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Claystone Developments

Prairie Rose Park – Concept Plan

Prepared for:

The Town of Langham

Town of LANGHAM

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Table of Contents

1.0 Introduction 2
1.1 Location Plan 2
2.0 Background 3
2.1 Ownership 3
2.2 Existing Land Use 3
2.3 Adjacent Land Use 3
2.4 Future Land Use 3
2.5 Topography 3
2.6 Utilities & Easements 4
3.0 Land Use Plan 5
3.1 Vision 5
3.2 Land Uses 6
3.3 Land Use Statistics 8
4.0 Regulatory Framework 8
4.1 Official Community Plan 8
4.2 Zoning Bylaw 12
5.0 Transportation 12
5.1 Roadways 12
5.2 Traffic Impact Assessment 13
6.0 Servicing 13
6.1 Water Distribution 13
6.2 Sanitary Sewer 14
6.3 Stormwater 15
6.4 Pond Configurations 19
7.0 Phasing 20

Appendix A – Figures

Appendix B – Sanitary Sewer Calculations

Appendix C – Traffic Impact Assessment

1.0 Introduction

The following report was prepared by Catterall & Wright on behalf of Claystone Developments. It outlines the background and details of a proposed Concept Plan on Surface Parcels #204033574 and #204033585 in the Town of Langham. The proposed development, situated on the east side of the Town next to existing development, has a combined area of 35.31 ha (87.25 ac).

1.1 Location Plan

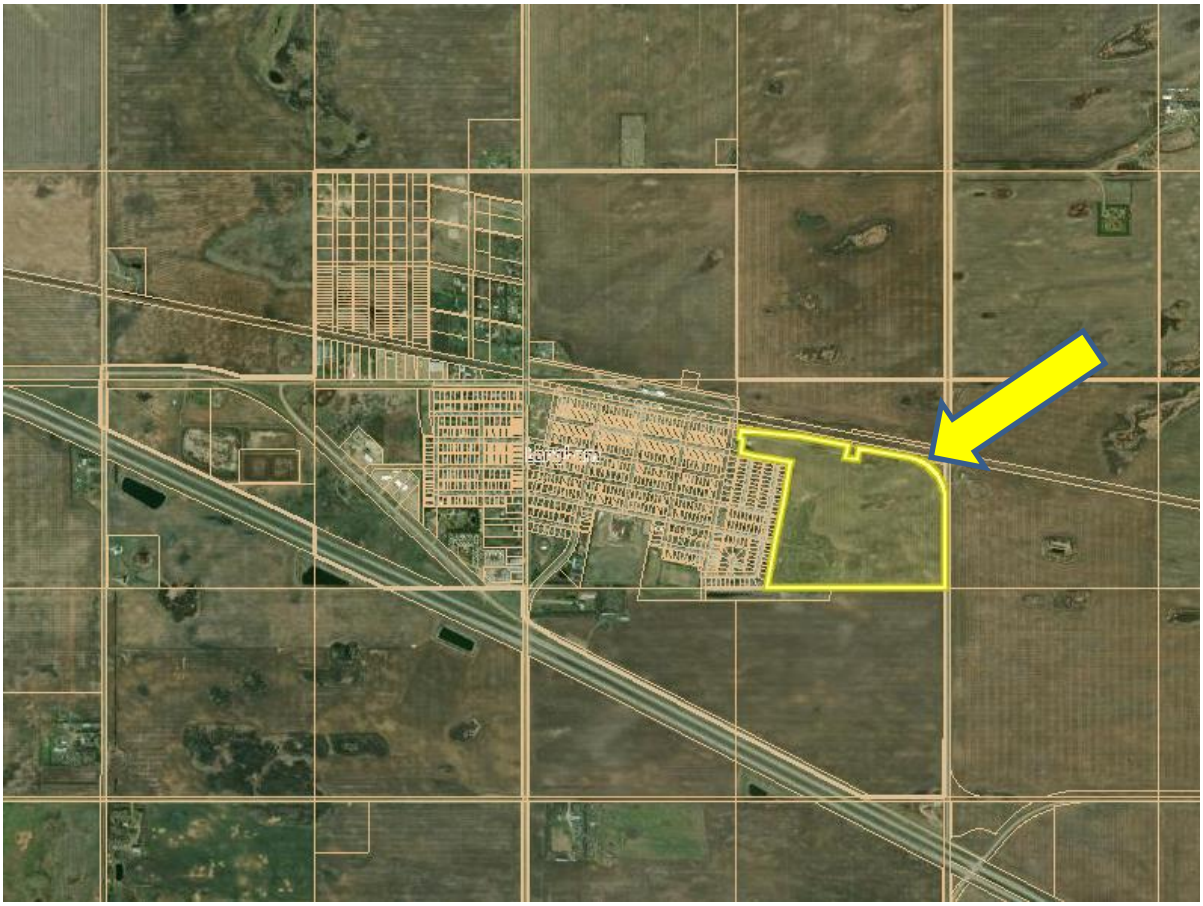


Figure 1 - Development Area

2.0 Background

2.1 Ownership

The subject lands are owned by the Town of Langham and Metta Properties Ltd. Claystone Developments has the option to purchase a portion of these lands for development. The intent is for a phased purchasing and development approach as the market warrants.

2.2 Existing Land Use

The subject lands are primarily used for agricultural purposes except for a few areas where tree bluffs are present and the southwest portion, which has some grading modifications completed several years ago. There are no buildings or structures on the property.

The property is zoned FUD – Future Urban Development.

2.3 Adjacent Land Use

To the south of the property is a Municipal Reserve and vacant land.

To the east of the property is Range Road 3073 and vacant land within the RM of Corman Park.

To the north of the property is Railway Street and vacant land within the Town that is designated as Future Open Space.

To the west of the property is existing low density residential development. This existing residential development consists of single family homes on typically 15m – 18m wide lots. Although all development in this area includes rear lanes, the most recently developed areas include front attached garages.

2.4 Future Land Use

The Town of Langham's Official Community Plan (OCP) identifies the parcel as Future Residential and Potential Residential.

2.5 Topography

The concept plan area generally drains from high points in the northeast to a low-lying area in the southwestern corner. Based on a review of existing topography and the Town's 2007 Storm Water Management Master Plan, this low-lying area was likely graded to create a wide shallow channel that ultimately discharges to the southwest around Finch Crescent south of Langham's existing soccer field, and through a network of swales and ditches which ultimately drains to the wastewater lagoon effluent ditch west of town. A significant 12.4 ha area of Langham drains into the linear park system, which will also serve as the stormwater outlet for the concept plan area. Therefore, this area must be considered

in future stormwater analysis. The figure below provides the general pre-existing drainage context for the concept area.

A review of existing topography indicates that the southwestern portion of the site has been partially graded away from its natural state. This includes a proposed crescent location as well as two high areas which are likely stockpile locations. Localized high and low points can be found throughout the concept area. Figure 4 in the attached drawing package includes contours for existing topography. See Appendix A for a detailed drawing showing the existing and proposed drainage.

2.6 Utilities & Easements

A 10m wide Sasktel easement runs east-west through the property. Note that this easement is located within a linear park on the proposed concept plan. While any conflicts will be addressed during the phase of development where the easement is present, it is anticipated that this easement be either within the park and/or back-of-lot.

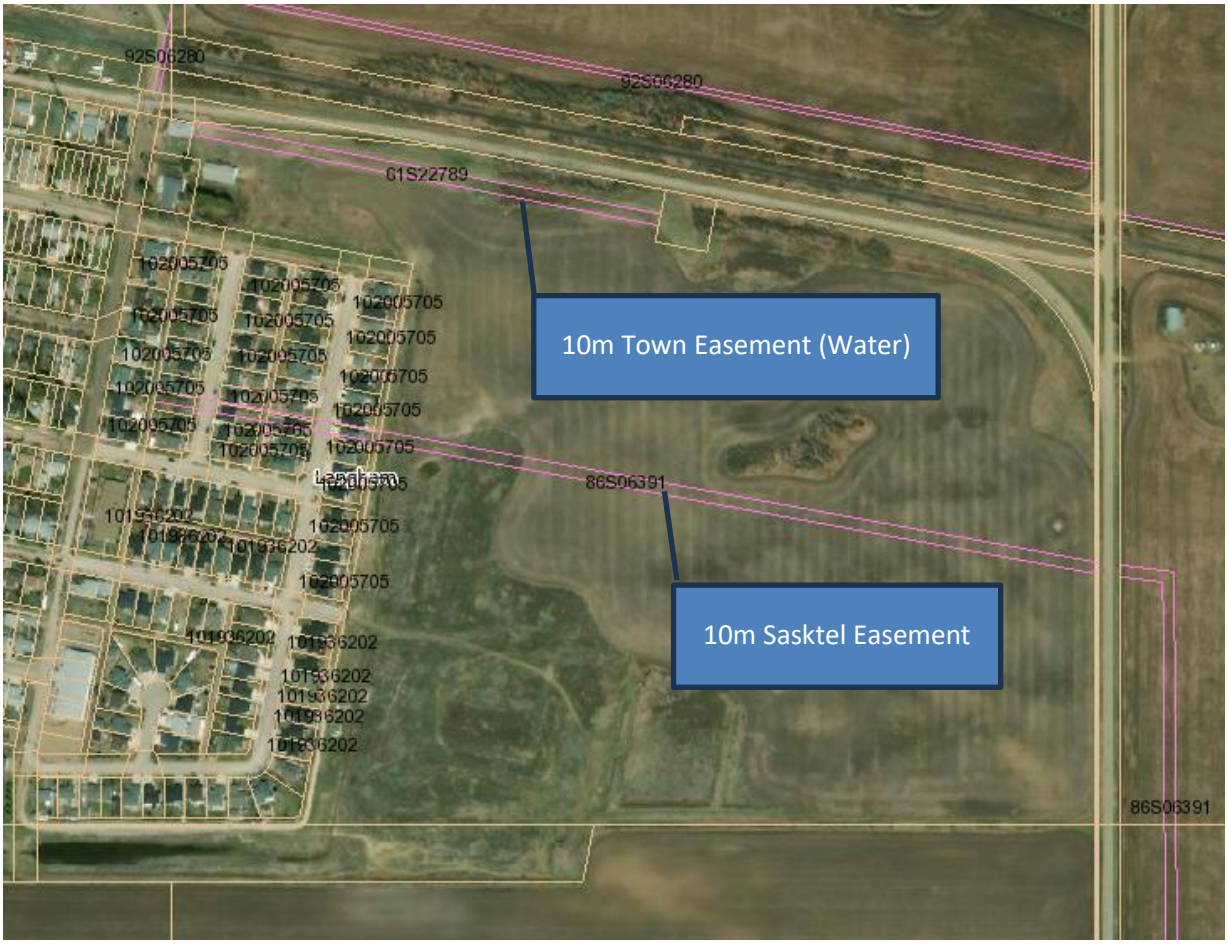


Figure 2 - Existing Easements

An additional 10m wide Town of Langham easement is located at the northern boundary of the property, spanning between a well site and the water treatment plant. Note this easement is located within a municipal buffer area on the proposed concept plan.

3.0 Land Use Plan

3.1 Vision

The proposed development is intended to provide a unique residential product to the Langham market. Many residential units back onto a series of linear green spaces, providing a highly sought-after housing product and pedestrian circulation system. The proposed development includes a mix of housing types, including low density residential (single family), and medium density (street townhouses, dwelling groups, and low/mid rise apartments). This mix of housing lends itself to attracting varying households in terms of income and housing needs. The proposed development also includes a mixed use parcel that intends to provide for commercial needs of the wider Langham community but also to stay flexible for multi-family development as the market warrants. In designing this development, the following key principles were considered:

Community

A new neighbourhood should be designed to create 'community'. This means creating a sense of place, where residents experience a sense of belonging. Unique public spaces, artwork, theming, streetscaping, and architectural guidelines are a few methods to achieve this. Anything that fosters interaction and pride in the community should be encouraged and implemented from the beginning.

Context

A new community needs to consider the environment, the economy, infrastructure (both existing and proposed), culture, recreation, and overall community well-being.

Moving Around

A well-designed community facilitates all modes of traffic. It has an adequate pedestrian linkage network, where those walking or cycling can circulate in, out, and around the community feeling comfortable and safe. The street network should disperse vehicular traffic where appropriate and provide sufficient access and egress.

Open & Natural

Successful communities embrace nature through parks, trails, forestry, and wetlands / ponds. In addition to providing recreational opportunities, these key features of a community encourage education of the natural environment. Every resident should be within a comfortable 5-minute walking distance to an open space where varying types of recreation are available.

The Future

Planning a community meets the current demand, but what about in 50 years? 100 years? Every effort should be made to create green infrastructure that reduces the cost of long-term maintenance, such as a storm system that utilizes overland drainage to natural low areas and storm water management facilities.

3.2 Land Uses

The land use plan is shown on the attached Figure – Concept Plan. Descriptions of each land use are as follows:

Low Density Residential

There are 10.43 ha of proposed low density residential development, equating to 156 units and 469 people. The low density residential development is dispersed throughout the development but primarily along local roadways and backing onto green spaces. Low density residential comes in the form of laned and laneless.

Providing laneless low density residential development to the Town of Langham is a new offering. Similar to most urban municipalities in Saskatchewan, the Town has always had rear lanes, and this form of development has continued. However, it is important to note that most urban municipalities experiencing growth will have a mix of laned and laneless housing product. The laned product is advantageous for facilitating narrow housing but also costs more due to the extra land required and surfacing construction. Laneless products are an appealing option for home buyers due to the convenience of having a 'garage to home' indoor access. Furthermore, builders continue to innovate and build houses of varying widths without a lane. For example, one of the most common lot widths in the City of Saskatoon is 10.36m.

The laneless product is primarily located on blocks backing the proposed parks.

Through discussions with Town of Langham staff, it was discovered that the lanes are not required for any Town services (eg. garbage pickup), and Town staff are amenable to providing both laned and laneless housing product.

Medium Density Residential

There are 10.39 ha of proposed medium density residential development, equating to 416 units and 831 people. Medium density residential may come in the form of semi-detached homes, street townhomes, dwelling group condominiums, or low/mid rise apartments. Due to the variety of housing types possible within this designation, a blended density rate of 40 units/ha was used to forecast units and population. The medium density residential areas are generally located at entrance points to the community and along busier roads, although some of the identified parcels that are only capable of a relatively lower density (eg. Street Townhomes) are located throughout the development.

Mixed-Use

There are 0.51 ha of proposed mixed use development, equating to 18 units and 36 people. This land use intends to make provision for either medium density residential development or small scale commercial development. As such, a blended density rate was used (35 units/ha) to forecast units and population. It is anticipated that the single mixed use site will be developed as residential; however, the developer will monitor demand for commercial development and prepare the site accordingly. Any commercial development proposed is not intended to compete with the downtown of Langham, but rather provide for either convenient/local commercial development or development that is benefited by pass-by traffic along Railway Street.

Municipal Reserve

The proposed development includes 3.43 ha of municipal reserve (MR) that can be programmed a variety of ways. Most of the MR areas are linear, which provides pedestrian circulation. Additionally, there is a large MR space (including a stormwater pond) in the southern part of the Concept Plan where a play structure could potentially be installed.

Municipal Reserve Calculation

Total Area	*35.29 ha*
Minus Utility	*0.26 ha*
Minus Buffers	*1.35 ha*
Minus Storm Ponds	*1.47 ha*
Total Developable Land	*32.21 ha*
10% MR Required	*3.22 ha*
MR Provided	*3.43 ha*
Over-dedication amount	*0.21 ha*

Note that the proposed development is currently showing a MR over-dedication of 0.21 ha. It is the developers intent to balance MR throughout the concept plan. This will take further analysis to establish storm pond sizes and may also include a concept plan amendment in future development phases.

The developer has consulted with the land owners (Metta Properties Ltd. and the Town of Langham) on future MR dedications to ensure a fair process. As phases of development proceed, the net lands entitlement for each land owner will be balanced via separate agreement.

Municipal Buffer

There are two municipal buffers in the proposed development, comprising 1.35 ha. The buffers purpose is primarily for spacing from roadways.

Utility

A single utility parcel (0.26 ha) is located in the north part of the proposed development. This parcel contains the Town well.

Roadways

Roadways proposed total 7.45 ha. Roadways are planned to establish connectivity in and out of the proposed development but also to be integrated with existing Langham development. The development will be connected via 3rd St E, Main St E, Railway St, Range Road 3073, and an additional connection to future development to the south.

3.3 Land Use Statistics

Claystone Developments - Prairie Rose Park							
Land Use	**Hectares**	**Acres**	**%**	**Units/Ha**	**Units**	**People/Unit**	**Population**
Residential							
Low Density	10.43	25.77	29.56%	15	156	3	469
Medium Density	10.39	25.67	29.44%	40	416	2	831
Mixed Use	0.51	1.26	1.45%	35	18	2	36
Total Residential	**21.33**	**52.71**	**60.44%**		**590**		**1336**
Roadways	**7.45**	**18.41**	**21.11%**				
Municipal Reserve	**3.43**	**8.48**	**9.72%**				
Municipal Buffer	**1.35**	**3.34**	**3.83%**				
Utility Area	**0.26**	**0.64**	**0.74%**				
Storm Pond (to HWL)	**1.47**	**3.63**	**4.17%**				
TOTAL	**35.29**	**87.20**	**100.00%**		**590**		**1336**
MR CALCULATION							
Developable Land	32.21	79.59					
Total MR Required	**3.22**	**7.96**					

Figure 3 - Land Use Statistics

4.0 Regulatory Framework

4.1 Official Community Plan

Langham's Official Community Plan (OCP) outlines various objectives and policies for new development in the Town. The following table displays relevant policies from the OCP, accompanied by the rationale of how the proposed development addresses the objective or policy.

Objective/Policy	Rationale
6.2(2) To allow for a full range of residential forms and densities which maximize housing accessibility for persons in all socioeconomic groups.	The proposed concept plan includes provision for low and medium density residential which will take the form single family homes, semi-detached home, townhomes, and low/mid rise apartments.
6.2(6) To support the development of pedestrian friendly, walkable and connected neighbourhoods.	The proposed concept plan includes a network of linear parks that facilitate pedestrian circulation within the neighbourhood and also to other areas of Langham.
6.2(7) To ensure that future forms of residential development are compatible with existing development, maintaining the character of Langham's residential neighbourhoods.	The developer's intent is to provide single family product that is of a similar size to existing Langham development. Multi family developments will be designed according to provisions of the zoning bylaw.
6.2(9) To accommodate affordable and alternative housing opportunities for the residents of Langham to age in place.	The proposed concept plan includes provision for single family, semi-detached homes, townhomes, and multi family development, lending itself to all ages and income levels.
6.2(10) To maintain a target density of 12.5 units per gross hectare in new residential developments.	The proposed development forecasts 16.7 units per gross hectare.
6.3(22) To promote walkability and the use of alternative transportation modes, residential areas shall be designed to serve pedestrian and cycling traffic as well as automobile traffic, creating safe and efficient linkages to schools, parks, public facilities and other community destinations.	The proposed concept includes consideration for a multi-use path network connecting local roadways with connection points to Main Street E, 3rd Street E, and future developments to the south.
7.2.1(1) To attract investment and foster economic growth. AND	The proposed concept plan includes a mixed use parcel adjacent to Railway St. This provides the visibility and access required for commercial development to be successful. It is important to note that the mixed use designation for this concept plan is intended to

7.2.1(2) To encourage business and increase employment and residential population within the Town.	be flexible between medium density residential and commercial uses. This flexibility is a key aspect to marketing the development to prospective buyers.
4.2(12) To promote and encourage a safe, accessible, and orderly multi-use transportation system throughout Langham to enhance traffic movements. 9.2(2) To promote land use and development patterns that ensure pedestrian and traffic safety. 9.3(7) Connectivity and traffic safety for pedestrians, cyclists and private vehicles shall be a consideration in all land use and development decisions. 9.2(9) To provide opportunities for the development of walking and cycling facilities within the Town of Langham, exploring linkages and connections between existing commercial areas (i.e. the downtown and along the service road); existing green spaces and destination sites within the community (e.g. community hall, rinks, schools, etc.); and existing and future residential areas within the community.	The proposed concept was designed with to meet typical requirements for intersection spacing and roadway network designs. Additionally, the proposed concept includes a multi-use path network connecting local roadways with connection points to Main Street E, 3rd Street E, and future developments to the south.
9.2(6) To ensure that future development remains within the area serviceable by the existing water and sewer system. 9.2(7) To encourage future development to align with the logical extension of existing infrastructure so much as feasible to maintain a compact form. 9.3 (1) Future subdivisions and development shall be logical, reasonable, and cost effective and will be limited to areas that can be efficiently provided with municipal services that will be serviceable at an acceptable cost to the Town.	The proposed concept plan is contained in an area which has been previously analyzed by Associated Engineering. The overall servicing strategies do not differ significantly from the Associated Engineering's previous analysis which indicated tie-in points to the City's existing water and sewer systems without needing additional booster stations or sewage pumping stations.

9.3(6) All developments shall be serviced in agreement with the Future Land Use Concept Plan or any future Area Concept Plans. The adequacy of municipal services will be monitored and upgrading or expansion of these systems shall equitably meet the needs of residents and other customers. Front-end costs of expanding municipal services and infrastructure shall be recovered through offsite development levies.	The proposed concept falls within Future and Potential Residential Areas as described in the Future Land Use Map. **It should be noted that there are proposed mixed use parcels in the concept which differ from the Future Land Use Map.** This change will be implemented through a future OCP amendment.
9.3(8) Subdivision and development proposals shall consider and confirm that sufficient functional capacity exists within municipal and provincial road networks. The Town may require the proponent to prepare a Traffic Impact Assessment where the existing capacity of these systems is in question or where required by the Ministry of Highways and Infrastructure.	The proposed development includes one access point to Railway Street. There is also one proposed access point to Range Road 3073. The proposed roadways with the subdivision will be local roadways servicing the proposed residential areas. Traffic generated by the development is not anticipated to have a major impact on any of the surrounding major roadways.
9.3(9) Subdivision and development within the vicinity of the CN Rail line shall be required to meet applicable provincial setback requirements, consider and assess the capacity of existing crossings and employ various screening and buffering techniques to promote public safety and mitigate nuisances related to noise and air pollution.	The proposed development is separated from the existing CN Rail line by Railway Street and therefor does not pose any setback constraints.
9.3(10) Lands necessary to extend utilities or other public services shall be dedicated at the time of subdivision.	Public services will be contained within proposed road right-of-ways. Additional correspondence with SaskTel will occur to discuss options for existing infrastructure in their easement which crosses the development area.

4.2 Zoning Bylaw

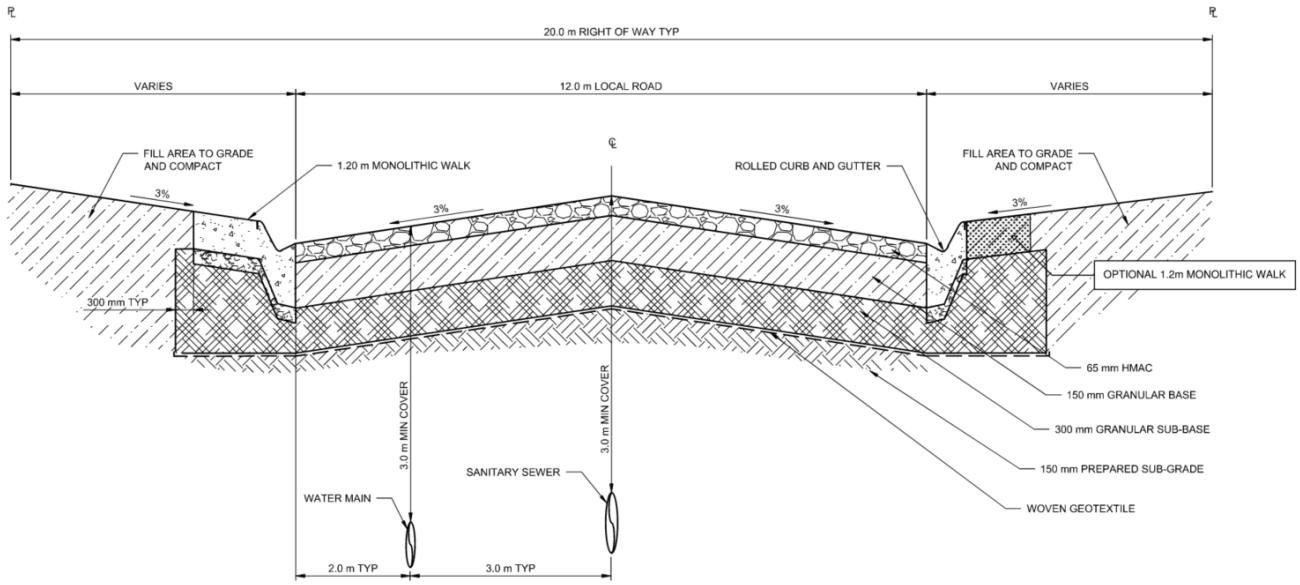
The subject lands are currently zoned Future Urban Development (FUD). In order to proceed with the first phase of development, a zoning map amendment is required. This will be implemented through a separate application to the Town.

5.0 Transportation

5.1 Roadways

The proposed transportation network includes a mix of 18m minor residential roads, 20m residential local roadways, and 6m lanes as per Section 3 of Langham's Development Standards. Refer to the attached concept plan for the location of these right-of-ways. Generally, the wider 20m ROW will be constructed on the 3rd Street extension and at proposed connection points to Highway 305 in the north and to the future neighbourhood to the south. The remainder of the proposed roadways will have 18m minor residential cross-sections. Using an 18m ROW in the residential areas allows for slightly larger residential lots over a 20m ROW. An 18 ROW has a 1.3m buffer distance to the property line from the back of walk and is widely used in other municipalities such as Saskatoon and Martensville. A design variance is requested from the Town's Development Standards.

Where indicated on the concept, 1.2m mono-walks will be installed. Langham's typical cross section is shown below for reference.



Typical Road Cross Section

5.2 Traffic Impact Assessment

A traffic impact assessment (TIA) was completed for the proposed development to establish the impact of the development on the existing traffic network and make recommendations to accommodate the increase in traffic, if needed. Based on the traffic operation analysis, the overall impact of the proposed development does not significantly impact the capacity, operations, or safety of the study intersections at any of the design horizons of the proposed development.

Though major improvements to the transportation network were not warranted, the completion of the study still resulted in the following recommendations to be made:

- It is recommended that the Ministry of Highways monitor the intersection of Highway 16 & Highway 305 for growth in left turn traffic and provide an exclusive left turn lane in the westbound direction when warranted.
- Within the northeast quadrant of the intersection of Highway 16 & Range Road 3074 there are existing trees within the sight triangle that are recommended to be removed. It is recommended that the Town of Langham and the Ministry of Highways ensure that no other developments, signs, or property fences be installed within the sight triangle.

6.0 Servicing

The overall servicing plan for the concept is displayed in Appendix A – Figure 4.

6.1 Water Distribution

The Town of Langham will supply water, which will be distributed to homes throughout the development via water distribution lines within the road right-of-ways. Isolation valves and hydrants will be installed for maintenance, isolation, and fire protection.

6.1.1 Existing Conditions

The Town's water treatment plant (WTP) is located long Railway Street and Fifth Avenue. Water usage has been estimated 250 litres per capita day (lcpd), based on reports prepared by Associated Engineering (AE). The WTP has a total potable water storage of 1,245 cubic metres, which is approximately 3.4X the average daily usage (WSA minimum requirement is 2X daily usage). This volume of storage will roughly support a total population of 2,500 persons. The Town's current raw water well pump's estimated combined capacity is 20.8 L/s (approximately 2,075 persons). The raw water filtration equipment's estimated capacity is 18.2 L/s (approximately 1,900 persons). The Town's raw water source license is 220 dam3/year (approximately 2,400 persons). The treated water distribution pump capacity is estimated at 17 L/s (approximately 2,275 persons). The Town is currently reviewing options for upgrading their WTP. Estimated current population of Langham is 1,600 persons.

According to the Infrastructure Master Plan and Development Levy Background Report (IMP Report) prepared by AE (2019), the existing WTP will be able to provide a fire flow to the future eastern growth area with over 63 L/s provided that a 250mm WM line is extended east along Main Street and a 200mm WM line interconnected to 3rd Street East.

6.1.2 Proposed Development

This plan proposes a network of 200mm and 250mm water mains with tie-in points to the Town's existing water distribution system at 3rd Street and Main Street. The existing water main diameter at 3rd Street is 150mm. The water main diameter at Main Street is a 250mm. Water distribution stubs would be left at the proposed roadways at the southern edge of the concept area to facilitate future development to the south. Based on reservoir capacity and assuming the town has a current population of approximately 1,740 people, the concept plan area would allow approximately 760 people to service before upgrades would be required. These limitations are approximately equivalent to all the single-family (10.67 ha), all the low/medium flex density (0.66 ha) and approximately 3 ha. of medium density and no mixed-use lands. Based on the current raw water filtration equipment's estimated capacity of 18.2 L/s (approximately 1,900 persons), this would limit this development's population to approximately 240 persons or 80 single family lots. The Town is currently reviewing options to upgrade the WTP.

6.1.3 Water Servicing - First Phase of Development

Water servicing for the initial phase of development would consist of a tie-in point to the existing 150mm water main at 3rd Street and Finch Crescent with a 200mm water main. As development progresses to the north in future phases, a second connection at Main Street would be made to provide a looped connection to the Concept Plan area.

6.2 Sanitary Sewer

6.2.1 Existing Conditions

Langham is currently serviced by two sewage pumping stations (SPS1 & SPS2) and a facultative sewage lagoon. The lagoon is located north of Town and has a design capacity of 3,000 people. SPS1 is located on the community's west side and services the entire Town of Langham. SPS1 has a design capacity of approximately 3,000 people. SPS2 services the newer east side of Langham and pumps into a gravity main, which flows to SPS1. SPS2 is located at the intersection of Fifth Avenue and Finch Crescent. According to Associated Engineering SPS2 has recently been upgraded to have an estimated total capacity of 35.7 L/s. The current calculated flow 3.9 L/s, with an estimated remaining capacity of 33.4 L/s. The IMP Report states limitations on the 100mm PVC force main capacity from SPS2, with a maximum flow of 11.8 L/s, and on the existing gravity system on Park Avenue between 2nd Street East and 3rd Street East, which has a estimated capacity of 25.9 L/s. It is estimated that this flowing at approximately 80% full or 20.7 L/s, which leaves approximately 5.2 L/s remaining

6.2.2 Proposed Development

Wastewater collection for the proposed concept plan area is intended to tie into Langham's existing gravity sewer system. A previous engineering analysis indicated a tie-in point at a 200mm diameter gravity sewer on 3rd Street at an invert elevation of 515.92m. This analysis assumed a minimum required depth of cover of 2.8m, and a minimum pipe slope of 0.40%. The analysis indicated that approximately 0.5-1.0m of fill would be required to maintain the targeted at the upper extents of the sanitary collection network in the northeast of the concept plan area. Otherwise, pipe insulation could also be utilized where minimum cover depths cannot be achieved.

The estimated wastewater flow generated by the overall development area, with an estimated population of 1336 persons, is 16.72 L/s (accounting for peak daily flow and infiltration allowances). Appendix B – Sanitary Sewer Calculations, has a table showing the detailed calculations of sanitary sewer generation. The estimated limitation/restriction of the sanitary sewer between 2nd Street and 3rd Street on Park Avenue will limit development to approximately 125 single-family lots.

6.2.3 Sanitary Sewer - First Phase of Development.

Sanitary servicing for the first phase of development (approximately 33 lots) will consist of tying into the existing 200mm diameter sewer stub identified at 3rd Street. Generally, sewer in the first phase will be installed as deep as possible to allow for future extensions to additional phases. Phase 1 has an estimated peak flow of 1.50 L/s. There should be adequate capacity in SPS2 for this initial phase. The limitation on SPS2's force main will limit the development population to approximately 760 ppl in the concept plan area. This is approximately equivalent to 70% of the single family lots, 50% of the medium density and 50% of the mixed-use lands.

6.3 Stormwater

6.3.1 Introduction

The proposed stormwater management strategy has been updated based on the 2020 Town of Langham Development Standards, shared with Catterall & Wright following the review meeting on February 10, 2024.

As part of the stormwater analysis for this project, the previous 2007 Stormwater Management Master plan was reviewed to gain an understanding of previous plans and design approaches for stormwater management in the concept area. The proposed stormwater approach is similar to "Option 2 – Overland Drainage" from the 2007 Report. This approach included constructing a stormwater detention pond and linear park, which will work in tandem to provide stormwater attenuation for the 1-in-100-year 24-hour event for the concept area. Stormwater would then be released to Langham's swale and ditch network at the pre-development 1-in-100-year 24-hour release rate. The approach outlined in this document is similar but has been updated based on the most recent stormwater requirements from the Water

Security Agency Stormwater Guidelines (EPB322) and the most recent City of Saskatoon Storm Water Drainage System design standards, which were referenced for rainfall data.

The proposed concept area will primarily utilize surface drainage with parcels and roadways draining through a gutter and shallow ditch network, conveying runoff to the proposed linear park network and stormwater detention pond for temporary storage. Storm sewer will be utilized as needed to help facilitate drain to the ponds. Where necessary, culverts will be utilized at driveways and other accesses that cross drainage paths and ditches. Where possible or necessary, storm sewers with catch basins may be installed in the proposed subdivision to drain areas that would otherwise require significant fill volumes for surface drainage.

