

DEVELOPMENT AGREEMENT

THIS AGREEMENT ("Agreement"), is made and entered into by and between _____, a Missouri limited liability company ("Developer") and the City of Columbia, Missouri, a municipal corporation of the State of Missouri ("City") and will be effective the date of signature by the Party last executing this Agreement ("Effective Date"). The City and the Developer may hereinafter be collectively referred to as the Parties and individually as a Party.

RECITALS

WHEREAS, Developer is the owner of a tract of land consisting of approximately 16.79 acres, more or less, located in the City of Columbia, generally located at the southeast corner of Scott Boulevard and Vawter School Road, and legally described on **Exhibit A** attached hereto and incorporated herein by this reference (the "Subject Property"); and

WHEREAS, on or about October 3, 2022, a planned development plan for the Subject Property known as the Copperstone Corner PD Plan was submitted to the City for approval and is attached hereto as **Exhibit B** (the "PD Plan"); and

WHEREAS, Developer desires to develop the Subject Property for a mix of uses, including commercial, office and residential uses. When fully developed, the Subject Property is anticipated to be subdivided and developed into approximately ten (10) lots as shown in the PD Plan attached hereto as **Exhibit B**; and

WHEREAS, the parties desire to set forth responsibility for the construction and dedication of certain public improvements associated with development of the Subject Property in this Agreement, it being the intent of this agreement to provide milestones for which the construction and dedication of such public improvements shall occur;

NOW, THEREFORE, in view of the foregoing Recitals and in consideration of the mutual promises, declarations, covenants and agreements of the City and Developer as hereinafter set forth, the Parties hereby agree as follows:

1. **Agreement to Run with the Land.** The provisions of this Agreement will constitute covenants running with the entirety of the Subject Property and each and every part of the Subject Property, and will bind the current Developer and all of such successors and assigns.

2. **Developer's Obligations.**

a) Traffic Impact Study Improvements – Vawter School Road. Developer will construct the following improvements identified in the January 30, 2023 Traffic Impact Study by Lochmueller Group, which is attached hereto as **Exhibit C** (the “Traffic Study”). All improvements listed below are for Phase One (1) of the PD Plan and must be completed by Developer, at Developer’s expense, and accepted by the City prior to the approval of any final plat of any lot within Phase One (1) of the PD Plan, with the exception of Lot 101 and any common lot necessary for the installation of the private streets shown in the PD Plan. A final plat may be approved for Lot 101 and such common lot(s) prior to completion of the improvements listed below; however, a building permit and certificate of occupancy may only be issued for a building on Lot 101 that is intended for Diventures, an indoor scuba instruction business, and provided that the City Traffic Engineer determines that the use will not have a significant impact on the surrounding transportation infrastructure.

- i. Construct a two-way, left-turn lane on Vawter School Road, starting east of the roundabout, through the intersection with Break Time/Capital Drive, and terminating just west of the intersection with Frontgate Drive/Creekfront Way.
- ii. Stripe the existing northbound approach of Frontgate Drive at Vawter School Road to provide a shared left-turn/through lane and a right-turn lane.
- iv. Install a stop sign and stop bar pavement markings for traffic exiting from the Subject Property to Vawter School Road. Install a stop sign and stop bar pavement markings for Frontgate Lane at its intersection with Frontgate Drive. Install a stop sign and stop bar pavement markings for Frontgate Lane at its intersection with Capital Drive.
- v. Construct a pedestrian crossing, with a continental crosswalk, signage, refuge island, and pedestrian actuate rapid flashing beacons along Vawter School Road to the west side of its intersection with Frontgate Drive.

b) Traffic Impact Study Improvements – Scott Boulevard. Developer will construct the following improvements identified in the January 30, 2023 Traffic Impact Study by Lochmueller Group, which is attached hereto as **Exhibit C** (the “Traffic Study”) as part of Phase Two (2) of the PD Plan. All improvements listed below must be completed by Developer, at Developer’s expense, and accepted by the City prior to the approval of any final plat of any lot on the Subject Property labeled as Phase 2 on the PD Plan.

- i. Construct a two-way, left-turn lane on Scott Boulevard extending from its current terminus north of the Silver Valley Drive northward, and terminating just south of the roundabout at Vawter School Road.

ii. Install a stop sign and stop bar pavement markings for traffic exiting from the Subject Property to Scott Boulevard.

iii. Construct a northbound right-turn bypass lane at the roundabout located at the intersection of Scott Boulevard and Vawter School Road and dedicate the right-of-way necessary for the improved roundabout, similar to that shown in Figure 18 of the Traffic Study and as depicted on the PD Plan.

3. **Construction and Bonding of Improvements.** Except as otherwise expressly indicated herein, all public improvements required under the regulations of the City or this Agreement must be constructed in accordance with the City's Street, Storm Sewer, and Sanitary Sewer Specifications and Standards, as may be amended, or any successor specifications and standards adopted by the City together with any final construction plans approved by the City prior to construction of such facilities. In connection with construction, the Developer shall be required to post bonds or other security as required by the city code. Developer is responsible for obtaining all necessary easements to construct improvements related to Developer's Development of the Subject Property.

4. **Phasing Plan.** If any development of the Subject Property, including final platting, will be phased, then a plan which generally describes the sequence of development of the Subject Property ("**Phasing Plan**") must be submitted to the Director of Community Development ("**Director**") concurrently with the first application for a Final Plat on the Subject Property. The Phasing Plan shall become final and binding upon Developer upon approval of the first Final Plat on the Subject Property. Thereafter, development and platting of the Subject Property shall occur in the sequence established in the Phasing Plan, and any amendments thereto. However, nothing contained in this paragraph shall be construed as precluding Developer from filing or developing more than one phase at a time. The Phasing Plan may not be amended except upon written approval of the Director, which shall not be unreasonably withheld, conditioned or delayed.

5. **Recording.** The City shall record this Agreement in the office of the Boone County Recorder of Deeds at the cost and expense of the Developer.

6. **Amendments.** Any amendment to this Agreement must be in writing and must be executed by the City and the Developer, and any future Developer of any part of the Subject Property who would otherwise be obligated to perform any of the requirements imposed upon the Developer by this Agreement. Oral modifications or amendments of this Agreement are of no force or effect.

7. **Remedies.** The parties to this Agreement may, either in law or equity, by suit, action, mandamus or other proceedings in court, seek declaratory relief, enforce and compel specific performance of this Agreement provided that in no event will the City have any liability in damages, costs or any other monetary liability to Developer or any affiliate of Developer, any person claiming through Developer, or to their respective successors, assigns, heirs and personal representatives in respect of any suit, claim, or cause of action arising out of this Agreement or any of the actions or transactions contemplated herein.

8. **Third Party Actions.** Developer will have the right, but not the obligation to assume the costs of defense of any action or proceeding initiated by a third party challenging this Agreement, the zoning or rezoning of the Subject Property, or any other actions or transactions contemplated by this Agreement (including, without limitation, to settle or compromise any claim or action for which Developer has assumed the defense) with counsel of Developer's choosing and the City and Developer agree that so long as no conflicts of interest exist between them, the same attorney or attorneys may simultaneously represent the City and Developer in any such proceeding. In no event will the City have any liability to Developer for damages or otherwise in the event that all or any part of this Agreement, or the approval of a zoning request or platting request, are declared invalid or unconstitutional in whole or in part by a final (as to which all rights of appeal have been exhausted or expired) judgment of a court of competent jurisdiction, and, in the event Developer elects not to assume such defense and costs, the City will have no obligation to defend or to assume the costs of defense of any such action.

9. **Notices.** All notices between the parties hereto must be in writing and must be sent by certified or registered mail, return receipt requested, by personal delivery against receipt or by overnight courier, will be deemed to have been validly served, given or delivered immediately when delivered against receipt or three (3) business days after deposit in the mail, postage prepaid, or one (1) business day after deposit with an overnight courier, and must be addressed as follows:

If to the City:

City of Columbia
Attn: City Manager
701 E. Broadway
Columbia, MO 65205

If to Developer:

With a copy to:

Each party will have the right to specify that notice is to be addressed to another address by giving to the other party ten (10) days written notice thereof.

10. **Insurance.** Developer must provide, at its sole expense, and maintain during all times in which Developer is constructing public improvements pursuant to this Agreement commercial general liability insurance with a reputable, qualified, and financially sound company licensed to do business in the State of Missouri, and unless otherwise approved by the City, with a rating by Best of not less than "A," that will protect the Developer, the City, and the City's officials, officers, and employees from claims which may arise from operations under this Agreement, whether such operations are by the Developer, its officers, directors, employees and agents, or any subcontractors of Developer. This liability insurance must include, but will not be limited to, protection against claims arising from bodily and personal injury and damage to property, resulting from all Developer operations, products, services or use of automobiles, or construction equipment. The amount of insurance required herein must be in no event less than the individual and combined sovereign immunity limits established by § 537.610 RSMo. for political subdivisions; provided that nothing herein will be deemed to waive the City's sovereign immunity. An endorsement must be provided which states that the City is named as an additional insured and stating that the policy will not be canceled or materially modified so as to be out of compliance with the requirements of this Section, or not renewed without 30 days advance written notice of such event being given to the City.

11. **Hold Harmless.** Developer at its sole cost and expense, hereby agrees to indemnify, protect, release, defend (with counsel acceptable to the City) and hold harmless the City, its municipal officials, elected officials, boards, commissions, officers, employees, attorneys, and agents from and against any and all causes of action, claims, demands, all contractual damages and losses, economic damages and losses, all other damages and losses, liabilities, fines, charges, penalties, administrative and judicial proceedings and orders, judgments, remedial actions of any kind, and all costs and expenses of any kind, including, without limitation, reasonable attorney's fees and costs of defense arising, directly or indirectly, in whole or in part, from the action or inaction of Developer, its agents, representatives, employees, contractors, subcontractors or any other person for whose acts Developer may be liable, in the activities performed, or failed to be performed, by Developer under this Agreement or in the development of the Subject property, except to the extent arising from or caused by the sole or gross negligence or willful misconduct of the City, its elected officials, officers, employees, agents or contractors. The indemnification, duty to defend and hold harmless obligations set forth in this Section will survive for a period of five (5) years from the date of expiration or termination of this Agreement.

12. **Sovereign Immunity.** Nothing in this Agreement shall constitute or be construed as a waiver of the City's governmental or official immunity or its officers or employees from liability or suit pursuant to Section 537.600 RSMo.

13. **No Third Party Beneficiaries.** There are no third party beneficiaries to this Agreement.

14. **Failure or Delay to Enforce.** No failure to exercise or delay in exercising any right hereunder on the part of any Party to this Agreement shall operate as a waiver thereof, and no single or partial exercise of any right of such Party shall preclude any other or further exercise of such right or the exercise of any other right.

15. **Power of the City.** Notwithstanding anything set forth in this Agreement to the contrary, no provision contained herein shall in any manner diminish or usurp the inherent rights and powers of the City to act in its capacity as a public body. Nothing herein shall relieve Developer from complying with all applicable laws and requirements.

16. **Inspection.** Upon reasonable prior notice, the City may conduct such periodic inspections of the projects herein, including any applicable phase, as may be generally provided in the applicable law or regulation for inspection thereof in order to confirm compliance with the terms of this Agreement. The Developer shall not deny the City and its officers and employees the right to inspect, upon reasonable prior written request, all engineering plans, construction contracts or other documents pertaining to the construction of the public infrastructure on the Subject Property. Notwithstanding the foregoing, Developer shall not be required to produce documents for inspection if such documents are attorney-client privileged or contain confidential, proprietary information or if production would violate the rights of any third parties.

17. **Governing Law.** This Agreement will be construed according to the laws of the State of Missouri. The Parties will comply with all local, state, and federal laws and regulations relating to the performance of this Agreement.

18. **Venue.** Any action at law, suit in equity, or other judicial proceeding to enforce or construe this Agreement, or regarding its alleged breach, must be instituted only in the Circuit Court of Boone County, Missouri.

19. **Entire Agreement.** This Agreement contains the entire and complete agreement between the City and the Developer with respect to the requirements imposed upon the Developer for the providing of certain rights-of-way and interests in land, and the construction and installation of certain improvements, all as hereinabove described in the Recitals for this Agreement and the above numbered paragraphs of this Agreement. Parties agree that this Agreement constitutes a lawful contract between the Parties and Developer hereby acknowledges and agrees that this Agreement and provisions of the

City's Code of Ordinances applicable to this Agreement constitute lawful exercises of the City's authority and police power.

[Remainder of page intentionally blank. Signature pages follow.]

IN WITNESS WHEREOF, the Parties have executed this Agreement and shall be effective on the last day and year indicated below.

CITY:
City of Columbia, Missouri

By: _____
De'Carlton Seewood, City Manager

Date: _____

ATTEST:

Sheela Amin, City Clerk

Approved as to form:

Nancy Thompson, City Counselor/rgt

On this _____ day of _____, 20__, before me appeared De'Carlton Seewood, to me personally known, who, being by me duly sworn, did say that he is the City Manager of the City of Columbia, Missouri, and that the seal affixed to the foregoing instrument is the corporate seal of the City and that this instrument was signed and sealed on behalf of the City by authority of its City Council and the City Manager acknowledged this instrument to be the free act and deed of the City.

IN TESTIMONY WHEREOF, I have hereunto set by hand and affixed my official seal, at my office in Columbia, Boone County, Missouri, the day and year first above written.

Notary Public

My commission expires: _____.

DEVELOPER:

_____, a Missouri Limited
Liability Company

By: _____

Name Printed:

Date _____

STATE OF MISSOURI)
) SS
COUNTY OF BOONE)

On this _____ day of _____, 20____, before me appeared
_____, to me personally known, who, being by me duly sworn did
say that he or she is _____ of
_____ and that said instrument was signed on behalf of
said corporation, acknowledged said instrument to be the free act and deed of said
corporation and that he or she executed the same for the purposes therein stated.

IN TESTIMONY WHEREOF, I have hereunto affixed my hand and notarial seal at my
office in the State and County aforesaid, on the day and year hereinabove first written.

_____,
Notary Public

My commission expires: _____

EXHIBIT A
Legal Description Subject Property

Legal Description – PD Zoning Amendment

A tract of land located in the west half of Section 33, Township 48 North, Range 13 West, city of Columbia, Boone County, Missouri, being Tract 1-A of the Survey recorded in Book 2860, Page 59, records of Boone County, Missouri, and being more particularly described as follows:

Beginning at the northwest corner of said Tract 1-A and the Northwest corner of said Section 33, thence along the north line of said tract, S 83°09'10"E, 879.15 feet; Thence leaving said Section line and the north line of said tract, S 01°26'05"W, 627.99 feet; Thence N 88°38'15"W, 374.36 feet; Thence S 01°21'25"W, 288.00 feet; Thence N 88°38'15"W, 501.98 feet to the West line of said Section 33; Thence along said West line, N 01°28'35"E, 1000.02 feet to the Point of Beginning and containing 16.79 Acres.

All bearings referenced to grid north of the Missouri state plane coordinate system nada83 (2011), epoch date 2010.00, central zone, by GPS observations using MoDOT VRS network.

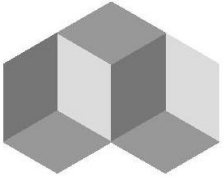

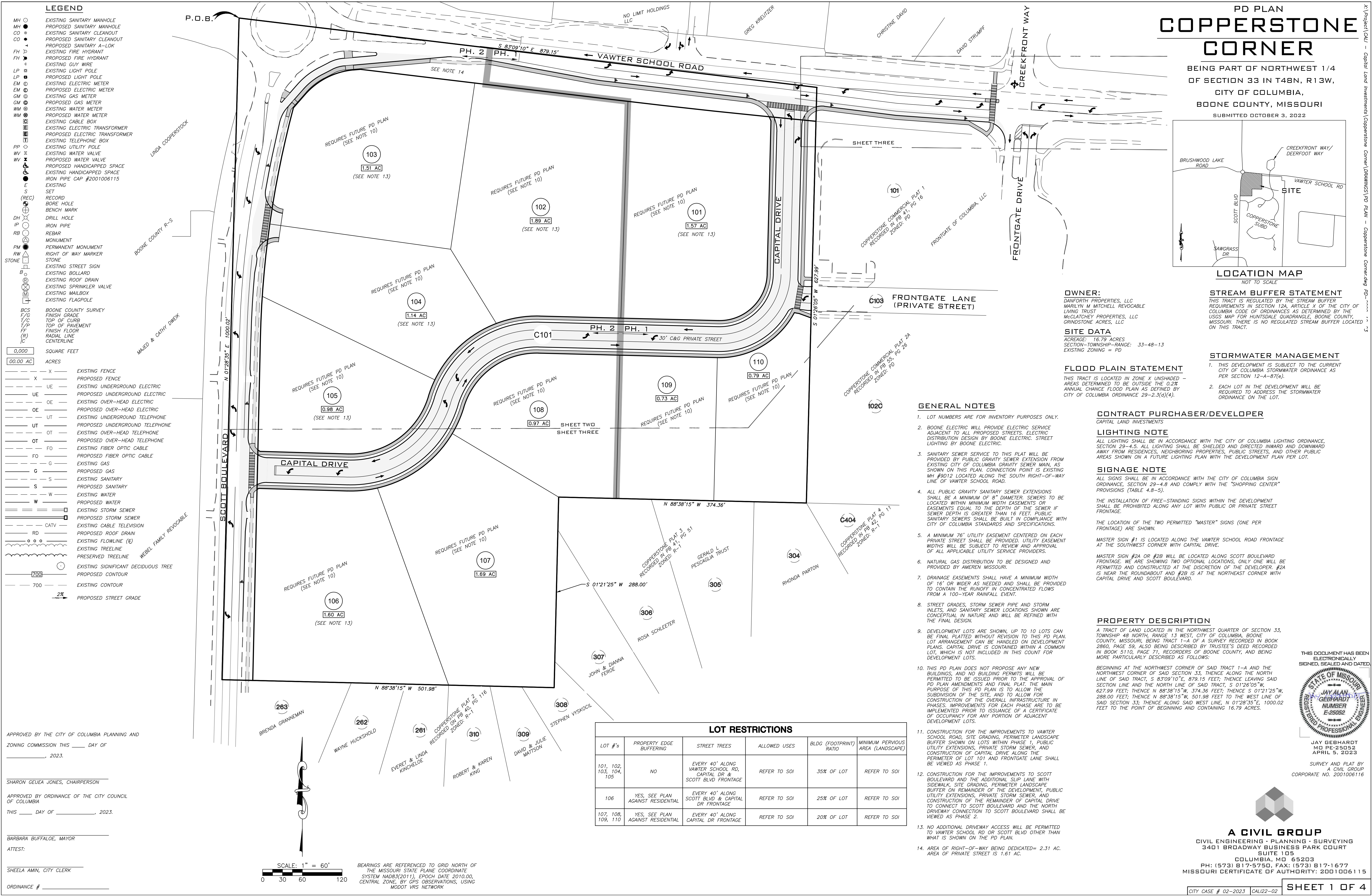
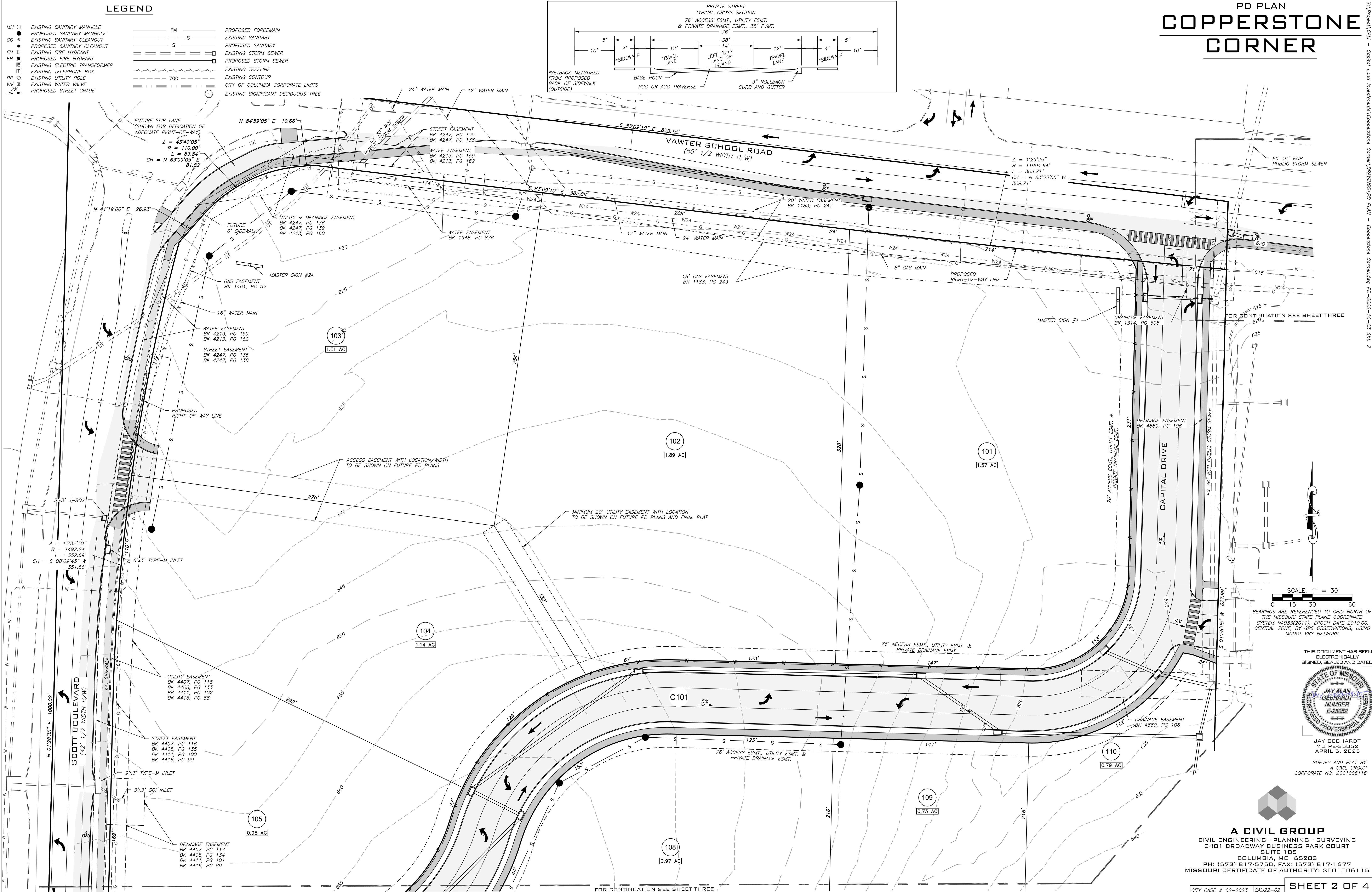
 <p>A Civil Group, LLC 3401 Broadway Business Park Ct. Suite 105 Columbia, Missouri 65203 (573) 817-5750</p>	<p>Jay Gebhardt Professional Land Surveyor LS-2001001909 Job #: CALI22.02</p>	 <p>Date: 02-23-2023</p>
<p>Missouri Professional Land Surveying Certificate of Authority: 2001006115</p>		
<p>Project Name/Description: Proposed Zoning Copperstone Corner Location: Tract 1-A survey recorded in Book 2860, Page 59, City of Columbia, Boone County, Missouri</p>		

