



MEMORANDUM

Date: January 06, 2015
To: David Bonk, Kumar Neppalli, PE
Town of Chapel Hill, North Carolina
From: Bill Schultheiss, PE
Re: South Columbia Street and Otey's Road Safety Review and Concept Development

Toole Design Group (TDG) was retained by the Town of Chapel Hill to review a concept design developed by Kimley-Horn and Associates, Inc. (KHI) at the northern intersection of South Columbia Street at Fordham Boulevard (attached as exhibit 2), to develop concept design alternatives for South Columbia Street from Purefoy Road to Culver Road, and to develop a crossing improvement concept for Otey's Road at Fordham Boulevard.

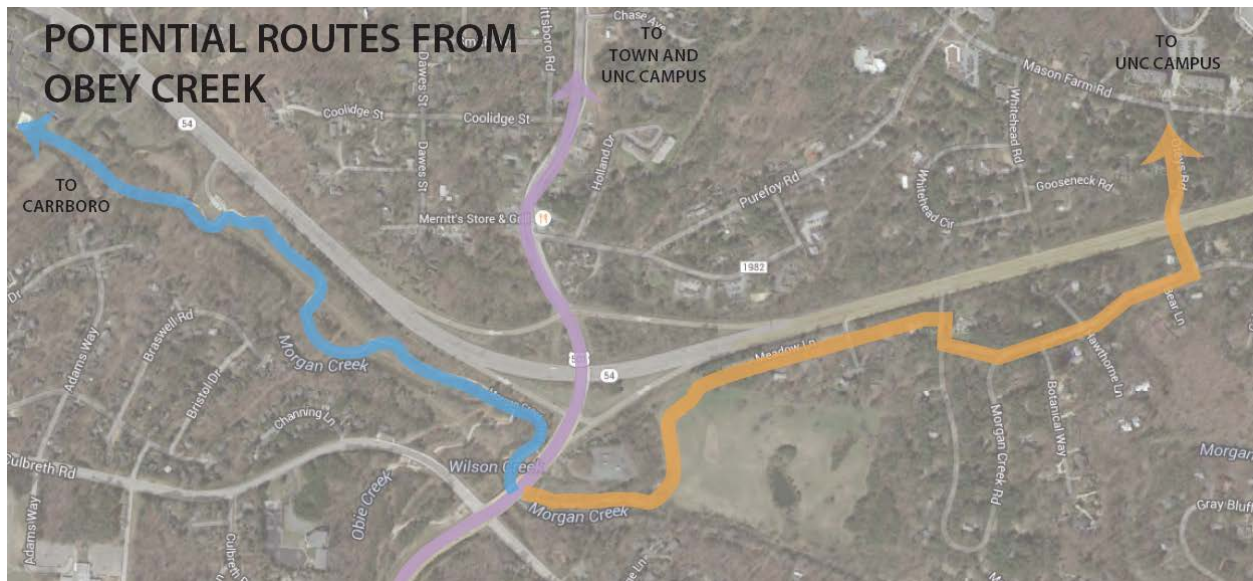
The intersection changes are being proposed to reduce potential motor vehicle delays at this intersection in the year 2022 which partially result from the construction of the Obey Creek Mixed Use Development project. A traffic impact study conducted by HNTB Corporation projects a change from Level of Service (LOS) of E to F during the evening peak period at this location in the year 2022 based on traffic forecast and industry standard traffic modeling. The intersection is forecasted to operate at a LOS C during the morning and mid-day periods. It would likely be operating at a higher LOS (A, B, or C) during non-peak periods where traffic volumes are reduced. The traffic study developed by HNTB and the concept design developed by KHI did not provide an assessment of existing pedestrian and bicyclist conditions nor did it provide recommendations for any improvements for those modes.

The intent of this review and concept development process is threefold:

- 1) To identify existing safety and access challenges for pedestrians and bicyclists which were not discussed in the report or concept drawing;
- 2) To review potential operational or safety challenges that may result from the proposed KHI design for all modes of transportation;
- 3) To develop concepts and recommendations which address existing and potential future pedestrian and bicyclists' safety and access as well as to implement goals identified in the 2014 Town Bicycle Master Plan.

Review of Existing Pedestrian and Bicyclist Safety Challenges

TDG completed a bicycle master plan for the Town in June of 2014¹ and for the University of North Carolina at Chapel Hill (UNC) in October 2014². Both plans identified a number of short and long term improvements along South Columbia Street between the proposed Obey Creek development and Purefoy Road (purple line in figure below). The plans also recommended the development of an alternative bicycle route to the UNC campus via the Morgan Creek Greenway, Morgan Creek Road, and Otey's Road (orange line). The Morgan Creek Greenway will also create an additional route to Carrboro once completed (blue line). The following graphic illustrates these three routes:



With increasing development south of Fordham Boulevard at Southern Village and Obey Creek, additional bicycle and pedestrian traffic is anticipated. The North Carolina Department of Transportation (NCDOT) recently widened South Columbia Street north of Purefoy Road to add bicycle lanes and sidewalks on both sides of the street. The Chapel Hill bicycle plan identified the intersections with the Fordham Boulevard entrance and exit ramps as locations in need of spot improvements for bicyclist safety. These intersections are designed with large curb radii exposing bicyclists to high speed motorist conflicts. These intersections also have an incomplete pedestrian network (sidewalks, curb ramps, crosswalks, signals). **Exhibit 1 illustrates key access and safety challenges for bicyclists and pedestrians.** Additional safety challenges include:

- Absence of street lighting along South Columbia Street
- Missing sidewalks along the east side of the street south of Fordham Boulevard
- Free flow right turn lane that allows high speed turns for northbound right turn onto Fordham Boulevard
- The size of the intersections increase exposure of bicyclists and pedestrians to turning traffic and allow traffic to turn at higher speeds
- Incomplete trail connections through Merritt's Pasture to allow alternate route to UNC Campus via Morgan Creek Road
- Missing crossings to allow pedestrians and bicyclists to cross South Columbia Street
- Unclear delineation of bicyclists path through merging areas reduces clarity of right-of-way at start of right turn lanes

¹ <http://www.townofchapelhill.org/town-hall/departments-services/design-chapel-hill/connected-community/the-chapel-hill-bike-plan>

² <http://move.unc.edu/bike/bike-plan/>

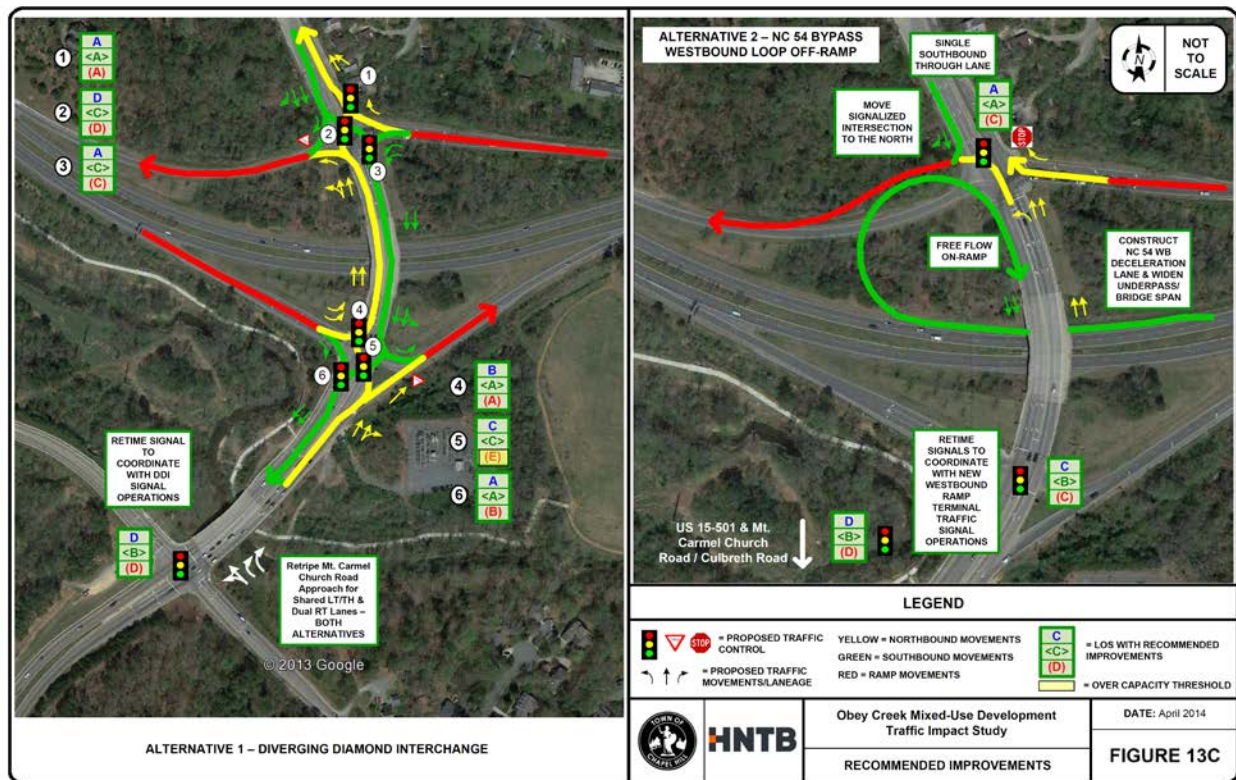
The deficiencies identified in Exhibit 1 are based on direct observation by TDG staff, a review of the proposed KHI alternative, and input provided from the public through the Town and University Bike Plans.

Review of HNTB Traffic Impact Study and KHI Concept Design

The HNTB study evaluated potential impacts for motor vehicle traffic mobility within portions of the Town that could result from a combination of regional growth in traffic and traffic generated by the Obey Creek project. The report does not provide recommendations for addressing the safety or access challenges that exist today or may be created by some of the proposed roadway changes for bicyclists or pedestrians. The study projected increasing traffic through the year 2022 to assess potential impacts on motorists LOS at intersections along South Columbia Street and other locations within the Town.