6.3.2 Calculation of Pre-Development Release Rate

The stormwater context of the concept area presents a unique challenge since approximately 12.4 hectares of the existing built-up area of Langham also drains into the concept plan area (see **Section 2.5**). Therefore, stormwater calculations for allowable release rates and storage requirements also considered this portion of Langham as if it was being newly developed as part of this project to ensure that the proposed stormwater management infrastructure can adequately handle both the existing and proposed new development and limit discharge to the broader area's original pre-development runoff rate.

Catterall & Wright have calculated the pre- and post-development runoff release rates for the 1-in-100-year 24-hour event using the most stormwater design parameters available for the City of Saskatoon. Key design parameters used to calculate intensity are summarized in **Table 1**. **Table 1** shows a 1-in-100-year 24-hour rainfall intensity of **5.33 mm/hour.** A preliminary stormwater model using XPSWMM was created, which utilizes the 1:100 year COS design storm. The proposed storm ponding had no issues with the peak run-off during that design event.

Table 1. Intensity-Duration-Frequency (IDF) Data – City of Saskatoon

Intensity-Duration-Frequency (IDF) Data

Duration Time		Intensity (mm/h)					
Minutes	**Hours**	**2-yr**	**5-yr**	**10-yr**	**25-yr**	**50-yr**	**100-yr**
5	-	75.6	111	140	182	227	272
10	-	53.2	77.9	98.3	129	160	194
15	-	43.3	64.0	80.9	106	130	157
30	-	28.0	44.3	57.7	79.1	96.3	117
60	1	16.7	29.0	38.6	54.0	67.4	82.4
120	2	10.8	17.7	23.3	31.8	39.8	47.9
360	6	4.82	7.45	9.63	12.8	16.0	19.2
720	12	2.78	4.07	5.12	6.66	8.26	9.85
1440	24	1.56	2.24	2.80	3.64	4.46	5.33

The IDF data are based on a study by university of Saskatchewan and Concordia University in 2020 to incorporate climate change impacts.

The intensity was used to determine and pre- and post-development peak runoff rates for the catchment area including the existing portion of Langham which drains into the concept area. The difference between the pre- and post-development release rates multiplied over a 24-hour period was taken as the required storage volume to limit the post-development release rate to the pre-development state. **Table 2** outlines this analysis.

The following conclusions can be drawn from **Table 2**:

- The total concept area, including the existing portion of Langham that drains into it and adjacent MR parcel, requires approximately 30,000 m^3 of storm water active storage to maintain release rates to the pre-development state. Approximately 6,350 m^3 of this volume is required for the existing Langham portion of the catchment area (based on a comparison of pre- and post-development release rates for the existing Langham 12.4 ha area).
- Due to the relatively flat nature of the surrounding drainage network and shallow discharge elevations, a 0.91m active storage depth is assumed. Based on this assumption, approximately 2.9 ha of ponding area would be required to meet the stormwater management needs of this development and the existing Langham neighbourhood.

Table 2. Summary of Pre and Post Development Flows for Catchment Area – Total Development

Pre-Development Peak Flow Rate				
Parcel	$C_{1:100}$	24-hour 1-in-100 Year Intensity (mm/hour)	Area (ha)	Peak Runoff Flow (m^3/s)
Phase 1 Area - Pre-development	0.20	5.33	35.29	0.105
Additional MR Parcel - Pre-development	0.20	5.33	2.40	0.007
Existing Langham Drainage Area - Pre-development	0.20	5.33	12.38	0.037
		Total:	**50.07**	**0.148**
Total Pre-Development Runoff Volume (m^3)				**12,824**
Post-Development Peak Flow Rate				
Parcel	$C_{1:100}$	24-hour 1-in-100 Year Intensity (mm/hour)	Area (ha)	Peak Runoff Flow (m^3/s)
Low Density Residential	0.6	5.33	10.43	0.095
Medium Density Residential	0.8	5.33	10.39	0.081
Mixed Use	0.8	5.33	0.51	0.043
Roadways	1.68	5.33	7.45	0.094
Municipal Reserve	0.30	5.33	3.43	0.017
Municipal Buffer	0.30	5.33	1.35	0.006
Utility Area	0.30	5.33	0.26	0.001
Storm Pond - Permanent Pool	1.00	5.33	1.47	0.012
Additional MR Parcel - Future MR	0.30	5.33	0.97	0.005
Additional MR Parcel - Ponding Area	1.00	5.33	1.43	0.020

Existing Langham Drainage Area - Post-development	0.60	5.33	12.38	0.110
		Total:	**50.07**	**0.496**
Total Post-Development Runoff Volume (m^3):				**42,844**
Difference Between Pre- and Post-Development Peak Flow Rate (m^3/s):				**0.348**
Pond Volume Rounded up to Nearest 500 (m^3):				**30,000**
Required Area at average 0.91 m Depth (ha):				**4.49**

6.3.2.1 First Phase of Development Including Existing Langham

The proposed first phase of development (see Figure 1) will utilize the existing linear park area, which runs east and south of Finch Crescent, for interim stormwater attenuation. As discussed above, this linear park also captures runoff from approximately 12.4 ha of Langham's existing built-up area. Therefore, the proposed first phase of development must also consider the storage required to manage flows from Langham's existing neighbourhoods. Refer to Figure 4 in the attached drawing package for a summary of the proposed stormwater management strategy.

An analysis of the existing surface topography indicates that approximately 3,760 m3 of storage is available in the linear park system before adjacent residential lots are impacted. This means an additional storage volume of 6,740 m^3 is required to provide adequate stormwater storage for the first phase of development and Langham's existing neighbourhoods. The first phase of development will excavate and grade out the MR from the culvert south of Finch Crescent to 3rd Street East. This initial pond will have an approximate volume of 16,700 m^3 and will exceed the ponding requirements of Phase 1.

If an average active storage depth of 0.91m is assumed, a ponding area of approximately 1.2 ha is required to service the first phase of development and the existing portions of Langham that drain into the concept plan area. There is sufficient area to meet this requirement in the existing MR parcel south of the development.

6.3.2.2 Servicing Capabilities of Proposed Ponding Areas

The current concept plan includes 4.49 hectares of assumed ponding area, which would provide an active storage volume of approximately 30,000 m^3, assuming 0.91m of active storage depth, sufficient to develop the entire concept area. The permanent storage area of the ponds is 2.9 hectares, with an estimated volume of 42,500 m^3.

Table 3. Summary of Storage Requirement for First Phase of Development

Pre-Development Peak Flow Rate				
Parcel	$C_{1:100}$	24-hour 1-in-100 Year Intensity (mm/hour)	Area (ha)	Peak Runoff Flow (m^3/s)
Phase 1 Area - Pre-development	0.20	5.33	4.56	0.014
Additional MR Parcel - Pre-development	0.20	5.33	2.40	0.007
Existing Langham Drainage Area - Pre-development	0.20	5.33	12.38	0.037
		Total:	**19.34**	**0.057**
Total Pre-Development Runoff Volume (m^3)				**4,951**
Post-Development Peak Flow Rate				
Parcel	$C_{1:100}$	24-hour 1-in-100 Year Intensity (mm/hour)	Area (ha)	Peak Runoff Flow (m^3/s)
Low Density Residential	0.6	5.33	2.05	0.018
Medium Density	0.8	5.33	0.66	0.008
Roadways	1.68	5.33	1.25	0.016
Municipal Reserve Area	0.30	5.33	0.60	0.003
Additional MR Parcel - Future MR	0.30	5.33	1.05	0.005
Additional MR Parcel - Ponding Area	1.00	5.33	1.35	0.020
Existing Langham Drainage Area - Post-development	0.60	5.33	12.38	0.110
		Total:	**19.34**	**0.179**
Total Post-Development Runoff Volume (m^3)				**15,478**
Difference Between Pre- and Post-Development Peak Flow Rate (m^3/s):				**0.122**
Pond Volume Required (m^3):				**10,527**
Pond Volume Rounded up to Nearest 500 (m^3):				**10,500**
Required Area at average 0.91 m Depth (ha):				**1.22**

6.4 Pond Configurations

The proposed retention ponds will have 2.9 hectares of permanent storage, with a minimum depth of 1.85 metres in the linear ponds along Finch Cr. to a maximum depth of 3.0 metres in the larger ponding areas. The proposed slide slopes will be no steeper than 3:1 from the bottom of the pond to the normal water level (NWL), where it allows a side slope of 1:5 will be constructed. From NWL to the back of lots, there will be a maximum slope of 5:1, but we will generally aim for a slope of 7:1. The figure on the next page shows a typical cross-section of a storm pond.

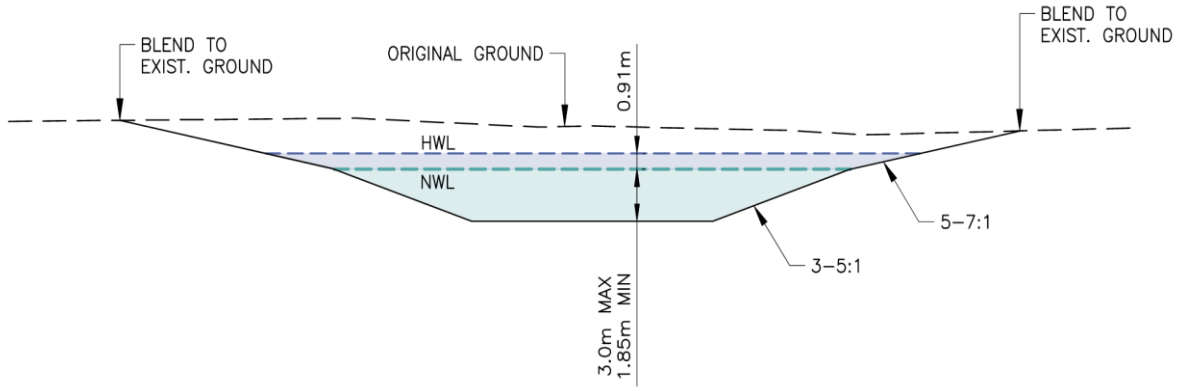


Figure 4 - Typical Storm Pond Cross-Section

7.0 Phasing

Phase 1 is located in the southwest corner of the proposed development. The first phase includes the downstream section of the proposed linear park, which will also manage stormwater from the initial phase. This phase will include essential water and sewer tie-ins at 3rd Street East.

It is anticipated that the next phases of development will be to the north of the initial phase and will include the completion of the linear park and a second connection point to the existing water network at Main Street East to provide a looped water system.

Subsequent development phases will likely occur from southwest to northeast based on demand for specific land uses and where connections can be made to stormwater management infrastructure.

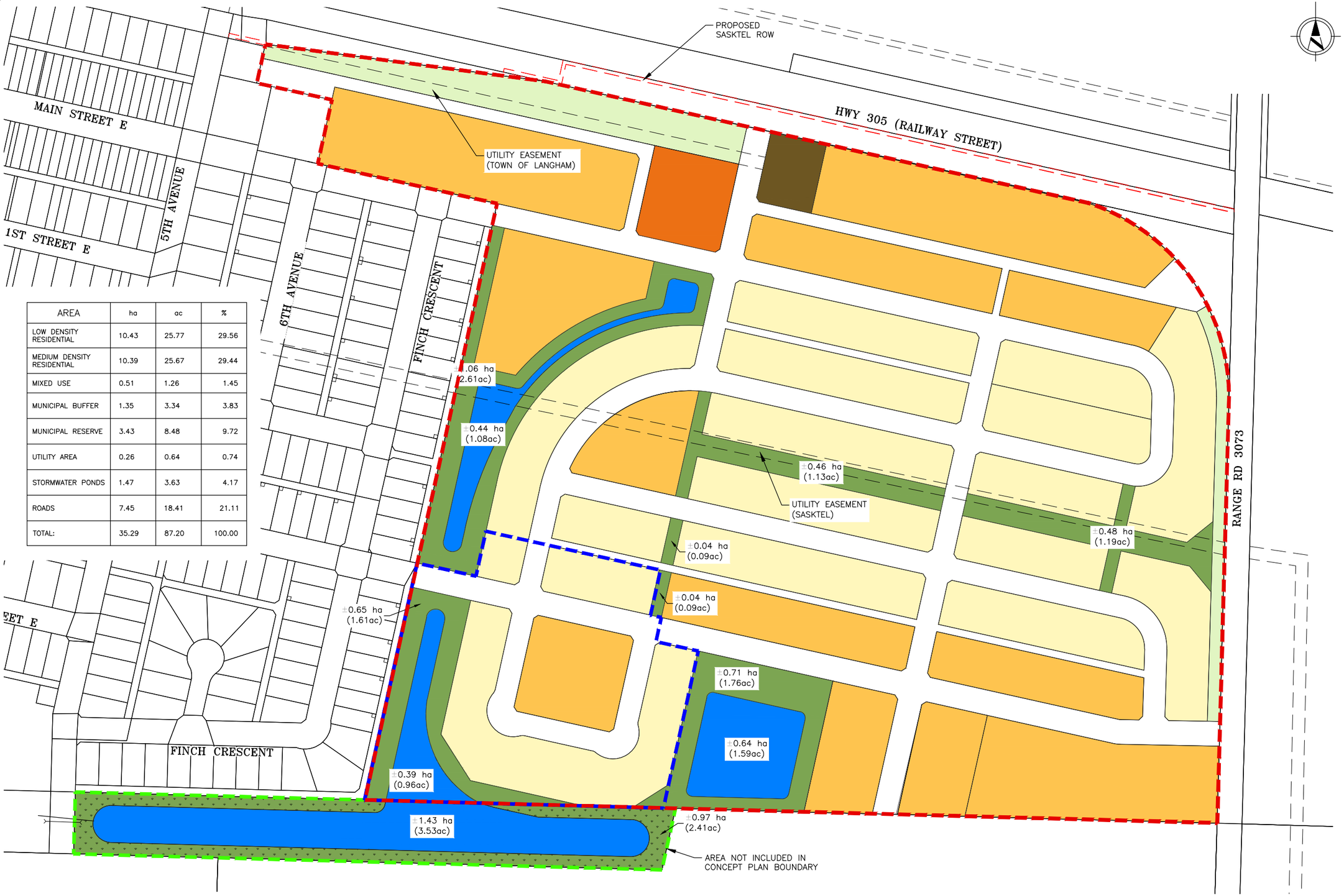
Respectfully submitted,

Catterall & Wright

Per: Reviewed:

Devin Clarke, RPP, MCIP Phil Shilling, P.Eng

Appendix A Figures



AREA	ha	ac	%
LOW DENSITY RESIDENTIAL	10.43	25.77	29.56
MEDIUM DENSITY RESIDENTIAL	10.39	25.67	29.44
MIXED USE	0.51	1.26	1.45
MUNICIPAL BUFFER	1.35	3.34	3.83
MUNICIPAL RESERVE	3.43	8.48	9.72
UTILITY AREA	0.26	0.64	0.74
STORMWATER PONDS	1.47	3.63	4.17
ROADS	7.45	18.41	21.11
TOTAL:	35.29	87.20	100.00

PRELIMINARY
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NOTE:
– DRAWING TO BE PRINTED IN COLOUR

CATTERALL & WRIGHT
CONSULTING ENGINEERS
1231 – 8th STREET EAST
SASKATOON, SK S7H 0S5
TEL: (306) 343-7280 | www.cwce.ca

PRAIRIE ROSE PARK

LEGEND:

- LOW DENSITY RESIDENTIAL
- MEDIUM DENSITY RESIDENTIAL
- MIXED USE
- MUNICIPAL BUFFER
- MUNICIPAL RESERVE
- UTILITY AREA
- STORMWATER POND
- EXIST. EASEMENT
- CONCEPT PLAN BOUNDARY
- PHASE 1

SCALE VERIFICATION
WHEN DRAWING IS PLOTTED FULL SIZE THIS LINE IS 30mm IN LENGTH.

DATE	REVISION

OWNER/CLIENT
CLAYSTONES DEVELOPMENTS

LOCATION
LANGHAM, SK

PROJECT
PRAIRIE ROSE PARK

SHEET TITLE
CONCEPT PLAN

SCALE 1:3000	DESIGNED DAC
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DATE 24/05/01	SHEET 1 of 1

DRAWING NUMBER
FIGURE 1

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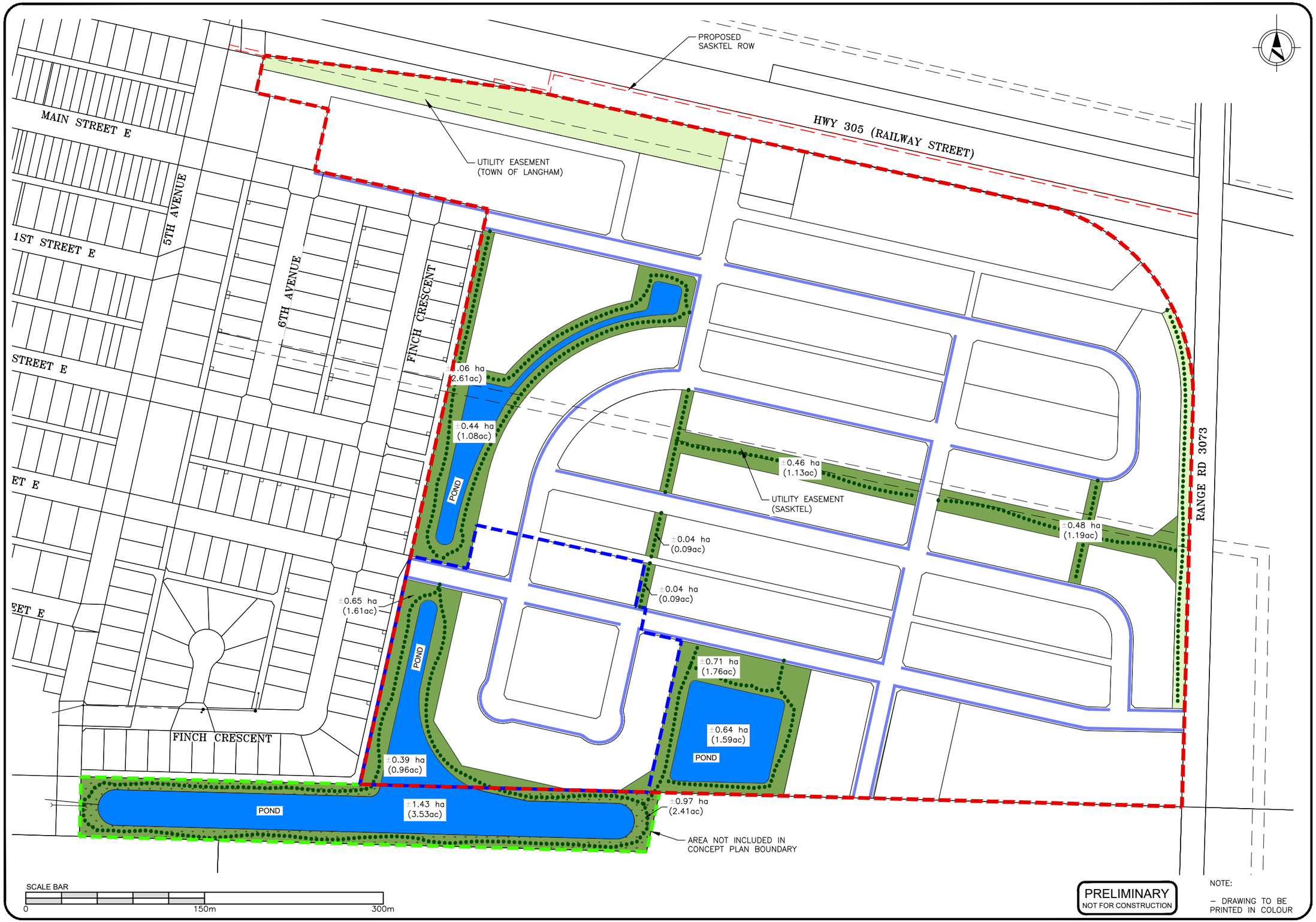

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PRAIRIE ROSE PARK

LEGEND:

- MUNICIPAL BUFFER
- MUNICIPAL RESERVE
- STORMWATER POND
- PROP. SIDEWALK
- PROP. PATHWAY
- CONCEPT PLAN BOUNDARY
- PHASE 1

SCALE VERIFICATION

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DATE	REVISION

OWNER/CLIENT
CLAYSTONES DEVELOPMENTS

LOCATION
LANGHAM, SK

PROJECT
PRAIRIE ROSE PARK

SHEET TITLE
PARKS AND PEDESTRIAN LINKAGES

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FIGURE 2

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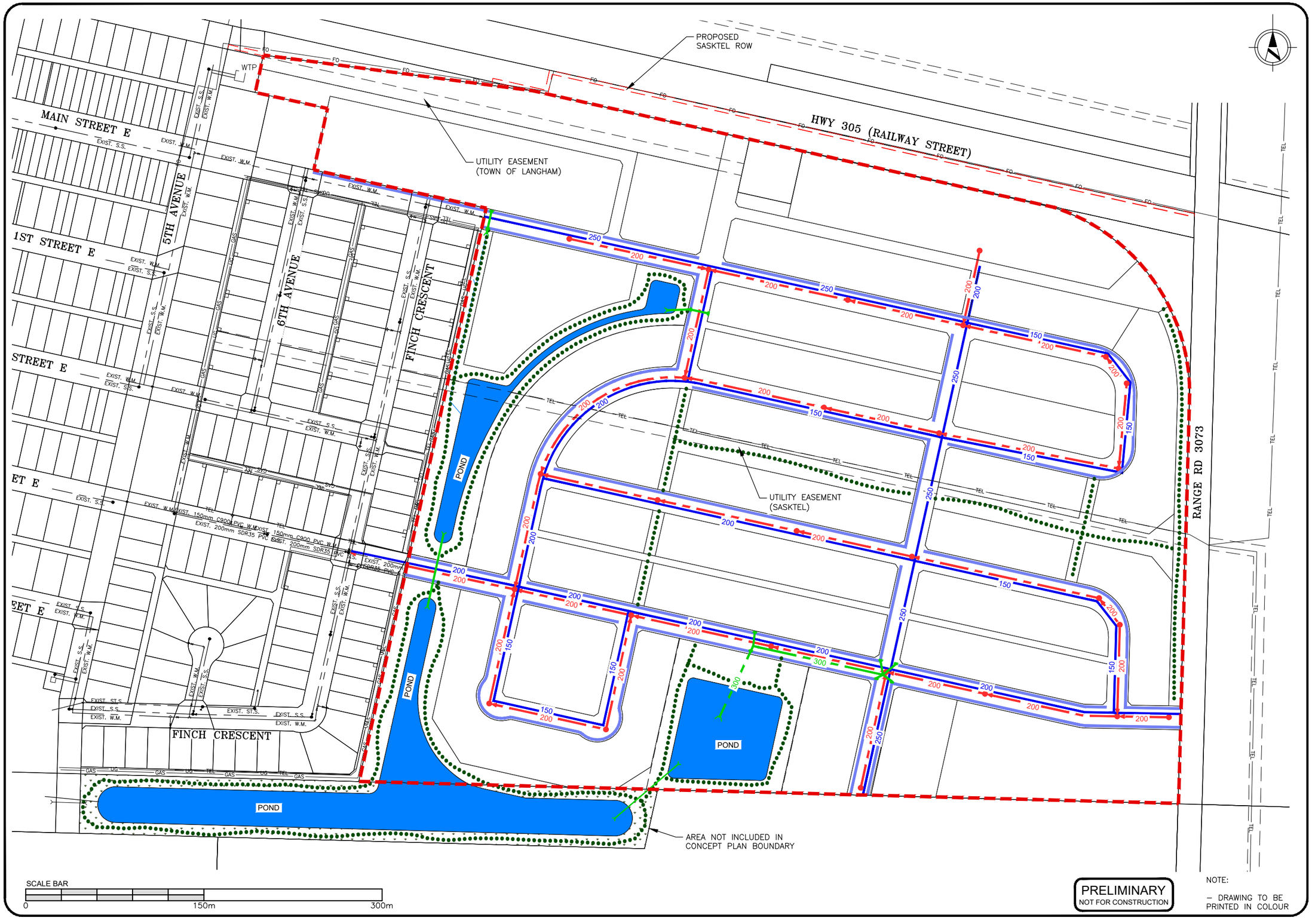

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PRAIRIE ROSE PARK

LEGEND:

- 200 — SANITARY SEWER
- 200 — WATER MAIN
- 300 — STORM SEWER
- MANHOLE
- FLOW DIRECTION
- OUTLET STRUCTURE
- CATCH BASIN
- CULVERTS
- DRAINAGE DITCH
- SITE BOUNDARY

SCALE VERIFICATION
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DATE	REVISION

OWNER/CLIENT
CLAYSTONES DEVELOPMENTS

LOCATION
LANGHAM, SK

PROJECT
PRAIRIE ROSE PARK

SHEET TITLE
SERVICING PLAN

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FIGURE 3

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TEL: (306) 343-7280 | www.cwce.ca

PRAIRIE ROSE PARK

LEGEND:

- DRAINAGE FLOW LINE
- 300 STORM SEWER
- OUTLET STRUCTURE
- CATCH BASIN
- CULVERTS
- DRAINAGE DITCH
- CONCEPT PLAN BOUNDARY
- EXIST. LANGHAM CATCHMENT AREA

SCALE VERIFICATION
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DATE	REVISION

OWNER/CLIENT
CLAYSTONES DEVELOPMENTS

LOCATION
LANGHAM, SK

PROJECT
PRAIRIE ROSE PARK

SHEET TITLE
SITE DRAINAGE

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FIGURE 4

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Appendix B Sanitary Sewer Calculations

CATTERALL & WRIGHT
CONSULTING ENGINEERS

PEAK FLOW FACTOR $= 1+\left(\frac{14}{4+\sqrt{\frac{P}{1000}}}\right)$

INFILTRATION = 0.17L/s/ha (COS Design Manual)

Water Usage = 250 lcpd

*3 ppl/unit single family; 2.5ppl/unit low/medium; 2ppl/unit Medium & Mixed

Overall Development

Land use	Area (ha)	Unit Count	Estimated Population	Infiltration (litres/sec)	Peak Factor	ADWF (l/s)	Peak Design Flow (L/s)
Single Family	10.43	156	469	1.15	3.72	1.36	6.20
Medium Density	10.39	416	831	1.15	3.72	2.41	10.08
Mixed Use (Commercial)	0.51	18	36	0.06	3.72	0.10	0.44
	21.33	**590**	**1336**	**2.36**	**3.72**	**3.87**	**16.72**

PHASE 1

Land use	Area (ha)	Unit Count	Estimated Population	Infiltration (litres/sec)	Peak Factor	ADWF (l/s)	Peak Design Flow (L/s)
Single Family	**3.93**	**33**	**99**	**0.43**	**3.72**	**0.29**	**1.50**

Appendix C Traffic Impact Assessment

RELIABLE

practical

TRUSTWORTHY

honest

Traffic Impact Assessment

Prairie Rose Park Development

Prepared for:

CLAYSTONE DEVELOPMENTS

Contact

1231 - 8th Street East
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CATTERALL & WRIGHT
CONSULTING ENGINEERS

December 8, 2023

TABLE OF CONTENTS

LETTER OF INTRODUCTION II

EXECUTIVE SUMMARY III

SIGNATURE PAGE IV

1 INTRODUCTION 1

2 EXISTING AND FUTURE BACKGROUND CONDITIONS 4

3 PROPOSED DEVELOPMENTS 10

4 TRAFFIC OPERATIONS 18

5 COLLISION REVIEW 26

6 LANE WARRANT ANALYSIS 27

7 ILLUMINATION WARRANT ANALYSIS 29

8 SIGHT DISTANCE 30

9 INTERSECTION CLEARANCE 30

10 ACCESSIBILITY 31

11 CONCLUSION AND RECOMMENDATIONS 31

12 CLOSURE 32

TABLE OF APPENDICES

APPPENDIX A	EXISTING TRAFFIC COUNTS	A
APPPENDIX B	CONCEPT PLAN OF THE PROPOSED DEVELOPMENT	B
APPPENDIX C	SYNCHRO ANAYLSIS FOR EXISTING, BACKGROUND, & TOTAL CONDITIONS	C
APPPENDIX D	RIGHT TURN LANE WARRANT ANALYSIS	D
APPPENDIX E	INTERSECTION ILLUMINATION WARRANT ANALYSIS	E
APPPENDIX F	INTERSECTION SIGHT DISTANCE REVIEW	F

LETTER OF INTRODUCTION

March 20, 2023

Claystone Developments
Attention: Shaun Unger, CEO
Email: shaun@claystonedevelopments.com

Dear Mr. Unger,

Re: Project No. 626.003 – Prairie Rose Park Traffic Impact Assessment

Catterall & Wright has a deep history of serving our clients in the Province of Saskatchewan for 58 years, since 1965. We pride ourselves on ensuring our services provide clients with practical solutions by taking a logical approach.

Our team has reviewed all applicable information thoroughly and we provide the following Traffic Impact Assessment for Claystone Development's proposed Prairie Rose Park development within the Town of Langham. We anticipate feedback and are planning a quick turnaround to both the Town of Langham and the Ministry of Highways to finalize the report, as needed.

Yours truly,

Brandon Williams, P.Eng.
Transportation Manager

EXECUTIVE SUMMARY

In response to the Ministry of Highways (MoH) requirement for a traffic impact assessment and the Town of Langham's request for a technical traffic memo, Catterall & Wright has prepared a traffic impact assessment on behalf of Claystone Developments that reviews the impacts of the proposed Prairie Rose Park subdivision on the existing transportation network and makes recommendations for mitigating impacts, as needed.

Catterall & Wright gathered turning movement count data from the Ministry of Highways where available and collected turning movement count data using a MioVision camera where existing data was not available. Turning movement count data was projected to the full buildout year (2038) using Ministry of Highways provided growth factors. Trip generation for the mixed-used subdivision was completed and considered reductions in standard rates based on internal trips from within the development and pass by trips. Trips were distributed across the existing and proposed network in a logical manner that considered how vehicles will enter and exit the development. The direction from which the traffic will approach and depart the project site depends upon several factors such as size of development, type of development, type of visitors/customers and surrounding population. Condition analysis was completed for the existing conditions (2023), future background conditions (2038), and total traffic conditions with all development related trips (2038). Catterall & Wright also completed a collision review for Highway 16 near the project site, a lane warrant analysis at the study intersections along Highway 16, illumination warrants for the Highway 16 & Highway 305 intersection, and reviewed sight distance and sight triangles at the study intersections along Highway 16.

From the analysis the following recommendations are being made based solely on existing conditions:

- It's recommended that the Ministry monitor the intersection of Highway 16 & Range Road 3074 for growth in left turn traffic and provide an exclusive left turn lane when it is warranted.
- Within the northeast quadrant of Highway 16 & Range Road 3074, a row of trees is present that is within the intersection's sight triangles. It is recommended that the Town remove the trees within the triangle and that no other developments, signs, or property fences be installed within the sight triangle.

SIGNATURE PAGE

Report Prepared by: _____

Brandon Williams, P. Eng.

Report Prepared & Reviewed by: _____

Nadeem Hyder, P. Eng.

PROFESSIONAL ENGINEER
N. HYDER
MEMBER 28883
24 YR. 03 MN. 19 DAY
SASKATCHEWAN

Association of Professional Engineers & Geoscientists of Saskatchewan
CERTIFICATE OF AUTHORIZATION
CATTERALL & WRIGHT
Number C848
Permission to Consult held by:

Discipline	Sk. Reg. No.	Signature
CIVIL	28883	

1 INTRODUCTION

1.1 STUDY PURPOSE & BACKGROUND

Claystone Developments (Claystone) is planning to develop a proposed subdivision – Prairie Rose Park in the Town of Langham, SK. The proposed subdivision is located south of Railway Street and west of Range Road 3073. The location plan of the proposed subdivision is illustrated in **Figure 1**.

As part of the development process, Saskatchewan's Ministry of Highways (MoH) and the Town of Langham (Town) required a Traffic Impact Assessment (TIA) report to understand the impact of the proposed subdivision on the transportation network within the study area.

Claystone retained Catterall & Wright (C&W) to conduct the TIA for the proposed subdivision. The results of the TIA analysis will be used to develop strategies to mitigate the adverse impacts of the proposed project, if any, on the transportation system within the study area.

1.2 PROJECT LOCATION

The proposed Prairie Rose Park subdivision is bordered by Railway Street to the north, Range Road 3073 to the east, and Finch Crescent to the west. The study area of the proposed project includes four (4) existing intersections and two (2) proposed intersections as listed below:

- Third Street East & Fifth Avenue (existing),
- Main Street East & Fifth Avenue (existing),
- Highway 16 & Range Road 3074 (existing),
- Highway 16 & Highway 305 (existing),
- Railway Street & Proposed Road north of the development (proposed), and
- Range Road 3073 & Proposed Road east of the development (proposed).

