River's Edge Apartments

Traffic Impact Analysis

Knightdale, NC

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WSP

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EXECUTIVE SUMMARY

River's Edge Apartments is a proposed apartment development located in the southwestern quadrant of the intersection of US 64 Business and Old Milburnie Road in Knightdale, NC. The current development plan shows 306 apartment dwelling units and an outparcel likely occupied by a 5,000 square-foot fast food restaurant with a drive-through window. Overall the development may generate 4,459 daily trips, including 270 non-pass-by trips in the AM peak hour and 268 non-pass-by trips in the PM peak hour. The site is expected to be build-out in 2015.

The study area includes one existing intersection and four proposed site entrance intersections.

1. US 64 Business at Old Milburnie Rd.....Exist. Signalized
2. US 64 Business at Site Entrance 1.....Prop. Unsignalized Right-In/Right-Out
3. US 64 Business at Site Entrance 2.....Prop. Unsignalized Right-In Only
4. Old Milburnie Rd at Site Entrance 3.....Prop. Unsignalized Full Movement Dr
5. Old Milburnie Rd at Site Entrance 4..... Prop. Unsignalized Full Movement Dr

This study documents the intersection level-of-service (LOS) analysis and queue analysis. LOS is a letter designated by the average vehicle delay time at an approach to an intersection with "A" representing little or no delay and "F" representing high levels of congestion. LOS D or better is considered acceptable. Weekday AM an PM peak hour traffic analyses were performed for the 2013 existing conditions, design year 2016 or one year past build-out, as well as the 2026 horizon year to determine the future improvement needs, as discussed below.

2013 Existing Condition Analysis

Existing traffic volumes, traffic flow characteristics, current traffic signal phasing and timing data, and intersection geometrics collected during field visits in the fall of 2013 were used to determine the current traffic operational performance.

As the south leg of the subject intersection only provides access to a then vacant building, this intersection effectively operated as a T-intersection. The traffic analyses indicate that the intersection of US 64 Business and Old Milburnie Road operated at LOS B during both AM and PM peak periods. Both eastbound and westbound US 64 Business approaches have low delays (LOS A and B) during the peak periods. The southbound Old Milburnie Road approach operated at LOS E in the AM peak hour and LOS D in the PM peak hour. The traffic analyses also show that the subject intersection does not have adequate storage capacities for the southbound turn lanes.

2016 No-Build Analysis

The 2016 No-Build analysis includes background traffic growth (3% per year) and traffic generated from the two off-site developments – the proposed 72-unit Loch Raven Pointe apartment development on Old Milburnie Road north of US 64 Business and the renovation / redevelopment of the existing vacant building in the southeastern quadrant of the US 64 Business / Old Milburnie Road intersection.

With the background traffic growth and the addition of off-site trips, the intersection of US 64 Business and Old Milburnie Road is expected to operate at LOS C during peak hours. The low volume northbound approach will see the highest average delays (63 to 66 seconds) and the lowest LOS (E). Similar to the existing conditions, the analyses show storage deficiencies for the southbound turn lanes. In addition, the existing 400-foot eastbound left-turn appears to require additional storage, assuming that the signal timings will remain unchanged.

2016 Build Analysis

The future build condition traffic volumes include the site traffic, volumes from the 2016 No-Build Analysis, as well as the background trip adjustments to account for the Milburnie Road extension to US 64 Business which is assumed to be completed as part of the proposed development.

The 2016 Build Conditions traffic analyses indicate that the intersection of US 64 Business and Old Milburnie Road/ Milburnie Road will operate at LOS D during both AM and PM peak hours. The northbound Milburnie Road approach, which is analyzed as a one-lane approach, is expected to operate at LOS F with over 80 seconds of delays during the peak hours. All the other approaches at this intersection and the four proposed site entrance intersections will operate at an overall acceptable LOS (D or better). In addition to the turn-lane storage deficiencies identified in the 2016 No-Build Condition analyses, the westbound left-turn lane on US 64 Business will also require a turn-lane extension to accommodate site trips and diverted background trips resulting from the Milburnie Road extension.

2016 Build with Improvements Analysis

The following improvements are recommended to mitigate site traffic impacts.

US 64 Business and Old Milburnie Road / Milburnie Road Improvements for 2016

- Extend the westbound left-turn lane on US 64 Business to provide 300 feet of storage (approximately 170-foot extension) and appropriate taper.
- Extend the existing Milburnie Road to US 64 Business in accordance with Town of Knightdale's 2027 Comprehensive Plan. It is assumed that Right-of-Way or easement is currently available for the planned extension.
- Construct a dedicated right-turn lane with appropriate taper on the northbound Milburnie Road approach between US 64 Business and Site Entrance 3.
- Construct a dedicated right-turn lane on eastbound US 64 Business with appropriate taper. This right-turn lane will start approximately 100 feet west of the Site Entrance 1 intersection.
- Traffic signal upgrades and timing optimizations to accommodate the proposed turn lane improvements.

With the proposed improvements, the US 64 Business and Old Milburnie Road / Milburnie Road intersection is expected to operate at LOS D in both AM and PM peak hours in design year 2016.

The proposed signal improvements will improve the northbound approach from LOS E in the 2016 No-Build Conditions to LOS D during peak hours. All the intersection approaches and proposed entrance intersections are expected to operate at acceptable LOS.

2026 Horizon Year Build Analysis

Similar to the 2016 Build Condition Analysis, the 2026 Build Condition traffic includes the site traffic the 2026 no-build background traffic which accounts for both the off-site developments and background traffic growth (over 34% growth compared with 2016 background traffic at the rate of 3% per year), and the background trip adjustments due to the Milburnie Road extension.

The 2026 build analyses assumed no improvements would be made to the roadway infrastructures, and as expected show significant increases in delays and deteriorations of LOS. The existing US 64 Business / Old Milburnie Road intersection is expected to operate at LOS E in the AM peak hour, and LOS F with over 115 seconds of delays in the PM peak hour. The storage deficiencies identified in the 2016 Build Condition traffic analyses are also expected be exacerbated.

2026 Horizon Year Build with Improvements Analysis

The following improvements are recommended to address the future deficiencies in 2026. Improvement items beyond the recommendations for the design year 2016 may be constructed as funding becomes available and developments occur in the vicinity of the study area in the future.

US 64 Business and Old Milburnie Road / Milburnie Road Improvements for 2026

- Widen the southbound Old Milburnie Road approach to provide a shared through/ left-turn lane with 250 feet of storage and a second right-turn lane with 250 feet of storage. The turn lane improvements will also require appropriate transitions and bay tapers.

- Extend the westbound right-turn lane on US 64 Business to provide 100 feet of storage and appropriate taper.

- Extend the westbound left-turn lane on US 64 Business to provide 350 feet of storage and appropriate taper.

- Extend the existing Milburnie Road to US 64 Business in accordance with Town of Knightdale's 2027 Comprehensive Plan. It is assumed that Right-of-Way or easement is currently available for the planned extension.

- Construct a dedicated right-turn lane with appropriate taper on the northbound Milburnie Road approach between US 64 Business and Site Entrance 3.

- Construct a second left-turn lane on eastbound US 64 Business with 300 feet of storage and appropriate taper.

- Construct a third through lane (convert the previously proposed right-turn lane) on eastbound US 64 Business and construct a receiving lane east of the intersection with appropriate length

and taper. The third through lane will start approximately 100 feet west of the Site Entrance 1 intersection, and will provide access to Site Entrance 1 and Site Entrance 2.

- Traffic signal upgrades and timing optimizations to accommodate the proposed turn lane improvements.

The proposed improvements will enable the US 64 Business and Old Milburnie Road / Milburnie Road intersection to operate at LOS D during both AM and PM peak hours in 2026. Due to the split signal phasing constraint, the Old Milburnie Road and Milburnie Road may experience longer delays (LOS E) during the peak hours. All the other intersection approaches and proposed site entrance intersections are expected to operate at acceptable LOS. The proposed turn lanes are expected to provide adequate storage capacities.

When this study report is prepared, the exact use for the 1.6-acre outparcel is not determined. A fast food restaurant is assumed for conservative trip estimates. It is suggested that this traffic study may be re-evaluated for the actual outparcel land use in the future. In addition, traffic conditions at the US 64 Business and Old Milburnie Road / Milburnie Road intersection should be monitored after the completion of the Milburnie Road extension, as the background trip diversions and queue lengths may be different from what is estimated in this report. Additional traffic signal phasing and timing adjustments may be required.

Based on the assumptions and traffic analyses documented in this report, this study concludes that with the proposed improvements constructed by the design year 2016, both the existing intersection and proposed site entrance intersections will operate at overall acceptable LOS. The proposed improvements for the 2016 design year will help to address many of the roadway improvement needs in horizon year 2026.

INTRODUCTION

River's Edge Apartments is a proposed apartment development located in the southwestern quadrant of the intersection of US 64 Business and Old Milburnie Road (SR 2217) in Knightdale, NC. The project site is bounded on the north by US 64 Business, on the west by Neuse River, and on the south by the Town of Knightdale Community Pool and tennis courts, and on the east by an adjoining property. Figure 1 illustrates the location of the site and surrounding area.

The development is proposed to consist of apartment buildings with a total of 306 dwelling units and an outparcel likely occupied by a 5,000 square-foot (SF) fast food restaurant with a drive-through window. The proposed site plan, as shown on Figure 2, illustrates the site layout and the locations of the four access points. Site Entrance 1 is a proposed right-in/right-out (RIRO) access on US 64 Business approximately 700 feet west of the Old Milburnie Road intersection; Site Entrance 2 is a right-in only entrance on US 64 Business serving the outparcel exclusively. Site Entrances 3 and 4 are proposed full movement driveways on the future Milburnie Rd extension providing access to the outparcel and the apartments respectively. Site Entrance 3 is estimated to be located approximately 200 feet south of US 64 Business. Site Entrance 4 is located at the bend of the existing unpaved Milburnie Road, approximately 500 feet south of the US 64 Business/ Old Milburnie Road intersection.

The study area includes one existing intersection and four proposed site entrance intersections.

1. US 64 Business at Old Milburnie Rd.....Exist. Signalized
2. US 64 Business at Site Entrance 1.....Prop. Unsignalized
3. US 64 Business at Site Entrance 2.....Prop. Unsignalized
4. Old Milburnie Rd at Site Entrance 3.....Prop. Unsignalized
5. Old Milburnie Rd at Site Entrance 4.....Prop. Unsignalized

Below is a detailed description of the existing study area roadway network. All Average Annual Daily Traffic (AADT) information provided in this description was obtained from NCDOT via the http://www.ncdot.gov/travel/statemapping/trafficvolumemaps/ website.

US 64 Business (New Bern Ave / Knightdale Blvd) is an east-west, 4-lane, median divided facility with a speed limit of 45 MPH. It is one of the two main corridors (the other being US 64/264) connecting Raleigh with Knightdale, Wendell, and Zebulon. The land use along US 64 Business between the Neuse River and I-540 is primarily residential with some commercial mixed in. Commercial uses are more prevalent west of the Neuse River and east of I-540. The 2013 AADT on US 64 Business was 26,000 vehicles per day (vpd) near the site.

Old Milburnie Road is a north-south, two-lane two-way collector street with a speed limit of 45 MPH. The land use along Old Milburnie Rd is primarily residential. Old Milburnie terminates on the southern end at the US 64 Business intersection. There is no AADT data on Milburnie Road within the past five years.

N

Not to Scale

Study Area Intersection :

1 US 64 Business @ Old Milburnie Road

Site Location

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Figure 1
Vicinity Map

Milburnie Road is a north-south, two-lane neighborhood street between Allison Drive and Cliffview Drive in the Green Pines residential community. The paved section of Milburnie Road is approximately 1,200 feet in length, and terminates at the northern end near the Knightdale Community Pool. There is no posted speed limit sign observed. No AADT data is available within the past five years. According to the Town of Knightdale's 2027 Comprehensive Plan, a future local street with 54 feet of Right-of-Way is proposed to connect the existing Milburnie Road to US 64 Business at its intersection with Old Milburnie Road.

Figure 3 illustrates the existing intersection lane configurations. The southern leg of the US 64 Business / Old Milburnie Road intersection serves as the driveway for an auto part/service specialty store "Car Cosmotology" in the southeastern quadrant of the intersection. When the study was conducted, it was a vacant warehouse/manufacturing facility. The traffic signal at this intersection is part of the US 64 Business Knightdale Closed Loop System. Based on the signal timing plans obtained from NCDOT, this signal is running a 140-second cycle length with split side street phasing during both AM and PM peak hours on weekdays.

For the purposes of the Traffic Impact Analysis (TIA), the full build-out of the site is assumed to be 2015. Thus, the design year in this study is 2016, or one year past build-out. This traffic study includes the intersection capacity analyses for the following six (6) scenarios:

1. The "**2013 Existing Conditions Analysis**" evaluates the current (2013) intersection operational performance.
2. The "**2016 No-Build Analysis**" examines the future traffic conditions where the proposed development is not constructed. This analysis takes into account background traffic growth (3% per year), other approved, expected developments in the area, and any proposed transportation improvements.
3. The "**2016 Build Analysis**" evaluates the intersection operational performance after distributing site trips through the study area intersections. This analysis also assumes the completion of the Milburnie Road extension to US 64 Business and estimates the resulting traffic pattern changes.
4. The "**2016 Build with Improvements Analysis**" is conducted if, comparing scenarios 2 and 3 above, there is any degradation in the operational performance of study area intersections as defined by the Town of Knightdale and the NCDOT. This analysis identifies and evaluates the mitigation measures.
5. The **"2026 Horizon Year Build Analysis"** evaluates the traffic conditions in 2026, taking into account the background traffic growth (3% per year), off-site development, development traffic, the completion of Milburnie Road extension and the traffic diversions caused by this new connector.
6. The **"2026 Horizon Year Build with Improvements Analysis"** identifies and evaluates the future transportation improvement needs for the study intersections.

The analyses were performed for both the weekday AM and PM peak hours. The existing intersection was studied in all scenarios while new intersections/site entrances were evaluated in the future year "Build" and "Build with Improvements" scenarios only. In accordance with the NCDOT Capacity Analysis Guidelines, "protected/permissive" left-turn phasing is not used for future condition analyses and no "No Right Turn on Red" (RTOR) is allowed in this study.

