Buffalo Bay Development

Municipality of Trent Lakes

Traffic Study

Final Report

Prepared by:
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Prepared for:
2394735 Ontario Inc
c/o Orion Group
Per EcoVue Consulting Services

September, 2015

September 22, 2015

2394735 Ontario Inc.
c/o Orion Group
989 Creditstone Road, Suite #200
Concord Ontario, L4K 4N7

Attn: Mr. Peter (Bedros) K. Avedian, President

Dear Sir:

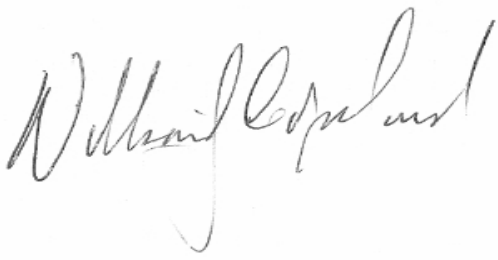
RE: Traffic Study for the Buffalo Bay Shoreline R Development, Part of Lot 17, Concession 14, Harvey Ward, Municipality of Trent Lakes

Tranplan Associates is pleased to present the results of the traffic study carried out in support of the proposed *Buffalo Bay Shoreline Residential Development* to be located on Part of Lot 17, Concession 14, Harvey Ward, Municipality of Trent Lakes. The property is located on the north shore of Pigeon Lake. Access to the site is described in the study analyses included Nichols Cove Road and its intersection with Peterborough County Road (CR) 36. The study analyses determined that Nichols Cove Road and its intersection with CR 36, with existing infrastructure, will accommodate the proposed development.

During future (2025) peak periods of traffic demand, the site entrance to Nichols Cove Road and the Nichols Cove Road intersection with CR 36 are forecast to operate at good levels of service. There will be considerable residual capacity to accommodate additional growth in traffic beyond the 2025 planning horizon used in the study analyses.

Tranplan Associates is pleased to have had the opportunity to work with your study team on this project. If you should require any further information on the study analyses or reporting, please contact me at your convenience

Yours truly,



William Copeland, P.Eng.
Principal
Tranplan Associates

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1. INTRODUCTION

1.1 Background

Tranplan Associates is pleased to present the results of this traffic study to determine the traffic impact of the proposed *Buffalo Bay Shoreline Residential Development* on Nichols Cove Road and its intersection with Peterborough County Rd (CR) 36. The study site is located in the Municipality of Trent Lakes south of CR 36 off Nichols Cove Road on the north shore of Pigeon (see *Exhibit 1 - Key Map* following report text). The B*uffalo Bay Shoreline Residential Development* is being planned as a 16 unit residential/recreational home subdivision located around Buffalo Bay on the north shore Pigeon Lake. The homes will be marketed to those looking for a seasonal recreational home while preserving the ecology of the existing shoreline. The proponent is now seeking the necessary planning approvals to initiate construction of this Shoreline Residential development. The full development including the internal circulation road and related parking areas is illustrated in *Exhibit 2 - Preliminary Site Plan*.

Discussions were held with the study team, the Municipality and the County of Peterborough to establish the study scope. Tranplan Associates staff completed four site visits to collect weekday and Saturday peak period traffic counts. The counts were carried out at the proposed site entrance to Nichols Cove Road and at the intersection of Nichols Cove Road with CR 36. The site visits also included observations of current traffic operations at the Nichols Cove Road intersection with CR 36 in the vicinity of the study intersection, a spot speed study on CR 36, measurement of the existing road cross-sections, review of adjacent land uses and field selection of the location for the site entrance to Nichols Cove Road.

Two peak period traffic counts were carried out on Friday August 7 and Saturday August 8, 2015. Since these observed volumes were taken during early August, no seasonal factor adjustments were applied to these traffic counts. The Friday PM and Saturday peak hour counts were then applied to the subsequent study analyses. These volumes are summarized in *Exhibit 3 – 2015 Observed Peak Hour Volumes.*

Traffic analyses completed for this study included intersection capacity analyses and auxiliary lane warrant evaluations. The capacity and auxiliary lane analyses were based on peak hour volumes for a 10 year planning horizon from 2015 to 2025. The forecast future total traffic volumes used in these analyses included traffic generated by full development of the *Buffalo Bay Shoreline Residential Development* combined with growth in background traffic on Nichols Cove Road and CR 36.

1.2 Principal Findings

The principal findings derived from the study analyses include the following:

- The present (2015) Nichols Cove Road intersection with CR 36 (see *Exhibit 3*) operates at good Levels of Service[1] (LoS) during peak periods of summer traffic demand.

[1] For definitions of Levels of Service see *Technical Appendix – Intersection Capacity Analysis*.

- The 85th percentile speeds observed on CR 36 during the study field work were observed to be 17 kph (EB) and 26 kph (WB) kph over the posted speed of 80 kph.
- The future site entrance intersection with Nichols Cove Road and the Nichols Cove Road intersection with CR 36 based on 2025 total peak period traffic volumes, are forecast to operate at Level of Service (LoS) "B" or better. This is a good LoS for peak hour conditions. There will be considerable residual capacity for additional growth in traffic beyond the 2025 planning horizon used in the study analyses.
- Future site trip generation is forecast to be 5 vehicle trips during a summer weekday PM peak hour and 6 vehicle trips during a summer Saturday peak hour period. These low peak hour volumes will have no real impact on future traffic operations on adjacent roads and intersections.
- Future 2025 total peak hour volumes at the site entrance to Nichols Cove Road will all be less than 20 vehicles per hour (vph). No auxiliary turn lanes will be required on Nichols Cove Road to support the new site entrance to the *Buffalo Bay* development.
- Based on 2025 total peak hour conditions, there will be no warrant for a westbound left turn lane at the intersection of CR 36 and Nichols Cove Road.
- There will be no warrant for an eastbound right turn lane or taper on CR 36 at the Nichols Cove intersection. The existing right turn taper will accommodate 2025 eastbound right turns from CR 36 onto Nichols Cove Road.
- The future site entrance to the study site is illustrated in the Preliminary Site Plan (see *Exhibit 2*). The site entrance has been located through in-field analysis to select a location with sufficient Turning Sight Distance (TSD) to the north and to the south along Nichols Cove Road. The select location for the entrance will provide 140 -150 m of TSD to the south. This TSD meets current Ministry of Transportation (MTO) standards for a 60 kph design speed. There are no restrictions on sight distance to the north along Nichols Cove Road.
- The new site entrance to the *Buffalo Bay* development will require a single inbound and single outbound lane. This entrance will provide good access to the study site.
- The internal circulation road can be constructed to current Municipality of Trent Lakes standards for a private (common lands condominium) road in a Shoreline Residential development. The internal roadways should be designed to accommodate municipal service vehicles and emergency service (EMS) vehicles.
- An additional secondary EMS access could be provided by connecting the western terminus of the site access road to Fire Route (FR) 96. This access would only be used for EMS vehicles during an emergency situation.

