HIGHLAND PIT MINERAL EXTRACTION SITE, TOWNSHIP OF LANARK HIGHLANDS, ONTARIO

TRAFFIC IMPACT STUDY

SEPTEMBER 15, 2022

Presented to:

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September 15, 2022

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Project No. 7298

CASTLEGLENN CONSULTANTS LTD.

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The following Traffic Impact Study (TIS) report has been produced, reviewed, and is respectfully submitted for consideration to whom it has been addressed.

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September 15, 2022

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TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF EXHIBITS

1.0 INTRODUCTION

Castleglenn Consultants Inc. were retained to undertake a Traffic Impact Study (TIS) in support of the proposed Highland Pit Mineral Extraction Site.

The proposed development is located on Highland Line Road, approximately 3 km west of the County Road 12 and Highland Line intersection. Highland Line is characterized as rural roadway that is infrequently travelled.

The proposed development includes two extraction sites on the south side of Highland Line. The two sites are bisected by Anderson Lane.

This traffic impact study includes the following components:

- A review of the study area, the quarry site locations, the roadway and intersection configurations adjacent land uses and existing Highland Line accesses within the vicinity of the two extraction sites;
- A review of existing (2021) background traffic operational conditions within the study area. The study saw the collection of traffic count information from the following intersections:
  - County Road 12 and Highland Line;
  - Highland Line and North Quarry Access.
- A description of the proposed extraction site development and its anticipated impact on future (2024) traffic operations;
- A site traffic forecast for the proposed development that reflected typical weekday morning and afternoon peak hour quarry operations. Intersection capacity analyses that were conducted assuming both existing and forecast operational morning and afternoon peak hours of travel demand within the study area; and
- A review of the proposed access arrangements along with suggested refinements that Ftook into account sight line requirements.

The following sections describe the analyses of traffic operations associated with the proposed development and presents the resulting performance measures (levels, of service, (v/c) volume-to-capacity ratios, queue length and delay estimates) for the anticipated time of (2024) build-out as well as proposed access locations.

2.0 EXISTING CONDITIONS

2.1 STUDY AREA AND SITE LOCATION

Exhibit 2-1 illustrates the general location of the proposed development on the south side of Highland Line. The proposed development includes two extraction sites (Extraction Area 1 and Extraction Area 2) bisected by Anderson Lane, which is a local road. The proposed development is opposite the existing mineral extraction site (McKinnon Pit owned by Arnott Bros. Construction, see Appendix D – Site Photos, Image 2).

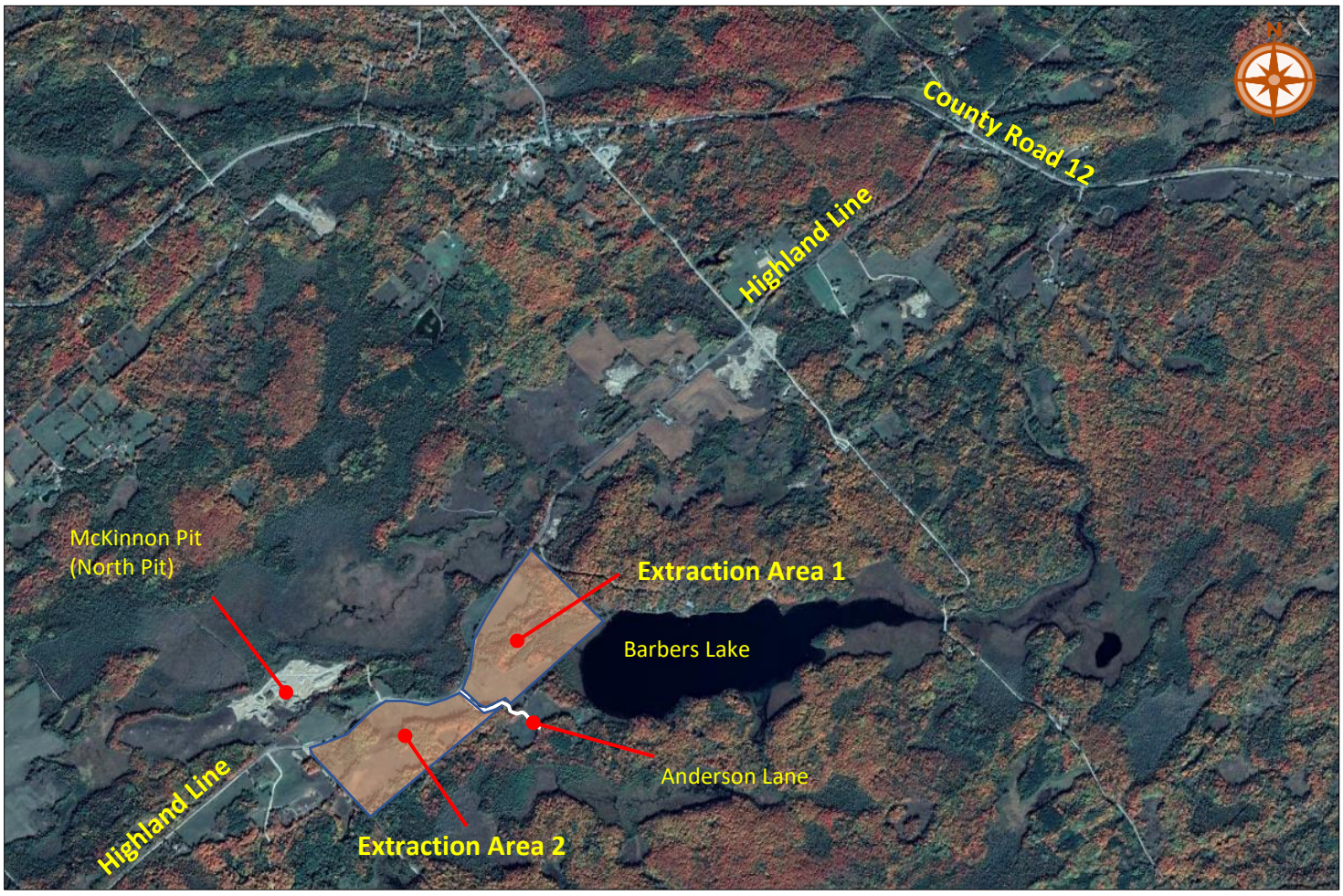


Exhibit 2-1: Study Area Context

2.2 STUDY AREA ROADWAYS

The following sub-sections serve to characterize the primary roadways within the vicinity of the proposed development:

LANARK COUNTY ROAD 12:

- County Road 12 is an east-west road between County Road 15 near Fergusons Falls in the east and Hamlet of Elphin in the west, where it becomes County Road 36. The road is a 2-lane undivided roadway with a posted speed limit of 80 km/h in the vicinity of the study area. The roadway has a rural cross-section.

HIGHLAND LINE:

- Highland Line is an east-west local road between County Road 12 in the east and County Road 36 in the west. The road runs largely parallel to County Road 12 and serves as an access to sparse developments in the area. The road is a 2-lane undivided roadway with a posted speed limit of 60 km/h and a rural cross-section. Highland Line is presently used by trucks, as there are four licensed pits along the roadway between the site's location and County Road 12.

Exhibit 2-2 illustrates the location of above roadways within the study area.

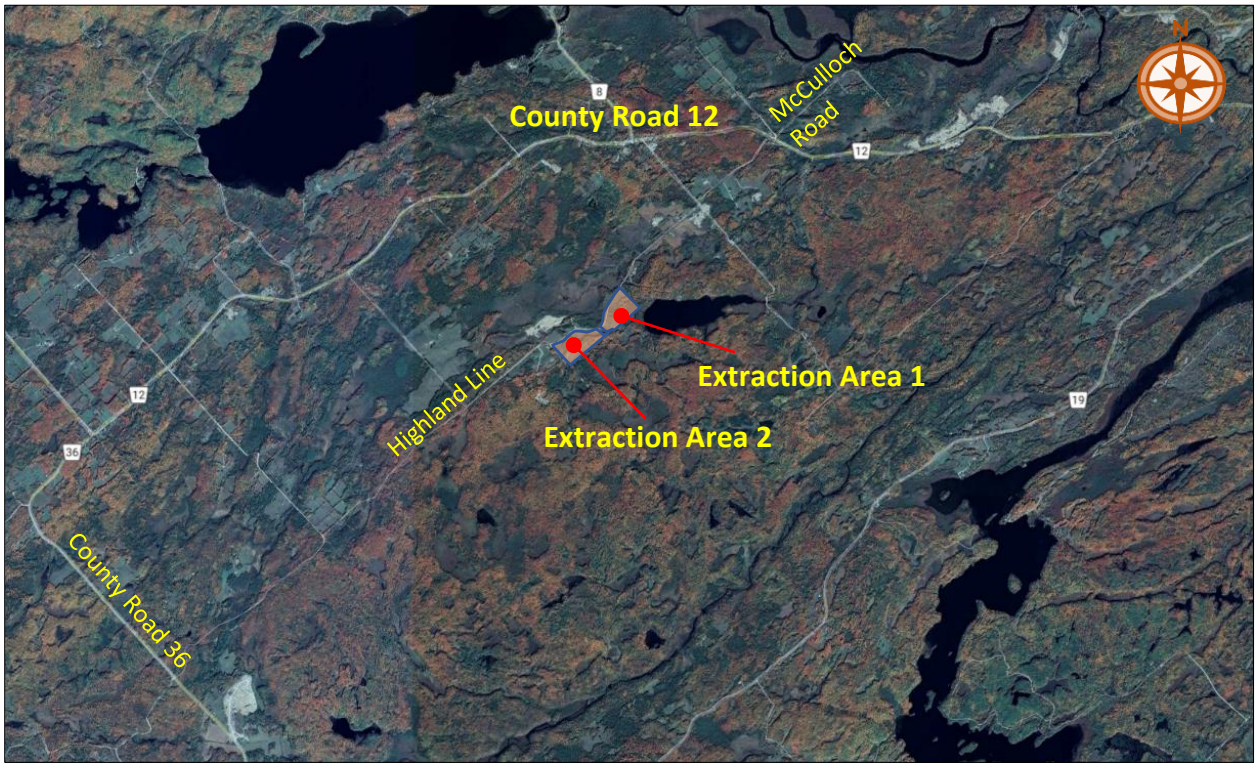


Exhibit 2-2: Study Area Roadways

2.3 STUDY AREA INTERSECTIONS

Traffic count information was collected on December 1st, 2021 at the following two intersections/access within the study area. The intersection lane arrangement-configuration was documented and the traffic operational performance characteristics determined for the following intersections:

Exhibit 2-3: County Road 12 / Highland Line Intersection

1. COUNTY ROAD 12 / HIGHLAND LINE-MCCULLOCH ROAD

- Exhibit 2-3 illustrates the County Road 12 / Highland Line 4-leg intersection;
- It STOP-controlled on the minor legs of the intersection;
- Highland Line is located on the south leg of the intersection, while McCulloch Road is on the north leg;
- The north and south leg are offset by about 30 meters;
- Each approach of the intersection provides for one lane of shared through-turn movement and no auxiliary lanes.

2. HIGHLAND LINE / NORTH QUARRY ACCESS

- Exhibit 2-4 illustrates the 3-leg Highland Line / North Quarry Access;
- It is a 3-way uncontrolled "T"-intersection;
- For the purposes of the traffic analysis, the minor north leg (Quarry Access) is assumed to be yield-controlled;
- Each approach of the intersection provides for one lane of shared through-turn movement and no auxiliary lanes;
- In the operational conditions, the intersection will effectively become a 4-leg intersection with the site access located on the south leg of the intersection.

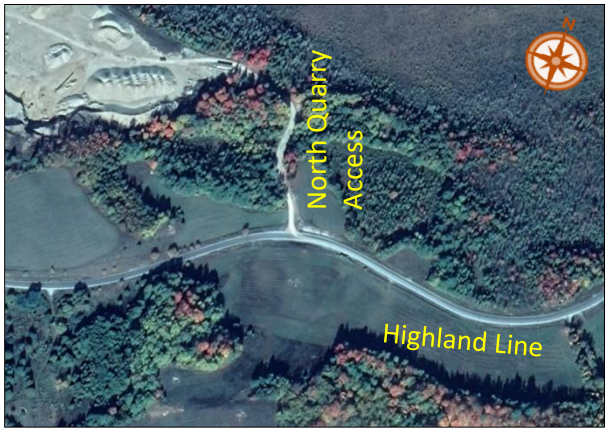


Exhibit 2-4: Highland Line and North Quarry Access

2.4 ADJACENT LAND USES

Exhibit 2-5 illustrates the general location of the proposed development site superimposed upon the Township of Lanark Highlands zoning by-law mapping and indicates that:

- The proposed site is zoned "MAR – Mineral Aggregate Resources Reserve";
- Surrounding Land uses are dominated by "Rural" and "Limited Services Rural"; and
- the Hamlet of Mcdonald's Corners is located about 2.5 km (straight line distance) to the northeast of site, or about 3.5 km via roadways.

