



CHRONICLE MILL

Traffic Impact Analysis

Belmont, North Carolina

Prepared for:

City of Belmont

October 2019 *(Updated)*

© Kimley-Horn and Associates, Inc., 2019

Kimley»Horn

**Traffic Impact Analysis for
Chronicle Mill
Belmont, North Carolina**

Prepared for:

**City of Belmont
Belmont, North Carolina**

Prepared by:

**Kimley-Horn and Associates, Inc.
NC License #F - 0102
200 South Tryon Street, Suite 200
Charlotte, North Carolina 28202
(704) 333-5131**

**October 2019 (Updated)
015020012**



Brady Finklea

10/17/19

TABLE OF CONTENTS

	<u>Page No.</u>
1.0 EXECUTIVE SUMMARY	1
2.0 INTRODUCTION	5
3.0 EXISTING TRAFFIC CONDITIONS	7
3.1 STUDY AREA	7
3.2 EXISTING INTERSECTION VOLUME DEVELOPMENT	8
4.0 BACKGROUND TRAFFIC VOLUME DEVELOPMENT	14
4.1 HISTORICAL BACKGROUND GROWTH TRAFFIC	14
4.2 APPROVED DEVELOPMENTS	14
4.3 PLANNED TRANSPORTATION PROJECTS	15
5.0 SITE TRAFFIC VOLUME DEVELOPMENT	20
5.1 SITE ACCESS	20
5.2 TRAFFIC GENERATION	20
5.3 SITE TRAFFIC DISTRIBUTION AND ASSIGNMENT	22
5.4 2022 BUILD-OUT TRAFFIC VOLUMES	22
5.5 2027 BUILD-OUT +5 TRAFFIC VOLUMES	22
6.0 CAPACITY ANALYSIS	27
6.1 MAIN STREET AND CATAWBA STREET (NC 7)	30
6.2 KEENER BLVD/PARK ST (NC 273) AND CATAWBA ST (NC 7)	31
6.3 KEENER BLVD (NC 273) AND R L STOWE RD/FORT WILLIAM AVE	33
6.4 MAIN STREET AND MYRTLE STREET/MCLEOD AVENUE	35
6.5 N MAIN STREET (NC 7) AND N CENTRAL AVENUE	36
6.6 PARK STREET (NC 273) AND HAWLEY AVE/PLANETREE DR	37
6.7 CATAWBA STREET (NC 7) AND 1ST STREET	38
6.8 1ST STREET AND BACK STREET	39
6.9 1ST STREET AND BROOK STREET	40
6.10 KEENER BOULEVARD (NC 273) AND BROOK STREET	41
6.11 1ST STREET AND ACCESS 1	42
6.12 1ST STREET AND ACCESS 2	43
6.13 BACK STREET AND ACCESS 3	43
6.14 SHORT STREET AND ACCESS 4	44
7.0 AUXILIARY TURN-LANE WARRANTS	45
8.0 CRASH DATA ANALYSIS	47
9.0 MITIGATION IMPROVEMENTS	49
APPENDIX	51

List of Figures

	<u>Page No.</u>
FIGURE 1.1 – IDENTIFIED MITIGATION IMPROVEMENTS	4
FIGURE 3.1 – STUDY AREA/SITE LOCATION	10
FIGURE 3.2 – PROPOSED SITE PLAN	11
FIGURE 3.3 – EXISTING ROADWAY LANEAGE	12
FIGURE 3.4 – 2019 EXISTING TRAFFIC VOLUMES	13
FIGURE 4.1 – APPROVED DEVELOPMENT AM PEAK-HOUR SITE TRIPS	16
FIGURE 4.2 – APPROVED DEVELOPMENT PM PEAK-HOUR SITE TRIPS	17
FIGURE 4.3 – 2022 BACKGROUND AM PEAK-HOUR TRAFFIC VOLUMES	18
FIGURE 4.4 – 2022 BACKGROUND PM PEAK-HOUR TRAFFIC VOLUMES	19
FIGURE 5.1 – SITE TRAFFIC DISTRIBUTION AND ASSIGNMENT	23
FIGURE 5.2 – 2022 BUILD-OUT AM PEAK-HOUR TRAFFIC VOLUMES	24
FIGURE 5.3 – 2022 BUILD-OUT PM PEAK-HOUR TRAFFIC VOLUMES	25
FIGURE 5.4 – 2027 BUILD-OUT +5 TRAFFIC VOLUMES	26
FIGURE 9.1 – IDENTIFIED MITIGATION IMPROVEMENTS	50

List of Tables

	<u>Page No.</u>
TABLE 3.1 – AM & PM INTERSECTION PEAK HOURS	9
TABLE 4.1 – APPROVED DEVELOPMENTS	14
TABLE 5.1 – TRIP GENERATION	21
TABLE 6.0-A - VEHICULAR LOS CONTROL DELAY THRESHOLDS FOR <u>UNSIGNALIZED</u> INTERSECTIONS	28
TABLE 6.0-B - VEHICULAR LOS CONTROL DELAY THRESHOLDS FOR <u>SIGNALIZED</u> INTERSECTIONS	28
TABLE 6.1 – MAIN STREET AND CATAWBA STREET (NC 7)	30
TABLE 6.2 – KEENER BOULEVARD/PARK STREET (NC 273) AND CATAWBA STREET (NC 7)	31
TABLE 6.3 – KEENER BOULEVARD (NC 273) AND R L STOWE RD/FORT WILLIAM AVE	33
TABLE 6.4 – MAIN STREET AND MYRTLE STREET/MCLEOD AVENUE	35
TABLE 6.5 – N MAIN STREET (NC 7) AND N CENTRAL AVENUE	36
TABLE 6.6 – PARK STREET (NC 273) AND HAWLEY AVENUE/PLANETREE DRIVE	37
TABLE 6.7 – CATAWBA STREET (NC 7) AND 1 ST STREET	38
TABLE 6.8 – 1 ST STREET AND BACK STREET	39
TABLE 6.9 – 1 ST STREET AND BROOK STREET	40
TABLE 6.10 – KEENER BOULEVARD (NC 273) AND BROOK STREET	41
TABLE 6.11 – 1 ST STREET AND ACCESS 1	42
TABLE 6.12 – 1 ST STREET AND ACCESS 2	43
TABLE 6.13 – BACK STREET AND ACCESS 3	43
TABLE 6.14 – SHORT STREET AND ACCESS 4	44
TABLE 8.1 – CRASH SEVERITY SUMMARY	47
TABLE 8.2 – CRASH FREQUENCY SUMMARY	47
TABLE 8.3 – CRASH TYPE SUMMARY	48

1.0 Executive Summary

The purpose of this Traffic Impact Analysis (TIA) is to evaluate the impacts on the surrounding transportation infrastructure as a result of the proposed Chronicle Mill development. The primary objectives of the study are:

- To estimate trip generation and distribution for the proposed development.
- To perform intersection capacity analyses for each of the identified study intersections.
- To determine the potential traffic impacts of the proposed development.
- To identify improvements to mitigate the proposed development's traffic impacts.

The proposed Chronicle Mill mixed-use redevelopment is located in the southwest quadrant of the Catawba Street (NC 7) and 1st Street intersection, just west of Keener Boulevard (NC 273) in Belmont, North Carolina. A vacant mill currently sits on the seven-acre site, previously used for the textile industry dating back to the early 1900s. The mill has been vacant since 2010 and is proposed to be repurposed to include a mix of residential and retail uses. Based on the site plan provided by the applicant, the proposed development is currently envisioned to include the following land uses and intensities:

- 240 multifamily units
- 10 townhome units
- 8,650 square feet of retail space

The proposed development exceeded the City of Belmont's TIA threshold as established by the *City of Belmont Land Development Code – Section 16.14 Traffic Impact Analysis*, resulting in the requirement of this study. The overall site density did not meet North Carolina Department of Transportation's (NCDOT's) TIA threshold; however, it should be noted that coordination also occurred with NCDOT staff in review of the assumptions and methodology documented in this TIA.

For the purposes of this TIA, the development is assumed to be completed (built-out) in 2022. Based on the provided site plan, the proposed development will be accessed via the following access points:

- *Access 1 – A full movement, unsignalized driveway connection to 1st Street approximately 60 feet south of Catawba Street (NC 7); intended connection for proposed townhomes
- Access 2 – A full movement, unsignalized driveway connection to 1st Street approximately 120 feet south of Catawba Street (NC 7); intended connection for proposed retail parking
- Access 3 – A full movement, unsignalized driveway connection to Back Street approximately 165 feet west of 1st Street; intended alternate connection for proposed retail parking
- Access 4 – A full movement, unsignalized driveway connection to Short Street, which serves as an extension of Back Street; intended connection for proposed multifamily/retail surface parking

**Note that since the July 2019 TIA submittal, the City and applicant have agreed to remove Access 1 as its location did not provide adequate spacing from Catawba Street (NC 7). The analysis in this TIA is based on the initial site plan that included this driveway. However, the final recommendations reflect consideration for this driveway being removed where only three driveways are proposed (still referred to as Access 2-4 for purposes of this TIA).*

A TIA Scoping Meeting was held with the City of Belmont, NCDOT and representatives of the applicant in Belmont on April 18, 2019, to obtain background information and to ascertain the scope

and parameters to be included in this TIA. The City's Memorandum of Understanding (MOU) was developed based on discussions from this meeting that documented all scoping parameters to be used for the TIA and was reviewed and agreed upon by the City of Belmont, NCDOT and the applicant. The approved MOU is included in the **Appendix**.

The following AM and PM peak-hour scenarios were analyzed to determine the proposed development's transportation impacts on the surrounding network:

- 2019 Existing Conditions
- 2022 Background Conditions
- 2022 Build-out Conditions
- 2027 Build-out Conditions + 5 years

Based on the expected site trip generation and discussions of projected travel patterns for the proposed site trips in context with the surrounding area, this TIA evaluated operations under each of the AM and PM peak-hour scenarios above for the following study area intersections as agreed upon at the TIA Scoping Meeting:

1. Main Street and Catawba Street (NC 7)
2. Keener Boulevard/Park Street (NC 273) and Catawba Street (NC 7)
3. Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue
4. Main Street and Myrtle Street/McLeod Avenue
5. N Main Street (NC 7) and N Central Avenue
6. Park Street (NC 273) and Hawley Avenue/Planetree Drive
7. Catawba Street (NC 7) and 1st Street
8. 1st Street and Back Street
9. 1st Street and Brook Street
10. Keener Boulevard (NC 273) and Brook Street
11. 1st Street and Access 1 (build-out conditions)
12. 1st Street and Access 2 (build-out conditions)
13. Back Street and Access 3 (build-out conditions)
14. Short Street and Access 4 (build-out conditions)

Note the following modifications from the background data collected were applied to the capacity analyses to meet NCDOT *Congestion Management Capacity Analysis Guidelines*:

- Right-turn-on-red (RTOR) operations were not allowed.
- Protected-only left-turn phasing was used for analysis of future operations where protected/permitted left-turn phasing is planned.
- Lost time adjust was added to the yellow and all-red times provided in the existing signal plans to maintain a total lost time of 5 seconds for each movement.

Kimley-Horn was retained to determine the potential transportation impacts of this development (in accordance with the traffic study guidelines in the *NCDOT Policy on Street and Driveway Access to North Carolina Highways* and set forth by the *City of Belmont Land Development Code – Section 16.14 Traffic Impact Analysis*) and to identify transportation improvements that may be required to mitigate these impacts. This report presents trip generation, distribution, capacity analyses, crash analyses and identified transportation improvements required to mitigate anticipated traffic demands produced by the subject development.

Based on the capacity analyses performed at each of the identified study intersections, along with review of the auxiliary turn-lane warrants and crash analyses contained herein, the following improvements are identified to mitigate the impact of the proposed development on the adjacent street network:

Keener Boulevard (NC 273) and Catawba Street (NC 7)

- Northbound right-turn lane along Keener Boulevard (NC 273) with 100' of storage

Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue

- Restripe the northbound approach of R L Stowe Road to provide a shared left/through lane and an exclusive right-turn lane
- Permitted-overlap phasing for the northbound right-turn movement along R L Stowe Road

1st Street and Access 1

- *Since the July 2019 TIA submittal, proposed Access 1 has been removed*

1st Street and Access 2

- Single eastbound egress and single ingress lane along Access 2

Back Street and Access 3

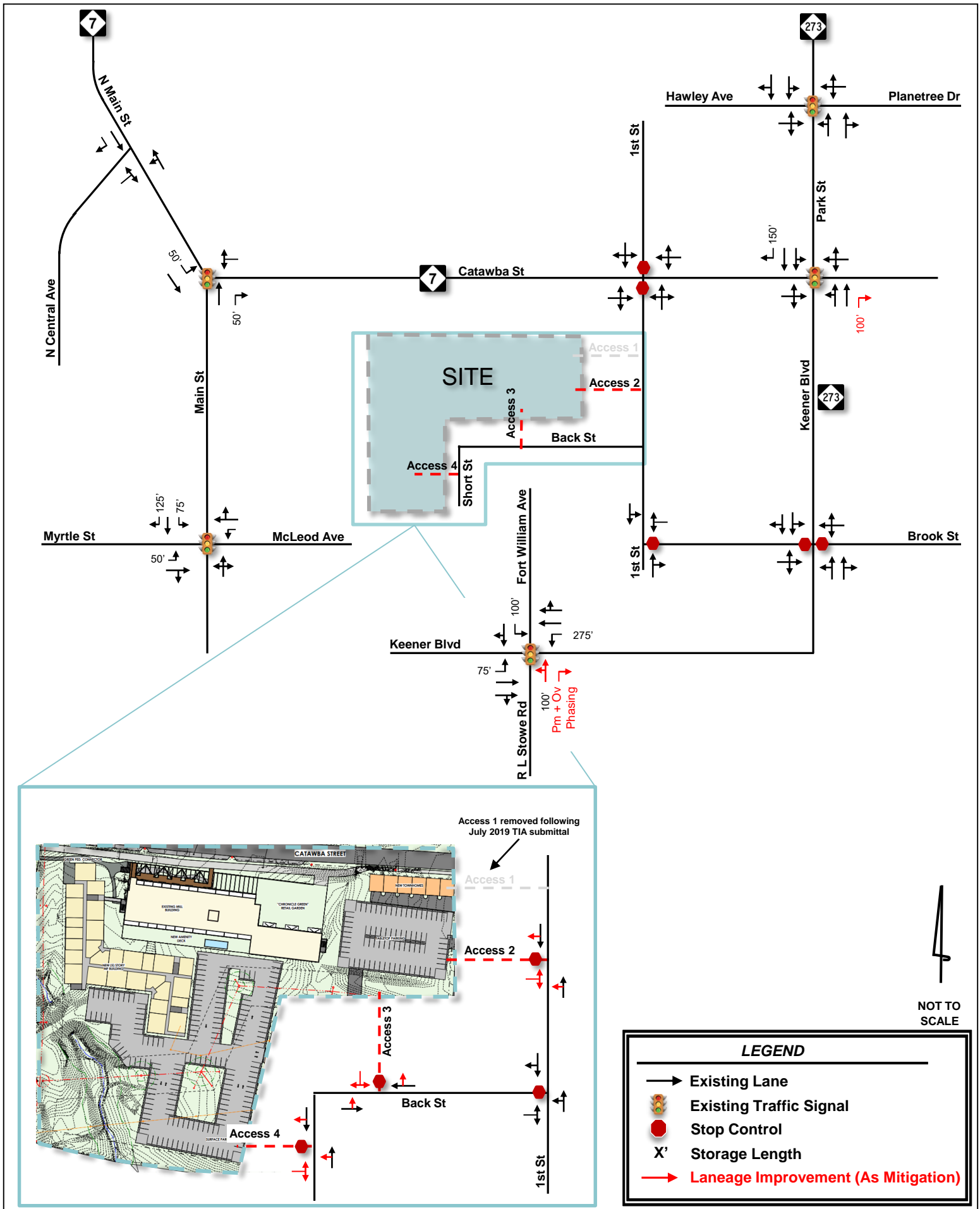
- Single southbound egress and single ingress lane along Access 3

Short Street and Access 4

- Single eastbound egress and single ingress lane along Access 4

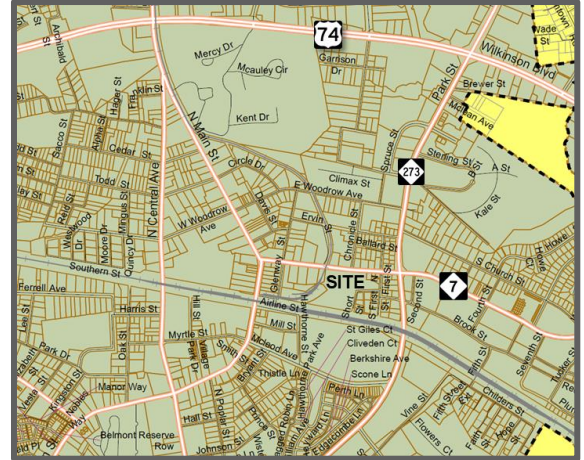
Based on review and coordination with the City, NCDOT and the applicant since the July 2019 TIA submittal, an eastbound right-turn lane along Catawba Street (NC 7) at 1st Street is not required to be installed to mitigate the impact of the proposed Chronicle Mill development. The right-turn lane was initially considered based on NCDOT's auxiliary turn-lane warrants where 37 projected right-turn movements warrants a 50-foot turn lane based on this graph; however, this volume warrant does not meet NCDOT's minimum 100-foot turn-lane length. In addition, the overall site density did not meet NCDOT's TIA threshold. Given the low right-turn volume, along with the low-speed, downtown character of this portion of Catawba Street (NC 7) and the potential impacts to the proposed site development, the eastbound right-turn lane is not required.

The mitigation improvements identified within the study area are shown in **Figure 1.1**. The improvements shown on this figure are subject to approval by NCDOT and the City of Belmont. All additions and attachments to the State and City roadway system shall be properly permitted, designed and constructed in conformance to standards maintained by the agencies.



2.0 Introduction

The proposed Chronicle Mill mixed-use redevelopment is located in the southwest quadrant of the Catawba Street (NC 7) and 1st Street intersection, just west of Keener Boulevard (NC 273) in Belmont, North Carolina. A vacant mill currently sits on the seven-acre site, previously used for the textile industry dating back to the early 1900s. The mill has been vacant since 2010 and is proposed to be repurposed to include a mix of residential and retail uses. Based on the site plan provided by the applicant, the proposed development is currently envisioned to include up to 250 multifamily dwelling units along with 8,650 square feet of retail space.



