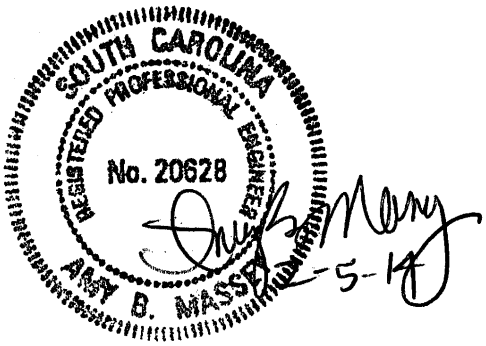
Traffic Impact Study for
Tree Tops Housing Development
Lancaster County, South Carolina



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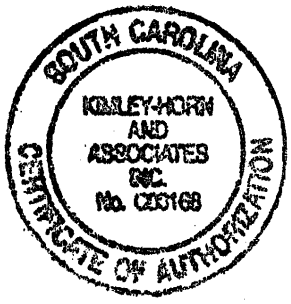

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The proposed Tree Tops housing development is located in Lancaster County, South Carolina along Van Wyck Road, approximately two miles to the west of the intersection of US 521 and Van Wyck Road. As currently envisioned, the proposed development will ultimately consist of 800 single family homes.

The development is expected to be completed (built-out) in 2024. The proposed development will be accessed via two full-movement unsignalized access points on Van Wyck Road.

This report presents trip generation, distribution, capacity analyses, and recommendations for transportation improvements required to meet anticipated traffic demands. The capacity analyses were performed under the following scenarios during the AM and PM peak hours:

- 2014 existing conditions
- 2024 background conditions (without the proposed development)
- 2024 build-out conditions.

As discussed with Lancaster County and South Carolina Department of Transportation (SCDOT) staff, the study area includes the following intersections:

- US 521 at Van Wyck Road (signalized)
- Van Wyck Road at proposed site Accesses #1 and #2 (unsignalized)

The study was performed in coordination with Lancaster County and SCDOT staff. Based on the study's results, the following improvements are recommended to accommodate **2024 build-out traffic conditions** due to the impact of the site:

- Conversion of the existing through-right lane on Van Wyck Road at US 521 to a left-through-right lane, and the incorporation of split signal phasing for the intersection.
- Construction of a southbound left-turn lane on Van Wyck Road at both Accesses #1 and #2, each with 200 feet of storage.

The recommended laneage is illustrated in Figure 8.1. Note that available sight distance should be verified at both access points, particularly at Access #1 where it appears that the applicable standards would not be met based on its currently planned location. It is recommended that the poor pavement conditions along existing Van Wyck Road be reviewed by SCDOT for potential application of state maintenance funding.

2.0 Introduction

The proposed Tree Tops housing development is located in Lancaster County, South Carolina along Van Wyck Road approximately two miles to the west of the intersection of US 521 and Van Wyck Road. As currently envisioned, the proposed development will ultimately consist of 800 single family homes.

The development is expected to be completed (build-out) in 2024. The proposed development will be accessed via two full-movement access points on Van Wyck Road.

Kimley-Horn and Associates, Inc. was retained to study the potential traffic impacts of this development and determine the transportation improvements that may be required to accommodate these impacts within the identified study area. This report presents trip generation, distribution, capacity analyses, and recommendations for transportation improvements required to meet anticipated traffic demands. This report reviews 2014 existing traffic conditions, 2024 background traffic conditions, and 2024 projected build-out traffic conditions.

The South Carolina Department of Transportation (SCDOT) and Lancaster County were contacted to obtain background information and to ascertain the elements to be covered in this traffic impact study (TIS). The study was prepared in accordance with the traffic study guidelines contained within SCDOT's *Access and Roadside Management Standards (ARMS) Manual* and performed in coordination with Lancaster County and SCDOT staff.

3.0 Inventory

3.1 Study Area

The identified study area for this TIS includes the following intersections:

- US 521 at Van Wyck Road (signalized)
- Van Wyck Road at Access #1 (proposed/unsignalized)
- Van Wyck Road at Access #2 (proposed/unsignalized)

