DAVENPORT

February 7, 2020

TRANSPORTATION IMPACT ANALYSIS

Pond Road Development

Buncombe County, NC

Prepared for
Fall Line Development

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Project #: 190710

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Transportation Impact Analysis

Pond Road Development
Buncombe County, NC

Prepared for Fall Line Development
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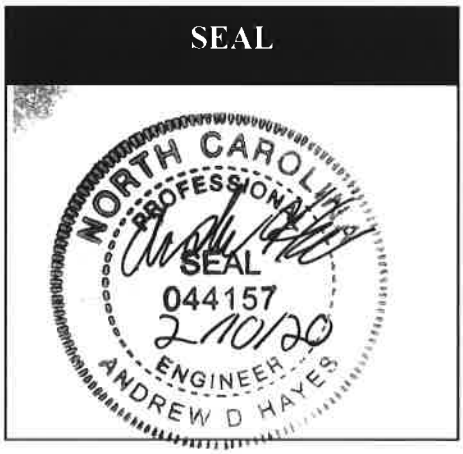

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Pond Road Development - Transportation Impact Analysis
Buncombe County, NC
February 7, 2020

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Pond Road Development - Transportation Impact Analysis
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1.0 Introduction

1.1 Site Description

The proposed Pond Road development is located on the northwest of Pond Road at House Lane in Buncombe County, North Carolina. DAVENPORT was retained to analyze the potential traffic impacts of this development and to identify transportation improvements that may be required to accommodate the impacts of both background traffic and new development traffic. The findings from the analysis are summarized in this report. The site plan is shown in Figure 1.

1.2 Project Description

This development is planned to consist of two phases. Phase 1 consists of 280 mid-rise multifamily dwelling units on the south side of the property. Phase 1 is expected to open in 2022. Phase 2 consists of 32 single family dwelling units, 80 low-rise multifamily dwelling units, and 295 mid-rise multifamily dwelling units. Low-rise multifamily includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have one to two levels. Mid-rise multifamily include apartments,townhouses, and condominiums that have between three and 10 levels. Phase 2 is expected to be open in 2023. The scope of this study was confirmed with NCDOT staff. The approved NCDOT TIA Scoping Checklist for the project is included in the Appendix.

1.3 Site Accesses

The development will utilize two accesses. The southern site access (Site Access 1) will be a right-in/out on Pond Road. The northern site access (Site Access 2) will be a full movement site access on Pond Road. The access locations are shown in the site plan in Figure 1.

1.4 Study Area

A vicinity map of all study intersections is provided in Figure 2. The following intersections were included in the study:

1. NC 112 (Sardis Road) at SR 3431 (Pond Road) (Unsignalized)
2. SR 3431 (Pond Road) at SR 3426 (McIntosh Road) (Signalized)
3. NC 191 (Brevard Road) at SR 3431 (Pond Road) (Signalized)
4. NC 191 (Brevard Road) at SR 3600 (Farmers Market) / SR 3414 (East Oakview Road) (Signalized)
5. NC 191 (Brevard Road) at I-40 Eastbound Ramp (Signalized)
6. NC 191 (Brevard Road) at I-40 Westbound Ramp (Signalized)
7. NC 191 (Brevard Road) at NC 112 (Sardis Road) / Ridgefield Boulevard (Signalized)
8. NC 112 (Sand Hill Road / Sardis Road) at SR 3412 (Sand Hill Road) (Signalized)

9. SR 3431 (Pond Road) at Site Access 1 (proposed unsignalized)
10. SR 3431 (Pond Road) at Site Access 2 (proposed unsignalized)

The above-mentioned intersections were analyzed for the following scenarios:

- 2020 Existing Conditions
- 2022 Future No Build Conditions
- 2022 Build Phase 1 Conditions
- 2022 Build Phase 1 with Improvements
- 2023 Future No Build Conditions
- 2023 Build Phase 1 Conditions
- 2023 Build Phase 1 with Improvements

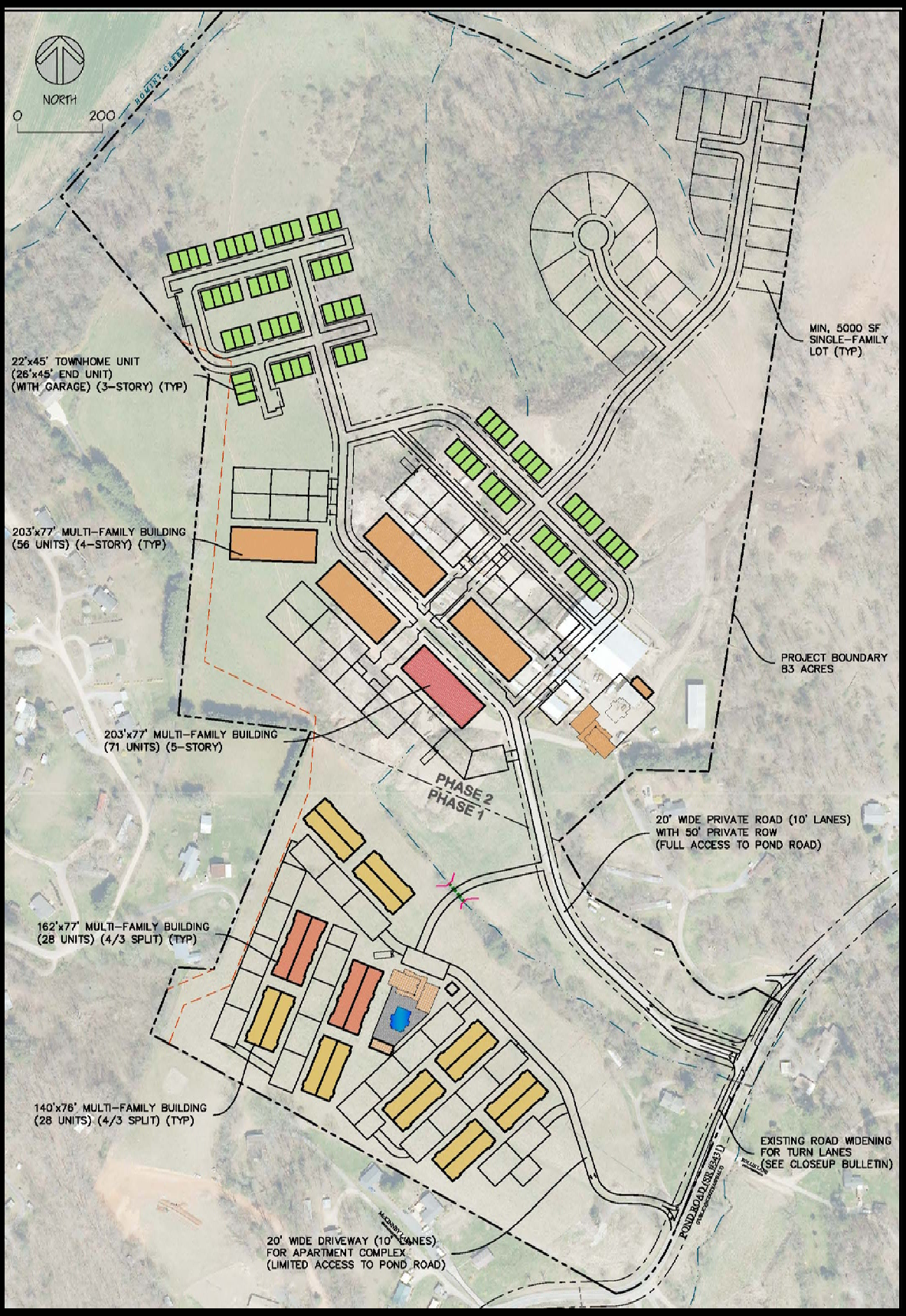

FIGURE 1
SITE PLAN

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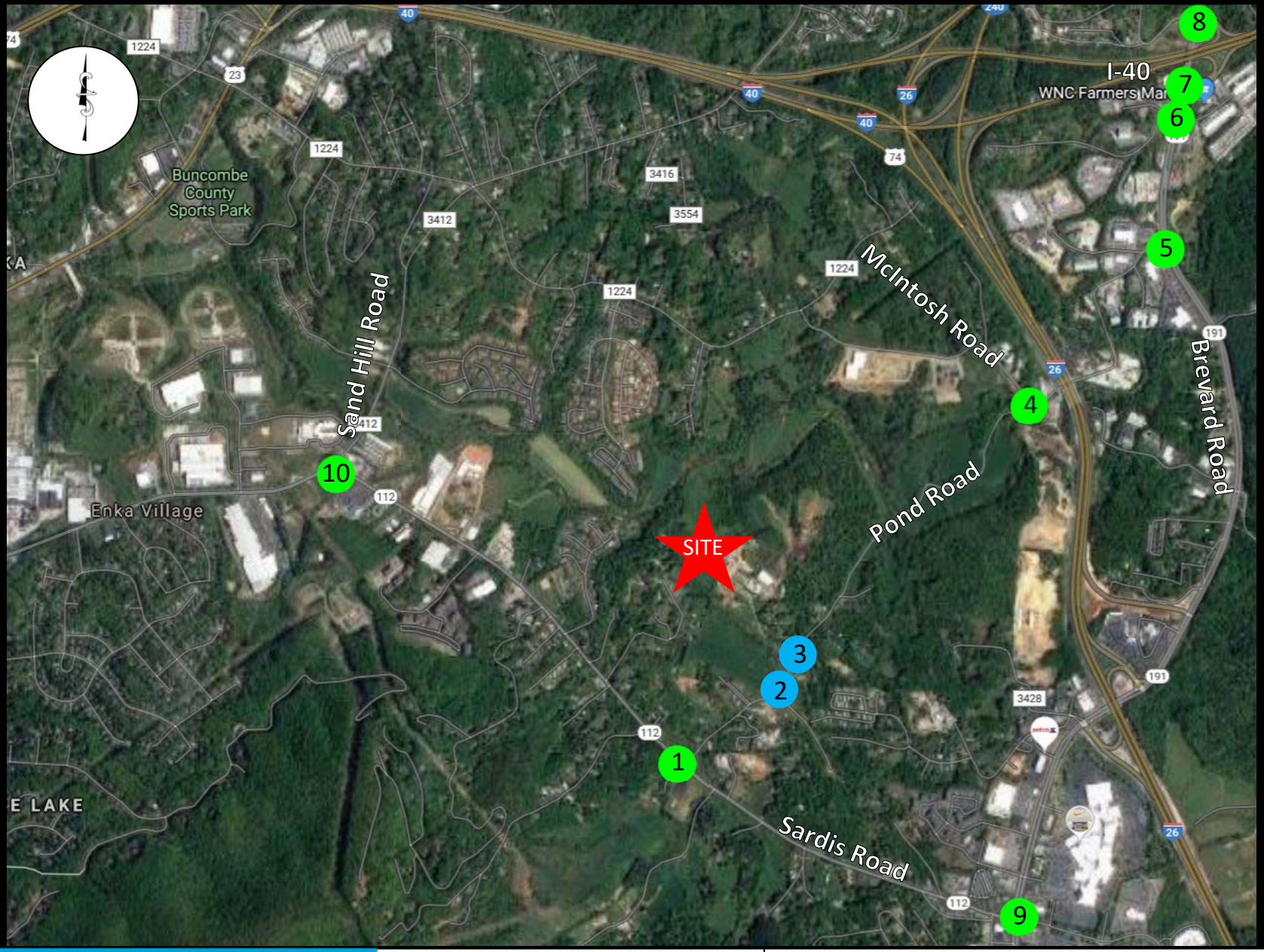

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FIGURE 2
VICINITY MAP

STUDY INTERSECTIONS
BACKGROUND
PROPOSED

2.0 Existing Conditions

2.1 Inventory

A field investigation was conducted by DAVENPORT staff to determine the existing roadway conditions in the study area. Table 2.1 presents a summary of this investigation. Figure 3 presents the existing lane geometry.