1.3 STUDY METHODOLOGY

The TIA was completed using the following methodology:

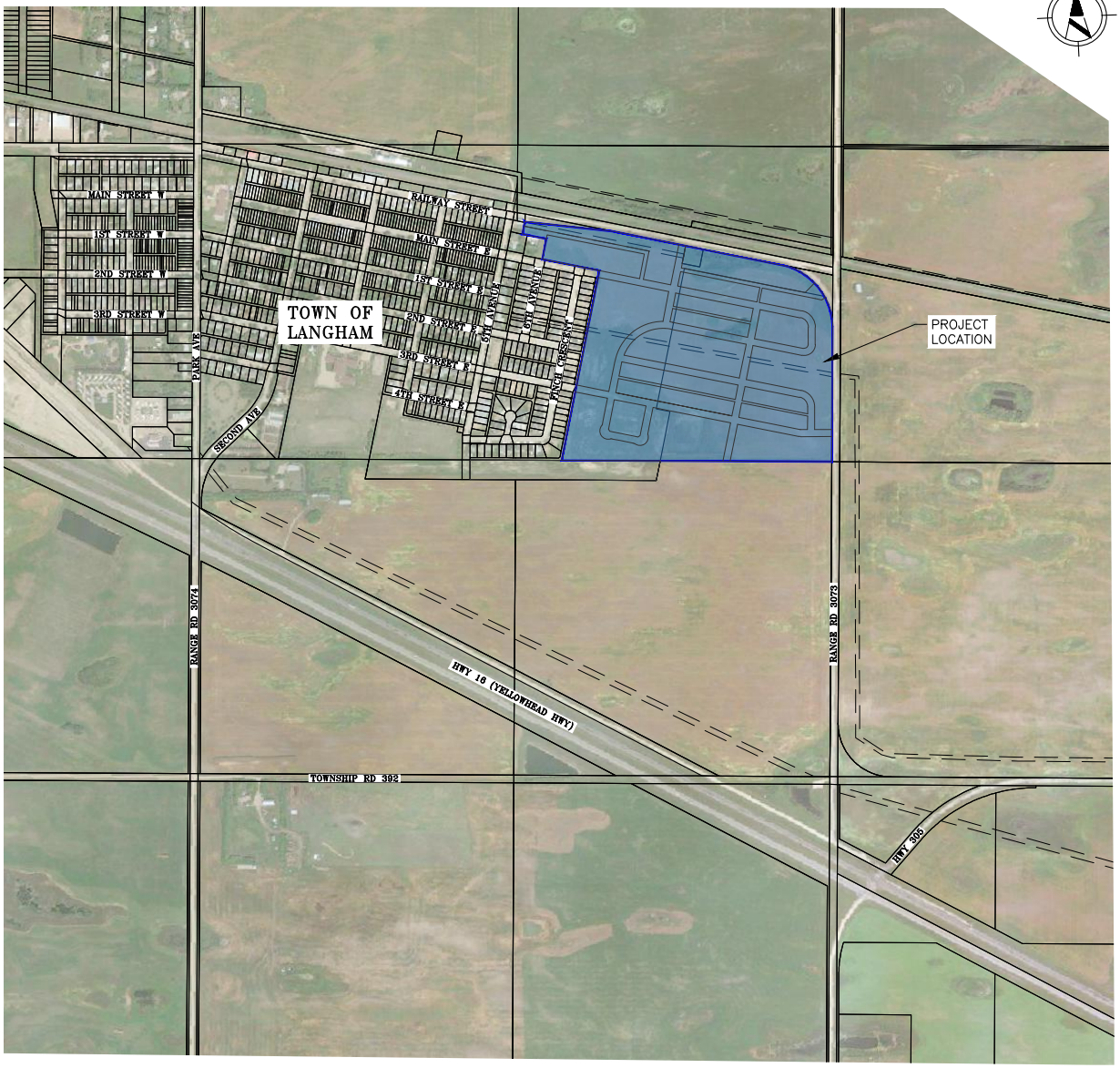
- Collect existing turning movement counts (2023) at the study intersections.
- Conduct an existing condition analysis at the study intersections using Synchro software.
- Project existing traffic volumes to the horizon years to determine the background traffic volumes at full build-out condition of the proposed subdivision. As the proposed subdivision is expected to be fully built out in 15 years (2038), the existing traffic volumes were projected to the year 2038 with a 2% annual growth rate (except for Highway 305 movements that used a MoH provided 3% annual growth rate).

- Estimate the site-generated trips from the proposed development assuming full build-out condition using Institute of Transportation Engineer's Trip Generation Manual (ITE Manual).
- Distribute the site-generated trips at the study intersections based on the surrounding area's population and employment distribution in relation to the proposed site utilizing a manual gravity model.
- Add development trips to the future background traffic volumes to determine the total peak hour volumes at the study intersections for the future horizon (2038).
- Conduct the capacity and level of service (LOS) analysis at the study intersections for the future background trips (2038) to determine the performance of the study intersections without the project trips.
- Conduct the capacity and level of service (LOS) analysis at the study intersection for the future total traffic volumes (background plus project trips). The objective of this analysis is to determine the performance of the study intersections with the proposed development trips and develop a strategy to mitigate the adverse impacts, if any, on the transportation system within the study area.
- Review the geometry of the highway intersections to determine if right-turn lanes, left-turn lanes, bypass lanes at the intersections satisfy the standard design requirements of the design vehicle. The design review was based on the Ministry's Geometric Design Guide.
- Conduct an illumination warrant on the intersection of Highway 16 & Highway 305 to determine if area lighting is required at the full buildout (2038) traffic volumes.

Project No.: 626.003

CLIENT: CLAYSTONE DEVELOPMENTS

Prairie Rose Park Traffic Impact Assessment



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DATE: 23/10/30	SHEET: 1 of 1

OWNER/CLIENT: CLAYSTONE DEVELOPMENTS

LOCATION: LANGHAM, SK

PROJECT: PRAIRIE ROSE PARK TRAFFIC IMPACT ASSESSMENT

SHEET TITLE: LOCATION PLAN

DRAWING NUMBER: FIGURE 1

2 EXISTING AND FUTURE BACKGROUND CONDITIONS

2.1 EXISTING LAND USE

The subject lands are primarily used for agricultural purposes except for a few areas where tree bluffs are present as well as the southwest portion which has some grading modifications completed several years ago. There are no buildings or structures on the property.

The property is zoned FUD – Future Urban Development.

2.2 ADJACENT LAND USE

To the south of the property is a Municipal Reserve and vacant land. To the east of the property is Range Road 3073 and vacant land within the RM of Corman Park. To the north of the property is Railway Street and vacant land within the Town that is designated as Future Open Space. To the west of the property is existing low density residential development.

2.3 FUTURE LAND USE

The Town of Langham's Official Community Plan (OCP) identifies the parcel as Future Residential and Potential Residential.

2.4 STUDY HORIZON YEARS

The proposed subdivision is expected to be fully built out in fifteen years. Thus, the year 2038 was selected for future traffic assessment of the Prairie Rose Park subdivision site. The existing traffic condition and the future horizon condition were analyzed as shown below:

- 2023 – Existing Conditions
- 2038 (Full Build Out) – Background & Post Development Conditions

2.5 EXISTING ROADWAYS

Highway 16 is a four-lane paved long-distance divided highway with a posted speed limit of 110km/hour in the vicinity of Langham. The highway runs in the east-west direction and borders the Town of Langham to the south.

Highway 305 is a two-lane paved undivided highway with a posted speed limit of 90km/hour in the vicinity of Langham. The road runs in east-west direction and deflects horizontally near the southeast corner of Langham and runs in the north-south direction after crossing Highway 16.

Range Road 3074/Second Ave is a two-lane paved undivided roadway with a posted speed limit of 40km/hour in the Town of Langham. The roadway runs in the north-south direction in the middle of the Town.

Railway Street is a two-lane paved undivided roadway with a posted speed limit of 40km/hour in the vicinity of the project site. The roadway runs in the east-west direction and borders the proposed Prairie Rose Park subdivision site to the north.

Range Road 3073 is an undivided two-lane paved roadway with a posted speed limit of 80 km/h. The roadway runs in the north south direction and borders the proposed development site to the east. Range Road 3071 is a paved roadway.

Fifth Ave is a two-lane residential local street that runs in the north-south direction one block west of the Prairie Rose Park proposed subdivision area. It is designed primarily to provide access to abutting properties. The posted speed is 40 km/hr.

Third Street & Main Street are both two-lane residential local streets that run in the east-west direction and provides access to the Prairie Rose Park subdivision from the west. They are designed primarily to provide access to abutting properties. The posted speed limit on this road is 40 km/hr.

2.6 EXISTING & FUTURE INTERSECTIONS

Highway 16 & Highway 305 Intersection is a 2-Way stop controlled intersection with Highway 16 operating as free flow. The intersection provides one exclusive right-turn lane, one through lane, and one shared through-left lane in the westbound direction, one exclusive left-turn lane, one through lane and one shared through-right lane in the eastbound direction, and one shared left-through-right lane in the northbound and southbound directions.

Highway 16 & Range Road 3074 Intersection is a 2-Way stop controlled intersection with Highway 16 operating as free flow. The intersection provides one exclusive right-turn lane, two through lanes, and one exclusive left-turn lane in the westbound direction, one exclusive left-turn lane, one through lane, and one shared through-right lane in the eastbound direction, and one shared left-through-right lane in the northbound and southbound directions.

Main Street East & Fifth Avenue Intersection is controlled by 2-way stop signs giving right-of-way to Fifth Avenue. It provides shared left-through-right lanes in all four directions.

Third Street East & Fifth Avenue Intersection is 4-Way Stop Controlled Intersection. It provides a shared left-through-right lane in all four directions.

2.7 EXISTING TRAFFIC COUNTS

C&W collected peak hour turning movement counts at the intersections of Main Street East & Fifth Avenue, Third Street East & Fifth Avenue, and Highway 16 & Highway 305. The data was collected using the MioVision Camera on October 24th, October 25th, and October 26th,2023, respectively. The peak hours occurred from

8:00 am to 9:00 am and 4:15 pm to 5:15 pm at the Highway 16 & Highway 305 intersection, from 7:45 am to 8:45 am and from 4:15 pm to 5:15 pm at Main Street East & Fifth Avenue intersection, and from 8:00 am to 9:00 am and 4:30 pm to 5:30 pm at the Third Street East & Fifth Avenue intersection.

The Saskatchewan Ministry of Highways (Ministry, MoH) provided turning movement counts at the Highway 16 & Range Road 3074 intersection. This data was collected on April 25th, 2023, from 6:00 am to 12:00 pm. The peak hour occurred between 10:45 am to 11:45 am during this collection period. Given that only morning data was provided at this intersection, the PM peak was assumed to generally encounter the same peak movements but in the opposite direction of travel.

The existing morning (AM) and evening (PM) peak hour turning movement counts at the study intersections are included in **Appendix A** and are illustrated in **Figure 2.**

2.8 FUTURE ROADWAY IMPROVEMENTS

MoH is planning to install an acceleration lane in the eastbound direction along Highway 16 at the Range Road 3074 intersection for southbound left turn movements in 2024.

In addition, two (2) new intersections within the proposed subdivision were analysed to determine if they were able to accommodate project trips for full build-out condition at the following locations:

- Railway Street & Proposed North Road
- Range Road 3073 & Proposed East Road

2.9 FUTURE BACKGROUND TRAFFIC VOLUMES

The background traffic growth reflects the growth in traffic volumes over time that are not related to the project trips. As the proposed site is expected to be fully developed in 15 years, the existing traffic volumes were projected to year 2038. Based on the information provided by the MoH, the 15-year linear growth factor for Highway 16 is 2% (growth factor of 1.3) and the peak hour trips are 12% of the average annual daily traffic (K factor is 0.12). For Highway 305, the 15-year growth factor is 1.45 and K factor is 0.14. For internal intersections, a 2% growth rate, and a K factor of 0.12 were assumed. The future background turning movement volumes (without project trips) at the study intersections during AM and PM peak periods are shown in **Figure 3**.

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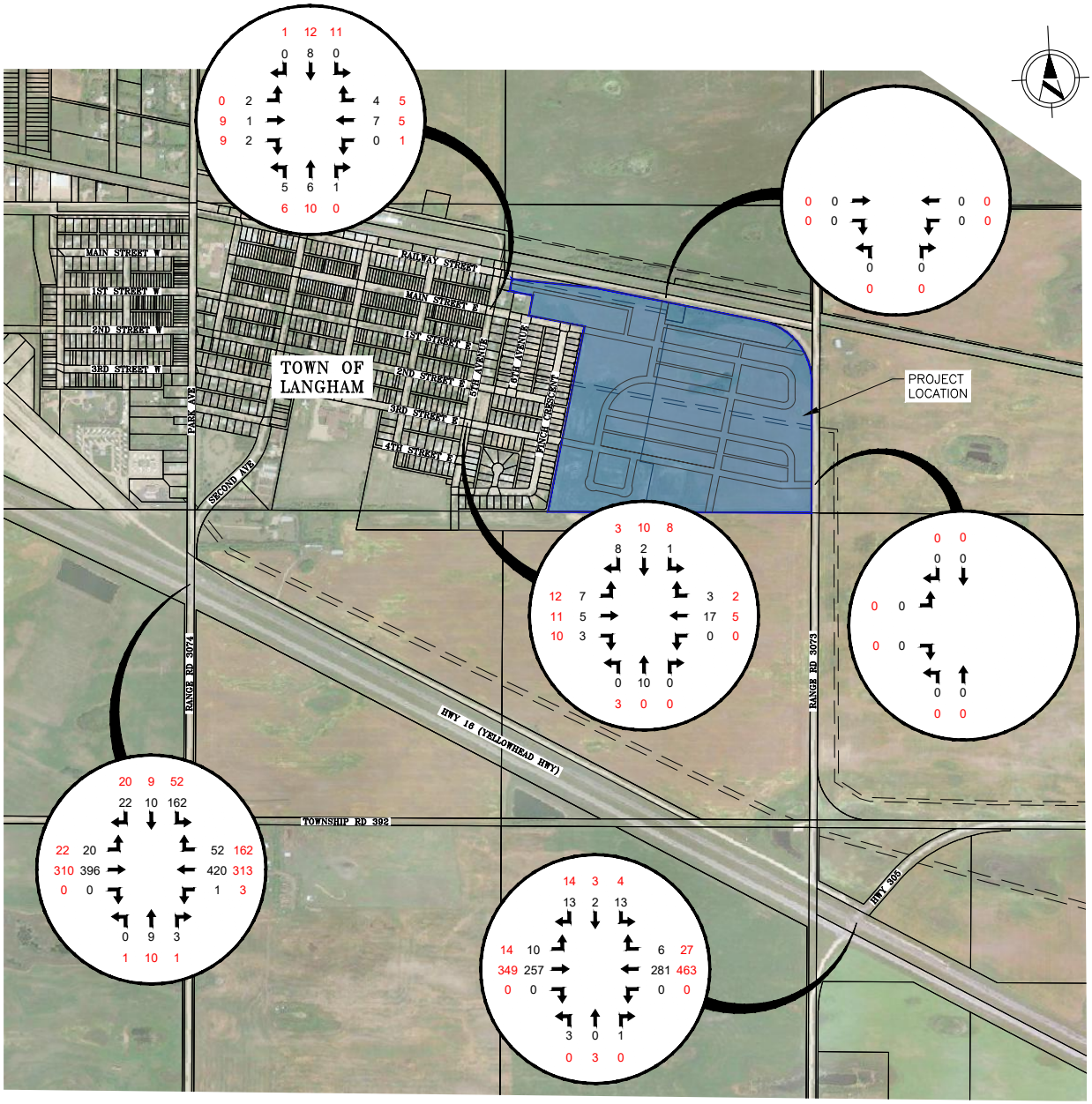

LEGEND:

20 AM PEAK HOUR VOLUME

20 PM PEAK HOUR VOLUME

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OWNER/CLIENT: CLAYSTONE DEVELOPMENTS

LOCATION: LANGHAM, SK

PROJECT: PRAIRIE ROSE PARK TRAFFIC IMPACT ASSESSMENT

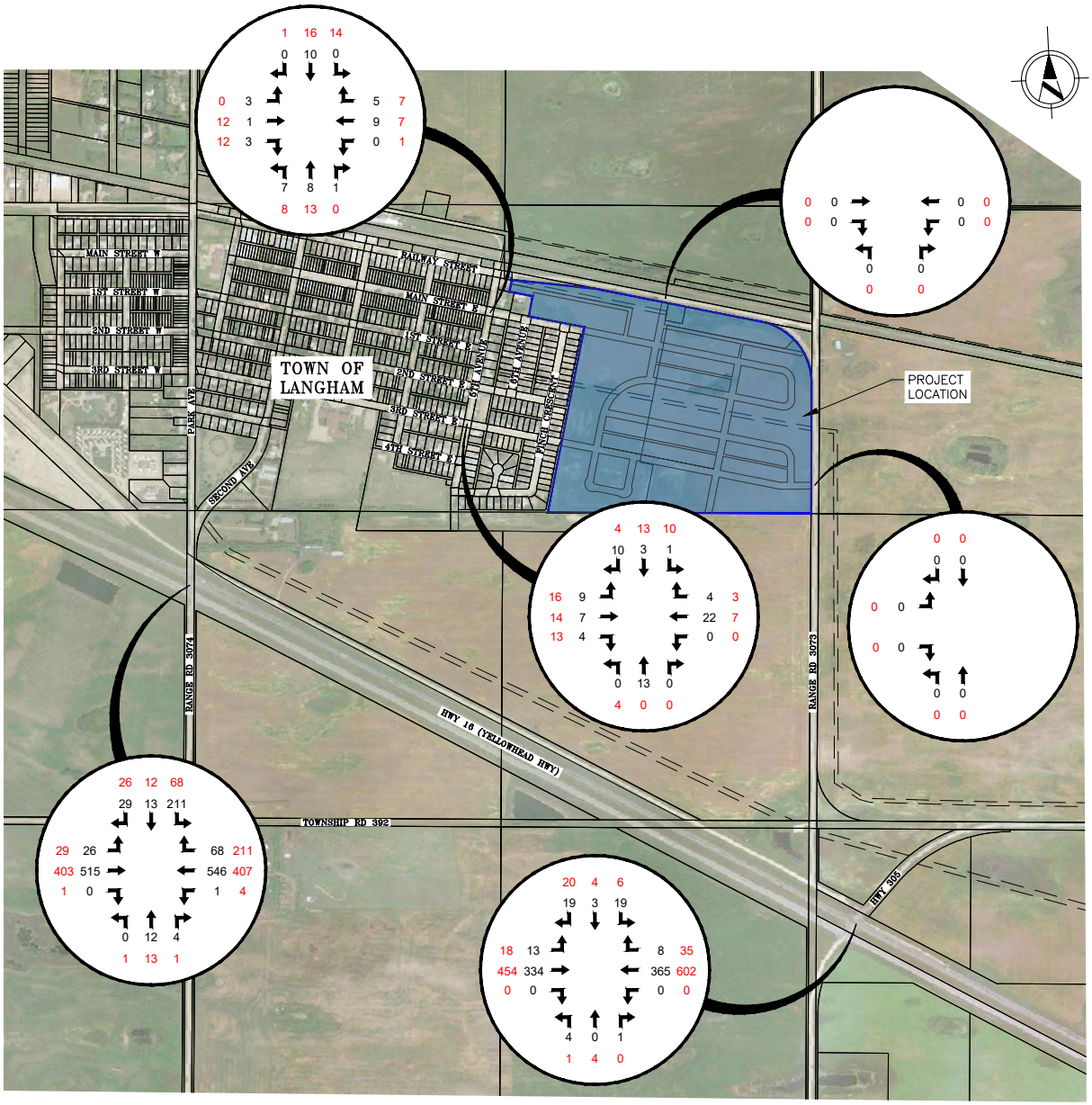
SHEET TITLE: EXISTING 2023 COUNTS

DRAWING NUMBER: FIGURE 2

Project No.: 626.003

CLIENT: CLAYSTONE DEVELOPMENTS

Prairie Rose Park Traffic Impact Assessment



LEGEND:

20 AM PEAK HOUR VOLUME

20 PM PEAK HOUR VOLUME

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DRAWN DL	CHECKED
DATE 23/10/30	SHEET 1 of 1
DRAWING NUMBER FIGURE 3	

OWNER/CLIENT
CLAYSTONE DEVELOPMENTS

LOCATION
LANGHAM, SK

PROJECT
PRAIRIE ROSE PARK TRAFFIC IMPACT ASSESSMENT

SHEET TITLE
2038 FUTURE BACKGROUND TRAFFIC VOLUMES

3 PROPOSED DEVELOPMENTS

3.1 TRIP GENERATION

The proposed Prairie Rose Park subdivision includes 45 acres (1,960,000 sq. ft.) of residential development and 8.99 acres (391,604 sq. ft.) of commercial development. The residential development consists of single-family dwelling units, multi-family units, townhouse/duplex units, and low-density flex zone units. For commercial development, a coverage of 40% (156,642 sq. ft.) was assumed to determine the gross floor area (GFA). The concept plan of the proposed development is attached as **Appendix B**

The trip generation rates from the proposed development were derived from Institute of Transportation Engineers (ITE) Trip Generation Manual, 11 Edition. The ITE standard trip rates were applied to gross floor area (GFA) of the commercial development and number of dwelling units for the residential housing. As a specific category of commercial/mixed-use is not included in ITE Manual, as similar land use of Shopping Plaza was used. The ITE standard trip generation rates are illustrated in **Table 3.1.**

Table 3.1 – Trip Generation Standard Rates

Land Use Type	ITE Code	Unit	AM Peak Hour			PM Peak Hour		
			Rate	In %	Out %	Rate	In %	Out %
Single Family Detached	210	Dwelling Units	0.7	25	75	0.94	63	37
Low Density Flex Zone	210	Dwelling Units	0.7	25	75	0.94	63	37
Townhouse/Duplex	215	Dwelling Units	0.48	25	75	0.57	59	41
Multi Family - Low Rise	220	Dwelling Units	0.4	24	76	0.51	63	37
Commercial/Mixed-Use	820	1000 Sq. Ft. GFA	0.84	62	38	3.4	48	52

The two-way vehicle trips anticipated to be generated from the proposed site during the weekday AM and PM peak hours are summarized in **Table 3.2**.

Table 3.2 – Trip Generation Estimates from the Proposed Site

Land Use Type	Size	Units	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Single Family Detached	160	No. of Units	28	84	112	95	56	150
Low Density Flex Zone	13	No. of Units	2	7	9	8	5	12
Townhouse/Duplex	144	No. of Units	17	52	69	48	34	82
Multi Family - Low Rise	138	No. of Units	13	42	55	44	26	70
Commercial/Mixed-Use	156.6	1000 Sq ft	82	50	132	256	277	533
Total Trips			**142**	**235**	**377**	**451**	**397**	**848**

The proposed site is expected to generate 377 primary vehicle trips during AM peak hour and 848 primary vehicle trips during PM peak hour. These estimated trips don't seem logical for a development located in a small town like Langham which has a population of approximately 1,500 people. In particular, the trips from the commercial/mixed-use development are higher than the expected trips from a development located in a small town.

While the ITE Manual serves as the primary reference for estimating traffic generation patterns across diverse land uses, its data primarily originates from major urban areas. Relying on such urban-centric data may lead to inaccuracies when applied to smaller municipalities. This highlights the necessity for an initiative aimed at establishing more pertinent trip generation rates tailored to the distinct characteristics of land uses prevalent in smaller towns.

The method employed in the ITE Manual for calculating average forecasted trips involves applying a weighted average trip generation rate. This entails multiplying the number of trip ends per unit of the independent variable by the number of units of the independent variable associated with the proposed development. Additionally, the standard deviation provided in the ITE Trip Generation Manual serves as a measure of the dispersion of data points around the calculated average.

Given that the proposed development is situated in a small town, the lower end of the data range collected for trip generation forecasts holds greater relevance. To adjust model trips originating from the development in a small town, we utilized the lower trip rates obtained by subtracting the standard deviation from the weighted average, as illustrated in **Table 3.3**.

Table 3.3 – Lower Range of the Trip Generation Rates

Land Use Type	ITE Code	Unit	AM Peak Hour			PM Peak Hour		
			Rate	In %	Out %	Rate	In %	Out %
Single Family Detached	210	Dwelling Units	0.46	25	75	0.63	63	37
Low Density Flex Zone	210	Dwelling Units	0.46	25	75	0.63	63	37
Townhouse/Duplex	215	Dwelling Units	0.34	25	75	0.39	59	41
Multi Family - Low Rise	220	Dwelling Units	0.28	24	76	0.36	63	37
Commercial/Mixed-Use	820	1000 Sq. Ft. GFA	0.42	62	38	2.14	48	52

Note: Trip numbers are rounded values.

The projected two-way vehicle trips expected to be generated from the proposed site, accounting for the lower range of data values during weekday AM and PM peak hours, are outlined in **Table 3.4.**

Table 3.4 – Trip Generation Estimates Using Lower Range of Trip Rates

Land Use Type	Size	Units	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Single Family Detached	160	No. of Units	18	55	74	64	37	101
Low Density Flex Zone	13	No. of Units	1	4	6	5	3	8
Townhouse/Duplex	144	No. of Units	12	37	49	33	23	56
Multi Family - Low Rise	138	No. of Units	9	2	39	31	18	50
Commercial/Mixed-Use	156.6	1000 Sq ft	41	25	66	161	174	335
Total Trips			**82**	**151**	**233**	**294**	**256**	**550**

Note: Trip numbers are rounded values.

Based on the lower range of values derived from the trip generation forecast data collected by ITE, the proposed site is anticipated to generate 233 primary vehicle trips during the AM peak hour and 550 primary vehicle trips during the PM peak hour. These figures aim to better reflect the trip generation characteristics of a development situated in a small municipality.

3.2 INTERNAL VERSUS EXTERNAL TRIPS

The development trips represent trips that stay within the development (internal capture trips) and the trips that leave the development via the adjacent roadway network (external trips). Internal trips are usually found in mixed land use areas where the origin and destination of trips are within the same developments, for instance, home to shopping, home to restaurant, or home to work trips within the same development. These trips can be made either by walking or by vehicles using the internal street network without using external roadways.

The ITE Trip Generation Handbook provides a methodology to estimate internal capture trips from a mixed-use development. The internal trip-making characteristics of a mixed-use development site are directly related to its mix of on-site land uses which are typically a combination of residential, office, retail, restaurant, entertainment, or hotel. When combined within a single mixed-use development, these land uses tend to interact and thus attract a portion of each other's trip generation. Table 6.1 of the ITE Handbook presents estimated unconstrained internal trip capture rates for trip origins within a mixed-use development and Table 6.2 presents estimated unconstrained internal trip capture rates for trip destinations with a mixed-use development. The internal capture trips calculated for residential, shopping center and restaurant land uses using the ITE procedure are illustrated in **Table 3.5**.

Table 3.5 – ITE Internal Capture Rates

Internal Trips	Outbound Trips				Inbound Trips			
	AM (%)	PM (%)	AM	PM	AM (%)	PM (%)	AM	PM
From Residential to Retail	1%	42%	1	34				
To Retail from Residential					17%	10%	7	13
From Retail to Residential	14%	26%	3	45				
To Residential from Retail					2%	46%	1	74

Note: Trip numbers are rounded values.

The next step is to estimate balanced demand between land use pairs by comparing the outbound and inbound trips for each land use pair and selecting the lower value for both directions. The purpose of this step is to ensure that the total trips made internally from one use to another equal the number received at the other end of the trip as both numbers must be the same. For example, in the above table, for trips from Residential to Retail during AM peak, the residential can generate only 2 trips, however, the retail can receive as many as 10 trips during the same hour. Thus, the controlling value is 2 trips. The external trip demand after balancing the internal trips is shown in **Table 3.6**.

Table 3.6 – External Trip Estimates from the Proposed Site

Land Use Type	Size	Units	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Single Family Detached	160	Units	18	55	74	64	37	101
Low Density Flex Zone	13	Units	1	4	6	5	3	8
Townhouse/Duplex	144	Units	12	37	49	33	23	56
Multi Family - Low Rise	138	Units	9	29	39	31	18	50
Residential Total			**41**	**126**	**167**	**133**	**82**	**215**
Internal trips to Shopping Center				1	1		13	13
Internal trips from Shopping Center			1		1	45		45
Residential External Trips			**41**	**125**	**165**	**88**	**68**	**156**
Commercial/Mixed-Use	156.6	1000 Sq ft	41	25	66	161	174	335
Commercial Total			**41**	**25**	**66**	**161**	**174**	**335**
Internal trips from Residential			1		1	13		13
Internal trips to Residential				1	1		45	45
Commercial External Trips			**40**	**24**	**64**	**148**	**129**	**277**
Total Trips			**80**	**149**	**229**	**235**	**197**	**433**

Note: Trip numbers are rounded values.

3.3 PASS-BY TRIPS

A pass-by trip is made as an intermediate stop on the way from an origin to a primary trip destination without a route diversion. Pass-by trips are attracted from traffic passing the site on an adjacent street that offers direct access to the development. For example, retail-oriented developments such as shopping centers, banks and restaurants often located adjacent to busy streets in order to attract motorists already on the street system for a different purpose. Thus, the pass-by trips do not add new traffic to the adjacent street system and may be reduced from the total external trips generated by the project site. The ITE Manual publishes the pass-by rates for Shopping Center land uses. The manual estimates 34% pass-by trips during the PM peak hour for the Shopping Center land use. Based on the above reduction, the additional new vehicle trips to be attracted to the proposed site during the weekday AM and PM peak hours are summarized in **Table 3.7**.

Table 3.7 – New Vehicle Trips to be Attracted to the Proposed Site

Land Use Type	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
Residential External Trips	41	125	165	88	68	156
Commercial External Trips	40	24	64	148	129	277
Commercial Pass By Trip Reduction	0%	0%	0%	34%	34%	34%
Commercial Net Trips	40	24	64	97	85	183
Total New Trips	**80**	**149**	**229**	**185**	**154**	**339**

Note: Trip numbers are rounded values.

As shown above, the proposed site is expected to generate 229 new vehicle trips during AM peak hour and 339 new vehicle trips during PM peak hour. A total of 80 vehicles will enter, and 149 vehicles will depart from the proposed subdivision during the AM peak hour. During the PM peak hour, 185 vehicles are expected to enter, and 154 vehicles are expected to depart to and from the subdivision.

3.4 TRIP DISTRIBUTION AND ASSIGNMENT

The site-generated trips were assigned to the study intersections based on the assessment of how a vehicle would enter or exit the site. The direction from which the traffic will approach and depart the project site depends upon several factors such as size of development, type of development, type of visitors/customers and surrounding population.

Based on the site observation, traffic count surveys and engineering judgement, the generated trips from the proposed development were assumed to be 30% to/from the southeast (Saskatoon), 15% to/from the northwest (North Battleford), 55% to/from the west (internal to Langham). **Figure 4** illustrates the trip distribution of site-generated trips and traffic assignment after full build-out of the proposed site.

3.5 TOTAL FORECAST VOLUMES

The total forecast volumes at the study intersections were obtained by adding the project trips to the future background traffic expected at the study intersections. **Figure 5** illustrates the total forecasted traffic volumes for the full build-out condition (year 2038).

