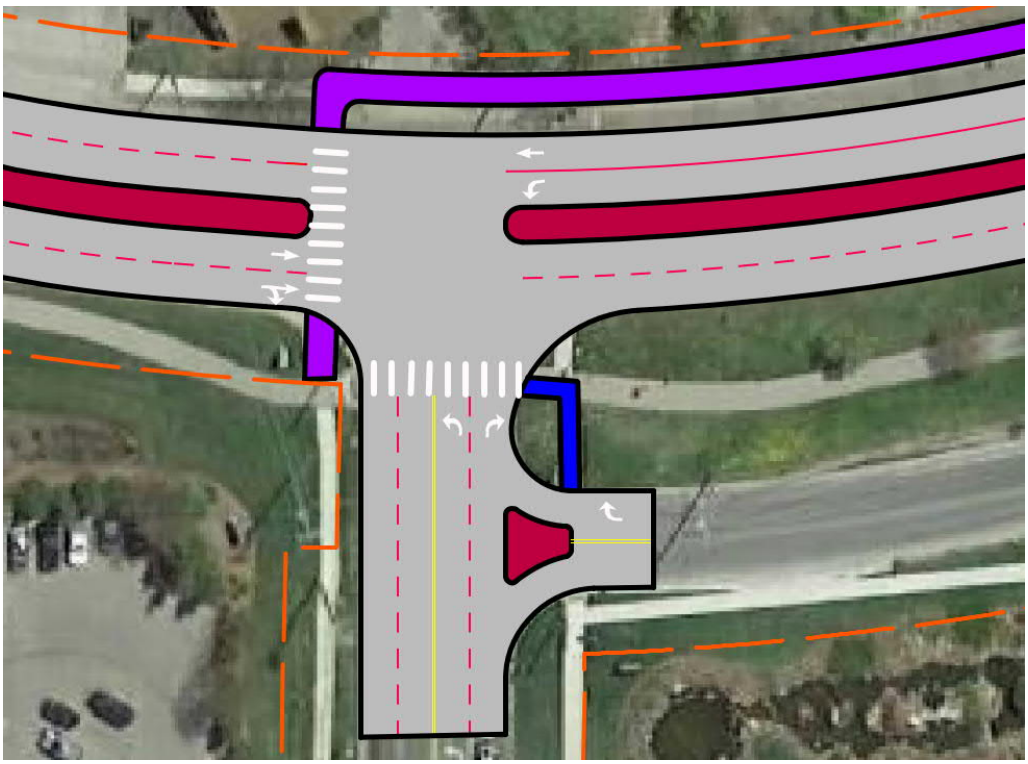
CONCEPT #1: SIGNAL MODIFICATIONS AND BAY STREET CHANGE IN ACCESS

MODIFICATION	ROW & UTILITY	OPERATIONS	NOTES
Remove Pre-Signal & Change in Access at Bay *(Right-In/Right-Out)*	No Major Impacts	Left-turn traffic to/from Bay would need to find alternate route. No significant change over existing LOS C	Improves safety by reducing vehicle conflicts through elimination of all left-turn movements to/from Bay Street.

This concept includes removal of the pre-signal located on the west leg of the intersection while modifying access at Bay Street/M-72 to allow right-in/right-out only. This would eliminate left-turn conflicts between Bay Street and M-72 vehicles while reducing the amount of signal equipment to be maintained. This alternative would marginally improve operations by eliminating delays associated with the left-turn movements at Bay Street, but existing level of service is not anticipated to significantly change. Google Streetview from December 2020 shows the existing signal at M-72 and Grand Parkway was recently modernized with a box span and has hemispherical detection and a disappearing case sign for the southbound right-turn movement. This concept would not require modification to these elements.

Right In/Right Out (RIRO)

Introducing a splitter island on Bay Street that directs traffic to turn right only and eliminates left-turns would provide for access while reducing the amount of potential vehicle conflicts. This configuration is compatible with removing the pre-signal as suggested for this concept or when converting to indirect left-turns as discussed for Concept #3.



