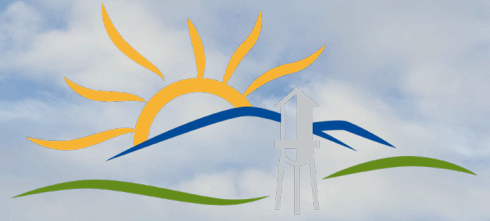


STARLINE

Business Park

Area Structure Plan



Claresholm



Adopted December 10, 2018

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1 INTRODUCTION

1.1 VISION

The Starline Business Park Area Structure Plan (ASP) is envisioned as a hub of industrial, business industrial and highway commercial uses, intended to expand and diversify industry, and stimulate commerce and trade activity in Claresholm and areas surrounding. The purpose of this plan aligns with the intent for the land as outlined in the Claresholm Municipal Development Plan (MDP). The MDP identifies the Plan area within its Land Use Map (Figure 4 - Claresholm Municipal Development Plan – Land Use Map) as an area planned to accommodate mainly industrial and industrial/commercial uses, with a portion adjacent to Highway 520 intended specifically for commercial use.

The Starline Business Park ASP is intended to guide the development of a range of diverse and complementary land uses within the planning area. The lands south of Highway 520 are envisioned to be developed as a logical and orderly expansion to the existing industrial area west of 5th Street. This area will include a variety of municipally serviced industrial uses that will service the medium industrial needs of the town and surrounding communities. The lands north of Highway 520 are envisioned to contain a mixture of business, commercial and light industrial land uses. Lands in this area will also be fully serviced and will provide a land use transition from the existing residential neighborhoods to the north and west, while offering opportunities for smaller business and commercial type uses. Both areas will provide an opportunity for development of a vehicle-oriented highway commercial development adjacent to Highway 520.

Development of the plan area will serve as a catalyst to support commercial and industrial development and provide employment opportunities to residents of Claresholm and areas in close-proximity. The future Highway 2 alignment is planned to the east of the plan area boundary, and will provide access for the travelling public, while acting as a main transportation route along Alberta's North/South Trade Corridor. The interface between existing and future planned land uses will be managed by ensuring adequate transitions between land uses using buffering techniques.

The eastern boundary of the plan area was established to abut the future Highway 2 right-of-way alignment as identified by Alberta Transportation. This eastern boundary may experience minor shifts during detailed design and construction which are expected to have minimal impacts on the scope of this plan. Major shifts in the alignment will require an amendment to the extent of the area identified in this plan.

Vision:

"The vision of the Starline Business Park ASP is to provide guidance for the orderly expansion of Claresholm's industrial area and to harmonize the plan area with developed areas within the Town, by building on existing development and taking advantage of the locational attributes of Highway 2 and Highway 520."

1.2 PURPOSE

The Starline Business Park ASP describes how 70 ha (173 acres) of farmland, located east of the current development limits of the town, will be developed into an efficient and orderly commercial, business and industrial park. The ASP has been prepared on behalf of the Town of Claresholm.

This document is designed to provide a framework to guide the development of the Starline Business Park plan area. This Plan will address planning issues in a comprehensive manner to effectively coordinate servicing and transportation infrastructure with the spatial organization of land uses. Additionally, this Plan seeks to introduce policy and guidelines that together, will create a successful and sustainable development.

1.3 INTERPRETATION

The following definitions may be used to interpret the Starline Business Park Area Structure Plan:

Alberta Transportation (AT)	A provincial body responsible for the long-term planning of the highway network and oversees the network's design, construction, and maintenance activities.
Area Structure Plan (ASP)	A statutory plan, adopted by bylaw, which provides a policy framework for subsequent redistricting, subdivision and development of a specified area of land in the municipality.
Council	The Council of the Town of Claresholm.
Development Plan	A plan that depicts the development of lands over time which may include but is not limited to: a detailed site plan, topographic information, geophysical assessment, hydrological assessment, traffic impact analysis, environmental overview, phasing, servicing and an archaeological and historical impact assessment.
Highway	A road that is designated as a primary highway pursuant to the Public Highways Development Act.
Highway 2 Realignment	The proposed Highway 2 alignment in accordance with the recommendations of the Alberta Transportation Functional Plan (2007) completed by Clifton ND Lea Consulting Inc. The current Highway 2 alignment will be shifted east to create a transportation utility corridor, situated on the east edge of the town limits and which will bypass the current town centre, removing travel interruptions that currently impede Alberta's north-south trade corridor.
Infrastructure	Public utility systems in the municipality that may include, but are not limited to, the transportation network, water and sewer systems, and solid waste management facilities.
Land Use Bylaw	A bylaw of the Municipality passed by Council as a land use bylaw pursuant to the provisions of the MGA and intended to control, and/or regulate the use and development of land and buildings within the municipality.

Land Use District	One or more divisions of the Land Use Bylaw establishing permitted and discretionary uses of land or buildings with attendant regulations.
Light Industrial	Industrial uses that include fabrication, manufacturing, assembly or processing of materials that are in refined form and that do not in their transformation create smoke, gas, odour, dust, noise, vibration of earth, soot or building lighting or any other nuisance factors, which are enclosed within a building within the subject property.
Medium Industrial	Industrial uses that include manufacturing, processing, assembly, distribution, service and repair uses that carry out a portion of their operation outdoors or require outdoor storage areas. Any nuisance associated with such uses should not generally extend beyond the boundaries of the site.
Municipality	The Town of Claresholm and when the context requires or referring to the area contained within the boundaries of the municipality.
Municipal Government Act (MGA)	Means the Municipal Government Act, Revised Statutes of Alberta, 2000, Chapter M-26, as amended.
Natural Features	Includes landscapes which are found in their natural state and may be remnant, undisturbed, diverse or contain unique environmental characteristics.
North South Trade Corridor (NSTC)	A contiguous series of provincial highways that connects Alberta with the U.S. at Coutts, and extends to the B.C. border west of Grande Prairie, and provides access to the Alaska Highway.
Qualified Professional	An individual with specialized knowledge recognized by the Municipality and/or licensed to practice in the Province of Alberta. Examples of qualified professionals include, but are not limited to engineers, geologists, hydrologists and surveyors.
Redistricting	Refers to the reclassification by the Municipality of a land use district in the Land Use Bylaw applicable to a specific area of the municipality.
Right-of-Way (ROW)	Means the total width of any land reserved or dedicated as a thoroughfare, lane, pedestrian way, or utility line.
Shall	Indicates that a policy is mandatory and must be complied with; however, where quantities or numerical standards form part of a policy, they may be varied at the discretion of the Development Authority, provided that the intent of the policy is still achieved and the variance is necessary to address unique circumstances that would otherwise render compliance with the policy impractical or impossible.

Should

Indicates that a policy is strongly encouraged, but can be varied where unique circumstances require other actions that would still satisfy the general intent of the policy and ASP.

Traffic Impact Assessment

An area-specific study which may include, but is not limited to, an analysis and evaluation of:

- a) the transportation related impacts of a proposed subdivision and/or development on the existing transportation network; and
- b) a program of future expansion and/or improvement of the transportation network to accommodate the proposed growth and to preserve the function and integrity of the network.

1.4 PLAN OBJECTIVES

The following Development Objectives have been created to help guide and strengthen the overall direction of the plan and policies contained within the Starline Business Park ASP:

1. To create a flexible development concept that could help to stimulate investment while continuing to respond to changing market conditions.
2. To provide investment security and land use predictability for land owners, business owners and potential developers.
3. To sensitively integrate development with surrounding land uses and the natural environment.
4. To promote high quality development with appropriate building, site and landscaping standards.
5. To recognize the importance of agriculture in the region and to support the continuing use of agricultural lands within the planning area until it is needed for development.
6. To provide opportunities for commercial and industrial development to serve the community's needs and diversify the Town and MD of Willow Creek's economic base.
7. To fulfill legislative requirements for Municipal Reserve dedication and contribute to the acquisition and development of parks, open spaces and recreational facilities within the planning area.
8. To efficiently and safely move people and goods to, from and within the planning area.
9. To provide efficient and economical services to meet the needs of future development.
10. To provide efficient and environmentally suitable storm water management facilities.
11. To provide utility services to meet the needs of future development.
12. To allow for an efficient, economical and logical phasing of development.

1.5 BACKGROUND INFORMATION

The Starline Business Park ASP lands are located along the eastern edge of the Town of Claresholm, strategically situated between Calgary, AB and Lethbridge, AB. The area encompassed within the Area Structure Plan was annexed into the Town of Claresholm in 2017 and comprises approximately 70 ha (173 ac) of land.

Highway 2 currently bisects the Town of Claresholm. Identified by Alberta Transportation in a Functional Study (2007) for future transportation plans, Highway 2 will be realigned east of its current alignment to travel adjacent to the eastern boundary of the Plan area. The realignment profile of Highway 2 has influenced the eastern extent of the plan area's eastern boundary, and further highlights the potential of the plan area to stimulate local business by providing a goods and services transportation corridor and services to the travelling public. As Highway 2 is a main north-south thoroughfare, development along this corridor will be highly visible.

The plan area is situated such that it is a logical expansion of existing industrial uses within the town. In addition to the extension of existing uses, the commercial and industrial business area will provide a hub for several smaller communities surrounding the town, and will assist in stimulating the local economy.

There currently exist two Area Structure Plans (ASP) within the Town. The Southwest Area Structure Plan guides the development of a 24-acre residential subdivision (207 residents at full build-out), while the Prairie Shores Area Structure Plan (ASP) guides the development of a 155-acre residential subdivision. Both planned residential subdivisions are within 2 kilometres of the Industrial ASP area, providing housing options in close-proximity. The physical proximity of residential land uses further increases viability of the plan area. Compatibility between existing land uses, including residential uses, will be ensured to achieve congruity through mitigative measures.

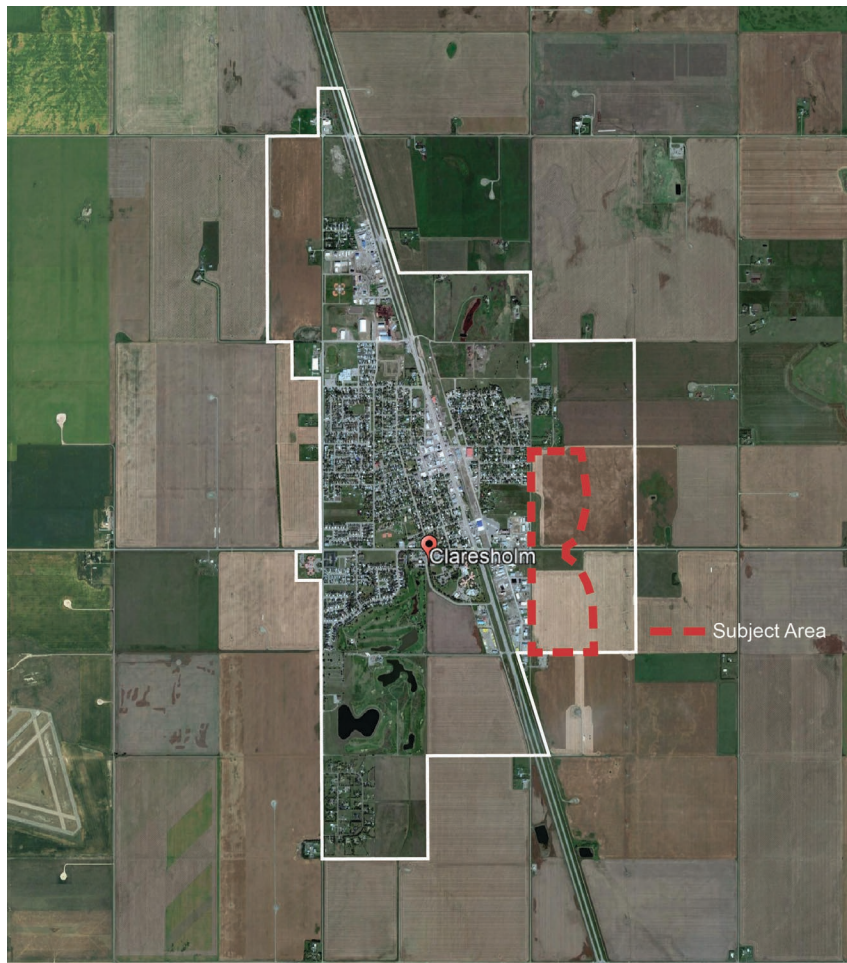
2 PLAN AREA

2.1 LOCATION AND CONTEXT

The Starline Business Park ASP is located adjacent to the future realignment of Highway 2, approximately 125 km south of Calgary and 90 km northwest of Lethbridge. Claresholm is located within a regional market area along the Highway 2 corridor which extends south from Calgary. This corridor connects several municipalities, including the Town of Okotoks, the Town of High River, the Town of Stavely, the Municipal District of Foothills No. 31, the Municipal District of Willow Creek No. 26, the Town of Nanton and the Town of Fort Macleod. The plan area encompasses a portion of areas legally described as 4;27;12;25;SW, and 4;27;12;24;;11,14 and the entirety of 4;27;12;24;;12,13.

The plan area is bisected by Highway 520 which runs east to west. Proposed transportation upgrades include the future alignment of Highway 2, which runs north to south, directly adjacent to the eastern boundary of the plan area. The opportunities and constraints of the plan area have been identified on Figure 3 - Opportunities and Constraints Map.

Figure 1 - Area Structure Plan Boundary



The lands surrounding the Plan area are described as:

- North – rural residential and agricultural land (bordered by future extension of 50 Ave E);
- East – agricultural land (Future Highway 2 realignment);
- South – agricultural land (bordered by future extension for 39 Ave E); and,
- West – residential/industrial land (established development).

2.2 LEGAL DESCRIPTIONS AND OWNERSHIP

Lands within the ± 70-hectare (173 ac) plan area are owned by several different property owners, as identified in Figure 2 - Ownership Plan, on the following page. All parcels are owned by private owners or corporations.

A summary of property ownership is provided in the Table 1- Property Ownership Within the Plan Area , below:

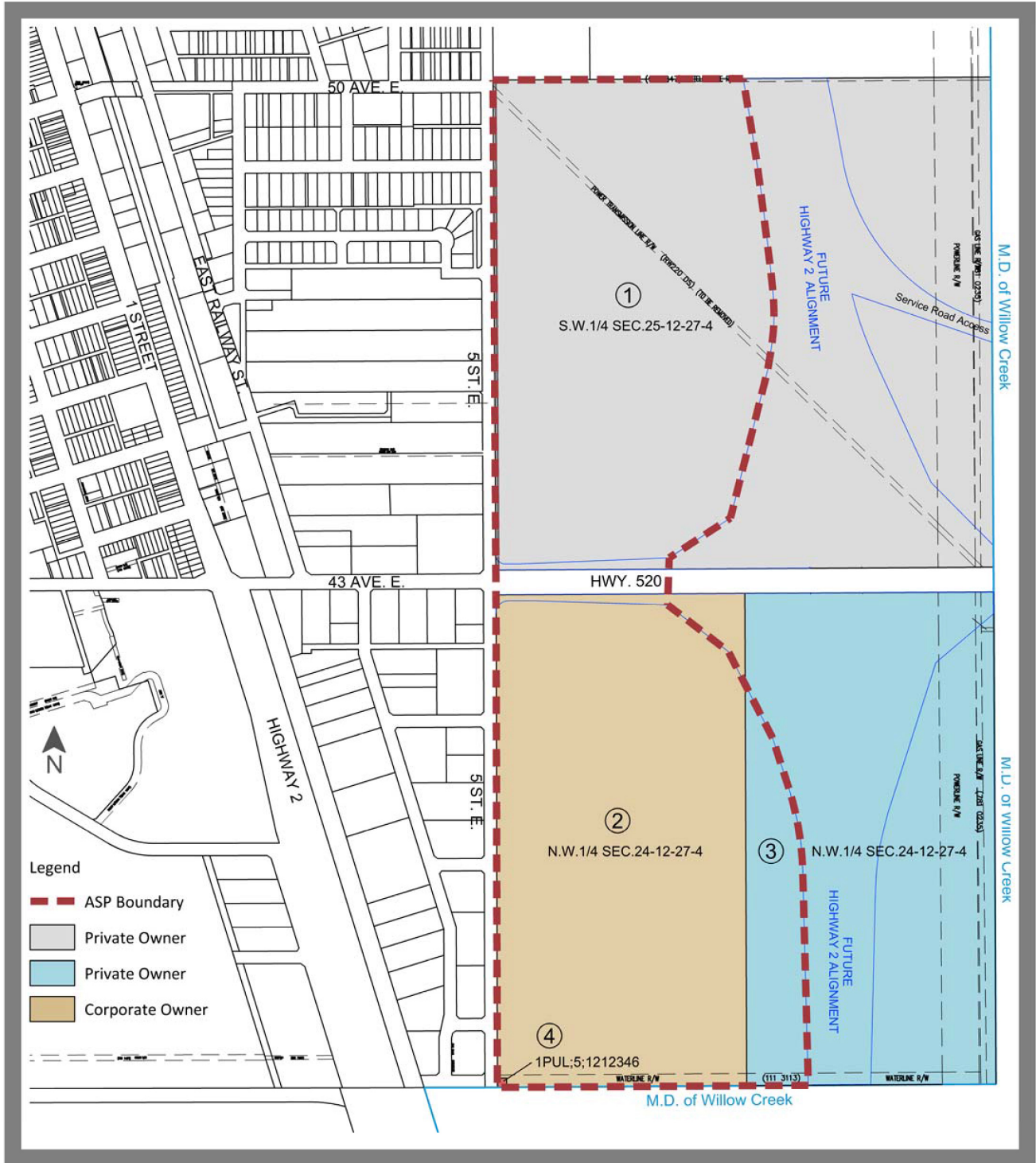
Table 1- Property Ownership Within the Plan Area

	Legal Description	Owner	Certificate of Title	Area (ha)	Area in Plan
1	4;27;12;25;SW	PRIVATE OWNER	041 430 594	64.7	33.06
2	4;27;12;24;;4,5	1584935 ALBERTA LTD.	131 095 301	32.4	31.32
3	4;27;12;24;;11,14	PRIVATE OWNER	051 113 139	32.4	5.13
4	1212346;5;1PUL	THE MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26	121 217 363	0.02	0.02
Total				129.52	69.53

(Total areas exclude Highway 520)

The Plan encompasses approximately 70 ha in area, within portions of the total titled land 129.5 ha identified in Table 1- Property Ownership Within the Plan Area . The western limits of the proposed Highway 2 alignment have been used to form the eastern limits of the plan area. It is expected that minor adjustments may be made to this boundary as detailed planning and engineering is undertaken related to the extent of the Highway 2 realignment, but minor adjustments will not require an amendment to the plan as a whole.

Figure 2 - Ownership Plan



2.3 RIGHT-OF-WAY AGREEMENTS

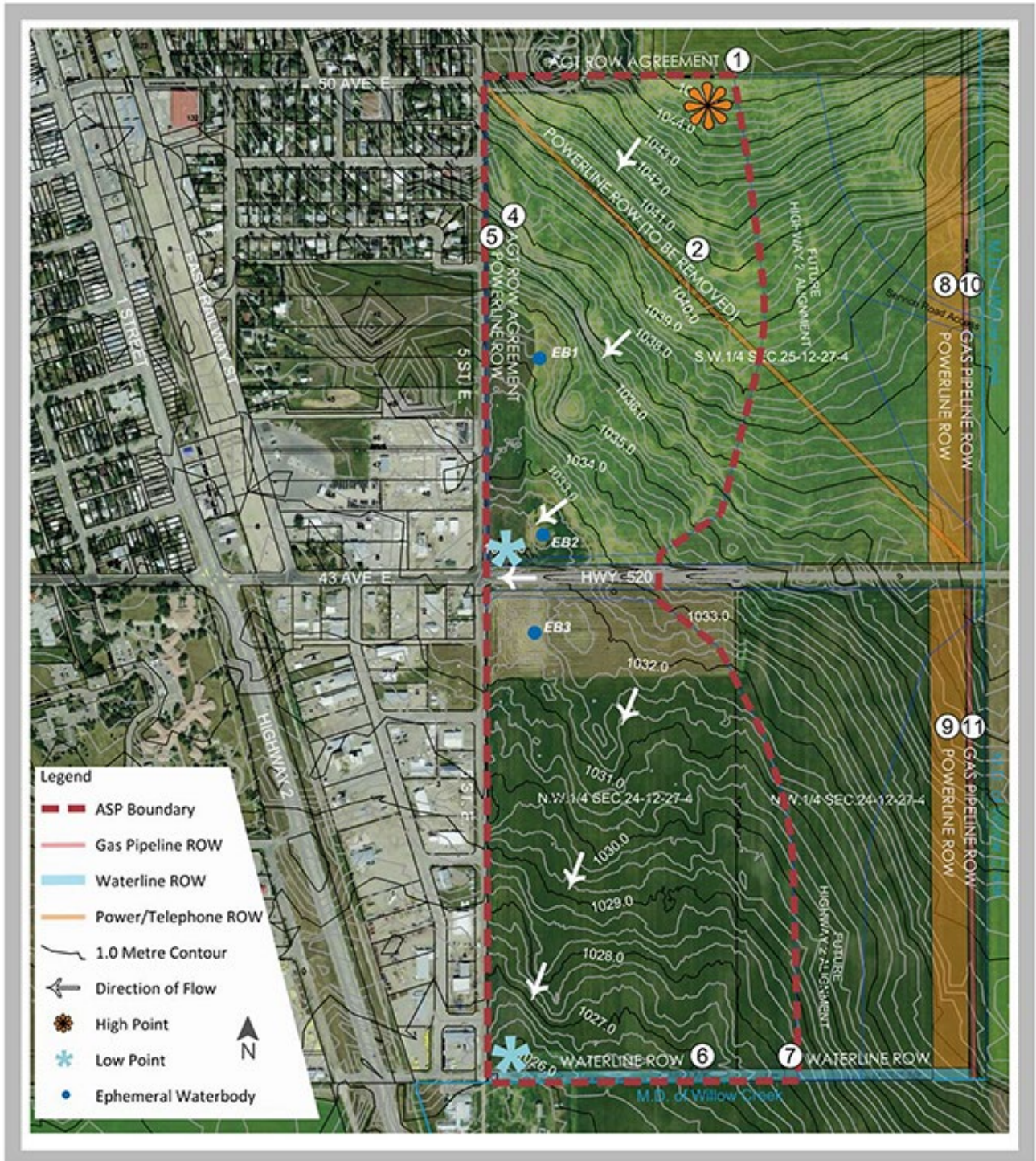
The land within the plan area is currently under cultivation and is utilized for agricultural purposes. Several rights-of-way exist and are identified in *Table 2 - Right-of-Way Agreements within the Plan Area Boundary*. No setbacks are required from identified rights-of-way.

Table 2 - Right-of-Way Agreements within the Plan Area Boundary

	Description	DOC #	Status	Set-Back
1	Alberta Government Telephones (AGT) ROW not over 20 acres	931200185	Operating	Not Required
2	Powerline ROW	2359EB	To be removed	Not Required
3	MLC Oil and Gas Ltd. ROW not over 20 acres	901119660 (Blanket)	Operating	Not Required
4	5M Alberta Government Telephones (AGT) ROW	4106EA	Operating	Not Required
5	10' Power ROW	4106EA	Operating	Not Required
6	Waterline ROW Plan 1113113	111282110	Operating	Not Required
7	Waterline ROW Plan 1113113	111282109	Operating	Not Required
8	AltaLink Powerline R/W	141101683	Operating	Not Required
9	AltaLink Powerline R/W	131208513	Operating	Not Required
10	Gas Pipeline R/W	781037564	Operating	TBD*
11	Gas Pipeline R/W	781050673	Operating	TBD*

** Note: These pipelines are licensed for sour gas – additional setbacks may be required.*

Figure 3 - Opportunities and Constraints Map



2.4 HIGHWAY 2 REALIGNMENT

Clifton ND Lea Consulting Inc. completed the *Highway 2:08 Claresholm Re-Alignment Functional Planning Study* in January 2007. The report identified a future Alberta Transportation (AT) objective to realign Highway 2 to provide a continuous uninterrupted transportation route, which bypasses the town to the US border.

The realignment is intended to align the Provincial highway right-of-way (ROW) with utilities to allow for consolidation of similar uses into a single transportation – utility corridor. As such, the right-of-way which will encompass the proposed highway realignment informed the delineation of a logical eastern boundary to the plan area, acting as a future physical constraint to development. The alignment of the proposed Highway 2 right-of-way is shown as a constraint on Figure 3 - Opportunities and Constraints Map.

2.5 TOPOGRAPHY AND VEGETATION

WSP completed a Biophysical Assessment of lands within the plan area in July 2018¹. The land within the Starline Business Park ASP area is described as gently undulating with mild topographical relief. The plan area slopes downwards to the southwest, of which, the highest point is located in the northeast corner at an elevation of 1045 m, and the lowest point is located in the southwest corner at 1026 m.

Land within the Starline Business Park ASP area is currently used for agricultural purposes. As such, cultivated fields (hay and canola) and pasturelands constitute approximately 95 percent of the area (Biophysical Assessment, WSP 2018).

2.6 SOILS AND GROUNDWATER

A geotechnical investigation was conducted for the plan area in June 2018 by BDT Engineering Ltd². The investigation identified that soils encountered in most of the test holes consisted of superficial topsoil (200mm-600mm) underlain by silty clay with traces of sand, generally followed by clay till ranging between 0.2m and 5.8m in thickness. Bedrock was encountered in most cases below the clay till, present to the maximum depth drilled.

The groundwater table was reported by BDT Engineering Ltd. to be 2.15 metres below the surface and is fairly isolated throughout the plan area. As such, the groundwater will, for the most part, have a negligible impact on future developments. The levels may fluctuate on a seasonal basis, and should be monitored prior to development in order to provide an early indication of dewatering requirements during excavations for underground utilities and foundations.

Recommendations for site preparation, grading, excavations, buildings, stormwater management and underground/surface utilities are provided in accordance with the findings.

^{1,2} Studies were undertaken using the plan boundary as originally identified, but later expanded. Site characteristics suggest that the results of the study would apply to the overall plan area, however confirmation of site suitability will be required prior to development.

2.7 ENVIRONMENTAL ASSESSMENT

As part of the overall review process, a Phase I Environmental Site Assessment (ESA) was undertaken by WSP in July 2018³. The purpose of a Phase I ESA is to identify actual and/or potential negative environmental conditions on and within 300m of the property and whether any additional investigation is required.

All Areas of Potential Environmental Concern (APEC) noted within the ESA, were outside of the plan area, but within the 300m buffer as included within the ESA. These APECs are not considered to have an impact on the Plan. The assessment does not recommend any further action related to the three offsite APECs given that the associated risks are considered to be low. Consideration should be paid to the recommendations within the ESA to ensure that proper care is taken when disturbing any of the above noted APECs.

2.8 BIOPHYSICAL SIGNIFICANCE

A Biophysical Assessment was prepared by WSP in July 2018⁴. The assessment provided a summary of biophysical information related to the Starline Business Park ASP area, identified environmental opportunities and constraints, and provided recommendations for environmental protection measures to be performed as part of site development.

There are no mapped wetlands or watercourses identified within the plan area as per the Alberta Merged Wetland Inventory or the Fish and Wildlife Information Database respectively. No prohibited noxious weeds were identified during the field survey; however, two species of noxious weeds were identified throughout the study area. The plan area is not within an environmentally significant area and no historical records of rare plant species or rare ecological communities were noted. One record of wildlife species was recorded within a 1 km radius of the plan area. The study area falls within sensitive amphibian, sensitive raptor and sharp-tailed grouse species zones; however, the plan area generally lacks the habitat required for these species (with the exception of the upland sandpiper and sharp-tailed grouse who may use hay lands).

The plan area is generally defined as having a low ecological value as it has been under cultivation since 1949 and does not contain any natural features. The BIA identified three ephemeral water bodies, however these water bodies are likely unsustainable in the long-term with development occurring on or in close proximity.

No additional studies are recommended for this area, however when development does occur, any activity that will affect any of the three ephemeral water bodies will be subject to regulatory approval under the *Alberta Water Act*. In addition, dependent on the time of year in which construction is occurring, pre-construction wildlife surveys may be required to determine if there are any active dens or nests identified and if so, appropriate mitigation measures set in place to remove or relocate.

^{3,4} *Studies were undertaken using the plan boundary as originally identified, but later expanded. Site characteristics suggest that the results of the study would apply to the overall plan area, however confirmation of site suitability will be required prior to development.*

2.9 ARCHAEOLOGICAL SIGNIFICANCE

A Historical Resources Overview was prepared by WSP in July 2018⁵. Although archaeological sites have been noted within 500m of the plan area, no sites have been recorded as existing within the ASP area boundary. The overall potential for encountering significant historic resources has been estimated as low within the project area. No further studies are recommended.

⁵ *Studies were undertaken using the plan boundary as originally identified, but later expanded. Site characteristics suggest that the results of the study would apply to the overall plan area, however confirmation of site suitability will be required prior to development.*

3 POLICY CONTEXT

3.1 GENERAL POLICY CONTEXT

The Starline Business Park ASP has considered applicable legislation and has achieved consistency with the regulations outlined in applicable Municipal and Provincial policies, explored in greater detail in the sections following.

3.2 MUNICIPAL GOVERNMENT ACT

Area Structure Plans are regulated under Section 633 of the Municipal Government Act (MGA), which states that an Area Structure Plan must consider: proposed land uses and densities; general location of public utilities and transportation systems and staging of development as well as any other factors deemed necessary by Council.

An ASP is considered a statutory document, and must be consistent with all higher-order plans, including the Municipal Development Plan and Provincial land use policies.

3.3 CLARESHOLM MUNICIPAL DEVELOPMENT PLAN

Claresholm Municipal Development Plan (MDP) provides the long-range land use direction for lands within the jurisdiction of the Town of Claresholm Figure 4 - Claresholm Municipal Development Plan – Land Use Map. The MDP designates land within the plan area as Industrial/Commercial north of Highway 520, Commercial directly to the south of Highway 520, and Industrial for the remainder of the plan area to the south (MDP Figure 3 – Future Land Use).

As defined within the MDP, the purpose of industrial lands is “to diversify the current industrial base into areas related to manufacturing and agri-food services while continuing to facilitate development in the agricultural and gas and petroleum service industries” (p. 15); the purpose of commercial lands is to “support and encourage commercial development in the central business district as well as in the identified nodes along the main transportation corridors” (p.11).

The Starline Business Park ASP area will encompass a range of uses that align with the MDP intended industrial and commercial land uses, intended to facilitate economic growth within the regional market.

Specifically related to the MDP goals for the Town, Section 1.2.4 CANAMEX Trade Corridor states the following relevant policies in support of economic development within the Town:

- To realize the economic development opportunities of Highway 2 that will be generated through the implementation of the CANAMEX Trade Corridor.
- To plan for the physical, social and economic development potential that will result from the Town’s strategic location in relation to the CANAMEX Trade Corridor and the economic activity that is planned for southwestern Alberta.

3.3.1 MDP Land Use Objectives

The MDP includes direction for the development of specific land uses within the boundaries of the Town of Claresholm. Relevant objectives have been listed below and refer to industrial and commercial uses, recreation, parks and open space, transportation, municipal infrastructure, environmental stewardship and the Town’s overall growth strategy.

3.3.2 Commercial Development

- 4.3.1 To continue to promote and attract new business to locate in Claresholm to increase the economic well-being.
- 4.3.2 To encourage the viability and expansion of existing businesses in Claresholm.
- 4.3.3 To improve the connectivity and communication between different businesses to enhance economic viability.
- 4.3.4 To encourage local residents and the surrounding trade area to support local business and merchants.
- 4.3.5 To encourage economic development initiatives that attract business and industry to ensure young working families choose to reside in Claresholm.
- 4.3.6 To work with the local Chamber of Commerce and business community to plan for the “new economy” that will follow highway re-alignment.
- 4.3.9 To strengthen the existing role of Claresholm as a regional service centre within the region.

3.3.3 Industrial Development

- 5.3.1 To create additional employment opportunities within the community by attracting more industry into the area.
- 5.3.2 To encourage industry compatible with a clean, safe, and environmentally-conscious community.
- 5.3.3 To ensure that industrial developers pay all infrastructure costs associated with any new development.
- 5.3.4 To continue to land bank and to encourage the servicing of industrial lands for industrial purposes.
- 5.3.5 To minimize land use conflicts between industrial and other land use types.
- 5.3.6 To encourage the use of landscaping or berming to visually screen incompatible or unsightly industrial uses.
- 5.3.7 To encourage private industry to develop industrial subdivisions.

3.3.4 Recreation, Parks and Open Space

- 6.3.3 To encourage more open space, parks and pathway systems.
- 6.3.6 To work towards improving campgrounds, acknowledging their increased use and importance to the local economy.
- 6.3.7 To create memorable and unique public spaces to enhance community character and build neighborhood identity.

3.3.5 Transportation

7.3.1 To work cooperatively with Alberta Transportation to endorse a future Highway 2 alignment with access structures that will facilitate the economic and social sustainability of the Town of Claresholm.

7.3.3 To capitalize on the vast amount of vehicular traffic by providing goods and services to the motoring public.

7.3.8 To define a roadway hierarchy and access control policy based on small town levels of service in keeping with the current traffic patterns.

7.3.9 To identify corridor plan area and determine roadway functionality for each plan area.

3.3.6 Municipal Infrastructure Services

8.3.1 To ensure a safe and secure water supply to satisfy the needs of the people of the Town of Claresholm.

8.3.2 To strive to be a municipal leader in the area of water conservation and management.

8.3.3 To continue to improve water distribution infrastructure.

8.3.5 To work consistently to improve storm water drainage infrastructure.

8.3.7 To ensure that private developers pay for all costs associated with new developments.

8.3.8 To ensure the Town is the facilitator of sound infrastructure design.

3.3.7 Environmental Stewardship

10.3.1 To promote environmental sustainability principles in land use planning decisions and development/construction practices.

10.3.4 To continue the development of parks, pathways and trails to upgrade the overall public open space system.

10.3.5 To continue developing the municipal storm water system for integration into the Town's public open space system while protecting wetlands, water courses and natural areas.

10.3.8 To be proactive in identifying and describing hazard lands with development constraints such as contaminated soils.

3.3.8 Growth Strategy

11.3.1 To acknowledge the importance of regional and intermunicipal growth planning.

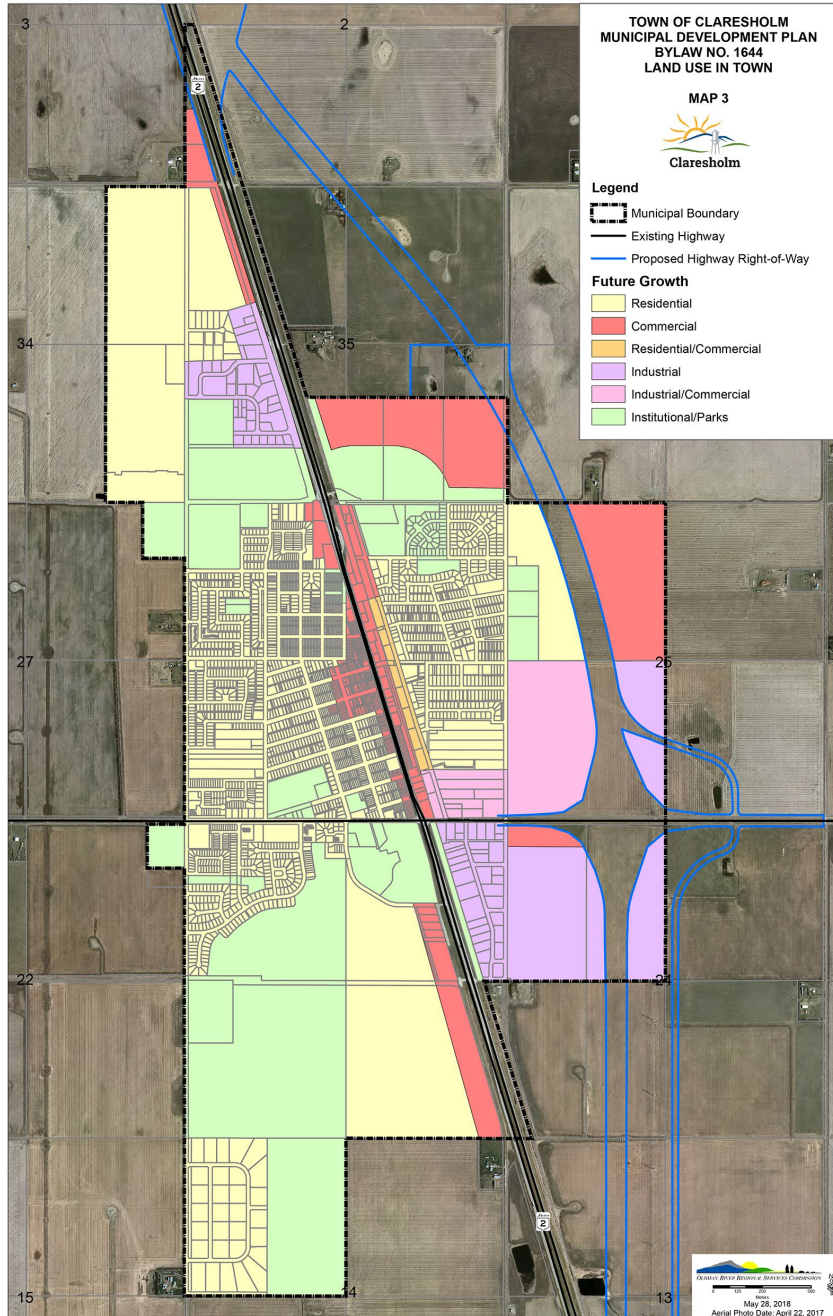
11.3.5 To encourage an agreement with the Province of Alberta to endorse a future alignment of Highway 2 in order to facilitate intermunicipal planning processes.

11.3.6 To further integrate intermunicipal planning with the Municipal District of Willow Creek and to ensure both municipalities are able to assure the other an efficient and compatible pattern of growth as defined by, and supported by Council.

3.3.9 Summary

The provisions which identify proposed land use within this area structure plan comply generally with the land use provisions identified within the Municipal Development Plan. It is encouraged that an amendment be undertaken by the Town to amend the MDP to identify the lands adjacent to Highway 520 as intended for highway commercial to assist in providing clarity and consistency between the two plans. However, if the MDP is not amended, this ASP will still be in general compliance with the MDP as is.

Figure 4 - Claresholm Municipal Development Plan – Land Use Map



3.4 CLARESHOLM LAND USE BYLAW NO. 1525

Lands located within the Starline Business Park ASP are currently districted AT - Agricultural/Transitional. The purpose of the AT–Agricultural/Transitional District is “intended to ensure lots typically on the periphery of existing developments are allowed limited uses and maintain parcels of larger sizes to give maximum flexibility for use and development when the land is required for urban development.” (Schedule 1-27).

Prior to development, and in accordance with the direction in this ASP, the land within the plan area shall be redistricted to an appropriate land use district. Based on the direction contemplated in this Area Structure Plan, the land uses planned for within Section 4 Development Concept, will include industrial and commercial land uses.

4 DEVELOPMENT CONCEPT

The Starline Business Park ASP provides a design concept and framework for future development of the planning area. The development concept encompasses a variety of uses, including commercial and industrial land uses while addressing development constraints within the planning area. The policies set forth in this ASP will define the location and types of anticipated development and provide guidance for how the planning area will develop over time.

Given the large geographical size of this ASP, as well as the historical and projected modest local growth rate within the Town of Claresholm and the ongoing development in the region, it is anticipated that the ASP planning area will not be fully developed for several decades. However, the impending need for new development lands has driven the creation of a logical framework within which, planning for future growth can begin, and from which, decision-makers can be guided and informed.

The Starline Business Park ASP has been crafted to best suit the characteristics of the planning area and future demands for commercial, industrial development on the eastern side of the Town of Claresholm. The ASP is intended to facilitate responsible development that is compatible with surrounding land uses and provides a positive contribution to the Town by:

1. Providing guidance and direction for a logical and efficient pattern of development and land uses within the planning area;
2. Providing efficient, economical and staged servicing and transportation solutions to meet the needs of future developers, business owners and customers;
3. Respecting the natural environment and conditions of the site and responsibly adjusting to the opportunities and constraints that exist in the planning area; and
4. Providing for staging of development in an economical and efficient manner.

By doing so, the ASP will also serve to restrict non-compatible land uses from establishment within the plan area; a consequence that could result in unnecessary hardship and disruption for future planned growth.

The proposed Starline Business Park ASP Development Concept is illustrated in and detailed in Figure 6 - Development Conceptual Plan and land use statistics shown in Table 3 - Development Statistics. It incorporates the development principles and objectives for each applicable land use within the plan area. A concept visioning exercise has been included in Figure 5 - Plan Area Conceptual Vision, in which land uses and their general location have been explored.

4.1 LAND USE

The Starline Business Park ASP intends to capitalize on the locational advantage of the lands by providing opportunities for industrial, commercial and employment-driven land uses, while recognizing the future realignment of Highway 2, including a focus on;

- A mix of business and industrial lot sizes;
- High visibility business exposure;
- Excellent commercial access;
- Adequate transitions from existing non-industrial uses;
- Respect for existing downtown commercial business;
- Maintaining existing natural topography and drainage; and,
- Full urban servicing.

Distribution of Land Uses

The Starline Business Park ASP is planned as an industrial and commercial area, consisting of 69.50 hectares. A statistical summary of the proposed land uses is explored in Table 3 - Development Statistics.

Table 3 - Development Statistics

	Area (ha)	GDA (%)
Gross Area	69.53	
HWY 520 Widening	0.75	
5 Street E Widening	0.62	
Waterline Right-of-Way	1.00	
Gross Developable Area (GDA)	67.16	100.0
Municipal Reserve*	4.19	6.2
Stormwater Management Facilities	4.36	6.5
Circulation	5.26	7.8
Net Developable Area	53.35	79.4
Highway Commercial	5.75	8.6
Business/Industrial	20.50	30.5
Industrial	27.10	40.4
Total	53.35	79.4

* denotes that Municipal Reserve percentages are subject to confirmation at the time of subdivision

The Starline Business Park ASP area has been divided into three general use categories: Industrial, Business/Industrial and Commercial. Given that the plan area is intersected by Highway 520, Highway Commercial land uses are limited to the areas along the north and south edges of Highway 520. The remainder of the plan area will be a mix of industrial to the south and business industrial to the north. The land use concept is intended to allow for a range of lot sizes, with smaller lots towards the north, and larger lots in the south. Unenclosed non-accessory outside storage is to only be permitted within the industrial land use areas.

Aesthetics will be a major consideration associated with development in the Starline Business Park ASP area. Both Highway 520 and Highway 2 will provide a visual gateway for Claresholm, and Highway 520 will become a main entrance into town. Outdoor activities, including storage areas, are a necessity for business operations, but should not be created so as to detract from the overall aesthetic appearance of the area. Visual screening and buffering techniques shall be used to facilitate the screening, including: building placement, screen fencing, landscaping and site grading. Details of the specific aesthetic requirements will be established through the Land Use Bylaw to protect the integrity of the Town of Claresholm and Highway 2 (once realigned).

The Starline Business Park ASP has been developed to align with the following general development objectives and policies:

Objective 1: *To create a flexible development concept that could help to stimulate investment while continuing to respond to changing market conditions.*

Policy 4.1.1 All future subdivision, development and land uses within the Starline Business Park planning area shall occur in general accordance with the Development Concept and policies of this Area Structure Plan.

Policy 4.1.2 The land use designations and lot boundaries depicted in this Area Structure Plan are graphical representations only. The exact location, size and shape of individual lots within the Starline Business Park Area Structure Plan shall be determined at the subdivision stage, in general accordance with the policies and guidance established in this Area Structure Plan and having regard for, but not being bound by, the Figure 6 - Development Conceptual Plan.

Objective 2: *To provide investment security and land use predictability for land owners, business owners and potential developers.*

Policy 4.2.1 Development shall comply with applicable Town of Claresholm policies and regulations current at the time of development.

Policy 4.2.2 Where possible, development and subdivision should follow existing property lines to reduce conflicts during development and phasing.

Objective 3: *To sensitively integrate development with surrounding land uses and the natural environment.*

Policy 4.3.1 Where permanent bodies of water or wetlands are present, a determination as to the Crown's interest under the Province of Alberta Public Lands Act shall be required prior to subdivision.

Policy 4.3.2 Where damage or loss of a wetland is contemplated by future development, approval under the Water Act and an approved wetland compensation plan shall be obtained prior to subdivision approval.

- Policy 4.3.3 Development adjacent to pipelines or wellheads within or adjacent to the planning area shall conform to the setbacks required by the Alberta Energy Regulator and the Development Authority.
- Policy 4.3.4 Appropriate erosion and sediment control techniques shall be utilized during construction and development activities to minimize impacts on adjacent bodies of water.
- Policy 4.3.5 Development within areas designated for business/industrial uses shall not produce nuisance factors that extend beyond the limits of the building.

Objective 4: *To promote high quality development with appropriate site, building and landscaping standards.*

- Policy 4.4.1 All land uses and buildings in high visibility locations within the Starline Business Park Area Structure Plan shall maintain a high aesthetic appearance. Architectural Design Guidelines may be developed to identify and maintain the aesthetic quality and appearance standards.
- Policy 4.4.2 Outdoor storage yards shall be screened from the view of adjacent public roadways and non-industrial land uses. Screening may consist of landscaping, fencing, berms or other screening methods acceptable to the Development Authority.
- Policy 4.4.3 Heavy industrial land uses or activities shall not be permitted within the planning area. Heavy industrial activities include those capable of having detrimental effects on humans or the natural environment through the discharge of emissions or other nuisance factors that may extend beyond the boundaries of the development site.

Objective 5: *To recognize the importance of agriculture in the region and to support the continuing use of agricultural lands within the planning area until it is needed for development.*

- Policy 4.5.1 Cultivation of lands within the plan area for agricultural purposes will continue to be encouraged in the interim period until the land is required for the development as identified within the plan.

4.2 LAND USE CATEGORIES

The spatial organization of land uses within the planning area has been designed in accordance with the objectives of this ASP and the policies outlined below.

This ASP has been developed to accommodate anticipated future demand for industrial and commercial development, and is intended to facilitate responsible development that is compatible with surrounding land uses and contributes positively to the growth of the Town and the region.

The 70-hectare planning area is a large tract of land. Within the planning area boundary, there are three distinct and somewhat separate precincts that correspond to three unique and independent planning approaches: The Business/Industrial Precinct in the north portion of the plan; the Highway Commercial Precinct in the central portion; and the Medium Industrial Precinct in the southern area of the planning area. For clarity and ease of reference, ASP objectives and the corresponding policies have been categorized in accordance with these three precincts.

4.2.1 Business/Industrial (precinct 1)

Approximately 20.50 ha of land in the northern portion of the plan area has been dedicated to Business/Industrial use. This area is intended for industrial businesses that carry out their operations such that no nuisance is created or apparent outside an enclosed building. These uses are intended to be compatible with any adjacent non-industrial district, namely the residential land uses along 5 Street E. The Town of Claresholm will consider uses compatible with residential parcels when processing development permit applications. Appropriate screening will also be required to buffer between residential uses and business/industrial uses.

4.2.2 Highway Commercial (precinct 2)

Approximately 5.75 ha of land has been designated Highway Commercial. As a new visual gateway and entrance into the Town, Highway 520 will be highly visible to the travelling public. The intent of the Highway Commercial area is to provide vehicle oriented commercial uses that will benefit the travelling public.

4.2.3 Medium Industrial (precinct 3)

Approximately 27.10 ha of land in the southern portion of the Plan area has been dedicated to Light and Medium Industrial Uses. These Industrial uses have been situated as a logical extension of industrial land uses currently adjacent west of the Plan area. Industrial specific uses are spatially separated from existing residential uses by Highway 520. These uses are buffered from residential uses by highway commercial and Highway 520.

Examples of Medium Industrial Uses could include: manufacturing, processing, assembly, distribution, service and repair uses, and uses which carry out a portion of their operation outdoors or require outdoor storage areas.

Objective 6: *To provide opportunities for commercial and industrial development to serve the community's needs and diversify the Town and MD of Willow Creek's economic base.*

Policy 4.6.1 All highway commercial land uses will be focused adjacent to Highway 520 and will create a gateway into the town creating an identity and maintaining aesthetic quality and appearance standards.

Policy 4.6.2 Highway commercial land uses will be developed in conjunction with Figure 6 - Development Conceptual Plan which will incorporate a linear greenspace to provide pedestrian connections and where appropriate, street furniture and other implements which create a quality pedestrian realm.

Figure 5 - Plan Area Conceptual Vision

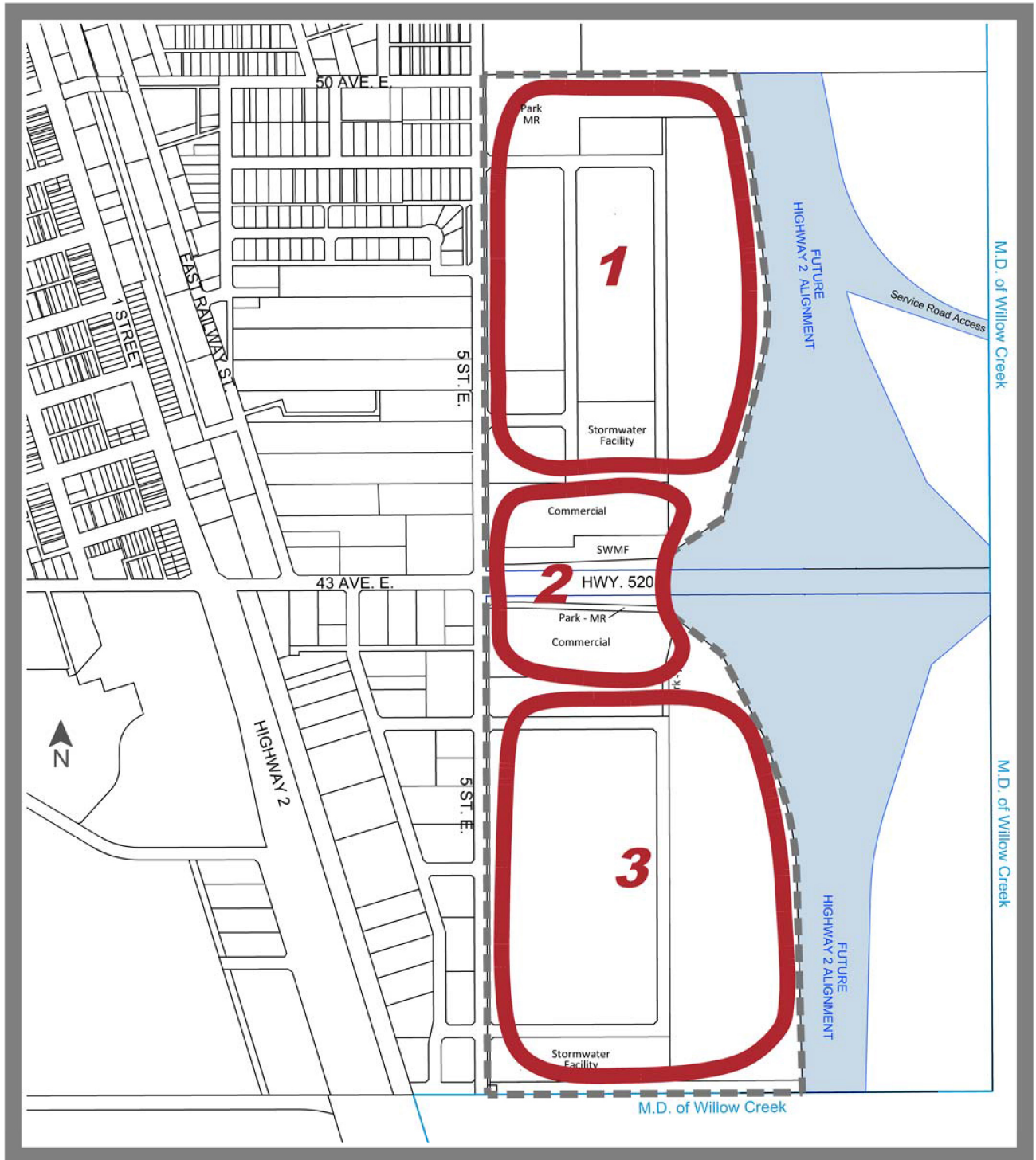
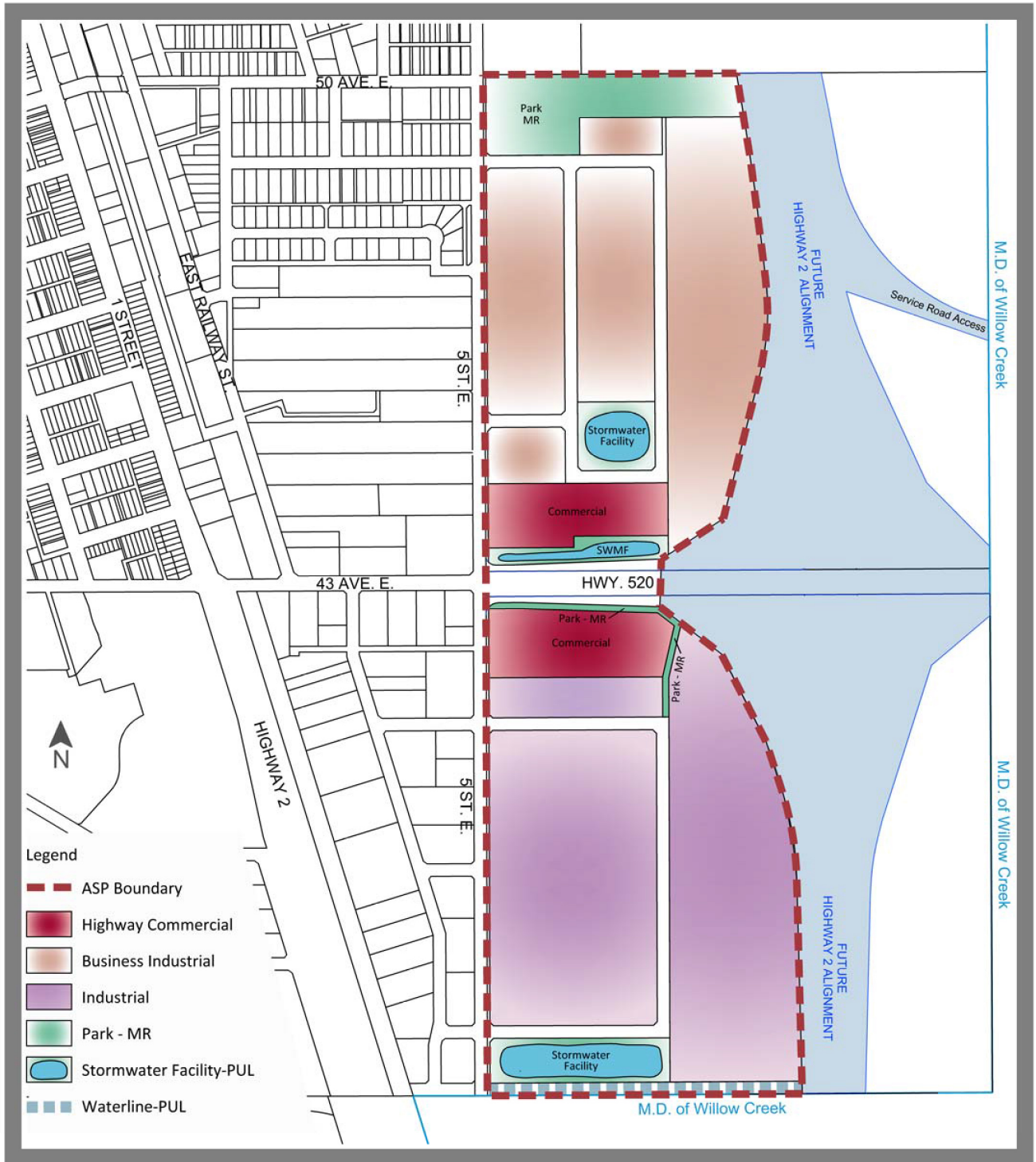


Figure 6 - Development Conceptual Plan



4.3 PARKS AND OPEN SPACE

Approximately 4.19 ha of land has been identified as Parks and Open Space areas, intended to provide an area of public land for active and passive recreational uses. Two small park spaces are provided within the plan area, located in the north industrial commercial precinct and a linear park adjacent to the southern portion of Highway 520. Parks & Open Spaces are intended to provide buffers from existing residential districts. Parks and Open spaces will provide pathway connections with trails constructed surrounding stormwater retention ponds, in attempt to provide contiguous pedestrian and cycle networks. Stormwater management facilities will include green areas but will be dedicated over and above the minimum requirement for municipal reserve.

Section 666(1) of the Municipal Government Act permits municipalities to require up to 10 percent of the developable area (or the cash equivalent) of a proposed subdivision to be dedicated as Municipal Reserve. Specifically, Section 666(1) states that a subdivision authority may require the owner of a parcel of land that is the subject of a proposed subdivision:

- to provide part of that parcel of land as municipal reserve, school reserve or municipal and school reserve;
- to provide money in place of municipal reserve, school reserve, or municipal and school reserve, or;
- to provide any combination of land or money referred to in clauses a) and b).

Parks and Open spaces are to be located generally in conformity with the Development Concept, and the total percentage will be dedicated through a combination of land and Cash in Lieu of land. The design and size of Municipal Reserve park space will be determined in detail at the subdivision stage. As per the results of the biophysical impact assessment, no areas within the plan area have been identified as containing environmentally significant lands for retention.

Objective 7: *To fulfill legislative requirements for Municipal Reserve and Environmental Reserve dedications and contribute to the acquisition and development of parks, open spaces and recreational facilities within the planning area.*

- Policy 4.7.1 A minimum of 10% of the gross developable area within the Starline Business Park ASP area, less Environmental Reserve areas, shall be dedicated a combination of as land for Municipal Reserve or cash-in-lieu of land in accordance with the provisions of the Municipal Government Act.
- Policy 4.7.2 The precise size, location and configuration of Municipal Reserves, parks and open spaces shall be determined at the time of subdivision, in general accordance with the Development Concept in Figure 6.
- Policy 4.7.3 Lands dedicated as municipal reserve shall be located generally in accordance with the areas delineated in Figure 6 - Development Concept.
- Policy 4.7.4 Pedestrian/cycle connectivity should recognize existing Parks and pathways (Patterson Park and the Claresholm Dog Park).
- Policy 4.7.5 Stormwater management facilities should incorporate walkways and landscaping to enhance these lands as open space or park areas.

5 TRANSPORTATION

5.1 CIRCULATION, ACCESS AND ROADWAYS

The Starline Business Park ASP is uniquely situated at the intersection of two significant Provincial Highways, Highway 520 and the future realignment of Highway 2. These two highways provide increased exposure to the plan area and have excellent vehicle capacity.

WSP undertook a Transportation Impact Assessment in October 2018 to review the plan area and required transportation upgrades required in conjunction with the development of the plan area. Alberta Transportation (AT) has confirmed that access off Highway 520 must respect a 150m setback from the Highway 2 interchange ramp terminal. As such, these constraints prohibit any form of access from Highway 520 into the plan area. Access to the plan area will be achieved through several intersections on 5 Street E which will be designed to accommodate anticipated traffic volumes, and support turning movements for trucks, commensurate with these land uses.

Both Highway 520 and 5 Street E will require Right-of-Way widenings to accommodate increased traffic volume. Highway 520 will be widened to reflect an arterial roadway profile. The design of required roadway widenings will be determined at the time of subdivision, and designed in accordance with the Town of Claresholm Servicing Standards. The internal road network will act to service proposed land uses and will allow for ease of circulation and property access.

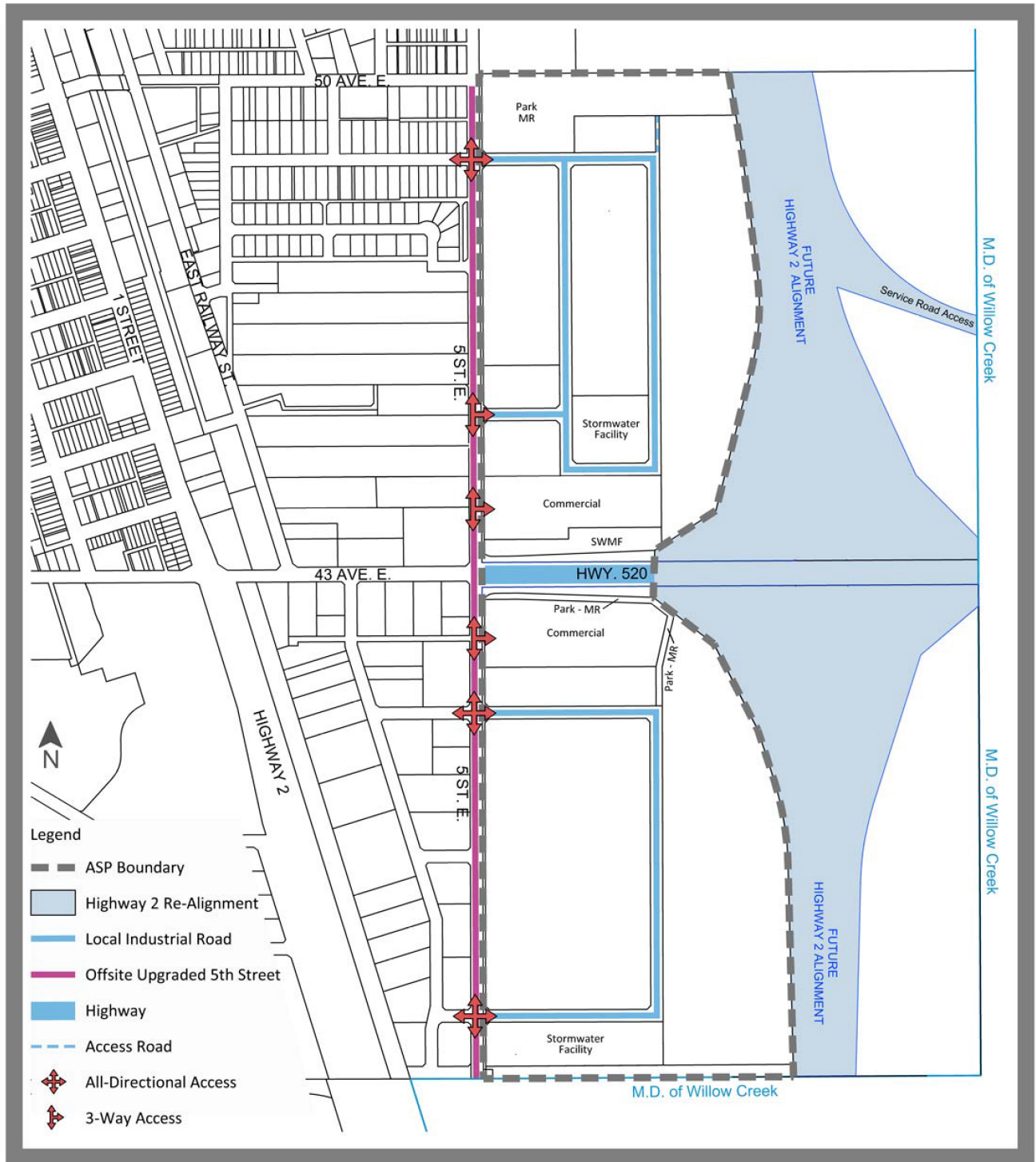
It is estimated that stage 1 of development will generate approximately 6,500 new vehicle trips per day. At full build out, this number will increase to approximately 22,000 new vehicle trips per day.

Both Highway 2 and Highway 520 intersections will require improvements due to current conditions, which will be further exacerbated through trips generated in association with the development of the plan area. Following these improvements as noted within the Traffic Impact Assessment, no further upgrades will be required at stage 1 of development. Full build out as estimated in 2040 will increase daily trips associated with the plan area, and will require a signalled intersection or a roundabout at the intersection of Highway 520 and 5 Street E. In addition, the increase in vehicular traffic will require an additional southbound lane on Highway 2 (in its existing alignment) or conversion to a roundabout.

Objective 8: *To efficiently and safely move people and goods to, from and within the planning area*

- Policy 5.8.1 Roadways within the Starline Business Park ASP will be developed in accordance with the designs identified in this plan, and with the Town's engineering standards.
- Policy 5.8.2 The Plan area shall be accessed by several access points distributed along 5 Street E, in accordance with Figure 7 – Transportation Network.
- Policy 5.8.3 Access to Highway 520 shall be prohibited.
- Policy 5.8.4 All-directional accesses may be contemplated off 5 Street E where an existing east/west collector road exists.
- Policy 5.8.5 The Highway 520 Right-of-Way and the 5 Street E Right-of-Way will be widened to accommodate increased traffic flow.

Figure 7 - Transportation Network



6 SERVICING

Servicing of the Starline Business Park ASP will consist of water, storm and sanitary infrastructure as well as utilities such as power, natural gas, phone and cable. Extensions or connections to regional water and wastewater trunks for servicing are planned. Connections would be made to existing sanitary and water services currently located West of the plan area. Garbage disposal services will be provided by the Town and will service the plan area. This section depicts the general servicing concepts for the Starline Business Park ASP. The details of these concepts will be further defined through subsequent reports and detailed engineering design in the future.

Stormwater management facilities are situated in areas where natural topographical lows exist to take advantage of natural drainage courses. Park spaces will provide connectivity to existing pathway networks.

Objective 9: *To provide efficient and economical services to meet the needs of future development.*

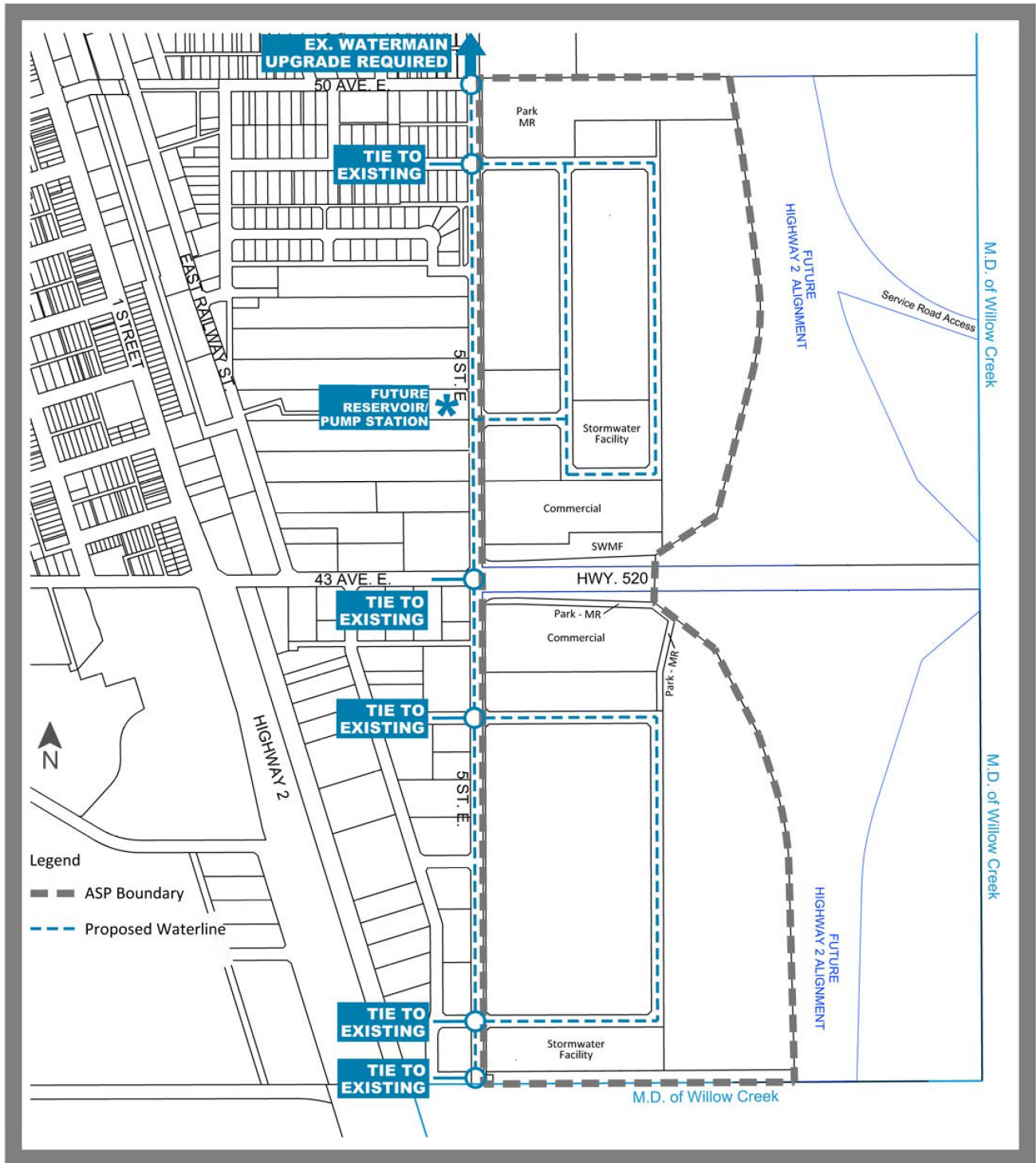
- Policy 6.9.1 All developments shall connect to the municipal water system in the Starline Business Park ASP.
- Policy 6.9.2 Water system infrastructure will be provided in accordance with the approved Water Distribution Servicing Plan to the satisfaction of the Subdivision Authority and to the Town of Claresholm standards.
- Policy 6.9.3 Sanitary sewer infrastructure will be provided in accordance with the approved Sanitary Servicing Plan to the satisfaction of the Subdivision Authority and to the Town of Claresholm standards.
- Policy 6.9.4 All developments within the Starline Business Park ASP area shall connect to the municipal sanitary sewer system available within and adjacent to the plan area.
- Policy 6.9.5 Waste removal services will be provided for within the plan area, and receptacles will be screened from view with the use of fencing, landscaping or other methods of screening deemed appropriate by the Development Officer.

6.1 WATER DISTRIBUTION SERVICING PLAN

Municipal water servicing will be achieved through 6 tie-ins which currently terminate at 5 Street E. A proposed waterline will run along 5 Street E and will act as the feeder for all water service within the plan area. Water distribution servicing for fire protection and potable use will be provided with an upgraded feeder main running along 5 Street E. This new 300 mm diameter feedermain will complete looping of the existing distribution network and will serve as a servicing connection point for the on-site watermain network. Existing water treatment, pumping and storage capacity win the Town have been reviewed and it has been confirmed that the existing systems have adequate capacity for at least 20 years of reasonable growth in consumption, including development of commercial and industrial land in the Starline ASP.

A future water reservoir and pumping station to replace the aging highway pump station and dome reservoir has been identified adjacent to the plan area. Figure 8 shows the water servicing plan.

Figure 8 - Water Servicing Plan



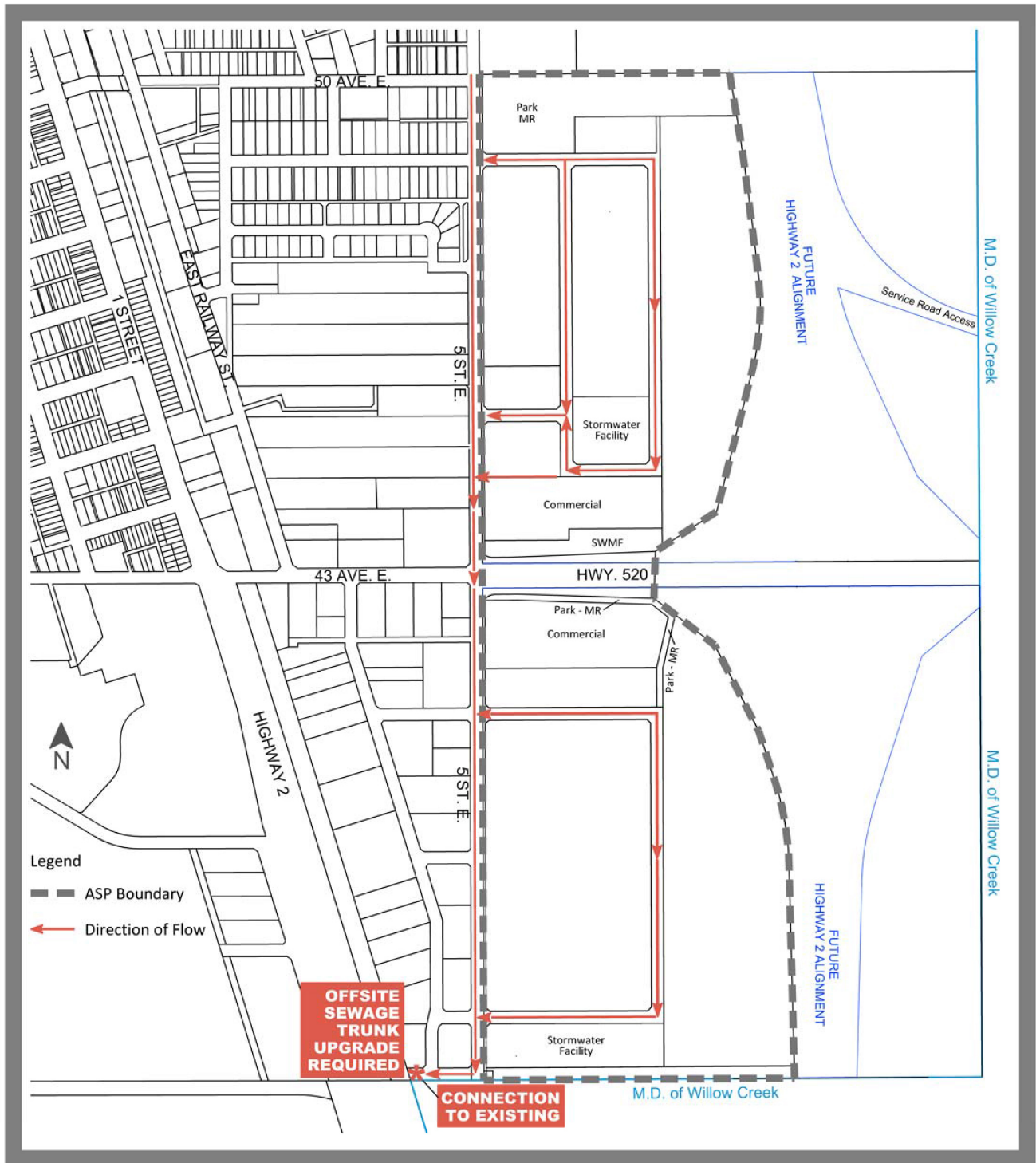
6.2 SANITARY SEWER SERVICING PLAN

Sanitary sewage collection will be provided with typical gravity sewer mains. A new trunk sewer along 5 Street E will provide the connection to the existing sewage collection system at the intersection of 39 Avenue and 3 Street E. This connection point is likely adequate for the initial stages of development, but an off-site upgrade will ultimately be required to accommodate the full extent of the ASP area. The precise timing of this upgrade and the currently available downstream capacity is to be reviewed in detail as development proceeds in the Starline ASP.

