PROJECT NO. 161-15869-00

THE NURSERY GOLF COURSE RV PARK

TRAFFIC IMPACT ASSESSMENT

MAY 2017

WSP

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TRAFFIC IMPACT ASSESSMENT

THE NURSERY GOLF AND COUNTRY CLUB INC.

Project No: 161-15869-00
Date: May 2017

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CORPORATE AUTHORIZATION

This report "**The Nursery Golf Course RV Park Traffic Impact Assessment**" was prepared by WSP Canada Inc. for **The Nursery Golf and Country Club Inc.** The quality of information, conclusions and estimates contained herein is consistent with the level of effort provided by WSP Canada Inc. and are based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions and qualifications set forth in this report. This report is intended to be used by **The Nursery Golf and Country Club Inc**. only, subject to the terms and conditions of its contract with WSP Canada Inc. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

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The Association of Professional Engineers and Geoscientists of Alberta

REVISION HISTORY

VERSION	DATE	DESCRIPTION
1	February 24, 2017	Issued for Review
2	May 18, 2017	Revised Based on County's Comments Issued for Approval

EXECUTIVE SUMMARY

WSP Canada Inc. was retained by The Nursery Golf and Country Club to complete a traffic impact assessment (TIA) for a proposed recreational vehicle (RV) park located east of Range Road 270 and south of Township Road 412 in the SW 07-41-26-W4M in Lacombe County.

The purpose of this study is to identify and assess potential traffic impacts on the study intersections and roadways associated with the proposed development, and to suggest required mitigation measures (if any) to allow the adjacent roadways to safely accommodate traffic generated by the development.

The Nursery Golf Course is an 18-hole public golf course located west of the QEII (Highway 2) and north of the City of Lacombe. The lands surrounding the golf course are primarily undeveloped farmland. The proposed RV Park will be located on the golf course at the existing driving range area. The current development concept plan for Phase 1 shows 31 stalls. However, a total of 35 stalls for Phase 1 were analyzed in this TIA in case of any changes to the site layout and stall sizing in the future. An additional 35 stalls were also considered for potential future RV park expansion. The RV Park Phase 1 is anticipated to be fully built out in approximately 2018.

Primary vehicular access to The Nursery Golf Course and the proposed RV Park will be obtained via Highway 2, Highway 12, Highway 792, Township Road 412, and Range Road 270. In this study, the Township Road 412 / Range Road 270 intersection and the road segments of Township Road 412 and Range Road 270 in the proximity of the study intersection were analysed.

The existing Township Road 412 / Range Road 270 intersection presents a flared Type IIId intersection treatment with provision for simultaneous through and left turn movements. In this study, a 2.5% linear traffic growth rate was used to estimate the future background traffic growth.

The following conclusions and recommendations were reached:

- It is anticipated that the 35-stall RV Park in Phase 1 would generate approximately 85 new trips on a summer weekday with 8 and 9 new trips during the weekday AM and PM peak hours, respectively. With the addition of 35 future stalls, the RV Park would generate approximately 170 new trips on a summer weekday with 16 and 18 new trips during the weekday AM and PM peak hours.
- The amount of trips generated by the proposed RV Park is not expected to significantly impact the study intersection and roadways.
- The existing Type IIId intersection treatment at the study intersection meets the requirement for the forecasted future traffic volumes. Therefore, no further intersection improvements will be required as a result of the proposed development.
- All traffic movements at the Township Road 412 / Range Road 270 intersection are expected to operate at LOS A during the AM and PM peak hours under the Phase 1 post-development traffic conditions and operate at LOS B or better up to the 20 year horizon (2037). The existing intersection treatment will be capable of accommodating the forecasted post-development traffic.
- Traffic on Township Road 412 east of Range Road 270 is expected to operate at LOS A during the AM and PM peak hours in summer seasons under the post-development traffic conditions up to the 20 year horizon (2037). Thus, it can be concluded that both Township Road 412 and Range Road 270 have sufficient capacity to accommodate the traffic generated by the proposed RV Park and anticipated future traffic growth.
- The intersection sight distances are adequate to both the east and west directions along Township Road 412 at the Range Road 270 intersection. There are no obstructions within driver's sight line triangles.

- The existing intersection treatment can safely accommodate the turning manoeuvres of recreational vehicles.
- Illumination at the study intersection will not be warranted.

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1 INTRODUCTION

WSP Canada Inc. was retained by The Nursery Golf and Country Club to complete a traffic impact assessment (TIA) for a proposed recreational vehicle (RV) park located east of Range Road 270 and south of Township Road 412 in the SW 07-41-26-W4M in Lacombe County. The subject site location is shown in Figure 1-1.

1.1 STUDY PURPOSE

The purpose of this study is to identify and assess potential traffic impacts on the study intersections associated with the proposed development, and to suggest required mitigation measures (if any) to allow the adjacent roadways to safely accommodate traffic generated by the development.

1.2 SITE AND VICINITY DESCRIPTION

1.2.1 SITE DESCRIPTION

The Nursery Golf Course is an 18-hole public golf course located west of Highway 2 and north of the City of Lacombe. The lands surrounding the golf course are primarily undeveloped farmland. The proposed RV Park will be located on the golf course at the existing driving range area. The current development concept plan for Phase 1 shows 31 stalls. However, a total of 35 stalls for Phase 1 were analyzed in this TIA in case of any changes to the site layout and stall sizing in the future. An additional 35 stalls were also considered for potential future RV park expansion. The RV Park Phase 1 is anticipated to be fully built out approximately in 2018. The proposed development concept plan is attached in Appendix B.

1.2.2 TRANSPORTATION NETWORK

Primary vehicular access to The Nursery Golf Course and the proposed RV Park will be obtained via Highway 2, Highway 12, Highway 792, Township Road 412, and Range Road 270. In this study, the Township Road 412 / Range Road 270 intersection and the road segments of Township Road 412 and Range Road 270 in the proximity of the study intersection were analysed.

Township Road 412 is a paved two-lane undivided road that connects Highway 792 to the west and the Highway 2 / 2A interchange to the east. The current daily traffic volume in the summer on Township Road 412 east of Range Road 270 is estimated to be 1,000 vehicles per day.

Range Road 270 is a paved two-lane roadway that provides access to the rural properties and farmland in the surrounding area. The current traffic volume in the summer on Range Road 270 is estimated to be approximately 210 vehicles per day south of Township Road 412 and 600 vehicles per day north of Township Road 412. The posted speed limit on Range Road 270 is 90 km/h.

The Township Road 412 / Range Road 270 intersection presents a flared Type IIId intersection treatment with provision for simultaneous through and left turn movements. The flared intersection operates so that the main (through) road through traffic has little or no delay when lead vehicles are turning left or right. This intersection is currently controlled by two-way stop signs on Range Road 270 with free flow conditions on Township Road 412.

1.3 ANALYSIS HORIZONS

Three analysis horizons were established in this study:

- Existing traffic conditions (2017),
- Phase 1 Full Build Out (2018), and
- 20 year horizon (2037).

Figure 1-1 Site Location

1.4 SCOPE OF WORK

The scope of this study includes the following:

- Determine current traffic operating conditions for the study intersection.
- Forecast background traffic volumes at the analysis horizons based on the anticipated traffic growth rate.
- Determine the number of trips generated by the development at each analysis horizons.
- Distribute the generated trips to different geographic areas (origins and destinations).
- Assign the generated trips to specific routes to and from the development.
- Forecast post-development (combined) traffic volumes at the study intersection and on the roadways for each analysis horizon.
- Propose appropriate intersection treatment and traffic control (if needed) for the study intersection.
- Evaluate capacity for Township Road 412 and Range Road 270.
- Determine roadway and intersection improvements as required to provide acceptable levels of service and safety while mitigating impacts due to the development.

1.5 METHODOLOGY

In order to meet the study objectives and accomplish the works stated above, the following methodology was used:

- Obtain the County's recent traffic counts on Township Road 412 and Range Road 270 and review WSP's 2010 traffic turning movement count at the Township Road 412 / Range Road 270 intersection to estimate current traffic volumes at the study intersection.
- Estimate total trips generated by the development based on ITE *Trip Generation Manual (9th Edition)* and the development information provided by the developer.
- Conduct illumination warrant analysis based on TAC's Guide for the Design of Roadway *Lighting (2006).*
- Analyze the delay, level of service (LOS) and queue lengths of the study intersections at weekday AM and PM peak periods for the analysis horizon traffic using Synchro Studio 9 (Synchro) software.
- Identify any improvements necessary for the intersection and roadways to accommodate the forecasted traffic volumes.

2 TRAFFIC ANALYSIS

This section analyzes the existing (2017), Phase 1 full build out (2018), and 20 year horizon (2037) traffic conditions for the study intersection. A linear traffic growth rate was applied to the existing traffic volumes to determine the future background traffic volumes.

2.1 EXISTING TRAFFIC

Lacombe County provided recent roadway traffic counts on Township Road 412 and Range Road 270. WSP conducted intersection turning movement counts at the Township Road 412 / Range Road 270 intersection in 2010 for the purpose of preparing a traffic impact assessment of the closure of the Range Road 270 intersection on Highway 2. The existing (2017) traffic volumes at the study intersection were estimated based on the County's recent traffic counts. The anticipated traffic turning movement patterns (left, right, and through) at the study intersection were estimated based on WSP's 2010 TIA. It is believed that WSP's 2010 estimates for the traffic turning movement patterns at the study intersection after the closure of Range Road 270 intersection on Highway 2 are still valid.

Figure 2-1 shows the estimated existing weekday AM and PM peak hour traffic turning movement volumes at the Township Road 412 / Range Road 270 intersection and the anticipated daily traffic volumes on the roadways.

2.2 BACKGROUND TRAFFIC

Background traffic (non-site traffic) is the traffic that exists without the addition of trips generated by the proposed development.

In consultation with the County, a 2.5% linear traffic growth rate is deemed to be adequate to estimate the future traffic growth on Township Road 412 and Range Road 270.

The forecasted background traffic volumes in terms of weekday average summer daily traffic (ASDT), AM and PM peak hour traffic at the analysis horizons are presented in Figures 2-2 and 2-3.

