D-7

Visual

Memorandum

06 June 2025

Project Name	Walker South Landfill Phase 2 Environmental Assessment	**Project No.**	12567140
Subject	Draft Comparative Evaluation Technical Memorandum for Visual Effects		

1. Introduction

This memo documents the assessment and evaluation of the Alternative Methods for the Walker South Landfill Phase 2 Environmental Assessment (EA) from a visual perspective. The Minister Approved Terms of Reference (Approved ToR) included a preliminary description of the methodology for evaluating the Alternative Methods (See Section 7.1 of the Approved ToR, September 2024). This memo is one of 13 memos that outline the evaluation of the Alternative Methods from the perspective of each discipline. These memos will be used in concert with one another, along with their evaluation tables, as supporting documents to the Alternative Methods Report. Memos were prepared for the following environmental components:

– Geology and Hydrogeology
– Surface Water Resources
– Noise and Vibration
– Air Quality
– Terrestrial and Aquatic Environment
– Land Use
– Agriculture
– Transportation
– Social Environment
– Economic Environment
– Built Heritage Resources and Cultural Heritage Landscapes
– Archaeology
– Visual

Each of the above disciplines also prepared existing conditions reports that were utilized in assessing and evaluating the Alternative Methods. Further, the disciplines referred to the Conceptual Design Report (CDR) that was prepared from a Site Design and Operations perspective in order to provide the appropriate level of detail on each of the Alternative Methods. The CDR will also form a supporting document to the Alternative Methods Report.

Each discipline is following the requirements as stated in the draft work plans that were presented in Appendix C of the Approved ToR. The work plan presents the scope of work required to complete the EA, including the scope of technical studies for each of the environmental components, and the evaluation of Alternative Methods.

1.1 Documentation

The results of these individual memos will be documented in separate stand-alone technical memorandums during the EA. The final Alternative Methods evaluation will form a chapter of the EA Report, with each of the stand-alone memorandums becoming supporting documents/appendices to the EA Report.

2. Assessment and evaluation of the alternative methods methodology

The assessment and evaluation of the Alternative Methods was conducted in three steps:

Step 1: confirm evaluation criteria and indicators/measures

Prior to undertaking the net effects analysis, the evaluation criteria, indicators, and measures previously developed in the ToR were reviewed with the public during Public Events and confirmed for application to each of the Alternative Methods. Evaluation criteria were developed for each Environmental Component listed above.

The Approved ToR set out the draft criteria and indicators for evaluating the Alternative Methods in the EA. As a result, the draft criteria, indicators, and measures provided in the ToR were reviewed and modified appropriately to suit the evaluation of the Alternative Methods.

Specifically, the criteria, indicators and measures were modified in consultation with review agencies and the public to ensure that an appropriate level of scrutiny and rigour was applied in evaluating the Alternative Methods. In doing so, the results of the evaluation phase will consist of clearly defined net effects for each Alternative Method.

Step 2: undertake the net effects analysis

With the evaluation criteria, indicators and measures confirmed through the preceding step, a net effects analysis of the Alternative Methods was carried out consisting of the following activities:

– Identify potential effects (based on measures) on the environment
– Develop and apply avoidance/mitigation/compensation/enhancement measures
– Determine net effects on the environment.

Step 3: carry out the comparative evaluation

In Step 3, the net effects identified for each Alternative Method in Step 2 were compared to one another in order to identify a Recommended Alternative Method. The comparison of net effects was completed using a “Reasoned Argument” evaluation methodology, as provided for in the Approved ToR.

Each Alternative Method was assessed based on the evaluation criteria, indicators and measures.

Each criterion was evaluated with the same indicators for each Alternative Method (including number and significance) to support the reasoned argument in the comparative rankings:

– Effect on views of the facility:
    - Predicted changes in views of the facility from the surrounding area
    - Visibility of project features from selected receptor locations
    - Level of visual contrast of project features from selected receptor locations

3. Step 1: confirm evaluation criteria and indicators/ measures

Evaluation Criteria and Indicators were adjusted during the development of the ToR based on feedback from Indigenous communities, government agencies, and the public.

Prior to undertaking the Comparative Evaluation of Alternative Methods process, a Public Event, accompanied by a virtual event, was held to present the Criteria and Indicators to the public and invite additional feedback. While feedback was received on other Criteria and Indicators, no comments focused on the Comparative Evaluation of Visual Effects.

Additional consultation was conducted through email correspondence with the Niagara Escarpment Commission (NEC) which identified viewpoints to be considered in the Visual Existing Conditions Report as to best evaluate the Project's impact on the scenic resources of the Niagara Escarpment. The NEC emphasized the need to consider the impact of the height of each of the proposed Alternative Methods within the Criteria and Indicators and provided resources and guidance regarding their Technical Criteria for Visual Impact Assessments.

While comments from the NEC have been incorporated into the comparative evaluation methodology, specifically through the addition of a viewpoint identified as being of interest to the NEC, no changes have been made to the Criteria and Indicators.

In order to fully characterize the indicators and to adopt measures by which potential effects could be identified, several considerations were developed for each indicator. These considerations are shown below in Table 3.1.

Table 3.1 Considerations for Indicators

Criteria	Indicators	Considerations
Effect on views of the facility	– Predicted changes in views of the facility from the surrounding area – Visibility of project features from selected receptor locations – Level of visual contrast of project features from selected receptor locations	– Area of theoretical visibility – Project features visible from each receptor location – Types of receptors within the area of theoretical visibility – View from within, of, and across the Niagara Escarpment

The potential effects for each Alternative Method were then identified on the basis of these considerations.

4. Step 2: net effects analysis

4.1 General assumptions

Table 4.1 outlines the assumptions for each Criteria evaluated.

Table 4.1 General Assumptions for Evaluation of the Visual Criteria

Criteria	Assumptions
Effect on views of the facility	– An agricultural end use is assumed for the purpose of this comparative evaluation. End use will be determined through development of a Closure Plan, either when the proposed landfill has two-years of capacity remaining or when it reaches 90% capacity, whichever occurs first. In addition to agricultural end use, recreation, naturalization, and a combination of the three will be considered.

4.2 Potential effects, mitigation measures, net effects

The potential effects for each Alternative Method were identified based on the characterized and documented existing visual conditions and on the basis of the considerations outlined in Table 3.1.

Net Effects have been categorized according to the definitions in Table 4.2.

Table 4.2 Categorization of Net Effects

Net Effect Category	Description
No Effect/No (Positive) Effect	No departure from the existing condition is expected.
Low Effect/Low (Positive) Effect	Effects are likely to be negligible or minor in scale if they are negligible or low in magnitude, of short duration, infrequent, small in spatial extent, reversible or readily avoided, and generate few or minor impacts in social or ecological contexts. Mitigation measures will allow baseline conditions to remain largely unchanged.
Moderate Effect/Moderate (Positive) Effect	Effects are likely to be medium in scale if they are moderate in magnitude, of moderate duration, occasionally frequent, possibly/partially reversible, and to generate a moderate level of impacts in social or ecological contexts. Mitigation measures may not fully eliminate, reduce, control or offset effects but should enable affected communities to maintain economic and social well-being, and should prevent the diminishment or loss of key components of the environment and its ecological functioning.
High Effect / High (Positive) Effect	Effects are likely to be severe in scale if they are high in magnitude, permanent/long term, frequent, irreversible, and over a large spatial extent or within an area of exclusive/preferred Indigenous use or of ecological/environmental sensitivity. High levels of impacts in social or ecological contexts are expected. There is a high degree of uncertainty of the effectiveness of mitigation measures, or mitigation measures are unable to fully address effects.

4.2.1 Landfill configuration options

The comparative evaluation of the Landfill Configuration Options is based on Zone of Theoretical Visibility (ZTV) modeling (**Appendix A**), and artistic impressions at three viewpoint locations (**Appendix B**). Additionally, to consider potential effects to views of and through the Niagara Escarpment, the location of the Walker Campus was identified within a view of the Escarpment from the Queen Elizabeth Way (QEW) 400-series highway, near the Garden City Bridge (**Appendix C**).

Zone of theoretical visibility (ZTV)

The ZTV illustrates land from which it is theoretically possible to view the proposed landform. This is based on the potential visibility of the landform at a maximum height of 31 m (Option A), 30 m (Option B), and 24 m (Option C). The following parameters were used for the analysis of each design option:

– A viewing height of 1.7 m, which is the average within the typical viewing level range of an adult.
– Approximately 30 to 33 points spread evenly across the proposed landform, referencing the proposed design elevations from the Lidar used.
– A digital surface model, created using 1 m Ontario Digital Terrain Model (Lidar-Derived) data, from Ontario Ministry of Natural Resources and Forestry (date Updated: January 21, 2025).

The GIS software digitally determines the likely extent over which the component would be visible or not visible. In interpreting the ZTV, the following issues must be considered:

– The ZTV only takes into account the landform and does not include land cover factors such as the presence of buildings and trees. It therefore represents the worst-case scenario of potential visual impacts.
– The ZTV does not take into account the effect of distance. The greater the distance from the proposal, the lower the impact, as the development will take up a smaller portion of the view, and atmospheric conditions may reduce the visual prominence of the proposal.

– The ZTV is only accurate to the resolution of the elevation model.

A composite of the three ZTV models was also generated for comparison purposes. The ZTV is marginally greater for Option A compared to B and C, and for Option B compared to C.

Artistic impressions

For the purposes of the comparative evaluation of alternative methods, artistic impressions were developed from three viewpoint locations, listed below. It is noted that the artistic impressions do not incorporate any mitigation measures that may be applied to reduce visual impact. Further, the visual impact illustrated in the artistic impressions may be naturally screened during the different seasons of the year.

– **Mountain Road**, east of Taylor Road (location #16, as identified in visual existing conditions reporting)
  - At this location, close to the proposed site, all three landfill configuration options are visible.
  - Additional vegetative screening could reduce the visual impact.
– **Garner Road**, southeast of the site (location #27, as identified in visual existing conditions reporting)
  - From this location, the existing Garner Road Berm is visible and obstructs views of Option C, though operations at peak height may be visible (e.g., machinery operating at the maximum top of waste).
  - The existing Garner Road Berm partially screens views of both Options A and B, with Option A being more visible above the berm.
  - Additional vegetative screening atop the berm could reduce the visual impact from this location.
– **Taylor Road**, north of the site. This viewpoint was added as it was identified to be of particular interest to the NEC. This viewpoint serves to allow consideration of effects to views from within the Niagara Escarpment.
  - Landfill Configuration Options A, B, and C are all visible from this viewpoint.
  - Existing berms and vegetation provide some mitigative screening at the western portion of the view.
  - Additional vegetative screening along edges of Walker-owned property adjacent Mountain Road and Taylor Road would reduce visual effect.

Additional inputs and considerations

In order to consider the potential effect of the facility on views of the Niagara Escarpment, the location of the Walker Campus was estimated within a view of the Escarpment from the QEW, near the Garden City Bridge. The image used was obtained from Google Street View and is dated 2023. From this viewpoint, features of the Walker Campus are not readily discernible, and it is expected that the proposed South Landfill Phase 2 would similarly not stand out as an easily discernible feature in views of the Escarpment. The exception to this could be when machinery is operating at the maximum top of waste, as it could introduce greater visual contrast and thus stand out on the horizon.

Additional visual receptor points will be identified, as needed, during the detailed Impact Assessment of the preferred option. At that stage, impact management measures will also be further developed and refined.

The following tables (Table 4.3 – Table 4.5) present the results of the net environmental effects evaluation for Landfill Configurations Options (Options A – C). The net effects have been determined by applying mitigation measures to the predicted potential environmental effects.

Table 4.3 Landfill Configuration Option A Visual Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on views of the facility	– Predicted changes in views of the facility from the surrounding area	– As the landfill reaches and exceeds existing grade it will begin to be visible from viewpoints in the surrounding area. During initial stages it will be below existing grade and not visible. – Theoretical visibility of the maximum top of waste extends beyond the Local Study Area, however existing vegetation will screen the site from much of the area identified in the ZTV modelling. – Views of the landfill from below the Niagara Escarpment are possible as maximum top of waste is reached; however, it is expected that at such distances the effect will be minimal, with the exception of machinery operation at the top of waste, which may be more visible at such distance as it presents higher visual contrast to the surrounding landscape.	– Retain and enhance existing visual screening features associated with the quarry. – Install additional permanent screening features (e.g., berms and vegetation). – Deploy temporary screening features as needed (e.g., fencing/netting to screen the active face). – Limit frequency and duration of instances where machinery is visible through operational planning. – Include consideration of the visual landscape in development of the Closure Plan.	The landfill will become visible from points in the surrounding area. Visual impact can be minimized through retention of existing screening measures, addition of new permanent and temporary screening features, as well as through operational planning. Visual effects are expected to decrease post-closure. **LOW NET EFFECTS**
	– Visibility of project features from selected receptor locations	– Features that may become visible include: • The landfill mound • Active face • Machinery • Landfill gas flares – Artistic impressions show the landfill mound at maximum top of waste will be: • Visible from location #16. • Partially visible from location #27; this view is partially screened by the existing Garner Road Berm. • Visible from Taylor Road, north of the site.	– Retain and enhance existing visual screening features associated with the quarry. – Install additional permanent screening features (e.g., berms and vegetation). – Deploy temporary screening features as needed (e.g., fencing/netting to screen the active face). – Limit frequency and duration of instances where machinery is visible through operational planning. – Include consideration of the visual landscape in development of the Closure Plan.	The landfill will become visible from the selected receptor points. Visual impact can be minimized through retention of existing screening measures, addition of new permanent and temporary screening features, as well as through operational planning. Visual effects are expected to decrease post-closure. **MODERATE NET EFFECTS**
	– Level of visual contrast of project features from selected receptor locations	– Given proximity to the East Landfill, and South Landfill Phase 1, the proposed South Landfill Phase 2 would be situated within and area where the local existing visual landscape already includes landfill mounds. – The level of visual contrast with the surrounding landscape is expected to change over time, with the highest potential for visual contrast occurring if and when the active face, machinery, and/or flares become visible to viewpoints outside the Walker Campus. – The level of visual contrast is expected to decrease as the interim and final cap is installed. – The level of visual contract is expected to be low at closure and post-closure as the site transitions to its end-use (agriculture, naturalization, recreation, or a combination of the three; to be determined prior to closure).	– Retain and enhance existing visual screening features associated with the quarry. – Install additional permanent screening features (e.g., berms and vegetation). – Deploy temporary screening features as needed (e.g., fencing/netting to screen the active face). – Limit frequency and duration of instances where machinery is visible through operational planning. – Include consideration of the visual landscape in development of the Closure Plan.	Given the proposed location within the existing Walker Campus, and adjacent landfill mounds, the degree of visual contrast is expected to be low and can be further minimized through visual screening measures and operational planning. **LOW NET EFFECTS**

Table 4.4 Landfill Configuration Option B Visual Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on views of the facility	– Predicted changes in views of the facility from the surrounding area	– As the landfill reaches and exceeds existing grade it will begin to be visible from viewpoints in the surrounding area. During initial stages it will be below existing grade and not visible. – Theoretical visibility of the maximum top of waste extends beyond the Local Study Area, however existing vegetation will screen the site from much of the area identified in the ZTV modelling. – Views of the landfill from below the Niagara Escarpment are possible as maximum top of waste is reached; however, it is expected that at such distances the effect will be minimal, with the exception of machinery operation at the top of waste, which may be more visible at such distance as it presents higher visual contrast to the surrounding landscape.	– Retain and enhance existing visual screening features associated with the quarry. – Install additional permanent screening features (e.g., berms and vegetation). – Deploy temporary screening features as needed (e.g., fencing/netting to screen the active face). – Limit frequency and duration of instances where machinery is visible through operational planning. – Include consideration of the visual landscape in development of the Closure Plan.	The landfill will become visible from points in the surrounding area. Visual impact can be minimized through retention of existing screening measures, addition of new permanent and temporary screening features, as well as through operational planning. Visual effects are expected to decrease post-closure. **LOW NET EFFECTS**
	– Visibility of project features from selected receptor locations	– Features that may become visible include: • The landfill mound • Active face • Machinery • Landfill gas flares – Artistic impressions show the landfill mound at maximum top of waste will be: • Visible from location #16. • Not visible from location #27; this view is fully screened by the existing Garner Road Berm. • Visible from Taylor Road, north of the site.	– Retain and enhance existing visual screening features associated with the quarry. – Install additional permanent screening features (e.g., berms and vegetation). – Deploy temporary screening features as needed (e.g., fencing/netting to screen the active face). – Limit frequency and duration of instances where machinery is visible through operational planning. – Include consideration of the visual landscape in development of the Closure Plan.	The landfill will become visible from the selected receptor points. Visual impact can be minimized through retention of existing screening measures, addition of new permanent and temporary screening features, as well as through operational planning. Visual effects are expected to decrease post-closure. **MODERATE NET EFFECTS**
	– Level of visual contrast of project features from selected receptor locations	– Given proximity to the East Landfill, and South Landfill Phase 1, the proposed South Landfill Phase 2 would be situated within and area where the local existing visual landscape already includes landfill mounds. – The level of visual contrast with the surrounding landscape is expected to change over time, with the highest potential for visual contrast occurring if and when the active face, machinery, and/or flares become visible to viewpoints outside the Walker Campus. – The level of visual contrast is expected to decrease as the interim and final cap is installed. – The level of visual contract is expected to be low at closure and post-closure as the site transitions to its end-use (agriculture, naturalization, recreation, or a combination of the three; to be determined prior to closure).	– Retain and enhance existing visual screening features associated with the quarry. – Install additional permanent screening features (e.g., berms and vegetation). – Deploy temporary screening features as needed (e.g., fencing/netting to screen the active face). – Limit frequency and duration of instances where machinery is visible through operational planning. – Include consideration of the visual landscape in development of the Closure Plan.	Given the proposed location within the existing Walker Campus, and adjacent landfill mounds, the degree of visual contrast is expected to be low and can be further minimized through visual screening measures and operational planning. **LOW NET EFFECTS**

Table 4.5 Landfill Configuration Option C Visual Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on views of the facility	– Predicted changes in views of the facility from the surrounding area	– As the landfill reaches and exceeds existing grade it will begin to be visible from viewpoints in the surrounding area. During initial stages it will be below existing grade and not visible. – Theoretical visibility of the maximum top of waste extends beyond the Local Study Area, however existing vegetation will screen the site from much of the area identified in the ZTV modelling. – Views of the landfill from below the Niagara Escarpment are possible as maximum top of waste is reached; however, it is expected that at such distances the effect will be minimal, with the exception of machinery operation at the top of waste, which may be more visible at such distance as it presents higher visual contrast to the surrounding landscape.	– Retain and enhance existing visual screening features associated with the quarry. – Install additional permanent screening features (e.g., berms and vegetation). – Deploy temporary screening features as needed (e.g., fencing/netting to screen the active face). – Limit frequency and duration of instances where machinery is visible through operational planning. – Include consideration of the visual landscape in development of the Closure Plan.	The landfill will become visible from points in the surrounding area. Visual impact can be minimized through retention of existing screening measures, addition of new permanent and temporary screening features, as well as through operational planning. Visual effects are expected to decrease post-closure. **LOW NET EFFECTS**
	– Visibility of project features from selected receptor locations	– Features that may become visible include: • The landfill mound • Active face • Machinery • Landfill gas flares – Artistic impressions show the landfill mound at maximum top of waste will be: • Visible from location #16. • Partially visible from viewpoint #27; this view is partially screened by the existing Garner Road Berm. • Visible from Taylor Road, north of the site.	– Retain and enhance existing visual screening features associated with the quarry. – Install additional permanent screening features (e.g., berms and vegetation). – Deploy temporary screening features as needed (e.g., fencing/netting to screen the active face). – Limit frequency and duration of instances where machinery is visible through operational planning. – Include consideration of the visual landscape in development of the Closure Plan.	The landfill will become visible from the selected receptor points. Visual impact can be minimized through retention of existing screening measures, addition of new permanent and temporary screening features, as well as through operational planning. Visual effects are expected to decrease post-closure. **MODERATE NET EFFECTS**
	– Level of visual contrast of project features from selected receptor locations	– Given proximity to the East Landfill, and South Landfill Phase 1, the proposed South Landfill Phase 2 would be situated within and area where the local existing visual landscape already includes landfill mounds. – The level of visual contrast with the surrounding landscape is expected to change over time, with the highest potential for visual contrast occurring if and when the active face, machinery, and/or flares become visible to viewpoints outside the Walker Campus. – The level of visual contrast is expected to decrease as the interim and final cap is installed. – The level of visual contract is expected to be low at closure and post-closure as the site transitions to its end-use (agriculture, naturalization, recreation, or a combination of the three; to be determined prior to closure).	– Retain and enhance existing visual screening features associated with the quarry. – Install of additional permanent screening features (e.g., berms and vegetation). – Deploy temporary screening features as needed (e.g., fencing/netting to screen the active face). – Limit frequency and duration of instances where machinery is visible through operational planning. – Include consideration of the visual landscape in development of the Closure Plan.	Given the proposed location within the existing Walker Campus, and adjacent landfill mounds, the degree of visual contrast is expected to be low and can be further minimized through visual screening measures and operational planning. **LOW NET EFFECTS**

4.2.2 Leachate management options

The proposed location of leachate management infrastructure for both Leachate Management Options is well-screened from viewpoints outside the Walker Campus by an existing berm and vegetation. Option A would involve the addition of a third lagoon, located adjacent to the existing two lagoons. Option B would involve construction of a wastewater treatment facility, assumed for the purposes of this evaluation to require a structure measuring approximately 120 m x 60 m x 15 m (length, width, height). Given the proposed location relative to the existing landforms and vegetation, neither leachate management option is expected to be visible from areas outside the Walker Campus. Once the preferred option is selected, and design advanced, visual effects and need for mitigation measures will be re-examined in the detailed Impact Assessment.

The following tables (Table 4.6 - Table 4.7) present the results of the net environmental effects evaluation for the Leachate Management Options A and B. The net effects have been determined by applying mitigation measures to the predicted potential environmental effects.

Table 4.6 Leachate Management Option A Visual Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on views of the facility	– Predicted changes in views of the facility from the surrounding area	– No changes to views of the lagoons are expected from the addition of a third lagoon.	– No additional impact management measures are required if existing berm and vegetation are retained.	No changes to existing views of the facility are expected. **NO NET EFFECTS**
	– Visibility of project features from selected receptor locations	– The lagoon is not expected to be visible from viewpoints outside the Walker Campus.	– No additional impact management measures are required if existing berm and vegetation are retained.	Lagoon is not expected to be visible from outside the Walker Campus. **NO NET EFFECTS**
	– Level of visual contrast of project features from selected receptor locations	– The lagoon is not expected to be visible from viewpoints outside the Walker Campus. – The lagoon would be situated adjacent existing lagoons and within the Walker Campus where the visual landscape is characterized by a variety of aggregate and waste management operations. As such, the introduction of an additional lagoon would not be perceived as in contrast to the existing visual landscape.	– No additional impact management measures are required if existing berm and vegetation are retained.	An additional lagoon at the proposed location is not expected to alter the existing visual character. **NO NET EFFECTS**

Table 4.7 Leachate Management Option B Visual Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on views of the facility	– Predicted changes in views of the facility from the surrounding area	– Based on the assumed dimensions of the facility, proposed location within the Walker Campus, and existing screening features (i.e., berms and vegetation), it is not expected that there will be views of the facility from areas outside the Campus. – Should the option be selected and the conceptual design advanced, changes in views of the facility should be considered, and where they are anticipated should be mitigated through application of standard visual screening measures (e.g., berms and vegetative screening).	– Retain existing visual screening features associated with the quarry. – Should the option be selected and the conceptual design advanced, changes in views of the facility should be considered, and where they are anticipated should be mitigated through application of standard visual screening measures (e.g., berms and vegetative screening).	Views of the facility from outside the Walker Campus are not expected to change. Should elements of the facility become visible from viewpoints outside the Campus, it is expected impacts can be mitigated through standard visual screening measures. **NO NET EFFECTS**
	– Visibility of project features from selected receptor locations	– Based on the assumed dimensions of the facility, proposed location within the Walker Campus, and existing screening features (i.e., berms and vegetation), it is not expected that there will be views of the facility from areas outside the Campus.	– Retain existing visual screening features associated with the quarry. – Should the option be selected and the conceptual design advanced, changes in views of the facility should be considered, and where they are anticipated should be mitigated through application of standard visual screening measures (e.g., berms and vegetative screening).	Views of the facility from outside the Walker Campus are not expected to change. Should elements of the facility become visible from viewpoints outside the Campus, it is expected impacts can be mitigated through standard visual screening measures. **NO NET EFFECTS**
	– Level of visual contrast of project features from selected receptor locations	– The on-site wastewater treatment facility is not expected to be visible from viewpoints outside the Walker Campus. – The on-site wastewater treatment facility would be situated adjacent existing lagoons and within the Walker Campus where the visual landscape is characterized by a variety of aggregate and waste management operations. As such, the introduction of the facility would not be perceived as in contrast to the existing visual landscape.	– Retain existing visual screening features associated with the quarry. – Should the option be selected and the conceptual design advanced, changes in views of the facility should be considered, and where they are anticipated should be mitigated through application of standard visual screening measures (e.g., berms and vegetative screening).	A wastewater treatment facility at the proposed location is not expected to alter the existing visual character. **NO NET EFFECTS**

5. Step 3: comparative evaluation

Table 5.1 Comparative Evaluation –Visual

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
Effect on views of the facility	– Predicted changes in views of the facility from the surrounding area	The landfill will become visible from points in the surrounding area. Visual impact can be minimized through retention of existing screening measures, addition of new permanent and temporary screening features, as well as through operational planning. Visual effects are expected to decrease post-closure. **LOW NET EFFECTS**	The landfill will become visible from points in the surrounding area. Visual impact can be minimized through retention of existing screening measures, addition of new permanent and temporary screening features, as well as through operational planning. Visual effects are expected to decrease post-closure. **LOW NET EFFECTS**	The landfill will become visible from points in the surrounding area. Visual impact can be minimized through retention of existing screening measures, addition of new permanent and temporary screening features, as well as through operational planning. Visual effects are expected to decrease post-closure. **LOW NET EFFECTS**	No changes to existing views of the facility are expected. **NO NET EFFECTS**	Views of the facility from outside the Walker Campus are not expected to change. Should elements of the facility become visible from viewpoints outside the Campus, it is expected impacts can be mitigated through standard visual screening measures. **NO NET EFFECTS**
	– Visibility of project features from selected receptor locations	The landfill will become visible from the selected receptor points. Visual impact can be minimized through retention of existing screening measures, addition of new permanent and temporary screening features, as well as through operational planning. Visual effects are expected to decrease post-closure. **MODERATE NET EFFECTS**	The landfill will become visible from the selected receptor points. Visual impact can be minimized through retention of existing screening measures, addition of new permanent and temporary screening features, as well as through operational planning. Visual effects are expected to decrease post-closure. **MODERATE NET EFFECTS**	The landfill will become visible from the selected receptor points. Visual impact can be minimized through retention of existing screening measures, addition of new permanent and temporary screening features, as well as through operational planning. Visual effects are expected to decrease post-closure. **MODERATE NET EFFECTS**	Lagoon is not expected to be visible from outside the Walker Campus. **NO NET EFFECTS**	Views of the facility from outside the Walker Campus are not expected to change. Should elements of the facility become visible from viewpoints outside the Campus, it is expected impacts can be mitigated through standard visual screening measures. **NO NET EFFECTS**
	– Level of visual contrast of project features from selected receptor locations	Given the proposed location within the existing Walker Campus, and adjacent landfill mounds, the degree of visual contrast is expected to be low and can be further minimized through visual screening measures and operational planning. **LOW NET EFFECTS**	Given the proposed location within the existing Walker Campus, and adjacent landfill mounds, the degree of visual contrast is expected to be low and can be further minimized through visual screening measures and operational planning. **LOW NET EFFECTS**	Given the proposed location within the existing Walker Campus, and adjacent landfill mounds, the degree of visual contrast is expected to be low and can be further minimized through visual screening measures and operational planning. **LOW NET EFFECTS**	An additional lagoon at the proposed location is not expected to alter the existing visual character. **NO NET EFFECTS**	A wastewater treatment facility at the proposed location is not expected to alter the existing visual character. **NO NET EFFECTS**
Environmental Component Ranking:		3rd	2nd	1st	1st	2nd
Environmental Component Rationale:		While the net effects are the same for each option, the magnitude of the effects will be marginally greater for Option A compared to B and C, and for Option B compared to C, as a result of their maximum top of waste heights. Therefore, from the visual perspective, Option C is preferred.			While the net effects are similar for both options, and both are feasible from the visual perspective, Option A is marginally preferred due to the potential of elements of Option B to become visible to viewpoints outside the Walker Campus as design is further refined, and/or existing screening features change over time.	

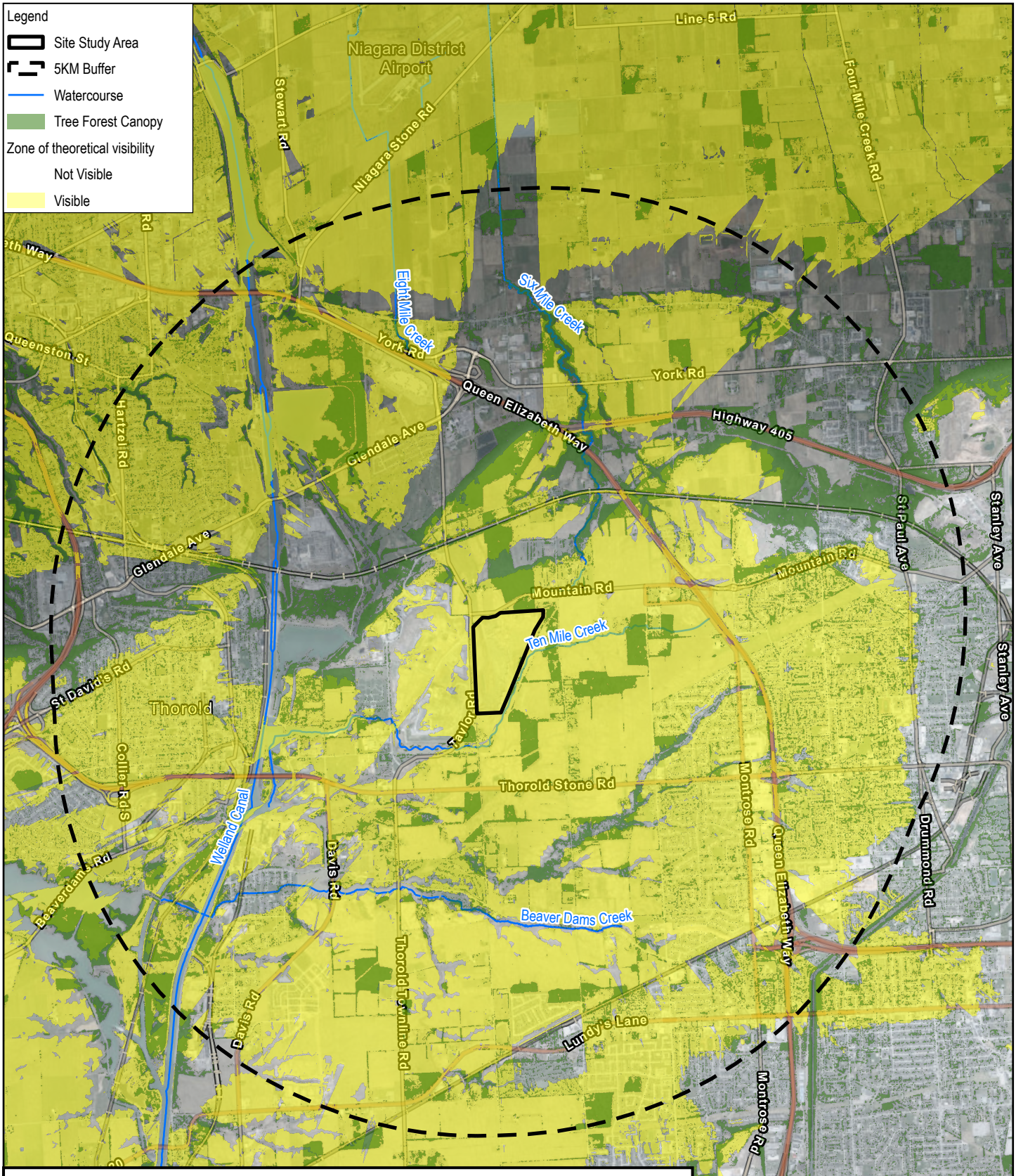
6. Conclusions

Based on the net environmental effects presented in Section 4.2, and the comparative evaluation in Section 5, Landfill Configuration Option C is preferred from the visual perspective. Leachate Management Option A, is marginally preferred over Option B. A detailed Visual Impact Assessment of the preferred methods will be undertaken during the detailed impact assessment stage of the EA process.

Appendices

Appendix A

Zone of Theoretical Visibility



Data Disclaimer

This Zone of Theoretical Visibility illustrates land from which it is theoretically possible to view the proposed landform. This is based on the potential visibility of the landform at a maximum height of 31 m. This analysis was generated using a digital elevation model created using 1 m Ontario Digital Terrain Model (Lidar-Derived) data. This analysis therefore takes into account the existing landform, however excludes vegetation and buildings. The Zone of Theoretical Visibility is only accurate to the resolution of the digital surface model.

Note:
Ontario Digital Terrain Model (Lidar-Derived) from Ontario Ministry of Natural Resources and Forestry (January 21, 2025)
Tree Forest Canopy from Niagara Region Tree and Forest Canopy Viewer (2024)

Paper Size ISO A4

0 600 1,200 1,800

Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

Walker Industries
Visual Existing Conditions Report

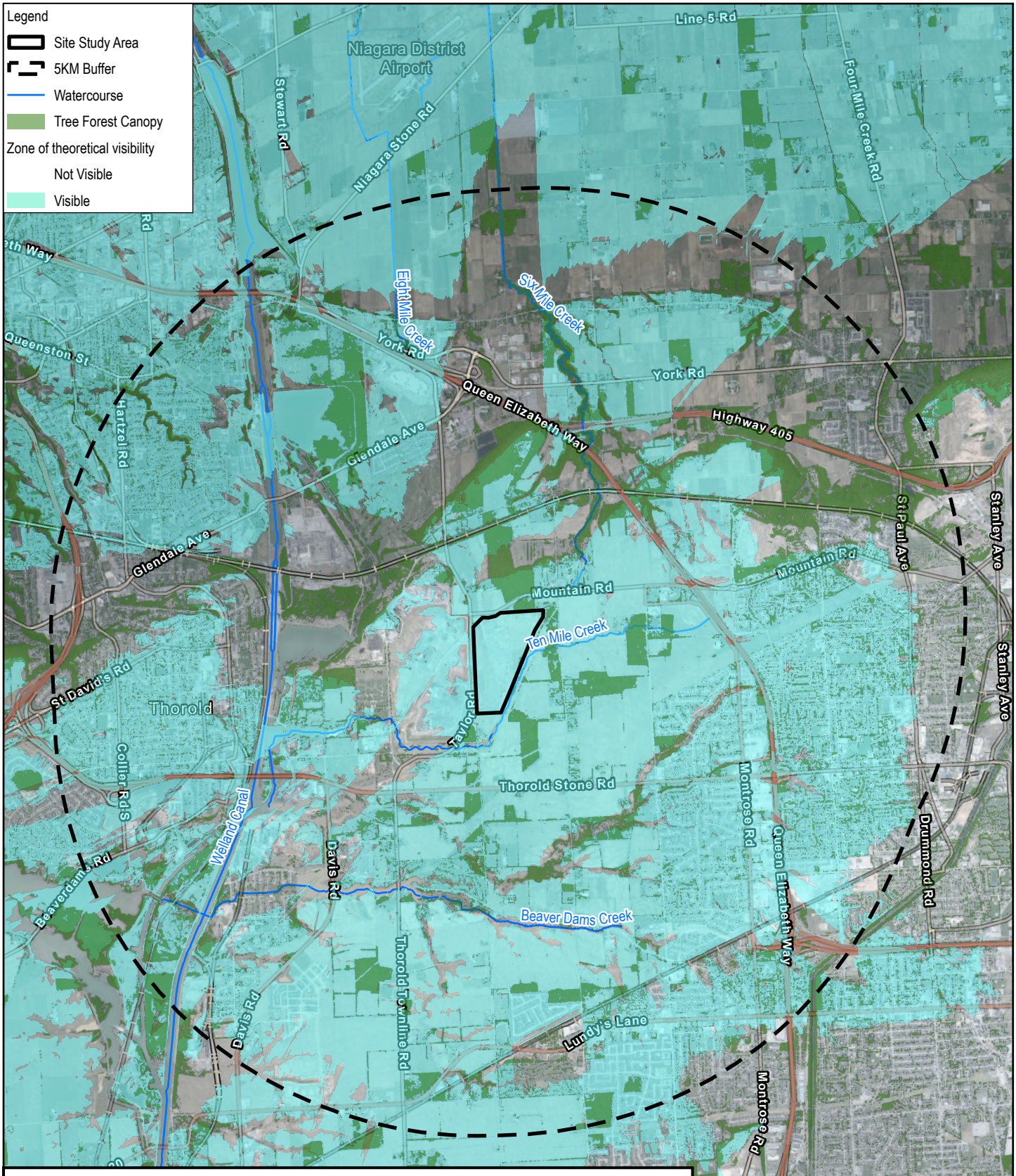
Project No. **12567140**
Revision No. **-**
Date **May 15, 2025**

Zone of Theoretical Visibility (Option A)

FIGURE 1

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Data Disclaimer

This Zone of Theoretical Visibility illustrates land from which it is theoretically possible to view the proposed landform. This is based on the potential visibility of the landform at a maximum height of 30 m. This analysis was generated using a digital elevation model created using 1 m Ontario Digital Terrain Model (Lidar-Derived) data. This analysis therefore takes into account the existing landform, however excludes vegetation and buildings. The Zone of Theoretical Visibility is only accurate to the resolution of the digital surface model.

Note:
Ontario Digital Terrain Model (Lidar-Derived) from Ontario Ministry of Natural Resources and Forestry (January 21, 2025)
Tree Forest Canopy from Niagara Region Tree and Forest Canopy Viewer (2024)

Paper Size ISO A4

0 600 1,200 1,800

Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

Walker Industries
Visual Existing Conditions Report

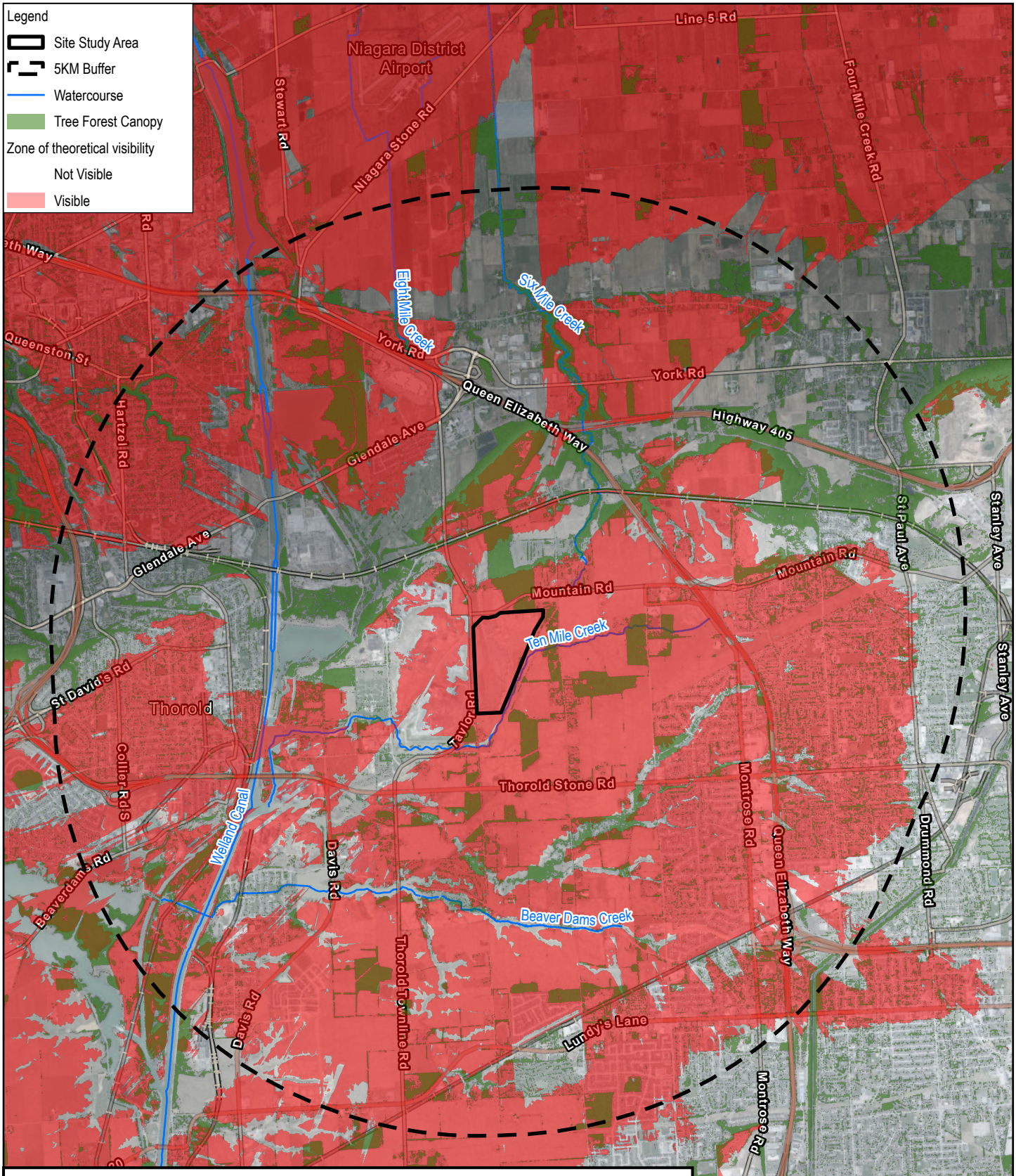
Project No. **12567140**
Revision No. **-**
Date **May 15, 2025**

Zone of Theoretical Visibility (Option B)

FIGURE 2

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Data Disclaimer

This Zone of Theoretical Visibility illustrates land from which it is theoretically possible to view the proposed landform. This is based on the potential visibility of the landform at a maximum height of 24 m. This analysis was generated using a digital elevation model created using 1 m Ontario Digital Terrain Model (Lidar-Derived) data. This analysis therefore takes into account the existing landform, however excludes vegetation and buildings. The Zone of Theoretical Visibility is only accurate to the resolution of the digital surface model.

Note:
Ontario Digital Terrain Model (Lidar-Derived) from Ontario Ministry of Natural Resources and Forestry (January 21, 2025)
Tree Forest Canopy from Niagara Region Tree and Forest Canopy Viewer (2024)

Paper Size ISO A4

0 600 1,200 1,800

Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

Walker Industries
Visual Existing Conditions Report

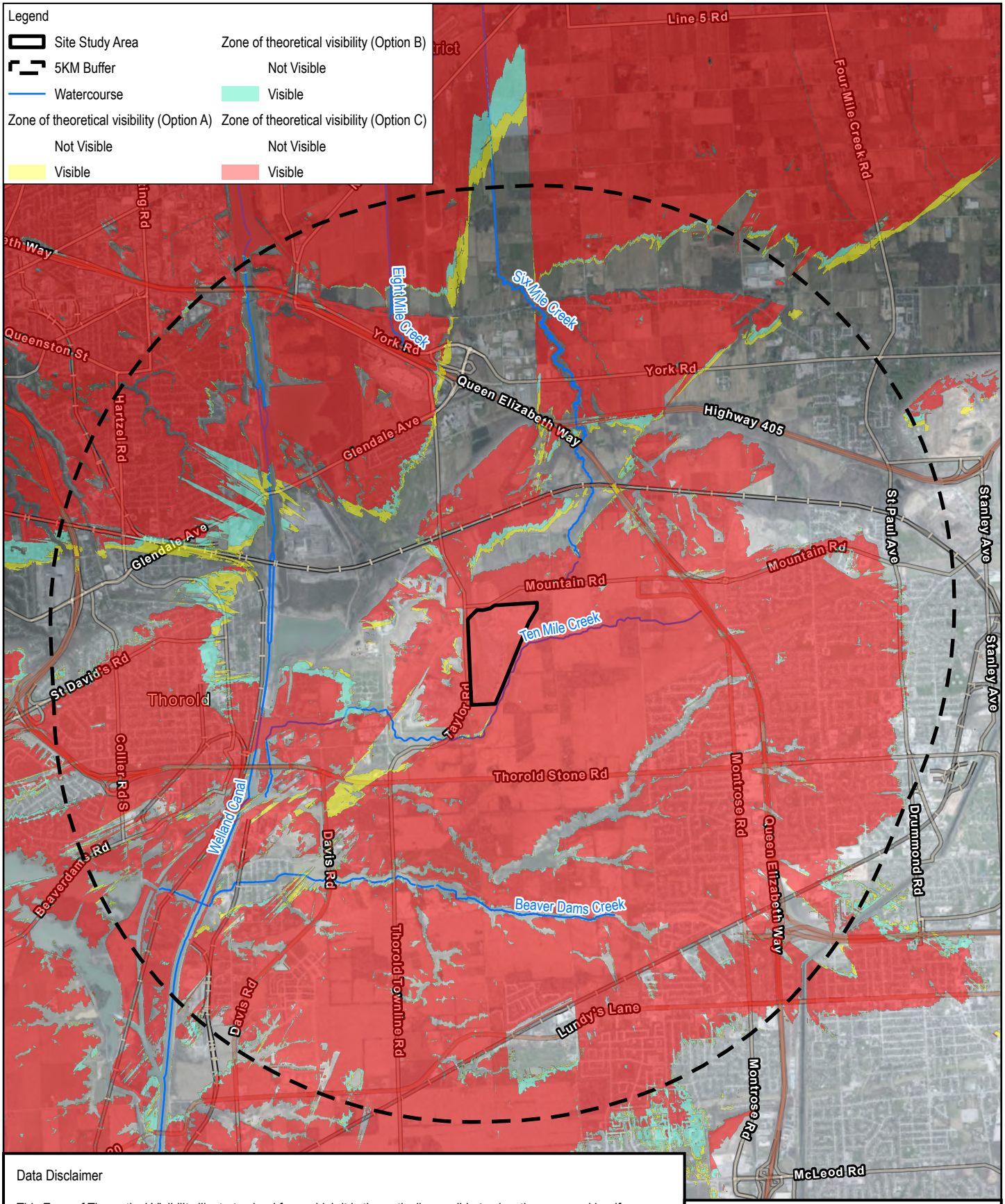
Zone of Theoretical Visibility (Option C)

Project No. **12567140**
Revision No. **-**
Date **May 15, 2025**

FIGURE 3

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Print date: 15 May 2025 - 12:55

Data source: imagery\Niagara_Land_Classification_2023: Copy of Copy of Hybrid Reference Layer: Province of Ontario, Esri Canada, Esri, TomTom, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA, USFWS, NRCan, Parks Canada



Data Disclaimer

This Zone of Theoretical Visibility illustrates land from which it is theoretically possible to view the proposed landform. This is based on the potential visibility of the landform at a maximum height of 24 m (Option A), 30 m (Option B), and 31 m (Option C). This analysis was generated using a digital elevation model created using 1 m Ontario Digital Terrain Model (Lidar-Derived) data. This analysis therefore takes into account the existing landform, however excludes vegetation and buildings. The Zone of Theoretical Visibility is only accurate to the resolution of the digital surface model.

Note:
Ontario Digital Terrain Model (Lidar-Derived) from Ontario Ministry of Natural Resources and Forestry (January 21, 2025)

Paper Size ISO A4

0 600 1,200 1,800

Meters

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

N

GHD

Walker Industries
Visual Existing Conditions Report

Zone of Theoretical Visibility – Composite Design Options

Project No. **12567140**
Revision No. **-**
Date **May 15, 2025**

FIGURE 4

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Print date: 15 May 2025 - 13:05
Ontario Imagery Web Map Service (OIWMS): © King's Printer for Ontario, 2022. Created by: yxiong2

Appendix B

Artistic Impressions

EXISTING VIEW



KEY PLAN



View Direction	118° - 198°
Horizontal Field Of View	80°
Camera Height	1.7 m
Camera Type	Canon EOS 5D
Lens Type	50 mm
Photograph Time and Date	12:16, 17 January 2025

Location	Mountain Road, Niagara Falls, ON, Canada
Coordinates	649540, 4777154 (NAD83 17N)
Viewpoint Elevation	186.5 m
Date of Photomontage	8 May 2025
Issue	v 01

Walker Environmental Group
Walker Sunrise, 12567140
South Landfill Phase 2, Artistic impressions

Location 16

GHD Pty Ltd
Level 8, 180 Lonsdale Street
Melbourne VIC 3000
T 61 3 8687 8000 **E** melmail@ghd.com.au **W** www.ghd.com

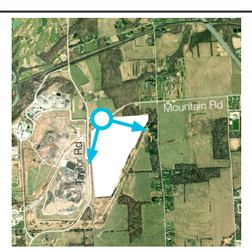
PROPOSED VIEW
OPTION A



PROPOSED VIEW
OPTION A
WITH RED OVERLAY



KEY PLAN



View Direction	118° - 198°
Horizontal Field Of View	80°
Camera Height	1.7 m
Camera Type	Canon EOS 5D
Lens Type	50 mm
Photograph Time and Date	12:16, 17 January 2025

Location	Mountain Road, Niagara Falls, ON, Canada
Coordinates	649540, 4777154 (NAD83 17N)
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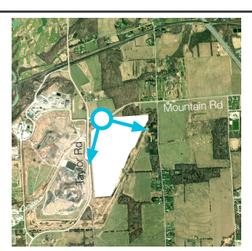
PROPOSED VIEW
OPTION B



PROPOSED VIEW
OPTION B
WITH RED OVERLAY



KEY PLAN



View Direction	118° - 198°
Horizontal Field Of View	80°
Camera Height	1.7 m
Camera Type	Canon EOS 5D
Lens Type	50 mm
Photograph Time and Date	12:16, 17 January 2025

Location	Mountain Road, Niagara Falls, ON, Canada
Coordinates	649540, 4777154 (NAD83 17N)
Viewpoint Elevation	186.5 m
Date of Photomontage	8 May 2025
Issue	v 01

Walker Environmental Group
Walker Sunrise, 12567140
South Landfill Phase 2, Artistic impressions

Location 16

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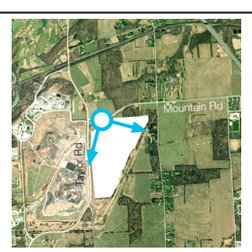
PROPOSED VIEW
OPTION C



PROPOSED VIEW
OPTION C
WITH RED OVERLAY



KEY PLAN



View Direction	118° - 198°
Horizontal Field Of View	80°
Camera Height	1.7 m
Camera Type	Canon EOS 5D
Lens Type	50 mm
Photograph Time and Date	12:16, 17 January 2025

Location	Mountain Road, Niagara Falls, ON, Canada
Coordinates	649540, 4777154 (NAD83 17N)
Viewpoint Elevation	186.5 m
Date of Photomontage	8 May 2025
Issue	v 01

Walker Environmental Group
Walker Sunrise, 12567140
South Landfill Phase 2, Artistic impressions

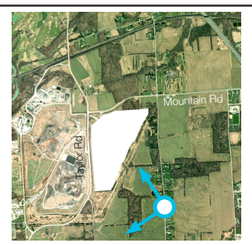
Location 16

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Level 8, 180 Lonsdale Street
Melbourne VIC 3000
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EXISTING VIEW



KEY PLAN



View Direction	242° - 322°
Horizontal Field Of View	80°
Camera Height	1.7 m
Camera Type	Canon EOS 5D
Lens Type	50 mm
Photograph Time and Date	10:53, 17 January 2025

Location	Garner Road, Niagara Falls, ON, Canada
Coordinates	650475, 4775803 (NAD83 17N)
Viewpoint Elevation	184.4 m
Date of Photomontage	8 May 2025
Issue	v 01

Walker Environmental Group
Walker Sunrise, 12567140
South Landfill Phase 2, Artistic impressions

Location 27

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PROPOSED VIEW
OPTION A



PROPOSED VIEW
OPTION A
WITH RED OVERLAY



KEY PLAN



View Direction	242° - 322°
Horizontal Field Of View	80°
Camera Height	1.7 m
Camera Type	Canon EOS 5D
Lens Type	50 mm
Photograph Time and Date	10:53, 17 January 2025

Location	Garner Road, Niagara Falls, ON, Canada
Coordinates	650475, 4775803 (NAD83 17N)
Viewpoint Elevation	184.4 m
Date of Photomontage	8 May 2025
Issue	v 01

Walker Environmental Group
Walker Sunrise, 12567140
South Landfill Phase 2, Artistic impressions

Location 27

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Level 8, 180 Lonsdale Street
Melbourne VIC 3000
T 61 3 8687 8000 **E** melmail@ghd.com.au **W** www.ghd.com

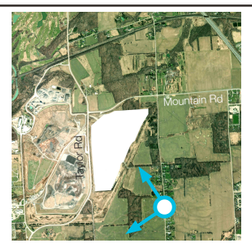
PROPOSED VIEW
OPTION B



PROPOSED VIEW
OPTION B
WITH RED OVERLAY



KEY PLAN



View Direction	242° - 322°
Horizontal Field Of View	80°
Camera Height	1.7 m
Camera Type	Canon EOS 5D
Lens Type	50 mm
Photograph Time and Date	10:53, 17 January 2025

Location	Garner Road, Niagara Falls, ON, Canada
Coordinates	650475, 4775803 (NAD83 17N)
Viewpoint Elevation	184.4 m
Date of Photomontage	8 May 2025
Issue	v 01

Walker Environmental Group
Walker Sunrise, 12567140
South Landfill Phase 2, Artistic impressions

Location 27

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PROPOSED VIEW
OPTION C



PROPOSED VIEW
OPTION C
WITH RED OVERLAY



KEY PLAN



View Direction	242° - 322°
Horizontal Field Of View	80°
Camera Height	1.7 m
Camera Type	Canon EOS 5D
Lens Type	50 mm
Photograph Time and Date	10:53, 17 January 2025

Location	Garner Road, Niagara Falls, ON, Canada
Coordinates	650475, 4775803 (NAD83 17N)
Viewpoint Elevation	184.4 m
Date of Photomontage	8 May 2025
Issue	v 01

Walker Environmental Group
Walker Sunrise, 12567140
South Landfill Phase 2, Artistic impressions

Location 27

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Melbourne VIC 3000
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EXISTING VIEW



KEY PLAN



View Direction	91° - 171°
Horizontal Field Of View	80°
Camera Height	1.7 m
Camera Type	Canon EOS 5D
Lens Type	50 mm
Photograph Time and Date	08:35, 9 May 2025

Location	Taylor Road, Niagara Falls, ON, Canada
Coordinates	649307, 4777403 (NAD83 17N)
Viewpoint Elevation	181.6 m
Date of Photomontage	20 May 2025
Issue	v 01

Walker Environmental Group
Walker Sunrise, 12567140
South Landfill Phase 2, Artistic impressions

Location - Taylor Road

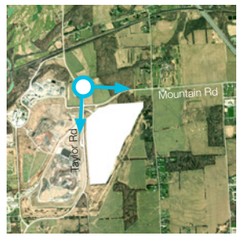
GHD Pty Ltd
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Melbourne VIC 3000
T 61 3 8687 8000 **E** melmail@ghd.com.au **W** www.ghd.com

PROPOSED VIEW
OPTION A



PROPOSED VIEW
OPTION A
WITH RED OVERLAY

KEY PLAN



View Direction	91° - 171°
Horizontal Field Of View	80°
Camera Height	1.7 m
Camera Type	Canon EOS 5D
Lens Type	50 mm
Photograph Time and Date	08:35, 9 May 2025

Location	Taylor Road, Niagara Falls, ON, Canada
Coordinates	649307, 4777403 (NAD83 17N)
Viewpoint Elevation	181.6 m
Date of Photomontage	20 May 2025
Issue	v 01

Walker Environmental Group
Walker Sunrise, 12567140
South Landfill Phase 2, Artistic impressions

Location - Taylor Road

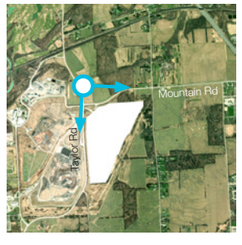
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PROPOSED VIEW
OPTION B



PROPOSED VIEW
OPTION B
WITH RED OVERLAY

KEY PLAN



View Direction	91° - 171°
Horizontal Field Of View	80°
Camera Height	1.7 m
Camera Type	Canon EOS 5D
Lens Type	50 mm
Photograph Time and Date	08:35, 9 May 2025

Location	Taylor Road, Niagara Falls, ON, Canada
Coordinates	649307, 4777403 (NAD83 17N)
Viewpoint Elevation	181.6 m
Date of Photomontage	20 May 2025
Issue	v 01

Walker Environmental Group
Walker Sunrise, 12567140
South Landfill Phase 2, Artistic impressions

Location - Taylor Road

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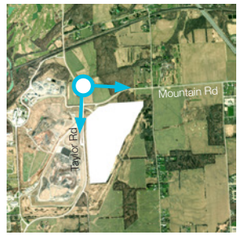
PROPOSED VIEW
OPTION C



PROPOSED VIEW
OPTION C
WITH RED OVERLAY



KEY PLAN



View Direction	91° - 171°
Horizontal Field Of View	80°
Camera Height	1.7 m
Camera Type	Canon EOS 5D
Lens Type	50 mm
Photograph Time and Date	08:35, 9 May 2025

Location	Taylor Road, Niagara Falls, ON, Canada
Coordinates	649307, 4777403 (NAD83 17N)
Viewpoint Elevation	181.6 m
Date of Photomontage	20 May 2025
Issue	v 01

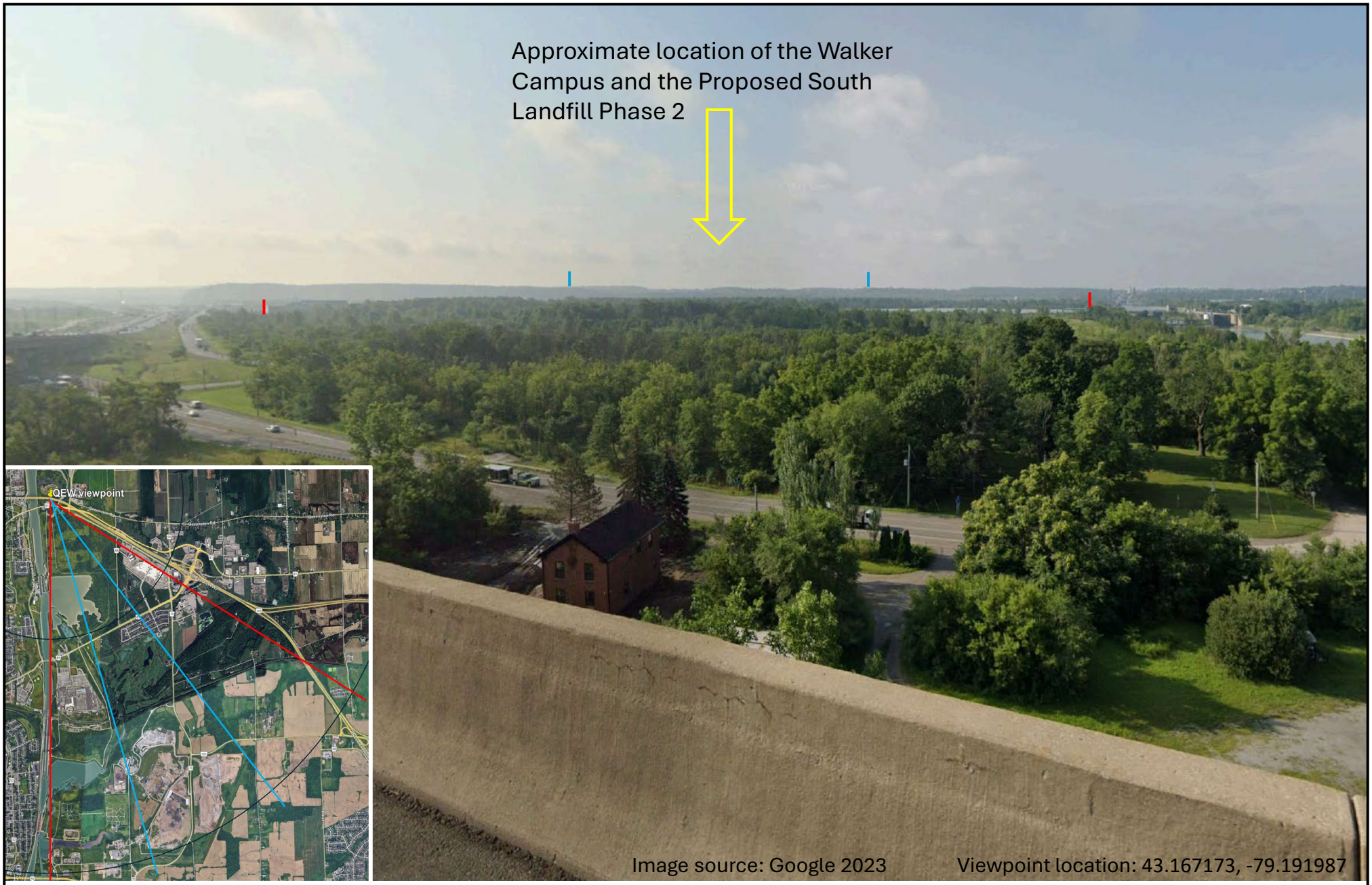
Walker Environmental Group
Walker Sunrise, 12567140
South Landfill Phase 2, Artistic impressions

Location - Taylor Road

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Appendix C

Existing (2023) View of the Walker Campus atop the Niagara Escarpment



View of Niagara Escarpment and Approximate location of the Walker Campus and the Proposed South Landfill Phase 2 from the Queen Elizabeth Way near the Garden City Bridge



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The Power of Commitment

D-8

Agriculture

DRAFT COMPARATIVE EVALUATION TECHNICAL MEMORANDUM: AGRICULTURE COMPONENT

FOR

WALKER SOUTH LANDFILL PHASE 2 ENVIRONMENTAL ASSESSMENT

PREPARED FOR:

2800 Thorold Townline Road

Niagara Falls, Ontario L2E 6S4

PREPARED BY:

432 Niagara Street, Unit 2

St. Catharines, Ontario L2M 4W3

C22109

MAY 27, 2025

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Table 5.1 Comparative Evaluation – Agriculture 10

1. INTRODUCTION

This memo documents the assessment and evaluation of the Alternative Methods for the Walker South Landfill Phase 2 Environmental Assessment (EA) from an agriculture perspective. The Minister Approved Terms of Reference (Approved ToR) included a preliminary description of the methodology for evaluating the Alternative Methods (See Section 7.1 of the Approved ToR, September 2024). This memo is one of 13 memos that outline the evaluation of the Alternative Methods from the perspective of each discipline. These memos will be used in concert with one another, along with their evaluation tables, as supporting documents to the Alternative Methods Report. Memos were prepared for the following environmental components:

- Geology and Hydrogeology
- Surface Water Resources
- Noise and Vibration
- Air Quality
- Terrestrial and Aquatic Environment
- Land Use
- Agriculture
- Transportation
- Social Environment
- Economic Environment
- Built Heritage Resources and Cultural Heritage Landscapes
- Archaeology
- Visual

Each of the above disciplines also prepared existing conditions reports that were utilized in assessing and evaluating the Alternative Landfill Footprints. Further, the disciplines referred to the Conceptual Design Report (CDR) that was prepared from a Site Design and Operations perspective in order to provide the appropriate level of detail on each of the Alternative Methods. The CDR will also form a supporting document to the Alternative Methods Report.