The proposed development exceeded the City of Belmont's TIA threshold as established by the *City of Belmont Land Development Code – Section 16.14 Traffic Impact Analysis*, resulting in the requirement of this study. The overall site density did not meet NCDOT's TIA threshold; however, it should be noted that coordination also occurred with NCDOT staff in review of the assumptions and methodology documented in this TIA.

For the purposes of this TIA, the development is assumed to be completed (built-out) in 2022. Based on the provided site plan, the proposed development will be accessed via the following access points:

- *Access 1 – A full movement, unsignalized driveway connection to 1st Street approximately 60 feet south of Catawba Street (NC 7); intended connection for proposed townhomes
- Access 2 – A full movement, unsignalized driveway connection to 1st Street approximately 120 feet south of Catawba Street (NC 7); intended connection for proposed retail parking
- Access 3 – A full movement, unsignalized driveway connection to Back Street approximately 165 feet west of 1st Street; intended alternate connection for proposed retail parking
- Access 4 – A full movement, unsignalized driveway connection to Short Street, which serves as an extension of Back Street; intended connection for proposed multifamily/retail surface parking

**Note that since the July 2019 TIA submittal, the City and applicant have agreed to remove Access 1 as its location did not provide adequate spacing from Catawba Street (NC 7). The analysis in this TIA is based on the initial site plan that included this driveway. However, the final recommendations reflect consideration for this driveway being removed where only three driveways are proposed (still referred to as Access 2-4 for purposes of this TIA).*

A TIA Scoping Meeting was held with the City of Belmont, NCDOT and representatives of the applicant in Belmont on April 18, 2019, to obtain background information and to ascertain the scope and parameters to be included in this TIA. The City's MOU (included in the **Appendix**) was developed based on discussions from this meeting that documented all scoping parameters to be used for the TIA and was reviewed and agreed upon by the City, NCDOT and the applicant.

Kimley-Horn was retained to determine the potential transportation impacts of this development (in accordance with the traffic study guidelines in the *NCDOT Policy on Street and Driveway Access to North Carolina Highways* and set forth by the *City of Belmont Land Development Code – Section 16.14 Traffic Impact Analysis*) and to identify transportation improvements that may be required to mitigate these impacts. This report presents trip generation, distribution, capacity analyses, crash analyses and identified transportation improvements required to mitigate anticipated traffic demands produced by the subject development.

3.0 Existing Traffic Conditions

Existing traffic conditions were coordinated with City of Belmont and NCDOT staff and collected through field observations and turning-movement counts to establish the existing conditions baseline analysis.

3.1 STUDY AREA

Based on coordination with the City, NCDOT and the applicant, the study area for this TIA includes the following existing intersections:

1. Main Street and Catawba Street (NC 7)
2. Keener Boulevard/Park Street (NC 273) and Catawba Street (NC 7)
3. Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue
4. Main Street and Myrtle Street/McLeod Avenue
5. N Main Street (NC 7) and N Central Avenue
6. Park Street (NC 273) and Hawley Avenue/Planetree Drive
7. Catawba Street (NC 7) and 1st Street
8. 1st Street and Back Street
9. 1st Street and Brook Street
10. Keener Boulevard (NC 273) and Brook Street

The study area was based on the *City of Belmont Land Development Code – Section 16.14 Traffic Impact Analysis*, which states “The limits of the study area shall be based on the location, size and extent of the proposed project, and an understanding of existing and future land uses and traffic conditions surrounding the site. The limits of the study area for the TIA shall be reviewed and approved by the City and NCDOT staff at the mandatory scoping meeting. At a minimum, the study area shall include all streets and signalized intersections within a 1-mile radius of the proposed site and/or where site traffic estimated for build-out of the project will constitute 10% or more of any signalized intersection approach during the peak hour. Unsignalized intersections between the required signalized intersections will be added to the scope as directed by the City.” Based on the 1-mile radius, up to seventeen potential signalized intersections were discussed. Given the expected site trip generation and based on discussions of projected travel patterns for the proposed site trips in context with the surrounding area, the study area listed above was agreed upon at the TIA Scoping Meeting and reviewed and approved by the City, NCDOT and the applicant as documented in the approved MOU included in the **Appendix**.

Figure 3.1 shows the study area intersections and the site location, **Figure 3.2** shows the proposed site plan for the development as provided by the applicant and **Figure 3.3** shows the existing roadway geometry at the study intersections. A full-sized site plan to scale is provided in the **Appendix**.

The primary roadways in the vicinity of the site are Catawba Street (NC 7), Keener Boulevard/Park Street (NC 273), Main Street and R L Stowe Road. The information below describes existing conditions for portions of these roadways within the vicinity of the site.

Catawba Street (NC 7) is a two-lane, undivided highway with a posted speed limit of 35 mph in the vicinity of the proposed site and transitions to 20 mph towards the west near the downtown core. This state highway is classified as a minor arterial by NCDOT’s functional classification system and as a major thoroughfare by Gaston-Cleveland-Lincoln Metropolitan Planning Organization

(GCLMPO). Based on 2017 NCDOT annual average daily traffic (AADT) maps, Catawba Street (NC 7) carries an AADT volume of 3,700 vehicles per day (vpd) west of Keener Boulevard/Park Street (NC 273) and 4,700 vpd east of Keener Boulevard/Park Street (NC 273).

Keener Boulevard/Park Street (NC 273) is a four-lane, undivided roadway with a posted speed limit of 35 mph through the study area. Keener Boulevard/Park Street (NC 273) is classified by NCDOT's functional classification system as a minor arterial and as a boulevard by GCLMPO. Based on 2017 NCDOT AADT maps, NC 273 carries an AADT volume of 18,000 vpd north of Catawba Street (NC 7) and 19,000 vpd south of Catawba Street (NC 7).

Main Street, designated as NC 7 north of Catawba Street, is a two-lane, undivided roadway with intermittent on-street parking within the downtown core and a posted speed limit of 20 mph through downtown, transitioning to 25 mph north of Woodrow Avenue. Main Street is classified by NCDOT's functional classification system as a minor arterial and as a major thoroughfare by GCLMPO. Based on 2017 NCDOT AADT maps, Main Street carries an AADT volume of 4,500 vpd north of Catawba Street (NC 7) and 5,400 vpd south of Catawba Street (NC 7).

3.2 EXISTING INTERSECTION VOLUME DEVELOPMENT

AM (6:30-8:30) and PM (4:30-7:00) intersection turning-movement, heavy-vehicle, pedestrian and bicycle counts were performed by National Data & Surveying Services on Tuesday, May 14, 2019, at the following intersections:

1. Main Street and Catawba Street (NC 7)
2. Keener Boulevard/Park Street (NC 273) and Catawba Street (NC 7)
3. Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue
4. Main Street and Myrtle Street/McLeod Avenue
5. N Main Street (NC 7) and N Central Avenue
6. Park Street (NC 273) and Hawley Avenue/Planetree Drive
7. Catawba Street (NC 7) and 1st Street
8. 1st Street and Back Street
9. 1st Street and Brook Street
10. Keener Boulevard (NC 273) and Brook Street

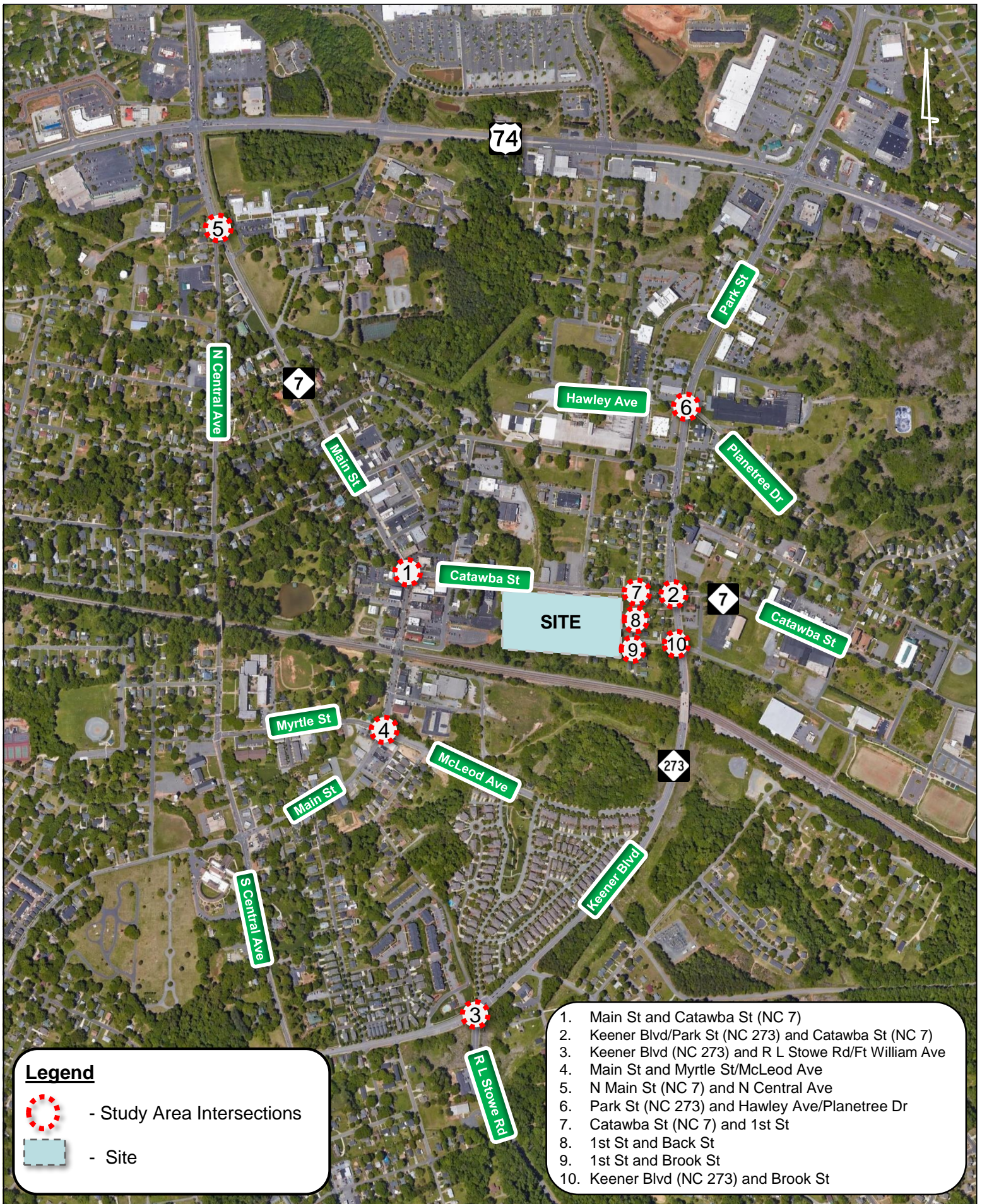
The AM and PM peak hours identified differed amongst some of the study intersections. The AM peak hour was found to be 7:15-8:15 AM at all but two of the study intersections, while the PM peak hour was more varied. The specific peak hour of each individual intersection was used as the baseline data to represent the highest collected traffic volumes within the specified count timeframes. The peak hours for each of the intersections are shown in **Table 3.1**.

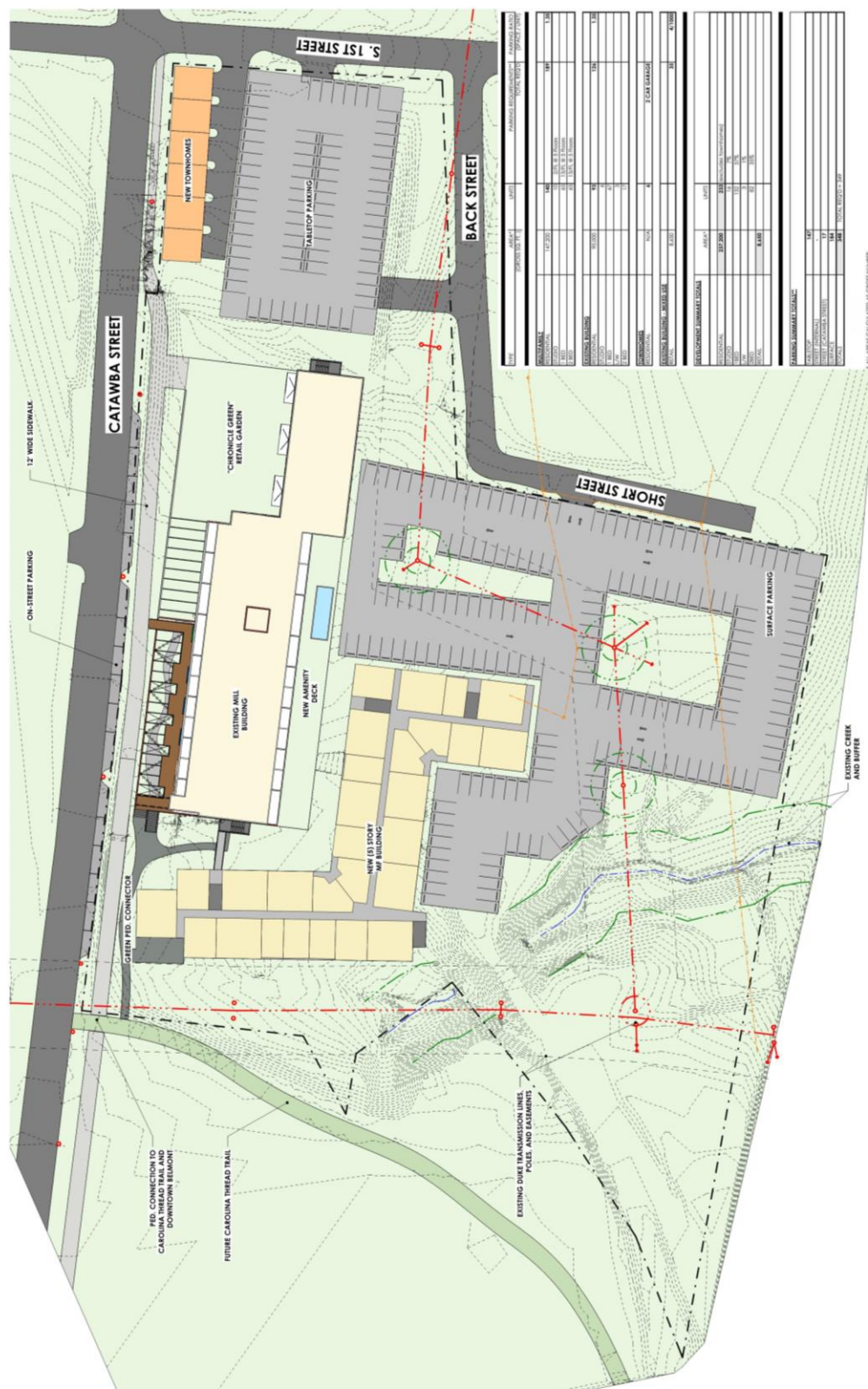
Table 3.1 – AM & PM Intersection Peak Hours

Intersection	AM Peak Hour	PM Peak Hour
1. Main Street and Catawba Street (NC 7)	7:15 AM - 8:15 AM	4:30 PM - 5:30 PM
2. Keener Blvd/Park St (NC 273) and Catawba St (NC 7)	7:00 AM - 8:00 AM	4:45 PM - 5:45 PM
3. Keener Blvd (NC 273) and RL Stowe Rd/Fort William Ave	7:15 AM - 8:15 AM	5:00 PM - 6:00 PM
4. Main Street and Myrtle Street/McLeod Avenue	7:15 AM - 8:15 AM	4:30 PM - 5:30 PM
5. N Main Street (NC 7) and N Central Avenue	7:30 AM - 8:30 AM	5:00 PM - 6:00 PM
6. Park St (NC 273) and Hawley Ave/Planetree Dr	7:15 AM - 8:15 AM	4:45 PM - 5:45 PM
7. Catawba Street (NC 7) and 1 st Street	7:15 AM - 8:15 AM	4:30 PM - 5:30 PM
8. 1 st Street and Back Street	7:15 AM - 8:15 AM	5:30 PM - 6:30 PM
9. 1 st Street and Brook Street	7:15 AM - 8:15 AM	5:30 PM - 6:30 PM
10. Keener Boulevard (NC 273) and Brook Street	7:15 AM - 8:15 AM	4:45 PM - 5:45 PM

Volumes were balanced along 1st Street between Back Street and Brook Street and along Brook Street between 1st Street and Keener Boulevard (NC 273) due to the short distance and limited driveways. However, no other volume balancing was performed throughout the study area due to the presence of public streets and other commercial and residential driveways. Peak-hour intersection turning-movement count data is provided in the **Appendix**.

Figure 3.4 shows the 2019 existing AM and PM peak-hour traffic volumes.

