Environmental Study Report

Wellington Road 124
Guelph-Eramosa Township 1 to Fife Road
Schedule C Class Environmental Assessment

Project Location:
Guelph-Eramosa Township

Prepared By:

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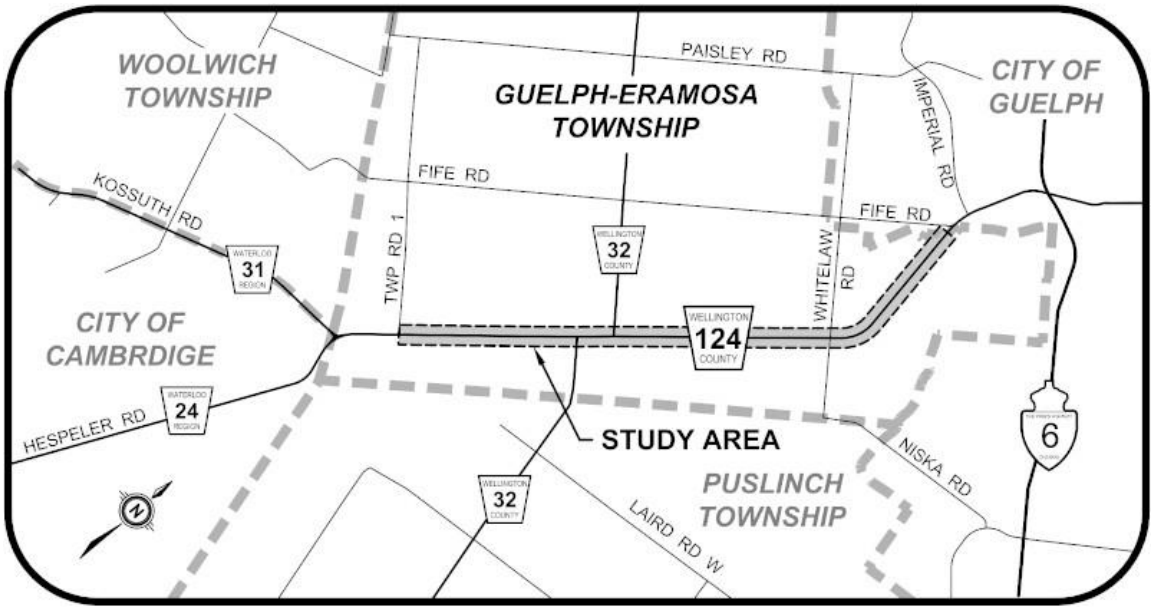
MTE File No.: 41093-200

Executive Summary

The County of Wellington has undertaken a Schedule C Class Environmental Assessment (Class EA) study in Guelph Eramosa Township (GET) for Wellington Road 124 (WR124) between GET Road 1 and Fife Road. The Study Area for the WR124 Class EA is illustrated in **Figure ES1**.

Figure ES1 - Study Area



The following Problem Statement outlines the purpose of this WR124 Class EA study:

> *WR 124 from Township Road 1 to Fife Road is in need of improvements in order to address existing traffic-carrying deficiencies, including poor/deteriorating levels of service at the intersections with WR 32 North and 32 South as well as plan for future growth along this important corridor. Improvements must also address the existing pavement condition while providing safe public access to the greatest possible extent.*

The WR124 Class EA was initiated in 2018, and included notification and contact with various agencies, utility companies and the public/property owners. Two Public Information Centres (PIC's) were also held. A number of background studies were also undertaken including:

- ✓ Natural Environment Report
- ✓ Stage 1 Archaeological Assessment
- ✓ Built Heritage and Cultural Heritage Assessment
- ✓ Transportation Study

Alternative solutions to address the problem statement were reviewed and screened:

- ✓ Do Nothing;
- ✓ Non-Structural Improvements (Development/Improvements to Alternate Modes of Transportation);
- ✓ Improvements to other Roads (to provide an alternative to WR 124);
- ✓ Construct WR 124 on a new Alignment;
- ✓ Improvements to WR 124.

Since implementing most of these alternative solutions do not fully address the problem statement for WR 124 and would still require improvements to WR 124, only the Do Nothing and Improvements to WR 124 alternative solutions were carried forward. The Alternative Design Concepts for WR 124 Improvements included two main components:

- ✓ Intersection Improvements:
  - Unsignalized Intersections (with turn lanes as required);
  - Signalized Intersections (with turn lanes as required);
  - Roundabouts (i.e. 1 roundabout at WR 32 and WR 124, or 2 roundabouts at each of WR 32S and WR 32N at WR 124).

- ✓ WR 124 Cross Section:
  - Two Lanes (one lane in direction);
  - Three Lanes (one lane in each direction, with centre two way left turn lane);
  - Four Lanes (two lanes in each direction);
  - Urban Cross Section (with paved area behind rollover curb);
  - Rural Cross Section (paved shoulder).

Copies of the Cross Section alternatives are illustrated in **Figure ES2** and the two (2) Roundabout Alternatives are shown in **Figures ES3 and ES4.**

These alternatives and their evaluations were presented to the public and stakeholders at Public Information Centre (PIC) No. 1 held on November 29, 2018. In addition, several meetings were held with property owners and businesses near the intersections of WR 124 and WR 32, as construction of the roundabout(s) would result in impacts to their property. The comments received from the public and agencies and technical studies was reviewed and evaluated, and PIC No. 2 was held on June 26, 2019 to present a preferred alternative to the public.

Figure ES2 - Cross Section Alternatives

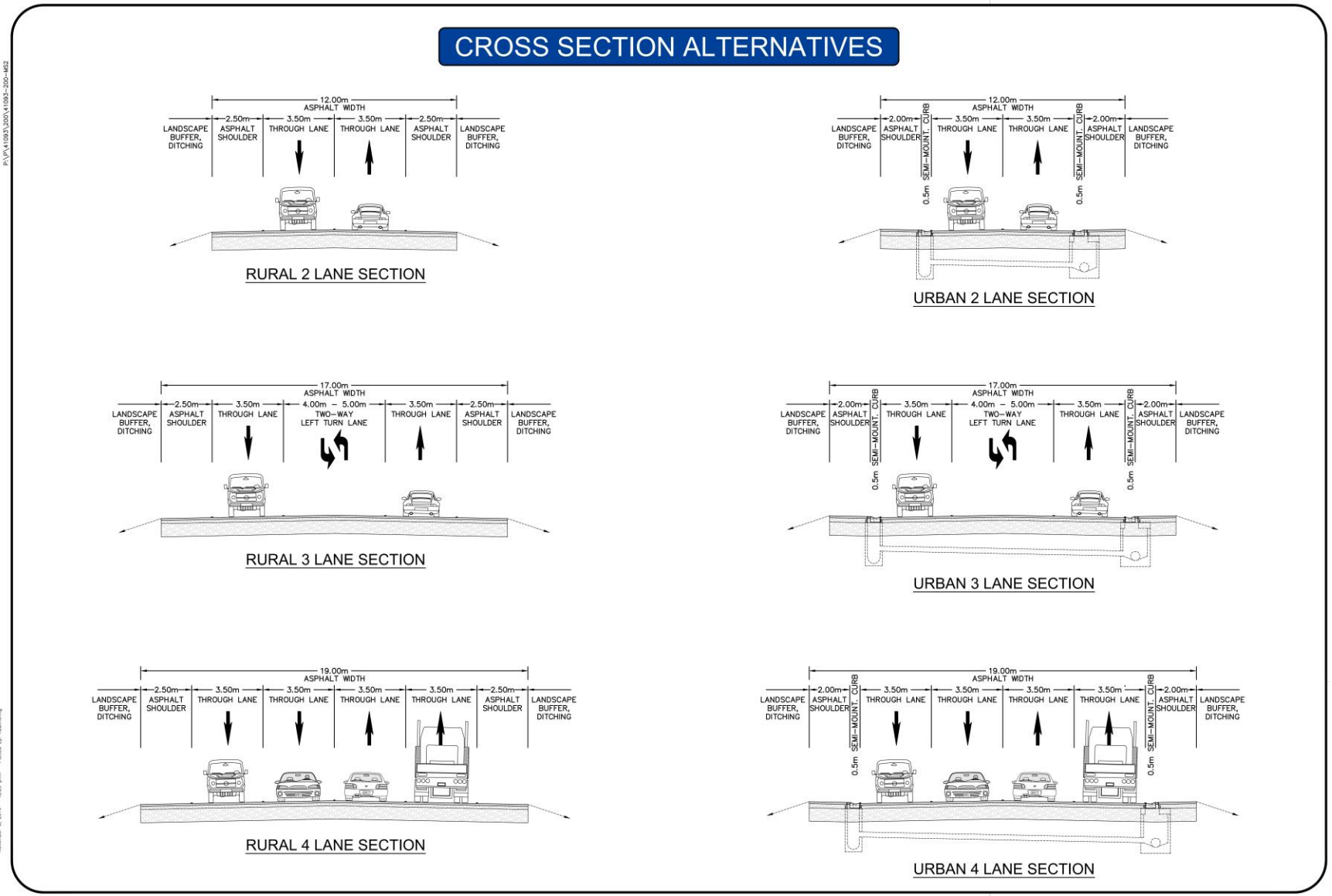


Figure ES3 – One Roundabout Alternative (PIC#1)

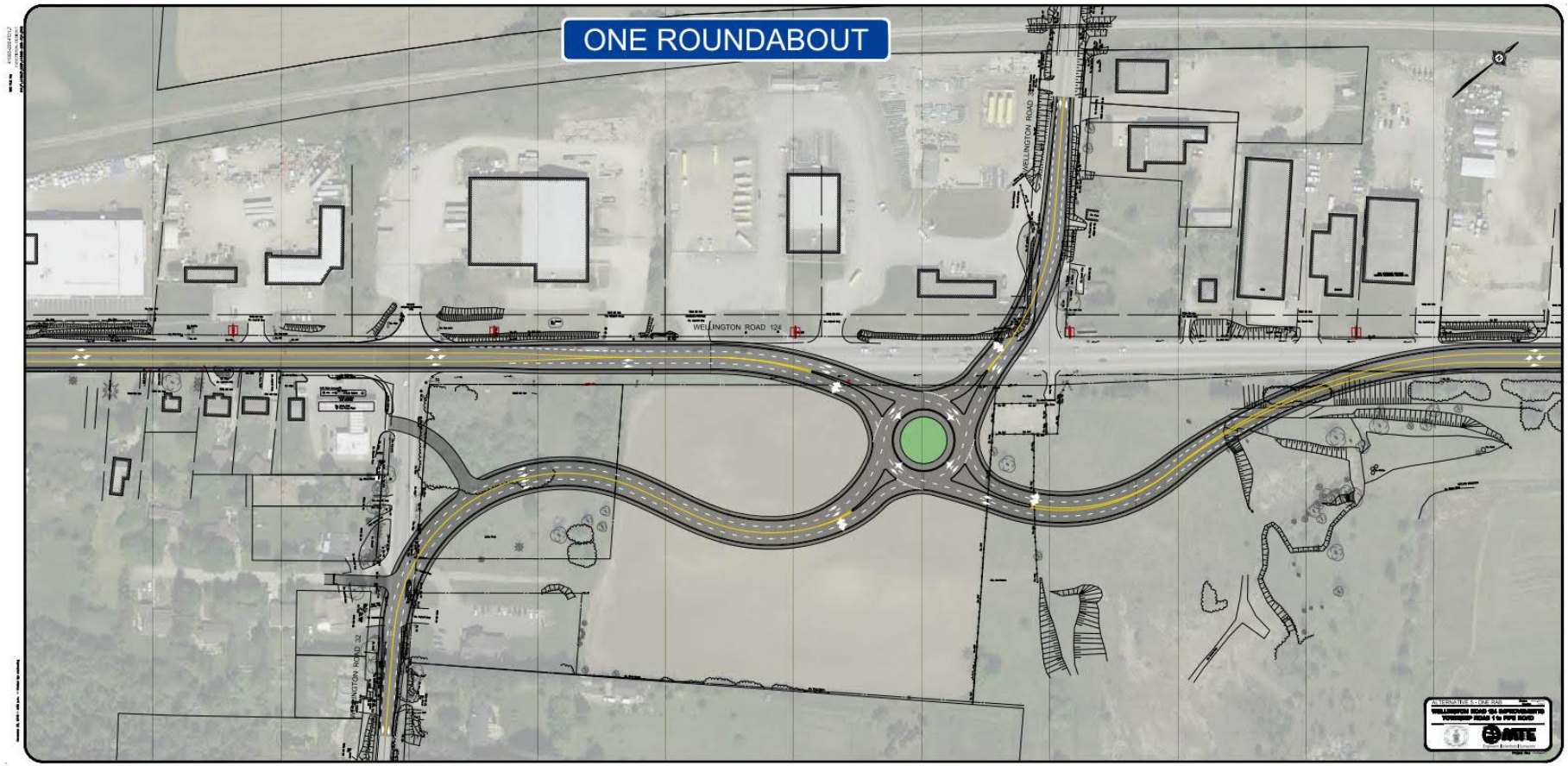
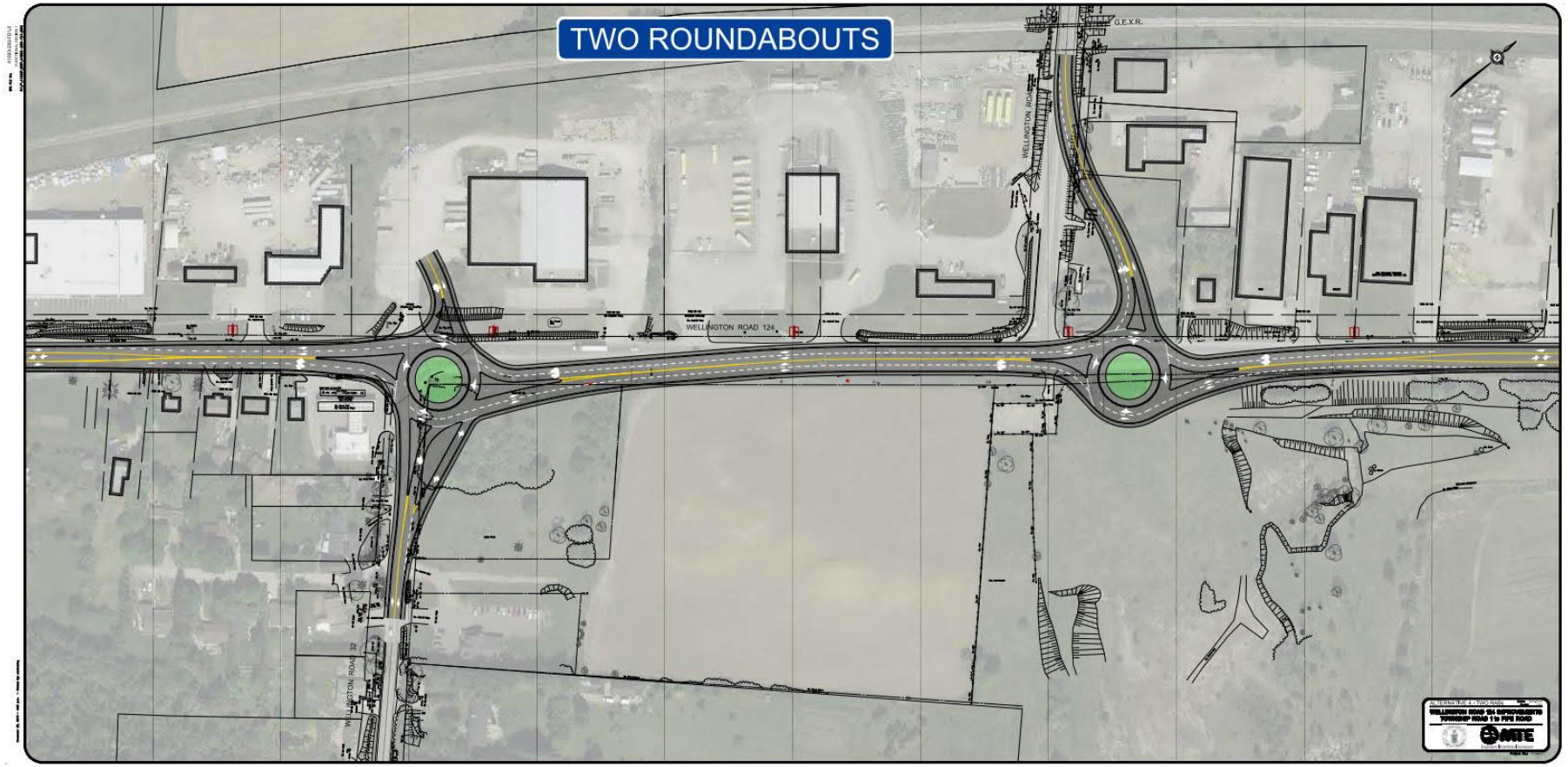


Figure ES4 – Two Roundabout Alternative (PIC#1)



The preferred alternative presented at PIC No. 2 included:

- ✓ Two roundabouts – 1 at WR 124 and WR 32N, and 1 at WR 124 and WR 32S;
- ✓ 4 lanes between the two roundabouts, with a centre median;
- ✓ 3 lanes between the rail crossing and the WR 32S roundabout, between the WR 32N roundabout and Whitelaw Road;
- ✓ 3 lanes between Fife Road and 350m west of Fife Road;
- ✓ 2 lanes between Township Rd 1 and the rail crossing;
- ✓ 2 lanes between Whitelaw Road and 350m west of Fife Road;
- ✓ Rural cross section - except at, and between, the roundabouts and at all intersections where an urban cross section would be implemented.

At PIC No. 2, three alternatives for the WR 124 and WR 32S roundabout were also presented for comment, namely:

- ✓ North leg aligns with the Welmar (7018 WR 124) east entrance;
- ✓ North leg aligns with the Superior Propane (7022 WR 124) west entrance;
- ✓ North leg would align with a new shared entrance on the property line between the Welmar and Superior Propane property.

Comments received from the public and agencies were reviewed and additional meetings were held with some of the property owners near the WR 124 and WR 32 roundabout intersections. Meetings with Welmar and Superior Propane determined that they preferred the roundabout alternative where the north leg of the WR 124 and WR 32S roundabout lines up with the existing Welmar east entrance. This roundabout alternative best suited both their safety and on site operations/access concerns.

In consideration of the technical information, public and agency comments gathered during this study including refinements made to the WR 32S roundabout as a result of a delegation to the Wellington County Roads Committee on November 12, 2019, the Recommended Design Alternative is similar to what was presented at PIC No. 2 and include the following key elements:

- New roundabouts at the intersections of WR 124 and WR 32N and WR 32S (i.e. two roundabouts – Figure ES5);
- All other existing intersections will remain the same with modifications to turn lanes as required;
- A twenty (20) metre wide right-of-way (except in areas where additional property is required for turn lanes or roundabouts);
- Required road widenings for the three and four lane sections and roundabout construction, will be to the south, holding the existing north edge of pavement such that the construction will not require any modifications or relocations to the existing Hydro One towers and transmission lines;
- A minimum of two (2) lanes of through traffic;

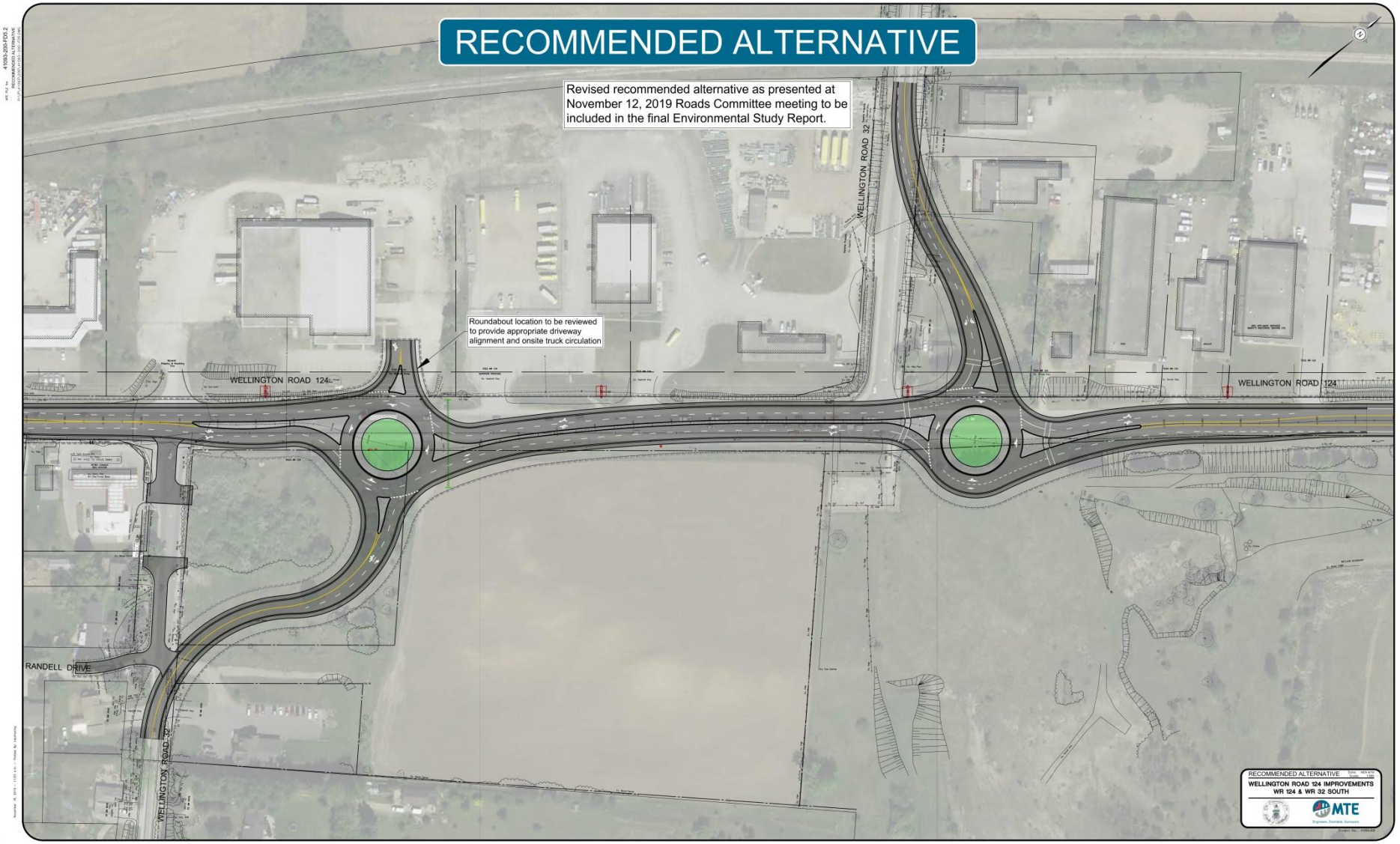
- Additional two way centre left turn lane to address the multiple driveway accesses between:
    - Fife Road and 350m east of Fife Road;
    - Whitelaw Road to WR 32N;
    - WR 32S to CN Rail crossing.

- Four (4) lanes between the two roundabouts at WR 32N and WR 32S;
- Rural cross section with paved shoulders, with the exception of at intersections and at the approaches to and between the two roundabouts at WR 32N and WR32S where an urban cross section with a 0.5m rollover curb will be installed with a paved area behind the curb;
- The paved shoulder and paved area behind the curb and gutter can accommodate disabled vehicles, cyclists and pedestrians;
- A raised median between the two roundabouts; and
- Storm sewers installed in the urban cross section areas;

A preliminary cost estimate to complete the Recommended Alternative Alignment B4 is approximately $15.8 million and will depend on construction timing and does not include property acquisition costs.

A Notice of Study Completion for this Class EA is anticipated to be filed on or about December 12, 2019 with the Ministry of Environment, Conservation and Parks (MECP, formerly MOECC), as well as provided to the public, agencies, and stakeholders by means of advertisements in local newspapers and mailings to adjacent property owners, tenants, and review agencies, with the Environmental Study Report (ESR) placed on public record for a thirty (30) day review period. Copies of the ESR will be made available at the Clerks' office in Wellington County, Guelph-Eramosa Township, and City of Guelph for the review period, as noted in the Notice of Study Completion.

Figure ES5 – Recommended Roundabout Alternative



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1.0 INTRODUCTION AND BACKGROUND

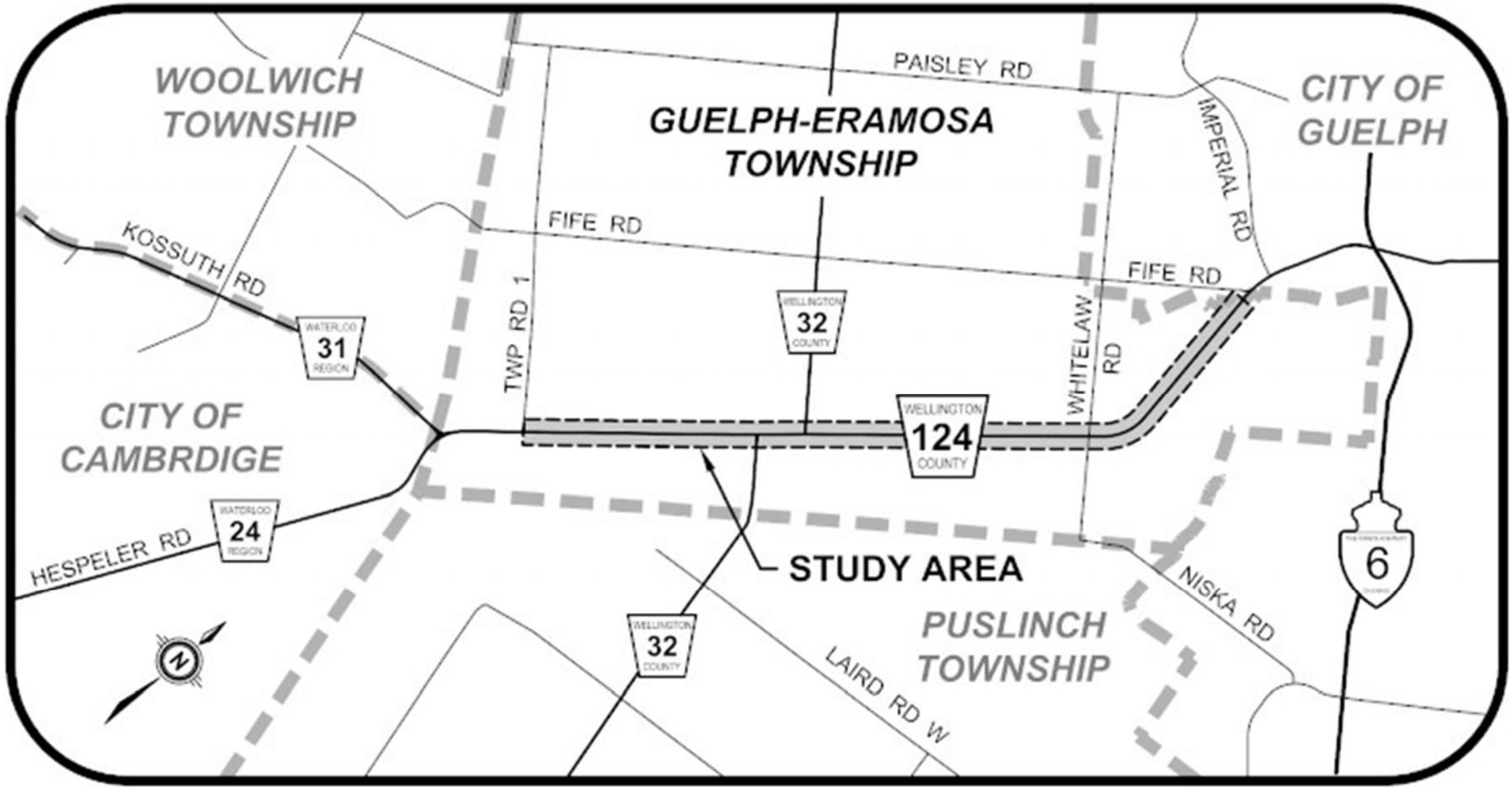
This Environmental Study Report (ESR) documents the Class Environmental Assessment (EA) process undertaken for the Improvements on Wellington Road 124 (WR124) between Guelph-Eramosa Township Road 1 and Fife Road in the County of Wellington. The study area is illustrated in **Figure 1.1**. The study followed the Schedule "C" Class (EA) process as outlined in the Municipal Class Environmental Assessment document.

WR 124 was once a part of King's Highway 24 which stretched over 250 km in length, from Long Point on Lake Erie to Collingwood on Georgian Bay. In 1997-1998, the highway was "downloaded" from the Provincial Government to cities, counties and other municipalities across Ontario in an attempt to reduce expenditures on highway maintenance. In January 1998 the portion of Highway 24 north of Cambridge to west of Caledon was transferred to the County of Wellington and became Wellington Road 124 (WR124).

The Guelph Wellington Transportation Study completed in 2005 identified a need to realign and upgrade WR 124 as a divided, 4-lane expressway, in agreement with the recommendations of an EA study completed by the MTO before the transfer of the road from the Province to the County. However, due to the cost estimated to be well over $50 million (in 2005) the County is not in a position to implement it without provincial support to fund the project.

Both the City of Cambridge and the City of Guelph have been growing rapidly for the past 15 years and the heavy inter-regional transportation demands are putting pressure on the existing transportation infrastructure. With the opening of the Fairway Road Bridge over the Grand River, WR124 also became a convenient alternative route between Kitchener and Guelph. As a result, the corridor must be upgraded to meet current demands and to accommodate future growth as identified in the previous studies and policies. The County of Wellington has decided to proceed with the Schedule C Class EA Study for the Improvements to WR 124 along the existing route in its current alignment.

Figure 1-1: Study Area



1.1 The Class Environmental Assessment (EA) Process

All municipalities in Ontario are subject to the provisions of the Environmental Assessment Act (EAA) and its requirements to follow the Environmental Assessment Process for most public works projects. The Ontario Municipal Engineers Association (MEA) Municipal Class Environmental Assessment document provides municipalities with a five-phase planning procedure approved under the EAA to plan and undertake all municipal road, sewage, stormwater management, water, and transit projects. The Class EA document also serves as a public statement of the decision making process followed by municipalities in the planning and implementation of needed infrastructure.

Based on the MEA Class EA document, projects are classified as either Schedule "A", "A+", "B", or "C" projects according to their environmental significance and the effects they may impose on the environment, as well as their relative financial costs. The main difference between the classifications/schedule types is the degree to which each project may adversely affect the existing environment. Schedule "A" and "A+" projects have minimal adverse effects, while Schedule "C" projects have the potential for significant environmental effects. Accordingly, each of these classifications requires a different level of review to complete the requirements of the Class EA, and thus comply with the EAA. **Figure 1.2** illustrates the process followed in the planning and design of projects covered by a Class EA. The Class EA process incorporates Phases considered essential for compliance with the requirements of the EAA, including public consultation, which is summarized below:

Phase 1

- Identify the problem or opportunity.

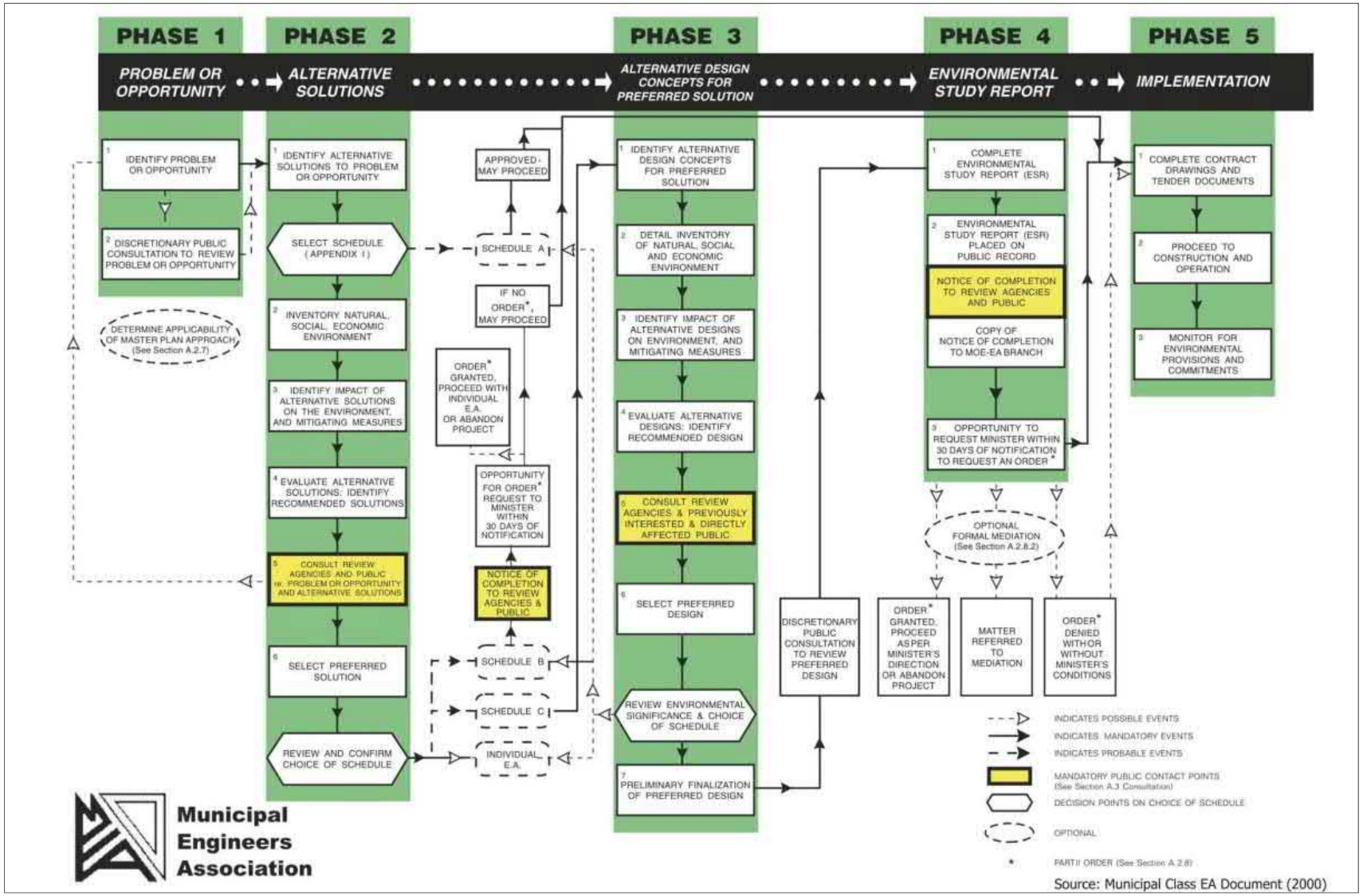
Phase 2

- Identify alternative solutions to address the problem or opportunity by taking into consideration the existing environment, select the project Schedule, and establish the preferred solution.
- Mandatory public and agency contact, normally in the form of a Notice of Commencement for Schedule B and C projects and as a Public Information Centre (PIC) for Schedule C projects. Notice of Study Commencement is the first mandatory point of contact.

Phase 3

- Examine alternative methods of implementing the preferred solution based on the environment, public and government agency input, anticipated environmental effects, and methods of mitigating negative effects.

Figure 1-2: Class Environmental Assessment (EA) Process



- Mandatory public and agency contact, normally in the form of a PIC for Schedule C projects or as a Notice of Completion for Schedule B projects. This is the second mandatory point of contact.

Phase 4

- Mandatory Notice of Completion of ESR (Schedule C projects only). This is the third mandatory contact point for Schedule C projects and also carries a mandatory requirement to include notification of the provision on how to submit a Part II Order Request.
- Document, in an Environmental Study Report (ESR), a summary of the rationale and the planning, design, and consultation process followed in the project and make such documentation available for scrutiny by review agencies and the public.

Phase 5

- Complete contract drawings and documents; proceed to construction and operation and monitor construction and operation (as required) for adherence to environmental provisions/commitments. This phase is optional and typically completed closer to construction.

Public and agency consultation is an important part of the planning process. The proponent is encouraged to resolve all concerns with the public prior to issuing a Notice of Completion and commencing the public review period. This applies to addendums and full projects. However, if members of the public or review agencies feel that significant outstanding issues have not been addressed during the Class EA process they may request the Minister of the Environment, Conservation and Parks (MECP) to require a proponent to comply with Part II of the EA Act (which addresses individual EAs), before proceeding with a proposed undertaking – this is what is known as a “Part II Order”.

Additional details on the Part II Order process, where to send requests, timelines, and factors for the Minister making a decision can be found in Section 10.0 of this Environmental Study Report.

1.2 Project Team Organization

The County of Wellington retained MTE Consultants Inc. (MTE) as their Prime Consultant to assist in completion of this Class EA Study. The “Project Team” consisted of members from the County of Wellington, MTE, and specialized sub-consultants needed to address specific requirements of the project. The Project Team, as identified below, changed due to various staff changes over the course of the study. The following is a list of all Project Team members involved in the project:

County of Wellington
Don Kudo, County Engineer
Joe de Koning, Construction Engineer
J.P. (Paul) Johnson, Operations Manager
Pasquale Costanzo, Technical Services Supervisor
Carey Hutchinson Engineering Services

MTE Consultants Inc.
Dave Hallman, Project Manager
Lyndsay Dokas, Project Coordinator
Nathan Duimering, Project Designer

In addition, the Project team consulted with staff from:

City of Guelph
Gwen Zhang, Transportation Planning Engineer
Kealy Dedman, General Manager/City Engineer
Allister McIlveen, Manager Transportation Services

Towship of Guelph-Eramosa
Harry Niemi, Director of Public Works

Region of Waterloo
Geoffery Keyworth, Transportation Division

1.3 Data Collection

A large part of the study involved the collection and review of existing information to determine the need for potential improvements within the identified Study Area in order to develop and evaluate alternative solutions and design concepts.

As part of the data collection phases, stakeholder consultation was undertaken throughout the study process. Target participants included property owners within the Study Area, the general public, technical agencies and stakeholder/interest groups. Information related to land use, traffic operations, the natural and social environment, existing utilities and other engineering related components was gathered. For ease of reference, the details pertaining to the public and agency consultation undertaken throughout the study is found in Section 9 – Public and Agency Consultation.

A list of background documents, including historical planning documents utilized in the development of the study recommendations and preparation of this ESR are as follows:

- ✓ Municipal Class Environmental Assessment, October 2000, as amended in 2007 and 2011.
- ✓ Guelph-Wellington Transportation Study, July 2005.

2.0 EXISTING & FUTURE CONDITIONS

2.1 Natural Environment

A Natural Environment Report was completed by Natural Resource Solutions Inc. (NRSI) in 2019 **(Appendix A)** which summarizes the natural environmental investigations undertaken for this project. Field visits were completed by NRSI between April 24 and July 12, 2018 to characterize natural features and identify significant and sensitive features and species within the Subject Lands.

2.1.1 Vegetation

Vegetation communities identified within and adjacent to the Subject Lands comprise wetlands, watercourses and the surrounding riparian areas. Two Provincially Significant Wetlands (PSWs) include the Ellis Creek Wetland Complex and the Speed River. These wetlands as well as a portion of the Guelph Southwest Wetland Complex, are identified as Core Greenlands within the County of Wellington's Official Plan. Two watercourses, Ellis Creek and a second watercourse referred to as "Tributary A", are regulated by the Grand River Conservation Authority (GRCA). The vegetation communities identified can be found in **Appendix A.**

A total of 102 plant species were inventoried within the Subject Lands in 2018. Of that number, 59 species (58%) are native and 43 species (42%) are non-native. No Species at Risk (SAR) or Species of Conservation Concern (SCC) were documented. One species considered to be locally significant, Black Maple, was observed within the subject lands during the tree inventory. While the two trees are located on private property, the crowns hang over the road right of way. A list of all species of plants recorded can be found in **Appendix A.**

2.1.2 Wildlife

2.1.2.1 Birds

A total of 45 bird species were documented within the Subject Lands in 2018. Of that number, 8 were confirmed to be breeding, 25 exhibited probable signs of breeding and 14 exhibited possible signs of breeding. 1 SAR species was observed (threatened provincially and federally):

- Barn Swallow – exhibited probable signs of breeding

1 SCC was observed (special concern provincially and federally):

- Eastern Wood-Pewee – exhibited possible signs of breeding

8 locally significant species were observed including the Baltimore Oriole, Eastern Kingbird (confirmed to be breeding), Savannah Sparrow (probable signs of breeding) and the Eastern Wood-Pewee, Willow Flycatcher and Vesper Sparrow (possible signs of breeding). A nest of Eastern Kingbird was found in the Ellis Creek Culvert.

Further details of the breeding bird survey methods and findings are contained in **Appendix A.**

2.1.2.2 Herpetofauna

2018 surveys confirmed 4 common species of amphibians including the Gray Treefrog, Northern Green Frog, American Toad and Spring Peeper. One common reptile species was observed, the Eastern Gartersnake. No SAR, SCC or regionally significant reptiles or amphibian species were observed. Further details are contained in **Appendix A.**

2.1.2.3 Mammals

4 common species of mammal were observed in 2018 including the Eastern Cottontail, Eastern Chipmunk, Eastern Gray Squirrel and White-tailed Deer. No SAR, SCC or locally significant mammal species were observed. Further details are contained in **Appendix A.**

2.1.2.4 Butterflies, Dragonflies and Damselflies

One SCC species, the Monarch Butterfly, was observed in the subject lands in a 2018 survey including their larval foodplant, Common Milkweed. No significant species of dragonflies or damselflies were observed in 2018. A list of all species of butterflies, dragonflies and damselflies known from the study area is included in **Appendix A.**

2.1.2.5 Road Mortality Surveys

Six road mortality surveys were completed where the only observations were of common mammal or bird species including a total of 4 Eastern Cottontails, 1 Gray Squirrel and 1 Northern Cardinal.

2.1.3 Aquatic Resources

2018 surveys showed 3 common species of fish, Blacknose Dace, Creek Chub and Brook (Speckled) Trout in Ellis Creek. No significant fish or mussel species were observed. Further details are contained in **Appendix A.**

2.1.4 Summary

Section 8.0, Table 8-1 identifies the environmental constraints within the Subject Lands, as well as mitigating and/or monitoring measures to reduce net impacts of the proposed improvements to WR 124.

2.2 Socio-economic Environment

2.2.1 Existing Land Use

Wellington County is situated in the western outer ring of the Greater Golden Horseshoe. The two Provincial Plans that apply to lands in Wellington County are the Growth Plan for the Greater Golden Horseshoe and the Greenbelt Plan. The Study Area is part of the Township of Guelph-Eramosa and is not located within the Greenbelt Area.

The current land use within the study area is a mix of agricultural, residential, commercial and industrial.

Based on the 2019 Wellington County Official Plan, the main central portion of the Study Area is designated as rural employment lands. East of Whitelaw Road and west of WR 32 South, the lands are mainly prime agricultural, aside from two residential Hamlet Areas – Shadow Drive near Fife Road and Highway24/Lake Road west of WR 32 South and east of the railway tracks. Figures 2.1 and 2.2 illustrate the current land use and zoning districts within the overall study area.

Within the study area, the County of Wellington Official Plan identifies a number of areas with site specific policies. The specific policies for each area are listed below.

- PA3-12 (Vet Clinic)
- PA3-19 (Automobile Sales and Related Uses - Wilson's Used Cars)
- PA3-21 (Propane Operations - Superior Propane, UPI Energy)

2.2.2 Summary

Section 8.0, Table 8-1 identifies potential impacts to the Socio-Economic Environment as a result of the proposed improvements to WR 124, as well as mitigating and/or monitoring measures to reduce net impacts.

2.3 Cultural Heritage Environment

A Stage 1 Archaeological Assessment and a Built Heritage and Cultural Heritage Landscape Assessment were completed by Archaeological Research Associates (ARA) in 2018. The following Sections 2.3.1 and 2.3.2 summarizes the findings of these studies.

Figure 2-1: Land Use Plan

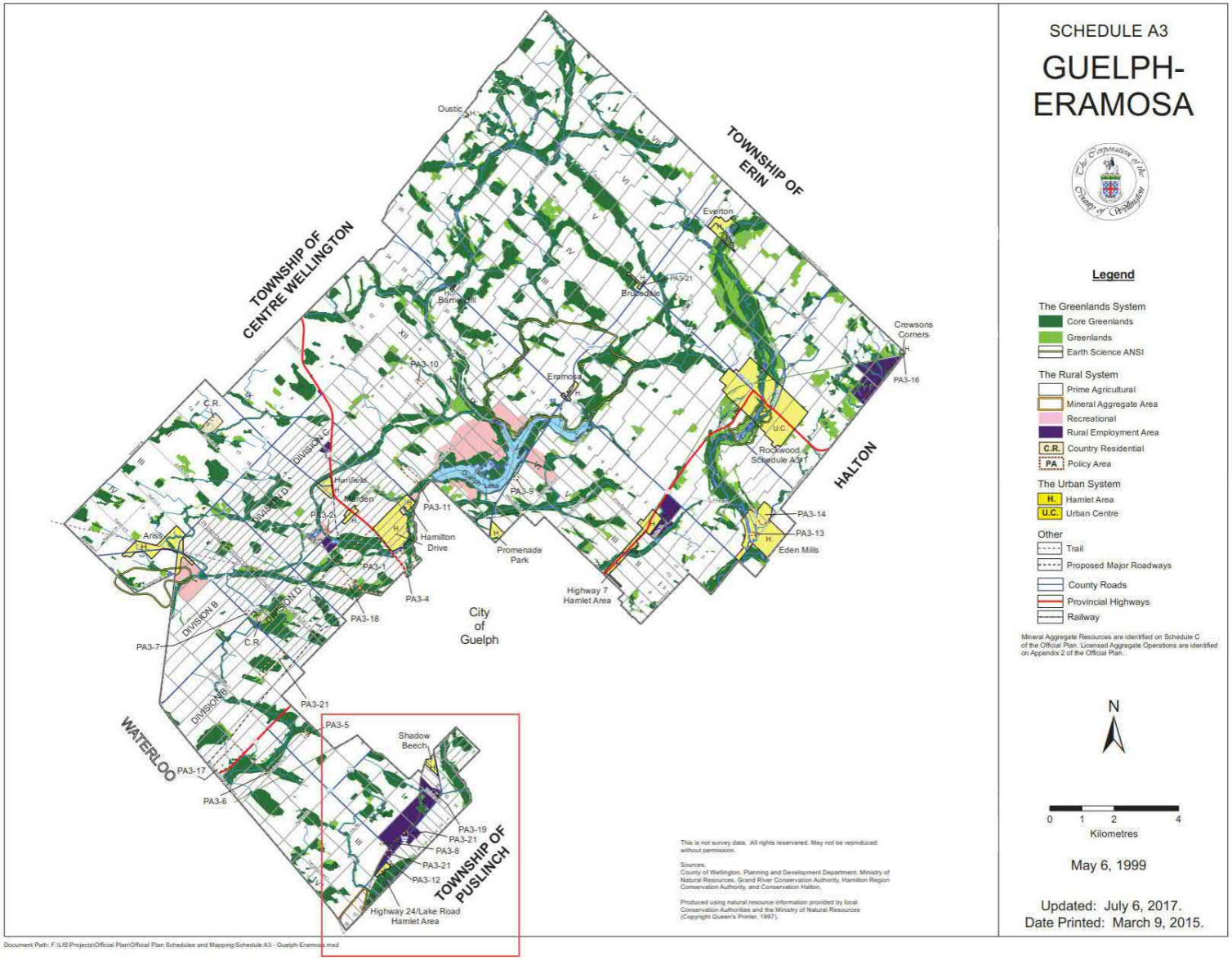
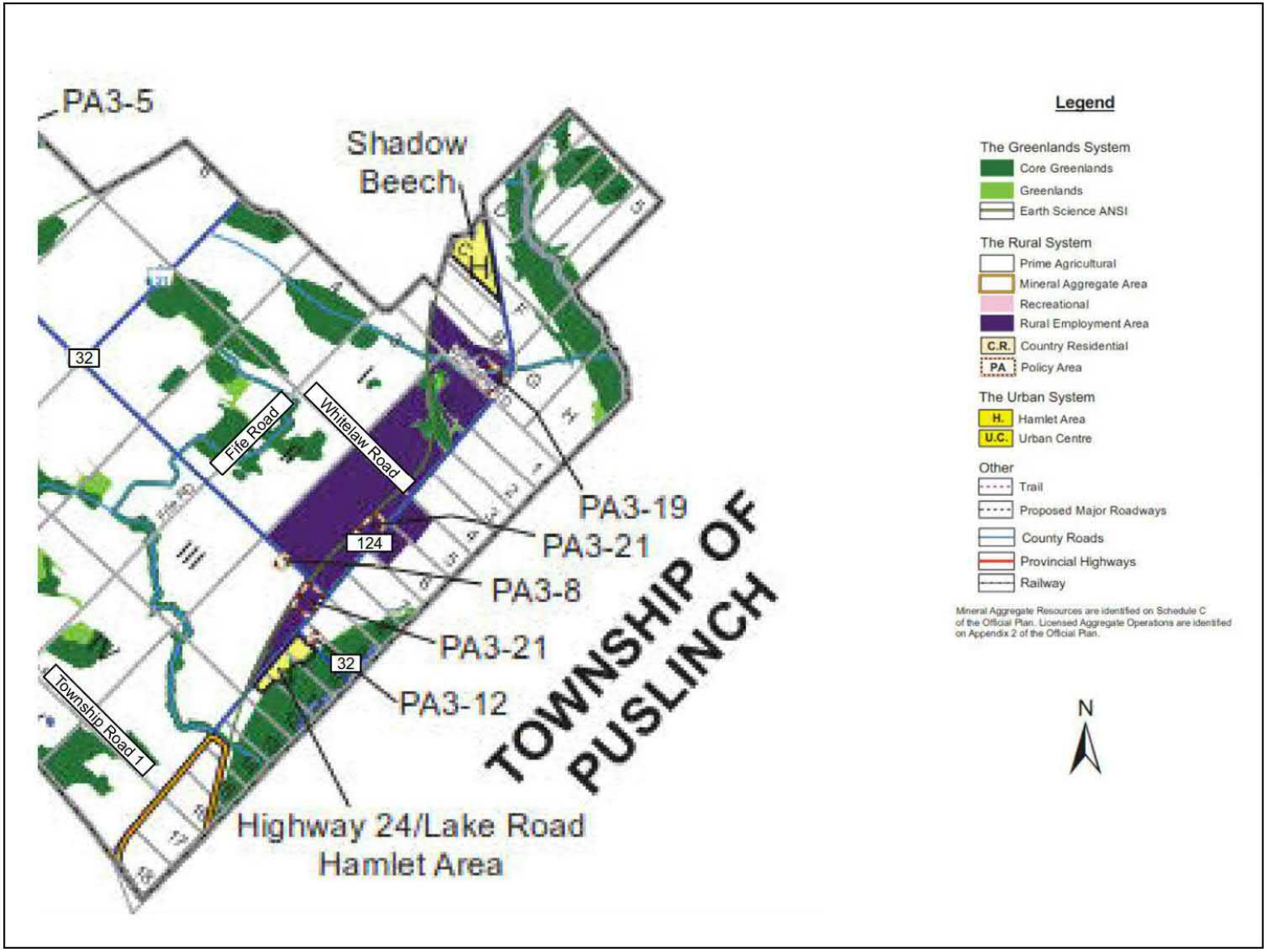


Figure 2-2: Land Use Plan – Zoom



2.3.1 Archaeological Environment

The Stage 1 Archaeological Assessment completed as part of the study found 27 registered archaeological sites, and nine previously identified but unregistered sites, within one kilometre of the study area, however none of these sites are located within or immediately adjacent to WR124. At the time of assessment, approximately 35% of the study area had archaeological potential falling within a mixture of grassed areas and agricultural fields, as shown in Figure 2.3. This includes the grassed lands adjacent to roadways and on residential lawns, as well as one larger and several smaller areas of cultivated agricultural fields. The remainder was either disturbed or previously assessed and not recommended for further work. Much of the study area has been altered through road construction and maintenance, commercial and industrial establishments and channelized waterway crossings. These past and ongoing activities have resulted in the removal of archaeological potential in several areas within the study boundaries.

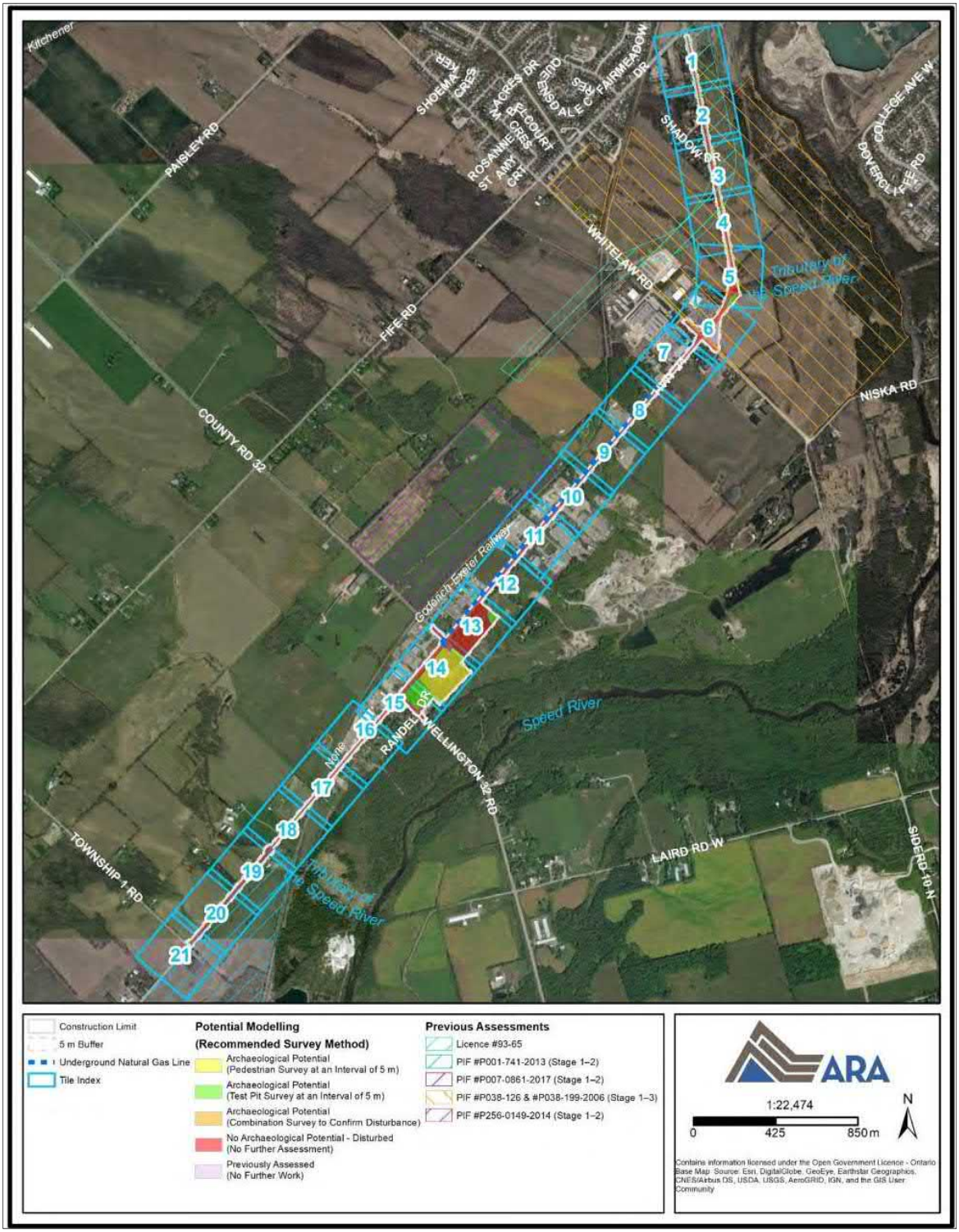
The complete *Stage 1 Archaeological Assessment* illustrating and describing the archaeological sites and their significance is provided in **Appendix B**.

2.3.2 Cultural Heritage Features

A Built Heritage and Cultural Heritage Landscape Assessment of the overall study area was completed by ARA and identified the following cultural heritage resources with potential value or interest within the study area boundaries:

- Six Built Heritage Resources (BHRs) and three Cultural Heritage Landscapes (CHLs);
- The BHRs consist of farmhouses, barns and other residential structures;
- The CHLs consist of an agricultural landscape, the Speed River and the GEXR railway crossing;
- None of the participating or abutting properties are listed as designated heritage properties recognized under the Ontario Heritage Act;
- The cultural heritage resources located within the study area are tied to the history of the initial settlement and growth of Euro-Canadian populations in the County and Township;
- Settlement in the vicinity of the study area began in the early 19th century and was relatively densely occupied by the mid-19th century, being located Southwest of the historic community of Guelph and serving as a transit route between the settlements at Galt and Guelph;
- Historically, land use was mainly agricultural and industrial and remains similar today, with a comparatively lesser extent of residential areas.

Figure 2-3: Results of Stage 1 Archeological Assessment



A summary of these features and key plan are illustrated in Figure 2.4, Table 2.1 and Table 2.2. The above-noted features and areas of significance are illustrated and described in the *Built Heritage and Cultural Landscape Assessment* in **Appendix C**.

2.3.3 Summary

Section 8.0, Table 8-1 identifies potential impacts to the Cultural Heritage Environment as a result of the proposed improvements to WR 124, as well as mitigating and/or monitoring measures to reduce net impacts.