Each discipline is following the requirements as stated in the draft work plans that were presented in Appendix C of the Approved ToR. The work plan presents the scope of work required to complete the EA, including the scope of technical studies for each of the environmental components, and the evaluation of Alternative Methods.

1.1 Documentation

The results of these individual memos will be documented in separate stand-alone technical memorandums during the EA. The final Alternative Methods evaluation will form a chapter of the EA Report, with each of the stand-alone memorandums becoming supporting documents/appendices to the EA Report.

2. ASSESSMENT AND EVALUATION OF THE ALTERNATIVE METHODS METHODOLOGY

The assessment and evaluation of the Alternative Methods was conducted in three steps:

Step 1: Confirm Evaluation Criteria and Indicators/Measures

Prior to undertaking the net effects analysis, the evaluation criteria, indicators, and measures previously developed in the ToR were reviewed with the public during Public Events and confirmed for application to each of the Alternative Methods. Evaluation criteria were developed for each Environmental Component listed above.

The Approved ToR set out the draft criteria and indicators for evaluating the Alternative Methods in the EA. As a result, the draft criteria, indicators, and measures provided for in the ToR were reviewed and modified appropriately to suit the evaluation of the Alternative Methods.

Specifically, the criteria, indicators and measures were modified in consultation with review agencies and the public to ensure that an appropriate level of scrutiny and rigour was applied in evaluating the Alternative Methods. In doing so, the results of the evaluation phase will consist of clearly defined net effects for each Alternative Method.

Step 2: Undertake the Net Effects Analysis

With the evaluation criteria, indicators and measures confirmed through the preceding step, a net effects analysis of the Alternative Methods was carried out consisting of the following activities:

- Identify potential effects (based on measures) on the environment
- Develop and apply avoidance/ mitigation/ compensation/ enhancement measures
- Determine net effects on the environment.

Step 3: Carry Out the Comparative Evaluation

In Step 3, the net effects identified for each Alternative Method in Step 2 were compared to one another in order to identify a Recommended Alternative Method. The comparison of net effects was completed using a "Reasoned Argument" evaluation methodology, as provided for in the Approved ToR.

Each Alternative Method was assessed based on the evaluation criteria, indicators and measures.

Each criterion was evaluated with the same indicators for each Alternative Method (including number and significance) to support the reasoned argument in the comparative rankings:

- Effects on existing Agricultural Land Base:
  - CLI Soil Capability classification
  - Soil Suitability classification
  - Climate
  - Level of Fragmentation
  - Proximity to Non-farm Land Uses
- Effects on Agri-Food Network:
  - Type(s) and proximity of agricultural operations
  - Type(s) and proximity of agricultural-related facilities
  - Predicted impacts on surrounding agricultural operations & agricultural related facilities

3. STEP 1: CONFIRM EVALUATION CRITERIA AND INDICATORS/MEASURES

Evaluation Criteria and Indicators were adjusted during the development of the ToR based on feedback from Indigenous communities, government agencies, and the public.

Prior to undertaking the Comparative Evaluation of Alternative Methods process, a Public Event, accompanied by a virtual event, was held to present the Criteria and Indicators to the public and invite additional feedback.

In addition to the Indicators identified within the Approved ToR, one additional indicator was added to the "Effects on existing Agricultural Land Base" Criteria. This includes the "End use agricultural area." This Indicator was added to assist in identifying the most preferred alternative, as the total area available for agricultural end use differs between the three alternatives.

In order to fully characterize these indicators and to adopt measures by which potential effects could be identified, several considerations were developed for each indicator. These considerations are shown below in Table 3.1.

Table 3.1 Considerations for Indicators

Criteria	Indicators	Considerations
Effects on existing Agricultural Land Base	– CLI Soil Capability classification – Soil Suitability classification – Climate – Level of Fragmentation – Proximity to Non-farm Land Uses – End use agricultural area	– Resulting CLI Capability after use – Ability for soil to be successfully cultivated for specialty crop production – Alteration to microclimatic conditions – Continuity with surrounding cultivated lands – Distance to closest non-farm land use – Area available for agriculture after use – Net change in area available for agricultural end use between existing quarry rehabilitation plan and alternatives
Effects on Agri-Food Network	– Type(s) and proximity of agricultural operations – Type(s) and proximity of agricultural-related facilities – Predicted impacts on surrounding agricultural operations & agricultural related facilities	– Distance to nearest agricultural operation – Distance to nearest livestock operation – Distance to nearest agriculture-related land use – Potential for indirect impacts on agricultural operations

The potential effects for each Alternative Method were then identified on the basis of these considerations.

4. STEP 2: NET EFFECTS ANALYSIS

4.1 General Assumptions

Table 4.1 outlines the assumptions for each Criteria evaluated.

Table 4.1 General Assumptions for Evaluation of Agriculture Criteria

Criteria	Assumptions
Effects on existing Agricultural Land Base	– Agriculture will be the end use – Soils will be sourced from the berms/surrounding area – Soils will be suitable for common field crop and specialty crop production – At least 1m of uncompacted soil medium will be available for plant growth – Lands can be feasibly tile drained – Parcel will not be severed for end use – Agricultural is not feasible within the pond identified in the existing quarry rehabilitation plan
Effects on Agri-Food Network	– No Assumptions

4.2 Potential Effects, Mitigation Measures, Net Effects

The potential effects for each Alternative Method were identified based on the characterized and documented existing agricultural conditions and on the basis of the considerations outlined in Table 3.1. Net Effects have been categorized according to the definitions in Table 4.2.

Table 4.2 Categorization of Net Effects

Net Effect Category	Description
No Effect / No (Positive) Effect	No departure from the existing condition is expected.
Low Effect / Low (Positive) Effect	Effects are likely to be negligible or minor in scale if they are negligible or low in magnitude, of short duration, infrequent, small in spatial extent, reversible or readily avoided, and generate few or minor impacts in social or ecological contexts. Mitigation measures will allow baseline conditions to remain largely unchanged.
Moderate Effect / Moderate (Positive) Effect	Effects are likely to be medium in scale if they are moderate in magnitude, of moderate duration, occasionally frequent, possibly/partially reversible, and to generate a moderate level of impacts in social or ecological contexts. Mitigation measures may not fully eliminate, reduce, control or offset effects but should enable affected communities to maintain economic and social well-being, and should prevent the diminishment or loss of key components of the environment and its ecological functioning.
High Effect / High (Positive) Effect	Effects are likely to be severe in scale if they are high in magnitude, permanent/long term, frequent, irreversible, and over a large spatial extent or within an area of exclusive/preferred Indigenous use or of ecological/environmental sensitivity. High levels of impacts in social or ecological contexts are expected. There is a high degree of uncertainty of the effectiveness of mitigation measures, or mitigation measures are unable to fully address effects such that valued components are diminished or lost.

The following tables (Table 4.3 - Table 4.7) present the results of the net environmental effects evaluation for each of the Alternative Methods. The net effects have been determined by applying the mitigation measures to the predicted potential environmental effects.

4.2.1 Landfill Configuration Options

Table 4.3 Landfill Configuration Option A Agricultural Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effects on existing Agricultural Land Base	– CLI Soil Capability classification	– Impact on CLI Capability from slope class: • 36.7 ha of CLI Class 2T lands • 25.87 ha CLI Class 5T lands	– No impact management measures feasible	– Minor reduction in agricultural capability from existing conditions. **LOW NET EFFECTS**
	– Soil Suitability classification	– Soil suitability for specialty crop production improved by allowing for cold air drainage.	– No impact management measures required	– Improvement to soil suitability for specialty crop production by allowing for cold air drainage. **LOW (POSITIVE) NET EFFECTS**
	– Climate	– Improved microclimatic conditions through cold air drainage	– No impact management measures required	– Existing quarry rehabilitation plan would not allow for cold air drainage. Cold air will no longer be trapped at the pit floor, improving soil suitability. **LOW (POSITIVE) NET EFFECTS**
	– Level of Fragmentation	– No anticipated effects associated with fragmentation.	– No impact management measures required	– No effect associated with fragmentation as lot creation is not proposed. **NO NET EFFECTS**
	– Proximity to Non-farm Land Uses	– No anticipated effects to surrounding non-agricultural operations.	– No impact management measures required	– No impacts on surrounding non-agricultural operations. **NO NET EFFECTS**
	– End use agricultural area	– Reduction in land available for agricultural end use compared to existing quarry rehabilitation plan.	– No impact management measures feasible	– Reduction of approximately 11.5 ha of land available for agricultural end use compared to existing quarry rehabilitation plan. **LOW NET EFFECTS**
Effects on Agri-Food Network	– Type(s) and proximity of agricultural operations	– Agricultural operations are well removed from the site, with the nearest active operation being a nursery.	– No impact management measures required	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**
	– Type(s) and proximity of agricultural-related facilities	– No agriculture-related uses located within Local Study Area.	– No impact management measures required	– No impacts on surrounding agriculture-related operations. **NO NET EFFECTS**
	– Predicted impacts on surrounding agricultural operations & agricultural related facilities	– No anticipated effects to surrounding agricultural operations.	– No impact management measures required	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**

Table 4.4 Landfill Configuration Option B Agricultural Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effects on existing Agricultural Land Base	– CLI Soil Capability classification	– Impact on CLI Capability from slope class: • 51.4 ha of CLI Class 3T lands • 11.17 ha CLI Class 5T lands	– No impact management measures feasible	– Minor reduction in agricultural capability from existing conditions. **LOW NET EFFECTS**
	– Soil Suitability classification	– Soil suitability for specialty crop production improved by allowing for cold air drainage.	– No impact management measures required	– Improvement to soil suitability for specialty crop production by allowing for cold air drainage. **LOW (POSITIVE) NET EFFECTS**
	– Climate	– Improved microclimatic conditions through cold air drainage	– No impact management measures required	– Existing quarry rehabilitation plan would not allow for cold air drainage. Cold air will no longer be trapped at the pit floor, improving soil suitability. **LOW (POSITIVE) NET EFFECTS**
	– Level of Fragmentation	– No anticipated effects associated with fragmentation.	– No impact management measures required	– No effect associated with fragmentation as lot creation is not proposed. **NO NET EFFECTS**
	– Proximity to Non-farm Land Uses	– No anticipated effects to surrounding non-agricultural operations.	– No impact management measures required	– No impacts on surrounding non-agricultural operations. **NO NET EFFECTS**
	– End use agricultural area	– Increase land available for agricultural end use compared to existing quarry rehabilitation plan.	– No impact management measures feasible	– Increase of approximately 3.2 ha of land available for agricultural end use compared to existing quarry rehabilitation plan. **LOW (POSITIVE) NET EFFECTS**
Effects on Agri-Food Network	– Type(s) and proximity of agricultural operations	– Agricultural operations are well removed from the site, with the nearest active operation being a nursery.	– No impact management measures required	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**
	– Type(s) and proximity of agricultural-related facilities	– No agriculture-related uses located within Local Study Area.	– No impact management measures required	– No impacts on surrounding agriculture-related operations. **NO NET EFFECTS**
	– Predicted impacts on surrounding agricultural operations & agricultural related facilities	– No anticipated effects to surrounding agricultural operations.	– No impact management measures required	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**

Table 4.5 Landfill Configuration Option C Agricultural Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effects on existing Agricultural Land Base	– CLI Soil Capability classification	– Impact on CLI Capability from slope class: • 45.0 ha of CLI Class 2T lands • 17.57 ha CLI Class 5T lands	– No impact management measures feasible	– Minor reduction in agricultural capability from existing conditions. **LOW NET EFFECTS**
	– Soil Suitability classification	– Soil suitability for specialty crop production improved by allowing for cold air drainage.	– No impact management measures required	– Improvement to soil suitability for specialty crop production by allowing for cold air drainage. **LOW (POSITIVE) NET EFFECTS**
	– Climate	– Improved microclimatic conditions through cold air drainage	– No impact management measures required	– Existing quarry rehabilitation plan would not allow for cold air drainage. Cold air will no longer be trapped at the pit floor, improving soil suitability. **LOW (POSITIVE) NET EFFECTS**
	– Level of Fragmentation	– No anticipated effects associated with fragmentation.	– No impact management measures required	– No effect associated with fragmentation as lot creation is not proposed. **NO NET EFFECTS**
	– Proximity to Non-farm Land Uses	– No anticipated effects to surrounding non-agricultural operations.	– No impact management measures required	– No impacts on surrounding non-agricultural operations. **NO NET EFFECTS**
	– End use agricultural area	– Reduction in land available for agricultural end use compared to existing quarry rehabilitation plan.	– No impact management measures feasible	– Reduction of approximately 3.2 ha of land available for agricultural end use compared to existing quarry rehabilitation plan. **LOW NET EFFECTS**
Effects on Agri-Food Network	– Type(s) and proximity of agricultural operations	– Agricultural operations are well removed from the site, with the nearest active operation being a nursery.	– No impact management measures required	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**
	– Type(s) and proximity of agricultural-related facilities	– No agriculture-related uses located within Local Study Area.	– No impact management measures required	– No impacts on surrounding agriculture-related operations. **NO NET EFFECTS**
	– Predicted impacts on surrounding agricultural operations & agricultural related facilities	– No anticipated effects to surrounding agricultural operations.	– No impact management measures required	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**

4.2.2 Leachate Management Options

Table 4.6 Leachate Management Option A Agricultural Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effects on existing Agricultural Land Base	– CLI Soil Capability classification	– No Effect. Lands already disturbed and have no agricultural capability.	– No impact management measures required	– No effect on CLI Capability. **NO NET EFFECTS**
	– Soil Suitability classification	– No Effect. Lands already disturbed and have no agricultural capability	– No impact management measures required	– No effect on Soil Suitability. **NO NET EFFECTS**
	– Climate	– No anticipated effects to microclimatic conditions.	– No impact management measures required	– No effects to microclimatic conditions. **NO NET EFFECTS**
	– Level of Fragmentation	– No anticipated effects associated with fragmentation.	– No impact management measures required	– No effect associated with fragmentation as lot creation is not proposed. **NO NET EFFECTS**
	– Proximity to Non-farm Land Uses	– No anticipated effects to surrounding non-agricultural operations.	– No impact management measures required	– No impacts on surrounding non-agricultural operations. **NO NET EFFECTS**
	– End use agricultural area	– No effect – lands not currently used for agriculture.	– No impact management measures required	– No impact on existing agricultural areas. **NO NET EFFECTS**
Effects on Agri-Food Network	– Type(s) and proximity of agricultural operations	– Agricultural operations are well removed from the site, with the nearest active operation being a nursery.	– No impact management measures required	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**
	– Type(s) and proximity of agricultural-related facilities	– No agriculture-related uses located within Local Study Area.	– No impact management measures required	– No impacts on surrounding agriculture-related operations. **NO NET EFFECTS**
	– Predicted impacts on surrounding agricultural operations & agricultural related facilities	– No anticipated effects to surrounding agricultural operations.	– No impact management measures required	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**

Table 4.7 Leachate Management Option B Agricultural Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effects on existing Agricultural Land Base	– CLI Soil Capability classification	– No Effect. Lands already disturbed and have no agricultural capability.	– No impact management measures required	– No effect on CLI Capability. **NO NET EFFECTS**
	– Soil Suitability classification	– No Effect. Lands already disturbed and have no agricultural capability	– No impact management measures required	– No effect on Soil Suitability. **NO NET EFFECTS**
	– Climate	– No anticipated effects to microclimatic conditions.	– No impact management measures required	– No effects to microclimatic conditions. **NO NET EFFECTS**
	– Level of Fragmentation	– No anticipated effects associated with fragmentation.	– No impact management measures required	– No effect associated with fragmentation as lot creation is not proposed. **NO NET EFFECTS**
	– Proximity to Non-farm Land Uses	– No anticipated effects to surrounding non-agricultural operations.	– No impact management measures required	– No impacts on surrounding non-agricultural operations. **NO NET EFFECTS**
	– End use agricultural area	– No effect – lands not currently used for agriculture.	– No impact management measures required	– No impact on existing agricultural areas. **NO NET EFFECTS**
Effects on Agri-Food Network	– Type(s) and proximity of agricultural operations	– Agricultural operations are well removed from the site, with the nearest active operation being a nursery.	– No impact management measures required	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**
	– Type(s) and proximity of agricultural-related facilities	– No agriculture-related uses located within Local Study Area.	– No impact management measures required	– No impacts on surrounding agriculture-related operations. **NO NET EFFECTS**
	– Predicted impacts on surrounding agricultural operations & agricultural related facilities	– No anticipated effects to surrounding agricultural operations.	– No impact management measures required	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**

5. STEP 3: COMPARATIVE EVALUATION

Table 5.1 Comparative Evaluation – Agriculture

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
Effects on existing Agricultural Land Base	– CLI Soil Capability classification	– Minor reduction in agricultural capability from existing conditions. **LOW NET EFFECTS**	– Minor reduction in agricultural capability from existing conditions. **LOW NET EFFECTS**	– Minor reduction in agricultural capability from existing conditions. **LOW NET EFFECTS**	– No effect on CLI Capability. **NO NET EFFECTS**	– No effect on CLI Capability. **NO NET EFFECTS**
	– Soil Suitability classification	– Improvement to soil suitability for specialty crop production by allowing for cold air drainage. **LOW (POSITIVE) NET EFFECTS**	– Improvement to soil suitability for specialty crop production by allowing for cold air drainage. **LOW (POSITIVE) NET EFFECTS**	– Improvement to soil suitability for specialty crop production by allowing for cold air drainage. **LOW (POSITIVE) NET EFFECTS**	– No effect on Soil Suitability. **NO NET EFFECTS**	– No effect on Soil Suitability. **NO NET EFFECTS**
	– Climate	– Existing quarry rehabilitation plan would not allow for cold air drainage. Cold air will no longer be trapped at the pit floor, improving soil suitability. **LOW (POSITIVE) NET EFFECTS**	– Existing quarry rehabilitation plan would not allow for cold air drainage. Cold air will no longer be trapped at the pit floor, improving soil suitability. **LOW (POSITIVE) NET EFFECTS**	– Existing quarry rehabilitation plan would not allow for cold air drainage. Cold air will no longer be trapped at the pit floor, improving soil suitability. **LOW (POSITIVE) NET EFFECTS**	– No effects to microclimatic conditions. **NO NET EFFECTS**	– No effects to microclimatic conditions. **NO NET EFFECTS**
	– Level of Fragmentation	– No effect associated with fragmentation as lot creation is not proposed. **NO NET EFFECTS**	– No effect associated with fragmentation as lot creation is not proposed. **NO NET EFFECTS**	– No effect associated with fragmentation as lot creation is not proposed. **NO NET EFFECTS**	– No effect associated with fragmentation as lot creation is not proposed. **NO NET EFFECTS**	– No effect associated with fragmentation as lot creation is not proposed. **NO NET EFFECTS**
	– Proximity to Non-farm Land Uses	– No impacts on surrounding non-agricultural operations. **NO NET EFFECTS**	– No impacts on surrounding non-agricultural operations. **NO NET EFFECTS**	– No impacts on surrounding non-agricultural operations. **NO NET EFFECTS**	– No impacts on surrounding non-agricultural operations. **NO NET EFFECTS**	– No impacts on surrounding non-agricultural operations. **NO NET EFFECTS**
	– End use agricultural area	– Reduction of approximately 11.5 ha of land available for agricultural end use compared to existing quarry rehabilitation plan. **LOW NET EFFECTS**	– Increase of approximately 3.2 ha of land available for agricultural end use compared to existing quarry rehabilitation plan. **LOW (POSITIVE) NET EFFECTS**	– Reduction of approximately 3.2 ha of land available for agricultural end use compared to existing quarry rehabilitation plan. **LOW NET EFFECTS**	– No impact on existing agricultural areas. **NO NET EFFECTS**	– No impact on existing agricultural areas. **NO NET EFFECTS**
	Criteria Ranking:	3rd	1st	2nd	1st	1st
	Criteria Rationale:	Option B is preferred over Option A and Option C, primarily due to the greater area available for agricultural end use. Option C is preferred over option A for the same reason.			Both options are equally preferred as the proposed leachate options will not be developed on existing agricultural lands and the lands have already been disturbed.	

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
Effects on Agri-Food Network	– Type(s) and proximity of agricultural operations	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**
	– Type(s) and proximity of agricultural-related facilities	– No impacts on surrounding agriculture-related operations. **NO NET EFFECTS**	– No impacts on surrounding agriculture-related operations. **NO NET EFFECTS**	– No impacts on surrounding agriculture-related operations. **NO NET EFFECTS**	– No impacts on surrounding agriculture-related operations. **NO NET EFFECTS**	– No impacts on surrounding agriculture-related operations. **NO NET EFFECTS**
	– Predicted impacts on surrounding agricultural operations & agricultural related facilities	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**	– No impacts on surrounding agricultural operations. **NO NET EFFECTS**
	Criteria Ranking:	1st	1st	1st	1st	1st
	Criteria Rationale:	All options are equally preferred as there are no anticipated effects on the agri-food network, regardless of what option is selected.			Both options are equally preferred as no effects on the Agri-Food Network are anticipated.	
Environmental Component Ranking:		3rd	1st	2nd	1st	1st
Environmental Component Rationale:		Option B is preferred over Option C, and Option C is preferred over Option A. The three alternatives primarily differ in the amount of land available for an agricultural end use, with Option B having the greatest area of agricultural end use. Although Option B will be primarily comprised of CLI Class 3 lands and Option A and C will be primarily comprised of CLI Class 2 lands, the greater area of land available for agricultural production will outweigh any potential decreases in crop yields associated with the lower CLI Capability.			There is a negligible difference between the two leachate options. Neither option will result in the loss of cultivatable lands, and the proposed developments will be located on previously disturbed lands that are not capable of agricultural production.	

6. CONCLUSIONS

Based on the net environmental effects presented in Section 4.2, and the comparative evaluation in Section 5, Landfill Configuration Option B is the most preferred alternative, followed by Landfill Configuration Option C, and lastly Landfill Configuration Option A. The two Leachate Management Options are equally preferrable, from an agricultural perspective.

D-9

Transportation



Memo

Draft Transportation Comparative Evaluation Memo

May 15, 2025

Walker Environmental Group

TYLin Project #: 100482

walker | TYLin

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Appendices

Appendix A – Future Total Conditions Traffic Analysis Synchro Reports

Appendix B – Future Total Conditions Traffic Volumes

Appendix C – Collision Assessment

Appendix D – Sightline Assessment

Appendix E – Vehicle Movement Diagrams

1 Introduction

This memo documents the assessment and evaluation of the alternative options for the Walker South Landfill Phase 2 Environmental Assessment (EA) from a transportation perspective. The Minister Approved Terms of Reference (approved ToR) included a preliminary description of the methodology for evaluating the Alternative Methods (see Section 7.1 of the approved ToR, September 2024). This memo is one of 13 memos that outline the evaluation of the Alternative Methods from the perspective of each discipline. These memos will be used in concert with one another, along with their evaluation tables, as supporting documents to the Alternative Methods Report. Memos were prepared for the following environmental components:

- Geology and Hydrogeology
- Surface Water Resources
- Noise and Vibration
- Air Quality
- Terrestrial and Aquatic Environment
- Land Use
- Agriculture
- Transportation
- Social Environment
- Economic Environment
- Cultural Heritage
- Archaeology
- Visual

Each of the above disciplines also prepared existing conditions reports that were utilized in assessing and evaluating the Alternative Landfill Footprints. Further, the disciplines referred to the Conceptual Design Report (CDR) that was prepared from a Site Design and Operations perspective in order to provide the appropriate level of detail on each of the Alternative Methods. The CDR will also form a supporting document to the Alternative Methods Report.

Each discipline is following the requirements as stated in the draft work plans that were presented in Appendix C of the Approved ToR. The work plan presents the scope of work required to complete the EA, including the scope of technical studies for each of the environmental components, and the evaluation of Alternative Methods.

1.1 DOCUMENTATION

The results of these individual memos will be documented in separate stand-alone technical memorandums during the EA. The final Alternative Methods evaluation will form a chapter of the EA Report, with each of the stand-alone memorandums becoming supporting documents/appendices to the EA Report.

2 Assessment and evaluation of the Alternative Methods methodology

The assessment and evaluation of the Alternative Methods was conducted in three steps:

Step 1: Confirm Evaluation Criteria and Indicators/Measures

Prior to undertaking the net effects analysis, the evaluation criteria, indicators, and measures previously developed in the ToR were reviewed with the public during Public Events and confirmed for application to each of the Alternative Methods. Evaluation criteria were developed for each Environmental Component listed below in Section 3..

The approved ToR set out the draft criteria and indicators for evaluating the Alternative Methods in the EA. As a result, the draft criteria, indicators, and measures provided for in the ToR were reviewed and modified appropriately to suit the evaluation of the Alternative Methods.

Step 2: Undertake the Net Effects Analysis

With the evaluation criteria, indicators and measures confirmed through the preceding step, a net effects analysis of the Alternative Methods was carried out consisting of the following activities:

- Identify potential effects (based on measures) on the environment
- Develop and apply avoidance/ mitigation/ compensation/ enhancement measures
- Determine net effects on the environment.

Step 3: Carry Out the Comparative Evaluation

In Step 3, the net effects identified for each Alternative Method in Step 2 were compared to one another in order to identify a Recommended Alternative Method. The comparison of net effects was completed using a "Reasoned Argument" evaluation methodology, as provided for in the Approved ToR.

Each Alternative Method was assessed based on the evaluation criteria, indicators and measures.

Each criterion was evaluated with the same indicators for each Alternative Method (including number and significance) to support the reasoned argument in the comparative rankings:

- Effect on traffic:
  - Operational Level of Service at intersections around the subject site
- Road Safety and Geometry:
  - Traffic collision assessment
  - Vertical and Horizontal Sightlines

3 Step 1: Confirm Evaluation Criteria and Indicators/Measures

Evaluation criteria and indicators were adjusted during the development of the ToR based on feedback from Indigenous communities, government agencies, and the public.

Prior to undertaking the comparative evaluation of Alternative Methods process, a public event, accompanied by a virtual event, was held to present the Criteria and Indicators to the public and invite additional feedback.

In order to fully characterize these indicators and to adopt measures by which potential effects could be identified, several considerations were developed for each indicator. These considerations are shown below in **Table 3-1**.

Table 3-1 Considerations for Indicators

Criteria	Indicators	Considerations
Effect on traffic	– Operational Level of Service at intersections around the subject site	– *Operational delays for traffic movements and volume to capacity (v/c) ratios for future total traffic conditions.*
Road Safety and Geometry	– Traffic collision assessment – Vertical and Horizontal Sightlines	– *Calculation of the predicted number of collisions for future total traffic conditions.* – *Assessment of vertical and horizontal sightlines at the three site accesses.*

The potential effects of each Alternative Method were then identified on the basis of these considerations.

4 Step 2: Net Effects Analysis

At this stage of the study, all three alternative options are assumed to retain the existing external and internal road network layout. A single future total traffic assessment (for horizon 1 and horizon 2) has been conducted to reflect this shared network configuration, along with common trip generation, distribution, and assignment characteristics across the three alternatives.

4.1 General Assumptions

The following table outlines the assumptions for each Criteria evaluated.

Table 4-1 General Assumptions for Evaluation of Transportation Criteria

Criteria	Assumptions
Effect on traffic	– Trip generation for future total traffic analysis was calculated based on 2023 inbound/outbound traffic operations at the subject site. – Trip distribution and assignment was completed using existing travel patterns discerned from intersection turning movement counts. – For future total traffic analysis, the background corridor growth factor was applied to all passenger vehicles and only heavy vehicles that were not bound for or leaving the subject site.
Road Safety and Geometry	– Vehicle Movement Diagrams: • Conducted using Quad Axle Level 1 and 2 – Class Transportation Truck – which represents the approximate size of landfill and quarry vehicles currently hauling materials to and from the subject site. • Conducted using existing aerial imagery due to the lack of existing and future intersection site plans. – Predicted Collision Calculation • Conducted using approximated AADT for future horizons. – Sightline Assessment • Conducted using publicly available aerial imagery and topographic data from Google Earth.

4.2 Potential Effects, Mitigation Measures, Net Effects

The potential effects for each Alternative Method were identified based on the characterized and documented existing traffic conditions and on the basis of the considerations outlined in **Table 3-1**. Net Effects have been categorized according to the definitions in **Table 4-2**.

Table 4-2 Categorization of Net Effects

Net Effect Category	Description
No Effect / No (Positive) Effect	No departure from the existing condition is expected in regards to site accesses as they are expected to remain unchanged for all three alternative options. Vehicle movement diagrams indicated adequate space at the three access locations, allowing for effective vehicle turning from Taylor Road and from Thorold Townline Road into the subject site. Similarly, horizontal and vertical sight line assessments indicate adequate sightlines at the three accesses.
Low Effect / Low (Positive) Effect	Effects are likely to be negligible or minor in scale if they are negligible or low in magnitude, of short duration, infrequent, small in spatial extent, reversible or readily avoided, and generate few or minor impacts in social or ecological contexts. Mitigation measures will allow baseline conditions to remain largely unchanged.
Moderate Effect / Moderate (Positive) Effect	Effects are likely to be medium in scale if they are moderate in magnitude, of moderate duration, occasionally frequent, possibly/partially reversible, and to generate a moderate level of impacts in social or ecological contexts. Mitigation measures may not fully eliminate, reduce, control or offset effects but should enable affected communities to maintain economic and social well-being, and should prevent the diminishment or loss of key components of the environment and its ecological functioning.
High Effect / High (Positive) Effect	Effects are likely to be severe in scale if they are high in magnitude, permanent/long term, frequent, irreversible, and over a large spatial extent or within an area of exclusive/preferred Indigenous use or of ecological/environmental sensitivity. High levels of impacts in social or ecological contexts are expected. There is a high degree of uncertainty of the effectiveness of mitigation measures, or mitigation measures are unable to fully address effects such that valued components are diminished or lost.

4.2.1 Traffic Modelling

4.2.1.1 Horizon Years

The proposed development was evaluated for two future scenarios based on consultation with Niagara Region staff: the expected year of full buildout for South Landfill Phase 2 (2031), referred to as Horizon 1, and a five-year post-buildout scenario (2036), referred to as Horizon 2.

Horizon 2 reflects a condition in which operations at the existing South Landfill (Phase 1) have fully ceased, and Phase 2 is operating at full capacity. In contrast, Horizon 1 represents a transitional phase, where Phase 2 operations are being phased in, while Phase 1, the existing quarry, and Phase 2 are all active to varying degrees.

4.2.1.2 Study Intersections

As per the methodology described in Section 3, the traffic analysis was conducted for the intersections summarized in **Table 4-3**. Traffic movement counts (TMCs) for each study intersection were collected on January 15, 2025, during weekday AM and PM peak periods.

Table 4-3 List of Modelled and Analysed Intersections within the Traffic Model

Intersection Name	Intersection Type	Date Counted
Taylor Road (Regional Road 70) and Thorold Stone Road (Regional Road 57)	Signalized	January 15, 2025
Taylor Road (Regional Road 70) and Walker Landfill East Access	Signalized	January 15, 2025
Taylor Road (Regional Road 70) and Mountain Road (Regional Road 101)	Signalized	January 15, 2025
Taylor Road (Regional Road 70) and Primary Quarry Access	Stop-controlled	January 15, 2025
Taylor Road (Regional Road 70) and Thorold Townline Road	Stop-controlled	January 15, 2025
Garner Road and Mountain Road (Regional Road 101)	Stop-controlled	January 15, 2025
Beechwood Road and Thorold Stone Road (Regional Road 57)	Stop-controlled	January 15, 2025
Beechwood Road and Taylor Road (Regional Road 70)	Stop-controlled	January 15, 2025
Old Thorold Stone Road and Thorold Townline Road	Stop-controlled	January 15, 2025
Thorold Townline Road and Landfill Northwest Access	Stop-controlled	January 15, 2025
Mountain Road (Regional Road 101) and Quarry Access (maintenance only)	Stop-controlled (assumed)	January 15, 2025
Thorold Townline Road Access and Thorold Public Works Access	Stop-controlled	January 15, 2025

4.2.1.3 Background Growth

Following consultation with Niagara Region staff, a background corridor growth rate of 2.0% per annum was applied to baseline eastbound and westbound through movements along Thorold Stone Road. Additionally, a 1.0% per annum rate was applied to northbound and southbound through movements along Taylor Road.

No background development traffic has been included in the development of future traffic models as there are no planned background developments within the vicinity the study area to be considered.

It should be noted that background growth rates have only been applied to the passenger vehicles and passing heavy vehicles, as the site-bound heavy vehicles (trucks containing quarry and landfill materials) are not expected to grow based on the subject site's operational capacity.

4.2.1.4 Trip Generation

Heavy vehicle traffic volumes collected in 2023 associated with the transport of landfill waste to and from the existing South Landfill (Phase 1) were used as a proxy, to identify site traffic volumes for proposed Phase 2 operations. Phase 2 is expected to maintain comparable (following an applied multiplier) annual volume and daily limit of solid, non-hazardous waste from residential and industrial, commercial, and institutional (IC&I) sources currently accepted at Phase 1. Existing inbound and outbound landfill and quarry trips to/from the project site were removed from the existing TMC data. New site trips are shown in **Table 4-4** which have been added to network trips to

develop future total traffic conditions volumes.

To reflect the "phased-in" approach anticipated during Horizon 1, where both Phase 1 and Phase 2 landfills are partially operational, the average 2023 landfill vehicle volumes were increased by 25 percent. This adjustment accounts for overlapping activities at both sites. Additionally, 2023 traffic volumes for quarry-bound vehicles were applied to represent a conservative scenario in which the quarry remains fully operational while Phase 2 landfill operations gradually increase. As part of the horizon 2 model.

For Horizon 2, the 2023 average landfill vehicle volumes were again applied, but not increased, with the assumptions that Phase 2 will fully replace Phase 1 with equal inbound and outbound traffic. However, all heavy vehicle traffic related to the quarry was assumed to be zero, as the quarry is expected to cease operations in this scenario.

The number of non-heavy vehicles site trips that are currently present under the existing conditions is not expected to change during the transition of operations from Phase 1 into Phase 2.

Table 4-4 One-way Heavy Vehicle Trip Generation

	Landfill Heavy Vehicles		Quarry Heavy Vehicles	
	AM	PM	AM	PM
Year 2023	28	27	14	13
Horizon 1 (Year 2031)	35	34	14	13
Horizon 2 (Year 2036)	28	27	0	0

4.2.1.5 Trip Distribution and Assignment

Quarry and landfill heavy vehicle trips were distributed to the boundary road network based on existing travel patterns observed at study intersections. Site-generated volumes were distributed to the network as shown in **Table 4-5**.

Table 4-5 Heavy Vehicle Trip Distribution

Gateway	Location	AM (IN)	AM (OUT)	PM (IN)	PM (OUT)
N1	Via North of Taylor Road	17.7%	30.6%	20%	32%
N2	Via North of Garner Road	0.0%	0.0%	0%	0%
E1	Via East of Mountain Road	8.1%	9.7%	10%	21%
E2	Via East of Thorold Stone Road	9.7%	8.1%	20%	3%
W1	Via West of Old Thorold Stone Road	8.1%	11.3%	0%	6%
W2	Via West of Thorold Stone Road	41.9%	27.4%	30%	18%

S1	Via South of Taylor Road/Thorold Townline Road	12.9%	12.9%	15%	21%
S2	Via South of Beechwood Road	1.6%	0.0%	0%	0%
S3	Via South of Garner Road	0.0%	0.0%	5%	0%

The assignment of quarry and landfill heavy vehicle trips into the project site was completed with the consideration of the three site access locations (Primary Quarry Access, Landfill East Access and Landfill Northwest Access). All three access locations will be operational for both Horizon 1 and 2 traffic scenarios. During Horizon 2 however, where no quarry-bound traffic is expected, the existing primary quarry access will be transitioned to accommodate landfill vehicles and passenger cars.

4.2.1.6 Traffic Capacity Analysis

The traffic capacity analysis identifies how well the intersections and access driveways are operating under existing conditions and how they are expected to operate in the future. The analysis contained in this report utilized the Highway Capacity Manual (HCM) methodology within the Synchro Software package. The reported intersection volume-to-capacity ratios (v/c) are a measure of the saturation volume for each turning movement, while the levels-of-service (LOS) are a measure of the average delay for each turning movement.

As part of the capacity analysis, TYLin detailed the traffic operation at all turning movements at the study intersections. Turning movements were identified and bolded in the summary table, based on the following criteria, as per the Niagara Region Traffic Impact Assessment Guidelines. It is noted that 95th percentile SimTraffic queueing analysis has not been completed for this phase of the study.

- At signalized intersections, movements with a v/c ratio greater than 0.85 and/or LOS "E" or worse are deemed to be "critical" in terms of operations. Movements that exceed those thresholds shall be evaluated for possible operational improvements.
- At unsignalized intersections, movements expected to operate at LOS "D" or worse.

The tables in Section 4.2.1.6 and Section 4.2.1.7 summarize the Synchro/HCM capacity and queuing results for the study intersections during the weekday AM and PM peak hours under baseline (2025) and future background and future total traffic conditions. Detailed Synchro reports are attached in **Appendix A**.

4.2.1.7 Future Total Traffic Analysis – Horizon 1 (2031)

The future total traffic volumes during the weekday AM/PM peak hours for the 2031 planning horizon were derived by combining the corresponding estimate of the site-generated heavy vehicle traffic. Resultant traffic operations, including LOS, and operational volume/capacity ratios are shown in **Table 4-6**. Synchro traffic results are presented in **Appendix A** and future total traffic volumes are presented in **Appendix B**.

Table 4-6 Future Total Conditions Traffic Analysis - Horizon 1 (2031)

Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	Delay (s)	LOS	v/c	Delay (s)	LOS
Signalized Intersections							
Thorold Townline Road/Taylor Road & Thorold Stone Road	*Overall*	*0.62*	*20*	*B*	*0.70*	*22*	*C*
	EBL	0.55	12	B	0.61	15	B
	EBT	0.32	6	A	0.56	13	B
	EBR	0.03	4	A	0.05	8	A
	WBL	0.08	17	B	0.21	20	C
	WBT	0.66	24	C	0.65	25	C
	WBR	0.06	16	B	0.07	17	B
	NBL	0.36	37	D	0.56	34	C
	NBTR	0.59	39	D	0.24	26	C
	SBL	0.19	35	C	0.15	26	C
	SBTR	0.77	40	D	0.83	42	D
Taylor Road & East Access	*Overall*	*0.33*	*6*	*A*	*0.39*	*6*	*A*
	EBL	0.08	21	C	0.08	21	C
	EBR	0.16	19	B	0.11	19	B
	NBL	0.08	4	A	0.01	4	A
	NBT	0.27	5	A	0.24	5	A
	SBT	0.24	5	A	0.33	6	A
	SBR	0.02	4	A	0.02	4	A
Taylor Road & Mountain Road	*Overall*	*0.45*	*20*	*B*	*0.38*	*14*	*B*
	WBL	0.73	44	D	0.57	39	D
	WBR	0.29	32	C	0.26	34	C
	NBTR	0.40	11	B	0.36	11	B
	SBL	0.06	5	A	0.15	5	A
	SBT	0.15	6	A	0.28	6	A
Stop-controlled Intersections							
Taylor Road & Primary Quarry Access	EBL	0.03	16	C	0.14	19	C
	EBR	0.01	10	B	0.03	13	B
	NBL	0.01	8	A	0.01	10	A
	NBT	0.21	0	A	0.17	0	A
	SBTR	0.14	0	A	0.29	0	A
Taylor Road & Thorold Townline Road	EBL	0.04	13	B	0.11	13	B
	EBR	0.04	13	B	0.11	13	B
	NBL	0.04	8	A	0.06	10	A
	NBT	0.20	0	A	0.17	0	A
	SBTR	0.20	0	A	0.28	0	A
Mountain Road & Garner Road	EBLTR	0.00	0	A	0.00	0	A
	WBLTR	0.02	1	A	0.03	1	A
	NBLTR	0.11	11	B	0.10	12	B
	SBLTR	0.02	12	B	0.01	15	C
Beechwood Road & Thorold Stone Road	EBTL	0.33	2	A	0.48	1	A
	EBR	0.00	0	A	0.01	0	A
	WBTR	0.31	0	A	0.30	0	A
	NBLTR	0.36	**79**	**F**	0.64	**196**	**F**

	SBLTR	0.39	**108**	**F**	0.68	**201**	**F**
Taylor Road & Beechwood Road	WBLR	0.07	2	B	0.05	10	B
	NBTR	0.21	0	A	0.19	0	A
	SBL	0.02	1	A	0.03	8	A
	SBT	0.21	0	A	0.28	0	A
Thorold Townline Road & Old Thorold Stone Road	EBLR	0.07	10	A	0.04	9	A
	NBTL	0.03	3	A	0.01	2	A
	SBTR	0.02	0	A	0.06	0	A
Thorold Townline Road/Access Road & North West Access Road	EBLTR	0.01	7	A	0.03	7	A
	WBLTR	0.07	7	A	0.04	7	A
	NBLTR	0.08	8	A	0.09	8	A
	SBLTR	0.01	7	A	0.09	8	A
Quarry Access & Mountain Road	EBTR	0.10	0	A	0.17	0	A
	WBTL	0.00	0	A	0.00	0	A
	NBLR	0.00	12	B	0.00	0	A
Thorold Townline Road & Thorold Public Works Access/Landfill West Access	EBLTR	0.01	9	A	0.00	9	A
	WBLTR	0.00	9	A	0.01	9	A
	NBLTR	0.00	0	A	0.00	0	A
	SBLTR	0.00	1	A	0.00	0	A

Under future total traffic conditions for Horizon 1, the study intersections generally operate at acceptable levels, with manageable delays and v/c ratios during both the AM and PM peak periods.

The southbound left-through-right (SBLTR) and northbound left-through-right (NBLTR) movements, however, operate with high delays and a Level of Service (LOS) of 'F'. While these movements are identified as critical per Niagara Region's transportation impact guidelines, it is noted that they already operate at LOS 'F' under existing conditions. The additional delay observed under Horizon 1 is primarily due to the application of a two percent annual corridor growth factor for through movements along Thorold Stone Road. Site-related traffic, under both existing and Horizon 1 conditions, generally does not travel northbound or southbound at this intersection. Site related traffic therefore does not meaningfully contribute to the critical delays observed.

Due to the significant volumes in the eastbound and westbound direction in contrast to the significantly lower volumes in the northbound and southbound direction, a traffic signal is not recommended at this intersection. Similarly, additional dedicated left and right turn lanes are also not expected to improve delays. While delays are high for the minor approach, no improvements are recommended due to the low number of vehicles travelling northbound and southbound.

4.2.1.8 Future Total Traffic Analysis – Horizon 2 (2036)

The future total traffic volumes during the weekday AM/PM peak hours for the 2036 planning horizon were derived by combining the corresponding estimate of the site-generated heavy vehicle traffic. Resultant traffic operations, including LOS, and operational volume/capacity ratios are shown in **Table 4-7**. Synchro traffic results are presented in **Appendix A** and future total traffic volumes are presented in **Appendix B**.

Table 4-7 Future Total Conditions Traffic Analysis - Horizon 2 (2036)

Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	Delay (s)	LOS	v/c	Delay (s)	LOS
Signalized Intersections							
Thorold Townline Road/Taylor Road & Thorold Stone Road	*Overall*	*0.65*	*20*	*B*	*0.73*	*22*	*C*
	EBL	0.58	16	B	0.65	18	B
	EBT	0.35	6	A	0.62	14	B
	EBR	0.03	4	A	0.05	8	A
	WBL	0.08	16	B	0.23	20	C
	WBT	0.70	24	C	0.70	26	C
	WBR	0.05	15	B	0.05	17	B
	NBL	0.36	37	D	0.57	35	C
	NBTR	0.60	39	D	0.23	26	C
	SBL	0.19	35	C	0.15	26	C
	SBTR	0.76	40	D	0.83	42	D
Taylor Road & East Access	*Overall*	*0.33*	*5*	*A*	*0.40*	*5*	*A*
	EBL	0.05	26	C	0.04	24	C
	EBR	0.11	21	C	0.08	21	C
	NBL	0.05	3	A	0.01	3	A
	NBT	0.25	4	A	0.22	4	A
	SBT	0.23	4	A	0.30	5	A
	SBR	0.02	3	A	0.01	3	A
Taylor Road & Mountain Road	*Overall*	*0.45*	*20*	*B*	*0.38*	*14*	*B*
	WBL	0.74	45	D	0.57	39	D
	WBR	0.29	32	C	0.27	34	C
	NBTR	0.40	11	B	0.36	11	B
	SBL	0.06	5	A	0.15	5	A
	SBT	0.15	6	A	0.29	6	A
Stop-controlled Intersections							
Taylor Road & Primary Quarry Access	EBL	0.02	15	C	0.12	18	C
	EBR	0.00	10	A	0.03	13	B
	NBL	0.01	8	A	0.00	9	A
	NBT	0.22	0	A	0.17	0	A
	SBTR	0.15	0	A	0.30	0	A
Taylor Road & Thorold Townline Road	EBL	0.04	12	B	0.11	13	B
	EBR	0.04	12	B	0.11	13	B
	NBL	0.04	8	A	0.05	9	A
	NBT	0.21	0	A	0.18	0	A
	SBTR	0.20	0	A	0.29	0	A
Mountain Road & Garner Road	EBLTR	0.00	0	A	0.00	0	A
	WBLTR	0.02	1	A	0.03	1	A
	NBLTR	0.11	11	B	0.10	12	B
	SBLTR	0.02	12	B	0.01	15	C
Beechwood Road & Thorold Stone Road	EBTL	0.37	1	A	0.53	0	A
	EBR	0.00	0	A	0.01	0	A
	WBTR	0.34	0	A	0.33	0	A
	NBLTR	0.43	**102**	**F**	1.06	**442**	**F**

	SBLTR	0.41	**130**	**F**	0.96	**350**	**F**
Taylor Road & Beechwood Road	WBLR	0.06	12	B	0.05	10	B
	NBTR	0.22	0	A	0.19	0	A
	SBL	0.02	8	A	0.03	8	A
	SBT	0.22	0	A	0.29	0	A
Thorold Townline Road & Old Thorold Stone Road	EBLR	0.06	10	A	0.04	9	A
	NBTL	0.02	3	A	0.01	2	A
	SBTR	0.02	0	A	0.06	0	A
Thorold Townline Road/Access Road & North West Access Road	EBLTR	0.01	7	A	0.03	7	A
	WBLTR	0.07	7	A	0.04	7	A
	NBLTR	0.08	8	A	0.07	8	A
	SBLTR	0.01	7	A	0.09	8	A
Quarry Access & Mountain Road	EBTR	0.10	0	A	0.17	0	A
	WBTL	0.00	0	A	0.00	0	A
	NBLR	0.00	12	B	0.00	0	B
Thorold Townline Road & Thorold Public Works Access/Landfill West Access	EBLTR	0.01	9	A	0.00	9	A
	WBLTR	0.00	9	A	0.01	9	A
	NBLTR	0.00	0	A	0.00	0	A
	SBLTR	0.00	1	A	0.00	0	A

Under horizon 2 traffic conditions, the study intersections continue to operate at generally acceptable levels, with satisfactory v/c ratios and manageable delays during both the AM and PM peak periods.

As observed in horizon 1, the northbound left-through-right (NBLTR) and southbound left-through-right (SBLTR) movements at the Beechwood Road & Thorold Stone Road intersection continue to experience high delays and operate at a LOS 'F'. These movements remain critical as per Niagara Region's transportation impact guidelines under both AM and PM conditions.. Compared to horizon 1, the delays for these specific movements increase further under horizon 2 conditions, reflecting the 2% annual cumulative growth in background traffic volumes along the corridor. Despite the worsening delay on the minor approach, site-related trips still contribute minimally, as they do not generally make northbound/southbound movement or turns at this intersection.

As in Horizon 1, signalization is not expected to be warranted resulting from the significantly lower minor approach volumes in comparison to those on the major approaches. Additional turn lane improvements are also recommended here as they do not improve traffic conditions.

The dominant traffic volumes remain concentrated in the eastbound and westbound directions, while northbound and southbound volumes remain low. Due to this imbalance, a traffic signal is not warranted, and additional dedicated turn lanes would not meaningfully improve intersection performance. Although delays remain elevated on the minor approaches, the low volume of vehicles using these movements does not justify further modifications.

4.2.2 Collision Assessment

The Safety Performance Function (SPF) is a statistical model, based on the Highway Safety Manual (1st Edition) and Traffic and Highway Engineering (SI Edition, 5th Edition), that estimates how many crashes a roadway segment is likely to experience based on factors such as average annual daily traffic (AADT). Using negative-binomial regression, the SPF accounts for the extra variability (or

overdispersion) observed in real-world crash data through an overdispersion parameter (k). To further enhance realism, the model can be adjusted with site-specific variables such as lane and shoulder widths and types, the presence and number of exclusive left and right turn lanes, intersection lighting, and other roadway characteristics to ensure the predictions closely reflect real-world conditions.

Two key values are derived from each SPF: the predicted crash frequency, which reflects the average expected number of crashes for sites with similar conditions; and the expected crash frequency, which adjusts that prediction by incorporating site-specific characteristics, especially the existing collision history as the basis for calibration. This ensures that current conditions are reflected in long-term projections.

In **Table 4-8**, each roadway segment is shown with its predicted and expected crash frequencies for the years 2025, 2031, and 2036. For comparison, the total number of collisions recorded over the past five years and the five-year average are also included to contextualize the projections. Further details for the calculation of predicted and expected collisions are provided in **Appendix C**.

Table 4-8 Future Conditions Collision Assessment

Road Intersection/Segment	Observed number of collisions over 2020-2024	Observed average yearly collision rate over 2020-2024	2025		2031		2036	
			Predicted	Expected	Predicted	Expected	Predicted	Expected
Garner Road & Mountain Road	1	0.2	1.380	1.087	1.431	1.116	1.474	1.141
Taylor Road & Mountain Road	4	0.8	3.876	2.956	4.066	3.056	4.231	3.141
Taylor Road & Beechwood Road	1	0.2	0.754	0.594	0.791	0.614	0.823	0.631
Thorold Stone Road & Taylor Road/Thorold Townline Road	28	5.6	7.515	6.581	8.369	6.775	9.155	6.930
Thorold Stone Road & Beechwood Road	5	1	1.984	1.497	2.194	1.573	2.376	1.633
Thorold Stone Road & Garner Road	10	2	7.515	4.009	8.070	4.105	8.564	4.182
Mountain Road between Garner Road and Taylor Road	4	0.8	0.638	0.668	0.677	0.701	0.712	0.729
Taylor Road between Mountain Road & Beechwood Road	2	0.4	1.209	0.998	1.283	1.042	1.348	1.080
Taylor Road between Beechwood Road & Thorold Townline Road	1	0.2	0.873	0.705	0.926	0.737	0.974	0.765
Taylor Road between Thorold Townline Road & Highway 58 & Thorold Stone Road & Thorold Townline Road	5	1	0.356	0.535	0.623	0.691	0.397	0.578
Garner Road Between Reta Street & Swart Street	2	0.4	0.346	0.348	0.346	0.348	0.346	0.348
Thorold Townline Road between Dead End & Old Thorold Stone Road	3	0.6	0.216	0.239	0.216	0.239	0.216	0.239

It is important to note that the predicted and expected collision frequencies are theoretical estimates derived from SPF calculations, which are primarily based on AADT volumes. Additionally, AADT values for the years 2020 to 2024 were estimated based on the 2025 AADT, introducing some uncertainty. As a result, the predicted and expected collision frequencies may show significant deviations from the observed historical collision rates. Therefore, future collision trends are more appropriately interpreted by examining the relative changes between 2025, 2031, and 2036, rather than by direct comparison with past observed data.

The intersections at Thorold Stone Road and Taylor Road and Thorold Stone Road and Garner Road register the highest crash frequencies. At the Thorold Stone and Taylor Road intersection, the model predicts 7.52 crashes in 2025, rising to 9.16 by 2036, while the expected values (incorporating local collision history) range from 6.58 to 6.93. Likewise, Thorold Stone and Garner Road shows predicted frequencies of about 7.52 in 2025 (increasing to 8.56 in 2036) but expected values calibrated down to roughly 4.0 to 4.2 crashes per year.

Second, the expected frequencies are consistently lower than the predicted values across all segments, highlighting the effect of local calibration. For example, Taylor Road and Mountain Road is predicted to have 3.88 crashes in 2025, but its expected frequency drops to 2.96, closer to its observed five-year average of 0.8 crashes per year. This pattern demonstrates how incorporating historical collision data tempers the raw statistical forecasts into more realistic estimates.

Third, certain low volume stretches, such as Garner Road between Reta Street and Swart Street and Thorold Townline Road between Dead End and Old Thorold Stone Road, exhibit both very low predicted and expected crash frequencies (around 0.24 to 0.35 crashes per year) and similarly low observed averages (0.4 to 0.6). The growth in traffic volumes lead to an associated increase in collision frequency.

4.2.3 Sightline Assessment

For this project, two types of sightline assessments were completed: Intersection Sight Distance (ISD) and Stopping Sight Distance (SSD). Both evaluations followed the TAC Geometric Design Guide Chapter 2 for SSD and Chapter 9 for ISD.

Intersection Sight Distance Assessment

According to TAC guidelines, ISD was assessed only at the Primary Quarry Access. This is because the Landfill East Access is signalized (Case D – Section 9.9.2, Chapter 9), and the Landfill Northwest Access is controlled by an All-Way Stop (Case E – Section 9.9.2, Chapter 9). In both cases, TAC does not recommend evaluating departure sight triangles.

At the Primary Quarry Access, the sightlines were found to be clear and unobstructed. Sight distances were calculated based on the posted speed of 70 km/h and a design speed of 90 km/h along Taylor Road. The following is the required ISD associated with the truck profile used in the analysis:

- The required ISD for a left turn from stop (Case B1) is 305 metres.
- The required ISD for a right turn from the minor road (Case B2) is 280 metres.

Full details of the sightline assessments are provided in **Appendix D**.

Stopping Sight Distance Assessment

SSD assessments for both horizontal and vertical alignments were completed for all three site accesses: Primary Quarry Access, Landfill East Access, and Landfill Northwest Access.

For the Primary Quarry Access and the Landfill East Access, located along Taylor Road, the posted speed is 70 km/h – attributing to the conservative design speed assumption of 90 km/h. Based on these conditions, the required SSD is 160 metres, in accordance with TAC standards (Table 2.5.2, Chapter 2).

Similarly, at the Landfill Northwest Access, located along Thorold Townline Road which has a posted speed limite of 50 km/h, and hence an assumed design speed of 70 km/h, the SSD requirement is 105 metres.

In all cases, the available sightlines for both horizontal and vertical alignments were found to be clear and unobstructed. Details of the horizontal SSD and vertical SSD assessments are provided in **Appendix D**.

4.2.4 Vehicle Movement Diagrams (VMD)

A vehicular swept path analysis was carried out for all site accesses, and vehicular movement diagrams (VMDs) were prepared using AutoTurn Analysis software. The truck profile used in the analysis was the Quad Axle Level 1 and 2 – Class Transportation Truck, as it closely resembles the existing vehicles operating at the site, particularly in terms of the number of axles and overall dimensions.

No operational concerns or issues related to insufficient space for truck turning maneuvers were identified at any of the site accesses. All VMDs have been compiled and are presented in **Appendix E.**

4.2.5 Landfill Configuration Options

Table 4-9 Landfill Configuration Option A-C Transportation Potential Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on traffic	– Operational Level of Service at intersections around the subject site	– All key study intersections operate at acceptable LOS and volume to capacity ratios. – Intersection of Beechwood Road & Thorold Stone Road retains critical delays on the minor approach during Horizon 1 and Horizon 2 models as observed under existing conditions.	– No improvements are recommended at the intersection of Beechwood Road & Thorold Stone Road as signalization is expected to not be warranted land additional turning lanes do not lead to improvements.	- High delays for NB and SB traffic at intersection of Beechwood Road & Thorold Stone Road will remain during horizon 1 and 2. These delays are generally not associated to site-generated traffic. **Low Effect / Low (negative) Effect**
Road Safety and Geometry	– Traffic collision assessment	– Expected collisions for Horizon 1 and Horizon 2 remain comparable to that expected by end of 2025.	– No new changes are recommended.	– No change in safety conditions. **No Effect**
	– Vertical and Horizontal Sightlines	– Adequate existing horizontal and vertical sightlines.	– No new changes are recommended as existing accesses are expected to remain unchanged under Horizon 1 and Horizon 2.	– No change in horizontal and vertical sightlines. **No Effect**

The potential effects, mitigation measures, and resulting net effects are expected to be consistent across Options A through C. As such, the traffic and road safety/geometry-related characteristics associated with landfill configuration have been combined into a single summary table, as shown above.

4.2.6 Leachate Management Options

Table 4-10 Leachate Management Option A - B Transportation Potential Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on traffic	– Operational Level of Service at intersections around the subject site	– Leachate mangement does not impact operational level on traffic.	– No improvements are recommended.	– No change in operational level of service. **No Effect**
Road Safety and Geometry	– Traffic collision assessment	– Leachate mangement does not impact expected and predicted collision frequency.	– No improvements are recommended.	– No change in safety conditions. **No Effect**
	– Vertical and Horizontal Sightlines	– Leachage management does not impact horizontal and vertical sightlines.	– No improvements are recommended.	– No change in horizontal and vertical sightlines. **No Effect**

The potential effects, mitigation measures, and resulting net effects are expected to be consistent between Options A and B. As such, the traffic and road safety/geometry-related characteristics associated with leachate management have been combined into a single summary table, as shown above.

5 Step 3: Comparative Evaluation

Table 5-1 Comparative Evaluation – Transportation

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
Effect on traffic	– Operational Level of Service at intersections around the subject site	– High delays for NB and SB traffic at intersection of Beechwood Road & Thorold Stone Road will remain during horizon 1 and 2. These delays are generally not associated to site-generated traffic. – No change in safety conditions. – No change in horizontal and vertical sightlines at site access locations. **Low Effect / Low (negative) Effect and No Effect**			– No effect on operational level of service. **No Effect**	
	Criteria Ranking:	Tied 1st	Tied 1st	Tied 1st	Tied 1st	Tied 1st
	Criteria Rationale:	There is no distinction between the Options in relation to effects from truck transport along access roads. All options retain the current conditions present at existing primary quarry access, the landfill east access and the landfill northwest access. Internal routes have not been assessed at this point in the study and therefore, no differences are assumed across the three options. All Options rank the same.			There is no distinction between the Options in relation to the traffic effects of the leachate management's transportation operations.	
Road Safety and Geometry	– Traffic collision assessment	– No change in safety conditions.			– No change in safety conditions. **No Effect**	
	– Vertical and Horizontal Sightlines	– No change in horizontal and vertical sightlines at site access locations.			– No change in horizontal and vertical sightlines at site access locations. **No Effect**	

	Criteria Ranking:	Tied 1st	Tied 1st	Tied 1st	Tied 1st	Tied 1st
	Criteria Rationale:	There is no distinction between the Options in relation to effects from truck transport along access roads. All Options rank the same.			There is no distinction between the Options in relation to the road safety/geometry effects of the leachate management's transportation operations.	
Environmental Component Ranking:		Tied 1st	Tied 1st	Tied 1st	Tied 1st	Tied 1st
Environmental Component Rationale:		There is no distinction between the Options in relation to the environmental impacts of the landfill configuration.			There is no distinction between the Options in relation to the environmental impacts of the leachate management's transportation operations.	