CONCEPT #2: ROUNDABOUT

MODIFICATION	ROW & UTILITY	OPERATIONS	NOTES
A) Single-Lane Roundabout	Not Assessed	PM Peak Hour 550.9"/Veh. (LOS F)	Conceptual design was not pursued due to poor operational performance (fatally flawed)
B) Multilane Roundabout w/Access to Bay Street *Four Approaches* *165' Inscribed Circle Diameter*	• Additional ROW: 4,686 SF • Significant east leg impact w/Ex. Building • Utility pole in NW quadrant	PM Peak Hour 12.6"/Veh. (LOS B)*	This concept requires realignment of Bay Street to facilitate the proper angle approaching the roundabout and would potentially impact the wetland area immediately south of Bay Street.
C) Multilane Roundabout w/o Access to Bay Street *Three Approaches* *165' Inscribed Circle Diameter*	• Additional ROW: 1,000 SF • Utility pole in NW quadrant	PM Peak Hour 9.7"/Veh. (LOS A)	This concept avoids significant impacts to the parcel east of the intersection while providing notable improvements in operations and safety relative to the existing box span signal.

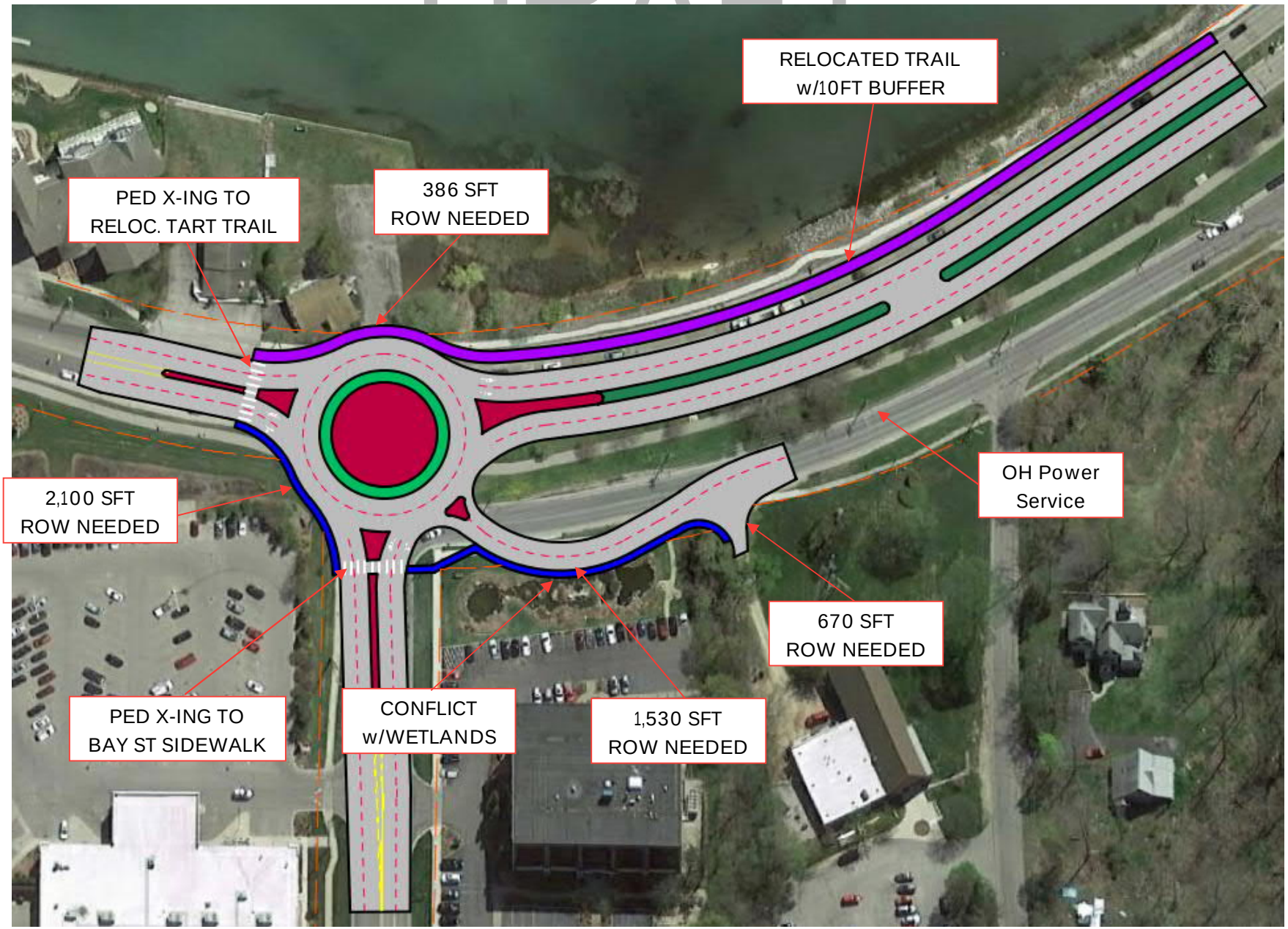
**Note: 50 veh/hr were assumed for all Bay Street volumes since existing traffic count data was not available for those movements.*

