TRAFFIC IMPACT STUDY

MITCHELL PROPERTY WAREHOUSE
(F.O. Mitchell & Brothers Property)

Industrial Development
Harford County, Maryland

Revised September 28, 2022

Revised June, 2022
November, 2021

Prepared For:

Chesapeake Real Estate Group

Prepared By:

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INTRODUCTION

The June 2022 Mitchell Property Warehouse Traffic Impact Study was revised to address the August 11, 2022 Harford County comments and Maryland Department of Transportation State Highway Administration (MDOT SHA) comments dated July18, 2022 and August 16, 2022.

Site Description & Access

The developer proposes to construct a 5,200,000 gsf of warehouse on the F.O. Mitchell & Brothers property. The property address is 1714 Perryman Road. The property is situated on the west side of MD 159 (Perryman RD) and the property boundary begins south of Canning House Road and extends to Fords Lane.

The subject property has direct access to Canning House Road and to MD 159. As shown on the site plan, Canning House would be relocated to intersect MD 159 north of its current location and will be extended to Chelsea Road. All site trips were assigned to this new road connection.

Scope of Services

The study was developed in accordance with the Harford County Adequate Public Facilities Ordinance and the Harford County Traffic Impact Study Guidelines. A scope of services document was developed by the County, which is included in the Appendix IV. The key intersections are listed below. Exhibit 1 shows the location of the site, the proposed Canning House Road extension and new connection to Chelsea Road, and the key intersections.

US 40 EB Ramps @ MD 22 (Signalized)	US 40 @ MD 132 (Signalized)
US 40 @ MD 7/MD 159 (Signalized)	US 40 @ MD 543 (Signalized)
US 40 @ Spesutia Road (Signalized)	MD 543 @ I-95 NB Ramps (Signalized)
MD 543 @ I-95 SB Ramps (Signalized)	MD 543 @ MD 7 (Signalized)
MD 715 @ US 40 EB Ramps (Signalzied)	MD 715 @ Old Philadelphia RD (Signalized)
MD 7 @ Stepney Road (Unsignalized)	MD 159 (Old Phil. RD) @ MD 159 (Perryman RD) (Roundabout)
MD 159 @ Spesutia Road (Unsignalized)	MD 159 @ Chelsea Road (Unsignalized)
MD 159 @ Fords Lane (Unsignalized)	MD 159 @ Canning House Road (Unsignalized)
Chelsea Road @ Woodley RD (Unsignalized)	Chelsea Road @ Proposed Canning House Road Extended (Unsignalized)

Study Methodology

The key intersections were counted during the weekday morning (6:00 AM - 9:30 AM) and evening (3:00 PM – 6:30 PM) peak hours. The key intersections were analyzed during the peak hour time periods under an existing, background, and the future traffic conditions. The intersection analysis methodologies are stated below.

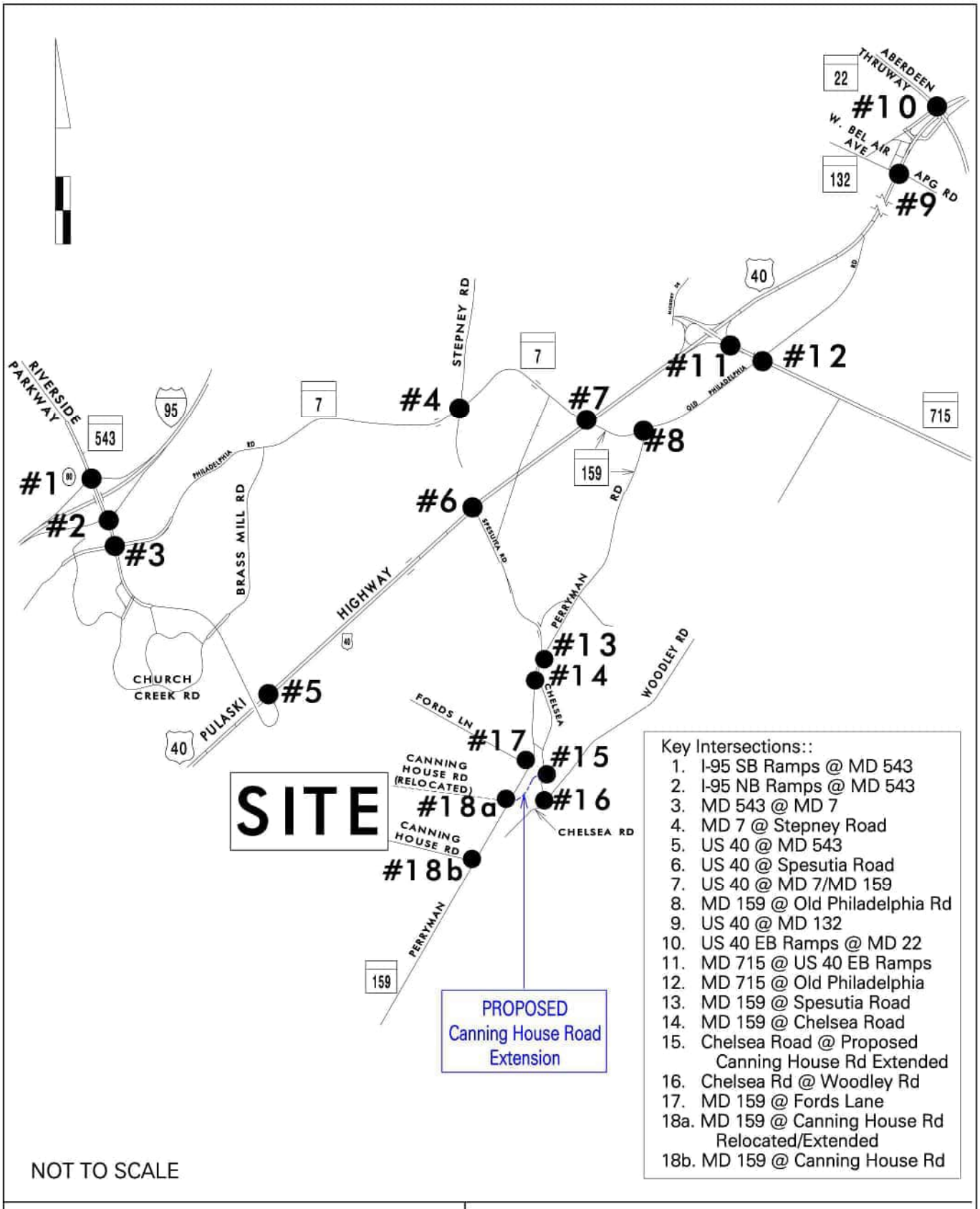
This study meets the County APFO standards by including analyses at all key intersections using the Critical Lane Volume (CLV) and Highway Capacity Manual software (HCS) methodologies. The HCS results are included at all key intersections, unless otherwise approved by Harford County.

Additionally, the signalized key intersections and the non-standard unsignalized intersections were analyzed with Synchro model. The Synchro model results were reported with HCM methodology, which is represented as Version HCM 2000. This methodology was requested by MDOT SHA and is accepted by Harford County. Finally, roundabout intersections were analyzed using the Sidra Intersection method. The results are listed in the following tables and the detailed calculations are included in Appendix I.

Vehicle queuing analyses were conducted at signalized intersections, as directed by the County. The SimTraffic queues from the Synchro model were also reported.

The Institute of Transportation Engineers', Trip Generation Manual, 11th Edition (ITE Manual) was used to determine the background and the future peak hour trips. The total future traffic volumes are described with the following formula:

Total Future Traffic = (Existing Traffic + Growth in Existing Traffic + Approved Development Traffic + Site Generated Traffic)



Key Intersections::

1. I-95 SB Ramps @ MD 543
2. I-95 NB Ramps @ MD 543
3. MD 543 @ MD 7
4. MD 7 @ Stepney Road
5. US 40 @ MD 543
6. US 40 @ Spesutia Road
7. US 40 @ MD 7/MD 159
8. MD 159 @ Old Philadelphia Rd
9. US 40 @ MD 132
10. US 40 EB Ramps @ MD 22
11. MD 715 @ US 40 EB Ramps
12. MD 715 @ Old Philadelphia
13. MD 159 @ Spesutia Road
14. MD 159 @ Chelsea Road
15. Chelsea Road @ Proposed Canning House Rd Extended
16. Chelsea Rd @ Woodley Rd
17. MD 159 @ Fords Lane

18a. MD 159 @ Canning House Rd Relocated/Extended

18b. MD 159 @ Canning House Rd

NOT TO SCALE

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EXHIBIT 1

Site Location Map

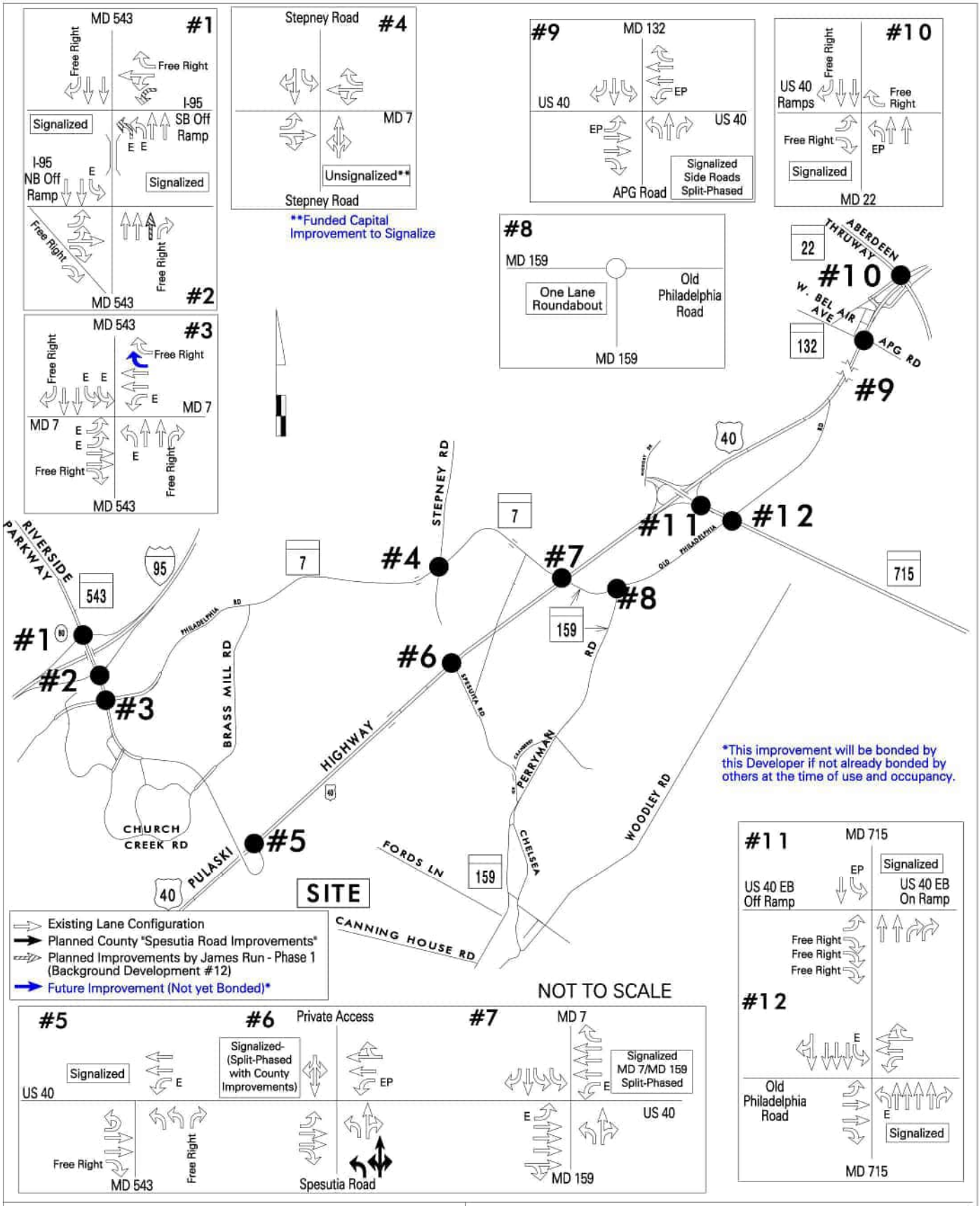

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EXHIBIT 2A

Lane Configuration

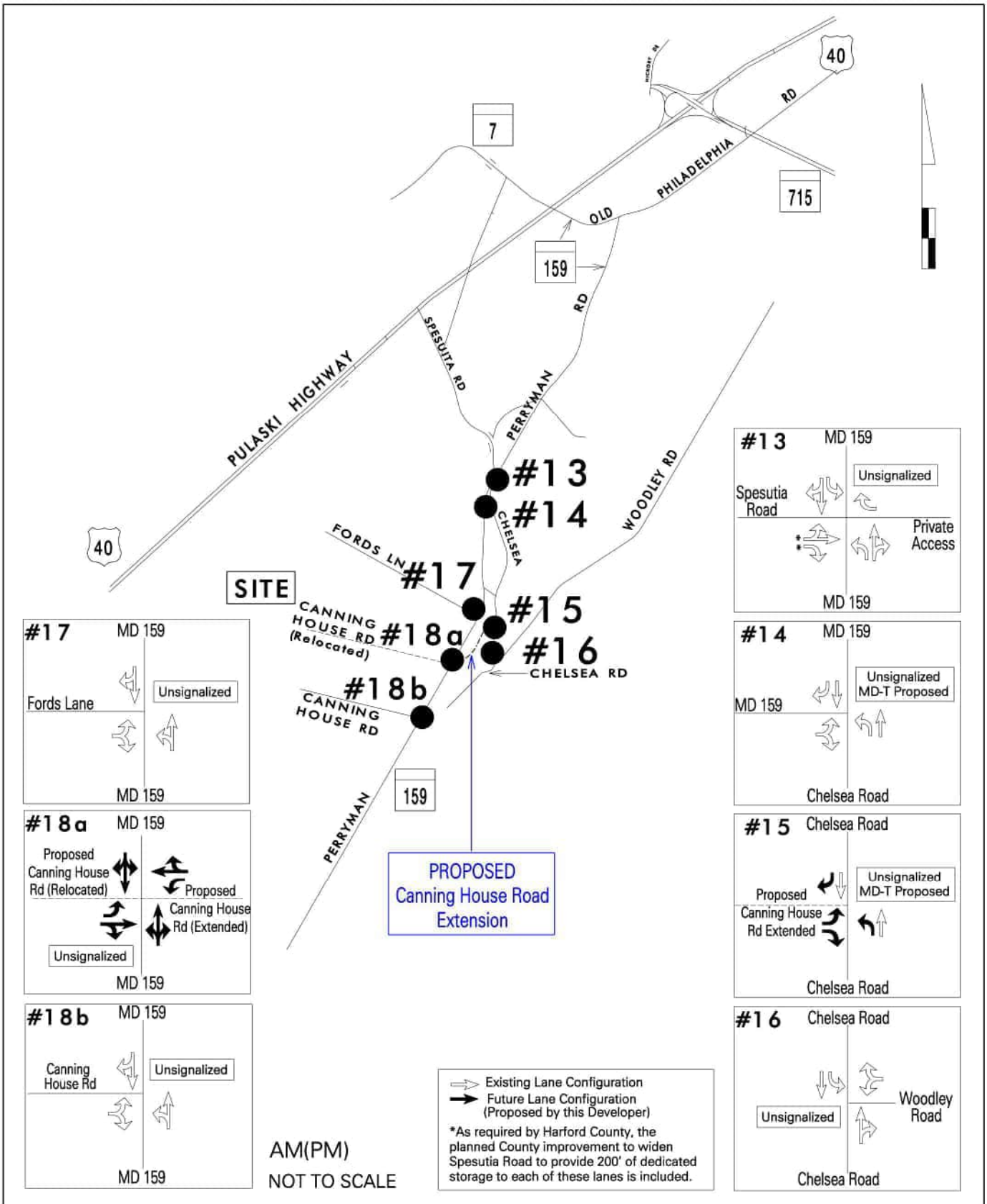

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EXHIBIT 2B
Lane Configuration

EXISTING CONDITION

The existing traffic condition was established with intersection turning movement counts that were conducted at the key intersections in March, 2022. This existing traffic data determines the baseline intersection levels of service.