The following sections of the Study Report contain the documentation and details of the analyses to support the principal findings of the study.

2. EXISTING CONDITIONS

This Section describes the roadway network, traffic volumes, operational analysis results and other notable characteristics under the baseline conditions.

2.1 The Study Site

The study site is located on the west side of Nichols Cove Road along the north shore of Pigeon Lake about 3.4 km south of CR 36. It is comprised of Part of Lot 17, Con. 14 in the geographic Township of Harvey now part of the Municipality of Trent Lakes (see *Exhibit 2*). The 99.9 ha site is comprised of undeveloped shore line and green space that is a mix of grass lands, wooded areas and wetlands. Future site development will consist of 16 recreational/residential units that will be developed along 11.5 ha of shoreline as illustrated in *Exhibit 2*. There are no current plans for any further future development on the site. The lands beyond the shore line development will remain in their current state. Additional detailed information about the study site and the proposed development is contained in related planning documentation. This documentation will be submitted with the traffic report as part of this planning approval process.

2.2 Adjacent Land Uses

The adjacent shoreline along Pigeon Lake has considerable cottage and recreational home development. Beyond this shore line, to the north, development on lands surrounding the study site is a mix rural residential homes, wooded areas, wet lands with some open areas in low end agricultural use. These uses are characteristic of this part of Peterborough County. There is a mix of older and newer rural residences located along the Nichols Cove Road corridor as well as adjacent Municipal roads and Fire Route roads that access Nichols Cove Road.

2.3 Access to the Study Site

Direct access to the study site will be provided by Nichols Cove Road. Nichols Cove road is a local municipal road under the jurisdiction of the Municipality of Trent Lakes. It provides local connectivity to the CR 36 corridor for the recreational homes along adjacent areas of Pigeon Lake as well as rural residences along the road corridor itself. *Exhibit 1* illustrates the general alignment of the Nichols Cove Rd Corridor between CR 36 and Pigeon Lake.

In the immediate vicinity of the study site Nichols Cove Road has a 6.3 m all-weather surface with 0.5 m gravel shoulders in a rural open ditch cross-section. In the vicinity of the study site it has a posted speed of 50 kph. The future site entrance will have to include an appropriate “approach” platform for vehicles entering the Nichols Cove Road corridor. In the vicinity of CR 36, Nichols Cove Road has a wider 7.5 m all-weather surface with 0.5 m gravel shoulders in a rural open ditch cross-section.

Access to the Nichols Cover Road corridor is provided by CR 36, formerly the Kings Highway 36 now under the jurisdiction of the County of Peterborough (see *Exhibit 1*). CR 36 is a rural arterial road that links communities such as Burleigh Falls, Buckhorn and Bobcaygeon across the mid-

northern tier of the County. CR 36 will provide connectivity for the study site to these communities as well as connections to the Kings Highway 28 to the east and Kings Highway 7 to the west.

In the vicinity of its intersection with Nichols Cove Road, CR 36 has a two lane rural open ditch cross-section with an 8.1 m asphalt platform including 0.5 m partial paved shoulders and 2.0 m gravel shoulders. Adjacent to the study site it has a posted speed of 80 kph. CR 36 will provide the study site with both local and regional access as illustrated in *Exhibit 1*.

2.4 The CR 36/Nichols Cove Road Intersection

The CR 36/Nichols Cove Road intersection is a "T" intersection with Nichols Cove Road as the minor Stop-controlled approach. The intersection and its approaches are illustrated in *Exhibit 4 – Study Intersections*. The east and west CR 36 approaches are single lane approaches with a shared through/left turn lane westbound lane and a shared eastbound through/right turn lane supported with a 55 m right turn taper. The Nichols Cove Road approach has a single shared right turn/left turn approach. Available Turning Sight Distance (TSD) from Nichols Cove Road along CR 36 was measured using Ministry of Transportation Ontario (MTO) procedures and standards. Available TSD is 220 m to the west and more than 220 m to the east. This meets MTO standards for a design speed of about 95 kph and provides for a stopping sight distance (SSD) for a design speed of 110 kph.

2.5 Current Traffic Data

Tranplan Associates staff carried out two peak period turning movement (TM) counts at the CR 36/Nichols Cove Road intersection and at the future site entrance location on Nichols Cove Road. The counts included a Friday PM count on August 7, 2015 and a Saturday mid-day count on August 8, 2015. The purpose of these counts was to obtain current background traffic volumes at the two study intersections. Since the counts were done during summer peak hour periods, no seasonal adjustment factor was applied to the observed data. These observed 2015 peak hour volumes are illustrated in *Exhibit 3 – 2015 Peak Hour Volumes*. These volumes were then applied to the subsequent study analyses. Based on these observed 2015 volumes, Nichols Cove Road in the vicinity of the study site is estimated to carry a summer average daily traffic volume (SADT) of 200 vehicles per day (vpd). The summer daily traffic volume (SADT) on CR 36 in the vicinity of Nichols Cove Road is estimated to be 4,300 vpd. Available County data for CR 36 in the vicinity of the Nichols Cove Road intersection lists non-summer average daily traffic volumes (ADT) of 2,350 in 2009[2].

2.6 Spot Speed Study

Tranplan Associates staff completed a spot speed study on CR 36 in the vicinity of Nichols Cove Road intersection. During one of the site visits, spot speed observations were taken on each of the eastbound traffic and westbound traffic streams. Speeds were measured using a calibrated *Traffic Advisor Pocket Radar* unit. The 85th percentile speed in the eastbound direction was found

[2] See County of Peterborough web site, Average Daily Volume Data

to be 97 kph and 106 kph in the westbound direction. This is 17 - 26 kph above the posted speed of 80 kph. A copy of the spot speed study data is included in the *Technical Appendix – Traffic Data*.

3. THE DEVELOPMENT

This Section describes the proposed changes to the subject site and the development of the site generated traffic.

3.1 The Proposed Development

The proposed development will be located on the west side of Nichols Cove Road along the north shore of Pigeon Lake. The development will be comprised of 16 recreational/cottage homes located on Buffalo Bay as illustrated in *Exhibit 2*. The subdivision itself will be located on about 11.5 ha. within a total study site of 99.9 ha. Lands beyond the development itself will remain in their existing state. Homes in the development will be marketed as recreational homes/cottages to people who will be interested in supporting the existing shoreline eco-system.

3.2 Site Trip Generation Forecasts

Peak hour trip generation forecasts for the recreational homes were based on relationships for *Land Use 260 – Recreational Homes* taken from the current Institute of Transportation Engineers (ITE) *Trip Generation Manual* (9th ed.). Tranplan Associates has applied the LU 260 trip generation rates to similar developments in Peterborough and Northumberland Counties. The trip generation forecast for the 16 residential units is summarized in *Table 1* following.