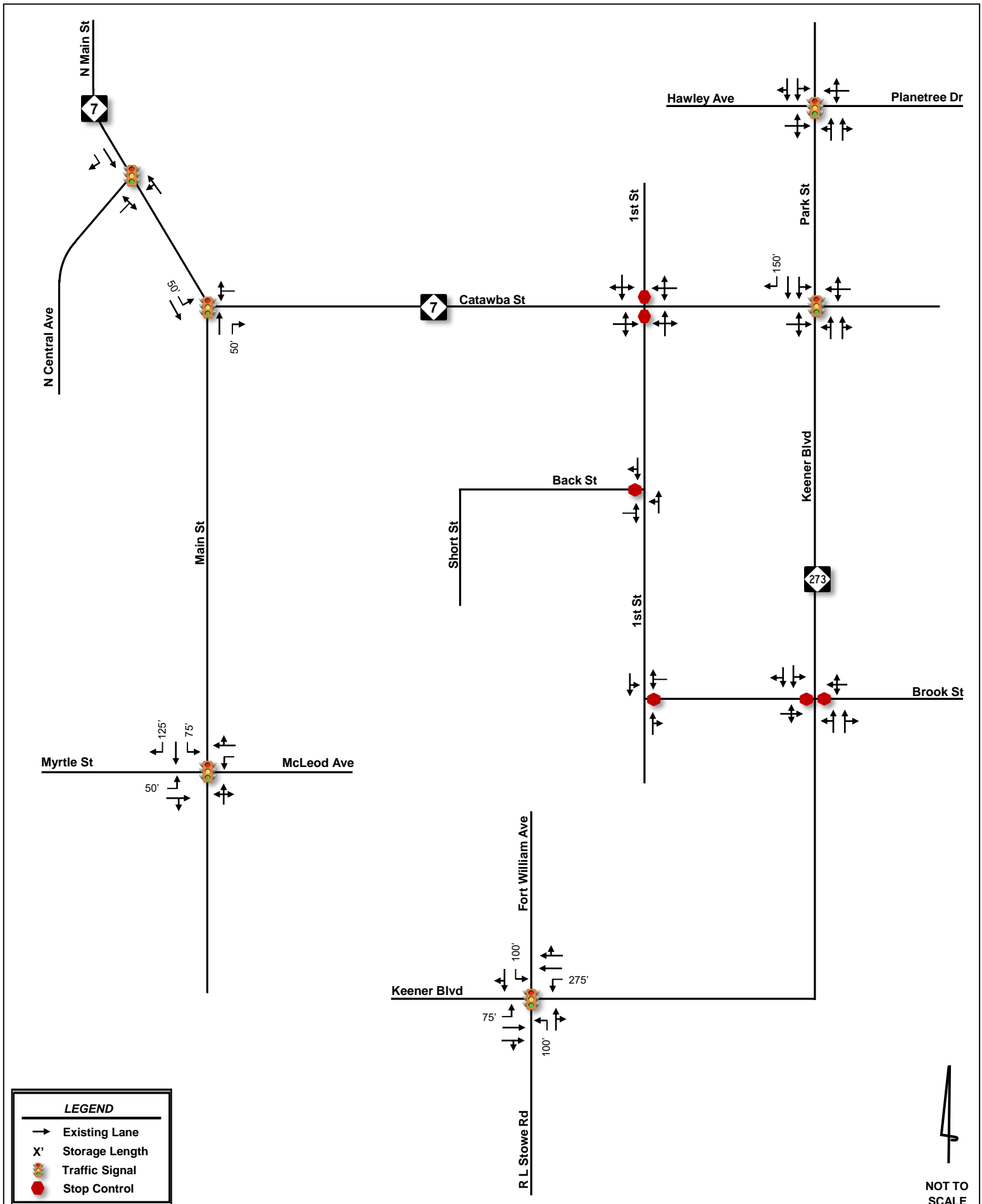




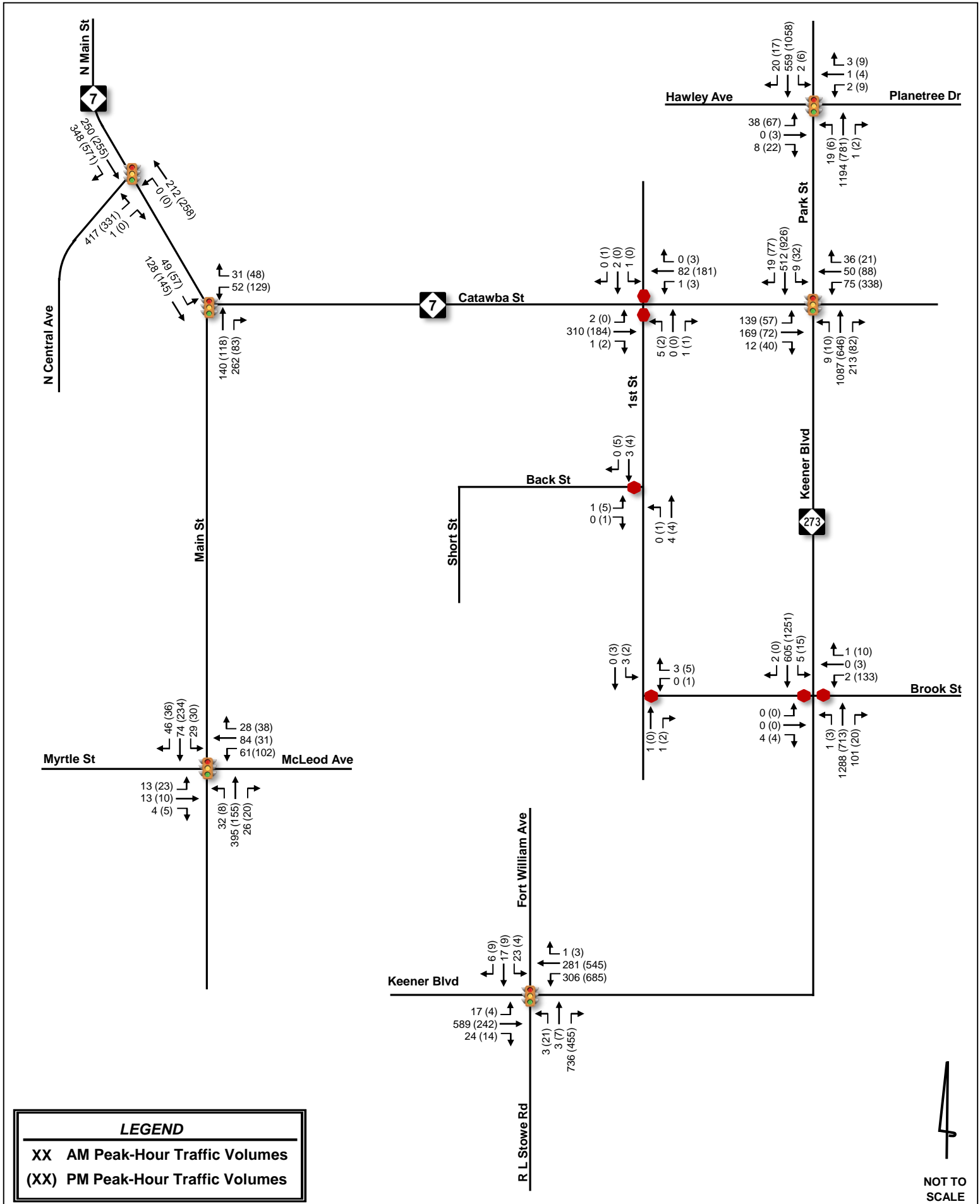
ALL AREAS CALCULATED AS GROSS NUMBER

Site Plan
SCALE: 1/32" = 1'-0"

1
A0.01



NOT TO SCALE



4.0 Background Traffic Volume Development

Projected background (non-project) traffic is defined as the expected growth or change in traffic volumes on the surrounding roadway network between the year the existing counts were collected (2019) and the expected build-out year (2022) absent the construction and opening of the proposed project. This includes both non-specific general growth based on historical increase in local traffic volumes (historical background growth), along with specific growth and/or change in traffic volumes caused by approved off-site developments that are not yet fully-constructed, and/or planned transportation projects specifically identified within the vicinity of the proposed development.

4.1 HISTORICAL BACKGROUND GROWTH TRAFFIC

Historical background growth is the increase in existing traffic volumes due to usage increases and non-specific growth throughout the area, and accounts for growth that is independent of specific off-site developments or planned transportation projects. Historical background growth traffic is calculated using an annual growth rate, which is applied to the existing traffic volumes up to the future horizon years. As shown in the approved MOU, an annual growth rate of two percent (2%) was applied to the 2019 existing peak-hour traffic volumes to calculate base 2022 and 2027 background traffic volumes. This growth rate was determined based on review of historical NCDOT AADT maps, specifically along Catawba Street (NC 7) between 2002 and 2016, in coordination with NCDOT and City of Belmont staff, along with consideration of the additional specific traffic being added by the approved developments discussed below.

4.2 APPROVED DEVELOPMENTS

Based on input from the City of Belmont and NCDOT staff, two approved developments that are expected to impact traffic volumes within the study area were included in the background traffic volumes for this TIA. These developments, land uses and intensities, and approximate build-out percentages are outlined in **Table 4.1**.

Table 4.1 – Approved Developments

Development	Land Use/Intensity	% Build-out	TIA Included?	Required Improvements
The Morris (Wayforth)	325 Apartments	0%	Yes	No required improvements at study intersections
Aberfoyle	132 Apartments 60 Townhomes (Per TTM)	4%	Yes (TTM)	No required improvements at study intersections

The Morris development was previously known as Wayforth at Belmont at the time the TIA was performed. Site volumes for The Morris (Wayforth) and Aberfoyle developments were obtained from the *Wayforth at Belmont Traffic Impact Analysis* (Kimley-Horn, February 2019) and the *Aberfoyle Rezoning Transportation Technical Memorandum* (Kimley-Horn, July 2017), respectively. Existing turning-movement splits were used to carry and assign these site volumes appropriately at study area intersections that were not included in the approved studies. Site traffic volume figures from the approved studies are included in the **Appendix**.

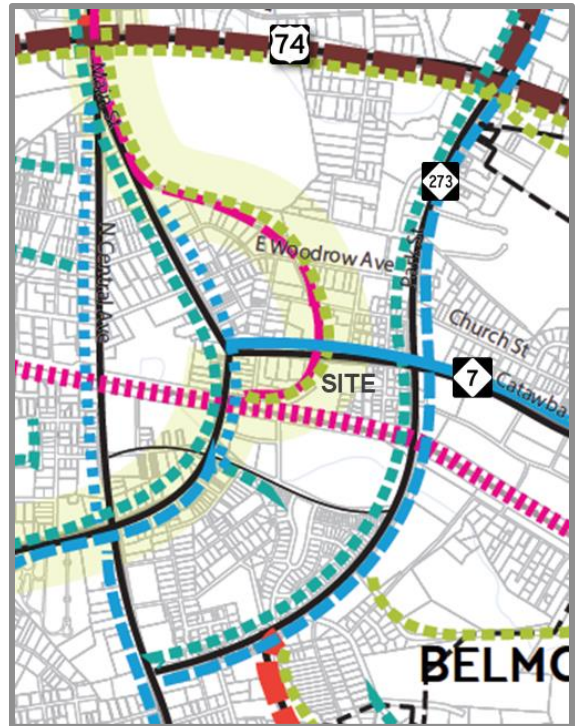
Figures 4.1 and **4.2** show the specific AM and PM peak-hour approved development trips, respectively. **Figures 4.3** and **4.4** show the projected 2022 background AM and PM peak-hour traffic volumes, respectively, that include the historical growth traffic and approved development trips.

4.3 PLANNED TRANSPORTATION PROJECTS

Based on review of the adopted transportation plans for the area, two future transportation projects have been identified within the study area. However, neither of these are currently funded based on the current planning documents and therefore were not included in the operations analyses discussed in **Section 6**. These projects include:

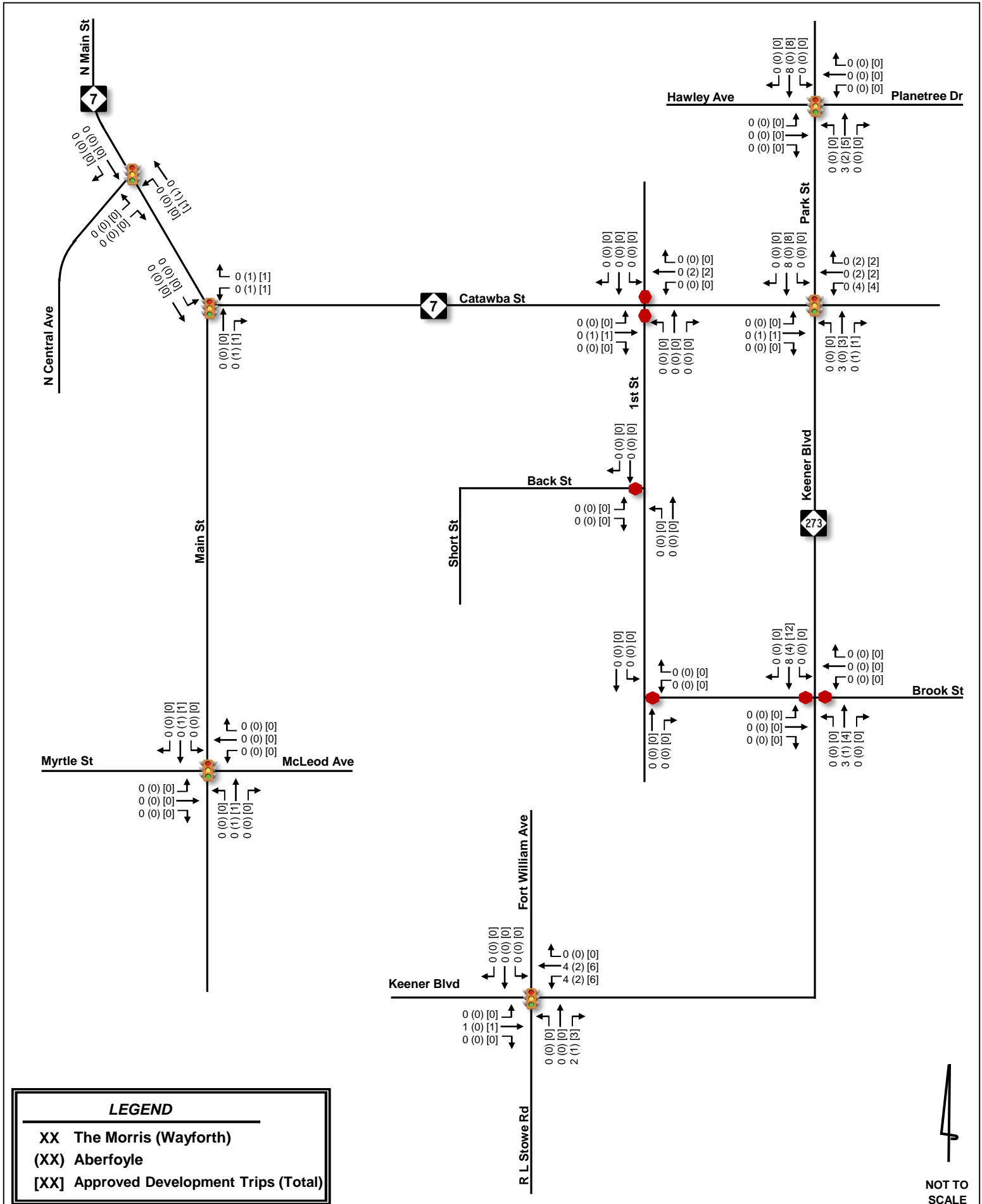
1. Proposed Multi-Use Path (through Proposed Site)
2. Keener Boulevard/Park Street (NC 273) On-Street Bike Lanes and Sidewalk

A multi-use path has been identified along the inactive rail line that crosses Catawba Street (NC 7) and runs along the western frontage of the proposed site based on Belmont's *Comprehensive Land Use Plan* (adopted in 2018), GCLMPO's *Comprehensive Transportation Plan* (CTP), as well as the Carolina Thread Trail's *Gaston County Master Plan*. An image from the Future Transportation Map within Belmont's *Comprehensive Land Use Plan* (CLUP) is shown to the right. The green-dotted line shown to run along the west side of the proposed site represents a proposed multi-use path or greenway. The thicker, but lighter green swath represents a Carolina Thread Trail corridor. Given the alignment identified in close proximity to the site, the specific multi-use path alignment should be reviewed with Carolina Thread Trail, GCLMPO and City of Belmont staff to determine if the portion of the planned multi-use path adjacent to the site should be incorporated into the site plan. It is important that the applicant coordinate with these agencies early in the site planning phase to determine the appropriate alignment and cross-section of this greenway.

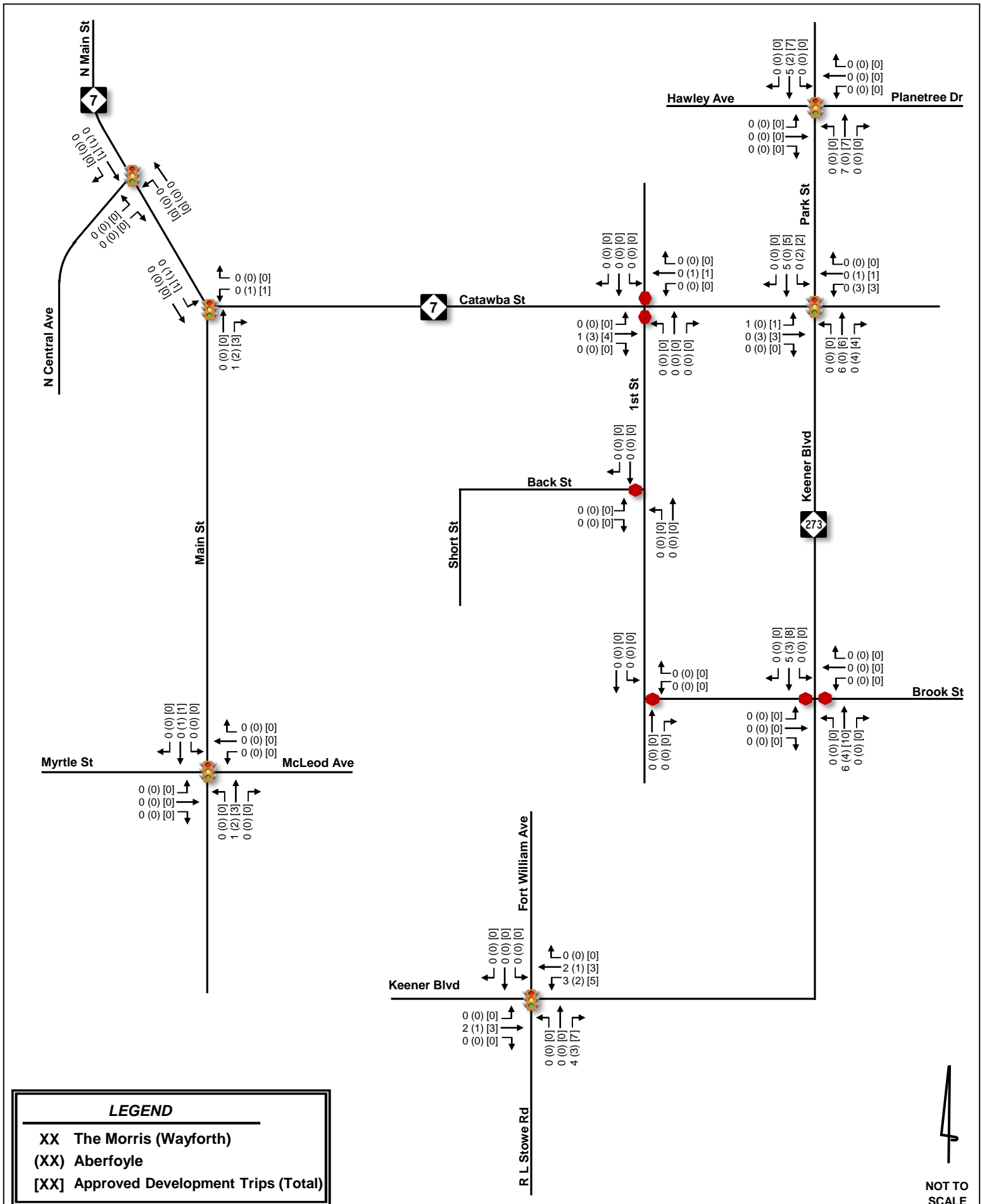


Below is additional information found in the adopted transportation planning documents relative to each of the identified projects:

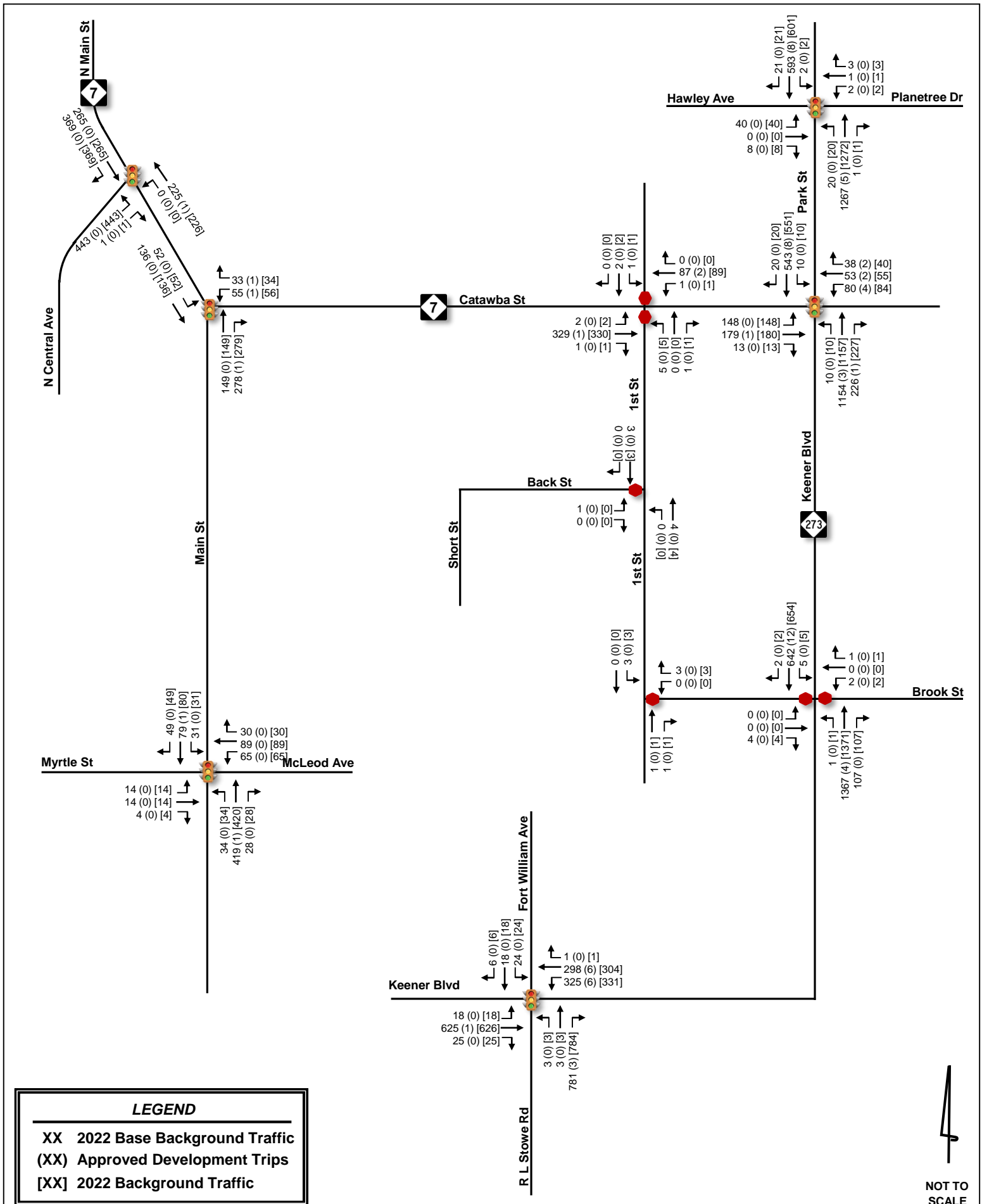
- **Proposed Multi-Use Path (through Proposed Site)**
 - Recommended multi-use path along inactive rail line
 - Included in the following transportation planning documents:
 - Belmont's *Comprehensive Land Use Plan* (2018)
 - Belmont Bicycle Master Plan (2012)
 - Belmont Pedestrian Master Plan (2009)
 - GCLMPO CTP
 - Carolina Thread Trail
- **Keener Boulevard/Park Street (NC 273) On-Street Bike Lanes and Sidewalk**
 - Proposed bike lanes/sidewalk along Park St (NC 273) between I-85 and Central Ave
 - Included in the following transportation planning documents:
 - Belmont's *Comprehensive Land Use Plan* (2018)
 - Belmont Bicycle Master Plan (2012)
 - GCLMPO CTP (Bicycle Plan)

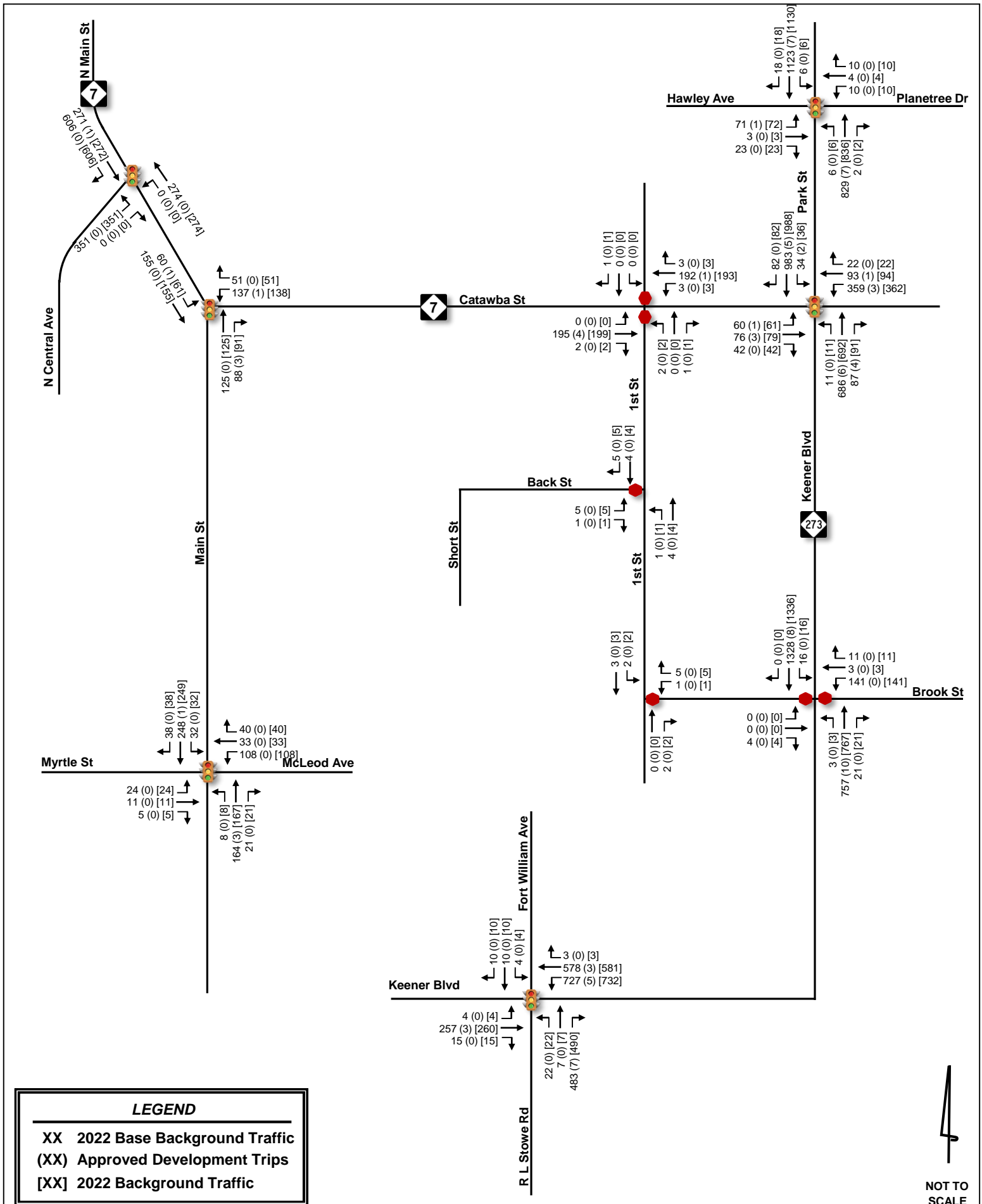


NOT TO SCALE



NOT TO SCALE





5.0 Site Traffic Volume Development

Site traffic developed for this TIA is defined as the site-generated vehicular trips expected to be added to the study area by the construction of the proposed development, and the distribution and assignment of that traffic throughout the surrounding network.

5.1 SITE ACCESS

Based on the site plan provided by the applicant, the proposed development will be accessed via the following access points:

- *Access 1 – A full movement, unsignalized driveway connection to 1st Street approximately 60 feet south of Catawba Street (NC 7); intended connection for proposed townhomes
- Access 2 – A full movement, unsignalized driveway connection to 1st Street approximately 120 feet south of Catawba Street (NC 7); intended connection for proposed retail parking
- Access 3 – A full movement, unsignalized driveway connection to Back Street approximately 165 feet west of 1st Street; intended alternate connection for proposed retail parking
- Access 4 – A full movement, unsignalized driveway connection to Short Street, which serves as an extension of Back Street; intended connection for proposed multifamily/retail surface parking

**Note that since the July 2019 TIA submittal, the City and applicant have agreed to remove Access 1 as its location did not provide adequate spacing from Catawba Street (NC 7). The analysis in this TIA is based on the initial site plan that included this driveway. However, the final recommendations reflect consideration for this driveway being removed where only three driveways are proposed (still referred to as Access 2-4 for purposes of this TIA).*

5.2 TRAFFIC GENERATION

The traffic generation potential of the proposed development was determined using the trip generation rates published in *Trip Generation* (Institute of Transportation Engineers, Tenth Edition, 2017) for all land uses.

Internally captured trips are trips that begin and end within the project site and do not access the external roadway network. Examples of likely internal capture trips include apartment residents visiting the retail shops. National Cooperative Highway Research Program (NCHRP) Report 684 *Enhancing Internal Trip Capture Estimation for Mixed-Use Developments*, produced by the Transportation Research Board, was used to calculate the internal capture for the development. This report provides extensive research into the internal capture rates for mixed-use developments. Internal capture calculations are included in the **Appendix**.

Pass-by trips are trips already on the roadway network that turn into the site as they pass by on the adjacent street. Pass-by percentages were calculated for the retail component of the proposed site based on the equations and data presented in the ITE *Trip Generation Handbook*, limited to a maximum of ten percent of the adjacent street traffic based on NCDOT and City of Belmont guidelines. Pass-by calculations can be seen in the **Appendix**.

Based on the most recent site plan provided by the applicant, the proposed development is currently envisioned to include the following land uses and intensities:

- 240 multifamily units
- 10 townhome units
- 8,650 square feet of retail space

As discussed at the TIA Scoping Meeting, the specific type of retail use is currently unknown, though is intended to serve the local community and attract pedestrians and bicyclists given the proposed residential uses along with the proximity to the downtown core with existing non-vehicular infrastructure in place. Therefore, multiple trip generation alternatives were performed and reviewed by the City, NCDOT and the applicant during the MOU review process. It was determined that the general shopping center use (ITE 820) is the most appropriate land use category. However, using the fitted linear equation for ITE 820, as recommended by NCDOT's Rate vs Equation spreadsheet, yielded 156 AM peak hour trips, much higher than expected trips given the intended uses. This is likely due to the proposed amount of retail square footage (8,650 square feet) being on the low end of ITE's fitted curve equation, where 351,000 square feet is the average of the 84 studies used by ITE to generate the equation. Note that the PM peak hour is also on the low end of the fitted curve equation; however, the resulting number of PM trips were determined to be reasonable. Therefore, to determine the AM peak-hour site trips, a ratio was first determined comparing ITE 820's average rate for the AM peak hour (0.94) to the PM average rate (3.81). This showed that generally speaking, the expected AM peak-hour site trips for a shopping center is approximately 25% of the expected PM peak-hour site trips. This ratio was then multiplied by the expected number of total PM trips (89) to calculate the expected AM total trips (22). This methodology was reviewed and approved by City and NCDOT staff as part of the MOU.

Table 5.1 summarizes the projected trip generation for the proposed development. During a typical weekday, the proposed development has the potential to generate 106 and 144 net new external trips during the AM and PM peak hours, respectively.

Land Use	Intensity	Daily	AM Peak Hour			PM Peak Hour		
			Total	In	Out	Total	In	Out
Shopping Center*	8,650 SF	1,138	22	14	8	89	43	46
Multifamily Housing Mid-Rise - (Apartments)	240 DU	1,306	81	21	60	103	63	40
Multifamily Housing Low-Rise - (Townhomes)	10 DU	35	5	1	4	8	5	3
Subtotal		2,479	108	36	72	200	111	89
Internal Capture		382	2	1	1	32	16	16
Pass-By		24	0	0	0	24	12	12
Net New External Trips		2,073	106	35	71	144	83	61

*Proposed Retail SF is on low end of AM fitted linear equation resulting in higher-than-expected AM trips; Instead, ratio of AM Rate to PM Rate factored by the PM total trips was used to calculate AM total trips

5.3 SITE TRAFFIC DISTRIBUTION AND ASSIGNMENT

The proposed development's trips were assigned to the surrounding network based on existing peak-hour turning movements, surrounding land uses, locations of similar land use and population densities in the area. The following site traffic distribution was reviewed and approved as part of the MOU by the City of Belmont, NCDOT and the applicant:

- 35% to/from the north along Park Street (NC 273)
- 25% to/from the north along Main Street (NC 7)
- 15% to/from the east along Catawba Street (NC 7)
- 15% to/from the south along R L Stowe Road
- 10% to/from the south and west along Main Street

The overall site traffic distribution and assignment is shown in **Figure 5.1**.