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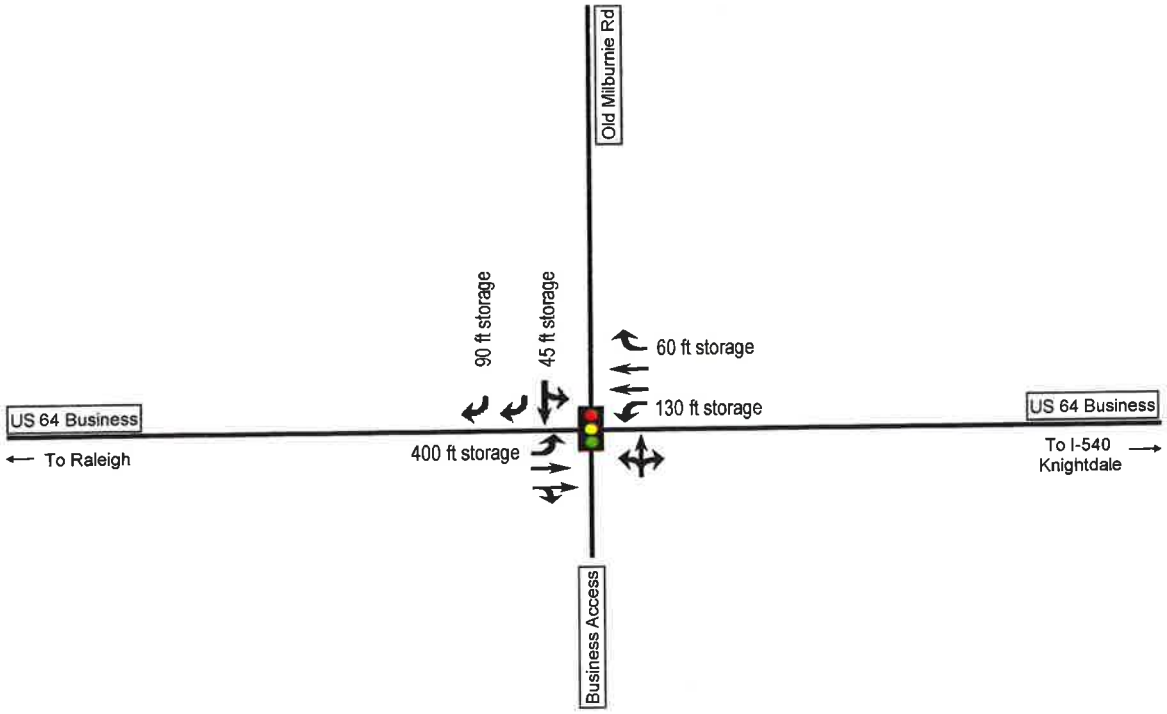

Legend	
——	Existing Roadway
- -	Proposed Roadway
	Signalized Intersection
	Unsignalized Intersection
	Existing Lane

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Figure 3
Existing Lane Configurations

2013 EXISTING CONDITIONS ANALYSIS

Traffic turning movement counts for the US 64 Business / Old Milburnie Road intersection and the US 64 Business / Westover Drive intersection were performed between the hours of 7:00 - 9:00 AM and 4:00 - 6:00 PM on Tuesday September 24, 2013. While the Westover Drive intersection is not part of the study area, traffic counts collected there will be used to estimate the redistributed background trips once the Milburnie Road extension (to US 64 Business) is complete. The traffic counts are provided in Appendix B and depicted in Figure 4. It was noted during the traffic data collection that the stop sign controlled fifth leg (Wells-Farm Road) in the northeastern quadrant of the US 64 Business / Old Milburnie Road intersection currently has very low traffic volumes (approximately 6 vehicles per hour including both ingress and egress traffic) during peak hours. For the purpose of this traffic study, this signalized intersection is analyzed as a four-leg intersection.

Existing volumes, traffic flow characteristics, traffic signal phasing and timing data, and intersection geometrics collected during field visits were used to determine the level of service. The level of service (LOS) is a measurement of average delay incurred at an intersection for a particular movement. LOS is defined by the Transportation Research Board's Highway Capacity Manual 2010 (HCM). The following tables give the HCM criteria for both signalized (HCM Exhibit 18-4) and unsignalized intersections (HCM Exhibit 19-1).

HCM Exhibit 18-4

LOS	Control Delay (s/veh)
A	≤10
B	> 10 - 20
C	> 20 - 35
D	> 35 - 55
E	> 55 - 80
F	> 80

HCM Exhibit 19-1

LOS	Control Delay (s/veh)
A	≤10
B	> 10 - 15
C	> 15 - 25
D	> 25 - 35
E	> 35 - 50
F	> 50

The LOS analysis for signalized and unsignalized intersections was completed through the use of Synchro, version 7. The software package categorizes the LOS based on HCM methodology and criteria. According to industry standards, any signalized intersection or any approach of an unsignalized intersection is considered acceptable if the Control Delay is LOS D or better with the LOS A representing little or no delay. Any signalized intersection or approach with a LOS of E or F is considered substandard and may need mitigation to improve the operational performance.

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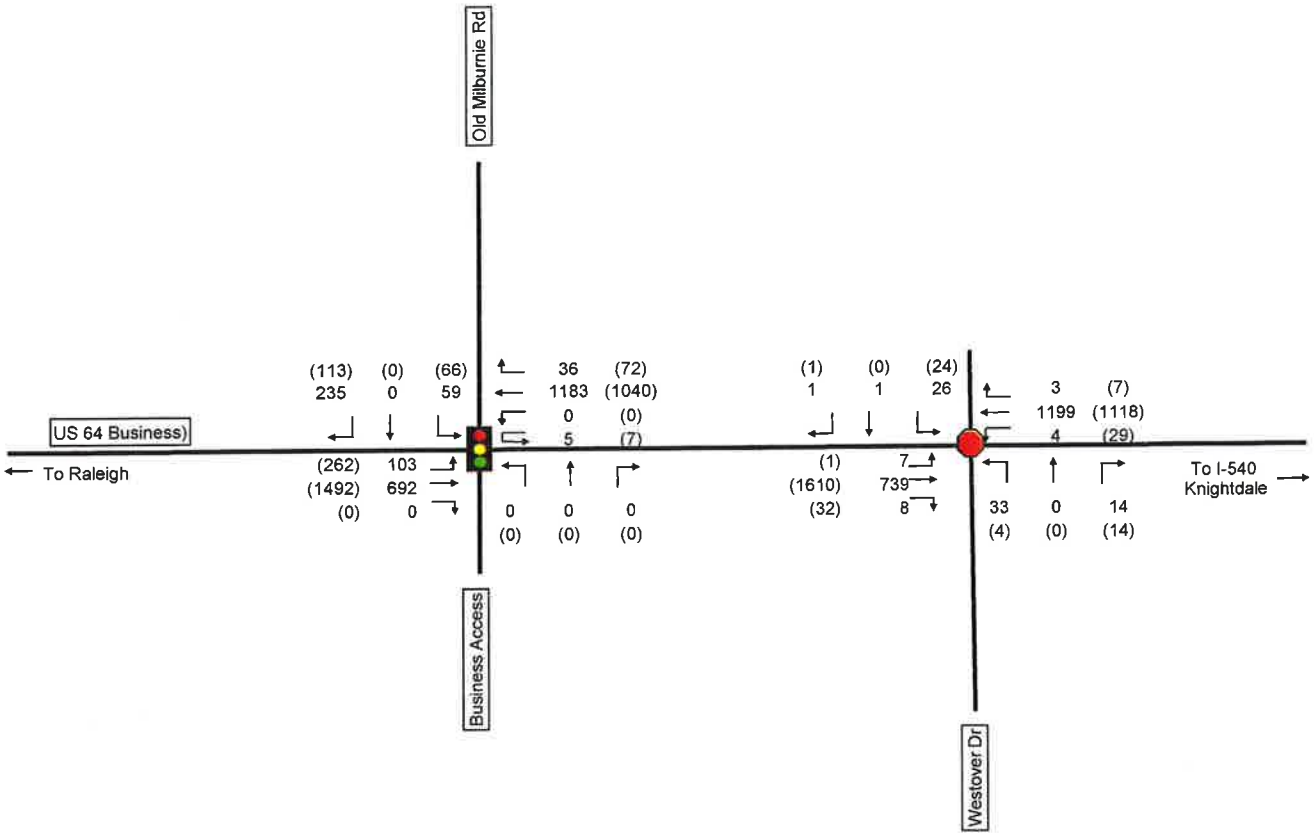

Legend	
⌐	Turning Movement
——	Existing Roadway
– –	Proposed Roadway
XX	AM Peak Hour Trips
(XX)	PM Peak Hour Trips

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Figure 4
2013 Traffic Volumes

Table 1 lists the LOS results from the 2013 Existing Conditions Analysis. Delay and LOS results are reported for each intersection approach. Intersection average delays (based on a weighted average of the approaches) and LOS are also reported for signalized intersections.

Table 1: Level of Service Analysis – 2013 Existing Conditions

Intersection	Approach		Existing (2013)			
			AM		PM	
			Delay (sec)	LOS	Delay (sec)	LOS
US 64 Business @ Old Milburnie Rd / Milburnie Rd	signalized	Intersection Average	**14.1**	**B**	**15.3**	**B**
	EB	US 64 Business	4.4	A	10.0	B
	WB	US 64 Business	9.2	A	16.3	B
	NB	Milburnie Rd	0.0	A	0.0	A
	SB	Old Milburnie Rd	56.3	E	51.9	D

Unacceptable LOS

As the south leg of the subject intersection only provides access to a vacant building when the study was conducted, this intersection effectively operated as a T-intersection. The existing condition analyses indicate that this intersection operated at LOS B during both AM and PM peak periods. Both eastbound and westbound US 64 Business approaches have low delays (LOS A and B) during the peak periods. The southbound Old Milburnie Road approach experienced an average delay of 56.3 seconds (LOS E) in the AM peak hour, and 51.9 seconds (LOS D) in the PM peak hour. The southbound right-turn movement peaked at 235 vehicles per hour (vph) during the AM peak hour, and represented a significant cause of AM delays for this approach.

Both the intersection capacity analyses and traffic simulations show that the short turn lanes on the southbound approach are inadequate to accommodate the peak hour queues. To meet the current traffic demands, the 90-foot second southbound right-turn lane likely needs to be extended to 200 feet, and the 45-foot southbound through/left-turn shared lane appears to require 175 feet of storage capacity.

The 60-foot westbound right-turn lane on US 64 Business, according to the traffic simulation results, may occasionally experience queue blockage. The traffic simulation program (SimTraffic) has a tendency to overestimate the "maximum queues" (over 110-feet in this case) for right-turn lane(s) where there is heavy traffic on the adjacent through lane(s). With the current 60 feet storage length, the existing right turn lane does not have any queue penalties during the AM peak hour, and only experiences queue blockages 1% of the time during the PM peak hour.

2016 NO-BUILD ANALYSIS

An annual growth rate of 3% was applied to the existing traffic to estimate the design year 2016 background traffic volumes. In addition, the 2016 No-Build traffic volumes include trips generated from two nearby proposed developments, as discussed below.

Loch Raven Pointe is a proposed 72-unit apartment development in the southwestern quadrant of Loch Raven Parkway and Old Milburnie Road just north of the US 64 Business. The apartment site is currently under construction and is expected to be built-out in January 2015. This new development is estimated to generate 39 trips in the AM peak hour and 57 trips in the PM peak hour. It is estimated that 95% of these peak hour trips will enter the US 64 Business / Old Milburnie Road intersection, and the apartment trips will be distributed based on the existing traffic pattern/turning movement counts.

The building in the southeastern quadrant of the US 64 Business / Old Milburnie Road intersection is now occupied by an auto accessory/service specialty store "Car Cosmotology". When the study was conducted, the then vacant building was expected to be renovated/redeveloped to include a 25,000 SF of manufacturing space and 5,000 SF of retail show rooms. With these assumptions, the building in the southeastern quadrant was estimated to generate 23 trips in the AM peak hour and 42 trips in the PM peak hour. The projected traffic volumes are believed to consistent with the current land use as well. It is also estimated that 60% of the peak hour trips will come from the west and 40% from the east on US 64 Business. Exit traffic is assumed to follow the same pattern.

Trips from both the Loch Raven Pointe development and the building in the southeastern quadrant are included in the future no-build condition traffic analyses. Figure 5 shows the 2016 No-Build peak hour traffic volumes. Detailed information on the two off-site developments, including the site plan and trip generation estimates, can be found in Appendix A "Memorandum of Understanding" and Appendix E "Off-Site Development Information".

The results of the 2016 No-Build analyses are summarized in Table 2 below.