Study Exhibits 2A and 2B display the existing intersection lane use, improvements planned by others, and improvements proposed by the developer. The peak hour volumes are shown on Exhibits 3A and 3B. The existing intersection conditions diagrams and the existing intersection turning movement counts are included in Appendix III.

Traffic Data Revisions

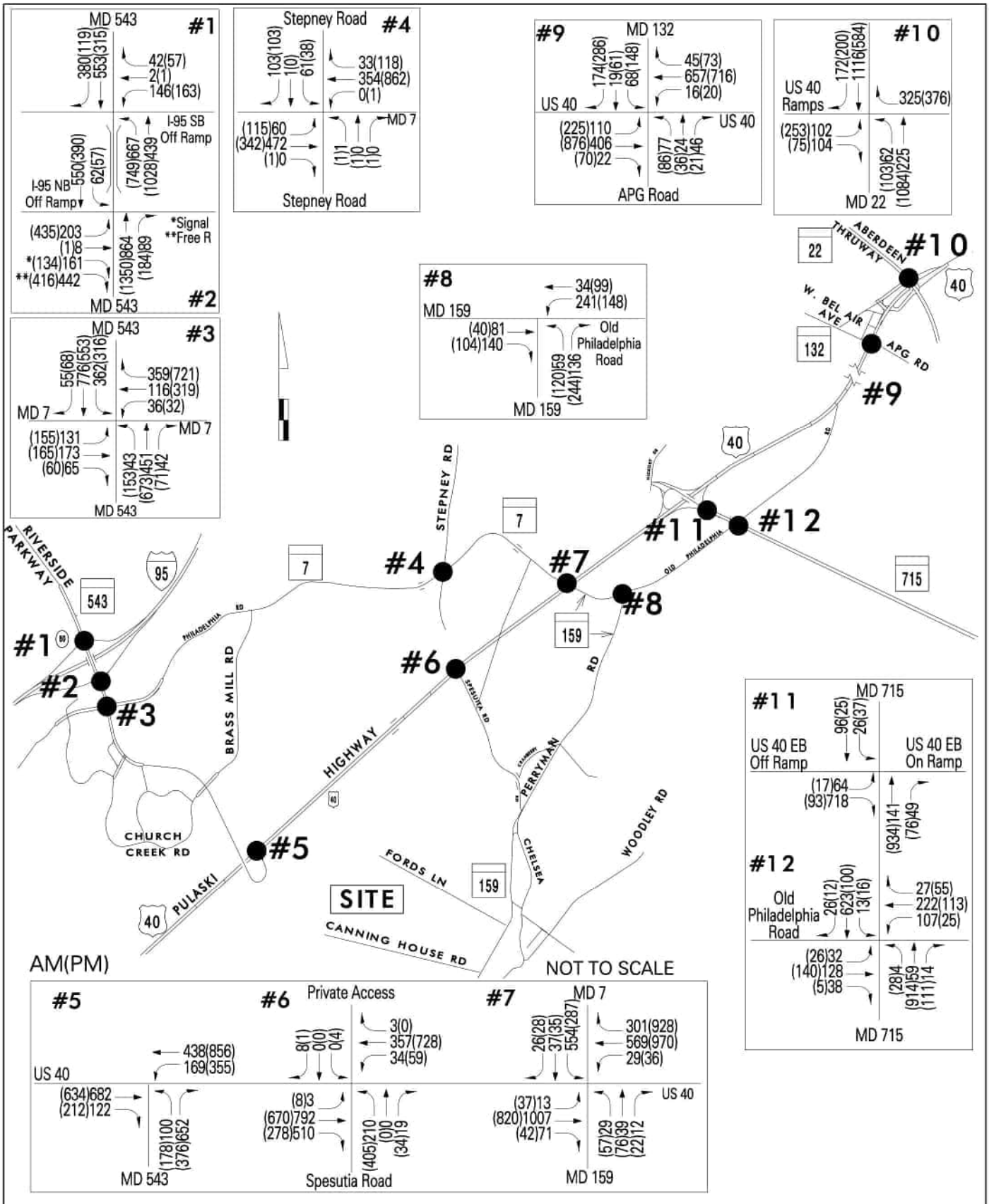
Study revisions to the existing traffic counts include a September 7, 2022 count conducted at the Woodley Road @ Chelsea Road intersection. Also, thirteen-hour counts were conducted at the MD 159 @ Chelsea Rd/MD 159 intersection and at the MD 159 @ Spesutia Road intersection for a Signal Warrant Analysis.

Truck Data

Truck percentages at the key intersections were determined with 24-hour traffic count data, conducted by Traffic Concepts, Inc. and with MDOT SHA data. The MDOT SHA data was used to determine the heavy truck percentages along roadways outside of the Perryman Peninsula. The September 2022 counts conducted by Traffic Concepts, Inc. determined the heavy truck percentages along MD 159 (Perryman Road), south of the roundabout and along Chelsea Road, north of Woodley Road. The TIS was revised with heavy truck percentages, as shown on the table below. The 24-hours counts and the MDOT SHA traffic data are provided in Appendix III.

STATE ROADWAY	CLASSIFICATION	Peak Hour % of Heavy Trucks
MD 543	Minor Arterial	12%[1]
US 40	Principal Arterial	10%[1]
MD 159 (Old Phil. RD)	Minor Arterial	Use 10% (No Data Available)
MD 7	Minor Arterial	Use 10% (No Data Available)
MD 132	Minor Arterial	5%[1]
MD 22	Principal Arterial	5%[1]
MD 715	Minor Arterial	Use 10% (No Data Available)
MD 159 (Perryman RD)	Major Collector	15% [2]

Source: 1. MDOT SHA Data & 2. Traffic Concepts, INC Data



TRAFFIC CONCEPTS, INC. 7525 Connelly Drive Suite B Hanover, Maryland 21076 410-760-2911	EXHIBIT 3A Existing Traffic Volumes

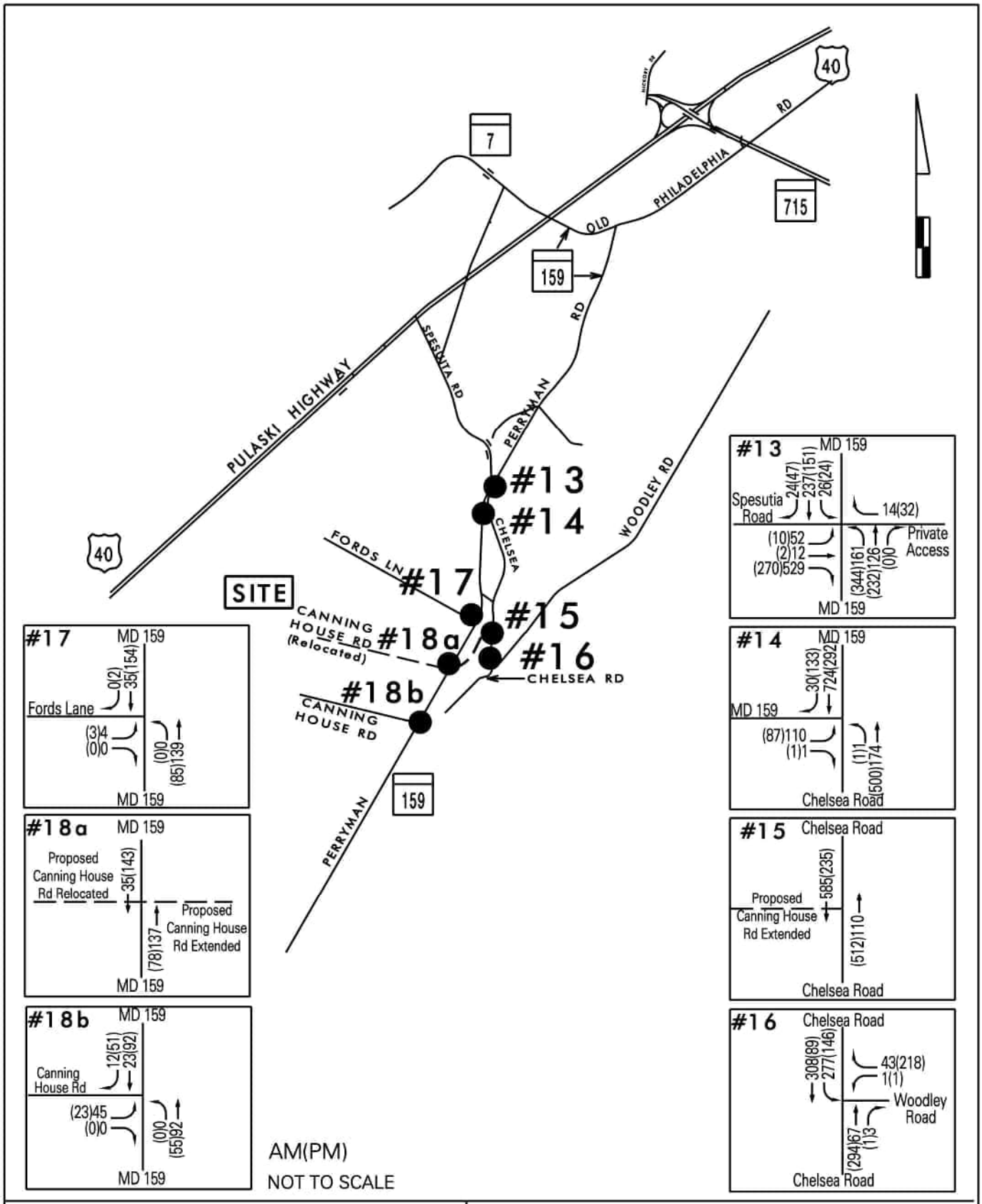


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EXHIBIT 3B
Existing Traffic Volumes

BACKGROUND CONDITION

The background condition evaluates the key intersections with the existing intersection volumes and with the total background peak hour trips. The background trips consist of trips generated by a traffic growth rate and trips generated by nearby developments that are approved, but are not completed.

Growth Rates

The required Harford County growth rate of 2.2 percent was applied to the key intersection volumes and was compounded over 5-years. Five years represents the project build-out period. The peak hour trips generated by the growth rates are shown on Exhibit 4.

Background Developments

Harford County DPZ identified fourteen (14) nearby developments that could impact the key intersections. The locations of these developments are shown on Exhibit 5. The background developments and the resulting background peak hour trips are shown below. All background trips were generated with the *ITE Manual 10th Edition*.

	AM		PM	
	IN	OUT	IN	OUT
1. Abingdon Addition (ITE LUC 210)				
20 sfu	**5**	**14**	**14**	**8**
2. Beech Creek Estates (ITE LUC 220)				
15 thu	**2**	**6**	**7**	**4**
3. Hollywoods (ITE LUC 220)				
250 condos	26	88	84	49
6. Woodlawn (ITE LUC 210)				
103 sfu	20	58	66	39
TOTAL BACKGROUNDS 3 & 6:	**46**	**146**	**150**	**88**
4. Monarch Glen				
1 sfu (ITE LUC 210)	0	1	1	0
15 thu (ITE LUC 220)	2	6	7	4
5. Redlief Run				
26 sfu (ITE LUC 210)	6	17	18	10
TOTAL BACKGROUNDS 4 & 5:	**8**	**24**	**26**	**14**

	AM		PM	
	IN	OUT	IN	OUT
7. 999-1041 Old Philadelphia Rd (Cranberry Run Ph II)				
Distribution Center – per ksf*	0.06	0.02	0.04	0.07
691.6 ksf	**41**	**14**	**28**	**48**
8. Abingdon Business Park (Lots 1-3)				
Distribution Center – per ksf*	0.06	0.02	0.04	0.07
2,064.8 ksf	**124**	**41**	**83**	**145**
9. Belcamp Commercial – Lots 1 & 2**				
Total New Trips	**85**	**78**	**78**	**66**
10. Capital Exports				
ITE Land Use Code 840				
8.0 ksf	**11**	**4**	**18**	**10**
11. Crossroads Community Church – 13.72 ksf house of worship***				
12. James Run****				
13. LEMS Contrating Company, Inc. – 8.8 ksf retail trade service***				
14. Riverside Business Park – Lot 36				
ITE Land Use Code 150				
242.94 ksf	**41**	**13**	**15**	**42**

* Harford County peak hour distribution center rates were used.

** Belcamp Commercial trips were copied directly from the approved TIS. The current plan, approved by Harford County, represents a trip reduction of the total site trips analyzed in the TIS. Excerpts of the approved TIS are included in Appendix II.

*** The peak hour trips, approved by the County, for these projects are accounted for with the projected growth rates.

**** The James Run site trips approved by the County are included are included in Appendix II.

The background development trips were distributed and assigned to the key intersections using the approved Harford County trip distribution patterns. The combined background peak hour trip assignment is provided on Exhibit 6. The distribution and assignment for each background development are provided in Appendix II.

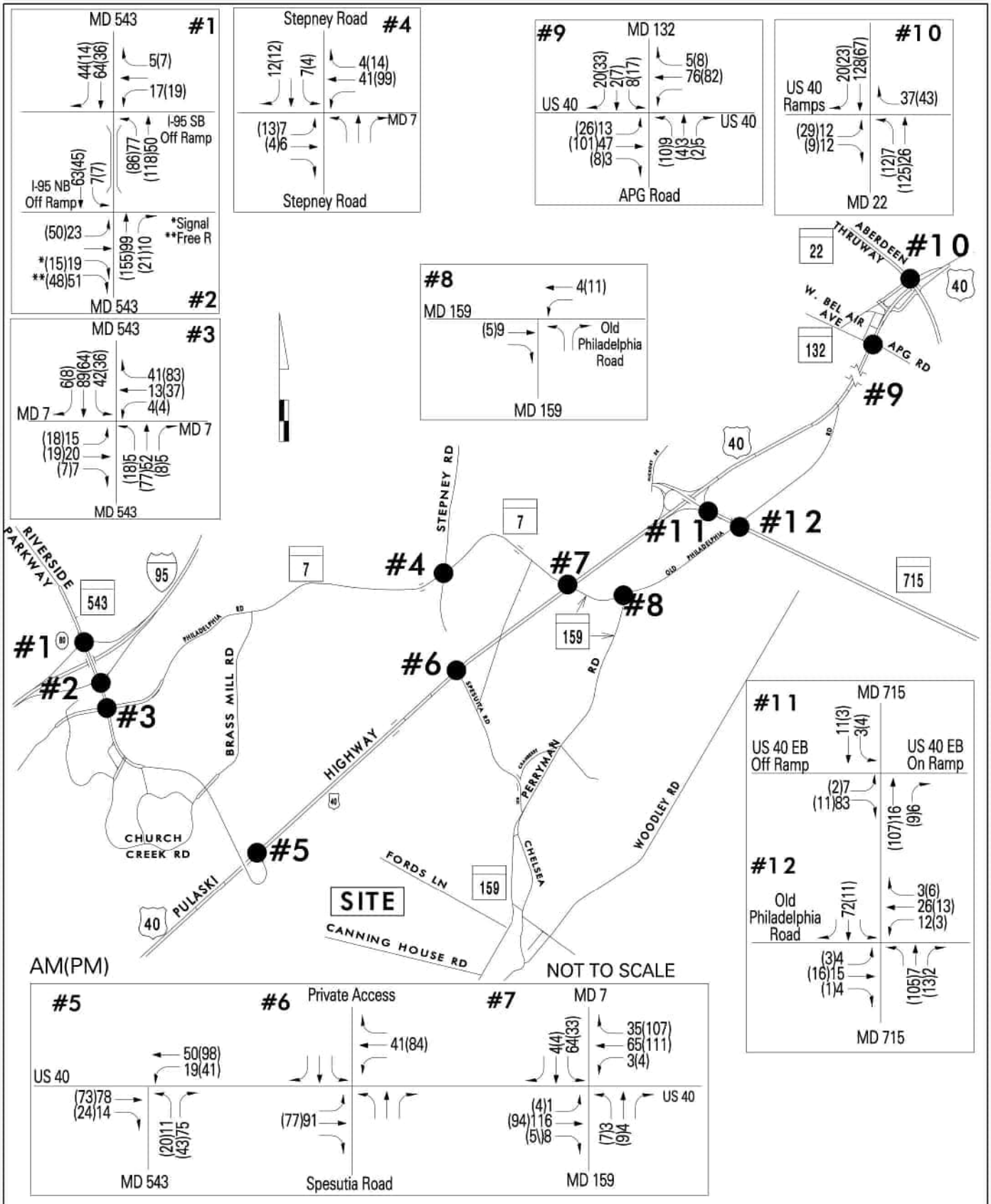

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EXHIBIT 4
Projected Growth Rates
(2.2% for Five Years)