Due to the projected increases in traffic volume, the northern intersection of South Columbia Street at Fordham Boulevard was identified as potentially operating at a failing LOS (F) during evening peak periods. To reduce motor vehicle delay, HNTB identified the following two potential options at this location:

- 1) Diverging Diamond Interchange (image on left)
- 2) Construction of new free flow ramp for westbound to southbound traffic (image on right)



It is important to note the HNTB traffic study identifies heavy vehicles as being 3% of the future southbound off-ramp traffic flow at this location. During the PM peak period the traffic flow is estimated to be approximately 536 vehicles which equates to approximately 18-20 trucks per hour. The study does not provide information on the type of heavy vehicle traffic which can range from a small delivery or trash type truck (SU type) to buses (BUS), or larger tractor trailer type trucks (WB-50 and WB-62). The WB-62 is a common truck size and a standard design vehicle to accommodate heavy

vehicle turns on interstate and limited access roadways and is an appropriate design vehicle for this location.

Review of Diverging Diamond Interchange Option (DDI) - HNTB Alternative 1

The DDI interchange design significantly reduces motor vehicle conflicts, reduces some potential conflicts with pedestrians and bicyclists while possibly intensifying others, and increases traffic capacity³. While these changes may improve motor vehicle flow they generally degrade safety and access for bicyclists for two primary reasons:



Figure 1 - DDI in Springfield, MO. Source FHWA DDI Informational Guide

- 1) They typically require pedestrians and bicyclists to travel in the middle of two streams of moving traffic in a shared use path. This can be uncomfortable if the path is less than 14 feet in width and feels like you are moving through a loud traffic canyon as shown in the photo as a barrier wall is required to protect the users.
- 2) These designs also are typically constructed with two to four free flowing ramps for motorized traffic to achieve the time saving efficiencies for motorists.

While these facilities can be shown to reduce delays for people walking or bicycling, those reductions in time are contingent on proper yielding behavior by motorists as they cross the unsignalized, free-flow ramps. In particular ramps where motorists are accelerating to access Fordham Boulevard are likely to present safety challenges for pedestrians and bicyclists motorists are less likely to yield where they accelerating onto a highway ramp. If multiple approach lanes provided, multiple-threat crashes are likely to result which can result in serious injury to pedestrians or bicyclists. It is not clear from the HNTB report if multiple lanes would be required for the entrance and exit ramps.

The approach geometry required for the motor vehicle travel lanes as they approach the entrance and exit ramps may generally not be sharp enough to reduce approaching vehicle speeds at the crosswalk to 10 or 15 mph which would increase yielding behavior. The FHWA DDI Guidebook lists many additional challenges for bicyclists and pedestrians which are difficult to mitigate without compromising the travel time and safety benefits intended for the motorist.

³ http://safety.fhwa.dot.gov/intersection/alter_design/pdf/fhwasa14067_ddi_infoguide.pdf



Figure 2 - DDI in Springfield, MO. Source FHWA DDI Informational Guide. Accelerating free flow ramps are circled green, decelerating ramps are circled red.

This type of interchange is not recommended in an urban area unless the following are provided:

Single Lane Approach Design Strategies

- Manage free flow ramp approach speeds to result in 10 to 15 mph speeds by providing raised crosswalks and tight curb radii
- Provide minimum 14 foot wide shared use path for crossings under 200 feet. As crossings lengthen beyond 200 feet, consider providing additional buffer width with vegetation to increase comfort.

Multiple Lane Approach Design Strategies

- Elimination of free flow ramp approaches with signals
- Provide minimum 14 foot wide shared use path for crossings under 200 feet. As crossings lengthen beyond 200 feet, consider providing additional buffer width with vegetation to increase comfort.

Review of Kimley-Horn Free Flow Ramp – HNTB Alternative 2

Kimley-Horn and Associates, Inc. (KHI) developed three concept designs at the northern intersection of South Columbia Street at Fordham Boulevard. These exhibits all provide variations of free flowing off-ramp approaches to South Columbia Street, with the only difference being the radius of curvature for the off ramp from Fordham Boulevard. For purposes of this review, only Figure 3 is assessed. **The KHI design is attached as Exhibit 2.** This figure provides additional geometric design detail as compared to the HNTB alternative 2 graphic. The design recommends the provision of:

- free flowing southbound right turns onto Fordham Boulevard
- free flowing southbound right turns onto South Columbia Street to reduce motorists delays and to ensure vehicles do not back up onto Fordham Boulevard.

The design conforms to AASHTO guidelines but fails to consider the impacts on pedestrians and bicyclists by emphasizing motorist mobility over the mobility and safety needs of other users. It is not an appropriate design for an urban area where bicyclist and pedestrians are routinely present on the roadway and the crossing has been previously identified as a major barrier to non-motorized travel. This is an increasingly urbanizing area in close proximity (approximately 1 mile) to the heart of the Town of Chapel Hill and the UNC Campus.

The free flow ramps are designed to accommodate a WB-62 tractor trailer truck turning into its own travel lane without encroaching onto other lanes to maintain the free flow capacity of the lane. This results in the need to provide a 60 to 70 foot radius turn which allows smaller vehicles to turn at higher speeds, lengthens crossing distances, and flattens the viewing angle between the turning motorist and approaching bicyclists and motorists on the South Columbia Street. The combination of these factors reduces safety for pedestrians and bicyclists and on the South Columbia Bridge, reduces safety between motor vehicles that may need to merge across higher

speed traffic to change lanes⁴. The concept does not provide any detail for existing safety deficiencies for pedestrians and bicyclists could or would be addressed. This design is not recommended for implementation without further modifications.

TDG Proposed Alternatives to Address Bicycle and Pedestrian Needs

TDG developed 3 design concepts to allow further exploration of opportunities to improve pedestrian and bicyclist deficiencies identified in this memo and in the bicycle master plan.

The TDG concepts are attached as Exhibit Three and are briefly described below. The concepts apply the following principals:

- balance the required objective of improving motorist mobility (as measured by LOS in the year 2022) with the safety and mobility needs of pedestrians and bicyclists who are more vulnerable roadway users;
- balance the need to provide a design that allows large vehicles to turn with the safety and mobility needs of pedestrians and bicyclists;
- modifies the KHI design for proposed Fordham westbound exit ramp to provide two approach lanes to minimize the likelihood of traffic backing up onto Fordham Boulevard;
- maintain the proposed access restrictions proposed by HNTB at the northern intersection of South Columbia Street and Fordham Boulevard;
- maintain access for larger vehicles up to the WB-62 design vehicle, but allows them to use all available width of receiving lanes to turn to minimize curb radius at corners;
- complete the missing pedestrian and bicycle network to provide routing options;
- minimize crossing distances;
- employ design techniques to improve the comfort of pedestrians and bicyclists recognizing they are vulnerable roadway users;
- reduce or eliminate locations with free flow traffic across bicycle and pedestrian conflict points;
- promote yielding by turning motorists through reduced corner radius;
- minimize exposure of bicyclists to merging or crossing traffic with pavement markings reducing the size of the area of conflict;
- highlight areas of conflict with green bicycle lanes and marked crosswalks ;
- use regulatory signs to notify motorists of responsibility to yield to pedestrians and bicyclists;
- narrow traffic lanes to cost effectively achieve lower vehicle speeds and provide additional space to allocate to bicyclists and pedestrians;
- recommend street lighting to improve safety of all users at locations of potential conflict.

Alternative 1

Alternative 1 depicts modest changes to the KHI design. The slip ramp designs remain in place for the southbound and northbound on-ramps to Fordham Boulevard. Adjustments to curbs are recommended to remove free flow traffic from the proposed westbound to southbound off ramp.

- Signal, stop control, or yield control for each on and off ramp is recommended in that prioritized order of consideration to ensure pedestrians and bicyclists have safe crossing opportunities;
- Modify intersection geometry for the northern intersection of South Columbia Street at Fordham Road to:

⁴ http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_w208.pdf

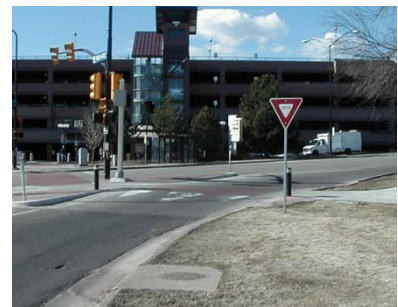
- allow a WB-62 to utilize the full width of the receiving roadway for turns, (recognizing this is a small percentage of the traffic);
- consider restriction of right-turn-on red for trucks which will need larger gaps in traffic if the dedicated receiving lane is not provided;
- to reduce likelihood vehicles queue into the through lanes on Fordham Boulevard⁵ the westbound to southbound off ramp provides a double right turn lane (shown on concept); this may require this may require trucks to control both lanes to make the right turn;
- It may be further necessary to lengthen the deceleration lane from Fordham Boulevard east of the the South Columbia Bridge. It appears space is available if the travel lane can be located in close proximity to the existing bridge support column.
- A median refuge is provided for the new northern crosswalk;
- Modify intersection geometry for the southern intersection of South Columbia Street at Fordham Boulevard;
 - Improve trail connections to Morgan Creek and Fan Branch Trails by widening sidewalk on the west side of the street and constructing new trail access on the east side of the street;
 - Add crosswalks to north and east legs of intersection
- Provide new trail connection through Merritt's Pasture connecting to Morgan Creek Road;
- Provide buffered bicycle lanes where space allows in accordance with the bicycle master plan recommendations by:
 - Use of 10 foot travel lanes adjacent to buffer;
 - Use of 10 foot left turn lanes.
- Provide green bicycle lanes at locations of conflicts with complementary regulatory signs notifying motorists are to yield to bicyclists prior to them merging or turning across the bike lane;
- Provision of crosswalk on the south side of Culver Road across South Columbia will improve ability of pedestrians and bicyclists to access the trail head.
- Provide street lighting at all intersections to improve visibility.
- While not shown in the drawings, consideration should be given to providing a raised crosswalk at the southbound and northbound on-ramp slip right turn lane crossings;
- The concept does not include provision of bicycle lanes on Mount Carmel Church Road which are included in the Town Bicycle Master Plan. Addition of these lanes would require widening the road 12 feet beyond existing pavement widths.



Buffered bike lane with 10 foot travel lanes on 45 mph arterial on Shields Street in Fort Collins, CO



Green bike lane within conflict area Seattle, WA



Raised crosswalk at slip right turn lane Boulder, CO

Alternative 2

Alternative 2 depicts includes many of the recommendations from Alternative 1, but provides a higher level of change by removing all slip ramp designs. Additionally for southbound bicyclists, the bicycle lane is replaced by a

⁵ This was based on preliminary modeling by HNTB of a controlled approach versus free flow

curb protected bicycle lane. The curb protected bicycle lane replaces the extended merging area with a single conflict point the combined bicycle and pedestrian crossing. The design of the corner promotes yielding by reducing bicyclists approach speeds and motorists turning speeds.