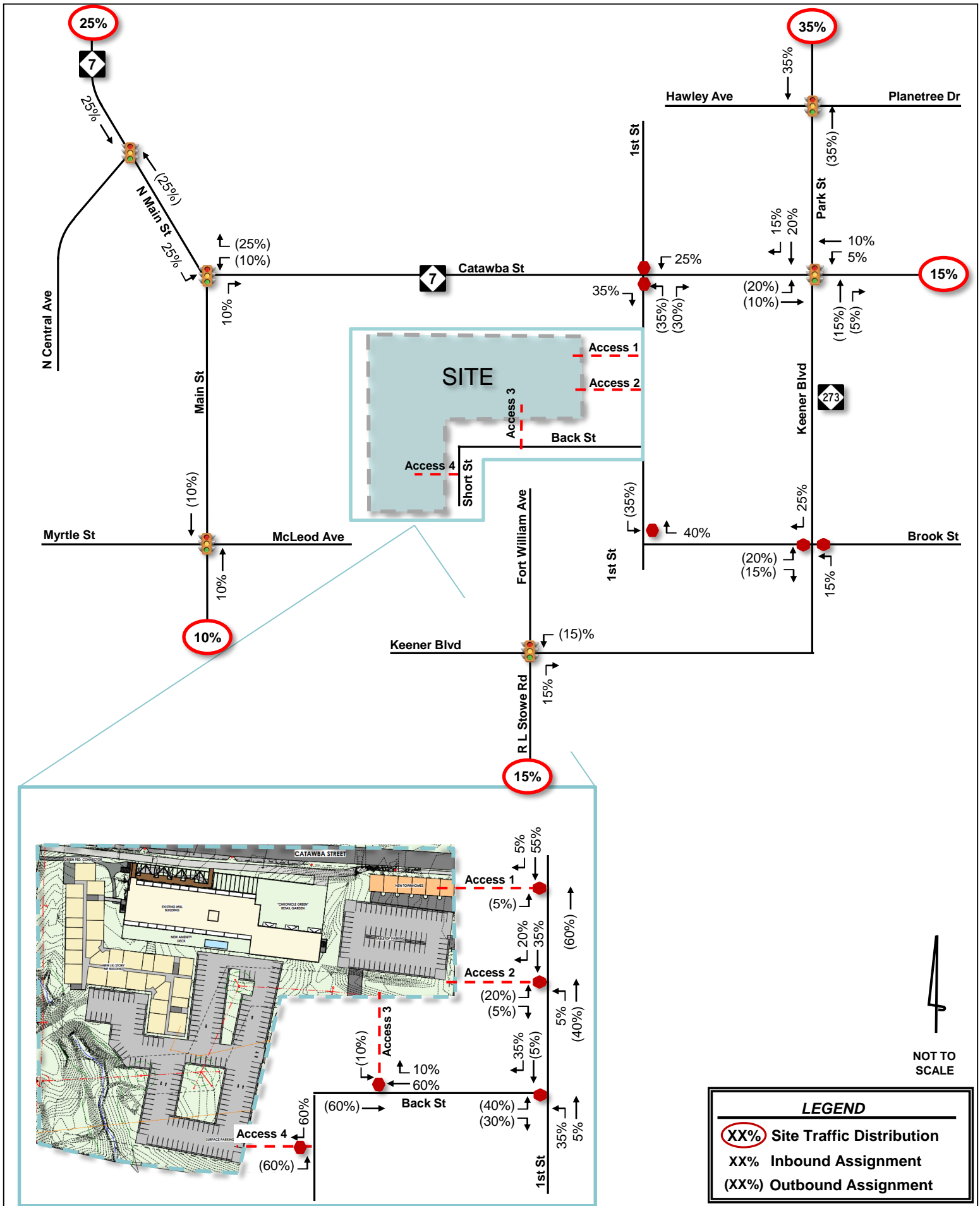
5.4 2022 BUILD-OUT TRAFFIC VOLUMES

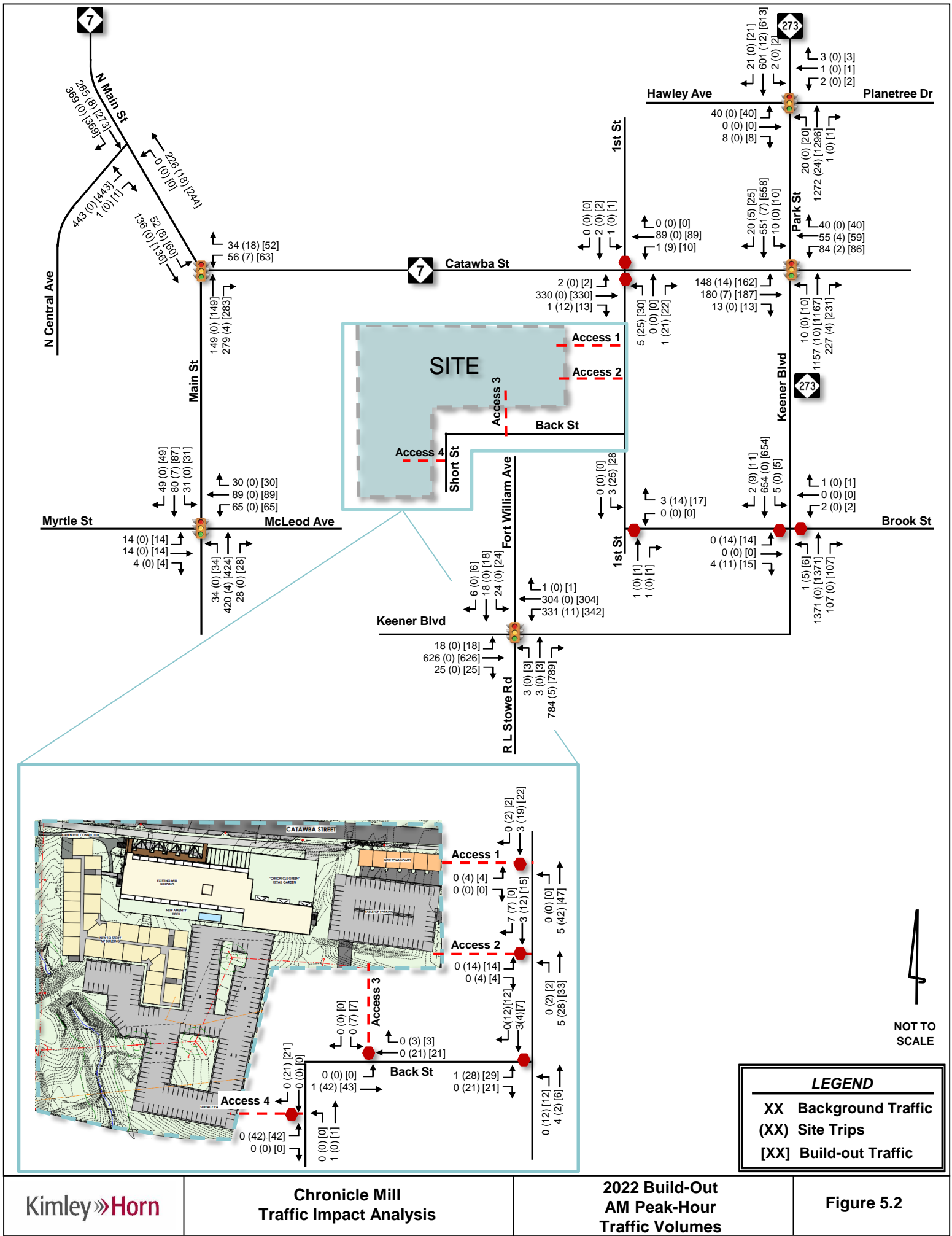
The 2022 build-out traffic volumes include the assignment of the projected site traffic generation added to the 2022 background traffic volumes. **Figures 5.2** and **5.3** show the projected 2022 build-out traffic volumes for the AM and PM peak hours, respectively.

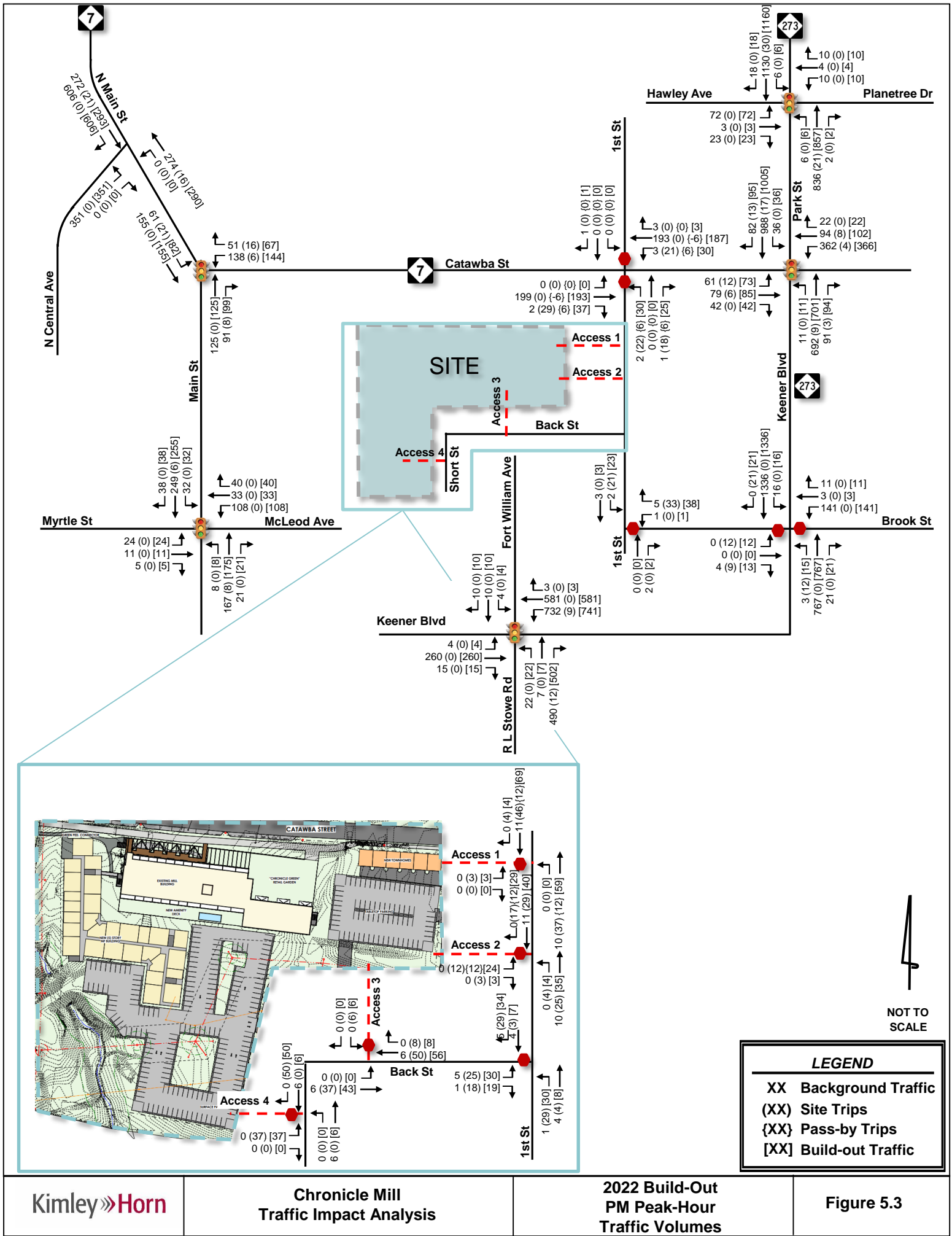
5.5 2027 BUILD-OUT +5 TRAFFIC VOLUMES

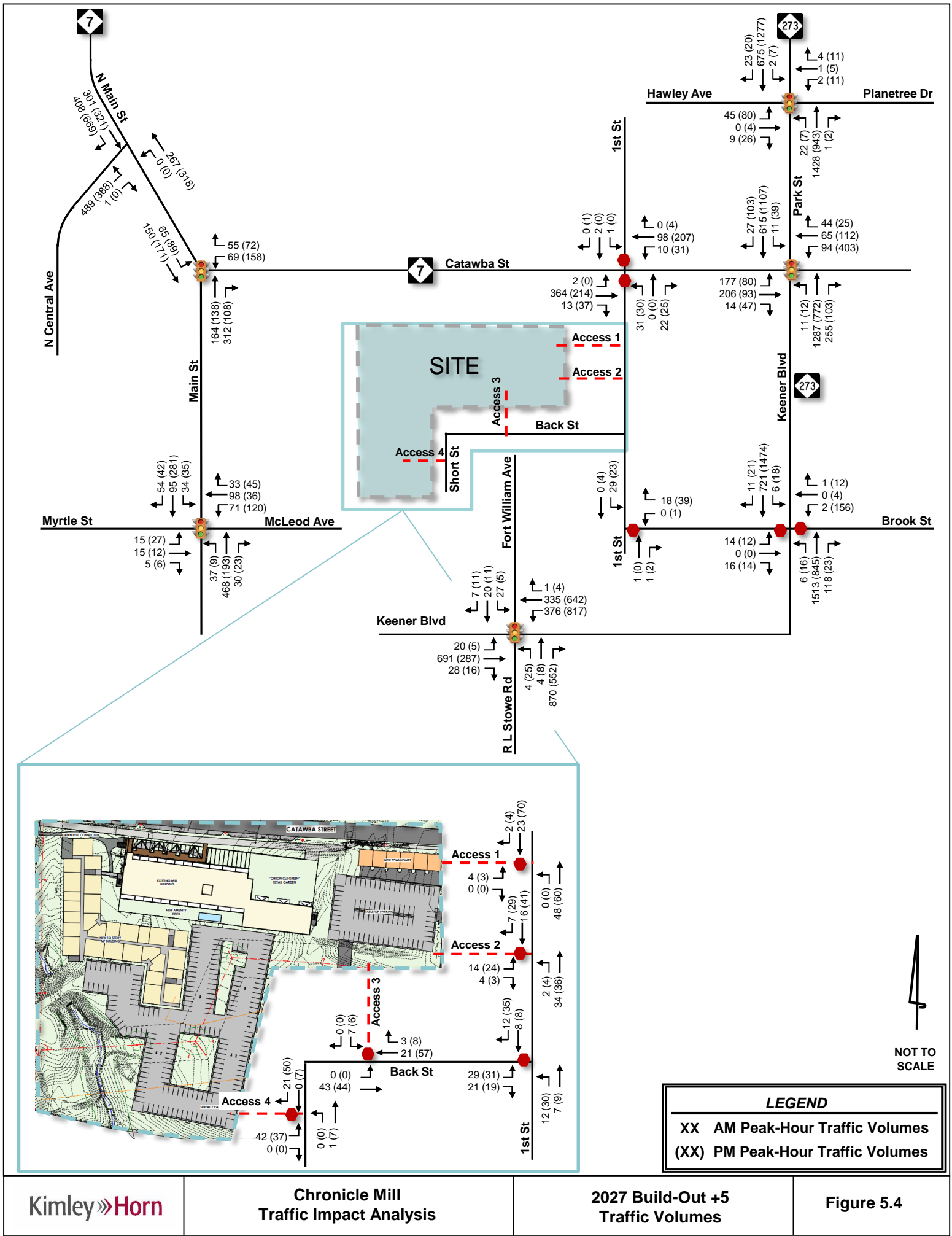
As required by the *City of Belmont Land Development Code – Section 16.14 Traffic Impact Analysis*, an analysis scenario of five years after the build-out year was performed. The 2027 build-out +5 traffic volumes include the assignment of the proposed site traffic generation added to the 2027 base background traffic volumes. **Figure 5.4** shows the projected 2027 AM and PM peak-hour build-out +5 traffic volumes.

Intersection volume development worksheets for all intersections and driveways within the study network are provided in the **Appendix**.









6.0 Capacity Analysis

Based on the requirements set forth by the *City of Belmont Land Development Code – Section 16.14 Traffic Impact Analysis* and in accordance with the traffic study guidelines in the *NCDOT Policy on Street and Driveway Access to North Carolina Highways*, capacity analyses were performed at the study area intersections for each of the following AM and PM peak-hour scenarios:

- 2019 Existing Conditions
- 2022 Background Conditions
- 2022 Build-out Conditions
- 2027 Build-out Conditions + 5 years

Capacity analyses were performed for the AM and PM peak hours using the Synchro Version 10 software to determine the operating characteristics at the signalized and stop-controlled intersections of the adjacent street network and to evaluate the impacts of the proposed development. Capacity is defined as the maximum number of vehicles that can pass over a particular road segment, or through a particular intersection, within a specified period of time under prevailing operational, geometric and controlling conditions within a set time duration.

The *Highway Capacity Manual* (HCM) defines level-of-service (LOS) as a “quantitative stratification of a performance measure or measures representing quality of service” and is used to “translate complex numerical performance results into a simple A-F system representative of travelers’ perceptions of the quality of service provided by a facility or service”. The HCM defines six levels of service, LOS A through LOS F, with A having the best operating conditions from the traveler’s perspective and F having the worst. However, it must be understood that “the LOS letter result hides much of the complexity of facility performance”, and that “the appropriate LOS for a given system element in the community is a decision for local policy makers”. According to the HCM, “for cost, environmental impact, and other reasons, roadways are typically designed not to provide LOS A conditions during peak periods but instead to provide some lower LOS that balances individual travelers’ desires against society’s desires and financial resources. Nevertheless, during low-volume periods of the day, a system element may operate at LOS A.”

LOS for a two-way stop-controlled (TWSC) intersection is determined by the control delay and is reported for the side-street approaches, typically during the highest volume periods of the day, the AM and PM peak periods. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. With respect to field measurements, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue to the time the vehicle departs from the stop line. It is typical for stop sign-controlled side streets and driveways intersecting major streets to experience long delays during peak hours, particularly for left-turn movements. The majority of the traffic moving through the intersection on the major street experiences little or no delay.

LOS for signalized intersections is reported for the intersection as a whole, and typically during the highest volume periods of the day, the AM and PM peak periods. One or more movements at an intersection may experience a low level-of-service, while the intersection as a whole may operate acceptably.

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

Table 6.0-A Vehicular LOS Control Delay Thresholds for Unsignalized Intersections		
Level-of-Service	Average Control Delay per Vehicle [sec/veh]	
A	≤ 10	Short Delays
B	> 10 – 15	
C	> 15 – 25	
D	> 25 – 35	Moderate Delays
E	> 35 – 50	
F	> 50	Long Delays

Table 6.0-B Vehicular LOS Control Delay Thresholds for Signalized Intersections		
Level-of-Service	Average Control Delay per Vehicle [sec/veh]	
A	≤ 10	
B	> 10 – 20	
C	> 20 – 35	
D	> 35 – 55	
E	> 55 – 80	
F	> 80	

NCDOT staff provided the signal geometric plans for each of the following signalized intersections:

- Main Street and Catawba Street (NC 7)
- Keener Boulevard/Park Street (NC 273) and Catawba Street (NC 7)
- Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue
- Main Street and Myrtle Street/McLeod Avenue
- N Main Street (NC 7) and N Central Avenue
- Park Street (NC 273) and Hawley Avenue/Planetree Drive

The provided signal plans were used in the development of the existing conditions Synchro network. The cycle lengths and splits were optimized given the timing inputs in the existing conditions network and in accordance with NCDOT Congestion Management guidelines. Per NCDOT *Congestion Management Capacity Analysis Guidelines*, protected only left-turn phasing was used for analysis of future operations where protected/permitted left-turn phasing exists. With the change from protected/permitted to protected phasing at the intersection of Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue, the splits were optimized at this intersection only under background conditions and maintained throughout the build-out and build-out +5 scenarios. The cycle lengths and splits were maintained at the remaining signalized intersections from existing conditions through all scenarios except where noted. Signal geometric plans are included in the **Appendix**.

The following modifications from the background data collected were applied to the capacity analyses to meet NCDOT *Congestion Management Capacity Analysis Guidelines*:

- RTOR operations were not allowed.
- Protected-only left-turn phasing was used for analysis of future operations where protected/permitted left-turn phasing is planned.
- Lost time adjust was added to the yellow and all-red times provided in the existing signal plans to maintain a total lost time of 5 seconds for each movement.

Note that peak-hour turning movement volumes less than four were not changed to four vehicles per hour in the analysis. Given that these volumes were located on movements where little to no volume would be regularly expected during the peak hours (e.g., turning movements at the unsignalized intersections near the site along 1st Street and Back Street), the counted traffic volumes were maintained.

Per NCDOT capacity analysis guidelines, existing peak-hour factors were used in the 2019 existing conditions analysis, and a peak-hour factor of 0.9 was used for all future-year scenarios. Heavy-vehicle percentages collected with the counts were used and maintained for all scenarios, subject to a two-percent minimum.

Mitigation for traffic impacts caused by the proposed development were noted and identified based on City of Belmont and NCDOT mitigation requirements. When determining the proposed development's traffic impact to the study area intersections, the 2022 build-out conditions were compared to the 2022 background conditions. Based on the *City of Belmont Land Development Code*, "the applicant shall be required to identify mitigation improvements to the roadway network if at least one of the following conditions exists when comparing future year background conditions to future year build-out conditions:

- a) the total average delay at an intersection or individual approach increases by 25% or greater, while maintaining the same LOS,
- b) the LOS degrades by at least one level,
- c) or the LOS is "D" or worse in background conditions and the proposed project shows a negative impact on the intersection or approach"

Capacity analysis reports generated by Synchro Version 10 software are included in the **Appendix** along with queuing and blocking reports generated by the SimTraffic microsimulation model.

6.1 MAIN STREET AND CATAWBA STREET (NC 7)

Table 6.1 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized, tee-intersection of Main Street and Catawba Street (NC 7).