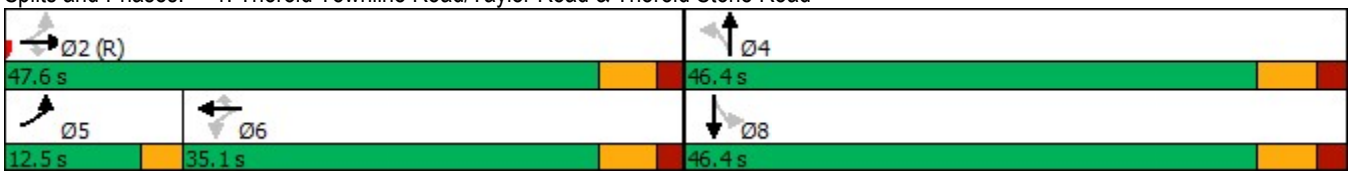
Appendix A:
Future Total Conditions Traffic Analysis Synchro Reports

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	274	734	34	19	898	38	26	118	33	26	71	209
Future Volume (vph)	274	734	34	19	898	38	26	118	33	26	71	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0		95.0	85.0		90.0	100.0		0.0	80.0		0.0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (m)	85.0			100.0			90.0			40.0		
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		0.967			0.888	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1573	3510	1498	1825	3544	1633	1755	1666	0	1534	1464	0
Flt Permitted	0.162			0.350			0.270			0.585		
Satd. Flow (perm)	268	3510	1498	672	3544	1633	499	1666	0	944	1464	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			39			74		19			197	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		291.4			1007.9			528.0			328.2	
Travel Time (s)		13.1			45.4			23.8			14.8	
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
Heavy Vehicles (%)	16%	4%	9%	0%	3%	0%	4%	8%	24%	19%	18%	16%
Adj. Flow (vph)	298	798	37	21	976	41	28	128	36	28	77	227
Shared Lane Traffic (%)												
Lane Group Flow (vph)	298	798	37	21	976	41	28	164	0	28	304	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)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5	6.1	6.1	30.5	6.1	6.1	30.5		6.1	30.5	
Trailing Detector (m)	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	
Detector 1 Size(m)	6.1	1.8	6.1	6.1	1.8	6.1	6.1	1.8		6.1	1.8	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
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	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2			6			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2		2	6		6	4	4		8		
Detector Phase	5	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	12.5	35.1	35.1	35.1	35.1	35.1	46.4	46.4		46.4	46.4	
Total Split (s)	12.5	47.6	47.6	35.1	35.1	35.1	46.4	46.4		46.4	46.4	
Total Split (%)	13.3%	50.6%	50.6%	37.3%	37.3%	37.3%	49.4%	49.4%		49.4%	49.4%	
Maximum Green (s)	9.5	41.5	41.5	29.0	29.0	29.0	40.0	40.0		40.0	40.0	
Yellow Time (s)	3.0	4.1	4.1	4.1	4.1	4.1	4.1	4.1		4.1	4.1	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.3	2.3		2.3	2.3	
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)	3.0	6.1	6.1	6.1	6.1	6.1	6.4	6.4		6.4	6.4	
Lead/Lag	Lead			Lag	Lag	Lag						
Lead-Lag Optimize?	Yes			Yes	Yes	Yes						
Vehicle Extension (s)	2.5	6.0	6.0	6.0	6.0	6.0	2.3	2.3		2.3	2.3	
Recall Mode	None	C-Max	C-Max	None	None	None	None	None		None	None	
Walk Time (s)		11.0	11.0	11.0	11.0	11.0	15.0	15.0		15.0	15.0	
Flash Dont Walk (s)		18.0	18.0	18.0	18.0	18.0	25.0	25.0		25.0	25.0	
Pedestrian Calls (#/hr)		0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	69.8	66.7	66.7	39.0	39.0	39.0	14.8	14.8		14.8	14.8	
Actuated g/C Ratio	0.74	0.71	0.71	0.41	0.41	0.41	0.16	0.16		0.16	0.16	
v/c Ratio	0.55	0.32	0.03	0.08	0.66	0.06	0.36	0.59		0.19	0.77	
Control Delay	13.9	6.2	2.2	19.6	25.8	1.9	45.8	40.0		34.6	26.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	13.9	6.2	2.2	19.6	25.8	1.9	45.8	40.0		34.6	26.4	
LOS	B	A	A	B	C	A	D	D		C	C	
Approach Delay		8.1			24.7			40.9			27.1	
Approach LOS		A			C			D			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 94			
Actuated Cycle Length: 94			
Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Green			
Natural Cycle: 95			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.77			
Intersection Signal Delay: 19.2		Intersection LOS: B	
Intersection Capacity Utilization 75.4%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 1: Thorold Townline Road/Taylor Road & Thorold Stone Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	274	734	34	19	898	38	26	118	33	26	71	209
Future Volume (vph)	274	734	34	19	898	38	26	118	33	26	71	209
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.1	6.1	6.1	6.1	6.1	6.4	6.4		6.4	6.4	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1573	3510	1498	1825	3544	1633	1755	1666		1534	1464	
Flt Permitted	0.16	1.00	1.00	0.35	1.00	1.00	0.27	1.00		0.59	1.00	
Satd. Flow (perm)	268	3510	1498	672	3544	1633	499	1666		945	1464	
Peak-hour factor, PHF	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)	298	798	37	21	976	41	28	128	36	28	77	227
RTOR Reduction (vph)	0	0	11	0	0	24	0	16	0	0	166	0
Lane Group Flow (vph)	298	798	26	21	976	17	28	148	0	28	138	0
Heavy Vehicles (%)	16%	4%	9%	0%	3%	0%	4%	8%	24%	19%	18%	16%
Turn Type	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2			6			4			8	
Permitted Phases	2		2	6		6	4	4		8		
Actuated Green, G (s)	66.7	66.7	66.7	39.0	39.0	39.0	14.8	14.8		14.8	14.8	
Effective Green, g (s)	66.7	66.7	66.7	39.0	39.0	39.0	14.8	14.8		14.8	14.8	
Actuated g/C Ratio	0.71	0.71	0.71	0.41	0.41	0.41	0.16	0.16		0.16	0.16	
Clearance Time (s)	3.0	6.1	6.1	6.1	6.1	6.1	6.4	6.4		6.4	6.4	
Vehicle Extension (s)	2.5	6.0	6.0	6.0	6.0	6.0	2.3	2.3		2.3	2.3	
Lane Grp Cap (vph)	533	2490	1062	278	1470	677	78	262		148	230	
v/s Ratio Prot	c0.15	0.23			c0.28			0.09			c0.09	
v/s Ratio Perm	0.25		0.02	0.03		0.01	0.06			0.03		
v/c Ratio	0.56	0.32	0.02	0.08	0.66	0.03	0.36	0.56		0.19	0.60	
Uniform Delay, d1	11.2	5.1	4.0	16.6	22.2	16.3	35.4	36.6		34.4	36.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.0	0.3	0.0	0.3	1.8	0.0	1.6	2.0		0.4	3.4	
Delay (s)	12.2	5.5	4.1	16.9	24.0	16.3	37.0	38.6		34.8	40.3	
Level of Service	B	A	A	B	C	B	D	D		C	D	
Approach Delay (s)		7.2			23.6			38.4			39.8	
Approach LOS		A			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	19.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	94.0	Sum of lost time (s)	15.5
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

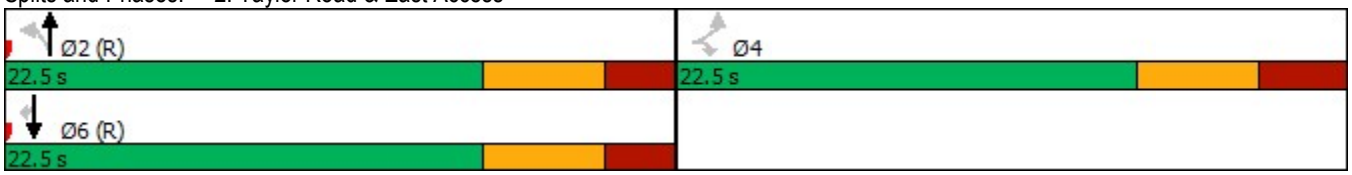


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	15	28	29	336	308	16
Future Volume (vph)	15	28	29	336	308	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	110.0			80.0
Storage Lanes	1	1	1			1
Taper Length (m)	2.5		100.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950		0.950			
Satd. Flow (prot)	913	816	913	1795	1830	933
Flt Permitted	0.950		0.549			
Satd. Flow (perm)	913	816	527	1795	1830	933
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		32				18
Link Speed (k/h)	50			70	70	
Link Distance (m)	70.6			713.0	427.2	
Travel Time (s)	5.1			36.7	22.0	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	100%	100%	100%	7%	5%	75%
Adj. Flow (vph)	17	32	33	386	354	18
Shared Lane Traffic (%)						
Lane Group Flow (vph)	17	32	33	386	354	18
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	6.1	6.1	6.1	30.5	30.5	6.1
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)	6.1	6.1	6.1	1.8	1.8	6.1
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)				28.7	28.7	
Detector 2 Size(m)				1.8	1.8	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Perm	Perm	Perm	NA	NA	Perm
Protected Phases				2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases	4	4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	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
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Maximum Green (s)	15.4	15.4	16.0	16.0	16.0	16.0
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.0	3.0	2.4	2.4	2.4	2.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.1	7.1	6.5	6.5	6.5	6.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	4.0	4.0	2.5	2.5	2.5	2.5
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	0.0	0.0	0.0	0.0	0.0	0.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	10.0	10.0	35.6	35.6	35.6	35.6
Actuated g/C Ratio	0.22	0.22	0.79	0.79	0.79	0.79
v/c Ratio	0.08	0.16	0.08	0.27	0.24	0.02
Control Delay	15.3	8.6	6.3	5.5	5.3	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.3	8.6	6.3	5.5	5.3	3.7
LOS	B	A	A	A	A	A
Approach Delay	11.0			5.6	5.2	
Approach LOS	B			A	A	

Intersection Summary			
Area Type:	Other		
Cycle Length: 45			
Actuated Cycle Length: 45			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green			
Natural Cycle: 45			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.27			
Intersection Signal Delay: 5.7		Intersection LOS: A	
Intersection Capacity Utilization 43.8%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: Taylor Road & East Access





Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	15	28	29	336	308	16
Future Volume (vph)	15	28	29	336	308	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.1	7.1	6.5	6.5	6.5	6.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	913	816	913	1795	1830	933
Flt Permitted	0.95	1.00	0.55	1.00	1.00	1.00
Satd. Flow (perm)	913	816	528	1795	1830	933
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	17	32	33	386	354	18
RTOR Reduction (vph)	0	29	0	0	0	7
Lane Group Flow (vph)	17	3	33	386	354	11
Heavy Vehicles (%)	100%	100%	100%	7%	5%	75%
Turn Type	Perm	Perm	Perm	NA	NA	Perm
Protected Phases				2	6	
Permitted Phases	4	4	2			6
Actuated Green, G (s)	4.0	4.0	27.4	27.4	27.4	27.4
Effective Green, g (s)	4.0	4.0	27.4	27.4	27.4	27.4
Actuated g/C Ratio	0.09	0.09	0.61	0.61	0.61	0.61
Clearance Time (s)	7.1	7.1	6.5	6.5	6.5	6.5
Vehicle Extension (s)	4.0	4.0	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	81	72	321	1092	1114	568
v/s Ratio Prot				c0.21	0.19	
v/s Ratio Perm	c0.02	0.00	0.06			0.01
v/c Ratio	0.21	0.04	0.10	0.35	0.32	0.02
Uniform Delay, d1	19.0	18.7	3.7	4.4	4.3	3.5
Progression Factor	1.01	1.01	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.8	0.3	0.6	0.9	0.8	0.1
Delay (s)	21.0	19.3	4.3	5.3	5.0	3.5
Level of Service	C	B	A	A	A	A
Approach Delay (s)	19.9			5.2	4.9	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	5.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	13.6
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

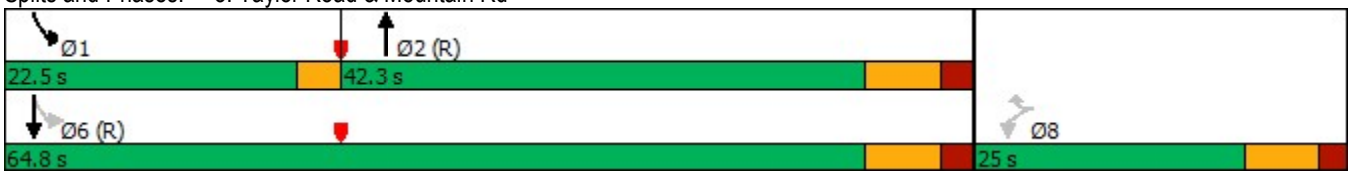


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	180	84	258	86	38	143
Future Volume (vph)	180	84	258	86	38	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0	0.0		0.0	95.0	
Storage Lanes	1	1		0	1	
Taper Length (m)	100.0				100.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850	0.966			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1722	1570	1650	0	1738	1671
Flt Permitted	0.950				0.471	
Satd. Flow (perm)	1722	1570	1650	0	862	1671
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		97	22			
Link Speed (k/h)	70		70			60
Link Distance (m)	184.1		195.9			753.7
Travel Time (s)	9.5		10.1			45.2
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	6%	4%	12%	14%	5%	15%
Adj. Flow (vph)	207	97	297	99	44	164
Shared Lane Traffic (%)						
Lane Group Flow (vph)	207	97	396	0	44	164
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		3.7			3.7
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (m)	6.1	6.1	30.5		6.1	30.5
Trailing Detector (m)	0.0	0.0	0.0		0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0		0.0	0.0
Detector 1 Size(m)	6.1	6.1	1.8		6.1	1.8
Detector 1 Type	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
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(m)			28.7			28.7
Detector 2 Size(m)			1.8			1.8
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Perm	Perm	NA		pm+pt	NA
Protected Phases			2		1	6

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases	8	8			6	
Detector Phase	8	8	2		1	6
Switch Phase						
Minimum Initial (s)	10.0	10.0	20.0		8.0	20.0
Minimum Split (s)	25.0	25.0	42.3		22.5	42.3
Total Split (s)	25.0	25.0	42.3		22.5	64.8
Total Split (%)	27.8%	27.8%	47.1%		25.1%	72.2%
Maximum Green (s)	18.0	18.0	35.0		19.5	57.5
Yellow Time (s)	5.0	5.0	5.0		3.0	5.0
All-Red Time (s)	2.0	2.0	2.3		0.0	2.3
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	7.0	7.0	7.3		3.0	7.3
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	2.4	2.4	2.4		2.8	2.4
Recall Mode	None	None	C-Max		None	C-Max
Walk Time (s)	7.0	7.0	13.0			13.0
Flash Dont Walk (s)	11.0	11.0	22.0			22.0
Pedestrian Calls (#/hr)	0	0	0			0
Act Effct Green (s)	14.8	14.8	54.1		65.0	60.7
Actuated g/C Ratio	0.16	0.16	0.60		0.72	0.68
v/c Ratio	0.73	0.29	0.40		0.06	0.15
Control Delay	50.3	9.1	12.0		4.4	6.2
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	50.3	9.1	12.0		4.4	6.2
LOS	D	A	B		A	A
Approach Delay	37.2		12.0			5.8
Approach LOS	D		B			A

Intersection Summary			
Area Type:	Other		
Cycle Length: 89.8			
Actuated Cycle Length: 89.8			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.73			
Intersection Signal Delay: 19.0		Intersection LOS: B	
Intersection Capacity Utilization 50.7%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 3: Taylor Road & Mountain Rd





Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	180	84	258	86	38	143
Future Volume (vph)	180	84	258	86	38	143
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.3		3.0	7.3
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.97		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1722	1570	1650		1738	1671
Flt Permitted	0.95	1.00	1.00		0.47	1.00
Satd. Flow (perm)	1722	1570	1650		861	1671
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	207	97	297	99	44	164
RTOR Reduction (vph)	0	81	9	0	0	0
Lane Group Flow (vph)	207	16	387	0	44	164
Heavy Vehicles (%)	6%	4%	12%	14%	5%	15%
Turn Type	Perm	Perm	NA		pm+pt	NA
Protected Phases			2		1	6
Permitted Phases	8	8			6	
Actuated Green, G (s)	14.8	14.8	52.9		60.7	60.7
Effective Green, g (s)	14.8	14.8	52.9		60.7	60.7
Actuated g/C Ratio	0.16	0.16	0.59		0.68	0.68
Clearance Time (s)	7.0	7.0	7.3		3.0	7.3
Vehicle Extension (s)	2.4	2.4	2.4		2.8	2.4
Lane Grp Cap (vph)	283	258	971		628	1129
v/s Ratio Prot			c0.23		0.00	c0.10
v/s Ratio Perm	c0.12	0.01			0.04	
v/c Ratio	0.73	0.06	0.40		0.07	0.15
Uniform Delay, d1	35.6	31.6	9.9		5.1	5.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	8.7	0.1	1.2		0.0	0.3
Delay (s)	44.3	31.7	11.1		5.1	5.5
Level of Service	D	C	B		A	A
Approach Delay (s)	40.3		11.1			5.4
Approach LOS	D		B			A

Intersection Summary			
HCM 2000 Control Delay	19.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	89.8	Sum of lost time (s)	17.3
Intersection Capacity Utilization	50.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	10	4	13	331	183	40
Future Volume (vph)	10	4	13	331	183	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	40.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	2.5		100.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.976	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1014	1089	1323	1746	1670	0
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1014	1089	1323	1746	1670	0
Link Speed (k/h)	48			60	60	
Link Distance (m)	375.1			753.7	268.8	
Travel Time (s)	28.1			45.2	16.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	80%	50%	38%	10%	11%	18%
Adj. Flow (vph)	11	4	14	360	199	43
Shared Lane Traffic (%)						
Lane Group Flow (vph)	11	4	14	360	242	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.4%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	4	13	331	183	40
Future Volume (Veh/h)	10	4	13	331	183	40
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	4	14	360	199	43
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	608	220	242			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	608	220	242			
tC, single (s)	7.2	6.7	4.5			
tC, 2 stage (s)						
tF (s)	4.2	3.8	2.5			
p0 queue free %	97	99	99			
cM capacity (veh/h)	349	713	1140			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	11	4	14	360	242
Volume Left	11	0	14	0	0
Volume Right	0	4	0	0	43
cSH	349	713	1140	1700	1700
Volume to Capacity	0.03	0.01	0.01	0.21	0.14
Queue Length 95th (m)	0.7	0.1	0.3	0.0	0.0
Control Delay (s)	15.7	10.1	8.2	0.0	0.0
Lane LOS	C	B	A		
Approach Delay (s)	14.2		0.3		0.0
Approach LOS	B				

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	27.4%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	13	24	46	322	284	33
Future Volume (vph)	13	24	46	322	284	33
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	50.0	0.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.986	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1393	1350	1644	1671	1593	0
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1393	1350	1644	1671	1593	0
Link Speed (k/h)	50			70	70	
Link Distance (m)	204.8			328.2	1008.3	
Travel Time (s)	14.7			16.9	51.9	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	31%	21%	11%	15%	19%	18%
Adj. Flow (vph)	14	26	49	346	305	35
Shared Lane Traffic (%)						
Lane Group Flow (vph)	14	26	49	346	340	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			7.4	7.4	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

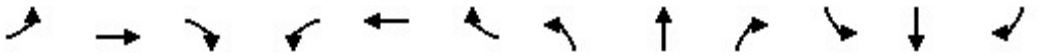
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 33.6%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	13	24	46	322	284	33
Future Volume (Veh/h)	13	24	46	322	284	33
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	14	26	49	346	305	35
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		7				
Median type				None	None	
Median storage veh)						
Upstream signal (m)				328		
pX, platoon unblocked						
vC, conflicting volume	766	322	340			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	766	322	340			
tC, single (s)	6.7	6.4	4.2			
tC, 2 stage (s)						
tF (s)	3.8	3.5	2.3			
p0 queue free %	96	96	96			
cM capacity (veh/h)	318	677	1171			

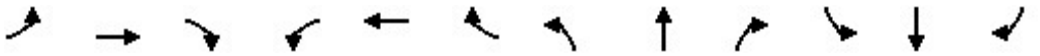
Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	40	49	346	340
Volume Left	14	49	0	0
Volume Right	26	0	0	35
cSH	910	1171	1700	1700
Volume to Capacity	0.04	0.04	0.20	0.20
Queue Length 95th (m)	1.0	1.0	0.0	0.0
Control Delay (s)	12.7	8.2	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	12.7	1.0		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	33.6%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	135	9	22	237	8	18	5	51	3	2	4
Future Volume (vph)	0	135	9	22	237	8	18	5	51	3	2	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt		0.991			0.996			0.907			0.940	
Flt Protected					0.996			0.988			0.984	
Satd. Flow (prot)	0	1697	0	0	1794	0	0	1675	0	0	1777	0
Flt Permitted					0.996			0.988			0.984	
Satd. Flow (perm)	0	1697	0	0	1794	0	0	1675	0	0	1777	0
Link Speed (k/h)		70			70			80			60	
Link Distance (m)		884.7			985.2			693.4			600.2	
Travel Time (s)		45.5			50.7			31.2			36.0	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	0%	13%	0%	0%	7%	0%	0%	0%	4%	0%	0%	0%
Adj. Flow (vph)	0	144	10	23	252	9	19	5	54	3	2	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	154	0	0	284	0	0	78	0	0	9	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)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Free			Free			Stop			Stop	

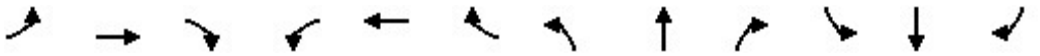
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 37.1%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	135	9	22	237	8	18	5	51	3	2	4
Future Volume (Veh/h)	0	135	9	22	237	8	18	5	51	3	2	4
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	0	144	10	23	252	9	19	5	54	3	2	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	261			154			456	456	149	508	456	256
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	261			154			456	456	149	508	456	256
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			96	99	94	99	100	99
cM capacity (veh/h)	1315			1439			507	496	892	441	495	787

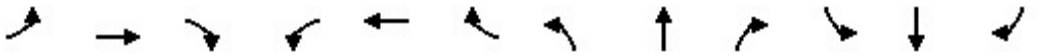
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	154	284	78	9
Volume Left	0	23	19	3
Volume Right	10	9	54	4
cSH	1315	1439	722	565
Volume to Capacity	0.00	0.02	0.11	0.02
Queue Length 95th (m)	0.0	0.4	2.8	0.4
Control Delay (s)	0.0	0.7	10.6	11.5
Lane LOS		A	B	B
Approach Delay (s)	0.0	0.7	10.6	11.5
Approach LOS			B	B

Intersection Summary				
Average Delay	2.2			
Intersection Capacity Utilization	37.1%	ICU Level of Service	A	
Analysis Period (min)	15			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	13	792	5	4	957	14	11	10	4	7	13	0
Future Volume (vph)	13	792	5	4	957	14	11	10	4	7	13	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.998			0.980				
Flt Protected		0.999						0.978			0.984	
Satd. Flow (prot)	0	3458	1633	0	3518	0	0	1646	0	0	1589	0
Flt Permitted		0.999						0.978			0.984	
Satd. Flow (perm)	0	3458	1633	0	3518	0	0	1646	0	0	1589	0
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		1007.9			1349.4			495.3			723.5	
Travel Time (s)		45.4			60.7			22.3			32.6	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	92%	4%	0%	25%	3%	36%	0%	20%	25%	57%	0%	0%
Adj. Flow (vph)	14	843	5	4	1018	15	12	11	4	7	14	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	857	5	0	1037	0	0	27	0	0	21	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	43.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	13	792	5	4	957	14	11	10	4	7	13	0
Future Volume (Veh/h)	13	792	5	4	957	14	11	10	4	7	13	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	14	843	5	4	1018	15	12	11	4	7	14	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1033			848			1395	1912	422	1492	1910	516
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1033			848			1395	1912	422	1492	1910	516
tC, single (s)	5.9			4.6			7.5	6.9	7.4	8.6	6.5	6.9
tC, 2 stage (s)												
tF (s)	3.1			2.5			3.5	4.2	3.5	4.1	4.0	3.3
p0 queue free %	96			99			85	79	99	83	79	100
cM capacity (veh/h)	318			654			83	52	521	41	66	509

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	SB 1
Volume Total	295	562	5	513	524	27	21
Volume Left	14	0	0	4	0	12	7
Volume Right	0	0	5	0	15	4	0
cSH	318	1700	1700	654	1700	74	55
Volume to Capacity	0.04	0.33	0.00	0.01	0.31	0.36	0.39
Queue Length 95th (m)	1.0	0.0	0.0	0.1	0.0	10.6	10.7
Control Delay (s)	1.6	0.0	0.0	0.2	0.0	79.0	107.5
Lane LOS	A			A		F	F
Approach Delay (s)	0.6			0.1		79.0	107.5
Approach LOS						F	F

Intersection Summary				
Average Delay	2.6			
Intersection Capacity Utilization	43.7%	ICU Level of Service		A
Analysis Period (min)	15			



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	1	37	323	2	21	332
Future Volume (vph)	1	37	323	2	21	332
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0		0.0	85.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	2.5				100.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.868		0.999			
Flt Protected	0.999				0.950	
Satd. Flow (prot)	1112	0	1685	0	1534	1614
Flt Permitted	0.999				0.950	
Satd. Flow (perm)	1112	0	1685	0	1534	1614
Link Speed (k/h)	80		70			70
Link Distance (m)	79.4		1008.3			713.0
Travel Time (s)	3.6		51.9			36.7
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	0%	51%	14%	0%	19%	19%
Adj. Flow (vph)	1	41	355	2	23	365
Shared Lane Traffic (%)						
Lane Group Flow (vph)	42	0	357	0	23	365
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		3.7			3.7
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	97		14	97	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.5%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	37	323	2	21	332
Future Volume (Veh/h)	1	37	323	2	21	332
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	1	41	355	2	23	365
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	767	356			357	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	767	356			357	
tC, single (s)	6.4	6.7			4.3	
tC, 2 stage (s)						
tF (s)	3.5	3.8			2.4	
p0 queue free %	100	93			98	
cM capacity (veh/h)	366	591			1113	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	42	357	23	365
Volume Left	1	0	23	0
Volume Right	41	2	0	0
cSH	582	1700	1113	1700
Volume to Capacity	0.07	0.21	0.02	0.21
Queue Length 95th (m)	1.8	0.0	0.5	0.0
Control Delay (s)	11.7	0.0	8.3	0.0
Lane LOS	B		A	
Approach Delay (s)	11.7	0.0	0.5	
Approach LOS	B			

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	27.5%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	30	13	29	54	24	8
Future Volume (vph)	30	13	29	54	24	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.960				0.966	
Flt Protected	0.966			0.983		
Satd. Flow (prot)	1506	0	0	1623	1485	0
Flt Permitted	0.966			0.983		
Satd. Flow (perm)	1506	0	0	1623	1485	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	307.8			204.8	258.0	
Travel Time (s)	22.2			14.7	18.6	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	13%	31%	34%	7%	25%	25%
Adj. Flow (vph)	38	16	36	68	30	10
Shared Lane Traffic (%)						
Lane Group Flow (vph)	54	0	0	104	40	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

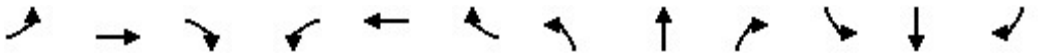
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 21.1%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	30	13	29	54	24	8
Future Volume (Veh/h)	30	13	29	54	24	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	38	16	36	68	30	10
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	175	35	40			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	175	35	40			
tC, single (s)	6.5	6.5	4.4			
tC, 2 stage (s)						
tF (s)	3.6	3.6	2.5			
p0 queue free %	95	98	97			
cM capacity (veh/h)	770	961	1387			

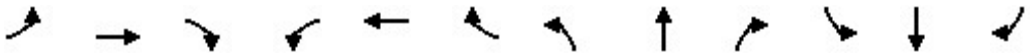
Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	54	104	40
Volume Left	38	36	0
Volume Right	16	0	10
cSH	818	1387	1700
Volume to Capacity	0.07	0.03	0.02
Queue Length 95th (m)	1.6	0.6	0.0
Control Delay (s)	9.7	2.8	0.0
Lane LOS	A	A	
Approach Delay (s)	9.7	2.8	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	21.1%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1	6	13	6	31	6	36	14	6	1	0
Future Volume (vph)	0	1	6	13	6	31	6	36	14	6	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt		0.880			0.916			0.966				
Flt Protected					0.987			0.994			0.957	
Satd. Flow (prot)	0	1522	0	0	1552	0	0	1610	0	0	1839	0
Flt Permitted					0.987			0.994			0.957	
Satd. Flow (perm)	0	1522	0	0	1552	0	0	1610	0	0	1839	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		108.3			156.3			390.5			72.5	
Travel Time (s)		7.8			11.3			28.1			5.2	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	0%	100%	0%	31%	17%	3%	17%	0%	50%	0%	0%	0%
Adj. Flow (vph)	0	1	8	16	8	39	8	45	18	8	1	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	9	0	0	63	0	0	71	0	0	9	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)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 19.6%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	0	1	6	13	6	31	6	36	14	6	1	0
Future Volume (vph)	0	1	6	13	6	31	6	36	14	6	1	0
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	0	1	8	16	8	39	8	45	18	8	1	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	9	63	71	9
Volume Left (vph)	0	16	8	8
Volume Right (vph)	8	39	18	0
Hadj (s)	-0.34	-0.12	0.12	0.18
Departure Headway (s)	3.8	4.0	4.2	4.3
Degree Utilization, x	0.01	0.07	0.08	0.01
Capacity (veh/h)	920	885	837	816
Control Delay (s)	6.8	7.3	7.6	7.3
Approach Delay (s)	6.8	7.3	7.6	7.3
Approach LOS	A	A	A	A

Intersection Summary				
Delay	7.4			
Level of Service	A			
Intersection Capacity Utilization	19.6%	ICU Level of Service	A	
Analysis Period (min)	15			



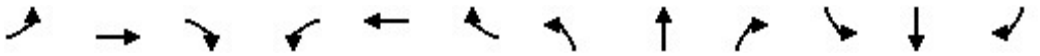
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	135	1	0	258	1	0
Future Volume (vph)	135	1	0	258	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.999					
Flt Protected					0.950	
Satd. Flow (prot)	1700	0	0	1830	1825	0
Flt Permitted					0.950	
Satd. Flow (perm)	1700	0	0	1830	1825	0
Link Speed (k/h)	70			70	50	
Link Distance (m)	184.1			884.7	224.6	
Travel Time (s)	9.5			45.5	16.2	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Heavy Vehicles (%)	13%	0%	0%	5%	0%	0%
Adj. Flow (vph)	167	1	0	319	1	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	168	0	0	319	1	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 23.6%		ICU Level of Service A	
Analysis Period (min) 15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	135	1	0	258	1	0
Future Volume (Veh/h)	135	1	0	258	1	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	167	1	0	319	1	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	184					
pX, platoon unblocked						
vC, conflicting volume			168		486	168
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			168		486	168
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1422		544	882

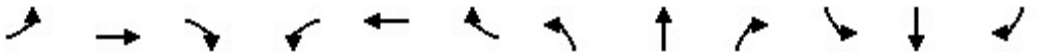
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	168	319	1
Volume Left	0	0	1
Volume Right	1	0	0
cSH	1700	1422	544
Volume to Capacity	0.10	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	11.6
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.6
Approach LOS			B

Intersection Summary			
Average Delay		0.0	
Intersection Capacity Utilization		23.6%	ICU Level of Service A
Analysis Period (min)		15	



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	10	0	0	2	2	64	3	3	19	0
Future Volume (vph)	0	0	10	0	0	2	2	64	3	3	19	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt		0.865			0.865			0.995				
Flt Protected								0.999			0.994	
Satd. Flow (prot)	0	1511	0	0	1662	0	0	1689	0	0	1492	0
Flt Permitted								0.999			0.994	
Satd. Flow (perm)	0	1511	0	0	1662	0	0	1689	0	0	1492	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		102.1			176.5			258.0			689.0	
Travel Time (s)		7.4			12.7			18.6			49.6	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	0%	10%	0%	0%	0%	0%	14%	0%	0%	32%	0%
Adj. Flow (vph)	0	0	11	0	0	2	2	71	3	3	21	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	11	0	0	2	0	0	76	0	0	24	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)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 13.9%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	10	0	0	2	2	64	3	3	19	0
Future Volume (Veh/h)	0	0	10	0	0	2	2	64	3	3	19	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	11	0	0	2	2	71	3	3	21	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	106	105	21	114	104	72	21			74		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	106	105	21	114	104	72	21			74		
tC, single (s)	7.1	6.5	6.3	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	99	100	100	100	100			100		
cM capacity (veh/h)	875	786	1034	856	788	995	1608			1538		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	11	2	76	24
Volume Left	0	0	2	3
Volume Right	11	2	3	0
cSH	1034	995	1608	1538
Volume to Capacity	0.01	0.00	0.00	0.00
Queue Length 95th (m)	0.2	0.0	0.0	0.0
Control Delay (s)	8.5	8.6	0.2	0.9
Lane LOS	A	A	A	A
Approach Delay (s)	8.5	8.6	0.2	0.9
Approach LOS	A	A		

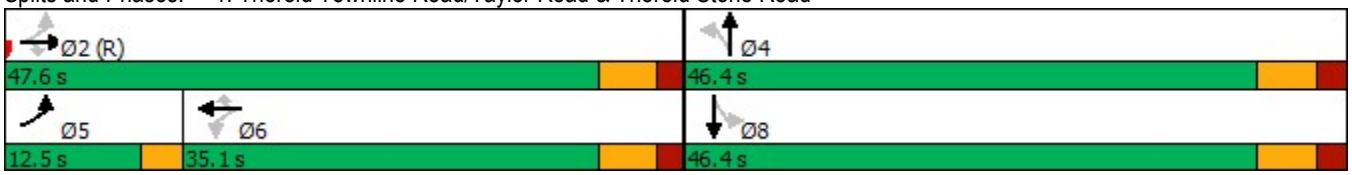
Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	13.9%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	268	808	34	19	991	38	26	124	31	26	73	204
Future Volume (vph)	268	808	34	19	991	38	26	124	31	26	73	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0		95.0	85.0		90.0	100.0		0.0	80.0		0.0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (m)	85.0			100.0			90.0			40.0		
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		0.970			0.889	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1601	3544	1498	1825	3544	1633	1755	1691	0	1534	1491	0
Flt Permitted	0.135			0.323			0.267			0.573		
Satd. Flow (perm)	227	3544	1498	621	3544	1633	493	1691	0	925	1491	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			39			74		17			187	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		291.4			1007.9			528.0			328.2	
Travel Time (s)		13.1			45.4			23.8			14.8	
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
Heavy Vehicles (%)	14%	3%	9%	0%	3%	0%	4%	8%	19%	19%	16%	14%
Adj. Flow (vph)	291	878	37	21	1077	41	28	135	34	28	79	222
Shared Lane Traffic (%)												
Lane Group Flow (vph)	291	878	37	21	1077	41	28	169	0	28	301	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)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5	6.1	6.1	30.5	6.1	6.1	30.5		6.1	30.5	
Trailing Detector (m)	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	
Detector 1 Size(m)	6.1	1.8	6.1	6.1	1.8	6.1	6.1	1.8		6.1	1.8	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
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	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2			6			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2		2	6		6	4	4		8		
Detector Phase	5	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	12.5	35.1	35.1	35.1	35.1	35.1	46.4	46.4		46.4	46.4	
Total Split (s)	12.5	47.6	47.6	35.1	35.1	35.1	46.4	46.4		46.4	46.4	
Total Split (%)	13.3%	50.6%	50.6%	37.3%	37.3%	37.3%	49.4%	49.4%		49.4%	49.4%	
Maximum Green (s)	9.5	41.5	41.5	29.0	29.0	29.0	40.0	40.0		40.0	40.0	
Yellow Time (s)	3.0	4.1	4.1	4.1	4.1	4.1	4.1	4.1		4.1	4.1	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.3	2.3		2.3	2.3	
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)	3.0	6.1	6.1	6.1	6.1	6.1	6.4	6.4		6.4	6.4	
Lead/Lag	Lead			Lag	Lag	Lag						
Lead-Lag Optimize?	Yes			Yes	Yes	Yes						
Vehicle Extension (s)	2.5	6.0	6.0	6.0	6.0	6.0	2.3	2.3		2.3	2.3	
Recall Mode	None	C-Max	C-Max	None	None	None	None	None		None	None	
Walk Time (s)		11.0	11.0	11.0	11.0	11.0	15.0	15.0		15.0	15.0	
Flash Dont Walk (s)		18.0	18.0	18.0	18.0	18.0	25.0	25.0		25.0	25.0	
Pedestrian Calls (#/hr)		0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	69.6	66.5	66.5	40.7	40.7	40.7	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.74	0.71	0.71	0.43	0.43	0.43	0.16	0.16		0.16	0.16	
v/c Ratio	0.58	0.35	0.03	0.08	0.70	0.05	0.36	0.60		0.19	0.76	
Control Delay	17.2	6.4	2.2	19.1	25.9	1.9	45.8	40.7		34.7	27.1	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	17.2	6.4	2.2	19.1	25.9	1.9	45.8	40.7		34.7	27.1	
LOS	B	A	A	B	C	A	D	D		C	C	
Approach Delay		8.9			24.9			41.5			27.7	
Approach LOS		A			C			D			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 94			
Actuated Cycle Length: 94			
Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Green			
Natural Cycle: 95			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.76			
Intersection Signal Delay: 19.7		Intersection LOS: B	
Intersection Capacity Utilization 77.6%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 1: Thorold Townline Road/Taylor Road & Thorold Stone Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	268	808	34	19	991	38	26	124	31	26	73	204
Future Volume (vph)	268	808	34	19	991	38	26	124	31	26	73	204
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.1	6.1	6.1	6.1	6.1	6.4	6.4		6.4	6.4	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1601	3544	1498	1825	3544	1633	1755	1690		1534	1492	
Flt Permitted	0.14	1.00	1.00	0.32	1.00	1.00	0.27	1.00		0.57	1.00	
Satd. Flow (perm)	228	3544	1498	621	3544	1633	493	1690		925	1492	
Peak-hour factor, PHF	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)	291	878	37	21	1077	41	28	135	34	28	79	222
RTOR Reduction (vph)	0	0	11	0	0	23	0	14	0	0	157	0
Lane Group Flow (vph)	291	878	26	21	1077	18	28	155	0	28	144	0
Heavy Vehicles (%)	14%	3%	9%	0%	3%	0%	4%	8%	19%	19%	16%	14%
Turn Type	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2			6			4			8	
Permitted Phases	2		2	6		6	4	4		8		
Actuated Green, G (s)	66.5	66.5	66.5	40.7	40.7	40.7	15.0	15.0		15.0	15.0	
Effective Green, g (s)	66.5	66.5	66.5	40.7	40.7	40.7	15.0	15.0		15.0	15.0	
Actuated g/C Ratio	0.71	0.71	0.71	0.43	0.43	0.43	0.16	0.16		0.16	0.16	
Clearance Time (s)	3.0	6.1	6.1	6.1	6.1	6.1	6.4	6.4		6.4	6.4	
Vehicle Extension (s)	2.5	6.0	6.0	6.0	6.0	6.0	2.3	2.3		2.3	2.3	
Lane Grp Cap (vph)	494	2507	1059	268	1534	707	78	269		147	238	
v/s Ratio Prot	c0.14	0.25			c0.30			0.09			c0.10	
v/s Ratio Perm	0.27		0.02	0.03		0.01	0.06			0.03		
v/c Ratio	0.59	0.35	0.02	0.08	0.70	0.03	0.36	0.58		0.19	0.60	
Uniform Delay, d1	14.5	5.3	4.1	15.6	21.7	15.3	35.2	36.6		34.2	36.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.5	0.4	0.0	0.4	2.2	0.0	1.6	2.2		0.4	3.4	
Delay (s)	16.0	5.7	4.1	16.0	23.9	15.3	36.9	38.8		34.6	40.1	
Level of Service	B	A	A	B	C	B	D	D		C	D	
Approach Delay (s)		8.2			23.4			38.5			39.6	
Approach LOS		A			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	19.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	94.0	Sum of lost time (s)	15.5
Intersection Capacity Utilization	77.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

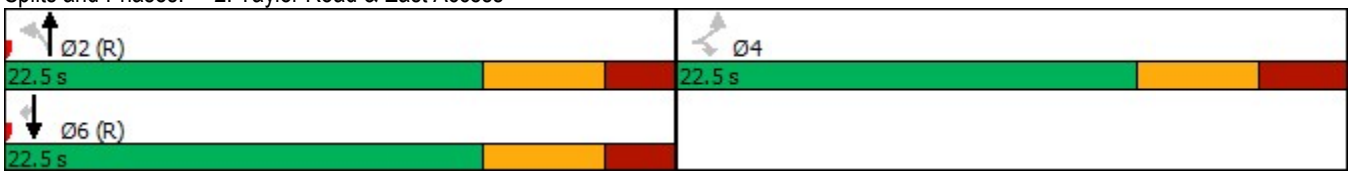


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	10	18	19	349	323	12
Future Volume (vph)	10	18	19	349	323	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	110.0			80.0
Storage Lanes	1	1	1			1
Taper Length (m)	2.5		100.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950		0.950			
Satd. Flow (prot)	913	816	913	1812	1830	978
Flt Permitted	0.950		0.541			
Satd. Flow (perm)	913	816	520	1812	1830	978
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		21				14
Link Speed (k/h)	50			70	70	
Link Distance (m)	70.6			713.0	427.2	
Travel Time (s)	5.1			36.7	22.0	
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	100%	100%	100%	6%	5%	67%
Adj. Flow (vph)	11	21	22	401	371	14
Shared Lane Traffic (%)						
Lane Group Flow (vph)	11	21	22	401	371	14
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	6.1	6.1	6.1	30.5	30.5	6.1
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)	6.1	6.1	6.1	1.8	1.8	6.1
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)				28.7	28.7	
Detector 2 Size(m)				1.8	1.8	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Perm	Perm	Perm	NA	NA	Perm
Protected Phases				2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases	4	4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	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
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Maximum Green (s)	15.4	15.4	16.0	16.0	16.0	16.0
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.0	3.0	2.4	2.4	2.4	2.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.1	7.1	6.5	6.5	6.5	6.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	4.0	4.0	2.5	2.5	2.5	2.5
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	0.0	0.0	0.0	0.0	0.0	0.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	10.0	10.0	40.3	40.3	40.3	40.3
Actuated g/C Ratio	0.22	0.22	0.90	0.90	0.90	0.90
v/c Ratio	0.05	0.11	0.05	0.25	0.23	0.02
Control Delay	14.9	8.9	4.1	3.4	3.2	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.9	8.9	4.1	3.4	3.2	2.8
LOS	B	A	A	A	A	A
Approach Delay	11.0			3.4	3.2	
Approach LOS	B			A	A	

Intersection Summary			
Area Type:	Other		
Cycle Length: 45			
Actuated Cycle Length: 45			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green			
Natural Cycle: 45			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.25			
Intersection Signal Delay: 3.6		Intersection LOS: A	
Intersection Capacity Utilization 38.0%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: Taylor Road & East Access





Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	10	18	19	349	323	12
Future Volume (vph)	10	18	19	349	323	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.1	7.1	6.5	6.5	6.5	6.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	913	816	913	1812	1830	978
Flt Permitted	0.95	1.00	0.54	1.00	1.00	1.00
Satd. Flow (perm)	913	816	519	1812	1830	978
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	11	21	22	401	371	14
RTOR Reduction (vph)	0	20	0	0	0	5
Lane Group Flow (vph)	11	1	22	401	371	9
Heavy Vehicles (%)	100%	100%	100%	6%	5%	67%
Turn Type	Perm	Perm	Perm	NA	NA	Perm
Protected Phases				2	6	
Permitted Phases	4	4	2			6
Actuated Green, G (s)	2.0	2.0	29.4	29.4	29.4	29.4
Effective Green, g (s)	2.0	2.0	29.4	29.4	29.4	29.4
Actuated g/C Ratio	0.04	0.04	0.65	0.65	0.65	0.65
Clearance Time (s)	7.1	7.1	6.5	6.5	6.5	6.5
Vehicle Extension (s)	4.0	4.0	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	40	36	339	1183	1195	638
v/s Ratio Prot				c0.22	0.20	
v/s Ratio Perm	c0.01	0.00	0.04			0.01
v/c Ratio	0.28	0.03	0.06	0.34	0.31	0.01
Uniform Delay, d1	20.8	20.6	2.8	3.5	3.4	2.7
Progression Factor	1.01	1.01	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.0	0.4	0.4	0.8	0.7	0.0
Delay (s)	26.1	21.1	3.2	4.3	4.1	2.8
Level of Service	C	C	A	A	A	A
Approach Delay (s)	22.8			4.2	4.0	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	4.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	13.6
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

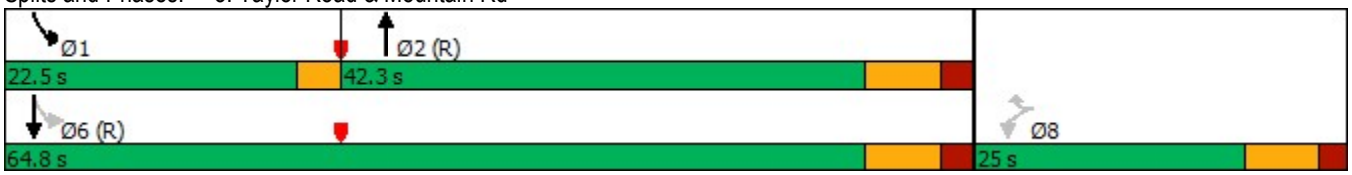


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	187	89	266	84	38	147
Future Volume (vph)	187	89	266	84	38	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0	0.0		0.0	95.0	
Storage Lanes	1	1		0	1	
Taper Length (m)	100.0				100.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850	0.968			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1738	1570	1683	0	1738	1700
Flt Permitted	0.950				0.465	
Satd. Flow (perm)	1738	1570	1683	0	851	1700
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		102	21			
Link Speed (k/h)	70		70			60
Link Distance (m)	184.1		195.9			753.7
Travel Time (s)	9.5		10.1			45.2
Peak Hour Factor	0.87	0.87	0.87	0.87	0.87	0.87
Heavy Vehicles (%)	5%	4%	10%	12%	5%	13%
Adj. Flow (vph)	215	102	306	97	44	169
Shared Lane Traffic (%)						
Lane Group Flow (vph)	215	102	403	0	44	169
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		3.7			3.7
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (m)	6.1	6.1	30.5		6.1	30.5
Trailing Detector (m)	0.0	0.0	0.0		0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0		0.0	0.0
Detector 1 Size(m)	6.1	6.1	1.8		6.1	1.8
Detector 1 Type	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
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(m)			28.7			28.7
Detector 2 Size(m)			1.8			1.8
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Perm	Perm	NA		pm+pt	NA
Protected Phases			2		1	6

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases	8	8			6	
Detector Phase	8	8	2		1	6
Switch Phase						
Minimum Initial (s)	10.0	10.0	20.0		8.0	20.0
Minimum Split (s)	25.0	25.0	42.3		22.5	42.3
Total Split (s)	25.0	25.0	42.3		22.5	64.8
Total Split (%)	27.8%	27.8%	47.1%		25.1%	72.2%
Maximum Green (s)	18.0	18.0	35.0		19.5	57.5
Yellow Time (s)	5.0	5.0	5.0		3.0	5.0
All-Red Time (s)	2.0	2.0	2.3		0.0	2.3
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	7.0	7.0	7.3		3.0	7.3
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	2.4	2.4	2.4		2.8	2.4
Recall Mode	None	None	C-Max		None	C-Max
Walk Time (s)	7.0	7.0	13.0			13.0
Flash Dont Walk (s)	11.0	11.0	22.0			22.0
Pedestrian Calls (#/hr)	0	0	0			0
Act Effct Green (s)	15.0	15.0	53.9		64.8	60.5
Actuated g/C Ratio	0.17	0.17	0.60		0.72	0.67
v/c Ratio	0.74	0.29	0.40		0.06	0.15
Control Delay	50.9	9.0	12.1		4.4	6.2
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	50.9	9.0	12.1		4.4	6.2
LOS	D	A	B		A	A
Approach Delay	37.4		12.1			5.9
Approach LOS	D		B			A

Intersection Summary			
Area Type:	Other		
Cycle Length: 89.8			
Actuated Cycle Length: 89.8			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.74			
Intersection Signal Delay: 19.3		Intersection LOS: B	
Intersection Capacity Utilization 51.4%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 3: Taylor Road & Mountain Rd





Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	187	89	266	84	38	147
Future Volume (vph)	187	89	266	84	38	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.3		3.0	7.3
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.97		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1570	1682		1738	1700
Flt Permitted	0.95	1.00	1.00		0.46	1.00
Satd. Flow (perm)	1738	1570	1682		850	1700
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	215	102	306	97	44	169
RTOR Reduction (vph)	0	85	9	0	0	0
Lane Group Flow (vph)	215	17	394	0	44	169
Heavy Vehicles (%)	5%	4%	10%	12%	5%	13%
Turn Type	Perm	Perm	NA		pm+pt	NA
Protected Phases			2		1	6
Permitted Phases	8	8			6	
Actuated Green, G (s)	15.0	15.0	52.7		60.5	60.5
Effective Green, g (s)	15.0	15.0	52.7		60.5	60.5
Actuated g/C Ratio	0.17	0.17	0.59		0.67	0.67
Clearance Time (s)	7.0	7.0	7.3		3.0	7.3
Vehicle Extension (s)	2.4	2.4	2.4		2.8	2.4
Lane Grp Cap (vph)	290	262	987		620	1145
v/s Ratio Prot			c0.23		0.00	c0.10
v/s Ratio Perm	c0.12	0.01			0.04	
v/c Ratio	0.74	0.07	0.40		0.07	0.15
Uniform Delay, d1	35.6	31.5	10.0		5.1	5.3
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	9.2	0.1	1.2		0.0	0.3
Delay (s)	44.7	31.6	11.2		5.2	5.6
Level of Service	D	C	B		A	A
Approach Delay (s)	40.5		11.2			5.5
Approach LOS	D		B			A

Intersection Summary			
HCM 2000 Control Delay	19.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	89.8	Sum of lost time (s)	17.3
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	7	3	10	343	190	38
Future Volume (vph)	7	3	10	343	190	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	40.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	2.5		100.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.978	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1067	1228	1521	1762	1688	0
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1067	1228	1521	1762	1688	0
Link Speed (k/h)	48			60	60	
Link Distance (m)	375.1			753.7	268.8	
Travel Time (s)	28.1			45.2	16.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	71%	33%	20%	9%	11%	13%
Adj. Flow (vph)	8	3	11	373	207	41
Shared Lane Traffic (%)						
Lane Group Flow (vph)	8	3	11	373	248	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 28.1%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	3	10	343	190	38
Future Volume (Veh/h)	7	3	10	343	190	38
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	3	11	373	207	41
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	622	228	248			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	622	228	248			
tC, single (s)	7.1	6.5	4.3			
tC, 2 stage (s)						
tF (s)	4.1	3.6	2.4			
p0 queue free %	98	100	99			
cM capacity (veh/h)	353	741	1220			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	8	3	11	373	248
Volume Left	8	0	11	0	0
Volume Right	0	3	0	0	41
cSH	353	741	1220	1700	1700
Volume to Capacity	0.02	0.00	0.01	0.22	0.15
Queue Length 95th (m)	0.5	0.1	0.2	0.0	0.0
Control Delay (s)	15.4	9.9	8.0	0.0	0.0
Lane LOS	C	A	A		
Approach Delay (s)	13.9		0.2		0.0
Approach LOS	B				

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	28.1%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	11	23	45	332	292	30
Future Volume (vph)	11	23	45	332	292	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	50.0	0.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.988	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1547	1396	1674	1700	1631	0
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1547	1396	1674	1700	1631	0
Link Speed (k/h)	50			70	70	
Link Distance (m)	204.8			328.2	1008.3	
Travel Time (s)	14.7			16.9	51.9	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	18%	17%	9%	13%	17%	10%
Adj. Flow (vph)	12	25	48	357	314	32
Shared Lane Traffic (%)						
Lane Group Flow (vph)	12	25	48	357	346	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			7.4	7.4	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

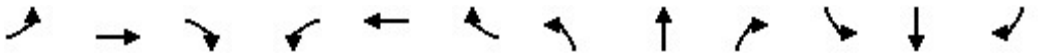
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 33.9%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	11	23	45	332	292	30
Future Volume (Veh/h)	11	23	45	332	292	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	12	25	48	357	314	32
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		7				
Median type				None	None	
Median storage veh)						
Upstream signal (m)				328		
pX, platoon unblocked						
vC, conflicting volume	783	330	346			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	783	330	346			
tC, single (s)	6.6	6.4	4.2			
tC, 2 stage (s)						
tF (s)	3.7	3.5	2.3			
p0 queue free %	96	96	96			
cM capacity (veh/h)	327	678	1175			

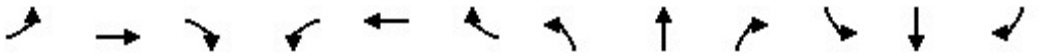
Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	37	48	357	346
Volume Left	12	48	0	0
Volume Right	25	0	0	32
cSH	1004	1175	1700	1700
Volume to Capacity	0.04	0.04	0.21	0.20
Queue Length 95th (m)	0.9	1.0	0.0	0.0
Control Delay (s)	12.4	8.2	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	12.4	1.0		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	33.9%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	140	9	22	247	8	18	5	51	3	2	4
Future Volume (vph)	0	140	9	22	247	8	18	5	51	3	2	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt		0.992			0.996			0.907			0.940	
Flt Protected					0.996			0.988			0.984	
Satd. Flow (prot)	0	1728	0	0	1809	0	0	1675	0	0	1777	0
Flt Permitted					0.996			0.988			0.984	
Satd. Flow (perm)	0	1728	0	0	1809	0	0	1675	0	0	1777	0
Link Speed (k/h)		70			70			80			60	
Link Distance (m)		884.7			985.2			693.4			600.2	
Travel Time (s)		45.5			50.7			31.2			36.0	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	0%	11%	0%	0%	6%	0%	0%	0%	4%	0%	0%	0%
Adj. Flow (vph)	0	149	10	23	263	9	19	5	54	3	2	4
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	159	0	0	295	0	0	78	0	0	9	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)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Free			Free			Stop			Stop	

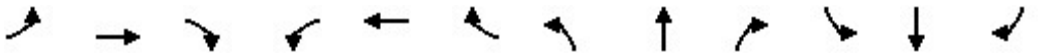
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 37.9%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	140	9	22	247	8	18	5	51	3	2	4
Future Volume (Veh/h)	0	140	9	22	247	8	18	5	51	3	2	4
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	0	149	10	23	263	9	19	5	54	3	2	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	272			159			472	472	154	524	472	268
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	272			159			472	472	154	524	472	268
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			96	99	94	99	100	99
cM capacity (veh/h)	1303			1433			495	485	887	430	485	776

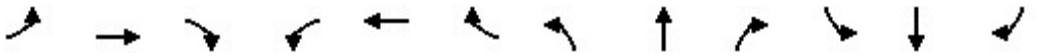
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	159	295	78	9
Volume Left	0	23	19	3
Volume Right	10	9	54	4
cSH	1303	1433	712	554
Volume to Capacity	0.00	0.02	0.11	0.02
Queue Length 95th (m)	0.0	0.4	2.8	0.4
Control Delay (s)	0.0	0.7	10.7	11.6
Lane LOS		A	B	B
Approach Delay (s)	0.0	0.7	10.7	11.6
Approach LOS			B	B

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	37.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	9	875	5	4	1056	12	11	9	4	5	13	0
Future Volume (vph)	9	875	5	4	1056	12	11	9	4	5	13	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.998			0.979				
Flt Protected		0.999						0.977			0.987	
Satd. Flow (prot)	0	3476	1633	0	3525	0	0	1700	0	0	1716	0
Flt Permitted		0.999						0.977			0.987	
Satd. Flow (perm)	0	3476	1633	0	3525	0	0	1700	0	0	1716	0
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		1007.9			1349.4			495.3			723.5	
Travel Time (s)		45.4			60.7			22.3			32.6	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	89%	4%	0%	25%	3%	25%	0%	11%	25%	40%	0%	0%
Adj. Flow (vph)	10	931	5	4	1123	13	12	10	4	5	14	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	941	5	0	1140	0	0	26	0	0	19	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 46.4%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	875	5	4	1056	12	11	9	4	5	13	0
Future Volume (Veh/h)	9	875	5	4	1056	12	11	9	4	5	13	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	10	931	5	4	1123	13	12	10	4	5	14	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1136			936			1528	2095	466	1632	2094	568
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1136			936			1528	2095	466	1632	2094	568
tC, single (s)	5.9			4.6			7.5	6.7	7.4	8.3	6.5	6.9
tC, 2 stage (s)												
tF (s)	3.1			2.5			3.5	4.1	3.5	3.9	4.0	3.3
p0 queue free %	96			99			81	77	99	86	72	100
cM capacity (veh/h)	285			601			63	44	486	36	51	471

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	SB 1
Volume Total	320	621	5	566	574	26	19
Volume Left	10	0	0	4	0	12	5
Volume Right	0	0	5	0	13	4	0
cSH	285	1700	1700	601	1700	61	46
Volume to Capacity	0.04	0.37	0.00	0.01	0.34	0.43	0.41
Queue Length 95th (m)	0.8	0.0	0.0	0.2	0.0	12.3	11.2
Control Delay (s)	1.3	0.0	0.0	0.2	0.0	102.1	130.3
Lane LOS	A			A		F	F
Approach Delay (s)	0.4			0.1		102.1	130.3
Approach LOS						F	F

Intersection Summary				
Average Delay	2.7			
Intersection Capacity Utilization	46.4%	ICU Level of Service		A
Analysis Period (min)	15			



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	1	30	332	2	19	339
Future Volume (vph)	1	30	332	2	19	339
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0		0.0	85.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	2.5				100.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.869		0.999			
Flt Protected	0.999				0.950	
Satd. Flow (prot)	1201	0	1715	0	1644	1656
Flt Permitted	0.999				0.950	
Satd. Flow (perm)	1201	0	1715	0	1644	1656
Link Speed (k/h)	80		70			70
Link Distance (m)	79.4		1008.3			713.0
Travel Time (s)	3.6		51.9			36.7
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	0%	40%	12%	0%	11%	16%
Adj. Flow (vph)	1	33	365	2	21	373
Shared Lane Traffic (%)						
Lane Group Flow (vph)	34	0	367	0	21	373
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		3.7			3.7
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	97		14	97	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 27.8%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	1	30	332	2	19	339
Future Volume (Veh/h)	1	30	332	2	19	339
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	1	33	365	2	21	373
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	781	366			367	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	781	366			367	
tC, single (s)	6.4	6.6			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.7			2.3	
p0 queue free %	100	95			98	
cM capacity (veh/h)	359	602			1144	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	34	367	21	373
Volume Left	1	0	21	0
Volume Right	33	2	0	0
cSH	590	1700	1144	1700
Volume to Capacity	0.06	0.22	0.02	0.22
Queue Length 95th (m)	1.4	0.0	0.4	0.0
Control Delay (s)	11.5	0.0	8.2	0.0
Lane LOS	B		A	
Approach Delay (s)	11.5	0.0	0.4	
Approach LOS	B			

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	27.8%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	29	12	26	53	22	8
Future Volume (vph)	29	12	26	53	22	8
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.960				0.964	
Flt Protected	0.966			0.984		
Satd. Flow (prot)	1557	0	0	1673	1545	0
Flt Permitted	0.966			0.984		
Satd. Flow (perm)	1557	0	0	1673	1545	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	307.8			204.8	258.0	
Travel Time (s)	22.2			14.7	18.6	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	10%	25%	27%	6%	18%	25%
Adj. Flow (vph)	36	15	33	66	28	10
Shared Lane Traffic (%)						
Lane Group Flow (vph)	51	0	0	99	38	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

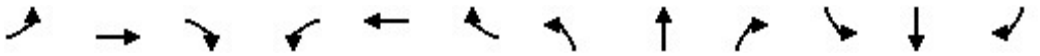
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 20.9%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	29	12	26	53	22	8
Future Volume (Veh/h)	29	12	26	53	22	8
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	36	15	32	66	28	10
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	163	33	38			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	163	33	38			
tC, single (s)	6.5	6.5	4.4			
tC, 2 stage (s)						
tF (s)	3.6	3.5	2.4			
p0 queue free %	95	98	98			
cM capacity (veh/h)	791	978	1425			

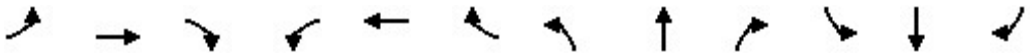
Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	51	98	38
Volume Left	36	32	0
Volume Right	15	0	10
cSH	838	1425	1700
Volume to Capacity	0.06	0.02	0.02
Queue Length 95th (m)	1.5	0.5	0.0
Control Delay (s)	9.6	2.6	0.0
Lane LOS	A	A	
Approach Delay (s)	9.6	2.6	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	20.9%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1	6	11	6	31	6	36	12	6	1	0
Future Volume (vph)	0	1	6	11	6	31	6	36	12	6	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt		0.880			0.914			0.970				
Flt Protected					0.989			0.994			0.957	
Satd. Flow (prot)	0	1522	0	0	1604	0	0	1665	0	0	1839	0
Flt Permitted					0.989			0.994			0.957	
Satd. Flow (perm)	0	1522	0	0	1604	0	0	1665	0	0	1839	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		108.3			156.3			390.5			72.5	
Travel Time (s)		7.8			11.3			28.1			5.2	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	0%	100%	0%	18%	17%	3%	17%	0%	42%	0%	0%	0%
Adj. Flow (vph)	0	1	8	14	8	39	8	45	15	8	1	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	9	0	0	61	0	0	68	0	0	9	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)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 19.5%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	0	1	6	11	6	31	6	36	12	6	1	0
Future Volume (vph)	0	1	6	11	6	31	6	36	12	6	1	0
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	0	1	8	14	8	39	8	45	15	8	1	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	9	61	68	9
Volume Left (vph)	0	14	8	8
Volume Right (vph)	8	39	15	0
Hadj (s)	-0.34	-0.20	0.08	0.18
Departure Headway (s)	3.8	3.9	4.1	4.3
Degree Utilization, x	0.01	0.07	0.08	0.01
Capacity (veh/h)	924	905	846	819
Control Delay (s)	6.8	7.2	7.5	7.3
Approach Delay (s)	6.8	7.2	7.5	7.3
Approach LOS	A	A	A	A