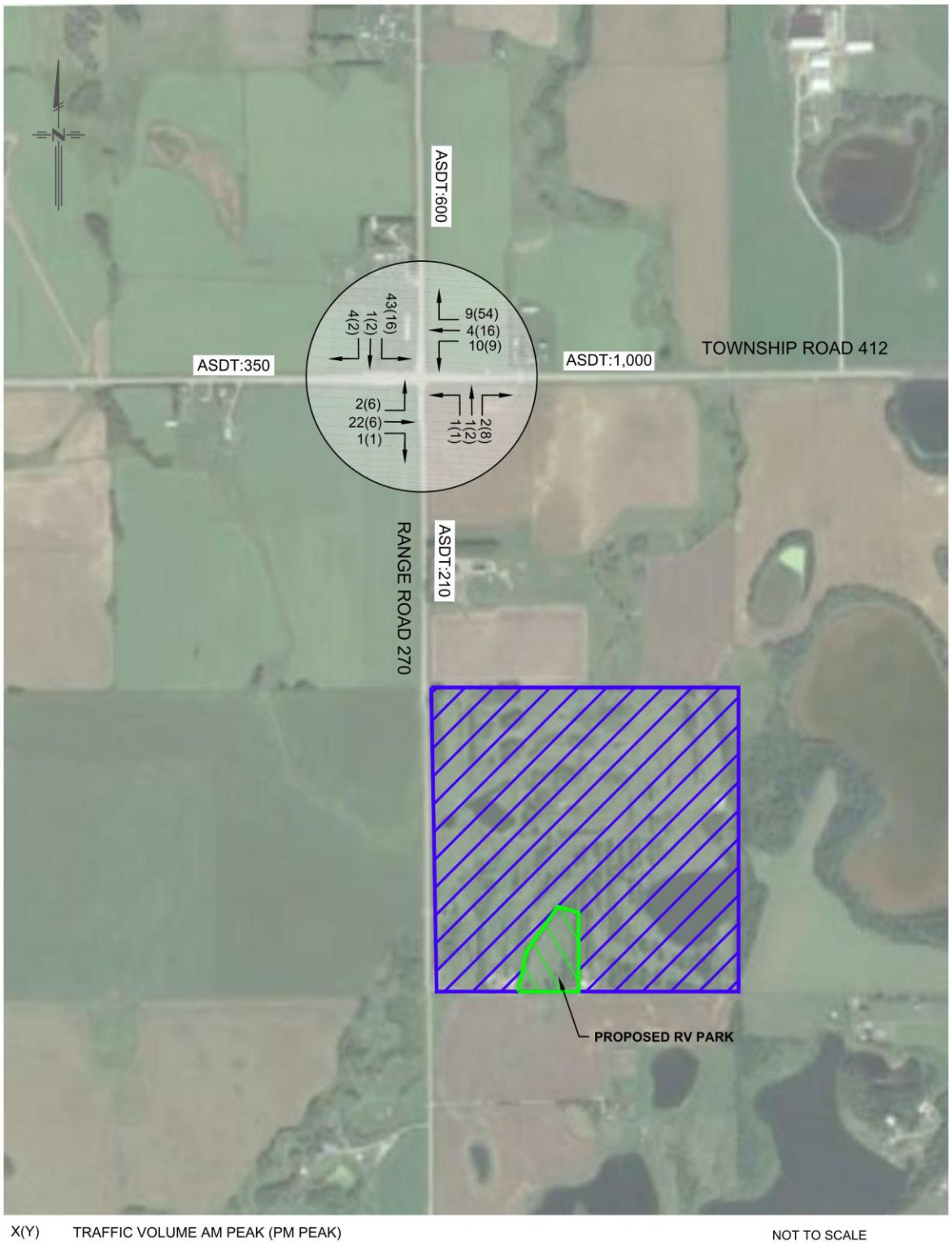

Figure 2-1 Existing (2017) Traffic

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Figure 2-2 Phase 1 (2018) Background Traffic

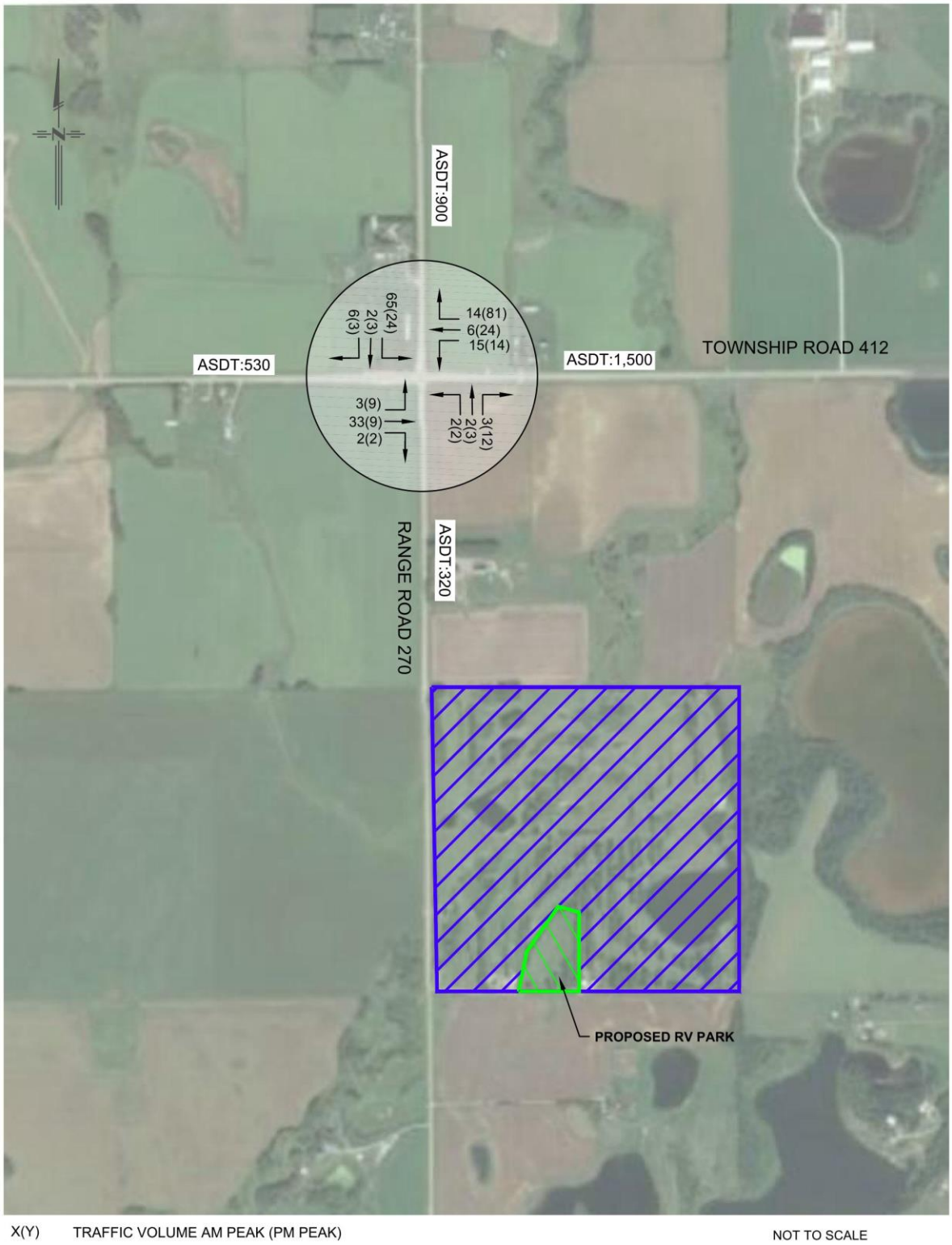

Figure 2-3 20 Year Horizon (2037) Background Traffic

2.3 TRIP GENERATION

To estimate the trips generated by the proposed RV park, the trip generation rates for Campground/Recreational Vehicle Park (Land Use Code: 416) in the Institute of Transportation Engineers (ITE) *Trip Generation Manual (9th Edition)* were used. The daily trip generation rate was estimated by multiplying the sum of AM and PM peak hour trip generation rates by five (5) (i.e., daily trip rates = 5 x (AM+PM)).

As stated previously, the current development concept plan for Phase 1 shows 31 stalls. However, a total of 35 stalls for Phase 1 were analyzed in this TIA in case of any changes to the site layout and stall sizing in the future.

Table 2-1 summarizes the estimated trips that would be generated by the 35 camp sites in Phase 1. It is estimated that the RV Park Phase 1 would generate a total of approximately 85 daily trips, 8 AM peak hour trips, and 9 PM peak hour trips when it is completed. The trips that would be generated by the RV Park with the additional future 35 stalls are illustrated in Table 2-2.

Table 2-1 Trip Generation – Phase 1 (35 Stalls)

STALLS: 35	WEEKDAY			AM PEAK HOUR			PM PEAK HOUR		
	TOTAL	IN	OUT	TOTAL	IN	OUT	TOTAL	IN	OUT
Directional Distribution	100%	50%	50%	100%	36%	64%	100%	65%	35%
Rates (Trips / Camp Site)	2.40	1.20	1.20	0.21	0.08	0.13	0.27	0.18	0.09
Total Trips	84	42	42	8	3	5	9	6	3

Table 2-2 Trip Generation – Ultimate (70 Stalls)

STALLS: 70	WEEKDAY			AM PEAK HOUR			PM PEAK HOUR		
	TOTAL	IN	OUT	TOTAL	IN	OUT	TOTAL	IN	OUT
Directional Distribution	100%	50%	50%	100%	36%	64%	100%	65%	35%
Rates (Trips / Camp Site)	2.40	1.20	1.20	0.21	0.08	0.13	0.27	0.18	0.09
Total Trips	168	84	84	16	6	10	18	12	6

2.4 TRIP DISTRIBUTION AND ASSIGNMENT

Trip distributions for the proposed RV Park were estimated based on the relative locations of surrounding populated areas and the road network in the vicinity of the site. It is anticipated that most of the traffic generated by the RV Park will be travelling from / to Highway 2 at the east. For the purpose of this study, it is assumed that 85% of the trips generated by the RV Park would be from Highway 2, 10% of the trips would be from the west along Township Road 412, and 5% would be from the north along Range Road 270.

Figure 2-4 illustrates the estimated trip distribution for the proposed RV Park at the study intersection. The resultant trip assignments are shown in Figures 2-5 and 2-6 for Phase 1 and ultimate stage, respectively.

2.5 COMBINED TRAFFIC

Combined traffic volumes (post-development traffic) include both background traffic and the traffic generated by the proposed development. Combined traffic volumes were calculated by superimposing the trips generated by the proposed development onto the future background traffic volumes. The resulting combined AM and PM peak hour traffic volumes at the study intersection are shown in Figures 2-7 and 2-8.

