
Transportation Technical Analysis

2011-2020 Georgetown University Campus Plan

Washington, DC

March 15, 2011



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TABLE OF CONTENTS

List of Figures	ii
List of Tables	ii
Introduction and Executive Summary	1
Report Organization and Summary	2
Report Scope.....	2
Existing Conditions.....	4
Site Location and Major Transportation Features	4
Site Access and Existing Road Network	4
Existing Traffic Volumes.....	10
Field Observations	11
Existing Capacity Analysis	19
Future Conditions with Campus Plan.....	26
Future with Campus Plan Traffic Volumes.....	26
Parking Increase.....	26
Trip Generation.....	26
Trip Distribution.....	27
Future with Campus Plan Capacity Analysis	27
Vehicular Capacity Analysis	27
Recommendations and Mitigation Measures.....	29
Conclusions	31

LIST OF FIGURES

Figure 1: Location of Georgetown University	3
Figure 2: Functional Class and Average Annual Weekday Volumes	5
Figure 3: Existing Lane Configurations and Traffic Controls for the GU Main Campus (1 of 2)	6
Figure 4: Existing Lane Configurations and Traffic Controls for the GU Main Campus (2 of 2)	7
Figure 5: Existing Number of Travel Lanes for the GU Main Campus	8
Figure 6: Site Access Locations for the GU Main Campus	12
Figure 7: Existing Peak Hour Traffic Volumes (1 of 2)	13
Figure 8: Existing Peak Hour Traffic Volumes (2 of 2)	14
Figure 9: Area Traffic Volumes	15
Figure 10: Existing Peak Hour Levels of Service (1 of 2)	24
Figure 11: Existing Peak Hour Levels of Service (2 of 2)	25
Figure 12: Trip Distribution for New Academic Trips	32
Figure 13: Trip Distribution for New Medical Trips	33
Figure 14: Future with Campus Plan Traffic Volumes (1 of 2)	34
Figure 15: Future with Campus Plan Traffic Volumes (2 of 2)	35
Figure 16: Future with Campus Plan Capacity Analysis Results (1 of 2)	36
Figure 17: Future with Campus Plan Capacity Analysis Results (2 of 2)	37

LIST OF TABLES

Table 1: GU and GUH Campus Trip Generation	10
Table 2: Influence of Campus Traffic on Adjacent Streets	10
Table 3: Existing Levels of Service	20
Table 4: Level of Service Results from 2000 Campus Plan	22
Table 5: Trip Generation Rate Calculated for Peak Period of Adjacent Street Traffic	27
Table 6: Trips Generated By Parking Increase for Peak Period of Adjacent Street Traffic	27
Table 7: Future with Campus Plan Vehicular Levels of Service	28
Table 8: Future with Campus Plan Vehicular Levels of Service with Signal Timing Improvements	30

INTRODUCTION AND EXECUTIVE SUMMARY

This report contains the Transportation Technical Analysis in support of the 2011-2020 Georgetown University Campus Plan. Georgetown University (GU) is located north of Canal Road/M Street in Northwest, Washington, D.C. GU's main entrance is located at 3700 O Street, NW in Northwest Washington, D.C. Figure 1 shows the location of Georgetown University, within the Georgetown neighborhood of the District of Columbia, and across the Potomac River from the Rosslyn neighborhood of northern Virginia. The University has approximately 14,033 students and 4,035 faculty/staff. Georgetown Hospital (GUH) is located on the north side of campus, with 609 licensed beds and approximately 4,269 GUH staff.

The primary objective of this analysis is to identify the impacts of the Georgetown University 2011-2020 Campus Plan. This report accomplishes that by evaluating vehicular and pedestrian capacity and delay in the existing conditions to a scenario with development of the Campus Plan. This report focuses on the existing transportation network within the vicinity of the site, the transportation elements of the proposed Campus Plan, and the possible impacts to the transportation network. The report also outlines short- and long-term recommendations to mitigate potential impacts of the 2011-2020 Campus Plan.

Based on the findings detailed below, this report makes the following conclusions and recommendations:

- The University does not impose unacceptable or objectionable impacts on traffic on the surrounding road network. University traffic accounts for a small percentage of traffic entering and exiting the study area during commuter rush hours, particularly along Canal Road. Although drivers experience regular delays of significant length along major commuter corridors, the University does not generate enough traffic to contribute substantially to these delays. Along Reservoir Road adjacent to GUH, campus-generated traffic does constitute a significant proportion of traffic during the commuter rush hours. At these locations, through traffic on Reservoir Road operates at acceptable conditions. Some turning movements onto Reservoir Road from side streets, including campus access roads, operate with significant delays. These delays are generated by signal timings that favor through traffic over side street traffic.
- The proposed campus plan and related increase in parking supply will not impose unacceptable or objectionable impacts on traffic on the surrounding road network. The increase will have a minimal impact on the surrounding roadway network. Signal timing improvements could alleviate conditions at certain intersections.
- In conjunction with the construction of the Campus Loop road and operational changes to GUTS to use the Canal Road gate, a study should be performed to investigate changes at the Canal Road gate necessary to accommodate the new GUTS routing.
- When the development site that includes the GUH parking addition is submitted for further processing, a traffic study of the Reservoir Road gates should be included to develop detailed mitigation measures for these intersections.

Report Organization and Summary

This report is organized into two sections: the first section summarizes the existing conditions of University transportation facilities and services and the second section analyses the future conditions with the proposed Campus Plan.

The findings of this technical report were used in the development of the Georgetown University 2011-2020 Campus Plan and the recommendations detailed in the *Transportation Report* that accompanies the Campus Plan submittal.

Report Scope

Gorove/Slade took the following actions as part of this study:

- Established a scope of work during meetings with the University;
- Reviewed University and neighborhood transportation studies compiled since 2000;
- Met with the University to identify existing conditions, concerns, and opportunities;
- Met with MedStar and its traffic consultant, O.R. George & Associates to discuss existing conditions, issues, and opportunities;
- Conducted several campus visits to establish existing conditions, concerns, and opportunities;
- Conducted field reconnaissance of existing roadway and intersection geometrics, traffic controls, speed limits and operations;
- Performed morning and afternoon peak period turning movement counts at the study intersections;
- Determined the existing levels of service at the study intersections;
- Compiled parking usage surveys to determine the parking demand;
- Assembled list of concerns and opportunities;
- Aided the Campus Plan team in refining plan alternatives and the selected Campus Plan;
- Constructed a traffic model of campus based on available data and observations to evaluate and refine the recommendations of the Campus Plan;
- Analyzed future conditions with the Campus Plan to determine potential impacts due to development;
- Analyzed existing Transportation Demand Management (TDM) program and recommended future steps to be included in the TDM program; and
- Compiled Transportation Report and Technical Analysis.



Figure 1: Location of Georgetown University

EXISTING CONDITIONS

Site Location and Major Transportation Features

Georgetown University is located in the northwest portion of Washington, DC, in Ward 2. The University is located in an area of the district that is primarily residential, with a few private and public developments and transportation projects located nearby.

The location of the University, as shown previously in Figure 1, is primarily bounded by Reservoir Road on the north, Canal Road on the south, the Foundry Branch Valley Park on the west, and 37th Street on the east. The campus is served by the Whitehurst Freeway and several principal arterials, including MacArthur Boulevard, Canal Road, M Street, the Francis Scott Key Bridge, and Wisconsin Avenue. Additionally, the University is served by minor arterials, including Reservoir Road and Foxhall Road, and major collector roadways, including 37th Street, 35th Street, and Prospect Street. The University is also served by several public transportation sources, including Metrorail, Metrobus, and the DC Circulator. Additionally, the University also provides a free shuttle for students and faculty/staff that connects the University to Arlington, Dupont Circle, and the Law Center campus.

The University is also served by a pedestrian network consisting of sidewalks and crosswalks along the local streets surrounding the campus. In addition to pedestrian accommodations, the campus is also served by the on- and off-street bicycle network, which consists of signed bicycle routes along local roadways and an existing multi-use trail.

Site Access and Existing Road Network

Regional access for the Georgetown University campus is provided primarily by Wisconsin Avenue, Whitehurst Freeway, Canal Road, and M Street. Local access is also provided by Foxhall Road, Reservoir Road, 39th Street, 38th Street, 37th Street, and Prospect Street. Figure 2 shows the street network hierarchy for the study area, as well as the average annual weekday traffic volumes for the heavily traveled roadways.

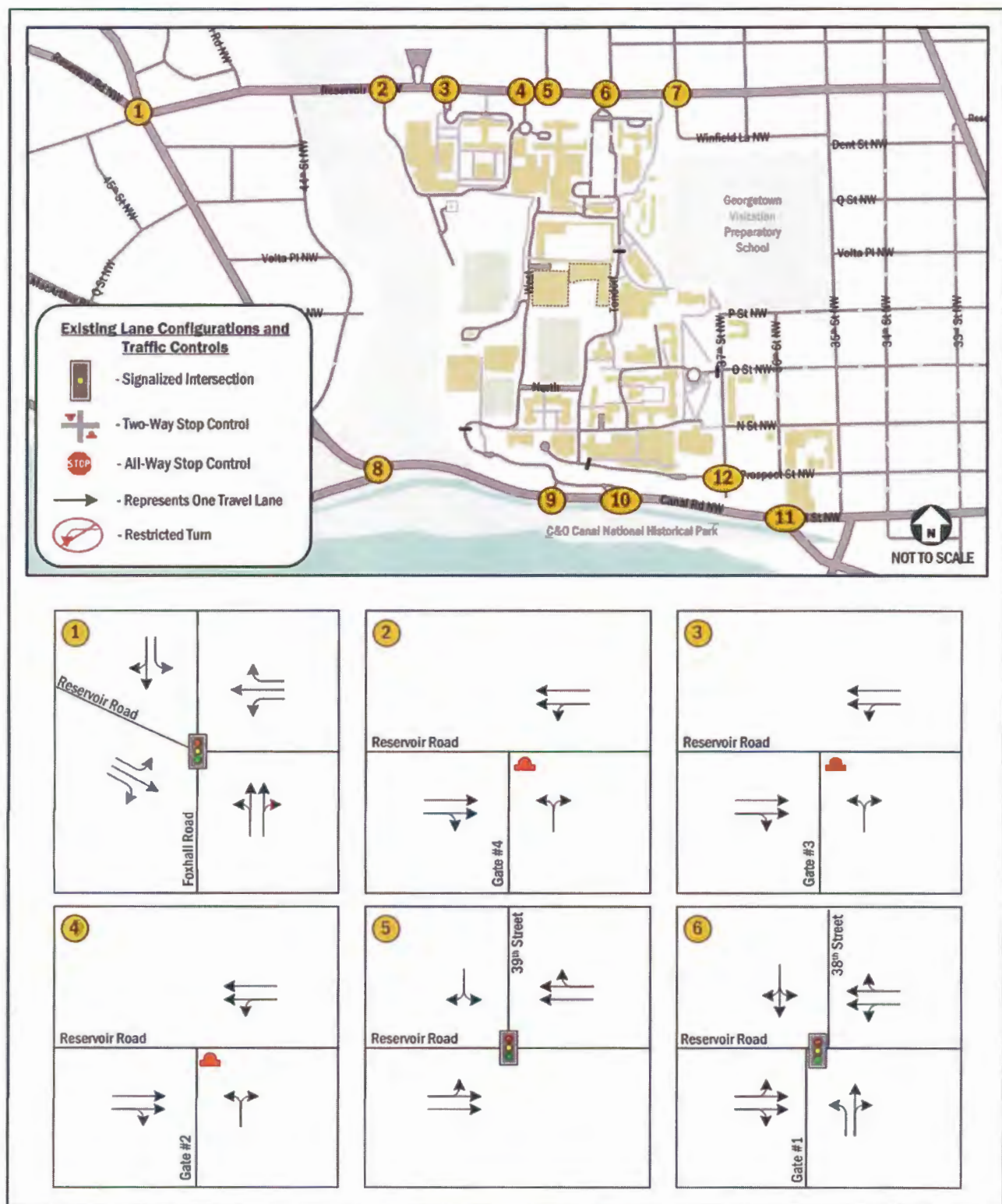
Gorove/Slade conducted field reconnaissance to obtain the existing lane usage and traffic controls at the intersections within the campus study area. Figure 3 and Figure 4 present the roadway lane configurations and traffic control devices provided at the study intersections. Figure 5 presents the number of travel lanes on the roadways surrounding the campus.

