Associated Engineering | 75 YEARS

REPORT

City of St. Albert

Neil Ross Road
Functional Alignment Study



APRIL 2022

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EXECUTIVE SUMMARY

The City of St. Albert commissioned this Functional Alignment Study (FAS) to finalize the alignment for Neil Ross Road, a crosstown roadway that will connect the future 127 Street to St. Albert Trail and Ray Gibbon Drive via the future Fowler Way. The development of the final alignment will support community growth and further establish the transportation network in the northeast corner of St. Albert. The corridor will provide a valuable connection between St. Albert and Sturgeon County. Associated Engineering partnered with Stantec and Thurber Engineering to complete the functional analysis and evaluation of a proposed alignment and conceptual design of Neil Ross Road.

The study's components involved an environmental overview, desktop geotechnical investigation, identification of utilities, and review of stormwater patterns in the area. This was completed in conjunction with the City of St. Albert, with Sturgeon County as part of the project team. Work included consultation with affected landowners whose land the proposed Neil Ross Road alignment would pass through to inform them of the planned roadway and gather feedback on the proposed alignment.

Neil Ross Road is proposed to be staged, with initial design as a two-lane divided Crosstown roadway that will expand to a four-lane cross-section, in line with the City of St. Albert Complete Streets Guidelines. The team also completed a traffic analysis of the road segment using Synchro to model the expected operations of Neil Ross Road. The results indicated that Neil Ross Road operates acceptably as a two-lane roadway through the horizon year of 2045. After 2045, it is recommended that Neil Ross Road be upgraded to a four-lane roadway when the volumes trigger the need for upgrades. This trigger is dependent on the volume growth rate, which is currently unknown past 2045 and will be dictated by development. The traffic forecast should be revisited during preliminary design to ensure that the latest traffic volumes and proposed geometric improvements remain accurate. The traffic analysis also highlighted operational deficiencies at the Neil Ross Road/Fowler Way and St. Albert Trail intersection (primarily the left-turning movement from Fowler Way) which have been addressed through the design of St. Albert Trail North Corridor Management Implementation design which is anticipated for construction in 2023.

The team reviewed design standards and provided recommendations on this project's most suitable parameters. The amount of right-of-way required by the alignment was also determined. A 'C' level cost estimate was produced for the design and construction of Neil Ross Road with two options:

- Staged construction as a two-lane roadway followed by expansion to four lanes: $25,090,000 +/- 30%.
- Construction as a four-lane roadway initially: $23,640,000 +/- 30%.

These totals are inclusive of costs for land acquisition, additional studies, all engineering and 10% contingency. The initial four-lane construction option is estimated to be about 6% less than the staged construction option. The proposed alignment is shown in the figure below with all four lanes constructed.



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1 INTRODUCTION

1.1 Project Background

The City of St. Albert (the City) and Sturgeon County, have advanced work on a functional planning study to develop the extension of Neil Ross Road to the future 127 Street. Associated Engineering (AE) in partnership with Stantec Consulting Ltd. and Thurber Engineering, has been retained to analyze and prepare the preferred roadway alignment. The Functional Alignment Study (FAS) is being undertaken now as the City sees an opportunity to establish the area's transportation network to support and inform potential developer-driven Area Structure Plans (ASPs). The determination of the roadway alignment will allow the City to protect the road right-of-way for the future.

Neil Ross Road is currently a short segment of east-west, 4-lane divided roadway connecting Element Drive North to the east side of St. Albert Trail. Once completed, the extension of Neil Ross Road will provide another east-west connection between St. Albert and Sturgeon County. This transportation connection will enable and enhance the growth and development of the north-east quadrant of the City and support regional connectivity.

After completing this functional planning study, the City plans to start field investigations in 2024, with construction tentatively scheduled for 2028/2029.

1.2 Project Scope

The scope of the FAS included an evaluation of the previously proposed concept developed in 2014 through extension of the approved alignment within the Erin Ridge North ASP, with relation to the City Complete Streets Design Guidelines and the TAC Geometric Design Guidelines. It also included identification of location constraints, including approved ASPs, environmental and wetland assessments, and historical resources impact assessments. Results of reviewing the past alignment led to the development of alternatives due to various areas of consideration, including environmental, geometric design, objectives of connectivity and network links, development servicing and costs. With the alternatives, a review was completed for a potential interim design that would account for the possible time variance between the construction of Neil Ross Road and the completion of 127 Street. The provisional design should minimize throw-away costs and negative impacts on future final tie-ins.

The following was used to inform this study:

- Regional implications, including future annexation and regional connectivity to future 127 Street and Sturgeon County.
- Desktop geotechnical and environmental studies.
- Developed design criteria.
- Stormwater patterns.
- Existing utilities and proposed sewer and water options.
- Developed cross-sections in line with the City guidelines.
- Access locations to guide future development.
- Land acquisition and landowner impacts.
- Consideration of staged construction and an interim functional design before 127 Street is constructed.
- Cost estimate, including design and construction costs.
- Communication with internal and external stakeholders, including affected landowners.

The study area is shown in Figure 1-1. The proposed conceptual alignment is located within an area primarily comprised of agricultural land. Most of the land is undeveloped with some existing and historical oil and gas infrastructure.



Figure 1-1
Study Area for the Proposed Neil Ross Road Extension

1.3 Roadway Constraints

Selecting and designing the conceptual alignment considered the following main constraints:

- Having a fixed starting point and curved alignment of existing road;
- Aligning the intersection of Neil Ross Road with 127 Street at 90 degrees;
- Tying into existing and potential future County roadways (Coal Mine Road); and,
- Available funding, detailed site conditions, and right-of-way acquisition may have an impact the final alignment and have not been considered in this report.

1.4 Background Reports

1.4.1 Municipal Development Plan

The *Transportation Network, Map 5*, in the Municipal Development Plan (MDP), includes the proposed Neil Ross Road from St. Albert Trail east to the City's boundary as adopted by Council in Bylaw 15/2007 through amendment 11/2012. The naming of Neil Ross Road was announced March 15, 2013.

1.4.2 Transportation Master Plan

The *Transportation Master Plan* completed in 2015 sets the vision and actions for the City's transportation network until 2042. Transportation is inclusive of roads, trails, sidewalks, and other infrastructure needed to move people and goods. The TMP identifies Neil Ross Road as a Crosstown road that is to connect with the future 127 Street. Element Drive North, Everitt Drive North, Coal Mine Road, and the extension of Ebony Way are designated as Neighbourhood roads. It also identifies a future rapid transit corridor along the east side of St. Albert Trail with a rapid transit station and park and ride on the west side of St. Albert Trail across from the Erin Ridge North Neighbourhood.

1.4.3 127 Street Functional Planning Study

A Functional Planning Study (FPS) for 127 Street was completed for Sturgeon County in August 2012. Previous studies identified the need for a new north-south connection in Sturgeon Valley – the extension of 127 Street from the City of Edmonton to Highway 2, north of St. Albert. This includes a crossing of the Canadian National Railway (CNR) and Sturgeon River. This FPS identified a preferred option for the 127 Street alignment.

The FPS recommended a semi-urban cross-section with a 6 m median width for the majority of the 127 Street extension until it transitions to meet the proposed City of Edmonton urban cross-section with a 4 m median approaching the City limits. The semi-urban cross-section was selected because:

- It has a moderate right-of-way width (55 m basic right-of-way, but wider in areas where the road is elevated or depressed), and;
- It has the least long-term maintenance costs as Sturgeon County can continue to use their current methods and equipment for plowing and snow removal. Also, this cross-section requires no underground storm sewer maintenance or replacements.

However, it is noted that the cross-section type for the section of 127 Street within the County has not yet been finalized.

At-grade intersections include (from north to south): Highway 2 (signalized), northeast arterial, i.e. Neil Ross Road, based on originally proposed alignment (stop-controlled), Coal Mine Road (stop-controlled), Bellerose Drive (signalized), Sturgeon Road (signalized), extension of 195 Avenue/Township Road 542 (stop-controlled), and extension of Poundmaker Road (stop-controlled). It will start out as a 2-lane road and is planned to ultimately be four lanes with a posted speed of 70 km/h and a design speed of 80 km/h. The CNR crossing is recommended to be grade-separated due to the excessively steep grades (8%) that would be required for the roadway to cross both Sturgeon Road and the tracks at-grade.

The following staging was proposed for the construction of 127 Street:

1. 2 lanes from the City of Edmonton limits to Sturgeon Road

2A. Extension of 2 lanes from Sturgeon Road to Bellerose Drive

2B. Extension of 2 lanes from Bellerose Drive to Highway 2
3. Completing the 4-lane semi-urban cross-section from the City of Edmonton limits to Bellerose Drive
4. Completing the 4-lane semi-urban cross-section from the Bellerose Drive to Highway 2

It is noted that the timing for the stages would be mostly driven by area development and traffic needs.

1.4.4 Erin Ridge North Area Structure Plan

The Erin Ridge North ASP came into effect in 2009 and was last amended in April 2019. The plan establishes the conceptual land use, transportation, and servicing patterns to implement the *Municipal Development Plan (MDP)*, which designates this area for commercial, residential, parks, and school uses. Erin Ridge North is to be developed over two phases and comprises of a total area of 149.6 ha. The area is bounded by Erin Ridge neighbourhood to the south, Neil Ross Road to the north as the boundary for Phase 1, North City limits as the north boundary for Phase 2, St. Albert Trail to the west, and the City limits at Range Road 253 to the east. The proposed Neil Ross Road alignment begins in the Erin Ridge North community. Neil Ross Road is accessed from Element Drive North, which extends north-south through both phases of the ASP. This intersection will provide all-directional access with signalization.

The objectives of the ASP are to:

- Develop a neighbourhood that connects to the adjacent Erin Ridge neighbourhood to the south and is connectable to surrounding future development;
- Provide a vehicle oriented urban commercial area to serve residents and the region;
- Create a community where the pedestrian circulation routes link residential areas to schools, parks and open space, commercial/retail areas, and to future and existing adjacent neighbourhoods;
- Provide a range of housing options to cater to a range of income, age and social groups, as well as tenure, which includes apartments, townhouses, semi-detached houses, single family houses, and mixed-use developments;
- Create an attractive neighbourhood activity centre, that provides for a mixture of commercial, residential, and potential civic uses in a compact, walkable built form that encourages interaction through and with a central open space; and,
- Establish convenient connectivity to transit within the neighbourhood and to the future transit station proposed on the west side of St. Albert Trail.

The objectives were considered in development of the conceptual alignment for Neil Ross Road.

The ASP also notes that the management of the stormwater from the north must be addressed so that it is not impacting development of Erin Ridge North Phase 2.

1.4.5 Solar Crest Area Structure Plan

At the time of this report, the Solar Crest ASP (formerly known as Keys Cross ASP) is conceptual and has not been finalized. However, for modelling purposes, we have included traffic from anticipated future development in this area. The Solar Crest ASP comprises of the area south of Old Coal Mine Road, northwest of Bellerose Drive, northeast of Coal Mine Road, east of Range Road 253, and west of the diagonal water line right-of-way. This is adjacent to the current St. Albert City limits. This area is mainly undeveloped agricultural land with some forest, except for an existing

church and residential property. Since Neil Ross Road is proposed to connect to Old Coal Mine Road, the construction of Neil Ross will have an impact on the Solar Crest development.

The currently proposed gross area of the Solar Crest ASP is 62.2 ha and consists of environmental reserve, low and medium density residential, mixed use, institutional, municipal reserve, public utility lot, stormwater management facility and a pumping station, and roadway allowance dedication. One access at the north end of the development is proposed to connect to Old Coal Mine Road, another access at the southwest corner near the existing church would connect to Coal Mine Road, and a third access would connect to Bellerose Drive at the south end. For traffic destined to or coming from south St. Albert and Edmonton, it is likely that vehicles would travel along Bellerose Drive to reach Solar Crest, as the travel distance would be about 2 kilometres less than using St. Albert Trail to go to Neil Ross Road. However, once constructed, the future 127 Street alignment would also provide a connection to Solar Crest from the south, as it would connect to Neil Ross Road just east of the ASP. Neil Ross Road would provide a logical connection to Solar Crest for vehicles destined to or coming from north St. Albert or Sturgeon County.

1.4.6 Dauphinais Area Structure Plan

The Dauphinais Area Structure Plan was a proposed ASP for the City annex land north and south of the Neil Ross Road extension, bounded by the future 127 Street to the east and existing development to the west. This plan area overlaps with the Solar Crest ASP. The Dauphinais ASP included three intersections on Neil Ross Road between the existing segment and the Old Coal Mine Road/127 Street intersection. The Gross Developable Area would be 286 ha and consist of a variety of proposed uses that would generate traffic, including residential, institutional, commercial, mixed use, school, and more. This ASP was ultimately rejected but since it was the most information currently available for the area, it was used as a basis to populate the annexed land surrounding Neil Ross Road in the EMME model used to traffic volumes for this study. These lands are now part of the Northeast St. Albert ASP that was being developed at the time this study was finalized.

2 STAKEHOLDER CONSULTATION

2.1 Internal Stakeholders

A meeting was held with internal stakeholders to review the alignment alternatives. This meeting was held at the City of St. Albert offices on December 17, 2019 and included representatives from the City and Sturgeon County. An overview of the project was provided by AE.

Two different alignment options were developed and presented to the City and identified stakeholders:

- Option 1 – extends east from Neil Ross Road, crosses the future 127 Street and Range Road 253, and then merges with Old Coal Mine Road.
- Option 2 - extends northeast from Neil Ross Road, crosses Township Road 544 and merges into Range Road 253.

The two presented options are shown in Figure 2-1.

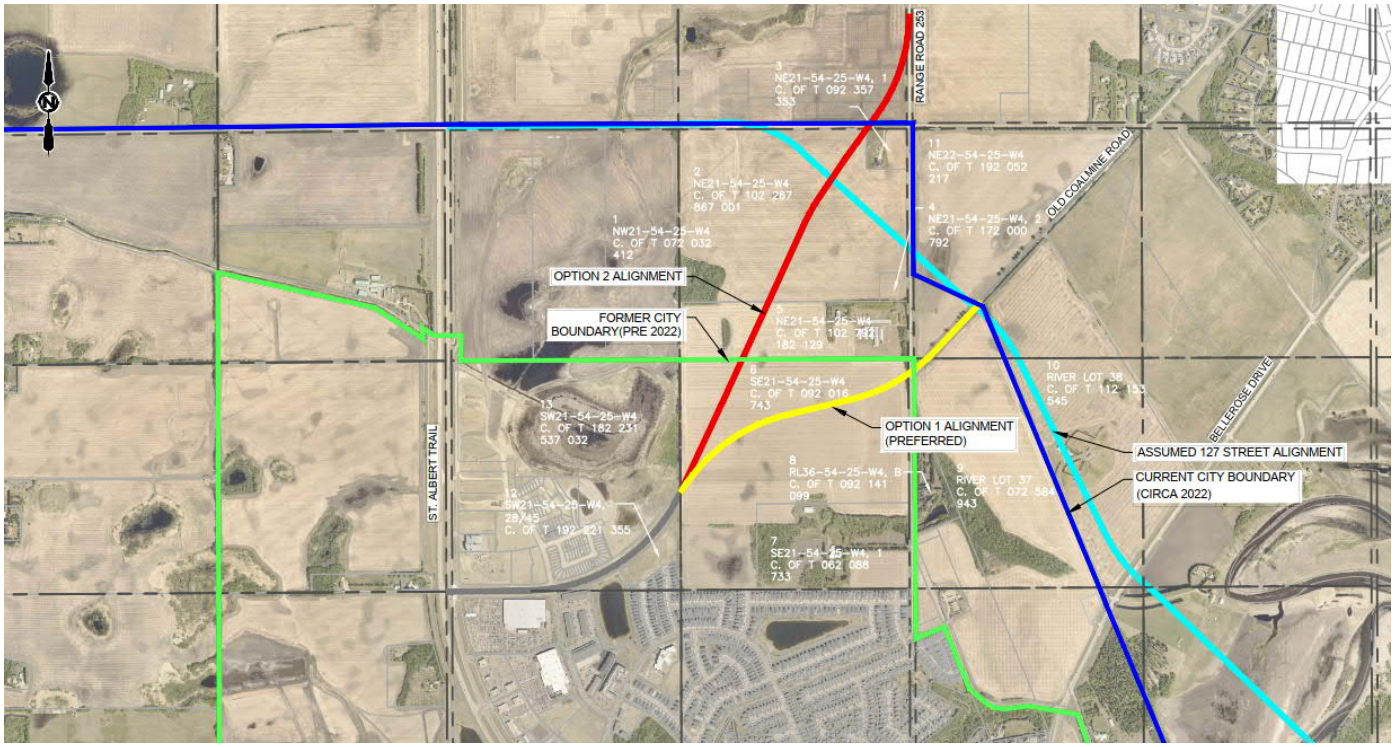


Figure 2-1
Proposed Alignment Options for the Neil Ross Road Extension

After discussion with stakeholders, Option 1 was selected as the preferred choice for the following reasons:

- It parallels the City of St. Albert arterials that travel from west to northeast.
- It provides a better pathway connection to the developed areas of Sturgeon County. Sturgeon County does not have any planned development or infill in any areas that would affect the alignment.
- It provides an improved and direct transportation link for the traffic that utilized the section of Coal Mine Road, now closed.

- Geometrically, it provides better intersection spacing, lane geometries, traffic control measures and 90 degree intersections than Option 2.
- It was agreed that Option 2 does not serve the City and County's objective of inter-regional connectivity.
- From an operations perspective, the City would prefer to tie into Coal Mine Road as directly as possible to maintain that access in the interim until 127 Street is constructed.
- Option 1 would cost about 25% less than Option 2 due to the shorter length of the alignment.

2.2 Landowner Consultation

Consultation with affected landowners was completed on an individual basis. The feedback gained from each meeting is detailed in Table 2-1. At the beginning of each meeting, AE advised the landowners of the following:

- The proposed alignment continues in a similar road network alignment as other east/west roads within the City. Council has passed general principles for road alignments and this road meets those principles.
- The extension of Neil Ross Road to 127 Street will be part of a future annexation transportation study.
- Constraints and considerations in developing the proposed alignment include:
  - Starting from the currently approved alignment at the west and future terminus to 127 Street in the east,
  - Geometric considerations, and
  - Environmental considerations.

Table 2-1
Landowner Consultation Summary

Stakeholder	Date of Meeting	Discussion and Feedback at Meeting
River Lot 37 Certificate of Title 072 584 943	February 24, 2020	• The 90-degree corner/road ROW at the south end of the River Lot 37 property will be removed. This odd shape needs to be addressed with geometric requirements including minimum spacing distances and tie-ins. This will be part of the ASP development. Development applications will look at specific connections to Neil Ross Road, with this study providing some go/no-go zones regarding design geometrics. • There are no population requirements to initiate construction. It will be development-driven with off-site levies moving the project forward. • River Lot 37 sees a benefit to the communities as Neil Ross Road will provide a quick short access to where people want to go. They do not see an issue but do not want to build what is not needed. They have given up considerable lands for environmental and municipal reserve requirements. • River Lot 37 recognizes that there is an impact now with the lack of east/west connectivity that has resulted in shortcutting through Erin Ridge and want to make sure that this does not happen in other neighbourhoods. In their opinion, it is obvious that Neil Ross Road is needed. • River Lot 37 to chat with City of St. Albert about their project intersection locations on Neil Ross Road and provide current information to the City. They will not do more work until Neil Ross Road alignment has been finalized. The City indicated that roundabouts are the preferred intersection type and will be investigated first. Level of service is key in design. • AE to provide River Lot 37 with range of cost for the construction of this project.
SE21-54-25-W4M Certificates of Title 092 016 743 and 062 088 733	February 21, 2020	• The proposed Neil Ross Road alignment does not follow the northern alignment that was indicated years ago (5 to 10 years ago) when SE21-54-25-W4M submitted to the City a plan or ASP outlining their development. • SE21-54-25-W4M expressed concern that this alignment will: 1. Segregate the northern portion of the property, rendering it undesirable for development. 2. With the length of the roadway and the cross-section (Complete Streets) standards to be built to, that the off-site levies would be too high and make it uneconomical to develop the land. • SE21-54-25-W4M was not planning to develop their property until the development to the west has been built out. It is estimated to be over 10 years away. • SE21-54-25-W4M would like to know how much land would be required for the roadway. AE to provide this information. • SE21-54-25-W4M indicated that if this alignment is selected, then they would not develop their property.

Stakeholder	Date of Meeting	Discussion and Feedback at Meeting
		• SE21-54-25-W4M did not have a copy of the plan that was submitted. The City to contact their development group for a copy of the plan or ASP that was submitted years ago.
SE21-54-25-W4M	July 17, 2020	• The project team presented an alternative alignment to SE21-54-25-W4M which would run closer to the northern edge of their quarter section. • However, SE21-54-25-W4M did not like that option either due to the bisection of their property. • SE21-54-25-W4M reiterated that they are not supportive of the alignment.
NE22-54-25-W4M Certificate of Title 192 052 217	February 21, 2020	• NE22-54-25-W4M informed the group that AE performs work for the company for transparency. • NE22-54-25-W4M did not see any issues with the proposed Neil Ross roadway alignment. • NE22-54-25-W4M was informed that a portion of their land would be required for the widening of Coal Mine Road to meet the 38 m cross-section required for the future four lanes.

3 STUDIES

3.1 Environmental Overview

An environmental overview was completed by Associated Environmental in November 2019. The baseline environmental features were reviewed for the two alignment options with a 30 m buffer on each. The environmental overview identified environmental sensitivities and the potential regulatory approvals, notifications, and/or permits that are anticipated for the project. The desktop investigation included review of publicly available aerial imagery and searches of government databases.

For the wetland delineation component, satellite and aerial photos were interpreted for changes in vegetation, evidence of soil saturation or inundation, and variations in topography. The assessment shows eight wetlands in the study area, all of which were classified as temporary graminoid marshes except one which is a seasonal graminoid marsh. Three dugouts were also identified, which were determined not to be subjected to the *Alberta Wetland Policy*. The wetlands and dugouts are shown in Figure 3-1 below.

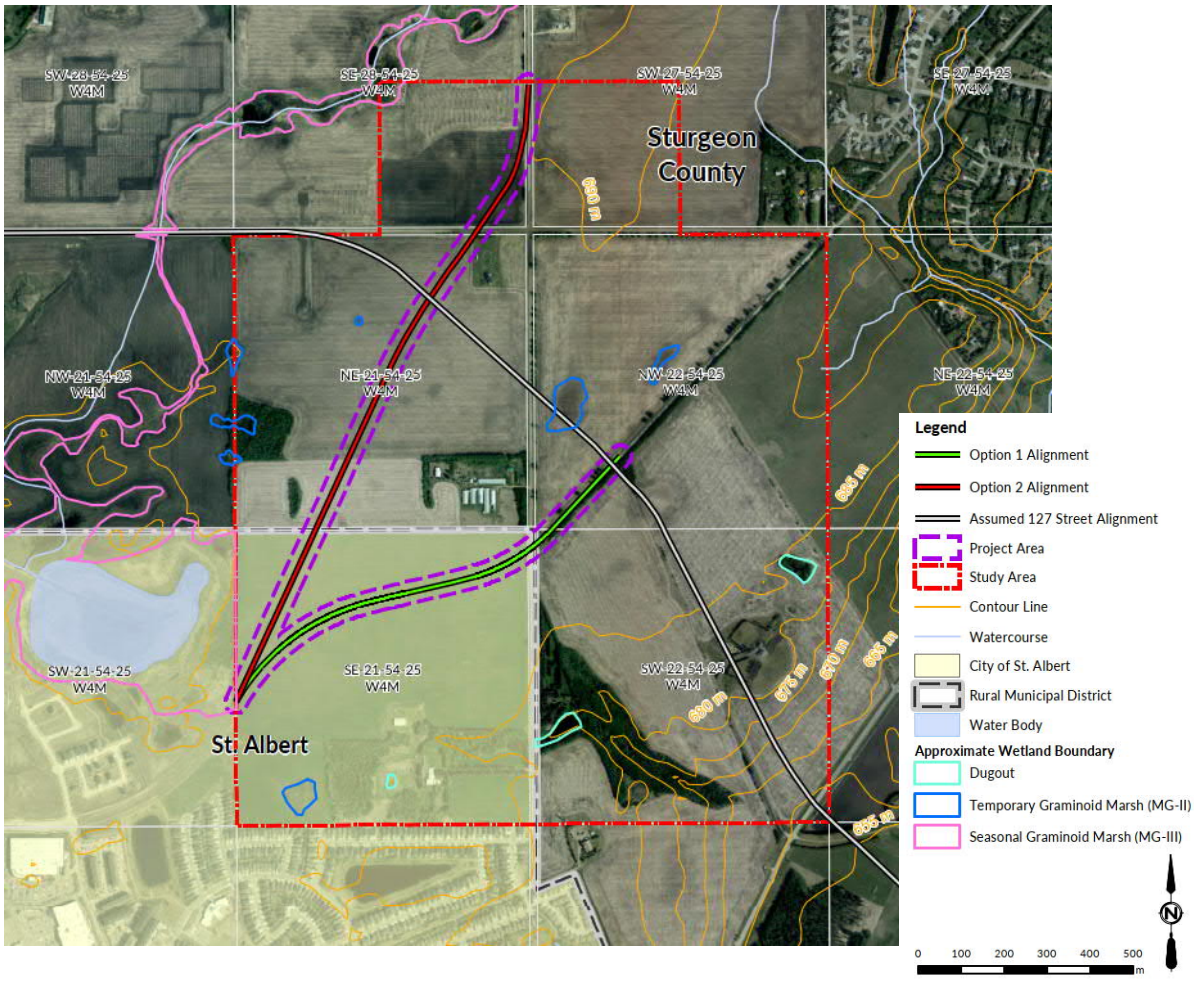


Figure 3-1
Wetland Delineation

The eight wetland areas and dugouts provide potential breeding habitat for amphibians. Wildlife species previously documented within 5 km of the study area and that have a potential nesting habitat within the study area include the Eastern Kingbird, Eastern Phoebe, and the Sora.

Based on the agricultural designation of the subject lands, there is a high probability that plant species regulated under the *Weed Control Act* occur within the study area. No rare plants have previously been recorded in the study area, though there is potential for natural forest patches to contain rare plant species.

Potential sources of contamination within the study area and/or adjacent lands include several existing, abandoned, and/or orphaned oil and gas infrastructure (e.g. well sites and pipelines). A review of historical information indicated several complaints and spills within the study area and neighbouring properties.

The potential for either alignment option to impact historical resources is low given the information from previous assessments and the terrain and topography of the study area.

Anticipated regulatory requirements include approvals from Alberta Culture, Multiculturalism and Status of Women (CMSW) under the *Historical Resources Act* and for permanent unavoidable impacts to a wetland under the *Water Act.* Other environmental recommendations and general compliance measures fall under the provincial *Agricultural Pests Act, Environmental Protection and Enhancement Act, Historical Resources Act, Soils Conservation Act, Weed Control Act, Wildlife Act,* and the federal *Migratory Birds Convention Act* and the *Species at Risk Act.*

The alignment recommendation is influenced from an environmental perspective by the following:

- Impacts to the wetland classified as the seasonal graminoid marsh should be avoided, if possible, through the planning and design of the selected alignment option.
- A Phase I Environmental Site Assessment (ESA) should be completed during preliminary design to evaluate areas of potential environmental concern. A Phase II ESA may be required based on the results of the Phase I ESA.
- An application for approval under the *Historical Resources Act* should be submitted at least 6 to 8 weeks prior to project tendering.
- Prior to project tendering, compliance recommendations should be reviewed and incorporated into construction planning documents as applicable.
- Mitigation measures pertaining to clubroot, erosion and sedimentation, contamination and hazardous materials, historical resources, weed management, and vegetation clearing should be included as part of the project's ECO Plan.

The complete environmental overview is provided in Appendix A.

3.2 Desktop Geotechnical Study

The geotechnical desktop study included a review of the available geotechnical and geological information, which enabled completion of a preliminary geotechnical assessment and recommendations for the proposed roadway and pavement design. Both proposed alignment options were reviewed in this geotechnical study. The study consisted of a review of: available in-house information from previous geotechnical studies, the Alberta Environment Water Well Database, available LiDAR and satellite images, and available surficial and bedrock geology maps. It should be noted that field drilling was not included in the desktop study.

Results indicate that the construction of the proposed roadway is geotechnically viable, with both options considered to have the same feasibility. Both proposed alignments are expected to be underlain by clay and/or sand and gravel over clay till overlying competent clay shale, coal, and sandstone bedrock at depths of greater than 14 m below ground surface. Organic deposits may be encountered along portions of the proposed alignments.

As the site goes through primarily flat terrain with low clay permeability, the natural drainage condition is poor. Drainage structures are required throughout the area. Cut and fill slopes should be topsoiled and revegetated as soon as possible to reduce potential slope erosion. In deep cuts, installation of erosion mats or other erosion control measured will be necessary. If needed based on water flow, ditch erosion protection should be provided.

The geotechnical report further recommended that construction of approach roads and intersections avoid any bogs or sloughs. Any organic materials and underlying soft soil should be sub-excavated to suitable soils or 1 m below the design subgrade level and replaced with good quality material. Subgrade should be scarified and recompacted to 98% of Standard Proctor Maximum Dry Density (SPMDD). Where ground conditions at the base are soft and wet, a non-woven geotextile should be placed over the base of the excavation.

Any fill should consist of inorganic low to medium plastic clay or granular fill, placed and compacted in 150 mm lifts to at least 98% of the SPMDD. The upper 300 mm of the subgrade should be scarified and compacted to 100% of the SPMDD.

The preliminary pavement structure design for both alignments is as follows:

Roadway	Design ESAL	Required Structural Number	Required Pavement Structure
Light Commercial and Industrial Road	1×10^6	102 mm	150 mm ACP over 300 mm Granular Base over 300 mm Prepared Subgrade

The next step in the project would involve a detailed geotechnical investigation with drilling of test holes at a spacing of approximately 200 m along the centreline of the chosen alignment. It is also recommended that standpipes be installed to assess the groundwater levels; these should be read periodically throughout the year.

For a complete description of the geotechnical conditions, desktop investigation results and recommendations, refer to the report in Appendix B.

3.3 Existing Utilities

Reviews of AbaData and Spin2 were completed to identify utilities at a desktop level. The utility conflicts are presented in Figure 3-2. At the initial start of project limits where Neil Ross Road intersects Element Drive, there are Fortis poles and lines that need to be considered. The alignment will cross an existing Telus fibre optic line running north-south along the east boundary of SW-21-54-25-W4M, as well as another running north-south along the east boundary of SE-21-54-W4M. There is a pipeline right of way owned by Gibson Energy crossing the Neil Ross Road alignment and extending northeast; according to AbaData, there was a crude oil pipeline which has been removed. Fortis lines and poles are shown crossing the southeast corner of SE-21-54-25-W4M, extending northeast from Edgewater Terrace to the start of Old Coal Mine Road at Range Road 253; these appear to be overhead power lines on the aerial image. An overhead Fortis line runs north-south along the east side of Range Road 253. There is a low-

pressure ATCO gas pipeline paralleling Old Coal Mine Road that extends northeast from Range Road 253, and another paralleling Range Road 253 going north. Further south, there is an additional branch of the low-pressure ATCO gas pipeline extending southeast from Range Road 253 that follows the boundary of the parcel identified as Plan 923RS, River Lot 36. There is also a sewer line right-of-way parallel to Range Road 253 on its west side, as well as a Telus trench. An abandoned well owned by Imperial Oil Resources Ltd. is shown at the intersection of Range Road 253 and Old Coal Mine Road with the status “RecExempt”. A water pipeline right of way extends northwest across Old Coal Mine Road near the end of the project limits.

Based on the information from AbaData and Spin2, the proposed Neil Ross Road alignment will cross existing street light cables, an abandoned oil pipeline right of way, two Telus trenches, an overhead transmission line, a sewer line, a low-pressure gas pipeline, and potentially a water line. During the preliminary and detailed design of Neil Ross Road all utilities should be located and investigated to determine any relocation and/or other requirements. Once the alignment is confirmed and design has begun, contact with the affected utility companies should be initiated as early in the project as possible to avoid delays.

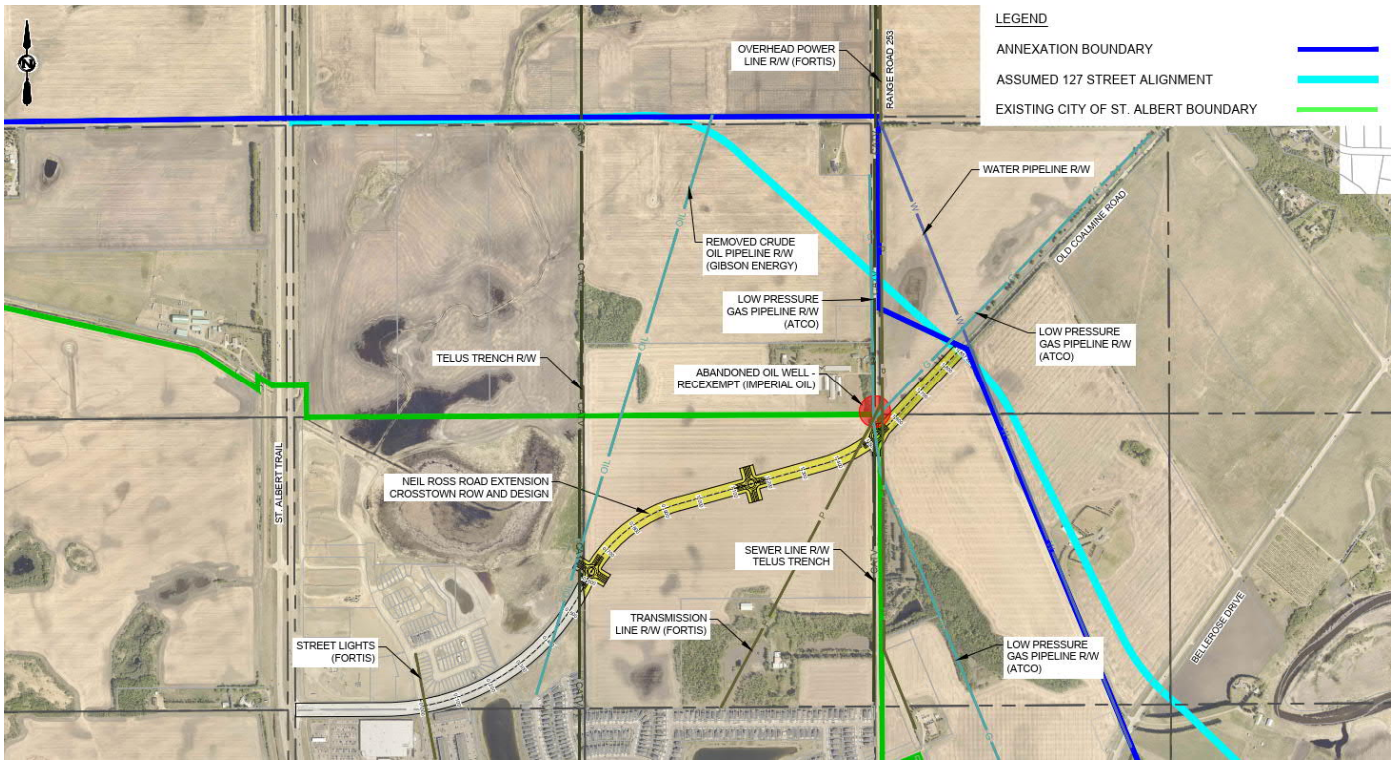


Figure 3-2
Neil Ross Road Extension Utility Impacts

3.4 Stormwater Management Concepts

An overview of the existing stormwater patterns in the alignment area was completed. A combination of 0.5 m and 15 m LiDAR surfaces were used to delineate the major drainage paths within the area east of St. Albert Trail. Note, using a 15 m LiDAR surface is very coarse for catchment delineation. A more detailed LiDAR surface should be acquired to validate the drainage paths discussed below.