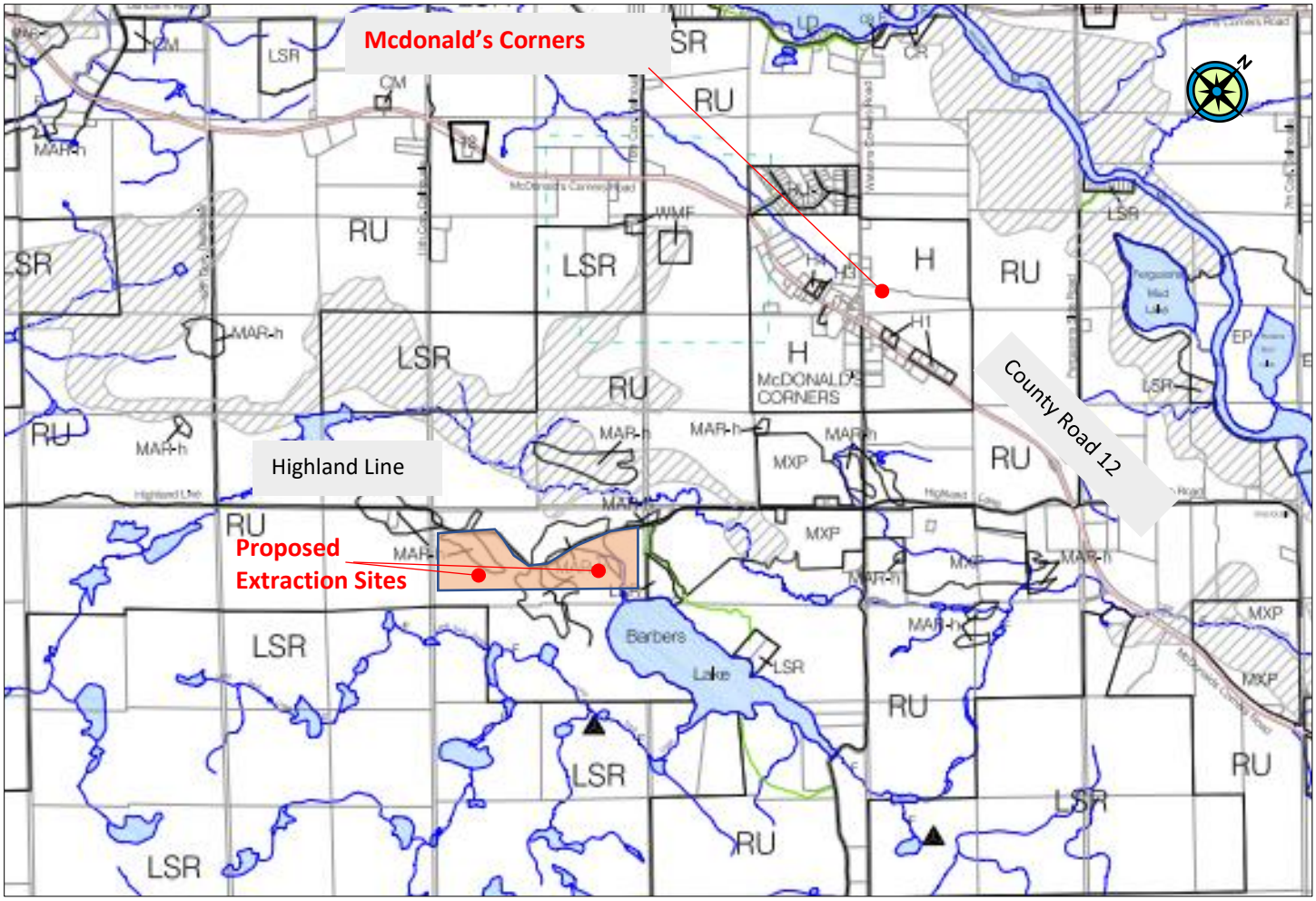


Exhibit 2-5: Development Location and Lanark Highlands Township Zoning By-Law Mapping

2.5 ADJACENT DRIVEWAYS

Exhibit 2-6 illustrates the locations of the existing access/driveways along Highland Line. The following provides a short description of each access/driveway:

- **1001 Highland Line** is an existing access connecting to the "*Wheelers Pancake House and Sugar Camp*" which provides for a sit-down restaurant and retail store located to the west of the proposed Extraction Area 2 site;
- A **Closed Township Road Allowance** is located immediately to the west of proposed Extraction Area 2 site. The Township noted that there are no plans for future development related to this access at the time of writing of this report;
- An access if provided to the **North (McKinnon) Pit** operated by Arnott Bros. Construction under the Aggregate Resource Act (License #609261) located opposite the proposed Extraction Area 2 site;
- **Anderson Lane** is a local Township roadway located between Extraction Areas 1 and 2. The roadway provides access to 137 Anderson Lane, a 2-storey residential dwelling;
- The **626 Highland Line** driveway provides access to a 2-storey residential dwelling to the east of Extraction Area 1; and
- **Leo Jay Road** is designated as a local Township roadway located east of the proposed Extraction Area 1 site. A review of aerial photography suggests that the road provides access to 5 residential dwellings.

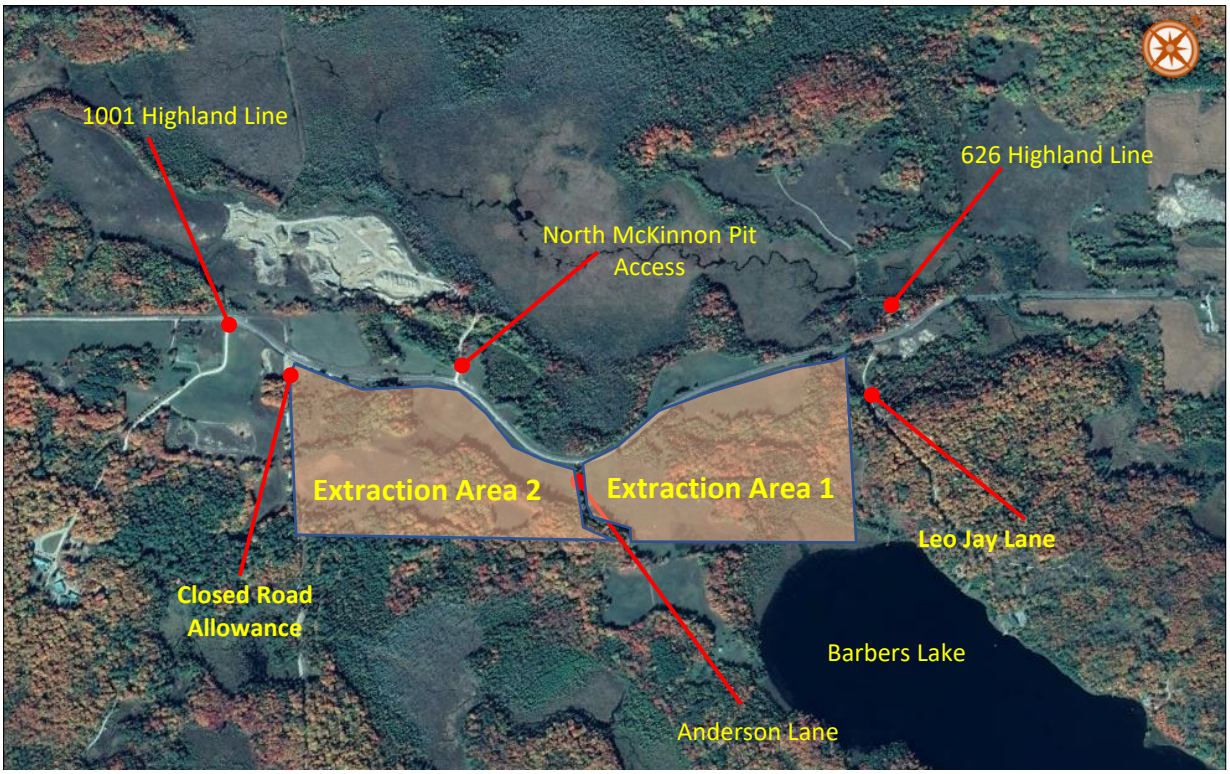


Exhibit 2-6: Adjacent Driveways

2.6 EXISTING TRAFFIC VOLUMES (2021)

Two manual traffic counts were conducted on December 1, 2021 at the following intersections:

- County Road 12 and Highland Line;
- Highland Line and North Pit Access.

The traffic counts were conducted during the morning (7-to-9 AM) and afternoon (3:30-to-5:30 PM) peak periods of travel demand. The traffic counts recorded the number of passenger and heavy vehicles as well as pedestrians/cyclists (of which there were none). Exhibit 2-7 illustrates existing (2021) balanced intersection traffic volumes for the morning and afternoon peak hours of travel demand.

The traffic counts were conducted in late Winter during the Covid-19 pandemic with some public health measures still in effect. Given the study area's remote location and insufficient historical traffic information for comparison purposes, identifying the impact of the public health measures upon summer peak traffic volumes remained a challenge. Section 4.4 highlights the efforts undertaken to address this challenge when developing traffic forecasts.

2.7 EXISTING TRAFFIC ANALYSIS

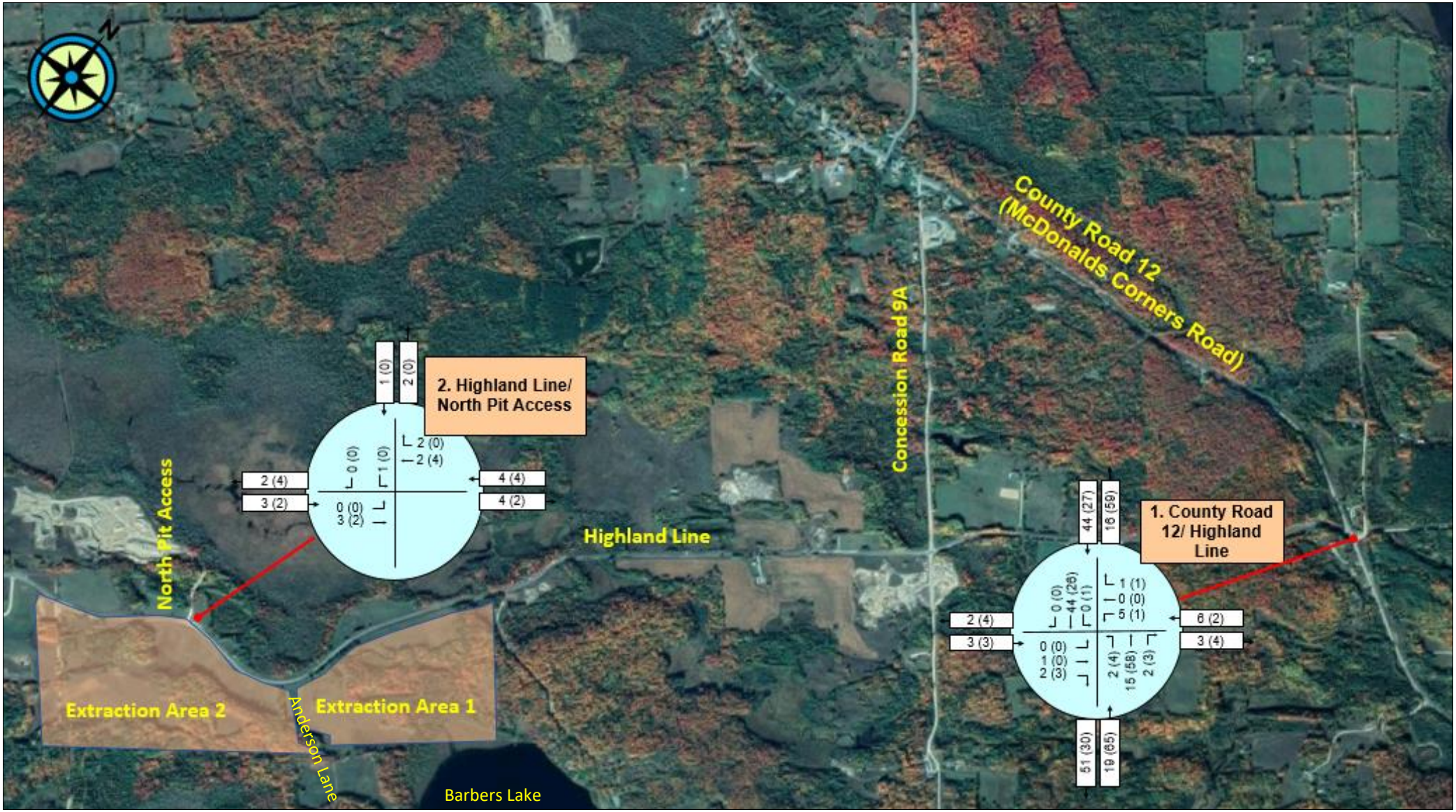
Intersection capacity analysis was undertaken utilizing Synchro™ 11 analysis software which incorporates Highway Capacity Manual (HCM) methodologies to determine level-of-service (delay-based) and volume-to-capacity (v/c) performance metrics. The analyses assumed a peak hour factor of 0.95 which simulates the busiest 15-minute-period of the overall peak hour. Appendix "C" documents the resulting Synchro output sheets indicating the existing operational performance.

Table 2-1 summarizes the intersection capacity analyses results that assume the existing traffic count information illustrated in Exhibit 2-7 and the existing intersection configurations. The table indicates that all the area intersections within the study area were found to operate at an excellent level of service "A" in all directions during the peak hours of travel demand.

Table 2-1: Existing Intersection Capacity Analysis

Intersection		Control Type	Critical Approach/ Movement	Weekday Morning Peak Hour (Afternoon Peak Hour)			
				Average Delay per Vehicle (seconds)	Level of Service	95th Percentile Queue (m)	Volume-to-Capacity Ratio (v/c)
1.	County Road 12 and Highland Line	Minor leg- STOP	Eastbound	9.0 (8.8)	A (A)	0.0 (0.0)	0.007 (0.003)
2.	Highland Line and North Pit Access	Minor leg- STOP	Southbound	9.4 (0.0*)	A (A)	0.0 (0.0)	0.001 (0.00*)

*No vehicles were recorded on the Southbound approach during the afternoon peak period traffic count



Morning (Afternoon)

Exhibit 2-7: Existing Intersection Traffic Volumes
(Vehicles-per-Hour)

3.0 THE DEVELOPMENT PROPOSAL

3.1 THE PROPOSED SITE & STUDY HORIZONS

Exhibit 3-1[1] illustrates the boundary of the proposed Highland extraction areas and the conceptual location of the mobile crushing operations within the sites. The site is sub-divided into two separate mineral extraction areas, referred to as "Extraction Area 1" and "Extraction Area 2". Both sites are both anticipated to be operational by the Spring of 2024.

Each of the individual extraction areas are proposed to be served by two accesses to provide a main and circulation secondary access. The exhibit illustrates the approximate conceptual location of the four access to the two extraction areas that were initially presented at the outset of this study.