EXHIBIT B
Copperstone Corner PD Plan



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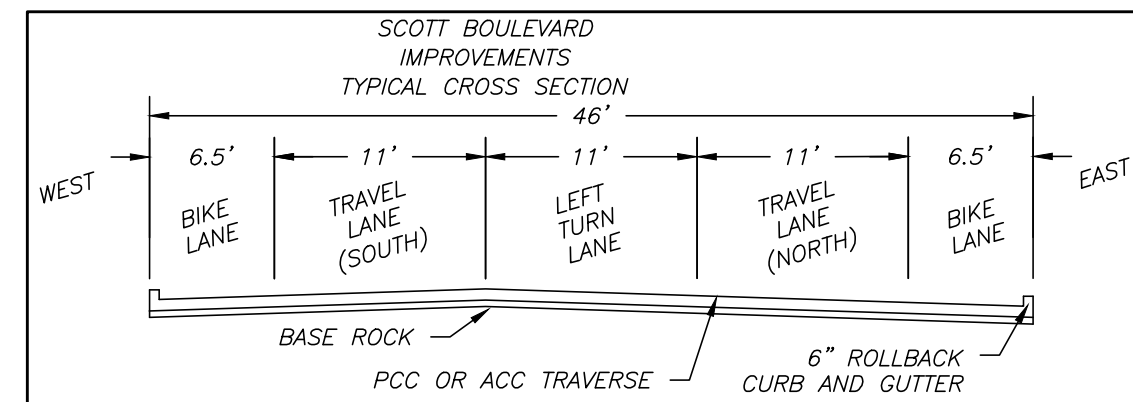
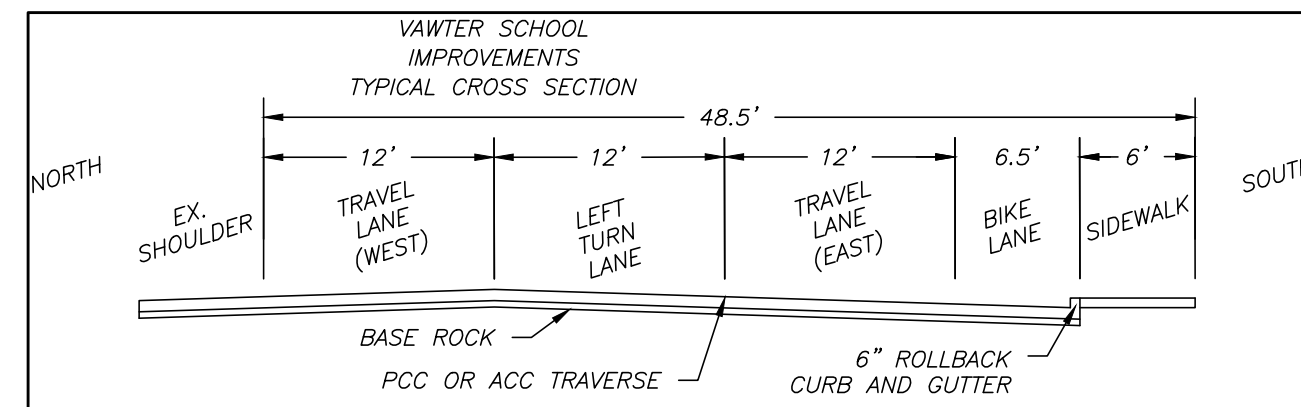
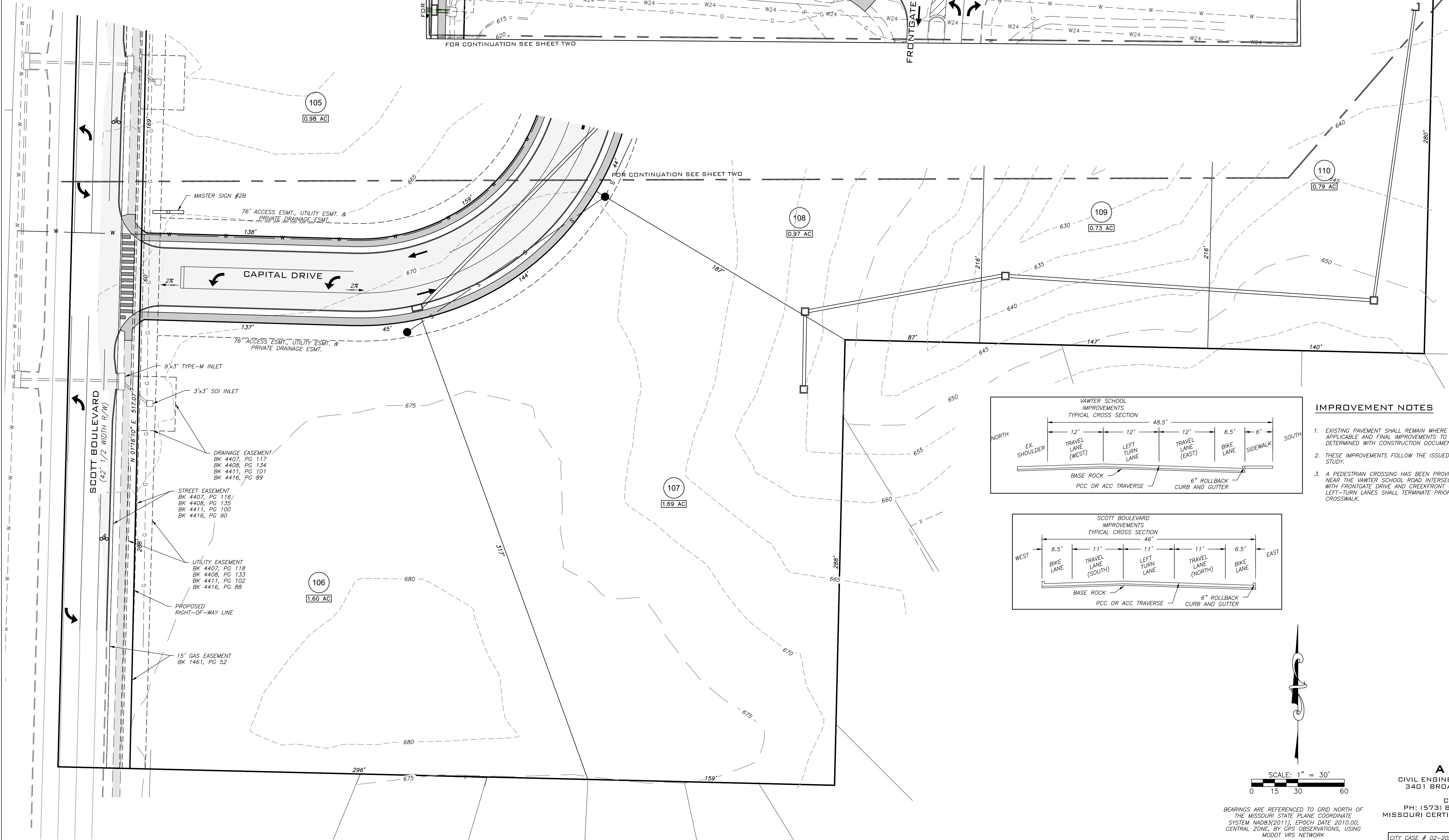
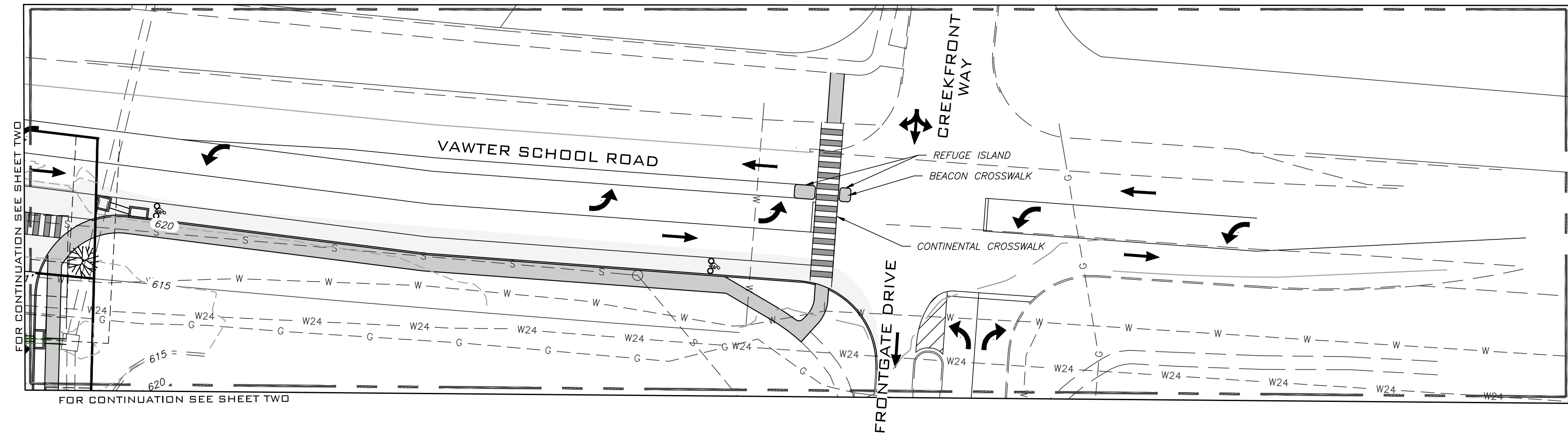
PD PLAN COPPERSTONE CORNER



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PD PLAN
**COPPERSTONE
CORNER**

LEGEND	
MH ○	EXISTING SANITARY MANHOLE
CO ●	PROPOSED SANITARY MANHOLE
CO ●	EXISTING SANITARY CLEANOUT
CO ●	PROPOSED SANITARY CLEANOUT
FD ○	EXISTING FIRE HYDRANT
FD ○	PROPOSED FIRE HYDRANT
ET ○	EXISTING ELECTRIC TRANSFORMER
ET ○	EXISTING TELEPHONE BOX
PP ○	EXISTING UTILITY POLE
WV X	EXISTING WATER VALVE
2% ▽	PROPOSED STREET GRADE
FM —	PROPOSED FORCEMAIN
S —	EXISTING SANITARY
S —	PROPOSED SANITARY
—	EXISTING STORM SEWER
—	PROPOSED STORM SEWER
—	EXISTING TREELINE
700 —	EXISTING CONTOUR
—	CITY OF COLUMBIA CORPORATE LIMITS
○	EXISTING SIGNIFICANT DECIDUOUS TREE



IMPROVEMENT NOTES

- EXISTING PAVEMENT SHALL REMAIN WHERE APPLICABLE AND FINAL IMPROVEMENTS TO BE DETERMINED WITH CONSTRUCTION DOCUMENTS.
- THESE IMPROVEMENTS FOLLOW THE ISSUED TRAFFIC STUDY.
- A PEDESTRIAN CROSSING HAS BEEN PROVIDED NEAR THE VAWTER SCHOOL ROAD INTERSECTION WITH FRONTGATE DRIVE AND CREEKFRONT WAY. THE LEFT-TURN LANES SHALL TERMINATE PRIOR TO THE CROSSWALK.

THIS DOCUMENT HAS BEEN
ELECTRONICALLY
SIGNED, SEALED AND DATED



JAY GEBHARDT
MO PE-25052
APRIL 5, 2023
SURVEY AND PLAT BY
A CIVIL GROUP
CORPORATE NO. 2001006116



A CIVIL GROUP
CIVIL ENGINEERING • PLANNING • SURVEYING
3401 BROADWAY BUSINESS PARK COURT
SUITE 105
COLUMBIA, MO 65203
PH: (573) 817-5750, FAX: (573) 817-1677
MISSOURI CERTIFICATE OF AUTHORITY: 2001006115

BEARINGS ARE REFERENCED TO GRID NORTH OF
THE MISSOURI STATE PLANE COORDINATE
SYSTEM NAD83(2011), EPOCH DATE 2010.00,
CENTRAL ZONE, BY GPS OBSERVATIONS, USING
MODOT VRS NETWORK

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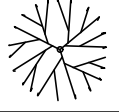

PD PLAN
COPPERSTONE
CORNER

LANDSCAPING NOTES

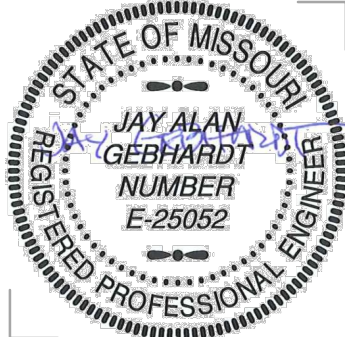
1. PROPOSED AREAS
ALL PROPOSED AREAS WILL BE COMPLIANT WITH LANDSCAPING REQUIREMENTS AT THE TIME A REVISED PD IS SUBMITTED.
2. TREE PRESERVATION:
CLIMAX FOREST TOTAL AREA: 0
REQUIRED TREE PRESERVATION AREA: 0
3. STREET FRONTAGE LANDSCAPING:
 - A. IN ACCORDANCE WITH SECTION 29-4.4(D)(1) ALL PARKING PAVED AREAS MORE THAN 40 FEET IN LENGTH WITHIN 25 FEET OF STREET RIGHT-OF-WAY SHALL BE IMPROVED WITH A LANDSCAPING BUFFER STRIP. STREET FRONTAGE LANDSCAPING SUBJECT TO FINAL SITE PLAN SUBMISSIONS.
 - B. IN ACCORDANCE WITH SECTION 29-4.4(D)(2) STREET TREE LANDSCAPING SHALL BE INSTALLED AS FOLLOWS:

VAWTER SCHOOL RD. FRONTAGE = 768 L.F.
1 TREE / 40 FT = 770/40 = 19.25 OR 20 TOTAL TREES
30% LARGE TREES = 6 TREES
REMAINING TREE VARIETIES = 14 TREES

SCOTT BLVD. = 913 L.F.
1 TREE / 40 FT = 920/40 = 22.8 OR 23 TOTAL TREES
30% LARGE TREES = 6.9 OR 7 TREES
REMAINING TREE VARIETIES = 16 TREES
C. STREET TREES SHALL BE REQUIRED ADJACENT CAPITAL DRIVE AND SHOWN WITH EACH DEVELOPMENT PLAN.
4. PROPERTY EDGE BUFFERING:
 - A. LOT 101 TO THE EAST OF THE SUBJECT PROPERTY DOES NOT REQUIRE PROPERTY EDGE BUFFERING. IN ACCORDANCE WITH TABLE 4.4-4 OF THE UDC, NO BUFFER REQUIRED AT COMMERCIAL TO COMMERCIAL TRANSITION.
 - B. LOT 102C TO THE EAST OF THE SUBJECT PROPERTY DOES NOT REQUIRE PROPERTY EDGE BUFFERING. IN ACCORDANCE WITH TABLE 4.4-4 OF THE UDC, NO BUFFER REQUIRED AT COMMERCIAL TO COMMERCIAL TRANSITION.
 - C. THE PROPERTIES ADJACENT TO THE SOUTHERN LINE OF THE SUBJECT PROPERTY ARE ZONED R-1. THESE 10 PROPERTIES REQUIRE A LEVEL 3 PROPERTY EDGE BUFFER IN ACCORDANCE WITH TABLE 4.4-4 OF THE UDC. A 10-FOOT WIDE LANDSCAPE BUFFER WITH FOUR CATEGORIES OF PLANTING MATERIAL REQUIRED. SEE TABLE 4.4-3 AND AN EIGHT-FOOT TALL SCREENING DEVICE IS REQUIRED AT A COMMERCIAL TO SINGLE-FAMILY RESIDENTIAL TRANSITION. A PORTION OF THE PROPERTY EDGE EXISTING LANDSCAPING IS INTENDED TO BE PRESERVED. THE EXISTING PRESERVED BUFFER WIDTH IS APPROXIMATELY 10'. EVERGREEN TREES ALONG PROPERTY LINE TO BE PLACED AT 10' CENTERS AND STAGGER THEM 5 TO 10 FEET HORIZONTALLY FROM THE PROPERTY LINE WITH A 10-FOOT WIDE LANDSCAPE BUFFER WITH FOUR CATEGORIES OF PLANTING MATERIALS.
 - D. SOME OF THE ADJACENT PROPERTIES HAVE EXISTING FENCES AND THE ADJACENT OWNERS DO NOT SUPPORT ANOTHER FENCE AS A SCREENING DEVICE.
5. PRESERVATION OF EXISTING LANDSCAPING:
THE EXISTING VEGETATION WITHIN EXISTING WOODED AREA WILL BE PRESERVED ALONG THE SOUTHERN PROPERTY LINE AND COUNT TOWARD THE SCREEN/BUFFER REQUIREMENTS.
6. REMOVAL AND REPLACEMENT OF SIGNIFICANT TREES SHALL COMPLY WITH SECTION 29-4.4(G)(1-3) OF THE CITY CODE. 23 SIGNIFICANT TREES ON THE SITE.

LANDSCAPING TABLE				
SYMBOL	QUANTITY	CONTAINER/SIZE	SPACING	CATEGORY
STREET FRONT BUFFERING				
	13	2" CAL - B&B	40' CENTERS	LARGE DECIDUOUS SHADE TREE - MATURE HEIGHT >45'
	30	2" CAL - B&B	40' CENTERS	LARGE DECIDUOUS SHADE TREE - MATURE HEIGHT >45'
RESIDENTIAL BUFFERING				
	223	6' HEIGHT	10' CENTERS	EVERGREEN TREE - MATURE HEIGHT 30'-35'

THIS DOCUMENT HAS BEEN
ELECTRONICALLY
SIGNED, SEALED AND DATED



JAY GEBHARDT
MO PE-26052
APRIL 5, 2023

SURVEY AND PLAT BY
A CIVIL GROUP
CORPORATE NO. 2001006115



A CIVIL GROUP
CIVIL ENGINEERING • PLANNING • SURVEYING
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PH: (573) 817-5750, FAX: (573) 817-1677
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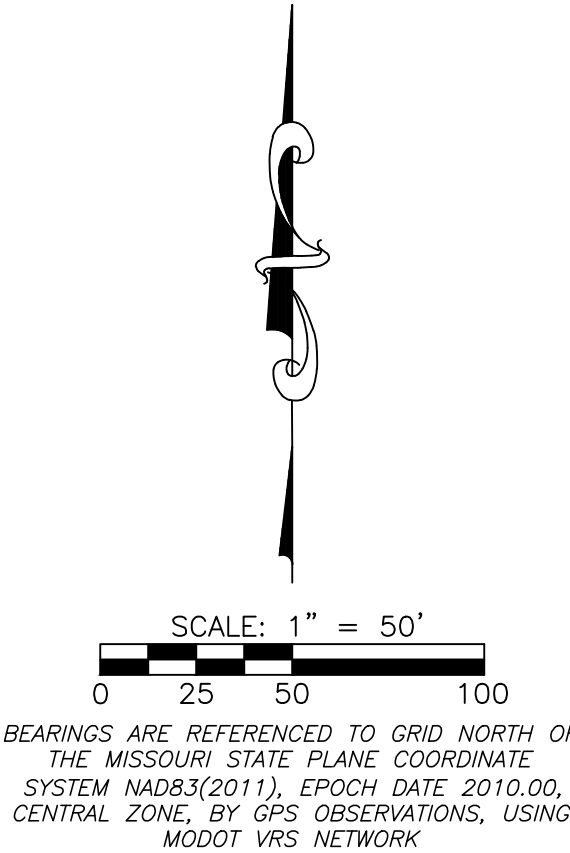
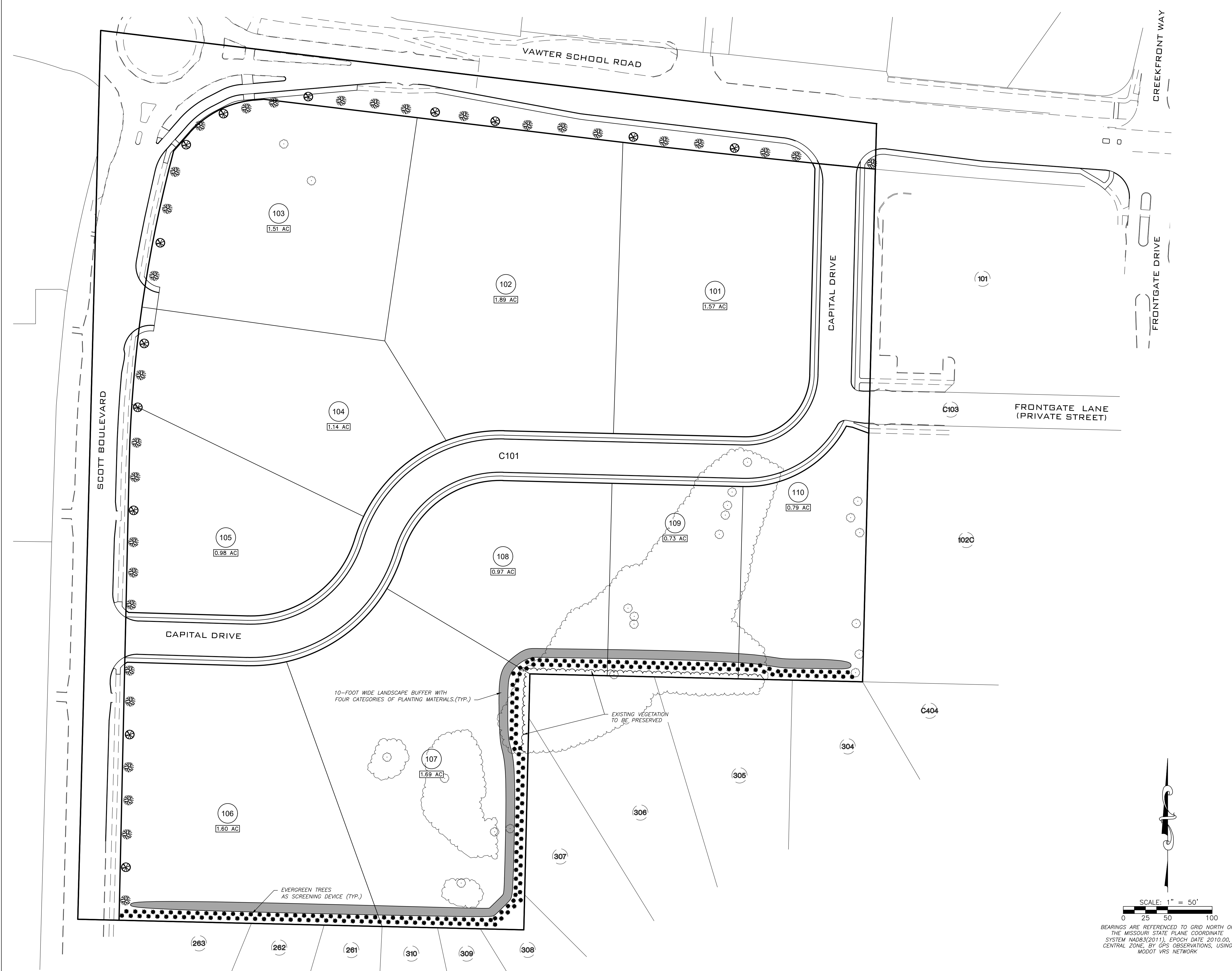


EXHIBIT C
Traffic Impact Study (January 30, 2023)

JANUARY 30, 2023

Revised

Originally Submitted September 19, 2022

Copperstone Corner Traffic Impact Study

City of Columbia, Missouri

Prepared for:

Capital Holding Group

117 Commerce Drive

Jefferson City, Missouri 65109

573-673-6837

Prepared by:

Lochmueller Group

411 N. 10th Street

Suite 200

St. Louis, MO 63101

314.621.3395



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Executive Summary

Lochmueller Group has completed the following revised traffic study pertaining to the proposed mixed-use development located in Columbia, Missouri. It is our understanding that Capital Land Investments would like to develop 16.8 acres in the southwest quadrant of Scott Boulevard and Vawter School Road. The proposed development, known as Copperstone Commercial, would seek access to both Scott Boulevard and Vawter School Road, both of which are City controlled roadways. In addition, the development would likely facilitate the extension of Frontgate Lane westward from its current terminus to Scott Boulevard.