The physical and service characteristics of the key roadways providing local site access are as follows:

- Wisconsin Avenue
Wisconsin Avenue is a 4-lane arterial located east of the Georgetown campus. DDOT classifies the roadway as a principal arterial north of M Street and a minor arterial south of M Street. Wisconsin Avenue has an average annual weekday volume of 19,800 vehicles north of M Street and 7,400 vehicles south of M Street. Within the limits of the study area, Wisconsin Avenue runs between Reservoir Road and M Street.
- Whitehurst Freeway
Whitehurst Freeway is a 4-lane arterial located south of the Georgetown campus. DDOT classifies the roadway as a freeway/expressway with an average annual weekday volume of 31,200 vehicles. Within the limits of the study area, Whitehurst Freeway runs south from Canal Road.



Figure 2: Functional Class and Average Annual Weekday Volumes



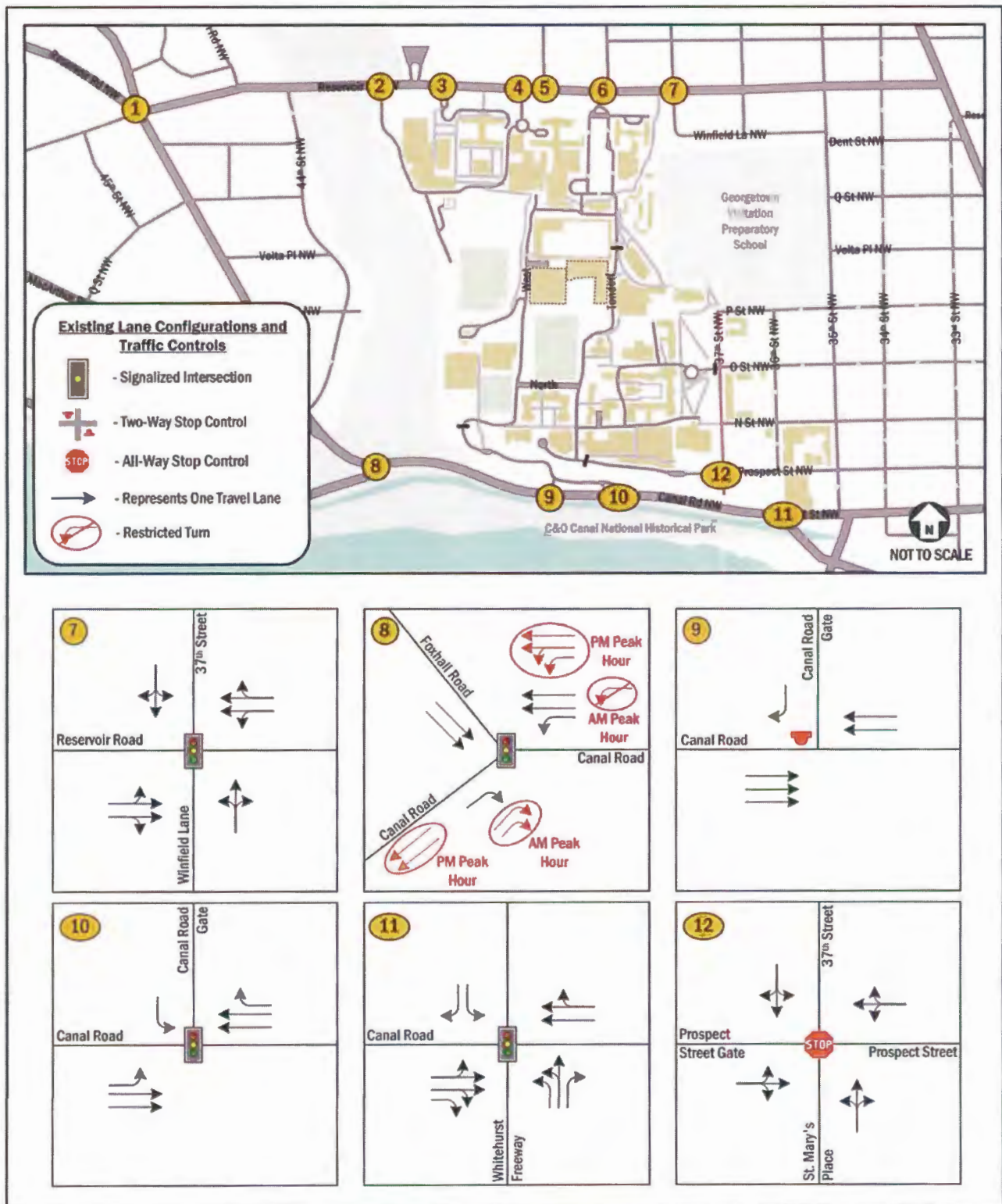


Figure 4: Existing Lane Configurations and Traffic Controls for the GU Main Campus (2 of 2)

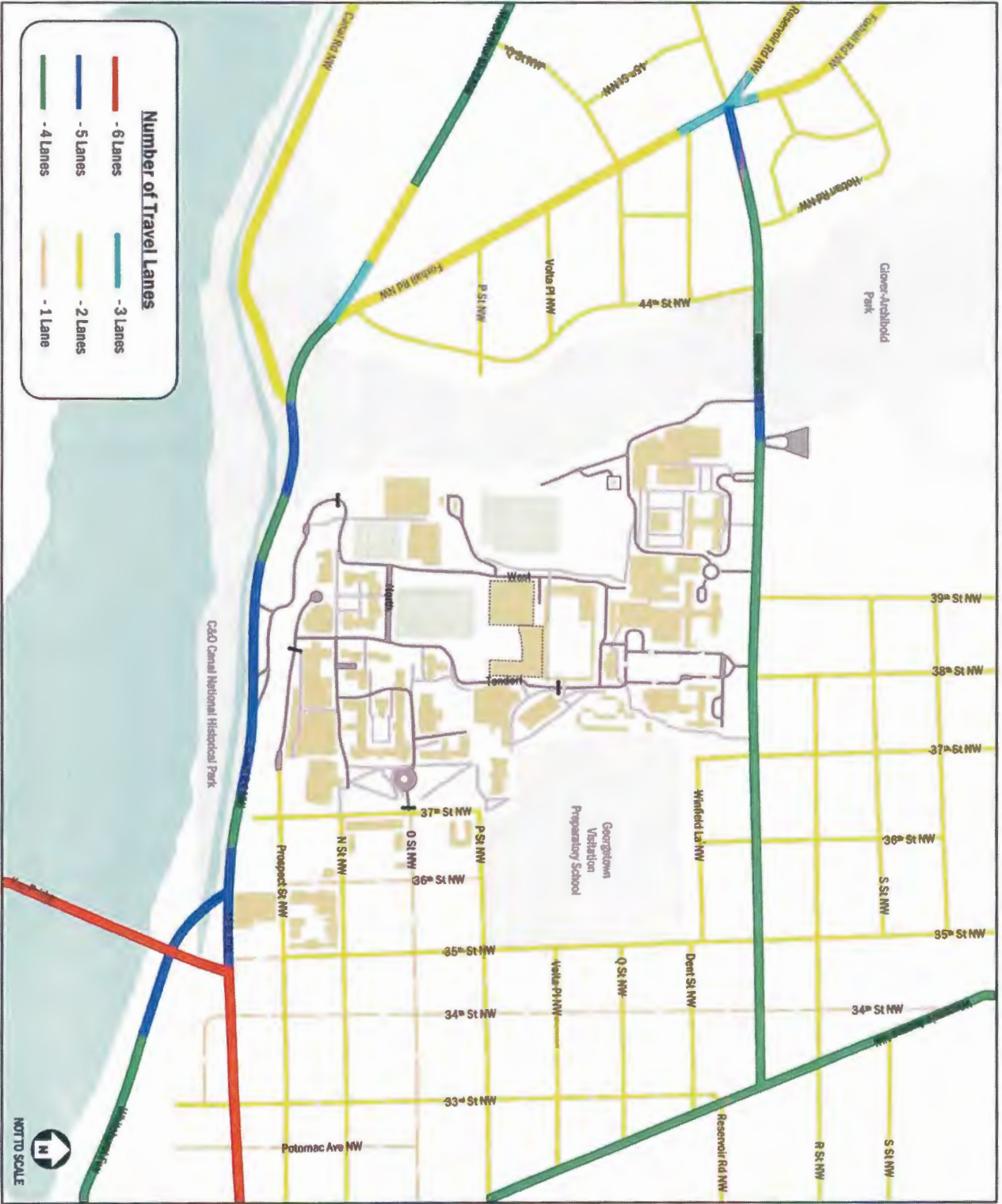


Figure 5: Existing Number of Travel Lanes for the GU Main Campus

- Canal Road

Canal Road runs along the southern border of the Georgetown campus. Canal Road is a 4-lane arterial east of Foxhall Road and a 2-lane arterial west of Foxhall Road. DDOT classifies the roadway as a principal arterial with an average annual weekday volume of 36,100 vehicles. Within the limits of the study area, Canal Road runs between Foxhall Road and Whitehurst Freeway.

- M Street

M Street is a 6-lane arterial (4-lanes during non-peak periods) located along the southern border of the Georgetown campus. DDOT classifies the roadway as a principal arterial with an average annual weekday volume of 24,200 vehicles. Within the limits of the study area, M Street runs between Whitehurst Freeway and Wisconsin Avenue.

- Foxhall Road

Foxhall Road is a 4-lane arterial located west of the Georgetown campus. DDOT classifies the roadway as a minor arterial with an average annual weekday volume of 19,800 vehicles south and 10,700 vehicles north of Reservoir Road. Within the limits of the study area, Foxhall Road runs between Reservoir Road and Canal Road.

- Reservoir Road

Reservoir Road is a 4-lane arterial located along the northern border of the Georgetown campus. DDOT classifies the roadway as a minor arterial. It has an average annual weekday volume of 17,700 vehicles west and 20,100 vehicles east of Foxhall Road. The average annual weekday volume is 17,800 vehicles between 39th Street and 38th Street and 9,700 vehicles east of 37th Street. Within the limits of the study area, Reservoir Road runs between Foxhall Road and Wisconsin Avenue.

- 39th Street

North of the Georgetown campus, 39th Street is a 2-lane roadway. DDOT classifies the roadway as a local road. Within the limits of the study area, 39th Street runs north from Reservoir Road.

- 38th Street

North of the Georgetown campus, 38th Street is a 2-lane roadway. DDOT classifies the roadway as a local road. Within the limits of the study area, 38th Street runs north from Reservoir Road.

- 37th Street

North of the Georgetown campus, 37th Street is a 2-lane roadway. DDOT classifies the roadway as a collector road with an average annual weekday volume of 2,400 vehicles. Within the limits of the study area, 37th Street runs north from Reservoir Road.

- Prospect Street

Prospect Street is a 2-lane roadway east of the Georgetown campus. DDOT classifies the roadway as a collector road with an average annual weekday volume of 3,200 vehicles. Within the limits of the study area, Prospect Street runs between 37th Street and Wisconsin Avenue.

Site access for the campus is provided by 6 gates that provide direct access to the campus. Figure 6 shows the primary access points on the GU campus. The primary access to the University is the Canal Road gate, which is located along the south side of campus. The gate is split into two roadways, with a stop-controlled outbound right-turn separated from a signalized intersection that provides full access inbound and a left-turn outbound from campus. Secondary access to the University is provided at the Prospect Street gate, which is located at the southeast corner of campus. The intersection is all-way stop-controlled at 37th Street. Access to the Hospital is provided at 4 gates along the north side of campus on Reservoir Road. Gates #4, #3, and #2 are stop-controlled. Gate #1 is a signalized intersection with the southbound approach of 38th Street.