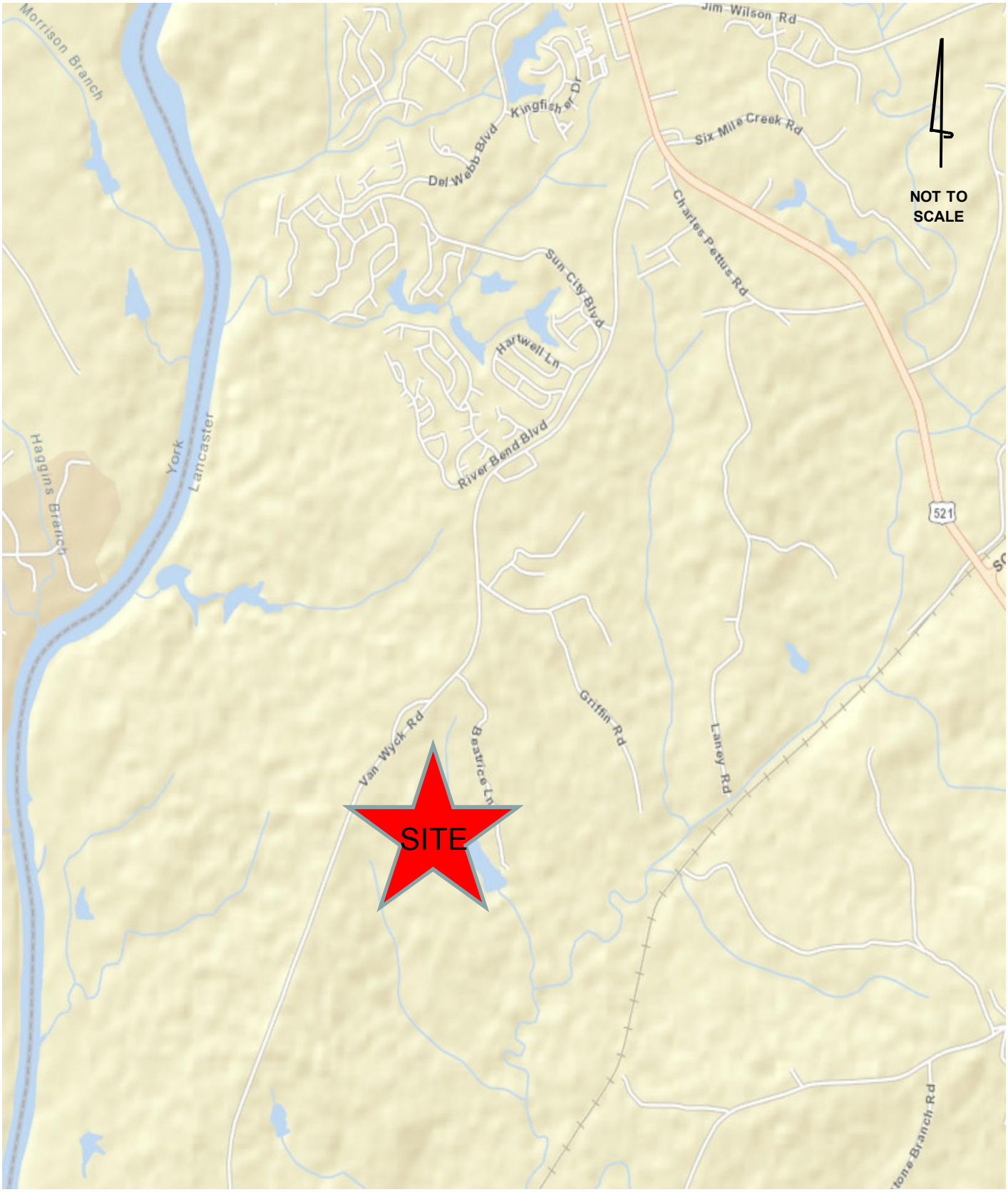
This study area was determined based on discussions with Lancaster County and SCDOT staff. Figure 3.1 shows the site location, and Figure 3.2 shows the proposed site plan for the project.

3.2 Existing Conditions

The major roadways in the project vicinity are US 521 and Van Wyck Road. Existing roadway laneage is depicted on Figure 3.3.

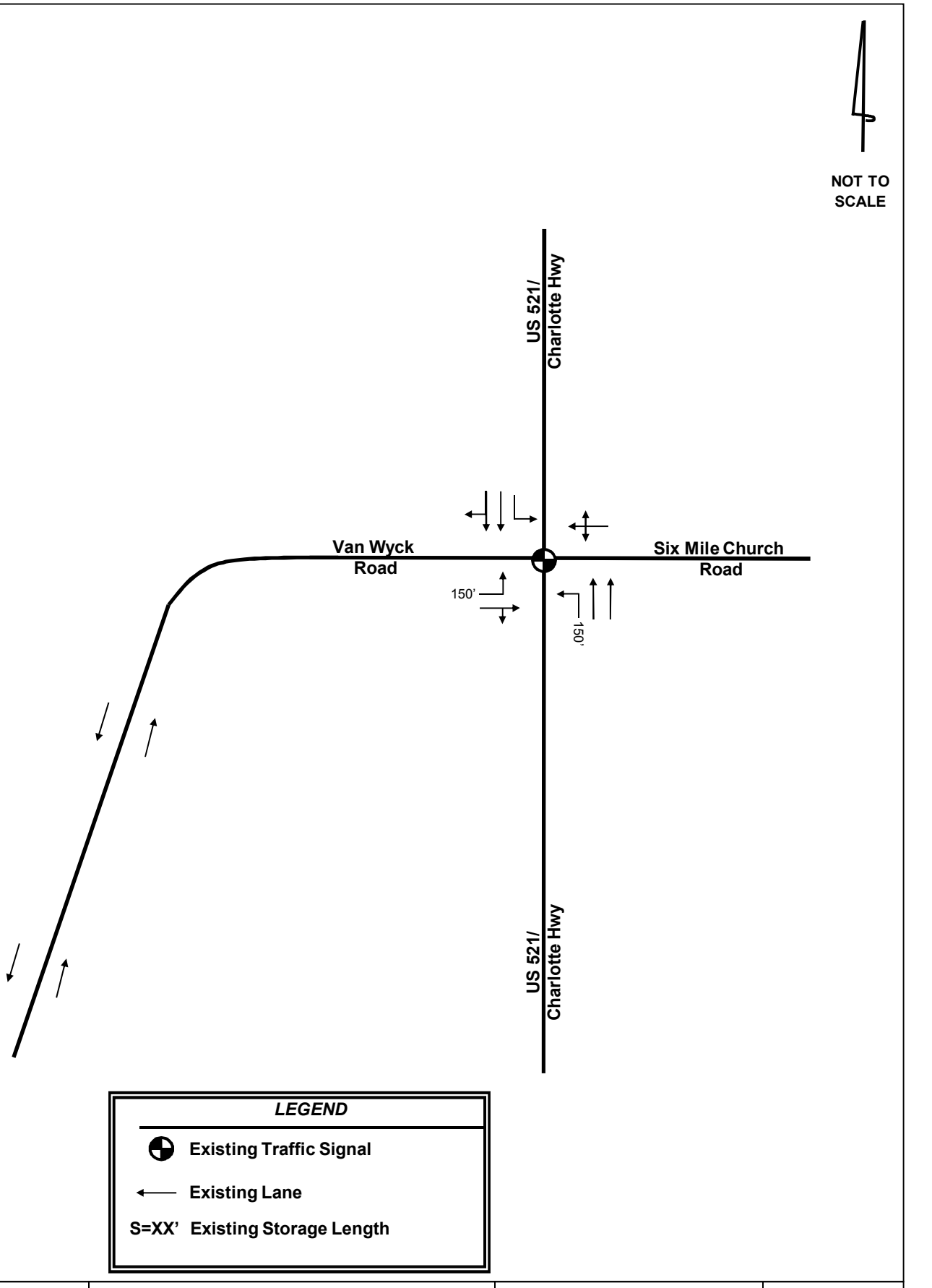
North of the intersection of US 521 and Van Wyck Road, US 521 is a five-lane, undivided roadway with a posted speed limit of 45 mph. South of the intersection of US 521 and Van Wyck Road, US 521 is a four-lane divided highway with a posted speed limit of 45 mph. According to 2012 SCDOT traffic counts available on-line, the average daily traffic (ADT) on US 521 north and south of this intersection are 22,500 and 12,800 vehicles per day (vpd), respectively.