Table 2.1 - Street Inventory

Facility Name	Route #	Typical Cross Section	Pavement Width	Speed Limit	Maintained By
Pond Road	SR 3431	2 lanes undivided	Approx. 20’	35 MPH	NCDOT
Sardis Road	NC 112	2 lanes undivided	Approx. 22’	45 MPH	NCDOT
McIntosh Road	SR 3426	2 lanes undivided	Approx. 20’	35 MPH	NCDOT
Brevard Road	NC 191	4 lanes divided	Approx. 72’	45 MPH	NCDOT
Farmers Market	SR 3600	2 lanes undivided	Approx. 50’	20 MPH Design Speed	NCDOT
East Oakview Road	SR 3414	2 lanes undivided	Approx. 24’	25 MPH	NCDOT
I-40	-	4 lanes divided	Approx. 120’	60 MPH	NCDOT
Sand Hill Road	NC 112 SR 3412	2 lanes undivided	Approx. 22’	45 MPH	NCDOT

2.2 Existing Traffic Volumes

Existing traffic volumes for this project were provided by Quality Counts. Table 2.2 contains the dates these counts were conducted. Figure 4 shows existing AM and PM peak hour volumes. More information can be found in the Traffic Volume Data section of the appendix.

Table 2.2 - Traffic Volume Data

Count Location:	Date Taken:	Collection by:
Sardis Road at Pond Road	1/30/2020	Quality Counts
McIntosh Road at Pond Road	1/30/2020	Quality Counts
Brevard Road at Pond Road	1/30/2020	Quality Counts
Brevard Road at Farmers Market	1/9/2020	Quality Counts
Brevard Road at I-40 Eastbound Ramps	1/9/2020	Quality Counts
Brevard Road at I-40 Westbound Ramps	1/9/2020	Quality Counts
Brevard Road at Sardis Road/Ridgefield Boulevard	1/9/2020	Quality Counts
Sand Hill Road at Sardis Road	1/9/2020	Quality Counts

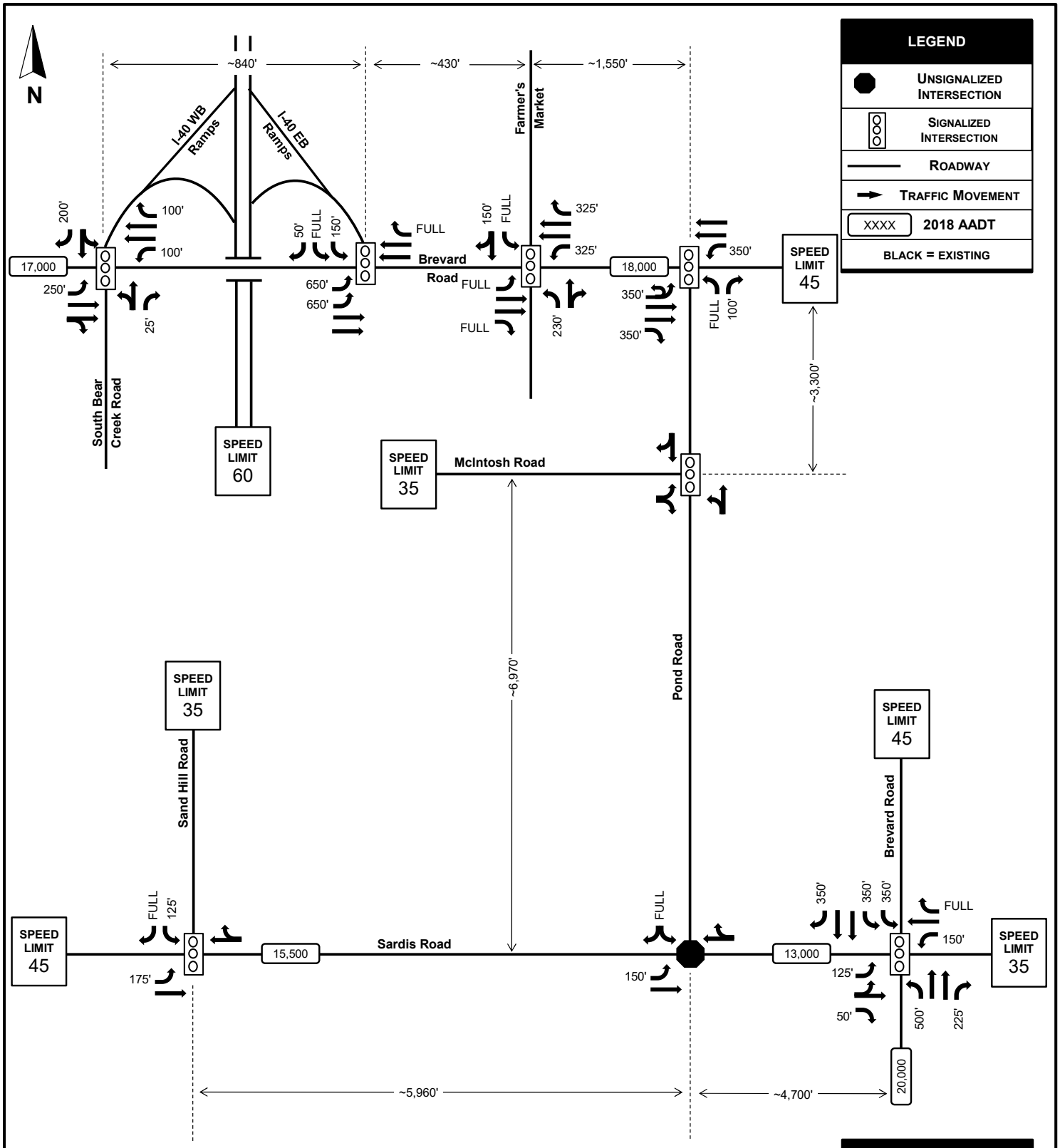

FIGURE 3
EXISTING LANE GEOMETRY

POND ROAD DEVELOPMENT
BUNCOMBE COUNTY, NC

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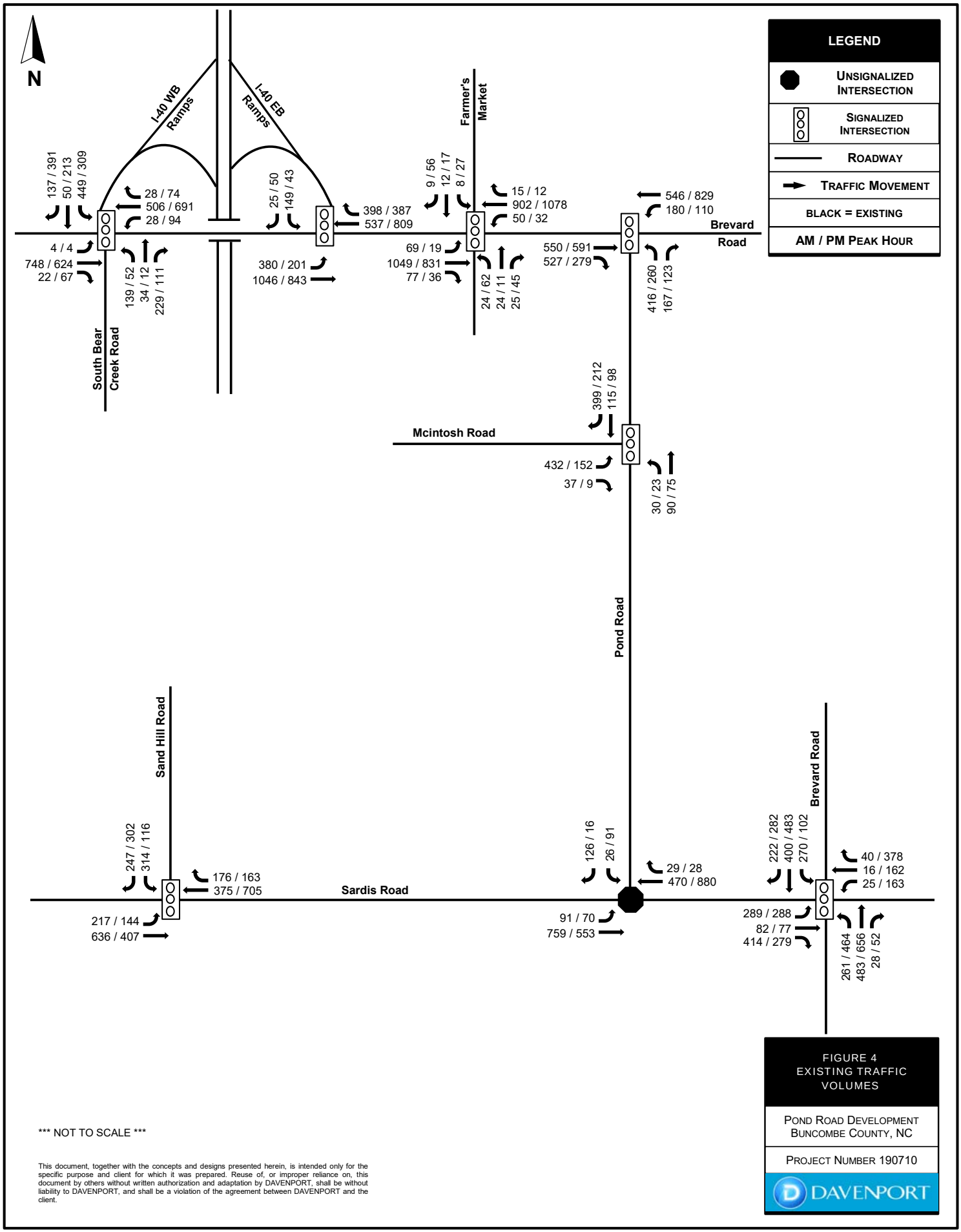

FIGURE 4
EXISTING TRAFFIC VOLUMES

POND ROAD DEVELOPMENT
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3.0 2020 Future No Build Conditions

3.1 Approved Developments

Approved developments are developments that have been recently approved in the area, but not yet constructed. Pond Road Subdivision is an approved development on Pond Road and south of McIntosh Road. The development is expected to consist of 100 single family dwelling units, 140 low-rise multifamily dwelling units, and 240 mid-rise multifamily dwelling units. The development is expected to be built in two phases; however, for this analysis, it will be assumed that both phases are built before Phase 1 of this project. The committed improvement for this development is 150' southbound right turn lane on Pond Road at the intersection with Sardis Road.

3.2 Committed Improvements

Committed Improvements are improvements that are planned by NCDOT, a local municipality, or a developer in the area, but not yet constructed. U-6047 is a NCDOT STIP project, which will improve the intersection of Sardis Road at Pond Road. Construction is planned for 2025. I-2513 is a NCDOT STIP project, which will upgrade I-26, I-240, I-40, and ramps. I-2513 project impact figure can be found in the appendix.

3.3 Future No Build Traffic Volumes

Based on the scoping with NCDOT, future no build volumes were computed by applying a 1.5% growth rate.

