2,500-foot wide study corridors of the Build Alternatives during the preliminary field investigations. Therefore, it is anticipated that the proposed project would not affect the rough-leaved loosestrife.

C.14.1.2 Canby's dropwort

According to the SCDNR and NCDENR databases, Canby's dropwort has not been documented in the project study area. According to the list of federally protected species obtained from the USFWS, Canby's dropwort "possibly occurs" in Marlboro County. The habitat of the Canby's dropwort has been limited in the project study area since fire suppression has allowed the herbaceous and shrub layers to become thick and overgrown in areas that may otherwise be suitable. In addition, the otherwise most potentially suitable areas have closed canopies which would prevent this species from receiving the proper light it needs to grow. NWI maps indicate that one small area of potential savannah and wet meadow wetlands occurs in close proximity to the Build Alternatives in Scotland County. Potentially suitable habitat is mapped throughout the remainder of the project study area near all of the Build Alternatives. However, suitable habitat was not observed within the 2,500-foot wide study corridors of the Build Alternatives during the preliminary field investigations. Therefore, it is anticipated that the proposed project would not affect Canby's dropwort.

C.14.1.3 Michaux's sumac

According to the SCDNR and NCDENR databases, Michaux's sumac has not been documented in the project study area. Based on data from the USFWS, it is known to occur in Richmond and Scotland Counties. Herbaceous and shrubby vegetation has become thick in areas that are

otherwise suitable for the species due to fire suppression throughout the project study area. Suitable habitat for Michaux's sumac occurs in close proximity to all of the Build Alternatives in Richmond and Scotland Counties as well as the northernmost portion of Marlboro County. Potentially suitable habitat may occur within the 2,500-foot wide corridors of the Build Alternatives; however, Michaux's sumac was not observed during the preliminary field visits. Therefore, it is anticipated that the proposed project would not affect Michaux's sumac.

C.14.1.4 American chaffseed

The USFWS lists this species as being known to occur in Scotland County. According to the SCDNR and NCDENR databases, there are no known occurrences of American chaffseed within the project study area. Fire has been suppressed in a majority of the project study area so that herbaceous and shrubby vegetation is thick in areas that may otherwise be suitable for this species. The use of herbicides in managed pine stands would limit the establishment of this species in areas that would otherwise be suitable. In addition, the majority of potentially suitable areas have closed canopies that would shade out this species. Pine savannah and wet flatwoods are mapped in close proximity to all Build Alternatives in Scotland County and northern Marlboro County. Potentially suitable habitat may occur within the 2,500-foot wide corridors of the Build Alternatives; however, American chaffseed was not observed during the preliminary field visits. Therefore, it is anticipated that the proposed project would not affect American chaffseed.

C.14.1.5 Bald eagle

The USFWS lists this species as being known to occur in Dillon, Marlboro, and Richmond Counties. According to the SCDNR and NCDENR databases, there are no documented bald eagle nest sites within or adjacent to the Build Alternatives. The nearest documented bald eagle nest is over 1.5 miles away from the nearest study corridor (Alternative 2). The documented nest is located near Lake Wallace and Burnt Factory Pond which are both large enough to provide sufficient prey to support an eagle pair and a chick. Other suitable nesting habitat within the project study area includes forested areas along portions of the Pee Dee River northwest of Bennettsville and Wallace that is within 0.62 miles of the River. However, these areas are approximately 1.5 miles from the nearest alternative (Alternative 1). Suitable foraging habitat within the study corridors can be found at mill ponds; however, no bald eagles or nests were observed within the 2500-foot Build Alternative corridors during the preliminary field visits. Therefore, it is anticipated that the proposed project would not affect the bald eagle

C.14.1.6 Red-cockaded woodpecker

The USFWS lists the species as known to occur in all four counties. According to the SCDNR and NCDENR databases, there are no documented red-cockaded woodpecker nest sites within or adjacent to the Build Alternative corridors, nor were any suitable old-growth pine forests observed within the study corridors. Known red-cockaded woodpecker nest sites are near the intersections of Road S-30E and Road S-464, north of Bennettsville, which is over two miles away from the nearest Build Alternative (Alternative 1). Pine forests within the project study area that are located south of S.C. Route 79 are predominantly managed timberlands and, therefore, are not likely to support red-cockaded woodpeckers.

However, a review of aerial photography indicates that extensive areas of pine forest along all the Build Alternatives north of S.C. Route 79 that resemble the documented nest colony forest. Pine stands are present within the study corridors, but most are less than 30 years of age and/or have dense undergrowth present due to fire suppression and are therefore not suitable for nesting or foraging habitat. No red-cockaded nest cavities or woodpeckers were observed in or adjacent to the 2,500-foot wide Build Alternative corridors during the preliminary site visits. Therefore, it is anticipated that the proposed project would not affect the species.

C.14.1.7 American alligator

The occurrence of the American alligator within the project study area is not well-documented. Based on information from the USFWS, the species is listed as known to occur in Scotland County. The species occurrence is listed as "Historic" for Scotland County, meaning the last documented sighting was 20 or more years ago. The Great Pee Dee River and its swamps and bottomlands west of the project study area provide suitable habitat for the species. However, the tributaries of the Great Pee Dee River that are located within the study corridors of the Build Alternatives do not provide suitable habitat for the species.

The American alligator does not venture too far upstream from large deepwater river systems such as the Great Pee Dee River due to lack of sufficient numbers of prey species (large fish, turtles, water fowl, etc.) in the shallow forested wetlands. Therefore, it is anticipated that the proposed project would not affect the species.

C.14.1.8 Shortnose sturgeon

NOAA Fisheries has designated Reedy Creek, the Little Pee Dee River, and several small tributaries to the Great Pee Dee River as suitable shortnose sturgeon habitat. The USFWS lists the species as being known to occur in Dillon, Marlboro, and Richmond Counties. According

to the SCDNR and NCDENR databases, there are no known occurrences of shortnose sturgeon within the study corridors for the Build Alternatives. Suitable habitat was not identified by NOAA Fisheries within the study corridors for Alternatives 1 and 2. Therefore, it is anticipated that construction of Alternatives 1 or 2 would not affect the species. However, Alternative 3 would cross Reedy Creek, which was identified by NOAA Fisheries as potentially suitable nursery habitat. Alternative 3 over Reedy Creek would be primarily built on structure (bridge), therefore impacts would be minimal. However, construction of Alternative 3 may affect, but is not likely to adversely affect, the shortnose sturgeon.

C.14.1.9 Carolina heelsplitter

The USFWS lists the Carolina heelsplitter as known to occur in Richmond County. According to the SCDNR and NCDENR databases, there are no known occurrences of Carolina heelsplitter within the project study area, and suitable habitat was not observed within, or in close proximity to, the 2,500-foot study corridors for the Build Alternatives during the preliminary field investigations.

The Pee Dee-Yadkin River drainage basin west of the project study area does harbor suitable habitat far upstream, but not in tributaries that are within the construction limits of the Build Alternatives. Therefore, it is anticipated that the project would not affect the species.

C.14.2 What would happen if a federally protected species was affected by the proposed project?

Section 7 of the ESA requires federal agencies ensure that their activities will not jeopardize the continued existence of federally protected species. If it is determined during the development of the project that the action may jeopardize the continued existence of federally listed, threatened, or endangered species or its designated critical habitat, formal Section 7 consultation would begin. The USFWS would prepare a biological opinion in which practicable alternatives would be identified that could allow potential impacts to be minimized or avoided for the project to be completed. If it is determined that the proposed project would jeopardize the continued existence of a species or modify its critical habit with the implementation of the Preferred Alternative the USFWS may issue an incidental take statement.

C.14.3 What would indirect and cumulative impacts to federally protected species be?

Protected species that have more than a minor amount of potential habitat within the project study area, or are known to occur within the project study area, have been evaluated for potential indirect

and cumulative impacts. These species are the red-cockaded woodpecker and bald eagle. Known locations of a bald eagle nest and a red-cockaded woodpecker nest colony were avoided by the Build Alternatives. A GIS analysis was performed within the project study area to determine if projected induced development impacts would affect known occurrences of, or suitable habitat for, these federally protected species.

Potential development predicted by the land use models for all of the Build Alternatives and the No-build alternative would encroach onto forested pine lands. However, much of these lands are similar to the forested pine lands within the footprint of the various Build Alternatives and consist of managed timberland. The trees are not mature enough, or the natural pine stands are not large enough, to support a colony of red-cockaded woodpeckers. Additionally, due to fire suppression in much of the project study area, the mid-story in many of the natural pine stands is too dense. Therefore, the projected induced development is not likely to occur in areas that would adversely impact the red cockaded woodpecker.

Based on a review of aerial photography and preliminary site visits within the project study area, there are forested areas within 0.69 mile of the Great Pee Dee River and Little Pee Dee River that could provide suitable nesting habitat for the bald eagle. Other than the rivers, Lake Wallace is the only other body of water in the project study area large enough to support bald eagles. None of the projected induced development tracts would impact areas suitable for eagle nesting or foraging.