Interim Alternative

An interim alternative was developed to allow the implementation of Alternative 1 with changes restricted to pavement markings and signs. This concept removes all curb changes thus it does not address many of the pedestrian needs.

Otey's Road Crossing of Fordham Boulevard Concept

The Town and UNC bicycle plans recommended development of a pedestrian and bicyclist crossing of Fordham Boulevard. Provision of a safe crossing at this location would create an additional crossing between South Columbia Street and Manning Drive for non-motorized travel. Fordham Boulevard acts as a significant barrier to non-motorized travel as Manning Drive and South Columbia streets are separated by more than one mile. To safely cross Fordham Boulevard it will be necessary to modify the median to provide refuge, channelize traffic turning onto and off from Fordham Boulevard, and to install a traffic signal to stop traffic on Fordham Boulevard. The traffic signal can potentially be Pedestrian Hybrid Beacon or a full traffic signal. Given the lower volume of pedestrian and bicycle traffic likely this location it is recommended a relatively hot response be provided to reduce the likelihood of users crossing against the light as gaps in traffic appear. The maximum wait time is suggested at 30 seconds. If this is not achievable, it is advisable the signal at least be coordinated with the signal at Manning Drive.

- Crossing island improvements for bicyclist and pedestrians within the median
- Sidewalk improvements
- Proposed location for channelizing islands on Otey's Road
- Proposed HAWK signal on Fordham Boulevard

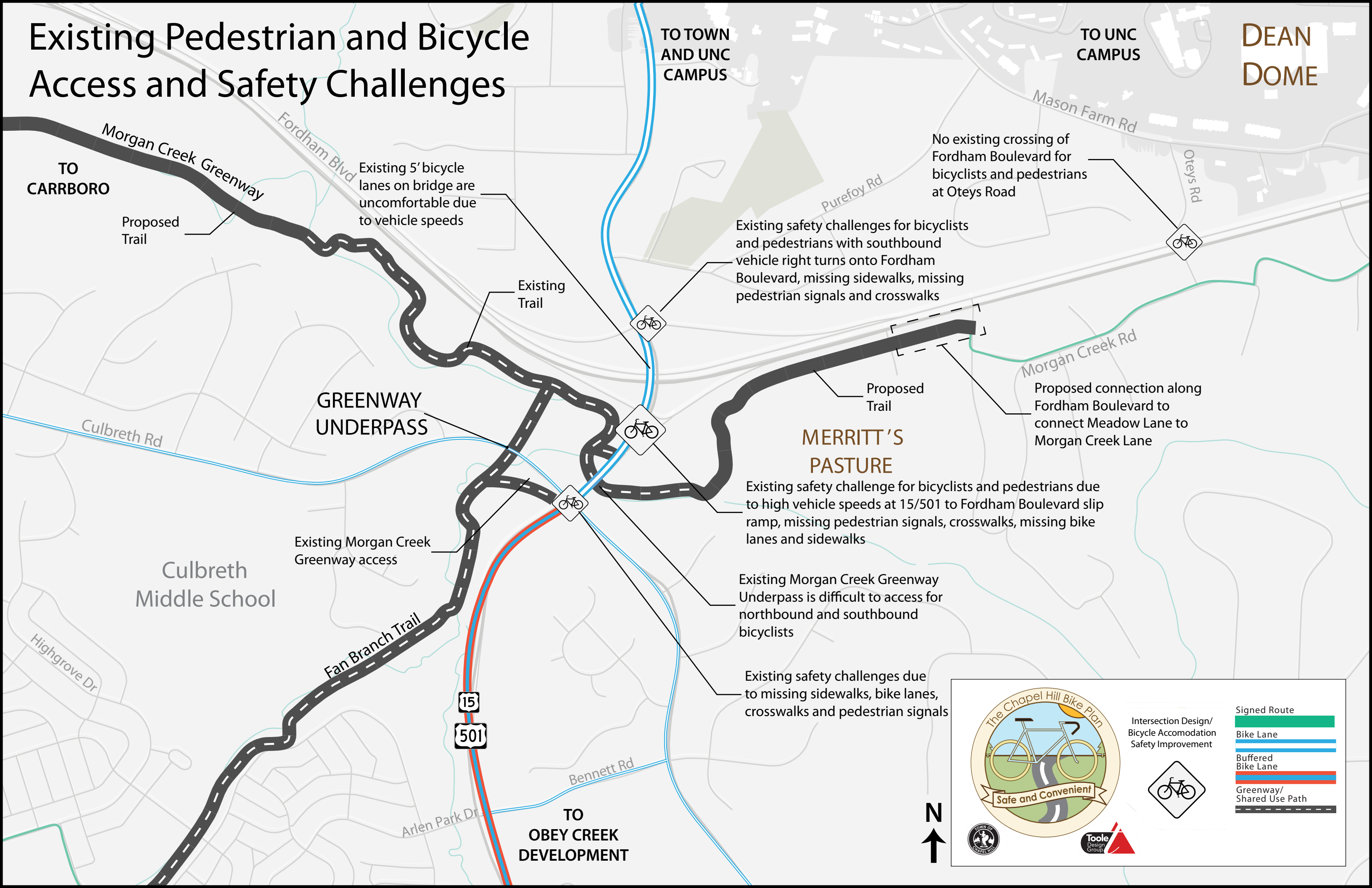


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EXHIBIT ONE

Existing pedestrian and bicycle access and safety challenges

Existing Pedestrian and Bicycle Access and Safety Challenges



The Chapel Hill Bike Plan
Safe and Convenient

Intersection Design/
Bicycle Accomodation
Safety Improvement

Signed Route

Bike Lane

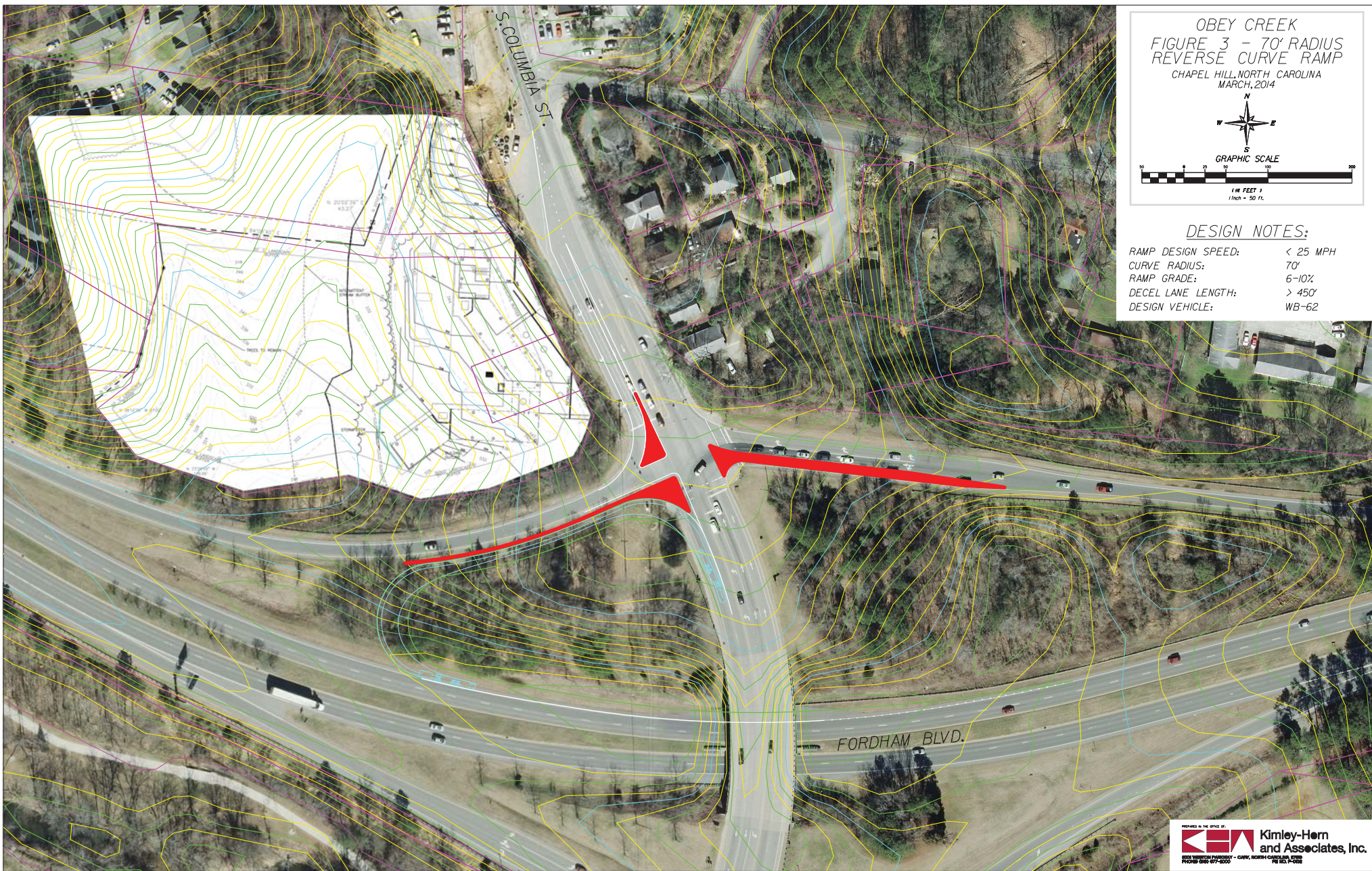
Buffered Bike Lane

Greenway/
Shared Use Path

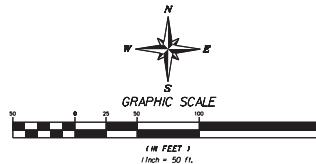


EXHIBIT TWO

Kimley-Horn and Associates, Inc. intersection design concept for the northern intersection of South Columbia Street at Fordham Road