Figure 2-4 Trip Distribution

Figure 2-5 Trip Assignment - Phase 1

Figure 2-6 Trip Assignment - Ultimate

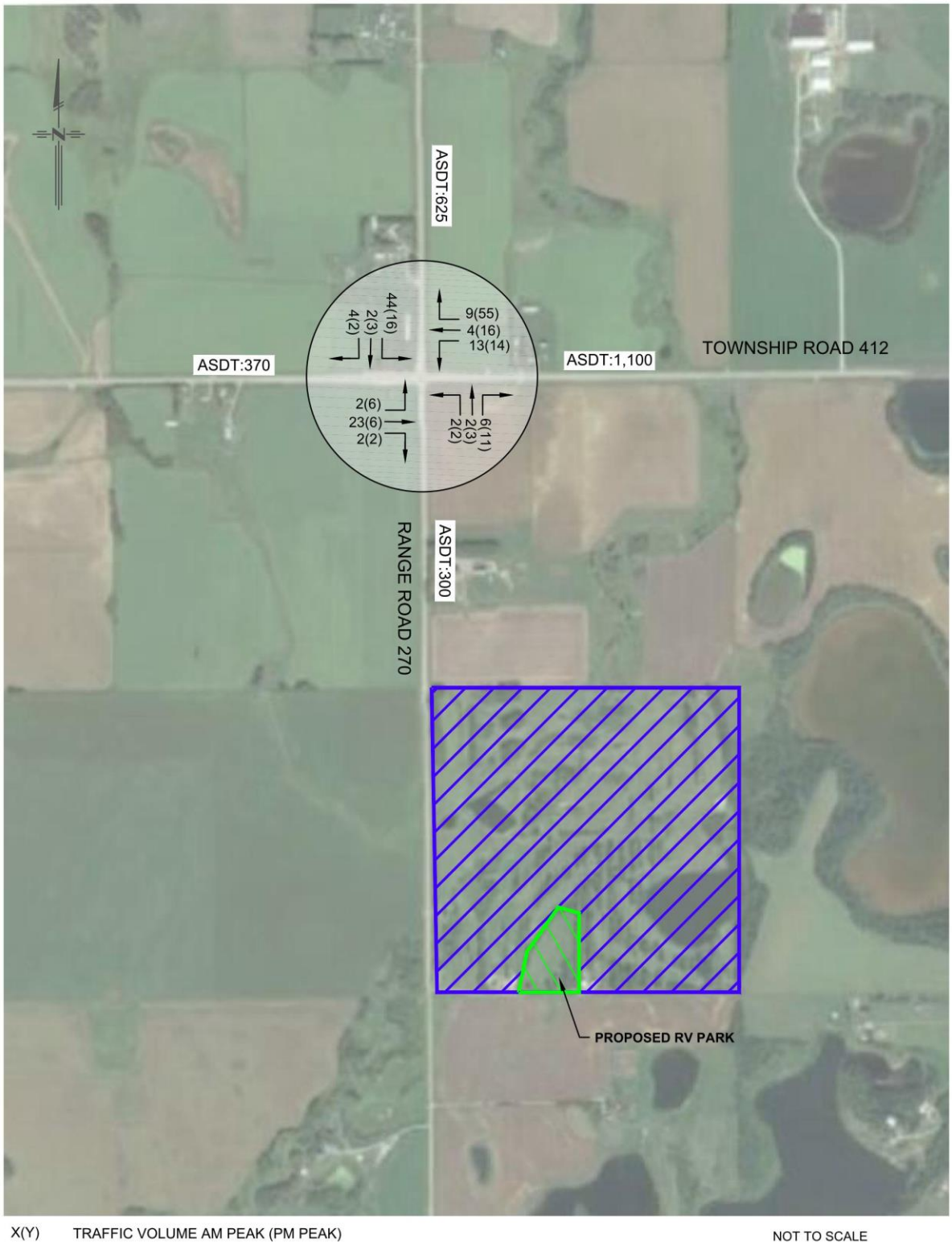

Figure 2-7 Phase (2018) Combined Traffic

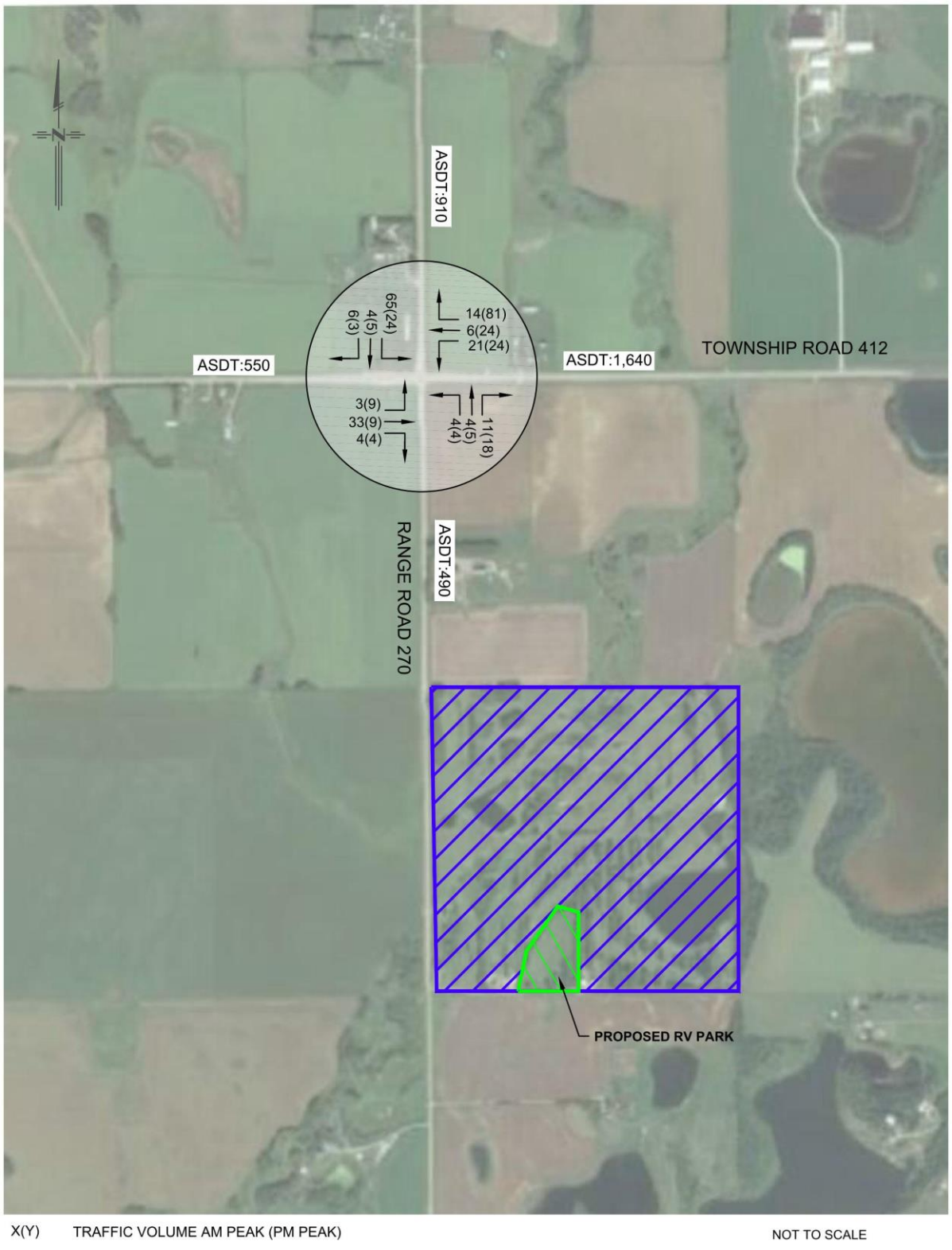

Figure 2-8 20 Year Horizon (2037) Combined Traffic

3 INTERSECTION ANALYSIS

This section presents the intersection analysis procedures that are specified in Alberta Transportation's *Highway Geometric Design Guide*.

3.1 LEFT TURN LANE WARRANT ANALTYSIS

The Township Road 412 / Range Road 270 intersection presents a flared Type IIId intersection treatment with provision for simultaneous through and left turn movements. The purpose of the left turn lane warrant analysis is to check if dedicated left turn lanes are required on Township Road 412 to accommodate the forecasted future left turning traffic. Table 3-1 outlines the traffic movement information at the study intersection during the AM and PM peak periods for each analysis horizon.

The left turn lane warrant analysis was based on a design speed of 110 km/h (posted speed 100 km/h) on Township Road 412.

Table 3-1 Left Turn Lane Warrant Analysis

EB **AM** PEAK	ADVANCING	OPPOSING	LEFT TURNS	% LEFT TURN	TRUCKS IN LT	WARRANTED?
2017 Traffic	25	23	2	8%	< 10%	No
2018 Combined	27	26	2	7%	< 10%	No
2037 Combined	40	41	4	8%	< 10%	No
EB **PM** PEAK	ADVANCING	OPPOSING	LEFT TURNS	% LEFT TURN	TRUCKS IN LT	WARRANTED?
2017 Traffic	13	79	6	46%	< 10%	No
2018 Combined	14	85	6	43%	< 10%	No
2037 Combined	22	129	9	41%	< 10%	No
WB **AM** PEAK	ADVANCING	OPPOSING	LEFT TURNS	% LEFT TURN	TRUCKS IN LT	WARRANTED?
2017 Traffic	23	29	10	43%	< 10%	No
2018 Combined	26	27	13	50%	< 10%	No
2037 Combined	41	40	21	51%	< 10%	No
WB **PM** PEAK	ADVANCING	OPPOSING	LEFT TURNS	% LEFT TURN	TRUCKS IN LT	WARRANTED?
2017 Traffic	79	13	9	11%	< 10%	No
2018 Combined	85	14	14	16%	< 10%	No
2037 Combined	129	22	24	19%	< 10%	No

*LT = Left Turns

The above left turn lane warrant analysis reveals that left turn lanes are not expected to be warranted for the east and westbound traffic at the Township Road 412 / Range Road 270 intersection even under the forecasted 20 year horizon (2037) post-development traffic conditions. The existing Type IIId intersection treatment at the study intersection meets the requirement for the forecasted future traffic volumes. Therefore, no further intersection improvements will be required.

3.2 RIGHT TURN LANE WARRANT ANALTYSIS

According to Alberta Transportation's *Highway Geometric Design Guide*, the warrant for a right turn lane requires that all of the following conditions be met:

- Main (or through) road AADT ≥ 1800,
- Intersecting road AADT ≥ 900, and
- Right turn daily traffic volume ≥ 360 for the movement in question.

In this study, ASDT volumes were used to conduct the right turn lane warrant analysis. Based on the forecasted traffic volumes on Township Road 412 and Range Road 270, dedicated right turn lanes are not expected to be warranted on Township Road 412 at the Range Road 270 intersection.

4 CAPACITY ANALYSIS

This section describes the method used for the capacity analysis and evaluates the operating level of service of the study intersection and roadways under the analysis horizon traffic conditions.

4.1 METHODOLOGY

To determine the operating conditions of an intersection or roadway, the concept of level of service (LOS) is generally used. The LOS of an intersection is a qualitative measure of capacity and operating conditions and is directly related to vehicle delay. LOS is given a letter designation from A to F, with LOS A representing very short delays and the best operating conditions, and LOS F representing very long delays and failure of a movement. LOS D is typically considered the limit of acceptable operation because excessive delays tend to occur beyond this threshold.