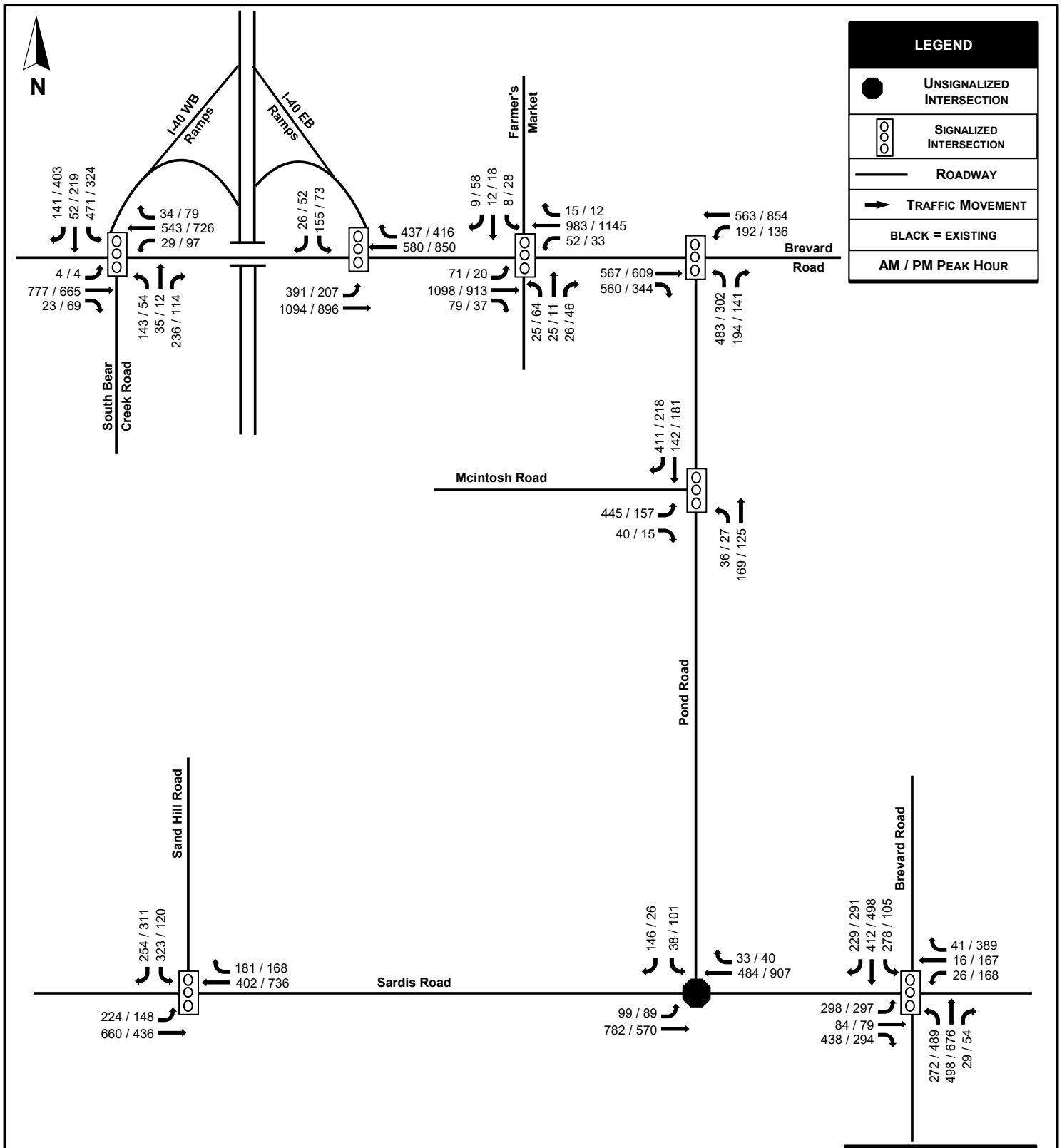

FIGURE 5
2022 FUTURE NO BUILD VOLUMES

POND ROAD DEVELOPMENT
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4.0 Methodology

4.1 Base Assumptions and Standards

In general, the analysis for this project was conducted utilizing NCDOT Congestion Management standards and local guidelines. The following table contains a summary of the base assumptions:

Table 4.1 - Assumptions	
Background Traffic Growth	1.5%
Signal Timing/Phasing	Based on signal plans obtained from NCDOT
Analysis Software	Synchro/SimTraffic Version 10.0 (signalized and unsignalized)
Lane widths	12-feet
Peak Hour Factor	0.90 for all movements expect In the AM, 0.75 was used traffic turning into and off of McIntosh Road at the intersection with Pond Road, since IC Imagine school is on McIntosh Road
Heavy Vehicle Percentage	2%

5.0 2022 Build Phase 1 Conditions

5.1 Trip Generation

Phase 1 is planned to consist of 280 dwelling units of multifamily housing. Local data based on the development was used, as agreed upon with NCDOT. Table 5.1 presents the results.

Table 5.1 - ITE Trip Generation

Average Weekday Driveway Volumes						24 Hour Volumes	AM Peak Hour		PM Peak Hour	
Phase	Land Use	ITE Land Use Code	Size		Data Source	Volume	Enter	Exit	Enter	Exit
1	Multifamily (Mid-Rise)	221	280	Dwelling Units	Equation - Adjacent	1,524	24	70	73	46
Phase 1 Trips						**1,524**	**24**	**70**	**73**	**46**

5.2 Trip Distribution

Site trips for this proposed development were distributed based existing travel patterns and engineering judgement. The trip distribution model (shown in Figure 6) was confirmed with the NCDOT, and utilizes the following overall directional percentages:

- 20% to/from the west on Brevard Road
- 25% to/from the east on I-40
- 5% to/from the west on I-40
- 5% to/from McIntosh Road
- 20% to/from the west on Sand Hill Road
- 9% to/from the north on Sand Hill Road
- 8% to/from the north on Brevard Road
- 6% to/from the south on Brevard Road
- 2% to/from Ridgefield Boulevard

5.3 2022 Build Volumes

The 2020 build volumes were obtained by summing future no build volumes and site trips. Site trips are shown in Figure 7.

The future build volume totals for AM and PM peaks are shown in Figure 8.

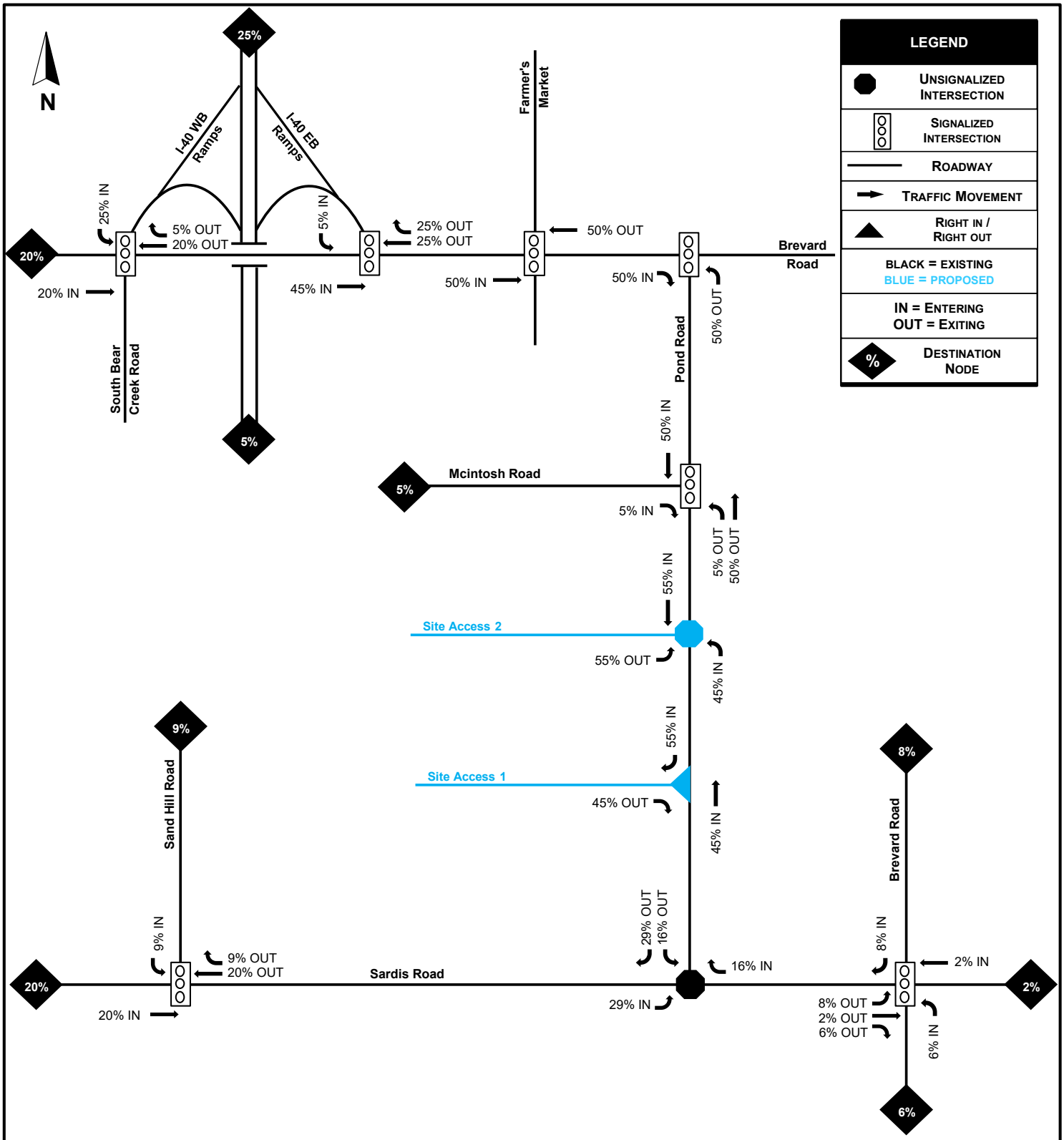

FIGURE 6
PHASE 1
TRIP DISTRIBUTION

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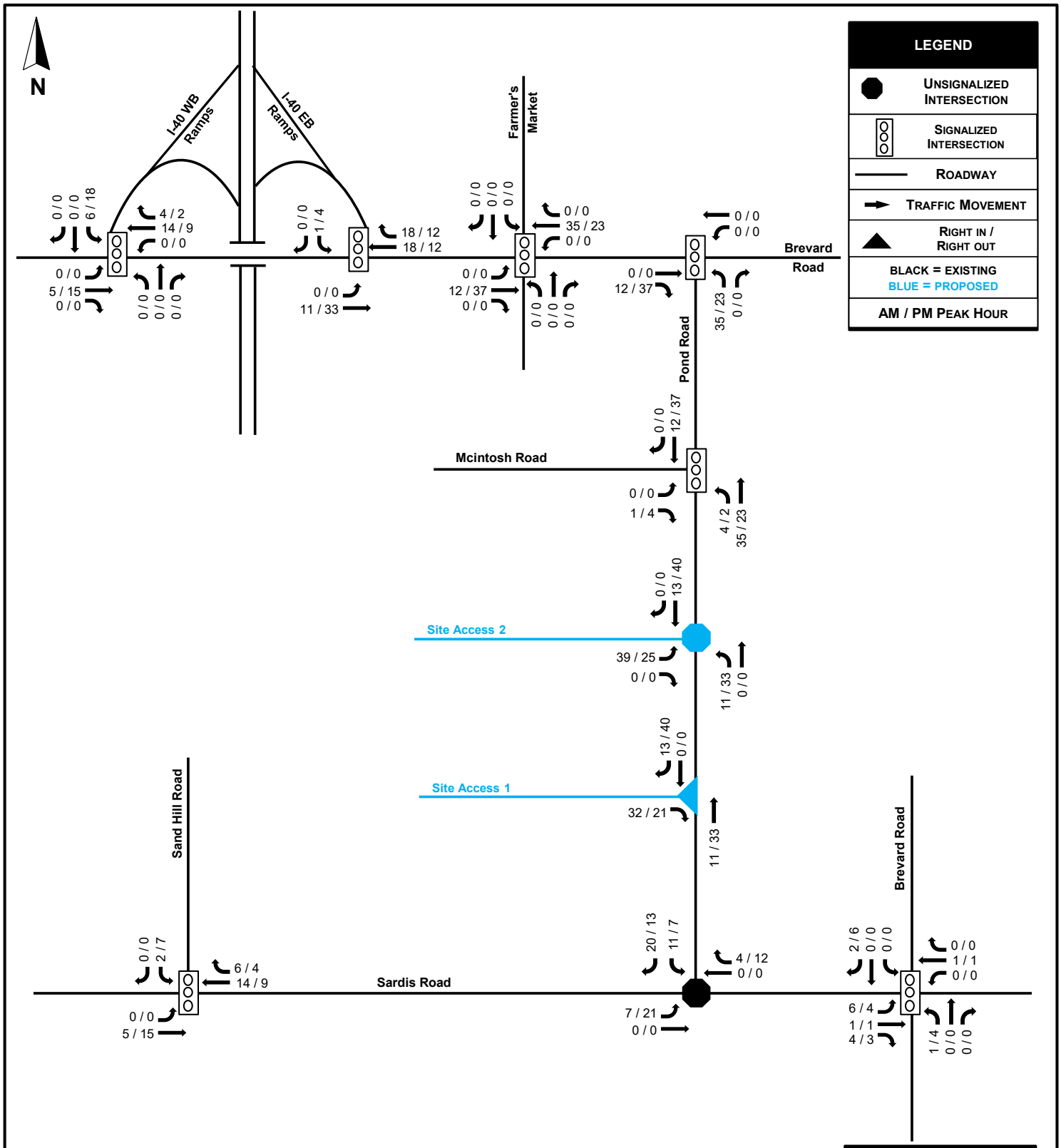

