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MEMORANDUM

Date: August 12, 2014
To: Kirk Roberts, P.E.
Jennifer Desrude, P.E.
City of Bloomington
From: Bryan Nemeth, P.E., PTOE
Molly Stewart, P.E.
Subject: Dwan Estate Subdivision Traffic Study
Bloomington, MN
cc: Marcus Thomas, P.E.

This document presents the traffic analysis for the proposed Dwan Estate residential Subdivision in Bloomington, Minnesota. This property is located south of Old Shakopee Road, and about 1.75 miles west of I-35W, as shown in Figure 1. The planned development includes the removal of one single family home and the addition of a 13-lot single family residential subdivision. With this development, a new connection on Overlook Drive between Xerxes Avenue and France Avenue is being proposed. A preliminary site plan for the development is included in Appendix A.

Traffic operations were analyzed at two intersections around the development site. These include the intersections of:

1. France Avenue at Overlook Drive
2. Xerxes Avenue at Overlook Drive

The purpose of this investigation was to analyze how the new connection on Overlook Drive between Xerxes Avenue and France Avenue will affect traffic conditions for nearby residents. In addition, the investigation will determine how well the existing roadways, lane layout, and traffic control handle the current and future traffic loads with the addition of the new development.

Existing Conditions

Overlook Drive forms two dead end segments between France Avenue and Xerxes Avenue. East of Xerxes Avenue, Overlook Drive is a minor collector. West of France Avenue, Overlook Drive is a major collector. The proposed connection of Overlook Drive would create a through street between France Avenue and Xerxes Avenue. France Avenue is a major collector at this location and Xerxes Avenue is a minor collector. The France Avenue & Overlook Drive intersection is side street stop-controlled with free movements on France Avenue. The Xerxes Avenue & Overlook Drive intersection is a t-intersection, so by design the southbound approach of Xerxes Avenue yields to the east/west traffic on



Overlook Drive. There is also a yield sign on the southbound Xerxes Avenue approach which provides further clarification of vehicle right of way. The studied intersections do not include turn lanes and the speed limit at all approaches is 30 mph.

A.M. and P.M. peak hour turning movement counts were collected on July 8, 2014 at the two study intersections. Figure 2 shows these turning movement counts along with the existing lanes and traffic control for each intersection. Additionally, 24-hour ADT counts were also collected on July 8 and 9, 2014 at the following three locations: France Avenue between Overlook Drive and 110th Street, Xerxes Avenue between Overlook Drive and 110th Street, and Thomas Avenue between Overlook Drive and 110th Street. AADT volumes were also obtained or calculated for other key roadway segments and are shown along with the collected AADT volumes in Figure 5.

Traffic Forecasts

The Build year for the proposed development is 2015. The Build Scenario assumes that the connection on Overlook Drive is complete, one single family home is removed, and 13 new single family housing units are constructed.

Trip generation for the site was determined using the Trip Generation Manual, 8th Edition, Institute of Transportation Engineers, 2008. Trip generation rates were evaluated for the site use, using data for Single Family Detached Housing (210). This rate was applied to the proposed site development. The proposed trip generation was added to the 2014 traffic counts. The site currently has one single family housing unit on it, which will be removed with the proposed development. The trip generation from the existing single family house being removed, the trip generation for the proposed development and net trips generated are shown in Table 1, Table 2 and Table 3 respectively.

Table 1: Trip Generation for Existing Single Family House Being Removed

Land Use	Use Size		AM Peak Hour						PM Peak Hour						Daily	
			ITE Trip Rate	Total	Enter	Exit	Enter	Exit	ITE Trip Rate	Total	Enter	Exit	Enter	Exit	ITE Trip Rate	Total
Single-Family Housing	1	Unit	0.77	1	26%	74%	0	1	1.02	1	64%	36%	1	0	9.57	10

Table 2: Trip Generation for Proposed Development

Land Use	Use Size		AM Peak Hour						PM Peak Hour						Daily	
			ITE Trip Rate	Total	Enter	Exit	Enter	Exit	ITE Trip Rate	Total	Enter	Exit	Enter	Exit	ITE Trip Rate	Total
Single-Family Housing	13	Units	0.77	10	26%	74%	3	7	1.02	13	64%	36%	8	5	9.57	124

Table 3: Net Trips Generated

Land Use	Use Size		AM Peak		PM Peak		Daily
			Enter	Exit	Enter	Exit	
Single-Family Housing	12	Units	3	6	7	5	114

The distribution of the generated trips was based on the current traffic pattern in the area. The majority of traffic generally heads east/west on Old Shakopee Road and east on 106th Street to access I-35W. The



trip generation volumes were distributed to the intersections being analyzed and followed the general pattern of current traffic.

The new development trips were added to the forecasted volumes to create the build volumes. The 2015 build volumes are shown in Figure 3 and the 2015 build AADT volumes are shown in Figure 5.

Future Traffic Considerations

Analysis was also completed for the intersections for a future year of 2025 for the build scenario. Background traffic was grown at the rate 1.0% per year. This growth is likely throughout the area within the next 10 years. The 2025 future build volumes are shown in Figure 4 and the 2025 future build AADT volumes are shown in Figure 5. It should be noted that the AADT shown on Figure 5 assumes that a small amount of neighborhood redistribution of traffic will occur on Overlook Drive. See the Additional Considerations section below for further discussion of this potential neighborhood traffic redistribution and potential measures that could be used to reduce it.

Traffic Operations Analysis

Analysis was completed at the intersections of France Avenue & Overlook Drive and Xerxes Avenue & Overlook Drive for scenarios considering the AM and PM peak hours for the 2014 existing conditions, 2015 Build condition, and 2025 Future Build condition. The analysis was performed using the methodology of the 2010 Highway Capacity Manual through Synchro, a traffic analysis software program by Trafficware. Results of the analysis are displayed as measures of effectiveness. Measures of effectiveness display quantitative information about the performance of an intersection. The primary measures that are used in this study are level of service and delay.

Level of Service

The operational analysis results are described as a Level of Service (LOS) ranging from A to F and these letters serve to describe a range of operating conditions for different types of facilities. Levels of Service are calculated based on the 2010 Highway Capacity Manual, which defines the level of service, based on control delay. Control delay is the delay experienced by vehicles slowing down for a stop sign and the wait time at stop sign. Level of Service D is commonly taken as an acceptable design year LOS. The level of service and its associated intersection delay for an unsignalized intersection is presented below.

Table 4: Related LOS to Control Delay

	Unsignalized Intersection Control Delay per Vehicle (sec.)
A	≤ 10
B	>10 and ≤ 15
C	>15 and ≤ 25
D	>25 and ≤ 35
E	>35 and ≤ 50
F	>50



Volume to Capacity Ratios

Volume to capacity ratio is the proportion of the actual traffic utilizing the facility to the facility's physical ability to carry a specific maximum volume. This is calculated by dividing the total traffic using the facility by the capacity of the facility. This can then determine if a facility is sufficient to handle the traffic that is expected to be traveling on it. A ratio greater than 1.00 predicts that the facility will be unable to discharge all of the demand arriving on it. Such a situation would result in long queues and extensive delays, or diversion to alternate routes.

Analysis

The two study intersections were analyzed based on the criteria listed above. Table 5 details the operational results for the France Avenue & Overlook Drive intersection and Table 6 details the operational results for the Xerxes Avenue & Overlook Drive intersection.

Table 5: Operational Analysis – France Avenue & Overlook Drive

Intersection and Traffic Control	Peak Hour	Intersection Delay*	Maximum Delay-LOS-v/c**
2014	AM	1	9-A-0.03
	PM	1	9-A-0.02
2015 Build Scenario	AM	3	9-A-0.03
	PM	2	9-A-0.02
2025 Build Scenario	AM	3	9-A-0.03
	PM	2	9-A-0.03

*Delay in seconds per vehicle **Maximum delay, LOS, and v/c ratio on any approach and/or movement

Table 6: Operational Analysis – Xerxes Avenue & Overlook Drive

Intersection and Traffic Control	Peak Hour	Intersection Delay*	Maximum Delay-LOS-v/c**
2014	AM	3	8-A-0.01
	PM	5	9-A-0.02
2015 Build Scenario	AM	4	8-A-0.01
	PM	6	9-A-0.02
2025 Build Scenario	AM	4	8-A-0.02
	PM	6	9-A-0.03

*Delay in seconds per vehicle **Maximum delay, LOS, and v/c ratio on any approach and/or movement

The traffic operations at the two unsignalized intersection requires no mitigation through all scenarios. With the addition of traffic due to the Development, operations will continue within acceptable levels through 2025. There are minimal delays and volume-to-capacity ratios are also consistently very low. No change in traffic control or additional capacity is needed.



Additional Considerations

Travel Times

Existing travel times were measured from Old Shakopee Road to the proposed development along multiple routes to assess the impacts the proposed development would have on the existing area. The measured travel times were used as a baseline and then were compared to 2015 Build travel times which were calculated taking into account the new trips generated by the proposed development. The existing and 2015 Build travel times for each route measured are shown in Figure 6.

As shown by the figure, the additional 13 housing units will have a minimal effect on average travel times. With the connection on Overlook Drive, there may be potential for traffic re-routing on Overlook Drive between France Avenue and Xerxes Avenue. Figures 7 to 14 show calculated travel times along different routes for northbound and southbound traffic assuming the proposed development and roadway connection on Overlook Drive are constructed. All segments assume a speed of 30 mph and delays at intersections are based off of field measurements and traffic modeling results. As displayed on the figures, the average travel times among the different route options do not vary significantly and there are several origin destination pairs that have multiple routes with essentially equivalent travel times. The average travel times are considered to be essentially equivalent within an error range of 5%.