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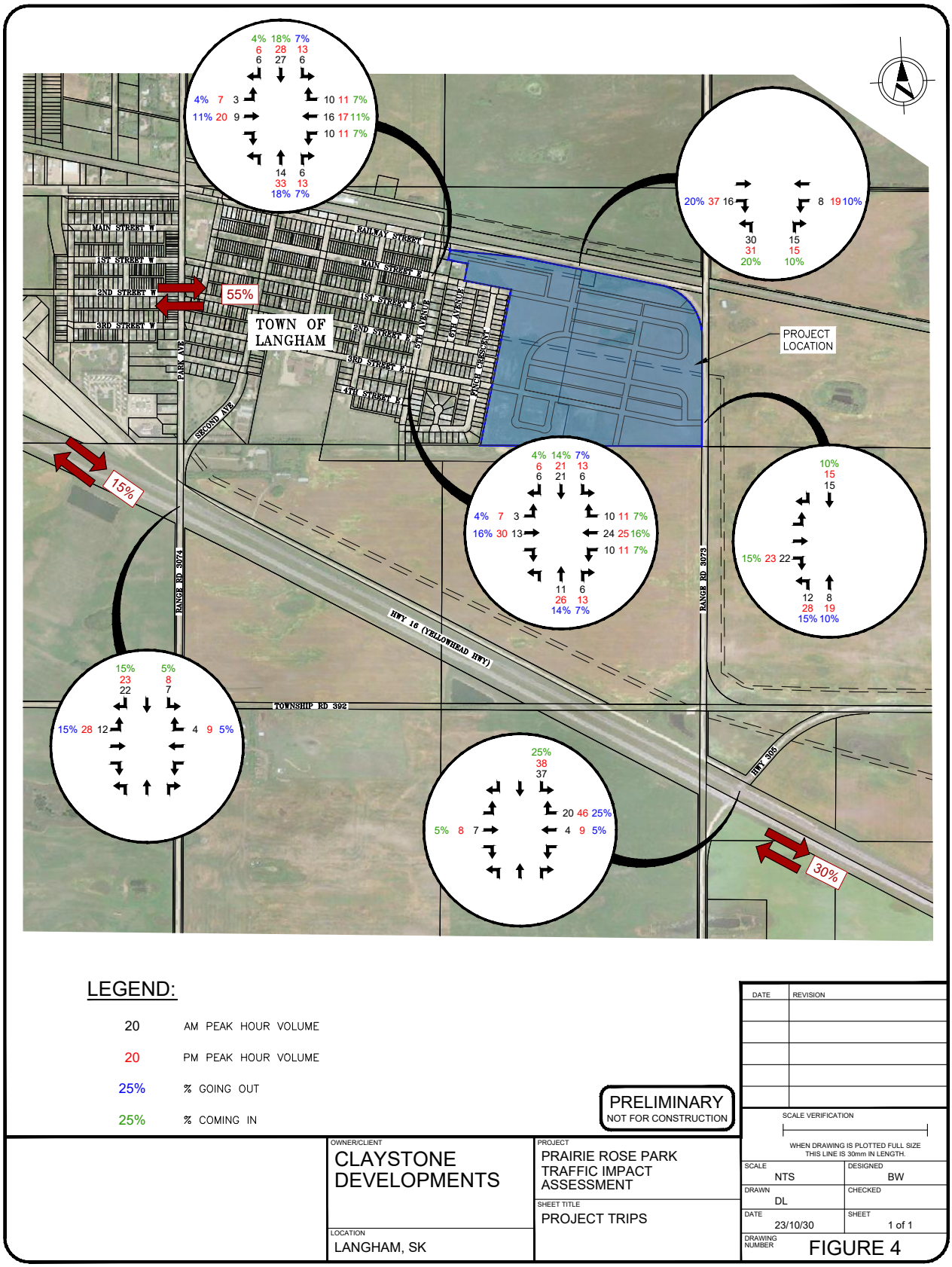

LEGEND:

20	AM PEAK HOUR VOLUME
20	PM PEAK HOUR VOLUME
25%	% GOING OUT
25%	% COMING IN

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LOCATION: LANGHAM, SK

PROJECT: PRAIRIE ROSE PARK TRAFFIC IMPACT ASSESSMENT

SHEET TITLE: PROJECT TRIPS

SCALE: NTS	DESIGNED: BW
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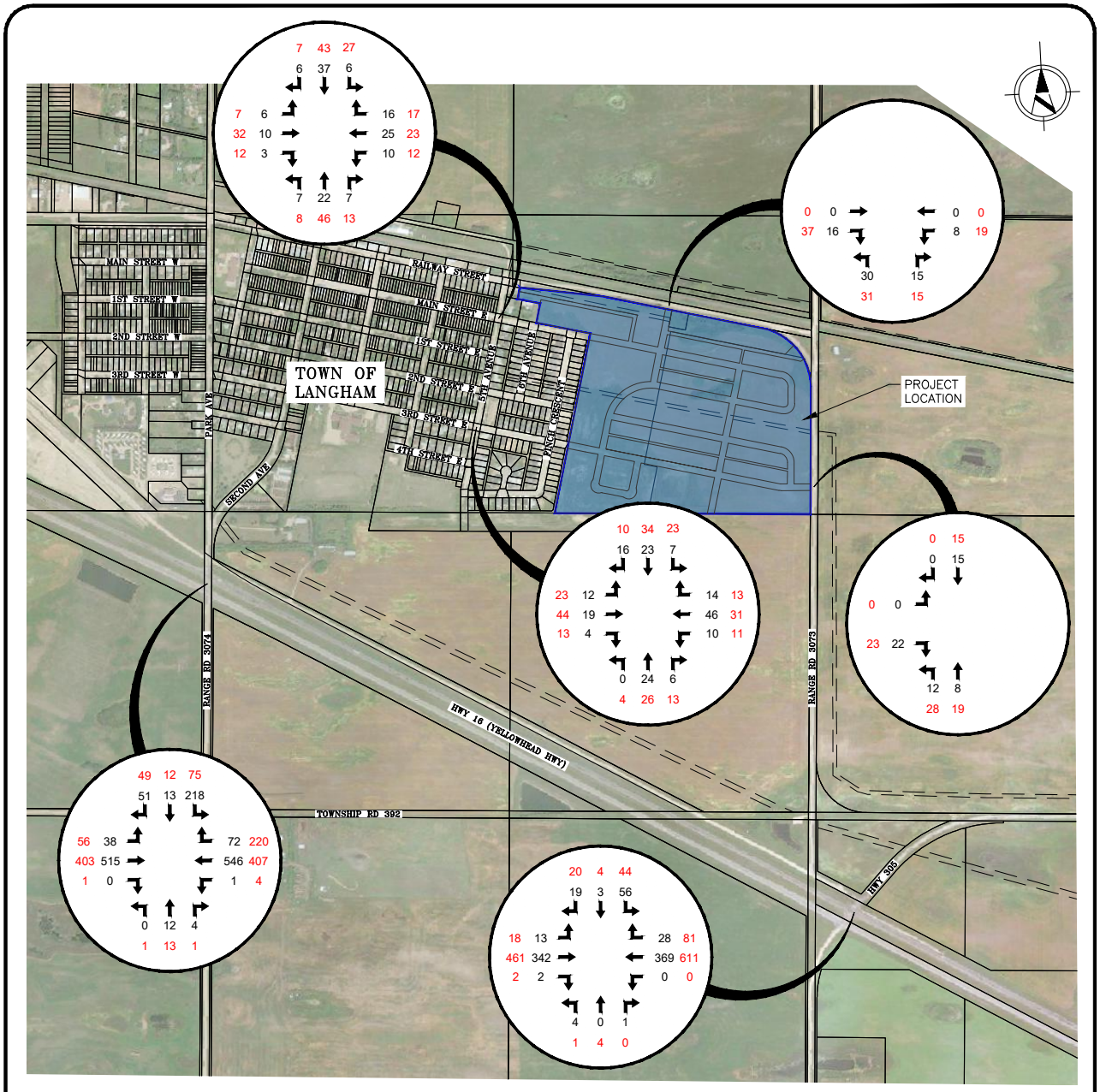
DATE: 23/10/30	SHEET: 1 of 1

DRAWING NUMBER: FIGURE 4

Project No.: 626.003

CLIENT: CLAYSTONE DEVELOPMENTS

Prairie Rose Park Traffic Impact Assessment



LEGEND:

20 AM PEAK HOUR VOLUME

20 PM PEAK HOUR VOLUME

PRELIMINARY
NOT FOR CONSTRUCTION

DATE	REVISION

SCALE VERIFICATION

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OWNER/CLIENT: CLAYSTONE DEVELOPMENTS

LOCATION: LANGHAM, SK

PROJECT: PRAIRIE ROSE PARK TRAFFIC IMPACT ASSESSMENT

SHEET TITLE: 2023 TOTAL TRIPS

SCALE: NTS	DESIGNED: BW
DRAWN: DL	CHECKED:
DATE: 23/10/30	SHEET: 1 of 1
DRAWING NUMBER: FIGURE 5	

4 TRAFFIC OPERATIONS

4.1 INTERSECTION ANALYSIS METHODOLOGY

Existing and total traffic forecast operations were assessed using Synchro 11.0 (industry-standard traffic micro-simulation software).

The level of service (LOS) analysis assesses the effectiveness of a transportation system alphabetically from A to F, with LOS A equating to the lowest user delay and LOS F to high user delay. LOS F is typically assumed to represent failure of a movement or intersection. LOS D or better is desirable for planning purposes. LOS E may be acceptable for left-turn movements to provide better service to opposing through movements. The LOS criteria are provided in **Table 4.1**.

Table 4.1 – LOS Criteria for Signalized and Un-Signalized Intersections

Level of Service	Average Total Delay (seconds) (Un-Signalized Intersection)	Average Total Delay (seconds) (Signalized Intersection)
A	10.0 or less	10.0 or less
B	10.1 to 15.0	10.1 to 20.0
C	15.1 to 25.0	20.1 to 35.0
D	25.1 to 35.0	35.1 to 55.0
E	35.1 to 50.0	55.1 to 80.0
F	Greater than 50.0	Greater than 80.0

Other measures, such as average vehicle delay and volume-to-capacity (v/c) ratio assist with the assessment. The v/c ratio represents the amount of congestion and available capacity at an intersection and for each individual movement at an intersection. V/c ratio generally is indicative of an intersection's flexibility and ability to accommodate fluctuations in traffic flow. Volume-to-capacity (v/c) has a theoretical maximum of 1.00 and a value of 0.85 is generally accepted as the maximum desirable value for design of intersection improvements in urban settings.

4.2 INTERSECTION LANE CONFIGURATION

The existing and proposed intersection controls and lane configurations of the study intersections are shown in **Table 4.2**. Initially, it was assumed that the proposed intersections will have one shared left-through-right lanes in all four directions.

Table 4.2 - Existing & Proposed Intersection Lane Configuration

Intersection	Control Type	Eastbound			Westbound			Northbound			Southbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Highway 16 & Highway 305	2-Way Stop	1	2	<	>	2	1	>	1	<	>	1	<
Highway 16 & RR 3074	2-Way Stop	1	2	<	1	2	1	>	1	<	>	1	1
Main St E & Fifth Ave	2-Way Stop	>	1	<	>	1	<	>	1	<	>	1	<
Third St E & Fifth Ave	4-Way Stop	>	1	<	>	1	<	>	1	<	>	1	<
Railway Street & Proposed Noth Road	1-Way Stop	-	1	<	>	1	-	>	-	<	-	-	-
RR 3073 & Proposed East Road	2-Way Stop	>	-	<	-	-	-	>	1	-	-	1	<

Note: > means no dedicated left turn lane but shared with the adjacent through lane
< means no dedicated right turn lane but shared with the adjacent through lane

4.3 PERFORMANCE OF STUDY INTERSECTIONS

The intersection capacity and LOS analysis were conducted at the study intersections for existing (2023), future background (2038), and the future total traffic (2038) horizons utilizing Synchro 11.0 software. The intersections were examined with existing and proposed control types and lane configurations. The detailed Synchro outputs for AM and PM peak hour analysis are provided in **Appendix C**.

4.4 2023 EXISTING CONDITIONS

The 2023 existing traffic capacity results for AM and PM peak hours are summarized in **Table 4.3**.

Table 4.3 – 2023 Existing Condition Analysis Results

AM Peak Hour			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	INT
Highway 16 & Highway 305 (existing)															
2023	Existing	LOS	A	A	A	A	A	A	B	B	B	B	B	B	A
		Delay (s)	7.9	0.0	0.0	0.0	0.1	0.0	10.5	10.8	10.8	10.2	10.2	10.2	0.8
		v/c	0.01	0.11	0.05	0.00	0.12	0.00	0.01	0.01	0.01	0.04	0.04	0.04	0.12
		95th% Queue (m)	0.2	0.0	0.0	0.0	0.0	0.0	0.32	0.2	0.2	1.0	1.0	1.0	-

Highway 16 & Range Road 3074 (existing)															
2023	Existing	LOS	A	A	A	A	A	A	B	B	B	C	C	C	A
		Delay (s)	8.5	0.0	0.0	8.2	0.0	0.0	13.1	13.1	13.1	16.7	16.7	16.7	3.3
		v/c	0.02	0.16	0.08	0.00	0.13	0.03	0.03	0.03	0.03	0.40	0.40	0.40	0.40
		95th% Queue (m)	0.5	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.7	14.6	14.6	14.6	-
Main Street E & Fifty Avenue (existing)															
2023	Existing	LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
		Delay (s)	8.7	8.7	8.7	8.9	8.9	8.9	0.0	2.8	2.8	0.0	1.2	1.2	4.9
		v/c	0.01	0.01	0.01	0.01	0.01	0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.01
		95th% Queue (m)	0.1	0.1	0.1	0.3	0.3	0.3	0.1	0.1	0.1	0.0	0.0	0.0	-
Third Street E & Fifth Avenue (existing)															
2023	Existing	LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
		Delay (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.7	6.7	6.7	7.0
		v/c	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01	0.03
		95th% Queue (m)	-	-	-	-	-	-	-	-	-	-	-	-	-
PM Peak Hour			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	INT
Highway 16 & Highway 305 (existing)															
2023	Existing	LOS	A	A	A	A	A	A	B	B	B	B	B	B	A
		Delay (s)	8.5	0.0	0.0	0.0	0.0	0.0	11.8	11.8	11.8	10.9	10.9	10.9	0.5
		v/c	0.01	0.14	0.07	0.00	0.19	0.02	0.01	0.01	0.01	0.03	0.03	0.03	0.19
		95th% Queue (m)	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	0.8	0.8	0.8	-
Highway 16 & Range Road 3074 (existing)															
2023	Existing	LOS	A	A	A	A	A	A	B	B	B	B	B	B	A
		Delay (s)	8.5	0.0	0.0	8.0	0.0	0.0	13.4	13.4	13.4	11.9	11.9	11.9	1.5
		v/c	0.02	0.13	0.06	0.00	0.10	0.10	0.03	0.03	0.03	0.14	0.14	0.14	0.14
		95th% Queue (m)	0.5	0.0	0.0	0.1	0.0	0.0	0.7	0.7	0.7	3.7	3.7	3.7	-
Main Street E & Fifty Avenue (existing)															
2023	Existing	LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
		Delay (s)	9.0	9.0	9.0	8.9	8.9	8.9	0.0	2.3	2.3	0.1	3.4	3.4	5.4
		v/c	0.02	0.02	0.02	0.01	0.01	0.01	0.0	0.0	0.0	0.01	0.01	0.01	0.02
		95th% Queue (m)	0.5	0.5	0.5	0.3	0.3	0.3	0.1	0.1	0.1	0.2	0.2	0.2	-
Third Street E & Fifth Avenue (existing)															
2023	Existing	LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
		Delay (s)	7.1	7.1	7.1	7.0	7.0	7.0	7.0	7.0	7.0	7.1	7.1	7.1	7.1
		v/c	0.04	0.04	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.04
		95th% Queue (m)	-	-	-	-	-	-	-	-	-	-	-	-	-

Highway 16 & Highway 305

At existing conditions, the intersection of Highway 16 & Highway 305 operates within the acceptable conditions. The overall intersection operates at LOS A during both the AM and PM peak hours. All individual movements operate at LOS B or better during both peak hours. The maximum v/c is 0.19 during the PM peak hour and queuing is not a concern.

Highway 16 & Range Road 3074

The intersection of Highway 16 & Range Road 3074 operates within acceptable conditions at the existing traffic conditions. The overall intersection operates at LOS A during both the AM and PM peak hours. The free flow movements along Highway 16 operate at LOS A during both peak hours. The northbound movements operate at LOS B during both peak hours and southbound movements operate at LOS C during the AM peak hour and LOS B during the PM peak hour. The maximum v/c is 0.40 and the maximum 95th percentile queue for southbound movements is 14.6 meters.

Main Street E & Fifth Avenue

At existing conditions, the intersection of Main Street East & Fifth Avenue operates well within the acceptable conditions during both the AM and PM peak hours. The overall intersection and all individual movements operate at LOS A during both peak hours. The maximum v/c is 0.02 and queuing is not a concern.

Third Street E & Fifth Avenue

The intersection of Third Street East & Fifth Avenue operates well within the acceptable conditions during both the AM and PM peak hours at existing conditions. The overall intersection and all individual movements operate at LOS A during both peak hours. The maximum v/c is 0.04 and queuing is not a concern.

4.5 2038 FUTURE BACKGROUND CONDITIONS

MoH is planning to construct an acceleration lane in the eastbound direction on Highway 16 for southbound left turn movements at Highway 16 & Range Road 3074 intersection in 2024. The eastbound acceleration lane was considered for the future background condition analysis. The results for the 2038 future background traffic condition analysis for AM and PM peak hours are summarized in **Table 4.4**.

Table 4.4 – 2038 Future Background Condition Analysis Results

AM Peak Hour			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	INT
Highway 16 & Highway 305 (existing)															
2038	Future Background	LOS	A	A	A	A	A	A	B	B	B	B	B	B	A
		Delay (s)	8.1	0.0	0.0	0.0	0.0	0.0	11.6	11.6	11.6	11.0	11.0	11.0	0.8
		v/c	0.01	0.14	0.07	0.00	0.15	0.00	0.01	0.01	0.01	0.07	0.07	0.07	0.15
		95th% Queue (m)	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	1.6	1.6	1.6	-

Highway 16 & Range Road 3074 (existing)															
2038	Future Background	LOS	A	A	A	A	A	A	C	C	C	D	D	D	A
		Delay (s)	9.0	0.0	0.0	8.6	0.0	0.0	15.2	15.2	15.2	27.2	27.2	27.2	5.2
		v/c	0.03	0.21	0.11	0.00	0.17	0.04	0.05	0.05	0.05	0.63	0.63	0.63	0.83
		95th% Queue (m)	0.7	0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	32.4	32.4	32.4	-
Main Street E & Fifty Avenue (existing)															
2038	Future Background	LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
		Delay (s)	8.7	8.7	8.7	9.0	9.0	9.0	0.0	3.2	3.2	0.0	0.9	0.9	4.9
		v/c	0.01	0.01	0.01	0.02	0.02	0.02	0.0	0.0	0.0	0.0	0.0	0.0	0.02
		95th% Queue (m)	0.2	0.2	0.2	0.4	0.4	0.4	0.1	0.1	0.1	0.0	0.0	0.0	-
Third Street E & Fifth Avenue (existing)															
2038	Future Background	LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
		Delay (s)	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1	6.7	6.7	6.7	7.0
		v/c	0.02	0.02	0.02	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.03
		95th% Queue (m)	-	-	-	-	-	-	-	-	-	-	-	-	-
PM Peak Hour			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	INT
Highway 16 & Highway 305 (existing)															
2038	Future Background	LOS	A	A	A	A	A	A	B	B	B	B	B	B	A
		Delay (s)	9.0	0.0	0.0	0.0	0.0	0.0	13.4	13.4	13.4	12.0	12.0	12.0	0.5
		v/c	0.02	0.19	0.09	0.00	0.25	0.02	0.02	0.02	0.02	0.06	0.06	0.06	0.25
		95th% Queue (m)	0.5	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	1.4	1.4	1.4	-
Highway 16 & Range Road 3074 (existing)															
2038	Future Background	LOS	A	A	A	A	A	A	C	C	C	B	B	B	A
		Delay (s)	9.0	0.0	0.0	8.2	0.0	0.0	15.6	15.6	15.6	13.8	13.8	13.8	1.7
		v/c	0.03	0.17	0.08	0.00	0.13	0.13	0.05	0.05	0.05	0.22	0.22	0.22	0.22
		95th% Queue (m)	0.8	0.0	0.0	0.1	0.0	0.0	1.1	1.1	1.1	6.2	6.2	6.2	-
Main Street E & Fifty Avenue (existing)															
2038	Future Background	LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
		Delay (s)	9.1	9.1	9.1	9.0	9.0	9.0	0.0	2.4	2.4	0.1	3.3	3.3	5.6
		v/c	0.02	0.02	0.02	0.01	0.01	0.01	0.0	0.0	0.0	0.01	0.01	0.01	0.03
		95th% Queue (m)	0.7	0.7	0.7	0.3	0.3	0.3	0.1	0.1	0.1	0.2	0.2	0.2	-
Third Street E & Fifth Avenue (existing)															
2038	Future Background	LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
		Delay (s)	7.1	7.1	7.1	7.0	7.0	7.0	7.1	7.1	7.1	7.2	7.2	7.2	7.1
		v/c	0.05	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.03	0.03	0.05
		95th% Queue (m)	-	-	-	-	-	-	-	-	-	-	-	-	-

Highway 16 & Highway 305

At future background conditions, the intersection of Highway 16 & Highway 305 is expected to operate within acceptable conditions. The overall intersection is expected to operate at LOS A during both the AM and PM peak hours. All individual movements are anticipated to operate at LOS B or better during both peak hours. The maximum v/c is anticipated to be 0.25 and queuing is expected to continue to not be a concern.

Highway 16 & Range Road 3074

The overall intersection of Highway 16 & Range Road 3074 is expected to continue operating at LOS A during both the AM and PM peak hours at future background traffic conditions. The free flow movements along Highway 16 are expected to operate at LOS A during both peak hours. The northbound movements are anticipated to deteriorate from LOS B to LOS C during both peak hours. The southbound movements are expected to deteriorate from LOS C to LOS D during the AM peak but continue operating at LOS B during the PM peak hour. The maximum v/c is expected to be 0.83 and the maximum 95th percentile queue for southbound movements is foreseen to be 32.4 meters.

Main Street E & Fifth Avenue

At future background conditions, the intersection of Main Street East & Fifth Avenue is expected to operate well within the acceptable conditions during both the AM and PM peak hours. The overall intersection and all individual movements are anticipated to operate at LOS A during both peak hours. The maximum v/c is expected to be 0.03 and queuing would not be a concern.

Third Street E & Fifth Avenue

The intersection of Third Street East & Fifth Avenue is anticipated to operate well within the acceptable conditions during both the AM and PM peak hours at future background traffic conditions. The overall intersection and all individual movements operate at LOS A during both peak hours. The maximum v/c is expected to be 0.05 and queuing would not be a concern.

4.6 2038 TOTAL TRAFFIC CONDITIONS

Two new intersections were added to the analysis at full build-out condition of the proposed subdivision. The results of traffic analysis for 2038 total traffic conditions (future background plus site-generated traffic) at the study intersections are illustrated in **Table 4.5**.

Table 4.5 – 2038 Total Traffic Condition Analysis Results

AM Peak Hour			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	INT
Highway 16 & Highway 305 (existing)															
2038	Total Traffic	LOS	A	A	A	A	A	A	B	B	B	B	B	B	A
		Delay (s)	8.2	0.0	0.0	0.0	0.0	0.0	11.7	11.7	11.7	12.0	12.0	12.0	1.4
		v/c	0.01	0.14	0.07	0.00	0.15	0.02	0.01	0.01	0.01	0.14	0.14	0.14	0.15
		95th% Queue (m)	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.3	3.6	3.6	3.6	-

Highway 16 & Range Road 3074 (existing)															
2038	Total Traffic	LOS	A	A	A	A	A	A	C	C	C	D	D	D	A
		Delay (s)	9.1	0.0	0.0	8.6	0.0	0.0	15.7	15.7	15.7	30.8	30.8	30.8	6.3
		v/c	0.04	0.21	0.11	0.00	0.17	0.04	0.05	0.05	0.05	0.70	0.70	0.70	0.70
		95th% Queue (m)	1.0	0.0	0.0	0.0	0.0	0.0	1.3	1.3	1.3	39.8	39.8	39.8	-
Main Street E & Fifty Avenue (existing)															
2038	Total Traffic	LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
		Delay (s)	9.5	9.5	9.5	9.4	9.4	9.4	0.0	1.4	1.4	0.0	0.8	0.8	4.8
		v/c	0.02	0.02	0.02	0.06	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.06
		95th% Queue (m)	0.6	0.6	0.6	1.5	1.5	1.5	0.1	0.1	0.1	0.1	0.1	0.1	-
Third Street E & Fifth Avenue (existing)															
2038	Total Traffic	LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
		Delay (s)	7.4	7.4	7.4	7.4	7.4	7.4	7.3	7.3	7.3	7.3	7.3	7.3	7.3
		v/c	0.04	0.04	0.04	0.08	0.08	0.08	0.04	0.04	0.04	0.05	0.05	0.05	0.08
		95th% Queue (m)	-	-	-	-	-	-	-	-	-	-	-	-	-
Railway Street & Proposed North Road (proposed)															
2038	Total Traffic	LOS	-	A	A	A	A	-	A	-	A	-	-	-	A
		Delay (s)	-	0.0	0.0	0.0	3.1	-	8.8	-	8.8	-	-	-	5.1
		v/c	-	0.02	0.02	0.01	0.01	-	0.05	-	0.05	-	-	-	0.05
		95th% Queue (m)	-	0.0	0.0	0.1	0.1	-	1.2	-	1.2	-	-	-	-
Range Road 3073 & Proposed East Road (proposed)															
2038	Total Traffic	LOS	A	-	A	-	-	-	A	A	-	-	A	A	
		Delay (s)	8.7	-	8.7	-	-	-	0.1	4.5	-	-	0.0	0.0	4.8
		v/c	0.03	-	0.03	-	-	-	0.01	0.01	-	-	0.02	0.02	0.03
		95th% Queue (m)	0.8	-	0.8	-	-	-	0.2	0.2	-	-	0.0	0.0	-
PM Peak Hour			EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	INT
Highway 16 & Highway 305 (existing)															
2038	Total Traffic	LOS	A	A	A	A	A	A	B	B	B	B	B	B	A
		Delay (s)	9.2	0.0	0.0	0.0	0.0	0.0	13.7	13.7	13.7	14.7	14.7	14.7	1.0
		v/c	0.02	0.19	0.10	0.00	0.25	0.05	0.02	0.02	0.02	0.16	0.16	0.16	0.25
		95th% Queue (m)	0.5	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.4	4.3	4.3	4.3	-
Highway 16 & Range Road 3074 (existing)															
2038	Total Traffic	LOS	A	A	A	A	A	A	C	C	C	B	B	B	A
		Delay (s)	9.2	0.0	0.0	8.2	0.0	0.0	16.7	16.7	16.7	14.4	14.4	14.4	2.2
		v/c	0.06	0.17	0.08	0.00	0.13	0.14	0.05	0.05	0.05	0.27	0.27	0.27	0.27
		95th% Queue (m)	1.6	0.0	0.0	0.1	0.0	0.0	1.2	1.2	1.2	8.4	8.4	8.4	-
Main Street E & Fifty Avenue (existing)															
2038	Total Traffic	LOS	B	B	B	A	A	A	A	A	A	A	A	A	A
		Delay (s)	10.1	10.1	10.1	10.0	10.0	10.0	0.0	0.9	0.9	0.1	2.7	2.7	5.3
		v/c	0.07	0.07	0.07	0.07	0.07	0.07	0.01	0.01	0.01	0.02	0.02	0.02	0.07
		95th% Queue (m)	1.8	1.8	1.8	1.7	1.7	1.7	0.1	0.1	0.1	0.4	0.4	0.4	-
Third Street E & Fifth Avenue (existing)															

2038	Total Traffic	LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
		Delay (s)	7.7	7.7	7.7	7.5	7.5	7.5	7.4	7.4	7.4	7.7	7.7	7.7	7.6
		v/c	0.10	0.10	0.10	0.07	0.07	0.07	0.05	0.05	0.05	0.08	0.08	0.08	0.10
		95th% Queue (m)	-	-	-	-	-	-	-	-	-	-	-	-	-
Railway Street & Proposed North Road (proposed)															
2038	Total Traffic	LOS	-	A	A	A	A	-	A	-	A	-	-	-	A
		Delay (s)	-	0.0	0.0	0.1	4.8	-	9.0	-	9.0	-	-	-	4.5
		v/c	-	0.03	0.03	0.01	0.01	-	0.05	-	0.05	-	-	-	0.05
		95th% Queue (m)	-	0.0	0.0	0.3	0.3	-	1.2	-	1.2	-	-	-	-
Range Road 3073 & Proposed East Road (proposed)															
2038	Total Traffic	LOS	A	-	A	-	-	-	A	A	-	-	A	A	A
		Delay (s)	8.8	-	8.8	-	-	-	0.1	4.4	-	-	0.0	0.0	4.7
		v/c	0.04	-	0.04	-	-	-	0.02	0.02	-	-	0.02	0.02	0.04
		95th% Queue (m)	0.8	-	0.8	-	-	-	0.4	0.4	-	-	0.0	0.0	-

Highway 16 & Highway 305

At total traffic conditions, the overall intersection of Highway 16 & Highway 305 is expected to continue operating at LOS A during both the AM and PM peak hours. The free flow movements along Highway 16 are expected to continue operating at LOS A during both peak hours. The northbound and southbound movements are anticipated to remain operating at LOS B during both the peak hours. The maximum v/c is foreseen to be 0.25 and the maximum 95th percentile queue for southbound movements are expected to be 4.3 meters. When considering the service road north of Highway 16, the queuing expected in the southbound direction is anticipated to not cause any operational concerns.

Highway 16 & Range Road 3074

The overall intersection of Highway 16 & Range Road 3074 is expected to continue operating at LOS A during both peak hours at 2038 total traffic conditions. The free flow movements along Highway 16 are expected to continue operating at LOS A during both peak hours. The northbound movements are expected to continue operating at LOS C during both the AM and PM peak hours. The southbound movements are expected to continue operating at LOS D during the AM peak hour and LOS B during the PM peak hour. The maximum v/c is expected to be 0.70 and the maximum 95th percentile queue for southbound movements are anticipated to be 39.8 meters which has potential to block upstream intersection of Range Road 3074 & North Parallel Road.

Main Street E & Fifth Avenue

At total traffic conditions, the intersection of Main Street East & Fifth Avenue is expected to operate well within the acceptable conditions during both AM and PM peak hours. The overall intersection is expected to operate at LOS A during both peak hours. The individual movements are anticipated to operate at LOS A during the AM peak hour and at LOS B or better during the PM peak hour. The maximum v/c is expected to be 0.07 and queuing is foreseen to not be a concern.

Third Street E & Fifth Avenue

The intersection of Third Street East & Fifth Avenue is anticipated to operate well within the acceptable conditions during both the AM and PM peak hours at total traffic conditions. The overall intersection and all individual movements are expected to operate at LOS A during both peak hours. The maximum v/c is expected to be 0.10 and queuing would not be a concern.

Railway Street & Proposed North Road

At total traffic conditions, the proposed intersection of Railway Street & Proposed North Road is expected to operate well within the acceptable conditions during both the AM and PM peak hours. The overall intersection and all individual movements are anticipated to operate at LOS A during both the peak hours. The maximum v/c is expected to be 0.05 and queuing would not be a concern.

Range Road 3073 & Proposed East Road

The proposed intersection of Range Road 3073 & Proposed East Road is anticipated to operate well within the acceptable conditions during both AM and PM peak hours at total traffic conditions. The overall intersection and all individual movements are anticipated to operate at LOS A during both peak hours. The maximum v/c is expected to be 0.04 and queuing is foreseen to not be a concern.

5 COLLISION REVIEW

Five-year historical collision data was requested from the Ministry along Highway 16 and Highway 305 in vicinity of the proposed development area. From the data provided, a total of five (5) collisions occurred at the Highway 16 & Highway 305 intersection and six (6) collisions occurred on the Highway 16 segment within vicinity of the development site during the last five years (2019-2023).

Of the collisions that occurred at the Highway 16 & Highway 305 intersection, one (1) collision was fatal, two (2) collisions resulted in injury, and two (2) collisions were Property Damage Only (PDO). Four (4) collisions occurred during daylight and one (1) occurred at night.

Of the accidents that occurred at the Highway 16 segment near Langham, one (1) collision resulted in injury, and five (5) collisions were PDO. On the Highway 16 segment, one (1) collision occurred during daylight and five (5) collisions occurred at night.

A breakdown of the collisions including severity of the collisions as reported by authorities is illustrated in **Table 5.1.**

Table 5.1 – Collision Summary

Collision Date	Severity	Natural Light
Highway 16 & Highway 305 Intersection		
August 1, 2022	Injury	Daylight
January 22, 2022	PDO	Daylight
February 24, 2021	PDO	Daylight
February 10, 2022	Fatal	Dark
January 31, 2022	Injury	Daylight
Highway 16 Segment near New Project (Non-Intersection)		
November 3, 2021	PDO	Dark
July 1, 2019	PDO	Dark
November 15, 2019	PDO	Dark
December 13, 2019	PDO	Dusk
January 31, 2022	Injury	Daylight
November 20, 2022	PDO	Dark

With one fatal collision, three collisions resulting in injury, and seven PDO collisions in the last five years, it was concluded that the Highway 16 segment in the vicinity of the project site is not a high-risk collision area.

6 LANE WARRANT ANALYSIS

Intersection turning lane warrants were assessed to improve potential traffic safety at the study intersections. The warrants were conducted for full build-out condition using the total forecast design hour volumes, existing intersection configurations, and existing study intersection alignments.

6.1 TURNING LANE WARRANTS

The Ministry's System Improvement Warrants provide the Standard Plans used to analyse right-turn lane (Plan No. 20614), bypass lane (Plan No. 20612), and flared intersection (Plan No. 20613) treatments.

Bypass Lane Warrant

The bypass lane intersection treatment is a type of left turn lane intersection treatment used on undivided highways where traffic is channelled around the left turn lane, where the left turn lane is not protected by divisional islands.

The intersection of Highway 16 & Range Road 3074 provides an exclusive left turn lane in both the eastbound and westbound directions. The intersection of Highway 16 & Highway 305 provides an exclusive left turn lane in the eastbound direction but the westbound left turn lane is shared with an outer through lane. Currently, the westbound left turn traffic at this intersection is very low and no left turning vehicles were observed during the peak hour turning movement counts at this intersection. In addition, this intersection provides a wide median which can accommodate 2-3 left turning vehicles. It is recommended that the Ministry monitors this intersection for left turn traffic growth and provide an exclusive left turn lane when it is warranted.

Right-Turn Lane Warrant

The Ministry specifies that the 10th year after the proposed construction date as the analysis horizon for warrants. As the proposed site is expected to be fully developed in 2038, the design hour volumes were projected for the year 2048 with a 2% annual growth rate.

Since an exclusive right turn lane is provided for westbound directions at both the study intersections on Highway 16, a right-turn lane warrant analysis was conducted for only the eastbound movement at both intersections. The right turn lane warrant analysis is included in **Appendix D** and results of the analyses are shown in **Table 6.1**.

