

Appendix A – Well Logs

208231

County Ramsey
 Quad St Paul East
 Quad ID 103A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
 Minnesota Statutes Chapter 1031

Entry Date 08/14/1991
 Update Date 03/10/2014
 Received Date

Well Name HILLCREST	Township 29	Range 22	Dir Section W 23	Subsection AABACD	Well Depth 550 ft.	Depth Completed 550 ft.	Date Well Completed
Elevation 1040	Elev. Method 7.5 minute topographic map (+/- 5 feet)				Drill Method Cable Tool	Drill Fluid	
Address					Use commercial	Status Sealed	
Contact 2200 LARPENTEUR AV ST PAUL MN 55109					Well Hydrofractured? Yes <input type="checkbox"/> No <input type="checkbox"/>	From	To
Stratigraphy Information					Casing Type Joint		
Geological Material	From	To (ft.)	Color	Hardness	Drive Shoe? Yes <input type="checkbox"/> No <input type="checkbox"/>	Above/Below	
DRIFT	0	165			Casing Diameter 8 in.	Weight 325 ft.	lbs./ft.
PLATTEVILLE	165	190			Open Hole From 325 ft. To 550 ft.		
ST. PETER	190	350			Screen? <input type="checkbox"/>	Type	Make
SHAKOPEE	350	382			Static Water Level 205 ft. land surface Measure 09/13/1999		
NEW RICHMOND	382	395			Pumping Level (below land surface)		
ONEOTA	395	490			Wellhead Completion Pitless adapter manufacturer Model <input type="checkbox"/> Casing Protection <input type="checkbox"/> 12 in. above grade <input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY)		
JORDAN	490	550			Grouting Information Well Grouted? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Specified		
					Nearest Known Source of Contamination feet Direction Type Well disinfected upon completion? <input type="checkbox"/> Yes <input type="checkbox"/> No		
					Pump <input type="checkbox"/> Not Installed Date Installed Manufacturer's name Model Number HP Volt Length of drop pipe ft Capacity g.p. Typ		
					Abandoned Does property have any not in use and not sealed well(s)? <input type="checkbox"/> Yes <input type="checkbox"/> No		
					Variance Was a variance granted from the MDH for this well? <input type="checkbox"/> Yes <input type="checkbox"/> No		
					Miscellaneous First Bedrock Platteville Formation Aquifer multiple Last Strat Jordan Sandstone Depth to Bedrock 165 ft Located by Minnesota Geological Survey Locate Method Digitized - scale 1:24,000 or larger (Digitizing Table) System UTM - NAD83, Zone 15, Meters X 499340 Y 4981941 Unique Number Verification Information from Input Date 01/01/1990		
Remarks WELL SEALED 9-13-1999. BY KEYS WELL CO. H-141981. LOG IN MGS BULL. NO. 28 P. 252. WELL SEALED 09-13-1999 BY 62012					Angled Drill Hole		
					Well Contractor Licensee Business Lic. or Reg. No. Name of Driller		

603061

County Ramsey
 Quad St Paul East
 Quad ID 103A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
 Minnesota Statutes Chapter 1031

Entry Date 12/30/1999
 Update Date 03/10/2014
 Received Date

Well Name HILLCREST	Township 29	Range 22	Dir Section W 23	Subsection ADA	Well Depth 486 ft.	Depth Completed 486 ft.	Date Well Completed 09/00/1999
Elevation	Elev. Method				Drill Method Cable Tool	Drill Fluid Water	
Address					Use irrigation	Status Active	
C/W 2200 LARPEN TEUR AV E ST PAUL MN 55109					Well Hydrofractured? Yes <input type="checkbox"/> No <input type="checkbox"/>	From To	
Stratigraphy Information					Casing Type Step down	Joint Welded	
Geological Material	From	To (ft.)	Color	Hardness	Drive Shoe? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Above/Below	
DRIFT	0	155	TAN	SOFT	Casing Diameter	Weight	Hole Diameter
LIMESTONE	155	187	GRAY	HARD	10 in. To 354 ft.	46.4 lbs./ft.	16 in. To 354 ft.
SANDSTONE/SHALE	187	343	GRAY	HARD	16 in. To 155 ft.	62.5 lbs./ft.	10 in. To 486 ft.
LIMEROCK	343	476	GRAY	HARD			
SANDSTONE	476	486	TAN	MEDIUM			
					Open Hole From 354 ft. To 486 ft.		
					Screen? <input type="checkbox"/>	Type Make	
					Static Water Level		
					207 ft.	land surface	Measure 09/03/1999
					Pumping Level (below land surface)		
					226 ft.	8 hrs.	Pumping at 500 g.p.m.
					Wellhead Completion		
					Pitless adapter manufacturer	Model	
					<input type="checkbox"/> Casing Protection	<input checked="" type="checkbox"/> 12 in. above grade	
					<input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY)		
					Grouting Information Well Grouted? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Specified		
					Material	Amount	From To
					neat cement	17 Cubic yards	0 ft. 354 ft.
					Nearest Known Source of Contamination		
					75 feet	North Direction	
					Well disinfected upon completion?		<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
					Pump <input type="checkbox"/> Not Installed Date Installed 09/29/1999		
					Manufacturer's name GOULD		
					Model Number 8RJHC	HP 60	Volt 460
					Length of drop pipe 260 ft	Capacity 650 g.p.	Typ Submersible
					Abandoned		
					Does property have any not in use and not sealed well(s)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
					Variance		
					Was a variance granted from the MDH for this well? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
					Miscellaneous		
					First Bedrock	Aquifer	
					Last Strat	Depth to Bedrock	155 ft
					Located by		
					Locate Method		
					System UTM - NAD83, Zone 15, Meters	X	Y
					Unique Number Verification Input Date		
					Angled Drill Hole		
					Well Contractor		
					Keys Well Co.	62012	RUSSELL, J.
					Licensee Business	Lic. or Reg. No.	Name of Driller
Remarks M.G.S. NO. 3995.							
Minnesota Well Index Report					603061		
					Printed on 07/02/2021 HE-01205-15		

849084

County Ramsey
 Quad St Paul East
 Quad ID 103A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
 Minnesota Statutes Chapter 1031

Entry Date 11/15/2020
 Update Date 11/18/2020
 Received Date 07/13/2020

Well Name MW-1 ST PAUL	Township 29	Range 22	Dir Section W 23	Subsection AABABC	Well Depth 25 ft.	Depth Completed 25 ft.	Date Well Completed 06/25/2020
Elevation 1030	Elev. Method LiDAR 1m DEM (MNDNR)				Drill Method	Drill Fluid	
Address					Use monitor well	Status Active	
Well 2200 LARPENTEUR AV E ST PAUL MN					Well Hydrofractured? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	From	To
Contact 250 ST PETER ST ST PAUL MN 55102					Casing Type Single casing	Joint	
Stratigraphy Information					Drive Shoe? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Above/Below	
Geological Material	From	To (ft.)	Color	Hardness	Casing Diameter 2 in. To 15 ft. lbs./ft.		
SILTY SAND/ GRAVEL	0	17	BLK/RED	HARD			
WET SILTY SAND	17	25	RED/BRN	HARD			
CLAY COBBLES	17	17	BLK/RED				
					Open Hole	From	ft. To
					Screen? <input checked="" type="checkbox"/>	Type slotted pipe	Make JOHNSON
					Diameter	Slot/Gauze	Length
					2 in.	0	10 ft.
						15 ft.	25 ft.
					Static Water Level		
					17 ft.	land surface	Measure 06/25/2020
					Pumping Level (below land surface)		
					ft.	hrs.	Pumping at g.p.m.
					Wellhead Completion		
					Pitless adapter manufacturer	Model	
					<input checked="" type="checkbox"/> Casing Protection	<input type="checkbox"/> 12 in. above grade	
					<input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY)		
					Grouting Information		
					Well Grouted?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
					<input type="checkbox"/> Not Specified		
					Material	Amount	From To
					bentonite	2 Sacks	4 ft. 12 ft.
					neat cement	2 Sacks	ft. 4 ft.
					Nearest Known Source of Contamination		
					feet	Direction	Type
					Well disinfected upon completion?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
					Pump <input checked="" type="checkbox"/> Not Installed		
					Date Installed		
					Manufacturer's name		
					Model Number	HP	Volt
					Length of drop pipe	ft	Capacity g.p. Typ
					Abandoned		
					Does property have any not in use and not sealed well(s)?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
					Variance		
					Was a variance granted from the MDH for this well?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
					Miscellaneous		
					First Bedrock	Aquifer	
					Last Strat	Depth to Bedrock ft	
					Located by	Minnesota Geological Survey	
					Locate Method	Digitization (Screen) - Map (1:24,000) (15 meters or	
					System	UTM - NAD83, Zone 15, Meters	X 499325 Y 4982027
					Unique Number Verification	Info/GPS from data	Input Date 11/18/2020
					Angled Drill Hole		
					Well Contractor		
					Thein Well Co., Inc.	1337	HILBRANDS, B.
					Licensee Business	Lic. or Reg. No.	Name of Driller
Remarks							

849085

County Ramsey
 Quad St Paul East
 Quad ID 103A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
 Minnesota Statutes Chapter 1031

Entry Date 11/15/2020
 Update Date 11/18/2020
 Received Date 07/13/2020

Well Name MW-2 ST PAUL	Township 29	Range 22	Dir Section W 23	Subsection ADDDAC	Well Depth 20 ft.	Depth Completed 20 ft.	Date Well Completed 06/25/2020
Elevation 1011	Elev. Method LiDAR 1m DEM (MNDNR)				Drill Method	Drill Fluid	
Address					Use monitor well	Status Active	
Well 2200 LARPENTEUR AV E ST PAUL MN					Well Hydrofractured? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> From To		
Contact 380 ST PETER ST ST PAUL MN					Casing Type Single casing Joint		
Stratigraphy Information					Drive Shoe? Yes <input type="checkbox"/> No <input type="checkbox"/> Above/Below		
Geological Material From To (ft.) Color Hardness					Casing Diameter Weight		
SANDY CLAY COBBLES 0 12 RED HARD					2 in. To 10 ft. lbs./ft.		
WET SILTY SAND 12 20 RED/BRN HARD							
					Open Hole From ft. To ft.		
					Screen? <input checked="" type="checkbox"/> Type plastic Make JOHNSON		
					Diameter Slot/Gauze Length Set		
					2 in. 0 10 ft. 10 ft. 20 ft.		
					Static Water Level		
					12 ft. land surface Measure 06/25/2020		
					Pumping Level (below land surface)		
					ft. hrs. Pumping at g.p.m.		
					Wellhead Completion		
					Pitless adapter manufacturer Model		
					<input checked="" type="checkbox"/> Casing Protection <input type="checkbox"/> 12 in. above grade		
					<input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY)		
					Grouting Information Well Grouted? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Specified		
					Material Amount From To		
					bentonite 1 Sacks 4 ft. 7 ft.		
					neat cement 2 Sacks ft. 4 ft.		
					Nearest Known Source of Contamination		
					feet Direction Type		
					Well disinfected upon completion? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
					Pump <input checked="" type="checkbox"/> Not Installed Date Installed		
					Manufacturer's name		
					Model Number HP Volt		
					Length of drop pipe ft Capacity g.p. Typ		
					Abandoned		
					Does property have any not in use and not sealed well(s)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
					Variance		
					Was a variance granted from the MDH for this well? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
					Miscellaneous		
					First Bedrock Aquifer		
					Last Strat Depth to Bedrock ft		
					Located by Minnesota Geological Survey		
					Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or		
					System UTM - NAD83, Zone 15, Meters X 499578 Y 4981319		
					Unique Number Verification Info/GPS from data Input Date 11/18/2020		
					Angled Drill Hole		
					Well Contractor		
					Thein Well Co., Inc. 1337 HILBRANDS, B.		
					Licensee Business Lic. or Reg. No. Name of Driller		
Remarks							
Minnesota Well Index Report					849085		
					Printed on 07/02/2021 HE-01205-15		

849086

County Ramsey
 Quad St Paul East
 Quad ID 103A

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING REPORT
 Minnesota Statutes Chapter 1031

Entry Date
 Update Date 11/18/2020
 Received Date 07/13/2020

Well Name MW-3 ST PAUL	Township 29	Range 22	Dir Section W 23	Subsection DADCBB	Well Depth 30 ft.	Depth Completed 30 ft.	Date Well Completed 06/25/2020
Elevation 1014	Elev. Method LiDAR 1m DEM (MNDNR)				Drill Method Other	Drill Fluid	
Address					Use monitor well	Status Active	
Well 2200 LARPENTEUR AV E ST PAUL MN					Well Hydrofractured? Yes <input type="checkbox"/> No <input type="checkbox"/> From To		
Contact 308 ST PETER ST ST PAUL MN					Casing Type Single casing Joint		
Stratigraphy Information					Drive Shoe? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Above/Below		
Geological Material From To (ft.) Color Hardness					Casing Diameter Weight		
SANDY CLAY 0 23 BLK/RED HARD					2 in. To 20 ft. lbs./ft.		
SILTY SAND 23 30 RED/BRN HARD							
					Open Hole From ft. To ft.		
					Screen? <input checked="" type="checkbox"/> Type plastic Make JOHNSON		
					Diameter Slot/Gauze Length Set		
					2 in. 0 10 ft. 20 ft. 30 ft.		
					Static Water Level		
					23 ft. land surface Measure 06/25/2020		
					Pumping Level (below land surface)		
					ft. hrs. Pumping at g.p.m.		
					Wellhead Completion		
					Pitless adapter manufacturer Model		
					<input checked="" type="checkbox"/> Casing Protection <input type="checkbox"/> 12 in. above grade		
					<input type="checkbox"/> At-grade (Environmental Wells and Borings ONLY)		
					Grouting Information Well Grouted? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not Specified		
					Material Amount From To		
					bentonite 2 Sacks 4 ft. 17 ft.		
					neat cement 2 Sacks ft. 4 ft.		
					Nearest Known Source of Contamination		
					feet Direction Type		
					Well disinfected upon completion? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
					Pump <input checked="" type="checkbox"/> Not Installed Date Installed		
					Manufacturer's name		
					Model Number HP Volt		
					Length of drop pipe ft Capacity g.p. Typ		
					Abandoned		
					Does property have any not in use and not sealed well(s)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
					Variance		
					Was a variance granted from the MDH for this well? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
					Miscellaneous		
					First Bedrock Aquifer		
					Last Strat Depth to Bedrock ft		
					Located by Minnesota Geological Survey		
					Locate Method Digitization (Screen) - Map (1:24,000) (15 meters or		
					System UTM - NAD83, Zone 15, Meters X 499412 Y 4980929		
					Unique Number Verification Info/GPS from data Input Date 11/18/2020		
					Angled Drill Hole		
					Well Contractor		
					Thein Well Co., Inc. 1337 HILBRANDS, B.		
					Licensee Business Lic. or Reg. No. Name of Driller		

Appendix B – DNR and USFWS Information



Minnesota Department of Natural Resources
Division of Ecological & Water Resources
500 Lafayette Road, Box 25
St. Paul, MN 55155-4025

June 16, 2022

Correspondence # MCE 2022-00297

Dustin Simonson
WSB & Associates

RE: Natural Heritage Review of the proposed Hill Crest Golf Course Redevelopment,
T29N R22W Section 23; Ramsey County

Dear Dustin Simonson,

As requested, the Minnesota Natural Heritage Information System has been reviewed to determine if the proposed project has the potential to impact any rare species or other significant natural features. Based on the project details provided with the request, the following rare features may be impacted by the proposed project:

State-listed Species

- Blanding's turtles (*Emydoidea blandingii*), a state-listed threatened species, have been documented in the vicinity of the proposed project. Blanding's turtles use upland areas up to and over a mile distant from wetlands, waterbodies, and watercourses. Uplands are used for nesting, basking, periods of dormancy, and traveling between wetlands. Factors believed to contribute to the decline of this species include collisions with vehicles, wetland drainage and degradation, and the development of upland habitat. Any added mortality can be detrimental to populations of Blanding's turtles, as these turtles have a low reproduction rate that depends upon a high survival rate to maintain population levels.

This project has the potential to impact this rare turtle through direct fatalities and habitat disturbance/destruction due to excavation, fill, and other construction activities associated with the project. Minnesota's Endangered Species Statute (*Minnesota Statutes*, section 84.0895) and associated Rules (*Minnesota Rules*, part 6212.1800 to 6212.2300 and 6134) prohibit the take of threatened or endangered species without a permit. As such, **the following avoidance measures are required:**

- Avoid aquatic impacts during hibernation season, between October 15th and April 15th, unless the area is unsuitable for hibernation.
- The use of [erosion control](#) blanket shall be limited to 'bio-netting' or 'natural-netting' types, and specifically not products containing plastic mesh netting or other plastic components.
 - Also, be aware that hydro-mulch products may contain small synthetic (plastic) fibers to aid in their matrix strength. These loose fibers could potentially re-suspend and make their way into Public Waters. As such, please review mulch products and not allow any materials with synthetic (plastic) fiber additives in areas that drain to Public Waters.
- Areas where there will be construction, especially aquatic areas, should be thoroughly checked for turtles before the use of heavy equipment or any ground disturbance.
 - The [Blanding's turtle flyer](#) must be given to all contractors working in the area.
 - Monitor for turtles during construction and report any sightings to the [DNR Nongame Specialist](#), Erica Hoaglund (Erica.Hoaglund@state.mn.us).
 - If turtles are in imminent danger they must be moved by hand out of harm's way, otherwise, they are to be left undisturbed.

If the above avoidance measures are not possible, please contact me as further action may be needed.

For additional information, see the [Blanding's turtle fact sheet](#), which describes the habitat use and life history of this species. The fact sheet also provides two lists of recommendations for avoiding and minimizing impacts to this rare turtle. **Please refer to both lists of recommendations and apply those that are relevant to your project.** For further assistance regarding the Blanding's turtle, please contact the DNR Regional Nongame Specialist, Erica Hoaglund.

Federally Protected Species

- The area of interest overlaps with a Rusty Patched Bumble Bee *High Potential Zone*. The rusty patched bumble bee (*Bombus affinis*) is federally listed as endangered and is likely to be present in suitable habitat within *High Potential Zones*. From April through October this species uses underground nests in upland grasslands, shrublands, and forest edges, and forages where nectar and pollen are available. From October through April the species overwinters under tree litter in upland forests and woodlands. The rusty patched bumble bee may be impacted by a variety of land management activities including, but not limited to, prescribed fire, tree-removal, haying, grazing, herbicide use, pesticide use, land-clearing, soil disturbance or compaction, or use of non-native bees. The [USFWS rusty patched bumble bee guidance](#) provides guidance on avoiding impacts to rusty patched bumble bee and a key for determining if actions are likely to affect the species; the determination key can be found in the appendix. If applicable, the DNR also

recommends reseeding disturbed soils with native species of grasses and forbs using [BWSR Seed Mixes](#) or [MnDOT Seed Mixes](#). Please visit the [USFWS Rusty Patched Bumble Bee Map](#) for the most current locations of *High Potential Zones*.

- To ensure compliance with federal law, conduct a federal regulatory review using the U.S. Fish and Wildlife Service's (USFWS) online [Information for Planning and Consultation \(IPaC\) tool](#).

Environmental Review and Permitting

- The Environmental Assessment Worksheet should address whether the proposed project has the potential to adversely affect the above rare features and, if so, it should identify specific measures that will be taken to avoid or minimize disturbance. Sufficient information should be provided so the DNR can determine whether a takings permit will be needed for any of the above protected species.
- Please include a copy of this letter and the MCE-generated Final Project Report in any state or local license or permit application. Please note that measures to avoid or minimize disturbance to the above rare features may be included as restrictions or conditions in any required permits or licenses.

The Natural Heritage Information System (NHIS), a collection of databases that contains information about Minnesota's rare natural features, is maintained by the Division of Ecological and Water Resources, Department of Natural Resources. The NHIS is continually updated as new information becomes available, and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features. However, the NHIS is not an exhaustive inventory and thus does not represent all of the occurrences of rare features within the state. Therefore, ecologically significant features for which we have no records may exist within the project area. If additional information becomes available regarding rare features in the vicinity of the project, further review may be necessary.

For environmental review purposes, the results of this Natural Heritage Review are valid for one year; the results are only valid for the project location and project description provided with the request. If project details change or the project has not occurred within one year, please resubmit the project for review within one year of initiating project activities.

The Natural Heritage Review does not constitute project approval by the Department of Natural Resources. Instead, it identifies issues regarding known occurrences of rare features and potential impacts to these rare features. For information on the environmental review process or other natural resource concerns, you may contact your [DNR Regional Environmental Assessment Ecologist](#).

Thank you for consulting us on this matter, and for your interest in preserving Minnesota's rare natural resources.

Sincerely,

A handwritten signature in black ink that reads "James Drake". The signature is written in a cursive style with a large, stylized "D".

James Drake
Natural Heritage Review Specialist
James.F.Drake@state.mn.us

Cc: Melissa Collins



United States Department of the Interior



FISH AND WILDLIFE SERVICE

Minnesota-Wisconsin Ecological Services Field Office

4101 American Blvd E

Bloomington, MN 55425-1665

Phone: (952) 252-0092 Fax: (952) 646-2873

<http://www.fws.gov/midwest/Endangered/section7/s7process/step1.html>

In Reply Refer To:

October 11, 2021

Consultation Code: 03E19000-2022-SLI-0101

Event Code: 03E19000-2022-E-00383

Project Name: Hillcrest Redevelopment Project

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

This response has been generated by the Information, Planning, and Conservation (IPaC) system to provide information on natural resources that could be affected by your project. The U.S. Fish and Wildlife Service (Service) provides this response under the authority of the Endangered Species Act of 1973 (16 U.S.C. 1531-1543), the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d), the Migratory Bird Treaty Act (16 U.S.C. 703-712), and the Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq.*).

Threatened and Endangered Species

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and may be affected by your proposed project. The species list fulfills the requirement for obtaining a Technical Assistance Letter from the U.S. Fish and Wildlife Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the ECOS IPaC website at regular intervals during project planning and implementation

for updates to species lists and information. An updated list may be requested through the ECOS IPaC system by completing the same process used to receive the enclosed list.

Consultation Technical Assistance

Please refer to the Midwest Region [S7 Technical Assistance](#) website for step-by-step instructions for making species determinations and for specific guidance on the following types of projects: projects in developed areas, HUD, CDBG, EDA, pipelines, buried utilities, telecommunications, and requests for a Conditional Letter of Map Revision (CLOMR) from FEMA.

Using the IPaC Official Species List to Make No Effect and May Affect Determinations for Listed Species

1. If IPaC returns a result of “There are no listed species found within the vicinity of the project,” then project proponents can conclude the proposed activities will have **no effect** on any federally listed species under Service jurisdiction. Concurrence from the Service is not required for **No Effect** determinations. No further consultation or coordination is required. Attach this letter to the dated IPaC species list report for your records. An example ["No Effect" document](#) also can be found on the S7 Technical Assistance website.
2. If IPaC returns one or more federally listed, proposed, or candidate species as potentially present in the action area of the proposed project – other than bats (see below) – then project proponents must determine if proposed activities will have **no effect** on or **may affect** those species. For assistance in determining if suitable habitat for listed, candidate, or proposed species occurs within your project area or if species may be affected by project activities, you can obtain [Life History Information for Listed and Candidate Species](#) through the S7 Technical Assistance website. If no impacts will occur to a species on the IPaC species list (e.g., there is no habitat present in the project area), the appropriate determination is **No Effect**. No further consultation or coordination is required. Attach this letter to the dated IPaC species list report for your records. An example ["No Effect" document](#) also can be found on the S7 Technical Assistance website.
3. Should you determine that project activities **may affect** any federally listed, please contact our office for further coordination. Letters with requests for consultation or correspondence about your project should include the Consultation Tracking Number in the header. Electronic submission is preferred.

Northern Long-Eared Bats

Northern long-eared bats occur throughout Minnesota and Wisconsin and the information below may help in determining if your project may affect these species.

This species hibernates in caves or mines only during the winter. In Minnesota and Wisconsin, the hibernation season is considered to be November 1 to March 31. During the active season (April 1 to October 31) they roost in forest and woodland habitats. Suitable summer habitat for northern long-eared bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥ 3 inches dbh for northern long-eared bat that have exfoliating bark, cracks, crevices, and/or hollows), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of forested/wooded habitat. Northern long-eared bats have also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat and evaluated for use by bats. If your project will impact caves or mines or will involve clearing forest or woodland habitat containing suitable roosting habitat, northern long-eared bats could be affected.

Examples of unsuitable habitat include:

- Individual trees that are greater than 1,000 feet from forested or wooded areas,
- Trees found in highly developed urban areas (e.g., street trees, downtown areas),
- A pure stand of less than 3-inch dbh trees that are not mixed with larger trees, and
- A stand of eastern red cedar shrubby vegetation with no potential roost trees.

If IPaC returns a result that northern long-eared bats are potentially present in the action area of the proposed project, project proponents can conclude the proposed activities **may affect** this species **IF** one or more of the following activities are proposed:

- Clearing or disturbing suitable roosting habitat, as defined above, at any time of year,
 - Any activity in or near the entrance to a cave or mine,
 - Mining, deep excavation, or underground work within 0.25 miles of a cave or mine,
 - Construction of one or more wind turbines, or
-

- Demolition or reconstruction of human-made structures that are known to be used by bats based on observations of roosting bats, bats emerging at dusk, or guano deposits or stains.

If none of the above activities are proposed, project proponents can conclude the proposed activities will have **no effect** on the northern long-eared bat. Concurrence from the Service is not required for **No Effect** determinations. No further consultation or coordination is required. Attach this letter to the dated IPaC species list report for your records. An example "[No Effect](#)" [document](#) also can be found on the S7 Technical Assistance website.

If any of the above activities are proposed, please use the northern long-eared bat determination key in IPaC. This tool streamlines consultation under the 2016 rangewide programmatic biological opinion for the 4(d) rule. The key helps to determine if prohibited take might occur and, if not, will generate an automated verification letter. No further review by us is necessary. Please visit the links below for additional information about "may affect" determinations for the northern long-eared bat.

[NLEB Section 7 consultation](#)

[Key to the NLEB 4\(d\) rule for federal actions that may affect](#)

[Instructions for the NLEB 4\(d\) assisted d-key](#)

[Maternity tree and hibernaculum locations by state](#)

Other Trust Resources and Activities

Bald and Golden Eagles - Although the bald eagle has been removed from the endangered species list, this species and the golden eagle are protected by the Bald and Golden Eagle Act and the Migratory Bird Treaty Act. Should bald or golden eagles occur within or near the project area please contact our office for further coordination. For communication and wind energy projects, please refer to additional guidelines below.

Migratory Birds - The Migratory Bird Treaty Act (MBTA) prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Service. The Service has the responsibility under the MBTA to proactively prevent the mortality of migratory birds whenever possible and we encourage implementation of recommendations that minimize potential impacts to migratory birds. Such measures include clearing forested habitat outside the nesting season (generally March 1 to August 31) or conducting nest surveys prior to clearing to avoid injury to eggs or nestlings.

Communication Towers - Construction of new communications towers (including radio, television, cellular, and microwave) creates a potentially significant impact on migratory birds, especially some 350 species of night-migrating birds. However, the Service has developed [voluntary guidelines for minimizing impacts](#).

Transmission Lines - Migratory birds, especially large species with long wingspans, heavy bodies, and poor maneuverability can also collide with power lines. In addition, mortality can occur when birds, particularly hawks, eagles, kites, falcons, and owls, attempt to perch on uninsulated or unguarded power poles. To minimize these risks, please refer to [guidelines](#) developed by the Avian Power Line Interaction Committee and the Service. Implementation of these measures is especially important along sections of lines adjacent to wetlands or other areas that support large numbers of raptors and migratory birds.

Wind Energy - To minimize impacts to migratory birds and bats, wind energy projects should follow the Service's [Wind Energy Guidelines](#). In addition, please refer to the Service's [Eagle Conservation Plan Guidance](#), which provides guidance for conserving bald and golden eagles in the course of siting, constructing, and operating wind energy facilities.

State Department of Natural Resources Coordination

While it is not required for your Federal section 7 consultation, please note that additional state endangered or threatened species may also have the potential to be impacted. Please contact the Minnesota or Wisconsin Department of Natural Resources for information on state listed species that may be present in your proposed project area.

Minnesota

[Minnesota Department of Natural Resources - Endangered Resources Review Homepage](#)

Email: Review.NHIS@state.mn.us

Wisconsin

[Wisconsin Department of Natural Resources - Endangered Resources Review Homepage](#)

Email: DNRERReview@wi.gov

We appreciate your concern for threatened and endangered species. Please feel free to contact our office with questions or for additional information.

Attachment(s):

- Official Species List
 - Migratory Birds
-

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Minnesota-Wisconsin Ecological Services Field Office

4101 American Blvd E

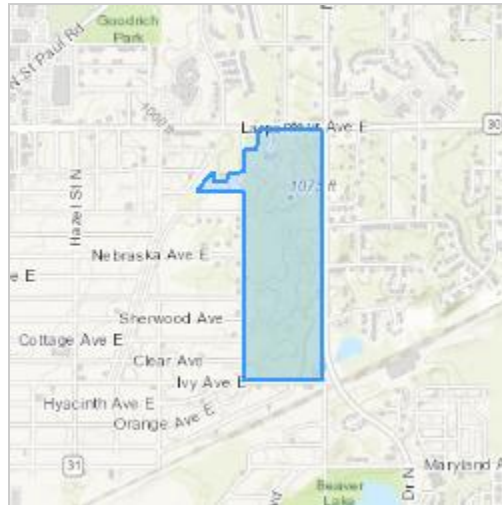
Bloomington, MN 55425-1665

(952) 252-0092

Project Summary

Consultation Code: 03E19000-2022-SLI-0101
Event Code: Some(03E19000-2022-E-00383)
Project Name: Hillcrest Redevelopment Project
Project Type: LAND - MANAGEMENT PLANS
Project Description: Land development project
Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/@44.98654885,-93.00757286620384,14z>



Counties: Ramsey County, Minnesota

Endangered Species Act Species

There is a total of 3 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries¹, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat <i>Myotis septentrionalis</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Insects

NAME	STATUS
Monarch Butterfly <i>Danaus plexippus</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate
Rusty Patched Bumble Bee <i>Bombus affinis</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9383 General project design guidelines: https://ecos.fws.gov/ipac/project/CKAO46AEKJGH5FJMLOV7FST5QY/documents/generated/5967.pdf	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act¹ and the Bald and Golden Eagle Protection Act².

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described [below](#).

-
1. The [Migratory Birds Treaty Act](#) of 1918.
 2. The [Bald and Golden Eagle Protection Act](#) of 1940.
 3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern](#) (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ [below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the [E-bird data mapping tool](#) (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found [below](#).

