TRAFFIC ANALYSIS & DESIGN, INC.

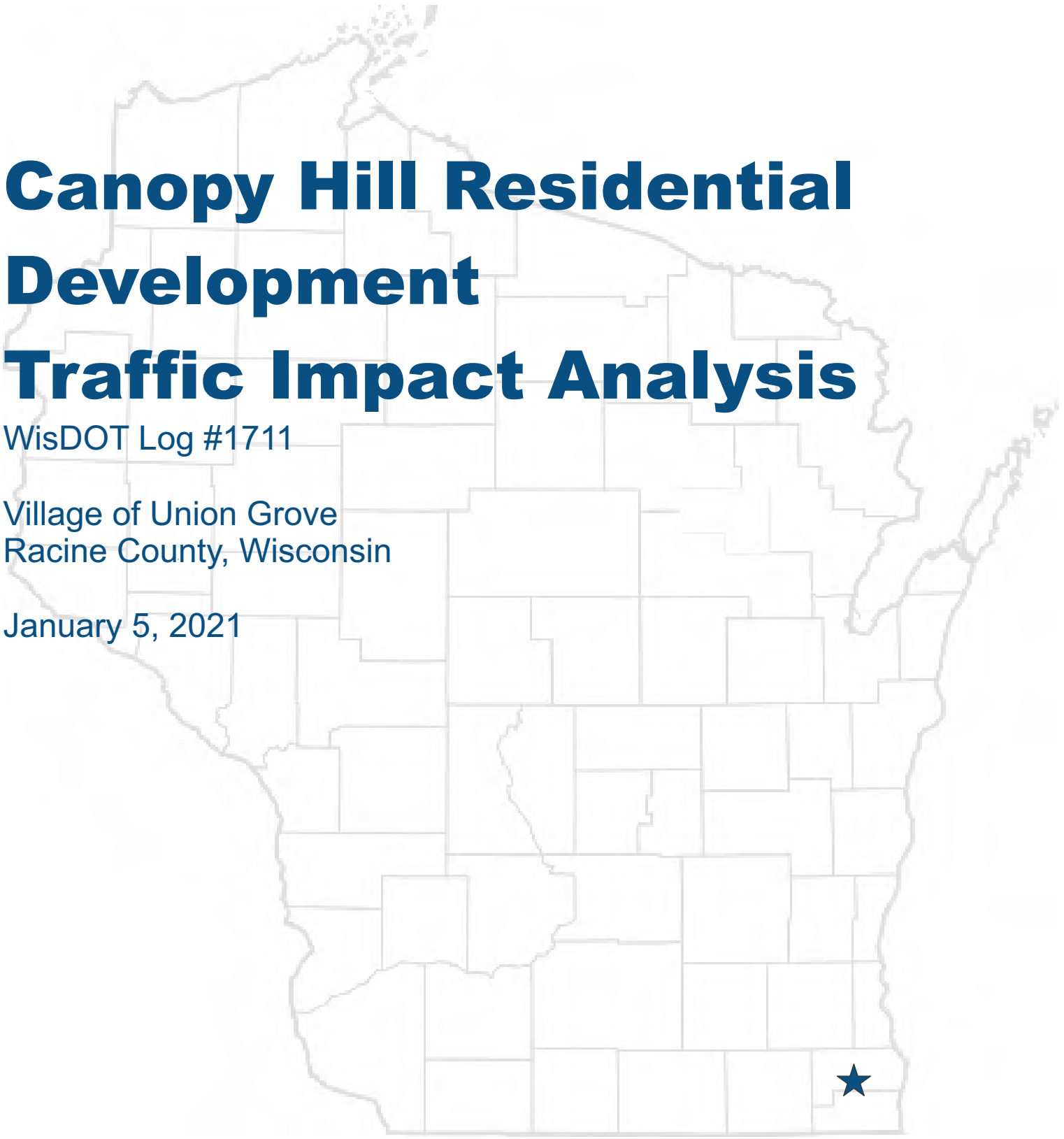
PO Box 128
Cedarburg, WI 53012
800.605.3091
www.tadi-us.com

Canopy Hill Residential Development Traffic Impact Analysis

WisDOT Log #1711

Village of Union Grove
Racine County, Wisconsin

January 5, 2021



TRAFFIC IMPACT STUDY FOR:

CANOPY HILL RESIDENTIAL DEVELOPMENT

VILLAGE OF UNION GROVE, RACINE COUNTY, WISCONSIN
(WisDOT Log #1711)

DATE SUBMITTED: January 5, 2021

PREPARED FOR:
Pinnacle Engineering Group
20725 Watertown Road, Suite 100
Brookfield, WI 53186
Phone: (262) 754-8888
Contact Person: Aaron Koch, P.E.

PREPARED BY:
TADI
PO Box 128
Cedarburg, WI 53012
Phone: (800) 605-3091
Contact Persons: Don Lee, P.E. (WisDOT TIA Certification # SE05-804-046)
John Bieberitz, P.E., PTOE (WisDOT TIA Certification # SE05-804-044)

"I certify that this Traffic Impact Analysis has been prepared by me or under my immediate supervision and that I have experience and training in the field of traffic and transportation engineering."

_____
Donald J. Lee, P.E.
Wisconsin Registration #35214-006
Traffic Analysis & Design, Inc.

Canopy Hill Residential Development
Traffic Impact Analysis
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LIST OF APPENDICES

CHAPTER I – INTRODUCTION & EXECUTIVE SUMMARY

PART A – PURPOSE OF REPORT AND STUDY OBJECTIVES

A residential development is proposed to be located on about 157 acres west of USH 45 (Colony Avenue), north of 7th Avenue, in the Village of Union Grove, Racine County, Wisconsin. The residential development will include a mix of single-family housing, multi-family housing, and assisted living. About 18 acres of the site will be dedicated to the Village as parkland. As part of the development, WisDOT has requested a traffic impact analysis be conducted to determine the additional traffic expected to be generated by the development and to identify roadway modifications, if any, attributed to the new development for the opening year (2021) traffic scenario.

This report documents the procedures, findings and conclusions of the traffic impact analysis. The analysis identifies recommended modifications based on existing intersection geometrics, background traffic volumes, and additional traffic expected to be generated by the proposed development.

PART B – EXECUTIVE SUMMARY

The executive summary includes a description of the study area, description of the proposed development and conclusions based on the findings of the TIA.

B1. Location of Study Site with Respect to Area Roadway Network

A residential development is proposed to be located on about 157 acres west of USH 45 (Colony Avenue), north of 7th Avenue, in the Village of Union Grove, as shown in Exhibit 1-1A. The study area for the proposed development includes the following intersections:

- Node 100: USH 45 & CTH C (Spring Street)
- Node 200: USH 45 & 58th Road/Proposed North Access Road
- Node 300: USH 45 & the north Union Grove High School driveway (outbound)
- Node 350: USH 45 & the north Union Grove High School driveway (inbound)/Proposed 5th Street Access Road
- Node 400: USH 45 & the south Union Grove High School driveway
- Node 500: USH 45 & 7th Avenue/Dog Park Access Drive

All study intersections operate with stop sign control on the minor street and/or driveway approaches except for the USH 45/CTH C intersection, which operates with roundabout control.

B2. On-Site Development Description

A conceptual site plan for the proposed development is shown on Exhibit 1-1B. The site is currently utilized for agricultural uses with wooded areas located throughout. The following land uses were assumed to occur on the proposed residential development site:

- *Single-Family Detached Housing – 188 lots/units*
- *Multi-Family Housing (Low-Rise) – 60 apartment units*
- *Single-Family Detached Housing – 68 duplex units*
- *Assisted Living – 60 beds/units*

Construction of the single-family housing and multi-family housing is expected to start in year 2021 with completion expected over the next few years. Timing on the assisted living facility is unknown at the time of this report. However, for planning purposes, full build out of all parcels and land uses is included in the Year 2021 build traffic scenario.

B3. Off-Site Development Description

No pending offsite development has been identified within the limits of the study area. It is noted that the lands located between the two development access roads is either owned by the existing church or is considered wetland/floodplain and is not considered to be developable.

B4. Site Generated Traffic

The traffic volumes expected to be generated are based on the size and type of the proposed uses and on a combination of trip rates and fitted curve equations as published in the ITE *Trip Generation Manual, 10th Edition*. Due to the land use types within this development, linked and pass-by trips are expected to be negligible.

At full buildout, the Canopy Hill development is expected to generate 3,160 new weekday daily trips, with 235 weekday trips occurring during the AM peak hour (60 in/175 out) and 305 trips occurring during the weekday PM peak hour (185 in/120 out).

B5. Proposed Access to the Developments

Access to the site will be via a new road network that connects to USH 45 at 58th Road and at a new access road aligned with the Union Grove High School's northern inbound only driveway, proposed to be designated as 5th Street. The existing church driveways that currently connect to USH 45 at each of these locations will have access to the new sideroad network. All access points are proposed as full access intersections.

B6. Recommended Modifications

The study area intersections were analyzed based on the procedures set forth in the *Highway Capacity Manual* (HCM) *6th Edition*. Intersection operation is defined by "level of service". Level of Service (LOS) is a quantitative measure that refers to the overall quality of flow at an intersection ranging from very good, represented by LOS 'A', to very poor, represented by LOS 'F'. For the purpose of this study, LOS D or better was used to define acceptable peak hour operating conditions.

Modifications to address traffic impacts are shown in Exhibit 1-2 for the Year 2021 traffic conditions and have been shown for the following two scenarios:

- "Background Traffic" – These modifications are expected to be necessary to accommodate Year 2021 background traffic volumes without the proposed residential development.
- "Build Traffic" – These modifications are expected to be necessary to accommodate the Year 2021 build traffic volumes, which includes the proposed residential development.

The analysis was conducted using existing intersection geometrics and traffic control. The following modifications, as shown in Exhibit 1-2, are recommended to accommodate the Year 2021 background and build traffic volumes, respectively. *Modifications are for jurisdictional consideration and are not legally binding. WisDOT and the Village of Union Grove reserve the right to determine alternative solutions.*

Node 100: USH 45 & CTH C

- *Background Traffic:* No modifications.
- *Build Traffic:* No modifications.

Node 200: USH 45 & 58th Road/Proposed North Access

- *Background Traffic:* No modifications.
- *Build Traffic:*

- Provide stop sign control on the west approach.
- Provide a shared through/left-turn lane and a dedicated right-turn lane on the north, south and west approaches.
- No modifications to the east approach are recommended.
- Provide for bike lane as part of southbound dedicated right-turn lane design (similar to existing northbound lanes).
- *A single-lane roundabout was considered for this intersection; however, due to the relatively low traffic volumes, warrants are not expected to be met.*

Node 300: USH 45 & N High School Driveway (outbound)

- *Background Traffic:* No modifications.
- *Build Traffic:* No modifications.

Node 350: USH 45 & N High School Driveway (inbound)/Proposed 5th Street Access

- *Background Traffic:* No modifications.
- *Build Traffic:*
  - Provide stop sign control on the west side of USH 45 aligned across from the high school driveway.
  - Provide a single shared lane on the west approach.
  - Consider extending the outside shoulder along the west side of USH 45 to the south, to a point immediately south of proposed 5th Street.
  - No modifications are recommended to the existing RRFB pedestrian crossing located immediately north of the intersection.