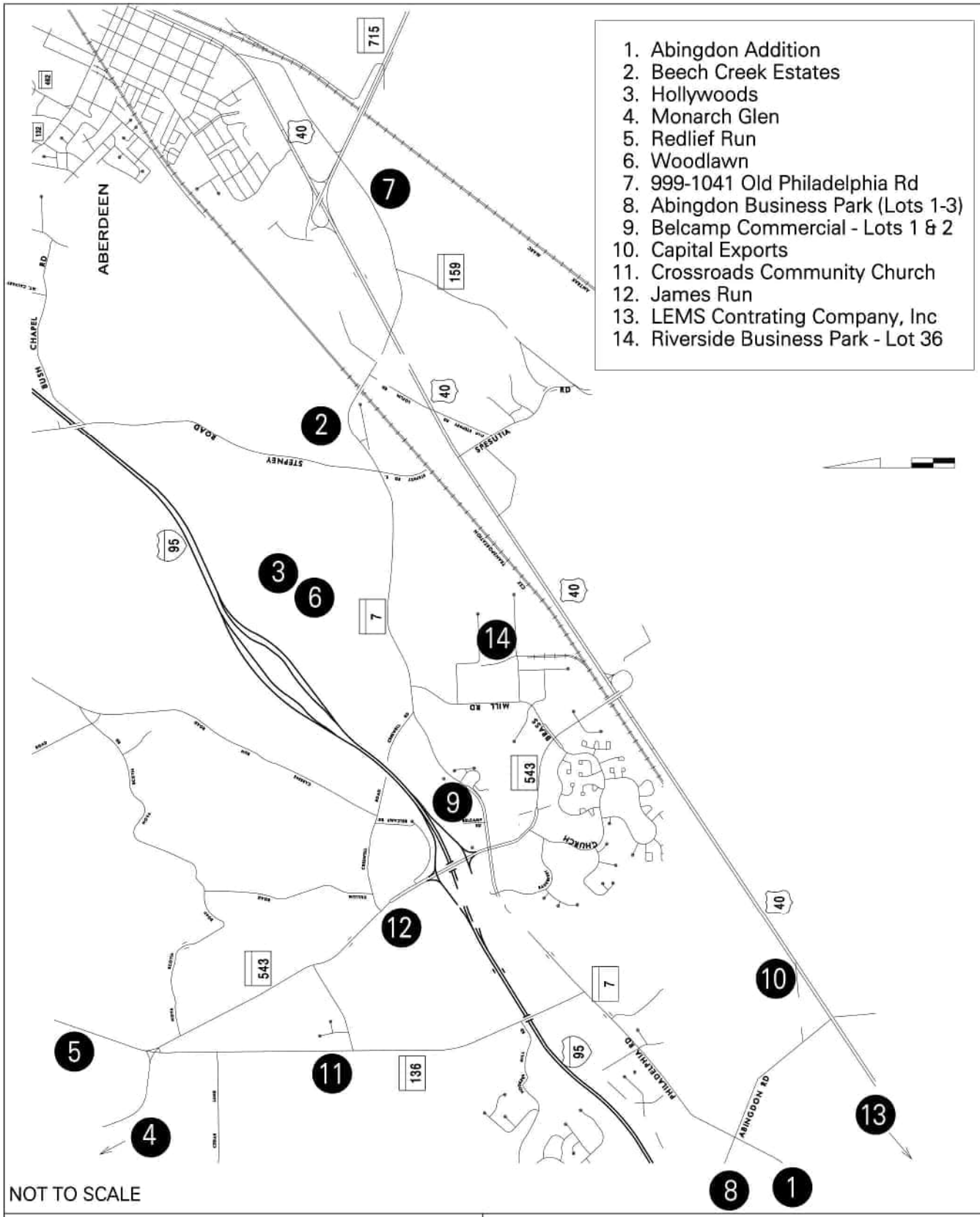

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EXHIBIT 5

Background Development Locations

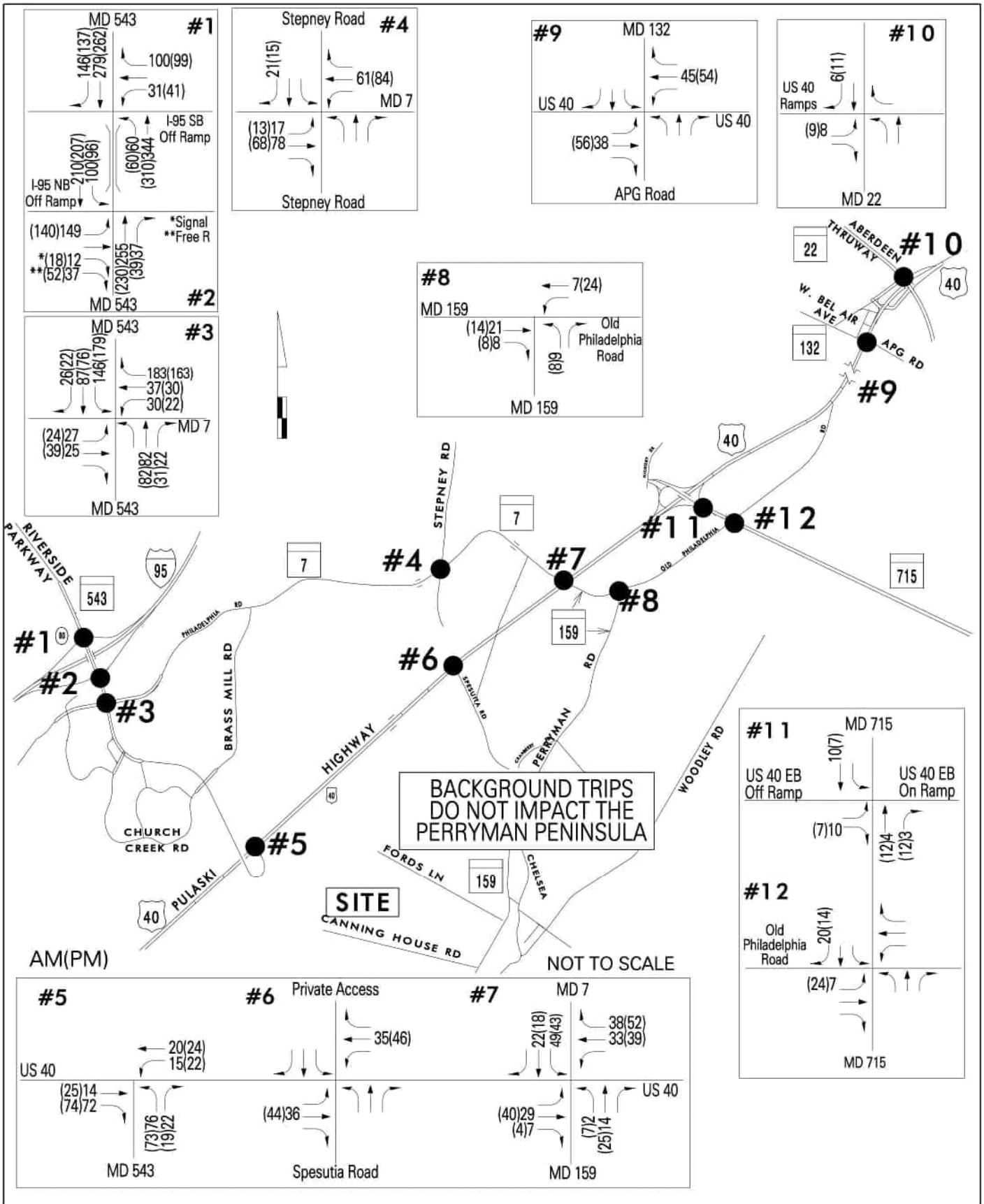

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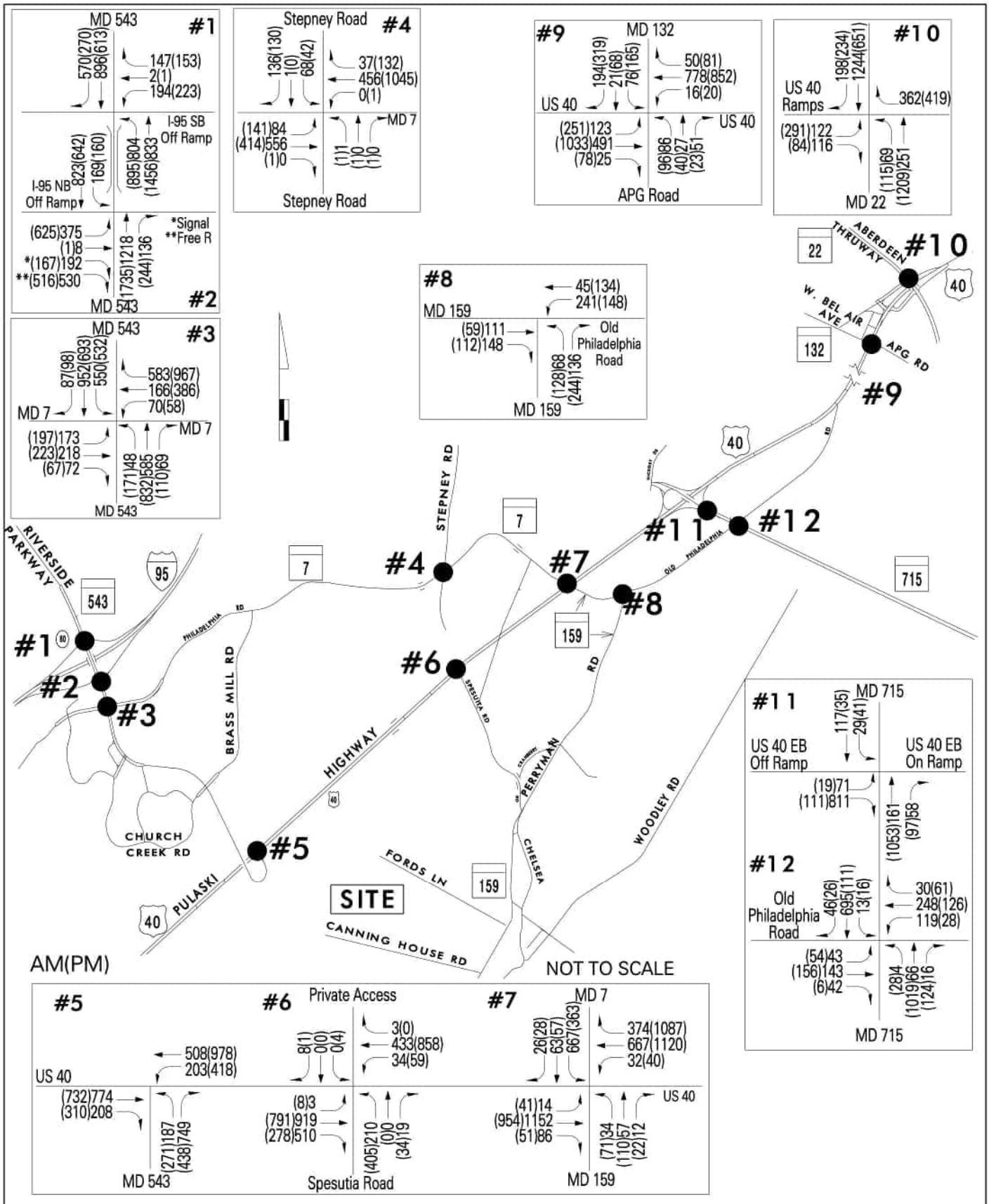
EXHIBIT 6

Background Traffic Volumes



TRAFFIC CONCEPTS, INC. 7525 Connelly Drive Suite B Hanover, Maryland 21076 410-760-2911	EXHIBIT 7A Total Background Traffic Volumes

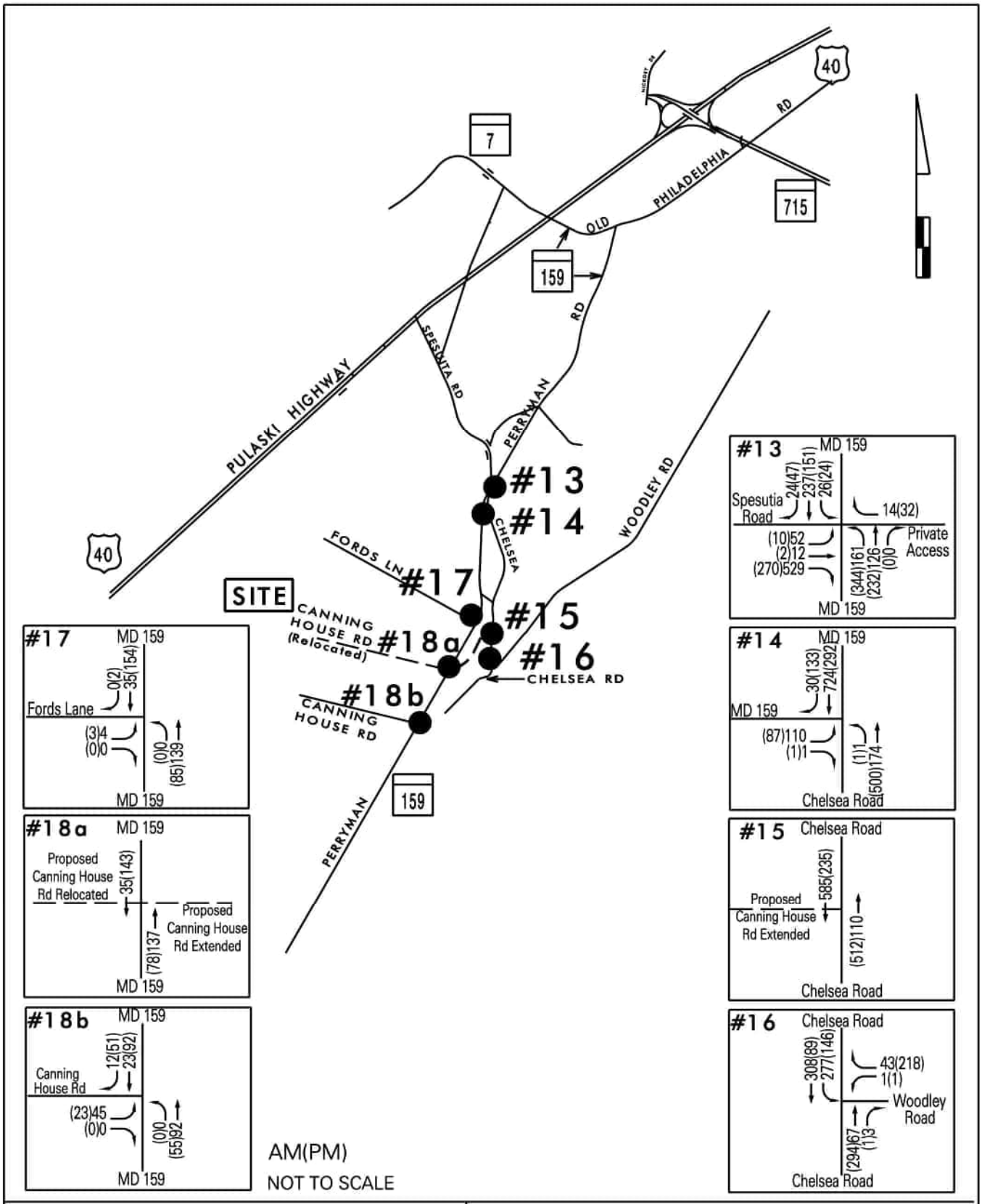


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EXHIBIT 7B

Total Background Traffic Volumes

FUTURE CONDITION

The future condition evaluates the impact that the new site generated peak hour trips have on the existing key intersections and the proposed new road connection labeled Canning House Road (Extended) between MD 159 and Chelsea Road.