For this study, WSP developed Synchro Studio 9 (Synchro) intersection simulation models for the study intersections when they are under signal or stop control. Synchro 9 follows the *Highway Capacity Manual, 2010* (HCM 2010) LOS criteria that are listed in Table 4-1. For two-way stop controlled intersections, the delay is typically calculated for the movements at the minor approaches only, since the major roads are considered to be operating at free flow conditions.

Table 4-1 Level of Service Criteria for Intersections (HCM 2010)

SIGNALIZED CONTROL DELAY (S)	UNSIGNALIZED CONTROL DELAY (S)	LOS BY VOLUME-TO-CAPACITY RATIO	
		v/c ≤ 1.0	*v/c* > 1.0
≤ 10	≤ 10	A	F
> 10 and ≤ 20	> 10 and ≤ 15	B	F
> 20 and ≤ 35	> 15 and ≤ 25	C	F
> 35 and ≤ 55	> 25 and ≤ 35	D	F
> 55 and ≤ 80	> 35 and ≤ 50	E	F
> 80	> 50	F	F

The procedure for roadway segment analysis and evaluation criteria used in this study follow those outlined in the *Highway Capacity Manual 2010 (HCM 2010).* HCM 2010 defines the measures of effectiveness to determine the automobile level of service. In this study, the percent time-spent-following (PTSF) was selected to evaluate the traffic operational performance of the roadway segments on Township Road 412 and Range Road 270. PTSF represents the freedom to maneuver and the comfort and convenience of travel. It is the average percentage of time that vehicles must travel in platoons behind slower vehicles due to the inability to pass. The LOS criteria for two-lane roadway segment as defined by HCM 2010 are shown in Table 4-2.

Table 4-2 Level of Service Criteria for Two-Lane Class II Highways (HCM 2010)

LOS	PTSF (%)	DESCRIPTION
A	≤ 40	Speed would be controlled primarily by roadway conditions. A small amount of platooning would be expected.
B	> 40 - 55	Passing demand and passing capacity are balanced. The degree of platooning are noticeable.
C	> 55 - 70	Most vehicles are travel in platoons. Speed are noticeably curtailed.
D	> 70 - 85	Platooning increase significantly. Passing demand is high, but passing capacity approaches zero. A high percentage vehicles are now travelling in platoons.
E	> 85	Demand is approaching capacity. Passing is virtually impossible. Speed are seriously curtailed.
F	-	Demand flow exceeds capacity. Operating conditions are unstable and heavy congestion exists.

4.2 CAPACITY ANALYSIS RESULTS

Synchro models were created for the study intersection based on the forecasted AM and PM peak hour traffic volumes at each analysis horizon using the existing intersection lane configurations.

4.2.1 TOWNSHIP ROAD 412 / RANGE ROAD 270

The Township Road 412 / Range Road 270 intersection is currently controlled by stop signs on Range Road 270 with free flow conditions on Township Road 412. Alberta Transportation's Type III left turn lanes are provided on the east and west approaches.

The traffic operational performance at the Township Road 412 / Range Road 270 intersection under the analysis horizon traffic conditions are summarized in Tables 4-3 to 4-5. The detailed Synchro outputs are attached in Appendix E.

Table 4-3 Capacity Analysis: Existing (2017) Traffic – Township Road 412 / Range Road 270

TRAFFIC MOVEMENTS	AM PEAK HOUR				PM PEAK HOUR			
	Delay (s)	LOS	*V/C*	95th Queue Length (m)	Delay (s)	LOS	*V/C*	95th Queue Length (m)
EBL	7.3	A	0.00	0.0	7.4	A	0.01	0.1
WBL	7.3	A	0.01	0.2	7.3	A	0.01	0.2
NBLTR	8.8	A	0.01	0.1	8.7	A	0.01	0.3
SBLTR	9.2	A	0.07	1.6	9.3	A	0.03	0.7
INT Summary	5.7	A	0.07	-	3.2	A	0.03	-

Table 4-4 Capacity Analysis: 2018 Post-Development Traffic – Township Road 412 / Range Road 270

TRAFFIC MOVEMENTS	AM PEAK HOUR				PM PEAK HOUR			
	Delay (s)	LOS	*V/C*	95th Queue Length (m)	Delay (s)	LOS	*V/C*	95th Queue Length (m)
EBL	7.3	A	0.00	0.0	7.4	A	0.01	0.1
WBL	7.3	A	0.01	0.2	7.3	A	0.01	0.3
NBLTR	8.8	A	0.01	0.3	8.8	A	0.02	0.5
SBLTR	9.3	A	0.07	1.7	9.5	A	0.03	0.8
INT Summary	5.8	A	0.07	-	3.6	A	0.03	-

Table 4-5 Capacity Analysis: 2037 Post-Development Traffic – Township Road 412 / Range Road 270

TRAFFIC MOVEMENTS	AM PEAK HOUR				PM PEAK HOUR			
	Delay (s)	LOS	*V/C*	95th Queue Length (m)	Delay (s)	LOS	*V/C*	95th Queue Length (m)
EBL	7.3	A	0.00	0.1	7.5	A	0.01	0.2
WBL	7.3	A	0.02	0.4	7.3	A	0.02	0.4
NBLTR	9.1	A	0.03	0.6	9.1	A	0.04	0.9
SBLTR	9.9	A	0.11	2.9	10.1	B	0.05	1.3
INT Summary	6.2	A	0.11	-	3.9	A	0.05	-

The above capacity analyses reveal that all traffic movements at the Township Road 412 / Range Road 270 intersection are expected to operate at LOS A during the AM and PM peak hours under the Phase 1 post-development traffic conditions and operate at LOS B or better up to the 20 year horizon (2037). The existing intersection treatment will be capable of accommodating the forecasted post-development traffic.

4.2.2 ROADWAY CAPACITY ANALYSIS

Following the HCM 2010 method, the roadway capacity analyses were conducted for the road segment on Township Road 412 east of Range Road 270 since the highest traffic volumes were forecasted on this approach at the study intersection. Table 4-6 summarizes the analysis results and the detail analysis worksheets are attached in Appendix E.

Table 4-6 Township Road 412 (East of Range Road 270) Operational Performance Analysis Results

ANALYSIS HORIZON	PERIOD	DIRECTION	PTSF	LOS
Existing Traffic (2017)	AM	Eastbound	24.7%	A
		Westbound	8.5%	A
	PM	Eastbound	9.1%	A
		Westbound	24.0%	A
2018 Post-Development Traffic	AM	Eastbound	24.4%	A
		Westbound	8.7%	A
	PM	Eastbound	9.3%	A
		Westbound	23.9%	A
2037 Post-Development Traffic	AM	Eastbound	24.1%	A
		Westbound	9.1%	A
	PM	Eastbound	9.4%	A
		Westbound	23.8%	A

Table 4-8 reveals that traffic on Township Road 412 east of Range Road 270 is expected to operate at LOS A during the AM and PM peak hours in summer seasons under the post-development traffic conditions up to the 20 year horizon (2037). It can be concluded that Township Road 412 and Range Road 270 have sufficient capacity to accommodate the traffic generated by the proposed RV Park.

5 ADDITIONAL CONSIDERATIONS

This section is intended as a general overview of a number of site aspects. Some additional issues have been identified for consideration.

5.1 SIGHT DISTANCE

The intersection sight distances along Township Road 412 at the Range Road 270 intersection were checked based on the photos taken in 2010 and the Township Road 412 vertical alignment profiles. It was found that the available sight distances exceed 800 m to both the east and west directions along Township Road 412 at the Range Road 270 intersection. In accordance with Alberta Transportation's *Highway Geometric Design Guide*, the required intersection sight distance for a recreational vehicle is 430 m based on a design speed of 110 km/h. Thus, it is deemed that the intersection sight distances are adequate at the Township Road 412 / Range Road 270 intersection.

5.2 OPERATIONAL ANALYSIS

The operational analysis was conducted for the longest vehicle expected to be used daily for the operations at the proposed development. In this study, the recreational vehicle was used in the operational analysis as the longest vehicle.

The horizontal layout intersection plan shown in Appendix D illustrates that the recreational vehicle can safely manoeuvre at the study intersection.

5.3 ILLUMINATION

The Township Road 412 / Range Road 270 intersection was evaluated for illumination requirements based on the latest revision of the Transportation Association of Canada's (TAC) *Guide for the Design of Roadway Lighting.* The following factors were evaluated:

- Geometric – geometric features of the intersection and associated roadways.
- Operational – present and proposed AADT, roadway classification and operating speeds on all connecting legs.
- Environmental – proximity to other lighted developments within the area.
- Collision – night-time highway collision history in the area that may be attributed to lack of illumination.

Based on the TAC requirements, illumination will not be warranted at the Township Road 412 / Range Road 270 intersection.

6 CONCLUSION AND RECOMMENDATIONS

This study has examined the traffic impacts associated with the proposed RV Park development located west of Highway 2 and east of Range Road 270 in Lacombe County. The conclusions and recommendations are summarized below:

- The existing Type IIId intersection treatment at the study intersection meets the requirement for the forecasted future traffic volumes. Therefore, no further intersection improvements will be required as a result of the proposed development.
- All traffic movements at the Township Road 412 / Range Road 270 intersection are expected to operate at LOS A during the AM and PM peak hours under the Phase 1 post-development traffic conditions and operate at LOS B or better up to the 20 year horizon (2037). The existing intersection treatment will be capable of accommodating the forecasted post-development traffic.
- Traffic on Township Road 412 east of Range Road 270 is expected to operate at LOS A during the AM and PM peak hours in summer seasons under the post-development traffic conditions up to the 20 year horizon (2037). Thus, it can be concluded that both Township Road 412 and Range Road 270 have sufficient capacity to accommodate the traffic generated by the proposed RV Park and anticipated future traffic growth.
- The intersection sight distances are adequate to both the east and west directions along Township Road 412 at the Range Road 270 intersection. There are no obstructions within driver's sight line triangles.
- The existing intersection treatment can safely accommodate the turning manoeuvres of recreational vehicles.
- Illumination at the study intersection will not be warranted.

7 REFERENCES

BIBLIOGRAPHY

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- Lacombe County Website, https://www.lacombecounty.com/. Retrieved February 3, 2017.
- Alberta Transportation Traffic Data Mapping. Retrieved February 6, 2017.
- Guide for the design of Roadway Lighting (2006), TAC.
- Range Road 270 / Township Road 412 and Range Road 274 / Township Road 412 TIA (2010), Genivar Inc. (now WSP).