Intersection Summary				
Delay	7.3			
Level of Service	A			
Intersection Capacity Utilization	19.5%	ICU Level of Service	A	
Analysis Period (min)	15			



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	140	1	0	269	1	0
Future Volume (vph)	140	1	0	269	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.999					
Flt Protected					0.950	
Satd. Flow (prot)	1730	0	0	1830	1825	0
Flt Permitted					0.950	
Satd. Flow (perm)	1730	0	0	1830	1825	0
Link Speed (k/h)	70			70	50	
Link Distance (m)	184.1			884.7	224.6	
Travel Time (s)	9.5			45.5	16.2	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Heavy Vehicles (%)	11%	0%	0%	5%	0%	0%
Adj. Flow (vph)	173	1	0	332	1	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	174	0	0	332	1	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

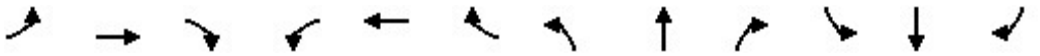
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 24.2%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	140	1	0	269	1	0
Future Volume (Veh/h)	140	1	0	269	1	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.81	0.81	0.81	0.81	0.81	0.81
Hourly flow rate (vph)	173	1	0	332	1	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	184					
pX, platoon unblocked						
vC, conflicting volume			174		506	174
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			174		506	174
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1415		530	875

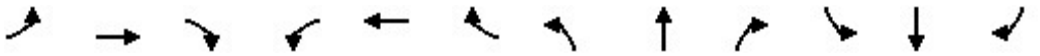
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	174	332	1
Volume Left	0	0	1
Volume Right	1	0	0
cSH	1700	1415	530
Volume to Capacity	0.10	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	11.8
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.8
Approach LOS			B

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	24.2%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	10	0	0	2	2	62	3	3	17	0
Future Volume (vph)	0	0	10	0	0	2	2	62	3	3	17	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt		0.865			0.865			0.995				
Flt Protected								0.999			0.993	
Satd. Flow (prot)	0	1511	0	0	1662	0	0	1732	0	0	1580	0
Flt Permitted								0.999			0.993	
Satd. Flow (perm)	0	1511	0	0	1662	0	0	1732	0	0	1580	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		102.1			176.5			258.0			689.0	
Travel Time (s)		7.4			12.7			18.6			49.6	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	0%	10%	0%	0%	0%	0%	11%	0%	0%	24%	0%
Adj. Flow (vph)	0	0	11	0	0	2	2	69	3	3	19	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	11	0	0	2	0	0	74	0	0	22	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)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 13.8%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	10	0	0	2	2	62	3	3	17	0
Future Volume (Veh/h)	0	0	10	0	0	2	2	62	3	3	17	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	11	0	0	2	2	69	3	3	19	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	102	101	19	110	100	70	19			72		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	102	101	19	110	100	70	19			72		
tC, single (s)	7.1	6.5	6.3	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	99	100	100	100	100			100		
cM capacity (veh/h)	880	790	1036	861	792	998	1611			1541		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	11	2	74	22
Volume Left	0	0	2	3
Volume Right	11	2	3	0
cSH	1036	998	1611	1541
Volume to Capacity	0.01	0.00	0.00	0.00
Queue Length 95th (m)	0.2	0.0	0.0	0.0
Control Delay (s)	8.5	8.6	0.2	1.0
Lane LOS	A	A	A	A
Approach Delay (s)	8.5	8.6	0.2	1.0
Approach LOS	A	A		

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	13.8%	ICU Level of Service	A	
Analysis Period (min)	15			

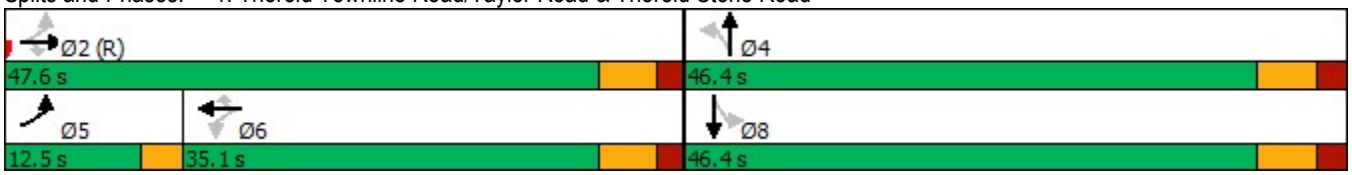
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	241	1160	48	36	896	33	57	89	20	51	165	254
Future Volume (vph)	241	1160	48	36	896	33	57	89	20	51	165	254
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0		95.0	85.0		90.0	100.0		0.0	80.0		0.0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (m)	85.0			100.0			90.0			40.0		
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		0.972			0.909	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1659	3579	1512	1825	3579	1201	1706	1701	0	1825	1611	0
Flt Permitted	0.172			0.236			0.213			0.684		
Satd. Flow (perm)	300	3579	1512	453	3579	1201	382	1701	0	1314	1611	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			49			74		15			103	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		291.4			1007.9			528.0			328.2	
Travel Time (s)		13.1			45.4			23.8			14.8	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	10%	2%	8%	0%	2%	36%	7%	12%	0%	0%	9%	8%
Adj. Flow (vph)	248	1196	49	37	924	34	59	92	21	53	170	262
Shared Lane Traffic (%)												
Lane Group Flow (vph)	248	1196	49	37	924	34	59	113	0	53	432	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)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5	6.1	6.1	30.5	6.1	6.1	30.5		6.1	30.5	
Trailing Detector (m)	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	
Detector 1 Size(m)	6.1	1.8	6.1	6.1	1.8	6.1	6.1	1.8		6.1	1.8	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
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	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2			6			4			8	

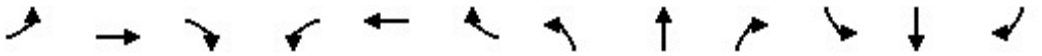
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2		2	6		6	4	4		8		
Detector Phase	5	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	12.5	35.1	35.1	35.1	35.1	35.1	46.4	46.4		46.4	46.4	
Total Split (s)	12.5	47.6	47.6	35.1	35.1	35.1	46.4	46.4		46.4	46.4	
Total Split (%)	13.3%	50.6%	50.6%	37.3%	37.3%	37.3%	49.4%	49.4%		49.4%	49.4%	
Maximum Green (s)	9.5	41.5	41.5	29.0	29.0	29.0	40.0	40.0		40.0	40.0	
Yellow Time (s)	3.0	4.1	4.1	4.1	4.1	4.1	4.1	4.1		4.1	4.1	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.3	2.3		2.3	2.3	
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)	3.0	6.1	6.1	6.1	6.1	6.1	6.4	6.4		6.4	6.4	
Lead/Lag	Lead			Lag	Lag	Lag						
Lead-Lag Optimize?	Yes			Yes	Yes	Yes						
Vehicle Extension (s)	2.5	6.0	6.0	6.0	6.0	6.0	2.3	2.3		2.3	2.3	
Recall Mode	None	C-Max	C-Max	None	None	None	None	None		None	None	
Walk Time (s)		11.0	11.0	11.0	11.0	11.0	15.0	15.0		15.0	15.0	
Flash Dont Walk (s)		18.0	18.0	18.0	18.0	18.0	25.0	25.0		25.0	25.0	
Pedestrian Calls (#/hr)		0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	58.7	55.6	55.6	37.4	37.4	37.4	25.9	25.9		25.9	25.9	
Actuated g/C Ratio	0.62	0.59	0.59	0.40	0.40	0.40	0.28	0.28		0.28	0.28	
v/c Ratio	0.61	0.56	0.05	0.21	0.65	0.07	0.56	0.24		0.15	0.83	
Control Delay	18.3	14.6	4.0	26.7	27.6	1.0	47.5	21.6		23.4	37.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	18.3	14.6	4.0	26.7	27.6	1.0	47.5	21.6		23.4	37.7	
LOS	B	B	A	C	C	A	D	C		C	D	
Approach Delay		14.9			26.6			30.5			36.1	
Approach LOS		B			C			C			D	

Intersection Summary

Area Type: Other
Cycle Length: 94
Actuated Cycle Length: 94
Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 22.7 Intersection LOS: C
Intersection Capacity Utilization 93.8% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 1: Thorold Townline Road/Taylor Road & Thorold Stone Road





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	241	1160	48	36	896	33	57	89	20	51	165	254
Future Volume (vph)	241	1160	48	36	896	33	57	89	20	51	165	254
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.1	6.1	6.1	6.1	6.1	6.4	6.4		6.4	6.4	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1659	3579	1512	1825	3579	1201	1706	1701		1825	1611	
Flt Permitted	0.17	1.00	1.00	0.24	1.00	1.00	0.21	1.00		0.68	1.00	
Satd. Flow (perm)	301	3579	1512	453	3579	1201	383	1701		1314	1611	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	248	1196	49	37	924	34	59	92	21	53	170	262
RTOR Reduction (vph)	0	0	20	0	0	20	0	11	0	0	75	0
Lane Group Flow (vph)	248	1196	29	37	924	14	59	102	0	53	357	0
Heavy Vehicles (%)	10%	2%	8%	0%	2%	36%	7%	12%	0%	0%	9%	8%
Turn Type	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2			6			4			8	
Permitted Phases	2		2	6		6	4	4		8		
Actuated Green, G (s)	55.6	55.6	55.6	37.4	37.4	37.4	25.9	25.9		25.9	25.9	
Effective Green, g (s)	55.6	55.6	55.6	37.4	37.4	37.4	25.9	25.9		25.9	25.9	
Actuated g/C Ratio	0.59	0.59	0.59	0.40	0.40	0.40	0.28	0.28		0.28	0.28	
Clearance Time (s)	3.0	6.1	6.1	6.1	6.1	6.1	6.4	6.4		6.4	6.4	
Vehicle Extension (s)	2.5	6.0	6.0	6.0	6.0	6.0	2.3	2.3		2.3	2.3	
Lane Grp Cap (vph)	397	2116	894	180	1423	477	105	468		362	443	
v/s Ratio Prot	c0.10	0.33			0.26			0.06			c0.22	
v/s Ratio Perm	c0.27		0.02	0.08		0.01	0.15			0.04		
v/c Ratio	0.62	0.57	0.03	0.21	0.65	0.03	0.56	0.22		0.15	0.81	
Uniform Delay, d1	12.4	11.8	8.0	18.6	23.0	17.2	29.2	26.2		25.7	31.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.6	1.1	0.1	1.6	1.7	0.1	4.9	0.1		0.1	9.9	
Delay (s)	15.0	12.9	8.1	20.2	24.7	17.3	34.1	26.4		25.8	41.6	
Level of Service	B	B	A	C	C	B	C	C		C	D	
Approach Delay (s)		13.1			24.2			29.0			39.9	
Approach LOS		B			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	21.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	94.0	Sum of lost time (s)	15.5
Intersection Capacity Utilization	93.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

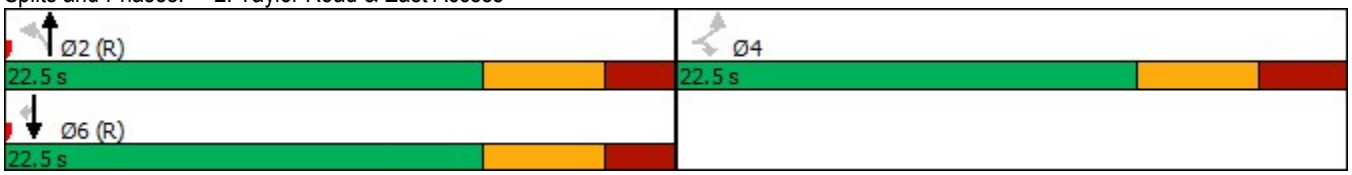


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	16	21	5	326	456	13
Future Volume (vph)	16	21	5	326	456	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	110.0			80.0
Storage Lanes	1	1	1			1
Taper Length (m)	2.5		100.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950		0.950			
Satd. Flow (prot)	971	837	913	1812	1847	816
Flt Permitted	0.950		0.491			
Satd. Flow (perm)	971	837	472	1812	1847	816
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		22				14
Link Speed (k/h)	50			70	70	
Link Distance (m)	70.6			713.0	427.2	
Travel Time (s)	5.1			36.7	22.0	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	88%	95%	100%	6%	4%	100%
Adj. Flow (vph)	17	22	5	340	475	14
Shared Lane Traffic (%)						
Lane Group Flow (vph)	17	22	5	340	475	14
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	6.1	6.1	6.1	30.5	30.5	6.1
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)	6.1	6.1	6.1	1.8	1.8	6.1
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)				28.7	28.7	
Detector 2 Size(m)				1.8	1.8	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Perm	Perm	Perm	NA	NA	Perm
Protected Phases				2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases	4	4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	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
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Maximum Green (s)	15.4	15.4	16.0	16.0	16.0	16.0
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.0	3.0	2.4	2.4	2.4	2.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.1	7.1	6.5	6.5	6.5	6.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	4.0	4.0	2.5	2.5	2.5	2.5
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	0.0	0.0	0.0	0.0	0.0	0.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	10.0	10.0	35.6	35.6	35.6	35.6
Actuated g/C Ratio	0.22	0.22	0.79	0.79	0.79	0.79
v/c Ratio	0.08	0.11	0.01	0.24	0.33	0.02
Control Delay	15.0	8.8	6.0	5.3	5.9	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.0	8.8	6.0	5.3	5.9	3.9
LOS	B	A	A	A	A	A
Approach Delay	11.5			5.3	5.8	
Approach LOS	B			A	A	

Intersection Summary			
Area Type:	Other		
Cycle Length: 45			
Actuated Cycle Length: 45			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green			
Natural Cycle: 50			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.33			
Intersection Signal Delay: 5.9		Intersection LOS: A	
Intersection Capacity Utilization 43.7%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: Taylor Road & East Access





Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	16	21	5	326	456	13
Future Volume (vph)	16	21	5	326	456	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.1	7.1	6.5	6.5	6.5	6.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	971	837	913	1812	1847	816
Flt Permitted	0.95	1.00	0.49	1.00	1.00	1.00
Satd. Flow (perm)	971	837	472	1812	1847	816
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	17	22	5	340	475	14
RTOR Reduction (vph)	0	20	0	0	0	5
Lane Group Flow (vph)	17	2	5	340	475	9
Heavy Vehicles (%)	88%	95%	100%	6%	4%	100%
Turn Type	Perm	Perm	Perm	NA	NA	Perm
Protected Phases				2	6	
Permitted Phases	4	4	2			6
Actuated Green, G (s)	4.0	4.0	27.4	27.4	27.4	27.4
Effective Green, g (s)	4.0	4.0	27.4	27.4	27.4	27.4
Actuated g/C Ratio	0.09	0.09	0.61	0.61	0.61	0.61
Clearance Time (s)	7.1	7.1	6.5	6.5	6.5	6.5
Vehicle Extension (s)	4.0	4.0	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	86	74	287	1103	1124	496
v/s Ratio Prot				0.19	c0.26	
v/s Ratio Perm	c0.02	0.00	0.01			0.01
v/c Ratio	0.20	0.03	0.02	0.31	0.42	0.02
Uniform Delay, d1	19.0	18.7	3.5	4.2	4.6	3.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	0.2	0.1	0.7	1.2	0.1
Delay (s)	20.6	18.9	3.6	5.0	5.8	3.5
Level of Service	C	B	A	A	A	A
Approach Delay (s)	19.6			4.9	5.7	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	6.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	13.6
Intersection Capacity Utilization	43.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

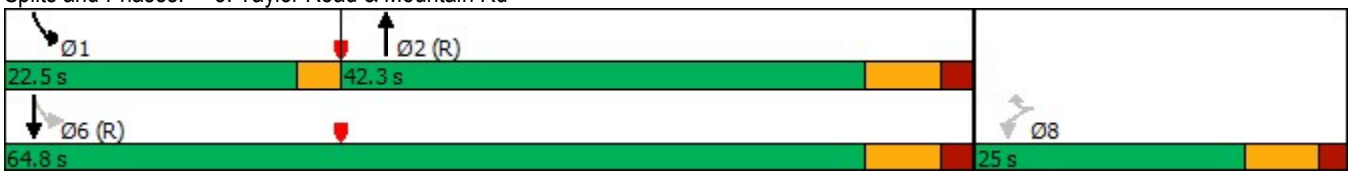


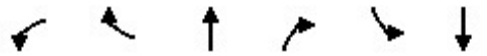
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	127	67	200	139	114	341
Future Volume (vph)	127	67	200	139	114	341
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0	0.0		0.0	95.0	
Storage Lanes	1	1		0	1	
Taper Length (m)	100.0				100.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850	0.945			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1706	1570	1670	0	1789	1812
Flt Permitted	0.950				0.497	
Satd. Flow (perm)	1706	1570	1670	0	936	1812
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		71	45			
Link Speed (k/h)	70		70			60
Link Distance (m)	184.1		195.9			753.7
Travel Time (s)	9.5		10.1			45.2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	7%	4%	5%	14%	2%	6%
Adj. Flow (vph)	134	71	211	146	120	359
Shared Lane Traffic (%)						
Lane Group Flow (vph)	134	71	357	0	120	359
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		3.7			3.7
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (m)	6.1	6.1	30.5		6.1	30.5
Trailing Detector (m)	0.0	0.0	0.0		0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0		0.0	0.0
Detector 1 Size(m)	6.1	6.1	1.8		6.1	1.8
Detector 1 Type	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
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(m)			28.7			28.7
Detector 2 Size(m)			1.8			1.8
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Perm	Perm	NA		pm+pt	NA
Protected Phases			2		1	6

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases	8	8			6	
Detector Phase	8	8	2		1	6
Switch Phase						
Minimum Initial (s)	10.0	10.0	20.0		8.0	20.0
Minimum Split (s)	25.0	25.0	42.3		22.5	42.3
Total Split (s)	25.0	25.0	42.3		22.5	64.8
Total Split (%)	27.8%	27.8%	47.1%		25.1%	72.2%
Maximum Green (s)	18.0	18.0	35.0		19.5	57.5
Yellow Time (s)	5.0	5.0	5.0		3.0	5.0
All-Red Time (s)	2.0	2.0	2.3		0.0	2.3
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	7.0	7.0	7.3		3.0	7.3
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	2.4	2.4	2.4		2.8	2.4
Recall Mode	None	None	C-Max		None	C-Max
Walk Time (s)	7.0	7.0	13.0			13.0
Flash Dont Walk (s)	11.0	11.0	22.0			22.0
Pedestrian Calls (#/hr)	0	0	0			0
Act Effct Green (s)	12.4	12.4	51.9		67.4	63.1
Actuated g/C Ratio	0.14	0.14	0.58		0.75	0.70
v/c Ratio	0.57	0.26	0.36		0.15	0.28
Control Delay	45.4	10.8	10.5		3.9	6.0
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	45.4	10.8	10.5		3.9	6.0
LOS	D	B	B		A	A
Approach Delay	33.4		10.5			5.5
Approach LOS	C		B			A

Intersection Summary			
Area Type:	Other		
Cycle Length: 89.8			
Actuated Cycle Length: 89.8			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.57			
Intersection Signal Delay: 12.7		Intersection LOS: B	
Intersection Capacity Utilization 49.3%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 3: Taylor Road & Mountain Rd





Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	127	67	200	139	114	341
Future Volume (vph)	127	67	200	139	114	341
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.3		3.0	7.3
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.94		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1706	1570	1670		1789	1812
Flt Permitted	0.95	1.00	1.00		0.50	1.00
Satd. Flow (perm)	1706	1570	1670		936	1812
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	134	71	211	146	120	359
RTOR Reduction (vph)	0	61	19	0	0	0
Lane Group Flow (vph)	134	10	338	0	120	359
Heavy Vehicles (%)	7%	4%	5%	14%	2%	6%
Turn Type	Perm	Perm	NA		pm+pt	NA
Protected Phases			2		1	6
Permitted Phases	8	8			6	
Actuated Green, G (s)	12.4	12.4	51.9		63.1	63.1
Effective Green, g (s)	12.4	12.4	51.9		63.1	63.1
Actuated g/C Ratio	0.14	0.14	0.58		0.70	0.70
Clearance Time (s)	7.0	7.0	7.3		3.0	7.3
Vehicle Extension (s)	2.4	2.4	2.4		2.8	2.4
Lane Grp Cap (vph)	235	216	965		735	1273
v/s Ratio Prot			c0.20		0.01	c0.20
v/s Ratio Perm	c0.08	0.01			0.10	
v/c Ratio	0.57	0.05	0.35		0.16	0.28
Uniform Delay, d1	36.2	33.6	10.0		4.4	5.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.6	0.1	1.0		0.1	0.6
Delay (s)	38.8	33.6	11.0		4.5	5.5
Level of Service	D	C	B		A	A
Approach Delay (s)	37.0		11.0			5.3
Approach LOS	D		B			A

Intersection Summary			
HCM 2000 Control Delay	13.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	89.8	Sum of lost time (s)	17.3
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	40	16	4	263	448	10
Future Volume (vph)	40	16	4	263	448	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	40.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	2.5		100.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.997	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1259	1089	1043	1830	1837	0
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1259	1089	1043	1830	1837	0
Link Speed (k/h)	48			60	60	
Link Distance (m)	375.1			753.7	268.8	
Travel Time (s)	28.1			45.2	16.1	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	45%	50%	75%	5%	3%	60%
Adj. Flow (vph)	43	17	4	283	482	11
Shared Lane Traffic (%)						
Lane Group Flow (vph)	43	17	4	283	493	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 34.2%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	40	16	4	263	448	10
Future Volume (Veh/h)	40	16	4	263	448	10
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	43	17	4	283	482	11
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	778	488	493			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	778	488	493			
tC, single (s)	6.8	6.7	4.8			
tC, 2 stage (s)						
tF (s)	3.9	3.8	2.9			
p0 queue free %	86	97	99			
cM capacity (veh/h)	309	494	780			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	43	17	4	283	493
Volume Left	43	0	4	0	0
Volume Right	0	17	0	0	11
cSH	309	494	780	1700	1700
Volume to Capacity	0.14	0.03	0.01	0.17	0.29
Queue Length 95th (m)	3.6	0.8	0.1	0.0	0.0
Control Delay (s)	18.5	12.5	9.6	0.0	0.0
Lane LOS	C	B	A		
Approach Delay (s)	16.8		0.1		0.0
Approach LOS	C				

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	22	59	49	278	432	15
Future Volume (vph)	22	59	49	278	432	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	50.0	0.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.995	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1825	1633	1134	1812	1752	0
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1825	1633	1134	1812	1752	0
Link Speed (k/h)	50			70	70	
Link Distance (m)	204.8			328.2	1008.3	
Travel Time (s)	14.7			16.9	51.9	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	0%	0%	61%	6%	8%	40%
Adj. Flow (vph)	23	63	52	296	460	16
Shared Lane Traffic (%)						
Lane Group Flow (vph)	23	63	52	296	476	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			7.4	7.4	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

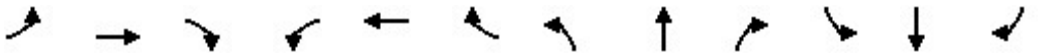
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	40.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	22	59	49	278	432	15
Future Volume (Veh/h)	22	59	49	278	432	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	23	63	52	296	460	16
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		7				
Median type				None	None	
Median storage veh)						
Upstream signal (m)				328		
pX, platoon unblocked						
vC, conflicting volume	868	468	476			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	868	468	476			
tC, single (s)	6.4	6.2	4.7			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.7			
p0 queue free %	92	89	94			
cM capacity (veh/h)	305	599	838			

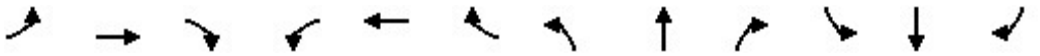
Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	86	52	296	476
Volume Left	23	52	0	0
Volume Right	63	0	0	16
cSH	818	838	1700	1700
Volume to Capacity	0.11	0.06	0.17	0.28
Queue Length 95th (m)	2.7	1.5	0.0	0.0
Control Delay (s)	13.3	9.6	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	13.3	1.4		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	40.3%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	255	21	30	179	1	15	4	36	2	1	0
Future Volume (vph)	1	255	21	30	179	1	15	4	36	2	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt		0.990			0.999			0.911				
Flt Protected					0.993			0.987			0.968	
Satd. Flow (prot)	0	1742	0	0	1843	0	0	1639	0	0	1395	0
Flt Permitted					0.993			0.987			0.968	
Satd. Flow (perm)	0	1742	0	0	1843	0	0	1639	0	0	1395	0
Link Speed (k/h)		70			70			80			60	
Link Distance (m)		884.7			985.2			693.4			600.2	
Travel Time (s)		45.5			50.7			31.2			36.0	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	0%	10%	0%	0%	4%	0%	20%	0%	0%	50%	0%	0%
Adj. Flow (vph)	1	274	23	32	192	1	16	4	39	2	1	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	298	0	0	225	0	0	59	0	0	3	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)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Free			Free			Stop			Stop	

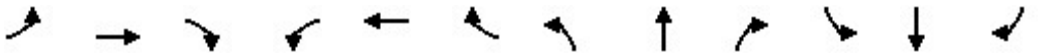
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 39.2%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	255	21	30	179	1	15	4	36	2	1	0
Future Volume (Veh/h)	1	255	21	30	179	1	15	4	36	2	1	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	1	274	23	32	192	1	16	4	39	2	1	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	193			297			544	544	286	585	556	192
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	193			297			544	544	286	585	556	192
tC, single (s)	4.1			4.1			7.3	6.5	6.2	7.6	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.7	4.0	3.3	4.0	4.0	3.3
p0 queue free %	100			97			96	99	95	99	100	100
cM capacity (veh/h)	1392			1276			414	437	758	332	431	854

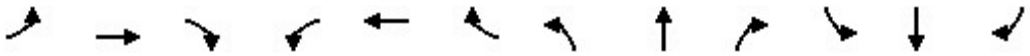
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	298	225	59	3
Volume Left	1	32	16	2
Volume Right	23	1	39	0
cSH	1392	1276	594	359
Volume to Capacity	0.00	0.03	0.10	0.01
Queue Length 95th (m)	0.0	0.6	2.5	0.2
Control Delay (s)	0.0	1.3	11.7	15.1
Lane LOS	A	A	B	C
Approach Delay (s)	0.0	1.3	11.7	15.1
Approach LOS			B	C

Intersection Summary				
Average Delay	1.8			
Intersection Capacity Utilization	39.2%	ICU Level of Service	A	
Analysis Period (min)	15			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	1194	13	1	964	14	9	14	2	5	22	0
Future Volume (vph)	5	1194	13	1	964	14	9	14	2	5	22	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.998			0.989				
Flt Protected								0.982			0.991	
Satd. Flow (prot)	0	3568	1633	0	3535	0	0	1866	0	0	1838	0
Flt Permitted								0.982			0.991	
Satd. Flow (perm)	0	3568	1633	0	3535	0	0	1866	0	0	1838	0
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		1007.9			1349.4			495.3			723.5	
Travel Time (s)		45.4			60.7			22.3			32.6	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	80%	2%	0%	0%	3%	7%	0%	0%	0%	20%	0%	0%
Adj. Flow (vph)	5	1231	13	1	994	14	9	14	2	5	23	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1236	13	0	1009	0	0	25	0	0	28	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	46.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	1194	13	1	964	14	9	14	2	5	22	0
Future Volume (Veh/h)	5	1194	13	1	964	14	9	14	2	5	22	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	5	1231	13	1	994	14	9	14	2	5	23	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1008			1244			1752	2251	616	1638	2257	504
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1008			1244			1752	2251	616	1638	2257	504
tC, single (s)	5.7			4.1			7.5	6.5	6.9	7.9	6.5	6.9
tC, 2 stage (s)												
tF (s)	3.0			2.2			3.5	4.0	3.3	3.7	4.0	3.3
p0 queue free %	99			100			71	66	100	88	44	100
cM capacity (veh/h)	360			567			31	41	439	40	41	518

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	SB 1
Volume Total	415	821	13	498	511	25	28
Volume Left	5	0	0	1	0	9	5
Volume Right	0	0	13	0	14	2	0
cSH	360	1700	1700	567	1700	39	41
Volume to Capacity	0.01	0.48	0.01	0.00	0.30	0.64	0.68
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	17.4	19.2
Control Delay (s)	0.5	0.0	0.0	0.1	0.0	196.0	201.1
Lane LOS	A			A		F	F
Approach Delay (s)	0.2			0.0		196.0	201.1
Approach LOS						F	F

Intersection Summary				
Average Delay	4.7			
Intersection Capacity Utilization	46.5%	ICU Level of Service		A
Analysis Period (min)	15			



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	33	299	0	29	451
Future Volume (vph)	0	33	299	0	29	451
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0		0.0	85.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	2.5				100.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865					
Flt Protected					0.950	
Satd. Flow (prot)	1445	0	1812	0	1772	1746
Flt Permitted					0.950	
Satd. Flow (perm)	1445	0	1812	0	1772	1746
Link Speed (k/h)	80		70			70
Link Distance (m)	79.4		1008.3			713.0
Travel Time (s)	3.6		51.9			36.7
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	15%	6%	0%	3%	10%
Adj. Flow (vph)	0	35	315	0	31	475
Shared Lane Traffic (%)						
Lane Group Flow (vph)	35	0	315	0	31	475
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		3.7			3.7
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 33.7%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	33	299	0	29	451
Future Volume (Veh/h)	0	33	299	0	29	451
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	35	315	0	31	475
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	852	315			315	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	852	315			315	
tC, single (s)	6.4	6.4			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.2	
p0 queue free %	100	95			97	
cM capacity (veh/h)	324	696			1240	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	35	315	31	475
Volume Left	0	0	31	0
Volume Right	35	0	0	0
cSH	696	1700	1240	1700
Volume to Capacity	0.05	0.19	0.03	0.28
Queue Length 95th (m)	1.2	0.0	0.6	0.0
Control Delay (s)	10.4	0.0	8.0	0.0
Lane LOS	B		A	
Approach Delay (s)	10.4	0.0	0.5	
Approach LOS	B			

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	33.7%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	5	26	13	49	55	30
Future Volume (vph)	5	26	13	49	55	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.887				0.952	
Flt Protected	0.992			0.990		
Satd. Flow (prot)	1690	0	0	1193	1829	0
Flt Permitted	0.992			0.990		
Satd. Flow (perm)	1690	0	0	1193	1829	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	307.8			204.8	258.0	
Travel Time (s)	22.2			14.7	18.6	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	0%	0%	38%	65%	0%	0%
Adj. Flow (vph)	6	30	15	57	64	35
Shared Lane Traffic (%)						
Lane Group Flow (vph)	36	0	0	72	99	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

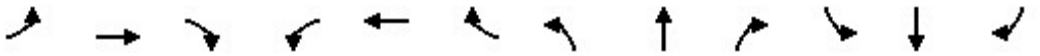
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 20.0%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	26	13	49	55	30
Future Volume (Veh/h)	5	26	13	49	55	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	6	30	15	57	64	35
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	168	82	99			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	168	82	99			
tC, single (s)	6.4	6.2	4.5			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.5			
p0 queue free %	99	97	99			
cM capacity (veh/h)	817	984	1296			

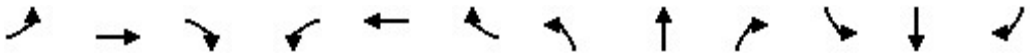
Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	36	72	99
Volume Left	6	15	0
Volume Right	30	0	35
cSH	951	1296	1700
Volume to Capacity	0.04	0.01	0.06
Queue Length 95th (m)	0.9	0.3	0.0
Control Delay (s)	8.9	1.7	0.0
Lane LOS	A	A	
Approach Delay (s)	8.9	1.7	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	20.0%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	3	16	15	2	5	12	3	30	21	31	1
Future Volume (vph)	0	3	16	15	2	5	12	3	30	21	31	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt		0.885			0.970			0.910			0.998	
Flt Protected					0.967			0.987			0.980	
Satd. Flow (prot)	0	1547	0	0	1802	0	0	1036	0	0	1879	0
Flt Permitted					0.967			0.987			0.980	
Satd. Flow (perm)	0	1547	0	0	1802	0	0	1036	0	0	1879	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		108.3			156.3			390.5			72.5	
Travel Time (s)		7.8			11.3			28.1			5.2	
Peak Hour Factor	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
Heavy Vehicles (%)	0%	67%	0%	0%	0%	0%	17%	0%	93%	0%	0%	0%
Adj. Flow (vph)	0	4	23	21	3	7	17	4	42	30	44	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	27	0	0	31	0	0	63	0	0	75	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)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 19.1%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	0	3	16	15	2	5	12	3	30	21	31	1
Future Volume (vph)	0	3	16	15	2	5	12	3	30	21	31	1
Peak Hour Factor	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
Hourly flow rate (vph)	0	4	23	21	3	7	17	4	42	30	44	1

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	27	31	63	75
Volume Left (vph)	0	21	17	30
Volume Right (vph)	23	7	42	1
Hadj (s)	-0.34	0.00	0.79	0.07
Departure Headway (s)	3.9	4.3	4.9	4.2
Degree Utilization, x	0.03	0.04	0.09	0.09
Capacity (veh/h)	881	815	717	846
Control Delay (s)	7.0	7.4	8.3	7.6
Approach Delay (s)	7.0	7.4	8.3	7.6
Approach LOS	A	A	A	A

Intersection Summary				
Delay		7.7		
Level of Service		A		
Intersection Capacity Utilization		19.1%	ICU Level of Service	A
Analysis Period (min)		15		



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	271	0	0	195	0	0
Future Volume (vph)	271	0	0	195	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1779	0	0	1812	1921	0
Flt Permitted						
Satd. Flow (perm)	1779	0	0	1812	1921	0
Link Speed (k/h)	70			70	50	
Link Distance (m)	184.1			884.7	224.6	
Travel Time (s)	9.5			45.5	16.2	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	8%	0%	0%	6%	0%	0%
Adj. Flow (vph)	285	0	0	205	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	285	0	0	205	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

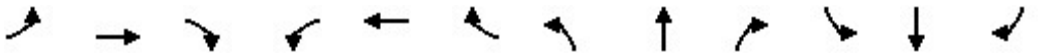
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 17.6%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	271	0	0	195	0	0
Future Volume (Veh/h)	271	0	0	195	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	285	0	0	205	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	184					
pX, platoon unblocked						
vC, conflicting volume			285		490	285
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			285		490	285
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1289		541	759

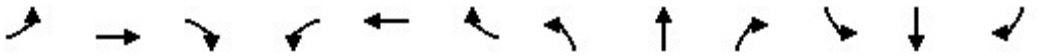
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	285	205	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1289	1700
Volume to Capacity	0.17	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay		0.0	
Intersection Capacity Utilization		17.6%	ICU Level of Service A
Analysis Period (min)		15	



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	3	3	0	1	1	48	0	0	66	0
Future Volume (vph)	0	0	3	3	0	1	1	48	0	0	66	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt		0.865			0.973							
Flt Protected					0.962			0.999				
Satd. Flow (prot)	0	1662	0	0	1798	0	0	1171	0	0	1921	0
Flt Permitted					0.962			0.999				
Satd. Flow (perm)	0	1662	0	0	1798	0	0	1171	0	0	1921	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		102.1			176.5			258.0			689.0	
Travel Time (s)		7.4			12.7			18.6			49.6	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	65%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	4	4	0	1	1	60	0	0	83	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	4	0	0	5	0	0	61	0	0	83	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)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

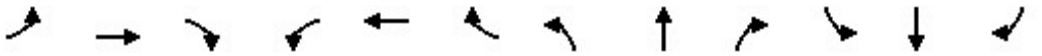
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 13.5%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	3	3	0	1	1	48	0	0	66	0
Future Volume (Veh/h)	0	0	3	3	0	1	1	48	0	0	66	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	0	0	4	4	0	1	1	60	0	0	82	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	145	144	82	148	144	60	82			60		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	145	144	82	148	144	60	82			60		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	827	750	983	821	750	1011	1528			1556		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	4	5	61	82
Volume Left	0	4	1	0
Volume Right	4	1	0	0
cSH	983	853	1528	1556
Volume to Capacity	0.00	0.01	0.00	0.00
Queue Length 95th (m)	0.1	0.1	0.0	0.0
Control Delay (s)	8.7	9.2	0.1	0.0
Lane LOS	A	A	A	
Approach Delay (s)	8.7	9.2	0.1	0.0
Approach LOS	A	A		

Intersection Summary				
Average Delay	0.6			
Intersection Capacity Utilization	13.5%	ICU Level of Service	A	
Analysis Period (min)	15			

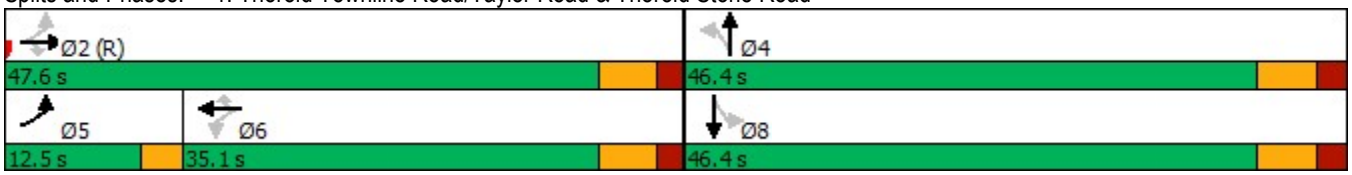


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	238	1277	48	36	989	29	57	90	20	51	169	251
Future Volume (vph)	238	1277	48	36	989	29	57	90	20	51	169	251
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0		95.0	85.0		90.0	100.0		0.0	80.0		0.0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (m)	85.0			100.0			90.0			40.0		
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		0.972			0.910	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1674	3579	1512	1825	3579	1276	1706	1740	0	1825	1634	0
Flt Permitted	0.140			0.207			0.210			0.684		
Satd. Flow (perm)	247	3579	1512	398	3579	1276	377	1740	0	1314	1634	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			49			74		15			99	
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		291.4			1007.9			528.0			328.2	
Travel Time (s)		13.1			45.4			23.8			14.8	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	9%	2%	8%	0%	2%	28%	7%	9%	0%	0%	7%	7%
Adj. Flow (vph)	245	1316	49	37	1020	30	59	93	21	53	174	259
Shared Lane Traffic (%)												
Lane Group Flow (vph)	245	1316	49	37	1020	30	59	114	0	53	433	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)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5	6.1	6.1	30.5	6.1	6.1	30.5		6.1	30.5	
Trailing Detector (m)	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	
Detector 1 Size(m)	6.1	1.8	6.1	6.1	1.8	6.1	6.1	1.8		6.1	1.8	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
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	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2			6			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2		2	6		6	4	4		8		
Detector Phase	5	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	8.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0		10.0	10.0	
Minimum Split (s)	12.5	35.1	35.1	35.1	35.1	35.1	46.4	46.4		46.4	46.4	
Total Split (s)	12.5	47.6	47.6	35.1	35.1	35.1	46.4	46.4		46.4	46.4	
Total Split (%)	13.3%	50.6%	50.6%	37.3%	37.3%	37.3%	49.4%	49.4%		49.4%	49.4%	
Maximum Green (s)	9.5	41.5	41.5	29.0	29.0	29.0	40.0	40.0		40.0	40.0	
Yellow Time (s)	3.0	4.1	4.1	4.1	4.1	4.1	4.1	4.1		4.1	4.1	
All-Red Time (s)	0.0	2.0	2.0	2.0	2.0	2.0	2.3	2.3		2.3	2.3	
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)	3.0	6.1	6.1	6.1	6.1	6.1	6.4	6.4		6.4	6.4	
Lead/Lag	Lead			Lag	Lag	Lag						
Lead-Lag Optimize?	Yes			Yes	Yes	Yes						
Vehicle Extension (s)	2.5	6.0	6.0	6.0	6.0	6.0	2.3	2.3		2.3	2.3	
Recall Mode	None	C-Max	C-Max	None	None	None	None	None		None	None	
Walk Time (s)		11.0	11.0	11.0	11.0	11.0	15.0	15.0		15.0	15.0	
Flash Dont Walk (s)		18.0	18.0	18.0	18.0	18.0	25.0	25.0		25.0	25.0	
Pedestrian Calls (#/hr)		0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	58.8	55.7	55.7	38.1	38.1	38.1	25.8	25.8		25.8	25.8	
Actuated g/C Ratio	0.63	0.59	0.59	0.41	0.41	0.41	0.27	0.27		0.27	0.27	
v/c Ratio	0.65	0.62	0.05	0.23	0.70	0.05	0.57	0.23		0.15	0.83	
Control Delay	22.4	15.6	3.9	27.8	28.8	0.2	48.8	21.6		23.5	37.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	22.4	15.6	3.9	27.8	28.8	0.2	48.8	21.6		23.5	37.8	
LOS	C	B	A	C	C	A	D	C		C	D	
Approach Delay		16.2			28.0			30.9			36.3	
Approach LOS		B			C			C			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 94			
Actuated Cycle Length: 94			
Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Green			
Natural Cycle: 95			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.83			
Intersection Signal Delay: 23.7		Intersection LOS: C	
Intersection Capacity Utilization 97.1%		ICU Level of Service F	
Analysis Period (min) 15			

Splits and Phases: 1: Thorold Townline Road/Taylor Road & Thorold Stone Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	238	1277	48	36	989	29	57	90	20	51	169	251
Future Volume (vph)	238	1277	48	36	989	29	57	90	20	51	169	251
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	6.1	6.1	6.1	6.1	6.1	6.4	6.4		6.4	6.4	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1674	3579	1512	1825	3579	1276	1706	1740		1825	1634	
Flt Permitted	0.14	1.00	1.00	0.21	1.00	1.00	0.21	1.00		0.68	1.00	
Satd. Flow (perm)	246	3579	1512	399	3579	1276	377	1740		1313	1634	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	245	1316	49	37	1020	30	59	93	21	53	174	259
RTOR Reduction (vph)	0	0	20	0	0	18	0	11	0	0	72	0
Lane Group Flow (vph)	245	1316	29	37	1020	12	59	103	0	53	361	0
Heavy Vehicles (%)	9%	2%	8%	0%	2%	28%	7%	9%	0%	0%	7%	7%
Turn Type	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2			6			4			8	
Permitted Phases	2		2	6		6	4	4		8		
Actuated Green, G (s)	55.7	55.7	55.7	38.1	38.1	38.1	25.8	25.8		25.8	25.8	
Effective Green, g (s)	55.7	55.7	55.7	38.1	38.1	38.1	25.8	25.8		25.8	25.8	
Actuated g/C Ratio	0.59	0.59	0.59	0.41	0.41	0.41	0.27	0.27		0.27	0.27	
Clearance Time (s)	3.0	6.1	6.1	6.1	6.1	6.1	6.4	6.4		6.4	6.4	
Vehicle Extension (s)	2.5	6.0	6.0	6.0	6.0	6.0	2.3	2.3		2.3	2.3	
Lane Grp Cap (vph)	367	2120	895	161	1450	517	103	477		360	448	
v/s Ratio Prot	c0.10	0.37			0.29			0.06			c0.22	
v/s Ratio Perm	c0.29		0.02	0.09		0.01	0.16			0.04		
v/c Ratio	0.67	0.62	0.03	0.23	0.70	0.02	0.57	0.22		0.15	0.81	
Uniform Delay, d1	13.6	12.3	8.0	18.3	23.3	16.8	29.4	26.3		25.8	31.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.1	1.4	0.1	2.1	2.3	0.1	5.6	0.1		0.1	9.8	
Delay (s)	17.7	13.7	8.0	20.4	25.6	16.8	34.9	26.4		25.9	41.6	
Level of Service	B	B	A	C	C	B	C	C		C	D	
Approach Delay (s)		14.2			25.1			29.3			39.9	
Approach LOS		B			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	22.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	94.0	Sum of lost time (s)	15.5
Intersection Capacity Utilization	97.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

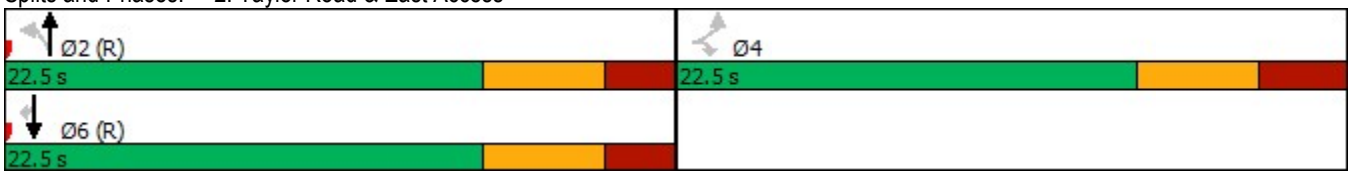


Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	9	15	4	341	476	10
Future Volume (vph)	9	15	4	341	476	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	110.0			80.0
Storage Lanes	1	1	1			1
Taper Length (m)	2.5		100.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1025	846	913	1830	1847	816
Flt Permitted	0.950		0.482			
Satd. Flow (perm)	1025	846	463	1830	1847	816
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		16				10
Link Speed (k/h)	50			70	70	
Link Distance (m)	70.6			713.0	427.2	
Travel Time (s)	5.1			36.7	22.0	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	78%	93%	100%	5%	4%	100%
Adj. Flow (vph)	9	16	4	355	496	10
Shared Lane Traffic (%)						
Lane Group Flow (vph)	9	16	4	355	496	10
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	6.1	6.1	6.1	30.5	30.5	6.1
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)	6.1	6.1	6.1	1.8	1.8	6.1
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)				28.7	28.7	
Detector 2 Size(m)				1.8	1.8	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Perm	Perm	Perm	NA	NA	Perm
Protected Phases				2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases	4	4	2			6
Detector Phase	4	4	2	2	6	6
Switch Phase						
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	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
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	50.0%
Maximum Green (s)	15.4	15.4	16.0	16.0	16.0	16.0
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.0	3.0	2.4	2.4	2.4	2.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.1	7.1	6.5	6.5	6.5	6.5
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	4.0	4.0	2.5	2.5	2.5	2.5
Recall Mode	None	None	C-Max	C-Max	C-Max	C-Max
Walk Time (s)	0.0	0.0	0.0	0.0	0.0	0.0
Flash Dont Walk (s)	11.0	11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	10.0	10.0	40.3	40.3	40.3	40.3
Actuated g/C Ratio	0.22	0.22	0.90	0.90	0.90	0.90
v/c Ratio	0.04	0.08	0.01	0.22	0.30	0.01
Control Delay	14.3	9.0	4.0	3.2	3.6	2.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.3	9.0	4.0	3.2	3.6	2.9
LOS	B	A	A	A	A	A
Approach Delay	10.9			3.2	3.6	
Approach LOS	B			A	A	

Intersection Summary			
Area Type:	Other		
Cycle Length: 45			
Actuated Cycle Length: 45			
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green			
Natural Cycle: 50			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.30			
Intersection Signal Delay: 3.6		Intersection LOS: A	
Intersection Capacity Utilization 44.7%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: Taylor Road & East Access





Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	9	15	4	341	476	10
Future Volume (vph)	9	15	4	341	476	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.1	7.1	6.5	6.5	6.5	6.5
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1025	846	913	1830	1847	816
Flt Permitted	0.95	1.00	0.48	1.00	1.00	1.00
Satd. Flow (perm)	1025	846	463	1830	1847	816
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	9	16	4	355	496	10
RTOR Reduction (vph)	0	15	0	0	0	3
Lane Group Flow (vph)	9	1	4	355	496	7
Heavy Vehicles (%)	78%	93%	100%	5%	4%	100%
Turn Type	Perm	Perm	Perm	NA	NA	Perm
Protected Phases				2	6	
Permitted Phases	4	4	2			6
Actuated Green, G (s)	2.0	2.0	29.4	29.4	29.4	29.4
Effective Green, g (s)	2.0	2.0	29.4	29.4	29.4	29.4
Actuated g/C Ratio	0.04	0.04	0.65	0.65	0.65	0.65
Clearance Time (s)	7.1	7.1	6.5	6.5	6.5	6.5
Vehicle Extension (s)	4.0	4.0	2.5	2.5	2.5	2.5
Lane Grp Cap (vph)	45	37	302	1195	1206	533
v/s Ratio Prot				0.19	c0.27	
v/s Ratio Perm	c0.01	0.00	0.01			0.01
v/c Ratio	0.20	0.02	0.01	0.30	0.41	0.01
Uniform Delay, d1	20.7	20.6	2.7	3.4	3.7	2.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.0	0.3	0.1	0.6	1.0	0.0
Delay (s)	23.7	20.8	2.8	4.0	4.7	2.8
Level of Service	C	C	A	A	A	A
Approach Delay (s)	21.9			4.0	4.7	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	4.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	45.0	Sum of lost time (s)	13.6
Intersection Capacity Utilization	44.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

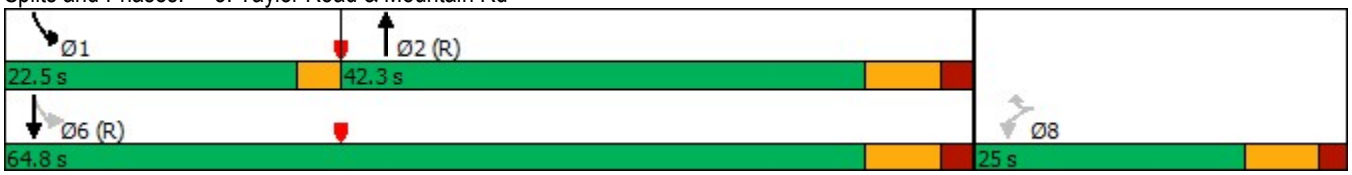


Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	131	71	208	134	114	355
Future Volume (vph)	131	71	208	134	114	355
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	75.0	0.0		0.0	95.0	
Storage Lanes	1	1		0	1	
Taper Length (m)	100.0				100.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850	0.947			
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1738	1570	1704	0	1789	1812
Flt Permitted	0.950				0.495	
Satd. Flow (perm)	1738	1570	1704	0	932	1812
Right Turn on Red		Yes		Yes		
Satd. Flow (RTOR)		75	42			
Link Speed (k/h)	70		70			60
Link Distance (m)	184.1		195.9			753.7
Travel Time (s)	9.5		10.1			45.2
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	5%	4%	4%	11%	2%	6%
Adj. Flow (vph)	138	75	219	141	120	374
Shared Lane Traffic (%)						
Lane Group Flow (vph)	138	75	360	0	120	374
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		3.7			3.7
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Number of Detectors	1	1	2		1	2
Detector Template	Left	Right	Thru		Left	Thru
Leading Detector (m)	6.1	6.1	30.5		6.1	30.5
Trailing Detector (m)	0.0	0.0	0.0		0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0		0.0	0.0
Detector 1 Size(m)	6.1	6.1	1.8		6.1	1.8
Detector 1 Type	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
Detector 1 Queue (s)	0.0	0.0	0.0		0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0		0.0	0.0
Detector 2 Position(m)			28.7			28.7
Detector 2 Size(m)			1.8			1.8
Detector 2 Type			Cl+Ex			Cl+Ex
Detector 2 Channel						
Detector 2 Extend (s)			0.0			0.0
Turn Type	Perm	Perm	NA		pm+pt	NA
Protected Phases			2		1	6

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Permitted Phases	8	8			6	
Detector Phase	8	8	2		1	6
Switch Phase						
Minimum Initial (s)	10.0	10.0	20.0		8.0	20.0
Minimum Split (s)	25.0	25.0	42.3		22.5	42.3
Total Split (s)	25.0	25.0	42.3		22.5	64.8
Total Split (%)	27.8%	27.8%	47.1%		25.1%	72.2%
Maximum Green (s)	18.0	18.0	35.0		19.5	57.5
Yellow Time (s)	5.0	5.0	5.0		3.0	5.0
All-Red Time (s)	2.0	2.0	2.3		0.0	2.3
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	7.0	7.0	7.3		3.0	7.3
Lead/Lag			Lag		Lead	
Lead-Lag Optimize?			Yes		Yes	
Vehicle Extension (s)	2.4	2.4	2.4		2.8	2.4
Recall Mode	None	None	C-Max		None	C-Max
Walk Time (s)	7.0	7.0	13.0			13.0
Flash Dont Walk (s)	11.0	11.0	22.0			22.0
Pedestrian Calls (#/hr)	0	0	0			0
Act Effct Green (s)	12.4	12.4	51.9		67.4	63.1
Actuated g/C Ratio	0.14	0.14	0.58		0.75	0.70
v/c Ratio	0.57	0.27	0.36		0.15	0.29
Control Delay	45.4	10.7	10.6		3.9	6.1
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	45.4	10.7	10.6		3.9	6.1
LOS	D	B	B		A	A
Approach Delay	33.2		10.6			5.6
Approach LOS	C		B			A

Intersection Summary			
Area Type:	Other		
Cycle Length: 89.8			
Actuated Cycle Length: 89.8			
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.57			
Intersection Signal Delay: 12.8		Intersection LOS: B	
Intersection Capacity Utilization 49.4%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 3: Taylor Road & Mountain Rd





Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	131	71	208	134	114	355
Future Volume (vph)	131	71	208	134	114	355
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.3		3.0	7.3
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.85	0.95		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1738	1570	1705		1789	1812
Flt Permitted	0.95	1.00	1.00		0.49	1.00
Satd. Flow (perm)	1738	1570	1705		932	1812
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	138	75	219	141	120	374
RTOR Reduction (vph)	0	65	18	0	0	0
Lane Group Flow (vph)	138	10	342	0	120	374
Heavy Vehicles (%)	5%	4%	4%	11%	2%	6%
Turn Type	Perm	Perm	NA		pm+pt	NA
Protected Phases			2		1	6
Permitted Phases	8	8			6	
Actuated Green, G (s)	12.4	12.4	51.9		63.1	63.1
Effective Green, g (s)	12.4	12.4	51.9		63.1	63.1
Actuated g/C Ratio	0.14	0.14	0.58		0.70	0.70
Clearance Time (s)	7.0	7.0	7.3		3.0	7.3
Vehicle Extension (s)	2.4	2.4	2.4		2.8	2.4
Lane Grp Cap (vph)	239	216	985		733	1273
v/s Ratio Prot			c0.20		0.01	c0.21
v/s Ratio Perm	c0.08	0.01			0.10	
v/c Ratio	0.58	0.05	0.35		0.16	0.29
Uniform Delay, d1	36.2	33.6	10.0		4.4	5.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.6	0.1	1.0		0.1	0.6
Delay (s)	38.9	33.6	11.0		4.5	5.6
Level of Service	D	C	B		A	A
Approach Delay (s)	37.0		11.0			5.3
Approach LOS	D		B			A

Intersection Summary			
HCM 2000 Control Delay	13.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	89.8	Sum of lost time (s)	17.3
Intersection Capacity Utilization	49.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	35	14	2	274	471	6
Future Volume (vph)	35	14	2	274	471	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0	40.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	2.5		100.0			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.998	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1332	1142	1217	1847	1855	0
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1332	1142	1217	1847	1855	0
Link Speed (k/h)	48			60	60	
Link Distance (m)	375.1			753.7	268.8	
Travel Time (s)	28.1			45.2	16.1	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	37%	43%	50%	4%	3%	33%
Adj. Flow (vph)	38	15	2	295	506	6
Shared Lane Traffic (%)						
Lane Group Flow (vph)	38	15	2	295	512	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 35.2%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	35	14	2	274	471	6
Future Volume (Veh/h)	35	14	2	274	471	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	38	15	2	295	506	6
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	808	509	512			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	808	509	512			
tC, single (s)	6.8	6.6	4.6			
tC, 2 stage (s)						
tF (s)	3.8	3.7	2.7			
p0 queue free %	88	97	100			
cM capacity (veh/h)	306	491	848			

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1
Volume Total	38	15	2	295	512
Volume Left	38	0	2	0	0
Volume Right	0	15	0	0	6
cSH	306	491	848	1700	1700
Volume to Capacity	0.12	0.03	0.00	0.17	0.30
Queue Length 95th (m)	3.2	0.7	0.1	0.0	0.0
Control Delay (s)	18.4	12.6	9.3	0.0	0.0
Lane LOS	C	B	A		
Approach Delay (s)	16.8		0.1		0.0
Approach LOS	C				

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	35.2%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	22	59	39	292	447	14
Future Volume (vph)	22	59	39	292	447	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	50.0	0.0			0.0
Storage Lanes	1	1	1			0
Taper Length (m)	2.5		2.5			
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.996	
Flt Protected	0.950		0.950			
Satd. Flow (prot)	1825	1633	1209	1812	1790	0
Flt Permitted	0.950		0.950			
Satd. Flow (perm)	1825	1633	1209	1812	1790	0
Link Speed (k/h)	50			70	70	
Link Distance (m)	204.8			328.2	1008.3	
Travel Time (s)	14.7			16.9	51.9	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	0%	0%	51%	6%	6%	36%
Adj. Flow (vph)	23	63	41	311	476	15
Shared Lane Traffic (%)						
Lane Group Flow (vph)	23	63	41	311	491	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			7.4	7.4	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

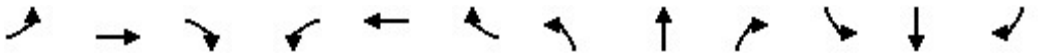
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	41.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	22	59	39	292	447	14
Future Volume (Veh/h)	22	59	39	292	447	14
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	23	63	41	311	476	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)		7				
Median type				None	None	
Median storage veh)						
Upstream signal (m)				328		
pX, platoon unblocked	1.00					
vC, conflicting volume	876	484	491			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	876	484	491			
tC, single (s)	6.4	6.2	4.6			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.7			
p0 queue free %	92	89	95			
cM capacity (veh/h)	306	587	861			

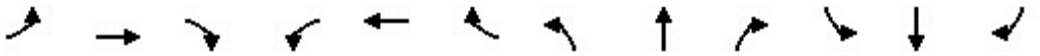
Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	86	41	311	491
Volume Left	23	41	0	0
Volume Right	63	0	0	15
cSH	802	861	1700	1700
Volume to Capacity	0.11	0.05	0.18	0.29
Queue Length 95th (m)	2.7	1.1	0.0	0.0
Control Delay (s)	13.4	9.4	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	13.4	1.1		0.0
Approach LOS	B			

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	41.0%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	262	21	30	185	1	14	4	36	2	1	0
Future Volume (vph)	1	262	21	30	185	1	14	4	36	2	1	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt		0.990			0.999			0.909				
Flt Protected					0.993			0.987			0.968	
Satd. Flow (prot)	0	1771	0	0	1843	0	0	1663	0	0	1395	0
Flt Permitted					0.993			0.987			0.968	
Satd. Flow (perm)	0	1771	0	0	1843	0	0	1663	0	0	1395	0
Link Speed (k/h)		70			70			80			60	
Link Distance (m)		884.7			985.2			693.4			600.2	
Travel Time (s)		45.5			50.7			31.2			36.0	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	0%	8%	0%	0%	4%	0%	14%	0%	0%	50%	0%	0%
Adj. Flow (vph)	1	282	23	32	199	1	15	4	39	2	1	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	306	0	0	232	0	0	58	0	0	3	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)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Free			Free			Stop			Stop	

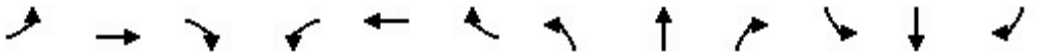
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 39.9%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	262	21	30	185	1	14	4	36	2	1	0
Future Volume (Veh/h)	1	262	21	30	185	1	14	4	36	2	1	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	1	282	23	32	199	1	15	4	39	2	1	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	200			305			560	560	294	600	570	200
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	200			305			560	560	294	600	570	200
tC, single (s)	4.1			4.1			7.2	6.5	6.2	7.6	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.0	3.3	4.0	4.0	3.3
p0 queue free %	100			97			96	99	95	99	100	100
cM capacity (veh/h)	1384			1267			412	429	751	323	423	847

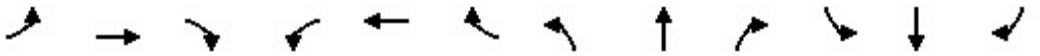
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	306	232	58	3
Volume Left	1	32	15	2
Volume Right	23	1	39	0
cSH	1384	1267	594	351
Volume to Capacity	0.00	0.03	0.10	0.01
Queue Length 95th (m)	0.0	0.6	2.5	0.2
Control Delay (s)	0.0	1.3	11.7	15.3
Lane LOS	A	A	B	C
Approach Delay (s)	0.0	1.3	11.7	15.3
Approach LOS			B	C

Intersection Summary				
Average Delay	1.7			
Intersection Capacity Utilization	39.9%	ICU Level of Service	A	
Analysis Period (min)	15			