Table 1: Site Trip Generation Forecasts in (vph)

Trip Generation Source	PM Peak Hour			Saturday Peak Hour		
	In	Out	**Total**	In	Out	**Total**
Recreational Homes (TE LU 260)	2	3	**5**	3	3	**6**
Total Site Traffic	***2***	***3***	***5***	***3***	***3***	***6***

No reductions were applied to the site trip generation forecasts developed from the ITE rates to account for linked trips to/from adjacent cottage areas and recreational facilities. In summary, no adjustments were made to the forecast site trip generation as illustrated in *Table 1* to account for pass-by or linked trips.

3.3 Site Trip Distribution

There are two "gateways" to/from the study site; CR 36 East and CR 36 West. It was assumed that the observed trip distribution to each of the Gateways from Nichols Cove Road would be representative of future site trip distribution. The distribution for future site traffic was developed from the observed turning movement volumes from Nichols Cove Road to the east and to the west. The observed trip distribution was found to be somewhat different for the Friday PM peak hour and the Saturday mid-day peak hour. Separate distribution rates were applied to the assignment of the future Friday PM traffic and the Saturday mid-day traffic. *Table 2* below summarizes the trip distribution rates used in the study analyses.

Table 2: Site Trip Distribution

GATEWAY	To/From Recreational Homes	
	Fri PM Pk	Sat Pk
CR 36 East	33%	20%
CR 36 West	67%	80%
Total	**100%**	**100%**

4. FUTURE CONDITIONS

This Section summarizes the assumptions used to develop future year traffic volumes, the operational analysis results and associated impacts to the transportation infrastructure.

4.1 Future Background Traffic

Future background traffic forecasts were developed for a 10 year planning horizon to 2025. The 10 year planning horizon will allow for planning approvals, build out of the study site and time for additional growth in background traffic. Future background traffic has been assumed to grow at the rate of 2.0% per year (compounded). The assumed rate of 2.0% annual traffic growth rate is somewhat higher than the general overall traffic growth rate in the County. The 2.0% per year (compounded) traffic growth factor was applied to the 2015 weekday observed peak hour volumes as illustrated in *Exhibit 3* to forecast 2025 background peak hour volumes for each of the two peak hour periods.

4.2 Future Total Traffic

The 2025 total weekday peak hour volumes for the CR 36/Nichols Cove study road network were computed by adding forecast peak hour site trip generation to the forecast 2025 background traffic. This site traffic was based on the trip generation forecasts and trip distribution assumptions described in *Sections 3.2 & 3.3.* The resulting total peak hour volumes are illustrated in *Exhibit 6 – 2025 Total Peak Hour Volumes.*

4.3 Site Traffic Impacts

Since the forecast 2025 peak volumes for the Site Entrance intersection with Nichols Cove Road are less than 15 vph on all approaches (see *Exhibit 6*), this intersection will operate at LoS "A". Detailed intersection capacity analyses were carried out to assess the impact of future site traffic on the Nichols Cove Road/CR 36 intersection. These analyses were done using current 2010 HCM intersection capacity analysis procedures as contained in Trafficware's *Synchro 8* software. The analyses were completed for both the 2015 and 2025 total peak hour volumes as illustrated in *Exhibit 6.* The results are summarized in *Table 3* following.

Table 3: Summary of Intersection Capacity Analyses

Nichols Cove Road/CR 36 Intersection						
	PM Peak Hour – Critical Movement			**Saturday Peak Hour – Critical Movement**		
	LoS (Delay)	**V/C**	**Queue[A]**	**LoS (Delay)**	**V/C**	**Queue[A]**
2015 Peak Hours	NB LR: **A/B** (11.1)	0.022	< 1 veh	NB LR: **A/B** (11.2)	0.015	< 1 veh
2025 Peak Hours	NB LR: **A/B** (12.1)	0.035	< 1 veh	NB LR: **A/B** (12,0)	0.027	< 1 veh

A – Queue is the 95th percentile vehicle queue length measured in vehicles

In reviewing *Table 3* it will be noted that the combined forecast growth in background traffic and future site traffic will have little impact on the Nichols Cove Road/CR 36 intersection. Delay in the critical northbound traffic turning movements on Nichols Cove Road is forecast to increase by

about 1 second. The turning movements at this intersection, during future 2025 summer peak hour conditions are forecast to operate at LoS "B" just beyond the boundary of LoS "A/B". This is a very good LoS with considerable residual capacity for future growth in traffic. Drivers accessing the CR 36 corridor will face levels of delay that will be similar to existing 2015 summer conditions. Detailed printouts of the capacity analyses for the site entrance intersection included in this analysis are posted in the *Technical Appendix - Intersection Capacity Analysis*.

4.4 Auxiliary Lane Warrant Analyses

Left turn lane warrant analyses were carried out to assess the future need for a westbound left turn lane on CR 36 at the Nichols Cove Road intersection based on 2025 summer peak hour conditions. Warrant analyses were carried out for the 2025 Friday PM peak hour and the 2025 Saturday mid-day total peak hour volumes (see *Exhibit 5*) as a worst case scenario. The analyses, based on MTO criteria and standards, determined that there will be no warrant for a westbound left turn lane on CR 36 at this intersection. The MTO nomograph used to evaluate the left turn lane warrants is provided in the *Technical Appendix – Auxiliary Lane Warrant Analyses.* In reviewing the warrant nomograph, it will be noted that the analyses were based on a 5% left turn volume for a 100 kph, design speed. The 2025 westbound left turn volumes at the Nichols Cove intersection are forecast to be less than 3% of the advancing traffic stream. The analyses were based on 20 kph over the posted speed limit (100 kph). The use of the higher design speed is based on the spot speed observations described in *Section 2.6*.

A right turn lane warrant analysis was also carried out to assess the need for an eastbound right turn lane or taper on CR 36 at the Nichols Cove Road intersection. At present the MTO has no specific design warrants for right turn lanes. Tranplan Associates usually applies the right turn warrant/standards developed and applied by the State of Virginia Department of Transportation (VDOT). These standards are detailed in a nomograph that considers approach volumes, right turn volumes and speed in assessing the need for a right turn lane. Based on the 2025 summer peak hour volumes (see *Exhibit 5*), it was determined that a fixed radius "rounding" will accommodate southbound right turns from CR 507 into the site entrance. The existing right turn 55 m eastbound taper will meet/exceed the requirements for future right turning traffic. Details of this analysis and the VDOT warrant nomograph are contained in the T*echnical Appendix – Auxiliary Lane Warrant Analyses*.