Table 6.1 – Right-Turn Warrant Results

Peak Hour	Advancing Volume (Va)	Right-turn Volume (Vr)	R=Vr/Va	Right-Lane Warranted?
Highway 16 & Highway 305 Intersection				
AM	214	2	0.009	No
PM	289	2	0.007	No
Highway 16 & Range Road 3074 Intersection				
AM	333	2	0.006	No
PM	276	1	0.005	No

The findings from the warrant analysis (illustrated in **Appendix D**) indicate that a right-turn lane is not warranted at either of the intersections in the eastbound direction. This conclusion stems from the assessment of development traffic at the study intersections. The plotted points representing AM and PM peak hour volumes for eastbound movements consistently fall to the left side of the curve, indicating that the traffic conditions do not meet the criteria warranting the implementation of a right-turn lane.

7 ILLUMINATION WARRANT ANALYSIS

An intersection illumination warrant was conducted to assess the illumination requirements at the study intersections on Highway 16. The warrants were conducted for full build-out conditions using the total forecasted design hour volumes and the existing intersection configurations. The following two levels of intersection illumination were assessed:

Intersection Delineation Lighting consists of the installation of high-pressure sodium (HPS) luminaire(s) over the intersecting roadway or median connector of divided highways for the purpose of illuminating vehicles entering or crossing the through highway route.

Intersection Area Lighting is the illumination of the intersection area and the adjacent through and auxiliary lanes of the through highway to a specified lighting criterion.

Highway 16 & Range Road 3074 Intersection

As the intersection of Highway 16 & Range Road 3074 already has area lighting, the warrant analysis for Intersection Delineation Lighting and Intersection Area Lighting were not conducted at this intersection.

Highway 16 & Highway 305 Intersection

The intersection of Highway 16 & Highway 305 has Intersection Delineation Lighting with light poles located at the median as well as the northwest and southeast quadrants. The warrant analysis for Intersection Area Lighting was conducted to determine if this intersection requires any additional lighting.

Illumination Warrant for Intersection Area Lighting

Based on the information provided by the Ministry, a K factor of 0.14 was used for Highway 305 and a K factor of 0.12 was used for Highway 16 to determine the AADT. As the PM peak hour volumes are higher in general, the K factors were applied to PM peak hours. **Table 7.1** illustrates the illumination warrant for the intersection area lighting at Highway 16 & Highway 305 intersection.

Table 7.1 – Intersection Area Lighting Warrant Analysis

Traffic Volume Warrant	Raised Channelization / Median Curbing Warrant	Traffic Accident Rate Warrant
No	No	No

Based on the warrant analysis, the intersection at Highway 16 & Highway 305 does not meet the Area Lighting warrant criteria. The warrant analysis is attached in **Appendix E.**

8 SIGHT DISTANCE

The Ministry's Design Manual provides the standard plans for sight distance requirements at intersections. Plan 20630 is used to determine the sight distance for entering vehicles at intersections based on the design speed of the intersecting roadways. The posted speeds on Highway 16, Highway 305, and Range Road 3074 are 110 km/h, 90km/h, and 40 km/h. The design speeds on Highway 16, Highway 305 and Range Road 3074 were assumed to be 130 km/hr, 110 km/h and 60 km/h respectively.

A driver entering a through highway must have sufficient sight distance to cross the highway or make a left or right turn. This sight distance is called a departure sight distance. As the left turn movement takes the longest time, it is used as the controlling movement. Based on the required sight triangle, it was noted that the departure sight distance is clear from any sort of obstruction that has potential to block a driver's view. The departure sight triangles at the study intersections are illustrated in **Appendix F1**.

Plan 20640 is used to draw a sight triangle at intersections to make sure the sight distances along both roadways are adequate to allow drivers of vehicles approaching simultaneously to see each other in time to prevent a collision at the intersection. The required sight triangles at the study intersections are illustrated in **Appendix F2**.

The intersection of Highway 16 & Highway 305 is clear from obstructions, however, the existing trees on the east side of the Range Road 3074 have potential to block driver's view travelling southbound on Range Road 3074. It is recommended the existing trees within the projected sight triangles be removed. It's also recommended that the Town and MoH ensure that no other developments, signs, or property fences be installed within the sight triangles.

9 INTERSECTION CLEARANCE

At a specific request from the Town of Langham, the intersection spacing both south and west from the existing intersection of Range Road 3073 and Railway Street was reviewed. Adequate clearance between the proposed intersections and the channelized eastbound right turn lane is of most concern. From the concept plan of the proposed subdivision within **Appendix B**, the proposed accesses/intersections onto Range Road 3073 (south of the existing intersection) and Railway Street (west of the existing intersection) are currently configured approximately 250 meters from the meeting points along both roads from the channelized eastbound right turn lane.

Based on Table 2.6.5 from the Transportation Association of Canada's (TAC) Geometric Design Guide for Canadian Roads, minimum intersection spacing for collector roads are 60 meters. Thus, the proposed configuration is viable without concern. Even if the existing roadways being considered (Range Road 3073 and Railway Street) were to one day be considered as arterial roads, the minimum intersection spacing for this road classification is 200 meters.

10 ACCESSIBILITY

Concurrent to the TIA, Catterall & Wright is also underway in producing a concept plan for the proposed development area. Configuration and layout of the transportation system has been completed at a high level, as seen in **Appendix B**. The concept also shows locations for proposed parks and pedestrian linkages. All roadways and sidewalks are anticipated to align with the Town of Langham's Development Standards.

All proposed roadways within the development are assumed to be paved, while back alley/lanes are anticipated to be surfaced with traffic gravel as per the Town's Development Standards. Sidewalk locations were proposed based on review of the Town's newer subdivision and how one sidewalk versus two sidewalks is provided throughout. Proposed sidewalk locations also considered where the expected busier streets will be and establishing connectivity to the Town's existing system to provide a continuous level of service throughout the community.

11 CONCLUSION AND RECOMMENDATIONS

The purpose of the Traffic Impact Assessment was to ensure that the existing and proposed study intersections would operate at a satisfactory Level of Service for existing and future traffic conditions at the full build-out of the proposed development.

The access to the proposed site is planned to be provided from Range Road 3074, west of the proposed development, and Range Road 3073 through Highway 305 east of the development. Both Highway 305 and Range Road 3074 form 4-legged, 2-way stop controlled intersections with Highway 16, which operates as free-flow.

Based on the traffic operation analysis, the overall impact of the proposed development does not significantly impact the capacity, operations, or safety of the study intersections. Analysis completed within the report identifies no capacity issues for existing traffic condition (2023) and future background condition (2038). For future total traffic condition (2038), the study intersections will continue to operate at an acceptable level of service with all individual movements operating at LOS C or better except for southbound movements at Highway 16 & Range Road 3074 intersection during the PM peak hour which are expected to operate at LOS D.

Based on the five-year historical collision data (2019-2023) provided by the Ministry, a total of 5 collisions occurred at the Highway 16 & Highway 305 intersection and 6 collisions occurred on the Highway 16 segment near Langham during this timeframe. One collision was fatal, three collisions were injury related and seven collisions were related to Property Damage Only (PDO). Upon review, it was interpreted that the Highway 16 segment in the vicinity of the project site is not a high-risk collision area.

Intersection illumination warrants were conducted to assess the illumination requirements for the study intersection on Highway 16. As the Intersection Area Lighting is already provided at Highway 16 & Range Road 3074 Intersection, illumination warrants were not conducted at this intersection.

The intersection of Highway 16 & Highway 305 provides Intersection Delineation Lighting with light poles located at the median as well as the northwest and southeast quadrants. The warrant analysis for Intersection Area Lighting was conducted at this intersection to determine if additional lighting will be required at the full buildout conditions. Based on the warrant analysis, the intersection at Highway 16 and Highway 305 does not meet the Area Lighting warrant criteria.

As an exclusive right turn lane is provided for eastbound direction at both the Highway 16 & Range Road 3075 intersection and the Highway 16 & Highway 305 intersection, right-turn lane warrant analysis was conducted solely for eastbound movements at both the study intersections. The results of the warrant analysis indicate that a right-turn lane for the eastbound direction is not warranted at both study intersections at the 10-year post development full buildout horizon (2048).

The intersection of Highway 16 & Range Road 3074 provides an exclusive left turn lane in both the eastbound and westbound directions. The intersection of Highway 16 & Highway 305 provides an exclusive left turn lane in eastbound direction but the westbound left turn lane is shared with an outer through lane. However, this intersection provides a wide median which can accommodate 2-3 left turning vehicles**. It is recommended that the Ministry observes this intersection for growth in left turn traffic and provide an exclusive left turn lane when it is warranted.**

The sight triangles were drawn at both the study intersections on Highway 16. The departure sight distances are clear from any sort of obstruction that has potential to block a driver' view. The sight triangle at Highway 16 & Highway 305 is clear from obstructions, however, existing trees observed on the east side of Range Road 3074 are within the sight triangle at the Highway 16 & Range Road intersection**. It is recommended that existing trees within this sight triangle are removed and that the Town in coordination with the Ministry of Highway ensure that no other developments, signs, or property fences be installed within the sight triangle.**

12 CLOSURE

We trust that we have provided sufficient information in this report in determining the impacts that may become apparent with the proposed development. We would be pleased to discuss any aspect of this report and invite all reasonable comments from the interested parties.

Yours truly,

Brandon Williams, P.Eng.
Transportation Manager

Appendix A Existing Traffic Counts

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Fifth Ave & 3rd Street - Data Collection Phase`
Site Code: 626.003
Start Date: 10/25/2023

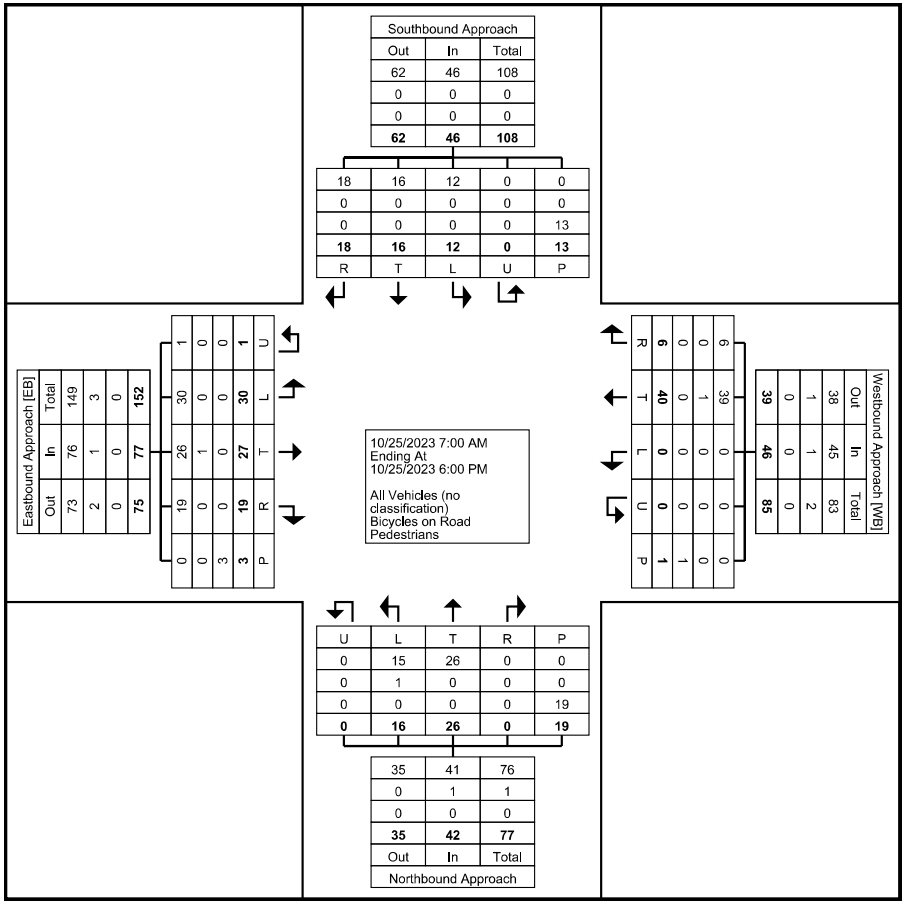
Turning Movement Data

Start Time	Southbound Approach Southbound						Westbound Approach Westbound						Northbound Approach Northbound						Eastbound Approach Eastbound						
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Int. Total
7:00 AM	1	0	0	0	0	1	0	2	0	0	0	2	0	2	2	0	0	4	0	0	0	0	0	0	7
7:15 AM	2	1	0	0	0	3	0	3	0	0	0	3	0	2	3	0	0	5	0	0	0	0	0	0	11
7:30 AM	1	0	0	0	0	1	0	4	0	0	0	4	0	1	0	0	0	1	0	0	1	0	0	1	7
7:45 AM	0	0	0	0	0	0	0	3	0	0	0	3	0	0	3	0	0	3	1	0	0	0	0	1	7
Hourly Total	4	1	0	0	0	5	0	12	0	0	0	12	0	5	8	0	0	13	1	0	1	0	0	2	32
8:00 AM	0	0	1	0	0	1	1	2	0	0	0	3	0	2	0	0	0	2	0	1	0	0	0	1	7
8:15 AM	2	0	0	0	0	2	1	3	0	0	0	4	0	0	0	0	3	0	0	0	3	0	0	3	9
8:30 AM	3	2	0	0	9	5	1	10	0	0	0	11	0	6	0	0	9	6	2	4	2	0	0	8	30
8:45 AM	3	0	0	0	0	3	0	2	0	0	0	2	0	2	0	0	2	2	1	0	2	0	1	3	10
Hourly Total	8	2	1	0	9	11	3	17	0	0	0	20	0	10	0	0	14	10	3	5	7	0	1	15	56
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4:00 PM	0	1	1	0	0	2	0	2	0	0	0	2	0	0	1	0	0	1	3	3	4	1	0	11	16
4:15 PM	2	1	0	0	2	3	0	2	0	0	0	2	0	2	1	0	1	3	0	1	3	0	1	4	12
4:30 PM	0	1	3	0	0	4	0	0	0	0	0	0	0	2	0	0	1	2	3	4	3	0	0	10	16
4:45 PM	1	5	1	0	1	7	1	3	0	0	1	4	0	0	1	0	1	1	2	2	3	0	0	7	19
Hourly Total	3	8	5	0	3	16	1	7	0	0	1	8	0	4	3	0	3	7	8	10	13	1	1	32	63
5:00 PM	2	2	2	0	1	6	0	0	0	0	0	0	0	4	0	0	0	4	3	3	1	0	0	7	17
5:15 PM	0	2	2	0	0	4	1	2	0	0	0	3	0	3	2	0	0	5	2	2	5	0	0	9	21
5:30 PM	1	1	1	0	0	3	0	1	0	0	0	1	0	0	1	0	0	1	1	4	2	0	1	7	12
5:45 PM	0	0	1	0	0	1	1	1	0	0	0	2	0	0	2	0	2	2	1	3	1	0	0	5	10
Hourly Total	3	5	6	0	1	14	2	4	0	0	0	6	0	7	5	0	2	12	7	12	9	0	1	28	60
Grand Total	18	16	12	0	13	46	6	40	0	0	1	46	0	26	16	0	19	42	19	27	30	1	3	77	211
Approach %	39.1	34.8	26.1	0.0	-	-	13.0	87.0	0.0	0.0	-	-	0.0	61.9	38.1	0.0	-	-	24.7	35.1	39.0	1.3	-	-	-
Total %	8.5	7.6	5.7	0.0	-	21.8	2.8	19.0	0.0	0.0	-	21.8	0.0	12.3	7.6	0.0	-	19.9	9.0	12.8	14.2	0.5	-	36.5	-
All Vehicles (no classification)	18	16	12	0	-	46	6	39	0	0	-	45	0	26	15	0	-	41	19	26	30	1	-	76	208
% All Vehicles (no classification)	100.0	100.0	100.0	-	-	100.0	100.0	97.5	-	-	-	97.8	-	100.0	93.8	-	-	97.6	100.0	96.3	100.0	100.0	-	98.7	98.6
Bicycles on Road	0	0	0	0	-	0	0	1	0	0	-	1	0	0	1	0	-	1	0	1	0	0	-	1	3
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	2.5	-	-	-	2.2	-	0.0	6.3	-	-	2.4	0.0	3.7	0.0	0.0	-	1.3	1.4
Pedestrians	-	-	-	-	13	-	-	-	-	-	1	-	-	-	-	-	19	-	-	-	-	-	3	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Fifth Ave & 3rd Street - Data Collection Phase`
Site Code: 626.003
Start Date: 10/25/2023
Page No: 2



Turning Movement Data Plot

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Fifth Ave & 3rd Street - Data Collection Phase`
Site Code: 626.003
Start Date: 10/25/2023

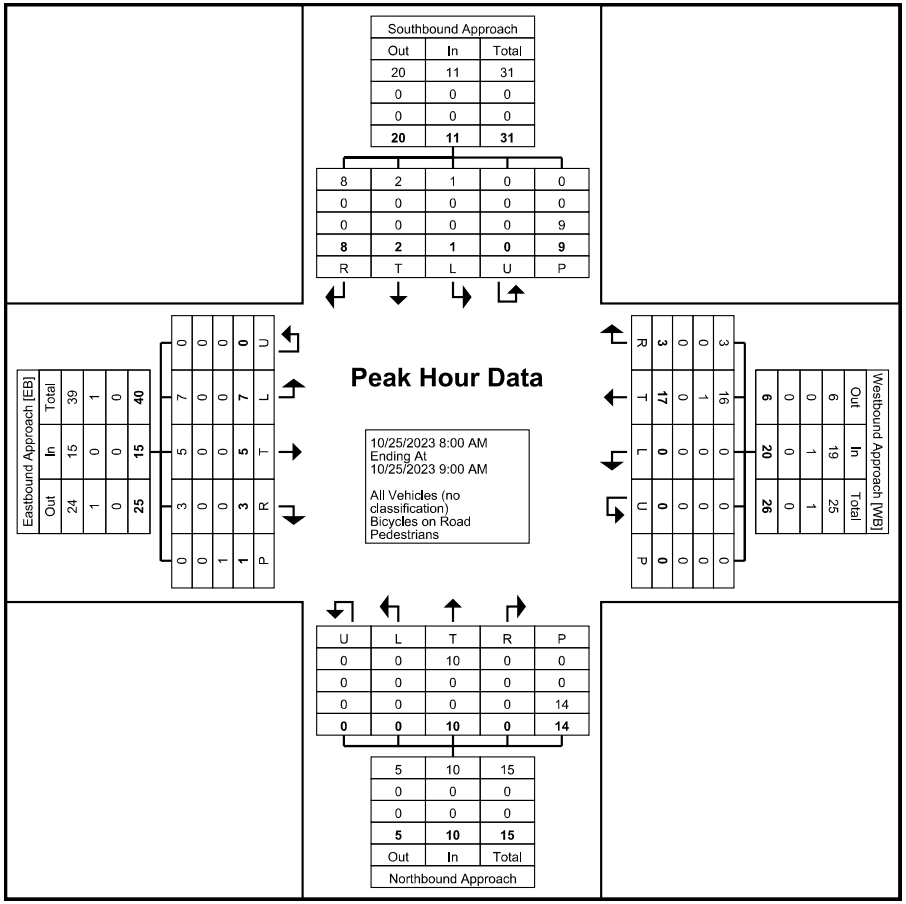
Turning Movement Peak Hour Data (8:00 AM)

Start Time	Southbound Approach						Westbound Approach						Northbound Approach						Eastbound Approach						
	Southbound						Westbound						Northbound						Eastbound						
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Int. Total
8:00 AM	0	0	1	0	0	1	1	2	0	0	0	3	0	2	0	0	0	2	0	1	0	0	0	1	7
8:15 AM	2	0	0	0	0	2	1	3	0	0	0	4	0	0	0	0	3	0	0	0	3	0	0	3	9
8:30 AM	3	2	0	0	9	5	1	10	0	0	0	11	0	6	0	0	9	6	2	4	2	0	0	8	30
8:45 AM	3	0	0	0	0	3	0	2	0	0	0	2	0	2	0	0	2	2	1	0	2	0	1	3	10
Total	8	2	1	0	9	11	3	17	0	0	0	20	0	10	0	0	14	10	3	5	7	0	1	15	56
Approach %	72.7	18.2	9.1	0.0	-	-	15.0	85.0	0.0	0.0	-	-	0.0	100.0	0.0	0.0	-	-	20.0	33.3	46.7	0.0	-	-	-
Total %	14.3	3.6	1.8	0.0	-	19.6	5.4	30.4	0.0	0.0	-	35.7	0.0	17.9	0.0	0.0	-	17.9	5.4	8.9	12.5	0.0	-	26.8	-
PHF	0.667	0.250	0.250	0.000	-	0.550	0.750	0.425	0.000	0.000	-	0.455	0.000	0.417	0.000	0.000	-	0.417	0.375	0.313	0.583	0.000	-	0.469	0.467
All Vehicles (no classification)	8	2	1	0	-	11	3	16	0	0	-	19	0	10	0	0	-	10	3	5	7	0	-	15	55
% All Vehicles (no classification)	100.0	100.0	100.0	-	-	100.0	100.0	94.1	-	-	-	95.0	-	100.0	-	-	-	100.0	100.0	100.0	100.0	-	-	100.0	98.2
Bicycles on Road	0	0	0	0	-	0	0	1	0	0	-	1	0	0	0	0	-	0	0	0	0	0	-	0	1
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	5.9	-	-	-	5.0	-	0.0	-	-	-	0.0	0.0	0.0	0.0	-	-	0.0	1.8
Pedestrians	-	-	-	-	9	-	-	-	-	-	0	-	-	-	-	-	14	-	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Fifth Ave & 3rd Street - Data Collection Phase`
Site Code: 626.003
Start Date: 10/25/2023
Page No: 4



Turning Movement Peak Hour Data Plot (8:00 AM)

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Fifth Ave & 3rd Street - Data Collection Phase`
Site Code: 626.003
Start Date: 10/25/2023

Turning Movement Peak Hour Data (4:30 PM)

Start Time	Southbound Approach						Westbound Approach						Northbound Approach						Eastbound Approach						
	Southbound						Westbound						Northbound						Eastbound						
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Int. Total
4:30 PM	0	1	3	0	0	4	0	0	0	0	0	0	0	2	0	0	1	2	3	4	3	0	0	10	16
4:45 PM	1	5	1	0	1	7	1	3	0	0	1	4	0	0	1	0	1	1	2	2	3	0	0	7	19
5:00 PM	2	2	2	0	1	6	0	0	0	0	0	0	0	4	0	0	0	4	3	3	1	0	0	7	17
5:15 PM	0	2	2	0	0	4	1	2	0	0	0	3	0	3	2	0	0	5	2	2	5	0	0	9	21
Total	3	10	8	0	2	21	2	5	0	0	1	7	0	9	3	0	2	12	10	11	12	0	0	33	73
Approach %	14.3	47.6	38.1	0.0	-	-	28.6	71.4	0.0	0.0	-	-	0.0	75.0	25.0	0.0	-	-	30.3	33.3	36.4	0.0	-	-	-
Total %	4.1	13.7	11.0	0.0	-	28.8	2.7	6.8	0.0	0.0	-	9.6	0.0	12.3	4.1	0.0	-	16.4	13.7	15.1	16.4	0.0	-	45.2	-
PHF	0.375	0.500	0.667	0.000	-	0.750	0.500	0.417	0.000	0.000	-	0.438	0.000	0.563	0.375	0.000	-	0.600	0.833	0.688	0.600	0.000	-	0.825	0.869
All Vehicles (no classification)	3	10	8	0	-	21	2	5	0	0	-	7	0	9	2	0	-	11	10	11	12	0	-	33	72
% All Vehicles (no classification)	100.0	100.0	100.0	-	-	100.0	100.0	100.0	-	-	-	100.0	-	100.0	66.7	-	-	91.7	100.0	100.0	100.0	-	-	100.0	98.6
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	1	0	-	1	0	0	0	0	-	0	1
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	-	0.0	-	0.0	33.3	-	-	8.3	0.0	0.0	0.0	-	-	0.0	1.4
Pedestrians	-	-	-	-	2	-	-	-	-	-	1	-	-	-	-	-	2	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Fifth Ave & 3rd Street - Data Collection Phase`
Site Code: 626.003
Start Date: 10/25/2023
Page No: 6

Peak Hour Data

10/25/2023 4:30 PM
Ending At
10/25/2023 5:30 PM

All Vehicles (no classification)
Bicycles on Road
Pedestrians

Southbound Approach

Out	In	Total
23	21	44
0	0	0
0	0	0
23	**21**	**44**

R	T	L	U	P
3	10	8	0	0
0	0	0	0	0
0	0	0	0	2
3	**10**	**8**	**0**	**2**

Eastbound Approach [EB]

Out	In	Total
10	33	43
1	0	1
0	0	0
11	**33**	**44**

U	L	T	R	P
0	0	0	0	0
0	12	11	10	0
0	0	0	0	0
0	0	0	0	0
0	**12**	**11**	**10**	**0**

Westbound Approach [WB]

Out	In	Total
19	7	26
0	0	0
0	0	0
19	**7**	**26**

R	T	L	U	P
2	5	0	0	0
0	0	0	0	0
0	0	0	0	1
0	0	0	0	0
2	**5**	**0**	**0**	**1**

U	L	T	R	P
0	2	9	0	0
0	1	0	0	0
0	0	0	0	2
0	**3**	**9**	**0**	**2**

Northbound Approach

Out	In	Total
20	11	31
0	1	1
0	0	0
20	**12**	**32**

Turning Movement Peak Hour Data Plot (4:30 PM)

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Hwy 16 & Hwy 305 - Data Collection Phase
Site Code: 626.003
Start Date: 10/26/2023

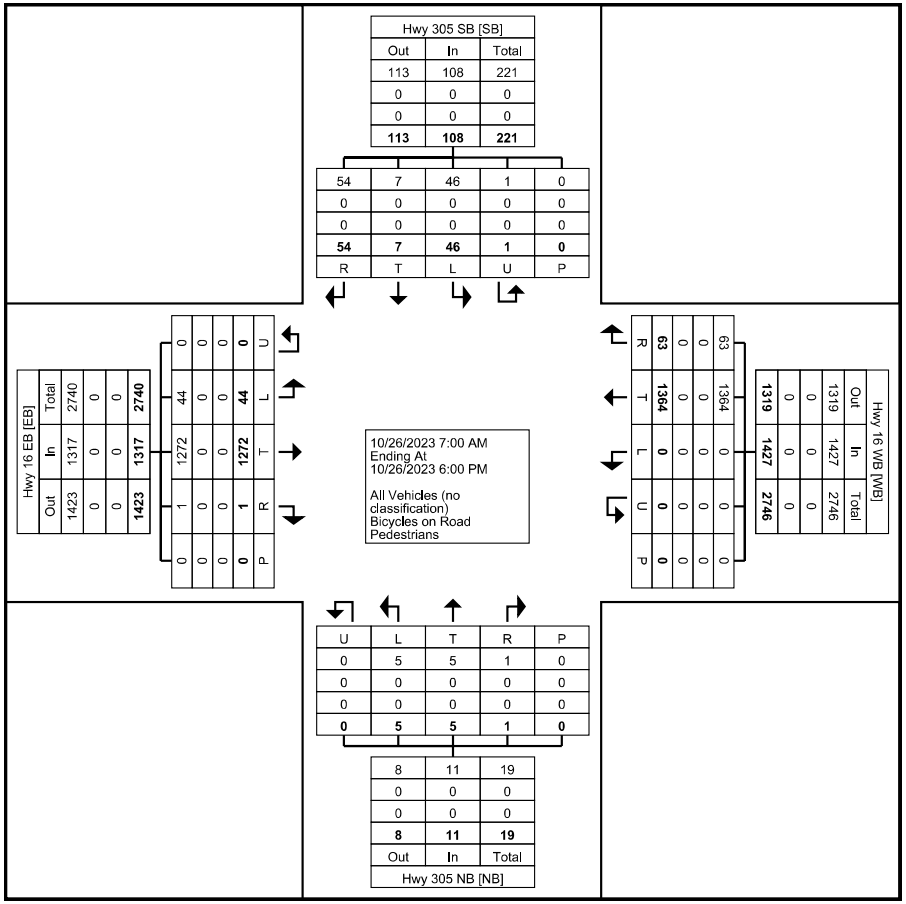
Turning Movement Data

Start Time	Hwy 305 SB Southbound						Hwy 16 WB Westbound						Hwy 305 NB Northbound						Hwy 16 EB Eastbound						
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Int. Total
7:00 AM	2	0	4	0	0	6	0	45	0	0	0	45	0	0	0	0	0	0	0	67	3	0	0	70	121
7:15 AM	5	0	12	0	0	17	1	38	0	0	0	39	0	1	0	0	0	1	1	85	0	0	0	86	143
7:30 AM	4	1	6	0	0	11	1	60	0	0	0	61	0	0	0	0	0	0	0	82	1	0	0	83	155
7:45 AM	4	0	2	0	0	6	3	50	0	0	0	53	0	0	0	0	0	0	0	65	1	0	0	66	125
Hourly Total	15	1	24	0	0	40	5	193	0	0	0	198	0	1	0	0	0	1	1	299	5	0	0	305	544
8:00 AM	7	0	3	0	0	10	1	60	0	0	0	61	0	0	1	0	0	1	0	79	3	0	0	82	154
8:15 AM	1	1	3	0	0	5	2	59	0	0	0	61	0	0	0	0	0	0	0	69	1	0	0	70	136
8:30 AM	2	0	6	1	0	9	1	85	0	0	0	86	1	0	2	0	0	3	0	60	5	0	0	65	163
8:45 AM	3	1	1	0	0	5	2	77	0	0	0	79	0	0	0	0	0	0	0	49	1	0	0	50	134
Hourly Total	13	2	13	1	0	29	6	281	0	0	0	287	1	0	3	0	0	4	0	257	10	0	0	267	587
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4:00 PM	5	0	2	0	0	7	4	107	0	0	0	111	0	0	0	0	0	0	0	97	3	0	0	100	218
4:15 PM	1	0	1	0	0	2	7	128	0	0	0	135	0	0	1	0	0	1	0	77	1	0	0	78	216
4:30 PM	3	1	1	0	0	5	4	120	0	0	0	124	0	0	0	0	0	0	0	96	2	0	0	98	227
4:45 PM	3	0	2	0	0	5	7	99	0	0	0	106	0	0	0	0	0	0	0	83	7	0	0	90	201
Hourly Total	12	1	6	0	0	19	22	454	0	0	0	476	0	0	1	0	0	1	0	353	13	0	0	366	862
5:00 PM	7	2	0	0	0	9	9	116	0	0	0	125	0	3	0	0	0	3	0	93	4	0	0	97	234
5:15 PM	2	1	1	0	0	4	8	100	0	0	0	108	0	0	0	0	0	0	0	95	3	0	0	98	210
5:30 PM	2	0	1	0	0	3	6	107	0	0	0	113	0	1	0	0	0	1	0	90	5	0	0	95	212
5:45 PM	3	0	1	0	0	4	7	113	0	0	0	120	0	0	1	0	0	1	0	85	4	0	0	89	214
Hourly Total	14	3	3	0	0	20	30	436	0	0	0	466	0	4	1	0	0	5	0	363	16	0	0	379	870
Grand Total	54	7	46	1	0	108	63	1364	0	0	0	1427	1	5	5	0	0	11	1	1272	44	0	0	1317	2863
Approach %	50.0	6.5	42.6	0.9	-	-	4.4	95.6	0.0	0.0	-	-	9.1	45.5	45.5	0.0	-	-	0.1	96.6	3.3	0.0	-	-	-
Total %	1.9	0.2	1.6	0.0	-	3.8	2.2	47.6	0.0	0.0	-	49.8	0.0	0.2	0.2	0.0	-	0.4	0.0	44.4	1.5	0.0	-	46.0	-
All Vehicles (no classification)	54	7	46	1	-	108	63	1364	0	0	-	1427	1	5	5	0	-	11	1	1272	44	0	-	1317	2863
% All Vehicles (no classification)	100.0	100.0	100.0	100.0	-	100.0	100.0	100.0	-	-	-	100.0	100.0	100.0	100.0	-	-	100.0	100.0	100.0	100.0	-	-	100.0	100.0
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	-	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Hwy 16 & Hwy 305 - Data Collection Phase
Site Code: 626.003
Start Date: 10/26/2023



Turning Movement Data Plot

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Hwy 16 & Hwy 305 - Data Collection Phase
Site Code: 626.003
Start Date: 10/26/2023

