SECTION 4

Description of Existing Environment in Planning Area

This section describes the existing environment to facilitate the identification of potential SCI to the natural environment as growth occurs in the Planning Area. The data for this section were gathered through literature reviews, geographic information system (GIS) analysis, phone conversations, letters, and meetings with various agency personnel.

4.1 Topography and Floodplains

The Town is located in the North Carolina Piedmont, with gently sloping to moderately steep terrain.

Floodplains function as storage areas for surface water during large rainfall events. Within floodplains, microtopographical variations often create pockets of riparian wetlands. These riparian areas provide multiple functions, including flood storage, wildlife habitat, corridors for wildlife movement, and water quality functions such as infiltration zones and surface water filtering.

Approximately 5.6 square miles of Federal Emergency Management Agency (FEMA) regulated floodplains are located inside the Planning Area; these floodplains represent 7 percent of the total Planning Area. A majority of the regulated floodplain area is within the Town's 100-foot stream buffer zone. Floodplains within watersheds greater than 1 square mile are regulated by FEMA. Flood Insurance Rate Maps (FIRMs) for the area are dated May 2, 2006 (FEMA, 2006). FIRMs for the Neuse River basin and Cape Fear River basin in Wake County are in the process of being updated and are expected to be available for public review in 2014. This will include new limited detailed floodplain studies as well as future flood conditions in some areas of the Cape Fear River basin, which will likely increase the floodplain information available to the Town. The floodplains may change in the future based on the revisions reflected in the updated FIRMs.

4.2 Soils

The major soil types are Appling, Creedmoor, and White Store. Other soil types include Congaree, Altavista, and Mayodan. These soils are mostly sandy loams. Soil types within floodplains and adjacent to streams include Wehadkee and Chewacla. Many of these soils, especially in the eastern portion of the Planning Area, have been impacted by development and other soil disturbances. These soils are gently sloping to steep, and are well-drained to moderately well-drained.

4.3 Land Use

Figure 4-2 illustrates the general land use categories within the Planning Area. The map shows land that is available for development, land that is already developed, and land that

is protected as open space. The developed land is divided into residential and non-residential uses. The open space category includes protected open space, floodplains, parks, and privately held open space.

Table 4-1 provides detail on the area within each general land use category. As shown in the table, approximately 64 percent of the Planning Area is developed land, 13 percent is open space, and another 22 percent is currently forested, agricultural, or vacant (no building on the parcel).

Figure 4-1 illustrates the riparian buffers within the Town's Planning Area, and these buffers account for 15.0 square miles or 18 percent of the Planning Area. Note that these calculations are based on the Town's ordinances, though the Planning Area includes some areas outside of the Town's jurisdiction that are not subject to the Town's requirements. The approximately 5.6 square miles of FEMA regulated floodplains are located inside the Planning Area; these floodplains represent 7 percent of the Planning Area.

TABLE 4-1
Planning Area Existing Land Use

General Land Use Type	Square Miles	Percent of Planning Area
Residential Developed	32.3	39%
Non-residential Developed[1]	20.9	25%
Undeveloped[2]	17.8	22%
Open Space[3]	10.7	13%
Open Water	0.7	1%
Total	**82.4**	**100%**

Source: Town of Cary, 2013b; NCWRC, 2013a

[1] Transportation is included within the Non-Residential category.

[2] Undeveloped land is any undeveloped land that has potential for development. Undeveloped land may be forested, agricultural, cleared, or residential with a minimum 10-acre lot.

[3] Open space area includes <0.1 square mile of Wildlife Resources Commission (NCWRC) Gamelands.

The actual percentage of open space within the Planning Area is likely greater than the amount indicated by Tables 4-1 and 4-2, and Figures 4-1 and 4-2 due to the following factors: (1) large portions of the areas classified as residential are open space because of the large amount of low-density development; (2) the Town requires open space in residential and commercial developments, and (3) the Town requires the use of buffers for protection of riparian areas and floodplains. In addition, the Town requires open space to be provided with the new developments. As a result, there are many areas that are undeveloped open space within the various general land use categories.

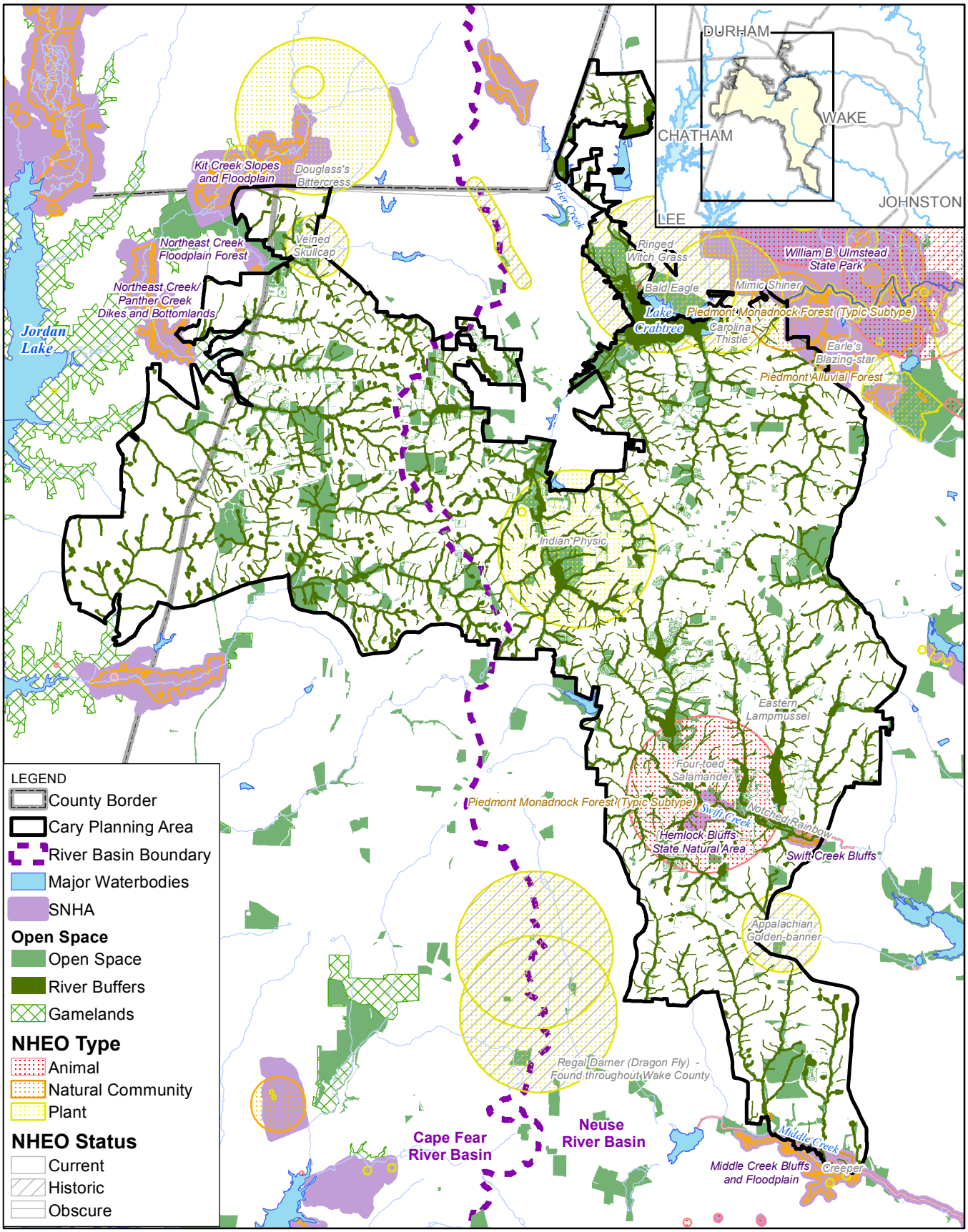

FIGURE 4-1
Environmental Features
2015 Secondary and Cumulative Impacts
Master Management Plan - Town of Cary

