DIN 01565

Water Resources Technical Report

Durham-Orange Light Rail Transit Project

July 24, 2015

The NEPA Preferred Alternative for the D-O LRT Project would generally follow NC 54, I-40, US 15-501, and the North Carolina Railroad (NCRR) Corridor in downtown Durham and east Durham. The alignment would begin at UNC Hospitals, parallel Fordham Boulevard, proceed east on NC 54, travel north on I-40, parallel US 15-501 before it turns east toward the Duke University campus along Erwin Road, and then follow the NCRR Corridor parallel to NC 147 through downtown Durham, before reaching its eastern terminus near Alston Avenue. The alignment would consist of at-grade alignment, fill and cut sections, and elevated structures. In two sections of the alignment, Little Creek and New Hope Creek, multiple Light Rail Alternatives are evaluated in the DEIS.

This technical report contains information for all alternatives analyzed in the DEIS. However, pursuant to MAP 21, the Moving Ahead for Progress in the 21st Century Act (P.L. 112-141), a NEPA Preferred Alternative has been developed, which recommends C2A in the Little Creek section of the alignment, NHC 2 in the New Hope Creek section of the alignment, the Trent/Flowers Drive station, and the Farrington Road Rail Operations and Maintenance Facility.

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List of Acronyms and Abbreviations

Acronym/Abbreviation	Definition
AA	Alternatives Analysis
CFR	Code of Federal Regulations
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
D-O	Durham-Orange
D-O LRT	Durham-Orange Light Rail Transit
DTCC	Durham Technical Community College
DUMC	Duke University Medical Center
DWR	Department of Water Resources
FEMA	Federal Emergency Management Agency
FEIS	Final Environmental Impact Statement
FIRM	Flood Insurance Rate Maps
GWIU	Groundwater Investigation Unit
HQW	high quality water
I-40	Interstate 40
JD	jurisdictional determination
LPA	locally preferred alternative
LRA	light rail alignment
LRT	light rail transit
MSL	mean sea level
MTP	Metropolitan Transportation Plan
NC	North Carolina
NCAC	North Carolina Administrative Code
NCCU	North Carolina Central University
NCDENR	North Carolina Department of Environment and Natural Resources
NCDWR	North Carolina Division of Water Resources
NCDWQ	North Carolina Division of Water Quality
EEP	Ecosystem Enhancement Program
NCNHP	North Carolina Natural Heritage Program
NCRR	North Carolina Railroad
NCWAM	North Carolina Wetland Assessment Method

Acronym/Abbreviation	Definition
NCWRC	North Carolina Wildlife Resources Commission
NFIP	National Flood Insurance Program
NHC	New Hope Creek
NRCS	Natural Resources Conservation Service
NRTR	Natural Resources Technical Report
NSW	nutrient sensitive water
ORW	outstanding resource water
ROMF	rail operations maintenance facility
TSM	transportation system management
UNC	University of North Carolina
US	United States
USACE	United State Army Corps of Engineers
USC	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
UT	unnamed tributary
VA	Veterans Affairs
WS	water supply

1. Introduction

Triangle Transit, in cooperation with the Federal Transit Administration (FTA), has prepared a Draft Environmental Impact Statement (DEIS) to evaluate a potential high-capacity transit improvement in the Triangle region, within the Durham-Orange (D-O) Corridor, between Chapel Hill and Durham. This technical appendix was prepared in consideration of the Scoping comments received from the stakeholder agencies, and documents the water resources present within the proposed improvements area and presents the anticipated effects to these water resources that would result from the implementation of the Light Rail Alternative.

This Water Resources Technical Report provides a detailed technical appendix to the assessment of water resources impacts presented in the *Durham-Orange Light Rail Transit Project DEIS,* Chapter 4.8.

1.1 Description of the Study Corridor

The D-O Corridor is located within the Triangle region. It extends roughly 17 miles from southwest Chapel Hill to east Durham, and includes several educational, medical, and other key activity centers which generate a large number of trips each day. The land uses in the D-O Corridor are supported by a network of major highways including NC 54, I-40, US 15-501, Erwin Road, and NC 147. Additional detail regarding the study corridor is included in the *Durham-Orange Light Rail Transit Project DEIS*, chapters 1 and 2.

1.2 Alternatives Considered

In addition to the Light Rail Alternatives, the DEIS considers a No-Build Alternative comprised of the existing and programmed transportation network improvements without the planned rail improvements and associated bus network modifications. Additional detail regarding the alternatives considered is included in the *Durham-Orange Light Rail Transit Project DEIS, chapter 2*.

1.2.1 No-Build Alternative

The No-Build Alternative is used for comparison purposes to assess the relative benefits and impacts of constructing a new transit project in the project area versus implementing only existing and planned transportation programs and projects scheduled to be built and implemented before forecast year 2040 and contained in the 2040 Metropolitan Transportation Plan (MTP). The No-Build Alternative is also a required alternative for comparison as part of the National Environmental Policy Act (NEPA) environmental analysis.

1.2.2 Light Rail Alternatives

Through the Alternatives Analysis and Scoping process, a majority of the proposed D-O LRT Project alignment was identified. However, there are a few areas where different alternatives were retained for further evaluation. As a result, the following multiple alignments crossing Little Creek and New Hope Creek are evaluated in the DEIS:

- Four potential crossings of Little Creek between Hamilton Road and the proposed Leigh Village Station (Alternatives C1, C1A, C2, and C2A)
- Three potential crossings of New Hope Creek and Sandy Creek between Patterson Place and South Square (Alternatives NHC LPA, NHC 1, and NHC 2)
- Station alternatives at Duke/VA Medical Centers (i.e., Duke Eye Center and Trent/Flowers Drive)

- Five proposed locations for the rail operations maintenance facility (ROMF) (i.e., Leigh Village ROMF, Farrington Road ROMF, Patterson Place ROMF, Cornwallis Road ROMF, and Alston Avenue ROMF)

The Light Rail Alternatives would generally follow North Carolina (NC) Highway 54 (NC 54), Interstate 40 (I-40), United States (US) 15-501, and the North Carolina Railroad (NCRR) Corridor in downtown Durham and east Durham. The alignment would begin in Chapel Hill at UNC Hospitals, parallel Fordham Boulevard, proceed eastward adjacent to NC 54, travel north along I-40, parallel US 15-501 before it would turn east toward Duke University and run within Erwin Road, and then follow the NCRR Corridor that parallels NC Highway 147 (NC 147) through downtown Durham, before reaching its eastern terminus in Durham near Alston Avenue. The alignment would consist of at-grade alignment, fill and cut sections, and elevated structures. A total of 17 stations are planned, and up to 5,100 parking spaces would be provided along the Light Rail Alternatives. In addition, a ROMF would be constructed to accommodate the D-O LRT fleet (initially 17 vehicles, with the ability to accommodate up to 26 vehicles without needing expansion).

Bus routes would be modified to feed into the D-O LRT stations, and headways would be adjusted to provide more frequent bus service and minimize transfer waiting times. These services would also connect light rail passengers with other area transportation hubs, including park-and-ride lots and transfer centers.

2. Legal and Regulatory Context

2.1 Groundwater

The North Carolina Environmental Management Commission has established groundwater standards for the protection of water supplies. Groundwater standards are listed in the North Carolina Administrative Code (NCAC) Title 15A – Environment and Natural Resources, Subchapter 2L as directed by N.C.G.S. § 143-214.1. These standards are intended to maintain and preserve the quality of groundwater, prevent and abate pollution and contamination of the waters of the state, protect public health, and permit management of the groundwater for its best usage by the citizens of North Carolina. In North Carolina, the Department of Environment and Natural Resources (NCDENR) Division of Water Resources (DWR) is responsible for administering several groundwater programs and carrying out enforcement actions for violations of environmental regulations. NCDENR DWR regulates groundwater by preventing pollution, managing and restoring degraded groundwater, and protecting groundwater resources.

2.2 Surface Waters and Wetlands

The Clean Water Act (CWA) (33 U.S.C. § 1251 et seq.) establishes the basic framework for regulating discharges of pollutants into waters of the United States. **Jurisdictional "waters of the United States**," including wetlands, streams, and open waters, are defined in 33 C.F.R. § 328.3 and are protected by Section 404 of the CWA (33 U.S.C. § 1344) which is administered and enforced in North Carolina by the U.S. Army Corps of Engineers (USACE), Wilmington District. Section 404 regulates the discharge of dredged or fill material in waters of the United States through the USACE permitting program. Fill material can be pipes, culverts, soil, rock, concrete, riprap, asphalt, brick, or other building materials. Section 401 regulates water quality through the NCDENR DWR water quality certification program. The permit review and issuance process first encourages avoidance of impacts, followed by minimizing impacts and lastly through mitigating unavoidable impacts.

Jurisdictional "waters of the United States" – Wetlands, streams, and open water ponds

2.3 Floodplains and Floodways

Floodplain management ordinance requirements are listed in 44 CFR Part 9. These regulations establish how Executive Order 11988, *Floodplain Management* (1977) and Executive Order 11990, *Protection of Wetlands* (1977) are implemented and enforced. These regulations apply to all federal agency actions that have the potential to affect or harm floodplains or wetlands. The Federal Emergency Management Agency (FEMA), in cooperation with federal, state, and local governments, has developed floodway and floodplain boundaries and flood insurance rate maps (FIRM) for Durham and Orange counties.

United States Department of Transportation (USDOT) Order 5650.2, *Floodplain Management and Protection* (1979), prescribes additional policies and procedures for transportation projects. The intent of Order 5650.2 is to ensure that a detailed floodplain analysis is included in the environmental documents and that proper consideration is given to the avoidance and mitigation of adverse floodplain effects. This analysis discusses any risk to, or resulting from, the proposed project including the impacts on mutual and beneficial floodplain values, the degree to which the proposed project provides direct or indirect support for development in the floodplain, and measures to minimize harm or restore or preserve the natural and beneficial floodplain values affected by the project.

2.4 Agency Jurisdiction and Coordination

Riparian Buffers – Vegetated stream corridors extending 50 feet perpendicular from the stream bank

The lead agencies with jurisdiction for water resources, impacts, and mitigation within the study area are the USACE and the NCDENR DWR. The DWR is also the lead agency for the Jordan Lake Water Supply Watershed Buffer Rules (15A NCAC 02B.0267), which protect water quality provided by **riparian buffers** within the Jordan Lake watershed. The study area is located largely within the Jordan Lake drainage basin and all waters described in this section drain to Jordan Lake which is part of the Haw River Watershed. Triangle Transit, the FTA, USACE, and DWR have worked together to identify water resources within the study area; discuss the potential impacts to water resources, water quality, and riparian buffers; and determine appropriate mitigation for unavoidable impacts within the project area.

Perennial stream – Contains flowing water year round
Intermittent stream – Contains flowing water for part of the year
Ephemeral channels – Contains flowing water only after storm events

Surface water features, or drainages, within the study area were evaluated to determine the hydrology of the streams (e.g., **perennial streams**, **intermittent streams**, or **ephemeral channels**) according to USACE and DWR guidelines. Each feature was evaluated as to whether it was defined as a "water of the United States" by the USACE or whether it was included in the jurisdiction of the DWR. Stream jurisdictional boundaries, as well as the hydrologic classification, were field-verified by the USACE on April 8, 2014. Subsequent to this agency field review, the USACE was provided additional Jurisdictional Determination requests to add additional areas to the study area. The USACE issued a Notification of Jurisdictional Determination dated May 12, 2014. A revised Notification of Jurisdictional Determination from the USACE was issued on November 7, 2014, appendix B. Additional field work was performed in January 2015 that identified additional water resources within the expanded study area. An updated Jurisdictional Determination was requested from the USACE in April 2015, the USACE issued an updated Jurisdictional Determination June 29, 2015, appendix B.

3. Methodology

Background research on water resources, including streams, wetlands and other area features was conducted prior to field investigations. Sources consulted included the following:

- U.S. Geological Survey (USGS) 7.5-minute quadrangle maps [Chapel Hill (1981); Southwest Durham (1987); Northwest Durham (1987)].
- U.S. Fish & Wildlife Service (USFWS) National Wetlands Inventory Maps (Accessed June, 2013).
- U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) (now known as Natural Resources Conservation Service [NRCS]) Soil Survey of Durham County, NC (1976) and Soil Survey of Orange County (1977).
- USDA NRCS Web Soil Survey (2013).
- Go MAPS – Durham County NC Public Access (Accessed June, 2013).
- Orange County, North Carolina interactive geographical information systems (GIS) (Accessed June, 2013).
- NCDENR DWR website (Accessed June, 2013).

Field reviews were conducted along the proposed D-O LRT Project on multiple dates between June, 2013 and January, 2015. The field investigators walked the following locations which are defined as the study area:

- A corridor approximately 400 feet wide, centered on each of the Light Rail Alternatives
- The proposed locations of light rail stations and park-and ride facilities
- The proposed locations of ROMFs

Field staff walked the proposed D-O LRT proposed common segments of the Light Rail Alternatives (LRA), alignment alternatives, associated stations, ROMFs alternatives, and parking areas.

The principal environmental scientist contributing to this document was Brandon J. Phillips.

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Additional personnel who contributed to portions of the field work and/or documentation for this Project were Environmental Scientists W. Brandon Fulton, LSS, PSC, PWS, and Joshua Kotheimer.

Wetlands were identified in general accordance with the methods prescribed in the USACE Wetland Delineation Manual (Environmental Laboratory, 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0; April 2012). Features identified within the study area were delineated and subsequently flagged in the field with blue and white striped surveyors tape. The boundaries were approximated with a Trimble GeoXH hand-held global positioning system (GPS) unit capable of sub-foot accuracy and mapped using ArcGIS

10.1 software. Streams were identified and assessed in the study area and photographs were taken. Stream and wetland jurisdictional boundaries, were field verified by the USACE on April 8, 2014 Subsequent to the field verification, the USACE issued a Notification of Jurisdictional Determination dated May 12, 2014 (Action ID: 201200957).

Subsequent to the agency field review, additional areas were added to the study corridor. Jurisdictional Determination request addendums were submitted to the USACE on July 31, August 19, and September 4, 2014, which presented potential jurisdictional features not included in the original Jurisdictional Determination request. A revised Notification of Jurisdictional Determination from the USACE was issued on November 7, 2014 (appendix B). An updated Jurisdictional Determination was requested from the USACE in April 2015, the USACE issued an updated Jurisdictional Determination June 29, 2015, appendix B.

4. Affected Environment

The following section summarizes the existing water resources located within the project corridor. Groundwater, surface waters and wetlands, floodplains and floodways, water quality are the water resources discussed in this section.

4.1 Groundwater

Groundwater levels and flow in the project study area vary widely, largely due to urban development. According to the USDA SCS Soil Survey of Durham County, North Carolina, and the USDA SCS Soil Survey of Orange County, North Carolina, the soil types with the highest water tables are located in multiple areas along the proposed study area; areas mapped as either Chewacla soils, Cartecay soils, Wehadkee soils or White Store soils. The Chewacla, Cartecay and White Store soils have a depth to the seasonal high water table that ranges from 0.5' to 1.5' below the ground surface while Wehadkee soils have a seasonal high water table that is at or near the ground surface. The crossings of Meeting of the Waters (Stream WW), Little Creek (Stream Y), New Hope Creek (Stream T), and Sandy Creek (Stream J) have the largest areas of these soil types within the proposed stud area. Construction in these areas may expose groundwater to the surface if excavation is required.

A review of information obtained in NC One Map showed no public water supply groundwater wells lie within approximately 1,500 feet of the study area in Durham or Orange counties (i.e., drinking water supply study area). A review of information obtained from the Orange County Health Director and the Durham County Environmental Health Division indicate that sixteen private well locations in Orange County and one hundred in Durham County are located within the drinking water supply study area (appendix A - Figure 1).

4.2 Surface Waters and Wetlands

The study area is located in the Cape Fear United States Geological Survey (USGS) Basin and the Neuse River Basin. The majority of the study area is located within the Haw watershed of the Cape Fear River Basin. A small portion of the most northeastern study area is located within the Upper Neuse watershed of the Neuse River Basin. The HUCODE-8 for the Haw is ID #03030002 and the Upper Neuse is ID #03020201, respectively, according to the USGS. Major streams in the project region (Meeting of the Waters, Sandy Creek, New Hope Creek, and Little Creek) generally flow in a southerly direction. All of the surface waters within the project study area (appendix A - Figures 2A-2L) drain into B. Everett Jordan Lake (Jordan Lake).

Jordan Lake, encompassing approximately 46,768 acres, is located in Chatham, Wake, Durham, and Orange counties, North Carolina. Construction of the Lake began in 1963, with impoundment beginning in 1981 and normal pool stage reached in 1982. Jordan Lake provides flood damage reduction, water supply, water quality control, fish and wildlife conservation, as well as outdoor recreational opportunities.

Surface water features, or drainages, within the study area were evaluated to determine the hydrology of streams (i.e., perennial streams, intermittent streams, or ephemeral channels), according to USACE and DWR guidelines. Each feature was evaluated as to whether it was defined as a "water of U.S." by the USACE or whether it was included in the jurisdiction of the DWR. Stream jurisdictional boundaries, as well as the hydrologic classification were field-verified by the USACE on April 8, 2014. Subsequent to this agency field review, the USACE was given requests to add additional areas to the study area. The USACE

issued a Notification of Jurisdictional Determination dated May 12, 2014 and an updated notice of determination was issued on November 7, 2014 (appendix B).

The 57 jurisdictional streams within the study area, as determined by the USACE, are listed in Table 1, roughly from south to north; these streams are also depicted in appendix B - Figures 4A through 4U. Streams identified as **intermittent** contain water for only part of the year, while streams identified as **perennial** contain water year round.

Surveys of the proposed project study area, including the proposed stations, ROMF's and park-and-ride facility locations, were conducted between June 2013 and January 2015. Potential wetland communities were first identified by reviewing National Wetlands Inventory maps and hydric soil lists for the study area and then conducting field visits to verify the presence/absence of a wetland. Jurisdictional wetlands are defined in the field as areas that exhibit positive evidence of three environmental parameters: hydrophytic vegetation, wetland hydrology, and hydric soils. Boundaries of the wetlands were determined through observations of vegetation and surficial hydrology as well as soil samples. Soil samples were taken where hydrology and vegetation indicated the potential presence of a wetland. Soil samples were evaluated using a shovel or auger to a depth of approximately 18 inches. Soils were compared to a Munsell Color chart (1994) to evaluate chroma values and to note the presence of mottling and oxidized root channels which indicate the presence of hydric soils.

The results of the on-site field reviews indicate that there are 46 potential jurisdictional wetland areas located within the alignment alternative study areas, as shown in appendix B - Figures 4 through 4U. These jurisdictional wetland boundaries were delineated, flagged in the field, and the boundaries were approximated using GPS. Jurisdictional wetland boundaries have been verified by the USACE and a Notification of Determination was issued on May 12, 2014 (Action ID. 201200957). Jurisdictional Determination request addendums were submitted to the USACE on July 31, August 19, and September 4, 2014, which presented potential jurisdictional features not included in the original Jurisdictional Determination request. A revised Notification of Jurisdictional Determination from the USACE was issued on November 7, 2014 (appendix B).

Table 2 summarizes the area of wetlands that are located within the alignment alternative study areas. The jurisdictional wetlands within the study area are listed in Table 2 roughly from south to north as shown in appendix B - Figures 4 – 4U.

Table 1: Jurisdictional Streams in the Study Area

Stream Designation (Stream Name)	Figure Number	Hydrology	Channel Bottom Width (feet)	Bank Height (feet)	Substrate	Description of Drainage	Linear Feet (Alignment Alternative)
YY (Meeting of the Waters)	Appendix B - 4B	Perennial	20	3	Sand, silt, cobble, rock	Flows southeast under US 15-501.	280 (LRA)
XX	Appendix B - 4B	Intermittent	8	3	Sand, silt, cobble	Tributary to Stream YY (Meeting of the Waters).	66 (LRA)
UU	Appendix B - 4B	Intermittent	6	4	Sand, silt	Tributary to Stream WW (Chapel Branch).	115 (LRA)
WW (Chapel Branch)	Appendix B - 4B	Perennial	12	3	Sand, silt, cobble	Flows southeast under US 15-501.	250 (LRA)
TT	Appendix B - 4B	Perennial	18	8	Sand, silt, cobble	Flows south from Prestwick Road towards Stream WW (Chapel Branch).	712 (LRA)
SS	Appendix B - 4C	Intermittent	2	1	Sand, silt	Flows southeast under Prestwick Road and Finley Golf Course Road into Stream RR.	580 (C1, C1A, C2)
SS	Appendix B - 4C	Intermittent	2	1	Sand, silt	Flows southeast under Prestwick Road and Finley Golf Course Road into Stream RR.	352(C2A)
RR	Appendix B - 4C	Perennial	5	1	Sand, silt	Flows south through Finley Golf Course.	540 (C1, C1A, C2)
RR	Appendix B - 4C	Perennial	5	1	Sand, silt	Flows south through Finley Golf Course.	333 (C2A)
QQ	Appendix B - 4C	Perennial	5	2	Sand, silt	Flows south under NC 54 (Raleigh Road) towards Finley Golf Course.	272 (C1, C1A, C2)
QQ	Appendix B - 4C	Perennial	5	2	Sand, silt	Flows south under NC 54 (Raleigh Road) towards Finley Golf Course.	176 (C2A)
LLL	Appendix B - 4C	Intermittent	2	1	Sand, silt, cobble	Flows west into Stream QQ.	90 (C2A)
MMM	Appendix B - 4C	Intermittent	4	1-3	Sand, silt, cobble, rock	Flows south under Brookberry Circle.	208 (C2)
KKK	Appendix B - 4C	Intermittent	2	1	Sand, silt	Flows southwest from NC 54 (Raleigh Road.).	168 (C2A)
EEE	Appendix B - 4C	Intermittent	2	1	Sand, silt, cobble	Flows east from Meadowmont Lane	78 (C1, C1A)
DD	Appendix B - 4D	Intermittent	6	0.5	Sand, silt	Flows east under NC 54 towards Stream EE.	250 (C2, C2A)

Stream Designation (Stream Name)	Figure Number	Hydrology	Channel Bottom Width (feet)	Bank Height (feet)	Substrate	Description of Drainage	Linear Feet (Alignment Alternative)
JJJ	Appendix B - 4D	Intermittent	4	1	Sand, silt	Flows east towards Stream Y (Little Creek).	65 (C2, C2A)
EE	Appendix B - 4D	Perennial	6	0.5	Sand, silt, cobble	Begins at NC 54 and flows southeast towards Stream Y (Little Creek).	178 (C2, C2A)
Y (Little Creek)	Appendix B - 4D	Perennial	25	4	Sand, silt, cobble, rock	Flows south under NC 54.	517 (C2, C2A)
OO	Appendix B - 4D	Intermittent	4	2	Sand, silt	Part of a braided stream network connecting Stream Y and Stream CC.	215 (C2, C2A)
CC	Appendix B - 4D	Perennial	20	4	Sand, silt, cobble	Flows southeast from NC 54.	230 (C2, C2A)
AA	Appendix B - 4D	Intermittent	5	1	Sand, silt	Flows southwest into Stream Z.	96 (C2, C2A)
Z	Appendix B - 4D	Perennial	6	1	Sand, silt	Flows south under George King Road and NC 54.	233 (C2, C2A)
Y (Little Creek)	Appendix B - 4E	Perennial	25	4	Sand, silt, cobble, rock	Flows southeast from Meadowmont Park towards NC 54.	433 (C1A)
Y (Little Creek)	Appendix B - 4E	Perennial	25	4	Sand, silt, cobble, rock	Flows southeast from Meadowmont Park towards NC 54.	564 (C1)
X	Appendix B - 4E	Perennial	20	2	Sand, silt, cobble	Tributary to Stream Y (Little Creek) with southeast flow.	180 (C1)
W	Appendix B - 4E	Intermittent	6	1	Sand, silt	Flows south into Stream Y (Little Creek).	197 (C1)
W	Appendix B - 4F	Intermittent	6	1	Sand, silt	Flows south into Stream Y (Little Creek).	448 (C1A)
GGG	Appendix B - 4F	Intermittent	4	1	Sand, silt	Flows southwest from George King Road towards Stream Y (Little Creek).	288 (C1A)
V	Appendix B - 4F	Intermittent	3	0.5	Sand, silt	Flows south from Pond B.	792 (C1, C1A)
V	Appendix B - 4F	Intermittent	3	0.5	Sand, silt	Flows south from Pond B.	760 (C2)
V	Appendix B - 4F	Intermittent	3	0.5	Sand, silt	Flows south from Pond B.	764(C2A)
M	Appendix B - 4G	Intermittent	4	2	Sand, silt	Flows north into Stream PP.	228 (LRA)
PP	Appendix B - 4G	Intermittent	4	2	Sand, silt	Flows southeast and crosses under I-40.	220 (LRA)
N	Appendix B - 4G	Intermittent	4	2	Sand, silt	Flows northeast under I-40 from Farrington Road and Wetland NNN.	244 (LRA)

Stream Designation (Stream Name)	Figure Number	Hydrology	Channel Bottom Width (feet)	Bank Height (feet)	Substrate	Description of Drainage	Linear Feet (Alignment Alternative)
N	Appendix B - 4G	Intermittent	4	2	Sand, silt	Flows northeast under I-40 from Farrington Road and Wetland NNN.	307 (ROMF Leigh Village)
N	Appendix B - 4G	Intermittent	4	2	Sand, silt	Flows northeast under I-40 from Farrington Road and Wetland NNN.	499 (ROMF Farrington)
NN	Appendix B - 4G	Perennial	7	2	Sand, silt, cobble	Flows east-northeast under I-40 from Farrington Road	88 (LRA)
NN	Appendix B - 4G	Perennial	7	2	Sand, silt, cobble	Flows east-northeast under I-40 from Farrington Road	139 (ROMF Farrington)
NN	Appendix B - 4G	Perennial	7	2	Sand, silt, cobble	Flows east-northeast under I-40 from Farrington Road	31 (ROMF Leigh Village)
MM	Appendix B - 4H	Perennial	12	3	Sand, silt, cobble, rock	Flows northeast under I-40.	297 (LRA)
LL	Appendix B - 4H	Perennial	8	2	Sand, silt, cobble	Flows east under I-40.	205 (LRA)
R	Appendix B - 4I	Intermittent	3	2	Sand, silt	Flows east under I-40 from Wetland S.	771 (LRA)
Q	Appendix B - 4J	Intermittent	3	1	Sand, silt	Flows northeast from Wetland Q into Stream P.	387 (NHC LPA)
QQQ	Appendix B - 4J	Intermittent	3	1	Sand, silt, cobble	Flows southeast towards Wetland O.	28 (ROMF Patterson Place)
P	Appendix B - 4J	Intermittent	3	1	Sand, silt	Flows east into Wetland P.	252 (NHC LPA)
O	Appendix B - 4J	Perennial	20	2	Sand, silt, cobble	Tributary to Stream T (New Hope Creek) with southeast flow.	133 (NHC LPA)
OOO	Appendix B - 4J	Intermittent	3	1	Sand, silt	Flows northeast towards New Hope Creek.	12 (ROMF Patterson Place)
XXX	Appendix B - 4J	Intermittent	8	2	Sand, silt	Flows southeast from Wetland N towards New Hope Creek.	204 (NHC LPA)
T (New Hope Creek)	Appendix B - 4J	Perennial	30	6	Sand, silt, cobble, rock	Flows southeast and is located west of Garrett Road	883 (NHC LPA)
J (Sandy Creek)	Appendix B - 4J	Perennial	30	4	Sand, silt, cobble, rock	Tributary to New Hope Creek. Flows southwest under Garrett Road	1,492 (NHC LPA)

Stream Designation (Stream Name)	Figure Number	Hydrology	Channel Bottom Width (feet)	Bank Height (feet)	Substrate	Description of Drainage	Linear Feet (Alignment Alternative)
K	Appendix B - 4J	Perennial	6	2	Sand, silt, cobble	Flows west into Sandy Creek.	876 (NHC LPA)
UUU	Appendix B - 4J	Perennial	20	3	Sand, silt, cobble, rock	Flows west under Garrett Road and into New Hope Creek.	409 (NHC LPA)
T (New Hope Creek)	Appendix B - 4K	Perennial	30	6	Sand, silt, cobble, rock	Flows southwest under US 15-501.	415 (NHC 1, NHC 2)
S	Appendix B - 4K	Perennial	15	5	Sand, silt, cobble, rock	Flows south under US 15-501.	477 (NHC 1, NHC 2)
L	Appendix B - 4K	Perennial	6	2	Sand, silt	Flows east into Wetland E.	175 (NHC 2)
J (Sandy Creek)	Appendix B - 4K	Perennial	30	4	Sand, silt, cobble, rock	Flows south-southwest under US 15-501 and Larchmont Road towards New Hope Creek.	437 (NHC 2)
I	Appendix B - 4K	Perennial	6	2	Sand, silt	Flows southwest into Sandy Creek.	1,430 (NHC LPA)
I	Appendix B - 4K	Perennial	6	2	Sand, silt	Flows southwest into Sandy Creek.	629 (NHC 2)
J (Sandy Creek)	Appendix B - 4K	Perennial	30	4	Sand, silt, cobble, rock	Flows south-southwest under US 15-501 and Larchmont Road towards New Hope Creek.	263 (NHC 1)
H	Appendix B - 4L	Intermittent	5	1	Sand, silt	Flows southeast towards University Drive	276 (NHC 2, NHC LPA)
G	Appendix B - 4L	Intermittent	4	2-3	Sand, silt	Flows southeast under University Drive and into Stream F.	198 (NHC 2, NHC LPA)
F	Appendix B - 4L	Perennial	25	6	Sand, silt, cobble, rock	Located south of University Drive Stream flows southwest towards Sandy Creek.	769 (NHC 2, NHC LPA)
E	Appendix B - 4M	Intermittent	4	0.5	Sand, silt	Flows south-southwest towards Tower Boulevard.	320 (LRA)
D	Appendix B - 4M	Intermittent	3	0.5	Sand, silt	Tributary to Stream E with southwestern flow.	61 (LRA)
C	Appendix B - 4M	Perennial	3	0.5	Sand, silt	Flows north into Wetland C.	47 (LRA)
B	Appendix B - 4M	Perennial	4	0.5	Sand, silt	Flows north into Wetland A towards Stream A.	187 (LRA)
A	Appendix B - 4M	Perennial	10	4	Sand, silt, cobble, rock	Flows west under US 15-501 towards Sandy Creek.	574 (LRA)
J (Sandy Creek)	Appendix B - 4N	Perennial	30	4	Sand, silt, cobble, rock	Flows south under W. Cornwallis Road and east of US 15-501.	1,214 (LRA)

Stream Designation (Stream Name)	Figure Number	Hydrology	Channel Bottom Width (feet)	Bank Height (feet)	Substrate	Description of Drainage	Linear Feet (Alignment Alternative)
GG	Appendix B - 4N	Intermittent	4	2-3	Sand, silt	Flows west into Sandy Creek.	268 (LRA), 154 (ROMF Cornwallis)
HH	Appendix B - 4N	Perennial	25	4-5	Sand, silt, cobble, rock	Flows southwest into Sandy Creek.	106 (LRA)
J (Sandy Creek)	Appendix B - 4O	Perennial	30	4	Sand, silt, cobble, rock	Flows south from Cameron Boulevard.	603 (LRA)
II	Appendix B - 4O	Intermittent	4	1-2	Sand, silt	Flows west into Sandy Creek.	403 (LRA)
JJ	Appendix B - 4O	Perennial	10	3	Sand, silt, cobble, rock	Flows west under Erwin Road and in to Sandy Creek.	463 (LRA)
J (Sandy Creek)	Appendix B - 4P	Perennial	30	4	Sand, silt, cobble, rock	Flows south on the west side of Erwin Road	2 (LRA)
KK	Appendix B - 4P	Perennial	12	4	Sand, silt, cobble, rock	Flows southwest under Erwin Road and into Sandy Creek.	684 (LRA)
WWW	Stream not included in JD; USACE verification pending	Perennial	5	4	Sand, silt, cobble, rock	Flows south under Durham Freeway (SR 147)	175 (LRA)

Stream Designation (Stream Name)	Figure Number	Hydrology	Channel Bottom Width (feet)	Bank Height (feet)	Substrate	Description of Drainage	Linear Feet (Alignment Alternative)
TOTALS							8,583 (LRA)* 3,203 (C1) 3,431 (C1A) 4,144 (C2) 3,667 (C2A) 338 (ROMF Leigh Village) 638 (ROMF Farrington) 40 (ROMF Patterson Place) 154 (ROMF Cornwallis) 7,309 (NHC LPA) 1,155 (NHC 1) 3,376 (NHC 2)

LRA consists of the common segments of the Light Rail Alternatives.
Based on the Jurisdictional Determination located in Appendix B.

**Includes 175 LF of Stream WWW*

Table 2: Jurisdictional Wetlands in the Study Area

Wetland Name	Figure Number	Wetland Type	Description of Drainage	Approximate Area (acres)
ZZ	Appendix B - 4B	Forested/Emergent	Located West of Carmichael Street. Drains north towards Chapel Branch.	0.12 (LRA)
WW	Appendix B - 4B	Forested/Emergent	Located adjacent to Chapel Branch.	0.04 (LRA)
YY	Appendix B - 4C	Emergent	Linear wetland adjacent to Finley Golf Course Road Connected to Stream SS.	0.04 (C1, C1A, C2, C2A)
GG	Appendix B - 4C	Forested	Drains to Stream RR.	0.37 (C2A)
GG	Appendix B - 4C	Forested	Drains to Stream RR.	0.23 (C1, C1A, C2)
EE	Appendix B - 4D	Forested	Drains to Little Creek.	1.17 (C2, C2A)
FF	Appendix B - 4D	Forested/Emergent	Located south of NC 54. Drains to Little Creek.	2.09 (C2, C2A)
DD	Appendix B - 4D	Forested	Located north of NC 54. Drains to Little Creek.	0.06 (C2, C2A)
CC	Appendix B - 4D	Forested	Located south of NC 54. Drains to Little Creek.	0.21 (C2, C2A)
CCC	Appendix B - 4E	Emergent	Located east of Park Bluff Drive. Drains to Little Creek.	0.17 (C1A)
CCC	Appendix B - 4E	Emergent	Located east of Park Bluff Drive. Drains to Little Creek.	0.06 (C1)
BBB	Appendix B - 4E	Forested/Emergent	Located east of Park Bluff Drive. Drains to Little Creek.	0.35 (C1A)
DDD	Appendix B - 4E	Forested	Located east of Park Bluff Drive. Drains to Little Creek.	0.29 (C1)
AA	Appendix B - 4E	Forested/Emergent	Located east of Park Bluff Drive and west of George King Road Drains to Little Creek.	2.11 (C1)
AA	Appendix B - 4E	Forested/Emergent	Located east of Park Bluff Drive and west of George King Road Drains to Little Creek.	0.57 (C1A)
BB	Appendix B - 4E and 4F	Forested/Emergent	Located west of George King Road Drains to Little Creek.	0.38 (C1)
Z	Appendix B - 4F	Forested/Emergent	Located west of George King Road and east of Little Creek. Drains to Little Creek.	0.45 (C1)
HHH	Appendix B - 4F	Emergent	Located west of George King Road. Drains directly to Stream GGG.	0.05 (C1A)
III	Appendix B - 4F	Forested	Located west of George King Road. Drains directly to Stream GGG.	0.26 (C1A)
Y	Appendix B - 4F	Forested	Located adjacent to George King Road on the east side.	0.06 (C1)
Y	Appendix B - 4F	Forested	Located adjacent to George King Road on the east side.	0.04 (C1A)

Wetland Name	Figure Number	Wetland Type	Description of Drainage	Approximate Area (acres)
NNN	Appendix B - 4G	Emergent	Located adjacent to Farrington Road on the east side. Drains directly into Stream N.	0.23-Leigh Village ROMF 0.33-Farrington ROMF
S	Appendix B - 4I	Forested	Located west of White Oak Drive. Drains directly into Stream R.	0.10 (LRA)
T	Appendix B - 4I	Scrub-Shrub	Located east of White Oak Drive. and adjacent to Stream R.	0.08 (LRA)
R	Appendix B - 4I	Forested	Located east of I-40 and south of US 15-501. Drains stormwater from the interstate to the east under the parking lot.	0.22 (LRA)
Q	Appendix B - 4J	Forested	Located southeast of Colonial Grand at Patterson Place Apartments. Drains northeast into Stream Q.	0.25 (NHC LPA)
OOO	Appendix B - 4J	Forested/Emergent	Former detention basin. Drains to the northeast.	0.05 (NHC LPA)
P	Appendix B - 4J	Forested	Linear wetland connected to Stream P. Drains to Stream P	0.02 (NHC LPA)
O	Appendix B - 4J	Forested	Located south of US 15-501 and east of SW Durham Drive. Drains towards Wetland N.	2.21 (NHC LPA)
N	Appendix B - 4J	Forested	Located south of US 15-501 and east of SW Durham Drive. Drains directly into Stream XXX.	2.30 (NHC LPA)
WWW	Appendix B - 4J	Forested	Located adjacent to Wetland N. Drains to Wetland YYY.	0.18 (NHC LPA)
YYY	Appendix B - 4J	Forested	Located south of Wetland N. Drains towards New Hope Creek.	0.03 (NHC LPA)
ZZZ	Appendix B - 4J	Forested	Located south of Wetland N. Drains towards New Hope Creek.	0.07 (NHC LPA)
XX	Appendix B - 4J	Forested	Drains south directly into Stream XXX.	0.10 (NHC LPA)
J	Appendix B - 4J	Forested	Located east of New Hope Creek and north of Sandy Creek. Drains into New Hope Creek.	0.71 (NHC LPA)
K	Appendix B - 4J	Forested	Located west of Garrett Road Drains into Sandy Creek.	0.04 (NHC LPA)
I	Appendix B - 4J	Forested	Located south of Sandy Creek and east of New Hope Creek.	0.31 (NHC LPA)
H	Appendix B - 4J	Emergent	Linear wetland draining directly into Stream K.	0.01 (NHC LPA)
VVV	Appendix B - 4J	Forested	Located south of Sandy Creek and West of Garrett Road Drains into Sandy Creek.	0.19 (NHC LPA)
UUU	Appendix B - 4J	Forested	Located west of Garrett Road and adjacent to Stream UUU. Drains into Stream UUU.	2.37 (NHC LPA)

Wetland Name	Figure Number	Wetland Type	Description of Drainage	Approximate Area (acres)
G	Appendix B - 4J	Forested	Located west of Garrett Road Drains directly into Sandy Creek.	0.03 (NHC LPA)
W	Appendix B - 4K	Forested/Emergent	Located directly adjacent to US 15-501 on the south side. Drains into New Hope Creek.	0.77 (NHC 1, NHC 2)
V	Appendix B - 4K	Forested	Located directly adjacent to US 15-501 on the south side. Drains into Stream S.	0.45 (NHC 1, NHC 2)
VV	Appendix B - 4K	Emergent	Located adjacent to US 15-501 on the north side. Drains into Stream S.	0.13 (NHC 1, NHC 2)
U	Appendix B - 4K	Forested	Located south of US 15-501. Drains into Stream S.	0.01 (NHC 1, NHC 2)
E	Appendix B - 4K	Forested	Located east of Garrett Road and south of US 15-501. Drains into Sandy Creek.	2.45 (NHC 2)
F	Appendix B - 4K	Emergent	Linear wetland east of Garrett Road Drains into Stream I.	0.01 (NHC LPA)
C	Appendix B - 4M	Forested/Emergent	Located east of US 15-501. Drains directly into Stream B.	0.08 (LRA)
A	Appendix B - 4M	Forested	Located east of US 15-501. Drains directly into Stream B.	0.11 (LRA)
TTT	Appendix B - 4N	Forested	Located east of Western Bypass Road and south of W. Cornwallis Road. Drains into Stream GG.	0.21 (LRA)
TTT	Appendix B - 4N	Forested	Located east of Western Bypass Road and south of W. Cornwallis Road Drains into Stream GG.	0.08 (ROMF Cornwallis)
XXX	Wetland not included in JD; USACE verification pending	Emergent	Located east of Campus Drive and south of Maxwell Avenue. Drains into Stream WWW.	0.158 (LRA)*

Wetland Name	Figure Number	Wetland Type	Description of Drainage	Approximate Area (acres)
Totals				1.118 (LRA)* 3.62 (C1) 1.71 (C1A) 3.80 (C2) 3.94 (C2A) 0.23 (ROMF Leigh Village) 0.33 (ROMF Farrington) 0.08 (ROMF Cornwallis) 8.88 (NHC LPA) 1.36 (NHC 1) 3.81 (NHC 2)

LRA consists of the common segments of the Light Rail Alternatives
Based on the Jurisdictional Determination located in Appendix B.

**Includes 0.158 acre of Wetland XXX*

In addition to the jurisdictional wetlands, there are jurisdictional open water features located within the study area. These open waters are referred to as ponds in the text and mapping and are shown in appendix B - Figures 4-4U and are described as follows:

Pond C (appendix B - Figure 4B) is an unnamed open water that is located north of Prestwick Road and south of NC 54. Pond C is lined with a masonry retaining wall and is well maintained. Pond C is approximately 0.107 acre in size and is located within the C1, C1A, C2, and C2A alternatives.

Pond D (appendix B - Figure 4C) is an unnamed open water that is located east of Finley Golf Course Road and south of NC 54. Pond D has a fountain to help maintain water quality and has a fringe of emergent wetland vegetation. Pond D is approximately 0.185 acre in size, is located within the C1, C1A, and C2 alternatives, and is partially located within the C2A alternative.

Pond E (appendix B - Figure 4C) is an unnamed open water that is located east of Finley Golf Course Road and south of NC 54 within the Finley Golf Course. Only a portion of Pond E is approximately 0.016 acre in size and is located within the C1, C1A, and C2 alternatives.

Pond F (appendix B - Figure 4C) is an unnamed open water that is located east of Finley Golf Course Road and south of NC 54 north of the Finley Golf Course. Pond F has a fountain to help maintain water quality and has a fringe of emergent wetland vegetation. Pond F serves as the headwaters for Stream QQ. Only a portion of Pond F is located within the C1, C1A, and C2 alternatives and is approximately 0.173 acre in size.

Pond H (appendix B - Figure 4C) is an unnamed open water that is located east of Friday Center Drive and south of NC 54. Pond H serves as the headwaters for Stream MMM. Pond H is approximately 0.129 acre in size and is located within the C2 alternative.

Pond G (appendix B - Figure 4C) is an unnamed open water that is located east of Friday Center Drive and south of NC 54. Pond G is unmaintained which has resulted in a shoreline fringe of palustrine scrub-shrub/emergent wetlands in addition to being covered by a thick layer of duckweed (*Lemna* sp.). Pond G is approximately 0.146 acre in size and is located within the C2 alternative.

Pond B (appendix B - Figure 4F) is an unnamed open water that is located west of Farrington Road and south of Wendell Road. Pond H serves as the headwaters for Stream V. Pond B is approximately 0.335 acre in size and is located within the C2 and C2A alternatives, and is partially located in the C1 and C1A alternatives.

Pond A (appendix B - Figure 4L) is an unnamed open water that is located northwest of University Drive and west of Martin Luther King Jr. Parkway. Pond A has a fountain to help maintain water quality and has a shoreline that is partially maintained by the adjacent apartment complex. Pond A serves as the headwaters for Stream H. Only a portion of Pond A (approximately 0.264 acre) is located within the NHC 2 alternative and the NHC LPA Alternative.

Pond Z (appendix A – Figure 2D) is an unnamed open water that is located east of Farrington Road and west of I-40. Pond Z is an agricultural pond within an existing pasture and has a shoreline fringe of vegetation including willow and dogwood. Pond Z is approximately 0.182 acre in size and is located in the Leigh Village ROMF. Pond Z has not yet been verified by the USACE and is not included in the Jurisdictional Determination located in appendix B.

Table 3 summarizes the area of ponds that are located within the alignment alternative study areas. The jurisdictional ponds within the study area are listed in Table 3 roughly from south to north as shown in appendix B - Figures 4 – 4U.

Table 3: Jurisdictional Ponds in the Study Area

Pond Designation	Figure Number	Alignment(s)	Area (acre)
C	Appendix B - 4B	C1, C1A, C2, C2A	0.107
D	Appendix B - 4C	C1, C1A, C2, C2A	0.185
E	Appendix B - 4C	C1, C1A, C2	0.016
F	Appendix B - 4C	C1, C1A, C2	0.173
H	Appendix B - 4C	C2	0.129
G	Appendix B - 4C	C2	0.146
B	Appendix B - 4F	C1, C1A, C2, C2A	0.335
Z*	Appendix B - 4G	Leigh Village ROMF	0.182
A	Appendix B - 4L	NHC 2, LRA	0.264

Based on the Jurisdictional Determination located in Appendix B.
LRA consists of the common segments of the Light Rail Alternatives.

* Pond Z not verified by the USACE

4.3 Floodplains and Floodway

Federal Emergency Management Administration, in cooperation with federal, state, and local governments, has developed floodway boundaries and FIRMs for Durham and Orange counties.

Floodplains are land areas adjacent to rivers and streams that are subject to recurring inundation. Owing to their continually changing nature, floodplain areas and other flood-prone areas need to be examined in light of how they might affect or be affected by development. Rivers and streams where FEMA has prepared detailed engineering studies may have designated floodways. A floodway is the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. For most waterways, the floodway is where the water is likely to be deepest and fastest and is the area of the floodplain that should be reserved (kept free of obstructions) to allow floodwaters to move downstream. Placing fill or buildings in a FEMA floodway may block the flow of water and increase flood elevations.

According to the FIRM maps for Durham and Orange counties, the study area falls within the FEMA 100-year floodplain in multiple areas along the proposed alignment alternatives. The crossings of Meeting of the Waters (Stream WW), Little Creek (Stream Y), New Hope Creek (Stream T), and Sandy Creek (Stream J) have the largest areas of floodplains within the proposed alignment alternatives as shown in appendix A - Figures 4A through 4F.