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	1318	13	1	1060	14	9	14	2	5	22	0
Future Volume (vph)	2	1318	13	1	1060	14	9	14	2	5	22	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. Factor	0.95	0.95	1.00	0.95	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.998			0.989				
Flt Protected								0.982			0.991	
Satd. Flow (prot)	0	3576	1633	0	3569	0	0	1866	0	0	1838	0
Flt Permitted								0.982			0.991	
Satd. Flow (perm)	0	3576	1633	0	3569	0	0	1866	0	0	1838	0
Link Speed (k/h)		80			80			80			80	
Link Distance (m)		1007.9			1349.4			495.3			723.5	
Travel Time (s)		45.4			60.7			22.3			32.6	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Heavy Vehicles (%)	50%	2%	0%	0%	2%	7%	0%	0%	0%	20%	0%	0%
Adj. Flow (vph)	2	1359	13	1	1093	14	9	14	2	5	23	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1361	13	0	1108	0	0	25	0	0	28	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Free			Free			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	47.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	1318	13	1	1060	14	9	14	2	5	22	0
Future Volume (Veh/h)	2	1318	13	1	1060	14	9	14	2	5	22	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	2	1359	13	1	1093	14	9	14	2	5	23	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1107			1372			1923	2472	680	1794	2478	554
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1107			1372			1923	2472	680	1794	2478	554
tC, single (s)	5.1			4.1			7.5	6.5	6.9	7.9	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.7			2.2			3.5	4.0	3.3	3.7	4.0	3.3
p0 queue free %	100			100			41	54	99	81	23	100
cM capacity (veh/h)	409			507			15	30	399	26	30	481

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	SB 1
Volume Total	455	906	13	548	560	25	28
Volume Left	2	0	0	1	0	9	5
Volume Right	0	0	13	0	14	2	0
cSH	409	1700	1700	507	1700	24	29
Volume to Capacity	0.00	0.53	0.01	0.00	0.33	1.06	0.96
Queue Length 95th (m)	0.1	0.0	0.0	0.0	0.0	24.0	24.1
Control Delay (s)	0.2	0.0	0.0	0.1	0.0	441.9	349.6
Lane LOS	A			A		F	F
Approach Delay (s)	0.1			0.0		441.9	349.6
Approach LOS						F	F

Intersection Summary				
Average Delay	8.3			
Intersection Capacity Utilization	47.8%	ICU Level of Service		A
Analysis Period (min)	15			



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	30	314	0	29	465
Future Volume (vph)	0	30	314	0	29	465
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0	0.0		0.0	85.0	
Storage Lanes	1	0		0	1	
Taper Length (m)	2.5				100.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.865					
Flt Protected					0.950	
Satd. Flow (prot)	1553	0	1812	0	1772	1779
Flt Permitted					0.950	
Satd. Flow (perm)	1553	0	1812	0	1772	1779
Link Speed (k/h)	80		70			70
Link Distance (m)	79.4		1008.3			713.0
Travel Time (s)	3.6		51.9			36.7
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	0%	7%	6%	0%	3%	8%
Adj. Flow (vph)	0	32	331	0	31	489
Shared Lane Traffic (%)						
Lane Group Flow (vph)	32	0	331	0	31	489
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.7		3.7			3.7
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	1.6		1.6			1.6
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14		14	24	
Sign Control	Stop		Free			Free

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 34.5%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	30	314	0	29	465
Future Volume (Veh/h)	0	30	314	0	29	465
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	32	331	0	31	489
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	882	331			331	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	882	331			331	
tC, single (s)	6.4	6.3			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.4			2.2	
p0 queue free %	100	95			97	
cM capacity (veh/h)	311	699			1223	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	32	331	31	489
Volume Left	0	0	31	0
Volume Right	32	0	0	0
cSH	699	1700	1223	1700
Volume to Capacity	0.05	0.19	0.03	0.29
Queue Length 95th (m)	1.1	0.0	0.6	0.0
Control Delay (s)	10.4	0.0	8.0	0.0
Lane LOS	B		A	
Approach Delay (s)	10.4	0.0	0.5	
Approach LOS	B			

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	34.5%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	5	26	12	39	55	30
Future Volume (vph)	5	26	12	39	55	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	0.887				0.952	
Flt Protected	0.992			0.988		
Satd. Flow (prot)	1690	0	0	1261	1829	0
Flt Permitted	0.992			0.988		
Satd. Flow (perm)	1690	0	0	1261	1829	0
Link Speed (k/h)	50			50	50	
Link Distance (m)	307.8			204.8	258.0	
Travel Time (s)	22.2			14.7	18.6	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Heavy Vehicles (%)	0%	0%	33%	56%	0%	0%
Adj. Flow (vph)	6	30	14	45	64	35
Shared Lane Traffic (%)						
Lane Group Flow (vph)	36	0	0	59	99	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)	24	14	24			14
Sign Control	Stop			Free	Free	

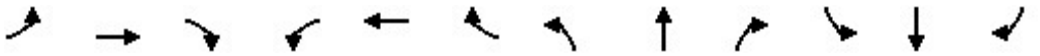
Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 19.4%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	26	12	39	55	30
Future Volume (Veh/h)	5	26	12	39	55	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	6	30	14	45	64	35
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	154	82	99			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	154	82	99			
tC, single (s)	6.4	6.2	4.4			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.5			
p0 queue free %	99	97	99			
cM capacity (veh/h)	833	984	1321			

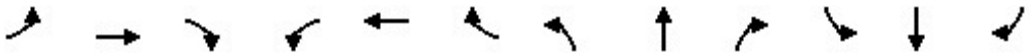
Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	36	59	99
Volume Left	6	14	0
Volume Right	30	0	35
cSH	955	1321	1700
Volume to Capacity	0.04	0.01	0.06
Queue Length 95th (m)	0.9	0.2	0.0
Control Delay (s)	8.9	1.9	0.0
Lane LOS	A	A	
Approach Delay (s)	8.9	1.9	0.0
Approach LOS	A		

Intersection Summary			
Average Delay		2.2	
Intersection Capacity Utilization		19.4%	ICU Level of Service
Analysis Period (min)		15	



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	3	16	15	2	5	12	3	20	21	31	1
Future Volume (vph)	0	3	16	15	2	5	12	3	20	21	31	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt		0.885			0.970			0.923			0.998	
Flt Protected					0.967			0.983			0.980	
Satd. Flow (prot)	0	1547	0	0	1802	0	0	1108	0	0	1879	0
Flt Permitted					0.967			0.983			0.980	
Satd. Flow (perm)	0	1547	0	0	1802	0	0	1108	0	0	1879	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		108.3			156.3			390.5			72.5	
Travel Time (s)		7.8			11.3			28.1			5.2	
Peak Hour Factor	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
Heavy Vehicles (%)	0%	67%	0%	0%	0%	0%	17%	0%	90%	0%	0%	0%
Adj. Flow (vph)	0	4	23	21	3	7	17	4	28	30	44	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	27	0	0	31	0	0	49	0	0	75	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)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Stop			Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 18.5%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	0	3	16	15	2	5	12	3	20	21	31	1
Future Volume (vph)	0	3	16	15	2	5	12	3	20	21	31	1
Peak Hour Factor	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71	0.71
Hourly flow rate (vph)	0	4	23	21	3	7	17	4	28	30	44	1

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	27	31	49	75
Volume Left (vph)	0	21	17	30
Volume Right (vph)	23	7	28	1
Hadj (s)	-0.34	0.00	0.70	0.07
Departure Headway (s)	3.9	4.2	4.8	4.2
Degree Utilization, x	0.03	0.04	0.07	0.09
Capacity (veh/h)	893	825	730	850
Control Delay (s)	7.0	7.4	8.1	7.5
Approach Delay (s)	7.0	7.4	8.1	7.5
Approach LOS	A	A	A	A

Intersection Summary				
Delay	7.6			
Level of Service	A			
Intersection Capacity Utilization	18.5%	ICU Level of Service	A	
Analysis Period (min)	15			



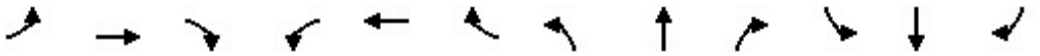
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	279	0	0	202	0	0
Future Volume (vph)	279	0	0	202	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt						
Flt Protected						
Satd. Flow (prot)	1795	0	0	1847	1921	0
Flt Permitted						
Satd. Flow (perm)	1795	0	0	1847	1921	0
Link Speed (k/h)	70			70	50	
Link Distance (m)	184.1			884.7	224.6	
Travel Time (s)	9.5			45.5	16.2	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	7%	0%	0%	4%	0%	0%
Adj. Flow (vph)	294	0	0	213	0	0
Shared Lane Traffic (%)						
Lane Group Flow (vph)	294	0	0	213	0	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	0.99	0.99	0.99	0.99	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Sign Control	Free			Free	Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 18.0%		ICU Level of Service A	
Analysis Period (min) 15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	279	0	0	202	0	0
Future Volume (Veh/h)	279	0	0	202	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	294	0	0	213	0	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	184					
pX, platoon unblocked						
vC, conflicting volume			294		507	294
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			294		507	294
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1279		529	750

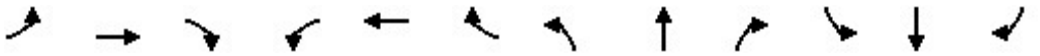
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	294	213	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1279	1700
Volume to Capacity	0.17	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay		0.0	
Intersection Capacity Utilization		18.0%	ICU Level of Service A
Analysis Period (min)		15	



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	3	3	0	1	1	38	0	0	66	0
Future Volume (vph)	0	0	3	3	0	1	1	38	0	0	66	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Util. 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
Frt		0.865			0.973							
Flt Protected					0.962			0.999				
Satd. Flow (prot)	0	1662	0	0	1798	0	0	1247	0	0	1921	0
Flt Permitted					0.962			0.999				
Satd. Flow (perm)	0	1662	0	0	1798	0	0	1247	0	0	1921	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		102.1			176.5			258.0			689.0	
Travel Time (s)		7.4			12.7			18.6			49.6	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	55%	0%	0%	0%	0%
Adj. Flow (vph)	0	0	4	4	0	1	1	48	0	0	83	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	4	0	0	5	0	0	49	0	0	83	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)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		1.6			1.6			1.6			1.6	
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)	24		14	24		14	24		14	24		14
Sign Control		Stop			Stop			Free			Free	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 13.5%		ICU Level of Service A	
Analysis Period (min) 15			

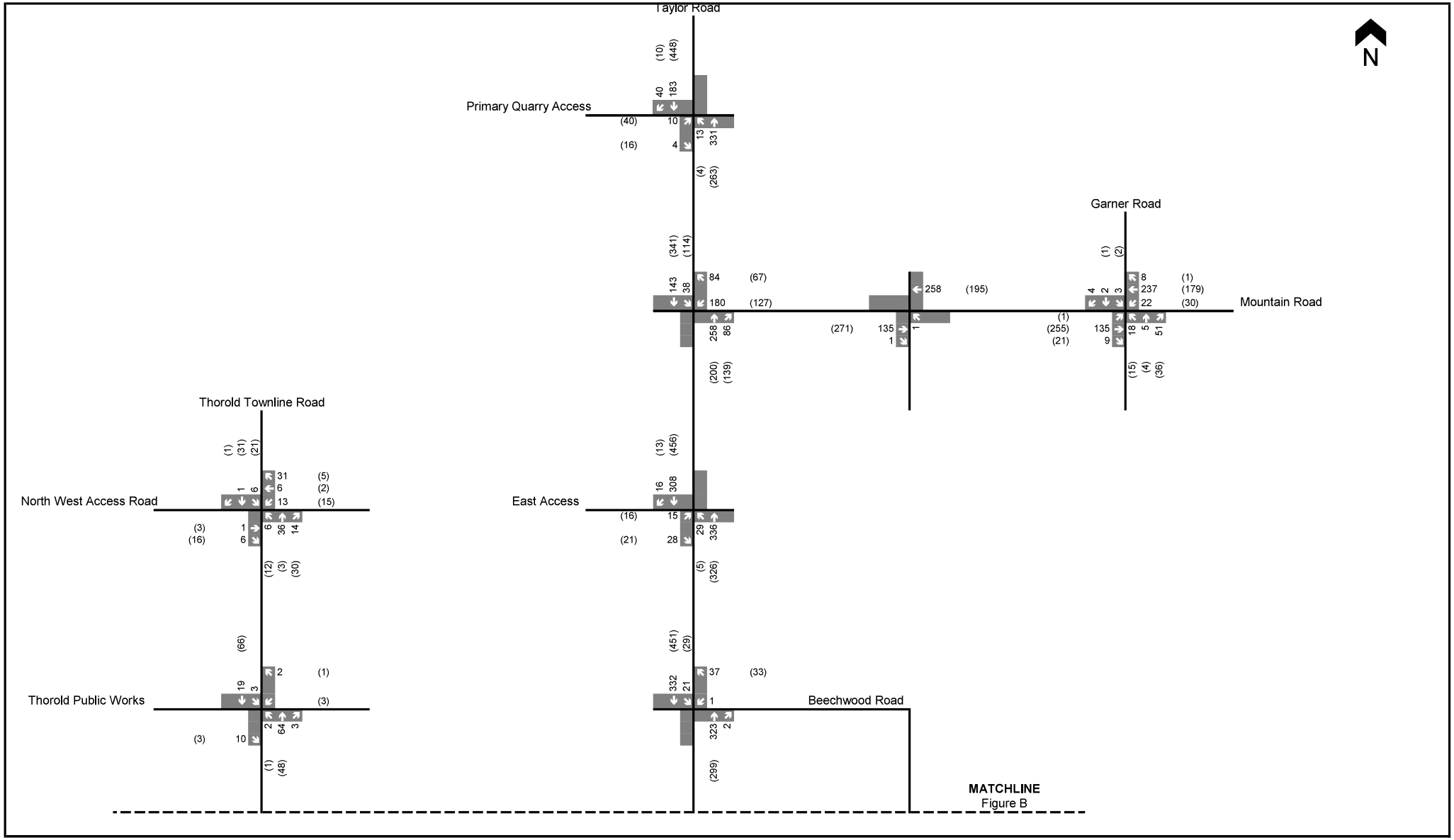


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	3	3	0	1	1	38	0	0	66	0
Future Volume (Veh/h)	0	0	3	3	0	1	1	38	0	0	66	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	0	0	4	4	0	1	1	48	0	0	82	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	133	132	82	136	132	48	82			48		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	133	132	82	136	132	48	82			48		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	842	762	983	836	762	1027	1528			1572		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	4	5	49	82
Volume Left	0	4	1	0
Volume Right	4	1	0	0
cSH	983	868	1528	1572
Volume to Capacity	0.00	0.01	0.00	0.00
Queue Length 95th (m)	0.1	0.1	0.0	0.0
Control Delay (s)	8.7	9.2	0.2	0.0
Lane LOS	A	A	A	
Approach Delay (s)	8.7	9.2	0.2	0.0
Approach LOS	A	A		

Intersection Summary				
Average Delay	0.6			
Intersection Capacity Utilization	13.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Appendix B:
Future Total Conditions Traffic Volumes

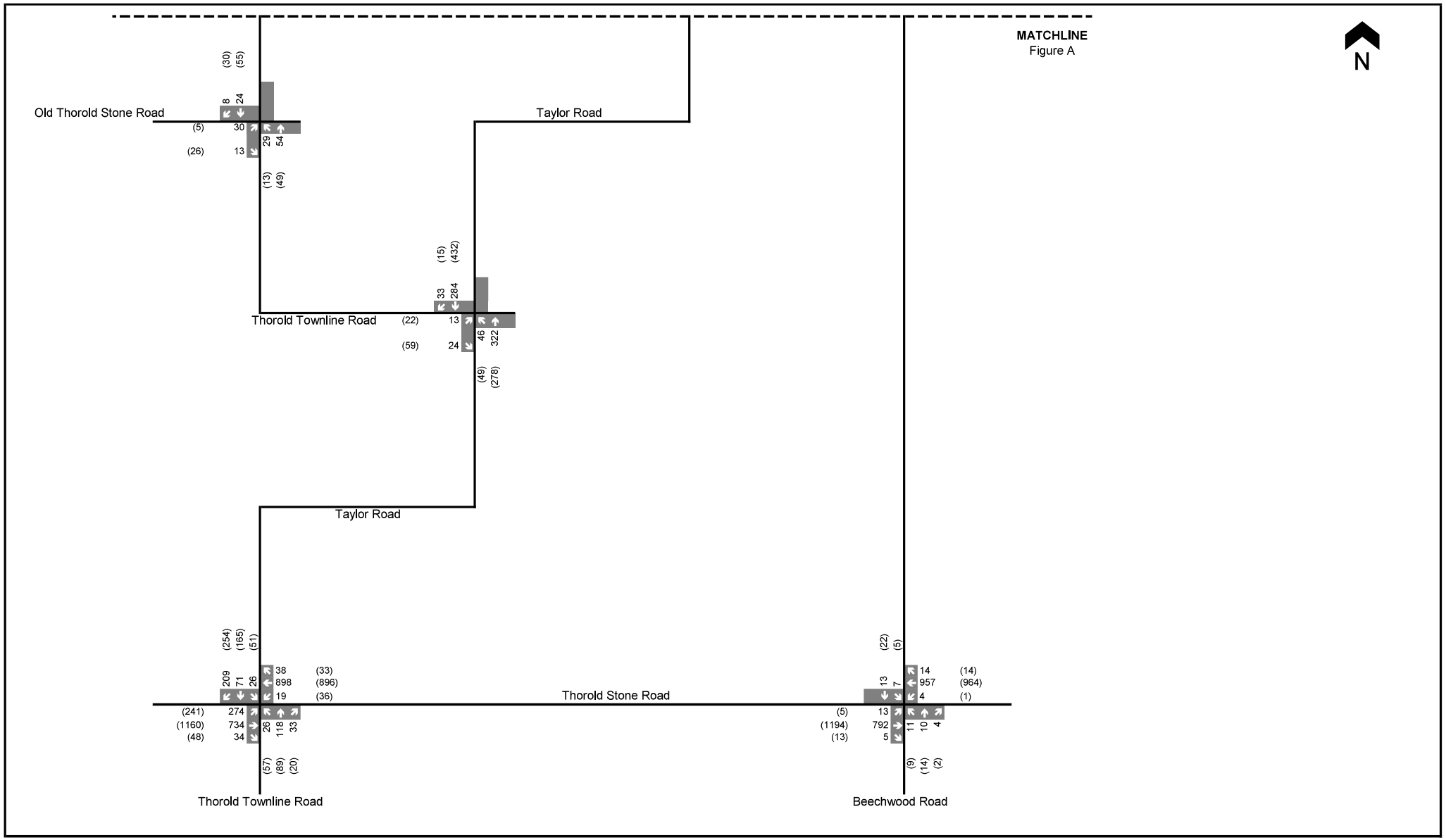


Legend

xx A.M. Peak Hour Traffic
(xx) P.M. Peak Hour Traffic

TYLin

FT H1 Traffic Volume A

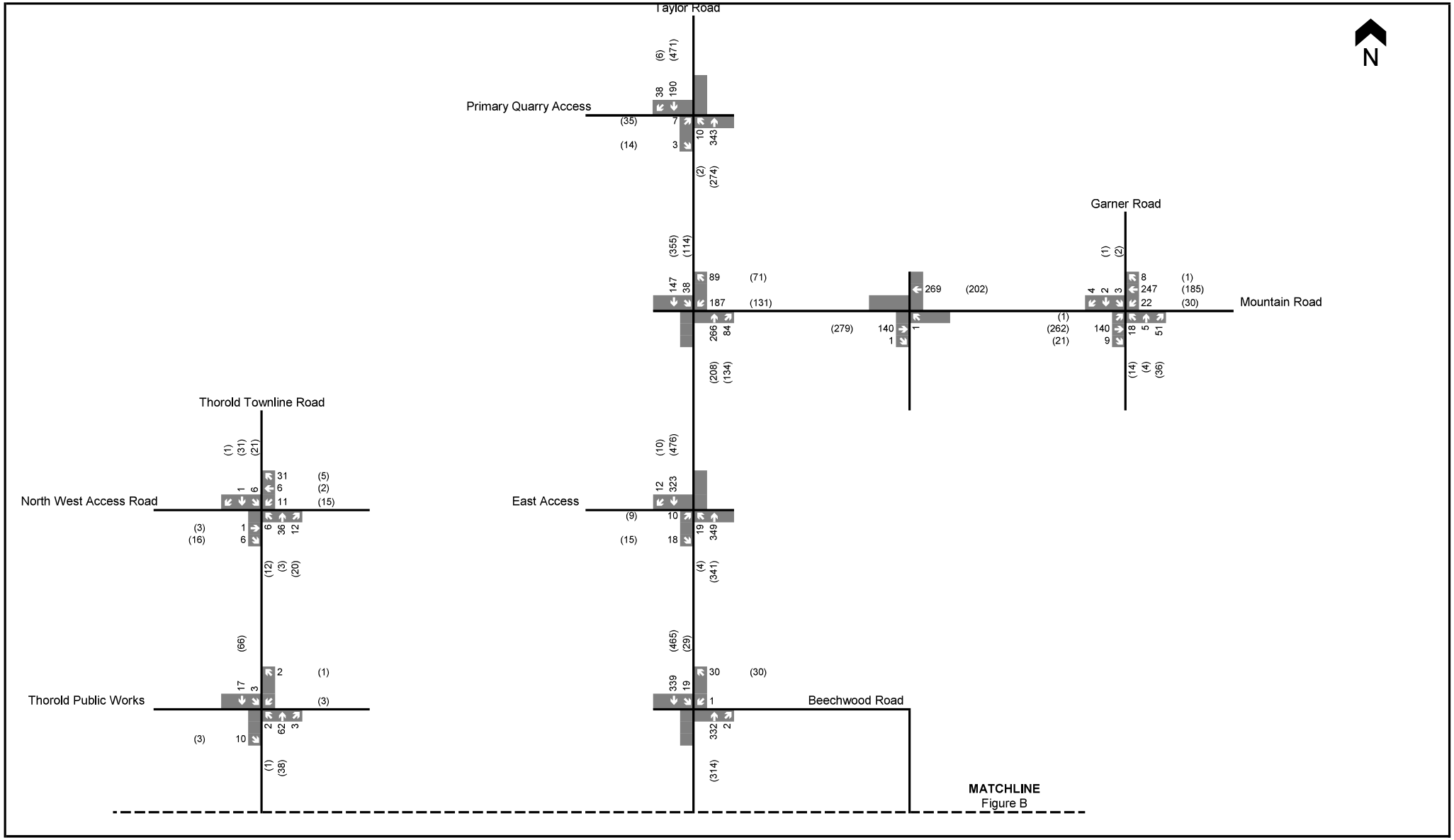


Legend

xx A.M. Peak Hour Traffic
(xx) P.M. Peak Hour Traffic

FT H1 Traffic Volume B

TYLin

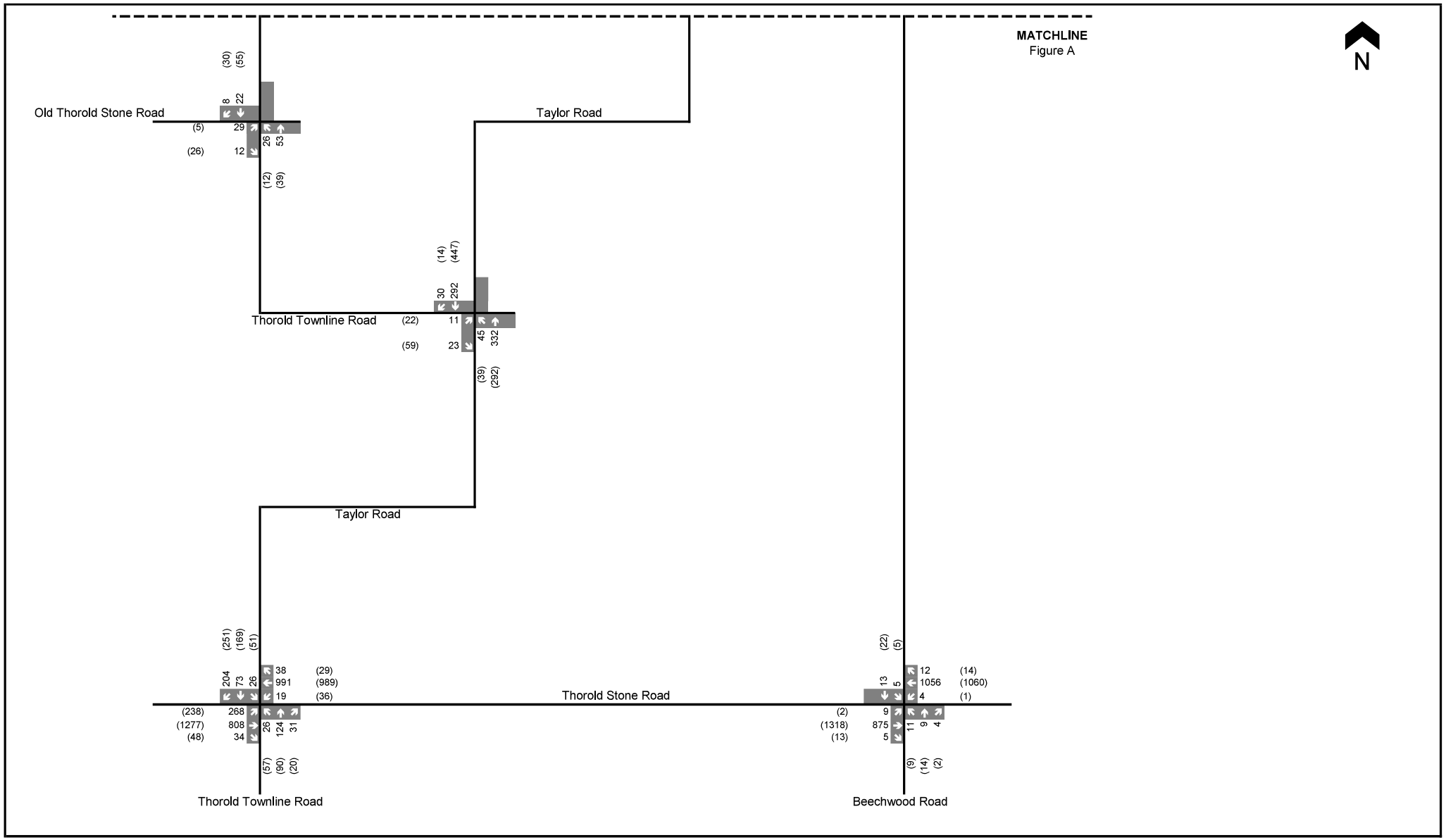


Legend

xx A.M. Peak Hour Traffic
(xx) P.M. Peak Hour Traffic

TYLin

FT H2 Traffic Volume A



Legend

xx A.M. Peak Hour Traffic
(xx) P.M. Peak Hour Traffic

TYLin

FT H2 Traffic Volume B

Appendix C:
Collision Assessment

2025

Road:	**Garner Road Between Reta Street & Swart Street**	
AADT	784	
Length (km)	2.31	
Two-way roadways		
AADT	784	
Length (miles)	1.44	
Predicted total crash frequency	0.301	Total collision/year
Overdispersion Parameter	0.164417879	
Lane width	3 m	
Shoulder	0.6 m	
Type of shoulder	Earth Shoulder	
Adjustment		
CMF Lane width	1.0500528	
CMF Shouder	1.094471488	
Predicted total crash frequency	0.346	Total collision/year
Expected Collisions		
2020	1	
2021	0	
2022	1	
2023	0	
2024	0	
Total Collisions	2	
Weight	0.946242497	
Expected Total Crash Frequency	0.348459555	Total collision/year

2031

Road:	**Garner Road & Mountain Road**	
	Data	
Major		
AADT	3804	
Minor		
AADT	784	
Intersection Type - Unsignalized	Four-leg stop-controlled intersections on rural two-lane two-way roads	
Predicted total crash frequency	1.57078	Collision Year
Overdispersion Parameter	0.24	
Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	0	1
Number of Approaches with Exclusive Right Turn Lanes	0	1
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Unsignalized	1.43051	
Expected Unsignalized Collisions		
2020	1	
2021	0	
2022	0	
2023	0	
2024	0	
Total Collisions	1	
Weight	0.74442	
Expected Total Craash Frequency	1.11602	Total collision/year

2036

Road:	**Garner Road & Mountain Road**	
	Data	
Major		
AADT	3999	
Minor		
AADT	784	
Intersection Type - Unsignalized	Four-leg stop-controlled intersections on rural two-lane two-way roads	
Predicted total crash frequency	1.61861	Collision Year
Overdispersion Parameter	0.24	
Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	0	1
Number of Approaches with Exclusive Right Turn Lanes	0	1
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Unsignalized	1.47407	
Expected Unsignalized Collisions		
2020	1	
2021	0	
2022	0	
2023	0	
2024	0	
Total Collisions	1	
Weight	0.73867	
Expected Total Craash Frequency	1.14112	Total collision/year

Formulas:
Source:Traffic and Highway Engineering, SI Edition, 5th Edition / Highway Safety Manual 1st Edition)

Table 5.17 Safety Performance Functions for Intersections

Intersection Type	*SPF*[10] *(Total Predicted Average Crash Frequency)*	*Overdispersion Parameter (k)*	*Equation #*
Three-leg stop-controlled intersections on rural two-lane two-way roads[1]	$N_{spf3sT} = e^{-9.86+(0.79)\times \ln AADT_{maj}+(0.49)\times \ln AADT_{min}}$	0.54	5.20
Four-leg stop-controlled intersections on rural two-lane two-way roads[2]	$N_{spf4sT} = e^{-8.56+(0.60)\times \ln AADT_{maj}+(0.61)\times \ln AADT_{min}}$	0.24	5.21
Four-leg signalized intersections on rural two-lane two-way roads[3]	$N_{spf4sG} = e^{-5.13+(0.60)\times \ln AADT_{maj}+(0.20)\times \ln AADT_{min}}$	0.11	5.22

(Continued)

Equations:

Empirical Bayes Weights

$$w_{total} = \frac{1}{1 + k_{total} \times \sum_{n=1}^{Y} N_{predicted,n(total)}} \quad \text{or} \qquad (5.39)$$

$$w_{FI} = \frac{1}{1 + k_{FI} \times \sum_{n=1}^{Y} N_{predicted,n(FI)}} \qquad (5.40)$$

where

w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
k_{FI} = overdispersion parameter for fatal and injury crashes
k_{total} = overdispersion parameter for total crashes
$N_{predicted,n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,n(total)}$ predicted average total crash frequency in year n from SPF

Expected Crash Frequency

$$N_{expected,1(total)} = (w_{total}) \times N_{predicted,1(total)} + (1 - w_{total}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(total)}}{\sum_{n=1}^{Y} C_{n(total)}} \right] \quad (5.41)$$

$$N_{expected,1(FI)} = (w_{total}) \times N_{predicted,1(FI)} + (1 - w_{FI}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(FI)}}{\sum_{n=1}^{Y} C_{n(FI)}} \right] \quad (5.42)$$

where

$N_{expected1,(FI)}$ = EB-adjusted estimated average crash frequency for year
$N_{expected1,(total)}$ = EB-adjusted estimated average crash frequency for year
w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
$N_{observed,\ n(FI)}$ = observed fatal and injury crash frequency in year n
$N_{observed,\ n(total)}$ = observed average total crash frequency in year n
$N_{predicted,\ n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,\ n(total)}$ = predicted average total crash frequency in year n from SPF
$C_{n(total)}$ = annual correction factor for total crashes in year n
$C_{n(FI)}$ = annual correction factor for fatal crashes in year n
n = year
Y = final year

Source: AASHTO, 2010; in Roess, Prassasand McShane, p.234

Type of Lane	CMF for Number of Approaches with Exclusive Turn Lane(s)			
	1	2	3	4
LT Lane(s)	0.90	0.81	0.73	0.66
RT Lane(s)	0.96	0.92	0.88	0.85

2025

Road:	**Mountain Road between Garner Road and Taylor Road**	
AADT	3584	
Length (km)	1.08	
Two-way roadways		
AADT	3584	
Length (miles)	0.67	
Predicted total crash frequency	0.643	Total collision/year
Overdispersion Parameter	0.351671575	
Lane width	3.3 m	
Shoulder	2.4 m or more	
Type of shoulder	Paved	
Adjustment		
CMF Lane width	1.0287	
CMF Shouder	0.9649	
Predicted total crash frequency	0.638	Total collision/year
Expected Collisions		
2020	2	1
2021	1	1
2022	1	1
2023	0	
2024	0	
Total Collisions	4	
Weight	0.816788183	
Expected Total Crash Frequency	0.667543652	Total collision/year

2031

Road:	**Mountain Road between Garner Road and Taylor Road**	
AADT	3804	
Length (km)	1.08	
Two-way roadways		
AADT	3804	
Length (miles)	0.67	
Predicted total crash frequency	0.682	Total collision/year
Overdispersion Parameter	0.351671575	
Lane width	3.3 m	
Shoulder	2.4 m or more	
Type of shoulder	Paved	
Adjustment		
CMF Lane width	1.0287	
CMF Shouder	0.9649	
Predicted total crash frequency	0.677	Total collision/year
Expected Collisions		
2020	2	1
2021	1	1
2022	1	1
2023	0	
2024	0	
Total Collisions	4	
Weight	0.807704527	
Expected Total Crash Frequency	0.700640518	Total collision/year

2036

Road:	**Mountain Road between Garner Road and Taylor Road**	
AADT	3999	
Length (km)	1.08	
Two-way roadways		
AADT	3999	
Length (miles)	0.67	
Predicted total crash frequency	0.717	Total collision/year
Overdispersion Parameter	0.351671575	
Lane width	3.3 m	
Shoulder	2.4 m or more	
Type of shoulder	Paved	
Adjustment		
CMF Lane width	1.0287	
CMF Shouder	0.9649	
Predicted total crash frequency	0.712	Total collision/year
Expected Collisions		
2020	2	1
2021	1	1
2022	1	1
2023	0	
2024	0	
Total Collisions	4	
Weight	0.799820363	
Expected Total Crash Frequency	0.729366958	Total collision/year

Formulas:
Source:Traffic and Highway Engineering, SI Edition, 5th Edition / Highway Safety Manual 1st Edition)

Table 5.14 Crash Modification Factors[a] (*CMFs*) for Lane Width on Roadway Segments

Roadway Type	*Lane Width*	*Average Annual Daily Traffic (AADT) (veh/day)*			*Equation Number*
		< 400	*400 to 2000*	*>2000*	
Rural Two-Lane[a]	2.7 m or less	1.05	$1.05 + 2.81 \times 10^{-4}(AADT - 400)$	1.50	5.2
	3 m	1.02	$1.02 + 1.75 \times 10^{-4}(AADT - 400)$	1.30	5.3
	3.3 m	1.01	$1.01 + 2.5 \times 10^{-5}(AADT - 400)$	1.05	5.4
	3.6 m or more	1.00	1.00	1.00	5.5
Undivided Rural Multilane[b]	2.7 m or less	1.04	$1.04 + 2.13 \times 10^{-4}(AADT - 400)$	1.38	5.6
	3 m	1.02	$1.02 + 1.31 \times 10^{-4}(AADT - 400)$	1.23	5.7
	3.3 m	1.01	$1.01 + 1.88 \times 10^{-5}(AADT - 400)$	1.04	5.8
	3.6 m or more	1.00	1.00	1.00	5.9
Divided Rural Multilane[c]	2.7 m or less	1.03	$1.03 + 1.38 \times 10^{-4}(AADT - 400)$	1.25	5.10
	3 m	1.01	$1.01 + 8.75 \times 10^{-5}(AADT - 400)$	1.15	5.11
	3.3 m	1.01	$1.01 + 1.25 \times 10^{-5}(AADT - 400)$	1.03	5.12
	3.6 m or more	1.00	1.00	1.00	5.13

[a]Note: The collision types related to lane width to which these *CMFs* apply are single-vehicle run-off-the-road and multiple-vehicle head-on, opposite direction sideswipe, and same direction sideswipe crashes.
[b]Note: Standard error of *CMF* is unknown.
[c]Note: To determine the *CMF* for changing lane width and/or *AADT*, divide the "new" condition *CMF* by the "existing" condition *CMF*.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

$$CMF_{lr} = (CMF_{ra} - 1)p_{ra} + 1.0 \quad (5.14)$$

where

CMF_{lr} = crash modification for the effect of lane width on total crashes.
CMF_{ra} = crash modification for the effect of lane width on single-vehicle run-off-the-road and/or related crashes on two-lane roads.
p_{ra} = proportion of total crashes constituted by single-vehicle run-off-the-road and/or related crashes on two-lane roads. HSM default value is 0.574, but a value based on actual local data is preferable when available.

Table 5.16 Safety Performance Functions for Rural Roadway Segments

Roadway Segment Type	*SPF*[c]	*Overdispersion Parameter (k)*	*Equation #*
Rural two-lane, two-way roadways[1,4]	$N_{spfrs} = (AADT) \times (L) \times (365) \times (10^{-6}) \times (e^{-0.312})$	0.236/L	**5.17**
Undivided rural multilane roadways[2,5,7]	$N_{spfru} = e^{(a+(b)\times(\ln AADT)+\ln L)}$	$k = \frac{1}{e^{(c+\ln(L))}}$	5.18
Divided rural multilane roadway segments[3,6,8]	$N_{spfru} = e^{(a+(b)\times(\ln AADT)+\ln L)}$	$k = \frac{1}{e^{(c+\ln(L))}}$	5.19

Note: SPF[c] gives the value of $N_{sp,i}$ which is the predicted total crash frequency for road segment *i*
L = length of segment, km
a, *b*, *c* = regression parameters (see Tables 5.18 and 5.19)
[1]Base conditions for roadway segments on rural two-lane, two-way roads are

Lane width (LW)	= 3.6 m
Shoulder width (SW)	= 1.8 m
Shoulder type	paved

[2]Base conditions for undivided rural four-lane roadway segments are

Lane width (LW)	= 3.6 m
Shoulder width (SW)	= 1.8 m
Shoulder type	paved
Sideslopes	= 1V:7H or flatter
Lighting	None
Automated speed enforcement	None

[3]Base conditions for divided rural multilane roadway segments are

Lane width (LW)	= 3.6 m
Shoulder width (SW)	= 2.4 m
Median width	= 9 m
Lighting	None
Automated speed enforcement	None

[4]*AADT* range for rural two-lane roadways is from zero to 17,800 veh/day.
[5]*AADT* range for undivided rural four-lane roadways is from zero to 33,200 veh/day.
[6]*AADT* range for divided rural four-lane roadways is from zero to 89,300 veh/day.
[7]See Table 5.18 for values of *a*, *b*, and *c* in Eq. 5.18 for undivided rural multilane segments.
[8]See Table 5.19 for values of *a*, *b*, and *c* in Eq. 5.19 for undivided rural multilane segments.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Table 5.18 SPF Coefficients for Total and Fatal-and-Injury Crashes on Undivided Roadway Segments (for Use in Equation 5.18)

Crash Severity Level	*a*	*b*	*c*
4-lane total	−9.653	1.176	1.675
4-lane fatal and injury	−9.410	1.094	1.796
4-lane fatal and injury[a]	−8.577	0.938	2.003

[a] Using KABCO scale, these include only KAB crashes. Crashes with severity level C (possible injury) are not included.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Equations:

Empirical Bayes Weights

$$w_{total} = \frac{1}{1 + k_{total} \times \sum_{n=1}^{Y} N_{predicted,n(total)}} \quad \text{or} \qquad (5.39)$$

$$w_{FI} = \frac{1}{1 + k_{FI} \times \sum_{n=1}^{Y} N_{predicted,n(FI)}} \qquad (5.40)$$

where

w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
k_{FI} = overdispersion parameter for fatal and injury crashes
k_{total} = overdispersion parameter for total crashes
$N_{predicted,n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,n(total)}$ predicted average total crash frequency in year n from SPF

Expected Crash Frequency

$$N_{expected,1(total)} = (w_{total}) \times N_{predicted,1(total)} + (1 - w_{total}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(total)}}{\sum_{n=1}^{Y} C_{n(total)}} \right] \qquad (5.41)$$

$$N_{expected,1(FI)} = (w_{total}) \times N_{predicted,1(FI)} + (1 - w_{FI}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(FI)}}{\sum_{n=1}^{Y} C_{n(FI)}} \right] \qquad (5.42)$$

where

$N_{expected1,(FI)}$ = EB-adjusted estimated average crash frequency for year
$N_{expected1,(total)}$ = EB-adjusted estimated average crash frequency for year
w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
$N_{observed,\ n(FI)}$ = observed fatal and injury crash frequency in year n
$N_{observed,\ n(total)}$ = observed average total crash frequency in year n
$N_{predicted,\ n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,\ n(total)}$ = predicted average total crash frequency in year n from SPF
$C_{n(total)}$ = annual correction factor for total crashes in year n
$C_{n(FI)}$ = annual correction factor for fatal crashes in year n
n = year
Y = final year

2025

Road:	**Taylor Road & Beechwood Road**
	Data
Major	
AADT	5800
Minor	
AADT	396
Intersection Type - Unsignalized	Three-leg stop-controlled intersections on rural two-lane two-way roads
Predicted total crash frequency	0.9201 Collision Year
Overdispersion Parameter	0.54

Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	1	0.9
Number of Approaches with Exclusive Right Turn Lanes	0	1
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Unsignalized	0.75414	
Expected Unsignalized Collisions		
2020	0	
2021	0	
2022	1	
2023	0	
2024	0	
Total Collisions	1	
Weight	0.71061	
Expected Total Craash Frequency	0.59378	Total collision/year

2031

Road:	**Taylor Road & Beechwood Road**
	Data
Major	
AADT	6161
Minor	
AADT	396
Intersection Type - Unsignalized	Three-leg stop-controlled intersections on rural two-lane two-way roads
Predicted total crash frequency	0.96505 Collision Year
Overdispersion Parameter	0.54

Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	1	0.9
Number of Approaches with Exclusive Right Turn Lanes	0	1
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Unsignalized	0.79099	
Expected Unsignalized Collisions		
2020	0	
2021	0	
2022	1	
2023	0	
2024	0	
Total Collisions	1	
Weight	0.70071	
Expected Total Craash Frequency	0.61411	Total collision/year

2036

Road:	**Taylor Road & Beechwood Road**	
	Data	
Major		
AADT	6475	
Minor		
AADT	396	
Intersection Type - Unsignalized	Three-leg stop-controlled intersections on rural two-lane two-way roads	
Predicted total crash frequency	1.00371	Collision Year
Overdispersion Parameter	0.54	
Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	1	0.9
Number of Approaches with Exclusive Right Turn Lanes	0	1
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Unsignalized	0.82267	
Expected Unsignalized Collisions		
2020	0	
2021	0	
2022	1	
2023	0	
2024	0	
Total Collisions	1	
Weight	0.69241	
Expected Total Craash Frequency	0.63114	Total collision/year

Formulas:

Source: Traffic and Highway Engineering, SI Edition, 5th Edition / Highway Safety Manual 1st Edition)

Table 5.17 Safety Performance Functions for Intersections

Intersection Type	*SPF*[10] *(Total Predicted Average Crash Frequency)*	*Overdispersion Parameter (k)*	*Equation #*
Three-leg stop-controlled intersections on rural two-lane two-way roads[1]	$N_{spf3sT} = e^{-9.86+(0.79)\times \ln AADT_{maj}+(0.49)\times \ln AADT_{min}}$	0.54	5.20
Four-leg stop-controlled intersections on rural two-lane two-way roads[2]	$N_{spf4sT} = e^{-8.56+(0.60)\times \ln AADT_{maj}+(0.61)\times \ln AADT_{min}}$	0.24	5.21
Four-leg signalized intersections on rural two-lane two-way roads[3]	$N_{spf4sG} = e^{-5.13+(0.60)\times \ln AADT_{maj}+(0.20)\times \ln AADT_{min}}$	0.11	5.22

(Continued)

Equations:

Empirical Bayes Weights

$$w_{total} = \frac{1}{1 + k_{total} \times \sum_{n=1}^{Y} N_{predicted,n(total)}} \quad \text{or} \qquad (5.39)$$

$$w_{FI} = \frac{1}{1 + k_{FI} \times \sum_{n=1}^{Y} N_{predicted,n(FI)}} \qquad (5.40)$$

where

w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
k_{FI} = overdispersion parameter for fatal and injury crashes
k_{total} = overdispersion parameter for total crashes
$N_{predicted,n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,n(total)}$ predicted average total crash frequency in year n from SPF

Expected Crash Frequency

$$N_{expected,1(total)} = (w_{total}) \times N_{predicted,1(total)} + (1 - w_{total}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(total)}}{\sum_{n=1}^{Y} C_{n(total)}} \right] \qquad (5.41)$$

$$N_{expected,1(FI)} = (w_{total}) \times N_{predicted,1(FI)} + (1 - w_{FI}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(FI)}}{\sum_{n=1}^{Y} C_{n(FI)}} \right] \qquad (5.42)$$

where

$N_{expected1.,(FI)}$ = EB-adjusted estimated average crash frequency for year
$N_{expected1,(total)}$ = EB-adjusted estimated average crash frequency for year
w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
$N_{observed,\ n(FI)}$ = observed fatal and injury crash frequency in year n
$N_{observed,\ n(total)}$ = observed average total crash frequency in year n
$N_{predicted,\ n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,\ n(total)}$ = predicted average total crash frequency in year n from SPF
$C_{n(total)}$ = annual correction factor for total crashes in year n
$C_{n(FI)}$ = annual correction factor for fatal crashes in year n
n = year
Y = final year

Source: AASHTO, 2010; in Roess, Prassas and McShane, p.234

Type of Lane	CMF for Number of Approaches with Exclusive Turn Lane(s)			
	1	2	3	4
LT Lane(s)	0.90	0.81	0.73	0.66
RT Lane(s)	0.96	0.92	0.88	0.85

2025

Road:	**Taylor Road & Mountain Road**	
	Data	
Major		
AADT	5604	
Minor		
AADT	3300	
Intersection Type - Signalized	Four-leg signalized intersections on rural two-lane two-way roads	
Predicted total crash frequency	5.30727	Collision Year
Overdispersion Parameter	0.11	
Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	2	0.81
Number of Approaches with Exclusive Right Turn Lanes	0	1
Type of Left Turn Phasing	Protec+Perm	
Number of Approaches with Left Turn Phasing	1	
CMF	0.99	
Number of intersection approaches that prohibit right turn on red (RTOR	0	
CMF	1	
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Signalized	3.87585	
Expected Signalized Collisions		
2020	1	
2021	1	
2022	1	
2023	1	
2024	0	
Total Collisions	4	
Weight	0.70109	
Expected Total Craash Frequency	2.95646	Total collision/year

2031

Road:	**Taylor Road & Mountain Road**	
	Data	
Major		
AADT	5949	
Minor		
AADT	3503	
Intersection Type - Signalized	Four-leg signalized intersections on rural two-lane two-way roads	
Predicted total crash frequency	5.56703	Collision Year
Overdispersion Parameter	0.11	
Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	2	0.81
Number of Approaches with Exclusive Right Turn Lanes	0	1
Type of Left Turn Phasing	Protec+Perm	
Number of Approaches with Left Turn Phasing	1	
CMF	0.99	
Number of intersection approaches that prohibit right turn on red (RTOR	0	
CMF	1	
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Signalized	4.06555	
Expected Signalized Collisions		
2020	1	
2021	1	
2022	1	
2023	1	
2024	0	
Total Collisions	4	
Weight	0.69098	
Expected Total Craash Frequency	3.05644	Total collision/year

2036

Road:	**Taylor Road & Mountain Road**	
	Data	
Major		
AADT	6252	
Minor		
AADT	3682	
Intersection Type - Signalized	Four-leg signalized intersections on rural two-lane two-way roads	
Predicted total crash frequency	5.79292	Collision Year
Overdispersion Parameter	0.11	
Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	2	0.81
Number of Approaches with Exclusive Right Turn Lanes	0	1
Type of Left Turn Phasing	Protec+Perm	
Number of Approaches with Left Turn Phasing	1	
CMF	0.99	
Number of intersection approaches that prohibit right turn on red (RTOR	0	
CMF	1	
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Signalized	4.23051	
Expected Signalized Collisions		
2020	1	
2021	1	
2022	1	
2023	1	
2024	0	
Total Collisions	4	
Weight	0.68243	
Expected Total Craash Frequency	3.14108	Total collision/year

Formulas
Source: Traffic and Highway Engineering, SI Edition, 5th Edition / Highway Safety Manual 1st Edition)

Table 5.17 Safety Performance Functions for Intersections (*continued*)

Three-leg stop-controlled intersections on rural multilane roads[4,7] and four-leg stop-controlled intersections on rural multilane roads[5,7]	$N_{spf3or4T} = e^{(a+b\times\ln AADT_{maj}+c\times\ln AADT_{min})}$	see Table 5.20	5.23
Four-leg signalized intersections on rural multilane highways[6,8]	$N_{spf3sT} = e^{(a+b\times\ln AADT_{maj}+c\times\ln AADT_{min})}$ or $N_{spf3sT} = e^{(a+d\times\ln AADT_{min})}$	see Table 5.21	5.24 5.25

Note: Equation 5.24 for four-leg signalized intersections on rural multilane highways is suitable for only generalized predictions as there are no associated base conditions for it. Also, Eq. 5.25 is suitable for only fatal and injury crashes (excluding possible injuries) on four-leg signalized intersections.
[1]$AADT_{maj}$ range is from zero to 19,500 veh/day, $AADT_{min}$ range from zero to 4300 veh/day.
[2]$AADT_{maj}$ range is from zero to 14,700 veh/day, $AADT_{min}$ range is from zero to 3500 veh/day.
[3]$AADT_{maj}$ range is from zero to 25,200 veh/day, $AADT_{min}$ range is from zero to 3500 veh/day.
[4]$AADT_{maj}$ range is from zero to 78,300 veh/day, $AADT_{min}$ range is from zero to 23,000 veh/day.
[5]$AADT_{maj}$ range is from zero to 78,300 veh/day, $AADT_{min}$ range is from zero to 7400 veh/day.
[6]$AADT_{maj}$ range is from zero to 43,300 veh/day, $AADT_{min}$ range is from zero to 18,500 veh/day.
[7]See Table 5. 20 for regression parameter values for *a, b,* and *c* in Eq. 5.23.
[8]See Table 5. 21 for regression parameter values for *a, b, c,* and *d* in Eqs. 5.24 and 5.25.
[10] Base conditions for three- and four-leg stop controlled intersections are
Intersection skew angle = 0°
Intersection left-turn lanes 0, except for stop controlled approaches
Intersection right-turn lanes 0, except for stop controlled approaches
Lighting None
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Table 5.21 SPF Coefficients for Four-Leg Signalized Intersections for Total and Fatal and Injury Crashes (for Use in Equations 5.24 and 5.25

Intersection Type/severity Level	*a*	*b*	*c*	*d*	*Overdispersion Parameter (Fixed k)*[a]
Four-leg signalized intersections on rural multilane highways (Total Crashes)	−7.182	0.722	0.337		0.277
Four-leg signalized intersections on rural multilane highways (Fatal and Injury Crashes)	−6.393	0.638	0.232		0.218
Four-leg signalized intersections on rural multilane highways (Fatal and Injury Crashes)[b]	−12.011			1.279	0.566

[a]This value should be used directly as the overdispersion parameter; no further computation is required.
[b]Using KABCO scale, these include only KAB crashes. Crashes with severity level C (possible injury) are not included.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Equations:

Empirical Bayes Weights

$$w_{total} = \frac{1}{1 + k_{total} \times \sum_{n=1}^{Y} N_{predicted,n(total)}} \quad \text{or} \qquad (5.39)$$

$$w_{FI} = \frac{1}{1 + k_{FI} \times \sum_{n=1}^{Y} N_{predicted,n(FI)}} \qquad (5.40)$$

where

w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
k_{FI} = overdispersion parameter for fatal and injury crashes
k_{total} = overdispersion parameter for total crashes
$N_{predicted,n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,n(total)}$ predicted average total crash frequency in year n from SPF

Expected Crash Frequency

$$N_{expected,1(total)} = (w_{total}) \times N_{predicted,1(total)} + (1 - w_{total}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(total)}}{\sum_{n=1}^{Y} C_{n(total)}} \right] \qquad (5.41)$$

$$N_{expected,1(FI)} = (w_{total}) \times N_{predicted,1(FI)} + (1 - w_{FI}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(FI)}}{\sum_{n=1}^{Y} C_{n(FI)}} \right] \qquad (5.42)$$

where

$N_{expected1,(FI)}$ = EB-adjusted estimated average crash frequency for year
$N_{expected1,(total)}$ = EB-adjusted estimated average crash frequency for year
w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
$N_{observed,\ n(FI)}$ = observed fatal and injury crash frequency in year n
$N_{observed,\ n(total)}$ = observed average total crash frequency in year n
$N_{predicted,\ n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,\ n(total)}$ = predicted average total crash frequency in year n from SPF
$C_{n(total)}$ = annual correction factor for total crashes in year n
$C_{n(FI)}$ = annual correction factor for fatal crashes in year n
n = year
Y = final year

Source: AASHTO, 2010; in Roess, Prassasand McShane, p.234

Type of Lane	CMF for Number of Approaches with Exclusive Turn Lane(s)			
	1	2	3	4
LT Lane(s)	0.90	0.81	0.73	0.66
RT Lane(s)	0.96	0.92	0.88	0.85

Type of LT Phasing	CMF for Number of Approaches w/LT Phasing			
	1	2	3	4
Permitted	1.00	1.00	1.00	1.00
Protected + Permitted, or Permitted + Protected	0.99	0.98	0.97	0.96
Protected	0.94	0.88	0.83	0.78

2025

Road:	**Taylor Road between Beechwood Road & Thorold Townline Road**	
AADT	5448	
Length (km)	1	
Two-way roadways		
AADT	5448	
Length (miles)	0.62	
Predicted total crash frequency	0.904	Total collision/year
Overdispersion Parameter	0.379805302	
Lane width	3.6 m or more	
Shoulder	2.4 m or more	
Type of shoulder	Paved	
Adjustment		
CMF Lane width	1	
CMF Shouder	0.9649	
Predicted total crash frequency	0.873	Total collision/year
Expected Collisions		
2020	0	
2021	0	
2022	1	
2023	0	
2024	0	
Total Collisions	1	
Weight	0.751058131	
Expected Total Crash Frequency	0.705234384	Total collision/year

2031

Road:	**Taylor Road between Beechwood Road & Thorold Townline Road**	
AADT	5783	
Length (km)	1	
Two-way roadways		
AADT	5783	
Length (miles)	0.62	
Predicted total crash frequency	0.960	Total collision/year
Overdispersion Parameter	0.379805302	
Lane width	3.6 m or more	
Shoulder	2.4 m or more	
Type of shoulder	Paved	
Adjustment		
CMF Lane width	1	
CMF Shouder	0.9649	
Predicted total crash frequency	0.926	Total collision/year
Expected Collisions		
2020	0	
2021	0	
2022	1	
2023	0	
2024	0	
Total Collisions	1	
Weight	0.739734607	
Expected Total Crash Frequency	0.73731311	Total collision/year

2036

Road:	**Taylor Road between Beechwood Road & Thorold Townline Road**	
AADT	6078	
Length (km)	1	
Two-way roadways		
AADT	6078	
Length (miles)	0.62	
Predicted total crash frequency	1.009	Total collision/year
Overdispersion Parameter	0.379805302	
Lane width	3.6 m or more	
Shoulder	2.4 m or more	
Type of shoulder	Paved	
Adjustment		
CMF Lane width	1	
CMF Shouder	0.9649	
Predicted total crash frequency	0.974	Total collision/year
Expected Collisions		
2020	0	
2021	0	
2022	1	
2023	0	
2024	0	
Total Collisions	1	
Weight	0.730042165	
Expected Total Crash Frequency	0.764771099	Total collision/year

Formulas:
Source:Traffic and Highway Engineering, SI Edition, 5th Edition / Highway Safety Manual 1st Edition)

Table 5.14 Crash Modification Factors[a] (*CMFs*) for Lane Width on Roadway Segments

Roadway Type	*Lane Width*	*Average Annual Daily Traffic (AADT) (veh/day)*			*Equation Number*
		< 400	*400 to 2000*	*>2000*	
Rural Two-Lane[a]	2.7 m or less	1.05	$1.05 + 2.81 \times 10^{-4}(AADT - 400)$	1.50	5.2
	3 m	1.02	$1.02 + 1.75 \times 10^{-4}(AADT - 400)$	1.30	5.3
	3.3 m	1.01	$1.01 + 2.5 \times 10^{-5}(AADT - 400)$	1.05	5.4
	3.6 m or more	1.00	1.00	1.00	5.5
Undivided Rural Multilane[b]	2.7 m or less	1.04	$1.04 + 2.13 \times 10^{-4}(AADT - 400)$	1.38	5.6
	3 m	1.02	$1.02 + 1.31 \times 10^{-4}(AADT - 400)$	1.23	5.7
	3.3 m	1.01	$1.01 + 1.88 \times 10^{-5}(AADT - 400)$	1.04	5.8
	3.6 m or more	1.00	1.00	1.00	5.9
Divided Rural Multilane[c]	2.7 m or less	1.03	$1.03 + 1.38 \times 10^{-4}(AADT - 400)$	1.25	5.10
	3 m	1.01	$1.01 + 8.75 \times 10^{-5}(AADT - 400)$	1.15	5.11
	3.3 m	1.01	$1.01 + 1.25 \times 10^{-5}(AADT - 400)$	1.03	5.12
	3.6 m or more	1.00	1.00	1.00	5.13

[a]Note: The collision types related to lane width to which these *CMFs* apply are single-vehicle run-off-the-road and multiple-vehicle head-on, opposite direction sideswipe, and same direction sideswipe crashes.
[b]Note: Standard error of *CMF* is unknown.
[c]Note: To determine the *CMF* for changing lane width and/or *AADT*, divide the "new" condition *CMF* by the "existing" condition *CMF*.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

$$CMF_{lr} = (CMF_{ra} - 1)p_{ra} + 1.0 \quad (5.14)$$

where

CMF_{lr} = crash modification for the effect of lane width on total crashes.
CMF_{ra} = crash modification for the effect of lane width on single-vehicle run-off-the-road and/or related crashes on two-lane roads.
p_{ra} = proportion of total crashes constituted by single-vehicle run-off-the-road and/or related crashes on two-lane roads. HSM default value is 0.574, but a value based on actual local data is preferable when available.