Van Wyck Road is a two-lane undivided roadway with a posted speed limit of 50 mph in the vicinity of the site. According to 2012 SCDOT traffic counts available on-line, Van Wyck Road has an ADT of 1,000 vpd south of the proposed site location. Poor pavement conditions along Van Wyck Road were observed in the field.



Kimley-Horn and Associates, Inc.	**Tree Tops Housing Development Traffic Impact Study**	**Project Vicinity Map**	**Figure 3.1**

Kimley-Horn and Associates, Inc.	**Tree Tops Housing Development Traffic Impact Study**	**Project Site Plan**	**Figure 3.2**



Kimley-Horn and Associates, Inc.	**Tree Tops Housing Development Traffic Impact Study**	**Existing Roadway Laneage**	**Figure 3.3**

4.0 Traffic Generation

The traffic generation potential of the proposed development was determined using the trip generation rates published in *ITE Trip Generation Handbook* (Institute of Transportation Engineers, Ninth Edition, 2012). The proposed development will ultimately consist of 800 single family homes upon build-out in 2024.

Table 4.0 summarizes the expected traffic generation for the proposed development. As shown, during a typical weekday at total project build-out, the proposed development has the potential to generate 570 and 683 trips during the AM and PM peak hours, respectively.

Table 4.0 - Trip Generation

Land Use	Intensity	Daily	AM Peak Hour			PM Peak Hour		
			Total	In	Out	Total	In	Out
Single-Family Homes	800 DU	7,114	570	143	427	683	430	253
Subtotal		**7,114**	**570**	**143**	**427**	**683**	**430**	**253**
Net New External Trips		**7,114**	**570**	**143**	**427**	**683**	**430**	**253**

Note: Trip generation was calculated using the following data:

Daily Traffic Generation

Single-Family Homes	[ITE 210]	=	Ln(T) = 0.92 Ln(X) + 2.72; (50% in, 50% out)

AM Peak-Hour Traffic Generation

Single-Family Homes	[ITE 210]	=	T = 0.70(X) + 9.74; (25% in, 75% out)

PM Peak-Hour Traffic Generation

Single-Family Homes	[ITE 210]	=	Ln(T) = 0.90 Ln(X) + 0.51; (63% in, 37% out)

5.0 Traffic Volumes

5.1 2014 Existing Traffic

Peak-hour intersection turning-movement counts were performed by Quality Counts, LLC from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM on Tuesday, January 14, 2014 at the intersection of US 521 and Van Wyck Road. The turning-movement count data is included in the Appendix. Figure 5.1 shows the 2013 existing AM and PM peak-hour traffic volumes.

5.2 Historical Growth Traffic

Historical growth traffic is the increase in existing traffic volumes due to usage increases and non-specific growth throughout the area. As directed by SCDOT and Lancaster County staff, an annual growth rate of 1.75 percent was applied to the existing traffic counts over ten years to calculate future background traffic volumes.

5.3 Approved Development Traffic

Approved development traffic is the traffic generated by approved but not yet constructed developments in the vicinity. Based on discussion with Lancaster County staff, a 66-acre commercially zoned property adjacent to the intersection of US 521 and Van Wyck Road does not have an approved development plan and is therefore not included in this study. In addition, Lancaster County staff reported that the Sun City-Carolina Lakes project is built-out in the Van Wyck area. Lastly, 13single family lots are approved for development in the Moreland Wood Subdivision on Van Wyck Road. As a result of this discussion, the direction from Lancaster County and SCDOT staff was to increase the initial 1.5-percent growth rate to 1.75 percent per year to reflect the overall 25-year growth indicated in the Rock Hill-Fort Mill Area Transportation Study (RFATS) model. Therefore, specific approved development traffic was not incorporated into this study.

5.4 2024 Background Traffic

The 2024 background traffic volumes include existing and historical growth traffic. The 2024 AM and PM peak-hour background traffic volumes are shown in Figure 5.1.