Node 400: USH 45 & S High School Driveway

- *Background Traffic:* No modifications.
- *Build Traffic:* No modifications.

Node 500: CTH K & 7th Avenue/Dog Park Access

- *Background Traffic:* No modifications.
- *Build Traffic:* No modifications.

Even though the overall intersection is expected to operate acceptably, the eastbound and westbound movements at the USH 45 intersection with 58th Road are expected to operate unacceptably during the weekday morning peak hour under build traffic conditions with delays slightly over (2 seconds greater than) the LOS D threshold for the westbound movements. Due to the relatively low volume of traffic on the sideroad approaches at this intersection, traffic signal control is not expected to be warranted under either the build traffic scenario. However, it is expected that gaps created by the existing roundabout control located immediately to the north along USH 45 at the CTH C intersection are allowing this intersection to operate better than reflected in the modeling software; therefore, this intersection should be monitored, and modifications should be considered as delays increase or are being experienced. It is noted that the inclusion of additional turn lanes at this intersection, above and beyond those recommended above, is not expected to improve the overall operations for the east and west approach movements.

Even though the overall intersection is expected to operate acceptably, the eastbound movements at the USH 45 intersection with 5th Street (proposed) are expected to operate unacceptably during the weekday morning peak hour under full build traffic conditions with delays slightly over (2 seconds greater than) the LOS D threshold. Due to the relatively low volume of traffic on the sideroad approaches at this intersection, traffic signal control is not expected to be warranted. However, it is expected that gaps created by the existing roundabout control located immediately to the north along USH 45 at the CTH C intersection will allow this intersection to operate better than reflected in the modeling software; therefore, this intersection should be monitored, and modifications should be considered as delays increase or are being experienced. It is noted that the inclusion of additional turn lanes at this intersection is not expected to improve the overall operations for the west approach movements.

B7. Conclusion

Except where noted in the previous section and described Chapter V, all movements at the study area intersections are expected to operate safely and efficiently with the development assumptions outlined in this TIA and with the identified recommended modifications if properly designed and implemented through the opening year of the development.

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N
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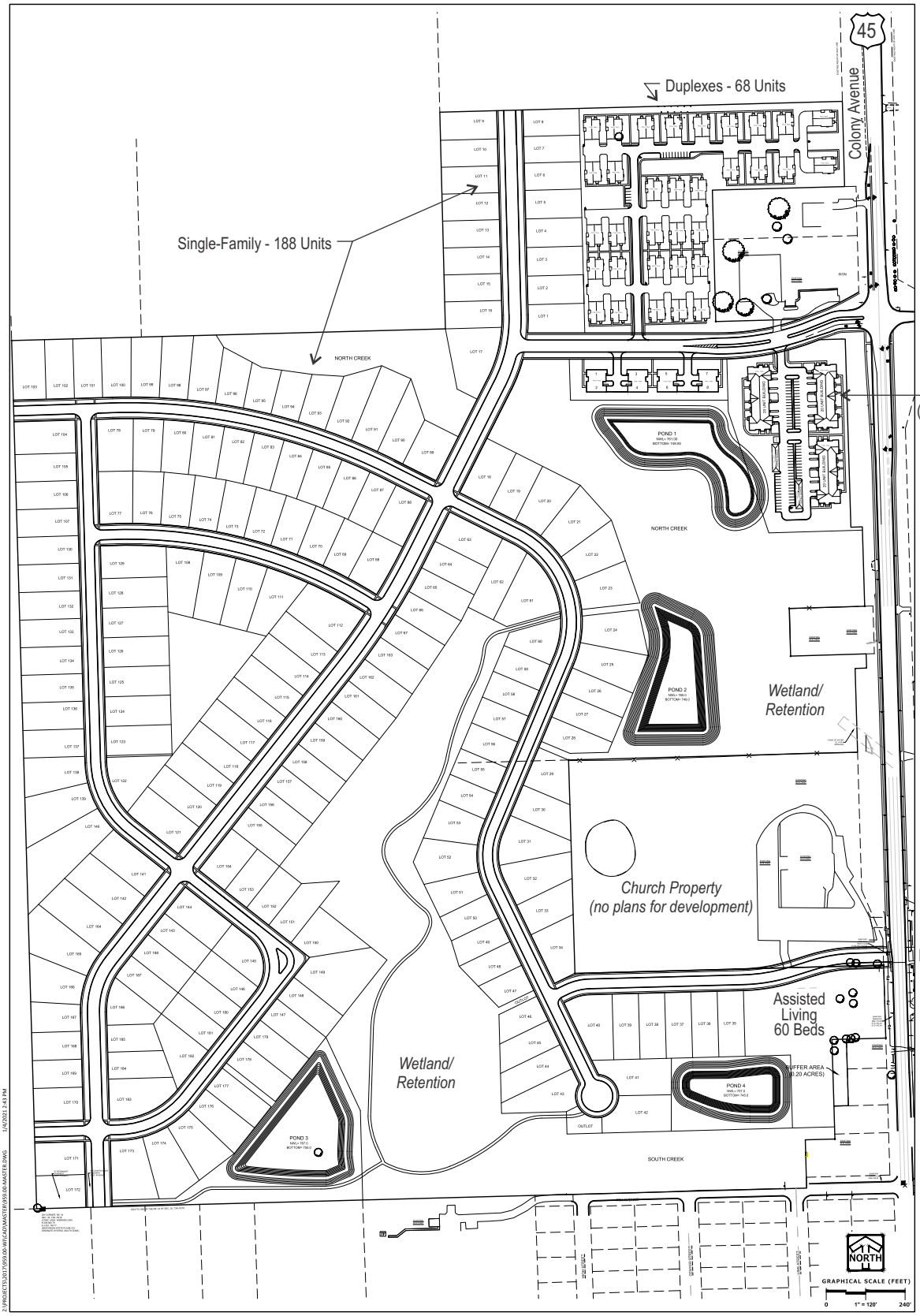
EXHIBIT 1-1A
SITE LOCATION MAP

CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI



CANOPY HILL- OVERALL SITE PLAN

01/04/2021

PINNACLE ENGINEERING GROUP 20725 WATERTOWN ROAD | SUITE 100 | BROOKFIELD, WI 53186 | WWW.PINNACLE-ENGR.COM PLAN | DESIGN | DELIVER PEGJOB# 959.00

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EXHIBIT 1-1B
CONCEPTUAL SITE PLAN

CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI

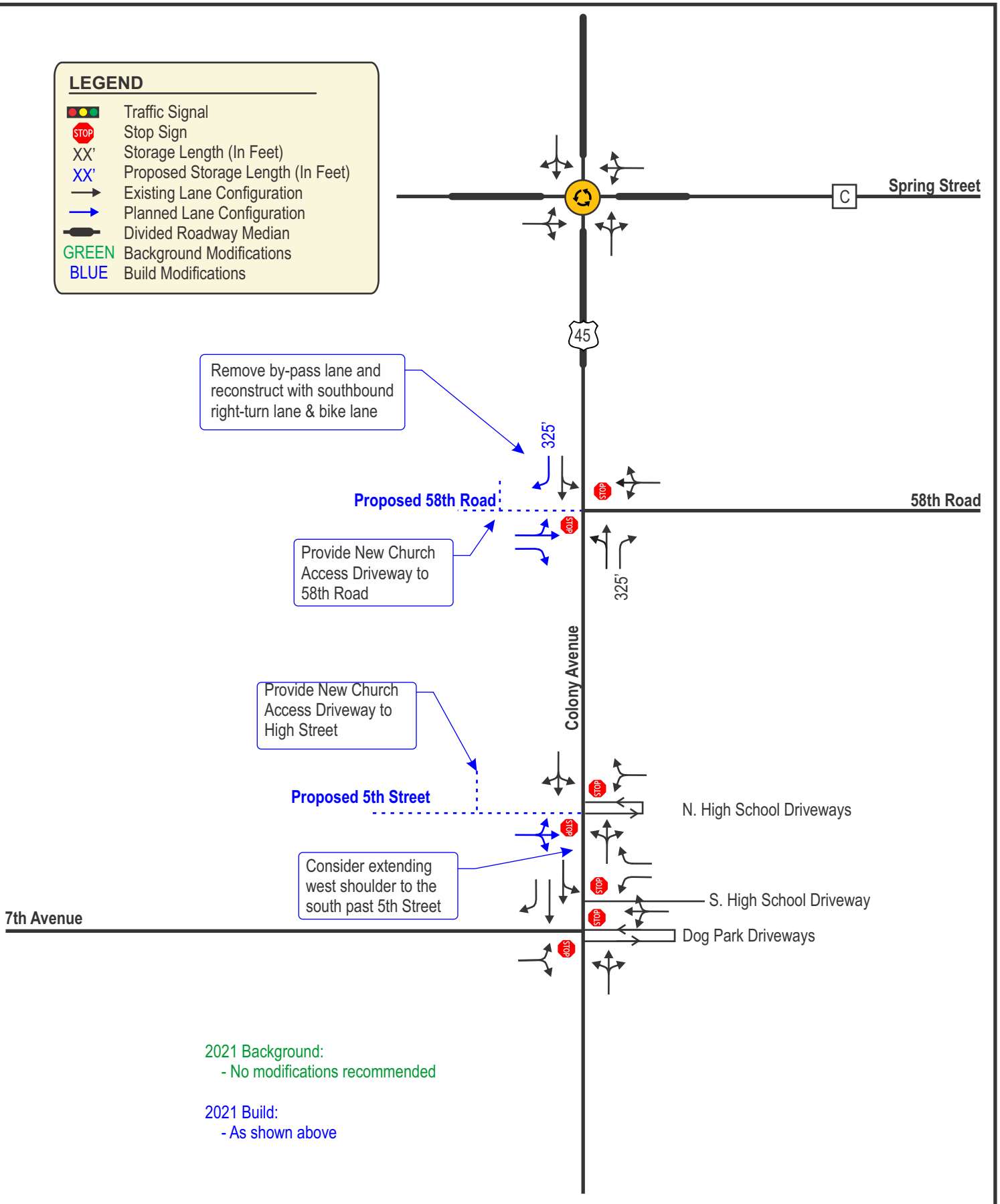

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EXHIBIT 1-2
RECOMMENDED MODIFICATIONS

CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI

CHAPTER II – PROPOSED DEVELOPMENT

PART A – ON-SITE DEVELOPMENT

A1. Development Description and Site Location

A residential development is proposed to be located on about 157 acres west of USH 45 (Colony Avenue), north of 7th Avenue, in the Village of Union Grove, Racine County, Wisconsin. The residential development will include a mix of single-family housing, multi-family housing, and assisted living. About 18 acres of the site will be dedicated to the Village as parkland. A project overview map illustrating the location of the proposed development site is shown in Exhibit 2-1.