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle <i>Haliaeetus leucocephalus</i> This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31
Black Tern <i>Chlidonias niger</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3093	Breeds May 15 to Aug 20

NAME	BREEDING SEASON
Bobolink <i>Dolichonyx oryzivorus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31
Canada Warbler <i>Cardellina canadensis</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10
Cerulean Warbler <i>Dendroica cerulea</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/2974	Breeds Apr 22 to Jul 20
Golden-winged Warbler <i>Vermivora chrysoptera</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8745	Breeds May 1 to Jul 20
Red-headed Woodpecker <i>Melanerpes erythrocephalus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Sep 10
Rusty Blackbird <i>Euphagus carolinus</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Wood Thrush <i>Hylocichla mustelina</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for

that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is $0.25/0.25 = 1$; at week 20 it is $0.05/0.25 = 0.2$.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

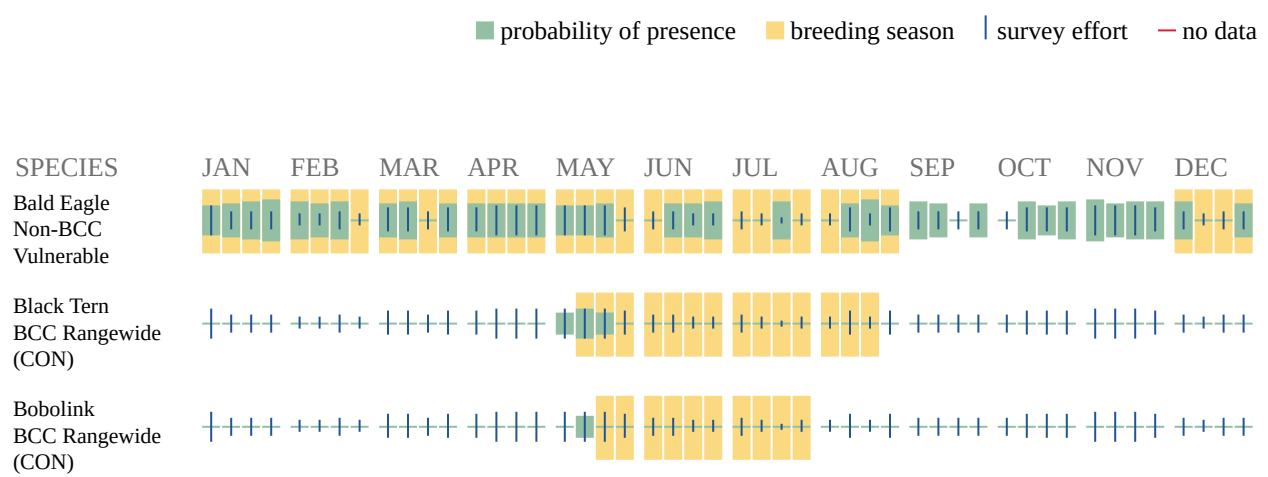
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

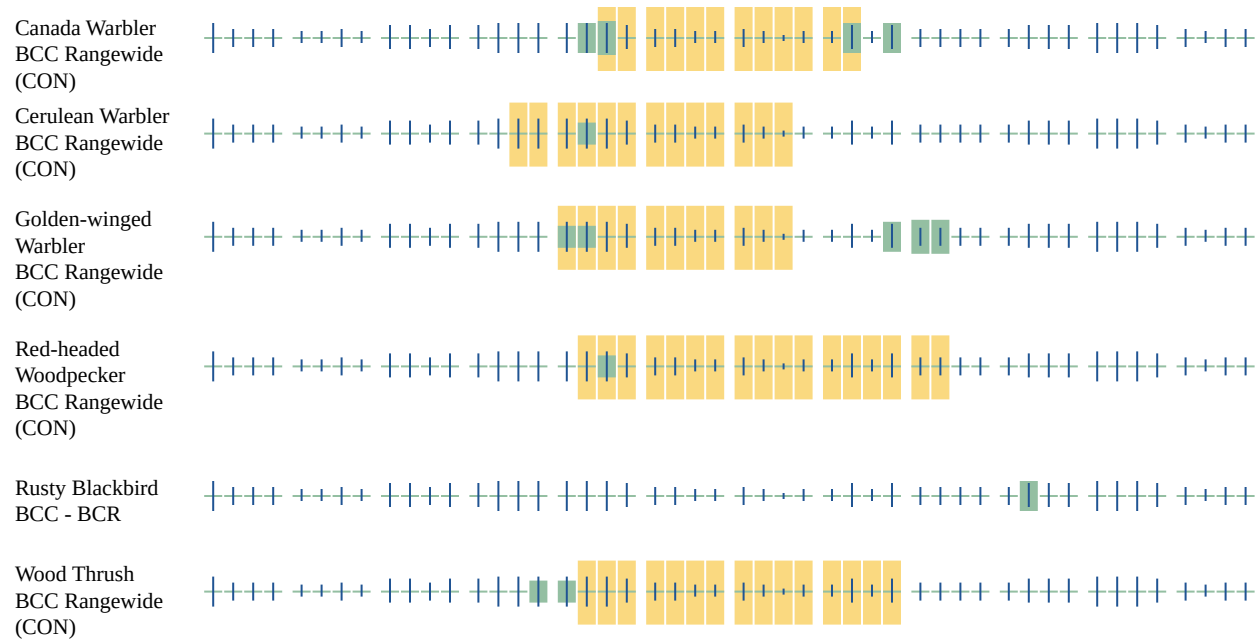
No Data (-)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Additional information can be found using the following links:

- Birds of Conservation Concern <http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php>
- Measures for avoiding and minimizing impacts to birds <http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php>
- Nationwide conservation measures for birds <http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf>

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. [Additional measures](#) or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [AKN Phenology Tool](#).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: [The Cornell Lab of Ornithology All About Birds Bird Guide](#), or (if you are unsuccessful in locating the bird of interest there), the [Cornell Lab of Ornithology Neotropical Birds guide](#). If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
 2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
 3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Eagle Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).
-

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the [Diving Bird Study](#) and the [nanotag studies](#) or contact [Caleb Spiegel](#) or [Pam Loring](#).

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to [obtain a permit](#) to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Appendix C – Phase Ia Cultural Resources and SHPO Response

September 13, 2021

Andi Moffatt
Vice President of Environmental Services
WSB & Associates
701 Xenia Avenue S, Suite 300
Minneapolis, MN 55416

RE: Hillcrest Golf Course Redevelopment Project
St. Paul, Ramsey County
SHPO Number: 2021-2707

Dear Andi Moffatt:

Thank you for consulting with our office during the preparation of an Alternative Urban Areawide Review (AUAR) for the above referenced project. According to your correspondence, the City of St. Paul is the Responsible Governmental Unit (RGU) for the environmental review, and the St. Paul Port Authority is the proposed developer for industrial and multi-family residential land uses at this site. Our comments at this time are meant as technical assistance only, as the scope of the proposed project has not been clearly defined and the regulatory framework for this project has not been established.

We have reviewed the submitted report titled *A Phase Ia Cultural Resource Assessment of the Proposed Hillcrest Golf Course Redevelopment Project, Saint Paul, Ramsey County, Minnesota, 55109, Township 29N, Range 22W, Section 23* (August 6, 2021) as prepared by Blondo Consulting. Our comments are provided below.

Archaeological Resources

Based on the information provided, we agree with the consultant's recommendation that a Phase I archaeological survey should be completed prior to any ground disturbing activities. The survey must meet the requirements of the Secretary of the Interior's Standards for Identification and Evaluation and should include an evaluation of National Register eligibility for any sites that are identified.

History/Architecture Properties

According to the report, eight (8) previously inventoried properties were identified within a half mile radius of the proposed project area. The **St. Paul Minneapolis and Manitoba Railway**, which has been determined eligible for listing in the National Register of Historic Places (NRHP), is located just south of the project area. The remaining seven (7) properties have not been evaluated to determine their eligibility for listing in the NRHP. There may be additional historic properties in the project area that have not yet been identified. If this project becomes a federal undertaking subject to review under Section 106 of the National Historic Preservation Act, further identification and evaluation efforts may be needed.

Hillcrest Golf Course: Based on the information provided, we agree that the Hillcrest Golf Course is **not eligible** for listing in the NRHP. While the property does have connection with the Jewish community, the connection appears to be one of convenience and business as opposed to one of social or community significance.

MINNESOTA STATE HISTORIC PRESERVATION OFFICE

50 Sherburne Avenue ■ Administration Building 203 ■ Saint Paul, Minnesota 55155 ■ 651-201-3287 mn.gov/admin/shpo ■ mnshpo@state.mn.us

AN EQUAL OPPORTUNITY AND SERVICE PROVIDER

Therefore, we are not yet convinced of the golf course's significance under Criterion A. Regardless, the loss of the original clubhouse renders the property ineligible due to a lack of integrity, as any historic association would be represented best in the building that housed the administration and social functions of the club. Furthermore, the property does not appear to possess significance under Criterion C as a notable golf course because, while largely intact, the course was not designed by a prominent figure and does not represent a significant design. A.W. Tillinghast's role in augmenting the original design is not a significant enough association to consider the golf course eligible for listing in the NRHP.

We would appreciate receiving an individual inventory form for the Hillcrest Golf Course for our records, so we can record the findings of this evaluation. The consultant should request a single inventory number for the property as a whole. The completed inventory form can be submitted electronically to Kelly Gragg-Johnson, Environmental Review Program Specialist, at kelly.graggjohnson@state.mn.us.

Please note that this comment letter does not address the requirements of Section 106 of the National Historic Preservation Act of 1966 and 36 CFR § 800. If this project is considered for federal financial assistance, or requires a federal permit or license, then review and consultation with our office will need to be initiated by the lead federal agency. Be advised that comments and recommendations provided by our office for this state-level review may differ from findings and determinations made by the federal agency as part of review and consultation under Section 106.

Please contact Kelly Gragg-Johnson at (651) 201-3285 or kelly.graggjohnson@state.mn.us if you have any questions regarding our comments.

Sincerely,



Sarah J. Beimers
Environmental Review Program Manager

**A Phase IA Cultural Resource Assessment
of the Proposed Hillcrest Golf Course Redevelopment Project
Saint Paul, Ramsey County, Minnesota, 55109
Township 29N Range 22W Section 23
SHPO Review and Compliance Number: PENDING
BC Project #: 2020-091**

**by
Steven J. Blondo, MA
and William Rayson
Blondo Consulting, LLC**

**August 6, 2021
FINAL REPORT**

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Attachment 1: Maps

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Management Summary/Abstract

Blondo Consulting, LLC (Blondo Consulting) was retained by WSB and Associates Inc. (WSB) to complete a Cultural Resource Assessment of the proposed Hillcrest Golf Course Redevelopment Project in Saint Paul, Ramsey County, Minnesota. This project involves the redevelopment of the Hillcrest Golf Course into mixed use industrial and residential. The proposed project is within Saint Paul's Northern Hayden Heights neighborhood, located in Section 23 of Township 29 North, Range 22 West. The project site is currently a recreational use area within an urban setting. The Area of Potential Effect (APE) is defined as the geographic area where an undertaking may directly or indirectly alter the character or use of existing historic properties. For the current project, the APE was defined as the approximately 105 acre site parcel.

The proposed project is being reviewed under an Alternative Urban Areawide Review (AUAR) by the Minnesota Environmental Quality Board (EQB) and requires compliance with state laws pertaining to cultural resources. The proposed project is also subject to review under Minnesota State Statute 138, the Historic Sites Act (138.666) and the Field Archaeology Act (138.40). Steven Blondo, MA was the Principal Investigator for the project. He meets the requirements of a qualified professional archaeologist under the Secretary of the Interior Standards and Qualifications and as defined by Minnesota Statute 138.31, subd. 10.

At project commencement, Blondo Consulting completed a literature search through the Minnesota State Historic Preservation Office (SHPO) and through the Office of the State Archaeologist (OSA) online Portal. The purpose of the literature search was to identify if previously reported or recorded archaeological and architectural sites exist within the proposed project area. No archaeological sites or historic structures were identified within the proposed project APE. An additional one-mile radius was addressed for archaeological sites and a half mile radius was addressed for historic structures to assist in developing a site context and better understand the prehistory and history of the area. The background search concluded in the finding of one previously recorded archaeological site within the one mile research radius, the Hillcrest Site 21RA0016. Additionally, eight previously inventoried architectural sites were identified within the half mile research radius of the proposed project area, including one National Register of Historic Places (NRHP) eligible Historic Property, the St. Paul and Minneapolis and Manitoba Railway.

The Hillcrest Golf Course was established in 1921 and meets the 50-year old threshold for historic property evaluation. An evaluation of the Hillcrest Golf Course revealed historic significance associated with the resilience of Minnesota's Jewish community during the height and heart of American anti-Semitism. The integrity of Hillcrest Golf Course relies on two key architectural features, the fairways and the clubhouse. Hillcrest's greens have been mostly unaltered since their professional redesign in 1936-1937, however the clubhouse, which was destroyed by fire in 1962 and rebuilt in 2000, does not meet the 50 year age criteria and does not resemble its original design. The Hillcrest Golf Course, lacking its original clubhouse does not retain historic integrity. Although the Hillcrest Golf Course is historically significant, it lacks

integrity and therefore does not meet the criteria for National Register eligibility. Additionally, although landscaping of the site has taken place, there is a potential to encounter previously unrecorded archaeological deposits. A Phase I Reconnaissance Survey is recommended prior to construction.

1.0 INTRODUCTION

Blondo Consulting, LLC (Blondo Consulting) was retained by WSB & Associates (WSB) to complete an assessment of potential cultural resources within the proposed Hillcrest Golf Course Redevelopment Project, Saint Paul, Ramsey County, Minnesota. The proposed project involves the redevelopment of the Hillcrest Golf Course into mixed use industrial and residential by the property's current owner, Saint Paul Port Authority (SPAA). SPAA hired WSB to conduct an Alternative Urban Areawide Review (AUAR), and in a letter to Blondo Consulting dated August 21, 2020 WSB requested a Phase IA Cultural Resource Assessment. This report is in answer to that request.

The proposed project is also subject for review under Minnesota Statute 138: Field Archaeology and the Historic Sites Act. Section 138.665 Subdivision 2 states,

the state, state departments, agencies, and political subdivisions, including the Board of Regents of the University of Minnesota, have a responsibility to protect the physical features and historic character of properties designated in section 138.662 and 138.664 or listed on the National Register of Historic Places created by Public Law 89-665. Before carrying out any undertaking that will affect designated or listed properties, or funding or licensing an undertaking by other parties, the state department or agency shall consult with the Minnesota Historical Society pursuant to the society's established procedures to determine appropriate treatments and to seek ways to avoid and mitigate any adverse effects on designated or listed properties. If the state department or agency and the Minnesota Historical Society agree in writing on a suitable course of action, the project may proceed (The Revisor of Statutes, 2018).

This Phase IA Cultural Resource Assessment involved a background literature search including a review of known archaeological sites and architectural properties. Results of the investigation are included in this report.

2.0 PROJECT AND SITE DESCRIPTION

The proposed project is located within Saint Paul's Northern Hayden Heights Neighborhood, in Section 23 of Township 29 North, Range 22 West, Saint Paul, Ramsey County, Minnesota. The proposed project involves the redevelopment of Hillcrest Golf Course into affordable housing units with limited commercial reality and a potential for business parks. The project is located in a recreational use area within an urban setting and contains the Hillcrest Golf Course, consisting of the eighteen-hole course, clubhouse, and a section of field to the northwest. The project parcel is approximately 105 acres (see Attachment I: Maps).

3.0 ENVIRONMENTAL SETTING

The project area lies within Minnesota SHPO Archaeological Region 4: Central Deciduous Region. Dr. Scott Anfinson (1990), former Minnesota State Archaeologist, first described these archaeological regions which help us to understand the prehistoric environment and better

understand where archaeological sites may be located. Archaeological Region 4: Central Deciduous is located in central and east central Minnesota. Its topography consists of a patchwork of moraines, till plains, and outwash plains (Anfinson, 1990; Gibbon et al., 2002). Prior to urban development, this area was a farm owned by Governor Alexander Ramsey (Emerson, 2006).

3.1 Soils

Within Archaeological Region 4, Soils reflect a diverse glacial and vegetational history. Most soils in this region range from medium to coarse textures with prairie soils in the south and west, and forest soils in the north and east (Anfinson 1990). Soils in the project area are described as part of the Kingley Sandy Loam complex found on 2 to 6 percent slopes. These soils are typically found on moraines and are made up of till as a parent material. A typical soil profile includes well drained soils to a depth of more than 80 inches where the water table is located (NRCS 2014).

3.2 Environmental Landscape

Numerous lakes are found throughout the region, some reaching depths of 30 meters. The Mississippi River flows through the eastern and central parts of the region with the St. Croix River forming the eastern boundary. The western part is drained by rivers that flow into the Red River. The natural vegetation is mostly Oak Openings and Barrens (Anfinson 1990; Gibbon et al. 2002). Today the area is located in the St. Paul Baldwin Plains and Moraines (222Md) subsection of the Minnesota and Northeast Iowa Morainal Section (222M). The Minnesota and Northeast Iowa Morainal Section consists of a long band of deciduous forest, woodland, and prairie. A large portion of this section consists of hummocky moraines that were deposited during the last glaciation along the eastern margin of the Des Moines ice lobe. Additional portions of this section consist of rolling or basal till that were deposited as drumlins with sand plains located within the moraines. These changes in landform directly affected the vegetation with sandy flat areas dominated by prairie, savanna, and oak/aspen woodlands; while hummocky moraines were dominated by mesic forests including sugar maple, basswood, American elm, and northern red oak (DNR, n.d.).

The St. Paul Baldwin Pains and Moraines subsection is dominated by a Superior lobe end moraine complex and associated series of outwash plains to the south. Topography is rolling to hummocky on the moraine (steep, short complex slopes) and level to rolling on the outwash. The topographic characteristics of this subsection are rolling to hummocky on the moraine and level to rolling on the outwash. The eastern boundary is formed by the St. Croix river, which flows into the Mississippi River southeast of the Twin Cities. Numerous lakes occur, mostly on the moraines (DNR ECS).

3.3 Geological Background

H.E. Wright (1972) identifies the physiographic regions overlaying the state. Overlaying the project area is the Owatonna Moraine Area (19) (Wright, 1972). Wright describes this area as extending southward from Minneapolis through the Iowa border. The eastern edge is bounded by the Rochester till plain and the western edge is bounded by the Blue Earth till plain. He

describes, “the northern part of the section carries a peninsula of the Big Woods southward into prairie” (Wright, 1972, pg. 573).

3.4 Prehistoric Flora and Fauna

Early prehistoric subsistence resources in the area may have included tundra species such as musk ox, and barren ground caribou. Over time the area was covered by pine forests, large herds of megafauna were rare. As prairies began to enter the southeastern portion of the region, large bison herds followed. Bison were common in all but the northeastern third of the region by about 7,000 years ago (Anfinson, 1990; Gibbon et al., 2002). As prairie retreated in the late Middle Prehistoric, faunal resources including beaver, moose, and black bear became abundant. Also, fish and waterfowl became common in the region’s numerous lakes and rivers. Wild Rice was an important food and economic resource during the Late Prehistoric and Early Historic periods (Anfinson, 1990; Gibbon et al., 2002).

4.0 CULTURAL HISTORY

Statewide contexts have been developed by the Minnesota State Historic Preservation Office (SHPO), which examines Minnesota’s recent Prehistoric through Historic past. These contexts are based on archaeological and historical research. They describe the history of the state and assist in predicting where specific types of sites may occur both geographically and temporally. Contexts allow us to identify property types and understand how to evaluate historic resources.

4.1 Pre-Contact Period

Native American contexts are commonly divided into three major traditions: Paleoindian, Archaic, and Woodland based on significant changes in how these communities lived and in what they ate. Historic contexts are generally divided into Contact and Post-Contact periods. The Contact period begins with early European exploration of the state and continues through the Post-Contact period including settlement and statehood.

4.1.1 Paleoindian Tradition (12,000 to 8,000 Before Present [B.P.]

The Paleoindian Tradition begins at the close of the Pleistocene era and beginning of the Holocene era. Native American Communities are small, mobile, and focused on hunting. During this period, the glacial ice retreats, Lake Agassiz (located on the edge of Traverse County, Minnesota) drains, and prairie vegetation advances into western Minnesota. Archaeological evidence from Paleoindian sites in Minnesota includes the Browns Valley Site, 21TR0005. They reflect the same general characteristics and patterns noted for Paleoindian sites throughout the central United States and Canada. Based on the small number of artifacts recovered from these sites, it can be assumed that these communities hunted a limited number of large animals, mainly mammoth and mastodons. As the Pleistocene era ended and the Holocene era began, these mega fauna gradually died out. Ancient species of bison followed the advance of prairie vegetation, giving Paleoindian peoples a new species to hunt. In addition to hunting large and small game, it is likely that gathering wild plant foods supplemented the diet of Paleoindian peoples.

Paleoindian peoples are known for their distinctive stone tools. Projectile points of this period show advanced craftsmanship and include large lanceolate projectile points. Because Paleoindian communities were small and nomadic, archaeologists have found only sparse, scattered evidence of Paleoindian peoples throughout the region.

4.1.2 Archaic Tradition (8,000 to 2,800 B.P.)

The beginning of the Archaic period is marked by a shift in diet and settlement patterns that represent an adaptation to environmental changes. Archaic peoples begin to use more diverse plant and animal resources. A broader range of tools including new projectile point forms, copper tools, and ground and pecked stone tools appear. Archaeological research does not present a clear picture of community size during this time. Research suggests both that community size increased and remained small with day-to-day activities taking place at a series of seasonal camps (Anfinson, 1987; 1997). Bison hunting remained an integral part of life for Archaic peoples. As with known Paleoindian sites, Archaic sites are relatively small and sparse.

4.1.3 Woodland Tradition (2,800 B.P. to European Contact)

In the Midwest region, archaeologists tend to divide the Woodland Tradition into three periods: Early, Middle, and Late. However, Anfinson (1987) suggests that in Minnesota it is more appropriate to divide the era into Initial and Terminal Woodland periods. Manufacturing ceramic vessels, utilizing bows and arrows, building burial mounds, and cultivating specific plant species, all mark the transition from the Archaic to the Woodland Tradition. Overall, subsistence during the Woodland Tradition remained similar to that of the Archaic period with communities dependent upon a diverse, seasonal resource base of plants and animals (Johnson, 1988; Anfinson, 1987).

Although community sizes have many similarities between the Early Woodland and Late Archaic period, by the Late Woodland period, populations are on the rise. This may be due to increased efficiency in food acquisition. Woodland period sites include burial mounds, small, limited-use sites, and large village and habitation sites. Sites are located either in areas where a community could focus on a specific resource or in environments capable of sustaining larger communities over longer periods of time.

4.1.4 Plains Village & Mississippian/Oneota Traditions (1,100 B.P. to European Contact)

Terminal Woodland period sites in Minnesota exhibit significant changes in subsistence and settlement patterns. Ceramic vessels with different form and decoration, settlement patterns shifting to larger and more permanent villages (usually near river settings) mark the change archaeologists refer to as the Plains Village and Mississippian/Oneota Traditions. Archaeological evidence indicates that both the Plains Village and Mississippian complexes relied heavily on bison hunting and intensive corn horticulture.

Archaeologists are unsure how the Oneota complexes developed. There are two common theories. The first suggests that groups migrating into the Upper Midwest brought with them new cultural traditions. The second theory proposes that people already living in the area began to adopt cultural changes different from groups around them.

Plains Village and Oneota site types are similar to those associated with the Woodland Tradition. The archaeological remains of these complexes range from burial mounds to small, limited-use sites and extensive habitation sites. Site location remains consistent with the Woodland Period.

4.2 Contact/Post-Contact Period (1630 to Present)

This period generally refers to the span of time extending from the first European explorations until intensive Euro-American settlement of the region. Minnesota's historical period began in 1673 when French explorers Marquette and Joliet discovered the upper portion of the Mississippi River. Ten years later, Catholic Missionary Father Louis Hennepin told his story of exploring Minnesota and being held captive by the Dakota Indians in the first book written about Minnesota, *Description de la Louisiane*.

The territory containing modern-day Minnesota was claimed by Spain, France, Great Britain, and the United States. Lieutenant Zebulon Montgomery Pike led the first United States expedition through Minnesota in 1805. Fort St. Anthony (later Ft. Snelling) was completed between 1819 and 1824, and in 1836 the Wisconsin Territory including a portion of Minnesota, was formed. Minnesota became a territory in 1849 and achieved statehood on May 11, 1858.

The fur trade drove much of the European exploration and settlement in Minnesota through the mid-1800s. While the fur trade impacted the Native American communities throughout all of Minnesota, the heaviest impacts came with European settlement after the 1860s. At that time, intensive settlement and agriculture dramatically transformed the landscape, displacing a large number of Native Americans. In 1862 tensions between white settlers and Native Americans resulted in the U.S. Dakota War. Ultimately, this war left 462 whites and "an unknown but substantial number" of Native Americans dead (Anderson and Woolworth, 1988). This conflict concluded with the hanging of 38 Dakota Indians in Mankato and the deportation of many others to Santee, Nebraska.

As white settlers made Minnesota their home, farming became the predominant industry. Wheat was the cash crop, and mills sprang up along major waterways across the state, notably in Minneapolis. Minnesota dominated the world in wheat processing until the 1930s.

In addition to milling, Minnesota was also a leader in lumbering and iron mining. Lumbering played a significant role in the development of northern Minnesota, with the industry peaking between 1899 and 1905. Iron mining began affecting the state's economy in 1884, when the Soudan Mine began shipping ore. The development of the Soudan Mine opened the Vermilion Iron Range, one of Minnesota's three iron ranges. Over the next two decades, mines sprang up across northern

and central portions of the state. The Mesabi, Cuyuna, and Vermilion Iron Ranges employed thousands of people and brought millions of dollars into Minnesota's economy. The rapid growth of mining cities such as Evelyth, Chisholm, Virginia, and Hibbing, as well as the port cities of Duluth, Minnesota and Superior, Wisconsin, were spurred by Minnesota's mining industry (Minnesota State University-Mankato, 2007).

Native American archaeological site types associated with this period are generally consistent with those of earlier periods, but European and Euro-American traders, missionaries, settlers, and industries affect the locations of these sites. This period also includes Euro-American immigrant settlement patterns, subsistence activities, and economic strategies. Sites associated with Euro-American immigrants appear in the mid-nineteenth century. Associated archaeological and historic site types categorized in the Contact/Post-Contact period include standing structures as well as archaeological sites. A number of these sites can be found near the project area and include schools and farms.

4.1.1 Saint Paul's Northern Hayden Heights Neighborhood

The land comprising the city of Saint Paul became part of the United States Northwest Territory in 1787. In 1805 Army officer Zebulon Pike negotiated a purchase of 100,000 acres from the Dakota, known as Pike's Purchase. The land Pike acquired was later used to establish Fort Snelling. In 1837 the United States government seized the remainder of the land comprising Saint Paul through a series of treaties. Following the recent annexations, Pierre "Pig's Eye" Parrant established the region's first settlement, Pig's Eye Landing, in 1838. Father Lucien Galtier of France established Saint Paul's Chapel on the bluffs above Pig's Eye Landing in 1841, later renaming the settlement after the church, Saint Paul. The territory of Minnesota was formally recognized in 1849, and Saint Paul was established as its capital. Saint Paul remains the capital of Minnesota (Visit Saint Paul, n.d.).

Saint Paul's Northern Hayden Heights neighborhood, which borders the city of Maplewood, is a roughly 350 acre neighborhood in the northeastern most part of the city. The Hillcrest Golf Course takes up nearly one third the Northern Hayden Heights Neighborhood. This area was formerly a 160 acre farm owned and operated by Minnesota Governor Alexander Ramsey. In 1913 Ramsey gave the property to his daughter, Marion Furness, who used the land for garden lots until selling it to White Bear Yacht Club golf pro Tom Vardon in 1921 (Empson, 2006; Shefchik, 2012). That same year, Tom Vardon opened the Hillcrest Golf Course, which remained in operation until 2017 (Shefchik, 2012). In 1997, major flooding one and a half miles west of Hillcrest Golf Course partially submerged sixty homes and as a result thirty-one homes were destroyed. Following the 1997 flood, Hillcrest Knoll Park, a public space operated by St. Paul Public Works was founded where the destroyed homes once stood. Hillcrest Knoll Park acts as a holding pond during rainy seasons. (Strudevant, 2016). Nearby Hillcrest Golf Course, which is on naturally high ground, was spared from the flooding.

5.0 BACKGROUND RESEARCH

A literature search was completed October 16, 2020 by Blondo Consulting staff member William Rayson. The Minnesota State Historic Preservation Office (SHPO) Inventory and Reports Database was accessed through an emailed request to the Survey and Inventory Coordinator, while the Office of the State Archaeologist’s (OSA) records were reviewed via the OSA Online Portal. During this search, previously recorded and reported architectural and archaeological sites were identified for a half-mile radius around the proposed project area.

Prior to the March 25, 2020 Stay At Home Order (issued by Governor Tim Walz), in person access to SHPO inventory files became limited. By March 25, 2020, state facilities (including the State Historic Preservation Office and Office of the State Archaeologist) were closed to prevent the spread of COVID-19. Office Staff began working from home, and accessible resources were reduced to previously digitized files. Due to these constraints, the current records search was limited to the Inventory and Reports Database search and Online Portal. An online search of the National Register of Historic Places and National Historic Landmark Database was also completed. These databases are limited by last being updated in 2014 and 2018. Mapping and files of local government HPCs (Historic/Heritage Preservation Councils), when available online, were also consulted.

5.1 Archaeology

The background records search, described above, was completed to identify previously recorded and reported archaeological and architectural sites within the project area. For a historic property (including archaeological sites) to be considered important within a cultural resource management context, it must meet a level of significance and retain historic integrity for National Register of Historic Places listing. The National Historic Landmark Database was also consulted. During that search, one archaeological site was identified within a one mile radius of the proposed project area (Table I).

Table I. Previously Recorded Archaeological Sites					
Site Number	Site Name	Cultural Affiliation	Description	NR Status	Distance from Site
21RA0016	Hillcrest	Precontact	Single Artifact	Unevaluated	0.59 miles

Hillcrest Site (21RA0016)

Hillcrest Site, 21RA0016, is an unevaluated prehistoric isolated find of unknown cultural affiliation consisting of one lithic artifact. This site is located on residential private property off Montana Avenue East, which is surrounded by wetlands. Hillcrest site was discovered in 1992 during a Phase I archaeological survey (OSA files). Hillcrest site (21RA0016) is located 0.59 miles east of the proposed project area.

5.2 Architecture

Additionally a search of Historic Properties within a half mile radius of the proposed project area was conducted. As a result, eight previously inventoried historic properties were identified within a half mile radius of the proposed project area. Eligible Historic Property St. Paul Minneapolis and Manitoba Railway (HE-MPC-5615) is located 196 feet south of the proposed project area (Table 2).