Table 6.1 - Main Street and Catawba Street (NC 7)							
Condition	Measure	WB	NB		SB		Intersection
		WBLR	NBT	NBR	SBL	SBT	LOS (Delay)
AM Peak Hour							
2019 Existing	LOS (Delay)	B (15.4)	A (7.5)		A (10.0)		A (9.2)
	Synchro 95th Q	m56'	32'	56'	27'	53'	
2022 Background	LOS (Delay)	B (16.2)	A (7.6)		A (9.8)		A (9.3)
	Synchro 95th Q	m61'	34'	56'	29'	59'	
2022 Build-out	LOS (Delay)	B (16.0)	A (7.6)		A (9.9)		A (9.5)
	Synchro 95th Q	m72'	34'	57'	32'	59'	
2027 Build-out +5	LOS (Delay)	B (16.0)	A (7.8)		B (10.0)		A (9.6)
	Synchro 95th Q	m76'	37'	62'	34'	64'	
PM Peak Hour							
2019 Existing	LOS (Delay)	B (12.6)	A (9.5)		B (12.0)		B (11.3)
	Synchro 95th Q	m67'	48'	35'	33'	69'	
2022 Background	LOS (Delay)	B (12.1)	A (9.2)		B (12.0)		B (11.1)
	Synchro 95th Q	m64'	47'	37'	36'	73'	
2022 Build-out	LOS (Delay)	B (13.0)	A (9.2)		B (12.1)		B (11.4)
	Synchro 95th Q	m73'	46'	39'	46'	73'	
2027 Build-out +5	LOS (Delay)	B (12.5)	A (9.3)		B (12.4)		B (11.4)
	Synchro 95th Q	m75'	50'	42'	49'	80'	

m Volume for 95th percentile queue is metered by upstream signal

Note that per NCDOT *Congestion Management Capacity Analysis Guidelines*, the capacity analysis results shown in **Table 6.1** reflect conditions where RTOR operations are not allowed, differing from the background data collected.

Table 6.1 shows the overall intersection is expected to operate at LOS A during the AM peak hour and LOS B during the PM peak hour under 2022 background conditions. When the proposed site traffic is added to the 2022 background volumes, the overall intersection is expected to continue to operate at LOS A during the AM peak hour and LOS B during the PM peak hour. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for capacity purposes.

6.2 KEENER BLVD/PARK ST (NC 273) AND CATAWBA ST (NC 7)

Table 6.2 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of Keener Boulevard/Park Street (NC 273) and Catawba Street (NC 7).

Table 6.2 - Keener Boulevard/Park Street (NC 273) and Catawba Street (NC 7)										
Condition	Measure	EB		WB		NB		SB		Intersection
		EBL	EBLTR	WBL	WBLTR	NBLTR	NBR	SBLT	SBR	LOS (Delay)
AM Peak Hour										
2019 Existing	LOS (Delay)	D (35.7)		C (22.7)		C (22.9)		A (9.3)		C (21.6)
	Synchro 95th Q	-	#172'	-	87'	#375'	-	73'	10'	
2022 Background	LOS (Delay)	C (20.6)		C (21.0)		C (28.7)		A (9.3)		C (22.5)
	Synchro 95th Q	-	#243'	-	111'	#420'	-	80'	m12'	
2022 Build-out	LOS (Delay)	C (27.0)		C (21.6)		C (30.4)		A (9.4)		C (24.4)
	Synchro 95th Q	-	#268'	-	117'	#427'	-	81'	15'	
2022 Build-out IMP (Option 1 NBR)	LOS (Delay)	C (21.9)		B (20.0)		B (17.1)		A (9.7)		B (16.3)
	Synchro 95th Q	-	#262'	-	113'	276'	98'	81'	15'	
2022 Build-out IMP (Option 2 EBL/WBL)	LOS (Delay)	C (21.4)		C (25.1)		B (11.9)		A (5.8)		B (12.8)
	Synchro 95th Q	#132'	95'	71'	72'	268'	-	71'	11'	
2027 Build-out +5	LOS (Delay)	C (31.8)		C (21.6)		C (21.2)		B (10.1)		C (20.2)
	Synchro 95th Q	-	#296'	-	125'	#377'	108'	88'	m15'	
PM Peak Hour										
2019 Existing	LOS (Delay)	A (6.3)		C (32.9)		B (19.8)		C (24.4)		C (23.1)
	Synchro 95th Q	-	86'	-	#269'	184'	-	#264'	m41'	
2022 Background	LOS (Delay)	A (6.6)		D (44.5)		C (21.8)		D (40.0)		C (32.8)
	Synchro 95th Q	-	80'	-	#356'	206'	-	#325	m40'	
2022 Build-out	LOS (Delay)	A (7.4)		D (53.2)		C (22.8)		D (45.0)		D (36.9)
	Synchro 95th Q	-	89'	-	#372'	#216'	-	#335'	m45'	
2022 Build-out IMP (Option 1 NBR)	LOS (Delay)	A (7.4)		D (53.2)		B (18.5)		C (34.4)		C (31.0)
	Synchro 95th Q	-	89'	-	#372'	178'	53'	#322'	m45'	
2022 Build-out IMP (Option 2 EBL/WBL)	LOS (Delay)	A (5.7)		C (27.8)		B (16.2)		C (22.7)		C (20.4)
	Synchro 95th Q	12'	18'	#272'	62'	184'	-	#227'	m45'	
2027 Build-out +5	LOS (Delay)	A (7.9)		F (91.0)		C (23.5)		E (75.2)		E (57.2)
	Synchro 95th Q	-	98'	-	#427'	#241'	57'	#389'	m46'	

95th percentile volume exceeds capacity, queue may be longer

m Volume for 95th percentile queue is metered by upstream signal

Note that per NCDOT *Congestion Management Capacity Analysis Guidelines*, the capacity analysis results shown in **Table 6.2** reflect conditions where RTOR operations are not allowed, differing from the background data collected.

Table 6.2 shows the signalized intersection currently operates at LOS C during both peak hours and is expected to continue to operate at LOS C during both peak hours under 2022 background conditions. Note that the decrease in delay between 2019 existing and 2022 background conditions, specifically the eastbound approach during the AM peak hour, is due to the change in peak-hour factors (PHFs). Based on NCDOT *Congestion Management Capacity Analysis Guidelines*, the PHFs obtained from the collected traffic count data were used for 2019 existing conditions only (0.75 AM PHF for the eastbound approach); however, a PHF of 0.9 was used for all future conditions.

When the proposed site traffic is added to the 2022 background volumes, the overall intersection is expected to drop from LOS C to LOS D during the PM peak hour, while multiple approaches are expected to increase delay when already operating at LOS D. Given the LOS degradation and increase in delay expected to be caused by the project, identification of mitigation improvements is

required. The following improvement options were evaluated at this intersection to mitigate the increase in delay and accommodate the added site traffic:

- Option 1 - Northbound Right-Turn Lane
- Option 2 – Eastbound/Westbound Left-Turn Lanes

Option 1 – Northbound Right-Turn Lane

As shown in **Figures 5.2** and **5.3**, given the location of the proposed site access points relative to this intersection, the proposed Chronicle Mill development is expected to add traffic to each approach at this intersection. With a southbound right-turn lane already provided, the highest-volume approach is the northbound approach during the AM peak hour. This intersection is located where a large volume of residential traffic from the southern peninsula region of Belmont traveling northbound in the morning towards I-85, I-485 and Charlotte split to either continue traveling north along NC 273 towards I-85 or have a choice to turn right onto Catawba Street (NC 7) to access US 74 eastbound towards I-485 or Charlotte. Therefore, the following improvement was considered for mitigation and further evaluated:

- Northbound right-turn lane along Keener Boulevard (NC 273) with 100' of storage

With this improvement in place, **Table 6.2** shows that the northbound and southbound approaches, as well as the overall intersection are expected to operate with less delay during both peak hours than shown under background conditions. The added capacity along the northbound approach benefits the southbound approach by allowing more time for the permitted left-turn movement, which yields to the northbound approach, thereby also allowing additional southbound through capacity. The storage length of 100 feet is based on Synchro 95th percentile lengths.

Option 2 – Eastbound/Westbound Left-Turn Lanes

Similarly, as shown in **Table 6.2**, the addition of left-turn lanes along the eastbound and westbound approaches of Catawba Street (NC 7) improves the overall intersection and approaches to operate with less delay than shown under background conditions. This option would benefit the northbound/southbound approaches by being able to flush out the eastbound/westbound traffic more quickly, thereby allowing more green time to be given back to the major-street northbound/southbound approaches of NC 273.

While both mitigation options are shown to mitigate the overall intersection delay caused by the proposed development, Option 2 would likely cause significant property and utility impacts as compared to Option 1. Multiple utility poles are currently located either within the sidewalk or slightly behind the back of sidewalk along both sides of Catawba Street (NC 7). The placement of these poles is likely due to the proximity of the existing residential homes specifically along the eastbound approach of Catawba Street (NC 7), with severe slopes already requiring steps and handrails, which are currently in place in the front yards of these homes. If the eastbound approach were further widened to install a left-turn lane, these front-yard slopes would become even more severe, with concern for the proximity of the residential structures to the travel lanes. Additionally, given the character of Catawba Street (NC 7) towards the downtown core to the west of this intersection, given the two options traffic would be better served to travel from the south along Keener Boulevard (NC 273) rather than through downtown and along Catawba Street (NC 7). Adding capacity to the eastbound approach rather than the northbound approach could potentially encourage more travelers to utilize Catawba Street (NC 7). Therefore, based on the relative performance of each mitigation option shown above along with the constraints discussed, the 2027 build+5 scenario reflects a northbound right-turn lane in place with 100 feet of storage (Option 1).

6.3 KEENER BLVD (NC 273) AND R L STOWE RD/FORT WILLIAM AVE

Table 6.3 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue.

Table 6.3 - Keener Boulevard (NC 273) and R L Stowe Rd/Fort William Ave										
Condition	Measure	EB		WB		NB		SB		Intersection
		EBL	EBTR	WBL	WBTR	NBL	NBTR	SBL	SBTR	LOS (Delay)
AM Peak Hour										
2019 Existing	LOS (Delay)	E (75.0)		E (64.2)		F (156.1)		E (66.3)		F (100.5)
	Synchro 95th Q	34'	#443'	#435'	132'	6'	#898'	48'	46'	
2022 Background	LOS (Delay)	F (92.0)		E (78.6)		F (202.0)		E (64.8)		F (127.9)
	Synchro 95th Q	40'	#498'	#578'	138'	8'	#1286'	55'	55'	
2022 Build-out	LOS (Delay)	F (92.0)		F (85.3)		F (205.9)		E (64.8)		F (131.3)
	Synchro 95th Q	40'	#498'	#604'	138'	8'	#1297'	55'	55'	
2022 Build-out IMP	LOS (Delay)	D (39.2)		B (12.1)		F (94.8)		D (51.5)		D (51.8)
	Synchro 95th Q	33'	351'	298'	51'	19'	#1032'	50'	50'	
2027 Build-out +5	LOS (Delay)	D (41.9)		B (12.6)		F (129.8)		D (51.8)		E (69.4)
	Synchro 95th Q	36'	#425'	336'	56'	22'	#1185'	53'	53'	
PM Peak Hour										
2019 Existing	LOS (Delay)	E (56.2)		D (45.7)		E (74.8)		E (62.4)		D (54.3)
	Synchro 95th Q	11'	166'	#865'	202'	34'	#663'	13'	42'	
2022 Background	LOS (Delay)	E (55.1)		F (93.3)		F (146.3)		E (61.5)		F (100.8)
	Synchro 95th Q	15'	180'	#1175'	203'	39'	#846'	16'	48'	
2022 Build-out	LOS (Delay)	E (55.1)		F (97.1)		F (157.5)		E (61.5)		F (106.1)
	Synchro 95th Q	15'	180'	#1193'	203'	39'	#872'	16'	48'	
2022 Build-out IMP	LOS (Delay)	D (44.4)		B (17.2)		B (15.8)		D (53.0)		C (20.8)
	Synchro 95th Q	13'	161'	#867'	105'	57'	235'	15'	44'	
2027 Build-out +5	LOS (Delay)	D (45.0)		C (21.0)		B (18.0)		D (53.7)		C (23.7)
	Synchro 95th Q	17'	177'	#1024'	121'	63'	289'	19'	47'	

95th percentile volume exceeds capacity, queue may be longer

Note that per NCDOT *Congestion Management Capacity Analysis Guidelines*, the capacity analysis results shown in **Table 6.3** reflect the following modifications applied to the capacity analyses that differ from the background data collected:

- RTOR operations were not allowed.
- Protected-only left-turn phasing was used for analysis of future operations where protected/permitted left-turn phasing exists for the westbound approach.

These modifications have a significant impact particularly at this intersection given both the high northbound right-turn volume and high westbound left-turn volume. With RTOR allowed along with protected/permitted left-turn phasing on the westbound approach, the overall intersection is expected to operate at LOS C during both peak hours under both 2022 background and 2022 build-out conditions. However, per City and NCDOT requirements, mitigation is determined by comparing background and build conditions with analyses that reflect these guidelines, as reflected in **Table 6.3**.

Table 6.3 shows the overall intersection is expected to operate at LOS F during both peak hours under 2022 background conditions. When the proposed site traffic is added to the 2022 background volumes, the overall intersection is expected to increase in delay along with multiple approaches when already at LOS E and F in background conditions. Therefore, identification of mitigation improvements is required. The following improvements were identified to mitigate the impact of the proposed site:

- Restripe the northbound approach of R L Stowe Road to provide a shared left/through lane and an exclusive right-turn lane
- Permitted-overlap phasing for the northbound right-turn movement along R L Stowe Road

With these improvements in place, **Table 6.3** shows that the added delay caused by the proposed site is expected to be fully mitigated and the overall intersection is expected to operate at LOS D during the AM peak hour and LOS C during the PM peak hour.

Note that further analysis was performed to determine if the improvements identified above would also be expected to significantly improve the intersection operations with RTOR allowed along with protected/permitted left-turn phasing on the westbound approach. The additional analysis showed that an exclusive right-turn lane with permitted-overlap phasing along the northbound approach would still provide significant benefit under the current operations. These improvements would allow dedicated green time for the heavy northbound right-turn volume during the protected phase for the westbound left-turn movement, where the right-turning vehicles would be able to proceed without stopping (before turning right on red) or without potentially being blocked by a through vehicle. Additionally, the analysis showed that the northbound right-turn lane would not need to be extended. Instead, the relatively low left-turn and through volume is not expected to block the right-turning traffic due to short queues that would be accommodated within the 100 feet currently provided, thereby allowing the northbound right-turn traffic to enter the turn lane and utilize the overlap phase.

6.4 MAIN STREET AND MYRTLE STREET/MCLEOD AVENUE

Table 6.4 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of Main Street and Myrtle Street/McLeod Avenue.

Table 6.4 - Main Street and Myrtle Street/McLeod Avenue										
Condition	Measure	EB		WB		NB	SB			Intersection
		EBL	EBTR	WBL	WBTR	NBLTR	SBL	SBT	SBR	LOS (Delay)
AM Peak Hour										
2019 Existing	LOS (Delay)	B (18.8)		C (23.4)		A (9.4)	A (4.4)			B (12.4)
	Synchro 95th Q	13'	16'	44'	64'	154'	10'	21'	14'	
2022 Background	LOS (Delay)	B (18.5)		C (21.6)		A (8.8)	A (4.6)			B (11.1)
	Synchro 95th Q	18'	20'	52'	81'	160'	13'	25'	17'	
2022 Build-out	LOS (Delay)	B (18.5)		C (21.6)		A (8.8)	A (4.7)			B (11.1)
	Synchro 95th Q	18'	20'	52'	81'	162'	13'	28'	18'	
2027 Build-out +5	LOS (Delay)	B (18.6)		C (22.1)		A (9.6)	A (4.7)			B (11.6)
	Synchro 95th Q	18'	22'	56'	89'	186'	14'	29'	20'	
PM Peak Hour										
2019 Existing	LOS (Delay)	B (15.0)		B (17.0)		A (9.0)	A (9.5)			B (11.6)
	Synchro 95th Q	19'	18'	63'	43'	68'	17'	83'	19'	
2022 Background	LOS (Delay)	B (14.8)		B (16.7)		A (8.8)	A (9.5)			B (11.4)
	Synchro 95th Q	22'	16'	68'	48'	73'	20'	88'	22'	
2022 Build-out	LOS (Delay)	B (14.8)		B (16.7)		A (8.9)	A (9.6)			B (11.4)
	Synchro 95th Q	22'	16'	68'	48'	76'	20'	92'	22'	
2027 Build-out +5	LOS (Delay)	B (14.8)		B (17.1)		A (9.1)	A (9.6)			B (11.6)
	Synchro 95th Q	24'	17'	75'	52'	84'	21'	100'	24'	

Note that per NCDOT *Congestion Management Capacity Analysis Guidelines*, the capacity analysis results shown in **Table 6.4** reflect conditions where RTOR operations are not allowed, differing from the background data collected.

Table 6.4 shows the signalized intersection is expected to operate at LOS B during both peak hours under 2022 background conditions. When the proposed site traffic is added to the 2022 background volumes, the overall intersection is expected to continue to operate at LOS B during peak hours. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for capacity purposes.

6.5 N MAIN STREET (NC 7) AND N CENTRAL AVENUE

Table 6.5 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized, tee-intersection of N Main Street (NC 7) and N Central Avenue. Given the skewed angle, N Main Street (NC 7) is considered the eastbound/westbound approaches with N Central Avenue the northbound approach.

Table 6.5 - N Main Street (NC 7) and N Central Avenue						
Condition	Measure	EB		WB	NB	Intersection
		EBT	EBR	WBLT	NBLR	LOS (Delay)
AM Peak Hour						
2019 Existing	LOS (Delay)	A (6.4)		B (16.1)	B (13.1)	B (10.4)
	Synchro 95th Q	131'	0'	118'	170'	
2022 Background	LOS (Delay)	A (7.5)		B (16.3)	B (13.5)	B (11.1)
	Synchro 95th Q	149'	0'	127'	184'	
2022 Build-out	LOS (Delay)	A (7.7)		B (16.8)	B (13.5)	B (11.3)
	Synchro 95th Q	154'	0'	137'	184'	
2027 Build-out +5	LOS (Delay)	A (8.4)		B (18.1)	B (14.7)	B (12.3)
	Synchro 95th Q	171'	0'	151'	212'	
PM Peak Hour						
2019 Existing	LOS (Delay)	A (4.9)		B (14.3)	B (12.0)	A (8.3)
	Synchro 95th Q	122'	0'	123'	133'	
2022 Background	LOS (Delay)	A (5.3)		B (15.2)	B (13.0)	A (8.9)
	Synchro 95th Q	140'	0'	141'	155'	
2022 Build-out	LOS (Delay)	A (5.6)		B (15.5)	B (13.1)	A (9.2)
	Synchro 95th Q	152'	0'	150'	155'	
2027 Build-out +5	LOS (Delay)	A (6.2)		B (17.1)	B (13.9)	A (10.0)
	Synchro 95th Q	168'	0'	166'	175'	

Note that per NCDOT *Congestion Management Capacity Analysis Guidelines*, the capacity analysis results shown in **Table 6.5** reflect conditions where RTOR operations are not allowed, differing from the background data collected.