Figure 2-4: Built Heritage and Cultural Landscape Assessment

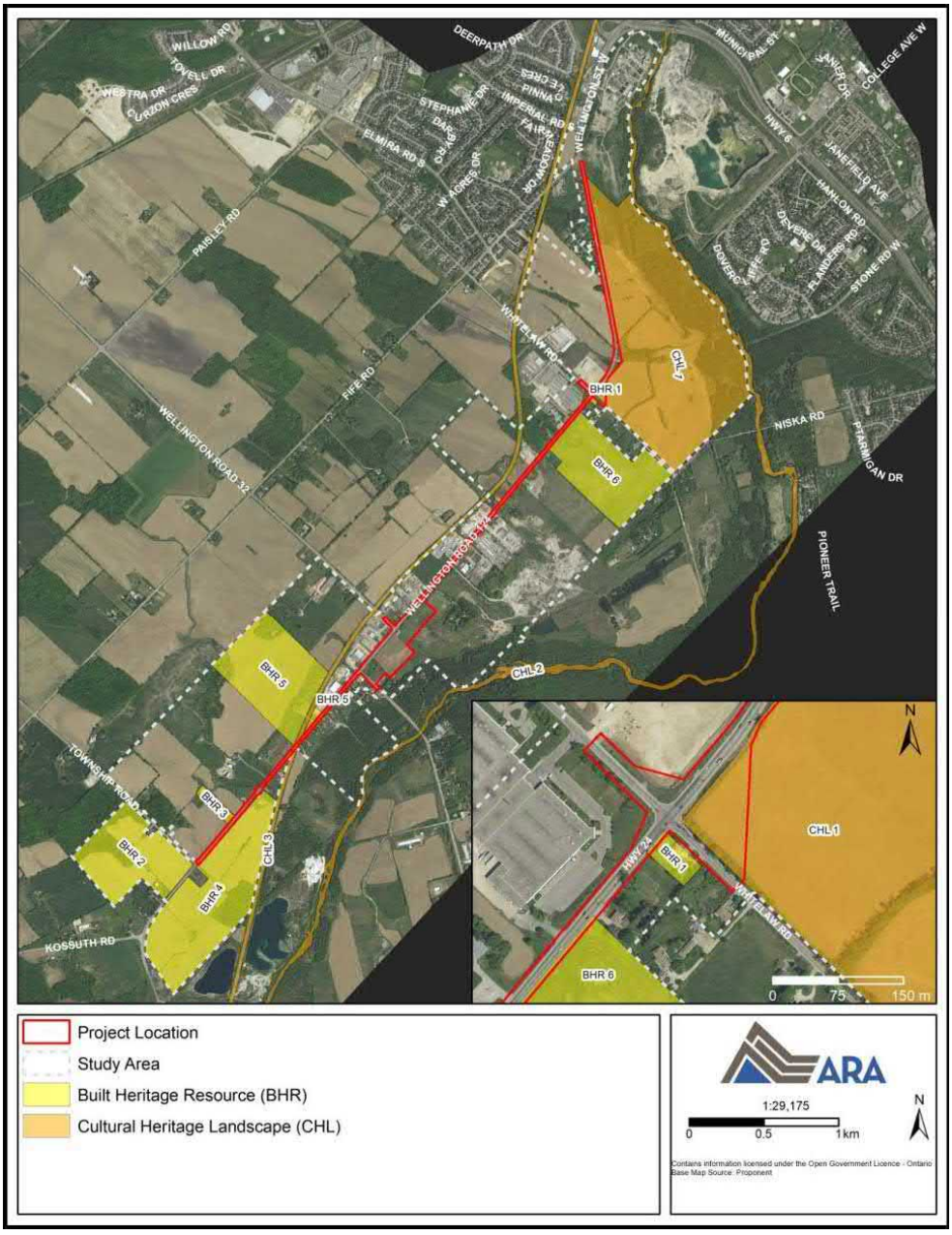


Table 2.1: Built Heritage Resources

Type/ Number	Address/Name	Value Statement(s)	Heritage Attributes
BHR 1	5050 Whitelaw Road	Good example of a stone farmhouse and associated with the farming community of Gourock, and the Dooley family.	Key heritage attributes include: two storey, three bay building with stone construction of two bays; two stone chimneys; datestone; and prominent location on the corner of Whitelaw Road and County Road 124.
BHR 2	6902 County Road 124	Barn and wood outbuilding contribute to the agricultural character of the area.	Key heritage attributes include: barn with gable roof and stone foundation; wood outbuilding with gable roof; location setback from road.
BHR 3	6920 County Road 124	Heavily treed lot and barn contributes to the rural character of the area.	Key heritage attributes include: barn with gable roof.
BHR 4	6939 County Road 124	Representative example of a Gothic Revival farmhouse and farm complex contributes to the agricultural character of the area.	Key heritage attributes include: Gothic Revival farmhouse with gable roof; lancet window opening in central gable; central entranceway flanked by a window on each side; rear addition; and barn with gable roof and stone foundation.
BHR 5	6974 County Road 124	Good example of a bank barn with an extended forebay and barn contributes to the agricultural character of the area.	Key heritage attributes include: stone wall visible to the Southeast of the modern house; bank barn with gable roof and stone foundation; extended forebay and four small windows in the side elevation; additional outbuildings; setback from the road on a rise of land; and situation adjacent to the G&GR Railway.
BHR 6	7133 County Road 124	Representative example of an Arts & Crafts style residential structure.	Key heritage attributes include: two-storey Arts & Crafts style house; large gable on façade; gable over front door supported by large brackets; dark bricks and wood accents; and placement setback from the road surrounded by mature trees.

Table 2.2: Cultural Heritage Landscapes

Type/ Number	Address/Name	Value Statement(s)	Heritage Attributes
CHL 1	7189 & 7263 County Road 124	Representative agricultural landscape and contributes to the agricultural character of the area.	Key heritage attributes include: agricultural fields; proximity to the Speed River; and views to the forested Speed River valley.
CHL 2	Speed River	Influenced the settlement of the area. Has been the ancestral home of First Nations peoples for 10,000 years; the Speed River CHL is important in defining, maintaining or supporting the character of an area as it dominates the landscape; the Speed River CHL is physically, functionally, visually and historically linked to its surroundings as it was a principle factor in influencing settlement patterns; the Speed River feeds into the Grand River, and the Grand River watershed is one of the best-known watersheds in Southwestern Ontario and is nationally designated as a Canadian Heritage River; the Speed River CHL is a landmark in the community; views to and from the river represent important scenic landscapes.	Key heritage attributes include: dams, mill ponds and industrial buildings along the river; agricultural uses and settlement along the river; recreational access including public parks, natural areas and trails; and areas of archaeological potential.
CHL 3	G&GR Railway	The G&GR CHL is a representative and early example of railway construction.	Key heritage attributes include: its original form and layout (i.e., length, width and construction methods); and its physical appearance and setting; views of the railway crossings and vistas along the trajectory of the historic route; and at grade crossing at County Road 124.

2.4 Transportation Conditions

As part of this Class EA Study, Paradigm Transportation Solutions Ltd. (Paradigm) documented current traffic conditions, operational deficiencies, and constraints experienced by the public travelling within the study area. The operational deficiencies and constraints identified are fundamental to the process of identifying what traffic and operational problems exist and to identify alternatives to address current and future requirements. A copy of their detailed Transportation Study is contained in Appendix D.

2.4.1 Road Network

In addition to Wellington Road 124 (WR 124), the main roadways reviewed as part of this study include Wellington Road 32 (WR 32), Guelph-Eramosa Township Road 1, Whitelaw Road and Fife Road. The sections of Fife Road, Beech Street, Shadow Drive, Whitelaw Road just north of WR 124, and WR 124 east of Fife Road are under the jurisdiction of the City of Guelph. The section of Township Rd 1 north of WR 124 and Whitelaw Road South of WR 124 are under the jurisdiction of the Township of Guelph-Eramosa. WR 124 west of Fife Road and intersecting roads WR 32 North and WR 32 South are under the jurisdiction of Wellington County. The characteristics of these roadways are as follows:

- ✓ WR 124 is an east-west, two-lane roadway with a rural cross-section, and one travel lane per direction. The posted speed limit is 70 kilometres per hour, decreasing to 60 kilometres per hour east of Fife Road in the City of Guelph. The WR 124 intersection with WR 32 South, WR 32 North, Whitelaw Road, and Fife Road operate with traffic control signals.

- ✓ Township Road 1 is a north-south, two-lane roadway with a rural cross-section and one travel lane per direction. The maximum speed limit is unposted and is assumed to be 50 kilometres per hour. The intersection at WR 124 is under minor street (Township Road) Stop sign control. Intersection improvements were undertaken in November 2018, and they included the addition of a Southbound left-turn lane on Township Road 1, and an eastbound left-turn lane on WR 124.

- ✓ WR 32 South is a north-south, two-lane roadway with a rural cross-section, and one travel lane per direction. The posted speed limit within the vicinity of WR 124 is 60 kilometres per hour. WR 32 South intersects WR 124 at a T intersection to the east of Township Road 1. A private driveway is included as the north leg at the intersection, which is under traffic signal control.

- ✓ WR 32 North is a north-south, two-lane roadway with a rural cross-section, and one travel lane per direction. The posted speed limit within the vicinity of WR 124 is 80 kilometres per hour. WR 32 North intersects WR 124 at a T-intersection

approximately 370 metres to the east of WR 32 South. The intersection is under traffic signal control.

- ✓ Whitelaw Road is a north-south, two-lane roadway with a rural cross-section and one travel lane per direction, extending from Paisley Road in the north and to Niska Road to the Southeast. At the start of this WR 124 study, the Niska Road bridge was closed, but was expected to be re-opened prior to the completion of this study. The Niska Road Bridge was in fact re-opened in October 2019. North of WR 124, the roadway has a posted speed limit of 60 kilometres per hour. South of WR 124, the roadway has a posted speed limit of 50 kilometres per hour.
- ✓ Beech Street and Shadow Drive are both Guelph Eramosa Township residential streets, intersecting WR 124 just west of Fife Road.
- ✓ Fife Road is an east-west, three-lane roadway with an urban cross-section and one travel lane per direction, and a centre two-way left-turn lane. The posted speed limit is 50 kilometres per hour. Pedestrian sidewalk facilities are provided on both sides of Fife Road within the study area. Cycling facilities in the form of designated bike lanes are provided on both sides of the roadway. Fife Road is a City of Guelph Street at its intersection with WR 124 within the boundaries of the City of Guelph.

Figure 2.5 details the existing lane configurations and traffic controls at the study area intersections as documented in mid-2018.

2.4.2 Existing Traffic Conditions

2.4.2.1 Base Year (2018) Traffic Volumes

To establish base year traffic conditions, eight-hour turning movement counts were undertaken at the five study intersections, on Tuesday 5 June 2018 from 7:00 AM to 9:00 AM, 11:00 AM to 2:00 PM and 4:00 PM to 7:00 PM.

All traffic movements including pedestrian crossings were counted in 15-minute intervals and vehicles were classified by type. Due to the presence of several driveway connections between the study intersections, volume balancing between intersections has not been applied.

The morning and afternoon peak hours were generally identified as 7:30 AM to 8:30 AM and 4:30 PM to 5:30 PM, respectively.

Figure 2.6 summarizes the existing weekday AM and PM peak hour traffic volumes. Raw traffic count data can be found in the Paradigm report in **Appendix D.**

Figure 2-5: Existing Lane Configurations and Traffic Control (2018)

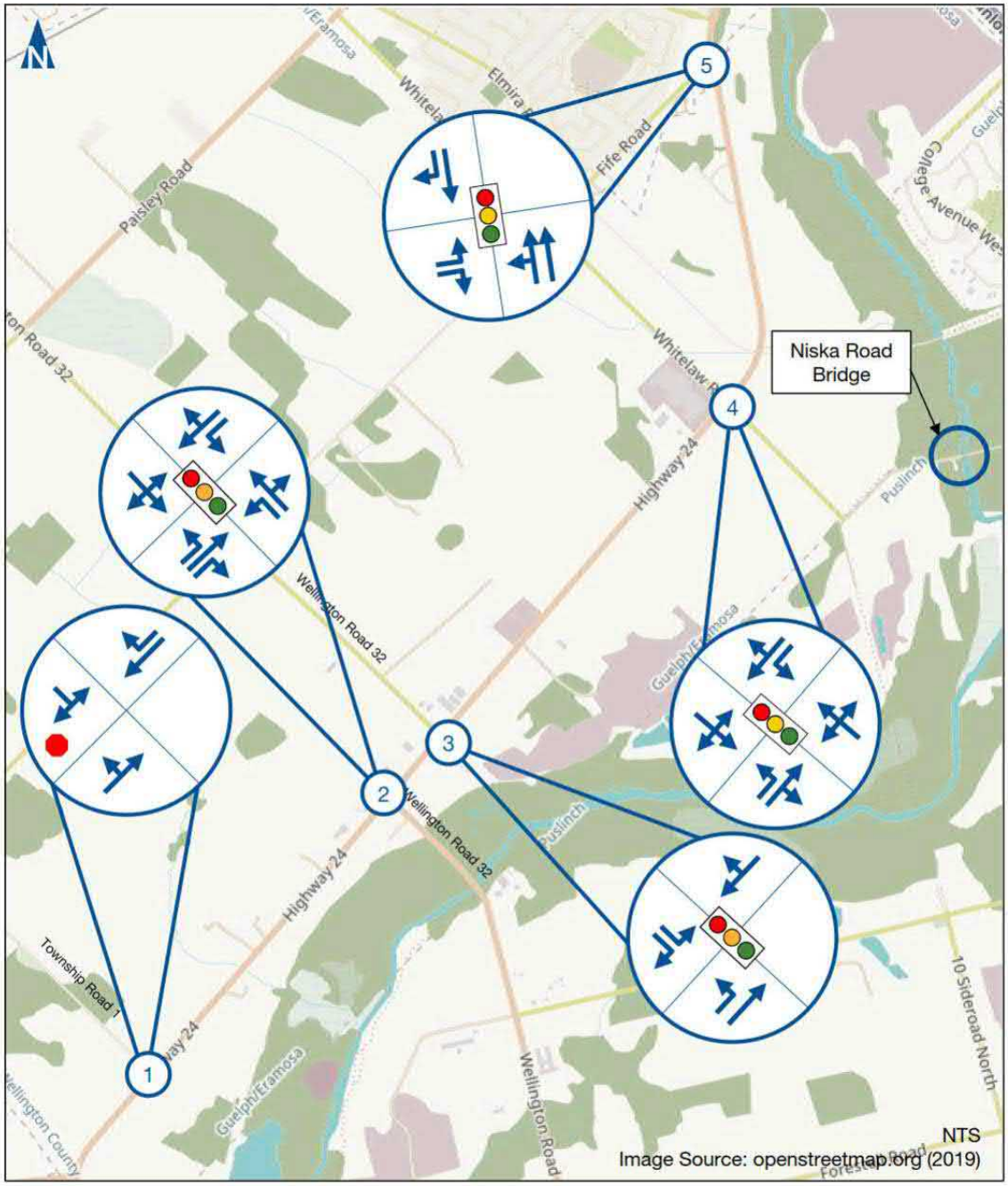
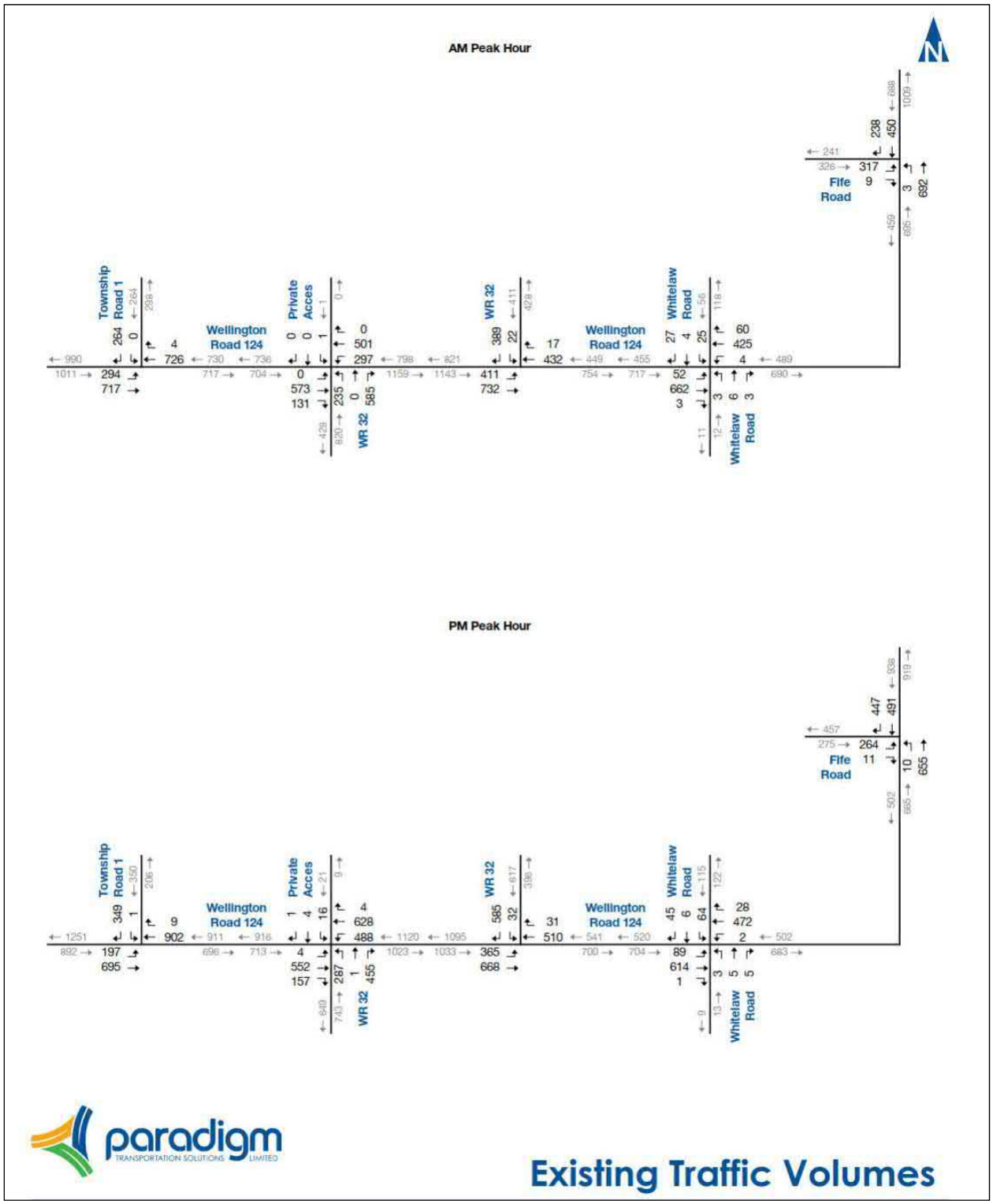


Figure 2-6: Existing Traffic Volumes (2018)



2.4.2.2 Intersection Operations

The operations of the WR 124 intersections were analysed using Synchro 9 with Highway Capacity Manual (HCM) 2000 procedures. The key parameters used in the analysis include:

- ✓ Existing (2018) traffic volumes;
- ✓ Existing lane configurations as noted at the date of the traffic counts (June 2018);
- ✓ Signal timing data as provided by Wellington County, and the City of Guelph, included for reference in **Appendix B** of the Paradigm Transportation Study Report;
- ✓ Heavy vehicle percentages, overall intersection peak hour factors (PHF) and conflicting pedestrian volumes as derived from the existing turning movement counts; and
- ✓ Synchro default values for all other inputs.

Intersection level of service (LOS) is a recognized method of quantifying the average delay experienced by drivers at intersections. It is based on the delay experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles desiring to make a particular movement, compared to the estimated capacity for that movement. The capacity is based on a number of criteria related to opposing traffic flows, intersection geometry and traffic control.

Table 2.3 contains the level of service criteria for signalized and stop-controlled intersections. The highest possible rating is LOS A, under which the average total delay is equal or less than 10.0 seconds per vehicle. When the average delay exceeds 80 seconds for signalized intersections, 50 seconds for unsignalized intersections or when the volume to capacity ratio is greater than 1.00, the movement is classed as LOS F, and remedial measures are usually implemented, if they are feasible. LOS E is usually used as a guideline for the determination of road improvement needs on through lanes, while LOS F may be acceptable for left-turn movements at peak times, depending on delays.

Table 2.3: Level of Service Definition

Level of Service	Signalized Intersections Average Total Delay (sec/veh)	Unsignalized Intersections Average Total Delay (sec/veh)
A	< = 10	< = 10
B	> 10 & < = 20	> 10 & < = 15
C	> 20 & < = 35	> 15 & < = 25
D	> 35 & < = 55	> 25 & < = 35
E	> 55 & < = 80	> 35 & < = 50
F	> 80	> 50

The intersection analysis considered the following operational performance measures of effectiveness:

- ✓ The LOS, based on the average control delay for each vehicle, for each turning movement;
- ✓ The volume to capacity ratio for each movement, where applicable; and
- ✓ The estimated 95th percentile queue length.

The detailed results of the operational performance measures for WR 124 intersections under existing (base year) traffic volumes for the weekday AM and PM peak hours can be found in the Paradigm Transportation Study Report contained in **Appendix D**. The following critical movements are noted at WR 124 & WR 32 South:

- ✓ In the AM peak hour, the northbound left-turn movement is operating at LOS F, with a v/c ratio of 1.03, and with 95th percentile queues exceeding available lane storage by 56 metres;
- ✓ In the AM peak hour, the northbound shared through/right-turn movement is operating at LOS F, with a v/c ratio of 0.95;
- ✓ In the PM peak hour, the northbound left-turn movement is operating at LOS F, with a v/c ratio of 1.15 and with 95th percentile queues exceeding available lane storage by 73 metres; and
- ✓ In the PM peak hour, the whole intersection is approaching capacity, operating at LOS D with a v/c ratio of 0.96.

The analysis results indicate all other intersections and movements are operating with generally acceptable levels of service. The Paradigm Transportation Study Report contained in **Appendix D** contains additional details including the detailed Synchro reports.

It is also noted that the Transportation Study initially analyzed the intersections of WR 124 and Township Road 1 and WR 124 and Whitelaw Road based on conditions current at the time. However, the Transportation Study was updated to also include the recently constructed improvements at WR 124 and Township Road 1, as well as future conditions at WR 124 and Whitelaw Road when the Niska Road Bridge is open.

2.4.3 Review of Collision History

Wellington County's Ontario Provincial Police (OPP) Detachment provided an inventory of all motor vehicle collisions (MVCs) on WR 124 from Township Road 1 to Fife Road for the period January 1, 2008 to December 31, 2017 (inclusive). The City of Guelph provided collision data for the intersection of WR 124 & Fife Road for the same period. A total of 550 motor vehicle collisions were recorded over this period. Table 2.4 summarizes the general location and type of each collision.

Table 2.4: Motor Vehicle Collision Summary

Location	Motor Vehicle Collision Type						Total
	PD	PD (NR)	FTR	PI	PI (FTR)	Fatal	
WR 124 at Township Road 1	47	20	2	12	3	0	84
WR 124 between Township Road 1 and WR 32	37	16	0	6	1	0	60
WR 124 at WR 32	154	25	10	31	0	1	221
WR 124 between WR 32 and Whitelaw Road	28	3	3	8	0	0	42
WR 124 at Whitelaw Road	68	23	5	11	0	0	107
WR 124 between Whitelaw Road and Fife Road	9	6	0	5	0	1	21
WR 124 at Fife Road	9	4	0	2	0	0	15
Total	**352**	**97**	**20**	**75**	**4**	**2**	**550**

PD – Personal Damage
PD (NR) – Personal Damage, No Response
FTR – Fail to Remain
PI – Personal Injury
PI (FTR) – Personal Injury, Fail to Remain

Of the 550 collisions documented, 82% involved property damage only, 14% involved a personal injury, and there were two fatalities (0.4%). The remaining 3.6% involved “fail to remain” collisions with no noted injuries. A total of 81 collisions involving injuries were reported (75 personal injury, four failing to remain, and two fatal collisions).

The largest number of collisions (221) was around the section of WR 124 at or between WR 32 North and WR 32 South. The records do not specify the locations relative to the North and South legs of WR 32, or the midblock between them. The second, third and the fourth largest locations (107, 84 and 60 collisions) were at Whitelaw Road, at Township Road 1 and between Township Road 1 and WR 32 respectively. The number of collisions is under 50 between WR 32 and Whitelaw Road (42) and between Whitelaw Road and Fife Road (21). There have been 15 recorded collisions at WR 124 and Fife Road over the last ten years.

The two (2) fatal collisions occurred on WR 124 between Whitelaw Road and Fife Road, and in the vicinity of WR 124 and WR 32. No further information related to time of day, day of week, weather or driver actions were provided in the dataset.

The four (4) personal injury collisions involving a vehicle or vehicles failing to remain on scene occurred at the intersection of WR 124/Township Road 1, or midblock between Township Road 1 and WR 32 South. No further information related to time of day, day of week, weather or driver actions were provided in the dataset.

Seventy-five (75) personal injury collisions occurred throughout the study area. It is noted that the frequency of personal injuries is higher at intersections as opposed to midblock. No further information related to time of day, day of week, weather or driver actions were provided in the dataset.

Collision information provided by the City of Guelph for the intersection of WR 124/Fife Road does not provide information in terms of driver action or condition. However, information related to time of day, collision type, lighting and environment conditions is provided. The following are noted from the dataset of 15 collisions:

- ✓ The majority of collisions included rear-end (7), turning movement (3) or single motor vehicle collisions (3). The remaining collisions comprised one approaching collision and one sideswipe collision;
- ✓ The majority of collisions (12) occurred under clear conditions. One collision occurred during snow, and the other two (2) during rain; and
- ✓ Ten (10) collisions occurred during daylight hours and two (2) occurred during night/dark conditions. The remaining collisions (3) occurred during dawn or dusk.

Overall, the data indicates the majority (81.6%) of the collisions involved property damage, 22% of which did not permit a response (i.e. self-reported collision). A total of 81 collisions involving injuries occurred, comprising two (2) fatal injuries, and 79 serious or minor injuries. The dataset and summary of collisions appear to indicate injuries were more frequent at intersections rather than midblock. No other trends or patterns could be extracted from the dataset.

2.5 Utilities

2.5.1 Gas

There is a Union Gas Gate Station Site (pressure regulator station) located just South of WR 124 at the intersection with WR 32 North. Union Gas has indicated a minimum clearance requirement of 20 m from their station to the road right-of-way. Station Technicians must be able to safely and readily access the station for maintenance and repair purposes.

There is an existing NPS 8 high pressure steel 3450 kPa transmission gas pipeline at the Gate Station Site. Minimum cover of 1.2 m is required for transmission pipelines. There is also an existing NPS 8 intermediate pressure steel gas main out of this station that runs

on the north side of WR 124 from WR 32 North easterly to Whitelaw Road that feeds the west side of Guelph. Minimum cover of 1.0 m is required for distribution pipelines.

There are smaller gas lines supplying homes and businesses throughout the project area, specifically on the South side of WR 124 from the CN Rail crossing to WR 32 North and on the north side of WR 124 from the Shadow Drive subdivision to Fife Road.

2.5.2 Area Hydro, Bell and Cable

Hydro One has high voltage transmission and distribution facilities within the study area. There are hydro towers and a transmission line running along the north side of WR 124. The transmission line enters the project limits when it crosses from the South side to the north side of WR 124 just east of Township Road 1. It continues following the road until Whitelaw Road where it turns north across Whitelaw Road. The Hydro One corridor intersects WR 124 again just after the curve in the road. Any transmission line or tower replacement and/or relocation would require a Class Environmental Assessment for Minor Transmission Facilities be completed. Estimated cost to relocate a Hydro One tower is a minimum of $1,000,000.

From Township Road 1 to Whitelaw Road, Bell have aerial lines on Bell-owned joint-use poles (with Hydro One) on the South side of WR 124 with overhead crossings to properties on the north side of the road. Additionally, there are several buried sections of cable (road crossings/building feeds) coming off of the pole lines. Bell has manholes, structures and direct buried cables between Whitelaw Road and Fife Road.

2.5.3 Municipal Services

The majority of properties within the study area are currently serviced by septic and well systems. There are HDPE/CSP storm pipes and related structures running along the north side of WR 124 in the vicinity of the Shadow Drive subdivision. There are some additional buried storm pipes including driveway culverts scattered throughout the study limits and a number of culverts crossing under WR 124.

2.6 Drainage

The study area is located within the Lower Speed River Watershed. The main drainage area comprising this watershed is the Speed River to the South, with a tributary of Ellis Creek crossing WR124 in the western portion of the study area and another watercourse named “Tributary A” crossing WR 124 between Whitelaw Road and Shadow Drive.

WR 124 can generally be described as having a relatively flat profile with a majority of longitudinal grades under 1%, with some short sections having a longitudinal grade of between 2% and 3%. In addition, WR 124 in the vicinity of Beech Street and Shadow Drive has a longitudinal grade of between 3% and 4%.

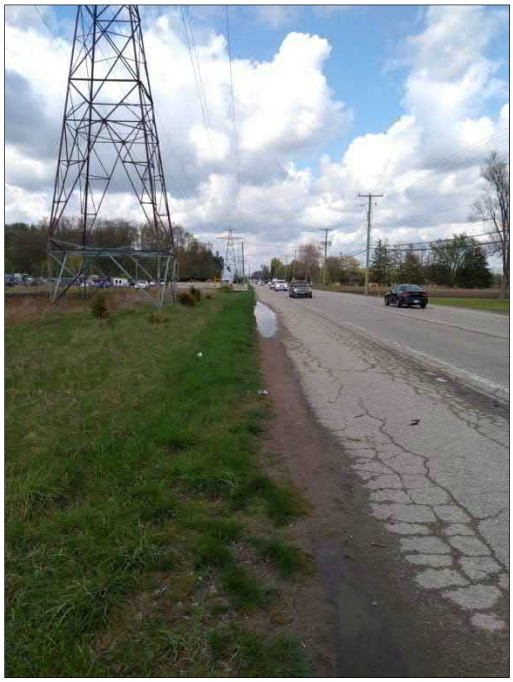
Other than a few sections where there are buried storm pipes, drainage is either accommodated by open ditches or direct runoff onto private property. As evidenced by gravel pits in the area, it appears that in many areas the drainage infiltrates directly into the natural granular substrate as opposed to ponding or draining towards a watercourse. However, there are a number of watercourses and culverts crossing WR 124 that do provide a drainage outlet as follows:

- ✓ Ellis Creek box culvert crossing approximately 700m east of Township Rd 1, which flows South towards the Speed River;
- ✓ Pipe culvert crossing at the CN Rail tracks approx. 300m east of Ellis Creek, which outlets along the tracks;
- ✓ Box culvert approximately 130m east of WR 32 South, (between the Welmar and Superior Propane properties) which outlets to the South
- ✓ An enclosed storm sewer running South on WR 32 South (west side) that appears to drain a small storm sewer system in the vicinity of WR 124 and WR 32 South, and outlets into the WR 32 South ditch and drains toward the Speed River;
- ✓ Pipe culvert approximately 900m west of Whitelaw Road which does not appear to have a defined outlet channel;
- ✓ Box culvert approximately 600m west of Whitelaw Road which does not appear to have a defined outlet channel;
- ✓ Box culvert approximately 300m east of Whitelaw Road, which drains a watercourse (Tributary A) to the South;
- ✓ Pipe culvert approximately 500m east of Whitelaw Road on the west side of the Hydro One easement crossing, which appears to drain to the South;
- ✓ Pipe culvert approximately 300m west of Fife Road which outlets the small storm system on the north side of WR 124, and drains into the field on the South side.

2.7 Pavement Condition

The road surface of WR 124 between the project limits is made up of flexible bituminous pavement. There may also be some original concrete road sections remaining under the asphalt travel lanes. The existing pavement is in deteriorated condition, with many locations showing cracking and disintegration of the pavement surface. Heavy traffic loading and poor drainage are contributing factors to the current pavement condition. There are examples of longitudinal cracking through the intersection, rutting and “alligator cracking” at the edge of the lane, and disintegration of the shoulder and transverse cracking across the lanes in as illustrated in Figure 2.7.

Figure 2-7: Pavement Condition Photos



3.0 TRAFFIC ANALYSIS

3.1 Future Traffic Forecasts

In order to analyze traffic conditions in the future if no improvements were undertaken, traffic projections for both the years 2031 and 2041 were calculated. Details of these projections are found in the Paradigm Transportation Study in Appendix D. Traffic projections for the 2031 and 2041 horizons are based on historic traffic growth on WR 124 and the general population growth in Wellington County and the City of Guelph.

Historic traffic patterns were reviewed using traffic count data on WR 124 from 2013 to 2016. The year to year growth rates among the individual eastbound and westbound road sections was found to vary from road section to section. The variability in these growth rates can be partially attributed to the limited number of available traffic counts and the various times of year in which the data was collected.

When the data is considered directionally, eastbound volumes have grown at a daily average of 1.75% and westbound volumes have decreased at an average of 0.51% from 2013. The average daily growth rate between the project limits of WR 124 as a whole is 0.62%. Table 3.1 summarizes the estimated average growth rates directionally and temporally.

Table 3.1: Historic Growth Rates

Direction	AM Peak Hour	PM Peak Hour	Daily
Eastbound	2.09%	1.41%	1.75%
Westbound	-0.46%	-0.57%	-0.51%
Both Directions	0.82%	0.42%	0.62%

Based on these historic growth rates, a growth rate of 2% compounded per annum was assumed to forecast traffic volumes to 2031. A lower growth rate of 1.5% compounded per annum was assumed to forecast traffic volumes between 2031 and 2041. These growth rates are considered to be conservative and align with industry standard growth rates when forecasting future traffic volumes. In addition, they are also consistent with the population growth projections in Wellington County and the City of Guelph from 2016 to 2031 and 2041.

3.2 2031 Traffic Operations

The operations of WR 124 intersections were analysed at the future 2031 horizon year using the existing intersection configurations and the same assumptions and parameters as in the analysis of existing conditions; however, signal timing splits and cycle lengths were optimized to accommodate the forecast growth in traffic. Details of these projected operations are found in the Paradigm Transportation Study in Appendix D. This analysis forecasted the following for 2031:

- ✓ The intersection of WR 124 & Township Road 1 is forecast to operate with poor levels of service, and well beyond capacity on the Southbound approach in both peak hours. This is due to the large volume of traffic on WR 124 which limits the number of gaps for side street traffic to enter the traffic stream. This poor level of service will result in congestion at Township Road 1, potentially resulting in turning vehicles taking unnecessary risks at this intersection;
- ✓ The intersection of WR 124 & WR 32 South is forecast to operate with several critical movements, and high levels of delay during both peak hours. Projected queue lengths exceed available storage for NB and WB left-turns;
- ✓ The intersection of WR 124 & WR 32 North is forecast to operate within capacity in the AM peak hour. However, in the PM peak hour, the intersection is forecast to operate beyond capacity;
- ✓ The intersection of WR 124 & Whitelaw Road is forecast to operate within capacity during both peak hours, with no critical movements; and
- ✓ The intersection of WR 124 & Fife Road is forecast to operate within capacity during both peak hours. The potential queue spillback in the AM peak hour could be accommodated within the existing two-way left turn lane on Fife Road.

3.3 2041 Traffic Operations

The operations of existing WR 124 intersections were also analysed at the 2041 horizon year using the existing intersection configurations and the same assumptions and parameters as in the analysis of existing conditions; however, signal timing splits and cycle lengths were optimized to accommodate the forecast growth in traffic. Details of these projected operations are found in the Paradigm Transportation Study in Appendix D. This analysis forecasted the following for 2041:

- ✓ The intersection of WR 124 & Township Road 1 is forecast to operate with poor levels of service, and well beyond capacity on the Southbound approach in both peak hours. This is due to the large volume of cross-traffic which limits the number of gaps for side street traffic to enter the traffic stream. This poor level of service will result in congestion at Township Road 1, potentially resulting in turning vehicles taking unnecessary risks at this intersection;

- ✓ The intersection of WR 124 & WR 32 South is forecast to operate with several critical movements, and high levels of delay during both peak hours. Projected queue lengths exceed available storage for NB and WB left-turns;
- ✓ The intersection of WR 124 & WR 32 North is forecast to operate with several critical movements, and high levels of delay during both peak hours;
- ✓ The intersection of WR 124 & Whitelaw Road is forecast to operate within capacity during both peak hours, with no critical movements; and
- ✓ The intersection of WR 124 & Fife Road is forecast to operate within capacity during both peak hours. The potential queue spillback in the AM peak hour could be accommodated within the existing two-way left turn lane on Fife Road.

4.0 EA PHASE 1: PROBLEM STATEMENT

Under Phase 1 of the Schedule "C" Class EA process, the problem (deficiency) or opportunity must be identified. A "Problem Statement" is prepared which describes, in detail, the various issues needing to be addressed by the Class EA study. In essence, the Problem Statement outlines the need and justification for the overall project and establishes the general parameters, or scope, of the study.

Most everyone who regularly travels WR 124 within the study area, experience regular problems with congestion, especially during peak hours. Based on the traffic analysis, and a review of the pavement and drainage conditions, the following Problem Statement was developed for the WR 124 Class EA study:

> *WR 124 from Township Road 1 to Fife Road is in need of improvements in order to address existing traffic-carrying deficiencies including poor/deteriorating levels of service at the intersections with WR 32 North and 32 South as well as plan for future growth along this important corridor. Improvements must also address the existing pavement condition while providing safe public access to the greatest possible extent.*

5.0 EA PHASE 2: DEVELOPMENT & EVALUATION OF ALTERNATIVE SOLUTIONS

Under Phase 2 of the Class EA process, all reasonable solutions to the problem (i.e. planning alternatives) are identified and described, including the "Do Nothing" alternative. Planning alternatives are alternative solutions to the problem or opportunity in the transportation network. Planning alternatives are identified by taking into consideration factors such as the existing environment, as well as public and agency input and establishing a preferred solution. The Environmental Assessment Act (EAA) requires that all reasonable planning alternatives to the undertaking be considered during the decision making process.

Solutions to address the Problem Statement that have been considered in the project planning and various background studies include:

5.1 Do Nothing

The Class EA process explicitly requires consideration of a "Do Nothing" alternative, which represents the effect on the transportation network of choosing to not complete any network improvements. In practical terms, 2031 and 2041 projected traffic conditions represented by "doing nothing" would, at minimum, result in additional delays to commuters, goods movement, emergency vehicles, etc. Delays to goods movement would have a negative impact, particularly on the industrial and commercial base along WR 124 which depends on timely shipments of goods; as well as industries and the larger economy in the Wellington County and City of Guelph which relies on timely movement of vehicles and people.

5.2 Non-Structural Improvements

This alternative refers generally to using alternative modes to accommodate travel demands: e.g. public transit, cycling, and walking. The background traffic information and counts received from the City of Guelph and Wellington County have considered these improvements as part of the overall system planning process, and included growth in PM peak hour mode share. However, even with these improvements, the existing capacity deficiencies are not addressed and would worsen significantly in the mature state. While non-structural improvements are a critical component of addressing long-term transportation needs, alone they are not sufficient to address all long-term needs.

It is important to note that in 2019 after the Wellington Rd 124 study was almost completed, the Region of Waterloo was examining alternatives to providing a GO train connection between Cambridge and Toronto (Union Station) via Guelph along the CN's Fergus Subdivision. The tracks of the Fergus Subdivision currently cross Wellington Rd

124 between Township Road 1 and WR 32 South. The thinking is that trains could utilize the Fergus Subdivision to provide a GO rail connection for residents of Cambridge to the existing GO line between Kitchener and Toronto via Guelph. Although its main purpose would be to carry passengers from Cambridge to Toronto, an added benefit would be to accommodate "Cambridge to Guelph" destination commuters.

At the time of writing of this report, this Fergus Subdivision Feasibility Study is in its very early stages, and it would be many years (at least 10 years) before implementation would occur if future decisions and approvals were made to proceed with this proposed train service. Given the existing issues with traffic congestion and pavement deficiencies, as well as significant traffic volumes from areas other than Cambridge, a new commuter rail line between Cambridge and Guelph would not address the project Problem Statement.

5.3 Improvements to Fife Road

Fife Road is a Township Road and City Street that parallels WR 124 approximately 1.3 km north and west of WR 124. Fife Road connects to WR 124 at the east end of the study area, and via Township Road 1 in the west. It is currently a suburban collector road within the City of Guelph and a rural road within the Township of Guelph-Eramosa. Although improving Fife Road to handle additional traffic may address some of the problems to be addressed on WR 124, Fife Road is outside the Wellington County's jurisdiction. In addition, increased traffic on Fife Road would require structural improvements, property purchases and compromise safety on this suburban/rural road with several residences. Improvements to Fife Road are therefore not considered a viable solution to address the WR 124 Class EA Study.

5.4 Improvements to Highway 7

Highway 7 between Kitchener and Guelph is an "east-west" provincial highway that parallels the eastern portion of WR 124, approximately 5.5 km to the north and west of WR 124. The MTO has been planning improvements for a new Highway 7 between Kitchener and Guelph for several years, and has moved forward with the early stages of this project. The approved improvements include a controlled access freeway to address the existing transportation deficiencies (volume and safety) on the highway between Kitchener/Waterloo and Guelph. However, WR 124 mainly serves traffic from Cambridge and areas to the South in addition to Kitchener and Guelph, and provides an important local and "county/regional" transportation facility. As a result, traffic on WR 124 will continue to grow regardless of whether Highway 7 is improved and widened.

5.5 Construct County Rd 124 on a New Alignment

In the 1980's, prior to the Province "downloading" Highway 24 to Wellington County, the MTO was working on a study to construct a new Highway 24 to the north of existing WR 124. This realignment would have impacted several existing private properties with many social and environmental impacts, making it a very expensive new roadway to construct. When the Province downloaded Highway 24 to Wellington County there were no funds included from the Province to construct a realigned and new Highway 24. As a result of the significant impacts and cost of a realigned WR 124, this solution is not considered viable.

5.6 Construct Improvements to Wellington Rd 124

This solution could include widening, intersection improvements, reconstruction and other ancillary improvements to the existing WR 124. Areas proposed for widening and improvements to intersections would be determined based on the traffic study completed for this project. Areas proposed for reconstruction would be determined based on existing drainage and road base structural problems, as well as a future geotechnical study to determine areas where the road base has insufficient strength. Included as part of these improvements could be intersection improvements including roundabouts, drainage and culvert improvements (i.e. new storm sewers, curb and gutter), auxiliary lane construction, utility relocations, and enhancements for pedestrians and cyclists.

5.7 Summary and Recommended Alternative Solution

Based on the above discussion regarding the Alterative Solutions, the Recommended Solution is considered to be a combination of:

- ✓ Construct Improvements to WR 124; and
- ✓ Implement non-structural improvements to enhance cycling and pedestrian feasibility.

Other improvements to existing highways and adjacent roads will continue to be implemented, however the traffic studies for this project has shown the need for improvements to WR 124 even with other road improvements outside the study area being completed by other jurisdictions.

6.0 EA PHASE 3: DEVELOPMENT & EVALUATION OF ALTERNATIVE DESIGN CONCEPTS FOR THE PREFERRED SOLUTION

6.1 Alternative Design Concepts Considered

Given the combination of alternative solutions to be considered, namely:

- ✓ Construct Improvements to WR 124;
- ✓ Implement non-structural improvements to enhance cycling and pedestrian feasibility,

The range of alternative design concepts considered were broken down into three main categories:

Cross Section – Road cross sections that can provide upgrades or improvements to the existing rural cross section, addressing drainage, lane widths, alternative modes of transportation and functional or operational issues. Cross section alternatives include:

- ✓ Rural Cross Section – Through traffic lanes with paved shoulders and drainage accommodated by roadside ditches;
- ✓ Urban Cross Section: - Through traffic lanes with Semi-Mountable or "rollover curb and gutter, with catchbasins and storm sewers to accommodate drainage, and a paved area behind the curb and gutter.

Number of Lanes – Various lane combinations to address congestion and/or safety. The number of lanes considered was:

- ✓ 2 Lane – one lane in each direction with turn lanes at intersections as required;
- ✓ 3 Lane – one lane in each direction with a centre two way left turn lane in selected areas with turn lanes at intersections as required;
- ✓ 4 Lane – two lanes in each direction with turn lanes at intersections as required.

Intersection Improvements

- ✓ Signalized Intersections with Turn Lanes
- ✓ Roundabouts

These alternatives were evaluated and presented at Public Information Centre No. 1. The various cross section and lane number alternatives are illustrated in Figures 6.1, 6.2 and 6.3.

Figure 6-1: 2-Lane Cross Section Alternatives

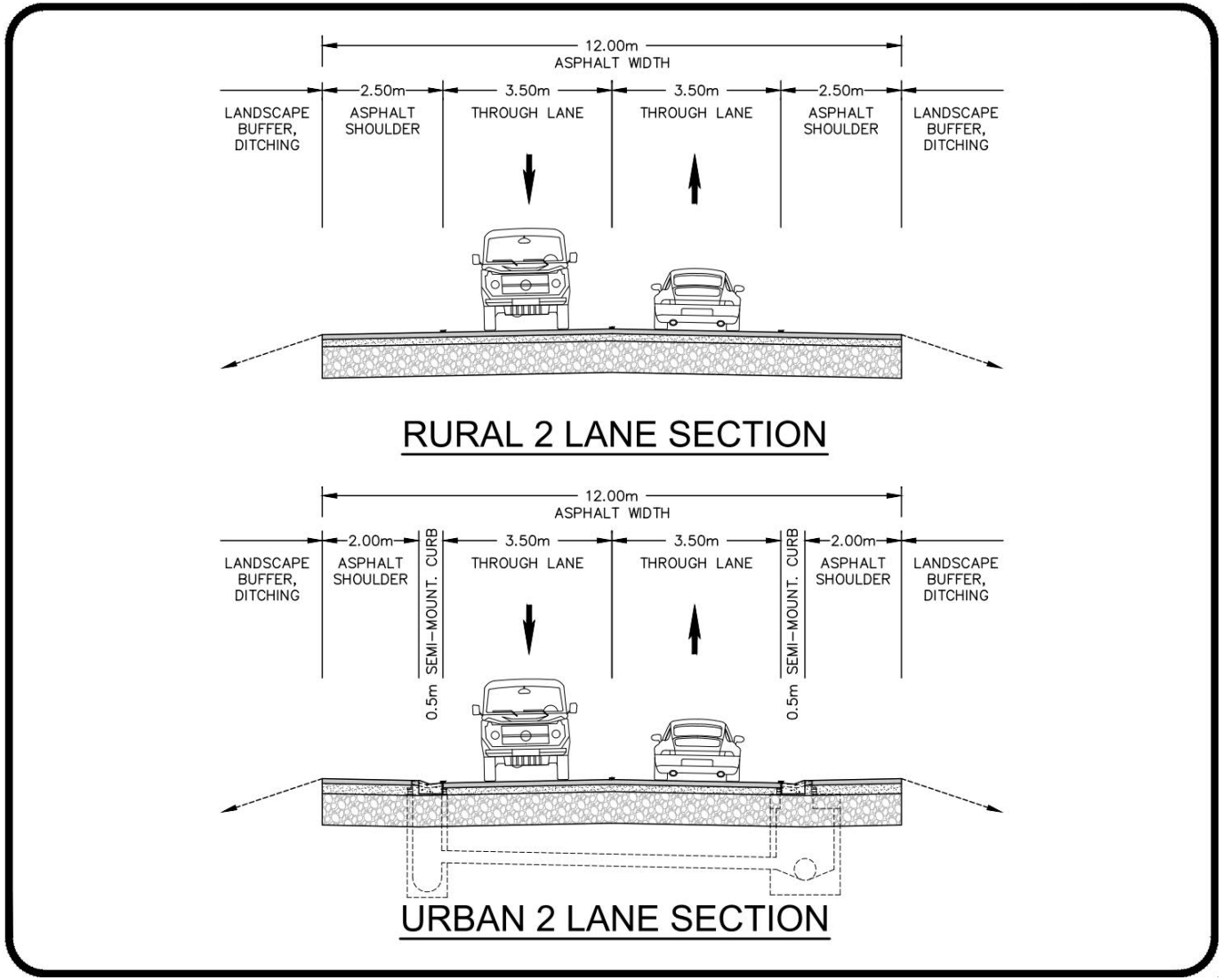


Figure 6-2: 3-Lane Cross Section Alternatives

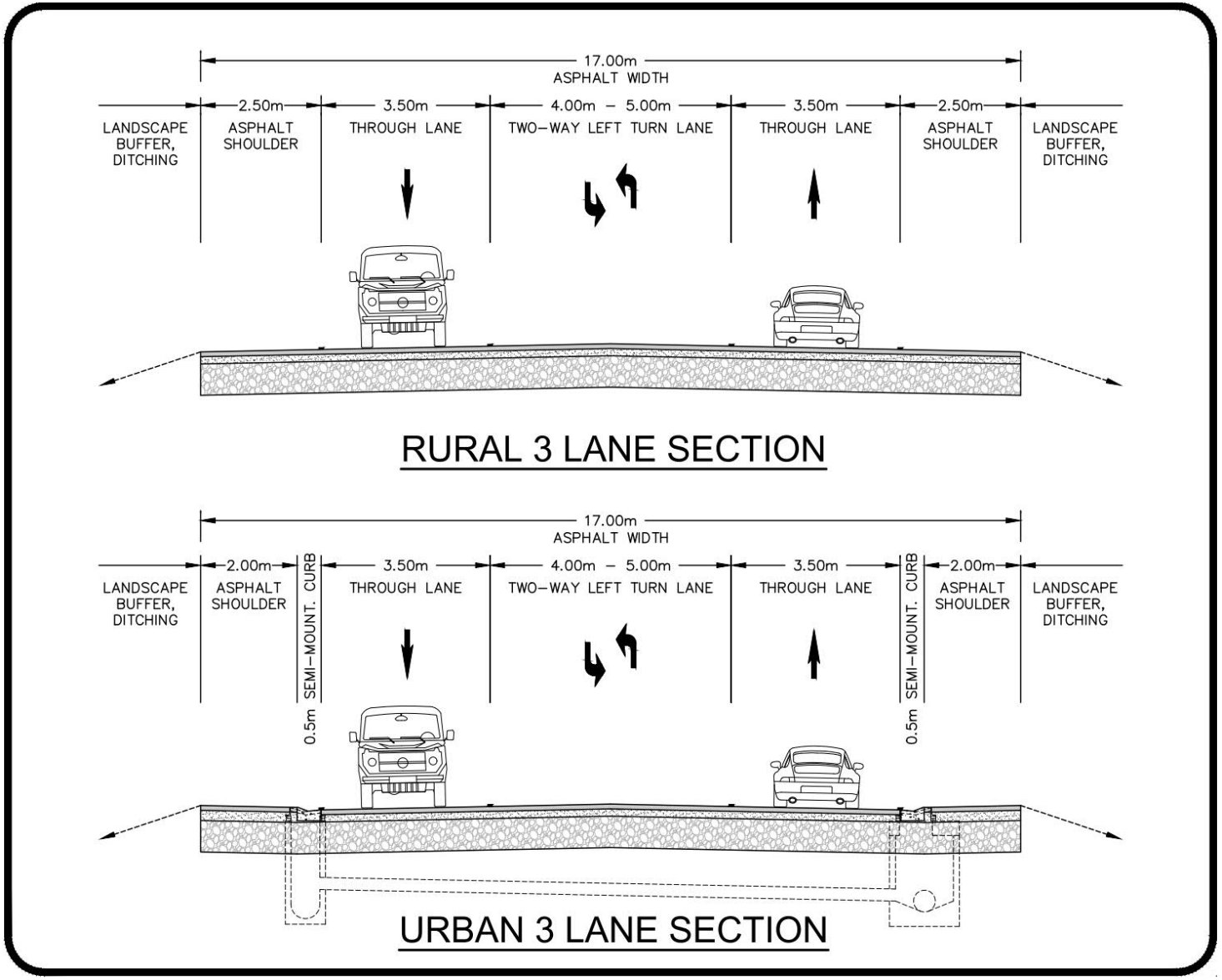
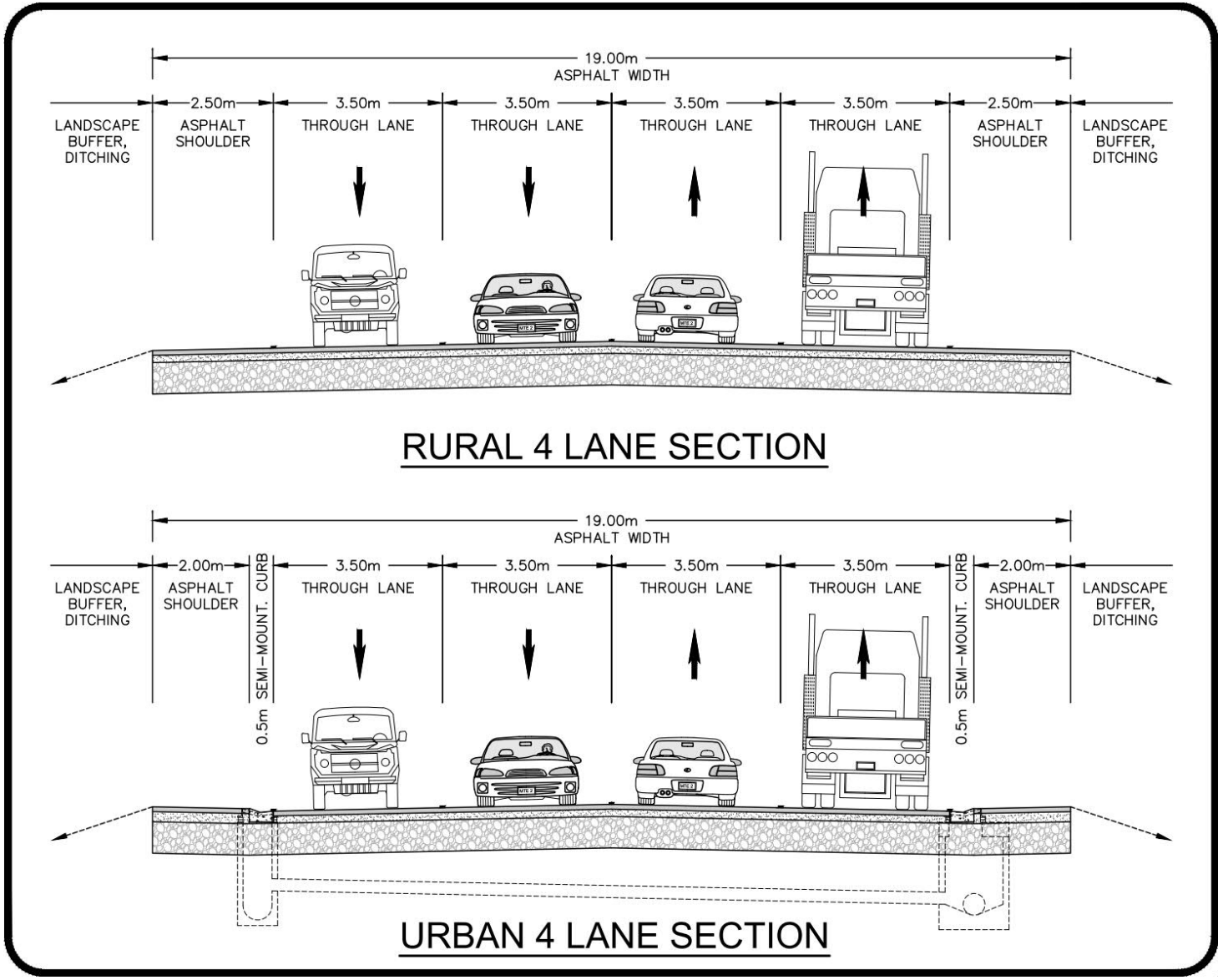


Figure 6-3: 4-Lane Cross Section Alternatives



All the alternatives developed for this study are further illustrated in “plan view” and contained in Appendix E2 for PIC No. 1. In summary, these alternatives are:

- ✓ **Alternative No. 1**: Two lanes with signalized intersections;
- ✓ **Alternative No. 2**: Three lanes with signalized intersections;
- ✓ **Alternative No. 3**: Four lanes with signalized intersections;
- ✓ **Alternative No. 4**: Two Roundabouts – one roundabout at Wellington Rd 124 and Wellington Rd 32N, and one roundabout at Wellington Rd 32 South;
- ✓ **Alternative No. 5**: One Roundabout – eliminate the two “Tee” intersections at Wellington Rd 124 and Wellington Road 32 North and 32 South, and replace with a single roundabout intersection.

A preliminary evaluation of these alternative design concepts was undertaken and presented at PIC No. 1. Figure 6.4 illustrates an Evaluation Matrix summarizing the evaluation of these five alternatives.

In order to address the project Problem Statement, it is important to understand how each of the alternatives addresses the current and projected traffic issues. Intersection level of service (LOS) is a recognized method of quantifying the average delay experienced by drivers at intersections. It is based on the delay experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles desiring to make a particular movement, compared to the estimated capacity for that movement. The capacity is based on a number of criteria related to opposing traffic flows, intersection geometry and traffic control.

Table 6.1 contains the level of service criteria for signalized and stop-controlled intersections. The highest possible rating is LOS A, under which the average total delay is equal or less than 10.0 seconds per vehicle. When the average delay exceeds 80 seconds for signalized intersections, 50 seconds for unsignalized intersections or when the volume to capacity ratio is greater than 1.00, the movement is classed as LOS F, and remedial measures are usually implemented, if feasible. LOS E is usually used as a guideline for the determination of road improvement needs on through lanes, while LOS F may be acceptable for left-turn movements at peak times, depending on delays.