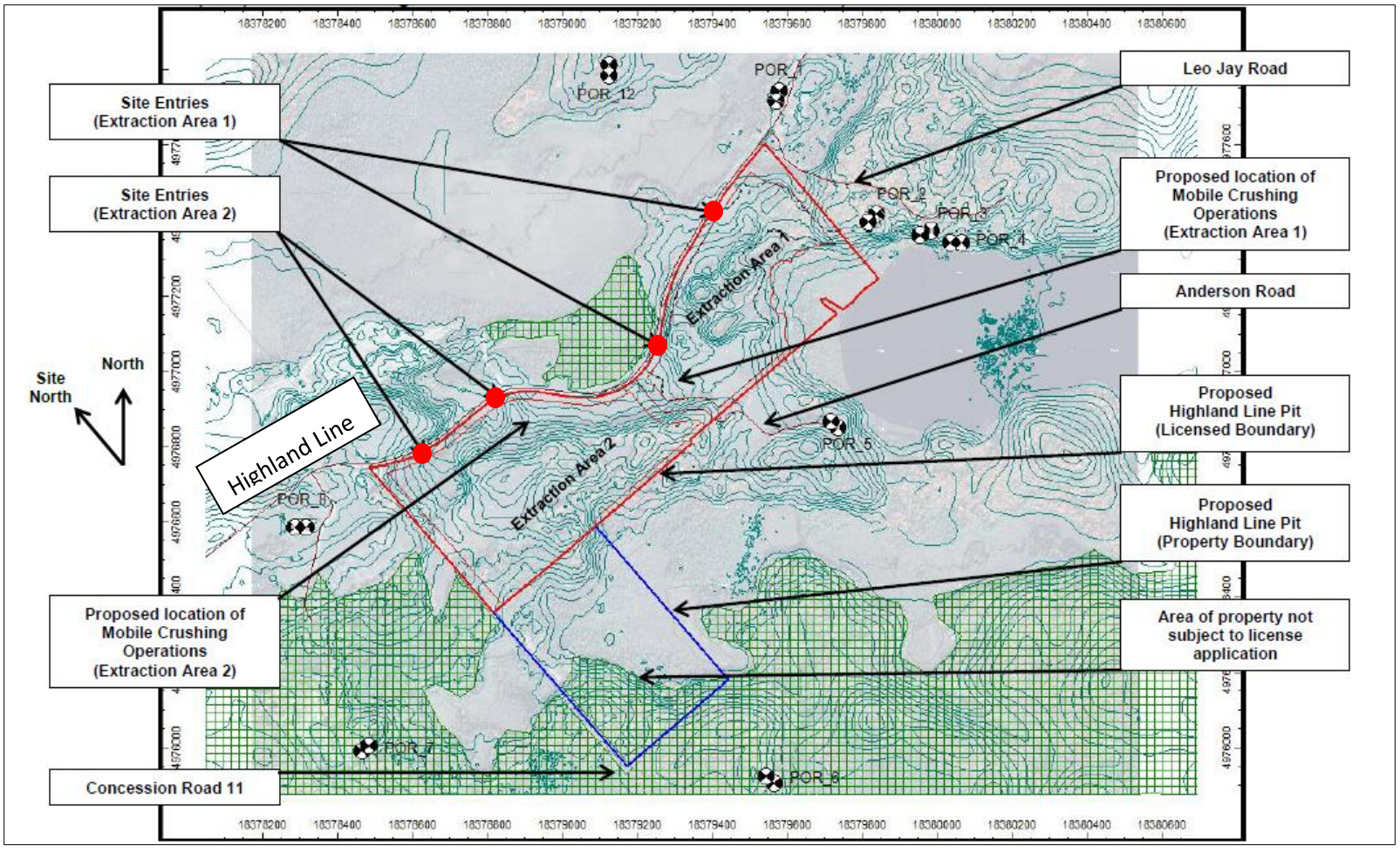


Exhibit 3-1: Proposed Extraction Pit Plan

1 Background image referenced from "*Acoustic Assessment for the Highland Line Pit, Lanark Highland Township, Lanark County, Ontario",* February, 2021 by Freefield Ltd.

4.0 TRAFFIC FORECASTING

4.1 BACKGROUND TRAFFIC GROWTH

A review of historical background traffic volumes provided by Lanark County (See Appendix "B") did not indicate a clear trend in background traffic growth. In the absence of such historical growth patterns, a 1 percent-per-year background growth rate was assumed to be applicable for the through movements along County Road 12.

However, recognizing that the traffic count undertaken for this study took place during the Winter season (December, 2021) when Covid restrictions were still in effect, and quarry operations along Highland Line would during the slow period, a worst-case scenario was developed which included:

- Significant adjustments to the through-traffic along Highland Line to account for the effect of peak summer volumes and active quarry operations; and
- adoption of a 2.5% annual background traffic growth rate.

Exhibit 4-1 illustrates the total traffic volumes for the 2024 first year of operation based upon the originally derived and "worst-case" summer estimates of traffic.

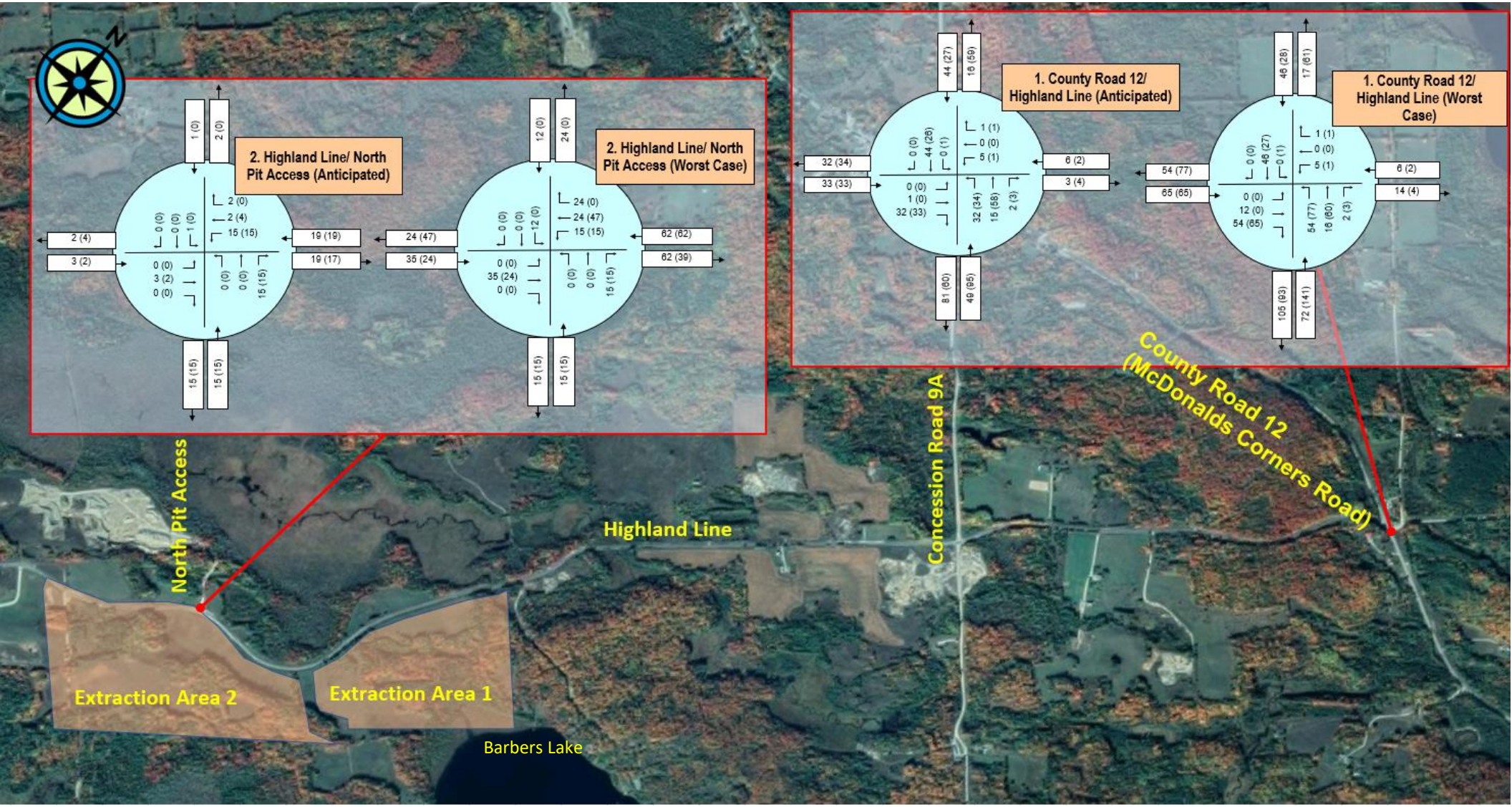
4.2 HAUL ROUTES

The primary haul route for the proposed mineral extraction sites would involve travelling eastward along Highland line to County Road 12 located to the east of the site..

Discussions with Thomas Cavanaugh Ltd, indicated that local deliveries coming from the west, would account for a maximum of only 2-loads-per-year. Given such low volume of trips, the traffic impacts of potential local delivery trips were negligible.

4.3 SITE TRAFFIC GENERATION

An Acoustic Assessment Report prepared by Freefield Ltd. was referenced to determine the appropriate traffic that would be generated by the proposed site. The report states that a **maximum** of 15 loads can be shipped out during the busiest hour of operations from each extraction area. Therefore, a total of 30 loads are expected to be shipped from the two areas as an absolute worst-case maximum traffic scenario permitted by the noise study. For the purposes of this document, it was conservatively assumed that the busiest hour of operations would coincide with both the morning and afternoon peak hours of travel demand. It is more likely that the traffic generated by the proposed extraction site during these periods would be significantly lower.



Morning (Afternoon)

Exhibit 4-1: Operational 2024 Forecast Traffic Volumes (Vehicles-per-Hour)

Table 4-1 summarizes the forecast traffic volumes that are anticipated to be generated by both individual extraction areas when in operation.

Table 4-1: Forecast Trip Generation: 2024 Horizon Year (Vehicles-per-Hour)
(Vehicles-per-Hour)

Extraction Area	*Morning Peak Hour*			*Afternoon Peak Hour*		
	In	**Out**	**Total**	**In**	**Out**	**Total**
Extraction Area 1	15	15	30	15	15	30
Extraction Area 2	15	15	30	15	15	30
Net New External Auto Trips	**30**	**30**	**60**	**30**	**30**	**60**

4.4 OPERATIONAL (2024) TRAFFIC ANALYSIS

Table 2-1 summarizes the intersection capacity analyses results assuming:

- the (2024) first year of operation traffic information illustrated in Exhibit 4-1; and
- the existing intersection lane configurations.

As indicated within Section 2.7, traffic operational analysis was undertaken utilizing Synchro™ 11 analysis software to simulate the busiest 15-minute-period of the overall morning and afternoon peak hours of travel demand. The Synchro output sheets for forecast 2024 operational traffic analysis are provided within Appendix "D".

Table 4-2 indicates that all the area intersections within the study area were found to continue to operate well below capacity at an excellent level of service (LOS "A" or "B") in all directions during the peak hours of travel demand assuming even the "worst-case" traffic forecast.

Table 4-2: Operational (2024) Intersection Capacity Analysis

	Intersection	Control Type	Critical Approach/ Movement	Weekday Morning Peak Hour (Afternoon Peak Hour)			
				Average Delay per Vehicle (seconds)	Level of Service	95th Percentile Queue (m)	Volume-to-Capacity Ratio (v/c)
1.	County Road 12 and Highland Line	Minor leg-STOP	Eastbound	9.7 (9.5)	A (A)	0.75 (0.75)	0.008 (0.041)
2.	All Access[1] (Worst-Case Scenario)	Minor leg-STOP	Northbound	9.9 (9.3)	A (A)	0.0 (0.75)	0.001 (0.018)
Worst Case Scenario Assuming 2.5% Background Traffic Growth and Summer Peak Adjustment along Highland Line							
3.	County Road 12 and Highland Line	Minor leg-STOP	Eastbound	10.0 (9.7)	B (A)	2.25 (2.25)	0.089 (0.081)
4.	All Access[1] (Worst-Case Scenario)	Minor leg-STOP	Northbound	10.6 (9.4)	B (A)	0.75 (0.75)	0.019 (0.019)

1. The analysis assumed a "worst-case" scenario where all traffic headed to each access would use a single access. The 2nd row represents the forecast operational parameters at each of the two extraction areas assuming a single access point where in reality two accesses were proposed.

5.0 ACCESS LOCATIONS REVIEW

As mentioned in Section 3.1, the initially planned mineral extraction areas are to be accessed via a total of 4 accesses, with 2 accesses in each extraction area[2]. Exhibit 5-1 illustrates the locations of each of the initially planned access locations where a visual sight line assessment was conducted.

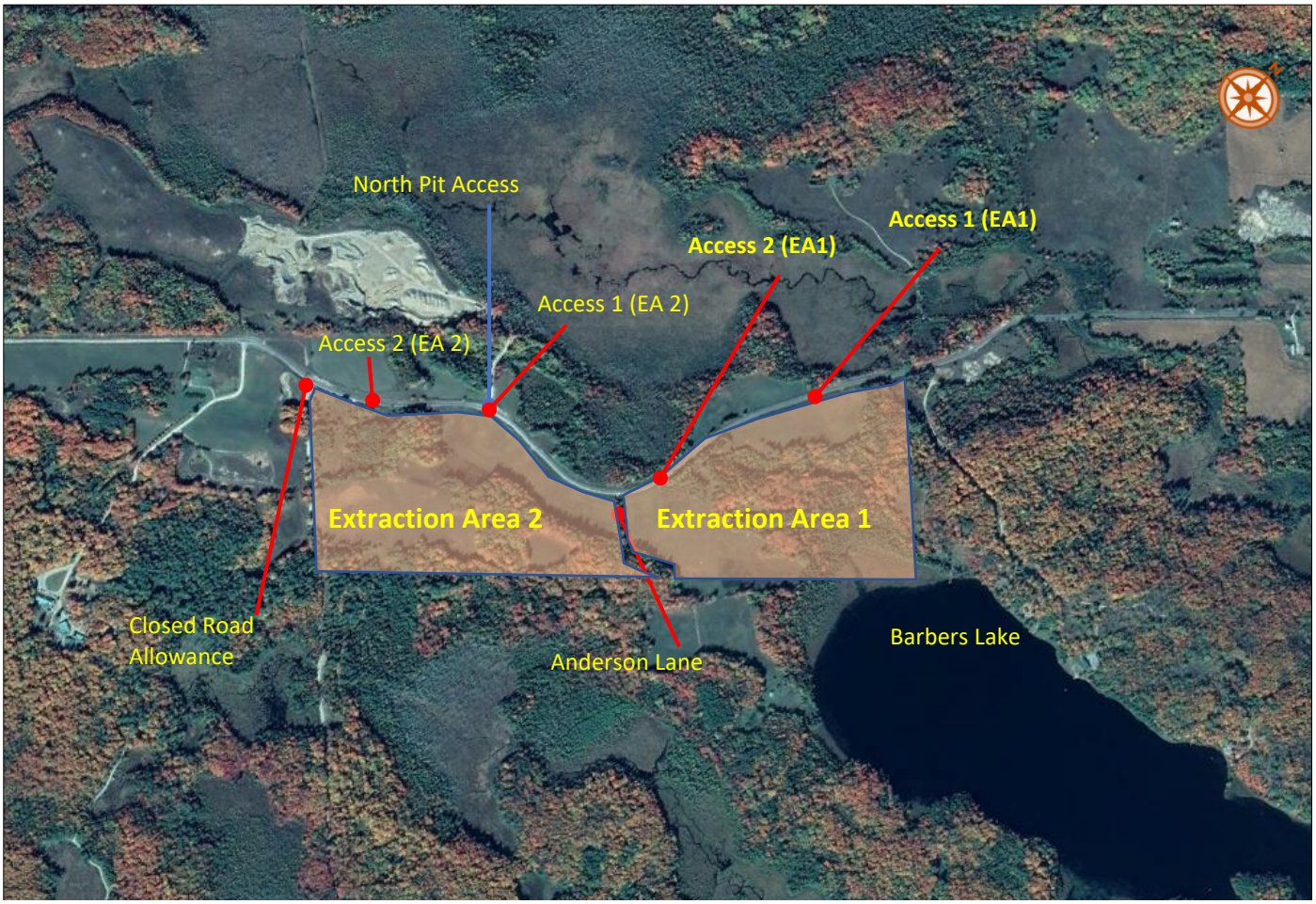


Exhibit 5-1: Highland Quarry – Initially Planned Access Locations

The following sub-sections illustrate the photographs taken on December 1, 2021 illustrating the available sight lines from each of the four planned access locations suggested at the outset of this study. The required sight distance was calculated as being 192 meters assuming a paved surface, a 3% grade, a 60kph operating speed along Highland Line, a truck driver view height of 2.33m at the access and a passenger vehicle approach height along Highland Line of 1.8m.