The available capacity in the sewage treatment and storage lagoons has been reviewed and it has been determined that there is adequate capacity in the treatment and storage facility to accommodate 20 years of reasonable growth within the town, including commercial and industrial growth in the Starline ASP lands.

Figure 9 provides the sanitary servicing plan for the Starline ASP lands.

Figure 9 - Sanitary Servicing Plan



6.3 STORMWATER SERVICING PLAN

Three stormwater management facilities have been proposed to manage stormwater runoff from the development lands. These facilities will provide attenuation storage to prevent downstream flooding as well as treatment to meet Alberta Environment Standards and Guidelines.

Wet Ponds – Stormwater Management Facilities `A` and `C` will be wet ponds and are planned to be built at the locations within the plan area, such that all stormwater runoff from the ASP will be routed through one of these two facilities

Dry Pond – Storm Water Management Facility `B` is planned to be a dry pond. This provides attenuation of stormwater runoff but minimal treatment. This facility is required so that major runoff can be managed prior to spilling over highway 520

A detailed stormwater management plan will be required as the ASP lands are developed. This will provide release rates for each parcel depending on the storage available in downstream stormwater management facilities.

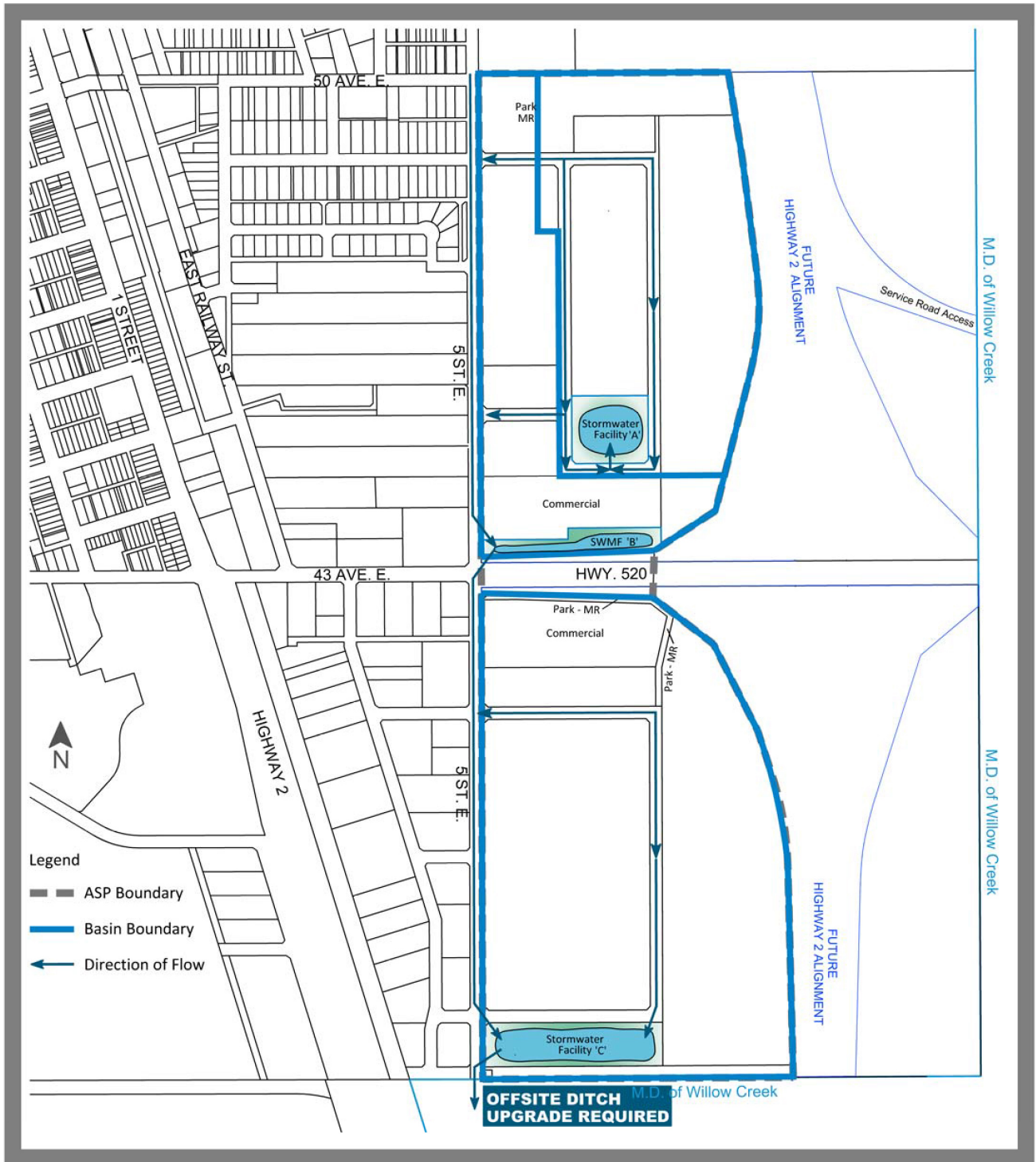
Figure 10 shows the stormwater servicing plan for the Starline ASP lands.

Objective 10: *To provide efficient and environmentally suitable storm water management facilities.*

Policy 6.10.1 Development parcels will be required to manage on-site grading and depression storage to ensure that stormwater drainage is discharged away from buildings and towards public road right-of-ways.

Policy 6.10.2 Stormwater from the development land is to be managed to meet Alberta Environment Standards and Guidelines. A detailed stormwater management analysis will be prepared to provide direction to site developers.

Figure 10 - Stormwater Servicing Plan



6.4 SHALLOW UTILITIES

Shallow utilities including natural gas, power, street lighting, phone and cable are available in the area adjacent to the site. Utilities will be extended by the respective franchise utility companies from their major trunk services. Utilities will be placed within road rights-of-way or within easements registered to lands within the plan area. Fibre optic technology should be utilized wherever possible and available.

Objective 11 To provide utility services to meet the needs of future development.

Policy 6.11.1 All shallow utility infrastructure required to provide service to development will be located underground, with an exception to power.

Policy 6.11.2 Notwithstanding policy 6.11.1 above, aerial power distribution facilities may be installed provided that road crossings are underground.

6.5 EMERGENCY RESPONSE SERVICES

Development within Starline Business Park ASP will be designed to accommodate emergency services. Ambulatory services for Starline Business Park ASP will be provided by Alberta Health Services. Policing within the Starline Business Park ASP will be managed by the RCMP from the detachment within the Town of Claresholm. Fire protection services within Starline Business Park ASP will be covered by the Town of Claresholm Fire Department.

7 IMPLEMENTATION

7.1 IMPLEMENTATION STRATEGY

The Starline Business Park ASP provides a policy framework for development. Once adopted, policies contained within the Plan will be binding and will direct the manner in which development occurs within the plan area. There are a number of studies, approvals and infrastructure improvements that will directly influence the ability of the Starline Business Park ASP to function as envisioned within this Plan, such as:

- Upgrades to major infrastructure on Highway 520 and 5 Street E;
- Servicing funding and payback methodology;
- Adjustments to the Highway 2 ROW; and,
- Favourable market conditions, and ability to capitalize on opportunities.

Minor adjustments to the future alignment of Highway 2 are expected to occur adjacent to the plan area during detailed design and construction phases. Major adjustments in which the proposed highway realignment shifts significantly, either east of the plan area or west into the plan area, will require an amendment to this document.

In addition, this Plan recognizes that development is subject to market conditions and has sought to provide flexibility to facilitate development under a range of conditions. This Plan should be understood to be a living document in so much as it can be adapted to accommodate for changes in areas such as sustainable technology, stormwater management techniques, etc. The Plan should be interpreted in a manner that considers the importance of these activities and allows for modification of the Plan through approval processes as required.

Objective 12 *To allow for an efficient, economical and logical phasing of development.*

Policy 7.12.1 Development will proceed from west to east on both sides of Highway 520, in general accordance with the Development Staging Plan (Figure 10 - Development Staging) in this ASP

Policy 7.12.2 Prior to developing the first subdivision, lands shall be redistricted to the appropriate land use districts in accordance with the Town's land use bylaw.

Policy 7.12.3 Development shall be generally in accordance with the land use concept in Figure 6 - Development Concept. Minor variations of land use boundaries and roadway alignments are expected and will not require amendments to the plan.

7.1.1 Land Use Districts

Lands within the Starline Business Park ASP boundaries are currently districted AT (Agricultural/Transitional) by The Town of Claresholm Land Use Bylaw No. 15-25 (2009). The purpose of the AG (Agricultural) district is to “ensure lots typically on the periphery of existing developments are allowed limited uses and maintain parcels of larger sizes to give maximum flexibility for use and development when the land is required for urban development.” (Schedule 1-27).

Lands designated for Highway Commercial, Business/Industrial, Industrial, Park and Public uses within this Plan will require rezoning to an appropriate land use district within the Town of Claresholm Land Use Bylaw.

7.1.2 Development Staging

Staging has been planned to optimize costs with development revenue in a reasonable and cost-effective manner, while utilizing existing infrastructure as much as possible prior to investment in major upgrades are triggered. Development is expected to commence adjacent to 5 Street E, west to east on both sides of Highway 520 to ensure that both stormwater management facilities are constructed prior to any other development. Build-out is expected to occur in three distinct stages; stage 1 will commence along 5 Street E on both sides of Highway 520. Stage 2 will include the remainder of the southern portion of the plan area abutting the Highway 2 ROW and will encompass the internal portion of the northern plan area and include the second stormwater facility. Stage 3 will build out in the NE corner of the northern portion of the plan area. Generally, the final stages of development within the plan area will commence adjacent to the future Highway 2 Alignment and Alberta Transportation right-of-way.

The development of the trunk infrastructure along 5th Street is required to service the ASP lands. Since this is a major up-front investment it is envisioned that this will be staged in a logical south to north direction as development proceeds. This is a fiscally prudent approach to balance the cost of major infrastructure with the benefit that it provides to the adjacent land. Should particular development stage proceed in advance of the adjacent infrastructure in 5th Street being available, it will be the developers responsibility to extend the necessary infrastructure.

Policy 7.12.5 Development within the plan area shall be undertaken in general accordance with the staging concept outlined in Figure 11 - Development Staging, however this figure provides a general pattern for development and minor deviation from what is proposed will be permitted where appropriate.

7.1.3 Cost Sharing

Off-site levies are anticipated to assist with the cost sharing of off-site infrastructure. As development proceeds, negotiations with the Town and developers will determine the levels of contribution.

7.1.4 Amendments to the Plan

Amendments to the Starline Business Park ASP Area Structure Plan may be initiated by person(s) with interest in the plan area. In this event, the proponent must follow all Town of Claresholm procedures for statutory plan amendment.

Figure 11 - Development Staging

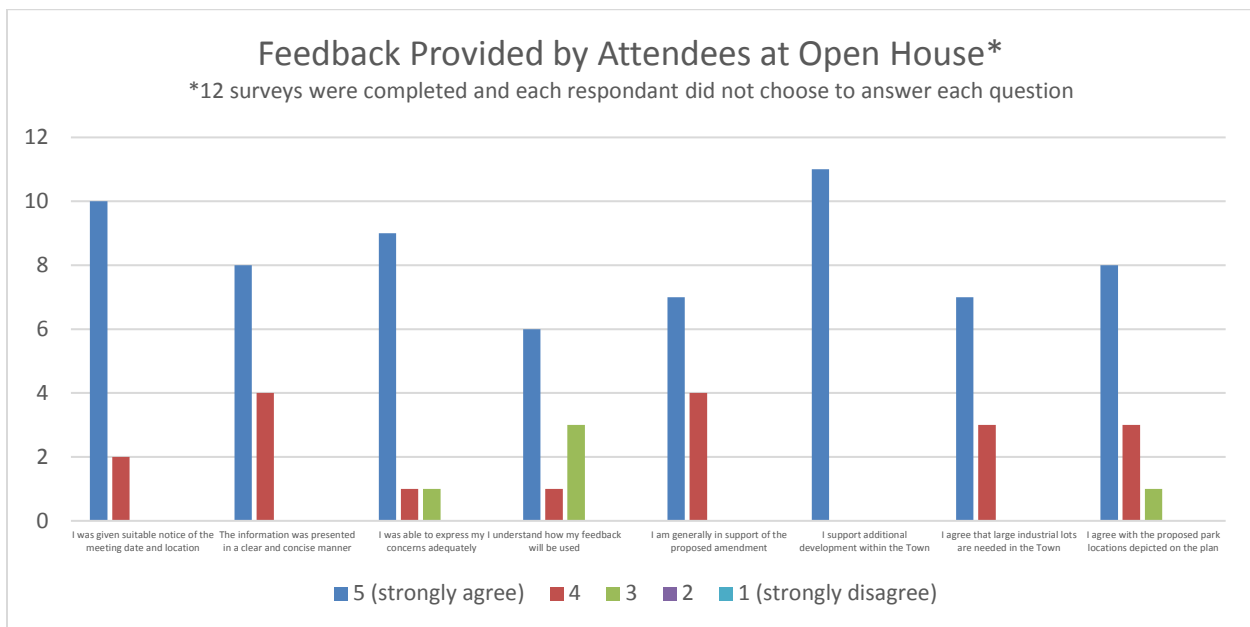


8 PUBLIC/STAKEHOLDER ENGAGEMENT

8.1 PUBLIC CONSULTATION AND STAKEHOLDER INFORMATION

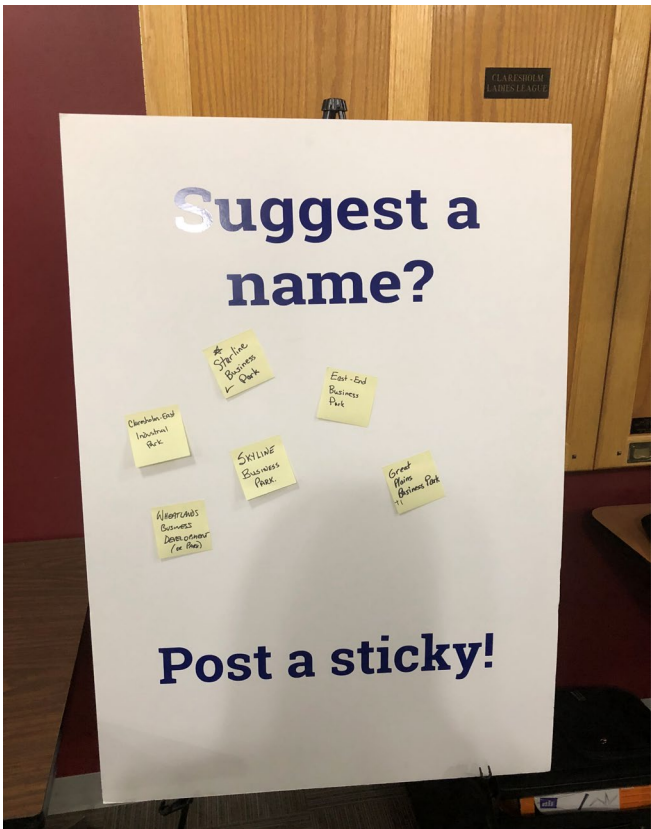
A public open house to review progress to date on the Starline Business Park Area Structure Plan (ASP) was held between 6PM and 8PM on Tuesday September 18, 2018 at the Bridges at Claresholm Golf Course. The Town of Claresholm has retained professional services consultant WSP Canada Group Ltd. to undertake the work associated with the preparation of this Area Structure Plan.

An open invite was advertised to all members of the public in the Claresholm Local Press. A total of 27 attendees were recorded as attending the open house, although more individuals attended (up to 35), the mayor and several members of Council. The feedback received related to the Starline Business Park ASP was mainly positive. 12 paper surveys were returned at the end of the evening and scored feedback has been summarized below. Generally, attendees agreed that the Town could benefit from more Industrial land opportunities to provide employment and stimulate the town's tax base.



The following comments were received as part of the survey:

1. It should provide area for potential growth to help the town to be viable into the future.
2. very excited that we are moving in this direction. We need more "ready" opportunities to bring jobs and commerce. Well done!
3. I think the needs of the community will be met with the proposed plan.
4. Is a traffic circle really the way to go on a major highway?
5. Are there any plans for more "downtown business"? Too many hoops to get business going.
6. We are relatively new to Claresholm so are happy to hear of this proposed plan. Sounds like a positive project for town development. Thank you for your good work for Claresholm.



APPENDIX A

TOWN OF CLARESHOLM

BIOPHYSICAL ASSESSMENT PLANNING FOR GROWTH

W1/2 24-12-17 W4M AND SW 25-12-17 W4M

JULY 13, 2018



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1 INTRODUCTION

The Town of Claresholm is planning for development of an Industrial / Commercial Park within portions of W1/2 24-12-17 W4M and SW 25-12-17 W4M (the Project). The planned developments will be located on what is currently rural property at the southeast edge of Claresholm, in the Municipal District of Willow Creek. The future development of these lands will allow for expansion of heavy industrial development and is also intended to support commercial development along Highway 520. Development is anticipated to commence in 2019.

The Town of Claresholm retained WSP Canada Inc. (WSP) to undertake a biophysical assessment for the Project Area. The Project Area includes approximately 48 ha of agricultural land. This property is bordered by 5th Street East and the existing Industrial Area to the west, and by agricultural fields to the north, east and south. Highway 520 bisects the north portion of the Project Area (Appendix A, Figure 1).

2 PROJECT SCOPE

The scope of the biophysical assessment for the Town of Claresholm Project is as follows:

- Map and classify wetlands, water features, and upland areas within the Project Area
- Complete a historical aerial photograph review to evaluate the permanence of identified wetlands
- Complete a desktop review of applicable federal and provincial databases to describe soils, topography, and hydrology and to identify any sensitive environmental features
- Complete a field survey to describe baseline conditions, including:
 - Wetlands, wet areas, and uplands
 - Incidental wildlife, rare plants, and rare ecological communities
- Recommend future studies, if required

3 STUDY AREA

The Study Area encompasses the Project Area and extends to include W1/2 24-12-27 W4M and the southern half of SW 25-12-27 W4M (Appendix A, Figure 1).

4 METHODOLOGY

The following sections describe the methods used during the desktop review and the field survey conducted for the Project.

4.1 CURRENT AND HISTORICAL LAND USE

Selected aerial photographs between 1949 and 2015 were reviewed. All aerial photographs, except one, were obtained from Alberta Environment and Parks (AEP) Air Photo Distribution Office. The aerial photographs reviewed are provided in Appendix B.

4.2 TERRAIN AND SOILS

The Agricultural Regions of Alberta Soil Inventory Database (AGRASID) (Alberta Agriculture and Forestry, 2018a) was reviewed for soils information pertaining to the Study Area.

4.3 WETLANDS, WET AREAS, AND UPLANDS

The objectives of this section are to describe existing wetlands, wet areas, and upland community types. A desktop review and a field survey were completed.

4.3.1 DATABASE REVIEW

The following reports and relevant databases were reviewed for wetland, water features, and upland information pertaining to the Study Area:

- Alberta Conservation Information Management System (ACIMS) within township 12 range 27 W4M dataset (AEP, 2018a)
 - Fisheries and Wildlife Management Information System (FWMIS) database (AEP, 2018b)
 - Alberta *Merged Wetland Inventory* (Government of Alberta, 2016)
 - Landscape Analysis Tool (LAT) report (Government of Alberta, 2018)
 - Environmentally Significant Areas of Alberta (ESA; Government of Alberta, 2014)
-

4.3.2 MAPPING AND CLASSIFICATION

Preliminary mapping of the Study Area was initially completed through the interpretation of historic aerial photographs and the Alberta *Merged Wetland Inventory* (Government of Alberta, 2016).

To help guide aerial photo selection, precipitation data for Township 012 Range 27 W4M (Alberta Agriculture and Forestry, 2018b) was reviewed and plotted to gain an understanding of inter-year precipitation variability that may influence wetlands (Diagram 4-1).

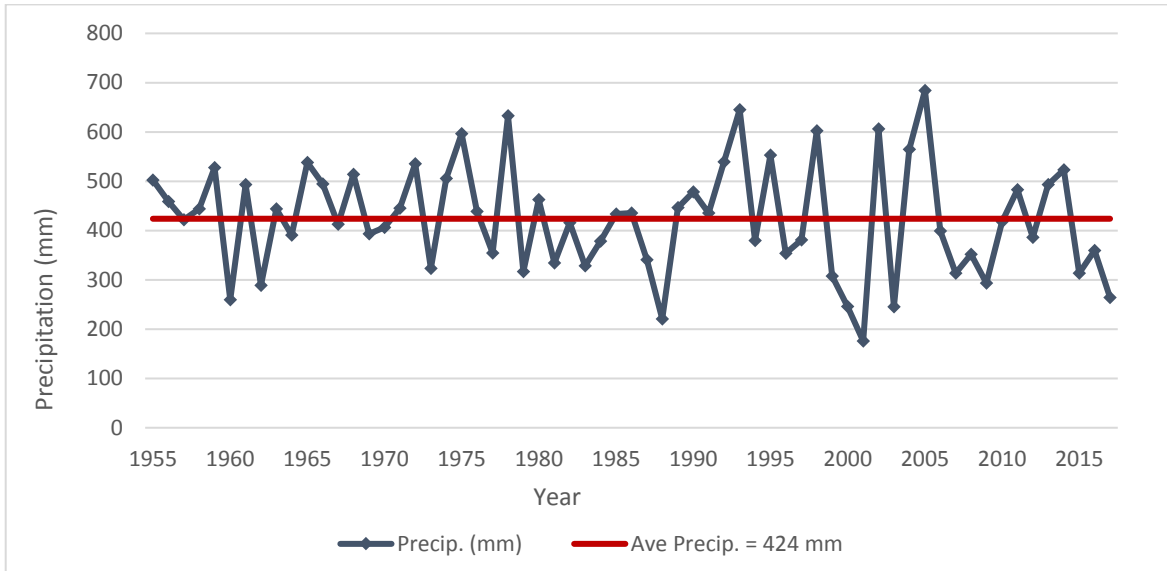


Diagram 4-1 Precipitation variability for T012R27W4M

Based on the inter-year precipitation and available imagery, eight years of historical photographs depicting wet, dry, and near normal conditions were selected for review. A summary of the aerial imagery used and associated precipitation conditions are presented in Table 4-1. The historical imagery reviewed for the Project are presented in Appendix B.

Table 4-1 Historical Aerial Photograph Details

DATE FLOWN ¹ ROLL AS PHOTO	IMAGE SOURCE	SCALE	SEASON ²	PRECIPITATION YEAR
Date: 3/07/1949 Roll: AS178 Photo: 151	Aerial BW scan AEP	1:40,000	Summer	NA
Date: 21/08/1961 Roll: AS810 Photo: 15	Aerial BW scan AEP	1:31,680	Summer	Slightly wet
Date: 28/07/1966 Roll: AS842 Photo: 205	Aerial BW scan AEP	1:31,680	Summer	Wet
Date: 15/04/1974 Roll: AS1447 Photo: 145	Aerial BW scan AEP	1:24,000	Spring	Wet
Date: 11/05/1982 Roll: AS2829 Photo: 20 and 30	Aerial BW scan AEP	1:8,000	Spring	Slightly drier
Date: 25/07/1992 Roll: AS4297 Photo: 95	Aerial BW scan AEP	1:30,000	Summer	Wet
Date: 21/07/1997 Roll: AS4837 Photo: 226	Aerial BW scan AEP	1:20,000	Summer	Dry
Date: 2015 Roll AS: NA Photo: NA	ESRI Imagery Service	NA	NA	Dry

Notes:

¹ Date is recorded as DD/MM/YYYY

² The aerial photograph review focused on wet conditions and the growing season. Early season (spring and early summer) and late season (late summer or fall) timing of images was preferred when available, to provide greatest chance to observe wetland conditions relating to annual inundation, permanence and maximal wetland extent in flood conditions.

'NA' – Not available or not applicable

During the historical aerial photograph review, potential wetlands/wet areas within the Study Area were differentiated from uplands based on the presence of hydrological influences (areas of standing water, bare ground, patchy vegetation, etc.) and information from the Alberta *Merged Wetland Inventory* (Government of Alberta, 2016). Wetlands were delineated following the Alberta *Wetland Identification and Delineation Directive* (Government of Alberta, 2015b).

The extents of potential wetlands, wet areas, and upland areas were mapped in an orthorectified geographic information system for field confirmation. All pre-field wetland boundaries were drawn and a wetland class assigned based on evidence of water permanence and changes to the observed vegetation (e.g. changes in image texture, colour etc.). The locations of potential wetlands and wet areas identified in the preliminary mapping were used to select field survey locations.

Preliminary mapping of wetlands, wet areas, and upland areas was refined following the field survey. Wetlands and wet areas were classified following AWCS and uplands were classified based on general vegetation type. Disturbances were classified based on land use.

4.3.3 FIELD SURVEY

Wetlands/wet areas identified in the preliminary mapping exercise were surveyed on June 29, 2018, following protocols detailed in the Alberta *Wetland Identification and Delineation Directive* (Government of Alberta, 2015b). Ephemeral water bodies within the Study Area, when observed, were documented, but not delineated.

Field data pertaining to soil (abundance of redox features [i.e., gleying and mottling]), vegetation, water chemistry (if present), and observations of surrounding landscape were recorded to confirm wetland extent. The overall wetland classification was confirmed by the vegetation zone representing the deepest and most permanent water and occupying greater than 5% of the total wetland area.

Other important site characteristics such as beaver activity, impoundments, dugouts, roads, ditching, misplaced or malfunctioning culverts, constructed wetlands/storm ponds/dugouts/channels, leaking irrigation infrastructure, or any other natural and unnatural features that may contribute to a given wetland being present or modifying the size, extent or duration of inundation were also recorded for consideration.

Any incidental rare vascular plant(s), rare ecological community observations, or weed species designated *noxious or prohibited noxious* under the *Weed Control Act* were noted. However, no targeted rare plant, rare ecological community, or weed surveys were completed.

4.4 WILDLIFE AND FISH

No wildlife specific surveys were completed, however, incidental observations during the field survey were recorded. The following databases were reviewed for wildlife and fisheries information pertaining to the Study Area:

- The Fisheries and Wildlife Management Information System [FWMIS] database was reviewed to identify historical records of wildlife within 1 km of the Study Area.
- A LAT report (Government of Alberta, 2018a) was generated to review any additional wildlife concerns that may be present within 1 km of the Study Area.

5 RESULTS

The following sections describe the results from the desktop review and the field survey for the Project.

5.1 CURRENT AND HISTORICAL LAND USE

Table 5-1 summarizes the review of select aerial photography for the area. Copies of the aerial photographs are provided in Appendix B.

Table 5-1 Aerial Photograph Summary

DATE	DESCRIPTION
1949	The Study Area is predominantly used for agricultural purposes and a farmyard is present within the SW 24-12-17 W4M. A road (Highway 520), oriented east to west, bisects the northern 1/3 of the Study Area and a range road (5 th Street E) is present along the western boundary of the Study Area. No wet areas are visible within the Study Area. The Town of Claresholm and Highway 2 are visible west of the Study Area.
1961	The Study Area appears similar to the previous photograph. However, a potential wet area appears south of the intersection of Highway 520 and 5 th Street E.
1966	The Study Area appears similar to the previous photograph. There are three potential wet areas visible in this photograph and all appear to have been cultivated.
1974	The Study Area appears similar to the previous photograph, except it appears to be more wet than the previous photograph. The potential wet areas appear larger than the previous photograph and an additional potential wet area also is visible. Additional development on the western boundary of the Study Area has occurred since 1966.
1982	The Study Area appears to be drier than the previous photograph. Two portions, one north and one south of the road (presently Highway 520) appears to have changed land use from cropland to hay land. Additional development on the western boundary of the Study Area has occurred since 1974.
1992	The Study Area appears similar to the previous photograph, except it appears there are no hay land portions within the Study Area. Four potential wet areas are visible and all appear to have been cultivated.
1997	The Study Area appears similar to the previous photograph, except a lease site within the southern extent has been developed. Three potential wet areas are visible in the Study Area.
2015	The Study Area appears similar to the previous photograph, except two portions, one north and one south of Highway 520 appears to have changed land use from cropland to hay land. Three potential wet areas are visible. The farmyard has been changed to a tanker storage yard area. A power transmission line, oriented north to south, is visible on the east boundary of the Study Area.

5.2 TERRAIN AND SOILS

The northern extent of the Study Area contains Orthic Dark Brown Chernozem on medium textured materials over medium or fine-textured till (Alberta Agriculture and Forestry, 2018a). The southern extent of the Study Area contains Orthic Dark Brown Chernozem on medium textured sediments deposited by wind and water and medium textured materials over medium or fine-textured till (Alberta Agriculture and Forestry, 2018a). The Study Area is described as an undulating, high relief landform with a limiting slope of 4% within the northern extent and low relief landform with a limiting slope of 2% within the remaining extent of the Study Area (Alberta Agriculture and Forestry, 2018a).

5.3 WETLANDS, WET AREAS, AND UPLANDS

The following subsections detail the findings for the desktop review and the results of the field survey to assess wetlands, wet areas, and uplands.

5.3.1 DATABASE REVIEW

No mapped wetlands were identified in the Study Area during the review of the Alberta *Merged Wetland Inventory* (Government of Alberta, 2016). No mapped watercourses were identified within the Project Area during the search of FWIMS database (AEP, 2018b).

ACIMS is a database of historical records of vascular and non-vascular plant species occurrences and rare ecological communities. A search of the ACIMS database on June 21, 2018, did not return any historical records of rare plant species or rare ecological communities within a 1 km radius of the Study Area (AEP, 2018a). The Study Area is not within an Environmentally Significant Area (Government of Alberta, 2014). The LAT report did not indicate the Study Area is within any special land use zones with respect to wetlands, wet areas or uplands.

5.3.2 MAPPING AND CLASSIFICATION

The aerial imagery review identified five potential wet areas within the Study Area. The Study Area, approximately 166 ha in size, is predominantly cultivated land (152.1 ha), with two small areas of hay land (9.6 ha). Highway 520 (1.0 ha) bisects the northern portion of the Study Area and 5th Street E (1.0 ha) is present on the western boundary of the Study Area. One tanker storage yard (1.8 ha) and a lease site (0.2 ha) and access road (0.4 ha) is located within the southern extent of the Study Area. A power transmission line, oriented north to south, is located along the eastern boundary of the Study Area.

5.3.3 FIELD SURVEY

A field survey was conducted on June 29, 2018. Based on observations, none of the potential wetlands or wet areas identified during preliminary mapping were wetlands according to the Alberta Wetland Classification System (AWCS; Government of Alberta, 2015a). Three ephemeral water bodies (EB) were observed within the Study Area during the field survey (Appendix A, Figure A-1). An ephemeral water body is an upland area that can be saturated or hold water for a short period of time, and typically contains a mixture of upland and water-tolerant plant species (Government of Alberta, 2015c). Crops are usually present if the area has been cultivated, although these might not be as robust as those on higher ground (Government of Alberta, 2015c).

Ephemeral water body EB1 (Appendix C, Photograph 1) and ephemeral water body EB2 (Appendix C, Photograph 2) are located within cropland and hay land. The vegetation within EB1 is dominated by planted crop species and alfalfa (*Medicago sativa*) with trace amounts of Russian thistle (*Salsola kali*). No hydric soil indicators were present. The vegetation within EB2 is dominated by crop species, alfalfa (*Medicago sativa*), wheatgrass species (*Agropyron* species) with trace amounts of foxtail barley (*Hordeum jubatum*), lamb's quarters (*Chenopodium album*), and wild mustard (*Sinapis arvensis*). No hydric soil indicators were present.

Ephemeral water body EB3 (Appendix C, Photograph 3) is located within hay land. The vegetation in EB3 is dominated by common dandelion (*Taraxacum officinale*), smooth brome (*Bromus inermis*), alfalfa, and perennial sow-thistle (*Sonchus arvensis*). Trace amounts of festuca species (*Fescue* species), foxtail barley, wheatgrass species, Canada thistle (*Cirsium arvense*), Kentucky bluegrass (*Poa pratensis*), and common goatsbeard (*Tragopogon dubius*) are present. No hydric soil indicators were present.

In addition, one disturbed location (Appendix C, Photograph 4), between the field, the tanker storage yard and the access road to the lease site, was holding water at the time of survey. This area was rutted from large farming equipment driving through the area while wet. Soil compaction may be present within this area. Russian thistle, lamb's quarters, foxtail barley, and slender wheatgrass (*Elymus trachycaulus*) were the dominant vegetation species at this location.

No rare plants or rare ecological communities were observed during the field survey. However, two species of *noxious* weeds, Canada thistle and perennial sow thistle, were observed throughout the Study Area. Under the Alberta *Weed Control Act*, landowners must control *noxious* weeds and remove *prohibited noxious* weeds. No *prohibited noxious* weeds were observed during the field survey.

5.4 WILDLIFE AND FISH

FWMIS is a database of historical records of wildlife and fish inventories that have been mapped in the province. A search of AEP's FWMIS database on June 28, 2018, returned one record of wildlife species within a 1 km radius of the Study Area. Table 5-2 lists the wildlife species and their status. No watercourses are present in the Study Area, and no fish records were identified within a 1 km radius of the Study Area.

Table 5-2 Wildlife Species Identified within a 1 km Radius of the Study Area

COMMON NAME	SCIENTIFIC NAME	STATUS ¹	HABITAT ¹
Grizzly bear	<i>Ursus arctos</i>	At Risk	Wet streambanks in mature spruce forest, gully bottoms, groundwater seepage areas, wet meadows and fens, disturbed sites (roadsides), toes of avalanche slopes, moist east- and north-facing slopes near treeline, regenerating burns and clearcuts

Source:

¹ AEP, 2018c

A LAT report was generated to determine any additional wildlife concerns that may be present within the Study Area. The LAT report noted that the Study Area and surrounding land reside within sensitive amphibian, sensitive raptor, sharp-tailed grouse survey area and other sensitive and endangered species zones (Government of Alberta, 2018). The additional sensitive and endangered species identified are: short-eared owl (*Asio flammeus*), mountain plover (*Charadrius montanus*), long-billed curlew (*Numenius americanus*), upland sandpiper (*Bartramia longicauda*), Sprague's pipit (*Anthus spragueii*), chestnut-collared longspur (*Calcarius ornatus*), loggerhead shrike (*Lanius ludovicianus*), and bank swallow (*Riparia riparia*).

No wildlife species of conservational concern were identified during the field survey. The following incidental wildlife were observed within the Study Area: red-tailed hawk (*Buteo jamaicensis*), red-winged blackbird (*Agelaius phoeniceus*), savannah sparrow (*Passerculus sandwichensis*), and white-tailed deer (*Odocoileus virginianus*). One small mammal burrow was observed along the quarter section line (Appendix C, Photograph 5).

The Study Area is primarily agricultural and developed land and contains marginal wildlife habitat that may be used for seasonal opportunistic forage or a means to traverse to other natural features outside of the Study Area. In addition, with the exception of the upland sandpiper and sharp-tailed grouse which may use hay lands, habitat required for the species listed above is limited within the Study Area.

6 CONCLUSIONS AND RECOMMENDATIONS

WSP was retained by the Town of Claresholm to conduct a biophysical assessment which provides baseline biophysical conditions of the Study Area in preparation for the planned development within portions of NW-24-12-17 W4M and SW-25-12-17 W4M. In support of the biophysical assessment a desktop review and field program were conducted.

Three ephemeral water bodies (EB1, EB2, and EB3), one lease site and access road, a tanker storage yard, Highway 520, 5th Street E, a power transmission line, two small areas of hay land, and cultivated land are present within the Study Area. No wetlands or watercourses were observed within the Study Area. No *prohibited noxious* weeds were observed during the field survey. However, two species of noxious weeds, Canada thistle and perennial sow thistle, were observed throughout the Study Area.

The Study Area is not within an ESA and no historical records of rare plant species or rare ecological communities were identified. One record of wildlife species within a 1 km radius of the Study Area was identified in the FWMIS database. Additionally, the LAT report indicated that the Study Area and surrounding land reside within sensitive amphibian, sensitive raptor, sharp-tailed grouse survey area and other sensitive and endangered species zones. The Study Area provides limited habitat required for the species listed above, with the exception of the upland sandpiper and sharp-tailed grouse which may use hay lands.

The Project Area is considered to have a low ecological value as it does not contain any natural features and has been under cultivation since at least 1949. The three ephemeral water bodies are likely unsustainable with future development occurring in their vicinity.

Based on the results of the biophysical assessment, no additional studies are recommended. However, prior to undertaking any future development in the Project Area, the following will be required:

- Although replacement (e.g. payment of compensation fees) is not required, any activities that will impact ephemeral water bodies require regulatory approval under the Alberta *Water Act*.
- Depending on the timing of construction, preconstruction wildlife surveys may be required, and if any active dens or nests are identified, mitigation measures should be developed.

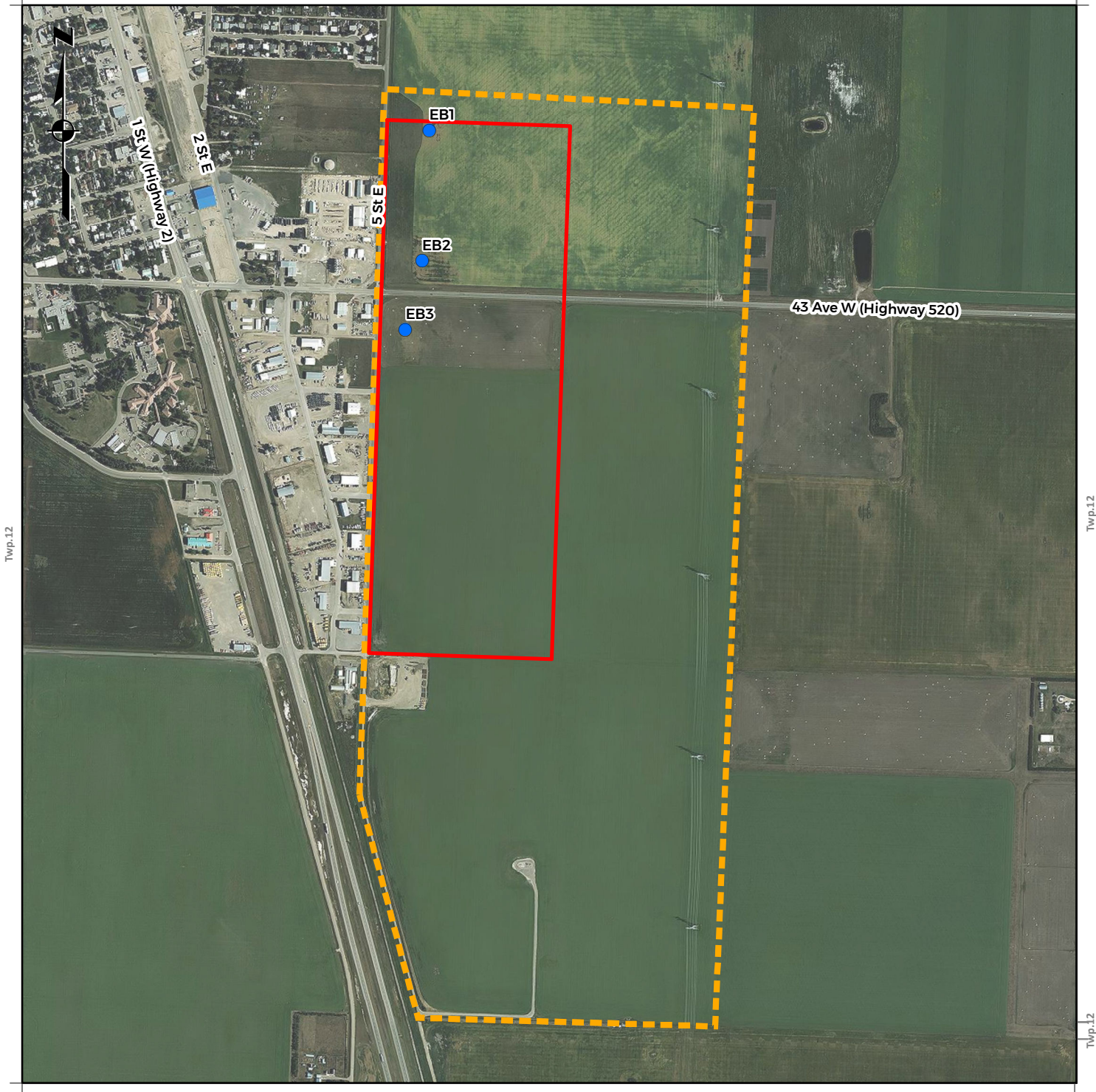
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APPENDIX

A FIGURES





Legend

Study Area

Project Area

Ephemeral Water Bodies



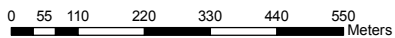
Site Diagram



Town of Claresholm

**04-25-012-27 W4M
12&13-24-012-27 W4M**

Scale: 1:12,500



Universal Transverse Mercator (Zone 12)
North American Datum (1983)

Report By: TG

WSP Job #: 181-07689-00

Figure Number

Drawn by: JH

Date Drawn: July 13, 2018

A-1

Reviewed By: JL

Inspection Date: N/A

Sheet 1 of 3

Report Name: Planning For Growth

Notes: Imagery Source: ESRI Imagery Service [2015]

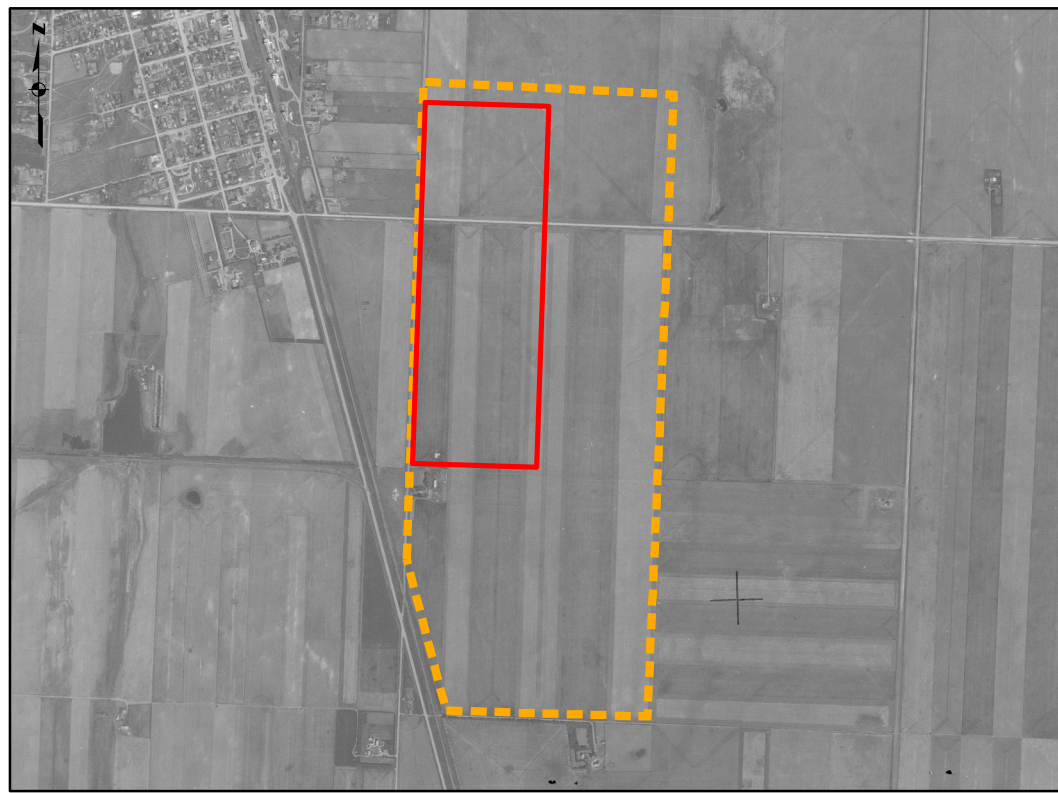
APPENDIX

B HISTORIC AERIAL PHOTOGRAPHS

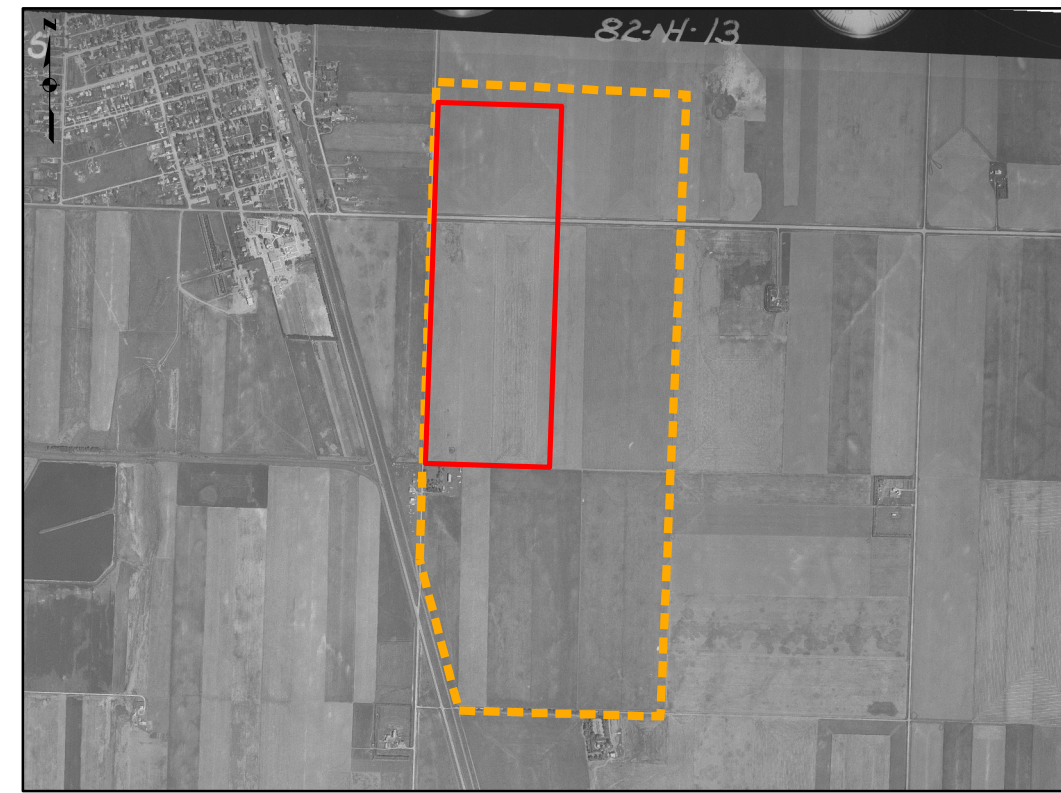


LIST OF FIGURES

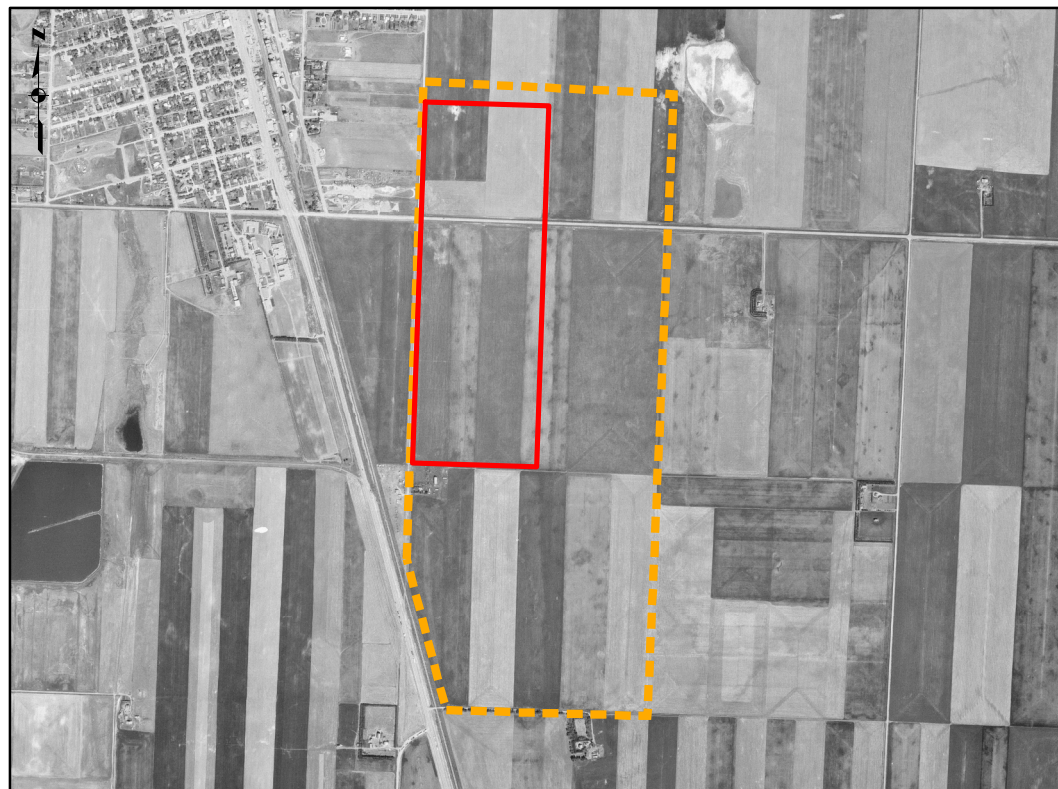
- FIGURE B1-4 HISTORICAL AERIAL PHOTOGRAPHS [1949, 1961, 1966, 1974]
- FIGURE B4-8 HISTORICAL AERIAL PHOTOGRAPH [1982, 1992, 1997, 2015]



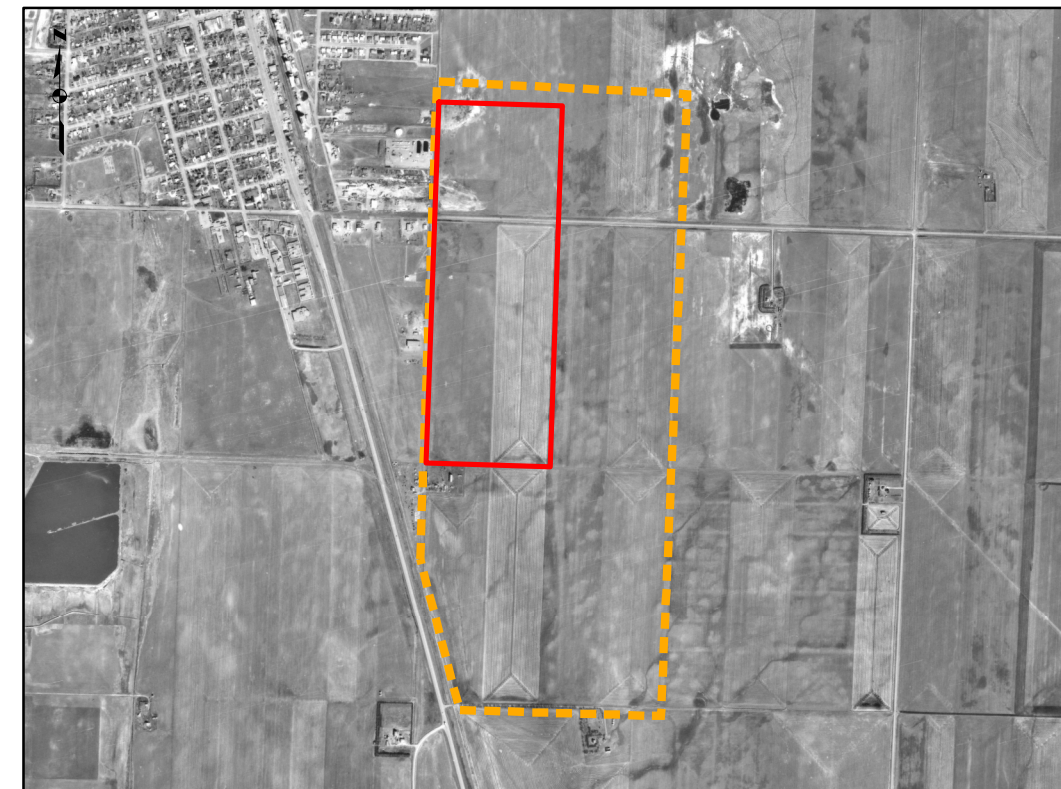
Aerial Photograph 1: July 3, 1949



Aerial Photograph 2: August 21, 1961



Aerial Photograph 3: July 28, 1966



Aerial Photograph 4: April 15, 1974

Draft

Image Source Table					
Images: Alberta Sustainable Resource Development					
Photo #	Source	Date	Line	Roll	Scale
1	AEP	July 3, 1949	N/A	AS178	1:40,000
2	AEP	August 21, 1961	N/A	AS810	1:31,680
3	AEP	July 28, 1966	N/A	AS842	1:31,680
4	AEP	April 15, 1974	N/A	AS1447	1:24,000

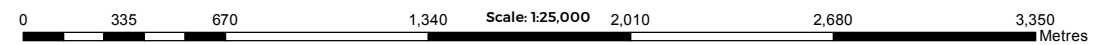


Historical Aerial Photographs

Town of Claresholm

04-25-012-27 W4M

12&13-24-012-27 W4M



Universal Transverse Mercator (Zone 12)
North American Datum (1983)



Figure Number

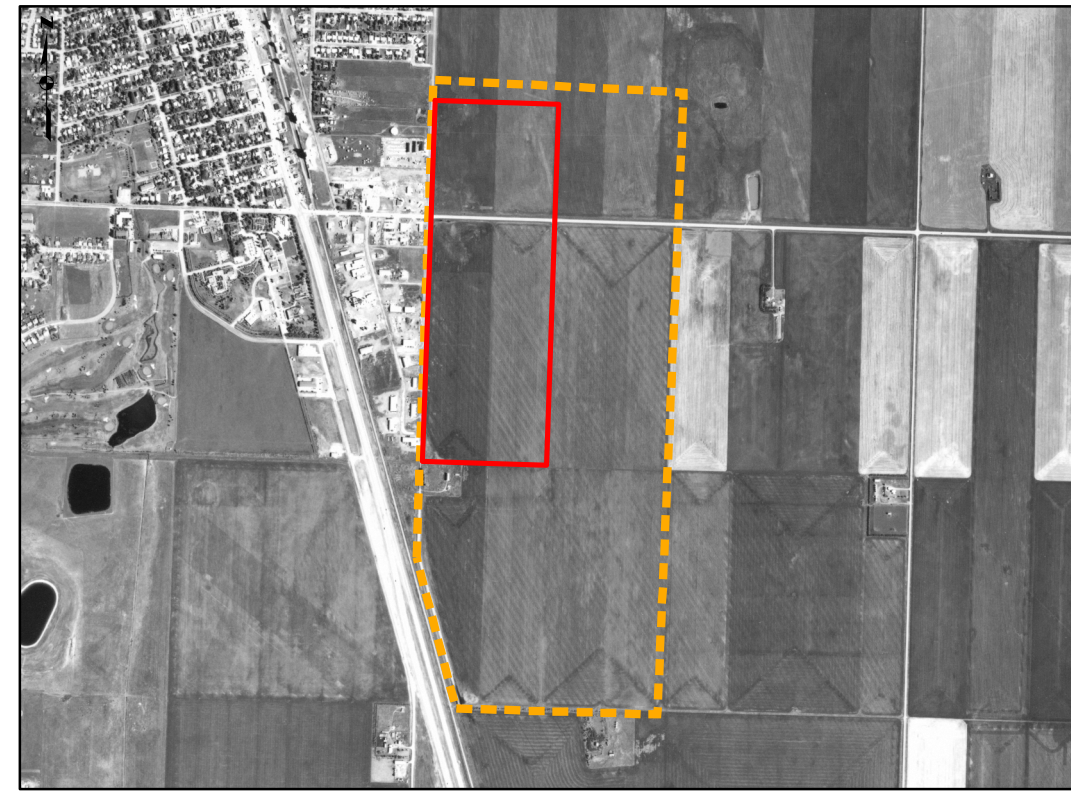
B1-4

Sheet 2 of 3

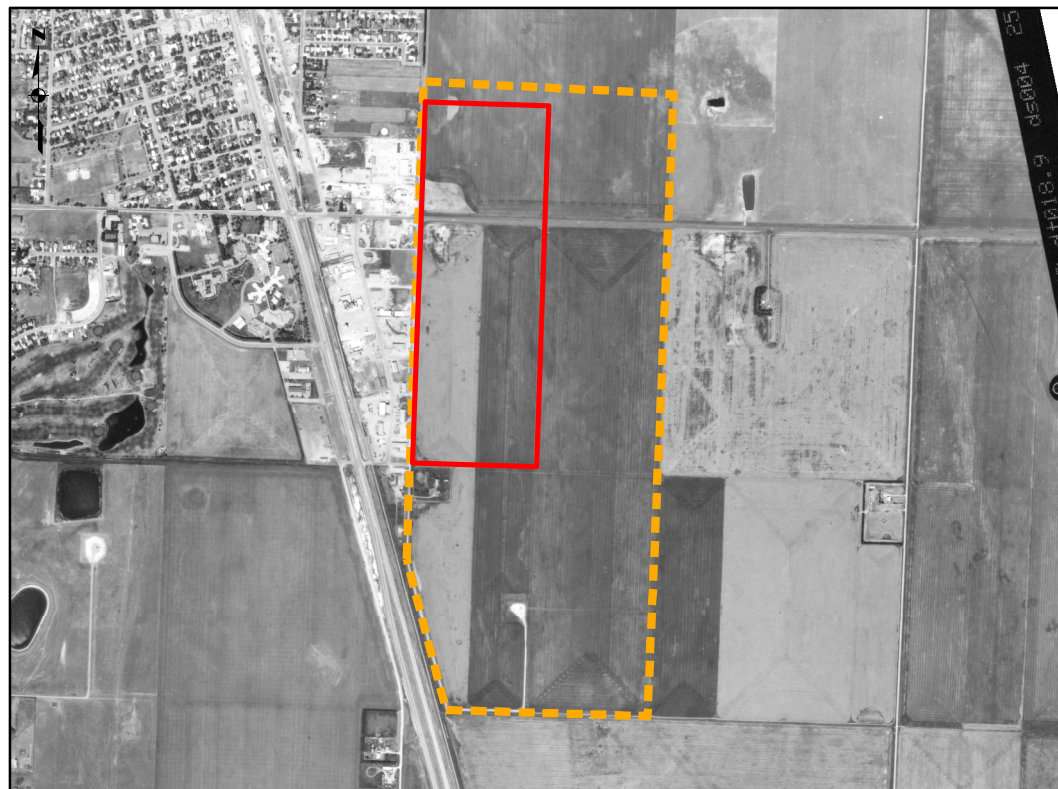
Report By: TG Drawn by: JH Reviewed By: JL WSP Job #: 181-07689-00 Date Drawn: July 13, 2018 Inspection Date: N/A Report Name: Planning For Growth



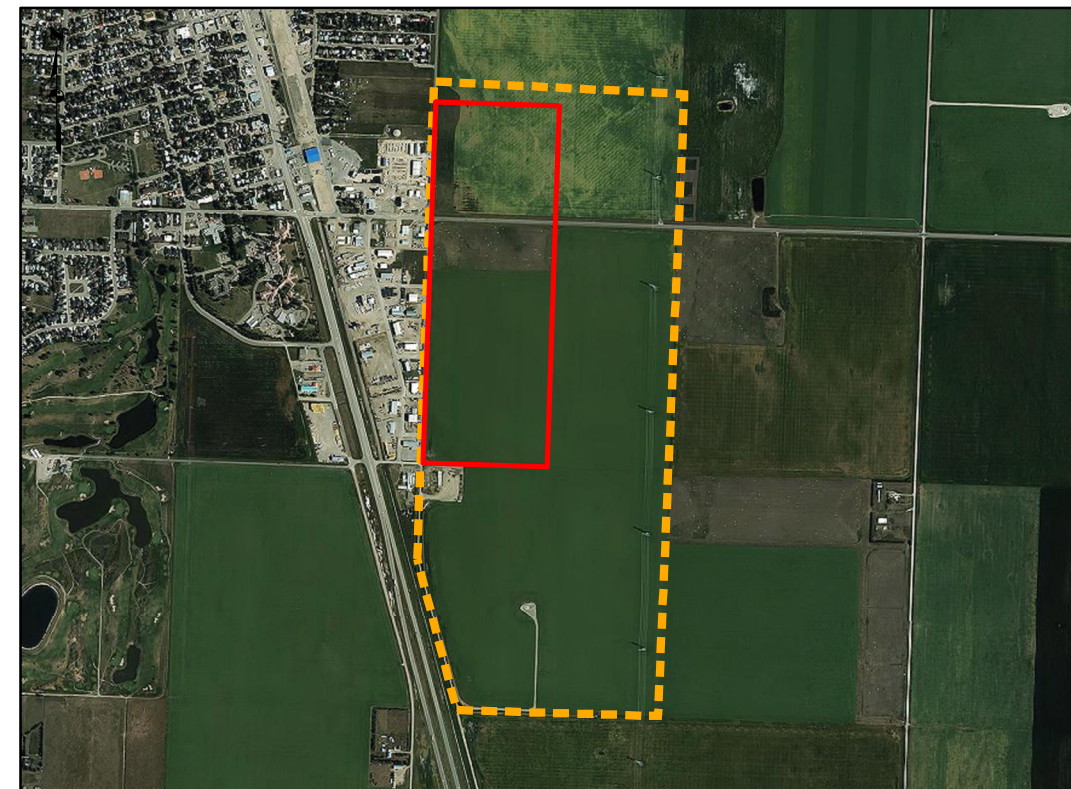
Aerial Photograph 5: May 11, 1982



Aerial Photograph 6: July 25, 1992



Aerial Photograph 7: July 21, 1997



Aerial Photograph 8: 2015

Draft

Image Source Table					
Images: Alberta Sustainable Resource Development					
Photo #	Source	Date	Line	Roll	Scale
5	AEP	May 11, 1982	N/A	AS2829	1:8,000
6	AEP	July 25, 1992	N/A	AS4297	1:30,000
7	AEP	July 21, 1997	N/A	AS4837	1:20,000
8	ESRI Imagery Service	2015	N/A	N/A	1:25,000

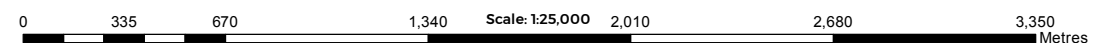


Historical Aerial Photographs

Town of Claresholm

04-25-012-27 W4M

12&13-24-012-27 W4M



Universal Transverse Mercator (Zone 12)
North American Datum (1983)



Figure Number

B5-8

Sheet 3 of 3

Report By: TG Drawn by: JH Reviewed By: JL WSP Job #: 181-07689-00 Date Drawn: July 13, 2018 Inspection Date: N/A Report Name: Planning For Growth

Note: All Aerial Photographs were geometrically aligned to NAD83 Zone11

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APPENDIX

C SITE PHOTOGRAPHS





June 29, 2018



Photograph 1 – EB1, showing crop land portion in the foreground and hay land portion in the background

June 29, 2018



Photograph 2 – EB2, interior showing hay land portion and crop land portion



June 29, 2018



Photograph 3 – EB3, interior

June 29, 2018



Photograph 4 – Highly disturbed area, showing rutting from equipment and tanker storage laydown in background

June 29, 2018



Photograph 5 – Burrow present along quarter section line between the NW and NE 24-12-27 W4M

APPENDIX B

TOWN OF CLARESHOLM

PHASE I ENVIRONMENTAL SITE ASSESSMENT

04-25-012-27 W4M

12-24-012-27 W4M

13-24-012-27 W4M

July 2018

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PREPARED FOR:

Town of Claresholm
221 – 45 Ave West
Claresholm, Alberta
T0L 0T0 Canada

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EXECUTIVE SUMMARY

Town of Claresholm contracted WSP to conduct a Phase I Environmental Site Assessment (ESA) of the property located at 04-25-012-27 W4M and 12 & 13-25-012-27 W4M (the Property).

The objectives of the ESA were to identify evidence of actual or potential contamination in relation to designated substances, on or within 300 m of, the Property and to summarize:

Contaminants of Potential Concern (CoPCs)	– CoPCs may include designated substances and/or chemical wastes.
Potentially Contaminating Activities (PCAs)	– PCAs may include waste management, industrial processes, or materials handling and storage activities on the Property or within 300 m of the Property.
Areas of Potential Environmental Concern (APECs)	– An APEC is an area where one or more CoPCs may be present on, in, or under the Property as determined through the identification of a PCA.

The purpose of the ESA was to provide information to the Town of Claresholm for due diligence investigation in support of a real estate transaction.

This report presents the results of the assessment, based on a records review, current owner/occupant interview, and a site visit. The following table summarizes the APECs identified.

DESCRIPTION OF APECs	PCAs	COPCs AND SPECIAL ATTENTION ITEMS	RISK
1. An unknown area within 16-23-012-27 W4M	<u>Off-site:</u> Spill in 1983	<u>CoPCs:</u> Unknown	Low
2. Multiple automotive repair and service shops in the light industrial area west and south of the Property	<u>Off-site:</u> The storage and use of engine coolants, lube oil, solvents and other chemicals	<u>CoPCs:</u> Engine coolant Lube oil Solvents Other chemicals and solvents	Low
3. Pole-mounted transformers along 5 th Street and a ground transformer beside the southwest corner of the Property	<u>Off-site:</u> Presence of transformers potentially containing PCBs	<u>Special Attention Item:</u> PCBs	Low

RECOMMENDATIONS

As of July 2018, within the limitations of the Phase I ESA methodology, no evidence of potential or actual contamination was revealed in connection with the Property.

No further action is recommended at this time for APECs # 1, #2, and #3. The risks are considered low for the following reasons:

- An intrusive investigation is not recommended for APEC #1. The risk of the PCA, the historical off-site spill on the adjacent west property, is considered low because no adverse effects were observable during the site visit, no documentation regarding soil or groundwater impacts were found in the records review and the inferred direction of groundwater is parallel to the Property.

- An intrusive investigation is not recommended for APEC #2. The risk of the PCA, the storage of engine coolants, lube oil, solvents and other automotive chemicals on adjacent west and south properties is considered low as no historical spills have been reported in regard to related activities and the inferred groundwater direction is parallel to the Property.
- APEC #3, the presence of the pole-mounted transformers and the ground transformer, does not warrant action at the present time; however, a qualified professional is required for the safe and proper removal and disposal if the transformers are removed. If the transformers are damaged or leaks are apparent, the owner of the transformer should be contacted to rectify the problem.

This executive summary is intended to be read in conjunction with, and is subject to, the same limitations as the remainder of the report.



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ACRONYMS AND ABBREVIATIONS

- Abadata Abacus Datagraphics Ltd.
- AEP Alberta Environment and Parks
- AER Alberta Energy Regulator
- APEC Area of Potential Environmental Concern
- APRS Aerial Photographic Record System
- AWWID Alberta Water Well Information Database
- CoPC Contaminant of Potential Concern
- CSA Canadian Standards Association
- EPEA Environmental Protection and Enhancement Act
- ESA Environmental Site Assessment
- ESAR Environmental Site Assessment Repository
- FCSI Federal Contaminated Sites Inventory
- FOIPP Freedom of Information and Protection of Privacy
- H.E.L.P. Help End Landfill Pollution
- NPRI National Pollutant Release Inventory
- O&G Oil and Gas
- PCB Polychlorinated Biphenyl
- PTMAA Petroleum Tank Management Association of Alberta
- SDS Safety Data Sheets
- SPIN Service Alberta Spatial Information System
- Valtus Valtus Imagery Services

1 PROJECT BACKGROUND

1.1 SCOPE OF WORK

The Town of Claresholm contracted WSP to conduct a Phase I Environmental Site Assessment (ESA) of the property located at 04-25-012-27 W4M and 12 & 13-25-012-27 W4M (the Property; Figure 1).

The objectives of the ESA were to identify evidence of actual or potential contamination in relation to designated substances, on or within 300 m of, the Property (Figure 2 and Figure 3) and to summarize:

Contaminants of Potential Concern (CoPCs)	– CoPCs may include designated substances and/or chemical wastes.
Potentially Contaminating Activities (PCAs)	– PCAs may include waste management, industrial processes, or materials handling and storage activities on the Property or within 300 m of the Property.
Areas of Potential Environmental Concern (APECs)	– An APEC is an area where one or more CoPCs may be present on, in or under the Property as determined through the identification of a PCA.

The purpose of the ESA was to provide information to the Town of Claresholm for due diligence investigation in support of a real estate transaction.

This report presents the results of the assessment, based on a records review, current owner/occupant interview, and a site visit. The following table summarizes the APECs identified.

1.2 METHODOLOGY

The Phase I ESA was performed in general conformance with the Canadian Standards Association *Z768 01 (R2016) Phase I Environmental Site Assessment* (Canadian Standards Association [CSA], 2001) and the Alberta Environment and Parks (AEP) Alberta Environmental Site Assessment Standard (AEP, 2016). This ESA is based on a site visit, a records review and an interview with personnel knowledgeable regarding the history of the Property. The available records were reviewed and are summarized in the ESA. The records that were sought included:

- Publicly available information including:
 - Historical aerial photographs
 - Title searches
 - Previous environmental assessments and reports
 - Wellsite and pipeline locations
 - Flood hazard maps
 - Regulatory information (e.g., permits/approvals/authorizations, regulatory orders, enforcement actions)
 - Petroleum storage tank records
 - Reported spills
 - Land use (i.e., zoning)

- Property and owner/operator records as available, including:
 - Site plans
 - Asbestos surveys
 - Spill records
 - Chemical inventory
 - Environmental monitoring records
 - Waste management protocols
 - Materials management protocols
 - Tank information
 - Previous audits or assessments

The Phase I ESA did not include tasks such as sample gathering, laboratory testing, or intrusive investigations.

Variations from the methodology standards, based on time limitations, included:

- Some historical use records for the Property and adjoining properties (i.e., fire insurance maps, business directories) were not reviewed.
- Land titles were not determined for adjoining properties.
- Interviews were not conducted with adjoining property landowners.

The Phase I ESA also contains WSP’s professional opinion on site-specific potential or actual environmental issues, the associated risks, and the follow up action required to better understand and mitigate the issues.

2 SITE DESCRIPTION

2.1 GENERAL PROPERTY INFORMATION

Property and Local Environment

Figure 3, Figure 4
Appendix A-1

Property address:	N/A
Property	04-25-012-27 W4M
Dominion Land	12 & 13-24-012-27 W4M
Survey location:	
Property area and dimensions:	48.56 hectares (120 acres) 1,200 m x 400 m
Nearest populated centre:	Adjacent to the Town of Claresholm
Nearest waterbody:	No waterbodies within 1 km

2.2 TITLES AND LAND USE

Land Title (04-25-012-027 W4M)
(Service Alberta Spatial Information System [SPIN], 2018)
Appendix A-1

Land Identification Number Code: 0021 707 013

Title Number: 041 430 594

Legal Description: MERIDAN 4 RANGE 27 TOWNSHIP 12 SECTION 25 QUARTER SOUTH WEST EXCEPTING THEREOUT ALL MINES MINERALS AND RIGHT TO WORK THE SAME

A title search was conducted on the SPIN website for the municipal address. The registered owner of the Property is Maury Russell McLeod and Marla Arlene McLeod. Previous owners were:

- Richard Doyle McPeak (1978 to 2004)
- Lester Roy Amundsen and Owen Jennings Amundsen (Unknown to 1978)

There were no restrictive covenants, easements, and caveats on the title.

Land Title (12&13-24-012-27 W4M)
(SPIN, 2018)
Appendix A-1

Land Identification Number Code: 0035 334 382

Title Number: 131 095 301

Legal Description: MERIDAN 4 RANGE 27 TOWNSHIP 12 SECTION 24 LEGAL SUBDIVISION 12 AND 13 IN THE NORTH WEST QUARTER EXCEPTING THEREOUT ALL MINES MINERALS

A title search was conducted on the SPIN website for the municipal address. The registered owner of the Property is 1584935 Alberta Ltd. Previous owners, back to 1993, were:

- Cheryl Lyn Markle and Margaret Markle (1999 to 2013)
- George Markle and Margaret Markle (1993 to 1999)

There were no restrictive covenants, easements, and caveats on the title.

Land Use

Figure 3

(Town of Claresholm, 2017)

Appendix A-2

Subject Property

The Property is a cultivated field. It is zoned as an Agricultural / Transitional District in the Town of Claresholm.