4.4 Water Quality

Water quality in the study area has been qualitatively assessed through a combination of field observations and literature review. Surface waters are discussed in the context of the river basin, sub-basin, hydrologic unit, as well as stream classifications as established by DWR. Data from ambient water quality and macro invertebrate monitoring stations maintained by both the County and State proximal to the project corridors have been reviewed. Additional literature that has been reviewed includes the 303(d) list of impaired waters and the basin wide assessment reports and water quality plans promulgated by DWR, including listings of National Pollution Discharge Elimination System (NPDES) permitted dischargers. The role that storm water and drainage issues in the project corridors would potentially have on water quality in the study area will be assessed, incorporating the findings of the

preliminary drainage assessment. A brief overview of key storm water infrastructure is also provided, including notable outfall locations.

The streams within the project study area drain to Jordan Lake. According to the DWR NC Water Quality Classifications by NC River Basin (http://portal.ncdenr.org/web/wq/ps/csu/classifications), the DWR stream classifications for the project study area streams are either Water Supply (WS)-IV; Nutrient Sensitive Waters (NSW) or WS-V; NSW. According to the DWR Water Quality Data Assessment 2012 303(d) list (http://portal.ncdenr.org/web/wq/ps/mtu/assessment), Stream Y (Little Creek) is the only stream within the project study area that is listed as a 303(d) impaired water.

5. Environmental Consequences

Anticipated impacts to water resources, notably jurisdictional streams and wetlands as well as regulated floodplain areas, are described in the following sections. The potential impacts to the existing water resources resulting from the proposed project are detailed below for the No-Build Alternative and the Light Rail Alternatives, which consist of the common alignment segments LRA, alignment alternatives (C1, C1A, C2, C2A, NHC LPA, NHC 1, and NHC 2), Duke/VA Medical Centers Station Alternatives (Duke Eye Center and Trent/Flowers Drive), and ROMF alternatives (Leigh Village ROMF, Farrington Road ROMF, Patterson Place ROMF, Cornwallis Road ROMF and Alston Avenue ROMF). The potential effects to water resources for the No-Build and Light Rail Alternatives are summarized in appendix A - Figures 2 through 4 and are summarized in Tables 4, 5, 6, 7, and 8 respectively.

5.1 No-Build Alternative

The No-Build Alternative includes existing and planned transit services; highway and transit facilities; and railroad improvements that are proposed to exist in 2040 and included in the fiscally constrained Long Range Transportation Plan adopted by the DCHC MPO (known locally as the Metropolitan Transportation Plan [MTP]); with the exception of the proposed rail transit improvements and related bus transit modifications. The potential effects to water resources for the No-Build are summarized in appendix A - Figures 2 through 4 and are summarized in Tables 4, 5, 6, 7, and 8. Under the No-Build Alternative there will be no project-related impacts to the water resources.

5.2 Light Rail Alternatives

Preliminary impact estimates to the jurisdictional features for the Light Rail Alternatives are based on design assumptions as shown in the *Basis for Engineering Design Plans* completed February 2015. Preliminary cut and fill limits were placed as an overlay on the GPS mapping of the approximate boundaries of jurisdictional stream and wetland features, riparian buffers, as well as floodplains and floodways mapping, to estimate impacts. Estimated impacts are subject to refinement based on the continuance of the design and further development of the engineering plans. The current level of design estimates impacts resulting from the extent of the final construction limits. Final construction limits as well as temporary construction easements, staging areas, etc., will be addressed and refined in further stages of design.

5.2.1 Groundwater

Since the construction of the D-O Light Rail Transit Project would not involve extensive excavation and the no public water supply wells are located within 1,500 feet of the project corridor, no groundwater impacts would be anticipated by the implementation of the proposed project. The 116 privately owned wells that are within 1,500 feet of the project corridor would not be affected by the operation of the light rail vehicles because the vehicles do not have gasoline or oils that could spill and contaminate the groundwater. In addition, each station location and park-and-ride facility would implement best management practices (BMP) for the collection and treatment of stormwater runoff.

5.2.2 Surface Waters and Wetlands

5.2.2.1 Streams

Table 4 summarizes the estimated stream impacts within the study area. Stream impacts are provided in linear feet (LF) and acreage. The jurisdictional streams within the study area are listed in Table 4 roughly from south to north as shown on Figures 2A through 2N.

Stream WW, named Chapel Branch, is a Relatively Permanent Water (RPW) with perennial flow that is located west and east of NC 54 and US 15-501 in the LRA. Stream WW (Chapel Branch) begins west of the project corridor and flows under NC 54 and US 15-501 through a culvert to the east side of NC 54 and US 15-501 where it is part of an Ecosystem Enhancement Program (EEP) stream mitigation project and flows off-site to the east. Stream WW is approximately 250 linear feet within the project corridor. Approximately 85 linear feet (0.024 acre) of Stream WW may be affected by the existing culvert extension in the LRA, unless the EEP requests a design change (appendix A - Figure 2A).

Stream TT is an unnamed RPW with perennial flow that is located south of Prestwick Road in the LRA. Stream TT begins at a culvert on the north side of the project corridor and flows south for approximately 712 linear feet before it flows off-site to the south. Stream TT is a tributary to Stream WW (Chapel Branch) south of the project corridor. Approximately 234 linear feet (0.061 acre) of Stream TT would be affected by the placement of a culvert under the rail alignment. Also, approximately 24 linear feet (0.007 acre) of Stream TT would be affected by the placement of a pedestrian culvert and riprap in the LRA (appendix A - Figure 2A).

Stream SS is an unnamed seasonal RPW with intermittent flow that is a tributary to Stream RR and is located south of NC 54 and east of Finley Golf Course Road in the C1, C1A, C2, and C2A alternatives. Stream SS begins at Wetland YY and flows for approximately 228 linear feet before entering Stream RR. Approximately 210 linear feet (0.019 acre) of Stream SS would be affected by the placement of a corrugated metal pipe (CMP) pipe in the C1, C1A and the C2 alternatives. Approximately 352 linear feet (0.032 acre) of Stream SS would be affected by the placement of a 30” CMP in the C2A alternative (appendix A - Figure 2B).

Stream RR is an unnamed RPW with perennial flow that is located south of NC 54 and east of Finley Golf Course Road in the C1, C1A, C2, and C2A alternatives. Stream RR begins off site to the north of the project corridor and flows south for approximately 683 linear feet before it flows off-site to the south. Approximately 173 linear feet (0.018 acre) of Stream RR would be affected by the placement of a pipe in the C1, C1A and C2 alternatives. Approximately 28 linear feet (0.004 acre) of Stream RR would be affected by the placement of a 30” CMP in the C2A alternative (appendix A - Figure 2B).

Stream QQ is an unnamed RPW with perennial flow that is located south of NC 54 and west of Friday Center Drive in the C1, C1A, and C2 alternatives. Stream QQ begins at a culvert draining Pond F in the northern portion of the project corridor and flows south for approximately 227 linear feet before it flows off-site to the south. Approximately 90 linear feet (0.011 acre) of Stream QQ would be affected by the placement of a pipe in the C2 alternative (appendix A - Figure 2B).

Stream LLL is an unnamed seasonal RPW with intermittent flow that is a tributary to Stream QQ and is located south of and largely parallel to NC 54 in the C2A alternative and is a tributary of Stream QQ. Stream LLL begins at a riprap lined stormwater outfall from NC 54 and flows for approximately 90 linear feet before joining in confluence with Stream QQ. Approximately 90 linear feet (0.004 acre) of Stream LLL would be affected by the placement of a pipe in the C2A alternative (appendix A - Figure 2B).

Stream MMM, an unnamed seasonal RPW with intermittent flow that begins from a culvert connected to Pond H, is located east of Friday Center Drive and south of NC 54 in the C2 alternative. Stream MMM flows south for approximately 208 linear feet before entering a pipe culvert under Finley Forest Drive. Approximately 114 linear feet (0.010 acre) of Stream MMM would be affected by the placement of a pipe in the C2 alternative (appendix A - Figure 2B).

Stream KKK is an unnamed seasonal RPW with intermittent flow that is located south of and perpendicular to NC 54 in the C2A alternative. Stream KKK begins at a stormwater outfall from NC 54 and flows for approximately 168 linear feet before entering a pipe culvert under a parking lot. Approximately 23 linear feet (0.002 acre) of Stream KKK would be affected by the extension of the culvert in the C2A alternative (appendix A - Figure 2B).

Stream W is an unnamed seasonal RPW with intermittent flow located west of George King Road in the C1A alternative. Stream W flows to the southwest through the C1A project corridor, and drains into Stream Y (Little Creek). Stream W is approximately 448 linear feet within the delineated C1A project corridor. Approximately 121 linear feet (0.008 acre) of Stream W would be affected by the placement of a pipe in the LRA (appendix A - Figure 2C).

Stream GGG is an unnamed seasonal RPW with intermittent flow located west of George King Road in the C1A alternative. Stream GGG flows to the southwest through the C1A project corridor. Stream GGG is approximately 228 linear feet within the delineated C1A project corridor. Approximately 87 linear feet (0.006 acre) of Stream GGG would be affected by the placement of a pipe in the LRA (appendix A - Figure 2C).

Stream V is an unnamed seasonal RPW with intermittent flow located east of George King Road in the LRA. Stream V begins at the pipe outlet of Pond B and flows southwest through the project corridor and turns into a braided channel prior to dissipating into uplands. Stream V is approximately 792 linear feet within the delineated project corridors. Approximately 322 linear feet (0.042 acre) of Stream V would be affected by the at-grade crossing in the LRA and the Leigh Village road network (appendix A - Figure 2C).

Stream PP is an unnamed seasonal RPW with intermittent flow located west of I-40. Stream PP flows southeast to a culvert which passes beneath I-40. Stream PP is approximately 220 linear feet within the LRA. Approximately 47 linear feet (0.005 acre) of Stream PP would be affected by the placement of a pipe in the LRA (appendix A - Figure 2D).

Stream N is an unnamed seasonal RPW with intermittent flow located west of I-40. Stream N begins at Wetland NNN and flows northeast through the project corridor under I-40. Stream N is approximately 499 linear feet (0.052 acre) within the LRA, Leigh Village and Farrington Road ROMF. Approximately 67 linear feet (0.006 acre) of Stream N would be affected by the placement of a pipe in the LRA. Approximately 307 linear feet (0.030 acre) of Stream N would be affected by the placement of a pipe in the Leigh Village ROMF. Approximately 499 linear feet (0.052 acre) of Stream N would be affected by the placement of a pipe in the Farrington Road ROMF (appendix A - Figure 2D).

Stream NN is an unnamed RPW with perennial flow that is located east of Farrington Road and flows under I-40 in the LRA. Stream NN begins in a forested area west of I-40 and flows east through the project corridor under I-40. Stream NN is approximately 143 linear feet (0.015 acre) within the LRA, Leigh Village ROMF, and Farrington Road ROMF. Approximately 47 linear feet (0.004 acre) of Stream NN would be affected by the placement of a pipe in the LRA. Approximately 31 linear feet (0.003 acre) of Stream NN would be affected by the placement of a pipe in the Leigh Village ROMF. Approximately 139 linear feet (0.014 acre) of Stream NN would be affected by the placement of a pipe in the Farrington Road ROMF (appendix A - Figure 2D).

Stream MM is an unnamed RPW with perennial flow that is located northeast of Bakers Mill Road and flows under I-40 in the proposed LRA. Stream MM begins in a forested area west of I-40 and flows northeast through the project corridor under I-40. Stream MM is approximately 297 linear feet within the LRA. Approximately 138 linear feet (0.029 acre) of Stream MM would be affected by the extension of the existing box culvert under I-40 in the LRA (appendix A - Figure 2E).

Stream LL is an unnamed RPW with perennial flow that is located southeast of Crystal Oaks Court and flows under I-40 in the LRA. Stream LL begins in a forested area west of I-40 and flows east through the project corridor under I-40. Stream LL is approximately 205 linear feet within the LRA. Approximately 74 linear feet (0.023 acre) of Stream LL would be affected by the extension of the existing culvert under I-40 in the LRA (appendix A - Figure 2E).

Stream R is an unnamed seasonal RPW with intermittent flow located north of Old Chapel Hill Road and west of I-40 in the LRA. Stream R begins at Wetland S and flows east through the project corridor. Stream R is approximately 771 linear feet within the LRA and park-and-ride lots. Approximately 766 linear feet (0.060 acre) of Stream R would be affected by the placement of a culvert under the park-and-ride lot and in the LRA (appendix A - Figure 2F).

Stream J, named Sandy Creek, is an RPW with perennial flow and is located west of Garrett Road in the NHC LPA. Stream J begins off site to the north and flows southwest through the project corridor. Stream J is approximately 1,490 linear feet within the NHC LPA. Approximately 8 linear feet (0.001 acre) of Stream J would be affected by the placement of a pier in the NHC LPA (appendix A - Figure 2G).

Stream I is an unnamed RPW with perennial flow that is located in the forested area east of Garrett Road in the NHC LPA. Stream I begins north of the NHC 2 alternative and flows southwest through the project corridors where it joins Stream J (Sandy Creek). Stream I is approximately 1,821 linear feet within the NHC LPA. Approximately 3 linear feet (less than 0.001 acre) of Stream I would be affected by the placement of a pier in the NHC LPA (appendix A - Figure 2H).

Stream H is an unnamed seasonal RPW with intermittent flow located west of University Drive in the NHC LPA and NHC 2 alternative. Stream H begins at Pond A adjacent to the apartment complex to the north and flows south through the project corridors towards University Drive. Stream H is approximately 276 linear feet within the NHC LPA and NHC 2 alternative. Approximately 157 linear feet (0.017 acre) of Stream H would be affected by the placement of a pipe in both the NHC LPA and NHC 2 alternative (appendix A - Figure 2I).

Stream G is an unnamed seasonal RPW with intermittent flow located east and west of University Drive in the NHC LPA and NHC 2 alternative. Stream G begins in the forested area west of University Drive and south of the apartment complex and flows southeast through the project corridors under University Drive where it joins with Stream F. Stream G is approximately 198 linear feet within the NHC LPA and NHC 2 alternative. Approximately 53 linear feet (0.004 acre) of Stream G would be affected by the extension of culverts under University Drive in both the NHC LPA and NHC 2 alternative (appendix A - Figure 2I).

Stream E is an unnamed seasonal RPW with intermittent flow located east of US 15 and south of Pickett Road in the LRA. Stream E flows southwest towards Tower Blvd. Stream E is approximately 320 linear feet within the LRA. Approximately 15 linear feet (0.001 acre) of Stream E would be affected by the placement of a pipe under the LRA (appendix A - Figure 2J).

Stream D is an unnamed seasonal RPW with intermittent flow located east of US 15 and south of Pickett Road in the LRA. Stream D flows southwest towards Stream E. Stream D is approximately 61 linear feet

within the LRA. Approximately 42 linear feet (0.004 acre) of Stream D would be affected by the placement of a pipe under the LRA (appendix A - Figure 2J).

Stream B is an unnamed RPW with perennial flow located east of US 15 and north of Pickett Road in the LRA. Stream B flows north towards Stream A. Stream B is approximately 187 linear feet within the LRA. Approximately 53 linear feet (0.004 acre) of Stream B would be affected by the placement of a culvert under the LRA (appendix A - Figure 2K).

Stream A is an unnamed RPW with perennial flow located east of US 15 and north of Pickett Road in the LRA. Stream A flows west across the LRA towards Stream J (Sandy Creek). Stream A is approximately 574 linear feet within the LRA. Approximately 51 linear feet (0.011 acre) of Stream A would be affected by the placement of a culvert under the LRA (appendix A - Figure 2K).

Stream GG is an unnamed seasonal RPW with intermittent flow located east of US 15-501 and south of West Cornwallis Road in the Cornwallis ROMF east of Stream J (Sandy Creek). Stream GG begins at a head cut south of West Cornwallis Road and flows north through Wetland TTT into a culvert under Western Bypass to Stream J (Sandy Creek). Stream GG is approximately 268 linear feet within the Cornwallis ROMF. Approximately 154 linear feet (0.012 acre) of Stream GG would be affected by the placement of a pipe under the Cornwallis ROMF (appendix A - Figure 2K).

Stream JJ is an unnamed RPW with perennial flow that is located north of Cameron Boulevard in the LRA. Stream JJ begins off site in the forested area east of the project corridor and flows west through the project corridor under Erwin Road in the LRA northeast of Stream T (New Hope Creek). Stream JJ is approximately 463 linear feet within the LRA northeast of Stream T (New Hope Creek). Approximately 32 linear feet (0.008 acre) of Stream JJ would be affected by the extension of an existing culvert under Erwin Road in the LRA (appendix A - Figure 2L).

Stream KK is an unnamed RPW with perennial flow that is located east and west of Erwin Road in the LRA. Stream KK begins off site in the forested area east of the project corridor and flows west through the project corridor, under Erwin Road, then south to Stream J (Sandy Creek). Stream KK is approximately 684 linear feet within the LRA northeast of Stream T (New Hope Creek). Approximately 73 linear feet (0.019 acre) of Stream KK would be affected by the extension of an existing culvert under Erwin Road in the LRA (appendix A - Figure 2L).

Stream J, named Sandy Creek, is an RPW with perennial flow and is located west of Erwin Road in the LRA. Stream J begins off site to the north and flows southwest through the project corridor. Stream J is approximately 2 linear feet within the LRA. Approximately 2 linear feet (0.001 acre) of Stream J would be affected by the extension of an existing culvert under Morreene Road in the LRA (appendix A - Figure 2L).

Table 4 summarizes the estimated stream impacts within the LRA and alignment alternative study areas. The jurisdictional streams within the study area are listed in Table 4 roughly from south to north as shown in appendix A - Figures 2A through 2M.

Table 4: Summary of Estimated Stream Impacts

Jurisdictional Area	Stream Type	No-Build Alternative	Impact Type	LRA LF (acre)	C1 LF (acre)	C1A LF (acre)	C2 LF (acre)	C2A LF (acre)	NHC LPA LF (acre)	NHC 1 LF (acre)	NHC 2 LF (acre)	ROMF LF (acre)
Stream WW (Chapel Branch)	Perennial	--	culvert extension	85 (0.024)	--	--	--	--	--	--	--	--
Stream TT	Perennial	--	culvert and riprap	258 (0.068)	--	--	--	--	--	--	--	--
Stream SS	Intermittent	--	pipe	--	210 (0.019)	210 (0.019)	210 (0.019)	352 (0.032)	--	--	--	--
Stream RR	Perennial	--	pipe	--	173 (0.018)	173 (0.018)	173 (0.018)	28 (0.004)	--	--	--	--
Stream QQ	Perennial	--	pipe	--	--	--	90 (0.011)	--	--	--	--	--
Stream LLL	Intermittent	--	pipe	--	--	--	--	90 (0.004)	--	--	--	--
Stream MMM	Intermittent	--	pipe	--	--	--	114 (0.010)	--	--	--	--	--
Stream KKK	Intermittent	--	culvert extension	--	--	--	--	23 (0.002)	--	--	--	--
Stream W	Intermittent	--	pipe	--	--	121 (0.008)	--	--	--	--	--	--
Stream GGG	Intermittent	--	pipe	--	--	87 (0.006)	--	--	--	--	--	--
Stream V	Intermittent	--	pipes	322 (0.042)	--	--	--	--	--	--	--	--
Stream PP	Intermittent	--	pipe	47 (0.005)	--	--	--	--	--	--	--	--
Stream N	Intermittent	--	pipe	67 (0.006)	--	--	--	--	--	--	--	499[1] (0.052) 499[2] (0.052)

Jurisdictional Area	Stream Type	No-Build Alternative	Impact Type	LRA LF (acre)	C1 LF (acre)	C1A LF (acre)	C2 LF (acre)	C2A LF (acre)	NHC LPA LF (acre)	NHC 1 LF (acre)	NHC 2 LF (acre)	ROMF LF (acre)
Stream NN	Perennial	--	pipe	47 (0.004)	--	--	--	--	--	--	--	88[1] (0.008) 139[2] (0.014)
Stream MM	Perennial	--	culvert extension	138 (0.029)	--	--	--	--	--	--	--	--
Stream LL	Perennial	--	culvert extension	74 (0.023)	--	--	--	--	--	--	--	--
Stream R	Intermittent	--	culvert	766 (0.060)	--	--	--	--	--	--	--	
Stream J (Sandy Creek)	Perennial	--	bridge pier	--	--	--	--	--	8 (0.001)	--	--	--
Stream I	Perennial	--	bridge pier	--	--	--	--	--	3 (0.001)	--	--	--
Stream H	Intermittent	--	pipe	--	--	--	--	--	157 (0.017)	--	157 (0.017)	--
Stream G	Intermittent	--	culvert extension	--	--	--	--	--	53 (0.004)	--	53 (0.004)	--
Stream E	Intermittent	--	pipe	15 (0.001)	--	--	--	--	--	--	--	--
Stream D	Intermittent	--	pipe	42 (0.004)	--	--	--	--	--	--	--	--
Stream B	Perennial	--	culvert	53 (0.004)	--	--	--	--	--	--	--	--
Stream A	Perennial	--	culvert	51 (0.011)	--	--	--	--	--	--	--	--
Stream GG	Intermittent	--	pipe	--	--	--	--	--	--	--	--	154[3] (0.012)
Stream JJ	Perennial	--	culvert extension	32 (0.008)	--	--	--	--	--	--	--	--
Stream KK	Perennial	--	culvert extension	73 (0.019)	--	--	--	--	--	--	--	--

Jurisdictional Area	Stream Type	No-Build Alternative	Impact Type	LRA LF (acre)	C1 LF (acre)	C1A LF (acre)	C2 LF (acre)	C2A LF (acre)	NHC LPA LF (acre)	NHC 1 LF (acre)	NHC 2 LF (acre)	ROMF LF (acre)
Stream J (Sandy Creek)	Perennial	--	culvert extension	2 (0.001)	--	--	--	--	--	--	--	--
Totals:		--		**2,072 (0.309)**	**383 (0.037)**	**591 (0.051)**	**587 (0.058)**	**493 (0.042)**	**221 (0.023)**	**0 (0.0)**	**210 (0.021)**	**587[1] (0.06) 638[2] (0.066) 154[3] (0.012)**

The alignment alternatives impacts are based on *Basis for Engineering Design* and the Jurisdictional Determination dated November 7, 2014 (appendix B). Jurisdictional areas outside of the LRA and alignment alternatives are designated with "--" to indicate that impacts are not applicable. All impacts are anticipated to be permanent. All types of impacts are not fully defined at this stage of the design.

LRA consists of the common segments of the Light Rail Alternatives.

1 = Leigh Village ROMF; 2 = Farrington Road ROMF; 3 = Cornwallis ROMF.

Estimated stream impacts for the various combinations of alignments range from a low of 2,455 linear feet (0.346 acre) of streams to a high of 3,522 linear feet (0.449 acre) of streams. The combination of the common segments of the Light Rail Alignment, C1 Alternative, the NHC 1 Alternative, either Duke/VA Medical Centers Station, and either the Patterson Place or Alston Avenue ROMF Alternatives would result in the lowest impacts to streams. The combination of the common segments of the Light Rail Alternatives, C1A Alternative, NHC LPA Alternative, either Duke/VA Medical Centers Station, and the Farrington Road ROMF would result in the greatest impacts to streams.

5.2.2.2 Wetlands

Wetland YY (approximately 0.04 acre) is an emergent wetland located south of NC 54 and east of Finley Golf Course Road. Portions of Wetland YY are located in the C1, C1A, C2, and C2A alternatives. Approximately 1,333 square feet (0.031 acre) of Wetland YY would be affected by fill in the C1 alternative. Approximately 1,333 square feet (0.031 acre) of Wetland YY would be affected by fill in the C1A alternative. Approximately 1,333 square feet (0.031 acre) of Wetland YY would be affected by a 30" corrugated metal pipe (CMP) in the C2 alternative. Approximately 1,354 square feet (0.031 acre) of Wetland YY would be affected by fill in the C2A alternative (appendix A - Figure 2B).

Wetland GG (approximately 0.37 acre) is a palustrine forested wetland located south of NC 54 and east of Finley Golf Course Road. Portions of Wetland GG are located in the C1, C1A, C2, and C2A alternatives. Approximately 1,682 square feet (0.039 acre) of Wetland GG would be affected by two new pipes and fill in the C1 alternative. Approximately 1,682 square feet (0.039 acre) of Wetland GG would be affected by two new pipes and fill in the C1A alternative. Approximately 1,682 square feet (0.039 acre) of Wetland GG would be affected by two new pipes and fill in the C2 alternative. Approximately 4,062 square feet (0.093 acre) of Wetland GG would be affected by two new pipes and fill in the C2A alternative (appendix A - Figure 2B).

Wetland BBB (approximately 0.35 acre) is a palustrine emergent wetland located east of Meadowmont Lane and south of Helmsdale Drive in the C1A alternative. Approximately 50 square feet (0.001 acre) of Wetland BBB would be affected by bridge piers in the C1A alternative (appendix A - Figure 2C).

Wetland AA (approximately 0.57 acre in the C1A alternative; approximately 2.40 acres in the C1 alternative) is a palustrine forested/emergent wetland located east of Meadowmont Lane and south of Helmsdale Drive in the C1A and C1 alternatives. Approximately 150 square feet (0.003 acre) of Wetland AA would be affected by bridge piers in the C1 alternative (appendix A - Figure 2C).

Wetland HHH (approximately 0.05 acre in the C1A alternative) is a palustrine emergent wetland located west of George King Road in the C1A alternative. Approximately 46 square feet (0.001 acre) of Wetland HHH would be affected by fill in the C1A alternative (appendix A - Figure 2C).

Wetland Y (approximately 0.06 acre in the C1 alternative; approximately 0.04 acre in the C1A alternative) is a palustrine forested wetland located east of George King Road in the C1 and C1A alternatives. Approximately 405 square feet (0.009 acre) of Wetland Y would be affected by fill from the LRA (appendix A - Figure 2C).

Wetland NNN (approximately 0.325 acre) is a palustrine emergent wetland located east of Farrington Road and serves as headwaters to Stream N within the Farrington Road ROMF. Approximately 14,139 square feet (0.325 acre) of Wetland NNN would be affected by fill in the Farrington Road ROMF (appendix A - Figure 2D). Approximately 9,975 square feet (0.229 acre) of Wetland NNN would be affected by fill in the Leigh Village ROMF (appendix A - Figure 2D). Wetland T (approximately 0.08 acre) is a palustrine scrub/shrub wetland located east of North White Oak Road and north of Old Chapel Hill

Road in the LRA and Gateway Station park-and-ride. Approximately 3,348 square feet (0.077 acre) of Wetland T would be affected by fill in the LRA and park-and-ride facility (appendix A - Figure 2F).

Wetland O (approximately 2.21 acres) is a palustrine forested wetland located east of SW Durham Drive and south of US 15-501 in the New Hope Creek Locally Preferred Alignment Alternative (NHC LPA). Approximately 226 square feet (0.005 acre) of Wetland O would be affected by bridge piers in the NHC LPA (appendix A - Figure 2G).

Wetland N (approximately 2.3 acre) is a palustrine forested wetland located east of SW Durham Drive and south of US 15-501 in the NHC LPA. Approximately 80 square feet (0.002 acre) of Wetland N would be affected by bridge piers in the NHC LPA (appendix A - Figure 2G).

Wetland J (approximately 0.71 acre) is a palustrine forested wetland located west of Garrett Road and south of US 15-501 in the NHC LPA. Approximately 150 square feet (0.003 acre) of Wetland J would be affected by bridge piers in the NHC LPA (appendix A - Figure 2G).

Wetland K (approximately 0.04 acre) is a palustrine forested wetland located west of Garrett Road and south of US 15-501 in the NHC LPA. Approximately 30 square feet (0.001 acre) of Wetland K would be affected by bridge piers in the NHC LPA (appendix A - Figure 2G).

Wetland W (approximately 0.77 acre) is a palustrine forested/emergent wetland located west of Garrett Road and south of US 15-501 in the New Hope Creek 1 (NHC 1) and New Hope Creek 2 (NHC 2) alternatives. Approximately 40 square feet (0.001 acre) of Wetland W would be affected by bridge piers in the NHC 1 alternative. Approximately 40 square feet (0.001 acre) of Wetland W would be affected by bridge piers in the NHC 2 alternative (appendix A - Figure 2H).

Wetland V (approximately 0.45 acre) is a palustrine forested wetland located west of Garrett Road and south of US 15-501 in the NHC 1 and NHC 2 alternatives. Approximately 289 square feet (0.007 acre) of Wetland V would be affected by bridge piers in the NHC 1 alternative. Approximately 289 square feet (0.007 acre) of Wetland V would be affected by bridge piers in the NHC 2 alternative (appendix A - Figure 2H).

Wetland E (approximately 2.45 acres) is a palustrine forested wetland located east of Garrett Road and south of US 15-501 in the NHC 2 alternative. Approximately 122 square feet (0.003 acre) of Wetland E would be affected by bridge piers in the NHC 2 alternative (appendix A - Figure 2H).

Wetland A (approximately 0.11 acre) is a palustrine forested wetland located east of US 15-501 and south of West Cornwallis Road in the LRA. Approximately 482 square feet (0.011 acre) of Wetland A would be affected by fill in the LRA (appendix A - Figure 2K).

Wetland TTT (approximately 0.21 acre) is a palustrine forested wetland located east of US 15-501 and south of West Cornwallis Road in the Cornwallis ROMF. Approximately 3,254 square feet (0.075 acre) of Wetland TTT would be affected by fill in the Cornwallis ROMF (appendix A - Figure 2K).

Wetland XXX (approximately 0.158 acre) is a palustrine emergent wetland located east of Campus Drive and south of Maxwell Avenue in the LRA. Approximately 50 square feet (0.001 acre) of Wetland XXX would be affected by a bridge pier in the LRA (appendix A - Figure 2M). As previously noted, USACE verification of the jurisdictional boundaries of Wetland XXX is pending.

Table 5 summarizes the estimated wetland impacts within the LRA and alignment alternative study areas. The jurisdictional wetlands within the study area are listed in Table 5 roughly from south to north as shown in appendix A - Figures 2A through 2N.

Table 5: Summary of Estimated Wetland Impacts

Wetland Name	Wetland Type	No Build	LRA (acre)	C1 (acre)	C1A (acre)	C2 (acre)	C2A (acre)	NHC LPA (acre)	NHC 1 (acre)	NHC 2 (acre)	ROMF and P&R (acre)
YY	Emergent	--	--	0.031	0.031	0.031	0.031	--	--	--	--
GG	Forested	--	--	0.039	0.039	0.039	0.093	--	--	--	--
BBB	Emergent	--	--	--	0.001	--	--	--	--	--	--
AA	Forested	--	--	0.003	--	--	--	--	--	--	--
HHH	Emergent	--	--	--	0.001	--	--	--	--	--	--
Y	Forested	--	0.009	--	--	--	--	--	--	--	--
NNN	Emergent	--	--	--	--	--	--	--	--	--	0.325[1]
T	Scrub/ shrub	---	0.077	--	--	--	--	--	--	--	0.077[2]
O	Forested	--	--	--	--	--	--	0.005	--	--	--
N	Forested	--	--	--	--	--	--	0.002	--	--	--
J	Forested	--	--	--	--	--	--	0.003	--	--	--
K	Forested	--	--	--	--	--	--	0.001	--	--	--
W	Forested	--	--	--	--	--	--	--	0.001	0.001	--
V	Forested	--	--	--	--	--	--	--	0.007	0.007	--
E	Forested	--	--	--	--	--	--	--	--	0.003	--
A	Forested	--	0.011	--	--	--	--	--	--	--	--
TTT	Forested	--	--	--	--	--	--	--	--	--	0.075[3]
XXX	Emergent	--	0.001	--	--	--	--	--	--	--	--
Totals:		**--**	**0.098***	**0.073**	**00.072**	**00.070**	**00.124**	**00.011**	**00.008**	**00.011**	**00.477**

The alignment alternatives impacts are based on *Basis for Engineering Design* and the Jurisdictional Determination date November 7, 2014 (appendix B). Jurisdictional areas outside of the LRA and alignment alternatives are designated with "--" to indicate that impacts are not applicable. All impacts are approximate and are anticipated to be permanent. All types of impacts are not fully defined at this stage of the design.
1 = Farrington Road ROMF; 2 = Leigh Village ROMF; 3 = Cornwallis ROMF.
LRA consists of the common segments of the Light Rail Alternatives.
**Includes 0.001 acre of impacts to Wetland XXX*

Wetland impacts for the various end-to-end alignment alternatives range from a low of 0.176 acre of wetlands to a high of 0.558 acre of wetlands. The combination of the Light Rail Alignment, C2 Alternative, the NHC 1 Alternative, either Duke/VA Medical Centers Station, and either the Patterson Place, or Alston Avenue ROMF Alternatives would result in the lowest impact to wetlands. The combination of the Light Rail Alternative, C2A Alternative, the NHC LPA or NHC 2 Alternative, either Duke/VA Medical Centers Station Alternative, and the Farrington Road ROMF Alternative would result in the greatest impact to wetlands.

5.2.3 Jordan Water Supply Riparian Buffer Impacts

Stream buffers based on the Jordan Lake Rules apply to the majority of the project area streams. Fifty-foot wide riparian buffers have been set directly adjacent to the top of bank of these surface waters.

Impacts to buffers include the at-grade alignments and the bridge piers/abutments, the Gateway Station park-and-ride, the Leigh Village ROMF, and the Cornwallis ROMF for the D-O Light Rail Transit Project.

The 0 to 30-foot Zone One buffer and the 30 to 50-foot Zone Two buffer adjacent to each buffered stream and the anticipated impacts to these buffers are depicted in appendix A - Figures 3A through 3G.

Stream YY (Meeting of the Waters) Jordan Lake Buffers would be affected by the placement of bridge piers for the elevated rail crossing along the proposed LRA. Approximately 48 square feet of Zone One buffer and 2 square feet of Zone Two buffer would be affected the placement of bridge piers (appendix A - Figure 3A).

Stream WW (Chapel Branch) Jordan Lake Buffers would be affected by the placement of a culvert for the at-grade rail crossing for the proposed LRA. Approximately 5,386 square feet of Zone One buffer and 3,607 square feet of Zone Two buffer would be affected by the at-grade rail crossing (appendix A - Figure 3A).

Stream RR Jordan Lake Buffers would be affected by the placement of a pipe for the at-grade rail crossing for the proposed C1, C1A, C2, and C2A alternatives. Approximately 9,706 square feet of Zone One buffer and 5,805 square feet of Zone Two buffer would be affected by the at-grade rail crossing for the C1, C1A and C2 alternatives. Approximately 3,321 square feet of Zone One buffer and 3,837 square feet of Zone Two buffer would be affected by the at-grade rail crossing for the C2A alternative (appendix A - Figure 3A).

Stream QQ Jordan Lake Buffers would be affected by the placement of a pipe for the at-grade rail crossing for the proposed C2 and C2A alternatives and by a bridge pier in the C1 and C1A alternatives. Approximately 50 square feet of Zone One buffer would be affected by the bridge pier for the C1 and C1A alternatives. Approximately 5,676 square feet of Zone One buffer and 3,650 square feet of Zone Two buffer would be affected by the at-grade rail crossing for the C2 alternative. Approximately 4,973 square feet of Zone One buffer and 4,487 square feet of Zone Two buffer would be affected by the at-grade rail crossing for the C2A alternative (appendix A - Figure 3A).

Stream KKK Jordan Lake Buffers would be affected by the placement of a pedestrian sidewalk adjacent to the proposed C2A alternative. Approximately 3,154 square feet of Zone One buffer and 3,736 square feet of Zone Two buffer would be affected by the pedestrian sidewalk for the C2A alternative (appendix A - Figure 3A).

Stream EE Jordan Lake Buffers would be affected by the placement of a bridge pier in the proposed C2 and C2A alternatives. Approximately 50 square feet of Zone One buffer would be affected by the bridge pier for the C2 and C2A alternatives (appendix A - Figure 3B).

Stream Y (Little Creek) Jordan Lake Buffers would be affected by the placement of bridge piers for the proposed C1, C1A, C2, and C2A alternatives. Approximately 97 square feet of Zone One buffer and 3 square feet of Zone Two buffer would be affected by the placement of bridge piers for the C1 alternative. Approximately 50 square feet of Zone One buffer and 1 square foot of Zone Two buffer would be affected by the placement of bridge piers for the C1A alternative. Approximately 2 square feet of Zone One buffer and 70 square feet of Zone Two buffer would be affected by the placement of bridge piers for the C2 and C2A alternatives (appendix A - Figure 3B).

Stream W Jordan Lake Buffers would be affected by the at-grade alignment in the proposed C1A alternative. Approximately 7,155 square feet of Zone One buffer and 4,611 square feet of Zone Two buffer would be affected by the at-grade alignment for the C1A alternative (appendix A - Figure 3B).

Stream GGG Jordan Lake Buffers would be affected by the at-grade alignment in the proposed C1A alternative. Approximately 4,963 square feet of Zone One Buffer and 3,468 square feet of Zone Two buffer would be affected by the at-grade alignment for the C1A alternative (appendix A - Figure 3B).

Stream V Jordan Lake Buffers would be affected by the at-grade crossing in the proposed LRA and the Leigh Village connector road. Approximately 20,474 square feet of Zone One buffer and 14,433 square feet of Zone Two buffer would be affected by the at-grade crossing and the Leigh Village connector road (appendix A - Figure 3B).

Pond B Jordan Lake Buffers would be affected by the at-grade crossing in the proposed LRA. Approximately 811 square feet of Zone Two buffer would be affected by the at-grade crossing in the proposed LRA (appendix A - Figure 3B).

Stream PP Jordan Lake Buffers would be affected by the at-grade crossing and the placement of a pipe in the proposed LRA. Approximately 4,349 square feet of Zone One buffer and 4,426 square feet of Zone Two buffer would be affected by the at-grade crossing and the placement of a pipe in the proposed LRA (appendix A - Figure 3C).

Stream N Jordan Lake Buffers would be affected by the at-grade crossing and the placement of a pipe in the proposed LRA, Leigh Village ROMF, and the Farrington Road ROMF. Approximately 5,552 square feet of Zone One buffer and 5,086 square feet of Zone Two buffer would be impacted by the at-grade crossing and the placement of a pipe in the proposed LRA. Approximately 23,490 square feet of Zone One buffer and 18,613 square feet of Zone Two buffer would be affected by the proposed Leigh Village ROMF. Approximately 34,324 square feet of Zone One buffer and 27,186 square feet of Zone Two buffer would be affected by the proposed Farrington Road ROMF (appendix A - Figure 3C).

Stream NN Jordan Lake Buffers would be affected by the at-grade crossing and the placement of a pipe in the proposed LRA, Leigh Village ROMF, and the Farrington Road ROMF. Approximately 4,393 square feet of Zone One buffer and 4,083 square feet of Zone Two buffer would be affected by the at-grade crossing and the placement of a pipe in the proposed LRA. Approximately 1,915 square feet of Zone One buffer and 1,296 square feet of Zone Two buffer would be affected by the proposed Leigh Village ROMF. Approximately 11,389 square feet of Zone One buffer and 10,581 square feet of Zone Two buffer would be affected by the proposed Farrington Road ROMF (appendix A - Figure 3C).

Stream MM Jordan Lake Buffers would be affected by the at-grade crossing and the placement of a pipe in the proposed LRA. Approximately 9,312 square feet of Zone One buffer and 5,929 square feet of Zone Two buffer would be affected by the at-grade crossing and the placement of a pipe in the proposed LRA (appendix A - Figure 3D).

Stream LL Jordan Lake Buffers would be affected by the at-grade crossing and the placement of a pipe in the proposed LRA. Approximately 6,918 square feet of Zone One buffer and 5,943 square feet of Zone Two buffer would be affected by the at-grade crossing and the placement of a pipe in the proposed LRA (appendix A - Figure 3D).

Stream R Jordan Lake Buffers would be affected by the at-grade crossing and the placement of a pipe in the proposed LRA and the proposed Gateway Station park-and-ride site. Approximately 45,875 square feet of Zone One buffer and 30,483 square feet of Zone Two buffer would be affected by the at-grade crossing and the placement of a pipe in the proposed LRA and the proposed Gateway Station park-and-ride site (appendix A - Figure 3D).

Stream T (New Hope Creek) Jordan Lake Buffers would be affected by the placement of bridge piers in the proposed New Hope Creek (NHC) LPA and by bridge piers in the NHC 1 and NHC 2 alternatives.

Approximately 100 square feet of Zone One buffer would be affected by the bridge piers for the NHC LPA. Approximately 100 square feet of Zone One buffer would be affected by the bridge piers for the NHC 1 and NHC 2 alternatives (appendix A - Figure 3E).

Stream S Jordan Lake Buffers would be affected by the placement of bridge piers in the proposed NHC 1 and NHC 2 alternatives. Approximately 100 square feet of Zone One buffer would be affected by the bridge piers for the NHC 1 and NHC 2 alternatives (appendix A - Figure 3E).

Stream J (Sandy Creek) Jordan Lake Buffers west of Garrett Road would be affected by the placement of bridge piers in the proposed NHC LPA. Approximately 1,536 square feet of Zone One buffer and 2,980 square feet of Zone Two buffer would be affected by the bridge piers for the NHC LPA (appendix A - Figure 3E).

Stream J (Sandy Creek) Jordan Lake Buffers east of Garrett Road would be affected by the placement of bridge piers in the proposed NHC 2 alternative. Approximately 50 square feet of Zone One buffer would be affected by the bridge pier for the NHC 2 alternative (appendix A - Figure 3E).

Stream J (Sandy Creek) Jordan Lake Buffers at Larchmont Road and US 15 would be affected by the placement of bridge piers in the proposed NHC 1 alternative. Approximately 2,795 square feet of Zone One buffer and 1,449 square feet of Zone Two buffer would be affected by the bridge piers for the NHC 1 alternative (appendix A - Figure 3E).

Stream I Jordan Lake Buffers would be affected by the placement of bridge piers in the proposed NHC LPA and NHC 2 alternative. Approximately 1,231 square feet of Zone One buffer and 2,160 square feet of Zone Two buffer would be affected by the bridge piers for the NHC LPA. Approximately 50 square feet of Zone One buffer and 50 square feet of Zone Two buffer would be affected by the bridge piers for the NHC 2 alternative (appendix A - Figure 3E).

Stream H Jordan Lake Buffers would be affected by the at-grade crossing and extension of an existing pipe in the proposed NHC LPA and NHC 2 alternative. Approximately 10,026 square feet of Zone One buffer and 6,775 square feet of Zone Two buffer would be affected by the at-grade crossing and extension of an existing pipe for the NHC LPA. Approximately 10,028 square feet of Zone One buffer and 6,782 square feet of Zone Two buffer would be affected by the bridge piers for the NHC 2 alternative (appendix A - Figure 3E).

Stream G Jordan Lake Buffers would be affected by the at-grade crossing and extension of an existing culvert in the proposed NHC LPA and NHC 2 alternative. Approximately 5,838 square feet of Zone One buffer and 6,968 square feet of Zone Two buffer would be affected by the at-grade crossing and extension of an existing culvert for the NHC LPA and for the NHC 2 alternative (appendix A - Figure 3E).

Stream F Jordan Lake Buffers would be affected by the at-grade alignment in the proposed NHC LPA and NHC 2 alternative. Approximately 880 square feet of Zone One buffer and 5,759 square feet of Zone Two buffer would be affected by the at-grade alignment for the NHC LPA and NHC 2 alternative (appendix A - Figure 3E).

Stream E Jordan Lake Buffers at would be affected by the at-grade alignment in the proposed LRA. Approximately 2,440 square feet of Zone One buffer and 2,893 square feet of Zone Two Buffer would be affected by the by the at-grade alignment for the LRA (appendix A - Figure 3F).

Stream B Jordan Lake Buffers would be affected by the at-grade alignment in the proposed LRA. Approximately 2,677 square feet of Zone One buffer and 2,209 square feet of Zone Two Buffer would be affected by the by the at-grade alignment for the LRA (appendix A - Figure 3F).

Stream A Jordan Lake Buffers would be affected by the at-grade alignment in the proposed LRA. Approximately 2,592 square feet of Zone One buffer and 1,145 square feet of Zone Two Buffer would be affected by the by the at-grade alignment for the LRA (appendix A - Figure 3F).

Stream J (Sandy Creek) Jordan Lake Buffers at Western Bypass and US 15 would be affected by the placement of bridge piers in the proposed LRA and Cornwallis ROMF. Approximately 194 square feet of Zone One buffer and 126 square feet of Zone Two buffer would be affected by the bridge piers for the LRA. Approximately 1,461 square feet of Zone Two buffer would be affected by the Cornwallis ROMF (appendix A - Figure 3F).

Stream J (Sandy Creek) Jordan Lake Buffers south of Cameron Boulevard would be affected by the bridge piers in the proposed LRA and in the improvements area to Cameron Boulevard. Approximately 100 square feet of Zone One buffer would be affected by the bridge piers for the LRA. Approximately 2,234 square feet of Zone One buffer and 1,758 square feet of Zone Two buffer would be affected by the improvements area to Cameron Boulevard (appendix A - Figure 3G).

Stream II Jordan Lake Buffers would be affected by the bridge piers in the proposed LRA. Approximately 64 square feet of Zone One buffer and 36 square feet of Zone Two buffer would be affected by the bridge piers for the LRA (appendix A - Figure 3G).

Stream JJ Jordan Lake Buffers would be affected by the at-grade alignment in the proposed LRA. Approximately 5,924 square feet of Zone One buffer and 7,369 square feet of Zone Two buffer would be affected by the at-grade alignment for the LRA (appendix A - Figure 3G).