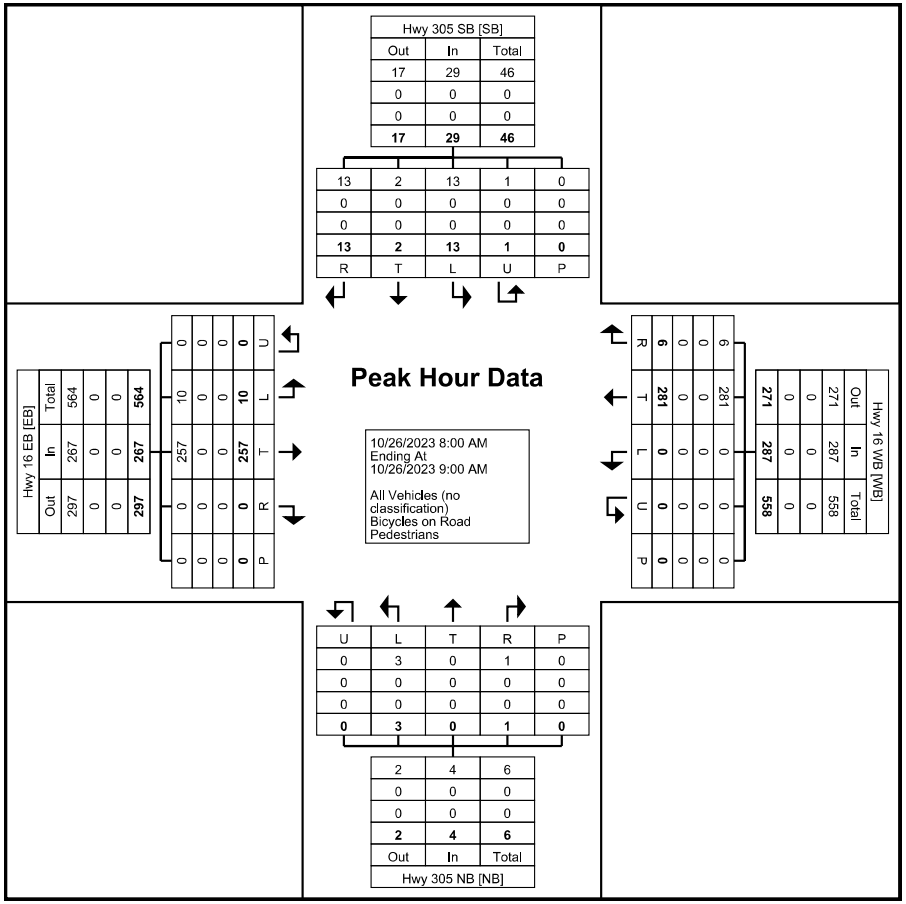
Turning Movement Peak Hour Data (8:00 AM)

Start Time	Hwy 305 SB Southbound						Hwy 16 WB Westbound						Hwy 305 NB Northbound						Hwy 16 EB Eastbound						
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Int. Total
8:00 AM	7	0	3	0	0	10	1	60	0	0	0	61	0	0	1	0	0	1	0	79	3	0	0	82	154
8:15 AM	1	1	3	0	0	5	2	59	0	0	0	61	0	0	0	0	0	0	0	69	1	0	0	70	136
8:30 AM	2	0	6	1	0	9	1	85	0	0	0	86	1	0	2	0	0	3	0	60	5	0	0	65	163
8:45 AM	3	1	1	0	0	5	2	77	0	0	0	79	0	0	0	0	0	0	0	49	1	0	0	50	134
Total	13	2	13	1	0	29	6	281	0	0	0	287	1	0	3	0	0	4	0	257	10	0	0	267	587
Approach %	44.8	6.9	44.8	3.4	-	-	2.1	97.9	0.0	0.0	-	-	25.0	0.0	75.0	0.0	-	-	0.0	96.3	3.7	0.0	-	-	-
Total %	2.2	0.3	2.2	0.2	-	4.9	1.0	47.9	0.0	0.0	-	48.9	0.2	0.0	0.5	0.0	-	0.7	0.0	43.8	1.7	0.0	-	45.5	-
PHF	0.464	0.500	0.542	0.250	-	0.725	0.750	0.826	0.000	0.000	-	0.834	0.250	0.000	0.375	0.000	-	0.333	0.000	0.813	0.500	0.000	-	0.814	0.900
All Vehicles (no classification)	13	2	13	1	-	29	6	281	0	0	-	287	1	0	3	0	-	4	0	257	10	0	-	267	587
% All Vehicles (no classification)	100.0	100.0	100.0	100.0	-	100.0	100.0	100.0	-	-	-	100.0	100.0	-	100.0	-	-	100.0	-	100.0	100.0	-	-	100.0	100.0
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0	-	-	-	0.0	0.0	-	0.0	-	-	0.0	-	0.0	0.0	-	-	0.0	0.0
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Hwy 16 & Hwy 305 - Data
Collection Phase
Site Code: 626.003
Start Date: 10/26/2023



Turning Movement Peak Hour Data Plot (8:00 AM)

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Hwy 16 & Hwy 305 - Data Collection Phase
Site Code: 626.003
Start Date: 10/26/2023

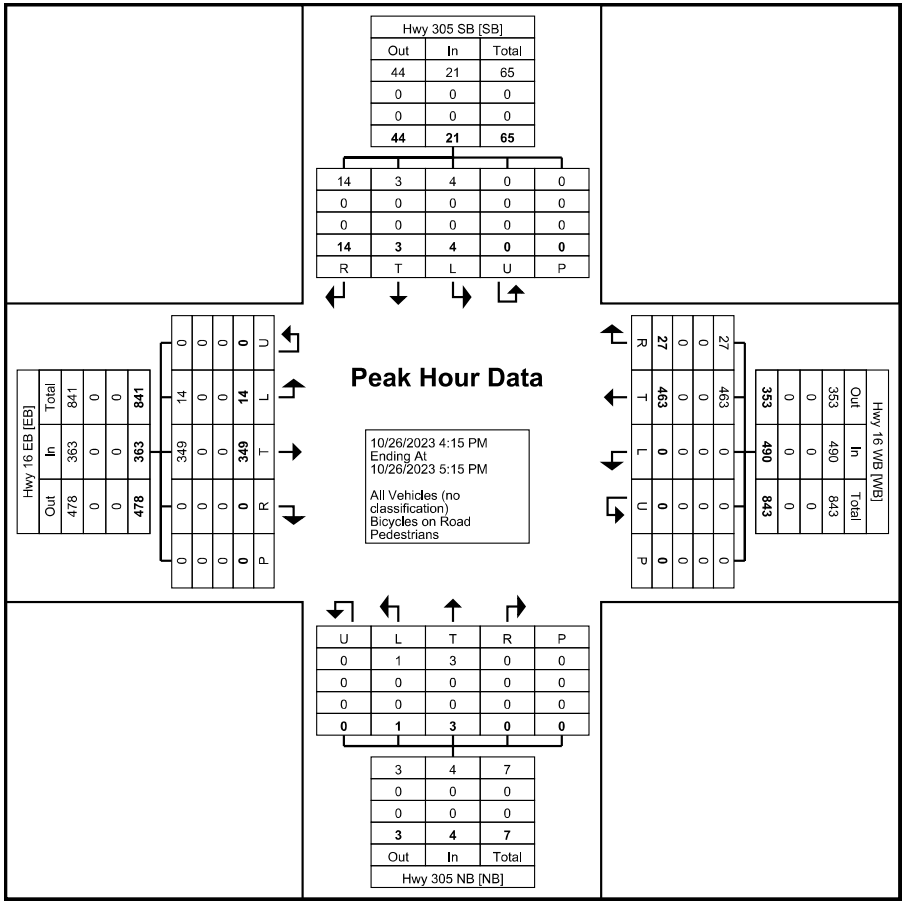
Turning Movement Peak Hour Data (4:15 PM)

Start Time	Hwy 305 SB Southbound						Hwy 16 WB Westbound						Hwy 305 NB Northbound						Hwy 16 EB Eastbound						
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Int. Total
4:15 PM	1	0	1	0	0	2	7	128	0	0	0	135	0	0	1	0	0	1	0	77	1	0	0	78	216
4:30 PM	3	1	1	0	0	5	4	120	0	0	0	124	0	0	0	0	0	0	0	96	2	0	0	98	227
4:45 PM	3	0	2	0	0	5	7	99	0	0	0	106	0	0	0	0	0	0	0	83	7	0	0	90	201
5:00 PM	7	2	0	0	0	9	9	116	0	0	0	125	0	3	0	0	0	3	0	93	4	0	0	97	234
Total	14	3	4	0	0	21	27	463	0	0	0	490	0	3	1	0	0	4	0	349	14	0	0	363	878
Approach %	66.7	14.3	19.0	0.0	-	-	5.5	94.5	0.0	0.0	-	-	0.0	75.0	25.0	0.0	-	-	0.0	96.1	3.9	0.0	-	-	-
Total %	1.6	0.3	0.5	0.0	-	2.4	3.1	52.7	0.0	0.0	-	55.8	0.0	0.3	0.1	0.0	-	0.5	0.0	39.7	1.6	0.0	-	41.3	-
PHF	0.500	0.375	0.500	0.000	-	0.583	0.750	0.904	0.000	0.000	-	0.907	0.000	0.250	0.250	0.000	-	0.333	0.000	0.909	0.500	0.000	-	0.926	0.938
All Vehicles (no classification)	14	3	4	0	-	21	27	463	0	0	-	490	0	3	1	0	-	4	0	349	14	0	-	363	878
% All Vehicles (no classification)	100.0	100.0	100.0	-	-	100.0	100.0	100.0	-	-	-	100.0	-	100.0	100.0	-	-	100.0	-	100.0	100.0	-	-	100.0	100.0
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	-	-	-	0.0	-	0.0	0.0	-	-	0.0	-	0.0	0.0	-	-	0.0	0.0
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Hwy 16 & Hwy 305 - Data
Collection Phase
Site Code: 626.003
Start Date: 10/26/2023



Turning Movement Peak Hour Data Plot (4:15 PM)

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Langham Main St & 5th Street - Data Collection Phase
Site Code: 626.003
Start Date: 10/24/2023

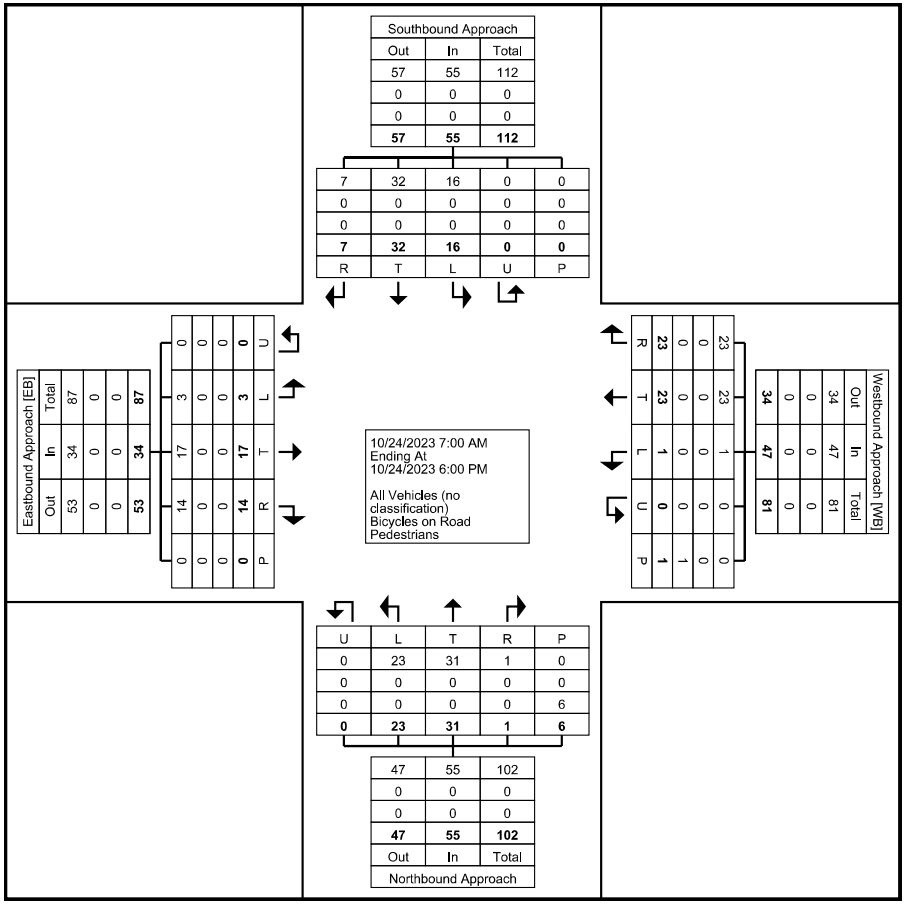
Turning Movement Data

Start Time	Southbound Approach Southbound						Westbound Approach Westbound						Northbound Approach Northbound						Eastbound Approach Eastbound						
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Int. Total
7:00 AM	0	0	0	0	0	0	4	1	0	0	0	5	0	2	2	0	0	4	0	0	0	0	0	0	9
7:15 AM	0	0	0	0	0	0	5	1	0	0	0	6	0	3	0	0	0	3	1	0	1	0	0	2	11
7:30 AM	0	1	0	0	0	1	0	2	0	0	0	2	0	5	0	0	0	5	0	0	0	0	0	0	8
7:45 AM	0	0	0	0	0	0	1	1	0	0	0	2	0	2	2	0	0	4	0	0	0	0	0	0	6
Hourly Total	0	1	0	0	0	1	10	5	0	0	0	15	0	12	4	0	0	16	1	0	1	0	0	2	34
8:00 AM	0	2	0	0	0	2	2	1	0	0	0	3	0	2	0	0	0	2	0	0	1	0	0	1	8
8:15 AM	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	3
8:30 AM	0	5	0	0	0	5	1	5	0	0	0	6	1	1	3	0	1	5	2	1	0	0	0	3	19
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	3
Hourly Total	0	8	0	0	0	8	3	6	0	0	0	9	1	4	6	0	1	11	2	1	2	0	0	5	33
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4:00 PM	1	3	3	0	0	7	2	1	0	0	0	3	0	1	0	0	1	1	0	0	0	0	0	0	11
4:15 PM	1	0	1	0	0	2	1	0	0	0	0	1	0	7	1	0	0	8	1	1	0	0	0	2	13
4:30 PM	0	4	4	0	0	8	1	2	0	0	1	3	0	1	1	0	4	2	2	2	0	0	0	4	17
4:45 PM	0	3	3	0	0	6	3	2	0	0	0	5	0	2	2	0	0	4	3	2	0	0	0	5	20
Hourly Total	2	10	11	0	0	23	7	5	0	0	1	12	0	11	4	0	5	15	6	5	0	0	0	11	61
5:00 PM	0	5	3	0	0	8	0	1	1	0	0	2	0	0	2	0	0	2	3	4	0	0	0	7	19
5:15 PM	1	1	0	0	0	2	0	1	0	0	0	1	0	1	0	0	0	1	2	4	0	0	0	6	10
5:30 PM	3	4	2	0	0	9	1	2	0	0	0	3	0	1	3	0	0	4	0	1	0	0	0	1	17
5:45 PM	1	3	0	0	0	4	2	3	0	0	0	5	0	2	4	0	0	6	0	2	0	0	0	2	17
Hourly Total	5	13	5	0	0	23	3	7	1	0	0	11	0	4	9	0	0	13	5	11	0	0	0	16	63
Grand Total	7	32	16	0	0	55	23	23	1	0	1	47	1	31	23	0	6	55	14	17	3	0	0	34	191
Approach %	12.7	58.2	29.1	0.0	-	-	48.9	48.9	2.1	0.0	-	-	1.8	56.4	41.8	0.0	-	-	41.2	50.0	8.8	0.0	-	-	-
Total %	3.7	16.8	8.4	0.0	-	28.8	12.0	12.0	0.5	0.0	-	24.6	0.5	16.2	12.0	0.0	-	28.8	7.3	8.9	1.6	0.0	-	17.8	-
All Vehicles (no classification)	7	32	16	0	-	55	23	23	1	0	-	47	1	31	23	0	-	55	14	17	3	0	-	34	191
% All Vehicles (no classification)	100.0	100.0	100.0	-	-	100.0	100.0	100.0	100.0	-	-	100.0	100.0	100.0	100.0	-	-	100.0	100.0	100.0	100.0	-	-	100.0	100.0
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Pedestrians	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	6	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Langham Main St & 5th Street - Data Collection Phase
Site Code: 626.003
Start Date: 10/24/2023



Turning Movement Data Plot

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Langham Main St & 5th Street - Data Collection Phase
Site Code: 626.003
Start Date: 10/24/2023

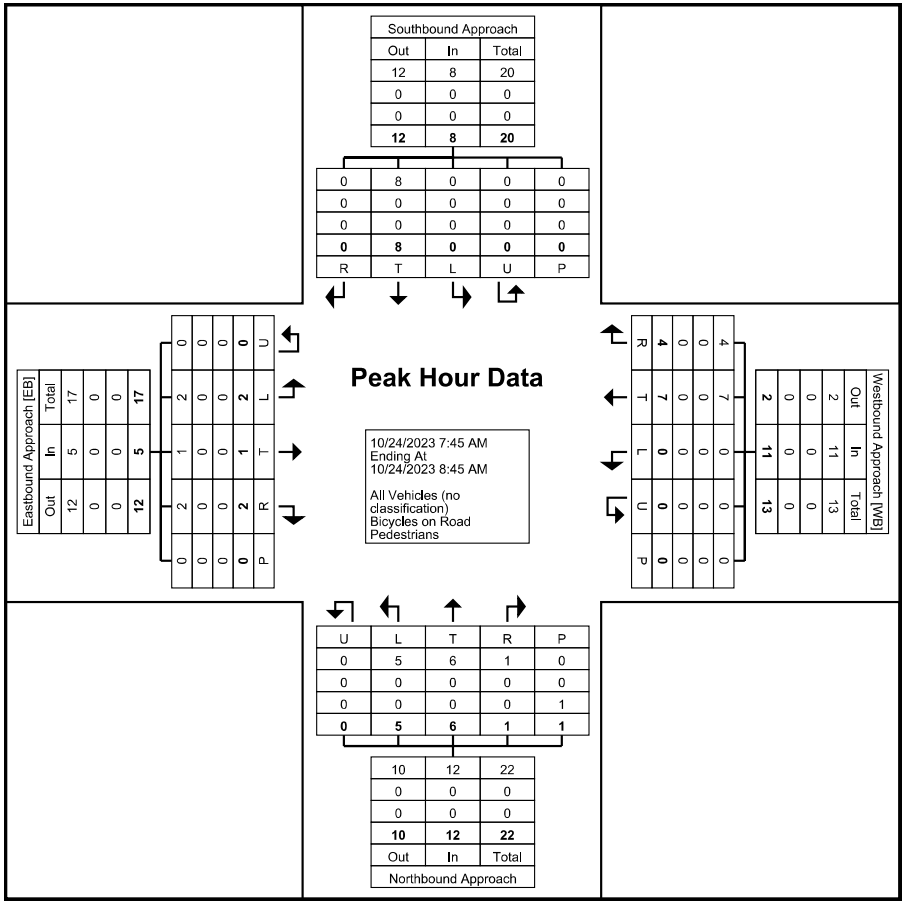
Turning Movement Peak Hour Data (7:45 AM)

Start Time	Southbound Approach						Westbound Approach						Northbound Approach						Eastbound Approach						
	Southbound						Westbound						Northbound						Eastbound						
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Int. Total
7:45 AM	0	0	0	0	0	0	1	1	0	0	0	2	0	2	2	0	0	4	0	0	0	0	0	0	6
8:00 AM	0	2	0	0	0	2	2	1	0	0	0	3	0	2	0	0	0	2	0	0	1	0	0	1	8
8:15 AM	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	3
8:30 AM	0	5	0	0	0	5	1	5	0	0	0	6	1	1	3	0	1	5	2	1	0	0	0	3	19
Total	0	8	0	0	0	8	4	7	0	0	0	11	1	6	5	0	1	12	2	1	2	0	0	5	36
Approach %	0.0	100.0	0.0	0.0	-	-	36.4	63.6	0.0	0.0	-	-	8.3	50.0	41.7	0.0	-	-	40.0	20.0	40.0	0.0	-	-	-
Total %	0.0	22.2	0.0	0.0	-	22.2	11.1	19.4	0.0	0.0	-	30.6	2.8	16.7	13.9	0.0	-	33.3	5.6	2.8	5.6	0.0	-	13.9	-
PHF	0.000	0.400	0.000	0.000	-	0.400	0.500	0.350	0.000	0.000	-	0.458	0.250	0.750	0.417	0.000	-	0.600	0.250	0.250	0.500	0.000	-	0.417	0.474
All Vehicles (no classification)	0	8	0	0	-	8	4	7	0	0	-	11	1	6	5	0	-	12	2	1	2	0	-	5	36
% All Vehicles (no classification)	-	100.0	-	-	-	100.0	100.0	100.0	-	-	-	100.0	100.0	100.0	100.0	-	-	100.0	100.0	100.0	100.0	-	-	100.0	100.0
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	-	0.0	-	-	-	0.0	0.0	0.0	-	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.0
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Langham Main St & 5th Street - Data Collection Phase
Site Code: 626.003
Start Date: 10/24/2023



Turning Movement Peak Hour Data Plot (7:45 AM)

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Langham Main St & 5th Street - Data Collection Phase
Site Code: 626.003
Start Date: 10/24/2023

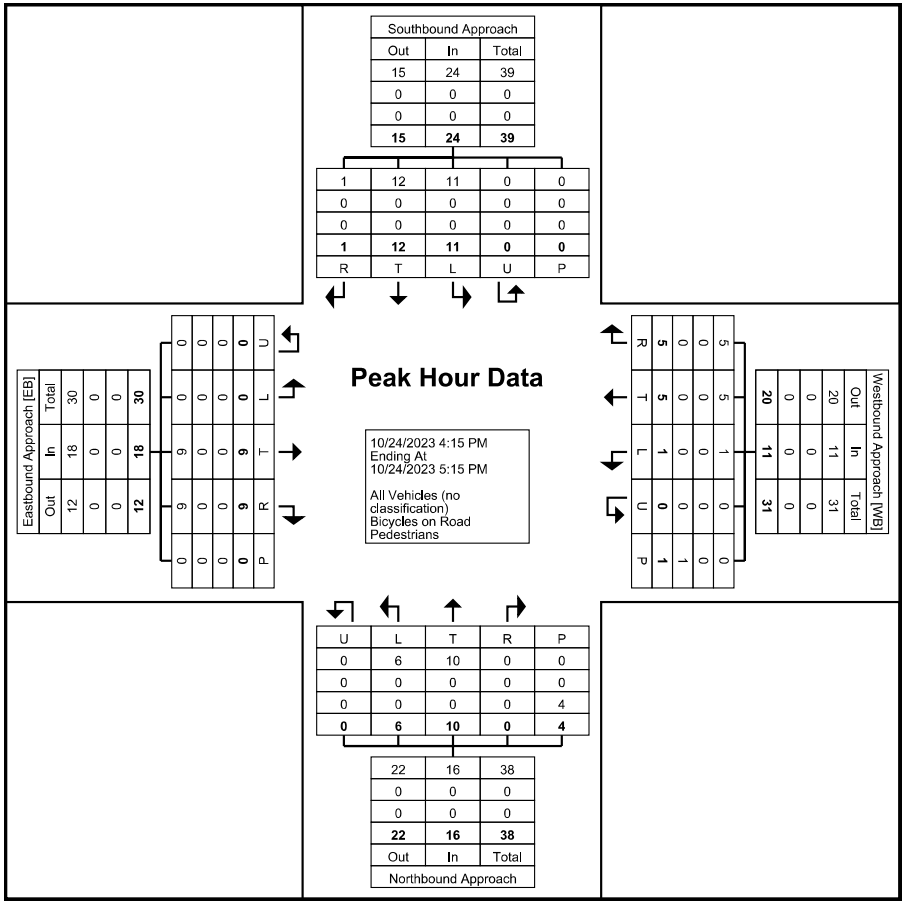
Turning Movement Peak Hour Data (4:15 PM)

Start Time	Southbound Approach						Westbound Approach						Northbound Approach						Eastbound Approach						
	Southbound						Westbound						Northbound						Eastbound						
	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Int. Total
4:15 PM	1	0	1	0	0	2	1	0	0	0	0	1	0	7	1	0	0	8	1	1	0	0	0	2	13
4:30 PM	0	4	4	0	0	8	1	2	0	0	1	3	0	1	1	0	4	2	2	2	0	0	0	4	17
4:45 PM	0	3	3	0	0	6	3	2	0	0	0	5	0	2	2	0	0	4	3	2	0	0	0	5	20
5:00 PM	0	5	3	0	0	8	0	1	1	0	0	2	0	0	2	0	0	2	3	4	0	0	0	7	19
Total	1	12	11	0	0	24	5	5	1	0	1	11	0	10	6	0	4	16	9	9	0	0	0	18	69
Approach %	4.2	50.0	45.8	0.0	-	-	45.5	45.5	9.1	0.0	-	-	0.0	62.5	37.5	0.0	-	-	50.0	50.0	0.0	0.0	-	-	-
Total %	1.4	17.4	15.9	0.0	-	34.8	7.2	7.2	1.4	0.0	-	15.9	0.0	14.5	8.7	0.0	-	23.2	13.0	13.0	0.0	0.0	-	26.1	-
PHF	0.250	0.600	0.688	0.000	-	0.750	0.417	0.625	0.250	0.000	-	0.550	0.000	0.357	0.750	0.000	-	0.500	0.750	0.563	0.000	0.000	-	0.643	0.863
All Vehicles (no classification)	1	12	11	0	-	24	5	5	1	0	-	11	0	10	6	0	-	16	9	9	0	0	-	18	69
% All Vehicles (no classification)	100.0	100.0	100.0	-	-	100.0	100.0	100.0	100.0	-	-	100.0	-	100.0	100.0	-	-	100.0	100.0	100.0	-	-	-	100.0	100.0
Bicycles on Road	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	0
% Bicycles on Road	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	-	0.0	0.0	-	-	0.0	0.0	0.0	-	-	-	0.0	0.0
Pedestrians	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	4	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-

Catterall & Wright
1221 - 8th Street East

Saskatoon, Saskatchewan, Canada S7H 0S5
306.343.7280 n.hyder@cwce.ca

Count Name: Langham Main St & 5th Street - Data Collection Phase
Site Code: 626.003
Start Date: 10/24/2023

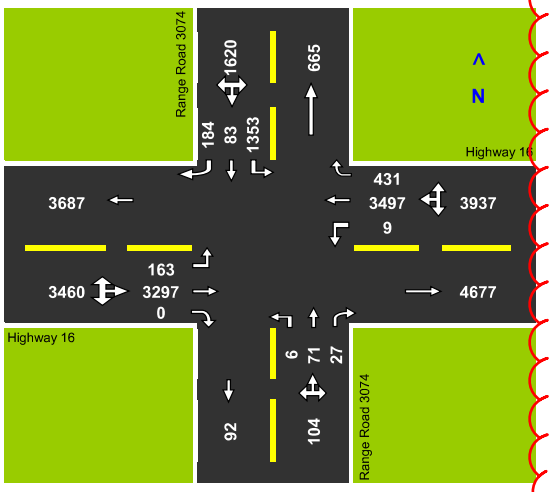


Turning Movement Peak Hour Data Plot (4:15 PM)

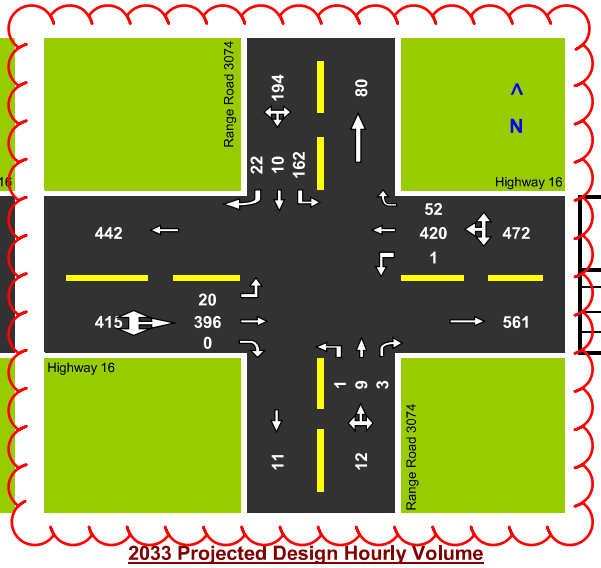
Langham Traffic Count Results

C.S: CS 16-23 Date: 4/25/2023 Start: 6:00:00
Km: 28.1 End: 12:00:00

2023 AADT

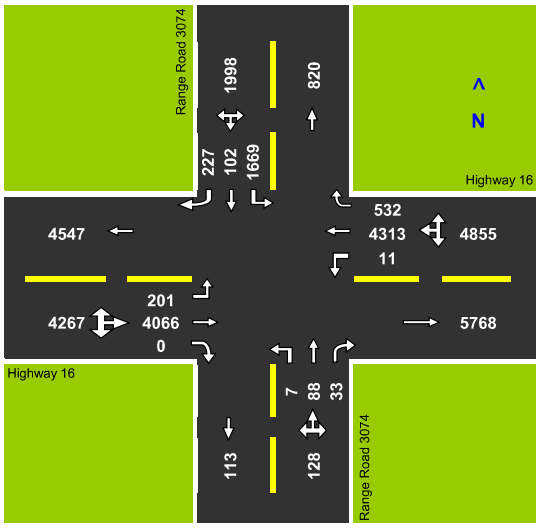


2023 Design Hourly Volume

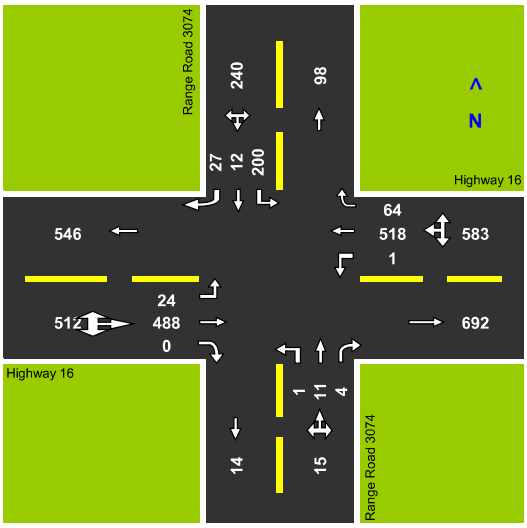


Leg	Current Leg AADT
Northbound	196
Southbound	2285
Eastbound	7147
Westbound	8614

2033 Projected AADT



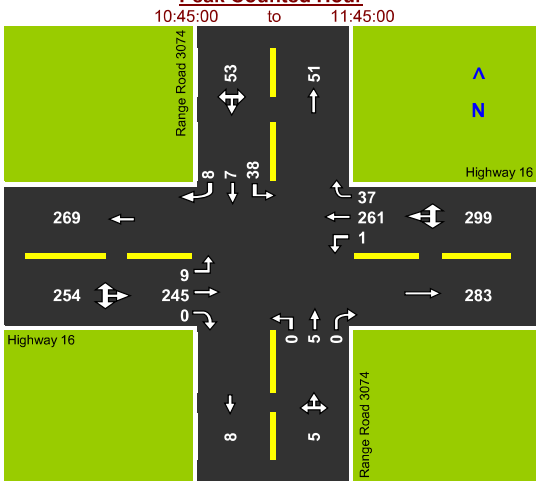
2033 Projected Design Hourly Volume



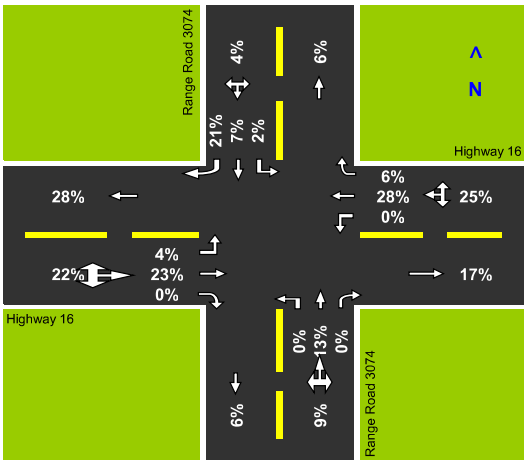
Leg	2033 Leg AADT
Northbound	241
Southbound	2818
Eastbound	8814
Westbound	10624

Peak Counted Hour

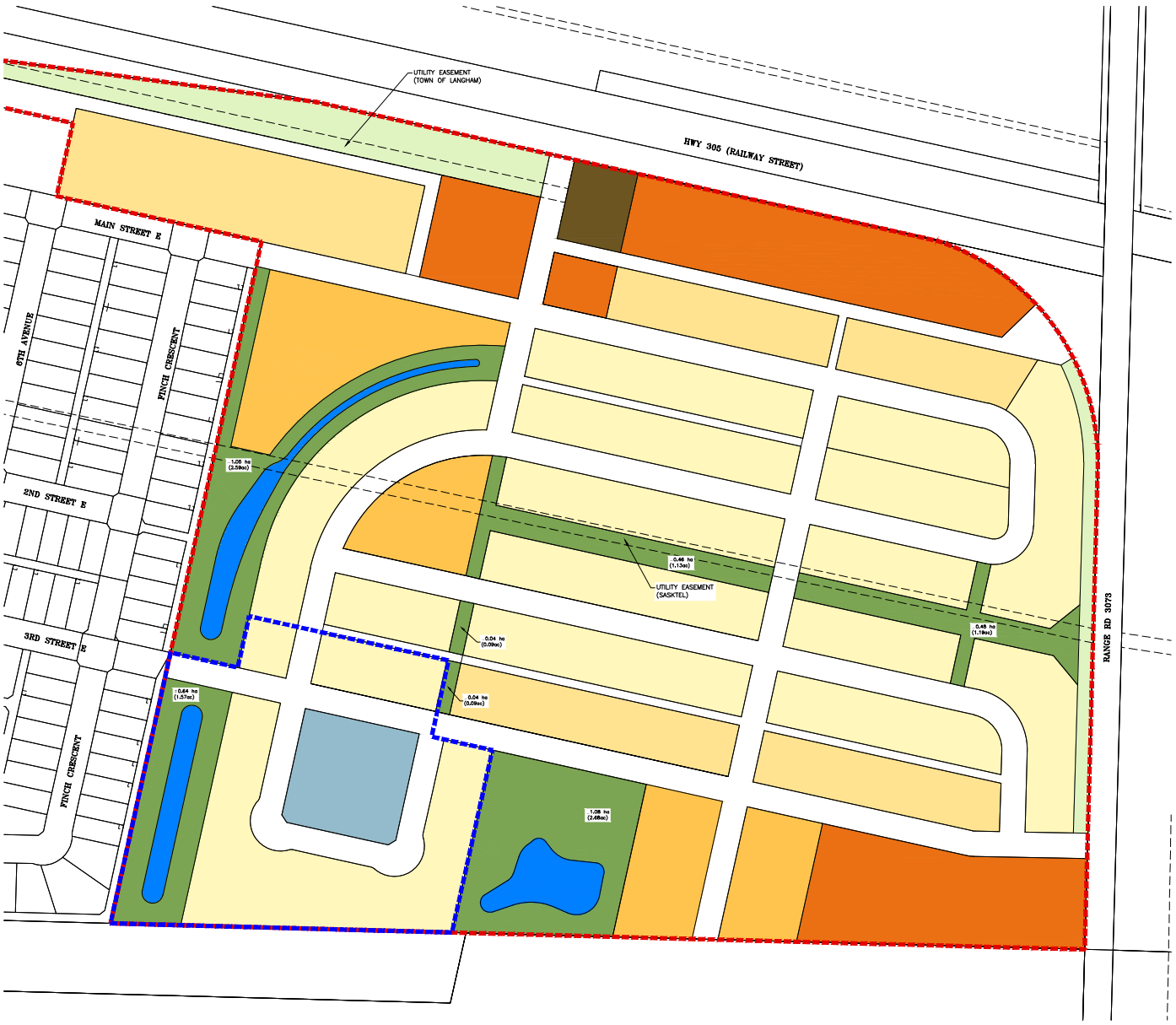
10:45:00 to 11:45:00



Truck Percentage During Traffic Count



Appendix B Concept Plan of the Proposed Development



AREA	ha	ac	%
SINGLE FAMILY	10.68	26.39	30.26
TOWNHOUSE/ DUPLEX	4.11	10.16	11.65
MULTI FAMILY	2.75	6.80	7.79
LOW DENSITY – FLEX ZONE	0.67	1.66	1.90
COMMERCIAL/ MIXED–USED	3.64	8.99	10.31
MUNICIPAL RESERVE	3.78	9.34	10.71
MUNICIPAL BUFFER	1.36	3.36	3.85
STORMWATER PONDS	0.77	1.90	2.18
UTILITY AREA	0.26	0.64	0.74
ROADS	7.27	17.96	20.60
TOTAL:	35.29	87.20	100.00

CATTERALL & WRIGHT
CONSULTING ENGINEERS
1231 – 8th STREET EAST
SASKATOON, SK S7H 0S5
TEL: (306) 343-7280 | www.cwce.ca

PRAIRIE ROSE PARK

LEGEND:
- SINGLE FAMILY
- TOWNHOUSE/DUPLEX
- MULTI FAMILY
- COMMERCIAL/MIXED–USED
- MUNICIPAL BUFFER
- MUNICIPAL RESERVE
- LOW DENSITY–FLEX ZONE
- UTILITY AREA
- STORMWATER POND
- EXIST. EASEMENT
- CONCEPT PLAN BOUNDARY
- PHASE 1

DRAWING TO BE PRINTED IN COLOUR

SCALE VERIFICATION
WHEN DRAWING IS PLOTTED FULL SIZE THIS LINE IS 50mm IN LENGTH.