- North-adjacent: Zoned: Agricultural / Transitional District
- East-adjacent: Zoned: Agricultural / Transitional District
- South-adjacent: Zoned: Beyond the Town of Claresholm
- West-adjacent: Zoned: Industrial and Public Districts

2.3 GENERAL INFORMATION FOR THE REGION

Natural Region and Subregion

(Downing & Pettapiece, 2006)

The Property is situated within the following Region and Subregion.

Region: Grassland

Subregion: Mixedgrass

Vegetation: Mainly agricultural with needle and thread, porcupine grass, northern, and western wheatgrass

Climate: Warmest month, temperature: July, 17.6 °C

Coldest month, temperature: January, -10.2 °C

Maximum Precipitation (month, volume): June, 394 mm

Soils: Dark Brown Chernozems and Gleysols in wetlands

Regional Land Use: Oil and gas, grazing, and irrigation-based farming

Soils and Topography

(Agriculture Canada, 1989)

Soil Reference Soil: Dark Brown Chernozemic soils

Classification: Parent Material: Loam

Mode of Deposition: Lacustrine

Topography: Undulating

Slopes: 1% to 3%

Surface Water and Groundwater Flow

(AEP, 2018a)

Appendix A-3

Regional Flood Hazard:

Flood hazard mapping is prepared for some communities in Alberta and is available via the AEP website. Flood hazards have not been identified in all communities and may exist in areas without flood hazard mapping. The current design flood standard in Alberta is the 100-year flood, determined when a flood hazard study is undertaken.

The Flood Hazard Map for the region does not show any floodway within 300 m of the Property.

(Natural Resources Canada, 2018) Appendix A-4

Regional Surface Drainage:

The region is flat with regional surface drainage to the west toward Clear Brook and to the southwest toward Willow Creek. It is anticipated groundwater flow, in the vicinity of the property, flows southwest.

Figure 4

Local Surface Drainage:

The Property slopes south-southwest with swales along either side of 5th Street and Highway 520, along the road allowance setbacks.

Regional Groundwater Flow:

Regional drainage and groundwater flow in the area is inferred to be towards Willow Creek southwest of the Property, based on the regional surface drainage.

Local Groundwater Flow:

Based on the local surface water flow and the regional groundwater flow, the groundwater near and below the Property is inferred to flow southwest.

3 RECORDS REVIEW

Various documents and resources were reviewed for information concerning past uses of, and activities at, the Property.

3.1 HISTORICAL AERIAL PHOTOGRAPH SUMMARY

Aerial photographs of the Property and vicinity were obtained from Valtus Imagery Services (Valtus, 2018) and the Aerial Photographic Record System (APRS, 2018).

WSP reviewed aerial photographs from 1949 to 2016, as summarized in Table 1. Photographs for 1949, 1966, 1982, 1992, 1999, and 2015 are reproduced on Figure 2. Historically, the Property was situated on agricultural land and has remained undeveloped. Light industrial land development adjacent west to the Property was first evident in 1974, continued progressively throughout the 1980s, and has not significantly changed since. No environmental concerns were apparent on, or adjacent to, the Property in any of the photographs.

Table 1 Historical Aerial Photograph Summary

DATE	SCALE	SOURCE	SUBJECT PROPERTY	NORTH ADJACENT PROPERTY	SOUTH ADJACENT PROPERTY	EAST ADJACENT PROPERTY	WEST ADJACENT PROPERTY
1949	1:40,000	APRS	The Property appeared to be cultivated farm land. There was one building along the south edge of the Property, north of another building on the adjacent south property. Highway 520 was apparent, dividing sections 24 and 25.	The property appeared to be cultivated farm land.	The property appeared to be cultivated farm land with several buildings, along the northwest edge.	The property appeared to be cultivated farm land.	The property appeared to be cultivated farm land.

DATE	SCALE	SOURCE	SUBJECT PROPERTY	NORTH ADJACENT PROPERTY	SOUTH ADJACENT PROPERTY	EAST ADJACENT PROPERTY	WEST ADJACENT PROPERTY
August 8, 1961	1:32,000	APRS	The building along the south edge of the Property was no longer apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.
July 28, 1966	1:32,000	APRS	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	A property northwest of the 5 th Street and Highway 520 intersection appears to be in the process of being developed.
April 15, 1974	1:24,000	APRS	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	Development of properties were apparent with several buildings on three or four distinct properties.
May 11, 1982	1:8,000	APRS	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	Development had continued with several more distinct properties and infrastructure apparent.
June 9, 1988	1:15,000	APRS	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.
July 25, 1992	1:30,000	APRS	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.
July 21, 1997	1:20,000	APRS	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.
June 11, 1999	1:20,000	Valtus	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.

DATE	SCALE	SOURCE	SUBJECT PROPERTY	NORTH ADJACENT PROPERTY	SOUTH ADJACENT PROPERTY	EAST ADJACENT PROPERTY	WEST ADJACENT PROPERTY
September 22, 2009	1:20,000	Valtus	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.
July 29, 2012	1:20,000	Valtus	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.	No significant changes were apparent.
2015	1:20,000	ESRI	No significant changes were apparent.	No significant changes were apparent.	The buildings were no longer apparent and the portion where the buildings were formerly located appeared to be used for storage.	No significant changes were apparent.	No significant changes were apparent.

3.2 ENVIRONMENTAL ENFORCEMENT SEARCH

(Environmental Law Centre, 2018; Province of Alberta, 2014)

Appendix A-5

WSP requested an Environmental Enforcement Historical Search for the owner of the Property, Maury McLeod and 1584935 Alberta Ltd. The search does not include cleanup orders under the *Litter Act*, or Environmental Protection Orders respecting unsightly property issued under *Environmental Protection and Enhancement Act* (EPEA).

No enforcement actions were identified related to the Property under the EPEA or its predecessor legislation.

3.3 STORAGE TANKS

(Petroleum Tank Management Association of Alberta [PTMAA], 2018)

Appendix A-6

The PTMAA maintains a registry of active tank sites and abandoned tank sites. The PTMAA cannot guarantee that tanks do not or have not existed on the locations requested. The main limitation of the PTMAA database is that it only includes information reported through registration or a survey of abandoned sites since 1992.

The PTMAA performed a search of the Property, SW 25-012-27 W4M and W ½ -24-012-27 W4M. There were no tanks registered with the PTMAA at the Property.

3.4 OIL AND GAS WELLS, PIPELINES AND FACILITIES

(Abacus Datagraphics Ltd. [Abadata], 2018) The Alberta Energy Regulator’s (AER’s) databases of oil and gas (O&G) wells, pipelines and facilities were searched using the map capabilities of Abadata. No O&G facilities, wells or pipelines have been located on or within 300 m of the Property.

3.5 WATER WELLS

(AEP, 2018b) Appendix A-7 As of July 4, 2018, the Alberta Water Wells Information Database (AWWID) was searched via the AEP website to identify wells that may be on or within 300 m of the Property. The exact locations for wells in the AWWID may be inaccurate due to the age of the records and/or the recording methods. Locations for wells are generally accurate to the quarter-section (+/- 560 m). WSP identified a total of two wells that may be within 300 m of the Property. A summary of these wells is provided in Appendix A-7. No wells were identified on the Property. The scope of this Phase I ESA does not include assessing abandoned wells or the efficacy of closure(s).

3.6 SPILL RECORDS

Railway Spills There are no railways within 300 m of the Property.
(Railway Association of Canada, 2018)

Oil and Gas Spills The spill database of the AER, last updated June 5, 2018, was searched for reported spills from oil and gas facilities.
(AER, 2018a) WSP summarized the information in Table 2.

Table 2 Summary of Spills On-site or Within 300 m of Property

DATE	LOCATION	VOLUME SPILLED/ RECOVERED (m ³)	PRODUCT	CONTAINED ON LEASE	DATE CLEANUP COMPLETE	OPERATOR/ LICENSE
September 15, 1983	16-23-012-27 W4M	1 / 0	Chemicals	No	August 20, 1985	Unknown Operator

3.6.1 POTENTIALLY CONTAMINATING ACTIVITY IDENTIFIED

PCA	The release of chemicals
CoPCs	The CoPC is unknown

3.7 CHEMICAL INVENTORIES

National Pollutant Release Inventory (NPRI)

(Environment Canada, 2018)

Appendix A-8

The NPRI requires that facilities which meet thresholds for full time employees and threshold volumes of certain substances must report the volumes discharged. As such, the NPRI list is not a complete list of all chemicals on a site, but does provide an indication of some of the chemicals that are used in large volumes, as required by the NPRI program.

The NPRI reports were obtained from the Environment Canada website for reporting years, 2003, 2004, and 2005 for Landmark Feeds, located at 4149 - 3rd Street East, within 300 m of the Property. The company ceased operation in 2005. The report indicated phosphorous was used at this location, with phosphorous being released as particulate matter via air. There were no reported on-site releases, on- or off-site disposal or recycling of phosphorous reported. This is not considered a CoPC given the setback from the property, inferred surface drainage and groundwater flow, and background concentrations likely found from fertilizers used on the Property.

Safety Data Sheets (SDS)

No SDS were provided by the client because no chemicals are used on the Property.

3.8 AUTHORIZATIONS AND PERMITS

(AEP, 2018c)

The Authorization Viewer is a searchable database of documents related to AEP approvals, licenses, registrations, authorizations, permits and certificates issued under the *Water Act* and *EPEA*.

The Property's location on 24-012-27 W4M and 25-012-27 W4M were searched on July 4, 2018 for authorizations and/or approvals on the AEP Authorization Viewer.

No documents were identified.

3.9 HAZARDOUS WASTE GENERATORS AND RECEIVERS

(AEP, 2018d)

As of July 4, 2018, the lists of hazardous waste generators (updated May 26, 2017) and hazardous waste receivers (updated January 18, 2017) were obtained from the AEP website. The lists did not include the subject Property, or the current owners as a hazardous waste generator or receiver.

3.10 LANDFILLS AND COAL FACILITIES

Alberta Energy Regulator

(AER, 2018b; Abadata, 2018)

The AER listings of landfills, coal holes, and coal mines were searched using the map capabilities of Abadata. There were no findings on or within 300 m of the Property.

Help End Landfill Pollution (H.E.L.P.)

(Alberta Environment, 1988)

H.E.L.P. was created to provide tracking and management of industrial landfills in Alberta. The document identifies 680 sites in Alberta.

The location of the Property was searched in H.E.L.P. and no landfills were identified on or within 300 m of the Property.

MacLaren Report
(Alberta Environment,
1982)

The MacLaren Report was undertaken to prepare an inventory of active and inactive landfill disposal sites. The document identifies 705 active sites and 447 inactive sites in Alberta, as of 1982.

The location of the Property was searched in the MacLaren Report and no landfills were identified on or within 300 m of the Property.

**Regional Waste
Contact List**
(Alberta Government, 2014)

The location of the Property was searched in the Regional Waste Management Authority Contact List and no landfills were identified on or within 300 m of the Property.

3.11 FEDERAL CONTAMINATED SITES INVENTORY

(Treasury Board of Canada
Secretariat, 2018)

The Federal Contaminated Sites Inventory (FCSI) includes information on all known federal contaminated sites under the custodianship of departments, agencies, and consolidated Crown corporations as well as those that are being or have been investigated to determine whether they have contamination arising from past use that could pose a risk to human health or the environment. The inventory also includes non-federal contaminated sites for which the Government of Canada has accepted some or all financial responsibility. It does not include sites where contamination has been caused by, and which are under the control of, enterprise Crown corporations, private individuals, firms, or other levels of government.

The FCSI was accessed on July 5, 2018, and does not show a contaminated site on or within 300 m of the Property.

3.12 PREVIOUS ENVIRONMENTAL REPORTS AND ASSESSMENTS

**Alberta Environment
and Parks (AEP)
Freedom of
Information and
Protection of Privacy
Act (FOIPP) Request**
(AEP, 2018e)
Appendix A-9

A search request regarding information related to potential environmental impact for the Property was submitted to AEP on June 22 and 25, 2018, using the FOIPP request form.

On June 26 and 29, 2018, the AEP indicated no records related to the search request were identified.

**Environmental Site
Assessment
Repository (ESAR)**
(AEP, 2018f)

The ESAR database, which is maintained by AEP, contains scientific, and technical information about assessed and/or reclaimed sites throughout Alberta. ESAR shows the approximate locations of assessed or reclaimed sites with markers. Each marker may contain links to multiple documents.

As of July 4, 2018, the AEP ESAR did not identify any documents for the Property or surrounding area.

4 SITE VISIT

WSP visited the Property on June 28, 2018, and were not accompanied. The purpose of the visit was to observe conditions at the Property and neighbouring sites that may have impacted soil and/or groundwater at the Property. The site visit documentation is contained in Appendix B.

4.1 PROPERTY OVERVIEW

The following observations were made during the visit of the Property (Figures 3 and 4):

- | | |
|---|---|
| Limitations Accessing or Observing the Property: | – No limitations were encountered during the site visit. |
| Topography: | – The topography of the Property and adjacent land is flat to gently rolling with a general slope south-southwest. |
| Summary of Activities and Features on the Property: | – The Property was undeveloped agricultural land used primarily for hay and canola crops.
– The Property is currently owned by two separate owners, separated by Highway 520.
– The housekeeping was good throughout the site visit.
– There were no buildings located on the Property.
– The farm land has had herbicides and pesticides applied per routine farming techniques.
– Transformers were observed mounted on poles along 5 th Street East and one transformer on the ground near the southwest edge of the Property. |

4.2 SURROUNDING PROPERTIES

The following observations were made of the surrounding properties adjacent to and in the vicinity of the subject Property (Figure 3 and 4).

- | | |
|-------------------------------------|---|
| - Current Occupant(s) and Activity: | Maury McLeod - Farming |
| Topography: | Mostly flat with slope to the southwest |
| - Current Occupant(s) and Activity: | Dennis Hoffman - Farming |
| Topography: | Mostly flat with slope to the southwest |

- Current Occupant(s) and Activity: Dennis Hoffman – Farming
Triple T Energy Services Company – Tank and truck storage area
- Topography: Mostly flat with slope to the southwest
- Current Occupant(s) and Activity: UFA Farm and Ranch Supply - Light industrial
Proven - Seed Supply Business - Light industrial
Isaiah Diesel Engine Repair - Light industrial
Don Needham Trucking - Light industrial
TJs Tree Trimming - Commercial
Gelowitz Holdings Inc. Fibreglass Tanks - Light industrial
Southgate RV and Service Centre - Light industrial
Welding Shop - Light industrial
Napa Auto Parts Centre - Light industrial
Torques Heavy Truck and Trailer Repair - Light industrial
Triple T - Oil Field Service Company - Light industrial (Tank and truck storage)
Town of Claresholm - Maintenance Yard - Light industrial
- Topography: Mostly flat with slope to the south

4.2.1 POTENTIALLY CONTAMINATING ACTIVITY IDENTIFIED

PCAs	The PCA is the presence of multiple automotive repair and servicing shops.
CoPCs	The CoPCs are the engine coolants, lube oil, solvents and other chemicals.

PCA	The PCA is the presence of transformers (ground and pole mounted) which may contain Polychlorinated Biphenyls (PCBs).
CoPCs	The Special Attention are PCBs.

No other environmental concerns were apparent on or adjacent to the Property.

4.3 OTHER POTENTIAL ISSUES

During the site visit there was no evidence observed of the following:

- Asbestos-containing materials
- Urea formaldehyde foam insulation
- Ozone-depleting substances
- Lead and lead-based paint
- Mould
- Radon
- Hydraulic equipment
- Chemical storage
- Unidentified odours
- Aboveground storage tanks
- Underground storage tanks and sumps
- Hazardous waste
- Non-hazardous waste
- Surface staining
- Stressed vegetation
- Pits, ponds, or excavations
- Electric/magnetic fields
- Vibrations

5 INTERVIEWS

WSP interviewed Mr. Dennis Hoffman, the lessee of the 12 & 13-24-012-27 W4M land, on June 28, 2018 (Appendix C). Mr. Hoffman indicated the following:

- Mr. Hoffman has farmed the property since 2003.
- No buildings have been located on the farmland since he began farming the land.
- Freshwater releases occurred in the field on the Property in 2015 and 2017 from a water line.
- The land is currently being used for hay and canola crops. Crops are sprayed with typical herbicides and pesticides twice yearly.
- Mr. Hoffman indicated there were no environmental concerns regarding the Property.

WSP attempted to contact Mr. Maury McLeod, the owner and occupant of the 04-25-012-27 W4M property, to conduct the interview regarding current and historical activities on the Property. As of the time of writing this report, the interview had not been completed. If the information obtained, when the interview is completed alters the findings of this ESA, the results will be forwarded under a separate cover.

6 DEVIATIONS

There were no deviations from the principal components (records review, site visit, and interview) of a Phase I ESA during the completion of this assessment.

7 LIMITATIONS

The findings and conclusions stated in this report regarding contamination of the Property are based solely on the extent of observations and information gathered during the Phase I ESA. A limiting factor was that the owner / occupant of the 04-25-012-27 W4M property could not be contacted to conduct the interview regarding current and historical activities on the Property. If the result of the interview alters the findings of this ESA, the results will be forwarded under a separate cover.

8 FINDINGS

The PCAs identified by WSP in the previous sections are summarized as three APECs in Table 3 and shown on Figure 4.

Table 3 Findings: Contaminants of Potential Concern in Areas of Potential Environmental Concern

DESCRIPTION OF APECs	PCAs	COPCs AND SPECIAL ATTENTION ITEMS	RISK
1. An unknown area within 16-23-012-27 W4M	<u>Off-site:</u> Spill in 1983	<u>CoPCs:</u> Unknown	Low
2. Multiple automotive repair and service shops in the light industrial area west and south of the Property	<u>Off-site:</u> The storage and use of engine coolants, lube oil, solvents and other chemicals.	<u>CoPCs:</u> Engine coolant Lube oil Solvents Other chemicals and solvents	Low
3. Pole-mounted transformers along 5 th Street and a ground transformer beside the southwest corner of the Property	<u>Off-site:</u> Presence of transformers potentially containing PCBs.	<u>Special Attention Item:</u> PCBs	Low

8.1 SPECIAL ATTENTION ITEMS

Section 7.2.1.12 of the CSA Standard requires that some items and conditions require special attention because of heightened public concern and/or specific environmental legislation. The special attention items, as listed in the CSA standard, include but are not limited to:

- Polychlorinated biphenyls
- Asbestos-containing materials
- Lead-containing materials
- Ozone-depleting substances
- Urea formaldehyde foam insulation
- Radon
- Mould
- Noise
- Electric and magnetic fields vibration

The following special attention items were identified during this ESA.

- Polychlorinated biphenyls
- Radon (identification was indirect)

Descriptions of the special items identified are included here to clarify the significance of the findings.

8.1.1 RADON

Although no evidence of radon was observed during the site visit or document review, all sites in Canada have the potential for the presence of radon. In compliance with the CSA standard, a brief overview of radon is provided here.

Radon is a colourless, odourless, and tasteless radioactive gas formed from the breakdown of uranium, a naturally occurring radioactive material found in soil, rock, and groundwater. Radon concentrations will vary depending on underlying geologic units, uranium geochemistry and radiometric geophysical response. As a gas, radon can move freely from the soil or bedrock into the atmosphere, and may accumulate in enclosed areas, such as mines or buildings.

According to Health Canada (Health Canada, 2017), "Remedial measures should be undertaken in ... [the normal occupancy area of a building, excluding mines and workplaces covered by guidelines for naturally occurring radioactive materials,] ... whenever the average annual radon concentration exceeds 200 Becquerel per cubic meter." The "normal occupancy area" refers to any part of the building where a person is likely to spend greater than four hours per day.

Generally, there are no legal requirements to test for radon. Notable exceptions are the regional-specific requirement for radon testing in daycare facilities in Quebec, and federal workplaces under the Canada Labour Code. There were no direct observations of radon at the Property, however the potential for radon exists throughout most of North America. In the absence of any region-specific or user-specific legislation for testing, there are no recommendations for radon testing at the Property at this time.

8.1.2 POLYCHLORINATED BIPHENYLS

The pole-mounted transformer on the west adjacent side of the Property and the ground transformer on the south adjacent side of the Property potentially may contain PCBs in the cooling oil. All transformer appeared to be in good condition.

PCBs refer to any one or any combination of 209 organochlorides with two to ten chlorine atoms attached to two benzene rings (biphenyl). These commercially used chemicals were first manufactured in 1929 and widely used as dielectric and coolant fluids in electrical transformers, capacitors, and fluorescent light ballasts. Exposure to PCBs can cause chloracne (severe form of acne), swelling of the upper eyelids, discoloration of the nails and skin, numbness in the arms and/or legs, weakness, muscle spasms, chronic bronchitis, and problems related to the nervous system. Prolonged high-level exposure might increase the risk of developing cancer of the liver or kidneys. Due to PCBs' toxicity and classification as a persistent organic pollutant, the use and production of PCBs has been restricted since 1980.

As long as this equipment is being used for its intended purpose, and is in good operating condition, it is not considered to be waste material. If the transformers are damaged or leaks, the owner of the transformer should be contacted immediately and required to address the situation as soon as possible.

9 CONCLUSIONS AND RECOMMENDATIONS

As of July 2018, within the limitations of the Phase I ESA methodology, no evidence of potential or actual contamination was revealed in connection with the Property.

No further action is recommended at this time for APEC # 1, #2, and #3. The risks are considered low for the following reasons:

- An intrusive investigation is not recommended for APEC #1. The risk of the PCA, the historical off-site spill on the adjacent west property, is considered low because no adverse effects were observable during the site visit, no documentation regarding soil or groundwater impacts were found in the records review and the inferred direction of groundwater is parallel to the Property.
- An intrusive investigation is not recommended for APEC #2. The risk of the PCA, the storage of engine coolants, lube oil, solvents and other automotive chemicals on adjacent west and south properties is considered low as no historical spills have been reported in regard to related activities and the inferred groundwater direction is parallel to the Property.
- APEC #3, the presence of the pole-mounted transformers and the ground transformer, does not warrant action at the present time; however, a qualified professional is required for the safe and proper removal and disposal if the transformers are removed. If the transformers are damaged or leaks are apparent, the owner of the transformer should be contacted to rectify the problem.

10 DISCLAIMER

The Town of Claresholm acknowledges and agrees that this report was prepared solely on its behalf and functions solely as a Phase I Environmental Site Assessment.

Where the Town of Claresholm is required to disseminate this report, either by law or in connection with the Town of Claresholm business activities, to any other party to whom this report is not addressed (the "Third Party"), the Town of Claresholm agrees to notify the Third Party of the terms of this disclaimer who in turn shall be bound by such terms. WSP accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made, or actions taken, based on this report.

Conclusions presented in this report represent the best technical judgment of WSP staff and should not be construed as legal advice. The conclusions are based on the Property conditions observed by WSP at the time of the site visit, and can only be extrapolated to an undefined limited area around these locations. The extent of the limited area depends on the soil and groundwater conditions, as well as the history of the Property reflecting natural, construction and other activities. Due to the nature of the investigation and the limited data available, WSP cannot warrant against undiscovered environmental liabilities or adverse impacts off-Property. By accepting this report The Town of Claresholm acknowledges and agrees that it may in part rely upon sources, either written or oral, that WSP considers reliable but which are not guaranteed or independently verified by WSP.

11 ROLES AND QUALIFICATIONS OF PERSONNEL

Ashley Appleby, B.Sc., was responsible for the preparation of the Phase I ESA Report. Mr. Appleby has written Industrial Property Phase I ESAs, conducted IOGC audits, liability assessments for acquisitions, and environmental compliance audits in conjunction with Oil and Gas Phase I ESAs.

Dellas Zaretsky, P.Ag., has reviewed the Phase I ESA prepared for the Property. Mr. Zaretsky has over 35 years of operating company and consulting experience in the environmental facets of the petroleum and coal industries in Western Canada. As a senior technical manager, he has directed professional and technical staff in the conduct of over 700 Phase I ESAs and liability assessments for the energy sector.

12 REFERENCES

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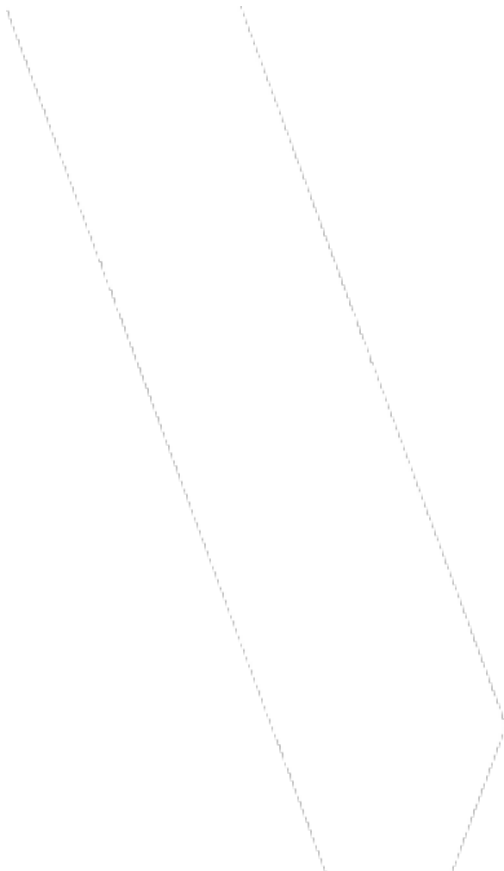
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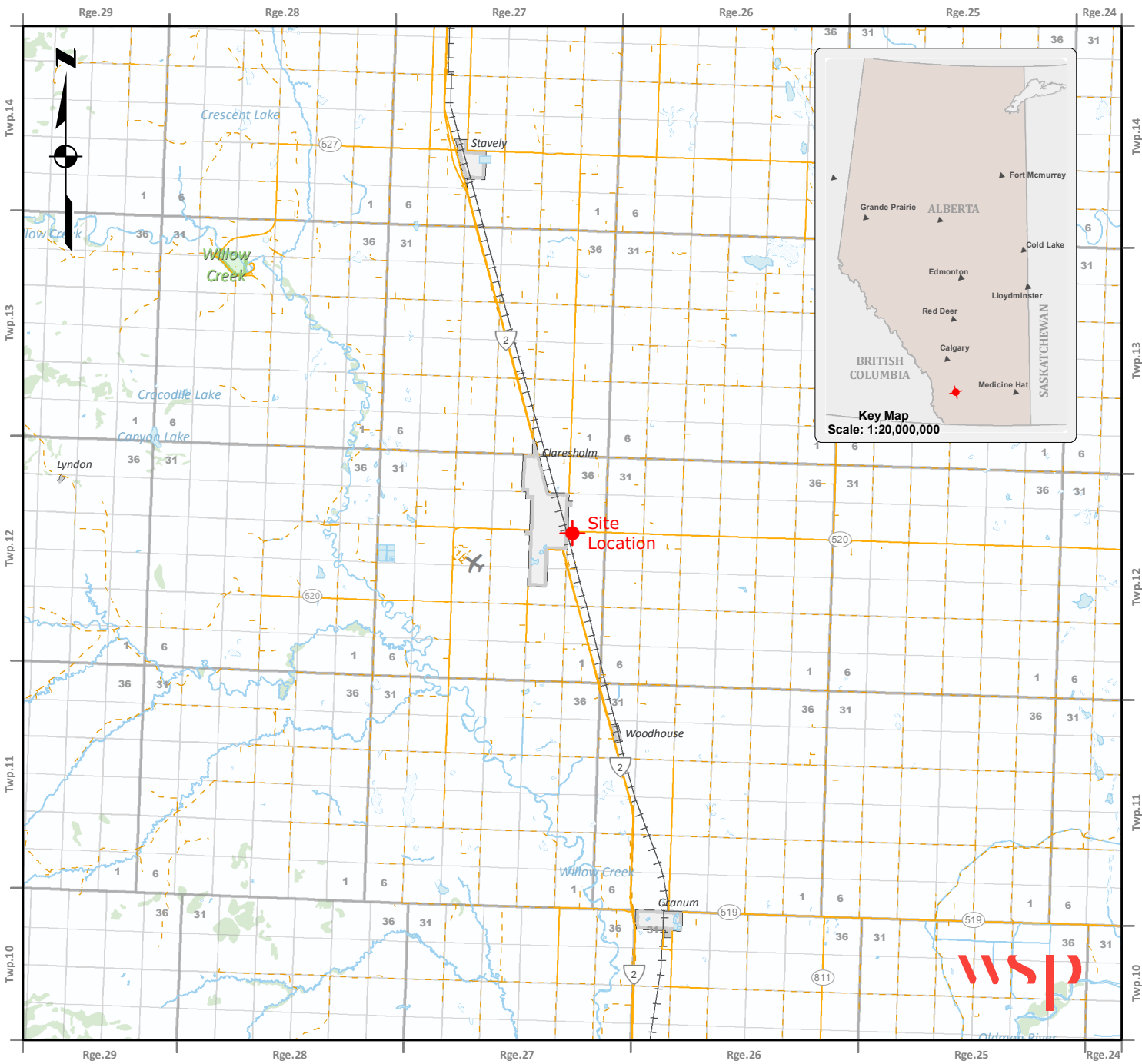
FIGURES



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FIGURE 1	PROPERTY LOCATION
FIGURE 2	HISTORICAL AERIAL PHOTOGRAPHS
FIGURE 3	PROPERTY AND ADJACENT AREA
FIGURE 4	AREAS OF POTENTIAL ENVIRONMENTAL CONCERN





Legend

- | | | | |
|-------------------|-----------------------|---------------------------|---------------------------|
| Activity | Transportation | Water Features | Environmental |
| Property Location | Paved Road | Perennial Lakes/Rivers | Provincial Park |
| Municipal | Gravel Road | Intermittent Lakes/Rivers | Vegetation |
| Urban Centre | Railway | Perennial Stream/Creek | Miscellaneous |
| | Airport | | Alberta Township Boundary |
| | Airfield | | Alberta Section Boundary |

Property Location



Town of Claresholm
12&13-24-012-27 W4M
and 04-25-012-27 W4M

Scale 1:250:000
 0 1 2 4 6 8 10 Km

Universal Transverse Mercator (Zone 12)
 North American Datum (1983)

Report By: AA

WSP Job #: 181-07689-00

Figure Number

Drawn by: JH

Date Drawn: July 4, 2018

1

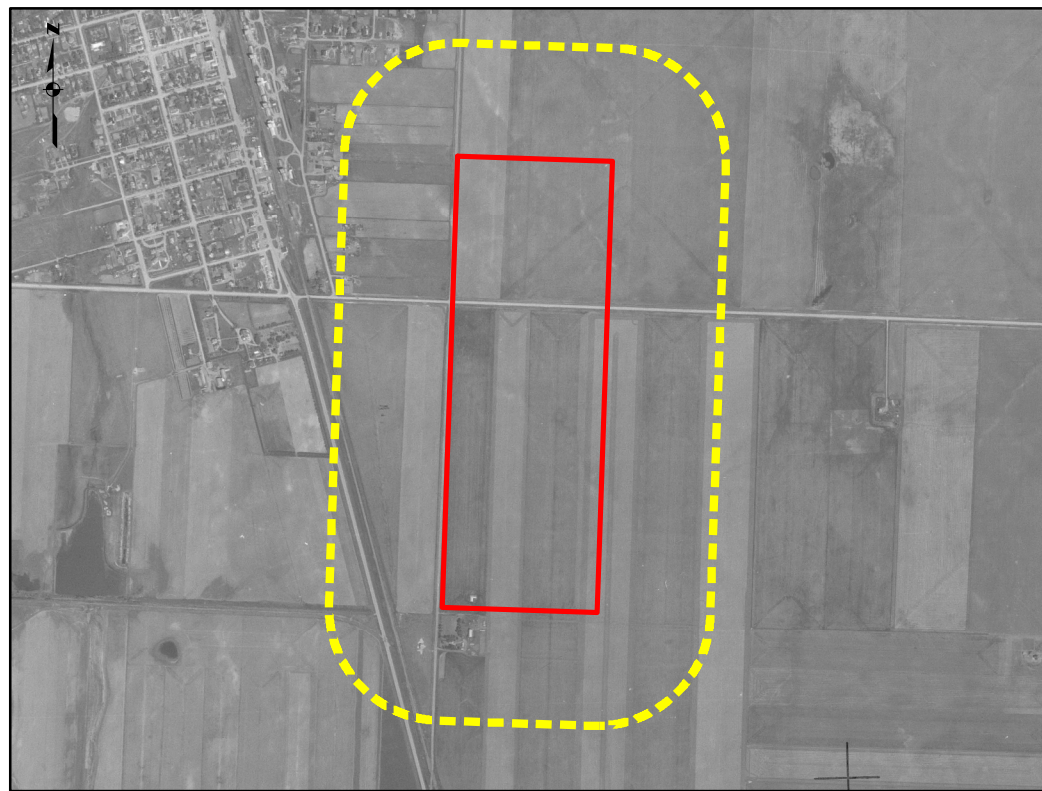
Reviewed By: DAZ

Inspection Date: June 28, 2018

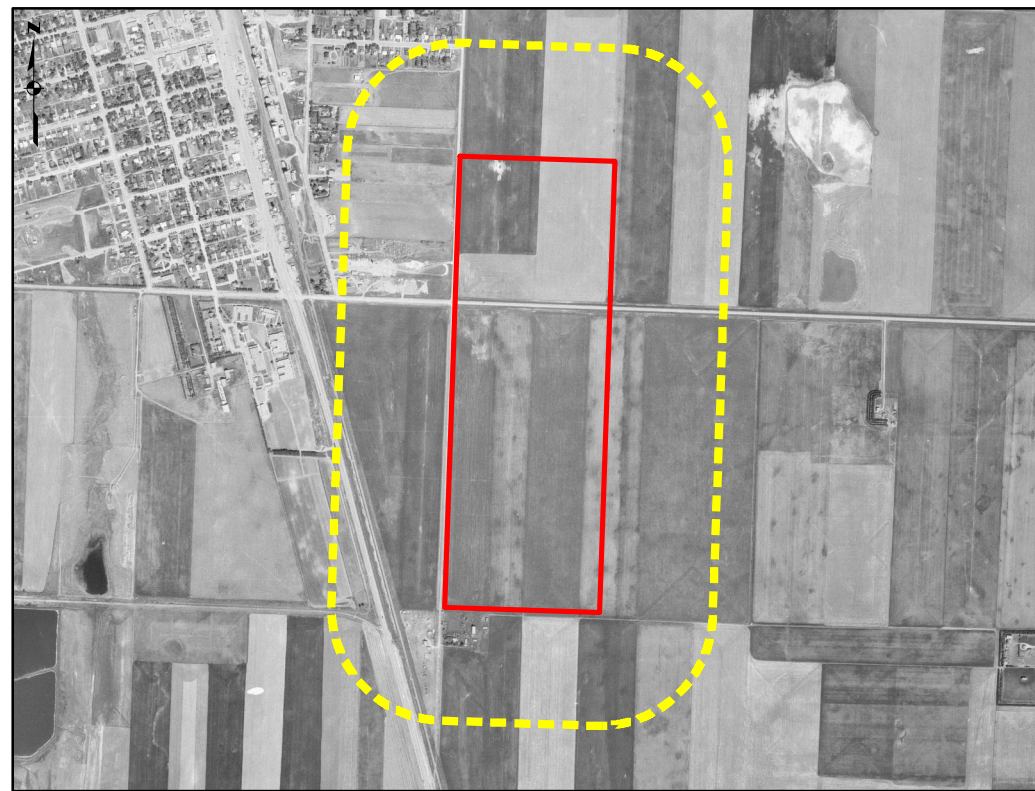
Sheet 1 of 4

Report Name: 2018 Phase I Environmental Site Assessment

Notes: Data provided by Altalis, Natural Resource Canada, ESRI Basemaps, GeoGratis



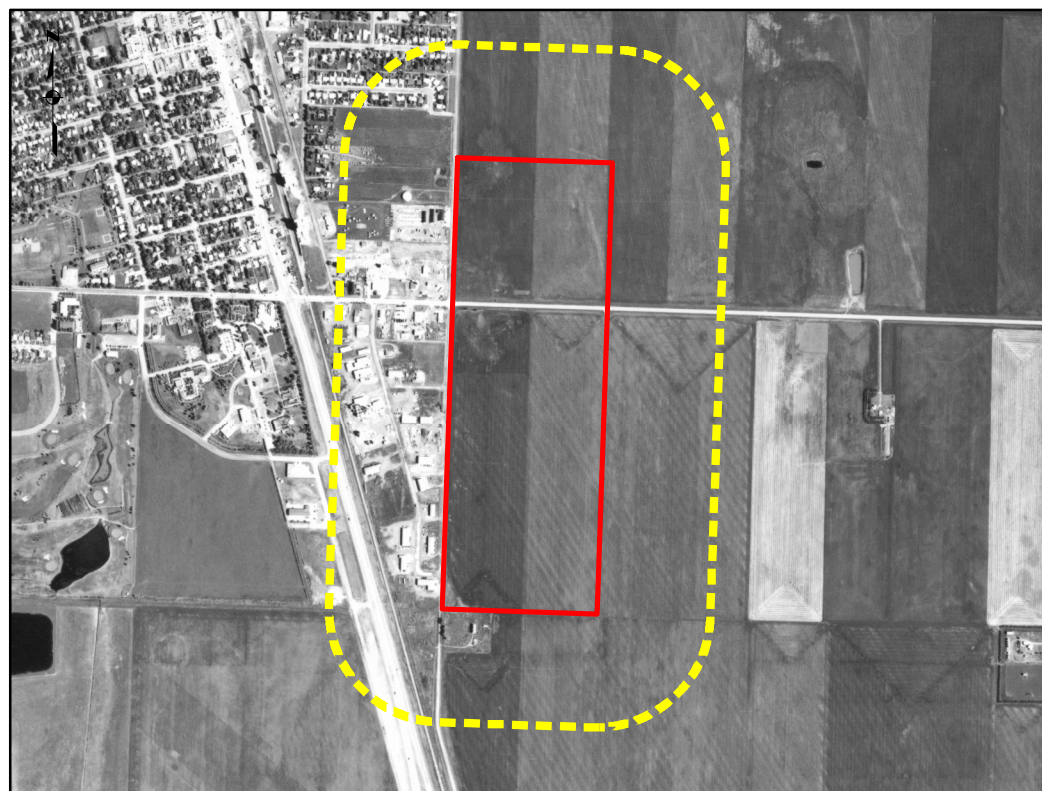
Aerial Photograph 1: July 3, 1949



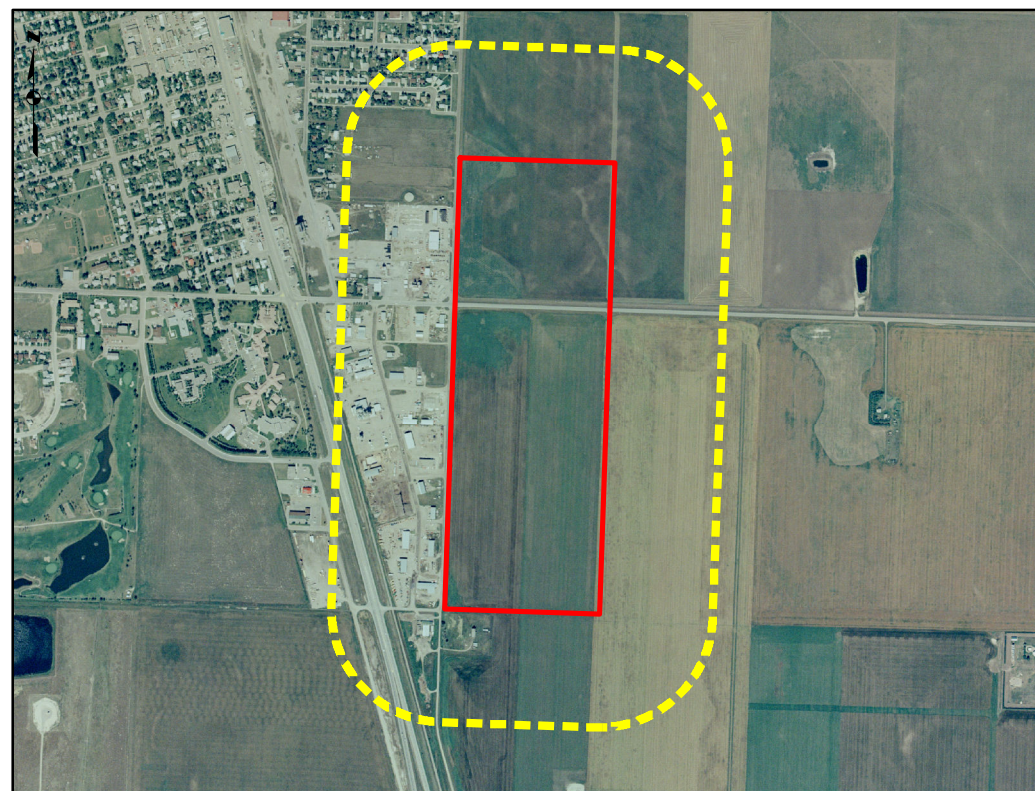
Aerial Photograph 2: July 28, 1966



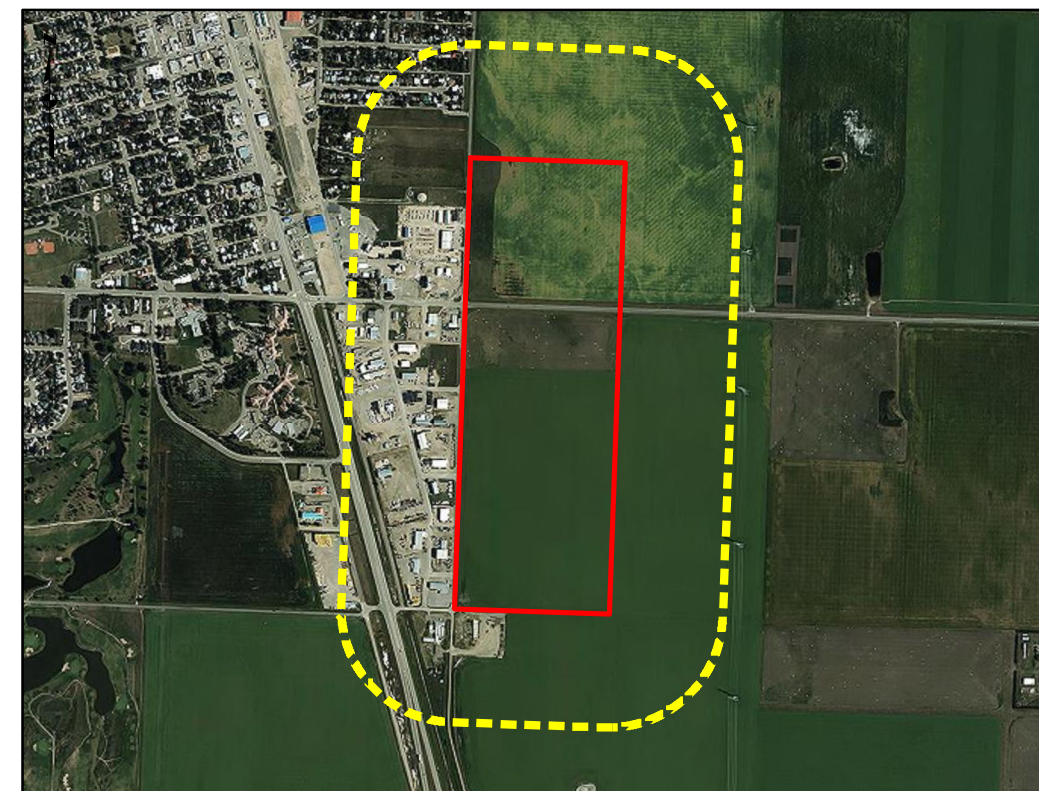
Aerial Photograph 3: May 11, 1982



Aerial Photograph 4: July 25, 1992



Aerial Photograph 5: June 11, 1999



Aerial Photograph 6: 2015

Image Source Table					
Images: Alberta Sustainable Resource Development					
Photo #	Source	Date	Line	Roll	Scale
1	Airphoto Service Alberta	July 3, 1949	N/A	N/A	1:40,000
2	Airphoto Service Alberta	July 28, 1966	N/A	N/A	1:32,000
3	Airphoto Service Alberta	May 11, 1982	N/A	N/A	1:8,000
4	Airphoto Service Alberta	July 25, 1992	N/A	N/A	1:30,000
5	Valtus Imagery Service	June 11, 1999	N/A	N/A	1:20,000
6	ESRI Imagery Service	2015	N/A	N/A	1:20,000



Legend
 Property Boundary
 Buffer - 300m



Historical Aerial Photographs

Town of Claresholm
 12&13-24-012-27 W4M
 and 04-25-012-27 W4M
 Scale: 1:20,000

Universal Transverse Mercator (Zone 12)
 North American Datum (1983)

Figure Number

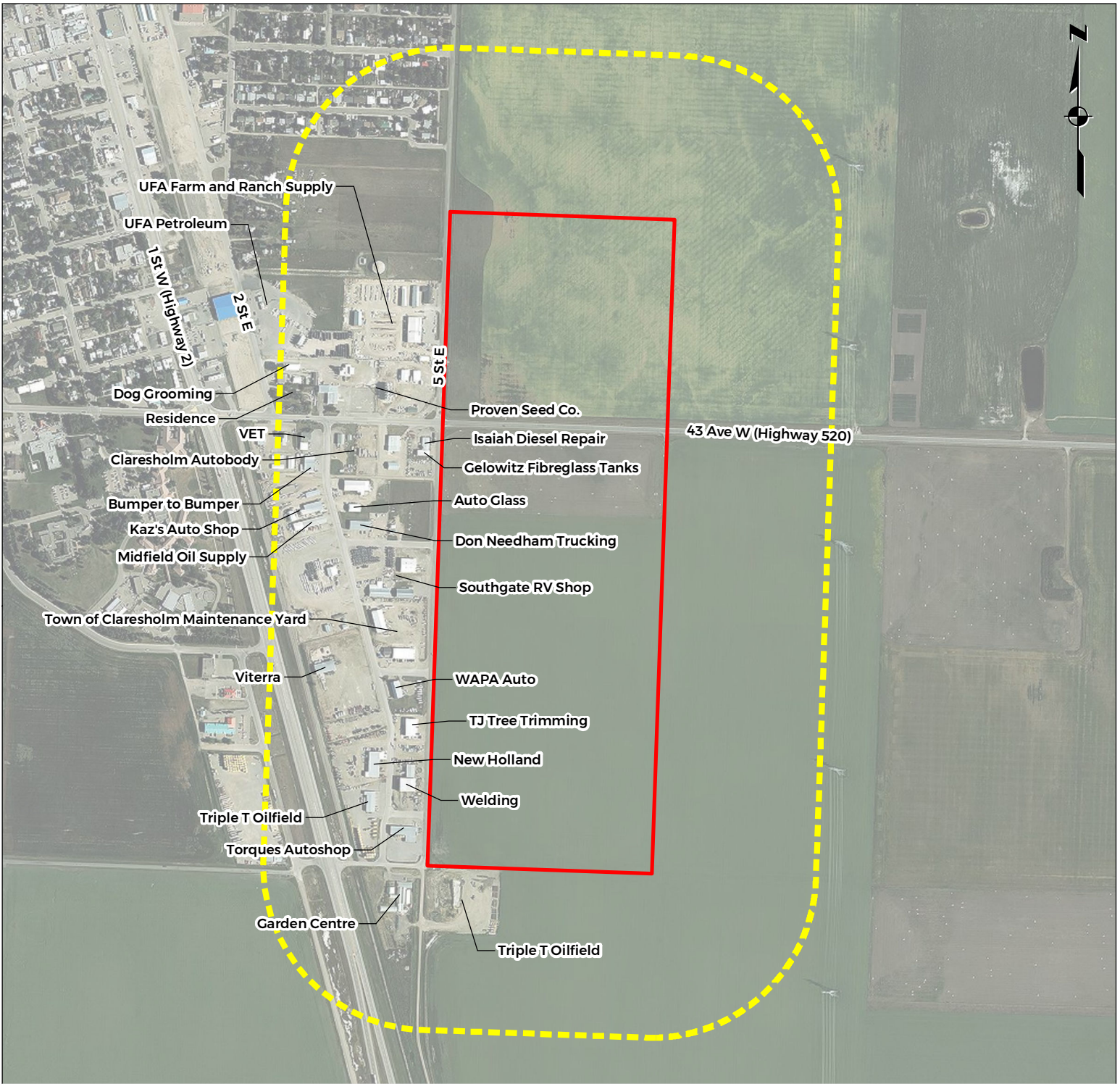
2

Sheet 2 of 4



Report By: AA Drawn by: JH Reviewed By: DAZ WSP Job #: 181-07689-00 Date Drawn: July 4, 2018 Inspection Date: June 28, 2018 Report Name: 2018 Phase I Environmental Site Assessment

Note: All Aerial Photographs were geometrically aligned to NAD83 Zone 11
 Disclaimer: WSP assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases WSP, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data. WSP Canada Inc. 237 - 4 Avenue SW, Suite 3300 Fifth Avenue Place, Calgary, Alberta T2P 4K3 Canada
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Legend

 Property Boundary

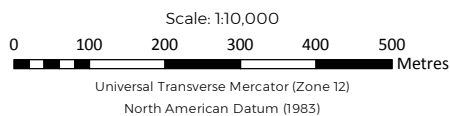
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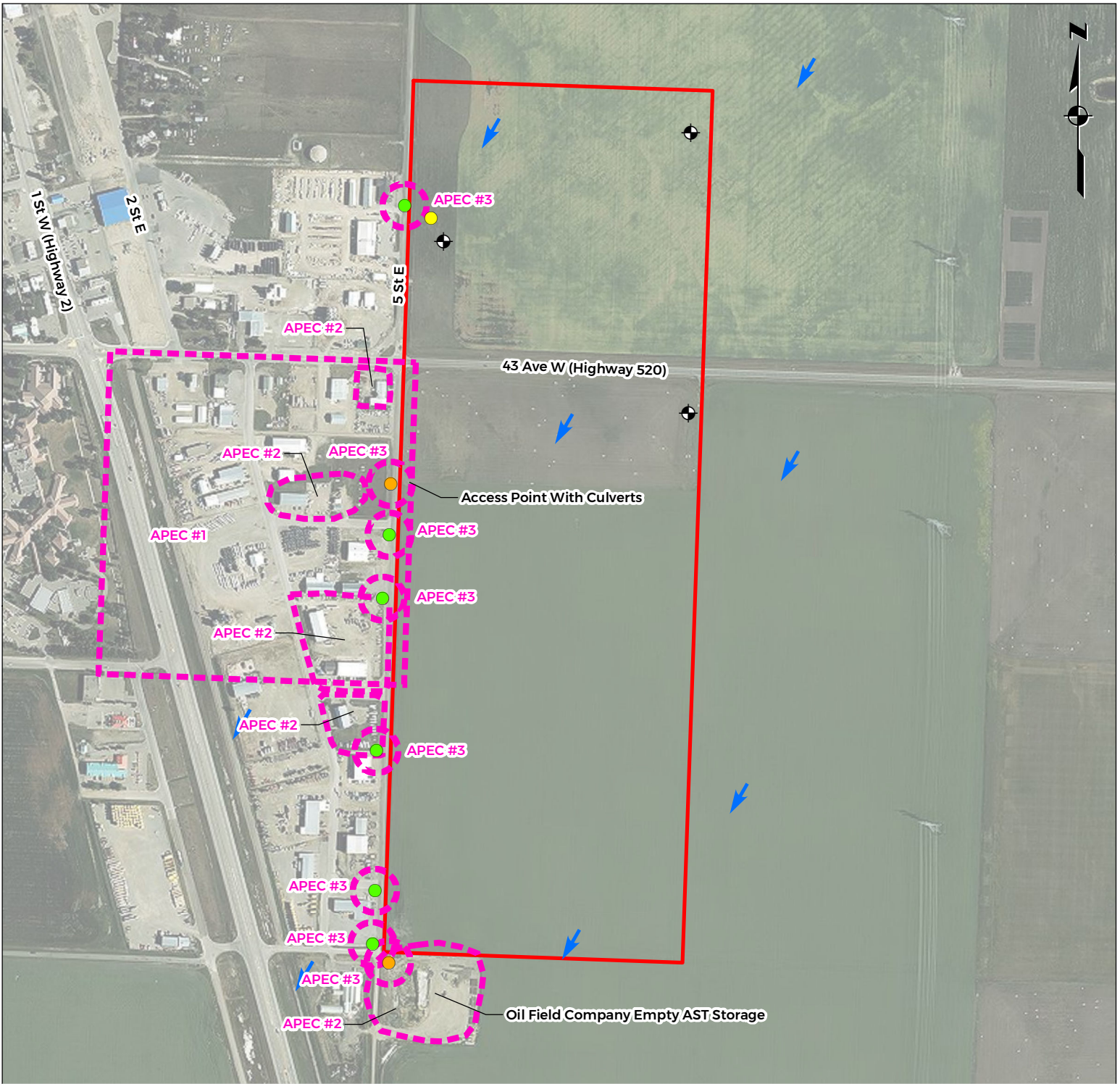
Property and Adjacent Area



Town of Claresholm
12&13-24-012-27 W4M
and 04-25-012-27 W4M



Report By: AA	WSP Job #: 181-07689-00	Figure Number 3 Sheet 3 of 4
Drawn by: JH	Date Drawn: July 4, 2018	
Reviewed By: DAZ	Inspection Date: June 28, 2018	
Report Name: 2018 Phase I Environmental Site Assessment		
Notes: Imagery Source: ESRI Imagery Service [2015]		



Legend

- Property Boundary
- Area of Potential Environmental Concern
- Pole-mounted Transformer
- Transformer
- Electric Service Box
- ⊕ Piezometer
- Inferred Groundwater Flow Direction

Note: APEC #3 is a 30m buffer around all transformers.

Areas of Potential Environmental Concern

	<p>Town of Claresholm 12&13-24-012-27 W4M and 04-25-012-27 W4M</p>	Report By: AA	WSP Job #: 181-07689-00	Figure Number 4 Sheet 4 of 4
	<p>Scale 1:7,500 0 75 150 225 300 375 Metres</p> <p style="font-size: 8px;">Universal Transverse Mercator (Zone 12) North American Datum (1983)</p>	Drawn by: JH	Date Drawn: July 4, 2018	
		Reviewed By: DAZ	Inspection Date: June 28, 2018	
	<p><i>Report Name: 2018 Phase I Environmental Site Assessment</i></p> <p style="font-size: 8px;"><i>Notes: Imagery Source: ESRI Imagery Service [2015]</i></p>			

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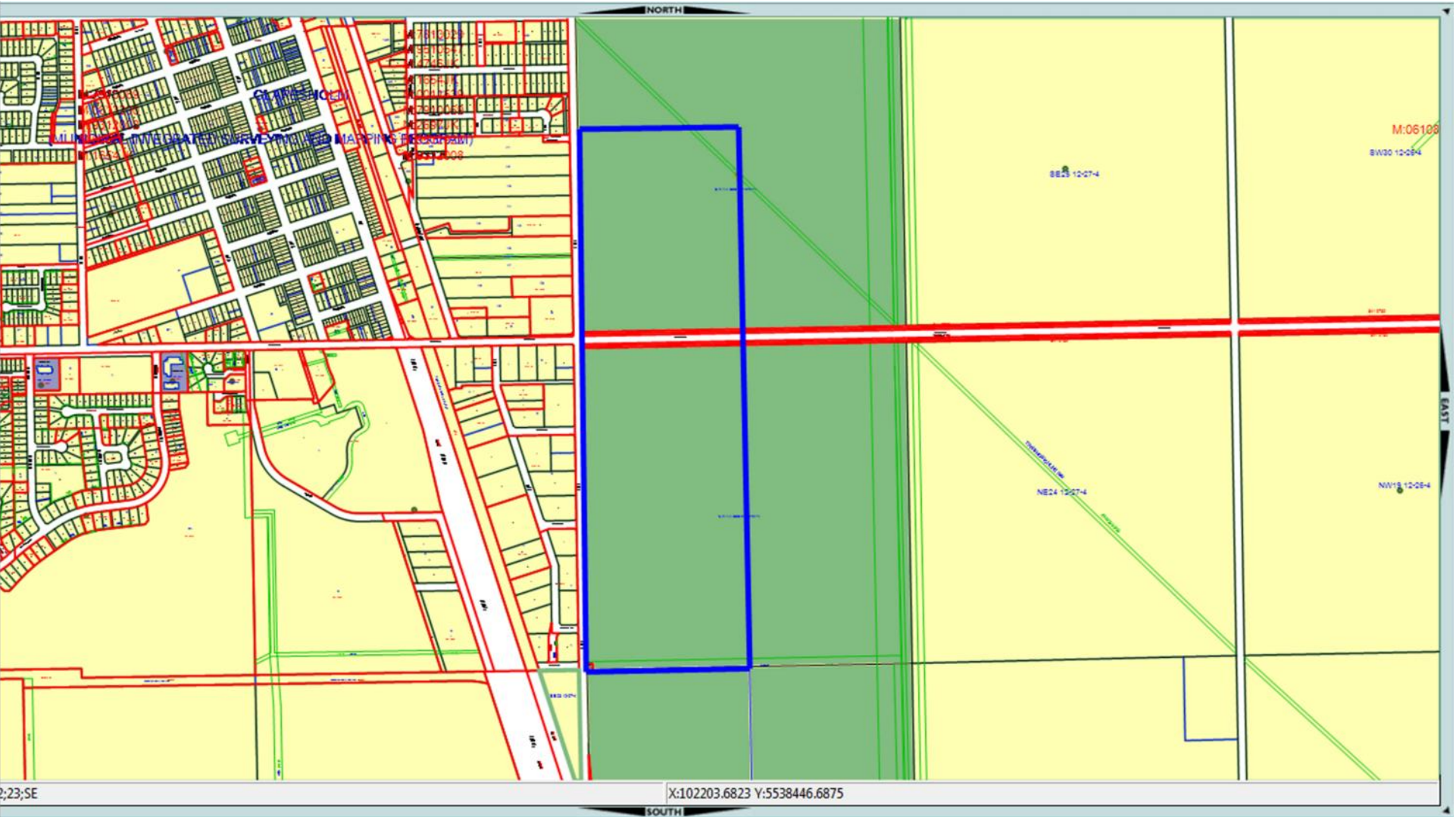
APPENDIX

A RECORDS REVIEW



APPENDIX

A-1 TITLES





HISTORICAL LAND TITLE CERTIFICATE
CURRENT TITLE WITH HISTORICAL DATA

S
LINC SHORT LEGAL TITLE NUMBER
0021 707 013 4;27;12;25;SW 041 430 594

LEGAL DESCRIPTION

MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 25
QUARTER SOUTH WEST
CONTAINING 64.7 HECTARES (160 ACRES) MORE OR LESS
EXCEPTING THOSE PORTIONS ON THE FOLLOWING LANDS

PLAN	NUMBER	HECTARES	ACRES MORE OR LESS
ROADWAY	2641GR		1.00

ALSO EXCEPTING THEREOUT

PLAN	NUMBER	HECTARES	ACRES MORE OR LESS
ROAD	8410732	0.406	1.00

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: TOWN OF CLARESHOLM

REFERENCE NUMBER: 041 177 144

REGISTERED OWNER(S)				
REGISTRATION	DATE (DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
041 430 594	12/11/2004	TRANSFER OF LAND		\$316,000

OWNERS

MAURY RUSSELL MCLEOD

AND

MARLA ARLENE MCLEOD

BOTH OF:

PO BOX 696

CLARESHOLM

ALBERTA T0L 0T0

AS JOINT TENANTS

ENCUMBRANCES, LIENS & INTERESTS

PAGE 2
041 430 594

REGISTRATION

NUMBER	DATE (D/M/Y)	PARTICULARS
2359EB .	20/10/1928	UTILITY RIGHT OF WAY GRANTEE - FORTISALBERTA INC. 320-17 AVE SW CALGARY ALBERTA T2S2V1 "TAKE THE PRIORITY OF CAVE 761094321, REGISTERED 26 07 1976 DATA UPDATED BY: TRANSFER OF UTRW NO. 1333FR" (DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY 021165379) (DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY 071353842)
4106EA .	28/11/1928	UTILITY RIGHT OF WAY GRANTEE - FORTISALBERTA INC. 320-17 AVE SW CALGARY ALBERTA T2S2V1 "W. 10 FT OF SECTION DATA UPDATED BY: TRANSFER OF UTRW NO. 1333FR" (DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY 001299361) (DATA UPDATED BY: CHANGE OF NAME 041479912)
781 037 564	14/03/1978	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. AS TO PORTION OR PLAN:7810235
901 119 660	11/05/1990	CAVEAT RE : RIGHT OF WAY AGREEMENT CAVEATOR - CANADIAN NATURAL RESOURCES LIMITED. BOX 6926, STATION "D" CALGARY ALBERTA T2P2G1 (DATA UPDATED BY: TRANSFER OF CAVEAT 931033708) (DATA UPDATED BY: CHANGE OF NAME 041404051)
931 033 708	12/02/1993	TRANSFER OF CAVEAT 901119660 TRANSFEREE - RANGER OIL LIMITED. 2700, 425-1 ST SW CAGLARY ALBERTA T2P3L8
931 200 185	18/08/1993	UTILITY RIGHT OF WAY GRANTEE - ALBERTA GOVERNMENT TELEPHONES. AS TO PORTION OR PLAN:9110847 TAKES PRIORITY OF CAVEAT 891085266

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

PAGE 3

041 430 594

REGISTRATION

NUMBER DATE (D/M/Y) PARTICULARS

REGISTERED 12/05/89

931 278 669 05/11/1993 CAVEAT
RE : RIGHT OF WAY AGREEMENT
CAVEATOR - AGT LIMITED.
BOX 2411
EDMONTON
ALBERTA T5J2S4
AGENT - TERRY M HENKELMAN

001 299 361 20/10/2000 TRANSFER OF UTILITY RIGHT OF WAY 4106EA.
TRANSFeree - UTILICORP NETWORKS CANADA (ALBERTA)
LTD.

021 165 379 14/05/2002 TRANSFER OF UTILITY RIGHT OF WAY 2359EB.
TRANSFeree - ALTALINK MANAGEMENT LTD.
ATTN: TRANSMISSION LAND DEPT
PO BOX 20, STATION M
CALGARY
ALBERTA T2P2G9

021 375 400 26/10/2002 MORTGAGE
MORTGAGEE - THE TORONTO DOMINION BANK.
156, 200-4 AVE S
LETHBRIDGE
ALBERTA T1J4C9
ORIGINAL PRINCIPAL AMOUNT: \$212,000

041 245 613 30/06/2004 CAVEAT
RE : PURCHASE AGREEMENT
CAVEATOR - MAURY MCLEOD
BOX 696
CLARESHOLM
ALBERTA T0L0T0
AGENT - TIMOTHY E PERRY

041 404 051 22/10/2004 CHANGE OF NAME
RE: CANADIAN NATURAL RESOURCES LIMITED.
BOX 6926, STATION "D"
CALGARY
ALBERTA T2P2G1
AFFECTS INSTRUMENT: 901119660

041 430 593 12/11/2004 CAVEAT
RE : VENDOR'S LIEN
CAVEATOR - RICHARD DOYLE MCPEAK
C/O NORTH & COMPANY
208 50 AVE WEST, PIO BOX 133
CLARESHOLM
ALBERTA T0L0T0

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

PAGE 4

041 430 594

REGISTRATION

NUMBER	DATE (D/M/Y)	PARTICULARS
		AGENT - TIMOTHY E PERRY
041 430 595	12/11/2004	MORTGAGE MORTGAGEE - AGRICULTURE FINANCIAL SERVICES CORPORATION. 4910 52 ST, BOX 5000 STN. MAIN CAMROSE ALBERTA T4V4E8 ORIGINAL PRINCIPAL AMOUNT: \$252,000
041 430 596	12/11/2004	MERGER OF CAVEAT 041245613
041 471 824	13/12/2004	DISCHARGE OF MORTGAGE 021375400
041 471 825	13/12/2004	DISCHARGE OF CAVEAT 041430593
041 479 912	20/12/2004	CHANGE OF NAME RE: FORTISALBERTA INC. 320-17 AVE SW CALGARY ALBERTA T2S2V1 AFFECTS INSTRUMENT: 4106EA .
061 047 075	31/01/2006	MORTGAGE MORTGAGEE - AGRICULTURE FINANCIAL SERVICES CORPORATION. 4910 52 ST, BOX 5000 STN. MAIN CAMROSE ALBERTA T4V4E8 ORIGINAL PRINCIPAL AMOUNT: \$248,000
071 353 842	16/07/2007	TRANSFER OF UTILITY RIGHT OF WAY 2359EB. TRANSFeree - FORTISALBERTA INC. 320-17 AVE SW CALGARY ALBERTA T2S2V1
101 369 049	21/12/2010	MORTGAGE MORTGAGEE - FARM CREDIT CANADA. 2ND FLOOR, 12040-149 STREET NW EDMONTON ALBERTA T5V1P2 ORIGINAL PRINCIPAL AMOUNT: \$600,000
111 033 851	09/02/2011	DISCHARGE OF MORTGAGE 041430595
111 033 852	09/02/2011	DISCHARGE OF MORTGAGE 061047075
141 101 683	01/05/2014	SURFACE RIGHTS BOARD ORDER IN FAVOUR OF - ALTALINK MANAGEMENT LTD.

(CONTINUED)

REGISTRATION

NUMBER DATE (D/M/Y) PARTICULARS

ORDER # 0374/2014

141 305 786 12/11/2014 MORTGAGE
MORTGAGEE - FARM CREDIT CANADA.
2 FL, 12040-149 ST NW
EDMONTON
ALBERTA T5V1P2
ORIGINAL PRINCIPAL AMOUNT: \$885,000

TOTAL INSTRUMENTS: 025

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN
ACCURATE REPRODUCTION OF THE CERTIFICATE OF
TITLE REPRESENTED HEREIN THIS 22 DAY OF JUNE,
2018 AT 11:57 A.M.

ORDER NUMBER: 35368230

CUSTOMER FILE NUMBER:



END OF CERTIFICATE

THIS ELECTRONICALLY TRANSMITTED LAND TITLES PRODUCT IS INTENDED
FOR THE SOLE USE OF THE ORIGINAL PURCHASER, AND NONE OTHER,
SUBJECT TO WHAT IS SET OUT IN THE PARAGRAPH BELOW.

THE ABOVE PROVISIONS DO NOT PROHIBIT THE ORIGINAL PURCHASER FROM
INCLUDING THIS UNMODIFIED PRODUCT IN ANY REPORT, OPINION,
APPRAISAL OR OTHER ADVICE PREPARED BY THE ORIGINAL PURCHASER AS
PART OF THE ORIGINAL PURCHASER APPLYING PROFESSIONAL, CONSULTING
OR TECHNICAL EXPERTISE FOR THE BENEFIT OF CLIENT(S).

ENCUMBRANCES, LIENS & INTERESTS

PAGE 2

041 177 144

REGISTRATION

NUMBER	DATE (D/M/Y)	PARTICULARS
2359EB .	20/10/1928	UTILITY RIGHT OF WAY GRANTEE - ALTALINK MANAGEMENT LTD. ATTN: TRANSMISSION LAND DEPT PO BOX 20, STATION M CALGARY ALBERTA T2P2G9 "TAKES THE PRIORITY OF CAVE 761094321, REGISTERED 26 07 1976 DATA UPDATED BY: TRANSFER OF UTRW NO. 1333FR" (DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY 021165379)
4106EA .	28/11/1928	UTILITY RIGHT OF WAY GRANTEE - UTILICORP NETWORKS CANADA (ALBERTA) LTD. "W. 10 FT OF SECTION DATA UPDATED BY: TRANSFER OF UTRW NO. 1333FR" (DATA UPDATED BY: TRANSFER OF UTILITY RIGHT OF WAY 001299361)
781 037 564	14/03/1978	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. AS TO PORTION OR PLAN:7810235
901 119 660	11/05/1990	CAVEAT RE : RIGHT OF WAY AGREEMENT CAVEATOR - CANADIAN NATURAL RESOURCES LIMITED. BOX 6926, STATION "D" CALGARY ALBERTA T2P2G1 (DATA UPDATED BY: TRANSFER OF CAVEAT 931033708) (DATA UPDATED BY: CHANGE OF NAME 041404051)
931 033 708	12/02/1993	TRANSFER OF CAVEAT 901119660 TRANSFeree - RANGER OIL LIMITED. 2700, 425-1 ST SW CAGLARY ALBERTA T2P3L8
931 200 185	18/08/1993	UTILITY RIGHT OF WAY GRANTEE - ALBERTA GOVERNMENT TELEPHONES. AS TO PORTION OR PLAN:9110847 TAKES PRIORITY OF CAVEAT 891085266 REGISTERED 12/05/89
931 278 669	05/11/1993	CAVEAT RE : RIGHT OF WAY AGREEMENT CAVEATOR - AGT LIMITED.

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

PAGE 3

041 177 144

REGISTRATION

NUMBER	DATE (D/M/Y)	PARTICULARS
		BOX 2411 EDMONTON ALBERTA T5J2S4 AGENT - TERRY M HENKELMAN
001 299 361	20/10/2000	TRANSFER OF UTILITY RIGHT OF WAY 4106EA. TRANSFeree - UTILICORP NETWORKS CANADA (ALBERTA) LTD.
021 165 379	14/05/2002	TRANSFER OF UTILITY RIGHT OF WAY 2359EB. TRANSFeree - ALTALINK MANAGEMENT LTD. ATTN: TRANSMISSION LAND DEPT PO BOX 20, STATION M CALGARY ALBERTA T2P2G9
021 375 400	26/10/2002	MORTGAGE MORTGAGEE - THE TORONTO DOMINION BANK. 156, 200-4 AVE S LETHBRIDGE ALBERTA T1J4C9 ORIGINAL PRINCIPAL AMOUNT: \$212,000
041 245 613	30/06/2004	CAVEAT RE : PURCHASE AGREEMENT CAVEATOR - MAURY MCLEOD BOX 696 CLARESHOLM ALBERTA T0L0T0 AGENT - TIMOTHY E PERRY
041 404 051	22/10/2004	CHANGE OF NAME RE: CANADIAN NATURAL RESOURCES LIMITED. BOX 6926, STATION "D" CALGARY ALBERTA T2P2G1 AFFECTS INSTRUMENT: 901119660
041 430 593	12/11/2004	CAVEAT RE : VENDOR'S LIEN CAVEATOR - RICHARD DOYLE MCPEAK C/O NORTH & COMPANY 208 50 AVE WEST, PIO BOX 133 CLARESHOLM ALBERTA T0L0T0 AGENT - TIMOTHY E PERRY
041 430 594	12/11/2004	TRANSFER OF LAND OWNERS - MAURY RUSSELL MCLEOD OWNERS - MARLA ARLENE MCLEOD (CONTINUED)

REGISTRATION

NUMBER DATE (D/M/Y) PARTICULARS

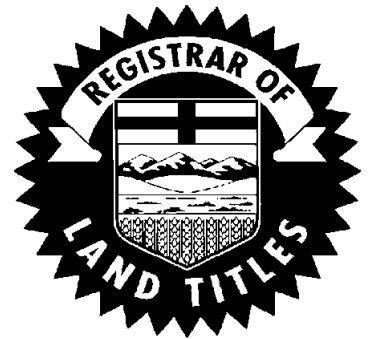
BOTH OF:
PO BOX 696
CLARESHOLM
ALBERTA T0L0T0
AS JOINT TENANTS
NEW TITLE ISSUED

TOTAL INSTRUMENTS: 014

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN
ACCURATE REPRODUCTION OF THE CERTIFICATE OF
TITLE REPRESENTED HEREIN THIS 22 DAY OF JUNE,
2018 AT 11:57 A.M.

ORDER NUMBER: 35368230

CUSTOMER FILE NUMBER:



END OF CERTIFICATE

THIS ELECTRONICALLY TRANSMITTED LAND TITLES PRODUCT IS INTENDED
FOR THE SOLE USE OF THE ORIGINAL PURCHASER, AND NONE OTHER,
SUBJECT TO WHAT IS SET OUT IN THE PARAGRAPH BELOW.

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PART OF THE ORIGINAL PURCHASER APPLYING PROFESSIONAL, CONSULTING
OR TECHNICAL EXPERTISE FOR THE BENEFIT OF CLIENT(S) .