Stream KK Jordan Lake Buffers would be affected by the at-grade alignment and Erwin Road widening in the proposed LRA. Approximately 12,473 square feet of Zone One buffer and 13,654 square feet of Zone Two buffer would be affected by the at-grade alignment for the LRA (appendix A - Figure 3G).

Stream J (Sandy Creek) Jordan Lake Buffers north and south of Morreene Road would be affected by the Morreene Road improvements in the proposed LRA. Approximately 4,123 square feet of Zone One buffer would be affected and 5,068 square feet of Zone Two buffer would be affected by the Morreene Road improvements (appendix A - Figure 3G).

Stream WWW Jordan Lake Buffers would be affected by the placement of a bridge pier in the proposed LRA. Approximately 50 square feet of Zone One buffer would be affected by the bridge pier for the LRA (appendix A - Figure 3H).

Table 6 summarizes the estimated riparian buffer impacts within the LRA and alignment alternative study areas. The jurisdictional riparian buffers affected within the study area are listed in Table 6 roughly from south to north as shown in appendix A - Figures 3A through 3H.

Table 6: Summary of Estimated Riparian Buffer Impacts

Stream Name	Type of Impact Area	No-Build	LRA (ft^2)	C1 (ft^2)	C1A (ft^2)	C2 (ft^2)	C2A (ft^2)	NHC LPA (ft^2)	NHC 1 (ft^2)	NHC 2 (ft^2)	ROMF and P&R (ft^2)
YY (Meeting of the Waters)	Buffer Zone One	--	48	--	--	--	--	--	--	--	--
YY (Meeting of the Waters)	Buffer Zone Two	--	2	--	--	--	--	--	--	--	--
WW (Chapel Branch)	Buffer Zone One	--	5,386	--	--	--	--	--	--	--	--
WW (Chapel Branch)	Buffer Zone Two	--	3,607	--	--	--	--	--	--	--	--
RR	Buffer Zone One	--	--	9,706	9,706	9,706	3,321	--	--	--	--
RR	Buffer Zone Two	--	--	5,805	5,805	5,805	3,837	--	--	--	--
QQ	Buffer Zone One	--	--	50	50	5,676	4,973	--	--	--	--
QQ	Buffer Zone Two	--	--	--	--	3,650	4,487	--	--	--	--
KKK	Buffer Zone One	--	--	--	--	--	3,154	--	--	--	--
KKK	Buffer Zone Two	--	--	--	--	--	3,736	--	--	--	--
EE	Buffer Zone One	--	--	--	--	50	50	--	--	--	--
Y (Little Creek)	Buffer Zone One	--	--	97	50	2	2	--	--	--	--
Y (Little Creek)	Buffer Zone Two	--	--	3	1	70	70	--	--	--	--
W	Buffer Zone One	--	--	--	7,155	--	--	--	--	--	--
W	Buffer Zone Two	--	--	--	4,611	--	--	--	--	--	--
GGG	Buffer Zone One	--	--	--	4,963	--	--	--	--	--	--
GGG	Buffer Zone Two	--	--	--	1.1.1. ,468	--	--	--	--	--	--
V	Buffer Zone One	--	1.1.2. 0,474	1.1.3. -	1.1.4. -	--	--	--	--	--	--
V	Buffer Zone Two	--	1.1.5. 4,433	1.1.6. -	1.1.7. -	--	--	--	--	--	--

Stream Name	Type of Impact Area	No-Build	LRA (ft^2)	C1 (ft^2)	C1A (ft^2)	C2 (ft^2)	C2A (ft^2)	NHC LPA (ft^2)	NHC 1 (ft^2)	NHC 2 (ft^2)	ROMF and P&R (ft^2)
V (Pond B)	Buffer Zone Two	--	811	--	--	--	--	--	--	--	--
PP	Buffer Zone One	--	4,349	--	--	--	--	--	--	--	--
PP	Buffer Zone Two	--	4,426	--	--	--	--	--	--	--	--
N	Buffer Zone One	--	5,552	--	--	--	--	--	--	--	23,490[1] 34,324[2]
N	Buffer Zone Two	--	5,086	--	--	--	--	--	--	--	18,613[1] 27,186[2]
NN	Buffer Zone One	--	4,393	--	--	--	--	--	--	--	1,915[1] 11,389[2]
NN	Buffer Zone Two	--	4,083	--	--	--	--	--	--	--	1,296[1] 10,581[2]
MM	Buffer Zone One	--	9,312	--	--	--	--	--	--	--	--
MM	Buffer Zone Two	--	5,929	--	--	--	--	--	--	--	--
LL	Buffer Zone One	--	6,918	--	--	--	--	--	--	--	--
LL	Buffer Zone Two	--	5,943	--	--	--	--	--	--	--	--
R	Buffer Zone One	--	45,875	--	--	--	--	--	--	--	--
R	Buffer Zone Two	--	30,483	--	--	--	--	--	--	--	--
T (New Hope Creek)	Buffer Zone One	--	--	--	--	--	--	100	100	100	--
S	Buffer Zone One	--	6,918	--	--	--	--	--	100	100	--
J (Sandy Creek)	Buffer Zone One	--	--	--	--	--	--	1,536	2,795	50	--
J (Sandy Creek)	Buffer Zone Two	--	--	--	--	--	--	2,980	1,449	--	--
I	Buffer Zone One	--	--	--	--	--	--	1,231	--	50	--
I	Buffer Zone Two	--	--	--	--	--	--	2,160	--	50	--
H	Buffer Zone One	--	--	--	--	--	--	10,026	--	10,028	--
H	Buffer Zone Two	--	--	--	--	--	--	6,775	--	6,782	--

Stream Name	Type of Impact Area	No-Build	LRA (ft^2)	C1 (ft^2)	C1A (ft^2)	C2 (ft^2)	C2A (ft^2)	NHC LPA (ft^2)	NHC 1 (ft^2)	NHC 2 (ft^2)	ROMF and P&R (ft^2)
G	Buffer Zone One	--	--	--	--	--	--	5,838	--	5,838	--
G	Buffer Zone Two	--	--	--	--	--	--	6,968	--	6,968	--
F	Buffer Zone One	--	--	--	--	--	--	880	--	880	--
F	Buffer Zone Two	--	--	--	--	--	--	5,759	--	5,759	--
E	Buffer Zone One	--	2,440	--	--	--	--	--	--	--	--
E	Buffer Zone Two	--	2,893	--	--	--	--	--	--	--	--
A	Buffer Zone One	--	2,592	--	--	--	--	--	--	--	--
A	Buffer Zone Two	--	1,145	--	--	--	--	--	--	--	--
B	Buffer Zone One	--	2,677	--	--	--	--	--	--	--	--
B	Buffer Zone Two	--	2,209	--	--	--	--	--	--	--	--
J (Sandy Creek)	Buffer Zone One	--	194	--	--	--	--	--	--	--	--
J (Sandy Creek)	Buffer Zone Two	--	126	--	--	--	--	--	--	--	1,461[3]
J (Sandy Creek)	Buffer Zone One	--	100	--	--	--	--	--	--	--	--
J (Sandy Creek)	Buffer Zone One	--	100	--	--	--	--	--	--	--	--
II	Buffer Zone One	--	64	--	--	--	--	--	--	--	--
II	Buffer Zone Two	--	36	--	--	--	--	--	--	--	--
J (Sandy Creek)	Buffer Zone One	--	2,234	--	--	--	--	--	--	--	--
J (Sandy Creek)	Buffer Zone Two	--	1,758	--	--	--	--	--	--	--	--
JJ	Buffer Zone One	--	5,924	--	--	--	--	--	--	--	--
JJ	Buffer Zone Two	--	7,369	--	--	--	--	--	--	--	--
KK	Buffer Zone One	--	12,473	--	--	--	--	--	--	--	--

Stream Name	Type of Impact Area	No-Build	LRA (ft^2)	C1 (ft^2)	C1A (ft^2)	C2 (ft^2)	C2A (ft^2)	NHC LPA (ft^2)	NHC 1 (ft^2)	NHC 2 (ft^2)	ROMF and P&R (ft^2)
KK	Buffer Zone Two	--	13,654	--	--	--	--	--	--	--	--
J (Sandy Creek)	Buffer Zone One	--	4,123	--	--	--	--	--	--	--	--
J (Sandy Creek)	Buffer Zone Two	--	5,068	--	--	--	--	--	--	--	--
WWW	Buffer Zone One	--	50	--	--	--	--	--	--	--	--
Totals: Zone One		--	142,196*	9,853	21,924	15,434	11,500	19,611	2,995	17,046	25,405[1] 45,713[2]
Totals: Zone Two		--	109,061	5,808	13,885	9,525	12,130	24,642	1,449	19,559	19,909[1] 37,767[2] 1,461[3]

The alignment alternatives impacts are based on *Basis for Engineering Design* and the Jurisdictional Determination dated November 7, 2014 (appendix B)..
1 = Leigh Village ROMF; 2 = Farrington Road ROMF; 3 = Cornwallis ROMF Jurisdictional areas outside of the LRA and alignment alternatives are designated with "--" to indicate that impacts are not applicable.
LRA consists of the common segments of the Light Rail Alternatives.
**Includes 50 ft^2 of impacts to Stream WWW Zone One buffer*

Riparian buffer impacts for the various alignments need to be evaluated based on the combination of impacts to Zone One (0 to 30 feet) and Zone Two (30 to 50 feet) as established by the Jordan Lake Water Supply Watershed Buffer Rules. When evaluating the impacts to the Jordan Water Supply Riparian Buffers, it should be noted that impacts to Zone One shall be multiplied by three and impacts to Zone Two shall be multiplied by one and one-half to determine mitigation needs. These mitigation needs are discussed in Section 3.2.2 - Jordan Water Supply Riparian Buffer Mitigation.

5.2.4 Ponds

Pond C is an unnamed open water that is located north of Prestwick Road and south of NC 54. Pond C is lined with a masonry retaining wall and is well maintained. Pond C is approximately 0.107 acre in size. Approximately 216 square feet (0.005 acre) of Pond C would be affected by fill for the rail embankment in the C2A alternative (appendix A - Figure 2B).

Pond D is an unnamed open water that is located east of Finley Golf Course Road and south of NC 54. Pond D has a fountain to help maintain water quality and has a fringe of emergent wetland vegetation. Pond D is approximately 0.185 acre in size within the C1, C1A, and C2 alternatives. Approximately 898 square feet (0.021 acre) of Pond D would be affected by fill for the rail embankment in the C1, C1A and C2 alternatives (appendix A - Figure 2B).

Pond G is an unnamed open water that is located east of Friday Center Drive and south of NC 54. Pond G is unmaintained which has resulted in a shoreline fringe of palustrine scrub-shrub/emergent wetlands in addition to being covered by a thick layer of duckweed (*Lemna* sp.). Pond G is approximately 0.146 acre

in size within C2 alternative. Approximately 2,288 square feet (0.053 acre) of Pond G would be affected by fill for the rail embankment in the C2 alternative (appendix A - Figure 2B).

Pond Z is an unnamed open water that is located east of Farrington Road and west of I-40. Pond Z is an agricultural pond within an existing pasture and has a shoreline fringe of vegetation including willow and dogwood. Pond Z is approximately 0.182 acre in size and is located in the Leigh Village ROMF. Approximately 7,928 square feet (0.182 acre) of Pond Z would be affected by fill for the Leigh Village ROMF (appendix A - Figure 2D).Pond Z has not yet been verified by the USACE and is not included in the Jurisdictional Determination.

Table 7 summarizes the estimated open water/pond impacts within the LRA and alignment alternative study areas. The open waters/ponds affected within the study area are listed in Table 7 roughly from south to north as shown on appendix A – Figures 2A–2M.

Table 7: Summary of Estimated Open Water/Pond Impacts

Jurisdictional Area	Type of Jurisdictional Area	No-Build	LRA (acre)	C1 (acre)	C1A (acre)	C2 (acre)	C2A (acre)	ROMF
Pond C	Open Water	--	--	--	--	--	0.005	--
Pond D	Open Water	--	--	0.021	0.021	0.021	--	--
Pond G	Open Water	--	--	--	--	0.053	--	--
Pond Z**	Open Water	--	--	--	--	--	--	0.182*
Totals		**--**	**0**	**0.021**	**0.021**	**0.074**	**0.005**	**0.182***

The alignment alternatives impacts are based on *Basis for Engineering Design* and the Jurisdictional Determination dated November 7, 2014 (appendix B). Jurisdictional areas outside of the LRA and alignment alternatives are designated with "--" to indicate that impacts are not applicable. All types of impacts are not fully defined at this stage of the design.
*Leigh Village ROMF
**Indicates a potentially jurisdictional feature subject to verification that was added in January 2015 and is not included in the Jurisdictional Determination.

LRA consists of the common segments of the Light Rail Alternatives.

Impacts to ponds for the various alignments range from a low of 0.005 acre of open waters to a high of 0.256 acre of open waters. The combination of the common segments of the Light Rail Alternative, C2A Alternative, any NHC Alternative, either Duke/VA Medical Centers Station, and any ROMF Alternative other than the Leigh Village ROMF Alternative would result in the lowest impact to ponds. The combination of the common segments of the Light Rail Alignment, C2 Alternative, any NHC Alternative, either Duke/VA Medical Centers Station, and Leigh Village ROMF Alternative would result in the greatest impact to ponds. No ponds are located in any of the NHC Alternatives, Duke/VA Medical Centers Station Alternatives, or park-and-ride facilities.

5.2.5 Floodplains and Floodways

Table 8 provides estimates of impacts to FEMA Floodways, 100-year Floodplains and 500-year Floodplains for the LRA, stations, park-and-ride facilities, as well as the C1, C1A, C2, C2A, NHC LPA, NHC 1, NHC 2, and ROMF alternatives. Appendix A - Figures 4A through 4F show the locations where the proposed LRA, C1, C1A, C2, C2A, NHC LPA, NHC 1 Alternative, NHC 2 Alternative, ROMFs, and Station park-and-ride facilities would encroach into the floodways and floodplains. Based on the *Basis for Engineering Design Plans*, it is anticipated that crossings of Meetings of the Waters (Stream YY), Little

Creek (Stream Y), New Hope Creek (Stream T), and Sandy Creek (Stream J) would require the construction of bridges to minimize impacts to regulatory floodways and floodplains.

Impacts to the 100-year floodplain for the various alignments range from a low of 6.095 acres of impacts to a high of 7.805 acres of impacts. The combination of the common segments of the Light Rail Alternatives, C1A Alternative, NHC 2 Alternative, either Duke/VA Medical Centers Station, and any of the ROMF Alternatives other than Cornwallis Road ROMF would result in the lowest impact to the 100-year floodplain. The combination of the Light Rail Alternative, C1 Alternative, NHC 1 Alternative, either Duke/VA Medical Centers Station, and the Cornwallis ROMF would result in the greatest impact to the 100-year floodplain.

Impacts to the 500-year floodplain for the various alignments range from a low of 0.378 acre of impacts to a high of 1.190 acres of impacts to the 500-year floodplain. The combination of the common segments of the Light Rail Alternative, C1A Alternative, NHC 2 Alternative, either Duke/VA Medical Centers Station, and any of the ROMF Alternatives other than Cornwallis Road ROMF would result in the lowest impact to the 500-year floodplain. The combination of the common segments of the Light Rail Alternative, any C Alternatives, NHC LPA Alternative, and the Cornwallis ROMF Alternative would result in the greatest impact to the 500-year floodplain.

Floodway impacts for the various proposed alignments range from a low of 0.851 acre of impacts to a high of 0.955 acre of impacts to the floodway. The combination of the common segments of the Light Rail Alignment, C1A Alternative, NHC 1 Alternative, and either Duke/VA Medical Centers Station alternatives would result in the lowest impact to floodways. The combination of the common segments of the Light Rail Alternative, C1 Alternative, NHC LPA Alternative, and either Duke/VA Medical Centers Station Alternatives would result in the greatest impact to floodways. None of the ROMF Alternatives would have an impact to a floodway.

Impacts to floodways and floodplains are depicted on appendix A - Figures 4A through 4F.

Table 8: Summary of Estimated Floodway and Floodplain Impacts

Stream Name (Figure#)	Type of Impact Area	No-Build	LRA (acre)	C1 (acre)	C1A (acre)	C2 (acre)	C2A (acre)	NHC LPA (acre)	NHC 1 (acre)	NHC 2 (acre)	ROMF and P&R (acre)
YY Figure 4A	100-Year Floodplain	--	0.007	--	--	--	--	--	--	--	--
WW Figure 4A	100-Year Floodplain	--	0.360	--	--	--	--	--	--	--	--
TT Figure 4A	500-Year Floodplain	--	0.079	--	--	--	--	--	--	--	--
Y Figure 4B	100-Year Floodplain	--	--	--	--	0.603	0.603	--	--	--	--
Y Figure 4C	100-Year Floodplain	--	--	1.441	0.278	--	--	--	--	--	--
T Figure 4D	Floodway	--	--	--	--	--	--	0.084	0.013	0.013	--
T Figure 4D	100-Year Floodplain	--	--	--	--	--	--	0.022	0.015	0.015	--
T Figure 4D	500-Year Floodplain	--	--	--	--	--	--	0.031	0.001	0.001	--
J Figure 4D	Floodway	--	--	--	--	--	--	0.012	0.165	0.008	--
J Figure 4D	100-Year Floodplain	--	--	--	--	--	--	0.087	0.607	0.009	--
J Figure 4D	500-Year Floodplain	--	--	--	--	--	--	0.597	0.206	0.005	--
F Figure 4D	Floodway	--	--	--	--	--	--	0.186	--	0.186	--
F Figure 4D	100-Year Floodplain	--	--	--	--	--	--	0.116	--	0.116	--
F Figure 4D	500-Year Floodplain	--	--	--	--	--	--	0.044	--	0.044	--

Stream Name (Figure#)	Type of Impact Area	No-Build	LRA (acre)	C1 (acre)	C1A (acre)	C2 (acre)	C2A (acre)	NHC LPA (acre)	NHC 1 (acre)	NHC 2 (acre)	ROMF and P&R (acre)
J Figure 4E	Floodway	--	0.006	--	--	--	--	--	--	--	--
J Figure 4E	100-Year Floodplain	--	0.008	--	--	--	--	--	--	--	0.065[1]
J Figure 4E	500-Year Floodplain	--	0.001	--	--	--	--	--	--	--	0.190[1]
J Figure 4F	Floodway	--	0.667	--	--	--	--	--	--	--	--
J Figure 4F	100-Year Floodplain	--	5.302	--	--	--	--	--	--	--	--
J Figure 4F	500-Year Floodplain	--	0.248	--	--	--	--	--	--	--	--
Totals:											
100-Year Floodplain		**--**	**5.677**	**1.441**	**0.278**	**0.603**	**0.603**	**0.225**	**0.622**	**0.140**	**0.065[1]**
500-Year Floodplain		**--**	**0.328**	**--**	**--**	**--**	**--**	**0.672**	**0.207**	**0.050**	**0.190[1]**
Floodway		**--**	**0.673**	**--**	**--**	**--**	**--**	**0.282**	**0.178**	**0.207**	**--**

The LRA and alignment alternatives impacts are based on *Basis of Engineering Design Plans* and FEMA FIRM map data. FEMA FIRM map data areas outside of the LRA and alignment alternatives are designated with "--", to indicate that impacts are not applicable. All types of impacts are not fully defined at this stage of the design. LRA consists of the common segments of the Light Rail Alternatives.

1 = Cornwallis ROMF

5.2.6 Water Quality

The streams in the project area are classified as either water supply watersheds WS-IV or WS-V according to the DWR. By definition, WS-IV areas are located in highly developed areas and WS-V areas are located in upstream areas.

There are no designated trout waters, anadromous fish waters or Primary Nursery Areas (PNA) present in the study area. There are no designated Outstanding Resource Waters (ORW), High Quality Waters (HQW) or water supply watersheds (WS-I or WS-II) within one mile downstream of the study area. WS-I areas are located in natural areas, WS-II areas are located in undeveloped areas, and WS-III areas are located in moderately developed areas. The North Carolina 2012 Final 303(d) list of impaired waters identifies Stream Y (Little Creek) as impaired. No benthic samples or fish surveys have been conducted on the project study area streams as part of this assessment.

Major NPDES Wastewater Facilities near the project area include the Mason Farm Wastewater Treatment Plant (NC0025241) located in Orange County south of Old Mason Farm Road, and the South Durham Water Reclamation Facility (NC0047597) located in Durham County south of NC 54 and east of Farrington Road. The Mason Farm Wastewater Treatment Plant is located approximately half a mile downstream of the study area. The South Durham Water Reclamation Facility is located approximately one mile downstream of the project area.

6. Mitigation

This section describes measures that will be used to reduce the adverse impacts to water resources, as well as mitigation that may be required for groundwater, surface waters, wetlands, floodplains and regulatory floodways and riparian buffer impacts. The Council on Environmental Quality has defined mitigation in 40 CFR Part 1508.20 to include: avoiding impacts, minimizing impacts, rectifying impacts, reducing impacts over time and compensating for impacts.

6.1 No-Build Alternative

Under the No-Build Alternative, no construction related to the project would take place; therefore, no project associated impacts to the water resources in the study area, including wetlands, streams, riparian buffers, groundwater, water quality and floodplains and floodways would occur and no mitigation would be warranted.

6.2 Light Rail Alternatives

Water resources within the study area intersect the project corridor, thereby making impacts to waters of the U.S. and floodplains as a result of the Light Rail Alternatives largely unavoidable. Efforts have been made to minimize the potential impacts to water resources during the preliminary design phase. Specific mitigation measures that will be implemented to compensate for unavoidable impacts will be refined and presented in the Final Environmental Impact Statement (FEIS). The following sections describe the mitigation currently identified for the wetlands and streams, groundwater, water quality, and floodplains and floodways resource impacts described in this report.

As a result of the identified impacts, it is anticipated that a Section 404/401 permit application will be required. The permit application must be completed during Engineering before construction activities may commence. This permit application will require the discussion of the measures employed throughout planning and design in order to avoid/minimize impacts to waters of the U.S. The 404/401 permit application must also include a compensatory mitigation proposal, which outlines the plan to provide compensation to offset permanent losses of waters of the U.S.

6.2.1 Groundwater

Efforts would be implemented to reduce the effects of the project on groundwater resources. The North Carolina Erosion and Sediment Control Planning and Design Manual (1988 - updated June 2006), and the North Carolina Department of Transportation design specifications will be used to minimize the impacts to terrestrial and aquatic habitats. These sediment and erosion control measures will help to protect aquatic resources that may contribute to groundwater recharge within the study area. Local standards set by the City of Durham and the Town of Chapel Hill may also need to be considered when designing erosion and sediment controls. These sediment and erosion control measures will help to protect aquatic resources that may contribute to groundwater recharge within the study area. In addition, each station location and park-and-ride facility would implement BMPs for the collection and treatment of stormwater runoff.

6.2.2 Surface Waters and Wetlands

The LRA would affect approximately 2,072 linear feet (0.309 acre) of stream based on the *Basis for Engineering Design Plans (February 2015)*. Additional impacts to streams would result from the alternatives selected at the Orange-Durham County line (C1, C1A, C2, or C2A alternatives), and the

crossings at New Hope Creek (NHC LPA, NHC 1 alternative, and NHC 2 alternative). Approximately 2,455 linear feet (0.346 acre) of impacts is the lowest impact amount for the combination of the LRA, C1 Alternative, the NHC 1 Alternative, either Duke/VA Medical Centers Station, and either the Patterson Place or Alston Avenue ROMF Alternatives. Approximately 3,864 linear feet (0.525 acre) of impacts is the highest impact amount for the combination of the LRA, C1 Alternative, the NHC 1 Alternative, either Duke/VA Medical Centers Station, and either the Patterson Place or Alston Avenue ROMF Alternatives. Stream bridging is being considered during preliminary design efforts to avoid and minimize impacts to streams. Additional efforts to minimize impacts to streams will be considered during future design efforts. Efforts will be made to minimize the use of riprap at pipe inlets and outfalls, relocate channels using natural channel design techniques, when practicable, and minimize impacts to stream channels and banks at proposed bridge locations.

The LRA would affect approximately 0.098 acre of wetlands based on the *Basis for Engineering Design Plans (February 2015)*. Additional impacts to wetlands would result from the alternatives selected at the Orange-Durham County line (C1, C1A, C2, or C2A alternatives), and the crossings at New Hope Creek (NHC LPA, NHC 1 alternative, and NHC 2 alternative). Approximately 0.176 acre of impacts is the lowest impact amount for the combination of the LRA, C2 alternative, NHC 1 alternative, and the Gateway Station park-and-ride. Approximately 0.558 acre of impacts is the highest impact amount for the combination of the LRA, C2A alternative, NHC LPA alternative, and the Farrington Road ROMF.

Open water (pond) impacts for the various alignments can range from a low of 0.005 acre of open waters to a high of 0.074 acre of open waters. Approximately 0.005 acre of open water impacts is the lowest impact amount for the combination of the LRA and C2A alternative. Approximately 0.256 acre of open water impacts is the highest impact amount for the combination of the LRA, C2 alternative and Leigh Village ROMF. No open water ponds are located in any of the NHC alternatives or park-and-ride facilities.

Three general types of wetland mitigation include avoidance, minimization, and compensatory mitigation. Throughout the project development and preliminary engineering design process, efforts have been made to avoid and minimize impacts to streams and wetlands. This is exemplified by the development of several alternative alignments in the vicinity Little Creek and New Hope Creek that follow existing travel corridors, and the shifting of sections of alternative alignments to avoid wetland impacts. Further, several measures and construction techniques are being incorporated in the design criteria to avoid and minimize impacts to wetlands and streams, such as using aerial structures on piers to cross larger wetland areas. The placement of the piers will be located outside of wetlands and streams to the greatest extent practicable. Moreover, top-down construction of the aerial structures will minimize disturbance to the wetland soils. For wetland crossings where it is not feasible to use aerial structures, impacts to these resources will be minimized by using retaining walls or similar structures and 2:1 side slopes. Bottomless culverts will be used to minimize stream crossing impacts.

Construction activities will be conducted in accordance with all local, state, and federal regulations, as well as BMPs, including the NCDENR *Manual of Stormwater Best Management Practices*, the *North Carolina Erosion and Sediment Control Planning and Design Manual*, and the *Design Standards in Sensitive Watersheds* (15A NCAC 04B.0124). Construction staging areas will be located away from wetlands, and preserved wetland areas will be demarcated prior to construction. Wetlands anticipated to be temporarily affected by construction would be restored to their original condition as much as possible and would be planted with an appropriate native wetland seed mix.

Where avoidance or minimization is not feasible or practicable, compensatory mitigation will be considered. Compensatory mitigation consists usually of: 1) the use of a local/regional mitigation bank

to purchase mitigation credits; 2) payment of in-lieu fees for mitigation credits, and: 3) restoration of existing degraded wetlands or waters, or the creation of waters of the U.S. of equal or greater value than the waters to be disturbed. These types of mitigation are only undertaken after avoidance and minimization actions are exhausted. Restoration and creation mitigation should only be undertaken, when practicable, in areas near the impact site (i.e., on-site compensatory mitigation).

The use of a regional Mitigation Bank is the preferred method that may be utilized to provide mitigation to satisfy the federal Clean Water Act compensatory mitigation requirements for this project in the event on-site mitigation is not feasible and/or practicable. If the purchase of available credits from a regional Mitigation Bank would not satisfy the project's mitigation requirements, the NCDENR EEP may also be requested to provide mitigation via purchase of in-lieu fee credits. A final determination regarding mitigation for impacts to waters of the U.S. rests with the USACE and DWR and compensatory mitigation for impacts would be resolved during the permitting phase of the proposed project.

In accordance with the *Memorandum of Agreement among the North Carolina Department of Environment and Natural Resources, the North Carolina Department of Transportation, and the U.S. Army Corps of Engineers, Wilmington District* (MOA), July 22, 2003, the EEP may be requested to provide mitigation via purchase of in-lieu fee credits. A final determination regarding mitigation for impacts to waters of the U.S. rests with the USACE and DWR and compensatory mitigation for impacts will be resolved during the permitting phase of the project. In the case of public transportation projects, the mitigation plan must be implemented before the proposed project is open to the traveling public.

6.2.3 Jordan Water Supply Riparian Buffer Mitigation

For the determination of the mitigation that will be required for impacts to the Jordan Water Supply Riparian Buffers, square feet of impacts to Zone One shall be multiplied by three and square feet of impacts to Zone Two shall be multiplied by one and one-half. Riparian buffer credits may be purchased from the Riparian Buffer Restoration Fund offered by the EEP, similar to the stream and wetland credits that may be purchased. Other forms of Jordan Water Supply Riparian Buffer impact mitigation may include the donation of real property, or of an interest in real property, or the restoration or enhancement of a non-forested riparian buffer as described in NCAC 02B.0268 item (7) and (8) respectively.

The impacts from the LRA would require 590,180 riparian buffer credits. The impacts from the C1 alternative would require 38,271 riparian buffer credits. The impacts from the C1A alternative would require 86,600 riparian buffer credits. The impacts from the C2 alternative would require 60,590 riparian buffer credits. The impacts from the C2A alternative would require 52,695 riparian buffer credits. The impacts from the NHC LPA would require 95,807 riparian buffer credits. The impacts from the NHC 1 alternative would require 11,159 riparian buffer credits. The impacts from the NHC 2 alternative would require 80,477 riparian buffer credits. The impacts from the Leigh Village ROMF would require 106,079 riparian buffer credits. The impacts from the Farrington Road ROMF would require 193,790 riparian buffer credits. The impacts from the Cornwallis ROMF would require 2,192 riparian buffer credits.

Table 9 summarizes the estimated riparian buffer mitigation credits required for the proposed impacts within the LRA and alignment alternative study areas. The jurisdictional riparian buffers affected within the study area are listed in Table 9 roughly from south to north as shown in appendix A - Figures 3-A through 3-G.

Table 9: Summary of Estimated Riparian Buffer Mitigation Credits Required

Type of Impact Area	No-Build	LRA	C1	C1A	C2	C2A	NHC LPA	NHC 1	NHC 2	ROMF
Buffer Zone One Credits	--	426,588	29,559	65,772	46,302	34,500	58,833	8,985	51,138	137,955[1] 137,139[2]
Buffer Zone Two Credits	--	163,592	8,712	20,828	14,288	18,195	36,974	2,174	29,339	58,271[1] 56,651[2] 2,192[3]
Total Required Credits	--	**590,180***	**38,271**	**86,600**	**60,590**	**52,695**	**95,807**	**11,159**	**80,477**	**106,079[1]** **193,790[2]** **2,192[3]**

1 = Leigh Village ROMF; 2 = Farrington Road ROMF; 3 = Cornwallis ROMF.
Jurisdictional areas outside of the LRA and alignment alternatives are designated with "--" to indicate that impacts are not applicable.
LRA consists of the common segments of the Light Rail Alternatives.
**Includes 50 ft² of Stream WWW Zone One buffer.*

The combination of the common segments of the Light Rail Alignment along with C1 Alternative, NHC 1 Alternative, and either the Patterson Place or Alston Avenue ROMF Alternatives would have the least amount of impacts to riparian buffers. This combination of alternatives would require a total of 639,610 riparian buffer credits. The combination of the common segments of the LRA, C1A Alternative, NHC LPA, and Farrington Road ROMF Alternative would have the highest amount of impacts to riparian buffers. This combination of alternatives would require a total of 966,377 riparian buffer credits.

6.2.4 Floodplains and Floodways

If hydraulic studies determine that the proposed LRA and associated alignment alternatives would cause an increase in the 100-year flood elevation, the following applies: 1) any increase of less than 0.1 feet is considered negligible and does not require mitigation, 2) a 1-foot maximum increase in the 100-year flood elevation is permissible provided that Triangle Transit purchases the additional potentially flooded property from any private landowner, or 3) Triangle Transit may make floodplain modifications to decrease the 100-year flood elevation to within 0.1 feet to avoid purchasing property. If the preferred alternative involves significant encroachment of the floodplain, the final environmental document must include: 1) Federal Transit Administration's finding that the proposed action is the only practicable alternative, 2) supporting documentation reflecting consideration of alternatives to avoid/reduce adverse impacts on the floodplain.

The *Basis for Engineering Design* plans call for bridging over the major streams of the study area that include Meeting of the Waters (Stream YY), Little Creek (Stream Y), New Hope Creek (Stream T), and Sandy Creek (Stream J) in an effort to minimize impacts to 100-year Floodplains, 500-year Floodplains and the FEMA Floodways. These bridges will be designed to minimize impacts to floodplains and regulatory floodways.

6.2.5 Water Quality

Indirect effects could occur to waters in the direct impact area resulting from stormwater runoff from the new impervious surfaces. BMPs would be implemented as engineering controls along the LRA, Station park-and-ride facilities, and ROMFs for stormwater runoff collection and treatment. BMPs that are installed would help to minimize water quality impacts resulting from pollutants carried by

stormwater runoff. Continued maintenance of these stormwater BMPs would ensure that these controls are functioning properly for the protection of area water quality. The utilization of BMPs would help to mitigate potential impacts to jurisdictional waters of the U.S. by avoiding impacts to jurisdictional areas.