2 "Extraction Area" is abbreviated "EA" in the following sections of the report

5.1 ACCESS 1 (EXTRACTION AREA 1) - NOT RECOMMENDED

- In the east direction (looking right):

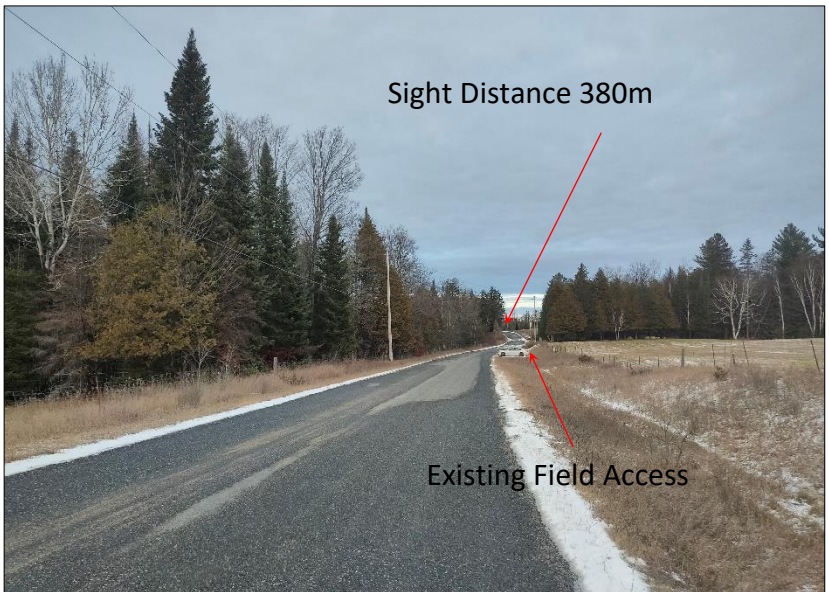


Exhibit 5-2: Access 1 (EA1) Looking East (380m SD)

- In the west direction (looking left):

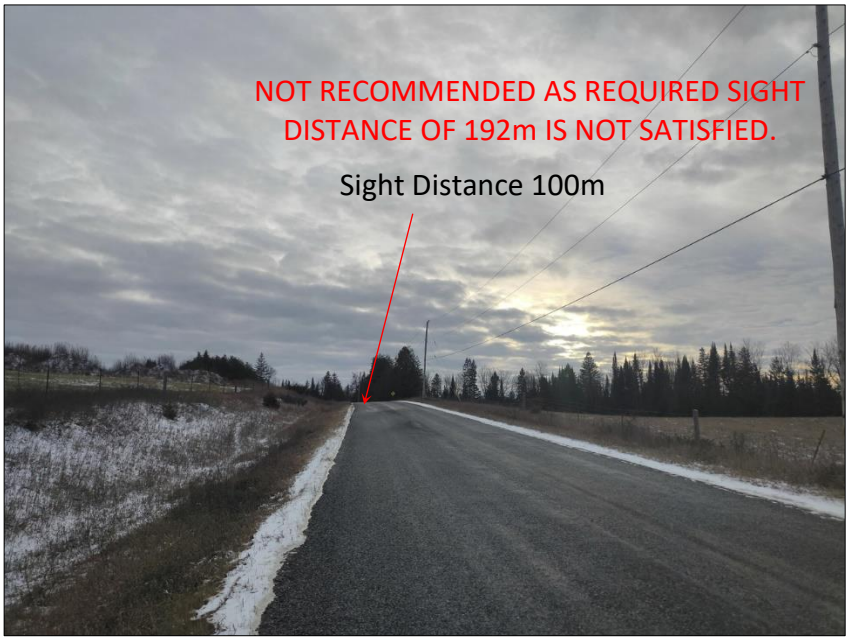


Exhibit 5-3: Access 1 (EA1) Looking West (100m SD)

5.2 ACCESS 2 (EXTRACTION AREA 1) – NOT RECOMMENDED

- In the east direction (looking right):

Exhibit 5-4: Access 2 (EA1) Looking East (130m SD)

- In the west direction (looking left):

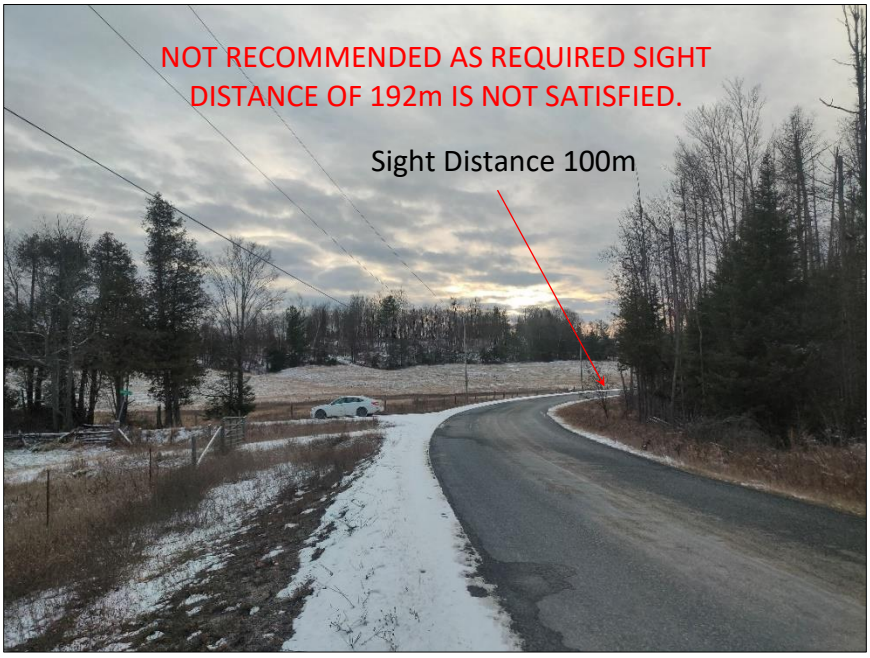


Exhibit 5-5: Access 2 (EA1) Looking West (100m SD)

5.3 ACCESS 1 (EXTRACTION AREA 2)

- In the east direction (looking right):

Exhibit 5-6: Access 1 (EA2) Looking East (75m SD)

- In the west direction (looking left):

Exhibit 5-7: Access 1 (EA2) Looking West (300m SD)

5.4 ACCESS 2 (EXTRACTION AREA 2) – NOT RECOMMENDED

- In the east direction (looking right):

Exhibit 5-8: Access 2 (EA2) Looking East (300 SD)

- In the west direction (looking left):

Exhibit 5-9: Access 2 (EA2) Looking West (110m SD)

5.5 SUMMARY OF ACCESS LOCATIONS

Table 5-1 provides a summary of the four initially planned access locations and the results of the sightline analysis. As noted within Section 5.0 the required sight distance to ensure safe access operations was determined to be 192 meters. Out of the four initially planned accesses, each were found to exhibit sightline deficiencies:

- *Access 1 (Extraction Area 1)* The sight distance deficiency could be addressed by considering an alternate location for the intesection further to the east (about 100 m) to the existing field access. This will ensure suitable sightlines to accommodate heavy vehicle operations. Section 5.7 describes this alternate location.
- *Access 2 (Extraction Area 1)*: The sight distance deficiency could be addressed by considering an alternate location for the intesection further to the east to ensure suitable sightlines to accommodate heavy vehicle operations. Section 5.7 describes this alternate location.
- *Access 1 (Extraction Area 2)*: The sight distance deficiency associated with this access can be significantly improved by the removal and sibsequent re-grading of the mound of earth on the south side of the roadway. This would greatly extend the available sight lines (from 75 metres to approximately 300 metres).
- *Access 2 (Extraction Area 2)*: The sight distance deficiency in the westerly direction would be unsuitable to accommodate heavy vehicle turning movements. No appropriate alternative location was found for this access. It was suggested that this access not be used by heavy vehicle traffic.

Table 5-1: Sight Distance Review at Existing Site Accesses

Extraction Access	Direction	SD Available (m)	SD Required[1] (m)	Satisfied/Deficient	Mitigation
Area 1 Access 1	Looking west	100	192	Deficient	Alternative Site Access Recommended
	Looking east	380		Satisfied	
Area 1 Access 2	Looking west	100		Deficient	Alternative Site Access Recommended
	Looking east	130		Deficient	
Area 2 Access 1	Looking west	300		Satisfied	Regrading of earth mound improves sight lines to resolve deficiency.
	Looking east	75 (300[2])		Deficient (Satisfied [2])	
Area 2 Access 2	Looking west	110		Deficient	Restriction of heavy vehicle movement at this access
	Looking east	300		Satisfied	

1. Required sight distance was calculated assuming a paved surface, 3% grade, a 60kph operating speed along Highland Line a truck driver view height of 2.33m at the access and a passenger vehicle approach height on Highland Line of 1.8m.
2. Sight Distance increases to 300m when mound of earth is removed.

5.6 ALTERNATIVE ACCESS 1 (EXTRACTION AREA 1) – RECOMMENDED

Exhibit 5-12 and Exhibit 5-13 illustrate the sightline distances assuming an alternative location for Access 1 to serve Extraction Area 1 which would be located approximately 100 meters east of the initially planned access, at the existing field access location. Below is the sightline summary for the alternative access:

- In the east direction (looking right):

Exhibit 5-10: Alternative Access 1 (EA1) Looking East (265m SD)

- In the west direction (looking left):

Exhibit 5-11: Alternative Access 1 (EA1) Looking West (210m SD)

5.7 ALTERNATIVE ACCESS 2 (EXTRACTION AREA 1) – RECOMMENDED

Exhibit 5-12 and Exhibit 5-13 illustrate the sightline distances assuming an alternative location for Access 2 to serve Extraction Area 1 which would be located approximately 250 meters east of the initially planned access. Table 5-2 summarizes the resulting sight line distances associated with this proposed access, which satisfies the 192m requirement in both directions.

- In the east direction (looking right):

Exhibit 5-12: Alternative Access 2 (EA1) Location Looking East (570m)

- In the west direction (looking left):

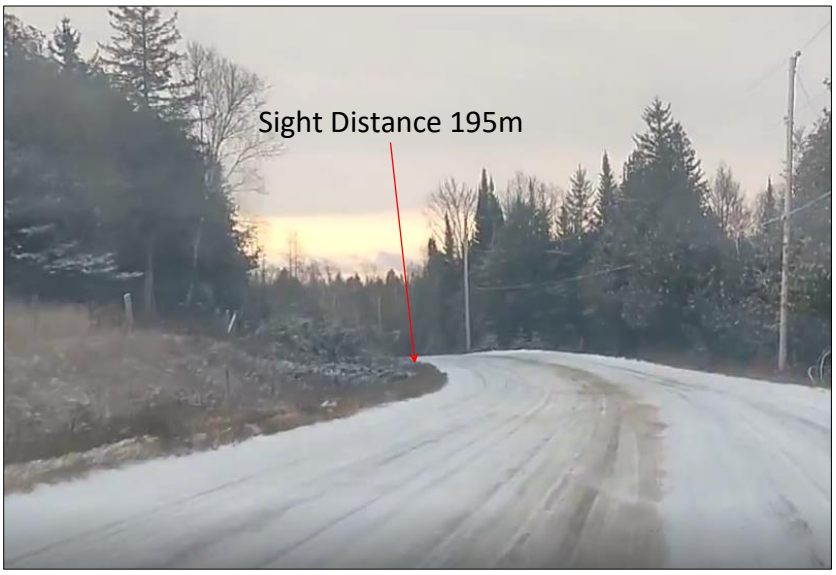


Exhibit 5-13: Alternative Access 2 (EA1) Location Looking West (195m)

Table 5-2: Sight Distance Review at Proposed Alternate Site Accesses

Access	Direction	SD Available (m)	SD Required[1] (m)	Satisfied/Deficient
Alternative EA1 Access 1	Looking west	210	192	Satisfied
	Looking east	265		Satisfied
Alternative EA1 Access 2	Looking East	570		Satisfied
	Looking West	195		Satisfied

1. The Required sight distance was calculated assuming a paved surface, 3% grade, a 60kph operating speed along Highland Line a truck driver view height of 2.33m at the access and a passenger vehicle approach height on Highland Line of 1.8m.

6.0 FINDINGS AND RECOMMENDATIONS

6.1 RECOMMENDATIONS: PROPOSED ACCESS LOCATIONS

Exhibit 6-1 illustrates the preferred positions of each accesses intended to serve the proposed Highland extraction sites.