Existing Traffic Volumes

Traffic counts were conducted at the key study intersections between the hours of 6:30 to 9:30 AM and 3:00 to 7:00 PM on typical weekdays. The results of the traffic counts are included in the Technical Attachments. The morning and afternoon peak hours for the system of intersections being studied occur between 7:45 am and 8:45 am and between 6:00 pm and 7:00 pm, respectively. Peak hour traffic volumes for the peak hour of the adjacent street traffic are shown on Figure 7 and Figure 8.

Table 1 shows the existing number of trips generated by the University and the Hospital during the morning and afternoon peak hours. These trips are grouped into those that enter the campus through the north gates located along Reservoir Road and the south gates located along Canal Road. As shown in the *Transportation Report* that accompanies this report, the trip generation trends on campus show a decrease in traffic using the southern gates, and an overall shift of traffic from the Prospect Street gate to Canal Road gate due to the addition of a traffic signal at the Canal Road gate.

Table 1: GU and GUH Campus Trip Generation

Gate Location	AM Peak Hour (7:45 am – 8:45 am)			PM Peak Hour (6:00 pm – 7:00 pm)		
	In	Out	Total	In	Out	Total
Reservoir Road	781	352	1,133	208	671	879
Canal Road	255	4	259	223	192	415
Total	1,036	356	1,392	431	863	1,294

The traffic volumes shown in Table 1 were used to estimate the percent of traffic on Canal Road and Reservoir Road adjacent to campus network that is travelling to and from the University and Hospital. This analysis was done by comparing the amount of traffic entering and exiting gates on Canal and Reservoir Roads to the total volume of vehicles that entered and exited the study area along the same roadways. The results of this analysis are contained in Table 2 and shown on Figure 9.

Table 2: Influence of Campus Traffic on Adjacent Streets

Gate Location	AM Peak Hour		PM Peak Hour	
	Into Study Area	Out Of Study Area	Into Study Area	Out Of Study Area
Reservoir Road	42.0%	26.5%	20.6%	43.8%
Canal Road	6.7%	0.01%	6.3%	5.3%

The results in the table show that commuter-based traffic dominates Canal Road. Even on the stretch of Canal Road adjacent to campus, GU accounts for less than 10% of the traffic entering and exiting the study area during commuter rush hours. GU- and GUH-based vehicles account for 6.7% and 6.3% of all traffic into the study area on Canal Road during the commuter weekday morning and afternoon peak hours, respectively. Traveling out of the study area, GU- and GUH-based vehicles account for 0.01% and 5.3% of all traffic on Canal Road during the commuter weekday morning and afternoon peak hours, respectively.

As would be expected, GU and GUH's influence on Reservoir is much higher, with Hospital and University traffic accounting for close to 30-45% of traffic on Reservoir Road adjacent to the campus during commuter rush hours. GU- and GUH-based vehicles account for 42.0% and 20.6% of all traffic into the study area on Reservoir Road during the commuter weekday morning and afternoon peak hours, respectively. Traveling out of the study area, GU- and GUH-based vehicles account for 26.5% and 43.8% of all traffic on Canal Road during the commuter weekday morning and afternoon peak hours, respectively.

Field Observations

Observations of the study intersections were performed by Gorove/Slade in order to determine the lane configurations and signal timings. During these observation periods, remarks were noted in regard to signal operation. The study area was observed on Monday and Tuesday, March 7 and 8, 2011 between 7:30 am and 9:00 am and between 4:30 pm and 6:00 pm.

- **Reservoir Road and Foxhall Road**

During the morning peak period, the intersection operated under unacceptable conditions. The majority of traffic was traveling north- and southbound on Foxhall Road. Consequently, these approaches appeared to incur the most delay, with long queues exceeding 10 vehicles developing during the red phase. Due to signal timings, the northbound approach appeared to be served during the green time, while the southbound approach was not fully served. The eastbound approach also appeared to incur significant delay, with long queues exceeding 10 vehicles developing during the red phase. The westbound approach appeared to incur little delay. Westbound queues of approximately 5-6 vehicles developed, with the majority of the queue waiting to turn left. This queue appeared to be served during the green time provided by a leading-left turn phase. The eastbound approach appeared to operate with a significant amount of delay due to the westbound left-turn phase. Queues of approximately 6-8 vehicles developed and were mostly served during the green time provided.

During the afternoon peak period, the intersection operated near capacity as well. The majority of traffic appeared to be traveling southbound on Foxhall Road. Consequently, the southbound approach appeared to incur the most delay with long queues exceeding 10 vehicles developing during the red phase. The northbound approach appeared to incur an acceptable amount of delay. Queues of approximately 8-10 vehicles developed but were served during the green time. The eastbound approach developed queues of approximately 4-6 vehicles. Westbound queues of approximately 5-6 vehicles developed, with the majority of the queue waiting to turn left. This east- and westbound queues appeared to be served during the green time provided.

Very little pedestrian activity was observed during the morning and afternoon peak periods.



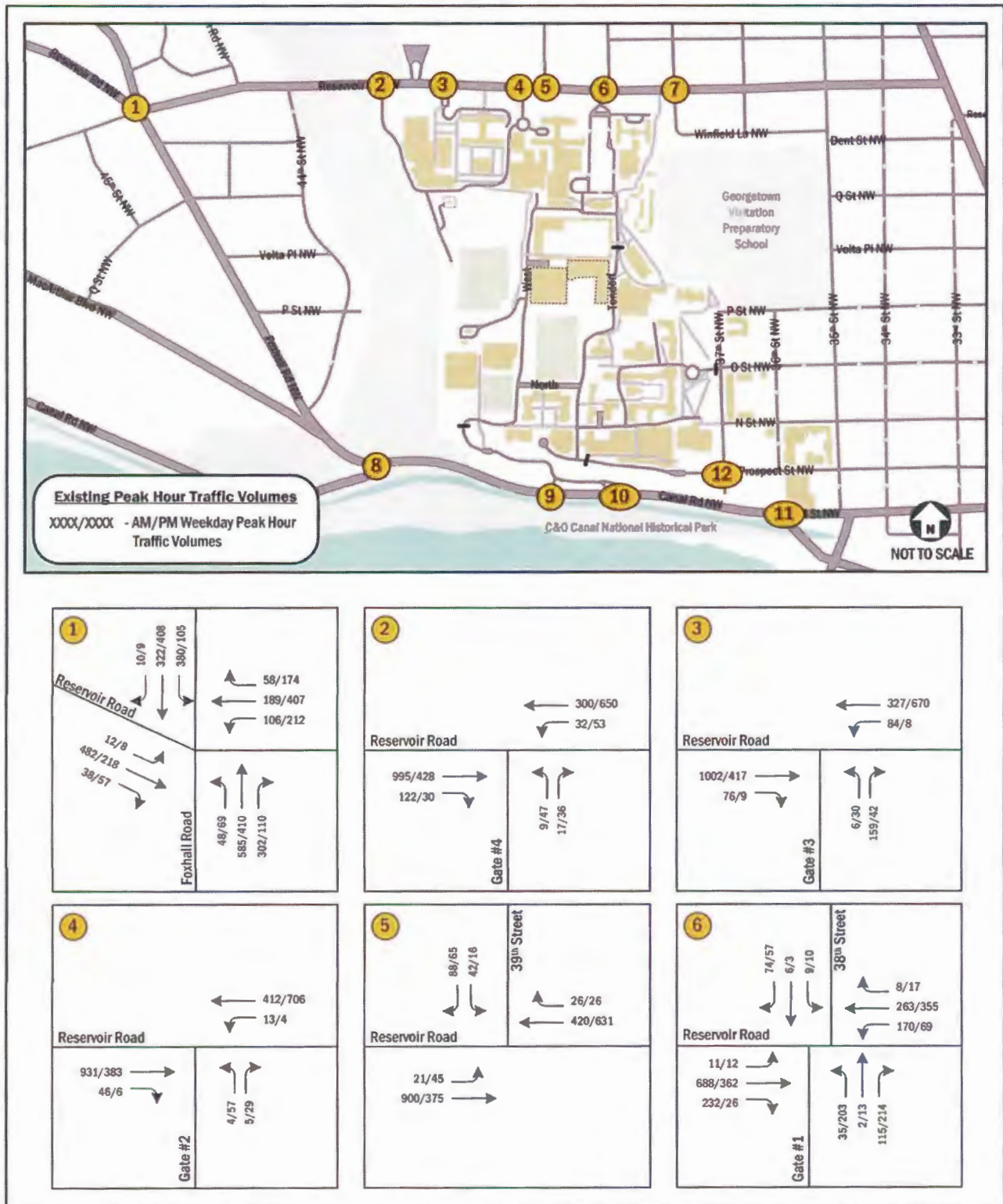


Figure 7: Existing Peak Hour Traffic Volumes (1 of 2)

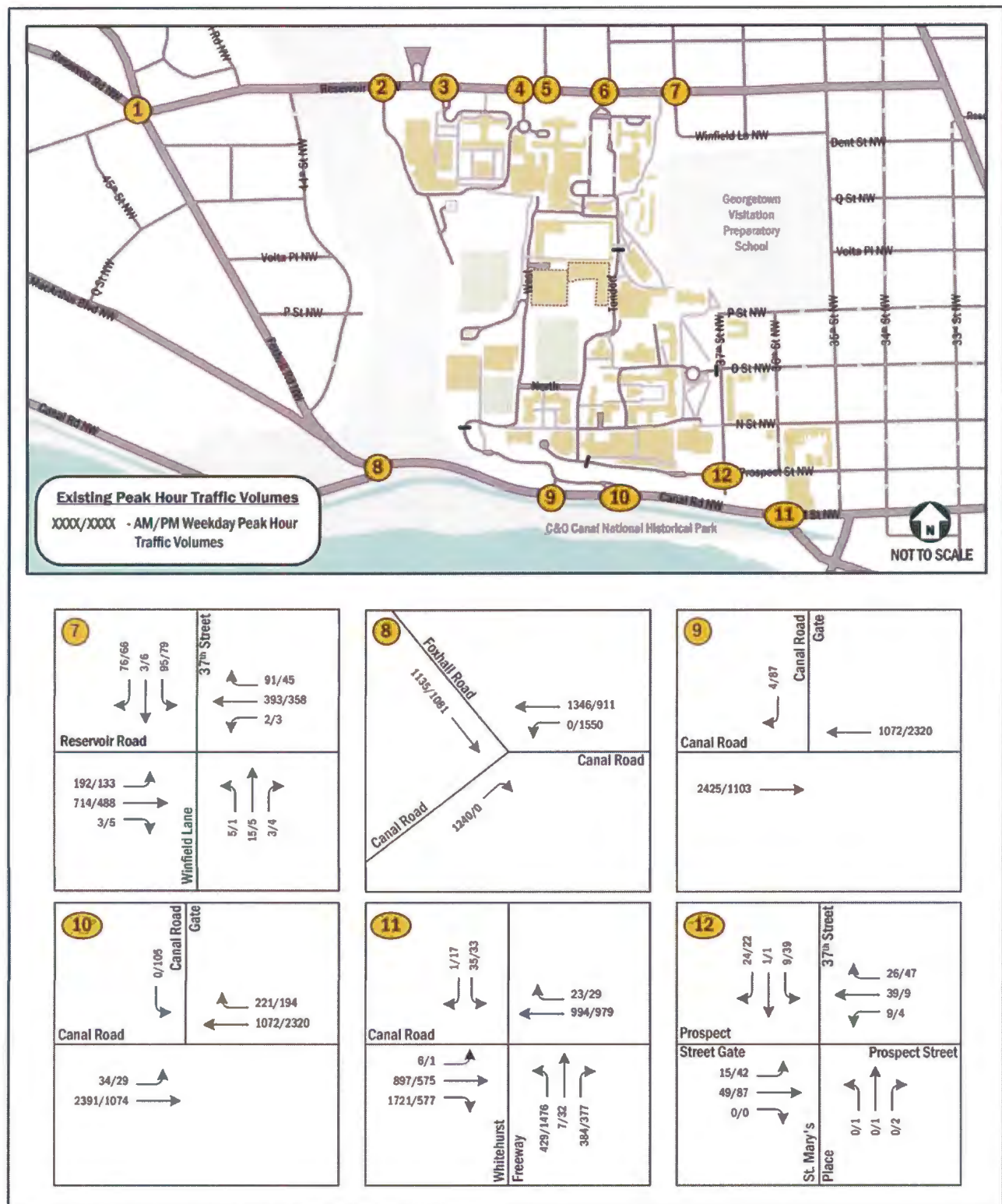


Figure 8: Existing Peak Hour Traffic Volumes (2 of 2)