Proposed Road Connection

As shown on the current site plan, the existing Canning House Road intersection at MD 159 will be eliminated. The developer will realign Canning House Road through the subject property to create a new intersection at MD 159, north of its current location. Canning House Road (extended) would be constructed by the developer and would span the distance from MD 159 to Chelsea Road. As stated, all new site generated trips were assigned to this new road connection.

This new roadway is designed as a main south to north thoroughfare connection in order to bypass the Perryman residential community along MD 159. This roadway is also designed with no residential and or commercial access points to encourage public use. Signage will be installed at the proposed site access and along MD 159 in order to direct passenger car and trucks to use the new public road. Due to the proposed signage directing traffic to use the new Canning House Road connection, the majority of diverted trips are outbound trips. The diverted trips include two-thirds of the existing (local) northbound through traffic diverted to Chelsea Road via Canning House Road extended, as shown on Exhibit 7C (Diverted Total Background Traffic for Canning House Road Extension).

A portion of the existing (local) southbound MD 159 traffic may use this new connection from Chelsea Road to MD 159. However, the study represents all existing (local) southbound MD 159 traffic using MD 159, which includes a right turn movement in order to continue south along MD 159. Therefore, no local southbound MD 159 trips were diverted to Chelsea Road to Canning House Road (extended).

Site Generated Trips

The developer proposes to construct warehouse buildings with a gross floor area of 5,200,000 s.f. The weekday peak hour trips associated with this project are shown below and were generated with data contained in the *ITE* Trip Generation Manual *11th E*dition.

	AM		PM	
	IN	**OUT**	**IN**	**OUT**
High Cube Fulfillment Center Warehouse ITE LUC 155				
5,200,000 gsf	632	148	324	508
Trucks Trips (30%)	**190**	**44**	**97**	**152**
Passenger Vehicles (70%)	**442**	**104**	**227**	**356**

The site generated truck trips are shown on Exhibits 8A and 8B and Exhibits 9A and 9B show the site generated passenger car trips. The total combined site generated trips are shown on Exhibits 10A and 10B.

The diverted traffic (Exhibit 7C) and combined site trips (Exhibits 10A & 10B) were added to the total background traffic volumes (Exhibits 7A & 7B) to obtain total future traffic volumes as shown on Exhibits 11A and 11B.

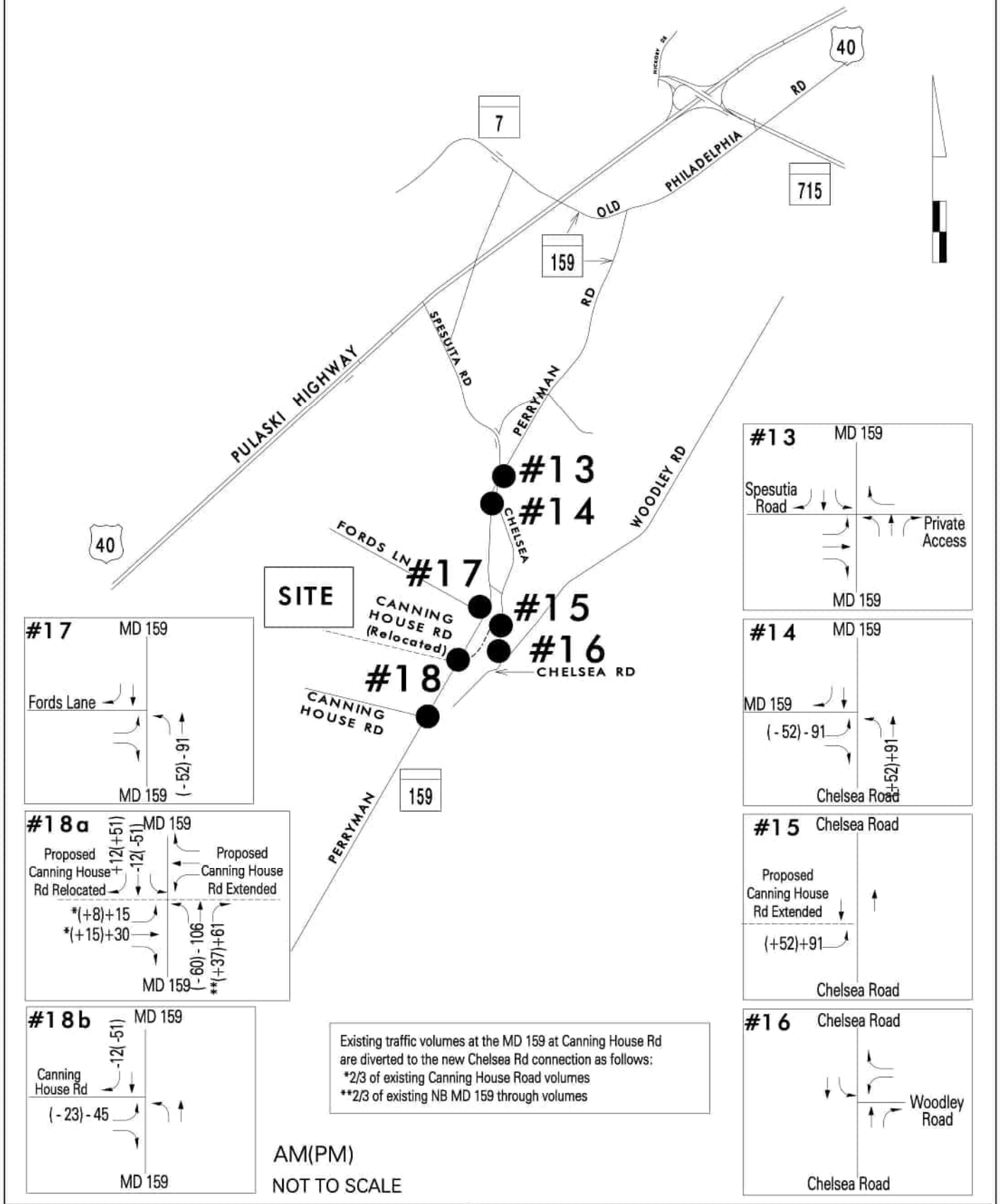

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EXHIBIT 7C

Diverted Total Background Traffic Volumes
(for Canning House Road Extension)

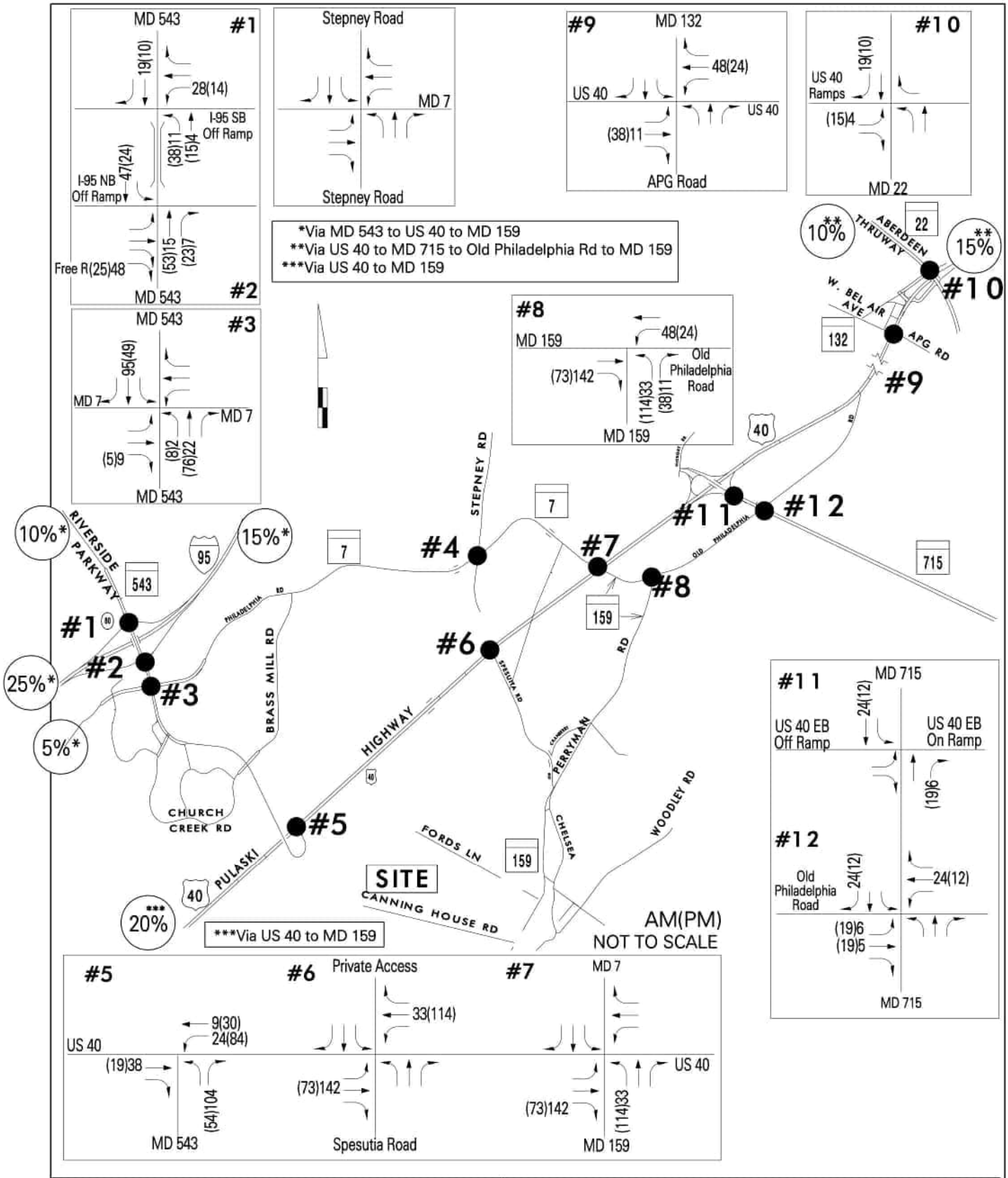

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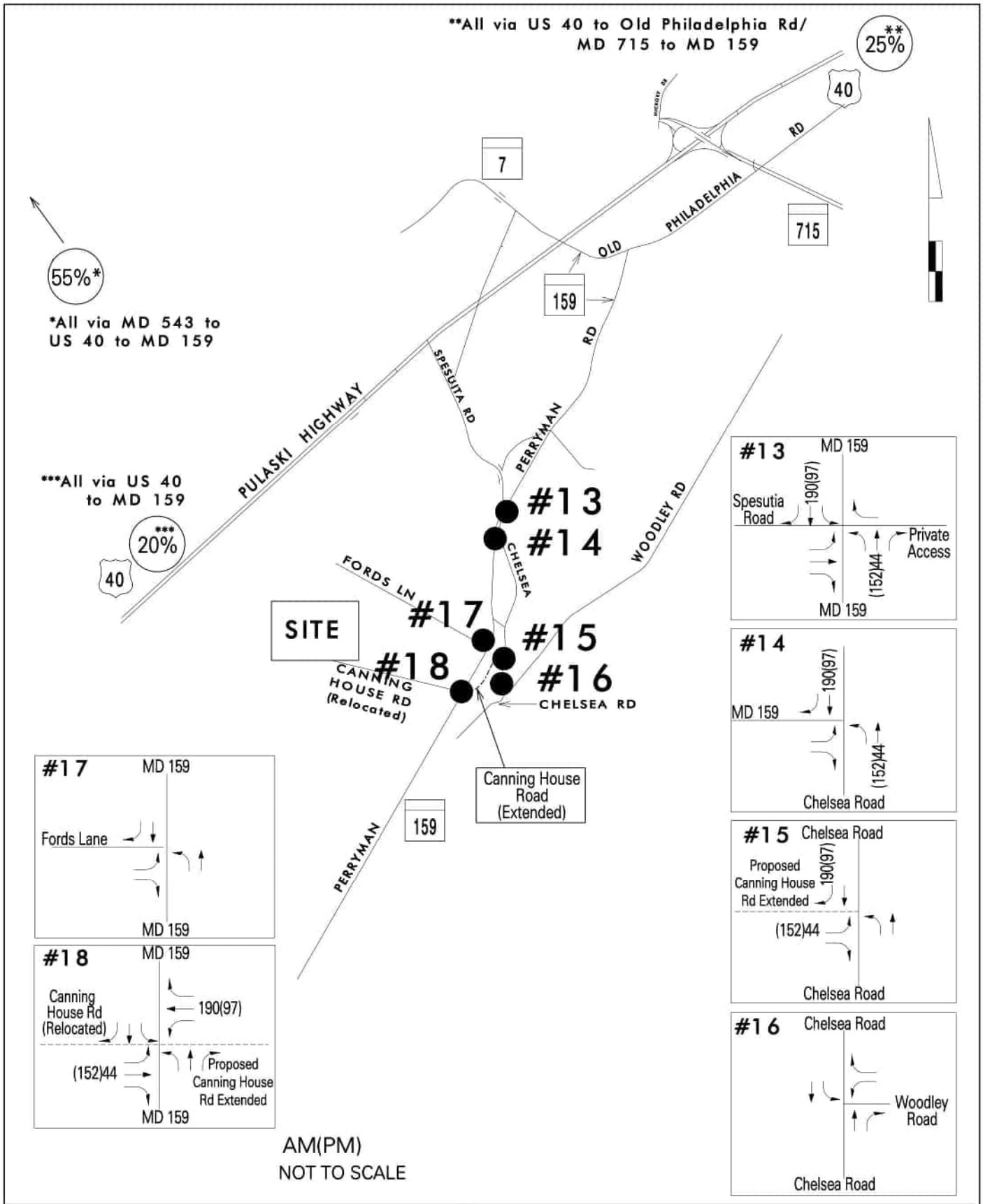
EXHIBIT 8A

Site Generated Traffic - Truck Trips



TRAFFIC CONCEPTS, INC. 7525 Connelly Drive Suite B Hanover, Maryland 21076 410-760-2911	EXHIBIT 8B Site Generated Traffic - Truck Trips