FIGURE 7
PHASE 1 SITE TRIPS

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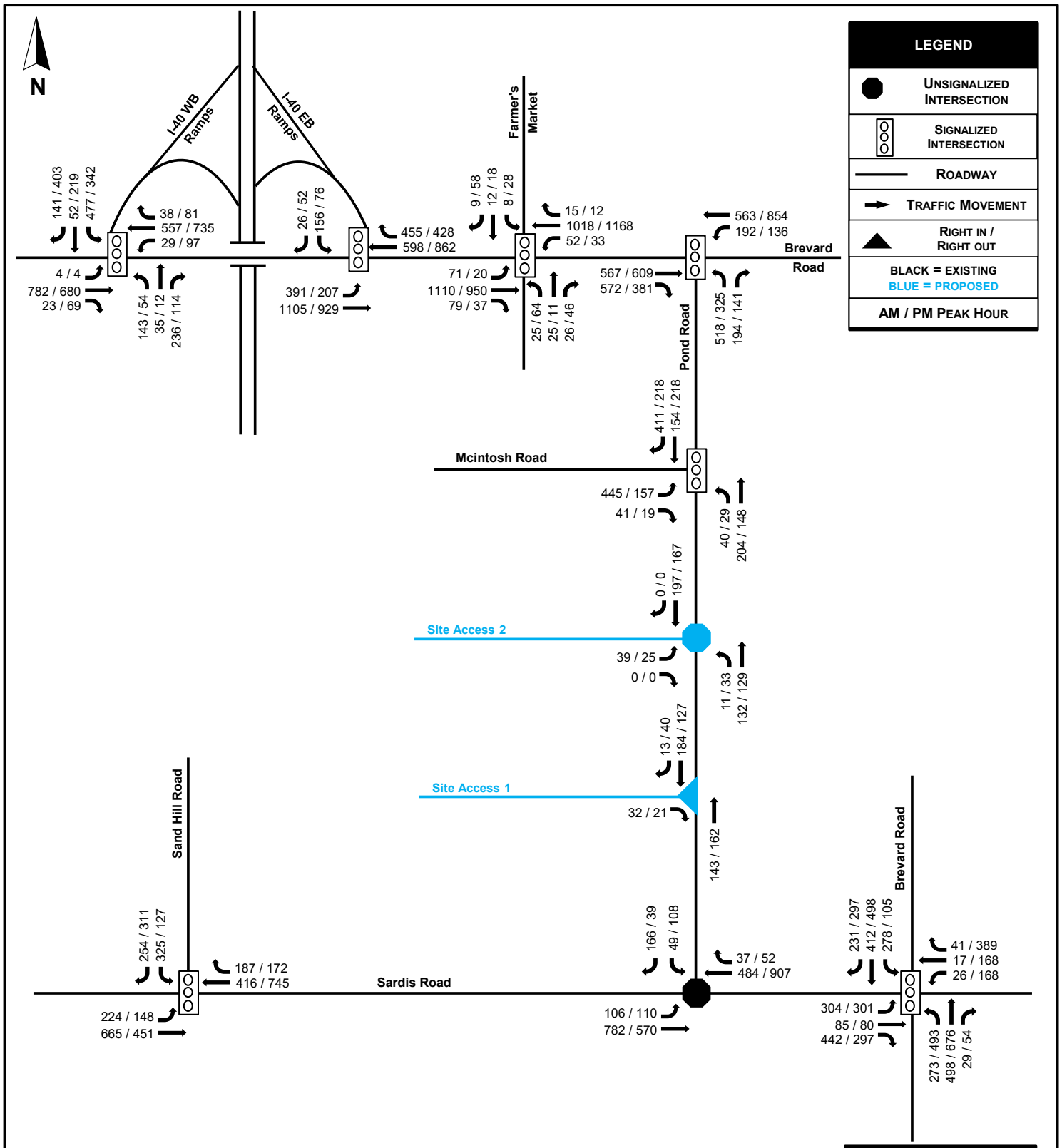

FIGURE 8
PHASE 1 BUILD VOLUMES

POND ROAD DEVELOPMENT
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6.0 2022 Capacity Analysis

6.1 Level of Service Evaluation Criteria

The Transportation Research Board's Highway Capacity Manual (HCM) utilizes a term "level of service" to measure how traffic operates in intersections and on roadway segments. There are currently six levels of service ranging from A to F. Level of service "A" represents low-volume traffic operations and Level of Service "F" represents high-volume, oversaturated traffic operations. However, in very congested areas, a simple LOS evaluation technique may not be sufficient to determine the true impact of a project. Synchro Traffic Modeling software was used to determine the level of service for studied intersections. Note for unsignalized intersection analysis, the level of service noted is for the worst approach of the intersection. This is typically the left turn movement for the side street approach, due to the number of opposing movements. All worksheet reports from the analyses can be found in the Appendix.

In accordance with NCDOT guidelines, mitigation is required when the Build condition exceeds the No-Build conditions by any of the following minimum thresholds:

1. The average delay at an intersection or individual approach increases by 25% or greater, or
2. The Level of Service degrades by at least one level above LOS D, or
3. Level of Service is "F"

Table 6.1 – Highway Capacity Manual

Levels of Service and Control Delay Criteria			
Signalized Intersection		**Unsignalized Intersection**	
Level of Service	Control Delay Per vehicle (sec)	Level of Service	Delay Range (sec)
A	≤ 10	A	≤ 10
B	> 10 and ≤ 20	B	> 10 and ≤ 15
C	> 20 and ≤ 35	C	> 15 and ≤ 25
D	> 35 and ≤ 55	D	> 25 and ≤ 35
E	> 55 and ≤ 80	E	> 35 and ≤ 50
F	> 80	F	> 50

6.2 Build Level of Service Discussion

The results of the level of service analysis are discussed by intersection below. The LOS results tables can be found in Section 6.3.

Sardis Road at Pond Road

For all scenarios with Sardis Road at Pond Road operating as a stop controlled intersection, the intersection operates as an LOS F for both the AM and PM. Signalizing this intersection would greatly reduce delay for the southbound direction with minimal delay impacts for the east- and westbound direction. Signalizing this intersection is recommended.

Pond Road at Site Access 1

This intersection operates as a right-in and out, which will mostly serve Phase 1. The intersection operates at LOS A for the eastbound direction in both AM and PM Peak Hours. No improvements are recommended.

Pond Road at Site Access 2

This intersection is proposed to have full access. The intersection operates at LOS B for eastbound direction and LOS A in the northbound direction in both Peak Hours. No improvements are recommended.

Pond Road at McIntosh Road

The intersection of Pond Road at McIntosh Road is near a school. Being near a school the intersection is expected to operate with high delay during the AM peak hour. For all scenarios, the intersection operates at LOS E in the AM Peak Hour and LOS B in the PM Peak Hour. No improvements are recommended.

Pond Road at Brevard Road

In all scenarios, this intersection operations at LOS C or better. No improvements are recommended.

Brevard Road at Farmers Market

In all scenarios, this intersection operations at LOS B or better. No improvements are recommended.

Brevard Road at I-40 EB Ramp

In all scenarios, this intersection operations at LOS B or better. No improvements are recommended.

Brevard Road at I-40 WB Ramp / South Bear Creek Road

The intersection of Brevard Road at I-40 WB Ramp and South Bear Creek Road operates at a LOS D in the AM Peak Hour for all scenarios. The interaction operates at a LOS C or better in the PM Peak Hour for all scenarios. No improvements are recommended.

Brevard Road at Sardis Road / Ridgefield Boulevard

The intersection of Brevard Road at Sardis Road and Ridgefield Boulevard operates at a LOS D in the AM Peak Hour for all scenarios. The intersection is expected to degrade from LOS D in existing scenario to LOS E of both No Build and Build in the PM Peak Hour. No improvements are recommended.

Sand Hill Road at Sardis Road

The intersection of Brevard Road at Sardis Road and Ridgefield Boulevard operates at a LOS D in the AM Peak Hour and LOS E in the PM Peak Hour for all scenarios. No improvements are recommended.

6.3 Level of Service Results

The Level of Service for the 2019 Existing through Build conditions are shown in Tables 6.2 – 6.11.

Table 6.2 - Sardis Road at Pond Road

Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
Existing	-	A (8.9)	A (0.0)	-	F (88.2)
2022 No Build	-	A (9.1)	A (0.0)	-	F (70.7)
2022 Build Phase 1	-	A (9.1)	A (0.0)	-	F (106.7)
2022 Build Phase 1 - Signal	**B (13.9)**	A (12.8)	A (9.2)	-	C (30.0)
PM Peak Hour					
Existing	-	B (10.9)	A (0.0)	-	F (>300)
2022 No Build	-	B (11.4)	A (0.0)	-	F (>300)
2022 Build Phase 1	-	B (11.8)	A (0.0)	-	F (>300)
2022 Build Phase 1 - Signal	**B (13.3)**	A (8.4)	B (13.6)	-	C (33.8)

Table 6.3 - Pond Road at Site Access 1					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
2022 Build Phase 1	-	A (9.5)	-	A (0.0)	A (0.0)
PM Peak Hour					
2022 Build Phase 1	-	A (9.2)	-	A (0.0)	A (0.0)

Table 6.4 - Pond Road at Site Access 2					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
2022 Build Phase 1	-	B (11.4)	-	A (7.7)	A (0.0)
PM Peak Hour					
2022 Build Phase 1	-	B (11.4)	-	A (7.7)	A (0.0)

Table 6.5 - Pond Road at McIntosh Road					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
Existing	**E (55.5)**	F (106.6)	-	A (7.9)	B (17.2)
2022 No Build	**E (63.4)**	F (132.0)	-	A (9.0)	B (18.7)
2022 Build Phase 1	**E (62.6)**	F (133.4)	-	A (9.8)	B (19.4)
PM Peak Hour					
Existing	**B (10.7)**	B (13.0)	-	A (7.7)	B (10.5)
2022 No Build	**B (11.7)**	B (15.2)	-	A (8.0)	B (11.6)
2022 Build Phase 1	**B (12.1)**	B (16.2)	-	A (8.1)	B (12.1)

Table 6.6 - Pond Road at Brevard Road					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
Existing	**C (22.5)**	B (14.8)	C (23.9)	D (35.1)	-
2022 No Build	**C (27.1)**	B (15.4)	C (30.1)	D (43.2)	-
2022 Build Phase 1	**C (30.7)**	B (15.5)	C (31.9)	D (54.0)	-
PM Peak Hour					
Existing	**B (16.1)**	B (15.2)	B (11.9)	C (28.9)	-
2022 No Build	**B (17.4)**	B (15.3)	B (14.1)	C (29.2)	-
2022 Build Phase 1	**B (18.0)**	B (15.6)	B (14.7)	C (30.1)	-

Table 6.7 - Brevard Road at Farmers Market					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
Existing	**B (13.3)**	B (10.3)	B 15.2)	C (31.5)	C (29.3)
2022 No Build	**B (13.8)**	B (10.5)	B (16.1)	C (31.5)	C (29.3)
2022 Build Phase 1	**B (14.0)**	B (10.4)	B (16.5)	C (31.5)	C (29.3)
PM Peak Hour					
Existing	**B (13.4)**	B (10.6)	B (11.7)	C (33.4)	C (33.3)
2022 No Build	**B (14.1)**	B (12.5)	B (11.7)	C (33.6)	C (33.5)
2022 Build Phase 1	**B (14.1)**	B (12.7)	B (11.7)	C (33.6)	C (33.5)

Table 6.8 - Brevard Road at I-40 EB Ramp					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
Existing	**B (10.2)**	B (10.7)	A (6.3)	-	C (26.7)
2022 No Build	**B (10.5)**	B (11.0)	A (7.0)	-	C (25.5)
2022 Build Phase 1	**B (10.6)**	B (11.3)	A (7.2)	-	C (24.9)
PM Peak Hour					
Existing	**A (9.8)**	A (9.1)	B (10.2)	-	B (13.9)
2022 No Build	**B (10.4)**	A (9.1)	B (10.9)	-	B (18.0)
2022 Build Phase 1	**B (10.5)**	A (9.0)	B (11.1)	-	B (18.2)