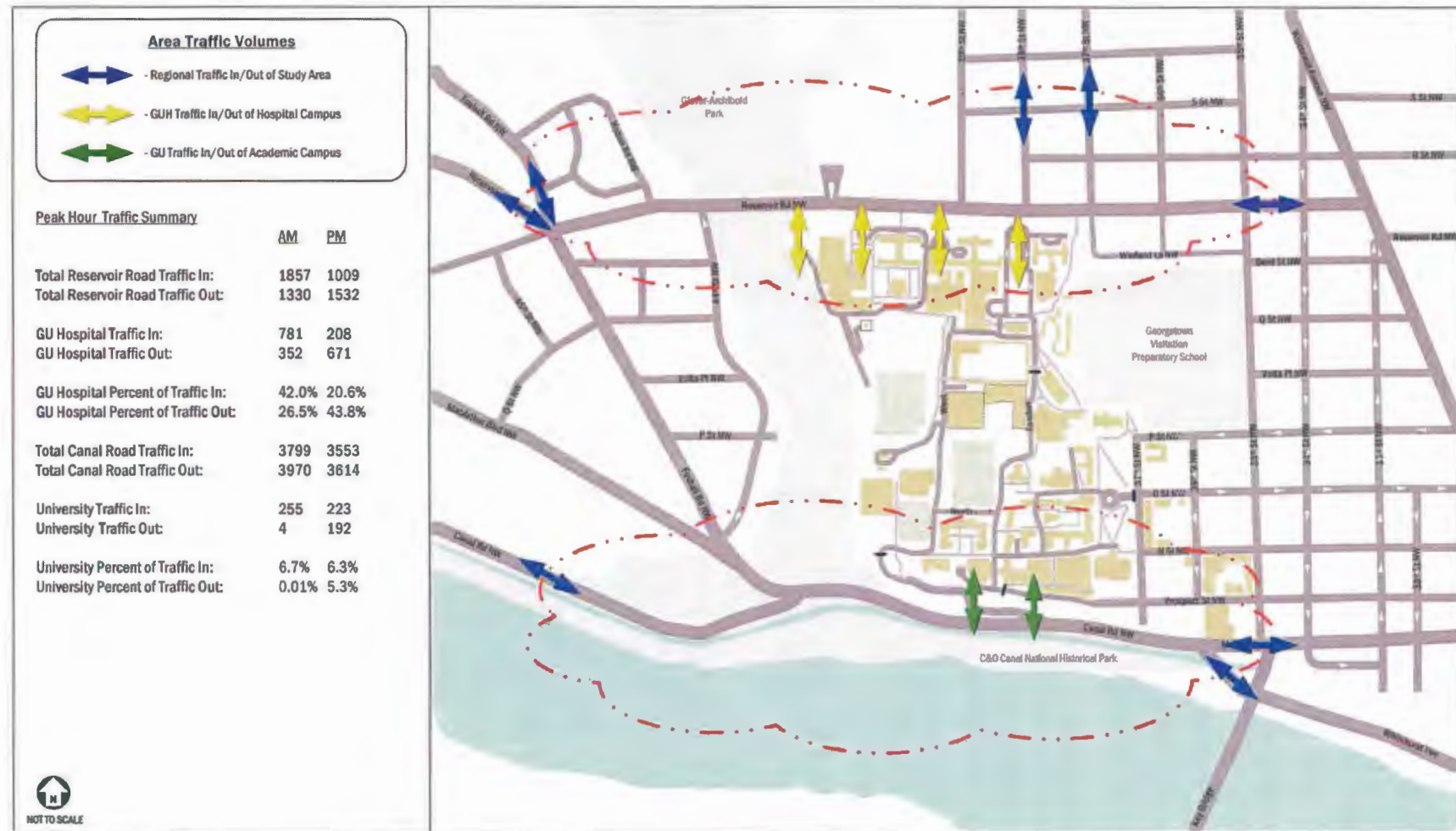


Figure 9: Area Traffic Volumes

- Reservoir Road and Gate #4

During the morning peak period, the intersection incurred little to no delay. The east- and westbound traffic appeared to experience little to no queue development. Occasional queues of 1-2 vehicles were observed due to vehicles turning into the Hospital. Few vehicles were observed exiting the Hospital.

During the afternoon peak period, the intersection experienced very little delay. The east- and westbound traffic experienced little to no queue development. Queues of approximately 2-3 vehicles developed at the Hospital exit. The queued vehicles incurred an acceptable amount of delay due to large gaps in traffic on Reservoir Road.

Very little pedestrian activity was observed during the morning and afternoon peak periods. However, a few pedestrians were observed traveling along Reservoir Road to and from the Hospital.

- Reservoir Road and Gate #3

During the morning peak period, the intersection incurred little to no delay. The east- and westbound traffic appeared to experience little to no queue development. However, queues of approximately 6-8 vehicles were observed along the northbound approach, exiting the Hospital, which incurred an unacceptable amount of delay.

During the afternoon peak period, the intersection experienced very little delay. The east- and westbound traffic experienced little to no queue development. Queues of approximately 2-3 vehicles developed at the Hospital exit. The queued vehicles incurred an acceptable amount of delay due to large gaps in traffic on Reservoir Road.

Very little pedestrian activity was observed during the morning and afternoon peak periods. However, a few pedestrians were observed traveling along Reservoir Road to and from the Hospital.

- Reservoir Road and Gate #2

During the morning peak period, the intersection incurred little to no delay. The east- and westbound traffic appeared to experience little to no queue development. Occasional queues of 1-2 vehicles were observed due to vehicles turning into the Hospital. Few vehicles were observed exiting the Hospital.

During the afternoon peak period, the intersection experienced very little delay. The east- and westbound traffic experienced little to no queue development. Queues of approximately 2-3 vehicles developed at the Hospital exit. The queued vehicles incurred an acceptable amount of delay due to large gaps in traffic on Reservoir Road.

Very little pedestrian activity was observed during the morning and afternoon peak periods. However, a few pedestrians were observed traveling along Reservoir Road to and from the Hospital.

- Reservoir Road and 39th Street

During the morning peak period, the intersection experienced very little delay. The east- and westbound traffic appeared to experience little delay, though queues of approximately 3-4 vehicles developed during the southbound green time. Southbound queues of approximately 2-3 vehicles developed but were served during the green phase.

During the afternoon peak period, the intersection experienced very little delay. The east- and westbound traffic developed queues of approximately 4-6 vehicles developed during the southbound green time. Southbound queues of approximately 1-2 vehicles developed but were served during the green phase.

Occasional pedestrian activity was observed during the morning and afternoon peak hour traveling along Reservoir Road to and from the Hospital.

- Reservoir Road and 38th Street/Gate #1

During the morning peak period, the intersection experienced very little delay. The east- and westbound traffic experienced little delay, although queues of approximately 3-4 vehicles developed during the north- and southbound green time. Queues of approximately 1-2 vehicles occasionally developed on the westbound approach due to vehicles turning left into the Hospital. Northbound and southbound queues of approximately 4-5 vehicles and 2-3 vehicles, respectively, developed but were served during the green phase.

During the afternoon peak period, the intersection experienced an unacceptable amount of delay due to the north- and southbound approaches. The east- and westbound traffic experienced little delay, although queues of approximately 4-6 vehicles developed during the north- and southbound green time. North- and southbound queues of approximately 8-10 vehicles developed, and the majority were not served during the green time. This was due to the lack of green time provided to the north- and southbound approaches in order to prioritize vehicular traffic on Reservoir Road.

Some pedestrian activity was observed traveling toward the Hospital during the morning peak period and away from Hospital during the afternoon peak period. The majority of pedestrians appeared to jaywalk across Reservoir Road during gaps in traffic instead of waiting for the walk signal.

- Reservoir Road and 37th Street/Winfield Lane

During the morning peak period, the intersection experienced an overall acceptable amount of delay. The east- and westbound traffic experienced little delay. Queues of approximately 3-4 vehicles developed during the north- and southbound green time. Northbound queues of approximately 3-4 vehicles developed but were served during the green phase. Southbound queues of approximately 8-10 vehicles developed, and the majority were not served during the green time. This was due to the lack of green time provided to the north- and southbound approaches in order to prioritize vehicular traffic on Reservoir Road.

During the afternoon peak period, the intersection experienced an overall acceptable amount of delay. The east- and westbound traffic experienced little delay. Queues of approximately 4-6 vehicles developed during the north- and southbound green time. Occasional northbound queues of approximately 1-2 vehicles developed. Southbound queues of approximately 6-8 vehicles developed, and the majority were served during the green time provided. However, similar to the morning peak period, a lack of green time provided to the north- and southbound approaches in order to prioritize vehicular traffic on Reservoir Road led to unacceptable delays on the southbound approach.

Some pedestrian activity was observed traveling toward the Hospital during the morning peak period and away from Hospital during the afternoon peak period. The majority of pedestrians appeared to jaywalk across Reservoir Road during gaps in traffic instead of waiting for the walk signal.

- Foxhall Road and Canal Road

During the morning peak period, the intersection operated at capacity. During the morning peak period, Canal Road west of Foxhall Road is one-way inbound to DC. At the intersection of Foxhall Road and Canal Road, the northeast-bound approach of Canal Road becomes 2 right-turn lanes and the westbound left-turn is prohibited. The northeast-bound approach of Canal Road and the eastbound approach of Foxhall Road appeared to experience a significant amount of delay. Long queues exceeding 10 vehicles per lane developed for the

northeast-bound and eastbound approaches. However, a significant amount of the queue was served during the green time provided. The westbound approach experienced no delay due to the configuration of the intersection.

During the afternoon peak period, the intersection experienced an overall acceptable amount of delay. During the afternoon peak period, Canal Road west of Foxhall Road is one-way outbound from downtown DC. At the intersection of Foxhall Road and Canal Road, the northeast-bound approach of Canal Road becomes 1-way southwest-bound and the westbound approach becomes 1 left-turn lane, 1 shared left/through lane, and 1 through lane. Heavy volumes of traffic traveling westbound and turning left on Canal Road and traveling southbound on Foxhall Road were observed. Queues of approximately 6-8 vehicles developed in the westbound left-turn lanes, but the queue was served during the green time provided. The eastbound approach also experienced an unacceptable amount of delay due green time given to the westbound left-turn phase. Queues of greater than 10 vehicles developed during the westbound left-turn phase.

Very little pedestrian activity was observed during the morning and afternoon peak periods.

- Canal Road and Canal Road Gate (Unsignalized)

During the morning peak period, the intersection experienced very little delay. The southbound approach experienced very little delay, with few cars exiting the University. The east- and westbound approaches experienced no delay.

During the afternoon peak period, the intersection also experienced an acceptable amount of delay. The east- and westbound approaches experienced no delay, though occasional queues extended from adjacent intersections. Vehicles exiting the University appeared to be able to turn within an acceptable amount of time due to gaps in westbound traffic.

Very little pedestrian activity was observed during the morning and afternoon peak hours.

- Canal Road and Canal Road Gate (Signalized)

During the morning peak period, the intersection experienced very little delay. During the morning peak period, the southbound approach of the University exit is closed. Due to this configuration, the eastbound approach free-flows through the intersection and experiences no delay. The westbound approach experienced a small amount of delay, with queues of approximately 4-6 vehicles developing during the eastbound left-turn phase.