Table 6.1: Level of Service Definitions

Level of Service	Signalized Intersections Average Total Delay (sec/veh)	Unsignalized Intersections Average Total Delay (sec/veh)
A	< = 10	< = 10
B	> 10 & < = 20	> 10 & < = 15
C	> 20 & < = 35	> 15 & < = 25
D	> 35 & < = 55	> 25 & < = 35
E	> 55 & < = 80	> 35 & < = 50
F	> 80	> 50

Figure 6-4: Evaluation matrix

WELLINGTON COUNTY ROAD 124 CLASS EA

Evaluation Matrix

Alternatives	Criteria				
	Social/Cultural Environment	Natural Environment	Heritage/Archaeological Environment	Traffic Considerations	Costs
Do nothing	Traffic congestion will continue to cause delays. No property required	No additional impacts to Natural Environment	No Heritage or Archaeological impacts	No improvements to current traffic conditions – congestion will continue/get worse (2041 LOS E-F)	Ongoing maintenance costs
Two lanes (One lane each direction)	Addresses congestion somewhat. Minimal Property required. Access issues remain, plus no left turn access between 32's Property widenings required at 6 properties	Very Minor impacts to Natural Environment. Ellis Creek Culvert requires minor widening	No Direct Heritage or Archaeological impacts	Improves Turn lanes at Rd 32 Intersections. 2041 LOS D-F. Paved shoulder provides area for pedestrians, cyclists and disabled vehicles	Lowest Capital Cost (approx. 10% cheaper than 3 lane option)
Three lanes (One lane each direction plus centre left turn lane)	Addresses congestion somewhat. Convenient left turn access to properties except between "32's". Property widenings required at 24 properties	Very Minor impacts to Natural Environment. Ellis Creek culvert and other culverts will require widening of approx. 4m.	No Direct Heritage or Archaeological impacts	Improves Turn lanes at Rd 32 Intersections. Reduces Congestion/delays 2041 LOS D-F. Paved shoulder provides area for pedestrians, cyclists and disabled vehicles	Estimated Capital Costs of approx. $10M plus HST
Four lanes (Two lanes each direction)	Addresses congestion somewhat. Property widenings required at 34 properties.	Minor impacts to Natural Environment. Ellis Creek culvert and other culverts will require widening of approx. 8m.	No Direct Heritage or Archaeological impacts	Improves Turn lanes at Rd 32 Intersections. Reduces congestion/delays 2041 LOS B-F. Paved shoulder provides area for pedestrians, cyclists and disabled vehicles	Highest Capital Cost (approx. 40% more expensive than 3 lane option)

Figure 6.4: Evaluation Matrix Cont'd

WELLINGTON COUNTY ROAD 124 CLASS EA

Evaluation Matrix

Alternatives	Criteria				
	Social/Cultural Environment	Natural Environment	Heritage/Archaeological Environment	Traffic Considerations	Costs
***Two roundabouts** at WR 32 North and South with 3 lanes east and west of Road 32	Addresses congestion. Property widenings required at 27 properties including 1 potential "buyout". Some access issues near roundabout	Minor impacts to Natural Environment. Ellis Creek culvert and other culverts will require widening of approx. 4m.	No Direct Heritage Impacts. Potential Archaeological Impact between Wellington Road 32 North and 32 South.	Roundabouts decrease severe collisions. Significantly reduces congestion/delays 2041 LOS A-C. Paved shoulder provides area for pedestrians, cyclists and disabled vehicles	Estimated Capital Costs approx. 20% higher than 3 lane signalized option
***Single roundabout** between WR 32 North and South with 3 lanes east and west of Road 32	Addresses congestion. Property widenings required at 29 properties including 1 large potential buyout. Some access issues near roundabout	Minor impacts to Natural Environment. Pot. Snake Habitat. Ellis Creek culvert and other culverts will require widening of approx. 4m.	No Direct Heritage impacts. Potential Archaeological Impact between Wellington Road 32 North and 32 South.	Roundabouts decrease severe collisions. Significantly reduces congestion/delays 2041 LOS A. Paved shoulder provides area for pedestrians, cyclists and disabled vehicles	Estimated Capital Costs approx. 25% higher than the 3 lane signalized option.

*** Preferred Alternative is Two Roundabouts at Wellington Road 32 North and 32 South which provide a superior traffic Level of Service (LOS) and a combination of 2, 3 and 4 lane cross section which addresses safety concerns.**

The traffic study in Appendix D analysed each alternative and based on projected 2041 traffic, determined the Intersection Level of Service (LOS) for each of the alternatives.

- ✓ Do Nothing: LOS E-F
- ✓ Alternative 1 – 2 Lanes with Signals: LOS D-F
- ✓ Alternative 2 – 3 Lanes with Signals: LOS D-F
- ✓ Alternative 3 – 4 Lanes with Signals: LOS B-F
- ✓ Alternative 4 – 2 Roundabouts @ Rd 32's: LOS A-C
- ✓ Alternative 5 – 1 Roundabout @ Rd 32's: LOS A

Several comments were received from the public and agencies as a result of PIC No. 1, and are summarized in Appendix E2, along with responses to each of the comments. Respondents were asked to indicate their specific preferences (along with additional comments) for each of the three general alternatives. A total of 22 people completed comment sheets for PIC No. 1. The results of these preferences are illustrated in Table 6.2.

Table 6.2: PIC No. 1 Respondents Preferences

Number of PIC No. 1 Respondents indicating their Preference for:									
Cross Section			**Number of Lanes**				**Intersection @ Rd 32's**		
Rural	**Urban**	**Hybrid**	**2**	**3**	**4**	**Other**	**Signals**	**2 RAB***	**1RAB***
12	6	3	4	11	5	1	2	6	13

*RAB - Roundabout

In summary, a majority of the respondents indicated they preferred:

- ✓ A rural cross-section;
- ✓ A 3 Lane Cross Section (Alternative 2);
- ✓ Roundabouts for the Road 32 Intersections, with most preferring 1 Roundabout (Alternative 5).

In general, the written comments included:

- ✓ Concerns with traffic speeds, and road improvements increasing speeds;
- ✓ Safety concerns west of Fife Road and previous fatal accident at Shadow Drive;
- ✓ Congestion problems;
- ✓ Impacts to private property;
- ✓ Noise attenuation;
- ✓ Pedestrians and cyclists should be accommodated;

- ✓ Road must accommodate farm equipment.

After PIC No. 1, individual meetings were held with private property owners, mostly in the vicinity of WR 32 and WR 124 to obtain their input due to the impacts the roundabout alternatives would have on their property and to determine if any adjustments could be made to the design to minimize as much as possible impacts to their property. The individual meetings were held with the following property owners after PIC No.1:

- ✓ Welmar (7018 WR 124)
- ✓ Petro Canada Station (7017 WR 124)
- ✓ Veterinary Clinic (5041 WR 32 South)
- ✓ Proposed Development on NE corner of 124 and 32N (5053 WR 32N)
- ✓ Bernardi (5043 WR 32 South)
- ✓ Scott Robinson/Barb Deter (5041 WR 32 South)
- ✓ Superior Propane (7022 WR 124)
- ✓ Lafarge (7051 WR 124)

A summary of the discussions with these property owners is summarised in Table 6.3 in Section 6.3.

6.2 Development of the Preferred Design Concept

6.2.1 Description of the Preferred Design Concept

The various background reports, evaluation of the various design concepts, and public and agency responses were all considered when determining a Preferred Design Concept.

After PIC No. 1, the comments received from the public and agencies were reviewed, and a Preferred Design Concept was developed and identified based on additional technical review. In general the Preferred Alternative consists of:

Cross Section: Mainly a “rural” cross section with paved shoulders and ditches, with some sections of “urban” cross section with “rollover” curb and gutter, catchbasins and storm sewers mainly around the intersections with Wellington Road 124. In all urban sections, a paved “shoulder” area is located behind the cub and gutter that can be used by cyclists and pedestrians;

Number of Lanes: Mainly consists of two lanes (one lane in each direction), with 3 lanes in areas with multiple driveways, and 4 lanes between the WR 32 North and 32 South intersections to accommodate the volume of traffic in these areas; The 3 lane sections

consist of one lane in each direction with a two-way centre left turn lane to improve safety for turning vehicles and reduce congestion and conflicts resulting from turning vehicles;

Intersections: The intersections with WR 124 within the study area to consist of:

- ✓ Township Road 1: Remain unsignalized;
- ✓ WR 32 South: Roundabout;
- ✓ WR 32 North: Roundabout;
- ✓ Whitelaw Road: Remain Signalized;
- ✓ Beech Street Remain unsignalized;
- ✓ Shadow Drive: Remain unsignalized;
- ✓ Fife Road: Remain Signalized.

In summary, the two intersections of WR 32 with WR 124 will consist of 2 roundabouts, and all other intersections will remain either signalized or unsignalized, with some modifications to the turn lane lengths etc. to address projected traffic movements.

The above preferred alternative was presented at PIC No. 2 held on June 19, 2019. The preferred alternative as described above was illustrated as "Preferred Alternative No. 6", and can be found in Appendix E3 for PIC No. 2. Alternative No. 6 was further refined to illustrate 3 alternative roundabout locations for the intersection of WR 124 and WR 32 South, and labelled Alternatives 6A, 6B and 6C. Due to the various private property accesses in the vicinity of WR 32 South and 24, each of these 3 roundabout alternatives has differing private property impacts.

6.2.2 Development of the Preferred Design Concept

Road Cross Section – The road cross section is mainly a rural cross section, with a 2.5m wide paved asphalt shoulder. However, in intersection areas, it is proposed to construct an urban section with a 0.5m wide "rollover curb" and a 2.0m wide paved asphalt area behind the curb to help delineate the intersection. In addition, the section of WR 124 between the two WR 32 intersections will also consist of the rollover curb urban section to address maintenance issues and help delineate the roundabouts. It is generally accepted that an "urban" cross section with a physical curb in place provides a strong visual delineation of the lane widths, and typically slows traffic somewhat which is an important factor for intersections, and especially roundabouts.

Number of Lanes – In general, two through lanes (one lane in each direction) on WR 124 will accommodate the projected future traffic volumes, with the proposed and appropriate intersection improvements.

However, it is proposed to construct three lanes, which incorporate two-way centre left turn lanes in addition to the two through lanes in areas of multiple driveway accesses.

Based on the Transportation Association of Canada Design Guidelines, the installation of a two way left turn lane in areas of multiple driveways will reduce conflicts and collisions from left turning vehicles accessing and egressing the driveways. In addition to increased safety benefits, traffic will experience less delay with left turning vehicles not being in the through lanes and therefore have less effect on through capacity. The existing speed limit throughout the study areas will remain at 70 km/h.

The areas on WR124 proposed for the three lane section with a two-way centre left turn lane are:

- ✓ From the west end of the Fife Road turn lanes to 350m west of Fife Road – there are several residential properties and driveways on the north side of WR 124, including the intersections of Shadow Drive and Beech Drive. In addition, there are some field entrances on the South side of WR 124 used by farm equipment during seasonal farm operations.
- ✓ From the west end of Whitelaw Road turn lanes to WR 32 North – there are multiple commercial and industrial driveways on both sides of WR 124 in this area, including several properties with trucking operations.
- ✓ From the west end of the WR 32 South Roundabout to east of the CN Rail crossing – there are multiple residential driveways on the South side of WR 124, and a number of commercial/industrial accesses on the north side.

Approaching, and between the two roundabouts at WR 32 North and 32 South, a four lane section is proposed to safely tie into the two lane roundabouts. It is also proposed to install a centre median between the two roundabouts to prevent left turns from existing and future driveway accesses, for safety reasons. Safe left turn access from private properties in this area can be achieved by turning right onto WR 124 then travelling through the roundabout, and exiting the roundabout in the direction that is desired.

Intersections – At Fife Road, Beech Street, Shadow Drive, Whitelaw Road and Township Road 1, the existing signalized or unsignalized configuration will accommodate future traffic conditions with some modifications to the turn lanes. At the WR 32 North and WR 32 South intersections with WR 124, the existing signalized intersections have, or will reach their capacity due to the volumes and types of turning movements required. The two proposed roundabouts perform best with respect to capacity, congestion and delays. In addition, roundabouts typically result in less severe collisions due to the reduction of traffic conflict points including right angle or “T-bone” collisions.

The single roundabout alternative for the WR 32 intersections (Alternative 5) was also reviewed and evaluated. The two roundabout alternative is preferred as:

- ✓ Even though a single roundabout would seem to be less expensive than two roundabouts, in actual fact the additional property impacts and additional asphalt requirements associated with one roundabout and approach roads make a single roundabout slightly more expensive than two roundabouts;
- ✓ Wellington County Road Operations staff prefer the two roundabouts due to less asphalt to maintain and ease of maneuvering snow plows to clear a 4-lane section with heavy traffic volume;
- ✓ EB to SB traffic and NB to WB traffic at WR 32 South and 124, is not mixed with SB to EB traffic and WB to NB traffic at WR 32 North and 124, providing less interaction between these two separate movements.

At PIC No. 2, there were three proposed options presented for the WR 32 South and WR 124 intersection. The difference between these three options was where they intersected with WR 124. The roundabout was shifted eastward from the existing WR 32 South intersection, to avoid access issues with the Petro Canada Station. This would result in closing a short portion of WR 32 South immediately South of WR 32 South but access would be maintained to the existing residences, Petro Canada and the private property on the SE corner of WR 124 and WR 32 South. Since the closed portion of WR 32 South is no longer needed as a County Road, ownership and maintenance of this closed portion will be discussed with Guelph Eramosa Township.

The three options are illustrated in Appendix E3 and are described as follows:

- ✓ **Alternative 6A** – Connects to a new entrance location on the property line between Welmar Industries and Superior Propane on the north side of WR 124. This would result in a shared entrance between the two properties. The County would close the two nearby existing entrances, and access/maintenance agreements for the new shared entrance entered into by the two property owners. This alternative was labelled as “Preferred” at PIC No. 2;
- ✓ **Alternative 6B** – Connects to the existing eastern entrance of Welmar Industries. The existing Superior Propane entrances and west Welmar Industries accesses on the north side of WR 124 would remain open;
- ✓ **Alternative 6C** – Connects to the existing west entrance at Superior Propane. The other existing east Superior Propane entrance and the two existing Welmar Industries accesses on the north side of WR 124 would remain open. However, the east Welmar Industries entrance would be problematic in that this entrance could not provide left turn access and is very close to the roundabout which results in some safety concerns.

6.3 Development of the Recommended Design Concept

At PIC No. 2, the preferred Design Concept was presented as outlined in Section 6.2. Comments were gathered at PIC No. 2, including specifically requesting which of Alternatives 6A, 6B or 6C was preferred. Twelve written comments sheets were received, and nine respondents indicated their preference as follows:

- ✓ Six respondents preferred Alternative 6A;
- ✓ Three respondents indicated “no preference”.

In general, the written comments concerning WR 124 Class EA included:

- ✓ Review design of Whitelaw Road Intersection to minimize impacts on their property and building on SW corner;
- ✓ Concerns with traffic staging and potential road closures on WR124, and impacts on their business on WR 32 North;
- ✓ Consider roundabouts at other intersections;
- ✓ Address current drainage issues;
- ✓ Make access to Petro Canada Station and the proposed closed portion of WR 32 South safe;
- ✓ Traffic speeds;
- ✓ Address impacts on wildlife;
- ✓ Extend two-way centre left turn lane to Township Rd 1;
- ✓ When Niska/Whitelaw Road opens traffic will increase on WR 124;
- ✓ WR 32 North must also be addressed at the CN Rail crossing to impact congestion at WR 124 and WR 32 North;
- ✓ Roundabouts must accommodate trucks;
- ✓ Speed and use of truck engine brakes should be addressed on WR 32 North.

After PIC No. 2, additional meetings were held with the owners of Welmar Industries and Superior Propane. Superior Propane indicated that they preferred not to have a direct link to their property at a roundabout, due to concerns with the travelling public mistakenly entering their property. Their concerns were safety related with potentially mixing public traffic which may enter their property, with their propane operations and trucking. Welmar Industries had no concerns with the north leg of the WR 32 South roundabout being located at their current east entrance.

Comments were also received from the property owners (Bernardi) at the SE corner of WR 124 and WR 32 South, who are concerned about the remnant property after the recommended alternative for the intersection of WR 124 and WR 32 South is constructed. With the intersection moving east of the existing intersection, some of the approach roads

to the roundabout will cut through their property not allowing the full property to be developed.

A summary of all the comments received during the meetings with property owners is summarized in Table 6.3. A keyplan illustrating the location of each of these property owners from Table 6.3 is contained in Figure 6.5.

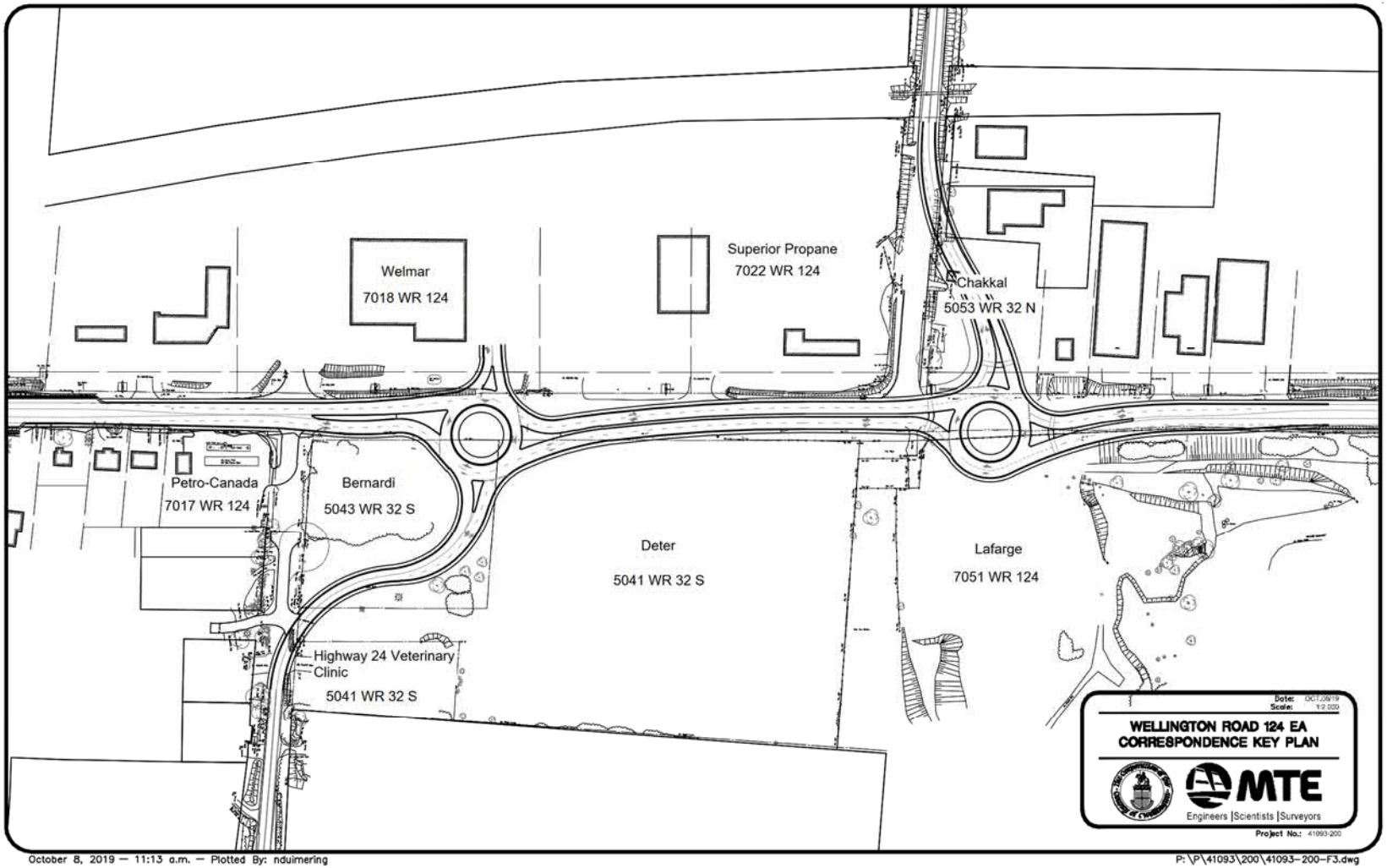
Table 6.3: Summary of Property Owners Discussion

Property/ Business	Owners	Date of Meeting	Summary of Discussions
Welmar 7018 WR 124	Brian and Janice Richards	February 5 and June 6, 2019	• 6A works for both Welmar (access to existing Welmar entrance) and Superior, 6B works for Superior (access to existing Superior Propane entrance), 6C works for both (shared access) • Who would maintain shared access pavement? • 6A has safety concerns for Superior Propane due to the possibility of the general public turning into property and driving in close proximity to dangerous materials being store/transported around the site.
Petro-Canada 7017 WR 124	Salman Qureshi (Owner) Mark L. Dorfman (Planner)	February 11, 2019	• Option 6 is the best, presented with a private driveway; • dead end may not be the best idea for safety; • Truck delivery is key • Garbage collection
5053 WR 32 N	Jagdeep (JC) Chakkal	February 27, 2019	Property will need to be purchased as it makes the property undevelopable.
Lafarge 7051 WR 124	Carol Siemiginowski, Land Manager SW ON and Atlantic Kevin Biggs, Operations Manager, SW ON Aggregates	March 26, 2019	Reviewed plans, they sent a follow-up letter with comments as follows: • Support the centre two way left turn lane; • Will design support anticipated truck volumes from pit? • Will there be conflicts with left turning vehicles on other side of road? • Need to discuss land purchases and compensation for road widenings
5041 WR 32 S	Barb and Scott Deter	April 2, 2019	• They are ok with the proposed changes – hope to slow traffic around vet office. • Possibility of using aggregate from their property? • Consider shifting roundabouts to leave more leftover room for Bernardis

Table 6.3: Summary of Property Owners Discussion cont'd

Property/ Business	Owners	Date of Meeting	Summary of Discussions
Highway 24 Vet Clinic 5041 WR 32 S	**Mary Thompson and Brenda Taylor**	April 8, 2019	Worried about traffic backup and traffic interruptions since they are high importance emergency medical. Concerns about closures and business loss during construction. Will fencing or signs have to be moved? Will there be difficulty getting in and out of driveway. Alignment of driveway can be adjusted.
5043 WR 32 S	Paul, Peter and Joe Bernardi	April 29	Agreed to send them the draft alternatives for consideration and discussion with a planner. They preferred a roundabout option with a shared entrance between Welmar and Superior Propane, a shared access with the Petro Canada Station, and WR325 with light radii to minimize impacts on their property. An access of the highway is important to them. Shared access between Welmar and superior leaves Bernardis with more useable property. Further comments were received by email on Jun 26/19: • Would like the proposed alignment of Rd 32S to have a radius of 75m and moved further South (which does not impact their property as significantly but does impact properties to the South more significantly); • Would like assurances that access be maintained to WR124 by means of an entrance off of the portion of WR32S t be closed at WR124; • Want notice of when the project will be going to Council to make a formal presentation.
Superior Propane 7022 WR 124	Lucky Attwal, Ian D'Cruz and Mario Christiano	June 6 and June 27 (Call)	Reviewed the options since they were not in attendance at PIC #1. Discussed needs related to truck traffic through site, discussed current accesses and uses – sent electronic files for their review by engineering/operations and drivers 6B (previously labeled 6A) was preferred – close current access closest to the roundabout for safety reasons and prevent sharp turns for transport trucks. Maintain at least 2 accesses minimum of 1 on 124.

Figure 6-5: Key Plan Showing Property Owners



7.0 DESCRIPTION OF THE RECOMMENDED DESIGN

7.1 Road Cross-Section and Design Criteria

A Preliminary Design has been completed on the Recommended Design and is contained in Appendix F.

Key elements of the Recommended Design for WR 124 include:

- New roundabouts at the intersections of WR 124 and WR 32 North and WR 32 South – Alternative 6B (labeled 6A at PIC#2) with the north leg of the WR 32 South roundabout lining up with the Welmar eastern entrance (7018 WR 124);
- All other existing intersections will remain in their signalized or unsignalized configuration with modifications to turn lanes as required;
- A twenty (20) metre wide right-of-way (except in areas where additional property is required for turn lanes or roundabouts);
- Required road widenings for the three and four lane sections and roundabout construction, will be to the South, holding the existing north edge of pavement such that the construction will not require any modifications or relocations to the existing Hydro One towers and transmission lines;
- A minimum of two (2) lanes of through traffic;
- Additional two way centre left turn lane on WR 124 to address the multiple driveway accesses between:
    - Fife Road and 350m east of Fife Road;
    - Whitelaw Road to WR 32 North;
    - WR 32 South to CN Rail crossing.
- Four (4) lanes between the two roundabouts at WR 32 North and WR 32 South;
- Rural cross section with paved shoulders, with the exception of at intersections and at the approaches to, and between, the two roundabouts at WR 32 North and WR 32 South where an urban cross section with a 0.5m rollover curb will be installed with a paved area behind the curb as illustrated in Figures 7.1 and 7.2;
- The paved shoulder and paved area behind the curb and gutter can accommodate disabled vehicles, cyclists and pedestrians;
- A raised median in the 4 lane section between the two roundabouts;
- Storm sewers installed in the urban cross section areas;
- Grading on Private Property

Existing cross-road culverts are to be extended, if necessary. The detail design process to investigate options for grading, new headwalls etc., to avoid culvert extensions and impacts on existing fish habitat. The proposed typical rural and urban cross-sections for WR 124 are illustrated in **Figures 7.1 and 7.2.**

The Preliminary Design of the Recommended Design is based on design criteria listed in **Table 7.1.**

Figure 7-1: Typical Rural Cross-Section (3 Lane)

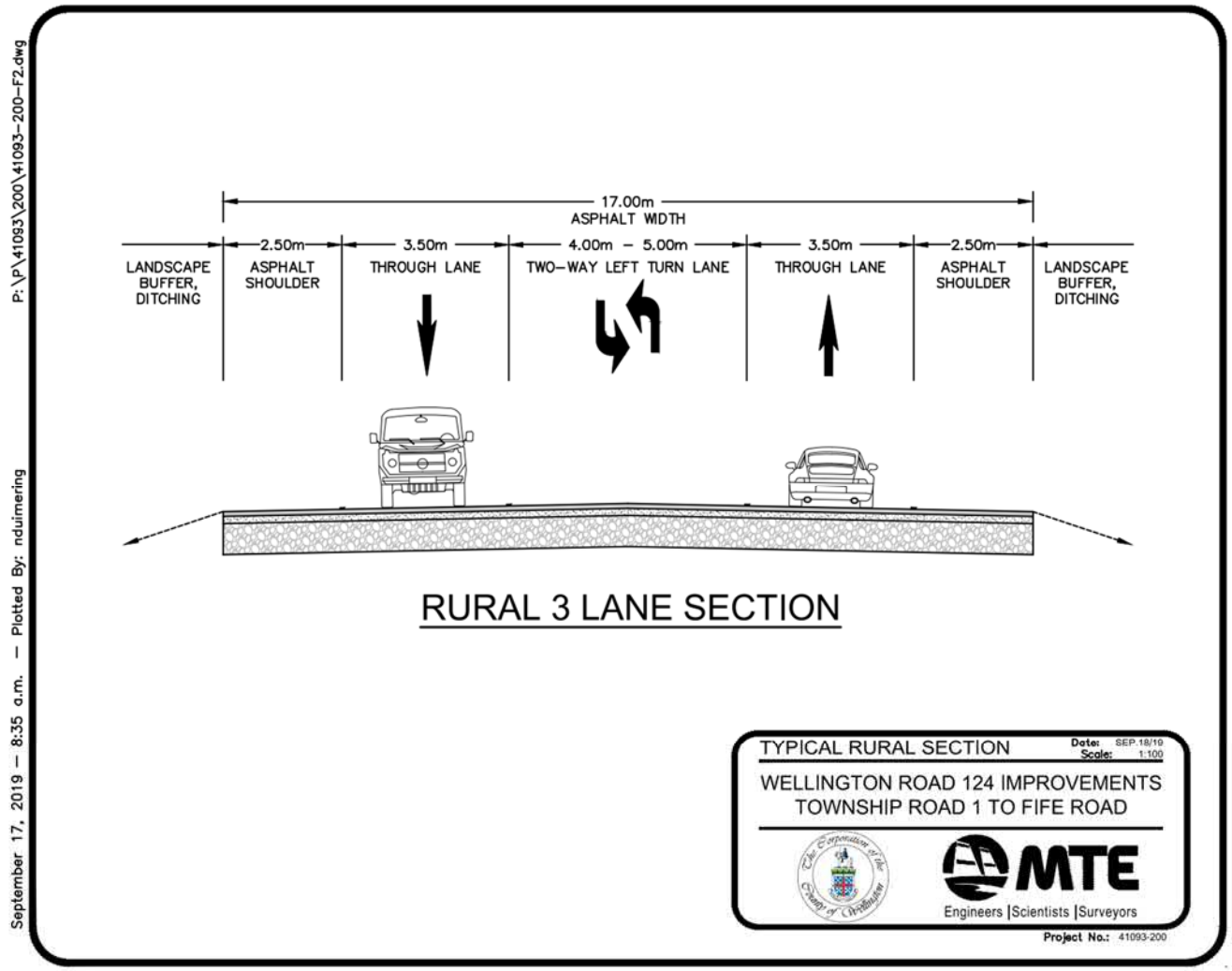


Figure 7-2: Typical Urban Cross Section (3 Lane)

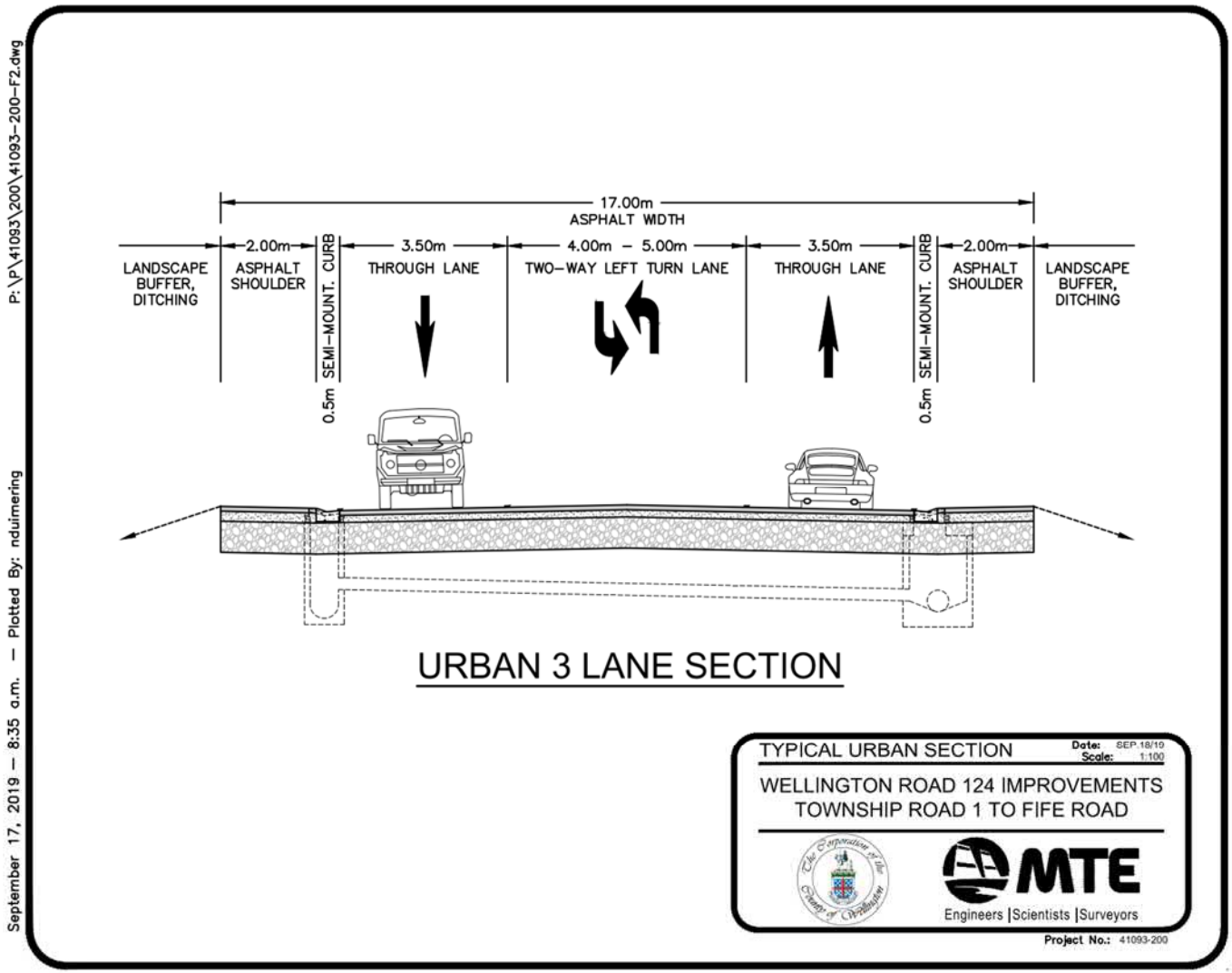


Table 7.1: Wellington Road 124 Preliminary Design Criteria Table

Criteria	**Design Element**	**Notes**
Design Speed	90km/h	
Posted Speed	70km/h	
Right of Way (ROW) width	720	Varies to accommodate grading
Horizontal Alignment Radius	390	TAC 2017 Table 3.2.4 High Speed 90km/h 0.06m/m Reverse
Lane width – inside	3.5m	
Lane width – outside	3.5m	
Left – Right turn width	3.25m	
Center island median width	1.75m – 2.0m	Excluding curbs
Intersection radius	16m	
Cross fall	2%	
Super elevation	6.090%	TAC 2017 Table 3.2.5
Vertical alignment	4% max	TAC 2017 Chapter 3.3.2.2.
K sag	38	TAC 2017 Table 3.3.4
K crest	39	TAC 2017 Table 3.3.2

The Recommended Design Concept addresses the comments received at PCC No. 2 as follows:

Table 7.2: PCC No. 2 Comments and Responses

Comment	**How the Recommended Design Concept Addresses the Comment**
Whitelaw Road Intersection – Resident concern with road being too close to structures etc. on property at SW corner – try to move Whitelaw Road widening to the east.	The configuration of the Whitelaw Road intersection with WR124 being moved further east away from the residential property will be considered as part of detail design when implications of drainage and property impacts on all four corners of the intersection will be considered.
Road closures during construction	It is intended to keep WR 124 open during most periods of construction. Construction signage (and detours if required) will be in place to direct traffic.
Roundabouts at other intersections	As part of the traffic analysis, it was found that all intersections other than WR 124 and the two WR 32 intersections will operate appropriately without the need to install a roundabout.
Address current drainage issues	Improvements and enhancements to drainage form WR 124 has been explored as part of the Preliminary Design, and will be explored further as part of detail design prior to construction.
Make access to closed portion of WR 32 South safe	The configuration for access to the closed portion of the (former) WR 32 South near WR124 has been designed to provide safe access to adjacent properties.
Traffic speeds	There is no plan to reduce traffic speeds at this time, other than as part of the approaches to the two roundabouts. Other posted speed reductions could be considered as part of detail design subject to final design details.

Table 7.2: PCC No. 2 Comments and Responses Cont'd

Comment	**How the Recommended Design Concept Addresses the Comment**
Impacts on Wildlife	All existing culvert crossings under WR 24 will remain in place to accommodate any existing wildlife crossing. New planting will consist of native plants to maintain and encourage wildlife habitat.
Extend two way centre turn lane to Township Rd 1	The number of private accesses between the rail crossing and Township Rd 1 does not necessarily warrant a turn lane in his area. The paved shoulder will be available for vehicles to bypass turning vehicles on WR 124.
Increased traffic when Niska Rd Bridge open, there will be increased traffic on WR 124	The design takes into account the projected traffic on Whitelaw Road and WR 124 when the Niska Road Bridge opens.
Improve WR32 North rail crossing	This crossing is outside the project study limits. The traffic analysis indicates that the proposed improvements to the WR 124 and WR 32 North intersection will address the congestion issues.
Roundabouts must accommodate trucks	The roundabouts will accommodate trucks. Vehicles should not pass other vehicles in a roundabout.
Truck speed and use of "jake" brakes should be addressed on WR 32 North	WR 32 is outside the limits of the study. However the County is aware of this comment.
Access to Welmar Industries and Superior Propane	The WR 32 South Roundabout is located at the Welmar east entrance, which does not provide direct access to Superior Propane driveway. Welmar is in favour of the Roundabout at their east access as it will improve access for deliveries and loading.
Impacts to the vacant property on the SE corner of WR124 and WR 32 South	There are still significant impacts to this property. However, the property owner expressed an interest in moving the

Table 7.2: PCC No. 2 Comments and Responses Cont'd

Comment	**How the Recommended Design Concept Addresses the Comment**
	roundabout as far west as possible. The Recommended alternative (6B) is the roundabout alternative that is furthest west, but still provides safe access for adjacent developed private properties. Negotiations and discussions with the property owner will have to be held to minimize property impacts. As part of property negotiations with all property owners on the SE quadrant of WR 124 and WR 32 South, there may be some remnant properties where land swaps could form part of the negotiations to maximize as much as possible the developability of the properties.
Avoid having west roundabout with direct access to Superior Propane to avoid public traffic mixing with Propane truck traffic.	The recommended design has direct access to the Welmar property, and not the Superior Propane property.
Move WR 32 South roundabout as far west as possible to minimize property impacts to the property at SE corner of WR124 and WR 32 South.	The WR 32 South roundabout will generally line up with the east Welmar entrance. This allows access to be maintained at the existing Petro Canada property on the SW corner of WR124 and WR 32 South. During detail design the revised WR 32 South approach to the west roundabout will be explored further to minimize impacts as much as possible to existing and adjacent developments and properties, including the property at the SE corner of WR124 and WR 32 South.
Concern with the WR 32 Roundabouts being too close to each other, thereby affecting traffic operations.	A peer review of the Roundabout preliminary design by CIMA+, found the locations of the two WR 32 Roundabouts was appropriate and will operate effectively.

8.0 PROJECT IMPACTS AND MITIGATION MEASURES

A key feature of the Environmental Assessment planning process is the avoidance and/or mitigation of impacts on the local environment. Under the Ontario Environmental Assessment Act, the environment refers to the natural, social, economic, and cultural components that make up the area. Table 8.1 identifies potential impacts that may result from the implementation and construction of the recommend design (during and following construction) and mitigation/monitoring measures.

Table 8.1: Mitigation measures

	Issue	Impacts and Mitigation Measures
1.0	**Natural Environment**	
1.1	Vegetation Removal and Grading	✓ 141 inventoried trees are anticipated to be removed due to grading for road construction, including 12 trees that are in poor condition; ✓ Mature, large stature trees should be reviewed during detail design for retention where possible; ✓ During Detail Design, grading should consider preserving exiting trees where possible; ✓ A Tree Inventory & Protection Plan (TIPP) should be prepared during detail design; ✓ Compensation for trees that need to be removed should be considered based on approximately a 2:1 basis.
1.2	Aquatic Habitat	✓ During Detail Design, extension of existing cross road culverts should be reviewed to minimize the requirement to extend the culverts i.e. grading, headwalls etc.; ✓ Ellis Creek provides direct habitat for a number of fish species including Brook Trout; ✓ Tributary A (east of Whitelaw Road) provides indirect fish habitat; ✓ If the culverts at Ellis Creek and Tributary A need to be extended, it is expected that a Harmful Alteration, Disruption or Destruction (HADD) may not be needed. However, due to the in-water work and the proximity of grading, a Request for Review for both crossings should be submitted to DFO for approval; ✓ No work in and adjacent to Ellis Creek may occur between October 1 and May 31; ✓ No work in and adjacent to Tributary A may occur between March 16 and June 30; ✓ Sediment and Erosion Control Plan to be prepared for work adjacent to Ellis Creek and Tributary A.
1.2	Wildlife and Wildlife Habitat Impacts	✓ Road construction is contained mainly within the existing road allowance, but may remove fringing areas of cultural meadows and other vegetation used by the Monarch Butterfly; ✓ Restoration seeding of non-urbanized areas should include common milkweed as part of a native mix; ✓ Removal of vegetation should occur outside the bird nesting season of April 1 to August 31 in accordance with the Migratory Birds Convention Act; ✓ Approximately 15 potential bat habitat trees were found in the study area;

Table 8.1: Mitigation Measures Cont'd

		✓ Removal and pruning of bat habitat trees should be avoided during active bat season (May 1 to September 30).
1.3	Indirect Impacts to Adjacent Trees, Vegetation and Wildlife Habitat	✓ Clearly defined construction limits in the form of tree protection fencing should be established to avoid unnecessary tree and vegetation removal; ✓ Tree protection fencing, as well as other measures such as pruning and compensation should be detailed in a TIPP; ✓ A Dust Control Plan should be prepared and implemented during construction; ✓ Construction activities should be limited to daylight hours whenever possible to avoid noise, vibration and artificial light impacts to wildlife; ✓ Due to the presence of potential snake habitat (especially on and near the property at the SE corner of the existing WR 124 and WR 32 South) additional field surveys are required in this area according to MNRF Significant Wildlife Habitat guidelines.
1.4	Sediment and Erosion	A Sediment and Erosion Control (ESC) Plan should consider: ✓ Placement of silt fencing along any construction limits that are down-gradient of construction zones and may receive sediment-laden runoff; ✓ Regular inspection, maintenance/repair and where necessary, replacement of damaged silt fencing; ✓ Operation and storage of all materials and equipment in a manner that prevents any deleterious substance from leaving the site ✓ Stripping and strategic placement of topsoil stockpiles, and placement of sediment control fencing around all stockpile areas; and, ✓ Re-vegetation of completed areas as soon as possible after construction.
1.5	Stormwater Management	✓ During Detail Design, Stormwater management issues must be considered; ✓ Drainage in rural sections will be conveyed through grassed roadside ditches which could provide some enhanced treatment to improve Stormwater quality; ✓ Storm sewers in urbanized road sections should outlet to grassed ditches which could provide some enhanced treatment to improve stormwater quality; ✓ Oil/Grit Separators to be considered at storm pipe outlets prior to outletting to a ditch or watercourse.
1.6	Ecological Restoration and Enhancement	✓ Roadside plantings should take the opportunity to use species of plants, shrubs and trees native to Wellington County and suitable to site conditions;

Table 8.1: Mitigation Measures Cont'd

		✓ Replacement trees on residential properties should be selected with an understanding of growth form, size, age and susceptibility to insects and disease; ✓ Native meadow seed mixes containing Common Milkweed and other flowering plant species that are pollinator friendly should be considered for the road allowance; ✓ If traffic safety conditions allow, the centre island of roundabouts provide an opportunity for native herbaceous and shrub species.
2.0	**Archaeological**	✓ During Detail Design, and prior to construction, areas to be disturbed that have been identified as having archaeological potential in the ARA Stage 1 Archaeological Assessment (Appendix B) must undergo a Stage 2 Archaeological Assessment; ✓ Should previously undocumented archaeological resources be discovered, it may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act;* ✓ The Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services.
3.0	**Built Heritage and Cultural Landscape**	✓ During Detail Design and construction phases, cultural heritage resources should be avoided where possible and any construction staging areas be located on lands located well away from any of the candidate Built Heritage Resources (BHR) and Cultural Heritage Landscapes (CHL); ✓ During the Detail Design and Construction phase, the removal of mature trees on BHRs 1, 2, 3 and 6 (Refer to Appendix C for details) be avoided where possible. For any trees that cannot be saved during construction, replacement with similar trees should be examined; ✓ The existing at-grade crossing of the G&GR Railway (CHL 3) be maintained during the Detail Design and Construction phase and that the railway crossing be returned to its pre-construction condition if safety and regulatory conditions allow; ✓ If intersection improvements at Whitelaw Road encroach on the property at the SW corner of Whitelaw Road and WR124 (BHR1 & CHL 1), a Cultural Heritage Evaluation Report should be undertaken to fully examine and evaluate the Cultural Heritage Value

Table 8.1: Mitigation Measures Cont'd

		or Interest (CHVI) of this property. If the property is found to be worthy of conservation, a Heritage Impact Assessment should be undertaken to examine mitigation options consistent with the identified CHVI of the property and local heritage policies (i.e., alternate design, relocation of the building, etc.); ✓ Consideration should be given to the type of construction techniques and machinery used in close proximity to cultural heritage resources (BHRs 1 and 4) to minimize any vibration impacts; ✓ Previously-unrecognized cultural heritage resources with CHVI identified as part of this project should be considered for inclusion on the Municipal Heritage Register.
4.0	**Socio-Economic Environment**	
4.1	Property Required to Implement the Recommended Design	✓ For any private property to be acquired as identified by the final approved detailed design, the owner would be compensated by Wellington County for the required land at fair market value. An independent appraisal will be completed for the land based upon recent local sales to determine fair market value; ✓ Any lands disturbed as a result of construction, such as with working/temporary easements acquired from private property owners, would be restored to their current state at minimum. ✓ All property negotiations and purchases could become subject to the Ontario Expropriations Act if time constraints on construction become a factor.
4.2	Potential reduction in air quality due to dust and/or emissions from construction equipment.	✓ Dust/debris control measures shall be undertaken to control roadway dust. Measures to be included in the construction plans may include, but not necessarily be limited to: o Application of water or non-chloride based compounds; o Soil and other material storage piles to be stabilized/covered to prevent wind and rain erosion; and/or o Fine particulate materials to be covered during transportation to and from the site. ✓ Contractor to use new or well-maintained heavy equipment and machinery, fitted with fully functional emission control systems/ muffler/exhaust baffles and engine covers.
4.3	Potential Construction noise impacts associated with construction activities.	✓ Construction should be limited to the time periods allowed by the locally applicable By-law/s. If construction activities are required outside of the hours, the Contractor must seek permits / exemptions directly from the County, Township, and/or City in advance.

Table 8.1: Mitigation Measures Cont'd

		✓ There should be explicit indication that Contractors are expected to comply with all applicable requirements of the contract and local Noise By-law/s. ✓ All equipment should be properly maintained to limit noise emissions. As such, all construction equipment should be operated with effective muffling devices that are in good working order. ✓ The Contract documents should contain a provision that any initial noise complaint will trigger verification that the general noise control measures agreed to be in effect. ✓ In the presence of persistent noise complaints, all construction equipment should be verified to comply with (MOE/MECP) NPC-115 guidelines. ✓ In the presence of persistent complaints and subject to the results of a field investigation, alternative noise control measures may be required, where reasonably available. In selecting appropriate noise control and mitigation measures, consideration should be given to the technical, administrative, and economic feasibility of the various alternatives. ✓ Although rock blasting is not anticipated, any blasting operations (if required) should be designed to meet any applicable overpressure and vibration limits established by the MOE/MECP in Publication NPC-119 and by the MTO in OPSS 120.
4.4	Future noise impacts resulting from increased traffic volumes.	✓ A preliminary Noise Study was not undertaken for this project for the following reasons: o there are no nearby back lotted residential properties where increased noise would impact the Outdoor Living Area in accordance with MOE Noise Guidelines; o with the exception of the area of the roundabouts, the centerline of WR 124 is not changing, which is a requirement for undertaking a Noise Study for back lotted Outdoor Living Areas under MOE Noise Guidelines.
4.5	Potential disruption to vehicular traffic during construction.	✓ Traffic disruption on existing roads shall be minimized as much as possible during construction; ✓ Consider at least one lane (under the control of flag persons) to remain open as much as possible on existing roads to maintain two-way traffic; ✓ A Construction staging and traffic management plan will be developed during the detailed design phase of the project.
4.6	Potential disruption to emergency response (i.e. ambulance, police,	✓ Emergency services to be notified of the construction by contractor – related activities and schedule to minimize/avoid delays during emergencies.

Table 8.1: Mitigation Measures Cont'd

	and fire) vehicles during construction	✓ Maintaining two-way traffic at all times during construction will be a guiding principle; ✓ Construction of the two roundabouts off set from the existing alignment for WR 124 will provide opportunity to maintain traffic on the existing alignment of WR 124 during construction of the roundabouts.
4.7	Potential disruption to pedestrians and cyclists during construction.	✓ Safe passage shall be maintained on existing roads for existing pedestrians and cyclists during construction.

9.0 PUBLIC AND AGENCY CONSULTATION

9.1 Consultation with the Public and Review Agencies

Early and ongoing consultation with the public and agencies is a key feature of the environmental assessment planning process. Consultation is a two-way process between the proponent (County of Wellington) and interested stakeholders, which provides opportunities for information exchange and for those affected or interested parties to provide input into the project and process.

It is important to identify the various stakeholders and interested parties for a Class EA project. For this project they include:

The Proponent: It is important to keep all departments and entities of the Proponent (County of Wellington) aware of the study status and issues being addressed. Staff of various County of Wellington departments were kept advised of this project regarding issues that may be of concern. Final approval of the Recommended Design was also presented to both the Roads Committee and Council for approval.

The Public: This includes individual members of the public who may be affected or impacted by the project, including property owners, developers, residents, businesses, and special interest groups (e.g. community associations, cycling interests, etc.). A number of meetings were held with property/business owners in the immediate vicinity of the proposed roundabouts at WR 32 North and South to gather valuable input, update them on progress and to ensure details of the proposed design did not unduly impact their property and business operations.

Review Agencies: Government Agencies that represent the policy positions of their respective departments, ministries, or authorities (e.g. Grand River Conservation Authority, Ministry of Natural Resources and Forestry, Ministry of Environment, Conservation and Parks, etc.). Also included in this group are other entities such as the Upper Grand District School Board and the Wellington Catholic District School Board.

Municipalities (other than the Proponent): The County of Wellington is made up of a number of local municipalities. The Study area is located in the Township of Guelph-Eramosa. Meetings were held with representatives from the Township as well as the adjacent City of Guelph to keep them up to date on issues discussed at the Project Team Meetings and to review and discuss issues relevant to their community.

The various Municipal Class Environmental Assessment schedules have different mandatory points of contact. Schedule C projects have (a minimum of) three (3) mandatory points of contact. The main points of contact for this study are summarized in the subsequent sections. In addition, information and notices etc. were posted on the

County of Wellington's website as part of the notification process. The link to the County's website is https://www.wellington.ca/en/resident-services/rd-wellingtonroad124ea.aspx.

9.2 Notice of Study Commencement

A Notice of Study Commencement was advertised on April 20, 2018 in the Wellington Advertiser.

A copy of the Notice of Study Commencement was also mailed to property owners and hand delivered to residents identified as being in or within 200 metres of the Study Area. Staff of various agencies and other interest groups were also mailed copies of the Notice of Study Commencement.

A copy of the Notice of Study Commencement and mailing list is included in Appendix E1.

9.3 Public Information Centre No. 1

PIC No. 1 was held on November 29, 2018 at Sanimax Offices, 5068 Whitelaw Road, Guelph from 5:00 pm to 8:00 pm. Approximately 44 people signed in at PIC No. 1.

PIC No. 1 was advertised in the Wellington Advertiser and a PIC Notice was mailed to members of the public and agencies. The mailing list for PIC No. 1 consisted of property owners within 200 metres of the Study Area, as well as people who expressed an interest in the project as a result of the Notice of Study Commencement, and others. The notice was also delivered by hand to residents and businesses in the Study Area. A PIC No. 1 sign board was placed one week prior to PIC No. 1 on the corner of Whitelaw Road and Wellington Road 124.

Copies of the Notice of PIC No. 1, Information Package, Display Boards, Advertisement, Comments and sign-in sheets are contained in Appendix E2. A summary table of comments received from PIC No. 1 and the Project Team Responses can be found in Appendix E4.

9.4 Public Information Centre No. 2

PIC No. 2 was held on June 19, 2019 at Sanimax Offices, 5068 Whitelaw Road, Guelph from 5:00 pm to 8:00 pm. Approximately 38 people signed in at PIC No. 2.

PIC No. 2 was advertised in the Wellington Advertiser and a PIC Notice was mailed to members of the public and agencies. The notice was also delivered by hand to residents and businesses in the Study Area. The mailing list for PIC No. 2 consisted of property owners within 200 metres of the Study Area, as well as people who expressed an interest in the project as a result of the Notice of Study Commencement, at PIC No. 1, and others.

Copies of the Notice of PIC No. 2, Information Package, Display Boards, Advertisement, Comments and sign-in sheets are contained in Appendix E3. A summary table of comments received from PIC No. 2 and the Project Team Responses can be found in Appendix E4.

9.5 Individual Meetings with Property/Business Owners near WR 32 N and S

Table 6.3 in Section 6.0 summarizes discussions held with property/business owners in the vicinity of the Wellington Road 32 and 124 intersections.

9.6 County of Wellington Roads Committee and Council Approvals

After reviewing comments from the public and agencies following PIC No. 2, County of Wellington staff prepared a report making a recommendation regarding the Wellington Road 124 Class EA to the Roads Committee – a standing Committee of County of Wellington Council - at the November 12, 2019 meeting. The Roads Committee report was forwarded to County Council for their approval at the November 28, 2019 council meeting.

A copy of the Council Agenda and Roads Committee Report is contained in Appendix E5. As illustrated in the Council Report some minor adjustments were made to the Recommended Design to address access issues at 5043 WR 32 South (Bernardi).

9.7 Notice of Study Completion

In accordance with County of Wellington Council approval for the Wellington Road 124 project, the Environmental Study Report was completed and the Notice of Study Completion was advertised on **December 12, 2019** in the Wellington Advertiser. The Notice of Study Completion can be found in Appendix E6**.** This notice was mailed to agencies, property owners and persons expressing interest in the project, as well as hand delivered to residents within the Study Area.

10.0 SUBMISSION OF ENVIRONMENTAL STUDY REPORT AND PART II ORDER REQUESTS

Hard copies of this Environmental Study Report (ESR) have been made available for the 30-day review period in the Clerk's offices in each of the County of Wellington, City of Guelph and Township of Guelph-Eramosa's municipal offices. The ESR is also available for review on the County of Wellington's website at https://www.wellington.ca/en/resident-services/rd-wellingtonroad124ea.aspx.

About Part II Orders - If you feel that significant outstanding issues have not been addressed in a Class Environmental Assessment process and could be better addressed through an Individual Environmental Assessment process, you can ask for a higher level of assessment. This is known as a Part II Order and anyone can make the request. A Part II Order request should not be made in an effort to delay or stop the planning and implementation of a Class Environmental Assessment project.

When to submit a Part II Order request - A Part II Order request can be made after the proponent issues the Notice of Study Completion and within the specified review period outlined in the notice. A Part II Order request should only be made when issues can't be resolved through:

- the Class Environmental Assessment process;
- discussions with the proponent; and/or
- mediation.

How to make a Part II Order request - As of July 1, 2018, A Part II Order Request Form must be used to request a Part II Order.

To submit your Part II Order Request, download the Part II Order Request Form at http://www.forms.ssb.gov.on.ca and search for "Part II Order Request**".** Complete the form and include the following information:

- name and address;
- project name;
- proponent name (i.e. County of Wellington);
- specific reasons why the request is being made – e.g. concerns and issues;
- why a higher level of environmental assessment would address your concerns;
- information about efforts to date to discuss and resolve concerns with the proponent;
- the outcome you are seeking from the Minister; and
- other matters relevant to the request.

A request must:

- focus on potential environmental effects of the project or the class environmental assessment process;
- not focus on decisions outside the class environmental assessment process (e.g. land-use planning decisions made under the *Planning Act* or issues related to municipal decision-making about the process); and
- not raise issues unrelated to the project.

Unless otherwise stated in a request, any personal information provided will become part of the public record and will be released, if requested, to any person.

Where to send request – A completed Part II Order Request Form must be sent to the Minister of Environment, Conservation and Parks or delegate. You should also send a copy of the form to the Director of Environmental Assessment and Permissions Branch as well as the Proponent:

Minister of the Environment, Conservation and Parks
Ministry of the Environment, Conservation and Parks
Floor 11
77 Wellesley Street West
Toronto ON M7A 2T5
minister.mecp@ontario.ca

Director, Environmental Assessment and Permissions Branch
Ministry of the Environment, Conservation and Parks
135 St. Clair Avenue West, 1st Floor
Toronto ON M4V 1P5
enviropermissions@ontario.ca

The Part II Order Request Form must also be sent to the County of Wellington (Proponent) and their Consultant Project Manager:

Don Kudo, P.Eng.
County Engineer
County of Wellington
74 Woolwich Street
Guelph, ON N1H 3T9
Telephone: 519-837-2601 Ext.2280
Email: donk@wellington.ca

Dave Hallman, P.Eng.
Senior Project Manager
MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener, ON N2B 3X9
Telephone: 519-743-6500 Ext. 1336
Email: dhallman@mte85.com

Timeline - Each Class Environmental Assessment establishes timelines for the Ministry's review of requests.

Minister's Decision - Minister's decisions on Part II Order requests are final. The minister has 4 options for a decision on a Part II Order request:

- refer the matter to mediation before making a decision;
- deny the request and inform the proponent and requester;
- deny the request but impose conditions; and/or
- require the Proponent to comply with the Part II Order and prepare a Terms of Reference and Individual Environmental Assessment.

If a request is **denied**, the Proponent can implement the project subject to any conditions imposed.

If a request is **granted,** the Proponent can begin preparing Terms of Reference for an Individual Environmental Assessment, if they still wish to move ahead with the project.

Factors for Minister Making Decision

The Minister of the Environment, Conservation and Parks will consider the following when making a decision:

- purpose of the Environmental Assessment Act;
- factors suggesting the proposed project differs from other projects in the class to which the Class EA applies;
- significance of the factors, and of the differences mentioned above;
- any reasons given by the requester;
- Proponent's response to the request; and
- Mediator's report—if available.

The Minister will also consider:

- extent and nature of public concern;
- potential for significant adverse environmental effects;
- Proponent's consideration of alternatives;
- considerations of urgency;
- Requester's participation in the planning process;
- nature of the request;
- implications for matters of significant provincial interest; and
- degree to which public consultation and dispute resolution have taken place.

11.0 PROJECT COST ESTIMATE

A cost estimate has been prepared based on the recommended design for WR 124, as reflected in the Preliminary Design Drawings (**Appendix F).** The cost estimate was derived by calculating preliminary estimated quantities and multiplying them by unit costs estimated at the time of writing of this report in 2019. The total project cost is estimated to be approximately $15,810,000 as outlined in **Table 11.1.** It should be noted that actual final costs will be based on detailed design, construction timing and staging, detailed geotechnical studies that will determine pavement structure, dewatering and fill requirements, as well as various approval agency and utility requirements, as applicable.

Table 11.1 has been prepared under the following assumptions and conditions:

- A Geotechnical Investigation must be completed to confirm soil conditions for road sub-base, pavement structure, potential dewatering & sub-excavation;
- Construction costs are estimated based on 2019 construction prices; and
- Estimate includes allowances only for utility relocation, design and approval, unforeseen items. Final costs will be dependent on final Detail Design.