HISTORICAL LAND TITLE CERTIFICATE
TITLE CANCELLED ON SEPTEMBER 14, 1992

S	LINC	SHORT LEGAL	TITLE NUMBER
	0021 706 999	4;27;12;25;NW	781 094 315
	0021 707 005	4;27;12;25;NE	
	0021 707 013	4;27;12;25;SW	
	0021 707 021	4;27;12;25;SE	

LEGAL DESCRIPTION

FIRST

MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 25

QUARTER NORTH WEST

CONTAINING 64.7 HECTARES (160 ACRES) MORE OR LESS

EXCEPTING THOSE PORTIONS ON THE FOLLOWING PLANS:

PLAN	NUMBER	ACRES MORE OR LESS
PARCEL A	6074HA	10.00
THE REGULATOR STATION SITE	7510394	0.52

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

SECOND

MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 25

QUARTER NORTH EAST

EXCEPTING THEREOUT ALL MINES AND MINERALS

AND THE RIGHT TO WORK THE SAME

AREA: 64.7 HECTARES (160 ACRES) MORE OR LESS

THIRD

MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 25

QUARTER SOUTH WEST

CONTAINING 64.7 HECTARES (160 ACRES) MORE OR LESS

EXCEPTING THOSE PORTIONS ON THE FOLLOWING LANDS

PLAN	NUMBER	HECTARES	ACRES MORE OR LESS
ROADWAY	2641GR		1.00

ALSO EXCEPTING THEREOUT

PLAN	NUMBER	HECTARES	ACRES MORE OR LESS
ROAD	8410732	0.406	1.00

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ENCUMBRANCES, LIENS & INTERESTS

PAGE 3

781 094 315

REGISTRATION

NUMBER	DATE (D/M/Y)	PARTICULARS
4106EA .	28/11/1928	UTILITY RIGHT OF WAY GRANTEE - CALGARY POWER LTD. "W. 10 FT OF SECTION DATA UPDATED BY: TRANSFER OF UTRW NO. 1333FR"
1532FD .	27/01/1942	UTILITY RIGHT OF WAY GRANTEE - CALGARY POWER LTD. AFFECTED LAND: 4;27;12;25;NW "DATA UPDATED BY: TRANSFER OF UTRW NO. 1333FR"
4246GD .	30/05/1950	MORTGAGE OF UTILITY RIGHT OF WAY MORTGAGEE - MONTREAL TRUST COMPANY. AFFECTS INSTRUMENT: 4106EA . AFFECTS INSTRUMENT: 1532FD . AFFECTS INSTRUMENT: 2359EB .
741 074 824	01/08/1974	UTILITY RIGHT OF WAY GRANTEE - CALGARY POWER LTD. AFFECTED LAND: 4;27;12;25;NW "N. 130 FT. OF W. 130 FT"
741 088 583	20/09/1974	UTILITY RIGHT OF WAY GRANTEE - CALGARY POWER LTD. AFFECTED LAND: 4;27;12;25;NW 4;27;12;25;NE "30 FT. STRIP"
751 003 810	15/01/1975	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. AFFECTED LAND: 4;27;12;25;NW "20 FT. STRIP"
751 052 010	30/05/1975	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. "30 FT. STRIP R/W ON PLAN 7510394 & 30 FT. STRIP"
781 037 564	14/03/1978	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. AS TO PORTION OR PLAN:7810235
801 007 897	17/01/1980	MORTGAGE OF UTILITY RIGHT OF WAY MORTGAGEE - MONTREAL TRUST COMPANY. AFFECTS INSTRUMENT: 751003810 AFFECTS INSTRUMENT: 751052010 AFFECTS INSTRUMENT: 781037564
821 137 892	09/08/1982	UTILITY RIGHT OF WAY

(CONTINUED)

REGISTRATION

NUMBER DATE (D/M/Y) PARTICULARS
-----GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY
LIMITED.

AFFECTED LAND: 4;27;12;25;NW

891 085 266 12/05/1989 CAVEAT

RE : RIGHT OF WAY AGREEMENT

CAVEATOR - ALBERTA GOVERNMENT TELEPHONES.

P.O. BOX 2411, EDMONTON

ALBERTA T5J2S4

AGENT - MERVIN L HENKLEMAN

901 119 660 11/05/1990 CAVEAT

RE : RIGHT OF WAY AGREEMENT

CAVEATOR - MLC OIL AND GAS LTD.

2600, 800-6 AVE SW

CALGARY

ALBERTA T2P3W2

AGENT - ROSANNA PRESTIA

921 227 697 14/09/1992 SUBDIVISION PLAN 9211776

AFFECTED LAND: 4;27;12;25;NW CANCELLED AS TO
PART

NEW TITLE ISSUED FOR THE REMAINDER

TOTAL INSTRUMENTS: 014

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN
ACCURATE REPRODUCTION OF THE CERTIFICATE OF
TITLE REPRESENTED HEREIN THIS 22 DAY OF JUNE,
2018 AT 11:57 A.M.

ORDER NUMBER: 35368230

CUSTOMER FILE NUMBER:



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OR TECHNICAL EXPERTISE FOR THE BENEFIT OF CLIENT(S).



HISTORICAL LAND TITLE CERTIFICATE

TITLE CANCELLED ON MAY 27, 1993

S	LINC	SHORT LEGAL	TITLE NUMBER
	0023 547 749	4;27;12;25;NW	921 227 697 +1
	0021 707 005	4;27;12;25;NE	
	0021 707 013	4;27;12;25;SW	
	0021 707 021	4;27;12;25;SE	

LEGAL DESCRIPTION

FIRST
MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 25
QUARTER NORTH WEST
CONTAINING 64.7 HECTARES (160 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

PLAN	NUMBER	HECTARES	ACRES
PARCEL A	6074HA		10.00
THE REGULATOR STATION SITE	7510394		0.52
SUBDIVISION	9211776	3.54	8.75

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

SECOND
MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 25
QUARTER NORTH EAST
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME
AREA: 64.7 HECTARES (160 ACRES) MORE OR LESS

THIRD
MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 25
QUARTER SOUTH WEST
CONTAINING 64.7 HECTARES (160 ACRES) MORE OR LESS
EXCEPTING THOSE PORTIONS ON THE FOLLOWING LANDS

PLAN	NUMBER	HECTARES	ACRES MORE OR LESS
ROADWAY	2641GR		1.00

ALSO EXCEPTING THEREOUT

PLAN	NUMBER	HECTARES	ACRES MORE OR LESS
ROAD	8410732	0.406	1.00

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

FOURTH
MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 25
QUARTER SOUTH EAST
CONTAINING 64.7 HECTARES (160 ACRES) MORE OR LESS
EXCEPTING THEREOUT THOSE PORTIONS ON THE FOLLOWING PLANS

PLAN	NUMBER	HECTARES	ACRES MORE OR LESS
ROADWAY	2641GR		1.00

ALSO EXCEPTING THEREOUT

PLAN	NUMBER	HECTARES	ACRES MORE OR LESS
ROAD	8410732	0.406	1.00

EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK THE SAME

ESTATE: FEE SIMPLE

MUNICIPALITY: TOWN OF CLARESHOLM

REFERENCE NUMBER: 781 094 315

REGISTERED OWNER(S)
REGISTRATION DATE (DMY) DOCUMENT TYPE VALUE CONSIDERATION

921 227 697 14/09/1992 SUBDIVISION PLAN

OWNERS

LESTER ROY AMUNDSEN (PHYSICIAN)
OF P.O. BOX 268
BLAIRMORE
ALBERTA

AND

OWEN JENNINGS AMUNDSEN (FARMER)
OF P.O. BOX 3
CLARESHOLM
ALBERTA
EXECUTORS FOR ADOLPH AMUNDSEN

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION
NUMBER DATE (D/M/Y) PARTICULARS

2359EB . 20/10/1928 UTILITY RIGHT OF WAY
GRANTEE - CALGARY POWER LTD.
AFFECTED LAND: 4;27;12;25;SW
"TAKES THE PRIORITY OF CAVE 761094321, REGISTERED
26 07 1976 DATA UPDATED BY: TRANSFER OF UTRW NO.

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

PAGE 3

921 227 697 +1

REGISTRATION

NUMBER	DATE (D/M/Y)	PARTICULARS
		1333FR"
4106EA .	28/11/1928	UTILITY RIGHT OF WAY GRANTEE - CALGARY POWER LTD. "W. 10 FT OF SECTION DATA UPDATED BY: TRANSFER OF UTRW NO. 1333FR"
4246GD .	30/05/1950	MORTGAGE OF UTILITY RIGHT OF WAY MORTGAGEE - MONTREAL TRUST COMPANY. AFFECTS INSTRUMENT: 4106EA . AFFECTS INSTRUMENT: 2359EB .
741 074 824	01/08/1974	UTILITY RIGHT OF WAY GRANTEE - CALGARY POWER LTD. AFFECTED LAND: 4;27;12;25;NW "N. 130 FT. OF W. 130 FT"
741 088 583	20/09/1974	UTILITY RIGHT OF WAY GRANTEE - CALGARY POWER LTD. AFFECTED LAND: 4;27;12;25;NW 4;27;12;25;NE "30 FT. STRIP"
751 003 810	15/01/1975	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. AFFECTED LAND: 4;27;12;25;NW "20 FT. STRIP"
751 052 010	30/05/1975	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. "30 FT. STRIP R/W ON PLAN 7510394 & 30 FT. STRIP"
781 037 564	14/03/1978	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. AS TO PORTION OR PLAN:7810235
801 007 897	17/01/1980	MORTGAGE OF UTILITY RIGHT OF WAY MORTGAGEE - MONTREAL TRUST COMPANY. AFFECTS INSTRUMENT: 751003810 AFFECTS INSTRUMENT: 751052010 AFFECTS INSTRUMENT: 781037564
821 137 892	09/08/1982	UTILITY RIGHT OF WAY GRANTEE - CANADIAN WESTERN NATURAL GAS COMPANY LIMITED. AFFECTED LAND: 4;27;12;25;NW

(CONTINUED)

 ENCUMBRANCES, LIENS & INTERESTS

PAGE 4

921 227 697 +1

REGISTRATION

NUMBER	DATE (D/M/Y)	PARTICULARS
891 085 266	12/05/1989	CAVEAT RE : RIGHT OF WAY AGREEMENT CAVEATOR - ALBERTA GOVERNMENT TELEPHONES. P.O. BOX 2411, EDMONTON ALBERTA T5J2S4 AGENT - MERVIN L HENKLEMAN
901 119 660	11/05/1990	CAVEAT RE : RIGHT OF WAY AGREEMENT CAVEATOR - RANGER OIL LIMITED. 2700, 425 - 1 STREET, S.W. CALGARY ALBERTA T2P3L8 (DATA UPDATED BY: TRANSFER OF CAVEAT 931033708)
921 227 698	14/09/1992	REQUEST FOR RELEASE OF D.C.T. DCT ISSUED SURRENDERED BY 931119618
931 033 708	12/02/1993	TRANSFER OF CAVEAT 901119660 TO - RANGER OIL LIMITED. 2700, 425 - 1 STREET, S.W. CALGARY ALBERTA T2P3L8
931 119 618	27/05/1993	SEPARATION - LINCS NEW TITLE ISSUED AFFECTS INSTRUMENT: 751052010 AFFECTS INSTRUMENT: 781037564

TOTAL INSTRUMENTS: 015

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN
 ACCURATE REPRODUCTION OF THE CERTIFICATE OF
 TITLE REPRESENTED HEREIN THIS 22 DAY OF JUNE,
 2018 AT 11:57 A.M.

ORDER NUMBER: 35368230

CUSTOMER FILE NUMBER:



END OF CERTIFICATE

(CONTINUED)

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HISTORICAL LAND TITLE CERTIFICATE
CURRENT TITLE WITH HISTORICAL DATA

S	LINC	SHORT LEGAL	TITLE NUMBER
	0030 223 697	4;27;12;24;;4,5	131 095 301
	0035 334 382	4;27;12;24;;12,13	

LEGAL DESCRIPTION

FIRST

MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 24
LEGAL SUBDIVISIONS 4 AND 5 IN THE SOUTH WEST QUARTER
CONTAINING 32.4 HECTARES (80 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

PLAN	NUMBER	HECTARES	(ACRES)	MORE OR LESS
ROAD	9410195	2.90	7.15	
ROAD	0313338	1.13	2.79	

EXCEPTING THEREOUT ALL MINES AND MINERALS

SECOND

MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 24
LEGAL SUBDIVISION 12 AND 13 IN THE NORTH WEST QUARTER
CONTAINING 32.4 HECTARES (80 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

PLAN	NUMBER	HECTARES	(ACRES)	MORE OR LESS
ROAD	2641GR	0.202	0.50	
ROAD	8410732	0.203	0.50	
SUBDIVISION	1212346	0.023	0.06	

EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE

MUNICIPALITY: TOWN OF CLARESHOLM/MUNICIPAL DISTRICT OF WILLOW CREEK NO.26

REFERENCE NUMBER: 121 217 363 +1

REGISTERED OWNER(S)
REGISTRATION DATE (DMY) DOCUMENT TYPE VALUE CONSIDERATION

131 095 301	26/04/2013	TRANSFER OF LAND	\$650,000	\$650,000
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OWNERS

1584935 ALBERTA LTD.

OF BOX 1106
CLARESHOLM
ALBERTA T0L 0T0

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION

NUMBER	DATE (D/M/Y)	PARTICULARS
741 037 605	25/04/1974	UTILITY RIGHT OF WAY GRANTEE - ALBERTA GOVERNMENT TELEPHONES. AFFECTED LAND: 4;27;12;24;;4,5 "PORTION DESCRIBED"
931 202 326	19/08/1993	CAVEAT RE : SURFACE LEASE CAVEATOR - CANADIAN NATURAL RESOURCES LIMITED. BOX 6926, STATION "D" CALGARY ALBERTA T2P2G1 AGENT - M L HENKELMAN AFFECTED LAND: 4;27;12;24;;4,5 (DATA UPDATED BY: CHANGE OF NAME 041403047)
931 294 455	24/11/1993	UTILITY RIGHT OF WAY GRANTEE - CANADIAN NATURAL RESOURCES LIMITED. BOX 6926, STATION "D" CALGARY ALBERTA T2P2G1 AFFECTED LAND: 4;27;12;24;;4,5 (DATA UPDATED BY: CHANGE OF NAME 041404101)
941 150 575	09/06/1994	DISCHARGE OF UTILITY RIGHT OF WAY 931294455 PARTIAL EXCEPT PLAN/PORTION: 9410279
041 403 047	22/10/2004	CHANGE OF NAME RE: CANADIAN NATURAL RESOURCES LIMITED. BOX 6926, STATION "D" CALGARY ALBERTA T2P2G1 AFFECTS INSTRUMENT: 931202326 AFFECTED PARTY: RANGER OIL LIMITED
041 404 101	22/10/2004	CHANGE OF NAME RE: CANADIAN NATURAL RESOURCES LIMITED. BOX 6926, STATION "D" CALGARY ALBERTA T2P2G1 AFFECTS INSTRUMENT: 931294455

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

PAGE 3
131 095 301

REGISTRATION

NUMBER DATE (D/M/Y) PARTICULARS

051 215 498 17/06/2005 CAVEAT
RE : SURFACE LEASE UNDER 20 ACRES
CAVEATOR - APACHE CANADA LTD.
1000, 700-9 AVE SW
CALGARY
ALBERTA T2P3V4
AGENT - BREANNE HALLIDAY
AFFECTED LAND: 4;27;12;24;;4,5

111 282 110 31/10/2011 UTILITY RIGHT OF WAY
GRANTEE - THE MUNICIPAL DISTRICT OF WILLOW CREEK
NO. 26.
GRANTEE - THE TOWN OF GRANUM.
AFFECTED LAND: 4;27;12;24;;12,13
AS TO PORTION OR PLAN:1113113

131 086 201 17/04/2013 CAVEAT
RE : VENDOR'S LIEN
CAVEATOR - CHERYL LYNN MARKLE
CAVEATOR - MARGARET MARKLE
BOTH OF:
C/O NORTH & COMPANY LLP
PO BOX 1300
CLARESHOLM
ALBERTA T0L0T0
AGENT - ANITA I WAHL

131 115 513 21/05/2013 DISCHARGE OF CAVEAT 051215498

131 138 722 12/06/2013 DISCHARGE OF CAVEAT 131086201

TOTAL INSTRUMENTS: 011

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TITLE REPRESENTED HEREIN THIS 22 DAY OF JUNE,
2018 AT 11:57 A.M.

ORDER NUMBER: 35368230

CUSTOMER FILE NUMBER:



END OF CERTIFICATE

(CONTINUED)

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HISTORICAL LAND TITLE CERTIFICATE
TITLE CANCELLED ON JANUARY 31, 1994

S	LINC	SHORT LEGAL	TITLE NUMBER
	0021 723 721	4;27;12;24;;4,5	931 169 806
	0021 723 739	4;27;12;24;;12,13	

LEGAL DESCRIPTION

FIRST

MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 24

LEGAL SUBDIVISIONS 4 AND 5 IN THE SOUTH WEST QUARTER
CONTAINING 32.4 HECTARES (80 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

FIRST:

PLAN	NUMBER	HECTARES	ACRES (MORE OR LESS)
RAILWAY R/W	RY8	1.13	2.79 (L.S.D. 4)

SECONDLY:

OUT OF LEGAL SUBDIVISION 4, THAT PORTION WHICH LIES TO THE
SOUTH WEST OF THE RAILWAY RIGHT OF WAY AS SHOWN ON PLAN RY8
CONTAINING 1.21 HECTARES (3 ACRES) MORE OR LESS
EXCEPTING THEREOUT ALL MINES AND MINERALS

SECOND

MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 24

LEGAL SUBDIVISION 12 AND 13 IN THE NORTH WEST QUARTER
CONTAINING 32.4 HECTARES (80 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

PLAN	NUMBER	HECTARES	ACRES (MORE OR LESS)
ROADWAY	2641GR	0.202	0.50 (L.S.D. 13)
ROAD	8410732	0.203	0.50 (L.S.D. 13)

EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE

MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26

REFERENCE NUMBER: 891 105 688

REGISTERED OWNER(S)				
REGISTRATION	DATE (DMY)	DOCUMENT TYPE	VALUE	CONSIDERATION
931 169 806	19/07/1993	TRANSFER OF LAND	\$28,000	\$28,000

OWNERS

GEORGE MARKLE
OF P.O. BOX 1501
CLARESHOLM
ALBERTA T0L 0T0
AS TO AN UNDIVIDED 1/2 INTEREST

MARGARET MARKLE
OF P.O. BOX 1501
CLARESHOLM
ALBERTA T0L 0T0
AS TO AN UNDIVIDED 1/2 INTEREST

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION

NUMBER	DATE (D/M/Y)	PARTICULARS
741 037 605	25/04/1974	UTILITY RIGHT OF WAY GRANTEE - ALBERTA GOVERNMENT TELEPHONES. AFFECTED LAND: 4;27;12;24;;4,5 "PORTION DESCRIBED"
891 122 472	28/06/1989	CAVEAT RE : PUBLIC ROAD WORK CAVEATOR - THE MINISTER OF TRANSPORTATION AND UTILITIES. DIRECTOR, PROPERTY SERVICES, TWIN ATRIA BUILDING MAIN FLOOR, 4999-98 AVENUE, EDMONTON ALBERTA T6B2X3 AGENT - PETER J W ROCHE
901 144 994	06/06/1990	CAVEAT RE : PUBLIC ROAD WORK CAVEATOR - THE MINISTER OF TRANSPORTATION AND UTILITIES. TWIN ATRIA BUILDING, MAIN FLOOR, 4999 - 98 AVENUE EDMONTON ALBERTA T6B2X3 AGENT - PETER J W ROCHE
931 169 807	19/07/1993	REQUEST FOR RELEASE OF D.C.T.
931 202 326	19/08/1993	CAVEAT RE : SURFACE LEASE CAVEATOR - RANGER OIL LIMITED. 2700, 425-1ST, S.W., CALGARY ALBERTA T2P3L8 AGENT - M L HENKELMAN

(CONTINUED)



HISTORICAL LAND TITLE CERTIFICATE
TITLE CANCELLED ON NOVEMBER 28,2003

S	LINC	SHORT LEGAL	TITLE NUMBER
	0025 898 388	4;27;12;24;;4,5	991 363 466
	0021 723 739	4;27;12;24;;12,13	

LEGAL DESCRIPTION

FIRST

MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 24
LEGAL SUBDIVISIONS 4 AND 5 IN THE SOUTH WEST QUARTER
CONTAINING 32.4 HECTARES (80 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

FIRST:

PLAN	NUMBER	HECTARES	ACRES (MORE OR LESS)
RAILWAY R/W	RY8	1.13	2.79 (L.S.D. 4)
ROAD	9410195	2.90	7.15 (L.S.D. 4 AND 5)

EXCEPTING THEREOUT ALL MINES AND MINERALS

SECOND

MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 24
LEGAL SUBDIVISION 12 AND 13 IN THE NORTH WEST QUARTER
CONTAINING 32.4 HECTARES (80 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

PLAN	NUMBER	HECTARES	ACRES (MORE OR LESS)
ROADWAY	2641GR	0.202	0.50 (L.S.D. 13)
ROAD	8410732	0.203	0.50 (L.S.D. 13)

EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE

MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26

REFERENCE NUMBER: 941 027 235 +10

REGISTERED OWNER(S)
REGISTRATION DATE (DMY) DOCUMENT TYPE VALUE CONSIDERATION

991 363 466 10/12/1999 TRANSMISSION OF
LAND

OWNERS

CHERYL LYNN MARKLE
OF BOX 1501
CLARESHOLM
ALBERTA T0L 0T0
EXECUTRIX FOR GEORGE MARKLE
AS TO AN UNDIVIDED 1/2 INTEREST

MARGARET MARKLE
OF BOX 1501
CLARESHOLM
ALBERTA T0L 0T0
AS TO AN UNDIVIDED 1/2 INTEREST

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION

NUMBER	DATE (D/M/Y)	PARTICULARS
741 037 605	25/04/1974	UTILITY RIGHT OF WAY GRANTEE - ALBERTA GOVERNMENT TELEPHONES. AFFECTED LAND: 4;27;12;24;;4,5 "PORTION DESCRIBED"
891 122 472	28/06/1989	CAVEAT RE : PUBLIC ROAD WORK CAVEATOR - THE MINISTER OF TRANSPORTATION AND UTILITIES. DIRECTOR, PROPERTY SERVICES, TWIN ATRIA BUILDING MAIN FLOOR,4999-98 AVENUE, EDMONTON ALBERTA T6B2X3 AGENT - PETER J W ROCHE AFFECTED LAND: 4;27;12;24;;4,5 4;27;12;24;;12,13
901 144 994	06/06/1990	CAVEAT RE : PUBLIC ROAD WORK CAVEATOR - THE MINISTER OF TRANSPORTATION AND UTILITIES. TWIN ATRIA BUILDING, MAIN FLOOR, 4999 - 98 AVENUE EDMONTON ALBERTA T6B2X3 AGENT - PETER J W ROCHE AFFECTED LAND: 4;27;12;24;;4,5 4;27;12;24;;12,13
931 202 326	19/08/1993	CAVEAT RE : SURFACE LEASE CAVEATOR - RANGER OIL LIMITED. 2700, 425-1ST, S.W., CALGARY ALBERTA T2P3L8 AGENT - M L HENKELMAN

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

PAGE 3
991 363 466

REGISTRATION

NUMBER DATE (D/M/Y) PARTICULARS

AFFECTED LAND: 4;27;12;24;;4,5

931 294 455 24/11/1993 UTILITY RIGHT OF WAY
GRANTEE - RANGER OIL LIMITED.
AFFECTED LAND: 4;27;12;24;;4,5

941 027 286 31/01/1994 DISCHARGE OF CAVEAT 891122472
AND CAVEAT 901144994
AFFECTED LAND: 4;27;12;24;;4,5

941 150 575 09/06/1994 DISCHARGE OF UTILITY RIGHT OF WAY 931294455
PARTIAL
EXCEPT PLAN/PORTION: 9410279

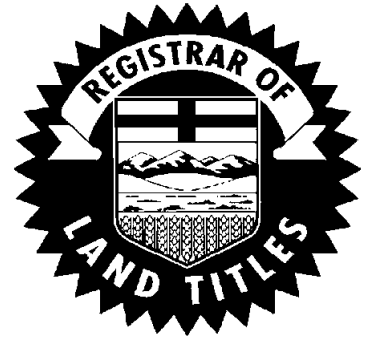
031 414 613 28/11/2003 ROAD PLAN 0313338
AFFECTED LAND: 4;27;12;24;;4,5 CANCELLED AS
TO PART
NEW TITLE ISSUED FOR THE REMAINDER

TOTAL INSTRUMENTS: 008

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN
ACCURATE REPRODUCTION OF THE CERTIFICATE OF
TITLE REPRESENTED HEREIN THIS 22 DAY OF JUNE,
2018 AT 11:57 A.M.

ORDER NUMBER: 35368230

CUSTOMER FILE NUMBER:



END OF CERTIFICATE

THIS ELECTRONICALLY TRANSMITTED LAND TITLES PRODUCT IS INTENDED
FOR THE SOLE USE OF THE ORIGINAL PURCHASER, AND NONE OTHER,
SUBJECT TO WHAT IS SET OUT IN THE PARAGRAPH BELOW.

THE ABOVE PROVISIONS DO NOT PROHIBIT THE ORIGINAL PURCHASER FROM
INCLUDING THIS UNMODIFIED PRODUCT IN ANY REPORT, OPINION,
APPRAISAL OR OTHER ADVICE PREPARED BY THE ORIGINAL PURCHASER AS
PART OF THE ORIGINAL PURCHASER APPLYING PROFESSIONAL, CONSULTING
OR TECHNICAL EXPERTISE FOR THE BENEFIT OF CLIENT(S).



HISTORICAL LAND TITLE CERTIFICATE
TITLE CANCELLED ON APRIL 26, 2013

S	LINC	SHORT LEGAL	TITLE NUMBER
	0030 223 697	4;27;12;24;;4,5	121 217 363 +1
	0035 334 382	4;27;12;24;;12,13	

LEGAL DESCRIPTION

FIRST

MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 24
LEGAL SUBDIVISIONS 4 AND 5 IN THE SOUTH WEST QUARTER
CONTAINING 32.4 HECTARES (80 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

PLAN	NUMBER	HECTARES	(ACRES)	MORE OR LESS
ROAD	9410195	2.90	7.15	
ROAD	0313338	1.13	2.79	

EXCEPTING THEREOUT ALL MINES AND MINERALS

SECOND

MERIDIAN 4 RANGE 27 TOWNSHIP 12
SECTION 24
LEGAL SUBDIVISION 12 AND 13 IN THE NORTH WEST QUARTER
CONTAINING 32.4 HECTARES (80 ACRES) MORE OR LESS
EXCEPTING THEREOUT:

PLAN	NUMBER	HECTARES	(ACRES)	MORE OR LESS
ROAD	2641GR	0.202	0.50	
ROAD	8410732	0.203	0.50	
SUBDIVISION	1212346	0.023	0.06	

EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE

MUNICIPALITY: TOWN OF CLARESHOLM/MUNICIPAL DISTRICT OF WILLOW CREEK NO.26

REFERENCE NUMBER: 041 072 639

REGISTERED OWNER(S)
REGISTRATION DATE (DMY) DOCUMENT TYPE VALUE CONSIDERATION

121 217 363 23/08/2012 SUBDIVISION PLAN

OWNERS

CHERYL LYNN MARKLE

OF P.O. BOX 1501
CLARESHOLM
ALBERTA T0L 0T0
AS TO AN UNDIVIDED 1/2 INTEREST

MARGARET MARKLE
OF P.O. BOX 1501
CLARESHOLM
ALBERTA T0L 0T0
AS TO AN UNDIVIDED 1/2 INTEREST

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION

NUMBER	DATE (D/M/Y)	PARTICULARS
741 037 605	25/04/1974	UTILITY RIGHT OF WAY GRANTEE - ALBERTA GOVERNMENT TELEPHONES. AFFECTED LAND: 4;27;12;24;;4,5 "PORTION DESCRIBED"
931 202 326	19/08/1993	CAVEAT RE : SURFACE LEASE CAVEATOR - CANADIAN NATURAL RESOURCES LIMITED. BOX 6926, STATION "D" CALGARY ALBERTA T2P2G1 AGENT - M L HENKELMAN AFFECTED LAND: 4;27;12;24;;4,5 (DATA UPDATED BY: CHANGE OF NAME 041403047)
931 294 455	24/11/1993	UTILITY RIGHT OF WAY GRANTEE - CANADIAN NATURAL RESOURCES LIMITED. BOX 6926, STATION "D" CALGARY ALBERTA T2P2G1 AFFECTED LAND: 4;27;12;24;;4,5 (DATA UPDATED BY: CHANGE OF NAME 041404101)
941 150 575	09/06/1994	DISCHARGE OF UTILITY RIGHT OF WAY 931294455 PARTIAL EXCEPT PLAN/PORTION: 9410279
041 403 047	22/10/2004	CHANGE OF NAME RE: CANADIAN NATURAL RESOURCES LIMITED. BOX 6926, STATION "D" CALGARY ALBERTA T2P2G1 AFFECTS INSTRUMENT: 931202326 AFFECTED PARTY: RANGER OIL LIMITED

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

PAGE 3

121 217 363 +1

REGISTRATION

NUMBER	DATE (D/M/Y)	PARTICULARS
041 404 101	22/10/2004	CHANGE OF NAME RE: CANADIAN NATURAL RESOURCES LIMITED. BOX 6926, STATION "D" CALGARY ALBERTA T2P2G1 AFFECTS INSTRUMENT: 931294455
051 215 498	17/06/2005	CAVEAT RE : SURFACE LEASE UNDER 20 ACRES CAVEATOR - APACHE CANADA LTD. 1000, 700-9 AVE SW CALGARY ALBERTA T2P3V4 AGENT - BREANNE HALLIDAY AFFECTED LAND: 4;27;12;24;;4,5
111 282 110	31/10/2011	UTILITY RIGHT OF WAY GRANTEE - THE MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26. GRANTEE - THE TOWN OF GRANUM. AFFECTED LAND: 4;27;12;24;;12,13 AS TO PORTION OR PLAN:1113113
131 086 201	17/04/2013	CAVEAT RE : VENDOR'S LIEN CAVEATOR - CHERYL LYNN MARKLE CAVEATOR - MARGARET MARKLE BOTH OF: C/O NORTH & COMPANY LLP PO BOX 1300 CLARESHOLM ALBERTA T0L0T0 AGENT - ANITA I WAHL
131 095 301	26/04/2013	TRANSFER OF LAND OWNERS - 1584935 ALBERTA LTD. BOX 1106 CLARESHOLM ALBERTA T0L0T0 NEW TITLE ISSUED

TOTAL INSTRUMENTS: 010

(CONTINUED)

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN
ACCURATE REPRODUCTION OF THE CERTIFICATE OF
TITLE REPRESENTED HEREIN THIS 22 DAY OF JUNE,
2018 AT 11:57 A.M.

ORDER NUMBER: 35368230

CUSTOMER FILE NUMBER:



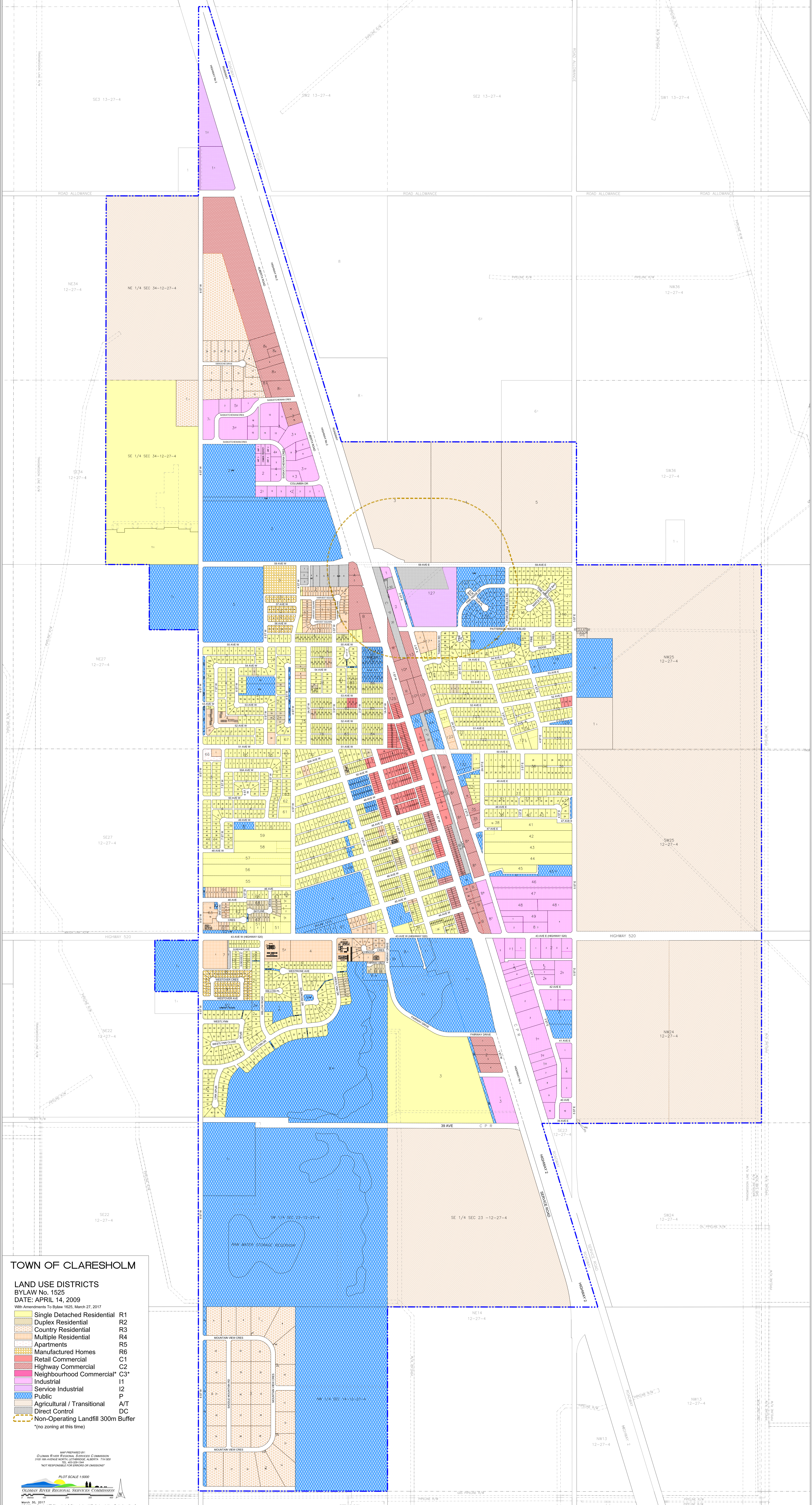
END OF CERTIFICATE

THIS ELECTRONICALLY TRANSMITTED LAND TITLES PRODUCT IS INTENDED
FOR THE SOLE USE OF THE ORIGINAL PURCHASER, AND NONE OTHER,
SUBJECT TO WHAT IS SET OUT IN THE PARAGRAPH BELOW.

THE ABOVE PROVISIONS DO NOT PROHIBIT THE ORIGINAL PURCHASER FROM
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APPRAISAL OR OTHER ADVICE PREPARED BY THE ORIGINAL PURCHASER AS
PART OF THE ORIGINAL PURCHASER APPLYING PROFESSIONAL, CONSULTING
OR TECHNICAL EXPERTISE FOR THE BENEFIT OF CLIENT(S).

APPENDIX

A-2 *BYLAW AND LAND ZONING*



TOWN OF CLARESHOLM

LAND USE DISTRICTS
 BYLAW No. 1525
 DATE: APRIL 14, 2009

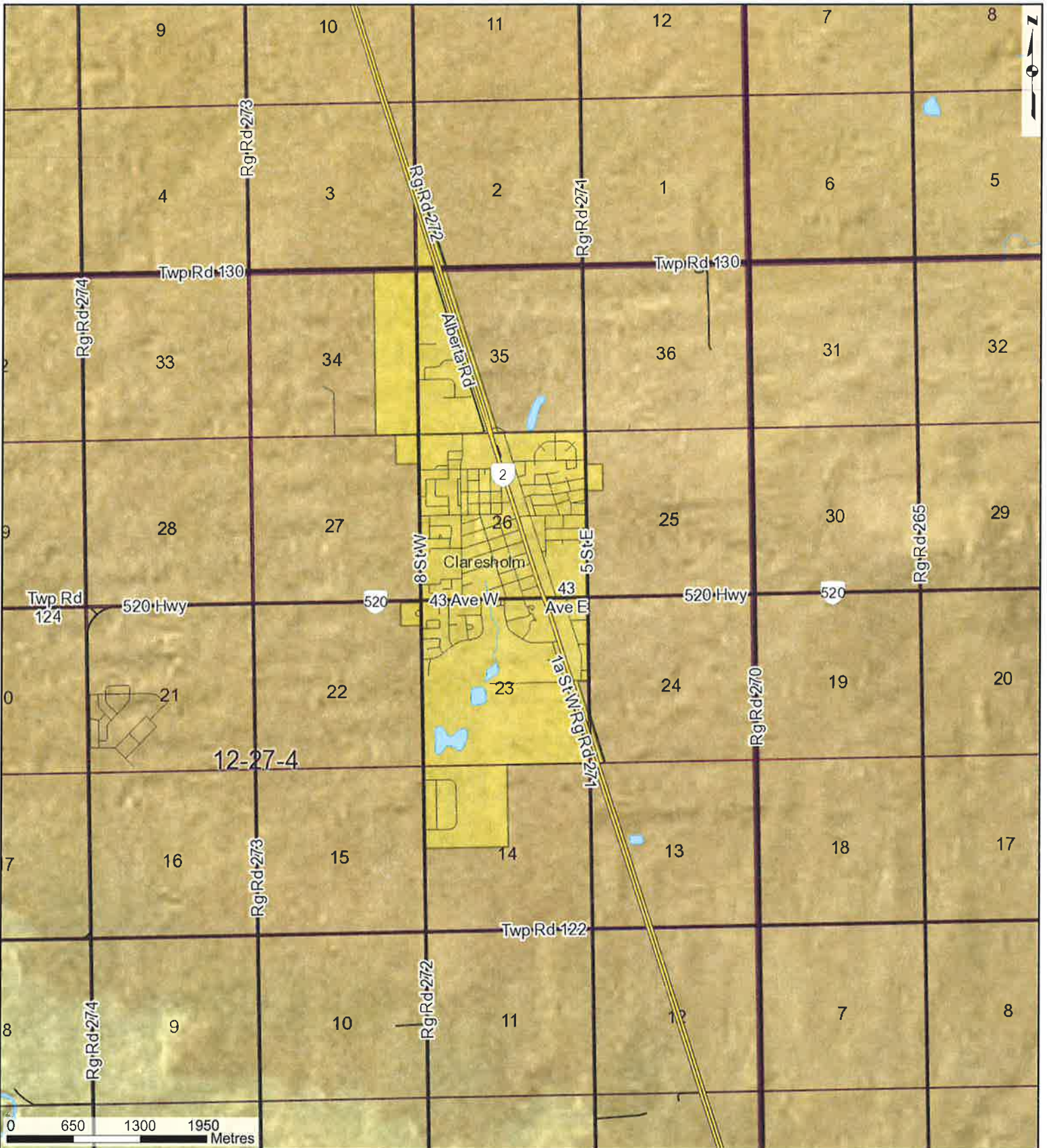
With Amendments To Bylaw 1625, March 27, 2017

- Single Detached Residential R1
- Duplex Residential R2
- Country Residential R3
- Multiple Residential R4
- Apartments R5
- Manufactured Homes R6
- Retail Commercial C1
- Highway Commercial C2
- Neighbourhood Commercial* C3*
- Industrial I1
- Service Industrial I2
- Public P
- Agricultural / Transitional A/T
- Direct Control DC
- Non-Operating Landfill 300m Buffer
 *(no zoning at this time)

MAP PREPARED BY:
 OLJMAN RIVER REGIONAL SERVICES COMMISSION
 3105 18th AVENUE NORTH, LETHBRIDGE, ALBERTA T1A 1S5
 TEL: 403.251.1341
 NOT RESPONSIBLE FOR ERRORS OR OMISSIONS

APPENDIX

A-3 *FLOOD HAZARD*



Legend

- Floodway
- Flood Fringe
- Overland Flow (Flood Fringe)
- Under Review
- 855.09 m Cross Section and Design Flood Level
- Water Body
- First Nation Boundary
- Municipal Boundary

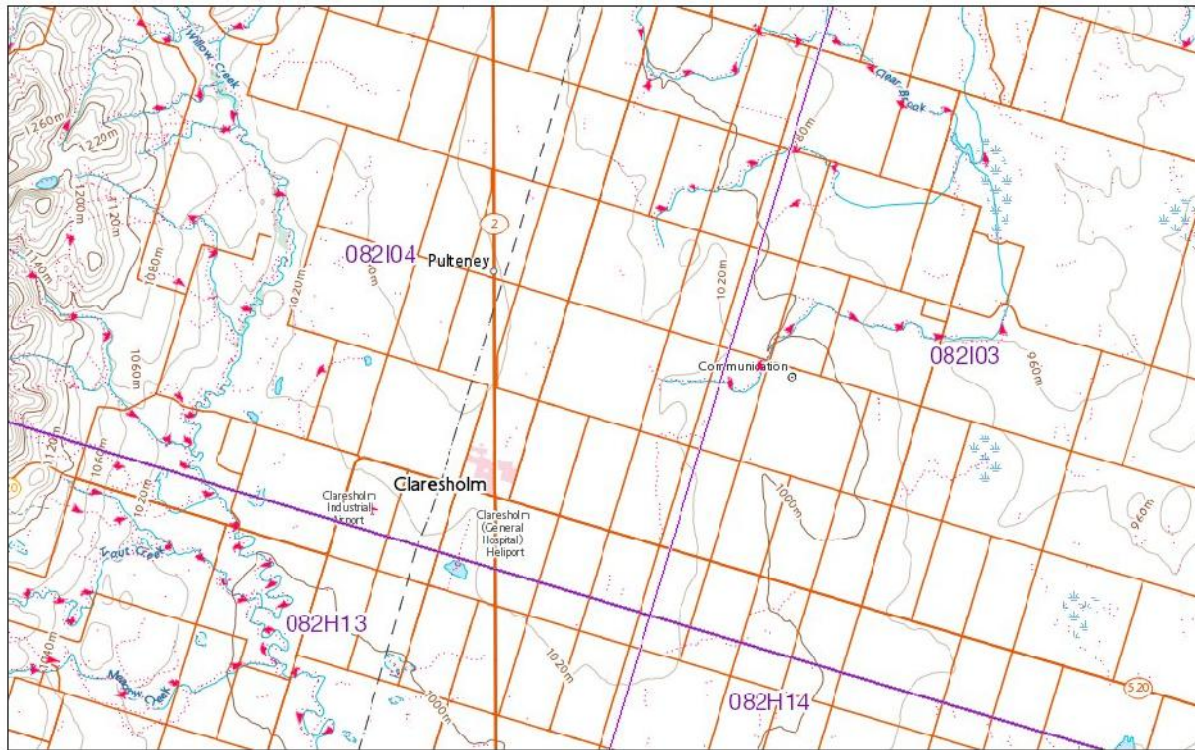
Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.
 Cadastral data provided by Alberta Data Partnerships Ltd. (ADP)
 Base Map Data provided by the Government of Alberta under the Alberta Open Government License, November, 2014
 National Framework Data © Department of Natural Resources Canada. All rights reserved.
 Alberta Road Network data provided by GeoBase ©
 Alberta Environment and Parks
 © 2015 Government of Alberta

Flood Hazard Map		
Projection: ALBERTA 10TM	Datum: NAD 83	Date: 2018-Jul-05
maps.srd.alberta.ca/floodhazard/		

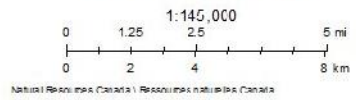
APPENDIX

A-4 *TOPORAMA*

Toporama



July 5, 2010



Natural Resources Canada / Ressources naturelles Canada

© Her Majesty the Queen in Right of Canada, as represented by the Minister of Natural Resources, 2018.
© Sa Majesté la Reine du chef du Canada, représentée par le ministre de Ressources naturelles Canada, 2018.

Canada

APPENDIX

A-5 ENFORCEMENT SEARCH

ENVIRONMENTAL LAW CENTRE

#410, 10115 - 100A Street, Edmonton, AB T5J 2W2

Phone: (780) 424-5099 Fax: (780) 424-5133

Internet: www.elc.ab.ca E-Mail: elc@elc.ab.ca

June 25, 2018

Our File: 120567

Mr. Ashley Appleby
WSP Canada Inc.
1212 - 58th Avenue SE
Calgary, AB T2H 2C9

Dear Mr. Appleby:

RE: Search Requested - Maury McLeod

In response to your request of June 22, 2018, we have searched the Environmental Enforcement Historical Search Service database for an exact match with respect to the above request, and can advise that as of today's date, there have been NO enforcement actions issued by Alberta Environment and Parks (AEP) pursuant to the Alberta "Environmental Protection and Enhancement Act" ("EPEA") and its predecessor legislation, the "Hazardous Chemicals Act", "Agricultural Chemicals Act", "Clean Water Act" and "Clean Air Act" to 1971, and/or pursuant to the "Water Act" from 1999 onwards.

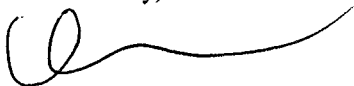
This search is limited to the following enforcement actions under EPEA and its predecessor legislation: Tickets, Prosecutions, Administrative Penalties, Warnings, Enforcement Orders, Enforcement Orders Concerning Waste, Environmental Protection Orders, Emergency Environmental Protection Orders, Emission Control Orders, Chemical Control Orders, Water Quality Control Orders and Stop Orders. This search is limited to the following enforcement actions under the Water Act: Prosecutions, Administrative Penalties, Water Management Orders, Warnings and Enforcement Orders. It does not include Clean Up Orders issued under the Litter Act or Environmental Protection Orders respecting unsightly property issued under EPEA; this information may be available from the local municipality.

Enforcement actions are entered in the database following: (1) the decision date, for prosecutions; (2) the date an administrative penalty was paid or due (30 days after issuance), whichever is sooner; and (3) the date the document was issued for all other enforcement actions.

These search results are based on information provided by AEP. AEP advises that they try to provide the best information possible. However, AEP advises that it cannot guarantee that the information provided is complete or accurate and that any person relying on these search results does so at their own risk. More information may be gained by referring to original enforcement documents. Alberta Energy Regulator (AER) enforcement actions are not included (see the AER Public Compliance dashboard database).

Copies of orders are available from the Environmental Law Centre. Any other enforcement information may be available directly from Alberta Environment.

Yours sincerely,



Cindy Dewing
Enforcement Search Service
Encl.

ENVIRONMENTAL LAW CENTRE

#410, 10115 - 100A Street, Edmonton, AB T5J 2W2

Phone: (780) 424-5099 Fax: (780) 424-5133

Internet: www.elc.ab.ca E-Mail: elc@elc.ab.ca

June 25, 2018

Our File: 120568

Mr. Ashley Appleby
WSP Canada Inc.
1212 - 58th Avenue SE
Calgary, AB T2H 2C9

Dear Mr. Appleby:

RE: Search Requested - 1584935 Alberta Ltd.

In response to your request of June 22, 2018, we have searched the Environmental Enforcement Historical Search Service database for an exact match with respect to the above request, and can advise that as of today's date, there have been NO enforcement actions issued by Alberta Environment and Parks (AEP) pursuant to the Alberta "Environmental Protection and Enhancement Act" ("EPEA") and its predecessor legislation, the "Hazardous Chemicals Act", "Agricultural Chemicals Act", "Clean Water Act" and "Clean Air Act" to 1971, and/or pursuant to the "Water Act" from 1999 onwards.

This search is limited to the following enforcement actions under EPEA and its predecessor legislation: Tickets, Prosecutions, Administrative Penalties, Warnings, Enforcement Orders, Enforcement Orders Concerning Waste, Environmental Protection Orders, Emergency Environmental Protection Orders, Emission Control Orders, Chemical Control Orders, Water Quality Control Orders and Stop Orders. This search is limited to the following enforcement actions under the Water Act: Prosecutions, Administrative Penalties, Water Management Orders, Warnings and Enforcement Orders. It does not include Clean Up Orders issued under the Litter Act or Environmental Protection Orders respecting unsightly property issued under EPEA; this information may be available from the local municipality.

Enforcement actions are entered in the database following: (1) the decision date, for prosecutions; (2) the date an administrative penalty was paid or due (30 days after issuance), whichever is sooner; and (3) the date the document was issued for all other enforcement actions.

These search results are based on information provided by AEP. AEP advises that they try to provide the best information possible. However, AEP advises that it cannot guarantee that the information provided is complete or accurate and that any person relying on these search results does so at their own risk. More information may be gained by referring to original enforcement documents. Alberta Energy Regulator (AER) enforcement actions are not included (see the AER Public Compliance dashboard database).

Copies of orders are available from the Environmental Law Centre. Any other enforcement information may be available directly from Alberta Environment.

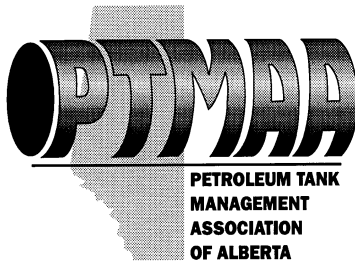
Yours sincerely,



Cindy Dewing
Enforcement Search Service
Encl.

APPENDIX

A-6 STORAGE TANKS



Petroleum Tank Management Association of Alberta

Suite 980, 10303 Jasper Avenue
Edmonton, Alberta T5J 3N6
PH: (780)425-8265 or 1-866-222-8265
FAX: (780)425-4722

June 22, 2018

Ashley Appleby
WSP Canada Inc.
3300, 237 – 4 Avenue SW
Calgary, AB
T2H 4K3

Dear Ashley Appleby:

As per your request, the PTMAA has checked the registration of active tank sites and inventory of abandoned tank sites and there are no records for the properties with the legal land description:

SW 25-012-27-W4
W 1/2 24-012-27-W4

Please note that both databases are not complete. The main limitation of these databases is that they only include information reported through registration or a survey of abandoned sites completed in 1992 and should not be considered as a comprehensive inventory of all past or present storage tank sites. The PTMAA cannot guarantee that tanks do not or have not existed at this location. Information in the databases is based on information supplied by the owner and the PTMAA cannot guarantee its accuracy. Information on storage tanks or on past or present contaminant investigations may be filed with the local Fire Department or Alberta Environment.

Yours truly,

Tennie Jacobsen
PTMAA

APPENDIX

A-7 WATER WELLS



Alberta Water Well Information Database Map

Projection

Web Mercator (Auxillary Sphere)

Datum

WGS 84

Date

7/4/2018, 3:52:45 PM

Legend

- Groundwater Drilling Report
- ◆ Baseline Water Well Report

<http://groundwater.alberta.ca/WaterWells/d/>

Information as depicted is subject to change, therefore the Government of Alberta assumes no responsibility for discrepancies at time of use.

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Reconnaissance Report

[View in Imperial](#)

[Export to Excel](#)

Groundwater Wells

Please click the water Well ID to generate the Water Well Drilling Report.

Well ID	LSD	SEC	TWP	RGE	M	DRILLING COMPANY	DATE COMPLETED	DEPTH (m)	TYPE OF WORK	USE	CHM	LT	PT	WELL OWNER	STATIC LEVEL (m)	TEST RATE (L/min)	SC_DIAM (cm)
140540	SW	24	12	27	4	UNKNOWN DRILLER	1917-09-05	19.20	Well Inventory	Domestic & Stock				PIERCE, J.H.			0.00
169628	SE	26	12	27	4	STAVELY WATER WELLS	1990-09-19	60.96	New Well-Abandoned	Domestic		8		GRAHAM, WALTER	3.81	9.09	0.00

APPENDIX

A-8 *NPRI CHEMICAL PRODUCTION*



Government
of Canada

Gouvernement
du Canada

[Home](#) → [National pollutant release inventory](#)

→ [Tools and resources for the National Pollutant Release Inventory data](#)

→ [National Pollutant Release Inventory Data Search](#)

Historical Substance Reports

Data as of: June 14, 2018

Please note the 2017 NPRI (National Pollutant Release Inventory) Data are preliminary. The preliminary data are made available for the purpose of engaging reporting facilities to review their submitted data and signal any necessary corrections or updates. Any interpretation of the 2017 NPRI (National Pollutant Release Inventory) data or their comparison with previous years' NPRI (National Pollutant Release Inventory) data must consider the possible presence of estimation, calculation or input errors made by facilities. Reviewed 2017 NPRI (National Pollutant Release Inventory) data will be made available once the annual quality control process is complete.

[Return to NPRI \(National Pollutant Release Inventory\) Data Search](#)

[Return to 2005 Facility & Substance Information for
LANDMARK FEEDS - CLARESHOLM](#)

[Additional resources for accessing, understanding and analyzing NPRI \(National Pollutant Release Inventory\) data.](#)

[NPRI \(National Pollutant Release Inventory\) data is also available for download in ACCESS and EXCEL formats.](#)

Company/Facility information: Landmark Feeds/Claresholm (2005)

Information for Claresholm

Company

Landmark Feeds

Facility	Claresholm
NPRI (National Pollutant Release Inventory) ID	6646
Address	4149 3rd Street East Claresholm, AB T0L0T0 canada

This facility reported that it closed during the 2005 reporting year.

(1) NOTE: as of the 2006 reporting year, the Disposal columns include information on tailings and waste rock disposals. Negative numbers are possible for on-site disposal of tailings and waste rock, which would reflect a net removal of the substances from the tailings or waste rock management area.

(2) NOTE: Off-site column under Disposal in this table includes 'Off-site Disposal' and 'Off-Site Treatment Prior to Final Disposal'

Phosphorus (total) (NA - 22)

Historical reports for Phosphorus (total) (NA - 22)

Year	On-Site Releases				Disposal ⁽¹⁾		Off-Site Recycling	<u>Units</u>
	Air	Water	Land	Total	On-Site	Off-Site ⁽²⁾		
<u>2005</u>	-	-	-	-	-	-	-	tonnes
<u>2004</u>	-	-	-	-	-	-	-	tonnes
<u>2003</u>	-	-	-	-	-	-	-	tonnes



[\[Back to top\]](#)

PM10 (NA - M09)

Historical reports for PM10 (NA - M09)

Year	On-Site Releases				Disposal ⁽¹⁾		Off-Site Recycling	<u>Units</u>
	Air	Water	Land	Total	On-Site	Off-Site ⁽²⁾		
<u>2004</u>	0.849	-	-	0.849	-	-	-	tonnes
<u>2003</u>	0.890	-	-	0.890	-	-	-	tonnes
<u>2002</u>	0.827	-	-	0.827	-	-	-	tonnes



[\[Back to top\]](#)

Units:

tonnes

g - grams

kg - kilograms

g TEQ (Toxic Equivalent) - grams of Toxic Equivalent

APPENDIX

A-9 *FOIP RESULTS*

Appleby, Ashley

From: jennifer.rampling@gov.ab.ca
Sent: Tuesday, June 26, 2018 9:35 AM
To: Appleby, Ashley
Subject: [E18-G-0952] Closure Letter No Records Available on ESAR - Cont.Site



FOIP Office, Informatics
5th Floor, Great West Life,
9920 - 108 Street
Edmonton, Alberta, T5K 2M4
Telephone: 780-427-4429
Fax: 780-427-9838
www.aep.alberta.ca

June 26, 2018

Mr. Ashley Appleby
WSP Canada
Suite 3300 237 4 Avenue SW
Calgary, Alberta T2P 4K3

Your File #: 181-07689
FOIP Request #: E18-G-0952
Order Number: FOIP-2018-2758

Dear Mr. Appleby:

Re: Freedom of Information and Protection of Privacy Act Request for records pertaining to the property located at W Sec 24 Twp 12 Rge 27 W 4 M and SW Sec 24 Twp 12 Rge 27 W4M, Claresholm

The following is in response to your request of June 22, 2018 for access under the Freedom of Information and Protection of Privacy Act to the following subject records:

Location: w Sec 24 Twp 12 Rge 27 W 4 M, SW Sec 24 Twp 12 Rge 27 W 4 M, Claresholm

Name(s): 1584935 Alberta Ltd. (Leonard Thom), George Markle & Margaret Markle & Cheryl Lynn Markle Current, Dennis Hoffman

Time
Frame: Historical to June 22, 2018

Records: Internal correspondence/documentation relating to scientific/technical reports, assessments, investigations, and if applicable, enforcement action. Any other records relating to the status of the subject site that cannot be made routinely available due to potential sensitivity of some or all of the information contained within the records.

A search of Alberta Environment & Parks record holdings has not identified any records relating to the subject of your request, based on the search parameters you provided to this office.

If you have any questions or concerns about the processing of your FOIP request, please write to the above address or call me at 780-643-2864, so that we can look at ways to address these issues. If, however, we are unable to resolve your concerns, under section 65(1) of the Freedom of Information and Protection of Privacy Act, you may ask the Information and Privacy Commissioner to review this decision. To request a review, you must complete and deliver a Request for Review form within 60 days from the date of this notice to the Commissioner at 410, 9925 – 109 Street, Edmonton, Alberta, T5K 2J8. The form is available under the Resources tab on the Commissioner's website www.oipc.ab.ca or you can call 1-888-878-4044 to request a copy of the form.

If you request a review, please provide the Commissioner with a copy of your original request, any letters of clarification, a copy of this letter and the reason why you are requesting a review.

If you have any questions or concerns, please write or call me at **780-643-2864**.

Yours truly,

Sheila G. Hart
Access and Privacy Advisor

Appleby, Ashley

From: jennifer.rampling@gov.ab.ca
Sent: Friday, June 29, 2018 9:24 AM
To: Appleby, Ashley
Subject: [E18-G-0959] Closure Letter No Records Available on ESAR - Cont.Site



FOIP Office, Informatics
5th Floor, Great West Life,
9920 - 108 Street
Edmonton, Alberta, T5K 2M4
Telephone: 780-427-4429
Fax: 780-427-9838
www.aep.alberta.ca

June 29, 2018

Mr. Ashley Appleby
WSP
Suite 3300 237 4 Ave SW
Calgary, Alberta T2P 4K3

Your File #: 181-07689-00
FOIP Request #: E18-G-0959
Order Number: FOIP-2018-2765

Dear Mr. Appleby:

Re: Freedom of Information and Protection of Privacy Act Request for records pertaining to the property located at SW Sec 24 Twp 12 Rge 27 W4M, Claresholm

The following is in response to your request of June 25, 2018 for access under the Freedom of Information and Protection of Privacy Act to the following subject records:

Location: SW Sec 24 Twp 12 Rge 27 W4M, Claresholm

Name(s): Current owner: Maury and Marla McLeod Prior owners: Richard Doyle McPeak, Lester and Owen Amundsen
Unknown

Time
Frame: Historical to June 25, 2018

Records: Internal correspondence/documentation relating to scientific/technical reports, assessments, investigations, and if applicable, enforcement action. Any other records relating to the status of the subject site that cannot be made routinely available due to potential sensitivity of some or all of the information contained within the records.

A search of Alberta Environment & Parks record holdings has not identified any records relating to the subject of your request, based on the search parameters you provided to this office.

If you have any questions or concerns about the processing of your FOIP request, please write to the above address or call me at 780-427-7533, so that we can look at ways to address these issues. If, however, we are unable to resolve your concerns, under section 65(1) of the Freedom of Information and Protection of Privacy Act, you may ask the Information and Privacy Commissioner to review this decision. To request a review, you must complete and deliver a Request for Review form within 60 days from the date of this notice to the Commissioner at 410, 9925 – 109 Street, Edmonton, Alberta, T5K 2J8. The form is available under the Resources tab on the Commissioner's website www.oipc.ab.ca or you can call 1-888-878-4044 to request a copy of the form.

If you request a review, please provide the Commissioner with a copy of your original request, any letters of clarification, a copy of this letter and the reason why you are requesting a review.

If you have any questions or concerns, please write or call me at **780-427-7533**.

Yours truly,

Sona Razi
Access and Privacy Advisor

APPENDIX

B SITE VISIT DOCUMENTATION



APPENDIX

B-1 *FIELD NOTES*

**Reconnaissance of Outdoor Area: 04-25-012-27 W4M**

(use multiple pages if there are several different yards, and show on site sketch)

Date: 28-Jun-2018**Weather:** 15 °C, Cloudy**Vision # :** 181-07689-00**Inspector:** Ashley Appleby**Other Reconnaissance Participants:** Allison Richards

Access limitations (vehicle obstructions, hazards)	None, walk access only
Current use	Agriculture - hay and canola crops
Past Use	Agriculture - hay and canola crops
Maintenance / housekeeping (Good/Fair/Poor)	Good
Topography	Flat with a slope to the southwest
Stormwater drainage description Overland direction, ditches, swales, drains, sumps Where do they drain to?	Southwest and swales along roads
Vegetation description Note stressed vegetation	Hay and canola
Surface soil description (gravel / paved / landscape)	95% cultivated crops, grasses along roadways
Waterbodies	None apparent
Evidence of surface water sheen / discolouration	None apparent
Evidence of disturbed soil or fill	None apparent
Evidence of debris / dumping / landfills include estimate of size and/or dimensions	None apparent
Evidence of excavations / pits /septic fields / cesspools	None apparent
Evidence of soil staining	None apparent
Evidence of degraded concrete / asphalt	None apparent
Evidence of underground tanks, pipe risers, boreholes	None apparent
Evidence of hydraulic equipment year of installation and condition	None apparent
Evidence of PCBs electrical units (transformers, capacitors) Details on Storage Sheet	None apparent
Location of material storage Details on Storage Sheet	None apparent
Location of waste storage Details on Storage Sheet	None apparent
Location of tanks and drums Details on Storage Sheet	None apparent
Odour concerns	None apparent

**Reconnaissance of Outdoor Area: 12 & 13-24-012-27 W4M**

(use multiple pages if there are several different yards, and show on site sketch)

Date: 28-Jun-2018**Weather:** 15 °C, cloudy and light rain**Vision # :** 181-07689-00**Inspector:** Ashley Appleby**Other Reconnaissance Participants:** Allison Richards

Access limitations (vehicle obstructions, hazards)	None, walk access only
Current use	Agriculture - hay and canola crops
Past Use	Agriculture - hay and canola crops
Maintenance / housekeeping (Good/Fair/Poor)	Good
Topography	Flat with a slope to the southwest
Stormwater drainage description Overland direction, ditches, swales, drains, sumps Where do they drain to?	Southwest and swales along roads
Vegetation description Note stressed vegetation	Hay and canola
Surface soil description (gravel / paved / landscape)	95% cultivated crops, grasses along roadways
Waterbodies	None apparent
Evidence of surface water sheen / discolouration	None apparent
Evidence of disturbed soil or fill	None apparent
Evidence of debris / dumping / landfills include estimate of size and/or dimensions	None apparent
Evidence of excavations / pits /septic fields / cesspools	None apparent
Evidence of soil staining	None apparent
Evidence of degraded concrete / asphalt	None apparent
Evidence of underground tanks, pipe risers, boreholes	None apparent
Evidence of hydraulic equipment year of installation and condition	None apparent
Evidence of PCBs electrical units (transformers, capacitors) Details on Storage Sheet	None apparent
Location of material storage Details on Storage Sheet	None apparent
Location of waste storage Details on Storage Sheet	None apparent
Location of tanks and drums Details on Storage Sheet	None apparent
Odour concerns	None apparent



Reconnaissance of Adjacent Properties within 300 m of subject Property

Date: 28-Jun-2018

Weather: 15⁰ C, Cloudy

Vision # : 181-07689-00

Inspector: Ashley Appleby

Other Reconnaissance Participants: Allison Richards

North Adjacent	Current use and Occupant	Agricultural - Maury McLeod
	Maintenance / housekeeping (Good/Fair/Poor)	Good
	Evidence of debris / dumping	None apparent
	Vegetation (type and note stressed areas)	Hay and canola crops, no stress vegetation or bare areas
	Surface soil description (gravel / paved / landscape)	Cultivated
	Topography (inc. elevation relative to subject Property)	Flat with a slope of the southwest
	Drainage (e.g. storm drains, overland direction, ditches)	Southwest and swales along roads
	Waterbodies (in BC within 1 km)	None apparent
South Adjacent	Current use and Occupant	Agricultural - Dennis Hoffman Light industrial - Triple T Oil Field Services
	Maintenance / housekeeping (Good/Fair/Poor)	Good
	Evidence of debris / dumping	None apparent
	Vegetation (type and note stressed areas)	Hay and canola crops, no stress vegetation or bare areas
	Surface soil description (gravel / paved / landscape)	Oil field service area is gravelled
	Topography (inc. elevation relative to subject Property)	Flat with a slope southwest
	Drainage (e.g. storm drains, overland direction, ditches)	Southwest and swales along roads
	Waterbodies (in BC within 1 km)	None apparent
East Adjacent	Current use and Occupant	Agricultural - Maury McLeod and Dennis Hoffman
	Maintenance / housekeeping (Good/Fair/Poor)	Good
	Evidence of debris / dumping	None apparent
	Vegetation (type and note stressed areas)	Canola and hay crops
	Surface soil description (gravel / paved / landscape)	Cultivated
	Topography (inc. elevation relative to subject Property)	Flat with a slope southwest
	Drainage (e.g. storm drains, overland direction, ditches)	Southwest and swales along roads
	Waterbodies (in BC within 1 km)	None apparent

West Adjacent	Current use and Occupant	UFA Farm and Ranch Supply - Light industrial Proven - Seed Supply Business - Light industrial Isaiah Diesel Engine Repair – Light industrial Don Needhama Trucking - Light industrial TJs Tree Trimming – Commercial Gelowitz Holdings Inc. Fibreglass Tanks - Light industrial Southgate RV and Service Centre - Light industrial Welding Shop - Light industrial Napa Auto Parts Centre - Light industrial Torques Heavy Truck and Trailer Repair - Light industrial Triple T - Oil Field Service Company - Light industrial (Truck and tank storage) Town of Claresholm, - Maintenance Yard – Light industrial
	Maintenance / housekeeping (Good/Fair/Poor)	Good
	Evidence of debris / dumping	None apparent
	Vegetation (type and note stressed areas)	No vegetation
	Surface soil description (gravel / paved / landscape)	Gravelled and paved
	Topography (inc. elevation relative to subject Property)	Flat
	Drainage (e.g. storm drains, overland direction, ditches)	Flat, with drainage toward swales along the roads
	Waterbodies (in BC within 1 km)	None apparent

APPENDIX

B-2 *FIELD PHOTOGRAPHS*

JUNE 28, 2018



Photograph 1 – Middle of 04-25-012-27 W4M Facing North

JUNE 28, 2018



Photograph 2 – Middle of 04-25-012-27 W4M Facing East

JUNE 28, 2018



Photograph 3 – Middle of 04-25-012-27 W4M Facing South

JUNE 28, 2018



Photograph 4 – Middle of 04-25-012-27 W4M Facing West
Note the commercial properties adjacent of the Property.

JUNE 28, 2018



Photograph 5 – Piezometer on West Side of the Property Facing Southwest
Note the piezometer was installed days before for a geotechnical investigation related to developing the Property.

JUNE 28, 2018



Photograph 6 – Bore Hole on West Side of the Property Facing Southwest
Note the bore hole was installed days before for a geotechnical investigation related to developing the Property.



JUNE 28, 2018



Photograph 7 – Piezometer on East Side of the Property Facing East
Note the piezometer was installed days before for a geotechnical investigation related to developing the Property.

JUNE 28, 2018



Photograph 8 – Adjacent West Properties Facing Northwest

JUNE 28, 2018



Photograph 9 – Adjacent West Road Facing North

JUNE 28, 2018



Photograph 10 – Adjacent West Properties Facing Southwest

JUNE 28, 2018



Photograph 11 – Adjacent West Road Facing South

JUNE 28, 2018



Photograph 12 – Adjacent West Road Facing Northwest
Note the pole mounted transformer adjacent to the property and electrical box along road set-back.

JUNE 28, 2018



Photograph 1 – Middle of 13-24-012-27 W4M Facing North

JUNE 28, 2018



Photograph 2 – Middle of 13-24-012-27 W4M Facing East

JUNE 28, 2018



Photograph 3 – Middle of 13-24-012-27 W4M Facing South

JUNE 28, 2018



Photograph 4 – Middle of 13-24-012-27 W4M Facing West

JUNE 28, 2018



Photograph 5 – Piezometer on Northeast Corner of 13-24-012-27 W4M Facing East
Note the piezometer was installed days before for a geotechnical investigation related to developing the Property.

JUNE 28, 2018



Photograph 6 – Bore Hole in Central 13-24-012-27 W4M Facing Southeast
Note the bore hole was installed days before for a geotechnical investigation related to developing the Property.

JUNE 28, 2018



Photograph 7 – Adjacent West Properties Facing Northwest

JUNE 28, 2018



Photograph 8 – Adjacent West Properties Facing Southwest
Note the pole mounted transformers along the road.

JUNE 28, 2018



Photograph 9 – Middle of 12-24-012-27 W4M Facing North

JUNE 28, 2018



Photograph 10 – Middle of 12-24-012-27 W4M Facing East

JUNE 28, 2018



Photograph 11 – Middle of 12-24-012-27 W4M Facing South

JUNE 28, 2018



Photograph 12 – Middle of 12-24-012-27 W4M Facing West

JUNE 28, 2018



Photograph 13 – Adjacent South Property Facing Southeast
Note the transformer on the adjacent property.

JUNE 28, 2018



Photograph 14 – Adjacent West Properties Facing Northwest

JUNE 28, 2018



Photograph 15 – Adjacent West Properties Facing West

JUNE 28, 2018



Photograph 16 – Adjacent Properties Facing Southwest.

APPENDIX

C INTERVIEW DOCUMENTATION



APPENDIX

C-1 12 & 13-024-012-27
W4M

1 General Property Information

1.1 Property Details

1.1.1 Property Name: 12 & 13-24-012-27 W4M

1.1.2 Full Postal Address: N/A

1.1.3 Telephone Number: confidential

1.1.4 Principal Contact Name: Dennis Hoffman
Position/years at this location: 15 years

1.1.5 Other Site Contacts: Leonard Thom

1.1.6 Number of Employees: Full-time Part-time Not Applicable (N/A)

1.1.7 Property Size: 80 acres

1.1.8 Site Ownership and Occupants: Is the Property Leased? Yes No N/A
Who is the landlord or management company? 1584935 Alberta Ltd.
Who is/are the tenant(s)? Dennis Hoffman
Who is the owner of record? 1584935 Alberta Ltd.
What is the validity of Land Use Rights (LUR) acquired? Years Infinite N/A

1.2 Property History

1.2.1 Recent History:

Briefly describe the history of the site, focusing on previous site utilization, environmentally relevant activities / installations.

Duration		Owner or Tenant Name	Type of Use (e.g. agriculture, industrial activities)
from	to		
2003	Present	Dennis Hoffman	Agricultural
Unknown	2003	George Markle	Agricultural

1.2.2 Distant Past Agricultural

1.3 Property Setting

Building Name	Area (ft ² or m ²)	Activities	Year of Construction	Building Materials (concrete block/wood frame)
None	N/A	N/A	N/A	N/A

1.3.1 Major site layout modifications and/or utilization changes on the Property:

Year	Modification of production facilities or buildings / Extension of facilities / Demolition of facilities / Shut-down of facilities
None	N/A

1.3.2 Are there indications or information concerning spills or leakages on the property or in the neighbourhood? (including current operations)

Date	Location	Substance	Spilled Amount	How or why did the spill occur?
2015, 2017	Middle of LSD 12 and 13	Fresh water	Unknown	Pipeline leak

1.3.3 Describe backfilling activities on the Property:
(including cut & fill, widespread backfilling, trenches / channels)

N/A _____ or None
 Source of backfilling material: N/A _____ or Unknown

1.3.4 Please describe pits/ponds or lagoons on subject property or adjoining property:

N/A _____ or None

1.4 Environmental Setting

1.4.1 Are there any sensitive receptors in the vicinity of the Property?
(i.e. endangered species)

N/A _____ or None

1.4.2 Describe past and present vegetation/pest control:
(methods / frequency / contractors / sterilants / pesticides)

2 x per year, typical herbicide and pesticide _____ or None

1.4.3 Name of nearest waterbodies:

None _____ or None

1.4.4 Describe any mineral rights activities associated with the site (oil wells, mining, quarrying, etc.):

N/A _____ or None

1.4.5 Describe surrounding land use and identify neighbouring facilities:
(residential, industrial, rural, industry (type of industry))

	Present	Past
North:	Agricultural	Agricultural
East:	Commercial	Agricultural
South:	Agricultural / Commercial	Agricultural / Commercial
West:	Agricultural	Agricultural

1.4.6 Have you had any environmental issues or conflicts with adjacent occupants?

N/A _____ or None

2 Property Activities

2.1 Documentation Available

2.1.1 Please provide an inventory of all chemicals used on-site:
(i.e. fuels, cleaners, lubricant, licensed or permitted chemicals). SDS lists are often the easiest means of finding a complete list.

N/A _____ or None

2.1.2 Briefly describe activities carried out on-site, including types of products / chemicals / materials handled:
If available, include / attach flow schematic.

Agricultural herbicides and pesticides _____ or None

2.1.3 Provide copies of any known environmental reports / investigations / remediation measures, assessments, spill reports, or soil/groundwater investigations already conducted on the Property or in the neighborhood:

N/A

or None

2.1.4 Provide copies of any internal audits, inspections, procedures:

(i.e. spill response, material handling, tank testing).

N/A

or None

2.1.5 Provide copies of any regulatory approvals, licenses, or permits:

N/A

or None

2.2 Waste

2.2.1 Hazardous Waste Generator

Please indicate the hazardous waste generator classification of your facility:

N/A

or Never

Hazardous Waste	Code <small>(see Alberta User Guide for Waste managers, AENV, 1996)</small>
None	N/A

2.2.2 Waste Storage Areas

Unit	Storage Area Name	Location	Status (Active/Inactive)	Type of Waste Stored
Satellite Accumulation <small>(including used oil)</small>	None	N/A	N/A	N/A
Less than 365 Day Accumulation Areas	None	N/A	N/A	N/A
365 day storage areas	None	N/A	N/A	N/A
Permitted Container Storage Areas	None	N/A	N/A	N/A
Treatment Storage and Disposal (TSD) facilities	None	N/A	N/A	N/A
Impoundments	None	N/A	N/A	N/A
Landfills	None	N/A	N/A	N/A
Waste Piles (including illegal dumping)	None	N/A	N/A	N/A
Boilers, Incinerators, Furnaces	None	N/A	N/A	N/A
Other	None	N/A	N/A	N/A

2.2.3 Corrective Action.

Please describe any corrective action/remediation related to current or previous hazardous waste storage installations performed on-site (include type and current status):

N/A

or None

Please provide an estimate of financial costs developed for Financial Assurances:

N/A

or N/A

2.3 Material Storage & Handling for Chemicals or Hazardous Materials

2.3.1 Underground Storage Tanks (UST).

Please list all current and former USTs:

Location	Contents	Name same as site map	Size	Protection From Spills *	Age
None	N/A	N/A	N/A	N/A	N/A

* leakage control, double-walled, overfill prevention, secondary containment, integrity testing, overfill alarms, etc.