Table 5.16 Safety Performance Functions for Rural Roadway Segments

Roadway Segment Type	*SPF*[e]	*Overdispersion Parameter (k)*	*Equation #*
Rural two-lane, two-way roadways[1,4]	$N_{spfrs} = (AADT) \times (L) \times (365) \times (10^{-6}) \times (e^{-0.312})$	0.236/L	**5.17**
Undivided rural multilane roadways[2,5,7]	$N_{spfru} = e^{(a+(b)\times(\ln AADT)+\ln L)}$	$k = \frac{1}{e^{(c+\ln(L))}}$	5.18
Divided rural multilane roadway segments[3,6,8]	$N_{spfru} = e^{(a+(b)\times(\ln AADT)+\ln L)}$	$k = \frac{1}{e^{(c+\ln(L))}}$	5.19

Note: SPF[e] gives the value of $N_{sp,i}$ which is the predicted total crash frequency for road segment *i*
L = length of segment, km
a, *b*, *c* = regression parameters (see Tables 5.18 and 5.19)
[1]Base conditions for roadway segments on rural two-lane, two-way roads are

Lane width (LW)	= 3.6 m
Shoulder width (SW)	= 1.8 m
Shoulder type	paved

[2]Base conditions for undivided rural four-lane roadway segments are

Lane width (LW)	= 3.6 m
Shoulder width (SW)	= 1.8 m
Shoulder type	paved
Sideslopes	= 1V:7H or flatter
Lighting	None
Automated speed enforcement	None

[3]Base conditions for divided rural multilane roadway segments are

Lane width (LW)	= 3.6 m
Shoulder width (SW)	= 2.4 m
Median width	= 9 m
Lighting	None
Automated speed enforcement	None

[4]*AADT* range for rural two-lane roadways is from zero to 17,800 veh/day.
[5]*AADT* range for undivided rural four-lane roadways is from zero to 33,200 veh/day.
[6]*AADT* range for divided rural four-lane roadways is from zero to 89,300 veh/day.
[7]See Table 5.18 for values of *a*, *b*, and *c* in Eq. 5.18 for undivided rural multilane segments.
[8]See Table 5.19 for values of *a*, *b*, and *c* in Eq. 5.19 for undivided rural multilane segments.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Table 5.18 SPF Coefficients for Total and Fatal-and-Injury Crashes on Undivided Roadway Segments (for Use in Equation 5.18)

Crash Severity Level	*a*	*b*	*c*
4-lane total	−9.653	1.176	1.675
4-lane fatal and injury	−9.410	1.094	1.796
4-lane fatal and injury[a]	−8.577	0.938	2.003

[a] Using KABCO scale, these include only KAB crashes. Crashes with severity level C (possible injury) are not included.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Equations:

Empirical Bayes Weights

$$w_{total} = \frac{1}{1 + k_{total} \times \sum_{n=1}^{Y} N_{predicted,n(total)}} \quad \text{or} \qquad (5.39)$$

$$w_{FI} = \frac{1}{1 + k_{FI} \times \sum_{n=1}^{Y} N_{predicted,n(FI)}} \qquad (5.40)$$

where

w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
k_{FI} = overdispersion parameter for fatal and injury crashes
k_{total} = overdispersion parameter for total crashes
$N_{predicted,n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,n(total)}$ predicted average total crash frequency in year n from SPF

Expected Crash Frequency

$$N_{expected,1(total)} = (w_{total}) \times N_{predicted,1(total)} + (1 - w_{total}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(total)}}{\sum_{n=1}^{Y} C_{n(total)}} \right] \qquad (5.41)$$

$$N_{expected,1(FI)} = (w_{total}) \times N_{predicted,1(FI)} + (1 - w_{FI}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(FI)}}{\sum_{n=1}^{Y} C_{n(FI)}} \right] \qquad (5.42)$$

where

$N_{expected1,(FI)}$ = EB-adjusted estimated average crash frequency for year
$N_{expected1,(total)}$ = EB-adjusted estimated average crash frequency for year
w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
$N_{observed,\ n(FI)}$ = observed fatal and injury crash frequency in year n
$N_{observed,\ n(total)}$ = observed average total crash frequency in year n
$N_{predicted,\ n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,\ n(total)}$ = predicted average total crash frequency in year n from SPF
$C_{n(total)}$ = annual correction factor for total crashes in year n
$C_{n(FI)}$ = annual correction factor for fatal crashes in year n
n = year
Y = final year

2025

Road:	Taylor Road between Mountain Road & Beechwood Road	
AADT	5804	
Length (km)	1.3	
Two-way roadways		
AADT	5804	
Length (miles)	0.81	
Predicted total crash frequency	1.253	Total collision/year
Overdispersion Parameter	0.292157924	
Lane width	3.6 m or more	
Shoulder	2.4 m or more	
Type of shoulder	Paved	
Adjustment		
CMF Lane width	1	
CMF Shouder	0.9649	
Predicted total crash frequency	1.209	Total collision/year
Expected Collisions		
2020	0	
2021	0	
2022	1	
2023	1	
2024	0	
Total Collisions	2	
Weight	0.739036136	
Expected Total Crash Frequency	0.997614317	Total collision/year

2031

Road:	Taylor Road between Mountain Road & Beechwood Road	
AADT	6161	
Length (km)	1.3	
Two-way roadways		
AADT	6161	
Length (miles)	0.81	
Predicted total crash frequency	1.330	Total collision/year
Overdispersion Parameter	0.292157924	
Lane width	3.6 m or more	
Shoulder	2.4 m or more	
Type of shoulder	Paved	
Adjustment		
CMF Lane width	1	
CMF Shouder	0.9649	
Predicted total crash frequency	1.283	Total collision/year
Expected Collisions		
2020	0	
2021	0	
2022	1	
2023	1	
2024	0	
Total Collisions	2	
Weight	0.727360756	
Expected Total Crash Frequency	1.042247036	Total collision/year

2036

Road:	**Taylor Road between Mountain Road & Beechwood Road**	
AADT	6475	
Length (km)	1.3	
Two-way roadways		
AADT	6475	
Length (miles)	0.81	
Predicted total crash frequency	1.397	Total collision/year
Overdispersion Parameter	0.292157924	
Lane width	3.6 m or more	
Shoulder	2.4 m or more	
Type of shoulder	Paved	
Adjustment		
CMF Lane width	1	
CMF Shouder	0.9649	
Predicted total crash frequency	1.348	Total collision/year
Expected Collisions		
2020	0	
2021	0	
2022	1	
2023	1	
2024	0	
Total Collisions	2	
Weight	0.717392399	
Expected Total Crash Frequency	1.080354135	Total collision/year

Formulas:
Source:Traffic and Highway Engineering, SI Edition, 5th Edition / Highway Safety Manual 1st Edition)

Table 5.14 Crash Modification Factors[a] (*CMFs*) for Lane Width on Roadway Segments

Roadway Type	*Lane Width*	*Average Annual Daily Traffic (AADT) (veh/day)*			*Equation Number*
		< 400	*400 to 2000*	*>2000*	
Rural Two-Lane[a]	2.7 m or less	1.05	$1.05 + 2.81 \times 10^{-4}(AADT - 400)$	1.50	5.2
	3 m	1.02	$1.02 + 1.75 \times 10^{-4}(AADT - 400)$	1.30	5.3
	3.3 m	1.01	$1.01 + 2.5 \times 10^{-5}(AADT - 400)$	1.05	5.4
	3.6 m or more	1.00	1.00	1.00	5.5
Undivided Rural Multilane[b]	2.7 m or less	1.04	$1.04 + 2.13 \times 10^{-4}(AADT - 400)$	1.38	5.6
	3 m	1.02	$1.02 + 1.31 \times 10^{-4}(AADT - 400)$	1.23	5.7
	3.3 m	1.01	$1.01 + 1.88 \times 10^{-5}(AADT - 400)$	1.04	5.8
	3.6 m or more	1.00	1.00	1.00	5.9
Divided Rural Multilane[c]	2.7 m or less	1.03	$1.03 + 1.38 \times 10^{-4}(AADT - 400)$	1.25	5.10
	3 m	1.01	$1.01 + 8.75 \times 10^{-5}(AADT - 400)$	1.15	5.11
	3.3 m	1.01	$1.01 + 1.25 \times 10^{-5}(AADT - 400)$	1.03	5.12
	3.6 m or more	1.00	1.00	1.00	5.13

[a]Note: The collision types related to lane width to which these *CMFs* apply are single-vehicle run-off-the-road and multiple-vehicle head-on, opposite direction sideswipe, and same direction sideswipe crashes.
[b]Note: Standard error of *CMF* is unknown.
[c]Note: To determine the *CMF* for changing lane width and/or *AADT*, divide the "new" condition *CMF* by the "existing" condition *CMF*.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

$$CMF_{lr} = (CMF_{ra} - 1)p_{ra} + 1.0 \quad (5.14)$$

where

CMF_{lr} = crash modification for the effect of lane width on total crashes.
CMF_{ra} = crash modification for the effect of lane width on single-vehicle run-off-the-road and/or related crashes on two-lane roads.
p_{ra} = proportion of total crashes constituted by single-vehicle run-off-the-road and/or related crashes on two-lane roads. HSM default value is 0.574, but a value based on actual local data is preferable when available.

Table 5.16 Safety Performance Functions for Rural Roadway Segments

Roadway Segment Type	*SPF*[e]	*Overdispersion Parameter (k)*	*Equation #*
Rural two-lane, two-way roadways[1,4]	$N_{spfrs} = (AADT) \times (L) \times (365) \times (10^{-6}) \times (e^{-0.312})$	0.236/L	**5.17**
Undivided rural multilane roadways[2,5,7]	$N_{spfru} = e^{(a+(b)\times(\ln AADT)+\ln L)}$	$k = \frac{1}{e^{(c+\ln(L))}}$	5.18
Divided rural multilane roadway segments[3,6,8]	$N_{spfru} = e^{(a+(b)\times(\ln AADT)+\ln L)}$	$k = \frac{1}{e^{(c+\ln(L))}}$	5.19

Note: SPF[e] gives the value of $N_{sp,i}$ which is the predicted total crash frequency for road segment *i*
L = length of segment, km
a, *b*, *c* = regression parameters (see Tables 5.18 and 5.19)
[1]Base conditions for roadway segments on rural two-lane, two-way roads are

Lane width (LW)	= 3.6 m
Shoulder width (SW)	= 1.8 m
Shoulder type	paved

[2]Base conditions for undivided rural four-lane roadway segments are

Lane width (LW)	= 3.6 m
Shoulder width (SW)	= 1.8 m
Shoulder type	paved
Sideslopes	= 1V:7H or flatter
Lighting	None
Automated speed enforcement	None

[3]Base conditions for divided rural multilane roadway segments are

Lane width (LW)	= 3.6 m
Shoulder width (SW)	= 2.4 m
Median width	= 9 m
Lighting	None
Automated speed enforcement	None

[4]*AADT* range for rural two-lane roadways is from zero to 17,800 veh/day.
[5]*AADT* range for undivided rural four-lane roadways is from zero to 33,200 veh/day.
[6]*AADT* range for divided rural four-lane roadways is from zero to 89,300 veh/day.
[7]See Table 5.18 for values of *a*, *b*, and *c* in Eq. 5.18 for undivided rural multilane segments.
[8]See Table 5.19 for values of *a*, *b*, and *c* in Eq. 5.19 for undivided rural multilane segments.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Table 5.18 SPF Coefficients for Total and Fatal-and-Injury Crashes on Undivided Roadway Segments (for Use in Equation 5.18)

Crash Severity Level	*a*	*b*	*c*
4-lane total	−9.653	1.176	1.675
4-lane fatal and injury	−9.410	1.094	1.796
4-lane fatal and injury[a]	−8.577	0.938	2.003

[a] Using KABCO scale, these include only KAB crashes. Crashes with severity level C (possible injury) are not included.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Equations:

Empirical Bayes Weights

$$w_{total} = \frac{1}{1 + k_{total} \times \sum_{n=1}^{Y} N_{predicted,n(total)}} \quad \text{or} \qquad (5.39)$$

$$w_{FI} = \frac{1}{1 + k_{FI} \times \sum_{n=1}^{Y} N_{predicted,n(FI)}} \qquad (5.40)$$

where

w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
k_{FI} = overdispersion parameter for fatal and injury crashes
k_{total} = overdispersion parameter for total crashes
$N_{predicted,n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,n(total)}$ predicted average total crash frequency in year n from SPF

Expected Crash Frequency

$$N_{expected,1(total)} = (w_{total}) \times N_{predicted,1(total)} + (1 - w_{total}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(total)}}{\sum_{n=1}^{Y} C_{n(total)}} \right] \qquad (5.41)$$

$$N_{expected,1(FI)} = (w_{total}) \times N_{predicted,1(FI)} + (1 - w_{FI}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(FI)}}{\sum_{n=1}^{Y} C_{n(FI)}} \right] \qquad (5.42)$$

where

$N_{expected1,(FI)}$ = EB-adjusted estimated average crash frequency for year
$N_{expected1,(total)}$ = EB-adjusted estimated average crash frequency for year
w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
$N_{observed,\ n(FI)}$ = observed fatal and injury crash frequency in year n
$N_{observed,\ n(total)}$ = observed average total crash frequency in year n
$N_{predicted,\ n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,\ n(total)}$ = predicted average total crash frequency in year n from SPF
$C_{n(total)}$ = annual correction factor for total crashes in year n
$C_{n(FI)}$ = annual correction factor for fatal crashes in year n
n = year
Y = final year

2025

Road:	**Thorold Stone Road & Beechwood Road**
	Data
Major	
Peak AM Volume	
Peak PM Volume	
AADT	14188
Minor	
AADT	396
Intersection Type - Unsignalized	Four-leg stop control (4ST)Total
Predicted total crash frequency	2.1786 Collision Year
Overdispersion Parameter	0.494

Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	0	1
Number of Approaches with Exclusive Right Turn Lanes	0	1
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Unsignalized	1.98405	
Expected Unsignalized Collisions		
2020	2	
2021	2	
2022	1	
2023	0	
2024	0	
Total Collisions	5	
Weight	0.50502	
Expected Total Craash Frequency	1.49696	Total collision/year

2031

	Data
Major	
Peak AM Volume	
Peak PM Volume	
AADT	15978
Minor	
AADT	396
Intersection Type - Unsignalized	Four-leg stop control (4ST)Total
Predicted total crash frequency	2.40955 Collision Year
Overdispersion Parameter	0.494

Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	0	1
Number of Approaches with Exclusive Right Turn Lanes	0	1
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Unsignalized	2.19437	
Expected Unsignalized Collisions		
2020	2	
2021	2	
2022	1	
2023	0	
2024	0	
Total Collisions	5	
Weight	0.47984	
Expected Total Craash Frequency	1.57311	Total collision/year

2036

Road:	**Thorold Stone Road & Beechwood Road**		
	Data		
Major			
Peak AM Volume			
Peak PM Volume			
AADT	17546		
Minor			
AADT	396		
Intersection Type - Unsignalized	Four-leg stop control (4ST)Total		
Predicted total crash frequency	2.60862	Collision Year	
Overdispersion Parameter	0.494		
Adjustment		CMF	
Number of Approaches with Exclusive Left Turn Lanes	0	1	
Number of Approaches with Exclusive Right Turn Lanes	0	1	
Intersection Light	Yes		
CMF for intersection lighting	0.9107		
Predicted total crash frequency - Unsignalized	2.37567		
Expected Unsignalized Collisions			
2020	2		
2021	2		
2022	1		
2023	0		
2024	0		
Total Collisions	5		
Weight	0.46007		
Expected Total Craash Frequency	1.63291	Total collision/year	

Formulas:
Source: Traffic and Highway Engineering, SI Edition, 5th Edition / Highway Safety Manual 1st Edition)

Table 5.17 Safety Performance Functions for Intersections

Intersection Type	*SPF*[10] *(Total Predicted Average Crash Frequency)*	*Overdispersion Parameter (k)*	*Equation #*
Three-leg stop-controlled intersections on rural two-lane two-way roads[1]	$N_{spf3sT} = e^{-9.86+(0.79)\times \ln AADT_{maj}+(0.49)\times \ln AADT_{min}}$	0.54	5.20
Four-leg stop-controlled intersections on rural two-lane two-way roads[2]	$N_{spf4sT} = e^{-8.56+(0.60)\times \ln AADT_{maj}+(0.61)\times \ln AADT_{min}}$	0.24	5.21
Four-leg signalized intersections on rural two-lane two-way roads[3]	$N_{spf4sG} = e^{-5.13+(0.60)\times \ln AADT_{maj}+(0.20)\times \ln AADT_{min}}$	0.11	5.22

(*Continued*)

Table 5.17 Safety Performance Functions for Intersections (*continued*)

Three-leg stop-controlled intersections on rural multilane roads[4,7] and four-leg stop-controlled intersections on rural multilane roads[5,7]	$N_{spf3or4T} = e^{(a+b\times \ln AADT_{maj}+c\times \ln AADT_{min})}$	see Table 5.20	5.23
Four-leg signalized intersections on rural multilane highways[6,8]	$N_{spf3sT} = e^{(a+b\times \ln AADT_{maj}+c\times \ln AADT_{min})}$ or $N_{spf3sT} = e^{(a+d\times \ln AADT_{min})}$	see Table 5.21	5.24 5.25

Note: Equation 5.24 for four-leg signalized intersections on rural multilane highways is suitable for only generalized predictions as there are no associated base conditions for it. Also, Eq. 5.25 is suitable for only fatal and injury crashes (excluding possible injuries) on four-leg signalized intersections.

[1] $AADT_{maj}$ range is from zero to 19,500 veh/day, $AADT_{min}$ range from zero to 4300 veh/day.
[2] $AADT_{maj}$ range is from zero to 14,700 veh/day, $AADT_{min}$ range is from zero to 3500 veh/day.
[3] $AADT_{maj}$ range is from zero to 25,200 veh/day, $AADT_{min}$ range is from zero to 3500 veh/day.
[4] $AADT_{maj}$ range is from zero to 78,300 veh/day, $AADT_{min}$ range is from zero to 23,000 veh/day.
[5] $AADT_{maj}$ range is from zero to 78,300 veh/day, $AADT_{min}$ range is from zero to 7400 veh/day.
[6] $AADT_{maj}$ range is from zero to 43,300 veh/day, $AADT_{min}$ range is from zero to 18,500 veh/day.
[7] See Table 5. 20 for regression parameter values for *a, b,* and *c* in Eq. 5.23.
[8] See Table 5. 21 for regression parameter values for *a, b, c,* and *d* in Eqs. 5.24 and 5.25.
[10] Base conditions for three- and four-leg stop controlled intersections are
Intersection skew angle = 0°
Intersection left-turn lanes 0, except for stop controlled approaches
Intersection right-turn lanes 0, except for stop controlled approaches
Lighting None

SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Table 5.20 SPF Coefficients for Three- and Four-Leg Intersections with Minor Road Stop Control for Total and Fatal-and-Injury Crashes (for Use in Eq. 5.23)

Intersection Type/severity Level	*a*	*b*	*c*	*Overdispersion Parameter (Fixed k)*[a]
Four-leg stop control (4ST) Total	−10.008	0.848	0.448	0.494
Four-leg stop control (4ST) Fatal and Injury	−11.554	0.888	0.525	0.742
Four-leg stop control (4ST) Fatal and Injury[b]	−10.734	0.828	0.412	0.655
Three-leg stop control (3ST) Total	−12.526	1.204	0.236	0.460
Three-leg stop control (3ST) Fatal and Injury	−12.664	1.107	0.272	0.569
Three-leg stop control (3ST) Fatal and Injury[b]	−11.989	1.013	0.228	0.566

[a]This value should be used directly as the overdispersion parameter; no further computation is required.
[b]Using KABCO scale, these include only KAB crashes. Crashes with severity level C (possible injury) are not included.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Equations:

Empirical Bayes Weights

$$w_{total} = \frac{1}{1 + k_{total} \times \sum_{n=1}^{Y} N_{predicted,n(total)}} \quad \text{or} \tag{5.39}$$

$$w_{FI} = \frac{1}{1 + k_{FI} \times \sum_{n=1}^{Y} N_{predicted,n(FI)}} \tag{5.40}$$

where

w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
k_{FI} = overdispersion parameter for fatal and injury crashes
k_{total} = overdispersion parameter for total crashes
$N_{predicted,n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,n(total)}$ predicted average total crash frequency in year n from SPF

Expected Crash Frequency

$$N_{expected,1(total)} = (w_{total}) \times N_{predicted,1(total)} + (1 - w_{total}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(total)}}{\sum_{n=1}^{Y} C_{n(total)}} \right] \quad (5.41)$$

$$N_{expected,1(FI)} = (w_{total}) \times N_{predicted,1(FI)} + (1 - w_{FI}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(FI)}}{\sum_{n=1}^{Y} C_{n(FI)}} \right] \quad (5.42)$$

where

$N_{expected1,(FI)}$ = EB-adjusted estimated average crash frequency for year
$N_{expected1,(total)}$ = EB-adjusted estimated average crash frequency for year
w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
$N_{observed,\ n(FI)}$ = observed fatal and injury crash frequency in year n
$N_{observed,\ n(total)}$ = observed average total crash frequency in year n
$N_{predicted,\ n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,\ n(total)}$ = predicted average total crash frequency in year n from SPF
$C_{n(total)}$ = annual correction factor for total crashes in year n
$C_{n(FI)}$ = annual correction factor for fatal crashes in year n
n = year
Y = final year

Source: AASHTO, 2010; in Roess, Prassas and McShane, p.234

Type of Lane	CMF for Number of Approaches with Exclusive Turn Lane(s)			
	1	2	3	4
LT Lane(s)	0.90	0.81	0.73	0.66
RT Lane(s)	0.96	0.92	0.88	0.85

2025

Road:	**Thorold Stone Road & Garner Road**	
	Data	
Major AADT	17044	
Minor AADT	6164	
Intersection Type - Signalized	Four-leg signalized intersections on rural multilane highwaysTotal Crashes	
Predicted total crash frequency	16.3409	Collision Year
Overdispersion Parameter	0.277	
Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	4	0.66
Number of Approaches with Exclusive Right Turn Lanes	2	0.92
Type of Left Turn Phasing	Permitted	
Number of Approaches with Left Turn Phasing	1	
CMF	1	
Number of intersection approaches that prohibit right turn on red (RTOR)	0	
CMF	1	
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Signalized	9.03613	
Expected Signalized Collisions		
2020	2	
2021	6	
2022	2	
2023	0	
2024	0	
Total Collisions	10	
Weight	0.28547	
Expected Total Craash Frequency	4.0086	Total collision/year

2031

Road:	**Thorold Stone Road & Garner Road**	
	Data	
Major AADT	19194	
Minor AADT	6164	
Intersection Type - Signalized	Four-leg signalized intersections on rural multilane highwaysTotal Crashes	
Predicted total crash frequency	17.8044	Collision Year
Overdispersion Parameter	0.277	
Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	4	0.66
Number of Approaches with Exclusive Right Turn Lanes	2	0.92
Type of Left Turn Phasing	Permitted	
Number of Approaches with Left Turn Phasing	1	
CMF	1	
Number of intersection approaches that prohibit right turn on red (RTOR	0	
CMF	1	
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Signalized	9.8454	
Expected Signalized Collisions		
2020	2	
2021	6	
2022	2	
2023	0	
2024	0	
Total Collisions	10	
Weight	0.2683	
Expected Total Craash Frequency	4.10492	Total collision/year

2036

Road:	**Thorold Stone Road & Garner Road**	
	Data	
Major		
AADT	21192	
Minor		
AADT	6164	
Intersection Type - Signalized	Four-leg signalized intersections on rural multilane highwaysTotal Crashes	
Predicted total crash frequency	19.1239	Collision Year
Overdispersion Parameter	0.277	
Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	4	0.66
Number of Approaches with Exclusive Right Turn Lanes	2	0.92
Type of Left Turn Phasing	Permitted	
Number of Approaches with Left Turn Phasing	1	
CMF	1	
Number of intersection approaches that prohibit right turn on red (RTOR	0	
CMF	1	
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Signalized	10.5751	
Expected Signalized Collisions		
2020	2	
2021	6	
2022	2	
2023	0	
2024	0	
Total Collisions	10	
Weight	0.2545	
Expected Total Craash Frequency	4.18235	Total collision/year

Formulas
Source: Traffic and Highway Engineering, SI Edition, 5th Edition / Highway Safety Manual 1st Edition)

Table 5.17 Safety Performance Functions for Intersections (*continued*)

Three-leg stop-controlled intersections on rural multilane roads[4,7] and four-leg stop-controlled intersections on rural multilane roads[5,7]	$N_{spf3or4T} = e^{(a+b\times\ln AADT_{maj}+c\times\ln AADT_{min})}$	see Table 5.20	5.23
Four-leg signalized intersections on rural multilane highways[6,8]	$N_{spf3sT} = e^{(a+b\times\ln AADT_{maj}+c\times\ln AADT_{min})}$ or $N_{spf3sT} = e^{(a+d\times\ln AADT_{min})}$	see Table 5.21	5.24 5.25

Note: Equation 5.24 for four-leg signalized intersections on rural multilane highways is suitable for only generalized predictions as there are no associated base conditions for it. Also, Eq. 5.25 is suitable for only fatal and injury crashes (excluding possible injuries) on four-leg signalized intersections.
[1]$AADT_{maj}$ range is from zero to 19,500 veh/day, $AADT_{min}$ range from zero to 4300 veh/day.
[2]$AADT_{maj}$ range is from zero to 14,700 veh/day, $AADT_{min}$ range is from zero to 3500 veh/day.
[3]$AADT_{maj}$ range is from zero to 25,200 veh/day, $AADT_{min}$ range is from zero to 3500 veh/day.
[4]$AADT_{maj}$ range is from zero to 78,300 veh/day, $AADT_{min}$ range is from zero to 23,000 veh/day.
[5]$AADT_{maj}$ range is from zero to 78,300 veh/day, $AADT_{min}$ range is from zero to 7400 veh/day.
[6]$AADT_{maj}$ range is from zero to 43,300 veh/day, $AADT_{min}$ range is from zero to 18,500 veh/day.
[7]See Table 5. 20 for regression parameter values for *a, b,* and *c* in Eq. 5.23.
[8]See Table 5. 21 for regression parameter values for *a, b, c,* and *d* in Eqs. 5.24 and 5.25.
[10] Base conditions for three- and four-leg stop controlled intersections are
Intersection skew angle = 0°
Intersection left-turn lanes 0, except for stop controlled approaches
Intersection right-turn lanes 0, except for stop controlled approaches
Lighting None
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Table 5.20 SPF Coefficients for Three- and Four-Leg Intersections with Minor Road Stop Control for Total and Fatal-and-Injury Crashes (for Use in Eq. 5.23)

Intersection Type/severity Level	*a*	*b*	*c*	*Overdispersion Parameter (Fixed k)*[a]
Four-leg stop control (4ST) Total	−10.008	0.848	0.448	0.494
Four-leg stop control (4ST) Fatal and Injury	−11.554	0.888	0.525	0.742
Four-leg stop control (4ST) Fatal and Injury[b]	−10.734	0.828	0.412	0.655
Three-leg stop control (3ST) Total	−12.526	1.204	0.236	0.460
Three-leg stop control (3ST) Fatal and Injury	−12.664	1.107	0.272	0.569
Three-leg stop control (3ST) Fatal and Injury[b]	−11.989	1.013	0.228	0.566

[a]This value should be used directly as the overdispersion parameter; no further computation is required.
[b]Using KABCO scale, these include only KAB crashes. Crashes with severity level C (possible injury) are not included.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Table 5.21 SPF Coefficients for Four-Leg Signalized Intersections for Total and Fatal and Injury Crashes (for Use in Equations 5.24 and 5.25

Intersection Type/severity Level	*a*	*b*	*c*	*d*	*Overdispersion Parameter (Fixed k)*[a]
Four-leg signalized intersections on rural multilane highways (Total Crashes)	−7.182	0.722	0.337		0.277
Four-leg signalized intersections on rural multilane highways (Fatal and Injury Crashes)	−6.393	0.638	0.232		0.218
Four-leg signalized intersections on rural multilane highways (Fatal and Injury Crashes)[b]	−12.011			1.279	0.566

[a]This value should be used directly as the overdispersion parameter; no further computation is required.
[b]Using KABCO scale, these include only KAB crashes. Crashes with severity level C (possible injury) are not included.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Equations:

Empirical Bayes Weights

$$w_{total} = \frac{1}{1 + k_{total} \times \sum_{n=1}^{Y} N_{predicted,n(total)}} \quad \text{or} \tag{5.39}$$

$$w_{FI} = \frac{1}{1 + k_{FI} \times \sum_{n=1}^{Y} N_{predicted,n(FI)}} \tag{5.40}$$

where

w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
k_{FI} = overdispersion parameter for fatal and injury crashes
k_{total} = overdispersion parameter for total crashes
$N_{predicted,n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,n(total)}$ predicted average total crash frequency in year n from SPF

Expected Crash Frequency

$$N_{expected,1(total)} = (w_{total}) \times N_{predicted,1(total)} + (1 - w_{total}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(total)}}{\sum_{n=1}^{Y} C_{n(total)}} \right] \quad (5.41)$$

$$N_{expected,1(FI)} = (w_{total}) \times N_{predicted,1(FI)} + (1 - w_{FI}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(FI)}}{\sum_{n=1}^{Y} C_{n(FI)}} \right] \quad (5.42)$$

where

$N_{expected1,(FI)}$ = EB-adjusted estimated average crash frequency for year
$N_{expected1,(total)}$ = EB-adjusted estimated average crash frequency for year
w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
$N_{observed,\ n(FI)}$ = observed fatal and injury crash frequency in year n
$N_{observed,\ n(total)}$ = observed average total crash frequency in year n
$N_{predicted,\ n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,\ n(total)}$ = predicted average total crash frequency in year n from SPF
$C_{n(total)}$ = annual correction factor for total crashes in year n
$C_{n(FI)}$ = annual correction factor for fatal crashes in year n
n = year
Y = final year

Source: AASHTO, 2010; in Roess, Prassasand McShane, p.234

Type of Lane	CMF for Number of Approaches with Exclusive Turn Lane(s)			
	1	2	3	4
LT Lane(s)	0.90	0.81	0.73	0.66
RT Lane(s)	0.96	0.92	0.88	0.85

Type of LT Phasing	CMF for Number of Approaches w/LT Phasing			
	1	2	3	4
Permitted	1.00	1.00	1.00	1.00
Protected + Permitted, or Permitted + Protected	0.99	0.98	0.97	0.96
Protected	0.94	0.88	0.83	0.78

2025

Road:	**Thorold Stone Road & Taylor Road**	
	Data	
Major	WB	EB
Peak AM Volume		
Peak PM Volume		
AADT	17044	
Minor		
Peak AM Volume		
Peak PM Volume		
AADT	6164	
Intersection Type – Signalized	Four-leg signalized intersections on rural multilane highwaysTotal Crashes	
Predicted total crash frequency	16.341	Collision Year
Overdispersion Parameter	0.277	
Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	4	0.66
Number of Approaches with Exclusive Right Turn Lanes	2	0.92
Type of Left Turn Phasing	Permitted	
Number of Approaches with Left Turn Phasing	1	
CMF	1	
Number of intersection approaches that prohibit right turn on red (RT(	0	
CMF	1	
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency – Signalized	9.0361	
Expected Signalized Collisions		
2020	9	
2021	6	
2022	5	
2023	8	
2024	0	
Total Collisions	28	
Weight	0.2855	
Expected Total Crash Frequency	6.5809	Total collision/year

2031

Road:	**Thorold Stone Road & Taylor Road**	
	Data	
Major	WB	EB
Peak AM Volume		
Peak PM Volume		
AADT	19194	
Minor		
Peak AM Volume		
Peak PM Volume		
AADT	6543	
Intersection Type - Signalized	Four-leg signalized intersections on rural multilane highwaysTotal Crashes	
Predicted total crash frequency	18.166	Collision Year
Overdispersion Parameter	0.277	
Adjustment		CMF
Number of Approaches with Exclusive Left Turn Lanes	4	0.66
Number of Approaches with Exclusive Right Turn Lanes	2	0.92
Type of Left Turn Phasing	Permitted	
Number of Approaches with Left Turn Phasing	1	
CMF	1	
Number of intersection approaches that prohibit right turn on red (RTOR	0	
CMF	1	
Intersection Light	Yes	
CMF for intersection lighting	0.9107	
Predicted total crash frequency - Signalized	10.0454	
Expected Signalized Collisions		
2020	9	
2021	6	
2022	5	
2023	8	
2024	0	
Total Collisions	28	
Weight	0.26437	
Expected Total Crash Frequency	6.77523	Total collision/year

2036

Road:	**Thorold Stone Road & Taylor Road**		
	Data		
Major	WB	EB	
Peak AM Volume			
Peak PM Volume			
AADT	21192		
Minor			
Peak AM Volume			
Peak PM Volume			
AADT	6877		
Intersection Type - Signalized	Four-leg signalized intersections on rural multilane highwaysTotal Crashes		
Predicted total crash frequency	19.8425	Collision Year	
Overdispersion Parameter	0.277		
Adjustment		CMF	
Number of Approaches with Exclusive Left Turn Lanes	4	0.66	
Number of Approaches with Exclusive Right Turn Lanes	2	0.92	
Type of Left Turn Phasing	Permitted		
Number of Approaches with Left Turn Phasing	1		
CMF	1		
Number of intersection approaches that prohibit right turn on red (RTOR	0		
CMF	1		
Intersection Light	Yes		
CMF for intersection lighting	0.9107		
Predicted total crash frequency - Signalized	10.9725		
Expected Signalized Collisions			
2020	9		
2021	6		
2022	5		
2023	8		
2024	0		
Total Collisions	28		
Weight	0.24756		
Expected Total Crash Frequency	6.93002	Total collision/year	

Formulas
Source: Traffic and Highway Engineering, SI Edition, 5th Edition / Highway Safety Manual 1st Edition)

Table 5.17 Safety Performance Functions for Intersections (*continued*)

Three-leg stop-controlled intersections on rural multilane roads[4,7] and four-leg stop-controlled intersections on rural multilane roads[5,7]	$N_{spf3or4T} = e^{(a+b\times\ln AADT_{maj}+c\times\ln AADT_{min})}$	see Table 5.20	5.23
Four-leg signalized intersections on rural multilane highways[6,8]	$N_{spf3sT} = e^{(a+b\times\ln AADT_{maj}+c\times\ln AADT_{min})}$ or $N_{spf3sT} = e^{(a+d\times\ln AADT_{min})}$	see Table 5.21	5.24 5.25

Note: Equation 5.24 for four-leg signalized intersections on rural multilane highways is suitable for only generalized predictions as there are no associated base conditions for it. Also, Eq. 5.25 is suitable for only fatal and injury crashes (excluding possible injuries) on four-leg signalized intersections.
[1]$AADT_{maj}$ range is from zero to 19,500 veh/day, $AADT_{min}$ range from zero to 4300 veh/day.
[2]$AADT_{maj}$ range is from zero to 14,700 veh/day, $AADT_{min}$ range is from zero to 3500 veh/day.
[3]$AADT_{maj}$ range is from zero to 25,200 veh/day, $AADT_{min}$ range is from zero to 3500 veh/day.
[4]$AADT_{maj}$ range is from zero to 78,300 veh/day, $AADT_{min}$ range is from zero to 23,000 veh/day.
[5]$AADT_{maj}$ range is from zero to 78,300 veh/day, $AADT_{min}$ range is from zero to 7400 veh/day.
[6]$AADT_{maj}$ range is from zero to 43,300 veh/day, $AADT_{min}$ range is from zero to 18,500 veh/day.
[7]See Table 5. 20 for regression parameter values for *a, b,* and *c* in Eq. 5.23.
[8]See Table 5. 21 for regression parameter values for *a, b, c,* and *d* in Eqs. 5.24 and 5.25.
[10] Base conditions for three- and four-leg stop controlled intersections are
Intersection skew angle = 0°
Intersection left-turn lanes 0, except for stop controlled approaches
Intersection right-turn lanes 0, except for stop controlled approaches
Lighting None
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Table 5.21 SPF Coefficients for Four-Leg Signalized Intersections for Total and Fatal and Injury Crashes (for Use in Equations 5.24 and 5.25

Intersection Type/severity Level	*a*	*b*	*c*	*d*	*Overdispersion Parameter (Fixed k)*[a]
Four-leg signalized intersections on rural multilane highways (Total Crashes)	−7.182	0.722	0.337		0.277
Four-leg signalized intersections on rural multilane highways (Fatal and Injury Crashes)	−6.393	0.638	0.232		0.218
Four-leg signalized intersections on rural multilane highways (Fatal and Injury Crashes)[b]	−12.011			1.279	0.566

[a]This value should be used directly as the overdispersion parameter; no further computation is required.
[b]Using KABCO scale, these include only KAB crashes. Crashes with severity level C (possible injury) are not included.
SOURCE: Based on *Highway Safety Manual*, 1st Edition, 2010, AASHTO, Washington, D.C.

Equations:

Empirical Bayes Weights

$$w_{total} = \frac{1}{1 + k_{total} \times \sum_{n=1}^{Y} N_{predicted,n(total)}} \quad \text{or} \qquad (5.39)$$

$$w_{FI} = \frac{1}{1 + k_{FI} \times \sum_{n=1}^{Y} N_{predicted,n(FI)}} \qquad (5.40)$$

where

w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
k_{FI} = overdispersion parameter for fatal and injury crashes
k_{total} = overdispersion parameter for total crashes
$N_{predicted,n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,n(total)}$ predicted average total crash frequency in year n from SPF

Expected Crash Frequency

$$N_{expected,1(total)} = (w_{total}) \times N_{predicted,1(total)} + (1 - w_{total}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(total)}}{\sum_{n=1}^{Y} C_{n(total)}} \right] \qquad (5.41)$$

$$N_{expected,1(FI)} = (w_{total}) \times N_{predicted,1(FI)} + (1 - w_{FI}) \times \left[\frac{\sum_{n=1}^{Y} N_{observed,y(FI)}}{\sum_{n=1}^{Y} C_{n(FI)}} \right] \qquad (5.42)$$

where

$N_{expected1,(FI)}$ = EB-adjusted estimated average crash frequency for year
$N_{expected1,(total)}$ = EB-adjusted estimated average crash frequency for year
w_{total} = empirical Bayes weight for total crashes
w_{FI} = empirical Bayes weight for fatal and injury crashes
$N_{observed,\ n(FI)}$ = observed fatal and injury crash frequency in year n
$N_{observed,\ n(total)}$ = observed average total crash frequency in year n
$N_{predicted,\ n(FI)}$ = predicted average fatal and injury crash frequency in year n from SPF
$N_{predicted,\ n(total)}$ = predicted average total crash frequency in year n from SPF
$C_{n(total)}$ = annual correction factor for total crashes in year n
$C_{n(FI)}$ = annual correction factor for fatal crashes in year n
n = year
Y = final year

Source: AASHTO, 2010; in Roess, Prassasand McShane, p.234

Type of Lane	CMF for Number of Approaches with Exclusive Turn Lane(s)			
	1	2	3	4
LT Lane(s)	0.90	0.81	0.73	0.66
RT Lane(s)	0.96	0.92	0.88	0.85

Type of LT Phasing	CMF for Number of Approaches w/LT Phasing			
	1	2	3	4
Permitted	1.00	1.00	1.00	1.00
Protected + Permitted, or Permitted + Protected	0.99	0.98	0.97	0.96
Protected	0.94	0.88	0.83	0.78

Appendix D:
Sightline Assessment



TYLin 380 Wellington Street West, Toronto, ON M5V 1E3

100482 - Walker Landfill EA TIS
Intersection Sight Distance - Primary Quarry Access

N

001

DATE
2025-05-06







TYLin 380 Wellington Street West, Toronto, ON M5V 1E3

100482 - Walker Landfill EA TIS
Stopping Sight Distance - Horizontal

N

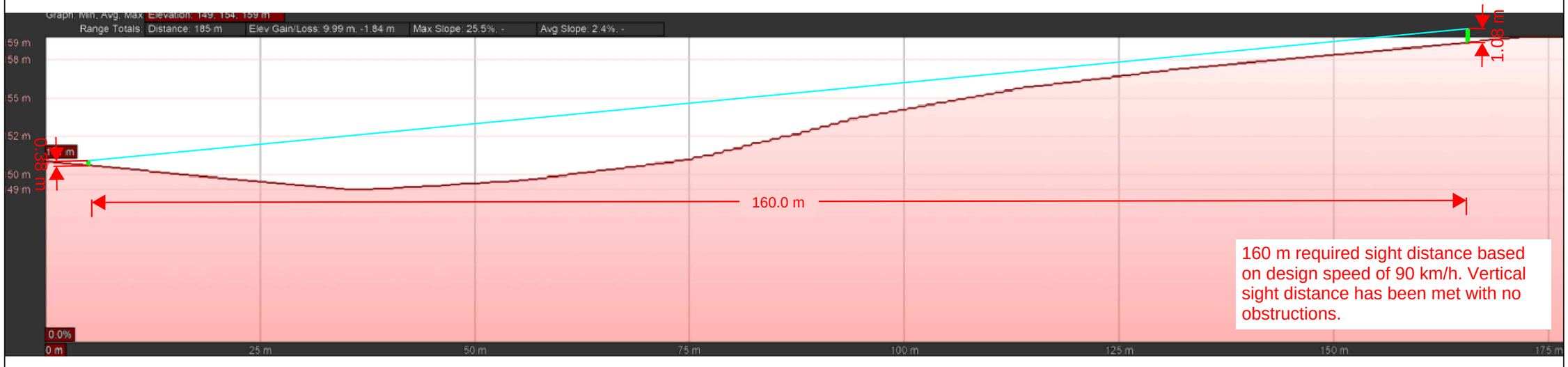
002

DATE
2025-05-06



TYLin 380 Wellington Street West, Toronto, ON M5V 1E3	100482 - Walker Landfill EA TIS Vertical Stopping Sight Distance - Primary Quarry Access (Northbound direction along Taylor Road)	N	003 DATE 2025-05-06

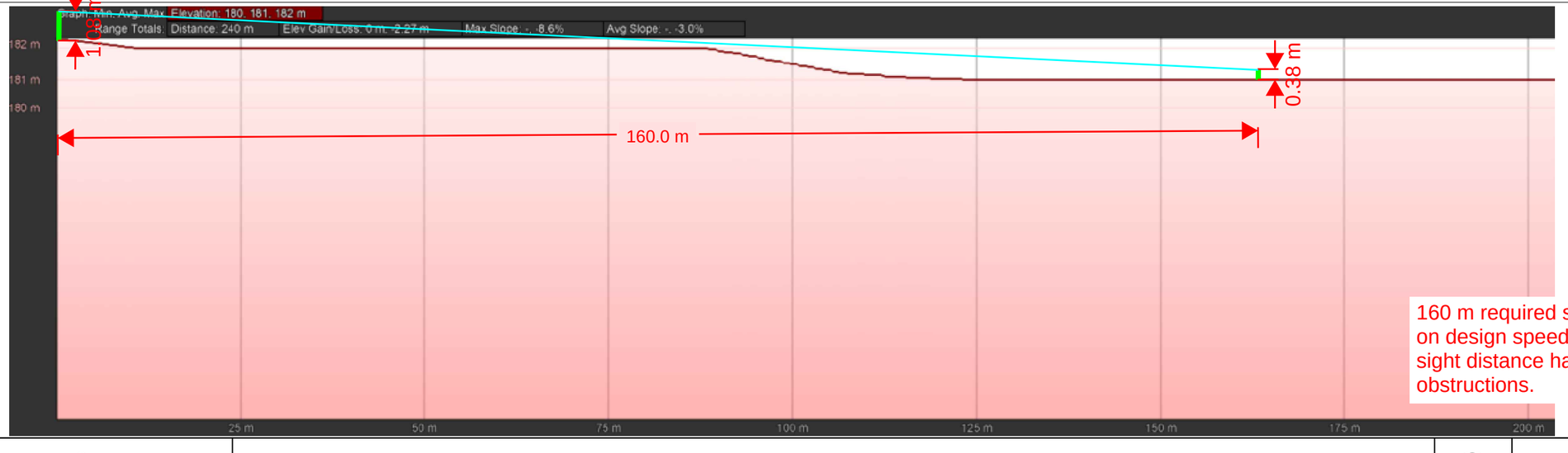




160 m required sight distance based on design speed of 90 km/h. Vertical sight distance has been met with no obstructions.

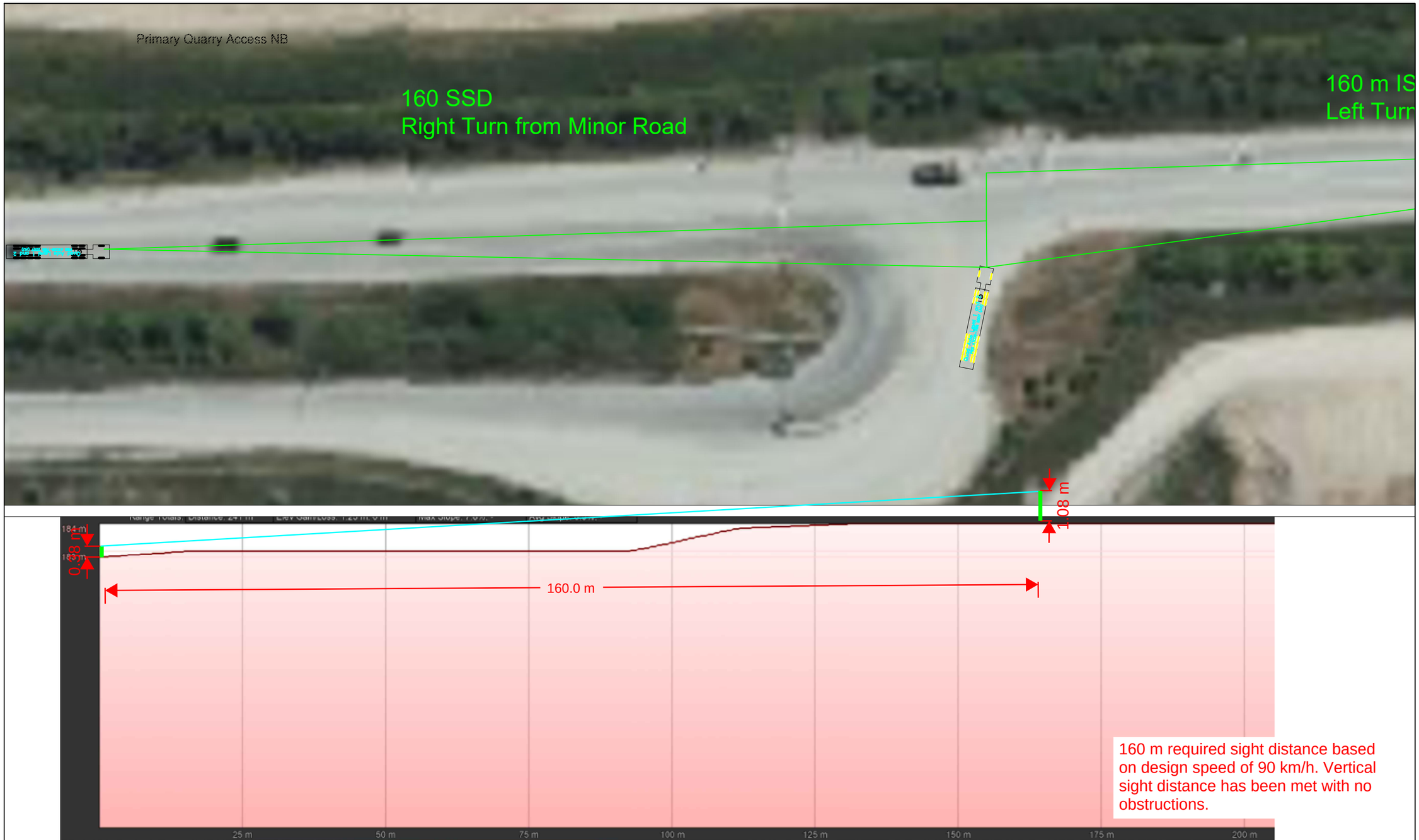
TYLin 380 Wellington Street West, Toronto, ON M5V 1E3	100482 - Walker Landfill EA TIS Vertical Stopping Sight Distance - Primary Quarry Access (Southbound direction along Taylor Road)	N	004 DATE 2025-05-06





160 m required sight distance based on design speed of 90 km/h. Vertical sight distance has been met with no obstructions.

TYLin 380 Wellington Street West, Toronto, ON M5V 1E3	100482 - Walker Landfill EA TIS Vertical Stopping Sight Distance - Landfill East Access (Northbound direction along Taylor Road)	N	005 DATE 2025-05-06



160 m required sight distance based on design speed of 90 km/h. Vertical sight distance has been met with no obstructions.

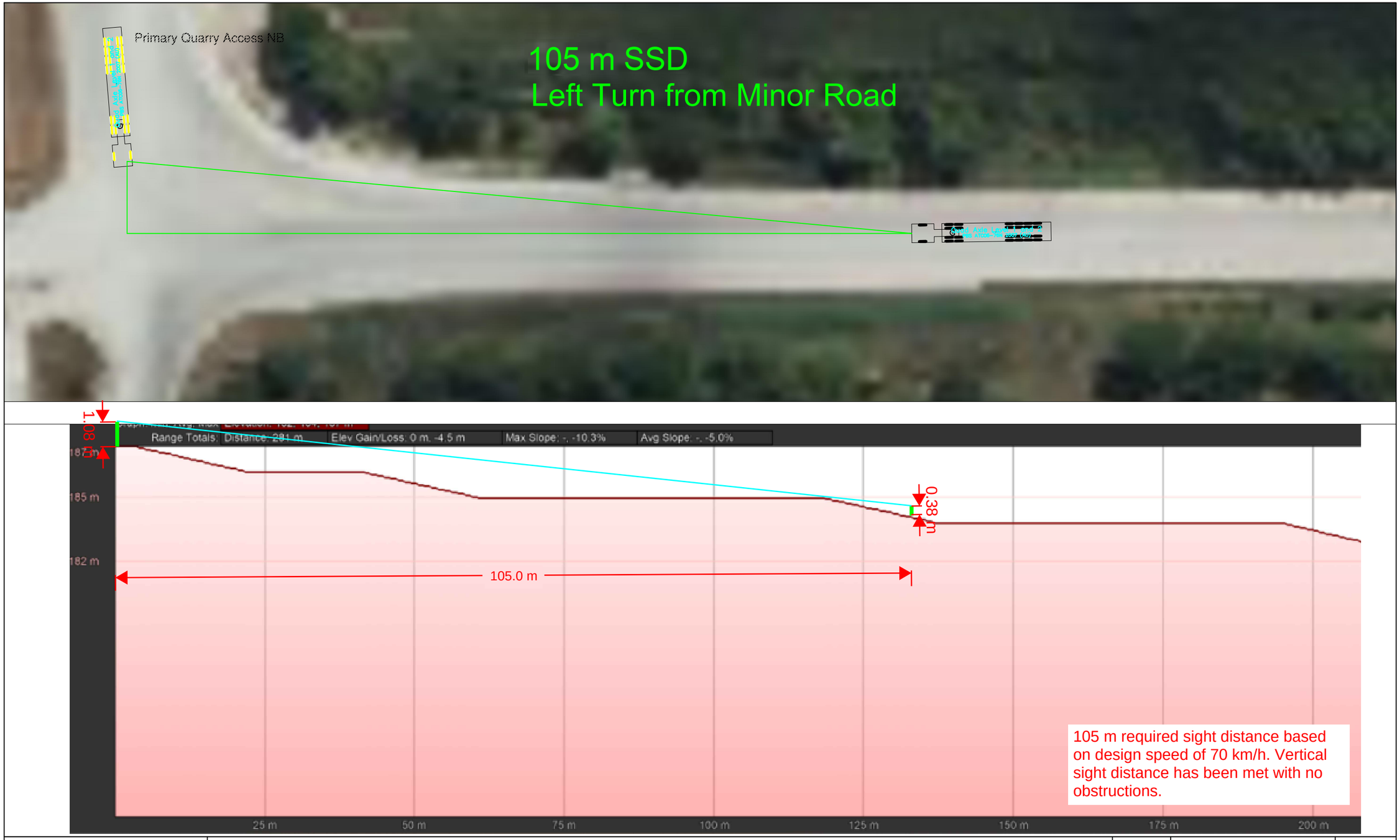
TYLin 380 Wellington Street West, Toronto, ON M5V 1E3

100482 - Walker Landfill EA TIS
Vertical Stopping Sight Distance - Landfill East Access (Southbound direction along Taylor Road)

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DATE
2025-05-06



TYLin 380 Wellington Street West, Toronto, ON M5V 1E3

100482 - Walker Landfill EA TIS
Vertical Stopping Sight Distance - Landfill Northwest Access (Northbound direction along Taylor Road)

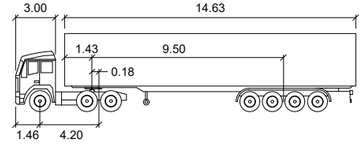
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DATE 2025-05-06

Appendix E:
Vehicle Movement Diagrams





Quad Axle Level 1 and 2

meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 23.0
Tractor Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

TYLin 380 Wellington Street West, Toronto, ON M5V 1E3

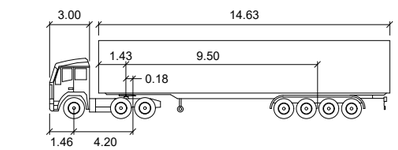
100482 - Walker Landfill EA TIS
Vehicle Movement Diagram

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008

DATE
2025-05-06

PRIMARY QUARRY ACCESS



Quad Axle Level 1 and 2

meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 23.0
Tractor Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

TYLin 380 Wellington Street West, Toronto, ON M5V 1E3

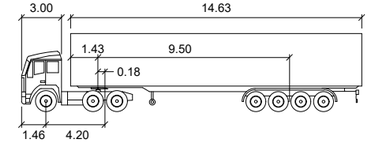
100482 - Walker Landfill EA TIS
Vehicle Movement Diagram

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DATE
2025-05-06





Quad Axle Level 1 and 2

meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 23.0
Tractor Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

TYLin 380 Wellington Street West, Toronto, ON M5V 1E3

100482 - Walker Landfill EA TIS
Vehicle Movement Diagram

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2025-05-06

D-10

Social Environment

Technical Memorandum

To:	Darren Fry, A.Sc.T., Project Director Environmental Division	**From:**	Tomasz Wlodarczyk, M.E.S Senior Advisor, Environmental and Social Impact Assessment
Company:	**Walker Environmental Group**		**SLR Consulting (Canada) Ltd.**
cc:	Janet Oswald, Environmental Planner, GHD; Erika Brown, Environmental Planner, GHD	**Date:**	June 11, 2025
		GHD Project No.	12567140
		SLR Project No.	209.099032.00001
		Revision	3

RE: Walker South Landfill Phase 2 Environmental Assessment_Comparative Evauation - Social Environment_v3_June 2025.docx

1.0 Introduction

This technical memorandum documents the assessment and evaluation of the Alternative Methods for the Walker South Landfill Phase 2 Environmental Assessment (EA) from a social environment perspective. The Minister Approved Terms of Reference (Approved ToR) included a preliminary description of the methodology for evaluating the Alternative Methods (See Section 7.1 of the Approved ToR, September 2024). This memo is one of 13 memos that outline the evaluation of the Alternative Methods from the perspective of each discipline. These memos will be used in concert with one another, along with their evaluation tables, as supporting documents to the Alternative Methods Report. Memos were prepared for the following environmental components:

- Geology and Hydrogeology
- Surface Water Resources
- Noise and Vibration
- Air Quality
- Terrestrial and Aquatic Environment
- Land Use
- Agriculture
- Transportation
- Social Environment
- Economic Environment
- Built Heritage Resources and Cultural Heritage Landscapes
- Archaeology
- Visual

Each of the above disciplines also prepared existing conditions reports that were utilized in assessing and evaluating the Alternative Methods. Further, the disciplines referred to the Conceptual Design Report (CDR) that was prepared from a Site Design and Operations perspective in order to provide the appropriate level of detail on each of the Alternative Methods. The CDR will also form a supporting document to the Alternative Methods Report.

Each discipline is following the requirements as stated in the draft work plans that were presented in Appendix C of the Approved ToR. The work plan presents the scope of work required to complete the EA, including the scope of technical studies for each of the environmental components, and the evaluation of Alternative Methods.

1.1 Documentation

The results of these individual memos will be documented in separate stand-alone technical memorandums during the EA. The final Alternative Methods evaluation will form a chapter of the EA Report, with each of the stand-alone memorandums becoming supporting documents/appendices to the EA Report.

2.0 Assessment and evaluation of the Alternative Methods methodology

The assessment and evaluation of the Alternative Methods was conducted in three steps:

Step 1: Confirm Evaluation Criteria and Indicators/Measures

Prior to undertaking the net effects analysis, the evaluation criteria, indicators, and measures previously developed in the ToR were reviewed with the public during Public Events and confirmed for application to each of the Alternative Methods. Evaluation criteria were developed for each Environmental Component listed above.

The Approved ToR set out the draft criteria and indicators for evaluating the Alternative Methods in the EA. As a result, the draft criteria, indicators, and measures provided in the ToR were reviewed and modified appropriately to suit the evaluation of the Alternative Methods.

Specifically, the criteria, indicators and measures were modified in consultation with review agencies and the public to ensure that an appropriate level of scrutiny and rigour was applied in evaluating the Alternative Methods. In doing so, the results of the evaluation phase will consist of clearly defined net effects for each Alternative Method.

Step 2: Undertake the Net Effects Analysis

With the evaluation criteria, indicators and measures confirmed through the preceding step, a net effects analysis of the Alternative Methods was carried out consisting of the following activities:

- Identify potential effects (based on measures) on the environment
- Develop and apply avoidance/ mitigation/ compensation/ enhancement measures
- Determine net effects on the environment.

Step 3: Carry Out the Comparative Evaluation

In Step 3, the net effects identified for each Alternative Method in Step 2 were compared to one another in order to identify a Recommended Alternative Method. The comparison of net effects was completed using a “Reasoned Argument” evaluation methodology, as provided for in the Approved ToR.

Each Alternative Method was assessed based on the evaluation criteria, indicators and measures.

Each criterion was evaluated with the same indicators for each Alternative Method (including number and significance) to support the reasoned argument in the comparative rankings:

- Displacement of Residents from Houses:

  - The number of households/residents (property owners and tenants) to be displaced (i.e., forced relocation) by the project itself regardless of whether their property has been purchased or not
  - The potential for or likelihood of voluntary out-migration of residents for consideration of the indirect effects on community character and cohesion
- Disruption to Use and Enjoyment of Residential Properties:
  - The number of existing residential households and/or future households that are located at specific receptor locations and potentially affected by noise, dust, odour, traffic, agricultural and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls
  - The number of existing residential households fronting/backing onto a haul route and potentially affected by changes in project-related traffic and traffic noise
  - Potential for or likelihood of changes in peoples' use of residential property
- Disruption to Use and Enjoyment of Public Facilities and Institutions:
  - The number of existing public facilities and institutions that may be affected by nuisance factors such as noise, dust, odour, traffic and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls
  - Potential for or likelihood of changes in operations of public facilities and institutions
  - Potential for or likelihood of changes in use and enjoyment of public facilities and institutions
- Loss/Disruption of Recreational Resources:
  - The number/nature of existing recreational resources and/or future features potentially affected by noise, dust, odour, visual effects and changes in project-related traffic; and the potential for and likelihood of changes in the presence of vermin and gulls
  - Potential for or likelihood of changes in operations of recreational features
  - Potential for or likelihood of changes in use and enjoyment of recreational resources
- Changes to Community Character:
  - Compatibility of landfill operations with the existing and likely future character of the community
  - Compatibility of the proposed end use with the existing and likely future character of the community
- Changes to Community Cohesion:
  - The extent of displacement
  - The potential for or likelihood of voluntary out-migration
  - Loss and the extent of disruption of recreational resources, public facilities and institutions, and the use and enjoyment of residential properties

3.0 Step 1: Confirm Evaluation Criteria and Indicators/Measures

Evaluation Criteria and Indicators were adjusted during the development of the ToR based on feedback from Indigenous communities, government agencies, and the public.

Prior to undertaking the Comparative Evaluation of Alternative Methods process, a Public Event, accompanied by a virtual event, was held to present the Criteria and Indicators to the public and invite additional feedback.

To fully characterize these indicators and to adopt measures by which potential effects could be identified, several considerations were developed for each indicator. These considerations are shown below in Table 3.1.

Table 3.1 Considerations for Indicators

Criteria	Indicators	Considerations
Displacement of Residents from Houses	• The number of households/residents (property owners and tenants) to be displaced (i.e., forced relocation) by the project itself regardless of whether their property has been purchased or not • The potential for or likelihood of voluntary out-migration of residents for consideration of the indirect effects on community character and cohesion	• Total number of households/residents displaced. • Differences between operations at the South Landfill (Phase 1) and those for South Landfill (Phase 2) Project that could result in a material change in public attitudes towards the South Landfill (Phase 2) Project and potentially motivate some people to out-migrate voluntarily. • Ratings of resident's sense of health, and well-being and key issues affecting resident's sense of health and well-being.
Disruption to Use and Enjoyment of Residential Properties	• The number of existing residential households and/or future households that are located at specific receptor locations potentially affected by noise, dust, odour, traffic, agricultural and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls • The number of existing residential households fronting/backing onto a haul route and potentially affected by changes in project-related traffic and traffic noise • Potential for or likelihood of changes in peoples' use of residential property	• Proximity of South Landfill (Phase 2) property boundary to the nearest residential properties. • The total number of existing residential households and/or future households potentially affected by landfill operations. • The total number of existing residential households fronting/backing onto a haul route and potentially affected by changes in project-related traffic and traffic noise. • Uniqueness or sensitivity of residential property uses potentially affected by landfill operations. • Material differences in the potential duration of landfill operations.

Criteria	Indicators	Considerations
Disruption to Use and Enjoyment of Public Facilities and Institutions	• The number of existing public facilities and institutions that may be affected by nuisance factors such as noise, dust, odour, traffic and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls • Potential for or likelihood of changes in operations of public facilities and institutions • Potential for or likelihood of changes in use and enjoyment of public facilities and institutions	• Proximity of South Landfill (Phase 2) property boundary to the nearest public facilities or institutions • The total number of existing and/or future public facilities and institutions potentially affected by landfill operations. • The total number of existing and/or future public facilities and institutions fronting/backing onto a haul route and potentially affected by changes in project-related traffic and traffic noise. • Unique or sensitive uses of public facilities or institutions potentially affected by landfill operations. • Potential duration of landfill operations.
Loss/Disruption of Recreational Resources	• The number/nature of existing recreational resources and/or future features potentially affected by noise, dust, odour, visual effects and changes in project-related traffic; and the potential for and likelihood of changes in the presence of vermin and gulls • Potential for or likelihood of changes in operations of recreational features • Potential for or likelihood of changes in use and enjoyment of recreational resources	• Proximity of South Landfill (Phase 2) property boundary to the nearest recreational resources. • The total number of existing and/or future recreational resources potentially affected by landfill operations. • The total number of existing and/or future recreational resources fronting/backing onto a haul route and potentially affected by landfill operations. • Uniqueness or sensitivity of recreational resources potentially affected by landfill operations. • Potential duration of landfill operations.
Changes to Community Character	• Compatibility of landfill operations with the existing and likely future character of the community • Compatibility of the proposed end use with the existing and likely future character of the community	• New or unique landfill operations or landfill configuration elements that have the potential to change the compatibility of the existing and likely future character of the community. • Potential encroachment of the landfill on features that support community character. • Commitment to agricultural area to be established in the post-closure.

Criteria	Indicators	Considerations
Changes to Community Cohesion	• The extent of displacement • The potential for or likelihood of voluntary out-migration • Loss and the extent of disruption of recreational resources, public facilities and institutions, and the use and enjoyment of residential properties	• See considerations for each criterion described above.

The potential effects for each Alternative Method were then identified on the basis of these considerations.

4.0 Step 2: Net Effects Analysis

4.1 General Assumptions

Table 4.1 outlines the assumptions for each Criteria evaluated.

Table 4.1 General Assumptions for Evaluation of Social Environment Criteria

Criteria	Assumptions
Displacement of Residents from Houses	• No residential dwellings (i.e., houses) will be developed within the landfill footprint nor elsewhere on Walker Campus land over the life of the Project. • Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to application of best industry design and management practices to mitigate adverse effects, regulatory compliance and neighbour/community engagement such that there are not likely to be material changes in public attitudes towards the South Landfill (Phase 2) Project which could potentially motivate people to out-migrate voluntarily.
Disruption to Use and Enjoyment of Residential Properties	• Landfill Operations ○ Landfill operations will comply with O. Reg. 232/98 that requires that landfills be designed and operated to ensure that nuisance impacts are minimized. ○ There may be a time lag of several years between the cessation of quarrying activities and the commencement of landfill operations resulting in changed existing conditions regarding nuisance effects (i.e., noise, dust, odour, traffic, visual intrusion). ○ Landfill configuration options vary in total site capacity, while assuming a consistent annual fill rate. ○ A larger site capacity results in a greater total volume of waste placed over a longer operating life, leading to greater duration of potentially disruptive nuisance effects (i.e., noise, dust, odour, traffic, visual intrusion).