In terms of how these travel times relate to the number of vehicles that would likely re-route can then be applied to the daily traffic count on France Avenue north of Overlook Drive (1,100). Evaluating the current daily traffic along two different cordons (Figure 15) indicates that the traffic is spread between many different roadways. The volume distribution of the re-route to Overlook Drive is based on the number of routes available with essentially equal travel times and assumes an equal split between each route. Applying an equal daily volume to each of the different routes results in a potential re-routing to Overlook Drive of zero to 250 vehicles per day split among Xerxes Avenue, Thomas Avenue, and Penn Avenue depending on how many vehicles decide that re-routing is a viable option. Based on the current traffic counts, this could amount to a potential increase of 0 to 20% vehicles per day on Xerxes Avenue, Thomas Avenue, and Penn Avenue, resulting in one car every 1 minute instead of every 1.2 minutes. This re-routing would be between neighborhoods on the south side of Bloomington, as this does not serve as a direct connection for regional non-Bloomington originated trips. This potential re-routing may not occur if measures are taken to increase the travel time of the vehicles using Overlook Drive with traffic calming measures.

**Table 7: Re-Routing Potential Version 1**

Potential Route Changes with Overlook Drive Connection				
Cordon Line		Version 1: Cordon North of 110th Street		
AADT on France, North of Overlook Dr.			1100	
Route	AADT	% of AADT	France Using Each Route	Could Use Overlook Dr Instead
West on 110th	4200	27%	293	0
North on France	6100	39%	426	0
North on Xerxes	2300	15%	161	54
North on Thomas	1100	7%	77	38
North on Penn	2050	13%	143	72
Total	15750	100%	1100	164

Table 8: Re-Routing Potential Version 2

Potential Route Changes with Overlook Drive Connection				
Cordon Line		Version 2: Cordon North of Old Shakopee Rd		
AADT on France, North of Overlook Dr.			1100	
Route	AADT	% of AADT	France Using Each Route	Could Use Overlook Dr Instead
West on Old Shak	0	0%	0	Assumes none of the traffic is destined to/from the West
North on Norm	0	0%	0	
North on France	12000	24%	263	
North on Xerxes	2350	5%	51	9
East on Old Shak	24850	50%	545	182
East on 106th	11000	22%	241	58
Total	50200	100%	1100	248

Traffic Calming Measures

If there are future concerns for speeding or traffic volume, traffic calming measures could be implemented on Overlook Drive. The proposed roadway connection is shown with curvature which will help to slow traffic down along the roadway. Landscaping along the roadway would also help to create a more residential feel and slow vehicles down. In addition, the measures shown on Figure 16 could also be implemented on Overlook Drive and would be anticipated to reduce speeds and traffic volumes.



Summary and Conclusions

The proposed development is estimated to consist of 13 single family detached housing units and a roadway connection between Xerxes Avenue and France Avenue on Overlook Drive. Based on the traffic analysis provided, our recommendations and conclusions are:

1. Both studied intersections will operate at an acceptable LOS if the new development and roadway connection are implemented. The trips generated from the development are not anticipated to have a significant impact on traffic operations at the nearby intersections.
2. The new connection may provide an equivalent route for residents to reach destinations to the north and east, but there is some potential for re-routing of traffic using Overlook Drive in the small magnitude as shown in Figure 5, between Xerxes Avenue and France Avenue.
3. Existing traffic control should remain at both study intersections, unless traffic calming measures are implemented.
4. In the future, if traffic speeds or volumes should be a concern, traffic calming measures could be applied.

Figures

Figure 1: Location Map

Figure 2: 2014 Existing Turning Movements

Figure 3: 2015 Build Turning Movements

Figure 4: 2025 Future Build Turning Movements

Figure 5: 2014 Existing, 2015 Build and 2025 Future Build AADT Volumes

Figure 6: 2014 Existing and 2015 Build Travel Times

Figure 7: Potential Routes For Future Neighborhood Connection (Northbound)

Figure 8: Potential Routes For Future Neighborhood Connection (Southbound)

Figure 9: Potential Routes For Future Neighborhood Connection (Extended) (Northbound)

Figure 10: Potential Routes For Future Neighborhood Connection (Extended) (Northbound)

Figure 11: Potential Routes For Future Neighborhood Connection (Extended) (Northbound)

Figure 12: Potential Routes For Future Neighborhood Connection (Extended) (Southbound)

Figure 13: Potential Routes For Future Neighborhood Connection (Extended) (Southbound)

Figure 14: Potential Routes For Future Neighborhood Connection (Extended) (Southbound)

Figure 15: Re-routing Potential Cordon

Figure 16: Traffic Calming Measures

Appendices

Appendix A: Preliminary Site Plan

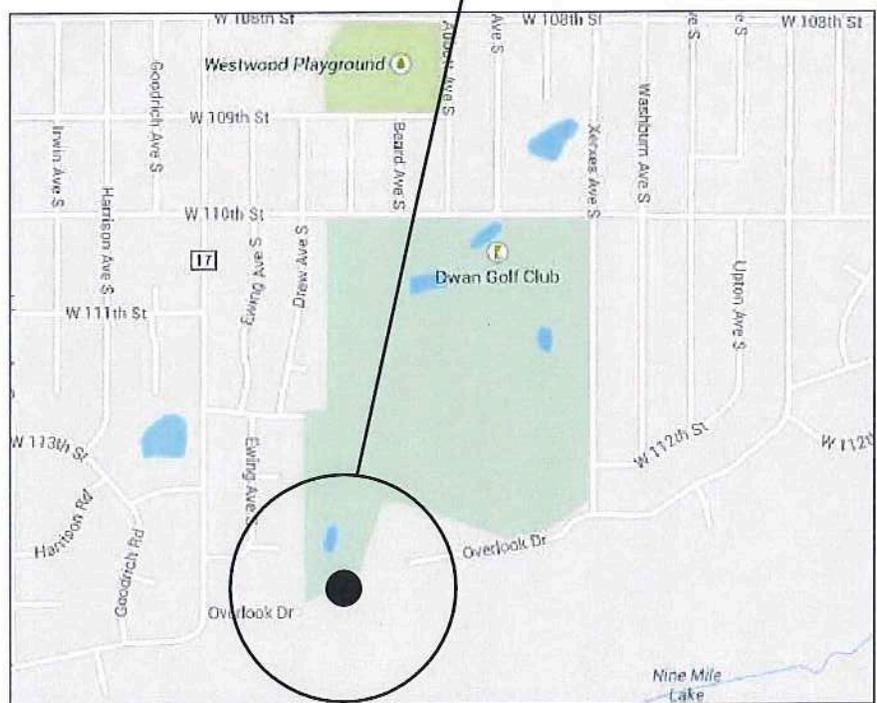
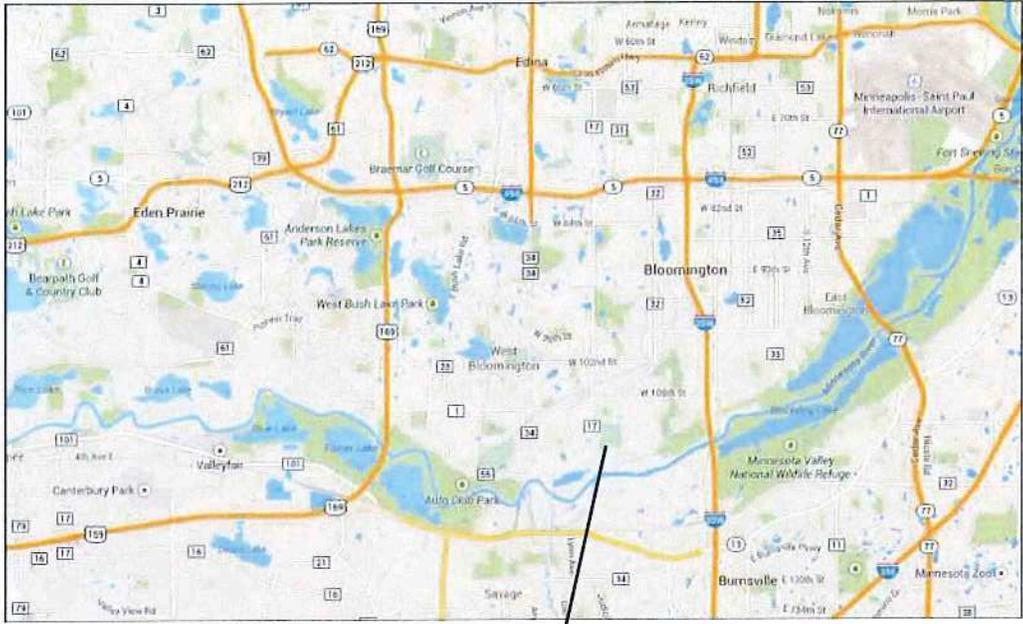


FIGURE 1: LOCATION MAP
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FIGURE 2: 2014 EXISTING TURNING MOVEMENTS

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FIGURE 3: 2015 BUILD TURNING MOVEMENTS

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FIGURE 4: 2025 FUTURE BUILD TURNING MOVEMENTS