2.3.2 Aboveground Storage Tanks (AST)

Please list all current and former ASTs:

Location	Contents	Name same as site map	Size	AST Construction				Protection from Spills*	Age
				Vertical or Horizontal	Saddle or Flush	Welded or Riveted	Metal or Plastic		
None	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

* leakage control, double-walled, overfill prevention, secondary containment, integrity testing, overfill alarms, etc.

2.3.3 Drums and Other Receptacles

Please list all current and former storage and handling locations for drums, and other containers, for materials, hazardous substances, fuel, and waste (liquid, solid, empty containers etc.), including loading/offloading areas:

Location	Contents	Number of drums and/or receptacles (greater than 55 g or 208 L)	Maximum storage per drum (L)	Protection from Spills*	Duration of Storage
None	N/A	N/A	N/A	N/A	N/A

* leakage control, double-walled, overfill prevention, secondary containment, integrity testing, spill kits, etc.

2.3.4 Loading/Offloading Areas

Location	Name as shown on site map	Description (rail spur, weigh-scale etc.)	Procedures (SOP documented, Volumes transferred, frequency etc.)	Protection from Spills *
None	N/A	N/A	N/A	N/A

* leakage control, secondary containment, spill kits, track trays, etc.

2.3.5 Above-Ground / Underground Pipelines

Provide the names of owners of any underground pipelines or pipeline right-of-ways which cross the Property:

Fresh water pipeline (Claresholm to Granum)

or None

Are there pipelines or way leaves used for chemicals and/or hazardous liquids on the Property?

Active

Inactive

Decommissioned

Never

Conveyed substances: N/A

Location and Purpose: N/A

Connected to:

Off-Site Storage

Loading

Port

Rail

N/A

2.3.6 Are (were) fuel stations for trucks, cars, or fork-lifts present on the Property?

Current
 Past
 Unknown
 Never

Date Removed: N/A

If yes, who is (was) the operator? N/A

How is (was) the ground protected against contaminants? N/A

2.4 Utilities / Water / Wastewater / Underground Injection

2.4.1 Contractors and Suppliers for the following services:

Energy/Utility Service	Provider(s)
Gas	Service not provided to the Property
Electricity	Service not provided to the Property
Coal	Service not provided to the Property
District heating / steam	Service not provided to the Property
Drinking (Potable) Water*	Service not provided to the Property
Storm water Disposal **	Service not provided to the Property
Sanitary Wastewater **	Service not provided to the Property
Production Wastewater **	Service not provided to the Property
Cooling Water **	Service not provided to the Property
Solid Waste Disposal	Service not provided to the Property
Hazardous Waste Disposal	Service not provided to the Property

*Municipal System / Private well on-site / Private well off-site

**On-site WWTP / Publicly Owned Treatment Works (POTW) / Infiltration / Underground Injection Wells

2.4.2 Sewage System

Please describe the Property's sewage disposal system:

(age, materials, separate/combined, under/above ground, discharge volume (actual & permitted), separators, Permits, inspection results)

N/A

2.4.3 List all groundwater extraction wells located on the Property?

(include current and former, potable, production water, monitoring wells)

Unknown
 Never

Well Name/ID	Location	Utilization (irrigation, potable, sanitary, process, monitoring)	Active / Inactive / Decommissioned	Permit (authority, expiration)	Volume (Permitted and Actual)
None	N/A	N/A	N/A	N/A	N/A

2.4.4 Surface Water

Does or did the facility operate under or have a permit to discharge to surface water?

Current
 Past
 Unknown
 Never

List all past and present permit numbers: N/A

Number of discharge points: N/A

Who is the permittee? N/A

2.4.5 Underground Injection Control

Does the facility inject fluids underground through:

Bored Holes
 Drilled Holes
 Driven Holes
 Dug Holes
 Never

What is the permit number? N/A

Where is the disposal well and how is the waste handled? N/A

2.5 Special Substances

This Phase I ESA does not include intrusive testing or sampling for special substances

2.5.1 Asbestos Containing Materials (ACM)

List potential ACM including: Pre-1980: insulation, cement products, floor tiles (9"x9" or 12"x12"), grout, drywall, plaster, compressed papers/boards, duct tapes, sealants, protective coatings, ceiling tiles.

Location of ACM	Type of ACM	Age
None	N/A	N/A

Any demolition/renovations/construction or removal activities involving ACM at your facility? Yes Never

Are there any removed ACMs stored / backfilled at your facility? Yes None

If yes, please provide details on each issue: N/A

2.5.2 Polychlorinated biphenyl (PCB) in Electrical Units

List potential PCB-containing electrical units including: transformers, capacitors, electromagnetic switches, voltage regulators, cables, heat transfer equipment, pre - 1980 fluorescent light ballasts:

Location of Unit	Type of unit (transformer / capacitor etc.)	[PCB] Range (look for label)	Age
None	N/A	N/A	N/A

2.5.3 Urea Formaldehyde Foam Insulation (UFFI)

List potential UFFI (including: Pre-1980 insulation (injection holes in exterior of building)):

Location of UFFI	Description of UFFI	Age
None	N/A	N/A

2.5.4 Ozone Depleting Substances (ODS)

List potential ODS (including: Pre-1994 Air-conditioners, fire extinguisher systems (do not include fire extinguishers)):

Location of ODS Unit	Type of ODS Unit	Age
None	N/A	N/A

2.5.5 Lead

List potential areas for lead (including: Pre-1976 painted surfaces, vehicle battery storage areas):

Location of LCM	Description of LCM	Age
None	N/A	N/A

2.5.6 Mould

List potential areas of mould:

Location of Suspected Mould	Description of Suspected Mould	Date Removed
None	N/A	N/A

3 Interviewer and Interviewee

Form completed by :	Ashley Appleby	and (WSP)
Date :	Thursday, June 28, 2018	

APPENDIX C

TOWN OF CLARESHOLM

HISTORICAL RESOURCES OVERVIEW

'PLANNING FOR GROWTH' INDUSTRIAL / COMMERCIAL PLANNING PROJECT

12&13-24-12-27 W4M & 4-25-12-27 W4M

JULY 13, 2018



This document contains sensitive information about Historic Resources that are protected under the provisions of the Alberta *Historical Resources Act*. This information is to be used to assist in planning the proposed project only. It is not to be disseminated, and no copies of this document are to be made without written permission of the Historic Resources Management Branch, Alberta Culture and Tourism

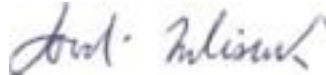
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PREPARED FOR:

TOWN OF CLARESHOLM
221 – 45 Avenue West
Claresholm, Alberta
T0L 0T0

This report was prepared by WSP Canada Inc. (WSP) for the account of TOWN OF CLARESHOLM, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

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1 INTRODUCTION

The Town of Claresholm (the Town) is planning for development of an Industrial / Commercial Park portions of NW-24-12-17 W4M and SW-25-12-17 W4M (the Project). The planned developments will be located on what is currently rural property at the southeast edge of Claresholm, in the Municipal District of Willow Creek (Figure 1). The future development of these lands will allow for eastward expansion of heavy industrial development, and is also intended to support commercial development along Highway 520. Development is anticipated to commence in 2019.

The Project Area includes approximately 48 ha (120 acres) of agricultural land at the southeast edge of the Town of Claresholm. This property is bordered by 5th Street East and the existing Industrial Area to the west, and by agricultural fields to the north, east and south. Highway 520 (Starline Road) dissects the north portion of the Project Area (Figure 2).

WSP Canada Inc. (WSP) was contracted to complete a Historical Resources Overview (HRO) of the Project, to support the planning of optimal land use by outlining potential historical resources constraints on development.

1.1 HISTORICAL RESOURCES REGULATORY BACKGROUND

In the Province of Alberta, Historical Resources are governed by the *Historical Resources Act* (HRA), which is administered by the Historical Resources Management Branch (HRMB) of Alberta Culture and Tourism (ACT). Deemed Crown property, historic resources include, but are not limited to archaeological sites, historic structures, and other built heritage with historic or architectural significance, and palaeontological sites. Certain Indigenous Traditional Use Sites are also considered historic resources and are likewise protected under the HRA.

Most types of activities with potential for ground disturbance, including urban developments, are required to obtain written approval under the HRA prior to commencement of the Project. In these cases, an application for formal approval under the HRA must be made to the HRMB, and requirements for a Historical Resources Impact Assessment (HRIA), palaeontological HRIA (pHRIA), and/or Indigenous Engagement may be issued.

1.2.1 POTENTIAL IMPACTS TO HISTORIC RESOURCES

Ground-disturbance resulting from industrial/ commercial development within the Project Area has the potential to negatively impact historic resources. Construction activities are considered to be high impact and may involve, but are not limited to, the following actions: heavy equipment traffic, vegetation removal (if required), topsoil salvage, subsoil grading, excavation, trenching, and landscaping.

1.2 PURPOSE

An HRO is a detailed desktop assessment of the potential for a project to impact historic resources. This kind of overview is particularly beneficial at the earlier planning stages of a Project, when locations that could trigger a requirement for HRIA can be avoided.

2 METHODS AND ASSUMPTIONS

2.1 HISTORICAL RESOURCES OVERVIEW APPROACH

The HRO includes identification of known historic resources in a Project Area and examination of other available data to determine the potential for the Project Area to contain additional historic resources. This overview includes the following:

- Review of the updated *Listing of Historic Resources* for the Historical Resource Value (HRV) attributes of the Project Area, to identify known historic resources (archaeological, historic, palaeontological, and Indigenous traditional use sites of a historic resources nature) for which avoidance or additional assessment has been required
- Detailed examination of aerial imagery, topographic maps, geological maps, soils data, and other ancillary data to identify terrain features, depositional environment, and evidence of previous disturbance which influence the archaeological, historic and palaeontological sensitivity of the Project Area
- Review of available records held by the Archaeological Survey and the Historic Places Stewardship section of the HRMB, including all known archaeological, historic period, and palaeontological resources in the local and regional study area
- GIS Mapping of the Project footprint relative to previously recorded historical resources, and areas determine to have higher potential for containing additional historical resources
- Description of the potential for encountering both known and previously unrecorded historic resources in the Project Area

For this Project, examinations were also made via a field inspection which included pedestrian survey of portions of the Project Area. This survey was opportunistic and therefore not systematic. However, it did provide an opportunity to observe the terrain and exposed surface of the property, complementing the desktop review.

2.2 ARCHAEOLOGICAL SENSITIVITY

A number of well-documented landscape characteristics and conditions are common to archaeological sites. For example, topographic features such as valleys, ridges, hills or escarpments, and terrestrial features associated with watercourses are generally considered to be areas of high archaeological potential since they provided protection, shelter, sustenance, and security to past peoples. Assessment of archaeological site potential or sensitivity is therefore based largely on a review of the environmental characteristics of the property, examination of existing disturbance, and potential for intact subsurface deposits.

In general, areas with moderate to high potential for archaeological sites contain at least one of the following features:

- Areas of level, well-drained terrain adjacent to defined water sources (streams and lakes)
- Micro-topographic relief, providing well-drained landforms adjacent to or within low-lying areas of otherwise poorly drained terrain such as wetlands
- Level to gently sloping tops and benches of well-defined, elevated landforms (such as knolls and eskers), particularly where these offer a commanding view of the surroundings

- Level or very gently sloping terrain adjacent to distinct breaks-in-slope

Archaeological sites frequently occur in clusters, concentrated on or around the same landform. Previously recorded sites are therefore also used as an indicator of potential for additional cultural materials to be present in an area.

Conversely, areas of low potential for archaeological sites are characterized by flat, featureless terrain, water saturated environments such as bogs, moderately to steeply sloping terrain and lands on which previous development has disturbed the sediments to the depth of the culturally-sterile C-horizon (i.e., bedrock or glacial deposits). While disturbed sediments still have potential for historic resources, the sediment movement and mixing associated with ground disturbance lowers our ability to interpret spatial patterning in these sites.

2.3 HISTORIC PERIOD SITE SENSITIVITY

In the Province of Alberta, historic structures are classified as structures or structural remains that are least 40 years of age, and records of these are maintained in the Heritage Survey inventory. Significant historic structures are those with connection to a historically notable person or event, depict some sort of unique architectural feature, or are among the best extant examples of a characteristic architectural style of a given historic period.

Most of the rural historic structure sites in the White Area of southern and central Alberta are related to early farmsteads. Review of aerial imagery provides evidence of standing structures. When direct observation of the structures is not available, comparison of the current and historic aerial imagery can provide evidence for the age of these structures. Examination of historic Township plans, homestead records and local history compilations may also aid in targeting locations at which historic structures are anticipated. Proximity to a historic townsite, trail or other transportation corridor increases the potential for encountering historic structures in a Project Area.

3 PROJECT AREA

3.1 REGIONAL SETTING

The Natural Regions and Subregions of Alberta map indicates that the Project is situated in the Mixedgrass natural subregion of the Grassland natural region. This subregion is characterized by level to undulating or hummocky terrain, underlain by glacio-lacustrine plains and till. Major soils in the area are Dark Brown Chernozems on better drained sites, while Gleysols develop in wetlands. The Mixedgrass subregion is mainly agricultural. Reference vegetation on the scattered native grasslands is characterized by needle and thread, porcupine grass, and northern and western wheatgrass, while shrublands are dominated by buckbrush (NRC, 2006).

3.2 LOCAL ENVIRONMENT

Situated between the Rocky Mountain foothills to the west and the Alberta Plains to the east, the Project Area consists of level to gently undulating agricultural lands (Photo 1). No named or unnamed watercourses are mapped within or immediately adjacent to the Project Area. The closest mapped watercourse is Willow Creek, approximately 7 km southwest of the Project Area. Several small ponds and sloughs are present in SW and NW-23-12-27 W4M, 1 km to the west, and ephemeral sloughs dot the landscape in SE-235-12-27 W4M, approximately 600 m to the east.

All the Project Area either is or was previously cultivated. Review of historic aerial photos (Figure 3) indicate that this property has been under relatively continuous cultivation since at least 1949.

Geologically, this location is situated on moraine deposits, which are typically characterized by undulating to hummocky terrain (AGS, 2018). Based on the abundant coarse deposits exposed on the cultivated surface, post-glacial deposition is minimal in this area, reducing the potential for encountering any intact, buried historic resources below the plough zone. While examination of the exposed surface did not include systematic transects, inspection was made of a selection of locations within the Project Area. No artifacts were observed during these inspections.

3.3 CULTURE HISTORY

Archaeological evidence demonstrates that past peoples have inhabited the Plains and Parklands of the Western Canada region for at least 12,000 years. Archaeologists categorize this time into two general periods: The Pre-contact Period (ca. 12,000 to 300 Years Before Present [B.P.]) and the Historic or Post-contact Period (300 B.P. to present). These periods are separated by the arrival of Europeans during exploration and the Fur Trade Era, which was well established by the 1700s (Saskatchewan Association of Professional Archaeologists [SAPA]). The overlap between these two periods is identified as the Proto-Historic Period, during which European influence on the First Nations traditional lifestyle was introduced during the initial phases of (typically indirect) contact between European and Aboriginal populations (Frison, 1991; Peck, 2011; SAPA, 2005; Walde, 1997).

Changes in technology and subsistence methods reflected in the archaeological record have been used to subdivide the Pre-contact into three more periods. The Early Pre-contact (12,000 to 7,500 B.P.) is identified by the presence of large projectile points used for spear-hunting megafauna such as the mammoth (*Mammuthus* sp.) and large species of bison (*Bison antiquus* and *Bison occidentalis*) present during this time. This period initiates toward the end of the Pleistocene geological epoch (approximately 2.5 million to 11, 700 B.P.), at which time most of these large mammals became extinct or began to evolve into their modern-day equivalents (i.e., *Bison bison*).

The Middle Pre-contact (7,500 to 2,000 B.P.) was marked by the Hypsithermal, a climatic warming event that altered the landscape from sub-tropical to a desert-like, grasslands environment in the south, and boreal forest to the north. This drastic change introduced a drought-ridden environment, which forced a change in subsistence methods and resulted in both human and animal migration north, where water-sources were more readily available (Pletz, 2010). Subsistence became more diversified. Atlatl technology was introduced, and the introduction of atlatl projectile points is diagnostic of this era in the archaeological record. These smaller dart tips were hafted onto a shaft and propelled using a longer spear and a lever. This technology allowed the skilled hunter to throw farther with more efficiency and accuracy.

The Late Pre-contact (2,000 to 170 B.P.) is marked by great technological change. Projectile points decrease in size significantly for use with bow and arrow weaponry. The introduction of pottery is perhaps the most significant change, representing an increased dependence on horticulture and a move to a more sedentary lifestyle. Trade and the dissemination of information and ideas between different First Nations is most apparent during this time and is demonstrated by the increased presence of imported lithic materials and items manufactured from materials such as coastal shell.

During the Post-contact, the advancement and success of the fur trade gradually led to the influx of permanent settlers and traders. The birth of the Métis culture was a product of the permanent establishment of European fur traders, a blending of predominantly French and First Nations traditions. Fur trade posts are an example of material culture from this prominent era. The decline and near extinction of the plains bison by the late 1800s forced a move from a traditional way of life for both Indigenous and Métis peoples and marked a period of change that led to the establishment of the Treaties with the Crown. The promise of settlement by European homesteaders led to the creation of the Residential School system and the outlawing of First Nations cultural practices in an effort to harmonize relations between the new Canadians, the Crown and the Indigenous population.

The eventual collapse of the fur trade and the Canadian Government's plan to build a nation resulted in the mass migration of European settlers and the settlement of the West. Based on the promise of bounty and rich agricultural yields away from persecution in Europe, people from an array of ethnic backgrounds flocked to the plains to take out homestead patents with the hope of a new life. Many of these pioneers endured challenges while adjusting to this new frontier. Building foundations from these humble beginnings dot the landscape and are a testament to the many successes and failures of early rural settlement. Despite these hardships, small communities soon formed and thrived based on the establishment of industry and the railway.

The Town of Claresholm, which incorporated as a village in 1903 and as a town in 1905, grew out of this early settlement period. A wooden railway station was built at Claresholm by 1895, shortly after establishment of the Calgary to Fort MacLeod leg of the Calgary and Edmonton Railway, and served as an important point of arrival and departure for passengers in the area for many years (Alberta Register of Historic Places, 2013a). The town quickly became a major railway centre between Calgary and Fort MacLeod, and was an important regional service centre for the surrounding district (Alberta Register of Historic Places, 2013b).

4 SITE FILE SEARCH RESULTS

A file search was made of the records held by the Archaeological Survey and the Historic Places Stewardship section of the HRMB. This included review of the HRVs of the Project Area, review of archaeological and historic structure site inventory forms for sections crossed by or adjacent to the Project Area, and review of the permit reports for previous HRIAs conducted within or near the Project Area. The locations of previously recorded archaeological sites and historic structures are illustrated on Figures 1 and 2.

4.1 HISTORICAL RESOURCES VALUES

Based on a review of the current *Listing of Historic Resources* (ACT 2018), none of the lands included in the Project Area have been assigned an HRV. Portions of an adjacent Section (LSDs 7 and 10-26-12-27 W4M) are classified as HRV 1h, indicating the presence of a designated Provincial Historic Resource of the historic period category (Figures 1 and 2; Table 1). HRV 1 status is assigned to lands owned by ACT for preservation and promotion under the HRA. These sites are afforded the highest level of protection under the HRA, and avoidance of impacts to HRV 1 sites is a Provincial mandate. No lands within these legal locations may be disturbed without prior Ministerial Approval.

Table 1 Designated Provincial Historic Resources

LEGAL (W4M)	SITE	HRV	DESCRIPTION	PROXIMITY
7-26-12-27	The Milnes Block	1h	Edwardian-style commercial block, constructed in 1910 for local businessman Thomas C. Milnes	~750 m WNW of Project Area
10-26-12-27	Canadian Pacific Railway Station	1h	Sandstone C.P.R. station building in downtown Claresholm; main facilitator of transport to the district between 1911 and 1966; now the Claresholm Museum	~800 m NW of the Project Area

The industrial/commercial developments, as currently envisioned, will not intersect these LSDs. Neither of these important sites will be impacted by the proposed development of the Project Area.

4.2 PREVIOUS STUDIES

Based on the results of the site file search, no HRIAs appear to have been conducted in the Project Area. One archaeological research permit was previously taken out for assessment of the South Foothills Transmission Project (Permit 13-020), a development approximately 300 m east of the Project Area.

4.3 ARCHAEOLOGICAL SITES

The Project is located in the EaPj Borden Block, within which three previously recorded archaeological sites are located. These sites include two artifact collections, and one historic period site. Adjacent Borden Block DIPj-1 includes four previously recorded sites, including one Pre-contact campsite, two artifact collections, and one reserved Borden number (site type unspecified).

While no sites have been previously recorded in close proximity to the Project, two of these sites are located in surrounding sections.

- Site **EaPj 1**, the Claresholm Post, was a North West Mounted Police outpost, situated along what is now 1st Street West in downtown Claresholm. This outpost, which included a barracks and a stable, was in operation from 1903 to 1904. The buildings were later bought and moved to a location west of town. Located approximately 600 m west-northwest of the Project Area, no impacts to this site location are anticipated.
- Site **EaPj-2** is the location from which a single projectile point was recovered by a local collector. This location is approximately 1 km west of the Project Area and will not be impacted by the proposed developments. The presence of this kind of artifact, however, provides evidence that Indigenous people were using this general area in the past, and additional Pre-contact sites could be expected in the surrounding sections.

4.4 HISTORIC SITES AND STRUCTURES

Numerous historic structures have been recorded in the lands surrounding the Project Area, most of which are located within the Town of Claresholm – which has, itself, been included in the Heritage Survey (HS) inventory (Figure 1; Table 2). Owing to the large number of sites recorded in the townsite (more than 400), only those structures situated in adjacent sections outside of town or along 5th Street East, which bounds the west side of the Project Area, are itemized below.

Table 2 Heritage Survey Sites in Proximity to the Project Area

HS #	LEGAL (W4M)	SITE TYPE	DESCRIPTION	PROXIMITY
1953	16-23-12-27	Rail Station	Rectangular long façade, hip gabled, roof; no date provided	~300 m west
14519	NE-14-12-27	Residence	Ira Wannamaker Homestead, wood frame house; constructed 1906	≥800 m south
14520	NE-14-12-27	Barn	Ira Wannamaker Homestead, wood frame house; no date provided	≥800 m south
14596	5-23-12-27	Cemetery	Claresholm Cemetery (8.76 acres); no date provided	~1.5 km west
14597	SW-24-12-27	Residence	S.D. Smith Homestead, wood frame house; no date provided	Immediately south (no longer present)
14598	SW-24-12-27	Barn	S.D. Smith Homestead, wood frame barn; no date provided	Immediately south (no longer present)
14599	NW-25-12-27	Residence	O.J. Amundsen Homestead, 2½ storey, wood frame house, constructed 1907	≥400 m north
14743	SW-36-12-27	Residence	Hugh Stanley Wyatt Homestead, 1½ storey, wood frame house, constructed 1903	≥1.2 km north
14761	SW-36-12-27	Barn	H.S. Wyatt Homestead, wood frame barn, constructed 1903	≥1.2 km north
17260	26-12-27	Urban Centre	Claresholm: established as a railway station c. 1893; incorporated as a village in 1903, and as a town in 1905. Includes multiple individual historic structures	Immediately west

None of the historic structures in close proximity to the Project Area will be directly impacted by the proposed developments. Field inspections for the biophysical assessments of the Project confirmed that the closest previously recorded HS sites, HS 14597, and 14598 in the S.D. Smith Homestead, are no longer present. That property is currently used for pipe and tanker storage (Photo 2).

Based on the historic aerial photographs reviewed (Figure 3), a single structure was present at the south end of 12-24-12-27 W4M in 1949. This structure, which was approximately 50 m north of the adjacent S.D. Smith Homestead, had an L-shape plan and appears to have had a gabled roofline. By 1961, the structure had been removed. No evidence of this structure is currently present in the Project Area.

4.5 INDIGENOUS TRADITIONAL USE SITES

Based on review of the Listing of Historic Resources (ACT, 2018), no Indigenous Traditional Use sites considered historic resources have been reported for the lands within or adjacent to the Project Area.

4.6 PALAEOLOGICAL RESOURCES

None of the lands included in the Project Area have been included in the current Listing of Historic Resources (ACT, 2018) for palaeontological resources or high palaeontological sensitivity.

5 SUMMARY AND RECOMMENDATIONS

5.1 EVALUATION

The Project Area is comprised of cultivated, level to very gently undulating terrain lacking any landform features typically associated with notable archaeological sites. At least some archaeological sites have been recorded in the surrounding sections, indicating that there is potential for additional historic resources in this area. However, no previously recorded sites are located within 500 m of the property. Given the shallow nature of the post-glacial deposits observed throughout the Project Area, no intact archaeological deposits are anticipated in the cultivated fields.

Considering the proximity to the Town of Claresholm, and the past presence of at least one structure on the property, potential exists for encountering historic structural remains. However, no standing structures requiring avoidance are present.

The Project Area has not been listed as possessing high palaeontological sensitivity, and no Indigenous Traditional Use sites of a historic resources nature have been identified in or surrounding the Project Area.

Based on the above considerations, potential for encountering significant historic resources (those requiring avoidance or additional assessment prior to development) is low in the Project Area.

5.2 RECOMMENDATIONS

Based on the results of the desktop review and field observations of the subject property, WSP has identified no historical resources concerns for the Project. As such, we recommend no further historical resources assessment for the proposed developments.

An application for HRA approval must be made to the HRMB's Online Permitting and Clearance (OPaC) application prior to development. Ideally, this will be completed following development of the Area Structure Plan. Requirements for HRIA are not anticipated.

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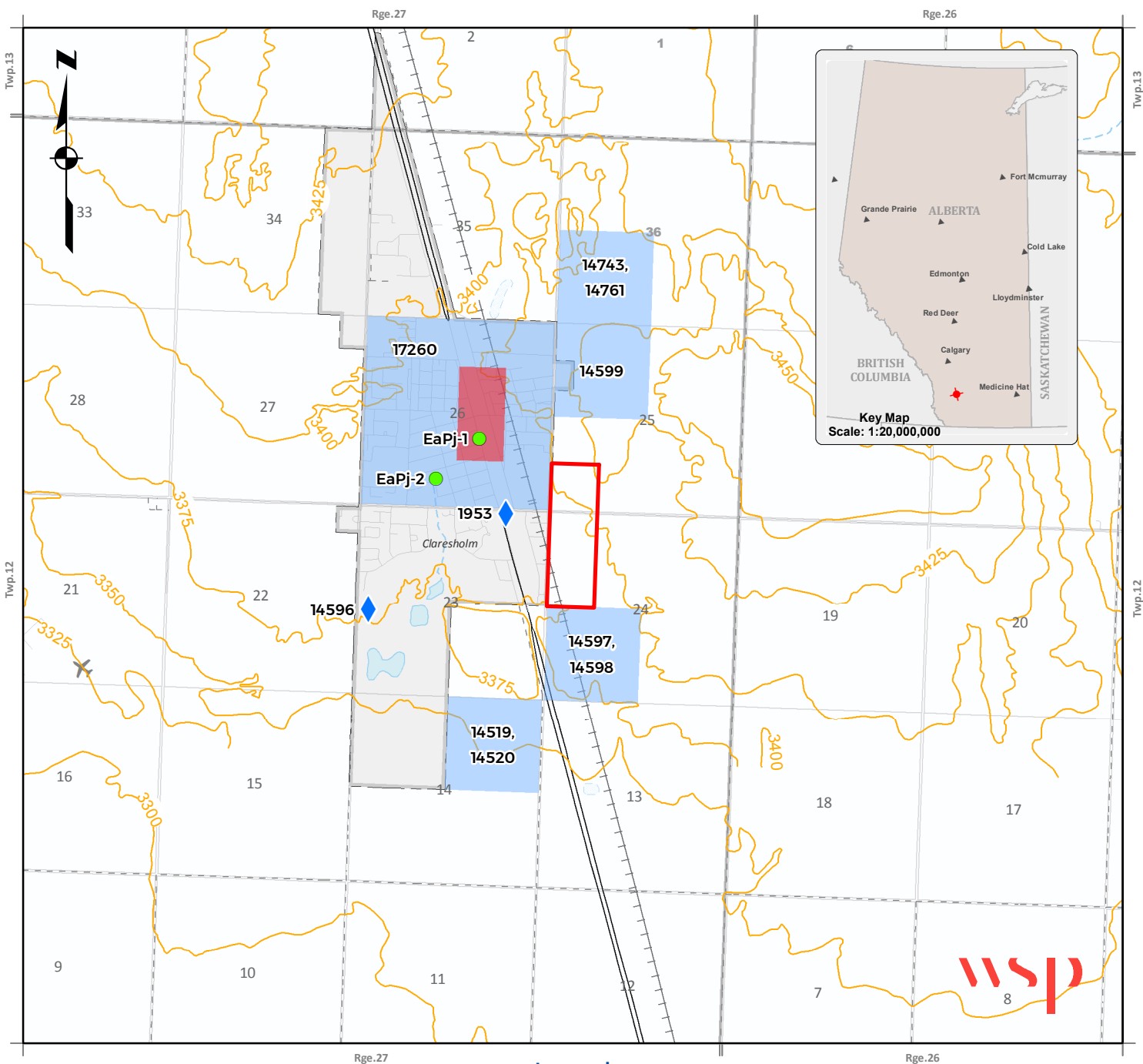
APPENDICES

A FIGURES



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FIGURE 2	PROJECT AREA
FIGURE 3	HISTORIC AERIAL PHOTOGRAPHS



Legend

Activity

- Property Boundary
- Historical Structures
- Archaeological Sites
- Historical Structures

Listing of Historical Resources

- HRV 1
- Miscellaneous**
- 10 m Contour Intervals

Transportation

- Paved Road
- Gravel Road
- Divided Road

Municipal

- Urban Centre

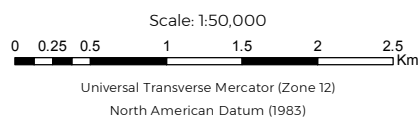
Water Features

- Perennial Lakes/Rivers
- Intermittent Lakes/Rivers
- Intermittent Stream/Creek

Project Overview



Town of Claresholm
12&13-24-027-12 W4M
and 04-25-012-27 W4M



Report By: JM

WSP Job #: 181-07689-00

Figure Number

Drawn by: JH

Date Drawn: July 12, 2018

1

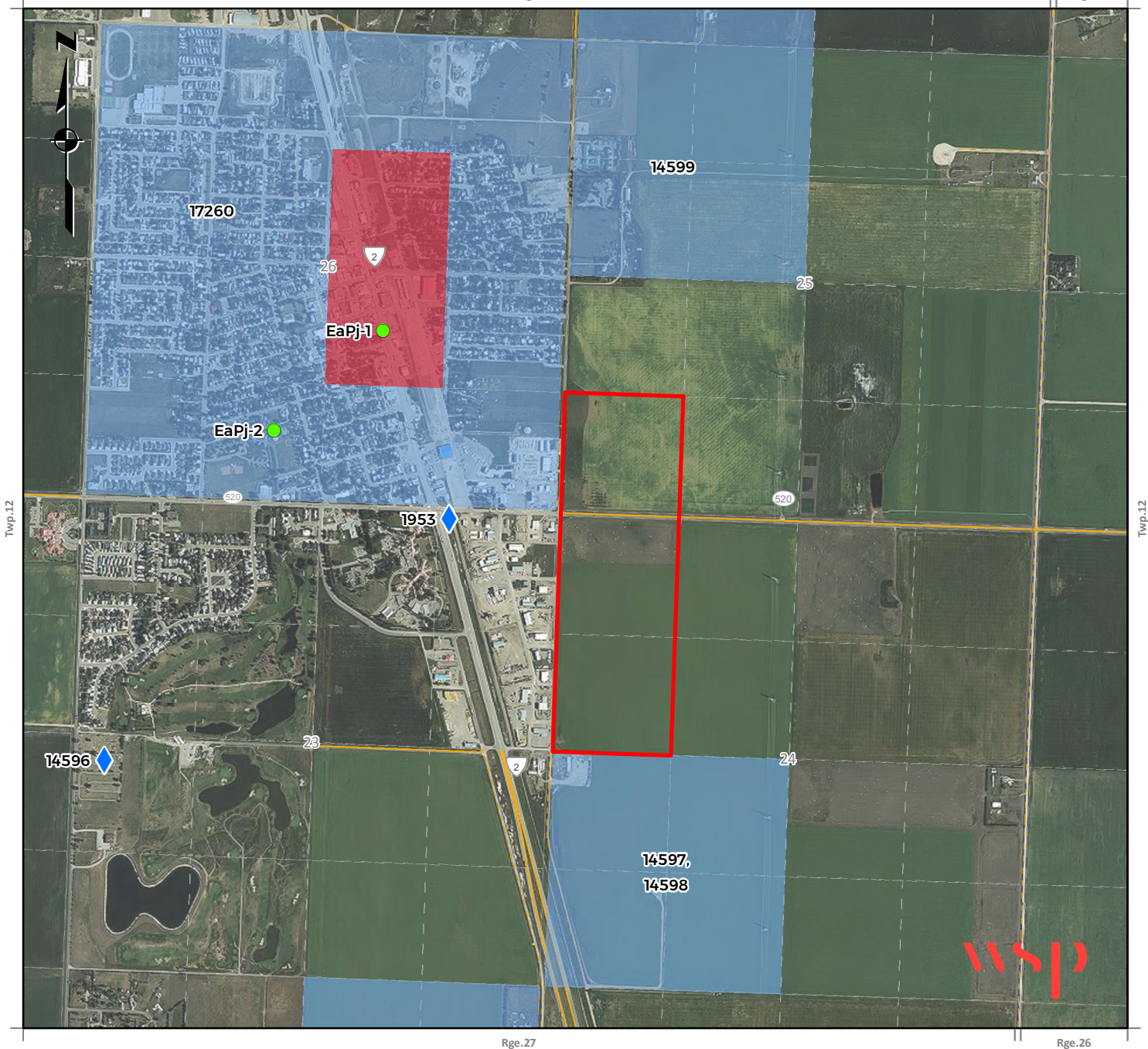
Reviewed By: JM

Inspection Date: N/A

Sheet 1 of 3

Report Name: Historical Resources Overview, Planning for Growth Area Structure Plan

Notes: Data provided by Altalis, Natural Resource Canada, ESRI Basemaps, GeoGratis



Legend

Activity

- Property Boundary
- ◆ Historical Structures
- Archaeological Sites
- Historical Structures

Listing of Historical Resources

- HRV 1

Miscellaneous

- Alberta Township Boundary
- Alberta Section Boundary

Project Area



Town of Claresholm

**12&13-24-027-12 W4M
and 04-25-012-27 W4M**

Scale: 1:20,000



Universal Transverse Mercator (Zone 12)
North American Datum (1983)

Report By: JM

WSP Job #: 181-07689-00

Figure Number

Drawn by: JH

Date Drawn: July 12, 2018

2

Reviewed By: JM

Inspection Date: N/A

Sheet 2 of 3

Report Name: Historical Resources Overview, Planning for Growth Area Structure Plan

Notes: Imagery Source: ESRI Imagery Service [2015]



Aerial Photograph 1: July 3, 1949



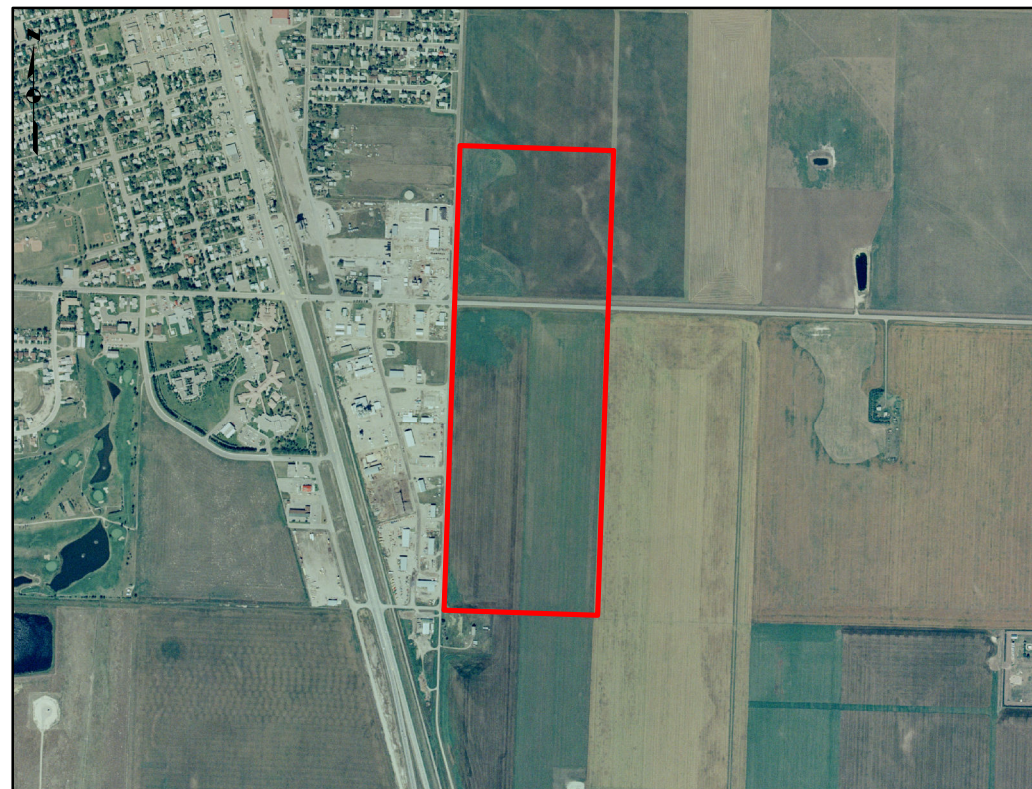
Aerial Photograph 2: July 28, 1966



Aerial Photograph 3: May 11, 1982



Aerial Photograph 4: July 25, 1992



Aerial Photograph 5: June 11, 1999

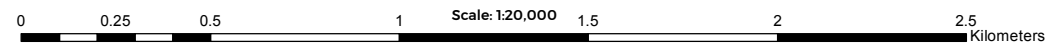


Aerial Photograph 6: 2015

Image Source Table					
Images: Alberta Sustainable Resource Development					
Photo #	Source	Date	Line	Roll	Scale
1	APRS	July 3, 1949	N/A	N/A	1:40,000
2	APRS	July 28, 1966	N/A	N/A	1:32,000
3	APRS	May 11, 1982	N/A	N/A	1:8,000
4	APRS	July 25, 1992	N/A	N/A	1:30,000
5	Valtus Imagery Service	June 11, 1999	N/A	N/A	1:20,000
6	ESRI Imagery Service	2015	N/A	N/A	1:20,000



Legend
 Property Boundary



Historical Aerial Photographs

Town of Claresholm
 12&13-24-027-12 W4M
 and 04-25-012-27 W4M

Universal Transverse Mercator (Zone 12)
 North American Datum (1983)



Figure Number
3
 Sheet 3 of 3

Report By: JM Drawn by: JH Reviewed By: JM WSP Job #: 181-07689-00 Date Drawn: July 12, 2018 Report Name: Historical Resources Overview, Planning for Growth Area Structure Plan

Note: All Aerial Photographs were geometrically aligned to NAD83 Zone 11
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APPENDICES

B

PHOTOGRAPHS



APPENDIX



Photograph 1 – View northeast across Project Area, illustrating typical terrain and the cultivated surface.



Photograph 2 – View southeast from Project Area to previous location of S.D. Smith Homestead (structures removed).

APPENDIX



GEOTECHNICAL EVALUATION PLANNING FOR GROWTH CLARESHOLM, ALBERTA

Prepared for: WSP Canada Inc.

BDT Engineering Ltd.
thurberbruce@outlook.com

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1.0 INTRODUCTION

This report presents the results of a geotechnical evaluation conducted by BDT Engineering Ltd. (BDT) for the proposed commercial / industrial lands located in on the east side of Claresholm, Alberta.

The scope of work for this evaluation was outlined in a proposal emailed to Mr. Trent Purvis, P.Eng., of WSP Canada Inc. (WSP) on April 28, 2018. The objective of this evaluation was to determine the general subsurface conditions in the area of the proposed town expansion and provide recommendations for the geotechnical aspects of design and construction.

Authorization to proceed with this work was received from Mr. Purvis on May 23, 2018.

2.0 PROJECT DETAILS AND SCOPE OF WORK

Based on the information provided by WSP, the proposed annexation area includes approximately 40 acres north of Highway 520 and 80 acres south of Highway 520 adjacent to the existing eastern boundary of Claresholm. The area will be developed as commercial / industrial lands. At the time of writing this report street layouts were not developed yet.

The scope of work for this evaluation included drilling 10 boreholes, a laboratory program to assist in classifying subsurface soils and a report providing the following design and construction recommendations:

- Design parameters for shallow foundations.
- Recommendations for Backfill materials and compaction.
- Design and construction provisions for control of groundwater and mitigation, if required.
- Recommendations for stormwater management facility design and construction.
- Concrete type for structural elements in contact with soils.
- Trench excavation recommendations as well as backfill materials, compaction and moisture content requirements.
- Asphalt pavement materials, structure design and recommendations for roadways (subgrade preparation, granular materials, asphalt materials).

3.0 GEOTECHNICAL FIELD AND LABORATORY WORK

The fieldwork for this evaluation was carried out on June 25, 2018, using a truck mounted solid stem auger drill rig contracted from Chilako Drilling Services Ltd. of Coaldale, Alberta. The drill rig was equipped with 150 mm diameter solid stem continuous flight augers. The borehole locations are presented on figure 1 in Appendix A.

Ten boreholes, (BH001 to BH010), were drilled at equally spaced locations across the development area.

Disturbed grab samples were obtained from each borehole at 0.75 m intervals. All soil samples were visually classified in the field, and the individual soil strata and the interface between them were noted. The borehole logs are presented in Appendix B. An explanation of the terms and symbols used on the borehole logs is also included in Appendix B.

A slotted 25 mm diameter PVC standpipe was installed in five of the boreholes to monitor groundwater levels. Auger cuttings were used to backfill around the standpipes and the boreholes were sealed at the surface with approximately 600 mm of bentonite chips.

Classification tests including natural moisture content, Atterberg Limits were subsequently performed on the collected borehole samples at BDT's Lethbridge Laboratory to aid in the determination of engineering properties. Laboratory results are noted on the borehole logs in Appendix B.

4.0 SITE AND SUBSURFACE CONDITIONS

4.1 SITE CONDITIONS

The site is located at the eastern edge of Claresholm, Alberta. At the time of the field drilling the lands were agricultural and the northern portion was covered with a seed crop. The southern portion of the lands appear to be summer fallow. The lands dipped gently from north to south.

4.2 SOIL CONDITIONS

It should be noted that geological conditions are innately variable. At the time of preparation of this report, information on subsurface stratigraphy was available only at discreet borehole locations. In order to develop recommendations from this information, it is necessary to make some assumptions concerning conditions other than at the borehole locations. Adequate field reviews should be provided during construction to check that these assumptions are reasonable.

The general subsurface stratigraphy comprised surficial layer of topsoil, underlain by native clay and or clay till, underlain by bedrock. The following sections provide a summary of the soils encountered in the borehole logs. A more detailed description is provided on the borehole logs in Appendix B.

4.2.1 TOPSOIL

A layer of topsoil was encountered in all boreholes. The topsoil ranged in thickness between 200 mm and 600 mm. Given these lands are agricultural in nature, varying depths of topsoil should be expected.

4.2.2 CLAY

Clay was encountered in borehole BH003 beneath the topsoil. The clay was approximately 1.0 m thick. The clay was described as silty, with a trace of sand, stiff, low plastic, moist and light brown.

4.2.3 CLAY TILL

Clay till was encountered beneath the clay in borehole BH003 and beneath the topsoil in all other boreholes. The clay till ranged in thickness for 0.2 m in BH003 to 5.8 m in BH010. The clay till was silty, with trace sand and gravel. The clay till was stiff to very stiff, generally increasing with depth, low to medium plastic, and damp to very moist. The clay till was olive brown with some grey mottling. White precipitates, oxide stains and coal specks were noted in the clay till.

4.2.4 BEDROCK

Bedrock was encountered beneath the clay till in all boreholes except BH009 and BH010 and was present to the maximum depth drilled. The bedrock was described as a claystone or siltstone and was weak, friable, moist, low plastic and light brown to grey.

4.3 GROUNDWATER CONDITIONS

At the time of drilling, seepage was encountered in BH003. The groundwater levels were measured on June 29, 2018. Table 4.3 summarizes the groundwater monitoring data.

Table 4.3 Groundwater Monitoring Data

Borehole Number	Depth of Standpipe below Ground Surface (m)	Depth to groundwater from ground surface (m) June 29, 2018
BH002	3.40	2.15
BH003	6.10	Dry
BH006	6.10	Dry
BH007	6.10	Dry
BH010	6.10	Dry

It appears that the groundwater encountered is perched above the bedrock within the lower portion of the clay till and isolated across the site. Given the isolated nature of the groundwater recorded, it is anticipated that groundwater for the most part will not impact future developments. It is noted that groundwater levels will fluctuate seasonally in response to climatic conditions and may be at a different depth when construction commences. Groundwater levels should be monitored prior to development. The intent is to provide an early indication of dewatering requirements during excavations for underground utilities and foundations.

5.0 GEOTECHNICAL RECOMMENDATIONS

5.1 GENERAL

The recommendations that follow offer options intended to aid in the development of the area. The recommendations are provided on the understanding and condition that BDT will be retained to review the relevant aspects of the final design drawings and specifications and will be retained to conduct such field reviews as are necessary to ensure compliance with geotechnical aspects of the Building Code, this report, and final plans and specifications. BDT accepts no liability for any use of this report in the event that BDT is not retained to provide these review services.

Recommendations are provided for shallow footings, grade supported floor slabs, below grade construction, general site development and lot grading, trench excavation and backfill, stormwater retention ponds, groundwater considerations, backfill materials and compaction, roadway design considerations and concrete type.

5.2 SITE PREPARATION

Subgrade preparation is required in all lots as well as all paved areas. This includes stripping of topsoil and deleterious fill materials, scarification, moisture conditioning, and compaction. The native clay and clay till soils should be acceptable for site grading purposes. The clay soils appear to be slightly below the optimum moisture content (OMC) and as such, moisture conditioning consisting of wetting will be required to reduce the swelling potential of this soil and to achieve the compaction standards recommended. Proof-rolling within roadways to detect soft areas is also recommended. The contractor should expect soil moisture variability across the site.

Shallow footings are generally feasible for commercial and light industrial buildings in all areas of the proposed development area. Further recommendations are provided in Section 5.10. However, because footings may be placed within areas of general engineered fill, full-time quality assurance monitoring by geotechnical personnel is required during fill placement. It is noted that placement of foundations on engineering cohesive fill thicknesses greater than 1.5 m require

special consideration regarding long-term consolidation of the fill and subsequent performance issues with the foundations / floor slabs-on-grade.

Slabs-on-grade construction for the development area should consider the precautions recommended for slabs-on-grade, including the subgrade preparation measures intended to improve slab performance.

All foundation recommendations presented in this report are based on the assumption that an adequate level of monitoring will be provided during construction and that all construction will be carried out by suitably qualified contractors, experienced in foundation and earthworks construction. An adequate level of monitoring is considered to be:

- For shallow foundations and slabs, inspection of bearing surfaces prior to placement of concrete of mudslabs, and design review during construction.
- For earthworks, full-time monitoring and compaction testing.

All such monitoring should be carried out by suitably qualified persons, independent of the contractor. One of the purposes of providing an adequate level of monitoring is to check that recommendations, based on information collected at discrete borehole locations, are applicable to other areas of the site.

5.3 SITE GRADING

All lots should be graded for drainage at a minimum of 2.0 %. The existing surficial site soils comprising clay and clay till are suitable for use as landscape fill materials or for use as general engineered fill materials for general grading. The moisture content of the site soils at surface generally appear to be below their OMC and may require wetting to achieve their anticipated OMC. General engineering fill materials for lot grading should be moisture conditions to within a range of -1 % to +2% of the OMC prior to compaction and compacted to a minimum of 98 % of SPD.

Further recommendations regarding backfill materials and compaction are in Appendix C.

5.4 CONSTRUCTION EXCAVATIONS

Excavations should be carried out in accordance with the Alberta Occupational Health and Safety (OH&S) Regulations. For this project, the depth for the majority of the excavations is assumed to be less than 3.0 m below existing ground surface. Excavations to deeper depths require special considerations. The following recommendations notwithstanding, the responsibility of trench and all excavation cutslopes resides with the Contractor and should take into consideration site-specific conditions concerning soil stratigraphy and groundwater. All excavations should be reviewed by a geotechnical engineer prior to personnel working within the base of the excavation.

Temporary excavations within stiff clay, clay till or bedrock soils which are to be deeper than 1.5 m should have the sides shored and braced or the slopes should be cut back no steeper than 1.0 horizontal to 1.0 vertical (1H:1V)

Flatter sideslopes may be required in some areas where groundwater is encountered within sand layers, which may cause local sloughing and instability of the excavation sidewalls. In these instances, the excavation configuration design should be reviewed by experienced personnel, prior to allowing personnel to enter the base of the excavation. Vertical trench cuts using trench box wall support are not recommended for this project due to the inherent difficulty in compacting the backfill materials to an engineered standard, as well as the potential of cave-ins of the excavation sidewalls against the utility box.

Any encountered groundwater seepage should be directed towards sumps for removal. Conventional construction sump pumps should be capable of groundwater control.

Temporary surcharge loads, such as spill piles, should not be allowed within a distance equal to the depth of the excavation from an unsupported excavation face or 3.0m, whichever is greater, while mobile equipment should be kept back at least 3.0m. All excavation sideslopes should be checked regularly for signs of sloughing, especially after rainfall periods. Small earth falls from the sideslopes are a potential source of danger to workmen and must be guarded against.

General recommendations regarding construction excavations are included in Appendix C.

5.5 TRENCH EXCAVATION AND BACKFILL

The moisture content of the clay and clay till soils encountered across the site generally varies below and above the anticipated optimum moisture content. The clay and clay till soils tend to be slightly dryer than the OMC at depth. It is expected that such soils will require slight wetting to achieve desired moisture content and proper compaction.

It is anticipated that conventional excavating equipment will be able to dig through the encountered bedrock. It is possible in isolated areas that pneumatic chisels will be required to break up the encountered siltstone and possible sandstone.

Any seepage, if encountered, should be directed towards a sump for removal from the excavation, where necessary. Temporary surcharge loads, such as spill piles, should not be allowed within 3.0 m of an unsupported excavation face, while mobile equipment should be kept back at least 1.0 m. All excavations should be checked regularly for signs of sloughing, especially after rainfall periods. Small earth falls from the sideslopes are a potential source of danger to workers and must be guarded against.

Trenches must be backfilled in such a way as to minimize the potential differential settlement and/or frost heave movements. A minimum density of 95% of Standard Proctor Density (SPD) is

recommended for all trenches, with the exception of the top 600 mm, which should be compacted to 98% of SPD. Clay backfill should be uniformly moisture conditioned to between \pm 2% of optimum moisture content (OMC). The compacted thickness of each lift of backfill should not exceed 150 mm. In order to achieve this uniformity, the lift thickness and compaction criteria must be strictly enforced.

General recommendations for trench excavation and backfill are included in Appendix C.

5.6 BACKFILL MATERIALS AND COMPACTION

The existing site soils comprising clay and clay till are considered acceptable for use as general engineered fill. Any soil containing deleterious matter should be removed from the site. The final decision on approved backfill materials should be made during construction.

General engineered fill should be clean, uniform, low to medium plastic clay or clay till, not containing deleterious matter, and compacted to 98% of SPD with moisture within 2% of OMC.

Further recommendations for backfill materials and compaction are included in Appendix D.

5.7 SUBGRADE PREPARATION

For all roadways the upper 300 mm of clay or clay till soils should be scarified and uniformly moisture conditioned to between -1% of optimum and 2% over OMC. The subgrade should then be uniformly compacted to a minimum of 98% of SPD.

All deleterious and unsuitable materials, including any sand pockets, if encountered, should be excavated from under proposed fill areas during the reconstruction operations.

The clay, clay till soils encountered are acceptable for subgrade construction. Sand layers if encountered should be removed. Proof-rolling to detect soft areas once the subgrade preparation activities are completed is also recommended.

5.8 Pavement Design Recommendations

Two pavement design sections are provided below. One for 'Local' roadways, and one for 'Collector' roadways.

Design Pavement Section		
Material Type	Local	Collector
Surface Course Asphalt Concrete (Type III)	75 mm	50 mm
Base Course Asphalt Concrete (Type II)		60 mm
Granular Base Course	200 mm	300 mm
Subgrade Preparation	300 mm	300 mm

The above recommended pavement layer thicknesses generally refer to average values and recognize typical construction variability. As such, constructed layer thicknesses should satisfy the thickness tolerances identified in the City of Lethbridge Engineering Standards for granular materials and asphalt concrete. All asphalt paving lifts should be compacted to a minimum of 93 % of the Maximum Relative Density, as per current City of Lethbridge Transportation Standards.

The pavement design should include provisions for subsurface drainage of the pavement granular layers. It is understood that the roadway cross section for this development contemplates a semi-rural cross section. Therefore, the granular layers should daylight to the ditches where possible.

5.9 CEMENT TYPE

Based on BDT’s local experience with the local soils, as well as the laboratory testing conducted to determine soluble sulphate levels, the properties of concrete for foundations in contact with soil or groundwater shall meet the requirements of CSA A23.1-14 Class S-2 exposure and have a minimum specified 56-day compressive strength of 32 MPa.

For this exposure classification, alternatives include the usage of Type HS Portland cement or blends of cement and supplementary cementing materials conforming to Type HS and/or Type HSb cements.

5.10 LIMIT STATES DESIGN

The design parameters provided in the following sections may be used to calculate the ultimate foundation capacity in each case. For Limit States Design (LSD) methodology, in order to calculate the factored load capacity, the appropriate Soil Resistance Factors must be applied to each loading conditions as follows:

$$\text{Factored Capacity} = \text{Ultimate Capacity} \times \text{Soil Resistance Factors}$$

In general, the following soil resistance factors in Table 5.10 must be incorporated into the foundation design. These factors are considered to be in accordance with the CFEM (2006).

Table 5.10 Soil Resistance Factors

Item	Soil Resistance Factor
Shallow Foundations	
Bearing Resistance	0.5
Passive Resistance	0.5
Horizontal resistance (sliding)	0.8

5.11 SHALLOW FOUNDATIONS

Shallow foundations, should be constructed a minimum of 1.4 m below the final design ground surface (frost protection requirements). Based on the soil stratigraphy and conditions on this site, it is recommended that shallow footings be founded on the clay, clay till or bedrock.

The ultimate static bearing pressure for the design of strip and spread footings at these depths may be taken as 300 kPa for the clay, clay till soils or Bedrock. Factoring should be considered as noted in section 5.10. Footing dimensions should be in accordance with the minimum requirements of the Building Code.

Bearing certifications by a geotechnical engineer is recommend to ensure that the shallow foundations are placed on competent native soils. If softer native soils are encountered at footing level, recommendations may be provided to lower the footing elevations to materials satisfying the design bearing capacity or to widen the footings within these areas. This should be a field determination at the time of bearing observation.

The anticipated foundation soils are of a low to medium plasticity, and therefore, are prone to volume changes (both heave and settlement) with varying moisture content. A permanent weeping tile system is also recommended around the outside perimeter of any structure at the foundation elevation to maintain a consistent moisture profile of the foundation soils.

Settlement of footings designed and constructed in accordance with the above recommendations should be well within the normally tolerated values of 25 mm total and 15 mm differential at factored loading. If this range of settlement is not tolerable, then a pile foundation system may be considered for the building.

Further recommendations regarding shallow foundations are presented in Appendix C.

5.12 FLOOR SLABS-ON-GRADE

For construction of floor slabs-on-grade for buildings in the development area the subgrade should be scarified to a minimum depth of 300 mm, and moisture conditioned to within –1% to +2% of the OMC. The minimum compaction should be 98% of SPD. The prepared subgrade should be proof-rolled and any soft or loose pockets detected should be reconditioned as recommended above or over-excavated and replaced with general engineered fill.

A levelling course of clean well-graded crushed gravel, at least 150 mm in compacted thickness, is recommended directly beneath the slabs-on-grade, unless a thicker course is required for structural purposes. The subgrade beneath slabs-on-grade should be protected at all times from moisture or exposure which may cause softening or disturbance of the subgrade soils. This applies during and after the construction period (and before and after replacement of the required general engineered fill). Should the exposed surface become saturated or disturbed, it should be reworked to achieve the above standards. If the subgrade is properly prepared as noted above, floor slab movements should be limited to less than approximately 25 mm. Slabs-on-grade should be separated from bearing members to allow some differential movement. If this range of differential movement is unacceptable, the owner should consider a structurally supported floor.

Recommended procedures for proof-rolling and backfill materials and further recommendations for slabs-on-grade construction are included in Appendix C.

5.13 STRUCTURAL SLABS

A structurally supported floor slab with a crawl space beneath may be used, if differential movements from a slabs-on-grade system are not tolerable. The crawl space floor should be graded toward a sump to collect water that may enter. The crawl space floor should also be covered with a vapour barrier and concrete. If a concrete floor is selected for the crawl space, bond breaks should be provided at the foundation walls and columns to allow it to move independently of the structure.

It is important that the crawl space be properly insulated and vented according to applicable building codes. The use of a crawl space with any covering other than concrete is not recommended for this development. Alternatively, the slab may be totally structurally supported with no crawl space. However, with this type of structurally supported floor slab system, there is a risk of ground movement relative to the slab. This relative movement can lead to problems if piping and other utilities that are connected to the slab are embedded within the ground beneath the slab. Utilities beneath the structurally supported floor slabs should be protected from differential movement by placing utilities within boxes suspended from the structural slab. In addition, a void form is recommended below the floor slab in order to prevent transfer of uplift pressures due to swelling clay soil.

5.14 BELOW GRADE WALLS

All below-grade walls should be designed to resist lateral earth pressure in an “at-rest” condition. This condition assumes a triangular pressure distribution and may be calculated using the following expression:

$$P_o = K_o (\gamma H + Q)$$

Where: P_o = Lateral earth pressure “at-rest” condition (no wall movement occurs at a given depth)

K_o = Coefficient of earth pressure “at-rest” condition (use 0.5 for cohesive backfill and 0.45 for sand and gravel backfill)

γ = Bulk unit weight of backfill soil (use 19 or 21 kN / m³ for cohesive or granular backfill, respectively).

H = Depth below final grade (m).

Q = Surcharge pressure at ground level (kPa).

It is assumed that drainage is provided for all below-grade walls through the installation of the weeping tile, and hydrostatic pressure will not be a factor in design. An acceptable weeping tile system should consist of a perforated weeping tile wrapped in a geosock or geotextile fabric, in turn surrounded with a minimum of 150 mm thick covering of washed rock (maximum size 25 mm). The weeping tile should have a minimum 0.5 % slope leading to a sump. The preferred method would be to have the sump discharge any water accumulation remotely from the building footprint towards ditches or other stormwater conveyance features. Based on site conditions it is anticipated that the sump pump will run intermittently and more often during and after rain events.

Backfill around concrete walls should not commence before the concrete has reached a minimum two-thirds of its design strength and the walls are laterally braced. Only hand-operated compaction equipment should be employed within 600 mm of the concrete walls. Caution should be used when compacting backfill to avoid high lateral loads caused by excessive compactive effort. A compaction standard of 95 % Standard Procter Density is recommended. To avoid differential wall pressures, the backfill should be brought up evenly around the walls. A

minimum 600 mm thick clay cap should be placed at the ground surface to reduce the infiltration of surface water.

5.15 FROST PROTECTION

For protection against frost-action, perimeter footings in heated structures should be extended to such depths as to provide a minimum soil cover of 1.4 m. Isolated or exterior footings in unheated structures should have a minimum soil cover of 2.1 m unless provided with equivalent insulation.

Pipes buried with less than 2.1 m of soil cover should be protected with insulation to avoid frost effects that might cause damage to or breakage of the pipes. Rigid insulation placed under areas subject to vehicular wheel loadings should be provided with a minimum thickness of 600 mm of compacted granular base.

5.16 SEISMIC DESIGN

The site classification recommended for seismic site response is Classification D, as noted in Table 4.1.8.4a of the NBCC.

6.0 STORMWATER POND DEVELOPMENT

6.1 GENERAL

Based on BDT's understanding of a typical stormwater management facility design, a dry pond typically has a base elevation of approximately 2 m to 3 m below final ground surface. A typical wet pond might have a base elevation ranging between 3 m and 5 m below final ground elevation. Such facilities are normally constructed as an excavation below ground surface. These facilities will provide overland stormwater storage for the area in accordance with City of Lethbridge guidelines.

Once the operational water level elevation of the wet pond is designed, it is recommended that the proposed sideslopes for the pond below normal operating level be no steeper than 3H:1V. Above the normal water level, the sideslopes are recommended to no steeper than 5H:1V.

6.2 FACILITY DESIGN

As discussed in the previous sections, the subsurface stratigraphy of the site comprises clay and clay till soils overlying bedrock. It is recommended that the clay or clay till soils be reworked into a low permeable compact clay liner to provide the required containment.

The use of native clay or clay till materials encountered on this site for construction of a remoulded clay liner for the pond is considered feasible, provided certain precautions are undertaken, as recommend in the following sections.

For the assessment of clay liner suitability, a laboratory constant head permeability test should be conducted on a remoulded sample of the native clay or clay till soil. Prior to final design and construction of the facility the borrow source should be reviewed to verify the site-specific permeability coefficient.

Based upon the site soil conditions and the antiipated permeability value, it is recommended that a preliminary thickness for the remoulded clay liner be 0.6 m long the base of the wet pond and 1.0 m along the sidewalls up to design operation water elevations (minimum recommended).

A liner thickness of 0.3 m may be given consideration for base liners in other areas of the proposed development (dry pond), which will only occasionally be below water. This thickness accounts for the potential of desiccation of the upper 0.2 m during the initial periods when the dry pond is empty. It also accounts for potential disturbance during storm events and to facilitate access during periods of maintenance. Thirdly, it is intended as an additional level of protection, to reduce the long-term infiltration of groundwater and soil saturation below the dry pond, as a means of maintaining long-term stability of the adjacent slopes.

The following discussions and recommendations pertain to the pond construction, including the construction of a low permeability complicated clay liner

6.3 POND CONSTRUCTION

6.3.1 GENERAL BASE PREPARATION

Following stripping any organic materials within the development area, the containment basin area should be over-excavated beneath the proposed invert elevation in order to allow sufficient thickness of compacted clay base liner. The clay or clay till soil within the base of the excavation should then be scarified to a minimum depth of 300 mm, moisture conditioned to between -1% and +2% of OMC, and recompacted to a minimum of 98 % of SPD. The prepared subgrade thickness may be taken into account in the design liner thickness.

The Pond sidewalls in the cut areas (up to HWL) should also be over-excavated a sufficient amount to allow the construction of a compacted clay liner with the exposed subgrade scarified, moisture conditioned, and compacted as noted above.

Monitoring of excavated soils within the pond footprint is recommended so that unsuitable materials, such as sands, are not used in critical construction items.

The composition and consistencies of the soils encountered on the site are such that conventional hydraulic excavators should be able to remove these materials. Cobbles and

boulders may be occasionally encountered within the clay till matrix. General recommendations regarding backfill materials and compaction as well as construction excavations are given in Appendix C.

Full-time monitoring is recommended by suitably qualified persons, independent of the Contractor, one of the purposes of providing an adequate level of monitoring is to check that recommendations, based on data obtained at discrete borehole locations, are relevant to other areas of the site.

7.0 DESIGN AND CONSTRUCTION GUIDELINES

General design and construction guidelines are provided in Appendix D, under the following supplemental heading:

- Shallow Foundations
- Floor Slabs-on-Grade
- Backfill Materials and Compaction
- Construction Excavations

These guidelines are intended to present standards of good practice. Although supplemental to the main text of this report, they should be interpreted as part of the report. Design recommendations presented herein are based on the premise that these guidelines will be followed. The design and construction guidelines are not intended to represent detailed specifications for the works although they may prove useful in the preparation of such specifications. In the event of any discrepancy between the main text of this report and Appendix D, the main text should govern.

8.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully Submitted

The image shows the official seal of the Professional Engineer of Alberta, featuring a bison and the name Bruce D. Thurber. To the right of the seal is a handwritten signature and the date 2/24/18.

Bruce D. Thurber, P.Eng., PMP
BDT Engineering Ltd.

P13556

APPENDIX A – SITE PLAN SHOWING BOREHOLE LOCATIONS

APPENDIX B – BOREHOLE LOGS

TERMS USED ON BOREHOLE LOGS

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on 0.075mm sieve): Includes (1) clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as inferred from laboratory or in situ tests.

DESCRIPTIVE TERM	RELATIVE DENSITY	N (blows per 0.3m)
Very Loose	0 TO 20%	0 to 4
Loose	20 TO 40%	4 to 10
Compact	40 TO 75%	10 to 30
Dense	75 TO 90%	30 to 50
Very Dense	90 TO 100%	greater than 50

The number of blows, N, on a 51mm O.D. split spoon sampler of a 63.5kg weight falling 0.76m, required to drive the sampler a distance of 0.3m from 0.15m to 0.45m.

FINE GRAINED SOILS (major portion passing 0.075mm sieve): Includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as estimated from laboratory or in situ tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH (KPA)
Very Soft	Less than 25
Soft	25 to 50
Firm	50 to 100
Stiff	100 to 200
Very Stiff	200 to 400
Hard	Greater than 400

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil.

GENERAL DESCRIPTIVE TERMS

Slickensided - having inclined planes of weakness that are slick and glossy in appearance.

Fissured - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.

Laminated - composed of thin layers of varying colour and texture.

Interbedded - composed of alternate layers of different soil types.

Calcareous - containing appreciable quantities of calcium carbonate.;

Well graded - having wide range in grain sizes and substantial amounts of intermediate particle sizes.

Poorly graded - predominantly of one grain size, or having a range of sizes with some intermediate size missing.

