

STUDY PLAN:  
BAT SURVEYS FOR THE MVP SOUTHGATE PROJECT  
IN ALAMANCE AND ROCKINGHAM COUNTIES, NORTH CAROLINA  
AND PITTSYLVANIA COUNTY, VIRGINIA

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## 1.0 Introduction

Mountain Valley Pipeline, LLC (“Mountain Valley”) is seeking a Certificate of Public Convenience and Necessity (“Certificate”) from the Federal Energy Regulatory Commission (FERC) pursuant to Section 7(c) of the Natural Gas Act to construct and operate the MVP Southgate Project (“Project”). The Project will be located in Pittsylvania County, Virginia and Rockingham and Alamance counties, North Carolina (Appendix A; Figure 1). Mountain Valley proposes to construct approximately 72-miles of 24-inch-diameter natural gas pipeline, known as the H-650 pipeline, to provide timely, cost-effective access to new natural gas supplies to meet the growing needs of natural gas users in the southeastern United States. Subject to receipt of the required permits and regulatory approvals, Mountain Valley anticipates construction of the Project to commence in spring of 2020.

The proposed Project will interconnect with and receive gas from the existing Mountain Valley Pipeline near Chatham, Virginia, and the East Tennessee Natural Gas, LLC., mainline near Eden, North Carolina, and will deliver gas to connections with customers’ existing facilities in Eden and Graham, North Carolina. The Project is a stand-alone project from the Mountain Valley Pipeline and has an expected in-service date of late 2020. In addition to the H-650 pipeline, Mountain Valley proposes to construct and operate two new compressor stations at milepost (MP) 0 in Pittsylvania County, VA, and near MP 26 in Rockingham County, NC, and four interconnects near MPs 0, 28, 30, and 72. Meter stations and other ancillary facilities required for the safe and reliable operation of the pipeline are also included.

To the extent practicable, Mountain Valley has routed the new pipeline parallel to existing corridors. As currently proposed, the pipeline is located parallel to existing utility corridors, trails, and roads for approximately 47 percent (34 miles [54.7 km]) of the proposed alignment. The Project limits-of-disturbance include a 100-foot-wide right-of-way (ROW), consisting of 50-feet (15.2 m) temporary and 50-feet (15.2 m) permanent easements. Where feasible, the ROW will be reduced in width to 75 feet (22.9 m) at resource crossings. The permanent ROW affects approximately 160.8 acres in Virginia and 283.7 acres in North Carolina. The temporary ROW affects approximately 266.6 acres in Virginia and 477.4 acres in North Carolina.

Access roads are 25-feet (7.6 m) wide for permanent or temporary use. To facilitate the construction and maintenance of the pipeline, 196 access roads are currently proposed to be constructed or improved. Of the 196 access roads, 68 will be in Virginia ( $\pm 23.2$  mi [37.3 km]) and 128 will be in North Carolina ( $\pm 28.3$  mi [45.5 km]). Additional temporary workspaces, laydown and contractor yards are also anticipated.



## 2.0 Basis for ESA Compliance

The Federal Endangered Species Act (ESA) of 1973 [16 U.S.C. 1531 et seq.] provides for listing, conservation, and recovery of endangered and threatened species of plants and wildlife. Under the ESA, the U.S. Fish and Wildlife Service (USFWS) is mandated to monitor and protect listed species. Many states enacted similar laws.

Section 9 of the ESA prohibits take of listed species. Take is defined by the ESA as, “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect” [16 U.S.C. 1532(19)]. USFWS further defines harm to include significant habitat modification or degradation [50 CFR §17.3].

Based on coordination with the USFWS Raleigh and Gloucester Field Offices, North Carolina Wildlife Resources Commission (NCWRC), and Virginia Department of Game and Inland Fisheries (VDGIF), the Project is not within the *known* range of any federally-endangered bat species. The Project is within the range of the federally-threatened northern long-eared bat (*Myotis septentrionalis*); however, because there are no *known* summer maternity roosts or winter hibernacula in the Project vicinity, any potential impacts to the species would be exempted under the species’ Final 4(d) rule (USFWS 2016). Based on these data, FERC’s Requirements under Section 7(a)(2) of the ESA for the Mountain Valley Southgate Project are met.

Under Section 7(a)(1) of the ESA, FERC has a requirement to use its authority to further the conservation of listed species. To that end, and because bat occurrence data within the Project area is significantly limited, Mountain Valley proposes to conduct targeted field surveys for bats as a Voluntary Conservation Measure for the Project.

According to the NCWRC’s *Protected Wildlife Species of North Carolina* (NCWRC 2017), nine species of bats are of concern in North Carolina (Table 1). Based on available data, none of these species are known to occur in Rockingham or Alamance counties.

Table 1. Federally or State-listed Bats in North Carolina

Common Name	Species	Federal Status	North Carolina Status
Indiana bat	<i>Myotis sodalis</i>	E	E
Gray bat	<i>Myotis grisescens</i>	E	E
Virginia big-eared bat	<i>Corynorhinus townsendii virginianus</i>	E	E
Northern long-eared bat	<i>Myotis septentrionalis</i>	T-4(d)	T
Rafinesque’s big-eared bat	<i>Corynorhinus rafinesquii rafinesquii</i>	SC	T

Common Name	Species	Federal Status	North Carolina Status
Eastern big-eared bat	<i>Corynorhinus rafinesquii macrotis</i>	SC	SC
Eastern small-footed bat	<i>Myotis leibii</i>	SC	SC
Florida yellow bat	<i>Lasiurus intermedius floridanus</i>	-	SC
Southeastern bat	<i>Myotis austroriparius</i>	SC	SC

E – Endangered; T-4(d) – Threatened with 4(d) Rule; T – Threatened; SC – Species of Concern

According to the VDGIF’s *Special Status Faunal Species in Virginia* (VDGIF 2018), 12 species of bats are of concern in Virginia (Table 2). Five of these species are listed in the Virginia Wildlife Action Plan (WAP).

Table 2. Federally or State-listed Bats in Virginia

Common Name	Species	Federal Status	Virginia Status
Indiana bat	<i>Myotis sodalis</i>	E	E
Gray bat	<i>Myotis grisescens</i>	E	E
Virginia big-eared bat	<i>Corynorhinus townsendii virginianus</i>	E	E
Northern long-eared bat	<i>Myotis septentrionalis</i>	T-4(d)	T
Eastern big-eared bat	<i>Corynorhinus rafinesquii macrotis</i>	SC	E
Little brown bat	<i>Myotis lucifugus</i>	-	E
Tri-colored bat	<i>Perimyotis subflavus</i>	-	E
Eastern small-footed bat	<i>Myotis leibii</i>	SC	WAP Tier I
Hoary bat	<i>Lasiurus cincereus</i>	-	WAP Tier IV
Eastern red bat	<i>Lasiurus borealis</i>	-	WAP Tier IV*
Silver-haired bat	<i>Lasionycteris noctivagans</i>	-	WAP Tier IV*
Southeastern bat	<i>Myotis austroriparius</i>	SC	WAP Tier IV

E – Endangered; T-4(d) – Threatened with 4(d) Rule; T – Threatened; SC – Species of Concern; Virginia Wildlife Action Plan, Species of Greatest Conservation Need (WAP) Tier I – Critical Conservation Need; WAP Tier IV – Moderate Conservation Need; \* - Proposed for Inclusion

Environmental Solutions & Innovations, Inc. (ESI), on behalf of Mountain Valley, proposes to conduct field surveys for bats. Studies will be carried out under ESI’s USFWS Federal Fish and Wildlife (TE02373A-12, TE56749B-2, TE01311C-0, and TE02365A-4), VDGIF (Threatened and Endangered Species 63022 and Scientific Collection 63023) and NCWRC (Threatened and Endangered Species [18-ES00406] and Scientific Collection [18-SC00839]) Permits.

Through submittal of this Study Plan, ESI requests concurrence with the methods and levels of effort for the Project herein, and site-specific authorization from USFWS, NCWRC and VDGIF to conduct proposed survey activities.

## 3.0 Field Surveys

Survey techniques will generally follow the USFWS 2018 *Rangewide Indiana Bat Survey Guidelines* (USFWS 2018); however, a targeted survey approach will be taken with respect to site placement and level of effort.

### 3.1 Level of Effort

A desktop habitat assessment was completed for the Project using the 2011 National Land Cover Database (NLCD; amended 2014). In lieu of conducting netting at an incremental rate of one site per kilometer, surveys are proposed for larger “survey blocks” which were identified as areas potentially conducive to high bat activity. Within these survey blocks, sampling will still be conducted at a rate of 1 site per linear kilometer of tree removal, however sites will be placed in the best available locations within each block, and not forced into 1-kilometer intervals. Although a preliminary analysis has been completed to identify potential net sites within survey blocks, final site locations will be determined by biologists on the ground, based on the presence of suitable features on the landscape.

#### 3.1.1 North Carolina

Forest habitat is proposed for removal along approximately 52 linear kilometers, among both the proposed pipeline route and access roads. A total of **63 survey sites** is proposed within these survey blocks (Table 3; Appendix A, Figure 2).

Table 3. Proposed Survey Areas in North Carolina

Survey Block	Number of Survey Sites	County
01	2	Rockingham
02	5	Rockingham
03	16	Rockingham
04	3	Rockingham
05	7	Rockingham
06	2	Rockingham
07	2	Rockingham
08	5	Rockingham
09	1	Alamance
10	1	Alamance
11	2	Alamance
12	3	Alamance
13	1	Alamance
14	8	Alamance
15	5	Alamance

A combination of mist netting and acoustic monitoring is proposed; surveys will be conducted at 52 mist net sites (minimum of 6 net nights per site) and 11 acoustic survey sites (minimum of 2 detector nights per site). The final survey method for each site will be determined by permitted ESI bat biologists based on observed field conditions and habitat suitability.

State natural areas (Rocky Branch Conglomerate Exposure, Stony Creek Forest, and ROA/Dan River Aquatic Habitat) and State managed areas (NC Clean Water Management Trust Fund Easement, NC Division of Mitigation Services Easement, Piedmont Land Conservancy Easement, and Mountains-to-Sea Trail) were identified within, or adjacent to, the Project area. Survey sites are proposed within, or near, these conservation areas; however, completion of these surveys is contingent on appropriate land access permissions.

### 3.1.2 Virginia

Forest habitat is proposed for removal along approximately 27 linear kilometers, among both the proposed pipeline route and access roads. A total of **30 survey sites** is proposed within these survey blocks (Table 4; Appendix A, Figure 3).

Table 4. Proposed Survey Areas in Virginia

Survey Block	Number of Survey Sites	County
01	5	Pittsylvania
02	7	Pittsylvania
03	5	Pittsylvania
04	4	Pittsylvania
05	9	Pittsylvania

Mist netting is proposed for all 30 identified sites; however, the final survey method will be determined by permitted ESI bat biologists based on observed field conditions and habitat suitability. Acoustic surveys may be conducted in lieu of netting if appropriate.

## 3.2 Presence / Probable Absence Survey

### 3.2.1 Mist Netting

#### 3.2.1.1 Qualified Surveyors

Mist net surveys will be completed by a team of one or more biologists, including an individual permitted to handle bats by the USFWS, NCWRC, and/or VDGIF.

#### 3.2.1.2 Net Placement

Mist nets are set to maximize coverage of flight paths used by bats along suitable travel corridors, foraging areas, and/or drinking areas. Riparian corridors are often used for travel or foraging; however, upland corridors (e.g., trails or logging roads) also provide suitable sites. In upland areas, net sites near road ruts holding water have resulted in

the capture of Indiana and northern long-eared bats. Site selection is based upon the extent of canopy cover, presence of an open flyway, and forest conditions near the site. The actual location and orientation of each net set is determined in the field. Coordinates of each net set are recorded via a combination of available technology including GIS systems (ESRI ArcMap), handheld GPS units, tablet computers, and customized software to ensure a high quality, easily interpreted, and universal standard of mapping for field studies and reporting for all target species.

### **3.2.1.3 Bat Capture**

Bats are live-caught in mist nets and released unharmed near the point of capture. Captured bats are identified to species, sex, age class, and reproductive condition. Weight and right forearm length of each individual are also recorded. Age is determined by examining the epiphyseal-diaphyseal fusion of long bones in the wing. Reproductive condition of female bats is recorded as pregnant (based on gentle abdominal palpation), lactating, post lactating, or non-reproductive. Time and location/net site of captured bats is recorded. Processing is typically completed within 30 minutes of the time each bat is removed from the net. Listed bat species captured and identified are photographed and recorded on standardized data sheets, provided in Appendix B. USFWS, VDGIF, and NCWRC will be contacted within 48 hours if any listed bat is captured.

### **3.2.1.4 Protocol for Addressing White-nose Syndrome**

White-nose syndrome (WNS) is a disease killing millions of bats in the eastern U.S. The disease, first found in New York, is spreading across the range of the Indiana and northern long-eared bat. All current federal and state guidelines for WNS decontamination, containment, and avoidance will be implemented. Biologists are kept aware of all current and changing WNS guidelines. Bat handling follows current WNS protocols set by the USFWS. Captured bats are examined for damage associated with WNS to the wing and uropatagium (tail) membranes, including use of white and/or ultraviolet light. Wing damage is categorized using the Wing-Damage Index Used for Characterizing Wing Condition of Bats Affected by White-nose Syndrome (Reichard 2008).

## **3.2.2 Acoustic Surveys**

### **3.2.2.1 Qualified Surveyors**

Acoustic detectors will be deployed by ESI scientists trained and experienced in acoustic survey techniques.

### **3.2.2.2 Detector Placement**

Preferred acoustic monitoring sites have limited acoustic clutter, which reduces the quality of the calls recorded (Britzke 2004, Broders et al. 2004), and regular bat traffic, including: 1) borders of riparian corridors running through open landscapes; 2) fencerows adjacent to open habitats; 3) utility corridors; 4) water sources including

ponds and open stretches of streams; and 5) other open linear corridors, including logging and other woodland roads/trails. Detectors are placed at locations that maximize the potential of detecting individual bats while allowing biologists to monitor the detectors for security and to ensure proper operation.

Typically, areas with high amounts of acoustic clutter created by wind, vegetation, insects, other bats, open water, sheer rock surfaces, wind turbines, or high tension lines are avoided. In the event such areas cannot be avoided, ESI will coordinate with USFWS and provide justification.

In general, detectors are positioned at least five feet (1.5 m) in any direction from vegetation or other obstructions, in areas without, or with minimal, vegetation within 33 feet (10 m) in front of the microphone, parallel to woodland edges, and at least 49 feet (15 m) from known or suitable roosts. Microphones are elevated greater than five feet (1.5 m) above ground level as well. Lastly, if possible, monitors are placed a minimum of 656 feet (200 m) apart.

Coordinates for each detector location are recorded and included in the final report.

### **3.2.2.3 Analysis of Recorded Echolocation Calls**

Recorded files are processed through Kaleidoscope Pro (Version 4.2; Wildlife Acoustics). This software is designed to identify bats to species and provide a statistical estimate of probability that federally-listed bats are present. If the results of this analysis indicate potential presence of listed bat species, ESI completes a visual review of the calls (per the steps outlined in the USFWS 2018 *Rangewide Indiana Bat Survey Guidelines*). Visual reviews are conducted by a USFWS approved biologist.

### **3.2.2.4 Follow-up Mist Netting at Acoustic Survey Sites**

If a federally-endangered *myotis* is detected during acoustic surveys, mist netting will be conducted following the USFWS 2018 *Rangewide Indiana Bat Survey Guidelines*. If the federally-listed species is not captured during the follow-up mist netting, the species will be considered absent from the survey site.

### **3.2.3 Habitat Characterization**

Habitat is described for each survey site. The emphasis of this description is habitat form: size and relative abundance of large trees and snags that potentially serve as roost trees, canopy closure, understory clutter/openness, water availability, and flight corridors. Habitat form is emphasized because Indiana and northern long-eared bats roost in a variety of tree species.

ESI's habitat characterization does more than emphasize species of large trees near the net. It identifies components of the canopy and subcanopy layers. All trees that reach into the canopy are canopy trees, regardless of their diameter/size. Many smaller trees are often also found in the canopy, and in some situations, the canopy can be

entirely composed of smaller diameter trees. ESI's habitat characterization identifies dominant and subdominant elements of the canopy.

The subcanopy, or understory, vegetation layer is well defined in classical ecological literature. It is that portion of the forest structure between the ground vegetation (to approximately 2 feet [0.6 m]) and the canopy layers, usually beginning at about 25 feet (7.6 m). Vegetation in the understory may come from:

- Lower branches of overstory trees;
- Small trees that will grow into the overstory;
- Small trees and shrubs that are confined to the understory.

The amount of understory, or clutter, is also recorded because, unlike the Indiana bat, the northern long-eared bat forages more under the tree canopy and closer to the ground where it can glean insects from vegetation. Information is recorded on standardized Data Sheets, provided in Appendix B.

### **3.2.4 Weather and Temperature**

Weather conditions are monitored each survey night to assure compliance with USFWS guidelines. For mist netting, conditions recorded include temperature, wind speed and direction, and percent cloud cover. Any of a variety of standard mercury or electric thermometers is used to record temperature, wind speed is determined by use of the Beaufort wind scale, and cloud cover is visually estimated. For acoustic surveys, the nearest National Oceanic and Atmospheric Administration (NOAA) National Weather Service station is monitored nightly to ensure weather requirements are met.

Weather data are provided in an appendix and summarized in the report. Information is recorded on standardized Data Sheets, provided in Appendix B.

### **3.3 Radio Telemetry**

Mountain Valley is proposing a targeted approach to radio telemetry. If captured, all Indiana bats will be fitted with radio-transmitters. Adult reproductive females are given first priority followed by juveniles, non-reproductive females, and adult males. For northern long-eared bats, if captured, a minimum of two females or juveniles per survey block will be fitted with radio-transmitters. If other tree-dwelling federally- or state-listed species (southeastern, little brown and tri-colored bats) are captured, up to two (2) adult reproductive females of each species will be fitted with radio-transmitters.

#### **3.3.1 Transmitter Attachment**

A small interscapular area is trimmed of fur and the transmitter is attached to this area with non-toxic surgical adhesive. Transmitters are activated and tested before attachment. The adhesive degrades over time (typically lasting 7 to 10 days) and the transmitter falls off the bat. Biologists record the transmitter weight, weight of the bat before and after transmitter attachment, and holding time. Bats are released unharmed

near the points of capture. Standardized data forms are used to record transmitter attachment information (Appendix B).

Transmitters are typically obtained from ®Holohil Systems Ltd. or ® Blackburn, or ®Telenax Transmitters (frequency of 171 and 172). Bat transmitter weights range from 0.009 to 0.017 ounce (0.25 to 0.5 g). Whenever possible, ESI uses 0.009- to 0.012-ounce (0.25- to 0.35-g) transmitters, as they are the lightest commercially available, least stressful to the bats, are usually less than five percent of the pre-attachment weight of the bat, and are not more than 10 percent of a bat's total body weight. Batteries on these transmitters typically last 7 to 14 days.

### **3.3.2 Diurnal Roost Telemetry**

To locate roosting bats, radio-telemetry signals are tracked using a ®Wildlife Materials TRX-2000S PLL Synthesized Tracking Receiver, an ®Advanced Telemetry Systems, Inc. Model R2000 Scanning Receiver, or a ®Communications Specialists R200 receiver with three-element folding Yagi directional antennas manufactured by either ®Wildlife Materials, Inc. or ®Titley Electronics, PTY LTD. Receivers are not water resistant and are not used during periods of heavy rain. If a day of effort is missed due to inclement weather, an additional day is added.

Beginning the day after bat capture and transmitter attachment, telemetry is used to locate each bat's diurnal roost. Roost trees are identified to species and diameter at breast height (dbh) is measured using a dbh tape or Biltmore stick. The approximate height at which the bat is roosting and general condition of the roost tree (dead, live, dying, % bark cover, etc.) is noted. A description of habitat near the roost tree is recorded. Standardized data forms are used to characterize roost trees and assess associated habitat. Occasionally, bats roost in man-made structures; the form also provides for assessment of man-made structures used as roosts (Appendix B). Depending on specific requests by landowners or the client, roosts can either be flagged, painted, receive a metal tag, or be staked for ease of future identification. Coordinates of each roost are recorded with a GPS unit. If a roost tree occurs in an area where biologists are not permitted access, then triangulation is used to estimate its location.

Bats are tracked for approximately 7 days, for a minimum of 4 hours per day per bat (or until the bat is found), after the date of capture or until the transmitter is shed or fails, whichever happens first. Emergence counts will be performed on each identified roost tree for a minimum of 2 days as suggested in the USFWS 2018 *Range-wide Indiana Bat Summer Survey Guidelines*.

### **3.4 Timeline and Reporting**

Surveys will be conducted during the regulatory survey window (15 May – 15 August 2018). Data are summarized in a detailed report and submitted to the appropriate state



and federal agencies within a month of completing the survey. The detailed report includes the following:

1. Detailed description of the project, methods, results, and discussion/interpretation of results;
2. Explanation of any modifications from the original survey plan (e.g., altered survey locations or addition of survey locations due to changes in Project design);
3. Copies of datasheets that will describe in detail:
  - Survey locations (including a site diagram and coordinates) and set-ups;
  - Habitat (including roosting potential) adjacent to each survey location;
  - Date, name of biologist(s) conducting survey, duration of survey, and weather conditions at each location;
  - Species, time of capture, sex, weight, reproductive status, right forearm length, and Reichard's wing damage index score;
  - If applicable, results of radio-tracking and roost tree emergence counts;
4. Color photographs of listed bats captured, mist-net/acoustic detector set-ups, and bat roosts located during radio-tracking (if Indiana bat captured).

### **3.5 Property Access (All Techniques)**

ESI's biologists may work only on properties where landowners or other competent authorities have granted access. If a bat that is targeted for radio telemetry is captured, ESI and the client will work to gain access to roost(s). Studies will be conducted only where landowners grant permission to do so. ESI uses radio-triangulation to estimate locations of bats roosting on inaccessible properties.

## **4.0 Request for Agency Concurrence**

### **4.1 Request for Site-Specific Authorization to Proceed**

Please consider this Study Plan a request for site-specific authorization to begin survey efforts.

### **4.2 Time of Clearing Restrictions**

ESI seeks confirmation that trees within the Project Area may be cleared at any time of year without restriction, unless a federally listed bat roost is located in the Project vicinity by this or another project.

Mountain Valley intends to use the 4(d) rule published in the Federal Register on 14 January 2016 to facilitate ESA compliance relative to the northern long-eared bat. As such, ESI seeks concurrence that upon completion of the study, tree-clearing restrictions will only be applied to the Project as follows:

- Within 150 feet (46 m) of trees used by female or juvenile northern long-eared bats during June and July;
- Within 0.25 mile (0.4 km) of a hibernacula known to previously contain northern long-eared bats;
- Within 5 miles (8 km) of a known or potentially suitable hibernacula (note that none are known) for the Indiana bat;
- Within 5 miles (8 km) of the point of capture for an Indiana bat for which roosting data are not available;
- Within 2.5 miles (4 km) of a known Indiana bat roost.

#### **4.3 Period for Which Survey Results are Valid**

We seek confirmation that results of the mist net survey remain valid for a period of two complete summer maternity seasons after the summer when the survey was completed.