Table 2. Previously Inventoried Historic Properties				
Site Number	Address	Name/Description	NR Status	Distance from Site
HE-MPC-5615	---	St. Paul Minneapolis and Manitoba Railway	Eligible	196 Feet
RA-MWC-0027	2300 Larpenteur Ave. E	house	Unevaluated	0.11 Miles
RA-MWC-0028	1709 McKnight Rd. N	Community Corrections	Unevaluated	0.09 Miles
RA-SPC-1736	1350 Hazel St. N	Hayden Heights School	Unevaluated	0.50 Miles
RA-SPC-1737	1435 Hazel St. N	house	Unevaluated	0.50 Miles
RA-SPC-4781	1971 Orange Ave. E	house	Unevaluated	0.36 Miles
RA-SPC-4782	1979 Orange Ave. E	house	Unevaluated	0.37 Miles
RA-SPC-5751	2095 Clear Ave.	Water Tank	Unevaluated	0.10 Miles

Hillcrest Golf Course

The proposed Hillcrest Golf Course redevelopment project encompasses the entirety of the Hillcrest country club. Originally farmland operated by Governor Alexander Ramsey, the land was given to Ramsey's daughter Marion Furness in 1913. Marion Furness used the property for garden lots until selling it to Tom Vardon in 1921 (Empson, 2006; Shefchik, 2012). The Hillcrest Golf Course was designed and constructed in 1921 by White Bear Yacht Club golf pro Tom Vardon (Shefchik, 2012). Originally named Lakeview, the private nine-hole golf course was renamed Hillcrest in 1923 (Bissen, 2019). Hillcrest opened up to the public for a couple years in order to fund a nine-hole expansion, then switched back to a private operation in 1928. In 1936 Hillcrest head pro Herb Snow invited famed golf course architect A.W. Tillinghast to visit, who suggested a series of alterations to the golf course. The following year, Tillinghast returned and approved of the club's alterations, which resulted in the Minnesota Golf Association (MGA) officially approving the course. Since 1937, the golf course has not undergone significant alterations (Shefchik, 2012). Hillcrest's ongoing financial troubles began during the Great Depression. In 1933, Hillcrest opened back up to the public in efforts to gain membership (Shefchik, 2012). It was during this time that anti-Semitism was surging across the country and in Minneapolis in particular.

German Jews, drawn to commercial opportunities in the Twin Cities were among the first of Minnesota's Jewish population to settle in the state. By 1880, Saint Paul had two Synagogues to accommodate its rising Jewish population. During the 1880s Eastern European Jews began to arrive in large numbers to the United States, fleeing anti-Semitism, poor economic conditions, and Russian race-riots. From 1900 to 1910, Minnesota's Jewish population more than doubled from 6,000 to 13,000. Minnesota's rising Jewish population was particularly vulnerable to the post World War I xenophobic "Americanism" which was directed inward at recent immigrants. Around this time, social, civic, and employment discrimination against Jews became commonplace. By the late 1930s most employment ads in Minnesota stated outright "Gentiles Preferred". The Great Depression accelerated discriminatory trends, and marginalized groups such as Minnesota's Jewish communities were hit particularly hard.

By 1936, Minneapolis was showing signs of economic recovery. During this time, hate group William Dudley Pelley's Silver Shirts began recruiting members in the Twin Cities, with one goal of segregating all Jews to one city in Minnesota. Minnesota's Silver Shirt chapter membership grew to 6,000, helping to normalize the increasing hate speech and discriminatory practices against Minnesota's Jewish population. Local efforts to counteract employment discrimination, including the Jewish Free Employment Bureau (later renamed the Jewish Employment Service) were successful, but employment discrimination climaxed as economic efforts shifted from Depression recovery to war efforts during the beginning of America's involvement in World War II. At this time, Jewish owned businesses which survived the Great Depression were facing boycotts. Journalist Selden Menefee noted in 1943 "*almost no evidence of anti-Semitism in the Northwest and West Central States. Except in Minneapolis, no one considered it to be a problem.*" Three years later Menefee followed up "*Signs of militant anti-Semitism I found almost entirely lacking [sic] except for Minneapolis.*" Another journalistic investigation by Carey McWilliams in 1946 concluded in deeming Minneapolis "*The capitol [sic] of anti-Semitism in the United States.*"

After WWII, Americans united over the defeat of fascism, and generally began to view discrimination as un-acceptable to their values. In 1947 Minneapolis mayor Hubert Humphrey conducted a "Mayor Self-Study" which concluded that 63% of Minneapolis firms racially discriminate in hiring practices. Following this study, several local organizations formed the Joint Committee for Employment Opportunity, which circulated a petition with over 10,000 signatures calling for racial and religious equal employment opportunities in the Twin Cities. As American values shifted, Jews became discriminated against less throughout the 1950s (Weber, 1991).

Discriminatory practices during the early 20th century extended to Minnesota's social clubs, as a result, Jewish social club Calumet Club was formed in Minneapolis in 1908. In 1913 Calumet Club members began talks of opening a Jewish golf club in the Twin Cities. In 1915 Calumet Club members opened up Minnesota's first Jewish country club, Northwood in Saint Paul, followed by Minneapolis club Oak Ridge in 1921 (Shefchik, 2012). In 1945 Hillcrest's ongoing financial troubles and the closing of Northwood culminated in a group of Jewish businessmen and Northwood

members purchasing Hillcrest. Hillcrest's timely switch to Jewish ownership coincided with the climax of anti-Semitism in Minnesota. During its Jewish ownership, Hillcrest had the distinction of hosting the Minnesota State Amateur Golf Tournament in 1962. Hillcrest Golf Course continued to run as an exclusively Jewish operation through the 1970s. Financial troubles continued with new ownership, Hillcrest experienced caddy strikes in the 1950s and a devastating clubhouse fire in 1962, which left Hillcrest without a clubhouse for 38 years (Orrick, 2017).

Hillcrest members were not spared from the reach of Bernie Madoff's fraudulent investment practices, which preyed on investors at affluent Jewish country clubs across the states (Biggs, 2009). One report concluded that during a period from the 1990s to the mid 2000s, members from Hillcrest and nearby Oak Ridge paid more than \$100 Million to Madoff's Ponzi scheme (Kansas, 2009; Wall Street Journal, 2009). In 2000 Hillcrest finally completed construction of a new clubhouse at a cost of \$2.8 Million, saddling the club with debt (Orrick, 2017). In 2011 the club was sold to Steamfitters Pipefitters Local 455 for \$4.3 Million, with an eventual plan to build a training center, which fell through. In 2017 Hillcrest closed due failing finances and hired SPAA to assist in selling.

Hillcrest's switch to Jewish ownership in 1945 represents the changing attitudes of Americans from the xenophobic aftermath of World War I to the post-World War II sense of unity, exemplifying the anti-Semitism in the Twin Cities in particular, and the triumph of the Jewish community. Due to its association with the height and heart of American anti-Semitism, and the backlash against discrimination it represents, Hillcrest Golf Course demonstrates historical significance under National Register Criterion A for its association with important historic events.

The period of significance for the Hillcrest Golf Course is linked to its Jewish ownership from 1945 through the 1970s. Prior to its Jewish ownership, in 1936-1937, famed golf architect A.W. Tillinghast recommended and approved of several alterations to the greens, including the utilization of his signature bunkers. Hillcrest's greens mostly retain Tillinghast's architectural integrity, however another key feature of the club, the clubhouse, has been absent since the clubhouse fire in 1962. Though the Hillcrest clubhouse was rebuilt in 2000, the redesigned clubhouse does not retain any historic resemblance to the original (Orrick, 2017). Examples of A.W. Tillinghast designed golf courses which are listed in the National Register, including Baltusrol Golf Club in Springfield, New Jersey and Winged Foot Golf Club in Mamaroneck, New York, have historic clubhouses which are crucial parts of their historic integrity (NRHP forms). The Hillcrest Golf Course, lacking its original clubhouse does not retain historic integrity. Having historical significance but not integrity, the Hillcrest Golf Course does not meet the criteria for National Register eligibility.

St. Paul Minneapolis and Manitoba Railway (HE-MPC-5615)

The St. Paul Minneapolis and Manitoba Railway was formed in 1879 when investors took over assets of St. Paul and Pacific. In 1890 ownership was transferred to Great Northern. Today the St. Paul and Manitoba Railway is still in use and is part of the BNSF Railway system (Schmidt and

Vermeer, 2009). Eligible Historic Property St. Paul Minneapolis and Manitoba Railway (HE-MPC-5615) is located 196 feet South of the proposed Hillcrest Golf Course Redevelopment Project.

6.0 RECOMMENDATIONS AND CONCLUSION

WSB retained Blondo Consulting to complete a Phase IA Cultural Resource Assessment for the proposed Hillcrest Golf Course Redevelopment Project in Saint Paul, Ramsey County, Minnesota. A literature search through the Minnesota SHPO and through the OSA online Portal concluded in the finding of one previously recorded archaeological site within one mile of the project area and eight previously inventoried properties within a half mile of the proposed project area. The Hillcrest Golf Course was established in 1921 and meets the 50-year old threshold for historic property evaluation. An evaluation of the Hillcrest Golf Course revealed historic significance associated with the resilience of Minnesota's Jewish community during the height and heart of American anti-Semitism. The Hillcrest Golf Course, lacking its original clubhouse does not retain historic integrity. Having historical significance but not integrity, the Hillcrest Golf Course does not meet the criteria for National Register eligibility.

Although landscaping of the site has taken place, there is a potential to encounter previously unrecorded archaeological deposits. A Phase I Reconnaissance Survey is recommended prior to construction. Due to the proximity of the project encompassing Hillcrest Golf Course, there is the potential to encounter cultural resources. Additional cultural resource investigations are recommended in consultation with the Minnesota State Historic Preservation Office, and the Office of the State Archaeologist.

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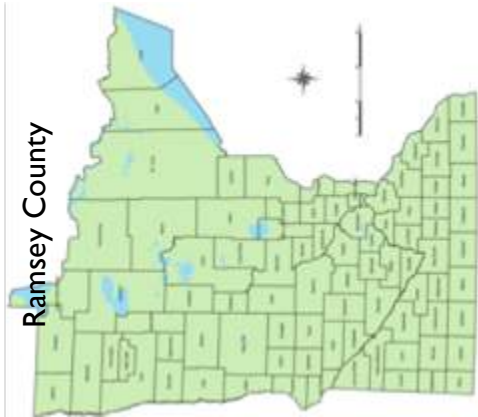
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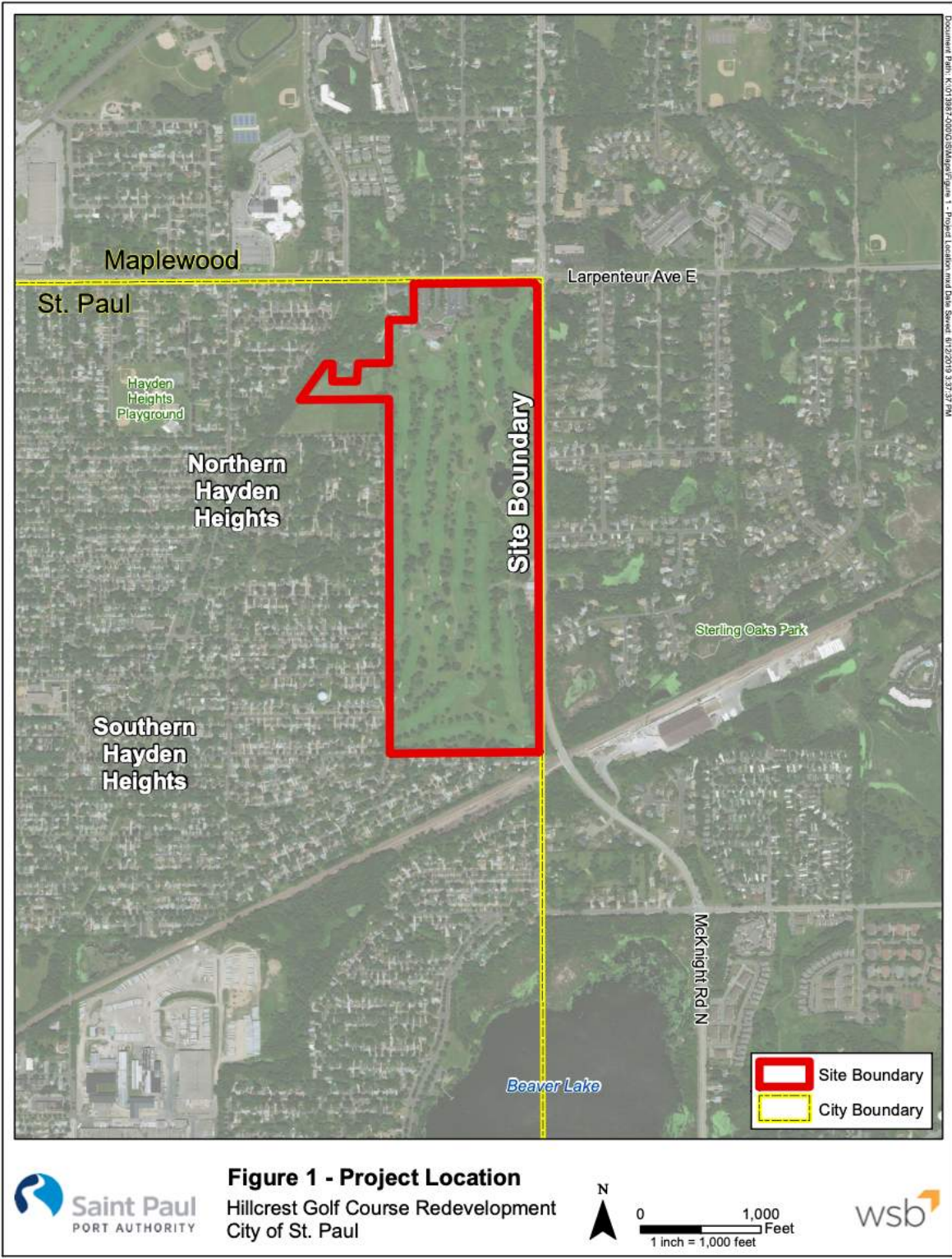
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Attachment I: Maps





**Attachment II: Photos
Provided by WSB**













Appendix D – Traffic Study

Memorandum

To: Bill Dermody, City of St. Paul
Monte Hillman, St Paul Port Authority

From: Chuck Rickart, PE, PTOE, WSB
Erik Seiberlich, WSB

Copy : Andi Moffatt, WSB

Date: June 24, 2022

Re: Final Traffic Analysis
Hillcrest AUAR
St Paul, Minnesota
WSB Project No. 16695-000

INTRODUCTION

The St. Paul Port Authority (SPPA) is proposing to redevelop the former Hillcrest Golf Course located in the southwest corner of Larpenteur Avenue & McKnight Road in northeastern St. Paul along the border with the City of Maplewood. The study area which is approximately 113 acres, is covered in the draft **Hillcrest Master Plan (Hillcrest MP)** which is currently under review by the St. Paul City Council. The redevelopment is anticipated to include a mix of residential, light industrial, and commercial uses consistent with the Hillcrest MP. **Figure 1** shows the project location.

A Transportation Planning Analysis was completed in conjunction with the **Hillcrest MP**. The analysis included documentation of the existing and future alternative land use concepts for the area. Some of the background data and analysis from that study will be used to complete this Traffic Analysis for the AUAR.

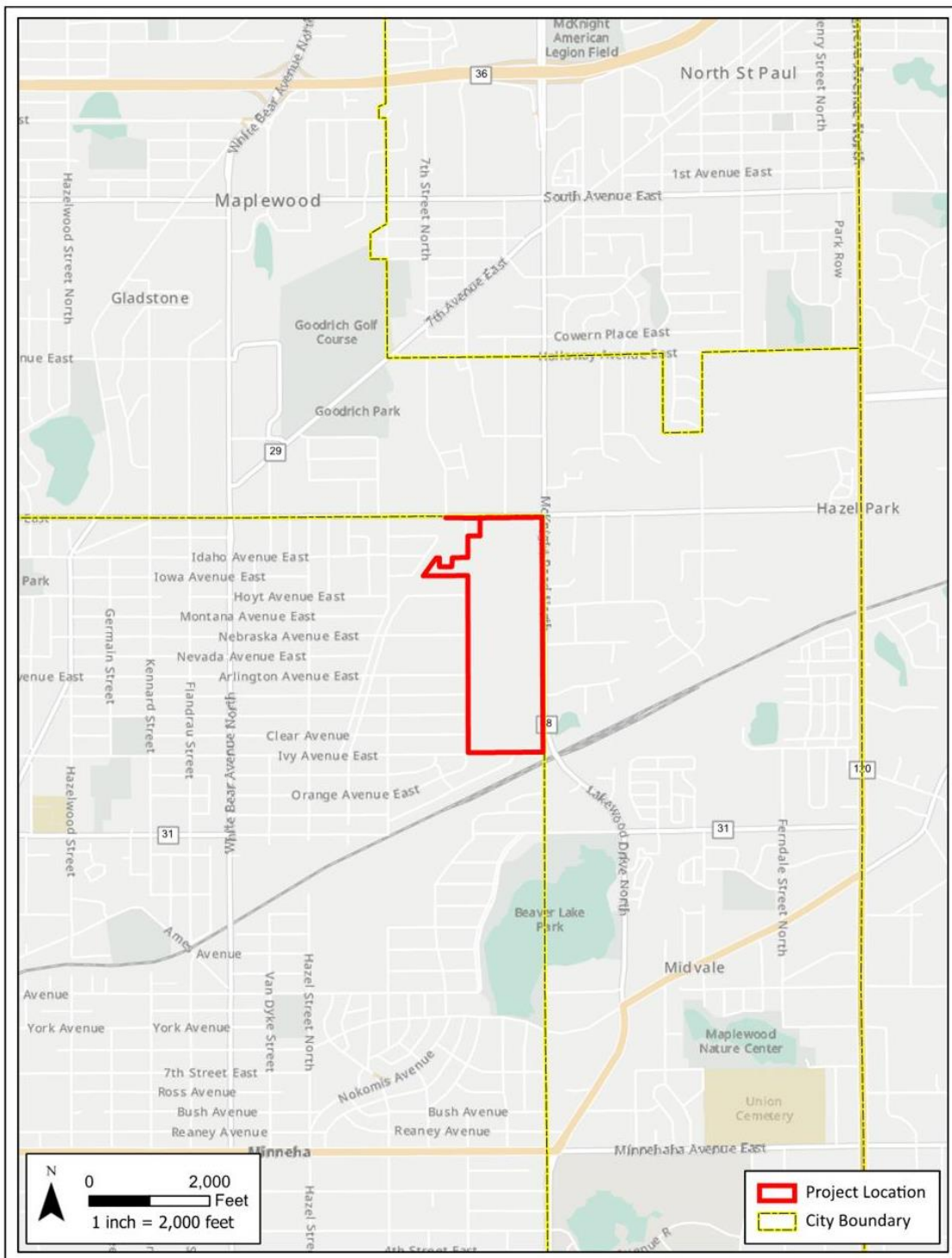
The following sections of this memorandum document the existing traffic conditions, development scenarios, traffic projections, traffic operations analysis, mitigation analysis and study conclusions and recommendations.

EXISTING CONDITIONS

The transportation and traffic impacts from the Hillcrest Golf Course site were evaluated for the adjacent facilities and at the following study intersections.

- Larpenteur Avenue at Howard Street – Side Street Stop Controlled
- McKnight Road at Larpenteur Avenue – Traffic Signal Controlled
- McKnight Road at Montana Avenue - Side Street Stop Controlled
- McKnight Road at Nebraska Avenue - Side Street Stop Controlled
- McKnight Road at Arlington Avenue - Side Street Stop Controlled
- Ivy Avenue at Hawthorne Avenue - Side Street Stop Controlled

Figure 1 – Project Location



Roadway Characteristics

The two primary roadways providing access to the site are Larpenteur Avenue (CSAH 30) and McKnight Road (CSAH 68). Each is discussed below:

Larpenteur Avenue (CSAH 30): Larpenteur Avenue is a two lane east-west Ramsey County roadway. It is classified as an A-Minor Augmenter. Larpenteur Avenue was recently upgraded to include striped bike lanes in both directions between Hazel Street and McKnight Road. The existing Average Daily Traffic (ADT) on Larpenteur Avenue is 8,500 vehicles per day (vpd) within the study area. The roadway has a posted speed limit of 30mph.

McKnight Road (CSAH 68): McKnight Road is a Ramsey County north/south roadway with a three-lane cross section and paved shoulders designated for biking. It is classified as an A-Minor Augmenter roadway. The existing ADT on McKnight Road is 12,600 vpd within the study area. The roadway has a posted speed limit of 45mph.

Existing Traffic Volumes

Weekday peak hour turning movement traffic volumes were collected as part of the Transportation Planning Analysis for the **Hillcrest MP**. The AM peak hour was determined to be 7:15 AM to 8:15 AM and the PM peak hour was determined to be 4:30 PM to 5:30 PM. **Figure 2** shows the existing area intersections that were analyzed as part of this study, with the existing AM and PM peak hour traffic volumes.

Existing Pedestrian / Bike Facilities

In the study area there are several pedestrian and bike facilities that would provide access to the site including:

- Sidewalks on some of the streets in the neighborhood to the west. These sidewalks currently dead-end at the site.
- Sidewalk on the west side of McKnight Road north of Larpenteur Avenue.
- Trail on the west side of McKnight Road south of Larpenteur Avenue.
- Furness Parkway Trail west of the site.
- On road striped bike lane on Larpenteur Avenue in both directions west of McKnight Road.
- Striped shoulder on McKnight Road.
- Striped shoulder on Larpenteur Avenue east of McKnight Road
- Signed and striped pedestrian crossings across McKnight Road with raised concrete medians at Arlington Avenue, Nebraska Avenue, Montana Avenue and Hoyt Avenue.
- Signed and striped pedestrian crossing across Larpenteur Avenue at Beebe Road.

The primary destinations for pedestrians in the area are local businesses located at McKnight Road and Larpenteur Avenue and along White Bear Avenue approximately $\frac{3}{4}$ mile west of the site. Larpenteur Avenue does not have sidewalk or trail facilities except for a short stretch near Mounds Park Academy. The neighborhoods to the west of the site do have sidewalks on some of the blocks. These sidewalks currently dead-end at the site and do not connect to the trail along McKnight Road.

The site is well connected to promote bicycling as a viable mode of transportation to the east and south. However, there are gaps in the existing facilities for trips to/from the north and west of the site. Larpenteur Avenue was recently restriped to provide bike lanes, but the lanes end at Hazel Street resulting in a gap to the White Bear Avenue area.

Figure 3 shows the existing pedestrian and bike facilities including existing sidewalk gaps.

Figure 2 – Existing Traffic Volumes

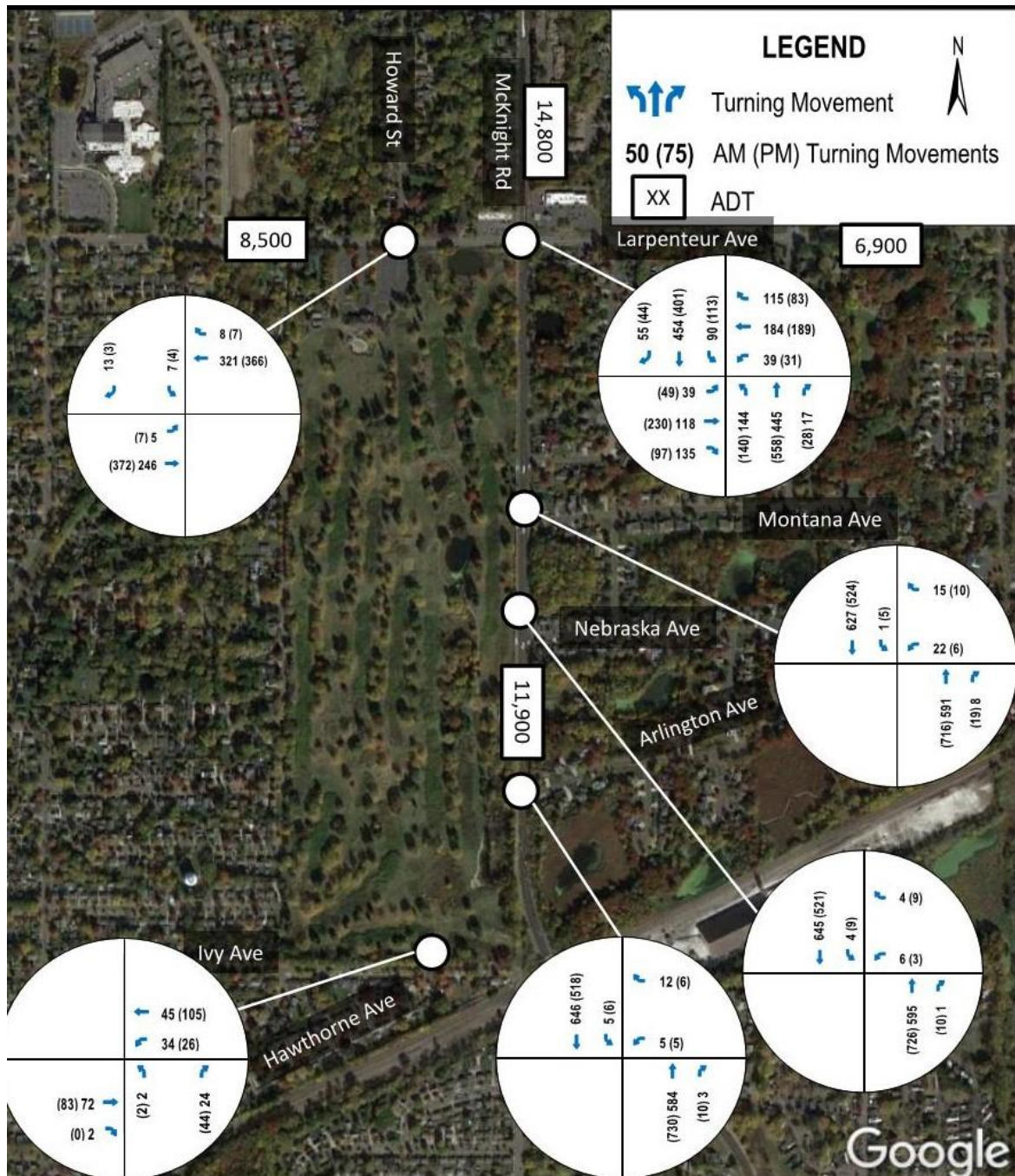
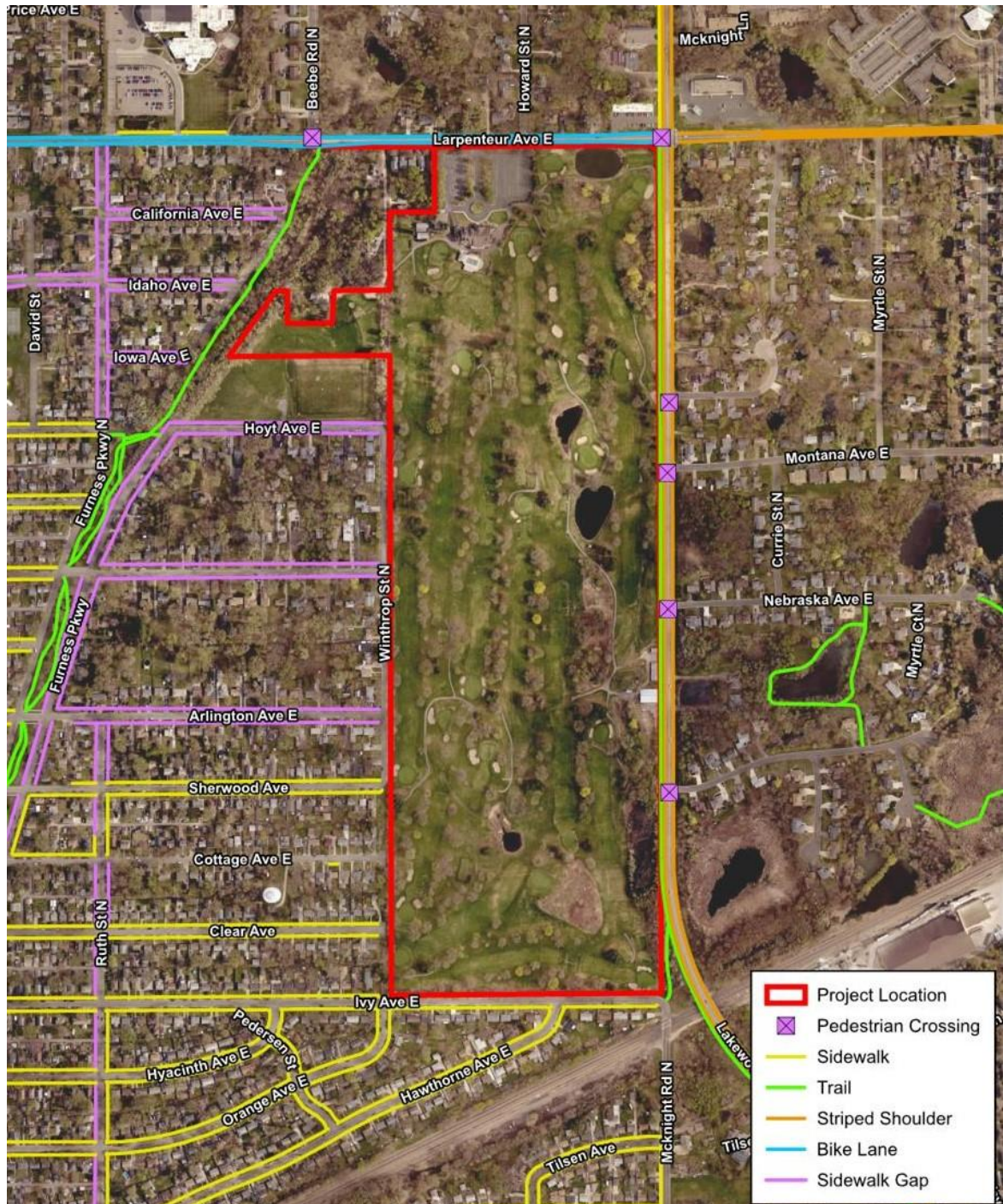


Figure 3 – Existing Pedestrian and Bike Facilities



Existing Transit Routes

Figure 4 shows the existing transit routes surrounding the site. Transit service in the project area is provided by Metro Transit however, there is no bus service provided directly adjacent to the site along either Larpenteur Avenue or McKnight Road. The routes in the area closest to the site include:

- **Route 64** is a local bus route from Downtown St. Paul to the Maplewood Mall via Payne Avenue, Maryland Avenue, White Bear Avenue, and continuing through North St. Paul and Maplewood. The route splits to Route 64N which passes closest to the site. The route operates during the weekdays and the weekend with 30-minute headway during the peak hours and 15 to 60-minute headways outside of peak hours. The current ridership (2019) for the bus stop closest to the site was 14 riders per day.
- **Route 74** is a local bus route from the 46th Street Station in Minneapolis to the Sun Ray Shopping Center in St. Paul via Ford Parkway, W 7th Street, Downtown St. Paul, and continuing through St. Paul to Maplewood. The route operates during the weekdays and the weekend with weekday 15 to 20-minute headways during the peak hours and 20 to 30-minute headways during the midday and evening hours. Service runs on a 20 to 30-minute headway on the weekends. The current ridership (2019) for the bus stops closest to the site was 3 riders per day.