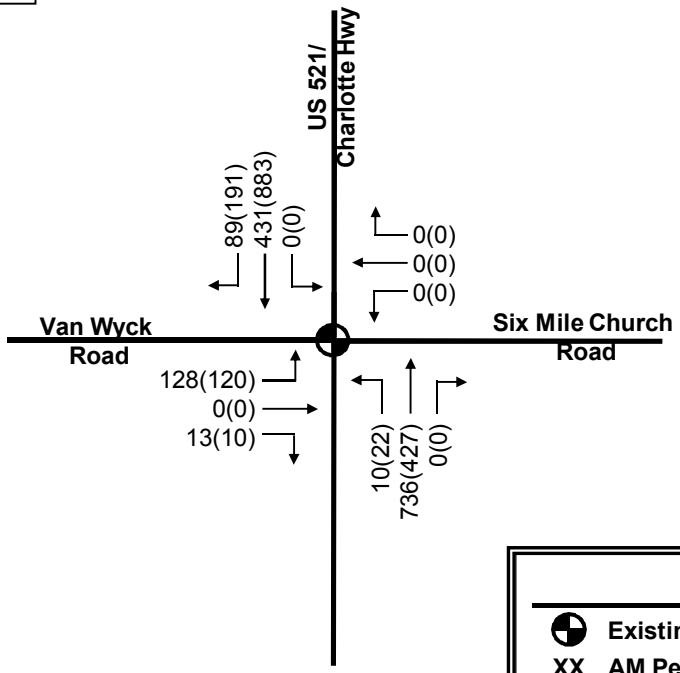
5.5 Site Traffic

The proposed site traffic was generated as discussed previously in Section 4.0, distributed, and assigned to the adjacent roadway network. The directional distribution and assignment was generally based on existing travel patterns and discussion with Lancaster County and SCDOT, shown in Figure 5.2.

5.6 2024 Build-out Traffic

Total 2024 AM and PM peak-hour build-out traffic volumes include the 2024 background traffic and the proposed site traffic, shown in Figures 5.3 and 5.4 respectively.

2014 Existing AM/PM Peak Hour Traffic Volumes

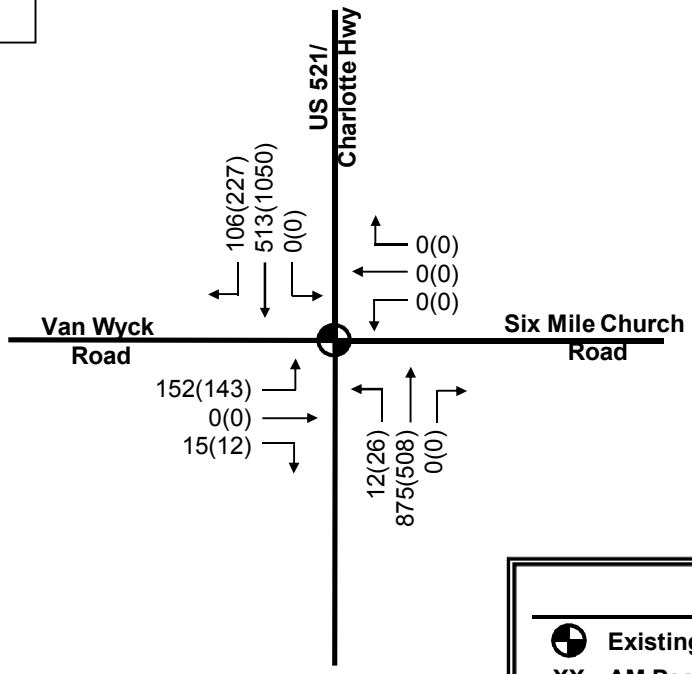


NOT TO SCALE

LEGEND

- Existing Traffic Signal
- XX AM Peak Hour Traffic Volume
- (XX) PM Peak Hour Traffic Volume

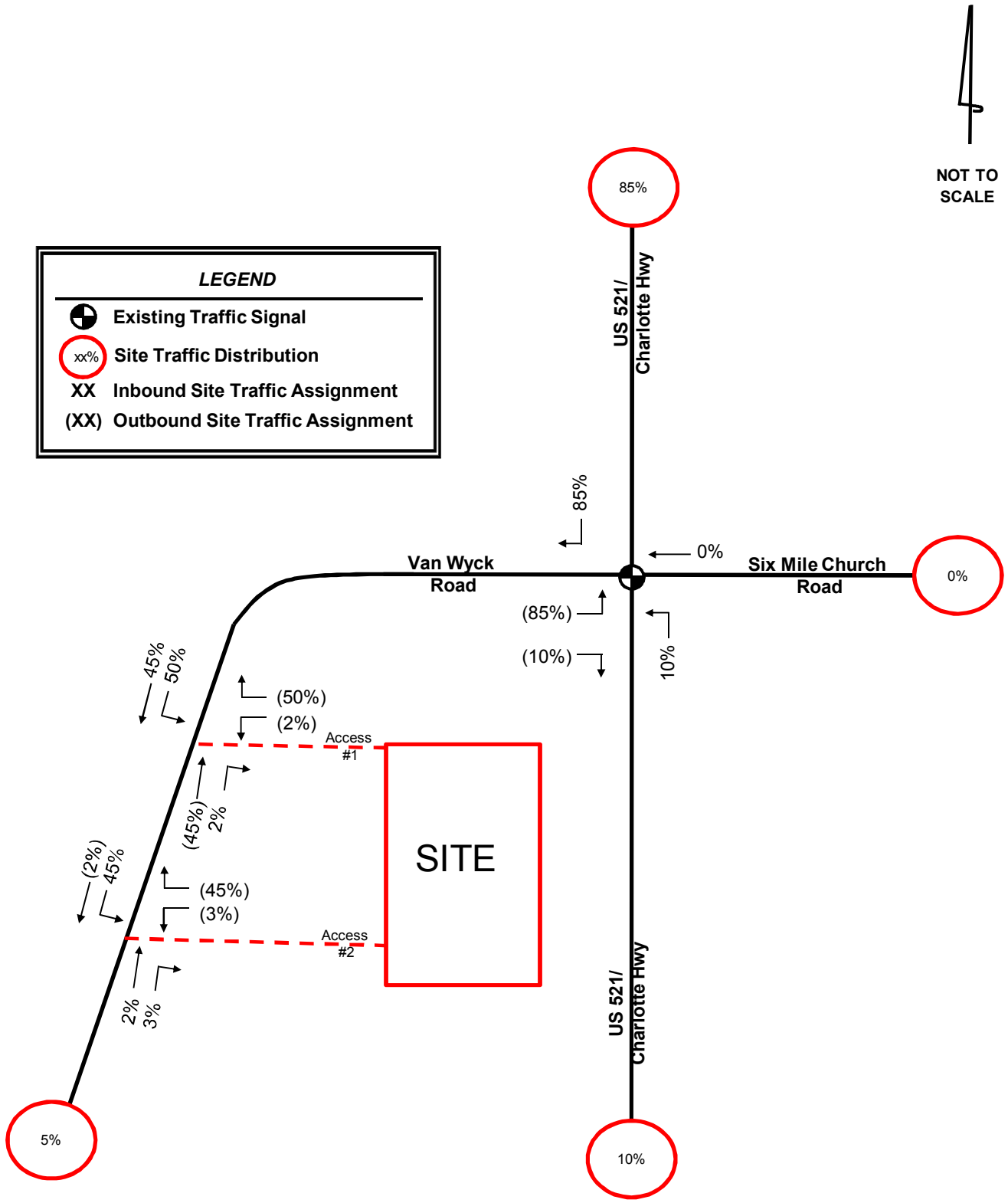
2024 Background AM/PM Peak Hour Traffic Volumes