During the afternoon peak period, the intersection also experienced an acceptable amount of delay. The east- and westbound approaches experienced an acceptable amount of delay, with queues of approximately 6-8 vehicles developing during the southbound green phase. Occasional eastbound queues extended from the intersection of Canal Road/M Street and Whitehurst Freeway. The southbound approach operated with an acceptable amount of delay as well, with queues of approximately 4-6 vehicles. Vehicles exiting the University turning left onto Canal Road/M Street appeared to experience delay due to the queues extending from the downstream intersection.

Occasional pedestrian activity was observed during the morning and afternoon peak hours, with the majority of pedestrians traveling to and from the University.

- Canal Road/M Street and Whitehurst Freeway

During the morning peak period, the intersection operated at capacity. The eastbound approach experienced a significant amount of delay, with long queues exceeding 10 vehicles developing during the north- and southbound green phases. Queues of approximately 4-6 vehicles developed on the westbound approach during the north- and southbound green phases. The northbound approach was heavily trafficked with vehicles turning onto Canal Road and M Street. Queues of approximately 8-10 vehicles developed but appeared to be served during the green time. Very little traffic was observed on the southbound approach with little to no queue development.

During the afternoon peak period, the intersection operated near capacity. The east- and westbound approaches experienced an acceptable amount of delay, with queues of approximately 8-10 vehicles developing during the north- and southbound green phases. However, a significant amount of the queue was served during the green time. The northbound approach was heavily trafficked with vehicles turning onto Canal Road and M Street. Queues exceeding 10 vehicles developed, but they were mostly served during the green time provided. Very little traffic was observed on the southbound approach with little to no queue development.

Occasional pedestrian activity was observed crossing Canal Road/M Street during the morning and afternoon peak periods. Pedestrians crossed only during the walk time due to heavy traffic on the east- and westbound approaches.

- Prospect Street & 37th Street

During the morning peak period, the intersection experienced very little delay. Queues of approximately 1-2 vehicles occasionally developed on the west- and southbound approaches.

During the morning peak period, the intersection experienced very little delay as well. Queues of approximately 1-2 vehicles occasionally developed on the east- and southbound approaches.

Significant pedestrian activity was observed during the morning and afternoon peak periods, with the majority traveling towards and away from the University, respectively.

Existing Capacity Analysis

Intersection capacity analyses were performed for the existing conditions at the intersections contained within the study area during the morning and afternoon peak hours. *Synchro, Version 7.0* was used to analyze the study intersections based on the Highway Capacity Manual (HCM) methodology. The results of the capacity analyses are expressed in level of service (LOS) and delay (seconds per vehicle) for each approach. A LOS grade is a letter grade based on the average delay (in seconds) experienced by motorists traveling through an intersection. LOS results range from "A" being the best to "F" being the worst. LOS E is typically used as the acceptable LOS threshold in the District; although LOS F is sometimes accepted in urbanized areas.

The existing LOS capacity analyses were based on: (1) the existing lane use and traffic controls; (2) the peak hour turning movement volumes; and (3) the Highway Capacity Manual (HCM) methodologies (using *Synchro 7* software). An average delay (of each approach) and LOS for the signalized intersections is also shown for an overall intersection LOS grade. The HCM does not give guidelines for calculating the average delay for a two-way stop-controlled intersection, as the approaches without stop signs would technically have no delay. Detailed LOS descriptions and the analysis worksheets are contained in the Technical Attachments.

Table 3 shows the results of the capacity analyses, including LOS and average delay per vehicle (in seconds). The existing capacity analysis results are also shown on Figure 10 and Figure 11. The capacity analyses results indicate that the majority study area intersections operate at acceptable levels of service during both the morning and afternoon peak hours. However, during the morning peak period, the intersection of Reservoir Road and Foxhall Road operates at unacceptable levels of service. Additionally, the intersection of Reservoir Road and 38th Street/Gate #1 operates at unacceptable levels of service during the afternoon peak period.

Table 3: Existing Levels of Service

Intersection	Approach	Existing Conditions (2011)			
		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS
Reservoir Rd & Foxhall Rd	Overall	96.8	F	68.7	E
	Eastbound	185.9	F	43.3	D
	Westbound	39.8	D	44.0	D
	Northbound	82.7	F	26.6	C
	Southbound	76.9	E	167.4	F
Reservoir Rd & Gate #4	Westbound Left	3.7	A	2.3	A
	Northbound	32.2	D	23.1	C
Reservoir Rd & Gate #3	Westbound Left	7.2	A	0.4	A
	Northbound	143.2	F	15.8	C
Reservoir Rd & Gate #2	Westbound Left	1.5	A	0.2	A
	Northbound	36.4	E	18.6	C
Reservoir Rd & 39 th St	Overall	10.6	B	6.7	A
	Eastbound	9.3	A	4.4	A
	Westbound	6.7	A	3.9	A
	Southbound	33.2	C	41.2	D
Reservoir Rd & 38 th St/Gate #1	Overall	7.3	A	105.4	F
	Eastbound	0.7	A	0.6	A
	Westbound	4.0	A	2.2	A
	Northbound	37.9	D	305.9	F
	Southbound	39.5	D	122.8	F
Reservoir Rd & 37 th St/Winfield Ln	Overall	24.3	C	14.5	B
	Eastbound	3.3	A	2.6	A
	Westbound	3.8	A	3.2	A
	Northbound	40.4	D	39.2	D
	Southbound	189.0	F	93.0	F
Foxhall Rd & Canal Rd	Overall	25.3	C	52.3	D
	Eastbound	29.0	C	154.7	F
	Westbound	0.3	A	7.3	A
	Northbound	49.0	D	--	--
Canal Rd & Canal Rd Gate (Unsignalized)	Westbound Left	12.1	B	21.5	C
Canal Rd & Canal Rd Gate (Signalized)	Overall	1.4	A	15.4	B
	Eastbound	1.4	A	3.8	A
	Westbound	1.4	A	18.9	B
	Southbound	--	--	54.6	D

Intersection	Approach	Existing Conditions (2011)			
		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS
Canal Rd/M St & Whitehurst Fwy/36 th St	Overall	65.2	E	49.8	D
	Eastbound	91.0	F	37.2	D
	Westbound	22.1	C	47.5	D
	Northbound	36.9	D	58.6	E
	Southbound	50.0	D	57.4	E
Prospect St & 37 th St	Overall	7.4	A	7.8	A
	Eastbound	7.6	A	8.1	A
	Westbound	7.4	A	7.1	A
	Northbound	0.0	A	7.3	A
	Southbound	7.1	A	7.7	A

For the purpose of this analysis, it is desirable to achieve a level of service (LOS) of "E" or better on each approach. The capacity analyses results indicate that the following intersections have movements that operate at unacceptable LOS during one or more peak periods:

- Reservoir Road and Foxhall Road;
- Reservoir Road and Gate #3;
- Reservoir Road and 38th Street/Gate #1;
- Reservoir Road and 37th Street/Winfield Lane;
- Canal Road and Foxhall Road; and
- Canal Road and Whitehurst Freeway.

The results from the capacity analyses generally confirm what was observed in the field.

- The intersection of Reservoir Road and Foxhall Road operates at unacceptable conditions during the morning peak hour due to the eastbound and southbound movements. This corresponds to the long queue observed for the southbound approach, which was not served during the green time provided, as well as the significant eastbound queue. The intersection also operates at unacceptable conditions during the afternoon peak hour due to the southbound movement. This corresponds to the long queue observed in the field.
- The north- and southbound approaches of Reservoir Road and 38th Street/Gate #1 operate at unacceptable conditions during the afternoon peak hour. This corresponds to the queues observed in the field due to signal timings.
- The southbound approach of Reservoir Road and 37th Street/Winfield Lane operates at unacceptable conditions during the morning peak hour. This corresponds to the southbound queue observed in the field.
- The westbound-bound approach of Canal Road and Foxhall Road operates at unacceptable conditions during the afternoon peak hour. This delay corresponds to the significant queue seen in the field.

- The intersection of Canal Road and Whitehurst Freeway operates at unacceptable conditions during the morning peak hour due to the eastbound approach. This corresponds to the long queues observed during the northbound and southbound green phases.

Comparison of 2011 and 2000 Capacity Analysis Results

The results of the existing capacity analysis show improvements in LOS in comparison with the existing conditions capacity analysis from the 2000 Campus Master Plan. The analysis consisted of seven intersections located near campus along Reservoir Road. Table 4 shows the level of service results from the 2000 Campus Master Plan.

Table 4: Level of Service Results from 2000 Campus Plan

Intersection	Approach	Campus Plan (2000)			
		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS
Reservoir Rd & 37 th St	Overall	27.3	C	11.4	B
Reservoir Rd & 38 th St/Gate #1	Overall	14.6	B	10.8	B
Reservoir Rd & 39 th St	Overall	11.7	B	8.4	A
Reservoir Rd & Gate #2	Eastbound	12.6	B	8.8	A
	Westbound	12.6	B	8.8	A
	Northbound	36.2	E	18.5	C
Reservoir Rd & Gate #3	Eastbound	12.4	B	8.6	A
	Westbound	12.4	B	8.6	A
	Northbound	27.9	D	18.3	C
Reservoir Rd & The French Embassy	Eastbound	8.4	A	9.3	A
	Westbound	8.4	A	9.3	A
	Northbound	24.9	C	20.2	C
Reservoir Rd & Gate #4	Eastbound	15.0	B	8.5	A
	Westbound	15.0	B	8.5	A
	Northbound	39.4	E	30.6	D
Reservoir Rd & Foxhall Rd	Overall	151.9	F	83.7	F

The following changes in LOS are outlined below:

- Reservoir Road and 37th Street
No significant changes.
- Reservoir Road and 38th Street/Gate #1
Morning peak hour LOS improved from LOS B in 2000 to LOS A in 2011. Afternoon peak hour LOS degraded from LOS B in 2000 to LOS F in 2011.
- Reservoir Road & 39th Street
No significant changes.
- Reservoir Road & Gate #2
No significant changes.

- Reservoir Road & Gate #3
Morning peak hour LOS for the northbound approach degraded from LOS D in 2000 to LOS F in 2011.
- Reservoir Road & The French Embassy
Intersection not analyzed in this report.
- Reservoir Road & Gate #4
Morning peak hour LOS for the northbound approach improved from LOS E in 2000 to LOS D in 2011, and afternoon peak hour LOS improved from LOS D in 2000 to LOS C in 2011.
- Reservoir Road & Foxhall Road
Morning peak hour LOS remained F but improved from 151.9 seconds of delay per vehicle in 2000 to 96.8 seconds in 2011. Afternoon peak hour LOS improved from LOS F in 2000 to LOS E in 2011.

Changes in LOS between the 2000 and 2011 capacity analyses are due to several factors, including changes in traffic volumes and traffic patterns, as well as changes to signal timings. Changes in LOS between the capacity analyses could also be due to improvements in the software used to estimate the delays and levels of service of the study area intersections.

As shown in the *Transportation Report* that accompanies this report, the trip generation trends on campus show a decrease in traffic using the southern gates, and an overall shift of traffic from the Prospect Street gate to Canal Road gate due to the addition of a traffic signal at the Canal Road gate. These shifts in traffic have a minimal impact to the LOS results at adjacent intersections.

Overall, signal timing changes have had the largest impact, demonstrating that the poor LOS results for side street traffic on Reservoir Road are attributable to choices in signal timing strategies by the District to favor through traffic on Reservoir Road. This report does not recommend any non-operational mitigation measures for these delays, such as adding capacity by widening side streets.