DEVELOPMENT LAND USE SCENARIOS

Three redevelopment land use scenarios have been included in the AUAR. The redevelopment is anticipated to include a mix of residential, light industrial, and commercial uses.

Table 1 summarizes the land use and density for each Scenario. These scenarios are consistent with the **Hillcrest MP**. The three scenarios have the similar land uses based on coverages; however, Scenario 3 proposes a denser development plan than Scenario 1 or Scenario 2. Scenario 1 represents the actual Comprehensive Plan land use density and block lengths. Scenario 1 also provides a “grid: internal roadway system, where Scenarios 2 and 3 include only the primary access streets within the development area. **Figures 5 and 6** show the proposed Land Use areas. All scenarios are also consistent with the land use in the **St. Paul 2040 Comprehensive Plan**.

Table 1 – Development Scenario Land Use

Land Use	Existing	Scenario 1 Comp Plan	Scenario 2 Master Plan	Scenario 3 Max Density
Light Industrial	--	708,000 sf	840,000 sf	1,000,000 sf
Multi-family residential		960 units	960 units	2,615 units
<i>Low Density</i>	--	180 units	180 units	315 units
<i>Medium Density</i>	--	360 units	360 units	900 units
<i>High Density</i>	--	420 units	420 units	1,400 units
Golf Course	107.7 ac	--		--
Public Park	--	5.0 ac	5.0 ac	5.0 ac
Passive Open Space	--	7.0 ac	7.0 ac	7.0 ac
Trail and Right-of-Way	--	14.3 ac	22.8 ac	14.3 ac
Wetlands	5.6 ac	6.0 ac	6.0 ac	6.0 ac
Stormwater ponds	--	2.0 ac	2.0 ac	2.0 ac

Figure 4 – Existing Transit Routes

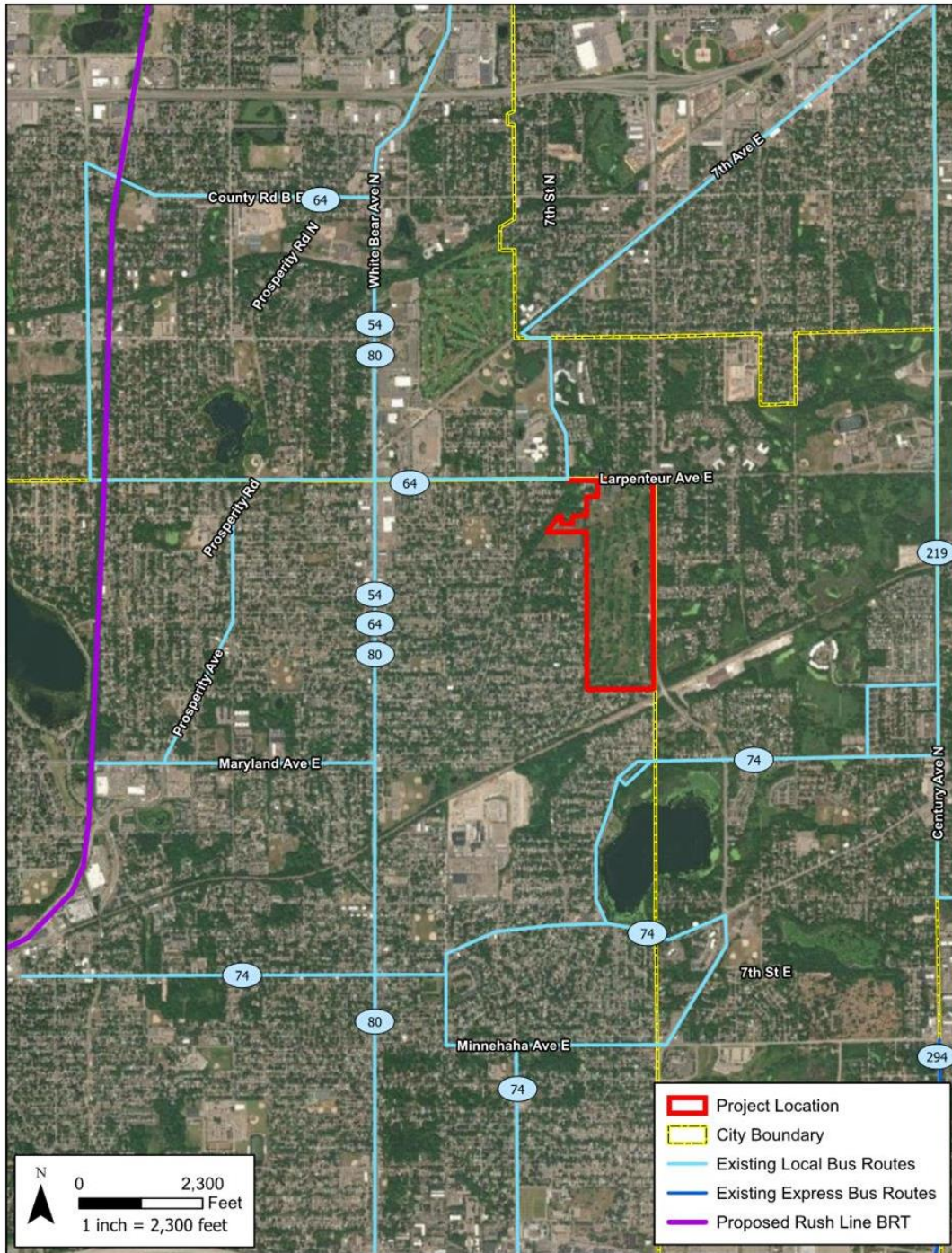


Figure 5 – Scenario 1

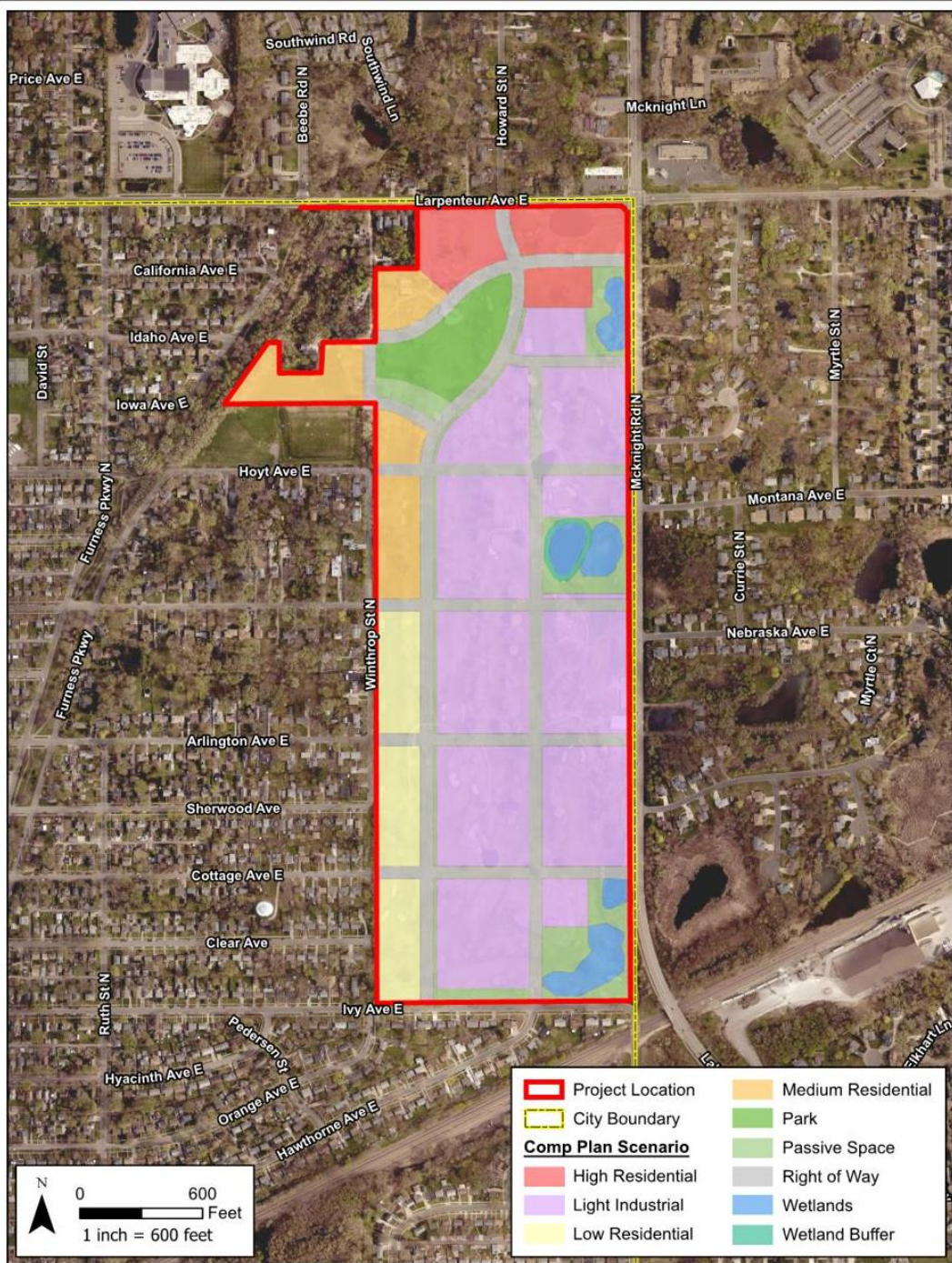
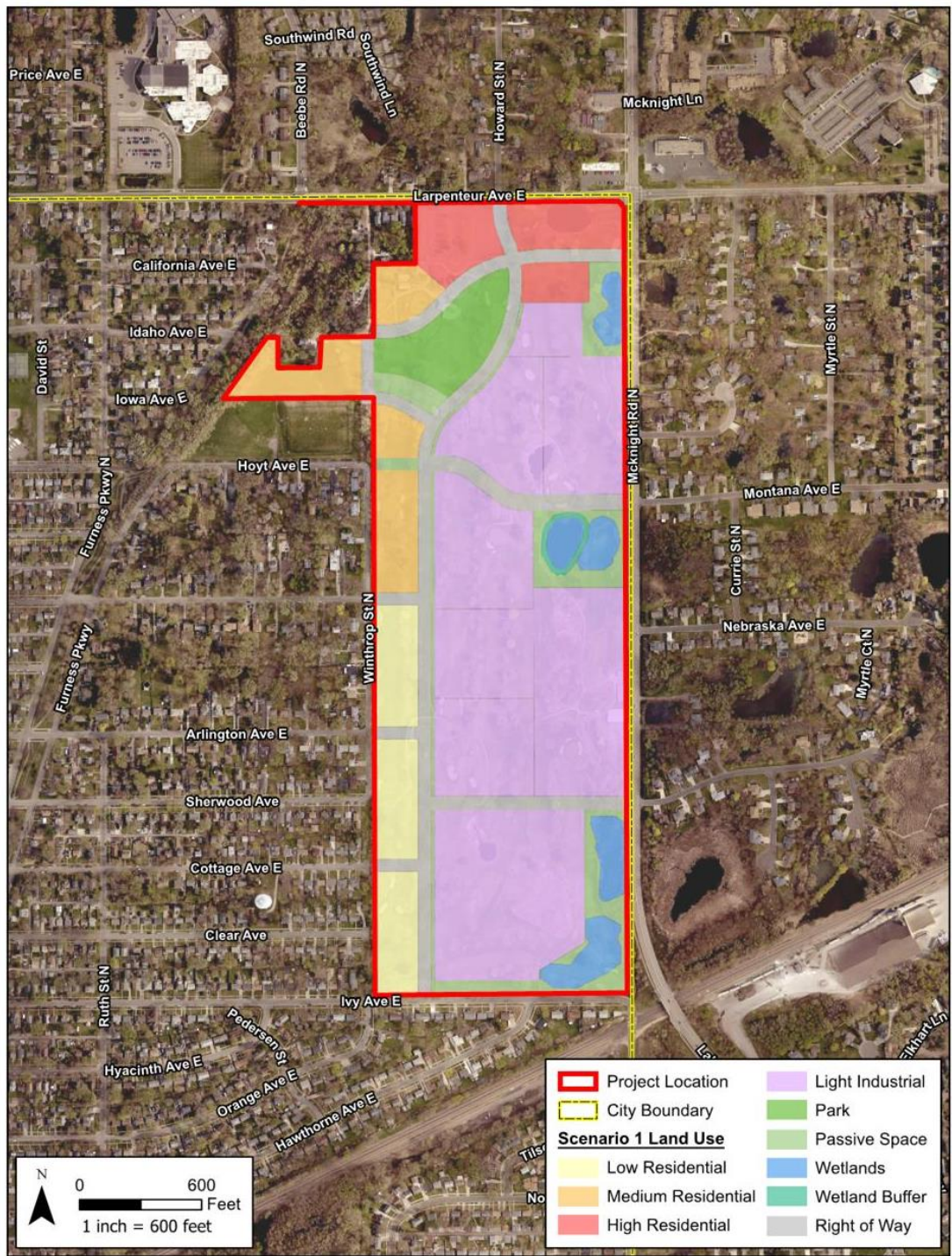


Figure 6 – Scenarios 2 and 3



BIKE / PEDESTRIAN FACILITIES

With each land use scenario, trail and sidewalk connections to the surrounding network will be provided.

As discussed previously and shown in **Figure 3**, the study area is connected to nearby bike facilities, with the most extensive network located to the east and south with gaps in the existing infrastructure for travel to/from the northern and western portion of the study area. Per the City of St. Paul Bike Plan, Ivy Avenue will provide an enhanced shared lane in the future that will run from the trail on McKnight Road to Prosperity Avenue. Arlington Avenue will also provide an enhanced shared lane in the future that will connect the Bruce Vento Trail to the Furness Trail.

As shown in **Figure 3**, the neighborhood to the west of the site has sidewalks on some of the blocks. The city's goal is to provide sidewalks on the remaining city streets, however, there is no immediate plan to provide these improvements. Any sidewalk that currently dead ends at the site will be connected to the site development. With the conversion of McKnight Road from 4 lanes to 3 lanes, pedestrian refuge islands were installed at Hoyt Avenue, Montana Avenue, Nebraska Avenue, and Arlington Avenue to improve pedestrian crossings.

With each of the development scenarios the following bike and sidewalk connections should be provided:

- A trail connection north of Hoyt Ave to the Furness Trail on the west side of the study area with a direct connection through the site to the trail on McKnight Road.
- An off-road trail on the south side of Larpenteur Avenue from McKnight Road to the west.
- A trail connection from the site on Howard Drive to Ivy Avenue.
- A pedestrian connection on the north side of Ivy Avenue from Winthrop Street to the existing pedestrian trail on McKnight Road with the reconstruction of Ivy Avenue.
- An extension of the future enhanced bike lane on Arlington Avenue through the site to the trail on McKnight Road
- Sidewalks along all roadways throughout the Hillcrest development Site.
- Sidewalks to the Hayden Heights neighborhood from the site on Nebraska Avenue, Arlington Avenue and Cottage Avenue.
- Reconstruct the existing pedestrian refuge islands on McKnight Road at Montana Avenue and Arlington Avenue as part of the construction of new left turn lanes for the site. The design will include a raised concrete median with signing and pavement markings. The detailed design will be completed as part of the final design for the site improvements and will be coordinated, reviewed and approved by Ramsey County.
- Design internal roadways to accommodate safe pedestrian crossings including bump-outs at intersections, tabled concrete crosswalks, and a tabled intersection at Howard Street and Idaho Avenue.
- Ensure that the pedestrian connectivity across McKnight Road to the City of Maplewood is maintained. Any changes or modification in the existing infrastructure resulting from the development will be reviewed and approved by Ramsey County and the City of Maplewood.
- Provide a pedestrian crossing of Larpenteur Avenue from the development site at Howard Street.

TRANSIT CONNECTIONS

Currently the transit service adjacent to the site is limited with no existing bus service provided along either Larpenteur Avenue or McKnight Road. To promote increased transit use, it is recommended to work with Metro Transit, to alter the existing route 64 or route 74 to pass through or pass adjacent to the site. Which of these routes, the length of the route extended and where bus stops are located, will be analyzed once a site development scenario is selected and Metro Transit reanalyzes the local bus routes in the area.

FREIGHT SERVICE

Truck activity within the Hillcrest Site is expected to be related to potential industrial truck traffic including, deliveries serving the site, garbage/recycling services, and school buses. Depending on the actual use on the industrial properties within the site, a large amount of truck or freight activity could occur. These uses are planned for the areas adjacent to McKnight Road and all truck access should be directed to McKnight Road. Trucks and freight activity should be limited and discouraged on all other roadways within the site by using methods such as:

- Design internal roadways to accommodate the expected level of freight activity within the area based on the proposed development, including:
 - Provide bump-outs at intersections to eliminate/discourage large vehicle turning.
 - Any industrial land use's access to Howard Street should not line up with Nebraska Avenue, Arlington Avenue, or Cottage Avenue to the west. Rather, any such access to Howard Street should be mid-block to discourage direct traffic access to the neighborhoods.
- Freight activity should be limited during the peak traffic periods to avoid potential conflicts. This can be accomplished through communication with the identified industrial business, area package services (i.e., UPS, FedEx, etc.) and refuse haulers.
- Evaluation of the need for on-street loading areas should be completed to accommodate some freight activity as actual development proposals are identified.

TRAFFIC PROJECTIONS

In order to analyze the land use scenarios and determine the appropriate lane configuration and traffic control needs on the area roadways and intersections, projected traffic volumes were determined. Projections were prepared for the 2040 horizon year. The following sections outline the projected background traffic growth, traffic generation from the study area, as well as the traffic distribution and projected traffic volumes.

Background Traffic Growth

Traffic growth in the vicinity of a proposed site will occur between existing conditions and any given future year due to other development within the region. This background growth must be accounted for and included in future year traffic forecasts. Based on the analysis included in the Transportation Planning Analysis for the *Hillcrest MP* a 0.5% annual growth rate was applied to the Existing traffic volumes to determine the 2040 No-Build traffic volumes.

Proposed Development Area Traffic Generation

The estimated trip generation from each of the proposed development scenarios is shown in **Tables 2a – 2c**. The trip generation rates used to estimate the proposed area traffic is based on other similar land uses as documented in the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 10th Edition. The tables show the Daily, AM peak and PM peak hour trip generation for each development scenario.

The traffic generation also includes a 5% internal trip reduction and 5% multimodal trip reduction. The internal trip reduction rate was calculated based on the ITE Trip Generation Manual guideline to determine a percentage of trips that would be destined to another land use within the site and not utilize the exterior roadways. ITE and the NCHRP conclude that trip capture rates for similar uses are 2% to 8%. With mainly housing and industrial land uses, the goal to increase walking opportunities to employment areas and engineering judgement, it was assumed that only 5% of the site traffic would be considered internal trips.

With the site development it was assumed that transit ridership will increase, and the majority of the transit trips were to occur in the peak periods. A 2.5% transit reduction was assumed for site. This percentage could increase if transit routes were rerouted closer to the site.

The City of St. Paul's goal is to increase the walking and bicycle mode share to 5%. The site development will focus on providing substantial trail and sidewalk connections throughout the site and to the adjacent neighborhoods so it is anticipated that a higher percentage of trips within the site will be walking or bicycling between the housing, community node, and active park. Therefore, it was assumed that a 2.5% bicycle mode split would be more feasible for the site. Transit use and bicycle use will therefore result in a reduction of 5% of the vehicular trips.

Proposed Development Area Traffic Distribution

Area generated trips were distributed to the adjacent roadway system based on several factors including the information in the Transportation Planning Analysis for the **Hillcrest MP**; the City's current Transportation Plan; anticipated origins and destinations for the residential land use, and existing travel patterns and future roadway connections. Based on these parameters the following general traffic distribution was used to distribute the projected traffic volumes to the area roadway network:

- 20% to/from the west on Larpenteur Avenue towards White Bear Avenue
- 25% to/from the north on McKnight Road
- 10% to/from the east on Larpenteur Avenue
- 25% to/from the south on McKnight Road
- 10% to/from the west/southwest on Ivy Avenue, Orange Avenue, and Hawthorne Avenue
- 10% to/from the west on various roadways in the Hayden Heights Neighborhood

Projected Traffic Volumes

Traffic forecasts were prepared for the 2040 no-build and build conditions. The traffic forecasts were prepared by adding the projected annual background traffic growth to the existing adjusted traffic volumes to determine the 2040 no-build condition and, by adding the projected annual background traffic growth to the existing adjusted traffic volumes and the anticipated area development site traffic generation to determine the 2040 build conditions for each Build Scenario.

Figure 7 – Figure 10 shows the 2040 no-build and 2040 build traffic volumes for each scenario.



Table 2a – Scenario 1 Trip Generation

Land Use Scenario 1 - Comp Plan																	
Planned Use	Size	Unit	ITE				ADT		Weekday AM Peak of Adjacent Street Traffic				Weekday PM Peak of Adjacent Street Traffic				
			Code	Discription	Setting/ Location	Variable	Rate	Total	Rate	Total	In	Out	Rate	Total	In	Out	
Industrial	708,000	Sq Ft	130	Industrial Park	Urban/ Suburban	per 1000sf	3.37	2,386	0.34	241	195	46	0.34	241	53	188	
Multi-Family (Low Density)	180	Unit	220	Multi Family Low Riise	Urban/ Suburban	per unit	6.74	1,213	0.40	72	17	55	0.51	92	58	34	
Multi-Family (Medium Density)	360	Unit	220	Multi Family Low Rise	Urban/ Suburban	per unit	6.74	2,426	0.40	144	35	109	0.51	184	116	68	
Multi-Family (High Density)	420	Unit	221	Multi Family Mid Rise	Urban/ Suburban	per unit	4.54	1,907	0.37	155	36	120	0.39	164	100	64	
Total Site Trips									7,932		612	283	330		680	326	354
Internal Capture & Multimodal Reduction (10%)									793		61	28	33		68	33	35
Total Scenario 1 Trips									7,139		612	283	330		680	326	354

Source: Institute of Transportation Engineers
Trip Generation Manual, 11th Edition

Table 2b – Scenario 2 Trip Generation

Land Use Scenario 2 - Master Plan																	
Planned Use	Size	Unit	ITE				ADT		Weekday AM Peak of Adjacent Street Traffic				Weekday PM Peak of Adjacent Street Traffic				
			Code	Discription	Setting/ Location	Variable	Rate	Total	Rate	Total	In	Out	Rate	Total	In	Out	
Industrial	840,000	Sq Ft	130	Industrial Park	Urban/ Suburban	per 1000sf	3.37	2,831	0.34	286	231	54	0.34	286	63	223	
Multi-Family (Low Density)	180	Unit	220	Multi Family Low Riise	Urban/ Suburban	per unit	6.74	1,213	0.40	72	17	55	0.51	92	58	34	
Multi-Family (Medium Density)	360	Unit	220	Multi Family Low Rise	Urban/ Suburban	per unit	6.74	2,426	0.40	144	35	109	0.51	184	116	68	
Multi-Family (High Density)	420	Unit	221	Multi Family Mid Rise	Urban/ Suburban	per unit	4.54	1,907	0.37	155	36	120	0.39	164	100	64	
Total Site Trips									8,377		657	319	338		725	336	389
Internal Capture & Multimodal Reduction (10%)									838		66	32	34		72	34	39
Total Scenario 2 Trips									7,539		657	319	338		725	336	389

Source: Institute of Transportation Engineers
Trip Generation Manual, 11th Edition

Table 2c -Scenario 3 Trip Generation

Land Use Scenario 3 - Max Density																	
Planned Use	Size	Unit	ITE				ADT		Weekday AM Peak of Adjacent Street Traffic				Weekday PM Peak of Adjacent Street Traffic				
			Code	Discription	Setting/ Location	Variable	Rate	Total	Rate	Total	In	Out	Rate	Total	In	Out	
Industrial	1,000,000	Sq Ft	130	Industrial Park	Urban/ Suburban	per 1000sf	3.37	3,370	0.34	340	275	65	0.34	340	75	265	
Multi-Family (Low Density)	315	Unit	220	Multi Family Low Riise	Urban/ Suburban	per unit	6.74	2,123	0.40	126	30	96	0.51	161	101	59	
Multi-Family (Medium Density)	900	Unit	220	Multi Family Low Rise	Urban/ Suburban	per unit	6.74	6,066	0.40	360	86	274	0.51	459	289	170	
Multi-Family (High Density)	1,400	Unit	221	Multi Family Mid Rise	Urban/ Suburban	per unit	4.54	6,356	0.37	518	119	399	0.39	546	333	213	
Total Site Trips									17,915		1,344	511	833		1,506	798	707
Internal Capture & Multimodal Reduction (10%)									1,792		134	51	83		151	80	71
Total Scenario 3 Trips									16,124		1,344	511	833		1,506	798	707

Source: Institute of Transportation Engineers
 Trip Generation Manual, 11th Edition