Installing a roundabout would reduce annual maintenance budget and time obligations associated with the existing signal. The pavement required to construct a roundabout is greater than the existing amount budgeted for replacing the road in kind, which is accounted for in the cost estimate for this concept. New hemispherical cameras recently installed could be salvaged along with the other signal equipment to support operations at other intersections in the area. From a safety perspective, this intersection is also a natural spot to slow down motorists with the roundabout acting as a gateway treatment to reduce speeds. One potential issue is the pedestrian accessibility and crossing the roundabout since there is no stop control (an issue inherent to all roundabouts). Providing an enhanced crossing with advanced signing and potentially the use of flashing beacons or other illuminated warning signs for the north leg should be considered due to the TART trail moving to the bay side and expected higher volumes of pedestrians/bicyclists completing that movement.

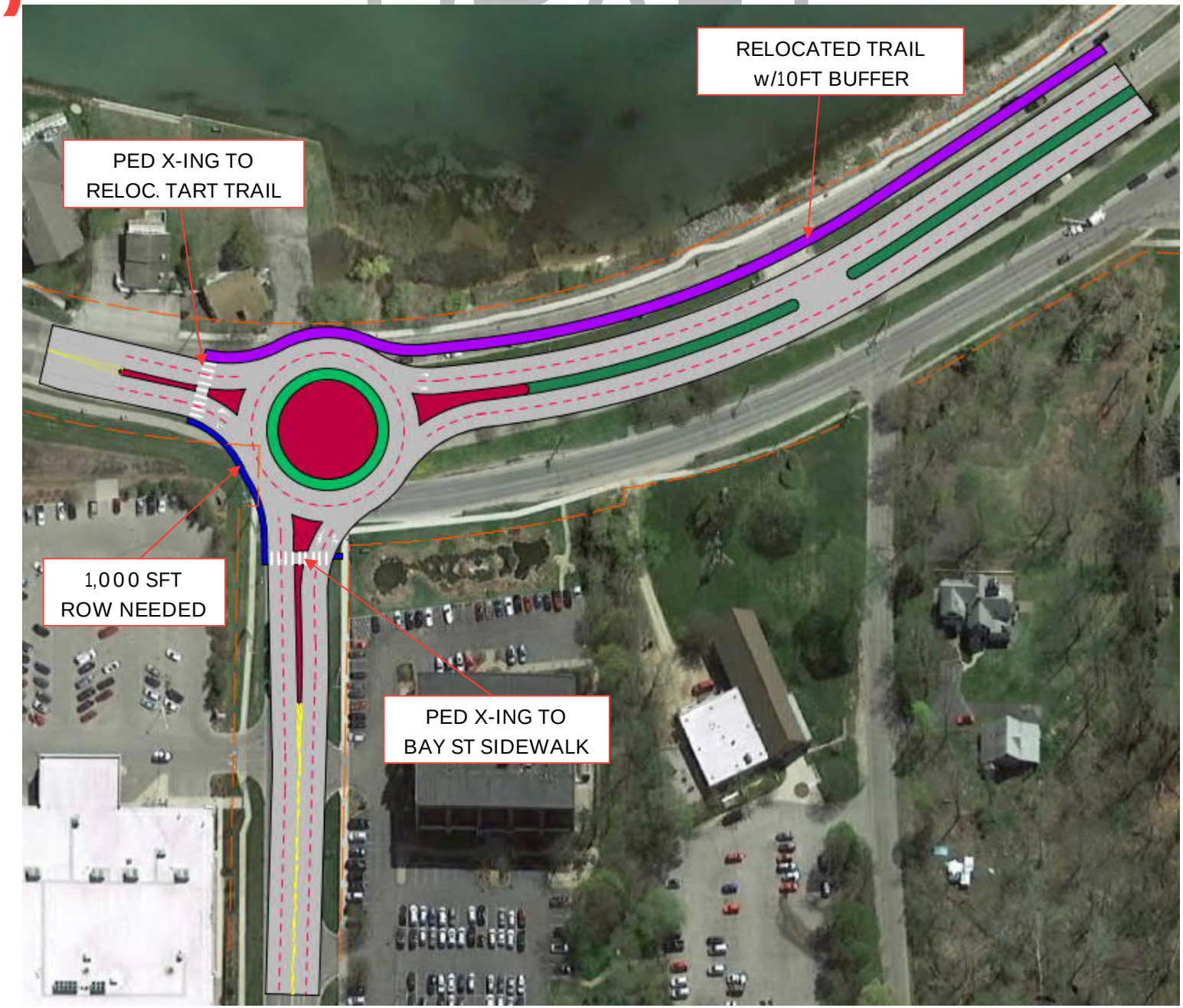
A single-lane roundabout is expected to fail with a LOS F based on current traffic volumes and was not advanced for further conceptual analysis. A multilane roundabout is expected to work operationally and two variations were explored; one with access to Bay Street and one without. A multilane roundabout with 165' diameter and access to Bay Street would impact the parcel located immediately east of the intersection which could require vacating and removing the building. Overall, this concept requires approximately 4,686 square feet of ROW acquisition versus approximately 1,000 square feet for the roundabout without access to Bay Street. The conceptual layout for both are shown on the following pages.