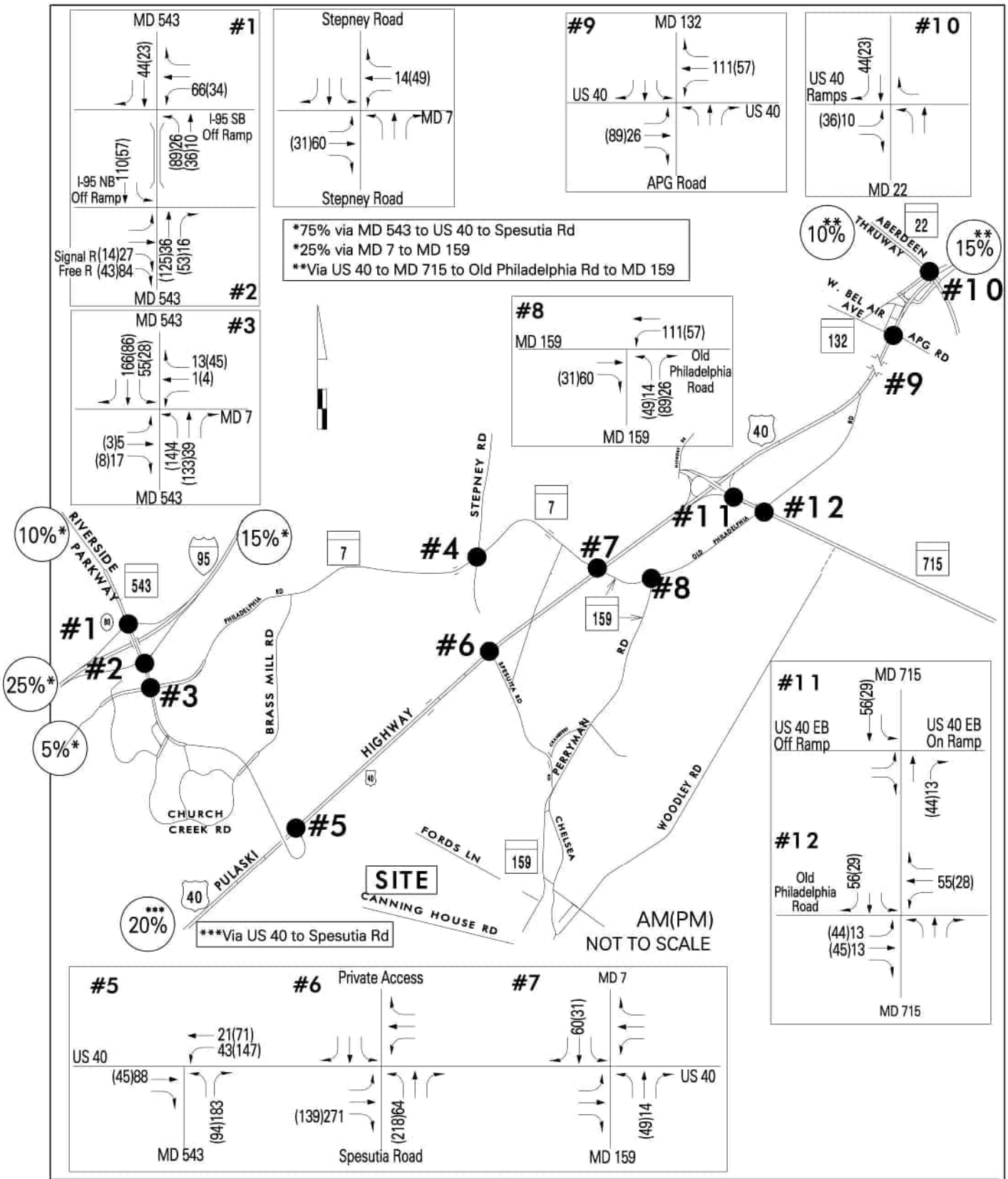


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EXHIBIT 9A

Site Generated Traffic - Passenger Vehicles

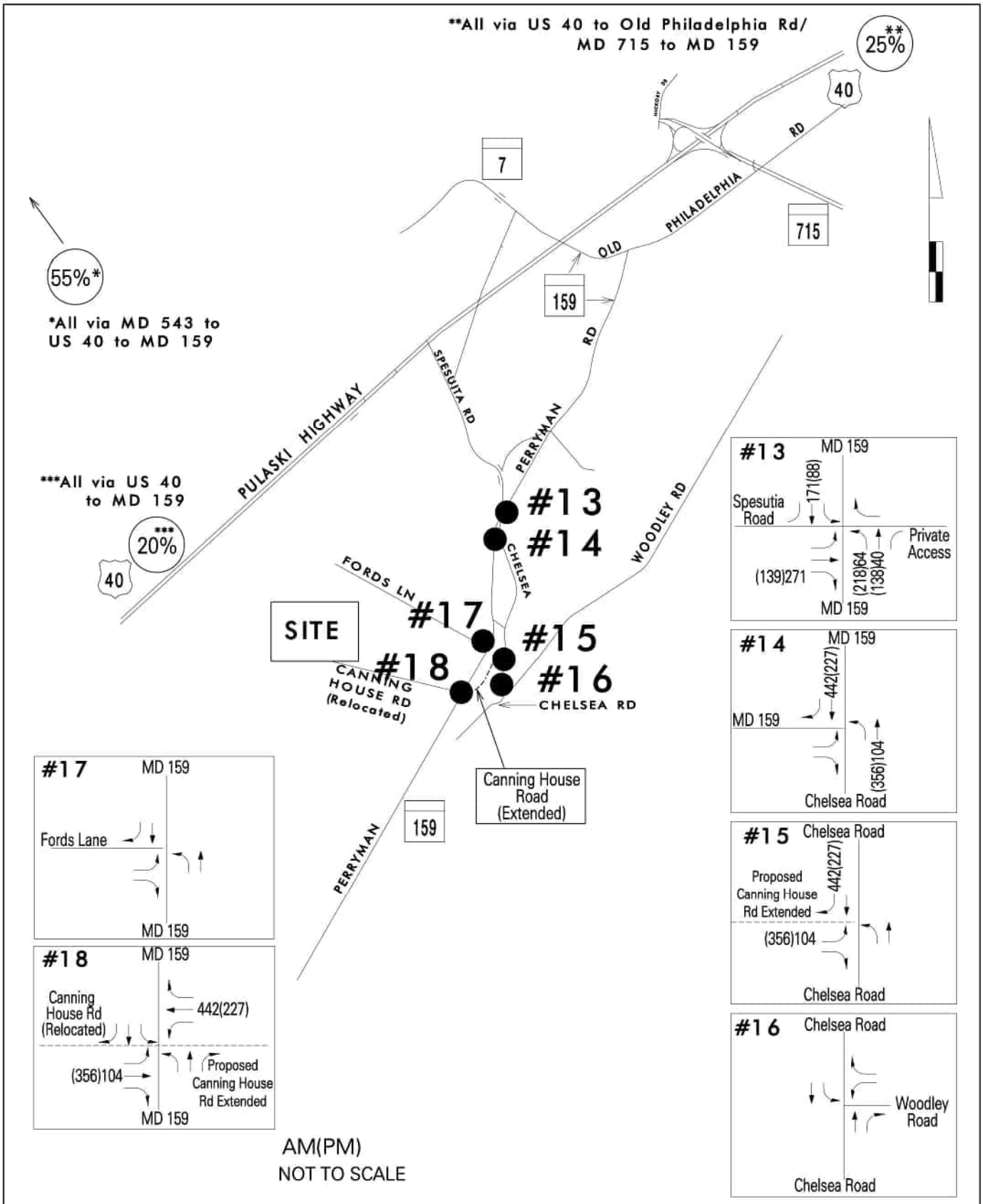

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EXHIBIT 9B

Site Generated Traffic - Passenger Vehicles

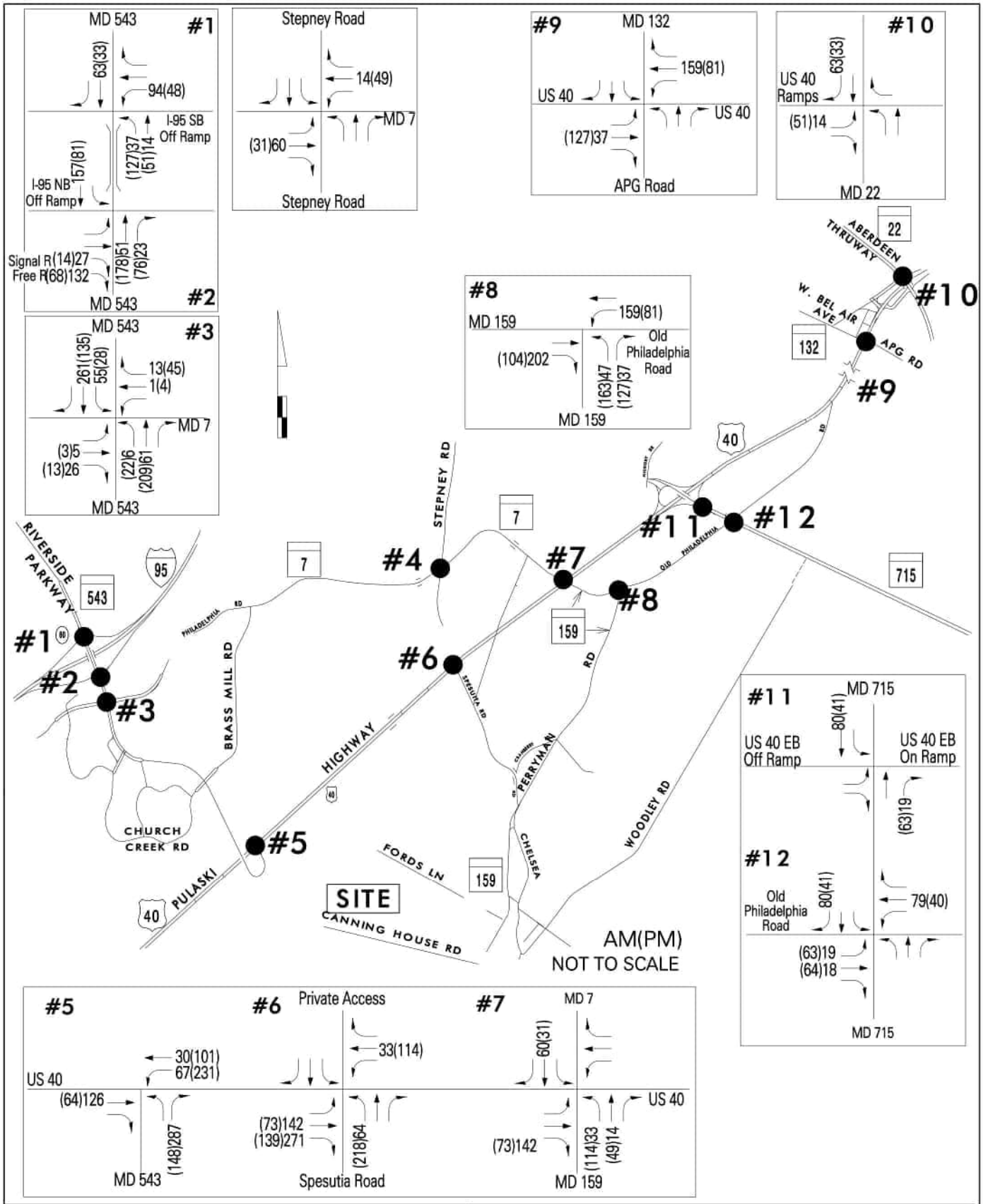

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EXHIBIT 10A

Total Site Generated Traffic

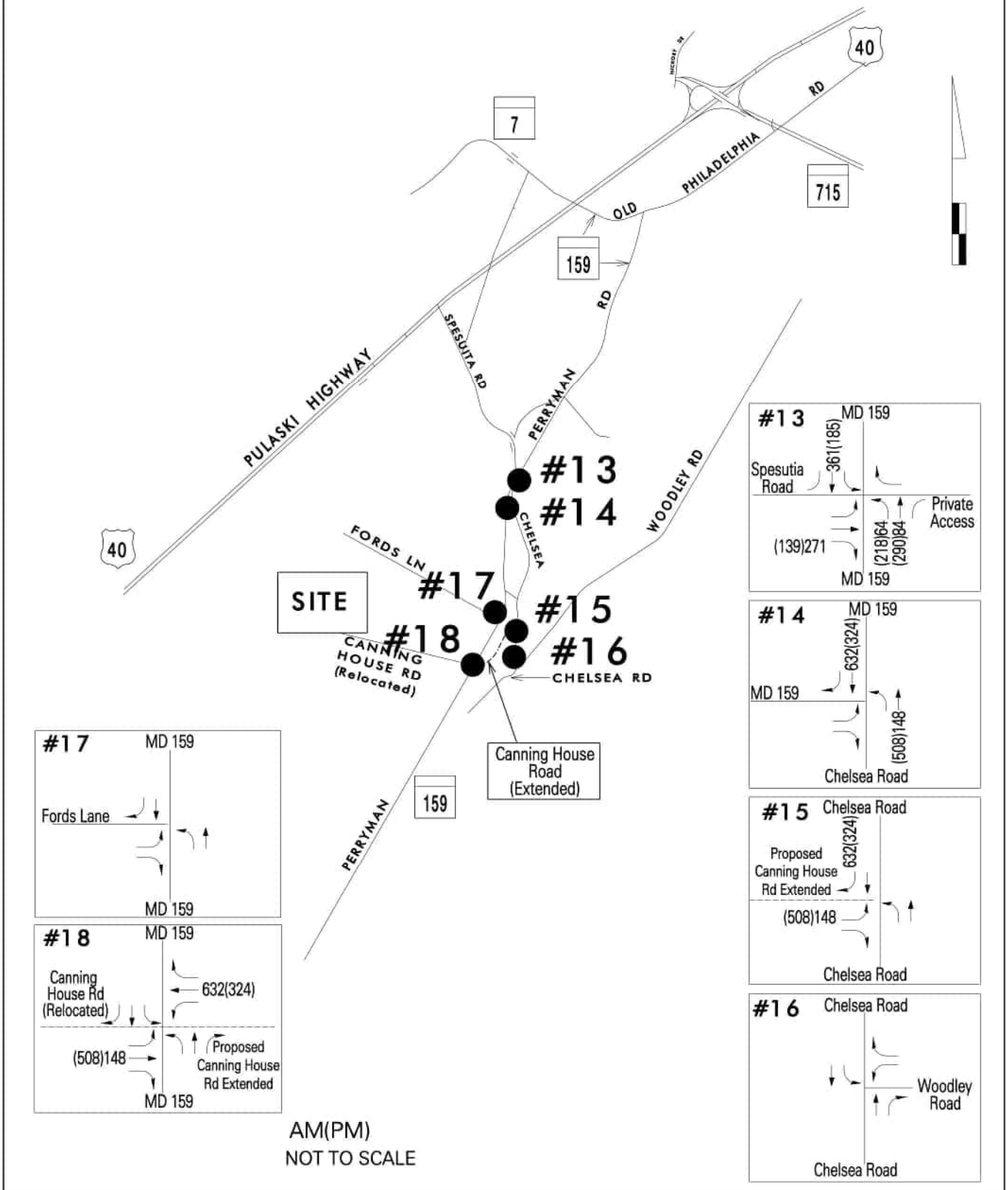

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EXHIBIT 10B

Total Site Generated Traffic

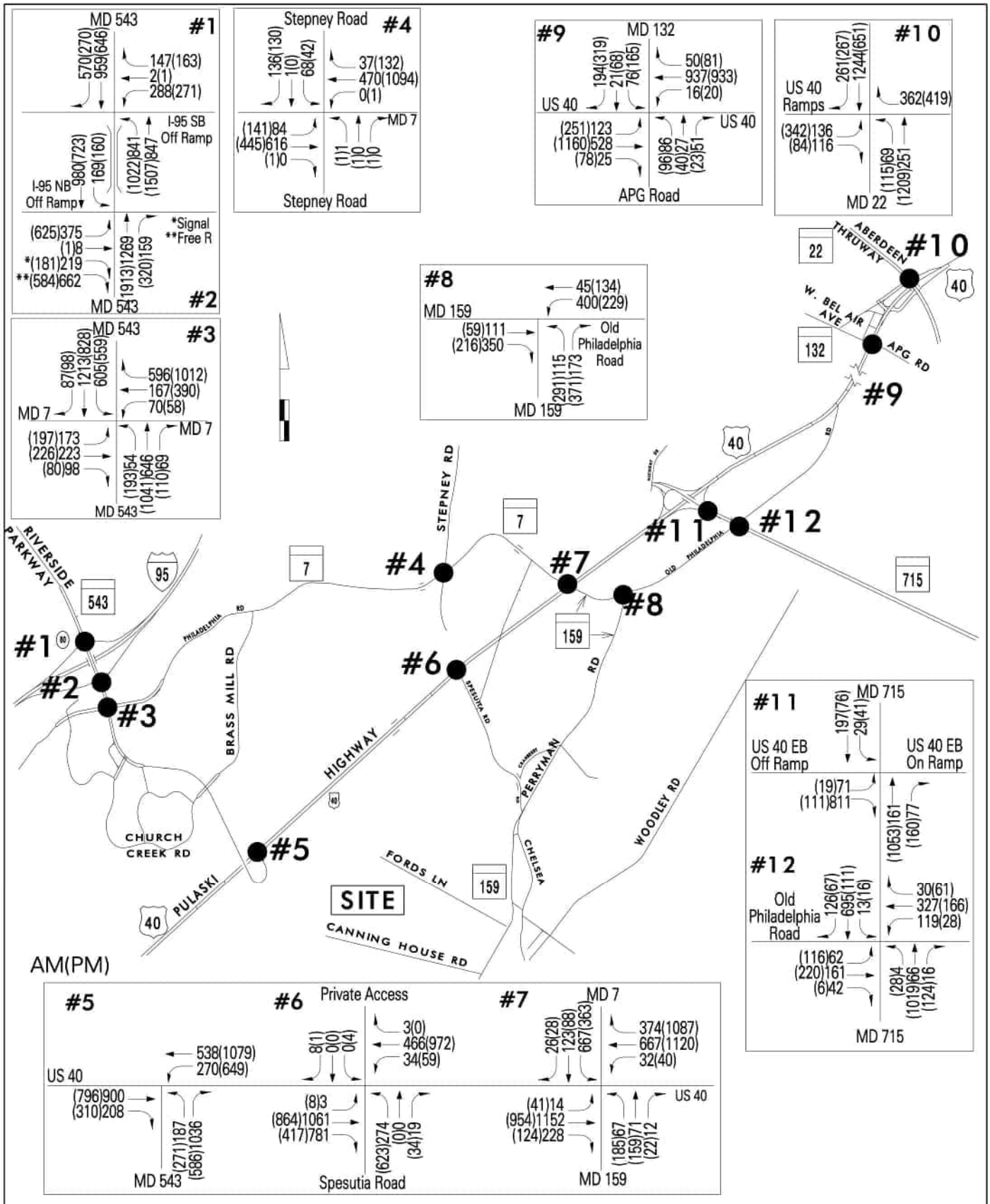

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EXHIBIT 11A

Total Future Traffic Volumes

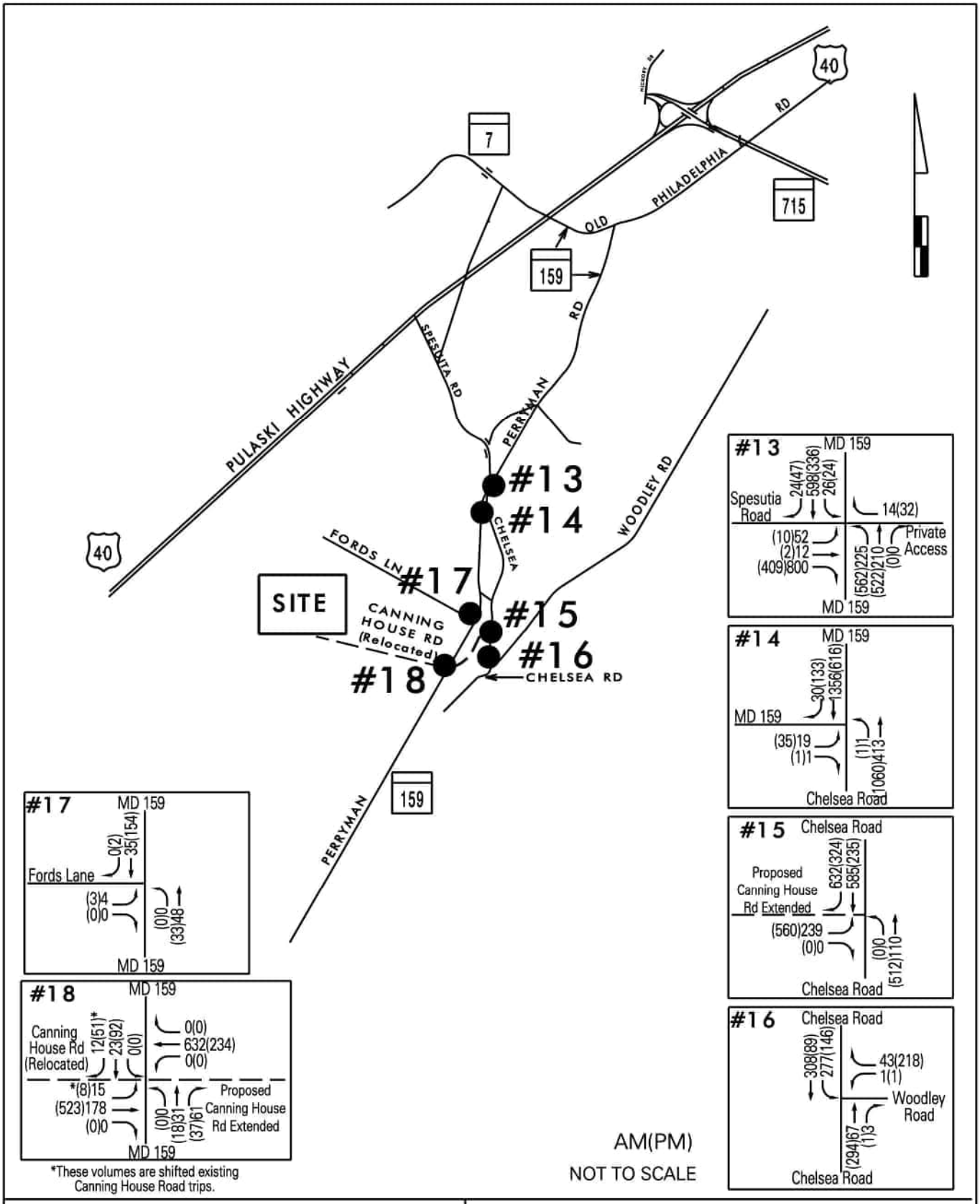

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EXHIBIT 11B

Total Future Traffic Volumes

INTERSECTION CAPACITY ANALYSIS

The following tables show the key intersection analysis results for the existing, background, and future traffic conditions using the required analysis methodologies. The detailed calculations are included in Appendix I.

CRITICAL LANE VOLUME ANALYSIS – AM PEAK HOUR			
KEY INTERSECTIONS	EXISTING CLV / LOS	BACKGROUND CLV / LOS	FUTURE CLV / LOS
1: I-95 SB Ramps @ MD 543	1119 / B	1093 / B	1206 / C
2: I-95 NB Ramps @ MD 543	664 / A	886 / A	906 / A
3: MD 543 @ MD 7	612 / A	847 / A	917 / A
4: MD 7 @ Stepney Road	577 / A	694 / A	754 / A
5: US 40 @ MD 543	604 / A	741 / A	877 / A
6: US 40 @ Spesutia Road	688 / A	684 / A*	802 / A*
7: US 40 @ MD 7/MD 159	735 / A	872 / A	929 / A
9: US 40 @ MD 132	616 / A	713 / A	800 / A
10: US 40 EB Ramps @ MD 22	778 / A	875 / A	889 / A
11: MD 715 @ US 40 EB Ramps	168 / A	188 / A	268 / A
12: MD 715 @ Old Philadelphia Rd	376 / A	424 / A	508 / A
13: MD 159 @ Spesutia Road	790 / A	491 / A*	916 / A*
14: MD 159 @ Chelsea Road	836 / A	836 / A	1377 / D
15: Chelsea Rd @ Proposed Canning House Rd (Extended)	-	-	824 / A
16: Chelsea Rd @ Woodley Rd	391 / A	391 / A	391 / A
17: MD 159 @ Fords Lane	143 / A	143 / A	52 / A
18: MD 159 @ Canning House Rd	137 / A	137 / A	739 / A (Relocated)
*Includes planned County Spesutia Road improvements, as required by Harford County.			

CRITICAL LANE VOLUME ANALYSIS – PM PEAK HOUR			
KEY INTERSECTIONS	EXISTING CLV / LOS	BACKGROUND CLV / LOS	FUTURE CLV / LOS
1: I-95 SB Ramps @ MD 543	1084 / B	1008 / B	1132 / B
2: I-95 NB Ramps @ MD 543	1062 / B	1230 / C	1301 / D
3: MD 543 @ MD 7	828 / A	1108 / B	1241 / C
4: MD 7 @ Stepney Road	1082 / B	1319 / D	1368 / D
5: US 40 @ MD 543	811 / A	984 / A	1250 / C
6: US 40 @ Spesutia Road	818 / A	762 / A*	942 / A*
7: US 40 @ MD 7/MD 159	695 / A	839 / A	892 / A
9: US 40 @ MD 132	853 / A	981 / A	1025 / B
10: US 40 EB Ramps @ MD 22	849 / A	956 / A	1007 / B
11: MD 715 @ US 40 EB Ramps	568 / A	639 / A	639 / A
12: MD 715 @ Old Philadelphia	408 / A	479 / A	563 / A
13: MD 159 @ Spesutia Road	584 / A	584 / A	987 / A
14: MD 159 @ Chelsea Road	588 / A	589 / A	1096 / B
15: Chelsea Rd @ Proposed Canning House Rd (Extended)	-	-	824 / A
16: Chelsea Rd @ Woodley Rd	660 / A	660 / A	660 / A
17: MD 159 @ Fords Lane	159 / A	159 / A	159 / A
18: MD 159 @ Canning House Rd	166 / A	166 / A	666 / A (Relocated)
*Includes planned County Spesutia Road improvements, as required by Harford County.			

SIDRA ROUNDABOUT ANALYSIS - AM PEAK HOUR			
KEY INTERSECTION	EXISTING DELAY / LOS	BACKGROUND DELAY / LOS	FUTURE DELAY / LOS
8: MD 159 @ Old Philadelphia Rd	6.0 / A	6.4 / A	12.7 / B
SIDRA ROUNDABOUT ANALYSIS - PM PEAK HOUR			
KEY INTERSECTION	EXISTING DELAY / LOS	BACKGROUND DELAY / LOS	FUTURE DELAY / LOS
8: MD 159 @ Old Philadelphia Rd	5.9 / A	6.3 / A	10.5 / B

HIGHWAY CAPACITY MANUAL SOFTWARE (HCS): SIGNAL CONTROL - AM PEAK HOUR			
KEY INTERSECTIONS	EXISTING Delay / LOS	BACKGROUND Delay / LOS	FUTURE Delay / LOS
1: I-95 SB Ramps @ MD 543*	32.7 / C	26.2 / C	31.0 / C
2: I-95 NB Ramps @ MD 543*	11.4 / B	20.8 / B	20.0 / B
3: MD 543 @ MD 7*	27.6 / C	29.2 / C	29.3 / C
4: MD 7 @ Stepney Road	-	10.3 / B**	10.2 / B**
5: US 40 @ MD 543	12.1 / B	13.0 / B	13.3 / B
6: US 40 @ Spesutia Road	16.9 / B	25.3 / C***	27.8 / C***
7: US 40 @ MD 7/MD 159	29.8 / C	31.4 / C	32.2 / C
9: US 40 @ MD 132	23.6 / C	24.6 / C	26.3 / C
10: US 40 EB Ramps @ MD 22	16.3 / B	18.0 / B	18.2 / B
11: MD 715 @ US 40 EB Ramps	3.7 / A	3.7 / A	3.7 / A
12: MD 715 @ Old Philadelphia	23.8 / C	24.1 / C	25.0 / C
HIGHWAY CAPACITY MANUAL SOFTWARE (HCS): SIGNAL CONTROL - PM PEAK HOUR			
KEY INTERSECTIONS	EXISTING Delay / LOS	BACKGROUND Delay / LOS	FUTURE 0elay / LOS
1: I-95 SB Ramps @ MD 543*	37.2 / D	30.5 / C	37.1 / D
2: I-95 NB Ramps @ MD 543*	18.0 / B	23.6 / C	25.9 / C
3: MD 543 @ MD 7*	29.2 / C	34.5 / C	45.8 / D
4: MD 7 @ Stepney Road	-	12.9 / B**	13.9 / B**
5: US 40 @ MD 543	16.7 / B	18.6 / B	20.8 / C
6: US 40 @ Spesutia Road	23.6 / C	30.0 / C***	32.4 / C***
7: US 40 @ MD 7/MD 159	32.8 / C	33.9 / C	34.5 / C
9: US 40 @ MD 132	31.2 / C	34.0 / C	36.6 / D
10: US 40 EB Ramps @ MD 22	15.4 / B	16.4 / B	17.9 / B
11: MD 715 @ US 40 EB Ramps	11.3 / B	11.9 / B	11.2 / B