Criteria	Assumptions
Disruption to Use and Enjoyment of Public Facilities and Institutions	• See Landfill Operations assumptions described above • Leachate Management ○ Continued use of existing municipal treatment and disposal systems will not impose further constraints on municipal treatment facility capacity or operations.
Loss/Disruption of Recreational Resources	• See Landfill Operations assumptions described above
Changes to Community Character	• Agricultural Land Use Post-closure ○ Landfill configuration options vary in the area of land available for agricultural use post-closure. ○ Presence of an agriculture area expected to support the continuity of the existing community character
Changes to Community Cohesion	• No Assumptions

4.2 Potential Effects, Mitigation Measures, Net Effects

The potential effects for each Alternative Method were identified based on the characterized and documented existing social environment conditions and because of the considerations outlined in Table 3.1. As noted above, it is assumed that Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to application of best industry design and management practices to mitigate adverse effects, regulatory compliance and neighbour/community engagement.

Net Effects have been categorized according to the definitions in Table 4.2.

Table 4.2 Categorization of Net Effects

Net Effect Category	Description
No Effect / No (Positive) Effect	No departure from the existing condition is expected.
Low Effect / Low (Positive) Effect	Effects are likely to be negligible or minor in scale if they are negligible or low in magnitude, of short duration, infrequent, small in spatial extent, reversible or readily avoided, and generate few or minor impacts in social or ecological contexts. Mitigation measures will allow baseline conditions to remain largely unchanged.
Moderate Effect / Moderate (Positive) Effect	Effects are likely to be medium in scale if they are moderate in magnitude, of moderate duration, occasionally frequent, possibly/partially reversible, and to generate a moderate level of impacts in social or ecological contexts. Mitigation measures may not fully eliminate, reduce, control or offset effects but should enable affected communities to maintain economic and social well-being, and should prevent the diminishment or loss of key components of the environment and its ecological functioning.

Net Effect Category	Description
High Effect / High (Positive) Effect	Effects are likely to be severe in scale if they are high in magnitude, permanent/long term, frequent, irreversible, and over a large spatial extent or within an area of exclusive/preferred Indigenous use or of ecological/environmental sensitivity. High levels of impacts in social or ecological contexts are expected. There is a high degree of uncertainty of the effectiveness of mitigation measures, or mitigation measures are unable to fully address effects such that valued components are diminished or lost.

The scope of work undertaken to support the comparative evaluation of Alternative Methods differs from that outlined in the Social Assessment Work Plan in the approved Terms of Reference. This deviation is due to the determination that the differences among the Alternative Methods would not result in material differences in potential effects between the options, upon review of the Alternative Methods as presented in the Conceptual Design Report and relying on professional opinion. As such, assessment of potential effects at Common Receptors to distinguish between these alternatives was deemed unnecessary at this stage. Instead, efforts to assess multiple and/or cumulative effects will be focused during the Detailed Impact Assessment phase to support the robust assessment of potential effects, at which stage confirmatory assessment at Common Receptors will also be conducted to re-affirm comparative evaluation decision-making. This confirmatory work will be appended to/documented in the revised Social Environment comparative evaluation memo.

The following tables (Table 4.3 -

Table 4.7) present the results of the net environmental effects evaluation for each of the Alternative Methods. The net effects have been determined by applying the mitigation measures to the predicted potential environmental effects.

4.2.1 Landfill Configuration Options

Table 4.3 Landfill Configuration Option A Potential Social Environment Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Displacement of Residents from Houses	• The number of households/residents (property owners and tenants) to be displaced (i.e., forced relocation) by the project itself regardless of whether their property has been purchased or not	• There are no households/residents on the landfill footprint. No displacement (i.e., forced relocation) required.	• None warranted	• No displacement (i.e., forced relocation) required. **NO EFFECT**
	• The potential for or likelihood of voluntary out-migration of residents for consideration of the indirect effects on community character and cohesion	• Changes in the operations at the South Landfill (Phase 1) and those for South Landfill (Phase 2) Project are minimal and not likely to result in a material change in public attitudes towards the South Landfill (Phase 2) Project and potentially motivate some people to out-migrate voluntarily. • Very few LSA residents are expected to be motivated to out-migrate voluntarily. Those most likely are those residents who are exposed to new or unfamiliar nuisance effects from the South Landfill (Phase 2) Project.	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to: ○ The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual effects; and from the presence of vermin and gulls ○ Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); and ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material changes in public attitudes towards the South Landfill (Phase 2) Project.	• Very few LSA residents are expected to be motivated to out-migrate voluntarily. **LOW EFFECT**
Disruption to Use and Enjoyment of Residential Properties	• The number of existing residential households and/or future households that are located at specific receptor locations and potentially affected by noise, dust, odour, traffic, agricultural and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls.	• Residents living in existing households within 1000 m of the landfill footprint may experience some disruption from noise, dust, odour, and traffic over the life of the landfill. There are ○ Two residences within 500 m and two residences within 500 and 1000 m north of the landfill footprint boundary. ○ One residence within 500 m and 13 residences within 500 and 1000 m east of the landfill footprint boundary. ○ No residences within 500 m and 16 residences within 500 and 1000 m south of the landfill footprint boundary.	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to: • The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual effects; and from the presence of vermin and gulls • Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); and • Continued neighbour/community engagement and complaint resolution such that there are not likely to be material changes in	• A few residents living in existing households within 1000 m of the landfill footprint may experience some disruption from noise, dust, odour, and traffic during operation. • Some residents living in existing households or in new households slated for future development within 2000 m of the landfill footprint and on top of the Niagara Escarpment may consider a landfill that is visible from their property and a more prominent feature on the landscape as being unattractive. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
		○ No residences within 500 m and no residences within 500 and 1000 m west of the landfill footprint boundary. • Some residents living in existing households within 2000 m of the landfill footprint and on top of the Niagara Escarpment may experience some disruption from visual effects. Some people may consider a landfill that is visible from their property and a more prominent feature on the landscape as being unattractive. • Some residents living in new households in areas slated for future development (e.g., Northwest Secondary Plan Area, Glendale Secondary Plan Area) or infilled within 2000 m of the landfill footprint may experience some disruption from visual effects.	public attitudes towards the South Landfill (Phase 2) Project.	
	• The number of existing residential households fronting/backing onto a haul route and potentially affected by changes in project-related traffic and traffic noise	• Residents living in existing residential households fronting/backing onto Taylor Road (including intersection with Old Thorold Stone Road), Mountain Road, and Thorold Stone Road / Highway 58 are not expected to experience increased disruption due to project-related traffic and traffic noise. • Some residents may experience disruption should there be a noticeable difference in traffic and traffic noise in comparison to conditions after quarry operations ceased.	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to: ○ Enforcement of truck traffic on haul routes to the landfill. ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material changes in public attitudes towards the South Landfill (Phase 2) Project.	• Some residents may experience disruption should there be a noticeable difference in traffic and traffic noise in comparison to conditions after quarry operations ceased and during operation. **LOW EFFECT**
	• Potential for or likelihood of changes in peoples' use of residential property	• Changes in South Landfill (Phase 2) related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls may be of sufficient magnitude on occasion to result in a change in people's use of residential property. Effects on	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to: ○ The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls may be of sufficient magnitude on occasion to result in a change in people's use of residential property. Effects on outdoor activities are expected to be most affected.

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
		outdoor activities are expected to be most affected.	effects; and from the presence of vermin and gulls ○ Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); ○ Enforcement of truck traffic on haul routes to the landfill; and ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material changes in public attitudes towards the South Landfill (Phase 2) Project.	**LOW EFFECT**
Disruption to Use and Enjoyment of Public Facilities and Institutions	• The number of existing public facilities and institutions that may be affected by nuisance factors such as noise, dust, odour, traffic and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls	• There are no public facilities or institutions located within the landfill footprint that would require displacement. • There is one existing cemetery (i.e., Hutt / Brown Cemetery within 1000 m of the landfill footprint that may be affected on occasion by landfill related noise, dust, odour, traffic and visual effects; or changes in the presence of vermin and gulls. • People's use and enjoyment of some public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarpment may experience some disruption from visual effects. Some people may consider a landfill that is visible and a prominent feature on the landscape as being unattractive • People's use and enjoyment of public facilities and institutions west of the landfill footprint or below the Niagara Escarpment are not expected to experience disruption from visual effects.	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to: ○ The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual effects; and from the presence of vermin and gulls ○ Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); ○ Enforcement of truck traffic on haul routes to the landfill; and ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material changes in public attitudes towards the South Landfill (Phase 2) Project.	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls may be of sufficient magnitude on occasion to result in a change in people's use and enjoyment of the Hutt / Brown Cemetery during operation. • People's use and enjoyment of some public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarment may experience some disruption from visual effects. Some people may consider a landfill that is visible and a prominent feature on the landscape as being unattractive. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**
	• Potential for or likelihood of changes in operations of public facilities and institutions	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls are not expected	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to:	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls are not expected to be of sufficient

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
		to be of sufficient magnitude, duration or frequency to result in a change in operations at the Hutt / Brown Cemetery. • Operations at public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarpment are not expected to require changes from visual effects. • Operations at public facilities and institutions located west of the landfill footprint or below the Niagara Escarpment west of the landfill footprint are not expected to be affected by visual effects.	○ The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual effects; and from the presence of vermin and gulls ○ Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); ○ Enforcement of truck traffic on haul routes to the landfill; and ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material changes in public attitudes towards the South Landfill (Phase 2) Project.	magnitude, duration or frequency to result in a change in operations at the Hutt / Brown Cemetery. • Operations at public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarpment are not expected to require changes from or be affected by visual effects. **NO EFFECT**
	• Potential for or likelihood of changes in use and enjoyment of public facilities and institutions	• There is one existing cemetery (i.e., Hutt / Brown Cemetery within 1000 m of the landfill footprint that may be affected on occasion by landfill related noise, dust, odour, traffic and visual effects; or changes in the presence of vermin and gulls. People visiting the cemetery may choose not to visit or to shorten their visit on occasion. • People's use and enjoyment at four public facilities and institutions located north, east, south and within 2000 m of the landfill footprint on top of the Niagara Escarpment may experience some disruption where the landfill is visible and a prominent feature on the landscape. • People's use and enjoyment of public facilities and institutions located west of the landfill footprint or below the Niagara Escarpment are not expected to experience disruption from visual effects.	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to: ○ The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual effects; and from the presence of vermin and gulls ○ Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); ○ Enforcement of truck traffic on haul routes to the landfill; and ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material changes in public attitudes towards the South Landfill (Phase 2) Project.	• People visiting the Hutt / Brown cemetery may choose not to visit or to shorten their visit on occasions where nuisance effects are noticeable or should the landfill be visible and a prominent feature on the landscape. • People's use and enjoyment at four public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarpment may experience some disruption where the landfill is visible and a prominent feature on the landscape. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**
Loss/Disruption of Recreational Resources	• The number/nature of existing recreational resources and/or future features potentially affected by noise, dust, odour, visual effects and changes in project-related traffic; and the potential	• There are no recreational resources within the landfill	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
	for and likelihood of changes in the presence of vermin and gulls.	footprint that would require displacement. • There are five recreational resources (one walking trail and 4 biking routes on existing roads) located within 1000 m of the landfill footprint that may be affected on occasion by landfill related noise, dust, odour, traffic and visual effects; or changes in the presence of vermin and gulls. • People's use and enjoyment of some public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarment may experience some disruption from visual effects. Some people may consider a landfill that is visible and a prominent feature on the landscape as being unattractive • People's use and enjoyment of public facilities and institutions west of the landfill footprint or below the Niagara Escarpment are not expected to experience disruption from visual effects.	manner as the South Landfill (Phase 1) with respect to: ○ The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual effects; and from the presence of vermin and gulls ○ Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); ○ Enforcement of truck traffic on haul routes to the landfill; and ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material changes in public attitudes towards the South Landfill (Phase 2) Project.	gulls may be of sufficient magnitude on occasion to result in a change in people's use and enjoyment of one walking trail and four existing biking routes during operation. • People's use and enjoyment of some recreational resources located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarment may experience some disruption from visual effects. Some people may consider a landfill that is visible and a prominent feature on the landscape as being unattractive. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**
	• Potential for or likelihood of changes in operations of recreational features	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls are not expected to be of sufficient magnitude, duration or frequency to result in a change in operations of trails and biking routes. • Operations at recreational resources located north, east, south and within 2000 m of the landfill footprint are not expected to require changes from visual effects. • Operations at public facilities and institutions located west of the landfill footprint or below the Niagara Escarpment west of the	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to: ○ The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual effects; and from the presence of vermin and gulls ○ Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); and ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material changes in public attitudes towards the South Landfill (Phase 2) Project.	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls are not expected to be of sufficient magnitude, duration or frequency to result in a change in operations of trails and biking routes. • Operations at recreational resources located north, east, south and within 2000 m of the landfill footprint are not expected to require changes from or be affected by visual effects. **NO EFFECT**

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
		landfill footprint are not expected to be affected by visual effects.		
	• Potential for or likelihood of changes in use and enjoyment of recreational resources	• There are five recreational resources located within 1000 m of the landfill footprint that may be affected on occasion by landfill related noise, dust, odour, traffic and visual effects; or changes in the presence of vermin and gulls. People walking or biking in the area may choose not to visit or use these resources. • People's use and enjoyment recreational resources located north, east, south and within 2000 m of the landfill footprint on top of the Niagara Escarpment may experience some disruption where the landfill is visible and a prominent feature on the landscape. Some people may consider a landfill that is visible and a prominent feature on the landscape as being unattractive to undertake recreational activities. • People's use and enjoyment of recreational resources located west of the landfill footprint or below the Niagara Escarpment are not expected to experience disruption from visual effects.	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to: ○ The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual effects; and from the presence of vermin and gulls ○ Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); and ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material changes in public attitudes towards the South Landfill (Phase 2) Project.	• There are five recreational resources located within 1000 m of the landfill footprint that may be affected on occasion by landfill related noise, dust, odour, traffic and visual effects; or changes in the presence of vermin and gulls. People walking or biking in the area may choose not to visit or use these recreational resources less frequently. • People's use and enjoyment recreational resources located north, east, south and within 2000 m of the landfill footprint on top of the Niagara Escarpment may experience some disruption where the landfill is visible and a prominent feature on the landscape. Some people may consider a landfill that is visible and a prominent feature on the landscape as being unattractive to undertake recreational activities. **LOW EFFECT**
Changes to Community Character	• Compatibility of landfill operations with the existing and likely future character of the community	• Landfill operations are compatible with the existing and likely future character of the community for the following reasons: ○ The South Landfill (Phase 2) will be an approved land use within the City of Niagara Falls that is compatible with Official Plan designations. ○ Landfill operations have existed in the Local Study Ares since the 1980's are not considered new or unfamiliar to community members. The South Landfill (Phase 2) represents a continuation of an	• None warranted	• Landfill operations are compatible with the existing and likely future character of the community. **NO EFFECT**

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
		existing industrial presence in the Local Study Area. ○ It is likely that future development of lands would occur within areas approved by the local municipalities having considered the likely presence of the South Landfill (Phase 2) Project. ○ Landfill operations are not expected to substantially affect features that support community character, such as social and community events, the friendliness of people living in the local communities. The landfill does not encroach on important tourism-related features such tourist accommodations, casinos and Niagara Falls itself. ○ Landfill operations are not expected to substantially affect features or issues that are negative influences on community character such as homelessness, poor affordability / housing and infrastructure, drug Use and crime.		
	• Compatibility of the proposed end use with the existing and likely future character of the community	• The proposed agricultural end use is compatible with the existing and likely future character of the community for the following reasons: ○ The proposed agricultural end use allows for a productive use of the land following years of quarrying activity, ○ A portion of the closed South Landfill (Phase 1) will also be made available for agriculture. ○ There is substantial existing agricultural activity in the LSA. ○ The continued (future) use of lands in Local Study Area is	• None warranted.	• The proposed agricultural end use is compatible with the existing and likely future character of the community. **NO EFFECT**

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
		promoted by municipal Official plan designations.		
Changes to Community Cohesion	• The extent of displacement	• Adverse effects on community cohesion are not likely for the following reason: ○ No displacement (i.e., forced relocation) is required.	• None warranted	• Adverse effects on community cohesion are not likely because no displacement (i.e., forced relocation) is required. **NO EFFECT**
	• The potential for or likelihood of voluntary out-migration	• Adverse effects on community cohesion are not likely for the following reasons: ○ Very few LSA residents are expected to be motivated to out-migrate voluntarily. ○ Those who might out-migrate voluntarily are likely to be replaced by others who would contribute to community cohesion in their own ways.	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to: ○ The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual effects; and from the presence of vermin and gulls ○ Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); and ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material changes in public attitudes towards the South Landfill (Phase 2) Project.	• Adverse effects on community cohesion are not likely because very few LSA residents are expected to be motivated to out-migrate voluntarily. **NO EFFECT**
	• Loss and the extent of disruption of recreational resources, public facilities and institutions, and the use and enjoyment of residential properties	• Adverse effects on community cohesion are not likely for the following reasons: ○ There are no recreational resources or public facilities or institutions within the landfill footprint that would require displacement. ○ Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls are not expected to be of sufficient magnitude, duration or frequency to result in a change in operations at nearby recreational resources, public facilities or institutions.	• None warranted	• Adverse effects on community cohesion are not likely because no community features that contribute to community cohesion will be displaced and nuisance effects are not expected to be of sufficient magnitude to change their operations or their use and enjoyment by residents. **NO EFFECT**

Table 4.4 Landfill Configuration Option B Potential Social Environment Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Displacement of Residents from Houses	• The number of households/residents (property owners and tenants) to be displaced (i.e., forced relocation) by the project itself regardless of whether their property has been purchased or not	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A **NO EFFECT**
	• The potential for or likelihood of voluntary out-migration of residents for consideration of the indirect effects on community character and cohesion	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A **LOW EFFECT**
Disruption to Use and Enjoyment of Residential Properties	• The number of existing residential households and/or future households that are located at specific receptor locations and potentially affected by noise, dust, odour, traffic, agricultural and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration A. **LOW EFFECT**
	• The number of existing residential households fronting/backing onto a haul route and potentially affected by changes in project-related traffic and traffic noise	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **LOW EFFECT**
	• Potential for or likelihood of changes in peoples' use of residential property	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **LOW EFFECT**
Disruption to Use and Enjoyment of Public Facilities and Institutions	• The number of existing public facilities and institutions that may be affected by nuisance factors such as noise, dust, odour, traffic and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration A. **LOW EFFECT**
	• Potential for or likelihood of changes in operations of public facilities and institutions	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**
	• Potential for or likelihood of changes in use and enjoyment of public facilities and institutions	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **LOW EFFECT**
Loss/Disruption of Recreational Resources	• The number/nature of existing recreational resources and/or future features potentially affected by noise, dust, odour, visual effects and changes in project-related traffic; and the	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **LOW EFFECT**

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
	potential for and likelihood of changes in the presence of vermin and gulls			
	• Potential for or likelihood of changes in operations of recreational features	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**
	• Potential for or likelihood of changes in use and enjoyment of recreational resources	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **LOW EFFECT**
Changes to Community Character	• Compatibility of landfill operations with the existing and likely future character of the community	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**
	• Compatibility of the proposed end use with the existing and likely future character of the community	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**
Changes to Community Cohesion	• The extent of displacement	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**
	• The potential for or likelihood of voluntary out-migration	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**
	• Loss and the extent of disruption of recreational resources, public facilities and institutions, and the use and enjoyment of residential properties	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**

Table 4.5 Landfill Configuration Option C Potential Social Environment Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Displacement of Residents from Houses	• The number of households/residents (property owners and tenants) to be displaced (i.e., forced relocation) by the project itself regardless of whether their property has been purchased or not	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A **NO EFFECT**
	• The potential for or likelihood of voluntary out-migration of residents for consideration of the indirect effects on community character and cohesion	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A **LOW EFFECT**
Disruption to Use and Enjoyment of Residential Properties	• The number of existing residential households and/or future households that are located at specific receptor locations and potentially	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration A.

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
	affected by noise, dust, odour, traffic, agricultural and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls			**LOW EFFECT**
	• The number of existing residential households fronting/backing onto a haul route and potentially affected by changes in project-related traffic and traffic noise	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **LOW EFFECT**
	• Potential for or likelihood of changes in peoples' use of residential property	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **LOW EFFECT**
Disruption to Use and Enjoyment of Public Facilities and Institutions	• The number of existing public facilities and institutions that may be affected by nuisance factors such as noise, dust, odour, traffic and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration A. **LOW EFFECT**
	• Potential for or likelihood of changes in operations of public facilities and institutions	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**
	• Potential for or likelihood of changes in use and enjoyment of public facilities and institutions	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **LOW EFFECT**
Loss/Disruption of Recreational Resources	• The number/nature of existing recreational resources and/or future features potentially affected by noise, dust, odour, visual effects and changes in project-related traffic; and the potential for and likelihood of changes in the presence of vermin and gulls	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **LOW EFFECT**
	• Potential for or likelihood of changes in operations of recreational features	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**
	• Potential for or likelihood of changes in use and enjoyment of recreational resources	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **LOW EFFECT**
Changes to Community Character	• Compatibility of landfill operations with the existing and likely future character of the community	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
	• Compatibility of the proposed end use with the existing and likely future character of the community	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**
Changes to Community Cohesion	• The extent of displacement	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**
	• The potential for or likelihood of voluntary out-migration	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**
	• Loss and the extent of disruption of recreational resources, public facilities and institutions, and the use and enjoyment of residential properties	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A	• Same as Landfill Configuration Option A. **NO EFFECT**

4.2.2 Leachate Management Options

Table 4.6 Leachate Management Option A Potential Social Environment Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Displacement of Residents from Houses	• The number of households/residents (property owners and tenants) to be displaced (i.e., forced relocation) by the project itself regardless of whether their property has been purchased or not	• There are no households/residents within the Walker Industries Niagara Campus boundary. No displacement (i.e., forced relocation) required.	• None warranted	• No displacement (i.e., forced relocation) required. **NO EFFECT**
	• The potential for or likelihood of voluntary out-migration of residents for consideration of the indirect effects on community character and cohesion	• Continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project is not likely to result in a material change in public attitudes towards the South Landfill (Phase 2) Project and potentially motivate some people to out-migrate voluntarily.	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to: ○ The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual effects; and from the presence of vermin and gulls ○ Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); and ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material change in public attitudes towards the South Landfill (Phase 2) Project.	• Residents are not expected to be motivated to out-migrate voluntarily. **NO EFFECT**

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Disruption to Use and Enjoyment of Residential Properties	• The number of existing residential households and/or future households that are located at specific receptor locations and potentially affected by noise, dust, odour, traffic, agricultural and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls	• Continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project is not likely to be a major additional source of noise, dust, odour, traffic, agricultural and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls that might result in disruption to the use and enjoyment of residential property.	• See impact management measures described above	• Disruption to use and enjoyment of residential property is not anticipated. **NO EFFECT**
	• The number of existing residential households fronting/backing onto a haul route and potentially affected by changes in project-related traffic and traffic noise	• Leachate will not be transported off-site via trucks. Therefore, no changes in traffic or traffic noise are anticipated	• None Warranted	• No changes in traffic or traffic noise are anticipated. **NO EFFECT**
	• Potential for or likelihood of changes in peoples' use of residential property	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in a change in people's use of residential property.	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to: ○ The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual effects; and from the presence of vermin and gulls ○ Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); and ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material change in public attitudes towards the South Landfill (Phase 2) Project.	• No changes to peoples' use of residential property are anticipated. **NO EFFECT**
Disruption to Use and Enjoyment of Public Facilities and Institutions	• The number of existing public facilities and institutions that may be affected by nuisance factors such as noise, dust, odour, traffic and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in disruption to four public facilities and institutions nearby the Niagara Campus along Thorold Townline Road	• See impact management measures described above.	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in disruption to four public facilities and institutions nearby the Niagara Campus along Thorold Townline Road.

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
				NO EFFECT
	• Potential for or likelihood of changes in operations of public facilities and institutions	• Continued use of existing municipal treatment and disposal systems will not result in a material reduction in the capacity of the existing Niagara-on-the-Lake sanitary sewer system and the Region of Niagara's Port Weller Wastewater Treatment Plant to the extent that operations would be constrained. • Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in disruption to four public facilities and institutions nearby the Niagara Campus along Thorold Townline Road	• None Warranted. Walker Environmental Group will continue to pay for the treatment services provided by local and regional municipalities.	• Continued use of existing municipal treatment and disposal systems will not result in a material reduction in the capacity of the existing Niagara-on-the-Lake sanitary sewer system and the Region of Niagara's Port Weller Wastewater Treatment Plant. **NO EFFECT**
	• Potential for or likelihood of changes in use and enjoyment of public facilities and institutions	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the use and enjoyment of the four public facilities and institutions north and west of the Niagara Campus nearest to proposed additional leachate pond.	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to: ○ The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual effects; and from the presence of vermin and gulls ○ Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); and ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material change in public attitudes towards the South Landfill (Phase 2) Project	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the use and enjoyment of the four public facilities and institutions north and west of the Niagara Campus nearest to proposed additional leachate pond. **NO EFFECT**
Loss/Disruption of Recreational Resources	• The number/nature of existing recreational resources and/or future features potentially affected by noise, dust, odour, visual effects and changes in project-related traffic; and the	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond)	• See impact management measures described above.	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond)

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
	potential for and likelihood of changes in the presence of vermin and gulls	for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the use and enjoyment of the four recreation resources north and west of the Niagara Campus nearest the proposed additional leachate pond.		for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the use and enjoyment of the four recreation resources north and west of the Niagara Campus nearest the proposed additional leachate pond **NO EFFECT**
	• Potential for or likelihood of changes in operations of recreational features	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the operations at four recreation resources north and west of the Niagara Campus nearest the proposed additional leachate pond.	• See impact management measures described above.	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the operations at four recreation resources north and west of the Niagara Campus nearest the proposed additional leachate pond. **NO EFFECT**
	• Potential for or likelihood of changes in use and enjoyment of recreational resources	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the use and enjoyment of the four recreation resources north and west of the Niagara Campus nearest the proposed additional leachate pond.	• See impact management measures described above.	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the use and enjoyment of the four recreation resources north and west of the Niagara Campus nearest the proposed additional leachate pond **NO EFFECT**
Changes to Community Character	• Compatibility of landfill operations with the existing and likely future character of the community	• Continued use of existing municipal wastewater treatment system is compatible with the existing and likely future character of the community for the following reasons: ○ Leachate treatment ponds have operated at the Niagara Campus since the 1980's and are not considered new or unfamiliar to community members. Option A represents a continuation of	• None Warranted	• Continued use of existing municipal wastewater treatment system is compatible with the existing and likely future character of the community. **NO EFFECT**

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
		an existing industrial activity on the Niagara Campus. ○ An additional leachate treatment pond is not expected to substantially affect features that support community character, nor to substantially affect features or issues that are negative influences on community character.		
	• Compatibility of the proposed end use with the existing and likely future character of the community	• Continued use of existing municipal wastewater treatment system does not affect the proposed agriculture end use and is therefore compatible with the existing and likely future character of the community.	• None Warranted.	• Continued use of existing municipal wastewater treatment system does not affect the proposed agriculture end use and is therefore compatible with the existing and likely future character of the community. **NO EFFECT**
Changes to Community Cohesion	• The extent of displacement	• Continued use of existing municipal wastewater treatment system does not required any displacement (i.e., forced relocation).	• None Warranted	• Adverse effects on community cohesion are not likely because no displacement (i.e., forced relocation) is required. **NO EFFECT**
	• The potential for or likelihood of voluntary out-migration	• Adverse effects on community cohesion are not likely for the following reasons: ○ Very few LSA residents are expected to be motivated to out-migrate voluntarily. ○ Those who might out-migrate voluntarily are likely to be replaced by others who would contribute to community cohesion in their own ways.	• Walker Environmental Group will manage the South Landfill (Phase 2) in a similar manner as the South Landfill (Phase 1) with respect to: ○ The application of best industry design and management practices to mitigate adverse effects from noise, dust, odour, traffic, agricultural and visual effects; and from the presence of vermin and gulls ○ Maintenance of regulatory compliance with respect to noise, air quality (i.e., dust and odour); and ○ Continued neighbour/community engagement and complaint resolution such that there are not likely to be material change in public attitudes towards the South Landfill (Phase 2) Project.	• Adverse effects on community cohesion are not likely because very few LSA residents are expected to be motivated to out-migrate voluntarily. **NO EFFECT**
	• Loss and the extent of disruption of recreational resources, public facilities	• Adverse effects on community cohesion are not anticipated because no community	• See impact management measures described above.	• Adverse effects on community cohesion are not likely because no community features that contribute to community cohesion will be displaced and nuisance

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
	and institutions, and the use and enjoyment of residential properties	features that contribute to community cohesion will be displaced. • Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls are not expected to be of sufficient magnitude, duration or frequency to result in a change in operations at nearby recreational resources, public facilities or institutions, nor the use and enjoyment of residential properties.		effects are not expected to be of sufficient magnitude to change their operations, nor the use and enjoyment of residential properties. **NO EFFECT**

Table 4.7 Leachate Management Option B Potential Social Environment Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Displacement of Residents from Houses	• The number of households/residents (property owners and tenants) to be displaced (i.e., forced relocation) by the project itself regardless of whether their property has been purchased or not	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**
	• The potential for or likelihood of voluntary out-migration of residents for consideration of the indirect effects on community character and cohesion	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**
Disruption to Use and Enjoyment of Residential Properties	• The number of existing residential households and/or future households that are located at specific receptor locations and potentially affected by noise, dust, odour, traffic, agricultural and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**
	• The number of existing residential households fronting/backing onto a haul route and potentially affected by changes in project related traffic and traffic noise	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**
	• Potential for or likelihood of changes in peoples' use of residential property	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**
Disruption to Use and Enjoyment of Public Facilities and Institutions	• The number of existing public facilities and institutions that may be affected by nuisance factors such as noise, dust, odour, traffic and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**
	• Potential for or likelihood of changes in operations of public facilities and institutions	• Development of an on-site wastewater treatment plant will not result in a material change in the capacity of the existing Niagara-on-the-Lake sanitary sewer system and the Region of Niagara's Port Weller Wastewater Treatment Plant.	• None Warranted	• Development of an on-site wastewater treatment plant will not result in a material change in the capacity of the existing Niagara-on-the-Lake sanitary sewer system and the Region of Niagara's Port Weller Wastewater Treatment Plant. **NO EFFECT**
	• Potential for or likelihood of changes in use and enjoyment of public facilities and institutions	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
				NO EFFECT
Loss/Disruption of Recreational Resources	• The number/nature of existing recreational resources and/or future features potentially affected by noise, dust, odour, visual effects and changes in project-related traffic; and the potential for and likelihood of changes in the presence of vermin and gulls	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**
	• Potential for or likelihood of changes in operations of recreational features	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**
	• Potential for or likelihood of changes in use and enjoyment of recreational resources	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**
Changes to Community Character	• Compatibility of landfill operations with the existing and likely future character of the community	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**
	• Compatibility of the proposed end use with the existing and likely future character of the community	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**
Changes to Community Cohesion	• The extent of displacement	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**
	• The potential for or likelihood of voluntary out-migration	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**
	• Loss and the extent of disruption of recreational resources, public facilities and institutions, and the use and enjoyment of residential properties	• Same as Leachate Management Option A	• Same as Leachate Management Option A	• Same as Leachate Management Option A **NO EFFECT**

5.0 Step 3: Comparative Evaluation

Table 5.1 Comparative Evaluation – Social Environment

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
Displacement of Residents from Houses	• The number of households/residents (property owners and tenants) to be displaced (i.e., forced relocation) by the project itself regardless of whether their property has been purchased or not.	• No displacement (i.e., forced relocation) required. **NO EFFECT**	• No displacement (i.e., forced relocation) required. **NO EFFECT**	• No displacement (i.e., forced relocation) required **NO EFFECT**	• No displacement (i.e., forced relocation) required. **NO EFFECT**	• No displacement (i.e., forced relocation) required. **NO EFFECT**
	• The potential for or likelihood of voluntary out-migration of residents for consideration of the indirect effects on community character and cohesion	• Very few LSA residents are expected to be motivated to out-migrate voluntarily. **LOW EFFECT**	• Very few LSA residents are expected to be motivated to out-migrate voluntarily. **LOW EFFECT**	• Very few LSA residents are expected to be motivated to out-migrate voluntarily. **LOW EFFECT**	• Residents are not expected to be motivated to out-migrate voluntarily. **NO EFFECT**	• Residents are not expected to be motivated to out-migrate voluntarily. **NO EFFECT**
	Criteria Ranking:	*1st preferred*	*1st preferred*	*1st preferred*	*1st preferred*	*1st preferred*
	Criteria Rationale:	*There is no distinction between the options in relation to displacement effects.*			*There is no distinction between the options in relation to displacement effects.*	
Disruption to Use and Enjoyment of Residential Properties	• The number of existing residential households and/or future households that are located at specific receptor locations and potentially affected by noise, dust, odour, traffic, agricultural and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls	• A few residents living in existing households within 1000 m of the landfill footprint may experience some disruption from noise, dust, odour, and traffic during operation. • Some residents living in existing households or in new households slated for future development within 2000 m of the landfill footprint and on top of the Niagara Escarpment may consider a landfill that is visible from their property and a more prominent feature on the landscape as being unattractive. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**	• A few residents living in existing households within 1000 m of the landfill footprint may experience some disruption from noise, dust, odour, and traffic during operation. • Some residents living in existing households or in new households slated for future development within 2000 m of the landfill footprint and on top of the Niagara Escarpment may consider a landfill that is visible from their property and a more prominent feature on the landscape as being unattractive. The landfill will become more visible and prominent as its final contour is achieved.	• A few residents living in existing households within 1000 m of the landfill footprint may experience some disruption from noise, dust, odour, and traffic during operation. • Some residents living in existing households or in new households slated for future development within 2000 m of the landfill footprint and on top of the Niagara Escarpment may consider a landfill that is visible from their property and a more prominent feature on the landscape as being unattractive. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**	• Disruption to use and enjoyment of residential property is not anticipated. **NO EFFECT**	• Disruption to use and enjoyment of residential property is not anticipated. **NO EFFECT**

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
			LOW EFFECT			
	• The number of existing residential households fronting/backing onto a haul route and potentially affected by changes in project-related traffic and traffic noise	• Some residents may experience disruption should there be a noticeable difference in traffic and traffic noise in comparison to conditions after quarry operations ceased and during operation. **LOW EFFECT**	• Some residents may experience disruption should there be a noticeable difference in traffic and traffic noise in comparison to conditions after quarry operations ceased and during operation. **LOW EFFECT**	• Some residents may experience disruption should there be a noticeable difference in traffic and traffic noise in comparison to conditions after quarry operations ceased and during operation. **LOW EFFECT**	• No changes in traffic or traffic noise are anticipated. **NO EFFECT**	• No changes in traffic or traffic noise are anticipated. **NO EFFECT**
	• Potential for or likelihood of changes in peoples' use of residential property	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls may be of sufficient magnitude on occasion to result in a change in people's use of residential property. Effects on outdoor activities are expected to be most affected. **LOW EFFECT**	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls may be of sufficient magnitude on occasion to result in a change in people's use of residential property. Effects on outdoor activities are expected to be most affected. **LOW EFFECT**	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls may be of sufficient magnitude on occasion to result in a change in people's use of residential property. Effects on outdoor activities are expected to be most affected. **LOW EFFECT**	• No changes to peoples' use of residential property are anticipated. **NO EFFECT**	• No changes to peoples' use of residential property are anticipated. **NO EFFECT**
	Criteria Ranking:	*1st preferred*	*1st preferred*	*1st preferred*	*1st preferred*	*1st preferred*
	Criteria Rationale:	*There are no distinctions between the options in relation to disruption to the use and enjoyment of residential properties. While there are slight differences between the options with respect to duration of landfill operations and final height, these are not considered to be material.*			*There are no distinctions between the options in relation to disruption to the use and enjoyment of residential properties.*	
Disruption to Use and Enjoyment of Public Facilities and Institutions	• The number of existing public facilities and institutions that may be affected by nuisance factors such as noise, dust, odour, traffic and visual effects; and the potential for and likelihood of changes in the presence of vermin and gulls	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls may be of sufficient magnitude on occasion to result in a change in people's use and enjoyment of the	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls may be of sufficient magnitude on occasion to result in a change in people's use and	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls may be of sufficient magnitude on occasion to result in a change in people's use and enjoyment of the	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
		Hutt / Brown Cemetery during operations. • People's use and enjoyment of some public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarment may experience some disruption from visual effects. Some people may consider a landfill that is visible and a prominent feature on the landscape as being unattractive. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**	enjoyment of the Hutt / Brown Cemetery during operations. • People's use and enjoyment of some public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarment may experience some disruption from visual effects. Some people may consider a landfill that is visible and a prominent feature on the landscape as being unattractive. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**	Hutt / Brown Cemetery during operations. • People's use and enjoyment of some public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarment may experience some disruption from visual effects. Some people may consider a landfill that is visible and a prominent feature on the landscape as being unattractive. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**	leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in disruption to four public facilities and institutions nearby the Niagara Campus along Thorold Townline Road. **NO EFFECT**	leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in disruption to four public facilities and institutions nearby the Niagara Campus along Thorold Townline Road. **NO EFFECT**
	• Potential for or likelihood of changes in operations of public facilities and institutions	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls are not expected to be of sufficient magnitude, duration or frequency to result in a change in operations at the Hutt / Brown Cemetery. • Operations at public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls are not expected to be of sufficient magnitude, duration or frequency to result in a change in operations at the Hutt / Brown Cemetery. • Operations at public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls are not expected to be of sufficient magnitude, duration or frequency to result in a change in operations at the Hutt / Brown Cemetery. • Operations at public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarpment are	• Continued use of existing municipal treatment and disposal systems is not expected to result in a material reduction in the capacity of the existing Niagara-on-the-Lake sanitary sewer system and the Region of Niagara's Port Weller Wastewater Treatment Plant. **NO EFFECT**	• Development of an on-site wastewater treatment plant is not expected to result in a material change in the capacity of the existing Niagara-on-the-Lake sanitary sewer system and the Region of Niagara's Port Weller Wastewater Treatment Plant. **NO EFFECT**

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
		Niagara Escarpment are not expected to require changes from visual effects. **NO EFFECT**	top of the Niagara Escarpment are not expected to require changes from visual effects. **NO EFFECT**	not expected to require changes from visual effects. **NO EFFECT**		
	• Potential for or likelihood of changes in use and enjoyment of public facilities and institutions	• People visiting the Hutt / Brown cemetery may choose not to visit or to shorten their visit on occasions where nuisance effects are noticeable or should the landfill be visible and a prominent feature on the landscape. • People's use and enjoyment at four public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarpment may experience some disruption where the landfill is visible and a prominent future on the landscape. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**	• People visiting the Hutt / Brown cemetery may choose not to visit or to shorten their visit on occasions where nuisance effects are noticeable or should the landfill be visible and a prominent feature on the landscape. • People's use and enjoyment at four public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarpment may experience some disruption where the landfill is visible and a prominent future on the landscape. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**	• People visiting the Hutt / Brown cemetery may choose not to visit or to shorten their visit on occasions where nuisance effects are noticeable or should the landfill be visible and a prominent feature on the landscape. • People's use and enjoyment at four public facilities and institutions located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarpment may experience some disruption where the landfill is visible and a prominent future on the landscape. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the use and enjoyment of the four public facilities and institutions north and west of the Niagara Campus nearest to proposed additional leachate pond. **NO EFFECT**	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the use and enjoyment of the four public facilities and institutions north and west of the Niagara Campus nearest to proposed additional leachate pond. **NO EFFECT**
	Criteria Ranking:	*1st preferred*	*1st preferred*	*1st preferred*	*1st preferred*	*1st preferred*
	Criteria Rationale:	*There are no distinctions between the options in relation to disruption to use and enjoyment of public facilities and institutions. While there are slight differences between the options with respect to duration of landfill operations and final height, these are not considered to be material differences.*			*There are no distinctions between the options in relation to disruption to the use and enjoyment of public facilities and institutions.*	

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
Loss/Disruption of Recreational Resources	• The number/nature of existing recreational resources and/or future features potentially affected by noise, dust, odour, visual effects and changes in project-related traffic; and the potential for and likelihood of changes in the presence of vermin and gulls	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls may be of sufficient magnitude on occasion to result in a change in people's use and enjoyment of one walking trail and four existing biking routes during operations. • People's use and enjoyment of some recreational resources located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarment may experience some disruption from visual effects. Some people may consider a landfill that is visible and a prominent feature on the landscape as being unattractive. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls may be of sufficient magnitude on occasion to result in a change in people's use and enjoyment of one walking trail and four existing biking routes during operations. • People's use and enjoyment of some recreational resources located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarment may experience some disruption from visual effects. Some people may consider a landfill that is visible and a prominent feature on the landscape as being unattractive. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls may be of sufficient magnitude on occasion to result in a change in people's use and enjoyment of one walking trail and four existing biking routes during operations. • People's use and enjoyment of some recreational resources located north, east, south and within 2000 m of the landfill footprint and on top of the Niagara Escarment may experience some disruption from visual effects. Some people may consider a landfill that is visible and a prominent feature on the landscape as being unattractive. The landfill will become more visible and prominent as its final contour is achieved. **LOW EFFECT**	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the use and enjoyment of the four recreation resources north and west of the Niagara Campus nearest the proposed additional leachate pond **NO EFFECT**	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the use and enjoyment of the four recreation resources north and west of the Niagara Campus nearest the proposed additional leachate pond **NO EFFECT**
	• Potential for or likelihood of changes in operations of recreational features	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls are not expected to be of sufficient magnitude, duration or	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls are not expected to be of sufficient magnitude,	• Changes in landfill related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls are not expected to be of sufficient magnitude, duration or frequency to	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
		frequency to result in a change in operations of trails and biking routes. • Operations at recreational resources located north, east, south and within 2000 m of the landfill footprint are not expected to require changes from visual effects. **NO EFFECT**	duration or frequency to result in a change in operations of trails and biking routes. • Operations at recreational resources located north, east, south and within 2000 m of the landfill footprint are not expected to require changes from visual effects. **NO EFFECT**	result in a change in operations of trails and biking routes. • Operations at recreational resources located north, east, south and within 2000 m of the landfill footprint are not expected to require changes from visual effects. **NO EFFECT**	system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the operations at four recreation resources north and west of the Niagara Campus nearest the proposed additional leachate pond. **NO EFFECT**	system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the operations at four recreation resources north and west of the Niagara Campus nearest the proposed additional leachate pond. **NO EFFECT**
	• Potential for or likelihood of changes in use and enjoyment of recreational resources	• There are five recreational resources located within 1000 m of the landfill footprint that may be affected on occasion by landfill related noise, dust, odour, traffic and visual effects; or changes in the presence of vermin and gulls. People walking or biking in the area may choose not to visit or use these recreational resources less frequently. • People's use and enjoyment recreational resources located north, east, south and within 2000 m of the landfill footprint on top of the Niagara Escarpment may experience some disruption where the landfill is visible and a prominent feature on the landscape. Some people may consider a landfill that is visible	• There are five recreational resources located within 1000 m of the landfill footprint that may be affected on occasion by landfill related noise, dust, odour, traffic and visual effects; or changes in the presence of vermin and gulls. People walking or biking in the area may choose not to visit or use these recreational resources less frequently. • People's use and enjoyment recreational resources located north, east, south and within 2000 m of the landfill footprint on top of the Niagara Escarpment may experience some disruption where the landfill is visible and a prominent feature on the landscape. Some people may consider a	• There are five recreational resources located within 1000 m of the landfill footprint that may be affected on occasion by landfill related noise, dust, odour, traffic and visual effects; or changes in the presence of vermin and gulls. People walking or biking in the area may choose not to visit or use these recreational resources less frequently. • People's use and enjoyment recreational resources located north, east, south and within 2000 m of the landfill footprint on top of the Niagara Escarpment may experience some disruption where the landfill is visible and a prominent feature on	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the use and enjoyment of the four recreation resources north and west of the Niagara Campus nearest the proposed additional leachate pond **NO EFFECT**	• Changes in leachate treatment related noise, dust, odour, traffic, agricultural and visual effects; and the presence of vermin and gulls from the continued use of the municipal wastewater treatment system (with an additional on-site leachate pond) for South Landfill (Phase 2) Project are not expected to be of sufficient magnitude to result in changes in the use and enjoyment of the four recreation resources north and west of the Niagara Campus nearest the proposed additional leachate pond **NO EFFECT**

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
		and a prominent feature on the landscape as being unattractive to undertake recreational activities. **LOW EFFECT**	landfill that is visible and a prominent feature on the landscape as being unattractive to undertake recreational activities. **LOW EFFECT**	the landscape as being unattractive to undertake recreational activities. **LOW EFFECT**		
	Criteria Ranking:	*1st Preferred*	*1st Preferred*	*1st Preferred*	*1st Preferred*	*1st Preference*
	Criteria Rationale:	*There are no distinctions between the options in relation to loss/disruption to recreational resources. While there are slight differences between the options with respect to duration of landfill operations and final height, these are not considered to be material.*			*There is no distinction between the options in relation to effects on recreational resources*	
Changes to Community Character	• Compatibility of landfill operations with the existing and likely future character of the community	• Landfill operations are compatible with the existing and likely future character of the community. **NO EFFECT**	• Landfill operations are compatible with the existing and likely future character of the community. **NO EFFECT**	• Landfill operations are compatible with the existing and likely future character of the community. **NO EFFECT**	• Continued use of existing municipal wastewater treatment system is compatible with the existing and likely future character of the community. **NO EFFECT**	• Continued use of existing municipal wastewater treatment system is compatible with the existing and likely future character of the community. **NO EFFECT**
	• Compatibility of the proposed end use with the existing and likely future character of the community	• The proposed agricultural end use is compatible with the existing and likely future character of the community. **NO EFFECT**	The proposed agricultural end use is compatible with the existing and likely future character of the community. **NO EFFECT**	The proposed agricultural end use is compatible with the existing and likely future character of the community. **POSITIVE EFFECT**	• Continued use of existing municipal wastewater treatment system does not affect the proposed agriculture end use and is therefore compatible with the existing and likely future character of the community. **NO EFFECT**	• Continued use of existing municipal wastewater treatment system does not affect the proposed agriculture end use and is therefore compatible with the existing and likely future character of the community. **NO EFFECT**
	Criteria Ranking:	*1st Preferred*	*1st Preferred*	*1st Preferred*	*1st Preferred*	*1st Preferred*
	Criteria Rationale:	*There are no distinctions between the options in relation to effects on community character.*			*There are no distinctions between the options in relation to effects on community character*	
Changes to Community Cohesion	The extent of displacement	• Adverse effects on community cohesion are not likely because no displacement (i.e., forced relocation) is required.	• Adverse effects on community cohesion are not likely because no displacement (i.e., forced relocation) is required.	• Adverse effects on community cohesion are not likely because no displacement (i.e., forced relocation) is required.	• Adverse effects on community cohesion are not likely because no displacement (i.e., forced relocation) is required.	• Adverse effects on community cohesion are not likely because no displacement (i.e., forced relocation) is required.

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
		NO EFFECT	**NO EFFECT**	**NO EFFECT**	**NO EFFECT**	**NO EFFECT**
	The potential for or likelihood of voluntary out-migration	• Adverse effects on community cohesion are not likely because very few LSA residents are expected to be motivated to out-migrate voluntarily. **NO EFFECT**	• Adverse effects on community cohesion are not likely because very few LSA residents are expected to be motivated to out-migrate voluntarily. **NO EFFECT**	• Adverse effects on community cohesion are not likely because very few LSA residents are expected to be motivated to out-migrate voluntarily. **NO EFFECT**	• Adverse effects on community cohesion are not likely because very few LSA residents are expected to be motivated to out-migrate voluntarily. **NO EFFECT**	• Adverse effects on community cohesion are not likely because very few LSA residents are expected to be motivated to out-migrate voluntarily. **NO EFFECT**
	Loss and the extent of disruption of recreational resources, public facilities and institutions, and the use and enjoyment of residential properties	• Adverse effects on community cohesion are not likely because no community features that contribute to community cohesion will be displaced and nuisance effects are not expected to be of sufficient magnitude to change their operations or their use and enjoyment by residents. **NO EFFECT**	• Adverse effects on community cohesion are not likely because no community features that contribute to community cohesion will be displaced and nuisance effects are not expected to be of sufficient magnitude to change their operations or their use and enjoyment by residents. **NO EFFECT**	• Adverse effects on community cohesion are not likely because no community features that contribute to community cohesion will be displaced and nuisance effects are not expected to be of sufficient magnitude to change their operations or their use and enjoyment by residents. **NO EFFECT**	• Adverse effects on community cohesion are not likely because no community features that contribute to community cohesion will be displaced and nuisance effects are not expected to be of sufficient magnitude to change their operations, nor the use and enjoyment of residential properties. **NO EFFECT**	• Adverse effects on community cohesion are not likely because no community features that contribute to community cohesion will be displaced and nuisance effects are not expected to be of sufficient magnitude to change their operations, nor the use and enjoyment of residential properties. **NO EFFECT**
	Criteria Ranking:	*1st preferred*	*1st preferred*	*1st preferred*	*1st preferred*	*1st preferred*
	Criteria Rationale:	*There are no distinctions between the options in relation to effects on community cohesion*			*There are no distinctions between the options in relation to effects on community cohesion*	
Environmental Component Ranking:		*1st preferred*	*1st preferred*	*1st preferred*	*1st preferred*	*1st preferred*
Environmental Component Rationale:		*There are no distinction between the options in relation to displacement effects, disruption to the use and enjoyment of residential properties, public facilities and institutions, loss/disruption to recreational resources or effects on community character and community cohesion. While there are slight differences between the options with respect to duration of landfill operations and final height, these are not considered to be material.*			*There are no distinctions between the options in relation to displacement effects, disruption to the use and enjoyment of residential properties, public facilities and institutions, loss/disruption to recreational resources or effects on community character and community cohesion.*	

6.0 Conclusions

Based on the net environmental effects presented in Section 4.2, and the comparative evaluation in Section 5.0, all three Landfill Configuration Options are ranked equally. Similarly, both Leachate Management Options are ranked equally.

7.0 Statement of Limitations

This report has been prepared by SLR Consulting (Canada) Ltd. (SLR) for Walker Environmental Group (the Client) in accordance with the scope of work and all other terms and conditions of the agreement between such parties. SLR acknowledges and agrees that the Client may provide this report to government agencies, interest holders, and/or Indigenous communities as part of project planning or regulatory approval processes. Copying or distribution of this report, in whole or in part, for any other purpose other than as aforementioned is not permitted without the prior written consent of SLR.

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8.0 Closure

This draft technical memorandum has been prepared by SLR Consulting (Canada) Ltd. (SLR) for Walker Environmental Group. Please do not hesitate to contact the undersigned at 647-462-6998 or twlodarczyk@slrconsulting.com with any questions.

Regards,

SLR Consulting (Canada) Ltd.



Tomasz Wlodarczyk, M.E.S
Senior Advisor, Environmental and Social Impact Assessment

D-11

Economic Environment

MEMORANDUM

Date: May 23, 2025

To: Darren Fry, A.Sc.T., Project Director, Environmental Division, Walker Environmental Group

cc: Janet Oswald, Environmental Planner, GHD; Erika Brown, Environmental Planner, GHD

From: Angus Keir, Principal, Avaanz

Project Name: **Walker South Landfill Phase 2 Environmental Assessment**

Subject: **DRAFT - Comparative Evaluation Technical Memorandum for the Economic Environment**

1. Introduction

This memo documents the assessment and evaluation of the Alternative Methods for the Walker South Landfill Phase 2 Environmental Assessment (EA) from an economic environment perspective. The Minister Approved Terms of Reference (Approved ToR) included a preliminary description of the methodology for evaluating the Alternative Methods (See Section 7.1 of the Approved ToR, September 2024). This memo is one of 13 memos that outline the evaluation of the Alternative Methods from the perspective of each discipline. These memos will be used in concert with one another, along with their evaluation tables, as supporting documents to the Alternative Methods Report. Memos were prepared for the following environmental components:

- Geology and Hydrogeology
- Surface Water Resources
- Noise and Vibration
- Air Quality
- Terrestrial and Aquatic Environment
- Land Use
- Agriculture
- Transportation
- Social Environment
- Economic Environment
- Cultural Heritage

- Archaeology
- Visual

Each of the above disciplines also prepared existing conditions reports that were utilized in assessing and evaluating the Alternative Landfill Footprints. Further, the disciplines referred to the Conceptual Design Report (CDR) that was prepared from a Site Design and Operations perspective in order to provide the appropriate level of detail on each of the Alternative Methods. The CDR will also form a supporting document to the Alternative Methods Report.

Each discipline is following the requirements as stated in the draft work plans that were presented in Appendix C of the Approved ToR. The work plan presents the scope of work required to complete the EA, including the scope of technical studies for each of the environmental components, and the evaluation of Alternative Methods.

1.1 Documentation

The results of these individual memos will be documented in separate stand-alone technical memorandums during the EA. The final Alternative Methods evaluation will form a chapter of the EA Report, with each of the stand-alone memorandums becoming supporting documents/appendices to the EA Report.

2. Assessment and evaluation of the Alternative Methods methodology

The assessment and evaluation of the Alternative Methods was conducted in three steps:

Step 1: Confirm Evaluation Criteria and Indicators/Measures

Prior to undertaking the net effects analysis, the evaluation criteria, indicators, and measures previously developed in the ToR were reviewed with the public during Public Events and confirmed for application to each of the Alternative Methods. Evaluation criteria were developed for each Environmental Component listed above.

The Approved ToR set out the draft criteria and indicators for evaluating the Alternative Methods in the EA. As a result, the draft criteria, indicators, and measures provided for in the ToR were reviewed and modified appropriately to suit the evaluation of the Alternative Methods.

Specifically, the criteria, indicators and measures were modified in consultation with review agencies and the public to ensure that an appropriate level of scrutiny and rigour was applied in evaluating the Alternative Methods. In doing so, the results of the evaluation phase will consist of clearly defined net effects for each Alternative Method.

Step 2: Undertake the Net Effects Analysis

With the evaluation criteria, indicators and measures confirmed through the preceding step, a net effects analysis of the Alternative Methods was carried out consisting of the following activities:

- Identify potential effects (based on measures) on the environment
- Develop and apply avoidance/ mitigation/ compensation/ enhancement measures
- Determine net effects on the environment.

Step 3: Carry Out the Comparative Evaluation

In Step 3, the net effects identified for each Alternative Method in Step 2 were compared to one another in order to identify a Recommended Alternative Method. The comparison of net effects was completed using a "Reasoned Argument" evaluation methodology, as provided for in the Approved ToR.

Each Alternative Method was assessed based on the evaluation criteria, indicators and measures.

Each criterion was evaluated with the same indicators for each Alternative Method (including number and significance) to support the reasoned argument in the comparative rankings:

- Effect on local economy:
  - Impact on businesses
    - Disruption/displacement of businesses (including tourism and farms)
    - Business opportunities
  - Labour market impacts
    - Impact on direct, indirect, and induced employment
  - GDP impacts
    - Impact on direct, indirect, and induced GDP
    - Retention of economic benefits within local economy
- Effect on Real Estate:
  - Property value impacts
- Effect on Public Finance:
  - Impact on municipal revenue
  - Impacts on municipal cost
  - Impact on assessment base
- Cost of Services:
  - Impact on customer cost of waste services

3. Step 1: Confirm Evaluation Criteria and Indicators/Measures

Evaluation Criteria and Indicators were adjusted during the development of the ToR based on feedback from Indigenous communities, government agencies, and the public.

Prior to undertaking the Comparative Evaluation of Alternative Methods process, a Public Event, accompanied by a virtual event, was held to present the Criteria and Indicators to the public and invite additional feedback.

In order to fully characterize these indicators and to adopt measures by which potential effects could be identified, several considerations were developed for each indicator. These considerations are shown below in Table 3.1.

Table 3.1 Considerations for Indicators

Criteria	Indicators	Considerations
Effect on Local Economy	– Impact on businesses • Disruption/displacement of businesses (including tourism and farms) • Business opportunities – Labour market impacts • Impact on direct, indirect, and induced employment – GDP impacts • Impact on direct, indirect, and induced GDP • Retention of economic benefits within local economy	Landfill configuration options • Disruption/displacement of businesses/farms may occur from: ○ Displacement due to land requirement associated with the physical location of a proposed facility. ○ Significant nuisance effects associated with landfill development become a factor in business/farm relocation decisions. ○ Disruption due to transportation related effects (e.g. road construction, traffic volume reducing operating levels of road network efficiency). ○ Nuisance effects (e.g., visual, odour, noise, dust) could potentially disrupt businesses by affecting customer experience, operational efficiency, or business image. • Length of landfill operations (years) Longer operations periods support sustained business opportunities, employment, and GDP contributions. • Total site capacity affects cumulative economic activity • Agricultural end use – larger areas support enhanced business opportunities for farming. • The extent to which economic benefits are retained within the local economy depends on the availability of a local and regional workforce, as well as the capacity of local and regional suppliers to

Criteria	Indicators	Considerations
		provide goods and services required for construction, operation, and post-closure activities. Leachate management options • Construction activity – construction of new on-site systems require labour, materials, and services, supporting business opportunities, employment, and GDP contributions. • Leachate treatment operations – operational spending supports economic activity. • The extent to which economic benefits are retained within the local economy depends on the availability of a local and regional workforce, as well as the capacity of local and regional suppliers to provide goods and services required for construction and operations activities.
Effect on Real Estate	– Property value impacts	Landfill configuration options • Scope and range of nuisance effects impacting use and enjoyment of residential properties in the site vicinity.
Effect on Public Finance	– Impact on municipal revenue – Impacts on municipal cost – Impact on assessment base	Landfill configuration options • Length of landfill operations (years) ○ The duration of landfill operations (years) is correlated with annual municipal revenue in the form of property taxes payable to the City of Niagara Falls and the Region of Niagara under the landfill property class rate. • Total site capacity affects cumulative royalties (revenue) received by municipalities based on total tonnage of residual waste placed in landfill. • Agricultural end use ○ Larger areas designated for agricultural end use have the potential to increase the property assessment base. Leachate management options • Municipal revenue ○ Municipal revenue is obtained by Town of Niagara-on-the-Lake through a volumetric charge to Walker for leachate discharged to sanitary sewer system. • Municipal cost ○ Town of Niagara-on-the-Lake incurs costs, paid to the Region of Niagara for conveyance and final treatment of leachate at the Port Weller Wastewater Treatment Plant.

Criteria	Indicators	Considerations
		• Assessment base ○ New leachate management infrastructure may increase assessed value of the Walker property and thereby generate additional property tax revenue payable to the City of Niagara Falls and the Region of Niagara.
Cost of Services	– Impact on customer cost of waste services	Landfill configuration options • Capital and operating expenditures are expected to be recovered through tipping fees. • Length of landfill operations (years) ○ Longer periods provide customers with extended access to local landfill disposal services, reducing transportation costs based on proximity. Leachate management options • Capital and operating expenditures are expected to recovered through tipping fees.

The potential effects for each Alternative Method were then identified on the basis of these considerations.

4. Step 2: Net Effects Analysis

4.1 General Assumptions

Table 4.1 outlines the assumptions for each Criteria evaluated.