The original traffic study was completed in September 2022 and offered a series of recommended improvements to the surrounding road system that included two-way, left turn lanes along Vawter School Road and Scott Boulevard, separate turn lanes on the access drives, aligning Capital Lane with the existing Break Time drive along Vawter School Road and prohibiting the left turns from the site, restriping Frontgate Drive at Vawter School Road to provide two outbound lanes, and pedestrian accommodations along Scott Boulevard and Vawter School Road. The study and the recommended improvements were reviewed and approved by the City of Columbia staff.

The intent of this revised study was to address the change in access along Vawter School Road. Capital Lane, as proposed, would now intersect Vawter School Road approximately 165 feet to the east of the existing Break Time access drive. Also, Diverntures has relocated within the site and would be developed along the eastern portion of the development. Initially, Capital Lane would be constructed so as to access Diventures and intersect with the extended Frontgate Lane. In addition, the revised study considers a scenario where only Diventures is developed on the site with the above referenced access (i.e., no access to Scott Boulevard).

The revised study again identifies the traffic generation associated with the proposed development, analyzes the traffic impacts associated with the proposed development, and determines the need for mitigation measures, if necessary. The following scenarios have been evaluated and are presented within this report:

- Existing Conditions (2022)
- 2024 Baseline Conditions (background traffic growth only)
- 2024 Forecasted Conditions – Scenario 1: Diventures Only (background traffic growth + Diventures assuming access to Vawter School Road and Frontgate Lane only)
- 2024 Forecasted Conditions – Scenario 2: Build Out (background traffic growth + full buildout of development with access to Scott Boulevard as well)
- 2044 Horizon Year Baseline Conditions
- 2044 Horizon Year Forecasted Conditions

The intersections included in the analysis are:

- Scott Boulevard & Vawter School Road (Roundabout)
- Vawter School Road & Break Time Drive (unsignalized)
- Vawter School Road & Frontgate Drive (unsignalized)
- Frontgate Drive & Frontgate Lane (unsignalized)
- Scott Boulevard & Silver Valley Drive (unsignalized)

Given the nature of the development, the revised traffic impact study continues to focus on the weekday morning and evening peak periods, as well as the Saturday midday peak period. Based upon the analysis of the above scenarios at these times, the following conclusions were reached:

- Today, the study intersections operate favorably during the weekday AM and PM peak periods as well as the Saturday midday peak hour. These time periods were chosen for analysis since they represent peak periods for the adjacent road system as well as the proposed development.
- During typical traffic conditions, there is little incentive for a motorist to travel through the Copperstone neighborhood as a means of avoiding the roundabout at the intersection of Scott Boulevard and Vawter School Road. Given the complexity of the neighborhood streets and the lack of a “straight shot” between Scott Boulevard and Vawter School Road, the associated travel time is shorter when vehicles remain on Scott Boulevard and Vawter School Road and do not travel through the neighborhood.
- When school is in session, brief vehicular queues longer than typical operations were observed; particularly on northbound and southbound Scott Boulevard and westbound Vawter School Road. The surges in traffic would often dissipate within minutes and traffic conditions would return to normal. School traffic would have the most impact during the morning when the school peak and the weekday AM peak coincide.
- Two additional developments have been previously approved and are underway within the vicinity of Copperstone Corner. The first would be a new development adjacent to the Break Time, which will consist of 4,500 SF of retail and 1,500 SF of fast-food restaurant with drive-through. Access would be provided via the existing access drive serving Break Time. The other development is along the west side of Scott Boulevard, south of Vawter School Road, and would provide for 35 single family detached homes with two points of full access. Both developments are expected to be in place by 2024. The background developments would be expected to contribute 73, 103, and 92 total new trips during the weekday AM, PM, and Saturday MD peak hours, respectively, to the area road system.
- The additional traffic from the development adjacent to the Break Time would decline the operating conditions associated with the southbound left turn exiting the site to a LOS F.

- Given the operating characteristics of the proposed Diventures, it is expected to generate a total of approximately 14, 160, and 95 new trips during the weekday morning, evening, and Saturday midday peak hours, respectively.
- The full build out of Copperstone Corner would generate a total of approximately 898, 1,377, and 1,163 trips during the weekday morning, evening, and Saturday midday peak hours, respectively, upon completion. However, when common and pass-by trips are taken into consideration, the proposed development would generate a total of approximately 407, 659, and 499 **new** trips during the weekday morning, evening, and Saturday midday peak hours, respectively.
- The latest proposed site plan ultimately provides for four site access drives serving Copperstone Corner. Two site access drives are proposed along Scott Boulevard, one site access drive proposed along Vawter School Road approximately 165 feet east of the existing access drive to Break Time (to be referred to as Capital Drive), and the fourth site access drive is proposed via an extension of Frontgate Lane thereby affording access to existing Frontgate Drive.
- Given the horizontal curvature of Scott Boulevard south of Vawter School Road, sight distance measurements were conducted to determine where along Scott Boulevard would access be safe to provide. Figure 12 in the following report illustrates the allowable frontage in which both drives could be located, assuming a minimum of 300 feet separation is maintained between the two drives. By locating the access drives within that allowable window, they would meet the MoDOT sight distance requirements for 40 mph and would allow for better queueing distance from the roundabout.
- All proposed intersections should conform to the sight distance requirements set forth by the American Association of State Highway and Transportation Officials (AASHTO). Sight distance measurements should be field verified prior to construction of the drives themselves once the site has been cleared. Furthermore, as part of the design and construction process, care should be given to ensure that signage and/or landscaping does not pose sight distance limitations at any of the proposed drive locations.
- The revised preliminary site plan includes several improvements to the study area that were identified in the original traffic study and reviewed and approved by the City of Columbia. These improvements include:
 - Each of the site access drives along Scott Boulevard and Vawter School Road would have designated turn lanes for exiting traffic.
 - Left-turn lanes into the site from Scott Boulevard and Vawter School Road are accommodated via two-way, left-turn lanes.
 - A two-way, left-turn lane along Vawter School Road is proposed starting east of the roundabout, traversing through the intersections with Break Time and with Capital Drive and terminating just west of the intersection with Frontgate Drive/Creekfront Way. The termination of this center lane would result in the provision of the eastbound left turn lane at Creekfront Way.

- The two-way left-turn lane along Scott Boulevard would extend from its current terminus north of Silver Valley Drive northward and stop just south of the roundabout at Vawter School Road. This provides the southbound left-turn lanes into the site along Scott Boulevard (not required until such time that access onto Scott Boulevard is provided).
 - The northbound approach at Vawter School Road and Frontgate Lane would be improved to provide a shared left-turn/through lane and a right-turn lane. This improvement is made through striping changes and not physical widening as there is ample width available to accommodate the restriping.
- In addition to the improvements already included within the latest site plan, it is recommended that traffic exiting to Scott Boulevard and Vawter School Road be placed under STOP control via installation of signage and a stop bar pavement markings. Additionally, it is recommended that a stop sign and stop bar be provided along Frontgate Lane at its intersection with Frontgate Drive. Currently that approach is under an implied stop as there is not a stop sign present. Within the development, side-street stop control should be provided at the internal intersection of Frontgate Lane with Capital Drive where traffic traveling along Frontgate Lane is required to stop.
- Two scenarios were analyzed for the 2024 forecasted conditions. The first scenario includes traffic from the Diventures development only given that no other uses are confirmed for the site at this time. The second scenario includes the full build out of the proposed development assuming various mixed uses as proposed by the developer. It was concluded that the introduction of the traffic associated with Copperstone Corner would have an impact upon traffic conditions along the adjacent roadways, which is mitigated by the proposed road improvements.
 - Scenario 1 – Diventures Only:
 - Access to the Diventures would be via Capital Drive to Vawter School Road or to Frontgate Drive via Frontgate Lane. No access would be provided via Scott Boulevard under this scenario.
 - The study intersections easily accommodate the introduction of the Diventures development's traffic with the proposed lane configuration and traffic control shown on the site plan.
 - Scenario 2 – Full Build:
 - Access to the development would be provided via all four proposed site access drives.
 - The study intersections adequately accommodate the introduction of the development's traffic with the proposed lane configuration and traffic control as shown on the site plan. In fact, the previously failing southbound left-turn at the Break Time would improve due to the ability to make a two-stage left-turn once a continuous two-way left-turn lane along Vawter School is provided.
 - The original traffic impact study recommended the prohibition of the left turn onto Vawter School Drive from Capital Lane due to the impact upon the Break Time drive, the failing operations for the northbound left turn movement and the

propensity for lengthy queues back into the site. However, the relocation of Capital Lane 165 feet to the east, thereby positively offsetting the proposed roadway from the Break Time drive resolves these issues and there is no longer reason to prohibit the northbound left turn from Capital Lane. Therefore, the proposed intersection of Capital Lane with Vawter School Road can accommodate all turning movements assuming:

- It is located at least 150 feet east of the Break Time's access drive.
 - A two-way, left-turn lane is provided along Vawter School Road serving both the Break Time access drive and Capital Lane.
 - Separate northbound left and right turn lanes are provided on Capital Lane.
 - Capital Lane has the right-of-way at its intersection with Frontgate Lane extension. Traffic on Frontgate Lane would be under STOP control.
- It is recommended that sidewalk be provided along the perimeter of the site to connect into the existing network. Additionally, it is recommending that a pedestrian crossing, with a continental crosswalk, signage, refuge island and pedestrian actuated rapid flashing beacons be provided along Vawter School Road to the west side of its intersection with Frontgate Dr to provide safe crossing for area residents. The exact location of this crossing should be at the direction of the City of Columbia with input from the Copperstone and Spring Creek neighborhoods.
 - By the year 2044 (20-year planning horizon), the roundabout at Scott Boulevard and Vawter School Road begins to show signs of exceeding capacity during the weekday morning and afternoon peak hours, regardless of the introduction of the proposed development. It is evident that the single-lane roundabout would likely need to be modified in the future in order to continue to efficiently accommodate the increasing traffic demands. Based upon a preliminary analysis of the year 2044 baseline traffic volumes, modifications akin to those illustrated in Figure 18 are offered for consideration by the City for future evaluation as traffic in the area grows. The modifications provide for bypass lanes on the northbound and westbound approaches as well as a turbo configuration to accommodate the heavy southbound left turn movement. In order to accommodate this future expansion of the roundabout, additional right of way needs should be dedicated on the SE corner of Vawter School Road and Scott Boulevard. Also, placement of the sidewalk, signage, landscaping, utilities, and other development features need to accommodate the future roundabout construction as much as feasible.

The following report outlines in detail the methodology and analysis that supports the above conclusions.

Introduction

Lochmueller Group has prepared the following revised traffic impact study pertaining to the proposed mixed-use development located in Columbia, Missouri. It is our understanding that Capital Land Investments would like to develop 16.8 acres in the southwest quadrant of Scott Boulevard and Vawter School Road. The intent is to develop the parcel as nine separate lots with varying commercial uses, of which the only known development at this time is the proposed Diventures on the eastern portion of the site.

The proposed development, known as Copperstone Commercial, would seek access to both Scott Boulevard and Vawter School Road, both of which are City controlled roadways. In addition, the development would facilitate the extension of Frontgate Lane westward from its current terminus to Scott Boulevard. **Figure 1** depicts the study area and the development that is under consideration. A conceptual plan for the proposed development is shown in **Figure 2**.



Figure 1: Copperstone Corner Site Area

The intent of this revised study is to identify the traffic generation associated with the proposed development, analyze the impacts associated with the additional traffic, and determine the need for mitigation measures, if necessary. As such, this study evaluates conditions during the morning and evening peak periods of a typical weekday, as well as the Saturday midday peak period as these periods represent the most critical times of day for traffic operations within the study area as well as the peak generation periods for the surrounding existing residential area. If traffic can be accommodated during these peak periods, it stands to reason that adequate capacity would be available throughout the

remainder of the day. This study was prepared in accordance with the requirements of the City of Columbia and the scope was approved during a Traffic Scoping Meeting held in July 2022.

Furthermore, the revised preliminary site plan includes several improvements to the study area that were identified in the original traffic study and reviewed and approved by the City of Columbia. These improvements include:

- Each of the site access drives along Scott Boulevard and Vawter School Road would have designated turn lanes for exiting traffic.
- Left-turn lanes into the site from Scott Boulevard and Vawter School Road are accommodated via two-way, left-turn lanes.
 - A two-way, left-turn lane along Vawter School Road is proposed starting east of the roundabout, traversing through the intersections with Break Time and with Capital Drive and terminating just west of the intersection with Frontgate Drive/Creekfront Way is provided. The termination of this center lane would result in the provision of the eastbound left turn lane is also provided at Creekfront Way.
 - The two-way left-turn lane along Scott Boulevard would extend from its current terminus north of Silver Valley Drive northward and stop just south of the roundabout at Vawter School Road. This provides the southbound left-turn lanes into the site along Scott Boulevard.
- The northbound approach at Vawter School Road and Frontgate Lane would be improved to provide a shared left-turn/through lane and a right-turn lane. This improvement is made through striping changes and not physical widening as there is ample width available to accommodate the restriping.

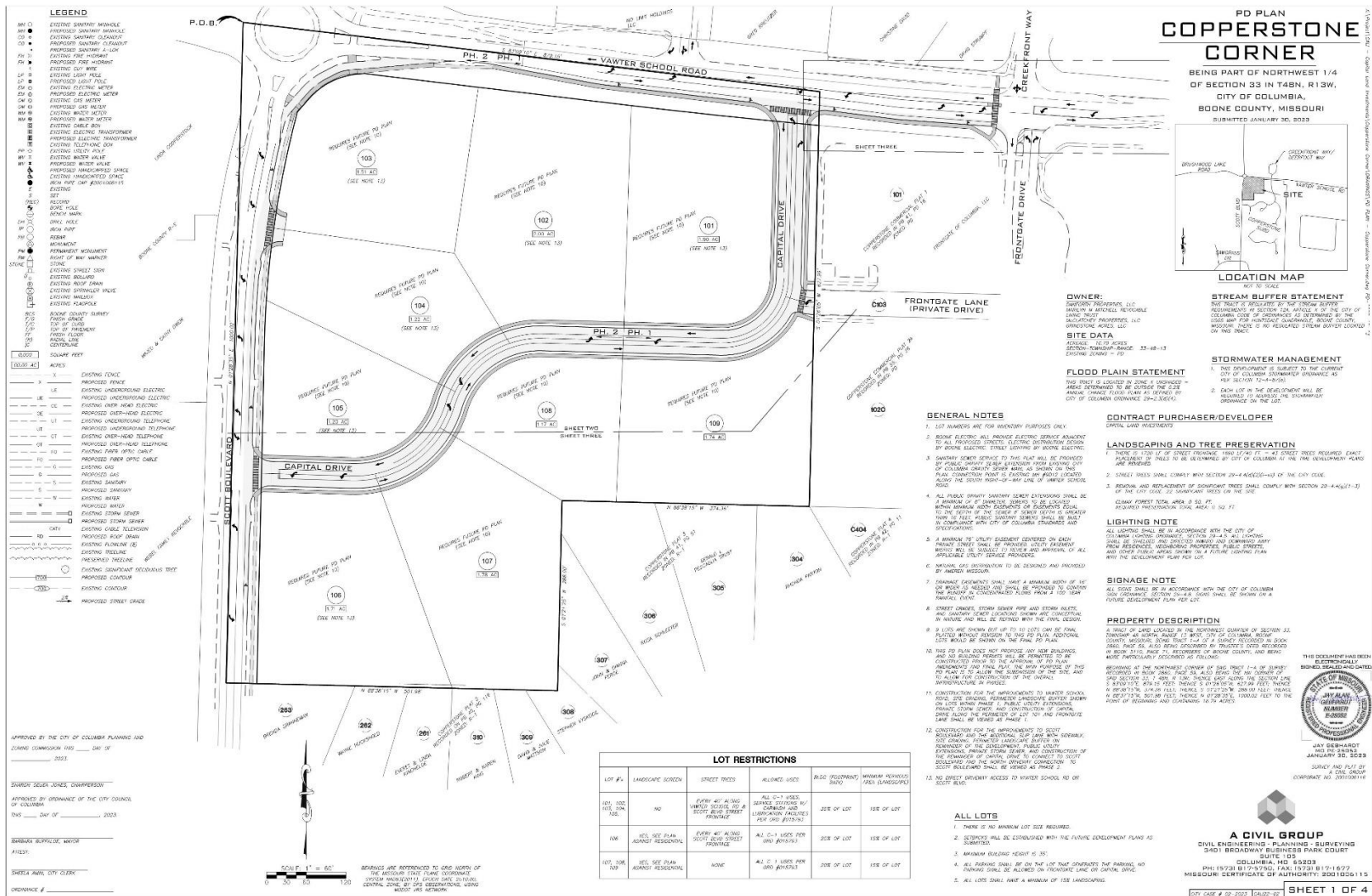


Figure 2: Copperstone Corner Preliminary Site Plan (Provided by Others)

COPPERSTONE CORNER
TRAFFIC IMPACT STUDY *(Revised)*

2022 Baseline Conditions

To identify the traffic impacts associated with the proposed development, it was first necessary to quantify roadway, traffic, and operating conditions as they currently exist.

Existing Roadway Network

The study area for this traffic impact study includes the following intersections:

- Scott Boulevard & Vawter School Road (Roundabout)
- Vawter School Road & Break Time Drive (unsignalized)
- Vawter School Road & Frontgate Drive (unsignalized)
- Frontgate Drive & Frontgate Lane (unsignalized)
- Scott Boulevard & Silver Valley Drive (unsignalized)

Scott Boulevard is functionally classified as a minor arterial with a posted speed limit of 40 miles per hour (mph). Within the study area, Scott Boulevard has one lane in each direction. In the vicinity of Silver Valley Drive a two-way center left-turn lane is provided along Scott Boulevard to accommodate traffic turning into and out of the Copperstone neighborhood and the private residences to the west.

Vawter School Road is functionally classified as a minor arterial with a posted speed limit of 40 mph within the study area. The intersection of Scott Boulevard with Vawter School is controlled as a single-lane roundabout where each approach is comprised of a single lane (no right-turn bypass lanes are present). To the west of the roundabout, Vawter School Road becomes Brushwood Lake Road and is under a Boone County jurisdiction.

An aerial view of the intersection of Scott Boulevard and Vawter School Road is shown in **Figure 3**.

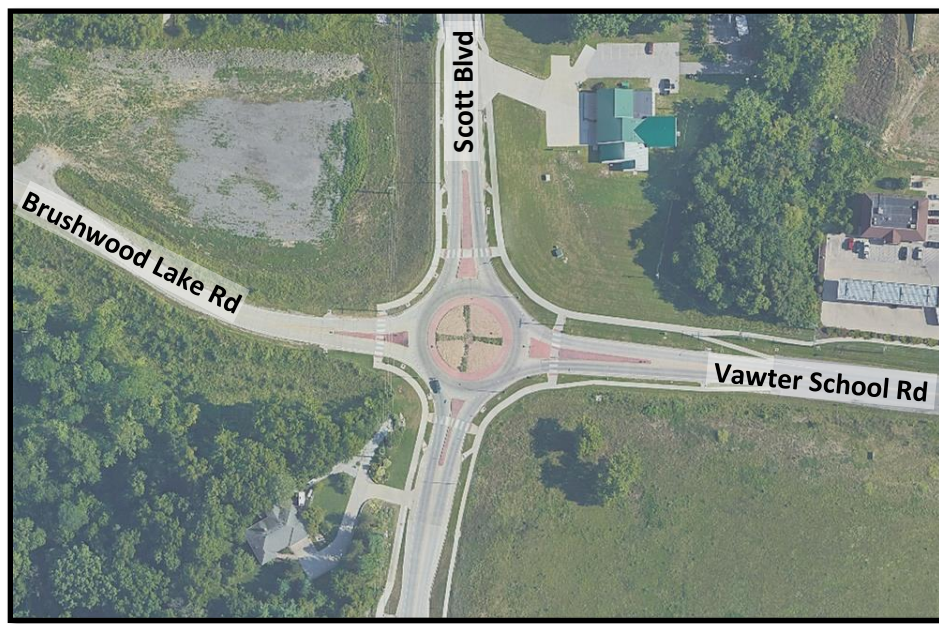


Figure 3: Aerial View of Scott Boulevard and Vawter School Road

The access drive to Break Time along Vawter School Road provides access to the Break Time gas station and convenience mart as well as other existing and proposed commercial uses. The intersection of Vawter School Road and Break Time's drive is an unsignalized, 3-legged "T" intersection with traffic along Vawter School Road traveling free and traffic exiting via the drive required to stop. However, it should be noted that there is not a posted STOP sign for the exit from Break Time and the stop is implied, which is not uncommon at commercial driveways. The eastbound and westbound approaches are comprised of a single lane, with left and right turns into the commercial property occurring via the travel lane. The southbound approach is comprised of separate left and right turn lanes.

Frontgate Drive is classified as a local road which provides access to the surrounding residential neighborhood, Copperstone. Creekfront Way, which serves the Spring Creek neighborhood, comprises the north leg of the intersection and aligns with Frontgate Drive. The intersection of Vawter School Road and Frontgate Drive is an unsignalized intersection with traffic along Vawter School Road traveling free and traffic exiting via Frontgate Drive or Creekfront Way required to stop. The eastbound approach is comprised of a single lane with a shared left-turn/through/right-turn lane. The westbound approach is comprised of a dedicated left-turn lane and one shared through/right-turn lane. The northbound and southbound approaches are comprised of a single lane approach, thereby accommodating left-turn/through/right-turn movements in the one lane. It should be noted that the approach of Frontgate Drive to Vawter School Road appears to be wide enough to accommodate two approach lanes although it is not striped as such.