Table 2: Level of Service Analysis – 2016 No-Build Conditions

Intersection	Approach		No-Build (2016)			
			AM		PM	
			Delay (sec)	LOS	Delay (sec)	LOS
US 64 Business @ Old Milburnie Rd / Milburnie Rd	signalized	Intersection Average	**21.4**	**C**	**30.0**	**C**
	EB	US 64 Business	16.2	B	25.0	C
	WB	US 64 Business	17.5	B	35.5	D
	NB	Milburnie Rd	62.9	E	66.0	E
	SB	Old Milburnie Rd	48.0	D	39.7	D

Unacceptable LOS

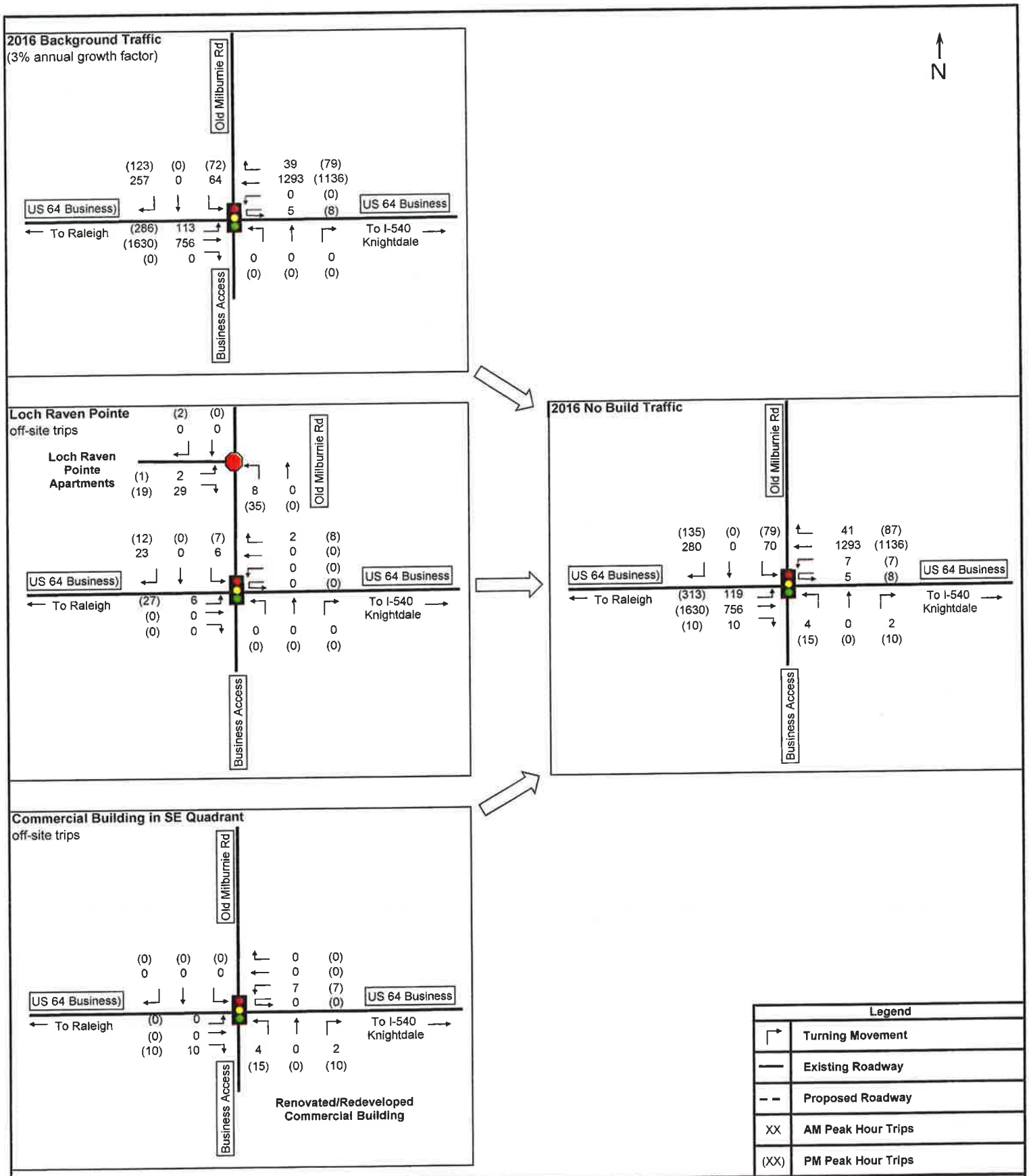

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Figure 5
2016 No-Build Traffic Volumes

With the background traffic growth and the addition of off-site trips, the intersection of US 64 Business and Old Milburnie Road is expected to operate at LOS C with the average intersection delays increased to 21.4 seconds in the AM peak hour and 30.0 seconds in the PM peak hour. Delays are also expected to increase on both US 64 Business approaches where the LOS varies from B to D. The northbound approach will see the highest average delays (63 to 66 seconds) and the lowest LOS (E), although the peak hour volumes are expected to be no more than 25 vph on this approach. The southbound approach, on the other hand, is estimated to experience delay reductions and operate at LOS D during both peak hours.

It should be noted that two changes in the analysis methods, as required in the current NCDOT traffic analysis guidelines, make it difficult to make direct comparisons between the existing and future no-build condition analysis results. First, the peak hour factors (PHFs) in the existing condition analyses were calculated from the current turning movement counts. A PHF of 0.9 is use for all future/projected condition analyses according to NCDOT's guidelines. The change of PHFs affects the vehicle arrival patterns and the resulting performance measures. Second, "protected/permissive" left-turn operations used in the existing condition analyses are replaced with "protected only" operations in the future condition analyses to make more conservative estimates on the storage length required.

Similar to the existing condition analyses, the capacity analyses and traffic simulations show storage deficiencies for the southbound turn lanes. In addition, the existing 400-foot eastbound left-turn appears to require a minimum of 175 feet of extension to meet peak hour traffic demands, assuming that the signal timings will remain unchanged.

SITE TRIP GENERATION AND DISTRIBUTION

The current site plan shows a total of 306 apartment units. While the exact use of the 1.6-acre outparcel has not been determined, the Town of Knightdale and NCDOT agreed that this traffic study will assume the use to be a fast food restaurant. Table 3 below shows the non-pass-by and pass-by trip estimates based on the Institute of Transportation Engineers' (ITE) Trip Generation Manual, 9th Edition, ITE Trip Generation Handbook, 2nd Edition, as well as North Carolina Department of Transportation (NCDOT) Congestion Management Section's Capacity Analysis Guidelines.

Table 3: Site Trip Generation

ITE CODE	LAND USE	SIZE		Average Daily Trips (24 Hours)			AM Peak Hour (One Hour Between 7 AM And 9 AM)			PM Peak Hour (One Hour Between 4 PM And 6 PM)		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
220	Apartment	306	DU	989	989	1,978	31	123	154	121	65	186
934	Fast-Food Restaurant with Drive-Through Window	5,000	SF	1,241	1,240	2,481	116	111	227	85	78	163
				Pass-By Trips (49% AM, 50% PM)			-56	-55	-111	-41	-41	-82
				Non-Pass-By Peak Hour Trips			60	56	116	44	37	81
TOTAL NON PASS-BY, EXTERNAL TRIPS				2,230	2,229	4,459	91	179	270	165	102	267

The apartments are expected to generate 1,978 daily trips, including 154 trips in the AM peak hour, and 186 trips in the PM peak hour. The drive-through fast-food restaurant attracts a portion of its trips from the background traffic passing the site. These *pass-by trips* are made as intermediate stops on the way from an origin to a primary trip destination without a route diversion. In traffic analysis, the pass-by trips are subtracted from the through-volumes passing a given site access point on an adjacent road, and added to the site driveway turning movements. It is estimated that 49% of the AM peak hour trips (227 trips) generated from the fast-food restaurant. In the PM peak hour, the pass-by trips are estimated to be 50% of the total restaurant trips (163 trips). The proposed development overall generates a total of 270 non-pass-by trips in the AM peak hour, and 267 non-pass-by trips in the PM peak hour.

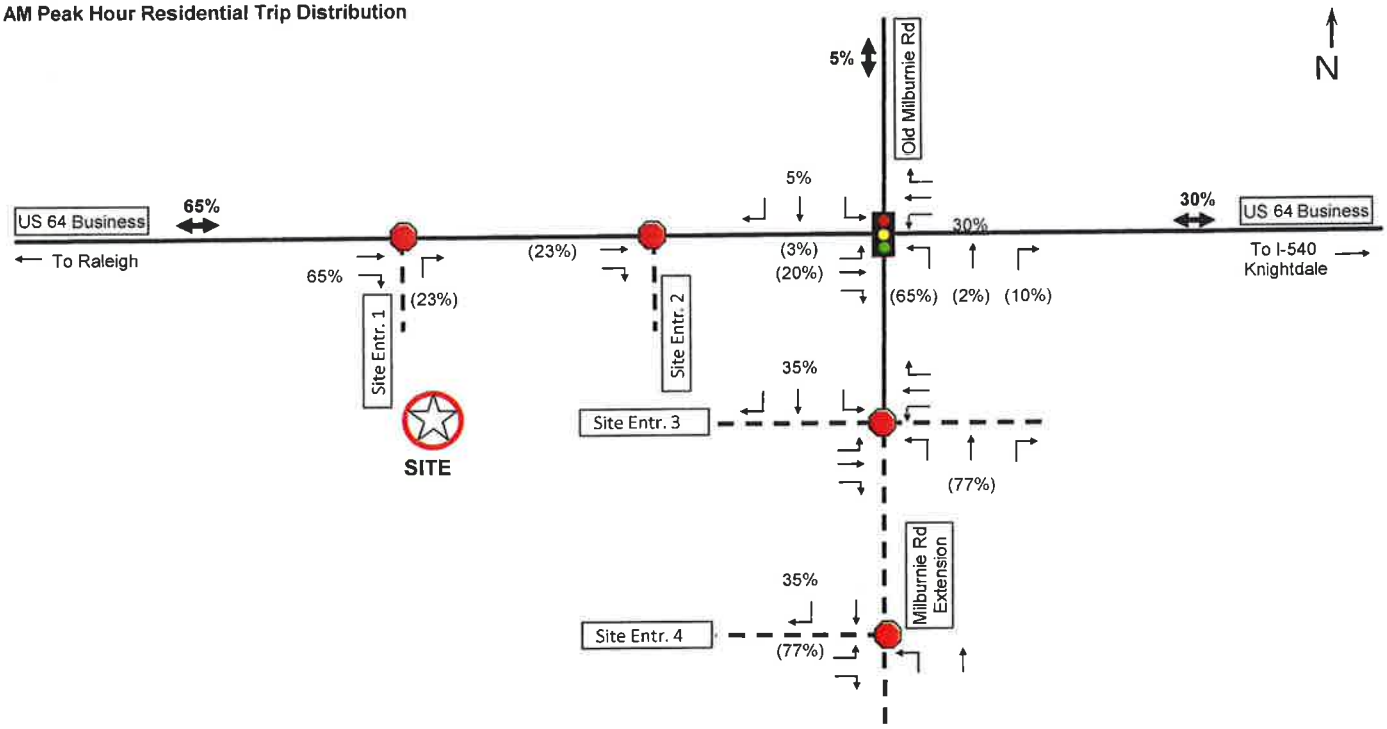
The directional distributions of the residential (apartment) site trips are based on the existing traffic pattern. It is estimated that in the AM peak hour, 65% of the apartment egress trips will head west on US 64 Business towards Raleigh, 30% will head east towards I-540 / Knightdale, and 5% will head north on Old Milburnie Rd. In the PM peak hour, 50% of the ingress trips will come from the west on US 64 Business, 45% from the east, and 5% from the north on Old Milburnie Rd. The ingress trips are assumed to following the same patterns as the egress trips during peak hours.

As the isolated outparcel (fast-food restaurant) has a right-in only entrance on the median divided US 64 Business and a full movement driveway on Milburnie Road, it is believed that most of the commercial trips will come from the west. After discussions with the Town of Knightdale and NCDOT, it is assumed that 90% pass-by trips will be coming from the west on US 64 Business, and 10% pass-by trips will be coming from the east. It is also assumed that 60% of the non-pass-by trips will come from the west on US 64 Business, 35% will come from the east and 5% will come from the north accessing the outparcel via the Milburnie Road entrance.

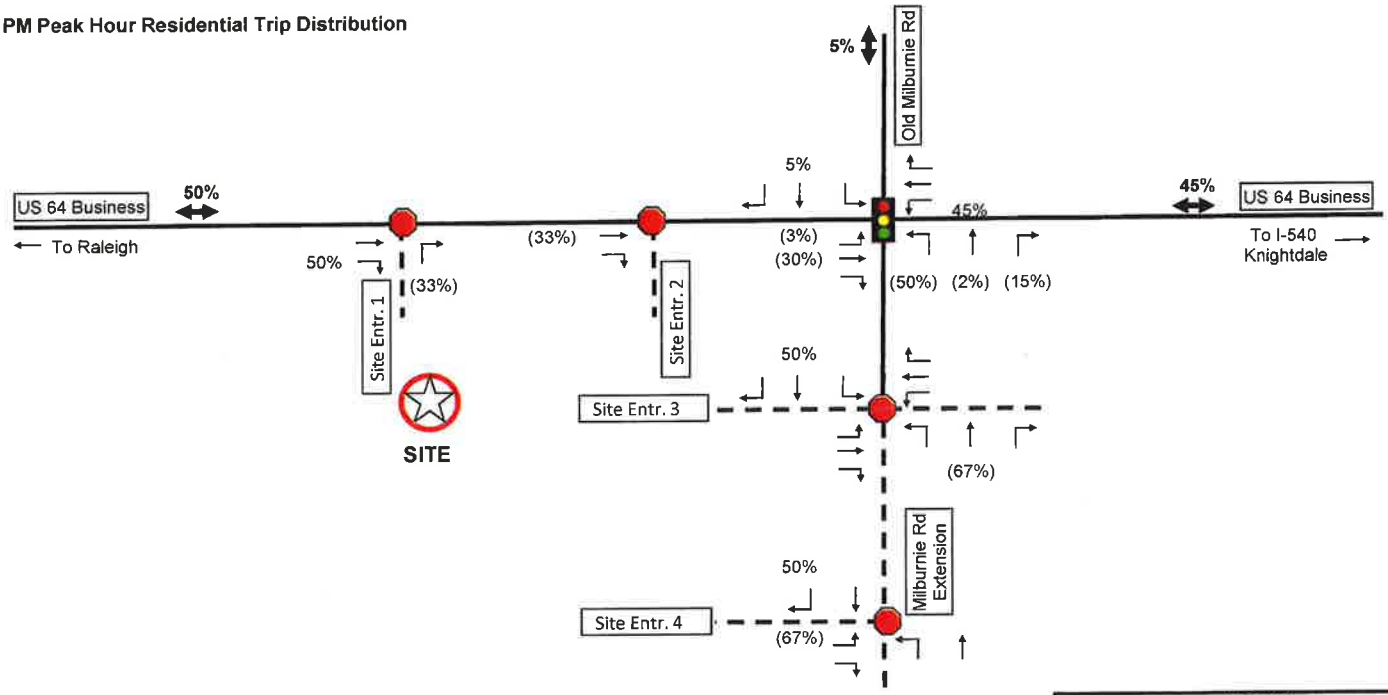
Figures 6 and 7 illustrate the peak hour residential and commercial trip distribution patterns respectively. The site trip volumes by land uses, as shown in Figure 8, were obtained by applying the site trip distribution percentages to the site trip generation estimates. Figure 9 summarizes the combined peak hour site traffic volumes.

It is expected that the proposed development will extend Milburnie Road to the US 64 Business intersection. The new Milburnie Road extension will provide a more convenient and safer access for the residents living on and off Westover Drive. After discussions with NCDOT and the Town of Knightdale, it is estimated that all the 2016 northbound left-turn traffic at the unsignalized US 64 Business / Westover Drive intersection will be diverted to the signalized US 64 Business / Old Milburnie Road intersection due to its safety benefit once the extension is completed. In addition, some residents will choose to use Milburnie Road (extension) as the preferred entrance due to its convenience. For the analysis purpose, it is assumed that half of the 2016 ingress peak hour traffic and half of the northbound right-turn (egress) traffic at the Westover Drive intersection will be diverted to the US 64 Business / Old Milburnie Road intersection. Figure 10 shows the redistributed 2016 background traffic volumes resulting from the Milburnie Road extension.