## **5.0 Literature Cited**

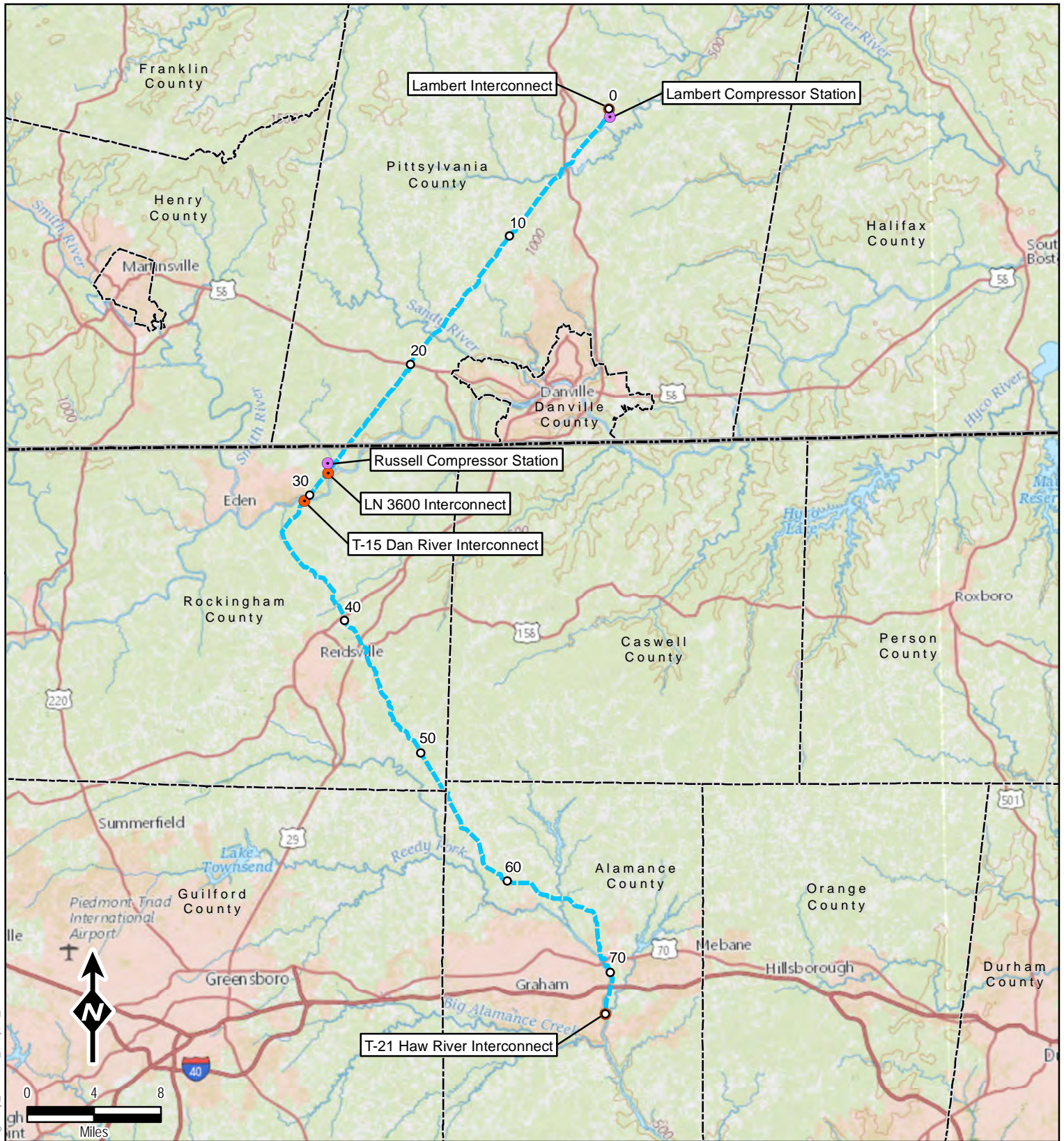
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**APPENDIX A  
FIGURES**

S:\1-PROJECTS\IN\EXTERNAL\300423\_MVP\_Southgate\Agency\_Consult\_Project\_Overview.mxd



**Legend**

- - - Proposed Pipeline Route
- Mileposts
- Compressor Station
- Meter Station
- - - County Boundary
- - - State Boundary

**Data Sources:** ESRI, USGS, TRC, EQT

1 inch = 8 miles  
When Printed 8.5x11

**Mountain Valley**  
PIPELINE, LLC

**Figure 1**  
Project Overview Map

**TRC**  
Results you can rely on

600 Willowbrook Ln  
West Chester, PA 19382



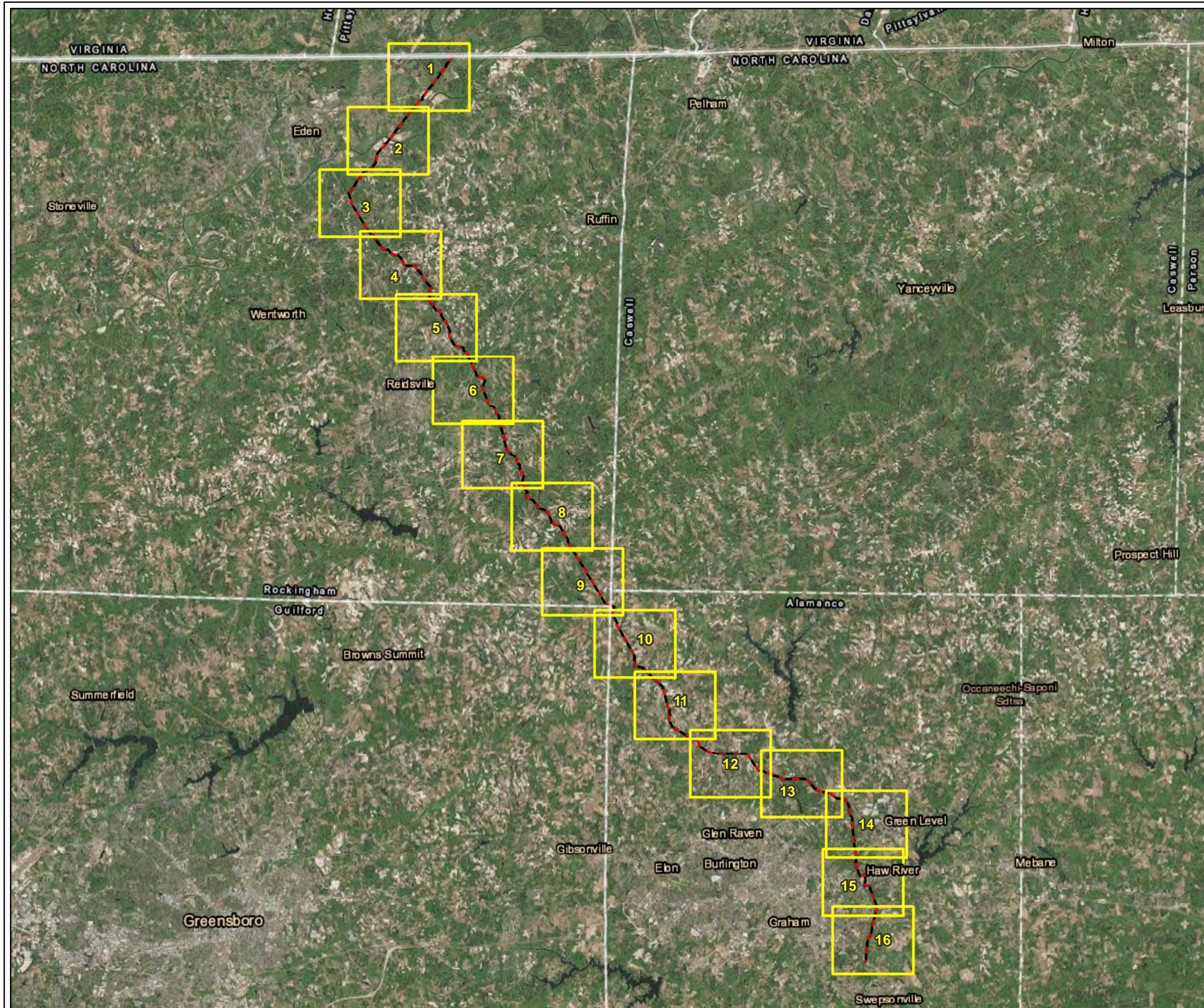
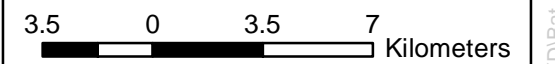
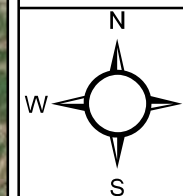
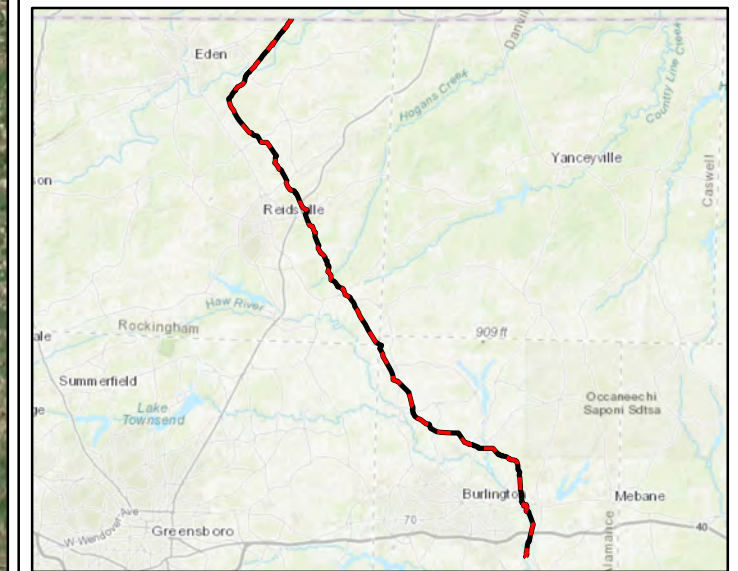


Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.

Map Key

- Proposed Centerline
- Proposed Access Road



Base Map: ESRI "World Imagery (Clarity)";  
accessed 7/10/2018

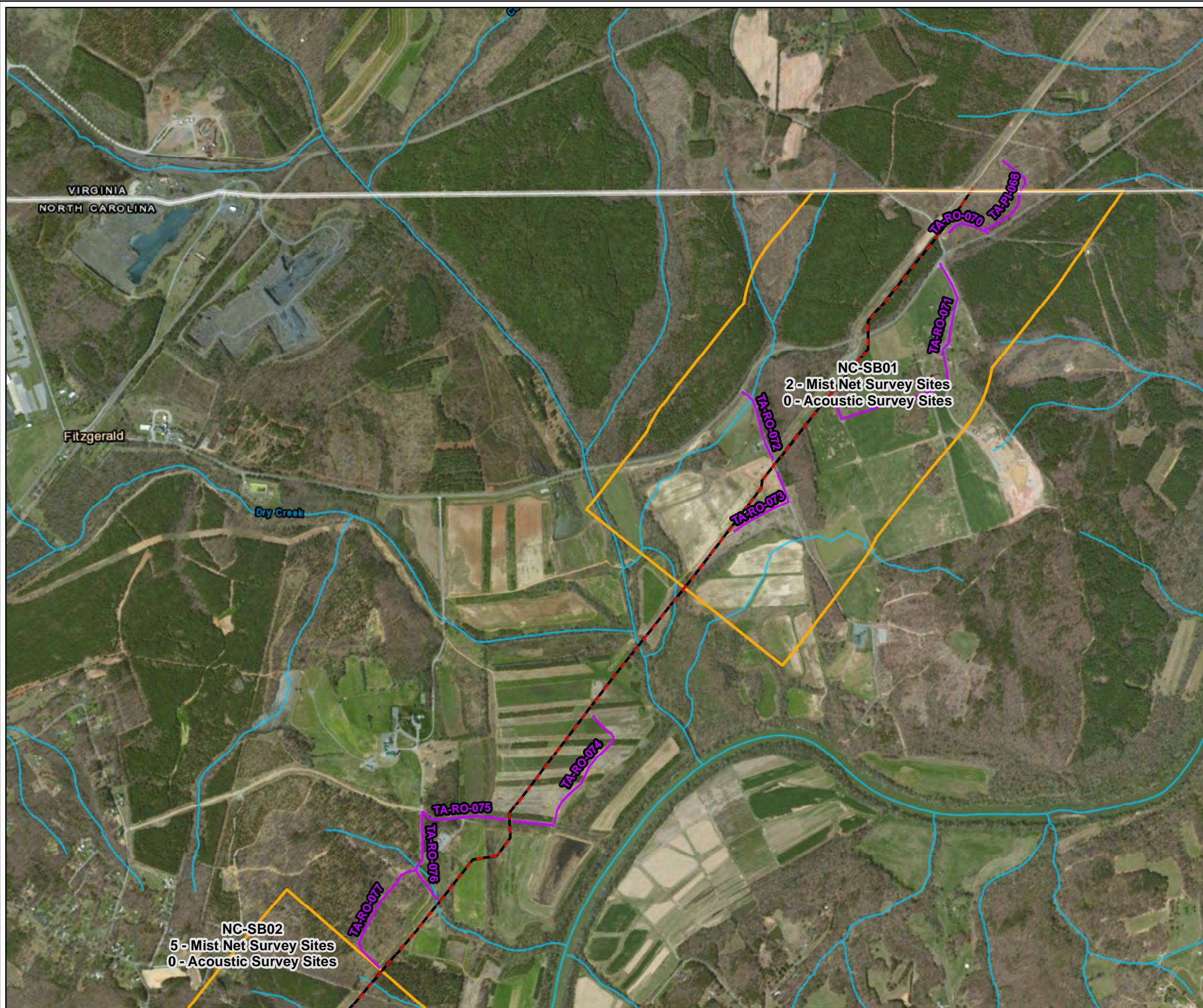


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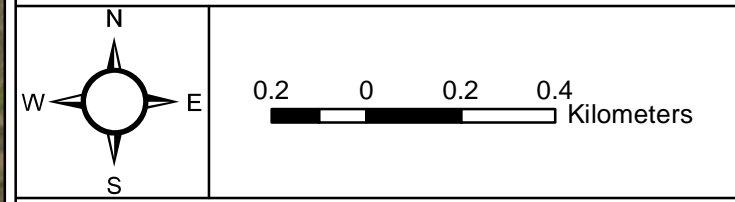
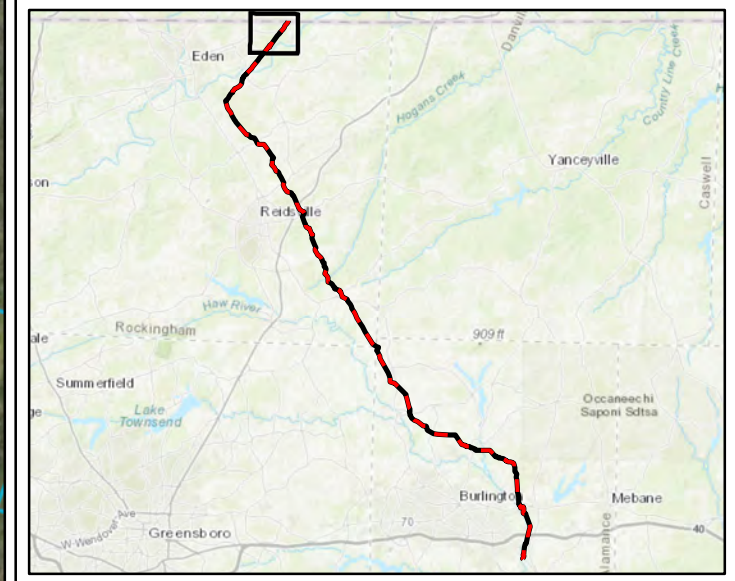
Project No. 1219.02



Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.



- Proposed Centerline
- Proposed Access Road
- Survey Block
- National Hydrography Dataset (NHD) Stream







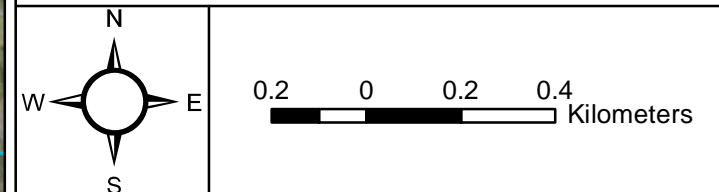
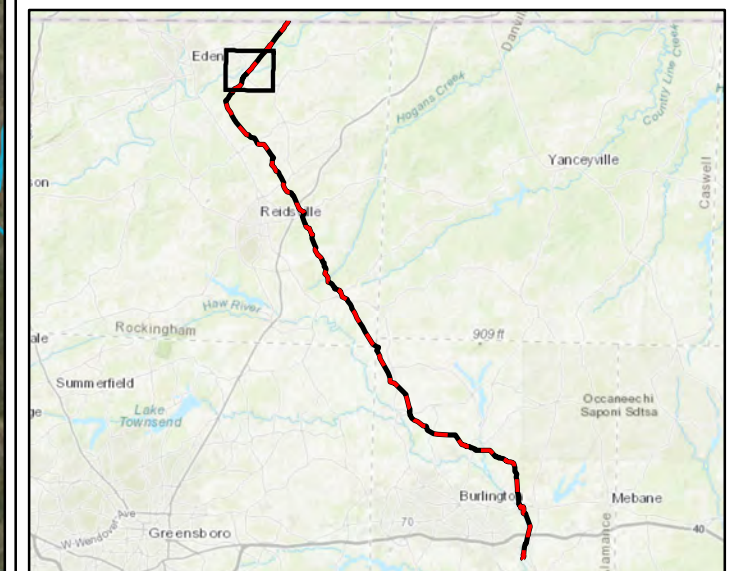
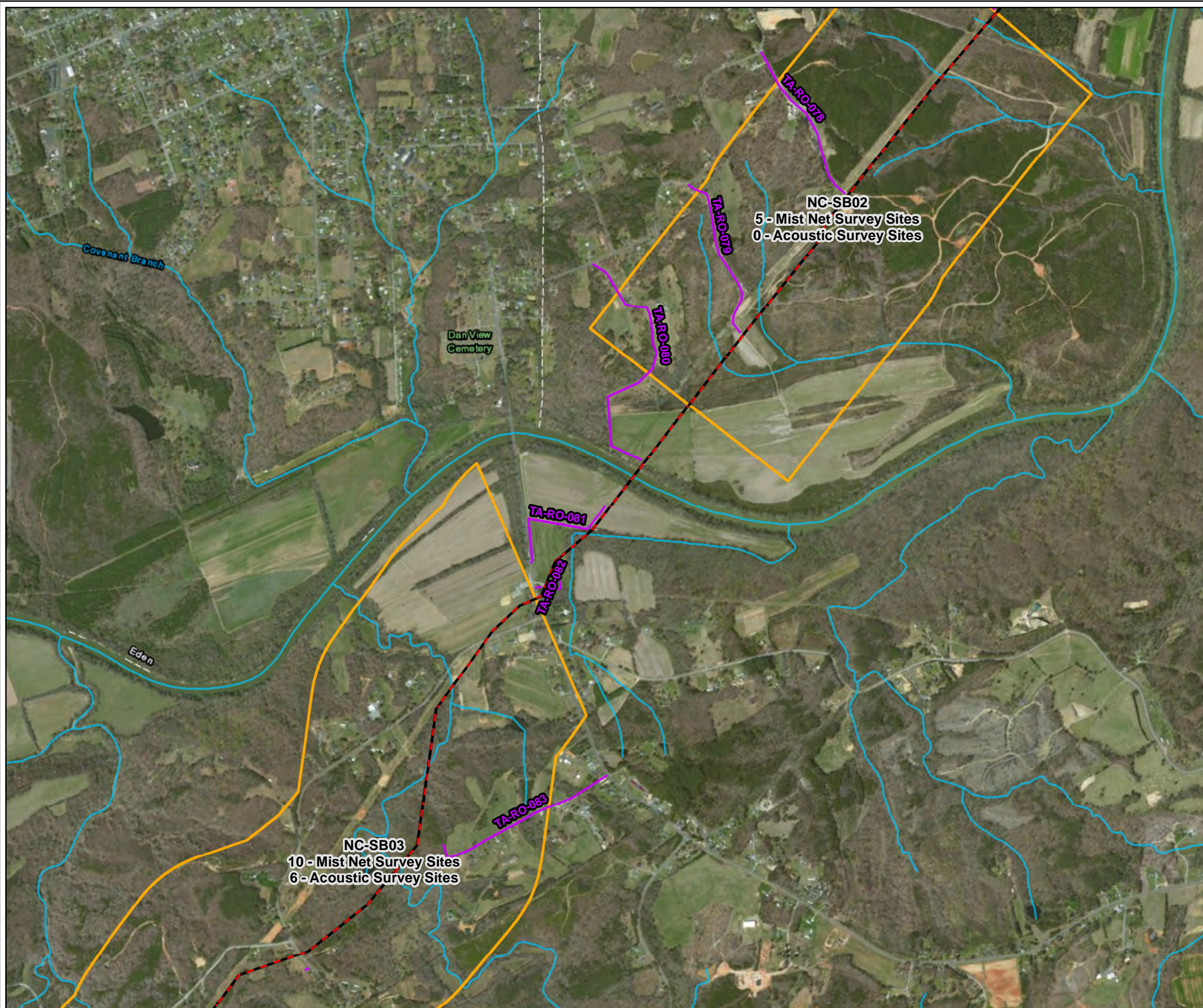
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Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.