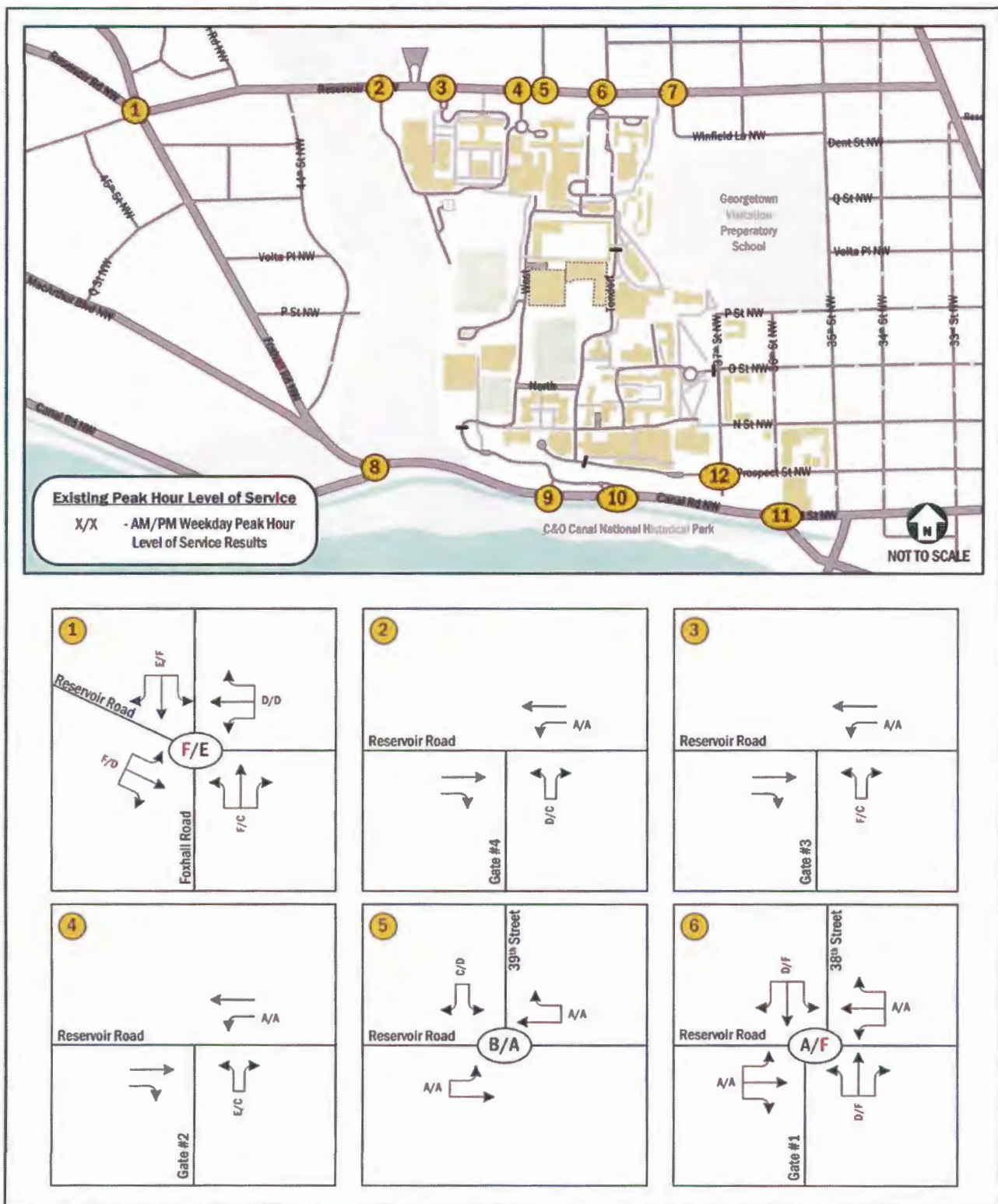


Figure 10: Existing Peak Hour Levels of Service (1 of 2)

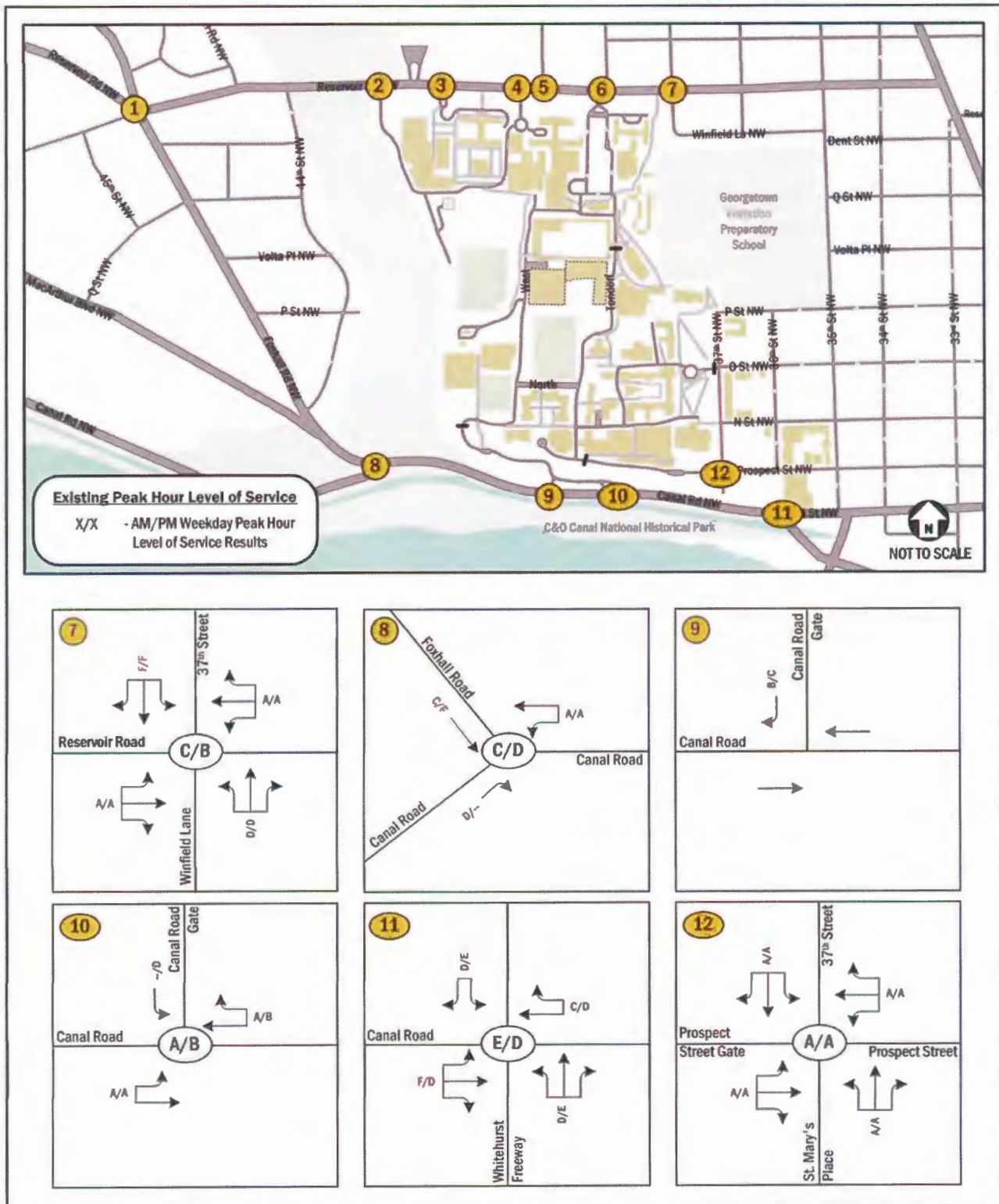


Figure 11: Existing Peak Hour Levels of Service (2 of 2)

FUTURE CONDITIONS WITH CAMPUS PLAN

Future with Campus Plan Traffic Volumes

The 2011-2020 Georgetown University Campus Plan projects the future growth and development on the campus for 2011-2020. The future conditions with the proposed Campus Plan generally include the traffic generated by background developments located near the University and inherent growth on the roadways. However, no approved background developments are located near the University and inherent growth on the adjacent roadways is assumed to be minimal due to existing capacity constraints.

The 2011- 2020 Georgetown University Campus Plan includes several development sites on campus to improve facilities and infrastructure improvements to improve circulation. GU expects a targeted growth in graduate student programs and no increase in undergraduate or medical students. Faculty and staff at the University and Hospital are expected to grow by approximately 10% by the end of the campus plan.

The Campus Plan also includes significant transportation infrastructure changes. This includes constructing new roadways to allow for better circulation on campus, including GUTS shuttles; establishing a more pedestrian-friendly environment on the east side of campus, including along Tondorf Drive; and increasing the parking cap to alleviate pressures on the Campus to accommodate Hospital and University visitors.

The *Transportation Report* identifies the locations of development areas in the Campus Plan. The *2010-2020 Georgetown University Campus Plan* provides a more detailed description of the proposed development.

Parking Increase

As previously stated, the University has a campus wide parking cap that limits the total number of parking spaces to 4,080, which was established in 1990 in order to reduce the University's impact on traffic in the surrounding neighborhood. In the Master Plan, the University is seeking to increase their parking capacity to 5,080 spaces. The increase in 1,000 spaces would be split between the Hospital (750 spaces) and academic portion (250 spaces) of the University.

Trip Generation

In order to evaluate the impact of the proposed additional spaces, trips were generated for the morning and afternoon peak hours. The trip generation rates were determined for the University based on existing count data at the University gates. Trips into and out of the University were determined based on the volume of vehicles at the gates on the south side of campus and the number of parking spaces accessible. It was assumed that visitors to the University would follow similar trip patterns as existing trips.

This report uses this methodology, basing future trips on the increase in parking supply, because the current parking supply is much less than the potential parking demand. Thus, this report assumes that these new spaces added to the supply will generate a proportional increase in traffic. An alternative would be to generate new trips based on the expected increase in faculty/staff, visitor and graduate student populations. This methodology was not selected because it would not account for any latent demand not already being served because of the constrained supply. Since the University plans on limiting the amount of faculty/staff that use the proposed increase in supply, the trip generation methodology used can be considered a conservative estimate of trips as the visitors and graduate students projected to use the new parking supply will likely generate fewer peak hour trips.

The trip generation rates for the Hospital visitors were assembled in a similar fashion, by comparing the trips generated per space at existing visitor parking at the Hospital. Existing patterns of vehicular trips entering and existing visitor parking facilities were obtained from count data in the *Transportation Management Plan for Georgetown University Hospital* prepared by O.R. George & Associates, Inc. on June 17, 2010. These trips and an inventory of existing visitor spaces were used to calculate an average trip generation rate for the Hospital.

Table 5 shows the trip generation rates determined for the morning and afternoon peak periods for the University and Hospital trips added by the Campus Plan.

Table 6 shows the trips generated by the additional parking spaces for the morning and afternoon peak periods of the adjacent street traffic and of the University, respectively.

Table 5: Trip Generation Rate Calculated for Peak Period of Adjacent Street Traffic

Parking Use	Trip Generation Rate (Trips/Parking Space)					
	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
University	0.25	0.05	0.30	0.20	0.25	0.45
Medical	0.20	0.05	0.25	0.05	0.25	0.30

Table 6: Trips Generated By Parking Increase for Peak Period of Adjacent Street Traffic

Parking Use	Number of Spaces	Trip Generation					
		AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
University	250 spaces	63	13	76	50	63	113
Hospital	750 spaces	150	38	188	38	189	227
Total	1,000 spaces	213	51	264	88	252	340

Trip Distribution

A trip distribution was also determined based on the existing count data for the University gates and nearby intersections. Based on existing traffic patterns, roadway configurations, and the separation of academic and medical uses within the University, separate trip distributions were calculated for the academic and medical parking spaces. Figure 12 and Figure 13 show the trip distributions calculated for the academic and medical uses, respectively.

These new trips generated were added to the existing volumes in order to determine the total future traffic conditions. As stated previously, no background growth was assumed. The total future traffic volumes with the additional 1,000 parking spaces for the morning and afternoon peak periods are shown on Figure 14 and Figure 15.

Future with Campus Plan Capacity Analysis

Vehicular Capacity Analysis

Intersection capacity analyses were performed for the future conditions with development at the intersections contained within the study area during the morning and afternoon peak hours. *Synchro, Version 7.0* was used to analyze the study intersections based on the Highway Capacity Manual (HCM) methodology, as outlined previously. The LOS capacity analyses for the future conditions with development were based on: (1) the existing lane use and traffic controls; (2) the peak hour turning movement volumes described previously and (3) the Highway Capacity Manual (HCM) methodologies

(using *Synchro 7* software). Detailed LOS descriptions and the analysis worksheets are contained in the Technical Attachments.