A2. Land Use and Intensity

The site is currently utilized for agricultural uses with wooded areas located throughout. The site is bordered by additional agricultural and wooded lands to the north, west and southwest. Two churches are located within or adjacent to the site along the west side of USH 45. A residential neighborhood is located immediately to the south and a few single residential properties exist both on the east and west sides of STH 59, adjacent to the proposed site. The Union Grove High School is located across the street, east side of USH 45, near the south end of the proposed site. A light industrial business park is also located to the southwest of the site.

A3. Site Plan

A copy of the conceptual site plan for the residential development is illustrated in Exhibit 2-2. Access to the site will be via a new road network that connects to USH 45 at 58th Road and at a new access road aligned with the Union Grove High School's northern inbound only driveway, proposed to be designated as 5th Street. The existing church driveways that currently connect to USH 45 at each of these locations will have access to the new sideroad network. All access points are proposed as full access intersections.

A4. Development Phasing

The following land uses were assumed to occur on the proposed residential development site:

- *Single-Family Detached Housing – 188 lots/units*
- *Multi-Family Housing (Low-Rise) – 60 apartment units*
- *Single-Family Detached Housing – 68 duplex units*
- *Assisted Living – 60 beds/units*

Construction of the single-family housing and multi-family housing is expected to start in year 2021 with completion expected over the next few years. Timing on the assisted living facility is unknown at the time of this report. However, for planning purposes, full build out of all parcels and land uses is included in the Year 2021 build traffic scenario.

PART B – STUDY AREA

B1. Influence Area

Based on the type of proposed land uses and the location of the site in relation to IH 41/94 and USH 45, the proposed development is expected to draw from a local and regional customer base. Therefore, the areas of significant influence include the Village of Union Grove and other surrounding cities, villages and towns in southeast Wisconsin and northeast Illinois.

B2. Area of Significant Traffic Impact

The study area for the proposed development includes the following intersections:

- Node 100: USH 45 & CTH C (Spring Street)
- Node 200: USH 45 & 58th Road/Proposed North Access Road
- Node 300: USH 45 & the north Union Grove High School driveway (outbound)
- Node 350: USH 45 & the north Union Grove High School driveway (inbound)/Proposed 5th Street Access Road
- Node 400: USH 45 & the south Union Grove High School driveway
- Node 500: USH 45 & 7th Avenue/Dog Park Access Drive

All study intersections operate with stop sign control on the minor street and/or driveway approaches except for the USH 45/CTH C intersection, which operates with roundabout control.

PART C – OFF-SITE LAND USE AND DEVELOPMENT

No pending offsite development has been identified within the limits of the study area. It is noted that the lands located between the two development access roads is either owned by the existing church or is considered wetland/floodplain and is not considered to be developable.

The Racine County/Union Grove 2035 comprehensive land use map is shown in Exhibit 2-4.

PART D – SITE ACCESSIBILITY

D1. Study Area Roadways

The study area roadways are discussed below:

USH 45, also designated as *Colony Avenue (north of 7th Avenue) and Main Street (south of 7th Avenue),* is a two-lane north/south undivided principal arterial that extends from STH 20 (Washington Avenue), about 2.6 miles north of CTH C, down past the Wisconsin State line and into the greater Chicago area. Within the study area, USH 45 provides local access between CTH C and STH 11. USH 45 has recently been reconstructed with wide shoulders for on-street bicycle travel and sidewalks along both sides of the roadway (there are no sidewalks on the west side of USH 45 between the Union Grove High School's north driveway and 7th Avenue). USH 45 has a 25-mph speed limit from the Union Grove downtown area to just north of the Union Grove High School, where the speed limit transitions to 45-mph. According to WisDOT, the Year 2017 annual average daily traffic (AADT) volumes on USH 45 were approximately 4,700 vehicles per day (vpd) immediately south of CTH C.

CTH C, also designated as *Spring Street,* is a two-lane east/west undivided collector highway that curves around and connects to STH 11 on the west side of Union Grove and leads to interchange access with IH 41/94 about 5 ½ miles to the northeast. The Year 2017 AADT volumes on CTH C were approximately 2,600-vpd west of USH 45. In the study area, CTH C is a rural roadway with no sidewalks and a 45-mph speed limit.

58th Road is a two-lane east/west undivided collector street that extends from USH 45 on the west to IH 41/94 five miles to the east. An interchange to IH 41/94 is located on STH 11 about 1,000 feet from 58th Road. The Year 2011 AADT volumes on 58th Road were approximately 1,200-vpd east of USH 45. 58th Road is a rural roadway with no sidewalks and a 55-mph speed limit.

D2. Alternative Modes of Transportation

USH 45 has recently been reconstructed with wide shoulders for on-street bicycle travel and sidewalks along both sides of the roadway; however, there are no sidewalks on the west side of USH 45 between the Union Grove High School's north driveway and 7th Avenue. Pedestrian sidewalks do not currently exist along either side of CTH C or 58th Road within the limits of the study area. Transit is not present within the study area.

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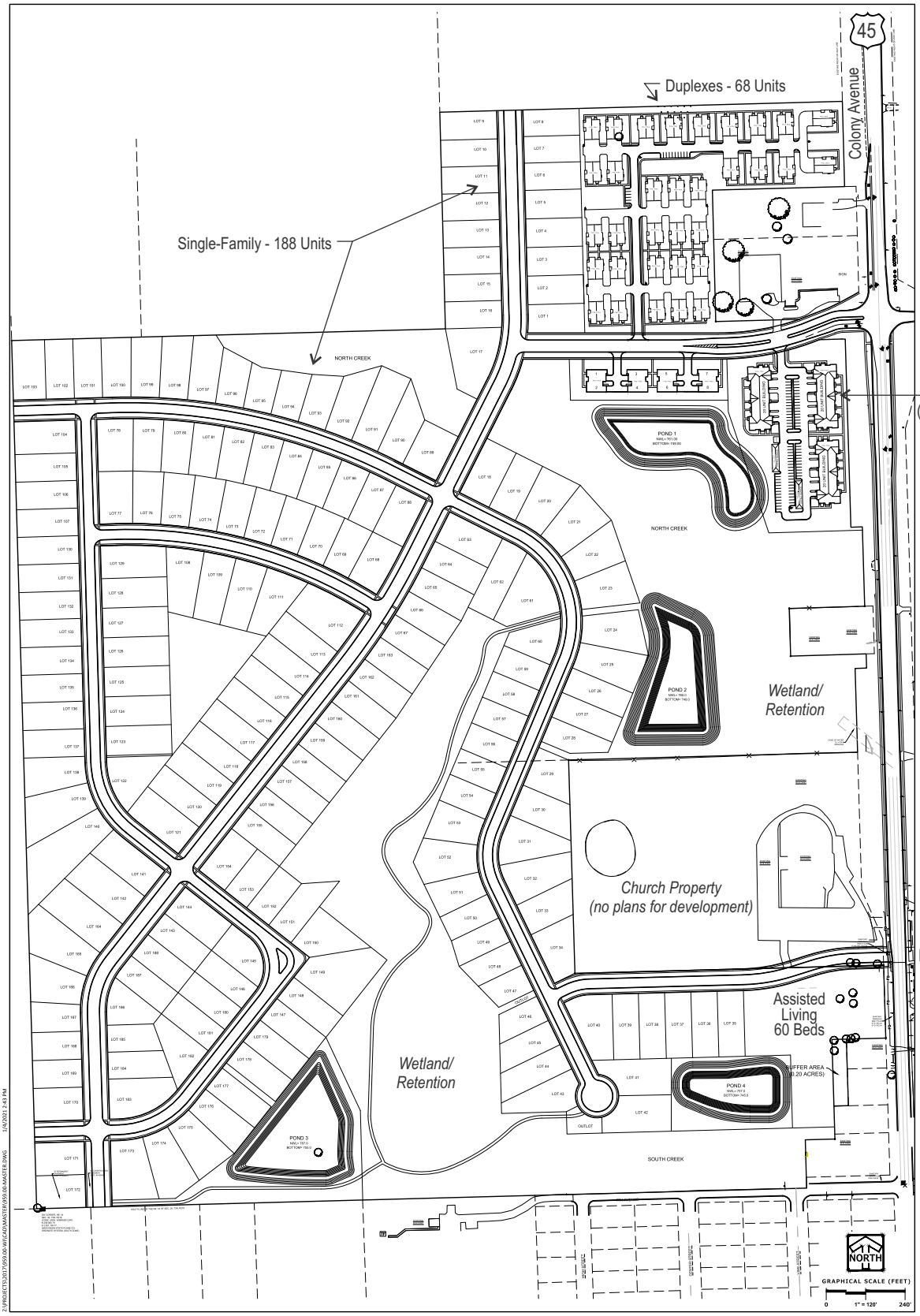
EXHIBIT 2-1
SITE LOCATION MAP

CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI



CANOPY HILL- OVERALL SITE PLAN

01/04/2021

PINNACLE ENGINEERING GROUP 20725 WATERTOWN ROAD | SUITE 100 | BROOKFIELD, WI 53186 | WWW.PINNACLE-ENGR.COM PLAN | DESIGN | DELIVER PEGJOB# 959.00

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EXHIBIT 2-2
CONCEPTUAL SITE PLAN

CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI

RECOMMENDED LAND USE PLAN FOR THE VILLAGE OF UNION GROVE PLANNING AREA: 2035

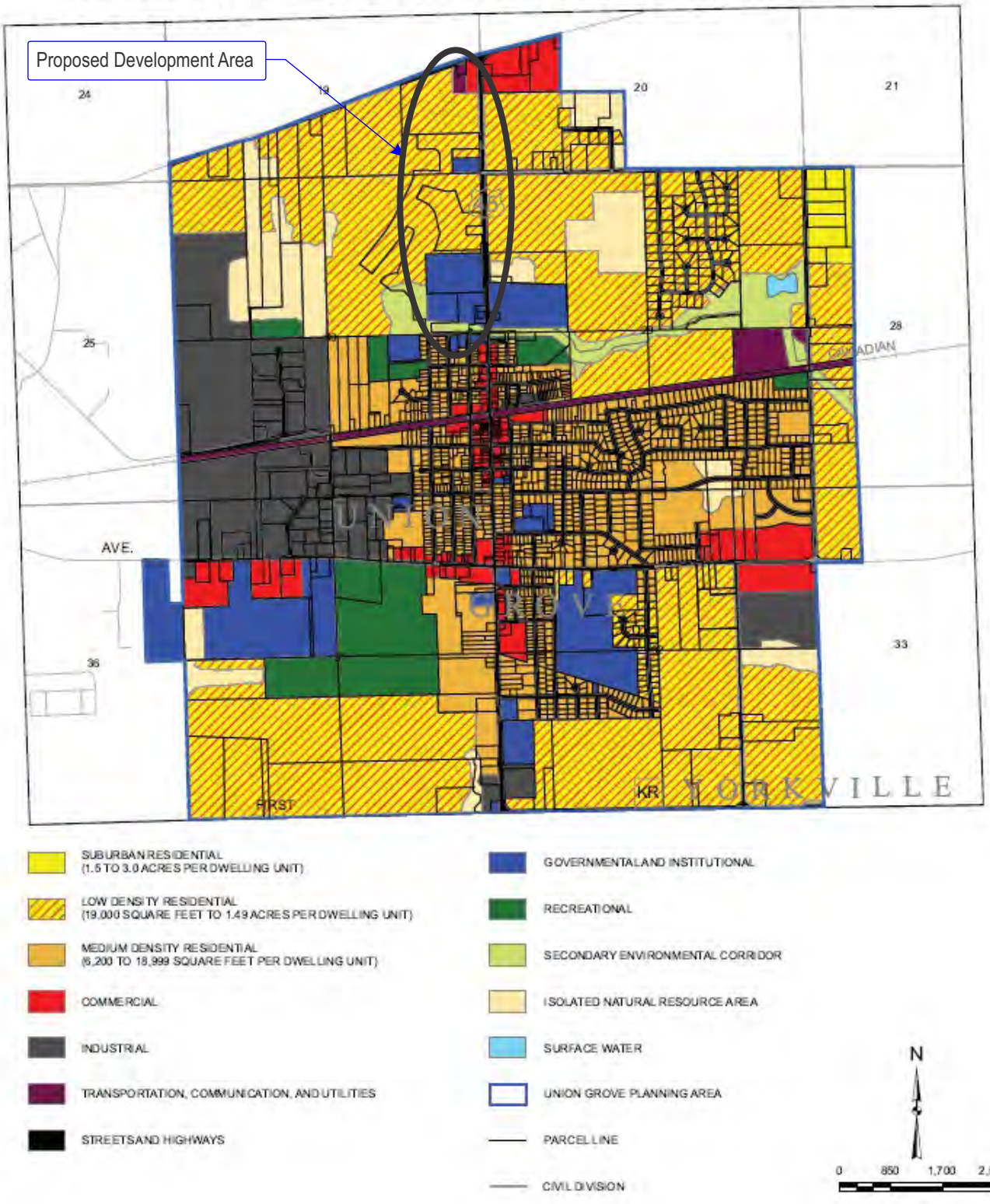

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EXHIBIT 2-4
RACINE COUINTY/UNION GROVE YEAR 2035 LAND USE MAP

CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI

CHAPTER III – ANALYSIS OF EXISTING CONDITIONS

PART A – PHYSICAL CHARACTERISTICS

Exhibit 3-1 shows the existing transportation detail for the study area intersections. More specifically, the exhibit illustrates intersection lane configurations, intersection traffic controls, and posted speed limits.

PART B – TRAFFIC VOLUMES

The weekday morning and weekday evening peak hours are expected to drive the improvements needed to adequately accommodate the residential development, as they represent the highest trip generation for the site and the highest volumes along the adjacent roadways.

Year 2016 weekday turning movement traffic counts were provided by WisDOT for the USH 45 intersection with CTH C. To supplement this count, weekday turning movement traffic counts were conducted by TADI at the other study intersections on September 23, 24, and 25 from 6:00-9:00 a.m. and from 3:00-6:00 p.m. Based on these turning movement counts, the weekday morning and weekday evening peak hours were identified as being 7:00 to 8:00 am and 3:00 to 4:00 pm, respectively. The existing traffic volumes, balanced utilizing the CTH C as the controlling intersection, are shown in Exhibit 3-2A.

Although the State of Wisconsin's Safer-at-Home order for the Covid-19 Pandemic was not in place at the time of the traffic counts, traffic volumes from September may still not be at their "normal" levels yet as businesses are in varied stages of transitioning back to full operation or full occupancy in their workplace. Comparing the peak hour turning movement counts collected for this study to WisDOT hourly count data shows that the 2011 WisDOT hourly volumes on 58th Road were 31% higher in the AM peak hour and 7% lower in the PM peak hour than the September 2020 traffic counts. Therefore, the weekday AM peak hour traffic volumes were increased by 31% on 58th Road to match the percent volume differences between the WisDOT historical hourly volumes and the September 2020 traffic counts. The PM peak hour traffic volumes were not adjusted as the most recent volumes were higher than the historic volumes. The factored volumes were balanced between intersections, utilizing the CTH C as the controlling intersection, and are shown as the Year 2020 Background traffic volumes in Exhibit 3-2B.

The traffic counts used to determine peak hour factors and truck percentages have been included in the appendix of this study.

PART C – CAPACITY LEVEL OF SERVICE

C1. Level of Service Definitions

The study area intersections were analyzed based on the procedures set forth in the *Highway Capacity Manual* (HCM) *6th Edition*. Intersection operation is defined by "level of service". Level of service (LOS) is a quantitative measure that refers to the overall quality of flow at an intersection ranging from very good, represented by LOS 'A', to very poor, represented by LOS 'F'. For the purpose of this study, LOS D was used to define acceptable peak hour operating conditions. Descriptions of the various levels of service are as follows:

> *LOS A* is the highest level of service that can be achieved. Under this condition, intersection approaches appear quite open, turning movements are easily made, and nearly all drivers find freedom of operation. At unsignalized intersections, average delays are less than 10 seconds.

LOS B represents stable operation. At unsignalized intersections, average delays are 10 to 15 seconds.

LOS C still represents stable operation, but periodic backups of a few vehicles may develop behind turning vehicles. Most drivers begin to feel restricted, but not objectionably so. At unsignalized intersections, average delays are 15 to 25 seconds.

LOS D represents increasing traffic restrictions as the intersection approaches instability. Delays to approaching vehicles may be substantial during short peaks within the peak period, but periodic clearance of long lines occurs, thus preventing excessive backups. At unsignalized intersections, average delays are 25 to 35 seconds.

LOS E represents the capacity of the intersection. At unsignalized intersections, average delays are 35 to 50 seconds.

LOS F represents jammed conditions where the intersection is over capacity and acceptable gaps for unsignalized intersections in the mainline traffic flow are minimal. At unsignalized intersections, average delays exceed 50 seconds.

C2. Year 2021 Background Traffic Operations – No Modifications

Exhibit 3-3 shows the Year 2021 background (no development) traffic peak hour operating conditions at the study area intersections. The background traffic analysis was conducted using the existing lane configurations shown in Exhibit 3-1 and the Year 2021 background traffic volumes shown in Exhibit 3-2B.

As shown in Exhibit 3-3, all movements are currently operating acceptably at LOS D or better at the study area intersections during the typical weekday morning and weekday evening peak periods under the Year 2021 background (no development) traffic volume conditions.

PART D – SOURCES OF DATA

The following sources of data were obtained for use in conducting this traffic study:

- Turning movement traffic counts – TADI and WisDOT
- Historic AADT hourly traffic counts – WisDOT
- Existing transportation details – TADI along with Google Earth
- Intersection Sight Distance Images – Google Earth
- On-site development information – Pinnacle Engineering Group

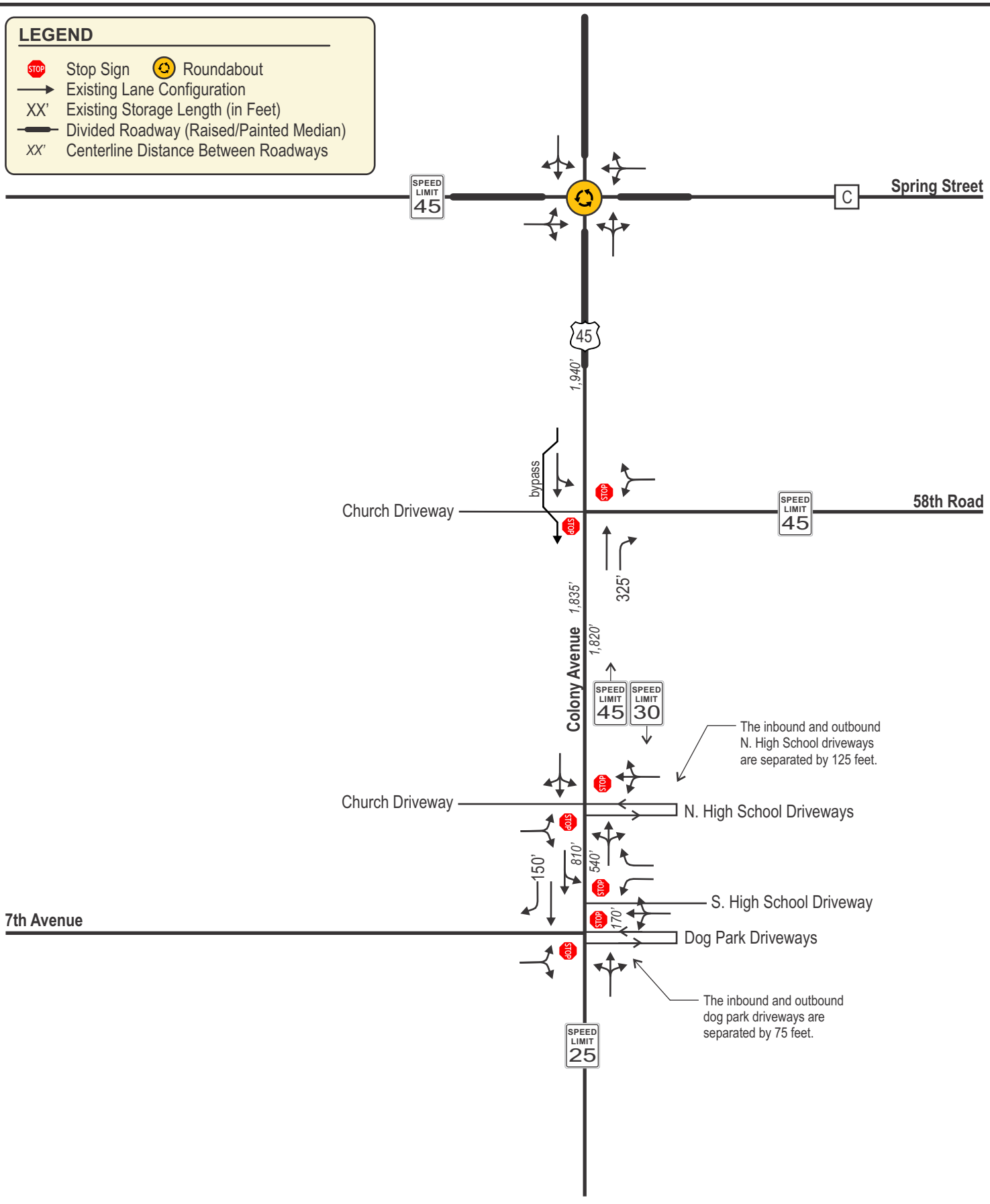

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EXHIBIT 3-1
EXISTING TRANSPORTATION SYSTEM

CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI

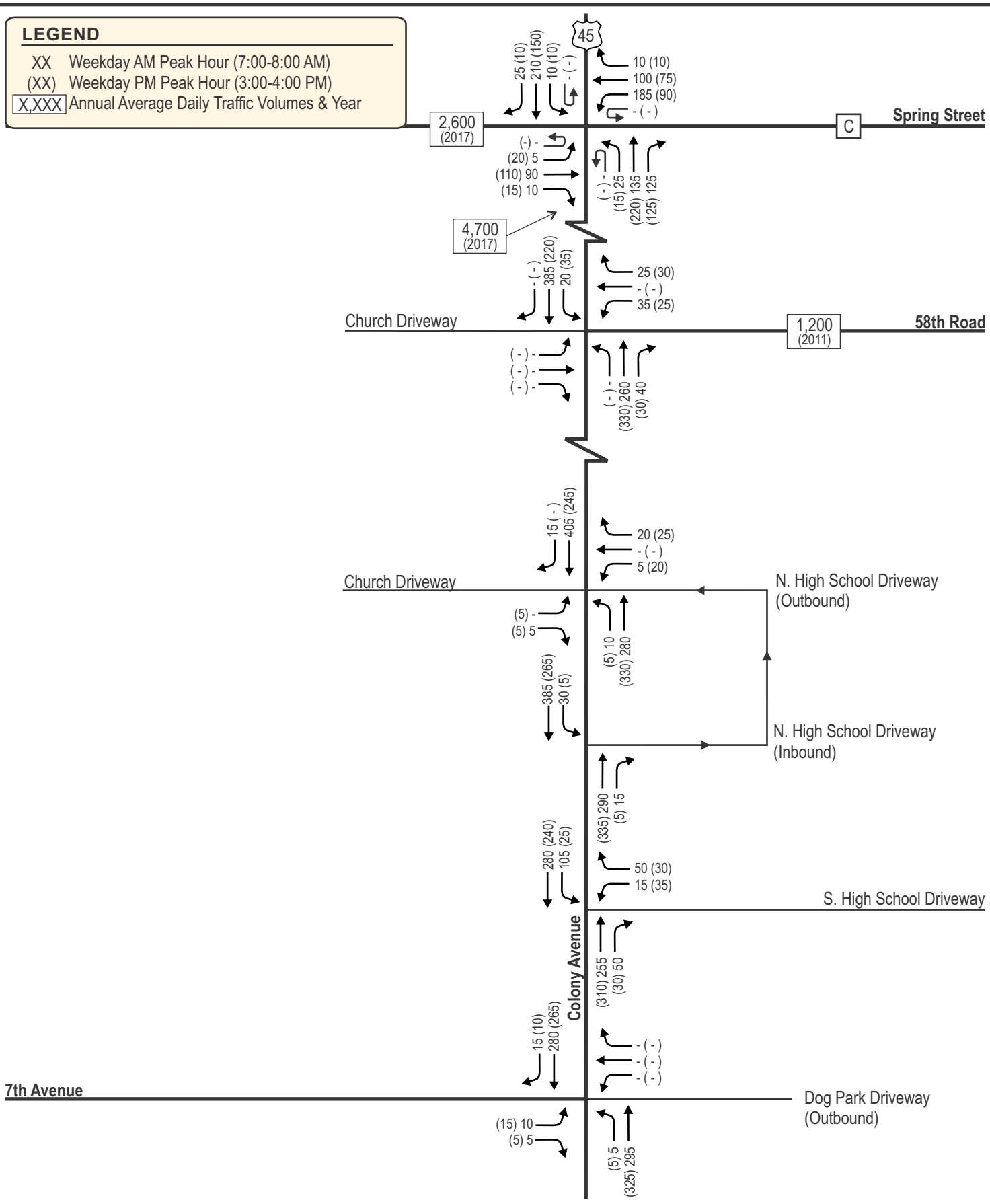

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EXHIBIT 3-2A
EXISTING TRAFFIC COUNTS
Balanced
CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI

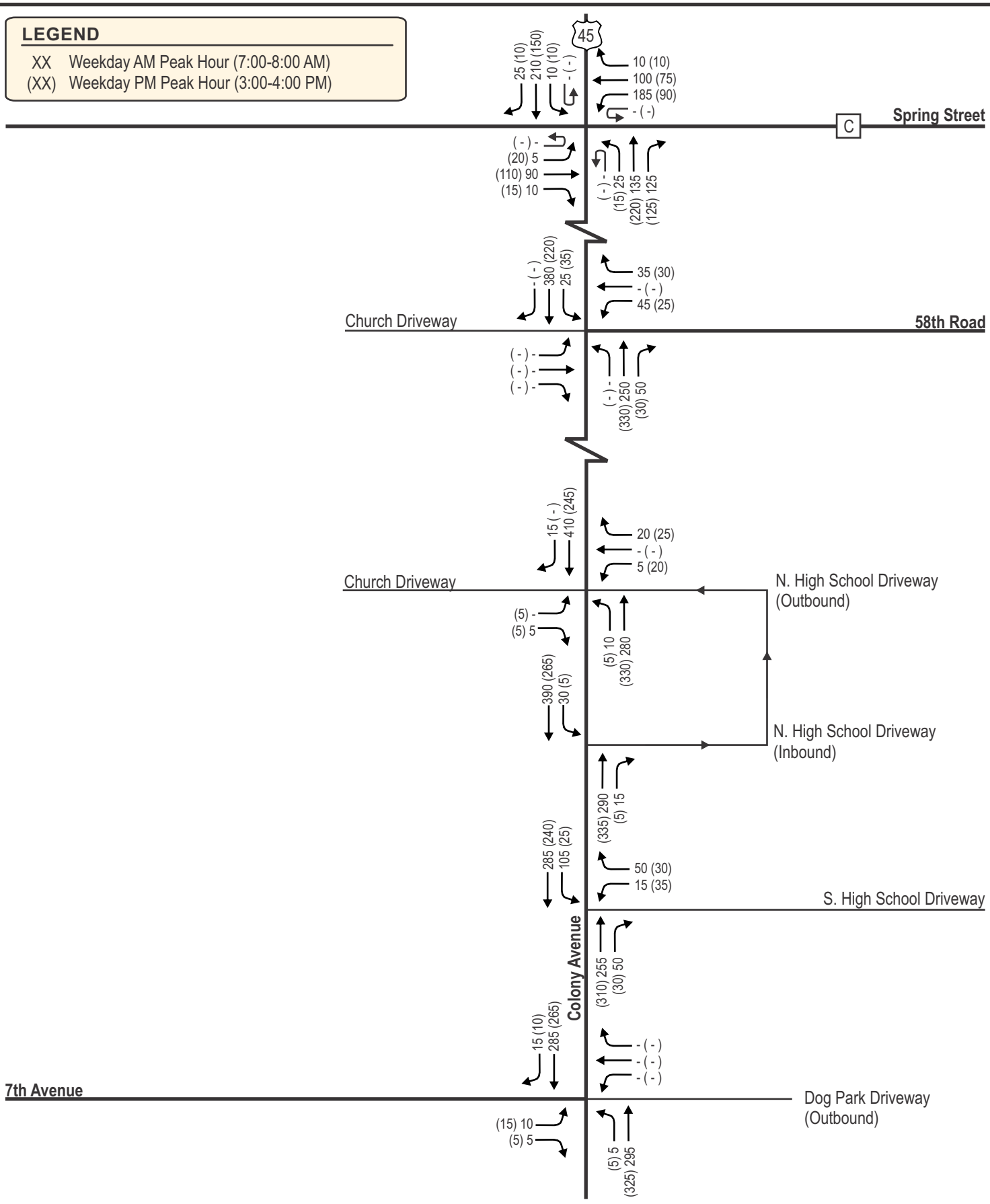

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EXHIBIT 3-2B
BACKGROUND TRAFFIC COUNTS
Factored to Pre-Covid-19 Values at 58th Road
CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI

Exhibit 3-3
Year 2020 Background Traffic Peak Hour Operating Conditions
Existing Geometrics and Traffic Control

Intersection	Peak Hour		Level of Service per Movement by Approach												Intersection Level of Service
			Eastbound			Westbound			Northbound			Southbound			
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
#100 - USH 45 & CTH H Roundabout Control	AM	LOS	A			A			A			A			A
		Delay	6			7			7			8			
		Queue	25			45			40			45			
	PM	LOS	A			A			A			A			A
		Delay	5			6			7			5			
		Queue	25			25			40			25			
#200 - USH 45 & 58th Road/Church D/W Two-Way Stop Control	AM	LOS	C			C			A		*	A	*	*	A
		Delay	19			24			9		*	8	*	*	
		Queue	25			45			0		*	25	*	*	
	PM	LOS	B			B			A		*	A	*	*	A
		Delay	15			15			8		*	8	*	*	
		Queue	0			25			0		*	25	*	*	
#300 - USH 45 & N High School (out)/Church D/W Two-Way Stop Control	AM	LOS	C			C	-	B	A		-	*		-	A
		Delay	18			24	-	11	9		-	*		-	
		Queue	0			25	-	25	0		-	*		-	
	PM	LOS	B			C	-	B	A		-	*		-	A
		Delay	13			17	-	11	8		-	*		-	
		Queue	0			25	-	25	0		-	*		-	
#350 - USH 45 & N High School (in) Two-Way Stop Control	AM	LOS	-			-			*		*	A			A
		Delay	-			-			*		*	9			
		Queue	-			-			*		*	25			
	PM	LOS	-			-			*		*	A			A
		Delay	-			-			*		*	8			
		Queue	-			-			*		*	0			
#400 - USH 45 & S High School Two-Way Stop Control	AM	LOS	-			D	-	B	*		*	A		*	A
		Delay	-			31	-	12	*		*	9		*	
		Queue	-			25	-	25	*		*	25		*	
	PM	LOS	-			C	-	B	*		*	A		*	A
		Delay	-			17	-	11	*		*	8		*	
		Queue	-			25	-	25	*		*	25		*	
#500 - USH 45 & 7th Avenue/Dog Park Two-Way Stop Control	AM	LOS	C			C			A		*	A		*	A
		Delay	16			15			8		*	8		*	
		Queue	25			0			0		*	0		*	
	PM	LOS	C			B			A		*	A		*	A
		Delay	15			14			8		*	8		*	
		Queue	25			0			0		*	0		*	

(-) movement that isn't available or allowed * free flow movement Delay value shown in seconds, Queue value shown in feet

CHAPTER IV – FORECASTED TRAFFIC

PART A – BACKGROUND TRAFFIC FORECASTING

Per WisDOT guidelines, future year analysis is not included in this study.

PART B – SITE TRAFFIC FORECASTING

To address any potential future traffic impacts along study area roadways and at the intersections adjacent to the development, it is necessary to identify the hourly and daily volume of traffic generated by the proposed development. The traffic volumes expected to be generated by the proposed development are based on the size and type of the proposed uses, and on trip rates as published in the Institute of Transportation Engineer's (ITE) *Trip Generation Manual, 10th Edition*. A combination of trip rates and fitted curve equations were utilized to determine the expected new trips based on current ITE practices. All trip generation calculations have been previously reviewed and approved by WisDOT.

B1. Trip Generation

As shown in Exhibit 4-3, under full buildout, the Canopy Hill development is expected to generate 3,160 new weekday daily trips, with 235 weekday trips occurring during the AM peak hour (60 in/175 out) and 305 trips occurring during the weekday PM peak hour (185 in/120 out).