Appendices

Appendix A: Water Resource Figures

Figure 1: Public Water Supply Wells and Private Well Locations

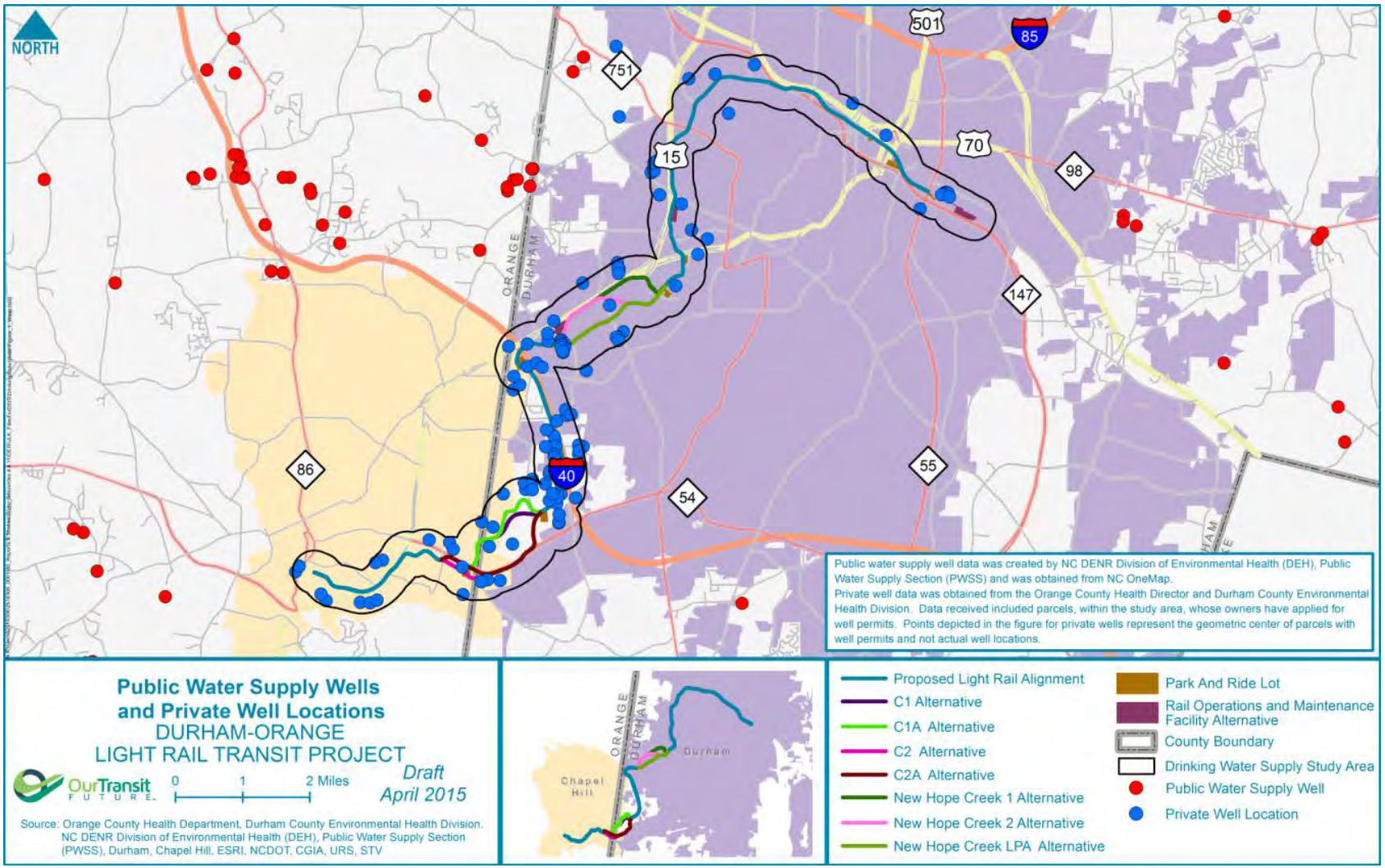


Figure 2A: Jurisdictional Waters Impacts

Figure 2B: Jurisdictional Waters Impacts

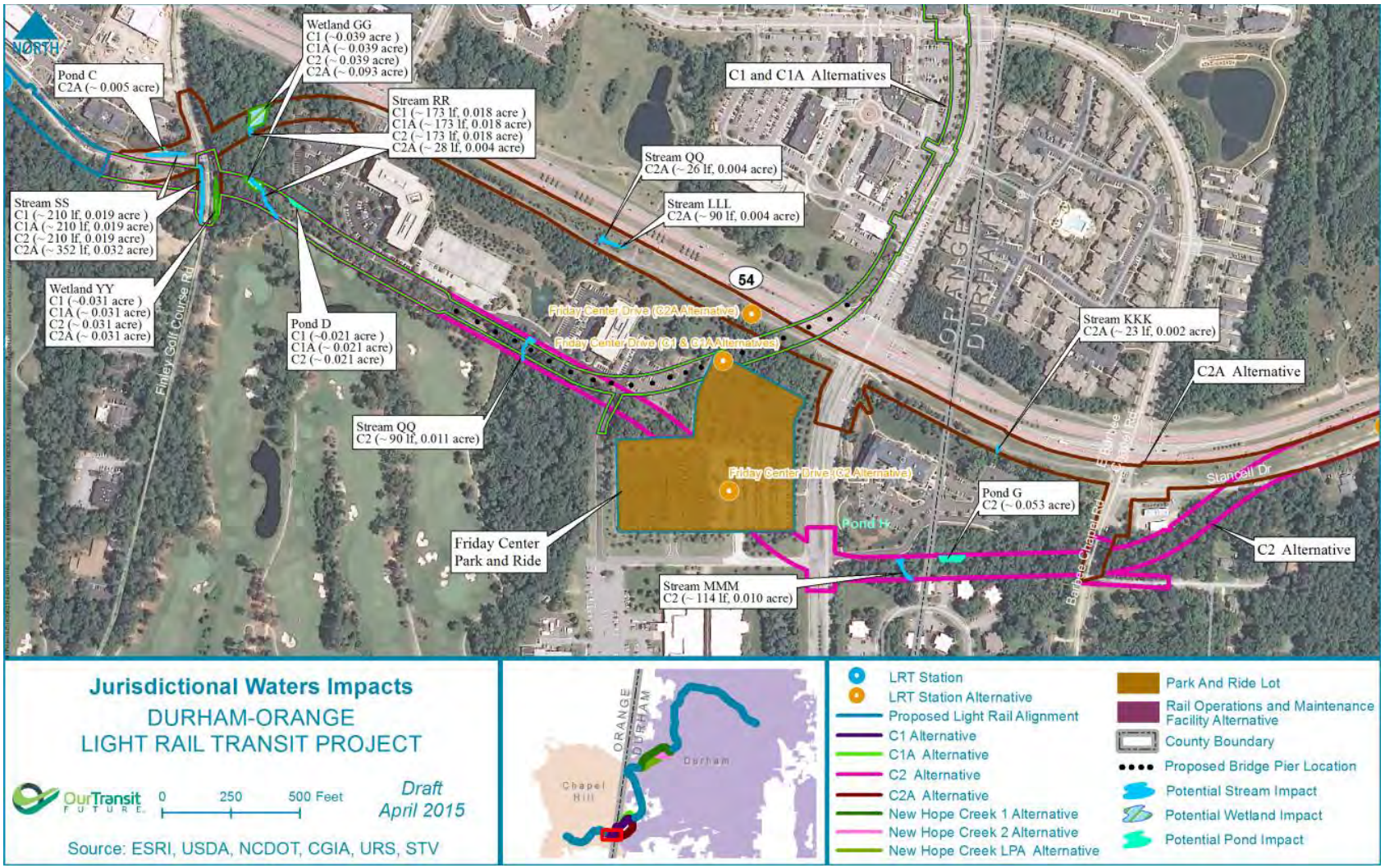


Figure 2C: Jurisdictional Waters Impacts

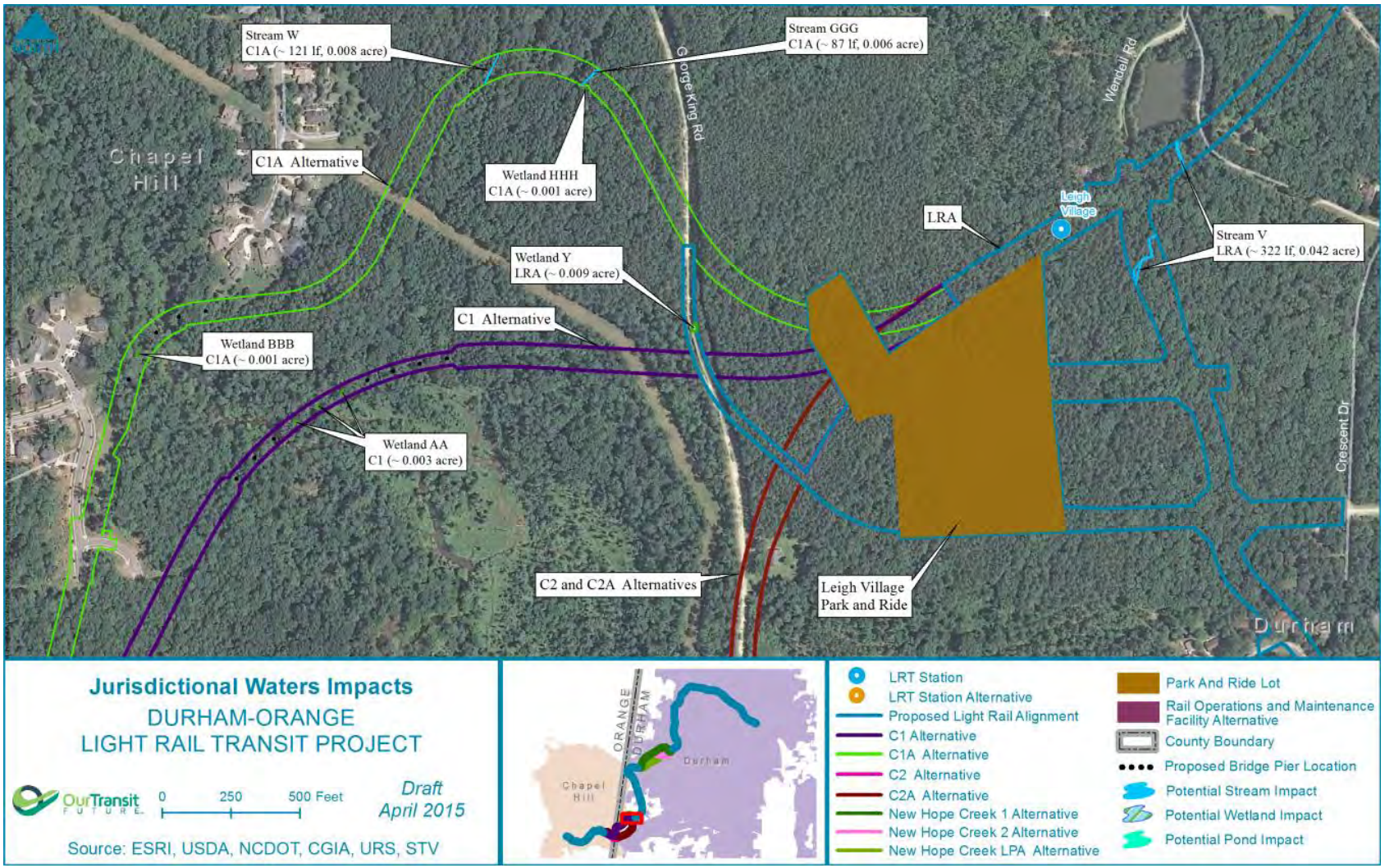


Figure 2D: Jurisdictional Waters Impacts

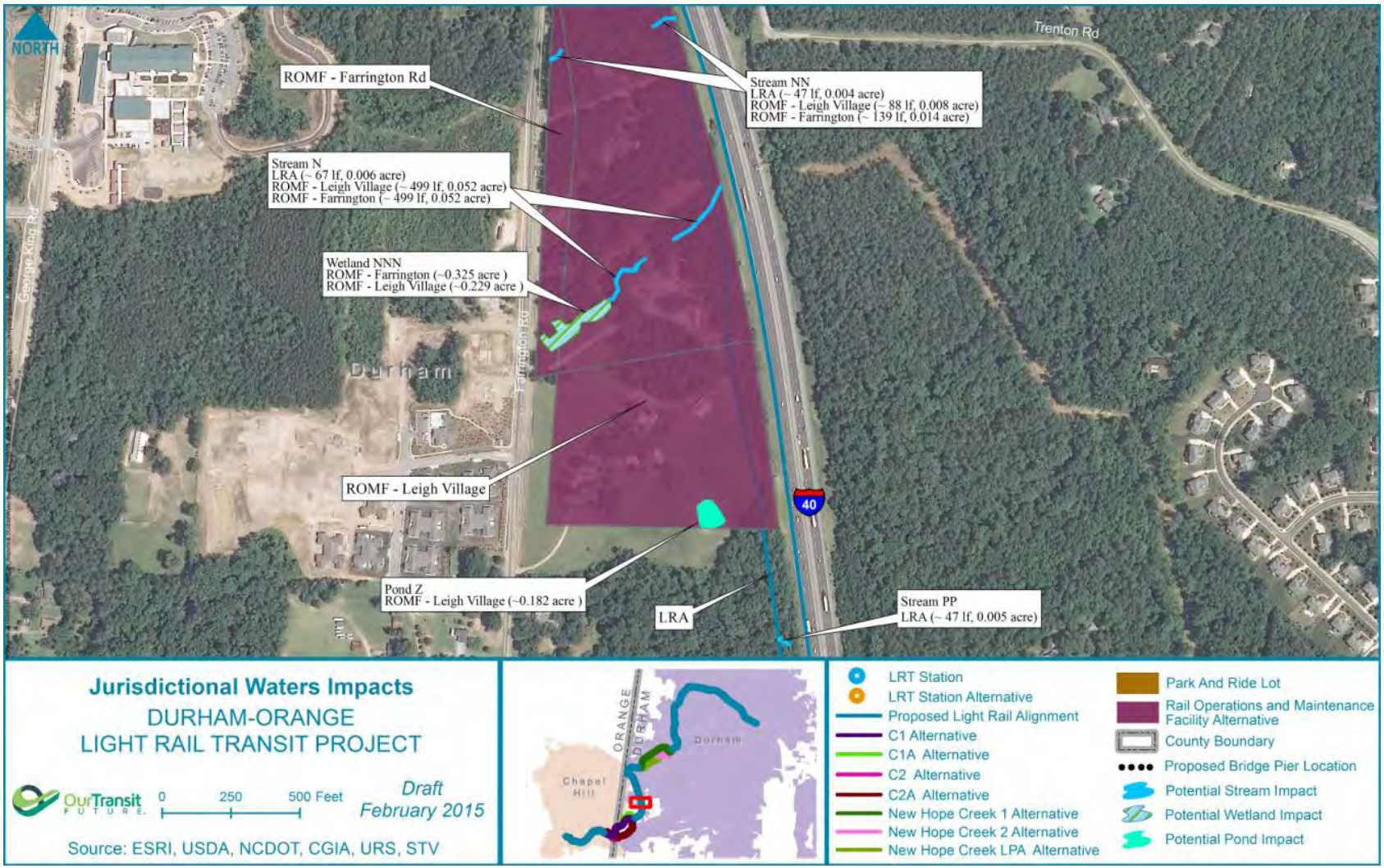


Figure 2E: Jurisdictional Waters Impacts

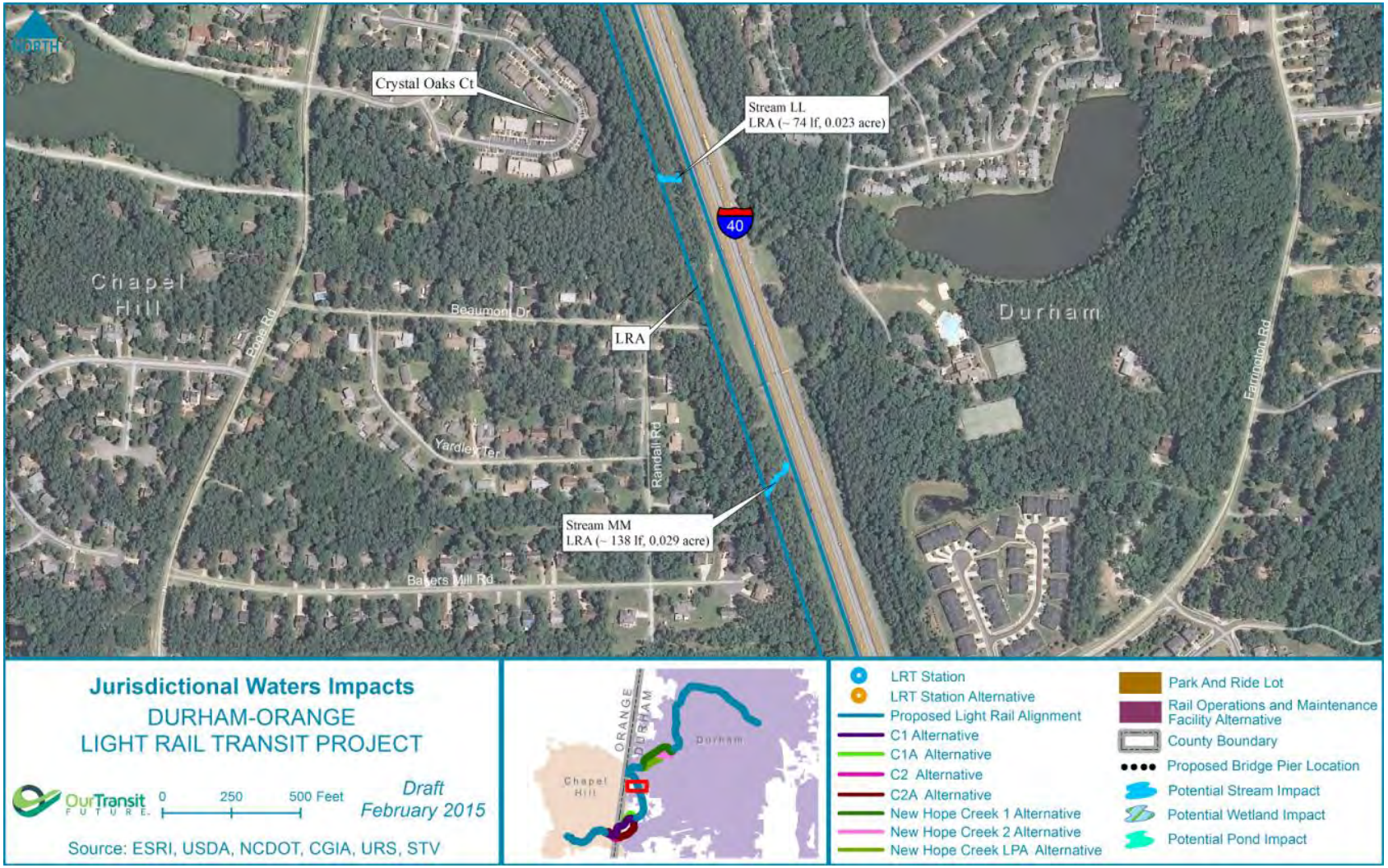


Figure 2F: Jurisdictional Waters Impacts

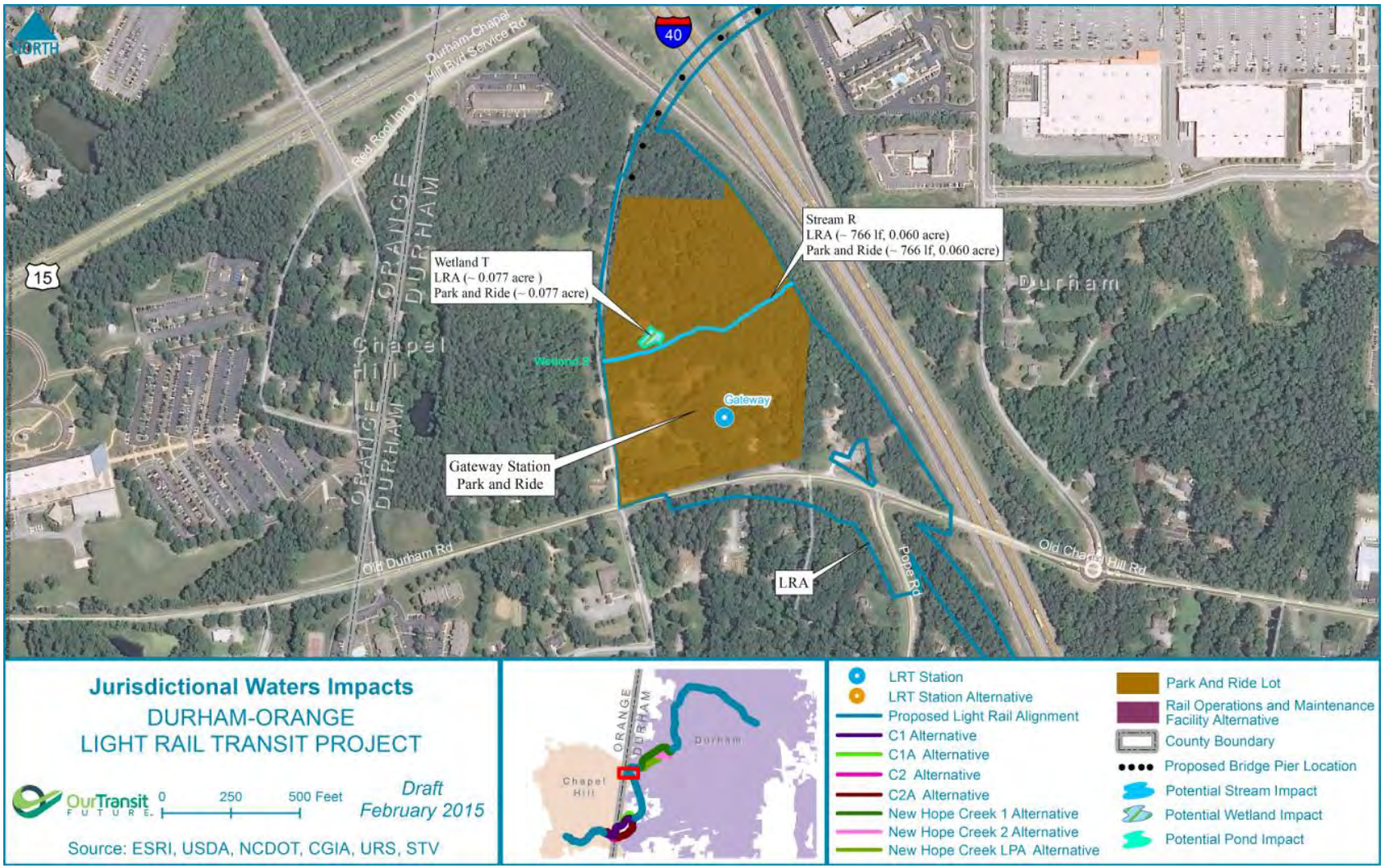


Figure 2G: Jurisdictional Waters Impacts

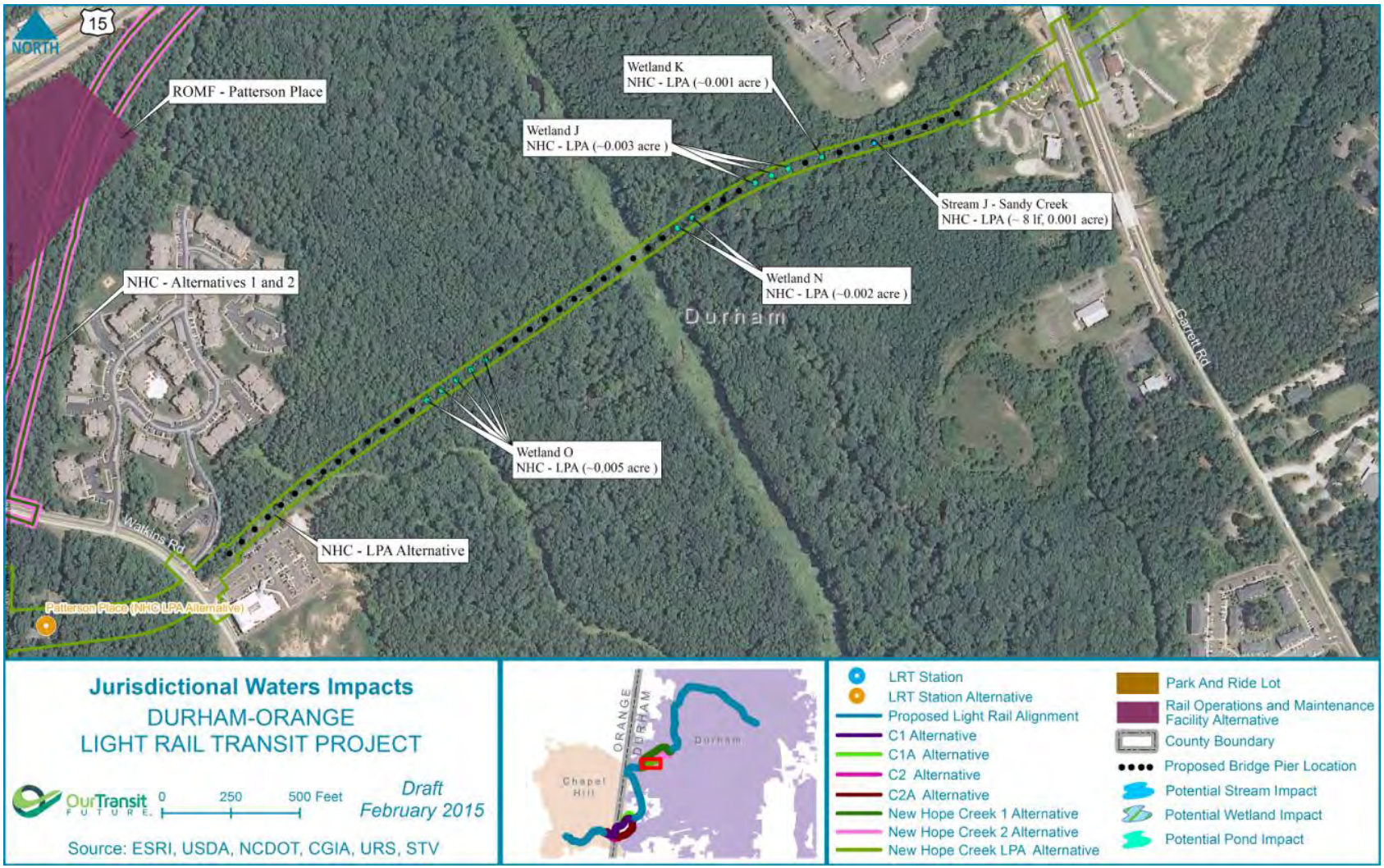


Figure 2H: Jurisdictional Waters Impacts

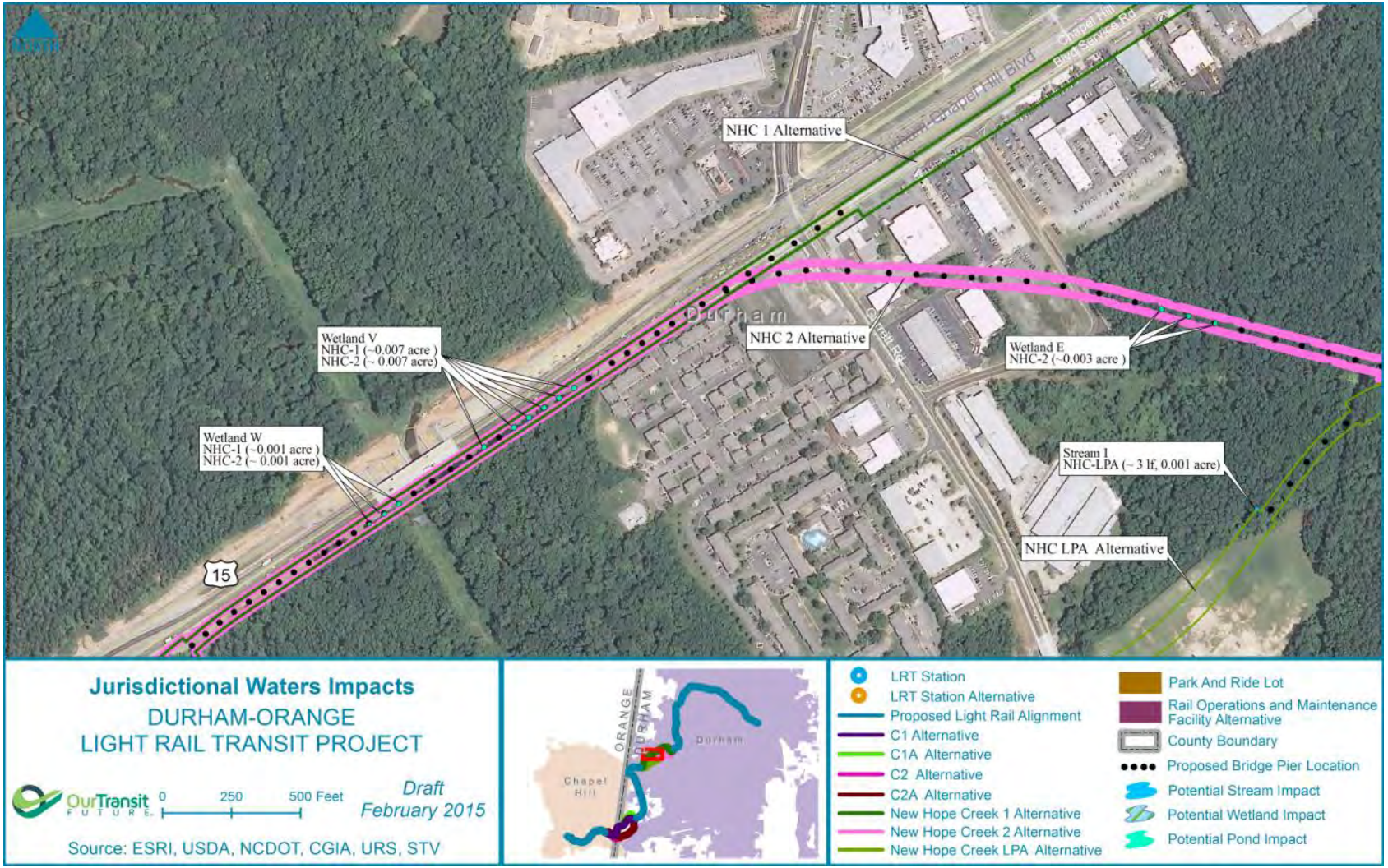


Figure 2I: Jurisdictional Waters Impacts

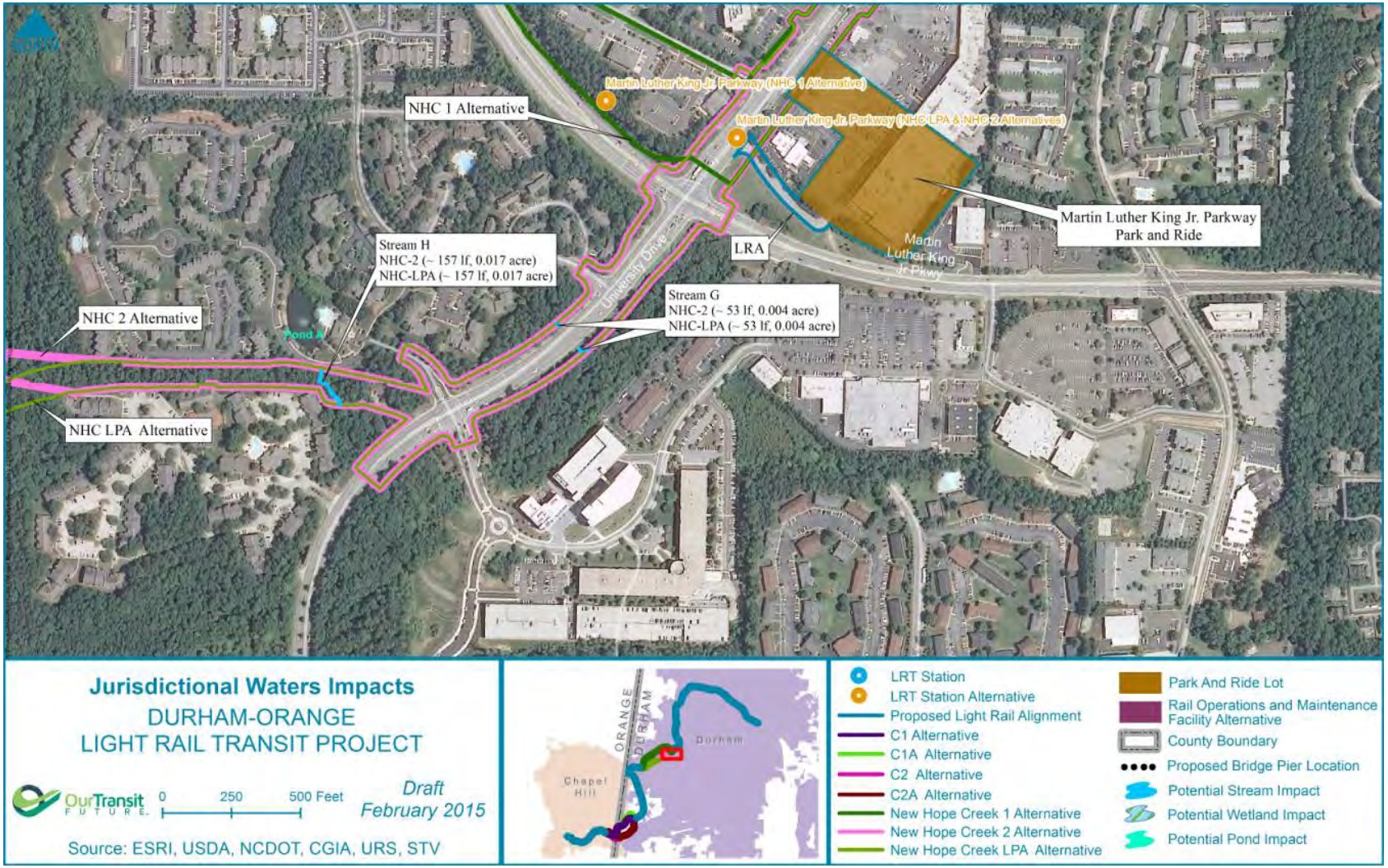


Figure 2J: Jurisdictional Waters Impacts

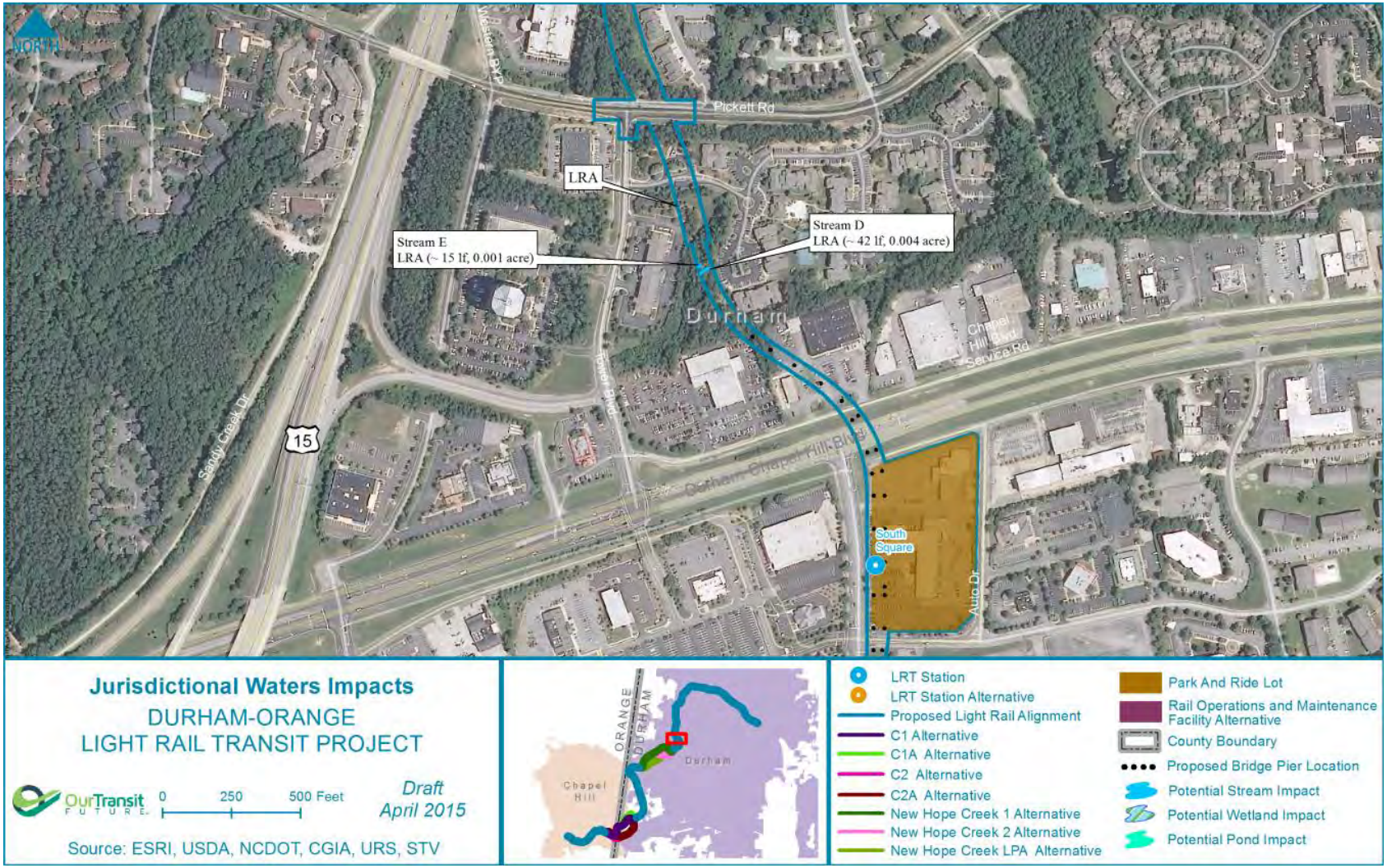


Figure 2K: Jurisdictional Waters Impacts

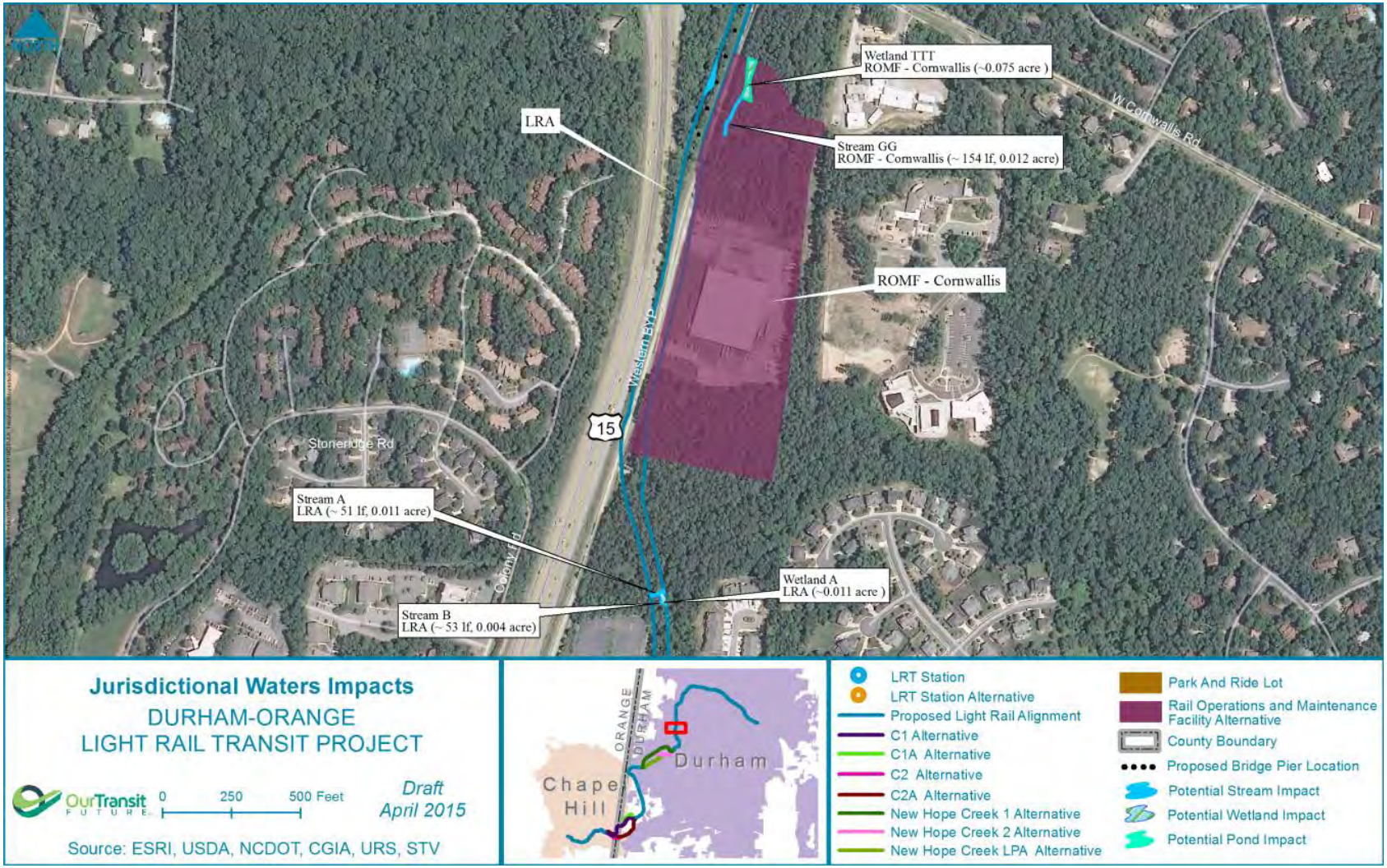


Figure 2L: Jurisdictional Waters Impacts

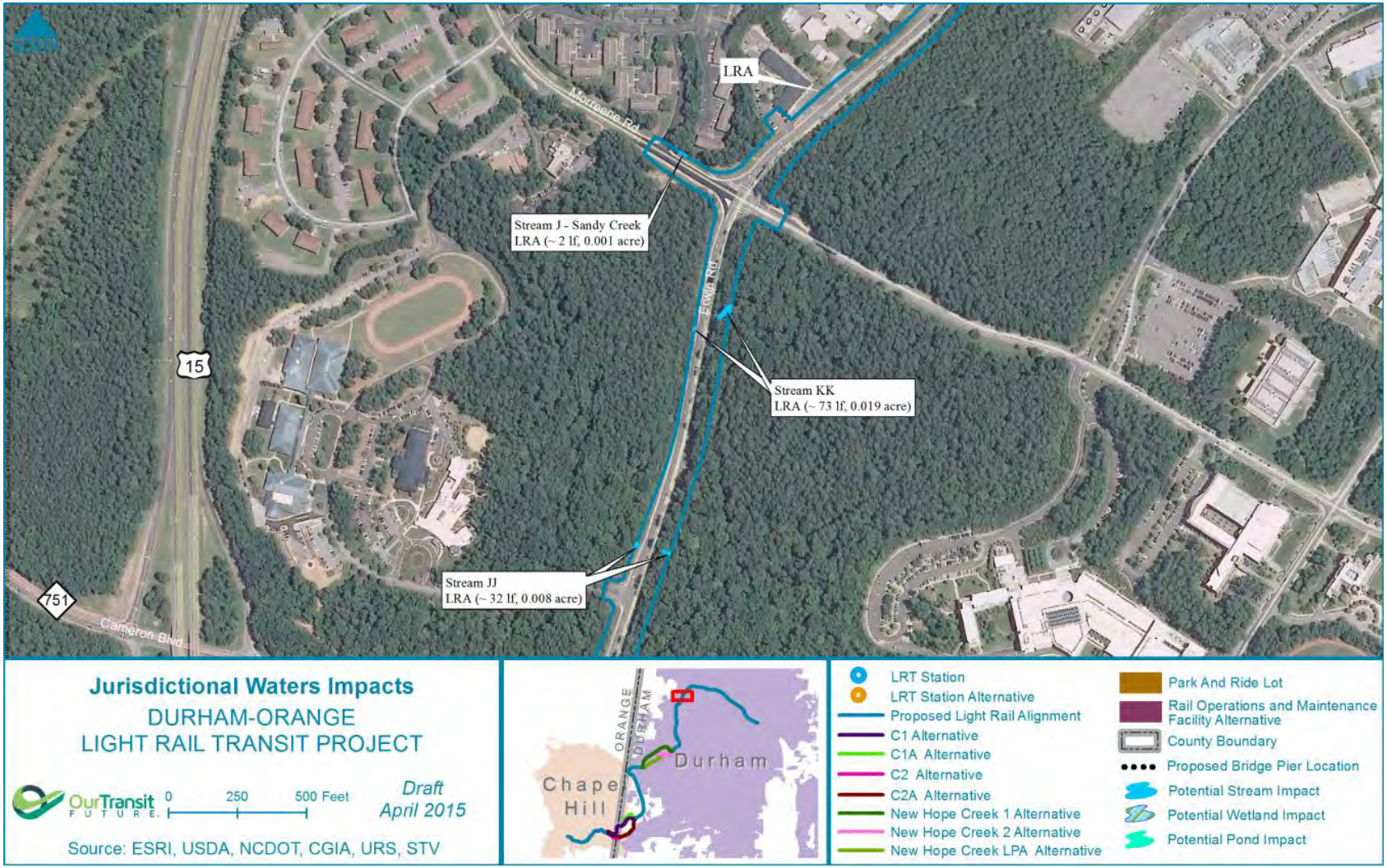


Figure 2M: Jurisdictional Waters Impacts

Figure 3A: Jordan Water Supply Riparian Buffer Impacts

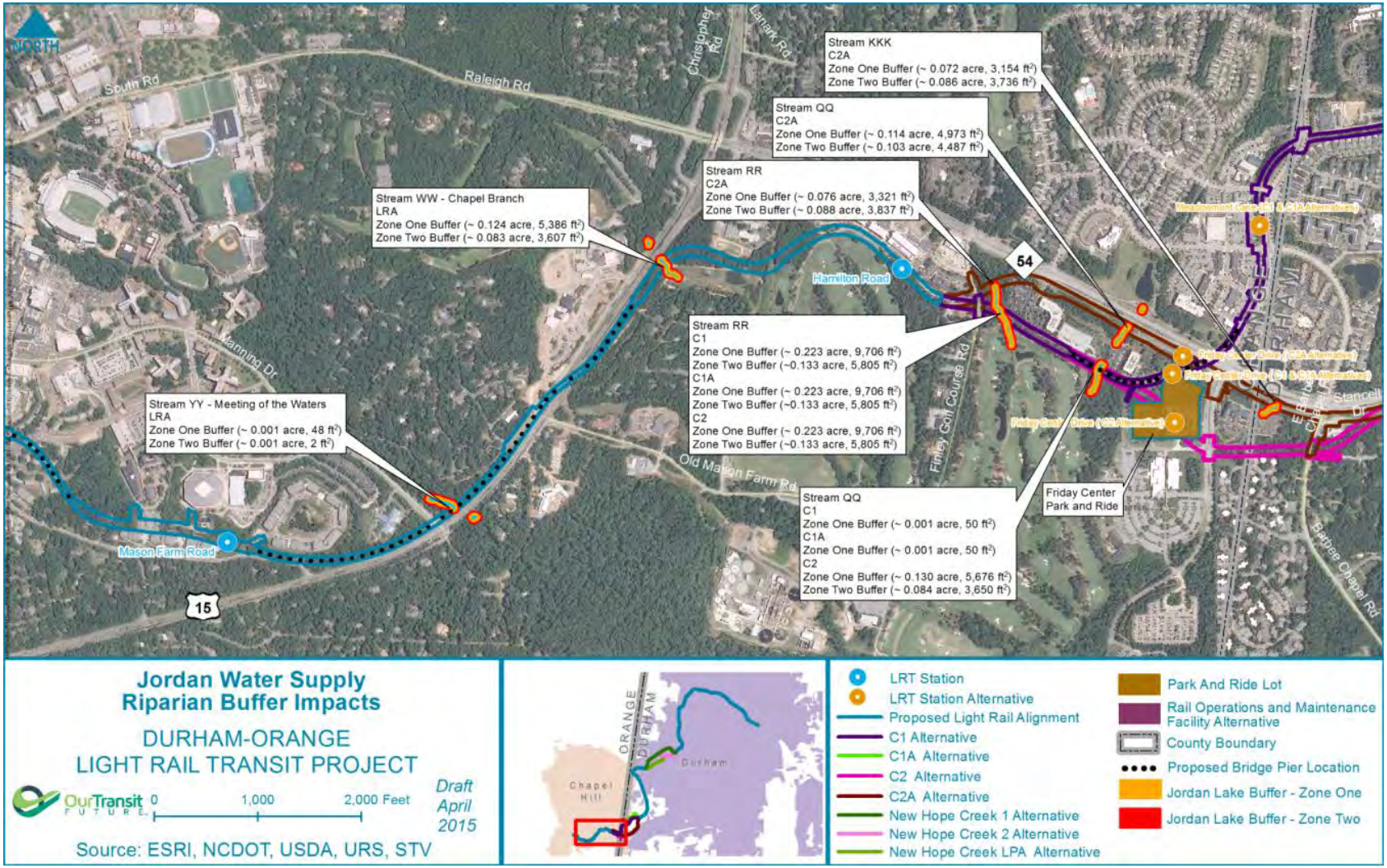


Figure 3B: Jordan Water Supply Riparian Buffer Impacts

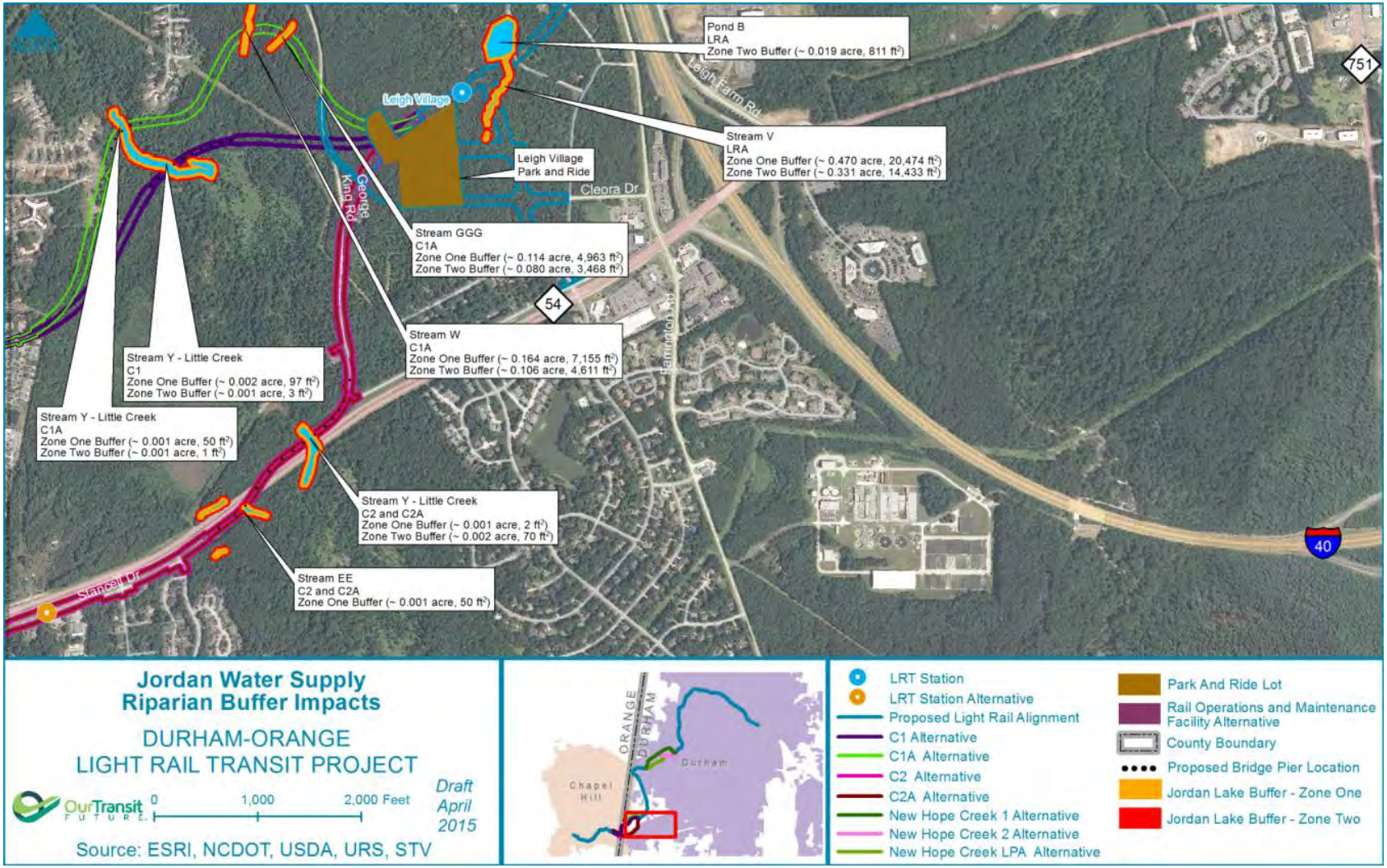


Figure 3C: Jordan Water Supply Riparian Buffer Impacts

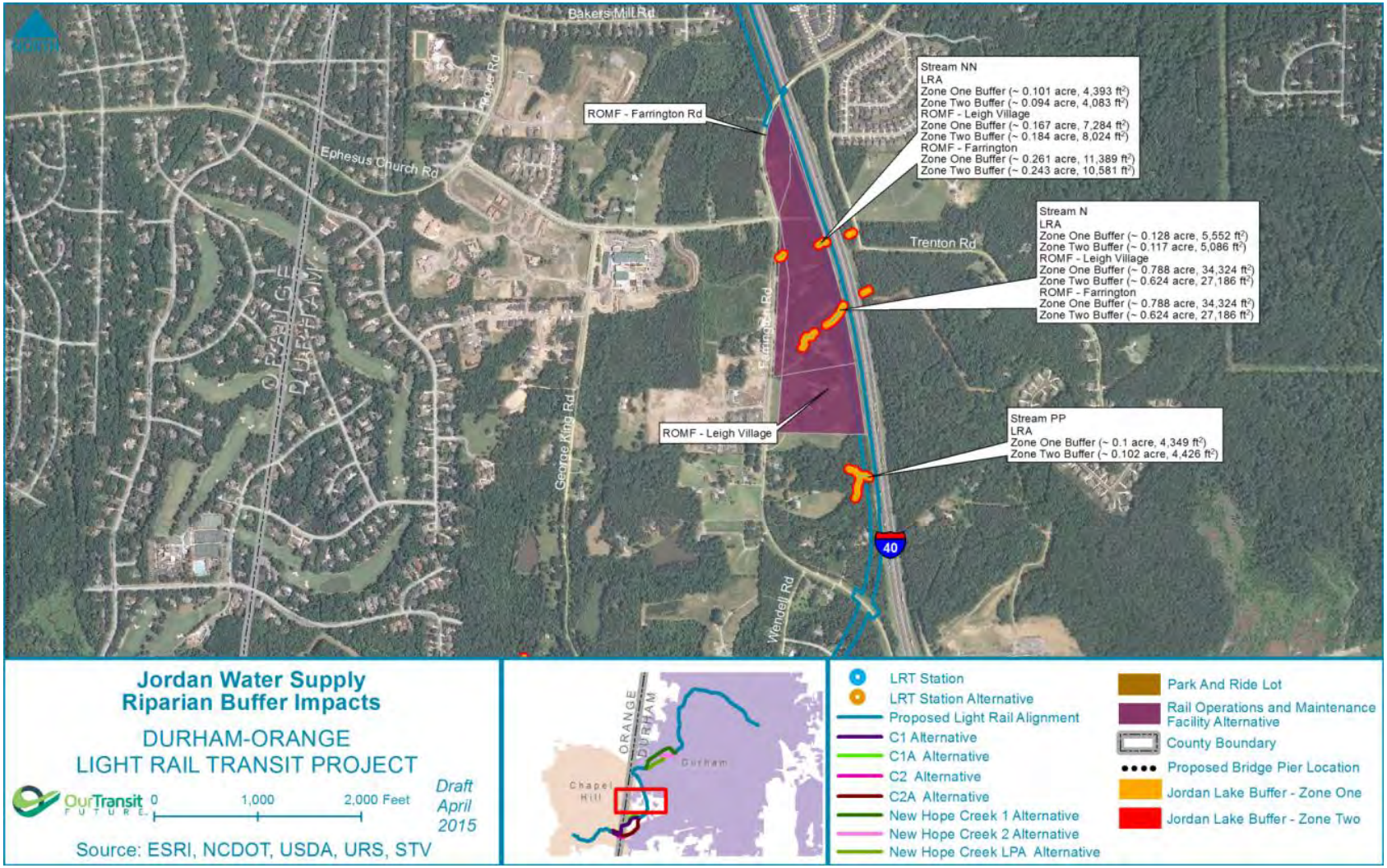


Figure 3D: Jordan Water Supply Riparian Buffer Impacts

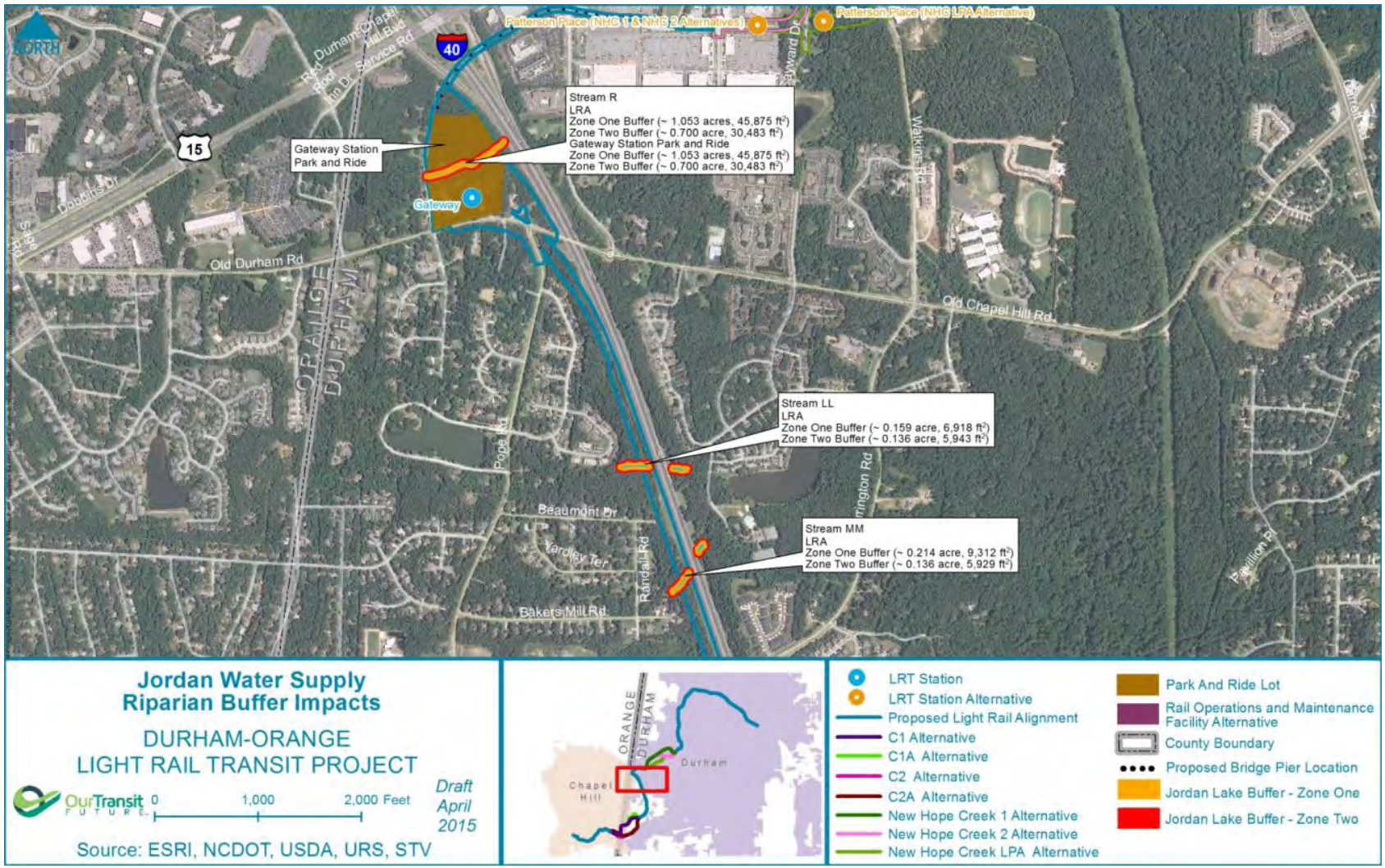


Figure 3E: Jordan Water Supply Riparian Buffer Impacts

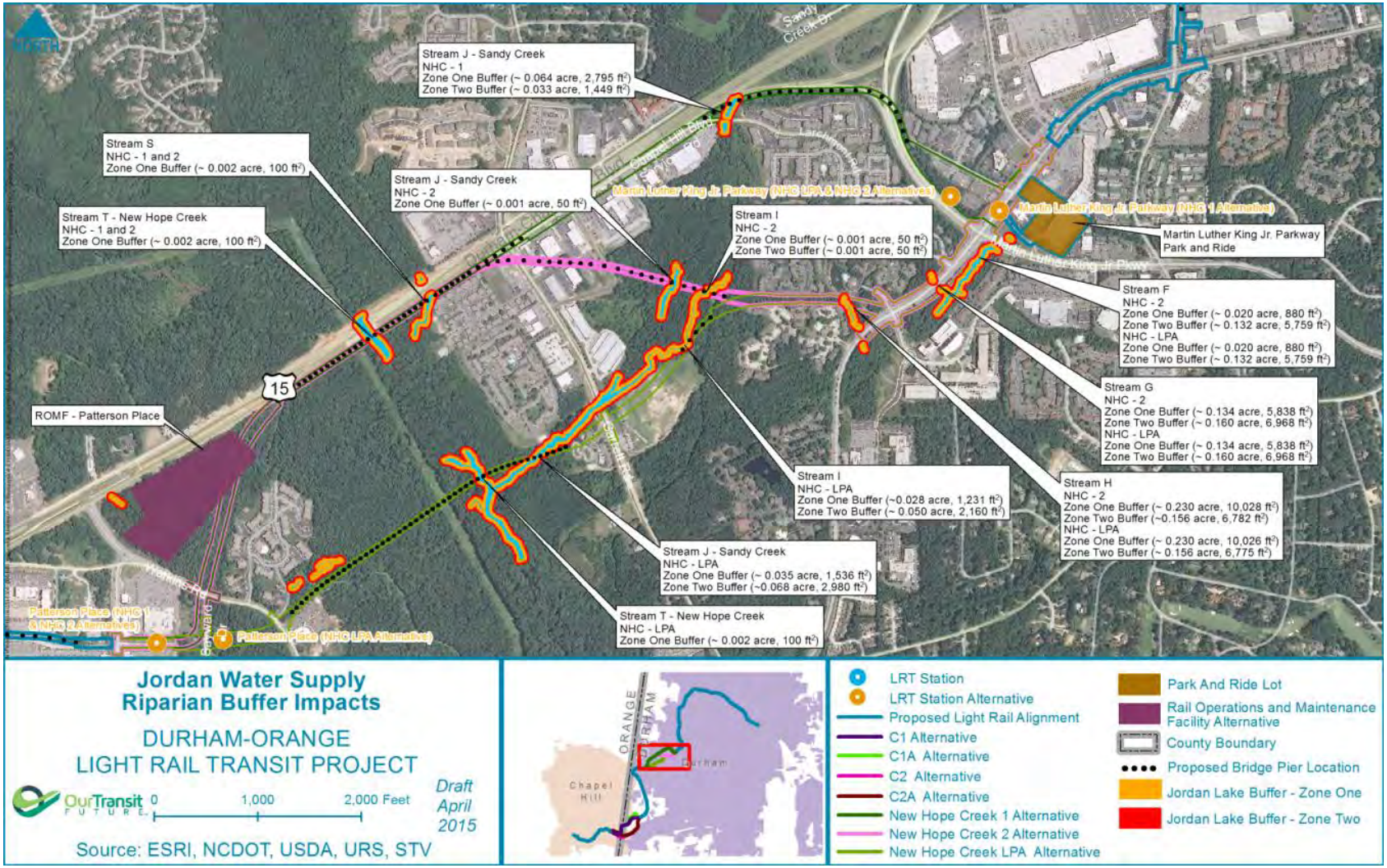


Figure 3F: Jordan Water Supply Riparian Buffer Impacts

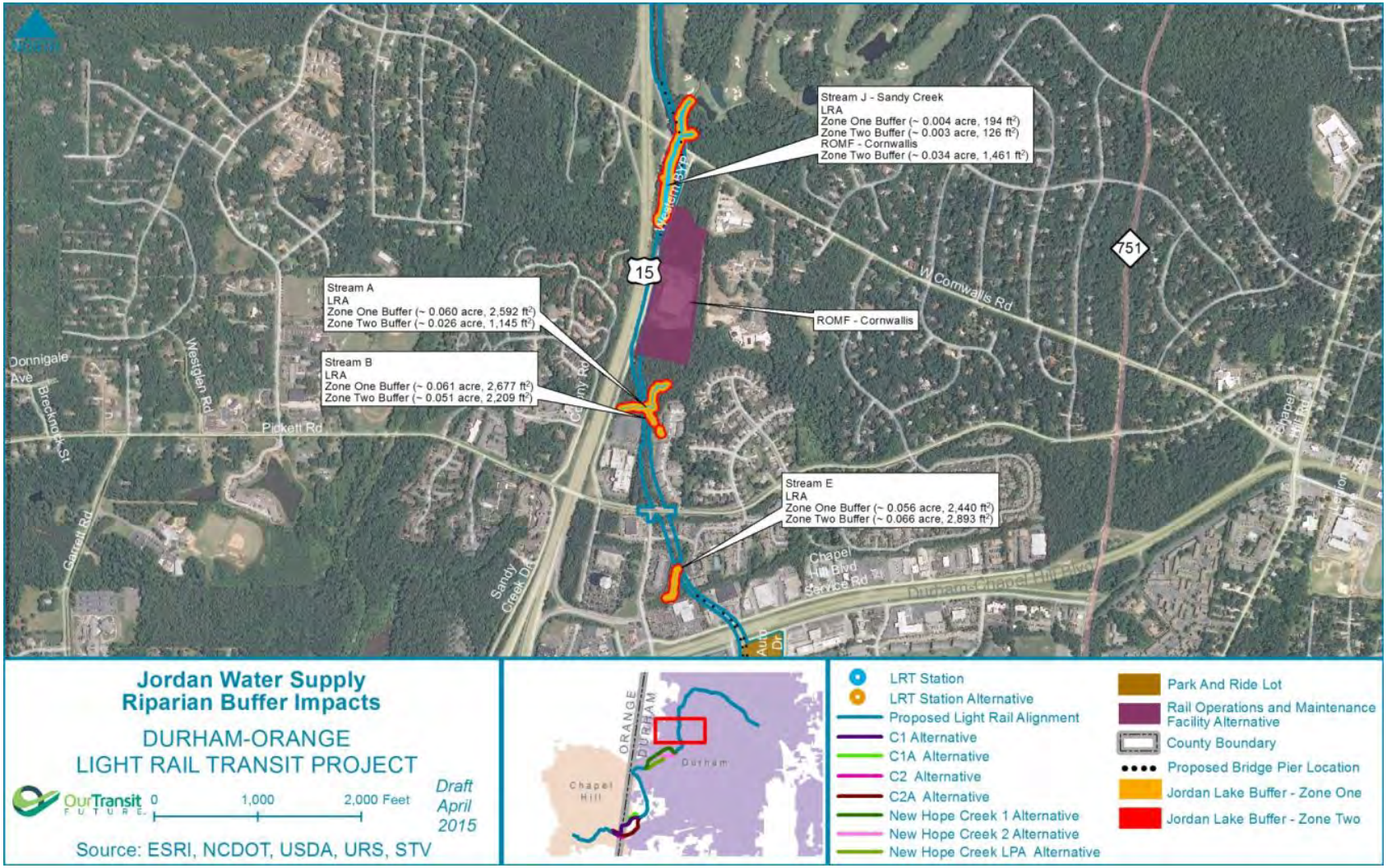


Figure 3G: Jordan Water Supply Riparian Buffer Impacts

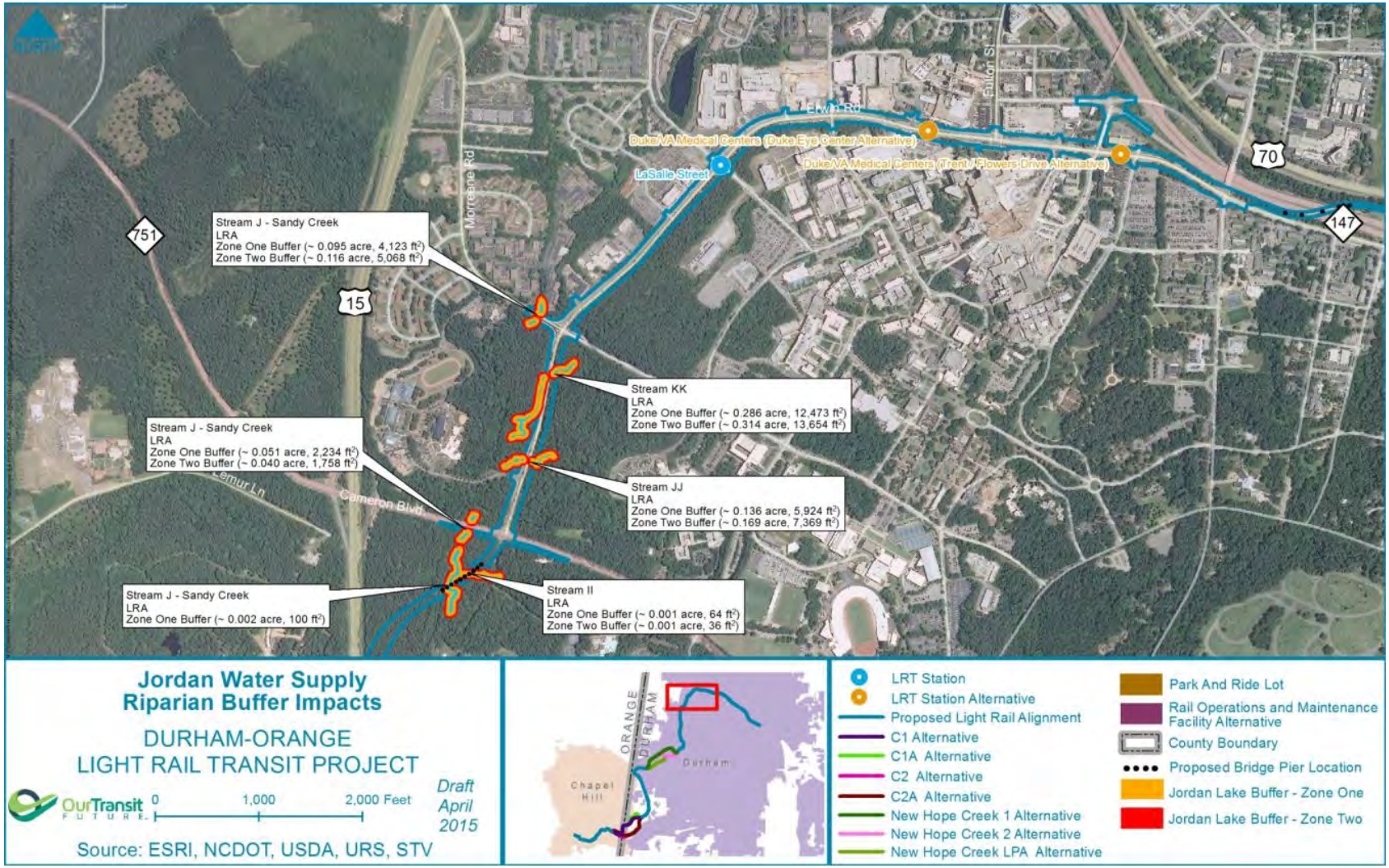


Figure 3H: Jordan Water Supply Riparian Buffer Impacts

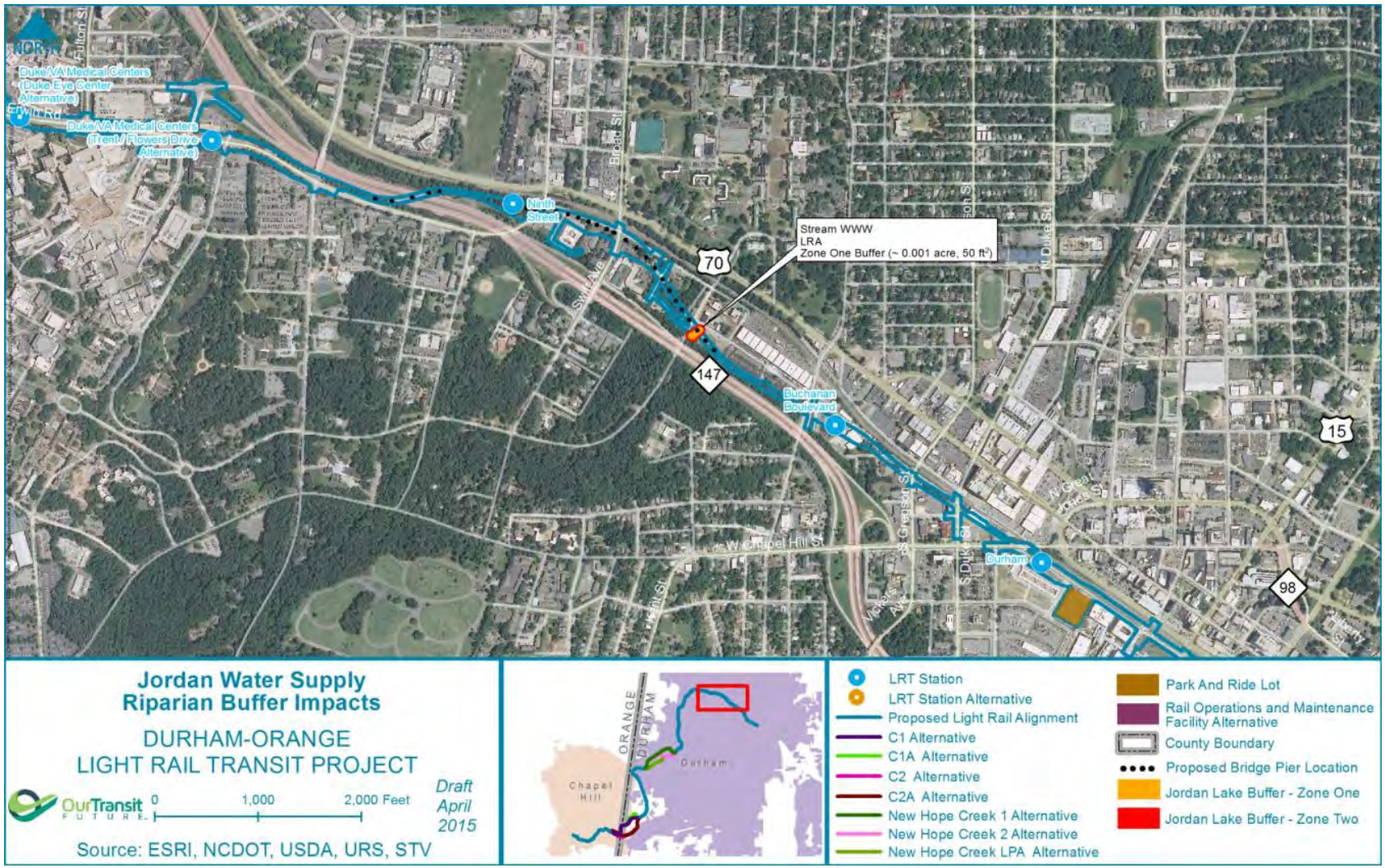


Figure 4A: Floodplains and Floodways

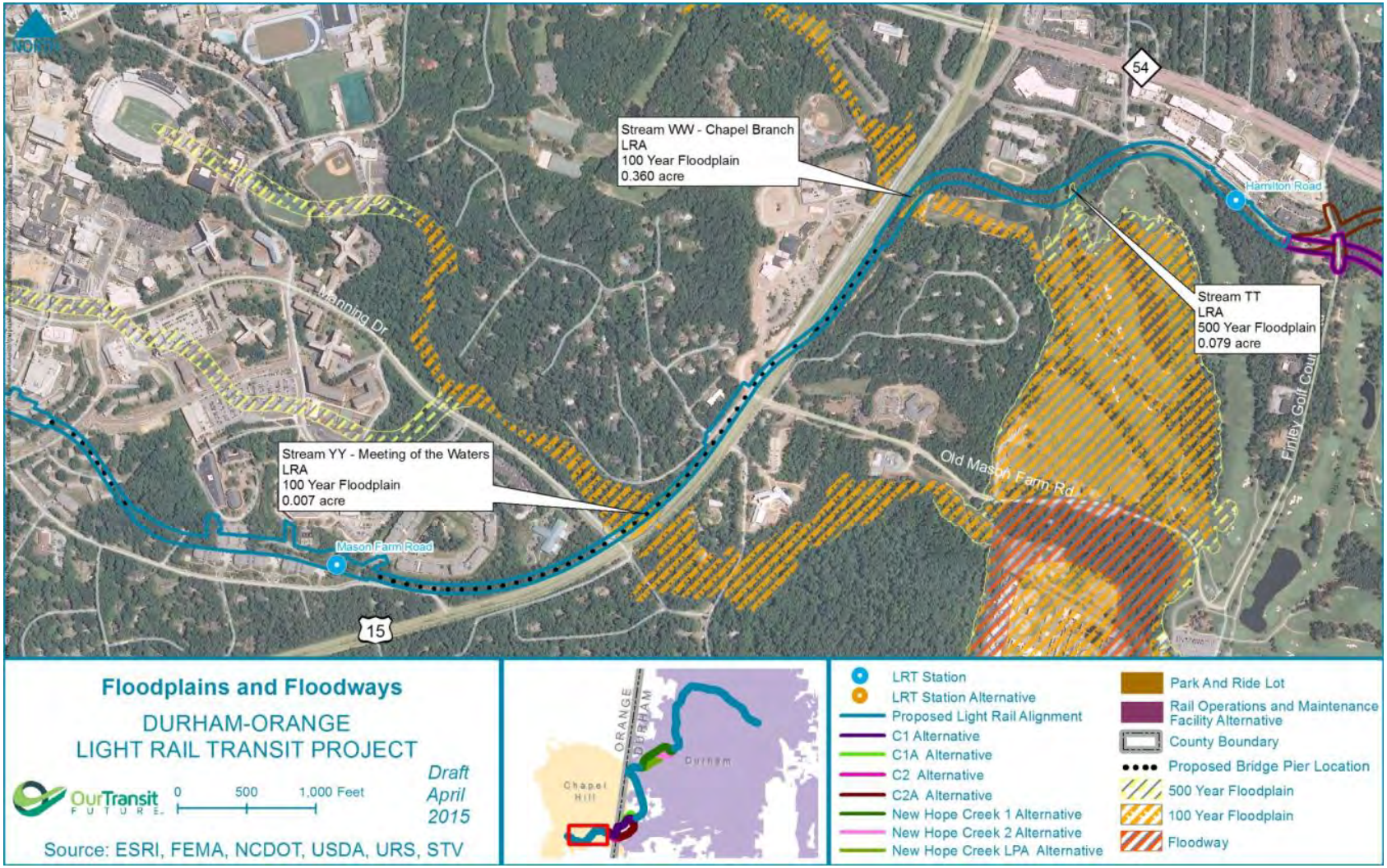


Figure 4B: Floodplains and Floodways

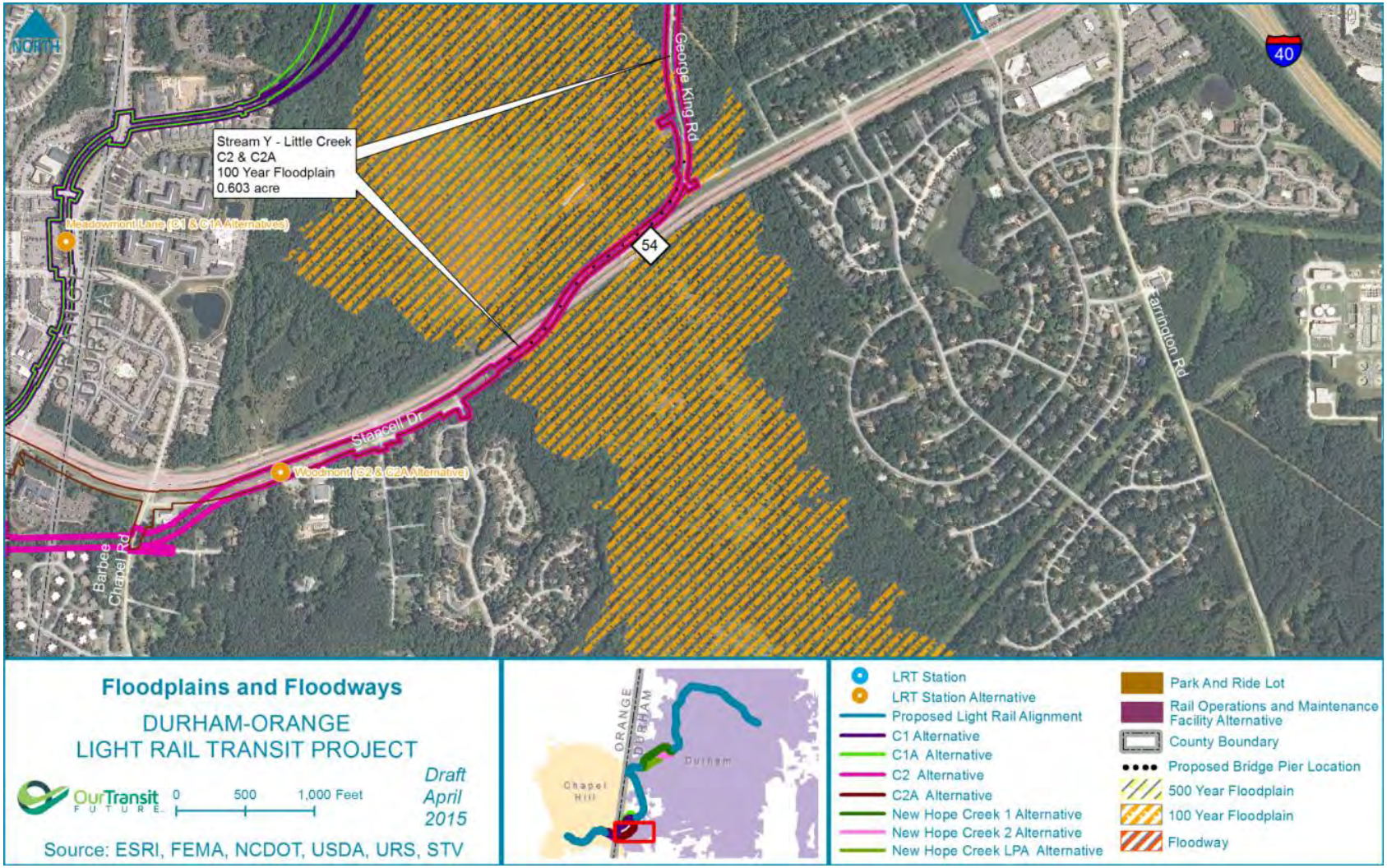


Figure 4C: Floodplains and Floodways

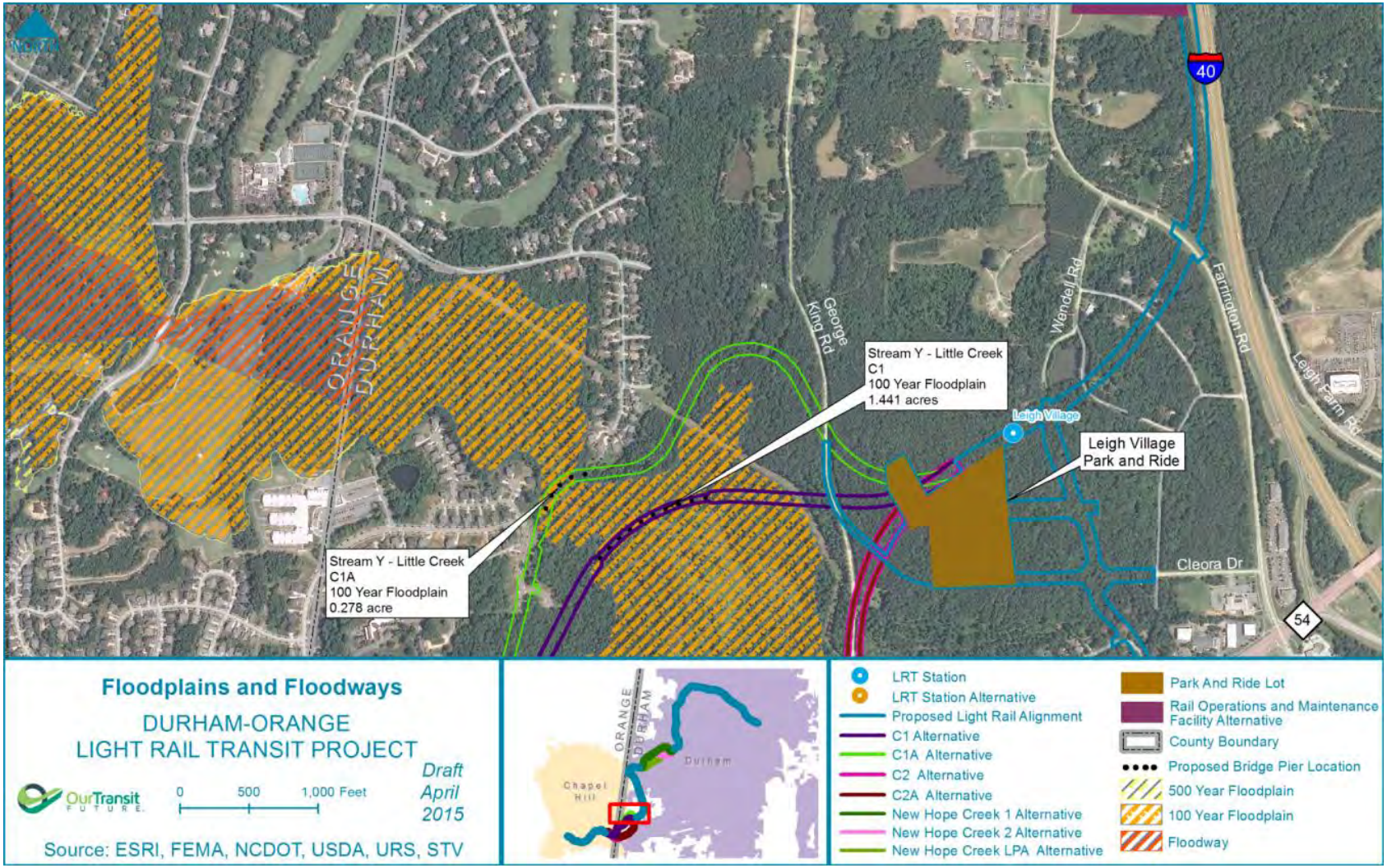


Figure 4D: Floodplains and Floodways

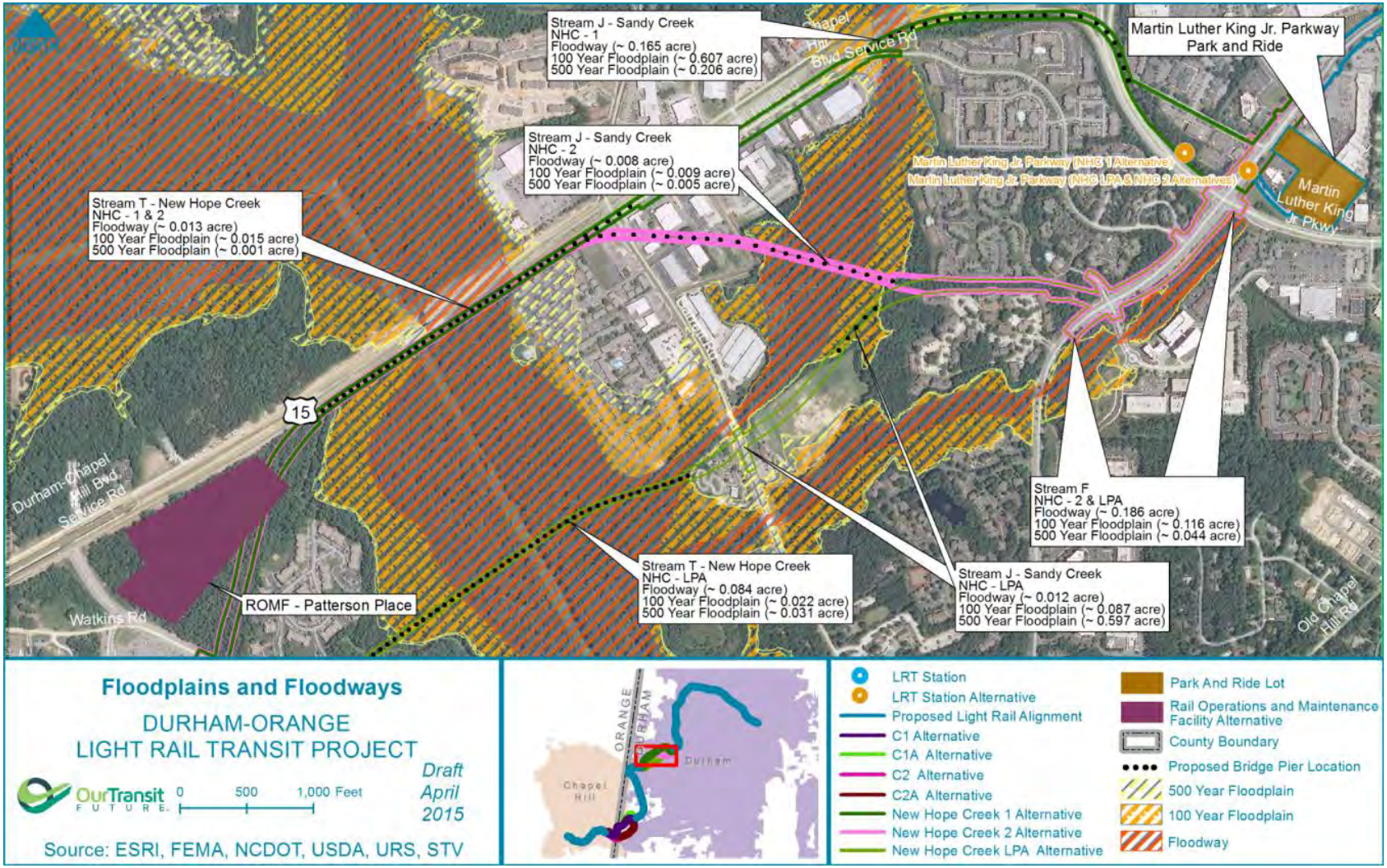


Figure 4E: Floodplains and Floodways

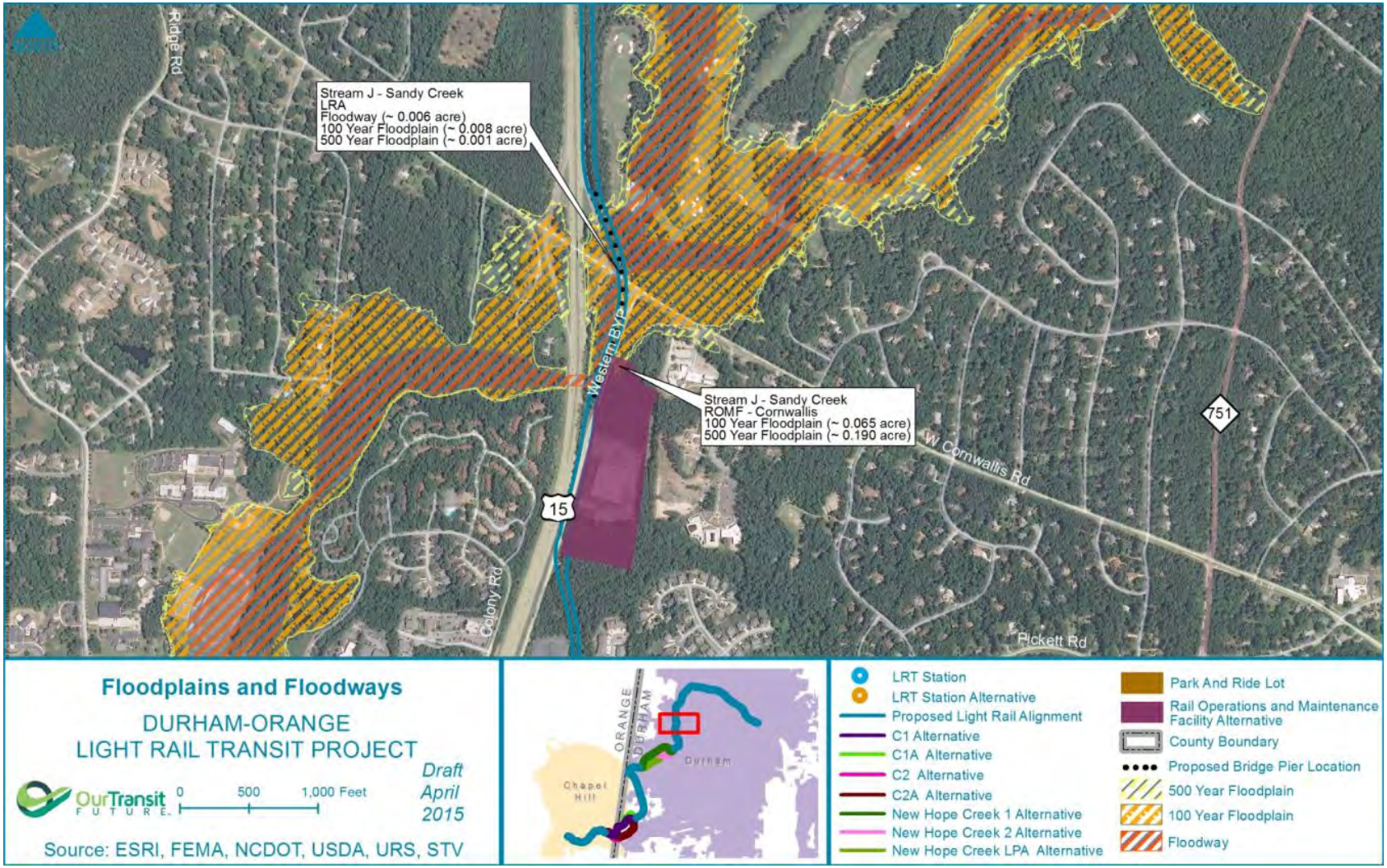
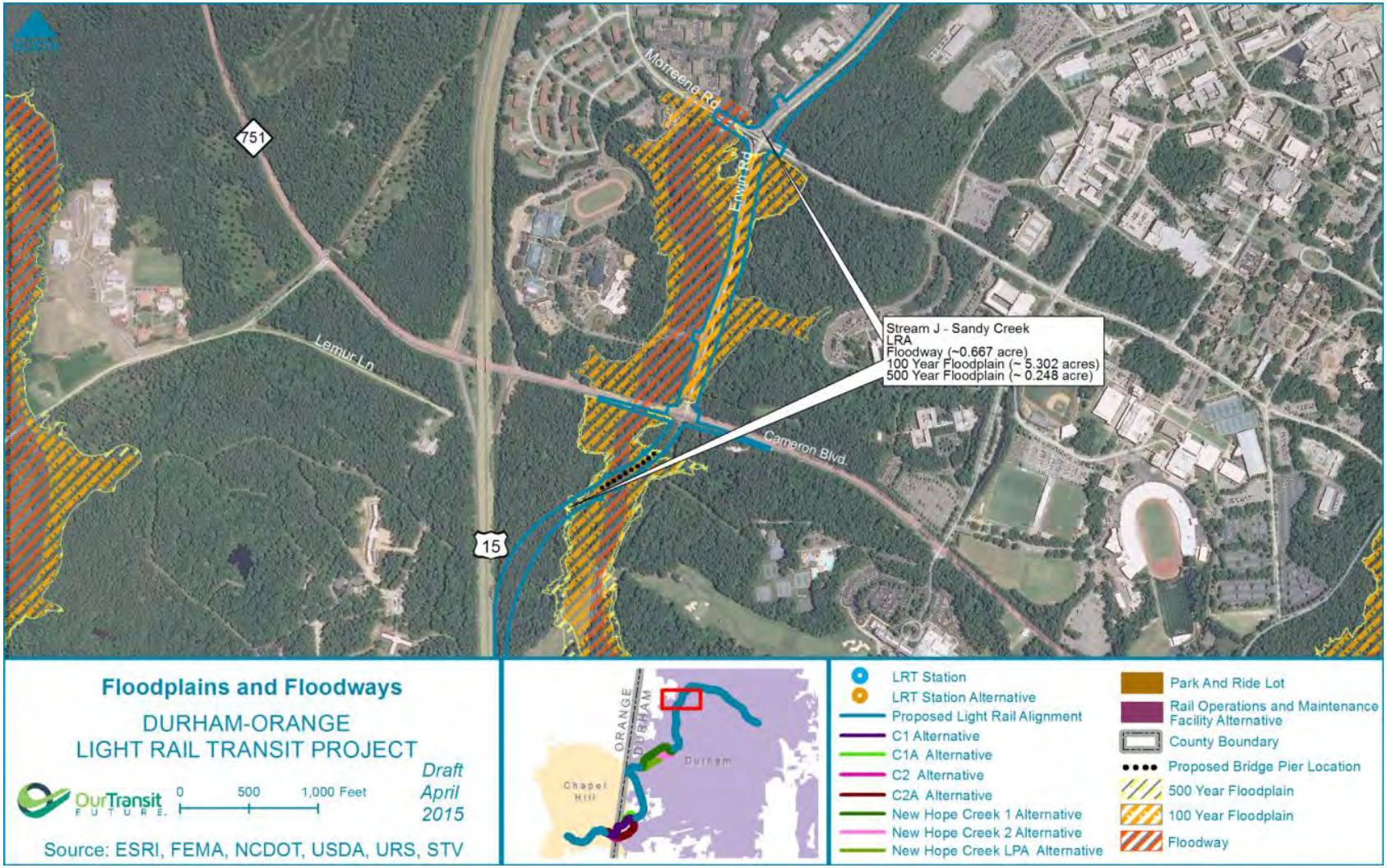


Figure 4F: Floodplains and Floodways



Appendix B - Jurisdictional Determination

from GPoindexter

AECOM DIN

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. SAW-2012-00957 County: Durham-Orange U.S.G.S. Quad: NC-Southwest Durham

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner: GoTriangle

Address: P.O. Box 13787

Research Triangle Park, NC 27709

Telephone Number:

Size (acres)	400	Nearest Town	Durham-Chapel Hill
Nearest Waterway	Little-New Hope Creek	River Basin	Haw
USGS HUC	03030002	Coordinates	Latitude: 35.958951
			Longitude: -78.981665

Location description: Proposed Durham-Orange Light Rail corridor from UNC Hospitals in Chapel Hill, Orange County, North Carolina, to Austin Avenue in Durham, Durham County, North Carolina adjacent to Little Creek and New Hope Creek in the Haw River Basin.
Per your request dated September 4, 2014, this determination is modified to include addendum 1 thru 3 verification of jurisdictional waters as defined by in field flagging and provided mapping included with reference request.
Per your request dated May 19, 2015, this determination is modified to include addendum 4 verification of jurisdictional waters as defined by in field flagging and provided mapping included with reference request.

Indicate Which of the Following Apply:

A. Preliminary Determination

_ Based on preliminary information, there may be waters of the U.S. including wetlands on the above described project area . We strongly suggest you have this property inspected to determine the extent of Department of the Army (DA) jurisdiction. To be considered final, a jurisdictional determination must be verified by the Corps. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also, you may provide new information for further consideration by the Corps to reevaluate the JD.

B. Approved Determination

_ There are Navigable Waters of the United States within the above described project area subject to the permit requirements of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

X There are waters of the U.S. including wetlands on the above described project area subject to the permit requirements of Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ We strongly suggest you have the waters of the U.S. including wetlands on your project area delineated. Due to the size of your property and/or our present workload, the Corps may not be able to accomplish this wetland delineation in a timely manner. For a more timely delineation, you may wish to obtain a consultant. To be considered final, any delineation must be verified by the Corps.

X The waters of the U.S. including wetlands on your project area have been delineated and the delineation has been verified by the Corps. We strongly suggest you have this delineation surveyed. Upon completion, this survey should be reviewed and verified by the Corps. Once verified, this survey will provide an accurate depiction of all areas subject to

CWA jurisdiction on your property which, provided there is no change in the law or our published regulations, may be relied upon for a period not to exceed five years.