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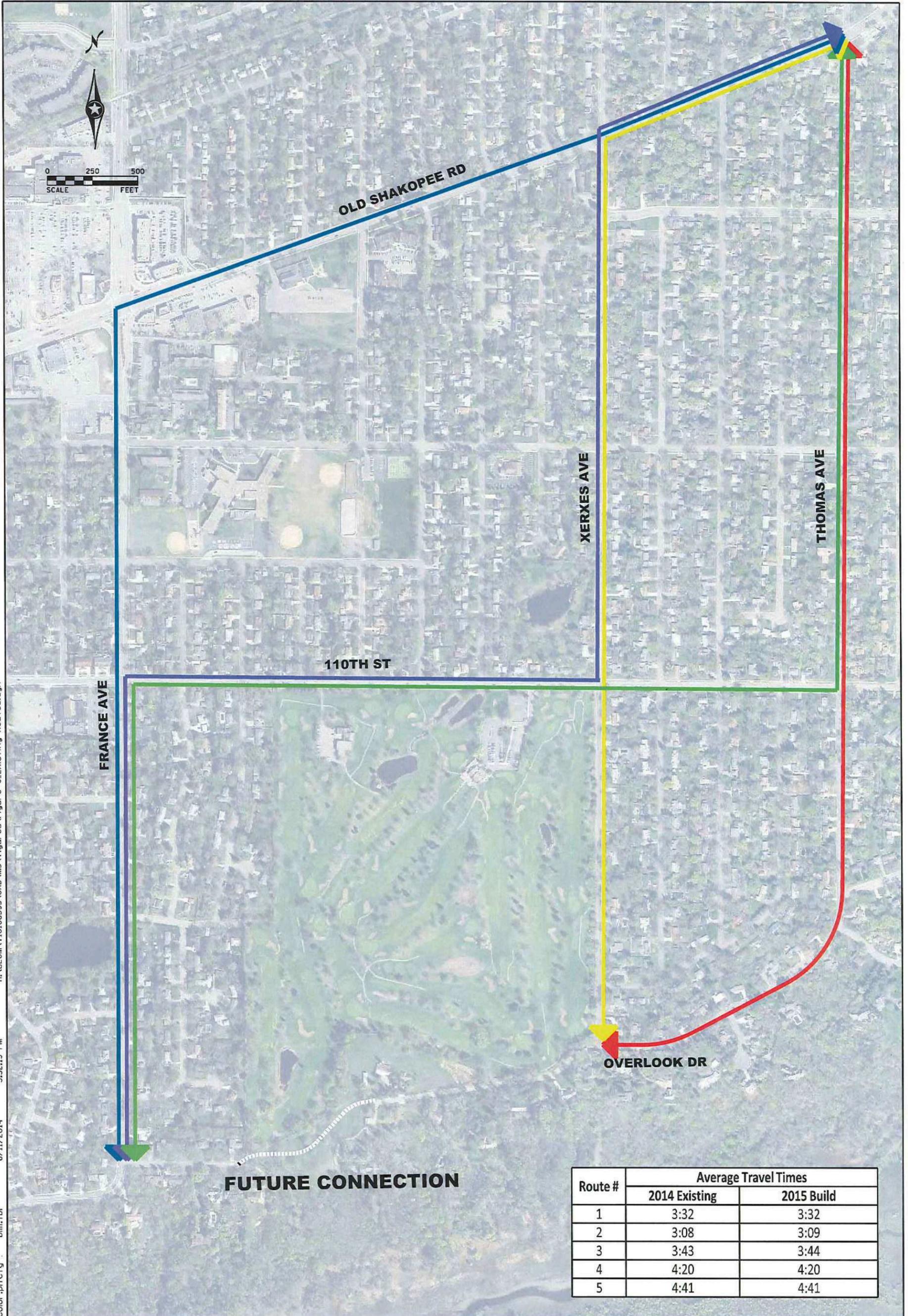




FIGURE 5: 2014 EXISTING, 2015 BUILD AND 2025 FUTURE BUILD AADT VOLUMES

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Route #	Average Travel Times	
	2014 Existing	2015 Build
1	3:32	3:32
2	3:08	3:09
3	3:43	3:44
4	4:20	4:20
5	4:41	4:41

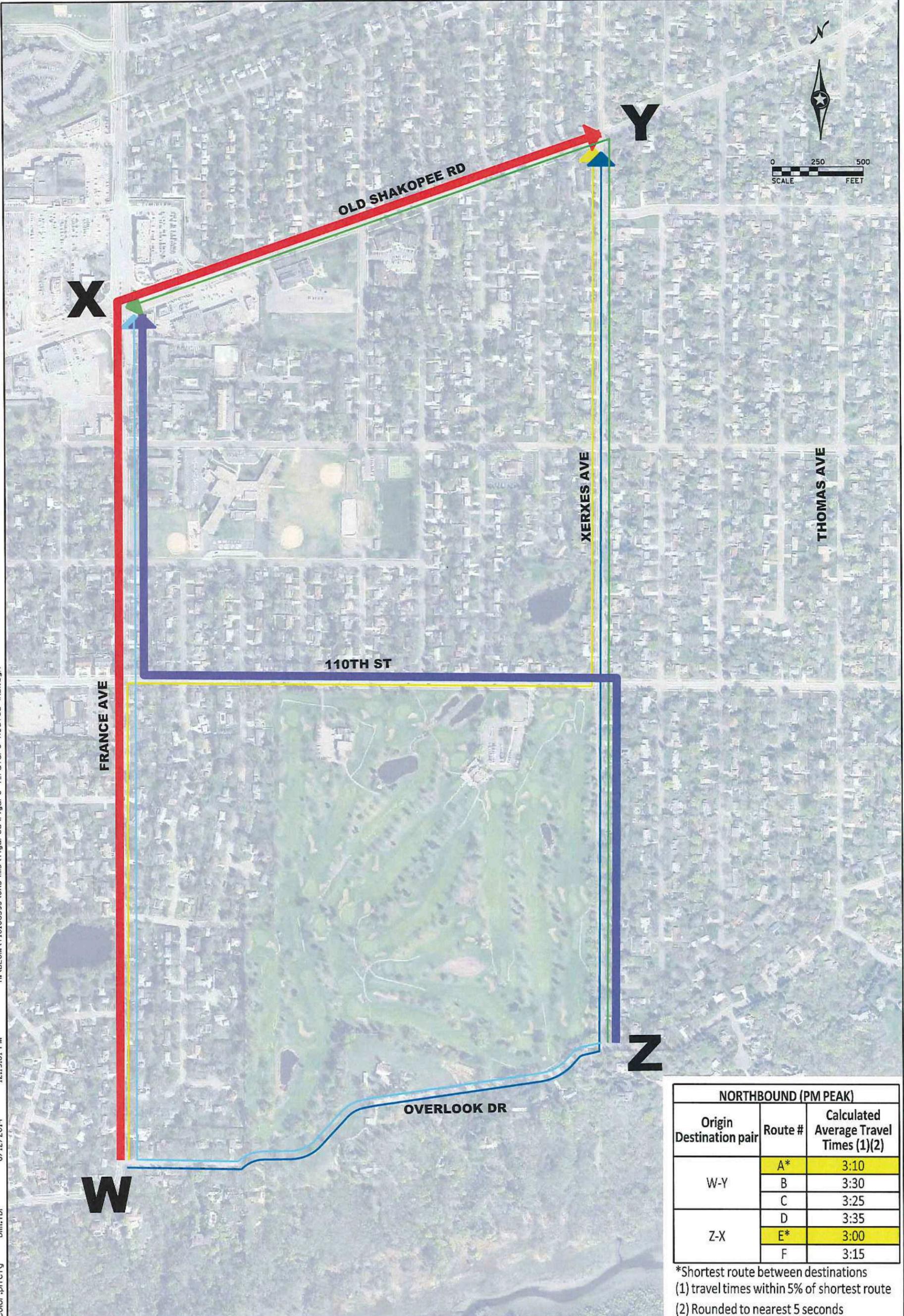
LEGEND

- **ROUTE 1**
- **ROUTE 2**
- **ROUTE 3**
- **ROUTE 4**
- **ROUTE 5**

FIGURE 6: 2014 EXISTING & 2015 BUILD TRAVEL TIMES

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NORTHBOUND (PM PEAK)		
Origin Destination pair	Route #	Calculated Average Travel Times (1)(2)
W-Y	A*	3:10
	B	3:30
	C	3:25
Z-X	D	3:35
	E*	3:00
	F	3:15

*Shortest route between destinations
 (1) travel times within 5% of shortest route
 (2) Rounded to nearest 5 seconds