OPERATIONAL IMPROVEMENTS

Since counts for Bay Street were unavailable, a nominal amount of 50 vehicles was applied to each entering and exiting movement from Bay for analysis. The roundabout was found to operate with an average delay of 12.6 seconds per vehicle (LOS B) during the PM peak hour with the south leg of Grandview reporting a 95th percentile queue of 24 vehicles (17 seconds of delay, LOS C). For reference, the intersection operates at an overall LOS C with 23.3 seconds of delay per vehicle under the existing condition during the PM peak hour. The roundabout provides improvement despite adding a fourth leg to the intersection (Bay Street). Operations improve even more when access to Bay Street is not provided (overall LOS A with delay of 9.7 seconds per vehicle).



Roundabout Concept w/Bay Access

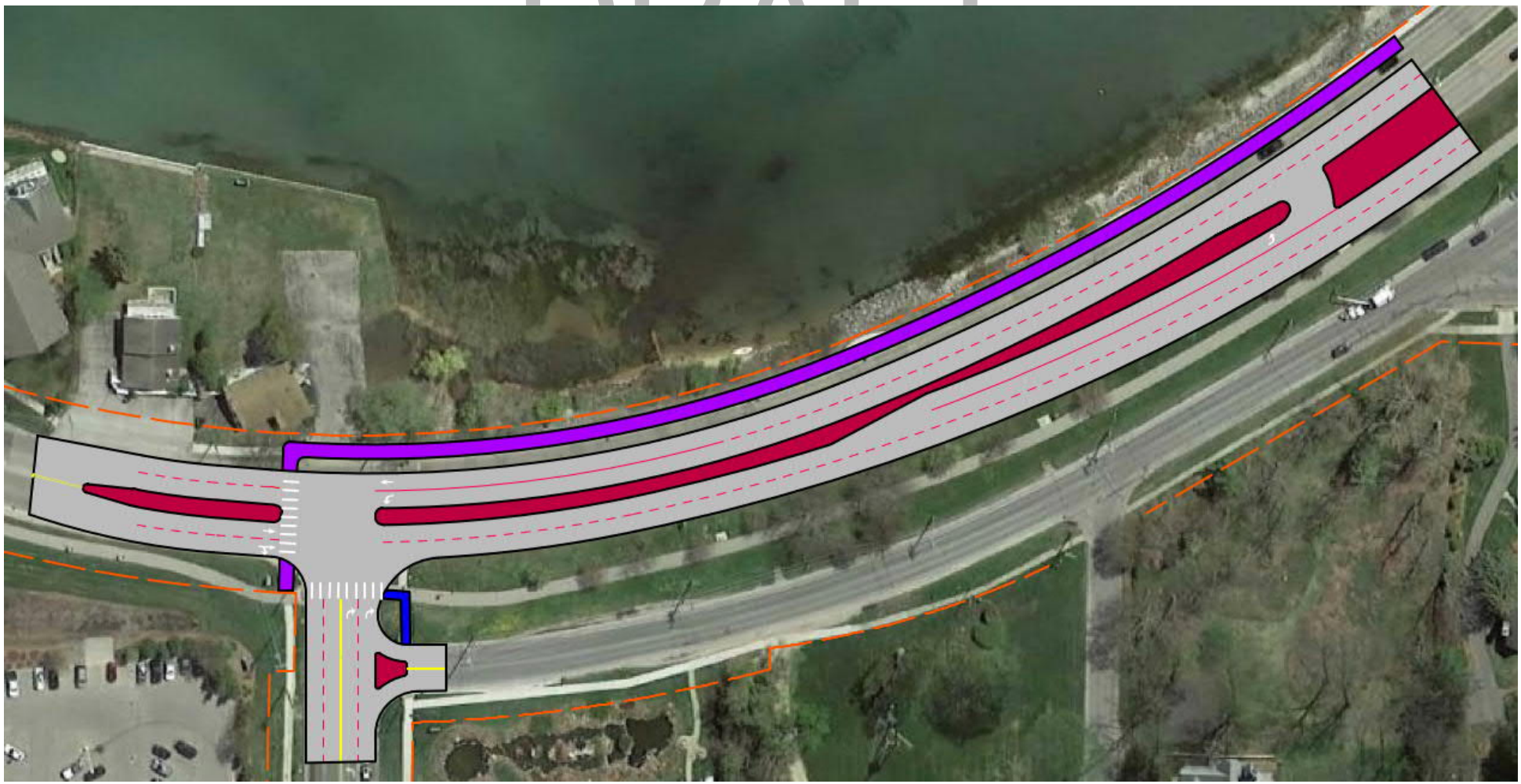


Roundabout Concept w/o Bay Access

CONCEPT #3: INDIRECT LEFT-TURNS

MODIFICATION	ROW & UTILITY	OPERATIONS	NOTES
Median Boulevard with Indirect Left-Turns from M-72 to Grandview Parkway	• No additional ROW is needed when restricting trucks from the crossover. • Avoids utility pole in NW quadrant	PM Peak Hour Main Intersection: 11.7”/Veh. (LOS B) Crossover: 13.0”/Veh. (LOS B)	Direct Left-Turns from WB Grandview Parkway to M-72 are maintained due to a lack of available ROW for a crossover north of the intersection. Trucks are prohibited from using the crossover since a loon would be required and is not feasible due to site constraints.

There is limited right-of-way (ROW) available north of the intersection which prevents full conversion of both left-turn movements to indirect left-turns. That said, converting the west leg of the intersection to facilitate a dual right-turn approach while adding a crossover and storage to the south along Grandview Parkway improves LOS for the northbound left-turn movement from D to B during the PM peak hour. More importantly, this conversion removes the conflict between eastbound left-turn vehicles and pedestrians using the north leg crosswalk. This concept does not include a truck loon since including one in the design would require an alignment shift greater than the extents possible to accommodate the required 95-feet from the edge line of the median storage lane to the outside edge of the loon. Further, a loon would conflict with relocation of the TART trail by infringing on the buffer space required between the trail and traveled way.