- The waters of the U.S. including wetlands have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on ____. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

- There are no waters of the U.S., to include wetlands, present on the above described project area which are subject to the permit requirements of Section 404 of the Clean Water Act (33 USC 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

- The property is located in one of the 20 Coastal Counties subject to regulation under the Coastal Area Management Act (CAMA). You should contact the Division of Coastal Management in Morehead City, NC, at (252) 808-2808 to determine their requirements.

Placement of dredged or fill material within waters of the US and/or wetlands without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **John Thomas at 919-554-4884 x25 or John.T.Thomas.JR@usace.army.mil**.

C. Basis For Determination: *There are stream channels within your project site which are tributaries of Little Creek & New Hope which flows into the Haw River and the Atlantic Ocean. .*

D. Remarks:

E. Attention USDA Program Participants

This delineation/determination has been conducted to identify the limits of Corps' Clean Water Act jurisdiction for the particular site identified in this request. The delineation/determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

F. Appeals Information (This information applies only to approved jurisdictional determinations as indicated in B. above)

This correspondence constitutes an approved jurisdictional determination for the above described site. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and request for appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

US Army Corps of Engineers
South Atlantic Division
Attn: Jason Steele, Review Officer
60 Forsyth Street SW, Room 10M15
Atlanta, Georgia 30303-8801

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by **8/05/2015**.

It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this correspondence.

Corps Regulatory Official: _____

Date: 6/05/2015 Expiration Date:

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete our Customer Satisfaction Survey, located online at http://regulatory.usacesurvey.com/.

Cc: Brandon Phillips, 900 West Trade Street, Suite 715, Charlotte, NC 28202-1144

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL		
Applicant: **GoTriangle**	File Number: **SAW-2012-00957**	Date: 6/05/15
Attached is:		See Section below
☐ INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)		A
☐ PROFFERED PERMIT (Standard Permit or Letter of permission)		B
☐ PERMIT DENIAL		C
☐ APPROVED JURISDICTIONAL DETERMINATION		D
☒ PRELIMINARY JURISDICTIONAL DETERMINATION		E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the district engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.
SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT
REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)
ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:	
If you have questions regarding this decision and/or the appeal process you may contact: **District Engineer, Wilmington Regulatory Division, Attn: John Thomas**	If you only have questions regarding the appeal process you may also contact: Mr. Jason Steele, Administrative Appeal Review Officer CESAD-PDO U.S. Army Corps of Engineers, South Atlantic Division 60 Forsyth Street, Room 10M15 Atlanta, Georgia 30303-8801 Phone: (404) 562-5137

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.		
_____ Signature of appellant or agent.	Date:	Telephone number:

For appeals on Initial Proffered Permits send this form to:

District Engineer, Wilmington Regulatory Division, John Thomas,

For Permit denials, Proffered Permits and approved Jurisdictional Determinations send this form to:

Division Engineer, Commander, U.S. Army Engineer Division, South Atlantic, Attn: Mr. Jason Steele, Administrative Appeal Officer, CESAD-PDO, 60 Forsyth Street, Room 10M15, Atlanta, Georgia 30303-8801 Phone: (404) 562-5137

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. SAW-2012-00957 County: Durham-Orange U.S.G.S. Quad: NC-Southwest Durham

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner: GoTriangle

Address: P.O. Box 13787

Research Triangle Park, NC 27709

Telephone Number:

Size (acres)	400	Nearest Town	Durham-Chapel Hill
Nearest Waterway	Little-New Hope Creek	River Basin	Haw
USGS HUC	03030002	Coordinates	Latitude: 35.958951
			Longitude: -78.981665

Location description: Proposed Durham-Orange Light Rail corridor from UNC Hospitals in Chapel Hill, Orange County, North Carolina, to Austin Avenue in Durham, Durham County, North Carolina adjacent to Little Creek and New Hope Creek in the Haw River Basin.
Per your request dated September 4, 2014, this determination is modified to include addendum 1 thru 3 verification of jurisdictional waters as defined by in field flagging and provided mapping included with reference request.
Per your request dated May 19, 2015, this determination is modified to include addendum 4 verification of jurisdictional waters as defined by in field flagging and provided mapping included with reference request.
Per your request dated June 19, 2015, this determination is modified to include the addendum changes verification of jurisdictional waters as defined by field inspections of June 3, 2015, and provided mapping included with the reference request.