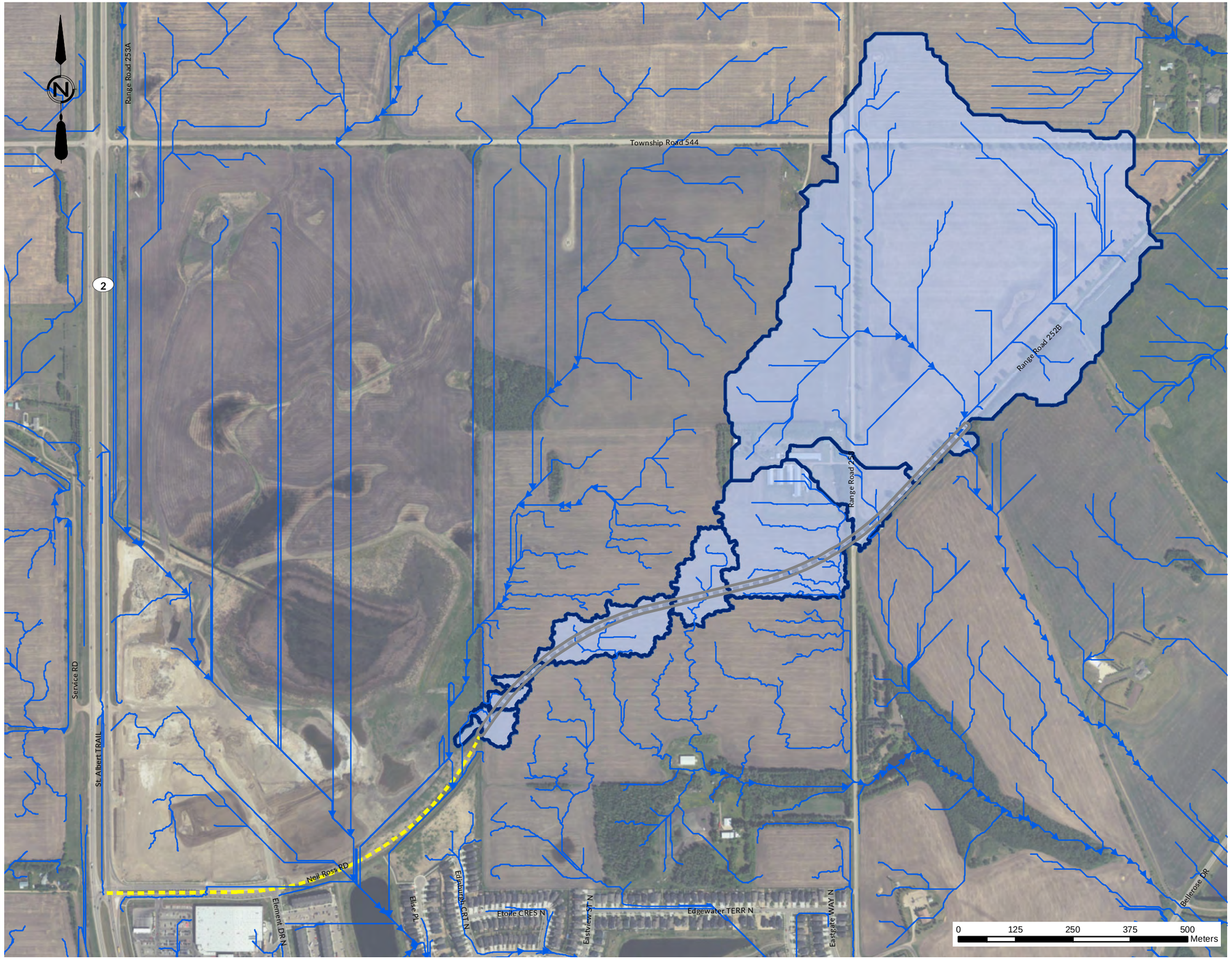
There are nine major drainage catchments impacted by the proposed Neil Ross roadway alignment as shown in Figure 3-3. The general drainage direction within the area is to the southeast towards Bellerose Drive. Drainage catchments were not delineated to the existing Neil Ross alignment as it is understood that there will be no upgrades or modifications required.

The area including the proposed Neil Ross roadway alignment was included in the City Northeast Storm Trunk project analysis based on the predesign report submitted to the City by AE in 2020.

Along the existing alignment, stormwater pipes convey flows south towards a wet pond. It is recommended that existing drainage patterns are maintained along the proposed Neil Ross roadway alignment. Future stormwater management should follow the City's proposed Sub Region Stormwater Project.

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



Legend

- Existing Neil Ross Roadway Alignment
- Proposed Neil Ross Roadway Alignment
- Drainage Path
- Catchment Area

Associated Engineering

CANADA'S BEST MANAGED COMPANIES
Platinum member

City of St. Albert
Alberta, Canada

FIGURE 3-3

NEIL ROSS ROADWAY
FUCTIONAL ALIGNMENT STUDY

EXISTING DRAINAGE PATTERNS AND CATCHMENTS

AE PROJECT No.	2019-3618
SCALE	1:8,000
APPROVED	
DATE	2020MAR16
REV	
DESCRIPTION	ISSUED FOR REPORT

SAVE DATE: 3/16/2020 4:02:24 PM SAVED BY:
DRAWING PATH: \\s-edm-fs-01\working\2019-3618-00\gis\ArcMap\Engineering\Fig1_NeilRossRoadFuctionalAlignmentStudy2.mxd
DATA SOURCE: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community;

3.5 Traffic Analysis

The project team has undertaken a transportation analysis of Neil Ross Road and its major intersections from St. Albert Trail to the anticipated limits of Neil Ross Road where it transitions to Sturgeon County land. The transportation analysis included development of recommended connections, intersection spacing and recommendations for lane geometries and traffic control measures for opening day.

3.5.1 Cross-Section and Forecast Volumes

Future long-term plans include Neil Ross Road as a four-lane divided Crosstown Roadway, with a two-lane undivided roadway in the interim. The long-term geometry reduces the median separation between the northbound and southbound lanes, consolidating the two directional intersections into one. As part of this analysis, an interim cross-section for Neil Ross Road consisting of a 2-lane undivided roadway was evaluated using 2019 and 2045 horizon year volumes. The ultimate 4-lane divided roadway geometry was also evaluated. 127 Street was modelled as a four-lane arterial for both scenarios at the 2045 horizon, which is consistent with the recommendations of the recently completed Transportation Network Improvement Strategy and allowed for isolated evaluation of the Neil Ross Road geometry.

For the 2045 horizon, the long-term geometry of the St. Albert Trail and Neil Ross Road intersections as provided in the *North St. Albert Trail Integration Plan* were incorporated into the Synchro analysis. The long-term geometry includes a future modification of St. Albert Trail into an urban design, consolidating the northbound and southbound directional intersections into a single intersection, reducing the median separation between the northbound and southbound lanes. The long-term geometry and the complete analysis with Synchro results is included in Appendix C.

Based on the Option 1 alignment, AE used the City's recently updated EMME model to generate anticipated traffic volumes along Neil Ross Road from St. Albert Trail to 127 Street. The most current version of the model uses a 2045 horizon which supersedes the 2042 horizon used for the TMP. Traffic volumes were generated for the 2019 (existing) condition and were also projected for the 2045 horizon year for the three primary intersections expected to be impacted:

- St. Albert Trail and Neil Ross Road
- Neil Ross Road and Element Drive
- Neil Ross Road and 127 Street

Volume forecasts were compared to previous projections (excluding the Neil Ross Road connection to 127 Street). Figure 3-4 illustrates the 2019 traffic volumes for the PM peak hour.

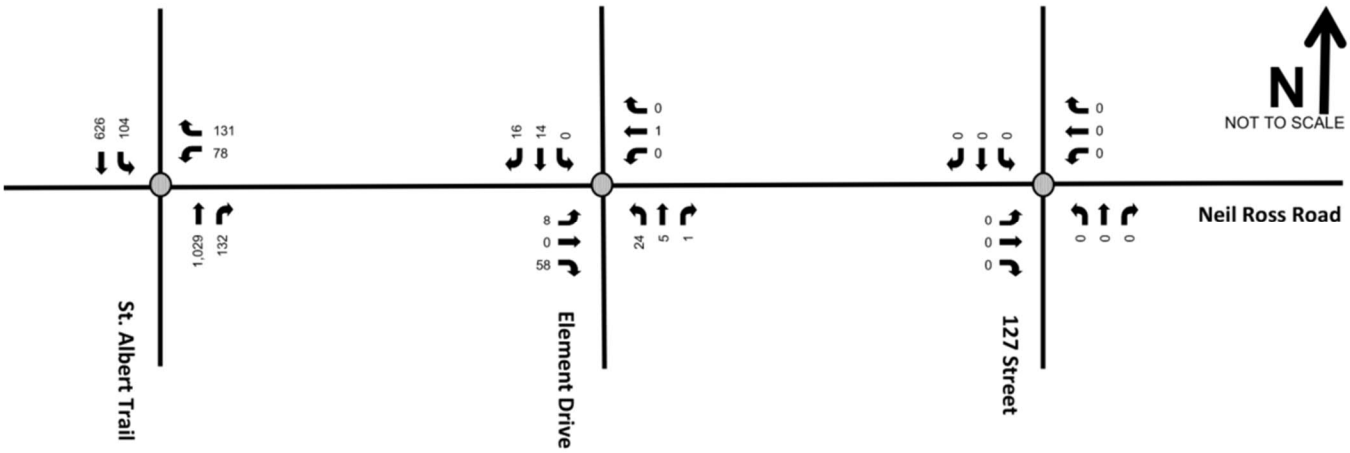


Figure 3-4
2019 Volumes (PM Peak Hour)

Figure 3-5 shows the originally forecasted PM peak hour traffic volumes along Neil Ross Road in 2042. The Element Drive and 127 Street intersections were not analysed in previous projections and were added on in this study.

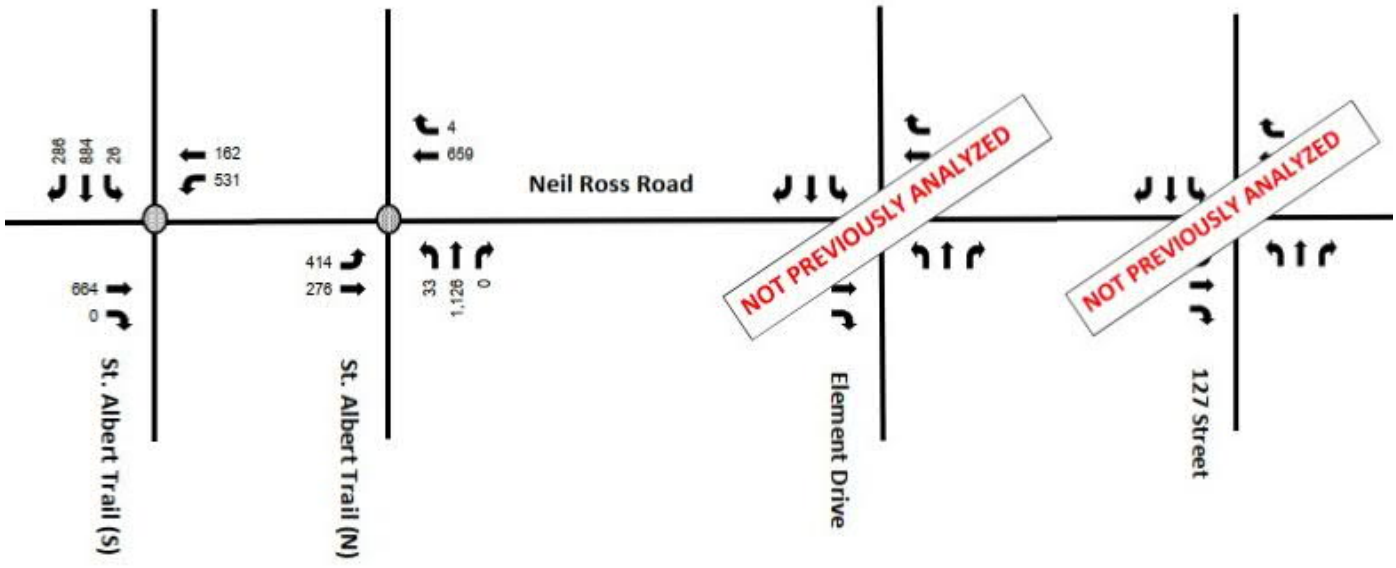


Figure 3-5
Original 2042 Forecast Volumes (PM Peak Hour)

Figure 3-6 shows updated forecasted PM peak hour traffic volumes along Neil Ross Road in 2045 (with the Neil Ross Road connection to 127 Street). Traffic forecasts depend on a number of factors including the assumptions in the model related to the timing of development and road connections, location of major access points, transit expansion and other factors. The 2045 model was updated based on more recent travel surveys and with more information about land development and transportation assumptions in Sturgeon County. One of the differences in the volumes is more of the east-west traffic stays on the corridor west of St. Albert Trail rather than going south on St. Albert Trail.

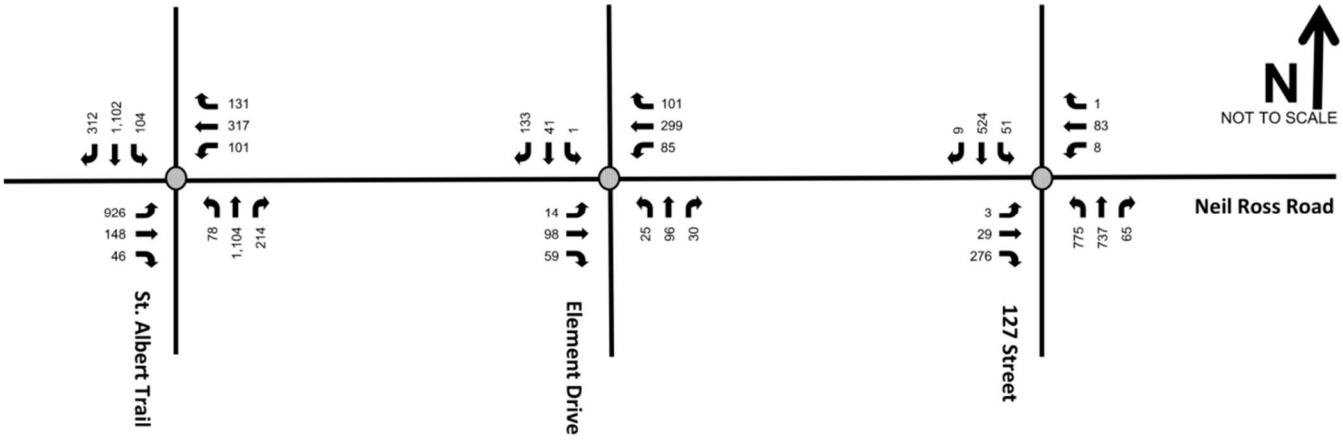


Figure 3-6
New 2045 Forecasted Volumes (PM Peak Hour)

3.5.2 Synchro Analysis

The intersection analysis for the analyzed intersections was undertaken using the Synchro 10 software package, which is based on the Highway Capacity Manual (HCM 2000). For unsignalized intersections, the methodology considers the intersection geometry, the traffic volumes, the posted speed limit, and the type of intersection control. The average delay for each individual movement from the minor street, the major street left-turn movements and the overall intersection are calculated. An operation level of service (LOS) is then assigned based on the calculated average delay. For signalized intersections, the methodology considers the intersection geometry, the traffic volumes, the posted speed limit, the traffic signal phasing/timing plan as well as pedestrian volumes. The average delay for each lane group and the overall intersection are calculated. An operation LOS is then assigned based on the calculated average delay. The level of service criteria for both signalized and unsignalized intersections is described in Table 3-1.

Table 3-1
Level of Service Criteria

Level of Service	Average Control Delay Signalized Intersection (seconds per vehicle)	Average Control Delay Unsignalized Intersection (seconds per vehicle)	Operational Conditions
A	10.0 or less	10.0 or less	Very good operation
B	10.1 to 20.0	10.1 to 15.0	Good operation
C	20.1 to 35.0	15.1 to 25.0	Acceptable operation
D	35.1 to 55.0	25.1 to 35.0	Congestion
E	55.1 to 80.0	35.1 to 50.0	Significant congestion
F	More than 80.0	More than 50.0	Unacceptable operation
Breakdown	Very high	Very high	Conditions are so poor that capacity calculations are meaningless

The volume-to-capacity (v/c) ratio was also considered. If the v/c ratio for a movement is greater than 1.00, then that movement has technically exceeded capacity.

The 2019 and newly forecasted 2045 traffic volume projections were incorporated into the City's Synchro model. As noted previously, both the interim and ultimate geometries for Neil Ross Road were incorporated into the 2045 horizon scenario. The results of the 2019 analysis are summarized in Table 3-2. The 2045 operational summary for the three intersections in the PM peak is shown in Table 3-3 and in Table 3-4 for the interim and long-term geometry, respectively.

Table 3-2
Operational Analysis Results for 2019 – Interim/Existing Conditions (PM Peak)

Intersection	Control Device	Measure	Eastbound			Westbound			Northbound			Southbound			Overall Intersection LOS
			Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
St. Albert Trail & Neil Ross Road	Signalized	Lane Geometry	-			L/L/R			T/T/R			L/T/T			A
		Volumes (vph)	-	-	-	78	0	131	-	1029	132	104	626	-	
		Level of Service	-	-		E	-	B	-	A	A	A	A	-	
		V/C ratio	-	-		0.32	-	0.56	-	0.37	0.11	0.30	0.23	-	
		Queue (m)	-	-		24	-	23	-	44	3	13	24	-	
Neil Ross Road & Element Drive	Signalized	Lane Geometry	L/T/T/R			L/T/T/R			L/TR			L/TR			A
		Volumes (vph)	8	0	58	0	1	0	24	5	1	0	14	16	
		Level of Service	A	-	A	-	A	-	A	A		-	A		
		V/C ratio	0.02	-	0.05	-	0.00	-	0.05	0.01		-	0.02		
		Queue (m)	2	-	0	-	0	-	5	2		-	3		

Table 3-3
Operational Analysis Results for 2045 Horizon with Interim Geometry (PM Peak)

Intersection	Control Device	Measure	Eastbound			Westbound			Northbound			Southbound			Overall Intersection LOS
			Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
St. Albert Trail & Neil Ross Road (2-lane)	Signalized	Lane Geometry	L/T/TR			L/L/T/T/R			L/L/T/T/T/R			L/T/T/T/R			F
		Volumes (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321	
		Level of Service	F	E		C	F	C	F	F	B	F	E	B	
		V/C ratio	1.23	0.60		0.07	0.84	0.54	0.69	1.09	0.45	1.07	0.98	0.57	
		Queue (m)	#472	41		16	#80	39	#29	#185	28	#84	#171	72	
Neil Ross Road (2-lane) & Element Drive	Signalized	Lane Geometry	L/T/T/R			L/T/T/R			L/TR			L/TR			A
		Volumes (vph)	14	98	59	85	299	101	25	96	30	1	41	133	
		Level of Service	A	A	A	A	A	A	A	A		A	A		
		V/C ratio	0.04	0.07	0.09	0.18	0.23	0.16	0.06	0.18		0.00	0.25		
		Queue (m)	3	6	5	12	15	7	5	13		1	11		
Neil Ross Road (2-lane) & 127 Street (4-lane)	Signalized	Lane Geometry	L/T/R			L/T/R			L/T/T/R			L/T/T/R			C
		Volumes (vph)	3	29	276	8	83	1	775	737	65	51	524	9	
		Level of Service	C	C	A	C	C	A	D	B	A	B	D	A	
		V/C ratio	0.01	0.08	0.52	0.03	0.23	0.00	0.96	0.37	0.07	0.23	0.82	0.02	
		Queue (m)	3	12	21	5	27	0	#212	51	5	9	#72	0	

#: 95th percentile volume exceeds capacity, queue may be longer.

Table 3-4
Operational Analysis Results for 2045 Horizon with Ultimate Geometry (PM Peak)

Intersection & Scenario	Control Device	Measure	Eastbound			Westbound			Northbound			Southbound			Overall Intersection LOS
			Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
St. Albert Trail & Neil Ross Road (4-lane) No Improvements on Geometry	Signalized	Lane Geometry	L/T/TR			L/L/T/T/R			L/L/T/T/R			L/T/T/T/R			F
		Volumes (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321	
		Level of Service	F	E		C	F	C	F	F	B	F	E	B	
		V/C ratio	1.23	0.60		0.07	0.84	0.54	0.69	1.09	0.45	1.07	0.98	0.57	
		Queue (m)	#472	41		16	#80	39	#29	#185	28	#84	#171	72	
St. Albert Trail & Neil Ross Road (4-lane) *Improved Geometry*	Signalized	Lane Geometry	L/L/T/TR			L/L/T/T/R			L/L/T/T/R			L/L/T/T/T/R			D
		Volumes (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321	
		Level of Service	E	D		C	D	B	E	D	A	E	D	A	
		V/C ratio	0.97	0.49		0.1	0.69	0.44	0.45	0.79	0.37	0.56	0.73	0.47	
		Queue (m)	#158	31		15	54	23	18	110	18	28	110	22	
Neil Ross Road (4-lane) & Element Drive	Signalized	Lane Geometry	L/T/T/R			L/T/T/R			L/TR			L/TR			A
		Volumes (vph)	14	98	59	85	299	101	25	96	30	1	41	133	
		Level of Service	A	A	A	A	A	A	A	A		A	A		
		V/C ratio	0.04	0.07	0.09	0.18	0.23	0.16	0.06	0.18		0.00	0.25		
		Queue (m)	3	6	5	12	15	7	5	13		1	11		
Neil Ross Road (4-lane) & 127 Street (4-lane)	Signalized	Lane Geometry	L/T/T/R			L/T/T/R			L/T/T/R			L/T/T/R			C
		Volumes (vph)	3	29	276	8	83	1	775	737	65	51	524	9	
		Level of Service	C	C	A	C	C	A	D	B	A	B	D	A	
		V/C ratio	0.01	0.04	0.52	0.03	0.12	0.00	0.96	0.37	0.07	0.23	0.82	0.02	
		Queue (m)	3	6	21	5	14	0	#212	51	5	9	#72	0	

#: 95th percentile volume exceeds capacity, queue may be longer.

Results of the analysis indicate that the interim geometry of a 2-lane undivided cross-section for Neil Ross Road is expected to be sufficient through the 2045 horizon based on the projected volumes. The intersections of Neil Ross Road and 127 Street and Neil Ross Road and Element Drive are expected to operate with an acceptable LOS and v/c ratios with both the interim and ultimate geometries.

However, the results show that intersection of St. Albert Trail and Neil Ross Road is expected to operate with deficiencies on several approaches based on the originally proposed concept design of the intersection. The primary cause of the operational deficiency appears to be the future eastbound to northbound movement, from Fowler Way to travel north on St. Albert Trail, where left-turning volumes are projected to exceed 900 vehicles in the PM peak hour. However, this movement is not expected to be impacted by the Option 1 alignment or extension of Neil Ross Road to 127 Street.

Further analysis was conducted to determine what potential mitigation measures could be considered to improve 2045 PM peak hour horizon conditions at the St. Albert Trail and Neil Ross Road intersection. The analysis indicates a second eastbound to northbound lane and a second southbound to eastbound lane would improve v/c ratios, vehicle delays and 95th percentile queues. The addition of each lane would correspond with opposing dual left-turn lanes. The required improvements to address the operational failures have been captured in the North St. Albert Trail improvements design work. Operational analysis results with the additional improvements are also shown in Table 3-4 and indicate that all movements are expected to operate with acceptable LOS, v/c ratios and 95th percentile queues based on this improvement to the original concept.

3.5.3 Lane Configurations and Traffic Control Measures

Based on the results of the Synchro analysis, Figure 3-7 illustrates the recommended lane geometries for opening day of the Neil Ross Road extension to 127 Street. Two lanes are sufficient for Neil Ross Road through Element Drive and 127 Street as long turn lanes are provided at the intersections. Turn bay lengths should be determined based on 95th percentile queues and adequacy to provide deceleration within each turn bay. Traffic signals are currently provided at St. Albert Trail and are recommended for the Element Drive and 127 Street intersections for opening day.

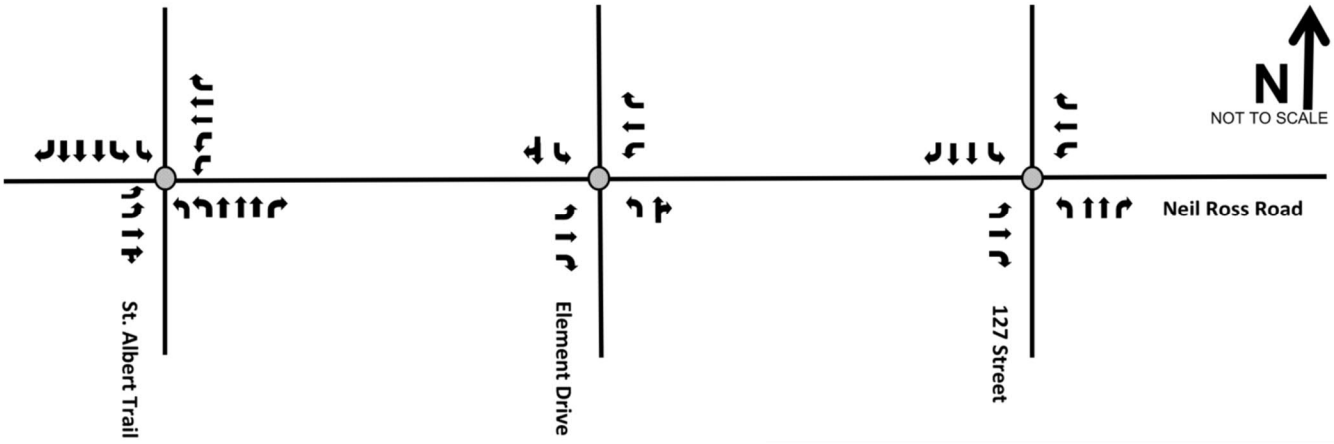


Figure 3-7
Recommended Lane Configuration for Intersections on Neil Ross Road

3.5.4 Mid-block Laning Requirements and Level of Service

The City requested AE to provide an indication of when four lanes may be needed between Element Drive and 127 Street. In an urban setting such as this, intersection operation is expected to limit link capacity and is an indicator of capacity needs. However, sometimes link capacity may also be assessed. This section uses a high-level link capacity assessment based on a variety of growth scenarios beyond 2045 to determine the potential timing for four-laning.

The lane capacity standards used here match those implemented in EMME. Four-laning is estimated to be required when link volumes exceed 1,600 veh/hr/lane, however, we know from experience that it is more desirable to provide four lanes when approach volumes exceed 1,000 veh/hr/lane. This allows motorists to maneuver around slower moving vehicles or pull over in an emergency without impeding traffic if needed.

Table 3-5 summarizes the traffic volume forecasts on Neil Ross Road between Element Drive and 127 Street in 2045. They are both below 1,000 veh/hr/lane.

Table 3-5
2045 PM Peak Forecast Link Volumes

Neil Ross Road	Eastbound Traffic (Veh/Hr)	Westbound Traffic (Veh/Hr)
West of 127 Street	308	867

Land development and traffic growth are uncertain beyond 2045 so a sensitivity analysis based on growth scenarios for 2%, 4%, 6% and 8% linear growth rates was used. Table 3-6 summarizes the volume forecasts on Neil Ross Road which shows that the westbound volumes are the higher volumes for the PM peak. Amber cells indicate when traffic volumes exceed 1000 veh/hr/lane, and red cells indicate when link capacity exceeds 1600 veh/hr/lane. Four-laning will start to be needed some time between 2047 and 2053 depending on how quickly development occurs. Note that these forecasts are based on assumed linear growth rates and should be reassessed as development plans become available.

Table 3-6
PM Peak Traffic Forecast West of 127 Street

Year	Eastbound				Westbound			
	2% Growth	4% Growth	6% Growth	8% Growth	2% Growth	4% Growth	6% Growth	8% Growth
2046	314	320	326	333	884	902	919	936
2047	320	333	346	359	902	938	974	1011
2048	327	346	367	388	920	975	1033	1092
2049	333	360	389	419	938	1014	1095	1180
2050	340	375	412	453	957	1055	1160	1274
2051	347	390	437	489	976	1097	1230	1376
2052	354	405	463	528	996	1141	1304	1486
2053	361	422	491	570	1016	1187	1382	1605
2054	368	438	520	616	1036	1234	1465	1733
2055	375	456	552	665	1057	1283	1553	1872
2056	383	474	585	718	1078	1335	1646	2022
2057	391	493	620	776	1100	1388	1745	2183
2058	398	513	657	838	1122	1444	1849	2358
2059	406	533	696	905	1144	1501	1960	2547
2060	415	555	738	977	1167	1561	2078	2750
2061	423	577	782	1055	1190	1624	2202	2970
2062	431	600	829	1140	1214	1689	2335	3208
2063	440	624	879	1231	1238	1756	2475	3465
2064	449	649	932	1329	1263	1827	2623	3742
2065	458	675	988	1436	1288	1900	2781	4041
2066	467	702	1047	1550	1314	1976	2947	4364
2067	476	730	1110	1674	1340	2055	3124	4713
2068	486	759	1176	1808	1367	2137	3312	5091
2069	495	789	1247	1953	1395	2222	3510	5498
2070	505	821	1322	2109	1422	2311	3721	5938

3.5.5 Access Management

The City's Complete Streets Guidelines for the Crosstown/Arterial roadway classification does not include a recommended intersection spacing. The Guidelines refer on several occasions to the Regional Transportation Corridor Design Guidelines used by the Region of Waterloo. The Waterloo Guidelines as well as the Edmonton Complete Streets Guidelines suggests a spacing standard of 215 m (Waterloo) and between 110 m to 250 m (Edmonton), based on whether proposed intersections are signalized or unsignalized. Similar roadways within the City of St. Albert generally measure within a 200 – 350 m spacing. Therefore, for relative consistency, a minimum spacing standard of 200 m measured from centreline to centreline of intersections along Neil Ross Road is recommended. Future intersections should also consider the context of the area, including consideration for roadway curvature, sightlines, topography, and environmental constraints. Collectively, it is recommended that an assessment be conducted for each proposed intersection location.

Access to Neil Ross Road through an extension of Edinburgh Court is not recommended. As Edinburgh Court provides connectivity to Everitt Drive and St. Albert Trail, a future connection from Edinburgh Court to Neil Ross Road may provide an attractive cut-through option for vehicles attempting to avoid congestion at the Neil Ross Road and St. Albert Trail intersections and for vehicles traveling south towards the City. In addition, Edinburgh Court is designed as a residential street with homes fronting the roadway. The potential traffic that could cut-through using this route would likely exceed the typical daily traffic volumes recommended for a residential street. In addition, Edinburgh Court would be a redundant connection to Element Drive, which is designed to accommodate higher traffic volumes than Edinburgh Court.

3.5.6 Traffic Analysis Conclusions

The evaluation of Neil Ross Road using Option 1 indicates that the corridor operates with an acceptable level of service except at St. Albert Trail. Option 1 consists of a future extension to Old Coal Mine Road, with an intersection at 127 Street. While planned as a future 4-lane divided crosstown roadway, analysis indicates that a 2-lane undivided road is expected to be sufficient through the horizon year as an interim cross-section. Signalization at the 127 Street and Element Drive intersections with Neil Ross Road are recommended on opening day. Auxiliary turn lanes are also recommended at both intersections.

The analysis indicates future operational deficiencies at the Neil Ross Road and St. Albert Trail intersection. However, the primary contributor to these deficiencies is the eastbound to northbound volumes, which are not expected to be impacted by the extension of Neil Ross Road to 127 Street. Additional mitigation measures beyond the long-term improvements planned at St. Albert Trail and Neil Ross Road include a second eastbound to northbound left-turn lane and a second southbound to eastbound left-turn lane. Operational analysis indicates adequate v/c ratios and reasonable 95th percentile queues with the improvements, however several movements are expected to continue to operate with a LOS F due to vehicle delays associated with the required longer cycle length.

An access management review of the proposed corridor and applicable classification suggest a minimum intersection spacing of 200 m may be appropriate for this corridor. Specific locations of each intersection should be evaluated with consideration for a broad range of factors, such as roadway curvature, sight lines, topography and environmentally sensitive areas.

4 ALIGNMENT

4.1 Design Standards

AE reviewed and compared the St. Albert, City of Edmonton, and Transportation Association of Canada (TAC) Standards in preparation of the conceptual alignment. The comparison and recommended standards to be used in design are shown in Table 4-1.

Table 4-1
Proposed Geometric Design Standards

	St. Albert	City of Edmonton	TAC	Recommended
Category	Crosstown (Arterial)	Arterial	Minor arterial	Arterial
Design speed (km/h)	70	70	70	70
Posted speed (km/h)	60	60	60	60
Horizontal Alignment				
Maximum Superelevation (m/m)	0.04	0.06	0.04	0.04
Minimum radius (m)	450	190	200	450
Sight Distance				
• Stopping sight distance (0.15 m, 6% down) (m)	116	116	116	116
• Decision sight distance (m)	240	240	240	240
Vertical Alignment				
Gradient:				
• Maximum gradient – rolling (%)	5	6	6	5
• Minimum gradient in cut (%)	0.60	0.60	0.50	0.60
Minimum K-values:				
• Crest (height of object = 0.15m)	17	17	17	17
• Sag (headlight)	255	255	255	255
• Sag (height of object = 0.15m)	23	23	23	23
• Sag (comfort)	10	10	10	10
Minimum vertical curve length (m)	70			70
Warrant for curve (Grade difference) (%)	1.5	1.0		1.5
Cross-Section				
Lane width:				
• Through (min, busses) (m)	3.5	3.7	3.3	3.5
• Right turning (m)	3.3	3.95	3.25	3.3
• Left turning (m)	3.3	3.95	3.25	3.3
Cross fall (m/m)				0.025

4.2 Cross-Section and Staging

Neil Ross Road will be an arterial roadway, designed with the Crosstown Residential cross-section identified in the St. Albert Complete Streets Guidelines. However, the final cross-section will be subject to confirmed land development. According to the results of the traffic analysis, a two-lane cross-section is expected to function sufficiently for at least the 2045 horizon. Should future volumes dictate a need for expansion (refer to Section 3.5.4), the two-lane cross-section can be expanded to four lanes. Figure 4-1 shows the ultimate Crosstown cross-section as per the City Guidelines. There are two 3.5 m drive lanes in each direction. A separated bike lane is provided on either side, as well as a separated sidewalk buffered by a planting area. It is noted that with the recent release of the updated Municipal Engineering Standards, the typical Crosstown Residential cross-section has been revised slightly from what is presented in the Complete Streets Guidelines. The standard right-of-way remains at 38m with only minor changes to the width of various cross-section elements. For the purposes of this FAS, the cross-section presented in Figure 4-1 is deemed unacceptable.

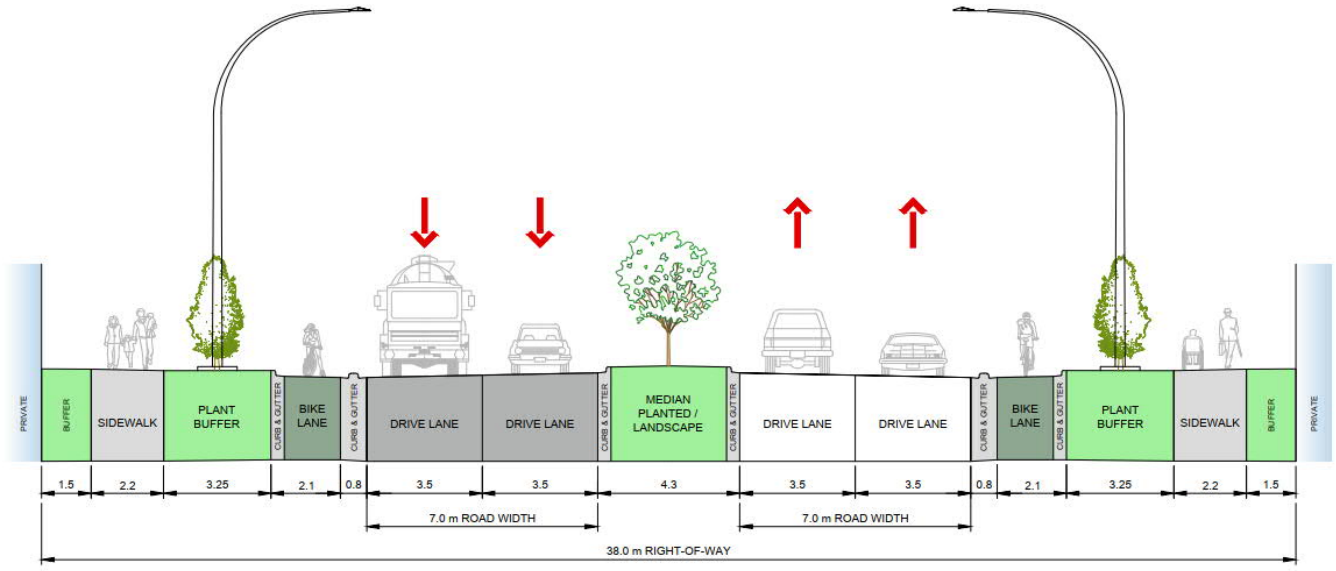


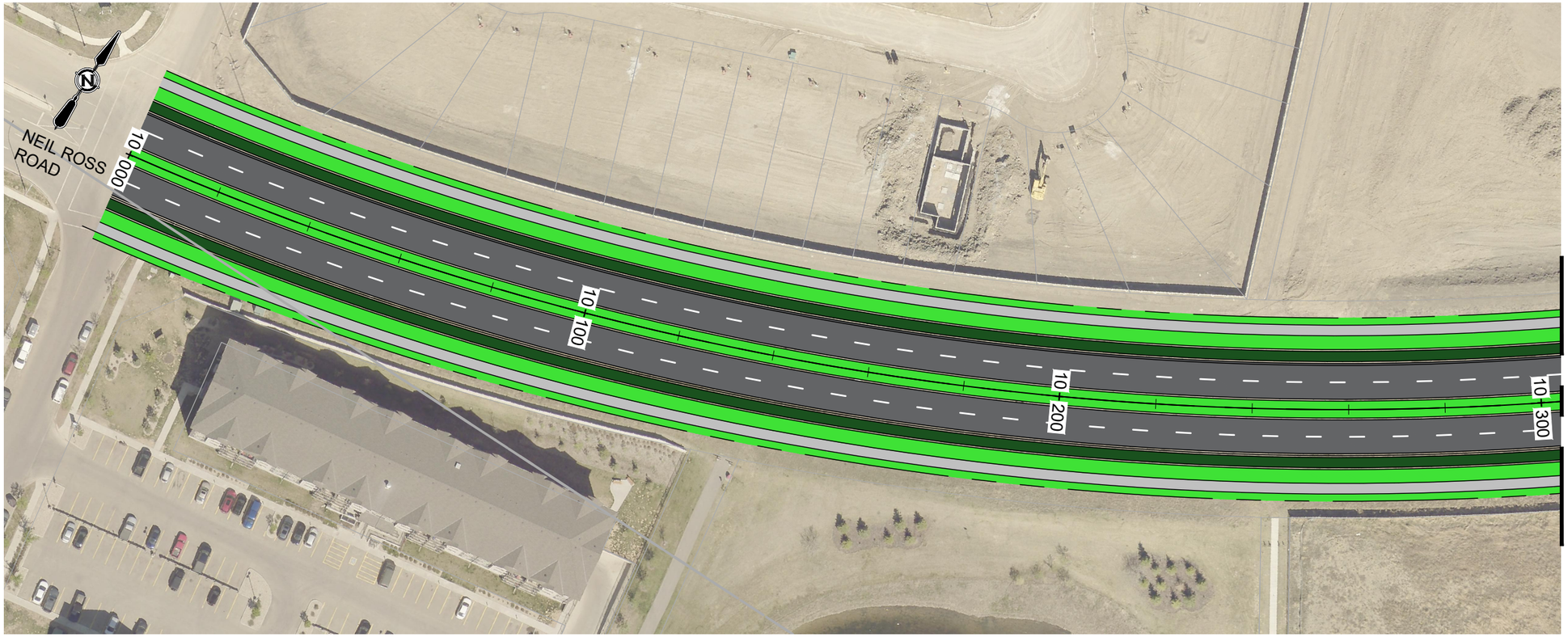
Figure 4-1
Crosstown Residential Cross-Section, Ultimate

4.3 Proposed Alignment

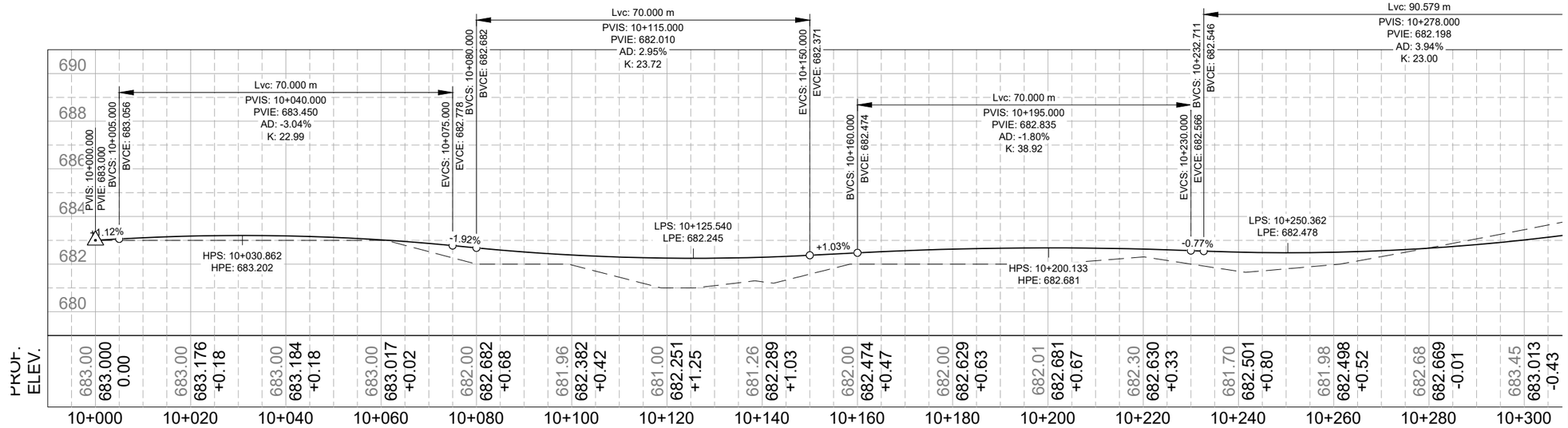
The conceptual plan and profile drawings are shown in Figure 4-2 to Figure 4-10.