Frontgate Lane is classified as a private road which provides access to the adjacent developments. The intersection of Frontgate Drive and Frontgate Lane is an unsignalized, 3-legged "T" intersection with traffic along Frontgate Drive traveling free and traffic approaching on Frontgate Lane required to stop. However, it should be noted that there is not a posted STOP sign along Frontgate Lane, and the stop is implied. The eastbound approach is comprised of a single lane with a shared left-turn/right-turn lane. The northbound and southbound approaches are comprised of a single lane each.

Silver Valley Drive is classified as a local road which provides access to the surrounding residential neighborhood, Copperstone. There is also a private drive serving a residence located directly opposite Silver Valley Drive. The intersection of Scott Boulevard with Silver Valley Drive is unsignalized. Traffic along Scott Boulevard may travel freely, while side-street traffic is required to stop. The eastbound and westbound movements both have single-lane approaches. The northbound and southbound approaches both have one shared through/right-turn lane and a left-turn lane provided within the existing two-way center left-turn lane.

Figure 4 illustrates the existing intersection lane configurations and traffic control at the study intersections.

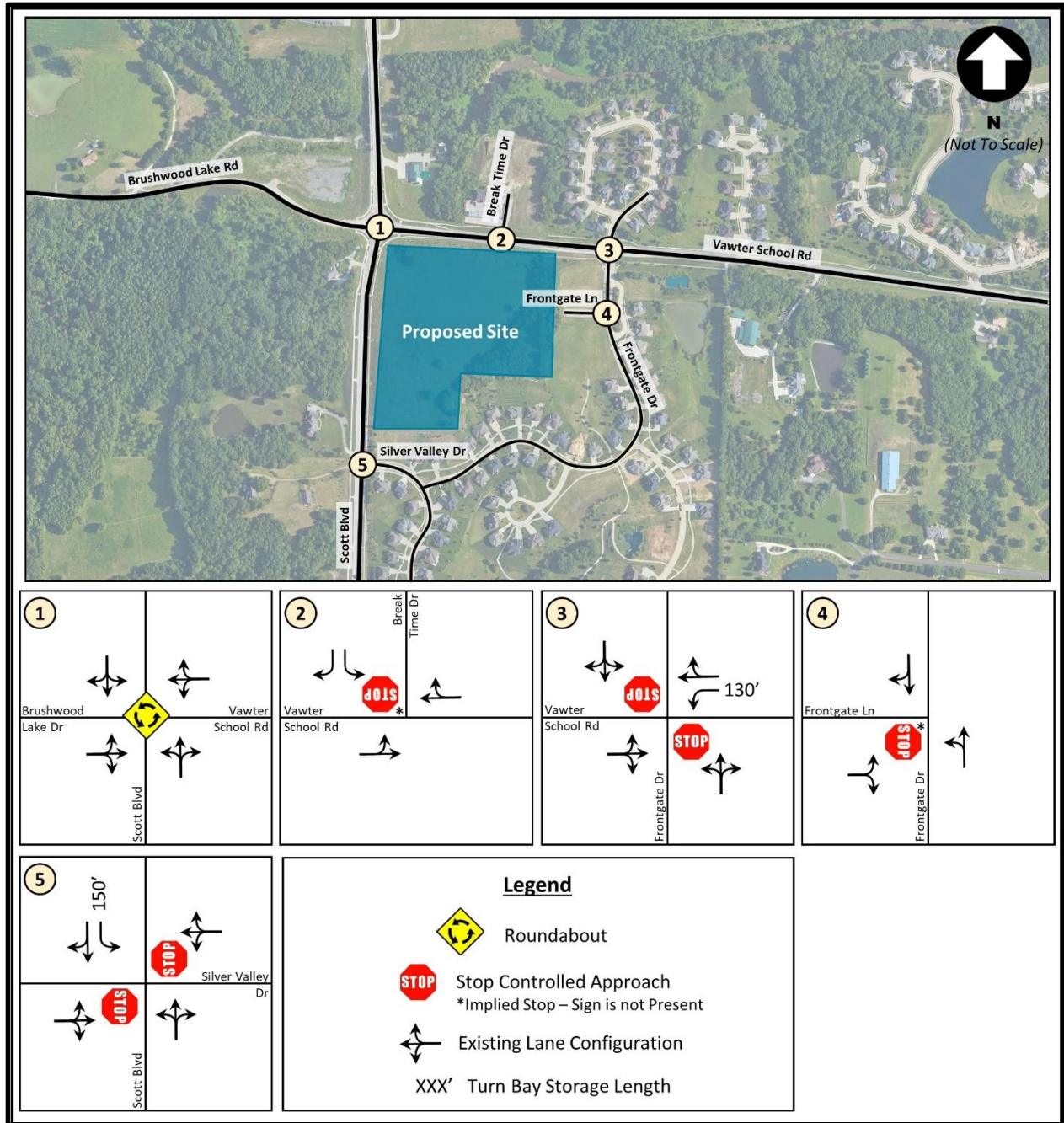


Figure 4. Existing Lane Configuration and Traffic Control

Pedestrian/Bicycle Accommodations

Scott Boulevard and Vawter School Road are both categorized as a Yellow Route for bicycle facilities. Yellow Routes are typically comprised of dedicated bike lanes that do not typically have physical barriers between vehicular traffic. Vehicular traffic along Yellow Routes may have higher speeds, and some of the bike crossings may not be signalized. Dedicated bike lanes are provided along Scott Boulevard within the site area. There are no dedicated bike lanes along Vawter School Road, however there are wide shoulders which could accommodate bikes unofficially.

Sidewalks are also provided throughout the site. Scott Boulevard has sidewalks along both sides of the street within the study area. Vawter School Road has sidewalks along both sides of the street as well. However, there is a short termination of the sidewalk network along both sides of the street between Scott Boulevard and Frontgate Drive resulting in a nearly 500 foot gap in the pedestrian network. The roundabout has pedestrian accommodations and refuge islands provided on all four approaches.

2022 Baseline Traffic Volumes

To quantify the 2022 baseline traffic volumes, turning movement counts were collected in July 2022. Based upon a review of the data, it was determined that the peak hours of traffic flow along the area roadways are 7:30 to 8:30 AM for the weekday AM peak period, 4:45 to 5:45 PM for the weekday PM peak period, and 11:15 AM to 12:15 PM for the Saturday midday peak period.

Given the need to collect data upon commencement of the study, it was inevitable that the traffic counts were conducted during the summer while school was not in session. However, discussions with the City of Columbia during the Traffic Scoping Meeting indicated that this would be acceptable as long as the data was adjusted accordingly to reflect conditions when school is in session. The City provided data from mid-May 2021 along Scott Boulevard, studies done that accounted for traffic associated with John Warner Middle School, and historical volume data for both Scott and Vawter School/Nifong from non summer months. Based upon the data provided by the City for the surrounding roadways and industry seasonal adjustment factors, the counts collected in July were conservatively increased by 10%. This increase was agreed to by the City of Columbia. Hence, the 2022 baseline traffic volumes, adjusted to represent non summer months, are illustrated in **Figure 5**.

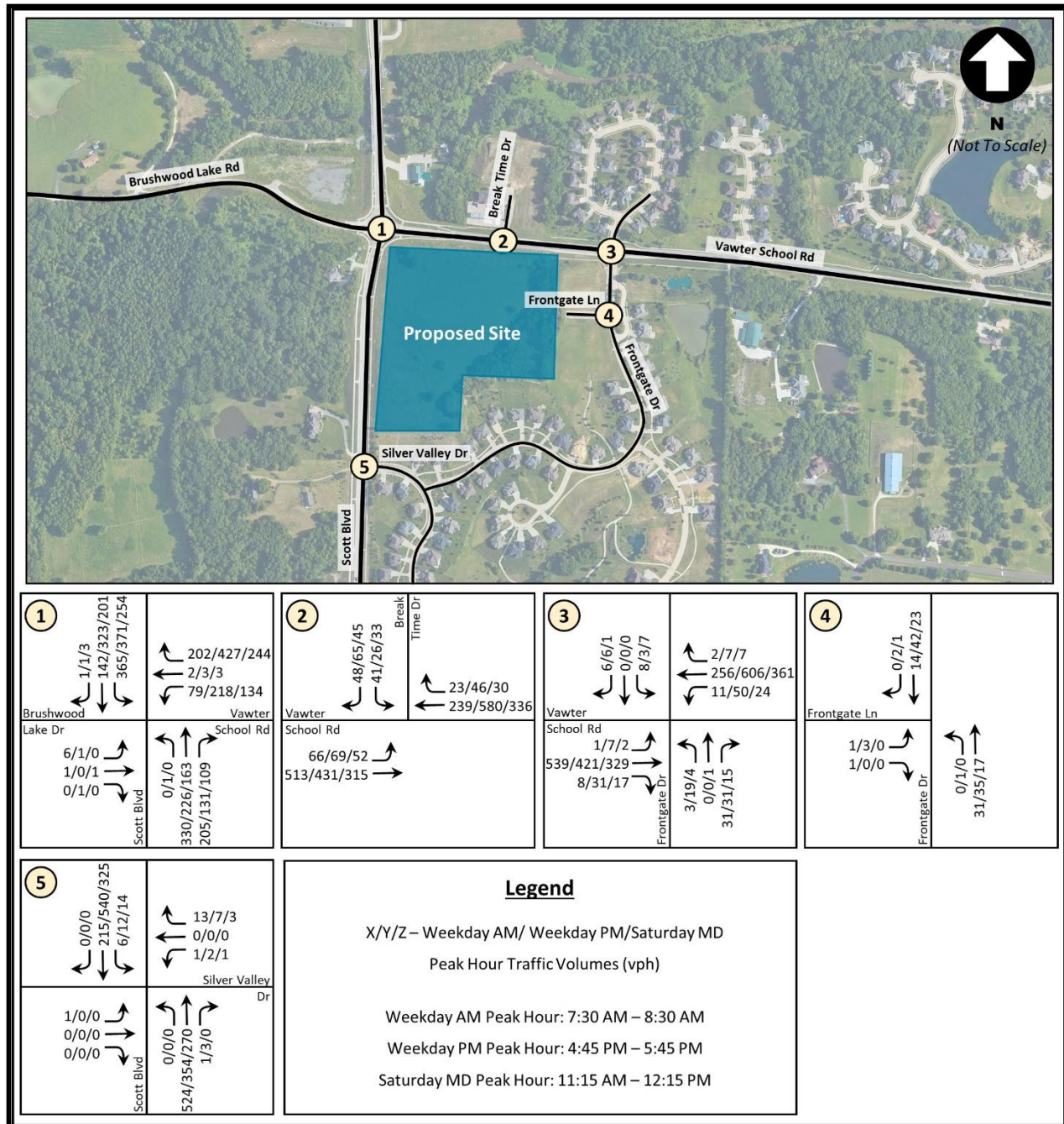


Figure 5: Year 2022 Baseline Traffic Volumes

2022 Baseline Operating Conditions

The baseline 2022 traffic operating conditions at the critical study intersections were evaluated based upon the traffic volumes presented in Figure 5. The analysis was completed using Synchro 11 traffic modeling software, which is based upon the methodologies outlined in the “Highway Capacity Manual” (HCM) published by the Transportation Research Board.

Intersection performance or traffic operations are quantified by six Levels of Service (LOS), which range from LOS A ("Free Flow") to LOS F ("Fully Saturated"). LOS C is normally used for design purposes and represents a roadway with volumes ranging from 70% to 80% of its capacity. LOS D is considered acceptable for peak period conditions in urban and suburban areas and would be an appropriate benchmark of acceptable traffic for the study area road system.

Levels of service for intersections are determined based on the average delay experienced by motorists. Signalized intersections reflect higher delay tolerances as compared to unsignalized and roundabout locations because motorists are accustomed to and accepting of longer delays at signals. For signalized, all-way stop, and roundabout intersections, the average control delay per vehicle is estimated for each movement and then aggregated for each approach and the intersection as a whole. For intersections with partial (side-street) stop control, the delay is calculated for the minor movements only (side-street approaches and major road left-turns) since thru traffic on the major road is not required to stop.

Table 1 summarizes the criterion for both signalized and unsignalized intersections, as defined by the Highway Capacity Manual (HCM) 6th Edition, last updated in 2016 by the Transportation Research Board.

Table 1: Intersection Level of Service Thresholds

Level of Service	Control Delay per Vehicle (sec/veh)	
	Signalized	Unsignalized/Roundabout
A	≤ 10	0-10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80	> 50

Operating conditions at the study intersections were evaluated using Synchro 11 and are summarized in **Table 2**. The measures of effectiveness reported include LOS, delay, queue, and volume-to-capacity ratio (v/c). The delay is reported in seconds per vehicle. The queue is reported in feet as the 95th percentile queue. The v/c ratio compares vehicle demand to the capacity of an associated lane group. A v/c ratio of 1.0 represents a road segment that is at capacity.

Table 2: Year 2022 Baseline Traffic Operating Conditions

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>		
	AM Peak Hour	PM Peak Hour	Sat MD Peak Hour
Scott Boulevard and Vawter School Road (roundabout)			
Overall Intersection	B (12.0)	C (14.3)	A (7.0)
Eastbound Approach	A (5.2) [<25] <0.01>	A (7.5) [<25] <0.02>	A (5.2) [<25] <0.01>
Westbound Approach	A (8.2) [50] <0.37>	C (16.1) [175] <0.74>	A (6.8) [50] <0.36>
Northbound Approach	C (17.6) [175] <0.73>	A (9.4) [50] <0.44>	A (6.4) [25] <0.29>
Southbound Approach	A (7.5) [50] <0.44>	C (15.1) [150] <0.71>	A (7.5) [50] <0.42>
Vawter School Road and Break Time Drive (unsignalized, side-street STOP)			
Eastbound Left-Turn	A (8.0) [<25] <0.06>	A (9.6) [<25] <0.09>	A (8.3) [<25] <0.05>
Southbound Approach	C (15.8) [<25] <0.17>	C (21.3) [<25] <0.23>	B (13.8) [<25] <0.12>
Southbound Left-Turn	C (22.4) [<25] <0.18>	E (35.9) [<25] <0.23>	C (18.0) [<25] <0.12>
Southbound Right-Turn	B (10.1) [<25] <0.07>	C (15.5) [<25] <0.20>	B (10.8) [<25] <0.08>
Vawter School Road and Frontgate Drive/Creekfront Way (unsignalized, side-street STOP)			
Eastbound Left-Turn	A (7.8) [<25] <0.00>	A (9.1) [<25] <0.01>	A (8.1) [<25] <0.00>
Westbound Left-Turn	A (8.7) [<25] <0.01>	A (8.5) [<25] <0.05>	A (8.1) [<25] <0.02>
Northbound Approach	B (13.6) [<25] <0.10>	D (23.6) [<25] <0.22>	B (12.5) [<25] <0.05>
Southbound Approach	C (16.9) [<25] <0.06>	C (22.0) [<25] <0.08>	C (17.8) [<25] <0.06>
Frontgate Drive and Frontgate Lane (unsignalized, side-street STOP)			
Eastbound Approach	A (8.6) [<25] <0.00>	A (9.1) [<25] <0.01>	A (8.8) [<25] <0.00>
Northbound Left-Turn	1/	A (7.3) [<25] <0.00>	1/
Scott Boulevard and Silver Valley Drive (unsignalized, side-street STOP)			
Eastbound Approach	C (20.5) [<25] <0.02>	1/	1/
Westbound Approach	B (13.5) [<25] <0.05>	B (13.7) [<25] <0.03>	B (11.1) [<25] <0.02>
Northbound Left-Turn	1/	1/	1/
Southbound Left-Turn	A (8.8) [<25] <0.01>	A (8.1) [<25] <0.01>	A (7.9) [<25] <0.01>

Delay presented in vehicles per second

1/ Due to a lack of traffic volume, there was no LOS calculated

- 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles

As shown, the study intersections operate favorably during the weekday AM and PM peak periods as well as the Saturday midday peak hour. The roundabout at Scott Boulevard and Vawter School Road operates with a LOS C or better overall during each peak period. Queue lengths at the roundabout are acceptable at eight vehicles or less on any given approach. The unsignalized, side-street STOP controlled intersections also operate favorably with each approach and movement having a LOS D or better. Queue lengths are minimal at each of the unsignalized intersections at less than one vehicle during all peak periods. Overall, it can be concluded that there is surplus capacity within the study area.

Potential for Cut-Through Traffic through Copperstone Neighborhood

Travel time runs were also performed through the residential neighborhood in order to assess the potential for cut through traffic to impact the neighborhood, regardless of the proposed development. The concern is that motorists traveling between Scott Boulevard to the south and Vawter School Road to the east would find it attractive to utilize Frontgate Drive, Blue Hollow Drive and Silver Valley Drive as a “cut through” as opposed to traversing the roundabout.

Under normal traffic conditions, vehicles choosing to head south through the neighborhood from Vawter School to Scott Boulevard via Frontgate Drive/Blue Hollow/Silver Valley Drive, would take, on average, approximately 1 minute and 37 seconds to complete the trip. Whereas, if a vehicle were to continue along Vawter School Road to Scott Boulevard, it would take approximately 54 seconds to reach Scott Boulevard south of Silver Valley Drive.

Similarly, travel time runs were completed under normal traffic conditions for northbound vehicles along Scott Boulevard looking to travel eastbound on Vawter School Road. If a vehicle makes a right onto Silver Valley Drive from Scott Boulevard and then travels to Vawter School Road via Blue Hollow and Frontgate Drives, that trip would take, on average, approximately 1 minute and 33 seconds. Whereas, if a vehicle continues north on Scott Boulevard and then makes a right-turn on Vawter School Road it would take approximately 58 seconds for that vehicle to pass the intersection with Frontgate Drive.

Therefore, it is evident that during typical traffic conditions, there is little incentive for a motorist to travel through the Copperstone neighborhood as a means of avoiding the roundabout at the intersection of Scott Boulevard and Vawter School Road. Given the complexity of the neighborhood streets and the lack of a “straight shot” between Scott Boulevard and Vawter School Road, the associated travel time is shorter when vehicles remain on Scott Boulevard and Vawter School Road and do not travel through the neighborhood. Furthermore, the travel time runs were also performed assuming the path of Frontgate Drive to Granite Springs Drive to Copperstone Creek Drive. However, the travel time runs through via Copperstone Creek Drive resulted in longer travel runs than the ones completed at Silver Valley Drive and therefore, it was concluded that vehicles would be less inclined to divert through the neighborhood via this route under normal traffic conditions.

Observations of School Traffic Peaks

As previously mentioned, the data utilized in this study was collected during July 2022 and then adjusted to reflect conditions when school is in session. Based upon the data provided by the City for the surrounding roadways and industry seasonal adjustment factors, the counts collected in July were conservatively increased by 10%.

In addition, prior to completion of the study, field observations of the morning and mid-afternoon school periods were conducted. It should be noted that school traffic would have the most impact during the morning when the school peak and the weekday AM peak coincide. However, the mid-afternoon school peak would occur prior to the weekday PM peak hour considered in this study.

During the morning peak period, occasional backups along both directions of Scott Boulevard approaching the roundabout were observed. One occasion of northbound traffic backing up past Silver Valley Drive was observed, as shown in **Figure 6**. In addition, a brief build-up of vehicles approaching from the east was observed, as shown in **Figure 7**. The most noticeable observation was that these queues build ups were short-lived within the morning peak hour, often dissipating within minutes of building up upon which typical traffic operations akin to that presented in the previous discussion would return. These “surges” were assumed to be attributable to the influx of traffic destined to the neighboring elementary and middle schools prior to their start times (7:30 AM for Gentry and John Warner Middle Schools and 8:20 AM for Beulah Ralph and Mill Creek Elementary Schools). There is also a school bus stop located north of the roundabout near Bellview Drive, where the bus can be stopped for several minutes while student load

and unload, potentially causing backups along Scott Boulevard that slow the flow of traffic within the roundabout itself.

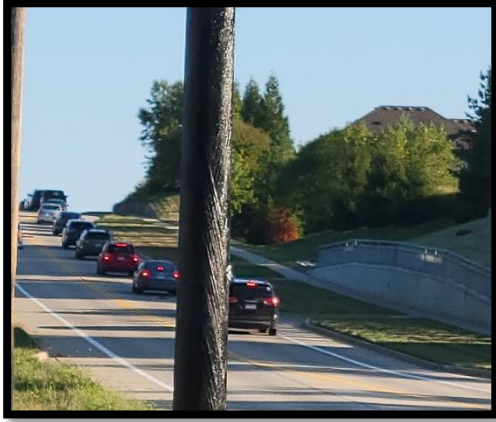


Figure 6: AM School Traffic Northbound Queue on Scott Boulevard



Figure 7: AM School Traffic Westbound Queue on Vawter School Road

During the mid-afternoon peak period, occasional backups along both directions of Scott Boulevard and along the westbound approach of Vawter School Road approaching the roundabout were again observed. However, the length and duration of these backups were considerably less than observed in the morning peak hour; likely due to the school dismissals not coinciding with the afternoon commuter peak period. **Figure 8** illustrates the observed backups, which upon dissipation traffic would return to typical operations. Again, these “surges” were assumed to be attributable to the influx of traffic destined to the neighboring elementary and middle schools prior to and following their dismissal times (2:35 PM for Gentry and John Warner Middle Schools and 3:20 PM for Beulah Ralph and Mill Creek Elementary Schools).



Figure 8: PM School Traffic at Scott & Vawter School Roundabout

Year 2024 Baseline Conditions

It is anticipated that the proposed Copperstone Corner development would be completed by the year 2024. Therefore, a 2024 baseline analysis was completed to see how the study intersections would operate prior to the introduction of the proposed development.

It should be noted that two additional developments are approved and underway within the vicinity of the development. The first would be a new development adjacent to the Break Time, which will consist of 4,500 SF of retail and 1,500 SF of fast-food restaurant with drive-through. Access would be provided via the existing access drive serving Break Time. The other development is along the west side of Scott Boulevard, south of Vawter School Road, and would provide for 35 single family detached homes with two points of full access.

Both developments are expected to be in place by 2024. Therefore, the site generated trips from those developments are included in the 2024 baseline traffic volumes. **Table 3** summarizes the associated trip generation for each development. As shown, the background developments would be expected to generate 73, 103, and 92 total new trips during the weekday AM, PM, and Saturday MD peak hours, respectively. The traffic for these uses was assigned to the area roadways using the same directional distribution applied to Copperstone Corner.

Table 3. Background Development Trip Generation Estimate

Land Use	LUC	Size	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday MD Peak Hour		
			In	Out	Total	In	Out	Total	In	Out	Total
Strip Retail Plaza (<40k)	822	4.5 kSF	7	4	11	22	22	44	8	7	15
Fast-Food Restaurant with Drive-Through	934	1.5 kSF	34	33	67	26	24	50	42	41	83
Single-Family Detached Housing	210	35	8	21	29	23	14	37	22	18	40
Gross Total Vehicular Trips			49	58	107	71	60	131	72	66	138
<i>*Total Pass-by Trips</i>			<i>17</i>	<i>17</i>	<i>34</i>	<i>14</i>	<i>14</i>	<i>28</i>	<i>23</i>	<i>23</i>	<i>46</i>
Total New Trips			32	41	73	57	46	103	49	43	92

*Pass-by rates per Table 2 / ITE Trip Generation Manual. Pass-By was only applied to LUC 934.