AM Peak Hour Residential Trip Distribution



PM Peak Hour Residential Trip Distribution



Legend	
↱	Turning Movement
——	Existing Roadway
- -	Proposed Roadway
XX%	Entering Site Traffic %
(XX%)	Exiting Site Traffic %

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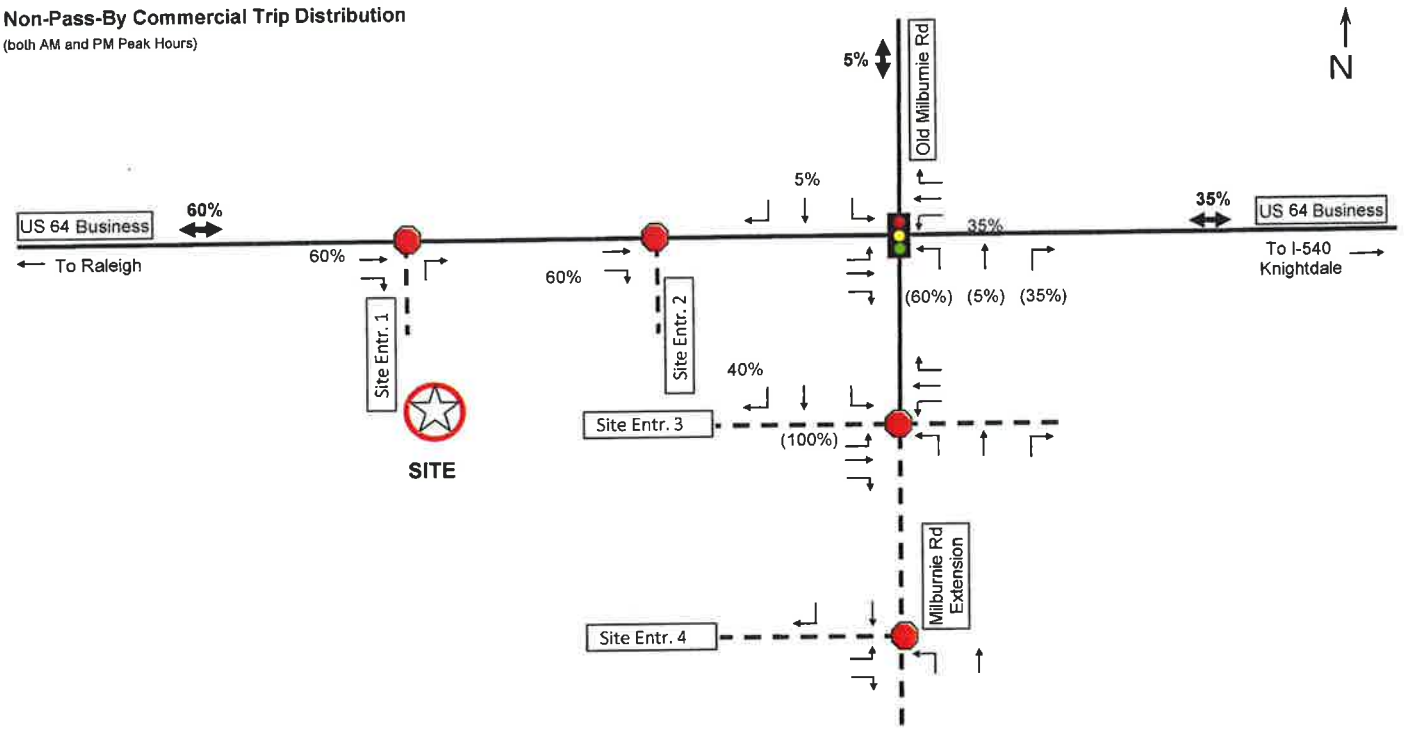
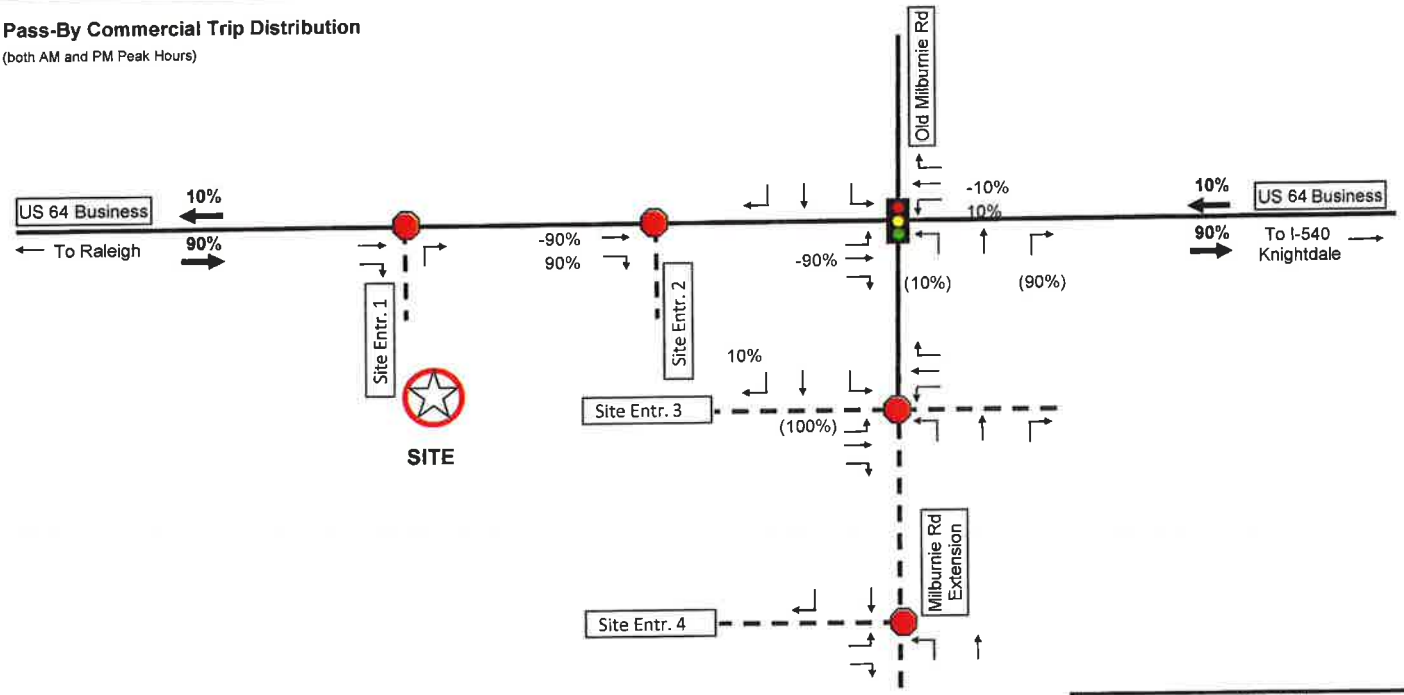
Figure 6
Residential Site Trip Distribution

Non-Pass-By Commercial Trip Distribution
(both AM and PM Peak Hours)



Pass-By Commercial Trip Distribution
(both AM and PM Peak Hours)



Legend	
↱	Turning Movement
——	Existing Roadway
- -	Proposed Roadway
XX%	Entering Site Traffic %
(XX%)	Exiting Site Traffic %

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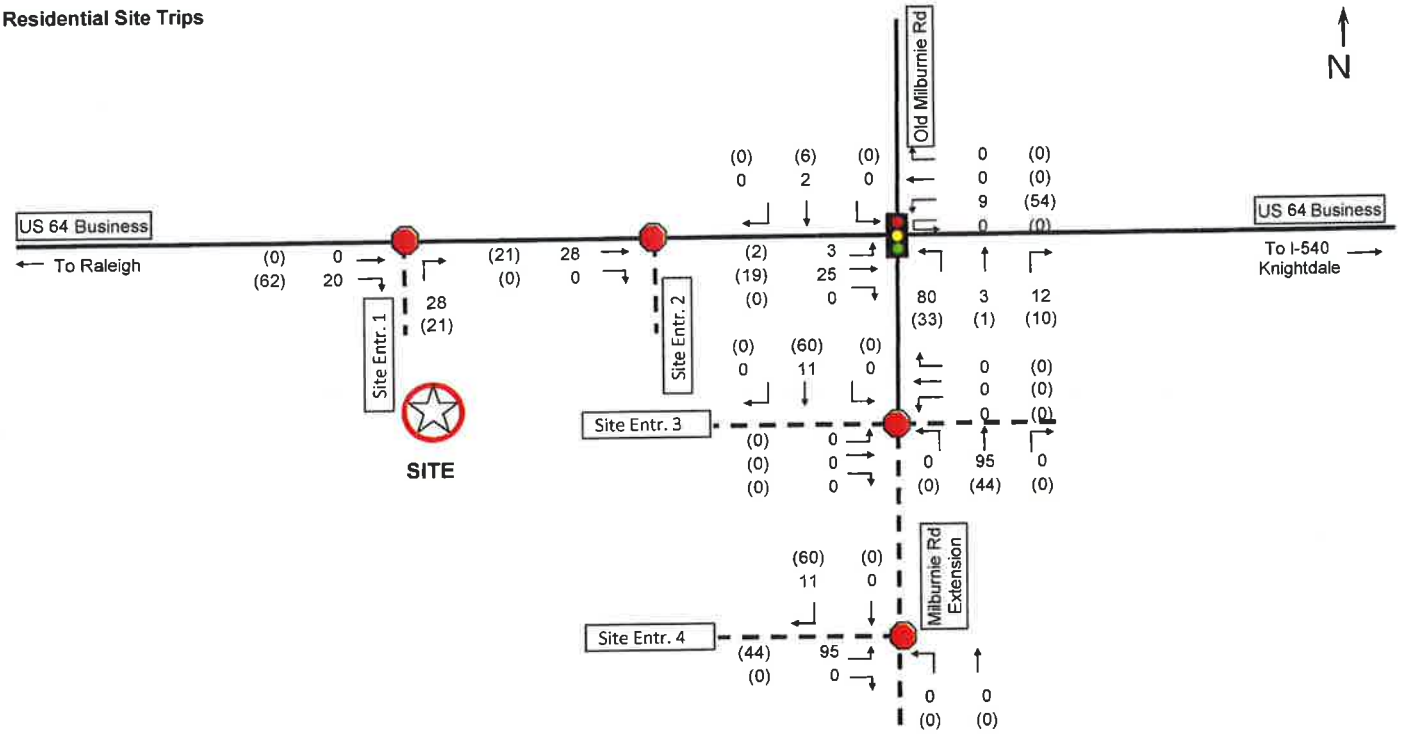
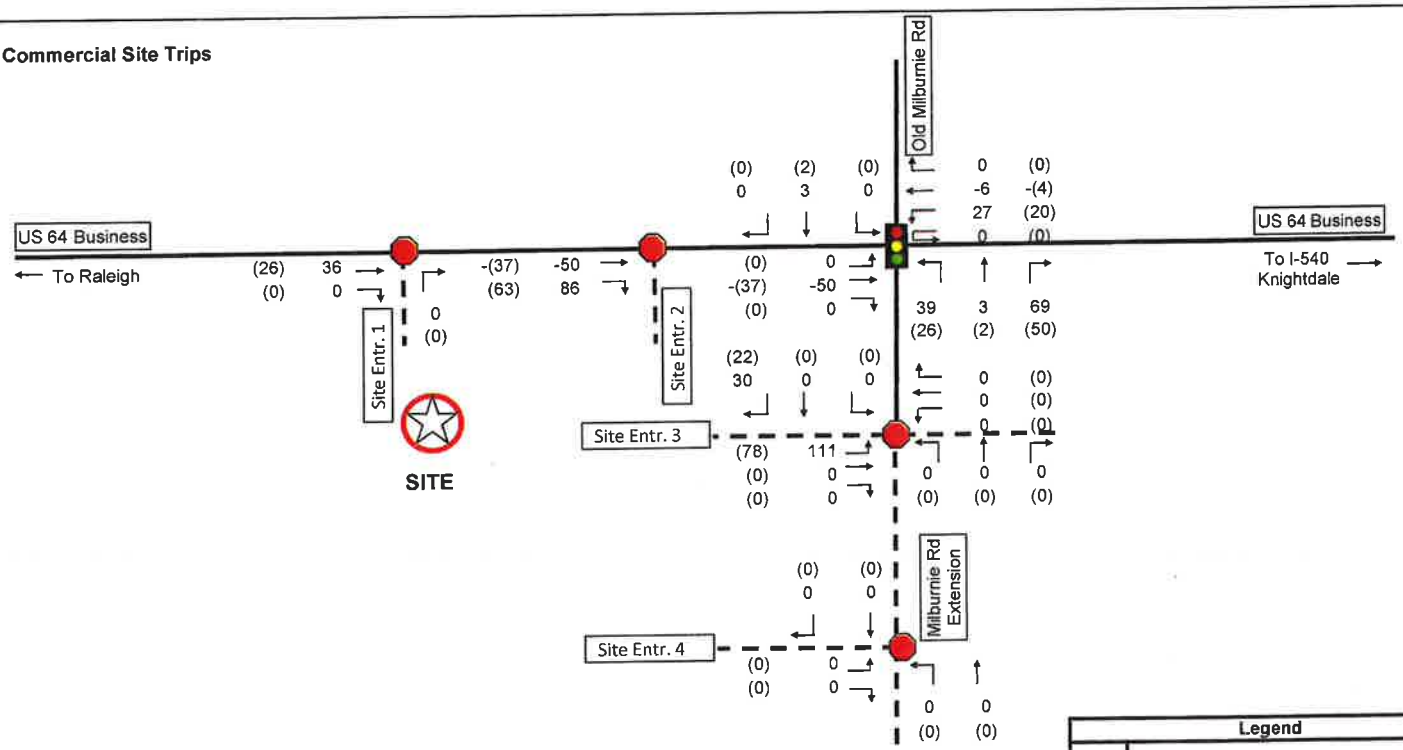
Figure 7
Commercial Site Trip Distribution

Residential Site Trips



Commercial Site Trips



Legend	
↱	Turning Movement
——	Existing Roadway
- -	Proposed Roadway
XX	AM Peak Hour Trips
(XX)	PM Peak Hour Trips