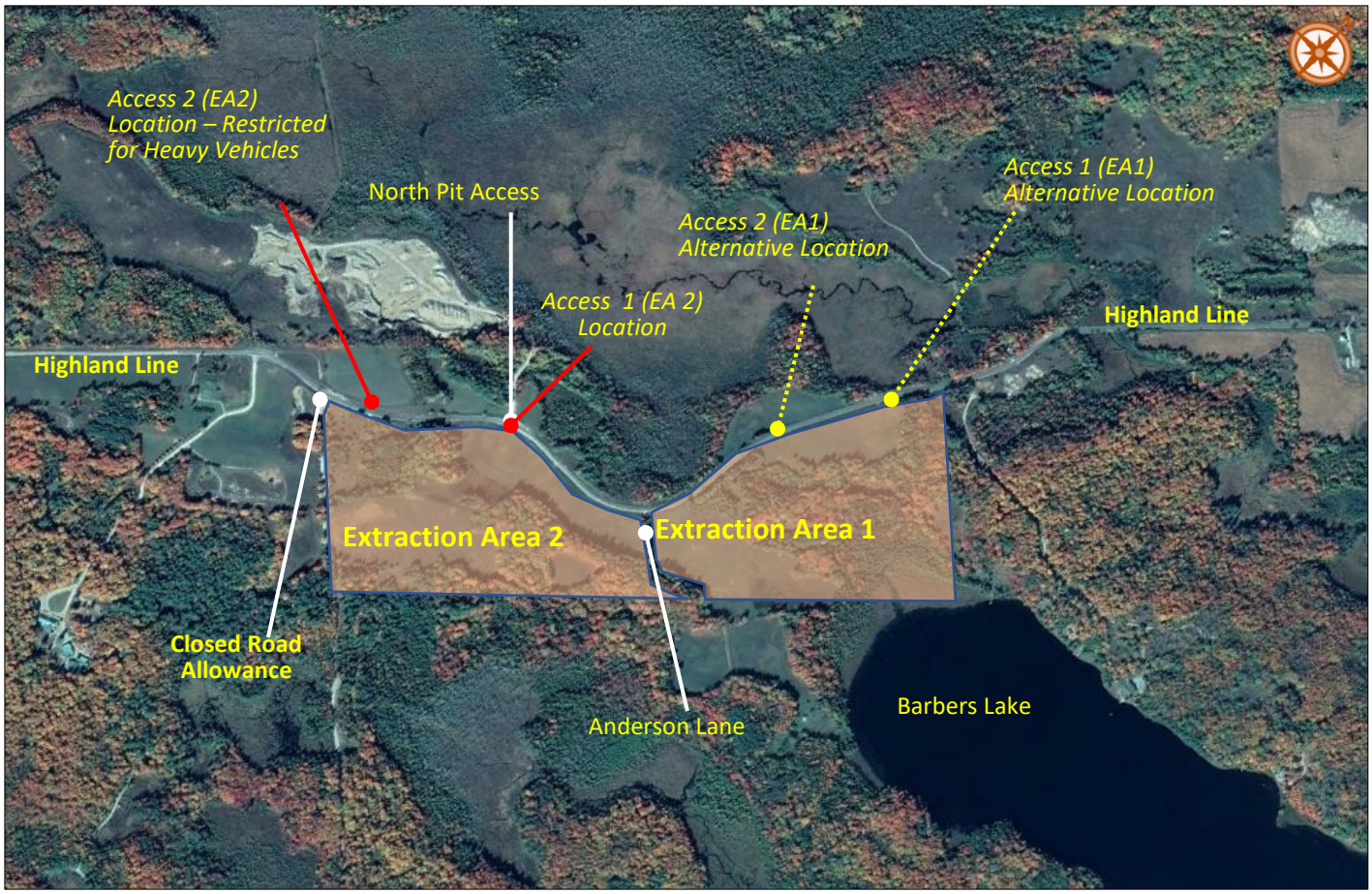


Exhibit 6-1: Proposed Access Locations

Note that…:

- An alternate Access1 (EA1) is to be considered that would be located approximately 100 meters to the east along Highland Road (at the existing field access) which offers better visibility;
- An alternate Access 2 (EA1) is to be considered that would be located approximately 250 meters to the east along Highland Road which offers better visibility;
- Access 1 (EA2) would remain in the same location as initially planned provided that the earth mound is removed and the access approach us regraded. This access would become the only heavy vehicle access to/from Extraction Area 2 due to deficient sight distance characteristics associated with Access 2.

- Access 2 (EA2) has no feasible relocation positions and would be unsuitable for heavy vehicle traffic.

6.2 SUMMARY OF FINDINGS

The Traffic Impact Study analysis resulted in the following findings:

- The expected traffic generated by the proposed mineral extraction site is as follows:
  - 30 two-way heavy vehicle trips during the morning peak hour; and
  - 30 two-way heavy vehicle trips during the afternoon peak hour;
  - The vehicle trips will be evenly split between the two extraction areas;
  - All trips will be destined to/from the east towards County Road 12.
- Based on the intersection capacity analysis, both study area intersections currently operate within acceptable traffic operational (levels-of-service, delay and volume-to-capacity) performance measures;
- Both intersections are forecast to continue to operate acceptably during the peak hours of travel demand during the 2024 operational forecast horizon year;
- A review of the extraction area accesses found that:
  - Access 1 (Extraction Area 1) has deficient sight lines for operation;
  - Access 2 (Extraction Area 1) has deficient sight lines for operation;
  - Access 1 (Extraction Area 2) has deficient sight lines for operation, however removal of the earth mound on the south side of the roadway, will address this deficiency;
  - Access 2 (Extraction Area 2) has deficient sight lines for operation and should not be used by heavy vehicle traffic.

6.3 SUMMARY OF RECOMMENDATIONS

It is recommended that Thomas Cavanagh Construction Ltd. consider:

- Relocating Access 1 (Extraction Area 1) approximately 100m to the east along Highland Line to provide sufficient sight lines at the entrance
- Relocating Access 2 (Extraction Area 1) approximately 250m to the east along Highland Line to provide sufficient sight lines at the entrance;
- Removing the earth mound near Access 1 (Extraction Area 2) to ensure sufficient sight distance at the entrance to the access is achieved; and
- Restrict heavy truck movement from using Area 2 (Extraction Area 2) as it has deficient sight distance characteristic and there does not appear to be any alternative viable location that can be considered for access relocation.

It is recommended that the Township of Lanark Highlands and Lanark County:

- Continue to monitor traffic conditions; and
- Permit the site application to proceed from a traffic analysis perspective.

APPENDIX A – BACKGROUND TRAFFIC COUNTS

Castleglenn Consultants
Engineers, Project Managers & Planners

County Road 12 / Highland Line

AM Peak

Movement		EB-LT		EB-TH		EB-RT		WB-LT		WB-TH		WB-RT		NB-LT		NB-TH		NB-RT		SB-LT		SB-TH		SB-RT	
Vehicles		Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy
7:00 AM	7:15 AM	0	0	0	0	0	1	2	1	0	1	0	0	0	0	1	1	0	0	0	1	11	0	0	0
7:15 AM	7:30 AM	0	0	0	0	1	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	14	1	0	0
7:30 AM	7:45 AM	0	0	1	0	0	0	3	0	0	0	1	0	0	1	2	1	0	0	0	0	9	1	0	0
7:45 AM	8:00 AM	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	8	0	0	0
8:00 AM	8:15 AM	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5	2	1	1	0	0	10	0	0	0
8:15 AM	8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0		4	0	0	0
8:30 AM	8:45 AM	0	0	0	0	2	1	0	0	0	0	0	0	0	0	7	2	0	0	0	0	7	1	0	0
8:45 AM	9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	0	1	11	0	0	0
	Peak	0	0	1	0	2	0	4	1	0	0	1	0	1	1	12	3	1	1	0	0	41	2	0	0

PM Peak

Movement		EB-LT		EB-TH		EB-RT		WB-LT		WB-TH		WB-RT		NB-LT		NB-TH		NB-RT		SB-LT		SB-TH		SB-RT	
Vehicles		Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy
3:30 PM	3:45 PM	0	0	0	0	0	0	1	0	0	0	0	0	1	0	9	0	2	0	0	0	7	1	0	0
3:45 PM	4:00 PM	0	0	0	0	0	0	1	0	0	0	0	0	2	1	7	0	3	0	0	0	2	1	0	0
4:00 PM	4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9	1	0	0	1	0	8	0	0	0
4:15 PM	4:30 PM	0	0	0	0	1	0	0	0	0	0	0	0	1	1	11	2	0	0	0	0	8	1	0	0
4:30 PM	4:45 PM	0	0	0	0	0	0	1	0	0	0	0	0	2	0	15	0	1	0	0	0	3	0	0	0
4:45 PM	5:00 PM	0	0	0	0	0	0	0	0	0	0	1	0	0	0	12	1	1	0	0	0	4	2	0	0
5:00 PM	5:15 PM	0	0	0	0	2	0	0	0	0	0	0	0	0	0	15	0	1	0	1	0	6	1	0	0
5:15 PM	5:30 PM	0	0	0	0	1	0	0	0	0	0	0	0	1	0	8	1	1	0	1	0	3	1	0	0
	Peak	0	0	0	0	3	0	1	0	0	0	1	0	3	1	53	3	3	0	1	0	21	4	0	0

North Pit Access

AM Peak

Movement		EB-LT		EB-TH		EB-RT		WB-LT		WB-TH		WB-RT		NB-LT		NB-TH		NB-RT		SB-LT		SB-TH		SB-RT	
Vehicles		Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy
7:00 AM	7:15 AM	0	0	1	0					1	0	0	0							0	0			0	0
7:15 AM	7:30 AM	0	0	0	0					0	1	0	0							0	0			0	0
7:30 AM	7:45 AM	0	0	0	1					0	1	0	0							0	0			0	0
7:45 AM	8:00 AM	0	0	0	0					0	1	0	0							0	0			0	0
8:00 AM	8:15 AM	0	0	0	0					0	0	0	0							0	0			0	0
8:15 AM	8:30 AM	0	0	0	0					0	1	0	2							0	0			0	0
8:30 AM	8:45 AM	0	0	2	1					0	0	0	0							0	1			0	0
8:45 AM	9:00 AM	0	0	0	0					0	0	0	0							0	0			0	0
	Peak	0	0	2	1	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	1	0	0	0	0

PM Peak

Movement		EB-LT		EB-TH		EB-RT		WB-LT		WB-TH		WB-RT		NB-LT		NB-TH		NB-RT		SB-LT		SB-TH		SB-RT	
Vehicles		Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy	Cars	Heavy
3:30 PM	3:45 PM	0	0	0	0					0	0	0	0							0	0			0	0
3:45 PM	4:00 PM	0	0	0	0					1	0	0	0							0	0			0	0
4:00 PM	4:15 PM	0	0	0	0					0	0	0	0							0	0			0	0
4:15 PM	4:30 PM	0	0	1	0					1	0	0	0							0	0			0	0
4:30 PM	4:45 PM	0	0	0	1					1	1	0	0							0	0			0	0
4:45 PM	5:00 PM	0	0	0	0					0	0	0	0							0	0			0	0
5:00 PM	5:15 PM	0	0	0	0					0	0	0	0							0	0			0	0
5:15 PM	5:30 PM	0	0	0	0					0	0	0	0							0	0			0	0
	Peak	0	0	1	1	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX B – LANARK COUNTY TRAFFIC INFORMATION

Castleglenn Consultants
Engineers, Project Managers & Planners

LANARK COUNTY
Working together to achieve greatness

Lanark County
99 Christie Lake Road, Perth Ontario, K7H 3C6
Tel: 613 267 1353 Fax: 613 267 2793

Traffic Summary

Station # - FP771PAC, Cr 12 012088 Watsons Crnrs. Rd. (Co. Rd. #8) to McDonalds Corners Hamlet Sign
Date - 0:00 Tuesday, June 02, 2015 to 0:00 Friday, June 05, 2015 (3 days of data)

Volume

	Total	Weekday	Weekend	ADT	AWDT	AWET
Combined	3250	3250	0	1083	1083	0
East	1628	1628	0	543	543	0
West	1622	1622	0	541	541	0
Days	3	3	-	3	3	-

Speed

	All Days	Weekdays	Weekend	
Mean speed	80.5	80.5	-	km/h
Median speed	80.3	80.3	-	km/h
85% speed	92.9	92.9	-	km/h

PSL = 60 km/h

Class

Class (*Scheme F3*)	All Days	%	Weekdays	Weekend
1 - CYCLE	35	1.1%	35	0
2 - PC	2120	65.2%	2120	0
3 - 2A-4T	859	26.4%	859	0
4 - BUS	68	2.1%	68	0
5 - 2A-6T	104	3.2%	104	0
6 - 3A-SU	33	1.0%	33	0
7 - 4A-SU	2	0.1%	2	0
8 - <5A DBL	1	0.0%	1	0
9 - 5A DBL	17	0.5%	17	0
10 - >6A DBL	7	0.2%	7	0
11 - <6A MULTI	0	0.0%	0	0
12 - 6A MULTI	0	0.0%	0	0
13 - >6A MULTI	4	0.1%	4	0

Average Daily Volume

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
East	0	522	548	558	0	0	0
West	0	494	555	573	0	0	0
Combined	0	1016	1103	1131	0	0	0
AM Pk East	-	54	53	57	-	-	-
PM Pk East	-	38	44	47	-	-	-
AM Pk West	-	28	32	27	-	-	-
PM Pk West	-	55	71	70	-	-	-
Days	-	1	1	1	-	-	-

Report created 10:54 Wednesday, February 17, 2016 using MTE version 4.0.6.0

Castleglenn Consultants
Engineers, Project Managers & Planners

Lanark County
99 Christie Lake Road, Perth Ontario K7H 3C6
Tel: 613 267 1353 Fax: 613 267 2793

LANARK COUNTY
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Traffic Summary

Station # - FJ36QF8X, 012088 - Watsons Crnrs. Rd. (Co. Rd. #8) to McDonalds Corners Hamlet Sign
Date - 0:00 Tuesday, May 30, 2017 to 0:00 Friday, June 02, 2017 (4 days of data)

Volume

	Total	Weekday	Weekend	ADT	AWDT	AWET
Combined	3596	3596	0	599	899	0
East	1845	1845	0	308	461	0
West	1751	1751	0	292	438	0
Days	6	4	2	6	4	2

Speed

	All Days	Weekdays	Weekend	
Mean speed	76.7	76.7	-	km/h
Median speed	76.7	76.7	-	km/h
85% speed	87.8	87.8	-	km/h