IF NOT 25 mm ADJUST SCALES
25 mm

SCALE(S) SHOWN ARE INTENDED FOR TABLOID (11X17) SIZE DRAWINGS UNLESS NOTED OTHERWISE



1 - PLAN 1:1000



2 - PROFILE H 1:1000, V 1:200

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FIGURE 4-2

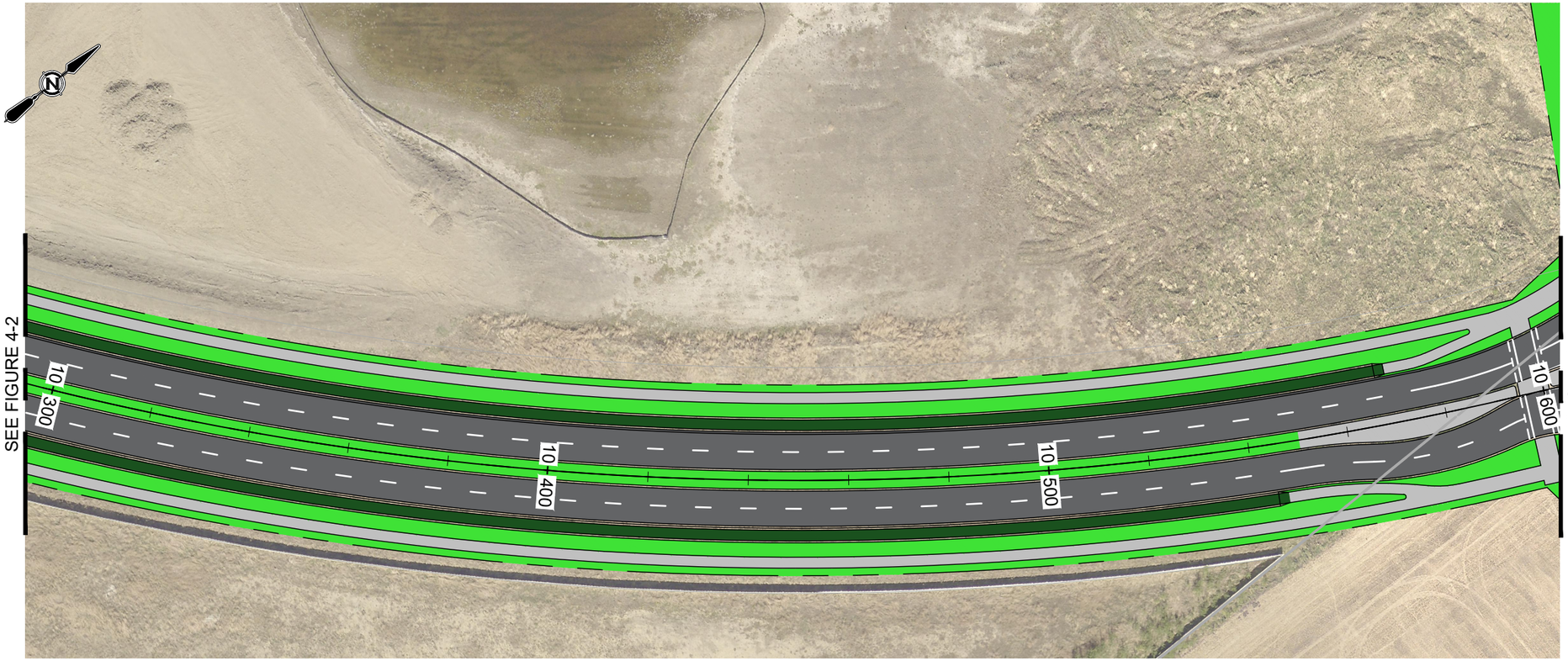
CITY OF ST. ALBERT
NEIL ROSS FUNCTIONAL ALIGNMENT STUDY

CIVIL
PREFERRED ALIGNMENT
STA 10+000 TO STA 10+300

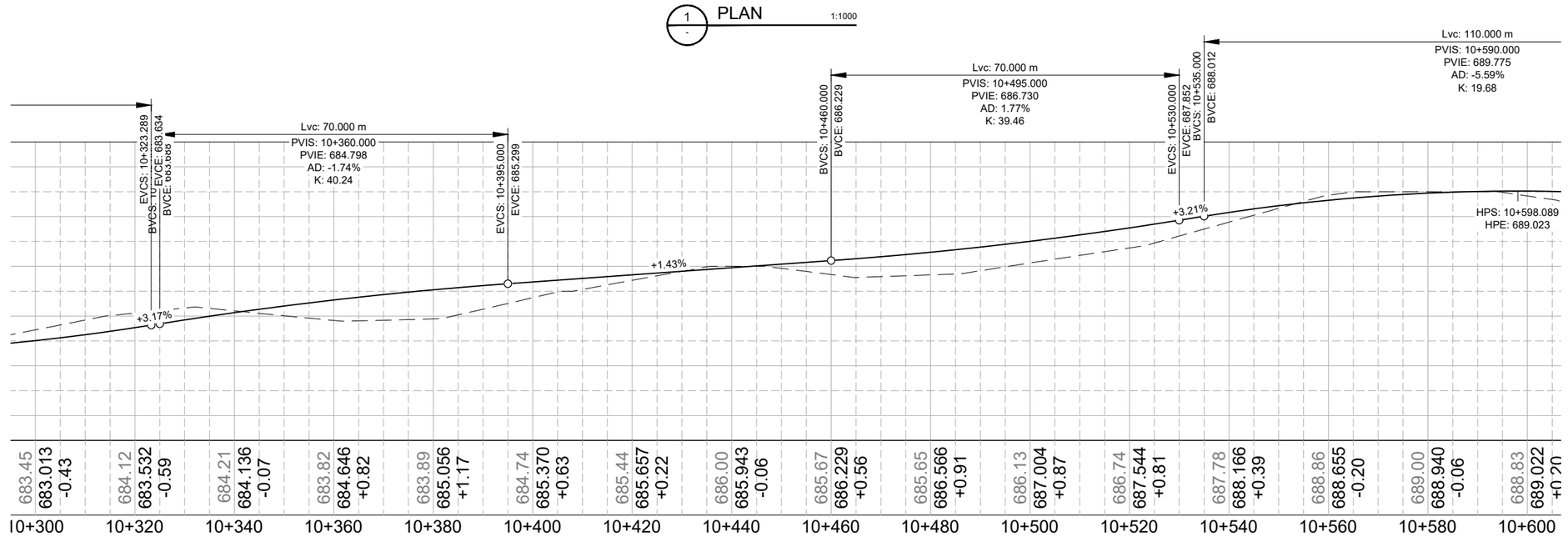
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FIGURE 4-3

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NEIL ROSS FUNCTIONAL ALIGNMENT STUDY

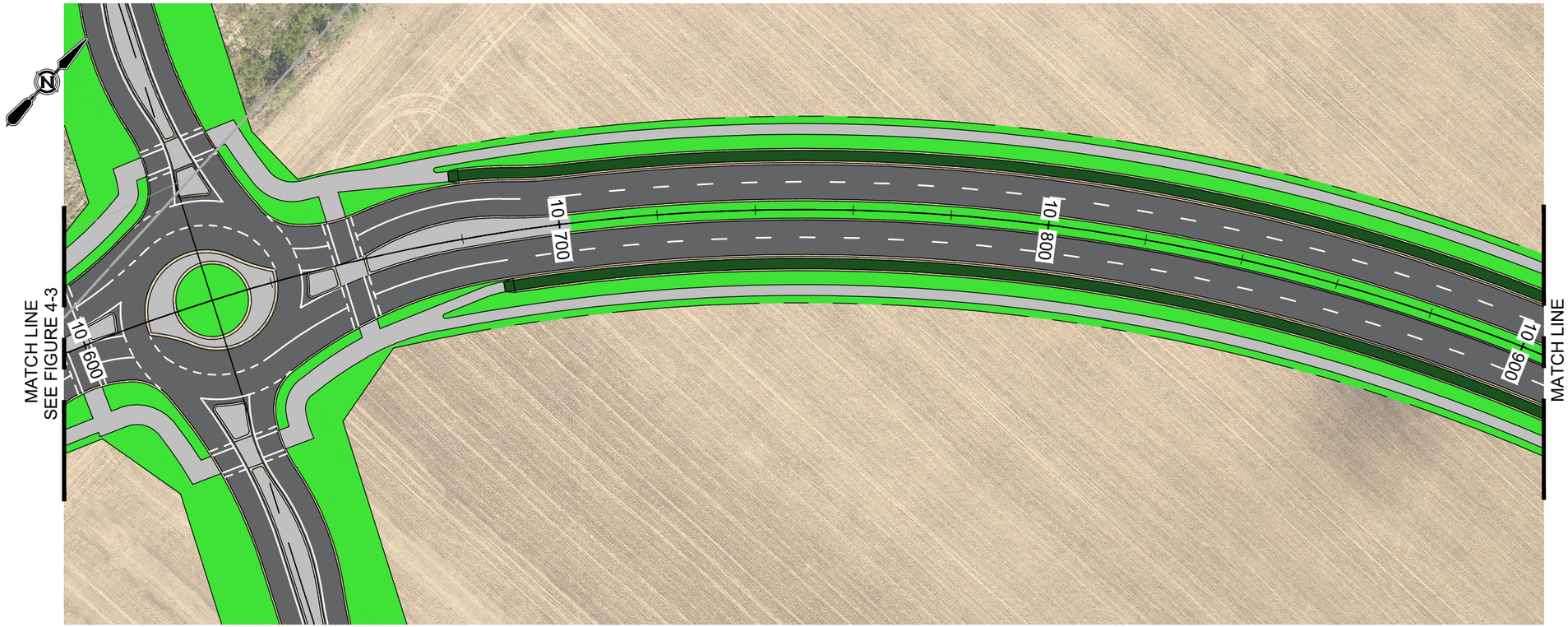
CIVIL
PREFERRED ALIGNMENT
STA 10+300 TO STA 10+600

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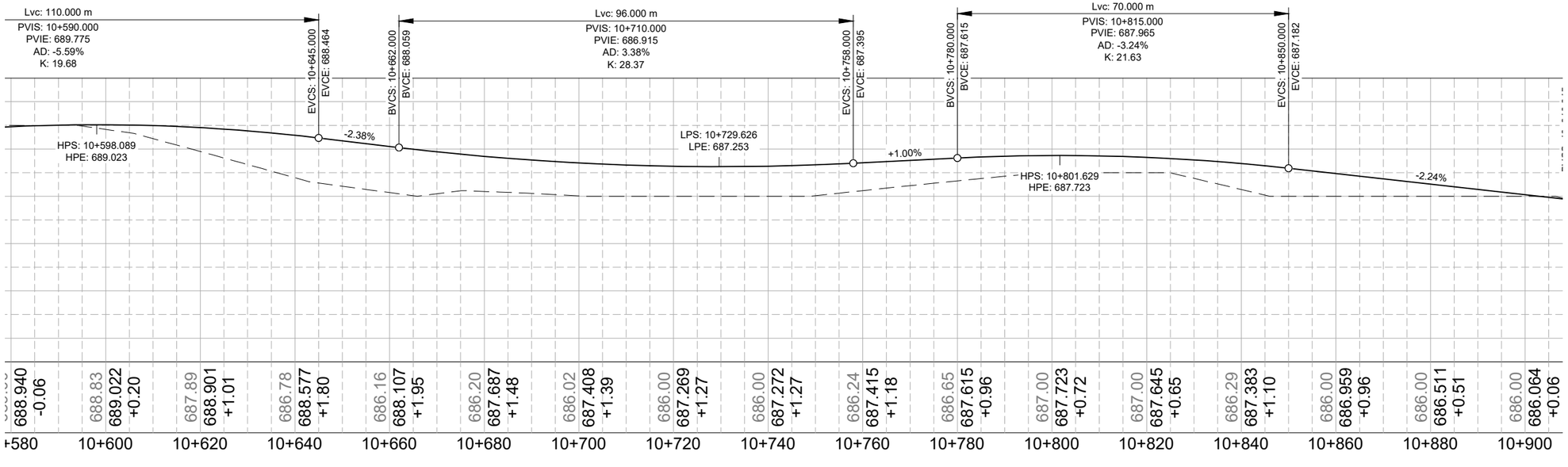
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1 PLAN 1:1000



2 PROFILE H 1:1000, V 1:200

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FIGURE 4-4

CITY OF ST. ALBERT
NEIL ROSS FUNCTIONAL ALIGNMENT STUDY

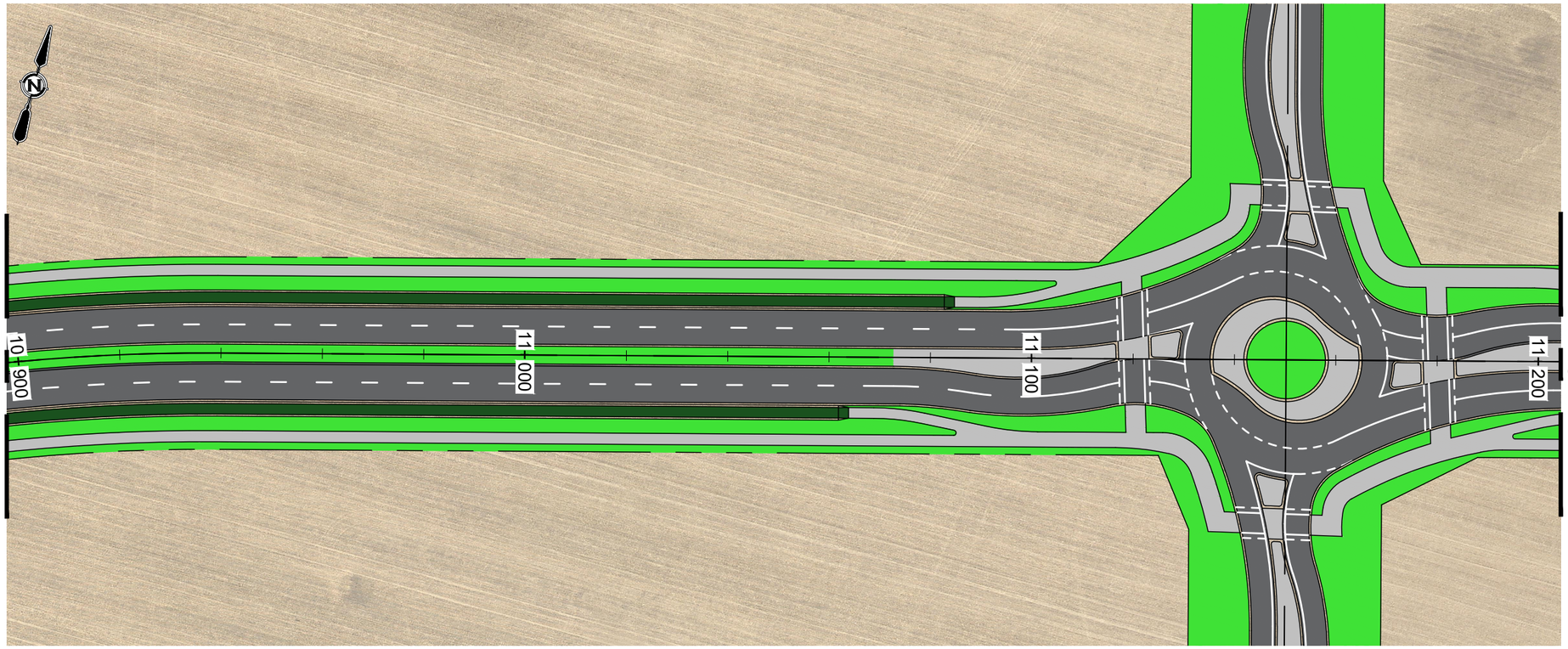
CIVIL
PREFERRED ALIGNMENT
STA 10+600 TO STA 10+900

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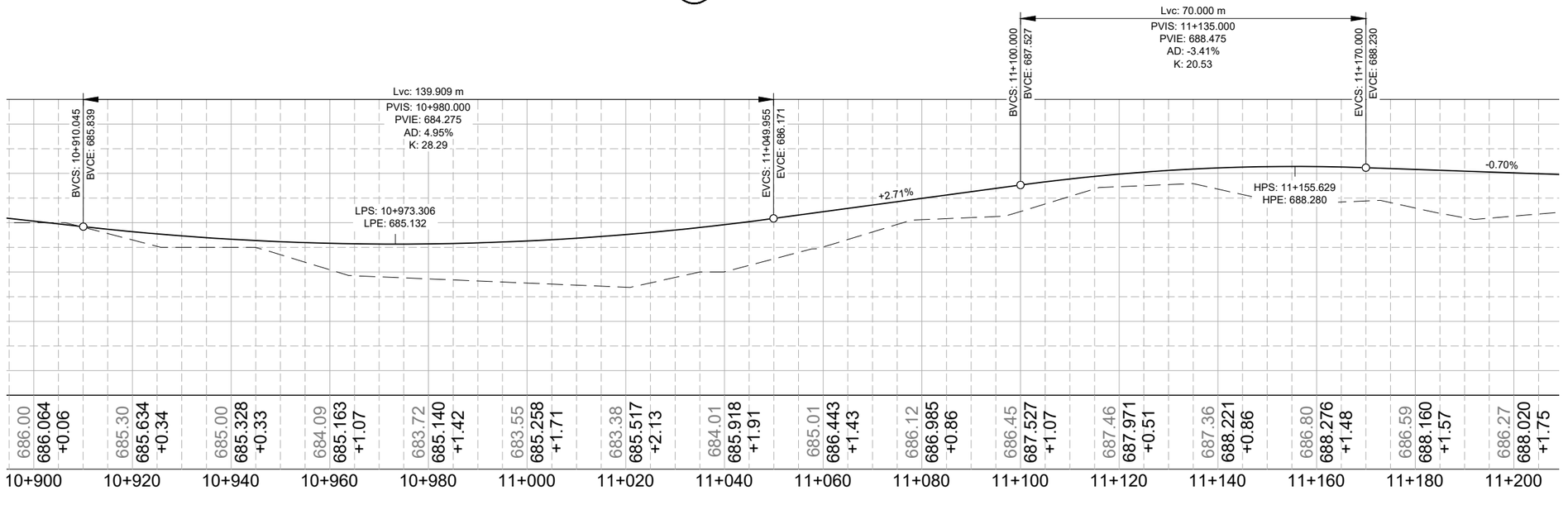
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1 - PLAN 1:1000



2 - PROFILE H 1:1000, V 1:200

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FIGURE 4-5

CITY OF ST. ALBERT
NEIL ROSS FUNCTIONAL ALIGNMENT STUDY

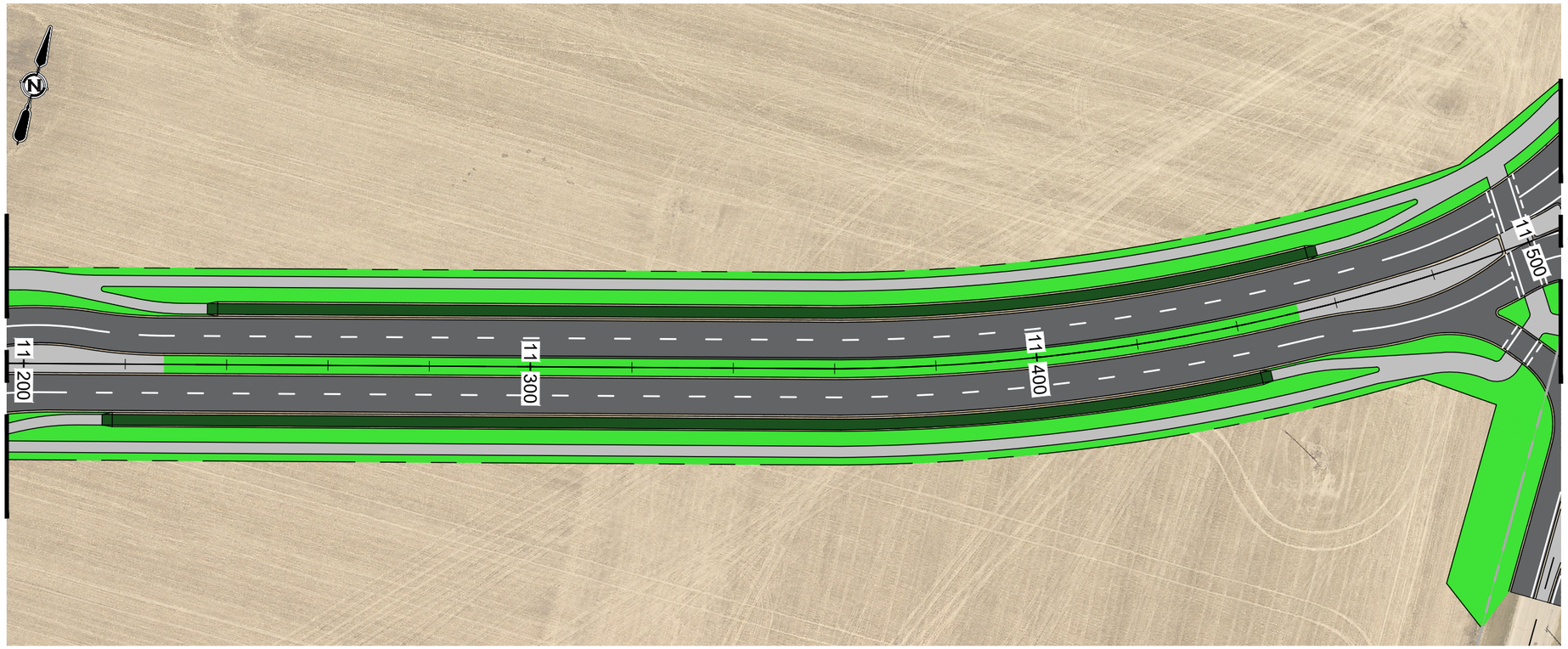
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STA 10+900 TO STA 11+200

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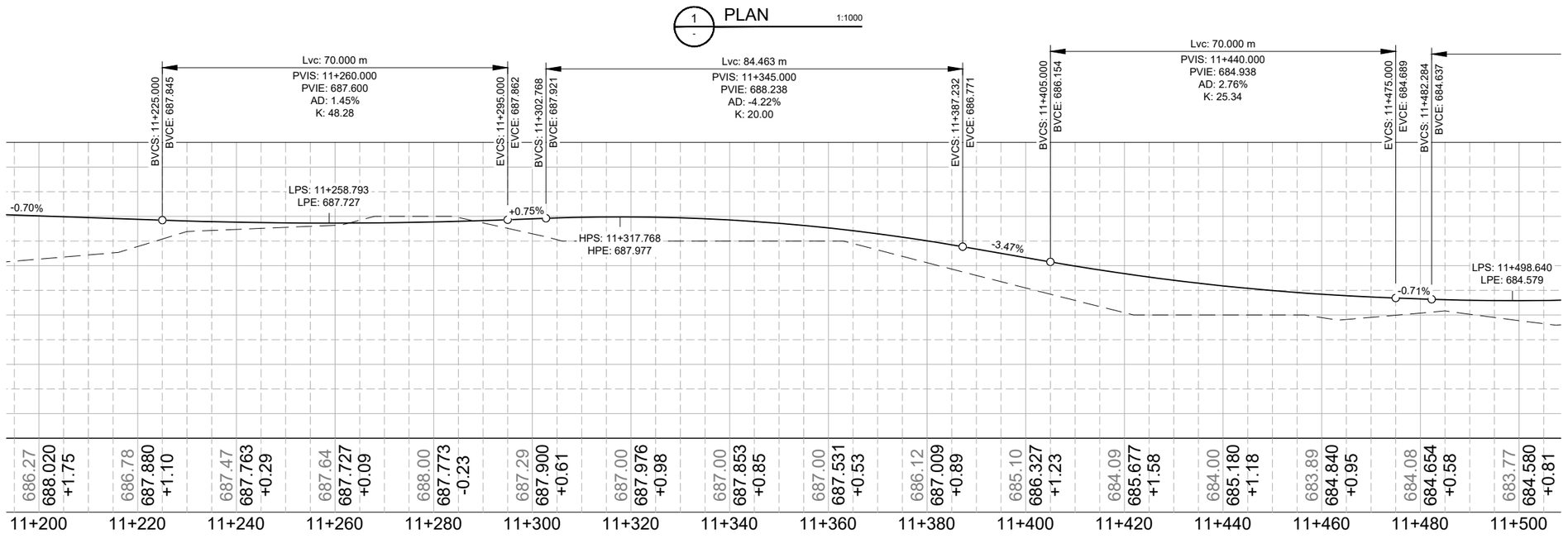
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25 mm

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1 - PLAN 1:1000



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FIGURE 4-6

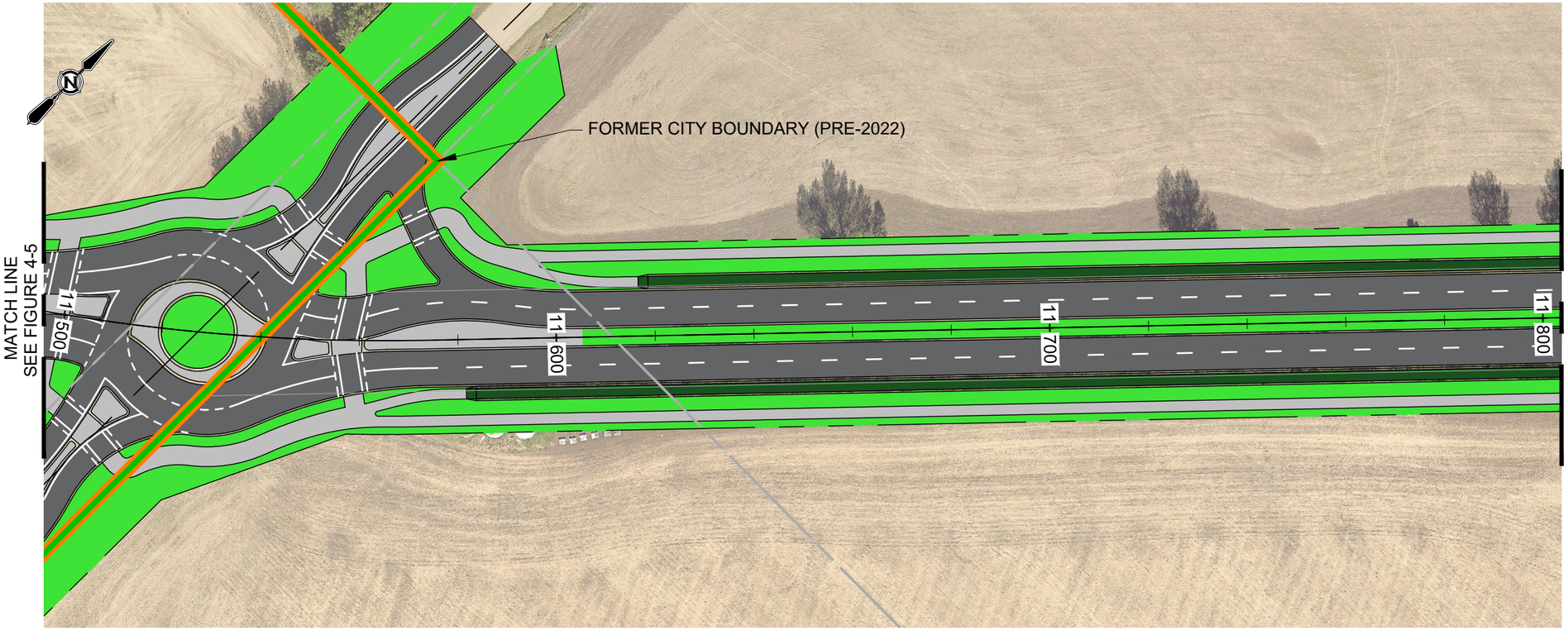
CITY OF ST. ALBERT
NEIL ROSS FUNCTIONAL ALIGNMENT STUDY

CIVIL
PREFERRED ALIGNMENT
STA 11+200 TO STA 11+500

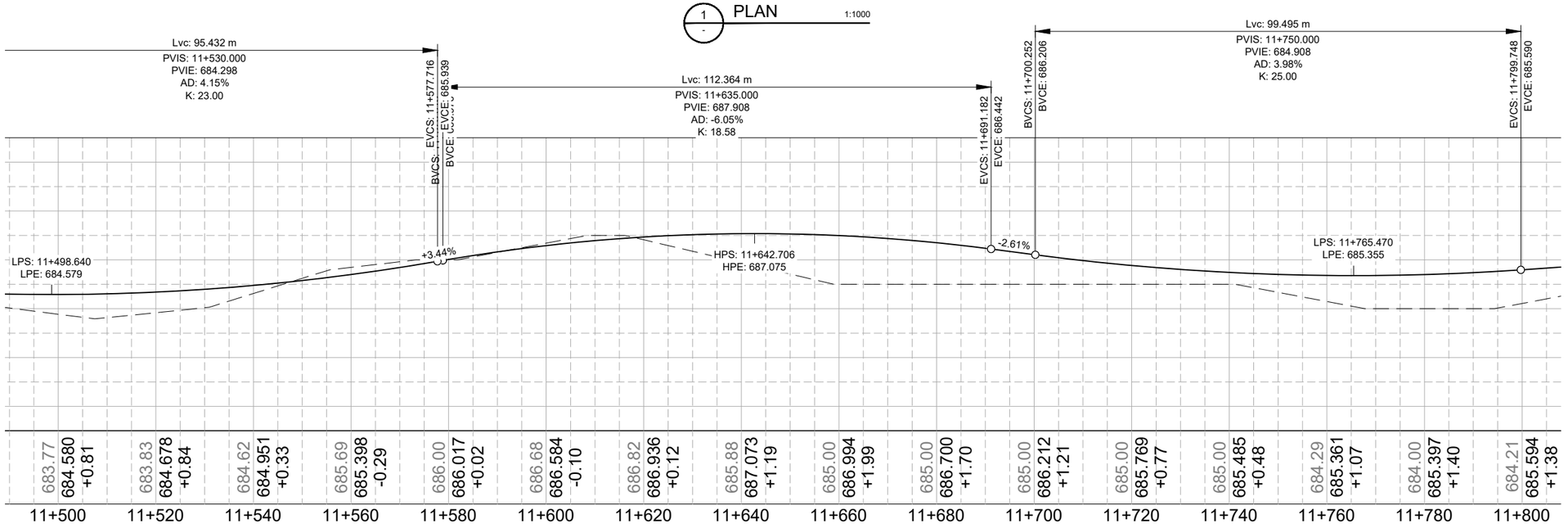
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1 PLAN 1:1000



2 PROFILE H 1:1000, V 1:200

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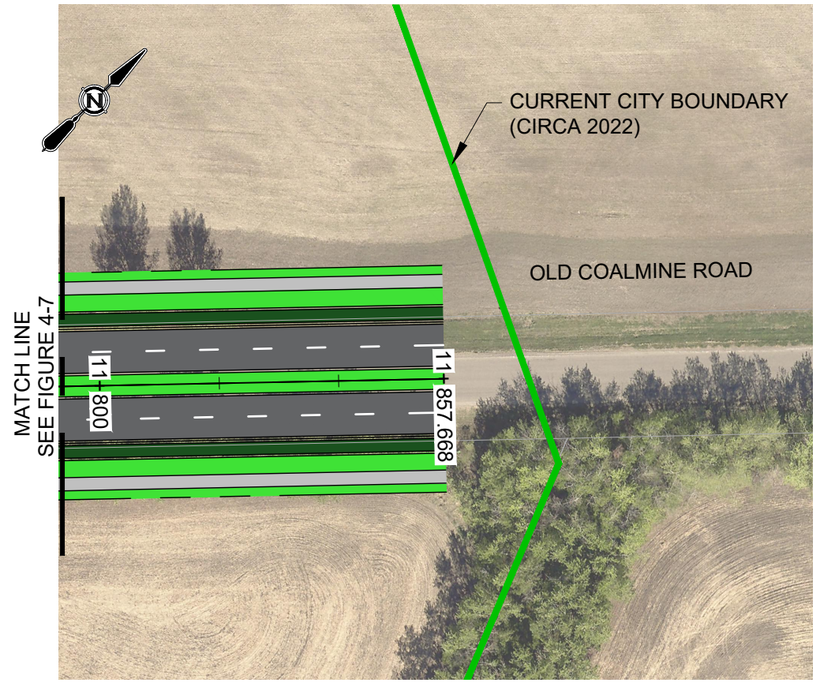
FIGURE 4-7

CITY OF ST. ALBERT
NEIL ROSS FUNCTIONAL ALIGNMENT STUDY

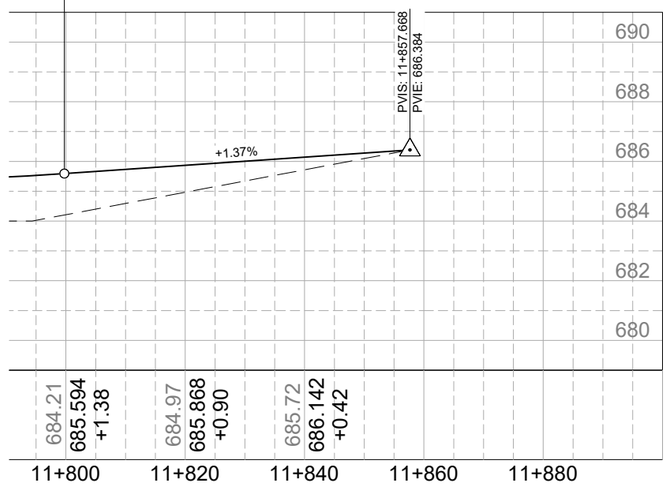
CIVIL
PREFERRED ALIGNMENT
STA 11+500 TO STA 11+800