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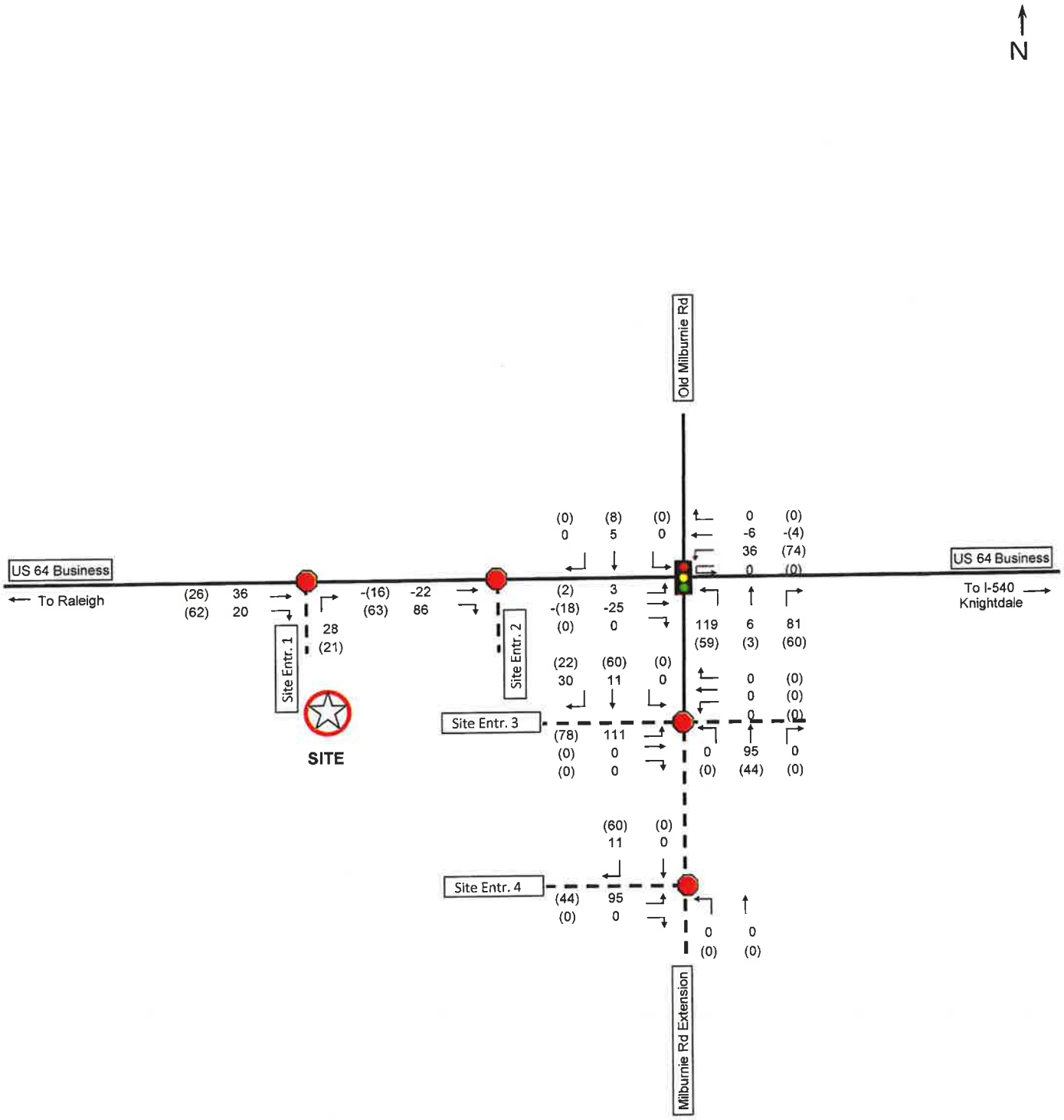
Figure 8
Peak Hour Site Trips by Land Uses



Legend	
↱	Turning Movement
——	Existing Roadway
- -	Proposed Roadway
XX	AM Peak Hour Trips
(XX)	PM Peak Hour Trips

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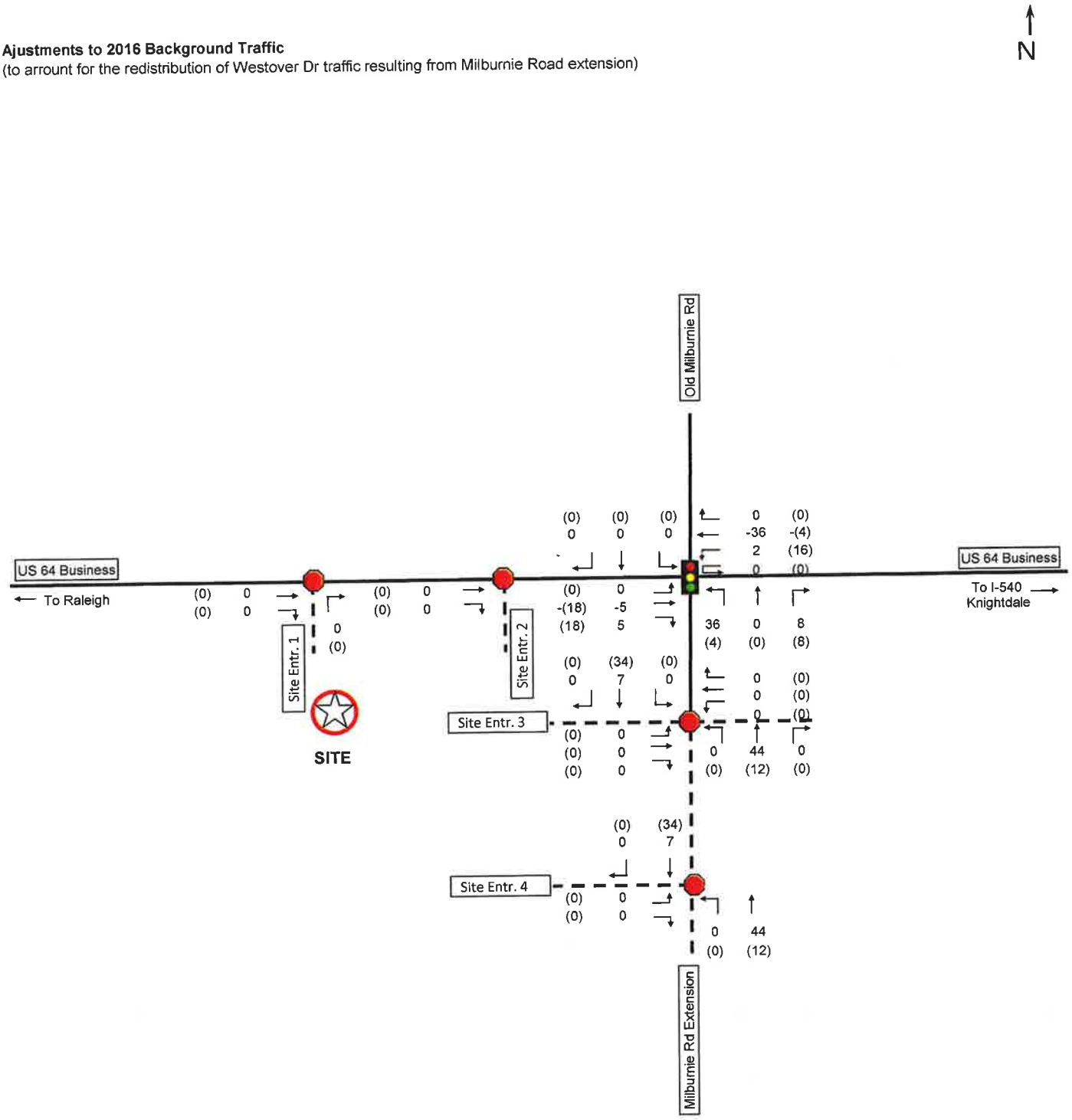
Figure 9
Peak Hour Site Traffic Volumes

Ajustments to 2016 Background Traffic
(to arrount for the redistribution of Westover Dr traffic resulting from Milburnie Road extension)



Legend	
⌐	Turning Movement
——	Existing Roadway
- -	Proposed Roadway
XX	AM Peak Hour Trips
(XX)	PM Peak Hour Trips

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Figure 10
2016 Build Condition
Background Traffic
Adjustments

2016 BUILD ANALYSIS

The total future build condition traffic volumes, as shown in Figure 11, include the site traffic, volumes from the Future No-Build Analysis as well as the background trip adjustments to account for the Milburnie Road extension. Table 4 summarizes the 2016 Build capacity analysis results.

Table 4: Level of Service Analysis - 2016 Build Conditions

Intersection	Approach		Build (2016)			
			AM		PM	
			Delay (sec)	LOS	Delay (sec)	LOS
US 64 Business @ Old Milburnie Rd / Milburnie Rd	signalized	Intersection Average	**39.1**	**D**	**50.0**	**D**
	EB	US 64 Business	30.1	C	53.0	D
	WB	US 64 Business	36.5	D	41.7	D
	NB	Milburnie Rd	80.9	F	93.9	F
	SB	Old Milburnie Rd	40.8	D	41.3	D
Site Entrance 1 @ US 64 Business	unsignalized	EB - US 64 Business	0.0	A	0.0	A
		WB - US 64 Business	0.0	A	0.0	A
		NB - Site Entrance 1	12.7	B	25.8	D
Site Entrance 2 @ US 64 Business	unsignalized	EB - US 64 Business	0.0	A	0.0	A
		WB - US 64 Business	0.0	A	0.0	A
Site Entrance 3 @ Milburnie Rd	unsignalized	EB - Site Entrance 3	11.2	B	11.0	B
		WB - Driveway	9.1	A	8.7	A
		NB - Milburnie Rd	0.0	A	0.0	A
		SB - Milburnie Rd	2.1	A	1.0	A
Site Entrance 4 @ Milburnie Rd	unsignalized	EB - Site Entrance 3	9.3	A	9.1	A
		NB - Milburnie Rd	0.0	A	0.0	A
		SB - Milburnie Rd	0.0	A	0.0	A

Unacceptable LOS

The 2016 Build Conditions traffic analyses indicate that, at the intersection of US 64 Business and Old Milburnie Road/ Milburnie Road, the new site trips and the diverted background trips due to the Milburnie Road extension will increase the average intersection delays to 39.1 seconds (LOS D) in the AM peak hour and 50 seconds (LOS D) in the PM peak hour. The northbound Milburnie Road approach, which is analyzed as a one-lane approach, is expected to operate at LOS F with over 80 seconds of delays during both peak hours. All the other approaches at this intersection will operate at an overall acceptable LOS (D or better).

All the four proposed site entrance intersections will operate at acceptable LOS with minimum delays expected on the free-flow US 64 Business and Milburnie Road.

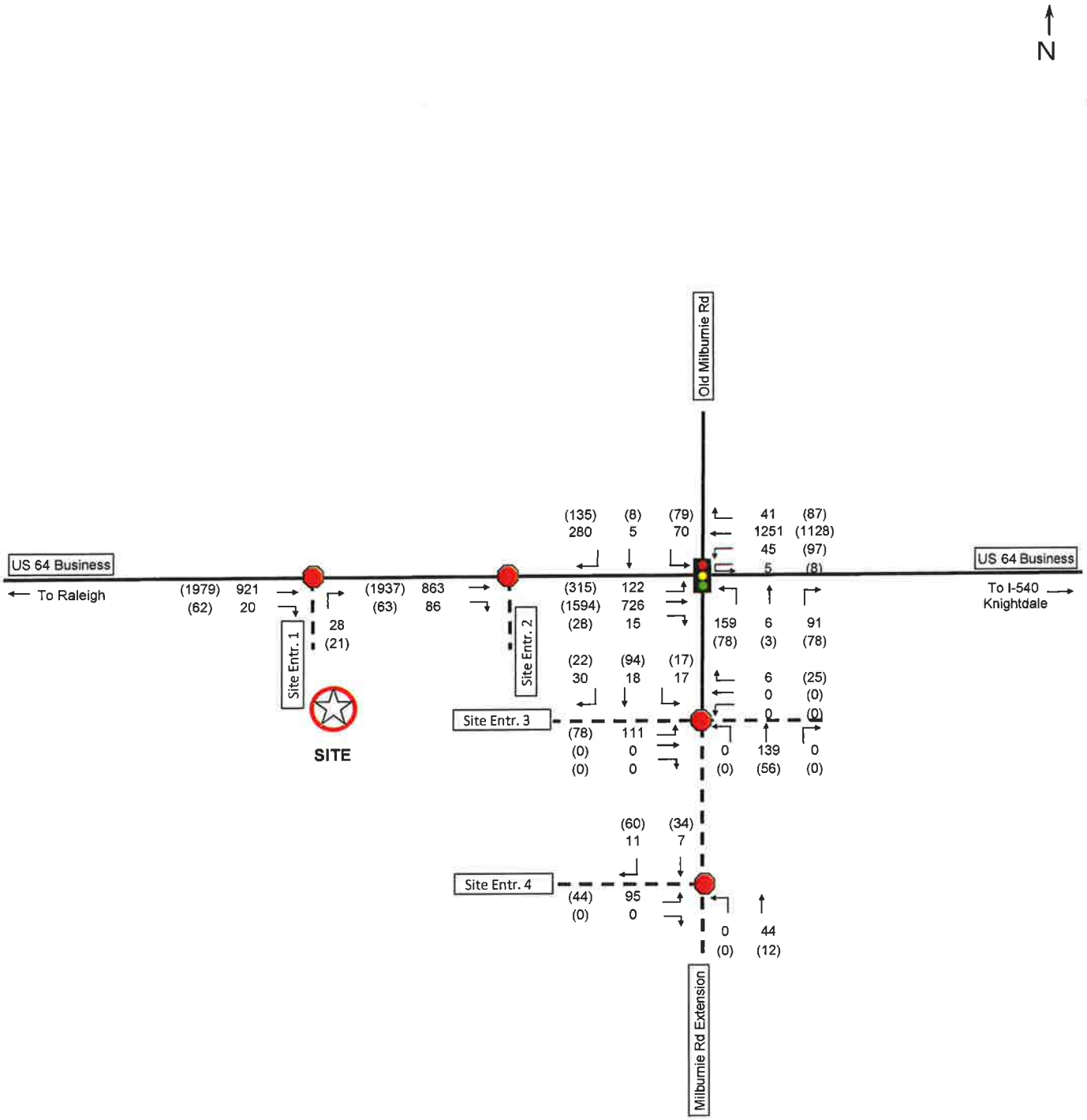

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Figure 11
2016 Build Condition
Traffic Volumes

Similar to the 2016 No-Build Condition analysis results, the capacity analyses and traffic simulations show that the existing southbound turn lanes on Old Milburnie Road, and the eastbound left-turn lane on US 64 Business will not be able to accommodate the peak hour traffic demands. In addition, the queue analyses indicate that the westbound left-turn lane on US 64 Business will also experience storage deficiencies during peak hours due to the addition of site trips and diverted background trips.