Table 11.1: Preliminary Design Cost Estimate

Wellington Road 124 - Township Road 1 to Fife Road

September 13, 2019				Twp. Rd. 1 to West of WR32S Roundabout		Double WR32 Roundabouts		East of WR 32 Roundabouts to West of		Whitelaw Road Intersection		Whitelaw Road to Fife Road		*TOTAL*
Item No.	Description	Unit	Unit Price	Estimated Quantity	Estimated Total	Estimated Quantity	Estimated Total	Estimated Quantity	Estimated Total	Estimated Quantity	Estimated Total	Estimated Quantity	Estimated Total	Estimated Total
A1 - Site Preparation & Removals														
A1.1	Traffic control	lump sum	Varies	1	$20,000.00	1	$40,000.00	1	$22,000.00	1	$20,000.00	1	$20,000.00	$122,000.00
A1.2	Construction layout	lump sum	Varies	1	$15,000.00	1	$30,000.00	1	$17,000.00	1	$10,000.00	1	$15,000.00	$87,000.00
A1.3	Remove & dispose of existing asphalt	m^2	$5.00	19,000	$95,000.00	18,000	$90,000.00	23,000	$115,000.00	6,500	$32,500.00	18,000	$90,000.00	$422,500.00
A1.4	Remove & dispose of existing curb & gutter	m	$10.00	0	$0.00	300	$3,000.00	0	$0.00	200	$2,000.00	0	$0.00	$5,000.00
A1.5	Remove and dispose of existing guiderail	m	$15.00	160	$2,400.00	0	$0.00	0	$0.00	150	$2,250.00	0	$0.00	$4,650.00
A1.6	Remove and dispose of existing traffic signals	lump sum	Varies	0	$0.00	2	$15,000.00	0	$0.00	1	$0.00	0	$0.00	$15,000.00
A1.7	Remove & dispose of existing storm sewer pipes and manholes	lump sum	Varies	1	$10,000.00	1	$20,000.00	1	$10,000.00	1	$15,000.00	1	$1,000.00	$56,000.00
A1.8	Cold plane asphalt joints	m^2	$60.00	300	$18,000.00	100	$6,000.00	500	$30,000.00	100	$6,000.00	400	$24,000.00	$84,000.00
A1.9	Tree removals, protection, maintain & relocate as required	lump sum	Varies	1	$10,000.00	1	$25,000.00	1	$12,000.00	1	$10,000.00	1	$15,000.00	$72,000.00
A1.10	Miscellaneous removals (pillars, signs etc.)	lump sum	Varies	1	$5,000.00	1	$15,000.00	1	$10,000.00	1	$10,000.00	1	$20,000.00	$60,000.00
	Subtotal Section A1 - Site Preparation & Removals				**$175,400.00**		**$244,000.00**		**$216,000.00**		**$107,750.00**		**$185,000.00**	**$928,150.00**
A2 - Road Works														
A2.1	Excavate to subgrade	m3	$12.00	16,675	$200,100.00	18,488	$221,850.00	21,025	$252,300.00	7,830	$93,960.00	15,370	$ 184,440.00	$952,650.00
A2.2	Roadway Paving													
A2.2.1	Granular 'A' (150mm)	tonnes	$18.00	8,625	$155,250.00	6,938	$124,875.00	10,688	$192,375.00	2,813	$50,625.00	7,050	$ 126,900.00	$650,025.00
A2.2.2	Granular B (400mm)	tonnes	$15.00	23,000	$345,000.00	18,500	$277,500.00	28,500	$202,500.00	7,500	$112,500.00	18,800	$ 282,000.00	$1,219,500.00
A2.2.3	SP 12.5 Surface Asphalt (50mm) Road	tonnes	$110.00	2,990	$328,900.00	2,405	$264,550.00	3,705	$407,550.00	975	$107,250.00	2,444	$ 241,345.00	$1,349,595.00
A2.2.4	SP 19 Base Asphalt (125 mm) Road	tonnes	$80.00	7,475	$598,000.00	6,013	$481,000.00	9,263	$741,000.00	2,438	$195,000.00	6,110	$ 421,590.00	$2,436,590.00
A2.3	Driveway Restoration	m^2	$15.00	2,500	$37,500.00	400	$6,000.00	1,700	$25,500.00	200	$3,000.00	4,000	$ 60,000.00	$132,000.00
A2.4	Curb & gutter													
A2.4.1	Concrete Curb & Gutter (all types)	m	$60.00	200	$12,000.00	3,700	$222,000.00	270	$16,200.00	1,500	$90,000.00	2,950	$ 177,000.00	$517,200.00
A2.4.2	Concrete spill way	each	$500.00	5	$2,500.00	4	$2,000.00	4	$2,000.00	6	$3,000.00	0	$ -	$9,500.00
A2.5	Concrete Sidewalk	m^2	$55.00	0	$0.00	2,400	$132,000.00	0	$0.00	275	$15,125.00	0	$ -	$147,125.00
A2.6	Supply and install detectable warning plates	Each	$250.00	0	$0.00	18	$4,500.00		$0.00	9	$2,250.00	0	$ -	$6,750.00
A2.7	Boulevard restoration - topsoil & sod	m^2	$15.00	0	$0.00	2,000	$30,000.00		$0.00		$0.00	5,000	$ 75,000.00	$105,000.00
A2.8	Boulevard restoration - topsoil & seed	m^2	$12.00	15,000	$180,000.00	13,000	$156,000.00	13,500	$162,000.00	2,300	$27,600.00	4,500	$ 54,000.00	$579,600.00
A2.9	Pavement Markings	m	$4.00	5,200	$20,800.00	2,900	$11,600.00	6,500	$26,000.00	1,400	$5,600.00	4,500	$ 18,000.00	$82,000.00
A2.10	New Guiderail	m	$100.00	210	$21,000.00	0	$0.00		$0.00	160	$16,000.00	0	$ -	$37,000.00
A2.11	Miscellaneous Geotextile, unsuitable soils & replacement, adjustments, subdrains etc.	lump sum	Varies	1	$100,000.00	1	$90,000.00	1	$100,000.00	1	$40,000.00	1	$ 80,000.00	$410,000.00
	Subtotal Section A2 - Road Works				**$2,001,050.00**		**$2,023,875.00**		**$2,127,425.00**		**$761,910.00**		**$1,720,275.00**	**$8,634,535.00**
A3 - Storm Sewers														
A3.1	Supply and install 450 - 525mm storm sewer	m	$300.00	0	$0.00	1,050	$315,000.00	0	$0.00	320	$96,000.00	885	$265,500.00	$676,500.00
A3.2	Supply and install catchbasins/ditch inlets/manholes/headwalls	ea	$4,750.00	0	$0.00	42	$199,500.00	0	$0.00	7	$33,250.00	12	$57,000.00	$289,750.00
A3.3	Concrete Culvert Reconstruction/extensions	ea	Varies	1	$250,000.00	1	$90,000.00	0	$0.00	0	$0.00	1	$50,000.00	$390,000.00
A3.4	Driveway culvert removal and replacement (15m long)	ea	$2,000.00	25	$50,000.00	4	$8,000.00	17	$34,000.00	2	$4,000.00	3	$6,000.00	$102,000.00
A3.5	Road Culvert Removal and Replacement	m	$400.00	105	$42,000.00	100	$40,000.00	60	$24,000.00	0	$0.00	42	$16,800.00	$122,800.00
A3.6	Adjustments to existing structures, connections, etc.	lump sum	Varies	0	$10,000.00	1	$15,000.00	1	$2,000.00	1	$5,000.00	1	$10,000.00	$42,000.00
	Subtotal Section A3 - Storm Sewers				**$352,000.00**		**$667,500.00**		**$60,000.00**		**$138,250.00**		**405,300.00**	**$1,623,050.00**
A4 - Miscellaneous/Provisional Items - Design														
A4.1	Utility relocations													$0.00
A4.1.1	Hydro	lump sum	$50,000.00	1	$60,000.00	1	$55,000.00	1	$55,000.00	1	$40,000.00	1	$45,000.00	$255,000.00
A4.1.2	Gas	lump sum	$5,000.00	1	$5,000.00	1	$25,000.00	1	$10,000.00	1	$5,000.00	1	$10,000.00	$55,000.00
A4.1.3	Bell/Rogers	lump sum	$20,000.00	1	$15,000.00	1	$15,000.00	1	$20,000.00	1	$10,000.00	1	$15,000.00	$75,000.00
A4.2	Hydrovac	lump sum	$10,000.00	1	$10,000.00	1	$10,000.00	1	$10,000.00	1	$10,000.00	1	$10,000.00	$50,000.00
A4.4	Traffic Signals Installation (pole bases, conduit, handwells, wiring, poles, controller,	lump sum	$100,000.00	0	$0.00	0	$0.00	0	$0.00	1	$100,000.00	0	$0.00	$100,000.00
A4.5	Allowance for unforeseen items (15%)	lump sum	Varies	1	$469,267.50	1	$545,306.25	1	$455,513.75	1	$316,186.50	1	$426,586.25	$2,212,860.25
	Subtotal Section A4 - Miscellaneous/Provisional Items				**$559,267.50**		**$650,306.25**		**550,513.75**		**$481,186.50**		**$506,586.25**	**$2,747,860.25**
	Subtotal Sections A1 to A4 - TOTAL ESTIMATED CONSTRUCTION COST				**$3,087,717.50**		**$3,585,681.25**		**2,953,938.75**		**$1,489,096.50**		**$2,817,161.25**	**$13,933,595.25**
A5	**Engineering/Project Management (12%)**				**$393,414.00**		**$457,245.00**	**1**	**383,411.00**	**1**	**$285,949.20**	**1**	**$357,269.00**	**$1,877,288.20**
	TOTAL Estimated Construction, Utility and Design Cost				**$3,481,131.50**		**$4,042,926.25**		**3,337,349.75**		**$1,775,045.70**		**$3,174,430.25**	**$15,810,883.45**

APPENDIX A

Natural Environment Report (Natural Resource Solutions Inc., Sept. 2019)

Draft

County Road 124 Class B Environmental Assessment

Natural Environment Report

Prepared for:

MTE Consultants Inc.
520 Bingemans Centre Drive,
Kitchener, ON N2B 3X9

Project No. 2085 | September 2019

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

County Road 124 Class B EA

Natural Environment Report

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1.0 Introduction

Natural Resource Solutions Inc. (NRSI) was retained as part of a team with MTE Consultants Inc. by the County of Wellington to complete the natural environment component of a Class B Environmental Assessment for the proposed improvements to County Road 124.

The County of Wellington intends to undertake improvements to County Road 124 within the project limits between County Road 1 and Fife Road, approximately 5.8km. The improvements will include roundabouts at the intersections with County Road 32 and Whitelaw Road, drainage improvements, some urbanization (i.e. curb and gutter, storm sewers) and minor widening within the right-of way. There are two culverts/watercourse crossings, including Ellis Creek and a second tributary.

The Subject Lands are located within the Grand River Watershed and the Speed-Eramosa River Sub-basin. Natural features are part of Wellington County's Core Greenlands System. The Subject Lands are located within Ecoregion 6E.

The majority of the land adjacent to the road is characterized by active agricultural use and rural residential properties. A number of commercial properties are located at the intersections of Road 124 with County Road 32. Natural features within and adjacent to the Subject Lands include Ellis Creek Wetland Complex which is a Provincially Significant Wetland, Guelph Southwest Wetland Complex which is a non-provincially significant wetland and two watercourses regulated by GRCA.

1.1 Study Area

For the purposes of this report, the term "Subject Lands" refers to the County Road 124 Right-Of-Way (ROW) and immediately adjacent lands surrounding Ellis Creek, Tributary A and the lands considered for roundabouts, as shown on Map 1. Natural features extend beyond the boundaries of the subject lands, and therefore a larger study area was considered for context. The term "study area" refers to the surrounding area (approximately 120m) for which additional information was collected and reviewed. Legacy data collected from agencies and wildlife atlases encompassed an area of approximately 1km around the Subject Lands to ensure that all surrounding natural features were considered.

2.0 Relevant Policies, Legislation and Planning Studies

Table 1 provides an overview of relevant policies that were considered to inform the field program and analysis. This section of the report was used to guide the evaluation of alternatives by identifying specific implications of these policies to each scenario. The Provincial Policy Statement (PPS) (OMMAH 2014) and the local Official Plans have specific policies which speak to activities that create or maintain infrastructure authorized under an EA process with respect to natural heritage features. Development adjacent to, or within important natural features (which would otherwise be strictly prohibited) may be permitted if it is demonstrated through an Environmental Impact Study (EIS) that there will be no serious adverse negative impacts to the features form or function. As such, minor encroachment into natural features by the preferred design alternative may be endorsed by the municipalities in support of this road improvement project if they are required.

Table 1. Relevant Policies, Legislation and Planning Studies

Policy/Legislation	Description	Project Relevance
Provincial Policy Statement (PPS) (OMMAH, 2014)	• Issued under the authority of Section 3 of the Planning Act and came into effect on April 30, 2014, replacing the 2005 PPS (MMAH 2005). • Section 2.1 of the PPS – Natural Heritage establishes clear direction on the adoption of an ecosystem approach and the protection of resources that have been identified as 'significant'. • The Natural Heritage Reference Manual (MNR 2010) and the Significant Wildlife Habitat Technical Guide (MNR 2000, MNRF 2015a) were prepared by the Ministry of Natural Resources and Forestry (MNRF) to provide guidance on identifying natural features and in interpreting the Natural Heritage sections of the PPS.	• Section 2.1.4 of the PPS states that development or site alteration shall not be permitted in Significant Wetland. • Section 2.1.5 of the PPS states that development or site alteration shall not be permitted in Significant Wildlife Habitat in Ecoregion 6E unless it has been demonstrated that there will be no negative impacts on the features or their ecological functions. • Section 2.1.7 of the PPS states that development or site alteration shall not be permitted in habitat of Endangered or Threatened species except in accordance with provincial or federal requirements. • Section 2.1.2 of the PPS states that the connectivity of natural features in an area should be maintained, restored, or where possible, improved. • Based on a preliminary analysis, the following natural features were identified within the study area which have implications under the PPS: o Significant Wetland o Potential habitat for Endangered and Threatened species; o Significant Wildlife Habitat, and o Fish Habitat.
Endangered Species Act (ESA 2007) (Government of Ontario 2007)	• The ESA prohibits killing, harming, harassing or capturing Species at Risk (SAR) and protects their habitats from damage and destruction.	• Several flora and fauna SAR were identified through the background review as having the potential to occur within the study area (Appendix I), although none were observed through the various surveys.
Migratory Birds Convention Act (MBCA) (Government of Canada 1994)	• The MBCA protects migratory game birds, insectivorous birds, and several other migratory non-game birds from persecution in the form of harassment. • The Act prohibits the harassment and destruction of bird nests during the course of construction and other related activities except under the authority of a permit obtained through the Canadian Wildlife Service (CWS) • The schedule of on-site work must consider MBCA windows, with timing of breeding bird season typically occurring between early April and late August; however, this is a guideline, since the MBCA applies to nesting bird species. • "Incidental take" is considered illegal, with the exception of a permit obtained from the CWS.	• Species protected by the MBCA were identified through the background review as having the potential to occur within the study area. • During the site preparation and/or construction phase of the project there is the potential for implications to birds and bird nests. • The schedule of construction activities, especially vegetation / tree clearing and site grading must have consideration for the general MBCA nesting periods for migratory birds in Canada.
The Canadian Fisheries Act (Government of Canada 1985)	• The federal Fisheries Act, 1985 (amended in 2016) requires that serious harm to fish be avoided unless authorized by the Minister of the Department of Fisheries and Oceans Canada (DFO). This applies to work being conducted in or near waterbodies that support fish that are part of, or support, a commercial, recreational, or Aboriginal fishery. • DFO has developed an online, assessment tool, where proponents can determine whether their projects require DFO review based on the type of water body the work is occurring in and the nature of the proposed activity.	• The road improvements where County Road 124 crosses Ellis Creek and Tributary A may have implications for fish and fish habitat. • In order to avoid causing serious harm to fish and fish habitat, an assessment screening will be required where work is proposed near/at Ellis Creek and Tributary A to determine whether a review by the DFO is required. Once detailed designs are known, the self-assessment will be completed to determine if there is potential for serious harm and if a request for review is needed.
Fish and Wildlife Conservation Act (FWCA) (Government of Ontario 1997)	• The FWCA contains provisions for the protection of certain bird species not protected by the MBCA, such as raptors. • Protection does not apply to American Crow (*Corvus brachyrhynchos*), Brown-headed Cowbird (*Molothrus ater*), Common Grackle (*Quiscalus quiscula*), House Sparrow (*Passer domesticus*), Red-winged Blackbird (*Agelaius phoeniceus*) or European Starling (*Sturnus vulgaris*). • The FWCA also protects furbearing mammals, their dens or habitual dwellings, other than the Red Fox (*Vulpes vulpes*) and Striped Skunk (*Mephitis mephitis*.	• Several furbearers are known from the study area based on a review of background information. Their dens cannot be destroyed without a permit from the MNRF. • Raptors and their nests are protected under the FWCA. Mitigation measures would be implemented for these species, if present. • The timing of construction activities, especially vegetation / tree clearing and site grading must have consideration for bird nesting and den sites for furbearing mammals.
Ontario Regulation 150/06 (GRCA 2015)	• Ontario Regulation 150/06 is the Regulation of Development, Interface with Wetlands and Alterations to Shorelines and Watercourses. • Through this regulation, the GRCA has the responsibility to regulate activities in natural and hazardous areas (i.e. areas in and near rivers, streams, floodplains, wetlands, and slopes).	• The GRCA regulates a portion of the study area, due to the presence of Provincially Significant and non-provincially significant wetlands and the associated floodplains. • There are also two regulated watercourses that transect the Subject Lands • Permitting from the GRCA must be obtained for proposed works within the regulation limit.
Wellington County Official Plan (County of Wellington 2019)	• The Official Plan (OP) includes policies related to the protection of the natural environment through the Greenlands System. • The OP states that the Greenland System will be maintained or restored to improve ecological function and biodiversity.	• The following is designated as Core Greenlands: Speed River Wetland Complex (Provincial Significance), Ellis Creek Wetland Complex (Provincial Significance), Guelph Southwest Wetland Complex • A PSW is typically provided a minimum 30 m buffer from development.

Policy/Legislation	Description	Project Relevance
	• A statement is required that tare no negative impacts within Provincially Significant Greenland features or a means for impacts to be mitigated in other greenland areas • Consideration is required for potential enhancement of environmental features of functions through site design alternatives."	• Habitat for Endangered species may also be present and is considered Core Greenlands.
Wellington County Woodlands Conservation By-law 5115-09 (County of Wellington 2009)	• The Woodlands Conservation By-law regulates the removal of trees within woodlands. • It is intended to conserve the forest cover within the County	• Trees may be removed for the County Road 124 construction • A formal tree inventory was completed for the Subject Lands. This report recommends that tree removal be limited to the area required for construction. Trees adjacent to the building envelope which are in good health should be retained.
City of Guelph Tree Bylaw No. 19058 (City of Guelph 2010)	• Aims to regulate tree protection within City limits. • Statutes of protection, aims that no person shall destroy, injure, or permit destruction towards a defined, regulated tree	• A Tree Inventory and Preservation Plan (TIPP) is required to demonstrate how remaining trees will be protected from injury, while outlining a replanting and compensation plan.

3.0 Collection and Review of Background Information

Existing natural heritage information was gathered and reviewed to identify key natural heritage features and species that are known, or have potential to occur, within the study area. Requests for background information were sent to the MNRF Guelph District, as well as to the GRCA. NRSI received background information on the natural features from GRCA (Pers. comm., R. Hamelin, Ecologist, May 29, 2018) and MNRF – Guelph District Office (Pers. comm., A. Vandervoort, Management Biologist, May 31, 2018). Background information on the natural environmental features within the study area was also gathered from the following sources:

- Natural Heritage Information Centre (NHIC) database (MNRF 2018a);
- Land Information (LIO) data base mapping (Government of Ontario 2018);
- Species at Risk (SAR) habitat descriptions and range mapping (MNRF 2018b);
- Fisheries and Oceans Canada (DFO) Aquatic Species at Risk Mapping Tool (DFO 2018)
- Grand River Conservation Network: Interactive Mapping Tool (GRCA 2016)

Initial wildlife species lists were compiled to provide information on species reported from the vicinity of the study area (10km radius) using various atlases; including the Ontario Mammal Atlas (Dobbyn 1994), the Ontario Reptile and Amphibian Atlas (ORAA) (Ontario Nature 2018), the Ontario Butterfly Atlas (MacNaughton et al. 2018), and the Ontario Odonata Atlas (OMNRF 2018). Data on breeding birds in the area was extracted from the Ontario Breeding Bird Atlas (OBBA) (Bird Studies Canada (BSC) et al. 2008). For the atlases providing data based on 10x10km survey squares (ORAA, OBBA, Ontario Odonata Atlas). These initial species lists were used to guide the scope and type of wildlife field surveys required as outlined in the following sections.

3.1 Species at Risk Screening

A preliminary screening exercise was conducted on SAR reported to occur in the study area to identify which species may have suitable habitat within the Subject Lands (Appendix I). This involved cross-referencing the preferred habitat for reported SAR and Species of Conservation Concern (SCC) against habitats known to occur in the Subject Lands (OMNR 2000). This was completed to ensure that the potential presence of all SAR and SCC was considered in the analysis of alternatives.

SAR are those listed on the Species at Risk in Ontario List (SARO) (Ministry of Environment, Conservation and Parks (MECP) 2019). These include species identified by the Committee on the Status of Species at Risk in Ontario (COSSARO) as provincially Endangered, Threatened, or Special Concern. Species listed as Endangered or Threatened are protected by the ESA, 2007 (Government of Ontario 2007), which also includes protection of their habitat.

Species designations included in the definition of SCC includes:

- Species designated provincially as Special Concern,
- Species that have been assigned a conservation status (S-Rank) of S1 to S3 or SH by the NHIC, and
- Species that are designated federally as Threatened or Endangered by the Committee for the Status of Endangered Wildlife in Canada (COSEWIC) but not provincially by the COSSARO.

SAR and SCC identified as having records within the study area and SAR that were observed during 2018 field surveys are discussed in Section 6.6. SCC are also discussed further within the context of SWH in Section 6.5.

3.2 Significant Wildlife Habitat Screening

A preliminary screening for the presence of SWH was completed for the study area (Appendix II). The Significant Wildlife Habitat Technical Guide (SWHTG) is a guideline document that outlines the types of habitats that the MNRF considers significant in Ontario as well as criteria to identify these habitats (MNR 2000, MNRF 2015a). The SWHTG groups SWH into 4 broad categories; 1) seasonal concentration areas, 2) rare vegetation communities and specialized wildlife habitat, 3) habitats of SCC, and 4) animal movement corridors. Based on the results of the preliminary screening exercise, the following 4 SWH types, which are discussed in Section 6.5 of this report, were considered to be candidate for the study area:

1. Seasonal Concentration Areas
    - Raptor Wintering Area
    - Snake Hibernaculum
2. Specialized Wildlife
    - Amphibian Breeding Habitat (Wetlands)
3. Habitat for SCC

- Marsh Breeding Bird Habitat
- Terrestrial Crayfish
- Special Concern and Rare Wildlife Species

4. Animal Movement Corridors
    - Amphibian

4.0 Field Methods

Terrestrial field surveys were undertaken within the Subject Lands to characterize natural features and identify significant and sensitive natural heritage features and species that have potential to be adversely affected by the proposed development. Field visits were completed on a total of 9 dates in April, May and June, 2018, plus incidental observations on additional days. A variety of field surveys were undertaken which are summarized in Table 2. Survey methods were undertaken in accordance with provincial and local guidance documents. The locations of specific monitoring stations are shown on Map 1.

During the field work program, all observations of birds, reptiles, amphibians, mammals, butterflies, dragonflies, and damselflies were documented on all field visits. This included actual direct observations of individuals, as well as signs of wildlife presence (i.e. tracks, scats, dens, nests etc.).

Table 2. Field Survey Summary

Survey Type	Protocol	Date[1]	Observer(s)[2]
Anuran Call Survey	BSC 2009	April 24	EG
		May 23	KM
		June 15	JM
Bat Cavity Tree Inventory	OMNR 2011, MNRF 2017	May 15	AR, KB
Breeding Bird Survey	OBBA 2001	June 8	EG, TL
		June 20	EG, KE
Ecological Land Classification	Lee et al. 1998	June 8 June 20	EG EG, KE
Road Mortality Survey (plus incidental mortality observations)		April 24 April 26 May 9 May 10 May 14 May 22 June 8	EG EG JM GM DS GM EG
Tree Inventory		July 6 July 19	EB, JB, KM EB, KM
Wetland Flagging and Confirmation		June 8	EG, TL
Aquatic Habitat Assessment and Fish Survey		July 12	GM, RY

[1]All surveys were conducted in 2018.

[2] AR = Amy Reinert, EG = Elaine Gosnell, DS = Dave Stevenson, GM = Gina MacVeigh, JB=Jeremy Bannon, JM = Jennifer McCarter, KB = Kim Broadbelt, KE = Kayla Ellis, KM = Kayla Martin, RY = Rachel Young, TL= Taylor Larking

4.1 Terrestrial Field Surveys

4.1.1 Vegetation Surveys

Vegetation communities were delineated using the standard Ecological Land Classification (ELC) System for southern Ontario (Lee et al. 1998) on June 8 and 20, 2018. Field investigations focused on areas with natural habitats in and adjacent to the Subject Lands, including along Ellis Creek, Tributary A, and Provincially Significant Wetlands (Maps 1A-1J). Details of each vegetation community were recorded including species composition, dominance, uncommon species or features, and evidence of human impact.

4.1.2 Tree Inventory

All trees e10cm Diameter at Breast Height (DBH) within the study area ROW, including roads and trails intersecting with Fairway Road throughout the study area, were inventoried and assessed by Certified Arborists on July 6, and 19, 2018. The following information was recorded for each tree:

- Species,
- DBH (cm),
- Number of stems
- Crown radius (m),
- General health (excellent, good, fair, poor, very poor),
- Potential for structural failure (improbable, possible, probable or imminent),
- Tree location (UTM coordinates), and
- General comments (i.e. disease, aesthetic quality, direction of lean, development constraints, sensitivity to development).

Trees were not tagged as part of the inventory. The location of each inventoried tree was georeferenced to sub-meter accuracy using an SXBlue II GNSS GPS unit by the Certified Arborist. Trees occurring on private property required a manual update of the tree point based on aerial interpretation of the crown, and arborist observations.

Trees beyond the expected extent of grading were not inventoried as they are unlikely to be affected by the proposed works. If there is a change in the expected extent of grading based on the preferred alternative, then additional trees may need to be inventoried.

The overall health of each tree and potential for structural failure was assessed based on the criteria outlined in Appendix III. In carrying out these assessments, NRSI has exercised a reasonable standard of care, skill and diligence as would be customarily and normally provided in carrying out these assessments. The assessments have been made using accepted arboricultural techniques. These include a visual examination of each tree for structural defects, scars, external indications of decay such as fungal fruiting bodies, evidence of insect attack, the condition of any visible root structures, the degree and direction of lean (if any), the general condition of the tree(s) and the surrounding site, and the current or planned proximity of property and people. None of the trees examined were dissected, cored, probed, or climbed and detailed root crown examinations involving excavation were not undertaken. The conditions for this assessment, including restrictions, professional responsibility and third-party liability can be found in Appendix III.

4.1.3 Bat Habitat Assessment

Three bat species listed as Endangered provincially may be present within the study area, and are afforded general habitat protection under the ESA (Government of Ontario 2007). Bat SAR include Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Tri-coloured Bat (*Perimyotis subflavus*).

These species are known to roost in tree cavities, hollows, leaf clusters, or under loose bark, as well as within buildings (OMNR 2000). NRSI biologists trained and experienced in the MNRF bat habitat assessment protocol (Ministry of Natural Resources and Forestry (OMNRF) 2017), visually scanned all trees e10cm Diameter at Breast Height (DBH) for the presence of cavities that may provide bat maternity colony habitat. Although the MNRF's guidance document, Bats and Bat Habitats: Guidelines for Wind Power Projects (OMNR 2011), specifies that all trees e25cm in DBH should be surveyed, all trees e10cm in DBH were scanned for cavities as a means of thoroughly searching for any potential habitat for bats. The bat habitat assessment was conducted on May 15, 2018 to determine if leaf clusters were present, which may indicate that Tri-coloured Bat utilizes the area as suitable roosting habitat. Bat cavity trees that may provide suitable habitat are shown on Map 2.

Information considered (and recorded, where applicable) for cavity trees included tree species, location, DBH, canopy cover, tree height, decay class according to Watt and Caceres (1999), and number of potentially suitable cavities. Other criteria were also considered, including the use of cavities by other wildlife, the potential for cavities to be used by predators,

supporting/surrounding habitat, and other characteristics which may contribute to the habitat requirements of these species, such as temperature regulation. Information considered for leaf clusters included searching Maple and Oak trees for small clusters of dead or dying leaves.

Habitat for bats may be present within the woodlands adjacent to the Subject Lands, as well; however, as any natural features outside the road right-of-way will be retained, focused plot surveys to identify potential maternity roosts were not deemed necessary.

4.1.4 Breeding Bird Surveys

Early morning breeding bird surveys were completed on June 8 and June 20, 2018 and data was recorded using standard OBBA call codes (OBBA 2001). Ten-minute point count surveys were conducted between dawn and 1000 hrs at 10 monitoring stations distributed throughout the study area natural features as shown on Map 1. All visual and auditory observations of birds were recorded as well as the highest level of breeding evidence exhibited for each recorded species.

4.1.5 Anuran Surveys

Evening anuran (frog and toad) call surveys were conducted on April 24, May 23, and June 15, 2019 using the Marsh Monitoring Program protocol (BSC 2009) at 6 stations within or adjacent to wetland habitats and other areas where vernal pools had the potential to be present. Survey locations are shown on Map 1. All calling anurans heard during 3-minute call counts were recorded to species and included an estimate of call intensity and number of individuals present. At each station, the survey time, air and water temperature, pH, wind speed, and cloud cover were recorded.

4.1.6 Additional Wildlife

All observations of wildlife were documented during all field visits. This included actual direct observations of individuals, as well as signs of wildlife presence (i.e. tracks, scats, dens, nests etc.). The locations of rare species were documented and recorded with a handheld GPS.

4.2 Aquatic Surveys

NRSI aquatic biologists conducted one visit to the study area on July 12, 2018 to characterize the aquatic habitat within Ellis Creek and Tributary A where they cross County Road 124. Habitat within Ellis Creek and Tributary A was assessed approximately 50m up and downstream

of the road. The assessment involved walking in a downstream to upstream direction, against the flow and characterizing the aquatic habitat.

In order to characterize aquatic habitats, the following information was recorded at each of the watercourse crossings:

- Substrate type,
- Channel depth, width, bankfull width, etc.,
- Water temperature,
- Dissolved oxygen, pH, conductivity and total dissolved solids,
- General bank stability,
- Riparian and aquatic vegetation,
- Cover type and quality, and,
- Flow conditions.

4.2.1 Fish Community Sampling

Fish sampling was conducted at Ellis Creek and Tributary A using a Smith-Root backpack electrofisher (LR-20B), set to a pulsating frequency of 60Hz, and an electric potential of 100 - 150 volts. Sampling involved one biologist with the backpack electrofisher and one alongside with a dip net walking in transects from the downstream end of the site to the upstream end. As fish were captured by net they were placed in a bucket for identification. Processed fish were released outside of the isolated sampling area. This process was repeated until no new species were encountered. Ellis Creek was shocked for a total of 169 seconds and Tributary A for 69 seconds. Electrofishing was conducted under a License to Collect Fish for Scientific Purposes from the MNRF (#1090377).

5.0 Existing Conditions

5.1 Soil, Terrain and Drainage

The Study Area is situated in the Guelph Drumlin Field physiographic region (GRCA 2016). The Guelph drumlins rest on dolostones of the Amabel and Guelph formations and, like most drumlin till plans and glacial meltwater spillways, the soils of this region generally consist of stony tills and deep gravel terraces (Chapman and Putnam 1984). The soil deposits surrounding County Road 124 are classified as Burford Series which is comprised of gravel that was deposited by glacial meltwaters in the form of spillways, which most commonly occur on the terraces of the Speed River (Department of Agriculture 1963).

The Burford series soils that surround the Study Area are primarily Burford loam, and to a lesser extent Guelph loam, Dumfires, Fox sandy loam, Donnybrook sandy loam, Granby sandy loam (Department of Agriculture 1963). Overall, the soil is course providing good drainage (Department of Agriculture 1963).

5.2 Vegetation

5.2.1 Vegetation Communities

The majority of the study area is characterized by active agricultural land as well as some residential, industrial and commercial lands. Natural features within and adjacent to the Subject Lands include Ellis Creek Wetland Complex which is a Provincially Significant Wetland (PSW), the Speed River PSW, the Guelph Southwest Wetland Complex which is a non-provincially significant wetland and 2 watercourses regulated by the Grand River Conservation Authority (GRCA) (Ellis Creek and a second watercourse referred to here as ‘Tributary A’).

A summary of ELC communities identified within the Subject Lands is provided in Table 3 and shown on Map 1.

Table 3. Vegetation Communities Identified within the Subject Lands

ELC Ecosite Type	ELC Description	Environmental Characteristics
Forest		
FOD7	Fresh Moist Lowland Deciduous forest	This lowland forest is located along the valley of Ellis Creek and is dominated by Green ash (Fraxinus pennslyvanica), Trembling aspen (Populus tremuloides), Manitoba Maple (Acer negundo) and American Basswood (Tilia americana) in the canopy and sub-canopy.
Wetlands		
SWD2	Ash Mineral Deciduous Swamp	This swamp is dominated by Freeman's Maple (*Acer X freemanii)* in the canopy, Common Buckthorn (*Rhamnus cathartica*), Grey/ Red Panicled Dogwood (*Cornus foemina ssp. racemosa*) and Red-oiser Dogwood (*Cornus stolonifera*) in the understory, and Sensitive fern (*Onoclea sensibilis*) and Horsetail species (*Equisetum sp.*) as groundcover.
SWD3	Maple Mineral Deciduous Swamp	This swamp has a canopy dominated by Silver Maple (*Acer saccharinum*) and Ash species (*Fraxinus sp.*) while the understory is dominated by Common Buckthorn, Common Lilac (*Syringa vulgaris*) and Red-oiser Dogwood.
SWD4-1	Willow Mineral Deciduous Swamp	The canopy and subcanopy of this swamp are dominated by Crack Willow (*Salix fragilis*) and White Willow (*Salix alba var. alba*) while the understory is dominated by Sandbar Willow (*Salix exigua*) and the groundcover is dominated by Reed Canary Grass (*Phalaris arundinacea*).
MAS2-1	Cattail Mineral Shallow Marsh	This marsh is dominated by Broad-leaved cattail (*Typha latifolia*).
Cultural		
CUM 1-1	Dry Moist Old Field Meadow	This meadow understory community is dominated by Common Buckthorn and Common Apple (*Malus domestica*) while the groundcover is dominated by grasses (Poaceae sp.)
CUW1	Mineral Cultural Woodland	This woodland is dominated by Manitoba Maple (*Acer negundo*), White Ash (*Fraxinus americana*) and American Basswood (*Tilia americana*) in the canopy and Siberian Elm (*Ulmus pumila*) and Manitoba Maple in the sub-canopy.
CUP3	Coniferous Plantation	This plantation has a canopy dominated by Norway Spruce (*Picea abies*), Staghorn Sumac (*Rhus hirta*) and Common Buckthorn in the understory.

5.2.2 Vascular Flora

A total of 102 vascular plant species were recorded during vegetation inventories within the Subject Lands in 2018 (including trees that were assessed during the tree inventory and were not in any of the assigned vegetation communities). A list of all species of plants can be found in Appendix IV.

The majority of species observed were native, with forty-three non-native species recorded during vascular flora surveys, comprising 42% of all vascular plant species observed.

Background information and SAR and SCC screening indicates that 3 SAR and 2 SCC plant species are known from within Wellington County (MNRF 2018) and have potential to be present in the Subject Lands. Although 1 Butternut (*Juglans cinerea*), which is listed as Endangered provincially and federally (MNRF 2018c, Government of Canada 2018), was observed by NRSI biologists adjacent to the SWD3 swamp in 2018, the tree was dead. No other SAR, or SCC species were documented.

One vascular plant species considered to be locally significant, Black Maple (*Acer saccharum ssp. nigrum*), (Dougan & Associates 2009, City of Guelph 2012), was observed within the Subject Lands (Map 2). Two individuals were documented in the north portion of the Subject Lands on private property during the tree inventory (Map 2). The crowns of these trees hang over the road right of way.

5.2.3 Tree Inventory

In total, 364 trees were inventoried, including 39 species. Of the trees inventoried and assessed, 208 (57.1%) are native and 156 (42.9%) are non-native species. A complete list of trees inventoried, including species, whether they are native or non-native and overall health is provided in Appendix V. Tree locations within the study area are shown on Map 3. A summary of the overall health of the trees inventoried within the study area, along with their potential for structural failure, is included in Appendix V. The majority of the trees inventoried are in good or fair condition with an improbable potential for structural failure.

The large majority of inventoried trees were planted as boulevard, garden or backyard trees, and generally showed signs of continued landowner or landscaper care such as mulching, suitable pruning practices, and garden bed maintenance. Others were located within the naturalized areas and have not been tended to. In some cases, trees were observed to be dead, to contain hanging branches, and/or to show signs of probable potential for failure.

5.3 Wildlife

5.3.1 Birds

A total of 101 bird species are reported from the Subject Lands based on the OBBA for Square 17NJ51 (BSC et al. 2008). The data found in the OBBA includes those species that have been observed in the area (10 x 10km range), are known to nest in the area, and/or have exhibited

some evidence of breeding in the area. A total of 45 species were documented within the Subject Lands during field surveys conducted by NRSI staff in 2018. Of the species observed, 8 were confirmed to be breeding ("CO"), and 25 exhibited probable ("PR") signs of breeding, such as females carrying food or nest materials, and 14 exhibited possible ("PO") signs of breeding such as singing or being observed in suitable breeding habitat. A list of all species of birds known from the study area is included in Appendix VI.

Background information indicates that 5 SAR and 4 SCC bird species are known from within Wellington County (MNRF 2016) or within 1km of the Subject Lands (BSC et al. 2008, OMNRF 2014). The SAR screening assisted in flagging 11 bird species, which potentially have suitable habitat within the Subject Lands, to be targeted during the breeding bird surveys.

NRSI observed 1 SAR bird species during 2018 surveys: Barn Swallow (*Hirundo rustica*). Barn Swallow is listed as Threatened provincially and federally (Government of Canada 2018, MECP 2019). Approximately 15 individuals were observed on June 20 from station BMB-010 (Map 2). These individuals exhibited probable ("PR") signs of breeding outside of the Subject Lands as they were observed flying in and out of a barn on the south side of the road (Map 2). Foraging individuals were also observed within the Subject Lands at monitoring stations BMB-007 and BMB-009; however, there was no evidence of breeding observed at these locations.

NRSI observed 1 SCC during field surveys. One Eastern Wood-Pewee (*Contopus virens*), listed as Special Concern provincially and federally (Government of Canada 2018, MECP 2019), was heard singing during the second breeding bird survey conducted on June 20, 2018 from station BMB-004. This bird was observed outside of the Subject Lands in the agricultural field to the south (Map 2). Given that this species was only documented during one breeding bird survey, it is considered to be a possible ("PO") breeding species within the Subject Lands.

A total of 10 bird species considered to be locally significant were observed (Dougan & Associates 2009, City of Guelph 2012). Of these, 2 species, Baltimore Oriole (*Icterus galbula*) and Eastern Kingbird (*Tyrannus tyrannus*) were confirmed to be breeding within the Subject Lands. A nest of Eastern Kingbird was found in the Ellis Creek culvert, while the Baltimore Oriole was observed entering a nest in a tree near BMB-004. One species, Savannah Sparrow (*Passerculus sandwichensis*), exhibited probable ("PR") signs of breeding at a number of point count stations. Three other locally significant species, Eastern Wood-Pewee (*Contopus virens*),

Willow Flycatcher (*Empidonax traillii*), and Vesper Sparrow (*Pooecetes gramineus*) exhibited possible ("PO") signs of breeding. General locations of significant species are shown on Map 2.

5.3.2 Herpetofauna

According to the background information 24 species of herpetofauna, including 3 SAR and 9 SCC, are known from within Wellington County (MNRF 2018) or within 10km of the Subject Lands (Ontario Nature 2018). The SAR screening assisted in flagging 3 SAR and 3 SCC species, which potentially have suitable habitat within the Subject Lands, to be targeted during 2018 surveys.

NRSI field investigations confirmed the presence of 4 species of amphibians within the Subject Lands. Four common species of anurans were recorded during call surveys and other site visits in 2018: Gray Treefrog (*Hyla versicolor*), Northern Green Frog (*Lithobates clamitans melanota*), American Toad (*Anaxyrus americanus*) and Spring Peeper (*Pseudacris crucifer*). Of the 6 survey stations monitored, 4 were documented to have calling anurans, while 2 were silent (Table 4).

One common reptile species, Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) was observed incidentally during fieldwork conducted in 2018.

No SAR, SCC, or regionally significant reptiles or amphibian species were observed. All species of herpetofauna known from the study area is included in Appendix VII.

Table 4. Anuran Call Survey Results from 2018

Anuran Call Station	Species	Anuran Call Survey			Total Number of Species	Total Number of Individuals
		1	2	3		
ANR-001	none				0	0
ANR-002	Spring Peeper	Code 1 (2)			1	2
ANR-003	none		Code 1 (1)		1	1
ANR-004	Gray Treefrog		Code 1 (2)		2	12
	Spring Peeper	Code 2 (8)	Code 1 (2)			
ANR-005	Spring Peeper	Code 1 (2)			1	2
ANR-006	Spring Peeper	Code 1 (2)			1	2

[1]Marsh monitoring anuran call code with estimated number of individuals in brackets.

5.3.3 Mammals

According to the Mammal Atlas of Ontario (Dobbyn 1994) and the MNRF (2018), 46 mammal species, including 5 SAR, are reported from within 10km of the Subject Lands, in Wellington County. NRSI staff observed evidence of 4 common mammal species in the Subject Lands, including the Eastern Cottontail, Eastern Chipmunk (*Tamias striatus*), Eastern Gray Squirrel (*Sciurus carolinensis*), and White-tailed Deer (*Odocoileus virginianus*). A list of all mammals species observed and known from background information is included in Appendix VIII.

Background information indicates that 3 SAR bats; Little Brown Myotis (*Myotis lucifungus*), Northern Myotis (*Myotis septentrionalis*), and Tri-coloured Bat (*Perimyotis subflavus*) are known from the study area (Dobbyn 1994, OMNRF 2018). In total, 15 potentially suitable bat maternity roost cavity trees were documented within the Subject Lands (Map 2).

5.3.4 Lepidoptera

The Ontario Butterfly Atlas had 18 species recorded for the Subject Lands and surrounding area, including 1 regionally significant species, Giant Swallowtail (*Papilio cresphontes*), and 1 SCC species, the Monarch Butterfly (*Danaus plexippus*) (MacNaughton et al. 2018). A list of all species of butterflies known from the study area is included in Appendix IX.

One SCC, the Monarch Butterfly (*Danaus plexippus)*, was observed in the Subject Lands by NRSI biologists in 2018. The larval foodplant of the Monarch, Common Milkweed (*Asclepias syriaca*), was also documented during ELC and vascular plant surveys in the CUM1-1 community within the Subject Lands. This species is discussed further in the context of Significant Wildlife Habitat (Section 6.5). No other significant butterfly species were observed.

5.3.5 Odonata

Background reviews revealed that 32 species of odonata (dragonflies and damselflies), including 3 locally significant species, were recorded in the Ontario Odonata Atlas in the vicinity of the Subject Lands (Ontario Odonata Atlas Database 2019). No significant species were observed by NRSI in 2018. A list of all species of dragonflies and damselflies known from the study area is included in Appendix X.

5.3.6 Road Mortality Surveys

Road mortality surveys and incidental observations of road mortality were completed by NRSI staff between April 24 and June 8, 2018. The only observations of wildlife on the road surface or shoulder within the Subject Lands were of common mammal species including 1 dead Eastern Cottontail (*Sylvilagus floridanus*) observed on May 9; 3 dead Eastern Cottontails and a Gray Squirrel on May 14, and a bird; 1 dead Northern Cardinal (*Cardinalis cardinalis*) observed on June 8.

5.4 Aquatic Resources

5.4.1 Watercourses

There are 2 watercourses within the Subject Lands. Ellis Creek flows south under County Road 124 in the southern portion of the Subject Lands, while Tributary A flows east under County Road 124 in the northern portion of the Subject Lands (Map 1). Both watercourses are tributaries of the Speed River which eventually flows into the Grand River.

5.4.2 Fish Community

Background reviews found that 2 species of SAR fish, Black Redhorse (*Moxostoma duquesnei*) and Redside Dace (*Clinostomus elongatus*), and 1 species of SAR mussel, Wavy-rayed Lampmussel (*Lampsilis fasciola*), all with potentially suitable habitat within the Subject Lands, have been reported in the vicinity of the Subject Lands (MNRF 2018).

NRSI aquatic biologists recorded 3 common species of fish during targeted surveys in Ellis Creek: Blacknose Dace (*Rhinichthys atratulus*), Creek Chub (*Semotilus atromaculatus*), and Brook (Speckled) Trout (*Salvelinus fontinalis*). No fish species were observed in Tributary A. No mussels were observed in either of the watercourses within the Subject Lands. A list of all species of fish known from the study area is included in Appendix XI.

No significant fish or mussel species were observed by NRSI during the field work.

6.0 Environmental Constraints

This section analyzes the significance and sensitivity of natural features to determine what areas need to be protected, and therefore are considered constraints, and what areas present opportunities for development. Natural features that are sensitive to disturbance are identified based on the rarity or significance of the feature or the functions/processes and/or policies inhibiting development within them. These areas are discussed in the context of natural heritage policies governing their protection.

This analysis is intended to guide the planned improvements to County Road 124 to avoid or minimize impacts to significant and sensitive natural features and their ecological functions. Identified natural features to be protected during development are shown on Map 2 and are described in detail below.

6.1 Watercourses

The two watercourses in the subject lands, Ellis Creek and Tributary A fall under the jurisdiction of the GRCA according to Ontario Regulation 150/06 (2015). The GRCA can prohibit or regulate the straightening, changing, diverting or interfering in any way with the existing channel the creek and its shorelines (GRCA 2015). Development, interference or alterations within the GRCA regulation limit may be permitted if, in the opinion of the GRCA, the development will not affect the control of flooding, erosion, dynamic beaches, pollution or the conservation of land. Typically, a 15-30m buffer from top of bank of watercourses is recommended.

6.2 Floodplain

As shown on Map 2, the Ellis Creek and Tributary A floodplains are regulated by the GRCA. In accordance with GRCA Ontario Regulation 150/06, Section 8.1.15, public infrastructure including roads, pipelines and utilities may be permitted in a regulated floodplain as determined through an Environmental Assessment process (GRCA 2015). Briefly, the EA must demonstrate that adverse hydraulic or fluvial impacts are limited, risk of flood damage to upstream and downstream properties is not increased, there is no loss of flood storage wherever possible, and intrusions on significant natural features or hydrologic or ecological functions are minimized (GRCA 2015). Development within the regulated area will also require prior permission from GRCA in the form of a permit pursuant to Ontario Regulation 150/06 (GRCA 2015).

6.3 Wetlands

6.3.1 Provincially Significant Wetlands

There are 2 PSW Complexes within the Subject Lands. The Ellis Creek PSW is situated just north of County Road 124 along Ellis Creek, while the Speed River PSW, is just south of the Subject Lands, running along the length of the Speed River (Map 1 and 2). Both PSW wetland complexes are regulated under the GRCA's *Regulation of Development, Interface with Wetlands and Alterations to Shorelines and Watercourses,* Ontario Regulation 150/06 (2015). Under this regulation, developments that could interfere with the hydrologic function of a wetland are prohibited within 120 m of all PSWs and wetlands greater than or equal to 2 ha in size, and within 30 m of wetlands less than 2 ha (GRCA 2015). Permitting may be granted for development to occur within GRCA-regulated areas if, in the GRCA's opinion, it can be demonstrated that the control of flooding, erosion, dynamic beaches, pollution or the conservation of land will not be affected by the development (GRCA 2015). Buffers to protect wetlands from development are typically 15-30m.

6.3.2 Other Wetlands

There are several non-provincially significant wetlands within the Subject Lands, including 3 wetland areas flagged by NRSI (Map 1 and 2). As outlined above, these wetlands are regulated under Ontario Regulation 150/06 and permits are required for developments occurring within the regulated area (GRCA 2015). Typically, 15 m wetland buffers are required for developments which are permitted to occur adjacent to all non-PSW wetlands.

6.4 Fish Habitat

Ellis Creek is found to be a coldwater watercourse and is considered to provide direct fish habitat for a small number of fish species, including the coldwater indicator species, Brook Trout. Direct fish habitat is defined as spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly in order to carry out their life processes. Tributary A did not contain any fish but is still considered to be indirect fish habitat. Should in-water work be required at the culvert/creek crossings, a permit will be required from the GRCA.

Section 35 of the federal *Fisheries Act* protects fish that are considered to be part of, or that support, Commercial, Recreational, and/or Aboriginal (CRA) fisheries (Government of Canada 1985). It also protects the habitat on which they rely. Any proposed work, undertaking, or activity should aim to avoid causing *serious* harm to CRA and supporting fish as well as their

habitat. Under the Act, *serious harm* is defined as *"the death of fish or the permanent alteration to, or destruction of, fish habitat,"* with fish habitat defined as *"spawning grounds and any other areas, including nursery, rearing, food supply and migration areas, on which fish depend directly or indirectly in order to carry out their life processes"*.

Any proposed works completed for the preferred alternative in the vicinity of Ellis Creek have the potential to cause *serious harm*. The proponent-led self-assessment must be completed for whichever preferred alternative is selected. If there is potential that the preferred alternative will cause *serious harm* the project will need to be submitted to DFO for a site-specific review. If *serious harm* cannot be avoided, a *Fisheries Act* Authorization will be required. Works occurring below the high-water mark of the creek, and particularly within the creek, have a higher probability of requiring a DFO review and potential *Fisheries Act* Authorization.

6.5 Significant Wildlife Habitat

The comprehensive background review was used to identify the following 7 candidate SWH types within the Subject Lands:

- Seasonal Concentration Areas
  - Raptor Wintering Area
  - Snake Hibernaculum
- Specialized Wildlife
  - Amphibian Breeding Habitat (Wetland)
- Habitat for Species of Conservation Concern
  - Marsh Bird Breeding Habitat
  - Terrestrial Crayfish
  - Special Concern and Rare Wildlife Species
- Animal Movement Corridors
  - Amphibian Movement Corridors

Based on existing background information, as well as the 2018 field program, a number of SWH types have been ruled out. The following 2 SWH types are considered Candidate within the Subject Lands.

6.5.1 Seasonal Concentration Areas

Snake Hibernaculum

Although only 1 snake was observed by NRSI biologists during site visits in 2018, it is often difficult to identify snake hibernaculum sites because snake hibernation takes places below ground and features are not easily identifiable. It is possible that features that reaching below the frost line, such as rock piles and old foundations may be present at the area near the intersection of County Road 124 and Country Road 32 south. This area should be considered Candidate SWH and is shown on Map 2.

6.5.2 Habitat for Species of Conservation Concern

Special Concern and Rare Wildlife Species

Based on the information collected from the various wildlife atlases and background resources, 25 SCC were reported from the larger study area (as shown in **Error! Reference source not found.**). Candidate habitat for 8 SCC was identified within the Subject Lands by comparing the results of vegetation community mapping to the habitat requirements for each of these species outlined in the SWHTG (OMNR 2000).

Two SCC, Eastern Wood-pewee (Special Concern) and Monarch (Special Concern), were confirmed within the Subject Lands during field surveys in 2018 (Map 2). According to the MNRF guidelines, for SCC habitat to qualify as SWH, it needs to be easily mapped and cover an important life stage component for the species (e.g. specific nesting habitat, foraging habitat, etc.) (MNRF 2015). Given these criteria, neither species is considered to have Confirmed SWH in the Subject Lands.

Although Eastern Wood-pewee was heard calling in high quality breeding habitat, it was only heard calling during 1 of the 2 breeding bird surveys and breeding evidence was not confirmed. Therefore, the habitat for this species is considered Candidate SWH (Map 2).

The Monarch butterfly and its larval foodplant, Common Milkweed, was observed in the Subject Lands by NRSI biologists in 2018, however, habitat within the Subject Lands should not be considered SWH for Monarch based on the following review of the criteria included in Appendix Q of the SWHTG (OMNR 2000) for the determination of significance of habitat for SCC:

- The breeding population of Monarch is Apparently Secure (S4B). Breeding habitat for Monarch is abundant and widespread throughout Ontario and the City of Guelph.

- Those habitats that provide the best opportunity for the long-term sustainability of the declining species are most significant (e.g., large well-protected sites; sites that best meet the species' habitat (OMNR 2000); the habitat within the Subject Lands is disturbed and does not offer long-term sustainability.
- Habitat for Monarch is relatively common throughout the planning area and throughout Ontario. The species occurs throughout North America.
- Undisturbed or least-disturbed habitats (e.g., no/few deleterious impacts from roads, human activities) are significant; however the Subject Lands are disturbed and impacted by roads.
- Large populations are not expected for Monarch in the Subject Lands due to the area/extent of breeding habitats.
- Habitat for Monarch is well represented in the municipality.

6.6 Habitat of Endangered and Threatened Species

6.6.1 Barn Swallow

As discussed in the Existing Conditions section, Barn Swallow, were observed within the Subject Lands. Barn Swallow is listed as Threatened federally and provincially (Government of Canada 2018, MECP 2019). Federally, Barn Swallows and their nests are protected from harm by the *Migratory Birds Convention Act* (Government of Canada 1994). Given its status in Ontario, Barn Swallow and its habitat are protected under the *Endangered Species Act (ESA)*, 2007 (Government of Ontario 2007). The General Habitat Description for the Barn Swallow (MNRF 2015) provides information on the area of habitat protected by the ESA, and comprises 3 categories:

- Category 1 - Barn Swallow nests.
- Category 2 - The area within 5 m of a Barn Swallow nest.
- Category 3 - The area between 5 and 200 m of the nest.

Given that the Barn Swallows were observed to be likely nesting in a barn just south of the Subject Lands, there is no evidence to suggest that there is Category 1 or 2 habitat within the Subject Lands, however the barn was within 200 m of the road right-of-way, suggesting that habitats within the Subject Lands could be considered Category 3 habitat for Barn Swallow by the MNRF. Barn Swallows depend on this habitat area for various life processes including rearing, feeding, and resting. Category 3 habitat has a high tolerance to alteration.

6.6.2 Species at Risk Bat Habitat

A SAR bat habitat assessment identified 15 potentially suitable bat cavity trees within the Subject Lands (Map 2). Confirming use by SAR bats is labour intensive and costly (consisting of 10 nights of bat acoustic monitoring, with acoustic data analysis). Therefore, if any of these trees are to be removed for the County Road 124 improvements, the tree removals should either be completed outside the peak roosting period for bats (April 30th to September 30th), or exit surveys should be conducted within 24 hours of the removal of identified cavity trees to confirm no active roosts are present. Exit surveys should follow the Bats and Bat Habitats guidelines authored by the MNR (2011), which stipulate that a 1.5hr visual survey should be conducted to confirm non-use.

6.6.3 Migratory Birds Convention Act

The removal of vegetation (trees, shrubs, grasses, etc.) or work on road structures, such as bridges and culverts, has the potential to disrupt nesting birds. The MBCA (Government of Canada 1994) prohibits the destruction of nests, birds and activities that would cause an adult bird to abandon a nest. Construction activities such as vegetation and tree removal are to occur outside of the core nesting period for migratory birds as established by the Canadian Wildlife Service (Canadian Wildlife Service (CWS) 2012). This period extends from approximately April 1 through August 31.

6.7 Locally Significant Species

Eleven species, considered rare in Wellington County and the City of Guelph (Dougan & Associates 2009, City of Guelph 2012), were observed within the Subject Lands. Two Black Maple trees were documented in the north portion of the Subject Lands on private property during the tree inventory (Map 2). The crowns of these trees hang over the County Road 124 right of way. In addition, 10 locally significant bird species were observed throughout the Subject Lands (for locations, see Map 2).

7.0 Impact Assessment and Mitigation Recommendations

An impact assessment was completed based on comparing the preferred alternative designed by MTE Consultants Inc. to the natural feature characterization and mapping. The preferred alternative was developed based on public and agency feedback and additional technical review. “Preferred Alternative 6” has been selected and is overlaid onto Map 2 showing natural environment constraints, as well as Map 3 to determine tree removal and retention. Additional details of the preferred alternative are provided in MTE’s Environmental Study Report. In general, the Preferred Alternative is described as:

- The preferred road cross-section is a combination of two and three lane rural or urban cross section, with a four-lane urban cross section including a centre median between the Road 32 Intersections. A three-lane cross-section is shown in areas with multiple driveway accesses to improve safety for turning vehicles and reduce congestion for through vehicles.

- The Road 32 Intersections consist of a Roundabout at Road 32 North and at Road 32 South (i.e. two Roundabouts, similar to Alternative 5 at PIC No. 1). The Road 32 Roundabouts in the Preferred Alternative 6 have been modified somewhat from what was shown at PIC No. 1, to address public comments including private property and driveway access issues.

- For the Road 32 South Roundabout, there are three proposed options or alternatives (Alternatives 6A, 6B and 6C) presented for additional comment. Each alternative has different property impacts and access requirements.

An analysis of direct impacts (physical displacement of natural features and habitats within the footprint of the development) and indirect impacts (e.g., such as due to construction disturbances and changes to runoff water quality) is provided.

7.1 Direct Impacts

7.1.1 Vegetation Removal and Grading

The planned road widening and improvements will require the removal of roadside vegetated areas that generally comprise periodically maintained meadow vegetation as well as mown grass lawn edges throughout the study area. Where improvements extend further from existing right-of-way, such as for roundabouts and intersections, lands are generally comprised of

cultural meadow, agricultural crops, deciduous hedgerows and scattered trees. No federally, provincially or regionally significant vegetation species will require removal as a result of the planned undertaking. See Map 2 and 3 for the extent of roadside grading requirements in relation to the mapped existing conditions.