Appendix A

ABBREVIATIONS AND UNITS

ABBREVIATION	DESCRIPTION
ITE	Institute of Transportation Engineers
AADT	Average Annual Daily Traffic
ASDT	Average Summer Daily Traffic
ATR	Automatic Traffic Recorder
V/C	Volume to Capacity Ratio
LOS	Level of Service
LT	Left Turn
TIMS	Transportation Infrastructure Management System
INT	Intersection
NB	Northbound
NBL	Northbound Left
NBLR	Northbound Left and Right
NBLTR	Northbound Left, Through, and Right
HCM	Highway Capacity manual
TAC	Transportation Association Canada
PTSF	Percent Time-Spent-Following
s	Second
m	Meter
km/h	Kilometers per hour

Appendix B

PROJECT INFORMATION

- **Site Location**
- **Study Intersection Photos**
- **Township Road 412 Alignment Profiles**
- **January 27, 2017 Email from the County**

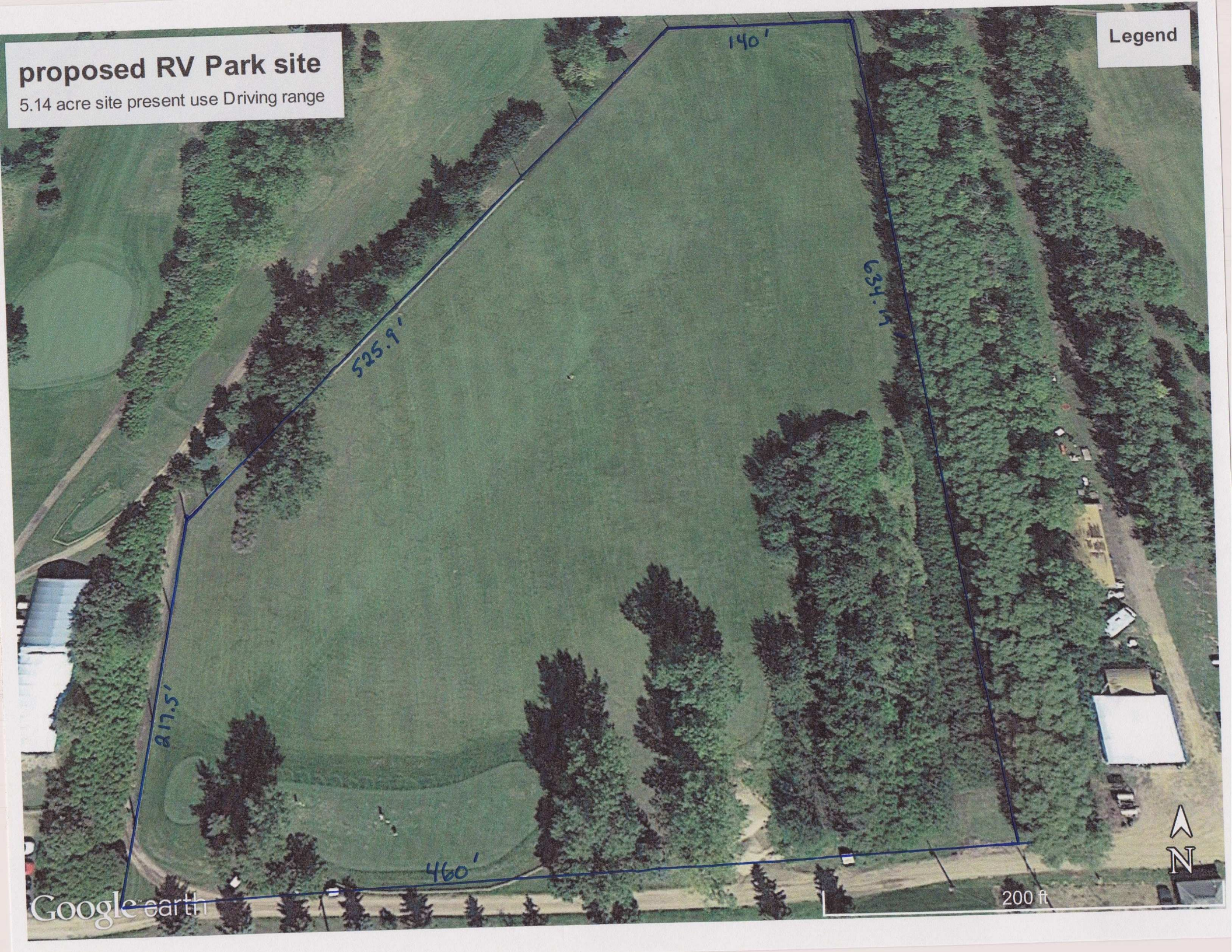
Nurery Golf RV Site

Friday, October 07, 2016

1:8,300

0 100 200 400 m

AbaData


proposed RV Park site
5.14 acre site present use Driving range
Legend
140'
525.9'
634.4'
817.5'
460'
N
200 ft
Google earth

Looking South at the Range Road 270 / Township Road 412 Intersection

Looking North at the Range Road 270 / Township Road 412 Intersection

Looking West at the Range Road 270 / Township Road 412 Intersection

Looking East at the Range Road 270 / Township Road 412 Intersection

Sun, James

From: Cajun Paradis <cparadis@lacombecounty.com>
Sent: January-27-17 10:50 AM
To: Sun, James
Cc: Suchy, Craig; Dale Freitag
Subject: RE: RV Park TIA - Lacombe County

Hi James,

The Operations Department has indicated that your methodology and approach look good. The evaluation or capacity of the current road structure to accommodate additional traffic should be completed on the Range Road and Township Road and not just the intersection, nor just at peak times. The 2.5% growth rate is acceptable.

The Latest Traffic Counts are:

Twp Road 41-2 east of RR 27-0 – 993 vpd
RR 27-0 south of Twp Road 41-2 – 209 vpd

Please let me know if you require anything further.

Cajun

LACOMBE COUNTY
Cajun Paradis
Planner/Development Officer
403.782.6601 | cparadis@lacombecounty.com
Where People are the Key

From: Sun, James [mailto:James.Sun@wspgroup.com]
Sent: January-27-17 9:35 AM
To: Cajun Paradis <cparadis@lacombecounty.com>
Cc: Suchy, Craig <Craig.Suchy@wspgroup.com>
Subject: RV Park TIA - Lacombe County

Hi Cajun,

We were retained by The Nursery and Country Club Inc. to prepare a Traffic Impact Assessment for a proposed 35-lot RV park located east of Range Road 270 and adjacent to the existing golf course. Please see attached sketch for the site location. I would like to touch base with you regarding the TIA preparation. Please let me know if you agree with our methodology and work scope.

- This TIA will be prepared in accordance with Alberta Transportation's Traffic Impact Assessment Guidelines.

- ITE's Trip Generation Manual (9th Edition) will be used for estimating the trips generated by the proposed RV park.

- The Township Road 412 / Range Road 270 will be analyzed in the study.

- A 2.5% annual traffic growth rate will be used to forecast future background traffic. Please advise if the growth rate is appropriate or not.

- I am wondering if the County has traffic counts on Township Road 412 and Range Road 270 in the vicinity of the study intersection.

Please let me know if you have any other concerns that you want us to address in the TIA. It would be greatly appreciated if you could reply to me at your earliest convenience.

Thanks

James Sun, MSc., P.Eng., PTOE
Transportation Engineer

WSP Canada Inc.
Suite 1200, 10909 Jasper Avenue
Edmonton, Alberta T5J 3L9
T 587-489-0161
C 780-233-0757
www.wspgroup.com

Please consider the environment before printing this email.