In addition, a background growth rate of 1.0%, which was agreed upon by the City of Columbia for use in the future scenarios, was also applied.

2024 Baseline Traffic Volumes

The additional background development detailed in Table 3 as well as an annual 1% background growth rate between 2022 and 2024 was added to the 2022 baseline traffic volumes shown in Figure 5 to produce the 2024 baseline traffic volumes shown in **Figure 9**.

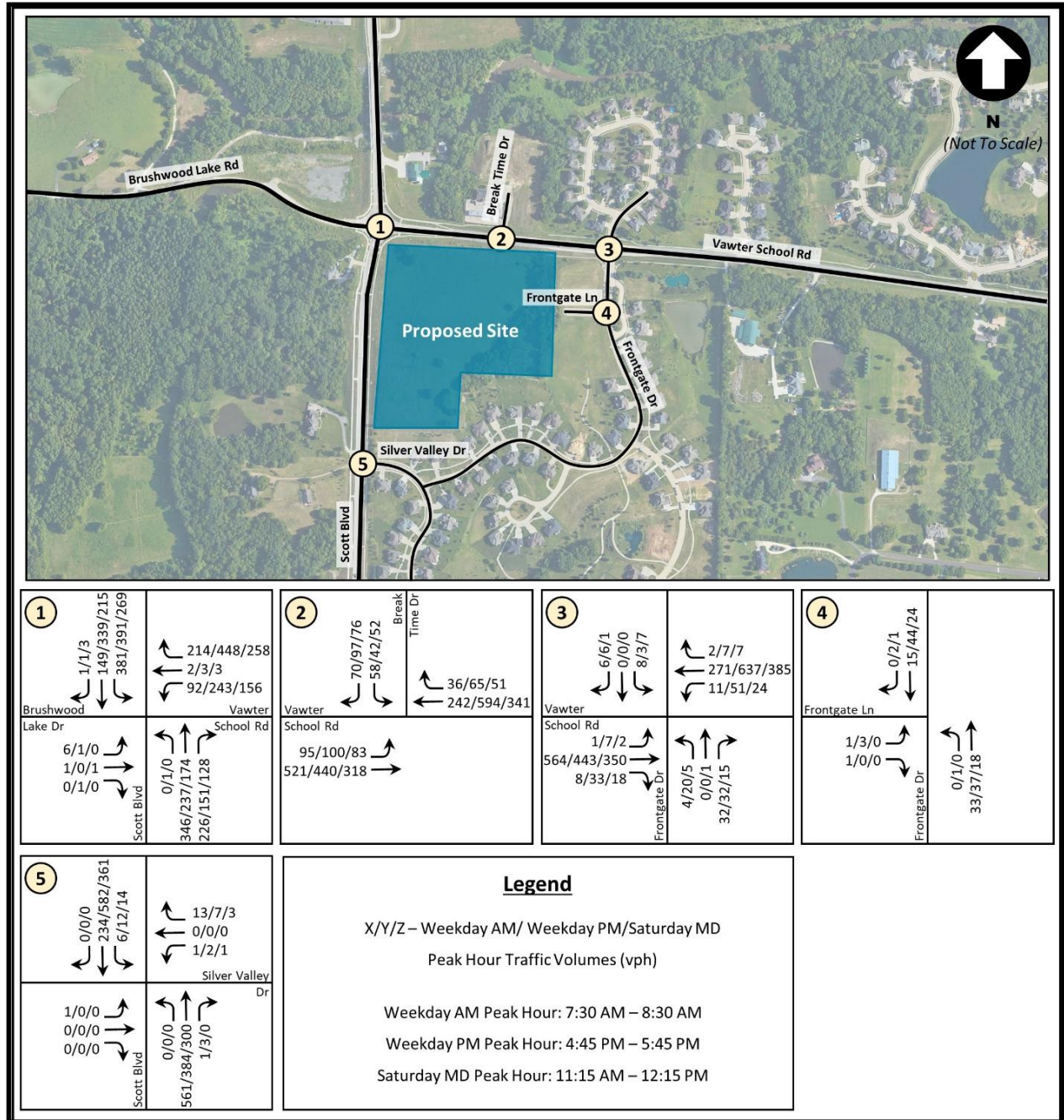


Figure 9: Year 2024 Baseline Traffic Volumes

2024 Baseline Operating Conditions

The 2024 baseline operating conditions are summarized in **Table 4**. The 2024 baseline operating conditions were evaluated using the same methodology applied to the year 2022 baseline conditions. As can be seen, the 2024 baseline operating conditions are largely comparable to the 2022 baseline operating conditions. The roundabout would still be expected to function well with an overall LOS C or better for each peak hour with acceptable queue lengths.

The other intersections would also continue to operate well with a LOS D or better for each approach, with the exception of the southbound left-turn from the Break Time access drive onto Vawter School Road during the PM peak hour, which would be expected to experience a failing LOS. It should be noted that this is a result of the additional development adjacent to the Break Time and the additional delay experienced by a vehicle making a southbound left-turn waiting to complete their movement. However, the queue length is less than three vehicles and the v/c ratio is 0.47, which indicates that there is still surplus capacity at this approach despite the delay.

Table 4: Year 2024 Baseline Traffic Operating Conditions

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>		
	AM Peak Hour	PM Peak Hour	Sat MD Peak Hour
Scott Boulevard and Vawter School Road (roundabout)			
Overall Intersection	B (14.2)	C (17.2)	A (7.6)
Eastbound Approach	A (5.4) [<25] <0.01>	A (8.0) [<25] <0.02>	A (5.5) [<25] <0.01>
Westbound Approach	A (9.0) [50] <0.40>	C (19.8) [225] <0.80>	A (7.3) [50] <0.40>
Northbound Approach	C (21.8) [200] <0.79>	B (10.4) [75] <0.49>	A (7.0) [25] <0.33>
Southbound Approach	A (8.0) [75] <0.47>	C (18.4) [200] <0.77>	A (8.2) [50] <0.46>
Vawter School Road and Break Time Drive (unsignalized, side-street STOP)			
Eastbound Left-Turn	A (8.2) [<25] <0.08>	A (9.9) [<25] <0.13>	A (8.6) [<25] <0.08>
Southbound Approach	C (18.6) [30] <0.29>	D (29.8) [55] <0.47>	C (16.8) [<25] <0.25>
Southbound Left-Turn	D (28.5) [30] <0.29>	F (57.9) [53] <0.47>	C (24.0) [<25] <0.25>
Southbound Right-Turn	B (10.4) [<25] <0.10>	C (17.6) [33] <0.32>	B (11.8) [<25] <0.15>
Vawter School Road and Frontgate Drive/Creekfront Way (unsignalized, side-street STOP)			
Eastbound Left-Turn	A (7.9) [<25] <0.00>	A (9.3) [<25] <0.01>	A (8.2) [<25] <0.00>
Westbound Left-Turn	A (8.8) [<25] <0.01>	A (8.6) [<25] <0.06>	A (8.2) [<25] <0.02>
Northbound Approach	B (14.3) [<25] <0.11>	D (26.4) [25] <0.25>	B (13.2) [<25] <0.06>
Southbound Approach	C (17.8) [<25] <0.06>	C (23.6) [<25] <0.09>	C (18.9) [<25] <0.07>
Frontgate Drive and Frontgate Lane (unsignalized, side-street STOP)			
Eastbound Approach	A (8.7) [<25] <0.00>	A (9.1) [<25] <0.01>	A (8.8) [<25] <0.00>
Northbound Left-Turn	1/	A (7.3) [<25] <0.00>	1/
Scott Boulevard and Silver Valley Drive (unsignalized, side-street STOP)			
Eastbound Approach	C (22.3) [<25] <0.02>	1/	1/
Westbound Approach	B (14.1) [<25] <0.05>	B (14.5) [<25] <0.03>	B (11.6) [<25] <0.02>
Northbound Left-Turn	1/	1/	1/
Southbound Left-Turn	A (9.0) [<25] <0.01>	A (8.2) [<25] <0.01>	A (7.9) [<25] <0.01>

Delay presented in vehicles per second

1/ Due to a lack of traffic volume, there was no LOS calculated

- 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles

Proposed Copperstone Corner Development

It is our understanding that Capital Land Investments would like to develop approximately 16.8 acres in the southwest quadrant of Scott Boulevard and Vawter School Road. The intent is to develop the parcel as nine separate lots with varying commercial and residential uses. The following trip generation methodology and calculations, as well as the proposed directional distributions, were provided to the City of Columbia for review and approval prior to completion of the forecasted analysis.

Trip Generation

In forecasting the proposed uses impacts upon traffic conditions, it was necessary to identify the site's trip generation potential, as any impacts to the surrounding road system would be tied to the net increase in trip generation. As previously stated, the Copperstone Commercial development would consist of 16.8 acres of commercial and residential uses. The site-generated traffic volumes for the proposed development were estimated using data provided in the Institute of Transportation Engineers (ITE) Trip Generation Manual, 11th Edition, with the exception of the Diventures use. The following land uses from ITE were included for the proposed mixed-use Copperstone development:

- LUC 220: Multifamily Housing (Low Rise) Not Close to Rail Transit
- LUC 565: Day Care Center
- LUC 710: General Office Building
- LUC 720: Medical-Dental Office Building – Stand-Alone
- LUC 822: Strip Retail Plaza (>40)
- LUC 850: Supermarket
- LUC 881: Pharmacy/Drug Store with Drive-Through Window
- LUC 912: Drive-In Bank
- LUC 932: High-Turnover (Sit-Down) Restaurant
- LUC 934: Fast-Food Restaurant with Drive-Through Window
- LUC 937: Coffee/Donut Shop with Drive-Through Window
- LUC 945: Convenience Store/Gas Station

One of the proposed land uses is a Diventures, which provides snorkeling, scuba diving, and swim classes. Diventures has locations across the nation. However, ITE does not provide an applicable land use code for the Diventures, therefore the trip generation was customized based on data received from the operator of Diventures in terms of their employee load, class sizes, and operations. As such, it is anticipated to generate a total of approximately 14, 160, and 95 new trips during the weekday morning, evening, and Saturday midday peak hours, respectively.

Due to the nature of the proposed development as a mixed-use site, it is reasonable to conceive that some vehicles, attracted to the site by one land use, would visit a neighboring land use before exiting the site. This vehicle behavior is captured in the operational analysis through an internal capture rate. The internal capture reduction for the proposed commercial development was calculated based upon the NCHRP Report 684: *Enhancing Internal Trip Capture Estimation for Mixed-Use Developments* (2011). This report provides an improved methodology to estimate how many internal trips will be generated in mixed-use developments—trips for which both the origin and destination are within the development (NCHRP Report 684 is attached for reference).

The internal capture rate is broken down between entering and exiting trips for the weekday AM, weekday PM, and Saturday midday peak hours. Using this report, internal capture rates were calculated based on the time of day and presented in **Table 5**.

Table 5. Internal Capture Rates by Time of Day

Weekday AM Peak Hour		Weekday PM Peak Hour		Saturday MD Peak Hour	
Entering	Exiting	Entering	Exiting	Entering	Exiting
12%	15%	28%	28%	27%	29%

It should be also emphasized that not all the trips generated by the proposed development would be *new* to the transportation network. Rather, a portion of the trips would be attracted to the proposed mixed-use development as part of an existing trip to another destination. Studies indicate that convenience-oriented uses such as gas stations, convenience stores, and restaurants attract a sizable amount of “pass-by trips”. These trips are already traveling past the site on the adjoining public roadways and would turn into the site to patronize the proposed development before continuing on to their original destination. The trips would generate turning movements at the proposed site access driveway but would not represent new trips to the surrounding roadway system. The Trip Generation Manual, published by ITE, provides pass-by trip percentages for Land Use Codes 565, 822, 850, 881, 912, 932, 934, 937, and 945. The pass-by rates for each of the land uses are detailed in **Table 6**.

Table 6. ITE Pass-By Rates

Land Use	Weekday AM	Weekday PM	Saturday MD
LUC 565: Day Care Center	44%	44%	0%
LUC 822: Strip Retail Plaza (>40)	40%	40%	31%
LUC 850: Supermarket	24%	24%	19%
LUC 881: Pharmacy/Drug Store with Drive-Through Window	49%	49%	49%
LUC 912: Drive-In Bank	29%	26%	35%
LUC 932: High-Turnover (Sit-Down) Restaurant	43%	43%	43%
LUC 934: Fast-Food Restaurant with Drive-Through Window	50%	55%	55%
LUC 937: Coffee/Donut Shop with Drive-Through Window	75%	50%	50%
LUC 945: Convenience Store/Gas Station	60%	56%	56%

The forecasted trips that would be generated by the proposed development are summarized in **Table 7**. As shown, the proposed mixed-use development would generate a total of approximately 898, 1,377, and 1,163 trips during the weekday morning, evening, and Saturday midday peak hours, respectively, upon completion. However, when common and pass-by trips are taken into consideration, the proposed development would generate a total of approximately 407, 659, and 499 *new* trips during the weekday morning, evening, and Saturday midday peak hours, respectively, upon completion.

Table 7. Copperstone Commercial Trip Generation Estimate

Land Use	LUC	Size	Weekday AM Peak Hour			Weekday PM Peak Hour			Saturday MD Peak Hour		
			In	Out	Total	In	Out	Total	In	Out	Total
Diventures – Custom Trip Gen	-	12 kSF	7	7	14	80	80	160	40	55	95
Multifamily Housing (Low Rise)	220	60 DUs	10	31	41	29	17	46	6	6	12
Day Care Center	565	5 kSF	29	26	55	26	30	56	0	1	1
General Office Building	710	10 kSF	20	3	23	4	21	25	1	1	2
Medical-Dental Office Building - Stand-Alone	720	15 kSF	35	9	44	17	41	58	7	9	16
Strip Retail Plaza (<40k)	822	15 kSF	21	14	35	52	52	104	25	25	50
Supermarket	850	30 kSF	51	35	86	146	145	291	178	177	355
Pharmacy with Drive-Through	881	13 kSF	25	24	49	67	66	133	71	68	139
Bank with Drive-Through	912	6 kSF	35	25	60	63	63	126	29	27	56
High-Turnover (Sit-Down) Restaurant	932	6 kSF	31	26	57	33	21	54	30	21	51
Fast-Food Restaurant with Drive-Through	934	3 kSF	68	66	134	51	48	99	95	92	187
Coffee Shop with Drive-Through	937	2 kSF	88	84	172	39	39	78	35	27	62
Convenience Store/Gas Station	945	8 Pumps	64	64	128	74	73	147	69	68	137
Gross Total Vehicular Trips			484	414	898	681	696	1377	586	577	1163
<i>Internal Capture *See Note</i>			<i>-46</i>	<i>-48</i>	<i>-94</i>	<i>-140</i>	<i>-144</i>	<i>-284</i>	<i>-129</i>	<i>-131</i>	<i>-260</i>
Net Total Vehicular Trips - Less Internal Capture			438	366	804	541	552	1093	457	446	903
<i>Total Pass-by Trips **See Note</i>			<i>199</i>	<i>199</i>	<i>397</i>	<i>217</i>	<i>217</i>	<i>434</i>	<i>202</i>	<i>202</i>	<i>404</i>
Total New Trips			239	167	407	324	335	659	255	244	499

*Internal capture rates per Table 1 / NCHRP Report

**Pass-by rates per Table 2 / ITE Trip Generation Manual

Directional Distribution

The site's trip generation would be assigned to the study area roadways in accordance with an anticipated directional distribution that reflects prevailing traffic patterns as well as the anticipated market area for the proposed development. Given the variety of land uses involved in the developments, directional distribution for the commercial components would vary from that experienced by the residential and office developments. The proposed directional distribution percentages for site generated trips are presented in **Table 8** and shown in **Figure 10**. The resulting site generated traffic for the proposed build out of the development is reflected in **Figure 11**.

Table 8. Directional Distribution Percentages Applied to Proposed Development

To/From	Percentage
Commercial Directional Distribution	
• To/From North on Scott Blvd	37%
• To/From South on Scott Blvd	35%
• To/From East on Vawter School Rd	25%
• To/From South on Frontgate Dr	3%
Residential/Office Directional Distribution	
• To/From North on Scott Blvd	45%
• To/From South on Scott Blvd	10%
• To/From East on Vawter School Rd	45%
• To/From South on Frontgate Dr	-

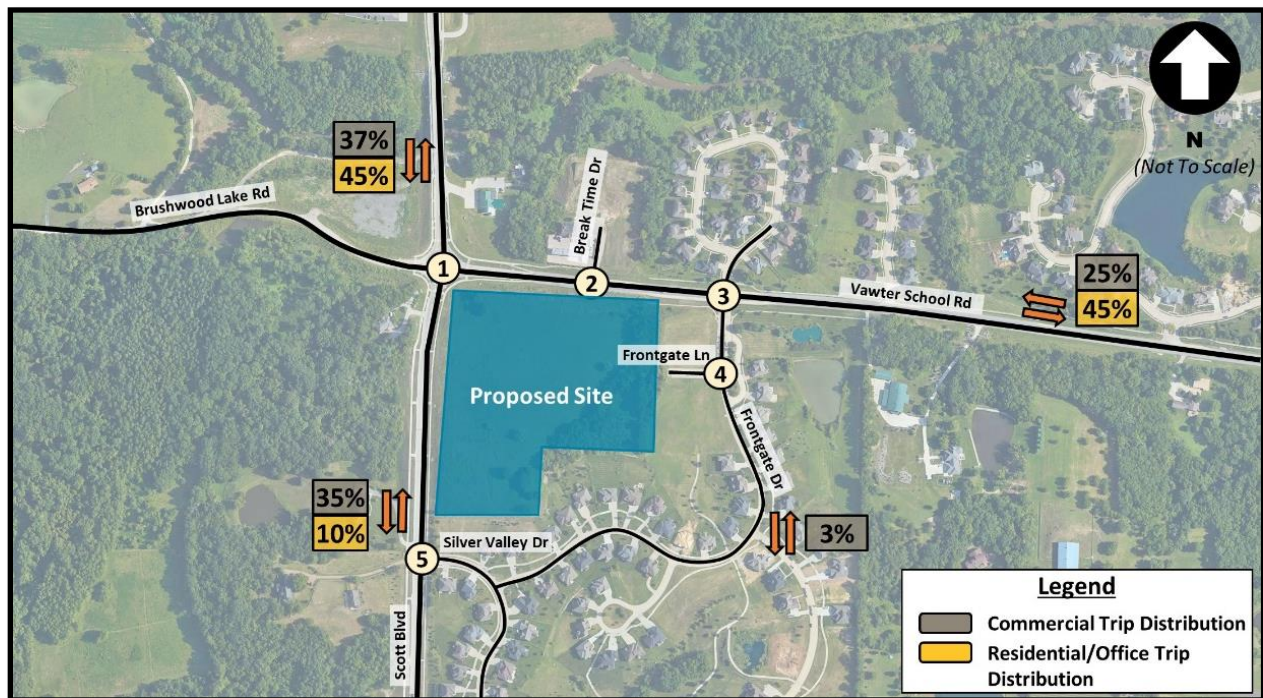


Figure 10: Directional Distribution

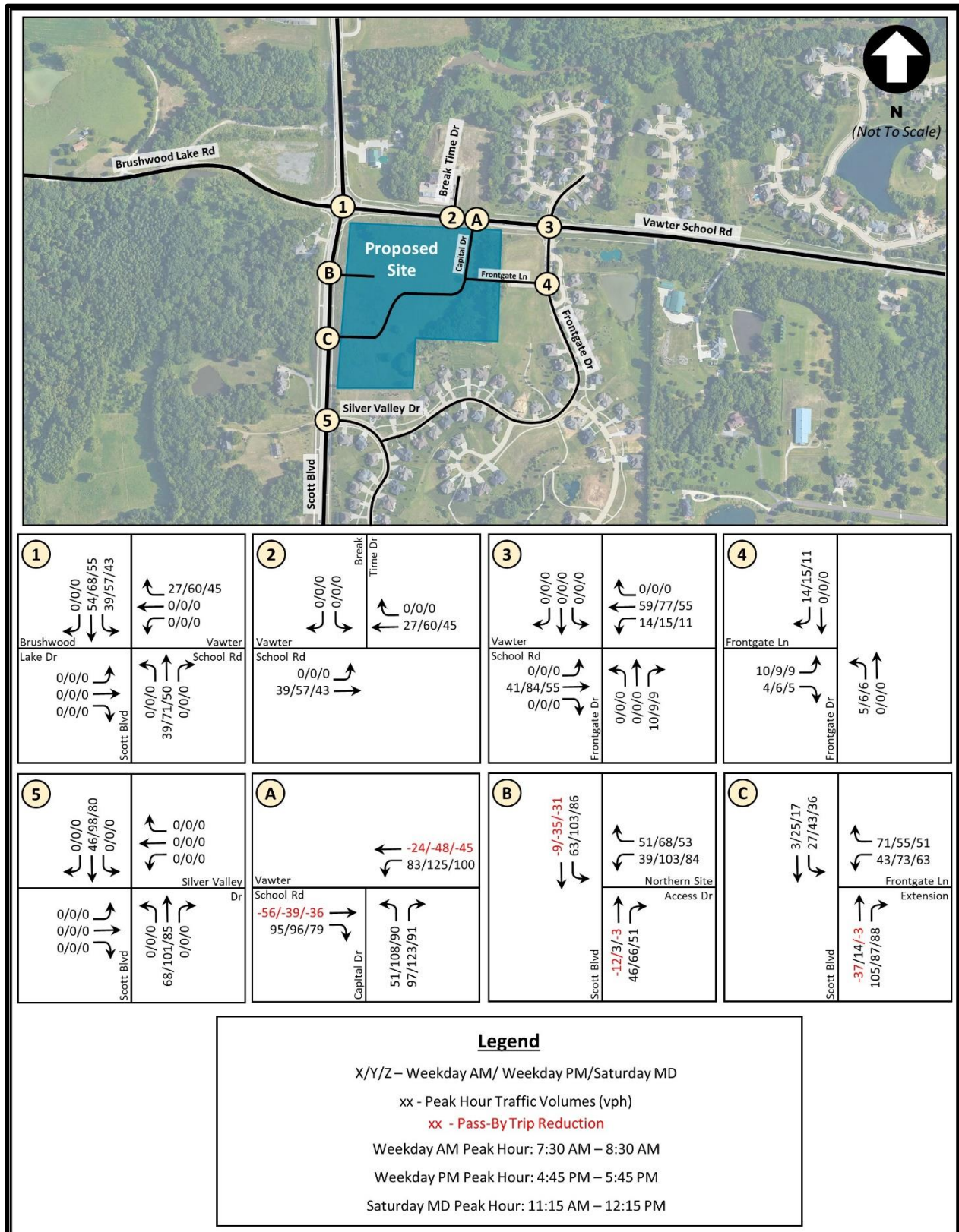


Figure 11. Copperstone Corner Site Generated Traffic Volumes – Full Build

Site Access Review

The proposed site plan, shown in Figure 2, provides for four site access drives. Two site access drives are proposed along Scott Boulevard, one site access drive is proposed along Vawter School Road and would be located approximately 165 feet east of the existing access drive to Break Time (to be referred to as Capital Drive), and the fourth site access drive is proposed via an extension of Frontgate Lane to proposed Capital Drive, thereby affording access to existing Frontgate Drive. In fact, the extension of Frontgate Lane to Capital Drive within the subject site would effectively provide a new connection between Frontgate Drive and Scott Boulevard, with Capital Drive terminating at the previously mentioned southern proposed site access drive along Scott Boulevard.