Previously constructed projects such as I-74 in North Carolina, S.C. Route 22 in Horry County, and the current widening along S.C. Route 38 in Dillon County, have contributed to cumulative upland and wetland habitat impacts in the I-73 North and South project study areas; however, none have directly impacted federally protected species. Proposed projects such as the SELL in Horry County, the widening along S.C. Route 9/S.C. Route 38 in Marlboro County, and I-73 South are also anticipated to contribute to cumulative upland and wetland habitat impacts in the project study area. Field surveys for federally listed species were completed as part of the NEPA process within the I-73 South Preferred Alternative study corridor and no federally protected species were found. The SELL project and widening along S.C. Route 9/S.C. Route 38 will involve the use of federal funding. Therefore, NEPA documentation will be prepared for these projects. It is anticipated that during the development of these roadway alignments, field surveys within the project study area would be conducted to identify and avoid impacts to federally listed species. Therefore, it is not anticipated that these projects would contribute to cumulative impacts to protected species.

One other large scale development in the project study area is being developed. A planned privately operated military training facility located in the northwestern portion of the I-73 North project study area could contribute to cumulative impacts to federally-protected species. Based on a review of aerial photography, the approximately 3,100-acre tract, 1,800 acres of which would be utilized,

is predominantly managed timberland. Because the site consists of managed pine, it is not likely that the bald eagle or red-cockaded woodpecker would be impacted.

C.15 State Species of Concern

Suitable habitat may be present in the project study area for Rare, Threatened, or Endangered Species listed by the SCDNR. However, according to the state agencies, no known locations of state species of concern occur within the study corridors of the Build Alternatives.

C.16 Wildlife

C.16.1 How would wildlife and their habitat be impacted by this project?

Wildlife along the Build Alternatives could be directly impacted by the proposed action as a result of the following:

- loss of habitat due to construction of the proposed new roadway and clearing of right-of-way;
- degradation of habitat caused by traffic noise, air quality impacts, water quality impacts, and, changes in wetland and stream hydrology; and,
- fragmentation of habitat by creating wildlife movement barriers that can limit access to critical foraging or nesting habitat and, in turn, create population isolation that may result in interruptions in breeding and affect gene flow in the population.

During construction, potential impacts include disruption of wildlife activities due to noise, and hazards to small animals during clearing and grading. Upon completion, habitat will have been converted to roadway. The degradation of habitat adjacent to the roadway could affect nesting and feeding habitats of birds, mammals, amphibians, and reptiles. Studies have demonstrated that there is typically a decline in bird populations along high traffic roadways that is generally attributed to highway noise.[17] A reduction in bird densities along highways with 10,000 vehicles per day has been measured in an approximately 0.93-mile wide zone along either side of the roadway. Bird densities are reduced within an approximately 1.8-mile wide zone along either side of the roadway where highways carry 60,000 vehicles per day. Studies have shown that there is can be a 20 to 98 percent reduction in bird densities in an 820-foot wide zone along each side of busy roadways.[18]

[17] G.L. Evink, *Interaction Between Roadways and Wildlife Ecology: A Synthesis of Highway Practice*, National Cooperative Highway Research Program (NCHRP) Synthesis 363 (Washington, D.C.: Transportation Research Board, 2002).

[18] AASHTO Center for Environmental Excellence website, http://environment.transportation.org/environmental_issues/construct_maint_prac/compendium/manual/3_13.aspx (May 30, 2007).

Fish and aquatic invertebrates would be most sensitive to degradation of water quality conditions potentially caused by the addition of impervious surfaces. Mammals, amphibians, and reptiles would most likely be impacted by wildlife/vehicle collisions because their movement patterns for food and/or habitat makes them more susceptible. In order to provide a method for comparison of potential direct wildlife habitat loss, Table C.29 provides the total acres as a metric for estimating potential loss of natural habitat that could occur along each of the Build Alternatives.

Table C.29
Potential Direct Wildlife Habitat Impacts in Acres

HABITAT TYPE	Build Alternatives 1	2 (Preferred)	3
Total Wetland Area	167.7	114.3	116.0
Total Natural Upland Area	746.6	755.0	552.4
TOTAL HABITAT IMPACT	**914.3**	**869.3**	**668.4**

Source: THE LPA GROUP INCORPORATED, 2007

Habitat fragmentation occurs as the result of subdividing larger parcels of wildlife habitat into smaller parcels. Habitat fragmentation can impact wildlife species by limiting access to the total area available for resources. Roadways can fragment habitats and have varying degrees of impact on different species. Larger species such as deer, bears, and coyotes may be able to cross the barrier created by a roadway with little or no impact. However, for smaller species that can not cross wide stretches of hot pavement, such as amphibians, the greater the potential impact due to fragmentation. For these species, the roadway may be a complete barrier, in effect confining them to the remaining habitat within the smaller parcel. The remaining habitat may not supply enough resources to support the population. Or, as in the case of many amphibians, the adults live in upland drier habitats but must return to wetland habitats to breed. If the barrier prevents access to the breeding habitat, the adults will be unable to reproduce.

In order to provide a method for comparison of potential direct wildlife habitat loss, Table C.29 provides the total acres as a metric for estimating potential loss of natural habitat that could occur along each of the Build Alternatives.

As indicated in Table C.29, Alternative 3 would impact the least amount of potential wildlife habitat. Alternative 2 would have the next lowest impact and Alternative 1 with the highest potential impact to wildlife habitat. Based on a review of aerial photography and GIS analysis, it appears that there is more upland habitat being actively farmed along Alternative 3 than Alternatives 2 and 1, which would account for low habitat impact ranking. This ranking is based on the total amount of potential habitat available along the Build Alternatives, but does not take into consideration low quality habitats such as isolated woodlots surrounded by agricultural fields or housing developments. However, these low quality areas do provide refuge and nesting habitat for some species of birds, mammals, reptiles, and amphibians.

The extent of potential impacts to wildlife depends on how the habitat is impacted by the roadway (bisected versus constructed along the edge), and the size of the habitat unit or habitat corridor that is being impacted.[19] For example, a roadway that is constructed through the middle of a large habitat unit may result in more habitat degradation than a roadway that is constructed adjacent to the unit because the zone of habitat degradation would occur on both sides of the roadway instead of only along one side of the roadway. A roadway that has a perpendicular crossing of habitat corridors, such as riparian habitat adjacent to streams, would result in less habitat loss and degradation than one that is adjacent and parallel to the habitat corridor. Table C.30 provides a comparison of

Table C.30
Relative Roadway Effects on Habitat

Impact Type	Large Unit		Small Unit		Wide Corridor		Narrow Corridor	
	Bisect	Edge	Bisect	Edge	Perpendicular	Edge	Perpendicular	Edge
Loss	Low	None	High	None	Low	None	Low	None
Degradation	High	Medium	High	High	Low	High	Low	High
Fragmentation	High	None	High	None	High	None	High	None

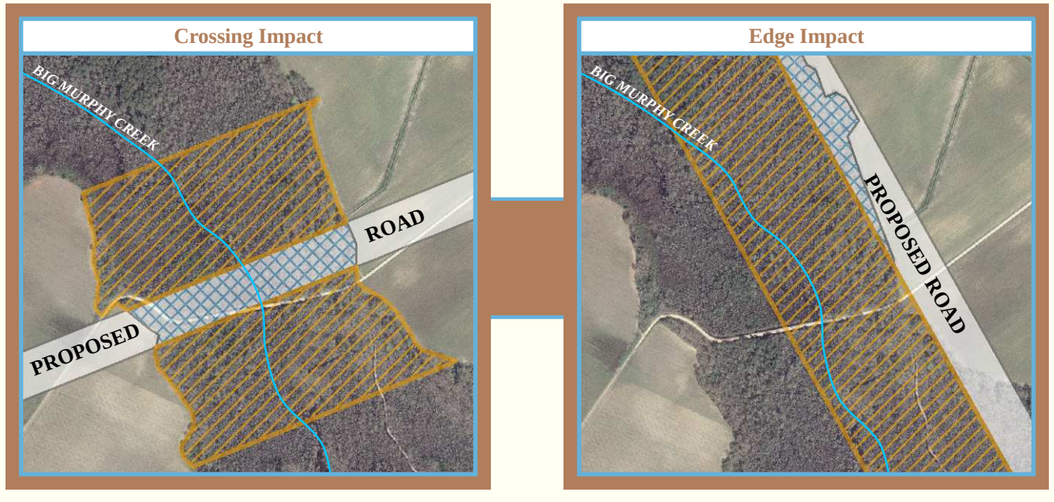
R.T. Forman , "Good and Bad Places for Roads: Effects of Varying Road and Natural Pattern on Habitat Loss, Degradation, and Fragmentation," *Proceedings of the 2005 International Conference on Ecology and Transportation*

the relative effects of highway placement on large and small habitat units and wide and narrow habitat corridors (refer to Figure C-36).