4.5 Future Site Access to Nichols Cove Road

The proposed location for the entrance to the study site is illustrated in *Exhibit 2.* This location was selected as part of the site plan development process. The selected location maximizes sight distances to the north and south along Nichols Cove Road. Based on field measurements completed by the study team, this entrance location will provide 140 – 150 m of turning sight distance (TSD) to the south and a stopping sight distance (SSD) for a speed of 80 kph. The TSD to the south meets/exceeds MTO requirements for a design speed of 65 kph. There will be no restrictions to TSD to the north. The posted speed on this section of Nichols Cove Road is 50 kph. The available sight distance at the new entrance will be sufficient to allow drivers exiting the study

site to select gaps of sufficient length in the Nichols Cove Road traffic stream to safely enter the corridor.

Based on the low forecast turning volumes (see *Exhibit 5*), a single inbound and a single outbound will provide good access to the study site. The outbound lane will serve shared right and left turns from the study site to Nichols Cove Road. The site entrance to Nichols Cove Road should be constructed to meet current County/Municipality of Trent Lake standards. A representative standard would be one for a rural residential subdivision road accessing a local Municipal road. Both this entrance and the internal site access road must be able to accommodate municipal service vehicles and EMS vehicles.

The internal circulation road as illustrated in *Exhibit 2* will provide direct access to each of the 16 units. It will also provide access to two Docking/Parking areas as illustrated in the exhibit. The single point access to Nichols Cove Road serving the 16 units meets current TAC criteria for single point access roads. The terminus of the access road on the western side of the site should be provided with a cul-de-sac or "hammer-head" treatment with geometrics to accommodate municipal service vehicles.

4.5 Emergency Vehicle Access

A secondary Emergency Vehicle (EMS) access can be provided with a connection from the western terminus of the access road to the eastern end of Fire Route 96 (see *Exhibit 2*). This connection will be for EMS access only. It is not intended to provide for a "through" traffic connection. This EMS link will also provide a reciprocal alternative EMS route the existing recreational homes located on Fire Route 96 that are presently served by only a single point access.

5. CONCLUSIONS AND RECOMMENDATIONS

This Section summarizes the salient findings of the analyses and identifies any necessary changes to the transportation infrastructure.

5.1 Conclusions

The following conclusions have been drawn from the field visits and traffic impact analyses completed for the *Buffalo Bay Shoreline Residential Development*:

- The present study road network operates at good LoS during 2015 summer peak periods of travel demand. There is considerable residual capacity for future growth in traffic.
- During future total 2025 peak hour conditions, all traffic movements at the Nichols Cove Road intersection with CR 36 will operate at LoS "B" or better. This is considered a very good LoS for peak hour traffic conditions.
- There will be no warrant for a future westbound left turn lane on CR 36 at the Nichols Cove Road intersection based on 2025 summer peak hour conditions.
- The existing 55 m right turn taper on eastbound CR 36 at the Nichols Cove Road intersection will meet right turn geometric requirements for 2025 summer peak hour conditions
- There will considerable residual capacity in the study road network for additional growth in traffic beyond the 2025 planning horizon used in the study analyses.
- There will be sufficient gaps in the CR 36 traffic stream to accept all future traffic from Nichols Cove Road.
- At the proposed site entrance location to Nichols Cove Road there will be about 140 – 150 m of TSD available to the south along Nichols Cove Road. There will be no restrictions to TSD to the north. This available TSD at the proposed site entrance exceeds MTO requirements for a 60 kph design speed.

5.2 Recommendations

The following recommendations have been developed from the study analyses and conclusions:

- The *Buffalo Bay Development* site entrance intersection with Nichols Cove Road can be constructed with a single lane inbound and single outbound lane on the site entrance roadway. Current Transportation Association of Canada (TAC) and MTO geometric design manuals can be used as a guide to supplement County and Municipality of Trent Lakes standards as may be required.
- A 15-18 m radius "rounding" should be provided on the north side of site entrance roadway at the Nichols Cove intersection to serve southbound right turns into the study site. This will accommodate municipal service vehicles, EMS vehicles and residents towing trailers.
- The site internal road network should have cross-sections and road geometrics that can accommodate municipal service vehicles, EMS vehicles and residents towing trailers.

- An appropriate EMS access link should be developed to connect the western terminus of the site access road to Fire Route 96 to the west. This link should be for EMS access only. It should be closed to normal through traffic.
- As required, all signage and pavement markings should be constructed in accordance with the guidance provided in the *Ontario Traffic Manual* (OTM) and *the Manual of Uniform Traffic Control Devices of Canada* (MUTCDC).

In summary, the future traffic generated by full development of the *Buffalo Bay Shoreline Residential Development* supported with an appropriate site entrance to Nichols Cove Road will have an acceptable impact on both the Nichols Cove Road and CR 36 corridors. With the construction of an EMS link to Fire Route 96, no additional new road infrastructure will be required to support the full development of *Buffalo Bay Shoreline Residential Development.*

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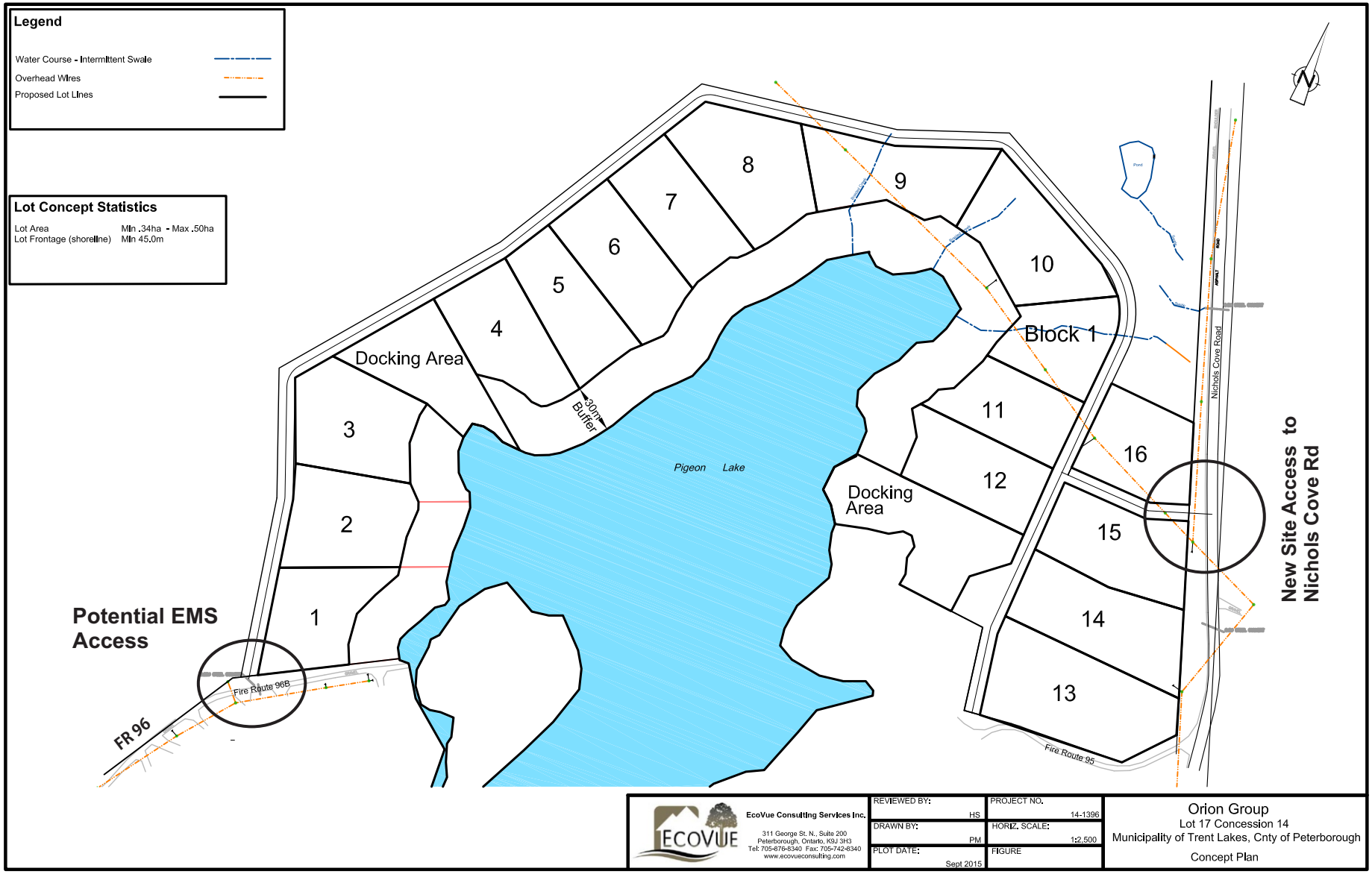
REPORT EXHIBITS