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DATE	2022APR13
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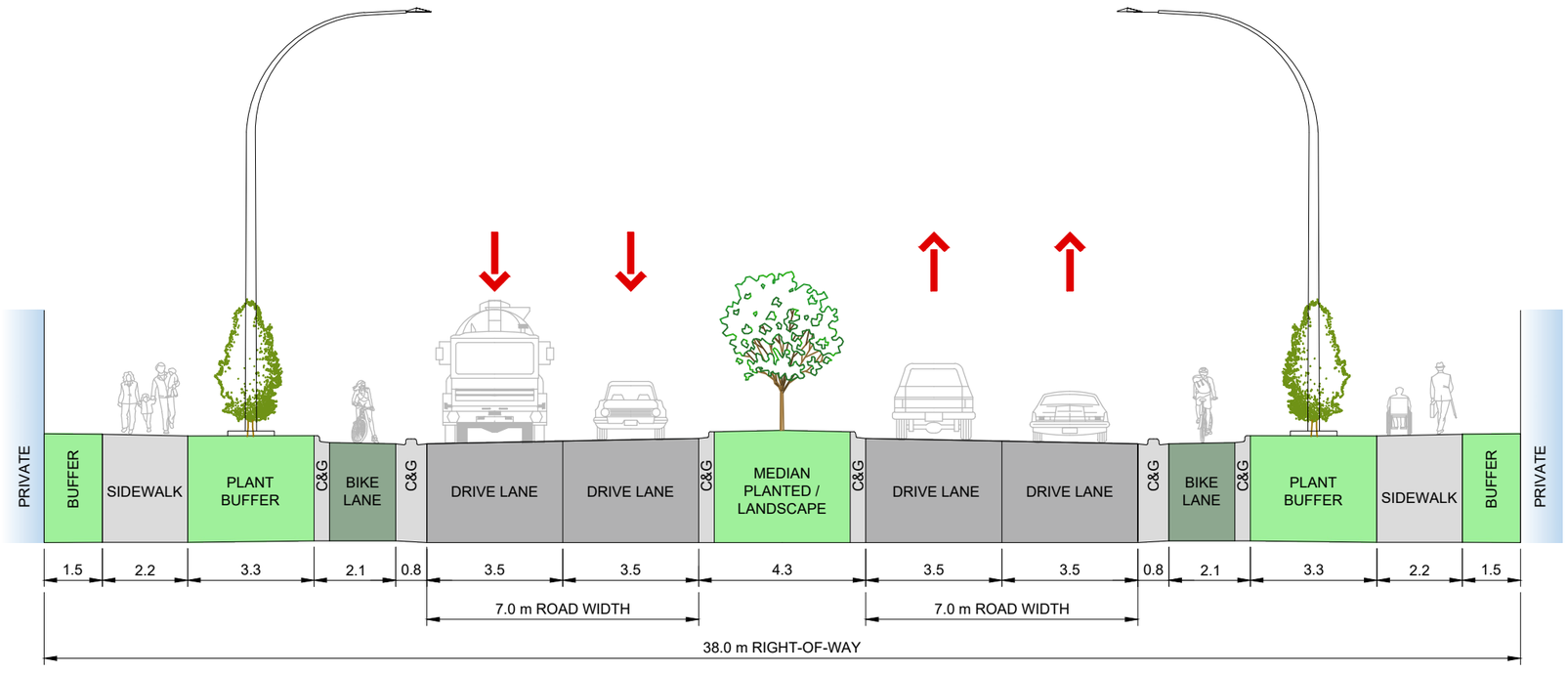
FIGURE 4-8

CITY OF ST. ALBERT
NEIL ROSS FUNCTIONAL ALIGNMENT STUDY

CIVIL
PREFERRED ALIGNMENT
STA 11+800 TO STA 11+880

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FIGURE 4-9

CITY OF ST. ALBERT
NEIL ROSS FUNCTIONAL ALIGNMENT STUDY

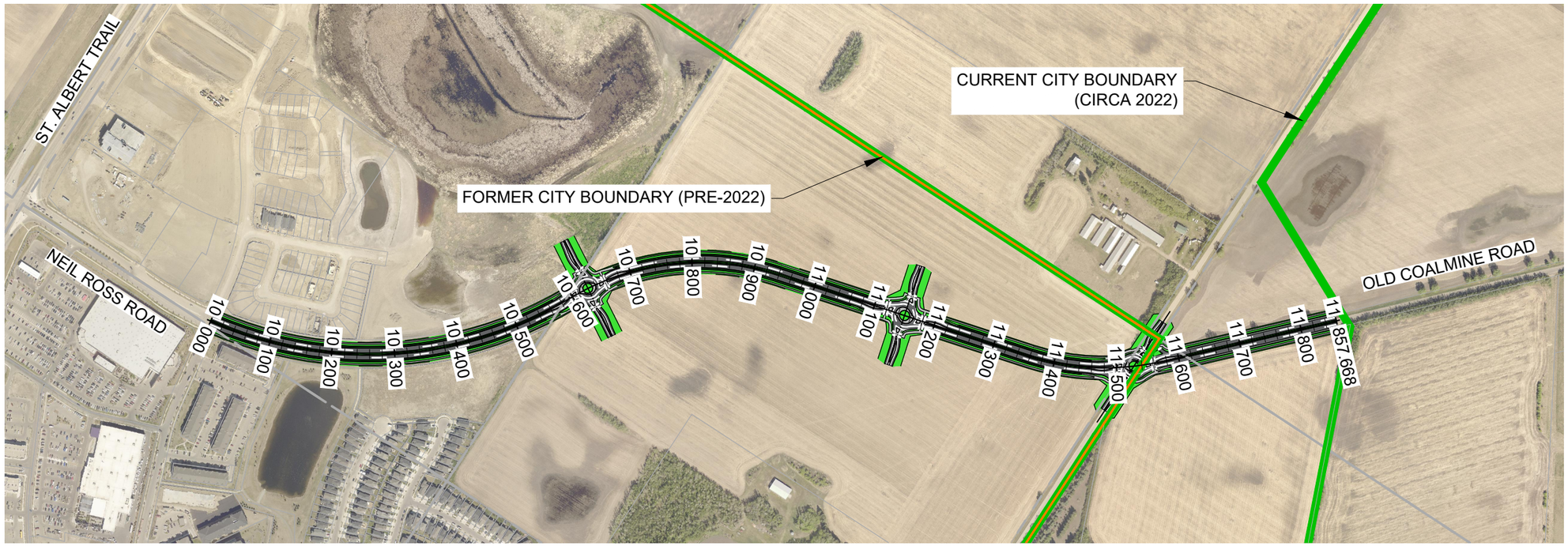
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TYPICAL SECTION

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FOR INFORMATION ONLY

FIGURE 4-10

CITY OF ST. ALBERT
NEIL ROSS FUNCTIONAL ALIGNMENT STUDY

CIVIL
PREFERRED ALIGNMENT
OVERALL LAYOUT

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4.4 Right of Way

The construction of Neil Ross Road will impact the land parcel SE-21-54-25-W4M. Based on consultation with the affected landowners, a secondary alignment was proposed for Option 1, where it was split into Options 1A and 1B. Option 1A followed the original selected alignment, and Option 1B more closely followed the north boundary of the quarter section. The proposed Option 1A would take up 3.94 ha of land area, whereas Option 1B would take up 4.53 ha. Option 1A would leave more land area available in the parcel to the north of the alignment at 15.8 ha, versus Option 1B would leave 5.4 ha of land north of the alignment. South of the alignment, Option 1A would provide 29.2 ha of area whereas Option 1B would provide 39 ha. Both options are shown with the change in available areas in Figure 4-11. As the landowners did not support, either option, the design team recommends continuing with Option 1A (original Option 1), based upon informing criteria and in acknowledgment that this is the option preferred by internal stakeholders and will be a lower cost than Option 1B.

IF NOT 25 mm ADJUST SCALES

SIZE OF LOT	OPTION A	OPTION B
6-SE21-54-25-W4 C. OF T 092 016 743	48.95 ha	
LAND PARCEL BELOW PROPOSED ALIGNMENT	29.23 ha	39.03 ha
LAND PARCEL OF PROPOSED ALIGNMENT	3.94 ha	4.53 ha
LAND PARCEL ABOVE PROPOSED ALIGNMENT	15.78 ha	5.39 ha

RANGE ROAD 253

OLD COALMINE ROAD

PRELIMINARY NEGOTIATED ANNEXATION AREA

ASSUMED 127 STREET ALIGNMENT

CITY OF ST. ALBERT BOUNDARY

NEIL ROSS ROAD EXTENSION - OPTION 1B

NEIL ROSS ROAD EXTENSION - OPTION 1A

POSSIBLE FUTURE ACCESS

FIXED START OF FUTURE NEIL ROSS ROAD

EXISTING NEIL ROSS RIGHT-OF-WAY

ST. ALBERT TRAIL

6
SE21-54-25-W4
C. OF T 092 016 743

7
SE21-54-25-W4. 1
C. OF T 062 088 733
16.21 ha

DRAFT DESIGN CONCEPT
Stantec APRIL 2009

BELLEROSE DRIVE

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Cultivate Life

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DRAFT

FIGURE 4-11

CITY OF ST. ALBERT
NEIL ROSS FUNCTIONAL ALIGNMENT STUDY

CIVIL
CONCEPTUAL ALIGNMENT

5 PRELIMINARY COST ESTIMATE

A preliminary cost estimate was completed for the design and construction of Neil Ross Road for two options:

- Staged construction as a two-lane roadway followed by expansion to four lanes: $25,090,000 +/- 30%.
- Construction as a four-lane roadway initially: $23,640,000 +/- 30%

The variance between the two construction options is expected to be around 6%, with the initial 4-lane construction option being lower.

The breakdown of both options is shown in Table 5-1.

Table 5-1
Neil Ross Road Class 'C' Cost Estimate

Item	Quantity	Unit Cost	Unit	Cost
Preliminary Work:				
Land acquisition	9.74	$90,000	acre	$880,000
Additional studies:				
Wetland Delineation (may be applicable and would include field delineation, a crown claim letter, Wetland Assessment Impact Report, and submission of a Water Act Approval)				$21,000
Environmental Permitting: Historical Resources Act, Environmental Protection and Enhancement Act				$5,000
Geotechnical Investigation				$25,000
			Subtotal:	$931,000
Staged Construction from 2-lane to 4-lane:				
Initial 2-lane construction:				
2-lane arterial (interim)	1.86	$3,250,000	km	$6,045,000
Roundabout for arterial roadways, 1-lane	3	$2,500,000	each	$7,500,000
Preliminary engineering				$136,000
Detailed design				$268,000
Construction administration				$512,000
			Subtotal:	$14,461,000
Expansion from 2-lane to 4-lane construction costs:				
Expansion to divided 4-lane arterial (ultimate)	1.86	$3,250,000	km	$6,045,000
Expansion to 2-lane roundabout (arterial)	3	$300,000	each	$900,000
Preliminary engineering				$70,000

Item	Quantity	Unit Cost	Unit	Cost
Detailed design				$138,000
Construction administration				$263,000
			Subtotal:	$7,415,000
		Subtotal Entire Staged Construction:		$21,875,000
Initial 4-lane Construction:				
Divided 4-lane arterial	1.86	$6,500,000	km	$12,090,000
2-lane roundabout for arterial roadways	3	$2,500,000	each	$7,500,000
Preliminary engineering				$205,000
Detailed design				$370,000
Construction administration				$390,000
		Subtotal Initial 4-lane Construction:		$20,555,000
		Total Staged Construction (with 10% contingency):		$25,090,000
		Total 4-lane Initial Construction (with 10% contingency):		$23,640,000

[1]Costs are based on Crosstown Residential Cross-Section, including: concrete sidewalks, planting strip, trees, illumination, curb and gutter, bike lanes, 4 roadway lanes (2 bus and 2 drive lanes), planting strip and storm drainage under planting strip

[2] Construction costs for roundabout expansion are based on stripping, paving, and concrete work

6 NEXT STEPS

The functional alignment study's completion has provided the general alignment for Neil Ross Road from its current location to the City boundary. The study included background data reviews, stakeholder consultation, traffic analysis, review of design standards and desktop reviews for environmental, geotechnical and drainage.

The next step would be to advance the study to the preliminary engineering phase, reinforcing the alignment and design. The preliminary engineering would involve the following items:

- Completing a field geotechnical investigation requiring drilling of test holes to determine soil conditions accurately. It would also provide a surfacing strategy.
- Discussions with the landowners should continue to obtain access for further required testing and evaluation, and for eventual land acquisition.
- A Phase I ESA for the alignment to determine the potential for environmental concerns. Depending on Phase I results, a Phase II ESA may be recommended, which would involve soil and groundwater sampling.
- Due to the proximity of one wetland to the tie-in point of the existing Neil Ross Road to the future alignment, wetland delineation may be required, depending on whether the wetland is removed or altered with the development.
- A survey of the alignment area to be used for finalizing the exact alignment and design.
- Contacting the utility holders to determine any special design requirements and permits.
- Preliminary geometric design and safety assessment.

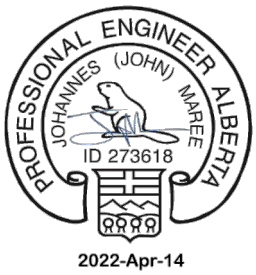
This preliminary engineering work would cement the alignment and allow for appropriate land acquisition which may then advance detailed design, preparation of a tender package and future construction.

CLOSURE

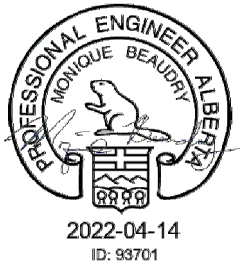
This report was prepared for the City of St. Albert to provide a functional alignment study for the expansion of Neil Ross Road to 127 Street.

The services provided by Associated Engineering Alberta Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

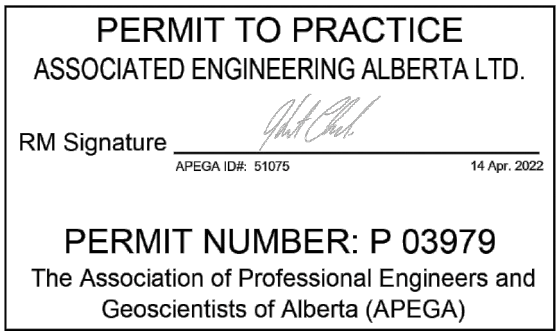
Respectfully submitted,
Associated Engineering Alberta Ltd.



John Maree, P.Eng., M.Eng.
Transportation Engineer



Monique Beaudry, P.Eng., RPP
Senior Transportation Planning Engineer



APPENDIX A – ENVIRONMENTAL OVERVIEW

Associated Engineering | GLOBAL PERSPECTIVE. LOCAL FOCUS.

REPORT

City of St. Albert

Neil Ross Functional Alignment Study Environmental Overview



NOVEMBER 2019

A Carbon Neutral Company

CANADA BEST MANAGED COMPANIES Platinum member

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1 INTRODUCTION

A Functional Alignment Study is being completed by Associated Engineering to evaluate options for the extension of Neil Ross Road located northeast of St. Albert, Alberta. Two alignment options are being evaluated and a 30 m buffer has been applied to each alignment to define the project area reviewed for this report (**Figure 1-1**). Option 1 is approximately 1.4 km long and extends east from Neil Ross Road, crossing Range Road 253 and curves to the north where it merges with Range Road 252B. Option 2 is approximately 2.0 km in length and extends northeast from Neil Ross Road, crossing Township Road 544 and merging into Range Road 253. Baseline environmental features were reviewed within a study area, which includes the lands encompassing both options (**Figure 1-1**) to accommodate for potential changes in the final road alignment **Table 1-1** provides a summary defining the project area and study area.

Table 1-1
Summary of Study Area and Project Area

Area	Definition
Project Area	A 30 m buffer around the center of each option where permanent project impacts are anticipated.
Study Area	The lands encompassing both option options where environmental features were evaluated.

This Environmental Overview (EO) is intended to support the Functional Alignment Study and concept level project planning by identifying environmental sensitivities as well as the potential regulatory approvals, notifications, and/or permits that are anticipated for the project.

2 METHODS

2.1 Desktop Review

Environmental sensitivities throughout the project area were identified through a desktop investigation. The desktop investigation included review of publicly available aerial imagery and searches of government databases. Sources of information included:

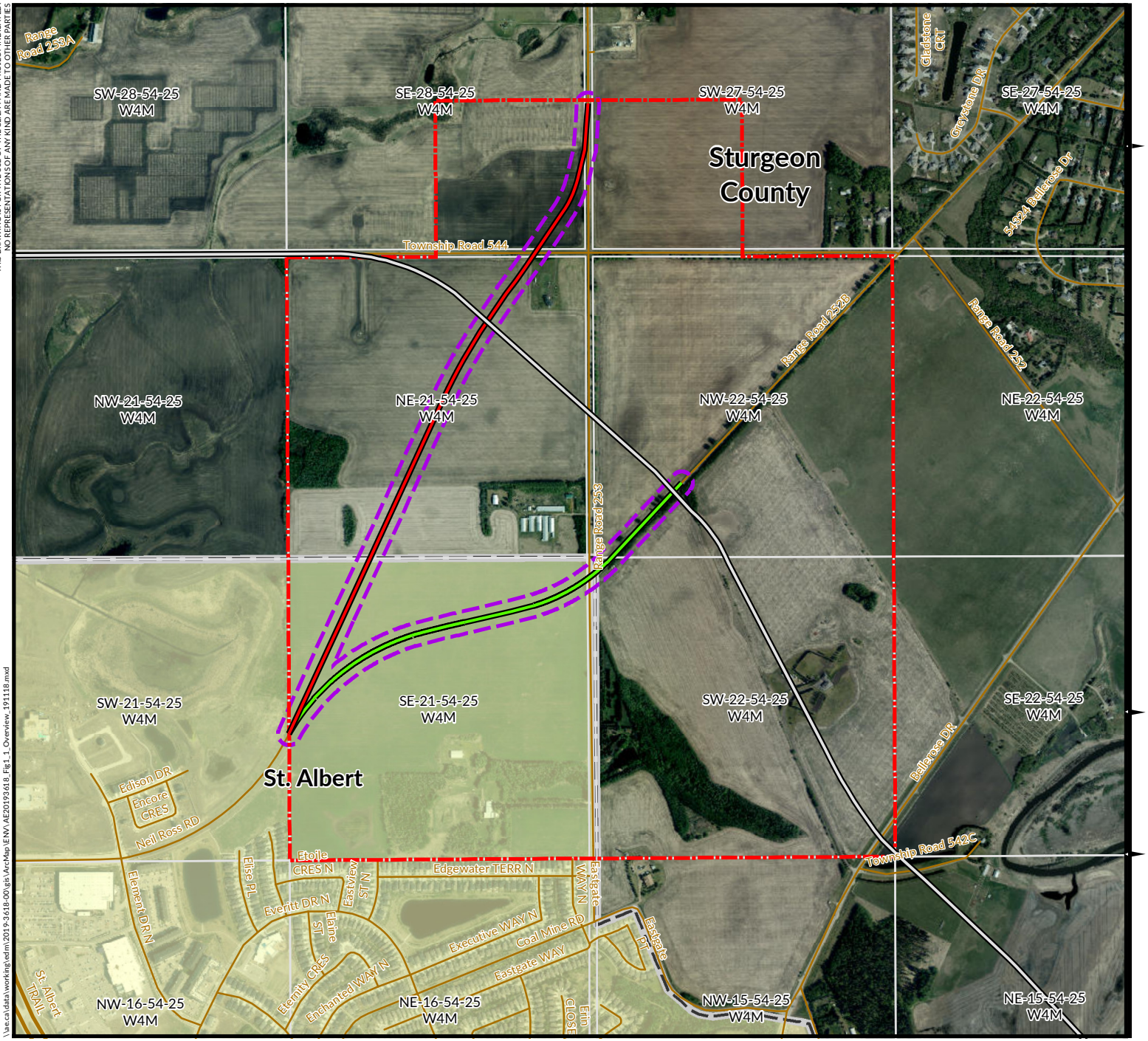
1) Government databases:
   - Agricultural Region of Alberta Soil Inventory Database (AGRASID) (Alberta Agriculture and Forestry 2019);
   - Alberta Conservation Information Management Systems (ACIMS) (Alberta Parks 2019); and
   - Fisheries and Wildlife Management Information System (FWMIS) (Alberta Environment and Parks 2019a).

2) Spatial data layers:
   - Abadata 2.0 (Abacus Datagraphics 2019);
   - Alberta Environment and Parks' wildlife sensitivity data sets (Alberta Environment and Parks 2019b); and
   - Alberta ArcHydro Phase 2 (Alberta Environment and Parks 2019c).

2.2 Wetland Delineation and Classification

In order to identify and map coarse wetland boundaries, historical aerial photography representing both wet and dry years was reviewed. Precipitation data were obtained through Alberta Agriculture and Rural Development AgroClimatic Information Service (Government of Alberta 2016). Relative wetness was assessed yearly and monthly using precipitation data from 1955 to 2018. From 1955 to 2018, data were ranked from highest to lowest amount of precipitation and grouped into wet, normal or dry years. The same approach was used for assessing relative wetness for the monthly precipitation data.

Desktop wetland delineation was completed through satellite and aerial photo interpretation using black and white aerial imagery from Alberta Environment and Parks (AEP) for the years 1969, 1970, 1971, 1979, 1987, 1993, 1994, 2007 (Alberta Environment and Parks 2019d); and more recent satellite images from Google Earth for the years 2004, 2008, 2011, 2012, 2013, 2014, 2015, 2016, 2017 (Google Earth Pro 2019). The desktop delineation methods followed the *Alberta Wetland Identification and Delineation Directive* (Government of Alberta 2015a). Images were interpreted for changes in vegetation, evidence of soil saturation or inundation, and variations in topography. Approximate wetland boundaries were created using ArcGIS. Wetland classification was completed for all wetlands delineated on the property, based on the *Alberta Wetland Classification System* (Government of Alberta 2015b).



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Associated Engineering

City of St. Albert Cultivate Life

Legend

- Option 1 Alignment
- Option 2 Alignment
- Assumed 127 Street Alignment
- Project Area
- Study Area
- Road
- City of St. Albert
- Rural Municipal District

0 100 200 300 400 500 m



FIGURE 1-1
Project Overview

City of St. Albert
Neil Ross Road Functional Alignment Study

AE PROJECT No.	2019-3618
DATE	2022 MARCH
SCALE*	1:15,000
COORD. SYSTEM	NAD 1983 3TM 114
REV	0
DESCRIPTION	ISSUED FOR DRAFT
DRAWN BY	WL
CHECKED BY	JL

ESRI World Imagary: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community; Roads: Statistics Canada, 2018; City: Altalis Ltd., 2019; Muncipal District: Altalis Ltd., 2018.

3 BASELINE ENVIRONMENTAL FEATURES

3.1 Land Use

The portions of the project area in SE 21-054-25 W4M are in the City of St. Albert. Aerial imagery reveals that these lands are currently used for agriculture. The portions of the project area in NE 21-054-25 W4M and W½ 22-054-25 W4M are in Sturgeon County. Currently, these lands are also primarily used for agriculture; however, there is also existing and historical oil and gas infrastructure (**Figure 3-1**).

3.2 Soils and Landform

The study area is in Soil Correlation Area 10 (Pedocan Land Evaluation Ltd. 1993), within the Thick Black Soil Zone of central Alberta. A search of the Agricultural Region of Alberta Soil Inventory Database (AGRASID) identified soils in the area as predominantly Eluviated Black Chernozems (Alberta Agriculture and Forestry 2019). Gleysolic soils likely occur in wetland areas. The landform is low relief – undulating with a slope gradient of 2% (Alberta Agriculture and Forestry 2019).

Soils in the agricultural lands are at high risk of being contaminated with clubroot, as fields in the Edmonton and Sturgeon County areas have been identified as areas with a risk of high levels of clubroot infestation (Government of Alberta 2019).

3.3 Surface Water Features

The headwaters of a small tributary to the Sturgeon River extend slightly into the eastern boundary of the study area; however, it is located over 200 m away from the outer edge of the project area associated with Option 1 (**Figure 3-2**).

Based on a desktop assessment, eight wetlands occur within the study area (**Figure 3-2**). **Table 3-1** provides a summary of the classification of these wetlands based on the *Alberta Wetland Classification System* (Government of Alberta 2015). All wetlands were classified as temporary graminoid marshes (MGII), except for wetland W1, which was classified as a seasonal graminoid marsh (MGIII). Three dugouts were also identified within the study area. A review of historical aerial imagery determined that these areas were not historically wet or hydrologically connected to a wetland. Therefore, these dugouts are not subject to the *Alberta Wetland Policy* (Environment and Sustainable Resource Development 2013).

Table 3-1
Wetlands Within the Study Area

Wetland Identification	Alberta Wetland Class	Area (ha)	Quarter Section
W1	MGIII	39.5	01-28-54-25-W4M 02-28-54-25-W4M 07-28-54-25-W4M 08-28-54-25-W4M 03-21-54-25-W4M 05-21-54-25-W4M 06-21-54-25-W4M 11-21-54-25-W4M 14-21-54-25-W4M
W2	MGII	0.34	06-21-54-25-W4M

Wetland Identification	Alberta Wetland Class	Area (ha)	Quarter Section
			10-21-54-25-W4M 11-21-54-25-W4M
W3	MGII	0.03	15-21-54-25-W4M
W4	MGII	0.22	14-21-54-25-W4M
W5	MGII	0.57	02-21-54-25-W4M
W6	MGII	0.14	10-21-54-25-W4M 11-21-54-25-W4M
W7	MGII	1.06	12-22-54-25-W4M
W8	MGII	0.28	12-22-54-25-W4M
Dugout 1	N/A; Created in 2008	0.08	01-21-54-25-W4M
Dugout 2	N/A; Created between 1969 and 1971	0.44	04-22-54-25-W4M
Dugout 3	N/A; Created between 1969 and 1971	0.42	06-22-54-25-W4M

3.4 Baseline Vegetation

As the majority of the lands within the study area are used for agricultural purposes, the vegetation is likely to consist mostly of agronomic crop species. Some of the agricultural lands may also be used as pasture, and these areas would likely support disturbance adapted grasses and forbs. In addition, there are five areas that have been identified as acreage/farmyards where the vegetation composition and structure appear to have been highly modified through development and landscaping. Given the amount of anthropogenic disturbance to these lands, there is a high probability that plant species regulated under the *Weed Control Act* (S.A. 2008, c. W-5.1) occur within the study area.

Several patches of natural forest occur throughout the study area. These forest patches appear to be dominated by deciduous trees and likely support many native plant species. As the study area is within the Central Parkland Natural Subregion of the Parkland Natural region, the dominant vegetation within the forest patches likely includes Trembling Aspen (*Populus tremuloides*), Saskatoon (*Amelanchier alnifolia*), Prickly Rose (*Rosa acicularis*), and Beaked Hazlenut (*Corylus cornuta*) (Natural Regions Committee 2006). Other species such as Bunchberry (*Cornus canadensis*), Wild Lily-of-the-valley (*Maianthemum canadense*), and Wild Sarsaparilla (*Aralia nudicaulis*) are common to the Central Parkland Natural Subregion (Natural Regions Committee 2006).

A search of the Alberta Conservation Information Management System database revealed that no rare plants have been previously recorded within the study area (Alberta Parks 2019). However, detailed vegetation assessments, including rare plant surveys, may not have been previously conducted within the study area and therefore the available information at a desktop level may be limited. There is potential that natural forest patches may contain rare plant species, as 20% of Alberta's rare vascular plant species occur in the Parkland Natural Region (Natural Regions Committee 2006).

3.5 Wildlife

Wildlife Sensitivity Maps show that the study area is located within the Sensitive Raptor Range for Bald Eagle (*Haliaeetus leucocephalus*), and within the Sharp-tailed Grouse (*Tympanuchus phasianellus*) range (Alberta Environment and Parks 2019a). Bald eagles are found near rivers and lakes and nest at the tops of tall trees (Cornell Lab of Ornithology 2019) and as such there is low potential for bald eagle to nest within the study area. Sharp-tailed grouse leks typically occur in open areas with short, sparse vegetation within landscapes dominated by agricultural production (Stavne 2006). However, detailed FWMIS data did not reveal any occurrences of sharp-tailed grouse within the study area or surrounding areas and given the close proximity of the study area to St. Albert and the disturbed nature of the lands the presence of a sharp-tailed grouse lek within the study area is unlikely.

Table 3-2 provides a summary of wildlife species of conservation concern that have been previously documented within 5 km from the study area (Alberta Environment and Parks 2019b).

Natural forest stands and wetlands within the study area provide valuable habitat for bird nesting. Certain bird species that are more tolerant of human activity may nest in trees and shrubs within acreage/farmyard areas. The study area is in the B4 Nesting Zone for migratory birds, which has a nesting period from mid April to late August (Government of Canada 2018). In Alberta, some non-migratory birds are known to nest prior to mid April. For example, Great Horned Owl (*Bubo virginianus*) nest in trees and may begin nesting as early as February (Salt and Salt 1976).

The eight wetland areas and existing dugouts provide potential breeding habitat for amphibians. There is potential for amphibian species of conservation concern, such as Canadian Toad (*Anaxyrus hemiophrys*), Western Toad (*Anaxyrus boreas*), and Barred Tiger Salamander (*Ambystoma mavortium*) to occur in these wetlands or dugouts.

Table 3-2
Wildlife Species Previously Documented Within 5 km of Study Area

Common Name (Scientific Name)	General Status of Alberta Wild Species[1]	*Wildlife Act*[2]	*Species at Risk Act*[3]	COSEWIC[4]	Nesting Habitat Requirements	Potential Nesting Habitat in Study Area
Bald Eagle (*Haliaeetus leucocephalus*)	Sensitive	NA	NA	Not at Risk	Nest in tall trees within forested areas adjacent to large water bodies, generally avoiding heavily developed areas (Cornell Lab of Ornithology 2019).	No – Unlikely to nest in forest patches within study area as they are not near to large water bodies and the surrounding landscape is heavily developed.
Eastern Kingbird (*Tyrannus tyrannus*)	Sensitive	NA	NA	NA	Nest in trees in open habitats (Cornell Lab of Ornithology 2019).	Yes – Natural forest patches, shelterbelts, and treed areas of acreages/farmyards.
Eastern Phoebe (*Sayornis phoebe*)	Sensitive	NA	NA	NA	Breed in wooded areas with suitable nesting sites, often near water. Natural nest sites include bare rock	Yes – Man made structures in the study area.

Common Name (Scientific Name)	General Status of Alberta Wild Species[1]	*Wildlife Act*[2]	*Species at Risk Act*[3]	COSEWIC[4]	Nesting Habitat Requirements	Potential Nesting Habitat in Study Area
					outcrops, but frequently nest on man-made structures such as eaves of buildings, bridges, culverts, and overhanging decks (Cornell Lab of Ornithology 2019).	
Great Blue Heron (*Ardea herodias*)	Sensitive	NA	NA	NA	Breeding colonies typically occur in isolated swamps or on islands near lakes and ponds bordered by forests (Cornell Lab of Ornithology 2019).	No –There is a lack of potential breeding habitat in the study area.
Sora / *Porzana carolina*	Sensitive	NA	NA	NA	Freshwater and brackish wetlands with cattail, sedges, and rushes (Cornell Lab of Ornithology 2019).	Yes – Wetlands in the study area.

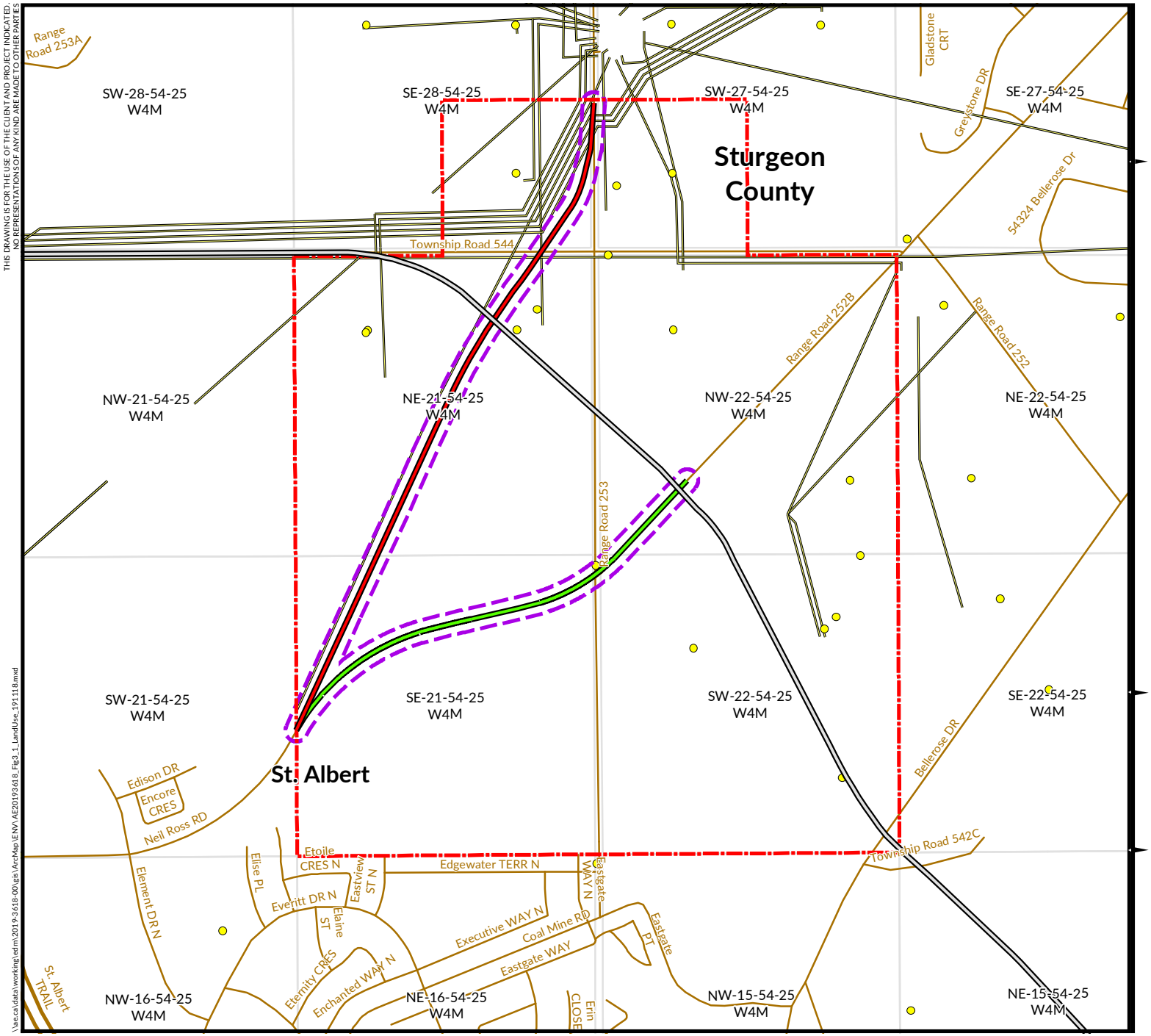
Source: [1] Alberta Wild Species General Status Listing - 2015 (Government of Alberta 2017)
[2] Wildlife Act, R.S.A. 2000, c. W-10
[3] Species at Risk Act, S.C. 2002, c. 29
[4] Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2017)

3.6 Potential Contamination

Potential sources of contamination within the study area and in adjacent lands include several existing, abandoned, and orphaned oil and gas infrastructure (e.g., wellsites and pipelines). A review of AbaData revealed multiple complaints and spills within the study area and neighbouring properties. Two active multi-well batteries (one gas multi-well battery and one crude oil multi-well proration battery) with several reported complaints and spills are located north of the study area in SW 27-054-25 W4M (Abacus Datagraphics 2019).

3.7 Historical Resources

A historical resources overview of the two options was completed by Circle CRM Group (**Appendix A**). Overall, the potential for either of the options to impact historical resources is low given the information from previous assessments and the terrain and topography of the study area.



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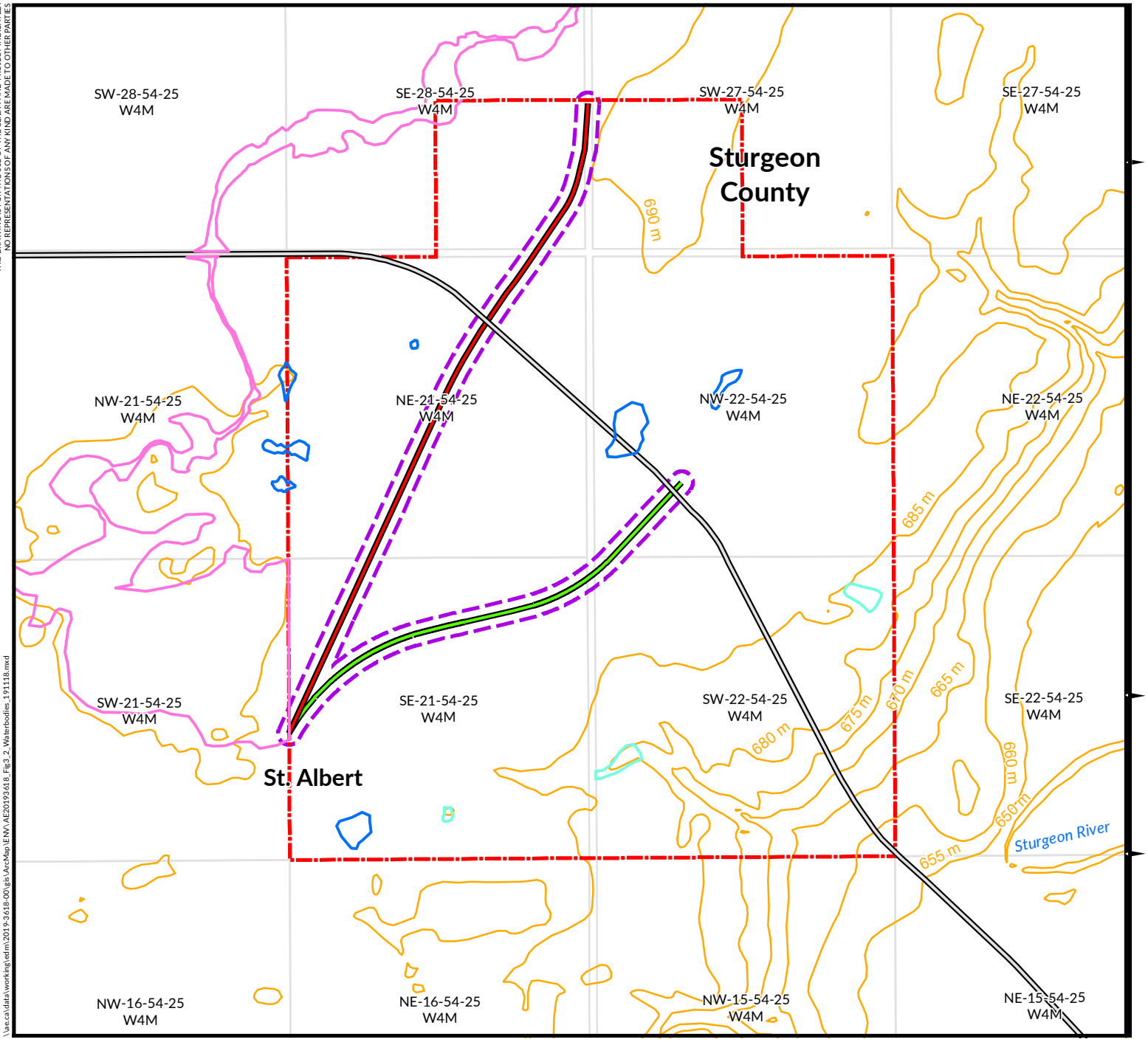
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FIGURE 3-1
Land Use

City of St. Albert
Neil Ross Road Functional Alignment Study

AE PROJECT No.	2019-3618
DATE	2022 MARCH
SCALE*	1:15,000
COORD. SYSTEM	NAD 1983 3TM 114
REV	0
DESCRIPTION	ISSUED FOR DRAFT
DRAWN BY	WL
CHECKED BY	JL

ESRI World Imagary: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community; Road: Statistics Canada, 2018; Existing Well and Pipeline: Alberta Energy Regulator, 2019; Muncipal District: Altalis Ltd., 2018; Land Use District: City of St. Alberta, 2019.