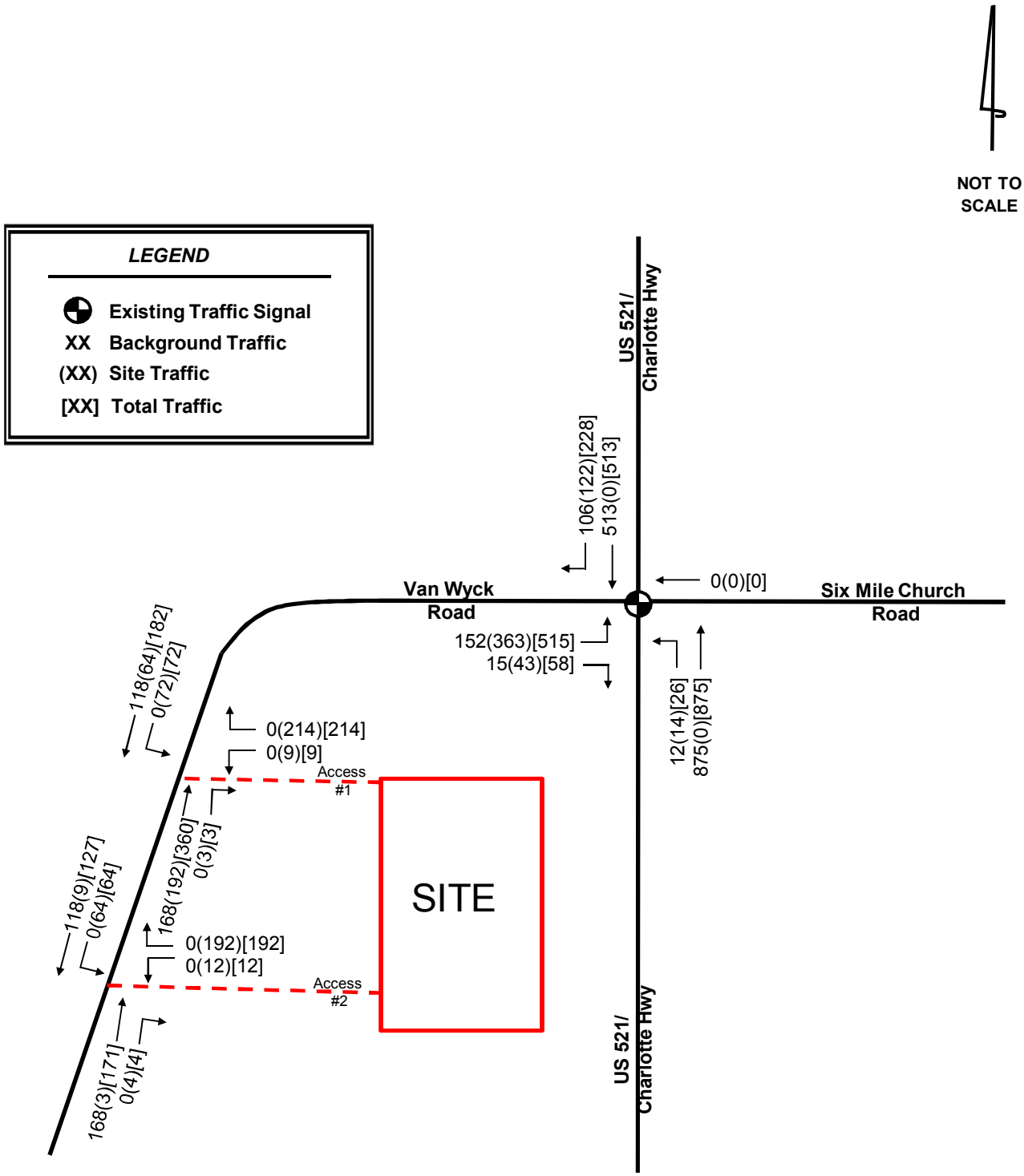
LEGEND

- Existing Traffic Signal
- XX AM Peak Hour Traffic Volume
- (XX) PM Peak Hour Traffic Volume