LEGEND

- **ROUTE A**
- **ROUTE D**
- **ROUTE B**
- **ROUTE E**
- **ROUTE C**
- **ROUTE F**

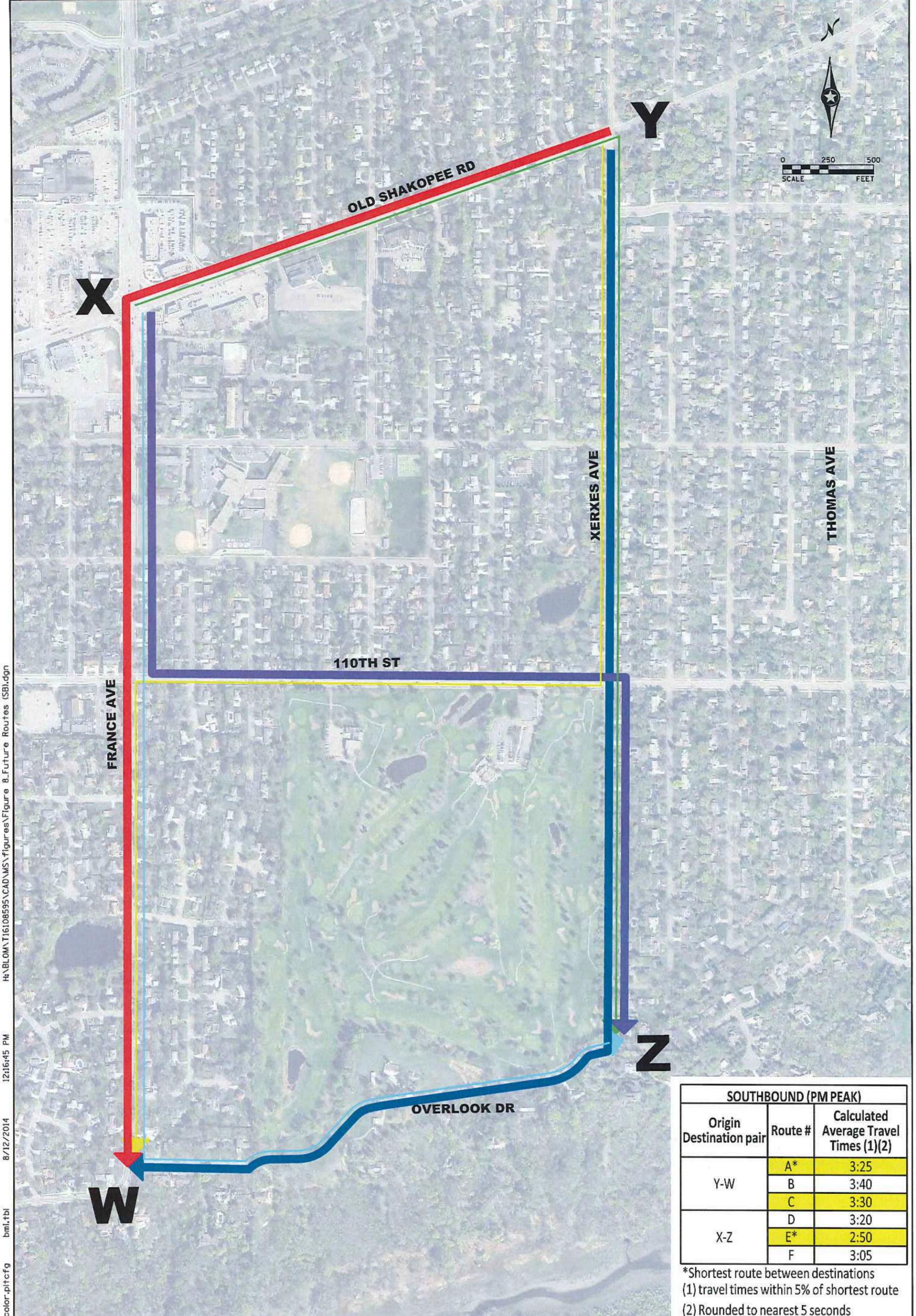
FIGURE 7: POTENTIAL ROUTES FOR FUTURE NEIGHBORHOOD CONNECTION NORTHBOUND

DWAN ESTATE SUBDIVISION TRAFFIC STUDY

BLOOMINGTON, MN



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SOUTHBOUND (PM PEAK)		
Origin Destination pair	Route #	Calculated Average Travel Times (1)(2)
Y-W	A*	3:25
	B	3:40
	C	3:30
X-Z	D	3:20
	E*	2:50
	F	3:05

*Shortest route between destinations
 (1) travel times within 5% of shortest route
 (2) Rounded to nearest 5 seconds

LEGEND

- ROUTE A
- ROUTE D
- ROUTE B
- ROUTE E
- ROUTE C
- ROUTE F

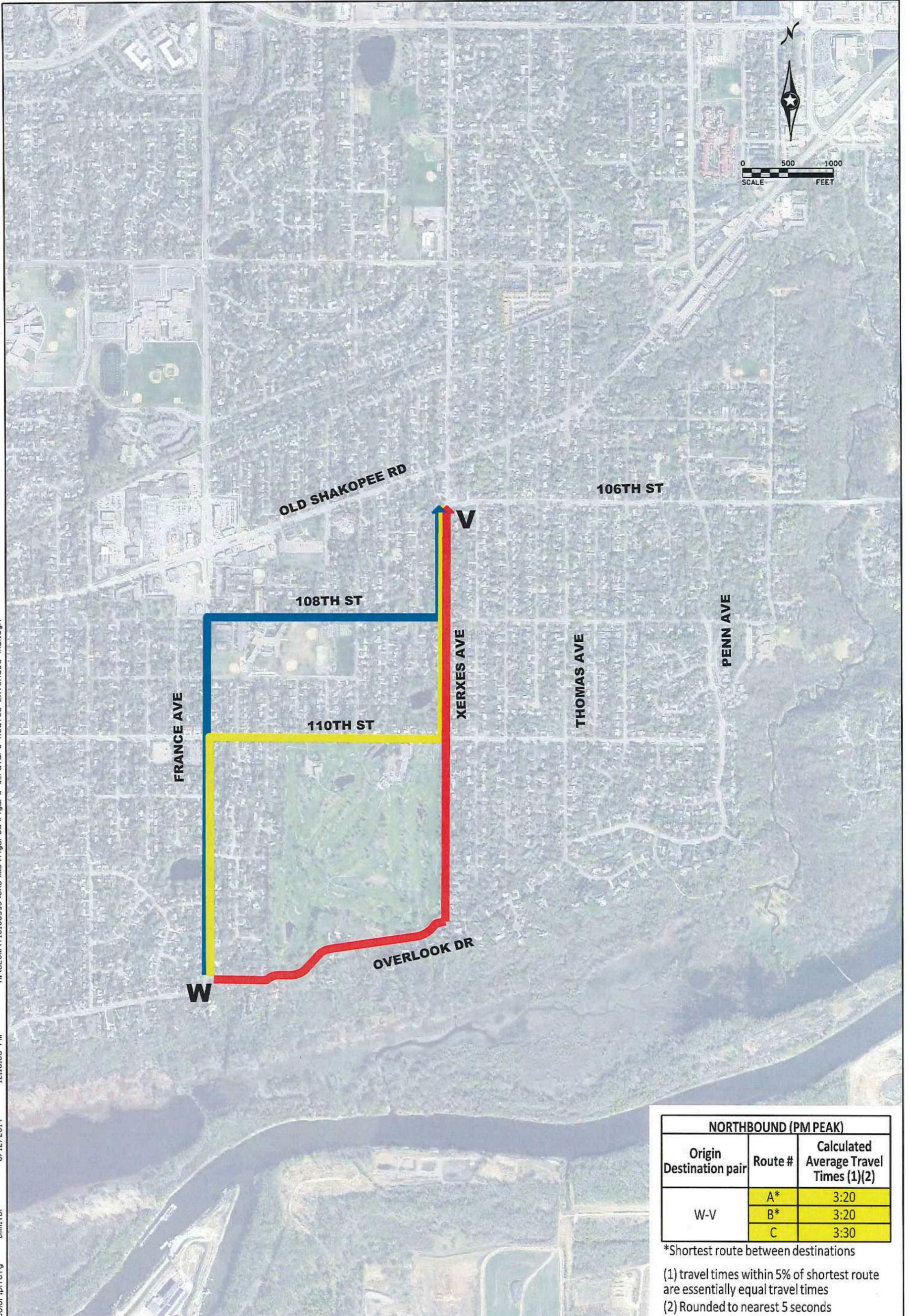
FIGURE 8: POTENTIAL ROUTES FOR FUTURE NEIGHBORHOOD CONNECTION SOUTHBOUND

DWAN ESTATE SUBDIVISION TRAFFIC STUDY

BLOOMINGTON, MN



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NORTHBOUND (PM PEAK)		
Origin Destination pair	Route #	Calculated Average Travel Times (1)(2)
W-V	A*	3:20
	B*	3:20
	C	3:30

*Shortest route between destinations
 (1) travel times within 5% of shortest route are essentially equal travel times
 (2) Rounded to nearest 5 seconds