Table 4.1 General Assumptions for Evaluation of Economic Environment Criteria

Criteria	Assumptions
Effect on Local Economy	Landfill configuration options • Operations ○ Landfill configuration options vary in total site capacity, while assuming a consistent annual fill rate. ○ A larger site capacity results in a greater total volume of waste placed over a longer operating life, leading to higher cumulative operational spending supporting business opportunities, employment, and contributions to GDP. ○ Total residual waste placed is calculated by multiplying the maximum annual residual waste (850,000 tonnes, assuming 1 tonne = 1 m^3) by the number of operating years. ○ The number of operating years is determined by dividing the total site capacity (m^3) by the total annual volume placed, which

Criteria	Assumptions
	includes 850,000 m³ of waste plus an additional 30–35% (32.5% average) for daily and interim cover. ○ Economic activity associated with landfill operations is expected to be largely retained within the local and regional economy. • No business or farm displacement is anticipated as a result of the landfill. ○ South Landfill Phase 2 is wholly within Walker's existing property. ○ No significant business disruption effects are anticipated which would cause potential business failure or create a major factor contributing to business relocation due to nuisance effects associated with landfill. ○ Vehicle traffic to landfill during operations will remain the same as current landfill operations (Phase 1). • No significant disruption of businesses due to nuisance effects is anticipated. • Current haul routes and site entrance for South Landfill (Phase 1) will remain unchanged for Phase 2 and therefore will not create any change to business use of the roadways assuming similar traffic volumes. • Temporary road construction at Taylor Road poses little potential for landfill to disrupt businesses/farms in the site vicinity. • Agricultural end use ○ Landfill configuration options vary in the area of land available for agricultural end use. ○ A larger area for agricultural end use is expected to support greater agricultural output and associated business opportunities. Leachate management options • Construction ○ All construction is contained on Walker's property, not encroaching on lands used by other businesses or farms. ○ Construction spending under Option A (expansion of the existing leachate management system) is expected to be materially lower than under Option B (development of a new on-site wastewater treatment plant). ○ Higher construction spending is associated with greater demand for materials, equipment, and labour, supporting business opportunities, employment, and GDP contributions. • Operations ○ Ongoing operations of either leachate management option are not likely to create material differences in employment, GDP, or business opportunities once the infrastructure is built.
Effect on Real Estate	Landfill configuration options • There is no anticipated difference in potential property value impacts based on landfill configuration type. Leachate management options

Criteria	Assumptions
	• Both leachate management options are not anticipated to impact property values.
Effect on Public Finance	Landfill configuration options • Operations ○ Landfill configuration options vary in total site capacity, while assuming a consistent annual fill rate. ○ Since the maximum annual fill rate is consistent across configuration options, a larger site capacity results in a longer operational period, generating more years of landfill property tax payable to the City of Niagara Falls and the Region of Niagara thereby increasing cumulative municipal revenues. ○ The expected number of landfill operating years is calculated by dividing the total site capacity (m^3) by the total annual volume placed, where annual volume includes 850,000 m^3 of residual waste plus an additional 30–35% (32.5% average) for daily and interim cover. ○ A larger site capacity supports the placement of a greater total volume of waste, leading to higher cumulative royalty payments to municipalities on a per-tonne basis. ○ The estimated total residual waste placed is calculated by multiplying annual residual waste (tonnes) by the number of operating years. • Agricultural end use ○ Landfill configuration options vary in the area of land available for agricultural use post-closure. ○ Agricultural end use may increase the local property assessment base, with land valued at up to $15,000 per acre based on 2023 farmland market values.[1] Leachate management options • Leachate Treatment ○ Under Option A (municipal wastewater treatment), the Town of Niagara-on-the-Lake receives municipal revenue through a volumetric charge to Walker for leachate discharged to the sanitary sewer system and the Town incurs costs, paid to the Region of Niagara for conveyance and final treatment at the Port Weller Wastewater Treatment Plant. ○ It is assumed that the on-site wastewater treatment plant under Option B will treat all leachate flows from Walker's Niagara Campus, including flows derived from the East Landfill, South Landfill Phase 1, and South Landfill Phase 2. ○ Under Option B all leachate flows from Walker's Niagara campus to the sanitary sewer system are expected to be eliminated. • Construction

[1] *Ontario Agricultural College, 2023 Farmland Value and Rental Value Survey: Summary of Findings (Guelph, ON: University of Guelph, April 2024), https://ofa.on.ca/wp-content/uploads/2024/04/ONFVRVS_AnnualReport_2023.pdf.*

Criteria	Assumptions
	○ Under Option A expansion of the leachate management system is not expected to result in an increase in the assessed value of the Walker property. ○ Under Option B development of the on-site wastewater treatment may increase the assessed value of the Walker property resulting in increased property tax revenue payable to the City of Niagara Falls and the Region of Niagara.
Cost of Services	Landfill configuration options • Operations ○ Landfill configuration options vary in total site capacity, while assuming a consistent annual fill rate. ○ Since the annual fill rate remains consistent, a larger site capacity extends the operational life of the landfill, providing customers with continued access to a waste disposal option with low transportation costs based on proximity over a longer period. ○ The expected number of landfill operating years is calculated by dividing the total site capacity (m^3) by the total annual volume placed, where annual volume includes 850,000 m^3 of residual waste plus an additional 30–35% (32.5% average) for daily and interim cover. Leachate management options • Option A represents a continuation of the existing leachate management approach, which involves discharge to the municipal sanitary system and requires relatively minor capital investment. As such, little to no change in tipping fees is anticipated to recover these costs, resulting in minimal to no impact on customer cost of waste services • Option B involves development of a new on-site wastewater treatment plant, with capital build costs estimated between $30–$50 million and significantly higher operating costs than under Option A. These costs would need to be recovered through increased tipping fees, resulting in a higher customer cost of service.

4.2 Potential Effects, Mitigation Measures, Net Effects

The potential effects for each Alternative Method were identified based on the characterized and documented existing economic environment conditions and on the basis of the considerations outlined in Table 3.1.

Net Effects have been categorized according to the definitions in Table 4.2.

Table 4.2 Categorization of Net Effects

Net Effect Category	Description
No Effect / No (Positive) Effect	No departure from the existing condition is expected.

Net Effect Category	Description
Low Effect / Low (Positive) Effect	Effects are likely to be negligible or minor in scale if they are negligible or low in magnitude, of short duration, infrequent, small in spatial extent, reversible or readily avoided, and generate few or minor impacts in social or ecological contexts. Mitigation measures will allow baseline conditions to remain largely unchanged.
Moderate Effect / Moderate (Positive) Effect	Effects are likely to be medium in scale if they are moderate in magnitude, of moderate duration, occasionally frequent, possibly/partially reversible, and to generate a moderate level of impacts in social or ecological contexts. Mitigation measures may not fully eliminate, reduce, control or offset effects but should enable affected communities to maintain economic and social well-being, and should prevent the diminishment or loss of key components of the environment and its ecological functioning.
High Effect / High (Positive) Effect	Effects are likely to be severe in scale if they are high in magnitude, permanent/long term, frequent, irreversible, and over a large spatial extent or within an area of exclusive/preferred Indigenous use or of ecological/environmental sensitivity. High levels of impacts in social or ecological contexts are expected. There is a high degree of uncertainty of the effectiveness of mitigation measures, or mitigation measures are unable to fully address effects such that valued components are diminished or lost.

The following tables (Table 4.3 - Table 4.7) present the results of the net environmental effects evaluation for each the Alternative Methods. The net effects have been determined by applying the mitigation measures to the predicted potential environmental effects.

4.2.1 Landfill Configuration Options

Table 4.3 Landfill Configuration Option A Economic Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on Local Economy	– Impact on businesses: • Disruption/displacement of businesses (including tourism and farms) • Business opportunities	– No businesses or farms are anticipated to be displaced because of landfill expansion. – Nuisance effects such as dust, noise, odours, litter, traffic, and visual impacts could represent a minor disruption at sensitive businesses or farms. – No landfill configuration specific effects regarding disruption/displacement of businesses or farms. – Business opportunities for supply and service contracts associated with initial construction and ~17.9 years of landfill operations. – Business opportunities for agricultural end use on 36.7 ha of land.	– Implementation of nuisance controls consistent with O. Reg 232/98 to mitigate effects on businesses and farms including dust suppression, odour and litter control, speed limits, and a public complaint-response system. – Existing berming and planting around proposed site will provide visual screening and noise attenuation for landfill.	No business or farm displacement, and no significant disruption. Business opportunities are associated with initial construction, ~17.9 years of landfill operations, and agricultural end use of 36.7 ha of land. Low positive effect
	– Labour market impacts: • Impact on direct, indirect, and induced employment	– Employment generated during initial construction and ~17.9 years of landfill operations, encompassing direct, indirect, and induced jobs.	– No mitigation measures required	Employment generated during initial construction and ~17.9 years of landfill operations, encompassing direct, indirect, and induced jobs. Moderate positive effect
	– GDP impacts:	– GDP generated during initial construction and ~17.9 years of	– No mitigation measures required	GDP generated during initial construction and ~17.9 years of landfill

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
	• Impact on direct, indirect, and induced GDP • Retention of economic benefits within local economy	landfill operations, encompassing direct, indirect, and induced economic activity. – Economic activity is expected to be largely retained within the local and regional economy.		operations, encompassing direct, indirect, and induced economic activity, with benefits largely retained within the local and regional economy. Moderate positive effect
Effect on Real Estate	– Property value impacts	– Reduction in market value of property in site vicinity due to landfill presence and nuisance effects. – No landfill configuration specific effects.	– Implementation of nuisance controls consistent with O. Reg 232/98 to mitigate effects on residents including dust suppression, odour and litter control, speed limits, and a public complaint-response system. – Existing berming and planting around proposed site will provide visual screening and noise attenuation for landfill. – Potential property value impacts will be evaluated as part of the detailed assessment, and mitigation measures—such as a property value protection plan—will be considered.	Impact management measures will be appropriate to mitigate potential effects on property values determined in the detailed assessment. There will be no net effects on property values. No effect
Effect on Public Finance	– Impact on municipal revenue	– ~18 years of property taxes payable to the City of Niagara Falls and the Region of Niagara under the landfill property class rate during the operations period. – Royalties generated on cumulative total of ~15,249,000 tonnes of residual waste disposed at landfill.	– No mitigation measures required	Municipal revenues generated during landfill operations period include ~18 years of property taxes and royalties on ~15,249,000 tonnes of residual waste. Moderate positive effect
	– Impacts on municipal cost	– No effect	– No mitigation measures required	No effect on municipal cost. No effect

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
	– Impact on assessment base	– Post-closure agricultural end use of 36.7 ha may increase the local property assessment base by ~$1.4 million (based on 2023 farmland market value).	– No mitigation measures required	Post-closure agricultural end use of 36.7 ha may increase the local property assessment base by ~$1.4 million (based on 2023 farmland market value). Low positive effect
Cost of Services	– Impact on customer cost of waste services	– ~17.9 years of customer access to landfill disposal services with low transportation costs based on proximity.	– No mitigation measures required	Sustained access to local landfill disposal services for ~17.9 years reduces transportation costs for customers. Moderate positive effect

Table 4.4 Landfill Configuration Option B Economic Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on Local Economy	– Impact on businesses: • Disruption/displacement of businesses (including tourism and farms) • Business opportunities	– No businesses or farms are anticipated to be displaced because of landfill expansion. – Nuisance effects such as dust, noise, odours, litter, traffic, and visual impacts could represent a minor disruption at sensitive businesses or farms. – No landfill configuration specific effects regarding disruption/displacement of businesses. – Business opportunities for supply and service contracts associated initial construction	– Implementation of nuisance controls consistent with O. Reg 232/98 to mitigate effects on businesses and farms including dust suppression, odour and litter control, speed limits, and a public complaint-response system. – Existing berming and planting around proposed site will provide visual screening and noise attenuation for landfill.	No business or farm displacement, and no significant disruption. Business opportunities are associated with initial construction, ~16.2 years of landfill operations, and agricultural end use of 51.4 ha of land. Low positive effect

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
		and ~16.2 years of landfill operations. – Business opportunities for agricultural end use on 51.4 ha of land.		
	– Labour market impacts: • Impact on direct, indirect, and induced employment	– Employment generated during initial construction and ~16.2 years of landfill operations, encompassing direct, indirect, and induced jobs.	– No mitigation measures required	Employment generated during initial construction and ~16.2 years of landfill operations, encompassing direct, indirect, and induced jobs. Moderate positive effect
	– GDP impacts: • Impact on direct, indirect, and induced GDP • Retention of economic benefits within local economy	– GDP generated during initial construction and ~16.2 years of landfill operations, encompassing direct, indirect, and induced economic activity. – Economic activity is expected to be largely retained within the local and regional economy.	– No mitigation measures required	GDP generated during initial construction and ~16.2 years of landfill operations, encompassing direct, indirect, and induced economic activity, with benefits largely retained within the local and regional economy. Moderate positive effect
Effect on Real Estate	– Property value impacts	– Reduction in market value of property in site vicinity due to landfill presence and nuisance effects. – No landfill configuration specific effects.	– Implementation of nuisance controls consistent with O. Reg 232/98 to mitigate effects on residents including dust suppression, odour and litter control, speed limits, and a public complaint-response system. – Existing berming and planting around proposed site will provide visual screening and noise attenuation for landfill. – Potential property value impacts will be evaluated as part of the detailed assessment, and mitigation	Impact management measures will be appropriate to mitigate potential effects on property values determined in the detailed assessment. There will be no net effects on property values. No effect

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
			measures—such as a property value protection plan—will be considered.	
Effect on Public Finance	– Impact on municipal revenue	– ~17 years of property taxes payable to the City of Niagara Falls and the Region of Niagara under the landfill property class rate during the operations period. – Royalties generated on cumulative total of ~13,794,000 tonnes of residual waste disposed at landfill.	– No mitigation measures required	Municipal revenues generated during landfill operations period include ~17 years of property taxes and royalties on ~13,794,000 tonnes of residual waste. Moderate positive effect
	– Impacts on municipal cost	– No effect	– No mitigation measures required	No effect on municipal cost. No effect
	– Impact on assessment base	– Post-closure agricultural end use of 51.4 ha may increase the local property assessment base by ~$1.9 million (based on 2023 farmland market value).	– No mitigation measures required	Post-closure agricultural end use of 51.4 ha may increase the local property assessment base by ~$1.9 million (based on 2023 farmland market value). Low positive effect
Cost of Services	– Impact on customer cost of waste services	– ~16.2 years of customer access to landfill disposal services with low transportation costs based on proximity.	– No mitigation measures required	Sustained access to local landfill disposal services for ~16.2 years reduces transportation costs for customers. Moderate positive effect

Table 4.5 Landfill Configuration Option C Economic Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on Local Economy	– Impact on businesses: • Disruption/displacement of businesses (including tourism and farms) • Business opportunities	– No businesses or farms are anticipated to be displaced because of landfill expansion. – Nuisance effects such as dust, noise, odours, litter, traffic, and visual impacts could represent a minor disruption at sensitive businesses or farms. – No landfill configuration specific effects regarding disruption/ displacement of businesses. – Business opportunities for supply and service contracts associated with initial construction and ~15.9 years of landfill operations. – Business opportunities for agricultural end use on 45.0 ha of land.	– Implementation of nuisance controls consistent with O. Reg 232/98 to mitigate effects on businesses and farms including dust suppression, odour and litter control, speed limits, and a public complaint-response system. – Existing berming and planting around proposed site will provide visual screening and noise attenuation for landfill.	No business or farm displacement, and no significant disruption. Business opportunities are associated with initial construction, ~15.9 years of landfill operations, and agricultural end use of 45.0 ha of land. Low positive effect
	– Labour market impacts: • Impact on direct, indirect, and induced employment	– Employment generated during initial construction and ~15.9 years of landfill operations, encompassing direct, indirect, and induced jobs.	– No mitigation measures required	Employment generated during initial construction and ~15.9 years of landfill operations, encompassing direct, indirect, and induced jobs. Moderate positive effect
	– GDP impacts: • Impact on direct, indirect, and induced GDP	– GDP generated during initial construction and ~15.9 years of landfill operations, encompassing direct, indirect,	– No mitigation measures required	GDP generated during initial construction and ~15.9 years of landfill operations, encompassing direct, indirect, and induced economic activity,

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
	• Retention of economic benefits within local economy	and induced economic activity. – Economic activity is expected to be largely retained within the local and regional economy.		with benefits largely retained within the local and regional economy. Moderate positive effect
Effect on Real Estate	– Property value impacts	– Reduction in market value of property in site vicinity due to landfill presence and nuisance effects. – No landfill configuration specific effects.	– Implementation of nuisance controls consistent with O. Reg 232/98 to mitigate effects on residents including dust suppression, odour and litter control, speed limits, and a public complaint-response system. – Existing berming and planting around proposed site will provide visual screening and noise attenuation for landfill. – Potential property value impacts will be evaluated as part of the detailed assessment, and mitigation measures—such as a property value protection plan—will be considered.	Impact management measures will be appropriate to mitigate potential effects on property values determined in the detailed assessment. There will be no net effects on property values. No effect
Effect on Public Finance	– Impact on municipal revenue	– ~16 years of property taxes payable to the City of Niagara Falls and the Region of Niagara under the landfill property class rate during the operations period. – Royalties generated on cumulative total of ~13,504,000 tonnes of residual waste disposed at landfill.	– No mitigation measures required	Municipal revenues generated during landfill operations period include ~16 years of property taxes and royalties on ~13,504,000 tonnes of residual waste. Moderate positive effect
	– Impacts on municipal cost	– No effect.	– No mitigation measures required	No effect on municipal cost.

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
				No effect
	– Impact on assessment base	– Post-closure agricultural end use of 45.0 ha may increase the local property assessment base by ~$1.7 million (based on 2023 farmland market value).	– No mitigation measures required	Post-closure agricultural end use of 45.0 ha may increase the local property assessment base by ~$1.7 million (based on 2023 farmland market value). Low positive effect
Cost of Services	– Impact on customer cost of waste services	– ~15.9 years of customer access to landfill disposal services with low transportation costs based on proximity.	– No mitigation measures required	Sustained access to local landfill disposal services for ~15.9 years reduces transportation costs for customers Moderate positive effect

4.2.2 Leachate Management Options

Table 4.6 Leachate Management Option A Economic Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on Local Economy	– Impact on businesses: • Disruption/displacement of businesses (including tourism and farms) • Business opportunities	– No businesses or farms are anticipated to be displaced/disrupted by the expansion of the existing leachate system. – Business opportunities associated with construction of the expanded leachate system through contracting and service providers.	– No mitigation measures required	No business or farm displacement, and no disruption. Business opportunities related to construction of the expanded leachate system through contracting and service providers. Low positive effect

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
	– Labour market impacts: • Impact on direct, indirect, and induced employment	– Employment generated during construction of the expanded leachate system, encompassing direct, indirect, and induced jobs.	– No mitigation measures required	Employment generated during construction of the expanded leachate system encompassing direct, indirect, and induced jobs. Low positive effect
	– GDP impacts: • Impact on direct, indirect, and induced GDP • Retention of economic benefits within local economy	– GDP generated during construction of the expanded leachate system, encompassing direct, indirect, and induced economic activity. – Economic activity is expected to be largely retained within the local and regional economy.	– No mitigation measures required	GDP generated during construction of the expanded leachate system, encompassing direct, indirect, and induced economic activity, with benefits largely retained within the local and regional economy. Low positive effect
Effect on Real Estate	– Property value impacts	– No effect	– No mitigation measures required	No effect on property values. No effect
Effect on Public Finance	– Impact on municipal revenue	– Annual revenue generated by the Town of Niagara-on-the-Lake through a volumetric charge to Walker for the discharge of up to 104,500 m^3/year of leachate to the sanitary sewer system.	– No mitigation measures required	Annual municipal revenue generated through volumetric charges to Walker for up to 104,500 m^3/year of leachate discharged to the sanitary sewer system. Low positive effect
	– Impacts on municipal cost	– Annual cost is incurred by the Town of Niagara-on-the-Lake, paid to the Region of Niagara, for the conveyance and treatment of up to 104,500 m^3/year of leachate at the	– No mitigation measures required	Annual municipal cost incurred for conveyance and treatment of leachate. Low effect

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
		Port Weller Wastewater Treatment Plant.		
	– Impact on assessment base	– No effect	– No mitigation measures required	No effect on assessment base. No effect
Cost of Services	– Impact on customer cost of waste services	– Little to no change in tipping fees is expected for the recovery of capital costs associated with the expanded leachate management system, combined with ongoing volumetric charges for discharge to the sanitary sewer.	– No mitigation measures required	Little to no impact on customer cost of waste services. Low effect

Table 4.7 Leachate Management Option B Economic Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on Local Economy	– Impact on businesses: • Disruption/displacement of businesses (including tourism and farms) • Business opportunities	– No businesses or farms are anticipated to be displaced/disrupted by development of on-site wastewater treatment plant. – Business opportunities associated with construction of on-site wastewater treatment plant through contracting and service providers.	– No mitigation measures required	No business or farm displacement, and no disruption. Business opportunities related to construction of on-site wastewater treatment plant through contracting and service providers. Low positive effect

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
	– Labour market impacts: • Impact on direct, indirect, and induced employment	– Employment generated during construction of on-site wastewater treatment plant, encompassing direct, indirect, and induced jobs.	– No mitigation measures required	Employment generated during construction of on-site wastewater treatment plant encompassing direct, indirect, and induced jobs. Moderate positive effect
	– GDP impacts: • Impact on direct, indirect, and induced GDP • Retention of economic benefits within local economy	– GDP generated during construction of on-site wastewater treatment plant, encompassing direct, indirect, and induced economic activity. – Economic activity is expected to be largely retained within the local and regional economy.	– No mitigation measures required	GDP generated during construction of on-site wastewater treatment plant, encompassing direct, indirect, and induced economic activity, with benefits largely retained within the local and regional economy. Moderate positive effect
Effect on Real Estate	– Property value impacts	– No effect	– No mitigation measures required	There will be no effect on property values. No effect
Effect on Public Finance	– Impact on municipal revenue	– Loss of annual revenue generated by the Town of Niagara-on-the-Lake through a volumetric charge to Walker for the discharge of leachate originating from East Landfill and South Landfill to the sanitary sewer system. – Increase in property tax revenue payable the City of Niagara Falls and the Region of Niagara due to higher assessed value of the Walker	– No mitigation measures required	Loss of annual municipal revenue generated through volumetric charges to Walker for leachate originating from East Landfill and South Landfill discharged to the sanitary sewer system. Low effect

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
		property following development of the on-site wastewater treatment plant.		
	– Impacts on municipal cost	– No cost incurred by the Town of Niagara-on-the-Lake, paid to the Region of Niagara, for the conveyance and treatment of leachate originating from Walker's East Landfill and South Landfill at the Port Weller Wastewater Treatment Plant.	– No mitigation measures required	No municipal cost incurred for conveyance and treatment of leachate originating from Walker's East Landfill and South Landfill. Low positive effect
	– Impact on assessment base	– Assessment value for Walker property in the City of Niagara Falls increases with development of on-site wastewater treatment plant.	– No mitigation measures required	Development of the on-site wastewater treatment plant may increase the assessed value of the Walker property. Low positive effect
Cost of Services	– Impact on customer cost of waste services	– Development of a new on-site wastewater treatment plant will involve substantial capital costs (estimated at $30–$50 million) and significantly higher operating expenses compared to current arrangements. These costs are expected to be recovered through increased tipping fees, resulting in a higher customer cost of service.	– No mitigation measures required	Tipping fees are expected to increase significantly resulting in a higher customer cost of waste services. Moderate effect

5. Step 3: Comparative Evaluation

Table 5.1 Comparative Evaluation – Economic Environment

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			**Leachate Management Options**	
		Option A	**Option B**	**Option C**	**Option A**	**Option B**
Effect on Local Economy	– Impact on businesses: • Disruption/displacement of businesses (including tourism and farms) • Business opportunities	No business or farm displacement, and no significant disruption. Business opportunities are associated with initial construction, ~17.9 years of landfill operations, and agricultural end use of 36.7 ha of land. Low positive effect	No business or farm displacement, and no significant disruption. Business opportunities are associated with initial construction, ~16.2 years of landfill operations, and agricultural end use of 51.4 ha of land. Low positive effect	No business or farm displacement, and no significant disruption. Business opportunities are associated with initial construction, ~15.9 years of landfill operations, and agricultural end use of 41.5 ha of land. Low positive effect	No business or farm displacement, and no disruption. Business opportunities related to construction of the expanded leachate system through contracting and service providers. Low positive effect	No business or farm displacement, and no disruption. Business opportunities related to construction of on-site wastewater treatment plant through contracting and service providers. Low positive effect
	– Labour market impacts: • Impact on direct, indirect, and induced employment	Employment generated during initial construction and ~17.9 years of landfill operations, encompassing direct, indirect, and induced jobs. Moderate positive effect	Employment generated during initial construction and ~16.2 years of landfill operations, encompassing direct, indirect, and induced jobs. Moderate positive effect	Employment generated during initial construction and ~15.9 years of landfill operations, encompassing direct, indirect, and induced jobs. Moderate positive effect	Employment generated during construction of the expanded leachate system encompassing direct, indirect, and induced jobs. Low positive effect	Employment generated during construction of on-site wastewater treatment plant encompassing direct, indirect, and induced jobs. Moderate positive effect

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			**Leachate Management Options**	
		Option A	**Option B**	**Option C**	**Option A**	**Option B**
	– GDP impacts: • Impact on direct, indirect, and induced GDP • Retention of economic benefits within local economy	GDP generated during initial construction and ~17.9 years of landfill operations, encompassing direct, indirect, and induced economic activity, with benefits largely retained within the local and regional economy. Moderate positive effect	GDP generated during initial construction and ~16.2 years of landfill operations, encompassing direct, indirect, and induced economic activity, with benefits largely retained within the local and regional economy. Moderate positive effect	GDP generated during initial construction and ~15.9 years of landfill operations, encompassing direct, indirect, and induced economic activity, with benefits largely retained within the local and regional economy. Moderate positive effect	GDP generated during construction of the expanded leachate system, encompassing direct, indirect, and induced economic activity, with benefits largely retained within the local and regional economy. Low positive effect	GDP generated during construction of on-site wastewater treatment plant, encompassing direct, indirect, and induced economic activity, with benefits largely retained within the local and regional economy. Moderate positive effect
	Criteria Ranking:	– 1st preferred	– 2nd preferred	– 3rd preferred	– 2nd preferred	– 1st preferred
	Criteria Rationale:	– Option A (1st preferred): Longest operational period (~17.9 years) with the greatest overall economic benefit in terms business opportunities, employment, and GDP despite a smaller post-closure agricultural area. – Option B (2nd preferred): Shorter operational period (~16.2 years) but larger post-closure agricultural area, offering greater long-term agricultural business opportunities. – Option C (3rd preferred): Shortest operational period (~15.9 years) and moderate agricultural reuse, resulting in the lowest overall economic benefit.			– Option B (1st preferred): Construction of a new on-site wastewater treatment plant provides greater economic benefits through greater construction related business opportunities, employment, and GDP contribution. – Option A (2nd preferred): Expansion of the existing leachate management system offers positive economic effects through construction but on a small scale compared to building a new on-site wastewater treatment plant.	
Effect on Real Estate	– Property value impacts	Impact management measures will be appropriate to mitigate potential effects on	Impact management measures will be appropriate to mitigate potential	Impact management measures will be appropriate to mitigate potential effects on	There will be no effect on property values.	There will be no effect on property values.

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			**Leachate Management Options**	
		Option A	**Option B**	**Option C**	**Option A**	**Option B**
		property values determined in the detailed assessment. There will be no net effects on property values. No effect	effects on property values determined in the detailed assessment. There will be no net effects on property values. No effect	property values determined in the detailed assessment. There will be no net effects on property values. No effect	No effect	No effect
	Criteria Ranking:	– 1st preferred	– 1st preferred	– 1st preferred	– 1st preferred	– 1st preferred
	Criteria Rationale:	– There is no distinction between the options in relation to net effects for property value impacts.			– There is no distinction between the Option A and Option B in relation to net effects for property value impacts.	
Effect on Public Finance	– Impact on municipal revenue	Municipal revenues generated during landfill operations period include ~18 years of property taxes and royalties on ~15,249,000 tonnes of residual waste. Moderate positive effect	Municipal revenues generated during landfill operations period include ~17 years of property taxes and royalties on ~13,794,000 tonnes of residual waste. Moderate positive effect	Municipal revenues generated during landfill operations period include ~16 years of property taxes and royalties on ~13,504,000 tonnes of residual waste. Moderate positive effect	Annual municipal revenue generated through volumetric charges to Walker for up to 104,500 m^3/year of leachate discharged to the sanitary sewer system. Low positive effect	Loss of annual municipal revenue generated through volumetric charges to Walker for leachate originating from East Landfill and South Landfill discharged to the sanitary sewer system. Low effect
	– Impacts on municipal cost	No effect on municipal cost No effect	No effect on municipal cost. No effect	No effect on municipal cost. No effect	Annual municipal cost incurred for conveyance and treatment of leachate.	No municipal cost incurred for conveyance and treatment of leachate originating from Walker's East Landfill and South Landfill.

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			**Leachate Management Options**	
		Option A	**Option B**	**Option C**	**Option A**	**Option B**
					Low effect	Low positive effect
	– Impact on assessment base	Post-closure agricultural end use of 36.7 ha may increase the local property assessment base by ~$1.4 million (based on 2023 farmland market value). Low positive effect	Post-closure agricultural end use of 51.4 ha may increase the local property assessment base by ~$1.9 million (based on 2023 farmland market value). Low positive effect	Post-closure agricultural end use of 45.0 ha may increase the local property assessment base by ~$1.7 million (based on 2023 farmland market value). Low positive effect	No effect to assessment base. No effect	Development of the on-site wastewater treatment plant may increase the assessed value of the Walker property. Low positive effect
	Criteria Ranking:	– 1st preferred	– 2nd preferred	– 3rd preferred	– 2nd preferred	– 1st preferred
	Criteria Rationale:	– Option A (1st preferred): Generates the greatest overall municipal revenue through an ~18 years of landfill property tax paid during operations and royalties on an estimated cumulative total of ~15,249,000 tonnes residual waste disposed. Post-closure agricultural end use of 36.7 ha may increase the local property assessment base by ~$1.4 million (based on 2023 farmland market value). – Option B (2nd preferred): Provides strong but lower municipal revenue compared to Option A with ~17 years of landfill property taxes paid during operations and royalties on an estimated cumulative total of ~13,794,000 tonnes residual waste disposed. This option offers a larger post-closure agricultural end use area of 51.4 ha that may increase the local property assessment base by ~$1.9 million (based on 2023 farmland market value). – Option C (3rd preferred): Offers the least municipal revenue with ~16 years of landfill property taxes paid during operations and royalties on an estimated cumulative total of ~13,504,000 tonnes of residual waste			– Option A (2nd preferred) generates municipal revenue through volumetric charge to Walker for leachate discharged to the sanitary sewer system but also results in costs incurred by municipality for the conveyance and final treatment of leachate. This option has no effect on property assessment value and therefore no impact on property tax revenues. – Under Option B, leachate flows to the municipal system are eliminated, and as a result, municipal revenues and costs associated with flows are also eliminated, resulting in a neutral net effect. This option may increase the assessed value of the Walker property with development of the	

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			**Leachate Management Options**	
		Option A	**Option B**	**Option C**	**Option A**	**Option B**
		disposed. Under this option post-closure agricultural end use of 45.0 ha may increase the local property assessment base by ~$1.7 million (based on 2023 farmland market value).			wastewater treatment plant resulting in higher property tax revenue. – Overall, Option B is slightly preferred from a public finance perspective due to the potential for increased property tax revenues resulting from a higher assessed value of the Walker property, combined with the absence of municipal costs for leachate management..	
Cost of Services	– Impact on customer cost of waste services	Sustained access to local landfill disposal services for ~17.9 years reduces transportation costs for customers. Moderate positive effect	Sustained access to local landfill disposal services for ~16.2 years reduces transportation costs for customers. Moderate positive effect	Sustained access to local landfill disposal services for ~15.9 years reduces transportation costs for customers Moderate positive effect	Little to no effect on customer cost of waste services. Low effect	Tipping fees are expected to increase significantly resulting in higher customer cost of waste services. Moderate effect
	Criteria Ranking:	– 1st preferred	– 2nd preferred	– 3rd preferred	– 1st preferred	– 2nd preferred
	Criteria Rationale:	– Option A (1st preferred): Provides the longest period (~17.9 years) for customer access to local landfill disposal services with low transportation costs based on proximity. – Option B (2nd preferred): Provides a shorter period (~16.2 years) for customer access to local landfill disposal services with low transportation costs based on proximity. – Option C (3rd preferred): Provides the shortest period (~15.9 years) of customer access to local landfill disposal services with low transportation costs based on proximity.			– Option A (1st preferred): Little to no effect on customer cost of waste services. – Option B (2nd preferred): Tipping fees are expected to increase significantly resulting in a higher customer cost of waste services.	

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			**Leachate Management Options**	
		Option A	**Option B**	**Option C**	**Option A**	**Option B**
Environmental Component Ranking:		– 1st preferred	– 2nd preferred	– 3rd preferred	– 1st preferred	– 1st preferred
Environmental Component Rationale:		– Option A (1st preferred) is ranked highest due to its longest operational period (~17.9 years), which maximizes sustained business opportunities, employment, GDP, and municipal revenues (in the form of property taxes on landfill and royalties on a cumulative total of ~15,249,000 tonnes residual waste disposed). This option also ensures the longest period of continued customer access to local landfill disposal services with low transportation costs based on proximity. While its post-closure agricultural use is smaller than other options (36.7 ha), the cumulative economic benefits make it the 1st preferred choice. Post-closure agricultural end use under this option may increase the local property assessment base by ~$1.4 million (based on 2023 farmland market value). – Option B (2nd preferred) provides a shorter operational period (~16.2 years) associated with shorter duration for sustained business opportunities, employment, GDP, and less cumulative municipal revenues (in the form of property taxes on landfill and royalties on ~13,794,000 tonnes residual waste disposed), and shorter period for continued customer access to local landfill disposal services with low transportation costs based on proximity. This option also encompasses the largest post-closure area for agricultural use (51.4 ha). Post-closure agricultural end use under this option may increase the local property assessment base by ~$1.9 million (based on 2023 farmland market value). – Option C (3rd preferred) ranks lowest due to its shortest operational life (~15.9 years), which is associated with the shortest duration for sustained business opportunities, employment, GDP, and least cumulative municipal revenues (in the form of property taxes on landfill and royalties on ~13,504,000 tonnes of residual waste disposed), and shortest period for continued customer access to local landfill disposal services with low transportation costs based on proximity. This option provides moderate post-closure agricultural reuse (45.0 ha) in comparison with the other			– Option A (1st preferred) involves expansion of the existing leachate management system, resulting in modest construction-related economic benefits, including business opportunities, employment, and GDP contributions. It generates municipal revenue through a volumetric charge for leachate discharged to the sanitary sewer system; however, this is offset by corresponding municipal costs for conveyance and final treatment. Under this option there is little or no impact on customer cost of waste services. – Option B (1st preferred) offers stronger economic benefits during construction of an on-site wastewater treatment plant, generating greater business opportunities, employment, and GDP contributions. Although this option eliminates municipal revenue from volumetric charges, the associated municipal costs for conveyance and treatment are also avoided. This option may increase the assessed value of the Walker property, which could result in higher annual property tax revenues. Tipping fees are expected to increase significantly under this option resulting in higher customer cost of waste services. – Overall, both options are ranked 1st preferred from an economic environment perspective. Option A offers modest construction-related	

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			**Leachate Management Options**	
		Option A	**Option B**	**Option C**	**Option A**	**Option B**
		options. Post-closure agricultural end use under this option may increase the local property assessment base by ~$1.7 million (based on 2023 farmland market value).			economic benefits with the advantage of lower customer costs of waste services. Option B provides strong construction-related economic benefits and potential gains in municipal property tax revenue but is associated with higher customer costs of waste services. The trade-off between these factors supports an equal ranking for both options.	

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Built Heritage Resources and
Cultural Heritage Landscapes

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE

MEMO

To:	Janet Oswald, GHD
From:	Nick Bogaert
Date:	May 15th, 2025
File:	Walker South Landfill Phase 2 EA, MHBC File "9811 BM"
Subject:	Draft Comparative Evaluation Results Technical Memorandum – Built Heritage Resources and Cultural Heritage Landscapes

DRAFT

The purpose of this memo is to provide the results of the comparative evaluation exercise undertaken by MHBC's cultural heritage team with respect to Built Heritage Resources and Cultural Heritage Landscapes associated with the proposed South Landfill Phase 2 Environmental Assessment project.

1. Introduction

This memo documents the assessment and evaluation of the Alternative Methods for the Walker South Landfill Phase 2 Environmental Assessment (EA) from a Built Heritage Resources and Cultural Heritage Landscapes perspective. The Minister Approved Terms of Reference (Approved ToR) included a preliminary description of the methodology for evaluating the Alternative Methods (See Section 7.1 of the Approved ToR, September 2024). This memo is one of 13 memos that outline the evaluation of the Alternative Methods from the perspective of each discipline. These memos will be used in concert with one another, along with their evaluation tables, as supporting documents to the Alternative Methods Report. Memos were prepared for the following environmental components:

- Geology and Hydrogeology
- Surface Water Resources
- Noise and Vibration
- Air Quality
- Terrestrial and Aquatic Environment
- Land Use
- Agriculture

- Transportation
- Social Environment
- Economic Environment
- Built Heritage Resources and Cultural Heritage Landscapes
- Archaeology
- Visual

Each of the above disciplines also prepared existing conditions reports that were utilized in assessing and evaluating the Alternative Landfill Footprints. Further, the disciplines referred to the Conceptual Design Report (CDR) that was prepared from a Site Design and Operations perspective in order to provide the appropriate level of detail on each of the Alternative Methods. The CDR will also form a supporting document to the Alternative Methods Report.

Each discipline is following the requirements as stated in the draft work plans that were presented in Appendix C of the Approved ToR. The work plan presents the scope of work required to complete the EA, including the scope of technical studies for each of the environmental components, and the evaluation of Alternative Methods.

1.1 Documentation

The results of these individual memos will be documented in separate stand-alone technical memorandums during the EA. The final Alternative Methods evaluation will form a chapter of the EA Report, with each of the stand-alone memorandums becoming supporting documents/appendices to the EA Report.

2. Assessment and evaluation of the Alternative Methods methodology

The assessment and evaluation of the Alternative Methods was conducted in three steps:

Step 1: Confirm Evaluation Criteria and Indicators/Measures

Prior to undertaking the net effects analysis, the evaluation criteria, indicators, and measures previously developed in the ToR were reviewed with the public during Public Events and confirmed for application to each of the Alternative Methods. Evaluation criteria were developed for each Environmental Component listed above.

The Approved ToR set out the draft criteria and indicators for evaluating the Alternative Methods in the EA. As a result, the draft criteria, indicators, and measures provided for in the ToR were reviewed and modified appropriately to suit the evaluation of the Alternative Methods.

Specifically, the criteria, indicators and measures were modified in consultation with review agencies and the public to ensure that an appropriate level of scrutiny and rigour was applied in evaluating the Alternative Methods. In doing so, the results of the evaluation phase will consist of clearly defined net effects for each Alternative Method.

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Step 2: Undertake the Net Effects Analysis

With the evaluation criteria, indicators and measures confirmed through the preceding step, a net effects analysis of the Alternative Methods was carried out consisting of the following activities:

- Identify potential effects (based on measures) on the environment
- Develop and apply avoidance/ mitigation/ compensation/ enhancement measures
- Determine net effects on the environment.

Step 3: Carry Out the Comparative Evaluation

In Step 3, the net effects identified for each Alternative Method in Step 2 were compared to one another in order to identify a Recommended Alternative Method. The comparison of net effects was completed using a "Reasoned Argument" evaluation methodology, as provided for in the Approved ToR.

Each Alternative Method was assessed based on the evaluation criteria, indicators and measures.

Each criterion was evaluated with the same indicators for each Alternative Method (including number and significance) to support the reasoned argument in the comparative rankings:

- Effect on known or potential built heritage resources and cultural heritage landscapes:
  - Number of known and potential built heritage resources and cultural heritage landscapes displaced or disrupted

3. Step 1: Confirm Evaluation Criteria and Indicators / Measures

Evaluation Criteria and Indicators were adjusted during the development of the ToR based on feedback from Indigenous communities, government agencies, and the public.

Prior to undertaking the Comparative Evaluation of Alternative Methods process, a Public Event, accompanied by a virtual event, was held to present the Criteria and Indicators to the public and invite additional feedback.

In order to fully characterize these indicators and to adopt measures by which potential effects could be identified, several considerations were developed for each indicator. These considerations are shown below in Table 3.1.

Table 3.1 Considerations for Indicators

Criteria	Indicators	Considerations
Effect on known or potential built heritage resources and cultural heritage landscapes	– Number of known and potential built heritage resources and cultural heritage landscapes displaced or disrupted	– *Total number of built heritage resources and cultural heritage landscapes displaced* – *Total number of known and potential built heritage resources and cultural heritage landscapes disrupted*

The potential effects for each Alternative Method were then identified on the basis of these considerations.

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4. Step 2: Net Effects Analysis

4.1 General Assumptions

Table 4.1 outlines the assumptions for each Criteria evaluated.

Table 4.2 General Assumptions for Evaluation of Cultural Heritage Resource Criteria

Criteria	Assumptions
Effect on known or potential built heritage resources and cultural heritage landscapes	– No assumptions made.

4.2 Potential Effects, Mitigation Measures, Net Effects

The potential effects for each Alternative Method were identified based on the characterized and documented existing cultural heritage resource conditions and on the basis of the considerations outlined in Table 3.1.

Based on the work undertaken through the Cultural Heritage Resources Existing Conditions and Screening Report, the Local Study Area is characterized by a range of land uses, including a mix of rural residential and agricultural uses. It was noted that there is an identified cultural heritage resource located approximately 1.8 km to the northeast of the Site Study Area. No other resources were identified within the Local Study Area. There were no potential or identified cultural heritage resources located within the Local Study Area. Based on the results of the screening exercise, no further reporting related to cultural heritage resources was identified as being required.

Net Effects have been categorized according to the definitions in Table 4.2.

Table 4.3 Categorization of Net Effects

Net Effect Category	Description
No Effect / No (Positive) Effect	No departure from the existing condition is expected.
Low Effect / Low (Positive) Effect	Effects are likely to be negligible or minor in scale if they are negligible or low in magnitude, of short duration, infrequent, small in spatial extent, reversible or readily avoided, and generate few or minor impacts in social or ecological contexts. Mitigation measures will allow baseline conditions to remain largely unchanged.
Moderate Effect / Moderate (Positive) Effect	Effects are likely to be medium in scale if they are moderate in magnitude, of moderate duration, occasionally frequent, possibly/partially reversible, and to generate a moderate level of impacts in social or ecological contexts. Mitigation measures may not fully eliminate, reduce, control or offset effects but should enable affected communities to maintain economic and social well-being, and should prevent the diminishment or loss of key components of the environment and its ecological functioning.
High Effect / High (Positive) Effect	Effects are likely to be severe in scale if they are high in magnitude, permanent/long term, frequent, irreversible, and over a large spatial extent or within an area of exclusive/preferred Indigenous use or of ecological/environmental sensitivity. High levels of impacts in social or ecological contexts are expected. There is a high degree of uncertainty of the effectiveness of mitigation measures, or mitigation measures are unable to fully address effects such that valued components are diminished or lost.

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The following tables (Table 4.3 - Table 4.7) present the results of the net environmental effects evaluation for each of the Alternative Methods. The net effects have been determined by applying the mitigation measures to the predicted potential environmental effects.

4.2.1 Landfill Configuration Options

Table 4.4 Landfill Configuration Option A Cultural Heritage Resources Potential Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on known or potential built heritage resources and cultural heritage landscapes	– Number of known and potential built heritage resources and cultural heritage landscapes displaced or disrupted	– No effect	– n/a	**NO NET EFFECTS**

Table 4.5 Landfill Configuration Option B Cultural Heritage Resources Potential Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on known or potential built heritage resources and cultural heritage landscapes	– Number of known and potential built heritage resources and cultural heritage landscapes displaced or disrupted	– No effect	– n/a	**NO NET EFFECTS**

Table 4.6 Landfill Configuration Option C Cultural Heritage Resources Potential Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on known or potential built heritage resources and cultural heritage landscapes	– Number of known and potential built heritage resources and cultural heritage landscapes displaced or disrupted	– No effect	– n/a	**NO NET EFFECTS**

4.2.2 Leachate Management Options

Table 4.7 Leachate Management Option A Cultural Heritage Resources Potential Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on known or potential built heritage resources and cultural heritage landscapes	– Number of known and potential built heritage resources and cultural heritage	– No effect	– n/a	**NO NET EFFECTS**

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Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
	landscapes displaced or disrupted			

Table 4.8 Leachate Management Option B Cultural Heritage Resources Potential Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on known or potential built heritage resources and cultural heritage landscapes	– Number of known and potential built heritage resources and cultural heritage landscapes displaced or disrupted	– No effect	– n/a	**NO NET EFFECTS**

5. Step 3: Comparative Evaluation

Table 5.9 Comparative Evaluation – Cultural Heritage Resources

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
Effect on known or potential built heritage resources and cultural heritage landscapes	– Number of known and potential built heritage resources and cultural heritage landscapes displaced or disrupted	**NO NET EFFECTS**	**NO NET EFFECTS**	**NO NET EFFECTS**	**NO NET EFFECTS**	**NO NET EFFECTS**
Environmental Component Ranking:		*1st*	1st	1st	1st	*1st*
Environmental Component Rationale:		*All options result in no net effects with respect to cultural heritage resources.*			*All options result in no net effects with respect to cultural heritage resources.*	

6. Conclusions

Based on the net environmental effects presented in Section 4.2 and the comparative evaluation in Section 5, there is no difference between the Landfill Configuration Options or Leachate Management Options from a cultural heritage perspective. Any option could be selected by the team.

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D-13

Archaeology

ARCHAEOLOGY | HERITAGE | OUTREACH | CONSERVATION

08 May 2025

Project Name	Walker South Landfill Phase 2 Environmental Assessment	**Project No.**	12567140
Subject	Draft Comparative Evaluation Technical Memorandum for Archaeology		

1. INTRODUCTION

This memo documents the assessment and evaluation of the Alternative Methods for the Walker South Landfill Phase 2 Environmental Assessment (EA) from archaeological resources perspective. The Minister Approved Terms of Reference (Approved ToR) included a preliminary description of the methodology for evaluating the Alternative Methods (See Section 7.1 of the Approved ToR, September 2024). This memo is one of 13 memos that outline the evaluation of the Alternative Methods from the perspective of each discipline. These memos will be used in concert with one another, along with their evaluation tables, as supporting documents to the Alternative Methods Report. Memos were prepared for the following environmental components:

- Geology and Hydrogeology
- Surface Water Resources
- Noise and Vibration
- Air Quality
- Terrestrial and Aquatic Environment
- Land Use
- Agriculture
- Transportation
- Social Environment
- Economic Environment
- Built Heritage Resources and Cultural Heritage Landscapes
- Archaeology
- Visual

Each of the above disciplines also prepared existing conditions reports that were utilized in assessing and evaluating the Alternative Landfill Footprints. Further, the disciplines referred to the Conceptual Design Report (CDR) that was prepared from a Site Design and Operations perspective in order to provide the appropriate level of detail on each of the Alternative Methods. The CDR will also form a supporting document to the Alternative Methods Report.

Each discipline is following the requirements as stated in the draft work plans that were presented in Appendix C of the Approved ToR. The work plan presents the scope of work required to complete the EA, including the scope of technical studies for each of the environmental components, and the evaluation of Alternative Methods.

1.1 Documentation

The results of these individual memos will be documented in separate stand-alone technical memorandums during the EA. The final Alternative Methods evaluation will form a chapter of the EA Report, with each of the stand-alone memorandums becoming supporting documents/appendices to the EA Report.

2. ASSESSMENT AND EVALUATION OF THE ALTERNATIVE METHODS METHODOLOGY

The assessment and evaluation of the Alternative Methods was conducted in three steps:

Step 1: Confirm Evaluation Criteria and Indicators/Measures

Prior to undertaking the net effects analysis, the evaluation criteria, indicators, and measures previously developed in the ToR were reviewed with the public during Public Events and confirmed for application to each of the Alternative Methods. Evaluation criteria were developed for each Environmental Component listed above.

The Approved ToR set out the draft criteria and indicators for evaluating the Alternative Methods in the EA. As a result, the draft criteria, indicators, and measures provided for in the ToR were reviewed and modified appropriately to suit the evaluation of the Alternative Methods.

Specifically, the criteria, indicators and measures were modified in consultation with review agencies and the public to ensure that an appropriate level of scrutiny and rigour was applied in evaluating the Alternative Methods. In doing so, the results of the evaluation phase will consist of clearly defined net effects for each Alternative Method.

Step 2: Undertake the Net Effects Analysis

With the evaluation criteria, indicators and measures confirmed through the preceding step, a net effects analysis of the Alternative Methods was carried out consisting of the following activities:

- Identify potential effects (based on measures) on the environment
- Develop and apply avoidance/ mitigation/ compensation/ enhancement measures
- Determine net effects on the environment.

Step 3: Carry Out the Comparative Evaluation

In Step 3, the net effects identified for each Alternative Method in Step 2 were compared to one another in order to identify a Recommended Alternative Method. The comparison of net effects was completed using a "Reasoned Argument" evaluation methodology, as provided for in the Approved ToR.

Each Alternative Method was assessed based on the evaluation criteria, indicators and measures.

Each criterion was evaluated with the same indicators for each Alternative Method (including number and significance) to support the reasoned argument in the comparative rankings:

- Effect on archaeological resources and areas of archaeological potential:
  - Area (ha) of archaeological potential (i.e., total area which may contain previously unidentified archaeological resources not impacted by previous development)
  - Number and type of archaeological sites affected

3. Step 1: Confirm Evaluation Criteria and Indicators/Measures

Evaluation Criteria and Indicators were adjusted during the development of the ToR based on feedback from Indigenous communities, government agencies, and the public.

Prior to undertaking the Comparative Evaluation of Alternative Methods process, a Public Event, accompanied by a virtual event, was held to present the Criteria and Indicators to the public and invite additional feedback.

In order to fully characterize these indicators and to adopt measures by which potential effects could be identified, several considerations were developed for each indicator. These considerations are shown below in Table 3.1.

Table 3.1 Considerations for Indicators

Criteria	Indicators	Considerations
Effect on archaeological resources and areas of archaeological potential	– Area (ha) of archaeological potential (i.e., total area which may contain previously unidentified archaeological resources not impacted by previous development) – Number and type of archaeological sites affected	– Area (ha) of archaeological potential (i.e., total area which may contain previously unidentified archaeological resources not impacted by previous development) – Number and status of previously identified archaeological resources (i.e., archaeological sites identified by previous archaeological assessments)

The potential effects for each Alternative Method were then identified on the basis of these considerations.

4. Step 2: Net Effects Analysis

4.1 General Assumptions

Table 4.1 outlines the assumptions for each Criteria evaluated.

Table 4.1 General Assumptions for Evaluation of Archaeological Criteria

Criteria	Assumptions
Effect on archaeological resources and areas of archaeological potential	– All potential ground disturbance, laydown areas, increased vibration and other construction activities represent potential effects to known and unknown archaeological resources.

4.2 Potential Effects, Mitigation Measures, Net Effects

The potential effects for each Alternative Method were identified based on the characterized and documented existing archaeological resource conditions and on the basis of the considerations outlined in Table 3.1.

All effects will require archaeological mitigation measures (i.e., Archaeological Assessments), which are outlined in the Ministry of Citizenship and Multiculturalism (MCM)'s *Standards and Guidelines for Consultant Archaeologists* (2011). The methods are laid out in a series of increasingly involved stages, including background study (Stage 1), property assessment (Stage 2), site-specific assessment (Stage 3) and mitigation of development impacts (Stage 4), depending on the cultural heritage value or interest of identified archaeological resources. Any fieldwork conducted will be documented in subsequent archaeological reports, which will be submitted to MCM for technical review. Indigenous communities will be engaged for the duration of any of this related work (i.e. in-field participation, draft report review).

An Existing Conditions Report was drafted in April 2025 by way of a Stage 1 archaeological assessment. It reviewed existing criteria and indicators within the present quarry lands but did not include buffer lands. It identified areas of archaeological potential primarily in the northeast and southern extents of the site study area. This was circulated to the engaged Indigenous communities for comment, with which there were no questions or concerns. This report informs the archaeological mitigation measures where applicable.

Significant sections of the lands of each Alternative Method are covered by previous assessments completed in 1988 and 1989, prior to the establishment of the present quarry. The assessment of these fields resulted in the identification of 15 Euro-Canadian and 15 Indigenous sites, which were addressed according to past standards. Fifteen of these sites are within the lands of the three Alternative Methods but have likely been removed by the operation of the quarry since then. The assessments do not meet current provincial standards, and these areas must be reassessed to confirm the status and the cultural heritage value or interest of each of these sites, where possible. Despite the requirement to reassess these lands, the previous assessment reduces the risk of significant archaeological resources within the Alternative Methods that are not previously known.

Net Effects have been categorized according to the definitions in Table 4.2.

Table 4.2 Categorization of Net Effects

Net Effect Category	Description
No Effect / No (Positive) Effect	No departure from the existing condition is expected.
Low Effect / Low (Positive) Effect	Effects are likely to be negligible or minor in scale if they are negligible or low in magnitude, of short duration, infrequent, small in spatial extent, reversible or readily avoided, and generate few or minor impacts in social or ecological contexts. Mitigation measures will allow baseline conditions to remain largely unchanged.
Moderate Effect / Moderate (Positive) Effect	Effects are likely to be medium in scale if they are moderate in magnitude, of moderate duration, occasionally frequent, possibly/partially reversible, and to generate a moderate level of impacts in social or ecological contexts. Mitigation measures may not fully eliminate, reduce, control or offset effects but should enable affected communities to maintain economic and social well-being, and should prevent the diminishment or loss of key components of the environment and its ecological functioning.
High Effect / High (Positive) Effect	Effects are likely to be severe in scale if they are high in magnitude, permanent/long term, frequent, irreversible, and over a large spatial extent or within an area of exclusive/preferred Indigenous use or of ecological/environmental sensitivity. High levels of impacts in social or ecological contexts are expected. There is a high degree of uncertainty of the effectiveness of mitigation measures, or mitigation measures are unable to fully address effects such that valued components are diminished or lost.

The following tables (Table 4.3 - Table 4.7) present the results of the net environmental effects evaluation for each of the Alternative Methods. The net effects have been determined by applying the mitigation measures to the predicted potential environmental effects.

4.2.1 Landfill Configuration Options

Table 4.3 Landfill Configuration Option A Archaeological Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on archaeological resources and areas of archaeological potential	– Area (ha) of archaeological potential (i.e., total area which may contain previously unidentified archaeological resources not impacted by previous development)	– Potential adverse effects on 15.39 ha of area with archaeological potential that may contain previously unidentified archaeological resources with cultural heritage value or interest.	– Conduct a Stage 2 archaeological assessment within all affected areas of archaeological potential in order to identify any archaeological resources that may be present in advance of any adverse effects. Any archaeological resources identified may require further work depending on their cultural heritage value or interest.	– Areas of archaeological potential will be addressed prior to potential adverse effects to determine appropriate mitigation measures for any archaeological resources with cultural heritage value or interest. **NO NET EFFECTS**
	– Number and type of archaeological sites affected	– Potential adverse effects on known or unknown archaeological sites within areas of archaeological potential.	– Any archaeological resources identified during a Stage 2 archaeological survey determined to have cultural heritage value or interest will be subject to a Stage 3 site-specific assessment and Stage 4 mitigation of development impacts where necessary. – A total of fifteen archaeological resources were previously identified in the footprint of the Alternative Method. While they likely no longer exist, since the previous assessment does not meet the current MCM standards, the area would need to be reassessed and evaluated to confirm the status of the archaeological sites.	– Potential adverse effects to potential archaeological resources with cultural heritage value or interest would be mitigated either through avoidance and protection or further excavation. **NO NET EFFECTS**

Table 4.4 Landfill Configuration Option B Archaeological Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on archaeological resources and areas of archaeological potential	– Area (ha) of archaeological potential (i.e., total area which may contain previously unidentified archaeological resources not impacted by previous development)	– Potential adverse effects on 15.39 ha of area with archaeological potential that may contain previously unidentified archaeological resources with cultural heritage value or interest.	– Conduct a Stage 2 archaeological assessment within all affected areas of archaeological potential in order to identify any archaeological resources that may be present in advance of any adverse effects. Any archaeological resources identified may require further work depending on their cultural heritage value or interest.	– Areas of archaeological potential will be addressed prior to potential adverse effects to determine appropriate mitigation measures for any archaeological resources with cultural heritage value or interest. **NO NET EFFECTS**
	– Number and type of archaeological sites affected	– Potential adverse effects on known or unknown archaeological sites within areas of archaeological potential.	– Any archaeological resources identified during a Stage 2 archaeological survey determined to have cultural heritage value or interest will be subject to a Stage 3 site-specific assessment and Stage 4 mitigation of development impacts where necessary. – A total of fifteen archaeological resources were previously identified in the footprint of the Alternative Method. While they likely no longer exist, since the previous assessment does not meet the current MCM standards, the area would need to be reassessed and evaluated to confirm the status of the archaeological sites.	– Potential adverse effects to potential archaeological resources with cultural heritage value or interest would be mitigated either through avoidance and protection or further excavation. **NO NET EFFECTS**

Table 4.5 Landfill Configuration Option C Archaeological Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on archaeological resources and areas of archaeological potential	– Area (ha) of archaeological potential (i.e., total area which may contain previously unidentified archaeological resources not impacted by previous development)	– Potential adverse effects on 15.39 ha of area with archaeological potential that may contain previously unidentified archaeological resources with cultural heritage value or interest.	– Conduct a Stage 2 archaeological assessment within all affected areas of archaeological potential in order to identify any archaeological resources that may be present in advance of any adverse effects. Any archaeological resources identified may require further work depending on their cultural heritage value or interest.	– Potential adverse effects to potential archaeological resources with cultural heritage value or interest would be mitigated either through avoidance and protection or further excavation. **NO NET EFFECTS**
	– Number and type of archaeological sites affected	– Potential adverse effects on known or unknown archaeological sites within areas of archaeological potential.	– Any archaeological resources identified during a Stage 2 archaeological survey determined to have cultural heritage value or interest will be subject to a Stage 3 site-specific assessment and Stage 4 mitigation of development impacts where necessary. – A total of fifteen archaeological resources were previously identified in the footprint of the Alternative Method. While they likely no longer exist, since the previous assessment does not meet the current MCM standards, the area would need to be reassessed and evaluated to confirm the status of the archaeological sites.	– Potential adverse effects to potential archaeological resources with cultural heritage value or interest would be mitigated either through avoidance and protection or further excavation. **NO NET EFFECTS**

4.2.2 Leachate Management Options

Table 4.6 Leachate Management Option A Archaeological Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on archaeological resources and areas of archaeological potential	– Area (ha) of archaeological potential (i.e., total area which may contain previously unidentified archaeological resources not impacted by previous development)	– Including effects of the Landfill Configuration Options, potential adverse effects on an additional 0.28 ha of area with archaeological potential that may contain previously unidentified archaeological resources with cultural heritage value or interest.	– Conduct a Stage 2 archaeological assessment within all affected areas of archaeological potential in order to identify any archaeological resources that may be present in advance of any adverse effects. Any archaeological resources identified may require further work depending on their cultural heritage value or interest.	– Areas of archaeological potential will be addressed prior to potential adverse effects to determine appropriate mitigation measures for any archaeological resources with cultural heritage value or interest. **NO NET EFFECTS**
	– Number and type of archaeological sites affected	– Including effects of the Landfill Configuration Options, potential adverse effects on previously unknown archaeological sites within areas of archaeological potential.	– Any archaeological resources identified during a Stage 2 archaeological survey with cultural heritage value or interest will be subject to a Stage 3 site-specific assessment and Stage 4 mitigation of development impacts where necessary.	– Potential adverse effects to potential archaeological resources with cultural heritage value or interest would be mitigated either through avoidance and protection or further excavation. **NO NET EFFECTS**

Table 4.7 Leachate Management Option B Archaeological Potential Environmental Effects, Mitigation Measures and Net Effects

Criteria	Indicators	Potential Effects	Impact Management Measures	Net Effects
Effect on archaeological resources and areas of archaeological potential	– Area (ha) of archaeological potential (i.e., total area which may contain previously unidentified archaeological resources not impacted by previous development)	– Including effects of the Landfill Configuration Options, potential adverse effects on an additional 0.28 ha of area with archaeological potential that may contain previously unidentified archaeological resources with cultural heritage value or interest.	– Conduct a Stage 2 archaeological assessment within all affected areas of archaeological potential in order to identify any archaeological resources that may be present in advance of any adverse effects. Any archaeological resources identified may require further work depending on their cultural heritage value or interest.	– Areas of archaeological potential will be addressed prior to potential adverse effects to determine appropriate mitigation measures for any archaeological resources with cultural heritage value or interest. **NO NET EFFECTS**
	– Number and type of archaeological sites affected	– Including effects of the Landfill Configuration Options, potential adverse effects on previously unknown archaeological sites within areas of archaeological potential.	– Any archaeological resources identified during a Stage 2 archaeological survey with cultural heritage value or interest will be subject to a Stage 3 site-specific assessment and Stage 4 mitigation of development impacts where necessary.	– Potential adverse effects to potential archaeological resources with cultural heritage value or interest would be mitigated either through avoidance and protection or further excavation. **NO NET EFFECTS**

5. STEP 3: COMPARATIVE EVALUATION

Table 5.1 Comparative Evaluation – Archaeological

Evaluation Criteria	Evaluation Indicator	Alternative Methods				
		Landfill Configuration Options			Leachate Management Options	
		Option A	Option B	Option C	Option A	Option B
Effect on archaeological resources and areas of archaeological potential	– Area (ha) of archaeological potential (i.e., total area which may contain previously unidentified archaeological resources not impacted by previous development)	– Areas of archaeological potential will be addressed prior to potential adverse effects to determine appropriate mitigation measures for any archaeological resources with cultural heritage value or interest. **NO NET EFFECTS**	– Areas of archaeological potential will be addressed prior to potential adverse effects to determine appropriate mitigation measures for any archaeological resources with cultural heritage value or interest. **NO NET EFFECTS**	– Areas of archaeological potential will be addressed prior to potential adverse effects to determine appropriate mitigation measures for any archaeological resources with cultural heritage value or interest. **NO NET EFFECTS**	– Areas of archaeological potential will be addressed prior to potential adverse effects to determine appropriate mitigation measures for any archaeological resources with cultural heritage value or interest. **NO NET EFFECTS**	– Areas of archaeological potential will be addressed prior to potential adverse effects to determine appropriate mitigation measures for any archaeological resources with cultural heritage value or interest. **NO NET EFFECTS**
	– Number and type of archaeological sites affected	– Potential adverse effects to potential archaeological resources with cultural heritage value or interest would be mitigated either through avoidance and protection or further excavation. **NO NET EFFECTS**	– Potential adverse effects to potential archaeological resources with cultural heritage value or interest would be mitigated either through avoidance and protection or further excavation. **NO NET EFFECTS**	– Potential adverse effects to potential archaeological resources with cultural heritage value or interest would be mitigated either through avoidance and protection or further excavation. **NO NET EFFECTS**	– Potential adverse effects on potential archaeological resources with cultural heritage value or interest would be mitigated either through avoidance and protection or further excavation. **NO NET EFFECTS**	– Potential adverse effects to potential archaeological resources with cultural heritage value or interest would be mitigated either through avoidance and protection or further excavation. **NO NET EFFECTS**
Environmental Component Ranking:		*Tied for 1st*	*Tied for 1st*	*Tied for 1st*	*Tied for 1st*	*Tied for 1st*
Environmental Component Rationale:		*There is no distinction between the Options in relation to archaeological resources. All options rank the same.*			*There is no distinction between the Options in relation to archaeological resources. All options rank the same.*	

6. CONCLUSIONS

Based on the net environmental effects presented in Section 0, and the comparative evaluation in Section 5, there is no distinction between the Options in relation to archaeological resources. All options rank the same.



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