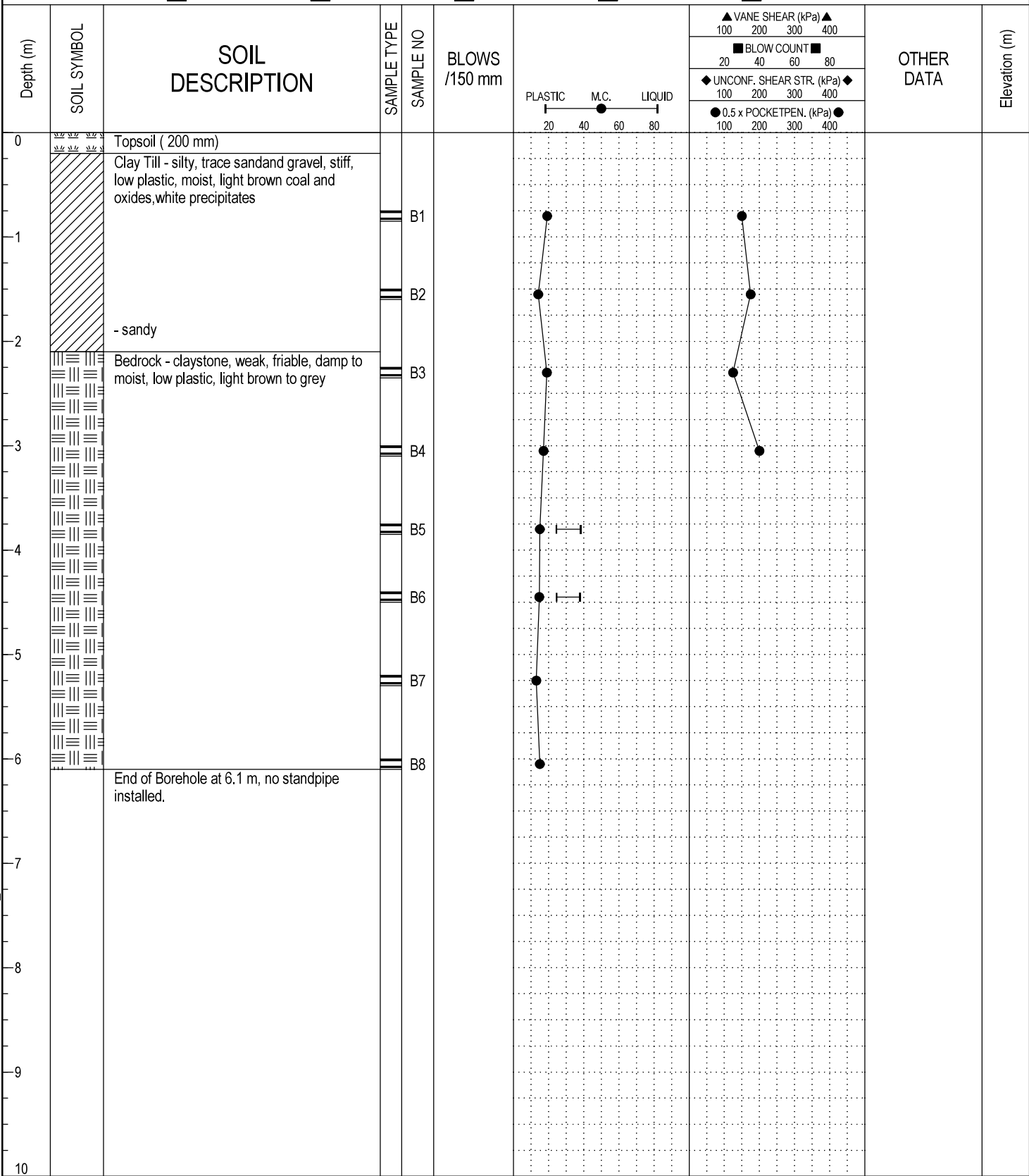
MODIFIED UNIFIED SOIL CLASSIFICATION

MAJOR DIVISION		GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA		
COARSE-GRAINED SOILS More than 50% retained on 75 µm sieve*	GRAVELS 50% or more of coarse fraction retained on 4.75 mm sieve	CLEAN GRAVELS	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	$C_u = D_{60} / D_{10}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting both criteria for GW	
		GRAVELS WITH FINES	GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		
		SANDS More than 50% of coarse fraction passes 4.75 mm sieve	CLEAN SANDS	GM		Silty gravels, gravel-sand-silt mixtures
			SANDS WITH FINES	GC		Clayey gravels, gravel-sand-clay mixtures
	FINE-GRAINED SOILS (by behavior) 50% or more passes 75 µm sieve*	SILTS Liquid limit	<50	ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands of slight plasticity	For classification of fine-grained soils and fine fraction of coarse-grained soils, <div style="text-align: center;"> PLASTICITY CHART </div>
			>50	MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts	
		CLAYS Above "A" line on plasticity chart negligible organic content Liquid limit	<30	CL	Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			30-50	CI	Inorganic clays of medium plasticity, silty clays	
			>50	CH	Inorganic clays of high plasticity, fat clays	
		ORGANIC SILTS AND CLAYS Liquid limit	<50	OL	Organic silts and organic silty clays of low plasticity	
>50	OH		Organic clays of medium to high plasticity			
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils	*Based on the material passing the 75 mm sieve Reference: ASTM Designation D2487, for identification procedure see D2488. USC as modified by PFRA		

SOIL COMPONENTS				OVERSIZE MATERIAL	
FRACTION	SIEVE SIZE		DEFINING RANGES OF PERCENTAGE BY MASS OF MINOR COMPONENTS		Rounded or subrounded COBBLES 75 mm to 300 mm BOULDERS > 300 mm
	PASSING	RETAINED	PERCENTAGE	DESCRIPTOR	
GRAVEL coarse fine	75 mm	19 mm	>35 %	"and"	Not rounded ROCK FRAGMENTS >75 mm ROCKS > 0.76 cubic metre in volume
	19 mm	4.75 mm	21 to 35 %	"y-adjective"	
SAND coarse medium fine	4.75 mm	2.00 mm	10 to 20 %	"some"	
	2.00 mm	425 µm	>0 to 10 %	"trace"	
	425 µm	75 µm			
SILT (non plastic) or CLAY (plastic)	75 µm		as above but by behavior		

Planning for Growth Claresholm		BOREHOLE NO: BH001
Client: WSP Canada Inc.		PROJECT NO: 2018-031
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE SHELBY TUBE CORE SAMPLE SPT SAMPLE GRAB SAMPLE NO RECOVERY



LOGGED BY: CA	COMPLETION DEPTH: 6.10 m
REVIEWED BY: BDT	COMPLETION DATE: 6-25-18

AB TRANS BOREHOLE LOG PLANNING FOR GROWTH.GPJ AB_TRANS.GDT 7-4-18

Planning for Growth Claresholm				BOREHOLE NO: BH002						
Client: WSP Canada Inc.				PROJECT NO: 2018-031						
Solid Stem Auger				ELEVATION:						
SAMPLE TYPE		<input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE SAMPLE <input type="checkbox"/> SPT SAMPLE <input type="checkbox"/> GRAB SAMPLE <input type="checkbox"/> NO RECOVERY								
BACKFILL TYPE		<input type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND								
Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	▲ VANE SHEAR (kPa) ▲ 100 200 300 400 ■ BLOW COUNT ■ 20 40 60 80 ◆ UNCONF. SHEAR STR. (kPa) ◆ 100 200 300 400 ● 0.5 x POCKETPEN. (kPa) ● 100 200 300 400			OTHER DATA	Elevation (m)
						PLASTIC	M.C.	LIQUID		
0		Topsoil (300 mm)								
0-1		Clay Till - silty, sandy, trace gravel, stiff to very stiff, damp, low plastic, olive brown, oxides coal		B1						
1-3.4		Bedrock - Clay stone and siltstone, weak, fraible, damp, low plastic, light brown		B2 B3 B4 B5						
3.4-4		End of Borehole at 3.4 m. Standpipe installed to 3.4 m. Standpipe dry when measured on June 29, 2018								
4-10										

AB TRANS BOREHOLE LOG PLANNING FOR GROWTH.GPJ AB_TRANS.GDT 7-4-18

LOGGED BY: CA	COMPLETION DEPTH: 3.40 m
REVIEWED BY: BDT	COMPLETION DATE: 6-25-18
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Planning for Growth Claresholm				BOREHOLE NO: BH003				
Client: WSP Canada Inc.				PROJECT NO: 2018-031				
Solid Stem Auger				ELEVATION:				
SAMPLE TYPE		<input checked="" type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> CORE SAMPLE <input type="checkbox"/> SPT SAMPLE <input type="checkbox"/> GRAB SAMPLE <input type="checkbox"/> NO RECOVERY						
BACKFILL TYPE		<input checked="" type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND						
Depth (m) Water Level	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE SAMPLE NO	BLOWS /150 mm		VANE SHEAR (kPa) 100 200 300 400	OTHER DATA	Elevation (m)
						BLOW COUNT 20 40 60 80		
0		Topsoil (300 mm)						
		Clay - silty, trace sand, stiff, low plastic, moist light brown						
1		Clay Till - silty, sandy, trace gravel, stiff to very stiff, damp, low plastic, olive brown, oxides coal	B1					
2		Bedrock - claystone, weak, friable, damp to moist, low plastic, light brown to grey	B2					
			B3					
			B4					
		- free water	B5					
			B6					
			B7					
		- Siltstone	B8					
6		End of Borehole at 6.1 m. Standpipe installed to 6.1 m. Groundwater level as noted recorded on June 29, 2018						

AB TRANS BOREHOLE LOG PLANNING FOR GROWTH.GPJ AB_TRANS.GDT 7-4-18

LOGGED BY: CA	COMPLETION DEPTH: 6.10 m
REVIEWED BY: BDT	COMPLETION DATE: 6-25-18
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Planning for Growth Claresholm	BOREHOLE NO: BH004
Client: WSP Canada Inc.	PROJECT NO: 2018-031
Solid Stem Auger	ELEVATION:

SAMPLE TYPE	<input checked="" type="checkbox"/> SHELBY TUBE	<input checked="" type="checkbox"/> CORE SAMPLE	<input checked="" type="checkbox"/> SPT SAMPLE	<input checked="" type="checkbox"/> GRAB SAMPLE	<input type="checkbox"/> NO RECOVERY
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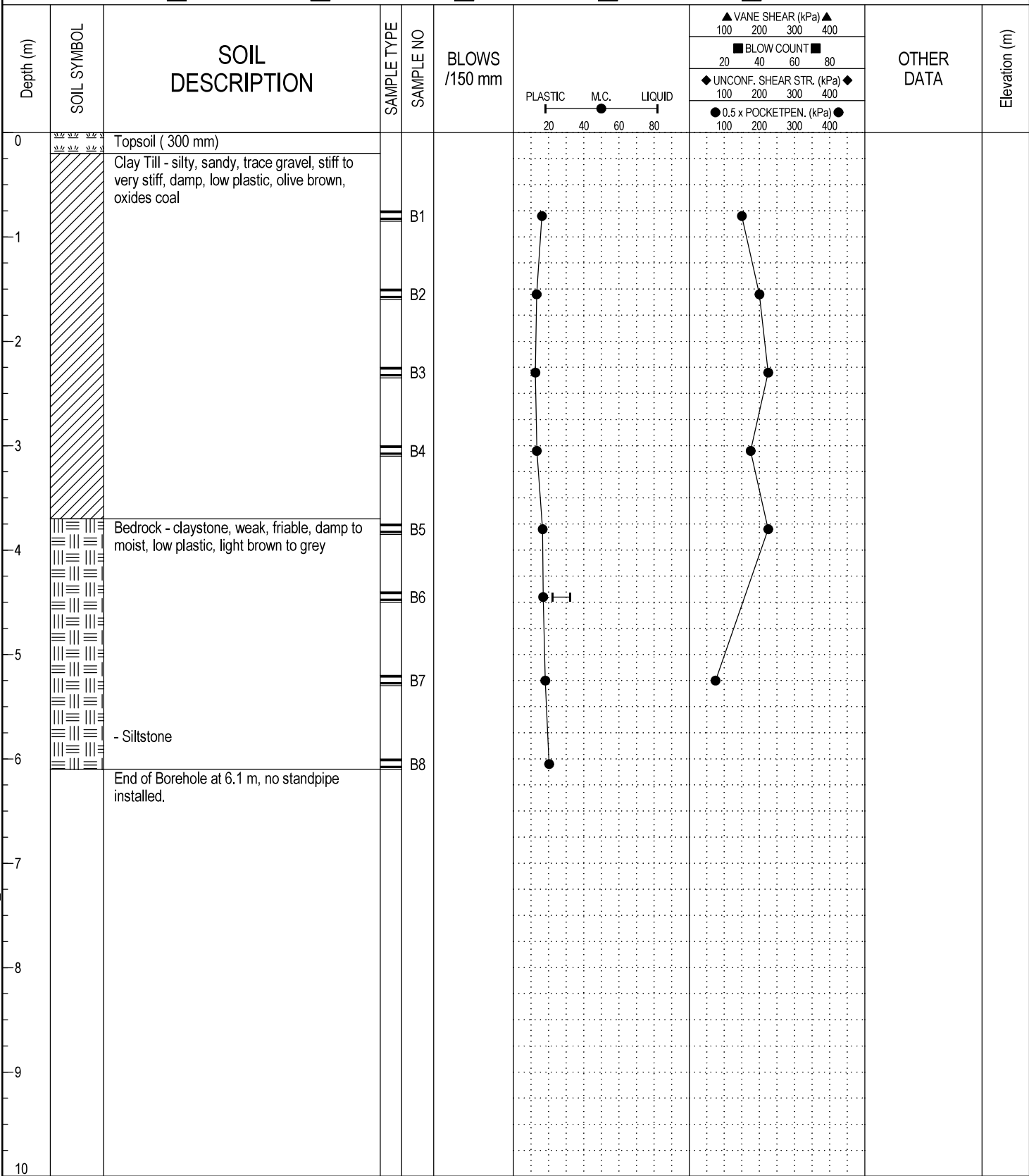
Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	PLASTIC M.C. LIQUID 20 40 60 80	▲ VANE SHEAR (kPa) ▲	■ BLOW COUNT ■	◆ UNCONF. SHEAR STR. (kPa) ◆	OTHER DATA	Elevation (m)
							100 200 300 400	20 40 60 80	100 200 300 400		
0		Topsoil (200 mm)									
0 - 1		Clay Till - silty, sandy, trace gravel, stiff to very stiff, damp, low plastic, olive brown, oxides coal		B1							
1 - 6.1		Bedrock - claystone, weak, friable, damp to moist, low plastic, light brown to grey		B2 B3 B4 B5 B6 B7 B8							
6.1		End of Borehole at 6.1 m, no standpipe installed.		B8							

AB TRANS BOREHOLE LOG - PLANNING FOR GROWTH.GPJ AB_TRANS.GDT 7-4-18

LOGGED BY: CA	COMPLETION DEPTH: 6.10 m
REVIEWED BY: BDT	COMPLETION DATE: 6-25-18
Page 1 of 1	

Planning for Growth Claresholm		BOREHOLE NO: BH005
Client: WSP Canada Inc.		PROJECT NO: 2018-031
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE SHELBY TUBE CORE SAMPLE SPT SAMPLE GRAB SAMPLE NO RECOVERY



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LOGGED BY: CA	COMPLETION DEPTH: 6.10 m
REVIEWED BY: BDT	COMPLETION DATE: 6-25-18

Planning for Growth Claresholm				BOREHOLE NO: BH006						
Client: WSP Canada Inc.				PROJECT NO: 2018-031						
Solid Stem Auger				ELEVATION:						
SAMPLE TYPE		<input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE SAMPLE <input type="checkbox"/> SPT SAMPLE <input type="checkbox"/> GRAB SAMPLE <input type="checkbox"/> NO RECOVERY								
BACKFILL TYPE		<input type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND								
Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	▲ VANE SHEAR (kPa) ▲ 100 200 300 400 ■ BLOW COUNT ■ 20 40 60 80 ◆ UNCONF. SHEAR STR. (kPa) ◆ 100 200 300 400 ● 0.5 x POCKETPEN. (kPa) ● 100 200 300 400			OTHER DATA	Elevation (m)
						PLASTIC	M.C.	LIQUID		
0		Topsoil (300 mm)								
0		Clay Till - silty, sandy, trace gravel, stiff to very stiff, damp, low plastic, olive brown, oxides coal								
1			B1							
2			B2							
3			B3							
4			B4							
4		Bedrock - claystone, weak, friable, damp to moist, low plastic, light brown to grey	B5							
5			B6							
6			B7							
6			B8							
6.1		End of Borehole at 6.1 m. Standpipe installed to 6.1 m. Standpipe dry when measured on June 29, 2018								

AB TRANS BOREHOLE LOG PLANNING FOR GROWTH.GPJ AB_TRANS.GDT 7-4-18

LOGGED BY: CA	COMPLETION DEPTH: 6.10 m
REVIEWED BY: BDT	COMPLETION DATE: 6-25-18
Page 1 of 1	

Planning for Growth Claresholm

BOREHOLE NO: **BH007**

Client: WSP Canada Inc.

PROJECT NO: 2018-031

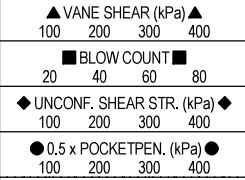
Solid Stem Auger

ELEVATION:

SAMPLE TYPE SHELBY TUBE CORE SAMPLE SPT SAMPLE GRAB SAMPLE NO RECOVERY

BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS SAND

Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	PLASTIC M.C. LIQUID			OTHER DATA	Elevation (m)
						20	40	80		
0		Topsoil (600 mm)								
0.6		Clay Till - silty, sandy, trace gravel, stiff to very stiff, damp, low plastic, olive brown, oxides coal								
1.0				B1						
1.5				B2						
2.0				B3						
2.5				B4						
3.0				B5						
3.5				B6						
4.0				B7						
4.5				B8						
6.1		End of Borehole at 6.1 m. Standpipe installed to 6.1 m. Standpipe dry when measured on June 29, 2018								

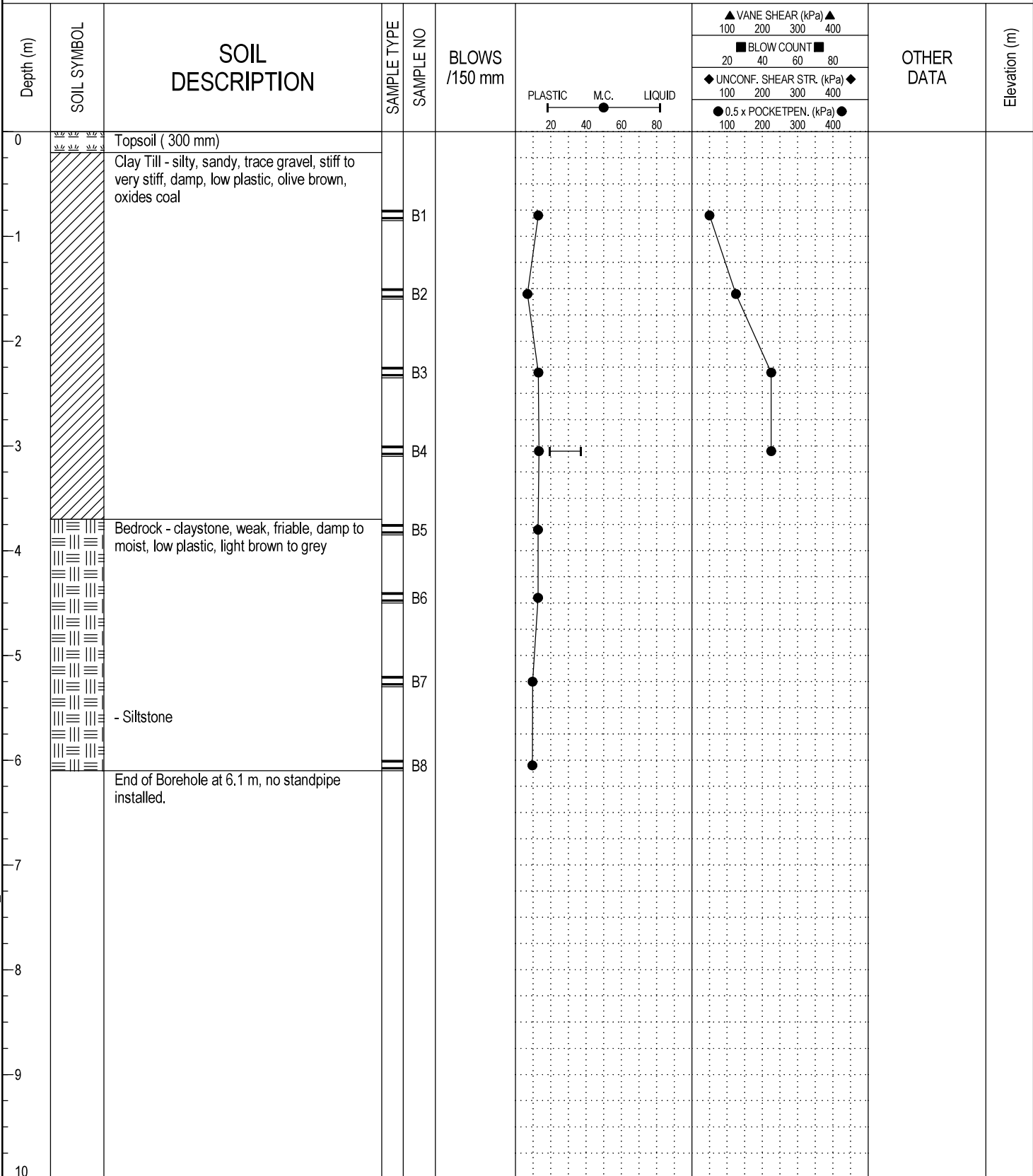


AB TRANS BOREHOLE LOG PLANNING FOR GROWTH.GPJ AB_TRANS.GDT 7-4-18

LOGGED BY: CA
 REVIEWED BY: BDT
 COMPLETION DEPTH: 6.10 m
 COMPLETION DATE: 6-25-18

Planning for Growth Claresholm		BOREHOLE NO: BH008
Client: WSP Canada Inc.		PROJECT NO: 2018-031
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE	<input type="checkbox"/> SHELBY TUBE <input checked="" type="checkbox"/> CORE SAMPLE <input checked="" type="checkbox"/> SPT SAMPLE <input type="checkbox"/> GRAB SAMPLE <input type="checkbox"/> NO RECOVERY
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AB TRANS BOREHOLE LOG PLANNING FOR GROWTH.GPJ AB_TRANS.GDT 7-4-18

LOGGED BY: CA	COMPLETION DEPTH: 6.10 m
REVIEWED BY: BDT	COMPLETION DATE: 6-25-18
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Planning for Growth Claresholm		BOREHOLE NO: BH009
Client: WSP Canada Inc.		PROJECT NO: 2018-031
	Solid Stem Auger	ELEVATION:

SAMPLE TYPE	<input checked="" type="checkbox"/> SHELBY TUBE	<input checked="" type="checkbox"/> CORE SAMPLE	<input checked="" type="checkbox"/> SPT SAMPLE	<input checked="" type="checkbox"/> GRAB SAMPLE	<input type="checkbox"/> NO RECOVERY
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Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	PLASTIC M.C. LIQUID 20 40 60 80	▲ VANE SHEAR (kPa) ▲	■ BLOW COUNT ■	◆ UNCONF. SHEAR STR. (kPa) ◆	OTHER DATA	Elevation (m)
							100 200 300 400	20 40 60 80	100 200 300 400		
0		Topsoil (400 mm)									
0 - 6.1		Clay Till - silty, sandy, trace gravel, stiff to very stiff, damp, low plastic, olive brown, oxides coal		B1 B2 B3 B4 B5 B6 B7							
6.1		End of Borehole at 6.1 m, no standpipe installed.		B8							
7											
8											
9											
10											

AB TRANS BOREHOLE LOG - PLANNING FOR GROWTH.GPJ AB_TRANS.GDT 7-4-18

LOGGED BY: CA	COMPLETION DEPTH: 6.10 m
REVIEWED BY: BDT	COMPLETION DATE: 6-25-18
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Planning for Growth Claresholm				BOREHOLE NO: BH010					
Client: WSP Canada Inc.				PROJECT NO: 2018-031					
Solid Stem Auger				ELEVATION:					
SAMPLE TYPE		<input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> CORE SAMPLE <input type="checkbox"/> SPT SAMPLE <input type="checkbox"/> GRAB SAMPLE <input type="checkbox"/> NO RECOVERY							
BACKFILL TYPE		<input type="checkbox"/> BENTONITE <input type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND							
Depth (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	BLOWS /150 mm	PLASTIC		OTHER DATA	Elevation (m)
						20	40		
0		Topsoil (300 mm)							
0		Clay Till - silty, sandy, trace gravel, stiff to very stiff, damp, low plastic, olive brown, oxides coal							
1			B1						
2			B2						
3			B3						
4			B4						
4		- very moist	B5						
5		- sand seam (300 mm)	B6						
6			B7						
6			B8						
6.1		End of Borehole at 6.1 m. Standpipe installed to 6.1 m. Standpipe dry when measured on June 29, 2018							

AB TRANS BOREHOLE LOG PLANNING FOR GROWTH.GPJ AB_TRANS.GDT 7-4-18

LOGGED BY: CA	COMPLETION DEPTH: 6.10 m
REVIEWED BY: BDT	COMPLETION DATE: 6-25-18
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APPENDIX C – GENERAL CONSTRUCTION GUIDELINES

SHALLOW FOUNDATIONS

Design and construction of shallow foundations should comply with relevant Building Code requirements.

The term 'shallow foundations' includes strip and spread footings, mat slab and raft foundations. Minimum footing dimensions in plan should be 0.45m and 0.9m for strip and square footings respectively.

No loose, disturbed or sloughed material should be allowed to remain in open foundation excavations.

Hand cleaning should be undertaken to prepare an acceptable bearing surface. Recompaction of disturbed or loosened bearing surface may be required.

Foundation excavations and bearing surfaces should be protected from rain, snow, freezing temperatures, excessive drying and the ingress of free water before, during and after footing construction.

Footing excavations should be carried down into the designated bearing stratum.

After the bearing surface is approved, a mud slab should be poured to protect the soil and provide a working surface for construction, should immediate foundation construction not be intended. All constructed foundations should be placed on unfrozen soils, which should be at all times protected from frost penetration.

All foundation excavations and bearing surfaces should be inspected by a qualified geotechnical engineer to check that the recommendations contained in this report have been followed.

Where over-excavation has been carried out through a weak or unsuitable stratum to reach into a suitable bearing stratum or where a foundation pad is to be placed above stripped natural ground surface such over-excavation may be backfilled to subgrade elevation utilizing either structural fill or lean-mix concrete. These materials are defined under the separate heading 'Backfill Materials and Compaction'.

FLOOR SLABS-ON-GRADE

All soft, loose or organic material should be removed from beneath slab areas. If any local 'hard spots' such as old basement walls are revealed beneath the slab area, these should be over-excavated and removed to not less than 0.9 m below underside of slab level. The exposed soil should be proof-rolled and the final grade restored by general engineered fill placement. If proof-rolling reveals any soft or loose spots, these should be excavated and the desired grade restored by general engineered fill placement. Proof-rolling should be carried out in accordance with the recommendations given elsewhere in this Appendix. The subgrade should be compacted to a depth of not less than 0.3m to a density of not less than 98 percent Standard Proctor Maximum Dry Density (ASTM Test Method D698).

A levelling course of 20mm crushed gravel at least 150 mm in compacted thickness, is recommended directly beneath all slabs-on-grade. Alternatively, a minimum thickness of 150mm of pit-run gravel overlain by a minimum thickness of 50 mm of 20mm crushed gravel may be used. Very coarse material (larger than 25 mm diameter) should be avoided directly beneath the slab-on-grade to limit potential stress concentrations within the slab. All levelling courses directly under floor slabs should be compacted to 100 percent of Standard Proctor maximum dry density.

General engineered fill, pit-run gravel and crushed gravel are defined under the heading 'Backfill Materials and Compaction' elsewhere in this Appendix.

The slab should be structurally independent from walls and columns supported on foundations. This is to reduce any structural distress that may occur as a result of differential soil movements. If it is intended to place any internal non-load bearing partition walls directly on a slab-on-grade, such walls should also be structurally independent from other elements of the building founded on a conventional foundation system so that some relative vertical movement of the walls can occur freely.

The excavated subgrade beneath slabs-on-grade should be protected at all times from rain, snow, freezing temperatures, excessive drying and the ingress of free water. This applies during and after the construction period.

A minimum slab concrete thickness of 100mm is recommended. Control joints should be provided in all slabs. Typically for a 125mm slab thickness; control joints should be placed on a 3 m square grid, should be sawn to a depth of one-quarter the slab thickness and have a width of approximately 3 mm.

Wire mesh reinforcement, 150 mm square grid, should be provided to reduce the possibility of uncontrolled slab cracking. The mesh should be adequately supported and should be located at mid-height of the slab with adequate cover.

Backfill Materials and Compaction

1.0 Definitions

“Landscape fill” is typically used in areas such as berms and grassed areas where settlement of the fill and noticeable surface subsidence can be tolerated. “Landscape fill” may comprise soils without regard to engineering quality.

“General engineered fill” is typically used in areas where a moderate potential for subgrade movement is tolerable, such as asphalt (i.e., flexible) pavement areas. “General engineered fill” should comprise clean, granular or clay soils.

“Select engineered fill” is typically used below slabs-on-grade or where high volumetric stability is desired, such as within the footprint of a building. “Select engineered fill” should comprise clean, well-graded granular soils or inorganic low to medium plastic clay soils.

“Structural engineered fill” is used for supporting structural loads in conjunction with shallow foundations. “Structural engineered fill” should comprise clean, well-graded granular soils.

“Lean-mix concrete” is typically used to protect a subgrade from weather effects including excessive drying or wetting. “Lean-mix concrete” can also be used to provide a stable working platform over weak subgrades. “Lean-mix concrete” should be low strength concrete having a minimum 28-day compressive strength of 3.5 MPa. Standard Proctor Density (SPD) as used herein means Standard Proctor Maximum Dry Density (ASTM Test Method D698). Optimum moisture content is defined in ASTM Test Method D698.

2.0 General Backfill and Compaction Recommendations

Exterior backfill adjacent to abutment walls, basement walls, grade beams, pile caps and above footings, and below highway, street, or parking lot pavement sections should comprise “general engineered fill” materials as defined above. Exterior backfill adjacent to footings, foundation walls, grade beams and pile caps and within 600 mm of final grade should comprise inorganic, cohesive “general engineered fill”. Such backfill should provide a relatively impervious surficial zone to reduce seepage into the subsoil against the structure.

Backfill should not be placed against a foundation structure until the structure has sufficient strength to withstand the earth pressures resulting from placement and compaction. During compaction, careful observation of the foundation wall for deflection should be carried out continuously. Where deflections are apparent, the compactive effort should be reduced accordingly.

In order to reduce potential compaction induced stresses, only hand-held compaction equipment should be used in the compaction of fill within 1 m of retaining walls or basement walls. If

compacted fill is to be placed on both sides of the wall, they should be filled together so that the level on either side is within 0.5 m of each other.

All lumps of materials should be broken down during placement. Backfill materials should not be placed in a frozen state, or placed on a frozen subgrade.

Where the maximum-sized particles in any backfill, material exceed 50 percent of the minimum dimension of the cross-section to be backfilled (e.g., lift thickness), such particles should be removed and placed at other more suitable locations on site or screened off prior to delivery to site.

Bonding should be provided between backfill lifts. For fine-grained materials, the previous lift should be scarified to the base of the desiccated layer, moisture-conditioned, and recompacted and bonded thoroughly to the succeeding lift. For granular materials, the surface of the previous lift should be scarified to about a 75 mm depth followed by proper moisture-conditioning and recompaction.

3.0 COMPACTION AND MOISTURE CONDITIONING

“Landscape fill” material should be placed in compacted lifts not exceeding 300 mm and compacted to a density of not less than 90 percent of SPD unless a higher percentage is specified by the jurisdiction.

“General engineered fill” and “select engineered fill” materials should be placed in layers of 150 mm compacted thickness and should be compacted to not less than 98 percent of SPD. Note that the contract may specify higher compaction levels within 300 mm of the design elevation. Cohesive materials placed as “general engineered fill” or “select engineered fill” should be compacted at 0 to 2 percent above the optimum moisture content. Note that there are some silty soils which can become quite unstable when compacted above optimum moisture content.

Granular materials placed as “general engineered fill” or “select engineered fill” should be compacted at slightly below (0 to 2%) the optimum moisture content. “Structural engineered fill” material should be placed in compacted lifts not exceeding 150 mm in thickness and compacted to not less than 100 percent of SPD at slightly below (0 to 2%) the optimum moisture content.

4.0 “GENERAL ENGINEERED FILL”

Low to medium plastic clay is considered acceptable for use as “general engineered fill,” assuming this material is inorganic and free of deleterious materials. Materials meeting the specifications for “select engineered fill” or “structural engineered fill” as described below would also be acceptable for use as “general engineered fill.”

5.0 “SELECT ENGINEERED FILL”

Low to medium plastic clay with the following range of plasticity properties is generally considered suitable for use as “select engineered fill”:

Liquid Limit	=	20 to 40%
Plastic Limit	=	10 to 20%
Plasticity Index	=	10 to 30%

Test results should be considered on a case-by-case basis.

“Pit-run gravel” and “fill sand” are generally considered acceptable for use as “select engineered fill.” See exact project or jurisdiction for specifications. The “pit-run gravel” should be free of any form of coating and any gravel or sand containing clay, loam or other deleterious materials should be rejected. No material oversize of the specified maximum sieve size should be tolerated. This material would typically have a fines content of less than 10%. The materials above are also suitable for use as “general engineered fill.”

Construction Excavations

Construction should be in accordance with good practice and comply with the requirements of the responsible regulatory agencies.

All excavations greater than 1.5m deep should be sloped or shored for worker protection.

Shallow excavations up to about 3m depth may use temporary sideslopes of 1H:1V. A flatter slope of 2H:1V should be used if groundwater is encountered. Localized sloughing can be expected from these slopes.

Deep excavations or trenches may require temporary support if space limitations or economic considerations preclude the use of sloped excavations.

For excavations greater than 3m depth, temporary support should be designed by a qualified geotechnical engineer. The design and proposed installation and construction procedures should be submitted to BDT for review.

The construction of a temporary support system should be monitored. Detailed records should be taken of installation methods, materials, in situ conditions and the movement of the system. If anchors are used, they should be load tested. BDT can provide further information on monitoring and testing procedures if required.

Attention should be paid to structures or buried service lines close to the excavation. For structures, a general guideline is that if a line projected down, at 45 degrees from the horizontal from the base of foundations of adjacent structures intersects the extent of the proposed excavation, these structures may require underpinning or special shoring techniques to avoid damaging earth movements. The need for any underpinning or special shoring techniques and the scope of monitoring required can be determined when details of the service ducts and vaults, foundation configuration of existing buildings and final design excavation levels are known.

No surface surcharges should be placed closer to the edge of the excavation than a distance equal to the depth of the excavation, unless the excavation support system has been designed to accommodate such surcharge.

APPENDIX E

TOWN OF CLARESHOLM

CLARESHOLM AREA STRUCTURE PLAN TRANSPORTATION IMPACT ASSESSMENT

NOVEMBER 15, 2018





CLARESHOLM AREA STRUCTURE PLAN TRANSPORTATION IMPACT ASSESSMENT

TOWN OF CLARESHOLM

DRAFT

PROJECT NO.: 181-07689-00
DATE: NOVEMBER 15, 2018

WSP
SUITE 3300
237 4TH AVENUE SW
CALGARY, AB, CANADA T2P 4K3

WSP.COM

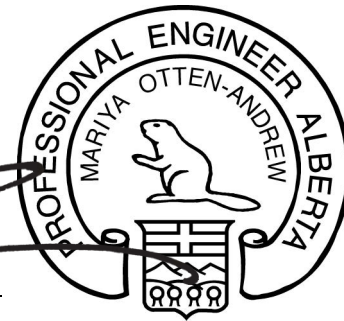
SIGNATURES

PREPARED BY

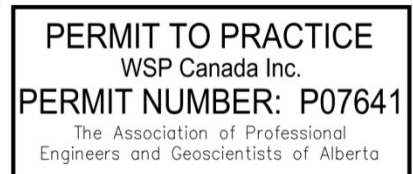
Kristen Faber, Engineer-in-Training
Transportation Planner

APPROVED¹ BY

Mariya Otten-Andrew, P.Eng., PTOE
Manager – Transportation Planning Alberta



Nov 17, 2018



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APPENDICES

A	FUTURE HIGHWAY 2 / HIGHWAY 520 INTERCHANGE
B	TURNING MOVEMENT COUNTS
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1 INTRODUCTION

WSP Canada Inc. has been retained by the Town of Claresholm (the town) to prepare a traffic impact assessment (TIA) to support the Area Structure Plan. The town is planning for approximately 70 ha of development on the east side of 5th Street East between 50 Avenue East and 39 Avenue East. This TIA will consider the impact of this new development on two study intersections:

- Highway 520 and 5th Street East
- Highway 520 and Highway 2 (1st Street West)

The development area and study intersections are illustrated in **Figure 1-1**.

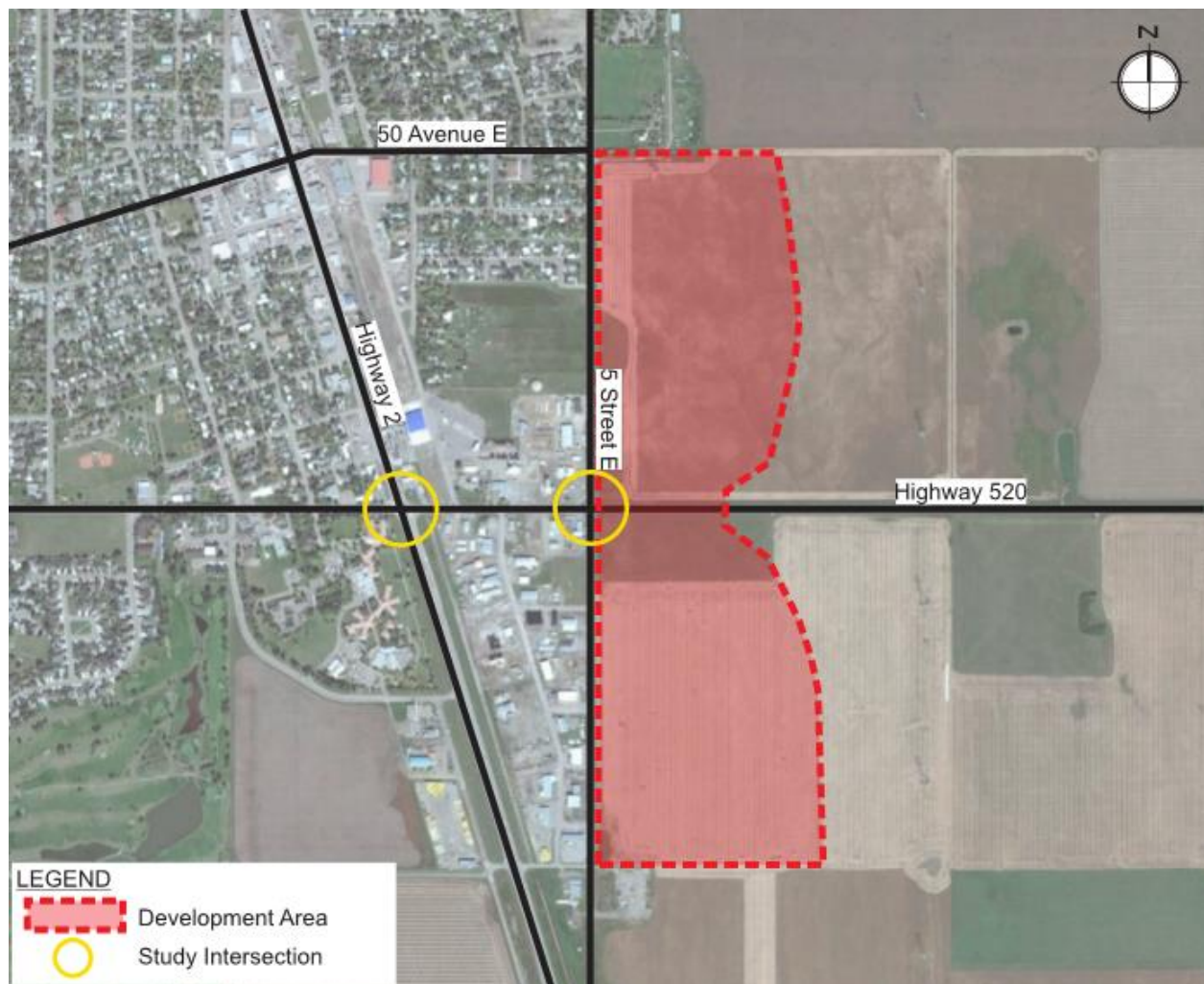


Figure 1-1 Development Area

2 ROAD NETWORK

2.1 EXISTING ROAD NETWORK

This section of the assessment describes the existing road network and traffic conditions within the study area.

2.1.1 HIGHWAY 2 (1 STREET WEST)

Highway 2 is a four-lane divided road that runs north-south and stretches from the Canada-U.S.A. border to northern Alberta. As Highway 2 enters Claresholm from the north, the posted speed limit reduces to 50 km/h and the right-of-way narrows to a four-lane urban cross-section with a raised centre median.

The Highway 2 and Highway 520 intersection is a two-way east-west stop-controlled intersection with channelized right-turns as well as northbound and southbound dedicated left-turn lanes. North of Highway 520, Highway 2 has an urban cross-section and has dense commercial development on either side. South of Highway 520, Highway 2 has a rural cross-section and no direct access for adjacent development.

2.1.2 HIGHWAY 520

Highway 520 is a two-lane undivided road that runs east-west between Highway 22 and Highway 23. As Highway 520 approaches Claresholm, the posted speed limit reduces to 50 km/h. Highway 520 has a rural cross-section east of 5th Street East and an urban cross-section west of 5th Street East. The Highway 520 and 5th Street intersection is a two-way north-south stop-controlled intersection.

2.1.3 5TH STREET EAST

5th Street East is a two-lane road with a rural cross-section. North of Highway 520, 5th Street East has an asphalt surface and a posted speed limit of 50 km/h. South of Highway 520, 5th Street East has a gravel surface and rural cross-section.

2.2 FUTURE ROAD NETWORK

Alberta Transportation has long term plans to realign Highway 2 to bypass Claresholm. A functional planning study for the bypass was completed in 2007 by Clifton ND Lea Consulting Inc.² This study determined the basic configuration of the interchange between Highway 2 and Highway 520 and defined the right of way requirements. The interchange will be located to the east of 5 Street East and the right of way requirements fall partially within the subject site and redefine the site's eastern boundary, significantly reducing the developable area, as shown in

² Highway 2:08 Claresholm Re-Alignment Functional Planning Study Executive Summary, 2007, Clifton ND Lea

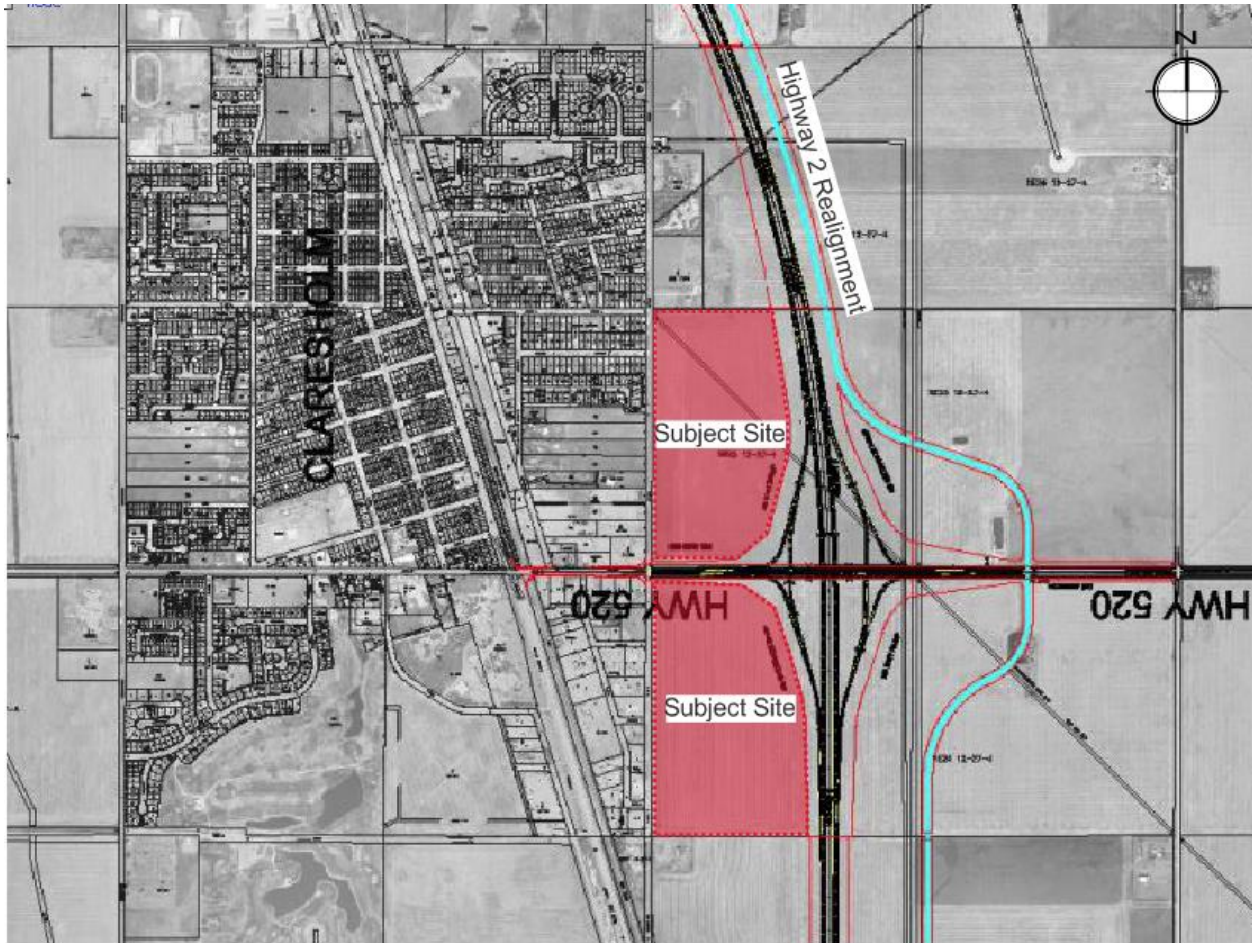


Figure 2-1, provided at larger scale in **Appendix A**. The functional planning study² noted that staging the construction of the interchange was neither practical nor economic and therefore recommended that the grade-separated interchange be constructed in the first instance. Alberta Transportation has advised that there is no timeframe for the construction of the bypass.

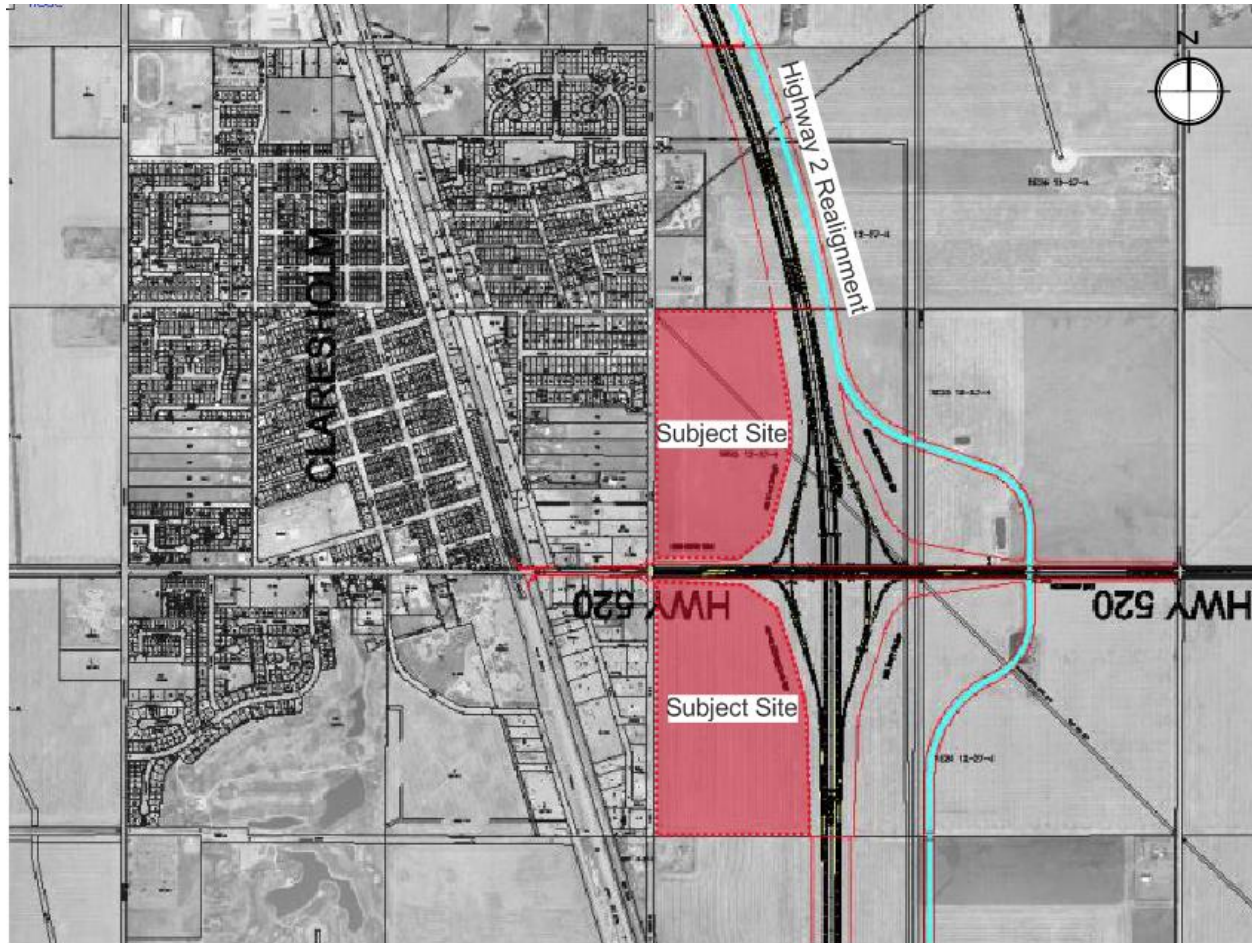


Figure 2-1 Future Highway 2 / Highway 520 interchange in context of subject site³

2.3 TRAFFIC VOLUMES

A turning movement count (TMC) was completed at the Highway 520 and 5th Street East intersection on Thursday, October 4, 2018 during the morning and afternoon peak periods. Alberta Transportation's 100th highest hour AM and PM peak hour traffic volumes were obtained for the Highway 2 and Highway 520 intersection for the year 2017 (Site ID 98100). These volumes were adjusted to reflect 2018 conditions by calculating the growth rate on each leg of the intersection using Alberta Transportation's historic Annual Average Daily Traffic (AADT) volumes. This data shows that the annualized growth rates on Highway 2 and Highway 520 over the period from 2008 to 2016 were:

- 0.47% for the segment of Highway 2 north of Highway 520;
- 0.95% for the segment of Highway 2 south of Highway 520;
- -0.56% for the segment of Highway 520 west of Highway 2; and
- 0.47% for the segment of Highway 520 east of Highway 2.

³ Base figure extracted from *Highway 2:08 Claresholm Re-Alignment Functional Planning Study Executive Summary, 2007, Clifton ND Lea*

The average of these segment growth rates is 0.33%. For the purposes of this assessment, a conservative annualized growth rate of 1.0% has been applied linearly to the 2017 Highway 2 and Highway 520 traffic volumes to obtain 2018 (current year) traffic volumes. The existing 2018 traffic volumes are illustrated in **Figure 2-1**.

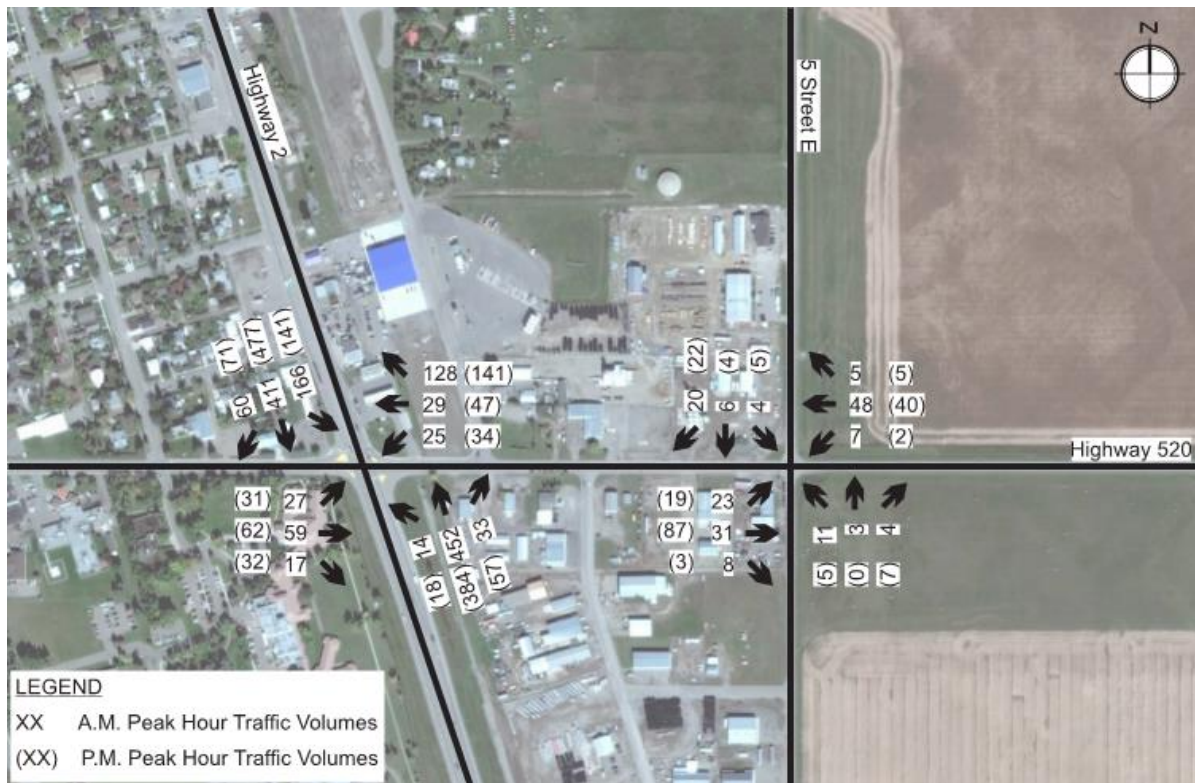


Figure 2-2 2018 Existing Traffic Volumes

The TMC data for the Highway 520 and 5th Street East intersection as well as the Alberta Transportation traffic volume data for the Highway 2 and Highway 520 intersection is attached in **Appendix B**.

2.4 INTERSECTION PERFORMANCE EVALUATION CRITERIA

The intersection capacity analysis was carried out at the study intersections during the morning and afternoon peak hours using Synchro 10 software package, which is based on the methodology outlined in the Highway Capacity Manual (HCM). The HCM methodology considers the intersection geometry, the traffic volumes, the type of intersection controls, and the pedestrian and cyclist volumes. The methodology then defines the Level of Service (LOS) based on the average delay per vehicle.

The LOS criteria for signalized and unsignalized (stop-controlled) intersections, as outlined in the Highway Capacity Manual is presented in **Table 2-1**. LOS A indicates good traffic flow with minimal delay, and LOS F indicates congested traffic operation with considerable delay. The operating conditions can also be expressed in terms of volume-to-capacity (v/c) ratio.

Table 2-1 Level of Service Criteria

LEVEL-OF-SERVICE	SIGNALIZED INTERSECTION (SECONDS)	UNSIGNALIZED INTERSECTION (SECONDS)
A	≤ 10	≤ 10
B	> 10 – 20	> 10 – 15
C	> 20 – 35	> 15 – 25
D	> 35 – 55	> 25 – 35
E	> 55 – 80	> 35 – 50
F	> 80	> 50

Source: Highway Capacity Manual

2.5 EXISTING OPERATING CONDITIONS

The intersections of Highway 2 and Highway 520 and Highway 520 and 5th Street East were analyzed using the existing lane configurations and traffic controls as shown in **Figure 2-1**.



Figure 2-3 Existing Lane Configurations and Traffic Control

The results of the existing conditions operation analysis are summarized in **Table 2-2**. The table features information on the overall intersection and critical movement. The detailed Synchro output results for the existing conditions are included in **Appendix C**.

Table 2-2 Existing Operating Conditions

INTERSECTION	OVERALL		CRITICAL MOVEMENT			
	LOS (Delay)	Max V/C	Movement	LOS (Delay)	v/c	95 th % Queue
AM PEAK HOUR						
Highway 2 & Highway 520	B (13.1 s)	0.83	EB-LT	F (116.8 s)	0.83	30.0 m
Highway 520 & 5th Street East	A (4.0 s)	0.04	NB-LTR	A (9.7 s)	0.02	13.2 m
PM PEAK HOUR						
Highway 2 & Highway 520	B (13.1 s)	0.81	EB-LT	F (104.4 s)	0.81	21.5 m
Highway 520 & 5th Street East	A (2.8 s)	0.04	NB-LTR	A (9.4 s)	0.02	13.3 m

Based on the results of the analysis, the eastbound and westbound approaches of Highway 2 and Highway 520 are operating poorly (LOS F) during the weekday morning and afternoon peak hours. Intersection improvements are required to accommodate existing traffic volumes and to improve intersection operations.

A signal warrant analysis was completed to determine if the installation of traffic signals at this study intersection would provide a positive impact on the intersection operations. Alberta Transportation considers a traffic control signal is warranted once a minimum of 100 cumulative warrant points is reached. The signal warrant analysis was completed for the Highway 2 and Highway 520 intersection for the existing traffic volumes. The signal warrant analysis indicates that signals are warranted at this intersection (149 warrant points). Further details are provided in Section 4.3 Traffic Signal Warrant Assessment.

The Highway 520 and 5th Street East intersection individual movements are operating acceptably (LOS C or better) with v/c ratios below 0.90. No improvements are required to accommodate the existing traffic volumes at this intersection.

3 TRAFFIC FORECAST

A traffic forecast, including an estimate of background traffic and site-generated traffic was conducted to estimate the future traffic volumes for Stage One opening year (2020) of the ASP lands, the 20-year horizon (2038) and at full build-out (2048) of the ASP lands. As there is no timeframe for the completion of the Highway 2 bypass, this assessment assumes that the existing road network remains in place until the 2048 assessment horizon.

3.1 BACKGROUND TRAFFIC GROWTH

Background traffic growth refers to the amount by which traffic volumes in the area would increase even if the development did not proceed. Background traffic forecasts were prepared for each horizon by applying an annualized growth rate of 1.0% linearly to the 2018 traffic volumes at the study intersections. As previously mentioned in Section 2.2, 1.0% was chosen as a conservative estimate of annual traffic growth as the average growth of Highway 2 and Highway 520 traffic was 0.33%. The 2020, 2038 and 2048 background traffic volumes are illustrated in **Figure 3-1**, **Figure 3-2** and **Figure 3-3**, respectively.

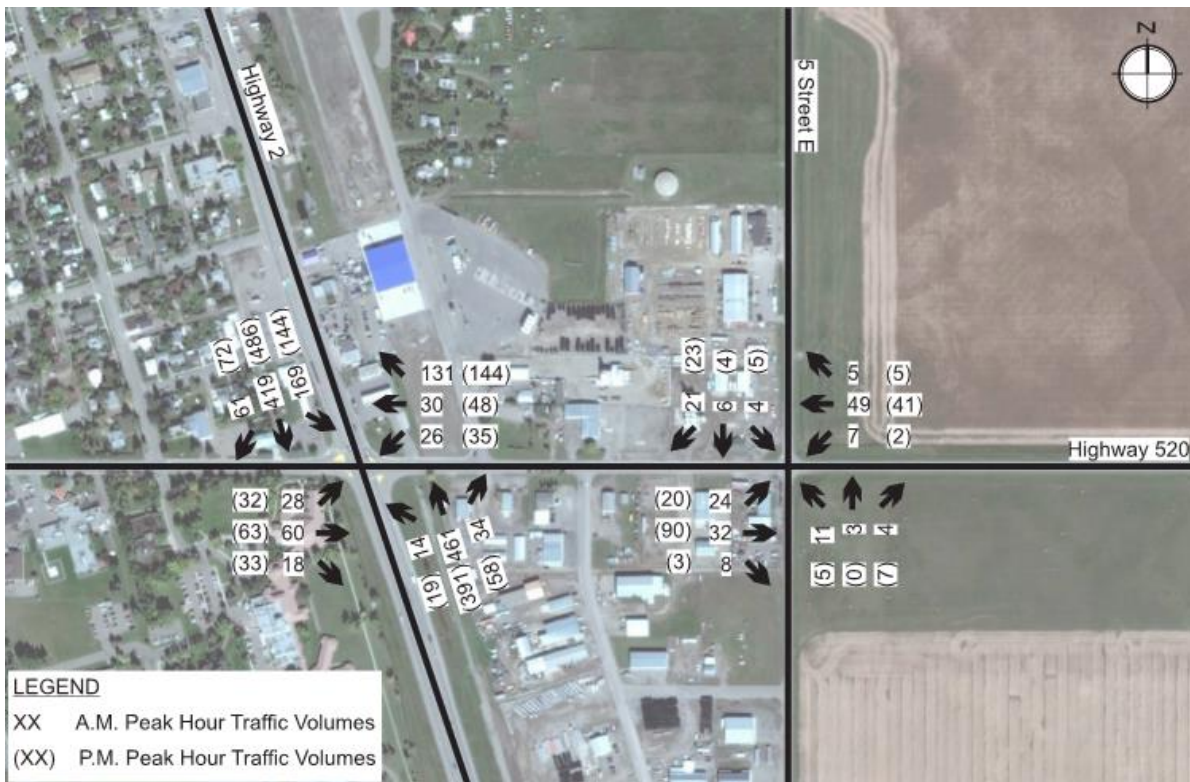


Figure 3-1 2020 Background Traffic Forecast



Figure 3-2 2038 Background Traffic Forecast

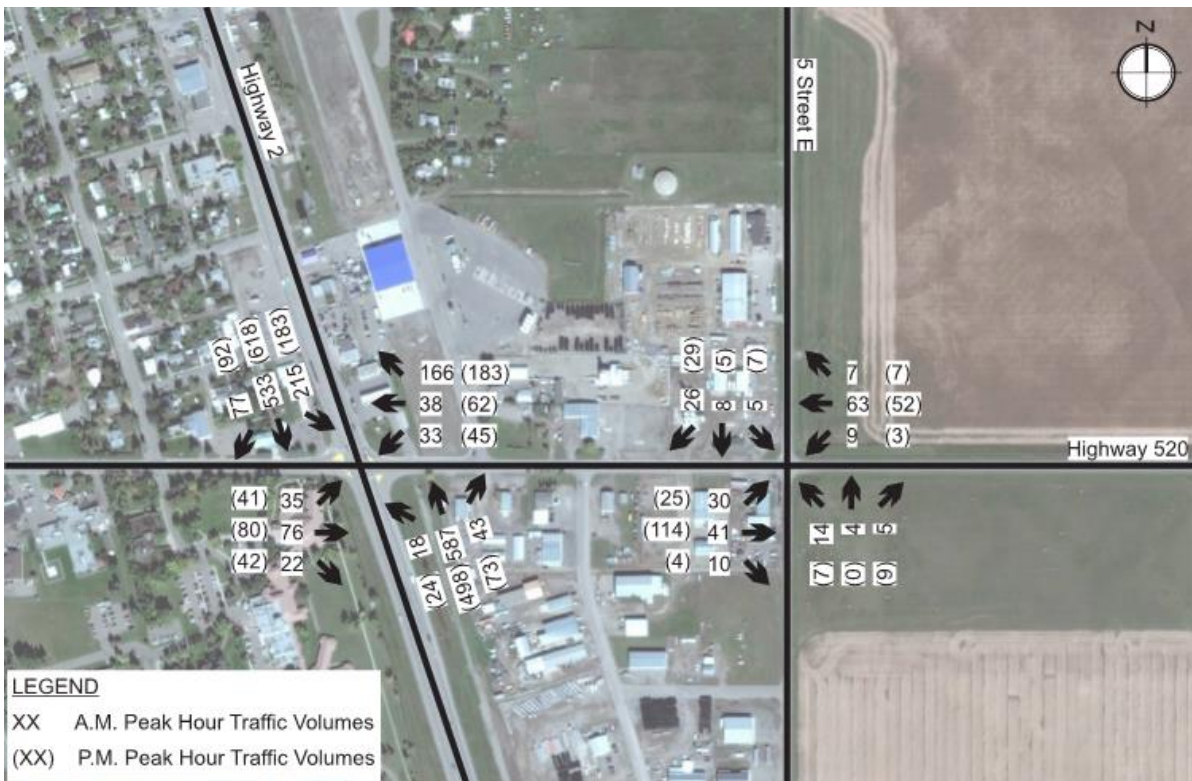


Figure 3-3 2048 Background Traffic Forecast

3.2 PROPOSED DEVELOPMENT

The proposed development, illustrated in **Figure 3-4**, will be built out in multiple stages over a long timeframe. For the purposes of this traffic assessment, we have defined a “Stage One” to allow for initial development in the near future, and “Full build-out” for the balance of the site. This provides an indication of impacts and infrastructure requirements associated with this ASP.

Stage One is assumed to be completed by 2020 and assumed to include the following, with frontage to 5th Street East:

- 2.75 ha of commercial development;
- 6 ha of business commercial development; and
- 13.5 ha of industrial development and.

Full build-out is expected to be completed by 2048 and will include a further:

- 3.0 ha of commercial development;
- 14.5 ha of business commercial development; and
- 13.6 ha of industrial development. Full build-out of the proposed development.

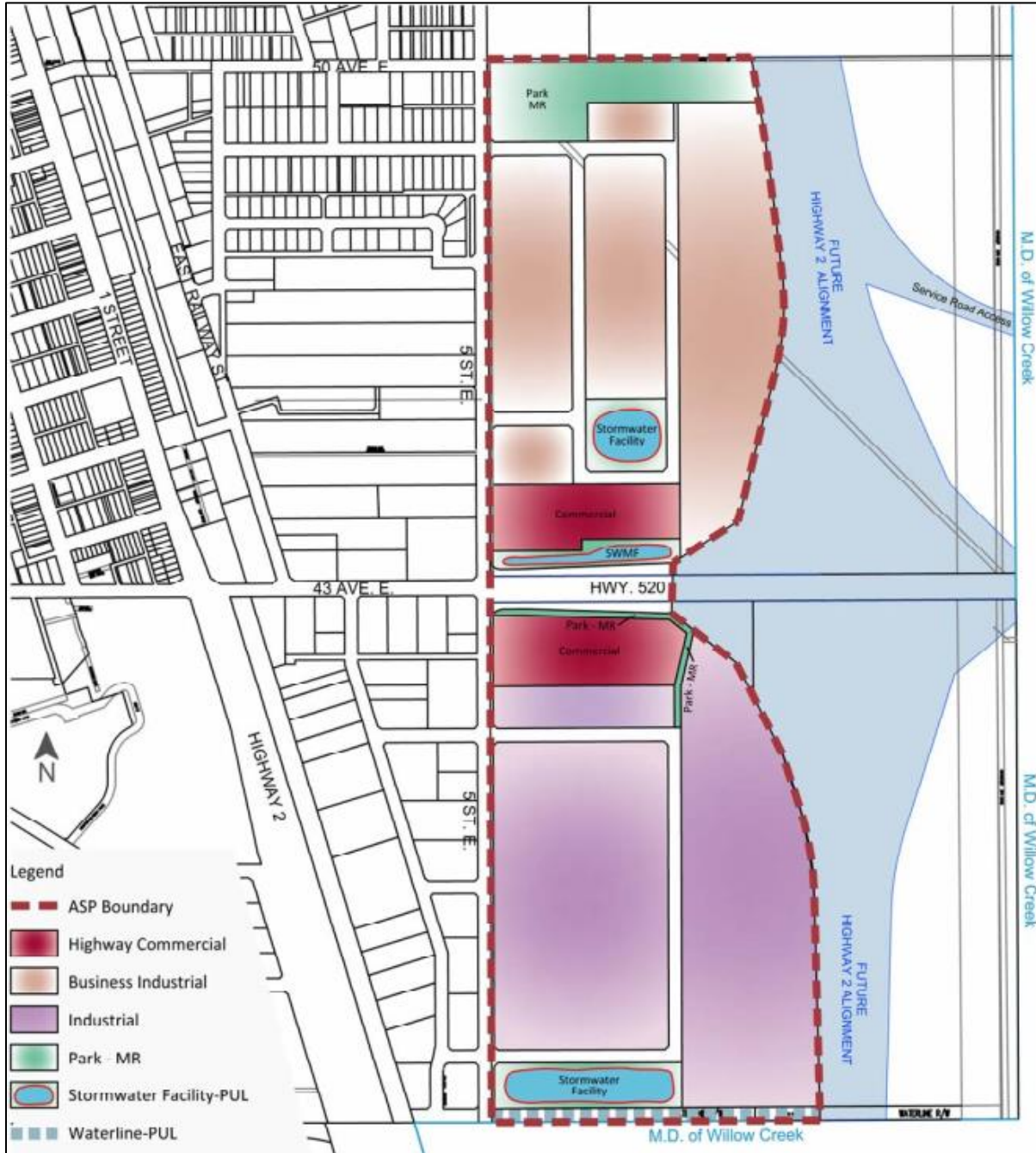


Figure 3-4 Proposed Development

3.3 TRIP GENERATION

The Institute of Transportation Engineers 10th Edition Trip Generation Manual (ITE Manual) was used to estimate the traffic generated by the proposed development for both the weekday morning and afternoon peak hours. Due to the uncertainty in the exact type of development that will occur within the parcels, a number of land uses that were believed to fit the character of the development were gathered from the ITE Manual and blended together. The ITE land uses attributed to each type of development are as follows:

- Commercial
 - Tractor Supply Store (ITE Code 810)
 - Construction Equipment Rental Store (ITE Code 811)
 - Discount Club (ITE Code 857)
 - Home Improvement Superstore (ITE Code 862)
 - Discount Home Furnishing Superstore (ITE Code 869)
 - Truck Stop (ITE Code 950)
- Industrial
 - General Light Industrial (ITE Code 110)
 - Manufacturing (ITE Code 140)
 - Warehousing (ITE Code 150)
 - Mini-warehousing (ITE Code 151)
- Business Commercial
 - Building Materials and Lumber Store (ITE Code 812)
 - Hardware/Paint Store (ITE Code 816)
 - Automobile Parts Sales (ITE Code 843)
 - Tire Store (ITE Code 848)

At the time of writing, the following development statistics were used to calculate trip generation Stage One will include 2.7 Ha of commercial development, 6 Ha of business commercial development and 13.5 Ha of industrial development along 5th Street East and is expected to be completed by 2020. Full build-out will include another 3.3 Ha of commercial development, 14.6 Ha of business commercial development, and 12.9 Ha of industrial development. Full build-out of the proposed development is expected to be completed by 2048. The development yield has been amended to that described in Section 3.2. This makes very little difference to the traffic generation of the site (zero change in trips for Stage 1 and 100 less trips for Full Buildout) and so will not materially impact the capacity assessment carried out herein.

It is likely that some trips generated within the development will be multi-use trips. Multi-use trips are defined as trips made between different on-site land uses. These trips do not require use of the local road network outside of the site and therefore reduce the traffic impact of the proposed development. A 5% reduction to the raw trip generation estimate was applied to account for multi-use trips at full build-out.

Pass-by trips are made as intermediary stops along the course of a trip between an origin and primary trip destination. Pass-by trips are attracted from existing traffic passing the site on adjacent streets with direct access to the site (i.e. Highway 520 and 5th Street East). Although these trips will be included in the driveway volumes to the site, they do not increase the overall traffic volumes on the study roads. The ITE 3rd Edition Trip Generation Handbook provides average pass-by trip percentages for some of the land uses above. These average pass-by rates are provided in **Table 3-1**.

Table 3-1 ITE Average Pass-by Trip Percentages

LAND USE	AVERAGE PASS-BY TRIP PERCENTAGES
Discount Club	37%
Home Improvement Superstore	42%
Hardware/Paint Store	26%
Automobile Parts Sales	43%
Tire Store	28%

Typically, the pass-by rates are estimated from the size of the development. In the instance of this development, this methodology would over estimate pass-by for the development and would result in all traffic from Highway 520 and 5th Street East becoming pass-by traffic.

For the purposes of this assessment, the pass-by rate was estimated based on the 35% of the background traffic volumes (2020 and 2048 pre-development horizons) and then applied to the commercial and business commercial trip generation during the afternoon peak hour. Detailed Trip Generation rates and a breakdown of pass-by trips are included in **Appendix D**.

The estimated number of new trips are provided in **Table 3-2**.

Table 3-2 New Trips

LAND USE	GFA ¹ (1,000 sq. ft.)	AM PEAK HOUR			PM PEAK HOUR		
		IN	OUT	TOTAL	IN	OUT	TOTAL
STAGE 1							
Commercial	72.7	41	23	64	60	72	132
Business Commercial	161.5	189	132	321	222	258	480
Industrial	363.3	109	35	144	45	106	151
Stage 1 Total		339	190	529	327	436	763
STAGE 2							
Commercial	80.7	492	483	975	460	416	876
Business Commercial	390.2	435	302	737	566	657	1,223
Industrial	366.0	104	34	138	42	102	144
Stage 2 Total		1,031	819	1,850	1,068	1,175	2,243
Full Build-out Total		1,370	1,009	2,379	1,395	1,611	3,006

¹ Gross Floor Area (GFA): The Gross Floor Area estimated by assuming 25% of the Net Developable Area was equal to the Gross Floor Area.

3.4 TRIP DISTRIBUTION AND ASSIGNMENT

The traffic forecast was completed by distributing the site-related traffic volumes and assigning them to the road network based on an assessment of how people will access and egress the site. Distribution refers to the origins and destinations of site-generated trips. Trip assignment assesses the actual route that the vehicle will take between their origin and destination. The assignment process assumes that motorists will choose the most efficient route and that once an intersection reaches capacity, drivers will choose alternate routes.

The portion of the development on the north side of Highway 520 and the portion of the development on the south side of Highway 520 were considered individually in the distribution and assignment of traffic and the same distribution was used for Stage 1 development and full build-out. **Table 3-3** outlines the directional distribution of traffic accessing/egressing the site.

Table 3-3 Trip Distribution

DIRECTION	NORTH OF HIGHWAY 520	SOUTH OF HIGHWAY 520
North	20%	15%
South	5%	10%
East	30%	30%
West	45%	45%

The generated trips were then assigned to the study road network using the identified trip distribution pattern at the Highway 2 and Highway 520 intersection as per the surveyed travel patterns. The site generated traffic volumes are illustrated in **Figure 3-5** and **Figure 3-6**.

The post-development traffic volumes for the 2020, 2038 and 2048 horizons are shown in **Figure 3-7**, **Figure 3-8**, and **Figure 3-9**, respectively.



Figure 3-7 2020 Post-development Traffic Volumes



Figure 3-8 2038 Post-development Traffic Volumes

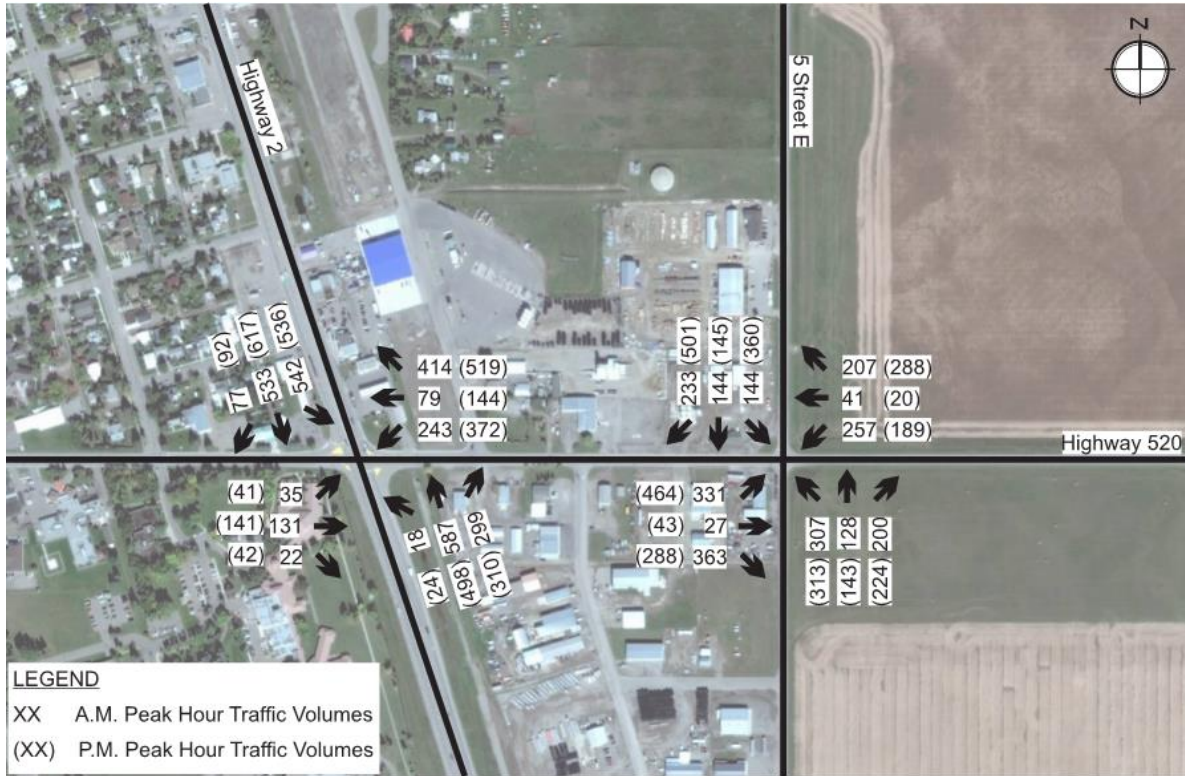


Figure 3-9 2048 Post-development Traffic Volumes

4 OPERATIONAL ASSESSMENT

The study intersections have been modelled under pre-development and post-development traffic conditions using Synchro/SimTraffic 10 to determine its performance. As there is no timeframe for the completion of the Highway 2 bypass, this assessment assumes that the existing road network remains in place until the 2048 assessment horizon.

4.1.1 ROUNDABOUT ANALYSIS

As per Alberta Transportation Design Bulletin #68, roundabouts were first considered as a higher degree of traffic control than the existing two-way stop controls at each of the study intersections. “The installation of new signals is allowed however an engineering rationale should be prepared and documented to show that a roundabout was considered and to show why the signalization option was chosen”.⁴ Capacity analysis for roundabout configurations was carried out using SIDRA Intersection 7.

Roundabouts require a significant footprint, and as such, can be difficult to retrofit in developed areas. At the intersection of Highway 2 and Highway 520, a roundabout configuration could offer sufficient capacity to support traffic demands projected in this study, however there is insufficient right of way at this location to provide roundabout that could support large multi-combination vehicle (MCV) movements. Therefore signals are considered more appropriate at this location.

Similarly, at the intersection of Highway 520 and 5 Street, a roundabout could provide the required capacity within the study horizon, however this would require land acquisition or localized realignment of 5 Street into the subject site to achieve the dimensions required to support MCVs.

4.1.2 TRAFFIC SIGNAL WARRANT ASSESSMENT

In accordance with the Alberta Transportation *Traffic Impact Assessment Guideline*, traffic signal warrant assessments have been carried out for all study intersections in accordance with the TAC *Canadian Traffic Signal and Pedestrian Signal Head Warrant Matrix Procedure*.

For the TAC warrant matrix procedure, one critical element which can determine the need for traffic signal control is the conflict between the stream of traffic on the main street and on the side street. In addition, various local factors including the road environment are also considered.