LEGEND

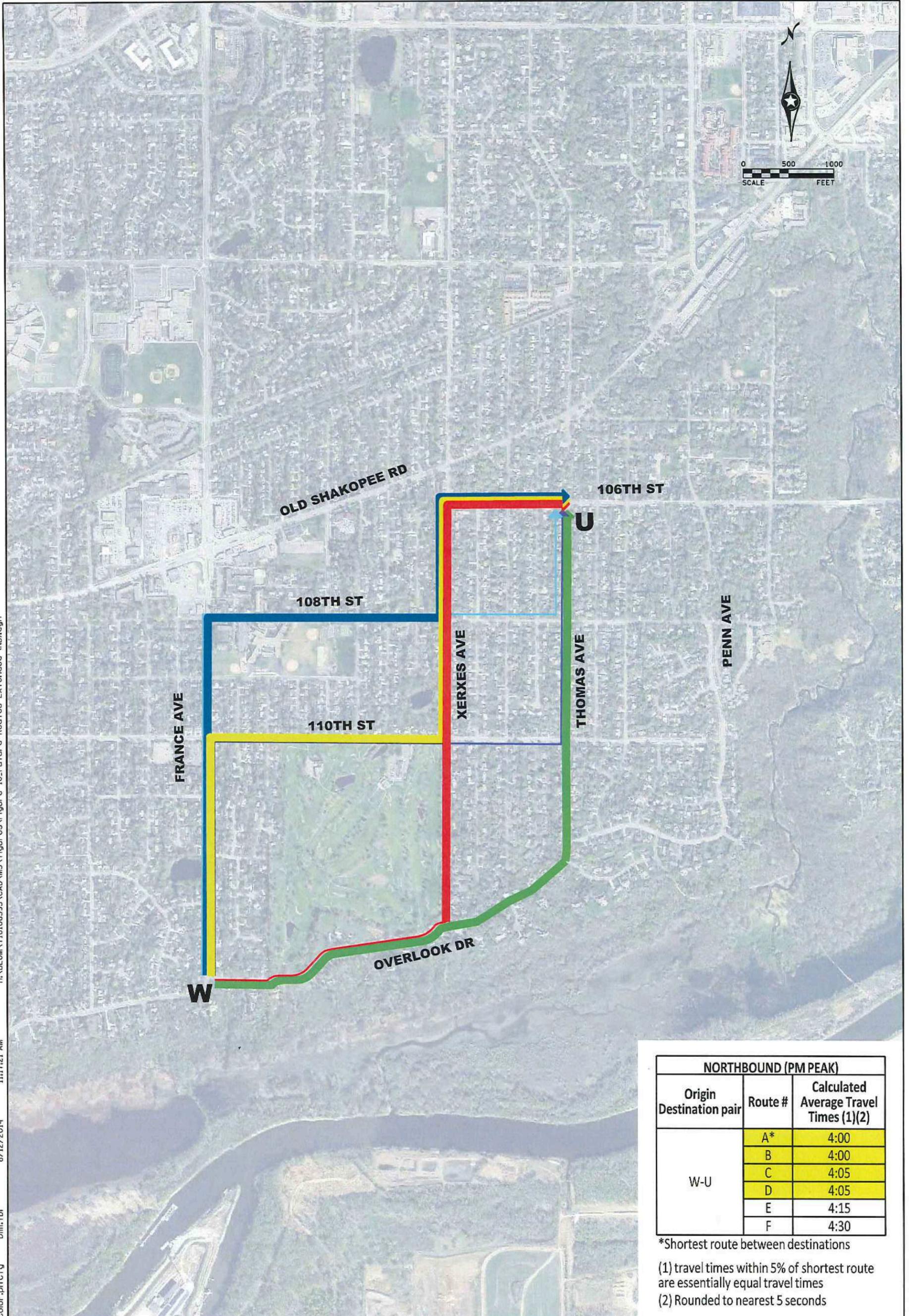
- ROUTE A
- ROUTE B
- ROUTE C

FIGURE 9: POTENTIAL ROUTES FOR FUTURE NEIGHBORHOOD CONNECTION (EXTENDED) NORTHBOUND

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NORTHBOUND (PM PEAK)		
Origin Destination pair	Route #	Calculated Average Travel Times (1)(2)
W-U	A*	4:00
	B	4:00
	C	4:05
	D	4:05
	E	4:15
	F	4:30

*Shortest route between destinations
 (1) travel times within 5% of shortest route are essentially equal travel times
 (2) Rounded to nearest 5 seconds

LEGEND

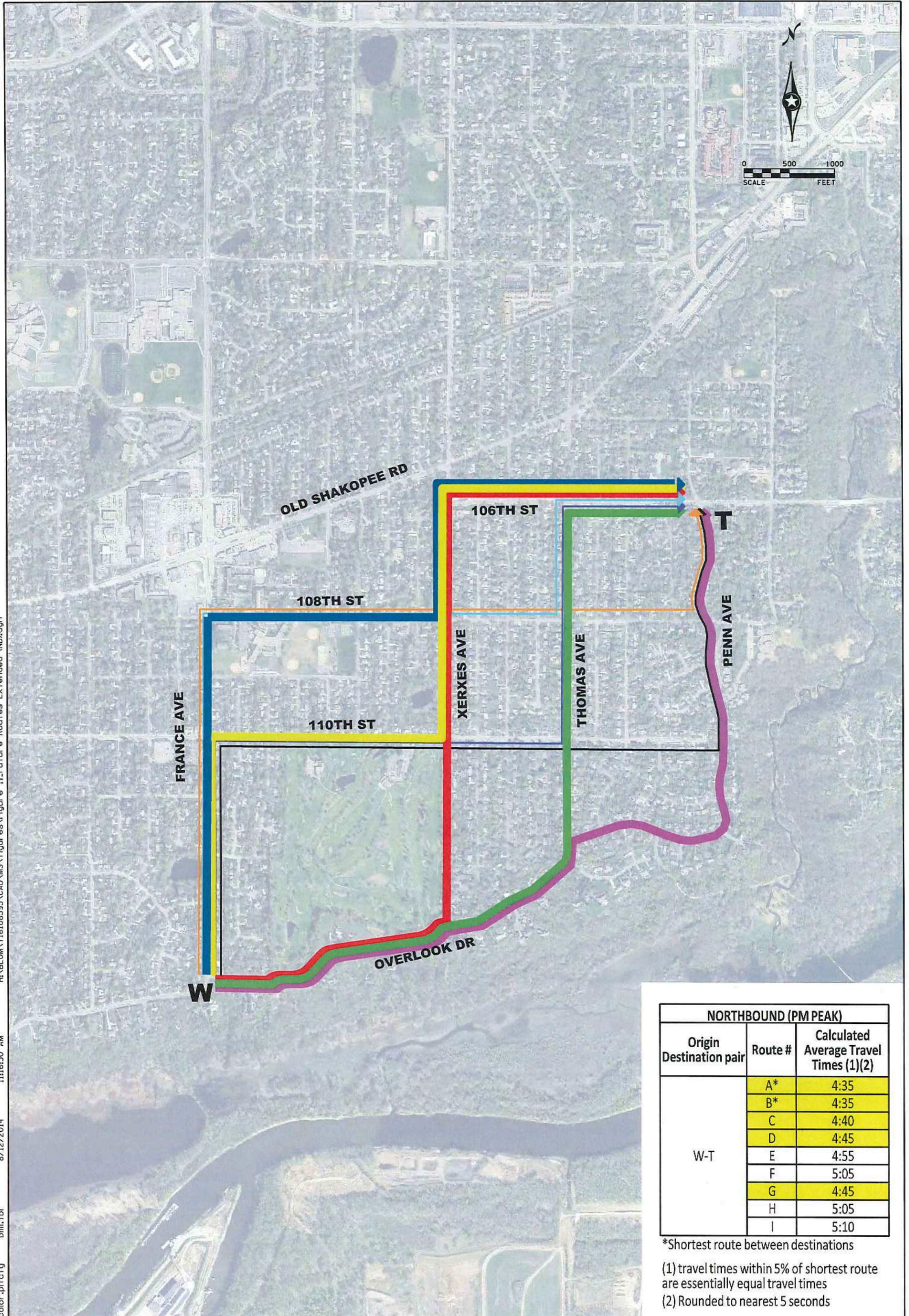
- ROUTE A
- ROUTE B
- ROUTE C
- ROUTE D
- ROUTE E
- ROUTE F

FIGURE 10: POTENTIAL ROUTES FOR FUTURE NEIGHBORHOOD CONNECTION (EXTENDED) NORTHBOUND

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NORTHBOUND (PM PEAK)		
Origin Destination pair	Route #	Calculated Average Travel Times (1)(2)
W-T	A*	4:35
	B*	4:35
	C	4:40
	D	4:45
	E	4:55
	F	5:05
	G	4:45
	H	5:05
	I	5:10

*Shortest route between destinations
 (1) travel times within 5% of shortest route are essentially equal travel times
 (2) Rounded to nearest 5 seconds