Table 6.9 - NC 55 Bypass at I-40 WB Ramp / South Bear Creek Road					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
Existing	**D (38.3)**	B (17.5)	A (4.9)	D (35.4)	F (94.8)
2022 No Build	**D (47.2)**	B (17.8)	A (5.2)	D (53.2)	F (117.1)
2022 Build Phase 1	**D (49.4)**	B (17.9)	A (5.8)	E (59.0)	F (122.2)
PM Peak Hour					
Existing	**B (19.8)**	C (20.1)	B (18.7)	A (5.2)	C (23.5)
2022 No Build	**C (21.1)**	C (21.2)	C (20.1)	A (5.2)	C (25.2)
2022 Build Phase 1	**C (22.4)**	C (21.8)	C (20.8)	A (5.2)	C (27.7)

Table 6.10 - Brevard Road at Sardis Road / Ridgefield Boulevard					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
Existing	**D (45.5)**	E (58.9)	E (59.6)	D (38.9)	D (38.1)
2022 No Build	**D (45.9)**	E (59.1)	E (59.4)	D (39.0)	D (38.8)
2022 Build Phase 1	**D (46.0)**	E (59.0)	E (59.5)	D (39.2)	D (38.9)
PM Peak Hour					
Existing	**D (54.4)**	E (57.1)	E (75.1)	D (48.6)	D (43.4)
2022 No Build	**E (55.7)**	E (57.0)	E (76.2)	D (51.0)	D (44.7)
2022 Build Phase 1	**E (56.2)**	E (57.4)	E (76.3)	D (52.1)	D (44.6)

Table 6.11 - Sand Hill Road at Sardis Road					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
Existing	**D (40.9)**	C (32.2)	C (22.1)	-	E (72.4)
2022 No Build	**D (46.4)**	D (36.8)	C (22.6)	-	F (85.0)
2022 Build Phase 1	**D (47.3)**	D (37.2)	C (22.8)	-	F (87.8)
PM Peak Hour					
Existing	**E (60.7)**	C (23.6)	D (38.6)	-	F (155.6)
2022 No Build	**E (67.3)**	C (24.4)	D (44.8)	-	F (172.3)
2022 Build Phase 1	**E (68.2)**	C (24.0)	D (48.2)	-	F (170.4)

Figure 11 illustrates the recommended improvements for the Phase 1 Build-out conditions.

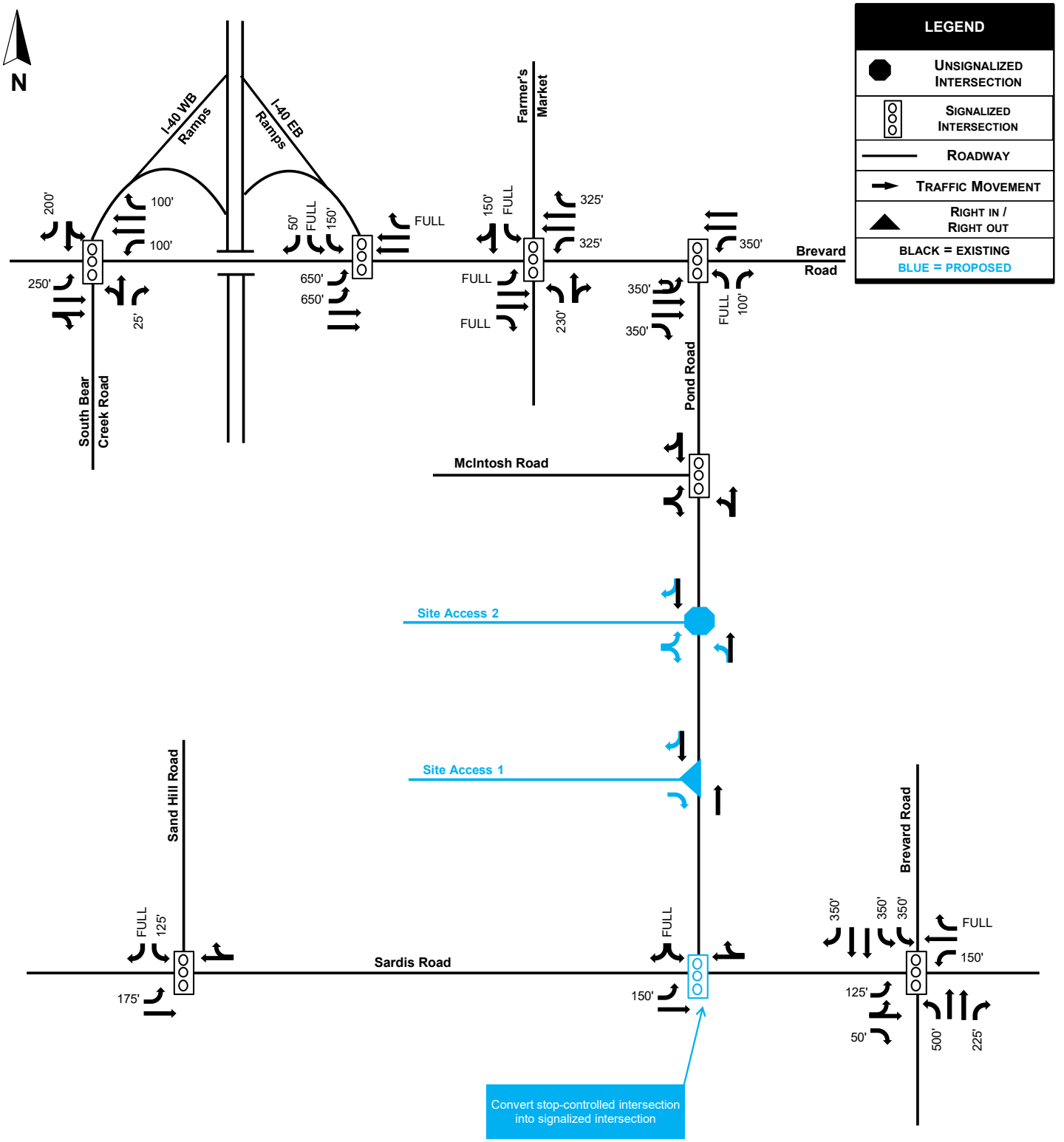

FIGURE 9
PHASE 1
RECOMMENDED
IMPROVEMENTS

POND ROAD DEVELOPMENT
BUNCOMBE COUNTY, NC

PROJECT NUMBER 190710

DAVENPORT

*** NOT TO SCALE ***

7.0 2022 Queue Analysis

Queuing analysis was conducted using SimTraffic simulation for the study intersections, based on a standard 15-minute seeding time and a 60-minute recording time. The maximum queue lengths are shown below, along with existing turn lane lengths. All queue reports can be found in the appendix. The queue length lengths are the highest value of AM or PM analysis.

In accordance with NCDOT guidelines, mitigation is required when the Build condition exceeds the No-Build conditions by any of the following minimum thresholds:

1. Increase of 50' or more in queue length
2. Left-turn and/or right-turn lane warrants (NCDOT's Policy on Street and Driveway Access to North Carolina Highway) are identified
3. Build with Capacity Improvements queue exceeds existing storage length

Table 7.1 -Sardis Road at Pond Road

2022 Scenario	Queue Length (ft)			
	Recommended Storage	No Build	Build	Signal
Eastbound Left	150	95	98	135
Eastbound Through	Full	-	-	244
Westbound	Full	24	22	285
Southbound Left	Full	184	258	134
Southbound Right	150	110	250	161

Table 7.2 - Pond Road at Site Access 1

2022 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound	Full	-	48

Table 7.3 - Pond Road at Site Access 2

2022 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound	Full	-	53
Northbound	Full	-	55

Table 7.4 - Pond Road at McIntosh Road			
2022 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound	Full	722	726
Northbound	Full	251	363
Southbound	Full	282	274

Table 7.5 - Brevard Road at Pond Road			
2022 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound U-Turn	350	54	50
Eastbound Through	Full	159	150
Eastbound Right	350	229	226
Westbound Left	350	220	219
Westbound Through	Full	134	148
Northbound Left	Full	1065	1065
Northbound Right	100	200	200

Table 7.6 - Brevard Road at Farmers Market			
2022 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound Left	Full	102	96
Eastbound Through	Full	179	162
Eastbound Right	Full	69	69
Westbound Left	325	77	84
Westbound Through	Full	241	239
Westbound Right	325	33	38
Northbound Left	230	96	108
Northbound Through	Full	96	87
Southbound Left	Full	77	53
Southbound Through	150	120	138

Table 7.7 - Brevard Road at I-40 EB Ramp			
2022 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound Left	650	174	187
Eastbound Through	Full	424	460
Westbound Through	Full	186	180
Westbound Right	Full	168	148
Southbound Left	Full	101	128
Southbound Right	25	96	112

Table 7.8 - Brevard Road at I-40 WB Ramp / South Bear Creek Road			
2022 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound Left	250	28	28
Eastbound Through	Full	286	287
Westbound Left	100	199	197
Westbound Through	Full	320	225
Westbound Right	100	180	200
Northbound Left-Through	Full	254	244
Northbound Right	25	125	124
Southbound Left-Through	Full	295	291
Southbound Right	200	125	125

Table 7.9 - Brevard Road at Sardis Road / Ridgefield Boulevard			
2022 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound Left	125	225	225
Eastbound Left-Through	Full	1398	1642
Eastbound Right	50	150	150
Westbound Left	150	249	250
Westbound Through	Full	406	262
Westbound Right	Full	452	453
Northbound Left	500	587	599
Northbound Through	Full	792	495
Northbound Right	225	71	68
Southbound Left	350	226	233
Southbound Through	Full	268	236
Southbound Right	350	288	283

Table 7.10 - Sand Hill Road at Sardis Road			
2022 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound Left	175	275	274
Eastbound Through	Full	1222	1188
Westbound Through	Full	384	1055
Southbound Left	125	225	225
Southbound Right	Full	1208	1218

8.0 Phase 1 Turn Lane Warrants

Turn Lane Warrants were performed for both site access. No turn lanes are recommended for Phase 1. Warrants' graphs can be found in the Appendix.

9.0 2023 Build Phase 2 Conditions

9.1 Trip Generation

Phase 2 is planned to consist of 32 single family dwelling units, 80 low-rise multifamily dwelling units, and 295 mid-rise multifamily dwelling units. Table 9.1 presents the results.

ITE Trip Generation										
Average Weekday Driveway Volumes						24 Hour Volumes	AM Peak Hour		PM Peak Hour	
Phase	Land Use	ITE Land Use Code	Size		Data Source	Volume	Enter	Exit	Enter	Exit
2	Single Family	210	32	Dwelling Units	Equation - Adjacent	364	7	21	21	13
2	Multifamily (Low-Rise)	220	80	Dwelling Units	Equation - Adjacent	564	9	30	30	18
2	Multifamily (Mid-Rise)	221	295	Dwelling Units	Equation - Adjacent	1,606	26	73	76	49
Phase 2 Trips						**2,534**	**42**	**124**	**127**	**80**

9.2 Trip Distribution

Site trips for this proposed development were distributed based existing travel patterns and engineering judgement. The trip distribution model (shown in Figure 6) was confirmed with the NCDOT, and utilizes the following overall directional percentages:

- 20% to/from the west on Brevard Road
- 25% to/from the east on I-40
- 5% to/from the west on I-40
- 5% to/from McIntosh Road
- 20% to/from the west on Sand Hill Road
- 9% to/from the north on Sand Hill Road
- 8% to/from the north on Brevard Road
- 6% to/from the south on Brevard Road
- 2% to/from Ridgefield Boulevard

9.3 2023 Build Volumes

The 2020 build volumes were obtained by summing future no build volumes, Phase 1 trips, and Phase 2 trips. Site trips are shown in Figure 7.

The future build volume totals for AM and PM peaks are shown in Figure 8.