Figure 7 – Projected 2040 No-Build Traffic Volumes

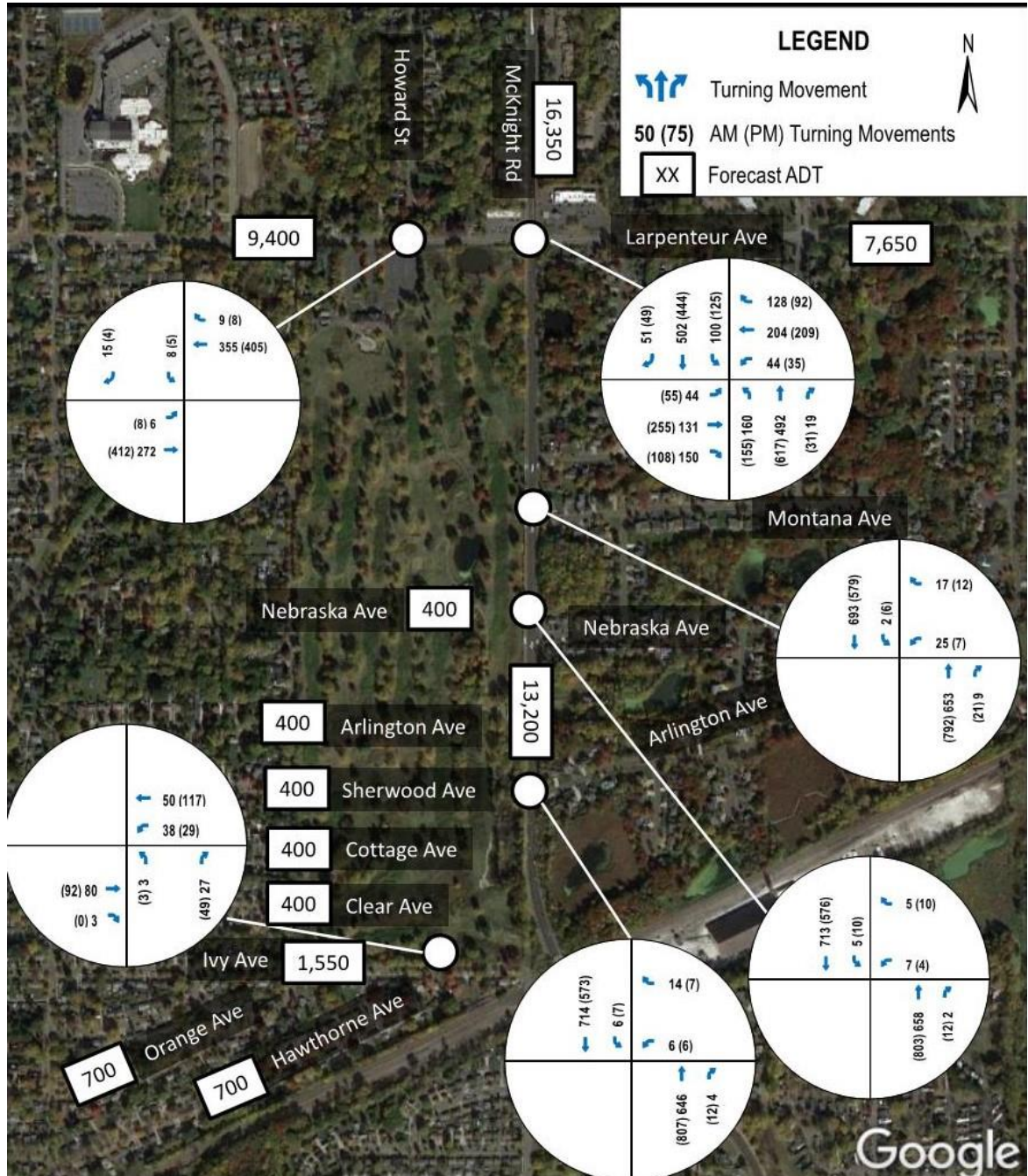


Figure 8 – Projected 2040 Build Scenario 1 Traffic Volumes

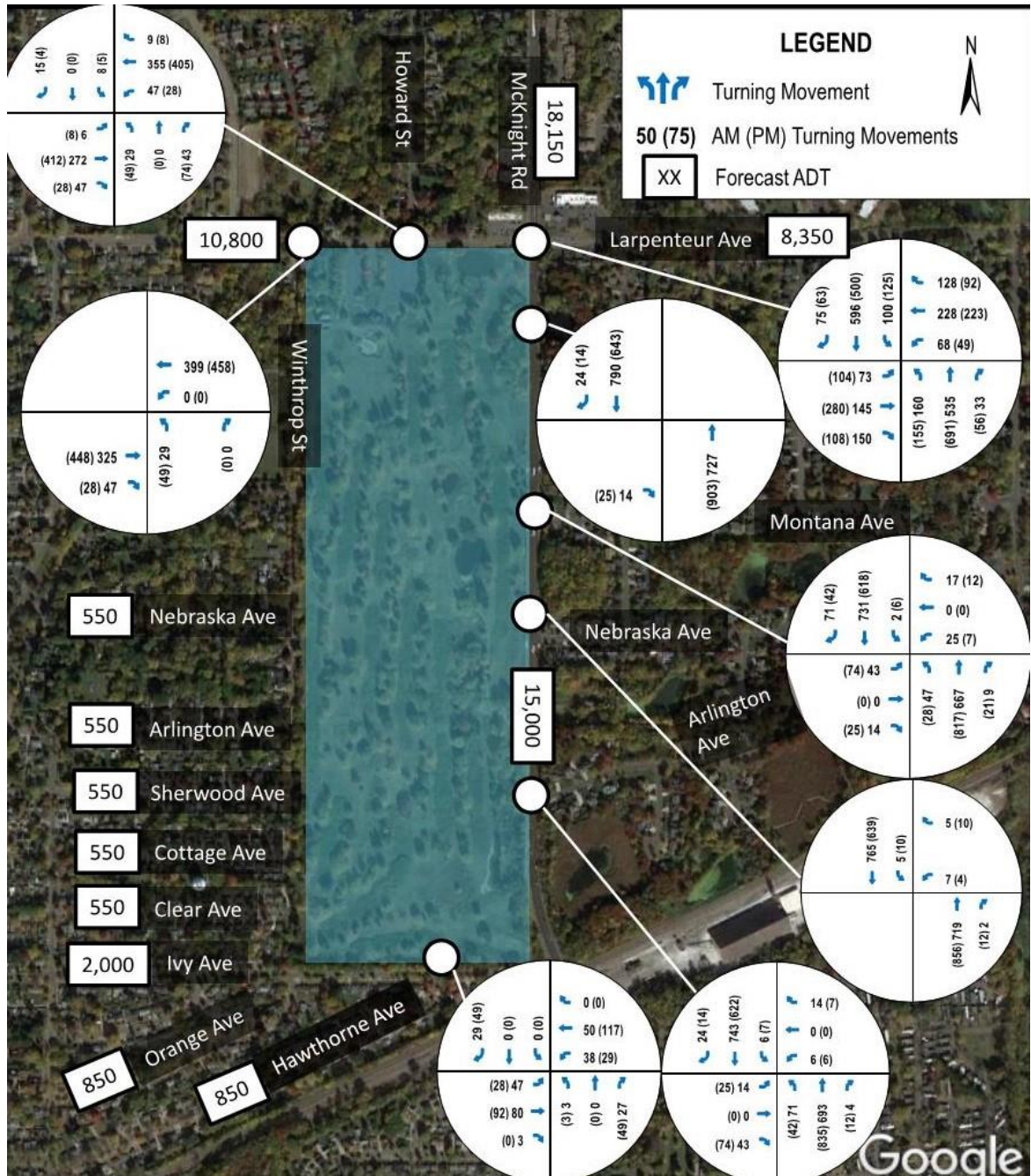


Figure 9 – Projected 2040 Build Scenario 2 Traffic Volumes

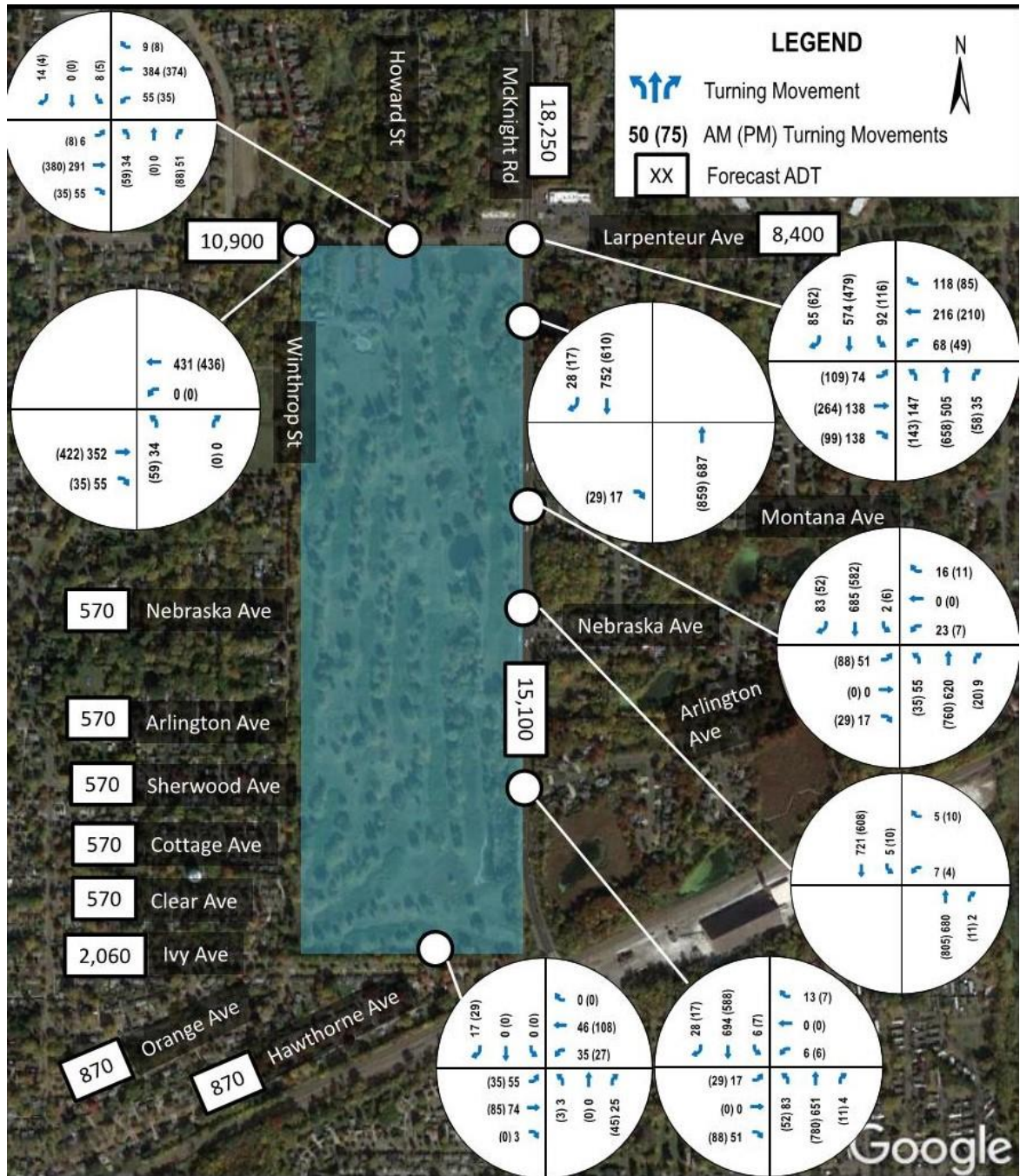
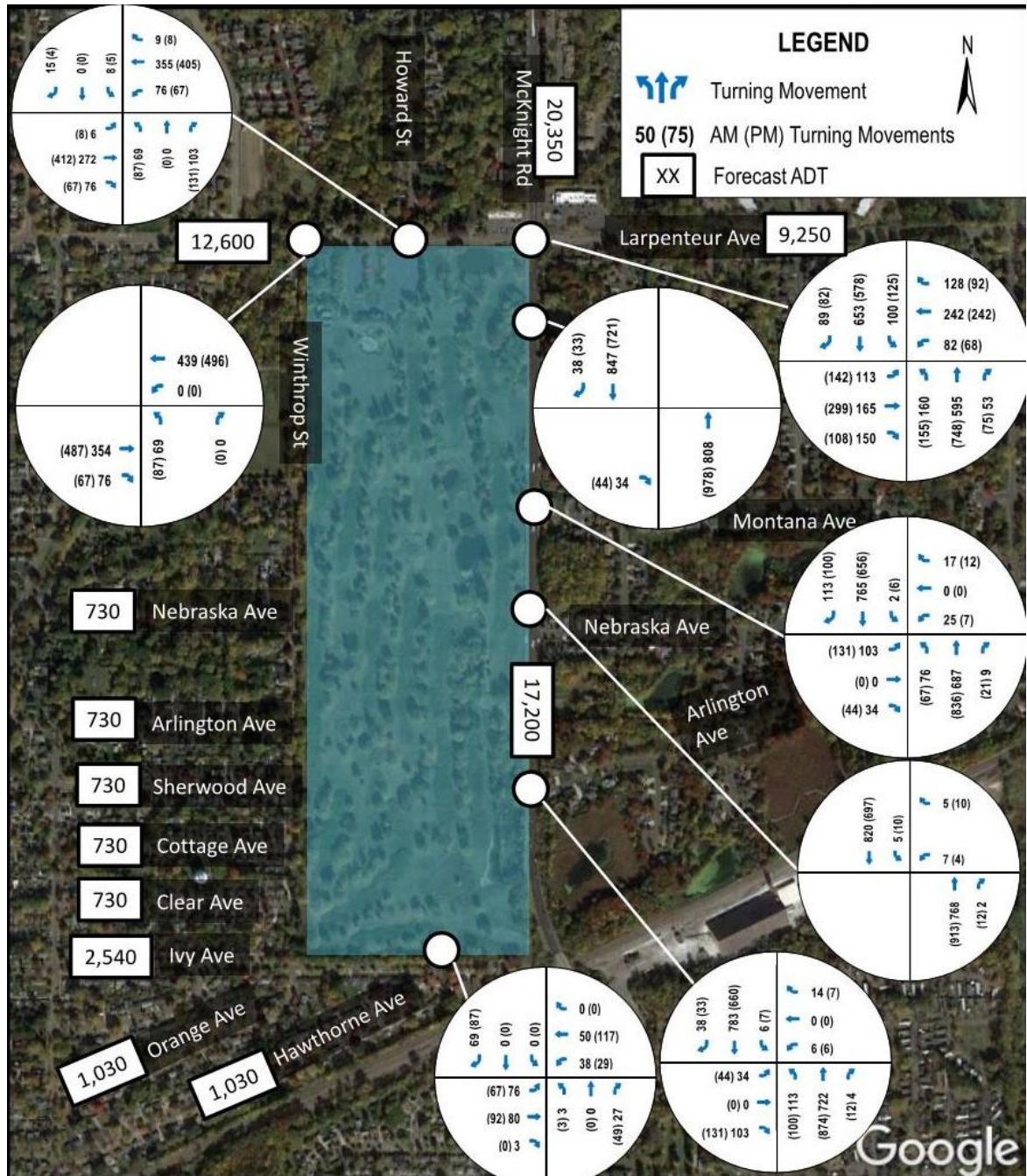


Figure 10 – Projected 2040 Build Scenario 3 Traffic Volumes



NEIGHBORHOOD TRAFFIC IMPACTS

The neighborhoods adjacent to the proposed Hillcrest development were evaluated based on the future traffic conditions. The projected 2040 traffic volumes on the streets through the Hayden Heights neighborhood west and south of the site were determined to evaluate the anticipated traffic impacts on the existing street system. The neighborhood streets that were included with the analysis are:

- Nebraska Avenue
- Arlington Avenue
- Sherwood Avenue
- Cottage Avenue
- Clear Avenue
- Ivy Avenue
- Orange Avenue
- Hawthorne Avenue

The 2040 No-Build traffic volume was estimated based on ITE trip generation rates for the number of houses on each block. The traffic conditions for each scenario were developed by adding the anticipated Hillcrest Development site traffic to the No-Build volumes to get the 2040 Build condition.

The traffic analysis discussed previously concluded that the 10% of the site traffic would be destined to/from the streets to the west and 10% of the site traffic would be destined to/from the streets to the south. **Table 3** below shows the projected 2040 traffic volumes on the adjacent streets for the No-build and each Build Scenario.

Table 3 – 2040 Neighborhood Street Traffic Conditions (vehicles per day)

Street	2040 No-Build	2040 Build Scenario 1	2040 Build Scenario 2	2040 Build Scenario 3
Nebraska Avenue	400	550	570	730
Arlington Avenue	400	550	570	730
Sherwood Avenue	400	550	570	730
Cottage Avenue	400	550	570	730
Clear Avenue	400	550	570	730
Ivy Avenue	1,550	2,000	2,060	2,570
Orange Avenue	700	850	870	1,030
Hawthorne Avenue	700	850	870	1,030

All streets within the area are considered local residential streets with low expected traffic volumes providing access to residences, parks, and schools. Based on accepted guidelines from Metropolitan Council, typical residential streets will carry less than 1,000 vpd. The only street in the area not classified as a local street is Ivy Avenue which is classified as a Major Collector in

the City's Comprehensive Plan. Major Collectors are streets that are anticipated to carry higher volumes of traffic, typically up to 8,000 vpd.

Based on the 2040 projected traffic volumes for each scenario outlined in **Table 3**, all the streets within the study area are at or below the typical traffic thresholds for a local residential street or Major Collector Street (Ivy Avenue). However, to discourage vehicle traffic through the neighborhood from the proposed site the following should be considered with the proposed Hillcrest development:

- Any industrial land use's access to Howard Street should not line up with Nebraska Avenue, Arlington Avenue, or Cottage Avenue to the west. Rather, any such access to Howard Street should be mid-block to discourage direct traffic access to the neighborhoods.
- No direct access from the multi-family residential land uses should be provided to Howard Street or Winthrop Street.
- .
- Provide off road pedestrian accommodations on the streets accessing the neighborhoods, including extension / connection of sidewalks.
- Provide the recommended improvements at the site access locations on Larpenteur Avenue at Howard Street, McKnight Road at Montana Avenue and McKnight Road at Arlington Avenue to discourage traffic from using the neighborhood streets.
- Implement the recommendations in the Freight Service section to discourage heavy vehicle traffic from using the neighborhood streets.
- As traffic in the area increases over time, especially on streets such as Ivy Avenue, traffic calming measures will be required to manage vehicle speed and public safety. The type of traffic calming measures that could be installed will be consistent with city policies and practices. It should be noted that installation of some traffic calming measures will result in a diversion of traffic to other neighborhood roadways. The determination of what type of traffic calming measure, the implementation, and financial responsibilities will be outlined in the developer's agreement between the St. Paul Port Authority and the City.

TRAFFIC OPERATIONS ANALYSIS

Existing and/or forecasted traffic operations were evaluated at the impacted area intersections in the study area. The analysis was conducted for the following scenarios.

1. Existing Conditions
2. Projected 2040 No-Build
3. Projected 2040 Build Scenario 1 – Comp Plan
4. Projected 2040 Build Scenario 2 – Master Plan
5. Projected 2040 Build Scenario 3 – Max Density

The following sections describe the methodology used to assess the operations and provide a summary of traffic operations for each scenario.

Methodology

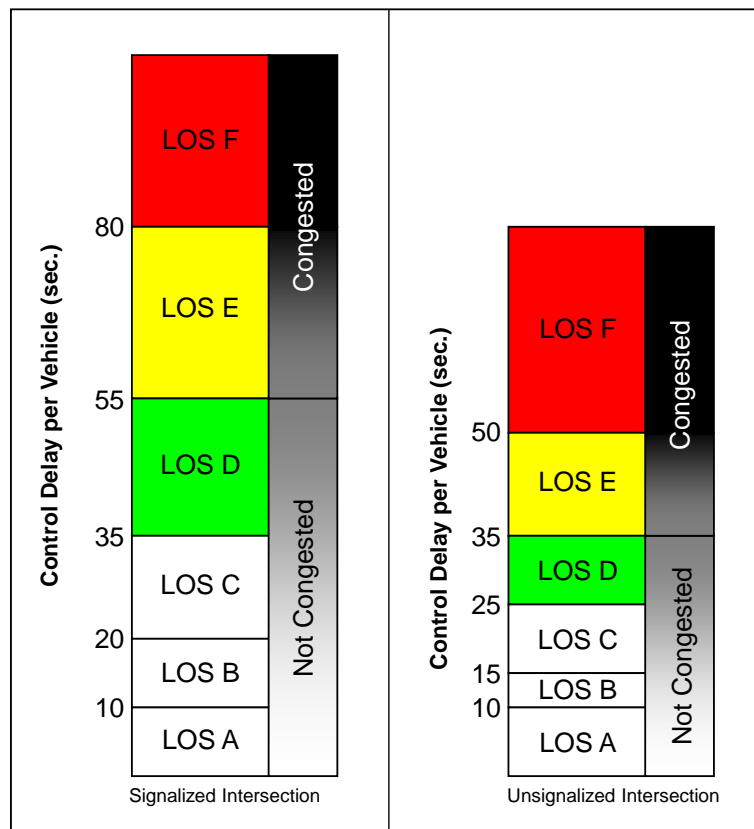
The intersections in the study area were evaluated during the AM and PM peak hours using Synchro/SimTraffic micro simulation software. The results are derived from established methodologies documented in the Highway Capacity Manual (HCM) The software was used to

evaluate the characteristics of the roadway network including lane geometrics, turning movement volumes, traffic control, and signal timing. In addition, the signal timing parameters for future year conditions were optimized using Synchro. This information was then transferred to SimTraffic, the traffic simulation model, to estimate average peak hour vehicle delays and queues. Due to the stochastic nature of the simulation models, there can be minor variations in the Measure of Effectiveness (MOEs) reported by the model between various runs. MOEs at the signal is similar in Synchro and SimTraffic, but adjacent intersections show varying MOEs because SimTraffic accounts for queuing and blocking more realistically than Synchro.

One of the primary measures of effectiveness used to evaluate intersection traffic operations, as defined in the HCM, is Level of Service (LOS) – a qualitative letter grade, A – F, based on seconds of vehicle delay due to a traffic control device at an intersection. LOS A conditions represent high quality operations (i.e., motorists experience very little delay or interference) and LOS F conditions represent very poor operations (i.e., extreme delay or severe congestion). For side street stop intersections, the overall intersection LOS is reported as the worst side street movement.

Figure 11 depicts a graphical interpretation of delay times that define level of service. The delay thresholds are lower for un-signalized intersections than signalized intersections due to the public’s perception of acceptable delays for different traffic controls as indicated in the HCM. In accordance with the Minnesota Department of Transportation (MnDOT) guidelines, this analysis used the LOS D/E boundary as an indicator of acceptable traffic operations.

Figure 11: LOS Ranges for Signalized and Un-signalized Intersections



SOURCE: Level of Service thresholds from the Highway Capacity Manual, 2000.

LOS and other Measure of Effectiveness (MOEs) were calculated from the models and are discussed in the following sections for each scenario. The capacity analysis worksheets are included in **Appendix A**.

Existing Conditions

The existing traffic operations were evaluated at intersections in the study area for the AM and PM peak hours. The traffic volumes shown in **Figure 2** were used in the Existing Conditions analysis. **Table 4 – Existing Traffic Operations Summary** shown below, summarizes the existing LOS and delays at the primary intersections in the study area based on the current lane geometry, traffic control and existing traffic volumes. The existing traffic signal timing received from Ramsey County was used to analyze the intersection of Larpenteur Avenue at McKnight Road.

Table 4 – Existing Traffic Operations Summary

Control	Intersection	AM Peak Hour		PM Peak Hour	
		LOS	Delay ⁽¹⁾ (sec/veh)	LOS	Delay ⁽¹⁾ (sec/veh)
Thru-Stop	Larpenteur Ave at Howard St	(A)	8	(A)	8
Sig	McKnight Rd at Larpenteur Ave ⁽²⁾	C (E)	32	C (E)	34
Thru-Stop	McKnight Rd at Montana Ave	(C)	16	(B)	11
Thru-Stop	McKnight Rd at Nebraska Ave	(B)	13	(B)	10
Thru-Stop	McKnight Rd at Arlington Ave	(B)	12	(B)	14
Thru-Stop	Ivy Ave at Hawthorne Ave	(A)	5	(A)	6

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Existing traffic signal timing

The analysis results show that all intersections are operating at an acceptable overall LOS C or better during both the weekday AM and PM peak hours with all movements operating at LOS C or better except at the Larpenteur Avenue and McKnight Road intersection where the following movements are operating at LOS E:

- Larpenteur Avenue at McKnight Road
 - AM Peak Hour
 - Southbound left LOS E
 - PM Peak Hour
 - Southbound left LOS E
 - Northbound left LOS E

2040 No-Build Analysis

Table 5 – 2040 No-Build Traffic Operations Summary shown below, summarizes the LOS and delays at the primary intersections in the study area based on the current lane geometry, traffic control and projected 2040 traffic volumes shown in **Figure 7** without any area development. The traffic signal timing was optimized for the analysis at the Larpenteur Avenue at McKnight Road intersection.

Table 5 – 2040 No-Build Traffic Operations Summary

Control	Intersection	AM Peak Hour		PM Peak Hour	
		LOS	Delay ⁽¹⁾ (sec/veh)	LOS	Delay ⁽¹⁾ (sec/veh)
Thru-Stop	Larpenteur Ave at Howard St	(A)	9	(B)	13
sig	McKnight Rd at Larpenteur Ave ⁽²⁾	D (F)	35	D (F)	43
Thru-Stop	McKnight Rd at Montana Ave	(C)	17	(C)	18
Thru-Stop	McKnight Rd at Nebraska Ave	(C)	18	(C)	19
Thru-Stop	McKnight Rd at Arlington Ave	(C)	22	(C)	22
Thru-Stop	Ivy Ave at Hawthorne Ave	(A)	4	(A)	4

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Optimized signal timing

The analysis results show that all intersections would be operating at an acceptable overall LOS D or better during both the weekday AM and PM peak hours with slight delay increase from existing conditions. All movements will be operating at LOS D or better except at the Larpenteur Avenue and McKnight Road intersection where the following movements would be operating at LOS E/F:

- Larpenteur Avenue at McKnight Road
 - AM Peak Hour
 - Northbound left LOS F
 - PM Peak Hour
 - Southbound left LOS F
 - Northbound left LOS E

Discussion with Ramsey County concluded that any need for improvements at the Larpenteur Avenue at McKnight Road intersection would be well into the future and the existing operation is adequate at this time. The intersection should continue to be monitored as the area develops.

2040 Build Analysis – Scenario 1 (Comp Plan)

Table 6 – 2040 Build Scenario 1 Traffic Operations Summary shown below, summarizes the LOS and delays at the primary intersections in the study area based on the existing lane geometry, traffic control and projected 2040 traffic volumes with full development of the area assuming Land Use Scenario 1 (Comp Plan) (**Figure 8**). The lane configuration on all site access streets included a single lane of approach. The traffic signal timing was optimized for the analysis at the Larpenteur Avenue at McKnight Road intersection.

Table 6 – 2040 Build Traffic Operations Summary – Scenario 1

Control	Intersection	AM Peak Hour		PM Peak Hour	
		LOS	Delay ⁽¹⁾ (sec/veh)	LOS	Delay ⁽¹⁾ (sec/veh)
Thru-Stop	Larpenteur Ave at Howard St	(B)	12	(B)	21
Sig	McKnight Rd at Larpenteur Ave ⁽²⁾	D (F)	45	D (F)	46
Thru-Stop	McKnight Rd at Montana Ave	(E)	36	(E)	47
Thru-Stop	McKnight Rd at Nebraska Ave	(C)	19	(C)	21
Thru-Stop	McKnight Rd at Arlington Ave	(D)	29	(D)	25
Thru-Stop	Ivy Ave at Hawthorne Ave	(A)	4	(A)	6
Thru-Stop	Larpenteur Ave at Winthrop St	(B)	9	(B)	13
Thru-Stop	McKnight Rd at North Site Access	(B)	11	(A)	11

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Optimized signal timing

The analysis results show that all intersections would be operating at an acceptable overall LOS D or better during both the weekday AM and PM peak hours with all movements operating at LOS D or better except the following movements operating at LOS E / F:

- McKnight Road at Larpenteur Avenue
 - AM Peak Hour
 - Northbound left LOS F
 - Westbound left/thru LOS E
 - Southbound left LOS F
 - Eastbound left LOS E
 - PM Peak Hour
 - Northbound left LOS F
 - Westbound left/thru LOS E
 - Southbound left LOS F
 - Eastbound left/thru LOS E
- McKnight Road at Montana Avenue
 - AM Peak Hour
 - Eastbound left LOS E
 - PM Peak Hour
 - Eastbound left LOS E

To improve the delay and level of service at the intersections with movements at LOS E or F mitigation improvements were analyzed. The mitigation included lengthening of the left turn lanes at the McKnight Road and Larpenteur Avenue and addition of two exit lanes (left/thru lane and right turn lane) on all the site access streets (northbound Howard Street, eastbound Montana Avenue and eastbound Arlington Avenue). The results of the analysis are included in **Table 7** and show that all intersections and movements would be operating at LOS D or better except the movements:

- McKnight Road at Larpenteur Avenue

- AM Peak Hour
 - Northbound left LOS E
- PM Peak Hour
 - Northbound left LOS E
- McKnight Road at Montana Avenue
 - PM Peak Hour
 - Eastbound left LOS E

Table 7 – 2040 Build Traffic Operations Summary – Scenario 1 with Mitigation

Control	Intersection	AM Peak Hour		PM Peak Hour	
		LOS	Delay ⁽¹⁾ (sec/veh)	LOS	Delay ⁽¹⁾ (sec/veh)
Thru-Stop	Larpenteur Ave at Howard St	(B)	12	(B)	13
Sig	McKnight Rd at Larpenteur Ave ⁽²⁾	C (E)	29	C (D)	28
Thru-Stop	McKnight Rd at Montana Ave	(D)	34	(E)	37
Thru-Stop	McKnight Rd at Nebraska Ave	(C)	18	(C)	21
Thru-Stop	McKnight Rd at Arlington Ave	(C)	22	(C)	20
Thru-Stop	Ivy Ave at Hawthorne Ave	(A)	4	(A)	6
Thru-Stop	Larpenteur Ave at Winthrop St	(B)	11	(B)	13
Thru-Stop	McKnight Rd at North Site Access	(B)	13	(A)	8

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Optimized signal timing

As the mitigation analysis indicates, two intersections would continue to have movements with LOS E. As indicated with the 2040 No-Build conditions Ramsey County concluded that any need for improvements at the Larpenteur Avenue at McKnight Road intersection would be well into the future and the existing operation is adequate at this time. The intersection would continue to be monitored as the area develops.

The other intersection that would continue to have movements with operations at LOS E is McKnight Road at Montana Avenue which is side street stop controlled. Even though this access is one of the main entrances to the development, the only movement at LOS E is the eastbound left turn from Montana Avenue to McKnight Road. This is not uncommon for side street stop-controlled intersections on higher volume roadways like McKnight Road. With no side street queuing issues in either peak hour or the fact that this intersection would not meet warrants for signalization, no mitigation is recommended with this proposed Land Use Scenario. This intersection should however be monitored as the area develops.

2040 Build Analysis – Scenario 2 (Master Plan)

Table 8 – 2040 Build Scenario 2 Traffic Operations Summary shown below, summarizes the LOS and delays at the primary intersections in the study area based on the existing lane geometry, traffic control and projected 2040 traffic volumes with full development of the area assuming Land Use Scenario 2 (Master Plan) (**Figure 9**). The lane configuration on all site access streets included a single lane of approach. The traffic signal timing was optimized for the analysis at the Larpenteur Avenue at McKnight Road intersection.

Table 8 – 2040 Build Traffic Operations Summary – Scenario 2

Control	Intersection	AM Peak Hour		PM Peak Hour	
		LOS	Delay ⁽¹⁾ (sec/veh)	LOS	Delay ⁽¹⁾ (sec/veh)
Thru-Stop	Larpenteur Ave at Howard St	(B)	12	(B)	14
Sig	McKnight Rd at Larpenteur Ave ⁽²⁾	D (F)	48	D (F)	49
Thru-Stop	McKnight Rd at Montana Ave	(E)	48	(F)	100+
Thru-Stop	McKnight Rd at Nebraska Ave	(C)	20	(C)	25
Thru-Stop	McKnight Rd at Arlington Ave	(D)	30	(D)	26
Thru-Stop	Ivy Ave at Hawthorne Ave	(A)	4	(A)	6
Thru-Stop	Larpenteur Ave at Winthrop St	(A)	10	(B)	11
Thru-Stop	McKnight Rd at North Site Access	(B)	11	(B)	11

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Optimized signal timing

The analysis results show that all intersections would be operating at an acceptable overall LOS D or better during both the weekday AM and PM peak hours with all movements operating at LOS D or better except the following movements:

- McKnight Road at Larpenteur Avenue
 - AM Peak Hour
 - Northbound left LOS E
 - Southbound left LOS F
 - Southbound right LOS E
 - PM Peak Hour
 - Northbound left LOS E
 - Southbound left LOS F
- McKnight Road at Montana Avenue
 - AM Peak Hour
 - Eastbound left LOS E
 - PM Peak Hour
 - Westbound left and right LOS F
 - Eastbound left and right LOS F

To improve the delay and level of service at the intersections with movements at LOS E or F, mitigation improvements were analyzed. The mitigation included, lengthening of the left turn lanes at the McKnight Road and Larpenteur Avenue and addition of two exit lanes (left/thru lane and right turn lane) on all the site access streets (northbound Howard Street, eastbound Montana Avenue, and eastbound Arlington Avenue). The results of the analysis are included in **Table 9** and show that all intersections and movements would be operating at LOS D or better except the movements:

- McKnight Road at Larpenteur Avenue
 - AM Peak Hour

- Southbound left LOS E
 - PM Peak Hour
 - Southbound left LOS F
- McKnight Road at Montana Avenue
 - AM Peak Hour
 - Eastbound left LOS E
 - PM Peak Hour
 - Eastbound left LOS E

Table 9 – 2040 Build Traffic Operations Summary – Scenario 2 with Mitigation

Control	Intersection	AM Peak Hour		PM Peak Hour	
		LOS	Delay ⁽¹⁾ (sec/veh)	LOS	Delay ⁽¹⁾ (sec/veh)
Thru-Stop	Larpenteur Ave at Howard St	(B)	12	(B)	13
Sig	McKnight Rd at Larpenteur Ave ⁽²⁾	C (E)	29	C (F)	33
Thru-Stop	McKnight Rd at Montana Ave	(E)	37	(E)	43
Thru-Stop	McKnight Rd at Nebraska Ave	(C)	19	(C)	23
Thru-Stop	McKnight Rd at Arlington Ave	(D)	29	(C)	21
Thru-Stop	Ivy Ave at Hawthorne Ave	(A)	4	(A)	6
Thru-Stop	Larpenteur Ave at Winthrop St	(A)	9	(B)	11
Thru-Stop	McKnight Rd at North Site Access	(C)	15	(B)	10

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
 (2) = Optimized signal timing

Similar to Scenario 1 the mitigation analysis for Scenario 2 indicates that two intersections would continue to have movements with unsatisfactory levels of service with slightly longer delays. Based on the analysis, no additional improvements would be recommended at either the Larpenteur Avenue at McKnight Road or McKnight Road at Montana Avenue intersections. However, both should be monitored as the area develops.

2040 Build Analysis – Scenario 3 (Max Build)

Table 10 – 2040 Build Scenario 3 Traffic Operations Summary shown below, summarizes the LOS and delays at the primary intersections in the study area based on the existing lane geometry, traffic control and projected 2040 traffic volumes full development of the area assuming Land Use Scenario 3 (Max Build) (**Figure 10**). The lane configuration on all site access streets included a single lane of approach. The traffic signal timing was optimized for the analysis at the Larpenteur Avenue at McKnight Road intersection.