12: MD 715 @ Old Philadelphia	21.0 / C	21.5 / C	22.8 / C

* These intersections are only analyzed in the Synchro model as required by MDOT SHA for all studies due to the extensive overlapping improvements and coordination of these signalized intersections.

** Includes Capital Project improvement with traffic signal control.

*** Includes planned County Spesutia Road improvements.

HIGHWAY CAPACITY MANUAL SOFTWARE (HCS): STOP CONTROL - AM PEAK HOUR			
KEY INTERSECTIONS	EXISTING Delay / LOS	BACKGROUND Delay / LOS	FUTURE *(with Improvements)* Delay / LOS
4: MD 7 @ Stepney Road			
EB Left - MD 7	8.4 / A	-	-
WB L/T - MD 7	8.5 / A	-	-
NB Approach – L/T/R	29.1 / D	-	-
SB Approach – L & T/R	18.7 / C	-	-
13: MD 159 @ Spesutia Road			
EB Approach – L/T & R	23.5 / C	23.5 / C	433.9 / F *(38.0 / E*)*
WB Approach – R	9.2 / A	9.2 / A	9.7 / A
NB Left - MD 159	8.3 / A	8.3 / A	10.4 / B
SB Left - MD 159	7.7 / A	7.7 / A	7.9 / A
14: MD 159 @ Chelsea Road			
EB Approach - L/R	29.6 / D	29.6 / D	79.7 / F *(28.5 / D with MD-T)*
NB Left - MD 159	9.6 / A	9.6 / A	13.5 / B
15: Chelsea Rd @ Proposed Canning House Rd Extended			
EB Approach – L & R	-	-	22.2 / C
NB Left – Chelsea Rd	-	-	12.0 / B
16: Chelsea Rd @ Woodley Rd			
WB Approach – L & R	9.4 / A	9.4 / A	9.4 / A
SB Left – Chelsea Rd	8.2 / A	8.2 / A	8.2 / A
17: MD 159 @ Fords Lane			
EB Approach - L/R	9.5 / A	9.5 / A	9.0 / A
NB L/T - MD 159	7.3 / A	7.3 / A	7.3 / A
18a: MD 159 @ Canning House Rd			
EB Approach - L/R	9.5 / A	9.5 / A	-
NB L/T - MD 159	7.3 / A	7.3 / A	-
18b: MD 159 @ Canning House Rd (Relocated/Extended)			
EB Approach – Left & Thru/R	-	-	12.5 / B
WB Approach – L/T/R	-	-	17.1 / C
NB Left - MD 159	-	-	7.3 / A
SB Left - MD 159	-	-	7.4 / A
**Includes improvements described in the Conclusions. Right turn headway factor reduced for free right turn movement; however, HCM does not accurately model and calculate the free right turn delay.*			

HIGHWAY CAPACITY MANUAL SOFTWARE (HCS): STOP CONTROL - PM PEAK HOUR			
KEY INTERSECTIONS	EXISTING Delay / LOS	BACKGROUND Delay / LOS	FUTURE *(with Improvements)* Delay / LOS
4: MD 7 @ Stepney Road			
EB Left - MD 7	11.6 / B	-	-
WB L/T - MD 7	8.0 / A	-	-
NB Approach – L/T/R	47.6 / E	-	-
SB Approach – L & T/R	36.9/ E	-	-
13: MD 159 @ Spesutia Road			
EB Approach – L/T & R	12.8 / B	12.8 / B	36.9 / E (26.3 / D*)
WB Approach – R	10.0 / A	10.0 / A	12.9 / B
NB Left - MD 159	8.7 / A	8.7 / A	11.9 / B
SB Left - MD 159	8.0 / A	8.0 / A	9.0 / A
14: MD 159 @ Chelsea Road			
EB Approach - L/R	21.5 / C	21.5 / C	87.9 / F *(13.9 / B with MD-T)*
NB Left - MD 159	8.4 / A	8.4 / A	9.6 / A
15: Chelsea Rd @ Proposed Canning House Rd Ext (MD-T)			
EB Approach – L & R	-	-	34.2 / D
NB Left – Chelsea Rd	-	-	8.7 / A
16: Chelsea Rd @ Woodley Rd			
WB Approach – L & R	11.7 / B	11.7 / B	11.7 / B
SB Left – Chelsea Rd	8.3 / A	8.3 / A	8.3 / A
17: MD 159 @ Fords Lane			
EB Approach - L/R	10.1 / B	10.1 / B	9.7 / A
NB L/T - MD 159	7.6 / A	7.6 / A	7.6 / A
18a: MD 159 @ Canning House Rd			
EB Approach - L/R	9.7 / A	9.7 / A	-
NB L/T - MD 159	7.6 / A	7.6 / A	-
18b: MD 159 @ Canning House Rd (Relocated/Extended)			
EB Approach – Left & Thru/R	-	-	15.6 / C
WB Approach – L/T/R	-	-	9.8 / A
NB Left - MD 159	-	-	7.6 / A
SB Left - MD 159	-	-	7.4 / A
**Includes improvements described in the Conclusions. Right turn headway factor reduced for free right turn movement; however, HCM does not accurately model and calculate the free right turn delay.*			

HIGHWAY CAPACITY MANUAL (HCM 2000): SIGNAL CONTROL - AM PEAK HOUR			
KEY INTERSECTIONS	EXISTING Delay / LOS	BACKGROUND Delay / LOS	FUTURE Delay / LOS
1: I-95 SB Ramps @ MD 543	32.7 / C	26.2 / C	31.0 / C
2: I-95 NB Ramps @ MD 543	11.4 / B	20.8 / B	20.0 / B
3: MD 543 @ MD 7	27.6 / C	29.2 / C	29.3 / C
4: MD 7 @ Stepney Road	-	9.7 / A*	10.0 / A*
5: US 40 @ MD 543	9.7 / A	13.0 / B	15.7 / B
6: US 40 @ Spesutia Road	17.4 / B	16.1 / B**	22.7 / C**
7: US 40 @ MD 7/MD 159	25.6 / C	31.1 / C	33.9 / C
9: US 40 @ MD 132	18.3 / B	19.7 / B	20.6 / C
10: US 40 EB Ramps @ MD 22	10.0 / B	10.7 / B	11.1 / B
11: MD 715 @ US 40 EB Ramps	2.5 / A	2.6 / A	2.6 / A
12: MD 715 @ Old Philadelphia	13.4 / B	13.8 / B	14.3 / B
HIGHWAY CAPACITY MANUAL (HCM 2000): SIGNAL CONTROL - PM PEAK HOUR			
KEY INTERSECTIONS	EXISTING Delay / LOS	BACKGROUND Delay / LOS	FUTURE 0elay / LOS
1: I-95 SB Ramps @ MD 543	37.2 / D	30.5 / C	37.1 / D
2: I-95 NB Ramps @ MD 543	18.0 / B	23.6 / C	25.9 / C
3: MD 543 @ MD 7	29.2 / C	34.5 / C	45.8 / D
4: MD 7 @ Stepney Road	-	19.2 / B*	19.5 / B*
5: US 40 @ MD 543	15.6 / B	20.4 / C	35.6 / D
6: US 40 @ Spesutia Road	43.6 / D	19.3 / B**	26.1 / C**
7: US 40 @ MD 7/MD 159	26.4 / C	42.5 / D	52.2 / D
9: US 40 @ MD 132	24.4 / C	31.1 / C	32.7 / C
10: US 40 EB Ramps @ MD 22	10.8 / B	12.7 / B	15.0 / B
11: MD 715 @ US 40 EB Ramps	6.6 / A	7.4 / A	7.2 / A
12: MD 715 @ Old Philadelphia	13.1 / B	13.9 / B	17.0 / B

*Includes County Capital Plan improvement for signalization.
**Includes planned County Spesutia Road improvements, as required by Harford County.