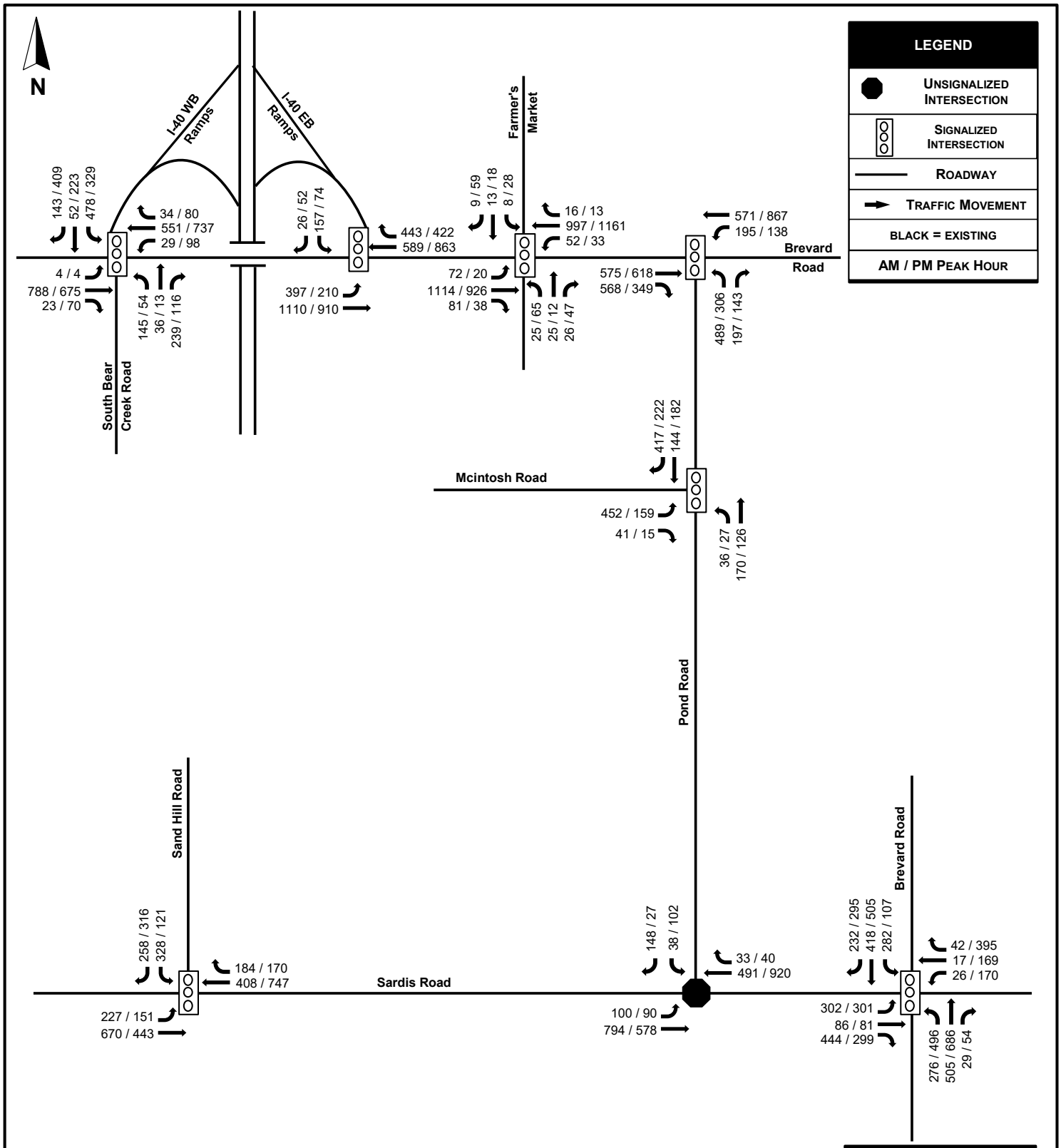

FIGURE 10
2023 FUTURE NO BUILD VOLUMES

POND ROAD DEVELOPMENT
BUNCOMBE COUNTY, NC

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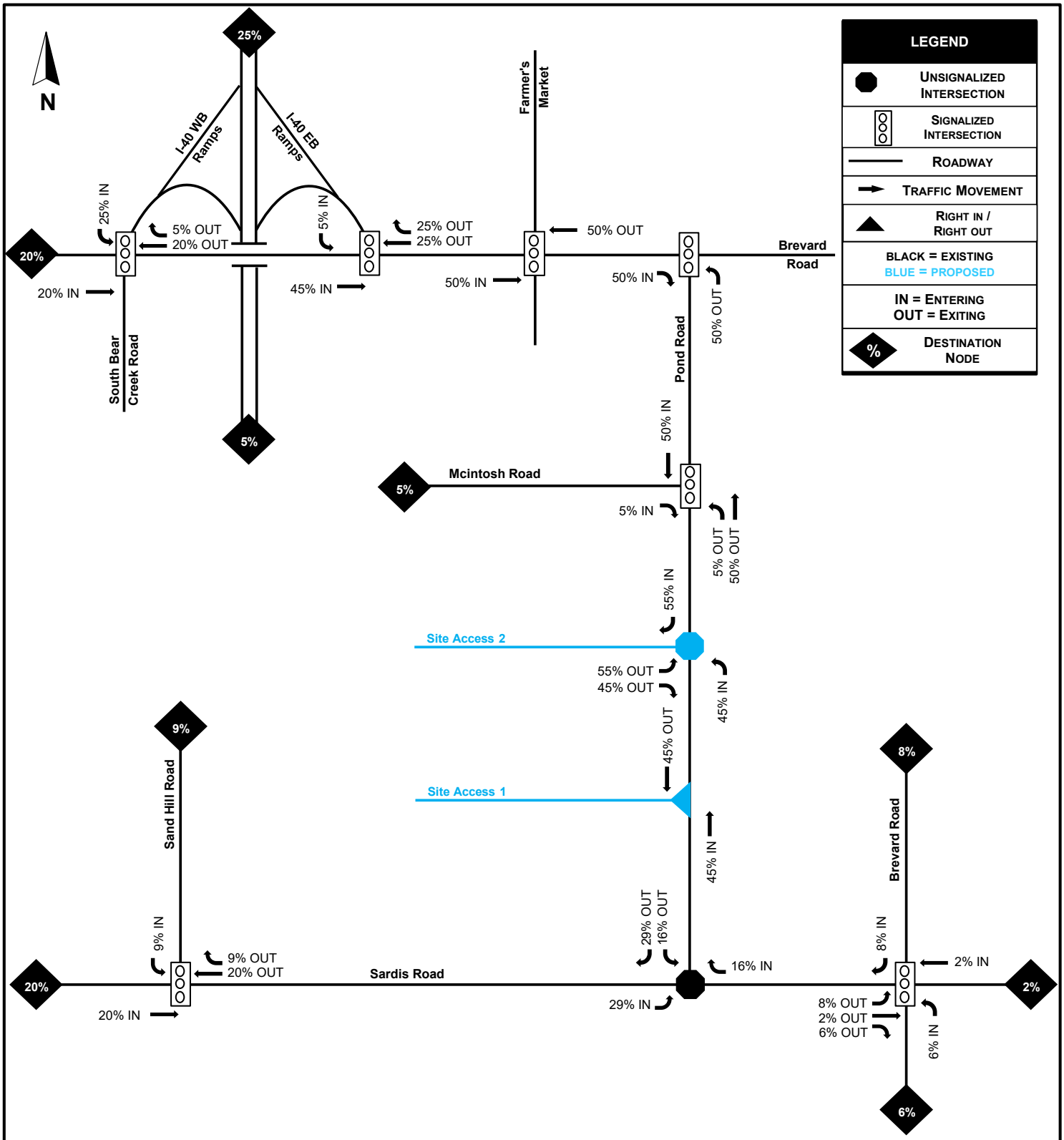

FIGURE 11
PHASE 2
TRIP DISTRIBUTION

POND ROAD DEVELOPMENT
BUNCOMBE COUNTY, NC

PROJECT NUMBER 190710

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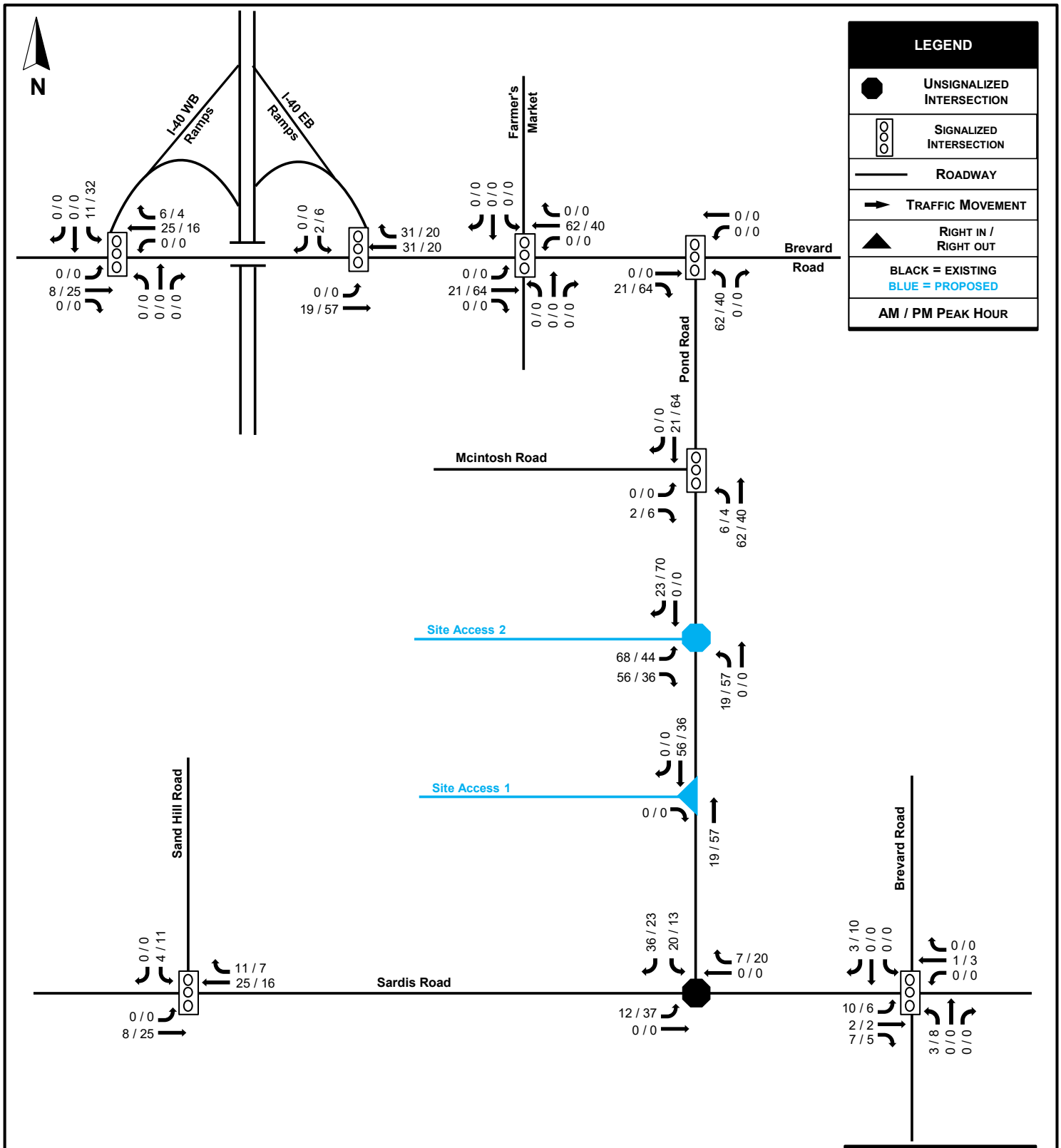