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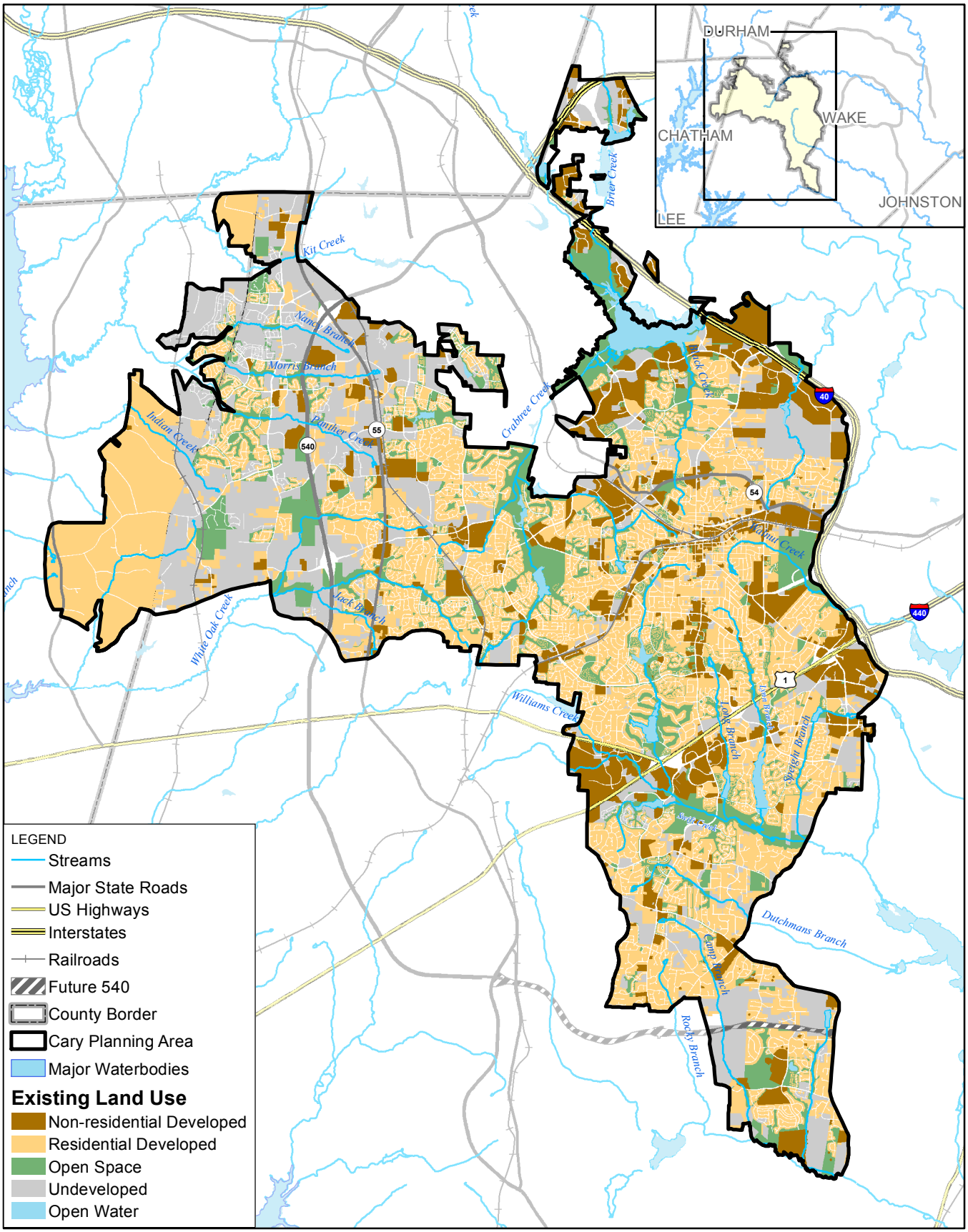

FIGURE 4-2
Existing Land Use
2015 Secondary and Cumulative Impacts
Master Management Plan - Town of Cary

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Table 4-2 provides a detailed breakdown of existing land use in the Planning Area. Residential use (39 percent) is currently the predominant land use within the Planning Area, with the majority of residential use classified as low-density (27 percent of total land use). Small amounts of clustered high- and medium-density residential developments exist. Commercial, industrial, and institutional land uses comprise 13 percent of the area. The most heavily urbanized areas lie along the I-40 corridor, US Highway 54 corridor, US Highway 1 (US 1) corridor, and in the northern area near RTP.

TABLE 4-2
Planning Area Detailed Existing Land Use

Land Use Type	Square Miles	Percent of Planning Area	Estimated Percent Imperviousness[3]	Estimated Impervious Square Miles
Commercial	2.2	3%	82%	1.8
Office Commercial/Industrial	2.2	3%	82%	1.8
Office Commercial/Institutional	3.7	4%	72%	2.6
Institutional	2.7	3 %	72%	1.9
Transportation[1]	10.1	12%	87%	8.7
High-Density Residential	2.6	3%	72%	1.9
Medium-Density Residential	4.4	5%	44%	1.9
Low-Density Residential	22.4	27%	21%	3.7
Very Low Density Residential	2.9	4%	6%	0.2
Agriculture/Forest[2]	4.7	6%	2%	0.0
Park/Open Space	10.7	13%	4%	0.4
Open Water	0.7	1%	N/A	-
Undeveloped	13.1	16%	3%	0.4
Total	**82.4**	**100%**		**25.3**

Sources: Town of Cary, 2013b

Note: The Town's land use categories are described in Appendix D.

[1] Transportation is not included in the land use data. The area used for transportation was estimated by subtracting the land use area from the transportation area.

[2] The percent imperviousness for the agriculture/forest category was assumed to be the average of the values for agriculture and forest outlined in CH2M HILL, 2002a

[3] Percent imperviousness values come from estimates from a modeling analysis (CH2M HILL, 2002a). Percent imperviousness values are capped in water supply watersheds. Thus, actual percent imperviousness for a given high-density development may not be as high as presented in Table 4-2.

Table 4-2 also includes estimates of percent imperviousness; the estimated values shown in the table were used in modeling analyses performed for the Town (CH2M HILL, 2002a). These values are based on literature values. The percent imperviousness per land class was used to estimate the impervious area for the 2013 land use data. These were then summed and divided by the total land area (with lakes subtracted out) to estimate the overall imperviousness value for existing land use conditions. The total percent impervious is approximately 30 percent.

4.4 Wetlands

For regulatory purposes under the Clean Water Act (CWA), the term "wetlands" means "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." In general, wetlands share three key characteristics: wetland hydrology, hydric soils, and hydrophytic vegetation. Wetlands and vegetated riparian areas are valuable because they are among the most biologically productive natural ecosystems in the world. They also protect wildlife, provide natural open spaces, protect water quality, control erosion, and limit flood damage.

TABLE 4-3
National Wetlands Inventory within the Planning Area

NWI Type	Acres
Emergent	14
Forested/Shrub	1,825
Lakes/Ponds	603
Total	**2,442**

Source: NC Center for Geographic Information and Analysis (NCCGIA), 2013

Wetlands, as classified in the US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI), within the Planning Area, are primarily riparian or bottomland forest associated with streams and their floodplains (Figure 4-3; Table 4-3) (NCCGIA, 2013, which is based on the 1982 USFWS NWI). Most of the NWI wetlands are forested and are part of bottomland communities adjacent to larger streams within the Planning Area. Analysis of the Wake County Soil Survey (U.S. Department of Agriculture [USDA], 1970) also shows hydric soils present, primarily along stream channels, concurring with NWI data indicating that wetlands within the Planning Area are primarily located within riparian and floodplain areas. Small areas of emergent wetlands are present along ponds. Open water ponds have been created along many of the streams within the Planning Area. While the NWI does not map all jurisdictional wetlands, it is useful in terms of classifying types of wetlands and their approximate locations within the Planning Area. It is important to note that many changes have taken place within the Planning Area since these data were compiled.

4.5 Prime or Unique Agricultural Land

North Carolina Executive Order 96, issued in 1984, charges all state agencies to minimize the loss of prime agricultural and forested lands as defined in the federal Farmland Protection Policy Act. The USDA Natural Resources Conservation Service has classified lands into three categories based on suitability for agricultural uses. These classifications incorporate soil type, slope, and water capacity. *Prime farmlands* are those soils with slopes between 0 and 8 percent in capability classes I and II, and some in capability class III. *Unique farmlands* are recognized for having the set of parameters necessary to produce certain high-value crops. The third category, *farmland of statewide importance*, includes soils that do not quite qualify as prime farmlands. Factors include steepness of slope, susceptibility to erosion, and permeability (USDA, 1998).

Currently, approximately 5.7 percent of the Planning Area remains in agricultural or forested use, as discussed later in this section. Because land use data, as discussed in Section 4.3, do not adequately represent land cover types, further analysis was conducted using the North Carolina Gap Analysis Project (NCGAP) data, which were based on 1992 satellite

imagery (NCGAP, 2006). Agricultural lands are concentrated in the western portion of the Planning Area and include pockets of both cultivated row crops and pasture areas.