Table 6.5 shows the signalized intersection is expected to operate at LOS B during the AM peak hour and LOS A during the PM peak hour under 2022 background conditions. When the proposed site traffic is added to the 2022 background volumes, the overall intersection is expected to continue to operate at LOS B during the AM peak hour and LOS A during the PM peak hour. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for capacity purposes.

6.6 PARK STREET (NC 273) AND HAWLEY AVE/PLANETREE DR

Table 6.6 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of Park Street (NC 273) and Hawley Avenue/Planetree Drive.

Table 6.6 - Park Street (NC 273) and Hawley Avenue/Planetree Drive						
Condition	Measure	EB	WB	NB	SB	Intersection
		EBLTR	WBLTR	NBLTR	SBLTR	LOS (Delay)
AM Peak Hour						
2019 Existing	LOS (Delay)	C (25.7)	C (21.7)	B (10.4)	A (4.6)	A (9.1)
	Synchro 95th Q	51'	4'	m198'	61'	
2022 Background	LOS (Delay)	C (24.8)	C (21.2)	B (11.3)	A (4.7)	A (9.5)
	Synchro 95th Q	44'	10'	m213'	66'	
2022 Build-out	LOS (Delay)	C (24.8)	C (21.2)	B (11.3)	A (4.7)	A (9.5)
	Synchro 95th Q	44'	10'	m214'	67'	
2027 Build-out +5	LOS (Delay)	C (25.4)	C (21.3)	B (12.9)	A (4.9)	B (10.7)
	Synchro 95th Q	49'	12'	m268'	75'	
PM Peak Hour						
2019 Existing	LOS (Delay)	C (24.6)	B (19.5)	B (16.4)	A (8.9)	B (13.0)
	Synchro 95th Q	21'	19'	m198'	170'	
2022 Background	LOS (Delay)	C (22.7)	C (18.8)	B (17.3)	A (9.6)	B (13.4)
	Synchro 95th Q	72'	24'	m218'	193'	
2022 Build-out	LOS (Delay)	C (22.7)	B (18.8)	B (17.3)	A (9.9)	B (13.5)
	Synchro 95th Q	72'	24'	m221'	202'	
2027 Build-out +5	LOS (Delay)	C (23.5)	B (18.9)	B (18.0)	B (11.1)	B (14.5)
	Synchro 95th Q	80'	27'	m236'	238'	

m Volume for 95th percentile queue is metered by upstream signal

Note that per NCDOT *Congestion Management Capacity Analysis Guidelines*, the capacity analysis results shown in **Table 6.6** reflect conditions where RTOR operations are not allowed, differing from the background data collected.

Table 6.6 shows the overall intersection is expected to operate at LOS A during the AM peak hour and LOS B during the PM peak hour under 2022 background conditions. When the proposed site traffic is added to the 2022 background volumes, the overall intersection is expected to continue to operate at LOS A during the AM peak hour and LOS B during the PM peak hour. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for capacity purposes.

6.7 CATAWBA STREET (NC 7) AND 1ST STREET

Table 6.7 summarizes the LOS, control delay and 95th percentile queue lengths at the existing unsignalized, full-movement intersection of Catawba Street (NC 7) and 1st Street, located approximately 220 feet west of Keener Boulevard/Park Street (NC 273). This intersection is expected to provide primary access for the proposed development.

Table 6.7 - Catawba Street (NC 7) and 1st Street						
Condition	Measure	EB	WB	NB	SB	Intersection
		EBLTR	WBLTR	NBLTR	SBLTR	LOS (Delay)
AM Peak Hour						
2019 Existing	LOS (Delay)	A (0.1)	A (0.3)	B (11.6)	B (12.3)	
	Synchro 95th Q	0'	0'	2'	1'	
2022 Background	LOS (Delay)	A (0.1)	A (0.1)	B (12.0)	B (12.4)	
	Synchro 95th Q	0'	0'	1'	0'	
2022 Build-out	LOS (Delay)	A (0.1)	A (0.9)	B (12.4)	B (12.9)	
	Synchro 95th Q	0'	1'	9'	0'	
2027 Build-out +5	LOS (Delay)	A (0.0)	A (0.8)	B (13.0)	B (13.5)	
	Synchro 95th Q	0'	1'	10'	1'	
PM Peak Hour						
2019 Existing	LOS (Delay)	A (0.0)	A (0.3)	B (10.7)	A (9.5)	
	Synchro 95th Q	0'	0'	1'	0'	
2022 Background	LOS (Delay)	A (0.0)	A (0.1)	B (11.1)	A (9.4)	
	Synchro 95th Q	0'	0'	0'	0'	
2022 Build-out	LOS (Delay)	A (0.0)	A (1.3)	B (12.0)	A (9.3)	
	Synchro 95th Q	0'	2'	9'	0'	
2027 Build-out +5	LOS (Delay)	A (0.0)	A (1.2)	B (12.5)	A (9.5)	
	Synchro 95th Q	0'	2'	9'	0'	

Table 6.7 shows the stop-controlled, side-street approaches of 1st Street are expected to operate with short delays during both peak hours under 2022 background conditions, and is expected to continue to operate with short delays with the addition of proposed site traffic. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for capacity purposes.

Review of auxiliary turn-lane warrants at this intersection is included in **Section 7.0**.

6.8 1ST STREET AND BACK STREET

Table 6.8 summarizes the LOS, control delay and 95th percentile queue lengths at the existing unsignalized, full-movement intersection of 1st Street and Back Street, located approximately 250 feet south of Catawba Street (NC 7). Back Street is planned to provide access to the multifamily portion of the proposed site.

Table 6.8 - 1st Street and Back Street					
Condition	Measure	EB	NB	SB	Intersection
		EBLR	NBLT	SBTR	LOS (Delay)
AM Peak Hour					
2019 Existing	LOS (Delay)	A (8.6)	A (0.0)	A (0.0)	
	Synchro 95th Q	0'	0'	0'	
2022 Background	LOS (Delay)	A (8.6)	A (0.0)	A (0.0)	
	Synchro 95th Q	0'	0'	0'	
2022 Build-out	LOS (Delay)	A (8.8)	A (4.8)	A (0.0)	
	Synchro 95th Q	4'	1'	0'	
2027 Build-out +5	LOS (Delay)	A (8.8)	A (4.5)	A (0.0)	
	Synchro 95th Q	4'	1'	0'	
PM Peak Hour					
2019 Existing	LOS (Delay)	A (8.6)	A (2.4)	A (0.0)	
	Synchro 95th Q	1'	0'	0'	
2022 Background	LOS (Delay)	A (8.6)	A (1.4)	A (0.0)	
	Synchro 95th Q	1'	0'	0'	
2022 Build-out	LOS (Delay)	A (9.1)	A (5.8)	A (0.0)	
	Synchro 95th Q	5'	2'	0'	
2027 Build-out +5	LOS (Delay)	A (9.1)	A (5.7)	A (0.0)	
	Synchro 95th Q	5'	2'	0'	

Table 6.8 shows the stop-controlled, side-street approach of Back Street is expected to operate with short delays during both peak hours under 2022 background conditions, and is expected to continue to operate with short delays with the addition of proposed site traffic. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for capacity purposes.

Review of auxiliary turn-lane warrants at this intersection is included in **Section 7.0**.

6.9 1ST STREET AND BROOK STREET

Table 6.9 summarizes the LOS, control delay and 95th percentile queue lengths at the existing unsignalized, full-movement intersection of 1st Street and Brook Street, located approximately 75 feet south of Back Street and approximately 275 feet west of Keener Boulevard (NC 273). Brook Street is expected to provide secondary access to the proposed site as a direct connection to Keener Boulevard (NC 273).

Table 6.9 - 1st Street and Brook Street					
Condition	Measure	WB	NB	SB	Intersection
		WBLR	NBTR	SBLT	LOS (Delay)
AM Peak Hour					
2019 Existing	LOS (Delay)	A (8.4)	A (0.0)	A (7.2)	
	Synchro 95th Q	0'	0'	0'	
2022 Background	LOS (Delay)	A (8.3)	A (0.0)	A (7.2)	
	Synchro 95th Q	0'	0'	0'	
2022 Build-out	LOS (Delay)	A (8.4)	A (0.0)	A (7.3)	
	Synchro 95th Q	1'	0'	1'	
2027 Build-out +5	LOS (Delay)	A (8.4)	A (0.0)	A (7.3)	
	Synchro 95th Q	1'	0'	2'	
PM Peak Hour					
2019 Existing	LOS (Delay)	A (8.4)	A (0.0)	A (2.4)	
	Synchro 95th Q	1'	0'	0'	
2022 Background	LOS (Delay)	A (8.4)	A (0.0)	A (2.9)	
	Synchro 95th Q	0'	0'	0'	
2022 Build-out	LOS (Delay)	A (8.5)	A (0.0)	A (6.5)	
	Synchro 95th Q	3'	0'	1'	
2027 Build-out +5	LOS (Delay)	A (8.5)	A (0.0)	A (6.3)	
	Synchro 95th Q	3'	0'	1'	

Table 6.9 shows the stop-controlled, side-street approach of Brook Street is expected to operate with short delays during both peak hours under 2022 background conditions, and is expected to continue to operate with short delays with the addition of proposed site traffic. Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for capacity purposes.

6.10 KEENER BOULEVARD (NC 273) AND BROOK STREET

Table 6.10 summarizes the LOS, control delay and 95th percentile queue lengths at the existing unsignalized, full-movement intersection of Keener Boulevard (NC 273) and Brook Street, located approximately 350 feet south of Catawba Street (NC 7). This intersection is expected to provide secondary access for the proposed development.

Table 6.10 - Keener Boulevard (NC 273) and Brook Street						
Condition	Measure	EB	WB	NB	SB	Intersection
		EBLTR	WBLTR	NBLTR	SBLTR	LOS (Delay)
AM Peak Hour						
2019 Existing	LOS (Delay)	A (9.3)	F (53.6)	A (0.1)	A (0.6)	
	Synchro 95th Q	1'	8'	0'	3'	
2022 Background	LOS (Delay)	A (9.1)	F (71.2)	A (0.0)	A (0.3)	
	Synchro 95th Q	0'	4'	0'	1'	
2022 Build-out	LOS (Delay)	D (30.1)	F (75.7)	A (0.1)	A (0.3)	
	Synchro 95th Q	17'	4'	1'	1'	
2027 Build-out +5	LOS (Delay)	E (38.2)	F (110.8)	A (0.1)	A (0.3)	
	Synchro 95th Q	22'	6'	1'	2'	
PM Peak Hour						
2019 Existing	LOS (Delay)	A (9.5)	F (389.7)	A (0.3)	A (0.5)	
	Synchro 95th Q	1'	354'	1'	3'	
2022 Background	LOS (Delay)	A (9.7)	F (319.7)	A (0.1)	A (0.3)	
	Synchro 95th Q	0'	305'	0'	2'	
2022 Build-out	LOS (Delay)	F (64.1)	F (392.2)	A (0.5)	A (0.3)	
	Synchro 95th Q	29'	330'	2'	2'	
2027 Build-out +5	LOS (Delay)	F (131.8)	F (797.3)	A (0.6)	A (0.4)	
	Synchro 95th Q	52'	454'	3'	2'	

Table 6.10 shows the stop-controlled eastbound approach of Brook Street currently operates with short delays during both peak hours and is expected to continue to operate with short delays through 2022 background conditions. However, the stop-controlled westbound approach currently operates, and is expected to continue to operate with long delays during both peak hours through 2022 background conditions. As shown in **Figures 5.2** and **5.3**, a relatively high amount of traffic is shown to turn to/from the east along Brook Street, specifically the northbound right during the AM and the reciprocating westbound left during the PM peak hour. These movements indicate that Brook Street is used as a cut-through route for vehicles attempting to avoid congestion at the adjacent signalized intersection of Keener Boulevard/Park Street (NC 273) and Catawba Street (NC 7). Note that the decrease in delay between 2019 existing and 2022 background conditions, specifically the westbound approach during the PM peak hour, is due to the change in PHFs. Based on NCDOT *Congestion Management Capacity Analysis Guidelines*, the PHFs obtained from the collected traffic count data were used for 2019 existing conditions only (0.80 PM PHF for the westbound approach); however, a PHF of 0.9 was used for all future conditions.

There is currently very little volume turning to/from the west along Brook Street prior to construction of the proposed Chronicle Mill. As shown in **Table 6.10**, the eastbound approach of Brook Street is expected to operate with moderate delays during the AM peak hour and long delays during the PM peak hour with the addition of proposed site traffic. Given this, potential mitigation was considered to address the added site traffic, specifically turn lane additions since the proximity to the adjacent signal along Keener Boulevard (NC 273) would not allow for appropriate spacing to install an additional traffic signal.

With an exclusive eastbound right-turn lane installed along Brook Street, the projected eastbound approach delay decreases by three seconds to 61 seconds per vehicle during the PM peak hour, still at LOS F. Given the minimal projected benefit expected, construction of an eastbound right-turn lane is not recommended as mitigation for the proposed Chronicle Mill development. It is typical for stop sign-controlled side streets and driveways intersecting major streets to experience long delays, particularly during peak hours. Additionally, drivers exiting the proposed site will have the option to alternatively utilize 1st Street/Catawba Street (NC 7) to access the existing traffic signal if drivers find it difficult or unsafe to turn from the stop-controlled approach of Brook Street onto Keener Boulevard (NC 273).

Since proposed site traffic is not expected to be added to the westbound approach, mitigation is not recommended to address the supposed cut-through traffic along the westbound approach of Brook Street. Similar to the discussion on the eastbound approach, if delay continues to increase along the westbound approach of Brook Street, drivers have the option to instead utilize the adjacent signal at Catawba Street (NC 7) to access Keener Boulevard (NC 273). The mitigation improvement identified in **Section 6.2** is also expected to benefit traffic at this intersection.

Review of auxiliary turn-lane warrants at this intersection is included in **Section 7.0**.

6.11 1ST STREET AND ACCESS 1

Table 6.11 summarizes the LOS, control delay and 95th percentile queue lengths at the proposed unsignalized, full-movement intersection of 1st Street and Access 1, located approximately 60 feet south of Catawba Street (NC 7). Based on the provided site plan, Access 1 is assumed to serve the townhome portion of the proposed site.

Note that since the July 2019 TIA submittal, the City and applicant have agreed to remove Access 1 as its location did not provide adequate spacing from Catawba Street (NC 7). The analysis in this TIA and in this section is based on the initial site plan that included this driveway. However, the final recommendations reflect consideration for this driveway being removed where only three driveways are proposed (still referred to as Access 2-4 for purposes of this TIA).

Table 6.11 - 1st Street and Access 1					
Condition	Measure	EB	NB	SB	Intersection
		EBLR	NBLT	SBTR	LOS (Delay)
AM Peak Hour					
2022 Build-out	LOS (Delay)	A (8.9)	A (0.0)	A (0.0)	
	Synchro 95th Q	0'	0'	0'	
2027 Build-out +5	LOS (Delay)	A (8.9)	A (0.0)	A (0.0)	
	Synchro 95th Q	0'	0'	0'	
PM Peak Hour					
2022 Build-out	LOS (Delay)	A (9.3)	A (0.0)	A (0.0)	
	Synchro 95th Q	0'	0'	0'	
2027 Build-out +5	LOS (Delay)	A (9.3)	A (0.0)	A (0.0)	
	Synchro 95th Q	0'	0'	0'	

Based on the site plan shown in **Figure 3.2**, the eastbound egress is assumed to include a single lane. As shown in **Table 6.11**, the stop-controlled eastbound approach of Access 1 is expected to operate with short delays and queues during both peak hours. Therefore, no additional improvements beyond construction of the driveway are recommended at this intersection for capacity purposes.

Based on review of the Synchro and SimTraffic simulation at the intersection of Catawba Street (NC 7) and 1st Street, queues are not expected to extend beyond Access 1.

6.12 1ST STREET AND ACCESS 2

Table 6.12 summarizes the LOS, control delay and 95th percentile queue lengths at the proposed unsignalized, full-movement intersection of 1st Street and Access 2, located approximately 120 feet south of Catawba Street (NC 7). Based on the provided site plan, Access 2 is assumed to serve as primary access to the retail parking.

Table 6.12 - 1st Street and Access 2					
Condition	Measure	EB	NB	SB	Intersection
		EBLR	NBLT	SBTR	LOS (Delay)
AM Peak Hour					
2022 Build-out	LOS (Delay)	A (8.8)	A (0.4)	A (0.0)	
	Synchro 95th Q	2'	0'	0'	
2027 Build-out +5	LOS (Delay)	A (8.8)	A (0.4)	A (0.0)	
	Synchro 95th Q	2'	0'	0'	
PM Peak Hour					
2022 Build-out	LOS (Delay)	A (9.1)	A (0.7)	A (0.0)	
	Synchro 95th Q	3'	0'	0'	
2027 Build-out +5	LOS (Delay)	A (9.2)	A (0.7)	A (0.0)	
	Synchro 95th Q	3'	0'	0'	

Based on the site plan shown in **Figure 3.2**, the eastbound egress is assumed to include a single lane. As shown in **Table 6.12**, the stop-controlled eastbound approach of Access 2 is expected to operate with short delays and queues during both peak hours. Therefore, no additional improvements beyond construction of the driveway are recommended at this intersection for capacity purposes.

Review of auxiliary turn-lane warrants at this intersection is included in **Section 7.0**.