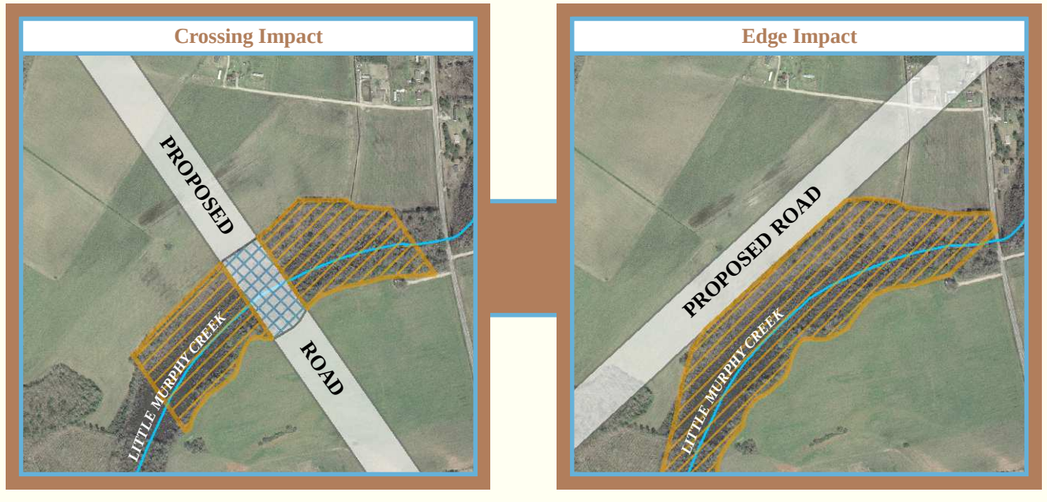
As described in Section C.12.3, (refer to page C-101), all of the Build Alternatives would cross riparian habitats associated with streams that serve as wildlife movement corridors as well as nesting

[19] R.T. Forman , "Good and Bad Places for Roads: Effects of Varying Road and Natural Pattern on Habitat Loss, Degradation, and Fragmentation," *Proceedings of the 2005 International Conference on Ecology and Transportation*, eds. C.L. Irwin, P. Garret, and K.P. McDermott. (Raleigh, NC: Center for Tranportation and the Environment, North Carolina State University, 2006), pp. 164-174.

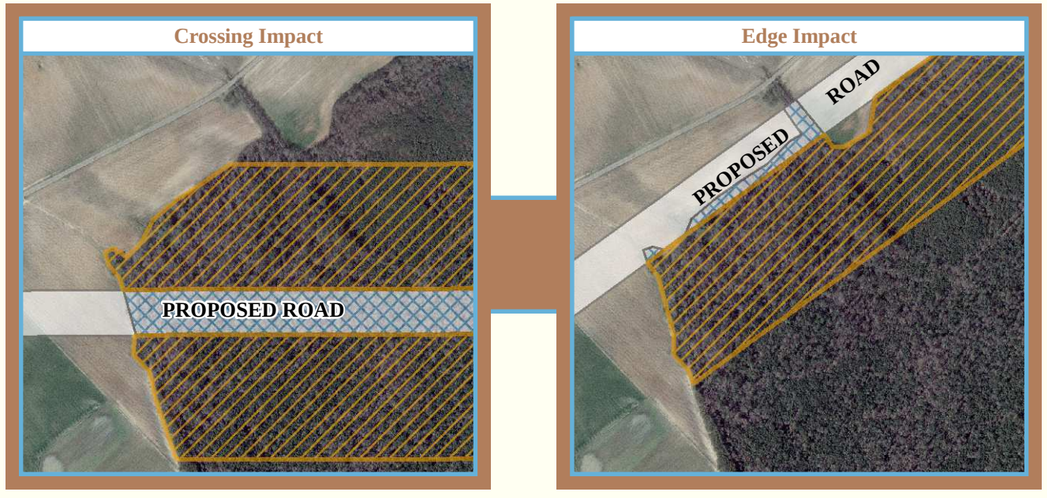
Wide Habitat Corridor



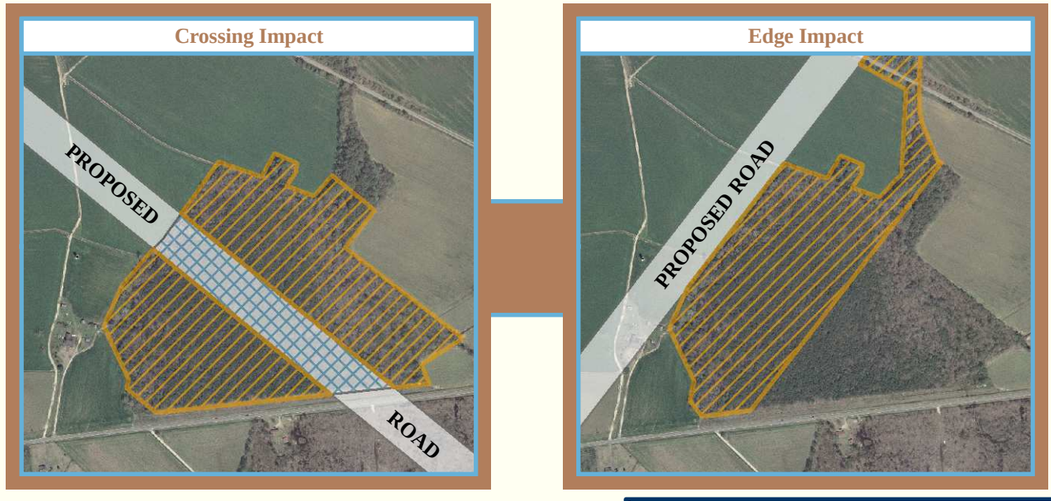
Narrow Habitat Corridor



Large Habitat Area



Small Habitat Area



Legend

- Potential Degradation Zone
- Habitat Loss
- Proposed Road

0 1000 2000 Feet

N W E S

FIGURE C-36

POTENTIAL ROADWAY IMPACTS TO WILDLIFE HABITAT

habitat for several neo-tropical migratory bird species. None of the Build Alternatives would be constructed immediately adjacent and parallel to the riparian corridors within the project study area and efforts were made to provide perpendicular crossings to the extent practicable to minimize impacts. Alternative 1 would impact the least number of these corridors with seven riparian wetland system crossings. However, it would have the highest habitat impacts with approximately 70 acres of direct riparian habitat loss. It would also have roughly 350 acres of adjacent habitat degradation where bird densities could be affected by highway noise. Alternative 2 would cross 12 systems and would result in approximately 53 acres of habitat loss and approximately 275 acres of adjacent habitat where bird densities could be affected by highway noise. Alternative 3 would also cross 12 riparian corridors and result in the loss of approximately 53 acres of habitat loss but would have the lowest impacts to adjacent habitat with approximately 234 acres of impact. GIS analysis indicates that there is over 40,000 acres of riparian corridor habitat within the project study area, therefore, these habitat corridor crossings would result in relatively low habitat loss and degradation impacts overall, but would have higher fragmentation impacts.

C.16.2 What impacts would occur to wildlife from construction?

Staging and stockpiling operations during construction could result in possible disruption to the resident wildlife population. Both the clearing of habitats, as well as the noise and vibration from construction operations could displace mobile wildlife species. Construction activities would stimulate competition between displaced species and the resident wildlife population adjacent to the construction site. Biotic impacts would be temporary, since staging and stockpiling areas would be returned to their natural state.

C.16.3 What can be done to minimize impacts to wildlife?

Potential impacts to wildlife could be minimized by timing of construction activities to avoid fish breeding periods, bridging suitable aquatic spawning and feeding areas where feasible, and limiting clearing outside the fill limits. Past studies show that habitat fragmentation and disruption of migration corridors have been reduced by providing safe wildlife crossings either over or under roadways. It has been demonstrated that a variety of wildlife will utilize culverts of various sizes for crossing roadways. Increasing culvert sizes beyond that required for stormwater flow could provide necessary access for many small to medium-sized species. Additional pipes or box culverts could be installed where high quality upland forested areas are bisected to provide safe passage of wildlife. Pipes placed in floodplains for stream and wetland mitigation purposes may also serve as wildlife passages. Fences along the right-of-way would prevent medium-sized animals from venturing onto the roadway surface and help direct them to culverts for safe passage under the roadway.

As previously mentioned, bridging associated with larger streams that have riparian corridors would also minimize habitat fragmentation impacts. The installation of animal crossing signs where the roadway crosses large areas of forested habitat or at documented wildlife movement corridors may reduce wildlife/vehicle collisions with large mammals by alerting motorist to the possibilities.

C.16.4 What indirect and cumulative impacts would occur to wildlife?

Indirect impacts to wildlife could result due to the loss of habitat and habitat degradation associated with development that would occur as the result of the construction of the Build Alternatives and the No-build Alternative. Based on a review of aerial photographs, the projected location of these developments does not appear to contribute to habitat fragmentation. Based on the results of the land use models, some of the projected development for the Build Alternatives would occur in Blenheim, Bennettsville, Clio, and McColl and along S.C. Route 9 and S.C. Route 177 N, north of Bennettsville. Projected development outside of the town limits would be clustered around the proposed interchanges with existing roadways and would occur predominantly in agricultural fields and the edges of forested patches (refer to Sections C.11 and C.12, pages C-94 and C-96, respectively). The projected development associated with the No-build Alternative would generally be close to I-95 and I-74, existing major routes at either end. Based on a review of aerial photography overlain with the projected development, it is anticipated that impacts to wildlife due to projected growth would be predominantly habitat degradation due to the proximity of the development to wildlife habitat and direct habitat loss instead of fragmentation. Table C.31 provides a comparison of potential indirect impacts to wildlife habitat (habitat loss) associated with each Build Alternative based on the predictions of the land use models.

As shown in Table C.31, Alternative 1 would have the least potential indirect wildlife habitat impacts followed by Alternative 3, and Alternative 2 would have the highest impact to wildlife

Table C.31
Potential Indirect Wildlife Habitat Impacts in Acres

HABITAT TYPE	Build Alternatives			
	1	2 (Preferred)	3	No-build
Total Wetland Area	5.9	9.7	9.6	3.1
Total Forested Upland Area	117.0	211.3	181.9	52.7
TOTAL HABITAT IMPACT	**122.9**	**221.0**	**191.5**	**55.8**

Source: THE LPA GROUP INCORPORATED, 2007

habitat. The No-build Alternative represents the baseline conditions, and would impact approximately 67 acres less than the lowest Build Alternative (Alternative 2).