Soils defined as prime farmland are present within the Planning Area. The major soil types in the Planning Area are Appling, Creedmoor, and White Store. Other soil types include Congaree, Altavista, and Mayodan. These soils are mostly sandy loams. Soil types within floodplains and adjacent to streams include Wehadkee and Chewacla. Of the major soil types within the Planning Area, Appling, Altavista, Congaree, Creedmoor, and Chewacla are listed as prime farmlands (USDA, 1998). Chewacla soils must be drained to be of use for agricultural purposes. Other soil types considered of statewide importance include Appling soils with steeper slopes, Mayodan thin silt loams, and White Store. Many of these soils, especially in the eastern portion of the Planning Area, have been impacted by previous development and other soil disturbances.

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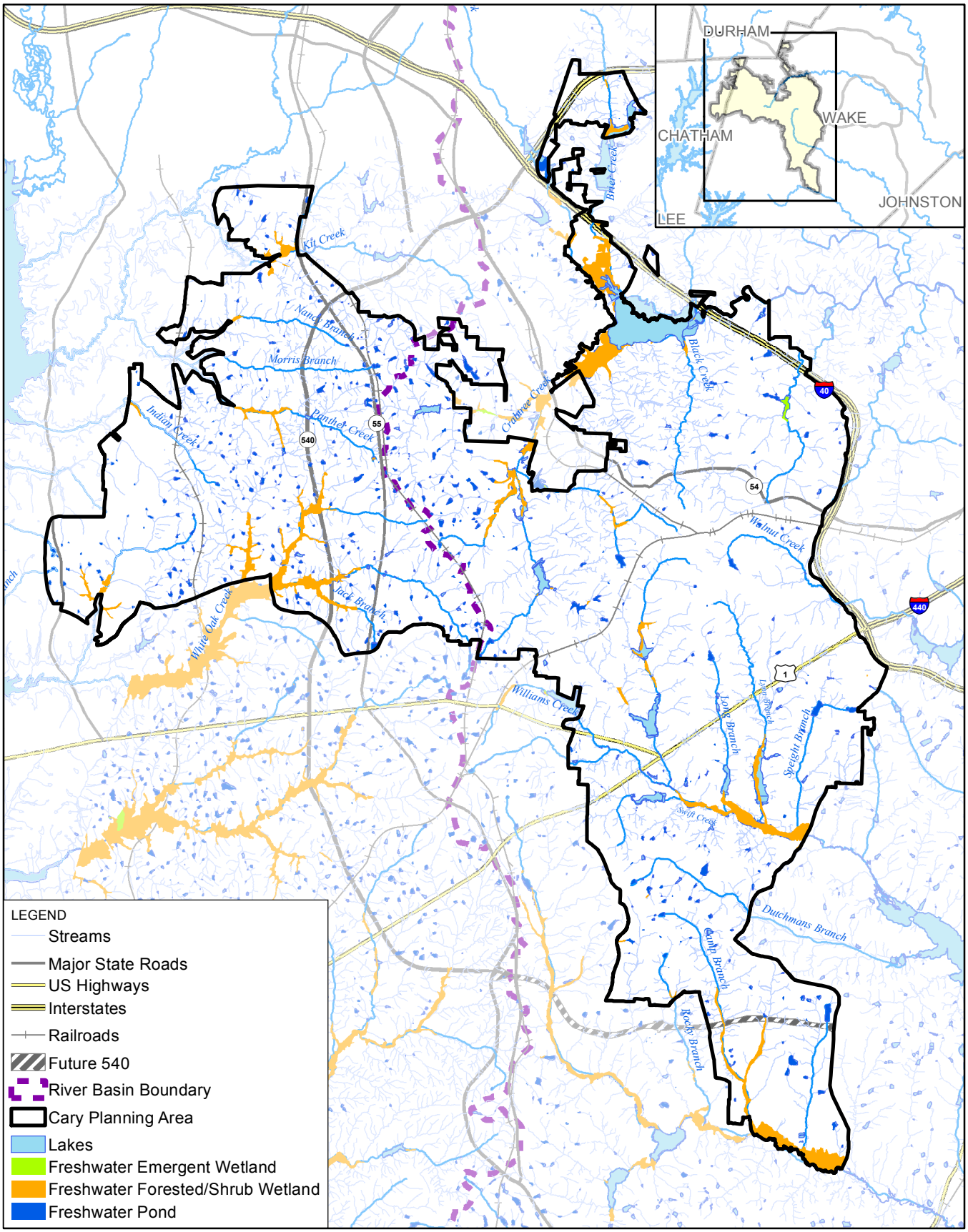

FIGURE 4-3
National Wetlands Inventory (NWI)
2015 Secondary and Cumulative Impacts
Master Management Plan - Town of Cary

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4.6 Public Lands and Scenic, Recreational, and State Natural Areas

This category includes public or conservation lands, federal, state, and local parks, and other scenic and recreational areas. Land use data provided by the Town show that 14 percent of land within the Planning Area is classified as parks, open water, or open space (Figure 4-2). Open spaces provide both scenic and recreational opportunities for residents. The major parks and recreation areas within the Planning Area are listed in Table 4-4.

Scenic areas also provide passive recreational opportunities such as hiking and bird watching when located on public land and include Significant Natural Heritage Areas (SNHAs). These areas are discussed in Section 4.13. Private conservation lands held by non-profit organizations such as the Triangle Land Conservancy also provide scenic and recreational value to the community.

Another nearby resource for the Town is Umstead State Park, which is located adjacent to the Planning Area and provides many types of recreational activities, including hiking, bird-watching, picnicking, camping, fishing, and boating. This 5,579-acre park also provides environmental education activities and is home to many rare species and their habitats.

TABLE 4-4
Parks within the Planning Area

Park	Total Acres	Acres within Planning Area	Owner
Existing			
Crabtree Park	331	331	Wake County
Bond Park	290	290	Town of Cary
Tom Brooks Park	239	239	Town of Cary
WakeMed Soccer Park	163	163	State of North Carolina
Hemlock Bluffs Nature Park	140	140	Town of Cary
Middle Creek Park	105	105	Wake County
Regency Park	53	53	Town of Cary
School-Park Site	147	147	Wake County
North Cary Park	61	61	Town of Cary
Cedar Fork District Park	31	27	Wake County/Town of Morrisville
Ritter Park	35	35	Town of Cary
Godbold Park	25	25	Town of Cary
Cary Tennis Park	22	22	Town of Cary
Marla Dorrel Park	18	18	Town of Cary
MacDonald Woods Park	14	14	Town of Cary
Davis Drive Park	16	16	Wake County
Sears Farm Rd Park	13	13	Town of Cary
Walnut Street Park	13	13	Town of Cary
White Oak Park	12	12	Town of Cary
Annie Jones Park	10	10	Town of Cary

TABLE 4-4
Parks within the Planning Area

Park	Total Acres	Acres within Planning Area	Owner
Lion's Park	6	6	Town of Cary
R.S. Dunham Park	6	6	Town of Cary
Lexie Lane Park	3	3	Town of Cary
Heater Park	1	1	Town of Cary
Urban Park	1	1	Town of Cary
Dorothy Park	1	1	Town of Cary
Rose Street Park	1	1	Town of Cary
Subtotal Existing	***1,754***	***1,750***	
Future			Town of Cary
Raftery Park	115	115	Town of Cary
Kit Creek/Shaffer Park	61	61	Town of Cary
Roberts Road Park	54	54	Town of Cary
Bartley Park	50	50	Town of Cary
Weldon Ridge Park	45	45	Town of Cary
Walnut Creek Park	44	44	Town of Cary
A.M. Howard Farm Park	30	30	Town of Cary
Tryon Road Park	24	24	Town of Cary
Morris Branch Park	21	21	Town of Cary
Carpenter Park	16	16	Town of Cary
New Hope Church Road Trailhead	12	12	Town of Cary
Town Center Park	12	12	Town of Cary
C.F. Ferrell Store Park	3	3	Town of Cary
Black Creek Greenway Trailhead Park	1	1	Wake County
Subtotal Future	***487***	***487***	
Total	**2,241**	**2,237**	

Sources: Town of Cary, 2013

4.7 Areas of Archaeological or Historical Value

SEPA requires the conservation and protection of the state's natural resources and preservation of "the important historic and cultural elements of our common inheritance." The National Register of Historic Places (NRHP) is the formal repository of information pertaining to historic structures and districts and is managed by the National Park Service (NPS). Places considered for listing include historic structures and districts, cemeteries, and archaeological sites. To assess the general character of cultural resources associated with the Planning Area, background research was conducted using the NRHP website (NPS, 2014). Three districts listed in the NRHP within the Planning Area are the Cary, Green Level, and Carpenter Historic Districts. Recognized national historic properties in the Planning Area include:

- Nancy Jones House
- Page-Walker Hotel
- Utley-Council House
- Ivy-Ellington House

As of 2014, there have been almost 1,900 archaeological sites identified, ranging from Paleo-Indian (10,000 BC) to 19th century industrial sites (NCDCR, 2014a).