B2. Mode Split

Pedestrians, bicyclists and potential future bus users may use their respective modes to access the proposed development, though these alternate modes are expected to make up a very small portion of the overall trips to/from the study area. Therefore, for the purpose of this TIA, all trips to/from the proposed development were assumed to occur via motor vehicle.

B3. Determination of Linked and Pass-by Trip Traffic

Due to the land use types within this development, linked and pass-by trips are expected to be negligible.

B4. Trip Distribution

The trip distribution for the residential development, listed below and shown in table format in Exhibit 4-3, and graphically on Exhibit 4-4, was determined based on the existing traffic counts, the type of proposed land uses and the location of existing populations within the study area. The trip distribution for the proposed development is as follows:

- 20% to/from the north on USH 45
- 35% to/from the south on USH 45
- 35% to/from the east on CTH C
- 10% to/from the east on 58th Road

B5. Trip Assignment

Trips expected to be generated by the residential development were assigned to the study area intersections based on the trip distribution summarized in the previous section. The residential development new trips are shown in Exhibit 4-5A. With the southern church driveway being relocated to the new 5th Street sideroad, the existing church driveway trips were redistributed onto 5th Street as shown on Exhibit 4-5B.

PART C – BUILD AND TOTAL TRAFFIC

Year 2021 Build Traffic

The Year 2021 background traffic volumes, Exhibit 3-2B, were added to the residential development new trips, Exhibit 4-5A, and the redistributed church driveway trips, Exhibit 4-5B, to determine the Year 2021 build traffic volumes (Exhibit 4-11).

Exhibit 4-3
Trip Generation Table

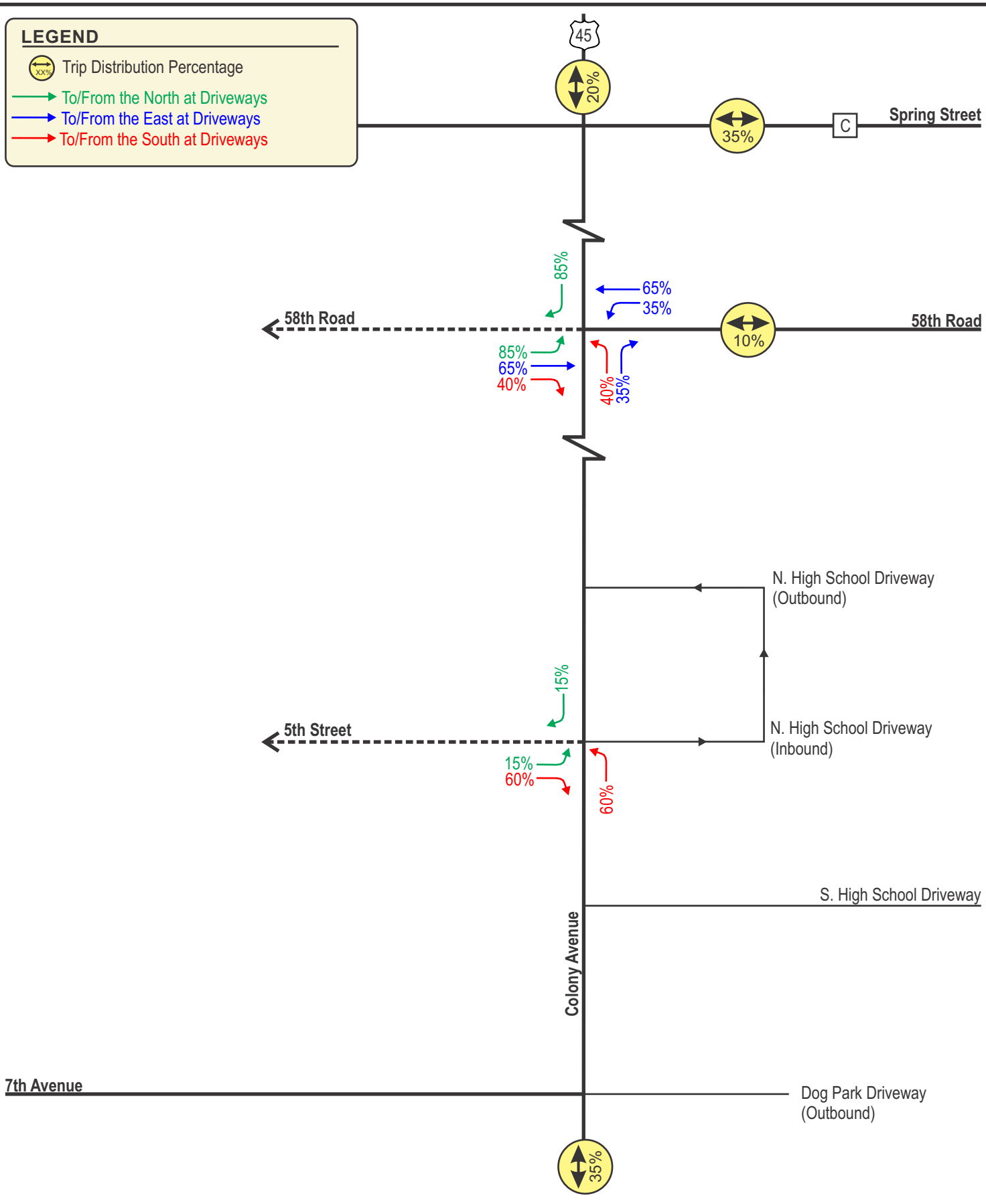
Land Use	ITE Code	Proposed Size	Weekday Daily	AM Peak In	AM Peak Out	AM Peak Total	PM Peak In	PM Peak Out	PM Peak Total
Single-Family Detached Housing *Single-Family Homes*	210	188 Units	1,860 FCE	35 (25%)	105 (75%)	140 FCE	115 (63%)	70 (37%)	185 FCE
Multi-Family Housing (Low-Rise) *Apartments*	220	60 Units	415 FCE	5 (23%)	25 (77%)	30 FCE	20 (63%)	15 (37%)	35 FCE
Single-Family Detached Housing *Duplex*	210	68 Units	730 FCE	15 (25%)	40 (75%)	55 FCE	45 (63%)	25 (37%)	70 FCE
Assisted Living	254	60 Beds	155 (2.60)	5 (63%)	5 (37%)	10 (0.19)	5 (38%)	10 (62%)	15 (0.26)
Total New Trips			**3,160**	**60**	**175**	**235**	**185**	**120**	**305**

Notes

ITE Trip Rates (X.XX) and/or Fitted Curve Equations (FCE) are from the ITE Trip Generation Manual, 10th Edition.

TRIP DISTRIBUTION (New Trips)

N. on USH 45	20%	625	15	35		35	30
S. on USH 45	35%	1110	20	60		65	40
E. on CTH C	35%	1110	20	60		65	40
E. on 58th Road	10%	315	5	20		20	10
	100%	***3160***	***60***	***175***		***185***	***120***



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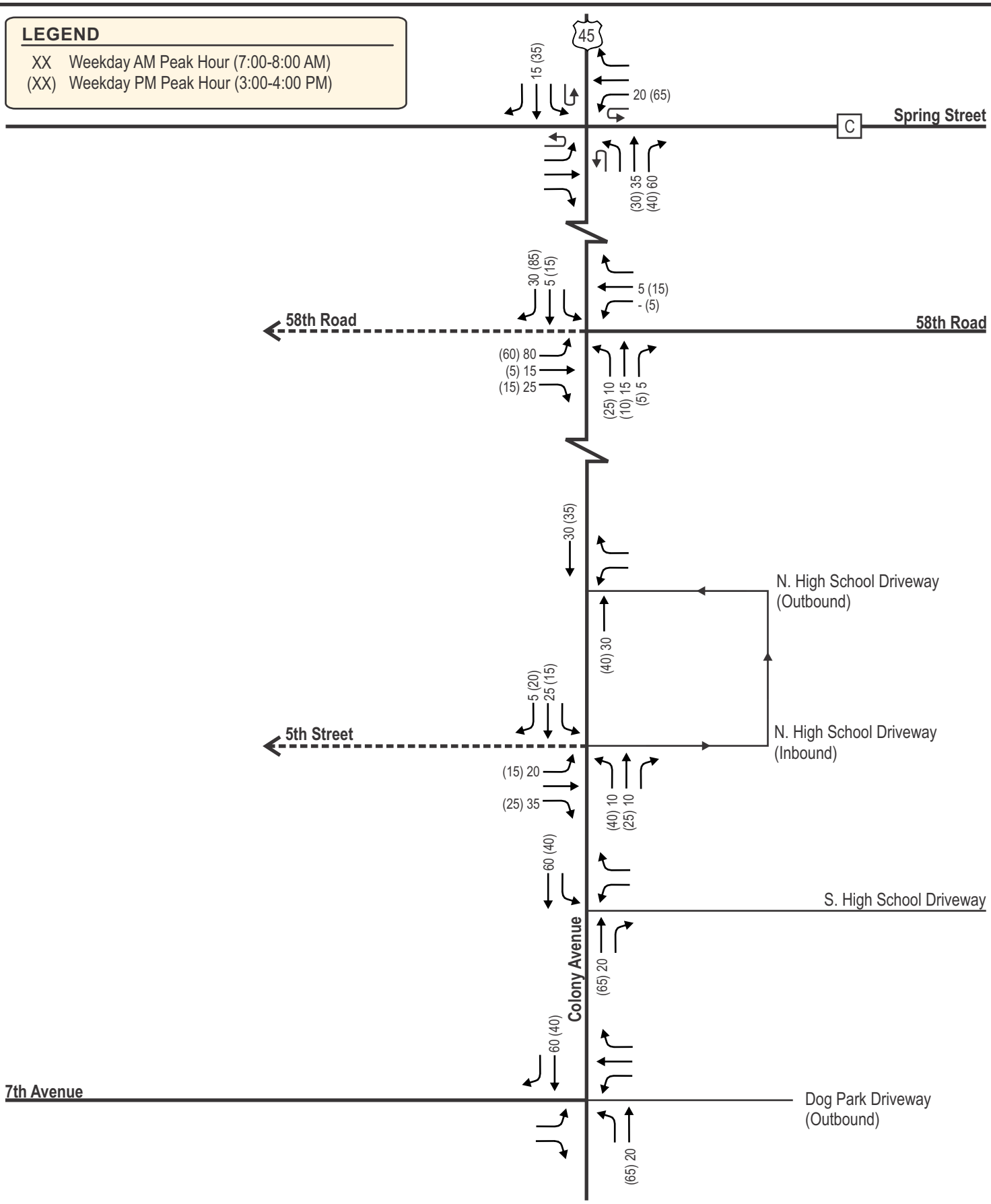
N
NOT TO SCALE