Table 10 – 2040 Build Traffic Operations Summary – Scenario 3

Control	Intersection	AM Peak Hour		PM Peak Hour	
		LOS	Delay ⁽¹⁾ (sec/veh)	LOS	Delay ⁽¹⁾ (sec/veh)
Thru-Stop	Larpenteur Ave at Howard St	(B)	13	(E)	38
Sig	McKnight Rd at Larpenteur Ave ⁽²⁾	D (F)	49	D (F)	54
Thru-Stop	McKnight Rd at Montana Ave	(F)	100+	(F)	100+
Thru-Stop	McKnight Rd at Nebraska Ave	(C)	22	(C)	27
Thru-Stop	McKnight Rd at Arlington Ave	(E)	44	(F)	55
Thru-Stop	Ivy Ave at Hawthorne Ave	(A)	4	(A)	6
Thru-Stop	Larpenteur Ave at Winthrop St	(B)	10	(B)	14
Thru-Stop	McKnight Rd at North Site Access	(C)	15	(B)	11

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
(2) = Optimized signal timing

The analysis results show that similar to 2040 Build Scenario 2, all intersections would be operating at an acceptable overall LOS D or better during both the AM and PM peak hours except at the McKnight Road at Montana Avenue intersection which would operate at LOS F in the PM peak hour. In addition, all movements would operate at LOS D or better except the following movements operating at LOS E / F:

- Larpenteur Avenue at Howard Street
 - PM Peak Hour
 - Northbound left LOS E
 - Southbound left LOS E
- McKnight Road at Larpenteur Avenue
 - AM Peak Hour
 - Westbound approach LOS F
 - Eastbound left LOS E
 - PM Peak Hour
 - Westbound approach LOS F
 - Eastbound approach LOS F
- McKnight Road at Montana Avenue
 - AM Peak Hour
 - Westbound left LOS E
 - Eastbound left and right LOS F
 - PM Peak Hour
 - Westbound left LOS E
 - Eastbound left and right LOS F
- McKnight Road at Arlington Avenue
 - AM Peak Hour
 - Eastbound left LOS E
 - PM Peak Hour
 - Eastbound left LOS F

To improve the delay and level of service at the intersections with movements at LOS E or F mitigation improvements were analyzed. The mitigation included, lengthening of the left turn lanes at the McKnight Road and Larpenteur Avenue and addition of two exit lanes (left/thru lane and right turn lane) on all the site access streets (northbound Howard Street, eastbound Montana Avenue, and eastbound Arlington Avenue). The results of the analysis are included in **Table 11** and show that all intersections and movements would be operating at LOS D or better except the movements:

- McKnight Road at Larpenteur Avenue
 - AM Peak Hour
 - Southbound left LOS F
 - PM Peak Hour
 - Southbound left LOS F
- McKnight Road at Montana Avenue
 - AM Peak Hour
 - Westbound left LOS E
 - Eastbound left and right LOS F
 - PM Peak Hour
 - Eastbound left and right LOS F
- McKnight Road at Arlington Avenue
 - PM Peak Hour
 - Eastbound left LOS E

Table 11 - 2040 Build Traffic Operations Summary – Scenario 3 with Mitigation

Control	Intersection	AM Peak Hour		PM Peak Hour	
		LOS	Delay ⁽¹⁾ (sec/veh)	LOS	Delay ⁽¹⁾ (sec/veh)
Thru-Stop	Larpenteur Ave at Howard St	(B)	12	(C)	19
Sig	McKnight Rd at Larpenteur Ave ⁽²⁾	C (E)	31	D (F)	36
Thru-Stop	McKnight Rd at Montana Ave	(F)	100+	(F)	100+
Thru-Stop	McKnight Rd at Nebraska Ave	(C)	23	(D)	27
Thru-Stop	McKnight Rd at Arlington Ave	(D)	34	(E)	46
Thru-Stop	Ivy Ave at Hawthorne Ave	(A)	4	(A)	6
Thru-Stop	Larpenteur Ave at Winthrop St	(B)	10	(B)	14
Thru-Stop	McKnight Rd at North Site Access	(B)	15	(B)	13

C = Overall LOS, (D) = Worst movement LOS, (1) = Overall Delay (worst movement for thru-stop intersections)
(2) = Optimized signal timing

With the addition of the site traffic for Scenario 3 (Max Density) and even including the proposed improvement mitigation, three intersections would have movements with increased delays and level of service over the other Build Scenarios.

Larpenteur Avenue at McKnight Road – Similar to the 2040 No-Build and other Build Scenarios it was concluded that any need for improvements at the intersection would be well into the future and the existing operation is adequate at this time. The intersection would continue to be monitored as the area develops.

McKnight Road at Montana Avenue – This intersection would continue to have significant delays for the Montana Avenue traffic with side street stop control. With this access as one of the main entrances to the development, delays of this magnitude will result in site traffic diverting to other site intersection. Other mitigation improvements should be considered including signalization or a roundabout. With either of these improvements the overall intersection would improve to a LOS B in the AM peak hour and LOS C in the PM peak hour with all movements at LOS C or better.

McKnight Road at Arlington Avenue – This intersection is also one of the main entrances to the development. For this intersection, the eastbound left turn would be operating at a LOS E in only the PM peak hour. Similar to the other Build Scenario this is not uncommon for side street stop-controlled intersections on higher volume roadways like McKnight Road. With no side street queuing issues or the fact that this intersection would not meet warrants for signalization, no mitigation would be recommended with this proposed Land Use Scenario. This intersection should however be monitored as the area develops.

EXTENDED ROADWAY ANALYSIS

A review of the potential traffic impacts from the proposed Hillcrest Golf Course development site was completed for the extended area roadway network including McKnight Road to the north and south; Larpenteur Avenue to the east and west, White Bear Avenue west of the site, Century Avenue east of the site, and Maryland Street south of the site. This review focused on the Average Daily Traffic (ADT) volumes for existing conditions, 2040 No-Build and 2040 Build conditions with the site related traffic volumes on the various roadway segments surrounding the Hillcrest Development Site.

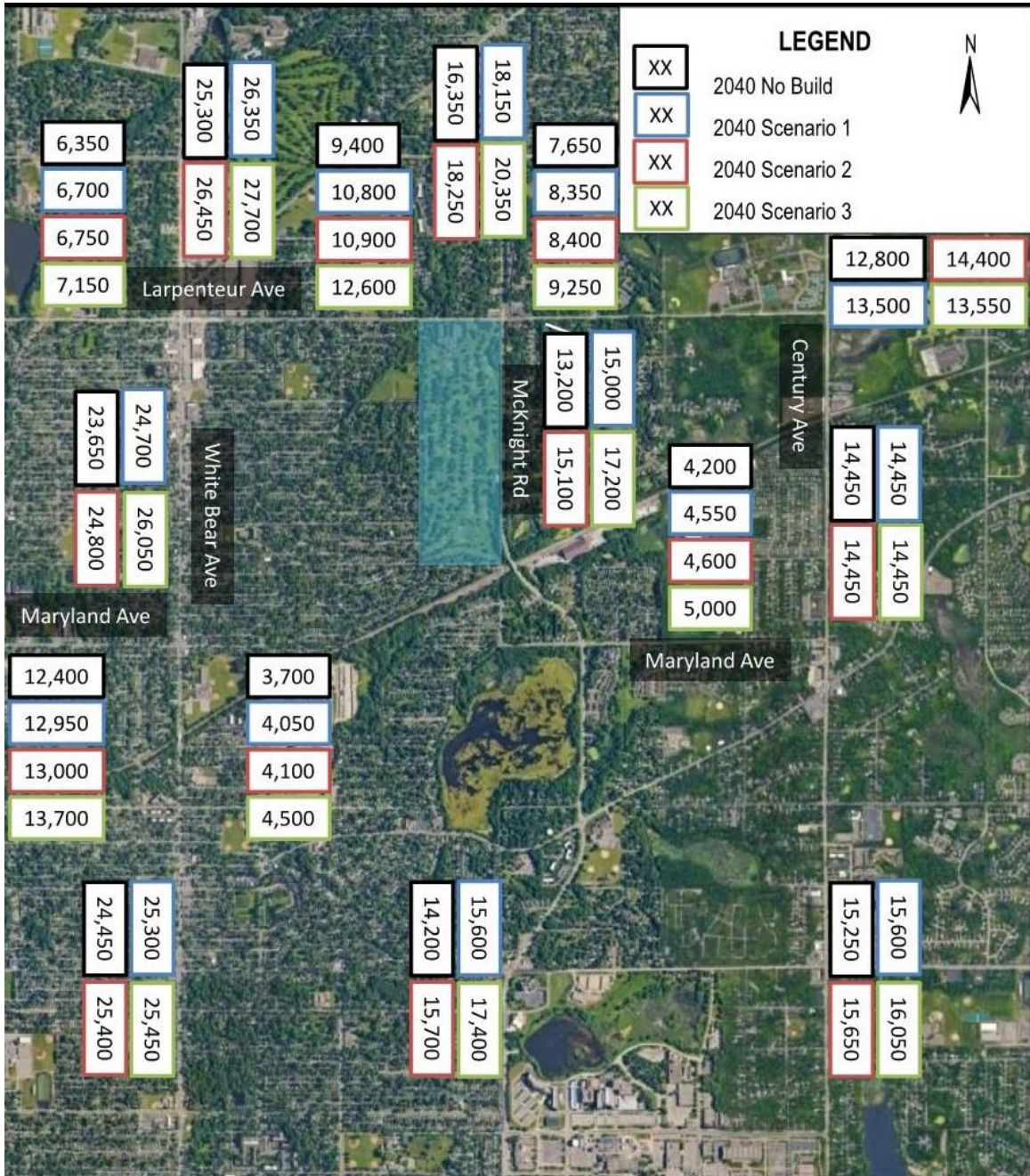
The primary roadways within the area and their expected future ADT traffic volumes under each scenario along with the estimated roadway capacities is summarized in **Table 12**. The planning level roadway capacities are based on the Highway Capacity Manual (HCM) standards. Although traffic volumes on these roadways are expected to increase, they are within or below the estimated capacity of the roadway facilities. A summary of the ADT traffic volumes is shown in **Figure 12**.

Table 12 – Extended Roadway Network Traffic Volume Change

Roadway	Existing ⁽¹⁾ (year)	2040 No-Build	2040 Build Scenario 1	2040 Build Scenario 2	2040 Build Scenario 3	Roadway Capacity
McKnight Road North of Larpenteur Ave	14,800 (2019)	16,350	18,150	18,250	20,350	14,000 – 18,500
McKnight Road South of Larpenteur Ave	11,900 (2019)	13,200	15,000	15,100	17,200	14,000 – 18,500
McKnight Road South of Maryland Ave	12,800 (2019)	14,200	15,600	15,700	17,400	14,000 – 18,500
Larpenteur Avenue West of White Bear Ave	5,700 (2018)	6,350	6,700	6,750	7,150	8,000 – 10,000
Larpenteur Avenue West of McKnight Rd	8,500 (2018)	9,400	10,800	10,900	12,600	8,000 – 10,000
Larpenteur Avenue East of McKnight Rd	6,900 (2018)	7,650	8,350	8,400	9,250	8,000 – 10,000
White Bear Avenue North of Larpenteur Ave	22,800 (2019)	25,300	26,350	26,450	27,700	28,000 – 32,000
White Bear Avenue South of Larpenteur Ave	21,300 (2019) ⁽²⁾	23,650	24,700	24,800	26,050	28,000 – 32,000
White Bear Avenue South of Maryland Ave	22,000 (2019) ⁽²⁾	24,450	25,300	25,400	26,450	28,000 – 32,000
Century Avenue North of Larpenteur Ave	11,400 (2017)	12,800	13,500	13,550	14,400	14,000 – 18,500
Century Avenue South of Larpenteur Ave	13,000 (2019)	14,450	14,450	14,450	14,450	14,000 – 18,500
Century Avenue South of Maryland Ave	13,600 (2017)	15,250	15,600	15,650	16,050	14,000 – 18,500
Maryland Avenue West of White Bear Ave	11,100 (2018)	12,400	12,950	13,000	13,700	8,000 – 10,000
Maryland Avenue East of White Bear Ave	3,300 (2018)	3,700	4,050	4,100	4,500	8,000 – 10,000
Maryland Avenue East of McKnight Road	3,750 (2018)	4,200	4,550	4,600	5,000	8,000 – 10,000

(1) = Source: MnDOT Traffic Mapping Application

Figure 12 – Extended Road Network Traffic Volumes



INTERNAL ROADWAY ANALYSIS

In addition to the external study intersection analysis, the proposed roadway network within the Hillcrest study area was evaluated to ensure the facilities are appropriately sized and to provide guidance on access and traffic controls. This evaluation was completed using Synchro/SimTraffic software and engineering judgement, focusing on the future 2040 conditions for each build scenario.

As discussed previously, Scenario 1 shows a “grid” internal roadway system, where Scenarios 2 and 3 include only the primary streets within the development area. The Scenario 1 roadway system shows direct access to McKnight Road at six locations, none of which line up with the existing street network on the east side of McKnight Road. These access locations would not meet Ramsey County access spacing guidelines. The additional north/south street shown in Scenario 1 would represent similar driveway access that would be assumed for Scenarios 2 or 3. Therefore, the internal roadway system shown for Scenario 2 and 3 was used for the internal roadway analysis.

All internal roadways were assumed to be two-lanes with side-street stop control at all internal intersections. **Figure 13** shows the proposed internal roadway network with the intersections included as part of the analysis and the locations of the assumed access from the land use areas.

Traffic forecasts were prepared assuming that traffic from each specific land use scenario was distributed to the internal roadway system based on the traffic distribution outline previously from the assumed access locations. The traffic forecasts for each build scenario are illustrated in **Figures 14-16**.

Results of the internal roadway system analysis indicates that in general, all internal roadways and intersections are all expected to operate acceptably under future year 2040 conditions during both the AM and PM peak hours with any of the 2040 build scenarios. **Table 13** provides a summary of the year 2040 internal intersection capacity analysis for each scenario.

Based on the results of the internal roadway capacity analysis and engineering judgement, the following should be considered:

- All internal streets should be two lanes (one lane in each direction) conforming to the requirements in the City of St. Paul Street Design Manual.
- All internal intersections should have side street stop control.
 - Idaho Avenue stops at Street A
 - Idaho Avenue stops at Howard Street
 - Street A stops Howard Street
 - Hoyt Avenue/Montana Avenue stops at Howard Street
 - Nebraska Avenue stops at Howard Street
 - Arlington Avenue W stops at Howard Street
 - Arlington Avenue E stops at Howard Street
 - Cottage Avenue stops at Howard Street
- Private access should be evaluated individually with each development proposal to ensure that all potential constraints are considered, including providing for truck traffic.
- Pedestrian facilities should be provided adjacent to each internal roadway with connections to external pedestrian facilities (see Bike / Pedestrian Facilities recommendations)

Table 13 – 2040 Build Internal Roadways Traffic Operations Summary

Control	Intersection	Scenario 1		Scenario 2		Scenario 3	
		AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
Thru-Stop	Street A at Idaho Ave	A (6 sec)	A (6 sec)	A (5 sec)	A (4 sec)	A (5 sec)	A (4 sec)
Thru-Stop	Howard St at Idaho Ave	A (7 sec)	A (6 sec)	A (6 sec)	A (6 sec)	A (8 sec)	A (8 sec)
Thru-Stop	Howard St at Street A	A (5 sec)	A (4 sec)	A (7 sec)	A (5 sec)	A (7 sec)	A (6 sec)
Thru-Stop	Howard St at Hoyt Ave/Montana Ave	A (7 sec)	A (7 sec)	A (7 sec)	A (5 sec)	A (7 sec)	A (7 sec)
Thru-Stop	Howard St at Nebraska Ave	A (5 sec)	A (5 sec)	A (6 sec)	A (5 sec)	A (7 sec)	A (6 sec)
Thru-Stop	Howard St at Arlington Ave W	A (4 sec)	A (5 sec)	A (6 sec)	A (5 sec)	A (7 sec)	A (7 sec)
Thru-Stop	Howard St at Arlington Ave E	A (7 sec)	A (7 sec)	A (6 sec)	A (6 sec)	A (7 sec)	A (6 sec)
Thru-Stop	Howard St at Cottage Ave	A (5 sec)	A (5 sec)	A (4 sec)	A (5 sec)	A (6 sec)	A (5 sec)

A = Worst movement LOS, (6 sec) = Worst movement delay for thru-stop intersections

Figure 13 – Internal Roadway Network and Access Locations

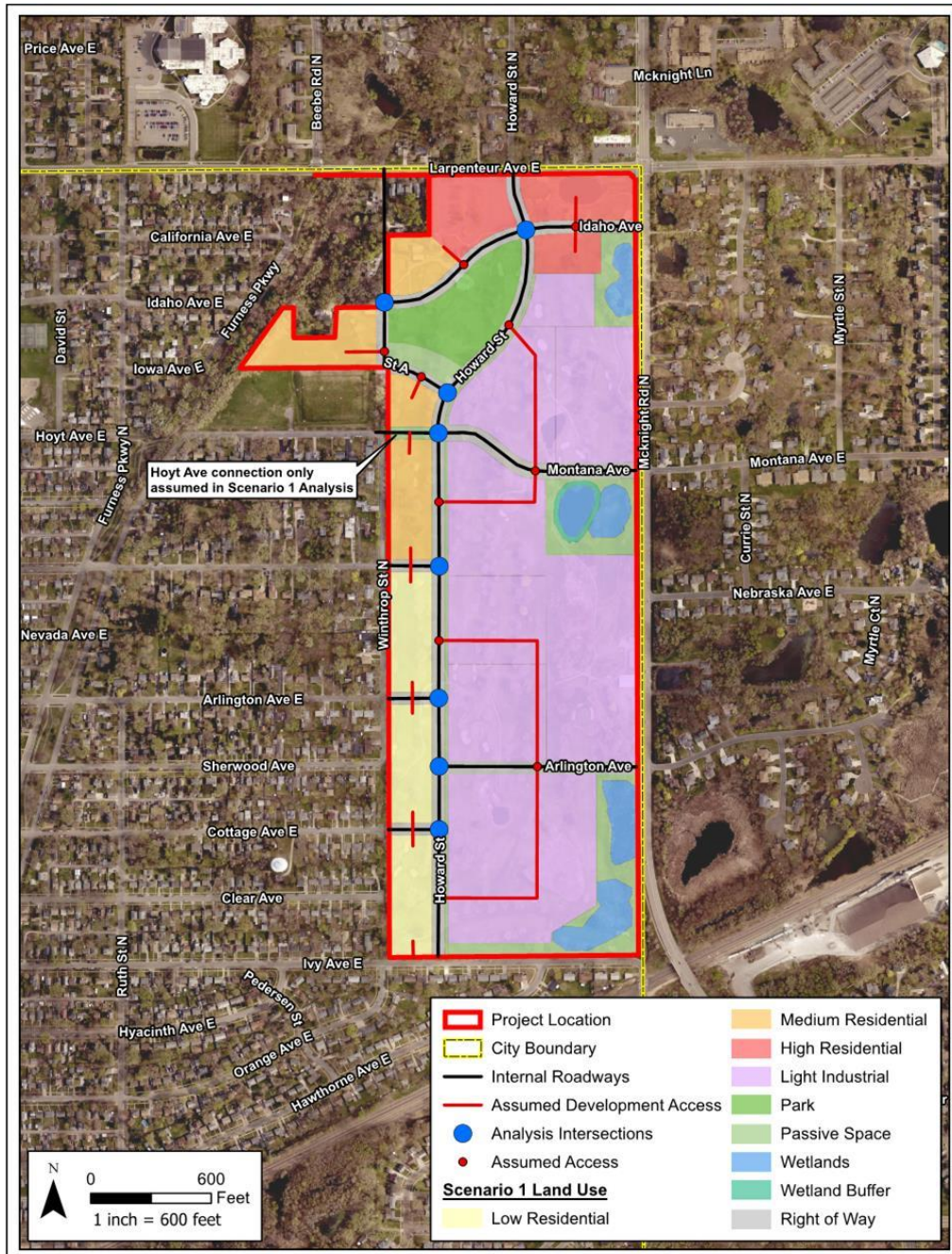


Figure 14 – 2040 Internal Roadway Traffic – Scenario 1

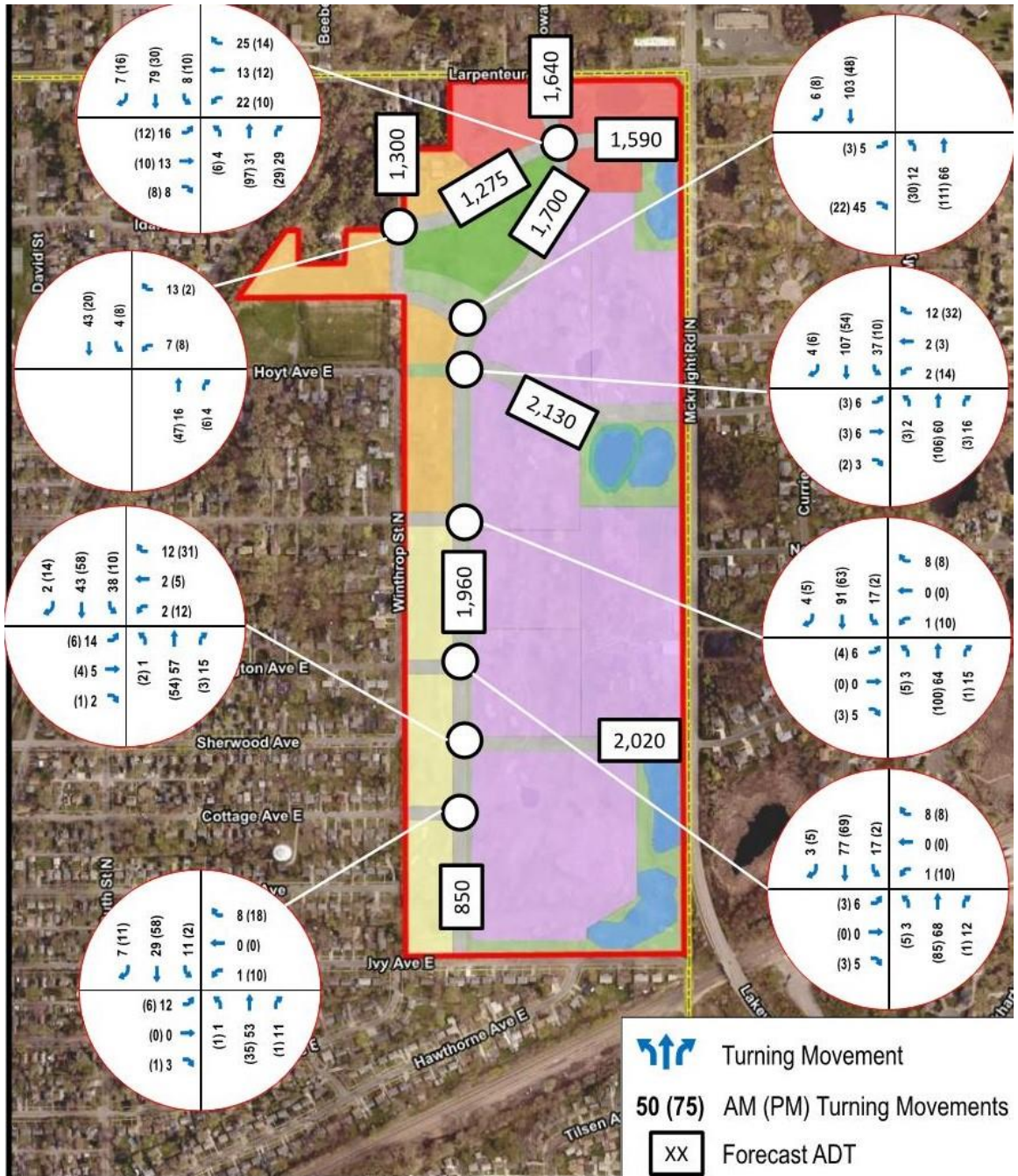


Figure 15 – 2040 Internal Roadway Traffic – Scenario 2

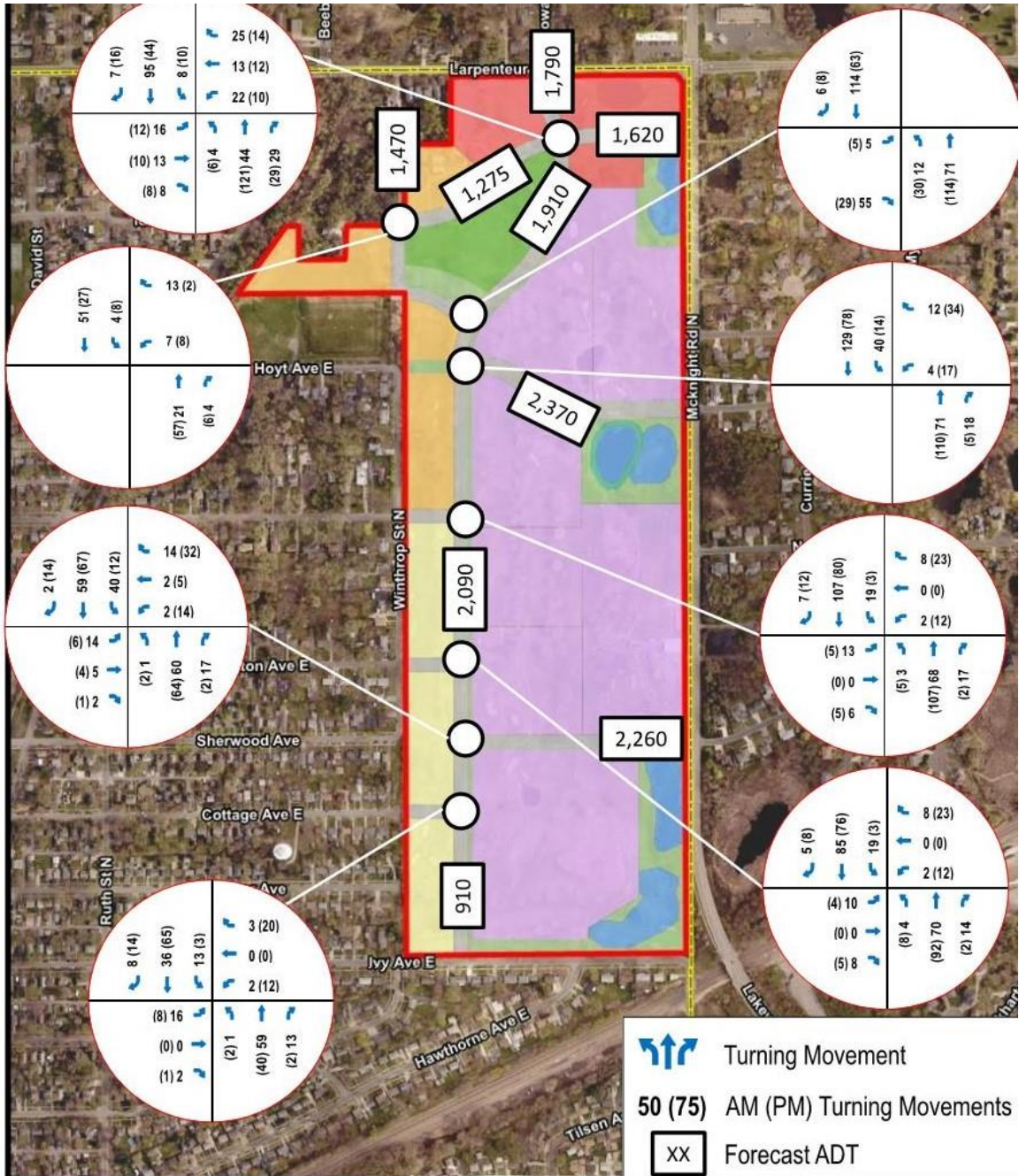
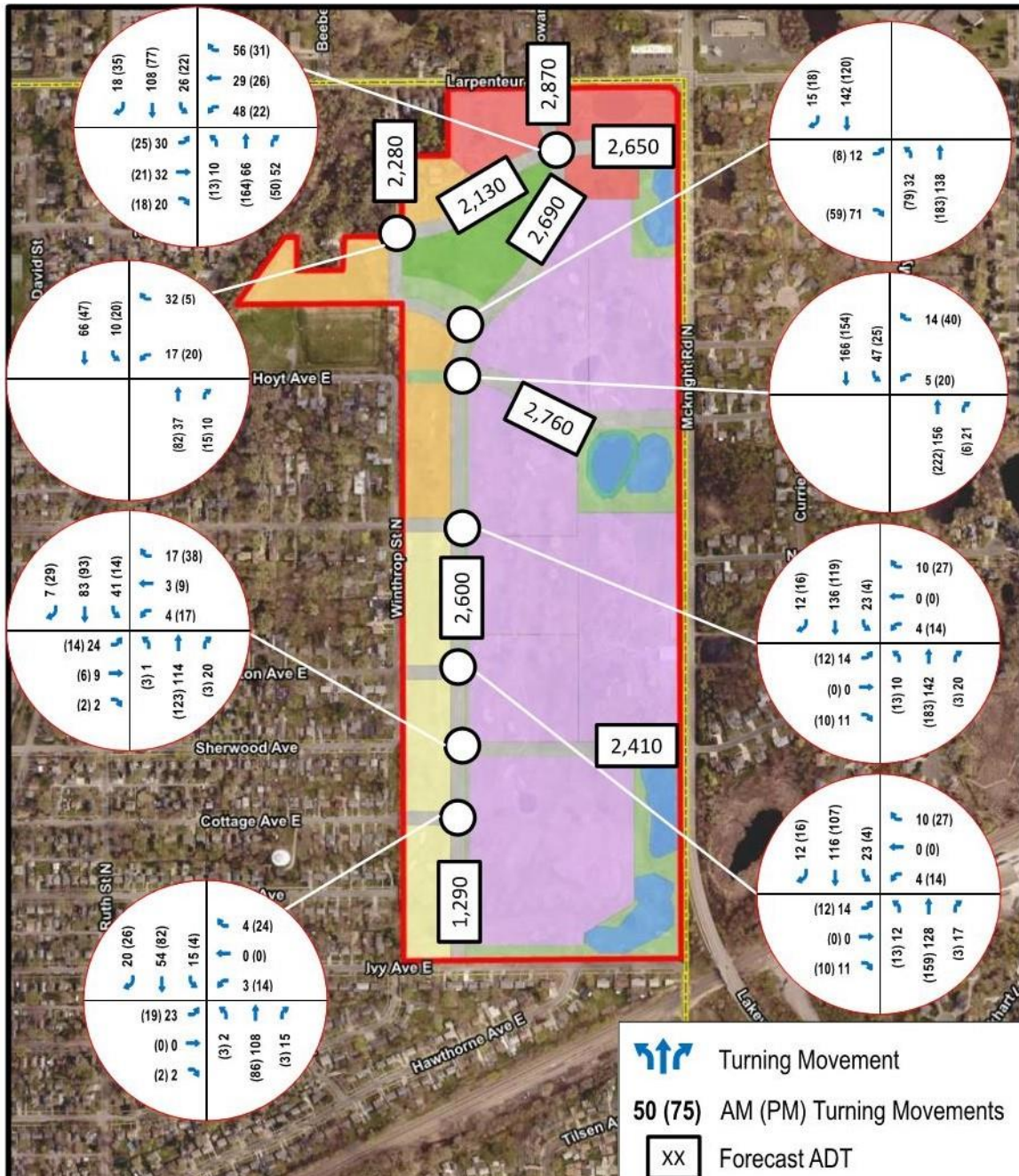


Figure 16 – 2040 Internal Roadway Traffic – Scenario 3



RECOMMENDATION / PROPOSED MITIGATION

Based on the analysis and conclusions documented in this study for each land use Scenario, the following is a summary of the 2040 Build transportation recommendations and proposed mitigation:

1. Roadway Improvements - Land Use Scenario 1 (Comp Plan)

- A. Lengthening of the left turn lanes to 300 ft at McKnight Road and Larpenteur Avenue. Monitor the intersection for additional improvements.
- B. Two exit lanes (left/thru lane and right turn lane) on all the site access streets (northbound Howard Street, eastbound Montana Avenue and eastbound Arlington Avenue).
- C. Monitor the intersection of McKnight Road at Montana Avenue as traffic volumes increase for lane configuration and/or traffic control improvements.