To support federal efforts to protect historic places, the Town is a Certified Local Government (CLG) (NCDCR, 2014b). The responsibilities of a CLG are to:

- Enforce state or local legislation for the designation and protection of historic properties.
- Establish a historic preservation review commission.
- Maintain a system for the survey and inventory of historic properties compatible with the statewide survey.
- Provide opportunities for public participation in the local program.

As a CLG, the Town is eligible for grant money and can provide local expertise during the nomination process for the NRHP. The Town has entered into a partnership with Wake County to manage cultural and historical resources.

4.8 Air Quality

The U.S. Environmental Protection Agency (USEPA) uses the Air Quality Index (AQI) to report ambient air quality conditions, and the AQI ranges from good, moderate, unhealthy for sensitive groups, unhealthy, to hazardous. In 2012, the median AQI in Wake County was 42, or good. No days were considered unhealthful and 4 days were considered unhealthful for sensitive populations (USEPA, 2012a).

A new, more stringent National Ambient Air Quality Standard (NAAQS) for ozone was established by USEPA in 1997. As of June 2005, Wake County, which was identified as a maintenance area, was no longer subject to the 1-hour standard. In March 2008, USEPA further strengthened the national standards for 8-hour ozone levels. Since 2006, the County has been listed as a maintenance area for the 8-hour ozone standard. Ozone is not directly emitted, but is formed when sunlight reacts with volatile organic compounds and nitrogen oxides (NOx) and is a component of smog. The largest source of the precursors to the formation of ozone in the Planning Area is exhaust from motor vehicles. The Raleigh and Durham area is listed as a maintenance area for carbon monoxide, which is primarily emitted from transportation and industrial sources (USEPA, 2013).

North Carolina had its lowest ozone levels on record in 2013 since air monitoring began in the early 1970s. The declining ozone levels coincided with lower emissions from the state's power plants. A recent report by the North Carolina Division of Air Quality (NCDAQ) shows that the state's coal-fired power plants have cut their NOx emissions, a primary industrial contributor to ozone pollution, by more than 80 percent since the General Assembly enacted the Clean Smokestacks Act in 2002 (NCDENR, 2013a).

4.9 Noise Levels

Within the Planning Area, noise is created primarily by two sources: the RDU airport and vehicular traffic. Typical flight patterns for the airport cross a small part of the northeast portion of the Planning Area. Noise levels are highest along traffic corridors, with lower noise levels in residential areas. Construction activities, which occur with development, are also present within the Planning Area and are temporary. Typical residential noise sources include lawn mowers, leaf blowers, and barking dogs. This noise is generally concentrated during daylight hours. Noise also is associated with industrial activities; however, industrial land uses comprise only 3 percent of land use, so this is not a major contributor of noise in the Planning Area.

4.10 Water Resources

4.10.1 Surface Water

The Town lies on the ridge between the Neuse and Cape Fear River basins. Roughly 71 percent of the study area lies in the Neuse River basin (HU 03020201) and 29 percent lies in the Cape Fear River basin (HU 03030002). The major tributaries of the Neuse River basin within the Planning Area include Crabtree Creek, Walnut Creek, Swift Creek, and Middle Creek (Table 4-5; Figure 4-4). The EMC classifies all water bodies within the state based on the best usage, and each classification represents certain designated uses. With the exception of Swift Creek, which is classified as Class WS-III, all of the tributaries in the Neuse River basin are classified as Class C (NCDENR, 2012a). (Note: The EMC has not classified many of the unnamed tributaries shown on Figure 4-4; stream classifications of unnamed tributaries correspond to the stream to which they drain.)

The major tributaries of the Cape Fear River basin within the Planning Area include Kit Creek, Panther Creek, and White Oak Creek (Table 4-5; Figure 4-4). Each of these tributaries drains to Jordan Lake, which is the Town's water supply and a popular recreation area. Generally the segments of the tributaries upstream of NC-55 are classified as Class C, and the segments downstream of NC-55 are classified as Class WS-IV (NCDENR, 2012a). In addition to the assigned classifications listed above, all waters within the Planning Area (and the entire Jordan Lake watershed) are classified as Nutrient Sensitive Waters (NSW), because they have been found to experience, or are subject to, excessive growths of macroscopic and/or microscopic vegetation that may impair the designated uses of the waters.

The designated uses of Class C waters include aquatic life propagation, maintenance of biological integrity, fishing, and secondary recreation activities. Class WS-III and WS-IV waters are suitable for all uses designated for Class C waters and are also suitable for drinking and culinary uses. The primary difference between Class WS-III and IV waters is the degree of development within the watershed at the time of classification; the watershed of Class WS-III waters is less developed than that of the Class WS-IV waters. Water supply watersheds (WSWs) comprise 49 percent of the Planning Area.

TABLE 4-5
Watersheds in the Planning Area

Watershed	EMC Subbasin	14-Digit Hydrologic Unit Code	EMC Water Quality Classification	Watershed Description
Neuse River Basin				
Crabtree Creek	03-04-02	03020201080010	C NSW	Tributaries include Coles Branch, Richlands Creek, Reedy Creek, Stirrup Iron Creek, and Brier Creek.
Walnut Creek		03020201090010	C NSW	Includes Lake Johnson.
Swift Creek		03020201110010	WS-III NSW	Macgregor Downs Lake, Dutchmans Branch, Williams Creek, and Long Branch drain to Swift Creek.
Middle Creek		03020201120010	C NSW	Includes Rocky Branch, Bells Lake, and Camp Branch. These creeks discharge to Middle Creek.
Cape Fear River Basin				
Kit Creek	03-06-05	03030002060140	C NSW; WS-IV NSW	Long Branch meets with Kit Creek, which eventually discharges to Jordan Lake.
Panther Creek		03030002060140	WS-IV NSW	Includes Nancy Branch and Morris Branch, which eventually discharge to Jordan Lake.
White Oak Creek		03030002060150	C NSW; WS-IV NSW	Includes Batchelor Branch, Clark Branch and Jack Branch, which eventually discharge to Jordan Lake.

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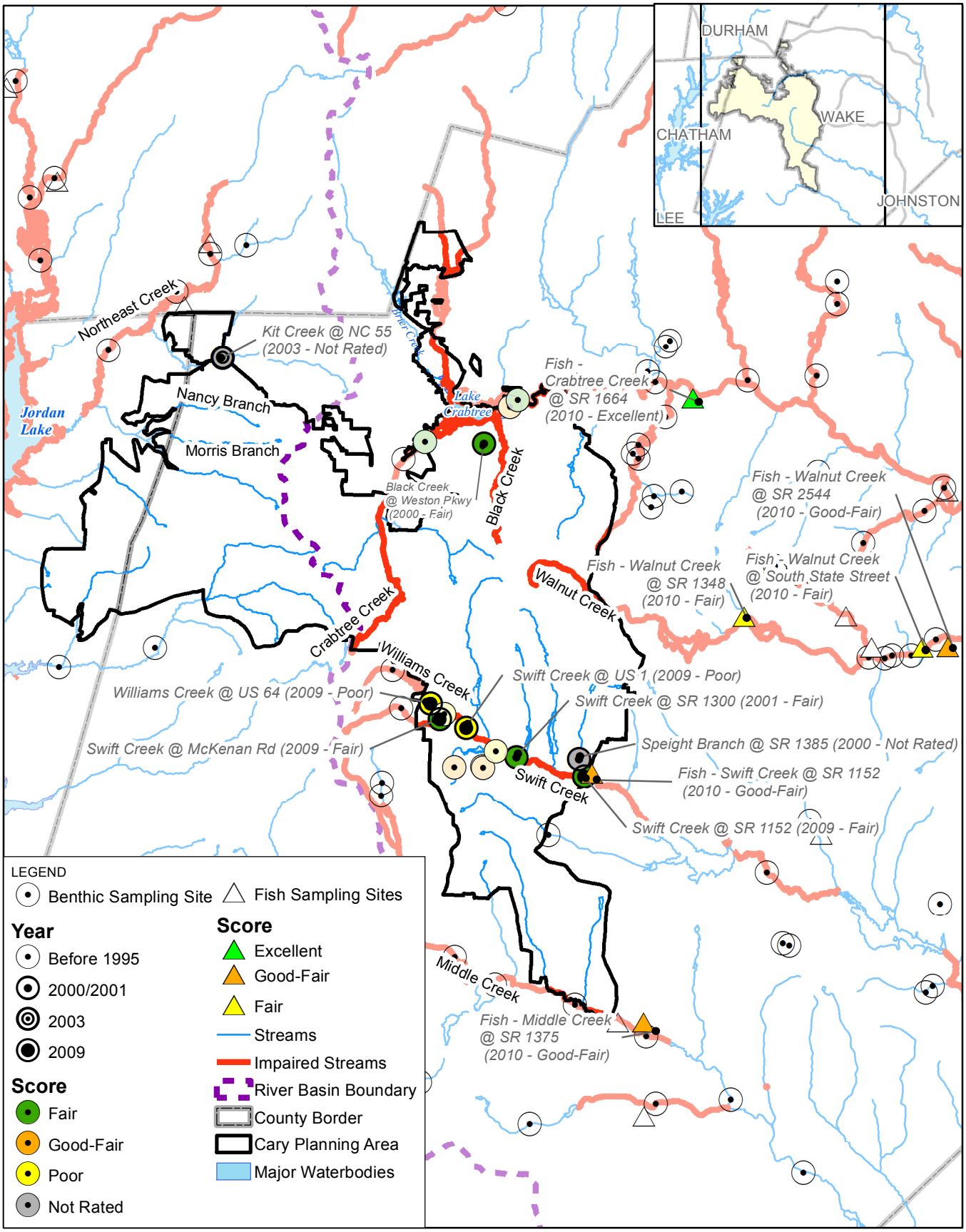