6.13 BACK STREET AND ACCESS 3

Table 6.13 summarizes the LOS, control delay and 95th percentile queue lengths at the proposed unsignalized, full-movement intersection of Back Street and Access 3, located approximately 165 feet west of 1st Street. Based on the provided site plan, Access 3 is assumed to serve as secondary access to the retail parking.

Table 6.13 - Back Street and Access 3					
Condition	Measure	EB	WB	SB	Intersection
		EBLT	WBTR	SBLR	LOS (Delay)
AM Peak Hour					
2022 Build-out	LOS (Delay)	A (0.0)	A (0.0)	A (8.9)	
	Synchro 95th Q	0'	0'	1'	
2027 Build-out +5	LOS (Delay)	A (0.0)	A (0.0)	A (8.9)	
	Synchro 95th Q	0'	0'	1'	
PM Peak Hour					
2022 Build-out	LOS (Delay)	A (0.0)	A (0.0)	A (9.1)	
	Synchro 95th Q	0'	0'	1'	
2027 Build-out +5	LOS (Delay)	A (0.0)	A (0.0)	A (9.1)	
	Synchro 95th Q	0'	0'	1'	

Based on the site plan shown in **Figure 3.2**, the southbound egress is assumed to include a single lane. As shown in **Table 6.13**, the stop-controlled southbound approach of Access 3 is expected to operate with short delays and queues during both peak hours. Therefore, no additional improvements beyond construction of the driveway are recommended at this intersection for capacity purposes.

6.14 SHORT STREET AND ACCESS 4

Table 6.14 summarizes the LOS, control delay and 95th percentile queue lengths at the proposed unsignalized, full-movement intersection of Short Street and Access 4. Short Street serves as a western extension of Back Street. Based on the provided site plan, Access 4 is assumed to serve the multifamily portion of the proposed site as well as additional surface parking for the retail.

Table 6.14 - Short Street and Access 4					
Condition	Measure	EB	NB	SB	Intersection
		EBLR	NBLT	SBTR	LOS (Delay)
AM Peak Hour					
2022 Build-out	LOS (Delay)	A (8.8)	A (0.0)	A (0.0)	
	Synchro 95th Q	4'	0'	0'	
2027 Build-out +5	LOS (Delay)	A (8.8)	A (0.0)	A (0.0)	
	Synchro 95th Q	4'	0'	0'	
PM Peak Hour					
2022 Build-out	LOS (Delay)	A (8.9)	A (0.0)	A (0.0)	
	Synchro 95th Q	3'	0'	0'	
2027 Build-out +5	LOS (Delay)	A (8.9)	A (0.0)	A (0.0)	
	Synchro 95th Q	3'	0'	0'	

Based on the site plan shown in **Figure 3.2**, the eastbound egress is assumed to include a single lane. As shown in **Table 6.14**, the stop-controlled eastbound approach of Access 4 is expected to operate with short delays and queues during both peak hours. Therefore, no additional improvements beyond construction of the driveway are recommended at this intersection for capacity purposes.

Review of auxiliary turn-lane warrants at this intersection is included in **Section 7.0**.

7.0 Auxiliary Turn-Lane Warrants

Warrants for additional turn-lane improvements for unsignalized intersections beyond those necessary for capacity were determined based on a review of the figure titled 'Warrant for Left and Right-Turn Lanes' found on page 80 in the *NCDOT Policy On Street And Driveway Access to North Carolina Highways*. The results of the warrants for left and right-turn lanes under 2022 background and build-out conditions are summarized by intersection below and included in the **Appendix**.

2022 Background Conditions

Keener Boulevard (NC 273) and Brook Street

- Northbound right-turn lane along Keener Blvd (NC 273) with a minimum storage length of 75'
- Southbound left-turn lane along Keener Blvd (NC 273) with a minimum storage length of 75'
- Northbound left-turn lane along Keener Blvd (NC 273) with a minimum storage length of 50'

2022 Build-out Conditions

Catawba Street (NC 7) and 1st Street

- Eastbound right-turn lane along Catawba St (NC 7) with a minimum storage length of 50'
- Westbound left-turn lane along Catawba St (NC 7) with a minimum storage length of 50'

*Based on review and coordination with the City, NCDOT and the applicant since the July 2019 TIA submittal, an eastbound right-turn lane along Catawba Street (NC 7) at 1st Street is **not required** to be installed to mitigate the impact of the proposed Chronicle Mill development. The right-turn lane was initially considered based on NCDOT's auxiliary turn-lane warrants where 37 projected right-turn movements warrants a 50-foot turn lane based on this graph; however, this volume warrant does not meet NCDOT's minimum 100-foot turn-lane length. In addition, the overall site density did not meet NCDOT's TIA threshold. Given the low right-turn volume, along with the low-speed, downtown character of this portion of Catawba Street (NC 7) and the potential impacts to the proposed site development, the eastbound right-turn lane is not required.*

Similar to the discussion under Option 2 in **Section 6.2**, widening for a westbound left-turn lane at this location would likely cause significant property and utility impacts. Multiple utility poles are currently located either within the sidewalk or slightly behind the back of sidewalk along both sides of Catawba Street (NC 7). The placement of these poles is likely due to the proximity of the existing residential homes, with severe slopes already requiring steps and handrails, which are currently in place in the front yards of these homes. Installing a westbound left-turn lane would require these front-yard slopes would to become even more severe, with concern for the proximity of the residential structures to the travel lanes. Additionally, given the character of Catawba Street (NC 7) towards the downtown core to the west of this intersection, given the two options traffic would be better served to travel from the south along Keener Boulevard (NC 273) rather than through downtown and along Catawba Street (NC 7). **Table 6.7** shows no operational issues expected at this intersection. Additionally, the proposed site traffic shown in **Figures 5.2** and **5.3** making this westbound left-turn onto 1st Street is travelling from the north or east to access the site. If accessing the site via 1st Street becomes challenging, drivers are provided the option to instead turn onto (or stay straight along) Keener Boulevard (NC 7) to alternatively access the site via Brook Street. Considering the impacts required to install this turn lane along with the alternative access option provided, a westbound left-turn lane is **not recommended** to be constructed at this intersection as part of the proposed Chronicle Mill development.

1st Street and Back Street

- Southbound right-turn lane along 1st Street with a minimum storage length of 50'

This turn lane is warranted based on the PM peak-hour volumes due to the evening influx for the both the residential and retail uses. However, there is relatively minor volume continuing south along 1st Street due to the railroad tracks. As shown in **Figure 5.3**, the southbound right-turn volume is expected to serve 83% of the total southbound approach, with only seven vehicles continuing south along 1st Street. Therefore, a southbound right-turn lane is **not recommended** to be constructed given the limited benefit expected from separating the through and right-turn volume.

Keener Boulevard (NC 273) and Brook Street

- Northbound right-turn lane along Keener Blvd (NC 273) with a minimum storage length of 75'
- Southbound left-turn lane along Keener Blvd (NC 273) with a minimum storage length of 75'
- Northbound left-turn lane along Keener Blvd (NC 273) with a minimum storage length of 75'

The proposed site is not expected to increase the warranted storage for the northbound right- and southbound left-turn lanes at this intersection; therefore, northbound right- and southbound left-turn lanes are **not recommended** to be constructed as part of the proposed Chronicle Mill development.

The proposed site is expected to increase the warranted northbound left-turn storage length by 25 feet. Widening of the northbound approach is constrained by both the overhead utility poles located within ten feet of the existing edge of pavement on either side of Keener Boulevard (NC 273) as well as the severe grade changes on either side as evidenced by the existing guardrails that extend to Brook Street accommodating the grade change to appropriately cross the railroad tracks. **Table 6.10** shows no operational issues expected for the northbound approach and review of the analysis shows no queueing or operational issues for the projected 15 northbound left-turn vehicles during the PM peak hour. Therefore, a northbound left-turn lane is **not recommended** to be constructed at this intersection as part of the proposed Chronicle Mill development.

Short Street and Access 4

- Southbound right-turn lane along Short Street with a minimum storage length of 50'

This turn lane is warranted based on the PM peak-hour volumes due to the evening influx of the residents. However, there is relatively minor volume continuing south along Short Street due to the railroad tracks. As shown in **Figure 5.3**, the southbound right-turn volume is expected to serve 89% of the total southbound approach, with only six vehicles continuing south along Short Street. Therefore, a southbound right-turn lane is **not recommended** to be constructed given the limited benefit expected from separating the through and right-turn volume.

8.0 Crash Data Analysis

Crash data was obtained at the study intersections for crashes that occurred between May 1, 2014, and April 30, 2019. Over this five-year period, 121 total crashes were reported at the existing study intersections. Note that there were no reported crashes at the intersection of Catawba Street (NC 7) and 1st Street. Therefore, the summaries below only reflect crashes reported at the remaining study area intersections. The breakdown of crashes at these study intersections by severity, frequency and crash type are shown in the tables below.

Table 8.1 – Crash Severity Summary

Crash Type	Number of Crashes
Fatal Crashes	0
Class A	1
Class B	4
Class C	8
Property Damage Only	108
Total	121

Table 8.1 above displays the total number of crashes by severity type from most to least severe. As shown, there were no fatal crashes reported. 89% of the crashes over the past five years at the study intersections had no injury reported. The crash types are defined as follows:

- Class A - crashes where serious injury is suspected and can include significant loss of blood or broken bones.
- Class B - crashes where minor injury is suspected, such as bruises or minor cuts.
- Class C - crashes wherein possible injuries occur, which are injuries reported by the person or indicated by his/her behavior, but no wounds or injuries are physically present, such as limping or complaint of neck pain.
- Property Damage Only (PDO) – crashes where no injury is reported.

Table 8.2 – Crash Frequency Summary

Location	Crashes/100 MEV
Main St and Catawba St (NC 7)	126.37
Keener Blvd/Park St (NC 273) and Catawba St (NC 7)	70.99
Keener Blvd (NC 273) and R L Stowe Rd/Fort William Ave	156.48
Main St (NC 7) and Myrtle St/McLeod Ave	21.27
N Main St (NC 7) and N Central Ave	32.42
Park St (NC 273) and Hawley Ave/Planetree Dr	34.59
1st St and Back St	181.82
1st St and Brook St	181.82
Keener Blvd (NC 273) and Brook St	27.23
Average	62.51

Table 8.2 shows the crash rates at the study area intersections resulted in a weighted average crash rate of 62.51 crashes per 100 million entering vehicles (MEV), with the highest rates occurring at the signalized intersections of Main Street/Catawba Street (NC 7) and Keener Boulevard (NC 273)/R L Stowe Road/Fort William Avenue. There have been 15 and 42 total crashes reported over this five-year period at these two intersections, respectively. Note that both unsignalized study

intersections along 1st Street (Back Street and Brook Street) each show a high crash rate; however, there was only one crash at these intersections over the past five years, yet show a high crash rate due to the limited traffic entering these intersections. Additionally, due to their proximity to one another, the one reported crash overlaps and is the same crash, which involved a parked vehicle.

Table 8.3 – Crash Type Summary

Crash Type	Main St and Catawba St (NC 7)	Keener Blvd/Park St (NC 273) and Catawba St (NC 7)	Keener Blvd (NC 273) and R L Stowe Rd/Fort William Ave	Main St (NC 7) and Myrtle St/McLeod Ave	N Main St (NC 7) and N Central Ave	Park St (NC 273) and Hawley Ave/Planetree Dr	1st St and Back St	1st St and Brook St	Keener Blvd (NC 273) and Brook St
Angle	2	6	2	3		2			2
Backing Up	3								
Fixed Object	1	1				1			
Left-Turn, Different Roadways	1	1				1			
Left-Turn, Same Roadway	1	1							
Other Collision with Vehicle		1							
Parked Motor Vehicle							1	1	
Ran off Road - Right	1					1			
Rear End, Slow or Stop	5	15	39		8	6			3
Rear End, Turn			1						
Sideswipe, Same Direction	1	2		1	1	1			3
Sideswipe, Opposite Direction		1							1
Total	15	28	42	4	9	12	1	1	9

The most common crash type within the study area was a rear-end collision caused by a slowing or stopping vehicle, making up 63% of total crashes. Further review of the crashes at the Keener Boulevard (NC 273)/R L Stowe Road/Fort William Avenue intersection shows that 23 of the 39 rear-end crashes were on the northbound approach of R L Stowe Road. As discussed in **Section 6.3**, there is a very heavy northbound right-turn demand. However, because the right-turn movement is currently combined with the through movement, there is no permitted-overlap phase, requiring these drivers to stop when red before turning. Restriping this approach to provide a shared left/through lane and an exclusive right-turn lane along with the addition of permitted-overlap phasing for the right-turn movement has been identified as mitigation. This improvement would allow vehicles to more fluidly progress through the intersection and would be expected to reduce rear-end crashes on this approach.

Crash data provided by NCDOT is included in the **Appendix**.

9.0 Mitigation Improvements

Based on the capacity analyses performed at each of the identified study intersections, along with review of the auxiliary turn-lane warrants and crash analyses contained herein, the following improvements are identified to mitigate the impact of the proposed development on the adjacent street network:

Keener Boulevard (NC 273) and Catawba Street (NC 7)

- Northbound right-turn lane along Keener Boulevard (NC 273) with 100' of storage

Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue

- Restripe the northbound approach of R L Stowe Road to provide a shared left/through lane and an exclusive right-turn lane
- Permitted-overlap phasing for the northbound right-turn movement along R L Stowe Road

1st Street and Access 1

- *Since the July 2019 TIA submittal, proposed Access 1 has been removed*

1st Street and Access 2

- Single eastbound egress and single ingress lane along Access 2

Back Street and Access 3

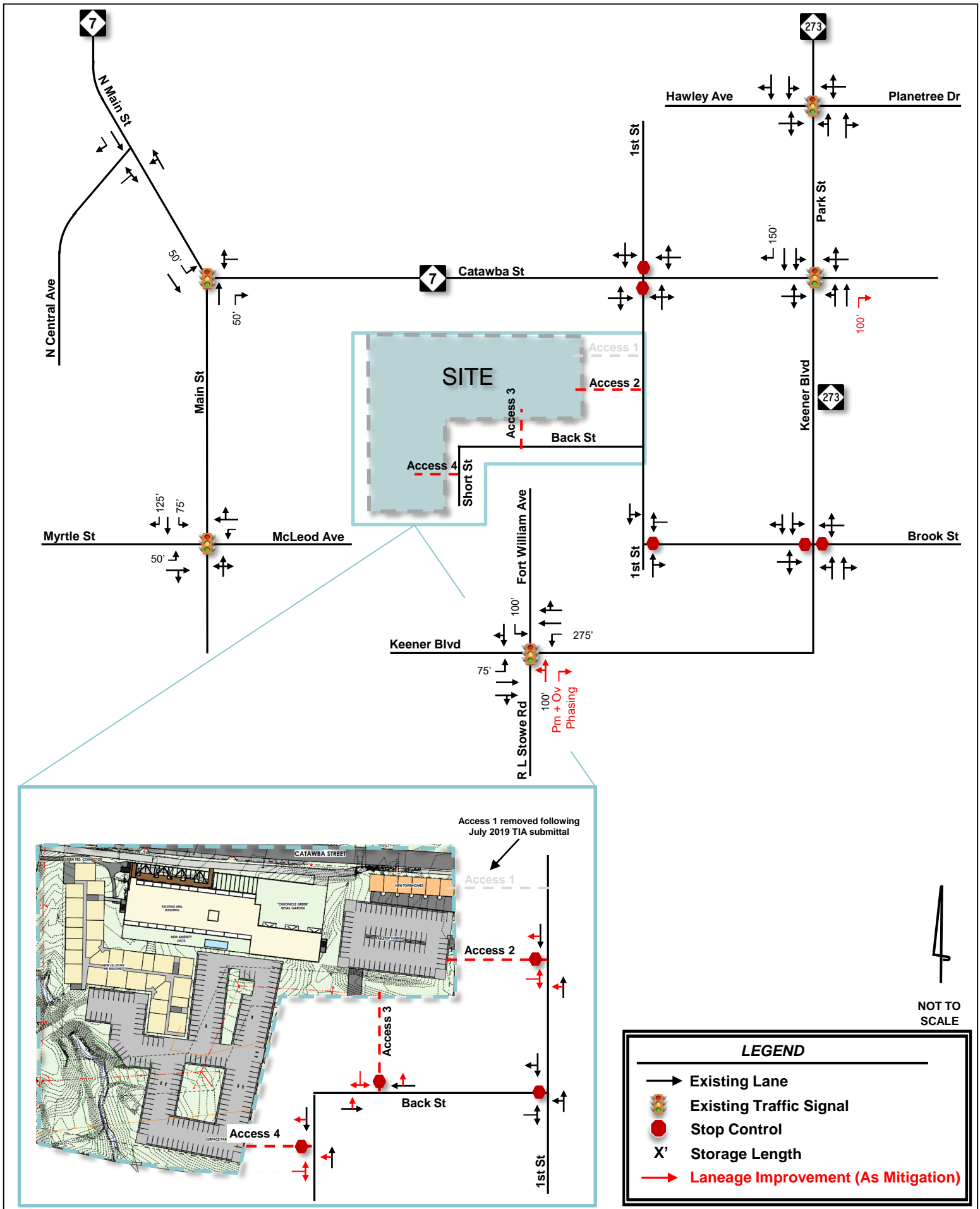
- Single southbound egress and single ingress lane along Access 3

Short Street and Access 4

- Single eastbound egress and single ingress lane along Access 4

Based on review and coordination with the City, NCDOT and the applicant since the July 2019 TIA submittal, an eastbound right-turn lane along Catawba Street (NC 7) at 1st Street is not required to be installed to mitigate the impact of the proposed Chronicle Mill development. The right-turn lane was initially considered based on NCDOT's auxiliary turn-lane warrants where 37 projected right-turn movements warrants a 50-foot turn lane based on this graph; however, this volume warrant does not meet NCDOT's minimum 100-foot turn-lane length. In addition, the overall site density did not meet NCDOT's TIA threshold. Given the low right-turn volume, along with the low-speed, downtown character of this portion of Catawba Street (NC 7) and the potential impacts to the proposed site development, the eastbound right-turn lane is not required.

The mitigation improvements identified within the study area are shown in **Figure 9.1**. The improvements shown on this figure are subject to approval by NCDOT and the City of Belmont. All additions and attachments to the State and City roadway system shall be properly permitted, designed and constructed in conformance to standards maintained by the agencies.



APPENDIX