Table C.32
Potential Cumulative Wildlife Habitat Impacts in Acres

HABITAT TYPE	Build Alternatives 1	2 (Preferred)	3	No-build
Total Wetland Area	176.7	127.1	119.1	3.1
Total Forested Upland Area	916.3	1,019.0	787.0	52.7
TOTAL HABITAT IMPACT	**1,093**	**1,146.1**	**906.1**	**55.8**

Source: THE LPA GROUP INCORPORATED, 2007

Cumulative impacts to wildlife species could occur regardless of which Build Alternative (including the No-build) is selected as the Preferred Alternative. Table C.32 shows the amount of wildlife habitat that would cumulatively be impacted as a result of the Build and No-build Alternatives.

Cumulative impacts could occur to the black bear population in Horry County as the result of the construction of I-73 South. The Horry County population of black bears has the highest number of automobile/bear collisions according to data obtained from SCDNR. All 26 of the collisions within the I-73 South project study area have occurred south of Conway. Eight of these occurred along S.C. Route 22 and it is anticipated that increased traffic on this roadway due to the construction of I-73 could increase the number of automobile/bear collisions. Additionally, as the area between Conway and the Atlantic Intracoastal Waterway continues to develop, bear habitat would be lost and/or fragmented, making the 10,000-acre Lewis Ocean Bay Heritage Preserve more important. Connections between Lewis Ocean Bay and the Waccamaw River, such as Sterrit Swamp and Tilly Swamp, become more important to avoid increased wildlife /vehicle collisions. The increased traffic on S.C. Route 22 may result in an increase in the number of collisions with other species, such as white-tailed deer and raccoons. Measures to minimize wildlife roadway mortality such as wildlife crossing culverts and warning signs for motorists are discussed above.

Impacts associated with the introduction and spread of nonnative invasive plant species could occur and cause degradation of wildlife habitat as a result of the proposed project. This is discussed in detail in Section C.13 (refer to page C-115). Management practices as described in Section C.13

could reduce the likelihood of the spread of non-native invasive plant species along the Preferred Alternative.

Wildlife species require various habitats to meet their food and nesting needs. Wetlands and natural forested uplands provide the most valuable habitat within the project study area because of higher wildlife species diversity, while agricultural fields and managed pine plantations are generally less diverse. The diversity and abundance of wildlife associated with the various aquatic and terrestrial habitats within the project study area are localized due to habitat fragmentation as the result of historic and current agriculture practices within the project study area. The greatest concentrations of wildlife within the project study area are anticipated to be found along the forested riparian wetlands and forested uplands associated with the major streams. Wildlife species typically use these linear forested habitats not only as foraging areas but also as travel corridors throughout their home range. Migratory birds, such as the eastern kingbird, northern parula warbler, and prothonotary warblers rely on the mid-story of these forested riparian habitats as nesting and foraging areas as well.

Other projects in or in the vicinity of the project study area that have been constructed or are in the planning stages that could result in cumulative wildlife impacts such as wildlife habitat loss, habitat degradation, and fragmentation impacts include the following:

- past construction of approximately 17 miles of I-74 in North Carolina;
- past construction of approximately 28.5 miles of S.C. Route 22;
- seven miles of current road widening along S.C. Route 38 in Dillon County;
- three miles of future widening along S.C. Route 9/S.C. Route 38 in Marlboro County;
- the future replacement of the S.C. Route 917 bridges over the Little Pee Dee River and its associated wetlands;
- the future construction of the 44-mile long portion of I-73 from I-95 to S.C. Route 22; and,
- the proposed 22-mile long Southern Evacuation Lifeline (SELL).

The proposed new I-73 South bridges over the Little Pee Dee River and its adjacent wetlands would be longer than the existing bridges on S.C. Route 917. The replacement S.C. Route 917 bridges would be the same length as the I-73 South bridges, therefore, a net improvement of wildlife habitat and wildlife movement corridors would result.

C.16.5 What potential impacts to migratory birds could result from I-73?

General threats to migratory bird species as a result of road construction include habitat loss, habitat degradation, and, to a lesser extent, habitat fragmentation. The construction of new roadways or the

widening of existing ones can contribute directly or indirectly to these. Clearing forests for the construction of a new roadway results in a direct loss of habitat utilized by forest birds, however, open right-of-way and brushy habitat created along edge of the right-of-way creates nesting and foraging habitat utilized by species other than forest birds. Other direct impacts that could potentially occur to wildlife and birds are discussed in greater detail in Section C.16.1 (refer to page C-122).

The current widening of S.C. Route 38, the past construction of U.S. Route 74 and S.C. Route 22, and the future construction of the SELL project, S.C. Route 917 bridge replacements, the widening of S.C. Route 9/S.C. Route 38, and I-73 South could also contribute to cumulative impacts to migratory bird habitat.

Cumulative impacts to migratory birds may also result from the construction of cell towers along new roadways such as SELL and I-73 North and South. Studies indicate that migratory birds frequently collide with lighted cell towers taller than 200 feet and their guy wires when flying at night and during inclement weather when visibility is hindered. It is generally accepted that the birds are attracted to the red warning lights more so than white strobe lights on the towers during periods of low visibility.[20] A review of the Federal Aviation Administration (FAA) GIS data layer for potential aircraft obstructions and the Federal Communication Commission (FCC) cell tower data layer indicates that there are 5 cell towers located within the I-73 North project study area, four of which are greater than 200 feet tall, all of these have red warning lights.

The average cell tower height in the I-73 North project study area is 285 feet. In the I-73 South project study area there are 23 cell towers, 17 of which are greater than 200 feet in height. The average height of cell towers in the I-73 South project study area is 279 feet. Of these 17 towers, 13 have red lights, three have strobe lights, and one is unknown. Currently there are 143 other structures such as television and radio towers that are 200 feet or greater in height within the I-73 North and South project study areas that could affect migratory birds. Measures recommended by the USFWS to minimize impacts to migratory birds due to cell towers include the following:

- Using existing structures instead of constructing new cell towers and design of new towers to accommodate multiple future antennas;
- Constructing towers less than 200 feet when possible; design new towers such that guy wires are not required;
- Clustering towers in areas outside migratory bird flight paths or in areas where fog and/or low cloud ceilings are common;
- Using the minimum number of lights as allowed by the FAA; use white strobe lights when possible; and,

[20] S.A. Gauthreaux and C.G. Belser, "The behavioral responses of migrating birds to different lighting systems on tall towers." *Remarks at 1st Conference of Avian Mortality at Communication Towers*, (Cornell University, Ithaca, NY August 1999).

- Removing towers that are no longer needed.

There is the potential for cell towers to be constructed along the Preferred Alternative especially in the more rural areas. However, there is no way to predict how tall the towers would be or how many would be erected. Other direct impacts that could potentially occur to wildlife and birds are discussed in greater detail in Section C.16.1, (refer to page C-122). Although cumulative impacts to migratory birds may occur as the result of the construction of I-73, the FHWA is not required to mitigate for these impacts.

C.17 Groundwater Resources

How would groundwater resources be impacted by the proposed project?

It is not likely that this project would impact groundwater. The Middendorf Aquifer, Black Creek Aquifer, and Pee Dee – Upper Cape Fear Aquifer are confined units deep below the surface of the ground (depending on their distance away from the coast), and would not be impacted by construction or reached by pollutants filtering through sediment and rock. The Black Creek Aquifer does have recharge/discharge areas throughout the Little Pee Dee River and its associated swamp systems. However, except during long periods of drought conditions, wetlands mainly serve as groundwater discharge areas.[21] This project would avoid and minimize any intrusion into wetlands if possible. For further information about wetlands, refer to Section C.12, page C-96.

Impacts could occur to the Surficial Aquifers due to its proximity to the surface, variability in depth, and that it contains unconfined units. During construction, the Surficial Aquifers could be exposed, leading to sediment entering the aquifers. Soluble materials such as petroleum products could be leaked or spilled during construction and enter these exposed areas and may cause contamination. However, best management practices would be in place, so if during construction, groundwater was encountered, a spill prevention control and countermeasures plan would be in place to manage spills and leaks of soluble materials.

While the majority of drinking water in the project study area is supplied through surface waters, Dillon, Marlboro, Richmond, and Scotland Counties use a substantial amount of groundwater for water supply, irrigation, and industrial uses.[22] Induced growth and development could increase the demand for groundwater needed in the project study area. Groundwater levels in aquifers are monitored by the United States Geological Survey, and the NCDENR or SCDHEC in their respective states. Dillon and Marlboro Counties are currently part of a six-county proposed capacity use area designated by SCDHEC to regulate the amount of groundwater being withdrawn and further protect

[21] Ralph C. Heath, *Groundwater Recharge in North Carolina,* Prepared for the Groundwater Section of the Division of Environmental Management, North Carolina Department of Environment, Health and Natural Resources, (1994) http://h2o.enr.state.nc.us/aps/gpu/documents/Heath-gwrechargeinNC.pdf (January 10, 2007).
[22] SCDHEC, *South Carolina Water Use Report 2005 Annual Summary,* (January 30, 2007).

the Middendorf and Black Creek Aquifers.[23] Any additional groundwater wells would need to be permitted prior to drilling, in accordance with state and local regulations.