EXHIBIT 4-4
PROPOSED TRIP DISTRIBUTION

CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI



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N
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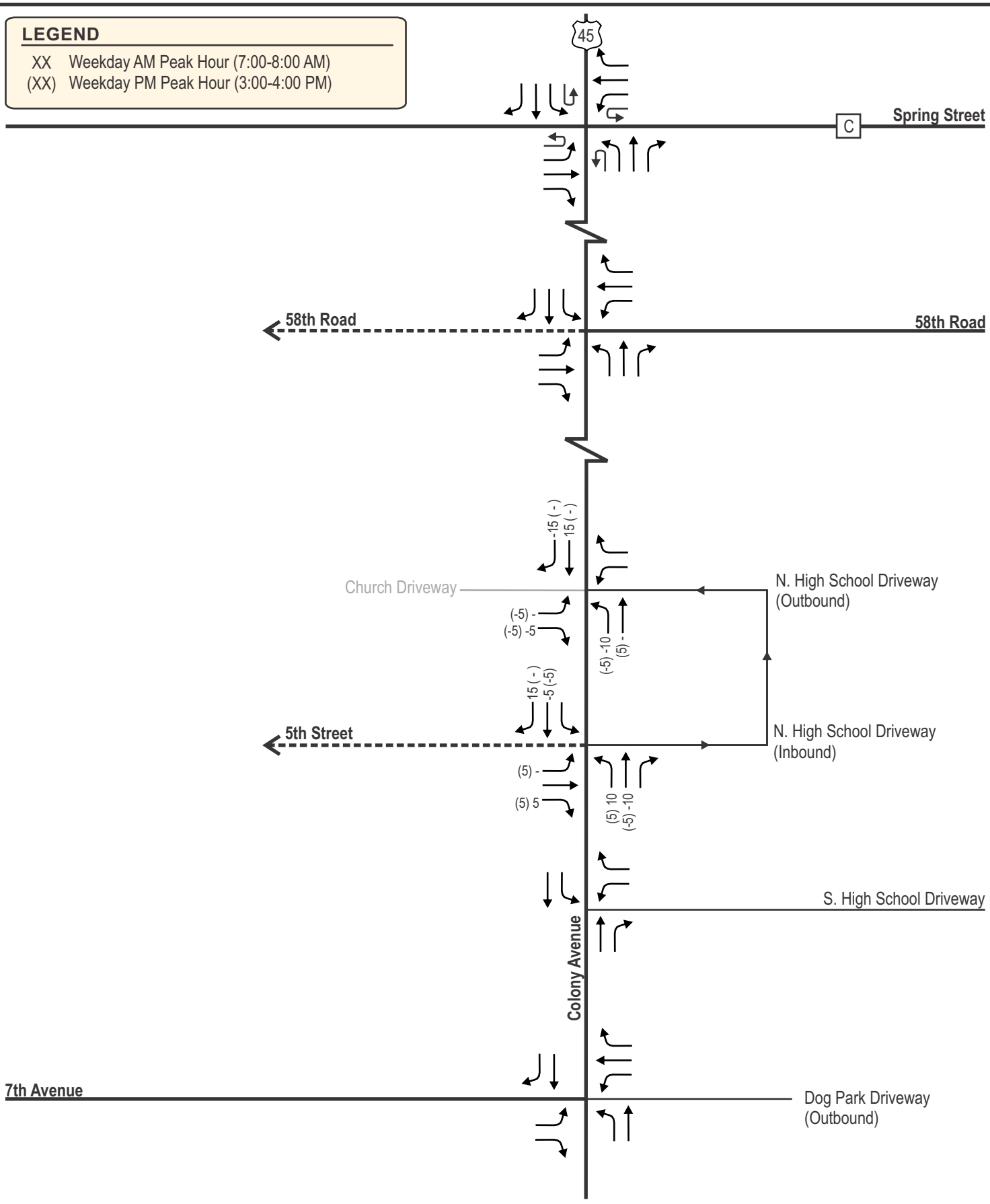
EXHIBIT 4-5A
DEVELOPMENT NEW TRIPS

CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI



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N
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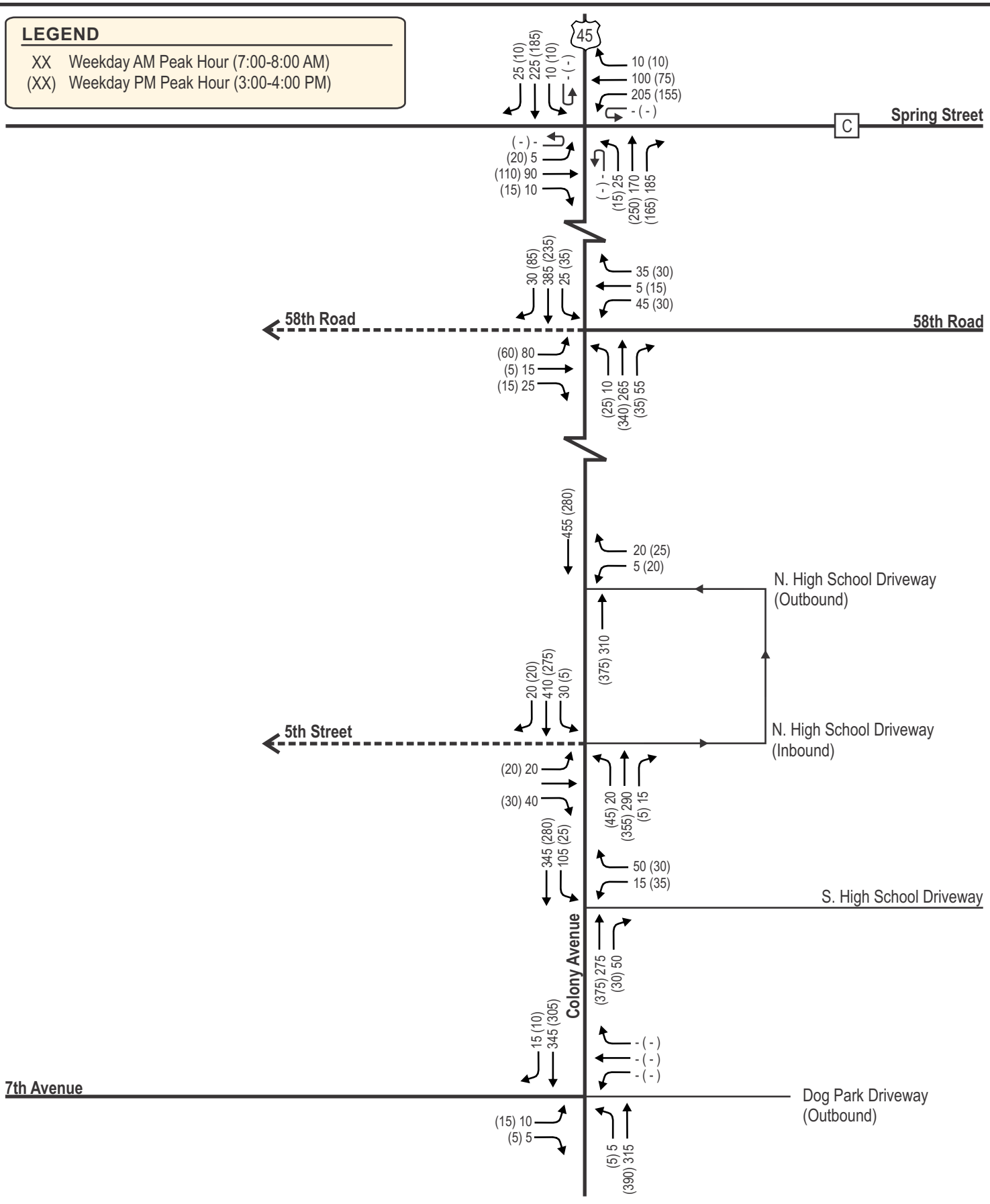
EXHIBIT 4-5B
REDISTRIBUTED DRIVEWAY TRIPS

CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI



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N
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EXHIBIT 4-11
BUILD TRAFFIC VOLUMES

CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI

CHAPTER V – TRAFFIC AND IMPROVEMENT ANALYSIS

PART A – SITE ACCESS

Access to the site will be via a new road network that connects to USH 45 at 58th Road and at a new access road aligned with the Union Grove High School's northern inbound only driveway, proposed to be designated as 5th Street. The existing church driveways that currently connect to USH 45 at each of these locations will have access to the new sideroad network. All access points are proposed as full access intersections.

PART B – CAPACITY LEVEL OF SERVICE ANALYSIS

B1. Year 2021 Build Traffic Operating Conditions – No Modifications

Exhibit 5-3 shows the Year 2021 build traffic peak hour operating conditions at the study area intersections. The Year 2021 build traffic includes the full build out of the proposed development site. The Year 2021 build traffic analysis was conducted using existing intersection configurations and traffic control.

As shown, all movements are expected to continue to operate at LOS D or better conditions except the following:

- The eastbound and westbound movements at the USH 45 intersection with 58th Road which are expected to operate at LOS E/F during the weekday morning peak period.
- The westbound left-turn movement at the USH 45 intersection with the south high school driveway which is expected to operate at LOS E during the weekday morning peak period.

B2. Year 2021 Build Traffic Operating Conditions – *With Modifications*

Modifications to accommodate the Year 2021 build traffic volumes (with development) are summarized in *Chapter VI – Recommendations and Conclusion*.

As shown in Exhibit 5-12, all movements are expected to improve to operate at LOS D or better conditions with the modifications recommended to accommodate Year 2021 build traffic volumes except the following:

- The eastbound and westbound movements at the USH 45 intersection with 58th Road which are expected to operate at LOS E/F during the weekday morning peak period.
- The westbound left-turn movement at the USH 45 intersection with the south high school driveway which is expected to operate at LOS E during the weekday morning peak period

PART C – QUEUEING ANALYSIS

To estimate storage length requirements for turn bays at the study area intersections with modifications, a queuing analysis has been conducted. Note that the 95th percentile probable queue lengths were used for the design of turn bay storage at stop sign controlled intersections. The following is a list of where the results of the queuing analysis can be found.

- Year 2021 Background Traffic – Exhibit 3-3
- Year 2021 Build Traffic – Exhibit 5-12

PART D – PEDESTRIAN, BICYCLE, BUS SERVICE AND MULTI-USE TRAIL CONSIDERATIONS

Pedestrian/multi-modal accommodations with connectivity to the roadway network are encouraged to promote alternative modes of transportation and relieve motorized-vehicle demands on the roadway network.

PART E – SPEED CONSIDERATIONS/SIGHT DISTANCE

The party responsible for designing the intersections will be responsible for cross-checking, verifying and designing for all applicable sight distances. Site observation utilizing street view indicates that intersection sight distance (ISD) is expected to be met at both proposed access points for the distances calculated and shown on Exhibit 5-27. ISD must be double checked during the permit application stage of development.

PART F – TRAFFIC CONTROL NEEDS

Modifications to the existing traffic control are recommended at several of the study area intersections as follows.

As recommended to accommodate Year 2021 build traffic:

- Install a stop sign on the west approach at the USH 45 intersection with 58th Road/Proposed North Access.
- Install a stop sign on the west approach at the USH 45 intersection with proposed 5th Street.

PART G – TRAFFIC SIGNAL WARRANT ANALYSIS

Warrants should be viewed as guidelines to help decide whether traffic signal controls may be installed. Meeting warrants does not translate to a legal requirement for their installation. Completed warrant analysis worksheets are included in the Appendix of this report. Development-related traffic was included based on the WisDOT hourly distributions of traffic for the various land use types for each included development area. Warrants 1 and 2 and a left-turn conflict analysis were evaluated as a part of this study under rural thresholds.