Appendix C

TRAFFIC ANALYSIS

- **Estimated Traffic Turning Movement at Study Intersection**

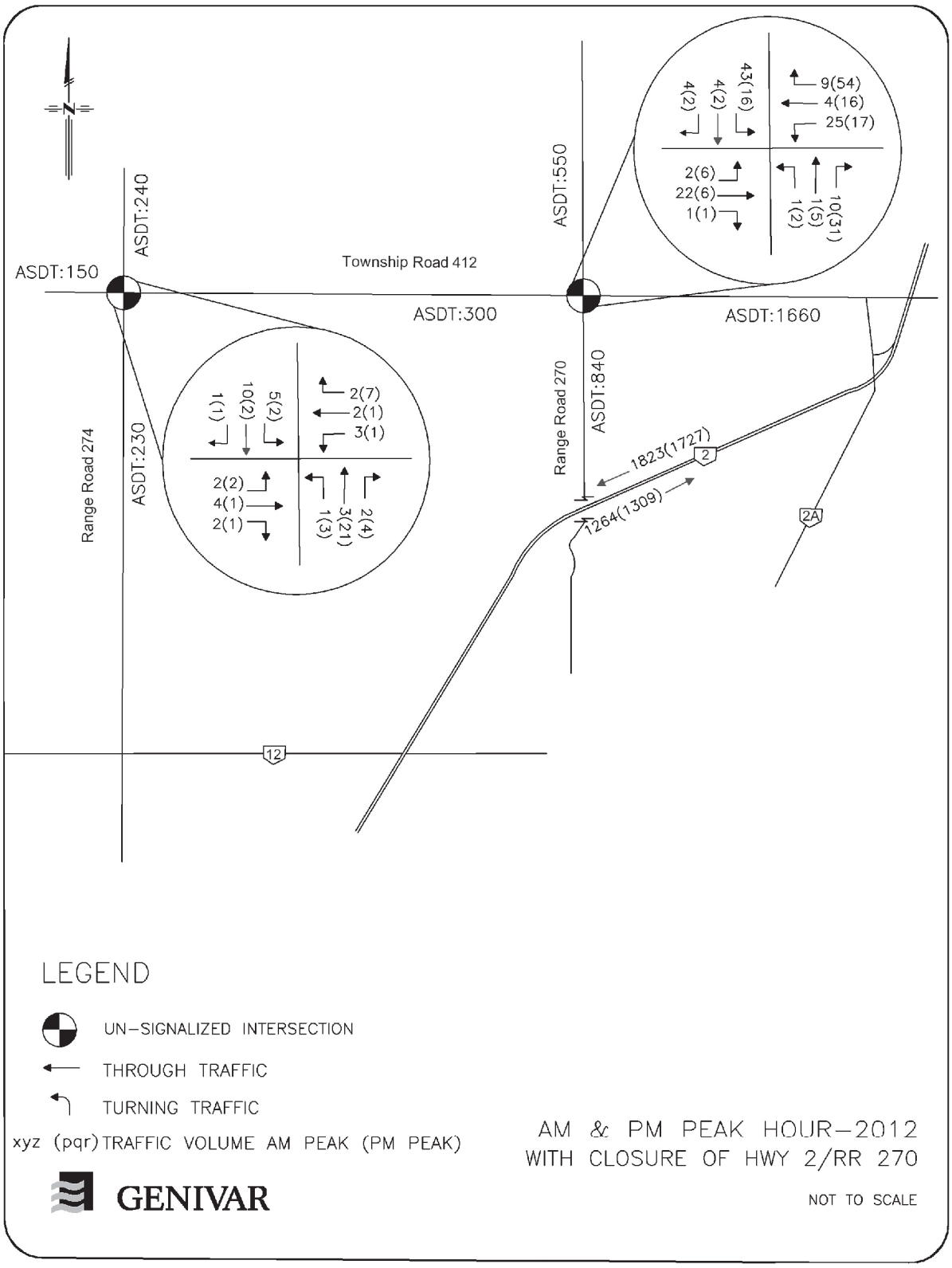


Exhibit 7: Forecasted Traffic (2012) – With Closure of HWY 2 / RR 270

Appendix D

INTERSECTION ANALYSIS

- **Illumination Warrant Analysis**
- **Recreational Vehicle Turning Movements**

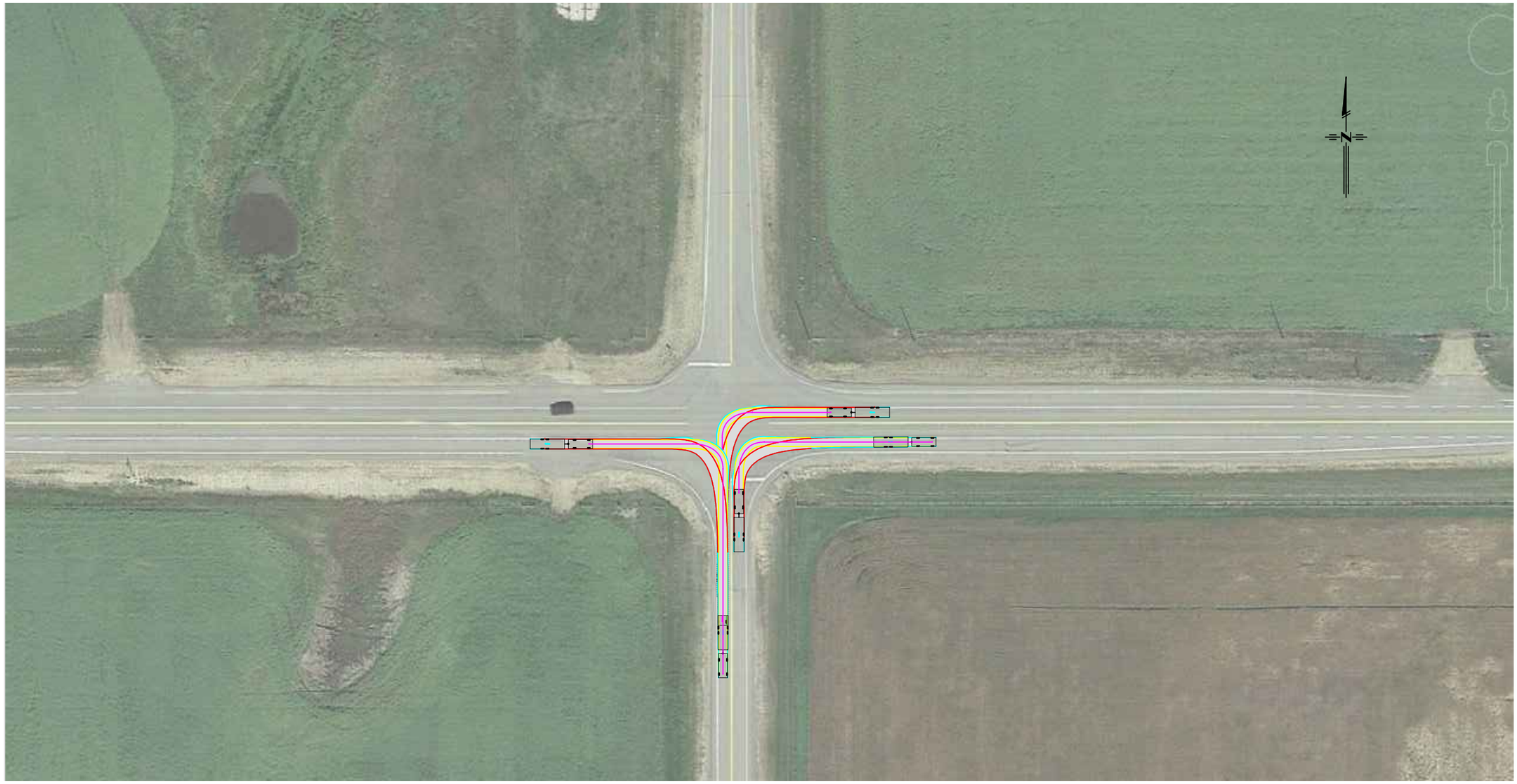
Road Name	**Township Road 412 / Range Road 270**
From	**20 Year Horizon (2037) Traffic Volumes**
Warrant Undertaken by	**James Sun**
Company Name	**WSP Canada Inc.**
Date	**14-Feb-16**

Warrant for Intersection Lighting (See Note 2)

Item No.	Classification Factor	Rating Factor 'R' 0	1	2	3	4	Weight Subcategory (if Applicable)	Weight 'W'	Enter 'R' Here	Score 'R' x 'W'	
Geometric Factors (G)											
1	Channelization	None	Right and/or Left Turn Lanes on Minor Approaches Only	Right Turn Lane(s) Only on Major Leg(s)	Left Turn Lane(s) on Major Leg(s)	Left and Right Turn Lanes on All Legs	Raised and Operating Speed Less than 70 km/h on at Least One Channelized Approach or	15			Only ONE 'R' Value is To Be Entered for These Three Rows!
							Raised and Operating Speed Less than 70 km/h or More on at Least One Channelized Approach or	20			
							Painted Only	5	0	0	
2	Approach Sight Distances on the Most Constrained Approach (Relative to Recommended Minimum Intersection Sight Distance)	100% or More	75% to 99%	50% to 74%	25% to 49%	<25%		10	0	0	
3	Horizontal Curvatures (Radius) at or Immediately Before Intersection on Any Leg for Posted Speed Limit of:										
	110 km/hr:	Tangent	>1800 m	1150 to 1800 m	750 to 1150 m	<750 m		5	0	0	
	90 or 100 km/h:	Tangent	>1400 m	950 to 1400 m	600 to 950 m	<600 m					
	70 or 80 km/h:	Tangent	>950 m	550 to 950 m	340 to 550 m	<340 m					
	60 km/h:	Tangent	>575 m	320 to 575 m	190 to 320 m	<190 m					
4	Angle of Intersection or Offset Intersection	90 Degree Angle	80 or 100 Degree Angle	-	70 or 110 Degree Angle	<70 or >110 Degree or Offset Intersection		5	0	0	
5	Downhill Approach Grades at or Immdediately Before Intersection on Any Leg	<3.0%	3.1 to 3.9% and Meets Design Guidelines for Type and Speed of Road	4.0 to 4.9% and Meets Design Guidelines for Type and Speed of Road	5.0 to 7.0% and Meets Design Guidelines for Type and Speed of Road	>7.0% OR Exceeds Maximum Gradient for Type and Speed of Road		3	0	0	
6	Number of Legs	-	3	4	5	6 or More		3	2	6	
									Subtotal Geometric Factors	6	G
Operational Factors (O)											
If the Intersection is signalized, Illumination is Warranted If the Intersection is NOT Signalized, Points should be Calculated on the Basis of EITHER the AADT Factor or the Signalization Warrant Factor.											
7	Either AADT (2-Way) (See Note 1): On Major Road and	<1000	1000 to 2000	2000 to 3000	3000 to 5000	>5000		10	1	10	
	On Minor Road	<500	500 to 1000	1000 to 1500	1500 to 2000	>2000		20	1	20	
	or Signalization Warrant (See Note 1)	Intersection Not Signalized and Volume-Based Signal Warrant is Less than 20% Satisfied	Intersection Not Signalized and Volume-Based Warrant is 20% to 40% Satisfied	Intersection Not Signalized and Volume-Based Warrant is 40% to 60% Satisfied	Intersection is Not Signalized and Volume-Based Warrant is Over 80% Satisfied			30			
8	Regular Nighttime Hourly Pedestrian Volume (See Note 2)	No Pedestrians	Up to 10	10 to 30	30 to 50	Over 50		10	0	0	
9	Intersection Roadway Classifications	No Primary Road Involved	Primary/Rural Major, Primary Rural Minor, or Primary/Designated Community Access	Primary/Secondary	Primary/Primary	Intersection Includes Divided Highway		5	0	0	
10	Operating Speed or Posted Speed Limit on Major Road (See Note 3)	50 km/h or Less	60 km/h	70 km/h	80 km/h	90 km/h or Over		5	3	15	
11	Operating Speed or Posted Speed Limit on Minor Road (See Note 3)	50 km/h or Less	60 km/h	70 km/h	80 km/h	90 km/h or Over		5	4	20	
									Subtotal Operational Factors	65	O
Environmental Factors (E)											
12	Lighted Development Within 150 m Radius of Intersection	-	In One Quadrant	In Two Quadrants	In Three Quadrants	In Four Quadrants		5	0	0	
									Subtotal Environmental Factors	0	E
Collision Factors (A)											
13	Average Annual Nighttime Collision Frequency (See Note 4) or Rate of Last Three Year (Only Collisions Potentially Attributable to Inadequate Lighting)	0 Collisions per Year	1 Collision per Year	-	3 or More Colisions Per Year OR At Least 1.5 Collisions per Million Entering Vehicles per Year and an Average Ratio of All Night-to-Day Collisions of at Least 1.5		1 or 2 Collisions per Year	15	0	0	Only ONE 'R' Value is To Be Entered for These Two Rows!
							3 or More Collisions per Year or Rate ≥1.5 Collisions/MEV	30			
									Subtotal Collision Factors	0	A
									G+O+E+A = Total Warranting Points	71	
									Warranting Condition	120	
									Difference ±	-49	D

Notes:

1 If the intersecition is not signalized, the user should choose EITHER the AADT OR the signalization factor. The points from either factor, but not both factors, may be used for the warrant point calculations.
2 The number of certain types of vulnerable pedestrians should be factored to reflect their increased need for visibility.
The number of child pedestrians (ages 12 and under) should be multiplied by two, and the number of senior pedestrians (age 65 and over) should be multiplied by 1.5.
3 85th percentile nighttime speed should be used, if available. Otherwise the posted speed may be used.
4 Reported collisions, rounded to the nearest whole number.



WSP

1200, 10909 JASPER AVENUE,
EDMONTON, ALBERTA CANADA, T5J 3L9
PHONE: 780 466-6555 - FAX: 780 463-0177 - WWW.WSPGROUP.COM

CLIENT:
THE NURSERY GOLF AND COUNTRY CLUB INC.