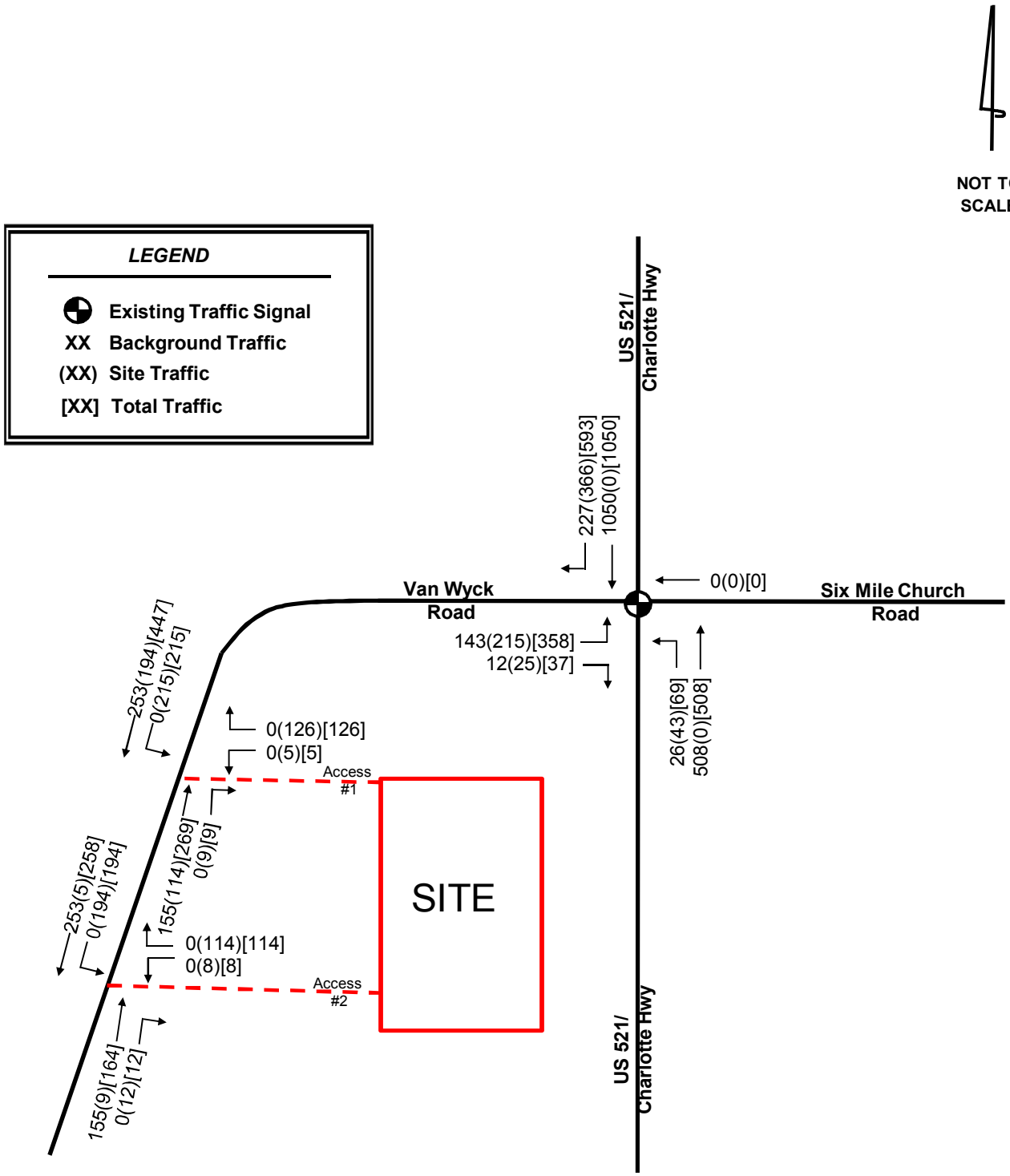
Kimley-Horn and Associates, Inc.	**Tree Tops Housing Development Traffic Impact Study**	**2014 Existing and 2024 Background Peak Hour Traffic Volumes**	**Figure 5.1**



Kimley-Horn and Associates, Inc.	Tree Tops Housing Development Traffic Impact Study	Site Traffic Distribution and Assignment	Figure 5.2



Kimley-Horn and Associates, Inc.	**Tree Tops Housing Development Traffic Impact Study**	**2024 Build-Out AM Peak Hour Traffic Volumes**	**Figure 5.3**



Kimley-Horn and Associates, Inc.	**Tree Tops Housing Development Traffic Impact Study**	**2024 Build-Out PM Peak Hour Traffic Volumes**	**Figure 5.4**

6.0 Capacity Analysis

Capacity analyses were performed for the AM and PM peak hours using the Synchro Version 8 software to determine the operating characteristics of the adjacent road network and the impacts of the proposed project.

Capacity is defined as the maximum number of vehicles that can pass over a particular road segment or through a particular intersection within a set time duration. Capacity is described by Level-of-Service (LOS) for the operating characteristics of a road segment or intersection. LOS is defined as a qualitative measure that describes operational conditions and motorist perceptions within a traffic stream. The *Highway Capacity Manual* defines six levels of service, LOS A through LOS F, with A being the best and F being the worst. LOS D is the typically accepted standard for signalized intersections in urban and suburban areas. For signalized intersections, LOS is defined for the overall intersection operation.

LOS for a two-way stop-controlled (TWSC) intersection is determined by the control delay and is defined for the minor movements. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. With respect to field measurements, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue to the time the vehicle departs from the stop line. LOS is not defined for a TWSC intersection as a whole. For descriptive purposes, results between LOS A and LOS C for the side street approach are assumed to represent short delays. Results between LOS D and LOS E for the side street approach are assumed to represent moderate delays, with LOS F representing long delays. It is typical for stop sign controlled side streets and driveways intersecting major streets to experience long delays during peak hours, particularly for left-turn movements. The majority of the traffic moving through the intersection on the major street typically experiences little or no delay.