Tree Removal

Of the 364 trees inventoried within the study area, 141 are anticipated to be removed. This includes 12 trees that have been recommended for removal solely as a result of its poor condition and location near the sidewalk and roadway. The remaining 135 trees require removal primarily based on the extent of the proposed site grading. This includes trees situated along the grading limit or in close proximity that may incur root damage as a result of grading. The majority of trees are in fair to good health with an improbable potential for structural failure, with a few that range from poor to dead with possible to probably potential for Failure. Tree sizes range from 10.2cm DBH to 81.9cm DBH.

Many trees are boundary trees for suburban homes along County Road 124. They function as screening and privacy for homeowners and are recommended to be retained wherever possible. Notable trees, including mature, large-stature trees, were identified and recommended for retention where possible within the road design elements.

It is recommended that compensation trees be planted within the County Road 124 ROW and in adjacent private properties where trees may be impacted at a ratio of approximately 2:1. Responsibility for compensation plantings resulting from tree removals associated with road improvement work may lie with the proponent of that project, governed by any applicable municipal policies and approvals.

It is recommended that trees proposed for removal that have a probable potential for structural failure and/or are in poor to very poor health or are dead be exempted from compensation requirements. Table 5 provides a summary of the trees inventoried throughout the study area, total number proposed for removal and the proposed compensation plan.

Table 5. Summary of Trees to be Removed and Recommended Compensation Plan

Tree Inventory	**Total**
Total number of trees inventoried	364
Total number of inventoried trees to be removed	139
Tree Compensation	
Number of trees in poor to very poor health or dead, and/or a probable potential for structural failure (exempt from compensation)	58
Number of trees in excellent to fair health to be removed	81
Recommended 2:1 compensation for remaining trees in excellent to fair health	**162**

As the road improvement design is further refined, detailed landscaping plans as part of a Tree Inventory and Protection Plan (TIPP) are recommended in order to determine the locations of compensation plantings, species composition, and maintenance methods during establishment.

Mitigation: Retain good quality healthy trees wherever possible. A TIPP be prepared at a later date when the road improvement design has been further detailed. Trees be planted in compensation for those removed at a 2:1 ratio.

7.1.2 Aquatic Habitat Impacts

Ellis Creek provides direct habitat for a small number of fish species, including the coldwater indicator species, Brook Trout. Tributary A provides indirect fish habitat.

The proposed road improvements will require an extension to the culverts at both creek crossings to accommodate grading related to the road widening in these areas. Based on the extent of the proposed work, it is expected that a Harmful Alteration, Disruption or Destruction (HADD) of fish habitat is unlikely. However, due to the need for in-water work and the proximity of grading to both of the watercourses, it is recommended that a Request for Review for both crossings be submitted to DFO for approval.

Based on the presence of Brook Trout, work in and adjacent to Ellis Creek is restricted during the time between October 1 and May 31. Work is restricted in and around Tributary A during the time between March 16 and June 30. A sediment and erosion control plan is required to protect the creeks from any impacts due to runoff from exposed soils during construction.

Mitigation: Proponent to complete a DFO assessment and likely a Request for Review for the work in and adjacent to Ellis Creek and Tributary A. A sediment and erosion control plan must be prepared for the work adjacent to Ellis Creek and Tributary A. Work is restricted in and

around Ellis Creek during the time between October 1 and May 31. Work is restricted in and around Tributary A during the time between March 16 and June 30.

7.1.3 Wildlife and Wildlife Habitat Impacts

Wildlife species in the study area are common, urban-adapted and disturbance-tolerant species as described in Section 4.0. The planned road improvements are contained largely within the existing right of way and will not require the removal of any important wildlife habitats. Although the road widening and improvements will remove fringing areas of cultural meadow and other early successional disturbed lands that may contain Common Milkweed used by the SCC Monarch, these removals are considered negligible in relation to availability of this species on the adjacent lands. As a means of mitigating these removal impacts, it is recommended that Common Milkweed be incorporated into a native seed mix to be applied along roadside areas post-construction.

Mitigation: Include common milkweed as part of native seed mix in restoration seeding.

Vegetation clearing has the potential to directly impact bird and nesting activity through damage and destruction of nests, eggs and young, or avoidance of the area by breeding adults. Vegetation clearing should therefore occur outside the bird nesting season of April 1-August 31. The destruction of migratory birds and their nests is prohibited under the federal *Migratory Birds Convention Act*.

Mitigation: Vegetation clearing should be scheduled outside the bird nesting season of April 1-August 31. If clearing must be done during the nesting season, nest searches of simple habitats, carried out by a qualified biologist, may be used as a mitigation measure.

<u>Species at Risk Bats</u>

Fifteen potential bat habitat trees inventoried within the study area. The typical approach to avoid impacts is to ensure that tree removal or pruning is not detrimental to bats is to conduct the work outside of the bat active season (May 1-September 30).

Mitigation: Avoid removal and pruning of bat habitat trees during the bat active season (May 1-September 30).

7.2 Indirect Impacts

The planned road improvements have the potential to cause indirect impacts to adjacent lands and natural features if not mitigated appropriately. Recommended mitigation measures are provided for each potential impact below.

7.2.1 Disturbance to Adjacent Trees, Vegetation and Wildlife Habitat

Significant natural features which may be negatively impacted during construction activities are limited in the project area. However, there are a few areas where road improvements and grading will extend into close proximity to trees and natural features, including along Ellis Creek, Tributary A and in the residential area in the north part of the project area. Efforts should be made to avoid unnecessary or inadvertent damage or destruction of vegetation adjacent to project construction limits. Individual trees in the project study area have been inventoried and assessed for removals, as well as where trees can be retained. Clearly defined construction limits in the form of tree protection fencing should be established to avoid unnecessary tree and vegetation removal.

Mitigation: Clearly defined construction limits in the form of tree protection fencing should be established to avoid unnecessary tree and vegetation removal. Tree protection fencing, as well as other measures such as pruning and compensation should be detailed in the TIPP to be prepared at a later date when the road improvement design has been further detailed.

Potential indirect impacts to natural features and wildlife may also arise from noise, vibrations, human presence, dust and artificial lighting associated with construction activities.

During construction activities such as vegetation clearing and grubbing, dust can potentially result in impacts to vegetation due to increased heat absorption and decreased transpiration as well as visual impacts. Impacts due to dust should be mitigated for by moistening areas of bare, dry soil with water as needed during construction activities to reduce the amount of dust produced.

Wildlife impacts resulting from dust, noise, and vibrations are expected to be temporary, minimal and localized during the construction of the proposed development. Furthermore, wildlife occupying the affected roadside areas are urban-adapted and resilient to some degree of disturbance. Significant effects on wildlife are not anticipated and it is expected that displaced wildlife species will return to the vicinity of the roadside features following construction.

Mitigation: Dust Control Plan should be prepared and implemented during construction. Construction activities should be limited to daylight hours to avoid noise, vibration and artificial light impacts to wildlife.

Significant Wildlife Habitat

Seasonal Concentration Area – Snake Hibernaculum, is identified as being possibly located in the area of the rock piles and old foundations near the intersection of County Road 124 with County Road 32 (south). The proposed road improvements including the roundabout overlap directly with this area. In order to avoid impacts to this potential significant wildlife habitat, additional field surveys should be carried out to determine if significant numbers and/or Species of Conservation Concern snakes and a hibernaculum is present. Guidance for the types of surveys and criteria for significance are provided by MNRF in the *Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E (2015).*

Mitigation: Additional field surveys according to MNRF SWH guidance are necessary to determine presence of SWH.

7.2.2 Sedimentation and Erosion

During vegetation removal and site grading activities, areas of bare soil will be exposed along roadside areas which have the potential to erode during rainfall events and impact adjacent lands and vegetation. Reduced vegetation cover along the roadsides in combination with the presence of exposed soils during construction activities may also increase the potential for stormwater flow to down-slope areas if not appropriately mitigated. Increased stormwater surface flow and erosion processes may cause the deposition of sediments onto down-slope vegetation, ultimately causing vegetation die-back or impaired health.

Soil compaction also has potential to occur as a result of heavy machinery in the area of construction. Soil compaction can greatly reduce the permeability of soils and affect their ability to retain water during rain/snow melt events. This will result in an increase in surface water run-off which will ultimately increase the erosion potential and the amount of sediment being transported into adjacent areas.

An Erosion and Sediment Control (ESC) Plan must be developed prior to any construction activities on-site. The primary principles associated with sedimentation and erosion protection measures are to: (1) minimize the duration of soil exposure, (2) retain existing vegetation, where

feasible, (3) encourage re-vegetation, (4) divert runoff away from exposed soils, (5) keep runoff velocities low, and (6) trap sediment as close to the source as possible.

Mitigation: The ESC Plan should include, but not be limited to, the following measures:

- *Placement of silt fencing along any construction limits that are down-gradient of construction zones and may receive sediment-laden runoff;*
- *Regular inspection, maintenance/repair and where necessary, replacement of damaged silt fencing;*
- *Operation and storage of all materials and equipment in a manner that prevents any deleterious substance from leaving the site*
- *Stripping and strategic placement of topsoil stockpiles, and placement of sediment control fencing around all stockpile areas; and,*
- *Re-vegetation of completed areas as soon as possible after construction.*

7.2.3 Stormwater Management

Details of stormwater management will be prepared through further investigation in the detailed design stages. However, based on MTE's design and recommendations most of the road runoff will be directed to roadside ditches. Road sections with curb and gutter will convey runoff through a storm sewer which then outlets into the roadside ditches. All drainage will eventually be conveyed by grassed ditches which could provide some enhanced treatment to improve stormwater quality. Storm Scepters will be considered at the storm pipe outlets prior to outletting to a ditch and any watercourse.

7.3 Ecological Restoration and Enhancement

It is recommended that roadside plantings take the opportunity to use native species of plants, shrubs and trees to enhance existing conditions and provide habitat for insects and wildlife. Tree and plant species should be native to Wellington County and suitable to the site conditions with consideration for hardy species that can tolerate roadside conditions. Replacement tree plantings on residential properties should be selected with an understanding of growth form, size, age and susceptibility to insects and disease.

A native meadow seedmix containing Common Milkweed, and other flowering plant species that are pollinator friendly can be applied to ROW. Traffic circles within the proposed roundabouts are an opportunity for native herbaceous and shrub species where possible.

8.0 Summary

NRSI was retained by the County of Wellington, as part of a team with MTE Consultants, to complete the natural environment component of a Class B EA for the improvements to County Road 124.

The study area is dominated by agricultural fields as well as commercial and residential land uses. Natural features present in the Subject Lands include Ellis Creek, provincially significant wetlands and forested areas associated with the valley lands of the creek and Tributary A. Right of way lands are primarily culturally influenced and include cultural meadow and woodland as well as hedgerows and residential trees. One SAR was found; the provincially and federally threatened barn swallow. This species was documented nesting in a barn on private property adjacent to the project study area. No sensitive habitat for this species is present in the study area limits.

Three inventoried trees were identified as potential SAR bat roosting habitat. The MECP has provided guidance to ensure that impacts to SAR bats are avoided by restricting tree removal to the time period outside of the bat active timing window. Two regionally rare Black Maples will be retained and will require protective fencing during the project. A Tree Inventory and Protection Plan is recommended to be prepared once the details of the proposed undertaking are further refined.

Additional field work is recommended to further investigate and confirm or rule out the presence of Significant Wildlife Habitat, snake hibernaculum associated with the old foundations and rubble on the property at the intersection of County Road 124 and County Road 32 south.

Aquatic habitat in the study area consists of Ellis Creek and Tributary A. Ellis Creek is a coldwater stream and provides direct habitat for a small number of fish species, including the coldwater indicator species, Brook Trout. Tributary A provides indirect fish habitat. Due to the close proximity of grading to both of the watercourses, it is recommended that a Request for Review for both crossings be submitted to DFO for approval. Key mitigations are timing windows for construction in or around Ellis Creek and Tributary A and the design and implementation of stormwater management and an Erosion and Sediment Control Plan to protect these watercourses.

Recommendations are provided in this report to ensure direct and indirect impacts to trees, fish habitat, adjacent lands, vegetation and significant wildlife habitats are avoided or appropriately

mitigated. These include recommendations for tree protection and stormwater management as described in the Stormwater Management Plan prepared by MTE. ROW enhancements through tree planting and native herbaceous seed mix including common milkweed and other flowering species are recommended.

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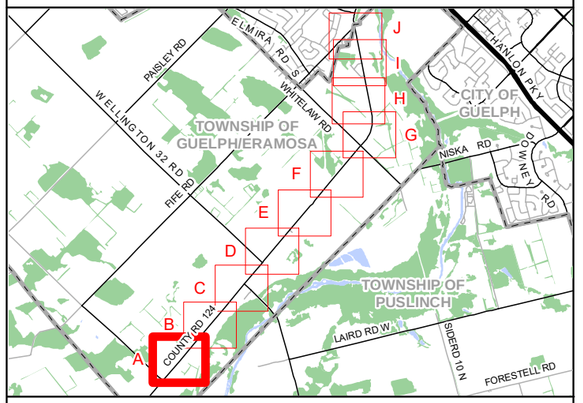
Maps

Map 1 A

County Road 124
Class B EA
Vegetation Communities and Monitoring Station Locations



Legend

- Study Area
- Railway
- Utility Line
- Permanent Watercourse

Monitoring Stations

- Aquatic Habitat Point (AHP)
- Anuran Monitoring Station (ANR)
- Breeding Bird Monitoring (BMB)
- Ecological Land Classifications (ELC)

(Ag) Agriculture

(CUM1-1) Dry - Moist Old Field Meadow Type

(CUP3) Coniferous Plantations

(CUW1) Mineral Cultural Woodland Ecosite

(FOD7) Fresh - Moist Lowland Deciduous Forest Ecosite

(SWD2) Ash Mineral Deciduous Swamp Ecosite

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Project: 2085
Date: September 6, 2019

NAD83 - UTM Zone 17
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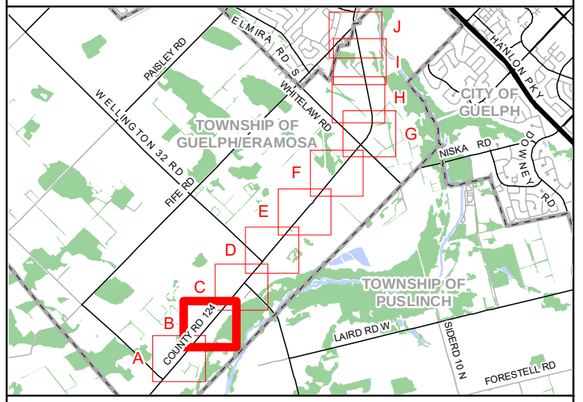
Map 1 B

County Road 124
Class B EA
Vegetation Communities and Monitoring Station Locations



Legend

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- Breeding Bird Monitoring (BMB)
- Ecological Land Classifications (ELC)

(Ag) Agriculture

(CUM1-1) Dry - Moist Old Field Meadow Type

(CUW1) Mineral Cultural Woodland Ecosite

(FOD7) Fresh - Moist Lowland Deciduous Forest Ecosite

(SWD2) Ash Mineral Deciduous Swamp Ecosite

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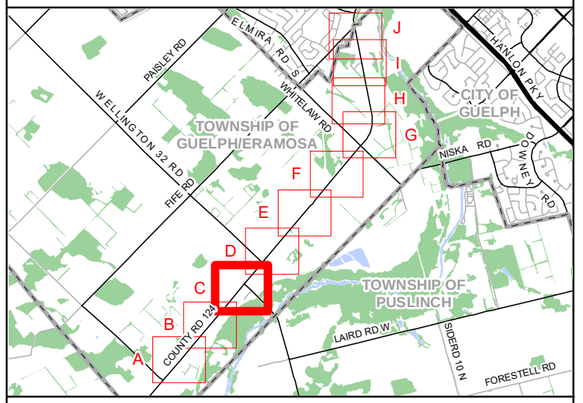
Map 1 C

County Road 124
Class B EA
Vegetation Communities and Monitoring Station Locations



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(Ag) Agriculture

(CUM1-1) Dry - Moist Old Field Meadow Type

(CUW1) Mineral Cultural Woodland Ecosite

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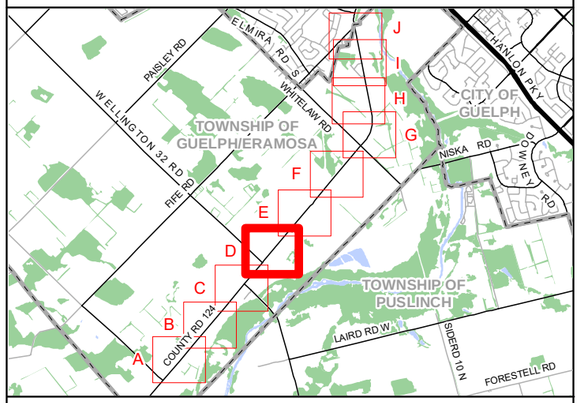
Map 1 D

County Road 124
Class B EA
Vegetation Communities and Monitoring Station Locations



Legend

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- Utility Line

Monitoring Stations

- Breeding Bird Monitoring (BMB)
- Ecological Land Classifications (ELC)

(Ag) Agriculture

(CUM1-1) Dry - Moist Old Field Meadow Type

(CUP3) Coniferous Plantations

(H1) Confierous Hedgegrow

(H2) Deciduous Hedgegrow

(MAS2-1) Cattail Mineral Shallow Marsh Type

(SWD4-1) Willow Mineral Deciduous Swamp Type

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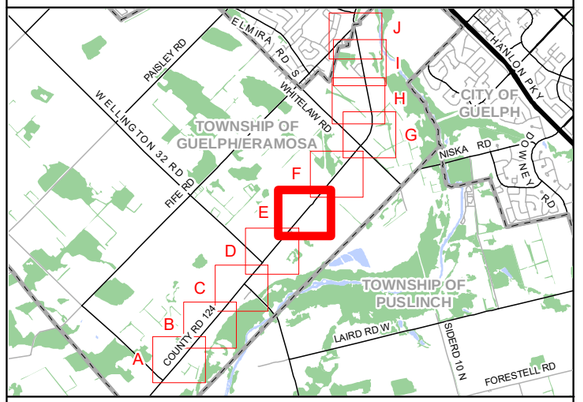
Map 1 E

County Road 124
Class B EA
Vegetation Communities and Monitoring Station Locations



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- Utility Line

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- Breeding Bird Monitoring (BMB)
- Ecological Land Classifications (ELC)

(Ag) Agriculture

(CUM1-1) Dry - Moist Old Field Meadow Type

(H2) Deciduous Hedgegrow

(SWD4-1) Willow Mineral Deciduous Swamp Type

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Aquatic, Terrestrial and Wetland Biologists

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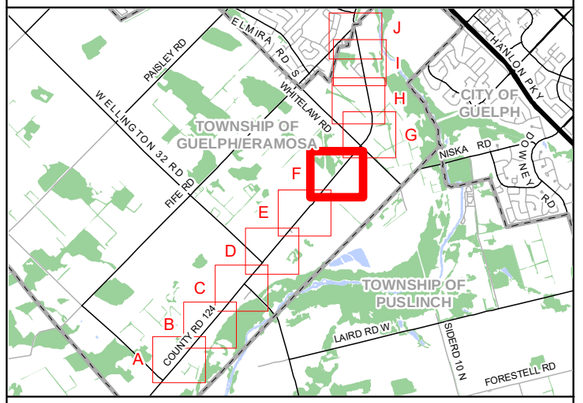
Map 1 F

County Road 124
Class B EA
Vegetation Communities and Monitoring Station Locations



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(CUM1-1) Dry - Moist Old Field Meadow Type

(CUP3) Coniferous Plantations

(SWD2) Ash Mineral Deciduous Swamp Ecosite

(SWD4-1) Willow Mineral Deciduous Swamp Type

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Project: 2085
Date: September 6, 2019

NAD83 - UTM Zone 17
Size: 11x17"
1:2,000

0 25 50 75 100 Metres

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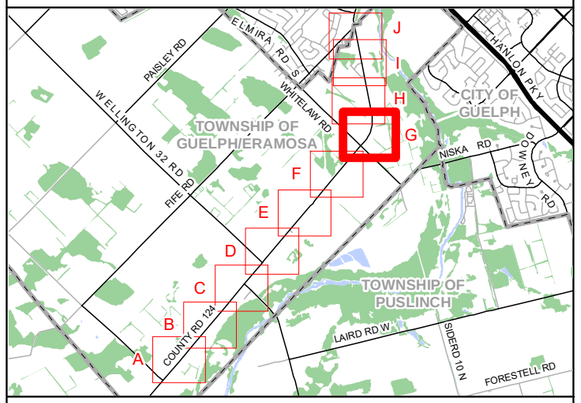
Path: X:\2085_CountryRoad124\NRSI_2085_Map1_VegetationCommunities_6K_2019_09_06_GCS.mxd

Map 1 G

County Road 124
Class B EA
Vegetation Communities and Monitoring Station Locations



Legend

- Study Area
- Utility Line
- Permanent Watercourse

Monitoring Stations

- Aquatic Habitat Point (AHP)
- Anuran Monitoring Station (ANR)
- Breeding Bird Monitoring (BMB)
- Ecological Land Classifications (ELC)

(Ag) Agriculture

(CUM1-1) Dry - Moist Old Field Meadow Type

(CUW1) Mineral Cultural Woodland Ecosite

(H2) Deciduous Hedgegrow

(MAS2-1) Cattail Mineral Shallow Marsh Type

(SWD3) Maple Mineral Deciduous Swamp Ecosite

(SWM) Storm Water Management Pond

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Project: 2085 Date: September 6, 2019	NAD83 - UTM Zone 17 Size: 11x17" **1:2,000**

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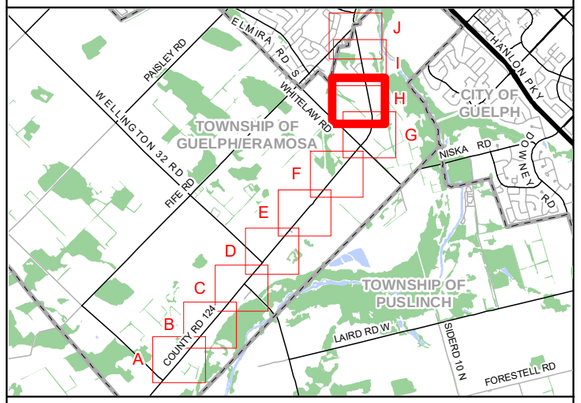
Map 1 H

County Road 124
Class B EA
Vegetation Communities and Monitoring Station Locations



Legend

- Study Area
- Utility Line
- Permanent Watercourse

Monitoring Stations

- Breeding Bird Monitoring (BMB)
- Ecological Land Classifications (ELC)

(Ag) Agriculture

(CUM1-1) Dry - Moist Old Field Meadow Type

(CUP3) Coniferous Plantations

(CUT1-1) Sumac Cultural Thicket Type

(H2) Deciduous Hedgegrow

(SWM) Storm Water Management Pond

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Date: September 6, 2019

NAD83 - UTM Zone 17
Size: 11x17"
1:2,000

0 25 50 75 100 Metres

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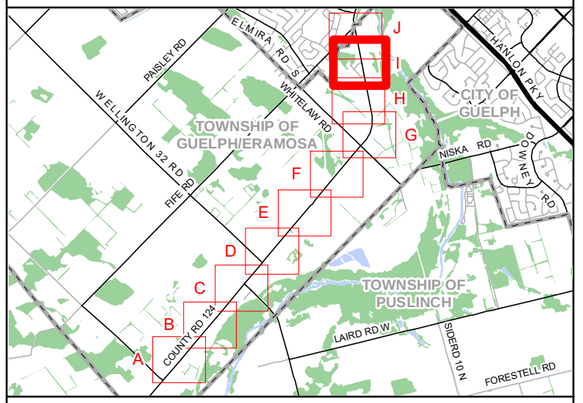
Map 1 I

County Road 124
Class B EA
Vegetation Communities and Monitoring Station Locations



Legend

- Study Area
- Railway
- Utility Line

Monitoring Stations

- Anuran Monitoring Station (ANR)
- Breeding Bird Monitoring (BMB)
- Ecological Land Classifications (ELC)

(Ag) Agriculture

(CUM1-1) Dry - Moist Old Field Meadow Type

(H2) Deciduous Hedgegrow

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Date: September 6, 2019

NAD83 - UTM Zone 17
Size: 11x17"
1:2,000

0 25 50 75 100 Metres

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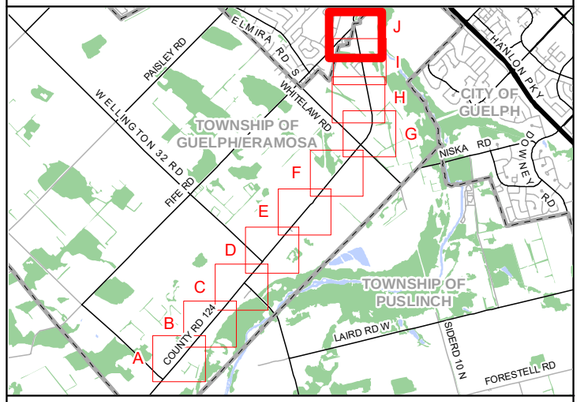
Path: X:\2085_CountryRoad124\NRSI_2085_Map1_VegetationCommunities_6K_2019_09_06_GCS.mxd

Map 1 J

County Road 124

Class B EA

Vegetation Communities and Monitoring Station Locations



Legend

- Study Area
- Railway
- Utility Line
- Permanent Watercourse

Monitoring Stations

- Breeding Bird Monitoring (BMB)
- Ecological Land Classifications (ELC)

(Ag) Agriculture

(CUM1-1) Dry - Moist Old Field Meadow Type

(H2) Deciduous Hedgegrow

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Project: 2085 Date: September 6, 2019	NAD83 - UTM Zone 17 Size: 11x17" **1:2,000**

0 25 50 75 100 Metres

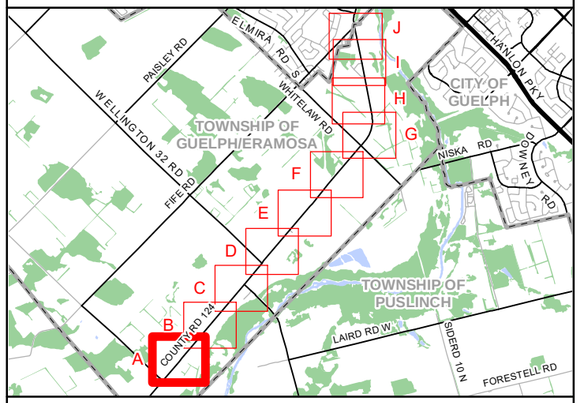
N

SPRINGDALE BLVD
CARDIFF WAY
FAIRMEADOW DR
FIFE RD
WELLINGTON ST W
COUNTY RD 124
Ag
Residential
CUM1-1
H2
BMB-001
BMB-002

Path: X:\2085_CountryRoad124\NRSI_2085_Map1_VegetationCommunities_6K_2019_09_06_GCS.mxd

Map 2 A

County Road 124
Class B EA
Environmental Constraints



Legend

- Study Area
- Railway
- Utility Line
- Proposed Grading Limit
- Proposed Road Alignment
- Permanent Watercourse
- Fish Habitat
- Watercourse Buffer (30m)
- Provincially Significant Wetland (PSW)
- Wetland (PSW) Buffer (30m)
- Wooded Area

Greenlands System

- Core Greenlands

SAR Habitat

- Potentially Suitable Bat Cavity

Species Observations

- SAR
  - 1, Barn Swallow (*Hirundo rustica*) (THR)
- SCC
  - 3, Monarch (*Danaus plexippus*) (SC)

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Date: September 13, 2019

NAD83 - UTM Zone 17
Size: 11x17"
1:2,000

0 25 50 75 100 Metres

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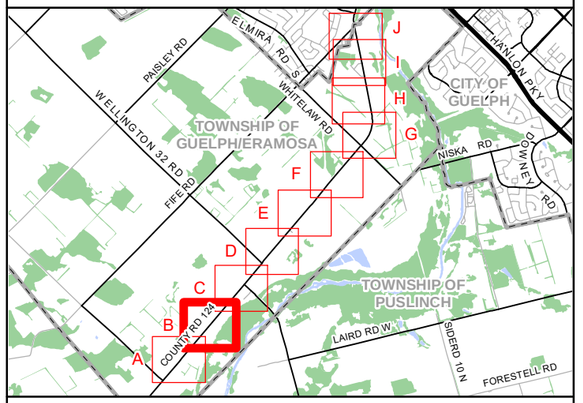
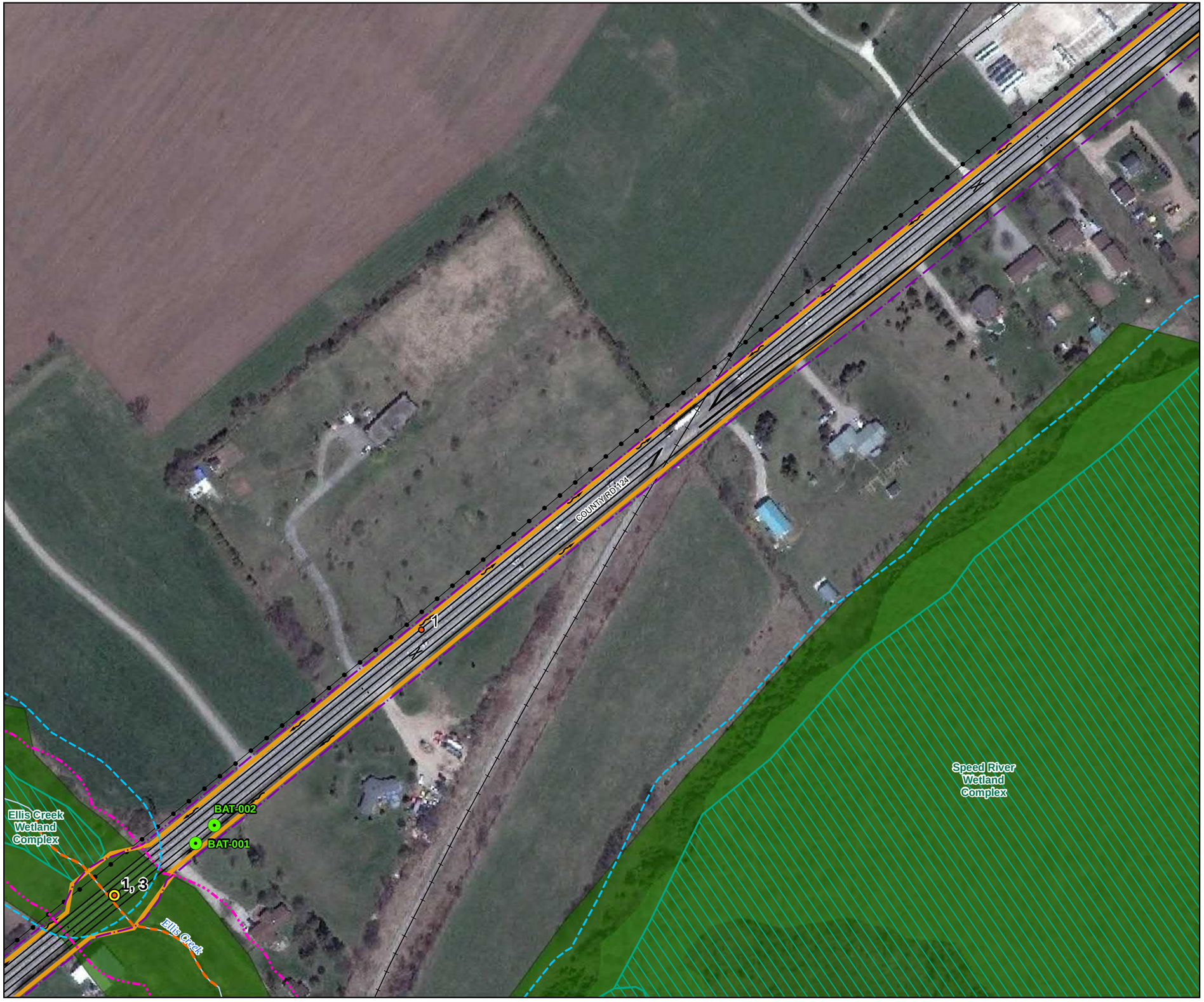
Path: X:\2085_CountryRoad124\NRSI_2085_Map2_Constraints_2K_2019_09_13_LEH.mxd

Map 2 B

County Road 124
Class B EA
Environmental Constraints





Legend

- Study Area
- Railway
- Utility Line
- Proposed Grading Limit
- Proposed Road Alignment
- Permanent Watercourse
- Fish Habitat
- Watercourse Buffer (30m)
- Provincially Significant Wetland (PSW)
- Wetland (PSW) Buffer (30m)
- Wooded Area

Greenlands System

- Core Greenlands

SAR Habitat

- Potentially Suitable Bat Cavity

Species Observations

- SAR
  - 1, Barn Swallow (*Hirundo rustica*) (THR)
- SCC
  - 3, Monarch (*Danaus plexippus*) (SC)

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Project: 2085
Date: September 13, 2019

NAD83 - UTM Zone 17
Size: 11x17"
1:2,000

0 25 50 75 100 Metres

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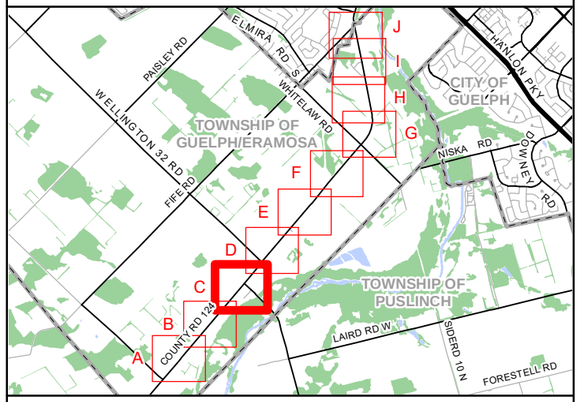
Map 2 C

County Road 124
Class B EA
Environmental Constraints



Legend

- Study Area
- Railway
- Utility Line
- Proposed Grading Limit
- Proposed Road Alignment
- Provincially Significant Wetland (PSW)
- Wetland (PSW) Buffer (30m)
- Wooded Area

Greenlands System

- Core Greenlands
- Greenlands

Candidate SWH

- Snake Hibernaculum

Species Observations

- SCC
  - 3, Monarch (*Danaus plexippus*) (SC)

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Date: September 13, 2019

NAD83 - UTM Zone 17
Size: 11x17"
1:2,000

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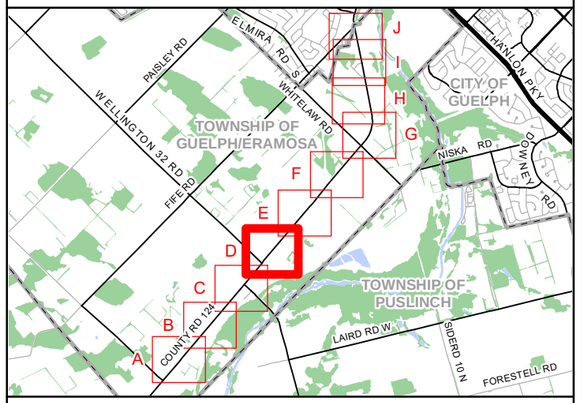
Map 2 D

County Road 124
Class B EA
Environmental Constraints



Legend

- Study Area
- Railway
- Utility Line
- Proposed Grading Limit
- Proposed Road Alignment
- NRSI Surveyed Wetland Boundary
- Wetland (Non-PSW) Buffer (15m)
- Wooded Area

Species Observations

- SAR
  - 1, Barn Swallow (*Hirundo rustica*) (THR)
- SCC
  - 3, Monarch (*Danaus plexippus*) (SC)
- Locally Significant Species
  - 7, Savannah Sparrow (*Passerculus sandwichensis*)
  - 9, Willow Flycatcher (*Empidonax traillii*)

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Project: 2085 Date: September 13, 2019	NAD83 - UTM Zone 17 Size: 11x17" **1:2,000**

0 25 50 75 100 Metres

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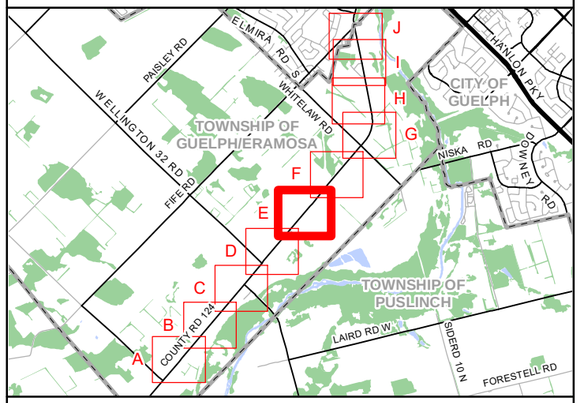
Map 2 E

County Road 124
Class B EA
Environmental Constraints



Legend

- Study Area
- Railway
- Utility Line
- Proposed Grading Limit
- Proposed Road Alignment

SAR Habitat

- Potentially Suitable Bat Cavity

Species Observations

- Locally Significant Species
  - 4, Baltimore Oriole (*Icterus galbula*)
  - 7, Savannah Sparrow (*Passerculus sandwichensis*)

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Project: 2085 Date: September 13, 2019	NAD83 - UTM Zone 17 Size: 11x17" **1:2,000**

0 25 50 75 100 Metres

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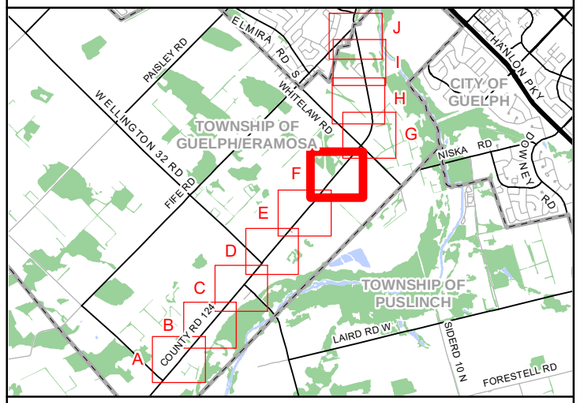
Map 2 F

County Road 124
Class B EA
Environmental Constraints



Legend

- Study Area
- Railway
- Utility Line
- Proposed Grading Limit
- Proposed Road Alignment
- Other Wetland (Non-PSW)
- Wetland (Non-PSW) Buffer (15m)
- Wooded Area

Greenlands System

- Core Greenlands

SAR Habitat

- Potentially Suitable Bat Cavity

Species Observations

- Locally Significant Species
  - 4, Baltimore Oriole (*Icterus galbula*)
  - 7, Savannah Sparrow (*Passerculus sandwichensis*)

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Date: September 13, 2019

NAD83 - UTM Zone 17
Size: 11x17"
1:2,000

0 25 50 75 100 Metres

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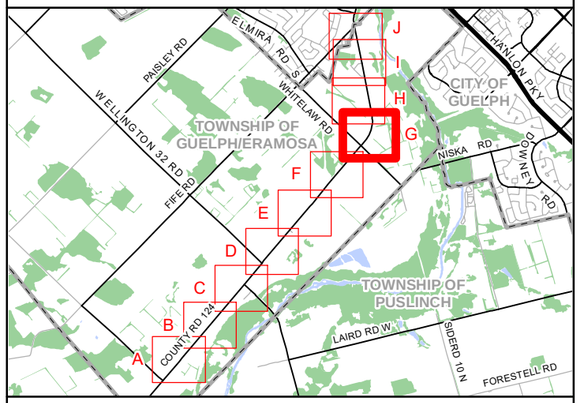
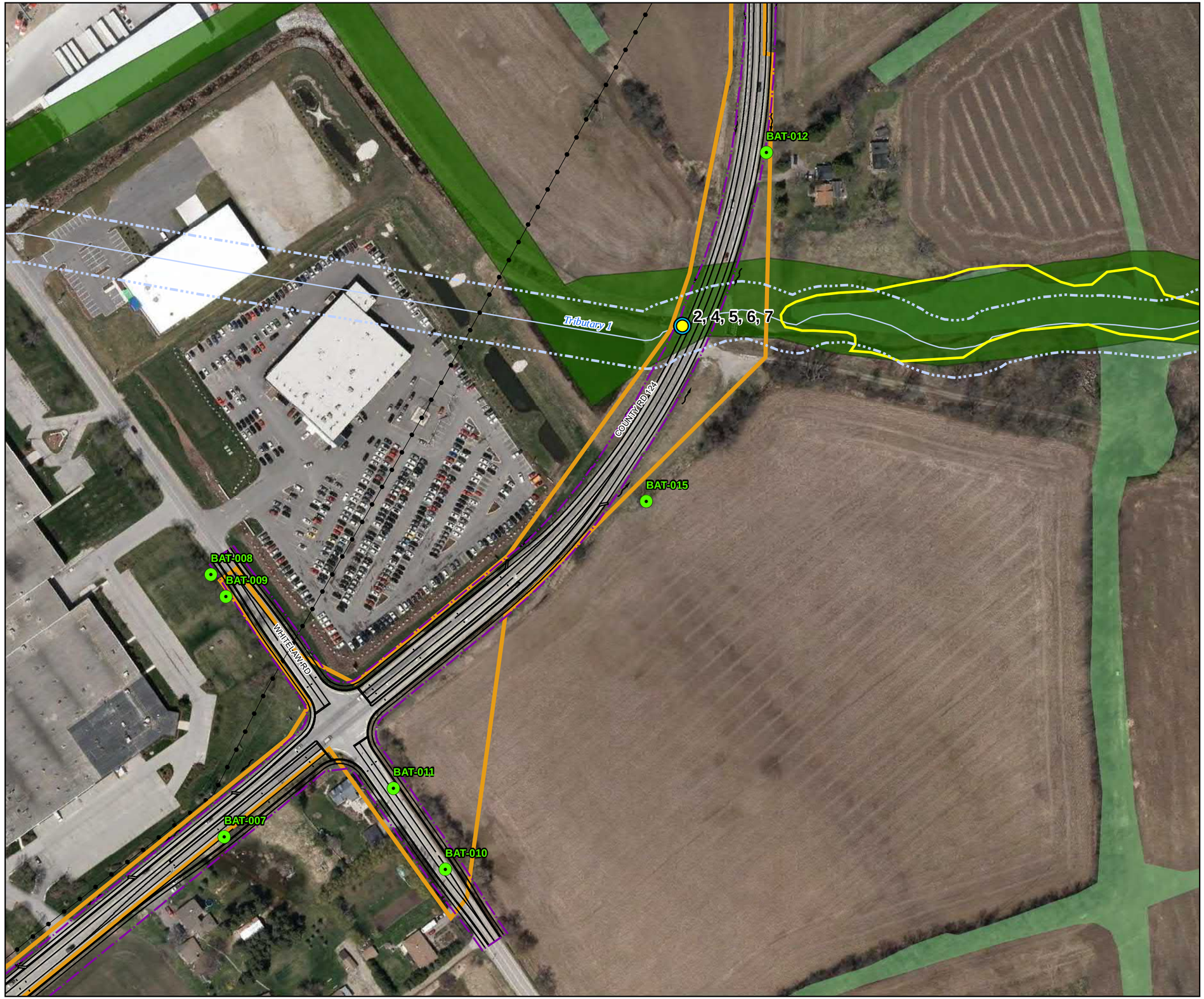
Map 2 G

County Road 124
Class B EA
Environmental Constraints





Legend

- Study Area
- Utility Line
- Proposed Grading Limit
- Proposed Road Alignment
- Permanent Watercourse
- Watercourse Buffer (15m)
- Wooded Area

Greenlands System

- Core Greenlands

Candidate SWH

- Habitat for SCC - Eastern Wood-Pewee

SAR Habitat

- Potentially Suitable Bat Cavity

Species Observations

- SCC
  - 2, Eastern Wood-Pewee (*Contopus virens*) (SC)
- Locally Significant Species
  - 4, Baltimore Oriole (*Icterus galbula*)
  - 5, Eastern Kingbird (*Tyrannus tyrannus*)
  - 6, Eastern Wood-Pewee (*Contopus virens*)
  - 7, Savannah Sparrow (*Passerculus sandwichensis*)

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Project: 2085 Date: September 13, 2019	NAD83 - UTM Zone 17 Size: 11x17" **1:2,000**

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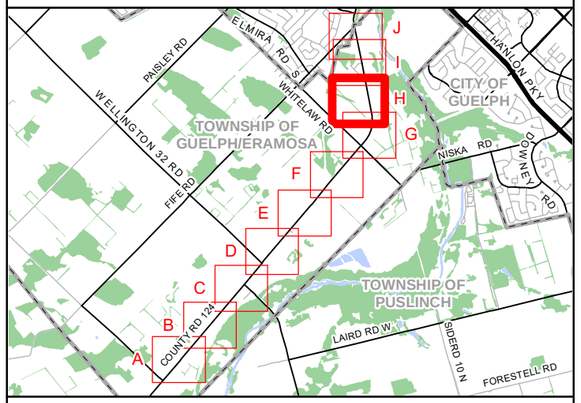
Map 2 H

County Road 124
Class B EA
Environmental Constraints



Legend

- Study Area
- Utility Line
- Proposed Grading Limit
- Proposed Road Alignment
- Wooded Area

Greenlands System

- Core Greenlands

SAR Habitat

- Potentially Suitable Bat Cavity

Species Observations

- Locally Significant Species
  - 5, Eastern Kingbird (*Tyrannus tyrannus*)
  - 8, Vesper Sparrow (*Pooecetes gramineus*)

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Project: 2085
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NAD83 - UTM Zone 17
Size: 11x17"
1:2,000

0 25 50 75 100 Metres

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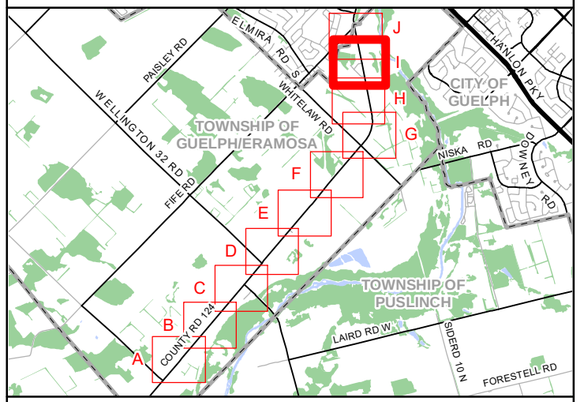
Map 2 I

County Road 124
Class B EA
Environmental Constraints



Legend

- Study Area
- Railway
- Utility Line
- Proposed Grading Limit
- Proposed Road Alignment
- Provincially Significant Wetland (PSW)
- Wetland (PSW) Buffer (30m)
- Wooded Area

Greenlands System

- Core Greenlands
- Greenlands

SAR Habitat

- Potentially Suitable Bat Cavity

Species Observations

- Locally Significant Species

7, Savannah Sparrow (*Passerculus sandwichensis*)

10, Black Maple (*Acer saccharum ssp. nigrum*)

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Project: 2085
Date: September 13, 2019

NAD83 - UTM Zone 17
Size: 11x17"
1:2,000

0 25 50 75 100 Metres

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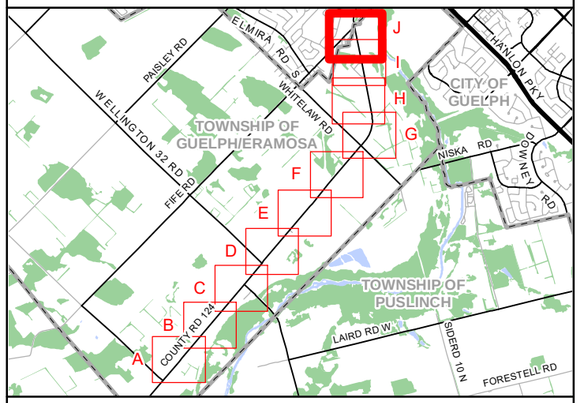
Map 2 J

County Road 124
Class B EA
Environmental Constraints



Legend

- Study Area
- Railway
- Utility Line
- Proposed Grading Limit
- Proposed Road Alignment
- Permanent Watercourse
- Provincially Significant Wetland (PSW)
- Wetland (PSW) Buffer (30m)
- Wooded Area

Greenlands System

- Core Greenlands

SAR Habitat

- Potentially Suitable Bat Cavity

Species Observations

- Locally Significant Species
  - 5, Eastern Kingbird (*Tyrannus tyrannus*)
  - 7, Savannah Sparrow (*Passerculus sandwichensis*)

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Date: September 13, 2019

NAD83 - UTM Zone 17
Size: 11x17"
1:2,000

0 25 50 75 100 Metres

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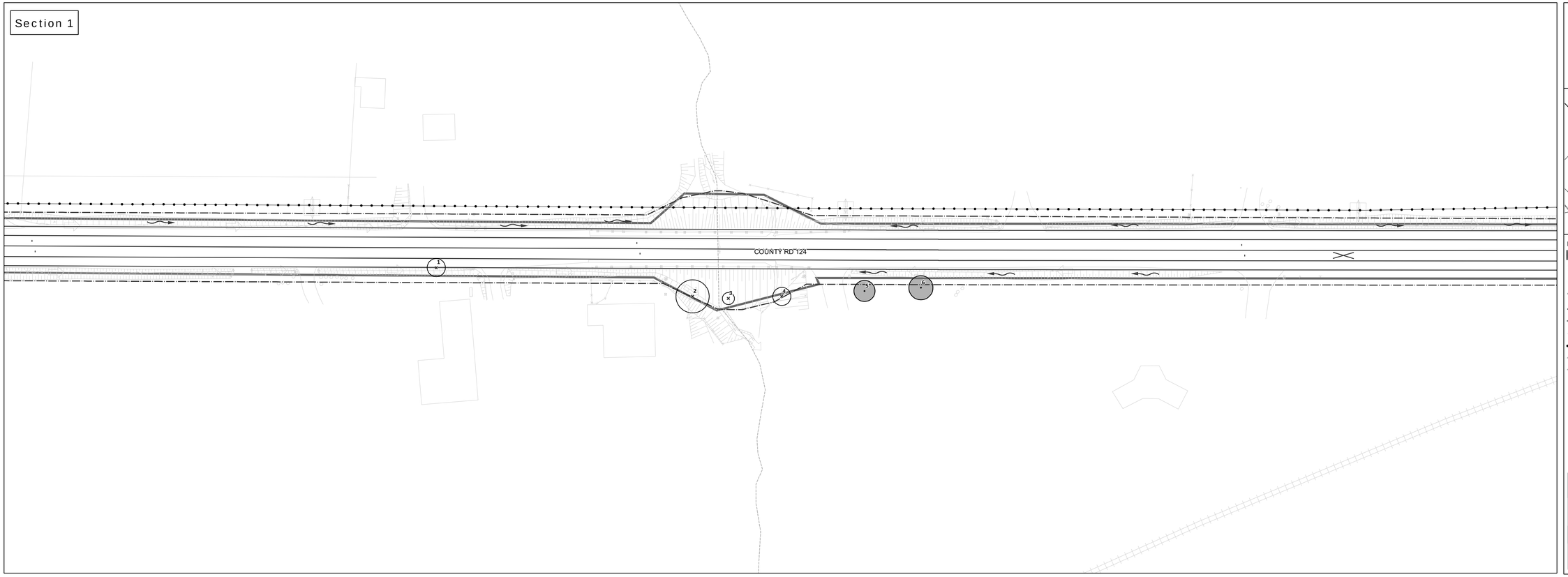
Path: X:\2085_CountryRoad124\NRSI_2085_Map2_Constraints_2K_2019_09_13_LEH.mxd

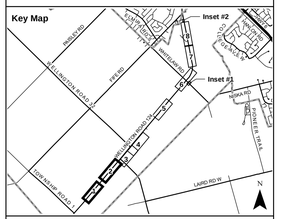
Section 1



Map 3a

County Road 124
Class B EA

Tree Inventory and Preservation Plan



Legend

- Study Area
- Inventoried Tree to be Retained (Crown to Scale)
- Inventoried Tree to be Removed (Crown to Scale)
- Potential Bat Habitat Tree (Crown to Scale)
- Proposed Grading Limit
- Proposed Road Alignment
- Existing Conditions
- Utility Line
- Permanent Watercourse
- Intermittent Watercourse

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Project: 2085
Date: September 17, 2019

NAD83 - UTM Zone 17
Size: 24x36"
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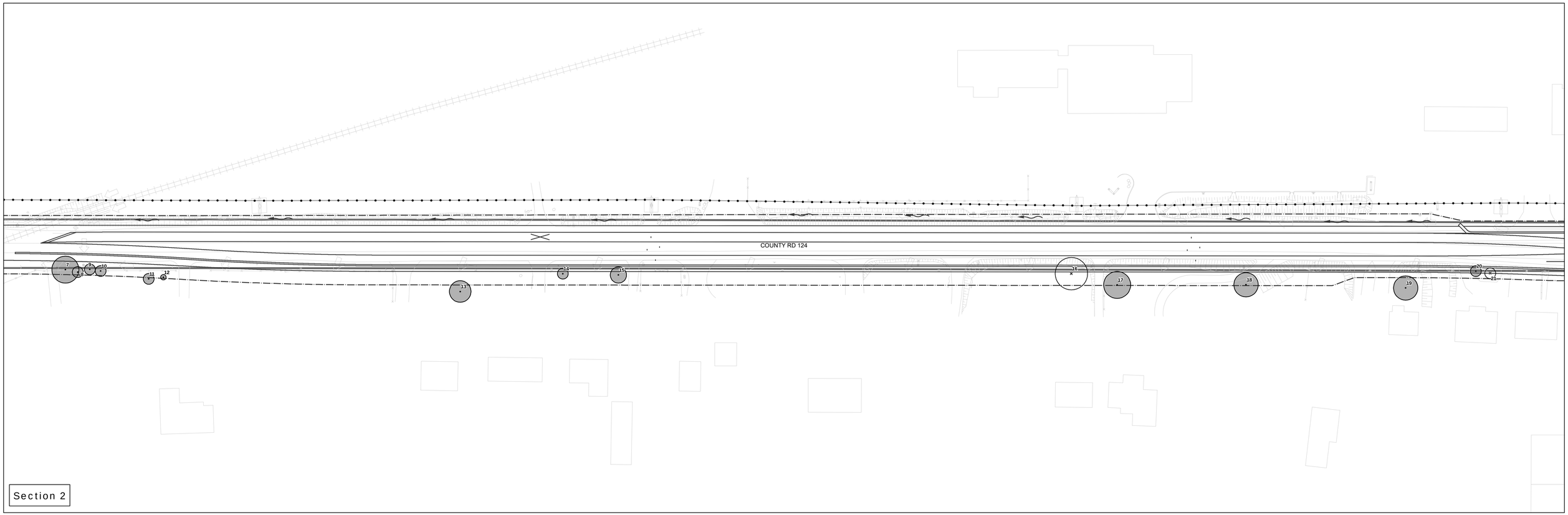


Section 2

Section 3

Section 2

WELLINGTON 32 RD

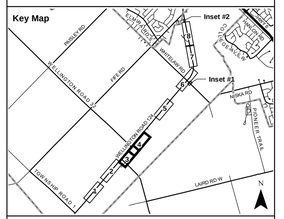
RANDELL DR

Map 3b

County Road 124
Class B EA

Tree Inventory and Preservation Plan

Key Map



Legend

- Study Area
- Inventoried Tree to be Retained (Crown to Scale)
- Inventoried Tree to be Removed (Crown to Scale)
- Potential Bat Habitat Tree (Crown to Scale)
- Proposed Grading Limit
- Proposed Road Alignment
- Existing Conditions
- Utility Line
- Permanent Watercourse
- Intermittent Watercourse

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Project: 2085
Date: September 17, 2019

NAD83 - UTM Zone 17
Size: 24x36"
1:650

0 10 20 30 40 Metres

N

Section 5

COUNTY RD 124

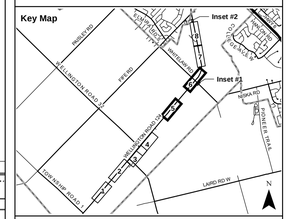
253 254 255 256 257 258 259

Map 3c

County Road 124
Class B EA

Tree Inventory and Preservation Plan

Key Map



Legend

- Study Area
- Inventoried Tree to be Retained (Crown to Scale)
- Inventoried Tree to be Removed (Crown to Scale)
- Potential Bat Habitat Tree (Crown to Scale)
- Proposed Grading Limit
- Proposed Road Alignment
- Existing Conditions
- Utility Line
- Permanent Watercourse
- Intermittent Watercourse

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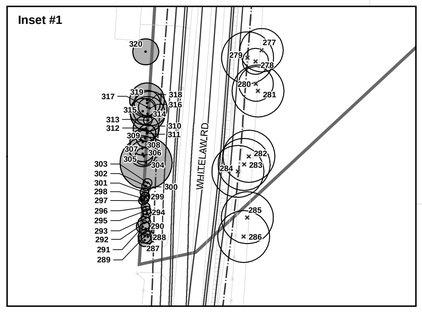
Project: 2085 Date: September 17, 2019	NAD83 - UTM Zone 17 Size: 24x36" 1:650

0 10 20 30 40 Metres

Inset #1



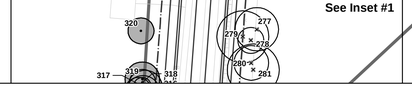
Section 6

COUNTY RD 124

WHITELAW RD

260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 321 322

See Inset #1



Section 7

COUNTY RD 124

323 324 325 326 327 328 329 330 331

Section 8

SHADOW DR

BEECH ST

See Inset #2

COUNTY RD 124

331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363

Inset #2

364

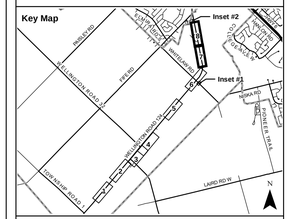
COUNTY RD 124

Map 3d

County Road 124
Class B EA

Tree Inventory and Preservation Plan

Key Map



Legend

- Study Area
- Inventoried Tree to be Retained (Crown to Scale)
- Inventoried Tree to be Removed (Crown to Scale)
- Potential Bat Habitat Tree (Crown to Scale)
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NAD83 - UTM Zone 17
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0 10 20 30 40 Metres

N

County Road 124 Class B EA

Map 3e

Tree Inventory and Preservation Plan - Tree Tables

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Project: 2085
Date: September 17, 2019
Size: 24x36"