OBEY CREEK
FIGURE 3 - 70' RADIUS
REVERSE CURVE RAMP
 CHAPEL HILL, NORTH CAROLINA
 MARCH, 2014



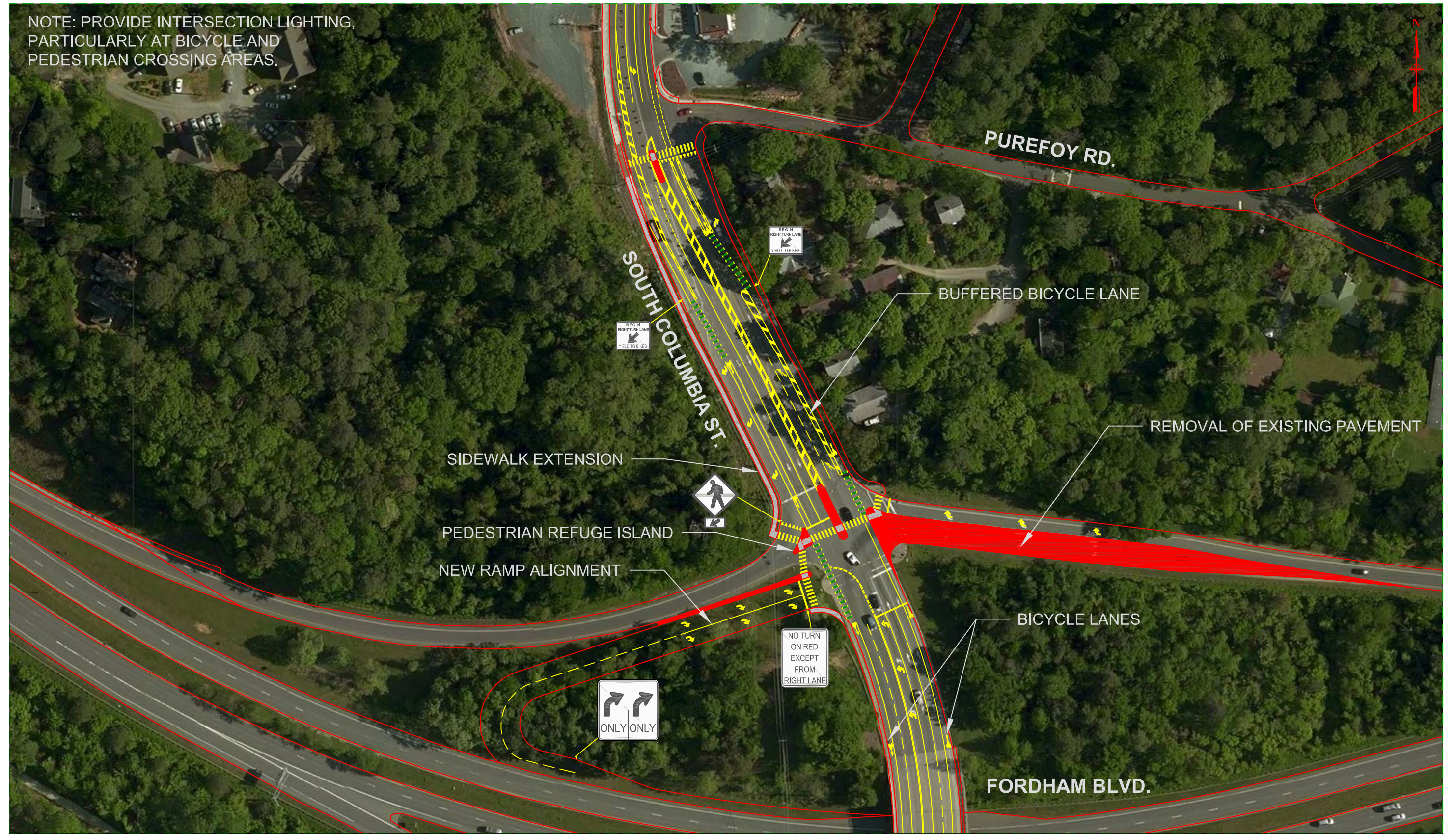
DESIGN NOTES:

- RAMP DESIGN SPEED: < 25 MPH
- CURVE RADIUS: 70'
- RAMP GRADE: 6-10%
- DECEL LANE LENGTH: > 450'
- DESIGN VEHICLE: WB-62

EXHIBIT THREE

Toole Design Group Concepts for South Columbia Street, Otey's Road, and Autoturn exhibits

NOTE: PROVIDE INTERSECTION LIGHTING,
PARTICULARLY AT BICYCLE AND
PEDESTRIAN CROSSING AREAS.



MATCHLINE - SEE SHEET SK-2



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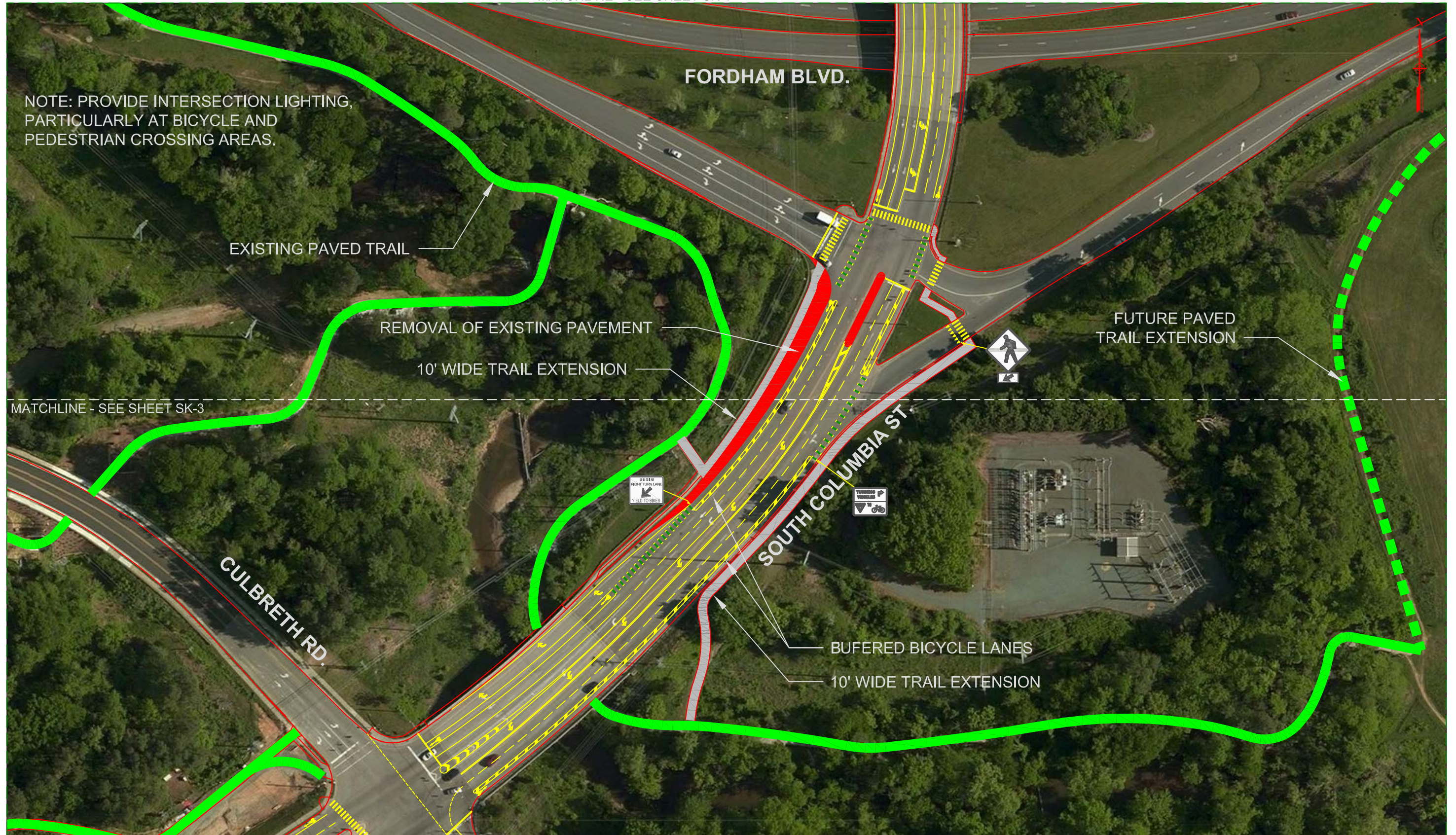
**TOWN OF CHAPEL HILL
ALTERNATE INTERSECTION DESIGN CONCEPTS
SOUTH COLUMBIA STREET - ALTERNATE 1**



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REV. 2:
REV. 3:
DESIGNED: JAC
DRAWN: JAC
CHECKED: WS
DATE: 1/6/2015

SHEET NAME:
S. COLUMBIA AT
FORDHAM BLVD
WESTBOUND RAMP
DRAWING NUMBER
SK-1
SHEET NUMBER
1 OF **13**

MATCHLINE - SEE SHEET SK-1



NOTE: PROVIDE INTERSECTION LIGHTING, PARTICULARLY AT BICYCLE AND PEDESTRIAN CROSSING AREAS.

FORDHAM BLVD.

EXISTING PAVED TRAIL

REMOVAL OF EXISTING PAVEMENT

10' WIDE TRAIL EXTENSION

MATCHLINE - SEE SHEET SK-3

FUTURE PAVED TRAIL EXTENSION

CULBRETH RD.

SOUTH COLUMBIA ST.