2016 BUILD WITH IMPROVEMENTS ANALYSIS

The traffic analyses show that the intersection of US 64 Business and Old Milburnie Road currently does not have adequate storage capacities for the southbound turn lanes. The northbound approach is expected to operate at LOS E in the No-Build Conditions due to the background traffic growth and off-site developments. Delays at this intersection will be further increased with the addition of site trips and diverted background trips resulting from the Milburnie Road extension. The following improvements are recommended to mitigate the site traffic impact.

US 64 Business and Old Milburnie Road / Milburnie Road

- Extend the westbound left-turn lane on US 64 Business to provide 300 feet of storage (approximately 170-foot extension) and appropriate taper.
- Extend the existing Milburnie Road to US 64 Business in accordance with Town of Knightdale's 2027 Comprehensive Plan. It is assumed that Right-of-Way or easement is currently available for the planned extension.
- Construct a dedicated right-turn lane with appropriate taper on the northbound Milburnie Road approach between US 64 Business and Site Entrance 3.
- Construct a dedicated right-turn lane on eastbound US 64 Business (see discussion below on Eastbound US 64 Business Right-Turn Lane Improvement).
- Traffic signal upgrades and timing optimizations to accommodate the proposed turn lane improvements.

While the traffic analyses show acceptable operational performance at all the four site entrance intersections, the eastbound right-turn peak hour site traffic volumes do meet the warrant for a dedicated right turn lane at the two site entrances on US 64 Business, according to the NCDOT's *Policy on Street and Driveway Access to North Carolina Highways*. After discussions with the Town of Knightdale and NCDOT, it is agreed that it is desirable from safety perspectives to construct a continuous right-turn lane instead of two separate short right-turn lanes on eastbound US 64 Business. Therefore the following improvement is recommended:

Eastbound US 64 Business Right-Turn Lane Improvement

Construct a dedicated right-turn lane on eastbound US 64 Business with 100 feet of storage length and appropriate taper at Site Entrance 1, and extend the right-turn lane through Site Entrance 2 to the Old Milburnie Road / Milburnie Road intersection.

The proposed improvements will help to reduce the intersection and approach delays, as shown on Table 5 below. The US 64 Business and Old Milburnie Road / Milburnie Road intersection is expected to operate at LOS C with 34.5 seconds of delays in the AM peak hour, and LOS D with 38.8 seconds of delays in the PM peak hour. While the northbound approach will still operate at LOS E with over 60 seconds of delays during peak hours, the traffic operational performance on this approach is similar to those in the 2016 No-Build conditions. Due to the grade on the southbound approach and the limited sight distances, the traffic signal operates with a split side street phasing which makes it difficult to further reduce delays on the northbound approach. It should also be noted that the northbound approach carries the lowest amount of traffic compared to other intersection approaches.

Table 5: Level of Service Analysis - 2016 Build with Improvements Conditions

Intersection	Approach		Build with Improvements (2016)			
			AM		PM	
			Delay (sec)	LOS	Delay (sec)	LOS
US 64 Business @ Old Milburnie Rd / Milburnie Rd	signalized	Intersection Average	**36.3**	**D**	**40.2**	**D**
	EB	US 64 Business	27.7	C	37.4	D
	WB	US 64 Business	33.8	C	41.3	D
	NB	Milburnie Rd	54.7	D	53.7	D
	SB	Old Milburnie Rd	53.1	D	49.2	D
Site Entrance 1 @ US 64 Business	unsignalized	EB - US 64 Business	0.0	A	0.0	A
		WB - US 64 Business	0.0	A	0.0	A
		NB - Site Entrance 1	12.6	B	24.6	C
Site Entrance 2 @ US 64 Business	unsignalized	EB - US 64 Business	0.0	A	0.0	A
		WB - US 64 Business	0.0	A	0.0	A
Site Entrance 3 @ Milburnie Rd	unsignalized	EB - Site Entrance 3	11.2	B	11.0	B
		WB - Driveway	9.1	A	8.7	A
		NB - Milburnie Rd	0.0	A	0.0	A
		SB - Milburnie Rd	2.1	A	1.0	A
Site Entrance 4 @ Milburnie Rd	unsignalized	EB - Site Entrance 3	9.3	A	9.1	A
		NB - Milburnie Rd	0.0	A	0.0	A
		SB - Milburnie Rd	0.0	A	0.0	A

Unacceptable LOS

The safety and operational benefits of separating the slowing right-turn vehicles from the eastbound through traffic stream on the median divided US 64 Business, which are the main reasons for the proposed right-turn improvement, can not be easily quantified.

The capacity analysis and simulation results show that the proposed improvements will provide adequate turn lane storage capacities except for three locations - the eastbound left-turn lane and the westbound right-turn lane on US 64 Business. While the traffic simulations show the eastbound left-turn queue length would be no more than 305 feet (max queue), the capacity analyses predict a 415-foot long queue (95% queue) in the PM peak hour which would exceed the 400-foot left-turn bay by 15 feet. Since the eastbound left-turn lane has an approximately 250-foot long taper and that the 95% queues rarely occur in reality, widening the eastbound left-turn lane to provide 15 feet of additional storage capacity is unlikely to provide any meaningful improvement and thus not recommended.

The queue length for the westbound right-turn lane on US 64 Business, as discussed in the Existing Condition Analyses, tends to be overestimated when there is heavy through traffic on adjacent lanes. With the current 60 feet storage length, the existing right turn lane does not have any queue penalties during the AM peak hour, and only experiences queue blockages 1% of the time during the PM peak hour. Thus no storage improvements are recommended for the westbound right-turn lane.

The third location is the southbound Old Milburnie Road where there are existing storage deficiencies. Since the proposed development is expected to add no more than 8 vehicles on this approach during peak hours and the resulting queue lengths are substantially similar to those in the Future No Build Conditions, no turn lane extensions are recommended to be completed by the proposed development for the southbound approach.

Another location worthy of mention is the northbound Milburnie Road traffic between US 64 Business and Site Entrance 3. The Site Entrance 3 is estimated to be located approximately 200 feet south of US 64 Business due to the existing site topography. The northbound right-turn lane between the two intersections likely will provide adequate storage for the right-turn queues which are estimated to be no more than 136 feet. The worst queues for the northbound through/ left-turn shared lane are expected to occur during the AM peak hour, and may extend up to 232 feet. The queue results suggest that there might be a few vehicles extending beyond the Site Entrance 3 intersection during the AM peak hour. The PM peak hour queue length is estimated to be no more than162 feet, and is unlikely to cause intersection blockages. It should be noted that the traffic analyses including the queue analyses are based on conservative trip generation estimates and assumptions (such as no RTOR or protected/permissive left-turn operations), and the predicted delays or queue lengths may not be observed in the field.

The proposed 2016 lane configurations are illustrated in Figure 12.

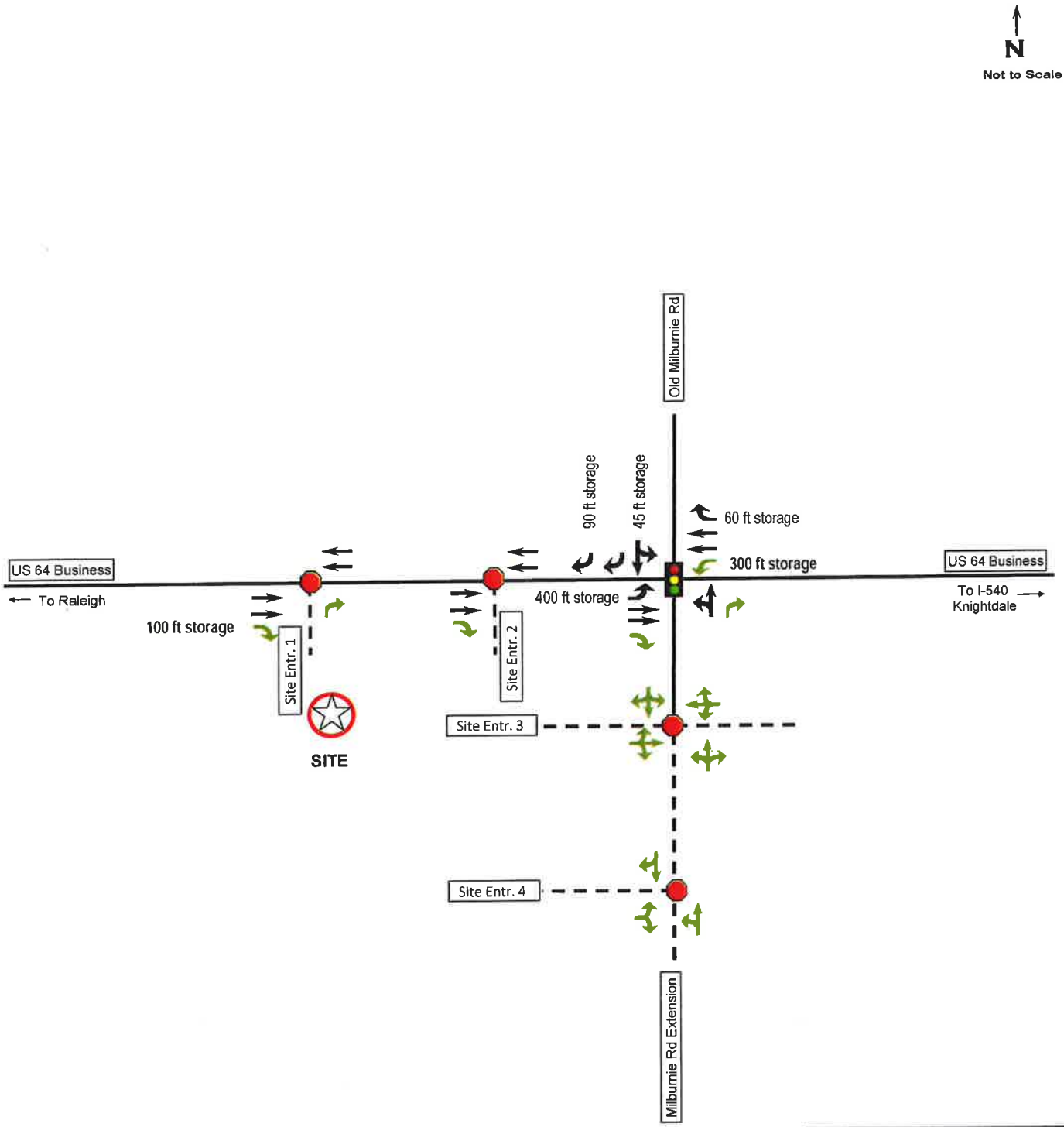

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Figure 12
2016 Build Proposed Lane Configurations

2026 HORIZON YEAR BUILD ANALYSIS

As requested by the Town of Knightdale, the 2026 Horizon Year Build Condition traffic analyses were performed to assess the long term impacts of the traffic growth, including the site traffic, on the study intersections. Similar to the 2016 Build Condition Analysis, the 2026 Build Condition traffic includes the site traffic (Figure 9), the 2026 no-build background traffic (Figure 13) which accounts for both the off-site developments and background traffic growth (over 34% growth compared with 2016 background traffic at the rate of 3% per year), and the background trip adjustments (Figure 14) due to the Milburnie Road extension. The 2026 peak hour build traffic volumes are summarized in Figure 15. Table 6 summarizes the 2026 Horizon Year Build capacity analysis results.

Table 6: Level of Service Analysis - 2026 Horizon Year Build Conditions

Intersection	Approach		Build (2026)			
			AM		PM	
			Delay (sec)	LOS	Delay (sec)	LOS
US 64 Business @ Old Milburnie Rd / Milburnie Rd	signalized	Intersection Average	**63.3**	**E**	**115.5**	**F**
	EB	US 64 Business	32.3	C	155.0	F
	WB	US 64 Business	48.3	D	66.8	E
	NB	Milburnie Rd	325.8	F	138.0	F
	SB	Old Milburnie Rd	45.6	D	42.2	D
Site Entrance 1 @ US 64 Business	unsignalized	EB - US 64 Business	0.0	A	0.0	A
		WB - US 64 Business	0.0	A	0.0	A
		NB - Site Entrance 1	15.1	C	45.9	E
Site Entrance 2 @ US 64 Business	unsignalized	EB - US 64 Business	0.0	A	0.0	A
		WB - US 64 Business	0.0	A	0.0	A
Site Entrance 3 @ Milburnie Rd	unsignalized	EB - Site Entrance 3	11.4	B	11.2	B
		WB - Driveway	9.2	A	8.7	A
		NB - Milburnie Rd	0.0	A	0.0	A
		SB - Milburnie Rd	2.0	A	1.0	A
Site Entrance 4 @ Milburnie Rd	unsignalized	EB - Site Entrance 3	9.4	A	9.3	A
		NB - Milburnie Rd	0.0	A	0.0	A
		SB - Milburnie Rd	0.0	A	0.0	A

Unacceptable LOS

The 2026 build analyses assumed no improvements would be made to the roadway infrastructures, and as expected show significant increases in delays and deteriorations of LOS. The existing US 64 Business / Old Milburnie Road intersection is expected to operate at LOS E in the AM peak hour, and LOS F with over 115 seconds of delays in the PM peak hour. The storage deficiencies identified in the 2016 Build Condition traffic analyses are also expected be exacerbated.