C.18 Surface Water Resources

C.18.1 What are the potential impacts to water quality?

For purposes of water quality, all ditches and canals that were jurisdictionally linked to Waters of the United States were included in both the stormwater runoff analysis and counted as stream crossings. Ditches and canals will be verified for linkage to jurisdictional waters during the wetland delineation of the Preferred Alternative. Most all impacts resulting from the Build Alternatives occur to intermittent streams or ditches. All waters in the project study area are classified as *freshwater* or type C by SCDHEC or NCDENR, respectively. No *outstanding resource waters*, protected waters, *freshwaters* with specific standards, or 303(d) impaired streams would be impacted by the Build Alternatives.

C.18.1.1 No-Build Alternative

Traffic would be expected to use other roadways in the project study area and pollutant loading would occur in different portions of the watershed units, depending on the locations of the stream/ditch crossings by existing routes. Over time, the increased traffic volumes on the existing routes would result in a larger addition of pollutants at these existing crossings.

Due to limited development likely to occur in the project study area by 2030, regardless of the proposed project, predicted land use modeling anticipates only one direct stream/ditch impact with the No-build Alternative in the Little Pee Dee River watershed unit (03040204-030) (refer to Figure C-37, page C-134, and Table C.33, page C-133).

C.18.1.2 Alternative 1

Alternative 1 would cross 83 streams/ditches over six watershed units, including the Pee Dee River (03040201-010), Pee Dee River (03040201-050), Crooked Creek (03040201-070), Three Creeks (03040201-090), and Buck Swamp (03040204-050), refer to Figure C-37 (page C-134). The Buck Swamp watershed unit would have the most crossings at 30 (refer to Table C.34, page C-135).

[23] SCDHEC, *Preliminary Assessment of the Groundwater Conditions in Part of the Pee Dee Region, South Carolina,* (2003) http://www.scdhec.gov/eqc/water/pubs/pdrprt.pdf (January 30, 2007).

Table C.33
Streams/Ditches Impacted by Predicted Development in the Project Study Area

			Number of Stream/Ditch Crossings			
			No-Build	Alternative 1	Alternative 2 (Preferred)	Alternative 3
Watershed	Pee Dee River Sub-Basin 03040201	Pee Dee River 03040201-010	0	0	0	0
		Pee Dee River 03040201-050	0	6	2	2
		Crooked Creek 03040201-070	0	6	6	5
		Three Creeks 03040201-090	0	15	13	9
	Little Pee Dee River Sub-Basin 03040204	Little Pee Dee River 03040204-010	0	0	0	1
		Little Pee Dee River 03040204-030	1	1	1	2
		Buck Swamp 03040204-050	0	0	1	5
		Total	**1**	**28**	**23**	**24**

The land use model (refer to Lane Use, Section C.1, page C-1), predicted induced development for Alternative 1, which was used to estimate potential indirect impacts to water quality. Impacts that would result from the induced development associated with Alternative 1 include 28 impacts to *freshwater* streams/ditches. These impacts would be spread over four watershed units; six within the Pee Dee River (03040201-050), six within Crooked Creek (03040201-070), 15 within Three Creeks (03040201-090), and one within the Little Pee Dee River (03040204-030), (refer to Table C.33).

C.18.1.3 Alternative 2

Alternative 2 would cross 75 streams/ditches in five different watershed units, including Pee Dee River (03040201-010), Crooked Creek (03040201-070), Three Creeks (03040201-090), and Buck Swamp (03040204-050), refer to Figure C-37. The Buck Swamp watershed unit would have the most crossings at 31 (refer to Table C.34, page C-135).

Hamlet
Little Pee Dee River (03040204-010)
Rockingham
38
74
177
Pee Dee River (03040201-010)
MARKS CREEK
1
RICHMOND COUNTY
MARLBORO COUNTY
EVERETTS LAKE
WHITES CREEK
WALLACE POND
Whites Creek (03040201-040)
HICKS CREEK
HUSBANDS CREEK
WOLF CREEK
Pee Dee River (03040201-050)
9
79
38
385
BURNT FACTORY POND
LILLY QUICK CREEK
LAKE WALLACE
MAKED CREEK
PHILS CREEK
BEAVERDAM CREEK
TARKILN CREEK
Bennettsville
MCCALLS MILLPOND
GREAT PEE DEE RIVER
Little Pee Dee River (03040204-010)
LIGHTWOOD KNOT CREEK
ASHER POND
GOODWINS MILLPOND
PANTHER CREEK
PARKER BRANCH
BEAVERDAM CREEK
MCNAIRS MILLPOND
MARSH BRANCH
BEVERLY CREEK
Crooked Creek (03040201-070)
381
McColl
GUM SWAMP
MCLAURINS MILLPOND
REEDY BRANCH
83
RED BLUFF LAKE
Tatum
15
HAGINS PRONG
COTTINGHAM CREEK
ALTERNATIVE 2 (PREFERRED)
ALTERNATIVE 1
MUDDY CREEK
Three Creeks (03040201-090)
Blenheim
THREE CREEKS
HENEGAN LAKE
LAKE CREEK
GREAT PEE DEE RIVER
LEITH CREEK
CAROLINA BRANCH
MARLBORO COUNTY
DILLON COUNTY
SHOE HEEL CREEK
MARTINS BRANCH
SWEAT SWAMP
57
HAYES SWAMP
LITTLE PEE DEE RIVER
Little Pee Dee River (03040204-030)
BEAVERDAM CREEK
Clio
ALTERNATIVE 3
9
34
REEDY CREEK
Buck Swamp (03040204-050)
95
LITTLE REEDY CREEK
CATFISH CANAL
Pee Dee River (03040201-050)
Catfish Creek (03040201-150)
38
BROWNSVILLE CREEK
ROGERS CREEK

Legend

- City/Town
- SCDHEC Water Quality Stations
  - Impaired
  - Not Impaired
  - NPDES Permitted Site
- Rivers and Streams
- Alternative Construction Limit
- I-73 Southern Project Preferred Alternative
- Interstate
- Highway
- State Boundary
- Study Area Boundary
- County Boundary

0 3 6 9 Miles

N W E S

FIGURE C-37

POTENTIALLY IMPACTED WATERSHED UNITS

Table C.34
Stream/Ditch Crossings by Build Alternative

			Number of Stream/Ditch Crossings		
			Alternative 1	Alternative 2 (Preferred)	Alternative 3
Watershed	Pee Dee River Sub-Basin 03040201	Pee Dee River 03040201-010	3	3	3
		Pee Dee River 03040201-050	15	0	0
		Crooked Creek 03040201-070	15	24	25
		Three Creeks -090	20	17	0
	Little Pee Dee River Sub-Basin 03040204	Little Pee Dee River -010	0	0	13
		Little Pee Dee River -030	0	0	15
		Buck Swamp -050	30	31	30
		Total	**83**	**75**	**86**

Alternative 2 would have indirect impacts to 23 streams/ditches within five watershed units due to projected induced development based on the land use model (refer to Table C.33, page C-133). Two stream impacts would occur within the Pee Dee River (03040201-050), six within Crooked Creek (03040201-070), and 13 within Three Creeks (03040201-090), and one each in the Little Pee Dee River (03040204-030) and Buck Swamp (03040204-050) for a total of 23 *freshwater* indirect stream impacts.

C.18.1.4 Alternative 3

Alternative 3 would cross the most streams/ditches with 86 crossings in six watershed units, including Pee Dee River (03040201-010), Crooked Creek (03040201-070), Three Creeks (03040201-090), Little Pee Dee River (both units 03040204-010 and 030), and Buck Swamp (03040204-050) (refer to Figure C-37 on page C-134, and Table C.34). Buck Swamp watershed unit would have the most crossings with 30.

Due to predicted induced development based on the land use model, Alternative 3 would indirectly impact 24 *freshwater* streams in six different watershed units (refer to Table C.33, page C-133). Two stream impacts are predicted within the Pee Dee River (03040201-050), five within Crooked Creek (03040201-070), nine within Three Creeks (03040201-090), three within the Little Pee Dee River (03040204, one in subunit -010 and two in subunit -030), and five within Buck Swamp (03040204-050).

C.18.2 How much pollutant would runoff into streams as a result of the Build Alternatives?

Water quality impacts could result due to pollutant buildup in new areas of the project study area from the increase in traffic volumes. Inorganic materials, volatile compounds (from petroleum products), dust from vehicle brakes and exhaust, and heavy metals can build-up on roadways and runoff into streams and wetlands due to rain.

In addition, water quality impacts could occur during normal operation and maintenance of the roadway from spraying of herbicides or use of paint and other materials. Best management practices (BMPs) would be used for maintenance of the road and the use of herbicides in the right-of-way. The implementation of BMPs would ensure that these maintenance activities would not have an impact to water quality in the project study area.