PROJECT:
RV PARK TIA

ISSUED FOR – REVISION:

IS	RE	DATE	DESCRIPTION

DISCIPLINE: CIVIL

TITLE: RECREATIONAL VEHICLE TURNING MOVEMENTS

PROJECT NO: 161–15869–00

DESIGNED BY: J.SUN

DRAWN BY: J.SUN

CHECKED BY: --

SCALE: 1:1000

DATE: --

IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.

25mm

SHEET NUMBER: 161–15869–00–01

SHEET #: 01 OF --

ISSUE: REVIEW

DATE OF: FEBRUARY 14, 2017

REV # 0

U:\PROJECTS\2017\Nursery Golf Course RV Development\Turning Movements\161–15869–00.dwg 01 Feb. 13, 2017 3:50 PM – Sun, James

11" x 17" (Tabloid) Last Saved: Feb. 13, 2017 3:50 PM By: james.sun

Appendix E

CAPACITY ANALYSIS

- **Synchro Outputs**
- **HCM 2010 Two-Lane Highway Capacity Analyses**

Intersection	
Int Delay, s/veh	5.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	22	1	10	4	9	1	1	2	43	1	4
Future Vol, veh/h	2	22	1	10	4	9	1	1	2	43	1	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	600	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	28	1	13	5	11	1	1	3	54	1	5

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	16	0	0	29	0	0	72	74	28	71	70	11
Stage 1	-	-	-	-	-	-	33	33	-	36	36	-
Stage 2	-	-	-	-	-	-	39	41	-	35	34	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1602	-	-	1584	-	-	919	816	1047	920	821	1070
Stage 1	-	-	-	-	-	-	983	868	-	980	865	-
Stage 2	-	-	-	-	-	-	976	861	-	981	867	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1602	-	-	1584	-	-	907	808	1047	910	813	1070
Mov Cap-2 Maneuver	-	-	-	-	-	-	907	808	-	910	813	-
Stage 1	-	-	-	-	-	-	981	866	-	978	858	-
Stage 2	-	-	-	-	-	-	962	854	-	975	865	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	3.2	8.8	9.2
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	941	1602	-	-	1584	-	-	919
HCM Lane V/C Ratio	0.005	0.002	-	-	0.008	-	-	0.065
HCM Control Delay (s)	8.8	7.3	-	-	7.3	-	-	9.2
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.2

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	6	1	9	16	54	1	2	8	16	2	2
Future Vol, veh/h	6	6	1	9	16	54	1	2	8	16	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	600	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	8	1	11	20	68	1	3	10	20	3	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	88	0	0	9	0	0	102	133	8	105	100	54
Stage 1	-	-	-	-	-	-	23	23	-	76	76	-
Stage 2	-	-	-	-	-	-	79	110	-	29	24	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1508	-	-	1611	-	-	879	758	1074	875	790	1013
Stage 1	-	-	-	-	-	-	995	876	-	933	832	-
Stage 2	-	-	-	-	-	-	930	804	-	988	875	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1508	-	-	1611	-	-	867	749	1074	857	780	1013
Mov Cap-2 Maneuver	-	-	-	-	-	-	867	749	-	857	780	-
Stage 1	-	-	-	-	-	-	990	871	-	928	826	-
Stage 2	-	-	-	-	-	-	919	799	-	971	870	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.4	0.8	8.7	9.3
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	976	1508	-	-	1611	-	-	862
HCM Lane V/C Ratio	0.014	0.005	-	-	0.007	-	-	0.029
HCM Control Delay (s)	8.7	7.4	-	-	7.2	-	-	9.3
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	5.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	2	23	2	13	4	9	2	2	6	44	2	4
Future Vol, veh/h	2	23	2	13	4	9	2	2	6	44	2	4
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	600	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	29	3	16	5	11	3	3	8	55	3	5

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	16	0	0	31	0	0	82	84	30	83	79	11
Stage 1	-	-	-	-	-	-	35	35	-	43	43	-
Stage 2	-	-	-	-	-	-	47	49	-	40	36	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1602	-	-	1582	-	-	905	806	1044	904	811	1070
Stage 1	-	-	-	-	-	-	981	866	-	971	859	-
Stage 2	-	-	-	-	-	-	967	854	-	975	865	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1602	-	-	1582	-	-	890	796	1044	887	801	1070
Mov Cap-2 Maneuver	-	-	-	-	-	-	890	796	-	887	801	-
Stage 1	-	-	-	-	-	-	979	864	-	969	850	-
Stage 2	-	-	-	-	-	-	950	845	-	963	863	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.5	3.6	8.8	9.3
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	952	1602	-	-	1582	-	-	895
HCM Lane V/C Ratio	0.013	0.002	-	-	0.01	-	-	0.07
HCM Control Delay (s)	8.8	7.3	-	-	7.3	-	-	9.3
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.2

Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	6	6	2	14	16	55	2	3	11	16	3	2
Future Vol, veh/h	6	6	2	14	16	55	2	3	11	16	3	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	600	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	8	8	3	18	20	69	3	4	14	20	4	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	89	0	0	10	0	0	117	148	9	122	114	54
Stage 1	-	-	-	-	-	-	24	24	-	89	89	-
Stage 2	-	-	-	-	-	-	93	124	-	33	25	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1506	-	-	1610	-	-	859	743	1073	853	776	1013
Stage 1	-	-	-	-	-	-	994	875	-	918	821	-
Stage 2	-	-	-	-	-	-	914	793	-	983	874	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1506	-	-	1610	-	-	843	731	1073	828	763	1013
Mov Cap-2 Maneuver	-	-	-	-	-	-	843	731	-	828	763	-
Stage 1	-	-	-	-	-	-	989	870	-	913	812	-
Stage 2	-	-	-	-	-	-	897	784	-	961	869	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.2	1.2	8.8	9.5
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	956	1506	-	-	1610	-	-	832
HCM Lane V/C Ratio	0.021	0.005	-	-	0.011	-	-	0.032
HCM Control Delay (s)	8.8	7.4	-	-	7.3	-	-	9.5
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	6.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	3	33	4	21	6	14	4	4	11	65	4	6
Future Vol, veh/h	3	33	4	21	6	14	4	4	11	65	4	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	600	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	4	41	5	26	8	18	5	5	14	81	5	8

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	25	0	0	46	0	0	126	129	44	130	123	16
Stage 1	-	-	-	-	-	-	51	51	-	69	69	-
Stage 2	-	-	-	-	-	-	75	78	-	61	54	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1589	-	-	1562	-	-	848	762	1026	843	767	1063
Stage 1	-	-	-	-	-	-	962	852	-	941	837	-
Stage 2	-	-	-	-	-	-	934	830	-	950	850	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1589	-	-	1562	-	-	826	747	1026	815	752	1063
Mov Cap-2 Maneuver	-	-	-	-	-	-	826	747	-	815	752	-
Stage 1	-	-	-	-	-	-	960	850	-	939	823	-
Stage 2	-	-	-	-	-	-	906	816	-	929	848	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.5	3.8	9.1	9.9
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	908	1589	-	-	1562	-	-	827
HCM Lane V/C Ratio	0.026	0.002	-	-	0.017	-	-	0.113
HCM Control Delay (s)	9.1	7.3	-	-	7.3	-	-	9.9
HCM Lane LOS	A	A	-	-	A	-	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0.4

Intersection	
Int Delay, s/veh	3.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	9	4	24	24	81	4	5	18	24	5	3
Future Vol, veh/h	9	9	4	24	24	81	4	5	18	24	5	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	600	-	-	600	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	11	5	30	30	101	5	6	23	30	6	4

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	131	0	0	16	0	0	182	227	14	192	180	81
Stage 1	-	-	-	-	-	-	36	36	-	141	141	-
Stage 2	-	-	-	-	-	-	146	191	-	51	39	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1454	-	-	1602	-	-	779	672	1066	768	714	979
Stage 1	-	-	-	-	-	-	980	865	-	862	780	-
Stage 2	-	-	-	-	-	-	857	742	-	962	862	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1454	-	-	1602	-	-	755	654	1066	731	695	979
Mov Cap-2 Maneuver	-	-	-	-	-	-	755	654	-	731	695	-
Stage 1	-	-	-	-	-	-	973	858	-	855	765	-
Stage 2	-	-	-	-	-	-	831	728	-	928	855	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	3.1	1.4	9.1	10.1
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	905	1454	-	-	1602	-	-	743
HCM Lane V/C Ratio	0.037	0.008	-	-	0.019	-	-	0.054
HCM Control Delay (s)	9.1	7.5	-	-	7.3	-	-	10.1
HCM Lane LOS	A	A	-	-	A	-	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0.2

TWO-LANE HIGHWAY LOS WORKSHEET

Analyst: James Sun Date: 2017-02-14

Site Information				
Highway		Township Road 412		
From / to		East of Range Road 270		
Jurisdiction		Lacombe County		
Analysis Year and Time Period		**2017 AM Peak Hour**		
Input Data				
Highway Classification		Class II		
Two-way Hourly Volume		90		
Truck Percentage		5%		
Directional Split		75/25		
Peak Hour Factor (PHF):		0.8		
Lane Width (ft)		12.0		
Shoulder Width (ft)		3.0		
Base Free Flow Speed (BFFS) (mi/h)		68		
Access Points (points / mi)		2		
No-passing zones		30%		
Estimate Free Flow Speed (FFS)				
Adjustment Factor for Lane and Shoulder Width		2.6		Exhibit 15-7
Adjustment Factor for Access Points		1.0		Exhibit 15-8
FFS (mi/h)		64.4		
Demand Adjustment for PTSF				
Eastbound Volume (V1, veh/h)		67		
Westbound Volume (V2, veh/h)		23		
Adjustment Factor for Grades		1.0		
Adjustment Factor for Heavey Vehicles (ET)		1.1		Exhibit 15-18
Adjustment Factor for Recreational Vehicles (ER)		1.0		
Heavey Vehicle Adjustment Factor (fHV, PTSF)		0.995		
Adjusted Demand Flow Rates				
Eastbound Volume (V1,PTSF)		84		
Westbound Volume (V2, PTSF)		29		
Estimate Percent Time-Spent-Following (PTSF)				
Eastbound	a	-0.0014		Exhibit 15-20
	b	0.973		
Westbound	a	-0.0014		Exhibit 15-20
	b	0.973		
Non-Passing Zone Adjustment Factor (fnp, PTSF)		33	%	Exhibit 15-21
Base Percent Time-Spent-Following (BPTSF)				
Eastbound		9.9%		Exhibit 15-10
Westbound		3.6%		
PTSF			**LOS**	
Eastbound		24.7%	**A**	Equation 15-9
Westbound		8.5%	**A**	
Determine Capaciy				
Eastbound		1692	veh/h	Equation 15-13