[redacted]

Legend

- Option 1 Alignment
- Option 2 Alignment
- Assumed 127 Street Alignment
- Project Area
- Study Area
- Contour Line
- Watercourse
- City of St. Albert
- Rural Municipal District
- Water Body

Approximate Wetland Boundary

- Dugout
- Temporary Graminoid Marsh (MG-II)
- Seasonal Graminoid Marsh (MG-III)

0 100 200 300 400 500 m

FIGURE 3-2
Water Bodies

City of St. Albert
Neil Ross Road Functional Alignment Study

AE PROJECT No.	2019-3618
DATE	2022 MARCH
SCALE*	1:15,000
COORD. SYSTEM	NAD 1983 3TM 114
REV	0
DESCRIPTION	ISSUED FOR DRAFT
DRAWN BY	WL
CHECKED BY	JL

ESRI World Imagary: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community; City: Altalis Ltd., 2019; Muncipal District: Altalis Ltd., 2018; Hydrography: Altalis Ltd., 1996; Contours: Altalis Ltd., 1994.

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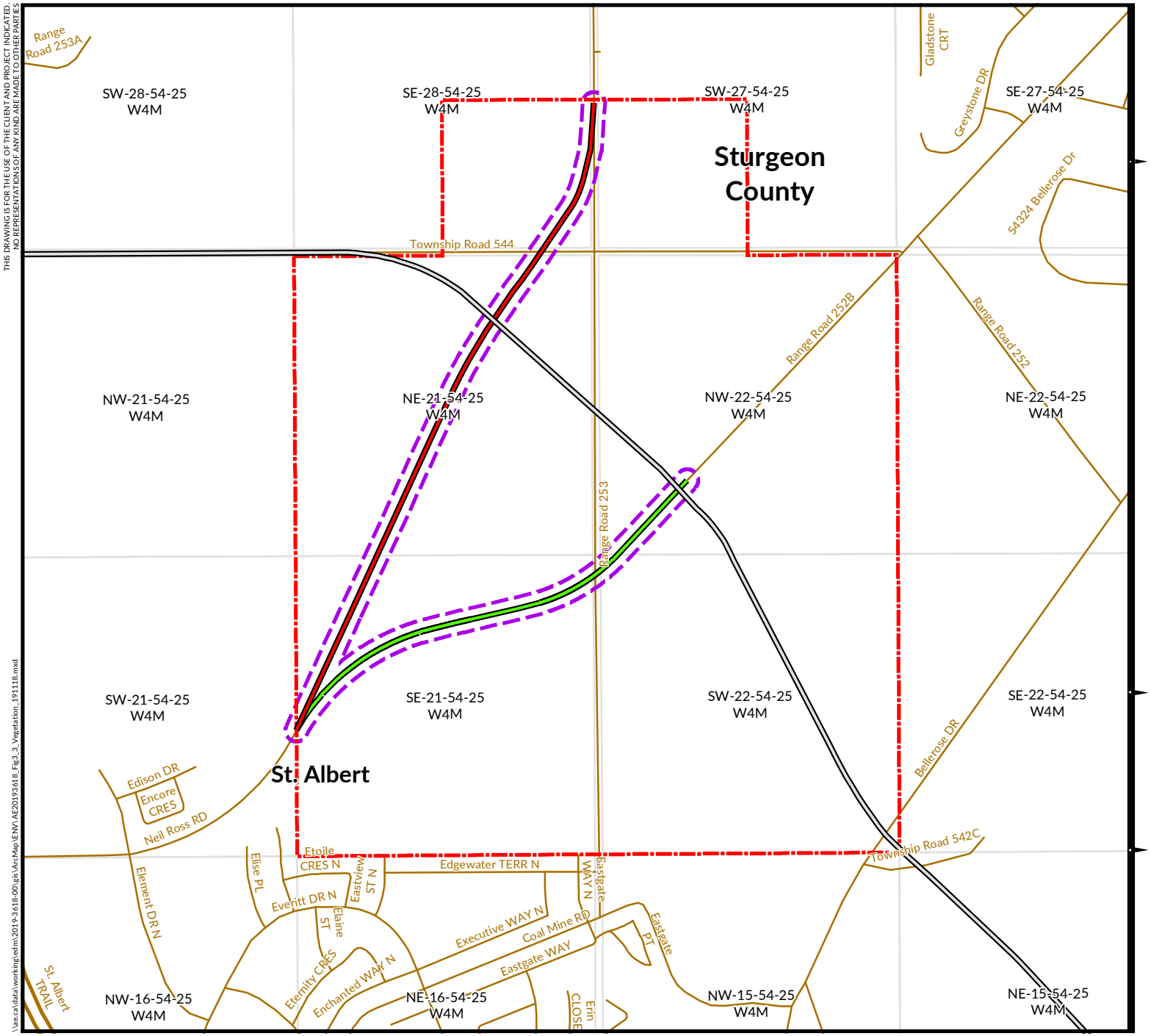


FIGURE 3-3
Baseline Vegetation

City of St. Albert
Neil Ross Road Functional Alignment Study

AE PROJECT No.	2019-3618
DATE	2022 MARCH
SCALE*	1:15,000
COORD. SYSTEM	NAD 1983 3TM 114
REV	0
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ESRI World Imagary: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community; Road: Statistics Canada, 2018; Muncipal District: Altalis Ltd., 2018; Historic Resource: Government of Alberta, 2019.

4 REGULATORY FRAMEWORK

Table 4-1 provides a summary of anticipated regulatory requirements for both options based on a review of environmental sensitivities and the current project area. The regulatory requirements should be revisited throughout the project planning and design as more details emerge.

Table 4-2 provides an overview of environmental legislation with recommendations and general practices to promote project compliance.

Table 4-1
Anticipated Regulatory Requirements for Both Alignment Options

Legislation	Requirement	Timing and Consideration
Historical Resources Act **R.S.A. 2000, c. H-9**	Approval from Alberta Culture, Multiculturalism and Status of Women (CMSW).	The typical review and timeline for Approval is 6 to 8 weeks. The project footprint, including limit of construction, is required as part of the application. It is not anticipated that a Historical Resources Impact Assessment will be required for either of the options.
Water Act **R.S.A. 2000, c. W-3**	Approval for permanent unavoidable impacts to Wetland 1.	Submission for approval at least 4 to 6 months prior to tender. Additional supplementary documents will be required to support an application for permanent wetland impacts including a Wetland Assessment Impact Report, ABWRET-A submission, public notice, and compensation.

Table 4-2
Environmental Legislation and Recommendations; and General Compliance Measures

Legislation	Recommendations and General Practices for Compliance
Provincial	
Agricultural Pests Act **R.S.A. 2000, c. A-8** Species with the potential to interfere with agricultural productivity are regulated under this Act.	• Follow applicable best management practices outlined in the Alberta Clubroot Management Plan (Government of Alberta 2014). • Incorporate these best management practices into the project-specific Environmental Construction Operations (ECO) Plan.
Environmental Protection and Enhancement Act **R.S.A. 2000, c. E-12** Activities with potential for environmental contamination are regulated under this Act.	• Complete a Phase I Environmental Site Assessment for the selected alignment during the preliminary design phase of the project. • Develop and implement site-specific Environmental Construction Operations (ECO) Plan and Erosion and Sediment Control (ESC) Plan prior to the start of construction.
Historical Resources Act **R.S.A. 2000, c. H-9** Archaeological and paleontological resources are regulated under this Act.	• Stop work and report discovery of any archaeological and paleontological resources to CMSW following standard reporting requirements (Appendix A).

Legislation	Recommendations and General Practices for Compliance
Soil Conservation Act **R.S.A. 2000, c. S-15** This Act imposes a duty upon every landholder to take appropriate measures to prevent soil loss or deterioration, or to mitigate the same where it has occurred.	• Develop and implement ECO and ESC Plans.
Weed Control Act **S.A. 2008, c. W-5.1** This Act regulates the specific weed species that are listed in Schedule 1 (prohibited noxious weeds) and Schedule 2 (noxious weeds) of the Act.	• Ensure equipment arrives on site in clean condition. • Use certified weed-free seed mix for any revegetation activities. • Destroy any prohibited noxious weeds and control noxious weeds.
Wildlife Act **R.S.A. 2000, c. W-10** Wilful molestation, disruption, or destruction of wildlife, or a house, nest, or den of wildlife, is prohibited under this Act.	• Conduct vegetation clearing activities outside of migratory and non-migratory bird nesting periods (mid February to late August). • Consult with a qualified environmental professional if vegetation clearing activities must be completed within bird nesting period. • Follow appropriate mitigation strategies to prevent/minimize potential human-wildlife interactions during construction activities. If an active nest or den is discovered, stop work and consult a qualified environmental professional.
Federal	
Migratory Birds Convention Act, 1994 **S.C. 1994, c. 22** This Act protects migratory birds, their eggs, and their active nests.	• Minimize the need for removal of vegetation in natural forest patches, wetlands, and treed/shrubby areas during planning of project area. • Conduct vegetation clearing activities outside of migratory bird nesting period (mid April to late August). • Consult with a qualified environmental professional if vegetation clearing activities must be completed within migratory bird nesting period and complete a pre-construction nest survey, if required.
Species at Risk Act **S.C. 2002, c. 29** Activities with potential to impact species at risk/of concern and/or their habitat are regulated under this Act.	• If species at risk are encountered during project construction, work should be stopped, and the sighting should be reported and discussed with a qualified environmental professional.

5 PLANNING RECOMMENDATIONS

Based on the baseline environmental information and the project area associated with each of the options, there are no major differences between the two options in terms of impacts to environmental sensitivities or regulatory requirements. For both options it is recommended that key environmental features including wetlands, natural forest patches, and treed/shrubby habitats should be avoided, where possible, if there are changes to the alignment during design phases of the project. In addition, the regulatory requirements should be revisited throughout the design phases of the project to evaluate any potential changes.

At this stage of the project there are three key areas including wetlands, contamination, and historical resources that should be considered in planning the next phases of project. The planning considerations and associated recommendations are outlined below in detail.

Wetlands
It is recommended that permanent impacts to Wetland 1 are avoided, if possible, through planning and design of the selected alignment.

If permanent impacts to this wetland cannot be avoided the following actions should be completed in the preliminary and detailed design phases of the project:

1) Obtain qualified environmental professionals to complete a field delineation of Wetland 1 in the growing season (May to October) and at least 10 months prior to the planned construction start date.
2) Submit an application for *Water Act* Approval a minimum of 4 to 6 months prior to project tendering. Note that qualified environmental professionals will need to complete the following actions as part of the *Water Act* Approval application:
    a. ABWRET-A submission; and
    b. Wetland Assessment Impact Report
3) A crown claim determination should be submitted to the Provincial Water Boundaries Unit of AEP prior to submitting the application for *Water Act* Approval. Additional regulatory requirements under the *Public Lands Act* may be required if the project overlaps with the bed and shore of a wetland.

Contamination
During preliminary design a Phase I Environmental Site Assessment (ESA) should be completed to evaluate areas of potential environmental concern. Note that a Phase II ESA may be required based on the results of the Phase I ESA.

Historical Resources
An application for Approval under the *Historical Resources Act* should be submitted a minimum of 6 to 8 weeks prior to project tendering. The project footprint, including construction limits and disturbance depths, need to be finalized as these areas are required as part of the *Historical Resources Act* Approval submission.

Prior to project tendering, the compliance recommendations outlined in Table 4-2 should be reviewed and incorporated into construction planning documents, as applicable. Mitigation measures pertaining to clubroot, erosion and sedimentation, contamination and hazardous materials, historical resources, weed management, and vegetation clearing should be included as part of the project's ECO Plan.

CLOSURE

This report was prepared for the City of St. Albert to provide information pertaining to environmental sensitivities and regulatory considerations for planning the Neil Ross Road extension.

The services provided by Associated Engineering Alberta Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
Associated Engineering Alberta Ltd.



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Environmental Scientist



April Ziegler, P. Biol.
Environmental Scientist

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APPENDIX A - HISTORICAL RESOURCES OVERVIEW

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MEMO

Date: November 15, 2019

To: April Ziegler
Associated Environmental Consultants Inc.

From: Kristin McKay
Circle CRM Group Inc.

Project: **City of St. Albert**
Neil Ross Road

Subject: **Historic Resources**

As per the above-noted project, please find below requested information with regard to historic resources. Please note that this information is current as of November 15, 2019 and may require updating depending upon the date of submission.

Project Scope

The City of St. Albert is seeking to extend the existing Neil Ross Road in the northeastern portion of the city; two alignment options are proposed. Both road options originate at the existing terminus of Neil Ross Road and extend northeast for 320-m, at which point Option 1 heads in a more northerly direction for 1.796 km and connects to Range Road 253, just north of Township Road 544. Option 2 remains in a general north-easterly direction for 1.981 km and intersects with Old Coalmine Road. The final alignment of the road options has not been finalized; therefore, the City of St. Albert has requested a 30-m buffer to account for minor alignment changes. The majority of the road work will be limited to surface disturbance at depths less than one metre. However, associated utility work will require deeper disturbance, possibly to depths of four metres. All ground disturbance will remain within the proposed 30-m buffer of the chosen alignment.

Historic Resources

Preliminary analysis shows that Project lands have been assigned a Historic Resource Value (HRV) of 5 for archaeology (High Archaeological Resource Sensitivity Zone) (October 2019). There are no known archaeology sites, palaeontological sites or Traditional Use Sites within 1 km of the Project. There are, however, four known Historic Sites within 1 km of the Project. These include two barns (HS 51400 and HS 2266) and two single residence dwellings (HS 2264 and 2265). One of the barns (HS 51400) was recorded in the SW of 21-54-25-W4M and review of ESRI World Imagery shows the affected quarter section has been cleared and construction of new buildings has taken place. The site was likely destroyed during the land clearing. One of the single dwelling residences (HS 2264) was recorded to the Section level only in Sec. 22-54-25-W4M. Review of ESRI World Imagery shows the Project traverses cultivated fields, well removed from visible residential yards

in this Section; therefore, the site will likely not be impacted. The remaining two sites, a residential dwelling (HS 2265) and a barn (HS 2266), were recorded in 2-22-54-25-W4M. These sites are in quarter sections outside of the proposed Project and will not be impacted.

Review of previous HRIAs conducted within or near the Project shows portions of the northeastern end of Option 1 were subject to HRIA under ASA permits 87-013 and 97-155. The first HRIA, under ASA permit 87-013, was in advance of the Federated Pipe Lines Ltd. Acheson pipeline extension Project. This project footprint crosses the proposed footprint in SW 27-54-24-W4M and SE 28-54-25-W4M. No new archaeological sites were identified in the vicinity of the current development under ASA 87-013. The second HRIA, under ASA permit 97-155, was in advance of the Fletcher Challenge Energy Canada Inc. St. Albert to Carbondale Pipeline Project. This project footprint crosses the proposed footprint in NE 21-54-25-W4M, SW 27-54-24-W4M and SE 28-54-25-W4M. No new archaeological sites were identified in the vicinity of the current development under ASA 97-155.

Evaluation and Recommendations

Review of ESRI World Imagery and NTS maps shows no waterways will be crossed. The closest major water course is the Sturgeon River, located 940 m to the southeast of the Project. In addition, the Project traverses generally flat and featureless terrain wholly disturbed by cultivation and existing roads with low potential to contain intact, subsurface cultural material. Given the above evaluation, *Historical Resources Act* Approval is recommended for the City of St. Albert Neil Ross Road.

APPENDIX B – GEOTECHNICAL DESKTOP STUDY

THURBER ENGINEERING LTD.

May 31, 2021 File No.: 26836

Associated Engineering Alberta Ltd.
9888 Jasper Avenue
Edmonton, Alberta
T5J 5C6

Attention: Ms. Heather Padavell, P.Eng.

NEIL ROSS ROAD FUNCTIONAL ALIGNMENT STUDY
ST. ALBERT, ALBERTA
GEOTECHNICAL DESKTOP STUDY

Dear Ms. Padavell:

This report presents the results of a geotechnical desktop study carried out by Thurber Engineering Ltd. (Thurber) for a functional alignment study (FAS) in St. Albert, Alberta.

This report supersedes the draft report submitted on December 12, 2019, and incorporates comments based on a revised Option 2 alignment provided by AE on May 26, 2021.

The desktop study was carried out in general accordance with our proposal to Ms. Padavell of Associated Engineering Alberta Ltd. (AE) dated August 8, 2019. Authorization to proceed was provided by Ms. Padavell on October 11, 2019.

It is a condition of this letter report that Thurber's performance of its professional services will be subject to the attached Statement of Limitations and Conditions.

1. PROJECT DESCRIPTION

We understand that the City of St. Albert (City) requires a corridor planning study for the extension of the arterial roadway, Neil Ross Road. The study area is shown on Drawing No. 26836-1, in Appendix A.

The City requires a functional analysis and recommendation for a proposed conceptual alignment of Neil Ross Road, an east-west arterial roadway in the northeast quadrant of the City from a location where the roadway currently terminates at Element Drive (east of St Albert Trail) and is anticipated to tie into the future 127 Street alignment.

Two alignment options were reviewed as part of this study:

- Option 1 – approximately 1.8 km long connecting from the existing Neil Ross Road and Element Drive to Township Road 544
- Option 2 – approximately 1.0 km long connecting from the existing Neil Ross Road and Element Drive to Coal Mine Road.

Thurber's scope of work included a review of the existing available geotechnical and geological information and providing preliminary geotechnical assessment and recommendations for the proposed roadway and pavement design.

A field drilling program is not required at this stage and hence was not included in our scope of work. A site reconnaissance was not completed as part of the scope of work as the access would be limited on private property.

2. METHODOLOGY

The desktop study consisted of the following tasks:

- A review of available geotechnical information from Thurber's in-house reports in the vicinity of the study area was carried out with no previous investigations found. Six water well records from the Alberta Environment Water Well Database were available in the general site area as shown on Drawing No. 26836-1 in Appendix A. A list of the reference material used is provided at the end of the text of this report and water well information pertinent to this report is included in Appendix C.
- A review of available LiDAR and satellite images of the area and a review of available surficial and bedrock geology maps were carried out to provide supplementary information on the expected soil and groundwater conditions.
- The preparation of this geotechnical letter report summarizing the existing geotechnical conditions in the study area and identifying any significant geotechnical constraints to the proposed development.

3. SITE TOPOGRAPHY AND GEOLOGY

3.1 Review of LiDAR

LiDAR data provided by the City of St. Albert and AE was used as a base for the geomorphology review of the site. Bare earth LiDAR was used to prepare the major contour lines presented on Drawing No. 26836-2, Appendix A. The ground elevation within the study area ranges from about 685 m to 690 m and the area is relatively flat along both alignment options.

3.2 Surficial Geology

Drawing No. 26836-3, Appendix A, shows the surficial geology of the study area with the major surficial geological units consisting of glaciolacustrine deposits, fluvial deposits, and organic deposits.

Glaciolacustrine deposits consisting of bedded silt, sand, and clay with pebbles are present in the majority of the study area.

Fluvial deposits consisting of primarily sand and gravel are present within the Sturgeon River valley.

The organic material has generally developed in poorly drained low-lying areas. The approximate locations of the organic deposits based on a review of satellite imagery are shown on Drawing No. 26836-3, Appendix A. Some of the poorly drained areas become temporarily filled by water during rainy periods.

3.3 Bedrock Geology

The study area is underlain by Upper Cretaceous bedrock of the Horseshoe Canyon Formation, which consists of sandstone, carbonaceous and bentonitic clay shale with occasional coal layers.

The bedrock surface along the proposed alignments is generally between 15 m and 25 m below ground surface.

3.4 Coal Mines

The review of the available coal mine mapping indicated no existing coal mines under the proposed road alignment options, as shown on the coal mine map in Appendix A.

4. SITE CONDITIONS

4.1 Surface Conditions

The proposed roadway alignment options start at the end of the existing Neil Ross Road section and cross through relatively flat agricultural land (elevations between 683 m and 690 m) to connect to either Township Road 544 or Coal Mine Road.

Options 1 and 2 run primarily through agricultural land.

Sloughs are located adjacent to the proposed alignment options; however, the alignments are generally clear of organic deposits, as shown on Drawing 26836-3 in Appendix A.

The ditches along the existing Coal Mine Road are relatively shallow and well drained.

4.2 Subsurface Soil and Bedrock Conditions

The generalized subsurface stratigraphy at this site, based on six water wells (260970, 260971, 260976, 260985, 294469, and 297084) available in the study area indicated clay and/or sand and gravel, over clay till over sandstone, clay shale and coal bedrock. In general, the bedrock was encountered at depths between about 14 m and 22 m.

Detailed descriptions of the subsurface conditions are presented on the water well records and in Appendix B. Drawing 26836-1 in Appendix A shows the approximate locations of the water wells.

4.3 Groundwater Conditions

The available groundwater information from water wells is summarized in Table 4.1 below.

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TABLE 4.1
SUMMARY OF GROUNDWATER LEVELS

TEST HOLE	TEST HOLE DEPTH (mBGS)	SLOTTED SCREEN DEPTH (mBGS)	LATEST WATER LEVEL READING (mBGS)
260971	48.8	42.7 to 48.8 (Bedrock)	19.2 (July 22, 1985)
260976	50.3	40.2 to 46.3 (Bedrock)	24.7 (May 1, 1967)
260985	39.6	26.2 to 39.6 (Bedrock)	5.8 (March 18, 1976)
294469	67.1	33.5 to 48.8 and 54.9 to 65.5 (Bedrock)	28.3 (April 10, 2000)
297084	61.0	27.4 to 30.5 36.6 to 45.7 50.3 to 53.3 (Bedrock)	20.6 (June 19, 2001)

Note: BGS = below ground surface

All groundwater wells were installed in bedrock. It should be noted that groundwater levels are expected to vary seasonally and may be higher after prolonged heavy rainfall. Therefore, the actual groundwater conditions at the time of construction may vary from those recorded during these investigations.

5. PRELIMINARY GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

Final details on the proposed roadway were not available at the time of this report; however, we understand that the roadway will ultimately be four lanes and road profiles will be an urban cross section until it ties into the assumed 127 Street alignment. East of the assumed 127 Street alignment will be maintained as a rural cross section with two lanes.

The results of the desktop review indicate that the construction of the proposed roadway is feasible from a geotechnical point of view. Both options are considered to have the same feasibility.

The proposed Option 1 and 2 alignments are expected to be underlain by clay and/or sand and gravel over clay till overlying competent clay shale, coal, and sandstone bedrock at depths of greater than 14 m below ground surface. Organic deposits may be encountered along portions of the proposed alignments.

The site is located within relatively flat glacial terrain and the permeability of the silty clay is low. Hence, the natural drainage condition is poor. Sloughs and large areas of organic deposits are present near the proposed roadway alignments. Suitable drainage structures or facilities are required to promote drainage in this area. It will also be important to provide good drainage at proposed intersections. This can be achieved by providing a suitable cross-fall on the subgrade draining to side ditches of at least 1 m in depth.

The glaciolacustrine clay and clay till soils along the proposed alignments have low potential for erosion. If sand is encountered near the surface, it will have a higher potential for erosion. Permanent cut and fill slopes should be topsoiled and revegetated as soon as possible to reduce potential slope erosion. In deep cuts, installation of erosion mats or other appropriate erosion control measures should be provided to limit erosion. In addition, water flow in roadway ditches should be evaluated and appropriate ditch erosion protection measures should be provided, where required.

When possible, the construction of approach roads and intersections should avoid any bogs or sloughs. From an available satellite image, organic materials, and water bodies (sloughs) were identified and outlined on Drawing No. 26836-3, Appendix A. Where it is not feasible to avoid these features, the organic materials and any underlying soft soil should be sub-excavated prior to embankment fill construction. Note that these areas with organic materials could be in a wet condition in the springtime or during heavy rainfall events.

6. PRELIMINARY PAVEMENT RECOMMENDATIONS

6.1 Subgrade Preparation

Based on the results of the desktop study, it is anticipated that the pavement structure will be constructed over clay or clay till. All existing deleterious materials such as highly organic fill or debris, when encountered, should be removed from the area. The exposed subgrades should be scarified and recompacted to 98 percent of the standard Proctor test and inspected by qualified geotechnical personnel to confirm that all deleterious material have been removed and to detect any soft areas that may be present.

There is a possibility that local areas of poor-quality fill material, silts, wet sands, or soft clays could be encountered, which should be sub-excavated to suitable soils or to a maximum depth of 1 m below the design subgrade level and replaced with good quality material. The sub-excavated depths should be decided in the field by a geotechnical engineer at the time of grading. Where ground conditions at the base of the excavation are soft and wet, a non-woven geotextile should be placed over the base of the excavation. Areas that have become softened as a result of construction traffic or weather conditions should be sub-excavated and replaced with well-compacted clay or cement modified as required.

Where the design subgrade level is less than 0.6 m above the exposed ground level or the existing grade, the exposed grade should be subcut to a depth of 0.6 m below design subgrade level, or as required to reach a stable base. Suitable excavated material or imported clay fill should be used to construct the road embankment to subgrade level.

Any additional fill required to raise the area to subgrade level should preferably consist of inorganic low to medium plastic clay or clean granular fill. The backfill should be placed and compacted in 150 mm compacted lifts to at least 98 percent of the Standard Proctor Maximum Dry Density (SPMDD). The upper 300 mm of the subgrade should be scarified and compacted to 100 percent of the SPMDD of the material.

The final compacted subgrade surface should be proof rolled to confirm that surface deflections are minimal under the influence of construction traffic. It is recommended that the finished subgrade surface be trimmed smooth and sloped at a minimum of 2 percent towards drainage ditches. The purpose of this is to drain any subsurface water from the subgrade and thereby prevent ponding of water on the subgrade surfaces which could result in swelling, softening and/or possible frost heaving of the clay subgrade

6.2 Design Parameters

For design purposes, it was assumed that the proposed roadways will be subjected to light commercial and industrial traffic loadings. Based on criteria provided by the City of Edmonton for light commercial and industrial roadways, a traffic loading of 1 x 10^6 ESALs was used for the design. The design parameters used in the design of the pavement structure are as follows:

- Subgrade CBR = 3 percent
- Resilient Modulus = 30 MPa
- Base Materials (Class 20) Structural Coefficient = 0.14
- Asphalt Concrete Pavement (ACP) Structural Coefficient = 0.40
- Reliability = 85 percent
- Growth Rate = 2 percent
- Performance or Design Life = 20 years
- Initial Pavement Serviceability = 4.2
- Final Pavement Serviceability = 2.5
- Overall Standard Deviation = 0.40
- Drainage Coefficient = 1.0.

Based on the assumed traffic loadings, the pavement structure was determined and is provided in Table 6.1 below.

TABLE 6.1
PRELIMINARY PAVEMENT STRUCTURE DESIGN
OPTION 1 AND 2 ALIGNMENTS

ROADWAY	DESIGN ESAL	REQUIRED STRUCTURAL NUMBER	REQUIRED PAVEMENT STRUCTURE
Light Commercial and Industrial Road	1 x 10^6	102 mm	150 mm ACP over 300 mm Granular Base over 300 mm Prepared Subgrade

Pavement materials should be provided and constructed in accordance with the current edition of the City of Edmonton Design and Construction Standards.

7. FURTHER WORK

A detailed geotechnical investigation, including test holes, should be undertaken during future stages of the project. These should include investigations of the alignment at a spacing of approximately 200 m along the centerline of the selected alignment.

Standpipes should be installed to assess the groundwater levels. These should be read on a periodic basis throughout the year to provide information on the potential variations in groundwater levels.

8. CLOSURE

This desktop study is based on widely spaced existing information and a general knowledge of subsurface conditions in the area. Hence, the evaluations and recommendations presented within are preliminary in nature and only intended to guide AE in developing their preliminary design options. Further investigation and recommendations will be required once a design option has been selected.

We trust that the above meets your present requirements, please do not hesitate to contact us should you have any questions.

Yours very truly,
Thurber Engineering Ltd.
Renato Clementino, Ph.D., P.Eng.
Review Principal

PROFESSIONAL GEOSCIENTIST ALBERTA
NIELS RASMUSSEN
May 31, 2021
ID# 92287

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE:
RM APEGA ID #: 72376
DATE: May 31, 2021
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Niels Rasmussen, P.Geo.
Geologist
//jf

Attachments:

- Statement of Limitations and Conditions
- Appendix A – Drawings
- Appendix B – Select Information from References

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

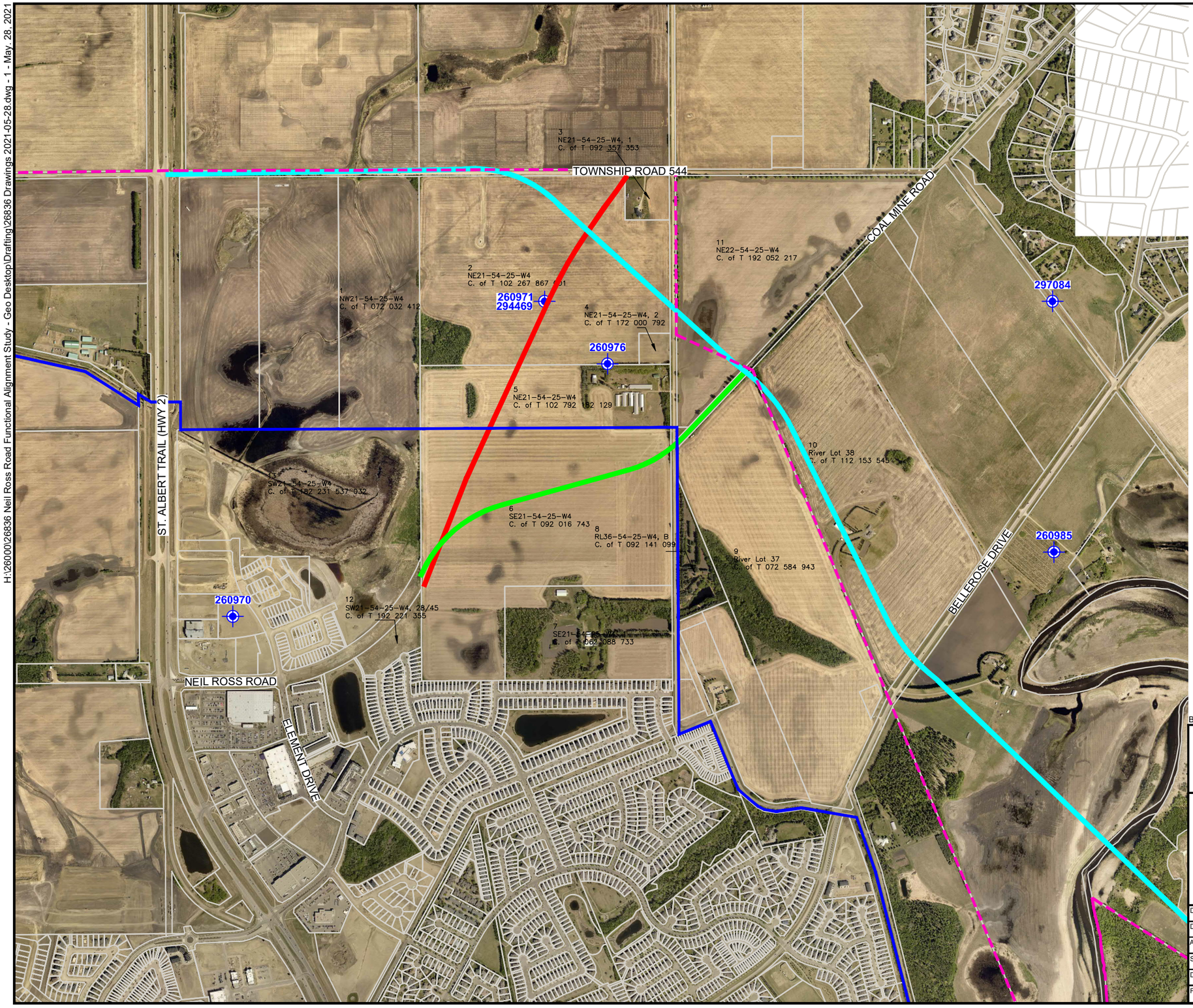
THURBER

APPENDIX A

Drawing Nos. 26836-1 through 26836-3

Coal Mine Map

H:\26000\26836 Neil Ross Road Functional Alignment Study - Geo Desktop\Drafting\26836 Drawings 2021-05-28.dwg - 1 - May. 28, 2021



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LEGEND

- OPTION 1 ALIGNMENT
- OPTION 2 ALIGNMENT
- ASSUMED 127 STREET ALIGNMENT
- WATER WELL
- CITY OF ST. ALBERT BOUNDARY
- ANNEXATION BOUNDARY

0 100 200 300 400 500 600 700 m

SCALE 1:12500

BASE PLAN PROVIDED BY ASSOCIATED ENGINEERING

Associated Engineering

NEIL ROSS ROAD FUNCTIONAL ALIGNMENT STUDY
ST. ALBERT, ALBERTA
GEOTECHNICAL DESKTOP STUDY

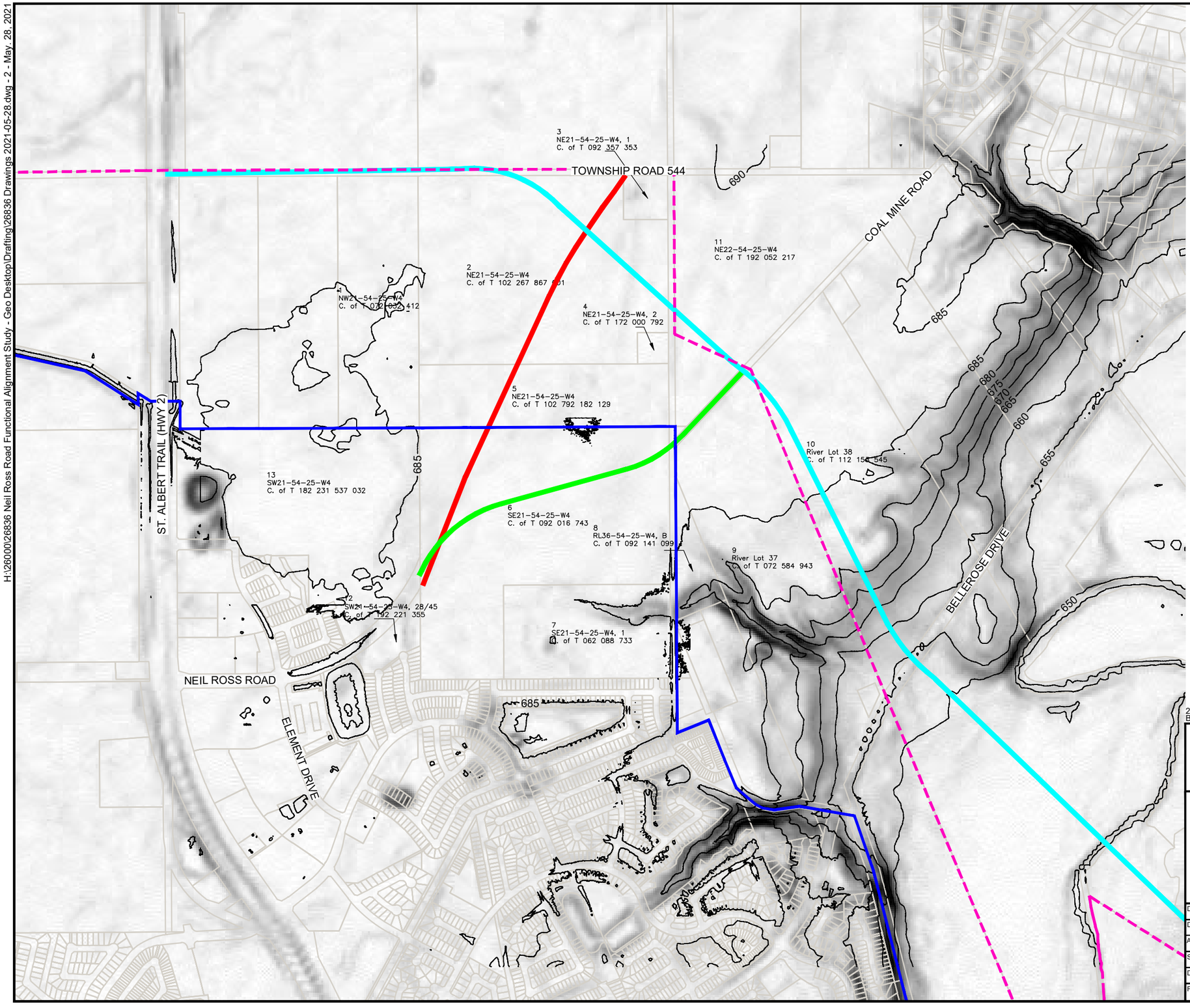
SITE PLAN

DWG No. 26836-1

DRAWN BY	KLW
DESIGNED BY	NFR
APPROVED BY	RVC
SCALE	1:12500
DATE	MAY 2021
FILE No.	26836

THURBER ENGINEERING LTD.