-  Proposed Centerline
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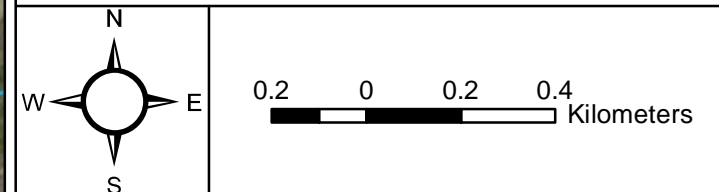
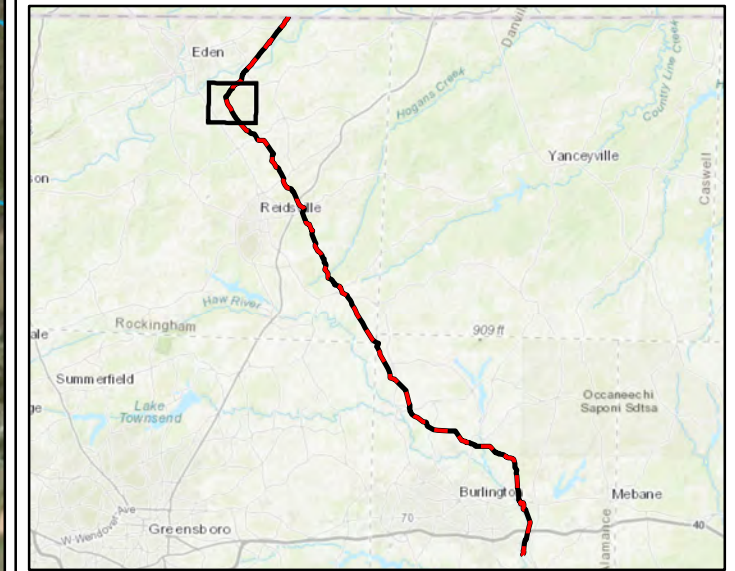
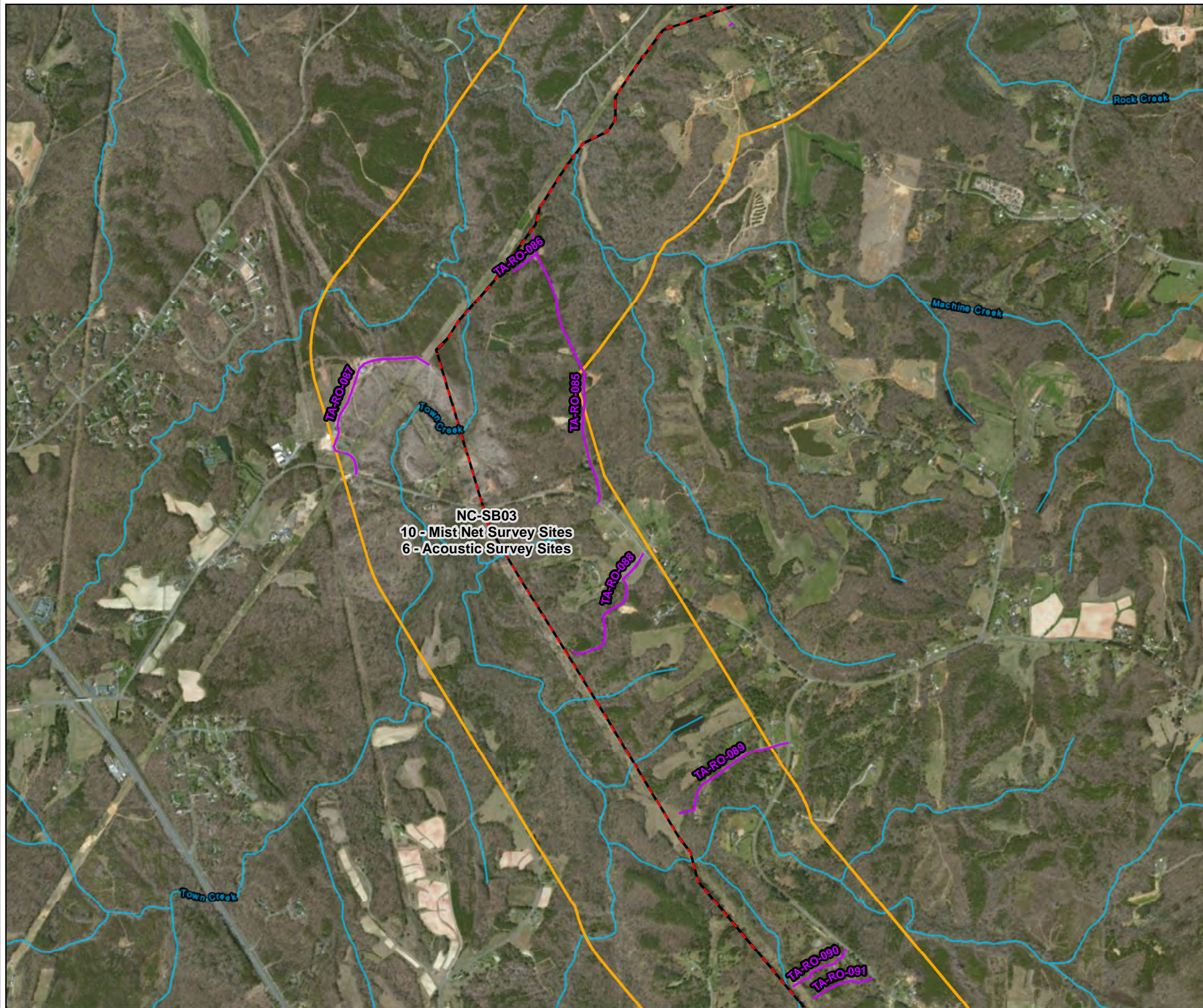
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Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.

-  Proposed Centerline
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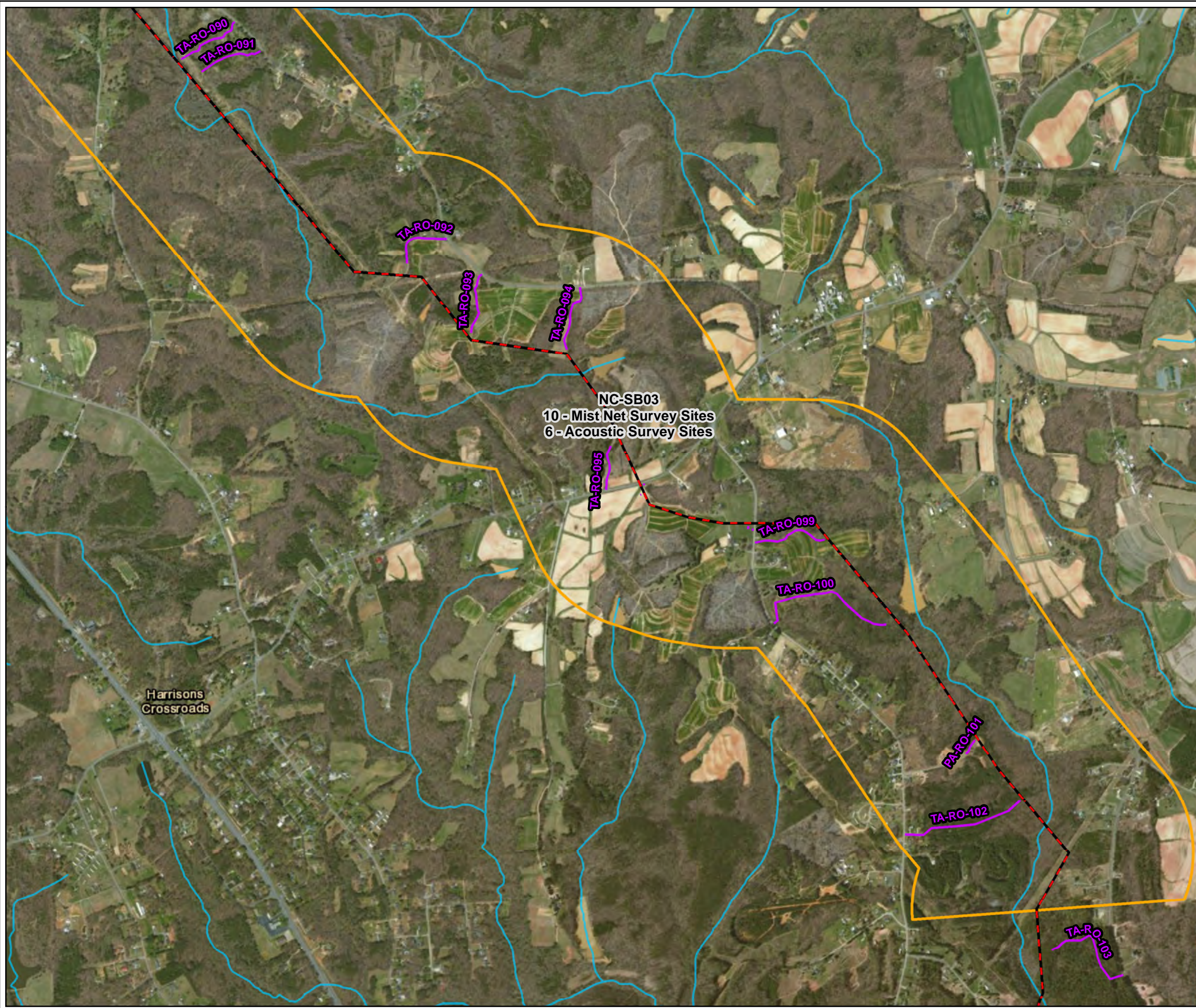


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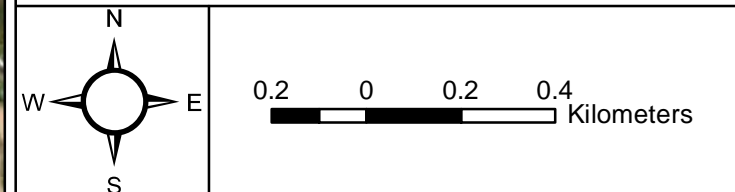
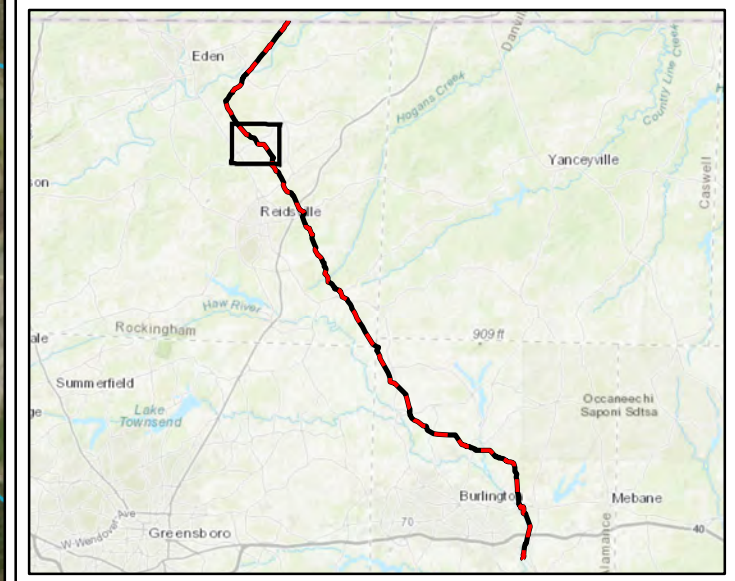
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Project No. 1219.02



Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.



- Proposed Centerline
- Proposed Access Road
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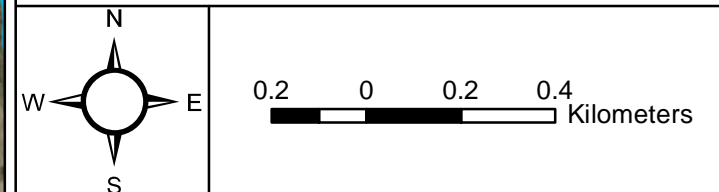
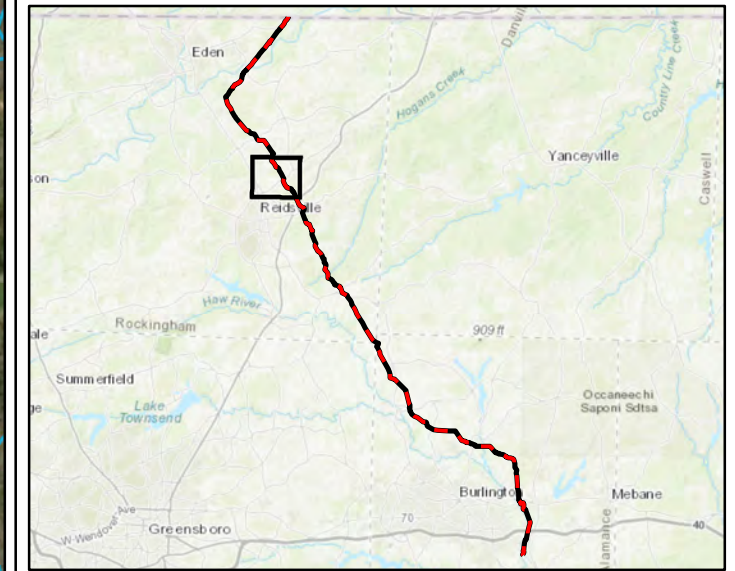
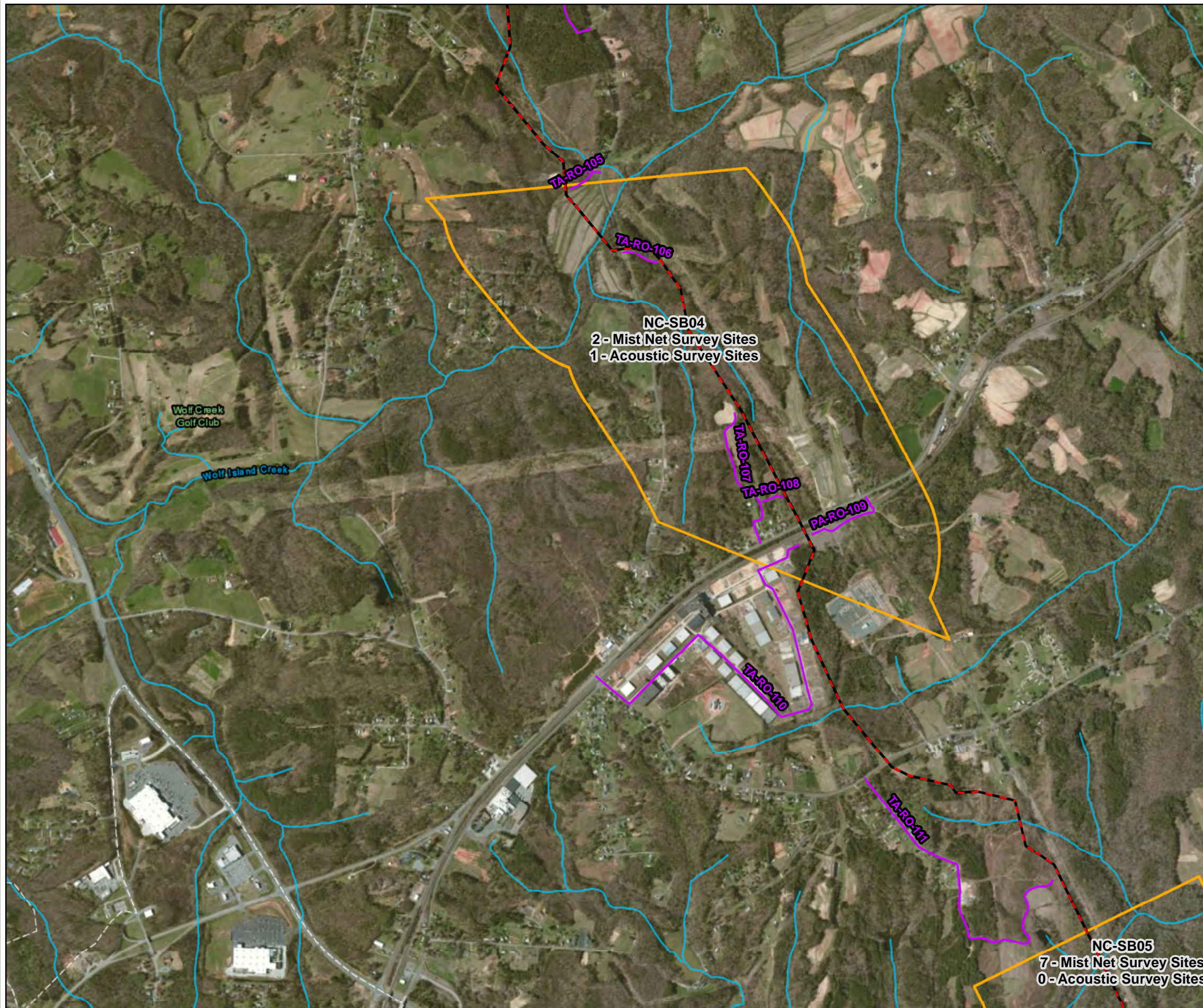
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Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.

-  Proposed Centerline
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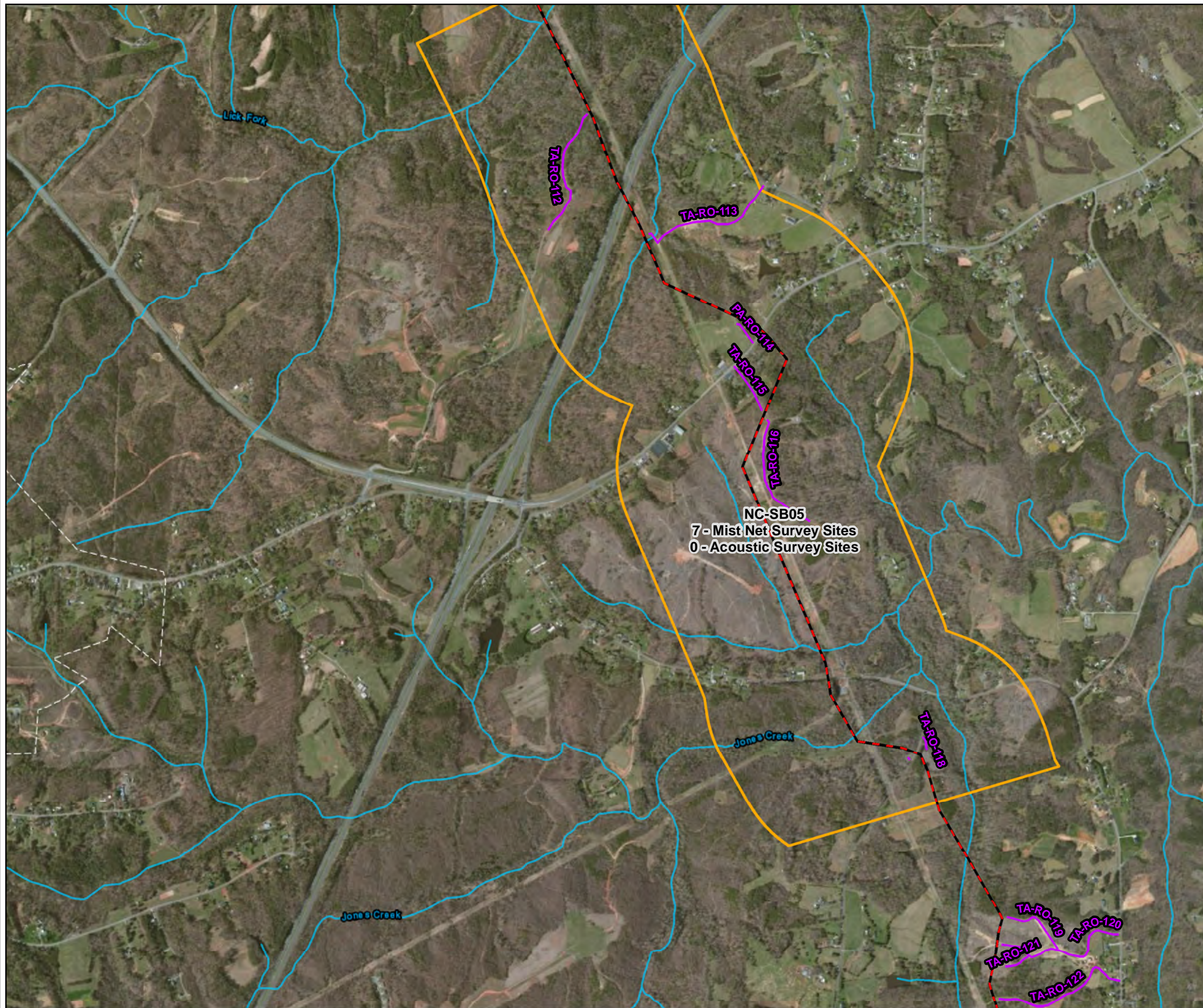


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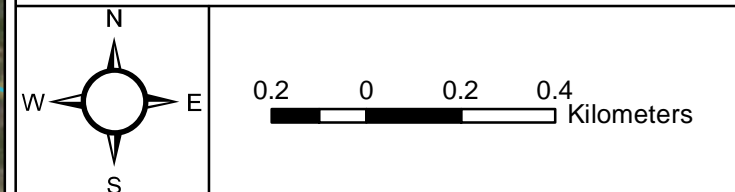
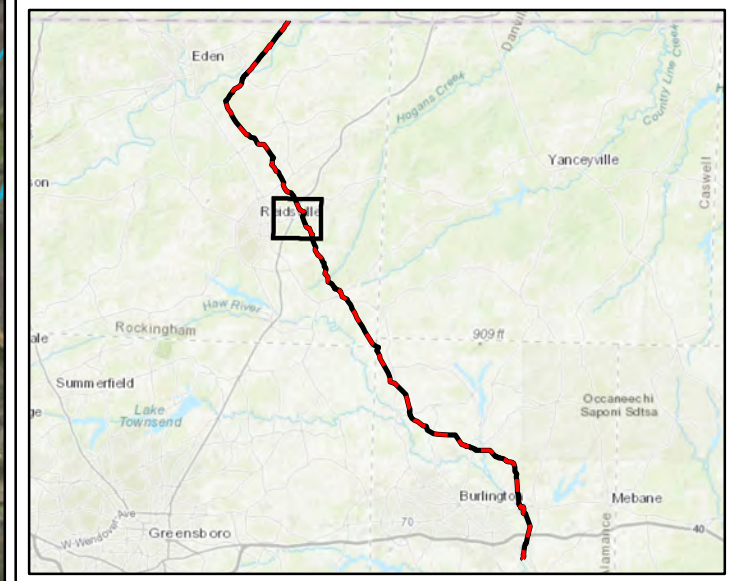
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Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.