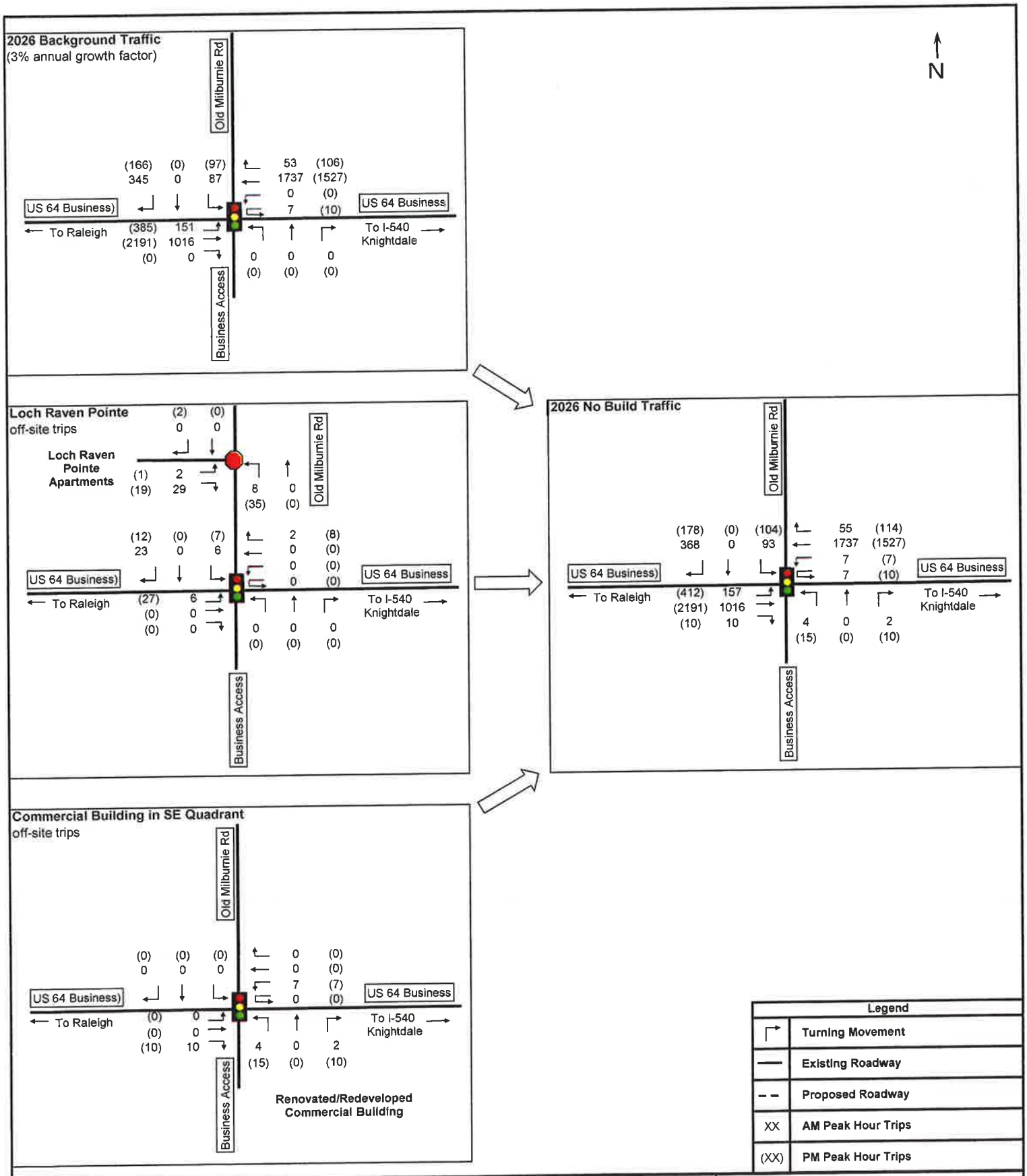

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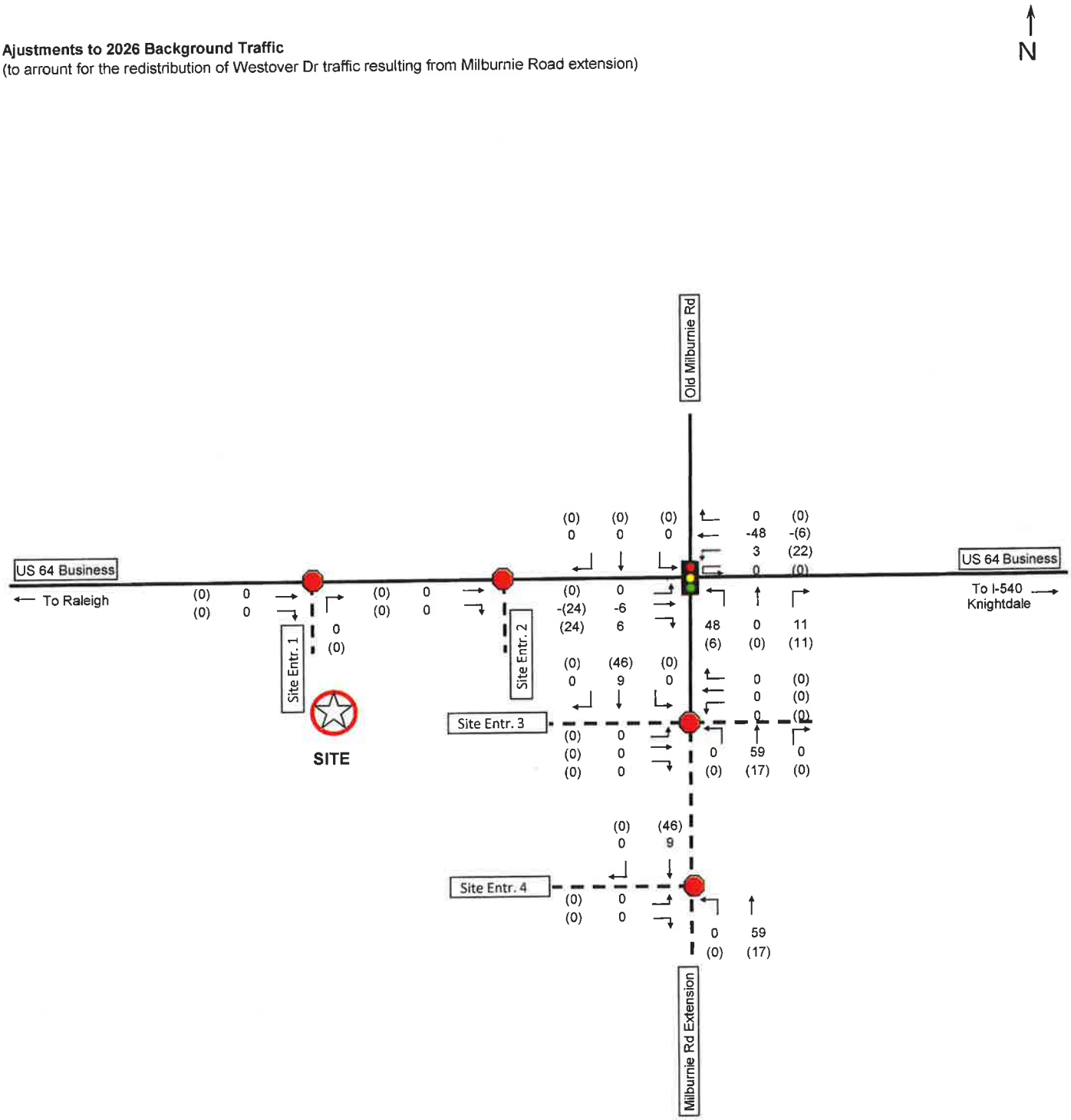
Figure 13
2026 No Build Traffic Volumes

Ajustments to 2026 Background Traffic
(to arrount for the redistribution of Westover Dr traffic resulting from Milburnie Road extension)



Legend	
↱	Turning Movement
——	Existing Roadway
- -	Proposed Roadway
XX	AM Peak Hour Trips
(XX)	PM Peak Hour Trips

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Figure 14
2026 Build Condition
Background Traffic
Adjustments

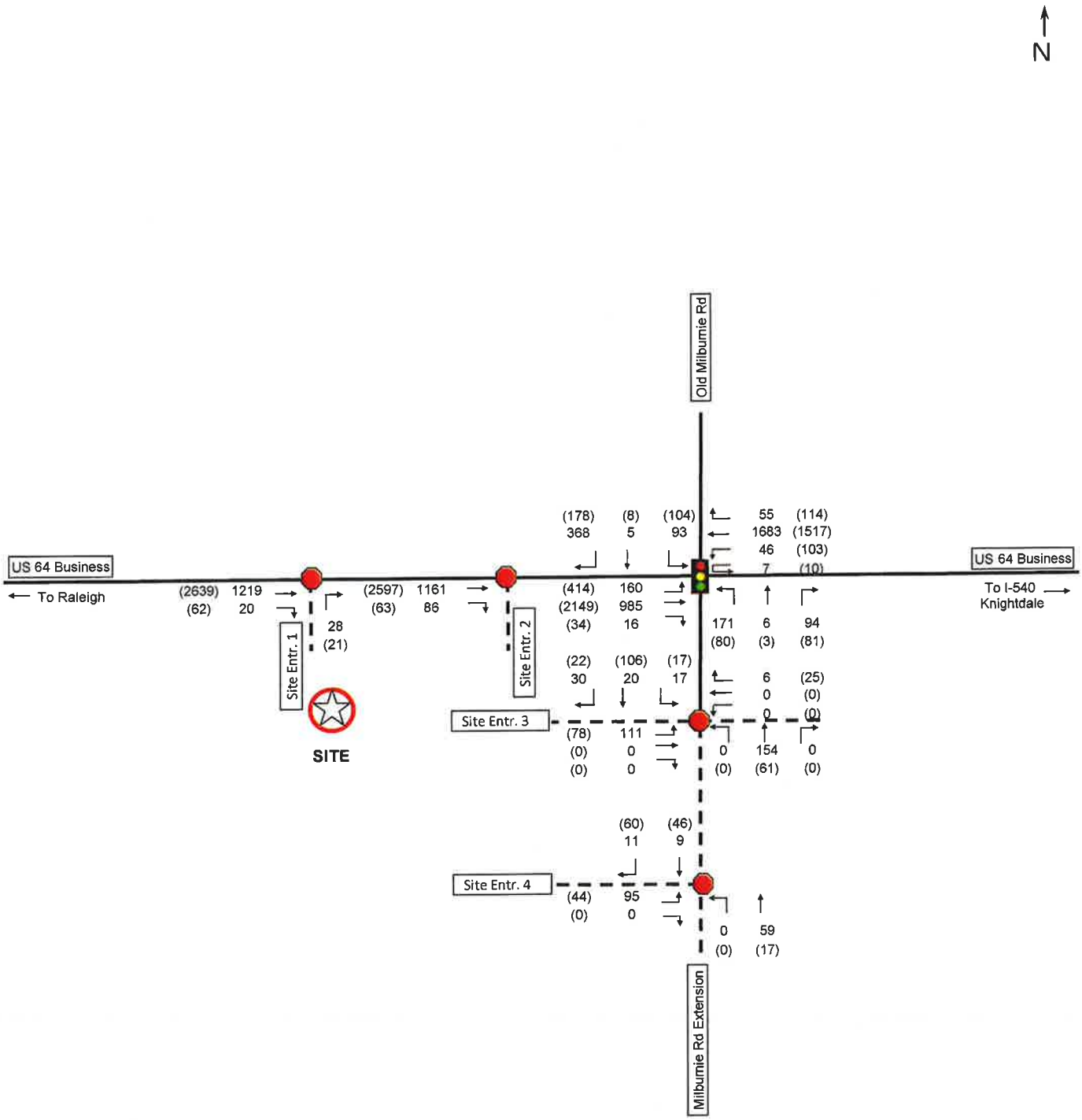

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Figure 15
2026 Build Condition
Traffic Volumes

2026 HORIZON YEAR BUILD WITH IMPROVEMENTS ANALYSIS

The following improvements, as illustrated in Figure 16, are recommended to address the future deficiencies. Many elements of the improvements listed below were also recommended for the design year 2016 Build Conditions.

US 64 Business and Old Milburnie Road / Milburnie Road

- Widen the southbound Old Milburnie Road approach to provide a shared through/ left-turn lane with 250 feet of storage and a second right-turn lane with 250 feet of storage. The turn lane improvements will also require appropriate transitions and bay tapers.
- Extend the westbound right-turn lane on US 64 Business to provide 100 feet of storage and appropriate taper.
- Extend the westbound left-turn lane on US 64 Business to provide 350 feet of storage and appropriate taper.
- Extend the existing Milburnie Road to US 64 Business in accordance with Town of Knightdale's 2027 Comprehensive Plan. It is assumed that Right-of-Way or easement is currently available for the planned extension.
- Construct a dedicated right-turn lane with appropriate taper on the northbound Milburnie Road approach between US 64 Business and Site Entrance 3.
- Construct a second left-turn lane on eastbound US 64 Business with 300 feet of storage and appropriate taper.
- Construct a third through lane (convert the previously proposed right-turn lane) on eastbound US 64 Business and construct a receiving lane east of the intersection with appropriate length and taper. The third through lane will start approximately 100 feet west of the Site Entrance 1 intersection, and will provide access to Site Entrance 1 and Site Entrance 2.
- Traffic signal upgrades and timing optimizations to accommodate the proposed turn lane improvements.

The proposed improvements build on top of the recommendations for the design year 2016, and will enable the US 64 Business and Old Milburnie Road / Milburnie Road intersection to operate at LOS D during both AM and PM peak hours. Due to the limitations of the side street split signal phasing, the Old Milburnie Road and Milburnie Road may experience delays exceeding 70 seconds (LOS E) during the peak hours. The proposed turn lanes are expected to provide adequate storage capacities. The northbound traffic queues on Milburnie Road may cause occasional blockages at the Site Entrance 3 intersection during both the AM and PM peak hours. Table 7 summarizes the 2026 Horizon Year Build with Improvement analyses results.