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LEGEND

- OPTION 1 ALIGNMENT
- OPTION 2 ALIGNMENT
- ASSUMED 127 STREET ALIGNMENT
- 685 GROUND CONTOUR (5m INTERVAL)
- CITY OF ST. ALBERT BOUNDARY
- ANNEXATION BOUNDARY

0 100 200 300 400 500 600 700 m

SCALE 1:12500

2016 LIDAR PROVIDED BY THE CITY OF ST. ALBERT
BASE PLAN PROVIDED BY ASSOCIATED ENGINEERING

Associated Engineering

NEIL ROSS ROAD FUNCTIONAL ALIGNMENT STUDY
ST. ALBERT, ALBERTA
GEOTECHNICAL DESKTOP STUDY

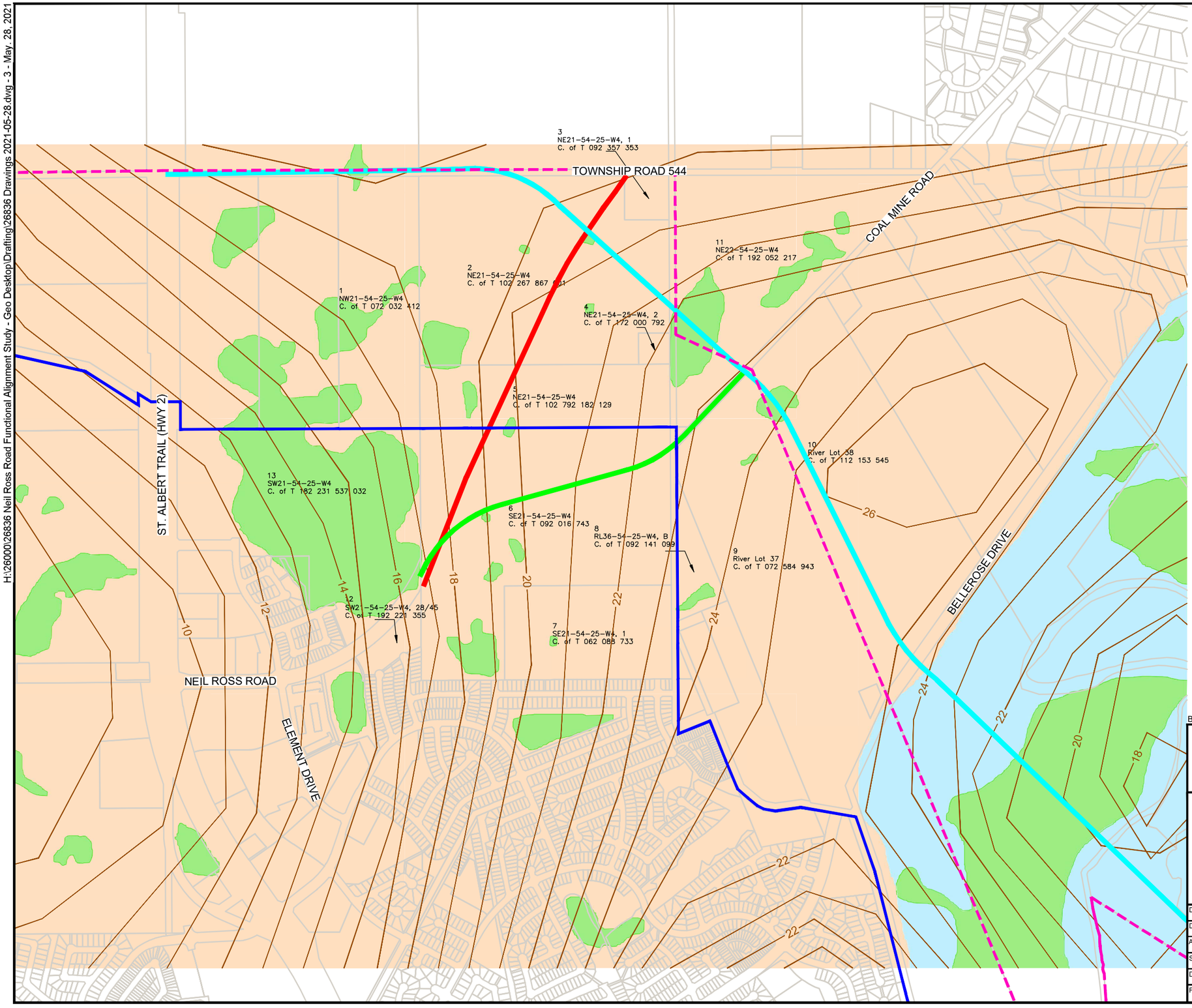
LIDAR PLAN

DWG No. 26836-2

DRAWN BY	KLW
DESIGNED BY	NFR
APPROVED BY	RVC
SCALE	1:12500
DATE	MAY 2021
FILE No.	26836

THURBER ENGINEERING LTD.

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LEGEND

- OPTION 1 ALIGNMENT
- OPTION 2 ALIGNMENT
- ASSUMED 127 STREET ALIGNMENT
- GLACIOLACUSTRINE DEPOSITS
- FLUVIAL DEPOSITS
- ORGANICS (FROM SATELLITE IMAGE INTERPRETATION)
- 24 — DRIFT THICKNESS CONTOUR (1m INTERVAL)
- CITY OF ST. ALBERT BOUNDARY
- ANNEXATION BOUNDARY

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0 100 200 300 400 500 600 700 m

SCALE 1:12500

BASE PLAN PROVIDED BY ASSOCIATED ENGINEERING

Associated Engineering

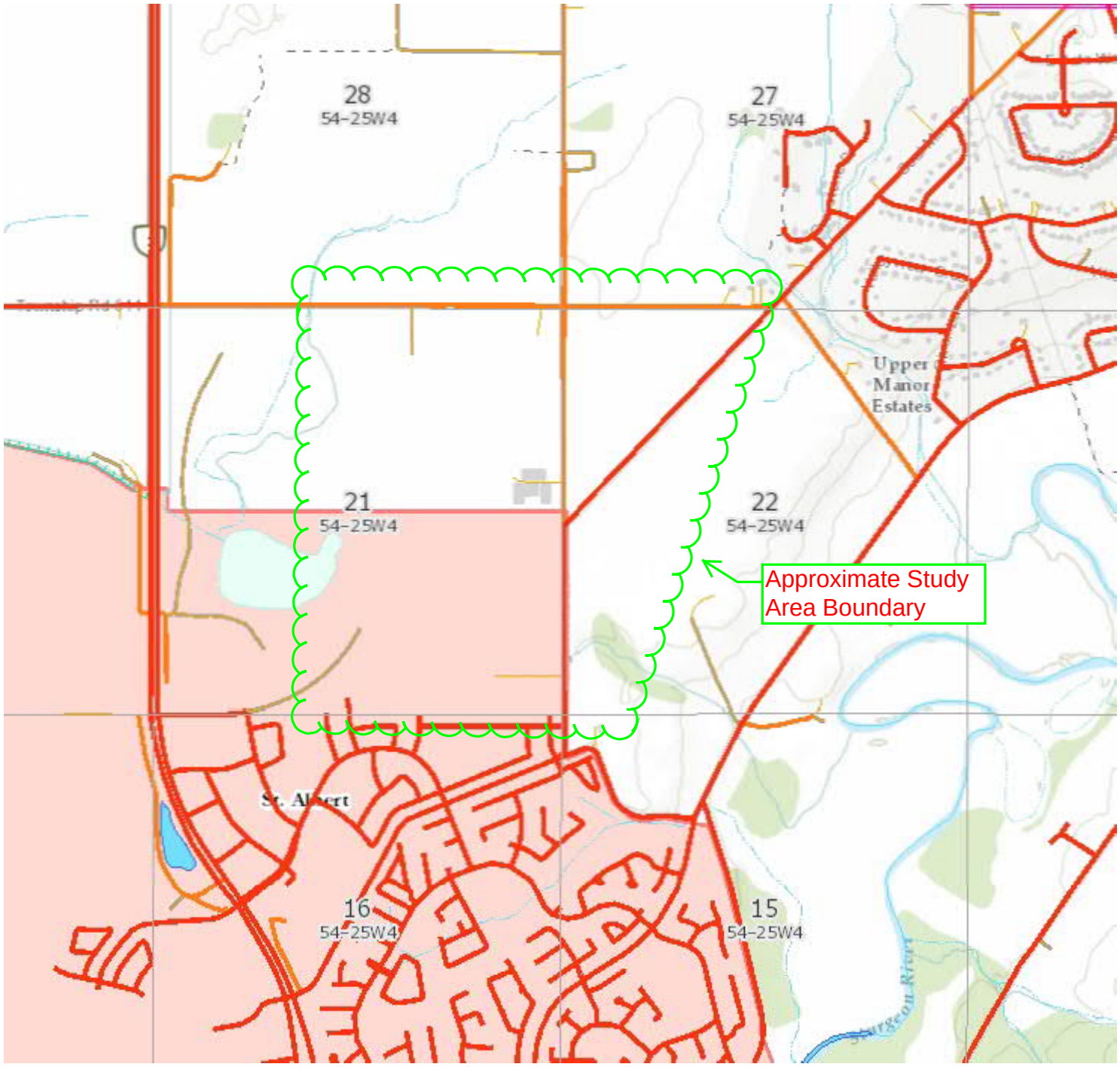
NEIL ROSS ROAD FUNCTIONAL ALIGNMENT STUDY
ST. ALBERT, ALBERTA
GEOTECHNICAL DESKTOP STUDY

SURFICIAL GEOLOGY

DWG No. 26836-3

DRAWN BY	KLW
DESIGNED BY	NFR
APPROVED BY	RVC
SCALE	1:12500
DATE	MAY 2021
FILE No.	26836

THURBER ENGINEERING LTD.



Coal Mine Map - 26836

Base Data provided by: Government of Alberta

Author AER

Printing Date: 11/27/2019

Date Date (if applicable)

Legend

- ATS Townships (large scale)
- ATS Sections without Road Allowance
- ATS section labels (medium scale)
- Provincial Boundaries
- Coal Mine Permit
- Coal Mine Polygon
  - Surface
  - Underground
- Roads Paved
- Roads Gravel
- Roads Other

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Scale: 38,411.72

0.59 Kilometers 0

Projection and Datum:

WGS84 Web Mercator Auxiliary Sphere

Alberta Energy Regulator

THURBER

APPENDIX B

Select Information from References

THURBER

LIST OF REFERENCES

Prior, G.J., Hathway, B., Glombick, P.M., Pana, D.I., Banks, C.J., Hay, D.C., Schneider, C.L., Grobe, M., Elgr, R. and Weiss, J.A. (2013): Bedrock geology of Alberta; Energy Resources Conservation Board, ERCB/AGS Map 600, scale 1:1,000,000.

Fenton, M.M., Waters, E.J., Pawley, S.M., Atkinson, N., Utting, D.J., and McKay, K. (2013): Surficial Geology of Alberta; ERCB/AGS Map 601, Scale 1: 1,000,000.

N. Atkinson and S. Lyster. Thickness and Distribution of Quaternary and Neogene Sediment in Alberta, Canada. Alberta Geological Survey. 2010.

Coal Mine Map Viewer. Alberta Energy Regulator. *http://extmapviewer.aer.ca*

Alberta Government. Groundwater Database, Alberta Water Wells. *http://groundwater.alberta.ca/WaterWells/d/*

THURBER

Alberta Environment Water Well Database

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GOWN ID

GIC Well ID 260970
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1981/09/13

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
KLUTHE, RAYMOND	P.O. BOX 33 ST. ALBERT				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	4	21	54	25	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.674443 Longitude -113.636385
How Location Obtained
Not Verified

Elevation 2250.00 ft
How Elevation Obtained
Estimated

Drilling Information

Method of Drilling
Rotary

Proposed Well Use
Domestic

Type of Work
New Well

Formation Log

Measurement in Imperial

Depth from ground level (ft)	Water Bearing	Lithology Description
37.00		Clay
43.00		Sand
46.00		Clay
65.00		Shale
75.00		Sandstone
78.00		Shale
80.00		Coal
114.00		Shale
116.00		Coal
120.00		Shale

Yield Test Summary

Measurement in Imperial

Recommended Pump Rate 0.00 igpm

Test Date	Water Removal Rate (igpm)	Static Water Level (ft)
1981/09/01	4.00	0.00

Well Completion

Measurement in Imperial

Total Depth Drilled	Finished Well Depth	Start Date	End Date
120.00 ft		1981/09/01	1981/09/01

Borehole

Diameter (in)	From (ft)	To (ft)
0.00	0.00	120.00

Surface Casing (if applicable)
Steel
Size OD : 4.50 in
Wall Thickness : 0.156 in
Bottom at : 116.00 ft

Well Casing/Liner
Size OD : 0.00 in
Wall Thickness : 0.000 in
Top at : 0.00 ft
Bottom at : 0.00 ft

Perforations

From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)	Hole or Slot Interval(in)

Perforated by

Annular Seal Driven
Placed from 0.00 ft to 116.00 ft
Amount

Other Seals

Type	At (ft)

Screen Type
Size OD : 0.00 in

From (ft)	To (ft)	Slot Size (in)

Attachment
Top Fittings
Bottom Fittings

Pack
Type
Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
GROVE DRILLING LTD

Copy of Well report provided to owner

Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GOWN ID

GIC Well ID 260970
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1981/09/13

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
KLUTHE, RAYMOND	P.O. BOX 33 ST. ALBERT				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	4	21	54	25	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.674443 Longitude -113.636385
How Location Obtained: Not Verified

Elevation 2250.00 ft
How Elevation Obtained: Estimated

Additional Information

Measurement in Imperial

Distance From Top of Casing to Ground Level: in
Is Artesian Flow:
Rate: igpm
Is Flow Control Installed:
Describe:

Recommended Pump Rate: 0.00 igpm
Recommended Pump Intake Depth (From TOC): 0.00 ft
Pump Installed:
Type:
Depth: ft
Make:
H.P.:
Model (Output Rating):

Did you Encounter Saline Water (>4000 ppm TDS):
Depth: ft
Gas:
Depth: ft
Well Disinfected Upon Completion:
Geophysical Log Taken:
Submitted to ESRD:
Sample Collected for Potability:
Submitted to ESRD:

Additional Comments on Well
DRILLER REPORTS SOFT WATER

Yield Test

Taken From Ground Level
Measurement in Imperial

Test Date	Start Time	Static Water Level
1981/09/01	12:00 AM	0.00 ft

Depth to water level

Pumping (ft)	Elapsed Time Minutes:Sec	Recovery (ft)

Method of Water Removal

Type: Bailer
Removal Rate: 4.00 igpm
Depth Withdrawn From: 116.00 ft

If water removal period was < 2 hours, explain why

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	ig	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
GROVE DRILLING LTD

Copy of Well report provided to owner

Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GOWN ID

GIC Well ID 260971
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1985/07/30

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
HORIA'S POULTRY FARM	RR2 ST. ALBERT				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	21	54	25	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.683483 Longitude -113.621161
How Location Obtained: Map

Elevation ft
How Elevation Obtained: Not Obtained

Drilling Information

Method of Drilling
Cable Tool

Proposed Well Use
Stock

Type of Work
New Well

Formation Log

Measurement in Imperial

Depth from ground level (ft)	Water Bearing	Lithology Description
73.00		Sand & Gravel
107.00		Gray Shale
117.00		Brown Shale
124.00		Coal
139.00		Brown Shale
141.00	Yes	Water Bearing Coal
159.00		Brown Shale
160.00		Gray Shale

Yield Test Summary

Measurement in Imperial

Recommended Pump Rate 0.00 igpm

Test Date	Water Removal Rate (igpm)	Static Water Level (ft)
1985/07/22	4.00	63.00

Well Completion

Measurement in Imperial

Total Depth Drilled	Finished Well Depth	Start Date	End Date
160.00 ft		1985/07/18	1985/07/22

Borehole

Diameter (in)	From (ft)	To (ft)
0.00	0.00	160.00

Surface Casing (if applicable)
Steel
Size OD : 5.56 in
Wall Thickness : 0.156 in
Bottom at : 124.00 ft

Well Casing/Liner
Steel
Size OD : 4.50 in
Wall Thickness : 0.000 in
Top at : 115.00 ft
Bottom at : 160.00 ft

Perforations

From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)	Hole or Slot Interval(in)
140.00	160.00	0.125		12.00

Perforated by Torch

Annular Seal Driven
Placed from 0.00 ft to 124.00 ft
Amount

Other Seals

Type	At (ft)

Screen Type
Size OD : 0.00 in

From (ft)	To (ft)	Slot Size (in)

Attachment
Top Fittings Bottom Fittings

Pack
Type Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
BIG IRON DRILLING LTD.

Copy of Well report provided to owner Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 260971
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1985/07/30

GOWN ID

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
HORIA'S POULTRY FARM	RR2 ST. ALBERT				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	21	54	25	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.683483 Longitude -113.621161
How Location Obtained: Map

Elevation ft
How Elevation Obtained: Not Obtained

Additional Information

Measurement in Imperial

Distance From Top of Casing to Ground Level in
Is Artesian Flow
Rate igpm
Is Flow Control Installed
Describe

Recommended Pump Rate 0.00 igpm
Recommended Pump Intake Depth (From TOC) 0.00 ft
Pump Installed Yes Depth ft
Type SUB Make 7EH05 H.P. .5
Model (Output Rating)

Did you Encounter Saline Water (>4000 ppm TDS) Depth ft
Gas Depth ft
Well Disinfected Upon Completion
Geophysical Log Taken
Submitted to ESRD
Sample Collected for Potability
Submitted to ESRD

Additional Comments on Well
DRILLER REPORTS SOFT WATER

Yield Test

Taken From Ground Level
Measurement in Imperial

Test Date	Start Time	Static Water Level
1985/07/22	12:00 AM	63.00 ft

Depth to water level

Pumping (ft)	Elapsed Time Minutes:Sec	Recovery (ft)

Method of Water Removal
Type Bailer
Removal Rate 4.00 igpm
Depth Withdrawn From 142.00 ft

If water removal period was < 2 hours, explain why

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	ig	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
BIG IRON DRILLING LTD.

Copy of Well report provided to owner
Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GOWN ID

GIC Well ID 260976
GoA Well Tag No.
Drilling Company Well ID
Date Report Received

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
RAVEN, A.	ST. ALBERT				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	9	21	54	25	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.681675 Longitude -113.618116
How Location Obtained: Map

Elevation 2255.00 ft
How Elevation Obtained: Survey-Transit

Drilling Information

Method of Drilling: Rotary

Proposed Well Use: Domestic & Stock

Type of Work: New Well

Formation Log

Measurement in Imperial

Depth from ground level (ft)	Water Bearing	Lithology Description
15.00		Brown Clay
22.00		Sandy Clay
24.00		Gravel
31.00		Blue Clay
33.00		Coal
41.00		Blue Clay
45.00		Gravel
48.00		Clay
58.00		Sand & Gravel
60.00		Coal
110.00		Blue Clay
112.00		Coal
116.00		Brown Clay
120.00		Coal
122.00		Sandstone
135.00		Shale
139.00		Coal
158.00		Shale
160.00		Rocks
165.00		Shale

Yield Test Summary

Measurement in Imperial

Recommended Pump Rate 0.00 igpm

Test Date	Water Removal Rate (igpm)	Static Water Level (ft)
1967/05/01	12.00	81.00

Well Completion

Measurement in Imperial

Total Depth Drilled	Finished Well Depth	Start Date	End Date
165.00 ft		1967/01/01	1967/05/17

Borehole

Diameter (in)	From (ft)	To (ft)
0.00	0.00	165.00

Surface Casing (if applicable)
Steel
Size OD : 6.63 in
Wall Thickness : 0.500 in
Bottom at : 77.00 ft

Well Casing/Liner
Steel
Size OD : 4.50 in
Wall Thickness : 0.375 in
Top at : 0.00 ft
Bottom at : 152.00 ft

Perforations

From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)	Hole or Slot Interval(in)
132.00	152.00	0.000		0.00

Perforated by: Unknown

Annular Seal
Placed from 0.00 ft to 0.00 ft
Amount

Other Seals

Type	At (ft)

Screen Type
Size OD : 0.00 in

From (ft)	To (ft)	Slot Size (in)

Attachment
Top Fittings Bottom Fittings

Pack
Type Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well: UNKNOWN NA DRILLER
Certification No: 1
Company Name: CORALTA DRLG
Copy of Well report provided to owner
Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 260976
GoA Well Tag No.
Drilling Company Well ID
Date Report Received

GOWN ID

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
RAVEN, A.	ST. ALBERT				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	9	21	54	25	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.681675 Longitude -113.618116
How Location Obtained: Map

Elevation 2255.00 ft
How Elevation Obtained: Survey-Transit

Additional Information

Measurement in Imperial

Distance From Top of Casing to Ground Level: in
Is Artesian Flow:
Rate: igpm
Is Flow Control Installed:
Describe:

Recommended Pump Rate: 0.00 igpm
Recommended Pump Intake Depth (From TOC): 0.00 ft
Pump Installed: Yes
Type: SUB
Depth: ft
Make:
H.P.:
Model (Output Rating):

Did you Encounter Saline Water (>4000 ppm TDS):
Depth: ft
Gas:
Depth: ft
Well Disinfected Upon Completion:
Geophysical Log Taken:
Submitted to ESRD
Sample Collected for Potability:
Submitted to ESRD: Yes

Additional Comments on Well
DRILLER REPORTS SOFT WATER

Yield Test

Taken From Ground Level
Measurement in Imperial

Test Date	Start Time	Static Water Level
1967/05/01	12:00 AM	81.00 ft

Depth to water level

Pumping (ft)	Elapsed Time Minutes:Sec	Recovery (ft)

Method of Water Removal
Type: Bailer
Removal Rate: 12.00 igpm
Depth Withdrawn From: 0.00 ft

If water removal period was < 2 hours, explain why

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	ig	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
CORALTA DRLG

Copy of Well report provided to owner

Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GOWN ID

GIC Well ID 260985
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1976/03/30

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
BELLEROSE, BOB	RR2 ST. ALBERT				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	SE	22	54	25	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.676172 Longitude -113.596474
How Location Obtained: Map

Elevation 2200.00 ft
How Elevation Obtained: Survey-Transit

Drilling Information

Method of Drilling: Rotary

Proposed Well Use: Domestic & Stock

Type of Work: New Well

Formation Log

Measurement in Imperial

Depth from ground level (ft)	Water Bearing	Lithology Description
6.00		Clay
20.00		Silt
64.00		Fine Grained Sand
87.00		Brown Shale
90.00		Gray Shale
93.00		Coal
116.00		Light Green Shale
118.00		Coal
126.00		Brown Shale
127.00		Coal
130.00		Gray Shale

Yield Test Summary

Measurement in Imperial

Recommended Pump Rate 10.00 igpm

Test Date	Water Removal Rate (igpm)	Static Water Level (ft)
1976/03/18	15.00	19.00

Well Completion

Measurement in Imperial

Total Depth Drilled	Finished Well Depth	Start Date	End Date
130.00 ft		1976/03/16	1976/03/18

Borehole

Diameter (in)	From (ft)	To (ft)
0.00	0.00	130.00

Surface Casing (if applicable)
Steel
Size OD : 5.56 in
Wall Thickness : 0.156 in
Bottom at : 88.00 ft

Well Casing/Liner
Galvanized Steel
Size OD : 4.50 in
Wall Thickness : 0.500 in
Top at : 0.00 ft
Bottom at : 130.00 ft

Perforations

From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)	Hole or Slot Interval(in)
86.00	130.00	0.250		10.00

Perforated by: Torch

Annular Seal: Driven
Placed from 86.00 ft to 88.00 ft
Amount

Other Seals

Type	At (ft)

Screen Type
Size OD : 0.00 in

From (ft)	To (ft)	Slot Size (in)

Attachment
Top Fittings
Bottom Fittings

Pack
Type
Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well: UNKNOWN NA DRILLER
Certification No: 1
Company Name: MAR-WAYNE WATER WELL DRILLING SERVICES LTD.
Copy of Well report provided to owner
Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GIC Well ID 260985
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1976/03/30

GOWN ID

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
BELLEROSE, BOB	RR2 ST. ALBERT				

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	SE	22	54	25	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.676172 Longitude -113.596474
How Location Obtained: Map

Elevation 2200.00 ft
How Elevation Obtained: Survey-Transit

Additional Information

Measurement in Imperial

Distance From Top of Casing to Ground Level: in
Is Artesian Flow:
Rate: igpm
Is Flow Control Installed:
Describe:

Recommended Pump Rate: 10.00 igpm
Recommended Pump Intake Depth (From TOC): 0.00 ft
Pump Installed: Yes
Depth: ft
Type: SUB
Make: 4"
H.P.: .5
Model (Output Rating):

Did you Encounter Saline Water (>4000 ppm TDS):
Depth: ft
Gas:
Depth: ft
Well Disinfected Upon Completion:
Geophysical Log Taken:
Submitted to ESRD:
Sample Collected for Potability:
Submitted to ESRD:

Additional Comments on Well
DRILLER REPORTS SOFT WATER

Yield Test

Taken From Ground Level
Measurement in Imperial

Test Date	Start Time	Static Water Level
1976/03/18	12:00 AM	19.00 ft

Depth to water level

Pumping (ft)	Elapsed Time Minutes:Sec	Recovery (ft)

Method of Water Removal
Type: Bailer
Removal Rate: 15.00 igpm
Depth Withdrawn From: 65.00 ft

If water removal period was < 2 hours, explain why

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	ig	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
MAR-WAYNE WATER WELL DRILLING SERVICES LTD.

Copy of Well report provided to owner

Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GOWN ID

GIC Well ID 294469
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2000/07/20

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
HABIB'S POULTRY FARMS	P.O. BOX 68 ST ALBERT				T8N 1N2

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	21	54	25	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.683483 Longitude -113.621161
How Location Obtained
Map

Elevation ft
How Elevation Obtained
Not Obtained

Drilling Information

Method of Drilling
Rotary

Proposed Well Use
Stock

Type of Work
New Well

Formation Log

Measurement in Imperial

Depth from ground level (ft)	Water Bearing	Lithology Description
30.00		Brown Clay
60.00		Gray Till
61.00		Coal
63.00		Gray Clay
66.00		Greenish Gray Shale
85.00		Fractured Shale
101.00		Mixed Shale
111.00		Coal
119.00		Brown Shale
120.00		Coal
122.00		Shale
125.00		Hard Coal
127.00		Brown Shale & Coal
137.00		Shale
139.00		Coal
163.00		Brown Shale
165.00		Brown Shale & Coal
190.00		Shale
192.00		Coal
210.00		Shale
214.00		Gray Sandstone
220.00		Shale

Yield Test Summary

Measurement in Imperial

Recommended Pump Rate 4.00 igpm

Test Date	Water Removal Rate (igpm)	Static Water Level (ft)
2000/04/10	4.10	92.70

Well Completion

Measurement in Imperial

Total Depth Drilled	Finished Well Depth	Start Date	End Date
220.00 ft		2000/04/07	2000/04/10

Borehole

Diameter (in)	From (ft)	To (ft)
0.00	0.00	220.00

Surface Casing (if applicable)
Plastic
Size OD : 6.00 in
Wall Thickness : 0.500 in
Bottom at : 104.00 ft

Well Casing/Liner
Plastic
Size OD : 4.50 in
Wall Thickness : 0.250 in
Top at : 100.00 ft
Bottom at : 220.00 ft

Perforations

From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)	Hole or Slot Interval(in)
110.00	160.00	0.125		12.00
180.00	215.00	0.000		0.00

Perforated by Saw

Annular Seal Shale Trap & Bentonite
Placed from 0.00 ft to 103.00 ft
Amount

Other Seals

Type	At (ft)

Screen Type
Size OD : 0.00 in

From (ft)	To (ft)	Slot Size (in)

Attachment
Top Fittings Bottom Fittings

Pack
Type Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
MAR-WAYNE WATER WELL DRILLING SERVICES LTD.

Copy of Well report provided to owner Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GOWN ID

GIC Well ID 294469
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2000/07/20

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
HABIB'S POULTRY FARMS	P.O. BOX 68 ST ALBERT				T8N 1N2

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	21	54	25	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.683483 Longitude -113.621161
How Location Obtained
Map

Elevation ft
How Elevation Obtained
Not Obtained

Additional Information

Measurement in Imperial

Distance From Top of Casing to Ground Level in
Is Artesian Flow
Rate igpm
Is Flow Control Installed
Describe

Recommended Pump Rate 4.00 igpm
Recommended Pump Intake Depth (From TOC) 184.00 ft
Pump Installed
Type
Depth ft
Make
H.P.
Model (Output Rating)

Did you Encounter Saline Water (>4000 ppm TDS)
Depth ft
Gas
Depth ft
Well Disinfected Upon Completion
Geophysical Log Taken
Submitted to ESRD
Sample Collected for Potability
Submitted to ESRD

Additional Comments on Well

DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 44 CMS.

Yield Test

Taken From Ground Level
Depth to water level

Measurement in Imperial

Test Date	Start Time	Static Water Level
2000/04/10	12:00 AM	92.70 ft

Method of Water Removal

Type Air
Removal Rate 4.10 igpm
Depth Withdrawn From 0.00 ft

If water removal period was < 2 hours, explain why

Pumping (ft)	Elapsed Time Minutes:Sec	Recovery (ft)
	0:00	144.72
	1:00	140.06
	2:00	136.09
	3:00	132.05
	4:00	128.81
	5:00	125.66
	6:00	122.93
	7:00	120.41
	8:00	117.91
	9:00	115.94
	10:00	114.40
	12:00	111.32
	14:00	108.86
	16:00	107.02
	20:00	104.20
	25:00	102.17
	30:00	101.08
	35:00	101.15
	40:00	101.38
	50:00	100.85
	60:00	100.26
	75:00	98.52
	90:00	98.88
	105:00	98.88
	120:00	97.77

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	ig	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
MAR-WAYNE WATER WELL DRILLING SERVICES LTD.

Copy of Well report provided to owner

Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

GOWN ID

GIC Well ID 297084
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2001/08/14

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
PNNICH, MARCO	P.O. BOX 92 SITE 212 RR2, ST ALBERT				T8N 1M9

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	22	54	25	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.683404 Longitude -113.596475
How Location Obtained: Not Verified

Elevation ft
How Elevation Obtained: Not Obtained

Drilling Information

Method of Drilling
Rotary

Proposed Well Use
Domestic

Type of Work
New Well

Formation Log

Measurement in Imperial

Depth from ground level (ft)	Water Bearing	Lithology Description
17.00		Brown Clay
71.00		Gray Clay
76.00		Gray Sandstone
78.00		Coal
80.00		Brown Shale
90.00		Green Shale
94.00		Coal
102.00		Green Shale
124.00		Gray Shale
126.00		Coal
141.00		Brown Shale
148.00		Coal
165.00		Brownish Gray Shale
171.00		Gray Sandstone
173.00		Coal
184.00		Brown Shale
190.00		Gray Shale
193.00		Coal
195.00		Brown Shale
197.00		Coal
200.00		Brown Shale

Yield Test Summary

Measurement in Imperial

Recommended Pump Rate 6.00 igpm

Test Date	Water Removal Rate (igpm)	Static Water Level (ft)
2001/06/19	6.00	67.60

Well Completion

Measurement in Imperial

Total Depth Drilled	Finished Well Depth	Start Date	End Date
200.00 ft		2001/06/15	2001/06/19

Borehole

Diameter (in)	From (ft)	To (ft)
0.00	0.00	200.00

Surface Casing (if applicable)
Plastic
Size OD : 6.00 in
Wall Thickness : 0.500 in
Bottom at : 85.00 ft

Well Casing/Liner
Plastic
Size OD : 4.50 in
Wall Thickness : 0.240 in
Top at : 81.00 ft
Bottom at : 200.00 ft

Perforations

From (ft)	To (ft)	Diameter or Slot Width(in)	Slot Length (in)	Hole or Slot Interval(in)
90.00	100.00	0.125		12.00
120.00	150.00	0.000		0.00
165.00	175.00	0.000		0.00

Perforated by Saw

Annular Seal Shale Trap & Bentonite
Placed from 0.00 ft to 84.00 ft
Amount

Other Seals

Type	At (ft)

Screen Type
Size OD : 0.00 in

From (ft)	To (ft)	Slot Size (in)

Attachment
Top Fittings Bottom Fittings

Pack
Type Grain Size
Amount

Contractor Certification

Name of Journeyman responsible for drilling/construction of well
UNKNOWN NA DRILLER

Certification No
1

Company Name
MAR-WAYNE WATER WELL DRILLING SERVICES LTD.

Copy of Well report provided to owner Date approval holder signed

Water Well Drilling Report

View in Metric | Export to Excel

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GIC Well ID 297084
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2001/08/14

GOWN ID

Well Identification and Location

Measurement in Imperial

Owner Name	Address	Town	Province	Country	Postal Code
PNNICH, MARCO	P.O. BOX 92 SITE 212 RR2, ST ALBERT				T8N 1M9

Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description
	NE	22	54	25	4				

Measured from Boundary of
ft from
ft from

GPS Coordinates in Decimal Degrees (NAD 83)
Latitude 53.683404 Longitude -113.596475
How Location Obtained: Not Verified

Elevation ft
How Elevation Obtained: Not Obtained

Additional Information

Measurement in Imperial

Distance From Top of Casing to Ground Level: in
Is Artesian Flow
Rate: igpm
Is Flow Control Installed
Describe

Recommended Pump Rate: 6.00 igpm
Recommended Pump Intake Depth (From TOC): 148.00 ft
Pump Installed: Yes
Type: SUB
Depth: ft
Make:
H.P.: .5
Model (Output Rating):

Did you Encounter Saline Water (>4000 ppm TDS):
Depth: ft
Gas:
Depth: ft
Well Disinfected Upon Completion:
Geophysical Log Taken:
Submitted to ESRD:

Sample Collected for Potability:
Submitted to ESRD:

Additional Comments on Well

DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 38 CMS. ALSO PERF FROM 190'-197'.

Yield Test

Taken From Ground Level
Measurement in Imperial

Test Date	Start Time	Static Water Level
2001/06/19	12:00 AM	67.60 ft

Method of Water Removal

Type: Bailer
Removal Rate: 6.00 igpm
Depth Withdrawn From: 0.00 ft

If water removal period was < 2 hours, explain why

Depth to water level

Pumping (ft)	Elapsed Time Minutes:Sec	Recovery (ft)
	0:00	99.57
	1:00	89.57
	2:00	83.37
	3:00	79.10
	4:00	76.44
	5:00	74.67
	6:00	73.29
	7:00	72.51
	8:00	71.75
	9:00	71.23
	10:00	70.90
	12:00	70.37
	14:00	69.91
	16:00	69.52
	20:00	69.16
	25:00	69.09
	30:00	68.86
	35:00	68.70
	40:00	68.60
	50:00	68.50

Water Diverted for Drilling

Water Source	Amount Taken	Diversion Date & Time
	ig	

Contractor Certification

Name of Journeyman responsible for drilling/construction of well: UNKNOWN NA DRILLER
Certification No: 1
Company Name: MAR-WAYNE WATER WELL DRILLING SERVICES LTD.
Copy of Well report provided to owner
Date approval holder signed

APPENDIX C – TRAFFIC ANALYSIS

Stantec

Memo

To:	Heather Padavell / Kent Eklund Associated Engineering	From:	Lindsay Haskins Stantec Edmonton AB Office
File:	113678286	Date:	April 14, 2022

Reference: Neil Ross Road Functional Alignment Study: Transportation Analysis

Stantec Consulting Ltd ("Stantec") is part of the project team with Associated Engineering ("Associated") undertaking the Neil Ross Road Functional Alignment Study on behalf of the City of St. Albert ("the City"). As part of this project, Stantec has undertaken a transportation analysis of major intersections along Neil Ross Road from St. Albert Trail to the anticipated limits of Neil Ross Road as it approaches Sturgeon County. This includes the development of recommended connections, intersection spacing and recommendations for lane geometries and traffic control measures for opening day. Outlined in this memorandum is a summary of our findings.

PREFERRED CONCEPT

Prior to undertaking this analysis, Associated met with the City and project stakeholders in December 2019 to discuss several alignment options that had been developed by the project team. An outcome of these discussions was a preference for Alignment Option 1, which extends Neil Ross Road from its current terminus to Coal Mine Road. This alignment would connect Neil Ross Road to the more densely populated portions of Sturgeon County and mitigate for the 2018 closure of Coal Mine Road to Eastgate Way in the Erin Ridge community.

For the 2045 horizon, the long-term geometry of the St. Albert Trail & Neil Ross Road intersections as provided in the North St. Albert Trail Integration Plan (ISL Engineering) were incorporated into the Synchro analysis. The long-term geometry includes a future modification of St. Albert Trail into an urban design, consolidating the northbound and southbound directional intersections into a single intersection, and reducing the median separation between the northbound and southbound lanes. Provided as an attachment is the long-term geometry of this intersection as utilized in this analysis.

2019 AND 2045 FORECAST VOLUMES

Using the Option 1 alignment, traffic volumes for the 2019 existing and 2045 horizon years were projected by Associated for three primary intersections expected to be impacted:

- St. Albert Trail & Neil Ross Road
- Neil Ross Road & Element Drive
- Neil Ross Road & 127 Street

Figure 1 illustrates the 2019 traffic volumes for the PM peak hour. **Figure 2** illustrates the forecasted PM peak hour traffic volumes for the 2045 horizon (with the Neil Ross Road connection to 127 Street).