2. Roadway Improvements - Land Use Scenario 2 (Master Plan)

- A. Lengthening of the left turn lanes to 300 ft at McKnight Road and Larpenteur Avenue. Monitor the intersection for additional improvements.
- B. Two exit lanes (left/thru lane and right turn lane) on all the site access streets (northbound Howard Street, eastbound Montana Avenue and eastbound Arlington Avenue).
- C. Monitor the intersection of McKnight Road at Montana Avenue as traffic volumes increase for lane configuration and/or traffic control improvements.

3. Roadway Improvements - Land Use Scenario 3 (Max Density)

- A. Lengthening of the left turn lanes to 300ft at McKnight Road and Larpenteur Avenue. Monitor the intersection for additional improvements.
- B. Two exit lanes (left/thru lane and right turn lane) on all the site access streets (northbound Howard Street, eastbound Montana Avenue, and eastbound Arlington Avenue).
- C. Improve the intersection of McKnight Road at Montana Avenue as traffic increases to include either traffic signal or roundabout control. Provide additional right-of-way to accommodate the improvements if necessary.
- D. Monitor the intersection of McKnight Road at Arlington Avenue as traffic volumes increase for lane configuration and/or traffic control improvements. Provide additional right-of-way to accommodate future improvements if necessary.

4. Internal Street System (All Land Use Scenarios):

- A. All internal streets should be two lanes (one lane in each direction) conforming to the requirements in the City of St. Paul Street Design Manual.
- B. All internal intersections should have side street stop control.
 - i. Idaho Avenue stops at Street A
 - ii. Idaho Avenue stops at Howard Street
 - iii. Street A stops Howard Street

- iv. Hoyt Avenue/Montana Avenue stops at Howard Street
 - v. Nebraska Avenue stops at Howard Street
 - vi. Arlington Avenue W stops at Howard Street
 - vii. Arlington Avenue E stops at Howard Street
 - viii. Cottage Avenue stops at Howard Street
- C. Private access should be evaluated individually with each development proposal to ensure that all potential constraints are considered, including providing for truck traffic.
- D. Pedestrian facilities should be provided adjacent to each internal street with connections to external pedestrian facilities (see Bike / Pedestrian Facilities recommendations)

5. Bike / Pedestrian Improvements (All Land use Scenarios):

- A. A trail connection north of Hoyt Avenue to the Furness Trail on the west side of the study area with a direct connection through the site to the trail on McKnight Road.
- B. An off-road trail on the south side of Larpenteur Avenue from McKnight Road to the west.
- C. A trail connection from the site on Howard Street at Ivy Street.
- D. A pedestrian connection on the north side of Ivy Avenue from Winthrop Street to the existing pedestrian trail on McKnight Road with the reconstruction of Ivy Avenue.
- E. An extension of the future enhanced bike lane on Arlington Avenue through the site to the trail on McKnight Road.
- F. Sidewalks along all roadways throughout the Hillcrest development Site.
- G. Sidewalks to the Hayden Heights neighborhood from the site on Nebraska Avenue, Arlington Avenue and Cottage Avenue.
- H. Reconstruct the existing pedestrian refuge islands on McKnight Road at Montana Avenue and Arlington Avenue as part of the construction of new left turn lanes for the site. The design will include a raised concrete median with signing and pavement markings. The detailed design will be completed as part of the final design for the site improvements and will be coordinated, reviewed and approved by Ramsey County.
- I. Design internal roadways to accommodate safe pedestrian crossings including bump-outs at intersections, tabled concrete crosswalks, and a tabled intersection at Howard Street and Idaho Avenue.
- J. Ensure that the pedestrian connectivity across McKnight Road to the City of Maplewood is maintained. Any changes or modification in the existing infrastructure resulting from the development will be reviewed and approved by Ramsey County and the City of Maplewood..
- K. Provide a pedestrian crossing of Larpenteur Avenue from the development site at Howard Street.

6. Transit Service (All Land Use Scenarios)

- A. Coordinate with Metro Transit to possibly alter the existing transit routes to pass through or adjacent to the site to promote increased transit use. Which route and where bus stops are located will be analyzed once a site development scenario is selected and Metro Transit reanalyzes the local bus routes in the area.

7. Freight Service (All Land Use Scenarios)

- A. Design internal roadways to accommodate the expected level of freight activity within the area based on the proposed development, including:
 - Provide bump-outs at intersections to elimination/discourage large vehicle turning.
 - i. Any industrial land use's access to Howard Street should not line up with Nebraska Avenue, Arlington Avenue, or Cottage Avenue to the west. Rather, any such access to Howard Street should be mid-block to discourage direct traffic access to the neighborhoods.
- B. Freight activity should be limited during the peak traffic periods to avoid potential conflicts through communication with the identified industrial business, area package services (i.e., UPS, FedEx, etc.) and refuse haulers.
- C. Evaluation of the need for on-street loading areas should be completed to accommodate some freight activity as actual development proposals are identified.

8. Neighborhood Improvements (All Land Use Scenarios)

- A. Any industrial land use's access to Howard Street should not line up with Nebraska Avenue, Arlington Avenue, or Cottage Avenue to the west. Rather, any such access to Howard Street should be mid-block to discourage direct traffic access to the neighborhoods.
- B. No direct access from the multi-family residential land uses should be provided to Howard Street or Winthrop Street. Provide off road pedestrian accommodations on the streets accessing the neighborhoods, including extension/connection of sidewalks.
- C. Provide the recommended improvements at the site access locations on Larpenteur Avenue at Howard Street, McKnight Road at Montana Avenue and McKnight Road at Arlington Avenue to discourage traffic from using neighborhood streets.
- D. Implement the recommendations in the Freight Service section to discourage heavy vehicle traffic from using the neighborhood streets.
- E. As traffic in the area increases over time, especially on streets such as Ivy Avenue, traffic calming measures will be required to manage vehicle speed and public safety. The type of traffic calming measures that could be installed will be consistent with city policies and practices. It should be noted that installation of some traffic calming measures will result in a diversion of traffic to other neighborhood roadways. The determination of what type of traffic calming measure, the implementation, and financial responsibilities will be outlined in the developer's agreement between the St. Paul Port Authority and the City.

APPENDIX A – CAPACITY ANALYSIS WORKSHEETS

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Total Del/Veh (s)	2.7	0.5	1.7	1.3	7.8	3.5	1.4

2: McKnight Road & Larpenteur Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.6	0.1	0.1	2.7	0.4	0.4	0.0	0.0	0.0	3.2	0.7	0.8
Total Del/Veh (s)	33.6	34.5	22.6	36.7	40.4	29.0	53.1	22.8	18.0	57.0	30.4	23.0

2: McKnight Road & Larpenteur Avenue Performance by movement

Movement	All
Denied Del/Veh (s)	0.5
Total Del/Veh (s)	32.1

3: McKnight Road & Montana Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	16.0	5.3	0.7	0.1	3.6	1.5	1.5

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	12.6	5.2	0.7	0.2	4.7	1.2	1.0

5: McKnight Road & Arlington Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.4	0.5	0.0	0.0	0.2
Total Del/Veh (s)	21.7	5.1	0.6	0.1	4.6	1.8	1.3

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Del/Veh (s)	0.1	0.1	0.1	0.2	0.1	0.1	0.1
Total Del/Veh (s)	0.2	0.0	2.1	0.2	5.0	2.7	1.0

Total Network Performance

Denied Del/Veh (s)	0.6
Total Del/Veh (s)	34.8

Queuing and Blocking Report
Existing AM (with existing signal timing)

05/05/2022

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	31	31
Average Queue (ft)	1	16
95th Queue (ft)	10	41
Link Distance (ft)	582	923
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 2: McKnight Road & Larpenteur Avenue

Movement	EB	EB	WB	WB	NB	NB	B8	SB	SB
Directions Served	L	TR	L	TR	L	TR	T	L	TR
Maximum Queue (ft)	136	263	139	404	174	356	66	174	410
Average Queue (ft)	31	131	39	181	118	220	6	94	227
95th Queue (ft)	82	223	105	347	193	357	39	177	381
Link Distance (ft)		586		1469		288	1091		1075
Upstream Blk Time (%)						4			
Queuing Penalty (veh)						23			
Storage Bay Dist (ft)	140		115		150			150	
Storage Blk Time (%)		10		25	3	15		0	19
Queuing Penalty (veh)		4		10	15	22		2	17

Intersection: 3: McKnight Road & Montana Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	54	7
Average Queue (ft)	23	0
95th Queue (ft)	51	5
Link Distance (ft)	1450	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		300
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report
Existing AM (with existing signal timing)

05/05/2022

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	36	31
Average Queue (ft)	9	2
95th Queue (ft)	32	13
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	40	31
Average Queue (ft)	13	3
95th Queue (ft)	38	18
Link Distance (ft)	1146	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (ft)	23	46
Average Queue (ft)	3	17
95th Queue (ft)	17	40
Link Distance (ft)	491	1280
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 93

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Total Del/Veh (s)	3.5	0.7	1.9	1.1	13.3	3.7	1.4

2: McKnight Road & Larpenteur Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	2.7	0.3	0.4	0.0	0.0	0.0	3.3	0.7	0.7
Total Del/Veh (s)	33.4	38.3	26.1	35.6	38.4	30.4	61.7	26.0	22.5	58.3	29.8	22.0

2: McKnight Road & Larpenteur Avenue Performance by movement

Movement	All
Denied Del/Veh (s)	0.4
Total Del/Veh (s)	34.3

3: McKnight Road & Montana Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	11.4	6.0	1.2	0.5	4.9	1.5	1.4

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	10.0	4.8	1.1	0.3	5.4	1.2	1.2

5: McKnight Road & Arlington Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.6	0.5	0.0	0.0	0.3
Total Del/Veh (s)	14.4	5.0	0.8	0.3	6.4	1.8	1.3

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBT	WBL	WBT	NBL	NBR	All
Denied Del/Veh (s)	0.2	0.1	0.2	0.1	0.1	0.2
Total Del/Veh (s)	0.2	2.0	0.3	6.0	2.7	0.9

Total Network Performance

Denied Del/Veh (s)	0.6
Total Del/Veh (s)	36.6

Queuing and Blocking Report
Existing PM (with existing signal timing)

05/05/2022

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	54	42
Average Queue (ft)	3	6
95th Queue (ft)	23	28
Link Distance (ft)	582	923
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 2: McKnight Road & Larpenteur Avenue

Movement	EB	EB	WB	WB	NB	NB	B8	SB	SB
Directions Served	L	TR	L	TR	L	TR	T	L	TR
Maximum Queue (ft)	164	405	123	342	175	374	238	174	485
Average Queue (ft)	48	194	29	164	130	283	35	105	205
95th Queue (ft)	132	337	82	289	210	401	147	184	377
Link Distance (ft)		586		1469		288	1091		1075
Upstream Blk Time (%)						11			
Queuing Penalty (veh)						83			
Storage Bay Dist (ft)	140		115		150			150	
Storage Blk Time (%)	0	21		20	7	26		3	15
Queuing Penalty (veh)	1	10		6	41	37		12	17

Intersection: 3: McKnight Road & Montana Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	42	31
Average Queue (ft)	16	3
95th Queue (ft)	42	17
Link Distance (ft)	1450	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		300
Storage Blk Time (%)		
Queuing Penalty (veh)		

Queuing and Blocking Report
Existing PM (with existing signal timing)

05/05/2022

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	31	31
Average Queue (ft)	11	5
95th Queue (ft)	35	24
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	30	31
Average Queue (ft)	9	4
95th Queue (ft)	30	21
Link Distance (ft)	1146	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (ft)	37	40
Average Queue (ft)	2	22
95th Queue (ft)	17	44
Link Distance (ft)	491	1280
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 208

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.2	0.1	0.0
Total Del/Veh (s)	3.2	0.6	1.8	1.8	8.5	4.1	1.5

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.7	0.1	0.1	2.5	0.4	0.4	0.0	0.0	0.0	3.1	0.7	0.7
Total Del/Veh (s)	24.5	24.1	17.2	23.1	25.1	20.5	91.3	30.1	25.2	51.5	39.8	31.8

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.5
Total Del/Veh (s)	35.5

3: McKnight Road & Montana Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	16.5	8.1	0.9	0.4	7.1	1.7	1.7

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	17.7	5.0	0.8	0.3	4.2	1.3	1.2

5: McKnight Road & Arlington Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.5	0.6	0.0	0.0	0.2
Total Del/Veh (s)	11.7	4.0	0.7	0.1	4.6	2.0	1.4

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Del/Veh (s)	0.2	0.3	0.2	0.2	0.1	0.1	0.2
Total Del/Veh (s)	0.2	0.1	2.2	0.4	4.4	2.6	1.0

Total Network Performance

Denied Del/Veh (s)	0.6
Total Del/Veh (s)	39.0

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	24	38
Average Queue (ft)	1	16
95th Queue (ft)	12	42
Link Distance (ft)	582	923
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	WB	WB	NB	NB	B8	SB	SB
Directions Served	L	TR	L	TR	L	TR	T	L	TR
Maximum Queue (ft)	163	226	118	275	174	376	291	174	500
Average Queue (ft)	38	121	31	147	145	260	47	100	276
95th Queue (ft)	101	196	81	239	213	409	201	196	448
Link Distance (ft)		586		1469		288	1091		1075
Upstream Blk Time (%)						16			
Queuing Penalty (veh)						106			
Storage Bay Dist (ft)	140		115		150			150	
Storage Blk Time (%)		6		15	22	21		0	30
Queuing Penalty (veh)		3		7	111	33		0	30

Intersection: 3: McKnight Road & Montana Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	64	30
Average Queue (ft)	30	2
95th Queue (ft)	57	12
Link Distance (ft)	1450	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		300
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	31	31
Average Queue (ft)	11	3
95th Queue (ft)	34	17
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	40	30
Average Queue (ft)	16	2
95th Queue (ft)	40	15
Link Distance (ft)	1146	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (ft)	42	54
Average Queue (ft)	4	18
95th Queue (ft)	22	43
Link Distance (ft)	491	1280
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 290

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.1	0.1	0.0
Total Del/Veh (s)	4.1	0.8	1.9	1.7	8.3	3.8	1.4

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	2.4	0.3	0.3	0.0	0.0	0.0	3.1	0.8	0.8
Total Del/Veh (s)	30.1	31.2	23.9	26.7	30.5	22.8	78.8	44.9	38.0	89.6	42.3	34.8

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.5
Total Del/Veh (s)	43.4

3: McKnight Road & Montana Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	17.8	7.9	1.6	0.5	7.9	1.5	1.7

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	34.7	8.1	1.3	0.5	5.7	1.2	1.4

5: McKnight Road & Arlington Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.7	0.8	0.0	0.0	0.4
Total Del/Veh (s)	22.0	6.6	1.1	0.3	9.0	1.7	1.5

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBT	WBL	WBT	NBL	NBR	All
Denied Del/Veh (s)	0.1	0.1	0.2	0.1	0.1	0.1
Total Del/Veh (s)	0.2	2.0	0.3	3.7	2.6	0.8

Total Network Performance

Denied Del/Veh (s)	0.7
Total Del/Veh (s)	58.2

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	SB
Directions Served	LT	LR
Maximum Queue (ft)	48	31
Average Queue (ft)	4	7
95th Queue (ft)	24	28
Link Distance (ft)	582	923
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	WB	WB	NB	NB	B8	SB	SB
Directions Served	L	TR	L	TR	L	TR	T	L	TR
Maximum Queue (ft)	164	365	139	317	174	382	774	174	717
Average Queue (ft)	46	178	39	162	148	347	375	125	297
95th Queue (ft)	123	309	100	269	215	417	871	208	616
Link Distance (ft)		586		1469		288	1091		1075
Upstream Blk Time (%)						45			0
Queuing Penalty (veh)						361			0
Storage Bay Dist (ft)	140		115		150			150	
Storage Blk Time (%)	0	18		19	10	48		10	20
Queuing Penalty (veh)	0	10		7	66	75		52	26

Intersection: 3: McKnight Road & Montana Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	47	37
Average Queue (ft)	15	4
95th Queue (ft)	41	22
Link Distance (ft)	1450	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		300
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	42	36
Average Queue (ft)	12	6
95th Queue (ft)	39	27
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	30	48
Average Queue (ft)	11	7
95th Queue (ft)	33	31
Link Distance (ft)	1146	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	WB	NB
Directions Served	LT	LR
Maximum Queue (ft)	42	61
Average Queue (ft)	3	23
95th Queue (ft)	19	47
Link Distance (ft)	491	1280
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 596

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.0
Total Del/Veh (s)	5.3	1.4	0.9	6.1	3.1	2.9	12.2	5.0	11.0	4.9	3.1

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	2.7	0.4	0.4	0.0	0.0	0.0	3.0	0.9	0.9
Total Del/Veh (s)	56.7	48.7	39.4	61.8	61.4	50.2	81.6	22.2	17.7	91.9	41.6	35.2

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.5
Total Del/Veh (s)	45.5

3: McKnight Road & Montana Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	35.8	20.9	24.2	6.3	8.6	1.0	0.2	4.6	3.2	2.4	4.0

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	18.6	4.4	0.8	0.1	4.2	1.4	1.2

5: McKnight Road & Arlington Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.1	0.1	0.1	3.1	0.7	0.6	0.0	0.0	0.0	0.5
Total Del/Veh (s)	19.1	8.8	30.2	6.7	5.8	1.4	0.1	6.1	2.1	1.6	2.6

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	NBL	NBR	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Del/Veh (s)	2.0	0.6	0.7	2.0	0.3	3.8	2.8	2.4	1.4

7: Winthrop Street & Larpenteur Avenue Performance by movement

Movement	EBT	EBR	WBT	NBL	All
Denied Del/Veh (s)	0.3	0.3	0.0	0.1	0.2
Total Del/Veh (s)	1.3	0.8	1.0	10.3	1.5

8: McKnight Road & N Site Access Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Del/Veh (s)	11.0	7.4	3.9	2.1	5.6

Total Network Performance

Denied Del/Veh (s)	0.7
Total Del/Veh (s)	43.0

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	88	99	72	53
Average Queue (ft)	5	29	34	17
95th Queue (ft)	36	82	60	44
Link Distance (ft)	582	591	738	923
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	174	388	174	525	174	302	174	721
Average Queue (ft)	82	200	69	280	142	234	111	383
95th Queue (ft)	178	343	166	475	204	339	198	634
Link Distance (ft)		591		1469		288		1075
Upstream Blk Time (%)						7		
Queuing Penalty (veh)						50		
Storage Bay Dist (ft)	150		150		150		150	
Storage Blk Time (%)	1	21	1	33	13	18	4	31
Queuing Penalty (veh)	3	15	2	22	71	27	26	29

Intersection: 3: McKnight Road & Montana Avenue

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	L	L	TR
Maximum Queue (ft)	129	59	52	14	22
Average Queue (ft)	46	22	22	0	2
95th Queue (ft)	94	51	48	7	13
Link Distance (ft)	1504	1450			1085
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			300	300	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	36	31
Average Queue (ft)	9	3
95th Queue (ft)	32	17
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	L	L	TR
Maximum Queue (ft)	84	52	71	30	20
Average Queue (ft)	34	16	25	3	1
95th Queue (ft)	65	42	54	18	10
Link Distance (ft)	923	1146			797
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			150	150	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	28	32	59	29
Average Queue (ft)	2	3	21	14
95th Queue (ft)	15	16	48	37
Link Distance (ft)	1004	484	1278	645
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Winthrop Street & Larpenteur Avenue

Movement	NB
Directions Served	LR
Maximum Queue (ft)	66
Average Queue (ft)	27
95th Queue (ft)	59
Link Distance (ft)	779
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 8: McKnight Road & N Site Access

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	42	329
Average Queue (ft)	14	59
95th Queue (ft)	40	229
Link Distance (ft)	434	1085
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 246

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.3	4.0	0.1	0.1	0.2
Total Del/Veh (s)	3.2	1.3	0.8	5.6	2.8	2.4	11.9	3.7	10.1	5.2	2.8

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	2.5	0.6	2.5	0.0	0.0	0.0	3.0	1.0	3.2
Total Del/Veh (s)	23.0	23.9	10.2	24.3	26.9	10.4	54.8	22.0	4.7	47.7	40.0	13.9

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.8
Total Del/Veh (s)	28.9

3: McKnight Road & Montana Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.1	1.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	33.8	6.8	26.2	7.2	7.5	1.0	0.2	4.7	3.5	2.6	3.9

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	17.9	3.9	0.8	0.1	3.9	1.5	1.2

5: McKnight Road & Arlington Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	3.9	0.1	0.1	3.1	0.7	0.6	0.0	0.0	0.0	0.6
Total Del/Veh (s)	17.3	7.3	22.0	6.2	5.3	1.3	0.1	7.0	2.2	1.6	2.4

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	NBL	NBR	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Del/Veh (s)	2.0	0.6	0.7	2.0	0.3	3.8	2.8	2.4	1.4

7: Winthrop Street & Larpenteur Avenue Performance by movement

Movement	EBT	EBR	WBT	NBL	All
Denied Del/Veh (s)	0.3	0.3	0.0	0.1	0.2
Total Del/Veh (s)	1.3	0.8	0.9	10.5	1.5

8: McKnight Road & N Site Access Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Del/Veh (s)	12.6	4.5	4.3	2.3	4.5

Total Network Performance

Denied Del/Veh (s)	1.0
Total Del/Veh (s)	30.2

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	WB	NB	NB	SB
Directions Served	LTR	LTR	LT	R	LTR
Maximum Queue (ft)	38	92	57	51	42
Average Queue (ft)	2	19	22	25	16
95th Queue (ft)	19	63	51	49	42
Link Distance (ft)	582	565	738		923
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				200	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	97	136	99	89	208	80	256	294	106	234	613	275
Average Queue (ft)	39	65	38	35	99	37	105	181	18	86	274	56
95th Queue (ft)	79	118	76	74	177	72	202	293	90	214	546	203
Link Distance (ft)		565			1457			276			1062	
Upstream Blk Time (%)							0	3	0		0	
Queuing Penalty (veh)							0	20	0		0	
Storage Bay Dist (ft)	300		250	250		250	300		250	250		250
Storage Blk Time (%)					0		0	5	0		13	0
Queuing Penalty (veh)					0		3	8	0		22	0

Intersection: 3: McKnight Road & Montana Avenue

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	101	47	64	52	8	27
Average Queue (ft)	35	14	23	17	0	2
95th Queue (ft)	76	41	54	41	7	12
Link Distance (ft)	1504		1450			1085
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		200		300	300	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	36	31
Average Queue (ft)	9	2
95th Queue (ft)	32	16
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	42	66	51	59	31	5
Average Queue (ft)	13	28	16	21	3	0
95th Queue (ft)	40	57	41	46	17	3
Link Distance (ft)	923		1146			797
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		200		150	150	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	28	32	59	29
Average Queue (ft)	2	3	21	14
95th Queue (ft)	15	16	48	37
Link Distance (ft)	1004	484	1278	645
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Winthrop Street & Larpenteur Avenue

Movement	NB
Directions Served	LR
Maximum Queue (ft)	66
Average Queue (ft)	26
95th Queue (ft)	56
Link Distance (ft)	779
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 8: McKnight Road & N Site Access

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	42	206
Average Queue (ft)	15	18
95th Queue (ft)	40	103
Link Distance (ft)	434	1085
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 54

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.0
Total Del/Veh (s)	3.5	1.3	0.5	5.3	3.0	1.8	14.4	8.6	10.0	5.2	3.6

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	2.9	0.4	0.4	0.0	0.0	0.0	3.1	0.7	0.8
Total Del/Veh (s)	64.8	56.8	47.4	54.6	55.2	45.0	90.5	25.8	22.4	89.5	35.5	29.9

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.4
Total Del/Veh (s)	45.3

3: McKnight Road & Montana Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	47.1	23.8	22.0	9.2	5.5	1.7	0.5	7.4	2.7	2.0	5.2

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	14.5	5.6	1.2	0.5	6.2	1.3	1.3

5: McKnight Road & Arlington Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.1	0.1	3.0	0.8	0.8	0.0	0.0	0.0	0.5
Total Del/Veh (s)	25.4	9.5	17.2	8.4	4.3	1.4	0.4	4.9	2.0	1.6	2.6

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBL	EBT	WBL	WBT	NBL	NBR	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.1	0.2	0.3	0.1	0.1	0.2
Total Del/Veh (s)	2.1	0.5	2.0	0.3	5.9	3.0	2.7	1.3

7: Winthrop Street & Larpenteur Avenue Performance by movement

Movement	EBT	EBR	WBT	NBL	All
Denied Del/Veh (s)	0.3	0.4	0.0	0.1	0.2
Total Del/Veh (s)	1.4	1.1	1.0	13.2	2.0

8: McKnight Road & N Site Access Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Del/Veh (s)	9.2	18.0	3.7	1.6	11.8

Total Network Performance

Denied Del/Veh (s)	0.6
Total Del/Veh (s)	46.1

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	41	100	116	31
Average Queue (ft)	3	21	54	11
95th Queue (ft)	20	71	92	35
Link Distance (ft)	582	591	738	923
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	175	550	174	459	174	304	174	518
Average Queue (ft)	118	305	69	238	146	280	115	309
95th Queue (ft)	206	502	165	387	204	328	196	485
Link Distance (ft)		591		1469		288		1075
Upstream Blk Time (%)		0				18		
Queuing Penalty (veh)		0				157		
Storage Bay Dist (ft)	150		150		150		150	
Storage Blk Time (%)	2	35	0	31	17	30	5	26
Queuing Penalty (veh)	8	38	0	15	124	43	27	30

Intersection: 3: McKnight Road & Montana Avenue

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	L	L	TR
Maximum Queue (ft)	178	37	40	30	5
Average Queue (ft)	74	15	11	3	0
95th Queue (ft)	141	40	35	18	3
Link Distance (ft)	1504	1450			1085
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			300	300	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	36	31
Average Queue (ft)	13	4
95th Queue (ft)	39	20
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	L	L
Maximum Queue (ft)	107	46	47	35
Average Queue (ft)	47	10	17	4
95th Queue (ft)	84	35	41	20
Link Distance (ft)	923	1146		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			150	150
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	35	34	50	38
Average Queue (ft)	4	3	24	19
95th Queue (ft)	21	18	47	41
Link Distance (ft)	1004	484	1278	645
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Winthrop Street & Larpenteur Avenue

Movement	NB
Directions Served	LR
Maximum Queue (ft)	80
Average Queue (ft)	36
95th Queue (ft)	66
Link Distance (ft)	779
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 8: McKnight Road & N Site Access

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	69	591
Average Queue (ft)	24	194
95th Queue (ft)	54	478
Link Distance (ft)	434	1085
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 442

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.4	3.9	0.1	0.1	0.4
Total Del/Veh (s)	3.6	1.3	0.5	5.5	2.9	1.9	13.3	5.2	9.6	5.5	3.2

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	2.7	0.5	2.6	0.0	0.0	0.0	3.2	0.8	3.2
Total Del/Veh (s)	26.6	29.4	9.2	26.1	30.4	13.6	55.5	25.4	6.5	53.3	26.6	7.9

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.6
Total Del/Veh (s)	27.7

3: McKnight Road & Montana Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	1.8	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	37.4	8.9	19.2	9.6	6.5	1.7	0.5	6.1	3.0	2.1	4.5

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	20.6	5.3	1.3	0.5	5.7	1.4	1.4

5: McKnight Road & Arlington Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.4	3.6	0.1	0.1	3.0	0.8	0.8	0.0	0.0	0.0	0.7
Total Del/Veh (s)	21.0	7.4	20.4	8.1	4.5	1.4	0.3	5.1	2.0	1.6	2.5

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBL	EBT	WBL	WBT	NBL	NBR	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.1	0.2	0.3	0.1	0.1	0.2
Total Del/Veh (s)	2.1	0.5	2.0	0.3	5.9	3.0	2.7	1.3

7: Winthrop Street & Larpenteur Avenue Performance by movement

Movement	EBT	EBR	WBT	NBL	All
Denied Del/Veh (s)	0.3	0.4	0.0	0.1	0.2
Total Del/Veh (s)	1.4	1.1	1.1	12.8	2.0

8: McKnight Road & N Site Access Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Del/Veh (s)	7.8	6.7	4.0	1.7	5.6

Total Network Performance

Denied Del/Veh (s)	1.0
Total Del/Veh (s)	30.2

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	WB	NB	NB	SB
Directions Served	LTR	LTR	LT	R	LTR
Maximum Queue (ft)	32	92	79	78	31
Average Queue (ft)	2	15	35	36	11
95th Queue (ft)	19	58	63	60	35
Link Distance (ft)	582	565	738		923
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				200	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	119	244	118	72	204	102	275	289	217	205	363	215
Average Queue (ft)	61	125	30	32	111	33	120	237	32	78	188	23
95th Queue (ft)	107	210	89	66	179	69	239	323	140	153	306	93
Link Distance (ft)		565			1457			276			1062	
Upstream Blk Time (%)							0	5	0			
Queuing Penalty (veh)							0	45	0			
Storage Bay Dist (ft)	300		250	250		250	300		250	250		250
Storage Blk Time (%)		0	0				0	10	0		3	0
Queuing Penalty (veh)		1	0				0	20	0		5	0