Exhibit 1
Key Map

Exhibit 2
Preliminary Site Plan



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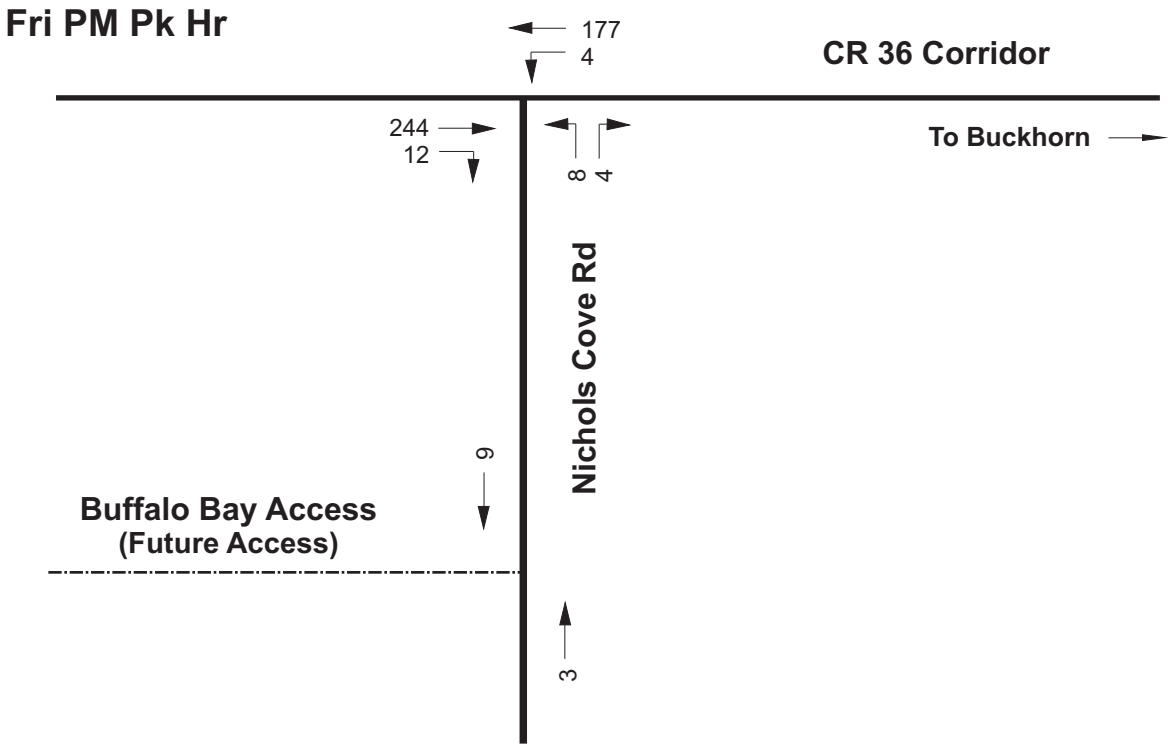
REVIEWED BY: HS	PROJECT NO. 14-1396
DRAWN BY: PM	HORIZ. SCALE: 1:2,500
PLOT DATE: Sept 2015	FIGURE

Orion Group
Lot 17 Concession 14
Municipality of Trent Lakes, Cnty of Peterborough
Concept Plan