Indicate Which of the Following Apply:

A. Preliminary Determination

_ Based on preliminary information, there may be waters of the U.S. including wetlands on the above described project area . We strongly suggest you have this property inspected to determine the extent of Department of the Army (DA) jurisdiction. To be considered final, a jurisdictional determination must be verified by the Corps. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also, you may provide new information for further consideration by the Corps to reevaluate the JD.

B. Approved Determination

_ There are Navigable Waters of the United States within the above described project area subject to the permit requirements of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

X There are waters of the U.S. including wetlands on the above described project area subject to the permit requirements of Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ We strongly suggest you have the waters of the U.S. including wetlands on your project area delineated. Due to the size of your property and/or our present workload, the Corps may not be able to accomplish this wetland delineation in a timely manner. For a more timely delineation, you may wish to obtain a consultant. To be considered final, any delineation must be verified by the Corps.

X The waters of the U.S. including wetlands on your project area have been delineated and the delineation has been verified by the Corps. We strongly suggest you have this delineation surveyed. Upon completion, this survey should be

reviewed and verified by the Corps. Once verified, this survey will provide an accurate depiction of all areas subject to CWA jurisdiction on your property which, provided there is no change in the law or our published regulations, may be relied upon for a period not to exceed five years.

- The waters of the U.S. including wetlands have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on ____. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

- There are no waters of the U.S., to include wetlands, present on the above described project area which are subject to the permit requirements of Section 404 of the Clean Water Act (33 USC 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

- The property is located in one of the 20 Coastal Counties subject to regulation under the Coastal Area Management Act (CAMA). You should contact the Division of Coastal Management in Morehead City, NC, at (252) 808-2808 to determine their requirements.

Placement of dredged or fill material within waters of the US and/or wetlands without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **John Thomas at 919-554-4884 x25 or John.T.Thomas.JR@usace.army.mil**.

C. Basis For Determination: *There are stream channels within your project site which are tributaries of Little Creek & New Hope which flows into the Haw River and the Atlantic Ocean. .*

D. Remarks:

E. Attention USDA Program Participants

This delineation/determination has been conducted to identify the limits of Corps' Clean Water Act jurisdiction for the particular site identified in this request. The delineation/determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

F. Appeals Information (This information applies only to approved jurisdictional determinations as indicated in B. above)

This correspondence constitutes an approved jurisdictional determination for the above described site. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and request for appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

US Army Corps of Engineers
South Atlantic Division
Attn: Jason Steele, Review Officer
60 Forsyth Street SW, Room 10M15
Atlanta, Georgia 30303-8801

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by **8/29/2015**.

It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this correspondence.

Corps Regulatory Official: _____

Date: 6/29/2015 Expiration Date:

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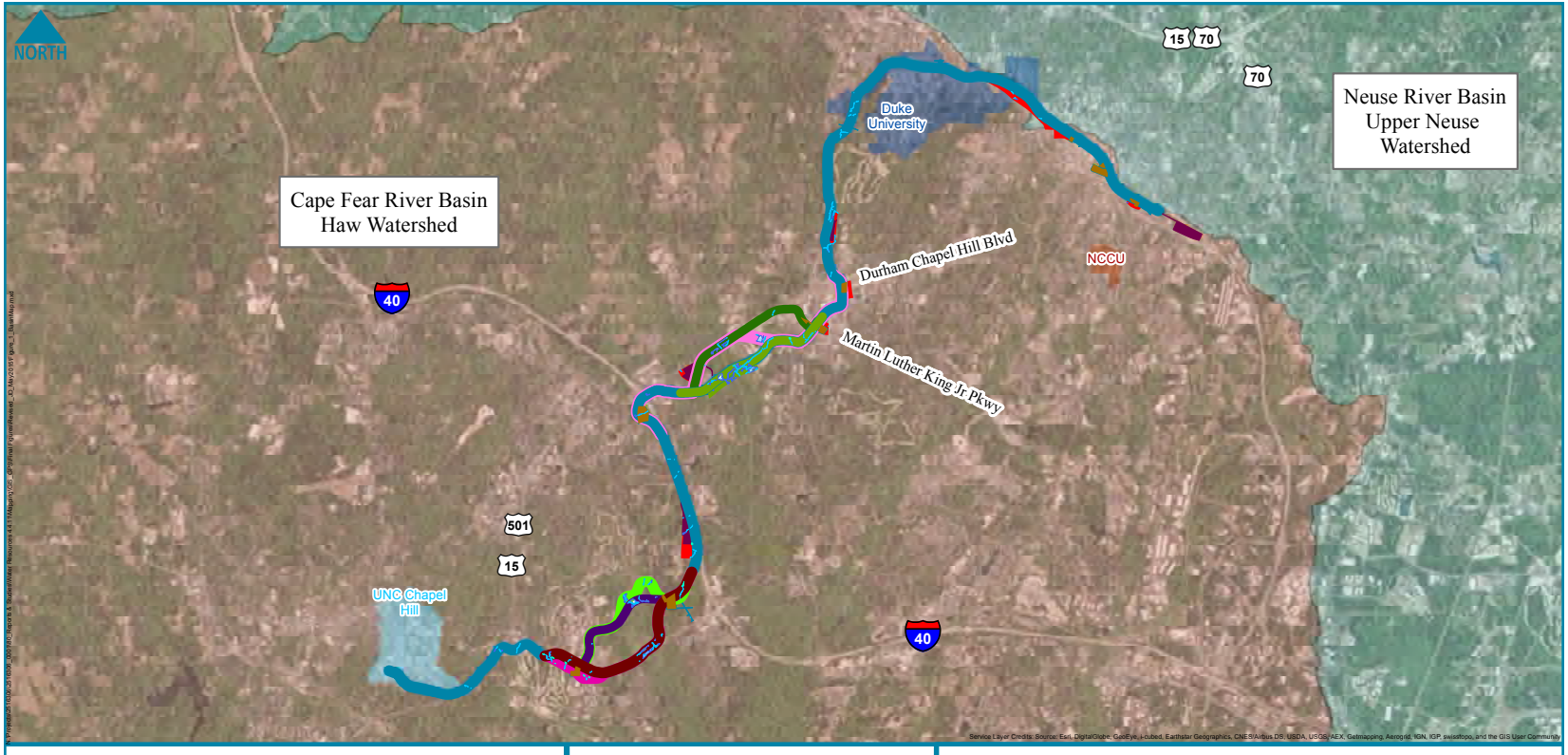


Water Resources - Figure 1

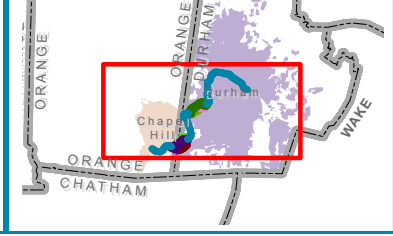
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 1 2 Miles

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- Proposed Light Rail Alignment
- C1 Alternative
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- C2A Alternative
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- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
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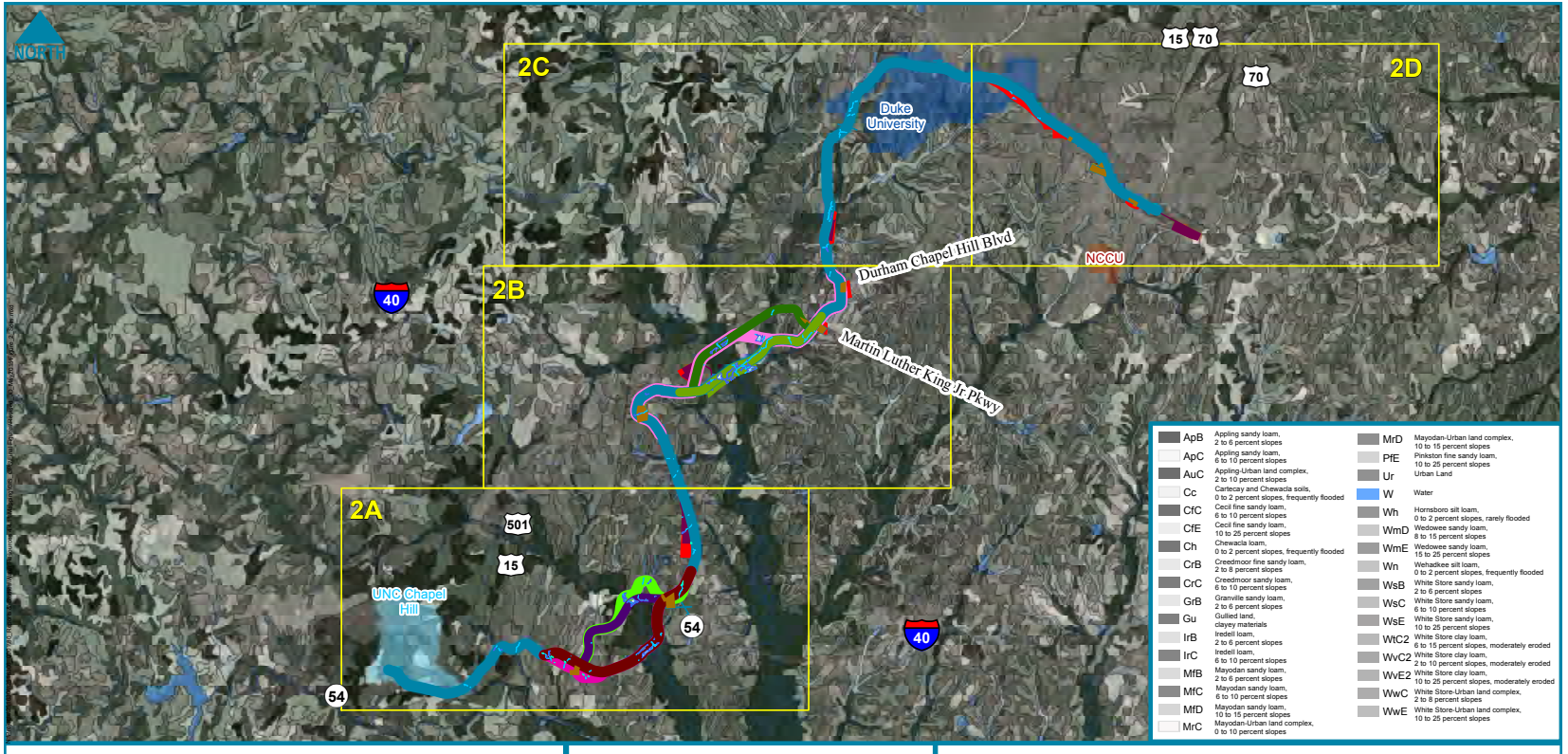

Water Resources - Figure 2

DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

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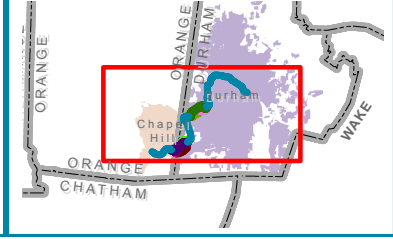
Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



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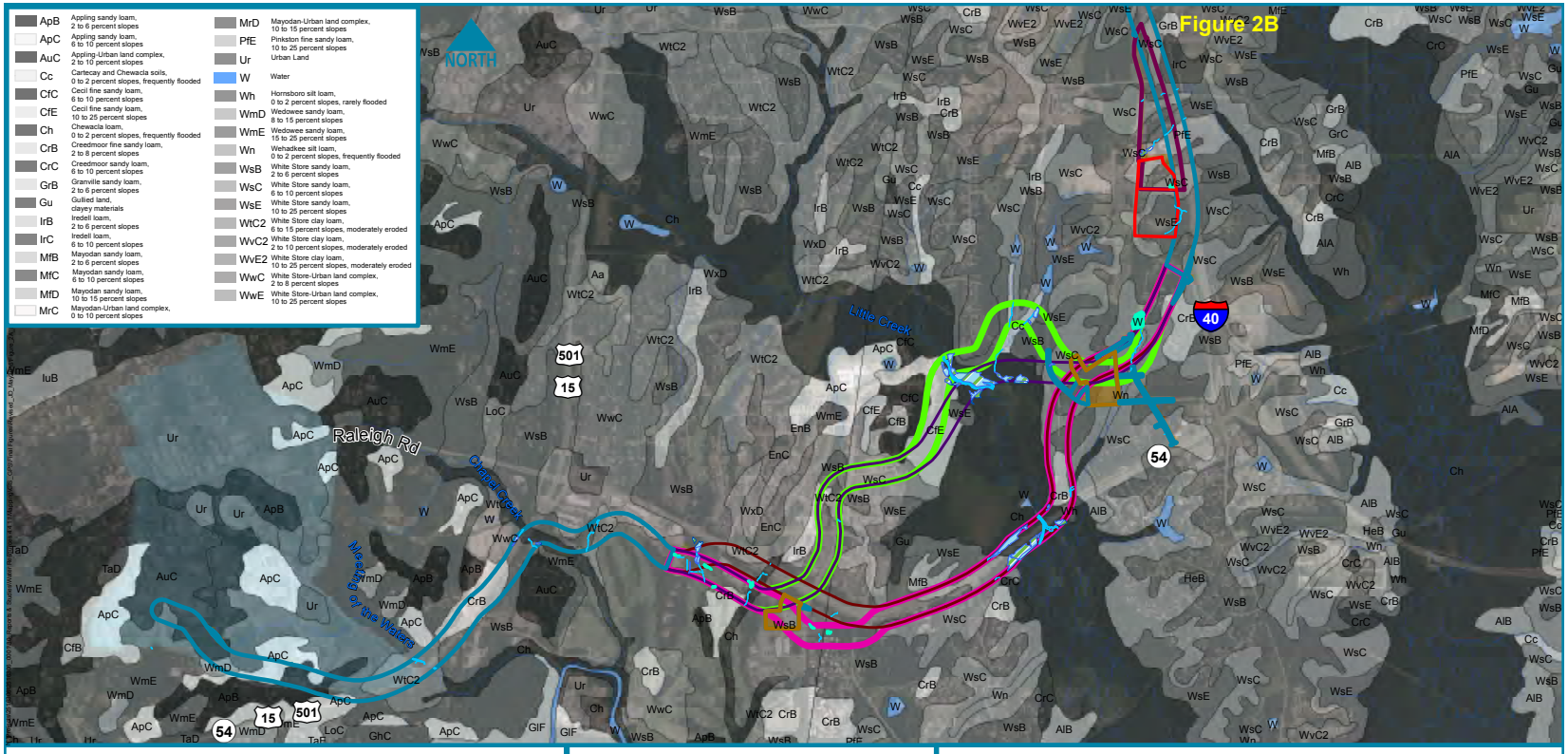


Water Resources - Figure 2A

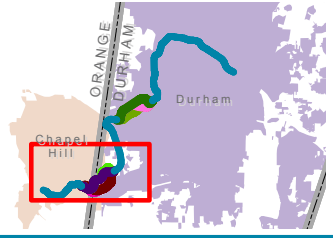
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 2,000 4,000 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



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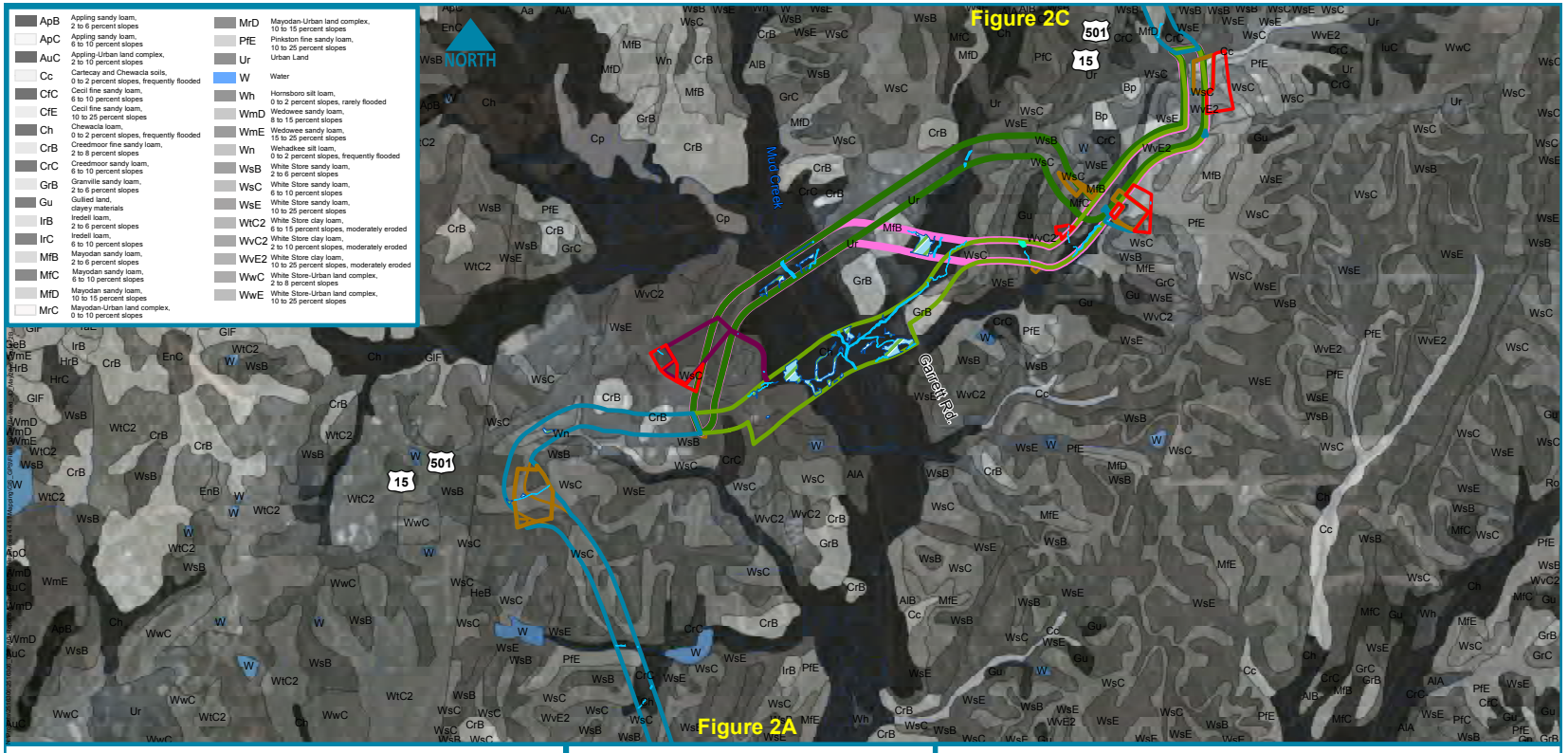

Water Resources - Figure 2B

DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 2,000 4,000 Feet

Draft
May 2015

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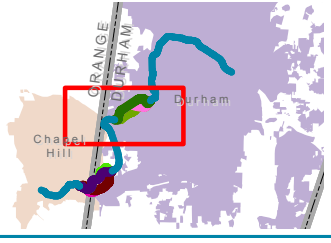

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Water Resources - Figure 2C

DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

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Draft
May 2015

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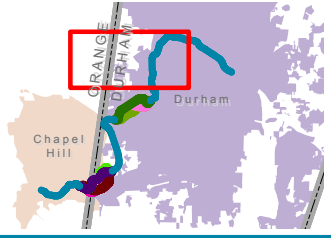

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Water Resources - Figure 2D

DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

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Draft
May 2015

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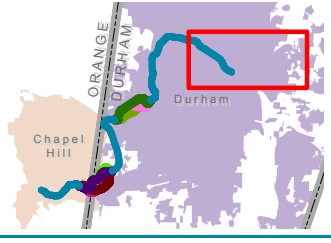

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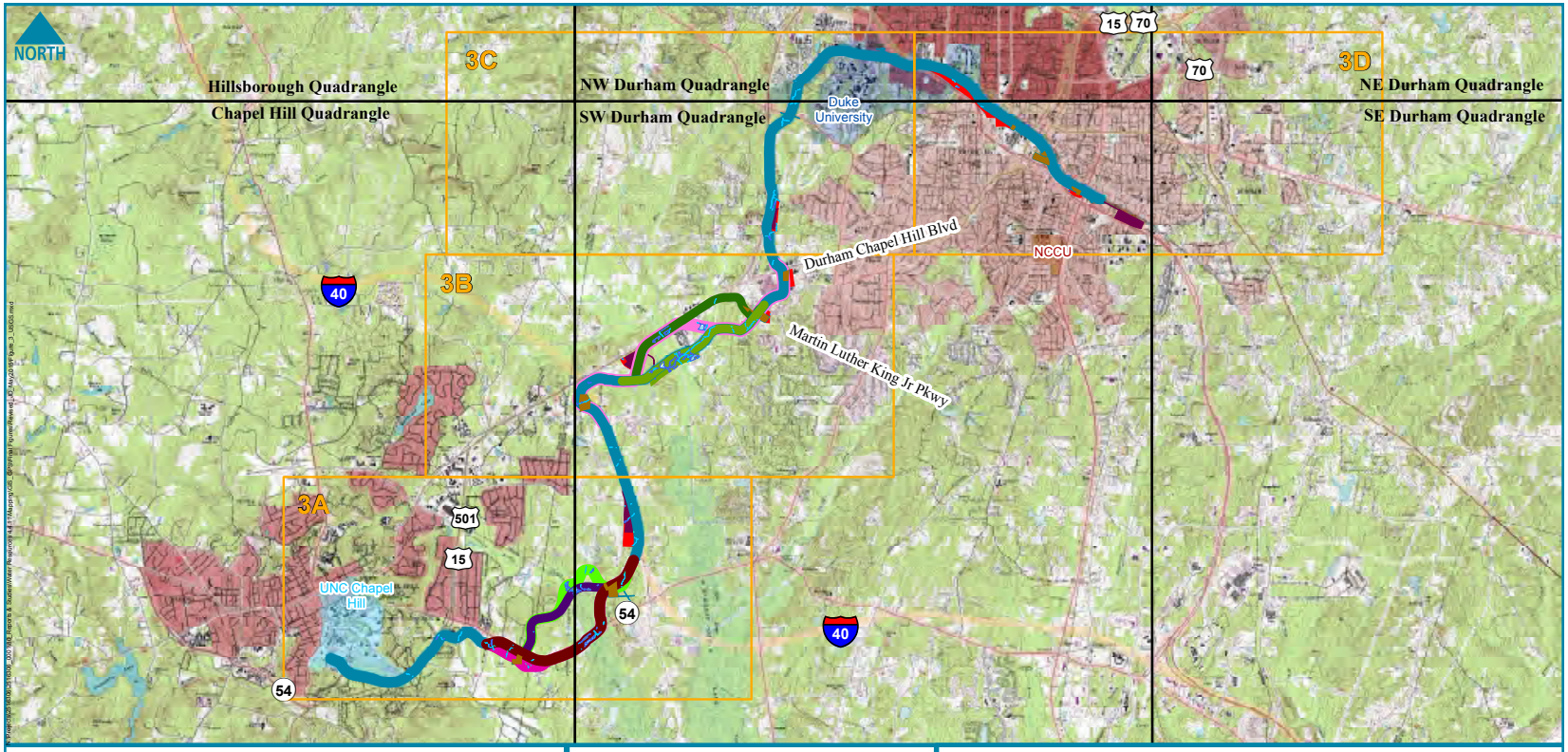

Water Resources - Figure 3

DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

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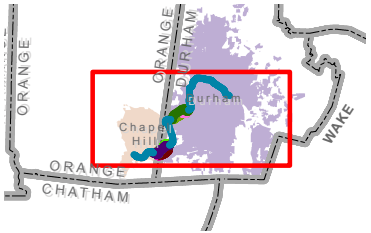
Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



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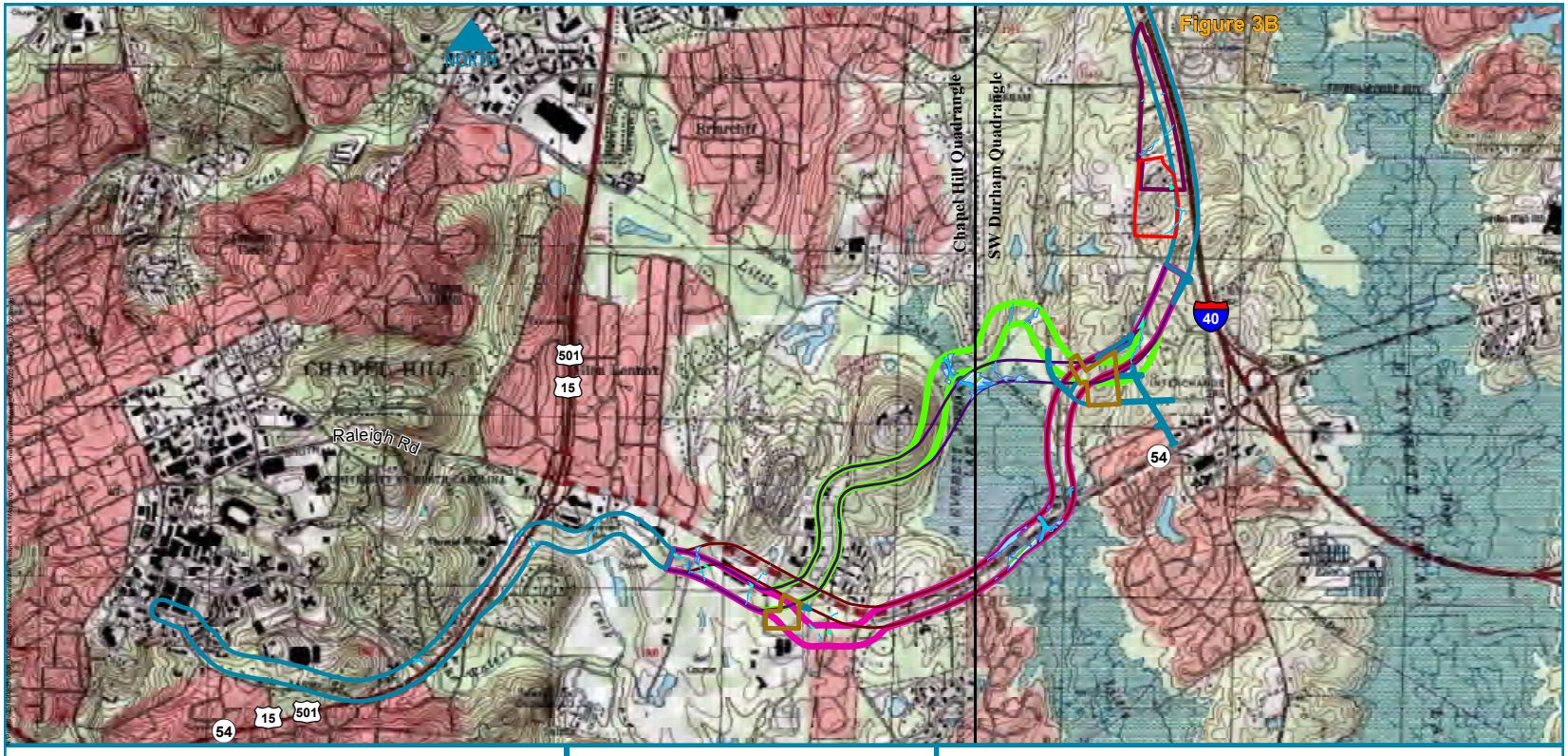

Water Resources - Figure 3A

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LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

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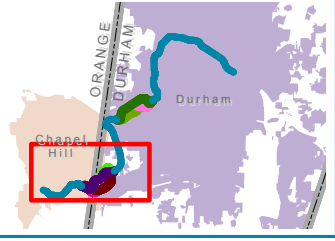

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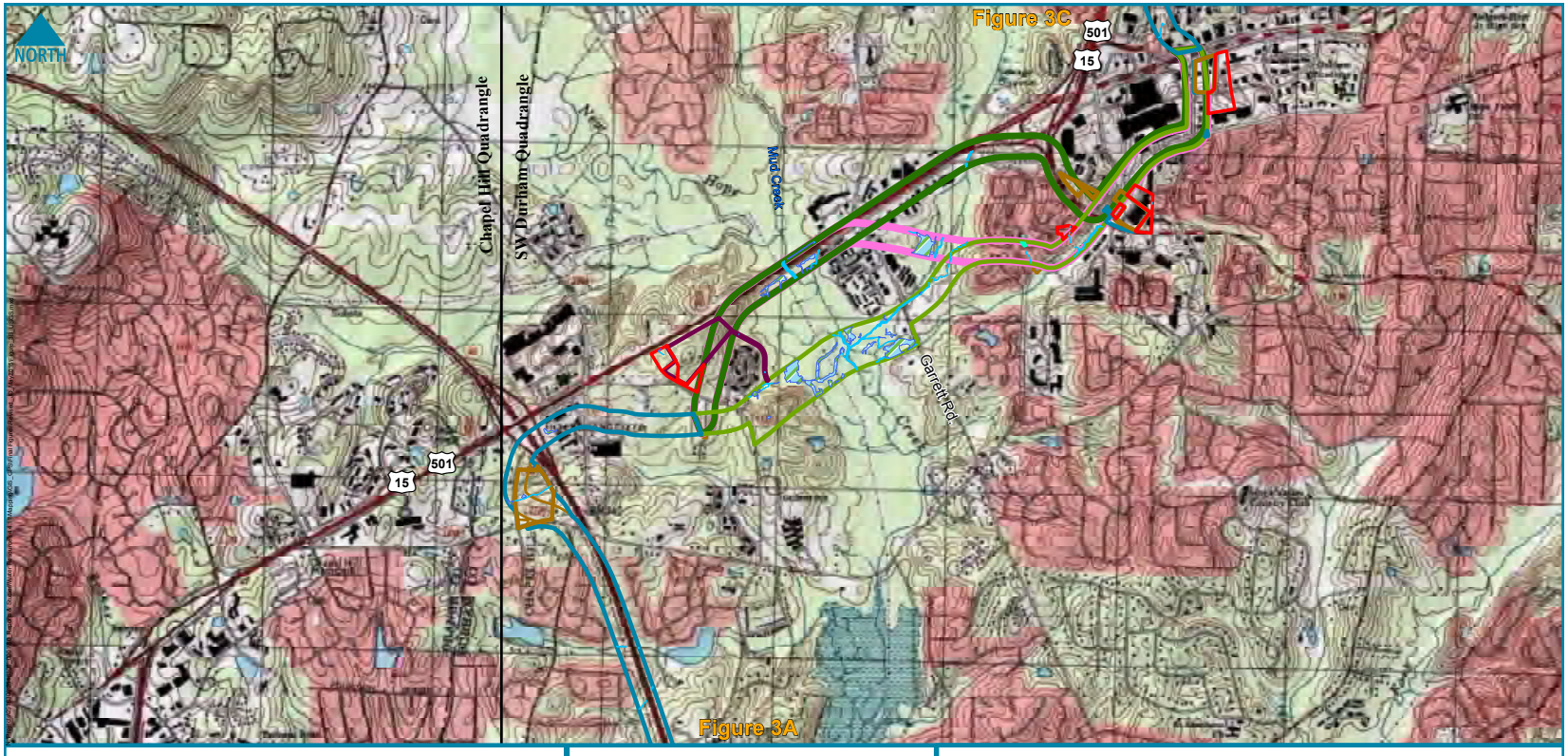


Water Resources - Figure 3B

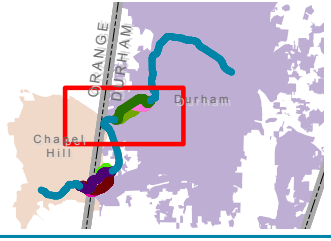
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

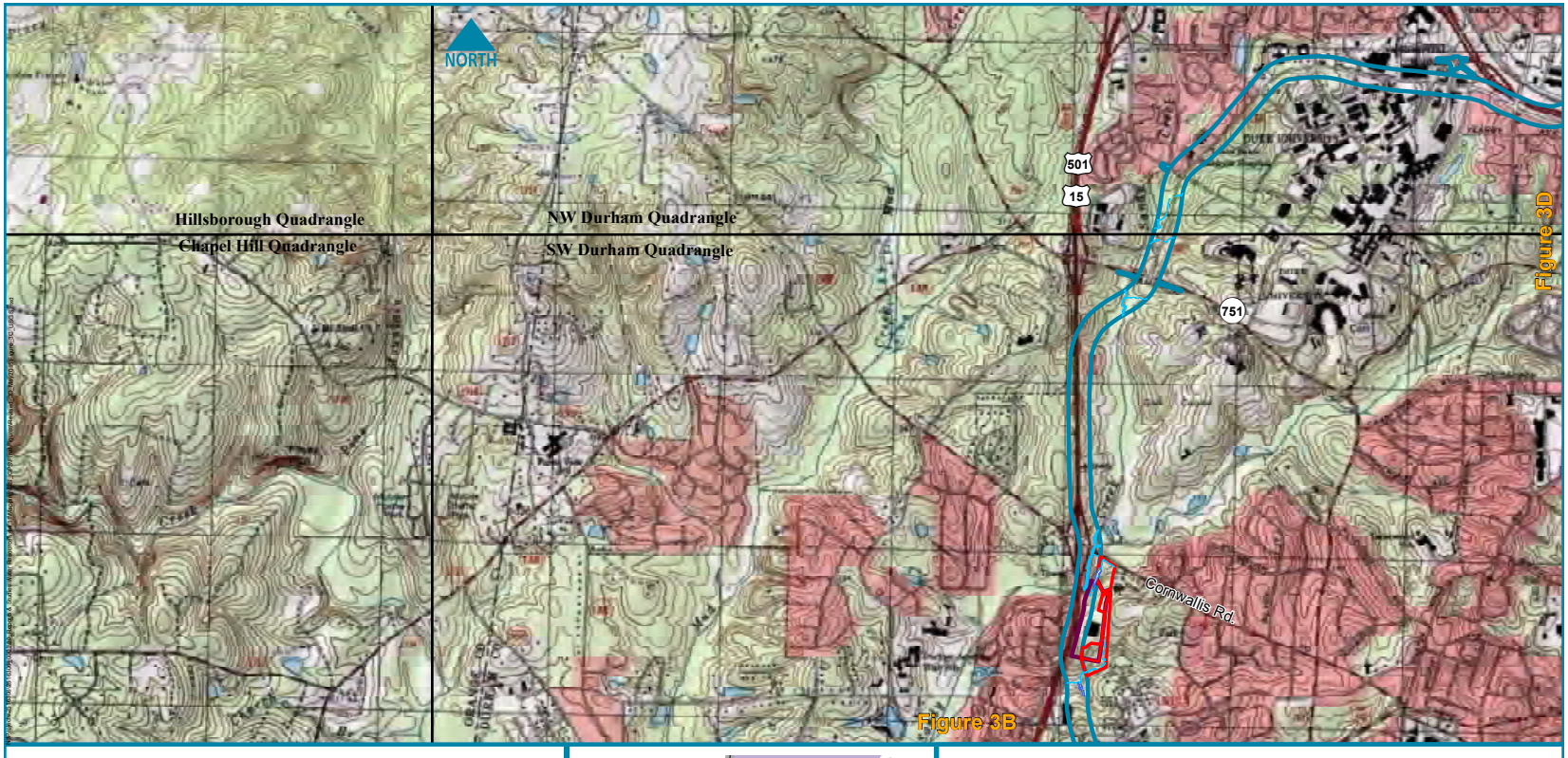
0 2,000 4,000 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond



Water Resources - Figure 3C

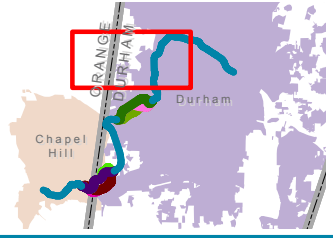
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

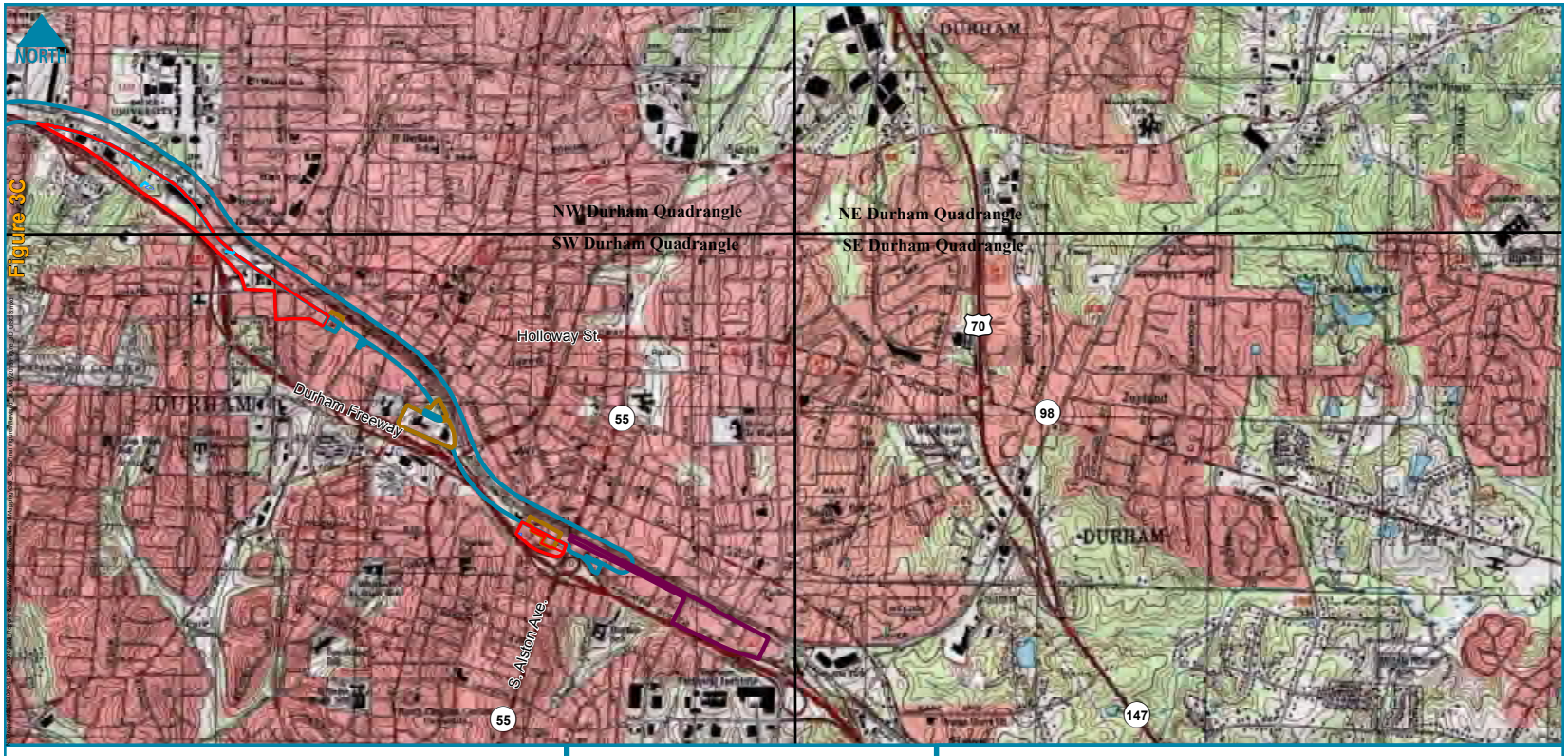
0 2,000 4,000 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond



Water Resources - Figure 3D

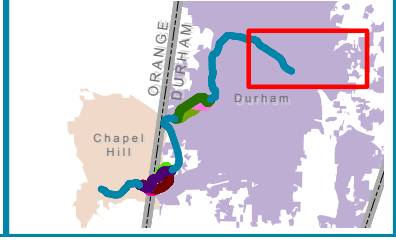
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

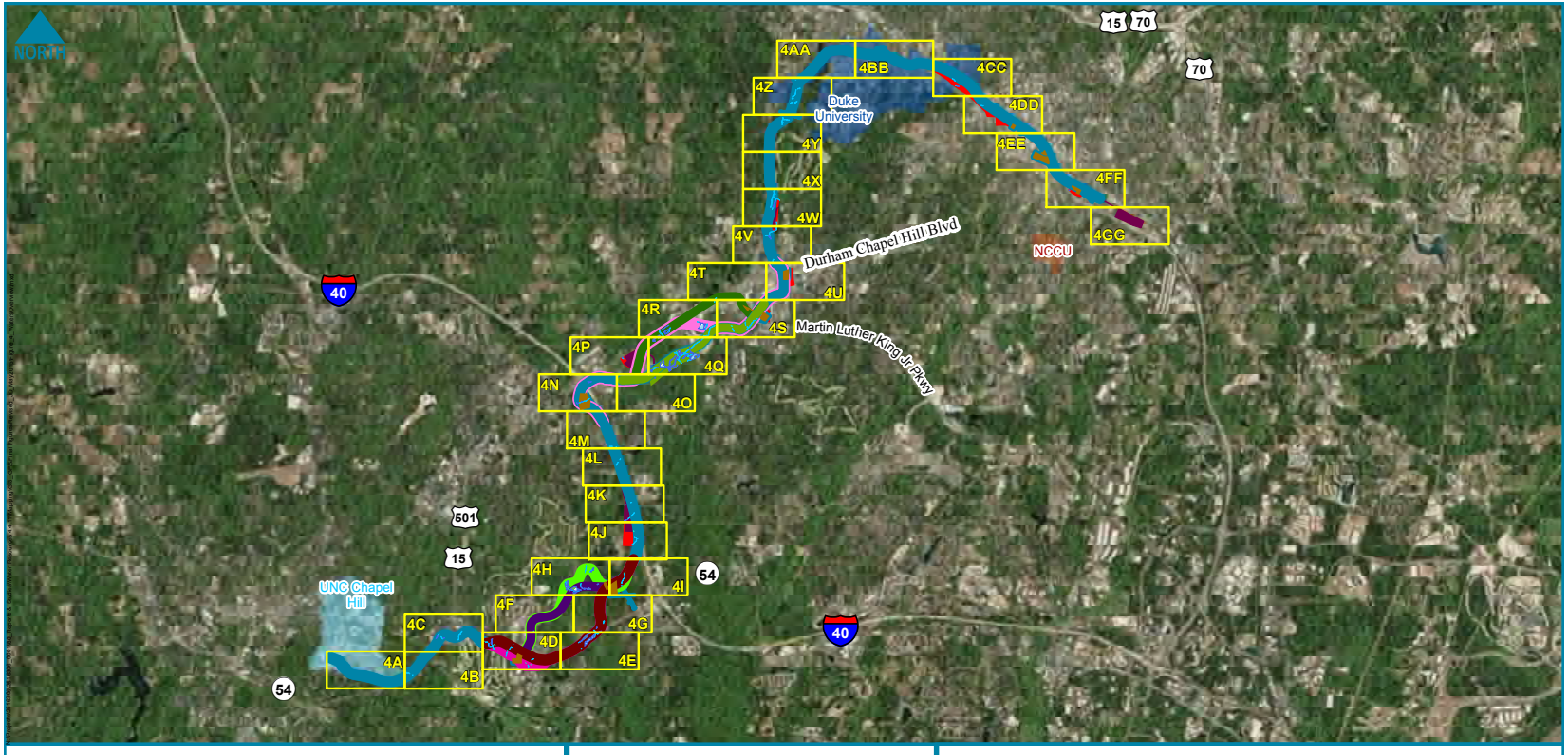
0 2,000 4,000 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond



Water Resources - Figure 4

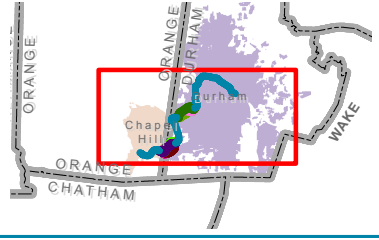
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 1 2 Miles

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Additional Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond

Water Resources - Figure 4A

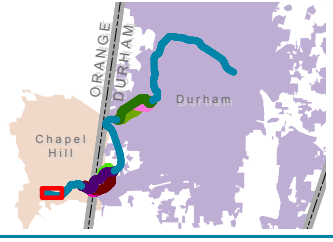
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond

Water Resources - Figure 4B

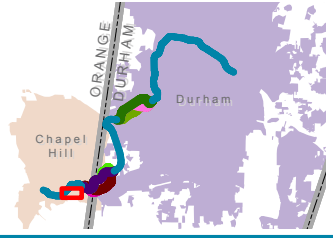
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond

Water Resources - Figure 4C

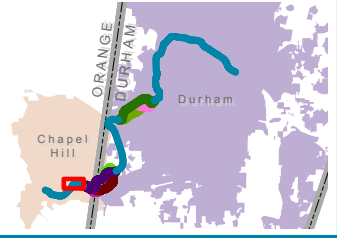
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond

Water Resources - Figure 4D

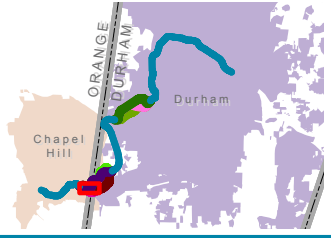
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