BEGIN RIGHT TURN LANE
YIELD TO BIKES

VEHICLE
BICYCLE

BUFURED BICYCLE LANES

10' WIDE TRAIL EXTENSION



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TOWN OF CHAPEL HILL ALTERNATE INTERSECTION DESIGN CONCEPTS SOUTH COLUMBIA STREET - ALTERNATE 1



REV. 1:
REV. 2:
REV. 3:
DESIGNED: JAC
DRAWN: JAC
CHECKED: WS
DATE: 1/6/2015

SHEET NAME:
S. COLUMBIA AT
FORDHAM BLVD
EASTBOUND RAMP
DRAWING NUMBER
SK-2
SHEET NUMBER
2 OF **13**



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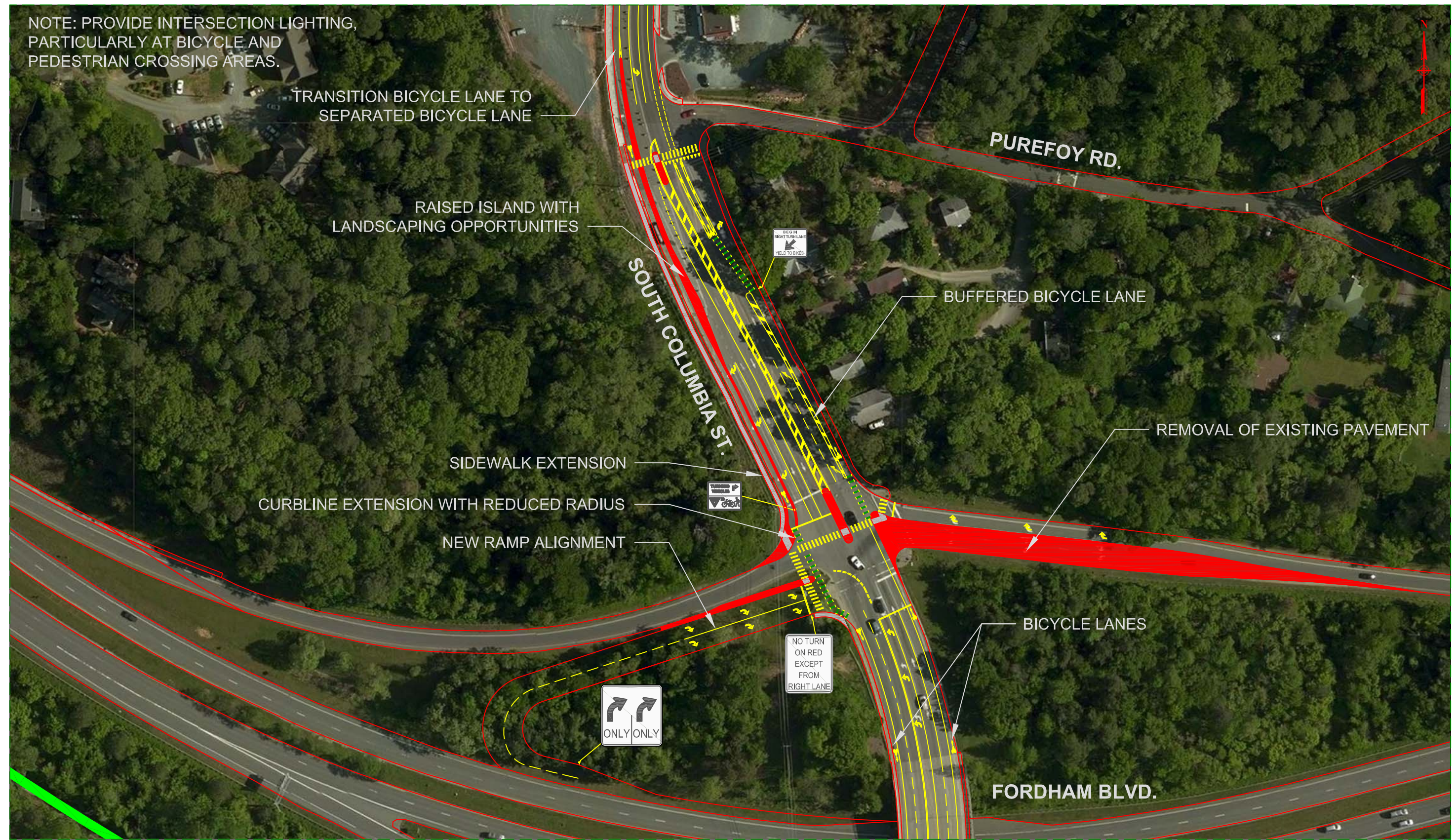
**TOWN OF CHAPEL HILL
 ALTERNATE INTERSECTION DESIGN CONCEPTS
 SOUTH COLUMBIA STREET - ALTERNATE 1**



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 REV. 3:
 DESIGNED: JAC
 DRAWN: JAC
 CHECKED: WS
 DATE: 1/6/2015

SHEET NAME:
 S. COLUMBIA AT
 CULBRETH ROAD
 DRAWING NUMBER
SK-3
 SHEET NUMBER
3 OF **13**

NOTE: PROVIDE INTERSECTION LIGHTING,
PARTICULARLY AT BICYCLE AND
PEDESTRIAN CROSSING AREAS.



TRANSITION BICYCLE LANE TO
SEPARATED BICYCLE LANE

RAISED ISLAND WITH
LANDSCAPING OPPORTUNITIES

PUREFOY RD.

SOUTH COLUMBIA ST.

BUFFERED BICYCLE LANE

REMOVAL OF EXISTING PAVEMENT

SIDEWALK EXTENSION

CURBLINE EXTENSION WITH REDUCED RADIUS

NEW RAMP ALIGNMENT

BICYCLE LANES

NO TURN
ON RED
EXCEPT
FROM
RIGHT LANE

ONLY ONLY

FORDHAM BLVD.

MATCHLINE - SEE SHEET SK-5



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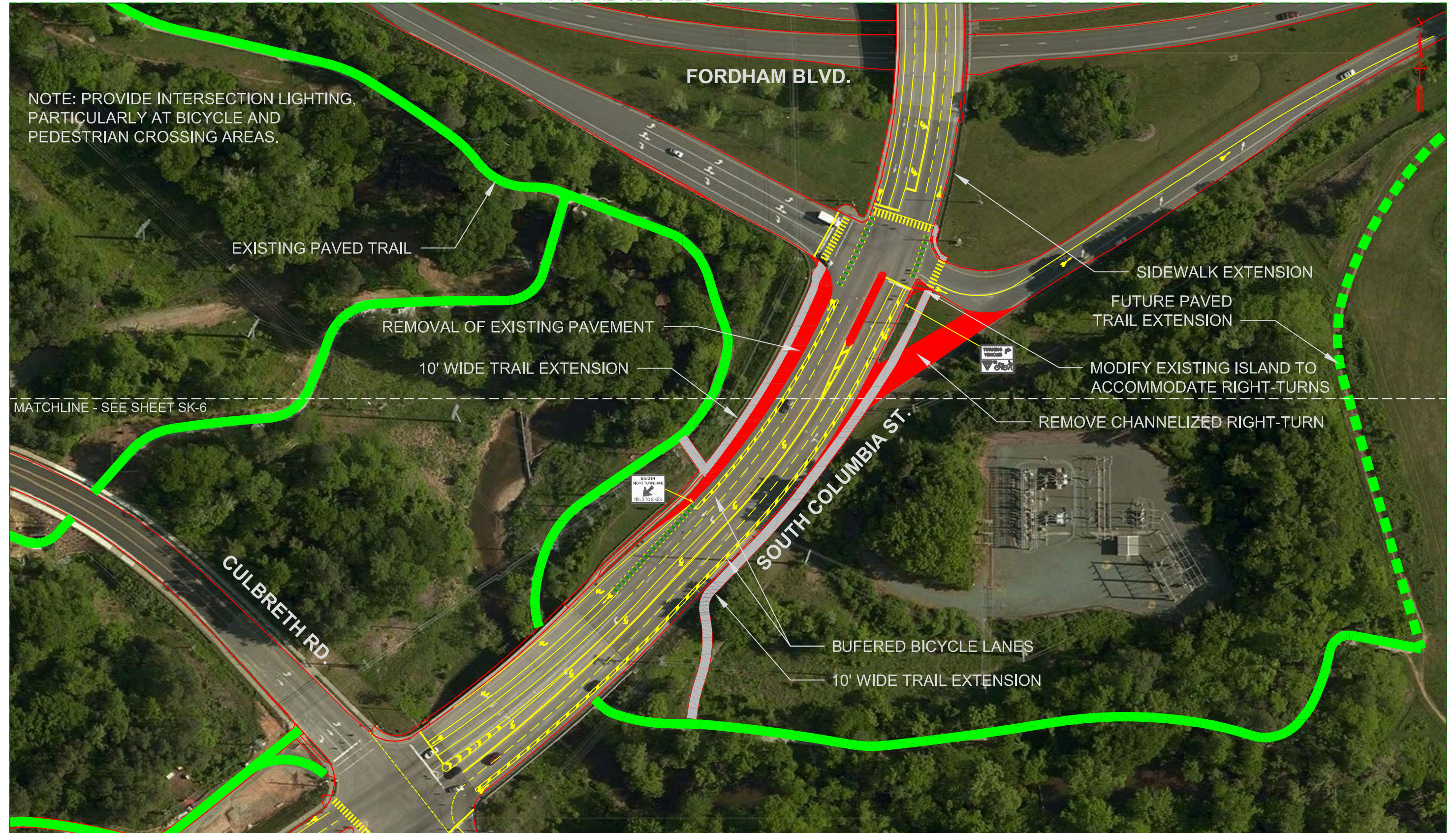
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ALTERNATE INTERSECTION DESIGN CONCEPTS
SOUTH COLUMBIA STREET - ALTERNATE 2**



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DESIGNED: JAC
DRAWN: JAC
CHECKED: WS
DATE: 1/6/2015

SHEET NAME:
S. COLUMBIA AT
FORDHAM BLVD
WESTBOUND RAMP
DRAWING NUMBER
SK-4
SHEET NUMBER
4 OF **13**

MATCHLINE - SEE SHEET SK-4



NOTE: PROVIDE INTERSECTION LIGHTING, PARTICULARLY AT BICYCLE AND PEDESTRIAN CROSSING AREAS.

FORDHAM BLVD.

EXISTING PAVED TRAIL

REMOVAL OF EXISTING PAVEMENT

10' WIDE TRAIL EXTENSION

SIDEWALK EXTENSION

FUTURE PAVED TRAIL EXTENSION

MODIFY EXISTING ISLAND TO ACCOMMODATE RIGHT-TURNS

REMOVE CHANNELIZED RIGHT-TURN

MATCHLINE - SEE SHEET SK-6

CULBRETH RD.

SOUTH COLUMBIA ST.