Table 6.0-A lists the LOS control delay thresholds published in the *Highway Capacity Manual (HCM)* for signalized intersections. Synchro Version 8 software uses the same LOS thresholds as those published in the *HCM*.

Table 6.0-A
Level-of-Service Control Delay Thresholds for Signalized Intersections

Level-of-Service	Control Delay per Vehicle [sec/veh]
A	≤ 10
B	> 10 – 20
C	> 20 – 35
D	> 35 – 55
E	> 55 – 80
F	> 80

Table 6.0-B lists the LOS control delay thresholds published in the *HCM* for unsignalized intersections, as well as the unsignalized operational descriptions assumed herein.

Table 6.0-B
Level-of-Service Control Delay Thresholds for Unsignalized Intersections

Level-of-Service	Average Control Delay per Vehicle [sec/veh]	
A	≤ 10	Short Delays
B	> 10 – 15	
C	> 15 – 25	
D	> 25 – 35	Moderate Delays
E	> 35 – 50	
F	> 50	Long Delays

Capacity analyses were performed for 2014 existing traffic conditions, 2024 background traffic conditions, and 2024 build-out traffic conditions using Synchro Version 8 software for the existing intersection of US 521 and Van Wyck Road. Capacity analyses were performed for 2024 build-out traffic conditions for the two proposed unsignalized full-movement access points on Van Wyck Road.

Existing signal plans were obtained from SCDOT and used for the existing signalized intersection of US 521 at Van Wyck Road. The signal plans are included in the Appendix.

Capacity analysis reports generated by Synchro Version 8 software are included in the Appendix and are briefly summarized in the following subsections. Intersection volume development worksheets are also included in the Appendix.

6.1 *US 521 at Van Wyck Road*

Table 6.1 summarizes the LOS and control delay (seconds per vehicle) at the signalized intersection of US 521 and Van Wyck Road under 2014 existing conditions, 2024 background conditions, and 2024 build-out conditions.

Table 6.1 - US 521 at Van Wyck Road

Condition	AM		PM	
	LOS	Delay	LOS	Delay
2014 Existing	A	8.9	A	8.6
2024 Background	A	9.9	B	10.0
2024 Build	C	25.3	C	25.5
2024 Build Improved	B	17.6	B	16.2

Under projected AM background and build-out and PM build-out conditions, the eastbound left queues along Van Wyck Road are expected to extend beyond the 150' of storage length in the left-turn lane. Considering the eastbound left-turn volume and associated queuing, dual left turns are recommended. Considering the relatively minimal eastbound right-turn volume, restriping of eastbound through-right lane to a left-through-right lane is recommended to accommodate the left-turning volume. This modification would dictate that eastbound and westbound movements operate under split phasing. This improvement is projected to decrease delay and improve LOS during both peaks.

It is noted that under projected AM background and build-out conditions, the northbound through queues along US 521 are expected to extend past Six Mile Creek Road, which is approximately 170 feet south of the US 521/Six Mile Church Road traffic signal. Six Mile Creek Road serves as an access to the Indian Land Fire Department.

6.2 *Van Wyck Road at Access #1 (northern access)*

Based on the capacity analysis results shown in Table 6.2, the proposed stop-controlled westbound approach of Access #1 at Van Wyck Road is expected to operate with short delays and minimal queues under 2024 build-out conditions with a single/shared westbound approach lane. In addition, the southbound approach is projected to operate at LOS A during both peaks with a single, shared through-left lane. Therefore, no capacity-related improvements are recommended.

Table 6.2 - Van Wyck Road at Access #1		
Condition	Measure	WB*
		WBLR
AM Peak Hour		
2024 Build-Out	LOS (Delay)	B (14.4)
	Synchro 95th Q	47'
PM Peak Hour		
2024 Build-Out	LOS (Delay)	B (12.3)
	Synchro 95th Q	22'

*Unsignalized Capacity analysis results provided for the worst minor street land group

6.3 *Van Wyck Road at Access #2 (southern access)*

Based on the capacity analysis results shown in Table 6.3, the proposed stop-controlled westbound approach of Van Wyck Road and Access #2 is expected to operate with short delays and minimal queues under 2024 build-out conditions with a single/shared westbound approach lane. In addition, the southbound approach is projected to operate at LOS A during both peaks with a single, shared through-left lane. Therefore, no capacity-related improvements are recommended.

Table 6.3 - Van Wyck Road at Access #2		
Condition	Measure	WB
		WBLR
AM Peak Hour		
2024 Build-Out	LOS (Delay)	B (11.1)
	Synchro 95th Q	28'
PM Peak Hour		
2024 Build-Out	LOS (Delay)	B (10.9)
	Synchro 95th Q	17'

*Unsignalized Capacity analysis results provided for the worst minor street land group

7.0 Auxiliary Turn Lane Warrants and Sight Distance

In accordance with Table 5-9 in the *SCDOT ARMS Manual*, for a left-turning movement with peak-hour volumes ranging from 50-200 vehicles with 0-10% of heavy vehicles, a left-turn lane with a minimum storage length of 200 feet should be constructed at both Accesses #1 and #2.

A limited field review of intersection and stopping sight distances was performed for existing conditions at the intersections of Van Wyck Road and Accesses #1 and #2. From the field review, the 495' stopping sight distance required for a 55 mph design speed on Van Wyck Road at Accesses #1 and #2 was met in both the northbound and southbound directions. However, if the site visit had been completed during seasons of dense foliage, it appears that the stopping sight distance would be limited. Should this be the case, the southbound stopping sight distance on Van Wyck Road at Access #1 may not be met. Intersection sight distance requirements (*SCDOT ARMS Manual,* 2008) and approximated field observations are shown in Tables 8.0 A and 8.0 B for Access #1 and Access #2, respectively.