QUEUING ANALYSIS – SIGNALIZED INTERSECTIONS - HCM

A queuing analysis was conducted at the signalized key intersections, with exclusive left turn lanes. Unless noted, the Highway Capacity Manual software (HCS) back-of-queues are listed for the background future traffic conditions. The detailed calculations are included in Appendix I.

	BACKGROUND 95TH Percentile HCS Queue (ft) AM(PM)	FUTURE 95TH Percentile HCS Queue (ft) AM(PM)	STORAGE (ft)	SITE ADDS (ft)
1: I-95 SB Ramps @ MD 543**				
2: I-95 NB Ramps @ MD 543**				
3: MD 543 @ MD 7**				
4: MD 7 @ Stepney Road				
EB Left	33(154)	34(175)	175	*
SB Left	71(56)	71(56)	150	*
5: US 40 @ MD 543				
WB Left – US 40	199(333)	264(608)	450	158
NB Left – MD 543	97(205)	97(205)	Continuous	*
6: US 40 @ Spesutia Road***				
EB Left – US 40	3(10)	3(10)	350	*
WB Left – US 40	25(47)	25(47)	400	*
NB Left & L/T/R - Spesutia	214(406)	260(586)	Continuous	*
7: US 40 @ MD 7/MD 159				
EB Left – US 40	19(56)	19(56)	350	*
WB Left – US 40	43(55)	43(55)	300	*
NB Left – MD 159	47(86)	94(237)	400	*
SB Left – MD 7	408(241)	408(241)	775**	*
9: US 40 @ MD 132				
EB Left – US 40	60(202)	60(210)	200	8
WB Left – US 40	9(16)	9(16)	185	*
NB Left – APG Rd	86(119)	86(119)	100	**0**
SB Left – MD 132	75(212)	75(212)	150	**0**

*This lane has adequate storage.
**These intersections are only analyzed in the Synchro model as required by MDOT SHA for all studies due to the extensive overlapping improvements and coordination of these signalized intersections. SimTraffic queues are reported at this intersection.
***Includes planned County Spesutia Road improvements (detailed on Exhibits 2A & 2B), as required by Harford County.

	BACKGROUND 95TH Percentile HCS Queue (ft) AM(PM)	FUTURE 95TH Percentile HCS Queue (ft) AM(PM)	STORAGE (ft)	SITE ADDS (ft)
10: US 40 EB Ramps @ MD 22				
EB Left – N. Rogers St	138(296)	157(372)	Continuous	*
NB Left – MD 22	28(40)	28(40)	215	*
11: MD 715 @ US 40 EB Ramps				
EB Left – US 40 EB Ramps	74(19)	74(19)	300	*
SB Left – MD 715	8(11)	8(11)	150	*
12: MD 715 @ Old Philadelphia				
EB Left – Old Phila	50(62)	76(147)	200	*
WB Left – Old Phila	139(30)	140(31)	300	*
NB Left – MD 715	4(30)	4(30)	275	*
SB Left – MD 715	13(17)	13(17)	60	*
*This lane has adequate storage.				

QUEUING ANALYSIS – SIGNALIZED INTERSECTIONS - SimTraffic

The MDOT SHA required that all of the signalized key intersections must be included in the Synchro model. Therefore, the SimTraffic 95th Percentile Back-of-Queue results for the background and future traffic conditions are listed below. A future condition with improvements analysis was modeled that includes a second westbound right turn lane along MD 7 at MD 543. The detailed calculations are included in Appendix I.

	BACKGROUND 95TH Percentile SimTraffic Queue (ft) AM(PM)	FUTURE 95TH Percentile SimTraffic Queue (ft) AM(PM	FUTURE- IMP 95TH Percentile SimTraffic Queue (ft) AM(PM)	STORAGE (ft)	SITE ADDS (ft)
1: I-95 SB Ramps @ MD 543					
WB Left/Thru	129(175)	176(195)	116(210)	Continuous	*
NB Left	364(339)	423(336)	413(356)	800	*
2: I-95 NB Ramps @ MD 543					
EB Left/Thru	267(409)	273(404)	284(383)	Continuous	*
SB Left	303(460)	238(382)	345(470)	575	*
3: MD 543 @ MD 7					
EB Left	213(174)	173(233)	204(188)	200	*
WB Left	154(105)	153(160)	151(123)	430	*
WB Right	-	-	142(343)	865	
NB Left	134(291)	118(484)	140(403)	280	123
SB Left	354(323)	378(346)	376(367)	575	*
4: MD 7 @ Stepney Road					
EB Left	61(145)	71(166)	66(147)	175	*
SB Left	75(93)	76(92)	82(118)	150	*
5: US 40 @ MD 543					
WB Left – US 40	199(366)	260(558)	247(534)	450	84
NB Left – MD 543	109(154)	109(160)	114(176)	Continuous	*
*This lane has adequate storage.					

	BACKGROUND 95TH Percentile SimTraffic Queue (ft) AM(PM)	FUTURE 95TH Percentile SimTraffic Queue (ft) AM(PM	STORAGE (ft)Storage (ft)	SITE ADDS (ft)
6: US 40 @ Spesutia Road**				
EB Left – US 40	9(37)	9(28)	400	*
WB Left – US 40	55(74)	63(76)	360	*
NB Left & L/T/R - Spesutia	122(198)	136(275)	Continuous	*
7: US 40 @ MD 7/MD 159				
EB Left – US 40	39(84)	42(93)	340	*
WB Left – US 40	70(89)	72(84)	300	*
NB Left – MD 159	72(123)	105(223)	400	*
SB Left – MD 7	325(218)	344(221)	775	*
9: US 40 @ MD 132				
EB Left – MD 132	106(298)	123(322)	Continuous	*
WB Left – APG Rd	95(118)	99(123)	110***	*
NB Left – US 40	116(286)	129(295)	200	9
SB Left – US 40	75(46)	38(81)	185	*
10: US 40 EB Ramps @ MD 22				
EB Left – N. Rogers St	143(227)	150(287)	Continuous	*
NB Left – MD 22	76(141)	70(196)	215	*
11: MD 715 @ US 40 EB Ramps				
EB Left – MD 715	41(48)	33(49)	150	*
NB Left – US 40 EB Ramps	77(51)	78(43)	300	*
12: MD 715 @ Old Philadelphia				
EB Left – MD 715	37(40)	37(33)	275	*
WB Left – MD 715	21(59)	17(77)	260	*
NB Left – Old Phila	50(69)	67(104)	200	*
SB Left – Old Phila	116(56)	105(52)	305	*

*This lane has adequate storage.
**Includes planned County Spesutia Road improvements (detailed on Exhibits 2A & 2B), as required by Harford County.
***Based on the SimTraffic queues from APG Road, the heavier left turn volume utilize the continuous storage without blocking the through and right turn movements.

SIGNAL WARRANT ANALYSIS RESULTS

Signal warrant analyses were conducted at the MD 159 at Spesutia Road and MD 159 at Chelsea Road intersections. The warrants were tested for the existing and the future traffic volumes. Future traffic volumes include the existing traffic and the new site trips using ITE diurnal curve data. ITE does not provide data for LUC 155; therefore, we used the ITE diurnal curve data for LUC 154 (High-Cube Transload and Short-Term Storage Warehouse). The warrant results are provided on the following tables and details of the individual warrant tests are included in the study appendix.

TRAFFIC SIGNAL WARRANT SUMMARY MD 159 AT SPESUTIA RD		
WARRANTS	**EXISTING**	**FUTURE**
1-Eight-Hour Vehicular Volume **A**-Minimum Vehicle Volume	NOT SATISFIED (met 0 of the required 8 hrs)	NOT SATISFIED (met 3 of the required 8 hrs)
1-Eight-Hour Vehicular Volume **B**-Interruption of Continuous Traffic	NOT SATISFIED (met 0 of the required 8 hrs)	NOT SATISFIED (met 1 of the required 8 hrs)
1-Eight-Hour Vehicular Volume -Combination of Warrants 1A & 1B	NOT SATISFIED (A: met 0 of the required 8 hrs) (B: met 0 of the required 8 hrs)	NOT SATISFIED (A: met 7 of the required 8 hrs) (B: met 1 of the required 8 hrs)
2-Four-Hour Vehicular Volume	NOT SATISFIED (met 0 of the required 4 hrs)	**SATISFIED** (met 10 of the required 4 hrs)
3-Peak Hour	NOT SATISFIED (met 0 of the required 1 hour)	NOT SATISFIED (met 0 of the required 1 hour)
4-Pedestrian Volume	NOT SATISFIED	NOT SATISFIED
5-School Crossing	NOT APPLICABLE	NOT APPLICABLE
6-Coordinated Signal System	NOT APPLICABLE	NOT APPLICABLE
7-Crash Experience	NOT SATISFIED	NOT SATISFIED
8-Roadway Network	NOT APPLICABLE	NOT APPLICABLE
9-Intersection Near A Grade Crossing	NOT APPLICABLE	NOT APPLICABLE

TRAFFIC SIGNAL WARRANT SUMMARY MD 159 AT CHELSEA RD		
WARRANTS	**EXISTING**	**FUTURE**
1-Eight-Hour Vehicular Volume **A**-Minimum Vehicle Volume	NOT SATISFIED (met 3 of the required 8 hrs)	NOT SATISFIED (met 5 of the required 8 hrs)
1-Eight-Hour Vehicular Volume **B**-Interruption of Continuous Traffic	NOT SATISFIED (met 4 of the required 8 hrs)	**SATISFIED** (met 13 of the required 8 hrs)
1-Eight-Hour Vehicular Volume -Combination of Warrants 1A & 1B	NOT SATISFIED (A: met 11 of the required 8 hrs) (B: met 6 of the required 8 hrs)	**SATISFIED** (A: met 11 of the required 8 hrs) (B: met 13 of the required 8 hrs)
2-Four-Hour Vehicular Volume	NOT SATISFIED (met 3 of the required 4 hrs)	**SATISFIED** (met 12 of the required 4 hrs)
3-Peak Hour	NOT SATISFIED (met 0 of the required 1 hour)	**SATISFIED** (met 4 of the required 1 hour)
4-Pedestrian Volume	NOT SATISFIED	NOT SATISFIED
5-School Crossing	NOT APPLICABLE	NOT APPLICABLE
6-Coordinated Signal System	NOT APPLICABLE	NOT APPLICABLE
7-Crash Experience	NOT SATISFIED	NOT SATISFIED
8-Roadway Network	NOT APPLICABLE	NOT APPLICABLE
9-Intersection Near A Grade Crossing	NOT APPLICABLE	NOT APPLICABLE

CONCLUSIONS AND RECOMMENDATIONS

The Harford County APFO standards require signalized intersections located within the development envelope to operate at a level of service "D" or better and all unsignalized intersections located within the development envelope to operate with a side road minor approach level of service of “D” or better. If the traffic study determines an intersection is rated “E” or lower, than the developer needs to mitigate only the new site generated trips.

Intersection Capacity Results

From a Critical Lane Volume (CLV) analysis standpoint, all key intersections would operate with acceptable levels of service during the future traffic conditions. The future HCS analyses show the *MD 159 at Spesutia Road and the MD 159 at Chelsea Road* intersections would operate with deficient delays.

MD 159 @ Spesutia Road

The analysis contains the County planned improvements that includes widening of Spesutia Road that creates a shared left/thru and a channelized right turn lane with 200 feet of dedicated storage. *With these County improvements, the HCS results show a level of service “F” (433.9 sec/veh) during the future AM peak hour and an “E” (36.9 sec/veh) during the future PM peak hour, along the Spesutia Road approach at future traffic conditions.*

Mitigation: A signal warrant analysis was conducted at this intersection, which determined the major warrants were not met for signal control under the existing or the full build out traffic conditions. However, in order to alleviate any concerns that MDOT-SHA may have regarding this intersection, the Developer agrees to prepare an updated traffic signal warrant analysis after occupancy of each building. If the analysis shows a signal is warranted, the Developer will design and install the traffic signal upon MDOT-SHA and Harford County approval.

Ultimately, if the installation of a traffic signal is not approved by MDOT-SHA, the County will require other mitigation options. A roundabout was considered at this intersection. However, due to right-of-way constraints, a roundabout large enough to service large trucks could not be constructed.

As such, the Developer's alternative mitigation plan is to construct the following geometric improvements. The existing right turn lane from Spesutia Road to MD 159 will be widened and channelization markings added to encourage right turning traffic to flow without stopping. Also, the existing small median along southbound MD 159 will be removed to provide a wider left turn lane for trucks turning into the private property across from Spesutia Road. This lane will also be extended to provide a longer queue area for trucks without blocking southbound vehicles along MD 159 passing through the intersection.

The existing channelized median on the private leg of the intersection will be cut back to improve the turning radius for large vehicles entering the property. Field observations show that these intersection modifications will improve the flow of traffic and shorten delay times for the left turning vehicles from northbound MD 159 and eastbound Spesutia Road. A conceptual mitigation plan is included in the revised TIS.

An HCM analysis was conducted to show the additional impact of the Developer improvements, and the improved operation of the free channelized right turn movement from Spesutia Road. However, HCM does not accurately calculate the free right turn delay. The base critical right turn headway factor for the Spesutia Road right turn movement was reduced to model the benefits resulting from the geometric improvements along MD 159 that encourage the free right turn movement. (HCM defines the critical headway "the minimum time interval in the major street that allows intersection entry to one minor street vehicle".) As shown in the HCM results tables, the analysis with these improvements show an "E" approach LOS (38.1 sec/veh) during the AM peak hour and a "D" approach LOS (26.3 sec/veh) during the PM peak hour along Spesutia Road.