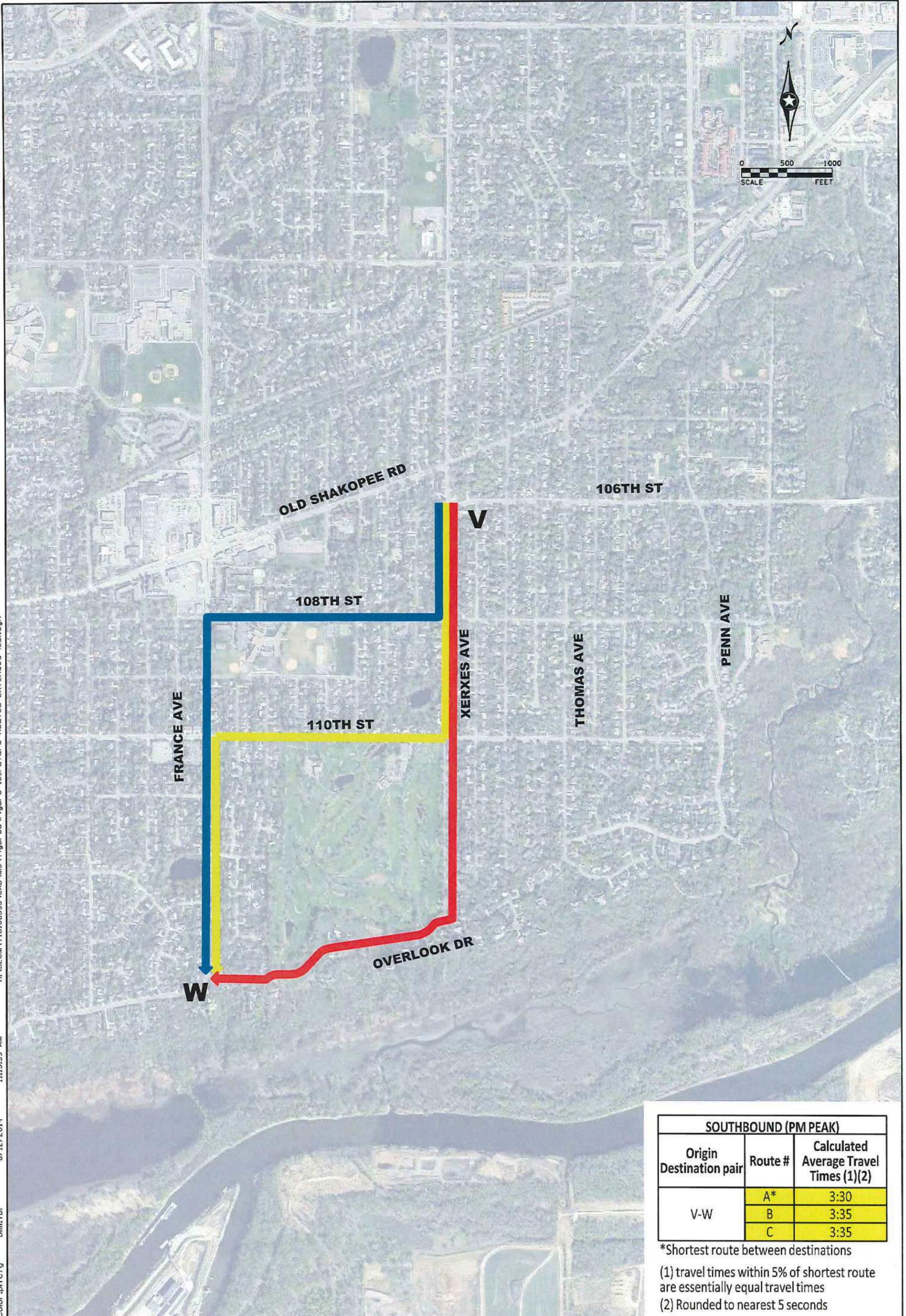
LEGEND

- ROUTE A
- ROUTE D
- ROUTE G
- ROUTE B
- ROUTE E
- ROUTE H
- ROUTE C
- ROUTE F
- ROUTE I

FIGURE 11: POTENTIAL ROUTES FOR FUTURE NEIGHBORHOOD CONNECTION (EXTENDED) NORTHBOUND

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SOUTHBOUND (PM PEAK)		
Origin Destination pair	Route #	Calculated Average Travel Times (1)(2)
V-W	A*	3:30
	B	3:35
	C	3:35

*Shortest route between destinations
 (1) travel times within 5% of shortest route are essentially equal travel times
 (2) Rounded to nearest 5 seconds

LEGEND

- ROUTE A
- ROUTE B
- ROUTE C

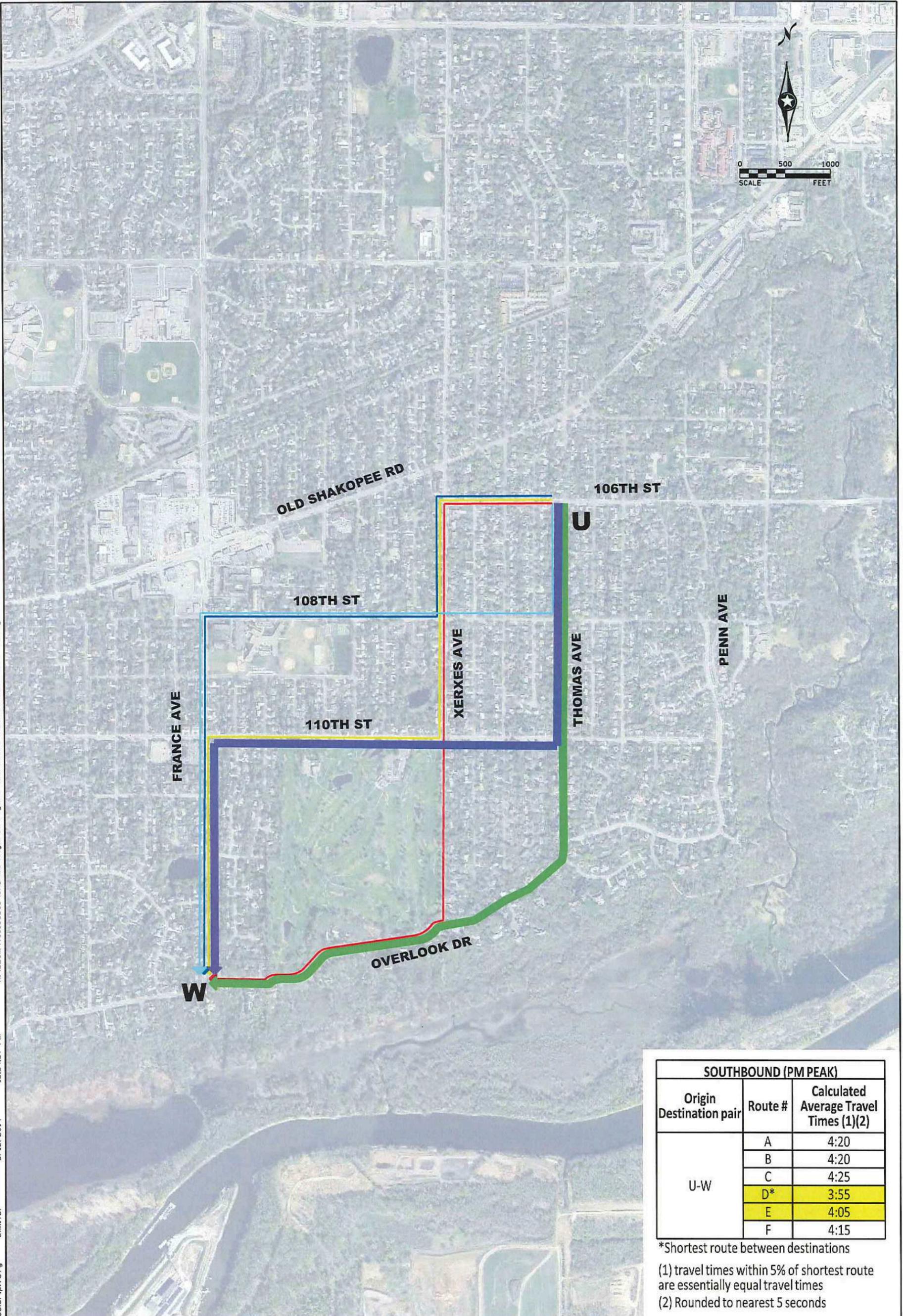
FIGURE 12: POTENTIAL ROUTES FOR FUTURE NEIGHBORHOOD CONNECTION (EXTENDED) SOUTHBOUND

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BLOOMINGTON, MN



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SOUTHBOUND (PM PEAK)		
Origin Destination pair	Route #	Calculated Average Travel Times (1)(2)
U-W	A	4:20
	B	4:20
	C	4:25
	D*	3:55
	E	4:05
	F	4:15

*Shortest route between destinations
 (1) travel times within 5% of shortest route are essentially equal travel times
 (2) Rounded to nearest 5 seconds