PSL = 60 km/h

Class

Class (*Scheme F3*)	All Days	%	Weekdays	Weekend
1 - CYCLE	24	0.7%	24	0
2 - PC	2407	66.9%	2407	0
3 - 2A-4T	996	27.7%	996	0
4 - BUS	45	1.3%	45	0
5 - 2A-6T	46	1.3%	46	0
6 - 3A-SU	64	1.8%	64	0
7 - 4A-SU	2	0.1%	2	0
8 - <5A DBL	0	0.0%	0	0
9 - 5A DBL	4	0.1%	4	0
10 - >6A DBL	5	0.1%	5	0
11 - <6A MULTI	0	0.0%	0	0
12 - 6A MULTI	0	0.0%	0	0
13 - >6A MULTI	3	0.1%	3	0

Average Daily Volume

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
East	0	514	521	572	238	0	0
West	0	509	538	600	104	0	0
Combined	0	1023	1059	1172	342	0	0
AM Pk East	-	54	54	57	56	-	-
PM Pk East	-	37	33	43	-	-	-
AM Pk West	-	29	37	41	29	-	-
PM Pk West	-	60	60	90	-	-	-
Days	-	1	1	1	1	1	1

Report created 14:01 Friday, January 26, 2018 using MTE version 4.0.6.0

Castleglenn Consultants
Engineers, Project Managers & Planners

Lanark County
99 Christie Lake Road, Perth Ontario K7H 3C6
Tel: 613 267 1353 Fax: 613 267 2793

LANARK COUNTY
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Traffic Summary

Station # - FJ42GN15, Cr 12 012088 Watsons Crnrs. Rd. (Co. Rd. #8) to McDonalds Corners Hamlet Sign
Date - Tuesday, June 18, 2019 to Friday, June 21, 2019 (3 days of data)

Volume

	Total	Weekday	Weekend	ADT	AWDT	AWET
Combined	3597	3597	0	1199	1199	0
East	1782	1782	0	594	594	0
West	1815	1815	0	605	605	0
Days	3	3	-	3	3	-

Speed

	All Days	Weekdays	Weekend	
Mean speed	75.3	75.3	-	km/h
Median speed	74.2	74.2	-	km/h
85% speed	92.2	92.2	-	km/h

PSL = 60 km/h

Class

Class (*Scheme F3*)	All Days	%	Weekdays	Weekend
1 - CYCLE	55	1.5%	55	0
2 - PC	2154	59.9%	2154	0
3 - 2A-4T	1071	29.8%	1071	0
4 - BUS	39	1.1%	39	0
5 - 2A-6T	216	6.0%	216	0
6 - 3A-SU	35	1.0%	35	0
7 - 4A-SU	4	0.1%	4	0
8 - <5A DBL	2	0.1%	2	0
9 - 5A DBL	2	0.1%	2	0
10 - >6A DBL	11	0.3%	11	0
11 - <6A MULTI	0	0.0%	0	0
12 - 6A MULTI	0	0.0%	0	0
13 - >6A MULTI	8	0.2%	8	0

Average Daily Volume

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
East	0	563	591	628	0	0	0
West	0	560	594	661	0	0	0
Combined	0	1123	1185	1289	0	0	0
AM Pk East	-	49	46	63	-	-	-
PM Pk East	-	40	42	50	-	-	-
AM Pk West	-	42	44	37	-	-	-
PM Pk West	-	66	70	92	-	-	-
Days	-	1	1	1	-	-	-

Report created 15:10 Wednesday, October 09, 2019 using MTE version 4.0.6.0

Castleglenn Consultants
Engineers, Project Managers & Planners

Lanark County
99 Christie Lake Road, Perth Ontario K7H 3C6
Tel: 613 267 1353 Fax: 613 267 2793

LANARK COUNTY
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Traffic Summary

Station # - HG46Z0J5, Cr12 012088 Watsons Crnrs. Rd. (Co. Rd. #8) to McDonalds Corners Hamlet Sign
Date - July 7, 2020 to July 10, 2020 (3 days of data)

Volume

	Total	Weekday	Weekend	ADT	AWDT	AWET
Combined	3208	3208	0	1069	1069	0
East	1588	1588	0	529	529	0
West	1620	1620	0	540	540	0
Days	3	3	-	3	3	-

Speed

	All Days	Weekdays	Weekend	
Mean speed	77.2	77.2	-	km/h
Median speed	77.4	77.4	-	km/h
85% speed	87.8	87.8	-	km/h

PSL = 60 km/h

Class

Class (*Scheme F3*)	All Days	%	Weekdays	Weekend
1 - CYCLE	60	1.9%	60	0
2 - PC	1985	61.9%	1985	0
3 - 2A-4T	912	28.4%	912	0
4 - BUS	26	0.8%	26	0
5 - 2A-6T	73	2.3%	73	0
6 - 3A-SU	86	2.7%	86	0
7 - 4A-SU	2	0.1%	2	0
8 - <5A DBL	0	0.0%	0	0
9 - 5A DBL	26	0.8%	26	0
10 - >6A DBL	21	0.7%	21	0
11 - <6A MULTI	0	0.0%	0	0
12 - 6A MULTI	0	0.0%	0	0
13 - >6A MULTI	17	0.5%	17	0

Average Daily Volume

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
East	0	520	488	580	0	0	0
West	0	505	508	607	0	0	0
Combined	0	1025	996	1187	0	0	0
AM Pk East	-	42	39	43	-	-	-
PM Pk East	-	39	43	70	-	-	-
AM Pk West	-	39	40	42	-	-	-
PM Pk West	-	48	49	93	-	-	-
Days	-	1	1	1	-	-	-

Report created 7:15 October 15, 2020 using MTE version 4.0.6.0

Castleglenn Consultants
Engineers, Project Managers & Planners

Traffic Summary

Station # - FJ199DQZ, Cr 12 012088 Watsons Crnrs. Rd. (Co. Rd. #8) to McDonalds Corners Hamlet Sign
Date June 8, 2021 to June 11, 2021 (3 days of data)

Volume

	Total	Weekday	Weekend	ADT	AWDT	AWET
Combined	3514	3514	0	1171	1171	0
East	1744	1744	0	581	581	0
West	1770	1770	0	590	590	0
Days	3	3	-	3	3	-

Speed

	All Days	Weekdays	Weekend	
Mean speed	81.5	81.5	-	km/h
Median speed	81.0	81.0	-	km/h
85% speed	94.7	94.7	-	km/h

PSL = 60 km/h

Class

Class (*Scheme F3*)	All Days	%	Weekdays	Weekend
1 - CYCLE	70	2.0%	70	0
2 - PC	1964	55.9%	1964	0
3 - 2A-4T	1198	34.1%	1198	0
4 - BUS	32	0.9%	32	0
5 - 2A-6T	156	4.4%	156	0
6 - 3A-SU	65	1.8%	65	0
7 - 4A-SU	1	0.0%	1	0
8 - <5A DBL	3	0.1%	3	0
9 - 5A DBL	10	0.3%	10	0
10 - >6A DBL	13	0.4%	13	0
11 - <6A MULTI	0	0.0%	0	0
12 - 6A MULTI	0	0.0%	0	0
13 - >6A MULTI	2	0.1%	2	0

Average Daily Volume

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
East	0	565	545	634	0	0	0
West	0	524	575	671	0	0	0
Combined	0	1089	1120	1305	0	0	0
AM Pk East	-	50	39	53	-	-	-
PM Pk East	-	45	41	51	-	-	-
AM Pk West	-	28	36	55	-	-	-
PM Pk West	-	71	63	78	-	-	-
Days	-	1	1	1	-	-	-

Report created 11:11 January 12, 2022 using MTE version 4.0.6.0

APPENDIX C – SYNCHRO TRAFFIC ANALYSIS EXISTING BACKGROUND 2021

HCM 6th TWSC
6: Highland Line & North Quarry Access

Highland Pit - Existing AM
04/12/2022

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	3	2	2	1	0
Future Vol, veh/h	0	3	2	2	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	33	100	100	100	0
Mvmt Flow	0	3	2	2	1	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	4	0	-	0	6	3
Stage 1	-	-	-	-	3	-
Stage 2	-	-	-	-	3	-
Critical Hdwy	4.1	-	-	-	7.4	6.2
Critical Hdwy Stg 1	-	-	-	-	6.4	-
Critical Hdwy Stg 2	-	-	-	-	6.4	-
Follow-up Hdwy	2.2	-	-	-	4.4	3.3
Pot Cap-1 Maneuver	1631	-	-	-	811	1087
Stage 1	-	-	-	-	815	-
Stage 2	-	-	-	-	815	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	1631	-	-	-	811	1087
Mov Cap-2 Maneuver	-	-	-	-	811	-
Stage 1	-	-	-	-	815	-
Stage 2	-	-	-	-	815	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	9.4
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1631	-	-	-	811
HCM Lane V/C Ratio	-	-	-	-	0.001
HCM Control Delay (s)	0	-	-	-	9.4
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	44	0	2	15	2	0	1	2	5	0	1
Future Vol, veh/h	0	44	0	2	15	2	0	1	2	5	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	5	0	50	20	50	0	0	0	20	0	0
Mvmt Flow	0	46	0	2	16	2	0	1	2	5	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	18	0	0	46	0	0	68	68	46	69	67	17
Stage 1	-	-	-	-	-	-	46	46	-	21	21	-
Stage 2	-	-	-	-	-	-	22	22	-	48	46	-
Critical Hdwy	4.1	-	-	4.6	-	-	7.1	6.5	6.2	7.3	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.3	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.3	5.5	-
Follow-up Hdwy	2.2	-	-	2.65	-	-	3.5	4	3.3	3.68	4	3.3
Pot Cap-1 Maneuver	1612	-	-	1303	-	-	930	826	1029	881	828	1068
Stage 1	-	-	-	-	-	-	973	861	-	953	882	-
Stage 2	-	-	-	-	-	-	1002	881	-	922	861	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1612	-	-	1303	-	-	927	824	1029	877	826	1068
Mov Cap-2 Maneuver	-	-	-	-	-	-	927	824	-	877	826	-
Stage 1	-	-	-	-	-	-	973	861	-	953	880	-
Stage 2	-	-	-	-	-	-	999	879	-	919	861	-

Approach	EB	WB	NE	SW
HCM Control Delay, s	0	0.8	8.8	9
HCM LOS			A	A

Minor Lane/Major Mvmt	NELn1	EBL	EBT	EBR	WBL	WBT	WBR	SWLn1
Capacity (veh/h)	950	1612	-	-	1303	-	-	904
HCM Lane V/C Ratio	0.003	-	-	-	0.002	-	-	0.007
HCM Control Delay (s)	8.8	0	-	-	7.8	0	-	9
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

HCM 6th TWSC
6: Highland Line & North Quarry Access

Highland Pit - Existing PM
04/12/2022

Intersection	
Int Delay, s/veh	0

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	0	2	4	0	0	0
Future Vol, veh/h	0	2	4	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	50	25	0	0	0
Mvmt Flow	0	2	4	0	0	0

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	4	0	-	0	6	4
Stage 1	-	-	-	-	4	-
Stage 2	-	-	-	-	2	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1631	-	-	-	1021	1085
Stage 1	-	-	-	-	1024	-
Stage 2	-	-	-	-	1026	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	1631	-	-	-	1021	1085
Mov Cap-2 Maneuver	-	-	-	-	1021	-
Stage 1	-	-	-	-	1024	-
Stage 2	-	-	-	-	1026	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1631	-	-	-	-
HCM Lane V/C Ratio	-	-	-	-	-
HCM Control Delay (s)	0	-	-	-	0
HCM Lane LOS	A	-	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	-

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	26	0	4	58	3	0	0	3	1	0	1
Future Vol, veh/h	1	26	0	4	58	3	0	0	3	1	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	16	0	25	5	0	0	0	0	0	0	0
Mvmt Flow	1	27	0	4	61	3	0	0	3	1	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	64	0	0	27	0	0	100	101	27	102	100	63
Stage 1	-	-	-	-	-	-	29	29	-	71	71	-
Stage 2	-	-	-	-	-	-	71	72	-	31	29	-
Critical Hdwy	4.1	-	-	4.35	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.425	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1551	-	-	1450	-	-	886	793	1054	884	794	1007
Stage 1	-	-	-	-	-	-	993	875	-	944	840	-
Stage 2	-	-	-	-	-	-	944	839	-	991	875	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1551	-	-	1450	-	-	882	790	1054	879	791	1007
Mov Cap-2 Maneuver	-	-	-	-	-	-	882	790	-	879	791	-
Stage 1	-	-	-	-	-	-	992	874	-	943	837	-
Stage 2	-	-	-	-	-	-	940	836	-	987	874	-

Approach	EB	WB	NE	SW
HCM Control Delay, s	0.3	0.5	8.4	8.8
HCM LOS			A	A

Minor Lane/Major Mvmt	NELn1	EBL	EBT	EBR	WBL	WBT	WBR	SWLn1
Capacity (veh/h)	1054	1551	-	-	1450	-	-	939
HCM Lane V/C Ratio	0.003	0.001	-	-	0.003	-	-	0.002
HCM Control Delay (s)	8.4	7.3	0	-	7.5	0	-	8.8
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0

Castleglenn Consultants
Engineers, Project Managers & Planners

APPENDIX D - SYNCHRO TRAFFIC ANALYSIS
FORECAST OPERATIONS 2024

Intersection	
Int Delay, s/veh	7.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	3	0	15	2	2	0	0	15	1	0	0
Future Vol, veh/h	0	3	0	15	2	2	0	0	15	1	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	33	0	100	100	100	0	0	100	100	0	0
Mvmt Flow	0	3	0	16	2	2	0	0	16	1	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	4	0	0	3	0	0	38	39	3	46	38	3
Stage 1	-	-	-	-	-	-	3	3	-	35	35	-
Stage 2	-	-	-	-	-	-	35	36	-	11	3	-
Critical Hdwy	4.1	-	-	5.1	-	-	7.1	6.5	7.2	8.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	7.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	7.1	5.5	-
Follow-up Hdwy	2.2	-	-	3.1	-	-	3.5	4	4.2	4.4	4	3.3
Pot Cap-1 Maneuver	1631	-	-	1158	-	-	972	857	854	759	858	1087
Stage 1	-	-	-	-	-	-	1025	897	-	780	870	-
Stage 2	-	-	-	-	-	-	986	869	-	806	897	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1631	-	-	1158	-	-	961	845	854	737	846	1087
Mov Cap-2 Maneuver	-	-	-	-	-	-	961	845	-	737	846	-
Stage 1	-	-	-	-	-	-	1025	897	-	780	858	-
Stage 2	-	-	-	-	-	-	972	857	-	791	897	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	6.4	9.3	9.9
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	854	1631	-	-	1158	-	-	737
HCM Lane V/C Ratio	0.018	-	-	-	0.014	-	-	0.001
HCM Control Delay (s)	9.3	0	-	-	8.2	0	-	9.9
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0