DATE	REVISION

OWNER/CLIENT
CLAYSTONE DEVELOPMENTS

LOCATION
LANGHAM, SK

PROJECT
PRAIRIE ROSE PARK

SHEET TITLE
CONCEPT PLAN

SCALE 1:1500	DESIGNED DAC
DRAWN DL	CHECKED
DATE 23/08/16	SHEET 4 of 4
DRAWING NUMBER 626-00204	

CATTERALL & WRIGHT
CONSULTING ENGINEERS

1231 – 8th STREET EAST
SASKATOON, SK S7H 0S5

TEL: (306) 343-7280 | www.cwce.ca

PRAIRIE ROSE PARK

LEGEND:

- MUNICIPAL BUFFER
- MUNICIPAL RESERVE
- STORMWATER POND
- PROP. SIDEWALK
- PROP. PATHWAY
- CONCEPT PLAN BOUNDARY
- PHASE 1

PRELIMINARY
NOT FOR CONSTRUCTION

DRAWING TO BE PRINTED IN COLOUR

SCALE VERIFICATION

WHEN DRAWING IS PLOTTED FULL SIZE THIS LINE IS 60mm IN LENGTH.

DATE	REVISION

OWNER/CLIENT
CLAYSTONE DEVELOPMENTS

LOCATION
LANGHAM, SK

PROJECT
PRAIRIE ROSE PARK

SHEET TITLE
PARKS AND PEDESTRIAN LINKAGES

SCALE	DESIGNED
1:1500	DAC
DRAWN	CHECKED
DL	
DATE	SHEET
23/08/16	5 of 5

DRAWING NUMBER
FIGURE 5

Appendix C Synchro Analysis for Existing, Background, & Total Traffic Conditions

Existing Traffic Conditions (2023)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	396	2	1	420	52	2	9	3	162	10	22
Future Volume (Veh/h)	20	396	2	1	420	52	2	9	3	162	10	22
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	417	2	1	442	55	2	9	3	171	11	23
Pedestrians		2			2			4			4	
Lane Width (m)		3.7			3.7			3.7			3.7	
Walking Speed (m/s)		1.1			1.1			1.1			1.1	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	501			423			718	967	216	708	913	227
vC1, stage 1 conf vol							464	464		448	448	
vC2, stage 2 conf vol							254	503		260	465	
vCu, unblocked vol	501			423			718	967	216	708	913	227
tC, single (s)	4.1			4.1			7.5	6.8	6.9	7.5	6.8	6.9
tC, 2 stage (s)							6.5	5.8		6.5	5.8	
tF (s)	2.2			2.2			3.5	4.2	3.3	3.5	4.2	3.3
p0 queue free %	98			100			100	98	100	65	97	97
cM capacity (veh/h)	1056			1128			475	399	785	494	422	772

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	21	278	141	1	221	221	55	14	205
Volume Left	21	0	0	1	0	0	0	2	171
Volume Right	0	0	2	0	0	0	55	3	23
cSH	1056	1700	1700	1128	1700	1700	1700	457	510
Volume to Capacity	0.02	0.16	0.08	0.00	0.13	0.13	0.03	0.03	0.40
Queue Length 95th (m)	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.7	14.6
Control Delay (s)	8.5	0.0	0.0	8.2	0.0	0.0	0.0	13.1	16.7
Lane LOS	A			A				B	C
Approach Delay (s)	0.4			0.0				13.1	16.7
Approach LOS								B	C

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	45.7%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	257	2	2	281	6	3	2	1	13	2	13
Future Volume (Veh/h)	10	257	2	2	281	6	3	2	1	13	2	13
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	271	2	2	296	6	3	2	1	14	2	14
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	302			273			461	600	136	460	595	148
vC1, stage 1 conf vol							294	294		300	300	
vC2, stage 2 conf vol							167	306		160	295	
vCu, unblocked vol	302			273			461	600	136	460	595	148
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)							6.5	5.5		6.5	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			100	100	100	98	100	98
cM capacity (veh/h)	1256			1287			624	559	887	630	564	872

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	11	181	92	101	197	6	6	30
Volume Left	11	0	0	2	0	0	3	14
Volume Right	0	0	2	0	0	6	1	14
cSH	1256	1700	1700	1287	1700	1700	631	717
Volume to Capacity	0.01	0.11	0.05	0.00	0.12	0.00	0.01	0.04
Queue Length 95th (m)	0.2	0.0	0.0	0.0	0.0	0.0	0.2	1.0
Control Delay (s)	7.9	0.0	0.0	0.2	0.0	0.0	10.8	10.2
Lane LOS	A			A			B	B
Approach Delay (s)	0.3			0.1			10.8	10.2
Approach LOS							B	B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	29.2%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	1	2	2	7	4	5	6	2	2	8	2
Future Volume (Veh/h)	2	1	2	2	7	4	5	6	2	2	8	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	2	1	2	2	7	4	5	6	2	2	8	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	38	31	9	32	31	7	10			8		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	38	31	9	32	31	7	10			8		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	99	100	100			100		
cM capacity (veh/h)	955	858	1073	969	858	1075	1610			1612		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	5	13	13	12
Volume Left	2	2	5	2
Volume Right	2	4	2	2
cSH	976	932	1610	1612
Volume to Capacity	0.01	0.01	0.00	0.00
Queue Length 95th (m)	0.1	0.3	0.1	0.0
Control Delay (s)	8.7	8.9	2.8	1.2
Lane LOS	A	A	A	A
Approach Delay (s)	8.7	8.9	2.8	1.2
Approach LOS	A	A		

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	16.7%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	7	5	3	2	17	3	2	10	2	1	2	8
Future Volume (vph)	7	5	3	2	17	3	2	10	2	1	2	8
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	7	5	3	2	18	3	2	11	2	1	2	8

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	15	23	15	11
Volume Left (vph)	7	2	2	1
Volume Right (vph)	3	3	2	8
Hadj (s)	0.01	-0.03	-0.02	-0.38
Departure Headway (s)	4.0	3.9	4.0	3.6
Degree Utilization, x	0.02	0.03	0.02	0.01
Capacity (veh/h)	891	902	885	981
Control Delay (s)	7.0	7.0	7.0	6.7
Approach Delay (s)	7.0	7.0	7.0	6.7
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.0		
Level of Service	A		
Intersection Capacity Utilization	16.7%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	22	310	1	3	313	162	1	10	1	52	9	20
Future Volume (Veh/h)	22	310	1	3	313	162	1	10	1	52	9	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	23	326	1	3	329	171	1	11	1	55	9	21
Pedestrians		2			2			4			4	
Lane Width (m)		3.7			3.7			3.7			3.7	
Walking Speed (m/s)		1.1			1.1			1.1			1.1	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	504			331			574	886	170	556	716	170
vC1, stage 1 conf vol							376	376		339	339	
vC2, stage 2 conf vol							198	510		218	377	
vCu, unblocked vol	504			331			574	886	170	556	716	170
tC, single (s)	4.1			4.1			7.5	6.8	6.9	7.5	6.8	6.9
tC, 2 stage (s)							6.5	5.8		6.5	5.8	
tF (s)	2.2			2.2			3.5	4.2	3.3	3.5	4.2	3.3
p0 queue free %	98			100			100	97	100	90	98	97
cM capacity (veh/h)	1053			1221			542	416	840	570	483	839

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	23	217	110	3	164	164	171	13	85
Volume Left	23	0	0	3	0	0	0	1	55
Volume Right	0	0	1	0	0	0	171	1	21
cSH	1053	1700	1700	1221	1700	1700	1700	441	606
Volume to Capacity	0.02	0.13	0.06	0.00	0.10	0.10	0.10	0.03	0.14
Queue Length 95th (m)	0.5	0.0	0.0	0.1	0.0	0.0	0.0	0.7	3.7
Control Delay (s)	8.5	0.0	0.0	8.0	0.0	0.0	0.0	13.4	11.9
Lane LOS	A			A				B	B
Approach Delay (s)	0.6			0.0				13.4	11.9
Approach LOS								B	B

Intersection Summary				
Average Delay	1.5			
Intersection Capacity Utilization	39.4%	ICU Level of Service		A
Analysis Period (min)	15			

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	349	2	2	463	27	1	3	2	4	3	14
Future Volume (Veh/h)	14	349	2	2	463	27	1	3	2	4	3	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	15	367	2	2	487	28	1	3	2	4	3	15
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	515			369			662	917	184	708	890	244
vC1, stage 1 conf vol							398	398		491	491	
vC2, stage 2 conf vol							264	519		217	399	
vCu, unblocked vol	515			369			662	917	184	708	890	244
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)							6.5	5.5		6.5	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			100	99	100	99	99	98
cM capacity (veh/h)	1047			1186			517	443	826	486	458	757

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	15	245	124	164	325	28	6	22
Volume Left	15	0	0	2	0	0	1	4
Volume Right	0	0	2	0	0	28	2	15
cSH	1047	1700	1700	1186	1700	1700	539	636
Volume to Capacity	0.01	0.14	0.07	0.00	0.19	0.02	0.01	0.03
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	0.0	0.3	0.8
Control Delay (s)	8.5	0.0	0.0	0.1	0.0	0.0	11.8	10.9
Lane LOS	A			A			B	B
Approach Delay (s)	0.3			0.0			11.8	10.9
Approach LOS							B	B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	31.9%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	9	9	1	5	5	6	10	2	11	12	1
Future Volume (Veh/h)	2	9	9	1	5	5	6	10	2	11	12	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	2	9	9	1	5	5	6	11	2	12	13	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	69	62	14	75	62	12	14			13		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	69	62	14	75	62	12	14			13		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	99	99	100	99	100	100			99		
cM capacity (veh/h)	907	819	1067	892	820	1069	1604			1606		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	20	11	19	26
Volume Left	2	1	6	12
Volume Right	9	5	2	1
cSH	925	924	1604	1606
Volume to Capacity	0.02	0.01	0.00	0.01
Queue Length 95th (m)	0.5	0.3	0.1	0.2
Control Delay (s)	9.0	8.9	2.3	3.4
Lane LOS	A	A	A	A
Approach Delay (s)	9.0	8.9	2.3	3.4
Approach LOS	A	A		

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	16.7%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	12	11	10	2	5	2	3	2	2	8	10	3
Future Volume (vph)	12	11	10	2	5	2	3	2	2	8	10	3
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	13	12	11	2	5	2	3	2	2	8	11	3

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	36	9	7	22
Volume Left (vph)	13	2	3	8
Volume Right (vph)	11	2	2	3
Hadj (s)	-0.08	-0.05	-0.05	0.02
Departure Headway (s)	3.9	3.9	4.0	4.0
Degree Utilization, x	0.04	0.01	0.01	0.02
Capacity (veh/h)	911	900	885	879
Control Delay (s)	7.1	7.0	7.0	7.1
Approach Delay (s)	7.1	7.0	7.0	7.1
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.1		
Level of Service	A		
Intersection Capacity Utilization	16.7%	ICU Level of Service	A
Analysis Period (min)	15		

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Background Traffic Conditions (2038)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	26	515	2	1	546	68	2	12	4	211	13	29
Future Volume (Veh/h)	26	515	2	1	546	68	2	12	4	211	13	29
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	27	542	2	1	575	72	2	13	4	222	14	31
Pedestrians		2			2			4			4	
Lane Width (m)		3.7			3.7			3.7			3.7	
Walking Speed (m/s)		1.1			1.1			1.1			1.1	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	651			548			930	1254	278	918	1183	294
vC1, stage 1 conf vol							601	601		581	581	
vC2, stage 2 conf vol							330	653		338	602	
vCu, unblocked vol	651			548			930	1254	278	918	1183	294
tC, single (s)	4.1			4.1			7.5	6.8	6.9	7.5	6.8	6.9
tC, 2 stage (s)							6.5	5.8		6.5	5.8	
tF (s)	2.2			2.2			3.5	4.2	3.3	3.5	4.2	3.3
p0 queue free %	97			100			99	96	99	45	96	96
cM capacity (veh/h)	928			1014			383	321	715	404	347	699

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	27	361	183	1	288	288	72	19	267
Volume Left	27	0	0	1	0	0	0	2	222
Volume Right	0	0	2	0	0	0	72	4	31
cSH	928	1700	1700	1014	1700	1700	1700	371	421
Volume to Capacity	0.03	0.21	0.11	0.00	0.17	0.17	0.04	0.05	0.63
Queue Length 95th (m)	0.7	0.0	0.0	0.0	0.0	0.0	0.0	1.2	32.4
Control Delay (s)	9.0	0.0	0.0	8.6	0.0	0.0	0.0	15.2	27.2
Lane LOS	A			A				C	D
Approach Delay (s)	0.4			0.0				15.2	27.2
Approach LOS								C	D

Intersection Summary			
Average Delay	5.2		
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	334	2	2	365	8	4	2	1	19	3	19
Future Volume (Veh/h)	13	334	2	2	365	8	4	2	1	19	3	19
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	14	352	2	2	384	8	4	2	1	20	3	20
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	392			354			598	777	177	594	770	192
vC1, stage 1 conf vol							381	381		388	388	
vC2, stage 2 conf vol							218	396		206	382	
vCu, unblocked vol	392			354			598	777	177	594	770	192
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)							6.5	5.5		6.5	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			99	100	100	96	99	98
cM capacity (veh/h)	1163			1201			544	492	835	553	499	817

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	14	235	119	130	256	8	7	43
Volume Left	14	0	0	2	0	0	4	20
Volume Right	0	0	2	0	0	8	1	20
cSH	1163	1700	1700	1201	1700	1700	555	645
Volume to Capacity	0.01	0.14	0.07	0.00	0.15	0.00	0.01	0.07
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	0.0	0.3	1.6
Control Delay (s)	8.1	0.0	0.0	0.1	0.0	0.0	11.6	11.0
Lane LOS	A			A			B	B
Approach Delay (s)	0.3			0.0			11.6	11.0
Approach LOS							B	B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	31.5%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	3	1	3	2	9	5	7	8	1	2	10	3
Future Volume (Veh/h)	3	1	3	2	9	5	7	8	1	2	10	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	3	1	3	2	9	5	7	8	1	2	11	3
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	48	40	12	42	40	8	14			9		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	48	40	12	42	40	8	14			9		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	99	100	100			100		
cM capacity (veh/h)	936	848	1068	953	847	1073	1604			1611		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	7	16	16	16
Volume Left	3	2	7	2
Volume Right	3	5	1	3
cSH	973	920	1604	1611
Volume to Capacity	0.01	0.02	0.00	0.00
Queue Length 95th (m)	0.2	0.4	0.1	0.0
Control Delay (s)	8.7	9.0	3.2	0.9
Lane LOS	A	A	A	A
Approach Delay (s)	8.7	9.0	3.2	0.9
Approach LOS	A	A		

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	16.7%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	9	7	4	2	22	4	2	13	2	1	3	10
Future Volume (vph)	9	7	4	2	22	4	2	13	2	1	3	10
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	9	7	4	2	23	4	2	14	2	1	3	11

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	20	29	18	15
Volume Left (vph)	9	2	2	1
Volume Right (vph)	4	4	2	11
Hadj (s)	0.00	-0.03	-0.01	-0.39
Departure Headway (s)	4.0	4.0	4.0	3.6
Degree Utilization, x	0.02	0.03	0.02	0.02
Capacity (veh/h)	885	898	875	973
Control Delay (s)	7.1	7.1	7.1	6.7
Approach Delay (s)	7.1	7.1	7.1	6.7
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.0		
Level of Service	A		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	403	1	4	407	211	1	13	1	68	12	26
Future Volume (Veh/h)	29	403	1	4	407	211	1	13	1	68	12	26
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	31	424	1	4	428	222	1	14	1	72	13	27
Pedestrians		2			2			4			4	
Lane Width (m)		3.7			3.7			3.7			3.7	
Walking Speed (m/s)		1.1			1.1			1.1			1.1	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	654			429			748	1152	218	724	931	220
vC1, stage 1 conf vol							490	490		440	440	
vC2, stage 2 conf vol							258	662		284	491	
vCu, unblocked vol	654			429			748	1152	218	724	931	220
tC, single (s)	4.1			4.1			7.5	6.8	6.9	7.5	6.8	6.9
tC, 2 stage (s)							6.5	5.8		6.5	5.8	
tF (s)	2.2			2.2			3.5	4.2	3.3	3.5	4.2	3.3
p0 queue free %	97			100			100	96	100	85	97	97
cM capacity (veh/h)	925			1123			451	336	781	484	410	780

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	31	283	142	4	214	214	222	16	112
Volume Left	31	0	0	4	0	0	0	1	72
Volume Right	0	0	1	0	0	0	222	1	27
cSH	925	1700	1700	1123	1700	1700	1700	354	521
Volume to Capacity	0.03	0.17	0.08	0.00	0.13	0.13	0.13	0.05	0.22
Queue Length 95th (m)	0.8	0.0	0.0	0.1	0.0	0.0	0.0	1.1	6.2
Control Delay (s)	9.0	0.0	0.0	8.2	0.0	0.0	0.0	15.6	13.8
Lane LOS	A			A				C	B
Approach Delay (s)	0.6			0.1				15.6	13.8
Approach LOS								C	B

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	43.4%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	454	2	2	602	35	1	4	2	6	4	20
Future Volume (Veh/h)	18	454	2	2	602	35	1	4	2	6	4	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	19	478	2	2	634	37	1	4	2	6	4	21
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	671			480			861	1192	240	919	1156	317
vC1, stage 1 conf vol							517	517		638	638	
vC2, stage 2 conf vol							344	675		281	518	
vCu, unblocked vol	671			480			861	1192	240	919	1156	317
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)							6.5	5.5		6.5	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			100	99	100	98	99	97
cM capacity (veh/h)	915			1079			427	363	761	394	381	679

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	19	319	161	213	423	37	7	31
Volume Left	19	0	0	2	0	0	1	6
Volume Right	0	0	2	0	0	37	2	21
cSH	915	1700	1700	1079	1700	1700	438	547
Volume to Capacity	0.02	0.19	0.09	0.00	0.25	0.02	0.02	0.06
Queue Length 95th (m)	0.5	0.0	0.0	0.0	0.0	0.0	0.4	1.4
Control Delay (s)	9.0	0.0	0.0	0.1	0.0	0.0	13.4	12.0
Lane LOS	A			A			B	B
Approach Delay (s)	0.3			0.0			13.4	12.0
Approach LOS							B	B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	12	12	1	7	7	8	13	2	14	16	1
Future Volume (Veh/h)	2	12	12	1	7	7	8	13	2	14	16	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	2	13	13	1	7	7	8	14	2	15	17	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	89	80	18	98	79	15	18			16		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	89	80	18	98	79	15	18			16		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	98	99	100	99	99	99			99		
cM capacity (veh/h)	875	799	1061	853	800	1065	1599			1602		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	28	15	24	33
Volume Left	2	1	8	15
Volume Right	13	7	2	1
cSH	909	909	1599	1602
Volume to Capacity	0.03	0.02	0.01	0.01
Queue Length 95th (m)	0.7	0.4	0.1	0.2
Control Delay (s)	9.1	9.0	2.4	3.3
Lane LOS	A	A	A	A
Approach Delay (s)	9.1	9.0	2.4	3.3
Approach LOS	A	A		

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	16.7%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	16	14	13	2	7	3	4	2	2	10	13	4
Future Volume (vph)	16	14	13	2	7	3	4	2	2	10	13	4
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	17	15	14	2	7	3	4	2	2	11	14	4

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	46	12	8	29
Volume Left (vph)	17	2	4	11
Volume Right (vph)	14	3	2	4
Hadj (s)	-0.07	-0.08	-0.02	0.03
Departure Headway (s)	3.9	3.9	4.0	4.1
Degree Utilization, x	0.05	0.01	0.01	0.03
Capacity (veh/h)	904	898	867	870
Control Delay (s)	7.1	7.0	7.1	7.2
Approach Delay (s)	7.1	7.0	7.1	7.2
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.1		
Level of Service	A		
Intersection Capacity Utilization	18.3%	ICU Level of Service	A
Analysis Period (min)	15		

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Total Traffic Conditions (2038)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	38	515	2	1	546	72	2	12	4	218	13	51
Future Volume (Veh/h)	38	515	2	1	546	72	2	12	4	218	13	51
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	40	542	2	1	575	76	2	13	4	229	14	54
Pedestrians		2			2			4			4	
Lane Width (m)		3.7			3.7			3.7			3.7	
Walking Speed (m/s)		1.1			1.1			1.1			1.1	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	655			548			980	1284	278	944	1209	294
vC1, stage 1 conf vol							627	627		581	581	
vC2, stage 2 conf vol							352	657		364	628	
vCu, unblocked vol	655			548			980	1284	278	944	1209	294
tC, single (s)	4.1			4.1			7.5	6.8	6.9	7.5	6.8	6.9
tC, 2 stage (s)							6.5	5.8		6.5	5.8	
tF (s)	2.2			2.2			3.5	4.2	3.3	3.5	4.2	3.3
p0 queue free %	96			100			99	96	99	42	96	92
cM capacity (veh/h)	925			1014			356	308	715	395	338	699

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	40	361	183	1	288	288	76	19	297
Volume Left	40	0	0	1	0	0	0	2	229
Volume Right	0	0	2	0	0	0	76	4	54
cSH	925	1700	1700	1014	1700	1700	1700	356	425
Volume to Capacity	0.04	0.21	0.11	0.00	0.17	0.17	0.04	0.05	0.70
Queue Length 95th (m)	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	39.8
Control Delay (s)	9.1	0.0	0.0	8.6	0.0	0.0	0.0	15.7	30.8
Lane LOS	A			A				C	D
Approach Delay (s)	0.6			0.0				15.7	30.8
Approach LOS								C	D

Intersection Summary			
Average Delay	6.3		
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		

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HCM Unsignalized Intersection Capacity Analysis
2: Hwy 305/Hyw 305 & Highway 16

03-19-2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	346	2	2	369	28	4	2	1	56	3	19
Future Volume (Veh/h)	13	346	2	2	369	28	4	2	1	56	3	19
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	14	364	2	2	388	29	4	2	1	59	3	20
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	417			366			612	814	183	604	786	194
vC1, stage 1 conf vol							393	393		392	392	
vC2, stage 2 conf vol							220	421		212	394	
vCu, unblocked vol	417			366			612	814	183	604	786	194
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)							6.5	5.5		6.5	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			99	100	100	89	99	98
cM capacity (veh/h)	1138			1189			536	480	828	548	493	815

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	14	243	123	131	259	29	7	82
Volume Left	14	0	0	2	0	0	4	59
Volume Right	0	0	2	0	0	29	1	20
cSH	1138	1700	1700	1189	1700	1700	545	593
Volume to Capacity	0.01	0.14	0.07	0.00	0.15	0.02	0.01	0.14
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	0.0	0.3	3.6
Control Delay (s)	8.2	0.0	0.0	0.1	0.0	0.0	11.7	12.0
Lane LOS	A			A			B	B
Approach Delay (s)	0.3			0.0			11.7	12.0
Approach LOS							B	B

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	10	3	10	25	16	7	22	7	6	37	9
Future Volume (Veh/h)	6	10	3	10	25	16	7	22	7	6	37	9
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	6	11	3	11	26	17	7	23	7	6	39	9
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	126	100	44	104	100	26	48			30		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	126	100	44	104	100	26	48			30		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	99	100	99	97	98	100			100		
cM capacity (veh/h)	808	784	1027	858	783	1049	1559			1583		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	20	54	37	54
Volume Left	6	11	7	6
Volume Right	3	17	7	9
cSH	820	868	1559	1583
Volume to Capacity	0.02	0.06	0.00	0.00
Queue Length 95th (m)	0.6	1.5	0.1	0.1
Control Delay (s)	9.5	9.4	1.4	0.8
Lane LOS	A	A	A	A
Approach Delay (s)	9.5	9.4	1.4	0.8
Approach LOS	A	A		

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	17.0%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	12	19	4	10	46	14	2	24	6	7	23	16
Future Volume (vph)	12	19	4	10	46	14	2	24	6	7	23	16
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	13	20	4	11	48	15	2	25	6	7	24	17

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	37	74	33	48
Volume Left (vph)	13	11	2	7
Volume Right (vph)	4	15	6	17
Hadj (s)	0.04	-0.06	-0.06	-0.15
Departure Headway (s)	4.2	4.1	4.1	4.0
Degree Utilization, x	0.04	0.08	0.04	0.05
Capacity (veh/h)	836	866	838	866
Control Delay (s)	7.4	7.4	7.3	7.3
Approach Delay (s)	7.4	7.4	7.3	7.3
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.3		
Level of Service	A		
Intersection Capacity Utilization	19.2%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	10	16	8	10	30	15
Future Volume (Veh/h)	10	16	8	10	30	15
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	17	8	11	32	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			28		46	20
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			28		46	20
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		97	98
cM capacity (veh/h)			1585		959	1058

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	28	19	48
Volume Left	0	8	32
Volume Right	17	0	16
cSH	1700	1585	990
Volume to Capacity	0.02	0.01	0.05
Queue Length 95th (m)	0.0	0.1	1.2
Control Delay (s)	0.0	3.1	8.8
Lane LOS		A	A
Approach Delay (s)	0.0	3.1	8.8
Approach LOS			A

Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	21.0%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	22	12	8	15	10
Future Volume (Veh/h)	10	22	12	8	15	10
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	23	13	8	16	11
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	56	22	27			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	56	22	27			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	98	99			
cM capacity (veh/h)	944	1056	1587			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	34	21	27
Volume Left	11	13	0
Volume Right	23	0	11
cSH	1017	1587	1700
Volume to Capacity	0.03	0.01	0.02
Queue Length 95th (m)	0.8	0.2	0.0
Control Delay (s)	8.7	4.5	0.0
Lane LOS	A	A	
Approach Delay (s)	8.7	4.5	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	21.1%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	56	403	1	4	407	220	1	13	1	75	12	49
Future Volume (Veh/h)	56	403	1	4	407	220	1	13	1	75	12	49
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	59	424	1	4	428	232	1	14	1	79	13	52
Pedestrians		2			2			4			4	
Lane Width (m)		3.7			3.7			3.7			3.7	
Walking Speed (m/s)		1.1			1.1			1.1			1.1	
Percent Blockage		0			0			0			0	
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	664			429			829	1218	218	780	987	220
vC1, stage 1 conf vol							546	546		440	440	
vC2, stage 2 conf vol							282	672		340	547	
vCu, unblocked vol	664			429			829	1218	218	780	987	220
tC, single (s)	4.1			4.1			7.5	6.8	6.9	7.5	6.8	6.9
tC, 2 stage (s)							6.5	5.8		6.5	5.8	
tF (s)	2.2			2.2			3.5	4.2	3.3	3.5	4.2	3.3
p0 queue free %	94			100			100	95	100	83	97	93
cM capacity (veh/h)	917			1123			398	306	781	456	383	780

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	59	283	142	4	214	214	232	16	144
Volume Left	59	0	0	4	0	0	0	1	79
Volume Right	0	0	1	0	0	0	232	1	52
cSH	917	1700	1700	1123	1700	1700	1700	323	526
Volume to Capacity	0.06	0.17	0.08	0.00	0.13	0.13	0.14	0.05	0.27
Queue Length 95th (m)	1.6	0.0	0.0	0.1	0.0	0.0	0.0	1.2	8.4
Control Delay (s)	9.2	0.0	0.0	8.2	0.0	0.0	0.0	16.7	14.4
Lane LOS	A			A				C	B
Approach Delay (s)	1.1			0.0				16.7	14.4
Approach LOS								C	B

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	45.3%	ICU Level of Service	A
Analysis Period (min)	15		

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HCM Unsignalized Intersection Capacity Analysis
2: Hwy 305/Hyw 305 & Highway 16

03-19-2024

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	461	2	2	616	81	1	4	2	44	4	20
Future Volume (Veh/h)	18	461	2	2	616	81	1	4	2	44	4	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	19	485	2	2	648	85	1	4	2	46	4	21
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		Raised			Raised							
Median storage veh)		2			2							
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	733			487			875	1261	244	936	1177	324
vC1, stage 1 conf vol							524	524		652	652	
vC2, stage 2 conf vol							351	737		284	525	
vCu, unblocked vol	733			487			875	1261	244	936	1177	324
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)							6.5	5.5		6.5	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			100	99	100	88	99	97
cM capacity (veh/h)	868			1072			422	343	757	387	376	672

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	19	323	164	218	432	85	7	71
Volume Left	19	0	0	2	0	0	1	46
Volume Right	0	0	2	0	0	85	2	21
cSH	868	1700	1700	1072	1700	1700	420	442
Volume to Capacity	0.02	0.19	0.10	0.00	0.25	0.05	0.02	0.16
Queue Length 95th (m)	0.5	0.0	0.0	0.0	0.0	0.0	0.4	4.3
Control Delay (s)	9.2	0.0	0.0	0.1	0.0	0.0	13.7	14.7
Lane LOS	A			A			B	B
Approach Delay (s)	0.3			0.0			13.7	14.7
Approach LOS							B	B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	7	32	12	12	23	17	8	46	13	27	43	7
Future Volume (Veh/h)	7	32	12	12	23	17	8	46	13	27	43	7
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	7	34	13	13	24	18	8	48	14	28	45	7
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	206	182	48	206	179	55	52			62		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	206	182	48	206	179	55	52			62		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	95	99	98	97	98	99			98		
cM capacity (veh/h)	707	695	1020	702	698	1012	1554			1541		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	54	55	70	80
Volume Left	7	13	8	28
Volume Right	13	18	14	7
cSH	755	778	1554	1541
Volume to Capacity	0.07	0.07	0.01	0.02
Queue Length 95th (m)	1.8	1.7	0.1	0.4
Control Delay (s)	10.1	10.0	0.9	2.7
Lane LOS	B	A	A	A
Approach Delay (s)	10.1	10.0	0.9	2.7
Approach LOS	B	A		