LEGEND

- ROUTE A
- ROUTE B
- ROUTE C
- ROUTE D
- ROUTE E
- ROUTE F

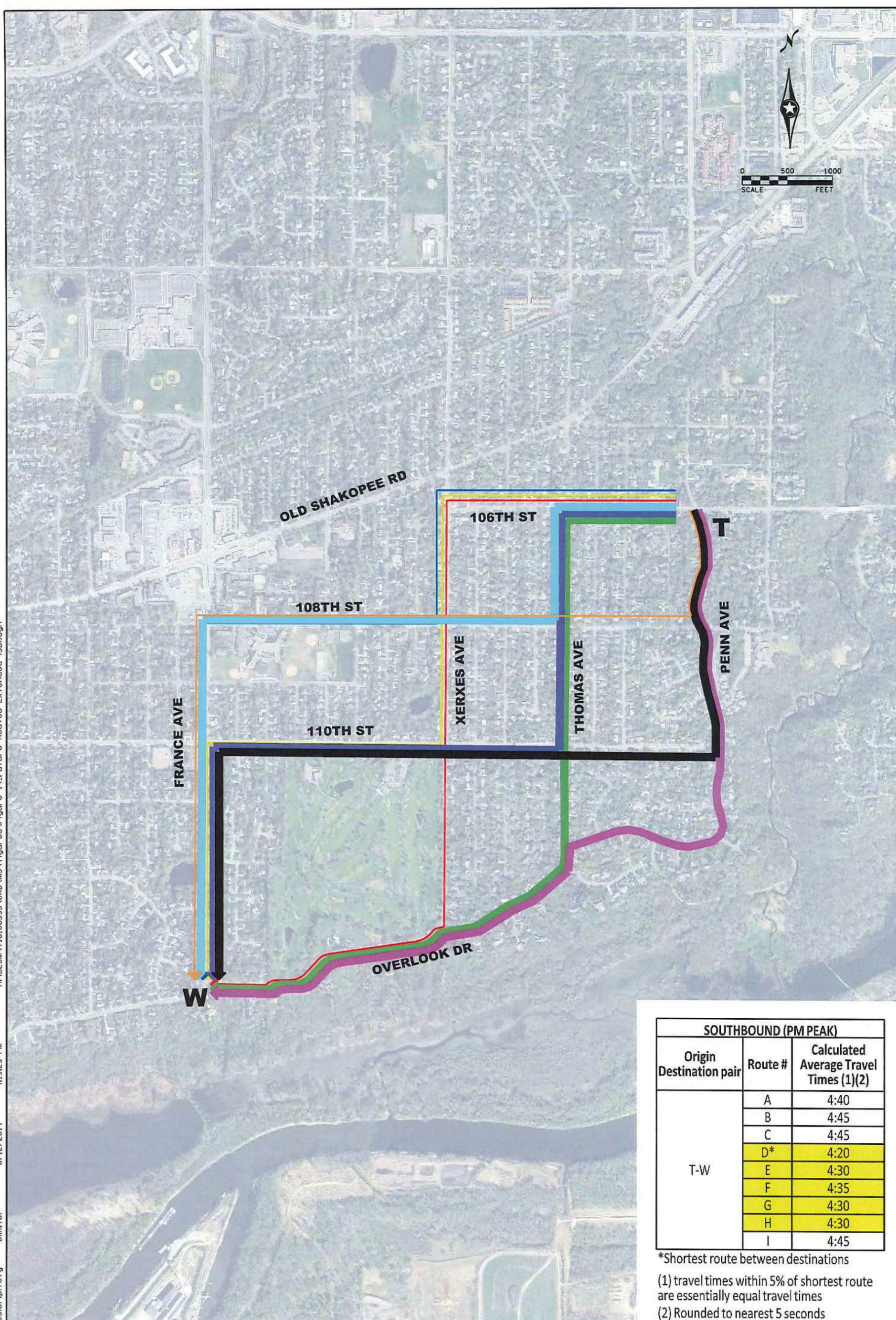
FIGURE 13: POTENTIAL ROUTES FOR FUTURE NEIGHBORHOOD CONNECTION (EXTENDED) SOUTHBOUND

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SOUTHBOUND (PM PEAK)		
Origin Destination pair	Route #	Calculated Average Travel Times (1)(2)
T-W	A	4:40
	B	4:45
	C	4:45
	D*	4:20
	E	4:30
	F	4:35
	G	4:30
	H	4:30
	I	4:45

*Shortest route between destinations
 (1) travel times within 5% of shortest route are essentially equal travel times
 (2) Rounded to nearest 5 seconds

LEGEND

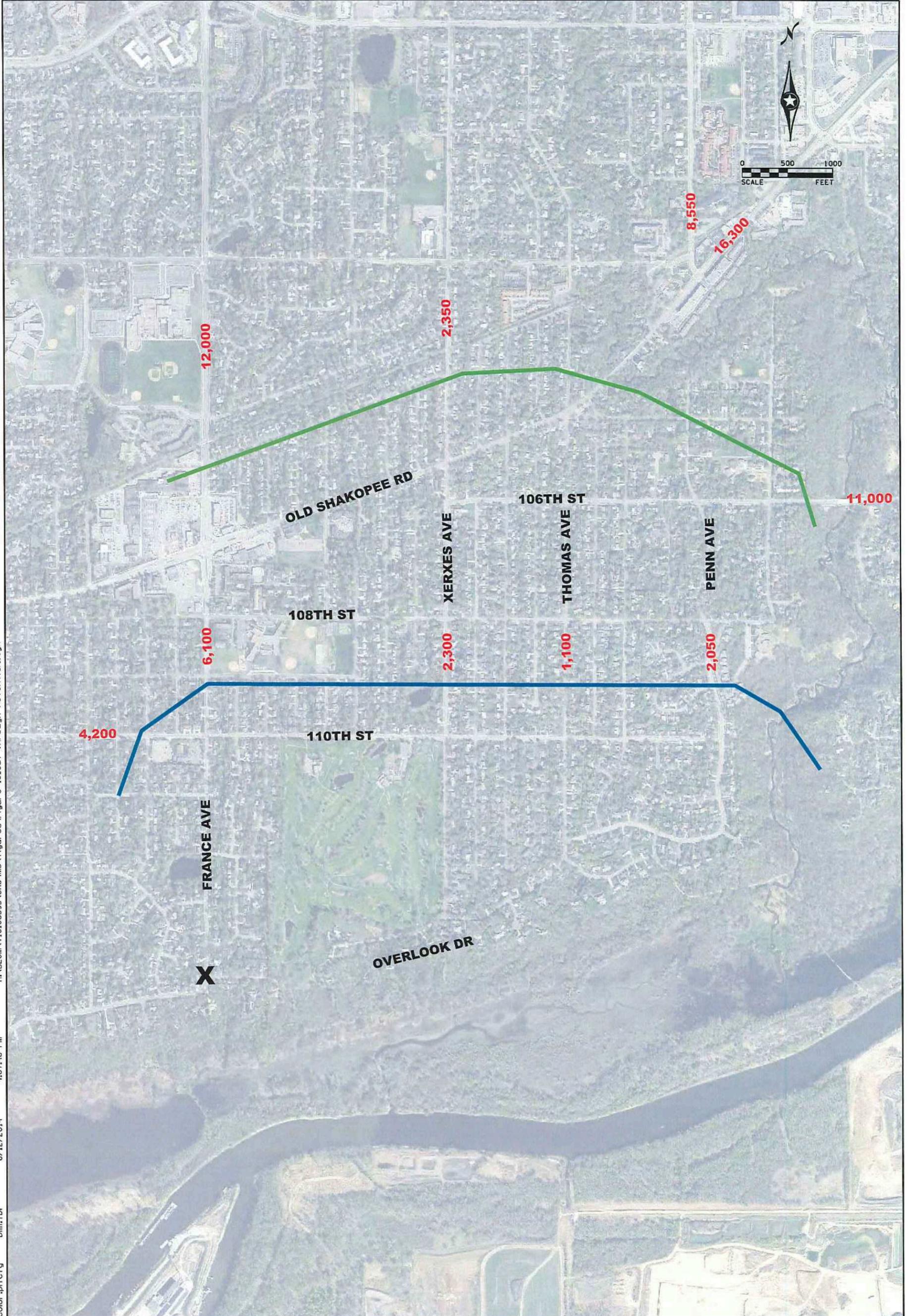
- ROUTE A
- ROUTE D
- ROUTE G
- ROUTE B
- ROUTE E
- ROUTE H
- ROUTE C
- ROUTE F
- ROUTE I

FIGURE 14: POTENTIAL ROUTES FOR FUTURE NEIGHBORHOOD CONNECTION (EXTENDED) SOUTHBOUND

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BLOOMINGTON, MN





LEGEND

- CORDON LINE 1
- CORDON LINE 2
- X** ORIGIN/DESTINATION
- XXXX** EXISTING AADT (SOURCE: MNDOT TRAFFIC MAP)