Intersection	
Int Delay, s/veh	4.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	44	0	32	15	2	0	1	32	5	0	1
Future Vol, veh/h	0	44	0	32	15	2	0	1	32	5	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	5	0	97	20	50	0	0	94	20	0	0
Mvmt Flow	0	46	0	34	16	2	0	1	34	5	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	18	0	0	46	0	0	132	132	46	149	131	17
Stage 1	-	-	-	-	-	-	46	46	-	85	85	-
Stage 2	-	-	-	-	-	-	86	86	-	64	46	-
Critical Hdwy	4.1	-	-	5.07	-	-	7.1	6.5	7.14	7.3	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.3	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.3	5.5	-
Follow-up Hdwy	2.2	-	-	3.073	-	-	3.5	4	4.146	3.68	4	3.3
Pot Cap-1 Maneuver	1612	-	-	1120	-	-	845	762	814	780	763	1068
Stage 1	-	-	-	-	-	-	973	861	-	880	828	-
Stage 2	-	-	-	-	-	-	927	827	-	904	861	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1612	-	-	1120	-	-	824	738	814	729	739	1068
Mov Cap-2 Maneuver	-	-	-	-	-	-	824	738	-	729	739	-
Stage 1	-	-	-	-	-	-	973	861	-	880	802	-
Stage 2	-	-	-	-	-	-	897	801	-	866	861	-

Approach	EB	WB	NE	SW
HCM Control Delay, s	0	5.4	9.6	9.7
HCM LOS			A	A

Minor Lane/Major Mvmt	NELn1	EBL	EBT	EBR	WBL	WBT	WBR	SWLn1
Capacity (veh/h)	811	1612	-	-	1120	-	-	770
HCM Lane V/C Ratio	0.043	-	-	-	0.03	-	-	0.008
HCM Control Delay (s)	9.6	0	-	-	8.3	0	-	9.7
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0

Intersection	
Int Delay, s/veh	7.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	0	2	0	15	4	0	0	0	15	0	0	0
Future Vol, veh/h	0	2	0	15	4	0	0	0	15	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	50	0	100	25	0	0	0	100	0	0	0
Mvmt Flow	0	2	0	16	4	0	0	0	16	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	4	0	0	2	0	0	38	38	2	46	38	4
Stage 1	-	-	-	-	-	-	2	2	-	36	36	-
Stage 2	-	-	-	-	-	-	36	36	-	10	2	-
Critical Hdwy	4.1	-	-	5.1	-	-	7.1	6.5	7.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	3.1	-	-	3.5	4	4.2	3.5	4	3.3
Pot Cap-1 Maneuver	1631	-	-	1159	-	-	972	858	855	961	858	1085
Stage 1	-	-	-	-	-	-	1026	898	-	985	869	-
Stage 2	-	-	-	-	-	-	985	869	-	1016	898	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1631	-	-	1159	-	-	961	846	855	933	846	1085
Mov Cap-2 Maneuver	-	-	-	-	-	-	961	846	-	933	846	-
Stage 1	-	-	-	-	-	-	1026	898	-	985	857	-
Stage 2	-	-	-	-	-	-	971	857	-	997	898	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	6.4	9.3	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	855	1631	-	-	1159	-	-	-
HCM Lane V/C Ratio	0.018	-	-	-	0.014	-	-	-
HCM Control Delay (s)	9.3	0	-	-	8.1	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	3.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	1	26	0	34	58	3	0	0	33	1	0	1
Future Vol, veh/h	1	26	0	34	58	3	0	0	33	1	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	16	0	91	5	0	0	0	91	0	0	0
Mvmt Flow	1	27	0	36	61	3	0	0	35	1	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	64	0	0	27	0	0	164	165	27	182	164	63
Stage 1	-	-	-	-	-	-	29	29	-	135	135	-
Stage 2	-	-	-	-	-	-	135	136	-	47	29	-
Critical Hdwy	4.1	-	-	5.01	-	-	7.1	6.5	7.11	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	3.019	-	-	3.5	4	4.119	3.5	4	3.3
Pot Cap-1 Maneuver	1551	-	-	1162	-	-	805	731	841	784	732	1007
Stage 1	-	-	-	-	-	-	993	875	-	873	789	-
Stage 2	-	-	-	-	-	-	873	788	-	972	875	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1551	-	-	1162	-	-	784	707	841	733	708	1007
Mov Cap-2 Maneuver	-	-	-	-	-	-	784	707	-	733	708	-
Stage 1	-	-	-	-	-	-	992	874	-	872	764	-
Stage 2	-	-	-	-	-	-	844	763	-	931	874	-

Approach	EB	WB	NE	SW
HCM Control Delay, s	0.3	2.9	9.5	9.3
HCM LOS			A	A

Minor Lane/Major Mvmt	NELn1	EBL	EBT	EBR	WBL	WBT	WBR	SWLn1
Capacity (veh/h)	841	1551	-	-	1162	-	-	848
HCM Lane V/C Ratio	0.041	0.001	-	-	0.031	-	-	0.002
HCM Control Delay (s)	9.5	7.3	0	-	8.2	0	-	9.3
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0

Intersection	
Int Delay, s/veh	3.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	35	0	15	24	24	0	0	15	12	0	0
Future Vol, veh/h	0	35	0	15	24	24	0	0	15	12	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	15	0	100	15	100	0	0	100	100	0	0
Mvmt Flow	0	37	0	16	25	25	0	0	16	13	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	50	0	0	37	0	0	107	119	37	115	107	38
Stage 1	-	-	-	-	-	-	37	37	-	70	70	-
Stage 2	-	-	-	-	-	-	70	82	-	45	37	-
Critical Hdwy	4.1	-	-	5.1	-	-	7.1	6.5	7.2	8.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	7.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	7.1	5.5	-
Follow-up Hdwy	2.2	-	-	3.1	-	-	3.5	4	4.2	4.4	4	3.3
Pot Cap-1 Maneuver	1570	-	-	1120	-	-	877	775	813	677	787	1040
Stage 1	-	-	-	-	-	-	984	868	-	744	841	-
Stage 2	-	-	-	-	-	-	945	831	-	769	868	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1570	-	-	1120	-	-	867	763	813	656	775	1040
Mov Cap-2 Maneuver	-	-	-	-	-	-	867	763	-	656	775	-
Stage 1	-	-	-	-	-	-	984	868	-	744	828	-
Stage 2	-	-	-	-	-	-	931	819	-	754	868	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	2	9.5	10.6
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	813	1570	-	-	1120	-	-	656
HCM Lane V/C Ratio	0.019	-	-	-	0.014	-	-	0.019
HCM Control Delay (s)	9.5	0	-	-	8.3	0	-	10.6
HCM Lane LOS	A	A	-	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	6.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	46	0	54	16	2	0	12	54	5	0	1
Future Vol, veh/h	0	46	0	54	16	2	0	12	54	5	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	5	0	97	20	50	0	0	94	20	0	0
Mvmt Flow	0	48	0	57	17	2	0	13	57	5	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	19	0	0	48	0	0	181	181	48	215	180	18
Stage 1	-	-	-	-	-	-	48	48	-	132	132	-
Stage 2	-	-	-	-	-	-	133	133	-	83	48	-
Critical Hdwy	4.1	-	-	5.07	-	-	7.1	6.5	7.14	7.3	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.3	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.3	5.5	-
Follow-up Hdwy	2.2	-	-	3.073	-	-	3.5	4	4.146	3.68	4	3.3
Pot Cap-1 Maneuver	1611	-	-	1118	-	-	785	717	811	705	717	1066
Stage 1	-	-	-	-	-	-	971	859	-	830	791	-
Stage 2	-	-	-	-	-	-	875	790	-	882	859	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1611	-	-	1118	-	-	753	680	811	620	680	1066
Mov Cap-2 Maneuver	-	-	-	-	-	-	753	680	-	620	680	-
Stage 1	-	-	-	-	-	-	971	859	-	830	750	-
Stage 2	-	-	-	-	-	-	829	749	-	808	859	-

Approach	EB	WB	NE	SW
HCM Control Delay, s	0	6.3	10	10.5
HCM LOS			B	B

Minor Lane/Major Mvmt	NELn1	EBL	EBT	EBR	WBL	WBT	WBR	SWLn1
Capacity (veh/h)	784	1611	-	-	1118	-	-	666
HCM Lane V/C Ratio	0.089	-	-	-	0.051	-	-	0.009
HCM Control Delay (s)	10	0	-	-	8.4	0	-	10.5
HCM Lane LOS	B	A	-	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0.2	-	-	0

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	24	0	15	47	0	0	0	15	0	0	0
Future Vol, veh/h	0	24	0	15	47	0	0	0	15	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	15	0	100	15	0	0	0	100	0	0	0
Mvmt Flow	0	25	0	16	49	0	0	0	16	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	49	0	0	25	0	0	106	106	25	114	106	49
Stage 1	-	-	-	-	-	-	25	25	-	81	81	-
Stage 2	-	-	-	-	-	-	81	81	-	33	25	-
Critical Hdwy	4.1	-	-	5.1	-	-	7.1	6.5	7.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	3.1	-	-	3.5	4	4.2	3.5	4	3.3
Pot Cap-1 Maneuver	1571	-	-	1133	-	-	878	788	827	868	788	1025
Stage 1	-	-	-	-	-	-	998	878	-	932	832	-
Stage 2	-	-	-	-	-	-	932	832	-	988	878	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1571	-	-	1133	-	-	868	776	827	842	776	1025
Mov Cap-2 Maneuver	-	-	-	-	-	-	868	776	-	842	776	-
Stage 1	-	-	-	-	-	-	998	878	-	932	820	-
Stage 2	-	-	-	-	-	-	918	820	-	969	878	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	2	9.4	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	827	1571	-	-	1133	-	-	-
HCM Lane V/C Ratio	0.019	-	-	-	0.014	-	-	-
HCM Control Delay (s)	9.4	0	-	-	8.2	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	5.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations		✣			✣			✣			✣	
Traffic Vol, veh/h	1	27	0	77	60	3	0	0	65	1	0	1
Future Vol, veh/h	1	27	0	77	60	3	0	0	65	1	0	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	16	0	91	5	0	0	0	91	0	0	0
Mvmt Flow	1	28	0	81	63	3	0	0	68	1	0	1

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	66	0	0	28	0	0	257	258	28	291	257	65
Stage 1	-	-	-	-	-	-	30	30	-	227	227	-
Stage 2	-	-	-	-	-	-	227	228	-	64	30	-
Critical Hdwy	4.1	-	-	5.01	-	-	7.1	6.5	7.11	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	3.019	-	-	3.5	4	4.119	3.5	4	3.3
Pot Cap-1 Maneuver	1549	-	-	1160	-	-	700	650	840	665	651	1005
Stage 1	-	-	-	-	-	-	992	874	-	780	720	-
Stage 2	-	-	-	-	-	-	780	719	-	952	874	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1549	-	-	1160	-	-	659	602	840	577	603	1005
Mov Cap-2 Maneuver	-	-	-	-	-	-	659	602	-	577	603	-
Stage 1	-	-	-	-	-	-	991	873	-	779	667	-
Stage 2	-	-	-	-	-	-	722	667	-	874	873	-

Approach	EB	WB	NE	SW
HCM Control Delay, s	0.3	4.6	9.7	9.9
HCM LOS			A	A

Minor Lane/Major Mvmt	NELn1	EBL	EBT	EBR	WBL	WBT	WBR	SWLn1
Capacity (veh/h)	840	1549	-	-	1160	-	-	733
HCM Lane V/C Ratio	0.081	0.001	-	-	0.07	-	-	0.003
HCM Control Delay (s)	9.7	7.3	0	-	8.3	0	-	9.9
HCM Lane LOS	A	A	A	-	A	A	-	A
HCM 95th %tile Q(veh)	0.3	0	-	-	0.2	-	-	0

APPENDIX E – SITE PHOTOS


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APPENDIX C – / h b { ¦ [¢ ! b ¢ { ¶ / ± {

Castleglenn Consultants
Engineers, Project Managers & Planners

Arthur Gordon

B.A., B.Eng., P. Eng.

Principal

Recently Completed Projects, Education and Memberships

Mr. Gordon is President of CastleGlenn Consultants Inc. He has served in the capacity as Director and Manager of Transportation Planning within major Canadian consulting engineering firms.

He has been responsible for numerous transportation planning and engineering design studies throughout Canada requiring detailed analysis, establishment of existing and forecast travel patterns and the development of sound rationale and justification for transportation/transit related infrastructure solutions.

Mr. Gordon has recently led the Highway 43 (Fox Creek) Major FPS and Highway 16-Highway 21 Major FPS to successful completion. In each case, he led a multi-disciplinary team of engineers to deliver a high-quality transportation solution to meet the needs of local residents and the Province. He worked with Alberta Transportation in the coordination and conduct of three Multiple Account Evaluation Sessions that saw more then 3-dozen interchange concepts presented, analyzed and evaluated from a variety of factors.

Mr. Gordon recently received the (2019) Minister's Award for Transportation Innovation by the Alberta Provincial government. This evidences his extensive experience with the development of transportation infrastructure within urbanized environments involving criteria and approaches that assess mobility, accessibility, level of service, parking circulation, operations and transit/pedestrian circulation measures within nationally significant campus environments. As well, his background includes life cycle analysis, road inventory, asset inventory, environmental assessment, transportation and transit economics, cost estimating and transportation implementation systems.

Mr. Gordon provides extensive consulting management expertise in major transportation functional planning and transit engineering studies and projects. He has managed and directed large interchange, freeway, highway and municipal transportation infrastructure initiatives inclusive of master planning studies addressing river and rail crossings. He offers multi-modal experience incorporating truck, airport, light rail as well as cycling, pedestrian design, traffic management, traffic impact, parking, site evaluation, traffic forecasting and transportation safety projects.

Mr. Gordon offers substantial functional planning experience having completed over 55 major functional planning and design assignments throughout his career.

Mr. Gordon is experienced with the development of transportation infrastructure within an urbanized environment involving criteria and approaches to assess mobility, accessibility, level of service, parking circulation, tourism operations and pedestrian circulation patterns within nationally significant campus environments.