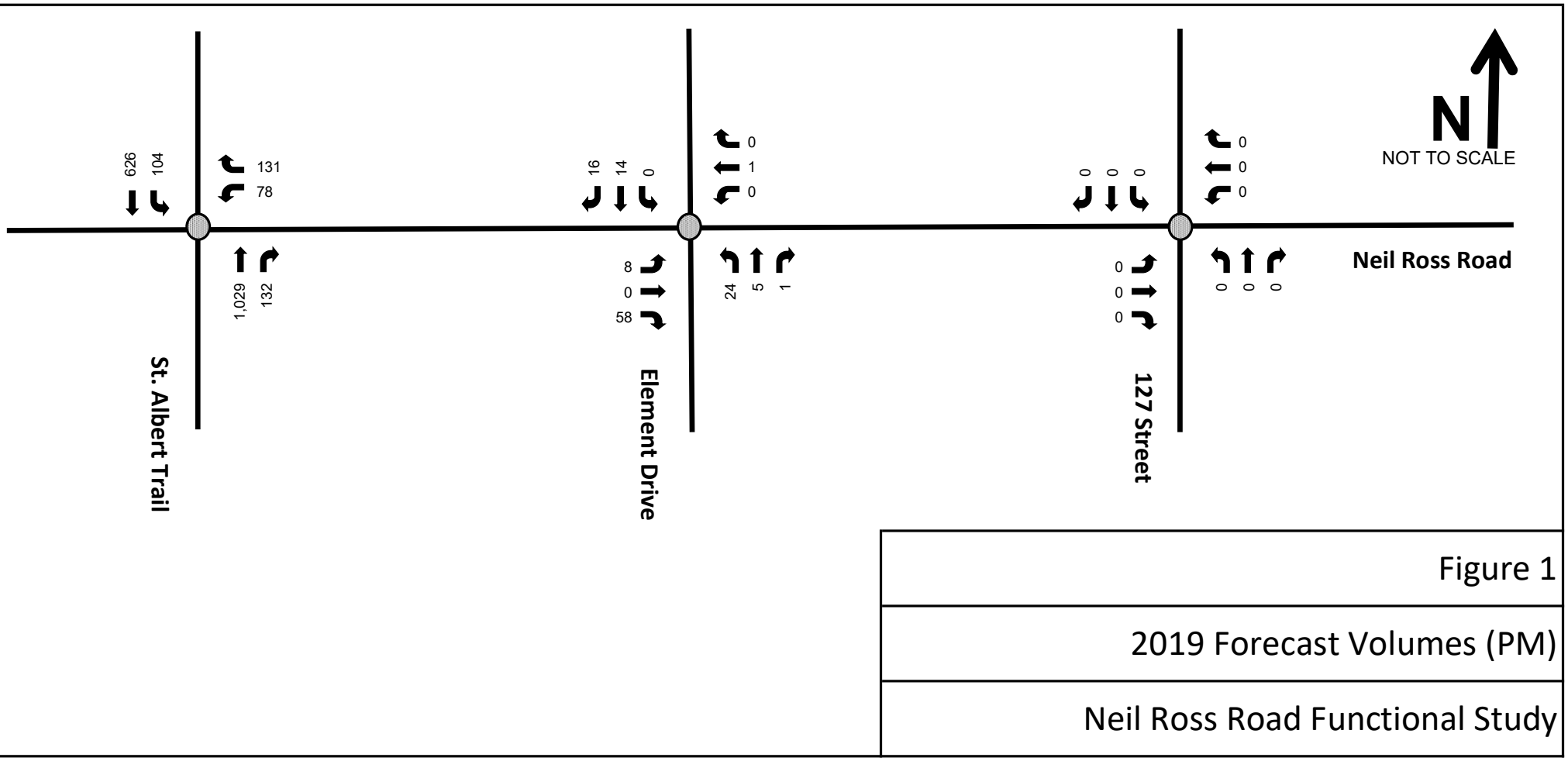


Figure 1

2019 Forecast Volumes (PM)

Neil Ross Road Functional Study

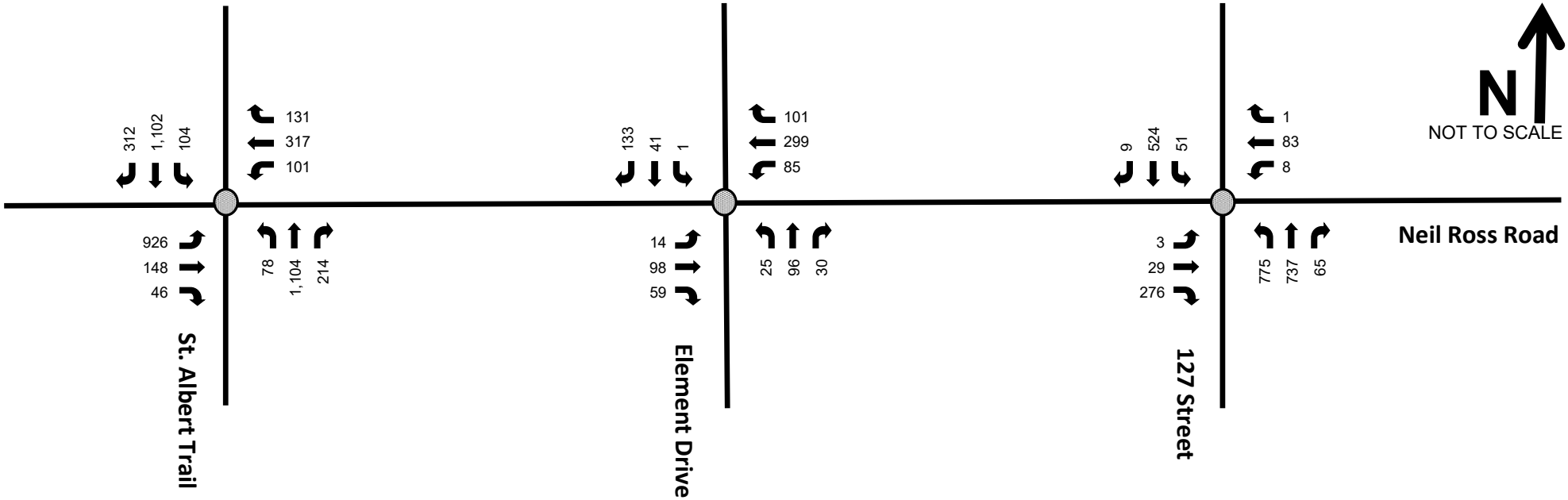


Figure 2

2045 Forecast Volumes (PM)

Neil Ross Road Functional Study

Reference: **Neil Ross Road Functional Alignment Study: Transportation Analysis**

SYNCHRO ANALYSIS

The intersection analysis for the analyzed intersections was undertaken using the Synchro 10.2 software package, which is based on the Highway Capacity Manual (HCM 2000).

For unsignalized intersections, the methodology considers the intersection geometry, the traffic volumes, the posted speed limit, and the type of intersection control. The average delay for each movement from the minor street, the major street left-turn movements and the overall intersection are calculated. An operation level of service ("LOS") is then assigned based on the calculated average delay. For signalized intersections, the methodology considers the intersection geometry, the traffic volumes, the posted speed limit, the traffic signal phasing/timing plan as well as pedestrian volumes. The average delays for each lane group and the overall intersection are calculated. An operation LOS is then assigned based on the calculated average delay. The level of service criteria for both signalized and unsignalized intersections is described in **Table 1**.

Table 1: Level of Service Criteria

Level of Service	Average Control Delay (seconds per vehicle)		Comment
	Signalized Intersection	Unsignalized Intersection	
A	10.0 or less	10.0 or less	Very good operation
B	10.1 to 20.0	10.1 to 15.0	Good operation
C	20.1 to 35.0	15.1 to 25.0	Acceptable operation
D	35.1 to 55.0	25.1 to 35.0	Congestion
E	55.1 to 80.0	35.1 to 50.0	Significant congestion
F	More than 80.0	More than 50.0	Unacceptable operation
Breakdown	Very high	Very high	Conditions so poor that capacity calculations are meaningless

The volume-to-capacity ("v/c") ratio was also considered. If the v/c ratio for a movement is greater than 1.00, then that movement has technically exceeded capacity.

The newly forecasted 2019 and 2045 traffic volume projections were incorporated into the City's Synchro model. As noted previously, both the interim and ultimate geometries were incorporated into the 2045 horizon scenario. The results of the 2019 analysis based on the existing geometry and existing traffic signal timing plans at the study intersections are summarized in **Table 2**. The results of the 2045 analysis using the interim geometry (i.e., a 2-lane undivided cross-section for Neil Ross Road (east of Element Drive) and 4-lane divided cross-section for 127 Street) and optimized traffic signal timing are summarized in **Table 3**. The results of the 2045 analysis using the ultimate geometry (i.e., a 4-lane divided cross-section for both Neil Ross Road (east of Element Drive) and 127 Street) and optimized traffic signal timing are summarized in **Table 4**.

The analysis results indicate the interim geometry of a 2-lane undivided cross-section for Neil Ross Road and a 4-lane divided cross-section for 127 Street is expected to be sufficient through the 2045 horizon based on the projected volumes. The intersection of Neil Ross Road & Element Drive is expected to operate with acceptable LOS and v/c ratios with both the interim and ultimate geometries in place.

Table 2 - Level of Service Summary (2019 Conditions)

Intersection	Scenario	Intersection Control Device	Interval	Measure	Eastbound			Westbound			Northbound			Southbound			Overall Intersection LOS
					Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
St. Albert Trail & Neil Ross Road	Existing Condition	Signalized	PM	Geometry					L/L/R			T/T/R			L/T/T		A
				Volumes (vph)				78		131		1029	132	104	626		
				Level of Service				E		B		A	A	A	A		
				V/C Ratio by Movement				0.32		0.56		0.37	0.11	0.30	0.23		
				Queue Length 95th (in metres)				24		23		44	3	13	24		
Element Drive & Neil Ross Road	Existing Condition	Signalized	PM	Geometry		L/T/T/R			L/T/T/R			L/TR			L/TR		A
				Volumes (vph)	8	0	58	0	1	0	24	5	1	0	14	0	
				Level of Service	A	-	A	-	A	-	A	A		-	A		
				V/C Ratio by Movement	0.02	-	0.05	-	0.00	-	0.05	0.01		-	0.02		
				Queue Length 95th (in metres)	2	-	0	-	0	-	5	2		-	3		

Table 3 - Level of Service Summary (2045 Horizon, Interim Geometry)

Intersection	Scenario	Intersection Control Device	Interval	Measure	Eastbound			Westbound			Northbound			Southbound			Overall Intersection LOS
					Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
St. Albert Trail & Neil Ross Road	2045 - Interim Geometry	Signalized	PM	Geometry		L/T/TR			L/L/T/T/R			L/L/T/T/T/R			L/T/T/T/R		F
				Volumes (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321	
				Level of Service	F	E		C	F	C	F	F	B	F	E	B	
				V/C Ratio by Movement	1.23	0.60		0.07	0.84	0.54	0.69	1.09	0.45	1.07	0.98	0.57	
				Queue Length 95th (in metres)	#472	41		16	#80	39	#29	#185	28	#84	#171	42	
Element Drive & Neil Ross Road	2045 - Interim Geometry	Signalized	PM	Geometry		L/T/T/R			L/T/T/R			L/TR			L/TR		A
				Volumes (vph)	14	98	59	85	299	101	25	96	30	1	41	133	
				Level of Service	A	A	A	A	A	A	A	A		A	A		
				V/C Ratio by Movement	0.04	0.07	0.09	0.18	0.23	0.16	0.06	0.18		0.00	0.25		
				Queue Length 95th (in metres)	3	6	5	12	15	7	5	13		1	11		
127 Street & Neil Ross Road	2045 - Interim Geometry	Signalized	PM	Geometry		L/T/R			L/T/R			L/T/T/R			L/T/T/R		C
				Volumes (vph)	3	29	276	8	83	1	775	737	65	51	524	9	
				Level of Service	C	C	A	C	C	A	D	B	A	B	D	A	
				V/C Ratio by Movement	0.01	0.08	0.52	0.03	0.23	0.00	0.96	0.37	0.07	0.23	0.82	0.02	
				Queue Length 95th (in metres)	3	12	21	5	27	0	#212	51	5	9	#72	0	

#95th percentile volume exceeds capacity; queue may be longer.

Table 4 - Level of Service Summary (2045 Horizon, Ultimate Geometry)

Intersection	Scenario	Intersection Control Device	Interval	Measure	Eastbound			Westbound			Northbound			Southbound			Overall Intersection LOS
					Left	Through	Right	Left	Through	Right	Left	Through	Right	Left	Through	Right	
St. Albert Trail & Neil Ross Road	2045 - Ultimate Geometry (Unimproved)	Signalized	PM	Geometry		L/T/TR			L/L/T/T/R			L/L/T/T/T/R			L/T/T/T/R		F
				Volumes (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321	
				Level of Service	F	E		C	F	C	F	F	B	F	E	B	
				V/C Ratio by Movement	1.23	0.60		0.07	0.84	0.54	0.69	1.09	0.45	1.07	0.98	0.57	
				Queue Length 95th (in metres)	#472	41		16	#80	39	#29	#185	28	#84	#171	42	
St. Albert Trail & Neil Ross Road	2045 - Ultimate Geometry (Improved)	Signalized	PM	Geometry		L/L/T/TR			L/L/T/T/R			L/L/T/T/T/R			L/L/T/T/T/R		D
				Volumes (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321	
				Level of Service	E	D		C	D	B	E	D	A	E	D	A	
				V/C Ratio by Movement	0.97	0.49		0.1	0.69	0.44	0.45	0.79	0.37	0.56	0.73	0.47	
				Queue Length 95th (in metres)	#158	31		15	54	23	18	110	18	28	110	22	
Element Drive & Neil Ross Road	2045 - Ultimate Geometry	Signalized	PM	Geometry		L/T/T/R			L/T/T/R			L/TR			L/TR		A
				Volumes (vph)	14	98	59	85	299	101	25	96	30	1	41	133	
				Level of Service	A	A	A	A	A	A	A	A		A	A		
				V/C Ratio by Movement	0.04	0.07	0.09	0.18	0.23	0.16	0.06	0.18		0.00	0.25		
				Queue Length 95th (in metres)	3	6	5	12	15	7	5	13		1	11		
127 Street & Neil Ross Road	2045 - Ultimate Geometry	Signalized	PM	Geometry		L/T/T/R			L/T/T/R			L/T/T/R			L/T/T/R		C
				Volumes (vph)	3	29	276	8	83	1	775	737	65	51	524	9	
				Level of Service	C	C	A	C	C	A	D	B	A	B	D	A	
				V/C Ratio by Movement	0.01	0.04	0.52	0.03	0.12	0.00	0.96	0.37	0.07	0.23	0.82	0.02	
				Queue Length 95th (in metres)	3	6	21	5	14	0	#212	51	5	9	#72	0	

#95th percentile volume exceeds capacity; queue may be longer.

Reference: **Neil Ross Road Functional Alignment Study: Transportation Analysis**

The intersection of St. Albert Trail & Neil Ross Road is expected to operate with deficiencies on several approaches even with the future urbanization of the intersection. The primary cause of the operational deficiency appears to be the future eastbound to northbound movement, from Neil Ross Road to travel north on St. Albert Trail, where left-turning volumes are projected to exceed 900 vehicles during the PM peak hour. However, this movement is not expected to be impacted by the Option 1 Alignment or extension of Neil Ross Road to 127 Street.

Further analysis was conducted to determine what potential mitigation measures could be considered to improve 2045 PM peak hour horizon conditions at the St. Albert Trail & Neil Ross Road intersection. The analysis indicates a 2nd eastbound to northbound lane and a 2nd southbound to eastbound lane would improve v/c ratios, vehicle delays and 95th Percentile Queues. The addition of each lane would correspond with opposing dual left-turn lanes. There appears to be adequate median space to accommodate the additional turn lanes. Operational analysis results with the additional improvements are detailed in **Table 4** and indicate that all movements are expected to operate with acceptable LOSs, v/c ratios and 95th Percentile Queues based on this improvement to the original concept.

LANE CONFIGURATIONS AND TRAFFIC CONTROL

Based on the results of the analysis, **Figure 3** illustrates the recommended lane geometries for opening day of the Neil Ross Road extension to 127 Street with a 2-lane undivided cross-section for Neil Ross Road (east of Element Drive) and a 4-lane divided cross-section for 127 Street, as well as improved lane configurations at the Neil Ross Road & St. Albert Trail intersection. Turn bay lengths should be determined based on 95th Percentile Queues and adequacy to provide deceleration within each turn bay. Traffic signals are currently provided at the Neil Ross Road & St. Albert Trail intersections. Traffic signals are recommended for the Neil Ross Road & Element Drive and Neil Ross Road & 127 Street intersections for opening day.

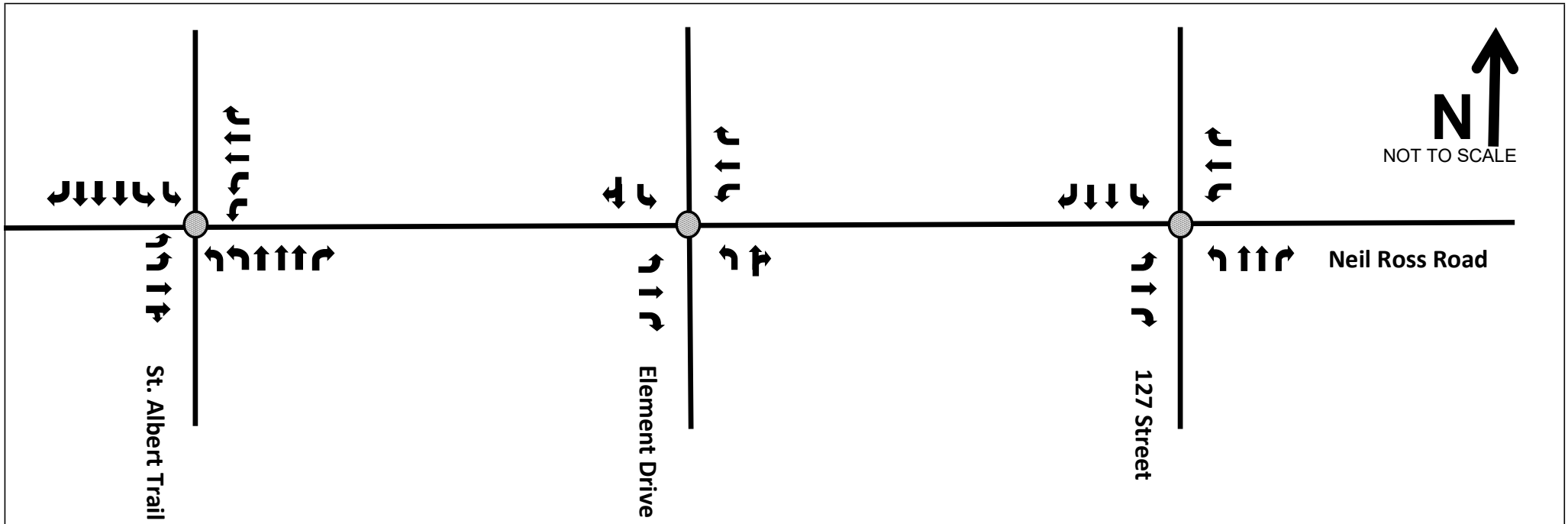


Figure 3

Recommended Intersection Geometries

Neil Ross Road Functional Study

ACCESS MANAGEMENT

A review of the City's Complete Street Guidelines for the Crosstown / Arterial roadway classification does not include a recommended intersection spacing requirement. The Guidelines refer on several occasions to the Regional Transportation Corridor Design Guidelines used by the Region of Waterloo. A review of the Waterloo Guidelines as well as the nearby Edmonton Complete Streets Guidelines suggests a spacing standard of 215m (Waterloo) and between 110m to 250m (Edmonton), based on whether proposed intersections are signalized or unsignalized. A review of similar roadways within the City of St. Albert was also conducted and generally measured to be within a 200 – 350m spacing. Therefore, for relative consistency, a minimum spacing standard of 200m measured from centerline to centerline of intersections along Neil Ross Road is recommended. Future intersections should also consider the context of the area, including consideration for curvature of the roadway, sightlines, topography, and environmental constraints. Collectively, it is recommended an assessment be conducted for each proposed intersection location.

Access to Neil Ross Road through an extension of Edinburgh Court is not recommended. As Edinburgh Court provides connectivity to Everitt Drive and St. Albert Trail, a future connection from Edinburgh Court to Neil Ross Road may provide an attractive cut-through option for vehicles attempting to avoid congestion at the Neil Ross Road & St. Albert Trail intersections and for vehicles traveling south towards the City. In addition, Edinburgh Court is designed as a residential street with homes fronting the roadway. The potential traffic that could cut-through using this route would likely exceed the typical daily traffic volumes seen on a residential street. In addition, Edinburgh Court would be a redundant connection to Element Drive, which is designed to accommodate higher traffic volumes than Edinburgh Court.

CONCLUSIONS

A detailed evaluation of Neil Ross Road assuming Alignment 1 was conducted from a traffic operations perspective. Alignment 1 consists of a future extension of Neil Ross Road to Coal Mine Road, with an intersection at 127 Street. While planned as a future 4-lane divided Crosstown roadway, analysis indicates a 2-lane undivided roadway is expected to be sufficient through the horizon years as an interim cross-section. However, signalization at the 127 Street intersection and Element Drive intersections with Neil Ross Road are recommended on opening day. Auxiliary turn lanes are also recommended at both intersections, as illustrated in **Figure 3**. The analysis indicates future operational deficiencies at the Neil Ross Road & St. Albert Trail modified intersection, however, the primary contributor to this deficiency is the eastbound to northbound volumes, which are not expected to be impacted by the extension of Neil Ross Road to 127 Street. Additional mitigation measures beyond the long-term improvements planned at St. Albert Trail & Neil Ross Road include a second eastbound to northbound left-turn lane and a second southbound to eastbound left-turn lane. There appears to be adequate median space to accommodate the additional turn lanes. Operations analysis indicates adequate, LOSs, v/c ratios and reasonable 95th Percentile Queues for all movements.

In addition, an access management review of the proposed corridor and applicable classification suggest a minimum intersection spacing of 200m may be appropriate for this corridor. Specific locations of each intersection should be evaluated with consideration for a broad range of factors, such as roadway curvature, sightlines, topography, and environmentally sensitive areas.

Reference: **Neil Ross Road Functional Alignment Study: Transportation Analysis**

Stantec Consulting Ltd.

Lindsay Haskins P.Eng.
Transportation Planning Team Lead

Phone: 780-969-2001
Lindsay.Haskins@stantec.com

Attachment: Long-Term Geometric Design, Synchro Outputs



NORTH ST. ALBERT TRAIL INTEGRATION PLAN

LONG TERM - SHEET 3: NEIL ROSS ROAD TO CITY LIMIT

JANUARY 28, 2019

NORTH



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	78	131	1029	132	104	626
Future Volume (vph)	78	131	1029	132	104	626
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0		0.0	105.0	
Storage Lanes	2	1		1	1	
Taper Length (m)	7.5				7.5	
Lane Util. Factor	0.97	1.00	0.95	1.00	1.00	0.95
Frt		0.850		0.850		
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3433	1583	3539	1583	1770	3539
Flt Permitted	0.950				0.243	
Satd. Flow (perm)	3433	1583	3539	1583	453	3539
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		142		143		
Link Speed (k/h)	50		50			50
Link Distance (m)	370.4		431.9			394.3
Travel Time (s)	26.7		31.1			28.4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	85	142	1118	143	113	680
Shared Lane Traffic (%)						
Lane Group Flow (vph)	85	142	1118	143	113	680
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	10.9		25.0			25.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	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
Turning Speed (k/h)	25	15		15	25	
Number of Detectors	1	1	2	1	1	2
Detector Template	Left	Right	Thru	Right	Left	Thru
Leading Detector (m)	2.0	2.0	10.0	2.0	2.0	10.0
Trailing Detector (m)	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
Detector 1 Size(m)	2.0	2.0	0.6	2.0	2.0	0.6
Detector 1 Type	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
Detector 1 Queue (s)	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
Detector 2 Position(m)			9.4			9.4
Detector 2 Size(m)			0.6			0.6
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Perm	Perm	NA	Perm	Perm	NA
Protected Phases			6			2
Permitted Phases	4	4		6	2	

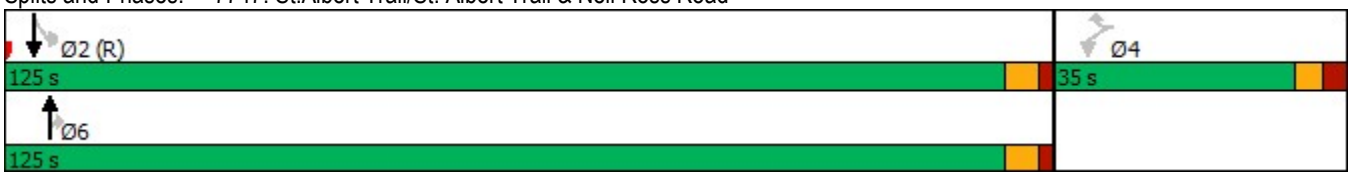


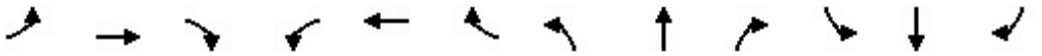
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Detector Phase	4	4	6	6	2	2
Switch Phase						
Minimum Initial (s)	12.0	12.0	15.0	15.0	15.0	15.0
Minimum Split (s)	24.5	24.5	47.0	47.0	24.0	24.0
Total Split (s)	35.0	35.0	125.0	125.0	125.0	125.0
Total Split (%)	21.9%	21.9%	78.1%	78.1%	78.1%	78.1%
Maximum Green (s)	28.5	28.5	119.0	119.0	119.0	119.0
Yellow Time (s)	3.5	3.5	4.0	4.0	4.0	4.0
All-Red Time (s)	3.0	3.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	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
Recall Mode	None	None	Max	Max	C-Max	C-Max
Walk Time (s)			7.0	7.0		
Flash Dont Walk (s)			24.0	24.0		
Pedestrian Calls (#/hr)			0	0		
Act Effct Green (s)	12.3	12.3	135.2	135.2	135.2	135.2
Actuated g/C Ratio	0.08	0.08	0.84	0.84	0.84	0.84
v/c Ratio	0.32	0.56	0.37	0.11	0.30	0.23
Control Delay	73.4	18.9	3.2	0.5	4.7	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	73.4	18.9	3.2	0.5	4.7	2.6
LOS	E	B	A	A	A	A
Approach Delay	39.3		2.9			2.9
Approach LOS	D		A			A
90th %ile Green (s)	13.3	13.3	134.2	134.2	134.2	134.2
90th %ile Term Code	Gap	Gap	Coord	Coord	Coord	Coord
70th %ile Green (s)	12.0	12.0	135.5	135.5	135.5	135.5
70th %ile Term Code	Min	Min	Coord	Coord	Coord	Coord
50th %ile Green (s)	12.0	12.0	135.5	135.5	135.5	135.5
50th %ile Term Code	Min	Min	Coord	Coord	Coord	Coord
30th %ile Green (s)	12.0	12.0	135.5	135.5	135.5	135.5
30th %ile Term Code	Min	Min	Coord	Coord	Coord	Coord
10th %ile Green (s)	12.0	12.0	135.5	135.5	135.5	135.5
10th %ile Term Code	Min	Min	Coord	Coord	Coord	Coord
Queue Length 50th (m)	14.1	0.0	35.5	0.0	6.2	18.2
Queue Length 95th (m)	23.7	23.1	44.3	3.2	12.7	23.7
Internal Link Dist (m)	346.4		407.9			370.3
Turn Bay Length (m)					105.0	
Base Capacity (vph)	611	398	2991	1360	382	2991
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.36	0.37	0.11	0.30	0.23

Intersection Summary	
Area Type:	Other

Cycle Length: 160	
Actuated Cycle Length: 160	
Offset: 123 (77%), Referenced to phase 2:SBTL, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.56	
Intersection Signal Delay: 6.5	Intersection LOS: A
Intersection Capacity Utilization 66.4%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 7747: St.Albert Trail/St. Albert Trail & Neil Ross Road



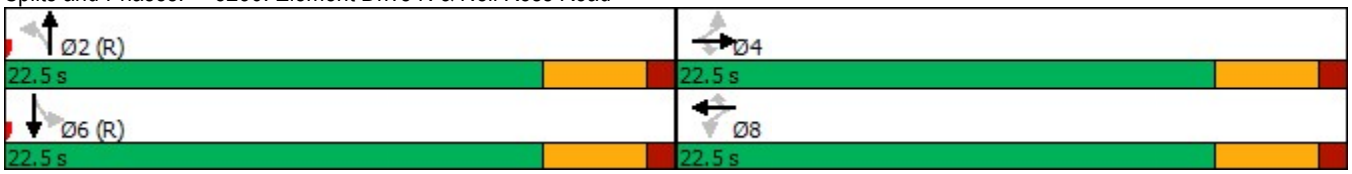


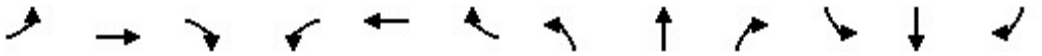
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	0	58	0	1	0	24	5	1	0	14	0
Future Volume (vph)	8	0	58	0	1	0	24	5	1	0	14	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Storage Length (m)	80.0		75.0	80.0		75.0	0.0		0.0	0.0		0.0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850					0.975				
Flt Protected	0.950						0.950					
Satd. Flow (prot)	1789	3579	1601	1883	3579	1883	1789	1836	0	1883	1883	0
Flt Permitted	0.757						0.748					
Satd. Flow (perm)	1426	3579	1601	1883	3579	1883	1409	1836	0	1883	1883	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			1040					1				
Link Speed (k/h)		60			60			60			60	
Link Distance (m)		370.4			286.0			115.5			149.1	
Travel Time (s)		22.2			17.2			6.9			8.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	9	0	63	0	1	0	26	5	1	0	15	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	9	0	63	0	1	0	26	6	0	0	15	0
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)		3.7			3.7			3.7			3.7	
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	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm		Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5	
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5	
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0		18.0	18.0	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	
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)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	18.0		18.0		18.0		18.0	18.0			18.0	
Actuated g/C Ratio	0.40		0.40		0.40		0.40	0.40			0.40	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio	0.02		0.05		0.00		0.05	0.01			0.02	
Control Delay	8.4		0.1		8.0		8.6	7.8			8.3	
Queue Delay	0.0		0.0		0.0		0.0	0.0			0.0	
Total Delay	8.4		0.1		8.0		8.6	7.8			8.3	
LOS	A		A		A		A	A			A	
Approach Delay		1.1			8.0			8.5			8.3	
Approach LOS		A			A			A			A	
Queue Length 50th (m)	0.4		0.0		0.0		1.3	0.3			0.7	
Queue Length 95th (m)	2.3		0.0		0.3		4.6	1.8			3.2	
Internal Link Dist (m)		346.4			262.0			91.5			125.1	
Turn Bay Length (m)	80.0		75.0									
Base Capacity (vph)	570		1264		1431		563	735			753	
Starvation Cap Reductn	0		0		0		0	0			0	
Spillback Cap Reductn	0		0		0		0	0			0	
Storage Cap Reductn	0		0		0		0	0			0	
Reduced v/c Ratio	0.02		0.05		0.00		0.05	0.01			0.02	

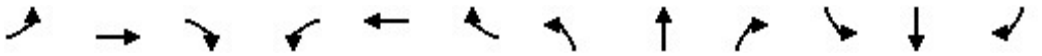
Intersection Summary			
Area Type:	Other		
Cycle Length: 45			
Actuated Cycle Length: 45			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green			
Natural Cycle: 45			
Control Type: Pretimed			
Maximum v/c Ratio: 0.05			
Intersection Signal Delay: 4.0		Intersection LOS: A	
Intersection Capacity Utilization 22.1%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 8236: Element Drive N & Neil Ross Road





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	3	29	276	8	83	1	775	737	65	51	524	9
Future Volume (vph)	3	29	276	8	83	1	775	737	65	51	524	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Storage Length (m)	65.0		65.0	65.0		65.0	65.0		65.0	65.0		65.0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
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	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	3579	1601	1789	3579	1601
Flt Permitted	0.699			0.736			0.176			0.349		
Satd. Flow (perm)	1317	1883	1601	1386	1883	1601	331	3579	1601	657	3579	1601
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			300			127			73			127
Link Speed (k/h)		60			60			60			60	
Link Distance (m)		433.5			362.3			119.7			282.0	
Travel Time (s)		26.0			21.7			7.2			16.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	32	300	9	90	1	842	801	71	55	570	10
Shared Lane Traffic (%)												
Lane Group Flow (vph)	3	32	300	9	90	1	842	801	71	55	570	10
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)		3.7			3.7			3.7			3.7	
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	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
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	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		6			2		7	4		3	8	

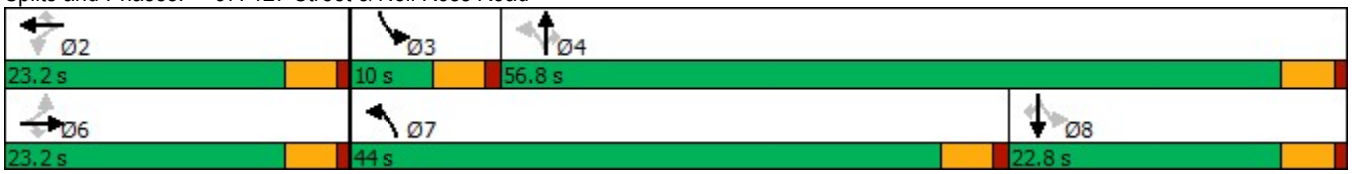


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2		2	4		4	8		8
Detector Phase	6	6	6	2	2	2	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	23.2	23.2	23.2	23.2	23.2	23.2	44.0	56.8	56.8	10.0	22.8	22.8
Total Split (%)	25.8%	25.8%	25.8%	25.8%	25.8%	25.8%	48.9%	63.1%	63.1%	11.1%	25.3%	25.3%
Maximum Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	39.5	52.3	52.3	5.5	18.3	18.3
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)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (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
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
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	Max	Max	Max	Max	Max	Max	None	None	None	None	None	None
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0		7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0		11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0		0	0		0	0
Act Effct Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	61.3	53.4	53.4	22.8	17.3	17.3
Actuated g/C Ratio	0.21	0.21	0.21	0.21	0.21	0.21	0.69	0.60	0.60	0.26	0.19	0.19
v/c Ratio	0.01	0.08	0.52	0.03	0.23	0.00	0.96	0.37	0.07	0.23	0.82	0.02
Control Delay	28.7	29.5	7.5	28.9	31.4	0.0	42.8	10.2	2.3	16.2	45.4	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.7	29.5	7.5	28.9	31.4	0.0	42.8	10.2	2.3	16.2	45.4	0.1
LOS	C	C	A	C	C	A	D	B	A	B	D	A
Approach Delay		9.8			30.9			25.9			42.2	
Approach LOS		A			C			C			D	
90th %ile Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	39.5	52.3	52.3	5.5	18.3	18.3
90th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Max	Hold	Hold	Max	Max	Max
70th %ile Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	39.5	52.3	52.3	5.5	18.3	18.3
70th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Max	Hold	Hold	Max	Max	Max
50th %ile Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	39.5	52.3	52.3	5.5	18.3	18.3
50th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Max	Hold	Hold	Max	Max	Max
30th %ile Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	39.5	51.5	51.5	5.5	17.5	17.5
30th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Max	Hold	Hold	Max	Gap	Gap
10th %ile Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	39.5	58.0	58.0	0.0	14.0	14.0
10th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Max	Hold	Hold	Skip	Gap	Gap
Queue Length 50th (m)	0.5	4.7	0.0	1.3	13.7	0.0	125.7	38.2	0.0	4.1	52.1	0.0
Queue Length 95th (m)	2.8	12.4	20.9	5.4	27.1	0.0	#212.4	50.5	5.2	9.2	#72.3	0.0
Internal Link Dist (m)		409.5			338.3			95.7			258.0	
Turn Bay Length (m)	65.0		65.0	65.0		65.0	65.0		65.0	65.0		65.0
Base Capacity (vph)	276	395	573	291	395	437	875	2151	991	237	736	430
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.08	0.52	0.03	0.23	0.00	0.96	0.37	0.07	0.23	0.77	0.02

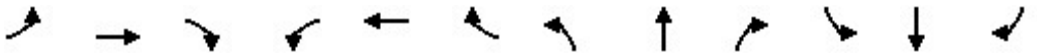
Intersection Summary

Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 89			
Natural Cycle: 90			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.96			
Intersection Signal Delay: 27.9		Intersection LOS: C	
Intersection Capacity Utilization 75.3%		ICU Level of Service D	
Analysis Period (min) 15			
90th %ile Actuated Cycle: 90			
70th %ile Actuated Cycle: 90			
50th %ile Actuated Cycle: 90			
30th %ile Actuated Cycle: 89.2			
10th %ile Actuated Cycle: 85.7			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 37: 127 Street & Neil Ross Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321
Future Volume (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		0.0	85.0		0.0	100.0		100.0	90.0		90.0
Storage Lanes	1		0	2		1	2		1	1		1
Taper Length (m)	7.5			60.0			7.5			20.0		
Lane Util. Factor	1.00	0.95	0.95	0.97	0.95	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frt		0.964				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3412	0	3433	3539	1583	3433	5085	1583	1770	5085	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3412	0	3433	3539	1583	3433	5085	1583	1770	5085	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		41				90			219			308
Link Speed (k/h)		60			50			50			50	
Link Distance (m)		258.0			370.4			431.9			394.3	
Travel Time (s)		15.5			26.7			31.1			28.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1007	161	50	110	345	142	85	1200	233	113	1198	349
Shared Lane Traffic (%)												
Lane Group Flow (vph)	1007	211	0	110	345	142	85	1200	233	113	1198	349
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)		7.4			7.4			7.4			7.4	
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	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		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
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
Detector 1 Size(m)	2.0	0.6		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
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
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
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
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	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			6