As shown in the site plan, each of the site access drives along Scott Boulevard and Vawter School Road would have designated turn lanes for exiting traffic. It is recommended that traffic exiting to Scott Boulevard and Vawter School Road be placed under STOP control via installation of signage and a stop bar pavement markings. Additionally, it is recommended that a stop sign and stop bar be provided along Frontgate Lane at its intersection with Frontgate Drive. Currently that approach is under an implied stop as there is not a stop sign present.

Additionally, separate left-turn lanes into the site from Scott Boulevard and Vawter School Road are to be provided. A two-way, left-turn lane along Vawter School Road starting east of the roundabout and traversing through the intersections with Break Time and Capital Drive before terminating just west of the intersection with Frontgate Drive/Creekfront Way is provided. An eastbound left turn lane is provided at Creekfront Way upon termination of the two-way, left-turn lane.

The two-way, left-turn lane along Scott Boulevard is extended from its current terminus north of Silver Valley Drive northward and stops just south of the roundabout at Vawter School Road. This provides the southbound left-turn lanes into the site along Scott Boulevard.

The northbound approach at Vawter School Road and Frontgate Lane would be improved to provide a shared left-turn/through lane and a right-turn lane. This improvement is made through striping changes and not through physical widening of the pavement as there is ample width available.

In addition to the improvements already included within the site plan, it is recommended that traffic exiting to Scott Boulevard and Vawter School Road be placed under STOP control via installation of signage and a stop bar pavement markings. Additionally, it is recommended that a stop sign and stop bar be provided along Frontgate Lane at its intersection with Frontgate Drive. Currently that approach is under an implied stop as there is not a stop sign present. Within the development, side-street stop control should be provided at the internal intersection of Frontgate Lane with Capital Drive where traffic traveling along Frontgate Lane is required to stop.

A pedestrian crossing, with a continental crosswalk, is to be provided along Vawter School Road just west of the intersection with Frontgate Lane/Creekfront Way to provide safe crossing for area residents. It is recommended that a refuge island and pedestrian actuated rapid flashing beacons also be provided at this location to provide safe crossing for area residents.

Sight Distance

Site distance measurements were collected at the proposed drive locations along Vawter School Road and Scott Boulevard. Both Vawter School Road and Scott Boulevard have a posted speed limit of 40 mph. Per Section 233.2.1 of the MoDOT Engineering Policy Guide, the required intersection sight distance for the posted speed limit is 40 mph is 445 feet.

The proposed site access drive via Capital Drive along Vawter School Road will be located approximately 375 feet east of the roundabout diverter island and 595 feet east of the centerline of the roundabout. There was a clear sight distance of 500 feet in either direction from the proposed Capital Drive. Therefore, there were no site obstructions or concerns with the proposed access drive to be located across from the Break Time.

There is ample sight distance to the north for both the northern and southern access drives proposed along Scott Boulevard. However, due to the vertical curvature of the road along Scott Boulevard and existing greenery, some sight distance concerns were noted to the south and the location of these proposed intersections needs to be carefully examined. As proposed, the northern site access drive would have 475 feet of sight distance to the south and the southern access drive would have 450 feet of sight distance to the south. Both measurements satisfy the MoDOT sight distance requirements for 40 mph. As such, it is recommended that the southern drive should be located no further south than 455 feet north of Silver Valley Drive and the northern access drive should be located no further north than 150 feet south of the roundabout diverter island terminus. **Figure 12** depicts the allowable window in which both drives can be located, assuming a minimum of 300 feet is maintained between the two intersections. By locating the access drives within that allowable window, they would meet the MoDOT sight distance requirements for 40 mph and would allow for better queueing distance from the roundabout.



Figure 12: Scott Boulevard Allowable Drive Area

All proposed intersections should conform to the sight distance requirements set forth by the American Association of State Highway and Transportation Officials (AASHTO). Therefore, it is recommended that once all weeds and tall grass have been removed in conjunction with the clearing of the site, that the sight distance measurements be field verified prior to construction of the drives themselves. Furthermore, as part of the design and construction process, care should be given to ensure that signage and/or landscaping does not pose sight distance limitations at any of the proposed drive locations.

Year 2024 Forecasted Conditions

Two scenarios were analyzed for the 2024 forecasted conditions. The first scenario evaluates traffic conditions assuming the development of the proposed Diventures only given that is the only confirmed user at this time. Access would be to Vawter School Road via Capital Drive as well as to Frontgate Drive via the proposed extension of Frontgate Lane to Capital Drive. Access to Scott Boulevard would not be provided.

The second scenario includes the full build out of the proposed development on all nine parcels. In addition to the access assumed for Scenario 1, full development of the site would facilitate the extension of Capital Lane to Scott Boulevard. In addition, there would be a second point of access provided to Scott Boulevard to the north of Capital Lane.

The forecasted operating conditions were evaluated using the same methodology applied to baseline conditions and presented below.

Scenario 1 – Diventures Only

As previously stated, Scenario 1 assumes that only the Diventures development is in place by the year 2024. Access to the Diventures would be via Capital Drive on Vawter School Road as well as via Frontgate Lane to Frontgate Drive. No access would be provided via Scott Boulevard.

Forecasted Traffic Volumes

As shown in Table 7, the Diventures is expected to generate a total of approximately 14, 160, and 95 *new* trips during the weekday morning, evening, and Saturday midday peak hours, respectively, upon completion. The site generated traffic for the Diventures development is shown in **Figure 13**. This traffic was then aggregated with 2024 baseline traffic volumes (Figure 9) to produce the 2024 forecasted traffic shown in **Figure 14**.

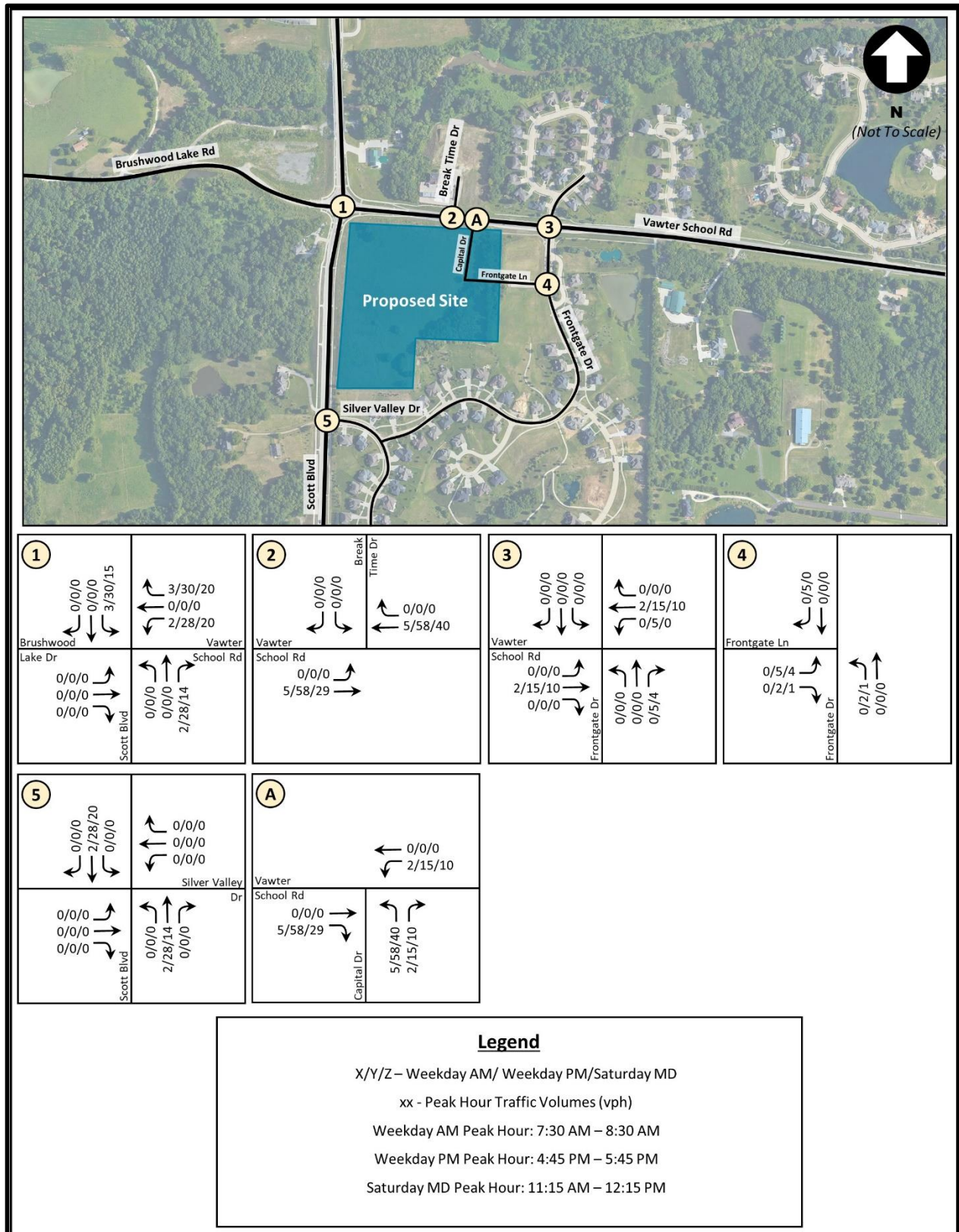


Figure 13. Site Generated Trips - Diventures Only

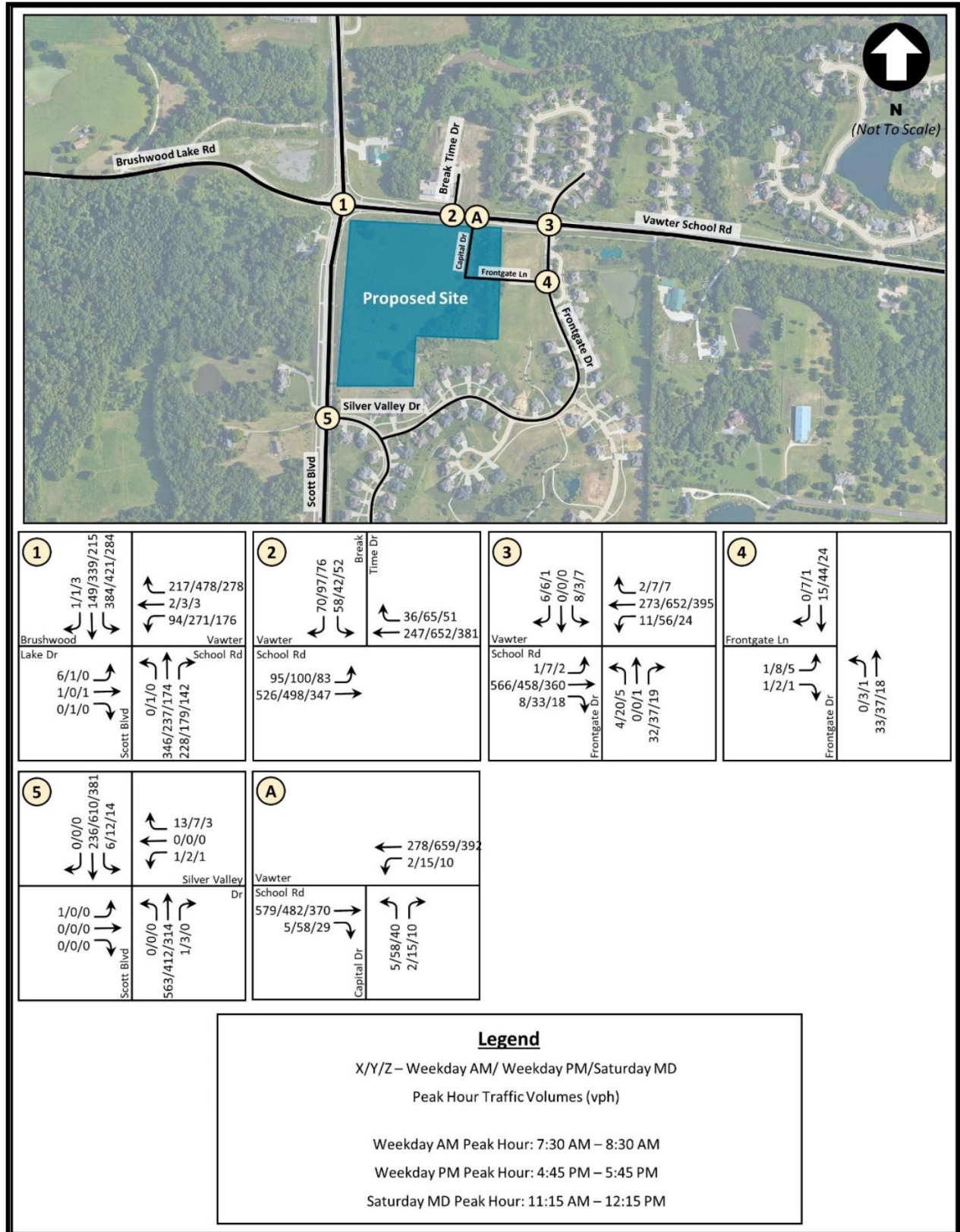


Figure 14: Year 2024 Forecasted Traffic Volumes – Diventures Only

Forecasted Operating Conditions

The forecasted conditions for the year 2024 with only the Diventures development in place were analyzed assuming that Capital Lane's approach to Vawter School Road (as well as Frontgate Drive's northbound approach) would be comprised of separate turn lanes, as shown in Figure 2. Furthermore, the road improvements recommended in the original traffic study were assumed to be in place, i.e., two-way left turn lane on Vawter School Road (there would not be a need for the two-way, left-turn lane on Scott Boulevard until such time that access is provided to that roadway). **Table 9** summarizes the year 2024 forecasted operating conditions that reflect the additional trips generated by the proposed Diventures.

Table 9. Year 2024 Forecasted Traffic Operating Conditions – Diventures Only

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>		
	AM Peak Hour	PM Peak Hour	Sat MD Peak Hour
Scott Boulevard and Vawter School Road (roundabout)			
Overall Intersection	B (13.3)	C (21.4)	A (8.1)
Eastbound Approach	A (5.4) [<25] <0.01>	A (8.6) [<25] <0.02>	A (5.7) [<25] <0.01>
Westbound Approach	A (8.9) [50] <0.41>	D (25.2) [275] <0.86>	A (7.9) [50] <0.44>
Northbound Approach	C (20.2) [250] <0.77>	B (11.9) [75] <0.55>	A (7.4) [50] <0.35>
Southbound Approach	A (8.0) [75] <0.47>	C (23.0) [250] <0.83>	A (8.7) [75] <0.49>
Vawter School Road and Break Time Drive (unsignalized, side-street STOP)			
Eastbound Left-Turn	A (8.2) [<25] <0.08>	B (10.3) [<25] <0.14>	A (8.8) [<25] <0.09>
Southbound Left-Turn	C (17.8) [<25] <0.18>	C (24.9) [<25] <0.24>	C (17.0) [<25] <0.17>
Southbound Right-Turn	B (10.4) [<25] <0.10>	C (19.4) [38] <0.35>	B (12.4) [<25] <0.16>
Vawter School Road and Capital Drive (unsignalized, side-street STOP)			
Westbound Left-Turn	A (8.8) [<25] <0.00>	A (8.7) [<25] <0.02>	A (8.3) [<25] <0.01>
Northbound Left-Turn	B (14.1) [<25] <0.02>	C (20.8) [<25] <0.23>	B (14.5) [<25] <0.11>
Northbound Right-Turn	B (12.6) [<25] <0.01>	B (12.0) [<25] <0.03>	B (10.8) [<25] <0.02>
Vawter School Road and Frontgate Drive/Creekfront Way (unsignalized, improved side-street STOP)			
Eastbound Left-Turn	A (7.9) [<25] <0.00>	A (9.3) [<25] <0.01>	A (8.2) [<25] <0.00>
Westbound Left-Turn	A (8.8) [<25] <0.01>	A (8.7) [<25] <0.06>	A (8.2) [<25] <0.02>
Northbound Left-Turn	C (21.0) [<25] <0.02>	E (48.3) [<25] <0.21>	C (19.2) [<25] <0.03>
Northbound Right-Turn	B (13.1) [<25] <0.09>	B (11.8) [<25] <0.07>	B (10.8) [<25] <0.04>
Southbound Approach	C (17.8) [<25] <0.06>	D (25.2) [<25] <0.09>	C (19.6) [<25] <0.07>
Frontgate Drive and Frontgate Lane (unsignalized, side-street STOP)			
Eastbound Approach	A (8.7) [<25] <0.00>	A (9.1) [<25] <0.02>	A (8.9) [<25] <0.03>
Northbound Left-Turn	A (0.0) [<25] <0.00>	A (7.4) [<25] <0.00>	A (7.3) [<25] <0.01>
Scott Boulevard and Silver Valley Drive (unsignalized, side-street STOP)			
Eastbound Approach	C (22.4) [<25] <0.02>	1/	1/
Westbound Approach	B (14.1) [<25] <0.05>	C (15.3) [<25] <0.04>	B (11.8) [<25] <0.02>
Northbound Left-Turn	1/	1/	1/
Southbound Left-Turn	A (9.0) [<25] <0.01>	A (8.3) [<25] <0.01>	A (8.0) [<25] <0.01>

Delay presented in vehicles per second

1/ Due to a lack of traffic volume, there was no LOS calculated

As can be seen, the study intersections comfortably accommodate the introduction of the Diventures development's traffic with the proposed lane configuration and traffic control shown on the site plan. The single-lane roundabout continues to operate favorably with a LOS C or better for each peak period.

Similarly, the other unsignalized intersections within the study area operate with minimal changes to the operating conditions when compared to the 2024 baseline operating conditions. In fact, the traffic operations at the existing intersection of Vawter School Road and Break Time Drive improve due to the addition of the two-way, left-turn lane along Vawter School Road. The southbound left-turns exiting the Break Time are able to complete a two-stage left-turn should they choose with the addition of the two-way left-turn lane.

The improved intersection at Vawter School Road and Frontgate Drive operates favorably with the introduction of the northbound left-turn/through and right-turn lane. This separation allows right-turning vehicles to make their movements without being delayed by left-turning vehicles.

The proposed access drive at Capital Drive and Vawter School Road operates well with a LOS C or better for each approach. Queues are minimal at less than one vehicle at this intersection for all peak periods. This indicates that there are no issues for vehicles turning left out of the site onto Vawter School Road.

As proposed, there would be approximately 165 feet separation between the existing Break Time access drive and the proposed Capital Lane (measured centerline to centerline) and the offset between the driveways is in a positive direction to minimize conflicts between left-turning vehicles into the respective sites. With a positive offset, motorists can use the two-way, left-turn lane to access either driveway without competing for the same space in the center lane. Motorists exiting the site can take advantage of the two-way, left-turn lane to complete their turn in two-stages, if desired. There would be more than 100 feet between the drives to facilitate exiting left turns from either drive, which is ample to accommodate the forecasted left turn volumes. The analysis reflected in Table 9 does assume the presence of the two-way, left-turn lane but does not assume any vehicles are storing in the center lane after completing their exiting left turn (which is a more conservative analysis).

Overall, it can be concluded that with just the Diventures development in place, no additional improvements beyond the following would be necessary to accommodate the forecasted traffic volumes:

- Capital Lane's approach to Vawter School Road would have designated turn lanes for exiting traffic.
- Left-turn lanes into the site from Vawter School Road would be accommodated via a two-way, left-turn lanes. The center turn lane along Vawter School Road would begin east of the roundabout, traversing through the intersections with Break Time and with Capital Drive and terminate just west of the intersection with Frontgate Drive/Creekfront Way. The termination of this center lane would result in the provision of the eastbound left turn lane at Creekfront Way.
- The northbound approach at Vawter School Road and Frontgate Lane would be improved to provide a shared left-turn/through lane and a right-turn lane. This improvement is accomplished through striping changes and not physical widening as there is ample width available.

Scenario 2 – Full Build

As previously stated, Scenario 2 assumes the development of all nine lots is in place by the year 2024. All four site access drives would be provided in Scenario 2; two to Scott Boulevard, one to Vawter School Road and the fourth access drive to Frontgate Lane.

Forecasted Traffic Volumes

The site generated traffic for the full development, is shown in Figure 11. This traffic was then aggregated with 2024 baseline traffic volumes (Figure 9) to produce the 2024 forecasted traffic shown in **Figure 15**.

Forecasted Operating Conditions

The forecasted conditions for the year 2024 assuming full build out were analyzed assuming that all of the site access drives along Vawter School Road and Scott Boulevard would be comprised of separate turn lanes at their exit. In addition, it is assumed that Frontgate Drive's northbound approach is restriped to provide separate turn lanes and that the road improvements recommended in the original traffic study were assumed to be in place, i.e., two-way left turn lanes on Scott Boulevard and Vawter School Road. **Table 10** summarizes the year 2024 forecasted operating conditions that reflect the additional trips generated by the full buildout of the proposed development.