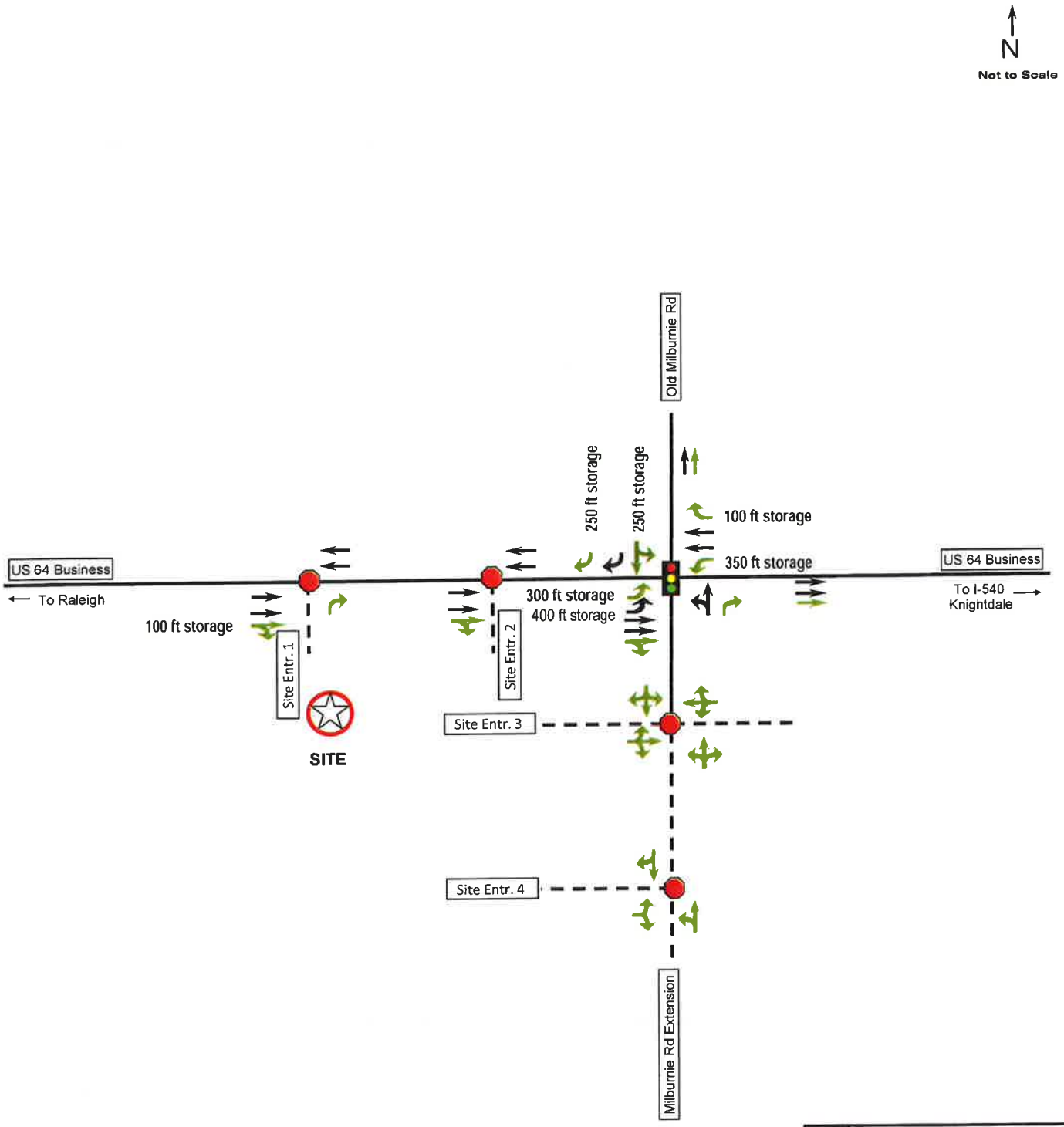

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Figure 16
2026 Build Proposed Lane Configurations

Table 7: Level of Service Analysis - 2026 Horizon Year Build w/ Improvements Conditions

Intersection	Approach		Build with Improvements (2026)			
			AM		PM	
			Delay (sec)	LOS	Delay (sec)	LOS
US 64 Business @ Old Milburnie Rd / Milburnie Rd	signalized	Intersection Average	**40.0**	**D**	**36.4**	**D**
	EB	US 64 Business	23.2	C	32.1	C
	WB	US 64 Business	37.6	D	36.5	D
	NB	Milburnie Rd	75.7	E	73.1	E
	SB	Old Milburnie Rd	70.5	E	53.6	D
Site Entrance 1 @ US 64 Business	unsignalized	EB - US 64 Business	0.0	A	0.0	A
		WB - US 64 Business	0.0	A	0.0	A
		NB - Site Entrance 1	12.0	B	21.8	C
Site Entrance 2 @ US 64 Business	unsignalized	EB - US 64 Business	0.0	A	0.0	A
		WB - US 64 Business	0.0	A	0.0	A
Site Entrance 3 @ Milburnie Rd	unsignalized	EB - Site Entrance 3	11.4	B	11.2	B
		WB - Driveway	9.2	A	8.7	A
		NB - Milburnie Rd	0.0	A	0.0	A
		SB - Milburnie Rd	2.0	A	1.0	A
Site Entrance 4 @ Milburnie Rd	unsignalized	EB - Site Entrance 3	9.4	A	9.3	A
		NB - Milburnie Rd	0.0	A	0.0	A
		SB - Milburnie Rd	0.0	A	0.0	A

Unacceptable LOS

CONCLUSIONS

The study indicates that the proposed River's Edge Apartments development may generate a total of 4,459 daily trips, including 270 non-pass-by trips in the AM peak hour and 268 non-pass-by trips in the PM peak hour. Traffic analyses were performed for the existing conditions, design year 2016, as well as the 2026 horizon year to determine the future improvement needs.

The traffic analyses show that the intersection of US 64 Business and Old Milburnie Road currently does not have adequate storage capacities for the southbound turn lanes. The northbound approach is expected to operate at LOS E in the No- Build Conditions due to the background traffic growth and off-site developments. Delays at this intersection will increase with the addition of site trips and diverted background trips resulting from the Milburnie Road extension. In addition, the eastbound right-turn site traffic will meet the warrant for a dedicated right turn lane at the two site entrances on US 64 Business, according to the NCDOT's *Policy on Street and Driveway Access to North Carolina Highways*. The following improvements are recommended to mitigate the site traffic impact.

US 64 Business and Old Milburnie Road / Milburnie Road Improvements for 2016

- Extend the westbound left-turn lane on US 64 Business to provide 300 feet of storage (approximately 170-foot extension) and appropriate taper.
- Extend the existing Milburnie Road to US 64 Business in accordance with Town of Knightdale's 2027 Comprehensive Plan. It is assumed that Right-of-Way or easement is currently available for the planned extension.
- Construct a dedicated right-turn lane on the northbound Milburnie Road approach between US 64 Business and Site Entrance 3 with appropriate taper.
- Construct a dedicated right-turn lane on eastbound US 64 Business with appropriate taper. This right-turn lane will start approximately 100 feet west of the Site Entrance 1 intersection.
- Traffic signal upgrades and timing optimizations to accommodate the proposed turn lane improvements.

With the proposed improvements, the US 64 Business and Old Milburnie Road / Milburnie Road intersection is expected to operate at LOS D in both AM and PM peak hours in design year 2016. The proposed signal improvements will improve the northbound approach from LOS E in the 2016 No-Build Conditions to LOS D during peak hours. All the intersection approaches and proposed entrance intersections are expected to operate at acceptable LOS.

Assuming the 3% annual growth rate, the background traffic will increase over 34% between design year 2016 and horizon year 2026. The following improvements are recommended to address the future deficiencies in 2026. Improvement items beyond the recommendations for the design year 2016 may be constructed as funding becomes available and developments occur in the vicinity of the study area in the future.

US 64 Business and Old Milburnie Road / Milburnie Road Improvements for 2026

- Widen the southbound Old Milburnie Road approach to provide a shared through/ left-turn lane with 250 feet of storage and a second right-turn lane with 250 feet of storage. The turn lane improvements will also require appropriate transitions and bay tapers.
- Extend the westbound right-turn lane on US 64 Business to provide 100 feet of storage and appropriate taper.
- Extend the westbound left-turn lane on US 64 Business to provide 350 feet of storage and appropriate taper.
- Extend the existing Milburnie Road to US 64 Business in accordance with Town of Knightdale's 2027 Comprehensive Plan. It is assumed that Right-of-Way or easement is currently available for the planned extension.
- Construct a dedicated right-turn lane on the northbound Milburnie Road approach between US 64 Business and Site Entrance 3 with appropriate taper.
- Construct a second left-turn lane on eastbound US 64 Business with 300 feet of storage and appropriate taper.
- Construct a third through lane (convert the previously proposed right-turn lane) on eastbound US 64 Business and construct a receiving lane east of the intersection with appropriate length and taper. The third through lane will start approximately 100 feet west of the Site Entrance 1 intersection, and will provide access to Site Entrance 1 and Site Entrance 2.
- Traffic signal upgrades and timing optimizations to accommodate the proposed turn lane improvements.

The proposed improvements will enable the US 64 Business and Old Milburnie Road / Milburnie Road intersection to operate at LOS D during both AM and PM peak hours in 2026. Due to the limitations of the side street split signal phasing, the Old Milburnie Road and Milburnie Road may experience longer delays (LOS E) during the peak hours. All the other intersection approaches and proposed site entrance intersections are expected to operate at acceptable LOS. The proposed turn lanes are expected to provide adequate storage capacities.

When this study report is prepared, the exact use for the 1.6-acre outparcel is not determined. A fast food restaurant is assumed for conservative trip estimates. It is suggested that this traffic study may be re-evaluated for the actual outparcel land use in the future. In addition, traffic conditions at the US 64 Business and Old Milburnie Road / Milburnie Road intersection should be monitored after the completion of the Milburnie Road extension, as the background trip diversions and queue lengths may be different from what is estimated in this report. Additional traffic signal phasing and timing adjustments may be required.

Based on the assumptions and traffic analyses documented in this report, this study concludes that with the proposed improvements constructed by the design year 2016, both the existing intersection and proposed site entrance intersections will operate at overall acceptable LOS. The proposed improvements for the 2016 design year will help to address many of the roadway improvement needs in horizon year 2026.

Table 8 on the following page below summarizes the capacity analyses and queue analyses of this traffic impact study.

Table 8: Level of Service and Queue Analysis Summary

River's Edge Apartments TIA Level of Service Analysis Summary

Intersection	Approach		Existing (2013)				No-Build (2016)				Build (2016)				Build with Improvements (2016)				Build (2026)				Build with Improvements (2026)			
			AM		PM		AM		PM		AM		PM		AM		PM		AM		PM		AM		PM	
			Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS	Delay (sec)	LOS
US 64 Business @ Old Milburnie Rd / Milburnie Rd	signalized	Intersection Average	14.1	B	15.3	B	21.4	C	30.0	C	39.1	D	50.0	D	36.3	D	40.2	D	63.3	E	115.5	F	40.0	D	36.4	D
	EB	US 64 Business	4.4	A	10.0	B	16.2	B	25.0	C	30.1	C	53.0	D	27.7	C	37.4	D	32.3	C	155.0	F	23.2	C	32.1	C
	WB	US 64 Business	9.2	A	16.3	B	17.5	B	35.5	D	36.5	D	41.7	D	33.8	C	41.3	D	48.3	D	66.8	E	37.6	D	36.5	D
	NB	Milburnie Rd	0.0	A	0.0	A	62.9	E	66.0	E	80.9	F	93.9	F	54.7	D	53.7	D	325.8	F	138.0	F	75.7	E	73.1	E
	SB	Old Milburnie Rd	56.3	E	51.9	D	48.0	D	39.7	D	40.8	D	41.3	D	53.1	D	49.2	D	45.6	D	42.2	D	70.5	E	53.6	D
Site Entrance 1 @ US 64 Business	unsignalized	EB - US 64 Business	--	--	--	--	--	--	--	--	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A
		WB - US 64 Business	--	--	--	--	--	--	--	--	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A
		NB - Site Entrance 1	--	--	--	--	--	--	--	--	12.7	B	25.8	D	12.6	B	24.6	C	15.1	C	45.9	E	12.0	B	21.8	C
Site Entrance 2 @ US 64 Business	unsignalized	EB - US 64 Business	--	--	--	--	--	--	--	--	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A
		WB - US 64 Business	--	--	--	--	--	--	--	--	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A
Site Entrance 3 @ Milburnie Rd	unsignalized	EB - Site Entrance 3	--	--	--	--	--	--	--	--	11.2	B	11.0	B	11.2	B	11.0	B	11.4	B	11.2	B	11.4	B	11.2	B
		WB - Driveway	--	--	--	--	--	--	--	--	9.1	A	8.7	A	9.1	A	8.7	A	9.2	A	8.7	A	9.2	A	8.7	A
		NB - Milburnie Rd	--	--	--	--	--	--	--	--	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A
		SB - Milburnie Rd	--	--	--	--	--	--	--	--	2.1	A	1.0	A	2.1	A	1.0	A	2.0	A	1.0	A	2.0	A	1.0	A
Site Entrance 4 @ Milburnie Rd	unsignalized	EB - Site Entrance 3	--	--	--	--	--	--	--	--	9.3	A	9.1	A	9.3	A	9.1	A	9.4	A	9.3	A	9.4	A	9.3	A
		NB - Milburnie Rd	--	--	--	--	--	--	--	--	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A
		SB - Milburnie Rd	--	--	--	--	--	--	--	--	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A	0.0	A

Unacceptable LOS

River's Edge Apartments TIA Queue Analysis Summary

Intersection	Approach		Storage Length (ft) Exist (2016) [2026]	Existing (2013)		No-Build (2016)		Build (2016)		Build w Improv. (2016)		Build (2026)		Build w Improv. (2026)	
				AM queue length (ft)	PM queue length (ft)	AM queue length (ft)	PM queue length (ft)	AM queue length (ft)	PM queue length (ft)	AM queue length (ft)	PM queue length (ft)	AM queue length (ft)	PM queue length (ft)	AM queue length (ft)	PM queue length (ft)
US 64 Business @ Old Milburnie Rd / Milburnie Rd	signalized	EBL	400 [300 & 400]	114	231	221	#564	#220	#566	203	415	#315	#792	122	#301
		EBR	(Lane Drop)	--	--	--	--	--	--	10	18	--	--	--	--
		WBL	130 (300) [350]	24	34	52	90	175	317	137	305	286	330	319	351
		WBR	60 [100**]	80	111	176	208	175	299	134	160	210	210	199	200
		NB THRU/LT	NA	0	0	50	88	#569	#356	232	162	#632	#379	#314	#176
		NBR	(200) [200]	--	--	--	--	--	--	129	136	--	--	157	162
		SB THRU/LT	45 [250]	131	166	124	135	124	140	142	149	155	175	209	220
		SBR	90 [250]	195	144	301	178	184	186	253	213	319	259	#243	134

Queue length greater than storage length

The queue lengths are Synchro 95th Percentile Queue or Simtraffic Max Queue, whichever is greater.

#: volume exceeds capacity, queue may be longer.

**: Due to limitations of the traffic simulation program, storage length is determined based on the maximum number of vehicles observed in the turn-lane/taper during one-hour simulation runs as recommended by NCDOT Congestion Managemen