An analysis was done using the FHWA's "Constituents of Highway Runoff" to estimate the amount of pollutant that would enter streams after a twenty-day buildup period, assuming there were no structures such as retention basins or ditches to filter sediment.[24] The volume of traffic and the estimated length for each Build Alternative within a watershed unit was used to calculate the pollutant load for one point per watershed unit. Standard equations were used to calculate the constituents in the pollutant load, which were developed based on studies completed on a rural interstate highway in Pennsylvania. In general, more pollutant would drain into streams that are in urbanized areas rather than those located in rural areas. This is due to the amount of vegetation along the sides of roadways that would filter pollutants prior to draining into streams. The results of this model and the constituent listing[25] are shown in Table C.35. While this is a general model for constituent loading into streams without filtering or retention structures, a more detailed analysis of pollutant runoff will be done for the Preferred Alternative. The No-build Alternative was analzed using the two main travel routes from future I-74 to I-95, which are S.C. Route 38 and U.S. Route 1/S.C. Route 9. While this captures a large amount of the traffic in the 2030 No-build Alternative, it does

[24] FHWA, 1981. FHWA/RD-81/042: "Constituents of Highway Runoff". Washington, D.C., 1981

[25] Using the model's equations, the sum of the constituents does not equal the amount of total solids for each Build Alternative.

Table C.35
Pollutant Discharge in Pounds

	No-build Scenarios		Build Alternatives		
	U.S. 1/ S.C. 9	S.C. 38	1	2 (Preferred)	3
Total Solids	**1349**	**704**	**3421**	**3430**	**4104**
Suspended Solids	212.48	70.08	751.00	911.04	1053.12
Total Organic Carbon	53.57	17.47	171.00	203.45	237.58
Chemical Oxygen Demand	235.01	178.90	415.00	416.06	474.70
Total Nitrogen	12.24	11.06	16.00	16.05	17.28
Total Kjeldahl Nitrogen	103.73	101.73	110.00	110.18	112.27
Total Phosphorus	1.44	0.47	5.00	6.13	7.09
Lead	0.35	0.12	1.00	1.26	1.48
Zinc	0.28	0.10	1.00	0.86	1.02
Iron	9.3	3.07	33.00	39.86	46.07
Copper	1.69	1.64	2.00	1.84	1.89
Cadmium	1.32	1.30	1.00	1.40	1.43
Chromium	0.15	0.05	1.00	0.65	0.68
Mercury	2.71	2.71	3.00	2.70	2.69

not account for the total amount of traffic which may use other routes throughout the project study area. Therefore, the amounts of pollutants listed in Table C.35 will underestimate the true amount of pollutants entering into streams as a result of the No-build Alternative.

Based on the calculated estimates from the model, Alternative 3 would have the highest amount of total solids discharged after a twenty-day build up period, while Alternatives 1 and 2 would have similar estimated amounts of total solids. Nutrient buildup as a result of increased Total Nitrogen and Total Kjeldahl Nitrogen would be similar among all Build Alternatives, while Alternative 3 would result in the highest amount of these pollutants. Total phosphorus would range between 5 and 7 pounds, with Alternative 3 resulting in the largest amount of total phosphorous being added to streams. All Build Alternatives would result in small amounts of lead, zinc, copper, cadmium, chromium and mercury being added into the streams. Iron would also be anticipated to be in pollutant runoff from the roadway, with Alternative 1 resulting in the least amount of iron being loaded into the stream and Alternative 3 being the highest amount.

Stormwater runoff from impervious surfaces may also indirectly impact water quality in the project study area. Based on the land use model, the indirect and cumulative development in the project study area was analyzed by watershed unit. The amount of impervious surface in relation to a developed tract varies and is dependent on what the tract is being used for, i.e. residential, commercial, industrial. Based on the NRCS's *Urban Hydrology for Small Watershed Basins: 1975*, the percentage of impervious surfaces would be 85 percent for commercial development, 72 percent for industrial development, 50 percent for public and institutional uses, and 25 percent for residential development.[26] Since the predicted development for the Build Alternatives was distinguished by type (i.e. residential, commercial, etc.), the amount of development was multiplied by the corresponding percentage. The results are shown in Table C.36 and separated by watershed unit. Alternative 2 would have the greatest amount of new impervious surfaces, which corresponds to it generating the most development by the land use model (refer to Land Use, Section C.1, page C-1). The greatest amount of development would be added to the Three Creeks Watershed Unit 03040201-

Table C.36
Anticipated Amount of New Impervious Surfaces by Induced Development in the Project Study Area (in acres)

			Acres of Impervious Surface				Total acres per watershed unit
			No-Build	Alt. 1	Alt. 2 (Preferred)	Alt. 3	
Watershed	Pee Dee River Sub-Basin 03040201	03040201-010	25.72	37.04	68.82	69.34	117,993
		03040201-040	0	0.67	0.67	0.78	19,834
		03040201-050	0	113.54	22.90	19.79	225,816
		03040201-070	0	91.09	127.09	105.11	49,569
		03040201-090	0	94.63	139.53	52.26	79,667
		03040201-120	2.94	2.99	8.31	5.31	84,380
		03040201-150	1.03	1.70	2.06	2.06	111,416
	Little Pee Dee River Sub-Basin 03040204	03040204-010	5.76	29.21	49.27	62.9	83,775
		03040204-030	13.68	21.96	41.31	51.70	107,985
		03040204-040	0.73	1.48	1.46	1.46	81,863
		03040204-050	0.36	3.61	23.21	32.58	97,567
		Total	**50.22**	**397.92**	**484.63**	**403.29**	

* Indicates watershed units that are administratively separated at the North Carolina/South Carolina state border.

[26] USDA-NRCS Soil Conservation Service Engineering Division. *Urban Hydrology for Small Watershed Basins, Technical Release no. 55*. January 1, 1975.

090 by Alternative 2 with over 139 acres, and then to the Crooked Creek/Crooked Creek-Lake Wallace Watershed Unit 03040201-070/03040201-0506 with 127 acres of new impervious surfaces. Impervious surfaces would not only be added to the previously described watershed units, but are also predicted to be added in the following watershed units described below.

Whites Creek watershed unit 03040201-040 is located in Marlboro County, South Carolina and watershed unit 03040201-0502 is located in Richmond County, North Carolina (refer to Figure C.37, page C-134). These watershed units comprise a single hydrologically connected watershed unit that has been separated at the North Carolina/South Carolina state line. The stream consists of Whites Creek and its tributaries including Wallace Pond and Everetts Lake, which eventually drains into the Great Pee Dee River near the North Carolina/South Carolina state line. Based on the 2000 WWQA, Whites Creek is considered a blackwater system, which is naturally low in pH, but it is fully supporting SCDHEC designated uses.

Pee Dee River watershed unit 03040201-120 is located in Dillon, Marion, and Florence Counties. Portions of Brownsville Creek are located in the project study area and eventually drain into the Great Pee Dee River (refer to Figure C.37, page C-134). The water quality of the portion of the watershed unit in the project study area is unknown at this time due to the lack of water quality monitoring stations within the portion of the watershed unit located within the project study area.

Catfish Creek Watershed Unit 03040201-150 is located in Marion and Dillon Counties and includes Catfish Creek and its tributaries, which eventually flow into the Great Pee Dee River (refer to Figure C.37, page C-134). A portion of the watershed unit is located within the project study area, consisting of the headwaters to Catfish Canal. No water quality monitoring stations exist in the portion of the watershed unit in the project study area; therefore, the water quality of the stream is unknown at this time.

Shoe Heel Creek Watershed Unit 03040204-040 is located in Dillon County on the border of the North Carolina state line and accepts drainage from Shoe Heel Creek and its tributaries, which eventually flow into the Little Pee Dee River. No water quality monitoring stations exist at this time in the watershed unit; therefore, the water quality of this stream is unknown at this time.

Impacts to watershed units begins to occur when ten percent or more of the watershed unit is comprised of impervious surfaces.[27] The amount of impervious surfaces from current residential, commercial, and industrial uses are estimated to be approximately 5,000 acres (refer to Land Use, Section C.1, page C-1). Due to the rural nature of the project area and the total acres per each watershed unit, no impacts are likely from the No-build or Build Alternatives as a result of the increase in impervious surfaces.

[27] Schueler, T. The Center for Watershed Protection. "Watershed Protection Techniques." (Vol. 1, No. 3, Fall 1994).

C.18.3 What best management practices and measures to minimize the amount of runoff pollution into streams could be used?

This proposed project would be located in mainly rural areas, so the roadway design would consist of grassy swales and vegetated slopes on the sides of the pavement which would help filter pollutants from the runoff. The runoff would be routed through grassy ditches, and as it moved through the ditches it would be filtered prior to entering streams. Retention ponds would be in place in some areas to allow pollutants to settle prior to entering streams. These design features, along with other BMPs found in the SCDOT, NCDOT, and FHWA guidelines, would be used during construction to minimize the amount of runoff pollution entering streams.

C.18.4 How would water quality impacts be minimized during construction?

Potential impacts to water quality from construction activities could be related to surface water runoff, accidental release of fuel or hydraulic fluids, sedimentation from soil erosion, and changes in stream channel grades. *The South Carolina Stormwater Management and Sediment Control Handbook for Land Disturbance Activities*,[28] provides information regarding stormwater management and sediment control during construction. Several Best Management Practices (BMPs) may be used during construction include the following:

- land grading;
- construction of temporary diversions to dispose of runoff to control erosion and sedimentation;
- construction of diversion dikes to prevent sediment-laden runoff from exiting the construction site;
- construction of temporary sediment traps which would detain sediment-laden runoff and trap the sediment to prevent impacts to surrounding water bodies;
- construction of sediment basins;
- straw bale dikes; and,
- rock dams to retain sediment on the construction site and prevent sedimentation of off-site water bodies.

The contractor would be required to comply with Section 107.26, SCDHEC's *Environmental Protection and Water Pollution Control* from the *South Carolina Highway Department Standard Specifications for Highway Construction*.[29] In addition, the contractor would be required to comply

[28] SCDHEC-OCRM, A Guide to Site Development and Best Management Practices for Stormwater Management and Sediment Control.