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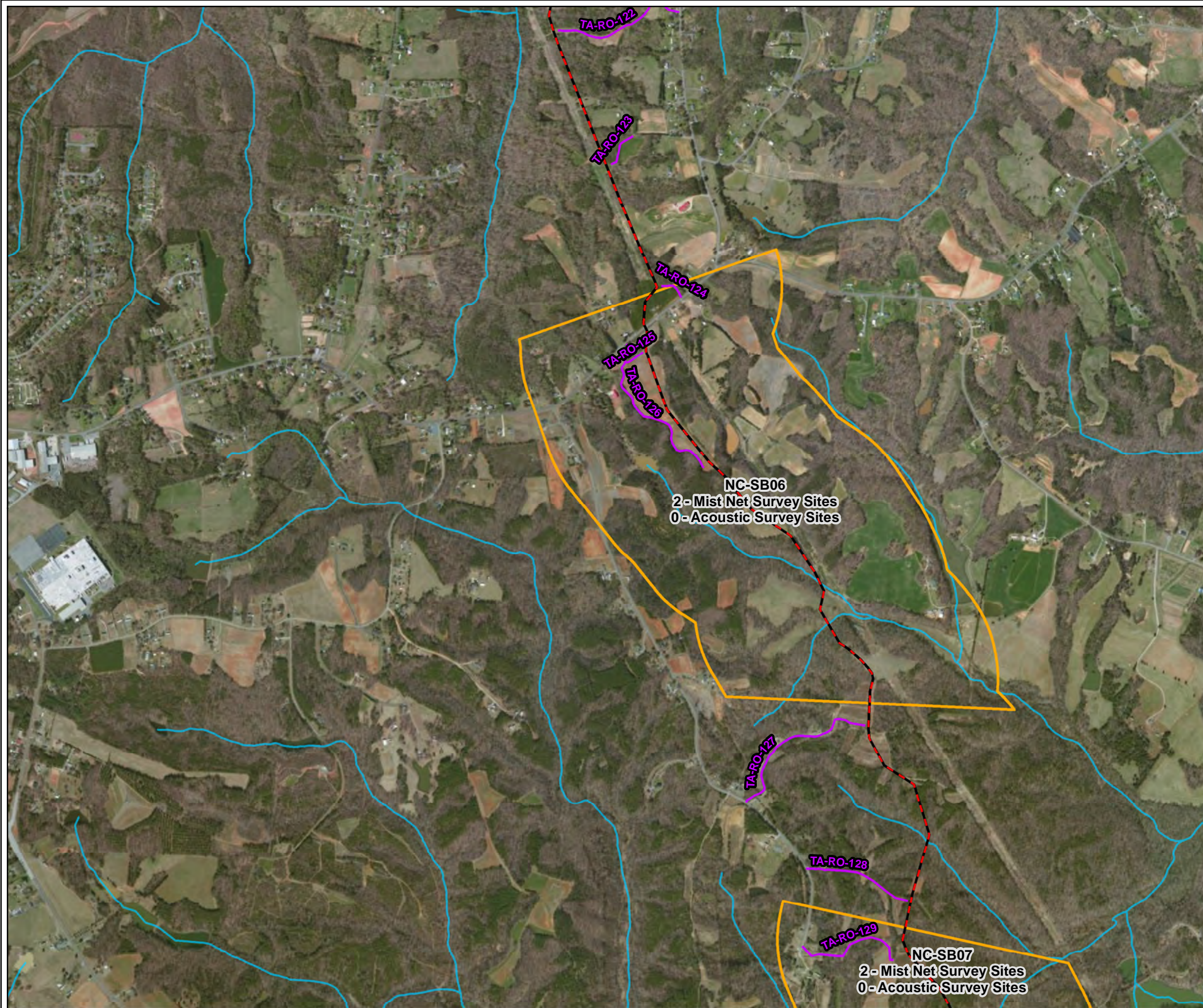




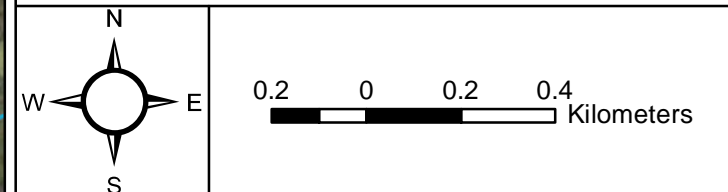
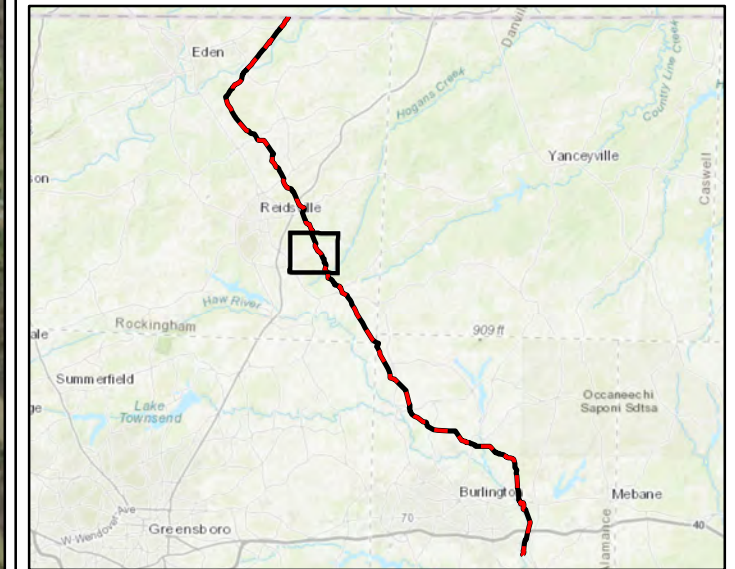


Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.

-  Proposed Centerline
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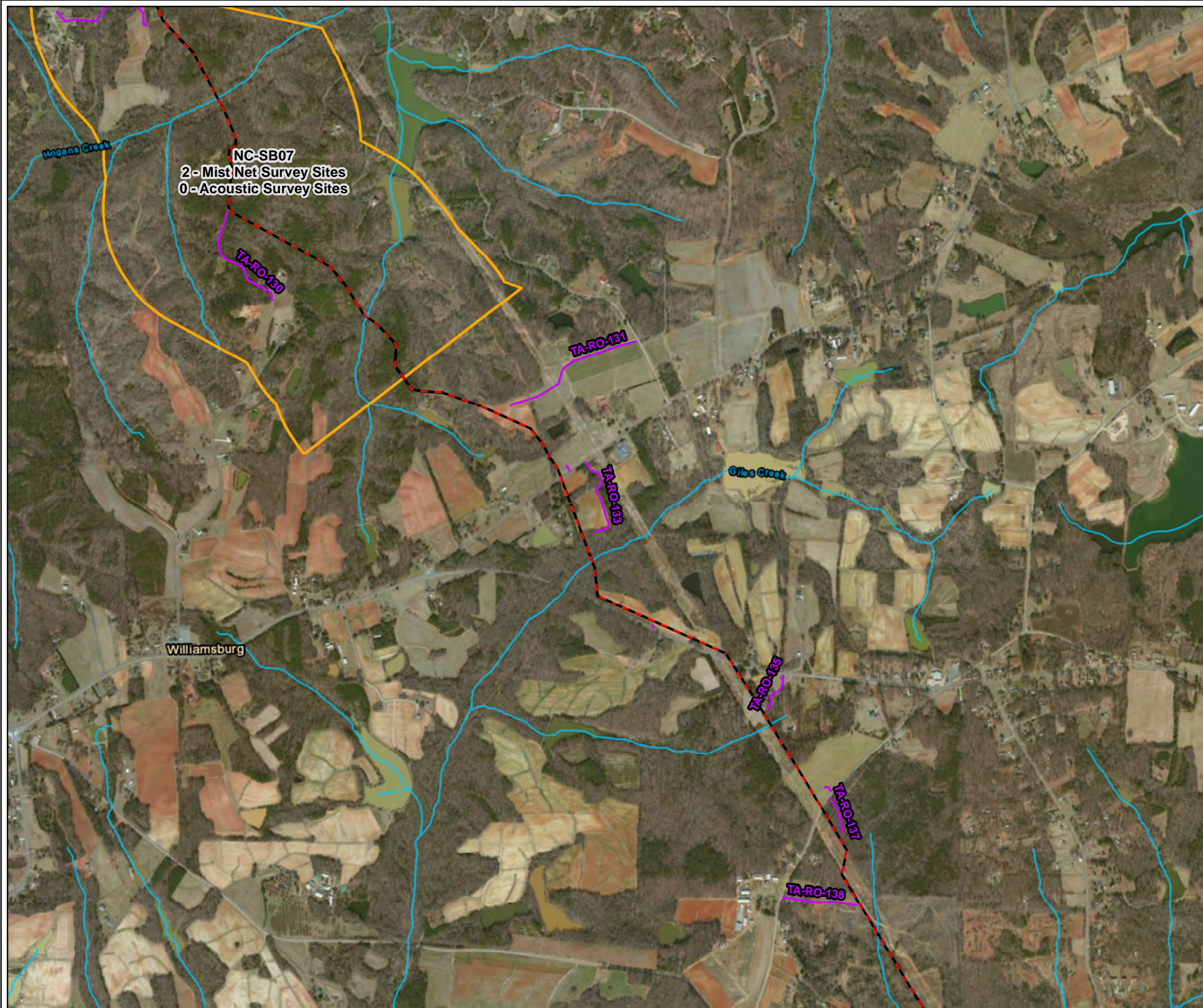
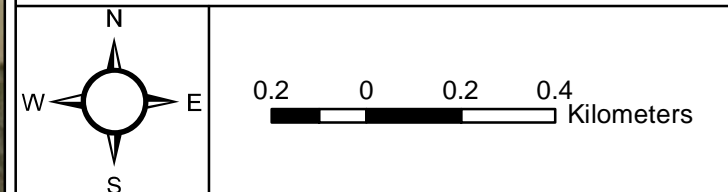
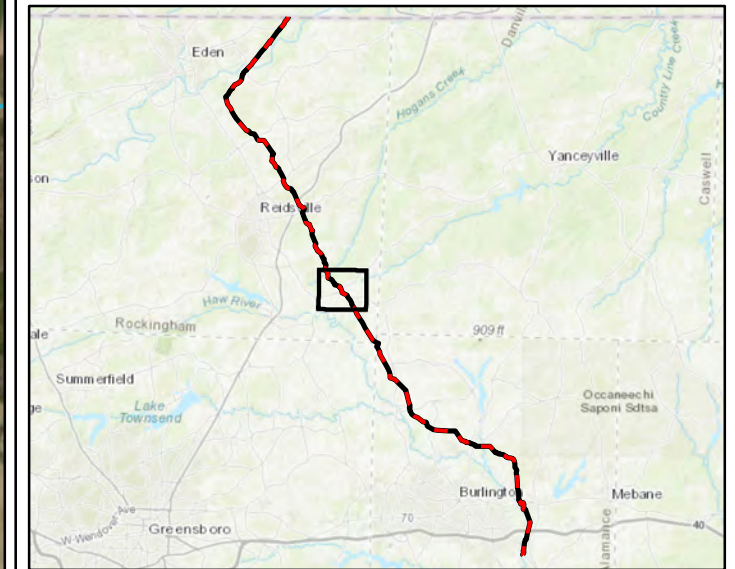


Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.





- Proposed Centerline
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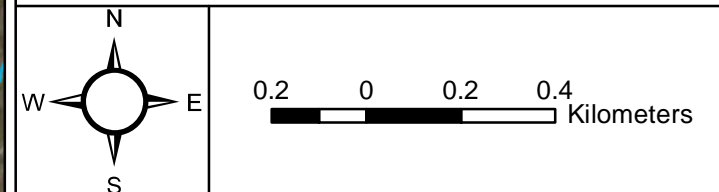
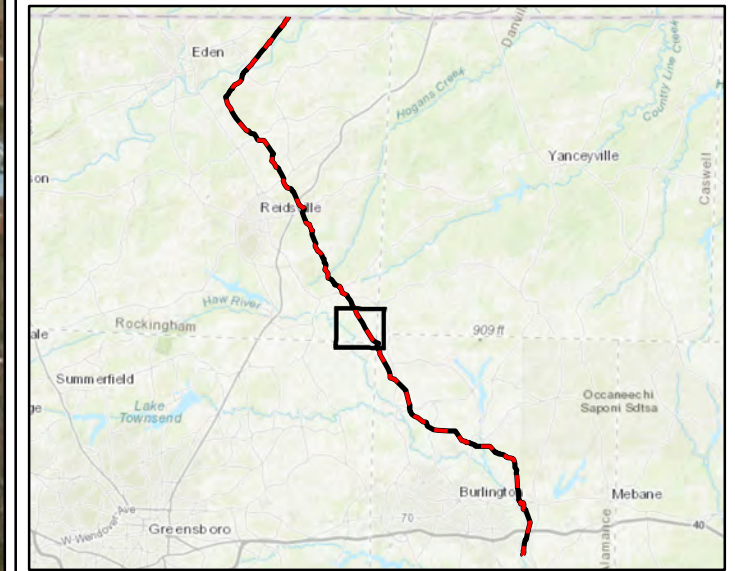
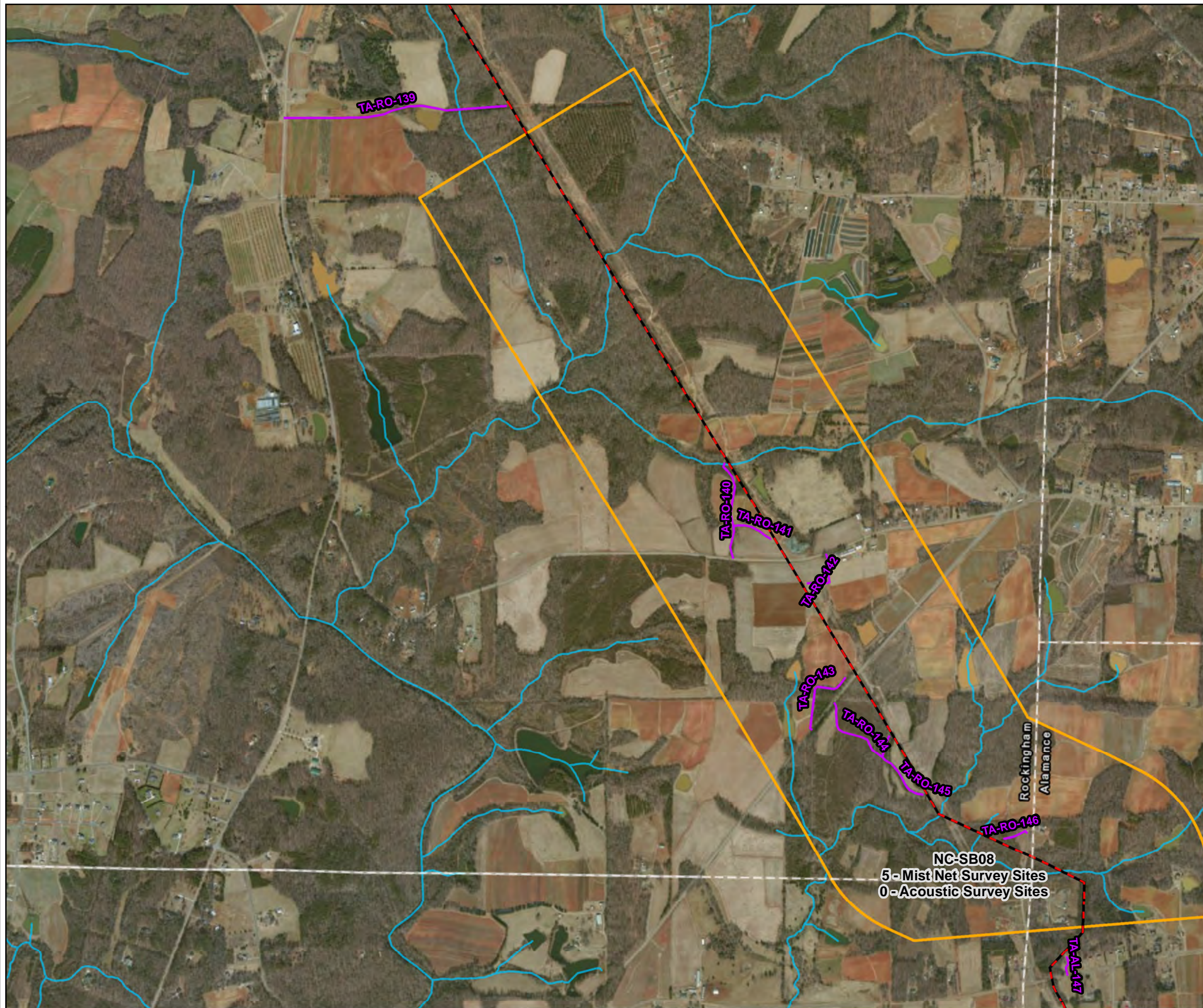


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Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.

-  Proposed Centerline
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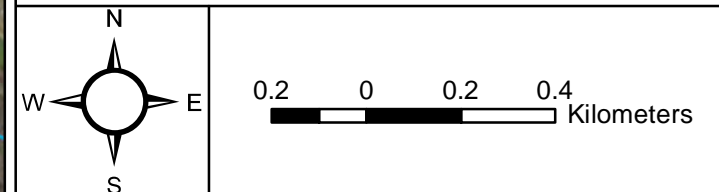
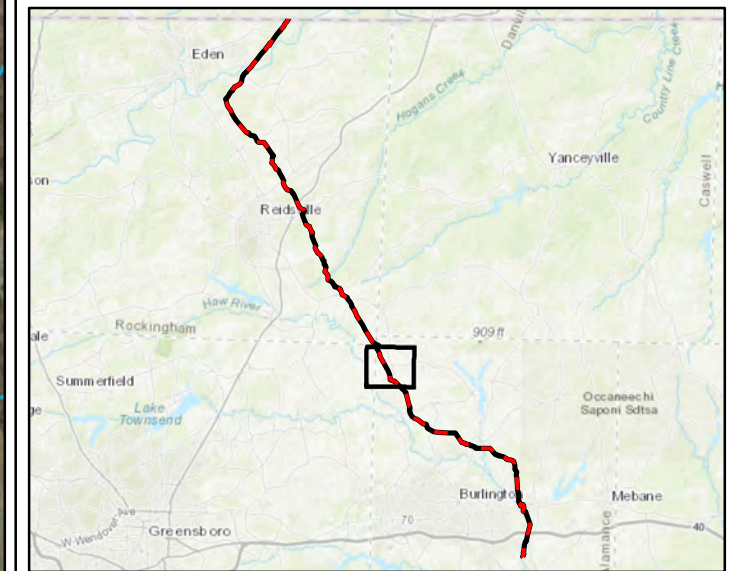
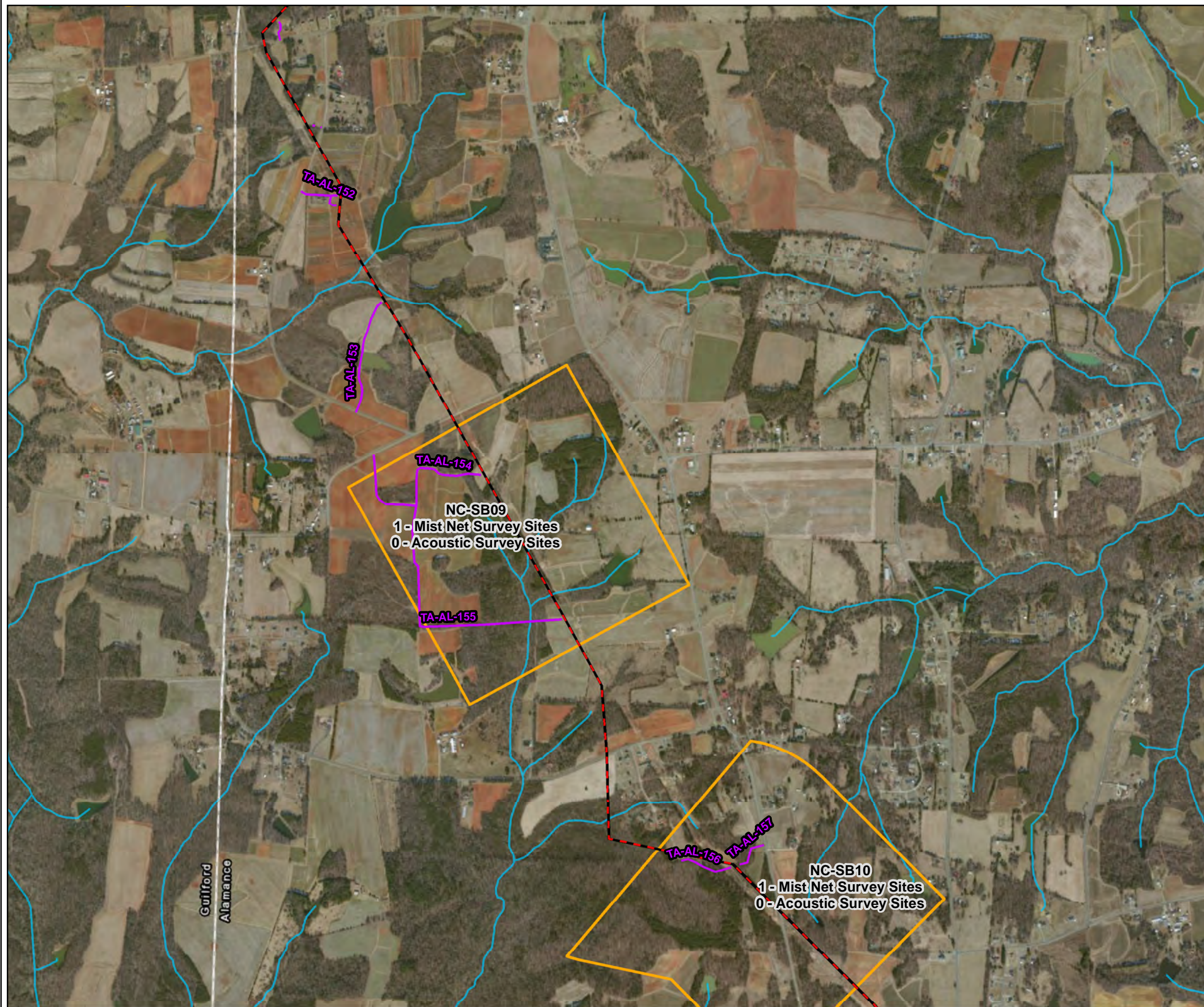
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Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.

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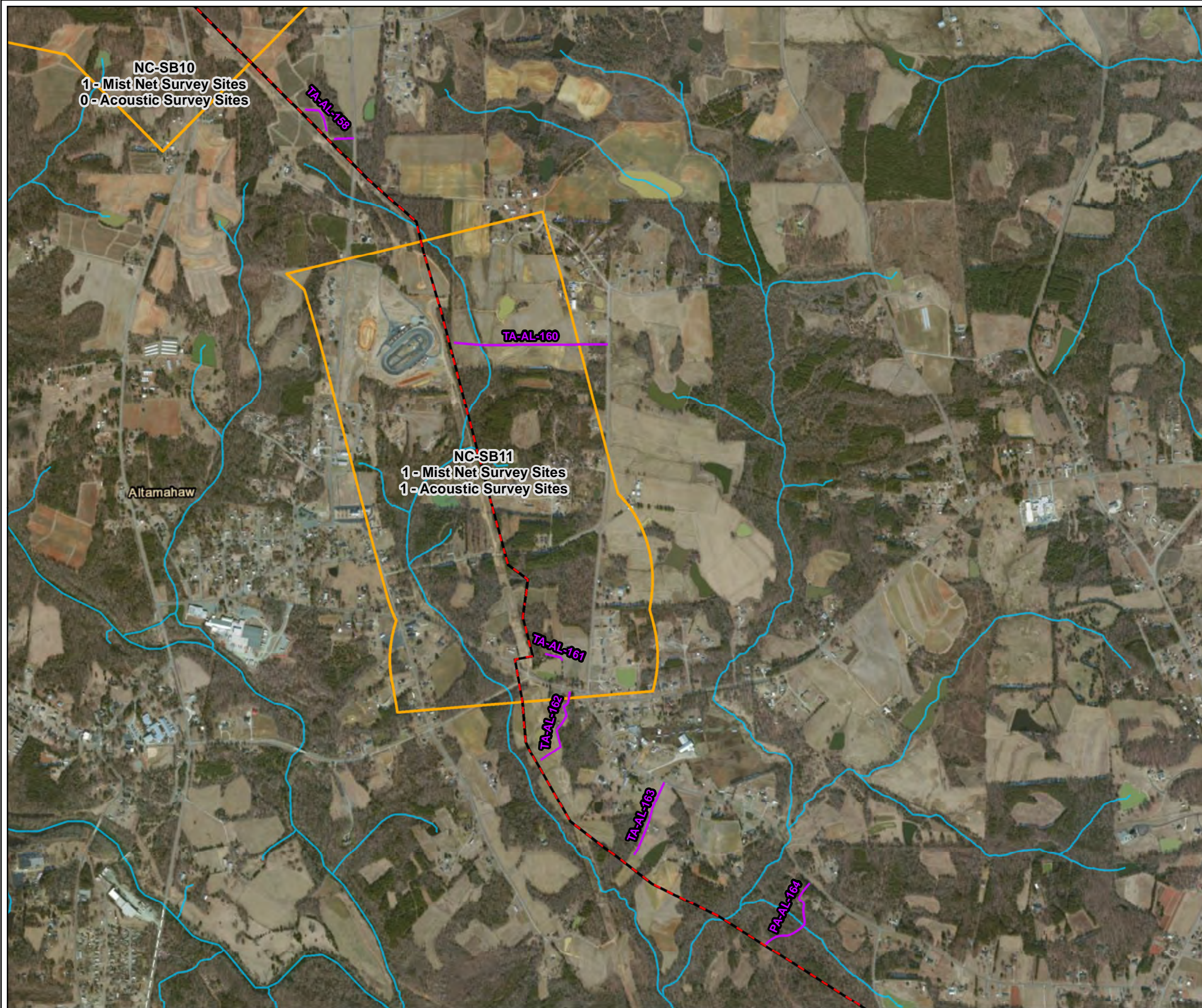
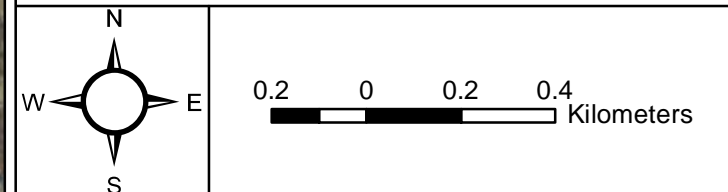
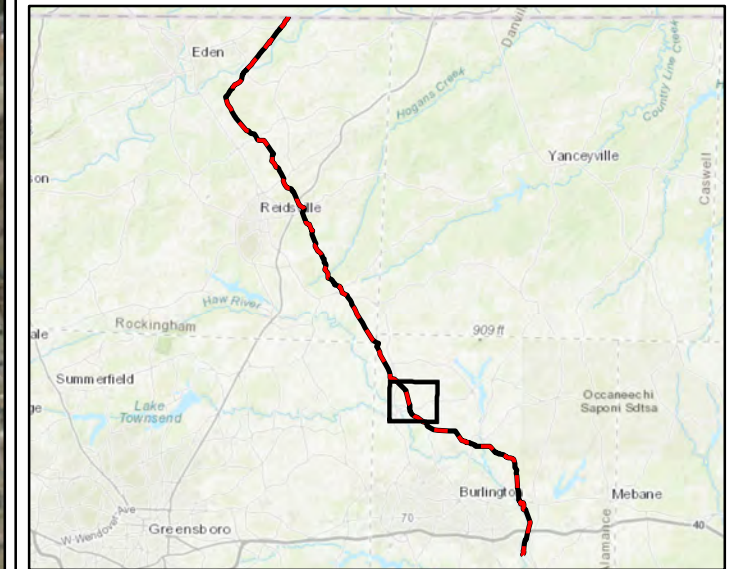


Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.