BUFERED BICYCLE LANES

10' WIDE TRAIL EXTENSION



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TOWN OF CHAPEL HILL ALTERNATE INTERSECTION DESIGN CONCEPTS SOUTH COLUMBIA STREET - ALTERNATE 2



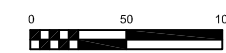
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DESIGNED: JAC
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CHECKED: WS
DATE: 1/6/2015

SHEET NAME:
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EASTBOUND RAMP
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SK-5
SHEET NUMBER
5 OF **13**



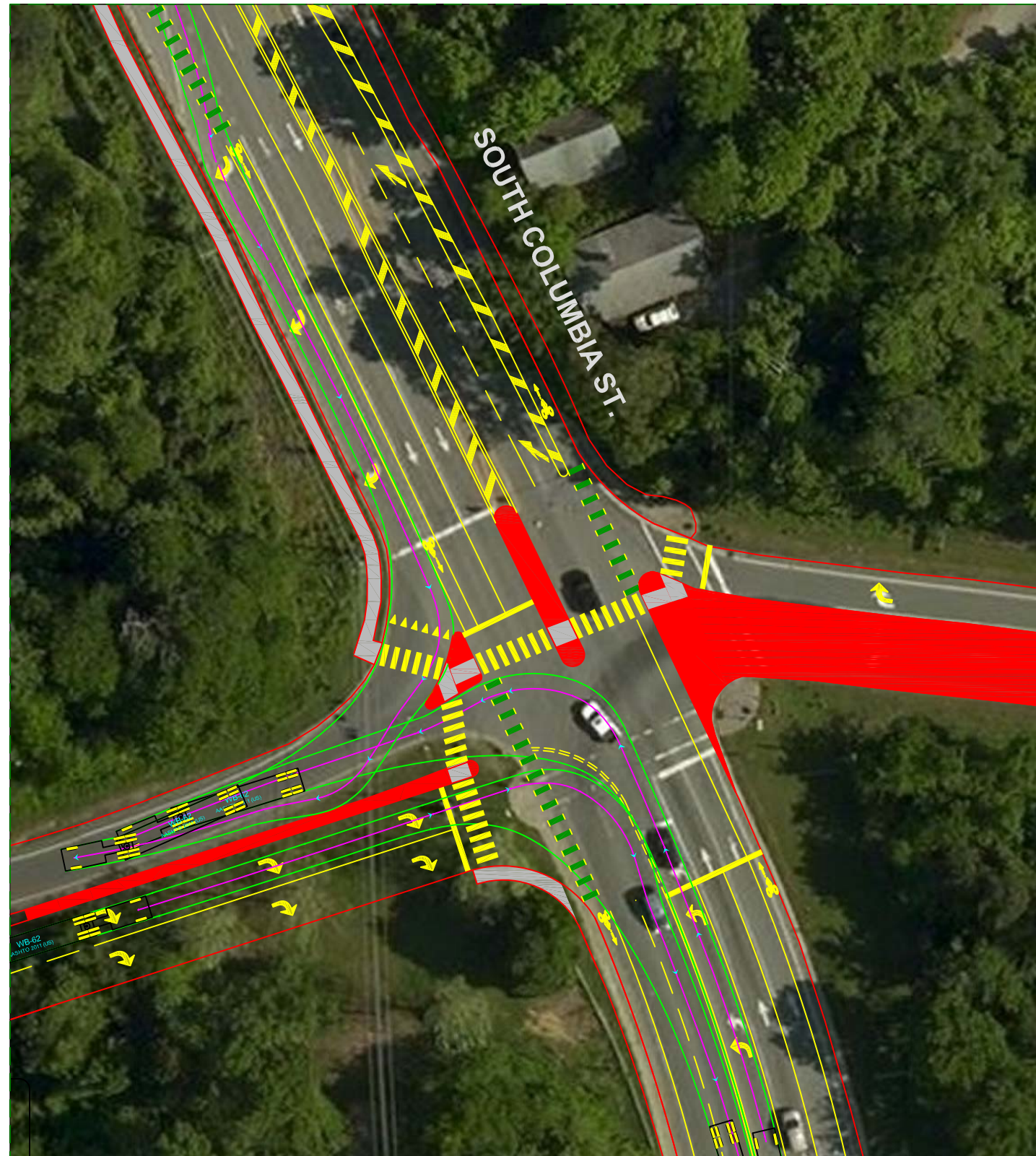
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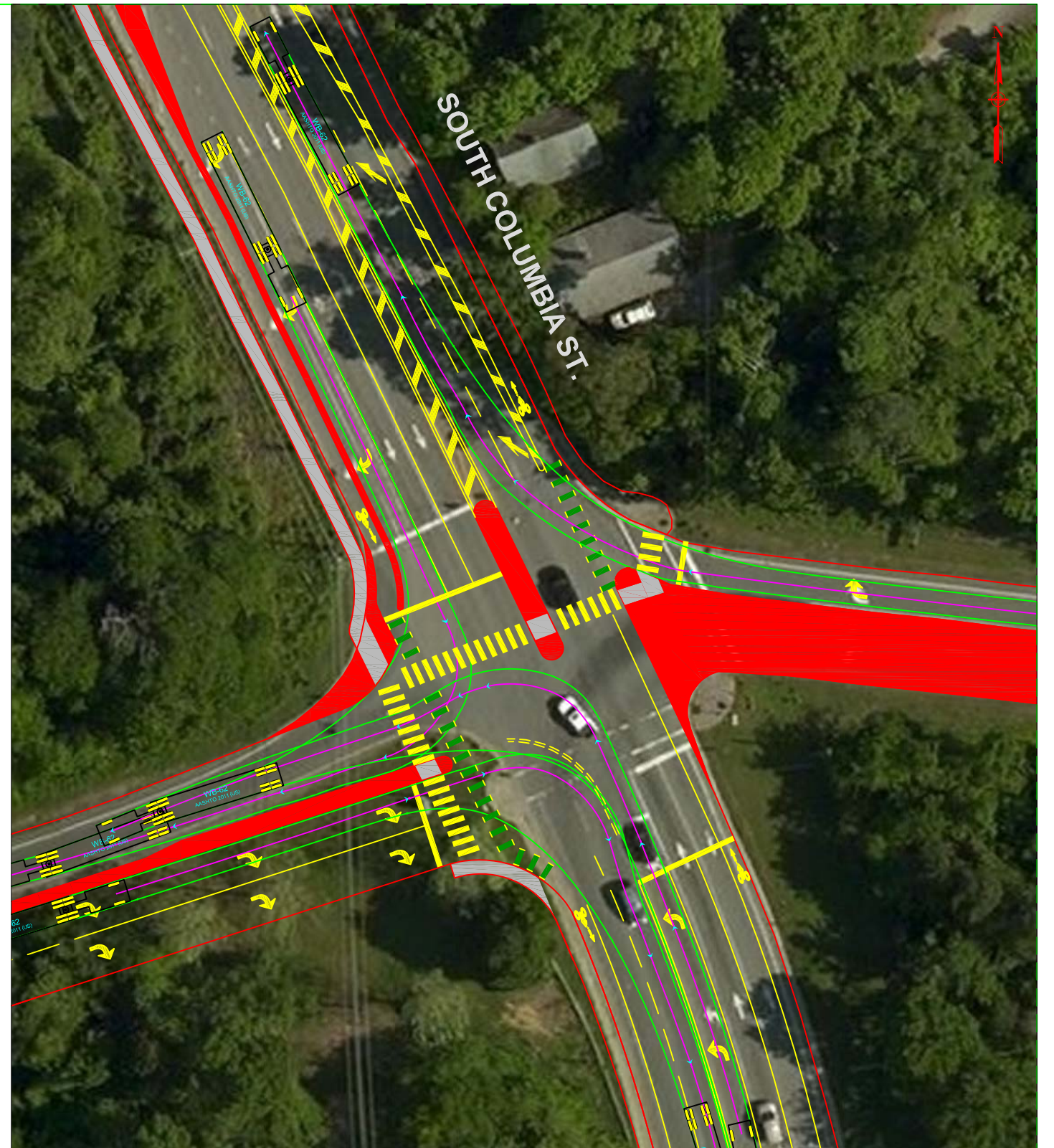


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 DATE: 1/6/2015

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 S. COLUMBIA AT
 CULBRETH ROAD
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SK-6
 SHEET NUMBER
6 OF **13**



ALTERNATIVE 1:-WB-62 TURNING MOVEMENTS



ALTERNATIVE 2: WB-62 TURNING MOVEMENTS



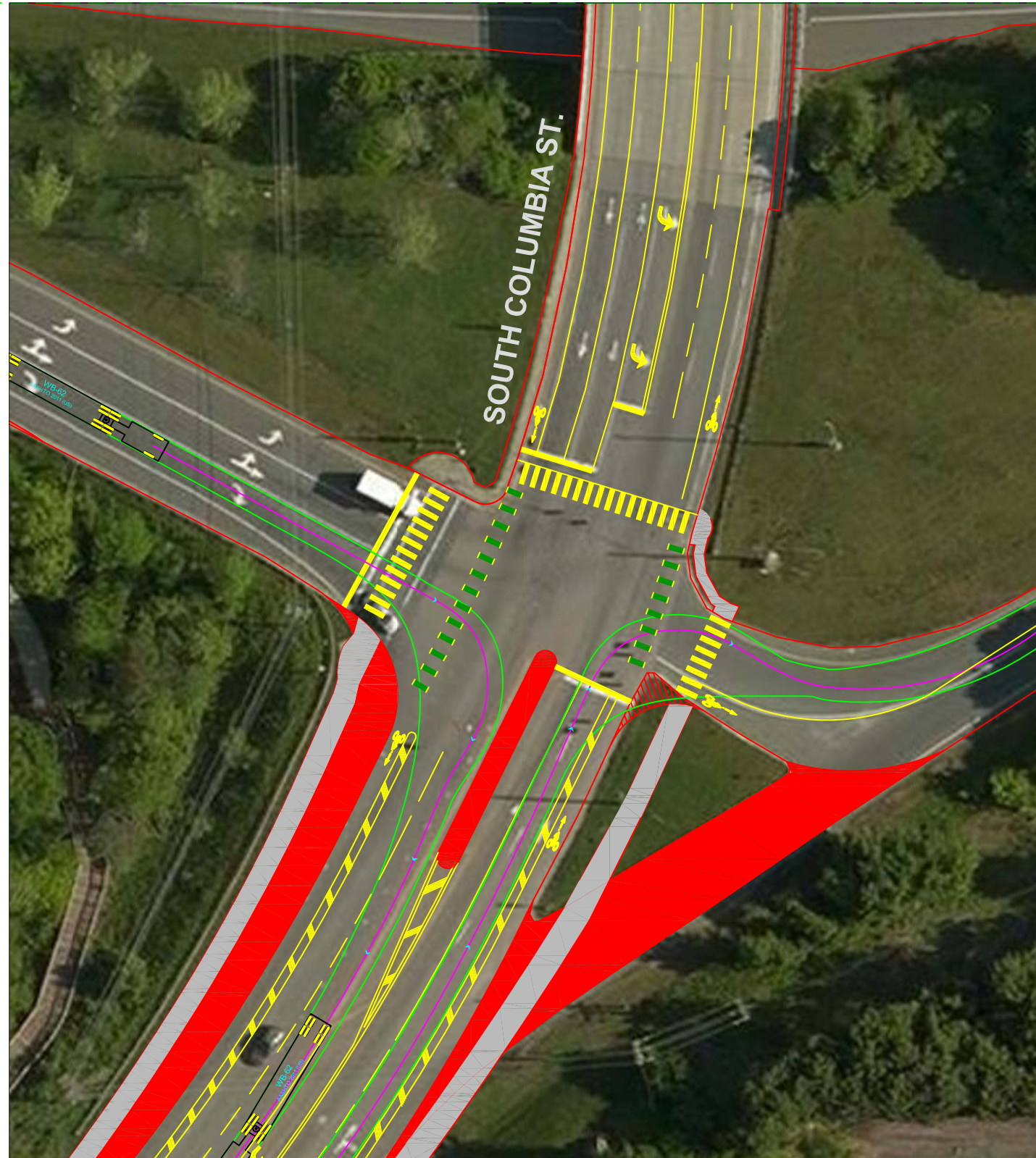
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 SOUTH COLUMBIA STREET -TURNING MOVEMENTS**