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Tree Number	Common Name	Scientific Name	Native/ Non-native	DBH (cm)	Stem Count	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Location	Proposed Action	Rationale for Removal	Comments
1	Colorado Spruce	*Picea pungens*	Non-Native	22.0	1	3	Improbable	Good	Boundary	Remove	Grading	Minor light pruning, pruned to raise crown.
2	Black Walnut	*Juglans nigra*	Native	30.1	3	5.5	Possible	Fair	Boundary	Remove	Grading	Codominant leaning leaders, cankers, small dead branches, vines.
3	White Ash	*Fraxinus americana*	Native	13.2	1	2.0	Improbable	Fair	Boundary	Remove	Grading	Slight bend in leader self-corrects, 25% dieback.
4	White Ash	*Fraxinus americana*	Native	21.9	2	3.0	Probable	Very Poor	Boundary	Remove	Grading	80% dieback, large dead branches, codominant leaders, vines.
5	Norway Maple	*Acer platanoides*	Non-Native	34.2	1	3.5	Possible	Poor	Boundary	Retain		Dieback, dead branches, water sprouts.
6	Norway Maple	*Acer platanoides*	Non-Native	41.4	1	4.0	Improbable	Good	Boundary	Retain		Codominant leaders with included bark, minor dieback only, slight hydro pruning only.
7	Russian Olive	*Elaeagnus angustifolia*	Non-Native	20.0	3	5.0	Improbable	Fair	Boundary	Retain		Codominant leaders, epicormic growth, dieback.
8	Russian Olive	*Elaeagnus angustifolia*	Non-Native	11.0	3	2.0	Improbable	Poor	Boundary	Retain		Multiple codominant stems, grow at wide unions, uneven low crown, 50% dieback.
9	Silver Maple	*Acer saccharinum*	Native	18.0	3	2.0	Improbable	Fair	Boundary	Retain		Water sprouts, epicormic growth, codominant leaders, crown outside of hydro lines.
10	Freeman's Maple	*Acer X freemanii*	Native	19.8	1	2.0	Improbable	Fair	Boundary	Retain		Slight lean away from road, other side of fence, dead epicormic growth.
11	Black Locust	*Robinia pseudoacacia*	Non-Native	19.0	2	2.0	Improbable	Fair	Boundary	Retain		Multiple codominant leaders, small dead epicormic growth.
12	Freeman's Maple	*Acer X freemanii*	Native	13.5	4	1.0	Improbable	Fair	Boundary	Retain		Growing in shrubby form, multiple codominant stems and numerous small shoots, bark cracks.
13	Austrian Pine	*Pinus nigra*	Non-Native	18.0	3	4.0	Improbable	Fair	Boundary	Retain		Codominant leaders, many dead branches.
14	Slippery Elm	*Ulmus rubra*	Native	26.4	2.0	Improbable	Good	Boundary	Retain			Slightly unbalanced crown due to hydro pruning, slight lean away from road.
15	Thornless Honey Locust	*Gleditsia triacanthos var. inermis*	Non-Native	18.1	1	3.0	Improbable	Fair	Boundary	Retain		Insect damage to bark, few small branches dead, growing into hydro.
16	Black Cherry	*Prunus serotina*	Native	81.9	1	6.0	Possible	Poor	Boundary	Remove	Safety	Crown 1-sided due to hydro pruning, 60% dieback of remaining branches, several dead branches.
17	Scots Pine	*Pinus sylvestris*	Non-Native	43.1	1	5.0	Improbable	Good	Boundary	Retain		Healthy crown, away from row.
18	Scots Pine	*Pinus sylvestris*	Non-Native	40.6	1	4.5	Improbable	Fair	Boundary	Retain		Minor dieback, dead branch.
19	Thornless Honey Locust	*Gleditsia triacanthos var. inermis*	Non-Native	23.0	1	4.5	Improbable	Good	Boundary	Retain		Minor dieback, codominant leaders with included bark.
20	Colorado Spruce	*Picea pungens*	Non-Native	19.0	1	2.0	Improbable	Good	Boundary	Retain		Minor self pruning, not overlapping hydro wires.
21	Colorado Spruce	*Picea pungens*	Non-Native	22.2	1	2.0	Probable	Very Poor	Boundary	Remove	Safety	95% dieback, only few small branches with foliage.
22	Siberian Elm	*Ulmus pumila*	Non-Native	19.6	1	3.5	Improbable	Poor	Subject Property	Retain		Leaf insect browse, minor epicormic growth, minor dieback.
23	Siberian Elm	*Ulmus pumila*	Non-Native	48.4	5	6.0	Improbable	Poor	Subject Property	Retain		Multiple codominant stems with included bark, major foliage insect damage, some dieback, several dead branches.
24	Common Apple	*Malus domestica*	Non-Native	61.7	2	7.0	Probable	Very Poor	Subject Property	Remove	Grading	Major dieback, large dead branches, water sprouts, unbalanced , large crack.
25	Siberian Elm	*Ulmus pumila*	Non-Native	27.8	1	4.0	Improbable	Fair	Subject Property	Remove	Grading	Codominant leaders with included bark, dieback, codominant leaders with included bark.
26	Siberian Elm	*Ulmus pumila*	Non-Native	15.9	1	2.0	Possible	Poor	Subject Property	Remove	Grading	Lower canopy dead, insect defoliation, competition for sunlight, minor dieback.
27	Siberian Elm	*Ulmus pumila*	Non-Native	10.8	1	2.0	Possible	Poor	Subject Property	Remove	Grading	Lower canopy dead, insect defoliation, competition for sunlight, minor dieback.
28	Siberian Elm	*Ulmus pumila*	Non-Native	13.5	1	2.0	Possible	Poor	Subject Property	Remove	Grading	Lower canopy dead, insect defoliation, competition for sunlight, minor dieback.
29	Siberian Elm	*Ulmus pumila*	Non-Native	13.5	1	2.0	Possible	Poor	Subject Property	Remove	Grading	Lower canopy dead, insect defoliation, competition for sunlight, minor dieback.
30	Siberian Elm	*Ulmus pumila*	Non-Native	24.4	1	2.5	Possible	Fair	Subject Property	Remove	Grading	Dead branches, dieback.
31	Siberian Elm	*Ulmus pumila*	Non-Native	16.1	1	3.0	Possible	Poor	Subject Property	Remove	Grading	Dead branches, major dieback.
32	Siberian Elm	*Ulmus pumila*	Non-Native	26.1	1	3.0	Possible	Fair	Subject Property	Remove	Grading	Dead branches, dieback.
33	Siberian Elm	*Ulmus pumila*	Non-Native	11.5	1	2.5	Possible	Fair	Subject Property	Remove	Grading	Dead branches, dieback.
34	Siberian Elm	*Ulmus pumila*	Non-Native	11.7	1	2.0	Possible	Poor	Subject Property	Remove	Grading	Lower canopy dead, insect defoliation, competition for sunlight, minor dieback.
35	Siberian Elm	*Ulmus pumila*	Non-Native	17.9	1	2.0	Possible	Poor	Subject Property	Remove	Grading	Lower canopy dead, insect defoliation, competition for sunlight, minor dieback.
36	Siberian Elm	*Ulmus pumila*	Non-Native	10.2	1	2.0	Probable	Very Poor	Subject Property	Remove	Grading	Topped, water sprouts, dieback, defoliation.
37	Siberian Elm	*Ulmus pumila*	Non-Native	17.8	1	2.0	Improbable	Fair	Subject Property	Remove	Grading	Insect defoliation, competition for sunlight, minor dieback.
38	Siberian Elm	*Ulmus pumila*	Non-Native	22.8	1	3.0	Improbable	Fair	Subject Property	Remove	Grading	Small dead branches.
39	Siberian Elm	*Ulmus pumila*	Non-Native	17.1	1	2.5	Possible	Poor	Subject Property	Remove	Grading	Small dead branches, defoliation, dieback, vines.
40	Siberian Elm	*Ulmus pumila*	Non-Native	12.8	1	2.5	Improbable	Fair	Subject Property	Remove	Grading	Dead branches, defoliation.
41	Siberian Elm	*Ulmus pumila*	Non-Native	17.2	1	2.0	Possible	Fair	Subject Property	Remove	Grading	Insect defoliation, competition for sunlight, minor dieback.
42	Siberian Elm	*Ulmus pumila*	Non-Native	13.6	1	2.0	Possible	Fair	Subject Property	Remove	Grading	Insect defoliation, competition for sunlight, minor dieback.
43	Siberian Elm	*Ulmus pumila*	Non-Native	14.7	2.5	Possible	Fair	Subject Property	Remove	Grading	Small dead branches.
44	Siberian Elm	*Ulmus pumila*	Non-Native	11.9	1	2.0	Possible	Very Poor	Subject Property	Remove	Grading	Grapevine throughout crown, dieback, crown leans heavily.
45	Siberian Elm	*Ulmus pumila*	Non-Native	17.3	1	2.5	Probable	Poor	Subject Property	Remove	Grading	Dead and dying branches, vines.
46	Siberian Elm	*Ulmus pumila*	Non-Native	13.0	1	2.0	Possible	Poor	Subject Property	Remove	Grading	Major dieback, vines, defoliation.
47	Siberian Elm	*Ulmus pumila*	Non-Native	10.8	1	1.0	Possible	Poor	Subject Property	Remove	Grading	Dieback, competition for sunlight, grapevine throughout lower crown, dieback.
48	Siberian Elm	*Ulmus pumila*	Non-Native	10.8	1	2.0	Possible	Fair	Subject Property	Remove	Grading	Insect defoliation, light pruning.
49	Siberian Elm	*Ulmus pumila*	Non-Native	12.0	1	1.5	Improbable	Fair	Subject Property	Remove	Grading	Small crown, minor dieback.
50	Siberian Elm	*Ulmus pumila*	Non-Native	26.5	1	3.0	Possible	Fair	Subject Property	Remove	Grading	Dieback, vines, small crown.
51	Siberian Elm	*Ulmus pumila*	Non-Native	14.0	1.5	Improbable	Very Poor	Subject Property	Remove	Grading	Topped, water sprouts, major dieback.
52	Siberian Elm	*Ulmus pumila*	Non-Native	13.9	1	3.0	Possible	Poor	Subject Property	Remove	Grading	Dieback, vines, small crown.
53	Siberian Elm	*Ulmus pumila*	Non-Native	21.1	2	3.0	Improbable	Fair	Subject Property	Remove	Grading	Small dead branches, dieback, vines.
54	Manitoba Maple	*Acer negundo*	Native	15.9	2	3.0	Possible	Poor	Subject Property	Remove	Grading	1 stem dead, grapevine throughout lower crown, phototrophic growth.
55	Siberian Elm	*Ulmus pumila*	Non-Native	19.8	1	2.0	Possible	Poor	Subject Property	Remove	Grading	Dieback, grapevine on stem only, good structure.
56	Manitoba Maple	*Acer negundo*	Native	27.5	2	5.0	Possible	Poor	Subject Property	Remove	Grading	Codominant stems have cracked apart, grapevine throughout lower crown.
57	Common Apple	*Malus domestica*	Non-Native	47.0	2	5.0	Probable	Very Poor	Subject Property	Remove	Grading	Large dead and broken branches, topped, extensive vines, rot at base and mainstem.
58	Manitoba Maple	*Acer negundo*	Native	35.6	4.5	Possible	Fair	Subject Property	Remove	Grading	Minor dieback, minor vines.
59	Siberian Elm	*Ulmus pumila*	Non-Native	13.8	1	2.0	Possible	Poor	Subject Property	Remove	Grading	Dieback, vines, small crown.
60	Siberian Elm	*Ulmus pumila*	Non-Native	15.5	1	2.5	Possible	Poor	Subject Property	Remove	Grading	Dieback, vines, small crown.
61	Siberian Elm	*Ulmus pumila*	Non-Native	13.5	1	2.0	Improbable	Poor	Subject Property	Remove	Grading	Dieback, vines, small crown.
62	Siberian Elm	*Ulmus pumila*	Non-Native	11.4	1	2.0	Improbable	Fair	Subject Property	Remove	Grading	Unewn crown due to phototrophic growth, insect defoliation, rubs on adjacent stem.
63	Siberian Elm	*Ulmus pumila*	Non-Native	17.1	1	2.0	Improbable	Fair	Subject Property	Remove	Grading	Unewn crown due to phototrophic growth, grapevine throughout lower crown, insect defoliation.
64	Siberian Elm	*Ulmus pumila*	Non-Native	12.9	1	2.0	Improbable	Fair	Subject Property	Remove	Grading	Insect defoliation, top of crown leans heavily.
65	Siberian Elm	*Ulmus pumila*	Non-Native	11.3	1	2.0	Improbable	Fair	Subject Property	Remove	Grading	Grapevine throughout crown, insect damage on leaves.
66	Siberian Elm	*Ulmus pumila*	Non-Native	20.5	3.0	Possible	Poor	Subject Property	Remove	Grading	Grapevine throughout lower crown, few branches broken, insect defoliation.
67	Siberian Elm	*Ulmus pumila*	Non-Native	14.4	2.0	Possible	Poor	Subject Property	Remove	Grading	Dead small branches, dieback, small crown.
68	Siberian Elm	*Ulmus pumila*	Non-Native	17.7	3.0	Possible	Poor	Subject Property	Remove	Grading	Insect defoliation, history of branch failure, grapevine throughout crown.
69	Siberian Elm	*Ulmus pumila*	Non-Native	26.1	3.0	Improbable	Fair	Subject Property	Remove	Grading	Codominant stems with included bark, grapevine in lower crown, leaf scorch.
70	Siberian Elm	*Ulmus pumila*	Non-Native	10.6	2.0	Possible	Poor	Subject Property	Remove	Grading	Insect defoliation, major dieback, vines.
71	Siberian Elm	*Ulmus pumila*	Non-Native	26.4	3.0	Possible	Poor	Subject Property	Remove	Grading	Insect defoliation, major dieback, vines.
72	Manitoba Maple	*Acer negundo*	Native	16.5	1	3.5	Possible	Fair	Subject Property	Remove	Grading	Dieback, leaning west, small dead branches.
73	Siberian Elm	*Ulmus pumila*	Non-Native	12.2	1	3.0	Improbable	Fair	Subject Property	Remove	Grading	Leaf scorch, competition for sunlight, grapevine in lower crown.
74	Manitoba Maple	*Acer negundo*	Native	25.8	2	3.0	Possible	Fair	Subject Property	Remove	Grading	Growing on angle, 1 stem parallel to ground, dieback, competition for sunlight.
75	Manitoba Maple	*Acer negundo*	Native	14.9	2	3.0	Improbable	Fair	Subject Property	Remove	Grading	Growing on angle, competition for sunlight, light pruning.
76	Siberian Elm	*Ulmus pumila*	Non-Native	14.8	2.0	Possible	Very Poor	Subject Property	Remove	Grading	Topped at 2m with water sprouts, vines.
77	Manitoba Maple	*Acer negundo*	Native	14.9	1	5.0	Possible	Fair	Subject Property	Remove	Grading	Leaning north, water sprouts, dieback.
78	Siberian Elm	*Ulmus pumila*	Non-Native	20.8	1	3.0	Possible	Fair	Subject Property	Remove	Grading	Small dead branches, insect defoliation, minor vines.
79	Siberian Elm	*Ulmus pumila*	Non-Native	16.3	1	4.0	Possible	Fair	Subject Property	Remove	Grading	Leaning north, extensive vine load, insect defoliation.
80	American Basswood	*Tilia americana*	Native	46.0	1	6.0	Possible	Poor	Subject Property	Remove	Grading	1 stem dead with cracking decay at base, other stems healthy, low branch structure, some branches bend to ground.
81	Crack Willow	*Salix fragilis*	Non-Native	45.0	4	6.0	Possible	Fair	Off-Property	Retain		Dieback, codominant leaders, included bark, small dead branches.
82	Crack Willow	*Salix fragilis*	Non-Native	80.0	2	5.0	Possible	Poor	Off-Property	Retain		Dead branches, dieback, leaning codominant leaders.
83	Crack Willow	*Salix fragilis*	Non-Native	45.8	3	6.0	Possible	Poor	Off-Property	Retain		Large cavity at root flare, 2 previous stems dead, epicormic growth.
84	Crack Willow	*Salix fragilis*	Non-Native	35.4	5.0	Improbable	Fair	Off-Property	Retain			Epicormic growth beginning competition for sunlight, few small dead branches.
85	Manitoba Maple	*Acer negundo*	Native	41.5	1	4.0	Possible	Poor	Off-Property	Retain		Growing on 45 degree angle, epicormic growth, competition for sunlight.
86	Crack Willow	*Salix fragilis*	Non-Native	32.5	2	5.0	Improbable	Fair	Off-Property	Retain		2nd stem shows signs of decay, competition for sunlight.
87	Manitoba Maple	*Acer negundo*	Native	18.5	3	3.0	Improbable	Fair	Off-Property	Retain		Competition for sunlight, growing on angle, vines in lower crown.
88	Manitoba Maple	*Acer negundo*	Native	16.2	1.5	Possible	Poor	Off-Property	Retain			Main stem running along ground, dead small branches.
89	Manitoba Maple	*Acer negundo*	Native	10.1	1	1.5	Possible	Fair	Off-Property	Retain		Unbalanced, small dead branches.
90	Green Ash	*Fraxinus pennsylvanica*	Native	16.7	1	2.0	Improbable	Fair	Off-Property	Retain		Sapwood rot, minor dieback, exit holes.
91	Manitoba Maple	*Acer negundo*	Native	22.3	1	4.0	Improbable	Fair	Off-Property	Retain		Growing on angle, competition for sunlight, uneven crown.
92	Crack Willow	*Salix fragilis*	Non-Native	65.3	1	7.0	Probable	Poor	Off-Property	Retain		Large dead broken leaning branches, butts, water sprouts.
93	Crack Willow	*Salix fragilis*	Non-Native	28.1	1	3.0	Improbable	Fair	Off-Property	Retain		Unbalanced, dieback, leaf scorch.
94	Bur Oak	*Quercus macrocarpa*	Native	23.8	1	4.0	Improbable	Fair	Off-Property	Retain		Epicormic growth, minor dieback.
95	Hawthorn species	*Crataegus sp.*	Native	18.5	2	5.0	Possible	Fair	Off-Property	Retain		Vertical crack, codominant leaders, included bark, epicormic growth.
96	Common Lilac	*Syringa vulgaris*	Non-Native	13.0	3	2.0	Possible	Fair	Off-Property	Retain		Codominant suckers, dead branches.
97	Common Lilac	*Syringa vulgaris*	Non-Native	11.1	2	2.0	Possible	Fair	Off-Property	Retain		Codominant leaders, dead branches, dieback.
98	Hawthorn species	*Crataegus sp.*	Native	15.0	2	2.5	Possible	Fair	Off-Property	Retain		Dieback, epicormic growth, minor lean toward road.
99	Hawthorn species	*Crataegus sp.*	Native	29.7	2	4.0	Improbable	Fair	Off-Property	Retain		Stems rub, Virginia Creeper throughout crown, competition for sunlight.
100	Hawthorn species	*Crataegus sp.*	Native	14.2	2	3.0	Improbable	Fair	Off-Property	Retain		Competition for sunlight, Virginia Creeper throughout crown, s-bends in branches.
101	Common Apple	*Malus domestica*	Non-Native	44.1	2	6.0	Probable	Very Poor	Off-Property	Retain		1 broken stem, dieback, codominant stem, cracks, water sprouts, dieback.
102	Manitoba Maple	*Acer negundo*	Native	30.0	4.0	Possible	Poor	Off-Property	Retain			Growing on angle, competition for sunlight, large branch hanging, vines throughout crown.
103	Siberian Elm	*Ulmus pumila*	Non-Native	25.9	1	4.0	Improbable	Fair	Off-Property	Retain		Leaf scorch, competition for sunlight, vines entering lower crown.
104	Green Ash	*Fraxinus pennsylvanica*	Native	20.5	4.0	Improbable	Fair	Off-Property	Retain			Minor dieback, relatively healthy.
105	Bur Oak	*Quercus macrocarpa*	Native	71.7	1	6.0	Improbable	Good	Boundary	Retain		Low branches, but overall good form and structure.
106	Freeman's Maple	*Acer X freemanii*	Native	32.0	2	4.0	Possible	Poor	Boundary	Remove	Safety	Codominant leaders, many dead branches, heavily, slight s-bends in stem.
107	Freeman's Maple	*Acer X freemanii*	Native	37.4	3.0	Possible	Very Poor	Boundary	Remove	Safety		Leader broken off, large tear away down stem is open showing signs of decay.
108	Freeman's Maple	*Acer X freemanii*	Native	39.4	1	4.0	Improbable	Good	Boundary	Retain		Very few dead branches are small, little library nailed to tree, codominant leaders.
109	Freeman's Maple	*Acer X freemanii*	Native	54.1	1	4.0	Improbable	Good	Boundary	Retain		Low codominant leaders. minor bark crack.
110	Freeman's Maple	*Acer X freemanii*	Native	46.6	1	4.0	Improbable	Good	Boundary	Retain		Multiple codominant leaders, 1 leader previously lost.
111	Red Oak	*Quercus rubra*	Native	60.8	1	4.0	Improbable	Good	Boundary	Retain		Overextended branches away from road, healthy crown and structure.
112	Colorado Spruce	*Picea pungens*	Non-Native	28.3	2.0	Improbable	Fair	Boundary	Retain			Healthy crown, hydro line in crown, pruned lower branches.
113	Colorado Spruce	*Picea pungens*	Non-Native	41.0	1	2.0	Improbable	Good	Boundary	Retain		Light pruning due to competition for sunlight, exuding sap from raised crown cuts.
114	Colorado Spruce	*Picea pungens*	Non-Native	31.2	1	2.0	Improbable	Good	Boundary	Retain		Light pruning due to competition for sunlight, exuding sap from raised crown cuts.
115	Colorado Spruce	*Picea pungens*	Non-Native	27.3	1	2.0	Improbable	Good	Boundary	Retain		Light pruning due to competition for sunlight, exuding sap from raised crown cuts.
116	Colorado Spruce	*Picea pungens*	Non-Native	37.9	1	2.0	Improbable	Good	Boundary	Retain		Light pruning due to competition for sunlight, exuding sap from raised crown cuts.
117	Norway Maple	*Acer platanoides*	Non-Native	57.6	4.5	Improbable	Fair	Boundary	Retain			Large open wound with fruiting bodies, included bark, full crown.
118	Colorado Spruce	*Picea pungens*	Non-Native	16.1	1	2.0	Improbable	Good	Boundary	Retain		Light pruning due to competition for sunlight, exuding sap from raised crown cuts.
119	Colorado Spruce	*Picea pungens*	Non-Native	26.4	1	2.0	Improbable	Good	Boundary	Retain		Light pruning due to competition for sunlight, exuding sap from raised crown cuts.
120	Colorado Spruce	*Picea pungens*	Non-Native	32.9	1	2.0	Improbable	Good	Boundary	Retain		Light pruning due to competition for sunlight, exuding sap from raised crown cuts.
121	Colorado Spruce	*Picea pungens*	Non-Native	41.7	1	2.0	Improbable	Good	Boundary	Retain		Light pruning due to competition for sunlight, exuding sap from raised crown cuts.
122	Colorado Spruce	*Picea pungens*	Non-Native	30.9	1	2.0	Improbable	Good	Boundary	Retain		Light pruning due to competition for sunlight, exuding sap from raised crown cuts.
123	White Elm	*Ulmus americana*	Native	28.9	2	5.0	Improbable	Fair	Subject Property	Remove	Grading	Codominant stems with included bark, moderate dieback, several small dead branches.
124	Siberian Elm	*Ulmus pumila*	Non-Native	20.3	2	2.5	Improbable	Fair	Subject Property	Retain		Insect defoliation, dieback, included bark.
125	Siberian Elm	*Ulmus pumila*	Non-Native	20.5	1	3.5	Improbable	Fair	Subject Property	Retain		Insect leaf defoliation, minor vines, minor dieback.
126	Siberian Elm	*Ulmus pumila*	Non-Native	17.2	1	3.0	Possible	Poor	Subject Property	Remove	Safety	Codominant stems with included bark, grapevine in lower crown, leaf scorch, epicormic growth, large branch hanging.
127	Siberian Elm	*Ulmus pumila*	Non-Native	11.9	1	2.0	Improbable	Fair	Subject Property	Retain		Grapevine throughout crown, leaf scorch.
128	Manitoba Maple	*Acer negundo*	Native	31.7	1	5.0	Possible	Very Poor	Subject Property	Remove	Safety	Low codominant leaders with conks in union, grapevine throughout crown, large branches hanging, competition for sunlight.
129	Common Apple	*Malus domestica*	Non-Native	10.3	1	2.0	Improbable	Good	Subject Property	Retain		Competition for sunlight on one side only, no other visible defects.
130	Slippery Elm	*Ulmus rubra*	Native	21.4	1	3.0	Improbable	Fair	Subject Property	Retain		Codominant leaders, grapevine in lower crown, leaf scorch.
131	Siberian Elm	*Ulmus pumila*	Non-Native	13.2	1	3.0	Improbable	Fair	Subject Property	Retain		Competition for sunlight, codominant leaders with included bark, grapevine in lower crown, leaf scorch.
132	Siberian Elm	*Ulmus pumila*	Non-Native	17.0	1	3.0	Improbable	Fair	Subject Property	Retain		Codominant leaders with included bark, grapevine in lower crown, leaf scorch.
133	Siberian Elm	*Ulmus pumila*	Non-Native	25.6	2	4.0	Improbable	Fair	Subject Property	Retain		Grapevine in lower crown, competition for sunlight with bushtrees, leaf scorch.
134	Slippery Elm	*Ulmus rubra*	Native	38.5	4.0	Improbable	Good	Subject Property	Remove	Grading	Codominant leaders with included bark, Virginia Creeper entering lower canopy.
135	Scots Pine	*Pinus sylvestris*	Non-Native	21.5	1	2.0	Improbable	Good	Subject Property	Retain		Somewhat sparse crown, no other visible defects.
136	Scots Pine	*Pinus sylvestris*	Non-Native	13.1	1	1.0	Improbable	Fair	Subject Property	Retain		Somewhat sparse foliage, no other visible defects.
137	Siberian Elm	*Ulmus pumila*	Non-Native	13.7	1	3.0	Improbable	Fair	Subject Property	Retain		Low codominant leaders with included bark, major leaf scorch.
138	White Spruce	*Picea glauca*	Native	30.9	1	3.0	Improbable	Fair	Boundary	Retain		Small dead branches, healthy apical growth.
139	White Birch	*Betula papyrifera*	Native	36.6	2	3.5	Improbable	Fair	Boundary	Retain		Small hollow cavity 1m high, cabling around codominant leaders, minor dieback.
140	White Spruce	*Picea glauca*	Native	19.9	1	1.0	Improbable	Good	Boundary	Retain		Pruned to raise crown, very slight bend in leader.
141	Bur Oak	*Quercus macrocarpa*	Native	69.3	3	6.0	Improbable	Fair	Boundary	Retain		Some dieback and small dead branches, overall healthy.
142	Norway Maple	*Acer platanoides*	Non-Native	12.4	1	2.0	Improbable	Good	Boundary	Retain		S-bends in stem likely due to competition for sunlight, lilac growing against stem.
143	Bur Oak	*Quercus macrocarpa*	Native	70.9	1	6.0	Improbable	Fair	Boundary	Retain		Some dieback creating somewhat sparse crown, overall good structure.
144	Eastern White Cedar	*Thuja occidentalis*	Native	11.0	2.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
145	Eastern White Cedar	*Thuja occidentalis*	Native	10.2	1.0	Improbable	Poor	Boundary	Retain			Densely planted, light pruning.
146	Eastern White Cedar	*Thuja occidentalis*	Native	14.0	2.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
147	Eastern White Cedar	*Thuja occidentalis*	Native	12.0	2.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
148	Eastern White Cedar	*Thuja occidentalis*	Native	11.0	2.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
149	Eastern White Cedar	*Thuja occidentalis*	Native	12.0	2.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
150	Eastern White Cedar	*Thuja occidentalis*	Native	11.0	2.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
151	Eastern White Cedar	*Thuja occidentalis*	Native	14.0	2.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
152	Eastern White Cedar	*Thuja occidentalis*	Native	11.5	1.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
153	Eastern White Cedar	*Thuja occidentalis*	Native	12.0	1.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
154	Eastern White Cedar	*Thuja occidentalis*	Native	16.0	2.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
155	Eastern White Cedar	*Thuja occidentalis*	Native	11.4	2.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
156	Eastern White Cedar	*Thuja occidentalis*	Native	10.5	2.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
157	Eastern White Cedar	*Thuja occidentalis*	Native	10.8	1.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
158	Eastern White Cedar	*Thuja occidentalis*	Native	12.0	2.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
159	Eastern White Cedar	*Thuja occidentalis*	Native	14.0	2.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
160	Eastern White Cedar	*Thuja occidentalis*	Native	11.0	1.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
161	Eastern White Cedar	*Thuja occidentalis*	Native	12.0	2.0	Improbable	Good	Boundary	Retain			Densely planted, light pruning.
162	Siberian Elm	*Ulmus pumila*	Non-Native	37.6	2	5.0	Possible	Poor	Subject Property	Retain		Several small to medium branches broken, codominant stems with included bark; insect defoliation.
163	White Spruce	*Picea glauca*	Native	22.6	1	2.5	Improbable	Good	Subject Property	Remove	Grading	Light pruning.
164	White Spruce	*Picea glauca*	Native	28.8	1	3.0	Improbable	Good	Subject Property	Remove	Grading	Light pruning.
165	White Spruce	*Picea glauca*	Native	25.9	1	2.5	Improbable	Good	Subject Property	Remove	Grading	Light pruning in lower branches, competition for sunlight.
166	White Spruce	*Picea glauca*	Native	25.8	1	2.5	Improbable	Good	Subject Property	Remove	Grading	Light pruning, excessive cone production, otherwise vigorous.
167	White Spruce	*Picea glauca*	Native	29.2	1	2.5	Improbable	Good	Subject Property	Remove	Grading	Light pruning.
168	White Spruce	*Picea glauca*	Native	26.4	1	2.5	Improbable	Good	Subject Property	Remove	Grading	Competition for sunlight, light pruning.
169	White Spruce	*Picea glauca*	Native	25.9	1	2.5	Improbable	Fair	Subject Property	Remove	Grading	Dieback due to competition for sunlight, light pruning.
170	White Spruce	*Picea glauca*	Native	19.1	2	2.5	Improbable	Good	Subject Property	Remove	Grading	Light pruning.
171	White Spruce	*Picea glauca*	Native	18.5	1	2.5	Improbable	Fair	Subject Property	Remove	Grading	Dieback due to competition for sunlight, light pruning.
172	White Spruce	*Picea glauca*	Native	23.7	1	2.5	Improbable	Fair	Subject Property	Remove	Grading	Dieback due to competition for sunlight, light pruning.
173	White Spruce	*Picea glauca*	Native	20.2	2	2.5	Improbable	Good	Subject Property	Remove	Grading	Light pruning.
174	White Spruce	*Picea glauca*	Native	23.5	2	2.5	Improbable	Good	Subject Property	Remove	Grading	Light pruning.
175	White Spruce	*Picea glauca*	Native	21.0	2.5	Improbable	Fair	Subject Property	Remove	Grading	Dieback due to competition for sunlight, light pruning.
176	White Spruce	*Picea glauca*	Native	25.5	1	2.5	Improbable	Good	Subject Property	Remove	Grading	Light pruning.
177	White Spruce	*Picea glauca*	Native	26.7	1	2.5	Improbable	Fair	Subject Property	Remove	Grading	Dieback due to competition for sunlight, light pruning.
178	White Spruce	*Picea glauca*	Native	16.7	1	2.5	Improbable	Fair	Subject Property	Remove	Grading	Dieback due to competition for sunlight, light pruning.
179	White Spruce	*Picea glauca*	Native	23.8	1	2.5	Improbable	Good	Subject Property	Remove	Grading	Light pruning.
180	White Spruce	*Picea glauca*	Native	21.4	2.5	Improbable	Good	Subject Property	Remove	Grading	Light pruning.
181	White Spruce	*Picea glauca*	Native	27.4	1	2.5	Improbable	Fair	Subject Property	Remove	Grading	Dieback due to competition for sunlight, light pruning.
182	White Spruce	*Picea glauca*	Native	24.1	1	2.5	Improbable	Fair	Subject Property

Appendix I
Species at Risk Screening

Scientific Name	Common Name	S-RANK[1]	ESA/ COSSARO[3]	COSEWIC[2]	SARA	Background Source	Habitat Preference[4,5,6,7, 8]	Suitable Habitats within Subject Property	Rationale
Vascular Plants									
Aesculus glabra var. glabra	Ohio Buckeye	S1				Oldham & Brinker 2009	Deciduous forests, swamps, and river-bank thickets.	No	No deciduous forests or river-bank thickets present within the study area.
Amorpha canescens	Lead-plant	S1				Oldham & Brinker 2009	Prairies, dry bluffs and hills, sandy roadsides and clearings; very local	Yes	Sandy roadsides and small clearings may be present within the study area.
Aureolaria flava	Smooth Yellow False Foxglove	S2?				Oldham & Brinker 2009	Oak openings, sandy oak and oak-hickory savanna, with jack pine and aspen often present, forest borders and clearings	Yes	No oak forests present within the study area however forest borders and small clearings may provide suitable habitat.
Botrychium oneidense	Blunt-lobed Grape Fern	S3?				Oldham & Brinker 2009	Understories of swampy to dry sandy hardwood or mixed forests, occasionally in conifer swamps.	No	No hardwood forests within the study area.
Botrychium rugulosum	Rugulose Grape Fern	S2				Oldham & Brinker 2009	Sandy fields and barrens, persisting in young forests.	Yes	Sandy fields are present within the study area.
Carex careyana	Carey's Sedge	S2				Oldham & Brinker 2009	Rich deciduous forests; rather local.	No	No rich deciduous forests within the study area.
Carex schweinitzii	Schweinitz's Sedge	S3				Oldham & Brinker 2009	Rather local, a species of calcareous soils occurring in springheads, springy seeps, and wet ground along cold spring-fed rivers and brooks, in mixed or coniferous cover; sometimes in the open.	No	No calcareous soil or spring fed rivers in forests found within the study area.
Carex tetanica	Rigid Sedge	S3				Oldham & Brinker 2009	Fens, sedge meadows, shores, interdunal swales, wet depressions in prairies, occasionally on limestone pavements, rarely in drier sites; a plant of calcareous soils but very local northward.	No	No fens or suitable habitat within the study area.
Carex trichocarpa	Hairy-fruited Sedge	S3				Oldham & Brinker 2009	Open, wet deciduous forests on floodplains, river banks, and floodplain marshes and meadows.	Yes	Floodplain marshes and meadows may be present within the study area.
Castanea dentata	American Chestnut	S1S2	END	E	Schedule 1	MNRF 2018a, Oldham & Brinker 2009	Moist to well drained forests on sand, occasionally heavy soils.	Yes	A small woodlot on fairly sandy soil is present within the study area.
Cirsium discolor	Field Thistle	S3				Oldham & Brinker 2009	Meadows, fields, clearings, hillsides, river banks, sparsely forested sites; roadsides, vacant lots, pine plantations.	Yes	Meadows, fields, clearings and roadsides are present within the study area.
Conioselinum chinense	Chinese Hemlock-parsl	S2				Oldham & Brinker 2009	Swamps with deciduous trees, cedar, tamarack; springy river banks, stream borders and springs. Usually in places were seepage is coming to the surface.	No	No swamps present within the study area.
Cuscuta campestris	Field Dodder	S2				Oldham & Brinker 2009	Banks of rivers, fields, croplands, neglected flower gardens, and waste areas.	Yes	Fields and croplands are abundant throughout the study area.

Scientific Name	Common Name	S-RANK[1]	ESA/ COSSARO[3]	COSEWIC[2]	SARA	Background Source	Habitat Preference[4,5,6,7, 8]	Suitable Habitats within Subject Property	Rationale
Cypripedium arietinum	Ram's-head Lady's Slip	S3				Oldham & Brinker 2009	Thrives best on low dunes, in partial shade of fringing conifers, along the northern shores of Lakes Michigan and Huron and on Lake Superior (where it also occurs on thin soil over rock); inland, under jack pine and oak and also in coniferous swamps (cedar, tamarack, spruce, fir).	No	No jack pine or coniferous swamps within the study area.
Cystopteris laurentiana	Laurentian Fragile Fern	S3				Oldham & Brinker 2009	Calcareous rock outcrops, usually limestone or sandstone, mostly in partial shade or shade.	No	No rock outcrops within the study area.
Erigenia bulbosa	Harbinger-of-spring	S3?				Oldham & Brinker 2009	Rich, often moist deciduous forests, including floodplains and river banks.	Yes	No deciduous forest within the study area but riverbanks are present.
Hypericum ascyron	Great St. John's-wort	S3?				Oldham & Brinker 2009	Moist ground along rivers and streams, ditches and wet meadows, borders of marshes and swamps.	Yes	Two streams and roadside ditches are present within the study area.
Hypericum prolificum	Shrubby St. John's-wort	S2				Oldham & Brinker 2009	Swamp borders, thickets, meadows, fields, roadsides, sandy open forests (oak); often in successional shrubby fields.	Yes	Meadows, fields, and roadsides are present throughout the study area.
Juglans cinerea	Butternut	S3?	END	E	Schedule 1	MNRF 2018a, MNRF 2018b, Oldham &	Stream banks, swamps, and upland beech-maple, oak-hickory, and mixed hardwood stands.	Yes	Stream banks and a small mixed hardwood
Juncus acuminatus	Sharp-fruited Rush	S3				Oldham & Brinker 2009	Moist, often sandy, sunny ground.	Yes	Moist, sandy ground may be present along the two streams that cross through the study area.
Lithospermum latifolium	American Gromwell	S3				Oldham & Brinker 2009	Shaded river banks and forested floodplains; borders of forests.	No	The two streambanks that cross through the study area are not shaded.
Magnolia acuminata	Cucumber Tree	S2	END	E		Oldham & Brinker 2009	Upland deciduous forest.	No	No upland deciduous forests within the study area.
Monarda didyma	Oswego-tea	S3				Oldham & Brinker 2009	Rich forests on banks and floodplains; along roadsides and in thickets.	Yes	Suitable habitat may be present along the roadside and in thickets throughout the study area.
Muhlenbergia sylvatica var. syl	Woodland Satin Grass	S2				Oldham & Brinker 2009	Swamps, moist thickets, stream and pond borders, etc., usually in shaded places.	No	The two streambanks that cross through the study area are not shaded.
Panax quinquefolius	American Ginseng	S3	END	E	Schedule 1	MNRF 2018a	Deep leaf litter in rich, moist deciduous woods, especially on rocky, shaded cool slopes in sweet soil	No	No rich deciduous forests within the study area.
Pascopyrum smithii	Western Wheat Grass	S2				Oldham & Brinker 2009	Adventive in dry soils along railroads, roadsides, on shores, etc	Yes	Suitable habitat may be present along the roadside throughout the study area.
Pellaea atropurpurea	Purple-stemmed Cliff-br	S3				Oldham & Brinker 2009	Rocky ledges, crevices in limestone pavement, low cliffs, and talus slopes. Usually not on exposed vertical cliffs.	No	No limestone or rocky areas within the study area.
Phlox subulata ssp. subulata	Moss Phlox	S1?				Oldham & Brinker 2009	Escapes from gardens and cemeteries, where it is frequently planted and often escapes to roadsides, clearings, shores, and banks	Yes	Roadsides and clearings throughout the study area may provide suitable habitat

Scientific Name	Common Name	S-RANK[1]	ESA/ COSSARO[3]	COSEWIC[2]	SARA	Background Source	Habitat Preference[4,5,6,7, 8]	Suitable Habitats within Subject Property	Rationale
Potamogeton hillii	Hill's Pondweed	S2	SC	SC		MNRF 2018a, Oldham & Brinker 2009	Shallow water of small lakes, ponds, ditches, and streams.	Yes	Shallow water in streams and ditches may be present within the study area.
Thalictrum thalictroides	Rue-anemone	S3				Oldham & Brinker 2009	Rich or sometimes dry deciduous forests.	No	No deciduous forests within the study area.
Valeriana uliginosa	Swamp Valerian	S2				Oldham & Brinker 2009	Rather local in wet alkaline places: fens, tamarack and cedar swamps (sometimes with spruce and sphagnum), wet prairies.	No	No fens, swamps or wet prairies within the study area.
Birds									
Empidonax virescens	Acadian Flycatcher	S2S3B	END	E	Schedule 1	MNRF 2018a	Mature, shady, deciduous forests; heavily wooded ravines; creek bottoms or river swamps; availability of good quality habitat is limiting factor; needs at least 30 ha of forest	No	No large tracts of mature forest present within the study area.
Haliaeetus leucocephalus	Bald Eagle	S2N, S4B	SC	NAR		MNRF 2018a, MNRF 2018b	Require large continuous area of deciduous or mixed woods around large lakes, rivers; require area of 255 ha for nesting, shelter, feeding, roosting; prefer open woods with 30 to 50% canopy cover; nest in tall trees 50 to 200 m from shore; require tall, dead, partially dead trees within 400 m of nest for perching; sensitive to toxic chemicals	No	No large tracts of forest surrounding a waterbody within the study area.
Riparia riparia	Bank Swallow	S4B	THR	T		MNRF 2018a, MNRF 2018b	Sand, clay or gravel river banks or steep riverbank cliffs; lakeshore bluffs of easily crumbled sand or gravel; gravel pits, road-cuts, grassland or cultivated fields that are close to water; nesting sites are limiting factor for species presence	No	No riverbank cliffs or bluffs present within study area. Cultivated fields are present but they are not close to water within the study area
Tyto alba	Barn Owl	S1	END	E	Schedule 1	MNRF 2018a	Open areas such as fields, agricultural lands with scattered woodlots, buildings and/or orchards; grasslands, sedge meadows, marshes; snow-cover limits ability to catch prey; species has intolerance to severe cold; nests in hollow trees and live trees >46 cm dbh; also nests in barns, abandoned buildings	Yes	Open areas in the form of agricultural lands, small woodlots and grasslands are present within the study area. Suitable nesting habitat in the form of hollow trees may be present
Hirundo rustica	Barn Swallow	S4B	THR	T		BSC 2008, MNRF 2014, MNRF 2018a, MNRF 2018b	Farmlands or rural areas; cliffs, caves, rock niches; buildings or other man-made structures for nesting; open country near body of water	Yes	Farmlands and rural areas are present within the study area. No man made structures present within the study area.
Chlidonias niger	Black Tern	S3B	SC	NAR		MNRF 2018a	Wetlands, coastal or inland marshes; large cattail marshes, marshy edges of rivers, lakes or ponds, wet open fens, wet meadows; returns to same area to nest each year in loose colonies; must have shallow (0.5 to 1 m deep) water and areas of open water near nests; requires marshes >20 ha in size; feeds over adjacent grasslands for insects; also feeds on fish, crayfish and frogs	No	Two tributarys cross the study area but they are small in size and don't have associated marsh areas. Any marshes present within the study area would be < 20 ha in size
Dolichonyx oryzivorus	Bobolink	S4B	THR	T	No Schedule	BSC 2008, MNRF 2018a, MNRF 2018b	Large, open expansive grasslands with dense ground cover; hayfields, meadows or fallow fields; marshes; requires tracts of grassland >50 ha	No	Grasslands are present within the study area but they are less than 10 ha in size.

Scientific Name	Common Name	S-RANK[1]	ESA/ COSSARO[3]	COSEWIC[2]	SARA	Background Source	Habitat Preference[4,5,6,7, 8]	Suitable Habitats within Subject Property	Rationale
Cardellina canadensis	Canada Warbler	S4B	SC	T	Schedule 1	MNRF 2018a, MNRF 2018b	Interior forest habitats with a dense, well-developed shrub and vegetation understory; along riparian zones or wet bottomland habitat. require tracts of land which are >30ha	No	No large dense forests present within the study area. Riparian zones within the study area are less than 30 ha in size.
Setophaga cerulea	Cerulean Warbler	S3B	THR	E	Schedule 1	MNRF 2018a	Mature deciduous woodland of Great Lakes- St. Lawrence and Carolinian forests, sometimes coniferous; swamps or bottomlands with large trees; area sensitive species needing extensive areas of forest (>100 ha)	No	No large tracts of forest present within study area.
Chaetura pelagica	Chimney Swift	S4B, S4N	THR	T	Schedule 1	BSC 2008, MNRF 2018a, MNRF 2018b	Commonly found in urban areas near buildings; nests in hollow trees, crevices of rock cliffs, chimneys; highly gregarious; feeds over open water	Yes	No buildings are located within the study area however suitable nesting habitat may be present in the form of hollow trees.
Chordeiles minor	Common Nighthawk	S4B	SC	T	Schedule 1	MNRF 2018a, MNRF 2018b	Open ground; clearings in dense forests; ploughed fields; gravel beaches or barren areas with rocky soils; open woodlands; flat gravel roofs	Yes	Open ground, an open woodland and ploughed fields are present within the study area.
Sturnella magna	Eastern Meadowlark	S4B	THR	T	No Schedule	BSC 2008, MNRF 2018a, MNRF 2018b	Open, grassy meadows, farmland, pastures, hayfields or grasslands with elevated singing perches; cultivated land and weedy areas with trees; old orchards with adjacent, open grassy areas >10 ha in size	Yes	Farmland with singing perches in the form of trees and fenceposts are present within the study area.
Caprimulgus vociferus	Eastern Whip-poor-will	S4B	THR	T	Schedule 1	MNRF 2018a	Dry, open, deciduous woodlands of small to medium trees; oak or beech with lots of clearings and shaded leaflitter; wooded edges, forest clearings with little herbaceous growth; pine plantations; associated with >100 ha forests; may require 500 to 1000 ha to maintain population	No	Any forest present within the study area is < 100 ha in size.
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC		MNRF 2018b, MNRF 2014	Open, deciduous, mixed or coniferous forest; predominated by oak with little understory; forest clearings, edges; farm woodlots, parks	Yes	Several small woodlots are present within the study area.
Vermivora chrysoptera	Golden-winged Warbler	S3B	SC	T	Schedule 1	MNRF 2018a, MNRF 2018b	Early successional habitat; shrubby, grassy abandoned fields with small deciduous trees bordered by low woodland and wooded swamps; alder bogs; deciduous, damp woods; shrubbery clearings in deciduous woods with saplings and grasses; brier-woodland edges; requires >10 ha	No	There is less than 10 ha of possible suitable habitat within the study area.
Ammodramus savannarum	Grasshopper Sparrow	S4B	SC	SC		BSC 2008	Well-drained grassland or prairie with low cover of grasses, taller weeds on sandy soil; hayfields or weedy fallow fields; uplands with ground vegetation of various densities; perches for singing; requires tracts of grassland > 10 ha	No	Grassland is present within the study area but it is smaller than 10 ha in size.
Ammodramus henslowii	Henslow's Sparrow	SHB	END	E	Schedule 1	MNRF 2018a	Large, fallow, grassy area with ground mat of dead vegetation, dense herbaceous vegetation, ground litter and some song perches; neglected weedy fields; wet meadows; cultivated uplands; a moderate amount of moisture needed; requires a minimum tract of grassland of 40 ha, but usually in areas >100 ha	No	Grassland is present within the study area but it is smaller than 10 ha in size.

Scientific Name	Common Name	S-RANK[1]	ESA/ COSSARO[3]	COSEWIC[2]	SARA	Background Source	Habitat Preference[4,5,6,7, 8]	Suitable Habitats within Subject Property	Rationale
Ixobrychus exilis	Least Bittern	S4B	THR	T	Schedule 1	MNRF 2018a	Deep marshes, swamps, bogs; marshy borders of lakes, ponds, streams, ditches; dense emergent vegetation of cattail, bulrush, sedge; nests in cattails; intolerant of loss of habitat and human disturbance	Yes	No large, deep marshes present within study area but there is dense emergent vegetation in the form of cattails surrounding the tributary located between Whitelaw Road and Shadow Drive that may provide suitable nesting habitat.
Lanius ludovicianus (ssp. migrans)	Loggerhead Shrike	S2B	END	E	Schedule 1	MNRF 2018a	Grazed pasture, marginal farmland with scattered hawthorn shrubs, hedgerows; fence posts, wires and associated low-lying wetland; located on core areas of limestone plain adjacent to Canadian Shield; greatest threat is fragmentation of suitable habitat due to natural succession; probably needs at least 25 ha of suitable habitat	No	Farmland with hedgerows, fence posts and wires present within study area but is not located on limestone plain of the Canadian Shield
Parkesia motacilla	Louisiana Waterthrush	S3B	THR	SC	Schedule 1	MNRF 2018a	Prefers wooded ravines with running streams; also woodlands swamps; large tracts of mature deciduous or mixed forests; canopy cover is essential; has strong affinity to nest sites; nests on ground	No	No wooded ravines or large tracts of mature forest within the study area.
Colinus virginianus	Northern Bobwhite	S1	END	E	Schedule 1	MNRF 2018a	Grassland, prairie or hay fields with woody cover in form of thickets, tangles of vines, shrubs; fence rows or woodland edges; cropland growing corn, soybeans or small grains and clover or grass; well-drained sandy or loamy soil; pond edges	Yes	Frence rows and woodland edges, as well as cropland growing corn or soybeans are present within the study area.
Contopus cooperi	Olive-sided Flycatcher	S4B	SC	T	Schedule 1	MNRF 2018a	Semi-open, conifer forest, prefers spruce; near pond, lake or river; treed wetlands for nesting; burns with dead trees for perching	No	No conifer forests near a waterbody are present within the study area.
Melanerpes erythrocephalus	Red-headed Woodpecker	S4B	SC	T	Schedule 1	MNRF 2018a, MNRF 2018b	Open, deciduous forest with little understory; fields or pasture lands with scattered large trees; wooded swamps; orchards, small woodlots or forest edges; groves of dead or dying trees; feeds on insects and stores nuts or acorns for winter; loss of habitat is limiting factor; requires cavity trees with at least 40 cm dbh; require about 4 ha for a territory	Yes	Fields and small woodlots are present within the study area. Several large cavity trees may provide suitable nesting habitat.
Asio flammeus	Short-eared Owl	S2N, S4B	SC	SC	Schedule 3	MNRF 2018a	Grasslands, open areas or meadows that are grassy or bushy; marshes, bogs or tundra; both diurnal and nocturnal habits; ground nester; destruction of wetlands by drainage for agriculture is an important factor in the decline of this species; home range 25 -125 ha; requires 75-100 ha of contiguous open habitat	Yes	Grassy meadows and open areas are present within the study area. Agricultural lands may provide 75 ha of contiguous open habitat.
Hylocichla mustelina	Wood Thrush	S4B	SC	T		BSC 2008, MNRF 2018a, MNRF 2018b	Carolinian and Great Lakes-St. Lawrence forest zones; undisturbed moist mature deciduous or mixed forest with deciduous sapling growth; near pond or swamp; hardwood forest edges; must have some trees higher than 12 m	No	No undisturbed forest with large trees located near a pond within the study area.
Icteria virens	Yellow-breasted Chat	S2B	END	E	Schedule 1	MNRF 2018a, MNRF 2018b	Thickets, tall tangles of shrubbery beside streams, ponds; overgrown bushy clearings with deciduous thickets; nests above ground in bush, vines etc.	Yes	Thickets and shrubbery present along roadside in several areas.

Scientific Name	Common Name	S-RANK[1]	ESA/ COSSARO[3]	COSEWIC[2]	SARA	Background Source	Habitat Preference[4,5,6,7, 8]	Suitable Habitats within Subject Property	Rationale
Herpetofauna									
Emydoidea blandingii	Blanding's Turtle (Great Lakes/St Lawrence population)	S3	THR	T	Schedule 1	MNRF 2018a, MNRF 2018b, GRCA 2018	Shallow water marshes, bogs, ponds or swamps, or coves in larger lakes with soft muddy bottoms and aquatic vegetation; basks on logs, stumps or banks; surrounding natural habitat is important in summer as they frequently move from aquatic habitat to terrestrial habitats; hibernates in bogs; not readily observed.	Yes	A pond and shallow marsh surrounding a small tributary may provide suitable habitat within the study area. No hibernation habitat present.
Thamnophis butleri	Butler's Gartersnake	S2	END	E	Schedule 1	MNRF 2018a	Wet meadows, pastures, margins of marshes and streams, and open country	Yes	Suitable habitat in the form of streams and open country may be present in within the study area.
Chelydra serpentina serpentina	Common Snapping Turtle	S2B	SC	SC	Schedule 1	ORAA 2018, MNRF 2018a, MNRF 2018b, GRCA 2018	Permanent or semi-permanent fresh water; marshes, swamps or bogs; rivers and streams with soft muddybanks or bottoms. The species often uses soft soil or clean dry sand on south-facing slopes for nest sites and may nest at some distance from water.	Yes	Freshwater marshes and two small streams are present within the study area and may provide suitable habitat.
Lampropeltis t. triangulum	Eastern Milksnake	S4		SC	Schedule 1	ORAA 2018	Farmlands, meadows, hardwood or aspen stands; pine forest with brushy or woody cover; river bottoms or bog woods; hides under logs, stones, or boards or in outbuildings; often uses communal nest sites.	Yes	Farmland and meadows present within the study area.
Thamnophis sauritus septentrionalis	Eastern Ribbonsnake (Great Lakes population)	S3	SC	SC	Schedule 1	MNRF 2018a, MNRF 2018b, GRCA 2018, ORRA 2018	Sunny grassy areas with low dense vegetation near bodies of shallow permanent quiet water; wet meadows grassy marshes or sphagnum bogs; borders of ponds, lakes or streams; hibernates in groups	Yes	Areas of low grass are present within the study area and may provide suitable habitat.
Ambystoma jeffersonianum	Jefferson Salamander	S2	END	E	Schedule 1	MNRF 2018a, MNRF 2018b	Damp shady deciduous forest, swamps, moist pasture, lakeshores; temporary woodland pools for breeding; hides under leaf litter, stones or in decomposing logs	No	No thick forest tracts, swamps, moist pasture are present directly within the study area, which is not on a lakeshore.
Ambystoma laterale - (2) jeffersonianum	Unisexual *Ambystoma* Jefferson dependent population	S2	END	E	No Schedule	MNRF 2018a, MNRF 2018b	Damp shady deciduous forest, swamps, moist pasture, lakeshores; temporary woodland pools for breeding; hides under leaf litter, stones or in decomposing logs	No	No thick forest tracts, swamps, moist pasture are present directly within the study area, which is not on a lakeshore.
Ambystoma sp. (genetics unknown)	Jefferson/ Unisexual Salamander Complex	S2				ORAA 2018	Damp shady deciduous forest, swamps, moist pasture, lakeshores; temporary woodland pools for breeding; hides under leaf litter, stones or in decomposing logs	No	No thick forest tracts, swamps, moist pasture are present directly within the study area, which is not on a lakeshore.
Sistrurus catenatus catenatus pop. 1	Massasauga (*Great Lakes/St. Lawrence population*)	S3	THR	T	Schedule 1	MNRF 2018a	Use upland, old field in summer; marsh, shrub swamp or bog; rivers and streams that provide sedge or low vegetative growth; in fall and winter; hibernate underground in mammal burrows, under rotting stumps, in rock crevices	Yes	Upland fields are present within the study area, as well as small marsh areas that may provide suitable habitat.

Scientific Name	Common Name	S-RANK[1]	ESA/ COSSARO[3]	COSEWIC[2]	SARA	Background Source	Habitat Preference[4,5,6,7, 8]	Suitable Habitats within Subject Property	Rationale
Graptemys geographica	Northern Map Turtle	S3B	SC	SC	Schedule 1	GRCA 2018	Large bodies of water with soft bottoms, and aquatic vegetation; basks on logs or rocks or on beaches and grassy edges, will bask in groups; uses soft soil or clean dry sand for nest sites; may nest at some distance from water.	No	No large bodies of water are present within are near the study area. However, there are many areas with soft soil that may be used for nesting.
Clemmys guttata	Spotted Turtle	S3	END	E	Schedule 1	MNRF 2018a	Unpolluted, shallow bodies of water such as streams, ponds, wet meadows, marshes or swamps with aquatic vegetation, logs or clumps of vegetation for basking; nest is dug near water in fine-textured soil (e.g. sand) or moss; vulnerable to factors affecting water quality, vegetation composition and structure; average home range size 3.7 ha	No	Due to the location of the study area, any waterbodies are not likely to be unpolluted.
Pseudacris triseriata pop. 2	Western Chorus Frog *(Great Lakes/St. Lawrence - Canadian Shield Population)*	S3	NAR	T	Schedule 1	ORAA 2018	Roadside ditches or temporary ponds in fields; swamps or wet meadows; woodland or open country with cover and moisture; small ponds and temporary pools ponds and temporary pools	Yes	Roadside ditches are present within the study area and there is the potential for temporary ponds in fields to occur. There is also a small pond adjacent to the study area.
Mammals									
Taxidea taxus jacksoni	American Badger *(jacksoni subspecies)*	S2	END	E	Schedule 1	MNRF 2018b	Open grasslands and oak savannahs; dens in new hole or enlarged existing hole; sometimes makes food caches	Yes	Suitable habitat in the form of open grasslands may be present within the study area.
Myotis leibii	Eastern Small-footed Myotis	S2S3	END			MNRF 2018a, MNRF 2018b, Dobbyn 1994	Roosts in caves, mine shafts, crevices or buildings that are in or near woodland; hibernates in cold dry caves or mines; maternity colonies in caves or buildings; hunts in forests	No	No caves or buildings are located within the study area.
Urocyon cinereoargenteus	Gray Fox	S1	THR	T	Schedule 1	MNRF 2018a	Hardwood forests with a mix of fields and woods; swamps; wooded, brushy or rocky habitats; woodland farmland edge; old fields with thickets; dens in hollow log or tree; individual has numerous winter dens throughout its range which is > 40 ha	Yes	The study area contains a mix of fields and woods and is near woodland farmland edges, which may provide suitable habitat
Myotis lucifungus	Little Brown Myotis	S5	END	E	Schedule 1	MNRF 2018a, MNRF 2018b, Dobbyn 1994	Uses caves, quarries, tunnels, hollow trees or buildings for roosting; winters in humid caves; maternity sites in dark warm areas such as attics and barns; feeds primarily in wetlands, forest edges	Yes	Several cavity trees are present within the study area that may provide suitable roosting habitat. No buildings are present directly within the study area.
Myotis septentrionalis	Northern Myotis	S3	END	E	Schedule 1	MNRF 2018a, MNRF 2018b, Dobbyn 1994	Hibernates during winter in mines or caves; during summer males roost alone and females form maternity colonies of up to 60 adults; roosts in houses, man-made structures but prefers hollow trees or under loose bark; hunts within forest, below canopy	Yes	Several cavity trees are present within the study area that may provide suitable roosting habitat. No buildings are present directly within the study area.