- Proposed Centerline
- Proposed Access Road
- Survey Block
- National Hydrography Dataset (NHD) Stream

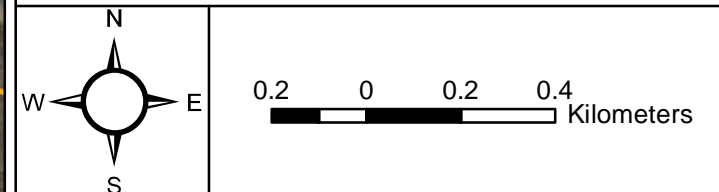
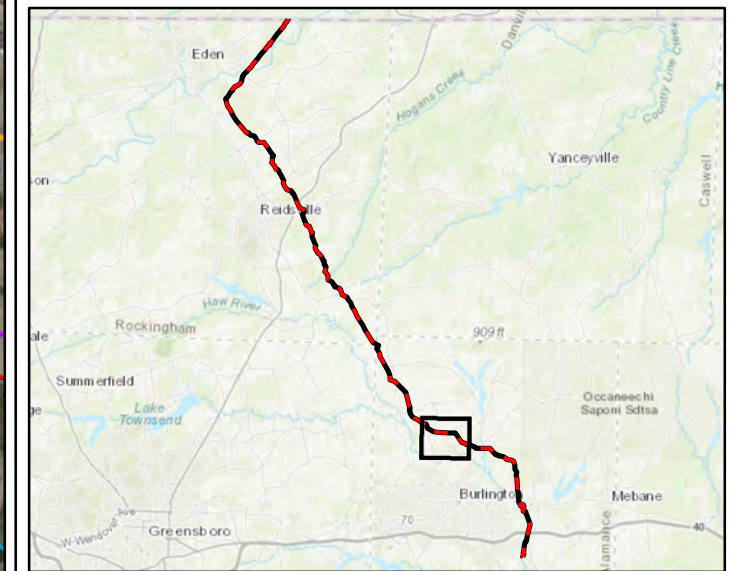
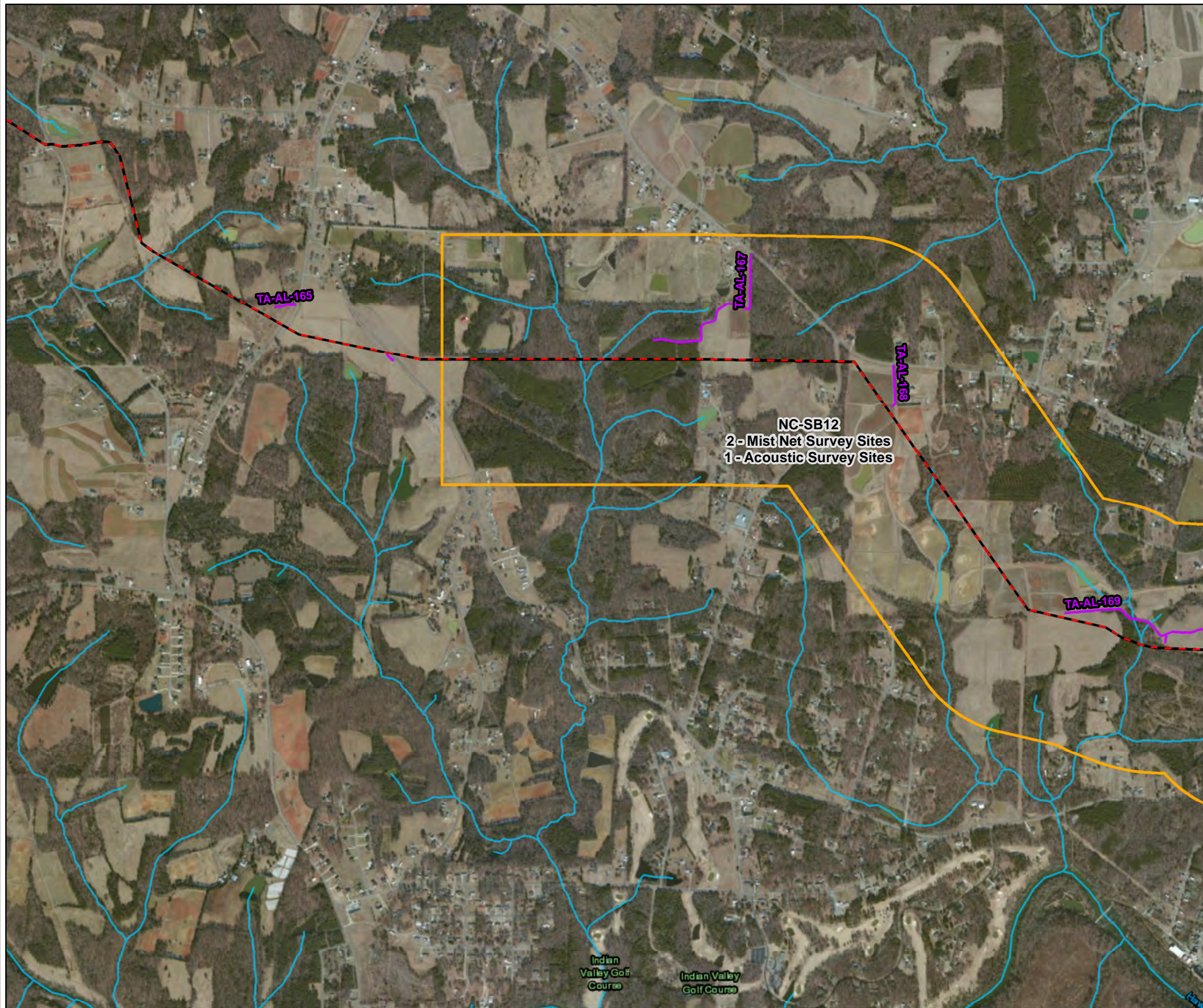


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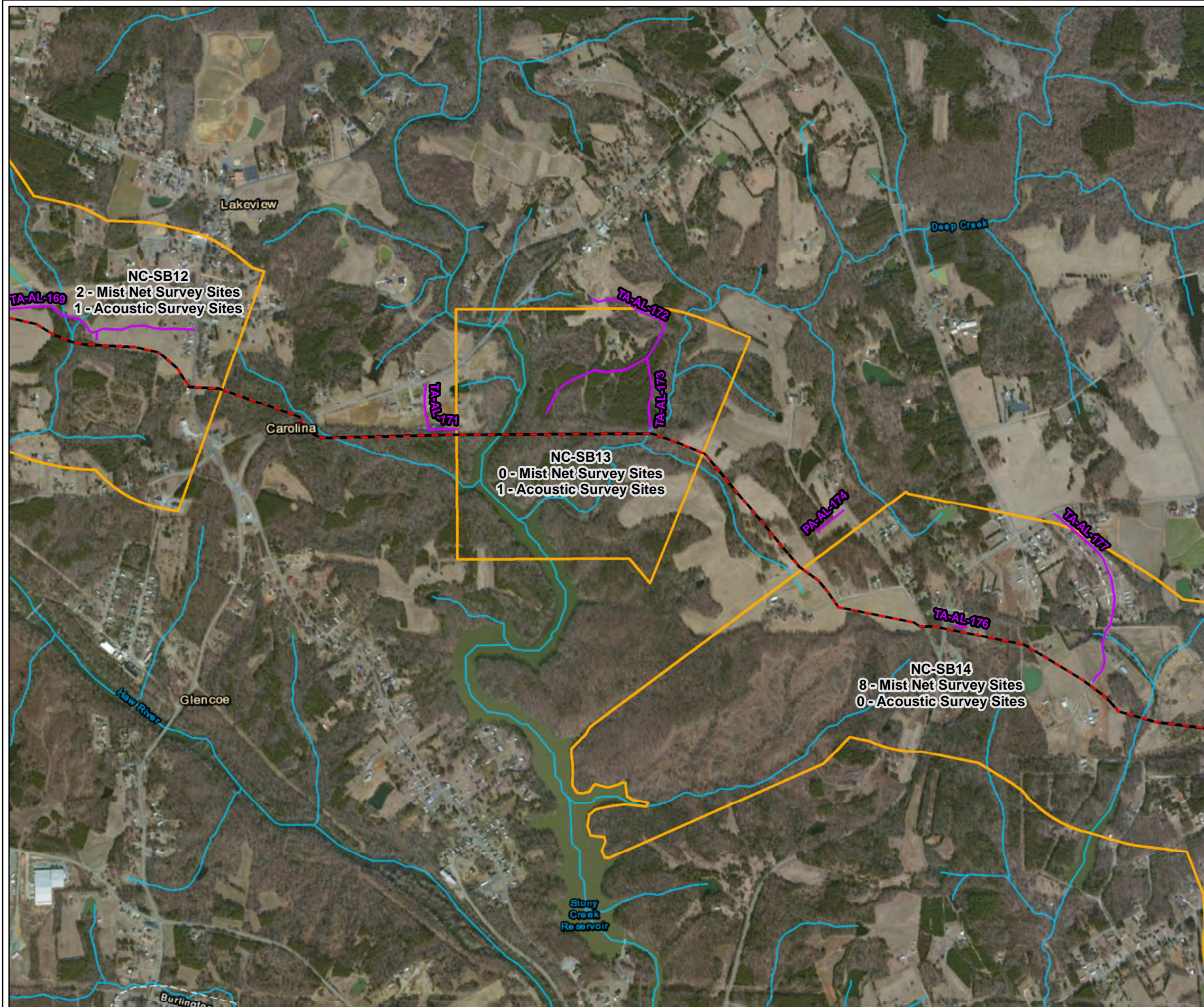


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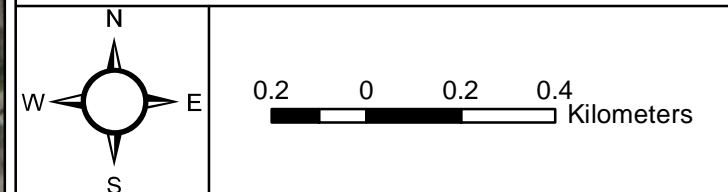
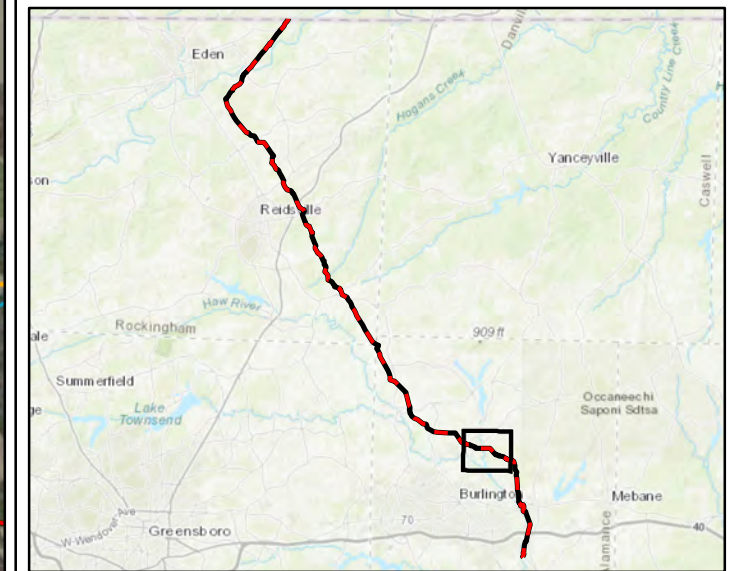
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Project No. 1219.02



Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.



- Proposed Centerline
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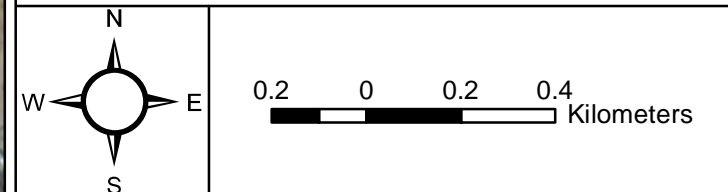
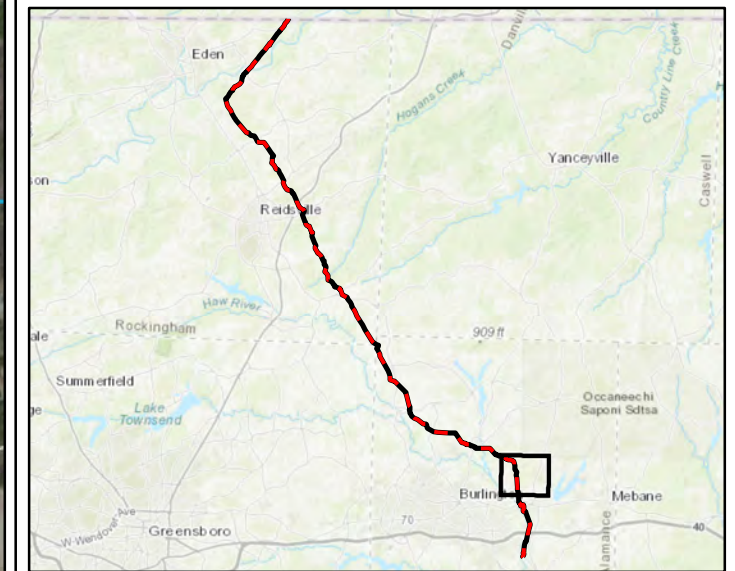
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Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.





-  Proposed Centerline
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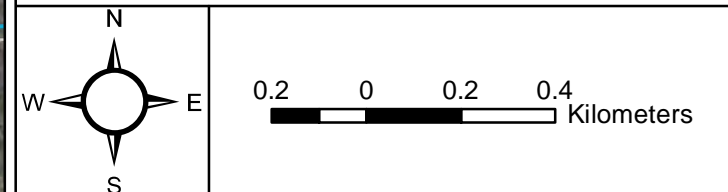
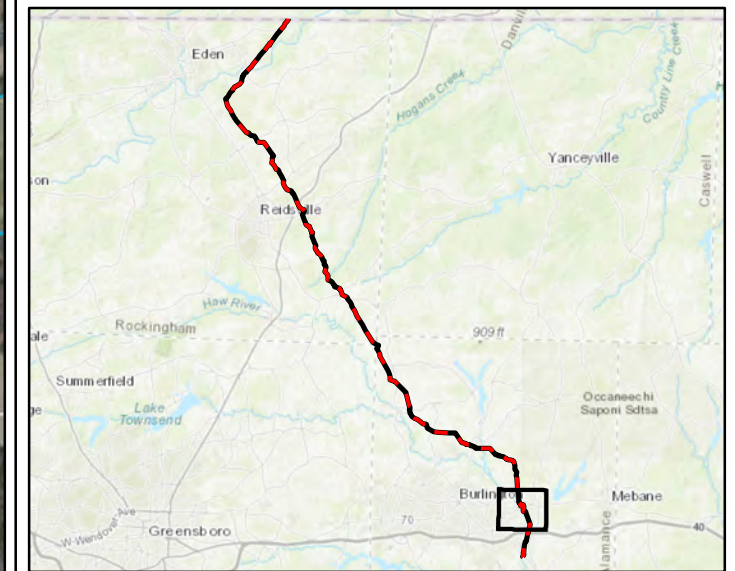
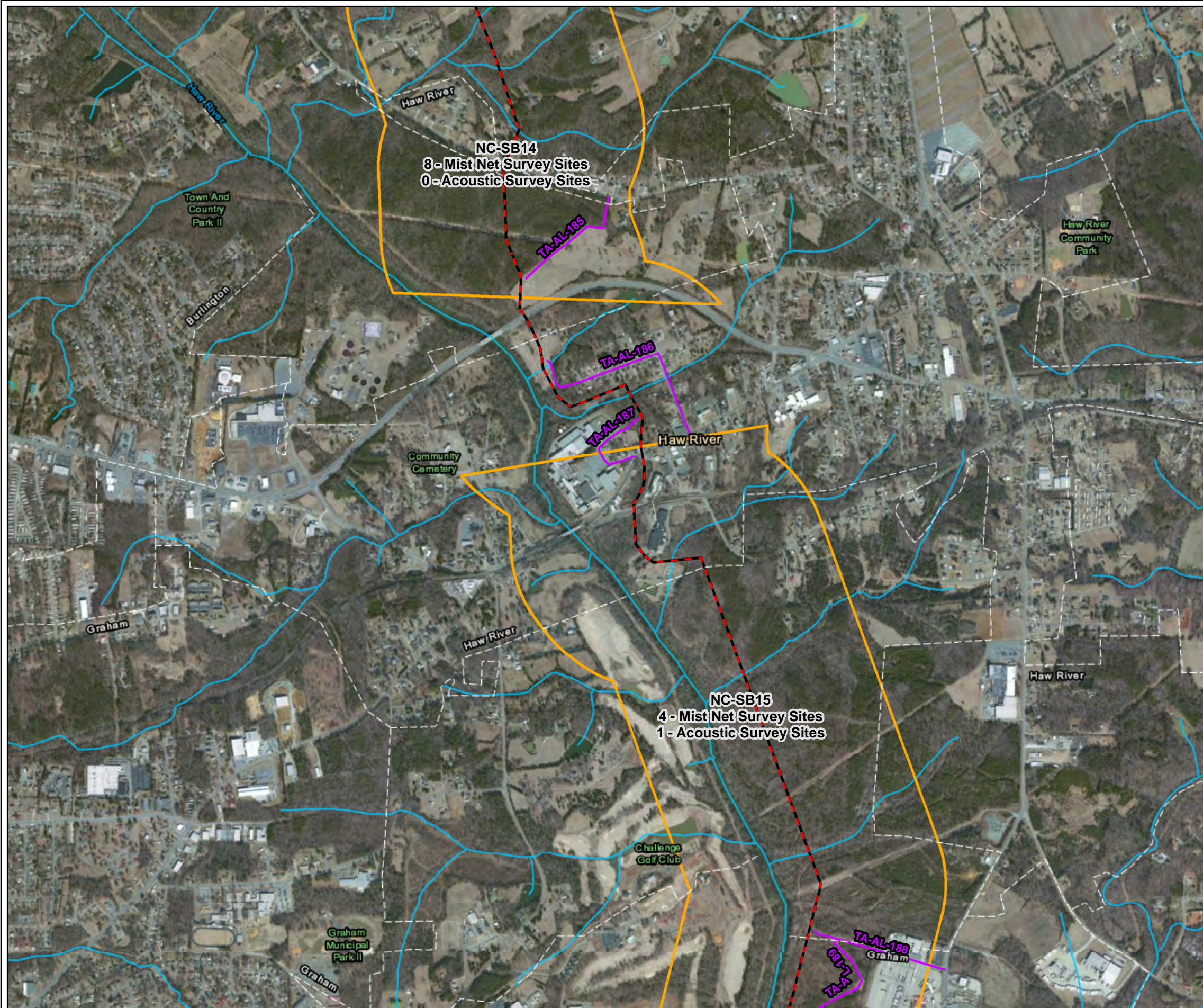