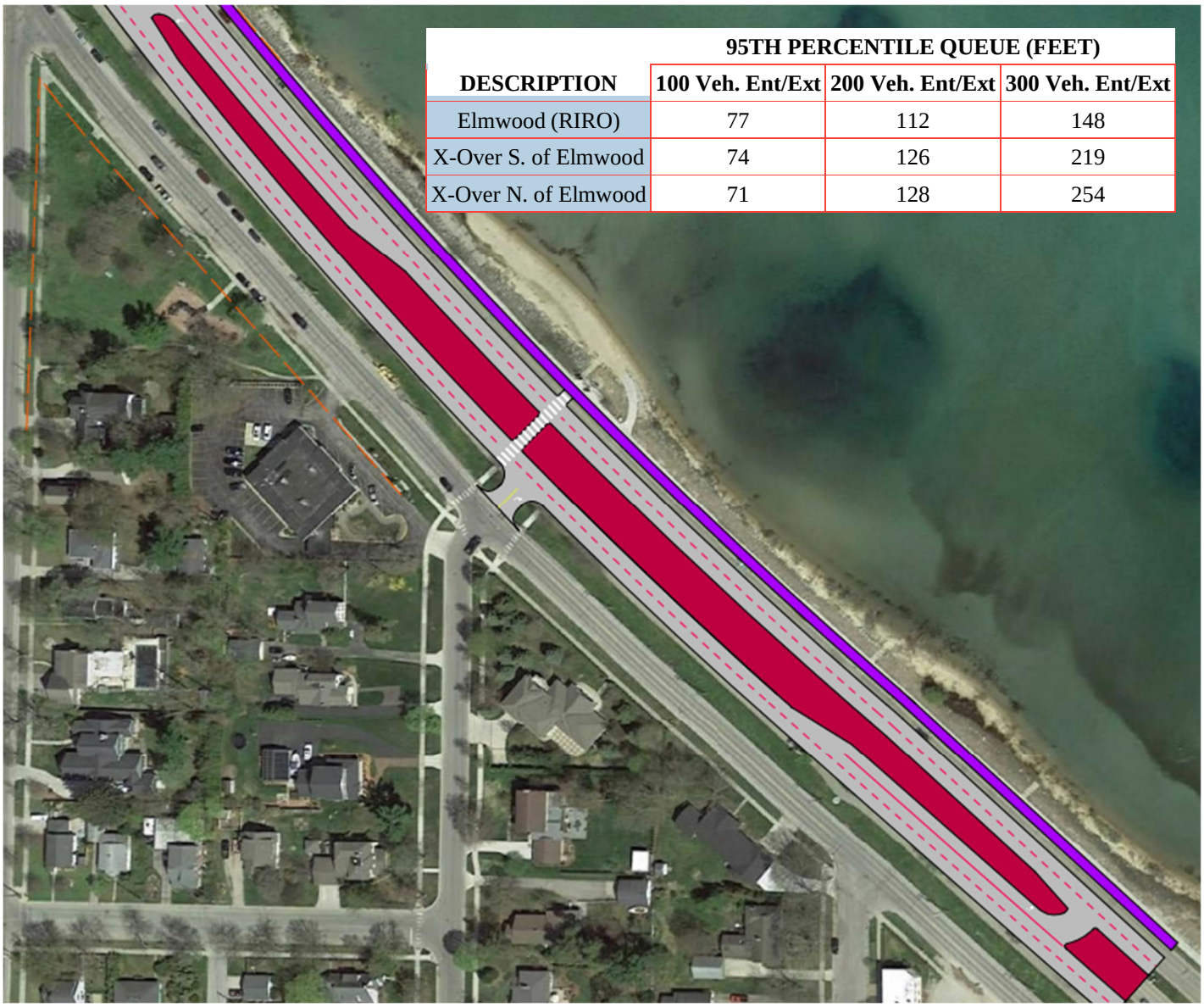


Indirect Left-Turn Concept

CONCEPT #4: CHANGE IN ACCESS AT ELMWOOD

MODIFICATION	ROW & UTILITY	OPERATIONS	NOTES
Change in Access at Elmwood *Indirect Left-Turns w/Grandview Pkwy Median Crossovers*	No additional ROW is needed when restricting trucks from the crossover.	PM Peak Hour Outbound Elmwood: 300 Veh.: 64.1"/Veh. (LOS F) 200 Veh.: 25.8"/Veh. (LOS D) 100 Veh.: 16.6"/Veh. (LOS C)	This could serve as a secondary access point and can operate unsignalized with indirect left-turns (excluding trucks due to loon constraints).