The traffic signal warrant equation is shown below. This takes into account factors such as intersection spacing, truck traffic, speed limits and the overall population of the area.

$$W = \left[\frac{C_{bt}(X_{v-v})}{K_1} + \frac{F(X_{v-p})L}{K_2} \right] C_i$$

Where:

- W = Cumulative warrant points;
- C_{bt} = Side Street Bus/Truck Factor;
- X_{v-v} = Sum of the individual cross products of the actual conflicting vehicle-vehicle movements;
- X_{v-p} = Sum of the individual cross products of the actual conflicting vehicle-pedestrian movements;
- K_1 = Vehicle-vehicle Denominator constant;

⁴ Policy 1 – AT Design Bulletin #68 Roundabout Design Guidelines on Provincial Highways (2014)

- K_2 = Vehicle-pedestrian Denominator constant;
- F = Pedestrian Demographics Factor;
- L = Number of lanes on the main street; and
- C_i = Product of the Road Characteristics Factor.

The TAC warrant matrix procedure states that a minimum warrant value of 100 cumulative warrant points (W) warrants a traffic control signal, however, Alberta Transportation considers a traffic control signal is warranted once a minimum of 100 cumulative warrant points is reached.

The signal warrant calculations are determined based on six (6) hour traffic volumes at the intersection over the following periods:

- Morning peak – two (2) hours;
- Midday peak – two (2) hours; and
- Evening peak – two (2) hours.

The pre-development and post-development traffic volumes, as determined in this assessment, were used as the highest one (1) hour volumes in the AM and PM peaks. Volumes during the other four (4) hours have been estimated by taking the highest one (1) hour peak volumes and applying factors derived from the hourly volume data recorded at Alberta Transportation’s permanent count site on Highway 2, located just north of the Highway 2 and Hwy 520 intersection (Site ID 60020890).

The input data and the calculations used for this assessment are provided in **Appendix E**. A summary of the signal warrant assessment is presented in **Table 4-1**.

Table 4-1 Traffic Signal Warrant Analysis Summary

INTERSECTION	SCENARIO	POINTS (W)	OUTCOME
Highway 2 / Highway 520	Existing 2018	149	Warranted
Highway 520 / 5 th Street East	Post-Development 2048	779	Warranted

The traffic signal warrant assessments conclude that signalization would eventually be warranted at both study intersections. Signalization would be warranted under Pre-Development conditions for the intersection of Highway 2 and Highway 520 as shown in Table 4-1. The Highway 520 and 5th Street East intersection becomes warranted at full build-out of the development in the 2048 horizon year. Traffic signals were not warranted at this intersection as part of the stage one development.

4.2 CAPACITY ANALYSIS – PRE-DEVELOPMENT

The pre-development capacity analysis evaluates the traffic conditions in the area that would occur if the development did not proceed. The study intersections were modeled with the existing infrastructure. However, the intersection of Highway 2 and Highway 520 was modelled as a signalized intersection based on the findings from the existing operating conditions (Section 2.4) and Traffic Signal Warrant Assessment (Section 4.1).

The results of the capacity analysis for the 2020, 2038 and 2048 pre-development horizons are presented in **Table 4-2**, **Table 4-3**, and **Table 4-4**, respectively. These tables feature information on the overall intersection and critical movement. Details regarding all movements can be found in the Synchro output reports in **Appendix F**.

Table 4-2 Synchro Results: 2020 Pre-Development

INTERSECTION	OVERALL		CRITICAL MOVEMENT			
	LOS (Delay)	Max V/C	Movement	LOS (Delay)	v/c	95 th % Queue
AM PEAK HOUR						
Highway 2 & Highway 520	B (10.7 s)	0.42	SB-L	B (16.4 s)	0.42	42.7 m
Highway 520 & 5th Street East	A (4.0 s)	0.04	NB-LTR	A (9.8 s)	0.03	12.7 m
PM PEAK HOUR						
Highway 2 & Highway 520	B (10.1 s)	0.34	SB-L	B (14.6 s)	0.34	37.0 m
Highway 520 & 5th Street East	A (2.8 s)	0.04	NB-LTR	A (9.5 s)	0.02	12.1 m

Table 4-3 Synchro Results: 2038 Pre-Development

INTERSECTION	OVERALL		CRITICAL MOVEMENT			
	LOS (Delay)	Max V/C	Movement	LOS (Delay)	v/c	95 th % Queue
AM PEAK HOUR						
Highway 2 & Highway 520	B (11.0 s)	0.51	SB-L	B (18.1 s)	0.51	57.5 m
Highway 520 & 5th Street East	A (4.0 s)	0.05	NB-LTR	B (10.0 s)	0.03	14.1 m
PM PEAK HOUR						
Highway 2 & Highway 520	B (10.5 s)	0.42	SB-L	B (16.3)	0.42	48.3 m
Highway 520 & 5th Street East	A (2.8 s)	0.05	NB-LTR	A (9.7 s)	0.02	11.8 m

Table 4-4 Synchro Results: 2048 Pre-Development

INTERSECTION	OVERALL		CRITICAL MOVEMENT			
	LOS (Delay)	Max V/C	Movement	LOS (Delay)	v/c	95 th % Queue
AM PEAK HOUR						
Highway 2 & Highway 520	B (11.4 s)	0.57	SB-L	C (21.1 s)	0.57	75.6 m
Highway 520 & 5th Street East	A (4.1 s)	0.05	NB-LTR	B (10.2 s)	0.03	13.3 m
PM PEAK HOUR						
Highway 2 & Highway 520	B (10.8 s)	0.47	SB-L	B (17.8 s)	0.47	60.1 m
Highway 520 & 5th Street East	A (2.9 s)	0.05	NB-LTR	A (9.8 s)	0.02	14.0 m

The capacity analysis results show that all intersections operate acceptably in the 2020, 2038, and 2048 pre-development traffic conditions, with an overall LOS B (or better) and individual movements operations at a LOS C or better during the weekday peak hours. No additional modifications are required to accommodate the pre-development traffic volumes at the study intersections.

4.3 CAPACITY ANALYSIS – POST-DEVELOPMENT

The results of the capacity analysis for the Stage 1 Opening Day (Year 2020), the 20-Year horizon (Year 2038) and Full Build-out (Year 2048) are presented in **Table 4-5**, **Table 4-6**, and **Table 4-7**, respectively. These tables feature information on the overall intersection and critical movement. Details regarding all movements can be found in the Synchro output reports in **Appendix G**.

Table 4-5 Synchro Results: 2020 Post-Development

INTERSECTION	OVERALL		CRITICAL MOVEMENT			
	LOS (Delay)	Max V/C	Movement	LOS (Delay)	v/c	95 th % Queue
AM PEAK HOUR						
Highway 2 & Highway 520	B (11.1 s)	0.58	SB-L	C (20.1 s)	0.58	70.8 m
Highway 520 & 5th Street East	A (7.8 s)	0.33	NB-LTR	C (15.7 s)	0.16	18.7 m
PM PEAK HOUR						
Highway 2 & Highway 520	B (11.8 s)	0.65	SB-L	C (22.5 s)	0.65	59.7 m
Highway 520 & 5th Street East	C (16.1 s)	0.73	SB-LTR	D (28.7 s)	0.73	41.3 m

The capacity analysis results show that the study intersections operate acceptably in the 2020 post-development traffic conditions, with an overall LOS C (or better) and most individual movements operations at a LOS C or better during the weekday peak hours. No modifications are required to accommodate the 2020 post-development traffic volumes at the study intersections.

Table 4-6 Synchro Results: 2038 Post-Development

INTERSECTION	OVERALL		CRITICAL MOVEMENT			
	LOS (Delay)	Max V/C	Movement	LOS (Delay)	v/c	95 th % Queue
AM PEAK HOUR						
Highway 2 & Highway 520	B (15.4 s)	0.87	SB-L	D (43.8 s)	0.87	171.7 m
Highway 520 & 5th Street East	A (8.0 s)	0.35	NB-LTR	C (16.6 s)	0.18	19.5 m
PM PEAK HOUR						
Highway 2 & Highway 520	B (13.0 s)	0.75	SB-L	C (29.0 s)	0.75	73.6 m
Highway 520 & 5th Street East	C (17.4 s)	0.76	SB-LTR	D (31.9 s)	0.76	47.5 m

The capacity analysis results show that the study intersections operate acceptably in the 2038 post-development traffic conditions, with an overall LOS C (or better) and individual movements operations at a LOS D or better during the weekday peak hours.

A protected-permissive signal timing phase will be required at Highway 2 and Highway 520 to accommodate the weekday morning southbound left-turn queue during the 2038 post-development traffic conditions.

Table 4-7 Synchro Results: 2048 Post-Development

INTERSECTION	OVERALL		CRITICAL MOVEMENT			
	LOS (Delay)	Max V/C	Movement	LOS (Delay)	v/c	95 th % Queue
AM PEAK HOUR						
Highway 2 & Highway 520	E (67.9 s)	1.40	SB-L	F (216.2 s)	1.40	179.9 m
Highway 520 & 5th Street East	F (Err)	Err	NB-LTR/SB-LTR	F (Err)	Err	--
PM PEAK HOUR						
Highway 2 & Highway 520	F (76.6 s)	1.43	SB-L	F (230.6 s)	1.43	198.2 m
Highway 520 & 5th Street East	F (Err)	Err	NB-LTR/SB-LTR	F (Err)	Err	--

The capacity analysis shows that both study intersections will operate poorly during both peak hours in the 2048 post-development traffic conditions, with an overall LOS E or worse. The southbound left-turn at Highway 2 and Highway 520 will operate poorly with a single left-turn lane. The northbound and southbound approaches at the intersection of Highway 520 and 5th Street East will experience considerable delay, congestion, and queue as a two-way stop-controlled intersection.

An (Err) is listed in place of a delay, v/c ratio, or queue for some movements in the proceeding tables. This is a Synchro output that signifies the traffic volumes greatly exceeds capacity and the software cannot compute a delay or queue.

It is noted that AT has long term plans for a Highway 2 bypass at Claresholm. The functional planning study for the bypass was completed in 2007 and preliminary design has identified the location of an interchange to the east of the subject site. The timing for construction of the bypass is unknown, however it could be in place by 2048 in which case the following upgrades, particularly at Highway 2 / Highway 520 would not be relevant. It is recommended to monitor development, traffic growth and network operation as the site is built out, and reconsider appropriate long term upgrades in the future.

Signalization will be required at the Highway 520 and 5th Street East intersection to ensure acceptable traffic operations for the post-development traffic. In addition to upgrading to signal control, the following geometric upgrades are also required to improve operational capacity:

Highway 2 / Highway 520

- An additional southbound left-turn lane on Highway 2
- Update signal timing to protected for the southbound double left-turn phase.
- A westbound left-turn lane on Hwy 520

Highway 520 / 5th Street East

- A double eastbound left-turn lane on Highway 520
- Update signal timing to protected for the eastbound double left-turn phase. An eastbound right-turn lane on all approaches
- A single left-turn lane on westbound, northbound, and southbound approaches

Highway 520 – between Highway 2 and 5th Street

- Upgrade Highway 520 to a four-lane facility

The Highway 2 and Highway 520 intersection modifications are illustrated in **Figure 4-1** and the Highway 520 and 5th Street East intersection modifications are illustrated in **Figure 4-2**. The Highway 520 and full networking modifications are illustrated in **Figure 2-3**.



Figure 4-1 Highway 2 / Highway 520 Intersection Modifications (2048 Full Build-out Horizon)



Figure 4-2 Highway 50 / 5th Street East Intersection Modifications (2048 Full Build-out Horizon)



Figure 4-3 Highway 520 Modifications (2048 Full Build-out Horizon)

Note that with the implementation of the geometric modifications above, the northbound and southbound left-turn 95th percentile queues at the Highway 520 and 5th Street East intersection are anticipated to reach 100 m or greater (LOS C and v/c ratio of 0.70 or less) during the weekday afternoon peak hour. The queues may block traffic from entering or exiting (i.e. trying to make a northbound left-turn) the commercial parcels depending on the location of the accesses. The lengthy queues on the northbound and southbound approaches can be accommodated by providing double left-turns on all approaches with protected phasing for all double left-turns.

As mentioned, the realignment of Highway 2 to the east of the development is a long term plan for Alberta Transportation. No timeline has been set for this realignment. It is anticipated that once Highway 2 is realigned,

travel patterns will alter and it is unlikely that the dual southbound left turn lanes at the existing Highway 2 / Highway 520 intersection would be needed. Furthermore, it would be beneficial to reserve additional right-of-way at the Highway 520 and 5th Street East intersection to allow for double left-turn lanes on the north approach (for dual southbound left-turn lanes) and on the east approach (for dual westbound left-turn lanes) to support the changed travel patterns.

The results of the 2048 traffic conditions with intersection modifications are summarized in **Table 4-8**. The capacity analysis results show that the study intersections operate acceptably 2048 post-development traffic conditions, with an overall LOS C (or better) and most individual movements operations at a LOS D or better during the weekday peak hours.

Table 4-8 Synchro Results: 2048 Post-Development – with Intersection Modifications

INTERSECTION	OVERALL		CRITICAL MOVEMENT			
	LOS (Delay)	Max V/C	Movement	LOS (Delay)	v/c	95 th % Queue
AM PEAK HOUR						
Highway 2 & Highway 520	C (23.7 s)	0.87	SB-L	D (49.5 s)	0.87	87.0 m
Highway 520 & 5th Street East - (EB Double Left, NB/SB/WB Single Left)	B (18.7 s)	0.78	EB-L	D (46.1 s)	0.78	54.4 m
Highway 520 & 5th Street East - (Double Lefts All Approaches)	C (27.1 s)	0.59	EB-L	D (50.5 s)	0.71	53.4 m
PM PEAK HOUR						
Highway 2 & Highway 520	C (27.8 s)	0.90	SB-L	D (54.4 s)	0.90	130.2 m
Highway 520 & 5th Street East - (EB Double Left, NB/SB/WB Single Left)	C (23.7 s)	0.82	EB-L	D (53.8 s)	0.82	96.5 m
Highway 520 & 5th Street East - (Double Lefts All Approaches)	C (28.9 s)	0.83	EB-L	D (54.8 s)	0.83	96.6 m

5 SUMMARY AND CONCLUSION

WSP Canada Inc. has been retained by the Town of Claresholm to prepare a traffic impact assessment for two intersections to support the Area Structure Plan:

- Highway 520 and 5th Street East
- Highway 520 and Highway 2 (1st Street West)

This study analyzed the future background and post-development operating conditions to identify the potential impacts and improvements required at the studied intersections as a result of the additional traffic generated by the proposed development.

The analysis was carried out at three horizon years (as there is no timeframe for the completion of the Highway 2 bypass, this assessment assumes that the existing road network remains in place until the 2048 assessment horizon):

- 2020 horizon year: Stage 1 Opening Day of the development;
- 2038 horizon year: 20-Year horizon
- 2048 horizon year: Full build-out of development

The results of the study led to the following conclusions:

- **Existing Operating Conditions**
 - At the Highway 2 and Highway 520 intersection the eastbound and westbound left-through movements are operating poorly (LOS F) with a v/c ratio of 0.83. Therefore, improvements are required to accommodate the existing traffic volumes at this intersection.
 - At the Highway 520 and 5th Street East intersection all the individual movements operating at an acceptable LOS C or better with v/c ratios below 0.90. Therefore, no improvements are required to accommodate the existing traffic volumes at this intersection.
- **2020, 2038 and 2038 Pre-development Operating Conditions**
 - With upgraded traffic control at the Highway 2 and Highway 520 intersection, the study intersections will continue to operate at an acceptable level of service. No additional improvements are required to support background traffic.
- **2020 and 2038 Post-development Operating Conditions**
 - With upgraded traffic control at the Highway 2 and Highway 520 intersection, the study intersections will operate acceptably in the 2020 and 2038 post-development traffic conditions, with an overall LOS C (or better) and individual movements operating at a LOS D or better during the weekday peak hours.
 - A protected-permissive signal timing phase will be required at Highway 2 and Highway 520 to accommodate the weekday morning southbound left-turn queue during the 2038 post-development traffic conditions.
 - No geometric improvements are required at these horizons.
- **2048 Post-development Operating Conditions**
 - The capacity analysis shows that both study intersections will operate poorly (LOS F) during both peak hours in the 2048 post-development traffic conditions, with an overall LOS E or worse and v/c ratios greater than 1.0.
 - Signalization of the Highway 520 and 5th Street East intersection will improve operational capacity for the assumed Post-Development traffic at the full build-out horizon. In addition to upgrading to signal control, the following geometric upgrades are also required to improve operational capacity of the network:

Highway 2 / Highway 520

- An additional southbound left-turn lane on Highway 2
- A westbound left-turn lane on Hwy 520

Highway 520 / 5th Street East

- A double eastbound left-turn lane on Highway 520
- An eastbound right-turn lane on all approaches
- A single left-turn lane on westbound, northbound, and southbound approaches

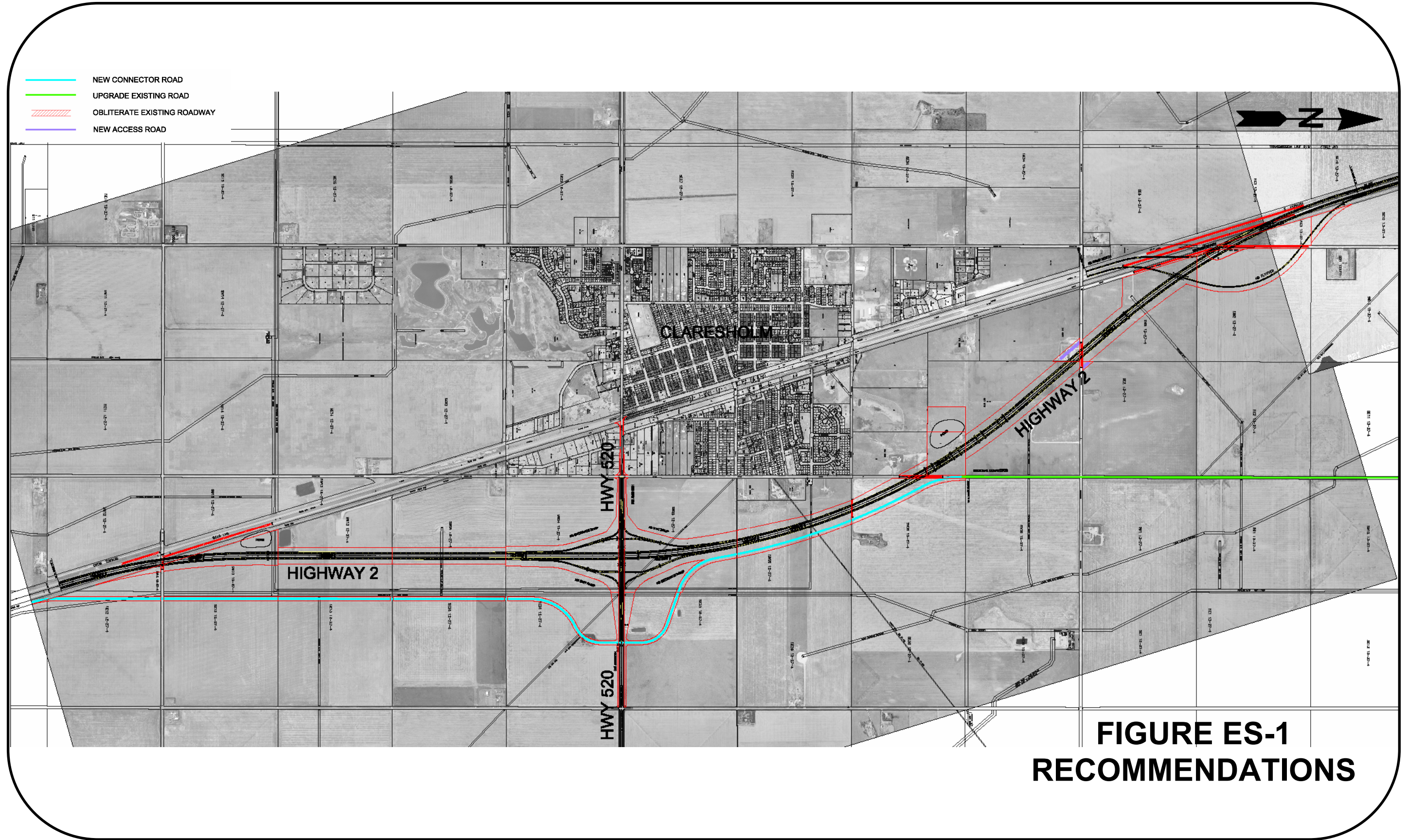
Highway 520 – between Highway 2 and 5th Street

- Upgrade Highway 520 to a four-lane facility
- Preserve the right-of-way for southbound and westbound double left-turn lanes at the Highway 520 and 5th Street intersection to accommodate future traffic patterns when Highway 2 is realigned to the east of the development.

It is noted that AT has long term plans to realign Highway 2 and bypass Claresholm. The functional planning study for the bypass was completed in 2007 and preliminary design has identified the location of an interchange to the east of the subject site. The timing for construction of the bypass is unknown, however it could be in place by 2048 in which case these abovementioned long-term upgrades may not be relevant. It is recommended to monitor development, traffic growth and network operation as the site is built out, and reconsider appropriate long-term upgrades in the future.

APPENDIX

A FUTURE HIGHWAY 2 / HIGHWAY 520 INTERCHANGE



APPENDIX

B TURNING MOVEMENT COUNTS

INTERSECTION
Thursday, October 04, 2018

AM Peak Period

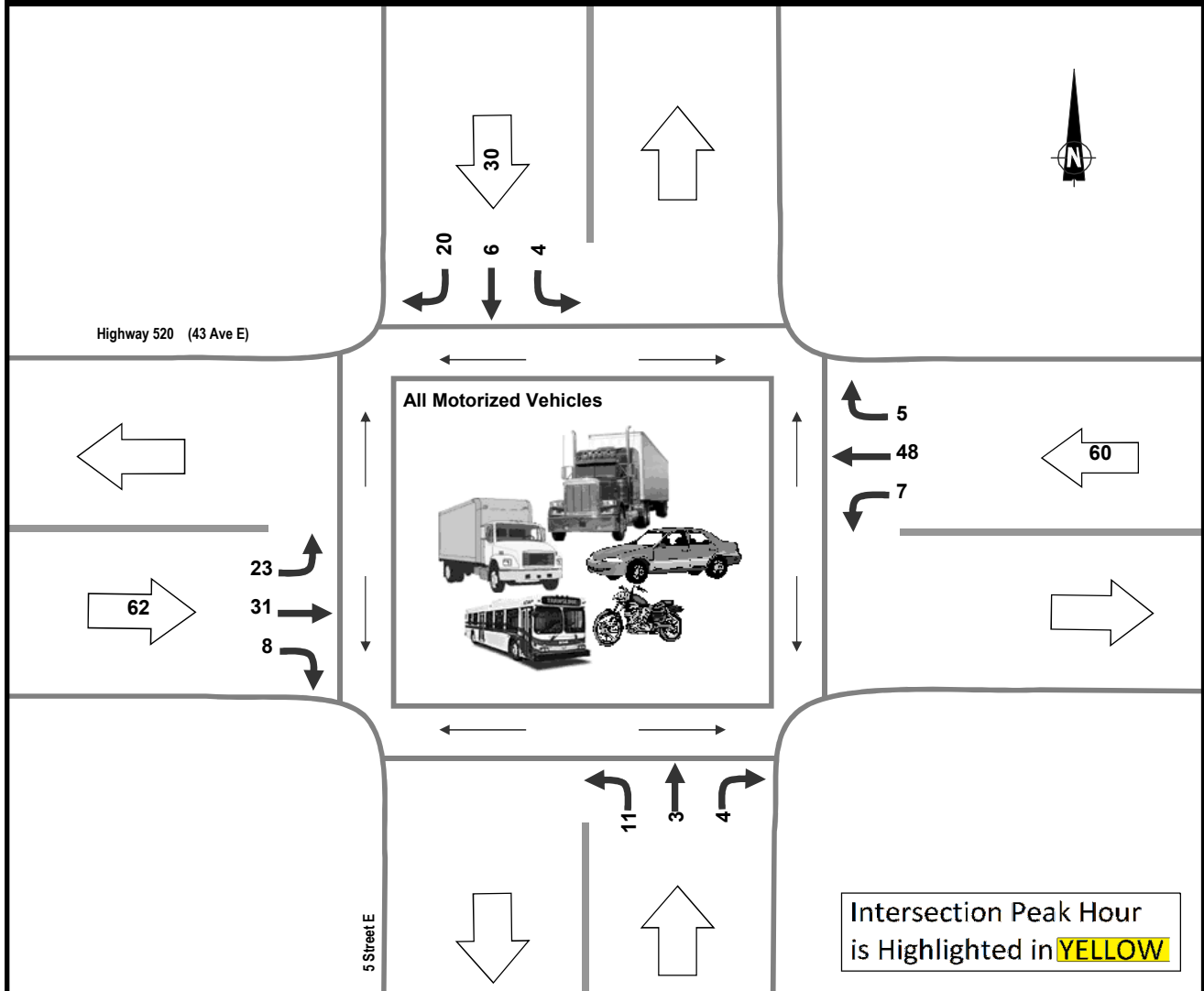
8:45 - 9:45

Project: 181-07689-00
Municipality: MD of Willow Creek
Weather: -5 C
Vehicle Class: All Motorized Vehicles

Notes: A u-turn was made from the west approach by a car, deer were in the area and crossed Highway 520 from the farmers fields, there was a surveyor in the area (surveying a building on 43 Ave E)

Peak Hour Traffic by Movement

8:00 AM to 10:00 AM



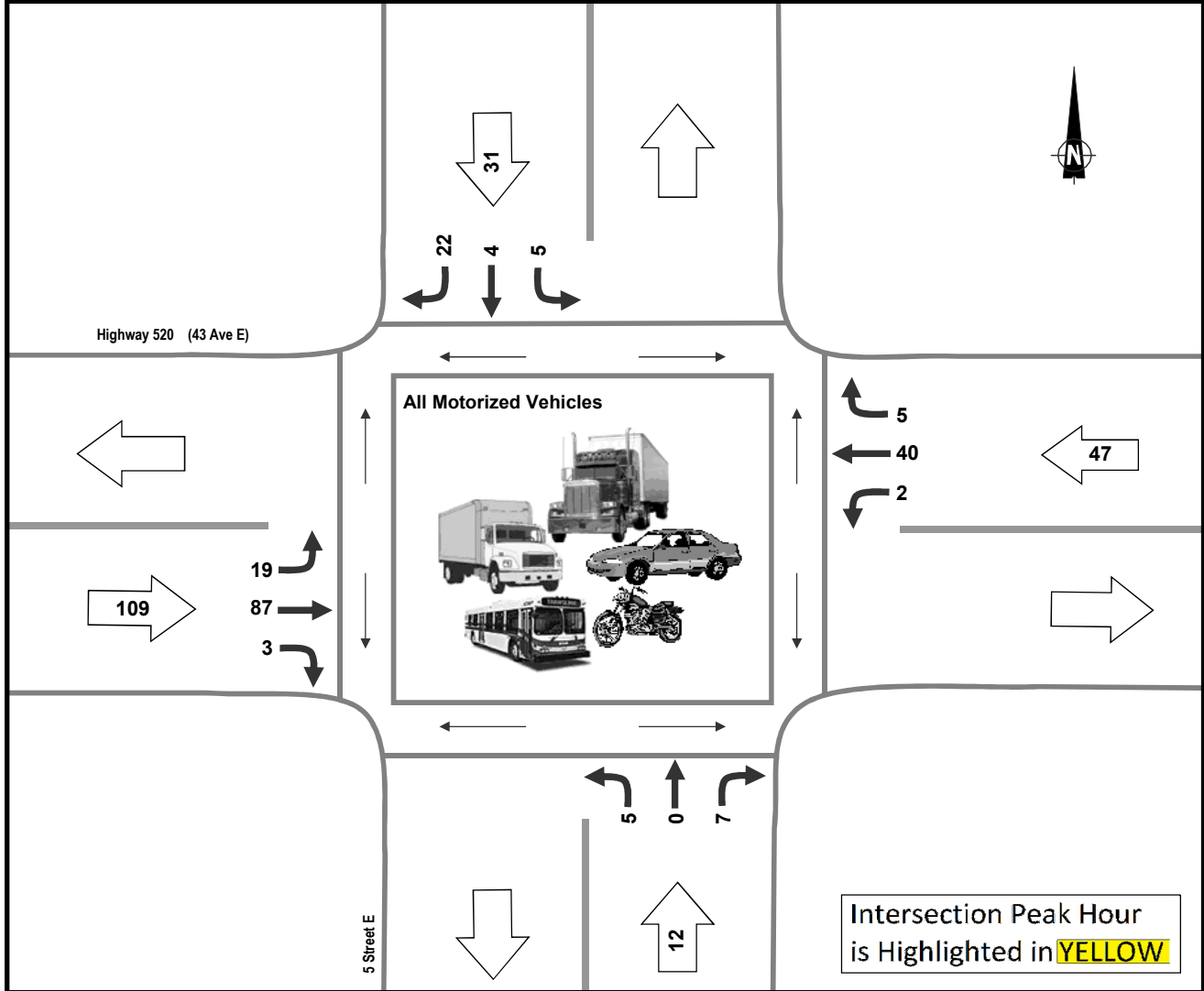
Time	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			PEDESTRIANS				Total Volumes
	left	thru	right	left	thru	right	left	thru	right	left	thru	right	N	S	W	E	
Peak Hour	4	6	20	11	3	4	23	31	8	7	48	5	0	0	0	0	170
PHF	0.33	0.75	0.71	0.69	0.75	0.50	0.64	0.78	0.50	0.88	0.80	0.63	0.00	0.00	0.00	0.00	0.70
Peak 15 X 4	12	8	28	16	4	8	36	40	16	8	60	8	0	0	0	0	244
Average Hour	3	6	15	9	4	3	18	30	7	5	48	3	0	0	0	0	149
Survey Total	6	12	29	17	8	6	36	59	13	10	96	6	0	0	0	0	298
8:00	0	0	0	1	1	1	2	6	0	1	11	0	0	0	0	0	23
8:15	1	2	3	1	2	0	4	9	2	0	12	0	0	0	0	0	36
8:30	1	1	4	0	1	0	5	9	0	1	16	1	0	0	0	0	39
8:45	1	1	7	2	1	1	5	7	2	2	7	2	0	0	0	0	38
9:00	3	2	3	3	1	0	3	10	0	2	14	1	0	0	0	0	42
9:15	0	1	5	2	1	1	6	6	4	2	12	1	0	0	0	0	41
9:30	0	2	5	4	0	2	9	8	2	1	15	1	0	0	0	0	49
9:45	0	3	2	4	1	1	2	4	3	1	9	0	0	0	0	0	30

Project: 181-07689-00
Municipality: MD of Willow Creek
Weather: 2 C
Vehicle Class: All Motorized Vehicles

Notes: Deer were in the area and crossed Highway 520 from the farmers fields, there was a surveyor in the area (surveying a building on 43 Ave E)

Peak Hour Traffic by Movement

3:00 PM to 5:00 PM



Time	NORTH Approach			SOUTH Approach			WEST Approach			EAST Approach			PEDESTRIANS				Total Volumes
	left	thru	right	left	thru	right	left	thru	right	left	thru	right	N	S	W	E	
Peak Hour	5	4	22	5	0	7	19	87	3	2	40	5	0	0	0	0	199
PHF	0.63	0.25	0.92	0.42	0.00	0.58	0.79	0.87	0.75	0.50	0.67	0.63	0.00	0.00	0.00	0.00	1
Peak 15 X 4	8	16	24	12	0	12	24	100	4	4	60	8	0	0	0	0	272
Average Hour	5	5	17	5	1	4	17	76	3	3	45	7	0	0	0	0	186
Survey Total	10	10	34	10	2	8	34	151	5	5	90	13	0	0	0	0	372
15:00	3	5	4	2	1	1	3	6	1	2	11	2	0	0	0	0	41
15:15	0	1	1	3	1	0	4	13	0	0	17	2	0	0	0	0	42
15:30	2	4	5	2	0	3	6	24	0	1	9	1	0	0	0	0	57
15:45	2	0	5	3	0	1	3	25	1	0	5	1	0	0	0	0	46
16:00	1	0	6	0	0	1	6	19	1	0	11	1	0	0	0	0	46
16:15	0	0	6	0	0	2	4	19	1	1	15	2	0	0	0	0	50
16:30	1	0	4	0	0	0	4	17	1	0	13	1	0	0	0	0	41
16:45	1	0	3	0	0	0	4	28	0	1	9	3	0	0	0	0	49

Turning Movement Summary Diagram

Reference No.: 98100

Intersection of:
2 & 520 AT CLARESHOLM

2017 AADT / ASDT ESTIMATES

North On 2		
Vehicle Type	Vol	%
A: Passenger Vehicle	9253	79.4
B: Recreational Vehicle	154	1.3
C: Bus	21	0.2
D: Single Unit Truck	226	1.9
E: Tractor Trailer Unit	1996	17.1
ASDT	13010	AADT 11650

West On 520		
Vehicle Type	Vol	%
A: Passenger Vehicle	1911	95.6
B: Recreational Vehicle	25	1.3
C: Bus	0	0.0
D: Single Unit Truck	35	1.8
E: Tractor Trailer Unit	29	1.5
ASDT	2230	AADT 2000

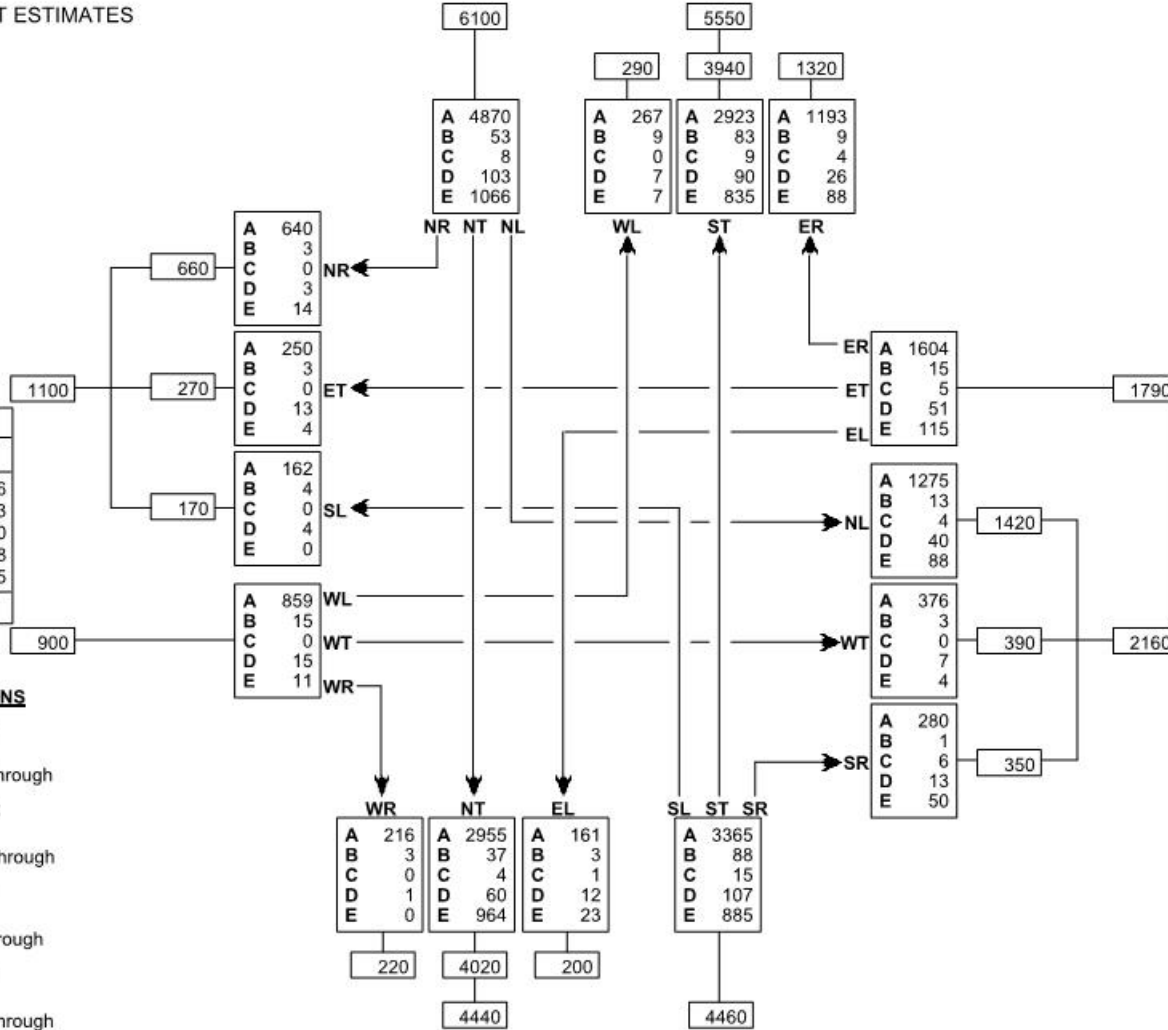
East On 520		
Vehicle Type	Vol	%
A: Passenger Vehicle	3535	89.5
B: Recreational Vehicle	32	0.8
C: Bus	15	0.4
D: Single Unit Truck	111	2.8
E: Tractor Trailer Unit	257	6.5
ASDT	4410	AADT 3950

TURNING MOVEMENT ABBREVIATIONS

- NR: Traffic From North Turning Right
- NL: Traffic From North Turning Left
- NT: Traffic From North Proceeding Through
- SR: Traffic From South Turning Right
- SL: Traffic From South Turning Left
- ST: Traffic From South Proceeding Through
- ER: Traffic From East Turning Right
- EL: Traffic From East Turning Left
- ET: Traffic From East Proceeding Through
- WR: Traffic From West Turning Right
- WL: Traffic From West Turning Left
- WT: Traffic From West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

- AADT: Annual Average Daily Traffic
Average daily traffic expressed as vehicles per day for period of January 1 to December 31 (365 days)
- ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day for period of May 1 to September 30 (153 days)



South On 2		
Vehicle Type	Vol	%
A: Passenger Vehicle	6697	75.2
B: Recreational Vehicle	131	1.5
C: Bus	20	0.2
D: Single Unit Truck	180	2.0
E: Tractor Trailer Unit	1872	21.0
ASDT	9940	AADT 8900

Turning Movement Summary Diagram

Reference No.: 98100

Intersection of:
2 & 520 AT CLARESHOLM

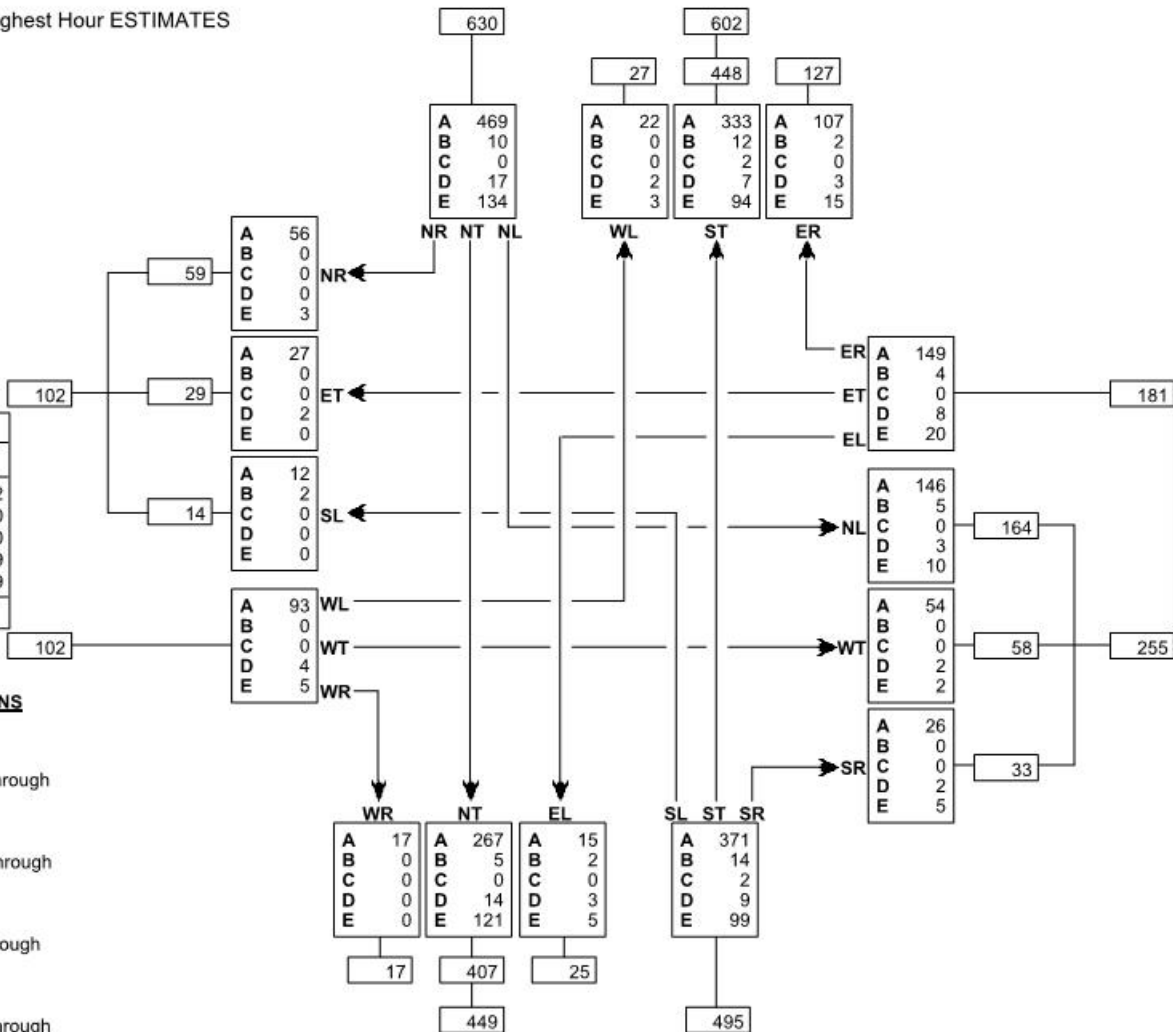
2017 a.m. 100th Highest Hour ESTIMATES

North On 2		
Vehicle Type	Vol	%
A: Passenger Vehicle	931	75.6
B: Recreational Vehicle	24	1.9
C: Bus	2	0.2
D: Single Unit Truck	29	2.4
E: Tractor Trailer Unit	246	20.0
Total	1232	

West On 520		
Vehicle Type	Vol	%
A: Passenger Vehicle	188	92.2
B: Recreational Vehicle	2	1.0
C: Bus	0	0.0
D: Single Unit Truck	6	2.9
E: Tractor Trailer Unit	8	3.9
Total	204	

East On 520		
Vehicle Type	Vol	%
A: Passenger Vehicle	375	86.0
B: Recreational Vehicle	9	2.1
C: Bus	0	0.0
D: Single Unit Truck	15	3.4
E: Tractor Trailer Unit	37	8.5
Total	436	

South On 2		
Vehicle Type	Vol	%
A: Passenger Vehicle	670	71.0
B: Recreational Vehicle	21	2.2
C: Bus	2	0.2
D: Single Unit Truck	26	2.8
E: Tractor Trailer Unit	225	23.8
Total	944	



TURNING MOVEMENT ABBREVIATIONS

- NR: Traffic From North Turning Right
- NL: Traffic From North Turning Left
- NT: Traffic From North Proceeding Through
- SR: Traffic From South Turning Right
- SL: Traffic From South Turning Left
- ST: Traffic From South Proceeding Through
- ER: Traffic From East Turning Right
- EL: Traffic From East Turning Left
- ET: Traffic From East Proceeding Through
- WR: Traffic From West Turning Right
- WL: Traffic From West Turning Left
- WT: Traffic From West Proceeding Through

Turning Movement Summary Diagram

Reference No.: 98100
 Intersection of:
 2 & 520 AT CLARESHOLM

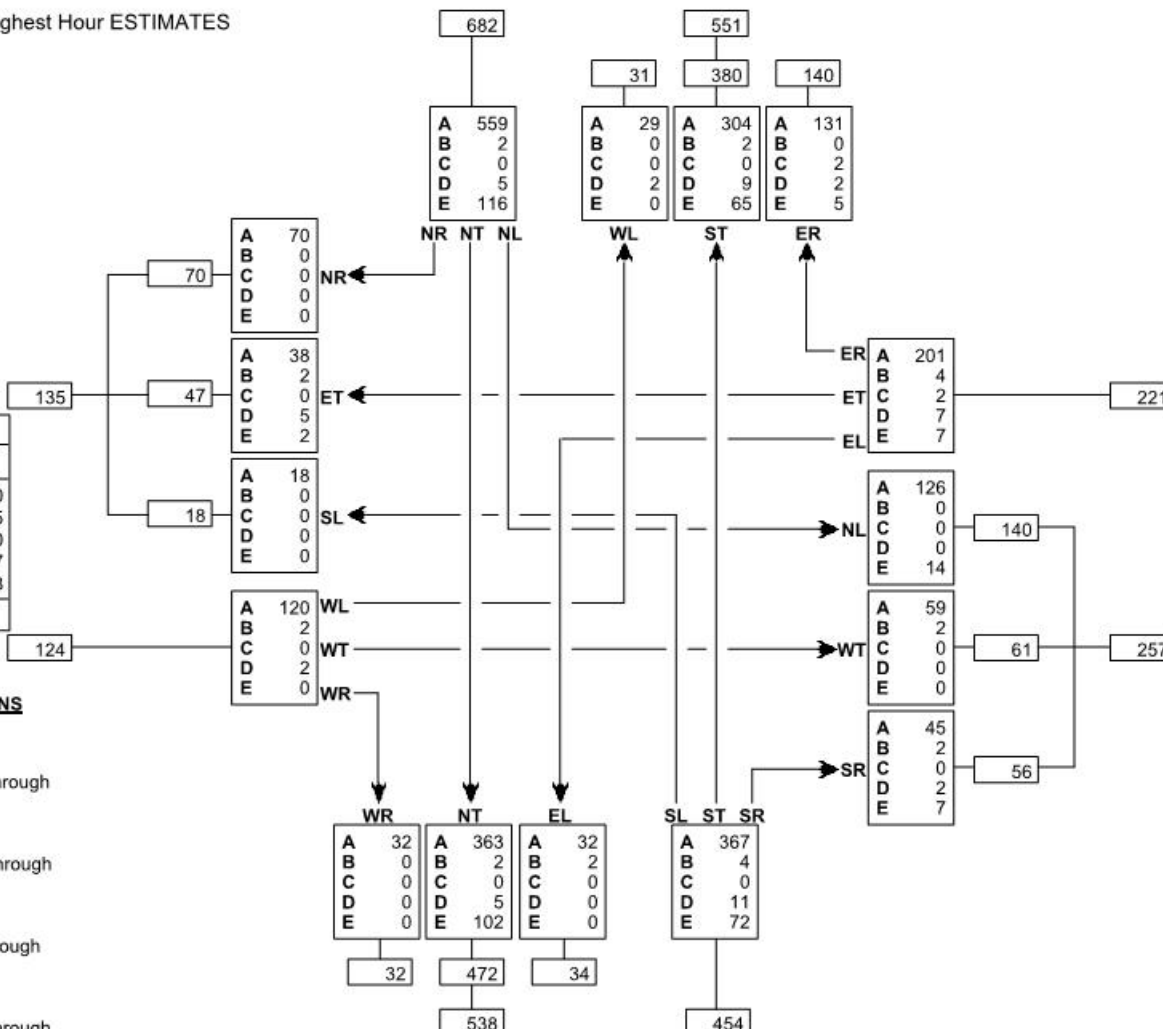
2017 p.m. 100th Highest Hour ESTIMATES

North On 2		
Vehicle Type	Vol	%
A: Passenger Vehicle	1023	83.0
B: Recreational Vehicle	4	0.3
C: Bus	2	0.2
D: Single Unit Truck	18	1.5
E: Tractor Trailer Unit	186	15.1
Total	1233	

West On 520		
Vehicle Type	Vol	%
A: Passenger Vehicle	246	95.0
B: Recreational Vehicle	4	1.5
C: Bus	0	0.0
D: Single Unit Truck	7	2.7
E: Tractor Trailer Unit	2	0.8
Total	259	

East On 520		
Vehicle Type	Vol	%
A: Passenger Vehicle	431	90.2
B: Recreational Vehicle	8	1.7
C: Bus	2	0.4
D: Single Unit Truck	9	1.9
E: Tractor Trailer Unit	28	5.9
Total	478	

South On 2		
Vehicle Type	Vol	%
A: Passenger Vehicle	794	80.0
B: Recreational Vehicle	8	0.8
C: Bus	0	0.0
D: Single Unit Truck	16	1.6
E: Tractor Trailer Unit	174	17.5
Total	992	



TURNING MOVEMENT ABBREVIATIONS

- NR: Traffic From North Turning Right
- NL: Traffic From North Turning Left
- NT: Traffic From North Proceeding Through
- SR: Traffic From South Turning Right
- SL: Traffic From South Turning Left
- ST: Traffic From South Proceeding Through
- ER: Traffic From East Turning Right
- EL: Traffic From East Turning Left
- ET: Traffic From East Proceeding Through
- WR: Traffic From West Turning Right
- WL: Traffic From West Turning Left
- WT: Traffic From West Proceeding Through

APPENDIX

C EXISTING CONDITIONS SYNCHRO RESULTS

Intersection												
Int Delay, s/veh	13.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↔		↔	↔	↔	↕↕	↔	↔	↕↕	↔
Traffic Vol, veh/h	27	59	17	25	29	128	14	452	33	166	411	60
Future Vol, veh/h	27	59	17	25	29	128	14	452	33	166	411	60
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	300	-	-	900	850	-	1800	1300	-	1000
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	19	7	0	32	7	14	0	23	21	8	33	5
Mvmt Flow	29	63	18	27	31	136	15	481	35	177	437	64

Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	1077	1302	219	1115	1302	241	437	0	0	481	0	0
Stage 1	791	791	-	511	511	-	-	-	-	-	-	-
Stage 2	286	511	-	604	791	-	-	-	-	-	-	-
Critical Hdwy	7.88	6.64	6.9	8.14	6.64	7.18	4.1	-	-	4.26	-	-
Critical Hdwy Stg 1	6.88	5.64	-	7.14	5.64	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.88	5.64	-	7.14	5.64	-	-	-	-	-	-	-
Follow-up Hdwy	3.69	4.07	3.3	3.82	4.07	3.44	2.2	-	-	2.28	-	-
Pot Cap-1 Maneuver	153	153	791	129	153	725	1134	-	-	1037	-	-
Stage 1	314	388	-	443	523	-	-	-	-	-	-	-
Stage 2	652	523	-	385	388	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	87	125	791	67	125	725	1134	-	-	1037	-	-
Mov Cap-2 Maneuver	87	125	-	67	125	-	-	-	-	-	-	-
Stage 1	310	322	-	437	516	-	-	-	-	-	-	-
Stage 2	491	516	-	251	322	-	-	-	-	-	-	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	99.1		37.6		0.2		2.4	
HCM LOS	F		E					

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1134	-	-	110	791	89	725	1037	-	-
HCM Lane V/C Ratio	0.013	-	-	0.832	0.023	0.645	0.188	0.17	-	-
HCM Control Delay (s)	8.2	-	-	116.8	9.7	100.3	11.1	9.2	-	-
HCM Lane LOS	A	-	-	F	A	F	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	4.8	0.1	3.1	0.7	0.6	-	-

Intersection												
Int Delay, s/veh	4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	23	31	8	7	48	5	11	3	4	4	6	20
Future Vol, veh/h	23	31	8	7	48	5	11	3	4	4	6	20
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	0	29	15	20	9	0	25	0	0	20
Mvmt Flow	24	33	9	7	51	5	12	3	4	4	6	21

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	56	0	0	42	0	0	167	156	38	157	158	54
Stage 1	-	-	-	-	-	-	86	86	-	68	68	-
Stage 2	-	-	-	-	-	-	81	70	-	89	90	-
Critical Hdwy	4.23	-	-	4.39	-	-	7.19	6.5	6.45	7.1	6.5	6.4
Critical Hdwy Stg 1	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.317	-	-	2.461	-	-	3.581	4	3.525	3.5	4	3.48
Pot Cap-1 Maneuver	1481	-	-	1410	-	-	782	740	972	814	738	965
Stage 1	-	-	-	-	-	-	905	827	-	947	842	-
Stage 2	-	-	-	-	-	-	910	841	-	923	824	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1481	-	-	1410	-	-	747	724	972	794	722	965
Mov Cap-2 Maneuver	-	-	-	-	-	-	747	724	-	794	722	-
Stage 1	-	-	-	-	-	-	890	813	-	931	838	-
Stage 2	-	-	-	-	-	-	879	837	-	900	810	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2.8	0.9	9.7	9.2
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	783	1481	-	-	1410	-	-	880
HCM Lane V/C Ratio	0.024	0.017	-	-	0.005	-	-	0.036
HCM Control Delay (s)	9.7	7.5	0	-	7.6	0	-	9.2
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0	-	-	0.1

Intersection: 3: Hwy 2 & Hwy 520

Movement	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	LT	R	L	T	T	L	T	T
Maximum Queue (m)	41.9	28.3	4.1	6.3	8.1	4.0	28.6	1.5	1.8
Average Queue (m)	14.0	11.1	0.2	1.1	0.4	0.1	10.2	0.1	0.1
95th Queue (m)	30.0	23.9	2.5	5.0	4.0	2.2	21.8	1.3	1.3
Link Distance (m)	94.4	405.2			256.0	256.0		349.8	349.8
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)			90.0	85.0			130.0		
Storage Blk Time (%)	2								
Queuing Penalty (veh)	0								

Intersection: 6: 5th St E & Hwy 520

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (m)	4.8	1.7	15.0	18.7
Average Queue (m)	0.2	0.1	4.6	6.3
95th Queue (m)	3.0	1.2	13.2	15.4
Link Distance (m)	405.2	259.6	252.5	330.0
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Network Summary

Network wide Queuing Penalty: 0

Intersection												
Int Delay, s/veh	13.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔	↔		↔	↔	↔	↕↕	↔	↔	↕↕	↔
Traffic Vol, veh/h	31	62	32	34	47	141	18	384	57	141	477	71
Future Vol, veh/h	31	62	32	34	47	141	18	384	57	141	477	71
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	Yield	-	-	Yield	-	-	Yield	-	-	Yield
Storage Length	-	-	300	-	-	900	850	-	1800	1300	-	1000
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	11	22	6	0	0	0	19	16	10	23	0
Mvmt Flow	33	65	34	36	49	148	19	404	60	148	502	75

Major/Minor	Minor2		Minor1		Major1			Major2				
Conflicting Flow All	1063	1240	251	1022	1240	202	502	0	0	404	0	0
Stage 1	798	798	-	442	442	-	-	-	-	-	-	-
Stage 2	265	442	-	580	798	-	-	-	-	-	-	-
Critical Hdwy	7.5	6.72	7.34	7.62	6.5	6.9	4.1	-	-	4.3	-	-
Critical Hdwy Stg 1	6.5	5.72	-	6.62	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.5	5.72	-	6.62	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4.11	3.52	3.56	4	3.3	2.2	-	-	2.3	-	-
Pot Cap-1 Maneuver	180	162	691	185	177	811	1073	-	-	1096	-	-
Stage 1	350	376	-	554	580	-	-	-	-	-	-	-
Stage 2	723	553	-	457	401	-	-	-	-	-	-	-
Platoon blocked, %								-	-	-	-	-
Mov Cap-1 Maneuver	98	138	691	99	150	811	1073	-	-	1096	-	-
Mov Cap-2 Maneuver	98	138	-	99	150	-	-	-	-	-	-	-
Stage 1	344	325	-	544	570	-	-	-	-	-	-	-
Stage 2	530	543	-	301	347	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	80.4	36.9	0.3	1.8
HCM LOS	F	E		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1073	-	-	121	691	123	811	1096	-	-
HCM Lane V/C Ratio	0.018	-	-	0.809	0.049	0.693	0.183	0.135	-	-
HCM Control Delay (s)	8.4	-	-	104.4	10.5	83.1	10.4	8.8	-	-
HCM Lane LOS	A	-	-	F	B	F	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	4.8	0.2	3.8	0.7	0.5	-	-

Intersection												
Int Delay, s/veh	2.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	19	87	3	2	40	5	5	0	7	5	4	22
Future Vol, veh/h	19	87	3	2	40	5	5	0	7	5	4	22
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	13	33	0	13	0	0	0	29	0	0	0
Mvmt Flow	20	92	3	2	42	5	5	0	7	5	4	23

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	47	0	0	95	0	0	196	185	94	186	184	45
Stage 1	-	-	-	-	-	-	134	134	-	49	49	-
Stage 2	-	-	-	-	-	-	62	51	-	137	135	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.49	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.561	3.5	4	3.3
Pot Cap-1 Maneuver	1573	-	-	1512	-	-	767	713	894	779	714	1031
Stage 1	-	-	-	-	-	-	874	789	-	969	858	-
Stage 2	-	-	-	-	-	-	954	856	-	871	789	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1573	-	-	1512	-	-	739	703	894	764	704	1031
Mov Cap-2 Maneuver	-	-	-	-	-	-	739	703	-	764	704	-
Stage 1	-	-	-	-	-	-	863	779	-	956	857	-
Stage 2	-	-	-	-	-	-	927	855	-	853	779	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	1.3			0.3			9.4			9		
HCM LOS							A			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	822	1573	-	-	1512	-	-	924
HCM Lane V/C Ratio	0.015	0.013	-	-	0.001	-	-	0.035
HCM Control Delay (s)	9.4	7.3	0	-	7.4	0	-	9
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection: 3: Hwy 2 & Hwy 520

Movement	EB	WB	WB	NB	NB	NB	SB	SB
Directions Served	LT	LT	R	L	T	T	L	T
Maximum Queue (m)	25.7	30.6	5.6	6.4	0.9	2.4	28.3	3.7
Average Queue (m)	12.1	11.7	0.2	1.4	0.0	0.1	8.5	0.1
95th Queue (m)	21.5	23.9	2.9	5.6	0.6	1.2	19.7	2.1
Link Distance (m)	94.4	405.2			256.0	256.0		349.8
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)			90.0	85.0			130.0	
Storage Blk Time (%)	0							
Queuing Penalty (veh)	0							

Intersection: 6: 5th St E & Hwy 520

Movement	EB	NB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (m)	7.3	20.6	9.3
Average Queue (m)	0.4	3.8	5.9
95th Queue (m)	3.6	13.3	12.7
Link Distance (m)	405.2	252.5	330.0
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

APPENDIX

D DETAILED TRIP GENERATION TABLES

Development Land Uses	ITE Land Uses	ITE Code	Units	AM				PM			
				Average Rate	Equation	% In	% Out	Average Rate	Equation	% In	% Out
Commercial	Tractor Supply Store	810	1000 Sq Ft GFA	NO AM INFO				1.4	-	47%	53%
	Construction Equipment Rental Store	811	1000 Sq Ft GFA	NO AM INFO				0.99	-	28%	72%
	Home Improvement Superstore	862	1000 Sq Ft GFA	1.57	-	57%	43%	2.33	-	49%	51%
	Discount Home Furnishing Superstore	869	1000 Sq Ft GFA	0.57	-	64%	36%	1.57	-	53%	57%
	Discount Club	857	1000 Sq Ft GFA	0.49	-	70%	30%	4.18	-	50%	50%
	Truck Stop	950	1000 Sq Ft GFA	26.49	$T=36.62(X)-106.33$	50%	50%	22.73	-	53%	47%
Logistics/Light Manufacturing	Manufacturing	140	1000 Sq Ft GFA	0.62	-	77%	23%	0.67	-	31%	69%
	General Light Industrial	110	1000 Sq Ft GFA	0.7	$\ln(T)=0.74\ln(X)+0.39$	88%	12%	0.63	$\ln(T)=0.69\ln(X)+0.43$	13%	87%
	Warehousing	150	1000 Sq Ft GFA	0.17	$T=0.12(X)+25.32$	77%	23%	0.19	$T=0.12(X)+27.82$	27%	73%
	Mini-Warehousing	151	1000 Sq Ft GFA	0.1	-	60%	40%	0.17	-	47%	53%
Commercial/Business	Automobile Parts Sales	843	1000 Sq Ft GFA	2.59	-	55%	45%	4.91	-	48%	52%
	Tire Store	848	1000 Sq Ft GFA	2.72	-	64%	36%	3.98	-	43%	57%
	Building Materials and Lumber Store	812	1000 Sq Ft GFA	1.57	-	63%	37%	2.06	-	47%	53%
	Hardware/Paint Store	816	1000 Sq Ft GFA	1.08	$T=1.28X-3.07$	54%	46%	2.68	-	47%	53%

LAND USE	STAGE 1 AREA (Ha)	STAGE 1 GFA (1000 sq ft)	A.M. RATE	P.M. RATE	A.M. TRIP ENDS	P.M. TRIP ENDS	PASS-BY REDUCTION		FINAL A.M. TRIP GEN			FINAL P.M. TRIP GEN				
							A.M.	P.M.	TOTAL	IN	OUT	TOTAL	IN	OUT		
Commercial	2.75	74.0														
<i>Blended Rate</i>	2.7	72.7	0.876667	2.094	64	152	0	20	64	41	23	132	60	72		
<i>Truck Stop</i>	0	0.0	26.49	22.73	0	0	0	0	0	0	0	0	0	0		
Business Commercial	6.0	161.5														
<i>Blended Rate</i>	6.0	161.5	1.99	3.4075	321	550	0	70	321	189	132	480	222	258		
Logistics/Light Manufactur	13.5	363.3														
<i>Blended Rate</i>	13.5	363.3	0.3975	0.415	144	151	0	0	144	109	35	151	45	106		
									529	339	190	763	327	436		

LAND USE	STAGE 2 AREA (Ha)	STAGE 2 GFA (1000 sq ft)	A.M. RATE	P.M. RATE	A.M. TRIP ENDS	P.M. TRIP ENDS	INTERNAL CAPTURE REDUCTION		PASS-BY REDUCTION		FINAL A.M. TRIP GEN			FINAL P.M. TRIP GEN		
							A.M.	P.M.	A.M.	P.M.	TOTAL	IN	OUT	TOTAL	IN	OUT
Commercial	3.0	80.7														
<i>Blended Rate</i>	1.50	40.4	0.876667	2.094	35	85	4	4	0	20	31	20	11	61	28	33
<i>Truck Stop</i>	1.50	40.4	26.49	22.73	1069	917	53	46	72	56	944	472	472	815	432	383
Business Commercial	14.5	390.2														
<i>Blended Rate</i>	14.5	390.2	1.99	3.4075	776	1330	39	67	0	40	737	435	302	1223	566	657
Logistics/Light Manufactur	13.6	366.0														
<i>Blended Rate</i>	13.6	366.0	0.3975	0.415	145	152	7	8	0	0	138	104	34	144	42	102
											1850	1031	819	2243	1068	1175

APPENDIX

E

TRAFFIC
SIGNAL
WARRANT
ANALYSIS



Alberta Transportation - Traffic Signal Warrant Analysis

Main Street (name)	Hwy 2	Direction (EW or NS)	NS
Side Street (name)	Hwy 520	Direction (EW or NS)	EW
Quadrant / Int #	1	Comments	Existing Conditions
for Warrant Calculation Results, please hit 'Page Down'	CHECK SHEET		

Road Authority:	Alberta Transportation
City:	Claresholm
Analysis Date:	2018 Oct 15, Mon
Count Date:	2018 Oct 16, Tue
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Hwy 2	NB	1		2			1	1,000	2
Hwy 2	SB	1		2			1	500	2
Hwy 520	WB		1				1		
Hwy 520	EB		1				1		

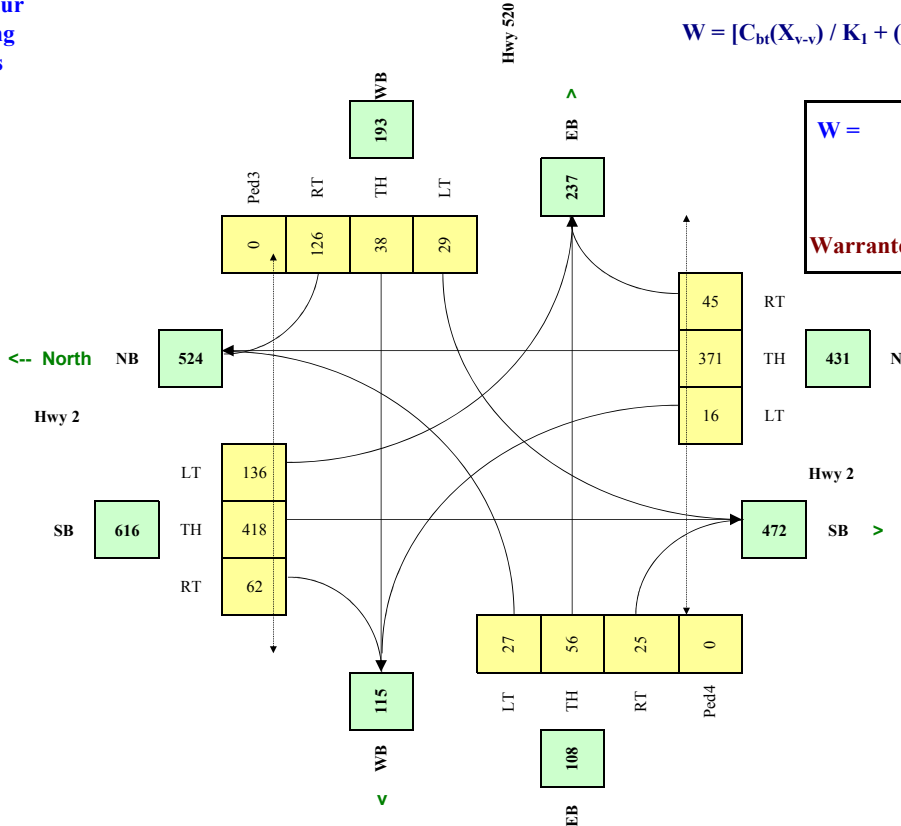
Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	3,780
Central Business District	(y/n)	y

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Hwy 2	NS	50	2.0%	n	1.0
Hwy 520	EW		2.0%	n	

Traffic Input	Set Peak Hours												Ped1	Ped2	Ped3	Ped4
	NB			SB			WB			EB			NS	NS	EW	EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	10	312	23	114	284	41	17	20	89	19	40	12				
8:00 - 9:00	14	452	33	166	411	60	25	29	128	27	59	17				
11:00 - 12:00	17	353	52	130	439	65	32	44	130	29	57	30				
12:00 - 13:00	17	361	53	133	448	66	32	45	133	29	58	30				
16:00 - 17:00	18	384	57	141	477	71	34	47	141	31	62	32				
17:00 - 18:00	17	361	53	133	448	66	32	45	133	29	58	30				
Total (6-hour peak)	93	2,223	271	817	2,507	369	172	230	754	164	334	151	0	0	0	0
Average (6-hour peak)	16	371	45	136	418	62	29	38	126	27	56	25	0	0	0	0

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p})L) / K_2] \times C_i$$



W =	149	149	0
		Veh	Ped
Warranted			

RESET SHEET



Alberta Transportation - Traffic Signal Warrant Analysis

Main Street (name)	Hwy 520	Direction (EW or NS)	EW
Side Street (name)	5th Street East	Direction (EW or NS)	NS
Quadrant / Int #	2	Comments	2048 Post-Development Horizon
for Warrant Calculation Results, please hit 'Page Down'			
CHECK SHEET			

Road Authority:	Alberta Transportation
City:	Claresholm
Analysis Date:	2018 Oct 19, Fri
Count Date:	2018 Oct 16, Tue
Date Entry Format:	(yyyy-mm-dd)

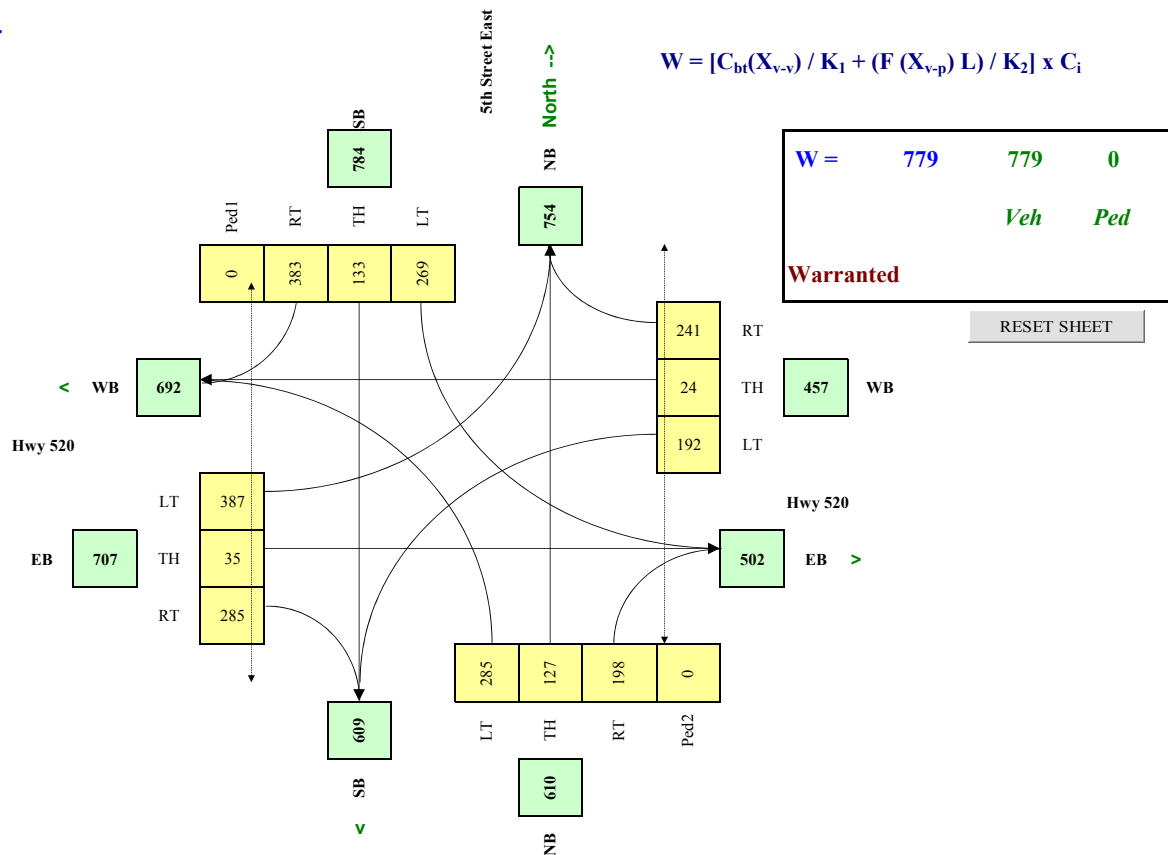
Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	Upstream Signal (m)	# of Thru Lanes
Hwy 520	WB				1			1,000	1
Hwy 520	EB				1			420	1
5th Street East	NB				1				
5th Street East	SB				1				

Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	3,780
Central Business District	(y/n)	y

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Hwy 520	EW	50	15.0%	n	0.0
5th Street East	NS		15.0%	n	

Traffic Input	Set Peak Hours												Ped1	Ped2	Ped3	Ped4
	NB			SB			WB			EB			NS	NS	EW	EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00	212	88	138	100	99	161	177	28	143	228	18	251	0	0	0	0
8:00 - 9:00	307	128	200	144	144	233	257	41	207	331	27	363	0	0	0	0
11:30 - 12:30	288	132	206	331	134	461	174	19	265	427	40	265	0	0	0	0
12:30 - 13:30	294	134	211	338	137	471	177	19	270	436	40	271	0	0	0	0
16:00 - 17:00	313	143	224	360	145	501	189	20	288	464	43	288	0	0	0	0
17:00 - 18:00	294	134	211	338	137	471	177	19	270	436	40	271	0	0	0	0
Total (6-hour peak)	1,708	759	1,190	1,611	796	2,298	1,151	146	1,443	2,322	208	1,709	0	0	0	0
Average (6-hour peak)	285	127	198	269	133	383	192	24	241	387	35	285	0	0	0	0

Average 6-hour Peak Turning Movements

























APPENDIX

F

PRE-
DEVELOPMENT
SYNCHRO
RESULTS

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	28	60	18	26	30	131	14	461	34	169	419	61
Future Volume (vph)	28	60	18	26	30	131	14	461	34	169	419	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		30.0	0.0		90.0	85.0		180.0	130.0		100.0
Storage Lanes	0		1	0		1	1		1	1		1
Taper Length (m)	7.5			7.5			60.0			50.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected		0.984			0.977		0.950			0.950		
Satd. Flow (prot)	0	1687	1615	0	1564	1417	1805	2935	1335	1671	2714	1538
Flt Permitted		0.898			0.848		0.494			0.473		
Satd. Flow (perm)	0	1539	1615	0	1358	1417	939	2935	1335	832	2714	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			60			139			60			65
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		111.3			229.9			268.1			362.1	
Travel Time (s)		8.0			16.6			19.3			26.1	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	19%	7%	0%	32%	7%	14%	0%	23%	21%	8%	33%	5%
Adj. Flow (vph)	30	64	19	28	32	139	15	490	36	180	446	65
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	94	19	0	60	139	15	490	36	180	446	65
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			5.6			5.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