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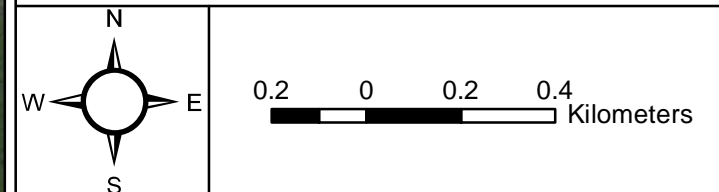
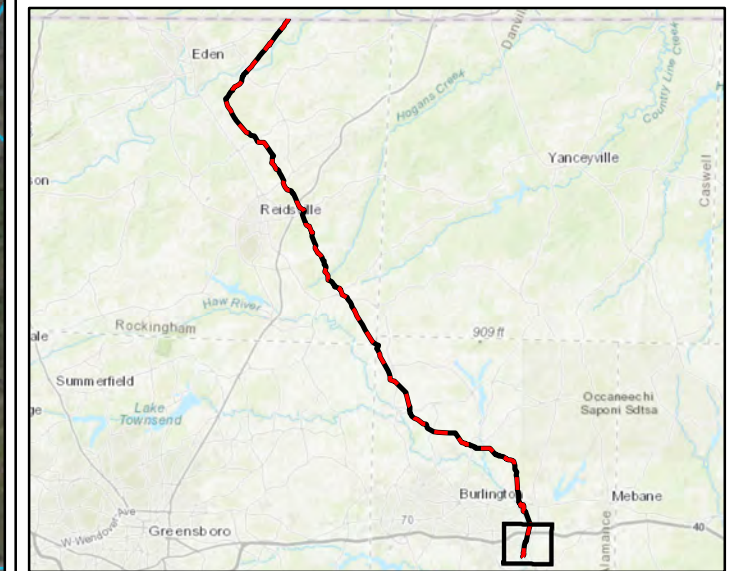
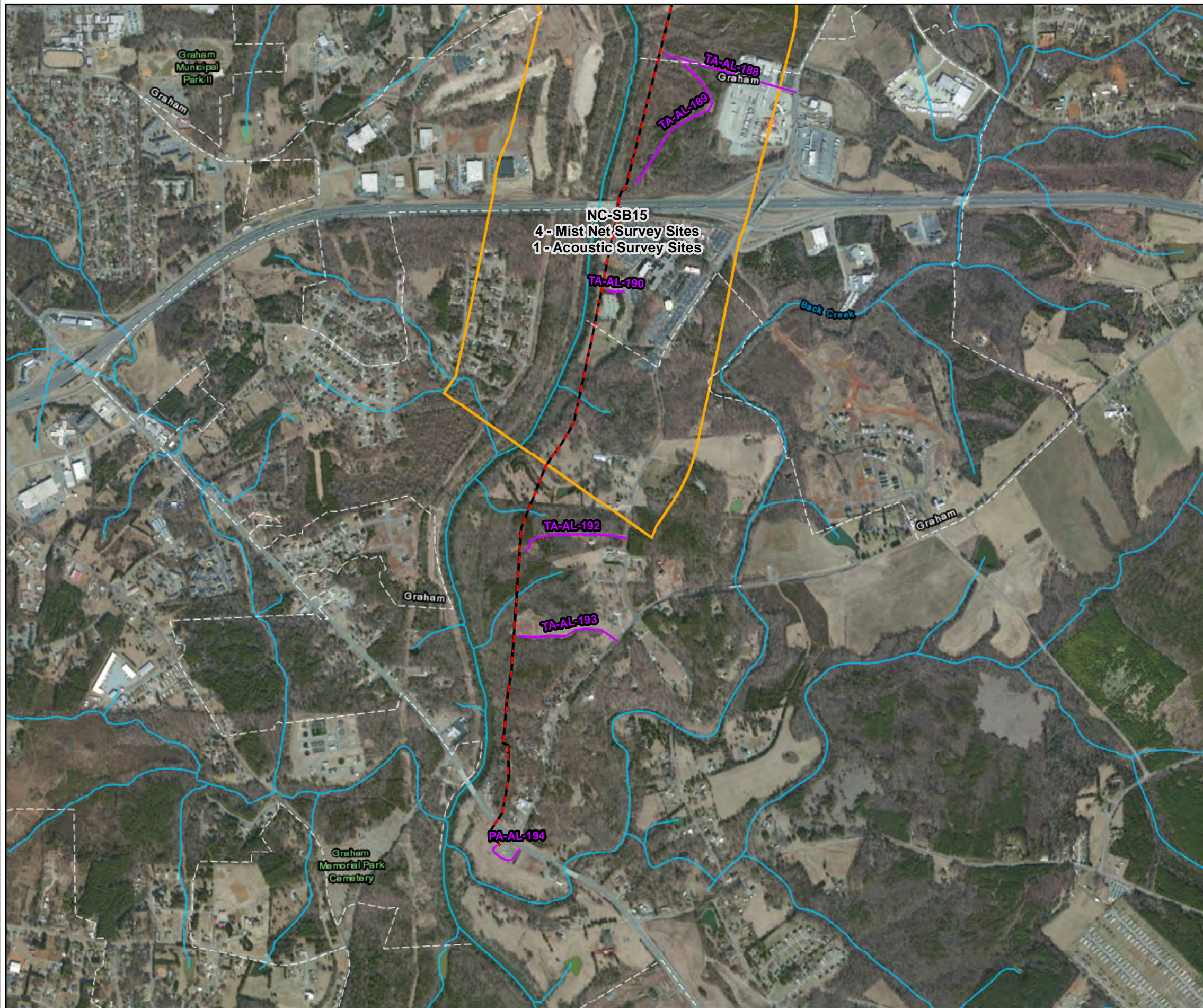
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Figure 2. Proposed survey sites along MVP Southgate Project in North Carolina.

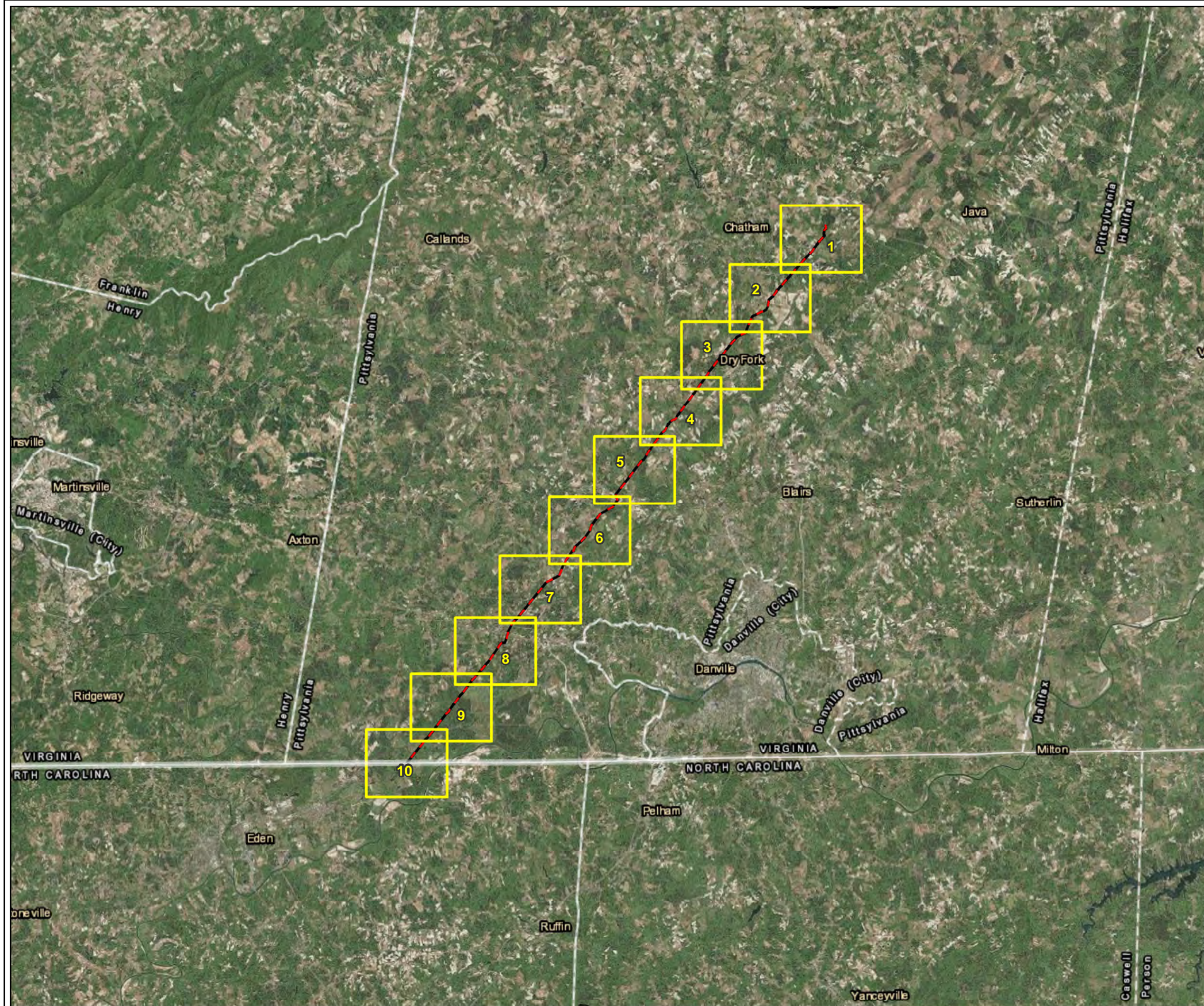
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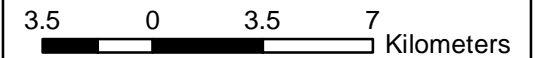
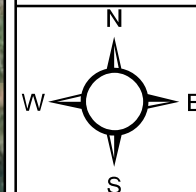
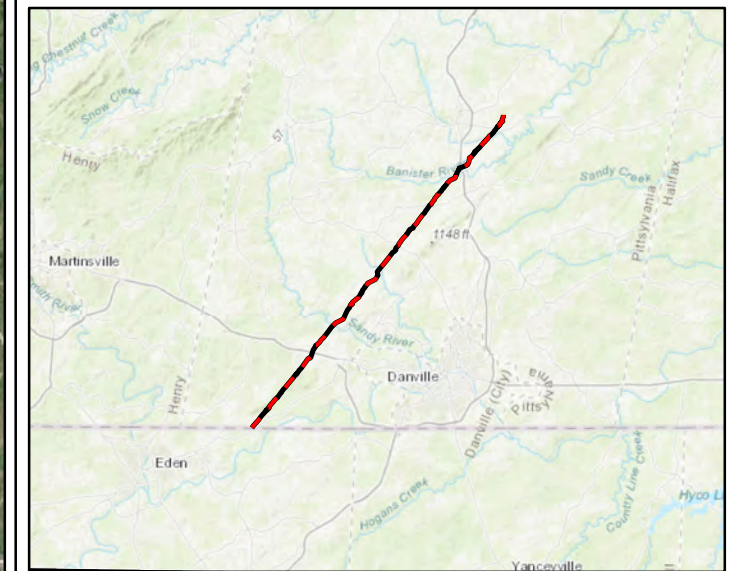


Figure 3. Proposed survey sites along MVP Southgate Project in Virginia.



Map Key

- Proposed Centerline
- Proposed Access Road



Base Map: ESRI "World Imagery (Clarity)";  
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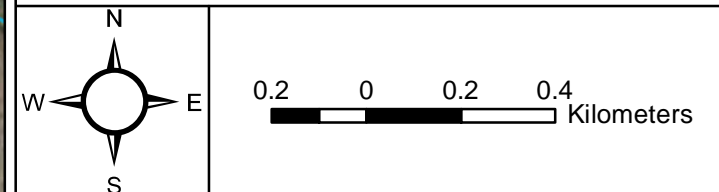
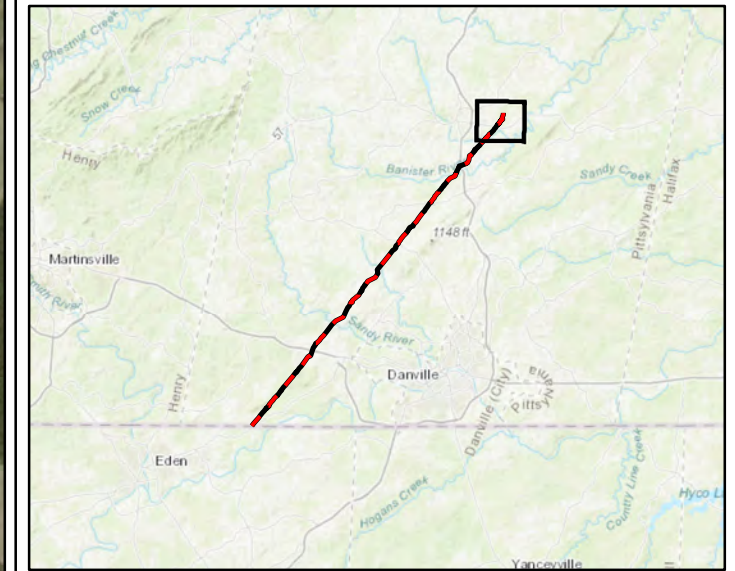
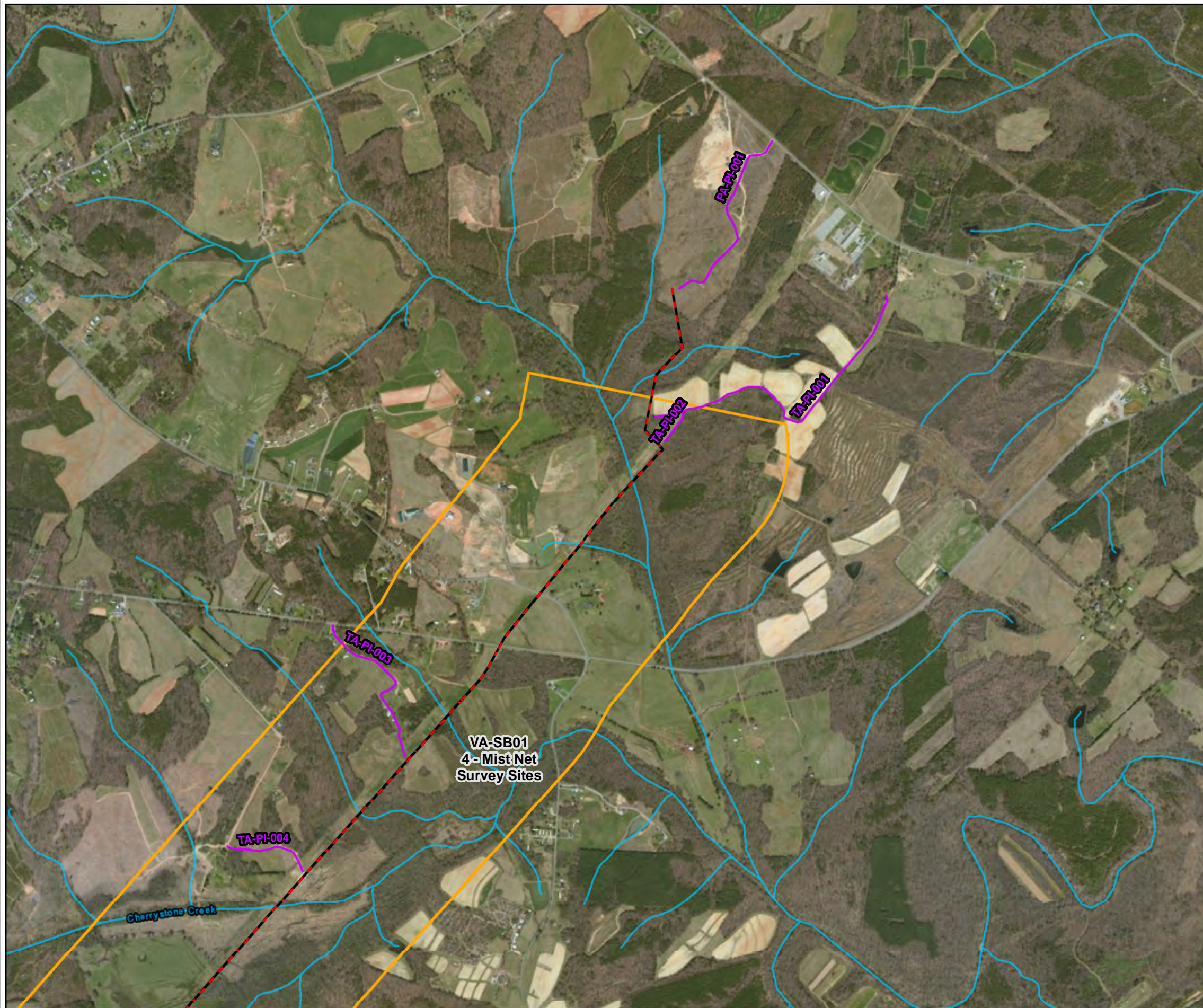
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Figure 3. Proposed survey sites along MVP Southgate Project in Virginia.

- Proposed Centerline
- Proposed Access Road
- Survey Block
- National Hydrography Dataset (NHD) Stream



Base Map: ESRI "World Imagery (Clarity)";  
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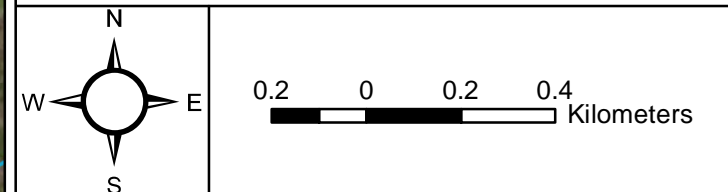
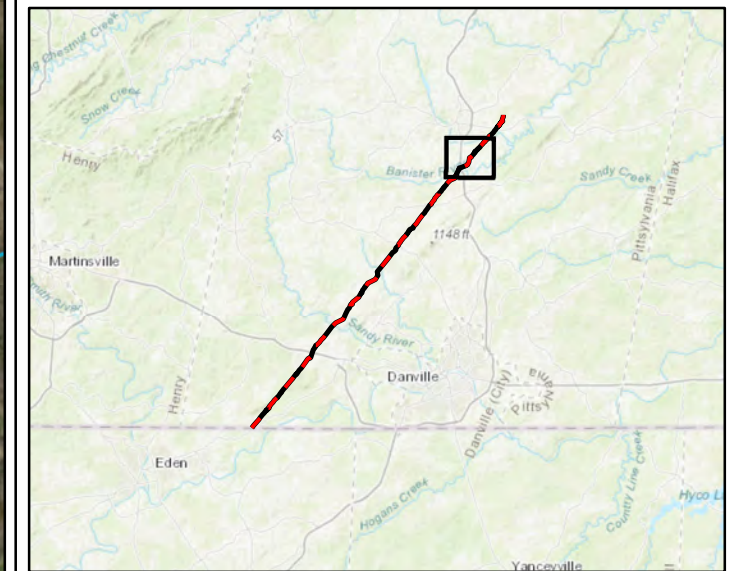
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Figure 3. Proposed survey sites along MVP Southgate Project in Virginia.

- Proposed Centerline
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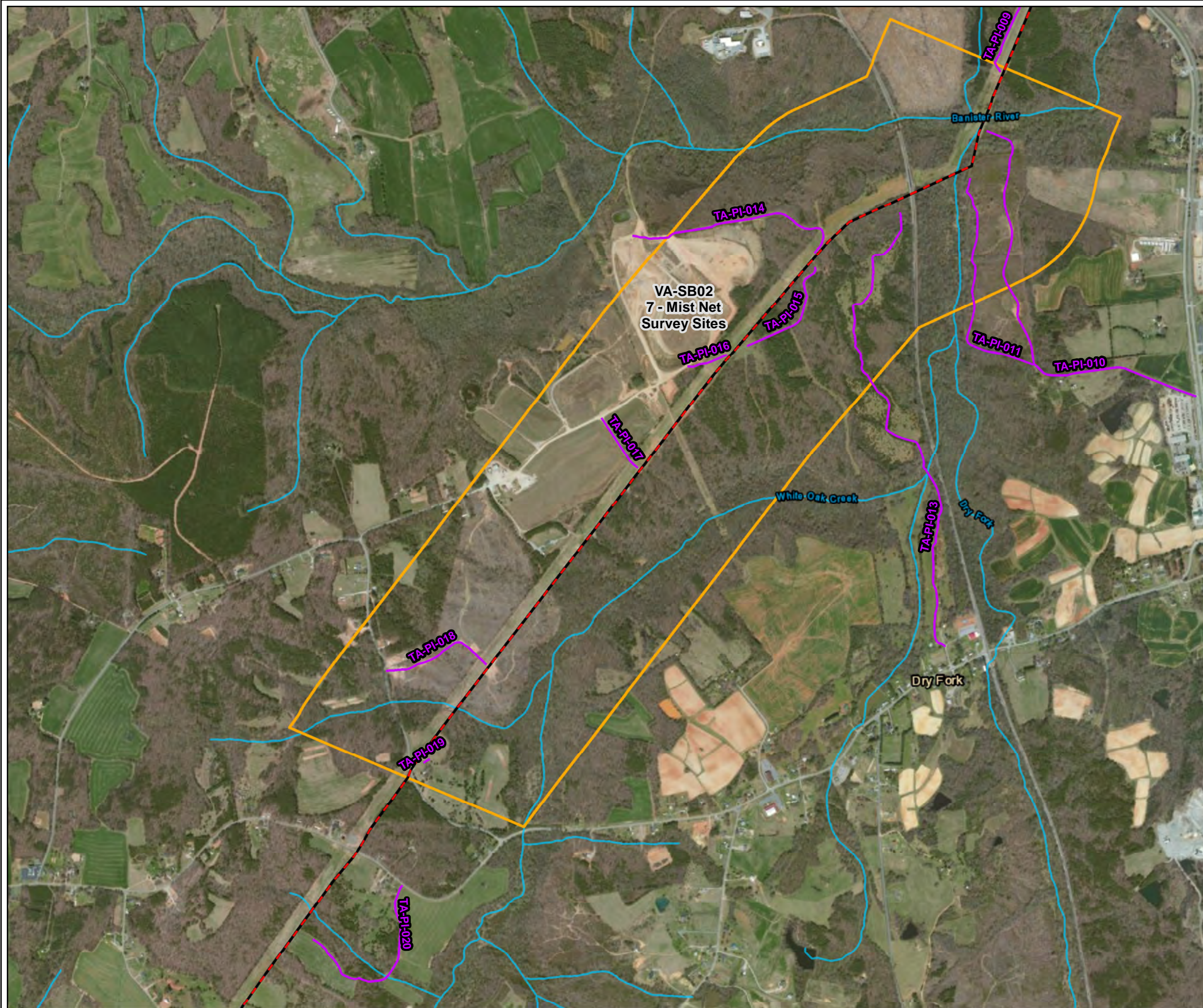
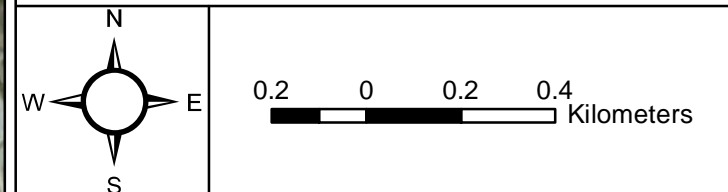
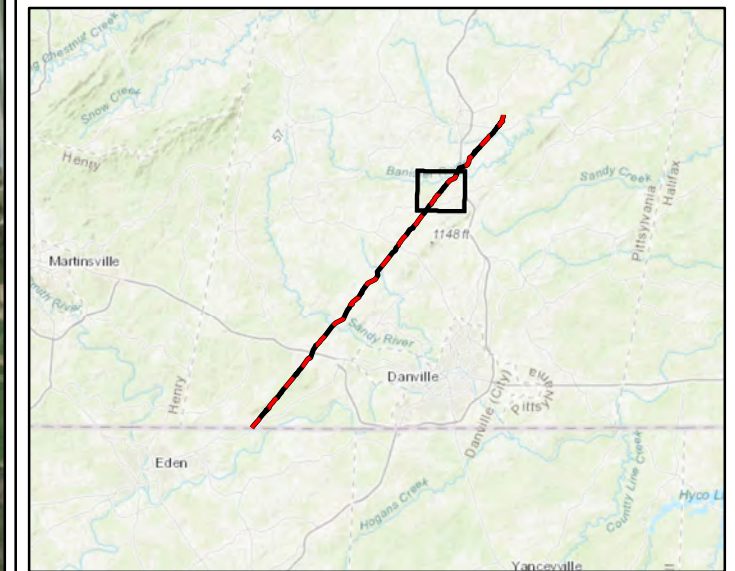


Figure 3. Proposed survey sites along MVP Southgate Project in Virginia.