Intersection: 3: McKnight Road & Montana Avenue

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	117	59	36	45	30	26
Average Queue (ft)	57	21	15	9	4	1
95th Queue (ft)	109	51	39	31	20	9
Link Distance (ft)	1504		1450			1085
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		200		300	300	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	36	31
Average Queue (ft)	14	4
95th Queue (ft)	39	21
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	59	79	40	41	30	5
Average Queue (ft)	18	38	10	14	4	0
95th Queue (ft)	49	62	35	34	19	3
Link Distance (ft)	923		1146			797
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		200		150	150	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	35	34	50	38
Average Queue (ft)	4	3	24	19
95th Queue (ft)	21	18	47	41
Link Distance (ft)	1004	484	1278	645
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Winthrop Street & Larpenteur Avenue

Movement	NB
Directions Served	LR
Maximum Queue (ft)	75
Average Queue (ft)	35
95th Queue (ft)	65
Link Distance (ft)	779
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 8: McKnight Road & N Site Access

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	69	199
Average Queue (ft)	23	51
95th Queue (ft)	52	166
Link Distance (ft)	434	1085
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 71

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0
Total Del/Veh (s)	4.4	1.3	0.7	5.3	2.8	3.1	10.4	4.8	11.6	3.9	2.8

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.6	0.1	0.1	2.7	0.4	0.4	0.0	0.0	0.0	4.7	2.4	2.5
Total Del/Veh (s)	38.2	35.5	26.4	39.5	44.2	35.1	72.7	24.6	24.6	95.3	67.2	59.8

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	1.1
Total Del/Veh (s)	47.4

3: McKnight Road & Montana Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	47.5	20.5	27.2	10.4	7.7	1.2	0.3	4.2	3.2	2.3	4.3

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	20.0	5.0	1.0	0.7	5.6	1.5	1.3

5: McKnight Road & Arlington Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.1	0.1	0.1	3.0	0.8	0.9	0.0	0.0	0.0	0.5
Total Del/Veh (s)	27.2	9.6	29.2	6.4	5.5	1.2	0.4	5.8	2.2	1.8	2.4

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	NBL	NBR	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Total Del/Veh (s)	2.0	0.6	0.3	2.0	0.4	4.3	2.8	2.4	1.3

7: Winthrop Street & Larpenteur Avenue Performance by movement

Movement	EBT	EBR	WBT	NBL	All
Denied Del/Veh (s)	0.3	0.3	0.0	0.1	0.2
Total Del/Veh (s)	1.4	0.8	0.9	8.8	1.3

8: McKnight Road & N Site Access Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Del/Veh (s)	11.3	9.0	4.1	1.8	6.5

Total Network Performance

Denied Del/Veh (s)	1.1
Total Del/Veh (s)	45.9

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	53	147	85	42
Average Queue (ft)	3	22	34	17
95th Queue (ft)	22	79	67	42
Link Distance (ft)	582	591	738	923
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	174	355	174	405	174	301	174	934
Average Queue (ft)	70	164	67	222	153	250	102	513
95th Queue (ft)	160	293	169	376	200	343	192	908
Link Distance (ft)		591		1469		288		1075
Upstream Blk Time (%)						9		3
Queuing Penalty (veh)						66		0
Storage Bay Dist (ft)	150		150		150		150	
Storage Blk Time (%)	0	11	0	24	16	23	2	45
Queuing Penalty (veh)	1	8	1	17	90	36	12	45

Intersection: 3: McKnight Road & Montana Avenue

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	L	L	TR
Maximum Queue (ft)	142	75	66	15	18
Average Queue (ft)	47	32	19	0	1
95th Queue (ft)	101	66	51	7	11
Link Distance (ft)	1504	1450			1085
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			300	300	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	48	31
Average Queue (ft)	10	2
95th Queue (ft)	36	14
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	L	L	TR
Maximum Queue (ft)	68	44	63	30	11
Average Queue (ft)	33	16	21	4	0
95th Queue (ft)	59	41	49	21	5
Link Distance (ft)	923	1146			797
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			150	150	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	22	32	50	52
Average Queue (ft)	2	3	14	18
95th Queue (ft)	13	17	41	43
Link Distance (ft)	1004	484	1278	645
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Winthrop Street & Larpenteur Avenue

Movement	NB
Directions Served	LR
Maximum Queue (ft)	57
Average Queue (ft)	22
95th Queue (ft)	50
Link Distance (ft)	779
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 8: McKnight Road & N Site Access

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	41	352
Average Queue (ft)	11	78
95th Queue (ft)	36	254
Link Distance (ft)	434	1085
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 276

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	4.1	0.1	0.1	0.2
Total Del/Veh (s)	4.2	1.3	0.7	5.0	2.9	3.2	12.4	3.9	10.5	4.3	2.8

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.1	0.6	2.7	0.6	2.5	0.0	0.0	0.0	3.1	1.0	3.0
Total Del/Veh (s)	32.7	28.2	12.3	27.7	30.6	11.8	49.5	20.9	4.1	55.8	34.8	10.8

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.8
Total Del/Veh (s)	28.4

3: McKnight Road & Montana Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	2.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	37.4	9.6	28.8	11.9	8.9	1.2	0.3	7.4	3.7	2.9	4.2

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	19.4	4.8	1.0	0.8	4.8	1.6	1.4

5: McKnight Road & Arlington Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.1	3.7	0.1	0.1	3.0	0.8	0.9	0.0	0.0	0.0	0.6
Total Del/Veh (s)	27.9	8.9	28.8	6.5	6.6	1.2	0.4	5.0	2.2	1.7	2.5

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	NBL	NBR	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Total Del/Veh (s)	2.0	0.6	0.3	2.0	0.4	4.3	2.8	2.4	1.3

7: Winthrop Street & Larpenteur Avenue Performance by movement

Movement	EBT	EBR	WBT	NBL	All
Denied Del/Veh (s)	0.3	0.3	0.0	0.1	0.2
Total Del/Veh (s)	1.4	0.8	1.0	9.2	1.4

8: McKnight Road & N Site Access Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Del/Veh (s)	14.8	4.5	4.3	1.9	4.5

Total Network Performance

Denied Del/Veh (s)	1.1
Total Del/Veh (s)	30.9

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	WB	NB	NB	SB
Directions Served	LTR	LTR	LT	R	LTR
Maximum Queue (ft)	59	126	66	77	42
Average Queue (ft)	4	19	21	24	17
95th Queue (ft)	25	70	54	53	43
Link Distance (ft)	582	565	738		923
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				200	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	128	159	117	134	263	145	232	292	209	249	507	275
Average Queue (ft)	47	70	46	37	116	42	118	194	16	97	257	57
95th Queue (ft)	98	131	86	89	201	95	193	300	86	226	418	203
Link Distance (ft)		565			1457			276			1062	
Upstream Blk Time (%)							0	2	0			
Queuing Penalty (veh)							0	16	0			
Storage Bay Dist (ft)	300		250	250		250	300		250	250		250
Storage Blk Time (%)					0		0	4	0	0	10	0
Queuing Penalty (veh)					1		0	7	0	0	18	0

Intersection: 3: McKnight Road & Montana Avenue

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	107	37	75	61	30	5
Average Queue (ft)	36	14	32	17	1	0
95th Queue (ft)	82	39	66	49	10	6
Link Distance (ft)	1504		1450			1085
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		200		300	300	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	42	23
Average Queue (ft)	10	2
95th Queue (ft)	35	15
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	150	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	47	63	50	67	30	16
Average Queue (ft)	12	28	16	20	3	1
95th Queue (ft)	39	53	43	47	19	7
Link Distance (ft)	923		1146		797	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	200		150		150	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	22	32	50	52
Average Queue (ft)	2	3	14	18
95th Queue (ft)	13	17	41	43
Link Distance (ft)	1004	484	1278	645
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Winthrop Street & Larpenteur Avenue

Movement	EB	NB
Directions Served	TR	LR
Maximum Queue (ft)	5	61
Average Queue (ft)	0	22
95th Queue (ft)	3	52
Link Distance (ft)	1342	779
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: McKnight Road & N Site Access

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	41	198
Average Queue (ft)	11	21
95th Queue (ft)	36	102
Link Distance (ft)	434	1085
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 43

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.2	0.0
Total Del/Veh (s)	2.5	1.3	0.7	5.4	2.5	1.1	12.3	6.6	12.6	4.8	2.9

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	2.5	0.4	0.4	0.0	0.0	0.0	6.2	3.5	3.5
Total Del/Veh (s)	50.4	48.0	40.0	40.0	42.4	31.7	78.7	36.6	28.9	108.8	55.3	50.9

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	1.2
Total Del/Veh (s)	49.4

3: McKnight Road & Montana Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	291.1	300.9	56.6	72.8	6.7	8.5	5.9	13.9	2.5	1.6	24.9

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	46.5	8.0	1.5	0.5	6.6	1.3	1.6

5: McKnight Road & Arlington Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.2	0.1	0.1	2.9	0.8	0.7	0.0	0.0	0.0	0.5
Total Del/Veh (s)	22.1	11.9	21.4	6.3	4.2	1.3	0.5	6.6	2.0	1.4	2.6

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBL	EBT	WBL	WBT	NBL	NBR	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2
Total Del/Veh (s)	2.3	0.6	1.9	0.4	5.8	3.0	3.0	1.4

7: Winthrop Street & Larpenteur Avenue Performance by movement

Movement	EBT	EBR	WBT	NBL	All
Denied Del/Veh (s)	0.4	0.4	0.0	0.1	0.2
Total Del/Veh (s)	1.3	0.9	0.9	10.9	1.6

8: McKnight Road & N Site Access Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	1.6	0.0	0.0	0.9
Total Del/Veh (s)	10.5	94.4	3.9	2.1	54.2

Total Network Performance

Denied Del/Veh (s)	1.7
Total Del/Veh (s)	79.2

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	39	84	94	37
Average Queue (ft)	3	12	45	9
95th Queue (ft)	20	50	76	32
Link Distance (ft)	582	591	738	923
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	174	517	174	392	175	302	174	668
Average Queue (ft)	109	263	56	185	137	292	132	411
95th Queue (ft)	209	454	142	321	209	317	212	886
Link Distance (ft)		591		1469		288		1075
Upstream Blk Time (%)		0				37		6
Queuing Penalty (veh)		0				333		0
Storage Bay Dist (ft)	150		150		150		150	
Storage Blk Time (%)	0	30	0	17	8	48	11	27
Queuing Penalty (veh)	2	31	0	8	57	75	61	34

Intersection: 3: McKnight Road & Montana Avenue

Movement	EB	WB	NB	NB	SB
Directions Served	LTR	LTR	L	TR	L
Maximum Queue (ft)	625	73	114	341	30
Average Queue (ft)	232	22	13	62	5
95th Queue (ft)	647	56	66	254	24
Link Distance (ft)	1504	1450		586	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			300		300
Storage Blk Time (%)				2	
Queuing Penalty (veh)				1	

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	36	31
Average Queue (ft)	12	5
95th Queue (ft)	36	24
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	L	L
Maximum Queue (ft)	117	40	34	35
Average Queue (ft)	46	10	15	4
95th Queue (ft)	86	33	37	20
Link Distance (ft)	923	1146		
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)			150	150
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	40	27	55	55
Average Queue (ft)	4	2	27	23
95th Queue (ft)	22	15	48	46
Link Distance (ft)	1004	484	1278	645
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Winthrop Street & Larpenteur Avenue

Movement	NB
Directions Served	LR
Maximum Queue (ft)	69
Average Queue (ft)	28
95th Queue (ft)	58
Link Distance (ft)	779
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 8: McKnight Road & N Site Access

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	59	1096
Average Queue (ft)	22	751
95th Queue (ft)	52	1382
Link Distance (ft)	434	1085
Upstream Blk Time (%)		3
Queuing Penalty (veh)		31
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 633

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.3	4.0	0.1	0.2	0.3
Total Del/Veh (s)	4.3	1.3	0.7	5.6	2.6	1.2	12.5	4.9	13.5	4.3	2.8

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	2.6	0.5	2.8	0.0	0.0	0.0	3.6	1.3	3.4
Total Del/Veh (s)	29.1	29.5	9.9	27.4	30.2	16.3	47.8	32.0	8.4	88.4	34.4	16.8

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.7
Total Del/Veh (s)	33.2

3: McKnight Road & Montana Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	2.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	42.5	7.5	33.8	13.0	5.3	1.8	0.3	11.4	2.9	1.8	4.4

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	22.5	6.4	1.3	0.6	7.7	1.4	1.5

5: McKnight Road & Arlington Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.4	3.5	0.1	0.1	2.9	0.8	0.7	0.0	0.0	0.0	0.7
Total Del/Veh (s)	22.9	8.2	21.0	6.4	4.0	1.3	0.5	7.6	2.1	1.0	2.5

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBL	EBT	WBL	WBT	NBL	NBR	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2
Total Del/Veh (s)	2.3	0.6	1.9	0.4	5.8	3.0	3.0	1.4

7: Winthrop Street & Larpenteur Avenue Performance by movement

Movement	EBT	EBR	WBT	NBL	All
Denied Del/Veh (s)	0.4	0.4	0.0	0.1	0.2
Total Del/Veh (s)	1.3	0.9	1.0	10.9	1.6

8: McKnight Road & N Site Access Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Del/Veh (s)	10.3	25.2	3.9	2.2	16.0

Total Network Performance

Denied Del/Veh (s)	1.1
Total Del/Veh (s)	39.9

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	WB	NB	NB	SB
Directions Served	LTR	LTR	LT	R	LTR
Maximum Queue (ft)	69	87	68	70	37
Average Queue (ft)	5	13	30	32	9
95th Queue (ft)	38	51	57	54	31
Link Distance (ft)	582	565	738		923
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				200	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	136	282	178	87	226	89	275	292	220	274	545	164
Average Queue (ft)	58	133	38	30	106	35	136	268	30	115	252	24
95th Queue (ft)	109	232	98	66	186	72	263	328	131	239	584	105
Link Distance (ft)		565			1457			276			1062	
Upstream Blk Time (%)							0	19	0		1	
Queuing Penalty (veh)							0	175	0		0	
Storage Bay Dist (ft)	300		250	250		250	300		250	250		250
Storage Blk Time (%)		1	0		0		0	27	0	6	4	0
Queuing Penalty (veh)		1	0		0		1	57	0	34	7	0

Intersection: 3: McKnight Road & Montana Avenue

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	138	67	54	42	36	10
Average Queue (ft)	53	21	18	8	5	0
95th Queue (ft)	111	51	47	27	24	5
Link Distance (ft)	1504		1450			1085
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		200		300	300	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	36	41
Average Queue (ft)	12	6
95th Queue (ft)	36	27
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	150	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	57	88	40	35	30	11
Average Queue (ft)	23	36	10	9	4	0
95th Queue (ft)	53	66	33	28	20	5
Link Distance (ft)	923		1146			797
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		200		150	150	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	40	27	55	55
Average Queue (ft)	4	2	27	23
95th Queue (ft)	22	15	48	46
Link Distance (ft)	1004	484	1278	645
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Winthrop Street & Larpenteur Avenue

Movement	EB	NB
Directions Served	TR	LR
Maximum Queue (ft)	6	83
Average Queue (ft)	0	28
95th Queue (ft)	3	64
Link Distance (ft)	1342	779
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: McKnight Road & N Site Access

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	64	714
Average Queue (ft)	22	240
95th Queue (ft)	52	615
Link Distance (ft)	434	1085
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 274

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.0
Total Del/Veh (s)	3.0	1.6	0.8	5.5	3.1	2.7	12.6	6.9	9.2	5.5	3.8

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.6	0.1	0.2	2.4	0.5	0.5	0.0	0.0	0.0	3.2	1.0	0.9
Total Del/Veh (s)	58.5	43.4	33.3	92.3	97.2	93.3	32.6	19.0	16.3	44.3	44.5	38.4

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.6
Total Del/Veh (s)	46.3

3: McKnight Road & Montana Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	204.9	169.1	43.3	17.3	10.9	1.3	0.3	6.4	3.6	2.7	19.1

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	21.5	6.5	1.0	0.3	6.2	1.5	1.4

5: McKnight Road & Arlington Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.1	0.1	3.1	0.9	0.6	0.0	0.0	0.0	0.6
Total Del/Veh (s)	43.5	21.9	21.6	7.8	7.5	1.9	0.8	6.3	2.3	1.5	4.4

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	NBL	NBR	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Total Del/Veh (s)	2.2	0.7	0.1	1.9	0.4	3.0	2.6	2.9	1.7

7: Winthrop Street & Larpenteur Avenue Performance by movement

Movement	EBT	EBR	WBT	NBL	All
Denied Del/Veh (s)	0.3	0.4	0.0	0.1	0.2
Total Del/Veh (s)	1.5	1.1	0.9	9.7	1.8

8: McKnight Road & N Site Access Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Del/Veh (s)	14.6	4.7	4.4	2.2	4.7

Total Network Performance

Denied Del/Veh (s)	0.8
Total Del/Veh (s)	49.6

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	14	138	131	52
Average Queue (ft)	1	32	53	20
95th Queue (ft)	9	92	92	46
Link Distance (ft)	582	591	738	923
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	174	381	175	693	174	294	174	677
Average Queue (ft)	102	193	123	399	108	226	95	388
95th Queue (ft)	190	324	229	750	195	316	201	609
Link Distance (ft)		591		1469		288		1075
Upstream Blk Time (%)						2		
Queuing Penalty (veh)						16		
Storage Bay Dist (ft)	150		150		150		150	
Storage Blk Time (%)	4	17	1	53	1	19	0	38
Queuing Penalty (veh)	12	19	2	43	4	31	1	38

Intersection: 3: McKnight Road & Montana Avenue

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	L	L	TR
Maximum Queue (ft)	508	75	88	22	30
Average Queue (ft)	237	33	32	1	2
95th Queue (ft)	475	67	69	11	14
Link Distance (ft)	1504	1450			1085
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			300	300	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	47	23
Average Queue (ft)	12	3
95th Queue (ft)	39	18
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	L	L	TR
Maximum Queue (ft)	170	41	82	31	16
Average Queue (ft)	68	15	38	4	1
95th Queue (ft)	133	39	71	22	9
Link Distance (ft)	923	1146			797
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			150	150	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	34	13	34	57
Average Queue (ft)	3	1	16	28
95th Queue (ft)	19	9	39	47
Link Distance (ft)	1004	484	1278	645
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Winthrop Street & Larpenteur Avenue

Movement	NB
Directions Served	LR
Maximum Queue (ft)	74
Average Queue (ft)	36
95th Queue (ft)	61
Link Distance (ft)	779
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 8: McKnight Road & N Site Access

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	74	160
Average Queue (ft)	24	19
95th Queue (ft)	55	91
Link Distance (ft)	434	1085
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 166

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.4	3.8	0.1	0.1	0.4
Total Del/Veh (s)	3.7	1.6	0.8	5.6	3.2	3.0	11.7	4.7	8.5	5.4	3.6

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.5	2.3	0.6	2.2	0.0	0.0	0.0	3.2	1.1	3.0
Total Del/Veh (s)	33.4	25.3	13.5	30.1	31.2	13.8	23.3	15.0	3.9	22.4	23.8	8.9

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.8
Total Del/Veh (s)	21.0

3: McKnight Road & Montana Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	2.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Total Del/Veh (s)	154.7	20.7	47.4	27.8	12.7	1.4	0.2	5.0	4.0	3.0	13.2

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	22.9	6.3	1.0	0.3	6.8	1.6	1.4

5: McKnight Road & Arlington Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.4	3.5	0.1	0.1	3.1	0.9	0.6	0.0	0.0	0.0	0.8
Total Del/Veh (s)	33.6	10.5	27.7	7.8	8.6	1.9	0.9	6.6	2.4	1.7	3.7

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	NBL	NBR	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Total Del/Veh (s)	2.2	0.7	0.1	1.9	0.4	3.0	2.6	2.9	1.7

7: Winthrop Street & Larpenteur Avenue Performance by movement

Movement	EBT	EBR	WBT	NBL	All
Denied Del/Veh (s)	0.3	0.4	0.0	0.1	0.2
Total Del/Veh (s)	1.5	1.1	1.0	9.6	1.9

8: McKnight Road & N Site Access Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Del/Veh (s)	12.9	3.6	4.3	2.1	4.1

Total Network Performance

Denied Del/Veh (s)	1.2
Total Del/Veh (s)	28.8

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	WB	NB	NB	SB
Directions Served	LTR	LTR	LT	R	LTR
Maximum Queue (ft)	34	115	65	77	37
Average Queue (ft)	3	26	34	37	19
95th Queue (ft)	16	77	60	61	44
Link Distance (ft)	582	565	738		923
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				200	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	163	164	118	108	246	157	240	269	85	273	459	275
Average Queue (ft)	60	77	50	47	112	49	68	173	14	55	208	31
95th Queue (ft)	117	136	94	91	202	105	138	255	57	146	348	133
Link Distance (ft)		565			1457			276			1062	
Upstream Blk Time (%)							0	0	0			
Queuing Penalty (veh)							0	3	0			
Storage Bay Dist (ft)	300		250	250		250	300		250	250		250
Storage Blk Time (%)					0	0	0	1			4	0
Queuing Penalty (veh)					0	0	0	2			7	0

Intersection: 3: McKnight Road & Montana Avenue

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	343	187	86	101	15	38
Average Queue (ft)	150	52	35	31	1	3
95th Queue (ft)	315	167	76	69	8	18
Link Distance (ft)	1504		1450			1085
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		200		300	300	
Storage Blk Time (%)	15	0				
Queuing Penalty (veh)	5	0				

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	52	23
Average Queue (ft)	13	2
95th Queue (ft)	40	14
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	150	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	63	114	40	74	30	16
Average Queue (ft)	26	43	15	34	4	2
95th Queue (ft)	57	78	39	65	21	11
Link Distance (ft)	923		1146		797	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	200		150		150	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	34	13	34	57
Average Queue (ft)	3	1	16	28
95th Queue (ft)	19	9	39	47
Link Distance (ft)	1004	484	1278	645
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Winthrop Street & Larpenteur Avenue

Movement	NB
Directions Served	LR
Maximum Queue (ft)	59
Average Queue (ft)	35
95th Queue (ft)	58
Link Distance (ft)	779
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 8: McKnight Road & N Site Access

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	65	66
Average Queue (ft)	25	4
95th Queue (ft)	55	37
Link Distance (ft)	434	1085
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 17

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.2	0.1	0.0
Total Del/Veh (s)	4.0	4.5	2.6	6.6	3.4	2.5	38.1	27.7	34.5	9.2	9.5

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.2	1.3	0.9	2.7	0.5	0.4	0.0	0.0	0.0	3.2	1.0	1.1
Total Del/Veh (s)	101.8	84.2	82.4	119.0	99.4	95.6	42.0	30.3	26.5	53.9	30.9	27.1

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.7
Total Del/Veh (s)	54.9

3: McKnight Road & Montana Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	92.2	123.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	10.0
Total Del/Veh (s)	614.9	609.6	42.3	21.1	9.0	3.7	0.9	12.7	3.1	2.3	60.6

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	22.2	9.8	1.7	0.7	8.0	1.3	1.6

5: McKnight Road & Arlington Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.1	0.1	2.8	1.1	1.4	0.0	0.0	0.0	0.7
Total Del/Veh (s)	54.5	30.0	24.1	9.8	5.9	2.2	0.9	8.9	2.1	1.3	5.7

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBL	EBT	WBL	WBT	NBL	NBR	SBR	All
Denied Del/Veh (s)	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.2
Total Del/Veh (s)	2.4	0.7	2.2	0.4	5.6	3.0	3.3	1.7

7: Winthrop Street & Larpenteur Avenue Performance by movement

Movement	EBT	EBR	WBT	NBL	All
Denied Del/Veh (s)	0.4	0.5	0.0	0.1	0.2
Total Del/Veh (s)	1.8	1.4	1.0	14.1	2.4

8: McKnight Road & N Site Access Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.2	0.0	0.0	0.0	0.0
Total Del/Veh (s)	10.7	56.2	4.2	1.7	32.9

Total Network Performance

Denied Del/Veh (s)	5.6
Total Del/Veh (s)	87.6

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	202	131	319	36
Average Queue (ft)	28	36	105	11
95th Queue (ft)	123	101	234	35
Link Distance (ft)	582	591	738	923
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (ft)	175	600	174	729	174	302	174	562
Average Queue (ft)	150	412	101	365	126	289	108	283
95th Queue (ft)	215	676	207	715	218	317	192	461
Link Distance (ft)		591		1469		288		1075
Upstream Blk Time (%)		6				27		
Queuing Penalty (veh)		32				269		
Storage Bay Dist (ft)	150		150		150		150	
Storage Blk Time (%)	10	49	2	49	1	43	0	24
Queuing Penalty (veh)	42	69	8	33	8	67	3	31

Intersection: 3: McKnight Road & Montana Avenue

Movement	EB	WB	NB	NB	SB	SB
Directions Served	LTR	LTR	L	TR	L	TR
Maximum Queue (ft)	1241	53	67	65	30	28
Average Queue (ft)	731	17	25	13	4	1
95th Queue (ft)	1533	46	54	93	21	12
Link Distance (ft)	1504	1450		586		1085
Upstream Blk Time (%)	14					
Queuing Penalty (veh)	0					
Storage Bay Dist (ft)			300		300	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	42	31
Average Queue (ft)	12	5
95th Queue (ft)	38	24
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		150
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	EB	WB	NB	SB	SB
Directions Served	LTR	LTR	L	L	TR
Maximum Queue (ft)	243	46	77	30	5
Average Queue (ft)	94	11	29	3	0
95th Queue (ft)	204	36	58	17	3
Link Distance (ft)	923	1146			797
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)			150	150	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	52	27	58	62
Average Queue (ft)	9	4	25	32
95th Queue (ft)	34	18	49	52
Link Distance (ft)	1004	484	1278	645
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Winthrop Street & Larpenteur Avenue

Movement	NB
Directions Served	LR
Maximum Queue (ft)	100
Average Queue (ft)	43
95th Queue (ft)	76
Link Distance (ft)	779
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 8: McKnight Road & N Site Access

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	71	852
Average Queue (ft)	27	518
95th Queue (ft)	57	1107
Link Distance (ft)	434	1085
Upstream Blk Time (%)		0
Queuing Penalty (veh)		5
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 566

1: Larpenteur Avenue & Howard Street Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.4	3.8	0.1	0.1	0.4
Total Del/Veh (s)	4.3	1.7	1.1	6.4	3.7	2.5	19.4	6.3	17.1	6.3	4.5

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	2.5	0.6	2.6	0.0	0.0	0.0	3.1	1.1	3.2
Total Del/Veh (s)	34.6	43.7	14.3	36.6	46.1	17.9	26.1	19.9	7.4	33.6	21.3	8.2

2: Larpenteur Avenue & McKnight Road Performance by movement

Movement	All
Denied Del/Veh (s)	0.7
Total Del/Veh (s)	26.4

3: McKnight Road & Montana Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.3	1.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Total Del/Veh (s)	314.3	144.9	30.4	13.0	10.3	1.9	0.5	8.5	3.5	2.4	27.2

4: McKnight Road & Nebraska Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	26.5	9.3	1.6	0.7	6.5	1.5	1.7

5: McKnight Road & Arlington Avenue Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.4	3.6	0.1	0.1	2.9	1.1	0.8	0.0	0.0	0.0	0.9
Total Del/Veh (s)	46.3	9.3	30.7	10.3	6.4	2.1	0.8	8.1	2.3	1.5	4.0

6: Hawthorne Avenue & Ivy Avenue Performance by movement

Movement	EBL	EBT	WBL	WBT	NBL	NBR	SBR	All
Denied Del/Veh (s)	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2
Total Del/Veh (s)	2.4	0.7	2.2	0.4	5.2	3.0	3.3	1.8

7: Winthrop Street & Larpenteur Avenue Performance by movement

Movement	EBT	EBR	WBT	NBL	All
Denied Del/Veh (s)	0.5	0.4	0.0	0.1	0.2
Total Del/Veh (s)	1.8	1.4	1.2	14.4	2.5

8: McKnight Road & N Site Access Performance by movement

Movement	EBR	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0
Total Del/Veh (s)	12.5	7.4	4.1	2.0	6.0

Total Network Performance

Denied Del/Veh (s)	1.2
Total Del/Veh (s)	40.0

Intersection: 1: Larpenteur Avenue & Howard Street

Movement	EB	WB	NB	NB	SB
Directions Served	LTR	LTR	LT	R	LTR
Maximum Queue (ft)	64	162	105	84	36
Average Queue (ft)	4	35	43	43	10
95th Queue (ft)	27	99	82	71	34
Link Distance (ft)	582	565	738		923
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)				200	
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 2: Larpenteur Avenue & McKnight Road

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	R	L	T	R	L	T	R	L	T	R
Maximum Queue (ft)	324	378	275	158	376	271	275	288	275	205	339	230
Average Queue (ft)	89	180	57	44	150	53	85	235	36	66	186	34
95th Queue (ft)	197	309	186	100	292	160	190	327	146	138	310	138
Link Distance (ft)		565			1457			276			1062	
Upstream Blk Time (%)							0	4	0			
Queuing Penalty (veh)							0	42	0			
Storage Bay Dist (ft)	300		250	250		250	300		250	250		250
Storage Blk Time (%)		4	0		3	0	0	8	0	0	2	0
Queuing Penalty (veh)		11	0		4	0	0	19	0	0	4	0

Intersection: 3: McKnight Road & Montana Avenue

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	615	225	47	56	30	22
Average Queue (ft)	345	118	17	23	3	2
95th Queue (ft)	670	287	43	45	18	13
Link Distance (ft)	1504		1450			1085
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		200		300	300	
Storage Blk Time (%)	64	0				
Queuing Penalty (veh)	28	0				

Intersection: 4: McKnight Road & Nebraska Avenue

Movement	WB	SB
Directions Served	LR	L
Maximum Queue (ft)	47	31
Average Queue (ft)	11	6
95th Queue (ft)	37	25
Link Distance (ft)	1260	
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)	150	
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 5: McKnight Road & Arlington Avenue

Movement	EB	EB	WB	NB	SB	SB
Directions Served	LT	R	LTR	L	L	TR
Maximum Queue (ft)	91	94	34	64	30	28
Average Queue (ft)	36	45	11	25	4	1
95th Queue (ft)	80	77	34	52	22	11
Link Distance (ft)	923		1146		797	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	200		150		150	
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 6: Hawthorne Avenue & Ivy Avenue

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	47	26	53	54
Average Queue (ft)	7	3	27	30
95th Queue (ft)	30	17	48	49
Link Distance (ft)	1004	484	1278	645
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 7: Winthrop Street & Larpenteur Avenue

Movement	NB
Directions Served	LR
Maximum Queue (ft)	95
Average Queue (ft)	42
95th Queue (ft)	73
Link Distance (ft)	779
Upstream Blk Time (%)	
Queuing Penalty (veh)	
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 8: McKnight Road & N Site Access

Movement	EB	NB
Directions Served	R	T
Maximum Queue (ft)	71	205
Average Queue (ft)	25	59
95th Queue (ft)	56	195
Link Distance (ft)	434	1085
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 109