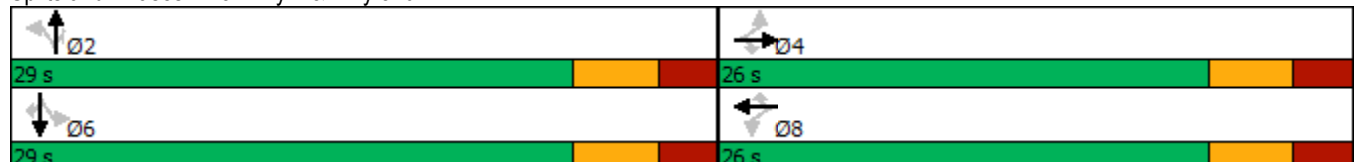
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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	29.0	29.0	29.0	29.0	29.0	29.0
Total Split (%)	47.3%	47.3%	47.3%	47.3%	47.3%	47.3%	52.7%	52.7%	52.7%	52.7%	52.7%	52.7%
Maximum Green (s)	20.0	20.0	20.0	20.0	20.0	20.0	23.0	23.0	23.0	23.0	23.0	23.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	Min
Walk Time (s)				8.0	8.0	8.0				8.0	8.0	8.0
Flash Dont Walk (s)				12.0	12.0	12.0				2.0	2.0	2.0
Pedestrian Calls (#/hr)				0	0	0				0	0	0
Act Effct Green (s)		20.2	20.2		20.2	20.2	25.9	25.9	25.9	25.9	25.9	25.9
Actuated g/C Ratio		0.40	0.40		0.40	0.40	0.51	0.51	0.51	0.51	0.51	0.51
v/c Ratio		0.15	0.03		0.11	0.21	0.03	0.32	0.05	0.42	0.32	0.08
Control Delay		12.0	0.4		11.7	3.7	10.1	11.5	2.0	16.4	11.5	3.6
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		12.0	0.4		11.7	3.7	10.1	11.5	2.0	16.4	11.5	3.6
LOS		B	A		B	A	B	B	A	B	B	A
Approach Delay		10.1			6.1			10.8				12.1
Approach LOS		B			A			B				B

Intersection Summary

Area Type:	Other
Cycle Length:	55
Actuated Cycle Length:	50.4
Natural Cycle:	55
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.42
Intersection Signal Delay:	10.7
Intersection LOS:	B
Intersection Capacity Utilization:	65.0%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 3: Hwy 2 & Hwy 520



Intersection												
Int Delay, s/veh	4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	24	32	8	7	49	5	11	3	4	4	6	21
Future Vol, veh/h	24	32	8	7	49	5	11	3	4	4	6	21
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	0	29	15	20	9	0	25	0	0	20
Mvmt Flow	26	34	9	7	52	5	12	3	4	4	6	22

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	57	0	0	43	0	0	174	162	39	163	164	55
Stage 1	-	-	-	-	-	-	91	91	-	69	69	-
Stage 2	-	-	-	-	-	-	83	71	-	94	95	-
Critical Hdwy	4.23	-	-	4.39	-	-	7.19	6.5	6.45	7.1	6.5	6.4
Critical Hdwy Stg 1	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.317	-	-	2.461	-	-	3.581	4	3.525	3.5	4	3.48
Pot Cap-1 Maneuver	1480	-	-	1409	-	-	773	734	971	806	732	963
Stage 1	-	-	-	-	-	-	899	823	-	946	841	-
Stage 2	-	-	-	-	-	-	908	840	-	918	820	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1480	-	-	1409	-	-	737	717	971	786	715	963
Mov Cap-2 Maneuver	-	-	-	-	-	-	737	717	-	786	715	-
Stage 1	-	-	-	-	-	-	883	808	-	929	837	-
Stage 2	-	-	-	-	-	-	876	836	-	894	805	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	2.8			0.9			9.8			9.3		
HCM LOS							A			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	775	1480	-	-	1409	-	-	878
HCM Lane V/C Ratio	0.025	0.017	-	-	0.005	-	-	0.038
HCM Control Delay (s)	9.8	7.5	0	-	7.6	0	-	9.3
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0	-	-	0.1

Intersection: 3: Hwy 2 & Hwy 520

Movement	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	LT	R	L	T	T	L	T	T
Maximum Queue (m)	26.4	23.8	5.4	10.1	54.4	46.4	56.2	55.1	48.3
Average Queue (m)	11.0	9.0	0.3	1.7	27.7	14.5	21.7	23.8	16.9
95th Queue (m)	22.4	19.1	3.9	6.7	48.1	34.6	42.7	42.6	36.2
Link Distance (m)	94.4	204.8			256.0	256.0		349.8	349.8
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)			90.0	85.0			130.0		
Storage Blk Time (%)	0								
Queuing Penalty (veh)	0								

Intersection: 6: 5th St E & Hwy 520























Movement	EB	NB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (m)	9.5	13.1	18.4
Average Queue (m)	0.5	4.7	6.6
95th Queue (m)	4.4	12.7	16.2
Link Distance (m)	183.6	252.5	330.0
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	63	33	35	48	144	19	391	58	144	486	72
Future Volume (vph)	32	63	33	35	48	144	19	391	58	144	486	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		30.0	0.0		90.0	85.0		180.0	130.0		100.0
Storage Lanes	0		1	0		1	1		1	1		1
Taper Length (m)	7.5			7.5			60.0			50.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected		0.983			0.979		0.950			0.950		
Satd. Flow (prot)	0	1741	1324	0	1814	1615	1805	3034	1392	1641	2935	1615
Flt Permitted		0.880			0.849		0.463			0.510		
Satd. Flow (perm)	0	1559	1324	0	1573	1615	880	3034	1392	881	2935	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			60			152			61			76
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		111.3			216.4			268.1			362.1	
Travel Time (s)		8.0			15.6			19.3			26.1	
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
Heavy Vehicles (%)	0%	11%	22%	6%	0%	0%	0%	19%	16%	10%	23%	0%
Adj. Flow (vph)	34	66	35	37	51	152	20	412	61	152	512	76
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	100	35	0	88	152	20	412	61	152	512	76
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			5.6			5.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

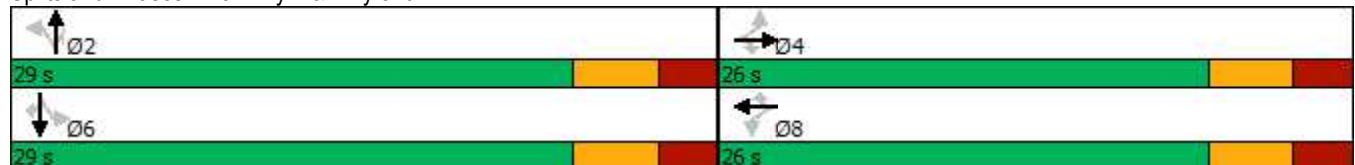
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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	29.0	29.0	29.0	29.0	29.0	29.0
Total Split (%)	47.3%	47.3%	47.3%	47.3%	47.3%	47.3%	52.7%	52.7%	52.7%	52.7%	52.7%	52.7%
Maximum Green (s)	20.0	20.0	20.0	20.0	20.0	20.0	23.0	23.0	23.0	23.0	23.0	23.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	Min
Walk Time (s)				8.0	8.0	8.0				8.0	8.0	8.0
Flash Dont Walk (s)				12.0	12.0	12.0				2.0	2.0	2.0
Pedestrian Calls (#/hr)				0	0	0				0	0	0
Act Effct Green (s)		20.2	20.2		20.2	20.2	25.9	25.9	25.9	25.9	25.9	25.9
Actuated g/C Ratio		0.40	0.40		0.40	0.40	0.51	0.51	0.51	0.51	0.51	0.51
v/c Ratio		0.16	0.06		0.14	0.21	0.04	0.26	0.08	0.34	0.34	0.09
Control Delay		12.0	2.3		11.8	3.5	10.3	11.0	3.7	14.6	11.6	3.4
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		12.0	2.3		11.8	3.5	10.3	11.0	3.7	14.6	11.6	3.4
LOS		B	A		B	A	B	B	A	B	B	A
Approach Delay		9.5			6.5			10.1				11.4
Approach LOS		A			A			B				B

Intersection Summary

Area Type: Other
 Cycle Length: 55
 Actuated Cycle Length: 50.4
 Natural Cycle: 55
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.34
 Intersection Signal Delay: 10.1
 Intersection Capacity Utilization 65.0%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service C

Splits and Phases: 3: Hwy 2 & Hwy 520



Intersection												
Int Delay, s/veh	2.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	20	90	3	2	41	5	5	0	7	5	4	23
Future Vol, veh/h	20	90	3	2	41	5	5	0	7	5	4	23
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	13	33	0	13	0	0	0	28	0	0	0
Mvmt Flow	21	95	3	2	43	5	5	0	7	5	4	24

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	48	0	0	98	0	0	203	191	97	192	190	46
Stage 1	-	-	-	-	-	-	139	139	-	50	50	-
Stage 2	-	-	-	-	-	-	64	52	-	142	140	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.48	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.552	3.5	4	3.3
Pot Cap-1 Maneuver	1572	-	-	1508	-	-	759	708	893	772	708	1029
Stage 1	-	-	-	-	-	-	869	785	-	968	857	-
Stage 2	-	-	-	-	-	-	952	856	-	866	785	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1572	-	-	1508	-	-	729	697	893	757	697	1029
Mov Cap-2 Maneuver	-	-	-	-	-	-	729	697	-	757	697	-
Stage 1	-	-	-	-	-	-	857	774	-	954	856	-
Stage 2	-	-	-	-	-	-	924	855	-	847	774	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	1.3			0.3			9.5			9.1		
HCM LOS							A			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	816	1572	-	-	1508	-	-	922
HCM Lane V/C Ratio	0.015	0.013	-	-	0.001	-	-	0.037
HCM Control Delay (s)	9.5	7.3	0	-	7.4	0	-	9.1
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection: 3: Hwy 2 & Hwy 520

Movement	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	LT	R	L	T	T	L	T	T
Maximum Queue (m)	29.4	24.3	4.2	11.4	52.3	38.8	47.3	58.5	51.2
Average Queue (m)	10.6	9.6	0.1	3.0	25.8	12.3	17.9	27.4	19.7
95th Queue (m)	23.0	20.0	2.2	9.0	44.5	28.7	37.0	48.7	41.1
Link Distance (m)	94.4	191.3			256.0	256.0		349.8	349.8
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)			90.0	85.0			130.0		
Storage Blk Time (%)	0								
Queuing Penalty (veh)	0								

Intersection: 6: 5th St E & Hwy 520























Movement	EB	NB	SB
Directions Served	LTR	LTR	LTR
Maximum Queue (m)	7.0	17.6	9.3
Average Queue (m)	0.2	3.3	6.1
95th Queue (m)	2.6	12.1	12.8
Link Distance (m)	197.1	252.5	330.0
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	33	70	21	30	35	154	17	542	40	198	492	71
Future Volume (vph)	33	70	21	30	35	154	17	542	40	198	492	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		30.0	0.0		90.0	85.0		180.0	130.0		100.0
Storage Lanes	0		1	0		1	1		1	1		1
Taper Length (m)	7.5			7.5			60.0			50.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected		0.984			0.977		0.950			0.950		
Satd. Flow (prot)	0	1687	1615	0	1565	1417	1805	2935	1335	1671	2714	1538
Flt Permitted		0.889			0.836		0.458			0.435		
Satd. Flow (perm)	0	1524	1615	0	1339	1417	870	2935	1335	765	2714	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			55			164			55			76
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		111.3			216.6			268.1			362.1	
Travel Time (s)		8.0			15.6			19.3			26.1	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	19%	7%	0%	32%	7%	14%	0%	23%	21%	8%	33%	5%
Adj. Flow (vph)	35	74	22	32	37	164	18	577	43	211	523	76
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	109	22	0	69	164	18	577	43	211	523	76
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			5.6			5.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

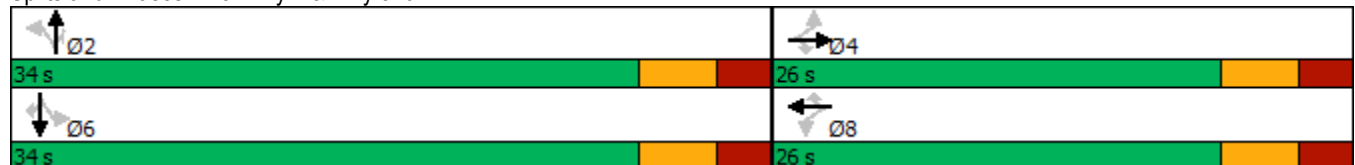
11/13/2018

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	34.0	34.0	34.0	34.0	34.0	34.0
Total Split (%)	43.3%	43.3%	43.3%	43.3%	43.3%	43.3%	56.7%	56.7%	56.7%	56.7%	56.7%	56.7%
Maximum Green (s)	20.0	20.0	20.0	20.0	20.0	20.0	28.0	28.0	28.0	28.0	28.0	28.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	Min
Walk Time (s)				8.0	8.0	8.0				8.0	8.0	8.0
Flash Dont Walk (s)				12.0	12.0	12.0				2.0	2.0	2.0
Pedestrian Calls (#/hr)				0	0	0				0	0	0
Act Effct Green (s)		20.4	20.4		20.4	20.4	28.5	28.5	28.5	28.5	28.5	28.5
Actuated g/C Ratio		0.39	0.39		0.39	0.39	0.54	0.54	0.54	0.54	0.54	0.54
v/c Ratio		0.19	0.03		0.13	0.25	0.04	0.36	0.06	0.51	0.36	0.09
Control Delay		14.2	1.5		13.9	4.2	9.4	11.2	2.7	18.1	11.2	3.1
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		14.2	1.5		13.9	4.2	9.4	11.2	2.7	18.1	11.2	3.1
LOS		B	A		B	A	A	B	A	B	B	A
Approach Delay		12.1			7.1			10.6			12.3	
Approach LOS		B			A			B			B	

Intersection Summary

Area Type: Other
 Cycle Length: 60
 Actuated Cycle Length: 52.8
 Natural Cycle: 60
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.51
 Intersection Signal Delay: 11.0
 Intersection Capacity Utilization 65.0%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service C

Splits and Phases: 3: Hwy 2 & Hwy 520



Intersection												
Int Delay, s/veh	4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	28	38	10	8	58	6	13	4	5	5	7	24
Future Vol, veh/h	28	38	10	8	58	6	13	4	5	5	7	24
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	0	29	15	20	9	0	25	0	0	20
Mvmt Flow	30	40	11	9	62	6	14	4	5	5	7	26

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	68	0	0	51	0	0	206	192	46	193	194	65
Stage 1	-	-	-	-	-	-	106	106	-	83	83	-
Stage 2	-	-	-	-	-	-	100	86	-	110	111	-
Critical Hdwy	4.23	-	-	4.39	-	-	7.19	6.5	6.45	7.1	6.5	6.4
Critical Hdwy Stg 1	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.317	-	-	2.461	-	-	3.581	4	3.525	3.5	4	3.48
Pot Cap-1 Maneuver	1466	-	-	1399	-	-	737	707	962	771	705	951
Stage 1	-	-	-	-	-	-	883	811	-	930	830	-
Stage 2	-	-	-	-	-	-	889	827	-	900	807	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1466	-	-	1399	-	-	696	687	962	747	685	951
Mov Cap-2 Maneuver	-	-	-	-	-	-	696	687	-	747	685	-
Stage 1	-	-	-	-	-	-	864	794	-	910	824	-
Stage 2	-	-	-	-	-	-	851	821	-	872	790	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	2.8	0.8	10	9.4
HCM LOS			B	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	741	1466	-	-	1399	-	-	854
HCM Lane V/C Ratio	0.032	0.02	-	-	0.006	-	-	0.045
HCM Control Delay (s)	10	7.5	0	-	7.6	0	-	9.4
HCM Lane LOS	B	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0	-	-	0.1

Intersection: 3: Hwy 2 & Hwy 520

Movement	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	LT	R	L	T	T	L	T	T
Maximum Queue (m)	31.1	30.9	12.2	12.5	62.7	43.2	69.0	52.2	42.8
Average Queue (m)	12.0	10.3	1.1	2.4	33.3	17.0	30.6	27.6	21.4
95th Queue (m)	25.0	23.4	7.2	8.0	54.5	37.1	57.5	46.7	39.4
Link Distance (m)	94.4	191.5			256.0	256.0		349.8	349.8
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)			90.0	85.0			130.0		
Storage Blk Time (%)	0								
Queuing Penalty (veh)	0								

Intersection: 6: 5th St E & Hwy 520























Movement	EB	B5	WB	NB	SB
Directions Served	LTR	T	LTR	LTR	LTR
Maximum Queue (m)	5.5	78.6	1.8	17.4	19.2
Average Queue (m)	0.4	3.9	0.1	5.1	7.1
95th Queue (m)	3.5	49.3	1.3	14.1	16.7
Link Distance (m)	196.9	191.5	259.6	252.5	330.0
Upstream Blk Time (%)		0			
Queuing Penalty (veh)		0			
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	38	74	39	41	57	169	22	460	68	169	571	85
Future Volume (vph)	38	74	39	41	57	169	22	460	68	169	571	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		30.0	0.0		90.0	85.0		180.0	130.0		100.0
Storage Lanes	0		1	0		1	1		1	1		1
Taper Length (m)	7.5			7.5			60.0			50.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected		0.983			0.980		0.950			0.950		
Satd. Flow (prot)	0	1741	1324	0	1816	1615	1805	3034	1392	1641	2935	1615
Flt Permitted		0.870			0.837		0.425			0.476		
Satd. Flow (perm)	0	1541	1324	0	1551	1615	808	3034	1392	822	2935	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			60			178			72			89
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		204.0			221.5			276.3			320.9	
Travel Time (s)		14.7			15.9			19.9			23.1	
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
Heavy Vehicles (%)	0%	11%	22%	6%	0%	0%	0%	19%	16%	10%	23%	0%
Adj. Flow (vph)	40	78	41	43	60	178	23	484	72	178	601	89
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	118	41	0	103	178	23	484	72	178	601	89
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			5.6			5.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

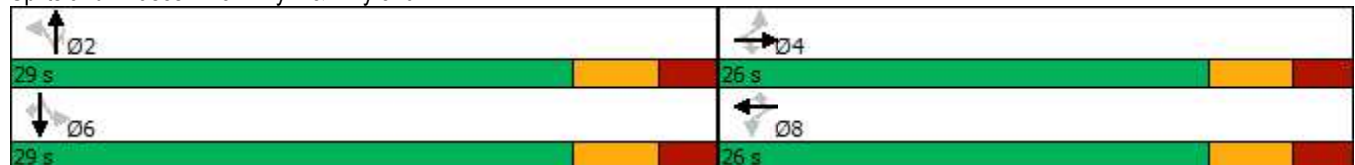
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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	29.0	29.0	29.0	29.0	29.0	29.0
Total Split (%)	47.3%	47.3%	47.3%	47.3%	47.3%	47.3%	52.7%	52.7%	52.7%	52.7%	52.7%	52.7%
Maximum Green (s)	20.0	20.0	20.0	20.0	20.0	20.0	23.0	23.0	23.0	23.0	23.0	23.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	Min
Walk Time (s)				8.0	8.0	8.0				8.0	8.0	8.0
Flash Dont Walk (s)				12.0	12.0	12.0				2.0	2.0	2.0
Pedestrian Calls (#/hr)				0	0	0				0	0	0
Act Effct Green (s)		20.2	20.2		20.2	20.2	26.2	26.2	26.2	26.2	26.2	26.2
Actuated g/C Ratio		0.40	0.40		0.40	0.40	0.52	0.52	0.52	0.52	0.52	0.52
v/c Ratio		0.19	0.07		0.17	0.24	0.06	0.31	0.10	0.42	0.40	0.10
Control Delay		12.5	3.0		12.3	3.4	10.4	11.2	3.6	16.3	12.1	3.3
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		12.5	3.0		12.3	3.4	10.4	11.2	3.6	16.3	12.1	3.3
LOS		B	A		B	A	B	B	A	B	B	A
Approach Delay		10.1			6.7			10.2			12.0	
Approach LOS		B			A			B			B	

Intersection Summary

Area Type: Other
 Cycle Length: 55
 Actuated Cycle Length: 50.7
 Natural Cycle: 55
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.42
 Intersection Signal Delay: 10.5
 Intersection Capacity Utilization 65.0%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service C

Splits and Phases: 3: Hwy 2 & Hwy 520



Intersection												
Int Delay, s/veh	2.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	23	105	4	2	48	6	6	0	8	6	5	27
Future Vol, veh/h	23	105	4	2	48	6	6	0	8	6	5	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	13	33	0	13	0	0	0	29	0	0	0
Mvmt Flow	24	111	4	2	51	6	6	0	8	6	5	28

Major/Minor	Major1		Major2		Minor1			Minor2				
Conflicting Flow All	57	0	0	115	0	0	236	222	113	223	221	54
Stage 1	-	-	-	-	-	-	161	161	-	58	58	-
Stage 2	-	-	-	-	-	-	75	61	-	165	163	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.49	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.561	3.5	4	3.3
Pot Cap-1 Maneuver	1560	-	-	1487	-	-	723	680	872	737	681	1019
Stage 1	-	-	-	-	-	-	846	769	-	959	851	-
Stage 2	-	-	-	-	-	-	939	848	-	842	767	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1560	-	-	1487	-	-	690	668	872	721	669	1019
Mov Cap-2 Maneuver	-	-	-	-	-	-	690	668	-	721	669	-
Stage 1	-	-	-	-	-	-	832	757	-	944	850	-
Stage 2	-	-	-	-	-	-	906	847	-	821	755	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.3	0.3	9.7	9.2
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	783	1560	-	-	1487	-	-	899
HCM Lane V/C Ratio	0.019	0.016	-	-	0.001	-	-	0.044
HCM Control Delay (s)	9.7	7.3	0	-	7.4	0	-	9.2
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.1

Intersection: 2: 5th Street East & Hwy 520

Movement	EB	B8	WB	NB	SB
Directions Served	LTR	T	LTR	LTR	LTR
Maximum Queue (m)	6.5	124.5	1.4	17.2	11.6
Average Queue (m)	0.4	5.5	0.0	3.6	6.8
95th Queue (m)	3.4	60.5	1.0	11.8	13.0
Link Distance (m)	192.6	197.3	199.5	262.4	283.7
Upstream Blk Time (%)	0				
Queuing Penalty (veh)	0				
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 3: Hwy 2 & Hwy 520























Movement	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	LT	R	L	T	T	L	T	T
Maximum Queue (m)	31.5	29.2	9.2	13.9	56.2	45.0	60.4	61.6	49.8
Average Queue (m)	11.9	11.8	0.6	4.1	28.3	15.6	25.0	30.2	22.9
95th Queue (m)	23.3	23.2	5.4	11.5	48.1	33.7	48.3	50.0	43.1
Link Distance (m)	188.0	197.3			265.8	265.8		310.0	310.0
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)			90.0	85.0			130.0		
Storage Blk Time (%)	0								
Queuing Penalty (veh)	0								

Network Summary

Network wide Queuing Penalty: 0

Lanes, Volumes, Timings
1: Hwy 2 & Hwy 520

11/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	76	22	33	38	166	18	587	43	215	533	77
Future Volume (vph)	35	76	22	33	38	166	18	587	43	215	533	77
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		30.0	0.0		90.0	85.0		180.0	130.0		100.0
Storage Lanes	0		1	0		1	1		1	1		1
Taper Length (m)	7.5			7.5			60.0			50.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected		0.985			0.977		0.950			0.950		
Satd. Flow (prot)	0	1690	1615	0	1564	1417	1805	2935	1335	1671	2714	1538
Flt Permitted		0.887			0.826		0.439			0.415		
Satd. Flow (perm)	0	1522	1615	0	1323	1417	834	2935	1335	730	2714	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			55			177			55			82
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		111.3			224.2			282.4			309.4	
Travel Time (s)		8.0			16.1			20.3			22.3	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	19%	7%	0%	32%	7%	14%	0%	23%	21%	8%	33%	5%
Adj. Flow (vph)	37	81	23	35	40	177	19	624	46	229	567	82
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	118	23	0	75	177	19	624	46	229	567	82
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			5.6			5.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings

1: Hwy 2 & Hwy 520

11/13/2018



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	34.0	34.0	34.0	34.0	34.0	34.0
Total Split (%)	43.3%	43.3%	43.3%	43.3%	43.3%	43.3%	56.7%	56.7%	56.7%	56.7%	56.7%	56.7%
Maximum Green (s)	20.0	20.0	20.0	20.0	20.0	20.0	28.0	28.0	28.0	28.0	28.0	28.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	Min
Walk Time (s)				8.0	8.0	8.0				8.0	8.0	8.0
Flash Dont Walk (s)				12.0	12.0	12.0				2.0	2.0	2.0
Pedestrian Calls (#/hr)				0	0	0				0	0	0
Act Effct Green (s)		20.4	20.4		20.4	20.4	29.8	29.8	29.8	29.8	29.8	29.8
Actuated g/C Ratio		0.38	0.38		0.38	0.38	0.55	0.55	0.55	0.55	0.55	0.55
v/c Ratio		0.21	0.04		0.15	0.27	0.04	0.39	0.06	0.57	0.38	0.09
Control Delay		15.0	1.6		14.6	4.2	9.3	11.2	2.9	21.1	11.2	3.0
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		15.0	1.6		14.6	4.2	9.3	11.2	2.9	21.1	11.2	3.0
LOS		B	A		B	A	A	B	A	C	B	A
Approach Delay		12.9			7.3			10.6			13.0	
Approach LOS		B			A			B			B	

Intersection Summary

Area Type: Other

Cycle Length: 60

Actuated Cycle Length: 54

Natural Cycle: 60

Control Type: Semi Act-Uncoord

Maximum v/c Ratio: 0.57

Intersection Signal Delay: 11.4

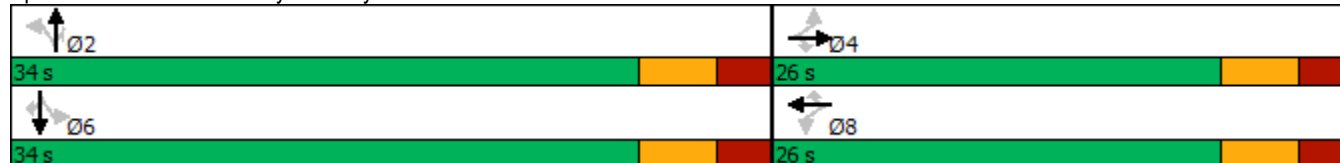
Intersection LOS: B

Intersection Capacity Utilization 65.0%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 1: Hwy 2 & Hwy 520



Intersection												
Int Delay, s/veh	4.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	30	41	10	9	63	7	14	4	5	5	8	26
Future Vol, veh/h	30	41	10	9	63	7	14	4	5	5	8	26
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	0	29	15	20	9	0	25	0	0	20
Mvmt Flow	32	44	11	10	67	7	15	4	5	5	9	28

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	74	0	0	55	0	0	223	208	50	209	210	71
Stage 1	-	-	-	-	-	-	114	114	-	91	91	-
Stage 2	-	-	-	-	-	-	109	94	-	118	119	-
Critical Hdwy	4.23	-	-	4.39	-	-	7.19	6.5	6.45	7.1	6.5	6.4
Critical Hdwy Stg 1	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.19	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.317	-	-	2.461	-	-	3.581	4	3.525	3.5	4	3.48
Pot Cap-1 Maneuver	1459	-	-	1394	-	-	718	692	957	753	691	943
Stage 1	-	-	-	-	-	-	874	805	-	921	823	-
Stage 2	-	-	-	-	-	-	879	821	-	891	801	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1459	-	-	1394	-	-	674	671	957	728	670	943
Mov Cap-2 Maneuver	-	-	-	-	-	-	674	671	-	728	670	-
Stage 1	-	-	-	-	-	-	854	786	-	900	817	-
Stage 2	-	-	-	-	-	-	838	815	-	861	783	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	2.8			0.9			10.2			9.5		
HCM LOS							B			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	720	1459	-	-	1394	-	-	841
HCM Lane V/C Ratio	0.034	0.022	-	-	0.007	-	-	0.049
HCM Control Delay (s)	10.2	7.5	0	-	7.6	0	-	9.5
HCM Lane LOS	B	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0	-	-	0.2

Intersection: 1: Hwy 2 & Hwy 520

Movement	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	LT	R	L	T	T	L	T	T
Maximum Queue (m)	32.6	25.8	19.3	12.5	69.2	57.1	84.4	64.8	55.7
Average Queue (m)	15.0	10.9	1.2	2.9	37.0	22.2	39.3	32.7	25.6
95th Queue (m)	28.3	23.0	8.5	9.5	58.8	46.3	75.6	57.0	48.1
Link Distance (m)	95.4	200.0			271.8	271.8		298.6	298.6
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)			90.0	85.0			130.0		
Storage Blk Time (%)	1						0		
Queuing Penalty (veh)	0						0		

Intersection: 2: 5th St E & Hwy 520























Movement	EB	B5	WB	NB	SB
Directions Served	LTR	T	LTR	LTR	LTR
Maximum Queue (m)	8.9	127.0	8.5	16.3	18.1
Average Queue (m)	0.5	4.2	0.4	4.9	7.1
95th Queue (m)	4.2	53.1	4.2	13.3	16.2
Link Distance (m)	188.4	200.0	258.6	256.0	293.1
Upstream Blk Time (%)		0			
Queuing Penalty (veh)		0			
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 1

Lanes, Volumes, Timings
1: Hwy 2 & Hwy 520

11/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	80	42	45	62	183	24	498	73	183	618	92
Future Volume (vph)	41	80	42	45	62	183	24	498	73	183	618	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		30.0	0.0		90.0	85.0		180.0	130.0		100.0
Storage Lanes	0		1	0		1	1		1	1		1
Taper Length (m)	7.5			7.5			60.0			50.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected		0.983			0.979		0.950			0.950		
Satd. Flow (prot)	0	1741	1324	0	1814	1615	1805	3034	1392	1641	2935	1615
Flt Permitted		0.864			0.828		0.398			0.458		
Satd. Flow (perm)	0	1530	1324	0	1535	1615	756	3034	1392	791	2935	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			60			193			77			97
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		131.7			221.9			269.5			308.3	
Travel Time (s)		9.5			16.0			19.4			22.2	
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
Heavy Vehicles (%)	0%	11%	22%	6%	0%	0%	0%	19%	16%	10%	23%	0%
Adj. Flow (vph)	43	84	44	47	65	193	25	524	77	193	651	97
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	127	44	0	112	193	25	524	77	193	651	97
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			5.6			5.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings

1: Hwy 2 & Hwy 520

11/13/2018



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	29.0	29.0	29.0	29.0	29.0	29.0
Total Split (%)	47.3%	47.3%	47.3%	47.3%	47.3%	47.3%	52.7%	52.7%	52.7%	52.7%	52.7%	52.7%
Maximum Green (s)	20.0	20.0	20.0	20.0	20.0	20.0	23.0	23.0	23.0	23.0	23.0	23.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	Min
Walk Time (s)				8.0	8.0	8.0				8.0	8.0	8.0
Flash Dont Walk (s)				12.0	12.0	12.0				2.0	2.0	2.0
Pedestrian Calls (#/hr)				0	0	0				0	0	0
Act Effct Green (s)		20.2	20.2		20.2	20.2	26.6	26.6	26.6	26.6	26.6	26.6
Actuated g/C Ratio		0.40	0.40		0.40	0.40	0.52	0.52	0.52	0.52	0.52	0.52
v/c Ratio		0.21	0.08		0.18	0.25	0.06	0.33	0.10	0.47	0.43	0.11
Control Delay		13.0	3.4		12.7	3.4	10.5	11.3	3.4	17.8	12.3	3.2
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		13.0	3.4		12.7	3.4	10.5	11.3	3.4	17.8	12.3	3.2
LOS		B	A		B	A	B	B	A	B	B	A
Approach Delay		10.5			6.8			10.3			12.5	
Approach LOS		B			A			B			B	

Intersection Summary

Area Type:	Other
Cycle Length:	55
Actuated Cycle Length:	51
Natural Cycle:	55
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.47
Intersection Signal Delay:	10.8
Intersection LOS:	B
Intersection Capacity Utilization:	65.4%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 1: Hwy 2 & Hwy 520



Intersection												
Int Delay, s/veh	2.9											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	25	114	4	3	52	7	7	0	9	7	5	29
Future Vol, veh/h	25	114	4	3	52	7	7	0	9	7	5	29
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	13	33	0	13	0	0	0	29	0	0	0
Mvmt Flow	26	120	4	3	55	7	7	0	9	7	5	31

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	62	0	0	124	0	0	257	242	122	244	241	59
Stage 1	-	-	-	-	-	-	174	174	-	65	65	-
Stage 2	-	-	-	-	-	-	83	68	-	179	176	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.49	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.561	3.5	4	3.3
Pot Cap-1 Maneuver	1554	-	-	1475	-	-	700	663	861	714	664	1012
Stage 1	-	-	-	-	-	-	833	759	-	951	845	-
Stage 2	-	-	-	-	-	-	930	842	-	827	757	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1554	-	-	1475	-	-	664	650	861	695	651	1012
Mov Cap-2 Maneuver	-	-	-	-	-	-	664	650	-	695	651	-
Stage 1	-	-	-	-	-	-	818	745	-	934	843	-
Stage 2	-	-	-	-	-	-	895	840	-	803	743	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	1.3			0.4			9.8			9.3		
HCM LOS							A			A		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	762	1554	-	-	1475	-	-	883
HCM Lane V/C Ratio	0.022	0.017	-	-	0.002	-	-	0.049
HCM Control Delay (s)	9.8	7.4	0	-	7.4	0	-	9.3
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0	-	-	0.2

Intersection: 1: Hwy 2 & Hwy 520

Movement	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	LT	R	L	T	T	L	T	T
Maximum Queue (m)	32.4	32.2	11.4	13.9	62.4	51.9	80.1	61.2	53.3
Average Queue (m)	13.3	11.7	0.5	4.4	32.3	19.3	31.0	35.4	27.9
95th Queue (m)	26.1	24.4	4.8	11.6	51.7	40.3	60.1	56.4	49.7
Link Distance (m)	115.9	197.7			258.9	258.9		297.8	297.8
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)			90.0	85.0			130.0		
Storage Blk Time (%)	0								
Queuing Penalty (veh)	0								

Intersection: 2: 5th Street East & Hwy 520

Movement	EB	B9	WB	NB	SB
Directions Served	LTR	T	LTR	LTR	LTR
Maximum Queue (m)	4.8	41.5	1.6	17.9	10.3
Average Queue (m)	0.2	1.4	0.1	4.8	6.4
95th Queue (m)	2.3	29.3	1.1	14.0	12.6
Link Distance (m)	193.0	197.7	187.8	259.5	294.6
Upstream Blk Time (%)		0			
Queuing Penalty (veh)		0			
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0























APPENDIX

G

POST-
DEVELOPMENT
SYNCHRO
RESULTS

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	28	73	18	64	37	175	14	461	95	247	419	61
Future Volume (vph)	28	73	18	64	37	175	14	461	95	247	419	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		30.0	0.0		90.0	85.0		180.0	130.0		100.0
Storage Lanes	0		1	0		1	1		1	1		1
Taper Length (m)	7.5			7.5			60.0			50.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected		0.986			0.969		0.950			0.950		
Satd. Flow (prot)	0	1698	1615	0	1498	1417	1805	2935	1335	1671	2714	1538
Flt Permitted		0.895			0.749		0.494			0.473		
Satd. Flow (perm)	0	1541	1615	0	1158	1417	939	2935	1335	832	2714	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			55			186			101			65
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		111.3			206.2			276.8			309.0	
Travel Time (s)		8.0			14.8			19.9			22.2	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	19%	7%	0%	32%	7%	14%	0%	23%	21%	8%	33%	5%
Adj. Flow (vph)	30	78	19	68	39	186	15	490	101	263	446	65
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	108	19	0	107	186	15	490	101	263	446	65
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			5.6			5.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

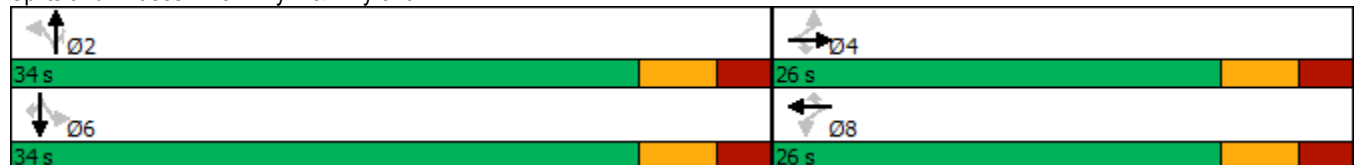
11/13/2018

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	34.0	34.0	34.0	34.0	34.0	34.0
Total Split (%)	43.3%	43.3%	43.3%	43.3%	43.3%	43.3%	56.7%	56.7%	56.7%	56.7%	56.7%	56.7%
Maximum Green (s)	20.0	20.0	20.0	20.0	20.0	20.0	28.0	28.0	28.0	28.0	28.0	28.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	Min
Walk Time (s)				8.0	8.0	8.0				8.0	8.0	8.0
Flash Dont Walk (s)				12.0	12.0	12.0				2.0	2.0	2.0
Pedestrian Calls (#/hr)				0	0	0				0	0	0
Act Effct Green (s)		20.4	20.4		20.4	20.4	29.4	29.4	29.4	29.4	29.4	29.4
Actuated g/C Ratio		0.38	0.38		0.38	0.38	0.55	0.55	0.55	0.55	0.55	0.55
v/c Ratio		0.18	0.03		0.24	0.28	0.03	0.30	0.13	0.58	0.30	0.07
Control Delay		14.6	0.9		15.8	4.2	9.1	10.5	2.9	20.1	10.6	3.1
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		14.6	0.9		15.8	4.2	9.1	10.5	2.9	20.1	10.6	3.1
LOS		B	A		B	A	A	B	A	C	B	A
Approach Delay		12.6			8.4			9.2			13.2	
Approach LOS		B			A			A			B	

Intersection Summary

Area Type: Other
 Cycle Length: 60
 Actuated Cycle Length: 53.7
 Natural Cycle: 60
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 0.58
 Intersection Signal Delay: 11.1
 Intersection Capacity Utilization 65.0%
 Analysis Period (min) 15
 Intersection LOS: B
 ICU Level of Service C

Splits and Phases: 3: Hwy 2 & Hwy 520



Intersection												
Int Delay, s/veh	7.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	128	32	57	40	49	74	27	20	15	51	30	91
Future Vol, veh/h	128	32	57	40	49	74	27	20	15	51	30	91
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	10	29	15	20	9	2	25	5	2	20
Mvmt Flow	136	34	61	43	52	79	29	21	16	54	32	97

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	131	0	0	95	0	0	579	554	65	533	545	92
Stage 1	-	-	-	-	-	-	337	337	-	178	178	-
Stage 2	-	-	-	-	-	-	242	217	-	355	367	-
Critical Hdwy	4.23	-	-	4.39	-	-	7.19	6.52	6.45	7.15	6.52	6.4
Critical Hdwy Stg 1	-	-	-	-	-	-	6.19	5.52	-	6.15	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.19	5.52	-	6.15	5.52	-
Follow-up Hdwy	2.317	-	-	2.461	-	-	3.581	4.018	3.525	3.545	4.018	3.48
Pot Cap-1 Maneuver	1389	-	-	1346	-	-	416	440	938	453	446	918
Stage 1	-	-	-	-	-	-	663	641	-	817	752	-
Stage 2	-	-	-	-	-	-	746	723	-	656	622	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1389	-	-	1346	-	-	313	381	938	382	386	918
Mov Cap-2 Maneuver	-	-	-	-	-	-	313	381	-	382	386	-
Stage 1	-	-	-	-	-	-	594	574	-	732	726	-
Stage 2	-	-	-	-	-	-	616	698	-	556	557	-

Approach	EB		WB		NB		SB	
HCM Control Delay, s	4.6		1.9		15.7		14.7	
HCM LOS					C		B	

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	401	1389	-	-	1346	-	-	554
HCM Lane V/C Ratio	0.164	0.098	-	-	0.032	-	-	0.33
HCM Control Delay (s)	15.7	7.9	0	-	7.8	0	-	14.7
HCM Lane LOS	C	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.6	0.3	-	-	0.1	-	-	1.4

Intersection: 3: Hwy 2 & Hwy 520

Movement	EB	WB	WB	NB	NB	NB	SB	SB	SB	
Directions Served	LT	LT	R	L	T	T	L	T	T	
Maximum Queue (m)	39.1	39.5	18.0	11.0	57.7	61.3	93.6	54.4	49.8	
Average Queue (m)	12.9	14.9	1.0	3.1	30.4	18.2	38.0	23.9	19.4	
95th Queue (m)	27.1	29.6	7.6	9.4	51.1	42.0	70.8	42.6	40.5	
Link Distance (m)	95.3	181.8			265.9	265.9		298.1	298.1	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (m)			90.0	85.0			130.0			
Storage Blk Time (%)	1								0	
Queuing Penalty (veh)	0								0	

Intersection: 6: 5th St E & Hwy 520























Movement	EB	B5	WB	NB	SB
Directions Served	LTR	T	LTR	LTR	LTR
Maximum Queue (m)	20.7	76.8	17.4	23.6	36.9
Average Queue (m)	5.9	3.8	1.7	9.3	15.9
95th Queue (m)	15.9	47.5	9.2	18.7	27.6
Link Distance (m)	206.4	181.8	258.9	260.9	287.8
Upstream Blk Time (%)	0				
Queuing Penalty (veh)	1				
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 1

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	77	33	121	69	233	19	391	111	224	486	72
Future Volume (vph)	32	77	33	121	69	233	19	391	111	224	486	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		30.0	0.0		90.0	85.0		180.0	130.0		100.0
Storage Lanes	0		1	0		1	1		1	1		1
Taper Length (m)	7.5			7.5			60.0			50.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected		0.985			0.969		0.950			0.950		
Satd. Flow (prot)	0	1737	1324	0	1774	1615	1805	3034	1392	1641	2935	1615
Flt Permitted		0.875			0.740		0.463			0.510		
Satd. Flow (perm)	0	1543	1324	0	1354	1615	880	3034	1392	881	2935	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			55			245			117			76
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		111.3			221.4			273.2			311.1	
Travel Time (s)		8.0			15.9			19.7			22.4	
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
Heavy Vehicles (%)	0%	11%	22%	6%	0%	0%	0%	19%	16%	10%	23%	0%
Adj. Flow (vph)	34	81	35	127	73	245	20	412	117	236	512	76
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	115	35	0	200	245	20	412	117	236	512	76
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			5.6			5.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

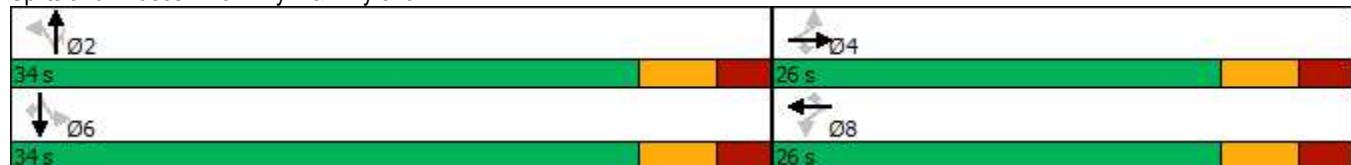


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	34.0	34.0	34.0	34.0	34.0	34.0
Total Split (%)	43.3%	43.3%	43.3%	43.3%	43.3%	43.3%	56.7%	56.7%	56.7%	56.7%	56.7%	56.7%
Maximum Green (s)	20.0	20.0	20.0	20.0	20.0	20.0	28.0	28.0	28.0	28.0	28.0	28.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	Min
Walk Time (s)				8.0	8.0	8.0				8.0	8.0	8.0
Flash Dont Walk (s)				12.0	12.0	12.0				2.0	2.0	2.0
Pedestrian Calls (#/hr)				0	0	0				0	0	0
Act Effct Green (s)		20.1	20.1		20.1	20.1	22.5	22.5	22.5	22.5	22.5	22.5
Actuated g/C Ratio		0.37	0.37		0.37	0.37	0.41	0.41	0.41	0.41	0.41	0.41
v/c Ratio		0.20	0.07		0.40	0.33	0.06	0.33	0.18	0.65	0.42	0.11
Control Delay		14.1	3.3		16.8	3.8	9.7	11.6	3.1	22.5	12.5	3.2
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		14.1	3.3		16.8	3.8	9.7	11.6	3.1	22.5	12.5	3.2
LOS		B	A		B	A	A	B	A	C	B	A
Approach Delay		11.6			9.6			9.7			14.5	
Approach LOS		B			A			A			B	

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	54.6
Natural Cycle:	60
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.65
Intersection Signal Delay:	11.8
Intersection LOS:	B
Intersection Capacity Utilization:	65.3%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 3: Hwy 2 & Hwy 520



Intersection												
Int Delay, s/veh	16.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	178	59	23	16	27	104	53	30	39	135	28	186
Future Vol, veh/h	178	59	23	16	27	104	53	30	39	135	28	186
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	5	13	33	10	13	5	10	2	29	5	2	5
Mvmt Flow	187	62	24	17	28	109	56	32	41	142	29	196

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	137	0	0	86	0	0	677	619	74	602	577	83
Stage 1	-	-	-	-	-	-	448	448	-	117	117	-
Stage 2	-	-	-	-	-	-	229	171	-	485	460	-
Critical Hdwy	4.15	-	-	4.2	-	-	7.2	6.52	6.49	7.15	6.52	6.25
Critical Hdwy Stg 1	-	-	-	-	-	-	6.2	5.52	-	6.15	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.2	5.52	-	6.15	5.52	-
Follow-up Hdwy	2.245	-	-	2.29	-	-	3.59	4.018	3.561	3.545	4.018	3.345
Pot Cap-1 Maneuver	1429	-	-	1461	-	-	356	404	917	407	427	968
Stage 1	-	-	-	-	-	-	575	573	-	880	799	-
Stage 2	-	-	-	-	-	-	756	757	-	558	566	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1429	-	-	1461	-	-	236	344	917	321	363	968
Mov Cap-2 Maneuver	-	-	-	-	-	-	236	344	-	321	363	-
Stage 1	-	-	-	-	-	-	496	494	-	759	789	-
Stage 2	-	-	-	-	-	-	573	747	-	430	488	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	5.4			0.8			21.6			28.7		
HCM LOS							C			D		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	344	1429	-	-	1461	-	-	506
HCM Lane V/C Ratio	0.373	0.131	-	-	0.012	-	-	0.726
HCM Control Delay (s)	21.6	7.9	0	-	7.5	0	-	28.7
HCM Lane LOS	C	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	1.7	0.5	-	-	0	-	-	5.9

Intersection: 3: Hwy 2 & Hwy 520

Movement	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	LT	R	L	T	T	L	T	T
Maximum Queue (m)	29.3	40.6	14.8	11.2	50.7	47.4	75.8	54.6	46.7
Average Queue (m)	13.0	20.3	1.0	2.6	27.1	14.2	33.6	27.1	21.7
95th Queue (m)	26.4	35.1	7.5	8.6	46.0	33.5	59.7	45.9	39.2
Link Distance (m)	95.3	197.2			262.6	262.6		300.2	300.2
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (m)			90.0	85.0			130.0		
Storage Blk Time (%)	0								
Queuing Penalty (veh)	0								

Intersection: 6: 5th St E & Hwy 520























Movement	EB	B5	WB	NB	SB
Directions Served	LTR	T	LTR	LTR	LTR
Maximum Queue (m)	25.8	83.5	7.2	32.4	56.9
Average Queue (m)	7.4	5.5	0.6	13.7	22.9
95th Queue (m)	20.1	60.2	3.7	24.0	41.3
Link Distance (m)	191.1	197.2	258.9	254.6	293.4
Upstream Blk Time (%)	0				
Queuing Penalty (veh)	0				
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 0

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	33	83	21	68	42	198	17	542	101	276	492	71
Future Volume (vph)	33	83	21	68	42	198	17	542	101	276	492	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		30.0	0.0		90.0	85.0		180.0	130.0		100.0
Storage Lanes	0		1	0		1	1		1	1		1
Taper Length (m)	7.5			7.5			60.0			50.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected		0.986			0.970		0.950			0.950		
Satd. Flow (prot)	0	1697	1615	0	1506	1417	1805	2935	1335	1671	2714	1538
Flt Permitted		0.897			0.764		0.458			0.427		
Satd. Flow (perm)	0	1544	1615	0	1186	1417	870	2935	1335	751	2714	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			55			211			107			76
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		111.3			206.2			276.8			309.0	
Travel Time (s)		8.0			14.8			19.9			22.2	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	19%	7%	0%	32%	7%	14%	0%	23%	21%	8%	33%	5%
Adj. Flow (vph)	35	88	22	72	45	211	18	577	107	294	523	76
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	123	22	0	117	211	18	577	107	294	523	76
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			5.6			5.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

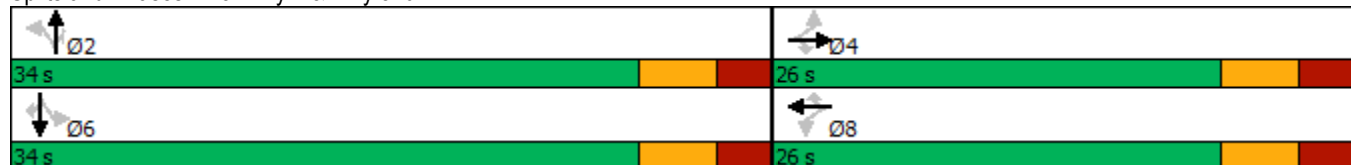


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	34.0	34.0	34.0	34.0	34.0	34.0
Total Split (%)	43.3%	43.3%	43.3%	43.3%	43.3%	43.3%	56.7%	56.7%	56.7%	56.7%	56.7%	56.7%
Maximum Green (s)	20.0	20.0	20.0	20.0	20.0	20.0	28.0	28.0	28.0	28.0	28.0	28.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	Min
Walk Time (s)				8.0	8.0	8.0				8.0	8.0	8.0
Flash Dont Walk (s)				12.0	12.0	12.0				2.0	2.0	2.0
Pedestrian Calls (#/hr)				0	0	0				0	0	0
Act Effct Green (s)		20.1	20.1		20.1	20.1	26.2	26.2	26.2	26.2	26.2	26.2
Actuated g/C Ratio		0.34	0.34		0.34	0.34	0.45	0.45	0.45	0.45	0.45	0.45
v/c Ratio		0.23	0.04		0.29	0.34	0.05	0.44	0.16	0.87	0.43	0.10
Control Delay		15.9	1.5		17.1	4.3	9.2	12.1	3.0	43.8	12.1	3.1
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		15.9	1.5		17.1	4.3	9.2	12.1	3.0	43.8	12.1	3.1
LOS		B	A		B	A	A	B	A	D	B	A
Approach Delay		13.7			8.9			10.7			21.8	
Approach LOS		B			A			B			C	

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	58.3
Natural Cycle:	60
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.87
Intersection Signal Delay:	15.4
Intersection LOS:	B
Intersection Capacity Utilization:	65.0%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 3: Hwy 2 & Hwy 520



Intersection												
Int Delay, s/veh	8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	132	38	59	41	58	75	29	21	16	52	31	94
Future Vol, veh/h	132	38	59	41	58	75	29	21	16	52	31	94
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	13	13	10	29	15	20	9	2	25	5	2	20
Mvmt Flow	140	40	63	44	62	80	31	22	17	55	33	100

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	142	0	0	103	0	0	609	582	72	561	573	102
Stage 1	-	-	-	-	-	-	352	352	-	190	190	-
Stage 2	-	-	-	-	-	-	257	230	-	371	383	-
Critical Hdwy	4.23	-	-	4.39	-	-	7.19	6.52	6.45	7.15	6.52	6.4
Critical Hdwy Stg 1	-	-	-	-	-	-	6.19	5.52	-	6.15	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.19	5.52	-	6.15	5.52	-
Follow-up Hdwy	2.317	-	-	2.461	-	-	3.581	4.018	3.525	3.545	4.018	3.48
Pot Cap-1 Maneuver	1376	-	-	1336	-	-	397	425	930	434	430	906
Stage 1	-	-	-	-	-	-	651	632	-	805	743	-
Stage 2	-	-	-	-	-	-	732	714	-	643	612	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1376	-	-	1336	-	-	294	365	930	362	369	906
Mov Cap-2 Maneuver	-	-	-	-	-	-	294	365	-	362	369	-
Stage 1	-	-	-	-	-	-	580	563	-	717	716	-
Stage 2	-	-	-	-	-	-	599	688	-	540	545	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	4.6			1.8			16.6			15.4		
HCM LOS							C			C		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	381	1376	-	-	1336	-	-	534
HCM Lane V/C Ratio	0.184	0.102	-	-	0.033	-	-	0.353
HCM Control Delay (s)	16.6	7.9	0	-	7.8	0	-	15.4
HCM Lane LOS	C	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.7	0.3	-	-	0.1	-	-	1.6

Intersection: 3: Hwy 2 & Hwy 520

Movement	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	LT	R	L	T	T	L	T	T
Maximum Queue (m)	32.3	40.1	18.8	12.4	68.4	53.3	162.9	211.5	164.3
Average Queue (m)	13.4	16.3	1.6	2.8	35.5	21.8	92.5	65.0	45.8
95th Queue (m)	25.9	32.0	10.5	9.2	55.9	44.1	171.7	184.2	141.0
Link Distance (m)	95.3	181.8			265.9	265.9		298.1	298.1
Upstream Blk Time (%)								0	0
Queuing Penalty (veh)								0	0
Storage Bay Dist (m)			90.0	85.0			130.0		
Storage Blk Time (%)	0				0		16	1	0
Queuing Penalty (veh)	0				0		39	2	0

Intersection: 6: 5th St E & Hwy 520























Movement	EB	B5	WB	NB	SB
Directions Served	LTR	T	LTR	LTR	LTR
Maximum Queue (m)	35.3	74.8	20.5	22.6	39.4
Average Queue (m)	8.6	5.0	2.4	10.4	16.0
95th Queue (m)	24.6	54.9	11.7	19.5	28.3
Link Distance (m)	206.4	181.8	258.9	260.9	287.8
Upstream Blk Time (%)		0			
Queuing Penalty (veh)		0			
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 41

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	38	88	39	127	78	258	22	460	121	249	571	85
Future Volume (vph)	38	88	39	127	78	258	22	460	121	249	571	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		30.0	0.0		90.0	85.0		180.0	130.0		100.0
Storage Lanes	0		1	0		1	1		1	1		1
Taper Length (m)	7.5			7.5			60.0			50.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected		0.985			0.970		0.950			0.950		
Satd. Flow (prot)	0	1738	1324	0	1777	1615	1805	3034	1392	1641	2935	1615
Flt Permitted		0.862			0.734		0.410			0.476		
Satd. Flow (perm)	0	1521	1324	0	1345	1615	779	3034	1392	822	2935	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			55			272			127			89
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		238.0			224.9			273.8			327.7	
Travel Time (s)		17.1			16.2			19.7			23.6	
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
Heavy Vehicles (%)	0%	11%	22%	6%	0%	0%	0%	19%	16%	10%	23%	0%
Adj. Flow (vph)	40	93	41	134	82	272	23	484	127	262	601	89
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	133	41	0	216	272	23	484	127	262	601	89
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			5.6			5.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

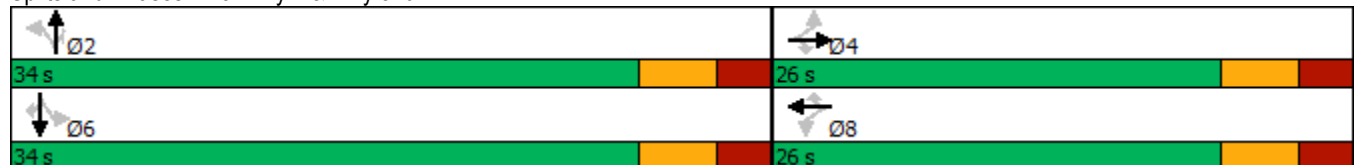
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Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	34.0	34.0	34.0	34.0	34.0	34.0
Total Split (%)	43.3%	43.3%	43.3%	43.3%	43.3%	43.3%	56.7%	56.7%	56.7%	56.7%	56.7%	56.7%
Maximum Green (s)	20.0	20.0	20.0	20.0	20.0	20.0	28.0	28.0	28.0	28.0	28.0	28.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	Min
Walk Time (s)				8.0	8.0	8.0				8.0	8.0	8.0
Flash Dont Walk (s)				12.0	12.0	12.0				2.0	2.0	2.0
Pedestrian Calls (#/hr)				0	0	0				0	0	0
Act Effct Green (s)		20.1	20.1		20.1	20.1	24.0	24.0	24.0	24.0	24.0	24.0
Actuated g/C Ratio		0.36	0.36		0.36	0.36	0.43	0.43	0.43	0.43	0.43	0.43
v/c Ratio		0.24	0.08		0.45	0.36	0.07	0.37	0.19	0.75	0.48	0.12
Control Delay		15.4	4.1		18.6	3.9	9.7	11.7	3.0	29.0	12.9	3.0
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		15.4	4.1		18.6	3.9	9.7	11.7	3.0	29.0	12.9	3.0
LOS		B	A		B	A	A	B	A	C	B	A
Approach Delay		12.7			10.4			9.9			16.4	
Approach LOS		B			B			A			B	

Intersection Summary

Area Type:	Other
Cycle Length:	60
Actuated Cycle Length:	56.1
Natural Cycle:	60
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.75
Intersection Signal Delay:	13.0
Intersection LOS:	B
Intersection Capacity Utilization:	66.1%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 3: Hwy 2 & Hwy 520



Intersection												
Int Delay, s/veh	17.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	181	74	24	16	24	105	54	30	40	136	29	190
Future Vol, veh/h	181	74	24	16	24	105	54	30	40	136	29	190
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	5	13	33	10	13	5	10	2	29	5	2	5
Mvmt Flow	191	78	25	17	25	111	57	32	42	143	31	200

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	136	0	0	103	0	0	703	643	91	625	600	81
Stage 1	-	-	-	-	-	-	473	473	-	115	115	-
Stage 2	-	-	-	-	-	-	230	170	-	510	485	-
Critical Hdwy	4.15	-	-	4.2	-	-	7.2	6.52	6.49	7.15	6.52	6.25
Critical Hdwy Stg 1	-	-	-	-	-	-	6.2	5.52	-	6.15	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.2	5.52	-	6.15	5.52	-
Follow-up Hdwy	2.245	-	-	2.29	-	-	3.59	4.018	3.561	3.545	4.018	3.345
Pot Cap-1 Maneuver	1430	-	-	1440	-	-	342	392	897	393	415	971
Stage 1	-	-	-	-	-	-	557	558	-	883	800	-
Stage 2	-	-	-	-	-	-	755	758	-	541	552	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	1430	-	-	1440	-	-	224	332	897	307	352	971
Mov Cap-2 Maneuver	-	-	-	-	-	-	224	332	-	307	352	-
Stage 1	-	-	-	-	-	-	478	479	-	758	790	-
Stage 2	-	-	-	-	-	-	569	748	-	413	474	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	5.1			0.8			22.9			31.9		
HCM LOS							C			D		

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	330	1430	-	-	1440	-	-	492
HCM Lane V/C Ratio	0.396	0.133	-	-	0.012	-	-	0.76
HCM Control Delay (s)	22.9	7.9	0	-	7.5	0	-	31.9
HCM Lane LOS	C	A	A	-	A	A	-	D
HCM 95th %tile Q(veh)	1.8	0.5	-	-	0	-	-	6.6

Intersection: 3: Hwy 2 & Hwy 520

Movement	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB
Directions Served	LT	LT	R	L	T	T	R	L	T	T
Maximum Queue (m)	37.6	53.9	19.2	14.0	56.3	47.4	7.2	84.7	54.1	50.3
Average Queue (m)	16.3	23.3	1.3	4.2	30.1	16.1	0.2	42.4	28.1	24.6
95th Queue (m)	30.4	41.3	8.6	11.8	50.0	37.5	5.1	73.6	47.5	43.4
Link Distance (m)	222.1	200.7			263.3	263.3			316.9	316.9
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (m)			90.0	85.0			180.0	130.0		
Storage Blk Time (%)	1									
Queuing Penalty (veh)	0									

Intersection: 6: 5th St E & Hwy 520























Movement	EB	B5	WB	NB	SB
Directions Served	LTR	T	LTR	LTR	LTR
Maximum Queue (m)	28.6	129.6	9.2	27.0	62.2
Average Queue (m)	9.0	5.7	0.7	13.3	26.8
95th Queue (m)	22.5	62.8	4.3	23.1	47.5
Link Distance (m)	187.6	200.7	258.6	268.5	292.1
Upstream Blk Time (%)	0				
Queuing Penalty (veh)	0				
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 1

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	131	22	243	79	414	18	587	299	542	533	77
Future Volume (vph)	35	131	22	243	79	414	18	587	299	542	533	77
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		30.0	0.0		90.0	85.0		180.0	130.0		100.0
Storage Lanes	0		1	0		1	1		1	1		1
Taper Length (m)	7.5			7.5			60.0			50.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected		0.990			0.964		0.950			0.950		
Satd. Flow (prot)	0	1717	1615	0	1455	1417	1805	2935	1335	1671	2714	1538
Flt Permitted		0.723			0.641		0.428			0.398		
Satd. Flow (perm)	0	1254	1615	0	968	1417	813	2935	1335	700	2714	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			36			275			318			82
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		314.2			206.2			276.8			309.0	
Travel Time (s)		22.6			14.8			19.9			22.2	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	19%	7%	0%	32%	7%	14%	0%	23%	21%	8%	33%	5%
Adj. Flow (vph)	37	139	23	259	84	440	19	624	318	577	567	82
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	176	23	0	343	440	19	624	318	577	567	82
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			5.6			5.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

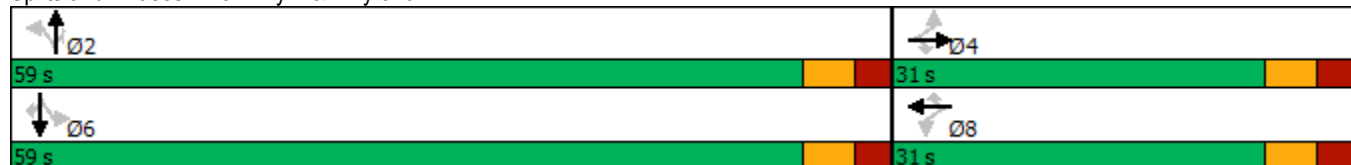


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Total Split (s)	31.0	31.0	31.0	31.0	31.0	31.0	59.0	59.0	59.0	59.0	59.0	59.0
Total Split (%)	34.4%	34.4%	34.4%	34.4%	34.4%	34.4%	65.6%	65.6%	65.6%	65.6%	65.6%	65.6%
Maximum Green (s)	25.0	25.0	25.0	25.0	25.0	25.0	53.0	53.0	53.0	53.0	53.0	53.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	Min
Walk Time (s)				8.0	8.0	8.0				8.0	8.0	8.0
Flash Dont Walk (s)				12.0	12.0	12.0				2.0	2.0	2.0
Pedestrian Calls (#/hr)				0	0	0				0	0	0
Act Effct Green (s)		25.0	25.0		25.0	25.0	53.0	53.0	53.0	53.0	53.0	53.0
Actuated g/C Ratio		0.28	0.28		0.28	0.28	0.59	0.59	0.59	0.59	0.59	0.59
v/c Ratio		0.51	0.05		1.28	0.74	0.04	0.36	0.35	1.40	0.35	0.09
Control Delay		33.4	5.5		182.2	19.7	8.2	10.4	2.1	216.2	10.4	2.2
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		33.4	5.5		182.2	19.7	8.2	10.4	2.1	216.2	10.4	2.2
LOS		C	A		F	B	A	B	A	F	B	A
Approach Delay		30.2			90.9			7.6			106.7	
Approach LOS		C			F			A			F	

Intersection Summary

















Area Type: Other
 Cycle Length: 90
 Actuated Cycle Length: 90
 Natural Cycle: 90
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 1.40
 Intersection Signal Delay: 67.9
 Intersection Capacity Utilization 101.0%
 Analysis Period (min) 15
 Intersection LOS: E
 ICU Level of Service G

Splits and Phases: 3: Hwy 2 & Hwy 520



HCM Unsignalized Intersection Capacity Analysis
6: 5th St E & Hwy 520

11/13/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	331	27	363	257	41	207	307	128	200	144	144	233
Future Volume (Veh/h)	331	27	363	257	41	207	307	128	200	144	144	233
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	352	29	386	273	44	220	327	136	213	153	153	248
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	264			415			1950	1736	222	1907	1819	154
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	264			415			1950	1736	222	1907	1819	154
tC, single (s)	4.2			4.4			7.2	6.5	6.5	7.1	6.5	6.4
tC, 2 stage (s)												
tF (s)	2.3			2.5			3.6	4.0	3.5	3.5	4.0	3.5
p0 queue free %	72			73			0	0	72	0	0	71
cM capacity (veh/h)	1239			1013			0	46	763	0	41	847
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	767	537	676	554								
Volume Left	352	273	327	153								
Volume Right	386	220	213	248								
cSH	1239	1013	0	0								
Volume to Capacity	0.28	0.27	Err	Err								
Queue Length 95th (m)	9.4	8.8	Err	Err								
Control Delay (s)	6.0	6.6	Err	Err								
Lane LOS	A	A	F	F								
Approach Delay (s)	6.0	6.6	Err	Err								
Approach LOS			F	F								
Intersection Summary												
Average Delay			Err									
Intersection Capacity Utilization			119.3%		ICU Level of Service				H			
Analysis Period (min)			15									

Intersection: 3: Hwy 2 & Hwy 520

Movement	EB	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	LT	R	L	T	T	R	L	T	T
Maximum Queue (m)	53.1	11.9	91.6	68.8	11.0	66.0	52.5	63.8	180.0	316.7	314.3
Average Queue (m)	25.3	0.4	43.1	6.8	2.3	36.5	20.8	9.9	179.9	308.4	298.9
95th Queue (m)	45.3	8.4	77.3	37.1	8.0	59.0	42.9	42.2	179.9	315.6	351.2
Link Distance (m)	298.2		181.8			265.9	265.9			298.2	298.2
Upstream Blk Time (%)										94	25
Queuing Penalty (veh)										0	0
Storage Bay Dist (m)		30.0		90.0	85.0			180.0	130.0		
Storage Blk Time (%)	7		0	0					98	0	
Queuing Penalty (veh)	2		2	0					260	2	

Intersection: 6: 5th St E & Hwy 520























Movement	EB	B5	WB	NB	SB
Directions Served	LTR	T	LTR	LTR	LTR
Maximum Queue (m)	54.6	199.0	81.5	278.1	305.0
Average Queue (m)	22.5	21.9	27.5	270.3	296.7
95th Queue (m)	43.8	123.1	55.8	277.0	303.6
Link Distance (m)	206.4	181.8	258.9	260.9	287.8
Upstream Blk Time (%)		1		100	100
Queuing Penalty (veh)		7		0	0
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 273

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	141	42	372	144	519	24	498	310	536	618	92
Future Volume (vph)	41	141	42	372	144	519	24	498	310	536	618	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0		30.0	0.0		90.0	85.0		180.0	130.0		100.0
Storage Lanes	0		1	0		1	1		1	1		1
Taper Length (m)	7.5			7.5			60.0			50.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected		0.989			0.965		0.950			0.950		
Satd. Flow (prot)	0	1732	1324	0	1758	1615	1805	3034	1392	1641	2935	1615
Flt Permitted		0.494			0.663		0.373			0.446		
Satd. Flow (perm)	0	865	1324	0	1207	1615	709	3034	1392	770	2935	1615
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			44			289			326			97
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		238.0			224.9			273.8			327.7	
Travel Time (s)		17.1			16.2			19.7			23.6	
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
Heavy Vehicles (%)	0%	11%	22%	6%	0%	0%	0%	19%	16%	10%	23%	0%
Adj. Flow (vph)	43	148	44	392	152	546	25	524	326	564	651	97
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	191	44	0	544	546	25	524	326	564	651	97
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			5.6			5.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4			8			2			6	

Lanes, Volumes, Timings
3: Hwy 2 & Hwy 520

11/13/2018

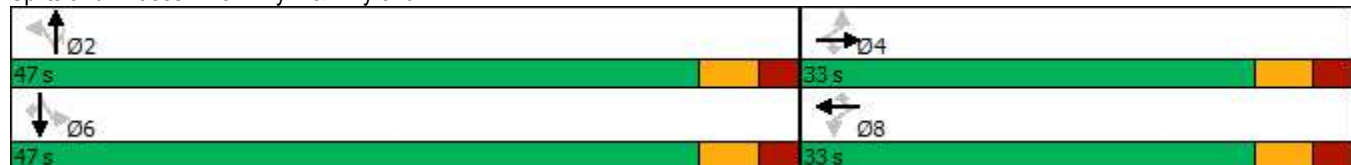


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Minimum Split (s)	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
Total Split (s)	33.0	33.0	33.0	33.0	33.0	33.0	47.0	47.0	47.0	47.0	47.0	47.0
Total Split (%)	41.3%	41.3%	41.3%	41.3%	41.3%	41.3%	58.8%	58.8%	58.8%	58.8%	58.8%	58.8%
Maximum Green (s)	27.0	27.0	27.0	27.0	27.0	27.0	41.0	41.0	41.0	41.0	41.0	41.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.0	6.0		6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	Min
Walk Time (s)				8.0	8.0	8.0				8.0	8.0	8.0
Flash Dont Walk (s)				12.0	12.0	12.0				2.0	2.0	2.0
Pedestrian Calls (#/hr)				0	0	0				0	0	0
Act Effct Green (s)		27.0	27.0		27.0	27.0	41.0	41.0	41.0	41.0	41.0	41.0
Actuated g/C Ratio		0.34	0.34		0.34	0.34	0.51	0.51	0.51	0.51	0.51	0.51
v/c Ratio		0.66	0.09		1.34	0.74	0.07	0.34	0.37	1.43	0.43	0.11
Control Delay		35.4	6.6		193.9	17.9	10.6	12.3	2.7	230.6	13.4	2.7
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		35.4	6.6		193.9	17.9	10.6	12.3	2.7	230.6	13.4	2.7
LOS		D	A		F	B	B	B	A	F	B	A
Approach Delay		30.1			105.7			8.6			106.0	
Approach LOS		C			F			A			F	

Intersection Summary

Area Type: Other
 Cycle Length: 80
 Actuated Cycle Length: 80
 Natural Cycle: 80
 Control Type: Semi Act-Uncoord
 Maximum v/c Ratio: 1.43
 Intersection Signal Delay: 76.6
 Intersection Capacity Utilization 111.2%
 Analysis Period (min) 15
 Intersection LOS: E
 ICU Level of Service H

Splits and Phases: 3: Hwy 2 & Hwy 520



HCM Unsignalized Intersection Capacity Analysis

6: 5th St E & Hwy 520

11/13/2018



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (veh/h)	464	43	288	189	20	288	313	143	224	360	145	501
Future Volume (Veh/h)	464	43	288	189	20	288	313	143	224	360	145	501
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)	488	45	303	199	21	303	329	151	236	379	153	527
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	324			348			2346	1894	196	2054	1894	172
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	324			348			2346	1894	196	2054	1894	172
tC, single (s)	4.1			4.2			7.2	6.5	6.5	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.6	4.0	3.6	3.5	4.0	3.3
p0 queue free %	60			83			0	0	70	0	0	39
cM capacity (veh/h)	1219			1168			0	35	783	0	35	863
Direction, Lane #												
	EB 1	WB 1	NB 1	SB 1								
Volume Total	836	523	716	1059								
Volume Left	488	199	329	379								
Volume Right	303	303	236	527								
cSH	1219	1168	0	0								
Volume to Capacity	0.40	0.17	Err	Err								
Queue Length 95th (m)	15.7	4.9	Err	Err								
Control Delay (s)	7.9	4.5	Err	Err								
Lane LOS	A	A	F	F								
Approach Delay (s)	7.9	4.5	Err	Err								
Approach LOS			F	F								
Intersection Summary												
Average Delay			Err									
Intersection Capacity Utilization			147.0%		ICU Level of Service				H			
Analysis Period (min)			15									

Intersection: 3: Hwy 2 & Hwy 520

Movement	EB	WB	WB	NB	NB	NB	NB	SB	SB	SB
Directions Served	LT	LT	R	L	T	T	R	L	T	T
Maximum Queue (m)	38.2	58.6	20.7	9.9	45.7	41.7	23.7	179.9	296.2	278.3
Average Queue (m)	24.4	37.8	6.0	4.0	34.6	24.3	8.1	165.9	178.4	150.5
95th Queue (m)	44.4	65.4	21.7	11.4	53.5	46.3	33.5	198.2	376.8	351.7
Link Distance (m)	222.1	200.7			263.3	263.3			316.9	316.9
Upstream Blk Time (%)									13	1
Queuing Penalty (veh)									0	0
Storage Bay Dist (m)			90.0	85.0			180.0	130.0		
Storage Blk Time (%)	8							70	3	
Queuing Penalty (veh)	3							217	18	

Intersection: 6: 5th St E & Hwy 520

Movement	EB	B5	WB	NB	SB
Directions Served	LTR	T	LTR	LTR	LTR
Maximum Queue (m)	50.2	45.5	19.2	282.9	301.8
Average Queue (m)	28.9	17.7	11.7	274.6	299.0
95th Queue (m)	55.0	116.7	21.8	296.2	305.6
Link Distance (m)	187.6	200.7	258.6	268.5	292.1
Upstream Blk Time (%)		0		82	92
Queuing Penalty (veh)		1		0	0
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 238