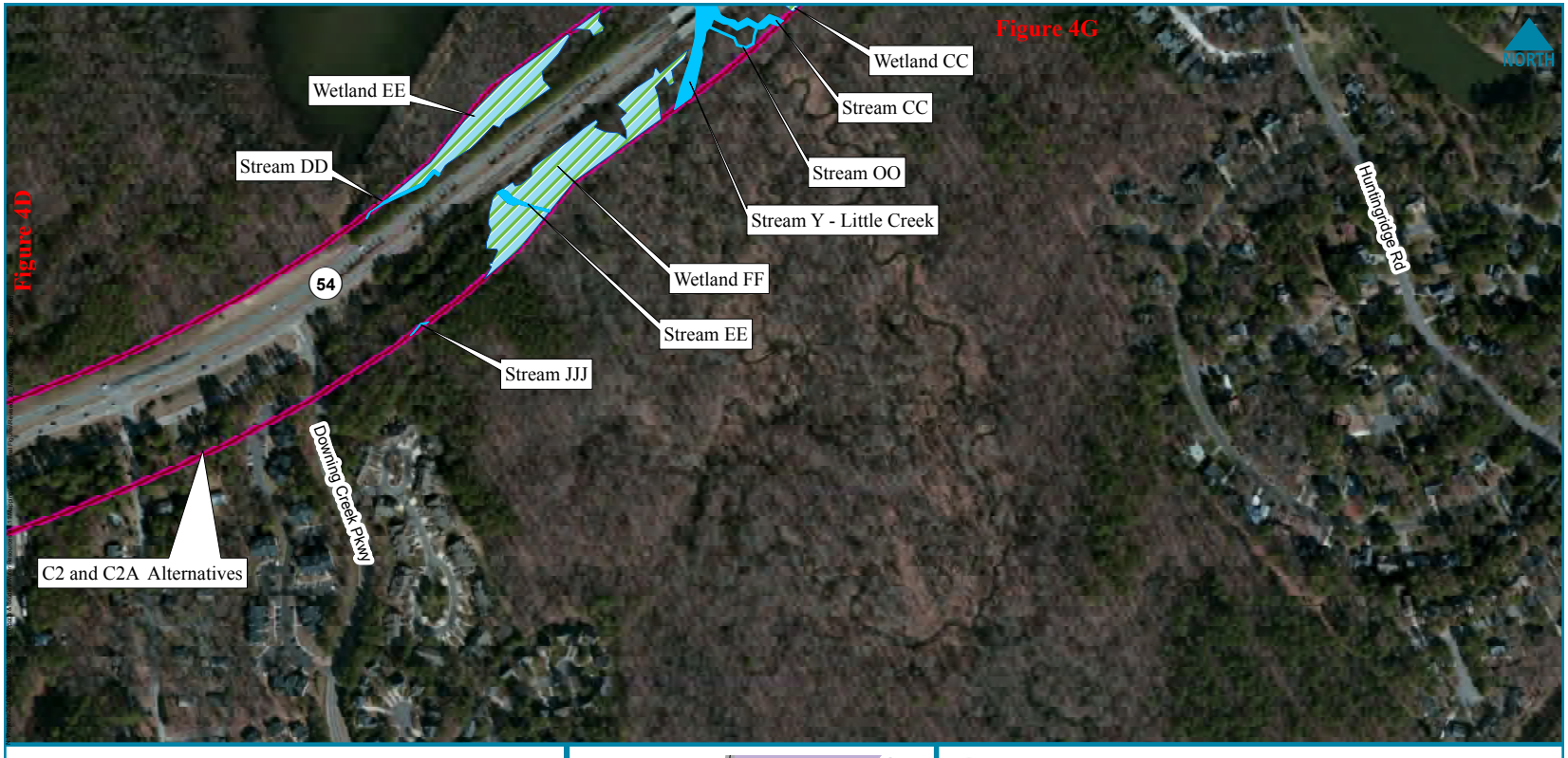
0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expandedl Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond



Water Resources - Figure 4E

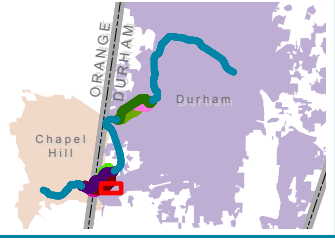
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

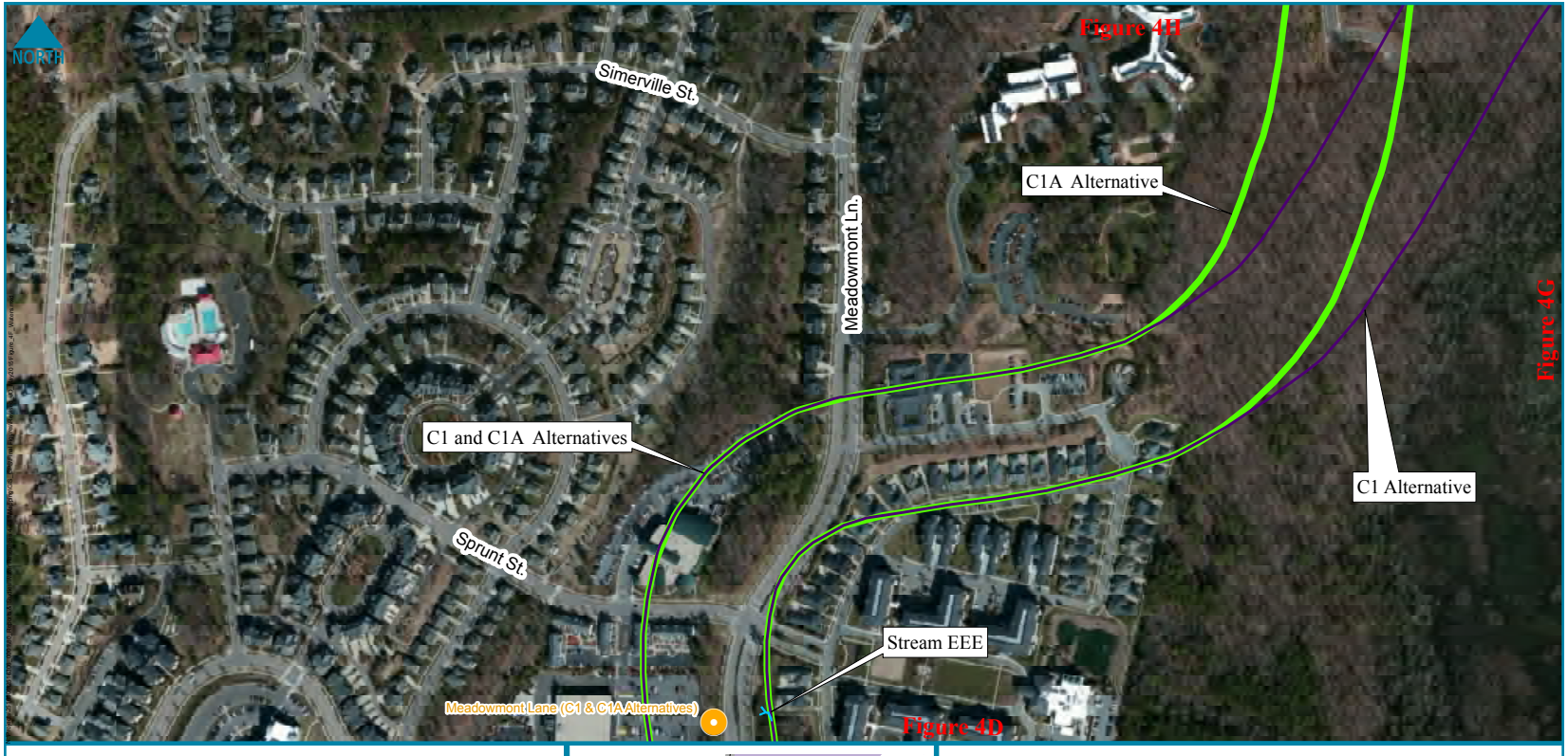
0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond



Water Resources - Figure 4F

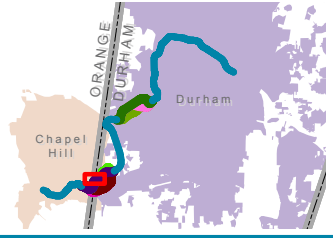
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond

Water Resources - Figure 4G

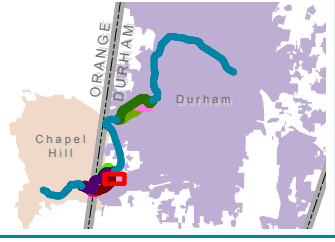
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

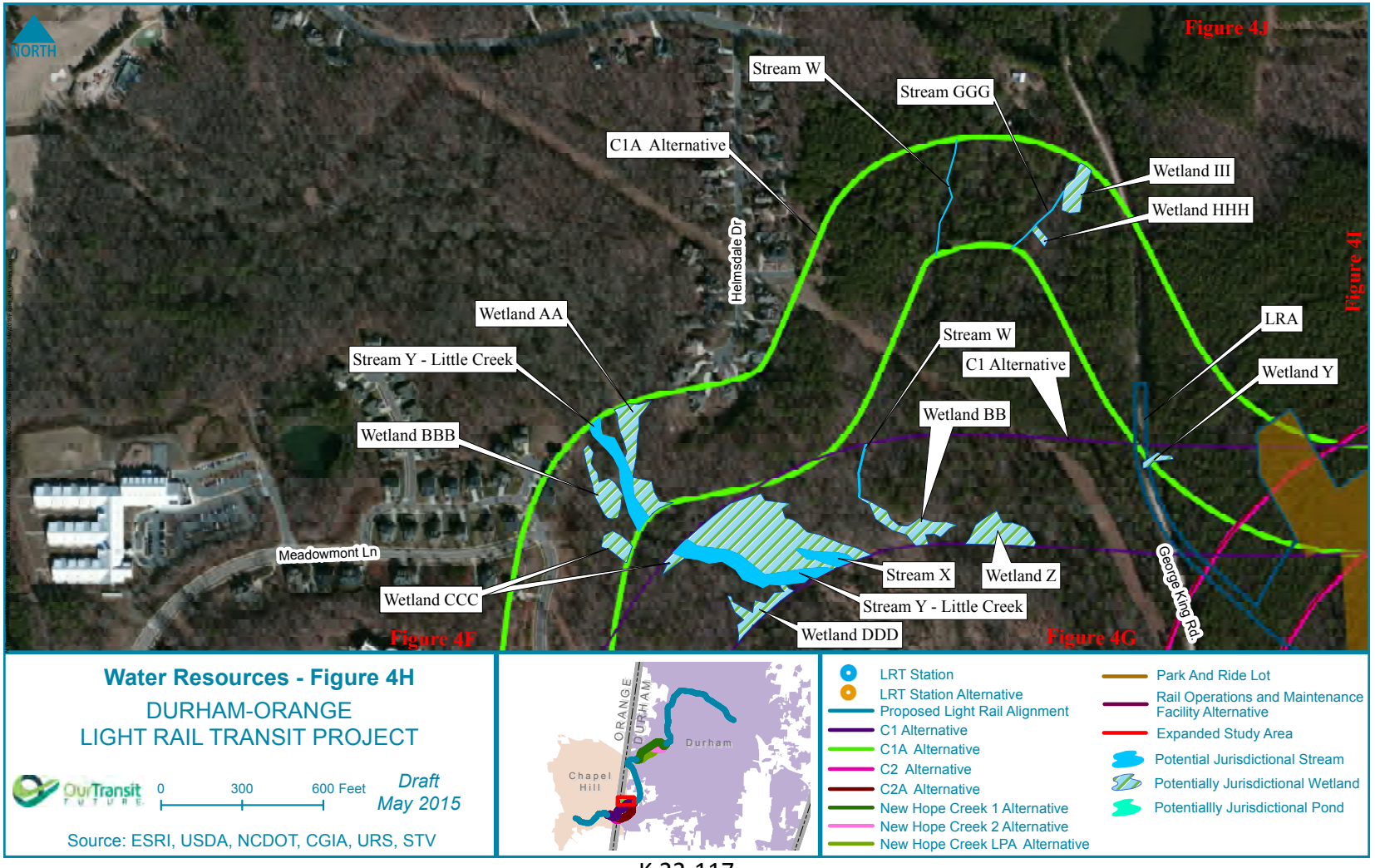
0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond



Water Resources - Figure 4H

DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV

- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond

Water Resources - Figure 4I

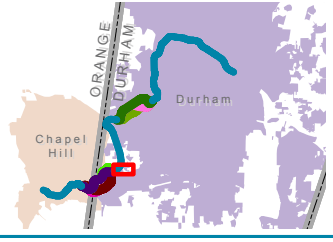
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond

Water Resources - Figure 4J

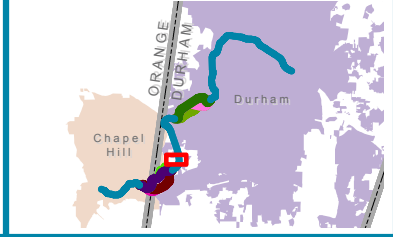
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

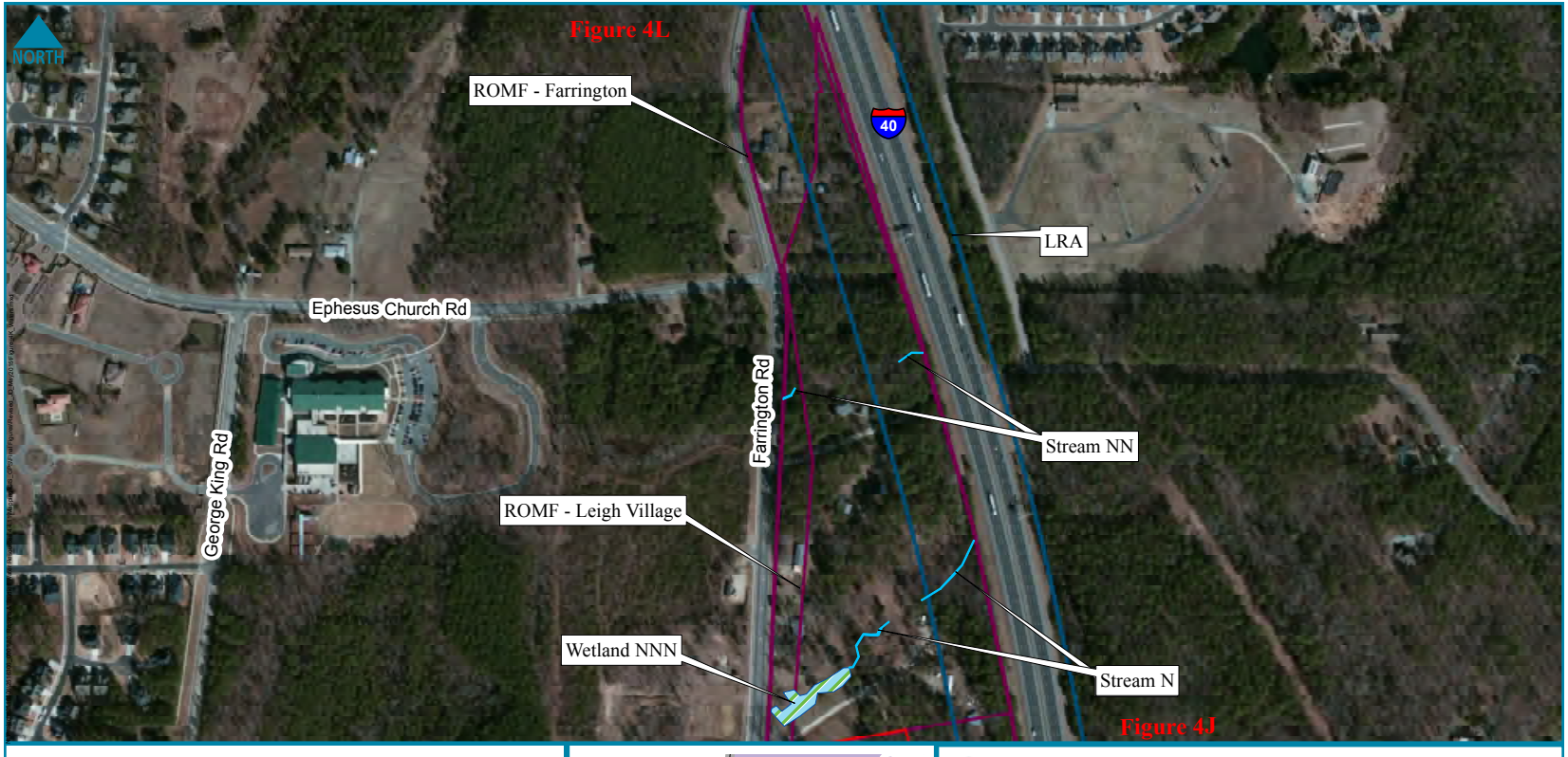
0 300 600 Feet

Draft
June 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond



Water Resources - Figure 4K

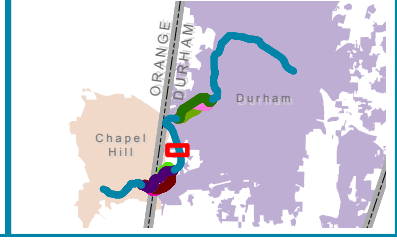
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond

Water Resources - Figure 4L

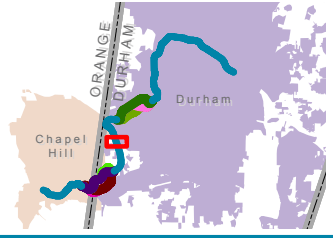
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond

Water Resources - Figure 4M

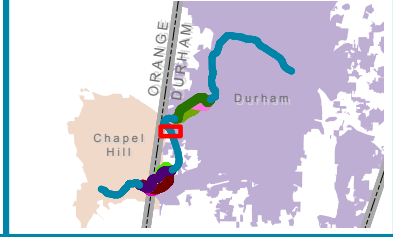
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond

Water Resources - Figure 4N

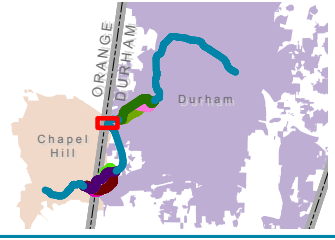
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

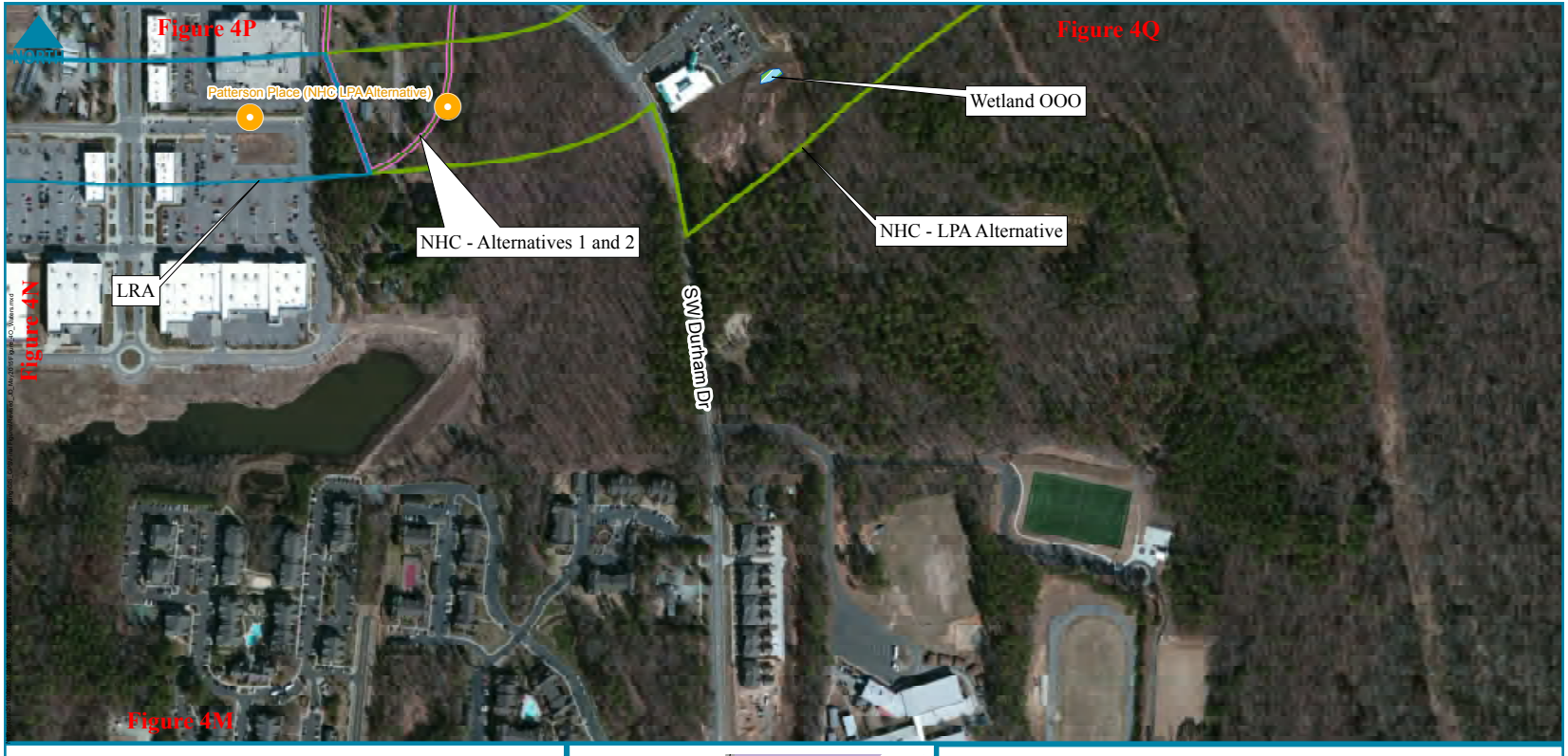
0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond



Water Resources - Figure 4O

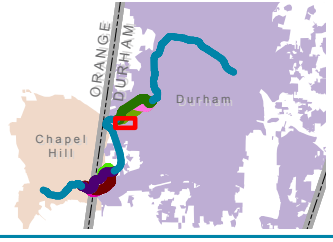
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond

Water Resources - Figure 4P

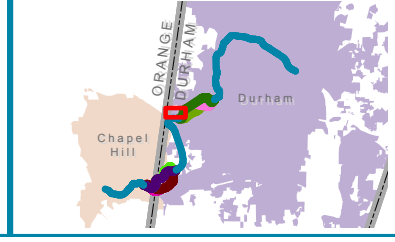
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond

Water Resources - Figure 4Q

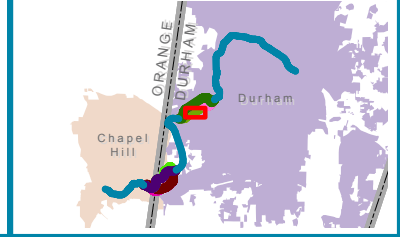
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

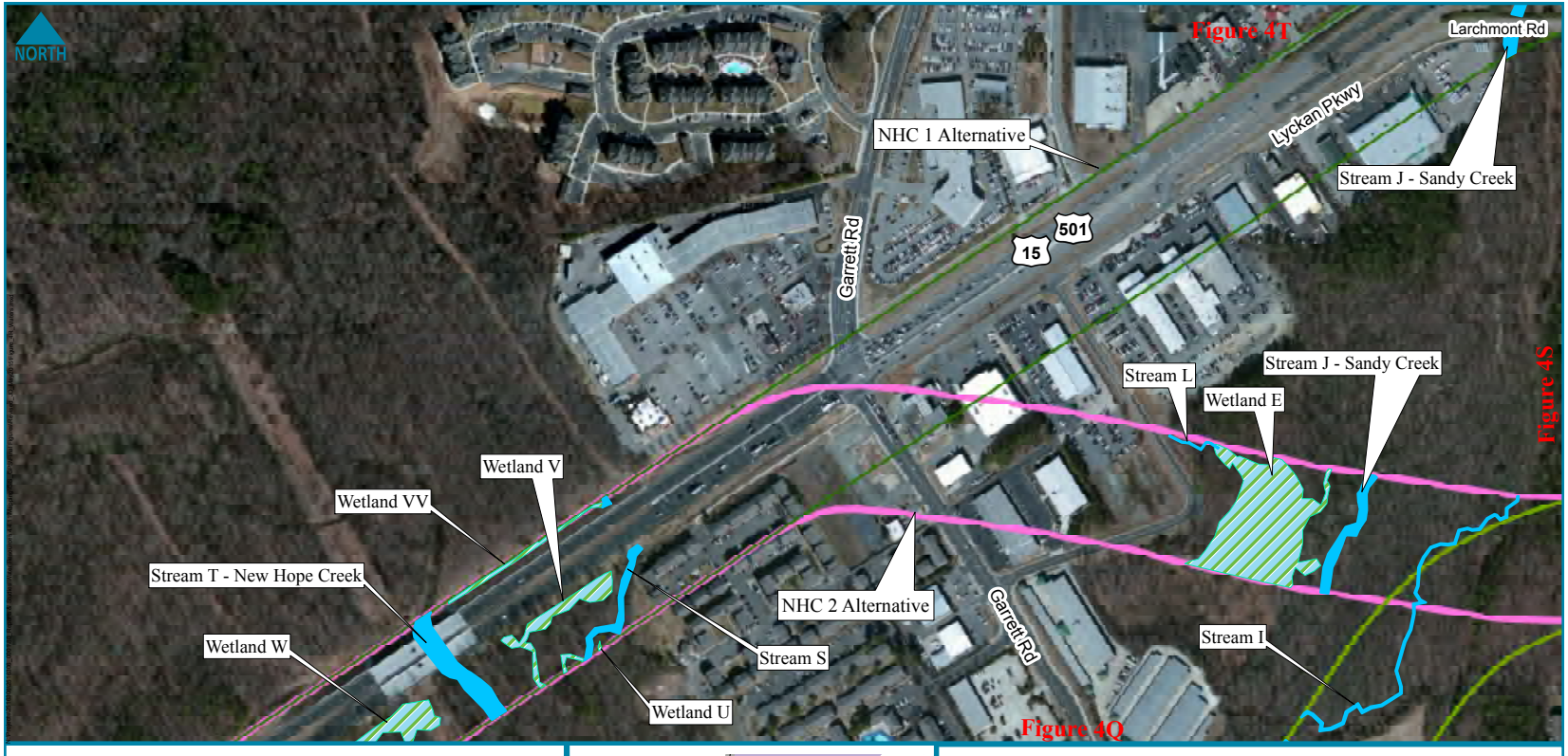
0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
- New Hope Creek LPA Alternative
- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
- Potential Jurisdictional Stream
- Potentially Jurisdictional Wetland
- Potentiallly Jurisdictional Pond



Water Resources - Figure 4R

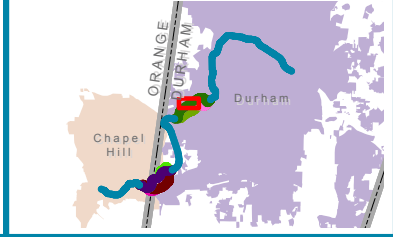
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
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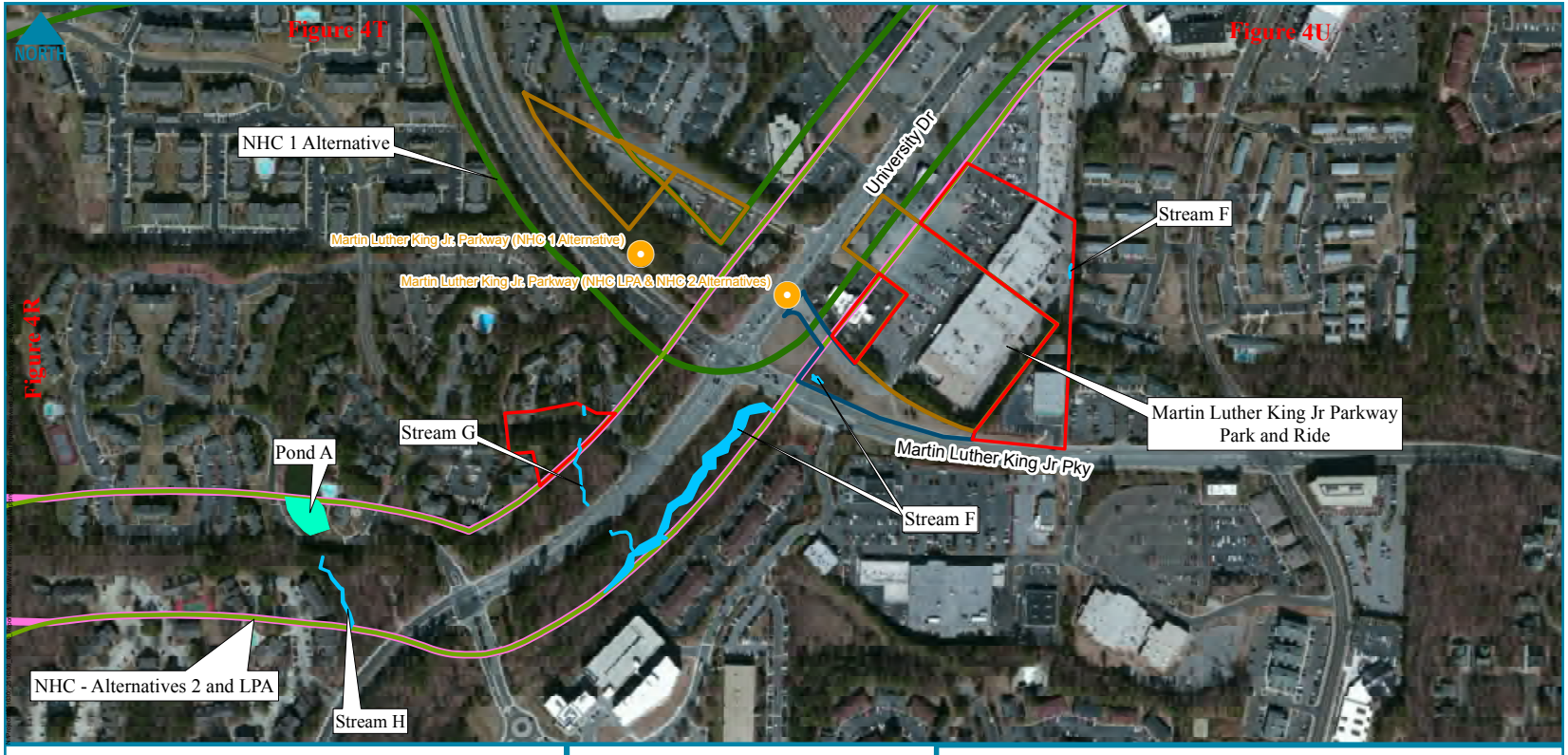


Water Resources - Figure 4S

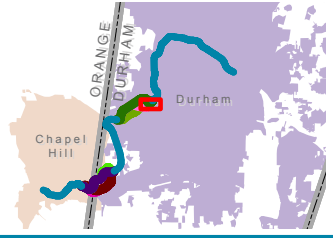
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
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Water Resources - Figure 4T

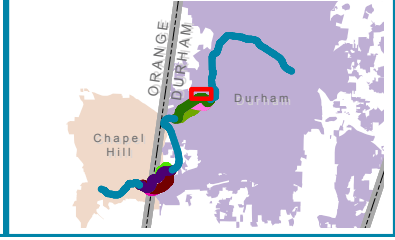
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
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- New Hope Creek 1 Alternative
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Water Resources - Figure 4U

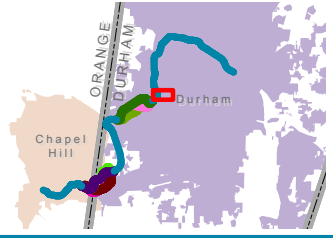
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
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- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
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Water Resources - Figure 4V

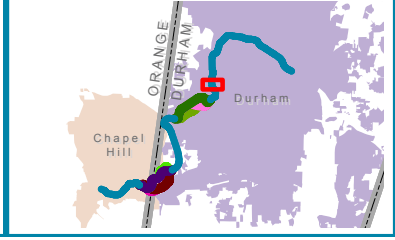
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
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- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
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Water Resources - Figure 4W

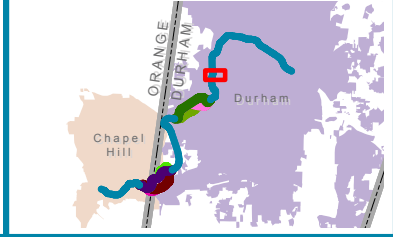
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
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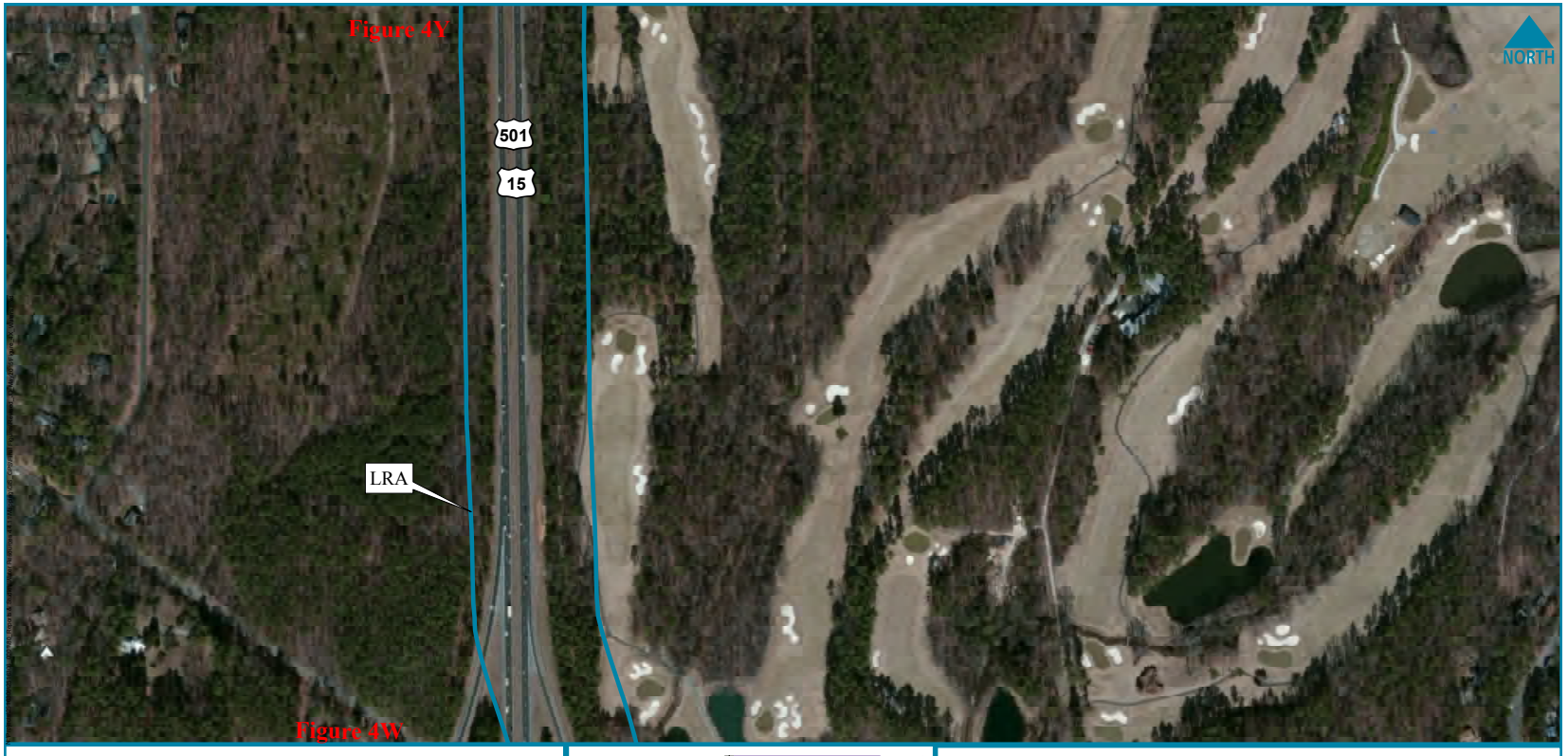


Water Resources - Figure 4X

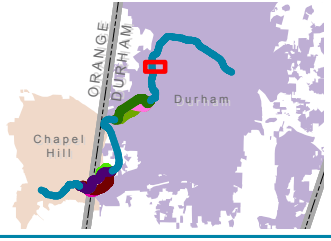
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
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- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
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Water Resources - Figure 4Y

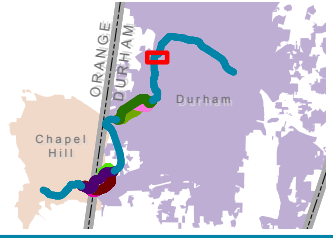
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



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- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
- New Hope Creek 1 Alternative
- New Hope Creek 2 Alternative
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- Park And Ride Lot
- Rail Operations and Maintenance Facility Alternative
- Expanded Study Area
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Water Resources - Figure 4Z

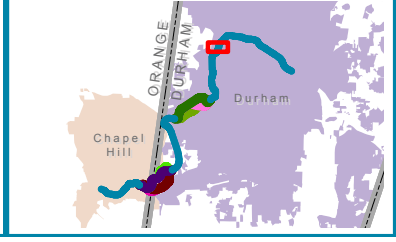
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



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- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
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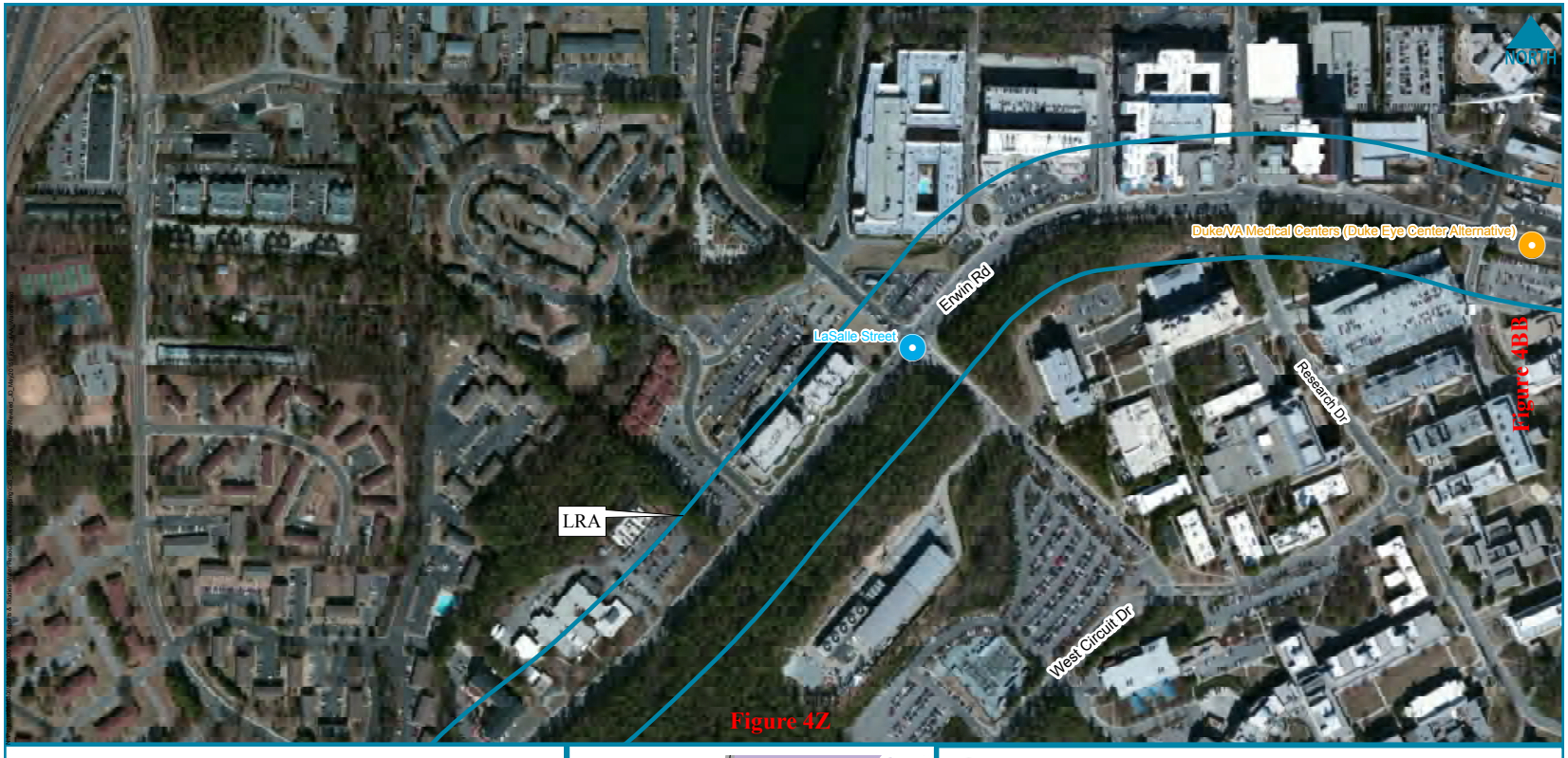


Water Resources - Figure 4AA

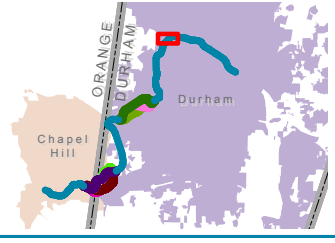
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



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- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
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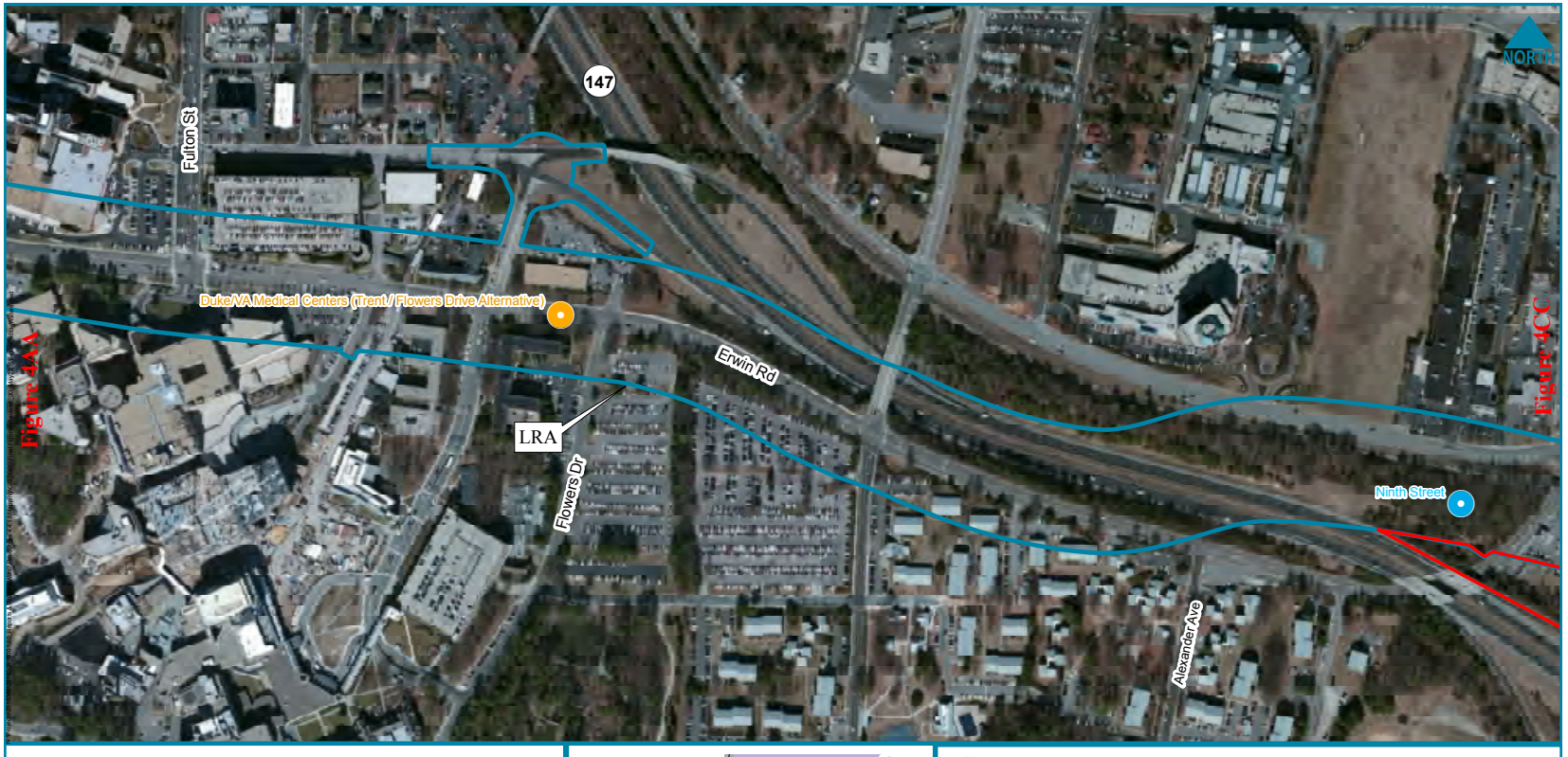


Water Resources - Figure 4BB

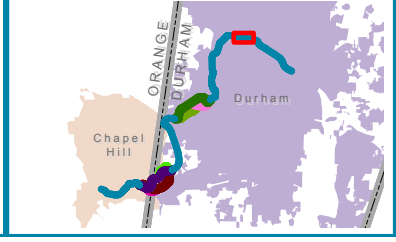
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



- LRT Station
- LRT Station Alternative
- Proposed Light Rail Alignment
- C1 Alternative
- C1A Alternative
- C2 Alternative
- C2A Alternative
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- New Hope Creek 2 Alternative
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Water Resources - Figure 4CC

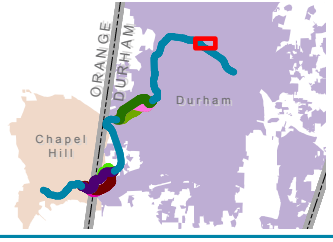
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
June 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