FIGURE 4-4
Water Resources
2015 Secondary and Cumulative Impacts
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Macroinvertebrate and fish communities are sampled by NCDENR to assess water quality and habitat conditions. Within the Neuse River basin portion of the Planning Area, benthic macroinvertebrate communities sampled by NCDENR are shown in Figure 4-4. Table 4-6 includes macroinvertabrate sampling data for Swift Creek , Crabtree Creek and Walnut Creek.

Crabtree Creek is sampled near the border of the Planning Area and Morrisville at NC 54. At the NC 54 site, the benthic macroinvertebrate community rating was Poor in 1988, 1995, 2000, and 2005. The low rating is due to many factors affecting habitat, including sediment loading and siltation, low dissolved oxygen (DO) levels, and high conductivity. Swift Creek, which drains portions of the Towns of Cary and Apex, is sampled at SR 1152 approximately 1.5 miles upstream of Lake Wheeler. This site received a bioclassification of Fair in 1989, 1995, 2000, 2005, and 2009. Logging and upstream development have influenced the bioclassification of this site (NCDENR, 2012b).

Within the Neuse River basin, there are several fish community sampling sites maintained by NCDENR in or near of the Planning Area, shown in Table 4-6 and Figure 4-4. Ratings assigned after sampling are based on both quantity of fish and diversity of species collected. The most recent sampling was conducted in 2010, and the site on Crabtree Creek at SR 1664 was assigned an Excellent rating. While other sites did not receive such high quality ratings, it is of particular note that the fish communities at the Walnut Creek and Swift Creek sites improved from 1995 to 2010. In Walnut Creek, sites at SR 1348 and South State Street, showed high percentages of diseased fish with sunfish being the primary species collected, which is indicative of a stressed stream. The Swift Creek site had previously exhibited a low species diversity but an abundance of fish, and improved to Good-Fair in 2010. The site on Middle Creek at SR 1375 is downstream of the South Cary WRF and showed some decline in score between 2005 and 2010, but will continue to be monitored (NCDENR, 2012b).

TABLE 4-6
Benthic Macroinvertebrate and Fish Community Monitoring Sites in the Planning Area

Type	Stream	1995	2000	2004/ 2005	2009/ 2010
Macroinvertebrate	Crabtree Creek @ NC 54	Poor	Poor	Poor	-
Fish	Crabtree Creek @ SR 1664	-[1]	Excellent	Excellent	Excellent
Fish	Walnut Creek @ SR 2544	Fair	Good-Fair	Good-Fair	Good-Fair
Fish	Walnut Creek @ S. State Street	-[1]	-[1]	-[1]	Fair
Fish	Walnut Creek @ SR 1348	Poor	-[1]	-[1]	Fair
Macroinvertebrate	Swift Creek @ SR 1152	Fair	Fair	Fair	Fair
Fish	Swift Creek @ SR 1152	Poor	Fair/ Good-Fair	-[1]	Good-Fair
Fish	Middle Creek @ SR 1375	-[1]	-[1]	Excellent	Good-Fair

Sources: NCDENR, 2012b; [1] Site not sampled

One benthic macroinvertebrate site is located within the Cape Fear portion of the Planning Area, but was not rated when sampled in 2003. This site is located on Kit Creek by NC 55 (NCDENR, 2004). No fish community sampling locations are present within the Cape Fear River basin portion of the Planning Area (NCDENR, 2005). These small streams drain to Jordan Lake, which is considered eutrophic.

4.10.2 303 (d) Listed Water Bodies

Section 303(d) of the CWA requires that states develop a list of waters not meeting water quality standards or with impaired uses. The state must prioritize these water bodies and prepare a management strategy or total maximum daily load (TMDL).

Water bodies within the Planning Area and listed on the Section 303(d) list are shown in Table 4-7 (NCDENR, 2012a). Swift Creek and its tributary, Williams Creek, are also impaired and were included on the 2012 303(d) list but are not included in the draft 2014 list (NCDENR, 2014). A TMDL has since been developed, discussed in Section 6. All streams in Table 4-7 are within the Neuse River basin. These streams have been impacted primarily by growth activities, including construction and the increase in urban runoff from storm sewers. Other factors contributing to impairment may include agriculture and the Cary WRFs.

There are limited data to determine whether water quality in these 303(d) listed streams is improving, degrading, or stable. Data collected in Crabtree Creek downstream of the North Cary WRF indicate that the stream is stable. Benthic data collected in 2005 showed decreases in the ephemeroptera, plecoptera, and trichoptera (EPT) scores, but an increase in 2010. Benthic data collected on Swift Creek show that the site experiences frequent fluctuations in discharge as a result of high impervious surface percentages upstream and indicate consistently low EPT richness.

TABLE 4-7
Planning Area Water Bodies Included on the 2012 303(d) List

Water Body	Impaired Use	Year Listed	Category and Reason for Listing	Potential Source(s)
Black Creek	Aquatic Life	1998	Ecological/biological Integrity	Urban Runoff/Storm Sewers
Brier Creek	Fish Consumption	2008	PCBs	Superfund Site
Crabtree Creek	Aquatic Life	1998	Impaired biological integrity; stressors not identified	Urban Runoff/Storm Sewers
Lake Crabtree	Overall	1998	Impaired biological integrity; turbidity and low DO violations	Land Development; Urban Runoff/Storm Sewers
Little Brier Creek	Fish Consumption	2008	PCBs	Superfund Site
Middle Creek	Aquatic Life	2010	Turbidity, zinc	Urban Runoff/Storm Sewers
Richlands Creek	Aquatic Life	2004	Impaired biological integrity; stressors not identified	Construction
Swift Creek*	Aquatic Life	1998	Ecological/biological Integrity	Land Development; Agriculture; Urban Runoff/Storm Sewers
Walnut Creek	Fish Consumption	2010	PCBs	Superfund Site
Williams Creek*	Aquatic Life	1998	Ecological/biological Integrity	Construction; Urban Runoff/Storm Sewers

Source: 2012 North Carolina 303(d) Impaired Waters List (NCDENR, 2012a)
PCBs - polychlorinated biphenyls
* Williams Creek and Swift Creek were not listed in the draft 2014 North Carolina 303(d) Impaired Waters List (NCDENR, 2014)

4.10.3 Wake County Watershed Assessment Summary

In an effort to characterize the health of its streams and watersheds, Wake County completed a watershed assessment in 2001. The goal of these efforts was to assess the overall effects of land use changes on stream physical structure and aquatic communities. This watershed assessment has not been updated.

In summary, three types of assessments were conducted in streams and watersheds county-wide:

- Biological assessment – Benthic organisms and fish were collected and identified, providing an estimate of long-term effects of water quality on the aquatic community.
- Habitat assessment – The effects of land use changes on streams were assessed to help differentiate the impacts of water quality pollutants versus habitat degradation on the stream environment.
- Stream geomorphology – Characteristics such as channel shape, channel slope, sediment load, and sediment size were assessed to help determine streambank erodibility and other potential areas of stream degradation.

This evaluation concluded that many of the streams in the County are degraded. Influencing factors include agricultural practices and urbanization, with the effects of urbanization on the biotic community structure more pronounced than agricultural effects. Within the Planning Area, 15 sites were evaluated (Table 4-8). The habitat scores could range from 0 to 200, with higher numbers correlated to better stream health. In the Crabtree Creek and Swift Creek watersheds, habitat conditions are mostly marginal (score of 60 to 100 points), correlating with Fair and Poor bioclassifications. Other ratings are marginal-suboptimal (101-112 points) and suboptimal (113-153 points). In general, streams exhibit slight to moderate entrenchment, with more entrenchment observed in the larger Crabtree and Swift Creeks. In the Middle Creek watershed, no sites were evaluated within the Planning Area. Watershed classifications and bioclassifications based on benthic macroinvertebrate sampling are in line with the majority of streams in the County.