FIGURE 12
PHASE 2 SITE TRIPS

POND ROAD DEVELOPMENT
BUNCOMBE COUNTY, NC

PROJECT NUMBER 190710

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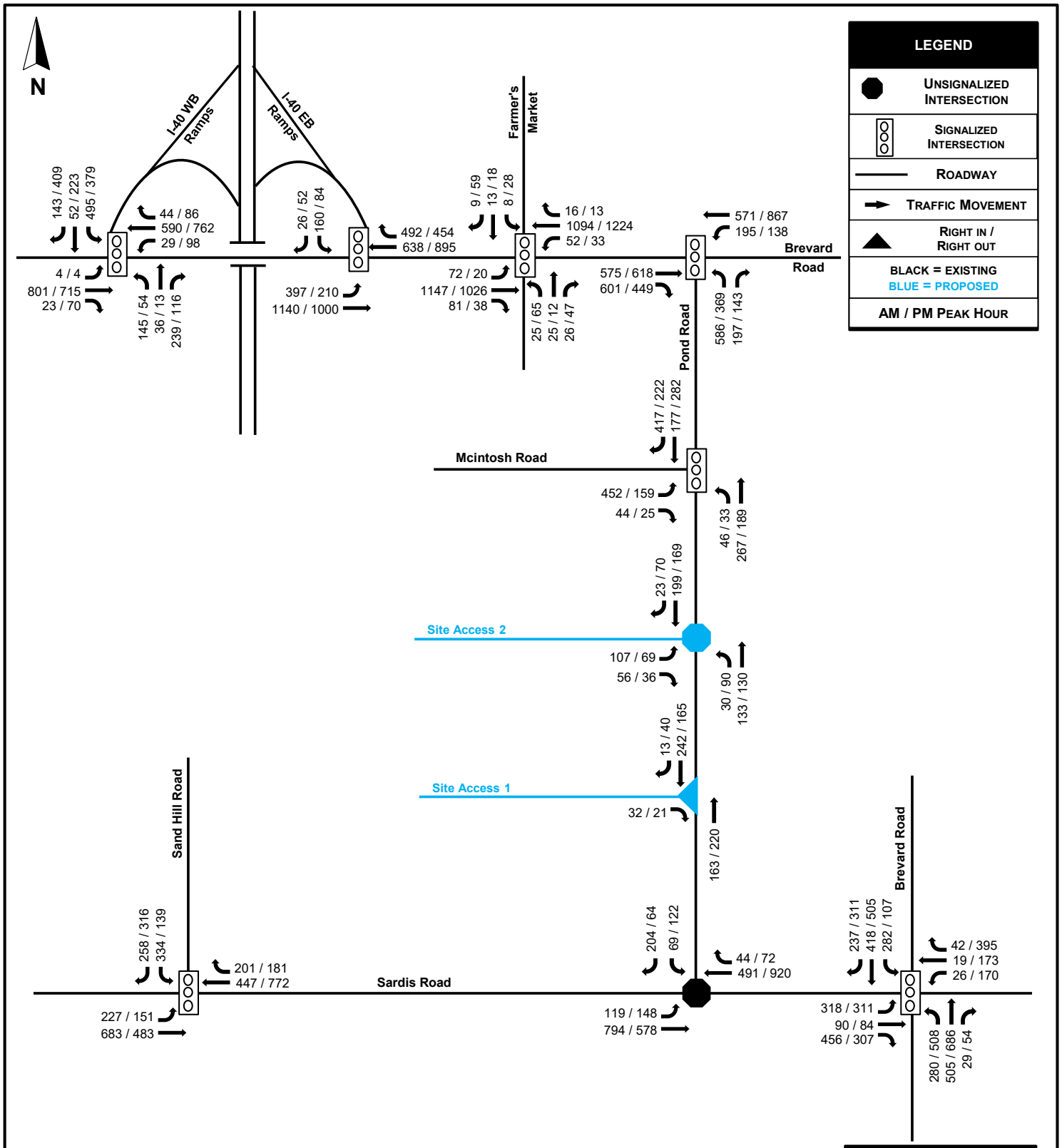

FIGURE 13
PHASE 2 BUILD VOLUMES

POND ROAD DEVELOPMENT
BUNCOMBE COUNTY, NC

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10.0 2023 Capacity Analysis

10.1 Build Level of Service Discussion

The results of the level of service analysis are discussed by intersection below. The LOS results tables can be found in Section 10.2.

Sardis Road at Pond Road

For all scenarios with Sardis Road at Pond Road operating as a stop controlled intersection, the intersection operates as an LOS F for both the AM and PM. Signalizing this intersection would greatly reduce delay for the southbound direction with minimal delay impacts for the east- and westbound direction. This intersection should be signalized in Phase 1. No other improvements are recommended for this intersection.

Pond Road at Site Access 1

This intersection operates as a right-in and out, which will mostly serve Phase 1. The intersection operates at LOS A for the eastbound direction in both AM and PM Peak Hours. No improvements are recommended.

Pond Road at Site Access 2

This intersection is proposed to have full access. The intersection operates at LOS B for eastbound direction and LOS A in the northbound direction in both Peak Hours. Per the turn lane warrents a northbound left turn lane and a southbound right turn lane should be installed with 100' of storage respectively and appropriate taper.

Pond Road at McIntosh Road

The intersection of Pond Road at McIntosh Road is near a school. Being near a school the intersection is expected to operate with high delay during the AM peak hour. For all scenarios, the intersection operates at LOS E in the AM Peak Hour and LOS B in the PM Peak Hour. No improvements are recommended.

Pond Road at Brevard Road

In the No Build Scenario, this intersection operations at LOS C in the AM Peak Hour; however, the intersection degrades to LOS D in the Build Scenario. With split adjustments the Build Scenario with improvements operates at LOS C. Brevard Corridor timings need to be adjusted in the AM after 3 months of Phase 2 being open.

Brevard Road at Farmers Market

In all scenarios, this intersection operations at LOS B or better. Since Brevard Road at Pond Road and Brevard Road at I-40 WB Ramp need timing improvements, then Brevard Corridor timings need to be adjusted in the AM after 3 months of Phase 2 being open.

Brevard Road at I-40 EB Ramp

In all scenarios, this intersection operations at LOS B or better. Since Brevard Road at Pond Road and Brevard Road at I-40 WB Ramp need timing improvements, then Brevard Corridor timings need to be adjusted in the AM after 3 months of Phase 2 being open.

Brevard Road at I-40 WB Ramp / South Bear Creek Road

The intersection of Brevard Road at I-40 WB Ramp and South Bear Creek Road operates at a LOS D in the AM Peak Hour for the No Build Scenario; however, Build Scenario degrades to LOS E. The interaction operates at a LOS C or better in the PM Peak Hour for all scenarios. Brevard Corridor timings need to be adjusted in the AM after 3 months of Phase 2 being open.

Brevard Road at Sardis Road / Ridgefield Boulevard

The intersection of Brevard Road at Sardis Road and Ridgefield Boulevard operates at a LOS D in the AM Peak Hour and LOS E in the PM Peak Hour for all scenarios. No improvements are recommended.

Sand Hill Road at Sardis Road

The intersection of Brevard Road at Sardis Road and Ridgefield Boulevard operates at a LOS D in the AM Peak Hour and LOS E in the PM Peak Hour for all scenarios. No improvements are recommended.

10.2 Level of Service Results

The Level of Service for the 2019 Existing through Build conditions are shown in Tables 10.1 – 10.10.

Table 10.1 - Sardis Road at Pond Road					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
2023 No Build	-	A (9.1)	A (0.0)	-	F (75.3)
2023 Build Phase 2	-	A (9.2)	A (0.0)	-	F (207.6)
2023 Build Phase 1 - Signal	**B (16.5)**	B (15.6)	B (11.0)	-	C (30.2)
PM Peak Hour					
2023 No Build	-	B (11.5)	A (0.0)	-	F (>300)
2023 Build Phase 2	-	B (12.7)	A (0.0)	-	F (>300)
2023 Build Phase 1 - Signal	**B (17.2)**	B (14.7)	B (14.2)	-	D (42.5)

Table 10.2 - Pond Road at Site Access 1					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
2023 Build Phase 2	-	A (9.9)	-	A (0.0)	A (0.0)
PM Peak Hour					
2023 Build Phase 2	-	A (9.4)	-	A (0.0)	A (0.0)

Table 10.3 - Pond Road at Site Access 2					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
2023 Build Phase 2	-	B (13.2)	-	A (7.8)	A (0.0)
2023 Build Phase 2 - Turn Lanes	-	B (13.0)	-	A (7.8)	A (0.0)
PM Peak Hour					
2023 Build Phase 2	-	B (13.8)	-	A (8.0)	A (0.0)
2023 Build Phase 2 - Turn Lanes	-	B (13.2)	-	A (8.0)	A (0.0)

Table 10.4 - Pond Road at McIntosh Road					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
2023 No Build	**E (67.4)**	F (140.8)	-	A (9.1)	B (19.3)
2023 Build Phase 2	**E (65.2)**	F (143.8)	-	B (12.1)	C (21.4)
PM Peak Hour					
2023 No Build	**B (11.8)**	B (15.3)	-	A (8.0)	B (11.8)
2023 Build Phase 2	**B (12.8)**	B (18.9)	-	A (8.2)	B (12.7)

Table 10.5 - Pond Road at Brevard Road					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
2023 No Build	**C (28.0)**	B (15.5)	C (32.6)	D (43.8)	-
2023 Build Phase 2	**D (41.3)**	B (15.9)	C (33.2)	F (87.6)	-
2023 Build Phase 2 - Timing Adjustment	**C (26.1)**	B (18.9)	C (28.9)	C (34.4)	-
PM Peak Hour					
2023 No Build	**B (17.5)**	B (15.5)	B (14.3)	C (29.3)	-
2023 Build Phase 2	**B (19.2)**	B (16.2)	B (15.8)	C (32.2)	-

Table 10.6 - Brevard Road at Farmers Market					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
2023 No Build	**B (13.9)**	B (10.5)	B (16.2)	C (31.5)	C (29.4)
2023 Build Phase 2	**B (14.3)**	B (10.4)	B (17.2)	C (31.5)	C (29.4)
2023 Build Phase 2 - Timing Adjustment	**B (13.6)**	B (11.0)	B (14.9)	C (31.5)	C (29.4)
PM Peak Hour					
2023 No Build	**B (14.2)**	B (12.6)	B (11.8)	C (33.7)	C (33.7)
2023 Build Phase 2	**B (14.3)**	B (13.0)	B (11.9)	C (33.7)	C (33.7)

Table 10.7 - Brevard Road at I-40 EB Ramp					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
2023 No Build	**B (10.6)**	B (11.1)	A (7.2)	-	C (25.3)
2023 Build Phase 2	**B (11.0)**	B (11.6)	A (7.9)	-	C (24.2)
2023 Build Phase 2 - Timing Adjustment	**B (10.8)**	B (11.8)	A (7.3)	-	C (24.2)
PM Peak Hour					
2023 No Build	**B (10.5)**	A (9.1)	B (11.0)	-	B (18.0)
2023 Build Phase 2	**B (10.8)**	A (9.0)	B (11.6)	-	B (19.0)

Table 10.8 - NC 55 Bypass at I-40 WB Ramp / South Bear Creek Road					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
2023 No Build	**D (50.9)**	B (18.0)	A (5.7)	E (61.5)	F (125.3)
2023 Build Phase 2	**E (57.1)**	B (18.1)	A (6.5)	E (78.4)	F (139.5)
2023 Build Phase 2 - Timing Adjustment	**C (29.6)**	D (35.3)	C (24.4)	A (8.1)	D (40.8)
PM Peak Hour					
2023 No Build	**C (21.8)**	C (21.5)	C (20.1)	A (5.2)	C (26.2)
2023 Build Phase 2	**C (26.2)**	C (22.9)	C (22.5)	A (5.3)	D (35.9)

Table 10.9 - Brevard Road at Sardis Road / Ridgefield Boulevard					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
2023 No Build	**D (45.8)**	E (58.4)	E (59.4)	D (39.1)	D (39.2)
2023 Build Phase 2	**D (45.9)**	E (57.3)	E (59.7)	D (39.5)	D (39.7)
PM Peak Hour					
2023 No Build	**E (56.7)**	E (57.5)	E (76.8)	D (53.0)	D (44.8)
2023 Build Phase 2	**E (58.1)**	E (58.9)	E (76.9)	E (56.3)	D (44.7)

Table 6.11 - Sand Hill Road at Sardis Road					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
2023 No Build	**D (48.7)**	D (38.4)	C (22.8)	-	F (90.5)
2023 Build Phase 2	**D (55.4)**	D (42.4)	C (24.4)	-	F (109.5)
PM Peak Hour					
2023 No Build	**E (70.4)**	C (25.5)	D (48.2)	-	F (178.5)
2023 Build Phase 2	**E (73.8)**	C (24.4)	E (59.1)	-	F (173.5)

Figure 14 illustrates the recommended improvements for the Phase 2 Build-out conditions.