Mr. Gordon has been retained by the Province of Alberta on several occasions to provide a peer review of other consultants functional planning submissions to address issues related to functionality, design adherence, cost, economic development impacts and provide added innovation. In many cases these assignments required political endorsement of the constituent municipalities.

Mr. Gordon also offers significant expertise in addressing the impacts of heavy vehicle traffic. He was a co-project manager responsible for the City of Edmonton's "*Truck Route and Regulation Study*" and has undertaken the "*National Capital Area Goods Movement Study*" and the "*Oakville Truck Route and Regulation Study*".

Mr. Gordon has developed a reputation of excellence in the area of communication and presentation skills. This has been displayed through numerous public consultation/ outreach exercises, providing expert witness testimony and prepared presentations to municipal councils, tribunals, executive committees and has testified to the Alberta Land Compensation Board and the Ontario Municipal Board. Most recently, Mr. Gordon was involved with the Hwy 63 Atmore Land Compensation Board. Mr. Gordon is known for incorporating public participation within the engineering process having coordinated technical review committee and public focus groups aimed at developing solutions that are community driven. He has participated in numerous exercises involving peer review and value engineering aimed at undertaking reviews of infrastructure proposals and preliminary design plans on behalf of municipalities, Alberta Transportation and the Ministry of Transportation of Ontario.

For the Province of Newfoundland and Environment Canada, he undertook the "*Trans-Canada Highway Improvements in the Vicinity of Terra Nova National Park*" (Newfoundland) that was used to assess alternative

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Recently Completed Projects, Education and Memberships

corridors and their impacts upon a provincially significant national park and the adjacent communities.

Within the field of transportation planning within a municipal setting Mr. Gordon's experience is diverse and multi-faceted. He co-authored the "*Implementing Employer Based Transportation Demand Management (TDM) Programs"* on behalf of the City of Ottawa. He is currently working with the Edmonton International Airport (EIA) to assess their infrastructure requirements. Moreover, he provided transportation planning expertise on the "*Parliamentary Precinct Study*" in the National Capital.

In addition, he is thoroughly familiar with various evaluation frameworks which address infrastructure upgrading, safety, road-user benefit / cost analysis, level of service, socio-economic impact analysis, economic justification, and the requirements necessary to meet Federal EA processes.

Mr. Gordon's experience includes rigorous technical analysis involving surveys of all heavy registered commercial vehicles, comprehensive community involvement, and a thorough operational comparative impact evaluation and assessment. Variables such as the adjacent area land uses, roadway classification, the number of lanes, geometric features, intensity of pedestrian activity, level of congestion, access density, origin-destination demand, alternate route viability, route continuity and consistency economic simulation. He has developed numerous methodologies for determining forecast travel patterns and the requirements for producing sound justifications for proposed improvements within an urban setting.

Transportation Engineering/Planning – Alberta -

- Highway 16 Clover Bar Road Functional Planning Study
- Highway 43 Fox Creek Functional Planning Study
- Coal Loading Facility Functional Planning: Integration with Hwy 3/3X Provincial Plans Detailed Design (Blairmore)
- Detailed Roadway Design - Airport Road East from Sparrow Dr to 5th St (Leduc County)
- East Ramp Terminal Detailed Design - Hwy 2:32 Interchange at Airport Road (Leduc County)
- EIA Commercial Development TIS (Edmonton International Airport)
- Leduc County Annexation Review (Leduc County)
- Highway 2 Corridor Improvement Study CIS (Calgary to Edmonton)
- City of Leduc Transportation Master Plan (Leduc)
- Airport Road Interchange Functional Planning Study (Edmonton International Airport)
- QE II - 65th Ave Interchange FPS (Leduc)
- Highway 63:01 FPS (Boyle)
- Highway 1 FPS (Old Banff Coach Road) & Hwy 563
- Athabasca Truck Route Study
- Highway 43 FPS (Hwy 33 to Hwy 16)
- Hwy 22X FPS (Calgary to Indus)
- QE II/Hwy 27 FPS (Olds)
- Bypass Discussion Paper
- Safety Rest Area Discussion Paper
- Highway 63 Median Vehicle Inspection Station Design
- Highway 63 FPS
- Highway 28A/28 FPS (Gibbons)
- Highway 1-RR33 Interchange Design FPS
- Highway 855 Corridor FPS
- Highway 27 (Olds & Sundre) FPS
- QE II (Bowden) FPS
- QE II &Township Road 265 Partial Interchange (Airdrie)
- Highway 3 & 6 Interchange FPS (Pincher Creek)
- Highway 14 FPS (Wainwright)
- Lacombe/Blackfalds Traffic Impact Assessment (Lacombe County)
- Highway 2A FPS (Ponoka)
- Highway 27 & Olds FPS (Olds)
- Highway 2A Transportation Planning Study (Blackfalds to Lacombe)
- QE II Corridor Management Study (Calgary to Innisfail)
- Highway 2A Transportation Planning Study (Red Deer to Blackfalds)
- Highway 1 Dunmore FPS
- Highway 3 & 36 Taber Access Management Planning Study
- QE II & Hwy 3 FPS, Fort Macleod, Alberta Transportation
- Highway 1 FPS, Brooks, Alberta Transportation
- Highway Vicinity Access Management Agreement, Highway 11 East of Red Deer FPS
- Highway 11 Realignment Study, East of Red Deer
- Highway 34 & Highway 2 Interchange, Grand Prairie, Functional Design
- QE II & Hwy 11 Interchange Upgrades Red Deer
- Highway 11 Twinning
- Review of Ontario Access Management Policies
- Review of Interstate Highway (FHWA) Access Management Policies

Castleglenn Consultants
Engineers, Project Managers & Planners

Arthur Gordon

B.A., B.Eng., P. Eng.

Principal

Recently Completed Projects, Education and Memberships

- Edmonton Transportation Master Plan: Truck Route Study

In addition, Mr. Gordon has undertaken numerous studies within Ontario as well as work in British Columbia and Newfoundland. A few of the relevant design projects are listed below:

- Woodroffe Avenue Reconstruction Traffic Management Plan
- Ottawa Civic Hospital Parking Garage Evaluation
- Ottawa General Hospital Smyth Road Intersection Modifications Detailed Design
- 1450 & 1454 Merivale Road Detailed Design, Tender Document and Construction Administration
- Craig Henry and Greenbank Road Intersection Improvement - Detailed Design
- Silver Seven Road Median Preliminary and Detailed Design
- Hunt Club Road - New Proposed Development Access and Right-In/Right-Out Access East of Hawthorne Road
- Moodie Drive and Dibble Road Intersection Modifications
- Mer Bleue Roundabout Design
- Strandherd Drive Pavement Markings and Signage Plan
- 350 Cresthaven Retail Development Design

Memberships

- Association of Professional Engineers, Geologists and Geophysicists of Alberta
- Professional Engineers, Ontario
- Institute of Transportation Engineers, Past President, National Capital Section
- Transportation Association of Canada, Transportation Planning Committee

Education

- B.Eng. Civil Engineering, Carleton University, 1984
- B.A. Economics and Law, Carleton University, 1980
- Masters Courses
- Accredited Health and Safety Auditor – Alberta Construction Safety Association

Castleglenn Consultants
Engineers, Project Managers & Planners

Andrey Kirillov

B.Eng

Transportation Planner

Mr. Andrey Kirillov is a *Transportation Planner* with CastleGlenn Consultants Inc.

Mr. Kirillov offers extensive training within the field of transportation planning, traffic analysis and functional planning. He has developed a diverse set of skills in the fields related to transportation traffic engineering, infrastructure planning and engineering.

Mr. Kirillov has knowledge of analyzing multi-modal traffic streams with both macro-and-micro modelling techniques, having been involved in numerous traffic operations studies, and transportation impact assessments (TIA), as well as major functional planning studies (FPS), and Transportation Master Plans.

Major Planning Projects (Ongoing)

- *Leduc County Transportation Master Plan (TMP) (Leduc County, Alberta):* Mr. Kirillov assisted with traffic analysis, communications and public engagement aspects of the project. His duties included helping with organization of in-person public houses, production of GIS exhibits and report review. A component of the TMP process involved identifying intersection upgrade requirements over the next 10 and 20-year time horizons throughout the entire county as well as addressing deficiencies in adherence to municipal design standards.

Transportation Impact Assessments

- *36B Harris Street Residential Development, (Perth, Ontario);* Mr. Kirillov lead the traffic analysis component of the traffic study in Town of Perth (about 7,500 residents). The study involved traffic forecasting, assignment and distribution for proposed new residential developments, and the analysis of 8 signalized and unsignalized intersections for existing, interim and future conditions. The findings were summarized to determine the traffic impact of the proposed residential development on the community and the timing and impacts to adjacent intersections.
- *IHA Seniors' Residence Development (Alexandria, Ontario)* Mr. Kirillov assisted with traffic analysis on the senior housing development within a community of 3,000 persons. The impact of the 500-unit development upon the community was evaluated from a traffic perspective inclusive of pedestrian connectivity within the surrounding area. The development was phased to determine the timing/staging of infrastructure/ new accesses upon the community.
- *Westhaven Subdivision (Arnprior, Ontario);* Mr. Kirillov was the lead traffic analyst for the Westhaven Subdivision Traffic Impact Study in the Town of Arnprior, ON (9,000 residents). The objective of the study was to evaluate the impact of the proposed residential subdivision on the adjacent road network. The analysis dealt with existing, future background and future design conditions using Synchro.
- *150 Kanata Avenue-1200 Maritime Way Residential Development (Ottawa, Ontario);* Mr. Kirillov was the lead traffic analyst for this study, which involved an analysis of nine intersections accounting for existing, interim, and future design horizons. The study included screening of mitigation strategies, such as roadway widening, signal timing and traffic signal phase adjustments, and implementation of a roundabout configuration. Analysis of mitigated conditions was conducted using both Synchro™ and Sidra™ softwares.
- *5329 Boundary Road Commercial Development (Ottawa, Ontario)*: Mr. Kirillov was the senior traffic analyst for this TIA in support of the proposed major fuel/commercial development. The study was required to follow both municipal and Provincial requirements, and dealt with a review of existing traffic, site traffic, site circulation and access management effecting the design of both municipal and provincial infrastructure.

Key skills

- Excellent verbal communication skills;
- Experienced in planning and problem solving;
- Experienced in engaging with public and stakeholders;
- Proficient in technical writing;
- Strong analytical capacity; and
- Proficient with…
  - Synchro versions 8/10;
  - Sidra Roundabout Analysis;
  - Microsimulation analysis using SimTraffic™ to model real-time vehicle conflicts and safety elements;
  - HCM 2000/HCM 2010/HCM 6 Traffic Analysis; and
  - ArcGIS and QGIS platforms.
  - Google Earth and similar GIS platforms
  - Microsoft Word Suite (Word, Excel, PowerPoint, Outlook, etc.)

Education

- B. Eng. Civil Engineering with Cooperative Education, Carleton University, 2021

Castleglenn Consultants
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Konstantin Joulanov

B. ASc, M. Eng.

Transportation Planner

Mr. Konstantin Joulanov has recently joined Castleglenn Consultants Inc. as a *Transportation Planner* with

Mr. Joulanov joined Castleglenn Consultants Inc. in October 2021, and since then he has undergone an extensive training on transportation planning and analysis.

Mr. Joulanov has developed a diverse set of skills in the fields related to transportation planning and engineering. Mr. Joulanov has knowledge of analyzing multi-modal traffic streams with both macro-and-micro modelling techniques, having been involved primarily in traffic operations studies, and transportation impact assessments (TIA), as well as having had some exposure to functional planning studies (FPS), and Transportation Master Plans.

Major Planning Projects (Ongoing)

- *Leduc County Transportation Master Plan (TMP) (Leduc County, Alberta, 2021):* Mr. Joulanov assisted with public engagement aspects and report preparation of the project. His duties included summarization of various findings as well as report review.
- *Highway 40 Network Review (Alberta, 2021):* Konstantin conducted a thorough traffic analysis involving at least 10 highway intersections and 8 roundabouts along the Highway 40 corridor south of Grande Prairie for both 10-year and 20-year time horizons. The analysis was used to determine intersection configurations and staging leading to functional design and costing. Minimum level of services thresholds was established at the outset to assure acceptable traffic operations.

Transportation Impact Assessments

- *777 Silver Seven Commercial Development, (Ottawa, Ontario);* Mr. Joulanov conducted the traffic analysis component of this TIA which involved a 9-story building housing medial and general offices and a multi-story self-storage centre. The study involved traffic forecasting, assignment and distribution for the proposed development, as well analysis of 5 signalized and unsignalized intersections which required determination of existing traffic and ultimate traffic conditions. The findings were summarized to judge traffic impact of the proposed development upon the surrounding residential community.
- *150 Kanata Avenue-1200 Maritime Way Residential Development (Ottawa, Ontario);* Konstantin assisted in the traffic analysis of this study, which involved a 350-unit 7/8/9-storey multi-use residential-commercial-retail complex. The project saw an evaluation of 9 intersections within the study area including ramp terminal intersections with the major 417 freeway corridor. Existing and ultimate time horizons were evaluated both with and without the development in place to determine the necessary infrastructure upgrades. The study also included screening of mitigation strategies, such as roadway widening, signal timing/phasing, and operational assessment of a roundabout configured intersection. Analysis of mitigated conditions was conducted using Synchro™ and Sidra™.
- *Proposed Storyland Quarry (Renfrew, Ontario);* This project involved securing the necessary approvals to establish a quarry operation near a major Provincial highway corridor. Mr. Joulanov conducted the traffic analysis component of this project which required an assessment of alternative access locations and configurations taking into account sight line requirement and heavy vehicle operational characteristics. A total of 3 alternative access arrangements were considered taking into account the traffic impact of the proposed development upon the surrounding roadways.

Key skills

- Excellent verbal communication skills;
- Experienced in planning and problem solving;
- Proficient in technical writing;
- Strong analytical capacity; and
- Proficient with…
  - Synchro versions 8/10;
  - Sidra Roundabout Analysis;
  - HCM 2000/HCM 2010/HCM 6 Traffic Analysis;
  - ArcGIS and QGIS platforms.
  - Google Earth and similar GIS platforms; and
  - Microsoft Word Suite (Word, Excel, PowerPoint, Outlook, etc.)

Education

- Bachelor of Applied Science in Civil Engineering, University of Ottawa,
- Masters of Engineering, Carleton University