Exhibit 3
2015 Summer Pk Hr Volumes



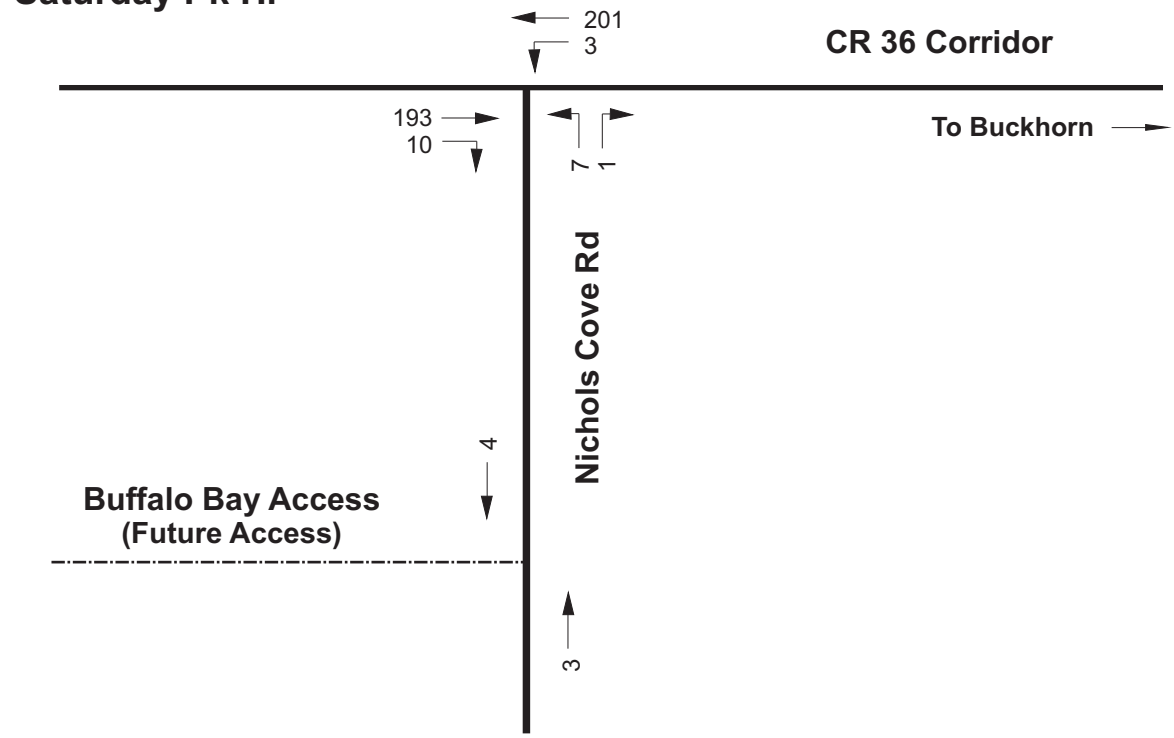


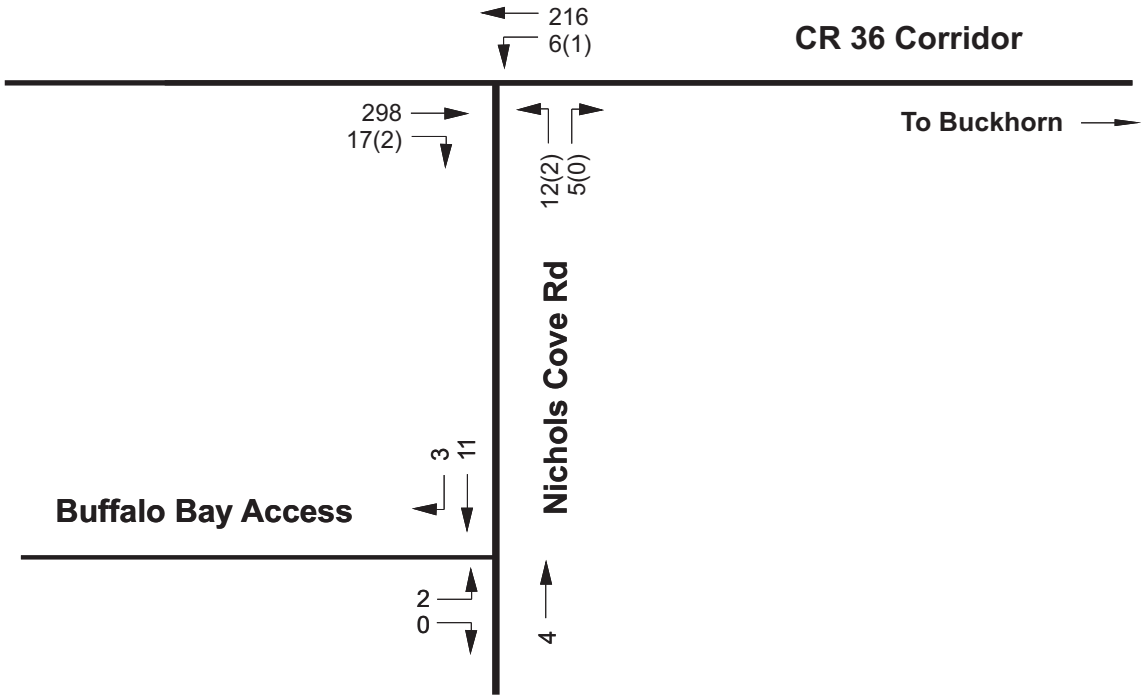
Exhibit 4
Study Intersections

Intersection of Nichols Cove Road and CR 36

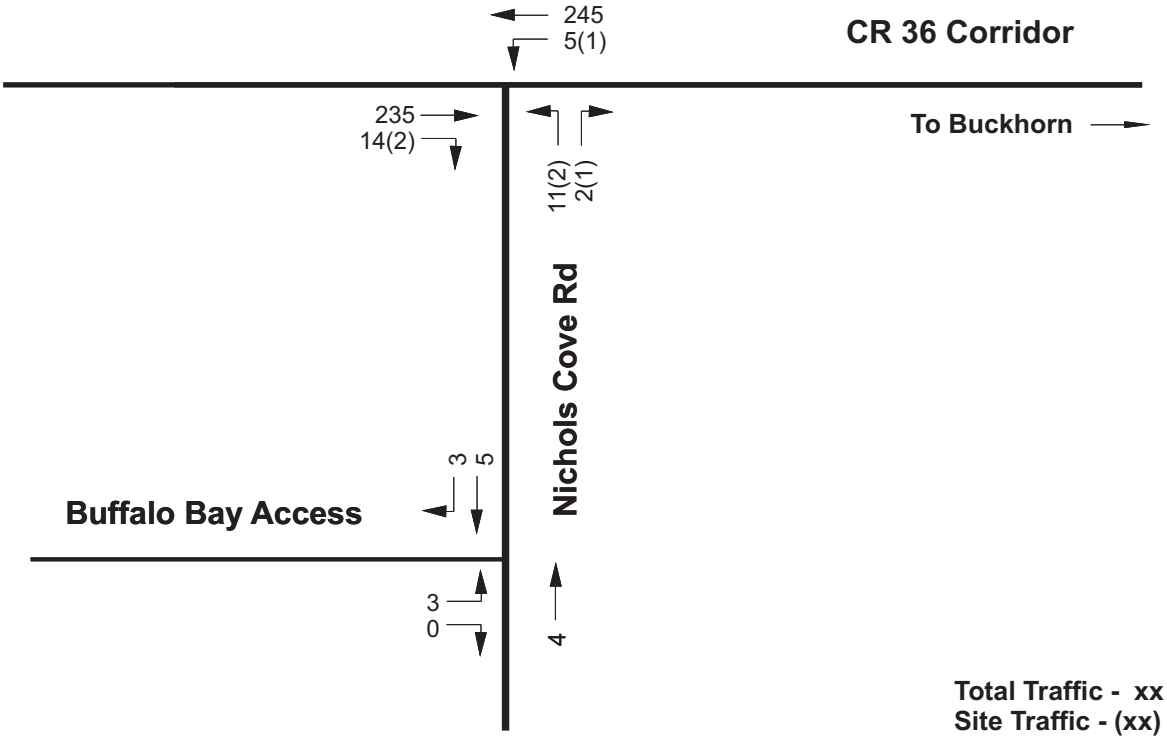
Proposed Site Entrance Location to Nichols Cove Road (Looking South)

Exhibit 5
2025 Summer Total Pk Hr Volumes

Fri PM Pk Hr



Saturday Pk Hr



Total Traffic - xx
Site Traffic - (xx)

TECHNICAL APPENDIX

Intersection Capacity Analyses

DEFINITION OF LEVELS OF SERVICE
Automobile Mode

UNSIGNALIZED INTERSECTIONS

Analysis of the Level of Service for unsignalized intersections is based on the ***Highway Capacity Manual*** *(HCM 2010)* procedures using current software for unsignalized intersections. The Level of Service for intersections is based on *Control Delay*. At two way stop controlled intersections (TWSC), *Control Delay* is the total elapsed time from a vehicle joining the queue until its departure from the stopped position at the head of the queue. The *Control Delay* also includes the time required to decelerate from a stop and to accelerate to the free-flow speed.