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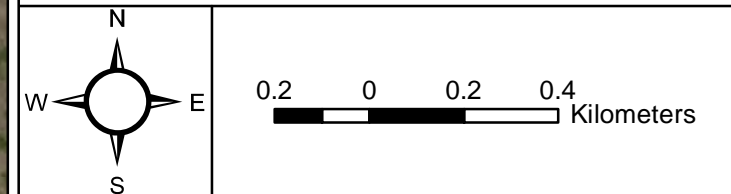
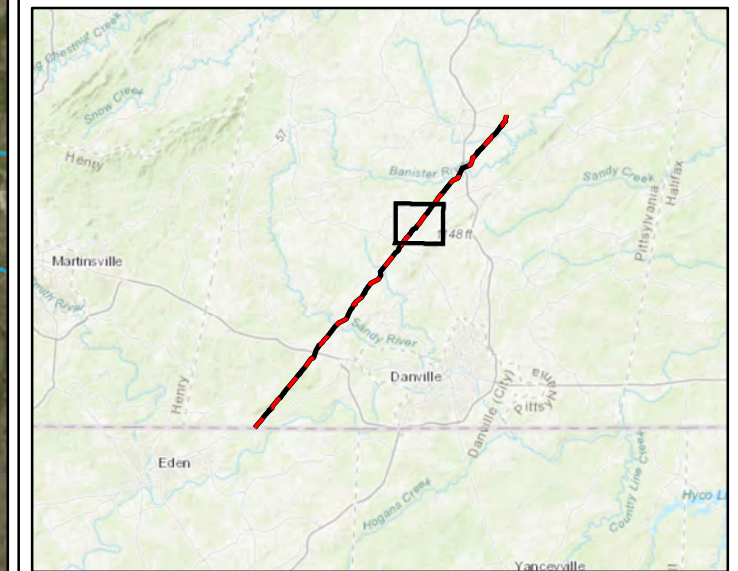
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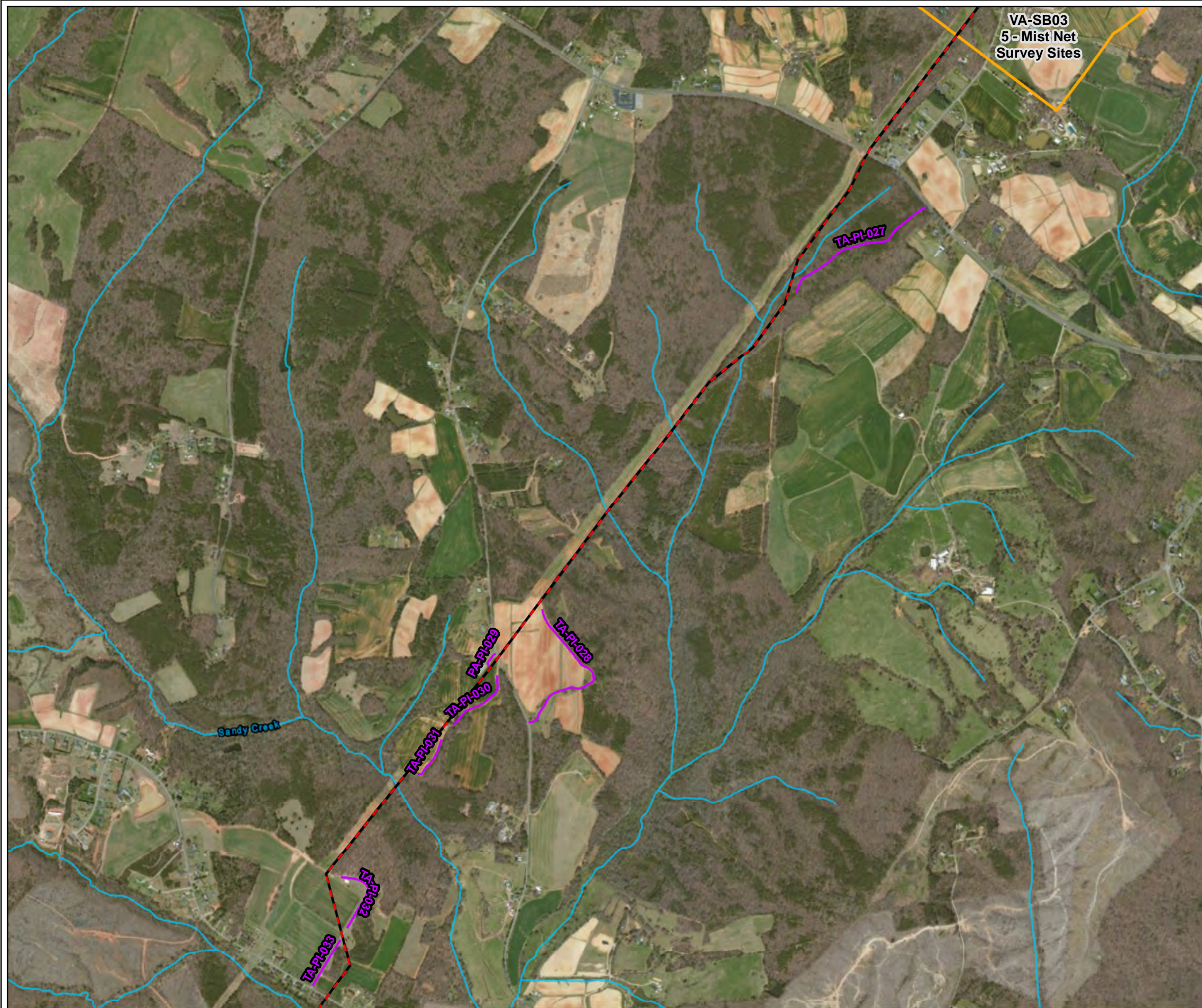
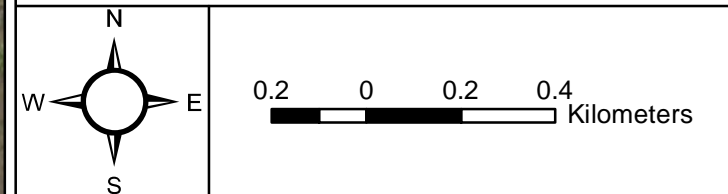
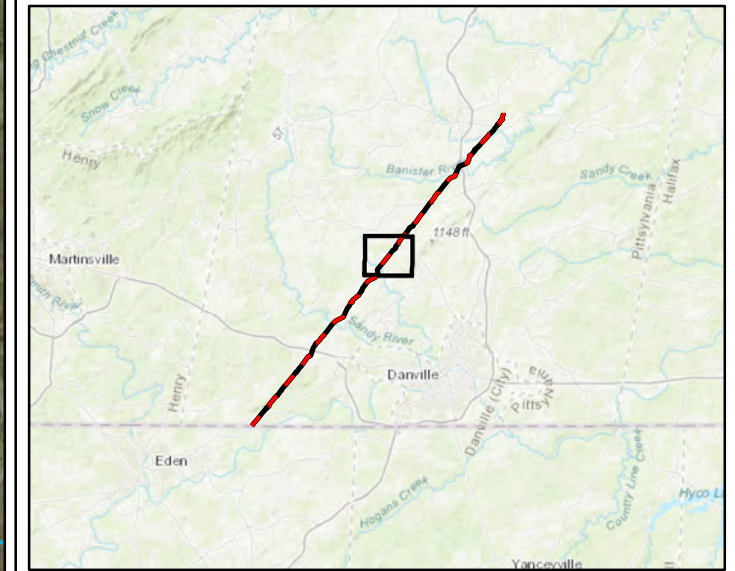


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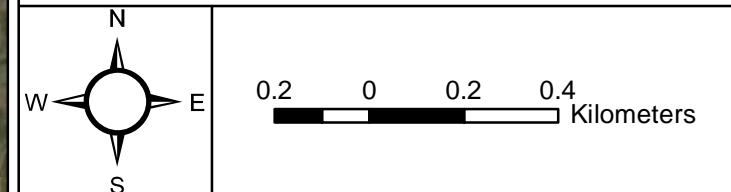
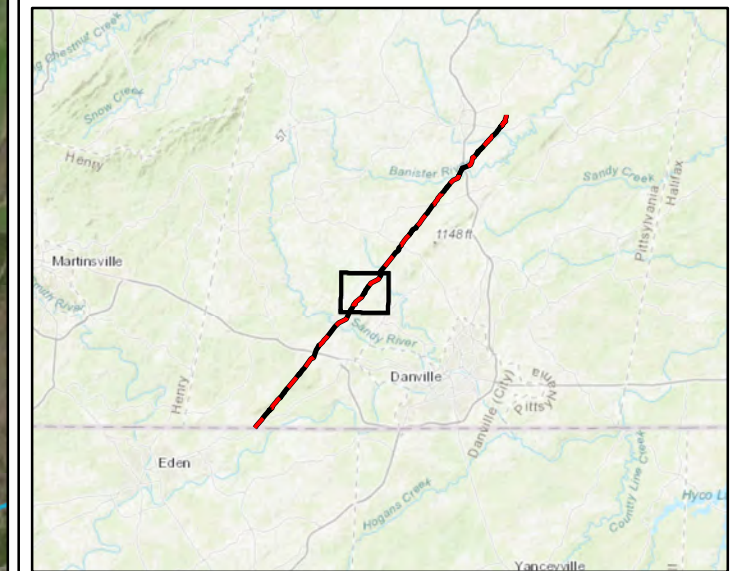
Project No. 1219.02





Figure 3. Proposed survey sites along MVP Southgate Project in Virginia.

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- Survey Block
- National Hydrography Dataset (NHD) Stream

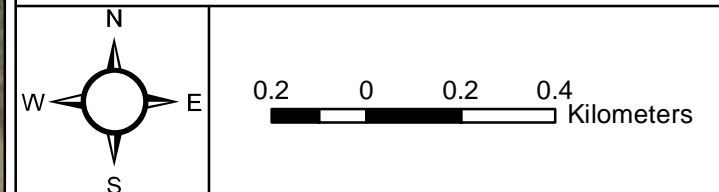
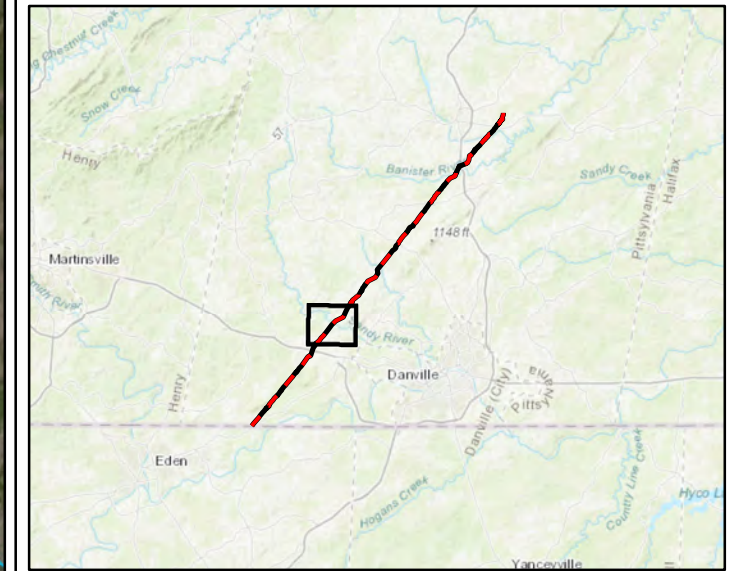
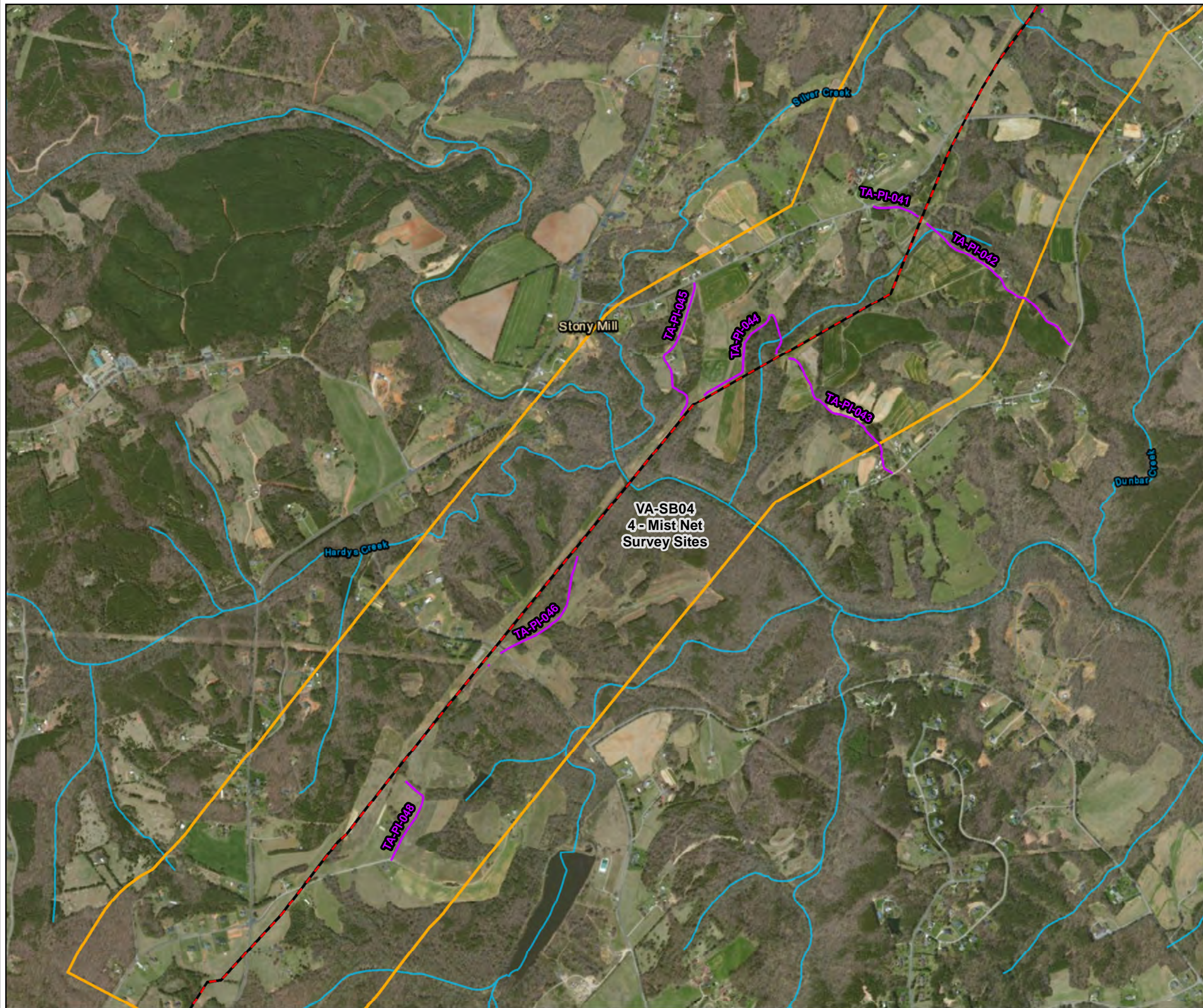


Base Map: ESRI "World Imagery (Clarity)";  
accessed 7/10/2018



Figure 3. Proposed survey sites along MVP Southgate Project in Virginia.

- Proposed Centerline
- Proposed Access Road
- Survey Block
- National Hydrography Dataset (NHD) Stream



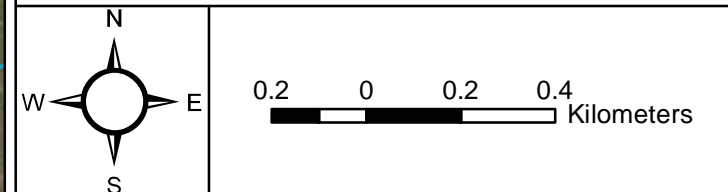
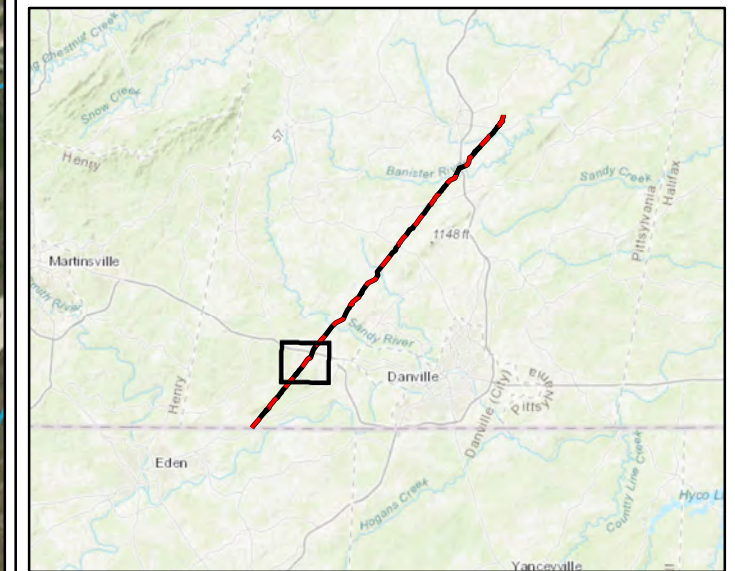
Base Map: ESRI "World Imagery (Clarity)";  
accessed 7/10/2018





Figure 3. Proposed survey sites along MVP Southgate Project in Virginia.

- - - Proposed Centerline
- Proposed Access Road
- Survey Block
- National Hydrography Dataset (NHD) Stream



Base Map: ESRI "World Imagery (Clarity)";  
accessed 7/10/2018



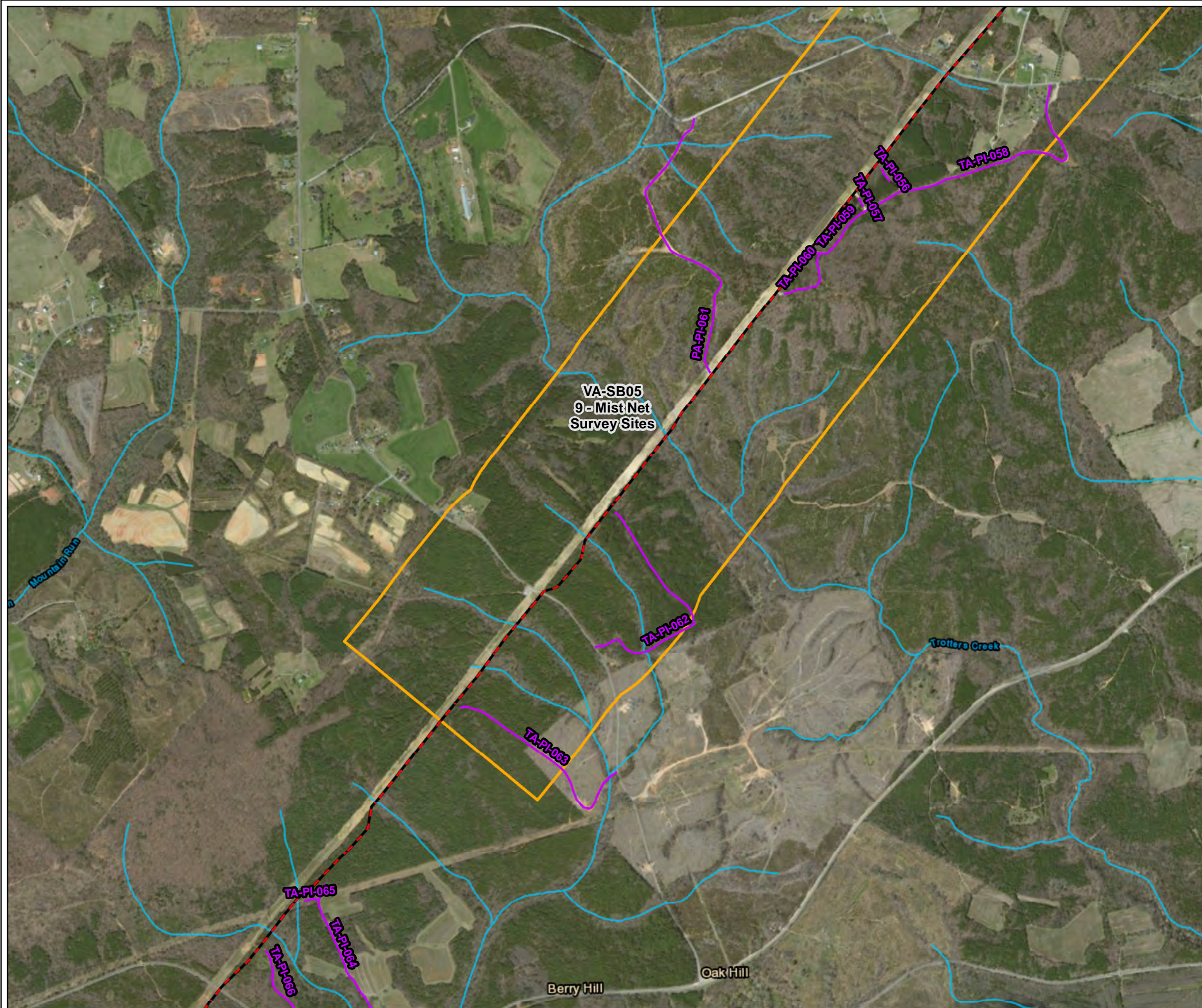
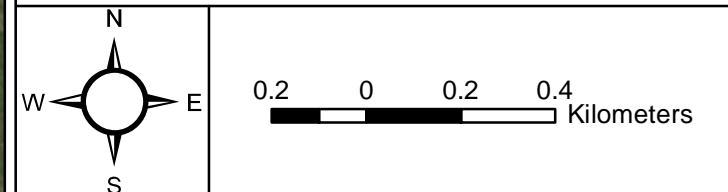
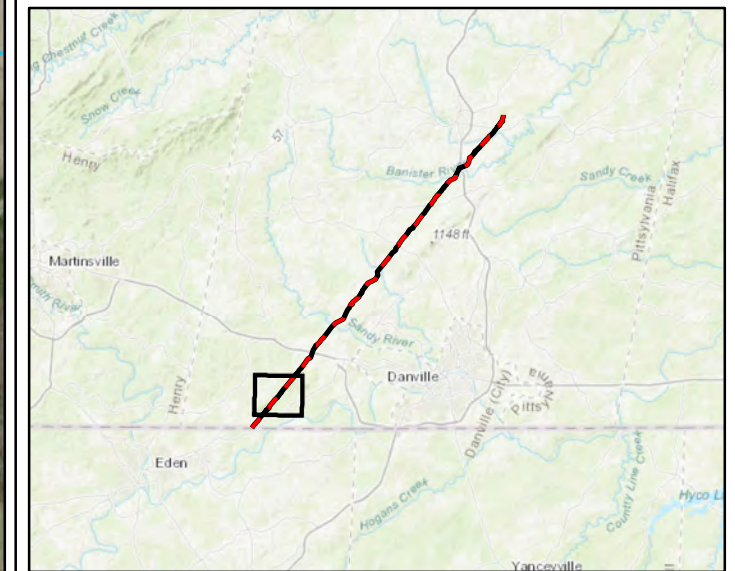


Figure 3. Proposed survey sites along MVP Southgate Project in Virginia.