Scientific Name	Common Name	S-RANK[1]	ESA/ COSSARO[3]	COSEWIC[2]	SARA	Background Source	Habitat Preference[4,5,6,7, 8]	Suitable Habitats within Subject Property	Rationale
Perimyotis subflavus	Tri-colored Bat	S3?	END	E	Schedule 1	MNRF 2018a, MNRF 2018b, Dobbyn 1994	Variety of forested habitats. Older forests and occasionally in barns or other structures may be used for roosts. They forage over water and along streams in the forest.	Yes	Several cavity trees are present within the study area that may provide suitable roosting habitat. No buildings are present directly within the study area.
Microtus pinetorum	Woodland Vole		SC	SC	Schedule 1	Dobbyn 1994	Mature deciduous forest in the Carolinian forest zone, with loose sandy soil and deep humus; grasslands, meadows and orchards with groundcover of duff or grass	No	Study area is not in the Carolinian forest zone.
Insects									
Lestes eurinus	Amber-winged Spreadwing	S3				Ontario Odonata Atlas Database 2018	Variety of permanent lakes and ponds with at least some emergent vegetation	Yes	A small pond is present within or directly adjacent to the study area.
Nicrophorus americanus	American Burying Beetle	SH	EXP	EXP	Schedule 1	MNRF 2014	Undisturbed mature deciduous forest.	No	Undisturbed mature deciduous forest not present within study area.
Danaus plexippus	Monarch	S2N, S4B	SC	SC	Schedule 1	MacNaughton et al. 2018, MNRF 2018a, MNRF 2018b	Exist primarily wherever milkweed and wildflowers exist; abandoned farmland, along roadsides, and other open spaces	Yes	Suitable habitat along roadsides and in open spaces may be present within the study area. The presence of milkweed within the study area is unknown.
Asterocampa clyton	Tawny Emperor	S2S3				GRCA 2018	Most typical in edge or riparian areas where hackberry trees are present. Less tolerant of subrubia compared to *A. celtis* , as hibernating larvae may be destroyed when leaves are raked	Yes	Suitable edge or riparian habitat may be present in the study area. The presence of hackberry trees within the area is unknown.
Pieris virginiensis	West Virginia White	S3	SC	SC		MNRf 2018a, MNRF 2018b	Mesic hardwood or hardwood-northern conifer-mixed forests on rich soils, including hardwood swamps. An important feature is plentiful suppply of the foodplants, generally toothworts	No	Mesic hardwood forests or swamps not present within study area. The presence of toothworts within the area is unknown.
Fishes									
Moxostoma duquesnei	Black Redhorse	S2	THR	T	No Schedule	MNRF 2018a	Lives in pools and riffle areas of medium-sized rivers and streams that are usually less than two metres deep. These rivers usually have few aquatic plants, a moderate to fast current, and a sandy or gravel bottom. In the spring, it migrates to breeding habitat where eggs are laid on gravel in fast water. The winter is spent in deeper pools. Adults feed on crustaceans and aquatic insects, while the young fish feed on plankton.	Yes	The aquatic habitat within the study area has not yet been assessed. It is possible that the two streams crossing through the study may provide suitable habitat.
Clinostomus elongatus	Redside Dace	S2	END	E	Schedule 1	MNRF 2018a	Prefers pools and slow-moving sections of relatively small (<10 m width), clear, cool, streams with sand or gravel bottoms , riffle/pool habitat and overhanging vegetation; preferred water temperature range 14-23°C	Yes	The aquatic habitat within the study area has not yet been assessed. It is possible that the two streams crossing through the study may provide suitable habitat.

Scientific Name	Common Name	S-RANK[1]	ESA/ COSSARO[3]	COSEWIC[2]	SARA	Background Source	Habitat Preference[4,5,6,7, 8]	Suitable Habitats within Subject Property	Rationale
Notropis photogenis	Silver Shiner	S2S3	SC	SC	Schedule 3	MNRF 2018a	Silver shiners prefer moderate to large size streams with swift currents that are free of weeds and have clean gravel or boulder bottoms.	No	The two tributaries that cross through the study area are too small in size and are not likely free of weeds.
Molluscs									
Lampsilis fasciola	Wavy-rayed Lampmussel	S1	THR	SC	Schedule 1	MNRF 2018a	Found in small to medium rivers with clear water. It lives in shallow riffle areas with clean gravel or sand bottoms. Like all mussels, this species filters water to find food, such as bacteria and algae. Mussel larvae are parasitic and must attach to a fish host, where they consume nutrients from the fish body until they transform into juvenile mussels and drop off. The Wavy-rayed lampmussel's fish hosts are the Largemouth bass and Smallmouth bass.	Yes	Suitbale habitat may be present within the two tributaries that cross through the study area. However, the aquatic habitat has not yet been characterized.

Appendix II
Significant Wildlife Habitat Screening

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 6E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Raptor Wintering Area					
Rational: Sites used by multiple species, a high number of individuals and used annually are most significant	Rough-legged Hawk Red-tailed Hawk Northern Harrier American Kestrel Snowy Owl Special Concern: Short-eared Owl Bald Eagle	Hawks/Owls: Combination of ELC Community Series; need to have present one Community Series from each land class: Forest: FOD, FOM, FOC Upland: CUM, CUT, CUS, CUW	The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. Raptor wintering sites need to be > 20 ha[cxlviii, cxlix] with a combination of forest and upland.[xvi, xvii, xviii, xix, xx, xxi]. Least disturbed sites, idle/fallow or lightly grazed field/meadow (>15ha) with adjacent woodlands[cxlix] Field area of the habitat is to be wind swept with limited snow depth or accumulation. Eagle sites have open water, large trees and snags available for roosting Information Sources • OMNRF Ecologist or Biologist • Field Natural Clubs • Natural Heritage Information Center (NHIC) Raptor Winter Concentration Area • Data from Bird Studies Canada • Reports and other information available from Conservation Authorities CAs.	Studies confirm the use of these habitats by: • One or more Short-eared Owls or; One or more Bald Eagles or; At least 10 individuals and two listed hawk/owl species • To be significant a site must be used regularly (3 in 5 years)[cxlix] for a minimum of 20 days by the above number of birds • The habitat area for an Eagle winter site is the shoreline forest ecosites directly adjacent to the prime hunting area • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMiST[cxlix] Index #10 and #11 provides development effects and mitigation measures.	Vegetation community classification and delineation has not yet been completed within the study area. However, based on aerial imagery interpretation, CUM may be present and no forest ecosites are present. Red-tailed Hawk, Northern Harrier, Bald eagle documented within the vicinity of the study area (BSC et al. 2006, MNRF 2018a, MNRF 2018b). No winter raptor surveys completed within the study area. No open water for eagle sites is present within the study area. **Candidate SWH**
Wildlife Habitat: Snake Hibernaculum					
Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant	Snakes: Eastern Gartersnake Northern Watersnake Northern Red-bellied Snake Northern Brownsnake Smooth Green Snake Northern Ring-necked Snake Special Concern: Milksnake Eastern Ribbonsnake Lizard: Special Concern (Southern Shield population): Five-lined Skink	For all snakes, habitat may be found in any ecosite other than very wet ones. Talus, Rock Barren, Crevice and Cave, and Alvar sites may be directly related to these habitats. Observations of congregations of snakes on sunny warm days in the spring or fall is a good indicator. For Five-lined Skink, ELC Community Series of FOD and FOM and Ecosites: FOC1 FOC3	• For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural locations. The existence of features that go below the frost line; such as rock piles or slopes, old stone fences, and abandoned crumbling foundations assist in identifying candidate SWH. • Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line[xliv, l, li, liii, cxii.] • Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover. • Five-lined skink prefer mixed forests with rock outcrop openings providing cover rock overlaying granite bedrock with fissures cciii. Information Sources • In spring, local residents or landowners may have observed the emergence of snakes on their property (e.g. old dug wells). • Reports and other information from CAs. • Local Field naturalists and experts, as well as university herpetologists may also know where to find some of these sites. clubs • Natural Heritage Information Center (NHIC) • OMNRF ecologist or biologist may be aware of locations of wintering skinks	Studies confirming: • Presence of snake hibernacula used by a minimum of five individuals of a snake sp. or; individuals of two or more snake spp. • Congregations of a minimum of five individuals of a snake sp. or; individuals of two or more snake spp. near potential hibernacula (eg. foundation or rocky slope) on sunny warm days in Spring (Apr/May) and Fall (Sept/Oct). • Note: If there are Special Concern Species present, then site is SWH • Note: Sites for hibernation possess specific habitat parameters (e.g. temperature, humidity, etc.) and consequently are used annually, often by many of the same individuals of a local population [i.e. strong hibernation site fidelity]. Other critical life processes (e.g. mating) often take place in close proximity to hibernacula. The feature in which the hibernacula is located plus a 30m buffer is the SWH[l] • SWHMiST[cxlix] Index #13 provides development effects and mitigation measures for snake hibernacula. • Presence of any active hibernaculum for skink is significant. • SWHMiST[cxlix] Index #37 provides development effects and mitigation measures for five-lined skink wintering habitat.	Eastern Gartersnake, Northern Red-bellied Snake, Northern Brownsnake, Milksnake, Eastern Ribbonsnake documented within the vicinity of the study area (Ontario Nature 2018). No targeted snake surveys have been completed within the study area. **Candidate SWH**

Significant Wildlife Habitat Assessment Tables

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 6E.

Rare Vegetation Community[1]	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes[1]	Habitat Description[1]	Detailed Information and Sources[1]	Defining Criteria[1]	Assessment Details
Savannah					
Rationale: Savannahs are extremely rare habitats in Ontario.	TPS1 TPS2 TPW1 TPW2 CUS2	A Savannah is a tallgrass prairie habitat that has tree cover between 25 – 60%.	• No minimum size to site Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources • Natural Heritage Information Center (NHIC) has location information on their website • OMNRF Ecologists • Field naturalists clubs • Conservation Authorities	Field studies confirm one or more of the Savannah indicator species listed in[lxxv] Appendix N should be present. Note: Savannah plant spp. list from Ecoregion 6E should be used[cxlviii]. • Area of the ELC Ecosite is the SWH. • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics sp.). • SWHMiST[cxlix] Index #18 provides development effects and mitigation measures.	Based on aerial imagery interpretation and knowledge of the study area, none of the listed ELC Communities are present. **Not SWH**
Tallgrass Prairie					
Rationale: Tallgrass Prairies are extremely rare habitats in Ontario.	TPO1 TPO2	A Tallgrass Prairie has ground cover dominated by prairie grasses. An open Tallgrass Prairie habitat has < 25% tree cover.	• No minimum size to site Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources • OMNR Districts • Natural Heritage Information Center (NHIC) has location information available on their website • Field naturalists clubs • Conservation Authorities	Field studies confirm one or more of the Prairie indicator species listed in[lxxv] Appendix N should be present. Note: Prairie plant spp. list from Ecoregion 6E should be used[cxlviii]. • Area of the ELC Ecosite is the SWH • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • SWHMiST[cxlix] Index #19 provides development effects and mitigation measures.	Based on aerial imagery interpretation and knowledge of the study area, none of the listed ELC Communities are present. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 6E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Amphibian Breeding Habitat (Wetland)					
Rationale: These habitats are extremely important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Tree frog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	ELC Community Classes SW, MA, FE, BO, OA and SA. Typically these wetland ecosites will be isolated (>120m) from woodland ecosites, however larger wetlands containing predominantly aquatic species (e.g. Bull Frog) may be adjacent to woodlands.	• Wetlands >500m2 (about 25m diameter)[ccvii] supporting high species diversity are significant; some small or ephemeral habitats may not be identified on MNRF mapping and could be important amphibian breeding habitats[clxxxiv]. • Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators. • Bullfrogs require permanent water bodies with abundant emergent vegetation. Information Sources • Ontario Herpetofaunal Summary Atlas (or other similar atlases) • Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count. • OMNRF Districts and wetland evaluations • Reports and other information available from CAs.	Studies confirm: • Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog/toad species and with at least 20 individuals (adults or eggs masses)[lxxi, lxxiii], or 2 or more of the listed frog/toad species with Call Level Codes of 3. or; Wetland with confirmed breeding Bullfrogs are significant. • The ELC ecosite wetland area and the shoreline are the SWH. • A combination of observational study and call count surveys[cviii] will be required during spring March to June) when amphibians are concentrated around suitable breeding habitat within or near the wetlands. • If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWHMiST[cxlix] Index #15 provides development effects and mitigation measures.	Vegetation community classification and delineation has not been completed within the study area, however, based on aerial imagery interpretation, an MA ELC communitiy class may be present within the study area. Eastern Newt, American Toad, Blue-spotted Salamander, Gray Tree Frog, Western Chorus Frog, Northern Leopard Frog, Pickerel Frog, Green Frog, Bullfrog documented within the vicinity of the study area (Ontario Nature 2018). No targeted amphibian surveys completed within the study area. The possible MA community class within the study area is adjacent to a PSW that is >500m2. **Candidate SWH**

Significant Wildlife Habitat Assessment Tables

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 6E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Marsh Bird Breeding Habitat					
Rationale: Wetlands for these bird species are typically productive and fairly rare in Southern Ontario landscapes.	American Bittern Virginia Rail Sora Common Gallinule American Coot Pied-billed Grebe Marsh Wren Sedge Wren Common Loon Sandhill Crane Green Heron Trumpeter Swan Special Concern: Black Tern Yellow Rail	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SAS1 SAM1 SAF1 FEO1 BOO1 For Green Heron: All SW, MA and CUM1 sites.	• Nesting occurs in wetlands • All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present[cxxiv]. • For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it may be found in upland shrubs or forest a considerable distance from water. Information Sources • Contact OMNRF, wetland evaluations are a good source of information. • Field naturalist clubs • Natural Heritage Information Center (NHIC) Records • Reports and other information available from CAs. • Ontario Breeding Bird Atlas[ccv]	Studies confirm: • Presence of 5 or more nesting pairs of Sedge Wren or Marsh Wren or 1 pair of Sandhill Cranes; or breeding by any combination of 5 or more of the listed species[l]. • Note: any wetland with breeding of 1 or more Black Terns, Trumpeter Swan, Green Heron or Yellow Rail is SWH[l]. • Area of the ELC ecosite is the SWH • Breeding surveys should be done in May/June when these species are actively nesting in wetland habitats. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi]. • SWHMiST[cxlix] Index #35 provides development effects and mitigation measures	Vegetation community classification and delineation has not been completed within the study area, however, based on aerial imagery interpretation, MAM and CUM1 ecosites may be present within the study area. American Bittern, Virginia Rail, Sora, Common Gallinule, Pied-billed Grebe, Marsh Wren, Green Heron, Black Tern documented within the vicinity of the study area (BSC et al. 2006). No targeted breeding bird surveys completed within the study area. There is emergent aquatic vegetation present in the wetland. **Candidate SWH**

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 6E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Terrestrial Crayfish					
Rationale: Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare.[ccii]	Chimney or Digger Crayfish: (*Fallicambarus fodiens*) Devil Crawfish or Meadow Crayfish: (*Cambarus Diogenes*)	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 MAS1 MAS2 MAS3 SWD SWT SWM	Wet meadow and edges of shallow marshes (no minimum size) identified should be surveyed for terrestrial crayfish. • Constructs burrows in marshes, mudflats, meadows, the ground can't be too moist. Can often be found far from water. • Both species are a semi-terrestrial burrower which spends most of its life within burrows consisting of a network of tunnels. Usually the soil is not too moist so that the tunnel is well formed. Information Sources • Information sources from "Conservation Status of Freshwater Crayfishes" by Dr. Premek Hamr for the WWF and CNF March 1998	Studies Confirm: • Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable marsh meadow or terrestrial sites[cci] • Area of ELC Ecosite or an ecoelement area of meadow marsh or swamp within the larger ecosite area is the SWH • Surveys should be done April to August during in temporary or permanent water Note the presence of burrows or chemistry are often the only indicator of presence, observance or collection of individuals is very difficult[cci] • SWHMiST[cxlix] Index #36 provides development effects and mitigation measures.	Vegetation community classification and delineation has not been completed within the study area, however, based on aerial imagery interpretation, the MAM ecosite may be present within the study area A terrestrial crayfish chimney was documented within the study area. **Confirmed SWH**
Wildlife Habitat: Special Concern and Rare Wildlife Species					
Rationale: These species are quite rare or have experienced significant population declines in Ontario.	All Special Concern and Provincially Rare (S1-S3, SH) plant and animal species. Lists of these species are tracked by the Natural Heritage Information Centre.	All plant and animal element occurrences (EO) within a 1 or 10km grid. Older element occurrences were recorded prior to GPS being available, therefore location information may lack accuracy.	When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites[lxxviii]. Information Sources • Natural Heritage Information Centre (NHIC) will have the Special Concern and Provincially Rare (S1-S3, SH) species lists with element occurrences data. • NHIC Website: "Get Information": http://nhic.mnr.gov.on.ca • Ontario Breeding Bird Atlas[ccv] • Expert advice should be sought as many of the rare spp. have little information available about their requirements.	Studies Confirm: • Assessment/inventory of the site for the identified special concern or rare species needs to be completed during the time of year when the species is present or easily identifiable. • The area of the habitat to the finest ELC scale that protects the habitat form and function is the SWH, this must be delineated through detailed field studies. The habitat needs to be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat or foraging habitat. • SWHMiST[cxlix] Index #37 provides development effects and mitigation	Several Special Concern and Provincially Rare species have been documented within the vicinity of the study area. Refer to Species of Conservation Concern Screening for details (Appendix II). **Candidate SWH**

Significant Wildlife Habitat Assessment Tables

Table 5. Characteristics of Animal Movement Corridors for Ecoregion 6E.

	Wildlife Species[1]	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes[1]	Habitat Criteria and Information Sources[1]	Defining Criteria[1]	Assessment Details
Wildlife Habitat: Amphibian Movement Corridors					
Rationale: Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.	Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	Corridors may be found in all ecosites associated with water. • Corridors will be determined based on identifying the significant breeding habitat for these species in Table 1.1.	Movement corridors between breeding habitat and summer habitat [clxxiv, clxxv, clxxvi, clxxvii, clxxviii, clxxix, clxxx, clxxxi]. Movement corridors must be determined when Amphibian breeding habitat is confirmed as SWH from Table 1.2.2 (Amphibian Breeding Habitat – Wetland) of this Schedule[i]. Information Sources • MNRF District Office • Natural Heritage Information Center NHIC • Reports and other information available from CAs • Field Naturalist Clubs	• Field Studies must be conducted at the time of year when species are expected to be migrating or entering breeding sites. • Corridors should consist of native vegetation, with several layers of vegetation. Cooridors unbroken by roads, waterways or bodies, and undeveloped areas are most significant[cxlix]. • Corridors should have at least 15m of vegetation on both sides of waterway [cxlix] or be up to 200m wide[cxlix] of woodland habitat and with gaps <20m [cxlix]. • Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat[cxlix]. • SWHMiST[cxlix] Index #40 provides development effects and mitigation measures.	Ellis Creek flows through the study area and may provide suitable habitat for amphibian movement. Candidate amphibian breeding habitat was idenitified in Table 3. **Candidate SWH**

Appendix III

Tree Assessment Criteria

Conditions of Tree Assessment

Limitations

This tree inventory and assessment is based on the circumstances and observations by Natural Resource Solutions Inc. (NRSI) as they existed at the time of the site inspection(s) of the Client's Property as described in this report (the "Property") and the trees situated thereon, and upon information provided by the Client to NRSI. The opinions in this assessment are based on observations made and using professional judgment, however, because trees are living organisms and subject to change, damage and disease, the analysis and recommendations as set out in this assessment are valid for 2 years from the date any such observations and assessment took place. As a result, the Client shall not rely upon this assessment, save and except for representing the circumstances and observations at the date of site inspection(s), and the analysis and recommendations made in relation to the proposed undertaking. It is recommended that the inventoried trees discussed in this assessment should be re-assessed periodically, where required (i.e. after 2 years).

Further Services

Neither NRSI, nor any assessor employed or retained by NRSI (the "Assessor") for the purpose of preparing or assisting in the preparation of this assessment shall be required to provide any further consultation or services to the Client including, without limitation, acting as an expert witness or witness in any court in any jurisdiction unless the Client has first made specific arrangements with respect to such further services, including providing payment of the Assessor's regular hourly billing fees.

NRSI accepts no responsibility for the implementation of all or any part of this report, unless specifically requested to examine the implementation of such activities recommended herein. Any request for the inspection or supervision of all or part of the implementation shall be made in writing and the details agreed to in writing by both parties.

Assumptions

The Client is hereby notified that where any of the information set out and referenced in this assessment are based on assumptions, facts or information provided to NRSI, NRSI

will in no way be responsible for the veracity or accuracy of any such information. Further, the Client acknowledges and agrees that NRSI has, for the purposes of preparing their assessment, assumed that the Property is in full compliance with all applicable federal, provincial, municipal and local statutes, regulations, by-laws, guidelines and other related laws. NRSI explicitly denies any legal liability for any and all issues with respect to non-compliance with any of the above-referenced statutes, regulations, by-laws, guidelines and laws as it may pertain to or affect the Property.

Restriction of Assessment

The assessment carried out was restricted to the Property as described in this report. This includes trees that are on adjacent property to County Road 124. NRSI is not legally liable for any other trees except those expressly discussed herein. The conclusions of this assessment do not apply to any areas, trees, or any other property not covered or referenced in this assessment.

Professional Responsibility

In carrying out this assessment, NRSI and any Assessor appointed for and on behalf of NRSI to perform and carry out the assessment has exercised a reasonable standard of care, skill and diligence. The assessment has been made using accepted arboricultural techniques. These include a visual examination of each tree for structural defects, scars, external indications of decay such as fungal fruiting bodies, evidence of insect attack, discolored foliage (during the leaf-on period), the condition of any visible root structures, the degree and direction of lean (if any), the general condition of the tree(s) and the surrounding site, and the current or planned proximity of property and people. Except where specifically noted in the assessment, none of the trees examined on the property were dissected, cored, probed, or climbed, and detailed root crown examinations involving excavation were not undertaken.

No guarantees are offered, or implied, that trees recommended for retention, or all parts of them, will remain standing. It is professionally impossible to predict with absolute certainty the behaviour of any single tree or group of trees, or all their component parts, in all given circumstances. Inevitably, a standing tree will always pose some risk. Most trees have the potential to fall, lean, or otherwise pose a danger to property and persons

in the event of extreme weather conditions, and this risk can only be eliminated if the tree is removed.

Without limiting the foregoing, no liability is assumed by NRSI or its directors, officers, employers, contractors, agents or Assessors for:

a) any legal description provided with respect to the Property;
b) issues of title and/or ownership with respect to the Property;
c) the accuracy of the Property line locations or boundaries with respect to the Property; and
d) the accuracy of any other information provided to NRSI by the Client or third parties;
e) any consequential loss, injury or damages suffered by the Client or any third parties, including but not limited to replacement costs, loss of use, earnings and business interruption; and
f) the unauthorized distribution of the assessment.

Third Party Liability

This assessment was prepared by NRSI for the Client. The data collected reflect NRSI's best assessment of the inventoried trees situated on the Property with the information available at the time of observation. Data analysis and the assessment of potential impacts to inventoried trees is specific to the proposed undertaking as described in this report. NRSI accepts no responsibility for any damages or loss suffered by any third party or by the Client as a result of decisions made or actions based upon the use of this assessment for purposes unrelated to the proposed undertaking.

General

Any plans and/or illustrations in this assessment are included only to help the Client visualize the issues in this assessment and shall not be relied upon for any other purpose.

This report shall be considered as a whole, no sections are severable, and the assessment shall be considered incomplete if any pages are missing.

Appendix IV

Vascular Flora Species Observed within the Subject Property

Appendix IV
Project Name/Location: County Road 124
Appendix Title: Vascular Plant Species Reported From the Study Area

Scientific Name	Common Name	SRANK[1]	SARO[2]	COSEWIC[3]	SARA Schedule[3]	Wellington County[4]	City of Guelph[6]	NHIC Data[#]	NRSI Observed							
									All Areas	SWD2	SWD3	SWD4-1	MAS2-1	CUM1-1	CUW1	CUP3
Onoclea sensibilis	Sensitive Fern	S5							X	X						
Equisetum arvense	Field Horsetail	S5							X			X	X			
Thuja occidentalis	White Cedar	S5							X							X
Picea abies	Norway Spruce	SE3							X							X
Picea glauca	White Spruce	S5							X		X	X				X
Pinus strobus	Eastern White Pine	S5							X							X
Pinus sylvestris	Scots Pine	SE5							X					X		X
Acer negundo	Manitoba Maple	S5							X						X	
Acer platanoides	Norway Maple	SE5							X							
Acer saccharinum	Silver Maple	S5							X		X					
Acer saccharum ssp. saccharum	Sugar Maple	S5							X							X
Acer saccharum ssp. nigrum	Black Maple	S4?				R-A	SG		X							
Rhus hirta	Staghorn Sumac	S5							X					X		X
Daucus carota	Wild Carrot	SE5							X					X		X
Asclepias syriaca	Common Milkweed	S5							X					X		
Ambrosia artemisiifolia	Common Ragweed	S5							X					X		
Arctium minus ssp. minus	Common Burdock	SE5							X							X
Cichorium intybus	Chicory	SE5							X					X		
Cirsium arvense	Canada Thistle	SE5							X					X	X	
Erigeron annuus	Daisy Fleabane	S5							X					X		
Eupatorium perfoliatum	Perfoliate Thoroughwort	S5							X				X			
Eupatorium maculatum ssp. maculatum	Spotted Joe-pye-weed	S5							X	X						
Euthamia graminifolia	Flat-topped Bushy Goldenrod	S5							X			X				
Leucanthemum vulgare	Ox-eye Daisy	SE5							X		X	X		X		X
Solidago canadensis	Canada Goldenrod	S5							X			X		X	X	X
Taraxacum officinale	Common Dandelion	SE5							X						X	
Tragopogon pratensis ssp. pratensis	Meadow Goat's-beard	SE5							X					X		
Tussilago farfara	Coltsfoot	SE5							X			X		X		
Impatiens capensis	Spotted Touch-me-not	S5							X	X						
Betula papyrifera	White Birch	S5							X							
Hesperis matronalis	Dame's Rocket	SE5							X		X					X
Lonicera tatarica	Tartarian Honeysuckle	SE5							X						X	
Viburnum trilobum	High Bush Cranberry	S5							X						X	
Silene latifolia	Bladder Campion	SE5							X					X		
Cornus foemina ssp. racemosa	Red Panicled Dogwood	S5							X	X						
Cornus stolonifera	Red-osier Dogwood	S5							X	X	X					
Euphorbia esula	Leafy Spurge	SE5							X					X		
Lotus corniculatus	Bird's-foot Trefoil	SE5							X		X	X		X		
Robinia pseudo-acacia	Black Locust	SE5							X							X
Vicia cracca	Tufted Vetch	SE5							X			X	X	X	X	
Fagus grandifolia	American Beech	S5							X							
Quercus macrocarpa	Bur Oak	S5							X							
Quercus rubra	Red Oak	S5							X							
Juglans cinerea	Butternut	S2?	END	E	Schedule 1	R	SG		X		X					
Juglans nigra	Black Walnut	S4							X		X					
Leonurus cardiaca ssp. cardiaca	Common Motherwort	SE5							X							X
Prunella vulgaris ssp. vulgaris	Common Heal-all	SE3							X					X		
Fraxinus americana	White Ash	S5							X		X				X	X
Fraxinus nigra	Black Ash	S5							X	X						
Fraxinus pennsylvanica	Green Ash	S5							X	X	X	X				
Syringa vulgaris	Common Lilac	SE5							X		X			X	X	X
Rumex crispus	Curly-leaf Dock	SE5							X					X		
Anemone canadensis	Canada Anemone	S5							X	X						
Thalictrum pubescens	Tall Meadow-rue	S5							X	X						
Rhamnus cathartica	European Buckthorn	SE5							X	X				X	X	X
Agrimonia gryposepala	Tall Hairy Agrimony	S5							X				X			
Crataegus punctata	Large-fruited Thorn	S5							X						X	
Malus pumila	Common Crabapple	SE5							X							
Rubus occidentalis	Black Raspberry	S5							X							X
Populus alba	Silver Poplar	SE5							X					X		
Populus balsamifera ssp. balsamifera	Balsam Poplar	S5							X			X				

Appendix IV
Project Name/Location: County Road 124
Appendix Title: Vascular Plant Species Reported From the Study Area

Scientific Name	Common Name	SRANK[1]	SARO[2]	COSEWIC[3]	SARA Schedule[3]	Wellington County[4]	City of Guelph[6]	NHIC Data[#]	NRSI Observed							
									All Areas	SWD2	SWD3	SWD4-1	MAS2-1	CUM1-1	CUW1	CUP3
Populus tremuloides	Trembling Aspen	S5							**X**	X		X				
Salix alba var. alba	White Willow	SE4							**X**			X	X			
Salix amygdaloides	Peach-leaved Willow	S5							**X**				X			
Salix eriocephala	Heart-leaved Willow	S5							**X**			X				
Salix fragilis	Crack Willow	SE5							**X**			X			X	
Salix purpurea	Basket Willow	SE4							**X**				X			
Linaria vulgaris	Butter-and-eggs	SE5							**X**				X			
Verbascum thapsus	Common Mullein	SE5							**X**					X		
Solanum dulcamara	Bitter Nightshade	SE5							**X**				X			
Tilia americana	American Basswood	S5							**X**		X				X	
Ulmus americana	White Elm	S5							**X**	X					X	
Ulmus rubra	Slippery Elm	S5							**X**							
Vitis riparia	Riverbank Grape	S5							**X**					X	X	
Scirpus atrovirens	Dark-green Bulrush	S5							**X**				X			
Hemerocallis fulva	Orange Day-lily	SE5							**X**							X
Cypripedium calceolus var. pubescens	Large Yellow Lady's Slipper	S5							**X**	X						
Phalaris arundinacea	Reed Canary Grass	S5							**X**		X	X				
Typha angustifolia	Narrow-leaved Cattail	S5							**X**		X					
Typha latifolia	Broad-leaved Cattail	S5							**X**				X			
					Total	**2**	**2**	**0**	**80**	**13**	**14**	**15**	**11**	**23**	**15**	**19**

[1]MNRF 2015a; [2]MNRF 2017; [3]Government of Canada 2017; [4]Dougan & Associates 2009; [5]City of Guelph 2012; [6]MNRF 2014

LEGEND
SRANK
S1 Critically Imperiled
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SU Unrankable
SNA Unranked
SX Presumed Extirpated
SH Possibly Extirpated (Historical)
S#? Rank Uncertain
COSSARO
END Endangered
THR Threatened
SC Special Concern
NAR Not at Risk
DD Data Deficient
EXP Extirpated
COSEWIC
E Endangered
T Threatened
SC Special Concern
NAR Not at Risk
DD Data Deficient
XT Extirpated
SARA Schedule
Schedule 1 Officially Protected under SARA
Schedule 2 Threatened/endangered; may be reassessed for consideration for inclusion to Schedule 1
Schedule 3 Special concern; may be reassessed for consideration for inclusion to Schedule 1

Appendix V
Tree Inventory

Table 6. Overall Condition of Trees Inventoried

Potential for Structural Failure Rating	Overall Condition						Total
	Excellent	Good	Fair	Poor	Very Poor	Dead	
Improbable	0	107	149	24	1	0	281
Possible	0	0	21	39	14	1	75
Probable	0	0	0	3	5	0	8
Imminent	0	0	0	0	0	0	0
Total	0	107	170	66	20	1	364

Table 7. Summary of Inventoried Tree

Common Name	Scientific Name	Good	Fair	Poor	Very Poor	Dead	Total
Native Species							
American Basswood	Tilia americana			1			1
American Beech	*Fagus grandifolia*	1					1
Balsam Poplar	Populus balsamifera		6	2			8
Black Cherry	Prunus serotina			1			1
Black Maple	Acer saccharum ssp. nigrum	2					2
Black Walnut	Juglans nigra	1	1				2
Bur Oak	Quercus macrocarpa	3	5				8
Eastern Cottonwood	Populus deltoides	6	7				13
Eastern White Cedar	Thuja occidentalis	17	16	2			35
Eastern White Pine	Pinus strobus	1					1
Freeman's Maple	Acer X freemanii	4	2	1	1		8
Green Ash	Fraxinus pennsylvanica		2				2
Hawthorn species	Crataegus sp.		6				6
Manitoba Maple	Acer negundo	3	15	9	2	1	30
Red Oak	*Quercus rubra*	1					1
Silver Maple	Acer saccharinum	3	1				4
Slippery Elm	Ulmus rubra	2	1				3
Sugar Maple	*Acer saccharum ssp. saccharum*	1	4	1			6
White Ash	Fraxinus americana		5	6	9		20
White Birch	Betula papyrifera		1				1
White Elm	Ulmus americana	1	2				3
White Spruce	Picea glauca	28	17				45
Willow species	Salix sp.		5	2			7
Total		74	96	25	12	1	208
Non-Native Species							
Austrian Pine	Pinus nigra		1				1
Black Locust	Robinia pseudoacacia		1	6			7
Colorado Spruce	Picea pungens	13	1		1		15
Common Apple	Malus domestica	1			3		4
Common Lilac	Syringa vulgaris		2				2
Common Pear	Pyrus communis			1			1
Crack Willow	Salix fragilis	5	18	6			29
European Ash	Fraxinus excelsior	1					1
Flowering Crab Apple	Malus baccata		1	1			2
Norway Maple	Acer platanoides	6	1	1			8
Norway Spruce	Picea abies	3					3
Russian Olive	Elaeagnus angustifolia		1	1			2
Scots Pine	Pinus sylvestris	2	2				4
Siberian Elm	Ulmus pumila	1	42	25	4		72
Thornless Honey Locust	Gleditsia triacanthos var. inermis	1	1				2
White Willow	Salix alba		3				3
Total		33	74	41	8		156
Overall Total		107	170	66	20	1	364

Appendix VI
Bird Species Report from the Study Area

Appendix VI
Project Name/Location: County Road 124
Appendix Title: Bird Species Reported From the Study Area

Scientific Name	Common Name	SRANK[1]	SARO[2]	COSEWIC[3]	SARA Schedule[3]	Wellington County Status[4]	City of Guelph Status[5]	MNRF SAR for Wellington County[7]	OBBA[8]	NHIC Data[9]	NRSI Observed			
											All Observations	Breeding Bird Survey 1	Breeding Bird Survey 2	Incidentals
Branta canadensis	Canada Goose	S5							CO		CO	OB	CO	
Anas platyrhynchos	Mallard	S5							CO		CO	PR	CO	
Columba livia	Rock Pigeon	SNA							CO		PO		OB	
Zenaida macroura	Mourning Dove	S5							CO		PR	PO	PR	
Charadrius vociferus	Killdeer	S5B, S5N							CO		PR	PO	PO	
Ardea herodias	Great Blue Heron	S4B				**	X		CO		OB		OB	
Butorides virescens	Green Heron	S4B				**	X		PR		OB		OB	
Cathartes aura	Turkey Vulture	S5B				√			PR		OB	OB		
Picoides pubescens	Downy Woodpecker	S5							CO		CO		CO	
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC		√	X		PR	X	PO		PO	
Empidonax alnorum	Alder Flycatcher	S5B							PO		PO	PO		
Empidonax traillii	Willow Flycatcher	S5B				√	X		PR		PO		PO	
Sayornis phoebe	Eastern Phoebe	S5B							CO		PR	PO	PO	
Myiarchus crinitus	Great Crested Flycatcher	S4B							CO		PO		PO	
Tyrannus tyrannus	Eastern Kingbird	S4B				√*	X		CO		CO	PO	PO	CO
Vireo gilvis	Warbling Vireo	S5B							CO		PR	PO	PO	
Vireo olivaceus	Red-eyed Vireo	S5B							CO		PR	PO	PO	
Cyanocitta cristata	Blue Jay	S5							CO		PR	PR	PO	
Corvus brachyrhynchos	American Crow	S5B							CO		PR	PO	PO	
Tachycineta bicolor	Tree Swallow	S4B							CO		PO	PO		
Stelgidopteryx serripennis	Northern Rough-winged Swallow	S4B							CO		PO		OB	
Hirundo rustica	Barn Swallow	S4B	THR	T				X	CO	X	PR		PR	
Poecile atricapillus	Black-capped Chickadee	S5							CO		PR	PO	PO	
Sitta carolinensis	White-breasted Nuthatch	S5							CO		PO	OB		
Troglodytes aedon	House Wren	S5B							CO		PR	PO	PO	
Turdus migratorius	American Robin	S5B							CO		CO	PR	CO	X
Dumetella carolinensis	Gray Catbird	S4B							CO		PR	PO	PO	
Sturnus vulgaris	European Starling	SNA							CO		CO	PO	CO	
Bombycilla cedrorum	Cedar Waxwing	S5B							CO		PR	PO	PO	
Passer domesticus	House Sparrow	SNA							CO		PR	PO	PO	
Spinus tristis	American Goldfinch	S5B							CO		PR	PR	PR	
Geothylpis trichas	Common Yellowthroat	S5B							CO		PR	PO	PO	
Setophaga petechia	Yellow Warbler	S5B							CO		PR	PO	PO	
Spizella passerina	Chipping Sparrow	S5B							CO		PO	PO		
Pooecetes gramineus	Vesper Sparrow	S4B				√*	X		PR		PO	PO		
Passerculus sandwichensis	Savannah Sparrow	S4B				√*	X		CO		PR	PO	PO	
Melospiza melodia	Song Sparrow	S5B							CO		PR	PO	PO	
Cardinalis cardinalis	Northern Cardinal	S5							CO		PR	PO	PO	X
Passerina cyanea	Indigo Bunting	S4B							CO		PR	PO	PO	
Agelaius phoeniceus	Red-winged Blackbird	S4							CO		CO	PR	PR	CO
Quiscalus quiscula	Common Grackle	S5B							CO		PR	PO	PR	
Molothrus ater	Brown-headed Cowbird	S4B							CO		PR	PR	PR	
Icterus galbula	Baltimore Oriole	S4B				√*	X		CO		CO	PO	CO	
								Total	**43**	**2**	**43**	**34**	**37**	**4**

1MNRF 2015a; 2MNRF 2017; 3Government of Canada 2018; 4Dougan & Associates 2009; 5City of Guelph 2012; 6MNRF 2016; 7 MNRF 2018; 8BSC et al. 2008; 9MNRF 2014

Appendix #
Project Name/Location: County Road 124
Appendix Title: Bird Species Reported From the Study Area

LEGEND
SRANK
S1 Critically Imperiled
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SU Unrankable
SNA Unranked
SX Presumed Extirpated
SH Possibly Extirpated (Historical)
S#? Rank Uncertain
COSSARO
END Endangered
THR Threatened
SC Special Concern
NAR Not at Risk
DD Data Deficient
EXP Extirpated
COSEWIC
E Endangered
T Threatened
SC Special Concern
NAR Not at Risk
DD Data Deficient
XT Extirpated
SARA Schedule
Schedule 1 Officially Protected under SARA
Wellington County
√ Significant and rare
√* Significant but not rare
** Only habitats that support/recently supported active nests considered signficant
City of Guelph
X Significant
Breeding Evidence Codes
OB Observed
PO Possible
PR Probable
CO Confirmed

Appendix VII
Herpetofauna Species Reported from the Study Area

Appendix VII
Project Name/Location: County Road 124
Appendix Title: Reptile and Amphibian Species Reported From the Study Area

Scientific Name	Common Name	SRANK[1]	SARO[2]	COSEWIC[3]	SARA Schedule[3]	Wellington County Status[4]	City of Guelph Status[5]	MNRF SAR for Wellington County[6]	Ontario Reptile and Amphibian Atlas[7]	NHIC Data[8]	NRSI Observed
Chelydra serpentina serpentina	Snapping Turtle	S3	SC	SC	Schedule 1	R		X	X		
Chrysemys picta marginata	Midland Painted Turtle	S5				X			X		
Lampropeltis taylori triangulum	Eastern Milksnake	S4	NAR	SC		R			X		
Storeria dekayi dekayi	Northern Brownsnake	S5	NAR	NAR		R	X		X		
Storeria occipitomaculata occipitomaculata	Northern Red-bellied Snake	S5				R	X		X		
Thamnophis sauritus septentrionalis	Eastern Ribbonsnake	S3	SC	SC	Schedule 1	R		X	X	X	
Thamnophis sirtalis sirtalis	Eastern Gartersnake	S5				X			X		X
Ambystoma hybrid pop. 3	Jefferson/Blue-spotted Salamander Complex	S2				R			X		
Ambystoma laterale	Blue-spotted Salamander	S4				R	X		X		
Notophthalmus viridescens viridescens	Red-spotted Newt	S5				R	X		X		
Plethodon cinereus	Eastern Red-backed Salamander	S5				X			X		
Anaxyrus americanus	American Toad	S5				X			X		X
Hyla versicolor	Tetraploid Gray Treefrog	S5				X			X		X
Pseudacris triseriata pop. 2	Western Chorus Frog *(Great Lakes/St. Lawrence - Canadian Shield Population)*	S3	NAR	T	Schedule 1	R			X		
Pseudacris crucifer	Spring Peeper	S5				X			X		X
Lithobates catesbeiana	American Bullfrog	S4				R	X		X		
Lithobates clamitans melanota	Northern Green Frog	S5				X			X		X
Lithobates palustris	Pickerel Frog	S4	NAR	NAR		R	X		X		
Lithobates pipiens	Northern Leopard Frog	S5	NAR	NAR		X			X		
Lithobates sylvatica	Wood Frog	S5				X			X		
								Total	**20**	**1**	**5**

[1]MNRF 2015a; [2]MNRF 2017; [3]Government of Canada 2017; [4]Dougan & Associates 2009; [5]City of Guelph 2012; [6]MNRF 2018; [7]Ontario Nature 2013; [8]MNRF 2014

Legend
SRANK
S1 Critically Imperiled
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SU Unrankable
SNA Unranked
SX Presumed Extirpated
SH Possibly Extirpated (Historical)
S#? Rank Uncertain
COSSARO
END Endangered
THR Threatened
SC Special Concern
NAR Not at Risk
DD Data Deficient
EXP Extirpated
COSEWIC
E Endangered
T Threatened
SC Special Concern
NAR Not at Risk
DD Data Deficient
XT Extirpated
SARA Schedule
Schedule 1 Officially Protected under SARA
Wellington County Status
X Significant
R
City of Guelph County Status
X Significant

Appendix VIII
Mammal Species Reported from the Study Area

Appendix VIII
Project Name/Location: County Road 124
Appendix Title: Mammal Species Reported From the Study Area

Scientific Name	Common Name	SRANK[1]	SARO[2]	COSEWIC[3]	SARA Schedule[3]	Wellington County Status[4]	City of Guelph Status[5]	MNRF SAR for Wellington County[6]	Ontario Mammal Atlas[7]	NHIC Data[8]	NRSI Observed
Didelphis virginiana	Virginia Opossum	S4				X			X		
Blarina brevicauda	Northern Short-tailed Shrew	S5				X			X		
Condylura cristata	Star-nosed Mole	S5				X			X		
Parascalops breweri	Hairy-tailed Mole	S4				R	X		X		
Sorex cinereus	Masked Shrew	S5				X			X		
Sorex fumeus	Smoky Shrew	S5				X			X		
Sorex palustris	Water Shrew	S5				R	X		X		
Eptesicus fuscus	Big Brown Bat	S4				X			X		
Lasionycteris noctivagans	Silver-haired Bat	S4				X			X		
Lasiurus borealis	Eastern Red Bat	S4				X			X		
Lasiurus cinereus	Hoary Bat	S4				X			X		
Myotis leibii	Eastern Small-footed Myotis	S2S3	END			R		X	X		
Myotis lucifugus	Little Brown Myotis	S4	END	E	Schedule 1	X		X	X		
Myotis septentrionalis	Northern Myotis	S3	END	E	Schedule 1	R		X	X		
Perimyotis subflavus	Tri-colored Bat	S3?	END	E	Schedule 1	R		X	X		
Lepus americanus	Snowshoe Hare	S5				R	X		X		
Lepus europaeus	European Hare	SNA				X			X		
Sylvilagus floridanus	Eastern Cottontail	S5				X			X		X
Castor canadensis	Beaver	S5				X			X		
Erethizon dorsatum	Porcupine	S5				X			X		
Glaucomys sabrinus	Northern Flying Squirrel	S5				R	X		X		
Glaucomys volans	Southern Flying Squirrel	S4	NAR	NAR		R	X		X		
Marmota monax	Woodchuck	S5				X			X		
Microtus pennsylvanicus	Meadow Vole	S5				X			X		
Microtus pinetorum	Woodland Vole	S3?	SC	SC	Schedule 1	R			X		
Mus musculus	House Mouse	SNA				X			X		
Napaeozapus insignis	Woodland Jumping Mouse	S5				R	X		X		
Ondatra zibethicus	Muskrat	S5				X			X		
Peromyscus leucopus	White-footed Mouse	S5				X			X		
Peromyscus maniculatus	Deer Mouse	S5				X			X		
Rattus norvegicus	Norway Rat	SNA				X			X		
Sciurus carolinensis	Eastern Gray Squirrel	S5				X			X		X
Synaptomys cooperi	Southern Bog Lemming	S4				R	X		X		
Tamiasciurus hudsonicus	Red Squirrel	S5				X			X		
Tamias striatus	Eastern Chipmunk	S5				X			X		X
Zapus hudsonius	Meadow Jumping Mouse	S5				X			X		
Canis latrans	Coyote	S5				X			X		
Mephitis mephitis	Striped Skunk	S5				X			X		
Mustela erminea	Ermine	S5				X			X		

Scientific Name	Common Name	SRANK[1]	SARO[2]	COSEWIC[3]	SARA Schedule[3]	Wellington County Status[4]	City of Guelph Status[5]	MNRF SAR for Wellington County[6]	Ontario Mammal Atlas[7]	NHIC Data[8]	NRSI Observed
Mustela frenata	Long-tailed Weasel	S4				R	X		X		
Mustela vison	American Mink	S4				X			X		
Procyon lotor	Northern Raccoon	S5				X			X		
Taxidea taxus taxus	American Badger			SC					X		
Vulpes vulpes	Red Fox	S5				X			X		
Odocoileus virginianus	White-tailed Deer	S5				X			X		X
					Total	**45**	**9**	**5**	**46**	**1**	**5**

[1]MNRF 2015a; [2]MNRF 2017; [3]Government of Canada 2017; [4]Dougan & Associates 2009; [5]City of Guelph 2012; [6]MNRF 2018; [7]Dobbyn 1994, [8]MNRF 2014

Legend
SRANK
S1 Critically Imperiled
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SU Unrankable
SNA Unranked
SX Presumed Extirpated
SH Possibly Extirpated (Historical)
S#? Rank Uncertain
COSSARO
NAR Not at Risk
SC Special Concern
THR Threatened
END Endangered
EXP Extirpated
DD Data Deficient
COSEWIC
NAR Not at Risk
SC Special Concern
T Threatened
E Endangered
XT Extirpated
DD Data Deficient
SARA Schedule
Schedule 1 Officially Protected under SARA
Wellington County (Natural Heritage Strategy)
X Present
R Rare
City of Guelph Status
X Locally Significant

Appendix IX
Lepidoptera Species Reported from the Study Area

Appendix IX
Project Name/Location: County Road 124
Appendix Title: Butterfly Species Reported From the Study Area

Scientific Name	Common Name	SRANK[1]	SARO[2]	COSEWIC[3]	SARA Schedule[3]	Wellington County Status[4]	City of Guelph Status[5]	TEA Atlas[6]	NHIC Data[7]	NRSI Observed
Battus philenor	Pipevine Swallowtail	SNA						X		
Papilio cresphontes	Giant Swallowtail	S4				X		X		
Papilio glaucus	Eastern Tiger Swallowtail	S5						X		
Papilio polyxenes	Black Swallowtail	S5						X		
Pieris rapae	Cabbage White	SNA						X		
Lycaena hyllus	Bronze Copper	S5						X		
Aglais milberti	Milbert's Tortoiseshell	S5						X		
Coenonympha tullia	Common Ringlet	S5						X		
Danaus plexippus	Monarch	S2N, S4B	SC	SC	Schedule 1	X*		X		X
Euptoieta claudia	Variegated Fritillary	SNA						X		
Junonia coenia	Common Buckeye	SNA						X		
Limenitis archippus	Viceroy	S5						X		
Limenitis arthemis astyanax	Red-spotted Purple	S5						X		
Nymphalis antiopa	Mourning Cloak	S5						X		
Polygonia comma	Eastern Comma	S5						X		
Polygonia comma	Eastern Comma/Hop Merchant	S5						X		
Vanessa atalanta	Red Admiral	S5						X		
Vanessa cardui	Painted Lady	S5						X		
					Total	**22**	**6**	**18**	**0**	**1**

[1]MNRF 2015a; [2]MNRF 2017; [3]Government of Canada 2017;[4]Dougan & Associates 2009; [5]City of Guelph 2012; [6]MacNaughton et al. 2017; [7]MNRF 2014

Appendix #
Project Name/Location: County Road 124
Appendix Title: Butterfly Species Reported From the Study Area

LEGEND
SRANK
S1 Critically Imperiled
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SU Unrankable
SNA Unranked
SX Presumed Extirpated
SH Possibly Extirpated (Historical)
S#? Rank Uncertain
COSSARO
NAR Not at Risk
SC Special Concern
THR Threatened
END Endangered
EXP Extirpated
DD Data Deficient
COSEWIC
NAR Not at Risk
SC Special Concern
T Threatened
E Endangered
XT Extirpated
DD Data Deficient
SARA Schedule
Schedule 1 Officially Protected under SARA
Wellington County Status
X Rare
X* Significant only within City of Guelph
City of Guelph Status
X Significant

Appendix X
Odonata Species Reported from the Study Area

Appendix X
Project Name/Location: County Road 124
Appendix Title: Dragonfly and Damselfly Species Reported From the Study Area

Scientific Name	Common Name	SRANK[1]	SARO[2]	COSEWIC[3]	SARA Schedule[4]	Wellington County Status[7]	City of Guelph Status[8]	Odonate Atlas[10]	NRSI Observed
Calopteryx aequabilis	River Jewelwing	S5						X	
Calopteryx maculata	Ebony Jewelwing	S5						X	
Hetaerina americana	American Rubyspot	S4						X	
Lestes disjunctus	Common Spreadwing	S5						X	
Lestes dryas	Emerald Spreadwing	S5						X	
Lestes eurinus	Amber-winged Spreadwing	S3				PR		X	
Lestes rectangularis	Slender Spreadwing	S5						X	
Lestes unguiculatus	Lyre-tipped Spreadwing	S5						X	
Argia fumipennis violacea	Violet Dancer	S5						X	
Argia moesta	Powdered Dancer	S5						X	
Enallagma antennatum	Rainbow Bluet	S4						X	
Enallagma boreale	Boreal Bluet	S5						X	
Enallagma carunculatum	Tule Bluet	S5						X	
Enallagma civile	Familiar Bluet	S5						X	
Enallagma ebrium	Marsh Bluet	S5						X	
Enallagma exsulans	Stream Bluet	S5						X	
Enallagma geminatum	Skimming Bluet	S4				PR		X	
Enallagma signatum	Orange Bluet	S4						X	
Ischnura verticalis	Eastern Forktail	S5						X	
Anax junius	Common Green Darner	S5						X	
Celithemis elisa	Calico Pennant	S5						X	
Erythemis simplicicollis	Eastern Pondhawk	S5						X	
Ladona julia	Chalk-fronted Corporal	S5				X	X	X	
Leucorrhinia intacta	Dot-tailed Whiteface	S5						X	
Leucorrhinia proxima	Red-waisted (Belted) Whiteface	S5				X	X	X	
Libellula luctuosa	Widow Skimmer	S5						X	
Libellula pulchella	Twelve-spotted Skimmer	S5						X	
Pachydiplax longipennis	Blue Dasher	S5						X	
Perithemis tenera	Eastern Amberwing	S4				X	X	X	
Plathemis lydia	Common Whitetail	S5						X	
Sympetrum obtrusum	White-faced Meadowhawk	S5						X	
Tramea lacerata	Black Saddlebags	S4						X	

Total	**5**	**3**	**32**	**0**

[1]MNRF 2014; [2]MNRF 2016; [3]COSEWIC 2016; [4]Government of Canada 2016; [5]Regional Municipality of Waterloo 1985; [6]Conservation Halton 2007; [7]Dougan & Associates 2009;8City of Guelph 2012; 9Hamilton Conservation Authority 2014; 10OMNR 2005

LEGEND
SRANK
S1 Critically Imperiled
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SU Unrankable
SNA Unranked
SX Presumed Extirpated
SH Possibly Extirpated (Historical)
S#? Rank Uncertain
Wellington County Status
X Significant
City of Guelph Status
X Significant

Appendix XI
Fish Species Reported from the Study Area

Appendix XI

Project Name/Location: County Road 124

Appendix Title: Fish Species Reported from the Study Area

Scientific Name	Common Name	SRANK[1]	SARO[2]	COSEWIC[3]	SARA Schedule[4]	NHIC Data[#]	NRSI Observed	Ellis Creek	Tributary A
Rhinichthys atratulus	Blacknose Dace	SNR					X	X	
Semotilus atromaculatus	Creek Chub	S5					X	X	
Salvelinus fontinalis	Brook (Speckled) Trout	S5					X	X	
						Total	**3**	**3**	**0**

[1]MNRF 2014; [2]MNRF 2016; [3]COSEWIC 2016; [4]Government of Canada 2016; #Hamilton Conservation Authority 2014

Legend
SRANK
S1 Critically Imperiled
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SU Unrankable
SNA Unranked
SX Presumed Extirpated
SH Possibly Extirpated (Historical)
S#? Rank Uncertain

APPENDIX B

Stage 1 Archaeological Assessment

APPENDIX B1

Stage 1 Archaeological Assessment (Archaeological Research Associates Ltd, February 2019)

ARCHAEOLOGY | HERITAGE | OUTREACH | EDUCATION

Stage 1 Archaeological Assessment
Wellington Road 124 Improvements
Township Road 1 to Fife Road
Municipal Class Environmental Assessment
Township of Guelph/Eramosa
Part of Multiple Lots and Concessions
Geographic Township of Guelph
Wellington County, Ontario

Prepared for
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PIF #P007-0916-2018
ARA File #2018-0096

13/02/2019

Original Report

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EXECUTIVE SUMMARY

Under a contract awarded in April 2018, Archaeological Research Associates Ltd. carried out a Stage 1 assessment of lands with the potential to be impacted by the proposed Wellington Road 124 Improvements Project in the Township of Guelph/Eramosa, Wellington County, Ontario. The assessment was completed as a component of a 'Schedule C' Municipal Class Environmental Assessment. This report documents the background research and potential modelling involved in the assessment, and presents conclusions and recommendations pertaining to archaeological concerns within the study area.

The Stage 1 assessment was conducted in April 2018 under Project Information Form #P007-0916-2018. The investigation encompassed the entirety of the project lands and additional adjacent lands. Specifically, the study area comprised approximately 5.73 km along Wellington Road 124 within the existing road allowance between Township Road 1 and Fife Road, a 5 m buffer beyond the existing road allowance, and a 9.31 ha parcel of land south of Wellington Road 124, between the two Wellington Road 32 intersections, to allow for design alternatives of two new roundabouts All field observations were made from accessible public areas; accordingly, no permissions were required for property access. At the time of assessment, the study area comprised the roadway platform, shoulders and ditches associated with Wellington Road 124, intersecting driveways and roadways as well as adjacent manicured lawns, agricultural fields and developed lands.

The Stage 1 assessment determined that the study area comprised a mixture of areas of archaeological potential, areas of no archaeological potential and previously assessed lands of no further archaeological concern. Archaeological Research Associates Ltd. recommends that the identified areas of archaeological potential be subject to a Stage 2 property assessment in accordance with Section 2.1 of the *Standards and Guidelines for Consultant Archaeologists* (MTC 2011:28–39).

The identified areas of no archaeological potential and the specified previously assessed lands do not require further archaeological assessment. Given that there are still archaeological concerns within the subject lands, no ground alterations or development of any kind may occur within the property until the Stage 2 assessment is complete and a recommendation that the lands require no further archaeological assessment is made.

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GLOSSARY OF ABBREVIATIONS

AMICK – AMICK Consultants Limited
ARA – Archaeological Research Associates Ltd.
MTC – (Former) Ministry of Tourism and Culture
MTCS – Ministry of Tourism, Culture and Sport
PIF – Project Information Form
PTP – Positive Test Pit
ROW – Right-of-Way
S&Gs – Standards and Guidelines for Consultant Archaeologists

PERSONNEL

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1.0 PROJECT CONTEXT

1.1 Development Context

Under a contract awarded in April 2018, ARA carried out a Stage 1 assessment under of lands with the potential to be impacted by the proposed Wellington Road 124 Improvements Project in the Township of Guelph/Eramosa, Wellington County, Ontario. The assessment was completed as a component of a 'Schedule C' Municipal Class Environmental Assessment. This report documents the background research and potential modelling involved in the assessment, and presents conclusions and recommendations pertaining to archaeological concerns within the study area.