TABLE 4-8
Wake County Watershed Assessment Summary

Stream Name	Nearest Road Crossing	Habitat Condition	Bioclass	Watershed Classification	Entrenchment
Little Brier Creek	Gateway Center Blvd	Marginal	Fair	Fair	Slight
Black Creek	Weston Pkwy	Marginal – Sub-optimal	-	Good-Fair	Slight
Crabtree Creek	SR 1795; Upstream of Cary WWTP	Marginal	Poor	Fair	Moderate
Crabtree Creek	Downstream of Cary WWTP near I-40	Marginal	Fair	Fair	Slight
Swift Creek	Near Richelieu Dr	Marginal	-	Fair	Moderate
Swift Creek	Swift Creek Greenway	Marginal	-	Fair	Slight
Swift Creek	US 1	Marginal	Poor	Fair	Slight
Swift Creek	Near US 1 & US 64	Sub-optimal	-	Good	Slight
Swift Creek	SR 1300; Hemlock Bluffs	Marginal – Sub-optimal	Poor	Good-Fair	Entrenched
Swift Creek	Holly Springs Rd	Marginal	Fair	Fair	Slight
Williams Creek	Old Raleigh Rd	Marginal	Poor	Fair	Entrenched
UT to Big Branch	Downstream of Goodmark	Marginal	-	Fair	Entrenched

UT = Unnamed tributary

Source: CH2M HILL, 2002b

The area within the Swift Creek watershed is subject to the Swift Creek Land Management Plan adopted by Wake County to protect Lake Wheeler and Lake Benson as potential sources of drinking water. This Plan establishes impervious surface limits, stormwater requirements, and recommendations regarding municipal and private sewer which the Town's Land Development Code meets or exceeds. The Town's ordinances are described in Section 6. NCDENR has developed a management strategy for the Jordan Lake Watershed and a nutrient TMDL for the Upper New Hope arm of Jordan Lake in the Cape Fear River basin and the EMC adopted rules to implement the strategy in 2010, which are still under legislative review. These programs impose requirements to control sources of nutrients resulting from development activities and nonpoint source pollution.

Further details of these strategies are presented in Section 6.

4.10.4 Groundwater

The Planning Area is located within the Triassic basin of the Piedmont region of North Carolina and is characterized by a thin regolith layer, which limits groundwater storage capacity. As a result, well yields tend to be low (around 5 to 25 gallons per minute [gpm]). Within the western portion of Wake County where the Planning Area is located, approximately 6 percent of precipitation reaches the groundwater for recharge, contributing approximately 35 to 55 percent of stream baseflow during normal precipitation years. Groundwater within the Planning Area is generally free of contaminants and is used as a source of drinking water by individuals and community well systems (CDM, 2003). Because

of the prevalence of triassic soils in the area, septic systems may not percolate well, and could pose a public health hazard if not properly designed, installed, and maintained.

Some residents within the Planning Area currently obtain their water from wells and/or discharge waste to septic systems. These residents could request the Town to connect them to the municipal water and sewer system when it becomes available to them. New development within the Planning Area will be served by the Town's existing treatment facilities.

4.11 Forest Resources

This section further describes lands within the grouped agricultural and forested land use category that are forested. In addition to land use data provided by the Town, land cover data developed by the NCGAP also were analyzed (NCGAP, 2006). This analysis is based on satellite imagery collected by USGS. These data provide a better understanding of the types of forest resources present within the Planning Area. Forestry resources descriptions are based on Shafale, 2012.

The dominant forest types within the Planning Area are Dry-Mesic Oak Pine Forests, Piedmont Dry-Mesic Pine Forests, and Piedmont/Mountains Dry-Mesic Oak and Hardwood Forests. Within the hardwood forest community, white oak (*Quercus alba*) is often the dominant species. Sweetgum (*Liquidambar styraciflua*) and tulip poplar (*Liriodendron tulipifera*) are the other main canopy species. Pine and hardwood mixed forests are dominated by Southern red (*Q. rubra*), post (*Q. stella*), and chestnut oaks (*Q. prinus*).

Another common forest type is Coniferous Cultivated Pine Plantations (natural and planted), with dominant pine species including loblolly (*Pinus taeda*), slash (*P. elliottii*), and longleaf (*P. palustris*).

Along stream corridors, Piedmont Mixed Bottomland Hardwood Forest communities are present. Tag alders (*Alnus serrulata*) and button bush (*Cephalanthus occidentalis*) often dominate the shrub communities. Typical bottomland forest canopy species include sweetgum, red maple, sycamore (*Plantanus occidentalis*) and black gum (*Nyssa sylvatica*), all of which are tolerant of wetter soils. Large areas of bottomland hardwood forest are adjacent to tributaries of Jordan Lake. Smaller communities are present along Crabtree Creek and Swift Creek (NCGAP, 2006).

Due to the fragmented nature of the forested parcels of land in the Planning Area, smaller areas of forest are not suitable for continued silviculture use. However, forested areas being converted to other land uses do provide a one-time source of wood products.

4.12 Shellfish or Fish and their Habitats

Water resources within the Planning Area provide aquatic habitat for various species of fishes and other aquatic organisms. These streams provide free-flowing, warm-water habitats with moderate gradients, generally alternating pools and riffle-runs, and substrates consisting mainly of rocks, gravel, sand, and mud. Many ponds also provide warm-water habitat within the Planning Area. Recreational fishing opportunities are available. Typical fishes caught within the streams and lakes include catfish, suckers, bass, crappie, and sunfish.

According to NCDENR fish community data, a 2010 survey of Swift Creek resulted in lower than expected species diversities, including suckers and darters, and a moderately high percentage of diseased fish. Approximately 70 percent of all fish collected since 1995 have been sunfish, typical of a stressed community in an urban stream that is in close proximity to a reservoir. In Crabtree Creek, the North Carolina Division of Water Resources (NCDWR) sampling site is downstream of Umstead State Park and the North Cary WRF and exhibits a healthy and diverse fish community. From 2000 to 2010, 28 species were surveyed from this site, including 2 intolerant species. In Walnut Creek, despite its urban setting, a very diverse community of 32 species was surveyed from 1991 to 2010, including 7 species of sunfish, 5 species of darters, and 3 intolerant species. While the swallowtail shiner (*Notropis procne*) was dominant, many darter species are present. Another indication of Walnut Creek community health is the relative lack of exotic species and the presence of intolerant species (NCDENR, 2012b).

4.13 Wildlife and Natural Vegetation

Upland wildlife communities are home to Virginia opossum (*Didelphis virginiana)*, raccoon (*Procyon lotor)*, eastern cottontail (*Sylvilagus floridanus)*, gray squirrel (*Sciurus carolinensis)*, red (*Vulpes vulpes)* and gray foxes (*Urocyon cinereoargenteus)*, and white-tailed deer (*Odocoileus virginianus)*, as well as the eastern mole (*Scalopus aquaticus)* and several species of shrews and mice. Amphibians and reptiles are abundant and diverse. Frogs, turtles, and water snakes inhabit wetlands and the perimeters of ponds and streams.

Bird life in the Planning Area is typical of the Carolina Piedmont. The Northern cardinal (*Cardinalis cardinalis*), American robin (*Turdus migratorius*), Carolina chickadee (*Poecile carolinensis*), Eastern bluebird (*Sialia sialis*), Eastern towhee (*Pipilo erythrophthalmus*), various sparrow and warbler species, and other songbirds make their homes in the backyard habitats and forests of the area. Hawks, such as the red-tailed hawk (*Buteo jamaicensis*), as well as owls and vultures, are predator and scavenger species known to inhabit the area. The many ponds and Crabtree Lake in the Planning Area attract a variety of waterfowl, including migratory species. Mallards, wood ducks, teal, and other ducks, as well as geese, may be seen during certain seasons. Wading birds, including great blue heron (*Ardea herodias*) and green heron (*Butorides virescens*), may be encountered along water body shallows.

Following is a discussion of the rare wildlife and wildlife habitats found within the Planning Area.

4.13.1 Rare, Threatened, or Endangered Species

Specific regulations exist at the state and federal levels to protect endangered and threatened species and their habitats from impacts due to public or private projects and land-disturbing activities. The primary law that protects sensitive wildlife species is the federal Endangered Species Act of 1973(ESA).