<u>MD 159 @ Chelsea Road</u>

The results of the HCM analyses show an "F" along the MD 159 (minor street) approach LOS during the future AM and PM peak hours. *Consequently, a signal warrant analysis was conducted for the existing and future traffic volumes. Warrants were met for only the future traffic conditions for Warrant 1 (Eight-Hour Volume), Warrant 2 (Four-Hour Volume), and Warrant 3 (Peak Hour Volume).*

Mitigation: *In order to alleviate any concerns that MDOT SHA may have regarding this intersection, the Developer agrees to prepare an updated traffic signal warrant analysis after occupancy of each building. If the analysis shows a traffic signal is warranted, the Developer will design and install the traffic signal upon MDOT-SHA and Harford County approval.*

If the installation of a traffic signal is not approved by MDOT SHA, the County will require other mitigation options. As such, the Developer's alternative mitigation plan is to construct a Maryland T intersection to improve delay along the northbound MD 159 left turn movement onto Chelsea Road. A Maryland T intersection, depicted on the concept plan, would provide acceptable delays at this intersection. The HCS minor approach LOS and delays are improved to an acceptable "D" LOS during the AM peak hour (28.5 seconds per vehicle of delay) and a "B" LOS during the PM peak hour (13.5 seconds per vehicle of delay).

MD 7 @ Spesutia Road

A capital project is established at this intersection and funds are available for the design and construction of a traffic signal at this intersection. As such, the intersection was evaluated with a traffic signal under the background and future traffic conditions. The signal control creates acceptable future levels of service. However, while there are funds available for this intersection if the installation of a traffic signal is not approved by MDOT SHA, other mitigation options must be considered and identified.

Therefore, the developer will extend the southbound Stepney Road left turn lane to provide 25-feet of additional storage plus deceleration and taper. Since a capital project is established, the developer will place in escrow the cost to design and construct the stated geometric improvement.

Access Improvements - Chelsea Road @ Canning Couse (Extended)

The Canning House and Chelsea Road intersection is planned as a Maryland T intersection. The HCS analysis shows a minor approach level of service "C" during the future AM peak and a level of service "D" during the future PM.

Queuing Analysis Results

The queuing analysis results determined the site would create queue storage deficiencies at the following intersections.

- *MD 543 at MD 7: NB MD 543 Left Turn Storage*
- *MD 543 at MD 7: WB MD 7 Right Turn*
- *US 40 at MD 543: WB MD 543 Left Turn Storage*
- *US 40 @ MD 132: NB US 40 Left Turn Storage*

MD 543 @ MD 7: Mitigation: *As shown on the table, the site adds 123 feet to the northbound MD 543 left turn lane. Therefore, the developer will extend the northbound MD 543 left turn storage area by 123 feet of storage.*

Additionally, in order to improve the overall intersection operation, the developer will construct a second westbound right turn lane along MD 7. This improvement was analyzed with the Synchro model (future with improvements). This improvement will be bonded by this Developer if not already bonded by others at the time of use and occupancy.

	BACKGROUND 95TH Percentile SimTraffic Queue (ft) AM(PM)	FUTURE 95TH Percentile SimTraffic Queue (ft) AM(PM	FUTURE- IMP 95TH Percentile SimTraffic Queue (ft) AM(PM)	STORAGE (ft)	SITE ADDS (ft)
MD 543 @ MD 7					
NB Left	134(291)	118(484)	140(403)	280	123

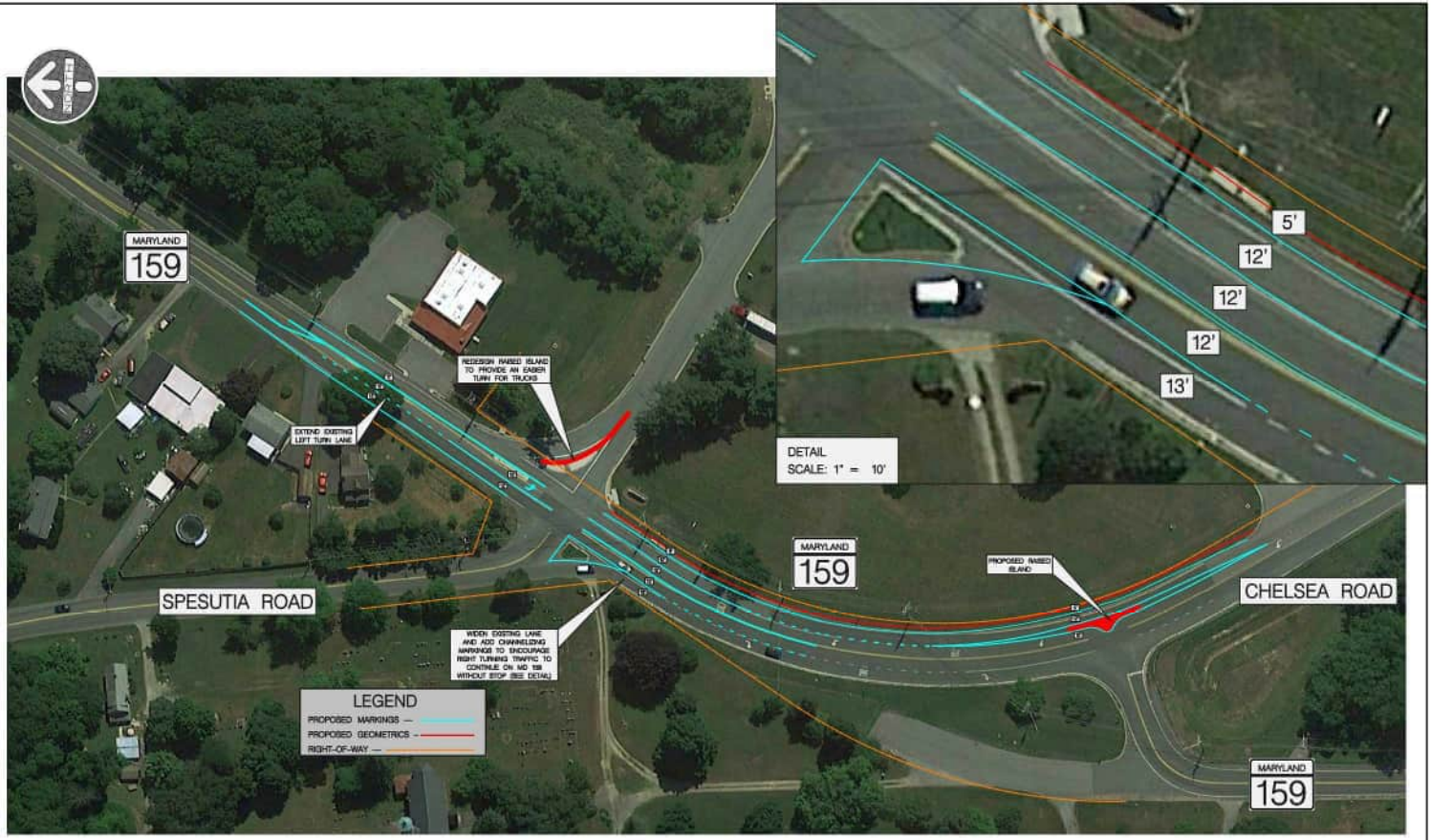
US 40 @ MD 543 Mitigation: *As shown on the table, the site adds 158 feet to the westbound US 40 left turn lane. Therefore, the developer will extend the westbound US 40 left turn storage area by 158 feet of storage.*

	BACKGROUND 95TH Percentile HCS Queue (ft) AM(PM)	FUTURE 95TH Percentile HCS Queue (ft) AM(PM)	STORAGE (ft)	SITE ADDS (ft)
US 40 @ MD 543				
WB Left – US 40	199(333)	264(608)	450	158

US 40 @ MD 132 Mitigation: *As shown on the table, the site adds 9 feet to the northbound US 40 left turn lane. Therefore, the developer will extend the northbound US 40 left turn storage area by the length of on vehicle or 25 feet.*

US 40 @ MD 132	*BACKGROUND 95TH Percentile SimTraffic Queue (ft) AM(PM)*	*FUTURE 95TH Percentile SimTraffic Queue (ft) AM(PM*	*STORAGE (ft)Storage (ft)*	*SITE ADDS (ft)*
NB Left – US 40	*116(286)*	*129(295)*	*200*	*9*

Based on results of this study and the proposed traffic mitigation, the developer meets the APFO standards. Therefore, we request approval of the proposed warehouse project from a traffic impact standpoint.



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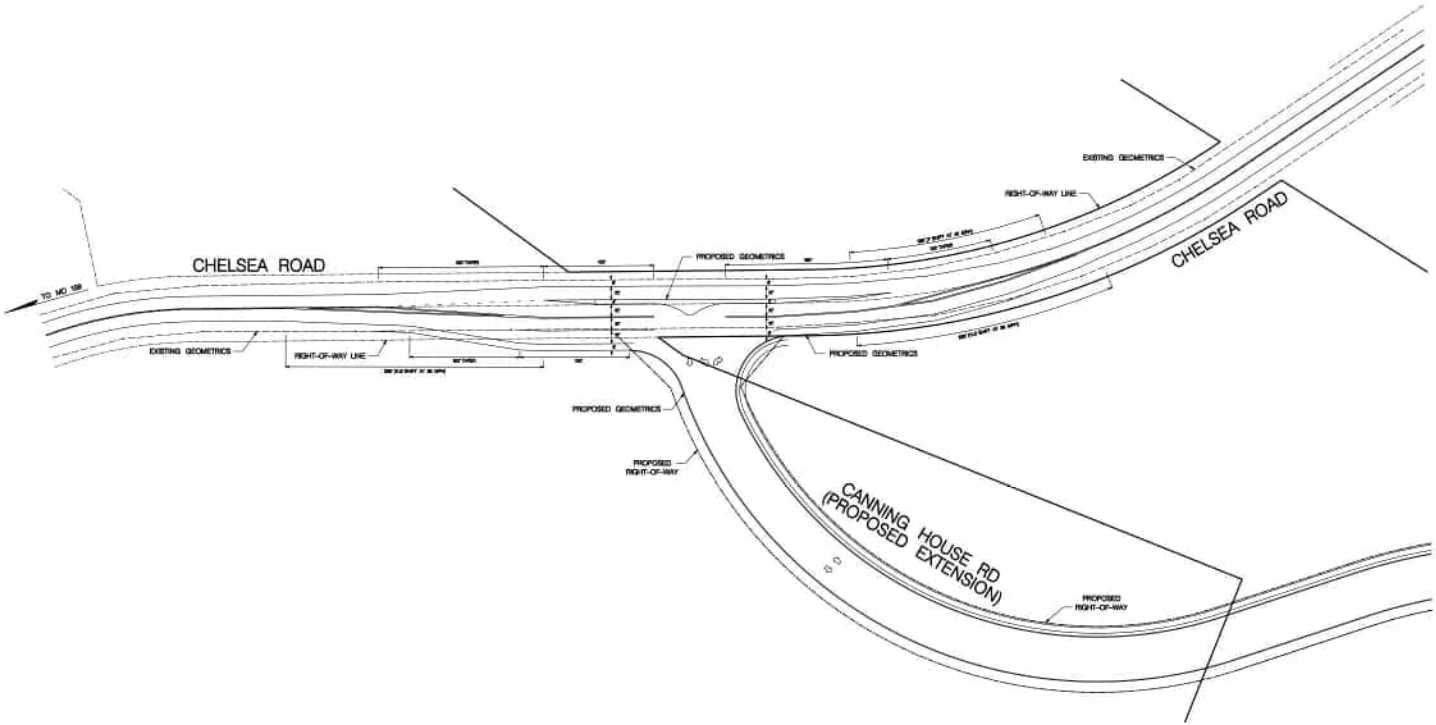
CONCEPT PLAN

MD 159 IMPROVEMENTS
HARFORD COUNTY

DRAWN: BY: S. PECK	DESIGNED: BY: S. SCHMID	CHECKED: BY: J.K. SCHMID
DATE: 9-23-2022	SHEET NO: 1 OF 1	SCALE: 1" = 40'



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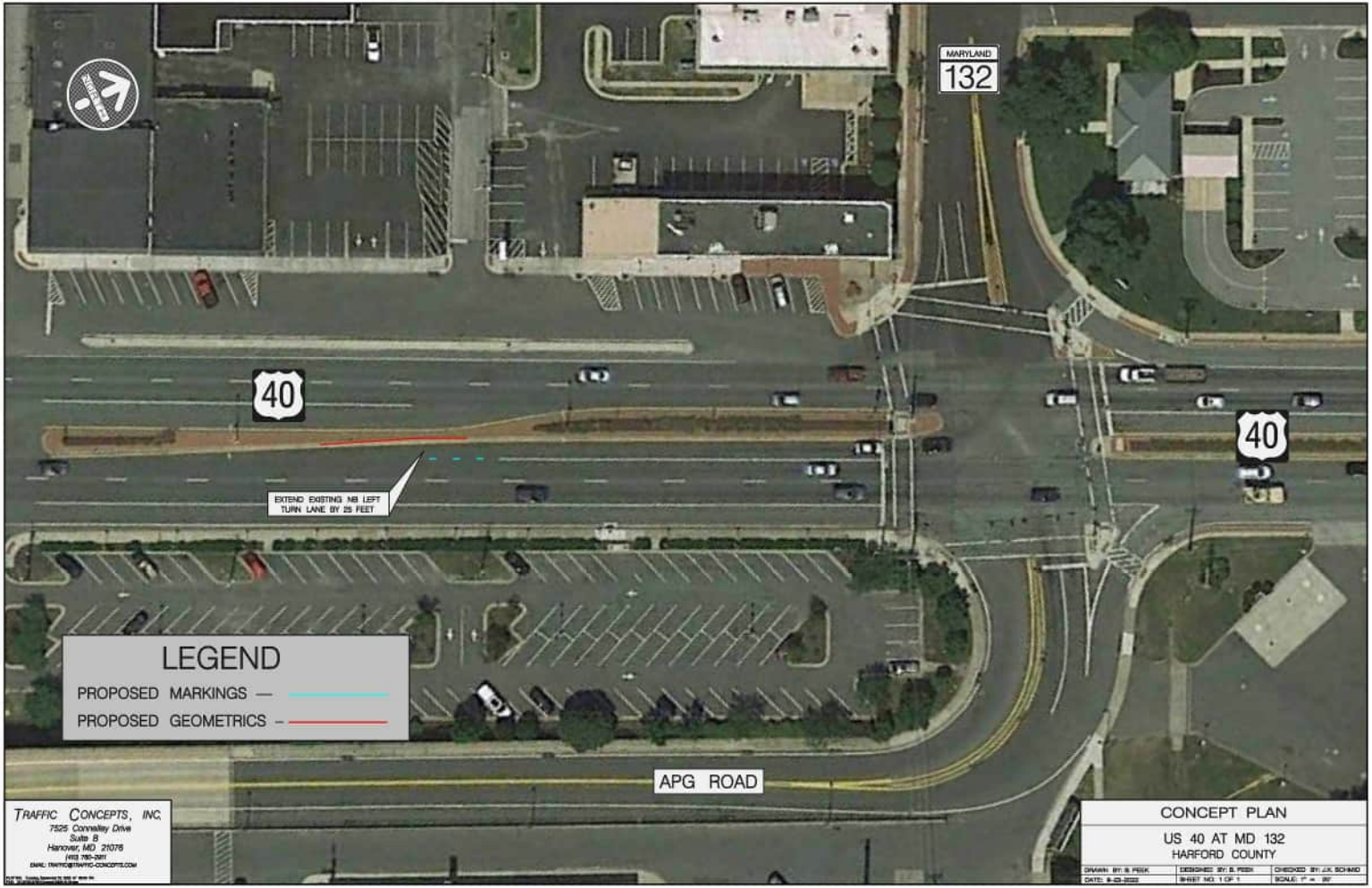
EMAIL: TRAFFIC@TRAFFIC-CONCEPTS.COM

Concept Plan

Chelsea Road at Canning House Road (Extended)
Harford County

DRAWN BY: S. PEEK	DESIGNED BY: S. PEEK	CHECKED BY: J.K. SCHMID
DATE: 9-23-2022	SHEET NO. 1 OF 1	SCALE: 1" = 40'



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CONCEPT PLAN

US 40 AT MD 132
HARFORD COUNTY

DRAWN: BY: S. FEEK	DESIGNED: BY: S. FEEK	CHECKED: BY: J.K. SCHMID
DATE: 9-23-2022	SHEET NO. 1 OF 1	SCALE: 1" = 20'