The analysis of individual movements at TWSC intersections can also include the estimate of the ratio of volume or demand to available capacity for the movements. This is commonly know as the (v/c) ratio. The v/c ratio provides some indication of how well these individual intersection movements will function during peak hour periods.

Level of Service definitions for unsignalized intersections as defined by the ***Highway Capacity Manual*** are summarized in the table below.

Definition of Level of Service for Unsignalized Intersections
(see Exhibit 19-1, Highway Capacity Manual 2010)

Level of Service	Average Delay (seconds)
A	0 - 10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	More than 50s and/or v/c > 1

Level of Service (LoS) for a TWSC intersection is determined by the computed or measured *Control Delay* and is defined for each minor movement at the intersection. LoS is not defined for the major street approaches or the intersection as a whole. LoS “F” is considered to be undesirable for design or planning purposes. However, many individual turning movements at TWSC intersections and commercial entrances along urban arterial corridors operate at LoS “F” during peak hour periods.

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	244	12	4	177	8	4
Conflicting Peds, #/hr	0	1	1	0	1	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	15	2	2	15	2	2
Mvmt Flow	265	13	4	192	9	4

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	279	0	474	274
Stage 1	-	-	-	-	273	-
Stage 2	-	-	-	-	201	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1284	-	549	765
Stage 1	-	-	-	-	773	-
Stage 2	-	-	-	-	833	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1283	-	546	764
Mov Cap-2 Maneuver	-	-	-	-	546	-
Stage 1	-	-	-	-	772	-
Stage 2	-	-	-	-	830	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	11.1
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	603	-	-	1283	-
HCM Lane V/C Ratio	0.022	-	-	0.003	-
HCM Control Delay (s)	11.1	-	-	7.8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	0.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	193	10	3	201	7	1
Conflicting Peds, #/hr	0	1	1	0	1	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	15	2	2	15	2	2
Mvmt Flow	210	11	3	218	8	1

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	222	0	441	217
Stage 1	-	-	-	-	216	-
Stage 2	-	-	-	-	225	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1347	-	574	823
Stage 1	-	-	-	-	820	-
Stage 2	-	-	-	-	812	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1346	-	571	822
Mov Cap-2 Maneuver	-	-	-	-	571	-
Stage 1	-	-	-	-	819	-
Stage 2	-	-	-	-	809	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	11.2
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	594	-	-	1346	-
HCM Lane V/C Ratio	0.015	-	-	0.002	-
HCM Control Delay (s)	11.2	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0	-	-	0	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	298	17	6	216	12	5
Conflicting Peds, #/hr	0	1	1	0	1	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	15	2	2	15	2	2
Mvmt Flow	324	18	7	235	13	5

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	343	0	582	335
Stage 1	-	-	-	-	334	-
Stage 2	-	-	-	-	248	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1216	-	475	707
Stage 1	-	-	-	-	725	-
Stage 2	-	-	-	-	793	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1215	-	471	706
Mov Cap-2 Maneuver	-	-	-	-	471	-
Stage 1	-	-	-	-	724	-
Stage 2	-	-	-	-	787	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	12.1
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	522	-	-	1215	-
HCM Lane V/C Ratio	0.035	-	-	0.005	-
HCM Control Delay (s)	12.1	-	-	8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	235	14	5	245	11	2
Conflicting Peds, #/hr	0	1	1	0	1	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	15	2	2	15	2	2
Mvmt Flow	255	15	5	266	12	2

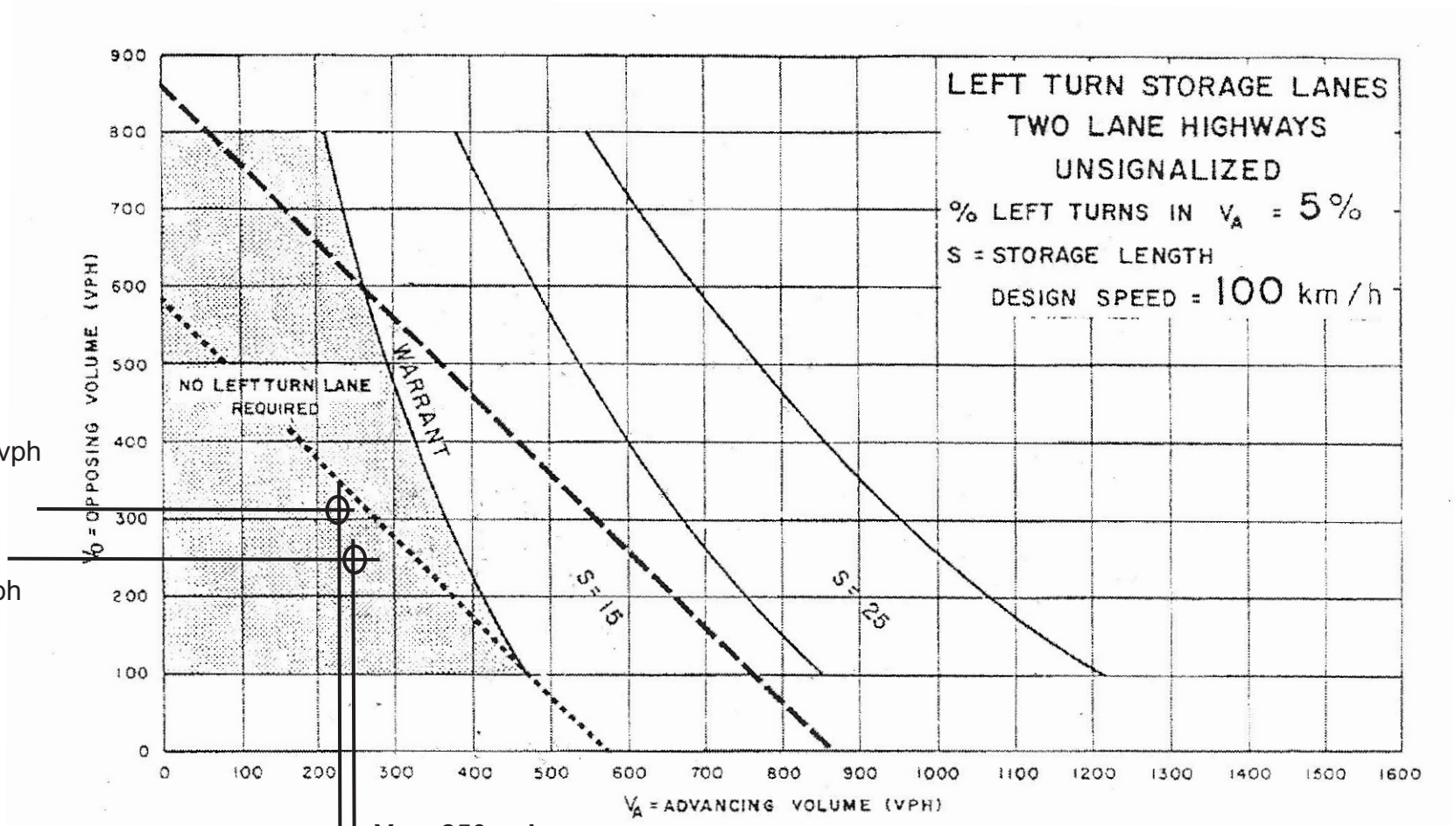
Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	272	0	541	265
Stage 1	-	-	-	-	264	-
Stage 2	-	-	-	-	277	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1291	-	502	774
Stage 1	-	-	-	-	780	-
Stage 2	-	-	-	-	770	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1290	-	499	773
Mov Cap-2 Maneuver	-	-	-	-	499	-
Stage 1	-	-	-	-	779	-
Stage 2	-	-	-	-	766	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	12
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	528	-	-	1290	-
HCM Lane V/C Ratio	0.027	-	-	0.004	-
HCM Control Delay (s)	12	-	-	7.8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0	-