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 REV. 3:
 DESIGNED: JAC
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 DATE: 1/6/2015

SHEET NAME:
 S. COLUMBIA AT
 FORDHAM BLVD
 WESTBOUND RAMP
 DRAWING NUMBER
SK-7
 SHEET NUMBER
7 OF **13**



ALTERNATIVE 2: WB-62 TURNING MOVEMENTS
 NOTE: ALTERNATIVE 1 TURNING MOVEMENTS ARE THE SAME FOR VEHICLES ENTERING FROM FORDHAM BLVD. AND MATCH EXISTING CONDITIONS FOR VEHICLES EXITING TO FORDHAM BLVD.



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REV. 1:
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 REV. 3:
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SHEET NAME:
 S. COLUMBIA AT
 FORDHAM BLVD
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SK-8
 SHEET NUMBER
8 OF **13**

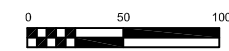


MATCHLINE - SEE SHEET SK-10



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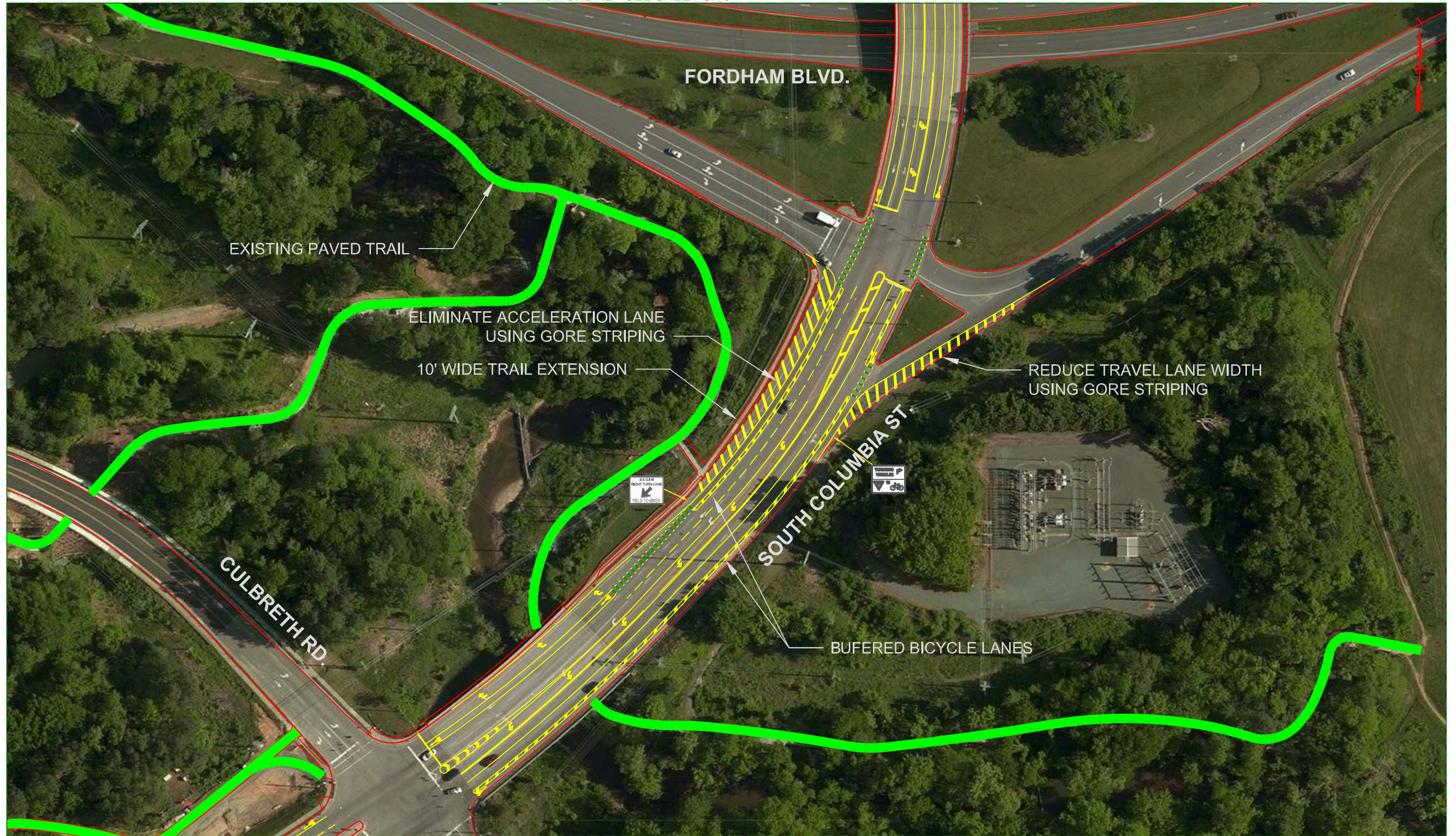
**TOWN OF CHAPEL HILL
 ALTERNATE INTERSECTION DESIGN CONCEPTS
 SOUTH COLUMBIA STREET - INTERIM CONDITION**



REV. 1:
 REV. 2:
 REV. 3:
 DESIGNED: JAC
 DRAWN: JAC
 CHECKED: WS
 DATE: 1/6/2015

SHEET NAME:
 S. COLUMBIA AT
 FORDHAM BLVD
 WESTBOUND RAMP
 DRAWING NUMBER
SK-9
 SHEET NUMBER
9 OF **13**

MATCHLINE - SEE SHEET SK-9



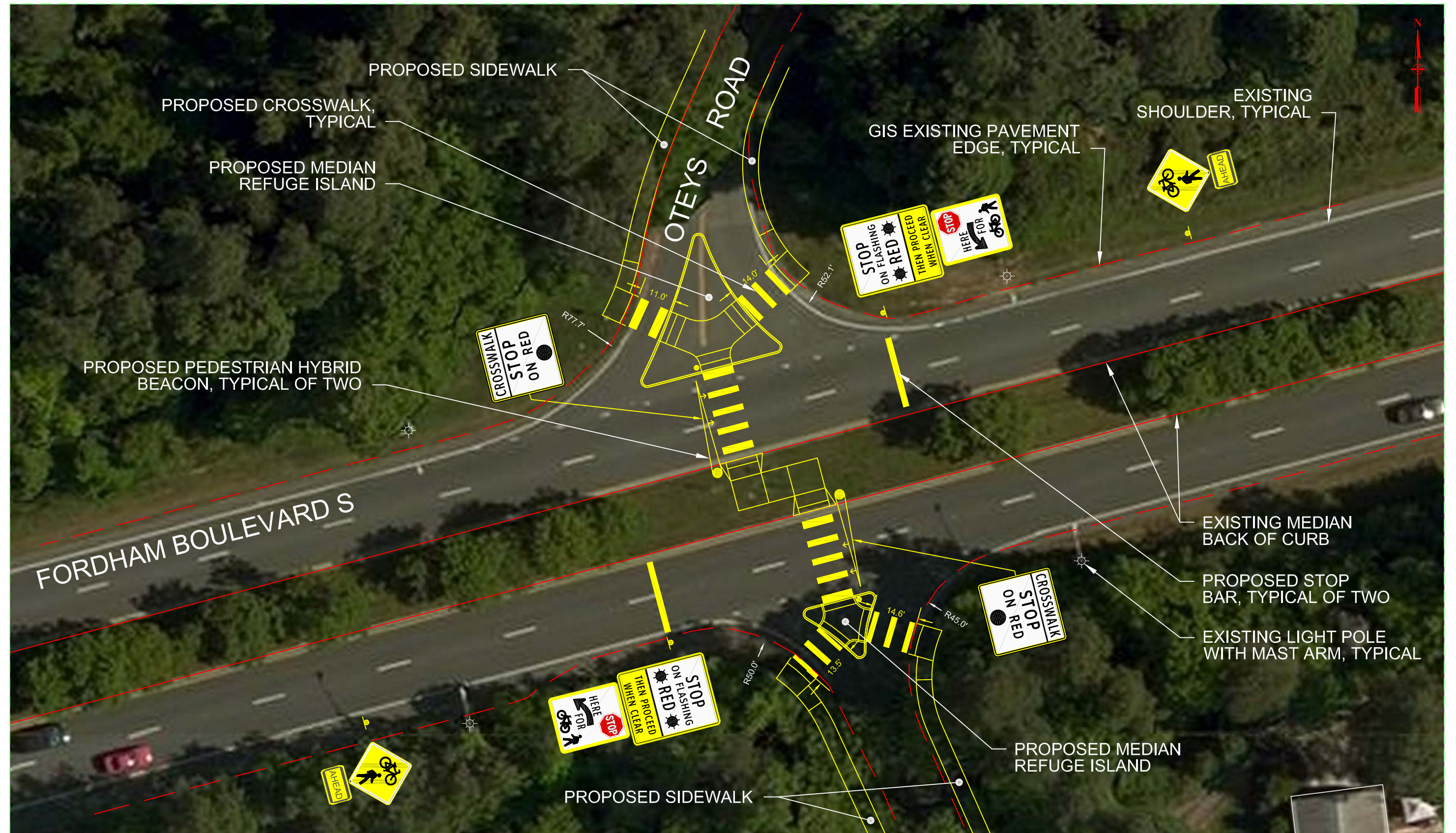
8484 GEORGIA AVENUE, SUITE 800, SILVER SPRING, MD 20910
 PHONE: (301) 927-1900 FAX: (301) 927-2800
 www.tooledesign.com