The USFWS identifies species that are federally listed as endangered, threatened, or species of concern and may have suitable habitat present or known occurrences in Wake County, as listed in Table 4-9 (USFWS, 2014a). Information obtained from the North Carolina Natural Heritage Program's (NCNHP) Natural Heritage Element Occurrence (NHEO) and SNHA

databases, updated in January 2014, were analyzed to identify occurrences of both state and federally listed species. There were no documented reports of individuals or populations of federally listed endangered or threatened species within the Planning Area (NCNHP, 2014).

The USFWS identified 20 federally listed species as having the potential to occur within Wake County as presented following Table 4-9. Of these, 16 are listed as Federal Species of Concern (FSC), 3 are endangered and 1 is proposed. Species listed as endangered includes the red-cockaded woodpecker (*Picoides borealis*), the dwarf wedgemussel (*Alasmidonta heterodon*), and Michaux's sumac (*Rhus michauxii*). The Northern long-eared bat (*Nyctophilus arnhemensis*), has been proposed for listing as federally endangered or threatened. The bald eagle (*Haliaeetus leucocephalus*) was removed from the Federal List of Threatened and Endangered Species in 2007, but remains federally protected (USFWS, 2014a). A brief discussion of these species is included following Table 4-9.

TABLE 4-9
Federally Listed Species within Wake County

Scientific Name	Common Name	Federal Status	County Status
Animals			
Aimophila aestivalis	Bachman's Sparrow	FSC	Historic
Ambloplites cavifrons	Roanoke bass	FSC	Current
Anguilla rostrata	American eel	FSC	Current
Etheostoma collis lepidinion	Carolina darter	FSC	Probable/potential
Haliaeetus leucocephalus	Bald eagle	BGPA	Current
Heterodon simus	Southern hognose snake	FSC	Obscure
Lythrurus matutinus	Pinewoods shiner	FSC	Current
Myotis austroriparius	Southeastern myotis	FSC	Historic
Myotis septentrionalis	Northern long-eared bat	P	Current
Noturus furiosus	Carolina madtom	FSC	Current
Picoides borealis	Red-cockaded woodpecker	E	Historic
Invertebrates			
Alasmidonta heterodon	Dwarf wedgemussel	E	Current
Elliptio lanceolata	Yellow lance	FSC	Current
Fusconaia masoni	Atlantic pigtoe	FSC	Current
Lasmigona subviridis	Green floater	FSC	Current
Insects			
Speyeria diana	Diana fritillary	FSC	Current
Plants			
Lindera subcoriacea	Bog spicebush	FSC	Current
Monotropsis odorata	Sweet pinesap	FSC	Historic
Rhus michauxii	Michaux's Sumac	E	Current
Sagittaria weatherbiana	Grassleaf arrowhead	FSC	Historic

TABLE 4-9
Federally Listed Species within Wake County

Scientific Name	Common Name	Federal Status	County Status
Trillium pusillum var. virginianumpusillum	VirginiaCarolina least trillium	FSC	Current

Source: USFWS, updated January 22, 2014
Note: A complete list of state-listed species is presented in Appendix E.

Federal Status
T = Threatened
E = Endangered
FSC = Federal Species of Concern
P = Proposed listing
BGPA = Bald and Golden Eagle Protection Act

The bald eagle is now protected by the Bald and Golden Eagle Protection Act (BGPA), which prohibits disturbing the eagle or its nests, which are often constructed near water and reused by the same pair year after year. The recovery of this species is largely due to the banning of harmful pesticides, including dichlorodiphenyltrichloroethane **(**DDT). According to the most recent version of the NHEO database provided by NCNHP, there is an inactive nest north of Lake Crabtree within the Planning Area and records of bald eagles at Jordan Lake (NCNHP, 2014).

The northern long-eared bat (*Myotis septentrionalis*) is proposed for listing as an endangered species. It is 3 to 4 inches in length, with a wingspan of 9 to 10 inches and is distinguished by its long ears. They roost individually or in colonies under tree bark or in crevices of both live and dead trees. They typically hibernate in caves and mines, usually large with large entrances, stable temperatures, and high humidity with limited air flow. White-nose syndrome, a fungal disease known to affect bats, is currently the predominant threat to this bat. White-nose syndrome is currently found in at least 22 of the 39 states with records of this species, including North Carolina, and continues to spread across much of the northern and eastern US (USFWS, 2014b). In 2013, NCWRC adopted a surveillance and response plan to outline steps to protect the species (NCWRC, 2013b). The northern long-eared bat has not been observed within the Planning Area or within Wake County (NCNHP, 2014).

The red-cockaded woodpecker, a federally endangered bird, is included in Table 4-9 as having the potential to occur within Wake County. This species was not identified within the Planning Area. Furthermore, the species is identified as historic and with the most observation within Wake County occurring in 1988 (NCNHP, 2014).

The dwarf wedgemussel (*Alasmidonta heterodon*), a freshwater mussel species, is federally listed as endangered. This small mussel is less than 1.5 inches in length and can be identified by its dentition pattern; the right valve has two lateral teeth, while the left valve has one. Habitat preferences include a slow to moderate current and a sand, gravel, or muddy stream or river bottom. As with other freshwater mussel species, glochidia are released into the water by females after reproduction. These glochidia then attach to host fishes for further development. The success of the species also depends on the success of specific host fishes. The tessellated darter (*Etheostoma olmstedi*), johnny darter (*Etheostoma nigrum*), and mottled sculpin (*Cottus bairdi*) have been identified as hosts for the dwarf wedgemussel (USFWS, 2014a). The original range of this species extended from New Brunswick, Canada, to North Carolina. This species has been found elsewhere in Swift Creek, Little River, and Buffalo Creek, but according to the most recent version of the NHEO database provided by NCNHP,

no individuals of dwarf wedgemussel have been recorded within the Planning Area. The NHEO database indicates the dwarf wedgemussel was observed in 2012 in Swift Creek downstream of Lake Benson, outside of the Planning Area (NCNHP, 2014).

Streams within the Swift Creek watershed are classified as Significant Aquatic Endangered Species Habitat (SAESH) due to the presence of dwarf wedgemussel. The Atlantic pigtoe and yellow lance, both FSC, were also observed in 2012, in Swift Creek downstream of the Planning Area, but not within the Planning area (NCNHP, 2014).

Michaux's sumac (*Rhus michaux*) is an upland terrestrial vascular plant that is considered endangered. This shrub grows to heights of 1 to 3 feet and flowers between June and July. Most plants are unisexual, which may partly explain the plant's rarity. Reproductive capacity is low. Typical habitat includes sandy or rocky open woods with basic soils. Repeated disturbance is necessary to provide open areas for this plant to be successful. Remaining populations are found along maintained roadway rights-of-way and areas managed with frequent fires. Threats to remaining populations include habitat loss due to development and fire suppression. The species has been located elsewhere in the county; no NHEO sites have been recorded within the Planning Area (NC NHP, 2014).

The NHEO database includes both state and federally listed species and populations, as well as natural communities. The SNHA database identifies exemplary or unique natural ecosystems (terrestrial and aquatic). Figure 4-1 illustrates the distribution of NHEO and SNHA occurrences within the Planning Area. Appendix E includes a complete list of species occurrences from the NHEO database within Wake County as well as within the Planning Area. Other sources of information regarding the presence of species or habitat include special surveys and the NCWRC.

A mussel survey was conducted by CZR, Inc. in June and July 2004 to determine if any federally listed mussel species are present within a portion of the Planning Area. As described by CZR, the majority of the survey sites exhibited wide forested riparian buffers in subdivision developments and undeveloped woodlands. Eight sites in the Middle Creek watershed were within the Planning Area. Twenty-two other sites were within the Swift Creek watershed (CZR, 2004).

Overall, the two dominant species of mussels found during the survey were eastern elliptio (*Elliptio complanata*) and variable spike (*Elliptio icterina*). These species are common and often abundant in the study area. The largest population of mussels was found in Middle Creek. At Site 16 on Middle Creek, the eastern floater (*Pyganodon cataracta*), Atlantic pigtoe (*Fusconaia masoni*) and eastern lampmussel individuals were found (CZR, 2004).

Most notable is that no individuals, live or relic, of the federally endangered dwarf wedgemussel were found during the 2004 CZR survey (CZR, 2004). Also, a study by CZR in 2001 found no dwarf wedgemussels on Middle Creek from approximately 1,500 feet upstream of SR 1006 to SR 1330 in Johnston County (CZR, 2001).