Auxiliary Lane Warrant Analyses

Left Turn Lane Warrant Analysis
CR 36/Nichols Cove Road
2025 Summer Peak Hours



Vo = 315 vph
(Fri PM)

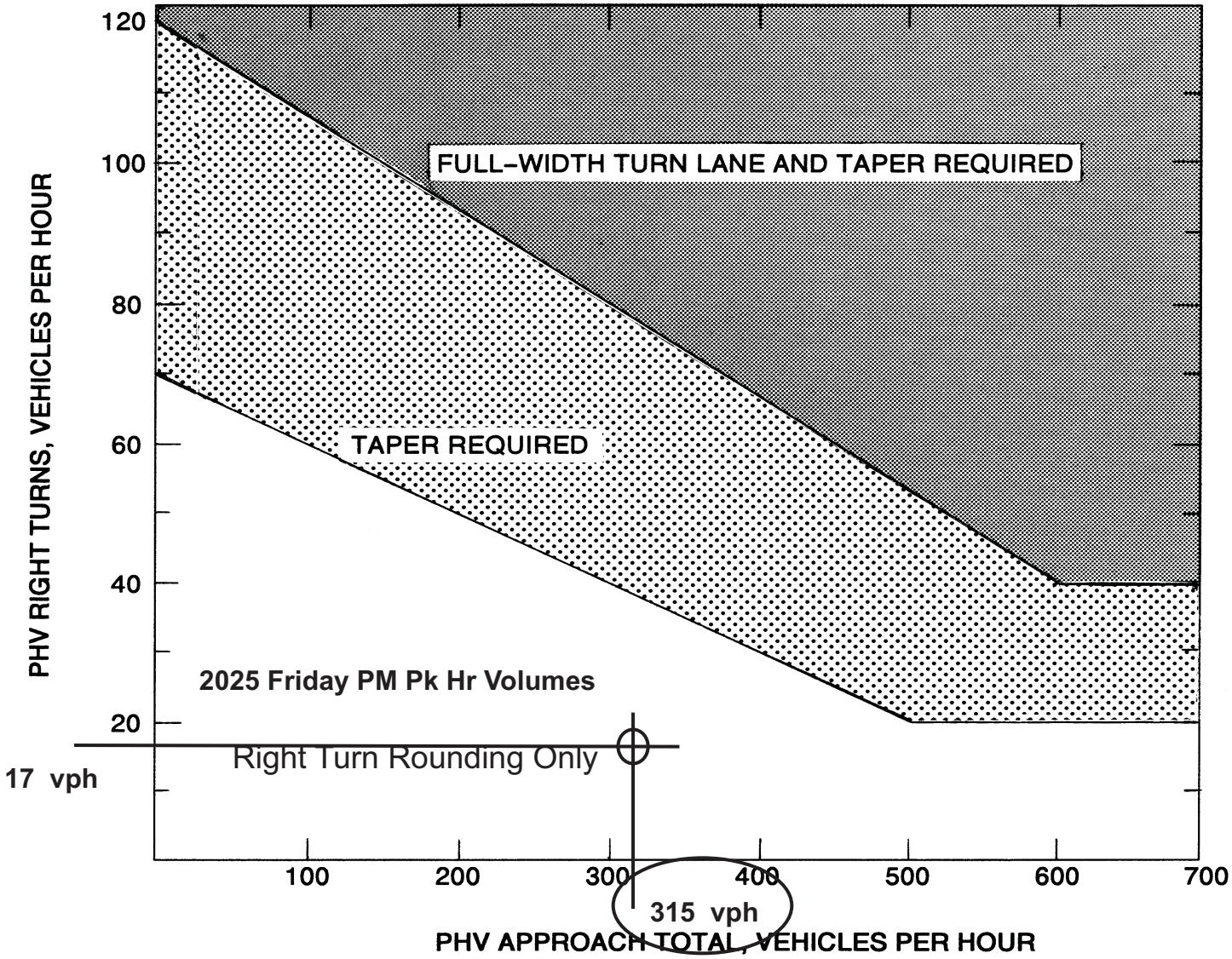
Vo = 249 vph
(Sat Pk Hr)

V_A = 250 vph
V_L = 5 ~ 2.0%

V_A = 222 vph
V_L = 6 ~ 2.7%

No Warrant for Left Turn Lane

VDOT Guidelines for Right Turn Treatment
Two Lane Highway



Appropriate Radius required at all Intersections and Entrances (Commercial or Private).

LEGEND

PHV - Peak Hour Volume (also Design Hourly Volume equivalent)

Adjustment for Right Turns

For posted speeds at or under 70 kph, PHV right turns > 40, and PHV total < 300.
Adjusted right turns = PHV Right Turns - 20
If PHV is not known use formula: PHV = ADT x K x D

K = the percent of AADT occurring in the peak hour
D = the percent of traffic in the peak direction of flow

Note: An average of 11% for K x D will suffice.