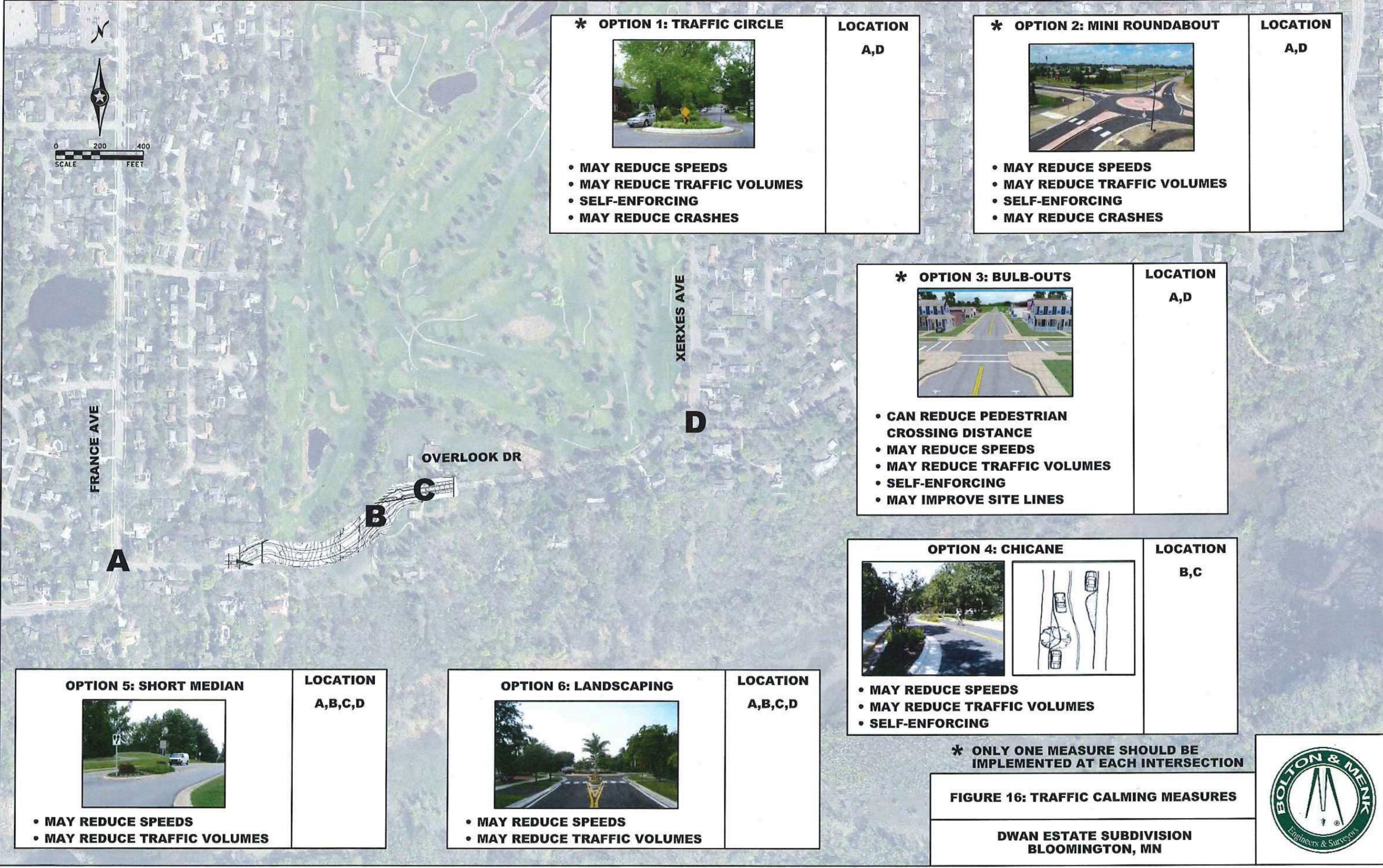
FIGURE 15: RE-ROUTING POTENTIAL CORDON

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TRAFFIC STUDY
BLOOMINGTON, MN**



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*** OPTION 1: TRAFFIC CIRCLE**



LOCATION
A,D

- MAY REDUCE SPEEDS
- MAY REDUCE TRAFFIC VOLUMES
- SELF-ENFORCING
- MAY REDUCE CRASHES

*** OPTION 2: MINI ROUNDABOUT**



LOCATION
A,D

- MAY REDUCE SPEEDS
- MAY REDUCE TRAFFIC VOLUMES
- SELF-ENFORCING
- MAY REDUCE CRASHES

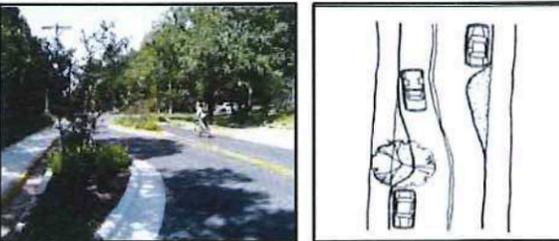
*** OPTION 3: BULB-OUTS**



LOCATION
A,D

- CAN REDUCE PEDESTRIAN CROSSING DISTANCE
- MAY REDUCE SPEEDS
- MAY REDUCE TRAFFIC VOLUMES
- SELF-ENFORCING
- MAY IMPROVE SITE LINES

OPTION 4: CHICANE



LOCATION
B,C

- MAY REDUCE SPEEDS
- MAY REDUCE TRAFFIC VOLUMES
- SELF-ENFORCING

OPTION 5: SHORT MEDIAN



LOCATION
A,B,C,D

- MAY REDUCE SPEEDS
- MAY REDUCE TRAFFIC VOLUMES

OPTION 6: LANDSCAPING



LOCATION
A,B,C,D

- MAY REDUCE SPEEDS
- MAY REDUCE TRAFFIC VOLUMES

*** ONLY ONE MEASURE SHOULD BE IMPLEMENTED AT EACH INTERSECTION**

FIGURE 16: TRAFFIC CALMING MEASURES

**DWAN ESTATE SUBDIVISION
BLOOMINGTON, MN**





BOLTON & MENK, INC.

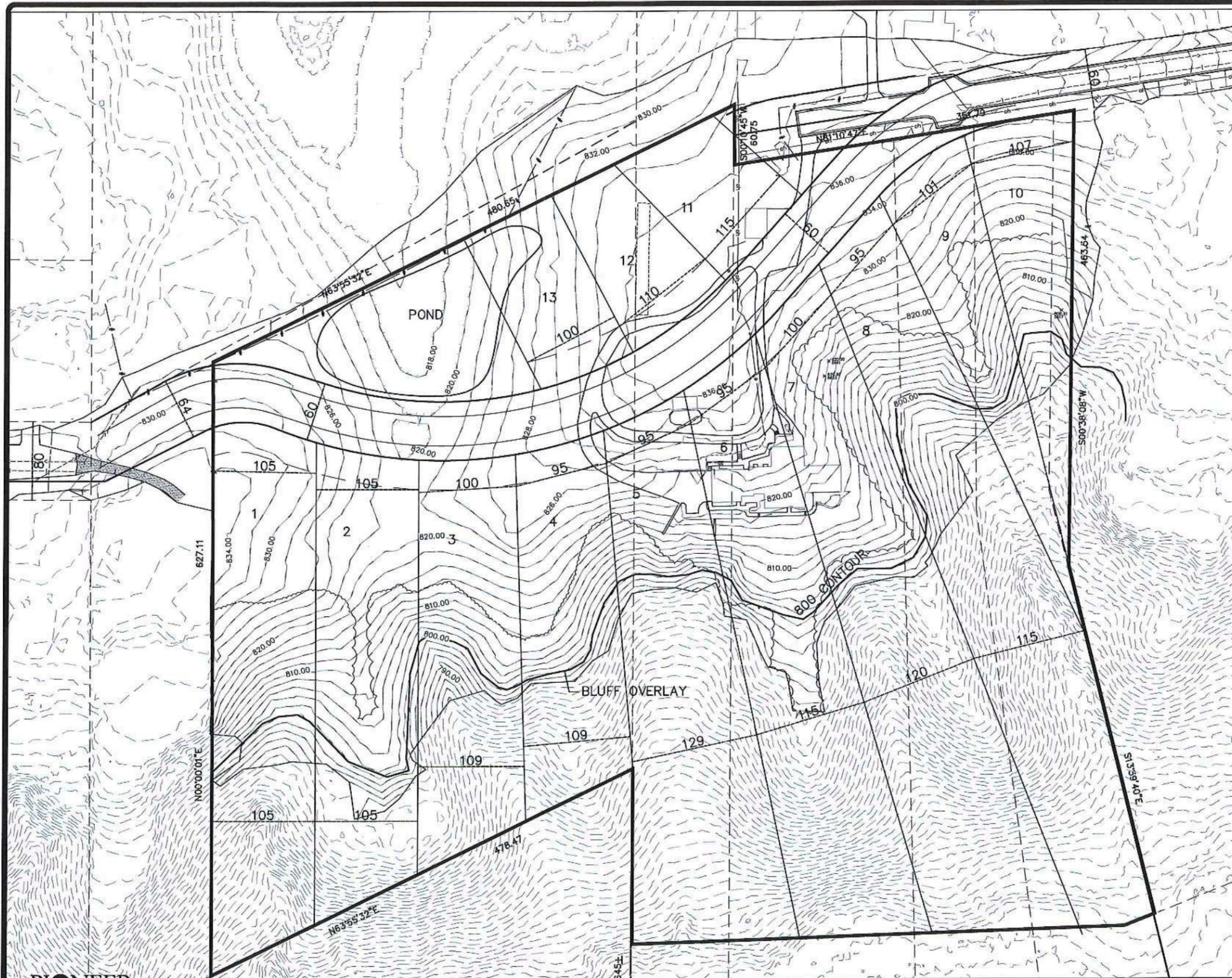
Consulting Engineers & Surveyors

12224 Nicollet Avenue • Burnsville, MN 55337

Phone (952) 890-0509 • Fax (952) 890-8065

www.bolton-menk.com

Appendix A: Preliminary Site Plan



SITE DATA:

GROSS AREA: ±15 ACRES

PROPOSED UNITS: 13
GROSS DENSITY: 0.87 UNITS/ACRE

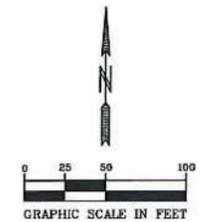
EXISTING ZONING: R1
COMP GUIDE PLAN: LOW DENSITY (0-5 U/A)

R1 STANDARDS:

- AREA: 11,000 SF
- LOT WIDTH: 80'
- FRONT SETBACK: 30'
- SIDE YARD: 10'
- REAR YARD: 30'

SOUTH END OF SITE IN BLUFF OVERLAY DISTRICT

SITE PLAN BASED ON AVAILABLE DATA
WETLANDS HAVE NOT BEEN DELINEATED



PIONEERengineering
CIVIL ENGINEERS LAND PLANNERS LAND SURVEYORS LANDSCAPE ARCHITECTS

2422 Enterprise Drive
Mendota Heights, MN 55120
(651) 681-1914
Fax: 681-9488
www.pioneereng.com

I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly Licensed Landscape Architect under the laws of the State of Minnesota.
Reg. No. XXX Date: XXX

Revisions
None XXX
XXX XXX

Date: 6-7-11
Designed: JLT
Drawn: JLT

CONCEPT PLAN 2

PETER JARVIS
6109 BLUE CIRCLE DRIVE SUITE 200
MINNETONKA, MINNESOTA 55343

BLOOMINGTON PROPERTY
BLOOMINGTON, MINNESOTA