[29] SCDHEC-OCRM, *South Carolina Stormwater Management and Sediment Control Handbook for Land Disturbance Activities* (2003), Appendix E.

with current federal and state laws, as well as regulations regarding water quality and stormwater management.

C.18.5 What are the cumulative impacts to water quality?

Numerous other roadway projects have been constructed, are currently being constructed, or are proposed within the Pee Dee Sub-basin (03040201) (refer to Figure C-38). These projects have had an effect on pollutant loading into the Pee Dee Sub-basin. Previous projects include work associated with I-74, accounting for 14 miles of roadwork completed in Richmond County, North Carolina in 2000. A seven-mile roadway widening project is currently being conducted in Dillon County along S.C. Route 38, extending from I-95 to Marion, South Carolina.

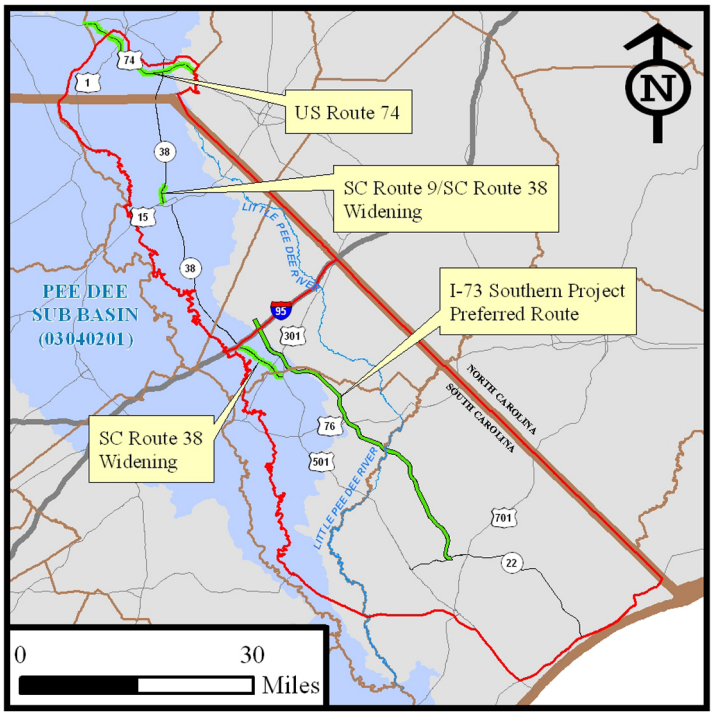


Figure C-38: Projects within the Pee Dee Basin

Three additional roadway projects are proposed to occur within the Pee Dee Sub-basin. I-73 South, a 44-mile new interstate, is proposed for construction between I-95 and S.C. Route 22 in Dillon, Marion, and Horry Counties, with new ROW varying from 300 to 400 feet. S.C. Route 22 would be upgraded to interstate standards until it terminates at U.S. Route 17 in North Myrtle Beach. Funding has not been secured for constructing I-73 South, and it is uncertain when construction for the project will begin. The second project is the widening of S.C. Route 9/S.C. Route 38 from two to five lanes, including a bridge replacement over Crooked Creek. The project extends for three miles from U.S. Route 15/401 to S.C. Route 9 Business in Marlboro County. A timeline for the S.C. Route 9/S.C. Route 38 project has not yet been determined. Although cumulative impacts to water quality could occur, the Section 401 water quality certification process would afford protection of the streams/ditches and watersheds identified within the project study area.

In addition to roadway projects, a new landfill and defense training facility is proposed to occur within the project study area. Prior to any construction, the proper permits for stormwater control and runoff would need to be obtained for these projects to be constructed. These projects would

require that standards be met for run-off control and treatment. The requirements are designed to minimize potential impacts to water quality and volumes during construction during construction and subsequent operation of these facilities.

All Build Alternatives cross a tributary to Little Reedy Creek just north of I-95 while Alternative 3 also crosses Reedy Creek before crossing the tributary to Little Reedy Creek at the same location as Alternatives 1 and 2. The Southern Preferred Alternative does not cross Little Reedy or Reedy Creeks or Buck Swamp, staying in the Catfish Creek drainage until approximately 10 miles south of Latta. Also, predicted development under the No-build Alternative and the Southern Preferred Alternative is located primarily at the proposed interchange with U.S. Route 501 west of Latta in the Catfish Creek watershed. Therefore, cumulative impacts to water quality of Buck Swamp from the highway crossing Reedy and Little Reedy Creek prior to their joining into Buck Swamp would not occur.

C.19 Floodplains

What direct impacts would there be to floodplains?

Flood Insurance Rate Maps identifying the 100-year floodplain were used to determine impacts associated with the Build Alternatives. The No-build Alternative was also reviewed as part of the impact analysis. Proposed construction limits for each Build Alternative were used to estimate the impacted area within the floodplain. Table C.37 lists the floodplain crossings for the Build Alternatives.

There are 15 different potential crossings for the Build Alternatives. Alternatives 1 and 2 had the most crossings, which was eight, while Alternative 3 has the least crossings with four. The area of floodplain impacts was totaled for each Build Alternative, and it was found that Alternative 3 would have the least amount of floodplain impacts with 25 acres, while Alternative 1 would have the highest impacts with 70 acres. The No-build Alternative would not have an effect on the floodplains in the project study area.

Engineering analysis of the floodplain impacts were conducted to further avoid and reduce impacts by bridging where possible. The use of bridges reduces wetland disturbance, and minimizes the impact of construction within the floodplain. Some bridge piers would however, have to be placed in regulatory floodways and/or floodplains for the construction of these structures. Furthermore, where feasible, the proposed crossings were located adjacent to existing road crossings to minimize the impact.

Table C.37
Floodplain Crossings Locations and Impact Areas

Location	Alternative 1	Alternative 2 (Preferred)	Alternative 3	Length of Impact (ft)	Acres of floodplain encroachment
Crooked Creek		X	X	500	4.4
Crooked Creek		X	X	200	0.7
Crooked Creek	X			3350	33.5
Lightwood Knot	X			440	3.0
Beverly Creek		X		300	2.2
Herndon Branch	X			280	3.4
Muddy Creek	X			1250	8.7
Cottingham Creek		X		1160	7.9
Three Creeks	X			1330	9.0
Hagins Prong		X		740	4.8
Reedy Creek			X	930	6.2
Little Reedy Creek	X	X		400	0.4
Little Reedy Creek	X	X		1080	10.6
Little Reedy Creek	X	X		250	1.9
Little Reedy Creek			X	1930	14.0
Total (Crossings)	**8**	**8**	**4**		
Total Impacted Area (acres)	**70.5**	**33.3**	**25.3**		

The preliminary level of design for the bridges and culverts did not include detailed hydrology studies at this stage of project development. Additionally, the mapped areas within the project study area are all shown as Zone A, which does not provide base flood elevations. However, floodplain encroachments are not likely to increase the flooding in the area since bridge structures will need to be designed to FEMA standards, which will result in less than a one-foot rise in the base flood elevation. Furthermore, structures would provide the minimum freeboard[30] above the design flood elevation and would not be exceeded by the 100-year storm.

Available FEMA studies were used to comply with Executive Order 11988, *Floodplain Management*, during the alternative analysis. However, during the design phase of the project, a detailed hydrologic

[30] Freeboard is "a factor of safety usually expressed in feet above a flood level for purposes of floodplain management. 'Freeboard' tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings, and the hydrological effect of urbanization of the watershed." Floodplain Management Association, http://www.floodplain.org/glossary_of_terms.htm (April 23, 2006).

study would need to be completed. Bridge and culvert designs must be conducted, as required by 23 CFR 650, Subpart A, *Location and Hydraulic Design of Encroachment on Floodplains*. This analysis would include establishing base flood elevations and adjusting bridge and culvert designs to minimize the risk of flooding upstream to less than one foot, as required by FEMA. Ongoing design efforts and coordination with resource and regulatory agencies will ensure that floodplain impacts are minimized during the design process.

Based on land use modeling, indirect and cumulative impacts to floodplains are anticipated to be minimal, with no anticipated impacts to the Great Pee Dee River floodplain.

C.20 Wild and Scenic Rivers

Would any Wild or Scenic Rivers be Impacted by the Proposed Project?

Based on the list of Wild and Scenic Rivers maintained by the National Park Service, no rivers or streams in the project study area are designated as Wild or Scenic Rivers.[31] The Little Pee Dee River flows through the project study area, and a part of this river is listed on the Nationwide Rivers Inventory. However, the listed portion is located approximately ten miles downstream of the project study area boundary, and would not be impacted by any of the Build Alternatives.[32]

The SCDNR's South Carolina Scenic Rivers Program website identified a 48-mile stretch of the Little Pee Dee River from the Marlboro County line through Dillon County to the Marion County line as a State Scenic River (Figure C-39).[33] While a portion of this designated area is in the project study area, the nearest alternative (Alternative 3) is approximately 0.5 mile west of the river. The proposed project would not cross the Little Pee Dee River; therefore, no State Scenic Rivers would be impacted by any of the Build Alternatives.