Traffic Signal Warrant Analysis – USH 45 & 58th Road/Proposed North Access Road

Traffic signal warrants were investigated at the USH 45 intersection with 58th Road under Year 2021 build traffic volumes in accordance with the 2009 MUTCD. USH 45 was analyzed as a major street with one lane on each approach. 58th Road was analyzed as a minor street as a minor street with one lane. None of the minor street right-turn movements were included in the warrant analysis. The posted speed limit is 45 mph along USH 45 therefore rural warrant thresholds were utilized.

The warrant analysis was conducted based on the 6-hour turning movement counts collected at USH 45 intersection with 58th Road as part of this study which were then factored for pre-Covid conditions as described in *Chapter III, Section B.*

Based on the warrant analysis, none of the warrants utilized for this study are expected to be met at USH 45 intersection with 58th Road under Year 2021 build traffic volume conditions.

All data pertaining to this signal warrant analysis are included in the Appendix of this report.

Exhibit 5-3
Full Build Traffic Peak Hour Operating Conditions
Existing Geometrics and Traffic Control

Intersection	Peak Hour		Level of Service per Movement by Approach												Intersection Level of Service
			Eastbound			Westbound			Northbound			Southbound			
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
#100 - USH 45 & CTH H Roundabout Control	AM	LOS	A			A			A			A			A
		Delay	6			7			7			8			
		Queue	25			45			40			45			
	PM	LOS	A			A			A			A			A
		Delay	7			8			9			9			
		Queue	25			55			65			50			
#200 - USH 45 & 58th Road/Proposed Access Two-Way Stop Control	AM	LOS	**F**			**E**			A		*	A	*	*	B
		Delay	86			37			9		*	9	*	*	
		Queue	165			70			0		*	25	*	*	
	PM	LOS	D			C			A		*	A	*	*	A
		Delay	28			21			8		*	9	*	*	
		Queue	40			30			25		*	25	*	*	
#300 - USH 45 & N High School (out)/Church D/W Two-Way Stop Control	AM	LOS	C			D	-	B	A		-	*		-	A
		Delay	20			27	-	11	9		-	*		-	
		Queue	0			25	-	25	0		-	*		-	
	PM	LOS	B			C	-	B	A		-	*		-	A
		Delay	15			20	-	12	8		-	*		-	
		Queue	0			25	-	25	0		-	*		-	
#350 - USH 45 & N High School (in)/Proposed High Street Two-Way Stop Control	AM	LOS	D			-			A		*	A			A
		Delay	26			-			9		*	9			
		Queue	40			-			25		*	25			
	PM	LOS	C			-			A		*	A			A
		Delay	17			-			8		*	9			
		Queue	25			-			25		*	0			
#400 - USH 45 & S High School Two-Way Stop Control	AM	LOS	-			**E**	-	B	*		*	A		*	A
		Delay	-			37	-	13	*		*	9		*	
		Queue	-			25	-	25	*		*	25		*	
	PM	LOS	-			C	-	B	*		*	A		*	A
		Delay	-			20	-	12	*		*	9		*	
		Queue	-			25	-	25	*		*	25		*	
#500 - USH 45 & 7th Avenue/Dog Park Two-Way Stop Control	AM	LOS	C			C			A		*	A		*	A
		Delay	18			17			8		*	9		*	
		Queue	25			0			0		*	0		*	
	PM	LOS	C			C			A		*	A		*	A
		Delay	17			16			8		*	9		*	
		Queue	25			0			0		*	0		*	

(-) movement that isn't available or allowed * free flow movement Delay value shown in seconds, Queue value shown in feet

Exhibit 5-12
Full Build Traffic Peak Hour Operating Conditions
Modified Geometrics and Traffic Control

Intersection	Peak Hour		Level of Service per Movement by Approach												Intersection Level of Service
			Eastbound			Westbound			Northbound			Southbound			
			LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
#100 - USH 45 & CTH H Roundabout Control	AM	LOS	A			A			A			A			A
		Delay	6			7			7			8			
		Queue	25			45			40			45			
	PM	LOS	A			A			A			A			A
		Delay	7			8			9			9			
		Queue	25			55			65			50			
#200 - USH 45 & 58th Road/Proposed Access Two-Way Stop Control	AM	LOS	**F**		B	**E**			A		*	A		*	B
		Delay	76		12	37			9		*	9		*	
		Queue	130		25	70			0		*	25		*	
	PM	LOS	D		A	C			A		*	A		*	A
		Delay	28		10	21			8		*	9		*	
		Queue	35		25	30			25		*	25		*	
#300 - USH 45 & N High School (out)/Church D/W Two-Way Stop Control	AM	LOS	C			D	-	B	A		-	*		-	A
		Delay	20			27	-	11	9		-	*		-	
		Queue	0			25	-	25	0		-	*		-	
	PM	LOS	B			C	-	B	A		-	*		-	A
		Delay	15			20	-	12	8		-	*		-	
		Queue	0			25	-	25	0		-	*		-	
#350 - USH 45 & N High School (in)/Proposed High Street Two-Way Stop Control	AM	LOS	D			-			A		*	A			A
		Delay	26			-			9		*	9			
		Queue	40			-			25		*	25			
	PM	LOS	C			-			A		*	A			A
		Delay	17			-			8		*	9			
		Queue	25			-			25		*	0			
#400 - USH 45 & S High School Two-Way Stop Control	AM	LOS	-			**E**	-	B	*		*	A		*	A
		Delay	-			37	-	13	*		*	9		*	
		Queue	-			25	-	25	*		*	25		*	
	PM	LOS	-			C	-	B	*		*	A		*	A
		Delay	-			20	-	12	*		*	9		*	
		Queue	-			25	-	25	*		*	25		*	
#500 - USH 45 & 7th Avenue/Dog Park Two-Way Stop Control	AM	LOS	C			C			A		*	A		*	A
		Delay	18			17			8		*	9		*	
		Queue	25			0			0		*	0		*	
	PM	LOS	C			C			A		*	A		*	A
		Delay	17			16			8		*	9		*	
		Queue	25			0			0		*	0		*	

(-) movement that isn't available or allowed * free flow movement Delay value shown in seconds, Queue value shown in feet

LEGEND

XX' ISD Distance from Proposed Access

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N
NOT TO SCALE

EXHIBIT 5-27
INTERSECTION SIGHT DISTANCE DIAGRAMS

CANOPY HILL RESIDENTIAL DEVELOPMENT - UNION GROVE, WI

CHAPTER VI – RECOMMENDATIONS AND CONCLUSION

PART A – RECOMMENDATIONS

A1. Recommended Modifications

The study area intersections were analyzed based on the procedures set forth in the *Highway Capacity Manual* (HCM) *6th Edition*. Intersection operation is defined by "level of service". Level of Service (LOS) is a quantitative measure that refers to the overall quality of flow at an intersection ranging from very good, represented by LOS 'A', to very poor, represented by LOS 'F'. For the purpose of this study, LOS D or better was used to define acceptable peak hour operating conditions.

Modifications to address traffic impacts are shown in Exhibit 1-2 for the Year 2021 traffic conditions and have been shown for the following two scenarios:

- "Background Traffic" – These modifications are expected to be necessary to accommodate Year 2021 background traffic volumes without the proposed residential development.
- "Build Traffic" – These modifications are expected to be necessary to accommodate the Year 2021 build traffic volumes, which includes the proposed residential development.

The analysis was conducted using existing intersection geometrics and traffic control. The following modifications, as shown in Exhibit 1-2, are recommended to accommodate the Year 2021 background and build traffic volumes, respectively. *Modifications are for jurisdictional consideration and are not legally binding. WisDOT and the Village of Union Grove reserve the right to determine alternative solutions.*

Node 100: USH 45 & CTH C

- *Background Traffic:* No modifications.
- *Build Traffic:* No modifications.

Node 200: USH 45 & 58th Road/Proposed North Access

- *Background Traffic:* No modifications.
- *Build Traffic:*
  - Provide stop sign control on the west approach.
  - Provide a shared through/left-turn lane and a dedicated right-turn lane on the north, south and west approaches.
  - No modifications to the east approach are recommended.
  - Provide for bike lane as part of southbound dedicated right-turn lane design (similar to existing northbound lanes).
  - *A single-lane roundabout was considered for this intersection; however, due to the relatively low traffic volumes, warrants are not expected to be met.*

Node 300: USH 45 & N High School Driveway (outbound)

- *Background Traffic:* No modifications.
- *Build Traffic:* No modifications.

Node 350: USH 45 & N High School Driveway (inbound)/Proposed 5th Street Access

- *Background Traffic:* No modifications.
- *Build Traffic:*
  - Provide stop sign control on the west side of USH 45 aligned across from the high school driveway.
  - Provide a single shared lane on the west approach.
  - Consider extending the outside shoulder along the west side of USH 45 to the south, to a point immediately south of proposed 5th Street.
  - No modifications are recommended to the existing RRFB pedestrian crossing located immediately north of the intersection.

Node 400: USH 45 & S High School Driveway

- *Background Traffic:* No modifications.
- *Build Traffic:* No modifications.

Node 500: CTH K & 7th Avenue/Dog Park Access

- *Background Traffic:* No modifications.
- *Build Traffic:* No modifications.

Even though the overall intersection is expected to operate acceptably, the eastbound and westbound movements at the USH 45 intersection with 58th Road are expected to operate unacceptably during the weekday morning peak hour under build traffic conditions with delays slightly over (2 seconds greater than) the LOS D threshold for the westbound movements. Due to the relatively low volume of traffic on the sideroad approaches at this intersection, traffic signal control is not expected to be warranted under either the build traffic scenario. However, it is expected that gaps created by the existing roundabout control located immediately to the north along USH 45 at the CTH C intersection are allowing this intersection to operate better than reflected in the modeling software; therefore, this intersection should be monitored, and modifications should be considered as delays increase or are being experienced. It is noted that the inclusion of additional turn lanes at this intersection, above and beyond those recommended above, is not expected to improve the overall operations for the east and west approach movements.

Even though the overall intersection is expected to operate acceptably, the eastbound movements at the USH 45 intersection with 5th Street (proposed) are expected to operate unacceptably during the weekday morning peak hour under full build traffic conditions with delays slightly over (2 seconds greater than) the LOS D threshold. Due to the relatively low volume of traffic on the sideroad approaches at this intersection, traffic signal control is not expected to be warranted. However, it is expected that gaps created by the existing roundabout control located immediately to the north along USH 45 at the CTH C intersection will allow this intersection to operate better than reflected in the modeling software; therefore, this intersection should be monitored, and modifications should be considered as delays increase or are being experienced. It is noted that the inclusion of additional turn lanes at this intersection is not expected to improve the overall operations for the west approach movements.

PART B – CONCLUSION

Except where noted in the previous section and described Chapter V, all movements at the study area intersections are expected to operate safely and efficiently with the development

assumptions outlined in this TIA and with the identified recommended modifications if properly designed and implemented through the opening year of the development.