Table 7.0 A- Intersection Sight Distance Required and Results for Van Wyck Road at Access #1

	Required Sight Distance	From Stop Bar- Westbound Left	From Stop bar- Westbound Right
Intersection Sight Distance- Passenger Car	610'	880'	535'
Intersection Sight Distance- Single Unit Truck	770'	900'	565'

Table 7.0 B- Intersection Sight Distance Required and Results for Van Wyck Road at Access #2

	Required Sight Distance	From Stop Bar- Westbound Left	From Stop bar- Westbound Right
Intersection Sight Distance- Passenger Car	610'	930'+	860'
Intersection Sight Distance- Single Unit Truck	770'	930'+	905'

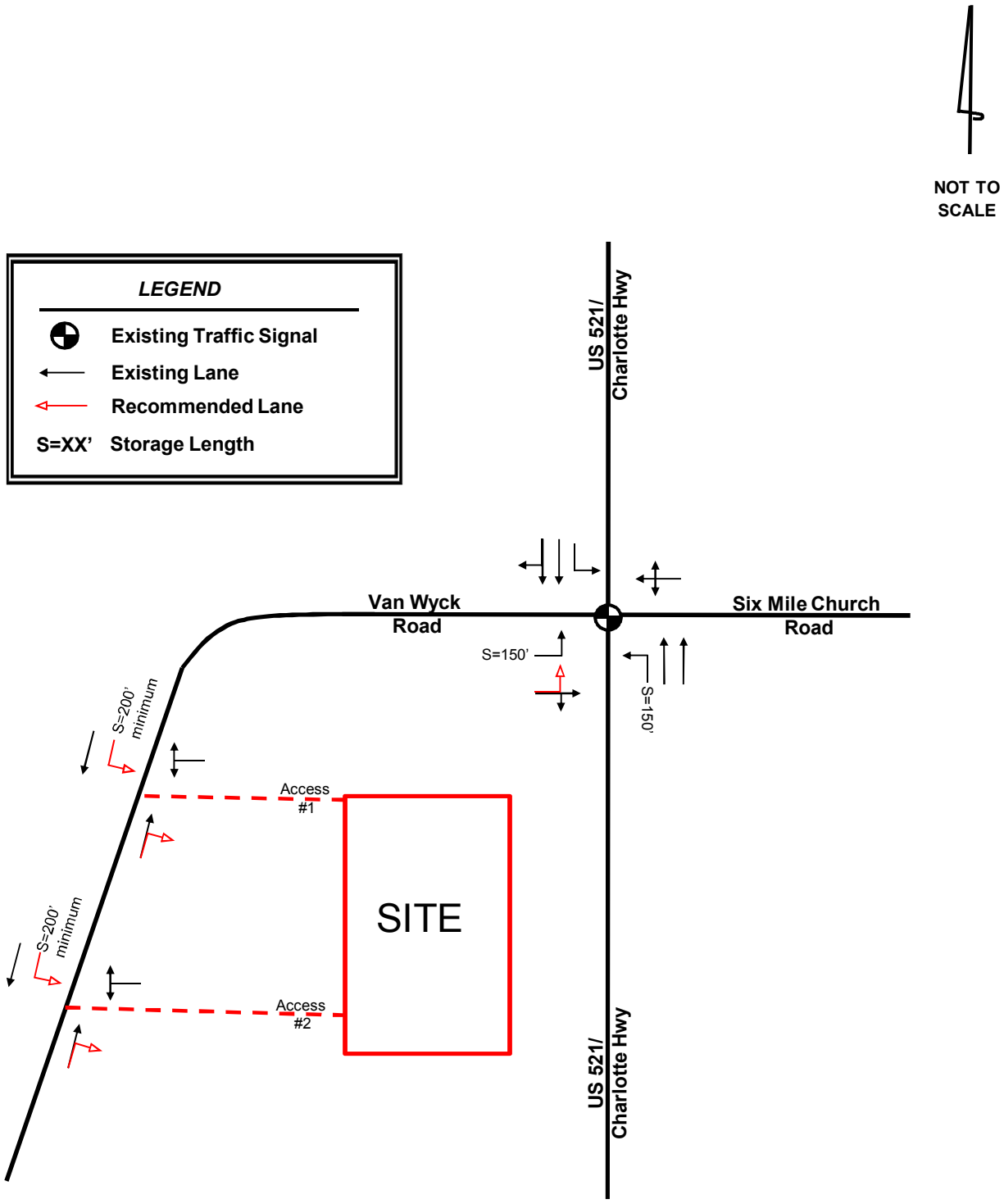
From the limited field review, it appears that that the applicable intersection sight distance standards would not be met for Access #1 based on its currently planned location. The intersection sight distance at Access #2 appears to be acceptable for passenger cars and single-unit trucks. The intersection sight distance standard for tractor/semitrailer vehicles would be 930 feet. It is noted that intersection and stopping sight distance at both access points should be formally reviewed as part of the planning-level design and permitting process.

8.0 Recommendations

The following improvements are recommended to accommodate **2024 build-out traffic conditions** due to the impact of the site:

- Restriping of the existing through-right lane on Van Wyck Road at US 521 to a left-through-right lane, with split signal phasing for the intersection.
- Construction of a southbound left-turn lane on Van Wyck Road at both Accesses #1 and #2, each with 200 feet of storage.

The recommended laneage is illustrated in Figure 8.1. Note that available sight distance should be verified at both access points, particularly at Access #1 where it appears that the applicable standards would not be met based on its currently planned location. It is recommended that the poor pavement conditions along existing Van Wyck Road be reviewed by SCDOT for potential application of state maintenance funding.



Kimley-Horn and Associates, Inc.	**Tree Tops Housing Development Traffic Impact Study**	**Recommended Roadway Laneage**	**Figure 8.1**

Appendix