- Proposed Centerline
- Proposed Access Road
- Survey Block
- National Hydrography Dataset (NHD) Stream



Base Map: ESRI "World Imagery (Clarity)";  
accessed 7/10/2018



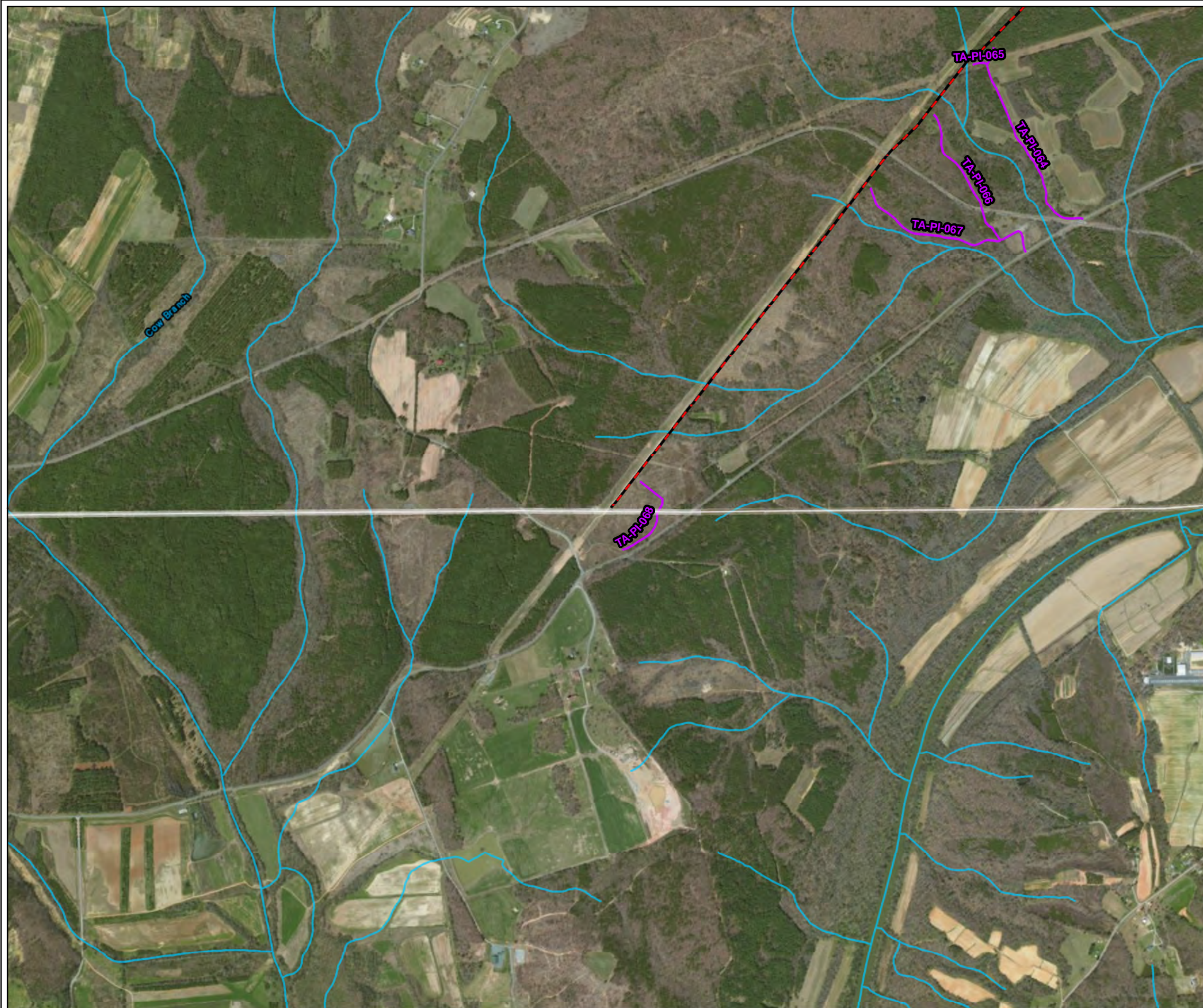
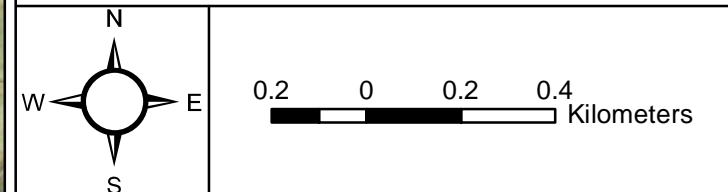
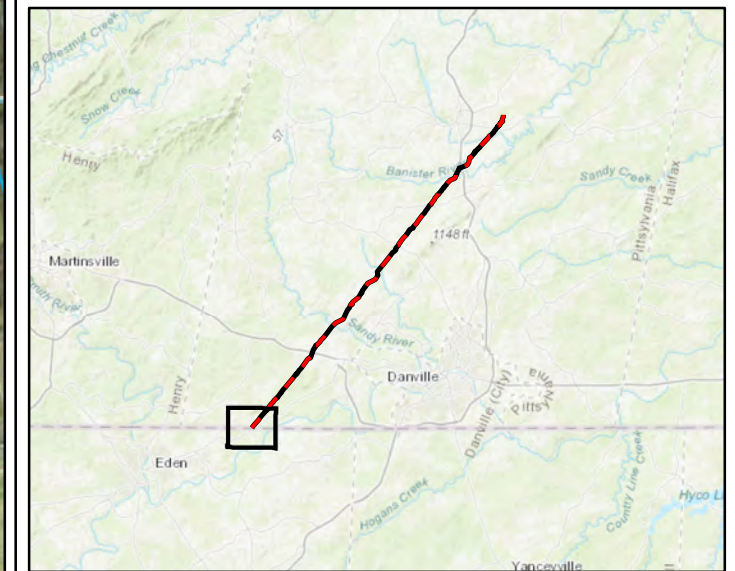


Figure 3. Proposed survey sites along MVP Southgate Project in Virginia.

- — Proposed Centerline
- — Proposed Access Road
- — National Hydrography Dataset (NHD) Stream



Base Map: ESRI "World Imagery (Clarity)";  
accessed 7/10/2018



**APPENDIX B  
EXAMPLE DATA SHEETS**





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### HABITAT ASSESSMENT

Project #: \_\_\_\_\_ Date: \_\_\_\_\_ State: \_\_\_\_\_ County: \_\_\_\_\_

Project Name: \_\_\_\_\_ Site Name/ #: \_\_\_\_\_ USGS Quad: \_\_\_\_\_

Permitted Biologist: \_\_\_\_\_ Other Field Staff: \_\_\_\_\_ State Permit #: \_\_\_\_\_

(full name)

(full name)

Federal Permit #: \_\_\_\_\_

Net/Trap/ Detector	Net/Trap/ Detector #	Latitude	Longitude	Picture #	Waypoint #
		° ' "N	° ' "W		
		° ' "N	° ' "W		
		° ' "N	° ' "W		
		° ' "N	° ' "W		

Distance to closest water source (meters): \_\_\_\_\_ Type of water source: \_\_\_\_\_

Water source name: \_\_\_\_\_

#### ESTIMATED WATER SOURCE CHARACTERISTICS (IF UNDER NETS OR DETECTOR):

Bank Height: \_\_\_\_\_ meters Channel Width: \_\_\_\_\_ meters Stream Width: \_\_\_\_\_ meters

Substratum: \_\_\_ Bedrock \_\_\_ Boulder \_\_\_ Cobble \_\_\_ Gravel \_\_\_ Sand \_\_\_ Silt/Clay

Still Water Present (Y/N): \_\_\_\_\_ Average Water Depth: \_\_\_\_\_ m or cm Clarity (H,M,L): \_\_\_\_\_

#### VEGETATION:

Dominant Canopy Species (> 40 cm/16" dbh) Subdominant Canopy Species (< 40 cm/16" dbh)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Estimated dbh range: Lg: \_\_\_\_\_ Sm: \_\_\_\_\_ Estimated dbh range: Lg: \_\_\_\_\_ Sm: \_\_\_\_\_

Relative abundance of dominant vs. subdominant (ratio): \_\_\_\_\_

Estimated canopy closure: \_\_\_ Closed \_\_\_ Moderate \_\_\_ Open

Roost tree potential consists of: \_\_\_ Hollow \_\_\_ Large Trees \_\_\_ Snags \_\_\_ Neither

*M. sodalis* roost tree potential is: \_\_\_ High \_\_\_ Moderate \_\_\_ Low

Roost potential comments: \_\_\_\_\_

*M. septentrionalis* roost tree potential is: \_\_\_ High \_\_\_ Moderate \_\_\_ Low

Roost potential comments: \_\_\_\_\_

Subcanopy clutter: \_\_\_ Closed \_\_\_ Moderate \_\_\_ Open

Subcanopy comprised largely of: \_\_\_ Lower Branches of Canopy Trees \_\_\_ Saplings \_\_\_ Shrubs

Common Subcanopy Species: \_\_\_\_\_

#### Check all that apply:

- \_\_\_ Mature Upland Forest
- \_\_\_ Young Upland Forest
- \_\_\_ Mature Lowland Forest
- \_\_\_ Young Lowland Forest
- \_\_\_ Recently Logged Forest
- \_\_\_ Forest Edge
- \_\_\_ Woodlot
- \_\_\_ Old Field
- \_\_\_ Crop/Pasture Land
- \_\_\_ Stream/River
- \_\_\_ Vernal Pool
- \_\_\_ Deepwater Lake/Pond
- Other \_\_\_\_\_

Herbaceous Cover: \_\_\_ Sparse \_\_\_ Moderate \_\_\_ Dense



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### HABITAT ASSESSMENT (continued)

<b>Project #:</b>	<b>State/County:</b>	<b>Site Name/#:</b>	<b>Initials:</b>
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#### SKETCH NETS and/or DETECTORS



<p><b>LEGEND</b></p> <p>Net: ● — ●</p> <p>Detector: □</p>	<p><b><u>DETAILED</u> HABITAT DESCRIPTION &amp; COMMENTS</b></p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
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**BAT CAPTURE DATA**

**WEATHER DATA**

Project #: \_\_\_\_\_ Date: \_\_\_\_\_  
 Project Name: \_\_\_\_\_ Site Name/#: \_\_\_\_\_  
 State: \_\_\_\_\_ County: \_\_\_\_\_  
 GPS Unit #: \_\_\_\_\_ Camera #: \_\_\_\_\_  
 Permitted Biologist: \_\_\_\_\_ Other Field Staff: \_\_\_\_\_ (full name)  
 State Permit #: \_\_\_\_\_ Federal Permit #: \_\_\_\_\_

Time (xxxx h)	Temp (°C)	Wind Speed (estimated - see chart)	% Cloud Cover (estimated)	Comments

Net/Trap/ Detector	Net/Trap/ Detector #	Latitude	Longitude	Length (m)	Height (m)	Time Up (xxxx h)	Time Down (xxxx h)	Picture #	Waypoint #
		° , ' "N	° , ' "W						
		° , ' "N	° , ' "W						
		° , ' "N	° , ' "W						
		° , ' "N	° , ' "W						

**Net Placement/Site Description:** \_\_\_\_\_

Capt #	Net/ Trap	Species	Time	Age (Ad/Jv)	Sex (M/F)	Repro. <sup>1</sup>	Wt (g)	RFA (mm)	Belly <sup>2</sup> (F/M/E)	Wing Index* (0-3)	Picture # /Guano/Hair Sample/Band #	Comments

<sup>1</sup> Reproductive Condition: Female = NR/PG/L/PL; Male = ↑/↓ (NR=Non-reproductive, PG=Pregnant, L=Lactating, PL=Post-Lactating; ↑=Ascended testes, ↓ Descende testes)  
<sup>2</sup> F=Full, M=Moderate, E=Empty  
 \* Refer to table on the back





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# BAT CAPTURE DATA (continued)

Project #: \_\_\_\_\_ Date: \_\_\_\_\_

Capt #	Net/Trap	Species	Site Name#:				Initials:					
			Time	Age (Ad/Jv)	Sex (M/F)	Repro. <sup>2</sup>	Wt (g)	RFA (mm)	Belly (F/M/E)	Wing Index* (0-3)	Comments	Picture # /Guano/Hair Sample/Band #

Wind Speed (mph)	Description	Visible Condition
0	Calm	
1-3	Light Air	Smoke rises vertically
4-7	Light Breeze	Direction of wind shown by smoke but not by wind vanes
8-12	Gentle Breeze	Wind felt on face; leaves rustle; ordinary wind vane moved by wind
13-18	Moderate Breeze	Leaves and small twigs in constant motion; wind extends light flag
19-24	Fresh Breeze	Raises dust and loose paper, small branches are moved
25-31	Strong Breeze	Small trees in leaf begin to sway; crested wavelets on inland water
32-38	Moderate Gale	Large branches in motion; telephone wires whistle; umbrellas used with difficulty
39-46	Fresh Gale	Whole trees in motion; inconvenience in walking against wind
		Breaks twigs off trees; generally impedes progress

Score	Description
0	<b>No damage.</b> Fewer than 5 small scar spots are present on the membranes.
1	<b>Light damage.</b> Less than 50% of flight membrane is depigmented (spitching), which is often visible only with transillumination.
2	<b>Moderate damage.</b> Greater than 50% of wing membrane covered with scar tissue (spitching). Scarring is visible without transillumination. Membrane exhibits some necrotic tissue and possibly few small holes (<0.5 cm diameter). Forearm skin may be flaking and discolored along the majority of the forearm.
3	<b>Heavy damage.</b> Deteriorated wing membrane and necrotic tissue. Isolated holes >0.5 cm are present in membranes. Necrotic or receding plagiopatagium and/or chiroptagium are evident.



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### BAT TRANSMITTER DATA

Project #: \_\_\_\_\_ Date: \_\_\_\_\_ Site Name/ #: \_\_\_\_\_  
 Project Name: \_\_\_\_\_ Camera #: \_\_\_\_\_  
 State: \_\_\_\_\_ County: \_\_\_\_\_ Picture #: \_\_\_\_\_  
 Bat Species: \_\_\_\_\_ Capture Time: \_\_\_\_\_  
 Permitted Biologist: \_\_\_\_\_ Other Field Staff: \_\_\_\_\_  
(full name) (full name)  
 State Permit #: \_\_\_\_\_ Federal Permit #: \_\_\_\_\_

Age Ad or Jv	Sex M or F	Reproductive Condition F=(NR/PG/L/PL; M=↑/↓	Wt (g)	RFA (mm)

Transmitter weight = \_\_\_\_\_ grams      Frequency number: \_\_\_\_\_  
 Transmitter + bat total weight = \_\_\_\_\_ grams      Band/color number: \_\_\_\_\_

**FINAL CHECK:**

- 1) Transmitter attachment (Y/N): \_\_\_\_\_
- 2) Signal receiving (frequency): \_\_\_\_\_
- 3) Band attachment (Y/N): \_\_\_\_\_
- 4) Condition of animal: \_\_\_\_\_
- 5) Description of release: \_\_\_\_\_

**RELEASE TIME:** \_\_\_\_\_ **TOTAL HOLD TIME:** \_\_\_\_\_ minutes

**RELEASE LOCATION:** \_\_\_\_\_

**COMMENTS:**

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### MOBILE TELEMETRY DATA

Project #: \_\_\_\_\_ Date: \_\_\_\_\_ State: \_\_\_\_\_ County: \_\_\_\_\_  
 Project Name: \_\_\_\_\_ GPS Unit #: \_\_\_\_\_  
 Permitted Biologist: \_\_\_\_\_ (full name) Other Field Staff: \_\_\_\_\_ (full name) State Permit #: \_\_\_\_\_  
 Federal Permit #: \_\_\_\_\_

Frequency	Sex	Age	Repro. Condition	Capture Site	Capture Date	Day of Search (1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> , etc.)

Start Time: \_\_\_\_\_ Ending Mileage: \_\_\_\_\_  
 End Time: \_\_\_\_\_ Starting Mileage: \_\_\_\_\_  
 Total Effort (hours): \_\_\_\_\_ Total Mileage: \_\_\_\_\_  
 Antennas:  Yagi  Directional  Both

**NOTE: Record coordinates as often as possible (at intersections and when you stop).**

Location (road or river name, etc.)	Latitude	Longitude	Comments (Bat frequency – if detected)







# ROOST TREE DATA

Project #: \_\_\_\_\_ Project Name: \_\_\_\_\_ Date: \_\_\_\_\_ State: \_\_\_\_\_ County: \_\_\_\_\_

GPS Unit #: \_\_\_\_\_ Waypoint: \_\_\_\_\_ Camera #: \_\_\_\_\_ Picture #: \_\_\_\_\_

Permitted Biologist: \_\_\_\_\_ Other Field Staff: \_\_\_\_\_ State Permit #: \_\_\_\_\_  
(full name) (full name)

Federal Permit #: \_\_\_\_\_

Latitude: \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ "N Longitude: \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ "W

Bat Species: \_\_\_\_\_ Sex(M/F): \_\_\_\_\_ Age(Ad/Jv): \_\_\_\_\_ Repro.: \_\_\_\_\_

Capture Date: \_\_\_\_\_ Capture Site: \_\_\_\_\_

Frequency: \_\_\_\_\_ Roost Name/#: \_\_\_\_\_

## ROOST TREE DATA

Roost tree species: \_\_\_\_\_ dbh: \_\_\_\_\_ cm

Estimated height from ground to roost: \_\_\_\_\_ (meters) Tree height \_\_\_\_\_ (meters)

Exfoliating bark (%): \_\_\_\_\_ Distance from capture site: \_\_\_\_\_ m or km (circle one)

Tree health: \_\_\_\_\_ Live \_\_\_\_\_ Dead \_\_\_\_\_ Partial

Observed roost potential: \_\_\_\_\_ Exfoliating Bark \_\_\_\_\_ Cracks/crevasses \_\_\_\_\_ Hollow \_\_\_\_\_ Unknown

Bat vocalizations: \_\_\_\_\_ Yes \_\_\_\_\_ No

Guano on ground/foilage: \_\_\_\_\_ Yes \_\_\_\_\_ No

Is guano fresh (if present)?: \_\_\_\_\_ Yes \_\_\_\_\_ No

Guano volume (if present): \_\_\_\_\_

## DESCRIPTION OF SURROUNDING HABITAT

Dominant Canopy Species (> 40 cm/16" dbh)

Subdominant Canopy Species (< 40 cm/16" dbh)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Estimated dbh range (cm): Lg: \_\_\_\_\_ Sm: \_\_\_\_\_

Estimated dbh range (cm): Lg: \_\_\_\_\_ Sm: \_\_\_\_\_

Estimated canopy closure at roost: \_\_\_\_\_ %

Slope: \_\_\_\_\_ Steep \_\_\_\_\_ Moderate \_\_\_\_\_ Slight \_\_\_\_\_ None Slope aspect: \_\_\_\_\_

Subcanopy Clutter: \_\_\_\_\_ Closed \_\_\_\_\_ Moderate \_\_\_\_\_ Open

Distance to nearest water source: \_\_\_\_\_ m or km (circle one) Distance to nearest flight corridor: \_\_\_\_\_ meters

Habitat Description: \_\_\_\_\_

### Check all that apply:

- \_\_\_ Mature Upland Forest    \_\_\_ Recently Logged Forest    \_\_\_ Crop/Pasture Land    \_\_\_ Shrub/scrub Swamp
- \_\_\_ Young Upland Forest    \_\_\_ Pine Plantation    \_\_\_ Stream/River    \_\_\_ Vernal Pool
- \_\_\_ Mature Lowland Forest    \_\_\_ Woodlot/ForestEdge    \_\_\_ Emergent Wetland    \_\_\_ Deepwater Lake/Pond
- \_\_\_ Young Lowland Forest    \_\_\_ Old Field    \_\_\_ Forested Swamp    \_\_\_ Other \_\_\_\_\_

Comments: \_\_\_\_\_



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# ROOST TREE DATA (continued)

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State/County: \_\_\_\_\_

Project Name/ #: \_\_\_\_\_

Date: \_\_\_\_\_

Frequency: \_\_\_\_\_

Roost Name/ #: \_\_\_\_\_

Initials: \_\_\_\_\_

## Sketch: Roost Tree Habitat



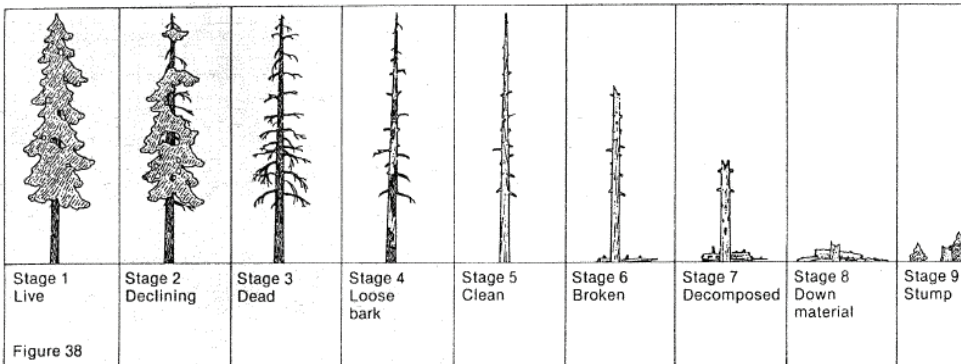
Large empty rectangular area for sketching the roost tree habitat.

Comments: \_\_\_\_\_  
\_\_\_\_\_

## Sketch: Roost Tree

Large empty rectangular area for sketching the roost tree.

### Stages of Decay:







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# ROOST TREE EMERGENCE DATA

Project #: \_\_\_\_\_ Date: \_\_\_\_\_ State: \_\_\_\_\_ County: \_\_\_\_\_

Project Name: \_\_\_\_\_ GPS Unit #: \_\_\_\_\_ Waypoint: \_\_\_\_\_

Permitted Biologist: \_\_\_\_\_ (full name) Other Field Staff: \_\_\_\_\_ (full name) State Permit #: \_\_\_\_\_

Federal Permit #: \_\_\_\_\_

Latitude: \_\_\_\_° \_\_\_\_' \_\_\_\_"N Longitude: \_\_\_\_° \_\_\_\_' \_\_\_\_"W

Roost Name/ #: \_\_\_\_\_

Radio-tagged bat present in tree: Yes \_\_\_\_ No \_\_\_\_

Complete the following information only if a radio-tagged bat is present in the roost

Bat species: \_\_\_\_\_ Sex(M/F): \_\_\_\_ Age(Ad/Jv): \_\_\_\_\_ Repro: \_\_\_\_\_

Capture date: \_\_\_\_\_ Capture site: \_\_\_\_\_ Frequency: \_\_\_\_\_

**NOTE:** Tallies of bat exits should be made at 2-minute intervals. Use the back lighting of the setting sun to help distinguish bats as silhouettes against the sky as they exit the roost. Please ensure that you are close enough to the roost to observe all exiting bats, but not close enough to influence emergence (do not stand directly beneath the roost and do not make unnecessary noise and/or conversation, and minimize use of lights).

Arrival time: \_\_\_\_\_ Departure time: \_\_\_\_\_ Total bats: \_\_\_\_\_

Emergence Time	Number of Bats	Emergence Aspect

Describe emergence: Did bats emerge simultaneously, fly off in the same direction, loiter, circle, disperse, etc. What time did the transmitted bat(s) emerge? What direction did the transmitted bat fly?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### ROOST TREE EMERGENCE DATA (continued)

Project #: \_\_\_\_\_

Project name: \_\_\_\_\_

Frequency: \_\_\_\_\_

Roost #: \_\_\_\_\_

Emergence Time	Number of Bats	Emergence Aspect