Table 7 shows the results of the capacity analyses, including LOS and average delay per vehicle (in seconds). The capacity analysis results are also shown on Figure 16 and Figure 17. The capacity analyses results indicate that the majority study area intersections operate at acceptable levels of service during both the morning and afternoon peak hours. However, during the morning peak period, the intersection of Reservoir Road and Foxhall Road operates at unacceptable levels of service. Additionally, the intersection of Reservoir Road and 37th Street/Gate #1 operates at unacceptable levels of service during the afternoon peak period.

Table 7: Future with Campus Plan Vehicular Levels of Service

Intersection	Approach	Total Future Conditions (2020)			
		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS
Reservoir Rd & Foxhall Rd	Overall	111.6	F	71.7	E
	Eastbound	200.3	F	43.4	D
	Westbound	43.8	D	52.7	D
	Northbound	109.6	F	26.7	C
	Southbound	81.8	F	170.1	F
Reservoir Rd & Gate #4	Westbound Left	3.8	A	2.2	A
	Northbound	38.5	E	24.9	C
Reservoir Rd & Gate #3	Westbound Left	7.8	A	0.4	A
	Northbound	220.1	F	16.5	C
Reservoir Rd & Gate #2	Westbound Left	1.6	A	0.2	A
	Northbound	43.1	E	19.5	C
Reservoir Rd & 39 th St	Overall	10.9	B	6.9	A
	Eastbound	9.9	A	4.4	A
	Westbound	7.0	A	4.5	A
	Southbound	33.2	C	41.2	D
Reservoir Rd & 38 th St/Gate #1	Overall	7.8	A	162.3	F
	Eastbound	0.9	A	0.6	A
	Westbound	4.4	A	2.3	A
	Northbound	39.6	D	393.3	F
	Southbound	39.5	D	137.6	F
Reservoir Rd & 37 th St/Winfield Ln	Overall	30.4	C	14.1	B
	Eastbound	3.5	A	3.1	A
	Westbound	4.0	A	3.2	A
	Northbound	40.4	D	39.2	D
	Southbound	233.4	F	96.0	F
Foxhall Rd & Canal Rd	Overall	28.1	C	56.7	E
	Eastbound	29.5	C	168.2	F
	Westbound	0.4	A	8.1	A
	Northbound	57.7	E	--	--
Canal Rd & Canal Rd Gate (Unsignalized)	Westbound Left	12.3	B	23.7	C
Canal Rd & Canal Rd Gate (Signalized)	Overall	1.5	A	19.1	B
	Eastbound	1.5	A	4.1	A
	Westbound	1.7	A	22.9	C

Intersection	Approach	Total Future Conditions (2020)			
		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS
Canal Rd/M St & Whitehurst Fwy/36 th St	Southbound	--	--	71.4	E
	Overall	70.8	E	54.9	D
	Eastbound	101.3	F	39.6	D
	Westbound	23.5	C	55.7	E
	Northbound	37.5	D	64.1	E
	Southbound	50.0	D	57.5	E
Prospect St & 37 th St	Overall	7.5	A	7.8	A
	Eastbound	7.6	A	8.2	A
	Westbound	7.4	A	7.1	A
	Northbound	0.0	A	7.3	A
	Southbound	7.2	A	7.8	A

For the purpose of this analysis, a LOS of E or better is considered acceptable. A LOS of F indicates unacceptable conditions. The capacity analyses results indicate the following:

- All study intersections operate at acceptable LOS during the morning and afternoon peak hours of the adjacent street traffic, except for the intersection of Reservoir Road and Foxhall Road during the morning peak period and the intersection of Reservoir Road and 38th Street/Gate #1 during the afternoon peak period. Both of these intersections operate with unacceptable LOS for the existing conditions scenario and experience minimal impact of the Campus Plan.
- Several individual approaches continue to operate at unacceptable LOS during one or more peak hour including:
 - Reservoir Road and Foxhall Road;
 - Reservoir Road and Gate #3;
 - Reservoir Road and 38th Street/Gate #1;
 - Reservoir Road and 37th Street/Winfield Lane;
 - Canal Road and Foxhall Road; and
 - Canal Road and Whitehurst Freeway.
- In the future scenario with the development of the Campus Plan, the southbound approach of Foxhall Road at Reservoir Road degrades from LOS E in the existing to LOS F.
- The majority of traffic congestion is due to the heavy commuter traffic flow through the intersections surrounding campus.

Recommendations and Mitigation Measures

The traffic generated by the Campus Plan does not create unacceptable conditions at any additional locations compared to the existing conditions, with the exception of the southbound approach of Foxhall Road at Reservoir Road. Thus the Campus Plan has a minimal impact to the surrounding roadway network.

With the addition of 1,000 net new parking spaces (750 for the Hospital and 250 for the University), there is not a sizeable change to University gate operations. The largest change in traffic conditions is projected for the intersection of Reservoir Road and 38th Street/Gate #1, with an increase in delay for vehicles exiting the Hospital. Additionally, vehicles will experience a higher delay than the existing conditions entering and exiting the Hospital at the other gates along Reservoir Road during the morning and afternoon peak hours, respectively. There may be small impacts to the non-campus traffic, but the most significant impacts will be on the campus users. Intersections in the surrounding area that operate poorly today are projected to operate slightly worse in the future with the parking increase.

Signal timing improvements could alleviate some delays at the following intersections, as shown in Table 8:

- Reservoir Road and 38th Street/Gate #1
- Reservoir Road and 37th Street/Winfield Lane
- Foxhall Road and Canal Road
- Canal Road/M Street & 36th Street/Whitehurst Freeway

Table 8: Future with Campus Plan Vehicular Levels of Service with Signal Timing Improvements

Intersection	Approach	Total Future Conditions (2011)			
		AM Peak Hour		PM Peak Hour	
		Delay	LOS	Delay	LOS
Reservoir Rd & 38 th St/Gate #1	Overall	8.0	A	18.5	B
	Eastbound	3.0	A	17.7	B
	Westbound	4.7	A	21.8	C
	Northbound	32.2	C	17.3	B
	Southbound	32.5	C	11.7	B
Reservoir Rd & 37 th St/Winfield Ln	Overall	14.4	B	11.3	B
	Eastbound	11.2	B	8.1	A
	Westbound	11.4	B	9.5	A
	Northbound	25.7	C	25.4	C
	Southbound	36.6	D	31.2	C
Foxhall Rd & Canal Rd	Overall	23.9	C	29.1	C
	Eastbound	37.3	D	61.5	E
	Westbound	0.4	A	15.1	B
	Northbound	37.9	D	--	--
Canal Rd/M St & Whitehurst Fwy/36 th St	Overall	53.9	D	54.9	D
	Eastbound	71.0	E	39.6	D
	Westbound	19.7	B	55.7	E
	Northbound	44.9	D	64.1	E
	Southbound	50.0	D	57.5	E

In addition to signal timing improvements, allowing the southbound left-turn phase out of the Canal Road gate during the morning peak period was investigated. Based on the future capacity analysis results, this phase may be accommodated with minimal impacts to the surrounding roadway network.

CONCLUSIONS

Based on the analysis and findings described above, this report makes the following conclusions and recommendations:

- The University does not impose unacceptable or objectionable impacts on traffic on the surrounding road network. University traffic accounts for a small percentage of traffic entering and exiting the study area during commuter rush hours, particularly along Canal Road. Although drivers experience regular delays of significant length along major commuter corridors, the University does not generate enough traffic to contribute substantially to these delays. Along Reservoir Road adjacent to GUH, campus-generated traffic does constitute a significant proportion of traffic during the commuter rush hours. At these locations, through traffic on Reservoir Road operates at acceptable conditions. Some turning movements onto Reservoir Road from side streets, including campus access roads, operate with significant delays. These delays are generated by signal timings that favor through traffic over side street traffic.
- The proposed campus plan and related increase in parking supply will not impose unacceptable or objectionable impacts on traffic on the surrounding road network. The increase will have a minimal impact on the surrounding roadway network. Signal timing improvements could alleviate conditions at certain intersections.
- In conjunction with the construction of the Campus Loop road and operational changes to GUTS to use the Canal Road gate, a study should be performed to investigate changes at the Canal Road gate necessary to accommodate the new GUTS routing.
- When the development site that includes the GUH parking addition is submitted for further processing, a traffic study of the Reservoir Road gates should be included to develop detailed mitigation measures for these intersections.



Figure 12: Trip Distribution for New Academic Trips



Figure 13: Trip Distribution for New Medical Trips

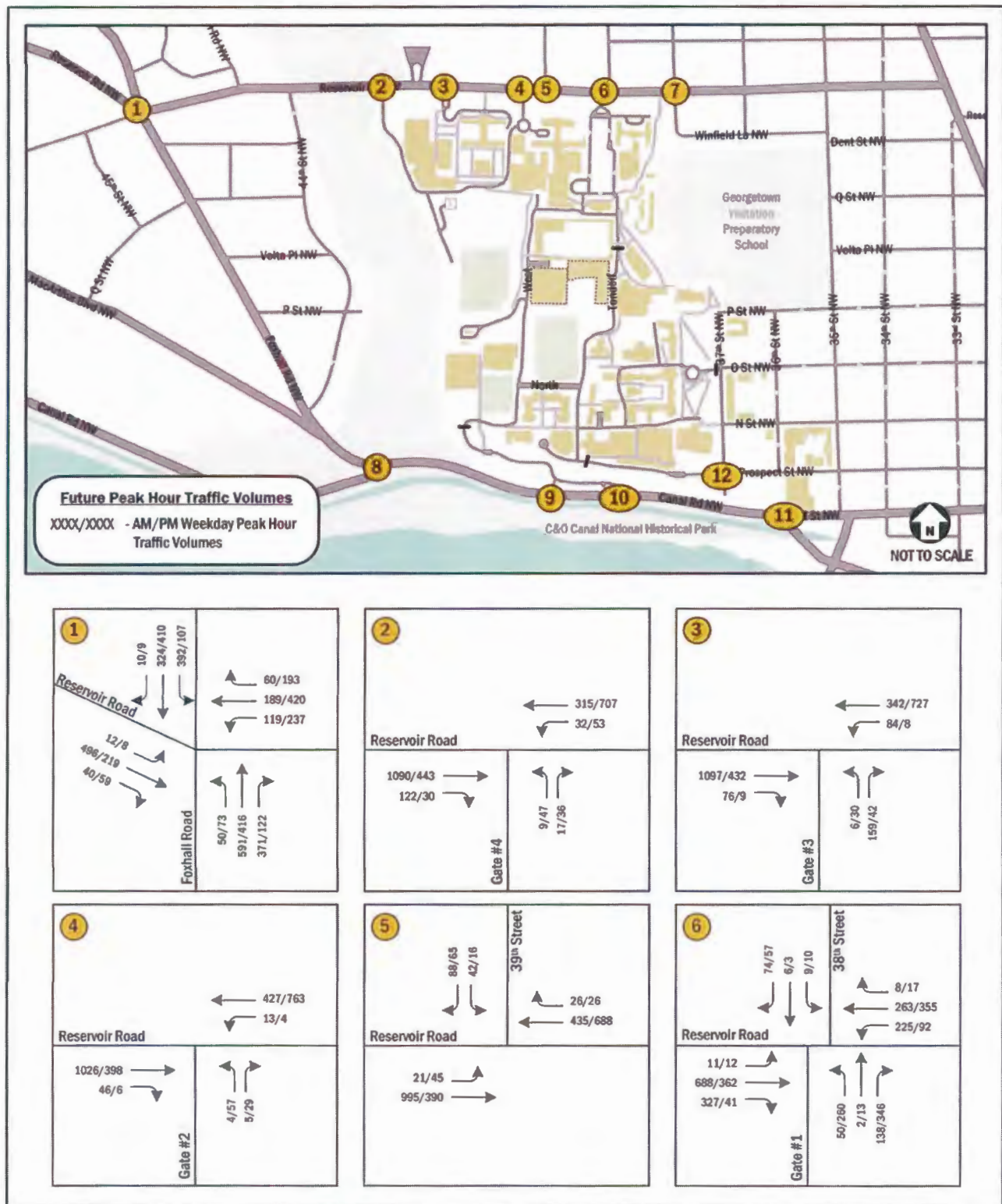


Figure 14: Future with Campus Plan Traffic Volumes (1 of 2)