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- LRT Station Alternative
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- C1A Alternative
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Water Resources - Figure 4DD

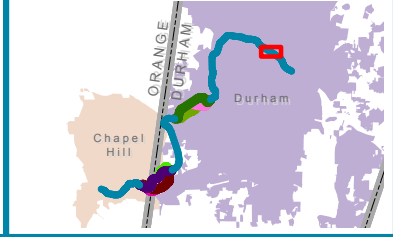
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



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Water Resources - Figure 4EE

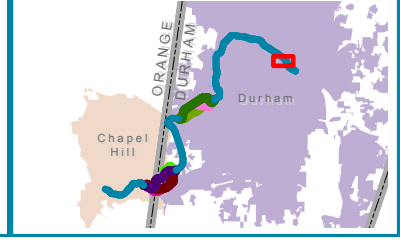
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



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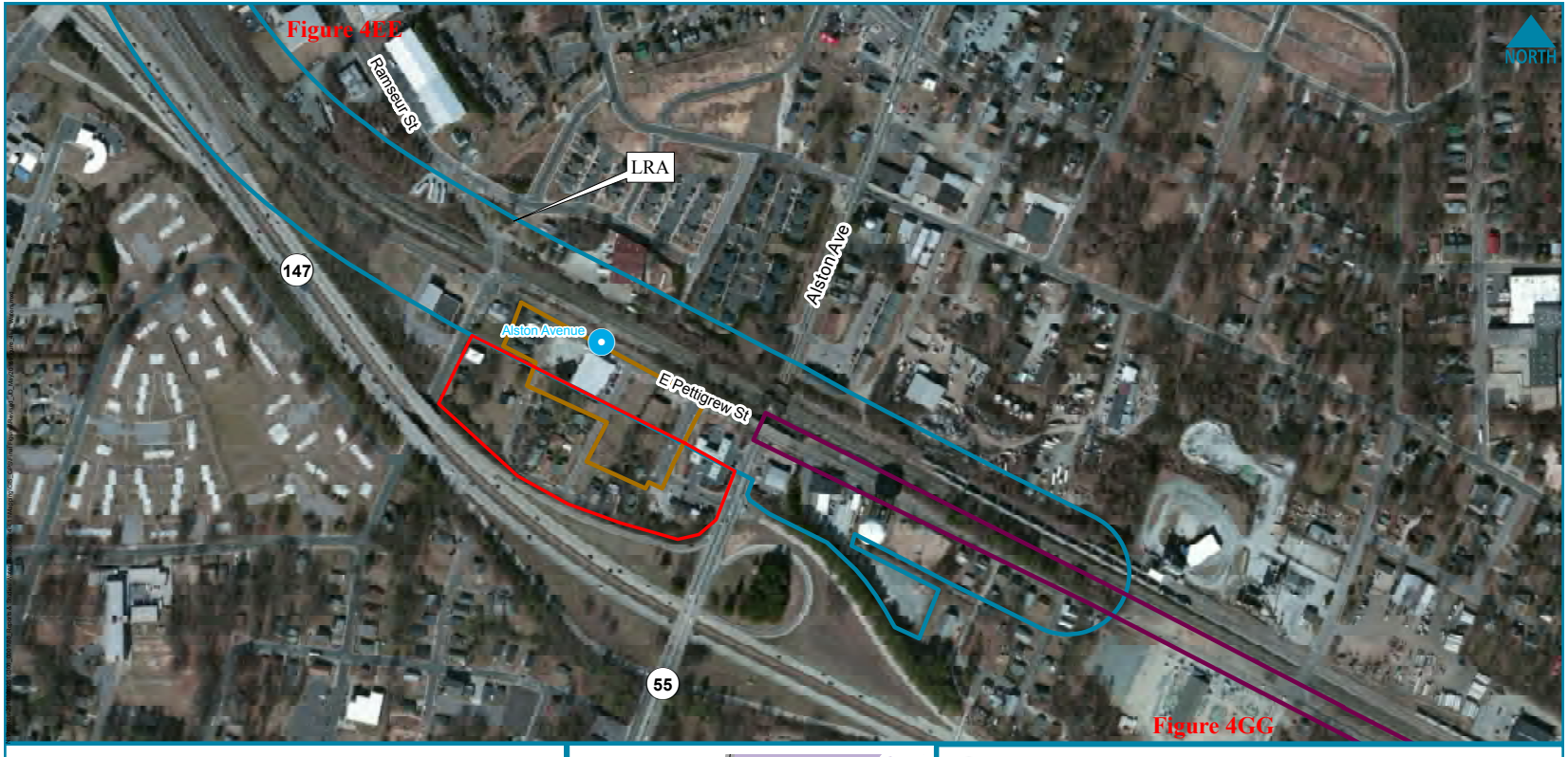


Water Resources - Figure 4FF

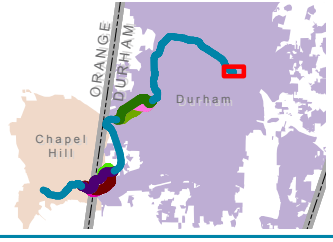
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



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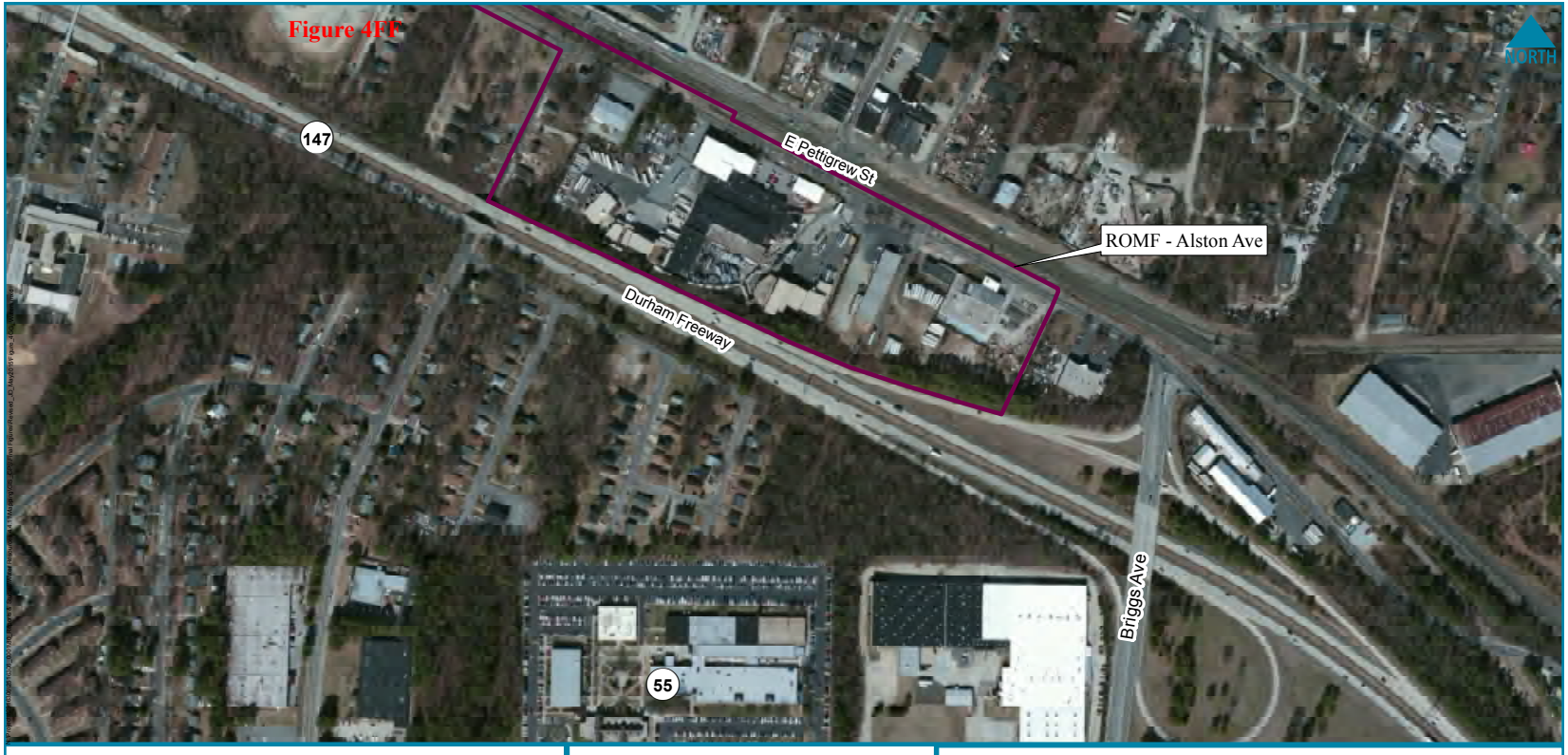


Water Resources - Figure 4GG

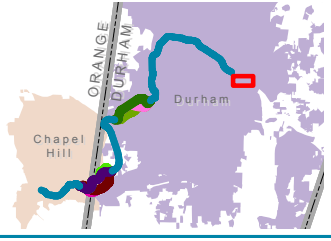
DURHAM-ORANGE
LIGHT RAIL TRANSIT PROJECT

OurTransit FUTURE

0 300 600 Feet

Draft
May 2015

Source: ESRI, USDA, NCDOT, CGIA, URS, STV



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Appendix C - Primary Scientist Resumes

Brandon Phillips

Senior Environmental Scientist

Mr. Phillips is a senior environmental scientist with 30 years of experience performing environmental studies and preparing compliance documents to meet local, state, and federal regulations, including NEPA and the Clean Water Act, Section 404 permit requirements. He has particular expertise in wetlands delineation, permitting, and mitigation, and the evaluation of impacts to rare, threatened, and endangered species. Mr. Phillips has also been responsible for discharge and spill prevention plans, Phase I site assessments, Phase II site sampling of hazardous materials, and hazardous waste management and disposal. He has appeared as an expert witness to provide testimony to support clients in the New York State Wetlands Appeals Court and multiple municipal hearings.

Firm
STV

Education
Bachelor of Science, Biology; Virginia Polytechnic Institute and State University

Certifications
North Carolina Department of Transportation (NCDOT) Wetland Assessment Method (WAM)

OSHA 40-hour HAZWOPER Certification

OSHA 8-hour HAZWOPER Refresher

Certified Hazardous Materials Manager

Contractor Rail Safety Certified: NJ TRANSIT, MTA/Metro-North Railroad, Norfolk Southern, CSXT

Professional Association of Diving Instructors/Open Water Scuba Diver

OSHA 10-hour Safety Training

Training
American Industrial Hygiene Association Training Course; Rutgers University

Project Experience

TT Durham-Orange LRT - Environmental Science Senior Manager
Conducting the natural resources evaluation and delineations of U.S. waters within the proposed 17.1-mile-long, $1.34 billion light rail corridor in Durham and Orange counties, NC, for Triangle Transit (TT). Mr. Phillips is preparing the Water Resources Technical Report, as well as the Water Resources sections of the EIS. He is also obtaining the jurisdictional determination for the streams and wetlands within the corridor. The project corridor, which has multiple alignments and station options, will connect major regional travel destinations that include Research Triangle Park, the University of North Carolina at Chapel Hill, and Duke University.

CATS LYNX Blue Line Extension - Environmental Science Senior Manager
Conducting the natural resources evaluation and delineations of U.S. waters within the proposed light rail extension corridor in Charlotte. Mr. Phillips is preparing the Natural Resources Technical Report, as well as the Natural Resources and Water Resources sections of the Environmental Impact Statement. He is also obtaining the jurisdictional determination for the streams and wetlands within the corridor and the Clean Water Act Section 404 Individual Permit. Mr. Phillips is currently assisting in regulatory compliance consulting.

NJ TRANSIT Hudson-Bergen Light Rail EIS - Environmental Scientist
Prepared the natural resources section of the Environmental Impact Statement (EIS) for a new light rail transit system along the Hudson River in Hudson and Bergen counties, NJ. Mr. Phillips completed a vegetation inventory and wildlife study for determination of the presence of rare, threatened, and endangered species within the proposed rail corridor. He identified areas where sensitive wildlife receptors were located and

recommended mitigation measures to ameliorate potential adverse impacts to wildlife. Mr. Phillips also performed rock face mapping for the geotechnical evaluation of the rail corridor.

Norfolk Southern Flowery Branch - Senior Environmental Specialist
Performing site investigation, wetlands delineations, jurisdictional determination, and permitting for the proposed culvert replacement of the Norfolk Southern rail line in Flowery Branch, GA. The project includes constructing new culverts to convey Flowery Branch Creek to Lake Lanier.

Norfolk Southern Lacy Siding - Senior Environmental Specialist
Conducted site investigation, wetlands delineations, jurisdictional determination, and permitting for the proposed double-tracking of the Norfolk Southern rail line in Jacksonville, FL. The project consisted of constructing 1.5 miles of track, including the construction of a new 186-foot, single-track bridge to carry this track over Six Mile Creek.

Norfolk Southern Ridgeville Siding - Senior Environmental Specialist
Conducted site investigations, wetlands delineations, and environmental permitting for the proposed double tracking of the Norfolk Southern rail line in Dorchester County, SC. The project consisted of constructing 11,000 feet of siding track.

MTA Capital Construction/LIRR East Side Access - Senior Environmental Specialist
Prepared site characterization reports for portions of Sunnyside Yard in Queens, NY, which will be developed for the $10 billion East Side Access project to establish Long Island Rail Road (LIRR) access to Manhattan's East Side, for the Metropolitan Transportation Authority (MTA). Mr. Phillips evaluated the laboratory results for soil and groundwater samples taken from proposed development footprints to assess the remediation required for various contaminants found in the project area.

NCDOT Division 11 Bridge Replacements - Environmental Science Senior Manager
Obtaining permitting for the replacement of multiple bridges in northwestern North Carolina for the North Carolina Department of Transportation (NCDOT) Division 11. The firm is responsible for all facets of Section 404/401 permitting and related environmental services, including the preparation of Natural Resource Technical Reports. Mr. Phillips is overseeing the completion of wetland delineations and the preparation of Clean Water Act Section 404/401 permit applications. The delineated boundaries of U.S. waters, including wetlands, are being located by using a hand-held GPS unit capable of subfoot accuracy. Results are being validated by a Professional Land Surveyor. Requests for jurisdictional determination are being prepared and will be submitted prior to the Section 404/401 permit applications. Key elements of the permit applications include a field review for protected species, impact avoidance and minimization measures, and a mitigation plan to compensate for U.S. water losses.

NCDOT Division 13 Bridge Replacements - Environmental Science Senior Manager
Obtaining Tennessee Valley Authority permits for multiple bridge replacement projects in western North Carolina for the North Carolina Department of Transportation (NCDOT) Division 13. Mr. Phillips is preparing permit applications as a subcontractor in cooperation with both NCDOT and the prime contractor.

NCDOT Division 10 Low-Impact Bridge Replacements (BD-5110) - Senior Environmental Specialist
Obtaining permitting for the replacement of multiple low-impact bridges in central North Carolina. STV is responsible for all facets of Section 404/401 permitting and related environmental services for this fast-paced project. STV's environmental scope includes the completion of wetland delineations and the preparation of Clean Water Act Section 404/401 permit applications. The delineated boundaries of U.S. waters, including wetlands, are located utilizing a hand-held GPS unit capable of subfoot accuracy. Requests for jurisdictional determination are being prepared and submitted as an attachment to the Section 404/401 permit applications. Key elements of the permit applications include a field review for protected species, impact avoidance and minimization measures, as well as a mitigation plan to compensate for U.S. water losses.

NYCT Lemon Creek Culvert Erosion Control Design and Environmental Permitting - Senior Environmental Specialist
Prepared the planting and restoration plans for the rehabilitation of the culvert over Lemon Creek on the Staten Island rapid transit line between Manee Avenue Bridge and Woodvale Avenue Bridge in Staten Island, NY. The culvert is an 80-foot, reinforced concrete arch in a regulated wetland. This project, which is part of a New York City Transit (NYCT) task order contract, includes completion of a field investigation and hydraulic analysis, design scour countermeasures, and environmental permitting.

SCDOT 10 D-B Bridges - Senior Environmental Specialist
Completed wetland delineations and collected field information to be used for the preparation of a natural resource technical memorandum for each bridge reviewed. The project entailed the replacement of 10 South Carolina bridges, five of which were field reviewed by Mr. Phillips. The delineated boundaries of waters of the U.S., including wetlands, were located utilizing a hand-held GPS unit capable of subfoot accuracy. He prepared requests for jurisdictional determination and submitted them to the U.S. Army Corps of Engineers Charleston District. Mr. Phillips also conducted a literature review of physical resources, such as physiography, topography, geology, soils, water resources and water quality, as well as biotic resources. He prepared a biological assessment for the protected species that may be located within the project areas and a determination as to the effect the project may have on the protected species identified.

Training (Cont'd.)

NJDEP Air Permitting Seminar; Rutgers University

Soil Erosion and Sediment Control NJDEP/SCS

Soil Conditions of Wetlands; Rutgers University

Lake Management; Rutgers University

Wetlands Systems of the Northeast; Rutgers University

Stormwater Wetlands Design - NC State University

Stream Restoration Design - NC State University

Memberships

Society of Wetland Scientists

Institute of Hazardous Materials Management

Academy of Hazardous Materials Management

North Carolina Association of Environmental Professionals

American Railway Engineering and Maintenance-of-Way Association (AREMA)

Norfolk Southern Proposed Roaring Fork Bridge Replacement - Senior Environmental Specialist
Provided environmental permitting services for the $5 million, single-track replacement bridge over the Roaring Fork in Wise County, VA. Mr. Phillips performed field investigations and assessments, providing information to contractors during the job showing, and prepared the permit application.

CSXT Iona Island Bridge Replacement - Senior Environmental Specialist
Performed wetlands permitting for this railway bridge replacement in Rockland County, NY. Mr. Phillips coordinated with the New York State Department of Environmental Conservation to determine wetland boundaries and impacts.

CSXT Mahoning River Bridge Replacement - Senior Environmental Specialist
Provided environmental permitting services for a $15 million, 490-foot, double-track replacement bridge over the Mahoning River in Youngstown, OH. Mr. Phillips performed field investigations and assessments, providing information to contractors during the job showing, and prepared the permit application.

CMS Steele Creek Middle School - Senior Environmental Specialist
Provided wetland delineations and stream assessments on a potential parcel for the Charlotte Mecklenburg School (CMS) District's proposed Steele Creek Middle School in Charlotte. Mr. Phillips met with U.S. Army Corps of Engineers (USACE) on site to confirm the wetland boundaries and stream classifications. He also submitted the jurisdictional determination request to the USACE.

College of St. Elizabeth Wetland Restoration - Senior Environmental Scientist
Managed and performed the delineation of contaminated on-site wetlands to determine regulatory constraints for remediation of coal tar contamination within an open water/wetland system at this college in Convent Station, NJ. Mr. Phillips prepared permit applications and received permits for remediation within jurisdictional areas. He performed remediation of the open water/wetland system followed by full restoration of the open water/wetland system.

PPL Lock Haven Substation - Environmental Science Senior Manager
Evaluating the streams on the site of the proposed PPL electric substation switchyard project in Lock Haven, PA. Mr. Phillips is collecting data on stream morphology and benthic fauna. As part of the Clean Water Act permit, he is also preparing the stream relocation mitigation design, routing the on-site streams around the proposed substation pad on Bald Eagle mountain.

Pacific Power & Electricity Arthur Kill Energy Pipeline - Environmental Project Manager

Identified environmental impacts and constraints for the layout and design of a fuel pipeline under the Arthur Kill between Staten Island, NY, and Elizabeth, NJ. Mr. Phillips provided wetlands delineations for the freshwater and tidal marsh wetlands located within the project corridor. He also identified the presence of an endangered species habitat in the area and provided habitat assessment.

Statoil Energy JFK International Environmental Compliance Manual - Consultant

Prepared an all-encompassing environmental assessment and compliance manual for the cogeneration (power plant) facility at JFK International Airport in Jamaica, NY. Mr. Phillips identified federal, state, and local environmental regulations applicable to the operation of the cogeneration facility, prepared an inventory of all hazardous materials used at the facility for SARA 313 reporting, and outlined the regulatory compliance requirements. He prepared a manual that was easy to use by all employees that included the identification of toxic substances used at the facility, the health dangers associated with these substances, contact information for response contractors and regulators, and emergency procedures to implement in cases of terrorism or disasters.

PTC Mitigation - Senior Environmental Specialist

Preparing the mitigation plan for the proposed widening of the Pennsylvania Turnpike in Chester County, PA. The Pennsylvania Turnpike Commission (PTC) is proposing the widening and reconstruction of a section of the turnpike, including a 6-mile section consisting of three 12-foot lanes of pavement on each side of a 26-foot wide median and paved outside 12-foot shoulders. Valley Creek, tributaries to Valley Creek, and the West and East Branch of Trout Creek will be affected by the construction.

City of Greensboro Ballinger Road Bridge and East Cone Boulevard Extension - Senior Environmental Specialist

Preparing the jurisdictional determination requests and nationwide permit applications for the East Cone Boulevard extension and Ballinger Road bridge improvement projects in Greensboro, NC. Mr. Phillips is also preparing the mitigation plan for the Ballinger Road bridge replacement and obtained the jurisdictional determination and nationwide permit.

SCDOT I-526 Extension (Mark Clark Expressway) EIS - Senior Environmental Specialist

Conducting the natural resources and waters resources field review efforts associated with the Environmental Impact Statement (EIS) for the I-526 extension project in Charleston County, SC. Mr. Phillips is conducting field investigations in cooperation with the U.S. Army Corps of Engineers (USACE) Charleston District and performing field data collection. Additionally, Mr. Phillips is authoring related sections of the EIS document being prepared for NEPA compliance. The extension of I-526 project

involves a study area encompassing an estimated 934 acres and will potentially include approximately seven miles of new roadway and two large bridges over the Stono River. The estimated $489 million roadway extension has been a high profile project since the 1970s and presents both engineering and environmental challenges. Key issues that Mr. Phillips is addressing in the EIS include impacts to U.S. waters, including, tidal and freshwater wetlands, protected species, essential fish habitat, and floodplains. Mr. Phillips is authoring portions of the Natural Resources Technical Memorandum that was developed pursuant to SCDOT guidelines as a precursor to the EIS. Field efforts include ground-truthing and performing wetland delineations on seven potential new location build alternatives, with each corridor extending approximately seven miles. He is participating in the preparation of the Section 404 Individual Permit application, as well as the request for jurisdiction determination and wetland and stream mitigation requirements.

NCDOT US 21 and Gilead Road Intersection Improvements (U-5114) - Environmental Task Manager

Provided environmental services that included preparation of a Natural Resources Technical Report, threatened and endangered species surveys and studies, ecological and biotic community studies and classification, wetland and stream delineation, and a request for jurisdictional determination for the North Carolina Department of Transportation (NCDOT) in Huntersville, NC. Mr. Phillips will also be responsible for preparing a Section 404/401 permit application for this project.

York County Fort Mill Southern Bypass - Senior Environmental Specialist

Obtained the Clean Water Act Section 404/401 permitting associated with the proposed 4.5-mile, non-controlled access facility in Fort Mill, SC. Mr. Phillips performed the environmental review of the existing natural resources within the project study area and authored the Natural Resources Technical Memorandum. He conducted protected species surveys that identified populations of Schweinitz's sunflower (*Helianthus schweinitzii*) in the study area, resulting in a formal Section 7 consultation between the FHWA and the U.S. Fish and Wildlife Service. Mr. Phillips participated in and conducted oversight of the relocation of sunflower populations from the project corridor to a nature preserve pursuant to the conditions of the Service's Biological Opinion. Services also included the delineation of jurisdictional waters of the U.S.; the submittal of a Request for Jurisdictional Determination package to the U.S. Army Corps of Engineers (USACE); and the preparation of a Clean Water Act Section 404 Individual Permit to the USACE on behalf of the county, including a compensatory mitigation plan that required the coordination with multiple mitigation banks. Mitigation coordination for the Fort Mill Southern Bypass included the preparation of a "Request for Bids" notice that was placed in the SC Business Opportunities newsletter on behalf of York County. This notice requested mitigation credit pricing from area

mitigation banks for providing mitigation credits required for four roadway projects to be constructed by York County. Mr. Phillips coordinated the opening of bids and the evaluation of the mitigation offers. He prepared recommendations to York County on which mitigation credits should be used for the roadway projects.

NCDOT Widening of I-485 from I-77 to Rea Road (R-4902) - Senior Environmental Scientist

Provided environmental services associated with widening I-485 (Charlotte Outer Loop) south of Charlotte from I-77 to SR 3642 (Rea Road) in Mecklenburg County, NC, for the North Carolina Department of Transportation (NCDOT). Mr. Phillips assisted in the preparation and submittal of a Section 404 nationwide permit application in which the U.S. Army Corps of Engineers permit was issued ahead of schedule and a permit modification was subsequently submitted to capture temporary stream impacts associated with installation of a work trestle. He also conducted monthly compliance inspections during construction.

SCDOT Carolina Bays Parkway Extension - Senior Environmental Specialist

Performed an environmental review of the proposed extension of Carolina Bays Parkway in Horry County, SC, including documentation of existing natural resources within the project study area. Mr. Phillips reviewed approximately 4 miles of new roadway from SC 544 to SC 707. He also prepared a Natural Resources Technical Memorandum that documents existing natural resources, including wetlands, water resources, plant communities, and protected species within the project study area.

City of High Point Hartley Drive Extension and Widening - Senior Environmental Specialist

Conducted site investigations, wetlands delineations, jurisdictional determination, and wetlands mitigation and permitting for the proposed extension and widening of Hartley Drive in High Point, NC. The project included subsurface exploration for approximately 5,300 feet of roadway traversing undeveloped, wooded, hilly terrain, and a 3-span bridge over a creek.

SCDOT SC 5 Violations and Restoration - Senior Environmental Specialist

Evaluated the sediment and erosion control violations that occurred during the widening and improvement of SC 5 in York, SC. A failure of the sediment and erosion control measures surrounding the project area allowed the migration of sediments off-site into natural areas that were not part of the proposed construction site. Mr. Phillips reviewed the areas affected as identified by the SCDOT and evaluated the conditions to determine a restoration plan. He prepared the resolution agreement between Boggs Paving, Inc., SCDOT, and the U.S. Army Corps of Engineers and developed a monitoring plan to be implemented.

U.S. Army Material Command Advanced Explosives Production EA - Project Manager
Managed the evaluation and Environmental Assessment (EA) of the proposed advanced explosives production facility at the Picatinny Arsenal in New Jersey. As part of a Department of Defense contract, Mr. Phillips determined environmental impacts to area flora and fauna that would be incurred by the development of a new energy production facility within an area known for supporting rare, threatened, and endangered species. He identified species within the production area and determined mitigation measures to reduce impacts.

Carolina Craftsman NC 42 East Residential Development - Senior Environmental Specialist
Obtained wetlands permitting for the construction of approximately 400 houses in a residential development in Johnston County, NC.

Centex Homes EIS - Project Manager
Prepared an Environmental Impact Statement (EIS) for a proposed residential subdivision on a former agricultural area in Indian Hill, NY. Mr. Phillips documented the animal and plant species on the site and determined if any rare, threatened, or endangered species would be affected by the project. He also provided wetland delineation and mapping, prepared wetlands permitting, and developed required wetland mitigation plans.

NYCT Charleston Bus Annex Tidal Wetlands Permit - Senior Environmental Specialist
Developed the planting and restoration plans for the construction of a new bus annex in Staten Island, NY, that included wetlands and state-regulated areas for New York City Transit (NYCT). The project also included a new stormwater line and outfall that discharged to the Arthur Kill River. Mr. Phillips created wetland restoration plans for submittal to the New York State Department of Environmental Conservation.

City of Charlotte Beckwith-Meadow Storm Drainage Improvements - Senior Environmental Scientist
Determined jurisdictional waters in approximately 553 acres to define jurisdictional areas for the City of Charlotte Beckwith-Meadow Storm Drainage Improvement Project. Mr. Phillips also gathered detailed information for the area between The Plaza-Midwood neighborhoods and East Sugar Creek Road in Mecklenburg County, NC.

City of Charlotte Stormwater Services Environmental Permitting - Senior Environmental Specialist
Provided environmental services for more than a dozen projects involving stormwater maintenance and improvements in Mecklenburg County, NC, for the City of Charlotte. Mr. Phillips participated in obtaining appropriate state and federal authorizations as needed for stormwater improvements associated with maintenance programs and capital improvement projects in accordance with requirements of Sections 404 and 401 of the Clean Water Act. He

oversaw field determinations and delineations of wetlands and U.S. jurisdictional waters, stream assessments, preparation for requests for jurisdictional determination, preparation of Section 404 nationwide permit applications, and protected species habitat assessments and surveys.

Joshua Kotheimer

Environmental Scientist

Mr. Kotheimer is an environmental specialist with expertise in using geospatial information and geographic information system (GIS) data in developing topographic, location, soils, and water resources figures, as well as assisting in the drafting of environmental compliance plans. He performs field reviews, conducts on-site research, develops field delineation, and collects project and Global Positioning System (GPS) data. Mr. Kotheimer's project experience includes bridges, highways and roadways, parks and recreation, rail, and water resources projects.

Project Experience

TT Durham-Orange LRT Project - Environmental Scientist

Developing water resources figures for the Durham-Orange Corridor for the Triangle Transit (TT) in Chapel Hill, NC. The TT is preparing a DEIS to evaluate a proposed $1.34 billion, 17.1-mile light rail transit (LRT) alignment between Chapel Hill and east Durham, NC. The alignment runs along US 15-501 and connects major regional travel destinations, including Research Triangle Park, the University of North Carolina Chapel Hill and Duke University and their respective medical centers, North Carolina Central University, and the Durham VA Medical Center, and provides convenient access to the Raleigh-Durham International Airport. Mr. Kotheimer is collecting spatial data using a Trimble Geo XH GPS unit capable of sub meter accuracy. He is also overseeing post-processing of data collected in the field as well as creating figures for the water resources section of the project. Mr. Kotheimer is using ArcGIS to calculate spatial data to be included in the water resources report.

NCDOT Division 10 Bridge Upgrade and Replacement (BD-5110) - Environmental Scientist

Developed topographic, location, soils, and water resources figures for 404 and 401 permitting requests for low impact bridge replacement projects for the North Carolina Department of Transportation (NCDOT) Division 10. Mr. Kotheimer assisted in field delineations of streams by collecting GPS data.

SCDOT I-526 (Mark Clark Expressway) Extension Environmental Impact Study - Environmental Scientist

Developing figures showing the project study area and mapping the areas of different wetland types as part of a DEIS to help define the project's effect on the region for the South Carolina Department of Transportation (SCDOT). I-526 is an 18-mile beltway in Charleston, SC. To improve regional mobility, SCDOT plans to extend the highway to Johns and James islands. Mr. Kotheimer is calculating the area of several essential fish habitat types that are expected to be disturbed during construction and after the bridge is complete. His duties include determining acreages of shading, roadway fill, and bridge pile fill impacts for the project and developing figures to visually

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Education

Bachelor of Science, Environmental Technology; North Carolina State University

Bachelor of Art, Chemistry; North Carolina State University

Certifications

GIS Graduate Certificate; North Carolina State University

OSHA 40-hour HAZWOPER

OSHA 8-hour HAZWOPER Refresher

OSHA 30-hour General Industry

Associate Environmental Professional; National Registry of Environmental Professionals (NREP AEP)

Memberships

Xi Sigma Pi, Forestry Honors Society

Computer Skills

Agilent Chem Station, GIS Software: ArcGIS 9.3- 10, ERDAS Imagine, GRASS GIS, Google Earth, Trimble GPS Pathfinder, DNR GPS, Quantum GIS, MicroStation

display these impacts. Mr. Kotheimer is working with remote sensing data, shapefiles, and CAD data to complete these tasks. He is also involved in the field evaluation of possible mitigation sites to be used to offset impacts from bridge construction. Mr. Kotheimer's other duties include researching impacts of noises on marine mammals that could be affected during the boring and driving of bridge piles.

SCDOT I-95 US 301 Interchange Improvement Design-Build - Environmental Scientist

Assisting in developing an environmental compliance plan for the I-95/US 301 Interchange and US 301 Connector improvement project located in Orangeburg County, SC, for the South Carolina Department of Transportation (SCDOT). The project will upgrade the existing partial access interstate interchange at I-95 and US 301 to a full access interchange and construct the US 301 Connector. The US 301 Connector will serve as an extension of US 301 and will be constructed as a new location roadway beginning at US 301 and ending east of I-95 at SC 6. The project will require the construction of a bridge over I-95 to accommodate the interchange upgrades and a bridge over the CSXT railroad. SC 6 will be improved to provide auxiliary lanes at the newly created intersection with the US 301 Connector. Mr. Kotheimer is creating site location, soils, and topographic figures and assisting in field delineations of waters, including soil and vegetation descriptions. He is also acquiring data from past jurisdictional determinations and incorporating it into new figures while updating new boundaries that were determined during field site visits.

NCDOT I-485 Widening from Rea Road to I-77 Design-Build - Senior Environmental Scientist

Provided environmental services associated with widening I-485 (Charlotte Outer Loop) south of Charlotte from I-77 to SR 3642 (Rea Road) in Mecklenburg County, NC. Mr. Kotheimer assisted in the preparation and submittal of a Section 404 nationwide permit application in which the U.S. Army Corps of Engineers permit was issued ahead of schedule and a permit modification was subsequently submitted to capture temporary stream impacts associated with the installation of a work trestle. He also conducted monthly compliance inspections during construction.

NCDOT US 21 and Gilead Road Intersection Improvements (U-5114) - Environmental Scientist

Developed calculations for improvements to US 21 and Gilead Road in Huntersville, NC. The project included determining alternative intersection design concepts that would reduce congestion and safety concerns while allowing for multiple modes of transportation, such as bicycles and pedestrians. The project also included roadway design and aesthetics to create a gateway for the Town of Huntersville. Mr. Kotheimer participated in endangered species field review for the Schweinitz's Sunflower.

City of Rock Hill Manchester Meadows Monitoring - Environmental Scientist

Assisted in field review for a mitigation site monitoring report of the 68-acre Manchester Meadows Soccer Complex mitigation area in Rock Hill, SC. As a result of the construction of the park, unavoidable impacts to approximately 850 linear feet of perennial stream was proposed, and stream mitigation was required to compensate for these impacts. Mr. Kotheimer assisted in conducting mitigation monitoring for the park, as required by the Section 404 wetlands permit. On-site mitigation consisted of a relocated stream (Stream A), enhancements to an existing stream (Manchester Creek), preservation of wetlands (Wetland A), preservation of riparian buffers, construction of a secondary floodplain channel, and the removal of invasive species (Appendix B –Mitigation Plan). He also provided physical and biological monitoring, including channel measurements, GPS locations, dip net evaluations, and photo documentation. Mr. Kotheimer also assisted in field work, developed figures, and helped edit the report.

City of Charlotte Beckwith-Meadow Storm Drainage Improvements - Environmental Scientist

Determined jurisdictional waters in approximately 553 acres to define jurisdictional areas for the City of Charlotte Beckwith-Meadow Storm Drainage Improvement Project. Mr. Kotheimer also gathered detailed information for the area between The Plaza-Midwood neighborhoods and East Sugar Creek Road in Mecklenburg County, NC.

Private Client Clyde Property Preliminary Wetlands Determination - Environmental Scientist

Conducted preliminary on-site research for water features labeled on U.S. Geological Survey quad maps and U.S. Department of Agriculture Natural Resources Conservation Service soil maps as part of a wetland review of Lot 18 in Rock Creek Center, Guilford County, NC. The review will result in the provision of a letter of findings for due diligence purposes. Mr. Kotheimer assisted in preliminary site visits to determine the limits of water features on the property. He created figures of water features mapped during site visits.

CPCC CATO Campus Wetlands Services - Environmental Scientist

Assisted in field delineations of water at Central Piedmont Community College (CPCC) in Charlotte, NC. The project involved a complete wetland delineation and on-site assessment of stream channels on CPCC property in coordination with the North Carolina Division of Water Resources for boundary verification. Mr. Kotheimer determined stream boundaries and logged this data with a Trimble GeoXH GPS unit. He developed field data figures, coordinated with the surveyor to obtain survey data, and converted data from CAD form to ArcGIS shapefiles.

Terminated 7/11/ 2014

W. Brandon Fulton, LSS, PSC, PWS

Environmental Science Senior Manager

Mr. Fulton is an environmental scientist with more than 10 years of experience. He has provided environmental consulting services to developers, engineers, school systems, municipalities, and government agencies as a scientist and project manager. Mr. Fulton has particular expertise with soil and wetland projects from the coastal plain to the mountain regions of North and South Carolina. He has performed Section 404 and 401 permitting services, preparation of Phase I and II environmental site assessments, mitigation resolution, on-site wastewater layout and design, identification of seasonally high water tables, saturated hydraulic conductivity testing, and erosion and sediment control consulting. Mr. Fulton has conducted numerous stream and wetland determinations and delineations, biological functional assessments, natural resource and ecological feasibility studies, and preparation of Clean Water Act Section 404 and 401 permit applications and natural resources technical reports for federal, state, and municipal agencies. In addition, he has performed protected plant and animal species surveys, threatened and endangered (T&E) surveys, water quality monitoring, and regulatory agency reporting and coordination. Mr. Fulton has also provided expertise in the preparation of numerous environmental documents in accordance with state and federal environmental regulations, including natural resources technical reports, protected species biological assessments, Environmental Assessments (EAs), and Environmental Impact Statements (EISs).

Project Experience

VRE Hamilton to Crossroads Third Track - Senior Scientist
Performed wetland delineations and habitat assessments for threatened and endangered species to construct approximately 3.1 miles of mainline track and associated construction for the Virginia Railway Express (VRE). Mr. Fulton coordinated with the U.S. Army Corps of Engineers, Virginia Department of Environmental Quality, the Virginia Marine Resources Commission, and the U.S. Fish and Wildlife Services to obtain Section 404/401 Permits and federal coastal zone consistency.

NCDOT Division 13C Design-Build Bridges - Senior Scientist
Providing complete environmental services for the replacement of 11 existing bridges throughout five counties for the North Carolina Department of Transportation (NCDOT). Mr. Fulton coordinated with NCDOT, U.S. Army Corps of Engineers, North Carolina Division of Water Quality, the Tennessee Valley Authority, and other resource agencies to obtain Section 404/401 Permits as well as other required permits.

NCDOT Division 11 Design-Build Bridges - Senior Scientist
Providing complete environmental services for the replacement of 10 existing bridges throughout four counties for the North Carolina Department of Transportation (NCDOT). Mr. Fulton coordinated with NCDOT, U.S.

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Education
Bachelor of Science, Natural Resources/Ecosystem Assessment; North Carolina State University

Professional Registrations
Licensed Soil Scientist: North Carolina

Licensed Professional Soil Classifier: South Carolina

Certifications
Professional Wetland Scientist; Society of Wetland Scientists (SWS)

Level I and II Erosion and Sediment Control/Stormwater Certification; NCDOT

Charlotte Mecklenburg Certified Site Inspector

Training
North Carolina Wetland Assessment Method (NCWAM)

Identification of Intermittent and Perennial Streams Refresher Course addendum, NCDWQ

NC Division of Water Quality - Aquatic Insect Collection Protocols for Stream Mitigation and Restoration Projects

Intermittent and Perennial Stream Identification for Riparian Buffer Rules

NC Wetland Plant Identification Workshop

Memberships
Soil Science Society of North Carolina

Society of Wetland Scientists

North Carolina Association for Environmental Professionals

Construction Management Association of America

Biotetchnology Advisory Board-Rowan Cabarrus Community College

Computer Skills
AutoCAD, GPS Trimble Units, ArcMap, Maptech Navigator (USGS), GPS Pathfinder Office, Microsoft Terrasync

Army Corps of Engineers, North Carolina Division of Water Quality, the Tennessee Valley Authority, and other resource agencies to obtain Section 404/401Permits as well as other required permits.

NCDOT Division 10 Low Impact Bridges - Environmental Scientist
Providing complete natural environment services for the replacement of 26 existing bridges throughout 5 NC counties. Services include wetland/stream delineation, a T&E survey, and community mapping and classification. Mr. Fulton is also contributing to Section 404/401 permitting and coordinated services with USACE and NCDWQ.

NCDOT Division 10 Bridge Upgrade and Replacement Program - Environmental Scientist
Providing complete natural environment services for the replacement of 11 existing bridges under the Bridge Upgrade and Replacement Program in Albemarle, NC. Services include wetland/stream delineation, a T&E survey, and community mapping and classification. Mr. Fulton is also contributing to Section 404/401 permitting and coordinated services with USACE and NCDWQ.

NCDOT Division 14 Low Impact Bridges - Environmental Scientist
Completed comprehensive natural environment services for the replacement of 17 existing bridges across 10 counties in western North Carolina. Services included wetland/stream delineation, a T&E survey, and community mapping and classification. Mr. Fulton also contributed to Section 404/401 permitting and coordinated services with USACE and NCDWQ. He also completed wetland/stream delineation (tagging jurisdictional areas).

Family Dollar Stores Soil Analysis - Environmental Consultant
Performed soil analyses for proposed locations of new Family Dollar Stores in multiple locations in North Carolina. Mr. Fulton identified the seasonally high water table and conducted saturated hydraulic conductivity analyses. He also managed environmental services, including the proposal generation and approval, coordination of field efforts, and reporting to the client.

Cabarrus County Schools Carolina International School – Senior Scientist
Performed wetland delineations for the proposed 82-acre Carolina International School site in Cabarrus County, NC. Mr. Fulton coordinated with the U.S. Army Corps of Engineers and the North Carolina Division of Water Quality to obtain jurisdictional determinations prior to construction.

Cabarrus County Schools A.T. Allan Elementary School Construction - Environmental Consultant
Reconciled notice of violations issued by the North Carolina Division of Water Quality (NCDWQ) for several sediment/erosion control and stormwater violations in the construction of the A.T. Allan Elementary School in Concord, NC. Mr. Fulton also addressed an un-permitted impact to an intermittent stream associated with road widening activities for the new school. His responsibilities included coordinating with regulatory agencies, engineers, and contractors associated with the school project; obtaining a

jurisdictional determination and after-the-fact 404 permit from the United States Army Corps of Engineers; and applying for a 401 water quality certification from the NCDWQ. He was able to successfully bring the project into compliance before the fall semester.

Mecklenburg County Schools New Lake Norman Charter School - Environmental Consultant
Performed wetland delineations for the proposed New Lake Norman Charter School in Huntersville, NC. Mr. Fulton obtained the jurisdictional determination and necessary permits from the United States Army Corps of Engineers and the North Carolina Division of Water Quality and managed field efforts.

FHWA Pilot Study - Project Manager
Led a NCDWQ subconsultant team for a Federal Highway Administration (FHWA) pilot study to determine the accuracy of stream representation on USGS and Soil Survey Maps in comparison to actual field conditions. Mr. Fulton performed stream mapping, delineation, and preparation of data in South Mountain State Park (Rutherford County, NC) on an approximately 1,300-acre watershed. He used a compilation of stream forms and GPS equipment to document stream origins, stream lengths, and flow durations. Mr. Fulton ultimately assisted in incorporating all the information into a spatial model and report for the FHWA.

NCDOT Modification of the I-485/I-85 Interchange - Environmental Scientist
Performing third-party construction oversight, compliance monitoring, and inspection for the design-build modification of the I-485/I-85 interchange in Charlotte, NC. Mr. Fulton is providing compliance monitoring to meet the regulatory requirements of the Section 404/401 permit, including determination revisions and permit modifications.

NCDOT I-485 Widening from Rea Road to I-77 Design-Build - Senior Scientist
Performed delineations of environmentally sensitive areas (ESAs) within the approximate 9.2-mile project corridor for placement of protective fencing. Mr. Fulton coordinated with the U.S. Army Corps of Engineers, the North Carolina Department of Transportation (NCDOT), North Carolina Division of Water Quality, and other resource agencies to obtain Section 404/401 Permits related to project impacts. He also provided monitoring and construction oversight to maintain compliance with permit conditions.

NCDOT NC 294 Upgrade - Environmental Scientist
Completing wetland and stream delineation, T&E survey, community mapping, and jurisdictional determination in preparation of a NRTR for the upgrade and widening of 2.1 miles of NC 294 in Cherokee County, NC. Mr. Fulton is also assisting in obtaining Section 404/401 permitting and coordinating services with USACE, NCDWQ, and other resource agencies.

NCDOT Hicks Grove Road Relocation - Environmental Scientist

Performed natural environment services for the replacement and relocation of Hicks Grove Road in Rutherford County, NC, including wetland/stream delineation, a T&E survey, and community type mapping in preparation of an NRTR.

SCDOT Carolina Bays Parkway Extension - Environmental Scientist
Performed field delineation, mapping, and compilation of wetland delineation as-built drawings for the 4.3-mile extension of the Carolina Bays Parkway to SC 707.

Mecklenburg County Parks and Recreation Matthews Regional Sports Complex - Senior Scientist
Performing wetland delineations on the proposed 160-acre sports complex in Matthews, NC, for the Mecklenburg County Parks and Recreation Department. Mr. Fulton is coordinating the verification of findings with the U.S. Army Corps of Engineers and the North Carolina Division of Water Quality to obtain jurisdictional determination and associated 404/401 permitting for the project's impacts.

Secrest, LLC, Proposed Residential Development Soil Analyses - Project Manager/Environmental Consultant
Performed on-site soil evaluations of approximately 900 acres in Union County, NC that Secrest was considering for a large residential subdivision. Mr. Fulton led field mapping efforts to determine the soil suitability for potential on-site wastewater systems, classified soils to the series level for the entire site, and performed saturated hydraulic conductivity analyses. Mr. Fulton was also responsible for proposals, scheduling staff for field efforts, and ensuring technical standards were met.