TOWN OF CHAPEL HILL
ALTERNATE INTERSECTION DESIGN CONCEPTS
SOUTH COLUMBIA STREET - INTERIM CONDITION



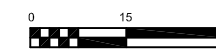
REV. 1:
 REV. 2:
 REV. 3:
 DESIGNED: JAC
 DRAWN: JAC
 CHECKED: WS
 DATE: 1/6/2015

SHEET NAME:
 S. COLUMBIA AT
 FORDHAM BLVD
 EASTBOUND RAMP
 DRAWING NUMBER
SK-10
 SHEET NUMBER
10 OF **13**



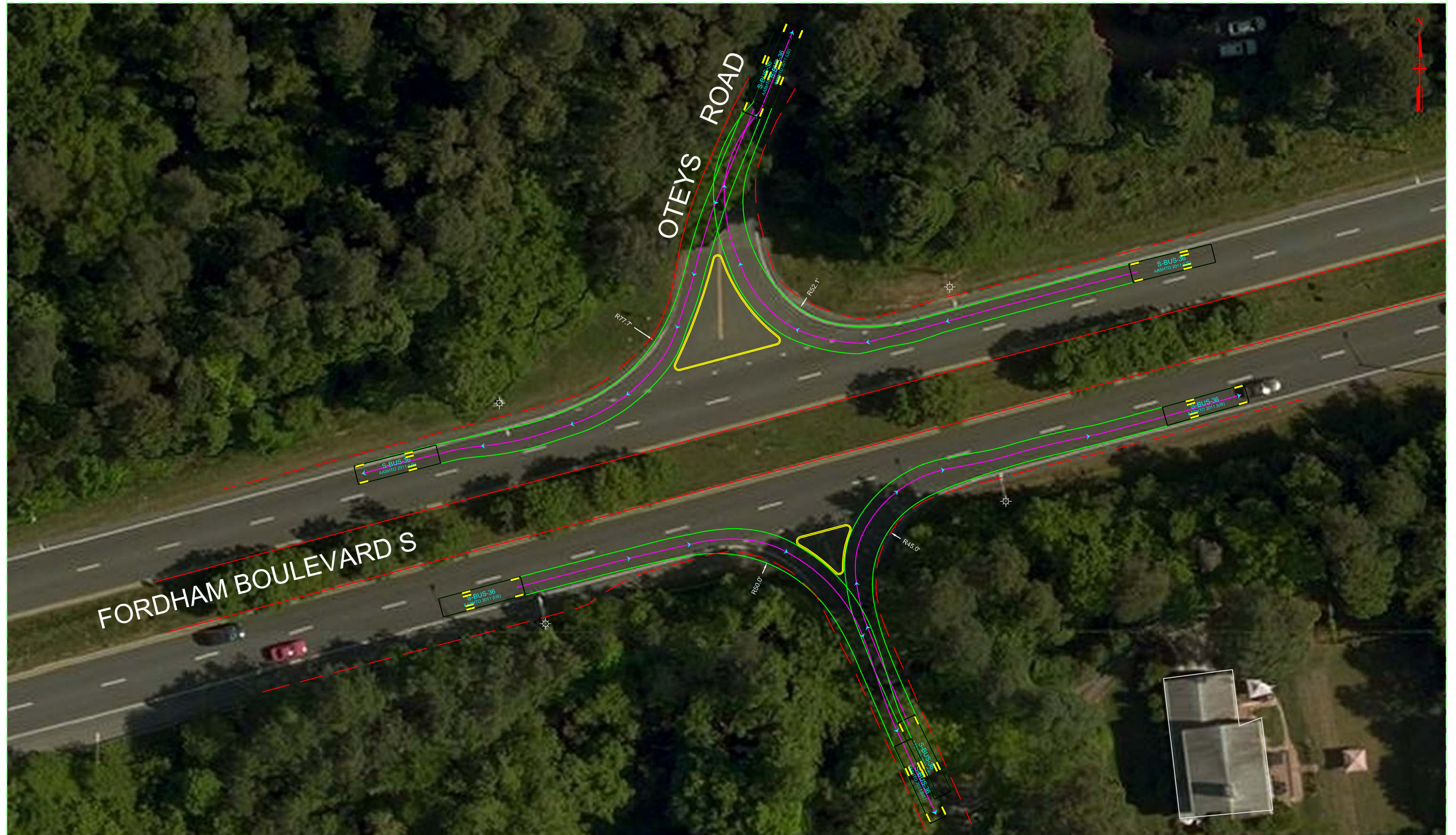
8484 GEORGIA AVENUE, SUITE 800, SILVER SPRING, MD 20910
 PHONE: (301) 927-1900 FAX: (301) 927-2800
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**TOWN OF CHAPEL HILL
 ALTERNATE INTERSECTION DESIGN CONCEPTS
 OTEYS ROAD PROPOSED CROSSING**



REV. 1:
 REV. 2:
 REV. 3:
 DESIGNED: EM
 DRAWN: EM
 CHECKED: WS
 DATE: 12/22/2014

SHEET NAME:
 Oteys Road
 Proposed Condition
 DRAWING NUMBER
SK-11
 SHEET NUMBER
11 OF **13**



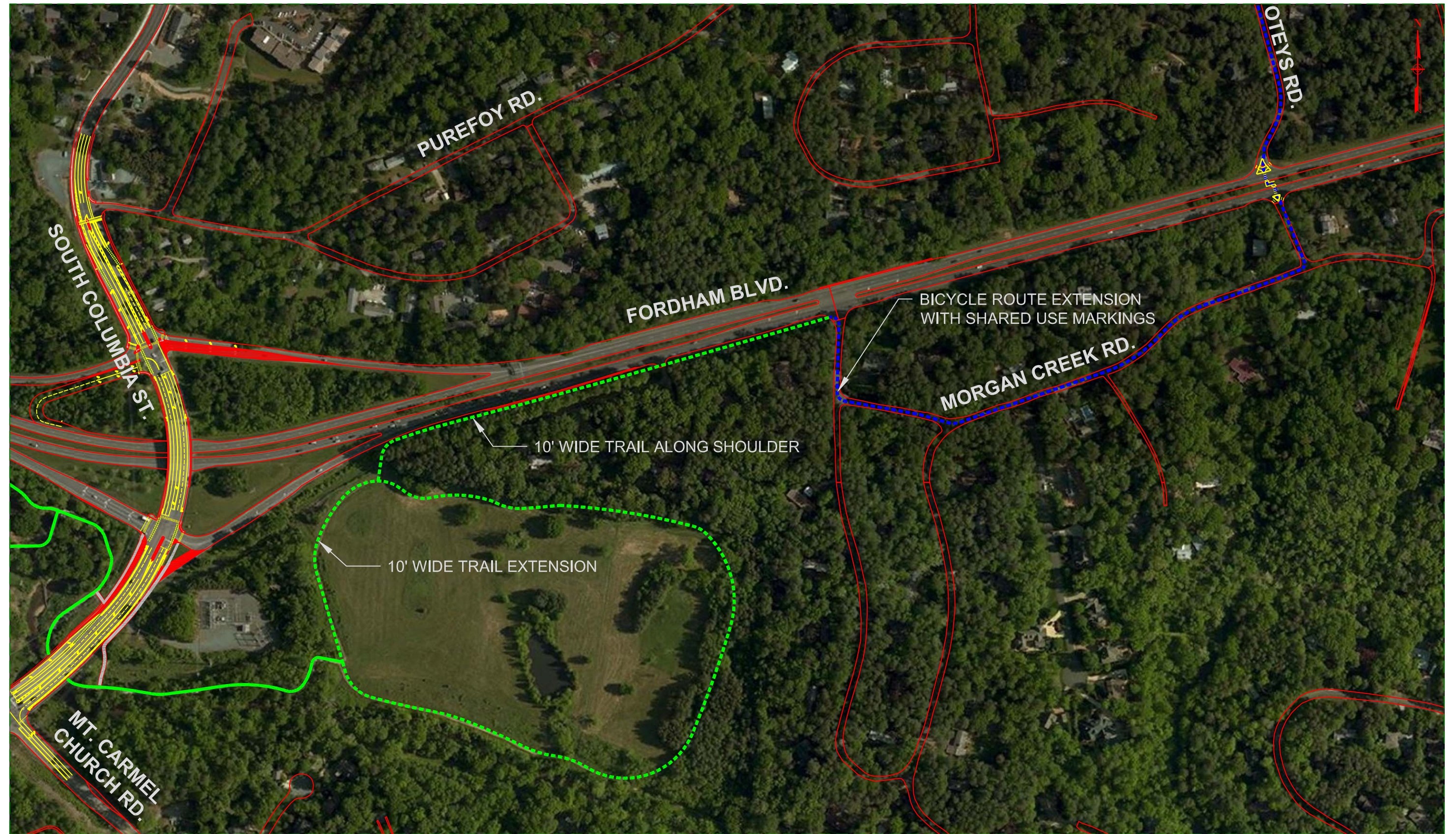
8484 GEORGIA AVENUE, SUITE 800, SILVER SPRING, MD 20910
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TOWN OF CHAPEL HILL
ALTERNATE INTERSECTION DESIGN CONCEPTS
OTEYS ROAD AUTO TURN FOR A SCHOOL BUS-36



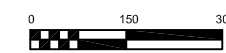
REV. 1:
 REV. 2:
 REV. 3:
 DESIGNED: EM
 DRAWN: EM
 CHECKED: WS
 DATE: 12/22/2014

SHEET NAME:
 Oteys Road
 Autoturn Exhibit
 DRAWING NUMBER
SK-12
 SHEET NUMBER
12 OF **13**



8484 GEORGIA AVENUE, SUITE 800, SILVER SPRING, MD 20910
 PHONE: (301) 927-1900 FAX: (301) 927-2800
 www.tooledesign.com

TOWN OF CHAPEL HILL
ALTERNATE INTERSECTION DESIGN CONCEPTS
SOUTH COLUMBIA STREET TO OTEYS ROAD BIKE ROUTE



REV. 1:
 REV. 2:
 REV. 3:
 DESIGNED: JAC
 DRAWN: JAC
 CHECKED: WS
 DATE: 1/6/2015

SHEET NAME:
 S. COLUMBIA ST TO
 OTEYS RD
 DRAWING NUMBER
SK-13
 SHEET NUMBER
13 OF **13**