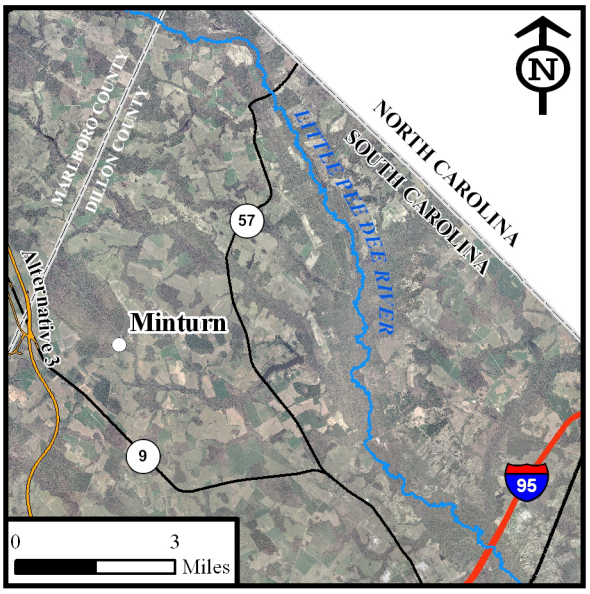


Figure C-39 State Scenic Portion of Little Pee Dee River

[31] NPS, Wild and Scenic Rivers System Website, http://www.nps.gov/rivers/wildriverslist.html#ga_nc_sc (December 5, 2006).

[32] NPS, Rivers, Trails, and Conservation Program Website, http://www.nps.gov/ncrc/programs/rtca/nri/states/sc.html (December 5, 2006).

[33] SCDNR. Little Pee Dee River of Dillon County Website, http://www.dnr.sc.gov/water/envaff/river/scenic/lilpddillion.html (December 5, 2006).

C.21 Resources Affected Uniformly

C.21.1 How would coastal resources be affected?

C.21.1.1 Coastal Zone Resources

The Coastal Zone is comprised of coastal waters and submerged bottoms seaward to the state's jurisdictional line as well as the lands and waters of the eight coastal counties of South Carolina, which include Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Horry and Jasper Counties.[34] The project study area does not fall within these eight counties and therefore, the Coastal Zone Management Act would not apply to this project.

C.21.1.2 Coastal Barrier Resources

Under the *Coastal Barrier Resource Act of 1982*, agencies are prohibited from using federal funds that would impact undeveloped coastal barrier units in the Coastal Barrier Resource System. No coastal barriers exist in the project study area; therefore the project would have no impact on coastal barriers.

C.21.2 How would energy be consumed by the project?

C.21.2.1 Energy consumption during construction

Construction of the Preferred Alternative would require an initial use of energy and resources that would not be used if the project were not built. In general, the amount of expended energy during construction would be a function of construction cost. The primary categories of energy consumption during construction are the following:

- excavation of rock and soil, and the transport and compaction of roadway embankment materials;
- manufacture, transport, and utilization of various construction materials (aggregate, concrete, street, etc.); and,
- manufacture, transport and installation of various manufactured items (guard rail, signs, lighting, etc.).

Construction of the proposed project would consume energy resources for a short time; however, the savings would be realized over the life of the facility, which would become more evident

[34] SCDHEC Website, http://www.scdhec.net/environment/ocrm/ (December 5, 2006).

closer to the design year. Completion of the facility would more than compensate for the energy lost during construction by increasing the efficiency of vehicles traveling through the project study area.

C.21.2.2 Energy consumption during the operation of the facility

Additional energy will be expended throughout the operational life of a transportation facility, mostly for vehicular travel in the form of fuel. Other lesser, but accumulative, energy uses include tires, oil, and miscellaneous vehicular maintenance items. Energy consumption due to travel would be directly proportional to how many vehicles use the facility.

Roadway maintenance would require an ongoing expenditure of energy in the form of maintenance materials and the fuel required for roadway, bridge, and drainage repairs. Energy consumption for maintenance would be relatively constant and independent of facility usage.

C.21.2.3 Energy conservation potential of the project

Energy conservation would come from one or more of the following factors:

- reduced vehicle-miles of travel;
- more efficient vehicle operation speeds;
- reduced accident potential;
- reduced construction effort; and/or,
- reduced traffic volume on existing area roadways.

C.21.2.4 Estimated statewide energy consumption savings with the Build Alternatives

The energy consumption savings for the project were derived from the results of the I-73 travel demand model. The model calculated the vehicle-miles of travel (VMT) for categories such as work, non-work, truck and statewide for the no-build and proposed alternatives. Using these categories and by comparing change in VMT for each alternative to the No-Build Alternative, the percent change in VMT for motorists throughout the project study area was estimated for each alternative. Using this percent change in VMT, an estimate of how much energy would be saved by the proposed project was determined by converting the changes to time and gasoline savings system wide. Alternative 1 is projected to have an overall energy consumption savings of 13 percent, while Alternatives 2 and 3 would result in 15 percent reduction in energy consumption compared to the No Build Alternative.

C.22 Permits

What Permits would be necessary to construct the proposed project?

C.22.1 Section 404 of the Clean Water Act

The USACE is authorized under Section 404 of the Clean Water Act to issue permits for the placement of dredged or fill material in waters of the United States, including jurisdictional wetlands. Jurisdictional wetlands within the Preferred Alternative will be delineated according to the *1987 Corps of Engineers Wetlands Delineation Manual*.[35] Impacts to waters of the United States and jurisdictional wetlands will be quantified and will require USACE authorization under Section 404. The South Carolina portion of I-73 would be permitted through the Charleston District of the USACE and the North Carolina portion would be permitted through the Wilmington District.

C.22.2 Section 401 Water Quality

Project applications for state and federal permits that would result in a discharge to wetlands and waters of the United States must obtain a Section 401 Water Quality Certification from SCDHEC in South Carolina and the NCDENR Division of Water Quality (DWQ) in North Carolina. Certification involves a review of the proposed project and analysis of its potential impact to water quality. This review is performed to ensure that any discharge into jurisdictional areas is in accordance with State water quality standards.

3.22.3 Section 402 of the Clean Water Act

Section 402 of the *Clean Water Act* (1972) authorizes the USEPA to issue NPDES permits for the discharge of pollutants into waters of the United States. This authority was transferred to SCDHEC in South Carolina and NCDENR in North Carolina. Regulations implemented by SCDHEC and NCDENR are intended to reduce the adverse effects of stormwater and sediment run-off. The regulations require completion of a site plan illustrating controls designed to reduce stormwater runoff and minimize sediment erosion. Projects that disturb greater than one acre of land require an NPDES permit, also referred to as a Land Disturbance Permit. The permit is obtained through SCDHEC in South Carolina and the NCDENR Division of Land Resources, Land Quality Section in North Carolina. The NPDES permit requires that measures to contain/pre-treat stormwater runoff prior to discharging into receiving waters be implemented and requires that

[35] U.S. Army Engineer Waterways Experiment Station Environmental Laboratory, *Corps of Engineers Wetlands Delineation Manual*, Technical Report Y-87-1 (1987).

a Stormwater Pollution Prevention Plan (SWPPP) be developed for the project which would minimize potential impacts during construction. For projects constructed in any region of South Carolina or in a coastal county in North Carolina that disturb greater than five acres of land, the development and approval of permanent water quality BMPs and a signed maintenance agreement to insure continued water quality protection are required.

C.22.4 Construction in State Navigable Waters

Article 14, Section 4 of the S.C. Constitution, 49-1-10 1976 Code of Laws of S.C., requires a permit for dredging or construction in state designated navigable waters. State navigable waters are defined as "waters which are navigable, have been navigable, or can be made navigable by removal of incidental obstructions by rafts of lumber or timber or by small pleasure or sport fishing boats. These waters are below the mean high water line in tidally influenced areas or below the ordinary high water mark in nontidal areas." When a Section 404/401 permit is required, a separate navigable waters permit application is not required as the Section 404/401 application serves as the state navigable water permit application. The Little Pee Dee River and Crooked Creek are the only state navigable waters located within the study area. The Little Pee Dee River is designated as navigable from it's confluence with Gum Swamp, east of Bennettsville, southeastward to the study area boundary and beyond. The portion of the Creek that is designated as state navigable extends from it's confluence with Quick Creek, north of Bennettsville, to its confluence with the Pee Dee River. Alternative 1 would be the only alternative that would require a State Navigable Water permit from SCDHEC.

C.22.5 Stormwater Management and Sediment Reduction Act of 1991

The *Stormwater and Sediment Reduction Act of 1991* applies to any land disturbing activity over two acres. Regulations implemented by SCDHEC are intended to reduce the adverse effects of stormwater and sediment run-off. The regulations require completion of a site plan illustrating controls designed to reduce stormwater runoff and minimize sediment erosion. To obtain a permit, the application must be sealed by a Professional Engineer and be approved by SCDHEC.

C.23 Short-term Uses Versus Long-term Productivity

The potential impacts of the proposed project must be weighed against the need for the interstate facility. Although potential adverse impacts may occur, the implementation of various mitigation measures would limit the extent of impacts that are deemed unavoidable. The local short-term impacts would be primarily associated with site preparation and construction of the interstate facility. Many of

the potential impacts would only occur during construction and would be considered short-term, including run-off from site preparation and construction areas. Other potential impacts such as permanent changes to the existing land use, loss of wetlands, loss of farmlands, and loss of habitat would be considered long-term. These impacts are discussed in detail throughout this FEIS. As discussed previously, the proposed project would provide long-term enhancement of opportunities for economic development, improved access for tourism, increased safety on existing roads, and provide a transportation system linkage (refer to Chapter One, Section 1.4).

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