According to NCWRC, the Middle Creek watershed provides suitable habitat for many state-listed mussel species including the Roanoke slabshell (*Elliptio roanokensis*), eastern lampmussel, creeper (*Strophitus undulatus*), triangle floater (*Aslasmidonta undulata*), and notched rainbow (*Villosa constricta*). NCWRC also identifies Swift Creek as suitable habitat for the eastern lampmussel, creeper, and triangle floater, and Crabtree Creek as suitable

habitat for the creeper, triangle floater, and notched rainbow mussel species (NCWRC, 2014). Of these species, the NHEO database indicates that within the Planning Area, the creeper was in Middle Creek in 2001, and the notched rainbow was observed in Swift Creek in 2006 (NCNHP, 2014).

4.13.2 Significant Natural Heritage Areas

Many of the listed species within Wake County and the Planning Area are found within SNHAs, as shown on Figure 4-1. These state-designated areas are sites with special biodiversity significance and may include habitat for rare species, exemplary or unique natural communities, important animal assemblages, or other important ecological features. SNHAs within the Planning Area are listed in Table 4-10. According to the SNHA database, there are no SNHAs identified as Aquatic Habitat within the Planning Area (NCNHP, 2014). A description of each area from the NCNHP is provided below (NCNHP, 2003).

TABLE 4-10
Significant Natural Heritage Areas

SNHA	Total Acres	Acres within Planning Area
Hemlock Bluffs State Natural Area	122	122
Middle Creek Bluffs And Floodplain	358	107
Northeast Creek Floodplain Forest	984	12
Swift Creek Bluffs	49	49
William B. Umstead State Park	5,579	83
Total	**7,092**	**373**

Source: NCNHP, 2014

Hemlock Bluffs State Natural Area contains steep, 80-foot-high, north-facing bluffs that support a disjunct population of eastern hemlock (*Tsuga canadensis*) 200 miles from its normal range in the mountains. The natural communities are small but good quality Piedmont/Coastal Plain Acidic Cliff and Piedmont Monadnock Forest types. Part of the site is owned by the North Carolina Division of Parks and Recreation; this is a Registered Heritage Area. The rest of the site is owned by the Town.

Middle Creek Bluffs and Floodplain is a segment of wide floodplain and slopes that support extensive mature Mesic Mixed Hardwood Forest natural community and areas of good quality Piedmont/Low Mountain Alluvial Forest communities. This site is privately owned.

Northeast Creek Floodplain Forest is a tract of mature forest, including Piedmont/Mountain Swamp Forest, Piedmont/Mountain Bottomland Forest, and Mesic Mixed Hardwood Forest. Plant species include the state significantly rare Indian physic (*Porteranthus stipulatus*), Lewis' heartleaf, and Douglass's bittercress. This site is owned by the USACE.

Swift Creek Bluffs contains a very mature Basic Mesic Forest natural community, as well as good quality Piedmont/Low Mountain Alluvial Forest and Floodplain Pool natural communities. Most of the site is owned by the Triangle Land Conservancy; the rest is privately owned.

William B. Umstead State Park is a 5,400-acre, unbroken expanse of diverse forests that provide important wildlife habitat. Rare plants found here include Michaux's sumac. Rare animals include the state special concern Neuse River Waterdog (*Necturus lewisi*) and four-

toed salamander (*Hemidactylium scutatum*). The park is owned by the North Carolina Division of Parks and Recreation.

4.13.3 Natural Vegetation

Within the Planning Area, natural vegetation is typical of Piedmont upland and bottomland communities. However, smaller unique ecosystems are also present. The following sections include descriptions of natural communities, from Schafale (2012), which are present within or near the Planning Area, according to the NHEO database (NCNHP, 2014). These communities are shown in Figure 4-1.

Piedmont/Coastal Plain Heath Bluff

Located along Crabtree Creek in Umstead State Park bordering the Planning Area, this community type is characterized as a rare shrub-dominated upland, which is situated on steep north-facing slopes or bluffs in dry, acidic, rocky soils. The dry soils combined with the cool, moist microclimate found on north slopes above a floodplain create the conditions necessary for the heaths to exist. Rhododendrons (*Rhododendron* spp.) and mountain laurel (*Kalmia latifolia*) are the dominant shrubs.

Piedmont/Coastal Plain Acidic Cliff

Cliff communities are distinguished from other communities by their lack of trees and shrubs, and are known for their moss-covered or bare substrates on rocky slopes. Cliff communities can have highly variable vegetation regimens, contingent on variables such as elevation, aspect (north- or south-facing), slope, and soil depth. An example of this community type is Hemlock Bluffs SNHA on Swift Creek, where the microclimate along a north-facing cliff supports a relict population of eastern hemlock and a population of sweet pinesap (*Monotropsis odorata).*

Piedmont Monadnock Forest

The presence of monadnocks, or rocky masses like quartzite that resist erosion, is a characteristic feature of the unusual topography where this forest type is found. The exposed, elevated positions of monadnocks make their forests susceptible to lightning and wind disturbance. The topography and substrate create an environment of dry, acidic soils with low plant diversity. It is dominated by chestnut oak (*Quercus montana*), with pines such as shortleaf (*Pinus echinata*) and Virginia (*P. virginiana*) filling in the potentially closed canopy. This specialized forest type can be found at Hemlock Bluffs SNHA.

Piedmont Bottomland Forest (High Subtype)

These sites occur on terraces, on the higher parts of depositional ridge and swale systems, and on some wide flat floodplains. Natural vegetation is a mix of bottomland oaks and poplars. The High Subtype is distinguished from the two low subtypes by having an appreciable component of upland oaks and hickories. An example of this forest type can be found at Middle Creek Bluffs.

Piedmont/Low Mountain Alluvial Forest

Piedmont/Low Mountain Alluvial Forests are located in river and stream floodplains where flooding deposits nutrient-laden sediment. Alluvial species such as sycamore (*Platanus occidentalis*), river birch (*Betula nigra*), and box elder (*Acer negundo*), along with a lack of

defined depositional fluvial landforms, distinguish this natural community type. This forest type can be found along Swift and Middle Creeks.

Mesic Mixed Hardwood Forest (Piedmont Subtype)

The upland Mesic Mixed Hardwood Forest community is usually found on lower, steep, and/or north-facing slopes with well-drained acidic soils, such as the Middle Creek Bluffs. It is categorized by its mesophytic tree canopy, which includes beech (*Fagus grandifolia*), Southern red oak, and tulip poplar. The absence of bottomland trees and base-loving plants separate this forest from other common community types.

Basic Mesic Forest (Piedmont Subtype)

Similar to the Mesic Mixed Hardwood Forest, this community is found on lower, north-facing slopes, but differs by having higher pH, or basic, soil types. The dominant canopy is characterized by beech, red oak, and tulip poplar, with the potential for some bottomland species such as black walnut (*Juglans nigra*) and southern sugar maple (*Acer floridanum*). The overall diversity of this community, with mesophytic, bottomland, and base-loving vegetation, sets it apart from other forest types.

Piedmont/Mountain Semipermanent Impoundment

This community type is best described as either an old, undisturbed, man-made or beaver pond in a floodplain such as that found on Middle Creek and others within the Triassic basin of the Piedmont. Being in a floodplain, these impoundments are subject to sudden flooding and draining, sedimentation, and other damaging events. Pond depth determines the vegetation type; in shallow areas, flood-tolerant trees such as red maple and willow oak (*Q. phellos*) populate the ponds. Deeper ponds support small duckweed (*Lemna perpusilla*) and green arrow-arum (*Peltandra virginica*). Wetland shrubs and herbs fill out the pond fringe.

4.14 Introduction of Toxic Substances

Toxic substances and their cleanup are regulated by the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The goals of these programs are to eliminate or reduce toxic waste; clean up waste that has been leaked, spilled, or improperly disposed; and protect people from harmful waste.

While there are no Superfund sites within the Planning Area, the Ward Transformer site, north of RDU airport, has impacted a number of water bodies in the Planning Area. These include Brier Creek, Little Brier Creek, Crabtree Creek, and Lake Crabtree. The facility manufactured and repaired transformers and switchgear. During these operations, PCBs were spilled onsite. PCBs are suspected carcinogens and bind strongly with soils and sediment. From the Ward Transformer site, PCBs entered surface waters during runoff events, eventually being carried into downstream water bodies. The site was placed on the National Priorities List in 2003. The contamination is not considered threatening to residents directly, but a fish advisory is in place for affected water bodies. NCDENR is currently investigating the site and began a remedial design in 2012 (USEPA, 2012b).

Other potential sources of toxic substances present in the Planning Area are agriculture-related substances such as fertilizers, herbicides, and pesticides. Other common toxic

substances such as glues, solvents, and paints are employed in the construction of homes and commercial buildings. Typical household hazardous wastes include oils, cleaners, solvents, paints, herbicides, and fertilizers.

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