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4		3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	12.0		5.0	12.0	12.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.5		9.5	24.5	24.5	9.5	37.0	37.0	9.5	37.0	37.0
Total Split (s)	74.0	84.5		14.0	24.5	24.5	9.5	38.5	38.5	13.0	42.0	42.0
Total Split (%)	49.3%	56.3%		9.3%	16.3%	16.3%	6.3%	25.7%	25.7%	8.7%	28.0%	28.0%
Maximum Green (s)	69.5	78.0		9.5	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	4.0	4.0	3.5	4.0	4.0
All-Red Time (s)	1.0	3.0		1.0	3.0	3.0	1.0	2.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	6.5		4.5	6.5	6.5	4.5	6.0	6.0	4.5	6.0	6.0
Lead/Lag	Lead	Lead		Lag	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)								7.0	7.0		7.0	7.0
Flash Dont Walk (s)								24.0	24.0		24.0	24.0
Pedestrian Calls (#/hr)								0	0		0	0
Act Effct Green (s)	69.5	13.7		73.2	17.5	17.5	5.4	32.5	32.5	9.0	36.1	36.1
Actuated g/C Ratio	0.46	0.09		0.49	0.12	0.12	0.04	0.22	0.22	0.06	0.24	0.24
v/c Ratio	1.23	0.60		0.07	0.84	0.54	0.69	1.09	0.45	1.07	0.98	0.57
Control Delay	149.0	59.9		20.7	82.9	32.4	98.3	108.8	10.3	168.7	77.1	11.7
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	149.0	59.9		20.7	82.9	32.4	98.3	108.8	10.3	168.7	77.1	11.7
LOS	F	E		C	F	C	F	F	B	F	E	B
Approach Delay		133.6			59.5			93.1			69.6	
Approach LOS		F			E			F			E	
90th %ile Green (s)	69.5	17.2		70.3	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
90th %ile Term Code	Max	Gap		Hold	Max	Max	Max	Coord	Coord	Max	Coord	Coord
70th %ile Green (s)	69.5	14.6		72.9	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
70th %ile Term Code	Max	Gap		Hold	Max	Max	Max	Coord	Coord	Max	Coord	Coord
50th %ile Green (s)	69.5	12.9		74.6	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
50th %ile Term Code	Max	Gap		Hold	Max	Max	Max	Coord	Coord	Max	Coord	Coord
30th %ile Green (s)	69.5	12.0		75.5	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
30th %ile Term Code	Max	Min		Hold	Max	Max	Max	Coord	Coord	Max	Coord	Coord
10th %ile Green (s)	69.5	12.0		72.8	15.3	15.3	7.0	32.5	32.5	11.2	36.7	36.7
10th %ile Term Code	Max	Min		Hold	Gap	Gap	Gap	Coord	Coord	Max	Coord	Coord
Queue Length 50th (m)	~387.5	27.4		9.0	56.3	15.1	13.8	~154.3	3.5	~40.8	137.8	10.1
Queue Length 95th (m)	#471.9	40.8		15.6	#79.8	38.8	#28.7	#185.4	27.7	#83.7	#170.9	41.8
Internal Link Dist (m)		234.0			346.4			407.9			370.3	
Turn Bay Length (m)	100.0			85.0			100.0		100.0	90.0		90.0
Base Capacity (vph)	820	1793		1675	424	269	123	1101	514	106	1225	615
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.23	0.12		0.07	0.81	0.53	0.69	1.09	0.45	1.07	0.98	0.57

Intersection Summary

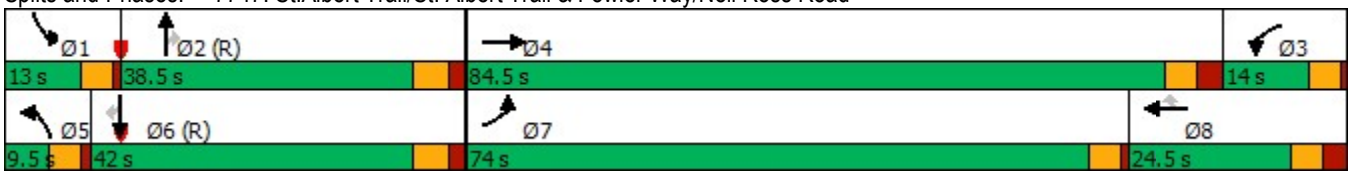
Area Type: Other

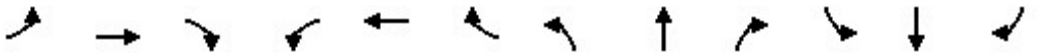
Cycle Length: 150	
Actuated Cycle Length: 150	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Natural Cycle: 135	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.23	
Intersection Signal Delay: 91.1	Intersection LOS: F
Intersection Capacity Utilization 106.3%	ICU Level of Service G
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7747: St.Albert Trail/St. Albert Trail & Fowler Way/Neil Ross Road





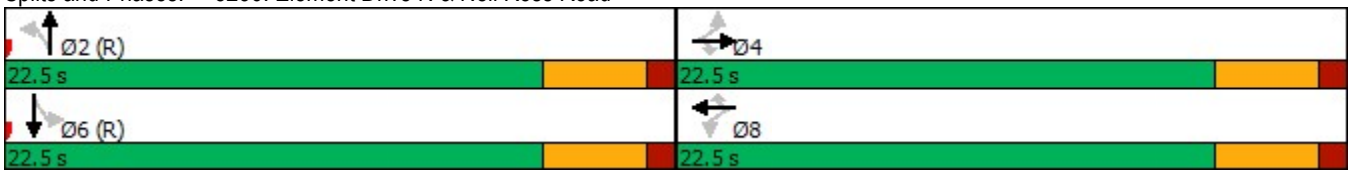
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	98	59	85	299	101	25	96	30	1	41	133
Future Volume (vph)	14	98	59	85	299	101	25	96	30	1	41	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Storage Length (m)	80.0		75.0	80.0		75.0	0.0		0.0	0.0		0.0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.964			0.886	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	3579	1601	1789	3579	1601	1789	1816	0	1789	1669	0
Flt Permitted	0.555			0.684			0.638			0.669		
Satd. Flow (perm)	1045	3579	1601	1288	3579	1601	1202	1816	0	1260	1669	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			64			110		33			145	
Link Speed (k/h)		60			60			60			60	
Link Distance (m)		370.4			286.0			115.5			149.1	
Travel Time (s)		22.2			17.2			6.9			8.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	15	107	64	92	325	110	27	104	33	1	45	145
Shared Lane Traffic (%)												
Lane Group Flow (vph)	15	107	64	92	325	110	27	137	0	1	190	0
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)		7.2			7.2			3.7			3.7	
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	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5	
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5	
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0		18.0	18.0	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	
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)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0		18.0	18.0	
Actuated g/C Ratio	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40		0.40	0.40	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio	0.04	0.07	0.09	0.18	0.23	0.16	0.06	0.18		0.00	0.25	
Control Delay	8.6	8.6	3.5	9.9	9.4	3.1	8.8	7.7		8.0	4.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	8.6	8.6	3.5	9.9	9.4	3.1	8.8	7.7		8.0	4.2	
LOS	A	A	A	A	A	A	A	A		A	A	
Approach Delay		6.8			8.2			7.9			4.2	
Approach LOS		A			A			A			A	
Queue Length 50th (m)	0.7	2.7	0.0	4.6	8.7	0.0	1.3	5.1		0.1	2.2	
Queue Length 95th (m)	3.2	6.1	5.0	11.7	15.3	6.5	4.7	13.3		0.7	11.2	
Internal Link Dist (m)		346.4			262.0			91.5			125.1	
Turn Bay Length (m)	80.0		75.0	80.0		75.0						
Base Capacity (vph)	418	1431	678	515	1431	706	480	746		504	754	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.04	0.07	0.09	0.18	0.23	0.16	0.06	0.18		0.00	0.25	

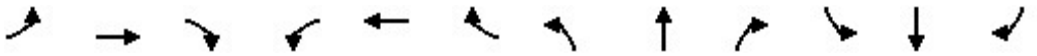
Intersection Summary

Area Type: Other
Cycle Length: 45
Actuated Cycle Length: 45
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.25
Intersection Signal Delay: 7.2 Intersection LOS: A
Intersection Capacity Utilization 37.4% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 8236: Element Drive N & Neil Ross Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321
Future Volume (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		0.0	85.0		0.0	100.0		100.0	90.0		90.0
Storage Lanes	1		0	2		1	2		1	1		1
Taper Length (m)	7.5			60.0			7.5			20.0		
Lane Util. Factor	1.00	0.95	0.95	0.97	0.95	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frt		0.964				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3412	0	3433	3539	1583	3433	5085	1583	1770	5085	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3412	0	3433	3539	1583	3433	5085	1583	1770	5085	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		41				90			219			308
Link Speed (k/h)		60			50			50			50	
Link Distance (m)		258.0			370.4			431.9			394.3	
Travel Time (s)		15.5			26.7			31.1			28.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1007	161	50	110	345	142	85	1200	233	113	1198	349
Shared Lane Traffic (%)												
Lane Group Flow (vph)	1007	211	0	110	345	142	85	1200	233	113	1198	349
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)		7.4			7.4			7.4			7.4	
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	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		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
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
Detector 1 Size(m)	2.0	0.6		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
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
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
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
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	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			6



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4		3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	12.0		5.0	12.0	12.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.5		9.5	24.5	24.5	9.5	37.0	37.0	9.5	37.0	37.0
Total Split (s)	74.0	84.5		14.0	24.5	24.5	9.5	38.5	38.5	13.0	42.0	42.0
Total Split (%)	49.3%	56.3%		9.3%	16.3%	16.3%	6.3%	25.7%	25.7%	8.7%	28.0%	28.0%
Maximum Green (s)	69.5	78.0		9.5	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	4.0	4.0	3.5	4.0	4.0
All-Red Time (s)	1.0	3.0		1.0	3.0	3.0	1.0	2.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	6.5		4.5	6.5	6.5	4.5	6.0	6.0	4.5	6.0	6.0
Lead/Lag	Lead	Lead		Lag	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)								7.0	7.0		7.0	7.0
Flash Dont Walk (s)								24.0	24.0		24.0	24.0
Pedestrian Calls (#/hr)								0	0		0	0
Act Effct Green (s)	69.5	13.7		73.2	17.5	17.5	5.4	32.5	32.5	9.0	36.1	36.1
Actuated g/C Ratio	0.46	0.09		0.49	0.12	0.12	0.04	0.22	0.22	0.06	0.24	0.24
v/c Ratio	1.23	0.60		0.07	0.84	0.54	0.69	1.09	0.45	1.07	0.98	0.57
Control Delay	149.0	59.9		20.7	82.9	32.4	98.3	108.8	10.3	168.7	77.1	11.7
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	149.0	59.9		20.7	82.9	32.4	98.3	108.8	10.3	168.7	77.1	11.7
LOS	F	E		C	F	C	F	F	B	F	E	B
Approach Delay		133.6			59.5			93.1			69.6	
Approach LOS		F			E			F			E	
90th %ile Green (s)	69.5	17.2		70.3	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
90th %ile Term Code	Max	Gap		Hold	Max	Max	Max	Coord	Coord	Max	Coord	Coord
70th %ile Green (s)	69.5	14.6		72.9	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
70th %ile Term Code	Max	Gap		Hold	Max	Max	Max	Coord	Coord	Max	Coord	Coord
50th %ile Green (s)	69.5	12.9		74.6	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
50th %ile Term Code	Max	Gap		Hold	Max	Max	Max	Coord	Coord	Max	Coord	Coord
30th %ile Green (s)	69.5	12.0		75.5	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
30th %ile Term Code	Max	Min		Hold	Max	Max	Max	Coord	Coord	Max	Coord	Coord
10th %ile Green (s)	69.5	12.0		72.8	15.3	15.3	7.0	32.5	32.5	11.2	36.7	36.7
10th %ile Term Code	Max	Min		Hold	Gap	Gap	Gap	Coord	Coord	Max	Coord	Coord
Queue Length 50th (m)	~387.5	27.4		9.0	56.3	15.1	13.8	~154.3	3.5	~40.8	137.8	10.1
Queue Length 95th (m)	#471.9	40.8		15.6	#79.8	38.8	#28.7	#185.4	27.7	#83.7	#170.9	41.8
Internal Link Dist (m)		234.0			346.4			407.9			370.3	
Turn Bay Length (m)	100.0			85.0			100.0		100.0	90.0		90.0
Base Capacity (vph)	820	1793		1675	424	269	123	1101	514	106	1225	615
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.23	0.12		0.07	0.81	0.53	0.69	1.09	0.45	1.07	0.98	0.57

Intersection Summary

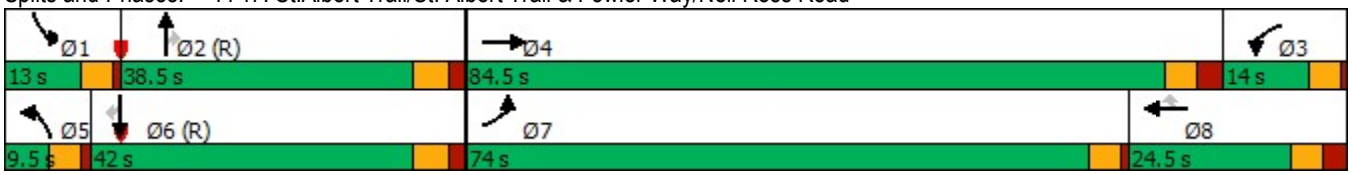
Area Type: Other

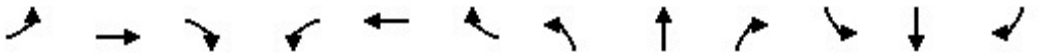
Cycle Length: 150	
Actuated Cycle Length: 150	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Natural Cycle: 135	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.23	
Intersection Signal Delay: 91.1	Intersection LOS: F
Intersection Capacity Utilization 106.3%	ICU Level of Service G
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7747: St.Albert Trail/St. Albert Trail & Fowler Way/Neil Ross Road





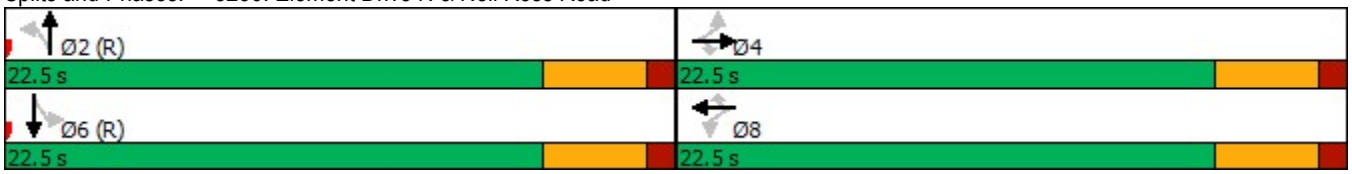
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	98	59	85	299	101	25	96	30	1	41	133
Future Volume (vph)	14	98	59	85	299	101	25	96	30	1	41	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Storage Length (m)	80.0		75.0	80.0		75.0	0.0		0.0	0.0		0.0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.964			0.886	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	3579	1601	1789	3579	1601	1789	1816	0	1789	1669	0
Flt Permitted	0.555			0.684			0.638			0.669		
Satd. Flow (perm)	1045	3579	1601	1288	3579	1601	1202	1816	0	1260	1669	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			64			110		33			145	
Link Speed (k/h)		60			60			60			60	
Link Distance (m)		370.4			286.0			115.5			149.1	
Travel Time (s)		22.2			17.2			6.9			8.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	15	107	64	92	325	110	27	104	33	1	45	145
Shared Lane Traffic (%)												
Lane Group Flow (vph)	15	107	64	92	325	110	27	137	0	1	190	0
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)		7.2			7.2			3.7			3.7	
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	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5	
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5	
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0		18.0	18.0	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	
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)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0		18.0	18.0	
Actuated g/C Ratio	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40		0.40	0.40	

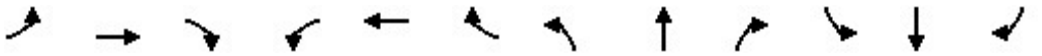
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio	0.04	0.07	0.09	0.18	0.23	0.16	0.06	0.18		0.00	0.25	
Control Delay	8.6	8.6	3.5	9.9	9.4	3.1	8.8	7.7		8.0	4.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	8.6	8.6	3.5	9.9	9.4	3.1	8.8	7.7		8.0	4.2	
LOS	A	A	A	A	A	A	A	A		A	A	
Approach Delay		6.8			8.2			7.9			4.2	
Approach LOS		A			A			A			A	
Queue Length 50th (m)	0.7	2.7	0.0	4.6	8.7	0.0	1.3	5.1		0.1	2.2	
Queue Length 95th (m)	3.2	6.1	5.0	11.7	15.3	6.5	4.7	13.3		0.7	11.2	
Internal Link Dist (m)		346.4			262.0			91.5			125.1	
Turn Bay Length (m)	80.0		75.0	80.0		75.0						
Base Capacity (vph)	418	1431	678	515	1431	706	480	746		504	754	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.04	0.07	0.09	0.18	0.23	0.16	0.06	0.18		0.00	0.25	

Intersection Summary

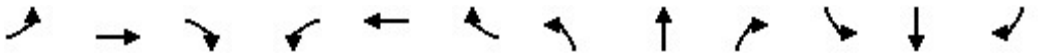
Area Type: Other
Cycle Length: 45
Actuated Cycle Length: 45
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.25
Intersection Signal Delay: 7.2 Intersection LOS: A
Intersection Capacity Utilization 37.4% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 8236: Element Drive N & Neil Ross Road





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	3	29	276	8	83	1	775	737	65	51	524	9
Future Volume (vph)	3	29	276	8	83	1	775	737	65	51	524	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Storage Length (m)	65.0		65.0	65.0		65.0	65.0		65.0	65.0		65.0
Storage Lanes	1		1	1		2	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	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	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	3579	1601	1789	3579	1601	1789	3579	1601	1789	3579	1601
Flt Permitted	0.696			0.735			0.176			0.349		
Satd. Flow (perm)	1311	3579	1601	1384	3579	1601	331	3579	1601	657	3579	1601
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			300			127			73			127
Link Speed (k/h)		60			60			60			60	
Link Distance (m)		433.5			362.3			119.7			282.0	
Travel Time (s)		26.0			21.7			7.2			16.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	3	32	300	9	90	1	842	801	71	55	570	10
Shared Lane Traffic (%)												
Lane Group Flow (vph)	3	32	300	9	90	1	842	801	71	55	570	10
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)		3.7			3.7			3.7			3.7	
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	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
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	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		6			2		7	4		3	8	

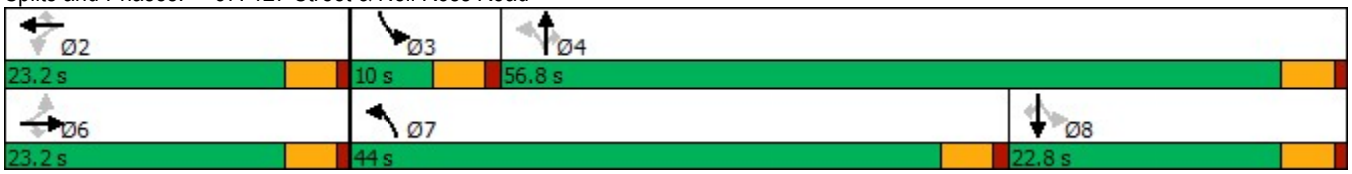


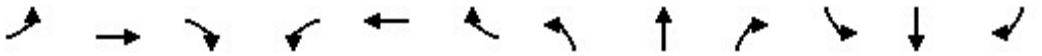
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2		2	4		4	8		8
Detector Phase	6	6	6	2	2	2	7	4	4	3	8	8
Switch Phase												
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	9.5	22.5	22.5	9.5	22.5	22.5
Total Split (s)	23.2	23.2	23.2	23.2	23.2	23.2	44.0	56.8	56.8	10.0	22.8	22.8
Total Split (%)	25.8%	25.8%	25.8%	25.8%	25.8%	25.8%	48.9%	63.1%	63.1%	11.1%	25.3%	25.3%
Maximum Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	39.5	52.3	52.3	5.5	18.3	18.3
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)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (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
Total Lost Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
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	Max	Max	Max	Max	Max	Max	None	None	None	None	None	None
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0		7.0	7.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0		11.0	11.0		11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0		0	0		0	0
Act Effct Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	61.3	53.4	53.4	22.8	17.3	17.3
Actuated g/C Ratio	0.21	0.21	0.21	0.21	0.21	0.21	0.69	0.60	0.60	0.26	0.19	0.19
v/c Ratio	0.01	0.04	0.52	0.03	0.12	0.00	0.96	0.37	0.07	0.23	0.82	0.02
Control Delay	28.7	28.8	7.5	28.9	29.4	0.0	42.8	10.2	2.3	16.2	45.4	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.7	28.8	7.5	28.9	29.4	0.0	42.8	10.2	2.3	16.2	45.4	0.1
LOS	C	C	A	C	C	A	D	B	A	B	D	A
Approach Delay		9.7			29.1			25.9			42.2	
Approach LOS		A			C			C			D	
90th %ile Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	39.5	52.3	52.3	5.5	18.3	18.3
90th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Max	Hold	Hold	Max	Max	Max
70th %ile Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	39.5	52.3	52.3	5.5	18.3	18.3
70th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Max	Hold	Hold	Max	Max	Max
50th %ile Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	39.5	52.3	52.3	5.5	18.3	18.3
50th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Max	Hold	Hold	Max	Max	Max
30th %ile Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	39.5	51.5	51.5	5.5	17.5	17.5
30th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Max	Hold	Hold	Max	Gap	Gap
10th %ile Green (s)	18.7	18.7	18.7	18.7	18.7	18.7	39.5	58.0	58.0	0.0	14.0	14.0
10th %ile Term Code	MaxR	MaxR	MaxR	MaxR	MaxR	MaxR	Max	Hold	Hold	Skip	Gap	Gap
Queue Length 50th (m)	0.5	2.4	0.0	1.3	7.0	0.0	125.7	38.2	0.0	4.1	52.1	0.0
Queue Length 95th (m)	2.8	6.4	20.9	5.4	13.6	0.0	#212.4	50.5	5.2	9.2	#72.3	0.0
Internal Link Dist (m)		409.5			338.3			95.7			258.0	
Turn Bay Length (m)	65.0		65.0	65.0		65.0	65.0		65.0	65.0		65.0
Base Capacity (vph)	275	752	573	290	752	437	875	2151	991	237	736	430
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.04	0.52	0.03	0.12	0.00	0.96	0.37	0.07	0.23	0.77	0.02

Intersection Summary

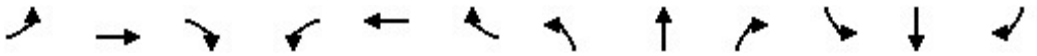
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 89			
Natural Cycle: 90			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.96			
Intersection Signal Delay: 27.8		Intersection LOS: C	
Intersection Capacity Utilization 75.3%		ICU Level of Service D	
Analysis Period (min) 15			
90th %ile Actuated Cycle: 90			
70th %ile Actuated Cycle: 90			
50th %ile Actuated Cycle: 90			
30th %ile Actuated Cycle: 89.2			
10th %ile Actuated Cycle: 85.7			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 37: 127 Street & Neil Ross Road





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321
Future Volume (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		0.0	85.0		0.0	100.0		100.0	90.0		90.0
Storage Lanes	1		0	2		1	2		1	1		1
Taper Length (m)	7.5			60.0			7.5			20.0		
Lane Util. Factor	1.00	0.95	0.95	0.97	0.95	1.00	0.97	0.91	1.00	1.00	0.91	1.00
Frt		0.964				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1770	3412	0	3433	3539	1583	3433	5085	1583	1770	5085	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3412	0	3433	3539	1583	3433	5085	1583	1770	5085	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		41				90			219			308
Link Speed (k/h)		60			50			50			50	
Link Distance (m)		258.0			370.4			431.9			394.3	
Travel Time (s)		15.5			26.7			31.1			28.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1007	161	50	110	345	142	85	1200	233	113	1198	349
Shared Lane Traffic (%)												
Lane Group Flow (vph)	1007	211	0	110	345	142	85	1200	233	113	1198	349
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)		7.4			7.4			7.4			7.4	
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	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		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
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
Detector 1 Size(m)	2.0	0.6		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
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
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
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
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	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			6



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4		3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	12.0		5.0	12.0	12.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.5		9.5	24.5	24.5	9.5	37.0	37.0	9.5	37.0	37.0
Total Split (s)	74.0	84.5		14.0	24.5	24.5	9.5	38.5	38.5	13.0	42.0	42.0
Total Split (%)	49.3%	56.3%		9.3%	16.3%	16.3%	6.3%	25.7%	25.7%	8.7%	28.0%	28.0%
Maximum Green (s)	69.5	78.0		9.5	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	4.0	4.0	3.5	4.0	4.0
All-Red Time (s)	1.0	3.0		1.0	3.0	3.0	1.0	2.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	6.5		4.5	6.5	6.5	4.5	6.0	6.0	4.5	6.0	6.0
Lead/Lag	Lead	Lead		Lag	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)								7.0	7.0		7.0	7.0
Flash Dont Walk (s)								24.0	24.0		24.0	24.0
Pedestrian Calls (#/hr)								0	0		0	0
Act Effct Green (s)	69.5	13.7		73.2	17.5	17.5	5.4	32.5	32.5	9.0	36.1	36.1
Actuated g/C Ratio	0.46	0.09		0.49	0.12	0.12	0.04	0.22	0.22	0.06	0.24	0.24
v/c Ratio	1.23	0.60		0.07	0.84	0.54	0.69	1.09	0.45	1.07	0.98	0.57
Control Delay	149.0	59.9		20.7	82.9	32.4	98.3	108.8	10.3	168.7	77.1	11.7
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	149.0	59.9		20.7	82.9	32.4	98.3	108.8	10.3	168.7	77.1	11.7
LOS	F	E		C	F	C	F	F	B	F	E	B
Approach Delay		133.6			59.5			93.1			69.6	
Approach LOS		F			E			F			E	
90th %ile Green (s)	69.5	17.2		70.3	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
90th %ile Term Code	Max	Gap		Hold	Max	Max	Max	Coord	Coord	Max	Coord	Coord
70th %ile Green (s)	69.5	14.6		72.9	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
70th %ile Term Code	Max	Gap		Hold	Max	Max	Max	Coord	Coord	Max	Coord	Coord
50th %ile Green (s)	69.5	12.9		74.6	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
50th %ile Term Code	Max	Gap		Hold	Max	Max	Max	Coord	Coord	Max	Coord	Coord
30th %ile Green (s)	69.5	12.0		75.5	18.0	18.0	5.0	32.5	32.5	8.5	36.0	36.0
30th %ile Term Code	Max	Min		Hold	Max	Max	Max	Coord	Coord	Max	Coord	Coord
10th %ile Green (s)	69.5	12.0		72.8	15.3	15.3	7.0	32.5	32.5	11.2	36.7	36.7
10th %ile Term Code	Max	Min		Hold	Gap	Gap	Gap	Coord	Coord	Max	Coord	Coord
Queue Length 50th (m)	~387.5	27.4		9.0	56.3	15.1	13.8	~154.3	3.5	~40.8	137.8	10.1
Queue Length 95th (m)	#471.9	40.8		15.6	#79.8	38.8	#28.7	#185.4	27.7	#83.7	#170.9	41.8
Internal Link Dist (m)		234.0			346.4			407.9			370.3	
Turn Bay Length (m)	100.0			85.0			100.0		100.0	90.0		90.0
Base Capacity (vph)	820	1793		1675	424	269	123	1101	514	106	1225	615
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.23	0.12		0.07	0.81	0.53	0.69	1.09	0.45	1.07	0.98	0.57

Intersection Summary

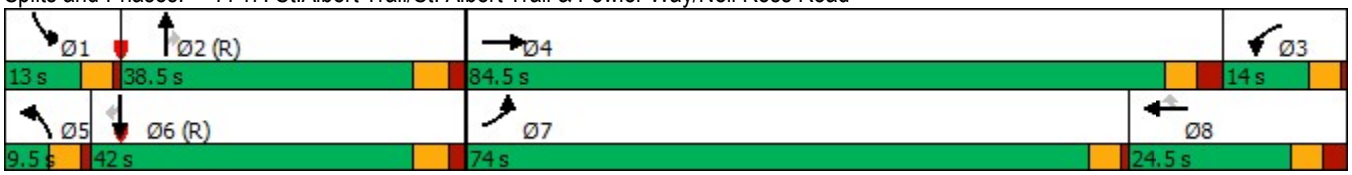
Area Type: Other

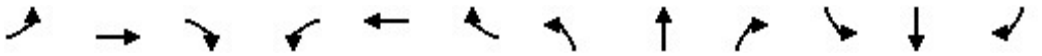
Cycle Length: 150	
Actuated Cycle Length: 150	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Natural Cycle: 135	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.23	
Intersection Signal Delay: 91.1	Intersection LOS: F
Intersection Capacity Utilization 106.3%	ICU Level of Service G
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7747: St.Albert Trail/St. Albert Trail & Fowler Way/Neil Ross Road





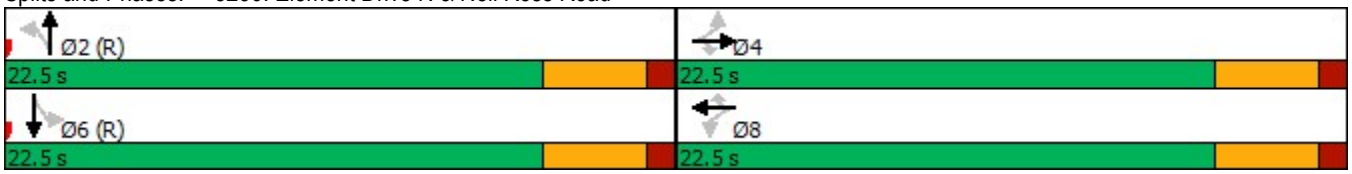
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	98	59	85	299	101	25	96	30	1	41	133
Future Volume (vph)	14	98	59	85	299	101	25	96	30	1	41	133
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Storage Length (m)	80.0		75.0	80.0		75.0	0.0		0.0	0.0		0.0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.964			0.886	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	3579	1601	1789	3579	1601	1789	1816	0	1789	1669	0
Flt Permitted	0.555			0.684			0.638			0.669		
Satd. Flow (perm)	1045	3579	1601	1288	3579	1601	1202	1816	0	1260	1669	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			64			110		33			145	
Link Speed (k/h)		60			60			60			60	
Link Distance (m)		370.4			286.0			115.5			149.1	
Travel Time (s)		22.2			17.2			6.9			8.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	15	107	64	92	325	110	27	104	33	1	45	145
Shared Lane Traffic (%)												
Lane Group Flow (vph)	15	107	64	92	325	110	27	137	0	1	190	0
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)		7.2			7.2			3.7			3.7	
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	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8		8	2			6		
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5	
Total Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5		22.5	22.5	
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0		18.0	18.0	
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5		3.5	3.5	
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		1.0	1.0	
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)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		4.5	4.5	
Lead/Lag												
Lead-Lag Optimize?												
Walk Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0		18.0	18.0	
Actuated g/C Ratio	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40		0.40	0.40	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio	0.04	0.07	0.09	0.18	0.23	0.16	0.06	0.18		0.00	0.25	
Control Delay	8.6	8.6	3.5	9.9	9.4	3.1	8.8	7.7		8.0	4.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	8.6	8.6	3.5	9.9	9.4	3.1	8.8	7.7		8.0	4.2	
LOS	A	A	A	A	A	A	A	A		A	A	
Approach Delay		6.8			8.2			7.9			4.2	
Approach LOS		A			A			A			A	
Queue Length 50th (m)	0.7	2.7	0.0	4.6	8.7	0.0	1.3	5.1		0.1	2.2	
Queue Length 95th (m)	3.2	6.1	5.0	11.7	15.3	6.5	4.7	13.3		0.7	11.2	
Internal Link Dist (m)		346.4			262.0			91.5			125.1	
Turn Bay Length (m)	80.0		75.0	80.0		75.0						
Base Capacity (vph)	418	1431	678	515	1431	706	480	746		504	754	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.04	0.07	0.09	0.18	0.23	0.16	0.06	0.18		0.00	0.25	

Intersection Summary

Area Type: Other
Cycle Length: 45
Actuated Cycle Length: 45
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 45
Control Type: Pretimed
Maximum v/c Ratio: 0.25
Intersection Signal Delay: 7.2 Intersection LOS: A
Intersection Capacity Utilization 37.4% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 8236: Element Drive N & Neil Ross Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321
Future Volume (vph)	926	148	46	101	317	131	78	1104	214	104	1102	321
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		0.0	85.0		0.0	100.0		100.0	90.0		90.0
Storage Lanes	2		0	2		1	2		1	2		1
Taper Length (m)	7.5			60.0			7.5			20.0		
Lane Util. Factor	0.97	0.95	0.95	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt		0.964				0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3433	3412	0	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3412	0	3433	3539	1583	3433	5085	1583	3433	5085	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		45				119			233			349
Link Speed (k/h)		60			50			50			50	
Link Distance (m)		258.0			370.4			431.9			394.3	
Travel Time (s)		15.5			26.7			31.1			28.4	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1007	161	50	110	345	142	85	1200	233	113	1198	349
Shared Lane Traffic (%)												
Lane Group Flow (vph)	1007	211	0	110	345	142	85	1200	233	113	1198	349
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)		7.4			7.4			7.4			7.4	
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	2	1	1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	2.0	10.0		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
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
Detector 1 Size(m)	2.0	0.6		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
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
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
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
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	Prot	NA		Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						8			2			6

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4		3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	5.0	12.0		5.0	12.0	12.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.5	24.5		9.5	24.5	24.5	9.5	37.0	37.0	9.5	37.0	37.0
Total Split (s)	38.0	50.6		11.9	24.5	24.5	9.5	38.0	38.0	9.5	38.0	38.0
Total Split (%)	34.5%	46.0%		10.8%	22.3%	22.3%	8.6%	34.5%	34.5%	8.6%	34.5%	34.5%
Maximum Green (s)	33.5	44.1		7.4	18.0	18.0	5.0	32.0	32.0	5.0	32.0	32.0
Yellow Time (s)	3.5	3.5		3.5	3.5	3.5	3.5	4.0	4.0	3.5	4.0	4.0
All-Red Time (s)	1.0	3.0		1.0	3.0	3.0	1.0	2.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.5	6.5		4.5	6.5	6.5	4.5	6.0	6.0	4.5	6.0	6.0
Lead/Lag	Lead	Lead		Lag	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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
Recall Mode	None	None		None	None	None	None	C-Max	C-Max	None	C-Max	C-Max
Walk Time (s)								7.0	7.0		7.0	7.0
Flash Dont Walk (s)								24.0	24.0		24.0	24.0
Pedestrian Calls (#/hr)								0	0		0	0
Act Effct Green (s)	33.4	12.5		36.5	15.5	15.5	6.1	33.0	33.0	6.5	35.5	35.5
Actuated g/C Ratio	0.30	0.11		0.33	0.14	0.14	0.06	0.30	0.30	0.06	0.32	0.32
v/c Ratio	0.97	0.49		0.10	0.69	0.44	0.45	0.79	0.37	0.56	0.73	0.47
Control Delay	59.2	40.0		25.2	52.3	15.3	58.2	39.9	5.6	61.9	37.1	5.5
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	59.2	40.0		25.2	52.3	15.3	58.2	39.9	5.6	61.9	37.1	5.5
LOS	E	D		C	D	B	E	D	A	E	D	A
Approach Delay		55.9			38.5			35.7			32.2	
Approach LOS		E			D			D			C	
90th %ile Green (s)	33.5	14.3		37.2	18.0	18.0	5.0	32.0	32.0	5.0	32.0	32.0
90th %ile Term Code	Max	Gap		Hold	Max	Max	Max	Coord	Coord	Max	Coord	Coord
70th %ile Green (s)	33.5	12.1		39.0	17.6	17.6	5.4	32.0	32.0	5.4	32.0	32.0
70th %ile Term Code	Max	Gap		Hold	Gap	Gap	Max	Coord	Coord	Max	Coord	Coord
50th %ile Green (s)	33.5	12.0		37.4	15.9	15.9	7.1	32.0	32.0	7.1	32.0	32.0
50th %ile Term Code	Max	Min		Hold	Gap	Gap	Max	Coord	Coord	Max	Coord	Coord
30th %ile Green (s)	33.5	12.0		35.7	14.2	14.2	7.2	32.5	32.5	8.3	33.6	33.6
30th %ile Term Code	Max	Min		Hold	Gap	Gap	Gap	Coord	Coord	Gap	Coord	Coord
10th %ile Green (s)	33.0	12.0		33.0	12.0	12.0	0.0	36.7	36.7	6.8	48.0	48.0
10th %ile Term Code	Gap	Min		Hold	Min	Min	Skip	Coord	Coord	Gap	Coord	Coord
Queue Length 50th (m)	115.0	18.7		8.6	39.4	4.6	9.6	92.0	0.0	12.9	91.9	0.0
Queue Length 95th (m)	#158.4	30.6		15.2	54.2	22.7	18.4	110.2	18.2	#27.6	110.1	21.8
Internal Link Dist (m)		234.0			346.4			407.9			370.3	
Turn Bay Length (m)	100.0			85.0			100.0		100.0	90.0		90.0
Base Capacity (vph)	1045	1394		1137	579	358	191	1527	638	203	1642	747
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.96	0.15		0.10	0.60	0.40	0.45	0.79	0.37	0.56	0.73	0.47

Intersection Summary

Area Type: Other

Cycle Length: 110	
Actuated Cycle Length: 110	
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green	
Natural Cycle: 105	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.97	
Intersection Signal Delay: 39.8	Intersection LOS: D
Intersection Capacity Utilization 79.8%	ICU Level of Service D
Analysis Period (min) 15	

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7747: St.Albert Trail/St. Albert Trail & Fowler Way/Neil Ross Road