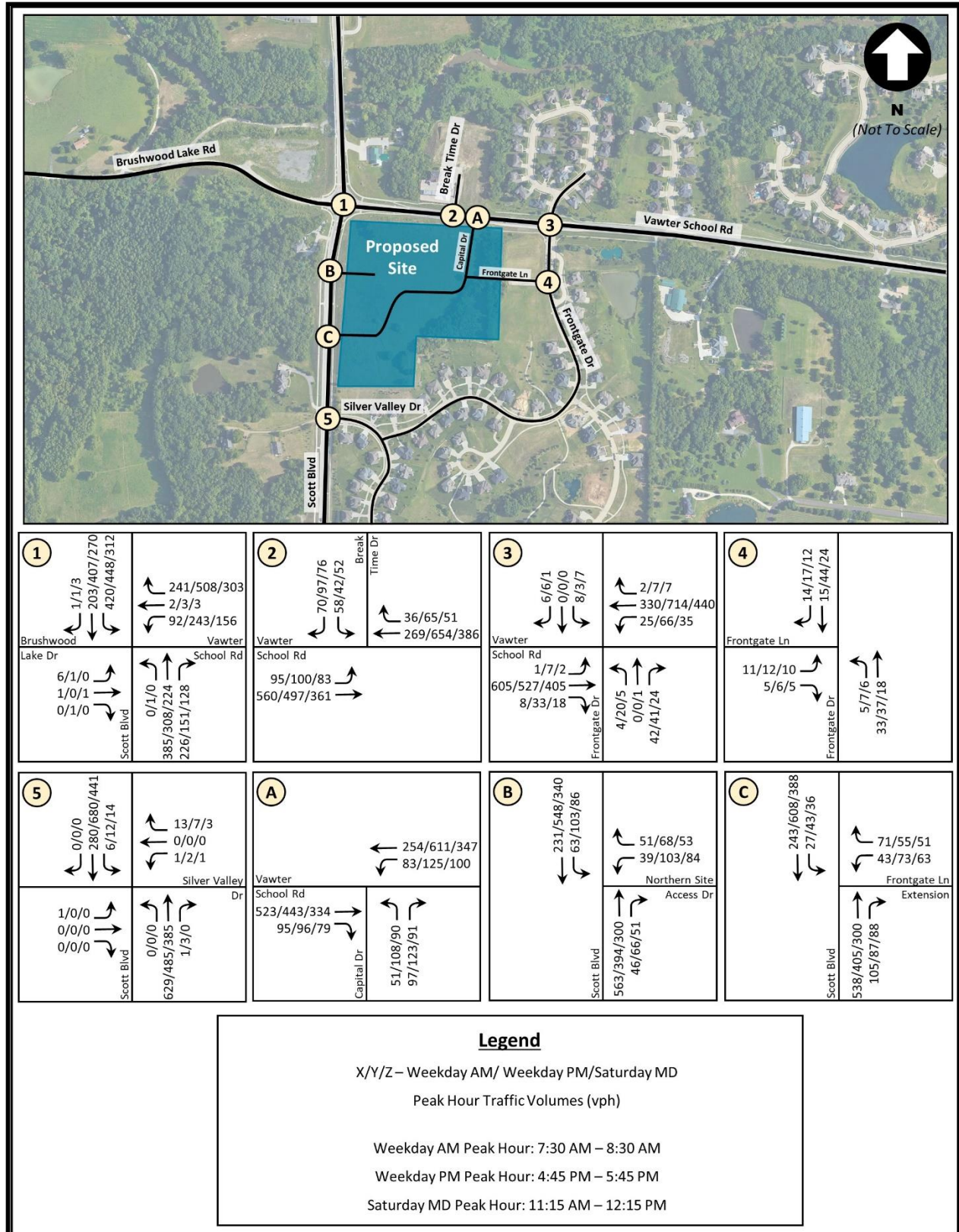


Figure 15: Year 2024 Forecasted Traffic Volumes – Full Build

Table 10. Year 2024 Forecasted Traffic Operating Conditions – Full Build

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>		
	AM Peak Hour	PM Peak Hour	Sat MD Peak Hour
Scott Boulevard and Vawter School Road (roundabout)			
Overall Intersection	C (17.1)	C (24.4)	A (9.1)
Eastbound Approach	A (6.0) [<25] <0.01>	A (9.0) [<25] <0.02>	A (6.1) [<25] <0.01>
Westbound Approach	B (10.1) [50] <0.45>	D (28.5) [300] <0.88>	A (8.7) [75] <0.47>
Northbound Approach	D (27.8) [250] <0.85>	B (13.7) [100] <0.60>	A (8.3) [50] <0.40>
Southbound Approach	A (9.4) [75] <0.55>	D (26.6) [300] <0.88>	A (9.8) [100] <0.55>
Vawter School Road and Break Time Drive (unsignalized, side-street STOP)			
Eastbound Left-Turn	A (8.2) [<25] <0.09>	B (10.0) [<25] <0.13>	A (8.6) [<25] <0.08>
Southbound Left-Turn	C (18.6) [<25] <0.19>	C (23.6) [<25] <0.23>	C (16.6) [<25] <0.17>
Southbound Right-Turn	B (10.6) [<25] <0.11>	C (18.3) [35] <0.33>	B (11.8) [<25] <0.15>
Vawter School Road and Capital Drive (unsignalized, side-street STOP)			
Westbound Left-Turn	A (9.4) [<25] <0.10>	A (9.2) [<25] <0.14>	A (8.6) [<25] <0.10>
Northbound Left-Turn	C (17.3) [<25] <0.16>	D (34.3) [65] <0.50>	C (18.2) [28] <0.27>
Northbound Right-Turn	B (14.4) [<25] <0.22>	B (13.5) [<25] <0.25>	B (11.7) [<25] <0.16>
Vawter School Road and Frontgate Drive/Creekfront Way (unsignalized, improved side-street STOP)			
Eastbound Left-Turn	A (8.1) [<25] <0.00>	A (9.4) [<25] <0.01>	A (8.3) [<25] <0.00>
Westbound Left-Turn	A (9.0) [<25] <0.03>	A (8.9) [<25] <0.07>	A (8.4) [<25] <0.03>
Northbound Left-Turn	D (25.4) [<25] <0.03>	F (60.9) [<25] <0.25>	C (22.3) [<25] <0.04>
Northbound Right-Turn	B (13.9) [<25] <0.12>	B (12.6) [<25] <0.08>	B (11.3) [<25] <0.05>
Southbound Approach	C (21.6) [<25] <0.08>	D (29.0) [<25] <0.11>	C (23.2) [<25] <0.08>
Frontgate Drive and Frontgate Lane (unsignalized, side-street STOP)			
Eastbound Approach	A (9.0) [<25] <0.03>	A (9.2) [<25] <0.03>	A (9.1) [<25] <0.06>
Northbound Left-Turn	A (7.3) [<25] <0.00>	A (7.4) [<25] <0.01>	A (7.3) [<25] <0.01>
Scott Boulevard and Silver Valley Drive (unsignalized, side-street STOP)			
Eastbound Approach	D (26.8) [<25] <0.02>	1/	1/
Westbound Approach	C (15.4) [<25] <0.06>	C (17.0) [<25] <0.04>	B (13.0) [<25] <0.03>
Northbound Left-Turn	1/	1/	1/
Southbound Left-Turn	A (9.3) [<25] <0.01>	A (8.5) [<25] <0.01>	A (8.2) [<25] <0.01>
Scott Boulevard and Northern Site Access Drive (unsignalized, side-street STOP)			
Westbound Left-Turn	C (17.4) [<25] <0.13>	D (27.7) [50] <0.42>	C (16.5) [<25] <0.23>
Westbound Right-Turn	B (14.6) [<25] <0.13>	B (11.9) [<25] <0.12>	B (10.6) [<25] <0.08>
Southbound Left-Turn	A (9.6) [<25] <0.09>	A (8.8) [<25] <0.11>	A (8.3) [<25] <0.08>
Scott Boulevard and Capital Lane Extension Southern Site Access Drive (unsignalized, side-street STOP)			
Westbound Left-Turn	C (16.6) [<25] <0.13>	C (21.4) [25] <0.27>	C (14.8) [<25] <0.16>
Westbound Right-Turn	C (15.3) [<25] <0.18>	B (11.9) [<25] <0.10>	B (10.8) [<25] <0.08>
Southbound Left-Turn	A (9.5) [<25] <0.04>	A (8.7) [<25] <0.05>	A (8.3) [<25] <0.03>

Delay presented in vehicles per second

1/ Due to a lack of traffic volume, there was no LOS calculated

As can be seen, the study intersections adequately accommodate the introduction of the entire development's traffic with the proposed lane configuration and traffic control shown on the latest site plan. The unsignalized intersections within the study area would continue to operate well. The intersections of Vawter School Road with the Break Time access drive and Capital Lane would be expected

to operate with a LOS D or better for each approach during all three peak periods. The southbound queue at Break Time is not expected to exceed two vehicles in either lane during any of the three peak periods. Similarly, the northbound queue on Capital Lane would be equal to three vehicles or less.

As previously discussed, there would be approximately 165 feet separation between the existing Break Time access drive and the proposed Capital Lane (measured centerline to centerline) and the offset between the driveways is in a positive direction to minimize conflicts between left-turning vehicles into the respective sites. Motorists exiting the site can take advantage of the two-way, left-turn lane to complete their turn in two-stages, if desired. There would be more than 100 feet between the drives to facilitate exiting left turns from either drive, which is ample to accommodate the forecasted left turn volumes. The analysis reflected in Table 10 does assume the presence of the two-way, left-turn lane but does not assume any vehicles are storing in the center lane after completing their exiting left turn (which is a more conservative analysis).

The improved intersection at Vawter School Road and Frontgate Drive continues to operate favorably with the introduction of the northbound left-turn/through and right-turn lane, with the exception of the PM peak hour where the left-turn/through movement operates at a LOS F. However, the queue length is expected to be one vehicle and the v/c ratio is only 0.25, which indicates that there is surplus capacity at this approach and the delay in completing the left turn is due to the heavy through volumes on Vawter School Road at that time of day.

Similarly, the access drive via the extension of Frontgate Lane at Frontgate Drive is expected to operate favorably. Each approach is expected to have a LOS A with minimal delays and queueing.

Both of the proposed access drives along Scott Boulevard are expected to operate well with a LOS D or better for each movement during each of the time periods analyzed. The expected queue lengths are minimal at two vehicles or less in any one turn lane. The southbound left-turning vehicles along Scott Boulevard are not expected to negatively impact (spillback towards) the roundabout at Scott Boulevard and Vawter School Road and the associated queue for vehicle turning left into the site would be one vehicle.

It should be noted that the roundabout at Scott Boulevard and Vawter School Road is showing signs that it is approaching but not yet at capacity. In the morning, the northbound approach would operate at a LOS D with a peak queue length of approximately ten vehicles and a v/c ratio of 0.85. Additionally, during the weekday PM peak hour, the westbound and southbound approaches would be expected to operate at a LOS D with a peak queue length of approximately twelve vehicles and a v/c ratio of 0.88. While these operating conditions are acceptable for the year 2024, even with the development's traffic, it does indicate that as traffic volumes in the area continue to grow over the future years, that the roundabout may eventually need to be reconfigured.

Overall, it can be concluded that with upon full buildout of the proposed Copperstone Corners development in place, no additional improvements beyond the following would be necessary to accommodate the forecasted traffic volumes:

- Capital Lane's approach to Vawter School Road would have designated turn lanes for exiting traffic.
- Left-turn lanes into the site from Vawter School Road would be accommodated via a two-way, left-turn lane. The center turn lane along Vawter School Road would begin east of the roundabout, traversing through the intersections with Break Time and with Capital Drive and terminate just west of the intersection with Frontgate Drive/Creekfront Way. The termination of this center lane would result in the provision of the eastbound left turn lane at Creekfront Way.
- Left-turn lanes into the site from Scott Boulevard would be accommodated via a two-way, left-turn lane. The two-way left-turn lane along Scott Boulevard would extend from its current terminus north of Silver Valley Drive northward and stop just south of the roundabout at Vawter School Road. This provides the southbound left-turn lanes into the site along Scott Boulevard.
- The northbound approach at Vawter School Road and Frontgate Lane would be improved to provide a shared left-turn/through lane and a right-turn lane. This improvement is accomplished through striping changes and not physical widening as there is ample width available.

Multimodal Accommodations

From a multimodal standpoint, it is recommended that sidewalk be provided along the perimeter of the site to connect into the existing sidewalk network. Additionally, it is recommending that a pedestrian crossing, with a continental crosswalk, signage, refuge island and pedestrian actuated rapid flashing beacons be provided along Vawter School Road just west of the intersection with Frontgate Drive to provide safe crossing for area residents (although the exact location of this crossing should be at the direction of the City of Columbia with input from the Copperstone and Spring Creek neighborhoods). The installation should be similar to that installed along Nifong Boulevard at the Mill Creek Crossing neighborhood, as shown in **Figure 16**.



Figure 16. Example of Recommended Pedestrian Crossing of Vawter School Road

Year 2044 Traffic Conditions

To assess the effects of long-term traffic growth within the study area, traffic conditions 20 years out were also considered.

Year 2044 Baseline Conditions

Traffic conditions *without* the proposed development were analyzed for the year 2044 to establish a baseline that would facilitate an assessment of the proposed development's long-term impact. Therefore, it was necessary to forecast anticipated growth within the study area based on an increase in "background" traffic resulting from increasing population and commercial growth in the City of Columbia. A background traffic growth rate of 1.0% per year was agreed upon by the City of Columbia for use in the future scenarios.

The 2044 horizon year baseline traffic volumes are shown in **Figure 17**.

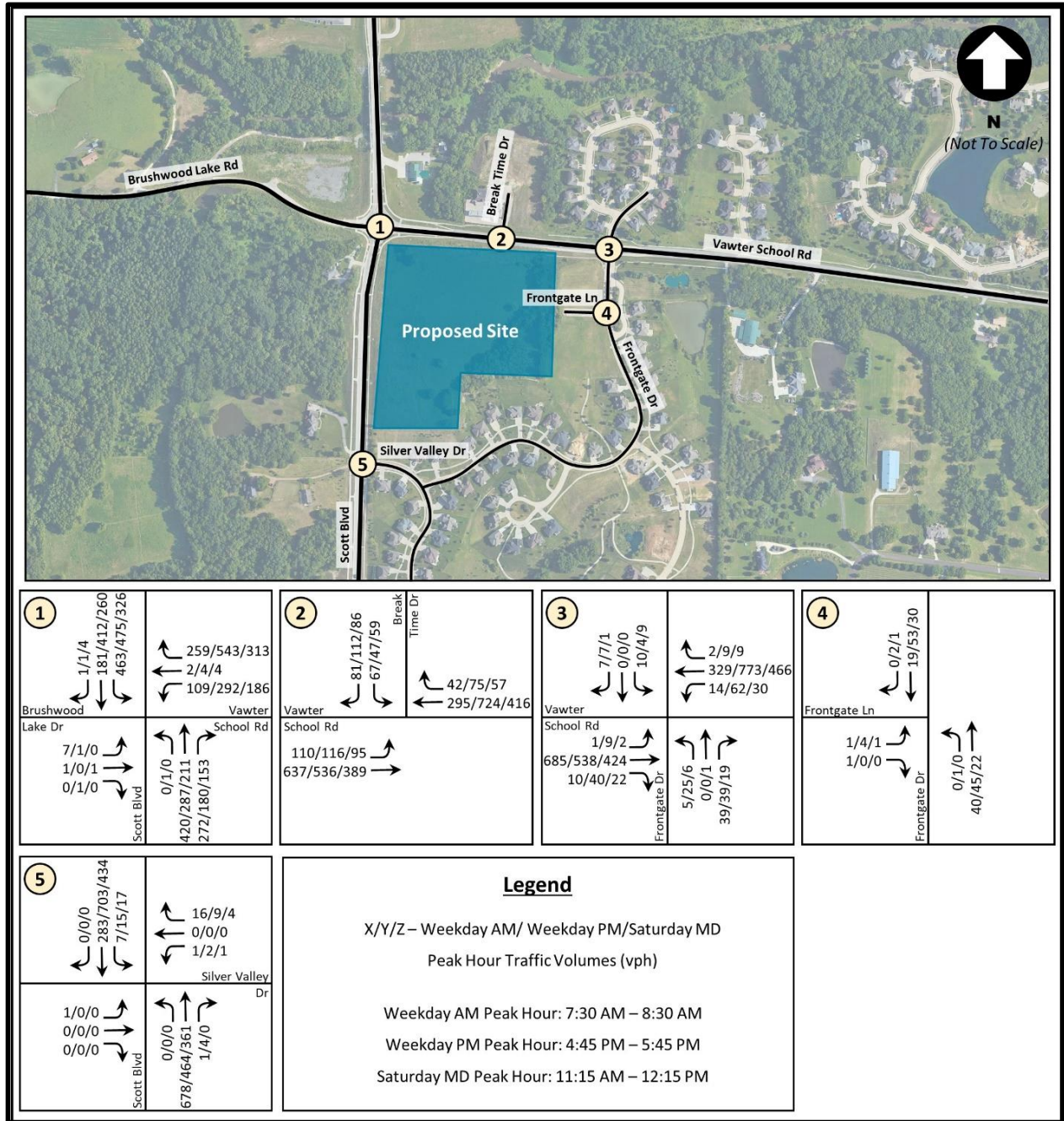


Figure 17: Year 2044 Baseline Traffic Volumes

The 2044 baseline operating conditions were evaluated using the same methodology applied to baseline and forecasted conditions for the year 2024 and are summarized in **Table 11**. No physical improvements were considered for the year 2044 baseline analysis.

Table 11. Year 2044 Baseline Traffic Operating Conditions

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>		
	AM Peak Hour	PM Peak Hour	Sat MD Peak Hour
Scott Boulevard and Vawter School Road (roundabout)			
Overall Intersection	E (35.8)	E (44.5)	A (9.7)
Eastbound Approach	A (6.2) [<25] <0.02>	B (10.2) [<25] <0.02>	A (6.4) [<25] <0.01>
Westbound Approach	B (11.9) [75] <0.52>	F (55.6) [525] <1.02>	A (9.3) [75] <0.50>
Northbound Approach	F (57.7) [450] <1.01>	C (15.6) [125] <0.65>	A (8.7) [50] <0.42>
Southbound Approach	B (10.1) [100] <0.58>	E (49.1) [450] <1.00>	B (10.6) [100] <0.58>
Vawter School Road and Break Time Drive (unsignalized, side-street STOP)			
Eastbound Left-Turn	A (8.4) [<25] <0.10>	B (11.0) [<25] <0.13>	A (9.0) [<25] <0.08>
Southbound Approach	D (28.6) [58] <0.49>	F (67.8) [110] <0.88>	C (22.4) [40] <0.38>
Southbound Left-Turn	E (49.8) [58] <0.49>	F (171.8) [110] <0.88>	E (36.0) [40] <0.38>
Southbound Right-Turn	B (11.0) [<25] <0.13>	C (24.2) [55] <0.45>	B (13.1) [<25] <0.19>
Vawter School Road and Frontgate Drive/Creekfront Way (unsignalized, side-street STOP)			
Eastbound Left-Turn	A (8.0) [<25] <0.00>	A (9.9) [<25] <0.01>	A (8.4) [<25] <0.00>
Westbound Left-Turn	A (9.3) [<25] <0.02>	A (9.0) [<25] <0.06>	A (8.5) [<25] <0.03>
Northbound Approach	C (17.2) [<25] <0.16>	F (50.6) [55] <0.47>	C (15.1) [<25] <0.09>
Southbound Approach	C (24.0) [<25] <0.11>	E (38.3) [<25] <0.17>	D (25.1) [<25] <0.11>
Frontgate Drive and Frontgate Lane (unsignalized, side-street STOP)			
Eastbound Approach	A (8.7) [<25] <0.00>	A (9.2) [<25] <0.01>	A (8.9) [<25] <0.00>
Northbound Left-Turn	1/	A (7.4) [<25] <0.00>	1/
Scott Boulevard and Silver Valley Drive (unsignalized, side-street STOP)			
Eastbound Approach	D (30.0) [<25] <0.03>	1/	1/
Westbound Approach	C (16.3) [<25] <0.08>	C (16.6) [<25] <0.05>	B (12.3) [<25] <0.03>
Northbound Left-Turn	1/	1/	1/
Southbound Left-Turn	A (9.5) [<25] <0.01>	A (8.5) [<25] <0.02>	A (8.1) [<25] <0.02>

Delay presented in vehicles per second

1/ Due to a lack of volume southbound in the AM peak hour, there was no LOS calculated.

- 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles

As can be seen, the baseline lane configuration and traffic control are not able to maintain operating conditions through the year 2044. The roundabout at Scott Boulevard and Vawter School Road would be expected to fail during the weekday AM and PM peak periods. The v/c ratio for the roundabout is forecasted to be over capacity at 1.01 and 1.02 during the weekday AM and PM peak hours, respectively. Therefore, it is evident that improvements should be made to the roundabout at Scott Boulevard and Vawter School Road in the future, regardless of the introduction of the proposed development.

In addition, as traffic volumes along Vawter School Road increase over the next twenty years, the southbound left-turn from the Break Time drive and the northbound approach of Frontgate Drive would also fail during the weekday PM peak hour. It should be noted that while the northbound approach at Vawter School Road and Frontgate Drive does fail, the queue length is minimal at just over two vehicles and the v/c ratio of only 0.47.

Recommended Improvements to Accommodate 2044 Baseline Traffic Needs

It is evident that the single-lane roundabout of Scott Boulevard and Vawter School Road would likely need to be modified in the future in order to continue to efficiently accommodate the increasing traffic demands. Based upon a preliminary analysis of the year 2044 baseline traffic volumes, the following modifications are offered for consideration by the City for future evaluation as traffic in the area grows:

- Eastbound Approach (Brushwood Lake Road):
 - No modifications recommended to this approach. However, if development should occur to the west in the future resulting in an increase in traffic traveling to and from Brushwood Lake Road, modifications may be required.
- Westbound Approach (Vawter School Road):
 - Provide a shared left/through lane and a right-turn bypass lane. It is intended that the right-turn bypass lane be tight within the roundabout to minimize property and pedestrian impacts. An additional receiving lane for the right-turn bypass would be required to the north of the roundabout.
- Northbound Approach (Scott Boulevard):
 - Provide a shared left/through lane and a right-turn bypass lane. It is intended that the right-turn bypass lane be tight within the roundabout to minimize property and pedestrian impacts. An additional receiving lane for the right-turn bypass would be required to the east of the roundabout.
- Southbound Approach (Scott Boulevard):
 - Provide a dedicated left-turn lane and a shared through/right turn lane. It is intended that the left-turn lane would be part of a turbo roundabout configuration and an additional travel lane along the west side within the roundabout would be required.

Figure 18 illustrates conceptually the proposed roundabout modifications that could be considered to address future traffic growth in the area. Table 12 summarizes the improved operations at the roundabout assuming the modifications are implemented.