	Westbound	1692 veh/h

TWO-LANE HIGHWAY LOS WORKSHEET

Analyst: James Sun Date: 2017-02-14

Site Information				
Highway		Township Road 412		
From / to		East of Range Road 270		
Jurisdiction		Lacombe County		
Analysis Year and Time Period		**2017 PM Peak Hour**		
Input Data				
Highway Classification		Class II		
Two-way Hourly Volume		109		
Truck Percentage		5%		
Directional Split		75/25		
Peak Hour Factor (PHF):		0.8		
Lane Width (ft)		12.0		
Shoulder Width (ft)		3.0		
Base Free Flow Speed (BFFS) (mi/h)		68		
Access Points (points / mi)		2		
No-passing zones		30%		
Estimate Free Flow Speed (FFS)				
Adjustment Factor for Lane and Shoulder Width		2.6		Exhibit 15-7
Adjustment Factor for Access Points		1.0		Exhibit 15-8
FFS (mi/h)		64.4		
Demand Adjustment for PTSF				
Eastbound Volume (V1, veh/h)		30		
Westbound Volume (V2, veh/h)		79		
Adjustment Factor for Grades		1.0		
Adjustment Factor for Heavey Vehicles (ET)		1.1		Exhibit 15-18
Adjustment Factor for Recreational Vehicles (ER)		1.0		
Heavey Vehicle Adjustment Factor (fHV, PTSF)		0.995		
Adjusted Demand Flow Rates				
Eastbound Volume (V1,PTSF)		38		
Westbound Volume (V2, PTSF)		99		
Estimate Percent Time-Spent-Following (PTSF)				
Eastbound	a	-0.0014		Exhibit 15-20
	b	0.973		
Westbound	a	-0.0014		Exhibit 15-20
	b	0.973		
Non-Passing Zone Adjustment Factor (fnp, PTSF)		33	%	Exhibit 15-21
Base Percent Time-Spent-Following (BPTSF)				
Eastbound		4.7%		Exhibit 15-10
Westbound		11.5%		
PTSF			**LOS**	
Eastbound		9.1%	**A**	Equation 15-9
Westbound		24.0%	**A**	
Determine Capaciy				
Eastbound		1692	veh/h	Equation 15-13

	Westbound	1692 veh/h

TWO-LANE HIGHWAY LOS WORKSHEET

Analyst: James Sun Date: 2017-02-14

Site Information				
Highway		Township Road 412		
From / to		East of Range Road 270		
Jurisdiction		Lacombe County		
Analysis Year and Time Period		**2018 Post-Development AM Peak Hour**		
Input Data				
Highway Classification		Class II		
Two-way Hourly Volume		99		
Truck Percentage		5%		
Directional Split		75/25		
Peak Hour Factor (PHF):		0.8		
Lane Width (ft)		12.0		
Shoulder Width (ft)		3.0		
Base Free Flow Speed (BFFS) (mi/h)		68		
Access Points (points / mi)		2		
No-passing zones		30%		
Estimate Free Flow Speed (FFS)				
Adjustment Factor for Lane and Shoulder Width		2.6		Exhibit 15-7
Adjustment Factor for Access Points		1.0		Exhibit 15-8
FFS (mi/h)		64.4		
Demand Adjustment for PTSF				
Eastbound Volume (V1, veh/h)		73		
Westbound Volume (V2, veh/h)		26		
Adjustment Factor for Grades		1.0		
Adjustment Factor for Heavey Vehicles (ET)		1.1		Exhibit 15-18
Adjustment Factor for Recreational Vehicles (ER)		1.0		
Heavey Vehicle Adjustment Factor (fHV, PTSF)		0.995		
Adjusted Demand Flow Rates				
Eastbound Volume (V1,PTSF)		92		
Westbound Volume (V2, PTSF)		33		
Estimate Percent Time-Spent-Following (PTSF)				
Eastbound	a	-0.0014		Exhibit 15-20
	b	0.973		
Westbound	a	-0.0014		Exhibit 15-20
	b	0.973		
Non-Passing Zone Adjustment Factor (fnp, PTSF)		33	%	Exhibit 15-21
Base Percent Time-Spent-Following (BPTSF)				
Eastbound		10.7%		Exhibit 15-10
Westbound		4.1%		
PTSF			**LOS**	
Eastbound		24.4%	**A**	Equation 15-9
Westbound		8.7%	**A**	
Determine Capaciy				
Eastbound		1692	veh/h	Equation 15-13

	Westbound	1692 veh/h

TWO-LANE HIGHWAY LOS WORKSHEET

Analyst: James Sun Date: 2017-02-14

Site Information				
Highway		Township Road 412		
From / to		East of Range Road 270		
Jurisdiction		Lacombe County		
Analysis Year and Time Period		**2018 Post-Development PM Peak Hour**		
Input Data				
Highway Classification		Class II		
Two-way Hourly Volume		118		
Truck Percentage		5%		
Directional Split		75/25		
Peak Hour Factor (PHF):		0.8		
Lane Width (ft)		12.0		
Shoulder Width (ft)		3.0		
Base Free Flow Speed (BFFS) (mi/h)		68		
Access Points (points / mi)		2		
No-passing zones		30%		
Estimate Free Flow Speed (FFS)				
Adjustment Factor for Lane and Shoulder Width		2.6		Exhibit 15-7
Adjustment Factor for Access Points		1.0		Exhibit 15-8
FFS (mi/h)		64.4		
Demand Adjustment for PTSF				
Eastbound Volume (V1, veh/h)		33		
Westbound Volume (V2, veh/h)		85		
Adjustment Factor for Grades		1.0		
Adjustment Factor for Heavey Vehicles (ET)		1.1		Exhibit 15-18
Adjustment Factor for Recreational Vehicles (ER)		1.0		
Heavey Vehicle Adjustment Factor (fHV, PTSF)		0.995		
Adjusted Demand Flow Rates				
Eastbound Volume (V1,PTSF)		41		
Westbound Volume (V2, PTSF)		107		
Estimate Percent Time-Spent-Following (PTSF)				
Eastbound	a	-0.0014		Exhibit 15-20
	b	0.973		
Westbound	a	-0.0014		Exhibit 15-20
	b	0.973		
Non-Passing Zone Adjustment Factor (fnp, PTSF)		33	%	Exhibit 15-21
Base Percent Time-Spent-Following (BPTSF)				
Eastbound		5.1%		Exhibit 15-10
Westbound		12.3%		
PTSF			**LOS**	
Eastbound		9.3%	**A**	Equation 15-9
Westbound		23.9%	**A**	
Determine Capaciy				
Eastbound		1692	veh/h	Equation 15-13

	Westbound	1692 veh/h

TWO-LANE HIGHWAY LOS WORKSHEET

Analyst: James Sun Date: 2017-02-14

Site Information				
Highway		Township Road 412		
From / to		East of Range Road 270		
Jurisdiction		Lacombe County		
Analysis Year and Time Period		**2037 Post-Development AM Peak Hour**		
Input Data				
Highway Classification		Class II		
Two-way Hourly Volume		150		
Truck Percentage		5%		
Directional Split		75/25		
Peak Hour Factor (PHF):		0.8		
Lane Width (ft)		12.0		
Shoulder Width (ft)		3.0		
Base Free Flow Speed (BFFS) (mi/h)		68		
Access Points (points / mi)		2		
No-passing zones		30%		
Estimate Free Flow Speed (FFS)				
Adjustment Factor for Lane and Shoulder Width		2.6		Exhibit 15-7
Adjustment Factor for Access Points		1.0		Exhibit 15-8
FFS (mi/h)		64.4		
Demand Adjustment for PTSF				
Eastbound Volume (V1, veh/h)		109		
Westbound Volume (V2, veh/h)		41		
Adjustment Factor for Grades		1.0		
Adjustment Factor for Heavey Vehicles (ET)		1.1		Exhibit 15-18
Adjustment Factor for Recreational Vehicles (ER)		1.0		
Heavey Vehicle Adjustment Factor (fHV, PTSF)		0.995		
Adjusted Demand Flow Rates				
Eastbound Volume (V1,PTSF)		137		
Westbound Volume (V2, PTSF)		52		
Estimate Percent Time-Spent-Following (PTSF)				
Eastbound	a	-0.0014		Exhibit 15-20
	b	0.973		
Westbound	a	-0.0014		Exhibit 15-20
	b	0.973		
Non-Passing Zone Adjustment Factor (fnp, PTSF)		33	%	Exhibit 15-21
Base Percent Time-Spent-Following (BPTSF)				
Eastbound		15.5%		Exhibit 15-10
Westbound		6.3%		
PTSF			**LOS**	
Eastbound		24.1%	**A**	Equation 15-9
Westbound		9.1%	**A**	
Determine Capaciy				
Eastbound		1692	veh/h	Equation 15-13

	Westbound	1692 veh/h

TWO-LANE HIGHWAY LOS WORKSHEET

Analyst: James Sun Date: 2017-02-14

Site Information				
Highway		Township Road 412		
From / to		East of Range Road 270		
Jurisdiction		Lacombe County		
Analysis Year and Time Period		**2037 Post-Development PM Peak Hour**		
Input Data				
Highway Classification		Class II		
Two-way Hourly Volume		180		
Truck Percentage		5%		
Directional Split		75/25		
Peak Hour Factor (PHF):		0.8		
Lane Width (ft)		12.0		
Shoulder Width (ft)		3.0		
Base Free Flow Speed (BFFS) (mi/h)		68		
Access Points (points / mi)		2		
No-passing zones		30%		
Estimate Free Flow Speed (FFS)				
Adjustment Factor for Lane and Shoulder Width		2.6		Exhibit 15-7
Adjustment Factor for Access Points		1.0		Exhibit 15-8
FFS (mi/h)		64.4		
Demand Adjustment for PTSF				
Eastbound Volume (V1, veh/h)		51		
Westbound Volume (V2, veh/h)		129		
Adjustment Factor for Grades		1.0		
Adjustment Factor for Heavey Vehicles (ET)		1.1		Exhibit 15-18
Adjustment Factor for Recreational Vehicles (ER)		1.0		
Heavey Vehicle Adjustment Factor (fHV, PTSF)		0.995		
Adjusted Demand Flow Rates				
Eastbound Volume (V1,PTSF)		64		
Westbound Volume (V2, PTSF)		162		
Estimate Percent Time-Spent-Following (PTSF)				
Eastbound	a	-0.0014		Exhibit 15-20
	b	0.973		
Westbound	a	-0.0014		Exhibit 15-20
	b	0.973		
Non-Passing Zone Adjustment Factor (fnp, PTSF)		33	%	Exhibit 15-21
Base Percent Time-Spent-Following (BPTSF)				
Eastbound		7.7%		Exhibit 15-10
Westbound		17.9%		
PTSF			**LOS**	
Eastbound		9.4%	**A**	Equation 15-9
Westbound		23.8%	**A**	
Determine Capaciy				
Eastbound		1692	veh/h	Equation 15-13

	Westbound	1692 veh/h