Indirect left-turns are ideal for this new entrance as they provide fewer conflicts and can operate with stop control, negating the need for a signal. The HAWK signal could also still be utilized as part of the final configuration to stop traffic for pedestrians with the crosswalk placed north of the intersection. If direct turning-movements to/from Elmwood are desired, modeling indicates that a signal is needed to prevent failing LOS for turning-movements. Since turning-movement counts were not available for this intersection, a sensitivity analysis was conducted to determine the amount of storage needed to support unsignalized operations at varying levels of demand, where the configuration was found to support up to 300 vehicles entering and 300 vehicles exiting Elmwood without a need for additional storage beyond the minimum design specification. Both Bay Street approaches would require a stop sign to prevent conflicts with incoming traffic completing the southbound right-turn movement from Grandview Parkway.



	95TH PERCENTILE QUEUE (FEET)		
DESCRIPTION	100 Veh. Ent/Ext	200 Veh. Ent/Ext	300 Veh. Ent/Ext
Elmwood (RIRO)	77	112	148
X-Over S. of Elmwood	74	126	219
X-Over N. of Elmwood	71	128	254

Right-In, Right-Out at Elmwood

	MODIFICATION	ROW & UTILITY	OPERATIONS	NOTES
Concept #1	Remove Pre-Signal & Change in Access at Bay *(Right-In/Right-Out)*	No Major Impacts	Left-turn traffic to/from Bay would need to find alternate route. No significant change over existing LOS C	Improves safety by reducing vehicle conflicts through elimination of all left-turn movements to/from Bay Street.
Concept #2	**A**) Single-Lane Roundabout	Not Assessed	PM Peak Hour 550.9"/Veh. (LOS F)	Conceptual design was not pursued due to poor operational performance (fatally flawed)
	B) Multilane Roundabout w/Access to Bay Street *Four Approaches* *165' Inscribed Circle Diameter*	• Additional ROW: 4,686 SF • Significant east leg impact w/Ex. Building • Utility pole in NW quadrant	PM Peak Hour 12.6"/Veh. (LOS B)*	This concept requires realignment of Bay Street to facilitate the proper angle approaching the roundabout and would potentially impact the wetland area immediately south of Bay Street.
	C) Multilane Roundabout w/o Access to Bay Street *Three Approaches* *165' Inscribed Circle Diameter*	• Additional ROW: 1,000 SF • Utility pole in NW quadrant	PM Peak Hour 9.7"/Veh. (LOS A)	This concept avoids significant impacts to the parcel east of the intersection while providing notable improvements in operations and safety relative to the existing box span signal.
Concept #3	Median Boulevard with Indirect Left-Turns from M-72 to Grandview Parkway	• No additional ROW is needed when restricting trucks from the crossover. • Avoids utility pole in NW quadrant	PM Peak Hour Main Intersection: 11.7"/Veh. (LOS B) Crossover: 13.0"/Veh. (LOS B)	Direct Left-Turns from WB Grandview Parkway to M-72 are maintained due to a lack of available ROW for a crossover north of the intersection. Trucks are prohibited from using the crossover since a loon would be required and is not feasible due to site constraints.
Concept #4	Change in Access at Elmwood *Indirect Left-Turns w/Grandview Pkwy Median Crossovers*	• No additional ROW is needed when restricting trucks from the crossover.	Outbound Elmwood (PM) 300 Veh.: 64.1"/Veh. (LOS F) 200 Veh.: 25.8"/Veh. (LOS D) 100 Veh.: 16.6"/Veh. (LOS C)	This could serve as a secondary access point and can operate unsignalized with indirect left-turns (excluding trucks due to loon constraints).

**Note: 50 veh/hr were assumed for all Bay Street volumes since existing traffic count data was not available for those movements.*