Table 12. Year 2044 Baseline Traffic Operating Conditions Assuming Improved Roundabout at Scott Boulevard & Vawter School Road

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>		
	AM Peak Hour	PM Peak Hour	Sat MD Peak Hour
Scott Boulevard and Vawter School Road (improved roundabout)			
Overall Intersection	A (8.3)	A (8.3)	A (7.3)
Eastbound Approach	B (13.9) [<25] <0.02>	C (21.2) [<25] <0.04>	B (11.5) [<25] <0.02>
Westbound Approach	A (8.7) [55] <0.30>	A (8.2) [112] <0.53>	A (7.4) [44] <0.27>
Northbound Approach	A (7.4) [96] <0.49>	A (6.9) [57] <0.32>	A (5.8) [31] <0.20>
Southbound Approach	A (8.9) [71] <0.37>	A (9.1) [83] <0.43>	A (8.2) [45] <0.28>

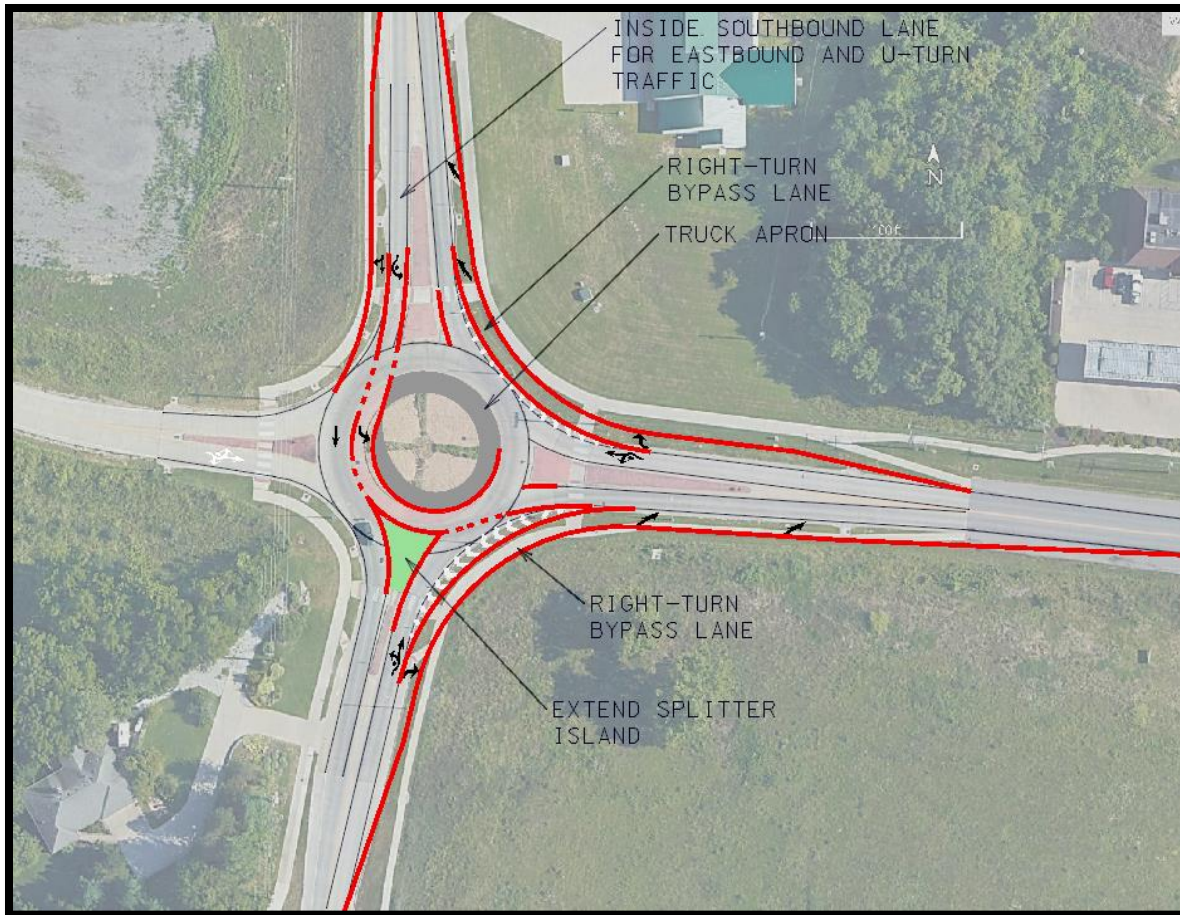


Figure 18: Conceptual Layout of Future Modifications at Scott Boulevard & Vawter School Road Roundabout

Year 2044 Forecasted Conditions

The 2044 horizon year forecasted traffic scenario assumes that the proposed development is in *place in addition to* the annual background growth rate of 1.0%. The 2044 baseline traffic volumes reflected in Figure 17 were combined with the site generated traffic volumes shown in Figure 11, resulting in the 2044 forecasted build traffic volumes shown in **Figure 19**.

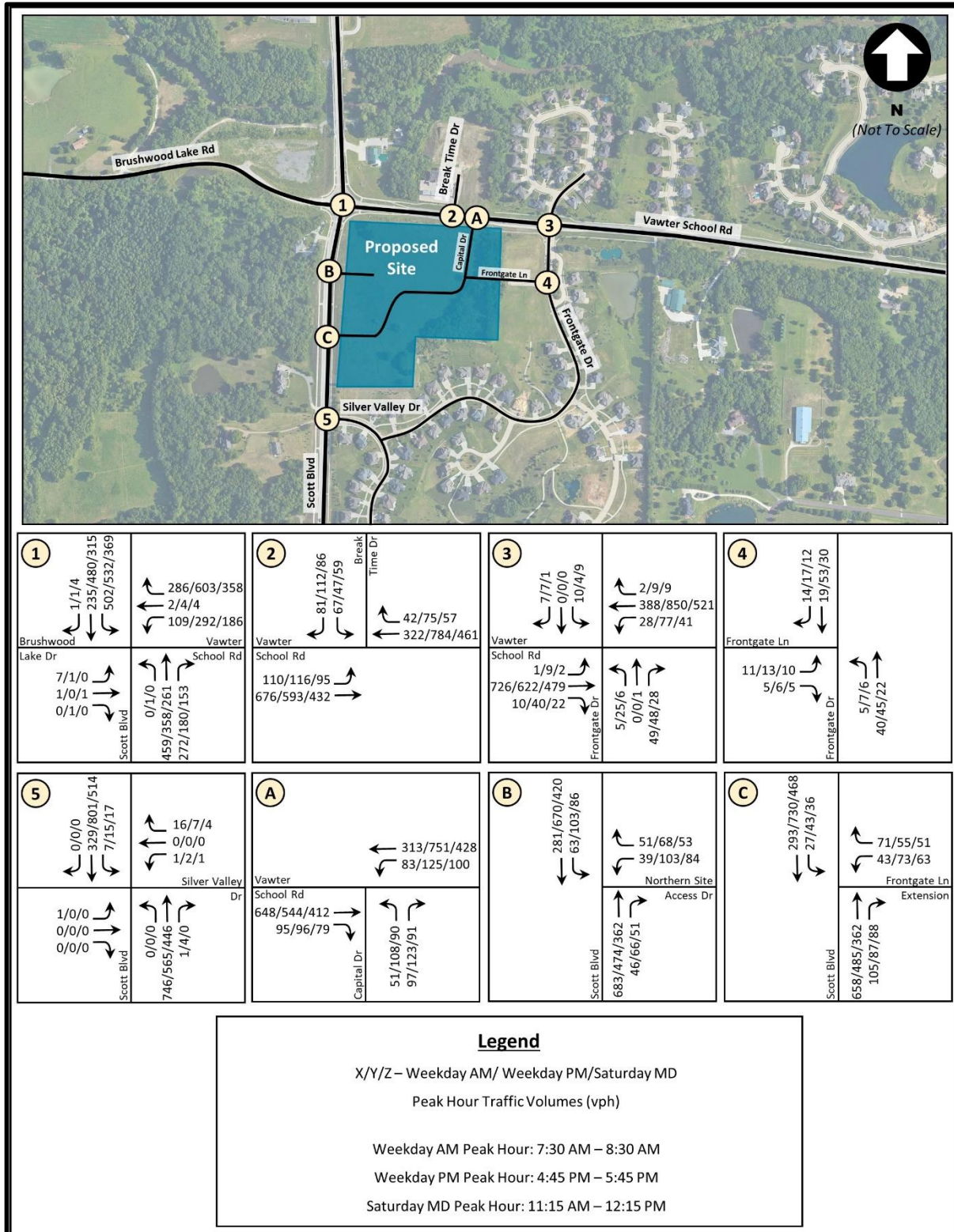


Figure 19: Year 2044 Forecasted Traffic Volumes

Forecasted operating conditions were evaluated using the same methodology applied previously and are summarized in **Table 13**. All of the previously recommended improvements identified for mitigation in the year 2024 forecasted conditions were assumed to be in place in the year 2044.

Table 13. Year 2044 Forecasted Traffic Operating Conditions

Intersection & Movements	LOS (Delay, sec) [Queue Length, feet] <v/c ratio>		
	AM Peak Hour	PM Peak Hour	Sat MD Peak Hour
Scott Boulevard and Vawter School Road (improved roundabout)			
Overall Intersection	A (8.7)	A (9.1)	A (7.5)
Eastbound Approach	C (15.2) [<25] <0.02>	D (28.8) [<25] <0.05>	B (13.0) [<25] <0.02>
Westbound Approach	A (9.0) [69] <0.36>	A (9.6) [172] <0.63>	A (7.6) [56] <0.32>
Northbound Approach	A (8.4) [187] <0.55>	A (7.5) [83] <0.42>	A (6.1) [43] <0.26>
Southbound Approach	A (8.7) [81] <0.40>	A (9.2) [101] <0.50>	A (8.1) [64] <0.31>
Vawter School Road and Break Time Drive (unsignalized, side-street STOP)			
Eastbound Left-Turn	A (8.5) [<25] <0.10>	B (11.1) [<25] <0.17>	A (8.9) [<25] <0.10>
Southbound Left-Turn	C (23.23) [28] <0.27>	D (31.7) [33] <0.32>	C (19.4) [<25] <0.22>
Southbound Right-Turn	B (11.3) [<25] <0.13>	C (24.9) [58] <0.46>	B (12.9) [<25] <0.18>
Vawter School Road and Capital Drive (unsignalized, side-street STOP)			
Westbound Left-Turn	A (9.9) [<25] <0.12>	A (9.6) [<25] <0.15>	A (9.0) [<25] <0.12>
Northbound Left-Turn	C (20.2) [<25] <0.20>	E (49.7) [88] <0.62>	C (23.0) [35] <0.33>
Northbound Right-Turn	C (17.1) [28] <0.27>	C (15.3) [28] <0.28>	B (12.6) [<25] <0.18>
Vawter School Road and Frontgate Drive/Creekfront Way (unsignalized, improved side-street STOP)			
Eastbound Left-Turn	A (8.2) [<25] <0.00>	B (10.1) [<25] <0.01>	A (8.6) [<25] <0.00>
Westbound Left-Turn	A (9.6) [<25] <0.04>	A (9.4) [<25] <0.10>	A (8.7) [<25] <0.04>
Northbound Left-Turn	D (34.1) [<25] <0.05>	F (131.7) [50] <0.51>	D (28.7) [<25] <0.06>
Northbound Right-Turn	C (16.1) [<25] <0.16>	B (14.0) [<25] <0.11>	B (12.1) [<25] <0.07>
Southbound Approach	D (31.0) [<25] <0.14>	E (49.2) [<25] <0.21>	D (32.2) [<25] <0.15>
Frontgate Drive and Frontgate Lane (unsignalized, side-street STOP)			
Eastbound Approach	A (9.0) [<25] <0.04>	A (9.1) [<25] <0.02>	A (9.1) [<25] <0.06>
Northbound Left-Turn	A (7.4) [<25] <0.00>	A (7.4) [<25] <0.01>	A (7.3) [<25] <0.01>
Scott Boulevard and Silver Valley Drive (unsignalized, side-street STOP)			
Eastbound Approach	E (36.9) [<25] <0.03>	1/	1/
Westbound Approach	C (18.0) [<25] <0.09>	C (21.0) [<25] <0.05>	B (13.8) [<25] <0.04>
Northbound Left-Turn	1/	1/	1/
Southbound Left-Turn	A (9.9) [<25] <0.01>	A (8.8) [<25] <0.02>	A (8.4) [<25] <0.02>
Scott Boulevard and Northern Site Access Drive (unsignalized, side-street STOP)			
Westbound Left-Turn	C (20.1) [<25] <0.15>	E (36.4) [65] <0.50>	C (18.5) [25] <0.26>
Westbound Right-Turn	C (17.0) [<25] <0.16>	B (12.8) [<25] <0.14>	B (11.2) [<25] <0.09>
Southbound Left-Turn	B (10.3) [<25] 0.10>	A (9.2) [<25] <0.12>	A (8.5) [<25] <0.08>
Scott Boulevard and Capital Lane Extension (unsignalized, side-street STOP)			
Westbound Left-Turn	C (19.2) [<25] <0.16>	D (26.1) [33] <0.32>	C (16.4) [<25] <0.18>
Westbound Right-Turn	C (18.0) [<25] <0.22>	B (12.9) [<25] <0.16>	B (11.3) [<25] <0.09>
Southbound Left-Turn	B (10.1) [<25] <0.05>	A (9.0) [<25] <0.05>	A (8.4) [<25] <0.04>

Delay presented in vehicles per second

1/ Due to a lack of traffic volume, there was no LOS calculated

- 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles

As shown, it is expected that the roundabout would operate favorably with an overall LOS A for each peak period assuming it is modified as shown in Figure 18. It should be noted that this roundabout was modeled using Sidra (rather than Synchro), which uses HCM methodology, due to Sidra's ability to replicate a turbo roundabout. However, more detailed modeling (ideally microscopic simulation) is recommended prior to proceeding with the redesign of the roundabout.

The presence of the two-way, left-turn lane along Vawter School Road across both the Break Time access drive and Capital Lane facilitate the left turns into and out of the respective sites through the year 2044. Queue lengths of less than four vehicles are expected and delays associated with the left turn from either site would be less than 50 seconds, on average, per vehicle during the peak periods.

The northbound left-turn from Frontgate Drive onto Vawter School Road would also experience a failing LOS during the PM peak period by the year 2044 (with and without the development in place). As previously mentioned, this is not uncommon for left turns from unsignalized intersections as vehicles must wait for a gap in the free-flowing traffic along Vawter School Road. With the improved striping at this approach, the right-turning vehicles would not be obstructed by the left-turning vehicles and would operate at a LOS C or better.

Each of the proposed site access drives along Scott Boulevard would continue to operate reasonably in the year 2044. Each approach to Scott Boulevard would operate at a LOS E or better and the peak queue lengths would be minimal; less than three vehicles. Even in the 2044 scenario, the southbound left-turning vehicles along Scott Boulevard are not expected to negatively impact the roundabout at Scott Boulevard and Vawter School Road and queues of left turns are anticipated to be typically only one vehicle.

Therefore, it is concluded that with the improvements recommended in conjunction with the proposed development, as well as future modifications to the roundabout at Scott Boulevard and Vawter School Road (that are dictated by growth in traffic volumes and not the proposed development), the area roadways could reasonably accommodate the proposed development and its associated traffic into the future years.

Conclusions

Lochmueller Group has completed the preceding revised traffic study pertaining to the Copperstone Corner mixed use development located in Columbia, Missouri. Upon full buildout, the proposed development seeks access to both Scott Boulevard and Vawter School Road, both of which are City controlled roadways. Initially, the proposed development only seeks the extension of Capital Lane from Vawter School Road to past the Diventures site, with a connection to the extension of Frontgate Lane.

Based on the preceding study, the following can be concluded:

- Today, the study intersections operate favorably during the weekday AM and PM peak periods as well as the Saturday midday peak hour. These time periods were chosen for analysis since they represent peak periods for the adjacent road system as well as the proposed development.
- During typical traffic conditions, there is little incentive for a motorist to travel through the Copperstone neighborhood as a means of avoiding the roundabout at the intersection of Scott Boulevard and Vawter School Road. Given the complexity of the neighborhood streets and the lack of a “straight shot” between Scott Boulevard and Vawter School Road, the associated travel time is shorter when vehicles remain on Scott Boulevard and Vawter School Road and do not travel through the neighborhood.
- When school is in session, brief vehicular queues longer than typical operations were observed; particularly on northbound and southbound Scott Boulevard and westbound Vawter School Road. The surges in traffic would often dissipate within minutes and traffic conditions would return to normal. School traffic would have the most impact during the morning when the school peak and the weekday AM peak coincide.
- Two additional developments have been previously approved and are underway within the vicinity of Copperstone Corner. The first would be a new development adjacent to the Break Time, which will consist of 4,500 SF of retail and 1,500 SF of fast-food restaurant with drive-through. Access would be provided via the existing access drive serving Break Time. The other development is along the west side of Scott Boulevard, south of Vawter School Road, and would provide for 35 single family detached homes with two points of full access. Both developments are expected to be in place by 2024. The background developments would be expected to contribute 73, 103, and 92 total new trips during the weekday AM, PM, and Saturday MD peak hours, respectively, to the area road system.
- The additional traffic from the development adjacent to the Break Time would decline the operating conditions associated with the southbound left turn exiting the site to a LOS F.
- Given the operating characteristics of the proposed Diventures, it is expected to generate a total of approximately 14, 160, and 95 new trips during the weekday morning, evening, and Saturday midday peak hours, respectively.

- The full build out of Copperstone Corner would generate a total of approximately 898, 1,377, and 1,163 trips during the weekday morning, evening, and Saturday midday peak hours, respectively, upon completion. However, when common and pass-by trips are taken into consideration, the proposed development would generate a total of approximately 407, 659, and 499 **new** trips during the weekday morning, evening, and Saturday midday peak hours, respectively.
- The latest proposed site plan ultimately provides for four site access drives serving Copperstone Corner. Two site access drives are proposed along Scott Boulevard, one site access drive proposed along Vawter School Road approximately 165 feet east of the existing access drive to Break Time (to be referred to as Capital Drive), and the fourth site access drive is proposed via an extension of Frontgate Lane thereby affording access to existing Frontgate Drive.
- Given the horizontal curvature of Scott Boulevard south of Vawter School Road, sight distance measurements were conducted to determine where along Scott Boulevard would access be safe to provide. Figure 12 in the following report illustrates the allowable frontage in which both drives could be located, assuming a minimum of 300 feet separation is maintained between the two drives. By locating the access drives within that allowable window, they would meet the MoDOT sight distance requirements for 40 mph and would allow for better queueing distance from the roundabout.
- All proposed intersections should conform to the sight distance requirements set forth by the American Association of State Highway and Transportation Officials (AASHTO). Sight distance measurements should be field verified prior to construction of the drives themselves once the site has been cleared. Furthermore, as part of the design and construction process, care should be given to ensure that signage and/or landscaping does not pose sight distance limitations at any of the proposed drive locations.
- The revised preliminary site plan includes several improvements to the study area that were identified in the original traffic study and reviewed and approved by the City of Columbia. These improvements include:
 - Each of the site access drives along Scott Boulevard and Vawter School Road would have designated turn lanes for exiting traffic.
 - Left-turn lanes into the site from Scott Boulevard and Vawter School Road are accommodated via two-way, left-turn lanes.
 - A two-way, left-turn lane along Vawter School Road is proposed starting east of the roundabout, traversing through the intersections with Break Time and with Capital Drive and terminating just west of the intersection with Frontgate Drive/Creekfront Way is provided. The termination of this center lane would result in the provision of the eastbound left turn lane is also provided at Creekfront Way.
 - The two-way left-turn lane along Scott Boulevard would extend from its current terminus north of Silver Valley Drive northward and stop just south of the roundabout at Vawter School Road. This provides the southbound left-turn lanes

into the site along Scott Boulevard (not required until such time that access onto Scott Boulevard is provided).

- The northbound approach at Vawter School Road and Frontgate Lane would be improved to provide a shared left-turn/through lane and a right-turn lane. This improvement is made through striping changes and not physical widening as there is ample width available to accommodate the restriping.
- In addition to the improvements already included within the latest site plan, it is recommended that traffic exiting to Scott Boulevard and Vawter School Road be placed under STOP control via installation of signage and a stop bar pavement markings. Additionally, it is recommended that a stop sign and stop bar be provided along Frontgate Lane at its intersection with Frontgate Drive. Currently that approach is under an implied stop as there is not a stop sign present. Within the development, side-street stop control should be provided at the internal intersection of Frontgate Lane with Capital Drive where traffic traveling along Frontgate Lane is required to stop.
- Two scenarios were analyzed for the 2024 forecasted conditions. The first scenario includes traffic from the Diventures development only given that no other uses are confirmed for the site at this time. The second scenario includes the full build out of the proposed development assuming various mixed uses as proposed by the developer. It was concluded that the introduction of the traffic associated with Copperstone Corner would have an impact upon traffic conditions along the adjacent roadways, which is mitigated by the proposed road improvements.
 - Scenario 1 – Diventures Only:
 - Access to the Diventures would be via Capital Drive to Vawter School Road or to Frontgate Drive via Frontgate Lane. No access would be provided via Scott Boulevard under this scenario.
 - The study intersections easily accommodate the introduction of the Diventures development's traffic with the proposed lane configuration and traffic control shown on the site plan.
 - Scenario 2 – Full Build:
 - Access to the development would be provided via all four proposed site access drives.
 - The study intersections adequately accommodate the introduction of the development's traffic with the proposed lane configuration and traffic control as shown on the site plan. In fact, the previously failing southbound left-turn at the Break Time would improve due to the ability to make a two-stage left-turn once a continuous two-way left-turn lane along Vawter School is provided.
 - The original traffic impact study recommended the prohibition of the left turn onto Vawter School Drive from Capital Lane due to the impact upon the Break Time drive, the failing operations for the northbound left turn movement and the propensity for lengthy queues back into the site. However, the relocation of Capital Lane 165 feet to the east, thereby positively offsetting the proposed roadway from the Break Time drive resolves these issues and there is no longer

reason to prohibit the northbound left turn from Capital Lane. Therefore, the proposed intersection of Capital Lane with Vawter School Road can accommodate all turning movements assuming:

- It is located at least 150 feet east of the Break Time's access drive.
 - A two-way, left-turn lane is provided along Vawter School Road serving both the Break Time access drive and Capital Lane.
 - Separate northbound left and right turn lanes are provided on Capital Lane.
 - Capital Lane has the right-of-way at its intersection with Frontgate Lane extension. Traffic on Frontgate Lane would be under STOP control.
- It is recommended that sidewalk be provided along the perimeter of the site to connect into the existing network. Additionally, it is recommending that a pedestrian crossing, with a continental crosswalk, signage, refuge island and pedestrian actuated rapid flashing beacons be provided along Vawter School Road to the west side of its intersection with Frontgate Dr to provide safe crossing for area residents. The exact location of this crossing should be at the direction of the City of Columbia with input from the Copperstone and Spring Creek neighborhoods.
 - By the year 2044 (20-year planning horizon), the roundabout at Scott Boulevard and Vawter School Road begins to show signs of exceeding capacity during the weekday morning and afternoon peak hours, regardless of the introduction of the proposed development. It is evident that the single-lane roundabout would likely need to be modified in the future in order to continue to efficiently accommodate the increasing traffic demands. Based upon a preliminary analysis of the year 2044 baseline traffic volumes, modifications akin to those illustrated in Figure 18 are offered for consideration by the City for future evaluation as traffic in the area grows. The modifications provide for bypass lanes on the northbound and westbound approaches as well as a turbo configuration to accommodate the heavy southbound left turn movement. In order to accommodate this future expansion of the roundabout, additional right of way needs should be dedicated on the SE corner of Vawter School Road and Scott Boulevard. Also, placement of the sidewalk, signage, landscaping, utilities, and other development features need to accommodate the future roundabout construction as much as feasible.

Overall, it was concluded that with the improvements presented in the revised site plan in place, the surrounding roadways can adequately accommodate the proposed development of Copperstone Corner and its associated traffic. Please contact our offices at (314) 446-3791 with any questions or comments concerning this report.

Completed by Lochmueller Group, Inc