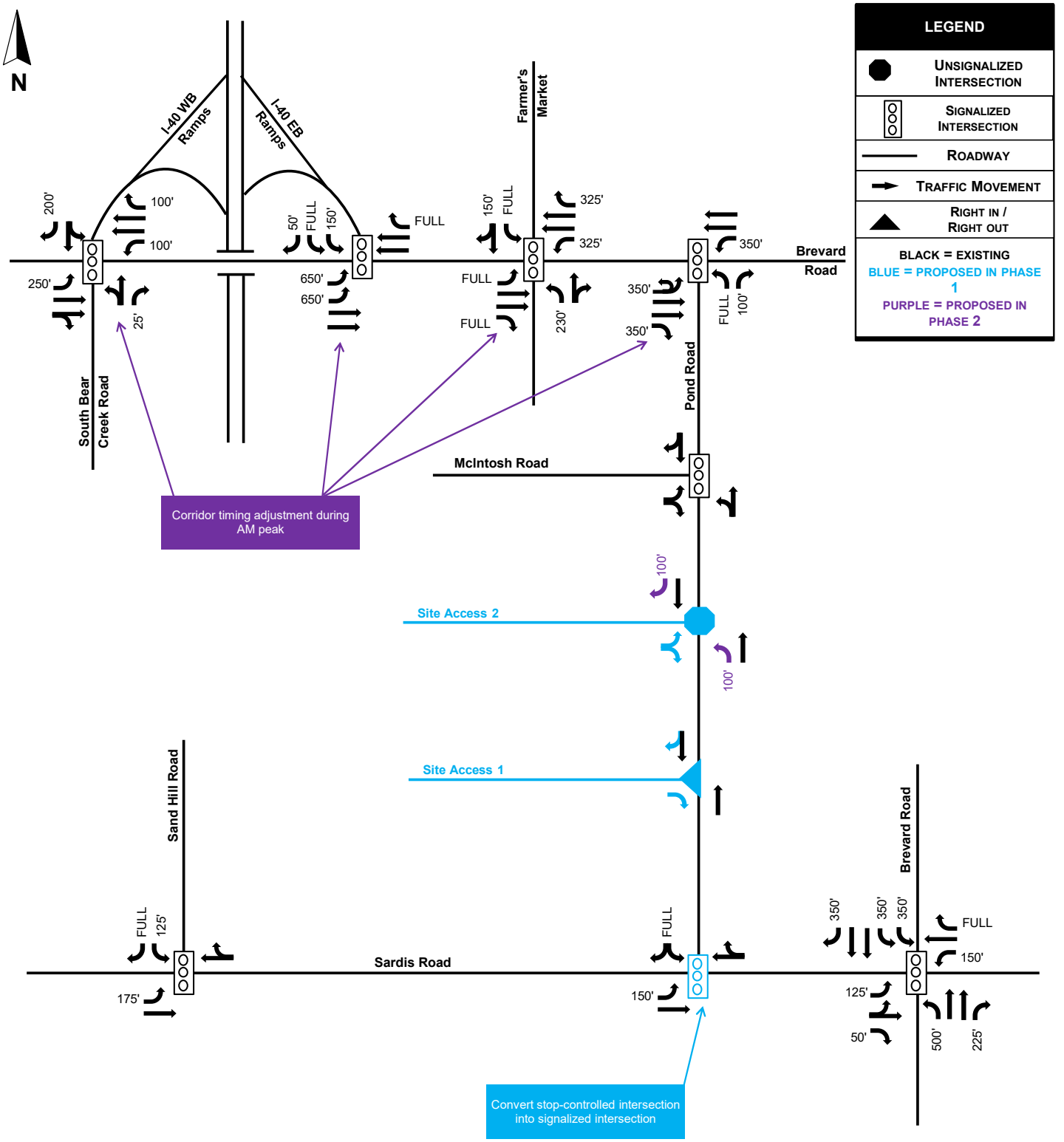

FIGURE 14
PHASE 2
RECOMMENDED
IMPROVEMENTS

POND ROAD DEVELOPMENT
BUNCOMBE COUNTY, NC

PROJECT NUMBER 190710

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11.0 2023 Queue Analysis

Queuing analysis was conducted using SimTraffic simulation for the study intersections, based on a standard 15-minute seeding time and a 60-minute recording time. The maximum queue lengths are shown below, along with existing turn lane lengths. All queue reports can be found in the appendix. The queue length lengths are the highest value of AM or PM analysis.

In accordance with NCDOT guidelines, mitigation is required when the Build condition exceeds the No-Build conditions by any of the following minimum thresholds:

4. Increase of 50' or more in queue length
5. Left-turn and/or right-turn lane warrants (NCDOT's Policy on Street and Driveway Access to North Carolina Highway) are identified
6. Build with Capacity Improvements queue exceeds existing storage length

Table 11.1 -Sardis Road at Pond Road

2023 Scenario	Queue Length (ft)			
	Recommended Storage	No Build	Build	Signal
Eastbound Left	150	88	148	208
Eastbound Through	Full	-	-	284
Westbound	Full	29	47	303
Southbound Left	Full	220	664	186
Southbound Right	150	207	250	182

Table 11.2 - Pond Road at Site Access 1

2023 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound	Full	-	41

Table 11.3 - Pond Road at Site Access 2

2023 Scenario	Queue Length (ft)			
	Recommended Storage	No Build	Build	Turn Lanes
Eastbound	Full	-	87	94
Northbound	Full	-	89	64

Table 11.4 - Pond Road at McIntosh Road			
2023 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound	Full	720	723
Northbound	Full	183	621
Southbound	Full	246	303

Table 11.5 - Brevard Road at Pond Road				
2023 Scenario	Queue Length (ft)			
	Recommended Storage	No Build	Build	AM Timing
Eastbound U-Turn	350	59	64	27
Eastbound Through	Full	159	147	126
Eastbound Right	350	178	172	204
Westbound Left	350	221	163	222
Westbound Through	Full	142	132	124
Northbound Left	Full	1068	1064	1065
Northbound Right	100	200	200	200

Table 11.6 - Brevard Road at Farmers Market			
2023 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound Left	Full	107	95
Eastbound Through	Full	192	197
Eastbound Right	Full	51	63
Westbound Left	325	68	81
Westbound Through	Full	237	243
Westbound Right	325	31	33
Northbound Left	230	99	88
Northbound Through	Full	83	83
Southbound Left	Full	70	72
Southbound Through	150	116	115

Table 11.7 - Brevard Road at I-40 EB Ramp			
2023 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound Left	650	180	177
Eastbound Through	Full	180	506
Westbound Through	Full	187	191
Westbound Right	Full	201	185
Southbound Left	Full	89	98
Southbound Right	25	124	86

Table 11.8 - Brevard Road at I-40 WB Ramp / South Bear Creek Road			
2023 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound Left	250	29	29
Eastbound Through	Full	282	307
Westbound Left	100	198	196
Westbound Through	Full	332	313
Westbound Right	100	185	180
Northbound Left-Through	Full	163	244
Northbound Right	25	125	125
Southbound Left-Through	Full	300	305
Southbound Right	200	125	125

Table 11.9 - Brevard Road at Sardis Road / Ridgefield Boulevard			
2023 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound Left	125	225	225
Eastbound Left-Through	Full	1202	1762
Eastbound Right	50	150	150
Westbound Left	150	249	249
Westbound Through	Full	399	432
Westbound Right	Full	445	456
Northbound Left	500	594	599
Northbound Through	Full	1029	1048
Northbound Right	225	121	70
Southbound Left	350	276	239
Southbound Through	Full	262	274
Southbound Right	350	278	296

Table 11.10 - Sand Hill Road at Sardis Road			
2023 Scenario	Queue Length (ft)		
	Recommended Storage	No Build	Build
Eastbound Left	175	275	275
Eastbound Through	Full	1255	1244
Westbound Through	Full	1072	1419
Southbound Left	125	225	225
Southbound Right	Full	1218	1218

12.0 Phase 2 Turn Lane Warrants

Turn Lane Warrants were done for both site access. Northbound left lane and southbound right turn lane are warrented for 100' of storage respectively and appropriate taper. Warrants' graphs can be found in the Appendix.

13.0 I-2513 Capacity Analysis

2023 No Build and Phase 2 Build with Improvements scenarios were analyzed with the I-2513 improvements. As Table 13.1 shows both scenarios operate at LOS for AM and PM Peak Hours. Synchro outputs can be found in the Appendix.

Table 13.1 - NC 55 Bypass at I-40 WB Ramp / South Bear Creek Road					
Scenario	Overall LOS	Level of Service by Approach (Delay in sec/veh)			
		Eastbound	Westbound	Northbound	Southbound
AM Peak Hour					
2023 No Build	**C (27.1)**	C (20.3)	C (25.4)	D (37.3)	C (30.5)
2023 Build Phase 2 with Improvements	**C (27.8)**	C (21.1)	C (28.3)	D (37.9)	C (29.3)
PM Peak Hour					
2023 No Build	**C (27.5)**	B (16.1)	C (26.2)	C (29.0)	D (37.3)
2023 Build Phase 2 with Improvements	**C (27.2)**	B (17.1)	C (26.7)	C (29.0)	D (35.3)

14.0 Summary and Conclusion

Site Overview

The proposed Pond Road development is located on the northwest of Pond Road at House Lane in Buncombe County, North Carolina. This development is planned to consist of two phases. Phase 1 consists of 280 mid-rise multifamily dwelling units on the south side of the property. Phase 1 is expected to open in 2022. Phase 2 consists of 32 single family dwelling units, 80 low-rise multifamily dwelling units, and 295 mid-rise multifamily dwelling units. Phase 2 is expected to be open in 2023.

The development will utilize two accesses. The southern site access (Site Access 1) will be a right-in/out on Pond Road. The northern site access (Site Access 2) will be a full movement site access on Pond Road.

Trip Generation

ITE Trip Generation										
Average Weekday Driveway Volumes						24 Hour Volumes	AM Peak Hour		PM Peak Hour	
Phase	Land Use	ITE Land Use Code	Size		Data Source	Volume	Enter	Exit	Enter	Exit
1	Multifamily (Mid-Rise)	221	280	Dwelling Units	Equation - Adjacent	1,524	24	70	73	46
Phase 1 Trips						**1,524**	**24**	**70**	**73**	**46**
2	Single Family	210	32	Dwelling Units	Equation - Adjacent	364	7	21	21	13
2	Multifamily (Low-Rise)	220	80	Dwelling Units	Equation - Adjacent	564	9	30	30	18
2	Multifamily (Mid-Rise)	221	295	Dwelling Units	Equation - Adjacent	1,606	26	73	76	49
Phase 2 Trips						**2,534**	**42**	**124**	**127**	**80**
Total Trips						**4,058**	**66**	**194**	**200**	**126**

Capacity Analysis and Recommendations

Overall, the capacity analysis anticipates adequate traffic capacity at the study intersections. Sardis Road at Pond Road operates at a LOS F as a stop controlled intersection, but is recommended to be signalized. With the addition of site traffic, the study intersections are anticipated to operate at the same levels of service with recommended improvements.

Sardis Road at Pond Road

Signalizing this intersection is recommended in Phase 1.

Pond Road at Site Access 1

No improvements are recommended.

Pond Road at Site Access 2

Northbound left turn and southbound right turn lanes are recommended with 100' of storage respectively and appropriate taper.

Pond Road at McIntosh Road

No improvements are recommended.

Pond Road at Brevard Road

Brevard Corridor timings need to be adjusted in the AM after 3 months of Phase 2 being open.

Brevard Road at Farmers Market

Since Brevard Road at Pond Road and Brevard Road at I-40 WB Ramp need timing improvements, then Brevard Corridor timings need to be adjusted in the AM after 3 months of Phase 2 being open.

Brevard Road at I-40 EB Ramp

Since Brevard Road at Pond Road and Brevard Road at I-40 WB Ramp need timing improvements, then Brevard Corridor timings need to be adjusted in the AM after 3 months of Phase 2 being open.

Brevard Road at I-40 WB Ramp / South Bear Creek Road

Brevard Corridor timings need to be adjusted in the AM after 3 months of Phase 2 being open.

Brevard Road at Sardis Road / Ridgefield Boulevard

No improvements are recommended.

Sand Hill Road at Sardis Road

No improvements are recommended.

Conclusion

In conclusion, this study has reviewed the impacts of the traffic generated by Pond Road development. With the recommended improvements in place, the proposed development and its traffic impacts can be accommodated.