Intersection Summary			
Average Delay	5.3		
Intersection Capacity Utilization	24.9%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	23	44	13	11	31	13	4	26	13	23	34	10
Future Volume (vph)	23	44	13	11	31	13	4	26	13	23	34	10
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	24	46	14	12	33	14	4	27	14	24	36	11

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	84	59	45	71
Volume Left (vph)	24	12	4	24
Volume Right (vph)	14	14	14	11
Hadj (s)	-0.01	-0.07	-0.13	0.01
Departure Headway (s)	4.2	4.2	4.2	4.3
Degree Utilization, x	0.10	0.07	0.05	0.08
Capacity (veh/h)	827	831	825	811
Control Delay (s)	7.7	7.5	7.4	7.7
Approach Delay (s)	7.7	7.5	7.4	7.7
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.6		
Level of Service	A		
Intersection Capacity Utilization	26.8%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	10	37	19	10	31	15
Future Volume (Veh/h)	10	37	19	10	31	15
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	39	20	11	33	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			50		82	30
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			50		82	30
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		96	98
cM capacity (veh/h)			1557		909	1044

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	50	31	49
Volume Left	0	20	33
Volume Right	39	0	16
cSH	1700	1557	949
Volume to Capacity	0.03	0.01	0.05
Queue Length 95th (m)	0.0	0.3	1.2
Control Delay (s)	0.0	4.8	9.0
Lane LOS		A	A
Approach Delay (s)	0.0	4.8	9.0
Approach LOS			A

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	21.7%	ICU Level of Service	A
Analysis Period (min)	15		

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Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	23	28	19	15	10
Future Volume (Veh/h)	10	23	28	19	15	10
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	24	29	20	16	11
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	100	22	27			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	100	22	27			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	98	98			
cM capacity (veh/h)	883	1056	1587			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	35	49	27
Volume Left	11	29	0
Volume Right	24	0	11
cSH	995	1587	1700
Volume to Capacity	0.04	0.02	0.02
Queue Length 95th (m)	0.8	0.4	0.0
Control Delay (s)	8.8	4.4	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	4.4	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	22.7%	ICU Level of Service	A
Analysis Period (min)	15		

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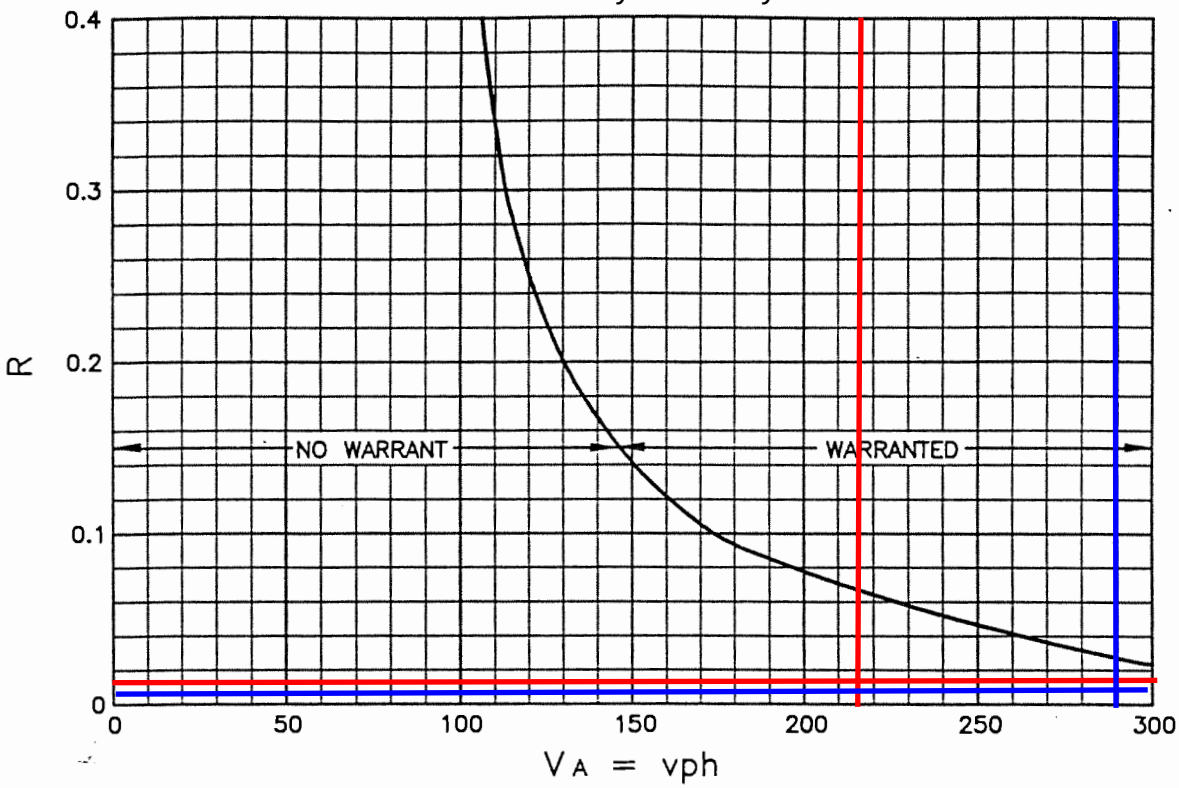
Appendix D Right Turn Lane Warrant Analysis

Eastbound Direction at Hwy 16 & Hwy 305 Intersection



Warrants are based on Design Hourly Volumes

V_A = Advancing Volume, includes Volume Right and Volume Left unless exclusive left turn lane.

V_R = Right Turn Volume, vph.

$R = V^R/V^A$

Warrants: NON FLARED INTERSECTION – Provide 3.7 m turning lane.
FLARED INTERSECTION – Lengthen deceleration lane to meet the right turn lane standard.

AM
VA = (13+342+2)*0.5*1.2 = 214 vehicles per hour
VR = 2 vehicles per hour
R = VR/VA = 0.009

Not Warranted

PM
VA = (18+461+2)*0.5*1.2 = 289 vehicles per hour
VR = 2 vehicles per hour
R = VR/VA = 0.007

Not Warranted

Saskatchewan Highways and Transportation

WARRANTS FOR RIGHT TURN LANES
RURAL HIGHWAYS

RECOMMENDED BY:		DIRECTOR TECH. STDS. & POLICIES	DATE	95.02.24	STANDARD PLAN NO	20614
APPROVED BY:		ASSIST. DEPUTY MINISTER OPERATIONS DIVISION	DATE	95-02-28	SHEET	1 of 2

LAST REV DATE: FEB.14,1995

ACAD DWG: 20614-1

NOTES:

1. Right turn lanes are warranted at the following locations:
   - intersections with other Provincial Highways.
   - Industrial Access Roads.
   - Provincial Campgrounds and Picnic Sites.

2. Use corrected peak hourly volumes (vph) projected to the 10th year after the proposed construction date. Refer to correction factors under DM 502–3 for further information.

3. Normally 0.6 m shoulder will be provided on turning lane.

4. 1.5 m shoulder may be provided on divided highways and at intersections where truck volumes are higher than normal, for example, at scale sites and access to industrial sites generating heavy truck volumes.

5. Length of the turning lane will be related to highway design speed and turning speed. See Standard Plan No. 20618.

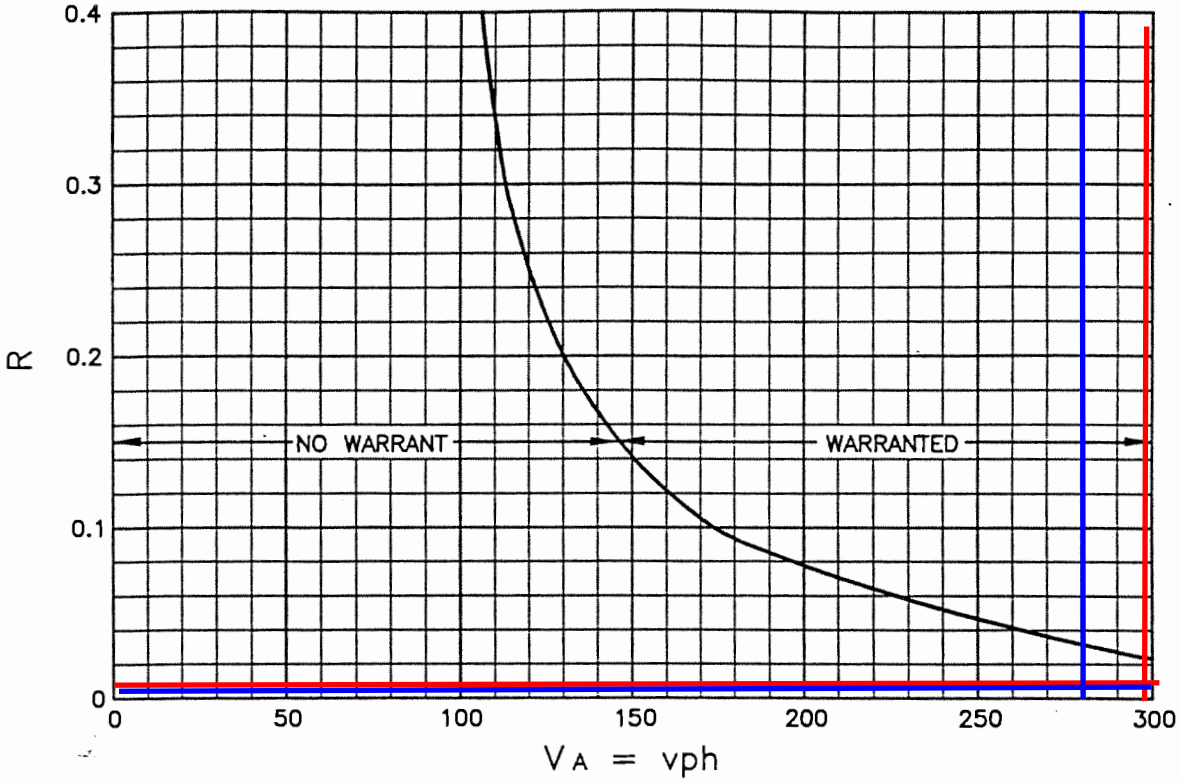
6. For 4 lane highways, the advancing volume should be based on 50% of the total directional volume (vph) or 25% of the total volume (where directional split is not a factor), with no further reduction for left turn vehicles.

Saskatchewan Highways and Transportation	WARRANTS FOR RIGHT TURN LANES RURAL HIGHWAYS					
RECOMMENDED BY:		DIRECTOR TECH. STDS. & POLICIES	DATE	95-02-24	STANDARD PLAN NO	20614
APPROVED BY:		ASSIST. DEPUTY MINISTER OPERATIONS DIVISION	DATE	95-02-28	SHEET	2 of 2

LAST REV DATE: FEB.14,1995

ACAD DWG: C-2

Eastbound Direction at Hwy 16 & Hwy 305 and Hwy 16 & RR 3074 Intersections



Warrants are based on Design Hourly Volumes

V_A = Advancing Volume, includes Volume Right and Volume Left unless exclusive left turn lane.

V_R = Right Turn Volume, vph.

$R = V^R/V^A$

Warrants: NON FLARED INTERSECTION – Provide 3.7 m turning lane.
FLARED INTERSECTION – Lengthen deceleration lane to meet the right turn lane standard.

AM
VA = (38+515+2)*0.5*1.2 =333 vehicles per hour
VR = 2 vehicles per hour
R = VR/VA = 0.006

Not Warranted

PM
VA = (56+403+1)*0.5*1.2 =276 vehicles per hour
VR = 2 vehicles per hour
R = VR/VA = 0.005

Not Warranted

Saskatchewan Highways and Transportation

WARRANTS FOR RIGHT TURN LANES
RURAL HIGHWAYS

RECOMMENDED BY:		DIRECTOR TECH. STDS. & POLICIES	DATE	95.02.24	STANDARD PLAN NO	20614
APPROVED BY:		ASSIST. DEPUTY MINISTER OPERATIONS DIVISION	DATE	95-02-28	SHEET	1 of 2

LAST REV DATE: FEB.14,1995

ACAD DWG: 20614-1

NOTES:

1. Right turn lanes are warranted at the following locations:
   - intersections with other Provincial Highways.
   - Industrial Access Roads.
   - Provincial Campgrounds and Picnic Sites.

2. Use corrected peak hourly volumes (vph) projected to the 10th year after the proposed construction date. Refer to correction factors under DM 502–3 for further information.

3. Normally 0.6 m shoulder will be provided on turning lane.

4. 1.5 m shoulder may be provided on divided highways and at intersections where truck volumes are higher than normal, for example, at scale sites and access to industrial sites generating heavy truck volumes.

5. Length of the turning lane will be related to highway design speed and turning speed. See Standard Plan No. 20618.

6. For 4 lane highways, the advancing volume should be based on 50% of the total directional volume (vph) or 25% of the total volume (where directional split is not a factor), with no further reduction for left turn vehicles.

Saskatchewan Highways and Transportation	WARRANTS FOR RIGHT TURN LANES RURAL HIGHWAYS					
RECOMMENDED BY:		DIRECTOR TECH. STDS. & POLICIES	DATE	95-02-24	STANDARD PLAN NO	20614
APPROVED BY:		ASSIST. DEPUTY MINISTER OPERATIONS DIVISION	DATE	95-02-28	SHEET	2 of 2

LAST REV DATE: FEB.14,1995

ACAD DWG: C-2

Appendix E Intersection Illumination Warrant Analysis

FIGURE 2621-2-1

WARRANTS FOR INTERSECTION AREA LIGHTING

1. Traffic Volume Warrant **Not Warranted**

   1.1 Through Highway

   $\frac{\text{Leg 1 AADT + Leg 2 AADT}}{2}$ = X1 >= 1500 AADT, (3996+5771)/2 = 4884

   , and

   1.2 Intersecting Roadway

   Leg 1 AADT + Leg 2 AADT = X2 >= 1000 AADT 492+41 = 533

   Note: For T intersections leg 1 or leg 2 = 0 AADT

2. Raised Channelization/Median Curbing Warrant **Not Warranted**

   2.1 Traffic Speed

   Posted speed limit or actual 85th percentile speed >= 60 km/h, and

   2.2 Traffic Engineering Assessment

   Traffic engineering assessment supports retention of the raised islands/median and the provision of area lighting.

   Note: The limits of the area lighting for raised islands should extend to the limits of the raised islands/media.

3. Traffic Accident Rate Warrant **Not Warranted**

   3.1 Traffic Volume

   Through highway traffic volume >= 1000 AADT, and 3996+5771= 9,768

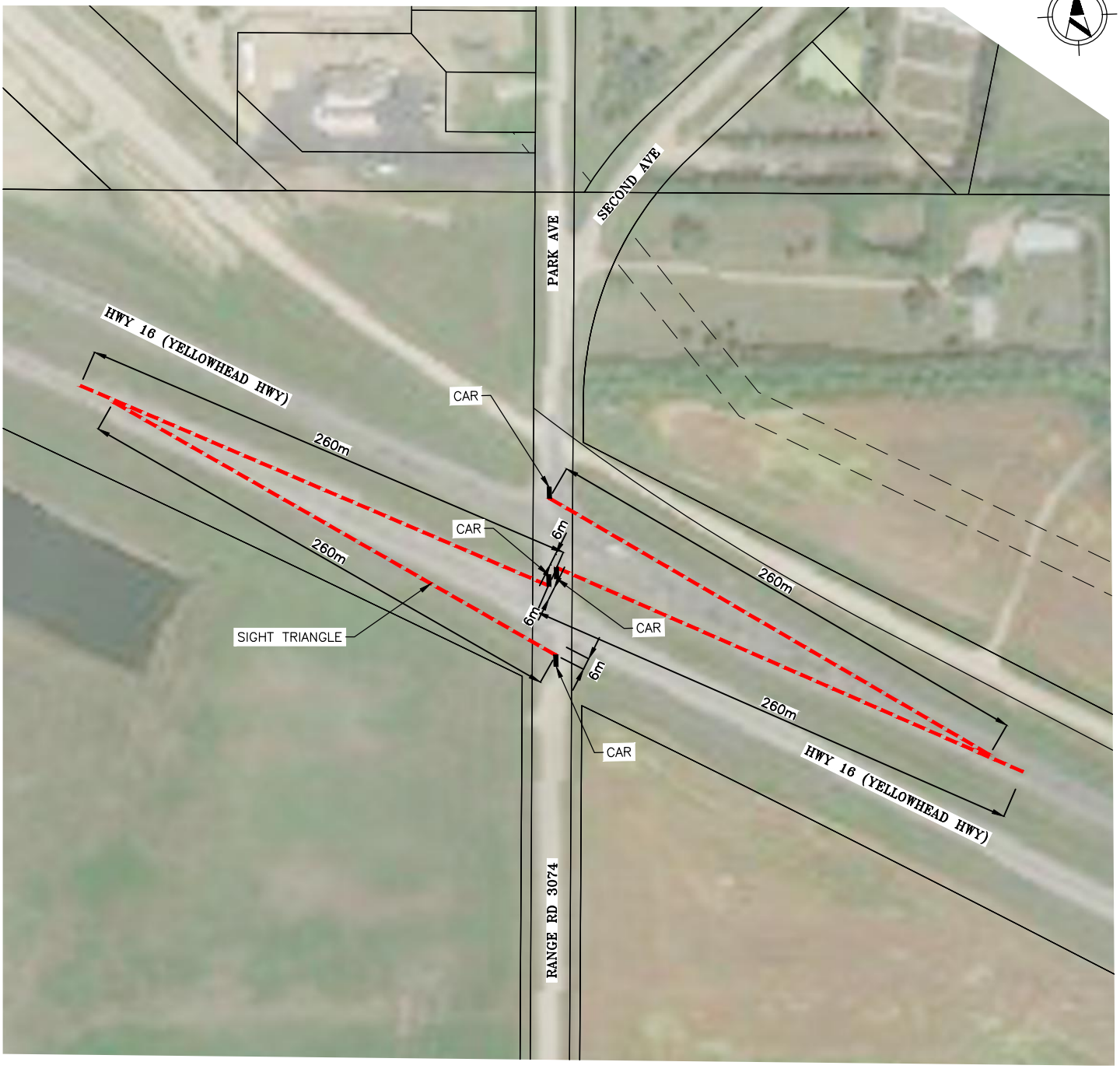
   3.2 Accident Rate

   The intersection accident rate is >= 1.5 accidents/million entering vehicles/year. The ratio of the last three year average night to day accident rate is > 1.5. A traffic engineering study supports area lighting as an acceptable expenditure.

   0.59 collisions per 1 million entering vehicles

   night to day ratio: 1.2

Appendix F Intersection Sight Distance Review



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DATE	REVISION

PRELIMINARY
NOT FOR CONSTRUCTION

SCALE VERIFICATION

WHEN DRAWING IS PLOTTED FULL SIZE
THIS LINE IS 30mm IN LENGTH.

OWNER/CLIENT
CLAYSTONE DEVELOPMENTS

LOCATION
LANGHAM, SK

PROJECT
PRAIRIE ROSE PARK
TRAFFIC IMPACT
ASSESSMENT

SHEET TITLE
SIGHT DISTANCE FOR
ENTERING VEHICLES
HWY 16 & RG RD 3074

SCALE	DESIGNED
NTS	BW
DRAWN	CHECKED
DL	
DATE	SHEET
23/10/30	1 of 2

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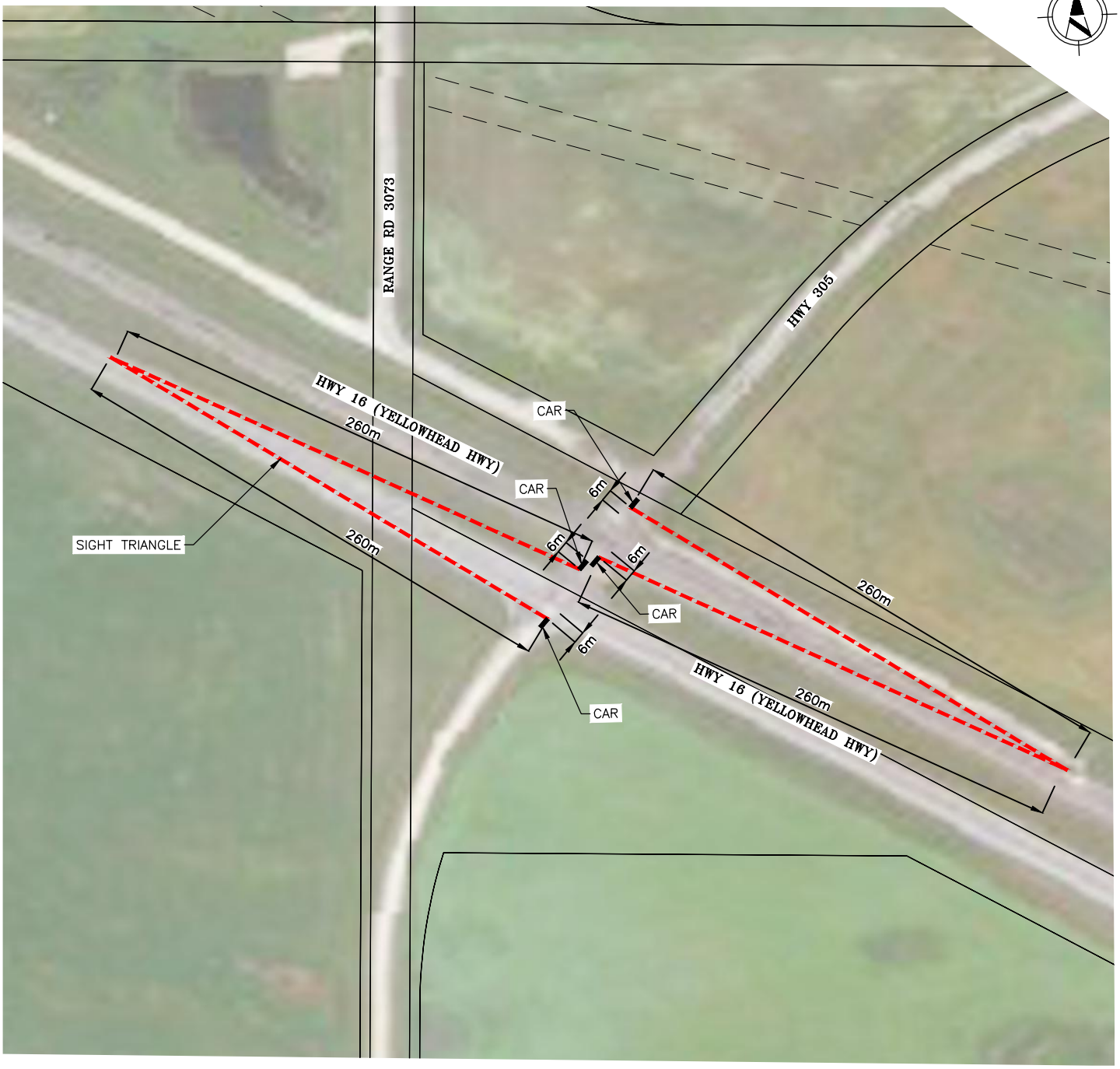

DATE	REVISION

PRELIMINARY
NOT FOR CONSTRUCTION

SCALE VERIFICATION

WHEN DRAWING IS PLOTTED FULL SIZE
THIS LINE IS 30mm IN LENGTH.

OWNER/CLIENT
CLAYSTONE DEVELOPMENTS

LOCATION
LANGHAM, SK

PROJECT
PRAIRIE ROSE PARK
TRAFFIC IMPACT
ASSESSMENT

SHEET TITLE
SIGHT DISTANCE FOR
ENTERING VEHICLES
HWY 16 & HWY 305

SCALE	DESIGNED
NTS	BW
DRAWN	CHECKED
DL	
DATE	SHEET
23/10/30	2 of 2

DRAWING NUMBER APPENDIX F1.2

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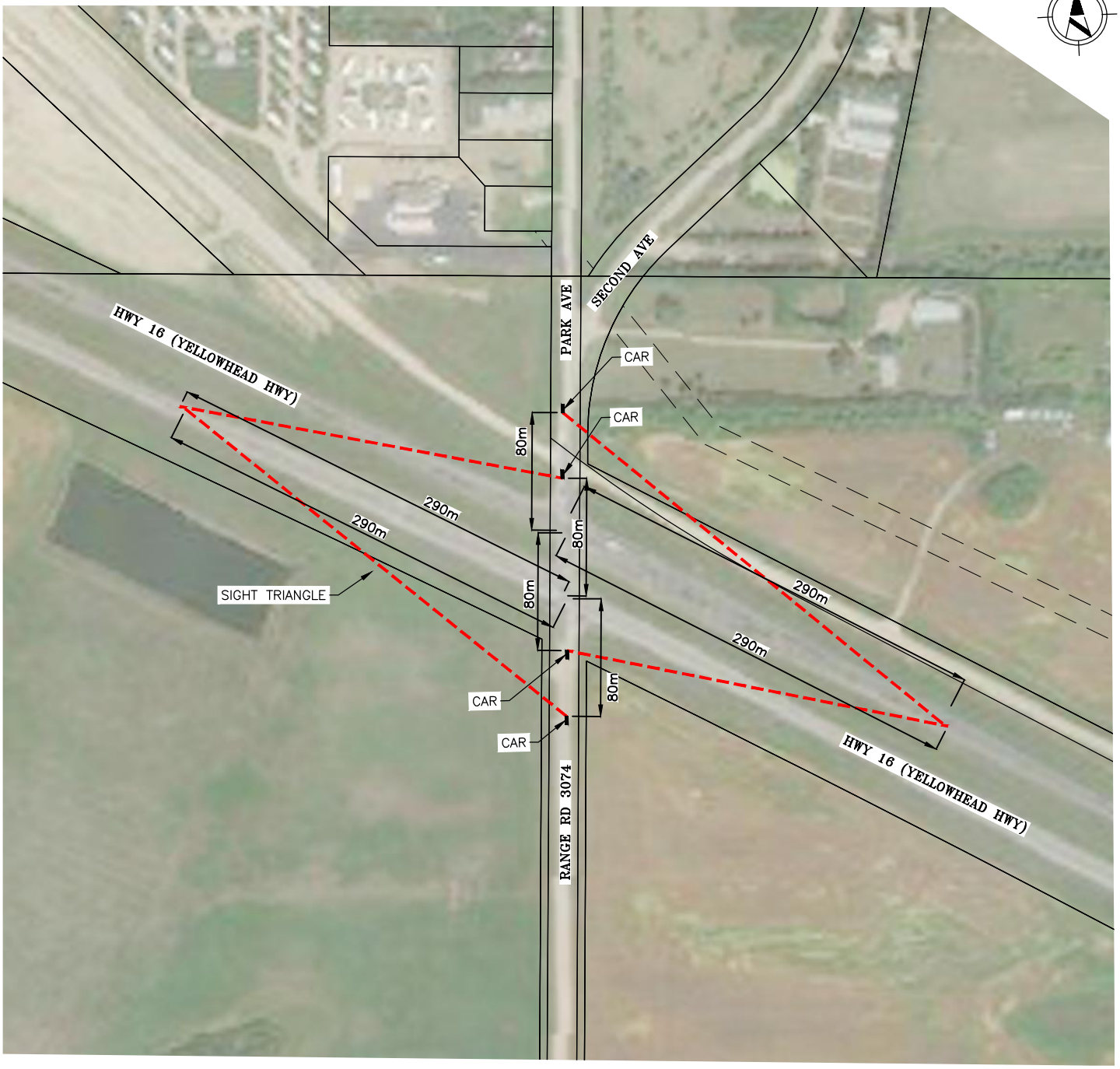

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DATE	REVISION

PRELIMINARY
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SCALE VERIFICATION

WHEN DRAWING IS PLOTTED FULL SIZE
THIS LINE IS 30mm IN LENGTH.

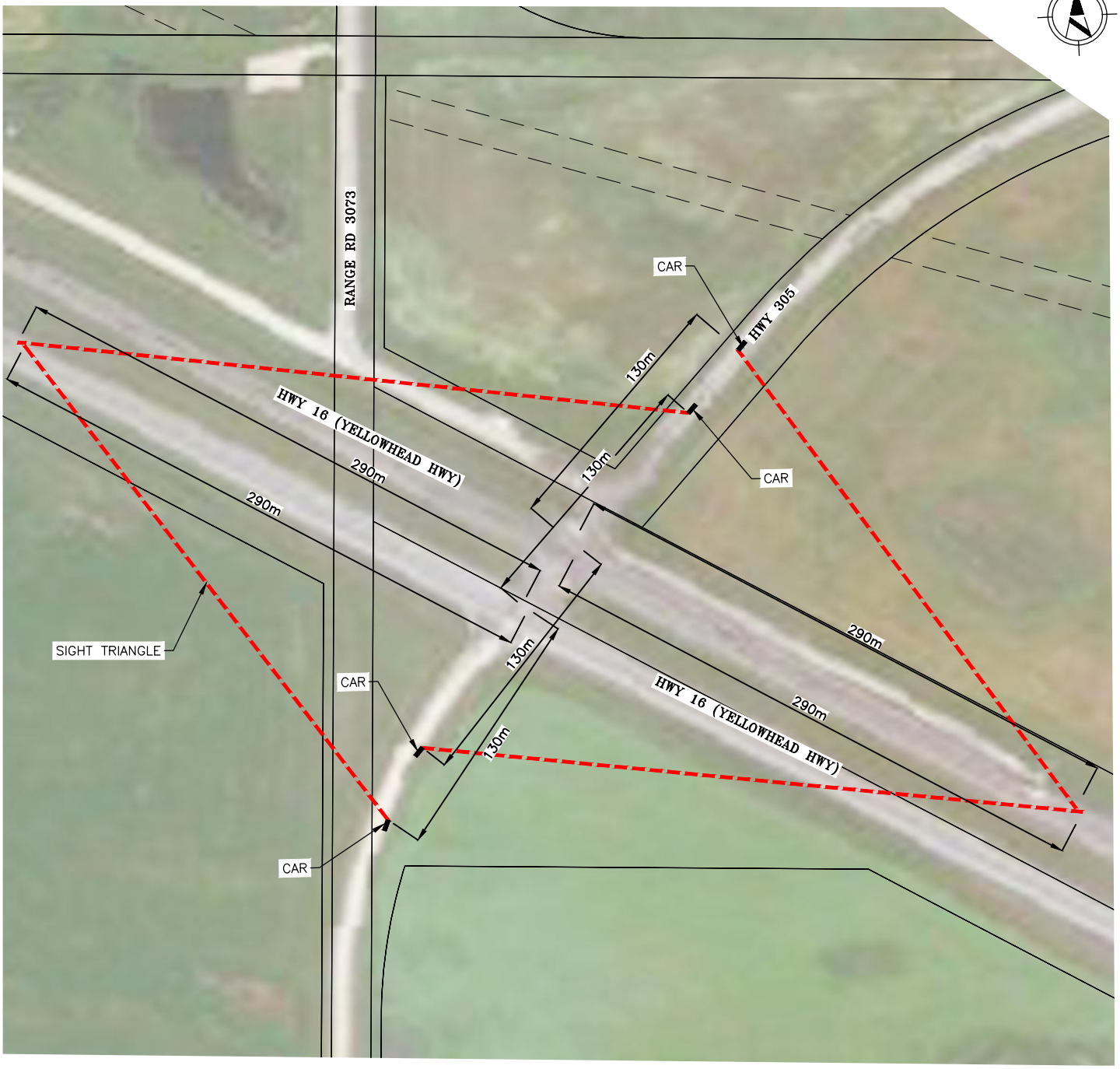
OWNER/CLIENT
CLAYSTONE DEVELOPMENTS

LOCATION
LANGHAM, SK

PROJECT
PRAIRIE ROSE PARK
TRAFFIC IMPACT
ASSESSMENT

SHEET TITLE
SIGHT TRIANGLES
AT INTERSECTIONS
HWY 16 & RG RD 3074

SCALE NTS	DESIGNED BW
DRAWN DL	CHECKED
DATE 23/10/30	SHEET 1 of 2
DRAWING NUMBER APPENDIX F2	



PRELIMINARY
NOT FOR CONSTRUCTION

DATE	REVISION

SCALE VERIFICATION

WHEN DRAWING IS PLOTTED FULL SIZE THIS LINE IS 30mm IN LENGTH.

SCALE NTS	DESIGNED BW
DRAWN DL	CHECKED
DATE 23/10/30	SHEET 2 of 2
DRAWING NUMBER APPENDIX F2	

OWNER/CLIENT
CLAYSTONE DEVELOPMENTS

LOCATION
LANGHAM, SK

PROJECT
PRAIRIE ROSE PARK
TRAFFIC IMPACT ASSESSMENT

SHEET TITLE
SIGHT TRIANGLES AT INTERSECTIONS HWY 16 & HWY 305

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