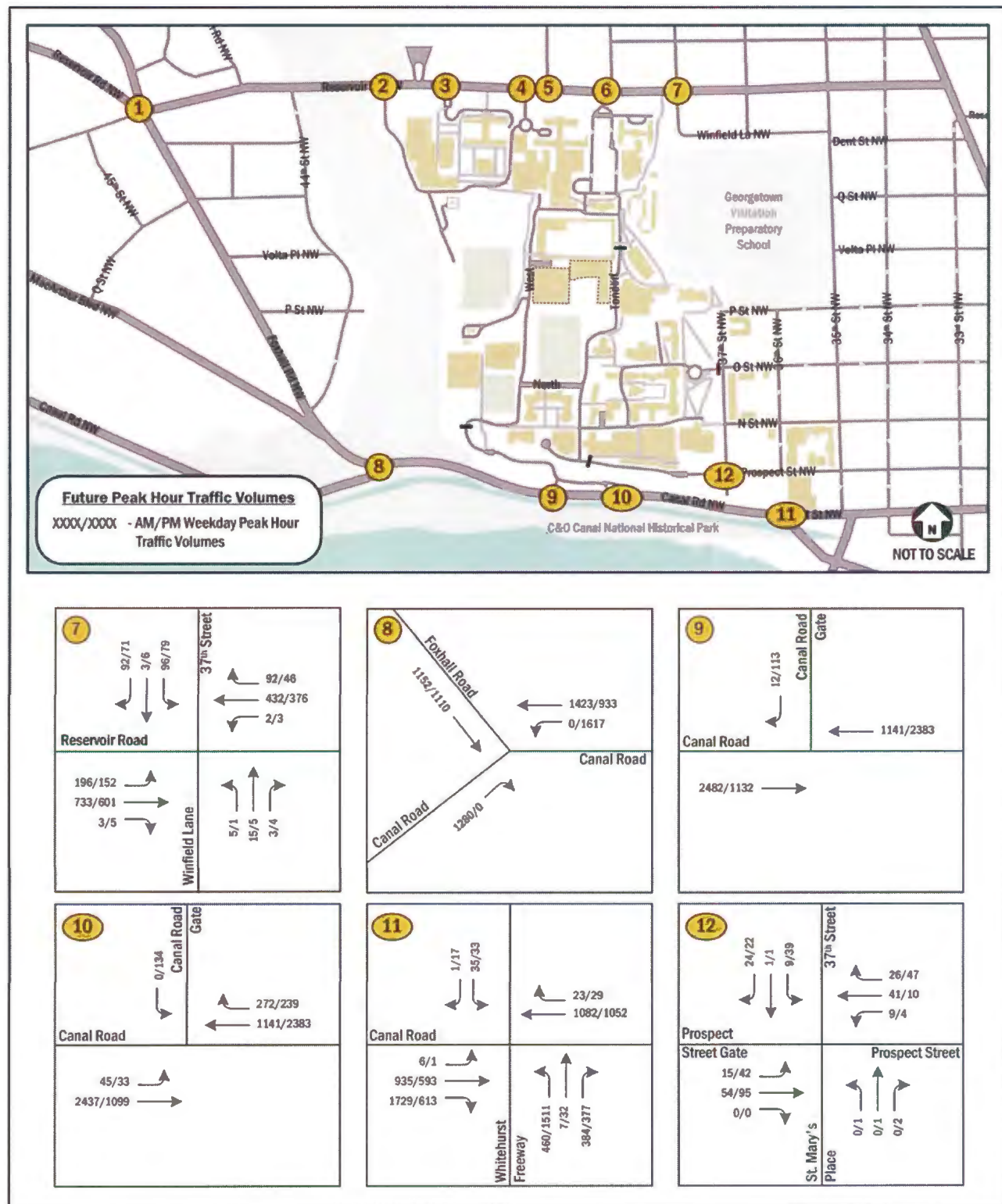


Figure 15: Future with Campus Plan Traffic Volumes (2 of 2)

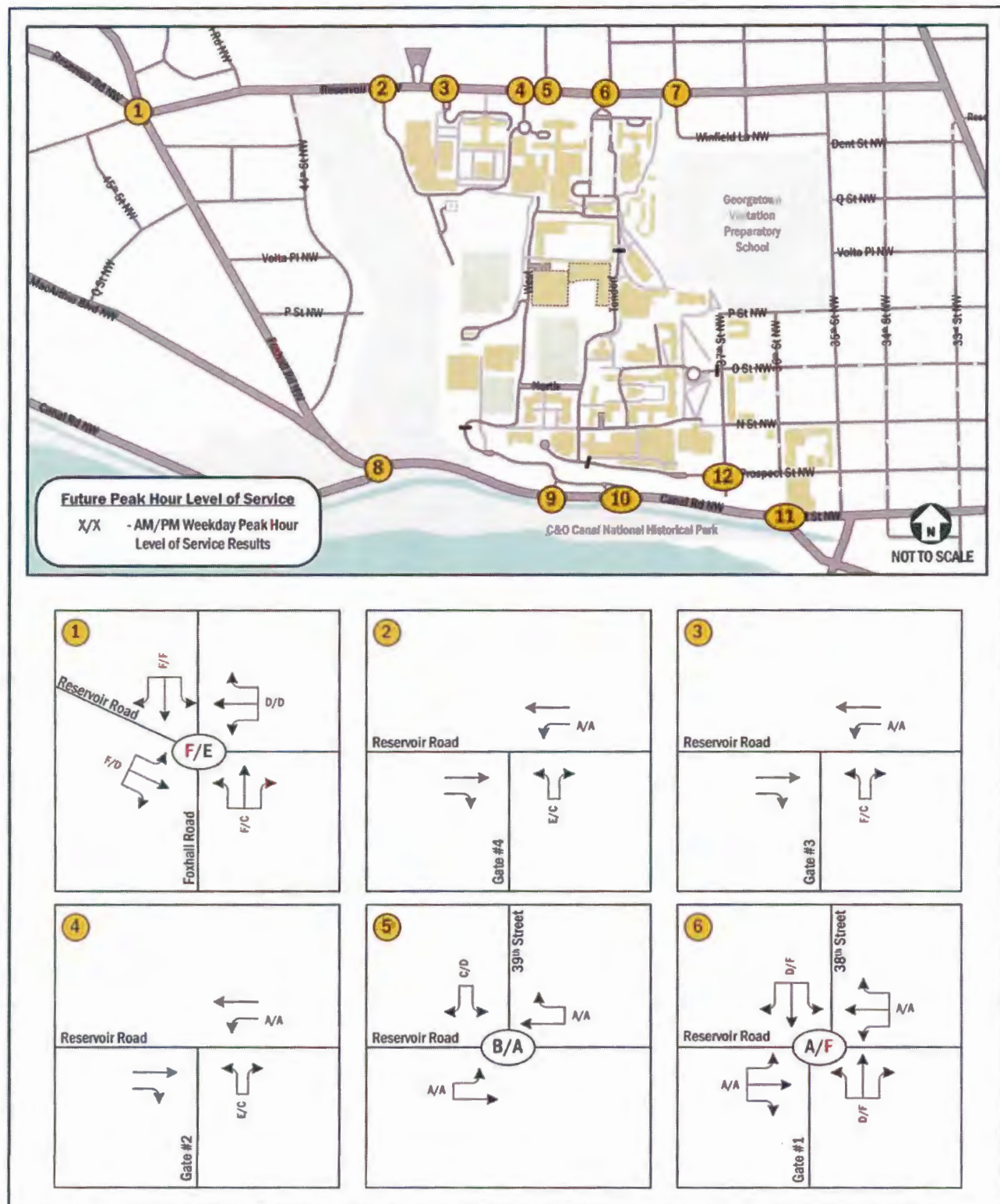


Figure 16: Future with Campus Plan Capacity Analysis Results (1 of 2)

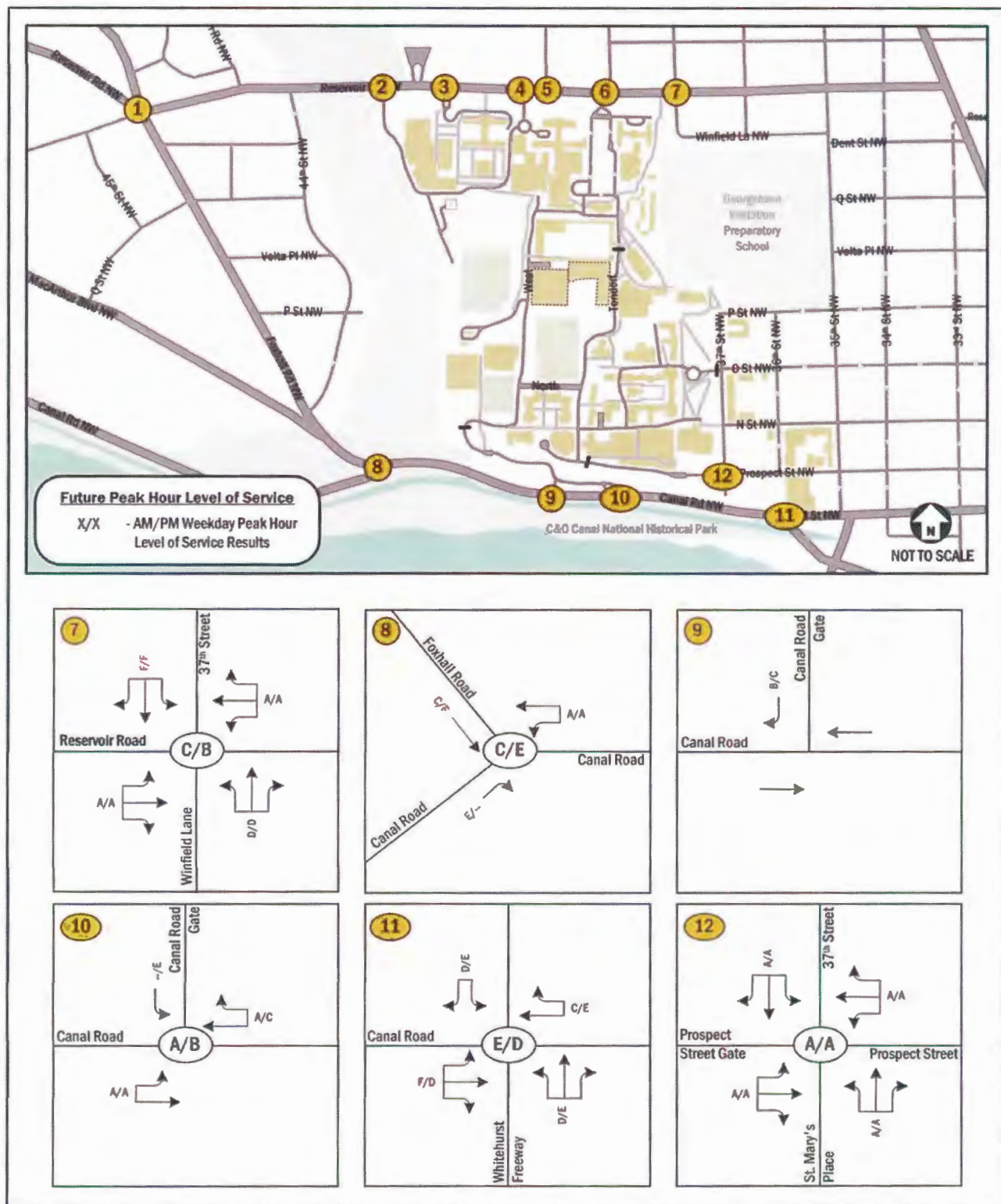


Figure 17: Future with Campus Plan Capacity Analysis Results (2 of 2)