The subject study area consists of an irregularly-shaped parcel of land with a total area of 30.99 ha (Map 1). This parcel is comprised predominantly of extant Wellington Road 124 ROW, being bounded on the northwest and southeast by a mixture of agricultural fields and residential, commercial and industrial developments. The Goderich-Exeter Railway (former Galt & Guelph Railway/Great Western Railway) runs largely parallel to the study area, initially along the southeast before crossing Wellington Road 124 at the intersection of the roadway with the northwest boundary of Lot 13, Division B South of Waterloo Road, where it then proceeds to run parallel to Wellington Road 124 along the northwest. In legal terms, the study area comprises parts of Lots 2, Concession 1–4 Division B, Lots A–G, Division E and Lots 1–16, Division B South of Waterloo Road in the Geographic Township of Guelph, Wellington County.

The Stage 1 assessment was conducted in May 2018 under PIF #P007-0916-2018. The investigation encompassed the entirety of the project lands and additional adjacent lands. Specifically, the study area comprised approximately 5.73 km along Wellington Road 124 within the existing ROW between Township Road 1 and Fife Road, a 5 m buffer beyond the existing road allowance, and a 9.31 ha parcel of land south of Wellington Road 124, between the two Wellington Road 32 intersections, to allow for design alternatives of two new roundabouts. All field observations were made from accessible public areas; accordingly, no permissions were required for property access. In compliance with the objectives set out in Section 1.0 of the *S&Gs* (MTC 2011:13–23), this investigation was carried out in order to:

- Provide information concerning the geography, history and current land condition of the study area;
- Determine the presence of known archaeological sites in the study area;
- Present strategies to mitigate project impacts to such sites, if they are located;
- Evaluate in detail the archaeological potential of the study area; and
- Recommend appropriate strategies for Stage 2 archaeological assessment, if some or all of the study area has archaeological potential.

The MTCS is asked to review the results and recommendations presented in this report and express their satisfaction with the fieldwork and reporting through a *Letter of Review and Entry into the Ontario Public Register of Archaeological Reports*.

1.2 Historical Context

After a century of archaeological work in southern Ontario, scholarly understanding of the historic usage of the area has become very well-developed. With occupation beginning in the Palaeo-Indian period approximately 11,000 years ago, the greater vicinity of the study area comprises a complex chronology of Indigenous and Euro-Canadian histories. Section 1.2.1 summarizes the region's settlement history, whereas Section 1.2.2 documents the study area's past and present land uses. Multiple previous archaeological reports containing relevant background information were obtained during the research component of the study. These reports are summarized in Section 1.3.3, and the references (including title, author and PIF number) appear in Section 7.0.

1.2.1 Settlement History

1.2.1.1 Pre-Contact

The Pre-Contact history of the region is lengthy and rich, and a variety of Indigenous groups inhabited the landscape. Archaeologists generally divide this vibrant history into three main periods: Palaeo-Indian, Archaic and Woodland. Each of these periods comprise a range of discrete sub-periods characterized by identifiable trends in material culture and settlement patterns, which are used to interpret past lifeways. The principal characteristics of these sub-periods are summarized in Table 1.

Table 1: Pre-Contact Settlement History
(Wright 1972; Ellis and Ferris 1990; Warrick 2000; Munson and Jamieson 2013)

Sub-Period	Timeframe	Characteristics
Early Palaeo-Indian	9000–8400 BC	Gainey, Barnes and Crowfield traditions; Small bands; Mobile hunters and gatherers; Utilization of seasonal resources and large territories; Fluted projectiles
Late Palaeo-Indian	8400–7500 BC	Holcombe, Hi-Lo and Lanceolate biface traditions; Continuing mobility; Campsite/Way-Station sites; Smaller territories are utilized; Non-fluted projectiles
Early Archaic	7500–6000 BC	Side-notched, Corner-notched (Nettling, Thebes) and Bifurcate traditions; Growing diversity of stone tool types; Heavy woodworking tools appear (e.g., ground stone axes and chisels)
Middle Archaic	6000–2500 BC	Stemmed (Kirk, Stanly/Neville), Brewerton side- and corner-notched traditions; Reliance on local resources; Populations increasing; More ritual activities; Fully ground and polished tools; Net-sinkers common; Earliest copper tools
Late Archaic	2500–900 BC	Narrow Point (Lamoka), Broad Point (Genesee) and Small Point (Crawford Knoll) traditions; Less mobility; Use of fish-weirs; True cemeteries appear; Stone pipes emerge; Long-distance trade (marine shells and galena)
Early Woodland	900–400 BC	Meadowood tradition; Crude cord-roughened ceramics emerge; Meadowood cache blades and side-notched points; Bands of up to 35 people
Middle Woodland	400 BC–AD 600	Saugeen tradition; Stamped ceramics appear; Saugeen projectile points; Cobble spall scrapers; Seasonal settlements and resource utilization; Post holes, hearths, middens, cemeteries and rectangular structures identified
Middle/Late Woodland Transition	AD 600–900	Princess Point tradition; Cord roughening, impressed lines and punctate designs on pottery; Adoption of maize horticulture at the western end of Lake Ontario; Oval houses and 'incipient' longhouses; First palisades; Villages with 75 people
Late Woodland (Early Iroquoian)	AD 900–1300	Glen Meyer tradition; Settled village-life based on agriculture; Small villages (0.4 ha) with 75–200 people and 4–5 longhouses; Semi-permanent settlements
Late Woodland (Middle Iroquoian)	AD 1300–1400	Uren and Middleport traditions; Classic longhouses emerge; Larger villages (1.2 ha) with up to 600 people; More permanent settlements (30 years)

Sub-Period	Timeframe	Characteristics
Late Woodland (Late Iroquoian)	AD 1400–1600	Pre-Contact Neutral tradition; Larger villages (1.7 ha); Examples up to 5 ha with 2,500 people; Extensive croplands; Also hamlets, cabins, camps and cemeteries; Potential tribal units; Fur trade begins ca. 1580; European trade goods appear

1.2.1.2 Post-Contact

The arrival of European explorers and traders at the beginning of the 17th century triggered widespread shifts in Indigenous lifeways and set the stage for the ensuing Euro-Canadian settlement process. Documentation for this period is abundant, ranging from the first sketches of Upper Canada and the written accounts of early explorers to detailed township maps and lengthy histories. The Post-Contact period can be effectively discussed in terms of major historical events, and the principal characteristics associated with these events are summarized in Table 2.

Table 2: Post-Contact Settlement History
(Smith 1846; Coyne 1895; Lajeunesse 1960; Cumming 1972; Ellis and Ferris 1990; Surtees 1994; AO 2015)

Historical Event	Timeframe	Characteristics
Early Contact	Early 17th century	Brûlé explores southern Ontario in 1610; Champlain travels through in 1613 and 1615/1616, encountering a variety of Indigenous groups (including both Iroquoian-speakers and Algonkian-speakers); European goods begin to replace traditional tools
	Mid- to late 17th century	Conflicts between various First Nations during the Beaver Wars result in numerous population shifts; European explorers continue to document the area, and many Indigenous groups trade directly with the French and English; 'The Great Peace of Montreal' treaty established between roughly 39 different First Nations and New France in 1701
Fur Trade Development	Early to mid-18th century	Growth and spread of the fur trade; Peace between the French and English with the Treaty of Utrecht in 1713; Ethnogenesis of the Métis; Hostilities between French and British lead to the Seven Years' War in 1754; French surrender in 1760
British Control	Mid-18th century	*Royal Proclamation* of 1763 recognizes the title of the First Nations to the land; Numerous treaties arranged by the Crown; First acquisition is the Seneca surrender of the west side of the Niagara River in August 1764
Loyalist Influx	Late 18th century	United Empire Loyalist influx after the American Revolutionary War (1775–1783); British develop interior communication routes and acquire additional lands; 'Between the Lakes Purchase' orchestrated by Haldimand in 1784 to obtain lands for Six Nations; *Constitutional Act* of 1791 creates Upper and Lower Canada
County Development	Late 18th to early 19th century	Became part of York County's 'West Riding' in 1792; Additional lands acquired in the second 'Between the Lakes Purchase' in 1792; Additional lands obtained in the 'Lake Simcoe-Nottawasaga Purchase' and 'Ajetance Purchase' in 1818, the 'Huron Tract Purchase' in 1827 and the 'Bond Head-Saugeen Treaty' in 1836; Wellington District and Waterloo County created in 1840; Wellington County created after the abolition of the district system in 1849
Township Formation	Early 19th century	Guelph was initially patented in a block to the 'Canada Company' in 1829; The first settlers arrived prior to the patent date, and included the Rifes, Hinds and Ryans in 1825 and a group of Scottish settlers in 1827; The 'Broad Road' (Waterloo Road) was begun by Absalom Shade in 1825 and was completed by the founding of Guelph in 1827; The township was fully surveyed by John McDonald in 1830 and comprised Divisions A–G; Many additional settlers arrived between 1829 and 1832

Historical Event	Timeframe	Characteristics
Township Development	Mid-19th to early 20th century	Guelph was one of the best settled townships in Ontario, with a population of 3,400 in 1845; The majority of settlers came from well-established and wealthy English families in Suffolk and Norfolk; 9,904 ha taken up by 1846, with 5,196 ha under cultivation; 3 grist mills and 2 saw mills in operation at that time; Traversed by the Grand Trunk Railway (1856), the Galt & Guelph Railway (1857), the Wellington, Grey & Bruce Railway (1870) and the Guelph Junction Railway (1888); The principal community was the Town/City of Guelph

1.2.2 Past and Present Land Use

During Pre-Contact and Early Contact times, the vicinity of the study area would have comprised a mixture of coniferous trees, deciduous trees and open areas. Indigenous communities would have managed the landscape to some degree. During the early 19th century, Euro-Canadian settlers arrived in the area and began to clear the forests for agricultural and settlement purposes. The vicinity of the study area was well-settled for the remainder of the Euro-Canadian period, being located southwest of the historic community of Guelph. Registries of the era identified the area of Guelph as a bustling settlement with substantial surrounding agricultural properties and development (Armstrong & Delion 1879)

In order to gain a general understanding of the study area's past land uses, two illustrated maps, two topographic maps and one aerial image were examined during the research component of the study. Specifically, the following resources were consulted:

- G. Leslie and C.J. Wheelock's *Map of the County of Wellington, Canada West* (1861) (OHCMP 2018);
- Walker & Miles' *Topographical and Historical Atlas of the County of Wellington, Ontario* (1877) (McGill University 2001);
- Topographic Maps from 1916 and 1935 (OCUL 2018); and
- An aerial image from 1954 (University of Toronto 2018).

The limits of the study area are shown on georeferenced versions of the consulted resources in Map 2–Map 6. The subject lands are focused along modern Wellington Road 124, a roadway corridor that has been in use since at least the mid-19th century and adjacent to which a variety of properties developed. The area was relatively densely occupied by the late 19th century, with a total of 22 farmsteads in proximity to the historically-surveyed road. An overview summary of land occupancy and associated structural features for the subject lands is provided in Table 3

Table 3: Occupational History and Past Land Uses

Lot	Concession and/or Division	Mid-19th Century Land Use	Late 19th Century Land Use	Mid-20th Century Land Use
16	Div. B, South of Waterloo Rd.	Part of Late Samuel Rife property; no structures indicated, Galt-Guelph Railway track bisects south part of lot	Part of Samuel Rife property; a structure is indicated on the NNW of the lot, Galt-Guelph Railway track bisects south part of lot	Part of Wellington Road 124 and an agricultural field on the southeast

Lot	Concession and/or Division	Mid-19th Century Land Use	Late 19th Century Land Use	Mid-20th Century Land Use
2	Con. 4, Div. B	Part of Joshua Diller and Edward Vance properties, the latter being bisected by the Galt-Guelph Railway line; a creek bisects both properties, no structures indicated	Part of J. McIntosh, and D. McIntosh properties, no structures indicated; a creek bisects the lot NW-SE.	Part of Wellington Road 124; multiple agricultural fields along northwest; part of the Ellis Creek Complex Provincial Swamp and a tributary of the Speed River traverse the property
15	Div. B, South of Waterloo Rd	Part of Late Samuel Rife property; no structures indicated, Galt-Guelph Railway track bisects centre part of lot	Part of Samuel Rife property; no structures indicated, Galt-Guelph Railway track bisects centre part of lot.	Part of Wellington Road 124 and an agricultural field on the southeast.
14	Div. B, South of Waterloo Rd	Part of Late Samuel Rife property; no structures indicated, a creek bisects the lot NW-SE, Galt-Guelph Railway track bisects north part of lot	Part of Samuel Rife property; a structure is indicated in the middle of the lot, a creek bisects the lot NW-SE, Galt-Guelph Railway track bisects north part of lot	Part of Wellington Road 124, a residential area adjacent to the road, and an agricultural field on the southeast; part of the Ellis Creek Complex Provincial Swamp and a tributary of the Speed River traverse the property
13	Div. B, South of Waterloo Rd	Part of Late Samuel Rife property; no structures indicated, Galt-Guelph Railway track bisects north part of lot	Part of Samuel Rife property; no structures indicated, Galt-Guelph Railway track bisects north part of lot	Part of Wellington Road 124, a railway line bisects the area SW-NE, agricultural field
12	Div. B, South of Waterloo Rd	R. Hinds property, a creek bisects the southern part of the lot; no structures indicated	R.W. Hinds property, a creek bisects the southern part of the lot; a structure is indicated in the WNW	Part of Wellington Road 124 and an agricultural field on the southeast; part of a railway line bisects the area SW-NE
2	Con. 3, Div. B	Part of R. Hinds and Watt. Hinds properties both bisected by the Galt-Guelph Railway line; a creek bisects the R. Hind property; no structures indicated.	Part of R. Hinds property and W. Hinds estate; Galt-Guelph Railway track bisects this lot along SE	Part of multiple agricultural fields along northwest
11	Div. B, South of Waterloo Rd	Part of W. Hinds property; no structures indicated; a creek bisects the southern part of the lot	R.W. Hinds property, a creek bisects the southern part of the lot; a structure is indicated in the WNW.	Part of Wellington Road 124, several building establishments
10	Div. B, South of Waterloo Rd	Part of Thomas Green property; no structures indicated; a creek bisects the SE part of the lot	Part of Geo. Blatchford property; no structures indicated; a creek bisects the SE part of the lot.	Part of Wellington Road 124 and Wellington Road 32, part of a treed and partially cultivated lot
9	Div. B, South of Waterloo Rd	Part of Thomas Green property; no structures indicated; a creek bisects the southern part of the lot	Part of Walter Sorby property; a creek bisects the SE part of the lot; a structure is indicated in the WNW of the lot.	Part of Wellington Road 124, part of a treed lot and agricultural lands
8	Div. B, South of Waterloo Rd	Part of Thomas Best property; no structures indicated; a creek bisects the southern part of the lot	Part of Walter Sorby property; a creek bisects the SE part of the lot; a structure is indicated in the SSE of the lot	Part of Wellington Road 124 and agricultural lands
2	Con. 2, Div. B	Part of Thomas Best and Jas. Keough properties, both are bisected by the Galt-Guelph Railway line, the label for the Gourock Post Office is in the ENE part of Jas. Keough property; no structures indicated.	No occupants identified (non-subscribers); Galt-Guelph Railway track bisects this lot along SE; two structures are identified in SE adjacent to Gourock Rd.	Part of Wellington Road 124 and agricultural lands

Lot	Concession and/or Division	Mid-19th Century Land Use	Late 19th Century Land Use	Mid-20th Century Land Use
7	Div. B, South of Waterloo Rd	Part of Thomas Best property; no structures indicated.	Part of Walter Sorby property; no structures indicated	Part of Wellington Road 124, part of a treed lot and agricultural lands
6	Div. B, South of Waterloo Rd	Part of Thomas Best property; no structures indicated	Part of Walter Sorby property; a structure is indicated in the ENE of the lot	Part of Wellington Road 124, part of a treed lot and agricultural lands
5	Div. B, South of Waterloo Rd	Part of J. McWhort property; no structures indicated	Part of J. Cunningham (?) property; the Gourock Post Office is identified in the NNE of the lot, no other structures indicated.	Part of Wellington Road 124, part of a treed lot and agricultural lands
4	Div. B, South of Waterloo Rd	Part of Ch. Walker property; an inn is located at the NNE corner of the lot.	Part of J. Woodhouse property; no structures indicated	Part of Wellington Road 124, a treed lot with farmstead driveway and agricultural lands
2	Con. 1, Div. B	Part of J.M, P. McGarr and Geo. Snelling properties; the Galt-Guelph Railway line bisects all three properties; no structures indicated.	No occupants identified (non- subscribers) on several properties with G. Snelling property in east part; Galt-Guelph Railway track bisects this lot SE–NW; a structure is identified in the NE	Part of Wellington Road 124, a treed lot with several farmstead driveway and agricultural lands
3	Div. B, South of Waterloo Rd	Part of Mrs. McConnell property; no structures indicated	Part of J. Keough Jr. property; no structures indicated	Part of Wellington Road 124, a treed lot with farmstead driveway and agricultural lands
2	Div. B, South of Waterloo Rd	Part of A Farrell property; no structures indicated	Part of A. Farnall property; no structures indicated	Part of Wellington Road 124, a treed lot with farmstead driveway and agricultural lands
1	Div. B, South of Waterloo Rd	Part of M. Dooly property; no structures indicated	Part of M. Deely property; no structures indicated	Part of Wellington Road 124 and Whitelaw Road, a treed lot and agricultural lands
G	Div. E	Part of Ben Budgeon property; no structures indicated	Part of B. Bludgeon property; two structures are indicated in proximity, one on the WNW of the lot and another on the SSE of the lot	Part of Wellington Road 124 and Whitelaw Road, a treed lot and agricultural lands
A	Div. E	Part of G. Snelling property; the Galt-Guelph Railway line bisects the NW part of the property; no structures indicated	Part of S. Barber property; a structure is indicated in the SE of the lot; the Great Western Railway track bisects this lot.	Farmstead at corner of Wellington Road 124 and Whitelaw Road, a well treed lots
F	Div. E	Part of F.J. Shadwick property; no structures indicated	Part of F.J. Chadwick (Shadwick?) property; no structures indicated	Part of Wellington Road 124, a treed lot and agricultural lands with a structure in the southwest
B	Div. E	Part of F.J.C. (Chadwick?) property; no structures indicated	Part of F.J. Chadwick (Shadwick?) property; no structures indicated; the Great Western Railway track bisects this lot	Part of Wellington Road 124, a treed lot with farmstead driveway and agricultural land
E	Div. E	Part of A. Oliver property; no structures indicated	Part of F.J. Chadwick (Shadwick?) property; no structures indicated	Part of Wellington Road 124, a treed lot and agricultural
C	Div. E	Part of R. Jackson property; the Galt-Guelph Railway line bisects the NW part of the property; no structures indicated	Part of F.J. Chadwick (Shadwick?) property; no structures indicated; the Great Western Railway track bisects this lot	Part of Wellington Road 124, a treed lot with farmstead driveway and agricultural land
D	Div. E	Part of J. Howitt property; no structures indicated	Part of J. Howitt property, no structures indicated.	Part of Wellington Road 124 and agricultural land

Located within the subject lands was the historic Gourock post office and an inn, attesting to the desirability of this area for residents and individuals transiting through the region, namely between the settlements at Galt and Guelph. Armstrong & Delion (1879:119) note that the Gourock post office is on the Guelph and Galt stage coach road in the Township of Guelph, at a distance of five miles from Guelph with daily mail delivery. Thomas David Thomas was the Post Master, while James Keough was the keeper of the adjacent inn. The Gourock Post Office Store advertised a "large and well selected stock" selling dry goods, groceries, hardware and crockery, among other goods, as well as repairing sewing and other machinery. It was also noted that farm produce was taken in exchange for goods "at the highest rates" (Armstrong & Delion 1879:119). Such historical accounts provide strong confirmation of the vibrant residency of the subject lands with a mixture of urban and rural populations involved in multifold enterprises from provisioning of goods and services to industry and agriculture.

What is clear from the consideration of these historic resources is that the area around the modern subject lands, following closely along the course of Wellington Road 124, was well settled by the mid-19th century. The ample area for agricultural development, the presence of creeks and tributaries of the Speed River suitable for milling, several historically surveyed roads, as well as the Galt and Guelph Railway line, and superseding railways, would have made this area desirable for settlement. Such desirability is well evidence by the large number of structures, farms, an inn and post office identified on historic maps of the surrounding lands. Settlement of this area remained largely similar into the mid-20th century, with key enterprises remaining based in agriculture and industry (Map 4–Map 6). The main evident transition from the mid-19th to mid-20th century is the increased agglomeration of population into larger surrounding areas, in this case mainly Guelph, while the former inns and rural stores, such as the Post Office at Gourock, progressively transitioned towards increasingly agrarian environs, before once again becoming part of a larger urban settlement with the progressive expansion of the landscape footprint of Guelph in the second half of the 20th century. Land use at the time of assessment can be classified as a mixture of agricultural, industrial, commercial, and, to a comparatively lesser extent, residential areas.

1.3 Archaeological Context

The Stage 1 assessment was conducted on May 31, 2018 under PIF #P007-0916-2018. The limits of the study area were confirmed using georeferenced aerial imagery showing artificial and natural formations in relation to the project lands.

The archaeological context of any given study area must be informed by 1) the condition of the property as found (Section 1.3.1), 2) a summary of registered or known archaeological sites located within a minimum 1 km radius (Section 1.3.2) and 3) descriptions of previous archaeological fieldwork carried out within the limits of, or immediately adjacent to, the subject lands (Section 1.3.3).

1.3.1 Condition of the Property

The study area lies within the Great Lakes–St. Lawrence forest, which is a transitional zone between the southern deciduous forest and the northern boreal forest. This forest extends along the St. Lawrence River across central Ontario to Lake Huron and west of Lake Superior along

the border with Minnesota, and its southern portion extends into the more populated areas of Ontario. This forest is dominated by hardwoods, featuring species such as maple, oak, yellow birch, white and red pine. Coniferous trees such as white pine, red pine, hemlock and white cedar commonly mix with deciduous broad-leaved species, such as yellow birch, sugar and red maples, basswood and red oak (MNRF 2015).

Physiographically, the study area lies within the Guelph Drumlin Field, which is located northwest of the Paris Moraine and includes roughly 300 broad oval drumlins of various sizes. The drumlins themselves consist largely of loamy and calcareous till, and analyses have placed the average grain sizes in the neighbourhood of 50% sand, 35% silt and 15% clay. These drumlins are not closely grouped, and the intervening low ground supports mainly fluvial materials created by river action (Chapman and Putnam 1984:137–138).

The soils within the subject lands consist predominantly of Burford soil along the extent of Wellington Road 124. Minor contributions of Donnybrook are present extending across Wellington Road 124 at the intersection with Wellington Road 32, while Fox soil is present in the very southwestern extent of the subject lands in the area around Township 1 Road. An area of Guelph loam is present between two areas of Burford soil in the north east of the study lands, spanning from approximately Whitelaw Road to Fife Road along Wellington Road 124. There is also an area of stream course that traverses the study area in the southwest; stream course soil is represented in the subject lands by a part of the Ellis Creek Complex Provincial Swamp and a tributary of the Speed River which has been channelized underneath of Wellington Road 124. The specific characteristics of these soil types are summarized in Table 4 (Hoffman et al. 1963).

Table 4: Soil Types

Soil Type	Great Soil Group	Parent Materials	Drainage	Main Crops
Burford Loam	Grey-Brown Podzolic	Gravel	Good	Spring grains, winter wheat, mixed hay, pasture and silage corn, orchards
Donnybrook Sandy Loam	Grey-Brown Podzolic	Gravel	Good	Nonarable, mostly trees, grasses, and grazing land (rarely cultivated)
Fox Sandy Loam	Grey-Brown Podzolic	Medium sand	Good	Hay, pasture crops, winter wheat, oats, silage corn
Guelph loam	Grey-Brown Podzolic	Loam till	Good	Hay, mixed grains, oats, winter wheat, silage corn, turnips
Stream Course	Alluvial Deposits	Loam	Surface	Generally non-arable

In terms of local watersheds, the subject lands fall within the Lower Speed River drainage basin, which is under the jurisdiction of the Grand River Conservation Authority (GRCA 2018). Specifically, the study area is traversed by tributaries of the Speed River and the Ellis Creek Complex Provincial Swamp, and is located 12 m south of the Guelph Southwest Complex Swamp, 72 m north of the Speed River Wetland Complex Provincial Swamp and 272 m west of the Speed River.

At the time of assessment, the study area comprised the roadway platform, shoulders and ditches associated with Wellington Road 124, intersecting driveways and roadways as well as adjacent manicured lawns, agricultural fields and developed lands. Field conditions were ideal during the

assessment, with excellent ground surface visibility. No unusual physical features were encountered that affected the results of the Stage 1 assessment.

1.3.2 Registered or Known Archaeological Sites

The Ontario Archaeological Sites Database and the Ontario Public Register of Archaeological Reports were consulted to determine whether any registered or known archaeological resources occur within a 1 km radius of the study area. The available MTCS search facility returned a total of 27 registered archaeological sites within at least a 1 km radius (the facility returns sites in a rectangular area, rather than a radius, potentially resulting in returns located beyond the specified distance). Nine other previously identified sites (i.e., unregistered sites) were noted within a 1 km radius during the research component of the study. The sites are summarized in Table 5.

Table 5: Registered or Known Archaeological Sites

Borden Number	Site Name (Identifier)	Time Period	Affinity	Site Type	Distance from Study Area
AiHb-111	Cowbrough I	Pre-Contact	Indigenous	Unknown	> 300 m
N/A	Cowbrough II	Pre-Contact	Indigenous	Unknown	> 300 m
AiHb-113	Van Soelen	Pre-Contact	Indigenous	Unknown	> 300 m
N/A	(Isolated Find)	Early Archaic	Indigenous	Findspot	> 300 m
N/A	(Isolated Find)	Pre-Contact; Post-Contact	Indigenous; Euro-Canadian	Scatter	> 300 m
AiHb-287	Hanlon: Field J, Site 7	Palaeo-Indian, Late	Indigenous	Findspot	> 1 km
AiHb-288	Hanlon: Field E, Site 3	Archaic, Early	Indigenous	Findspot	> 1 km
AiHb-289	Hanlon: Field H, Site 4	Post-Contact	Euro-Canadian	Homestead	> 1 km
AiHb-293	-	Pre-Contact	Indigenous	Findspot	> 1 km
AiHb-331	Frasson Fields site	Archaic	Indigenous	Scatter	> 300 m
AiHb-332	Woodland Meadows site	Archaic	Indigenous	Scatter	> 300 m
AiHb-333	Davidson Drumhills site	Pre-Contact	Indigenous	Scatter	> 300 m
N/A	(Find #15)	Pre-Contact	Indigenous	Findspot	> 300 m
N/A	(Find #16)	Pre-Contact	Indigenous	Findspot	> 300 m
N/A	(Find #17)	Pre-Contact	Indigenous	Findspot	> 300 m
N/A	(Find #18)	Archaic	Indigenous	Findspot	> 300 m
AiHb-353	(Site 1)	Post-Contact	Euro-Canadian	Farmstead	50 m - 300 m
AjHb-31	Southcreek IV	Archaic, Late	Indigenous	Findspot	> 1 km
AjHb-32	Southcreek V	Archaic, Late	Indigenous	Findspot	> 1 km
AjHb-42	Mitchell Farm Site #1	Archaic, Middle	Indigenous	Hunting	> 1 km
AjHb-43	Mitchell Farm Site #6	Post-Contact	Euro-Canadian	Homestead	> 1 km
AjHb-44	Mitchell Farm 7	Post-Contact, Pre-Contact	Indigenous, Euro-Canadian	Unknown	> 1 km
AjHb-45	IF #9 (Mitchell Farm)	Archaic, Late	Indigenous	Findspot	> 1 km
AjHb-46	IF#10 (Mitchell Farm)	Archaic, Middle	Indigenous	Findspot	> 1 km
AjHb-47	Kortright	Woodland, Late	Indigenous, Iroquoian	Findspot	> 1 km
AjHb-48	Kortright 2	Post-Contact	Euro-Canadian	Homestead	> 1 km
AjHb-79	-	Post-Contact	Euro-Canadian	Homestead	> 1 km
AjHc-2	County Line	Archaic, Late, Woodland, Early	Indigenous	Camp/Campsite	> 1 km
AjHc-24	-	Archaic, Middle	N/A	Camp/Campsite	> 1 km
AjHc-25	-	Pre-Contact	N/A	Scatter	> 1 km
AjHc-26	-	Pre-Contact	N/A	Scatter	> 1 km
AjHc-28	-	Archaic, Middle	Indigenous	Findspot	> 1 km

Borden Number	Site Name (Identifier)	Time Period	Affinity	Site Type	Distance from Study Area
AjHc-29	-	Archaic, Late	Indigenous	Findspot	> 1 km
AjHc-30	-	Pre-Contact	N/A	Scatter	> 1 km
N/A	(Location 1)	Post-Contact	Euro-Canadian	Scatter	50 m - 300 m
N/A	(Location 2)	Post-Contact	Euro-Canadian	Scatter	50 m - 300 m

None of these archaeological sites are located within or immediately adjacent to the project lands; accordingly, they have no potential to traverse the study area. AiHb-353, Location 1 and Location 2 are located within 300 m of the study area, however, and must be considered as relevant features of archaeological potential. The remaining sites represent more distant archaeological resources.

1.3.3 Previous Archaeological Work

Reports documenting assessments conducted within the subject lands and assessments that resulted in the discovery of archaeological sites that could extend into the subject lands were sought during the research component of the study. In order to ensure that all relevant past work was identified, an investigation was launched to identify all reports involving assessments within 50 m of the study area. The investigation determined that there are five reports on record documenting previous archaeological fieldwork within the specified distance. Copies of the reports were obtained, and the previous results and recommendations are summarized below in fulfilment of the requirements set out in Section 7.5.8 Standards 4–5 of the *S&Gs* (MTC 2011:126). The reports are discussed in chronological order by project, and the limits of the previous assessments are shown in the report mapping.

1.3.3.1 Highway 24

In Summer 1993, an archaeological assessment was carried out for the preferred alignment of Highway 24 between Guelph Avenue in Cambridge and the Hanlon Expressway under Licence #93-65 (MTO 1996). The assessed corridor has a roughly southwest to northeast trajectory and traverses the subject lands along approximately the northern half of the portion of Wellington Road 124 that extends between Whitelaw Road and Fife Road (Map 8–Map 12). Background research determined that the corridor had archaeological potential, and the field survey resulted in the identification of five locations of archaeological materials: Cowbrough I (AiHb-111), Cowbrough II (AiHb-112), Van Soelen (AiHb-113) and two isolated finds. Both Cowbrough 1 and Van Soelen were Pre-Contact lithic scatters, whereas Cowbrough II was a Euro-Canadian homestead. The isolated finds consisted of an Early Archaic projectile point and a lithic drill fragment alongside a nineteenth century pipe bowl. Cowbrough I was recommended for further work, as it was the only site located within the proposed Right-of-Way. Cowbrough II and Van Soelen were not recommended for further work because they were "sufficiently removed from the construction zone" (MTO 1996). None of these sites are located within or adjacent to the subject study area.

1.3.3.2 Woodland Properties Development

In 2005 and 2006 under PIF #P038-126 and #P038-199-2006, AMICK conducted Stage 1–3 assessments of an approximately 156.64 ha property in the Township of Guelph/Eramosa

(AMICK 2011). The area assessed through Stage 2 pedestrian survey on the west and east side of Wellington Road 124 between Whitelaw Road and Fife Road overlap in part with the subject lands. The Stage 1–2 was undertaken in April and June 2005, and April 2006 and identified an assemblage of 18 Indigenous artifacts, including projectile points, a scraper, a biface, and lithic debitage, which were consistent with an Archaic period affiliation. These artifacts were identified in three small clusters and four isolated find spots. No further work was recommended for the four isolated findspots, while the three discrete clusters were identified as being of further CHVI, being registered as the Frasson Fields (aka Frasson Meadows, Frasson Wood) site (AiHb-331), the Woodland Meadows site (AiHb-332) and the Davidson Drumhills site (AiHb-333).

The three sites of CHVI identified during the Stage 2 assessment were subjected to Stage 3 assessment in November 2006 (AMICK 2011). These three sites are within 1 km. but do not traverse the subject lands, being located within a cultivated agricultural field west of Wellington Road 124 between Whitelaw Road and Fife Road. Stage 3 assessments at all three sites identified no cultural features and recovered only a limited further assemblage of Indigenous artifacts; these three sites were deemed to be of no further CHVI and were cleared for development (Map 8–Map 14).

1.3.3.3 Spencer Pit

From May to October 2013 under PIF #P001-741-2013, Stantec undertook a Stage 1–2 assessment of an approximately 50.3 ha study area on lands comprised of parts of Lots 14–18, Concession B South of Waterloo Road in the Geographic Township of Guelph (Stantec 2013). This assessment overlaps with the subject lands along the southeastern edge of Wellington Road 124 from the intersection of Township Road 1 and Lot 16 Concession B South of Waterloo Road to Lot 14 Concession B South of Waterloo Road (Map 8, Map 26–Map 29). This assessment identified two locations of CHVI. Location 1, being 10 x 17 m, was identified based on the recovery of 30 early 20th century Euro-Canadian artifacts from a ploughed agricultural field in the southern portion of Lot 17. Location 2, being 25 x 35 m, was identified based on the recovery of 14 late 19th to early 20th century Euro-Canadian artifacts identified in an agricultural field in Lot 18. Neither of these locations were identified as having further CHVI.

In May 2014 under PIF# P256-0149-2014 Stantec undertook a Stage 2 assessment of additional lands on part of Lot 17, Concession B South of Waterloo Road in the Geographic Township of Guelph (Stantec 2014). This area does not overlap with the subject lands but is situated directly adjacent southeast of Township 1 Road along the southern border of Wellington Road 124 crossing Lot 17, Concession B South of Waterloo Road (Map 8, Map 29). This Stage 2 assessment identified no archaeological resources and as such no further archaeological assessment was recommended.

1.3.3.4 Proposed Industrial Development

In the fall of 2017, under PIF #P007-0861-2017, ARA undertook Stage 1 and 2 assessments of an area located at 5081 Wellington Road 32 in the Township of Guelph/Eramosa (ARA 2018). These assessments were undertaken in close proximity to, but do not traverse, the subject lands located along the northwest extent of Wellington Road 124 across Lot 2 Concession 2 Division B (Map 8, Map 10–Map 11). ARA identified a site, Site 1 (AiHb-353), comprised of a 144 x 89 m (NE-SW) scatter of Euro-Canadian archaeological materials located in the southeastern part of the property

assessed. The retained assemblage, yielded from 35 PTPs and a surface scatter, comprised 404 Euro-Canadian artifacts and 65 faunal remains. Based on historic research and diagnostic artifacts ARA identified the principal time frame of occupation for the site as being from ca. 1830/1840–1910/1920. The available evidence suggested that Site 1 (AiHb-353) represents a refuse accumulation associated with the construction and occupation of a rural farmhouse. The site was found to be of further CHVI and was recommended for Stage 3 site specific assessment.

2.0 STAGE 1 BACKGROUND STUDY

2.1 Background

The Stage 1 assessment involved background research to document the geography, history, previous archaeological fieldwork and current land condition of the study area. This desktop examination included research from archival sources, archaeological publications and online databases. It also included the analysis of illustrated maps, topographic maps and aerial images. The results of the research conducted for the background study are summarized below.

With occupation beginning approximately 11,000 years ago, the greater vicinity of the study area comprises a complex chronology of Pre-Contact and Post-Contact histories (Section 1.2). Artifacts associated with Palaeo-Indian, Archaic, Woodland and Early Contact traditions are well-attested in the Township of Guelph/Eramosa, and Euro-Canadian archaeological sites dating to pre-1900 and post-1900 contexts are likewise common. The presence of 36 previously identified sites in the vicinity of the subject lands demonstrates the desirability of this locality for early settlement (Section 1.3.2). Five reports were identified that documented assessments in direct proximity to the subject lands. The investigation confirmed that none of the identified archaeological sites could extend into the subject lands. Background research identified several areas along Wellington Road 124 that had been previously assessed (Section 1.3.3).

The natural environment of the study area would have been attractive to both Indigenous and Euro-Canadian populations as a result of proximity to the Speed River and its surrounding tributaries. The soils would have been ideal for a variety of agricultural pursuits, and the diverse local vegetation would also have encouraged settlement throughout Ontario's lengthy history. Euro-Canadian populations would have been particularly drawn to Wellington Road 124, which was a historically-surveyed thoroughfare, as well as the Galt & Guelph Railway.

In summary, the background study included an up-to-date listing of sites from the Ontario Archaeological Sites Database (within at least a 1 km radius), the consideration of previous local archaeological fieldwork (within at least a 50 m radius), the analysis of topographic maps and historic settlement maps (at the most detailed scale available), and the study of aerial images. ARA therefore confirms that the standards for background research set out in Section 1.1 of the *S&Gs* (MTC 2011:14–15) were met.

2.2 Field Methods (Property Inspection)

In order to gain first-hand knowledge of the geography, topography and current condition of the study area, a property inspection was conducted on May 31, 2018 (Image 1–Image 64). Environmental conditions were ideal during the inspection, with a mixture of partly cloudy and sunny skies, a high of 32°C with excellent lighting. ARA therefore confirms that fieldwork was carried out under weather and lighting conditions that met the requirements set out in Section 1.2 Standard 2 of the *S&Gs* (MTC 2011:16).

The study area was subjected to random spot-checking in accordance with the requirements set out in Section 1.2 of the *S&Gs* (MTC 2011:15–17). Specifically, the inspection began in the northeast part of the study area along the edge of Wellington Road 124 and progressed to the

southwest within the accessible public lands (Map 8). The visually inspected areas were examined under conditions that permitted good visibility of land features. The inspection confirmed that all surficial features of archaeological potential (e.g., the historic roadways) were present where they were previously identified and did not result in the identification of any additional features of archaeological potential not visible on mapping (e.g., relic water channels, patches of well-drained soils, etc.).

The inspection determined that parts of the study area were disturbed by past ground and soil altering activities. An extant residential structure with a construction style consistent with an origin in the mid-1850s was identified on the southwest corner of the intersection of Wellington Road 124 and Whitelaw Road. Approximately one-third of this structure, portions of the lawn and laneway, adjacent to Whitelaw Road fall within the subject lands. No natural features (e.g., sloped lands, overgrown vegetation, heavier soils than expected, etc.) or other significant built features (e.g., heritage structures, landscapes, plaques, monuments, cemeteries, etc.) that would affect assessment strategies were identified.

2.3 Analysis and Conclusions

In addition to relevant historical sources and the results of past archaeological assessments, the archaeological potential of a property can be assessed using its soils, hydrology and landforms as considerations. Section 1.3.1 of the *S&Gs* (MTC 2011:17–18) recognizes the following features or characteristics as indicators of archaeological potential: previously identified sites, water sources (past and present), elevated topography, pockets of well-drained sandy soil, distinctive land formations, resource areas, areas of Euro-Canadian settlement, early transportation routes, listed or designated properties, historic landmarks or sites, and areas that local histories or informants have identified with possible sites, events, activities or occupations.

The Stage 1 assessment resulted in the identification of several features of archaeological potential in the vicinity of the study area (Map 7). The closest and most relevant indicators of archaeological potential (i.e., those that would directly affect survey interval requirements) include 4 primary water sources (the Speed River and 3 tributaries of the Speed River); 11 historic roadways (e.g., Fife Road, Wellington Road 124, Wellington Road 32, Township Road 1, Wellington Road 32, Whitelaw Road, etc.); 22 historic farmstead localities; 1 historic post office locality (Gourock Post Office); 1 historic inn locality; 1 historic railroad (the Galt & Guelph Railway/Great Western Railway); and 3 previously identified archaeological sites (AiHb-353, Location 1 and Location 2). Background research did not identify any features indicating that the study area has potential for deeply buried archaeological resources.

Although proximity to a feature of archaeological potential is a significant factor in the potential modelling process, current land conditions must also be considered. Section 1.3.2 of the *S&Gs* (MTC 2011:18) emphasizes that 1) quarrying, 2) major landscaping involving grading below topsoil, 3) building footprints and 4) sewage/infrastructure development can result in the removal of archaeological potential, and Section 2.1 of the *S&Gs* (MTC 2011:28) states that 1) permanently wet areas, 2) exposed bedrock and 3) steep slopes (> 20°) can also be considered as having no archaeological potential.

Background research identified multiple previous assessments within and adjacent to the subject lands (Section 1.3.3). The areas within study area that were previously assessed under PIF #P038-126-2006 and #P001-741-2013 were not recommended for further work, and ARA agrees that these lands have no further archaeological concerns. Although the area previously assessed under Licence #93-65 was not recommended for further assessment, ARA does not believe that the methods or mapping meet current assessment standards. Accordingly, this area of overlap has been subject to potential modelling under PIF #P007-0916-2018.

ARA's visual inspection, coupled with the analysis of aerial images, topographic mapping and digital environmental data, resulted in the identification of numerous areas of no archaeological potential within the remainder of the study area. Specifically, alterations associated with road construction and maintenance (e.g., Wellington Road 124 and associated road embankments), commercial and industrial establishments (e.g., car lots, aggregate extraction areas, a service station) and channelized waterway crossings (e.g., culverts under Wellington Road 124 for the Ellis Creek Complex Provincial Swamp and a tributary of the Speed River) have resulted in the removal of archaeological potential in several areas. These areas have clearly been impacted by past and ongoing earth-moving activities, resulting in the disturbance of the original soils to a significant depth and severe damage to the integrity of any archaeological resources.

The remainder of the assessed area either has potential for Indigenous and Euro-Canadian archaeological materials or require test pit survey to confirm the presence/extent of any subsurface disturbances. Specifically, the areas of archaeological potential include the grassed lands adjacent to roadways and on residential lawns, as well as one larger and several smaller areas of cultivated agricultural fields.

The Stage 1 assessment determined that the study area comprised a mixture of areas of archaeological potential, areas of no archaeological potential and previously assessed lands of no further archaeological concern. At the time of assessment, 35.48% (11.00 ha) of the study area had archaeological potential falling within a mixture of grassed areas and agricultural fields, 55.43% (17.18 ha) of the study area was disturbed and has no archaeological potential and 9.08% (2.82 ha) was previously assessed and not recommended for further work. Of the areas with archaeological potential, 17.68% (5.48 ha) are suitable for pedestrian survey and 17.36% (5.38 ha) for test pit survey, while 0.44% (0.14 ha) require combination survey to confirm disturbance. The potential modelling results are depicted in Map 8–Map 29. The limits of the study area are depicted as a layer in this map.

3.0 RECOMMENDATIONS

The Stage 1 assessment determined that the study area comprised a mixture of areas of archaeological potential, areas of no archaeological potential and previously assessed lands of no further archaeological concern (Map 8–Map 29). ARA recommends that the identified areas of archaeological potential be subject to a Stage 2 property assessment in accordance with Section 2.1 of the *S&Gs* (MTC 2011:28–39).

The agricultural fields must be assessed using the pedestrian survey method at an interval of 5 m. All ground surfaces must be recently ploughed (typically within the month prior to assessment), weathered by one heavy rainfall or several light rains, and provide at least 80% visibility. If archaeological materials are encountered, the transect interval must be decreased to at least 1 m and a close inspection of the ground must be conducted over a minimum of a 20 m radius around the find. This interval must be continued until the full extent of the scatter has been defined. If the field conditions within the agricultural lands along the edges of the ROW are not adequate for pedestrian survey at the time of assessment, the test pit survey method can be utilized to complete the assessment of any narrow corridors (≤ 10 m) as set out in Section 2.1.2 Standard 1f of the *S&Gs* (MTC 2011:32).

The grassed and uncultivated areas along the road edge and the adjacent residential and commercial lawns must be assessed using the test pit survey method. A test pit survey interval of 5 m will be required due to the proximity of the lands to the identified features of archaeological potential. Given the likelihood that several grassed areas fronting on adjacent developed lands have been impacted by past construction activities, a combination of visual inspection and test pit survey should be utilized to confirm the extents of any disturbed areas in accordance with Section 2.1.8 of the *S&Gs* (MTC 2011:38). This will allow for the empirical evaluation of the integrity of the soils and the depth of any past disturbances. If disturbance cannot be confirmed, then a test pit survey interval of 5 m must be maintained in these areas.

Regardless of the survey method employed, each test pit must be excavated into at least the first 5 cm of subsoil, and the resultant pits must be examined for stratigraphy, potential features and/or evidence of fill. The soil from each test pit must be screened through mesh with an aperture of no greater than 6 mm and examined for archaeological materials. If archaeological materials are encountered, all PTPs must be documented and intensification may be required.

The identified areas of no archaeological potential and the specified previously assessed lands do not require further archaeological assessment. Given that there are still archaeological concerns within the subject lands, no ground alterations or development of any kind may occur within the property until the Stage 2 assessment is complete and a recommendation that the lands require no further archaeological assessment is made.

4.0 ADVICE ON COMPLIANCE WITH LEGISLATION

Section 7.5.9 of the *S&Gs* requires that the following information be provided for the benefit of the proponent and approval authority in the land use planning and development process (MTC 2011:126–127):

- This report is submitted to the Minister of Tourism, Culture and Sport as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the MTCS, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.
- It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.
- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*.
- The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 requires that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services.

5.0 IMAGES

Image 1: Disturbed Lands – Previous Development
(May 31, 2018; Facing South)

Image 2: Disturbed Lands – Roadway
(May 31, 2018; Facing Southeast)

Image 3: Area of Potential – Grassed Area
(May 31, 2018; Facing East)

Image 4: Area of Potential – Grassed Area
(May 31, 2018; Facing Southeast)

Image 5: Disturbed Lands – Commercial Establishment
(May 31, 2018; Facing North)

Image 6: Area of Potential – Grassed Area
(May 31, 2018; Facing South)

Image 7: Area of Potential – Grassed Area
(May 31, 2018; Facing North-Northwest)

Image 8: Disturbed Lands – Roadway
(May 31, 2018; Facing South-Southeast)

Image 9: Area of Potential – Grassed Area
(May 31, 2018; Facing North)

Image 10: Disturbed Lands – Roadway
(May 31, 2018; Facing North)

Image 11: Area of Potential – Cultivated Field
(May 31, 2018; Facing North-Northeast)

Image 12: Disturbed Lands – Roadway and Embankment
(May 31, 2018; Facing South)

Image 13: Area of Potential – Grassed Area
(May 31, 2018; Facing North)

Image 14: Area of Potential – Cultivated Field
(May 31, 2018; Facing North)

Image 15: Area of Potential – Cultivated Field
(May 31, 2018; Facing South)

Image 16: Disturbed Lands – Roadway
(May 31, 2018; Facing West)

Image 17: Disturbed Lands – Ditch
(May 31, 2018; Facing South)

Image 18: Disturbed Lands – Ditch and Drainage
(May 31, 2018; Facing South)

Image 19: Disturbed Lands – Ditch
(May 31, 2018; Facing South)

Image 20: Previously Assessed Lands
(May 31, 2018; Facing Southwest)

Image 21: Area of Potential – Grassed Area
(May 31, 2018; Facing East-Northeast)

Image 22: Area of Potential – Grassed Area
(May 31, 2018; Facing Northeast)

Image 23: Area of Potential – Cultivated Field
(May 31, 2018; Facing East)

Image 24: Previously Assessed Lands
(May 31, 2018; Facing East-Southeast)

Image 25: Previously Assessed Lands
(May 31, 2018; Facing East)

Image 26: Area of Potential – Combination Survey
(May 31, 2018; Facing North-Northwest)

Image 27: Area of Potential – 19th Century Stone House
(May 31, 2018; Facing East)

Image 28: Area of Potential – Grassed Area
(May 31, 2018; Facing Southeast)

Image 29: Area of Potential – Grassed Area
(May 31, 2018; Facing North-Northeast)

Image 30: Area of Potential – Cultivated Field
(May 31, 2018; Facing Northeast)

Image 31: Area of Potential – Cultivated Field
(May 31, 2018; Facing South-Southwest)

Image 32: Area of Potential – Plough-Accessible Area
(May 31, 2018; Facing Southwest)

Image 33: Area of Potential – Combination Survey
(May 31, 2018; Facing Southwest)

Image 34: Area of Potential – Grassed Area
(May 31, 2018; Facing Northeast)

Image 35: Area of Potential – Grassed Area
(May 31, 2018; Facing Northeast)

Image 36: Area of Potential – Grassed Area
(May 31, 2018; Facing Southwest)

Image 37: Area of Potential – Grassed Area
(May 31, 2018; Facing East)

Image 38: Area of Potential – Grassed Area
(May 31, 2018; Facing Northeast)

Image 39: Area of Potential – Grassed Area
(May 31, 2018; Facing Southwest)

Image 40: Disturbed Lands – Aggregate Extraction
(May 31, 2018; Facing South)

Image 41: Disturbed Lands – Aggregate Extraction
(May 31, 2018; Facing North-Northeast)

Image 42: Disturbed Lands – Gravel Road and Union Gas Installation
(May 31, 2018; Facing Southeast)

Image 43: Disturbed Lands – Aggregate Extraction
(May 31, 2018; Facing Northeast)

Image 44: Disturbed Lands – Road Shoulder
(May 31, 2018; Facing Southwest)

Image 45: Disturbed Lands – Previously Altered Area
(May 31, 2018; Facing Northwest)

Image 46: Disturbed Lands – Service Station and Roadway
(May 31, 2018; Facing Southwest)

Image 47: Disturbed Lands – Roadway
(May 31, 2018; Facing Northeast)

Image 48: Disturbed Lands – Roadway
(May 31, 2018; Facing Northwest)

Image 49: Area of Potential – Grassed Area
(May 31, 2018; Facing Southeast)

Image 50: Area of Potential – Grassed Area
(May 31, 2018; Facing Southwest)

Image 51: Disturbed Lands – Gravel Driveway
(May 31, 2018; Facing North)

Image 52: Area of Potential – Grassed Area
(May 31, 2018; Facing East)

Image 53: Area of Potential – Grassed Area
(May 31, 2018; Facing North-Northeast)

Image 54: Area of Potential (Grassed Area) and Disturbed Lands (Railway)
(May 31, 2018; Facing North)

Image 55: Disturbed Lands – Railway Tracks
(May 31, 2018; Facing South)

Image 56: Area of Potential – Grassed Area
(May 31, 2018; Facing Northeast)

Image 57: Disturbed Lands – Road Embankment
(May 31, 2018; Facing Northeast)

Image 58: Area of Potential – Grassed Area
(May 31, 2018; Facing West)

Image 59: Area of Potential – Cultivated Field
(May 31, 2018; Facing Southwest)

Image 60: Area of Potential – Cultivated Field
(May 31, 2018; Facing Northeast)

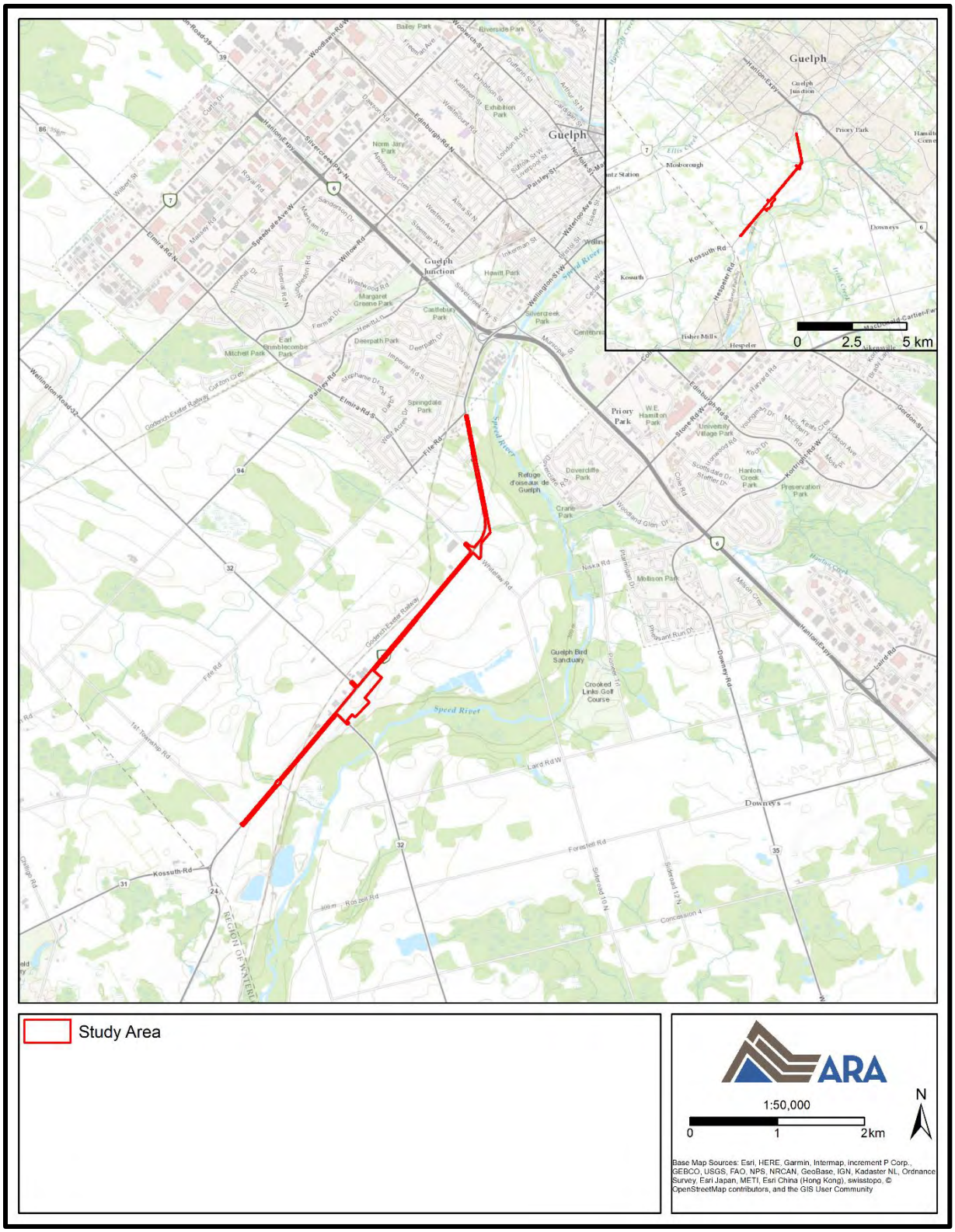
Image 61: Area of Potential – Cultivated Field
(May 31, 2018; Facing Northeast)

Image 62: Area of Potential – Cultivated Field
(May 31, 2018; Facing West)

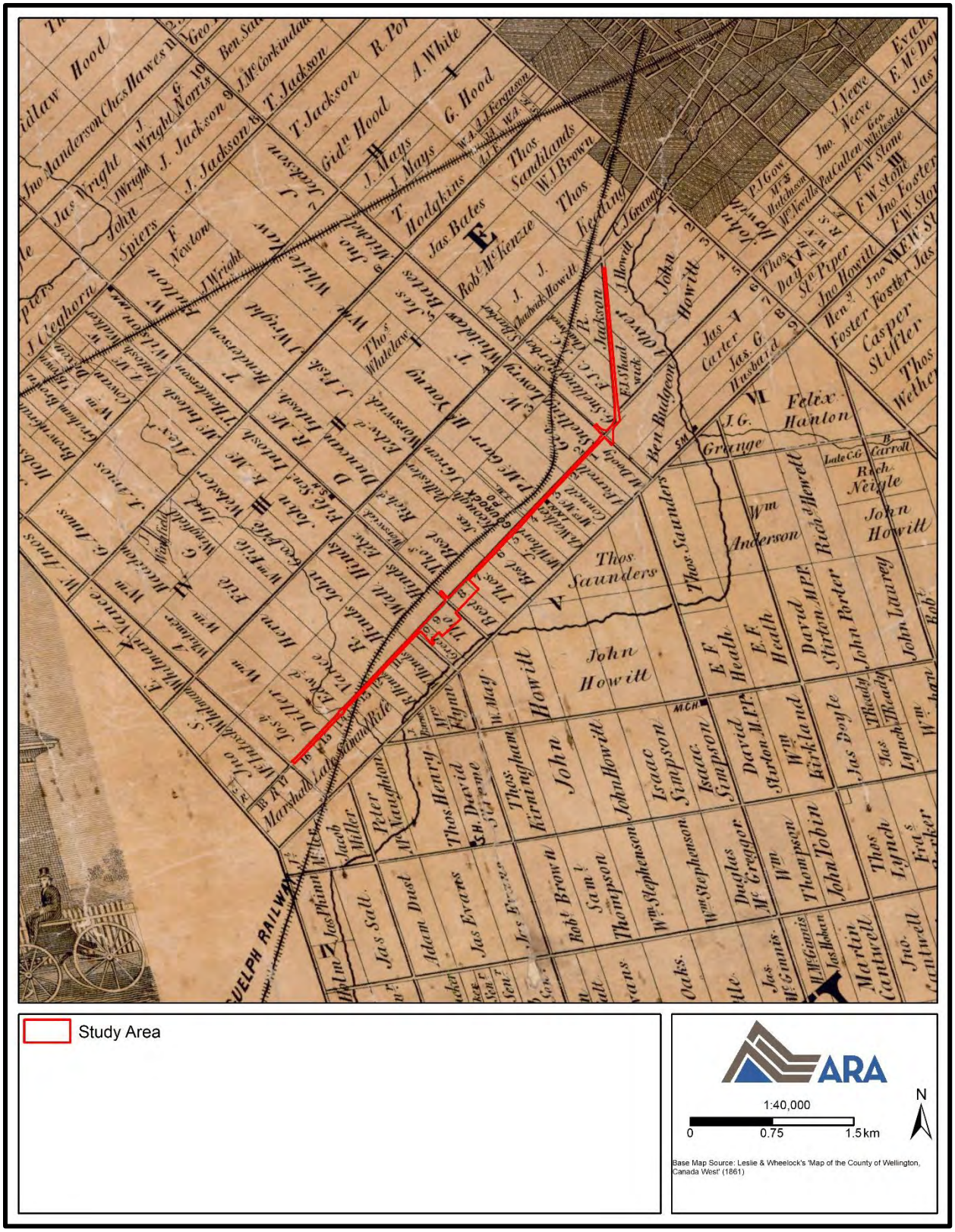
Image 63: Area of Potential – Cultivated Field
(May 31, 2018; Facing North)

Image 64: Disturbed Lands – Roadway
(May 31, 2018; Facing East)

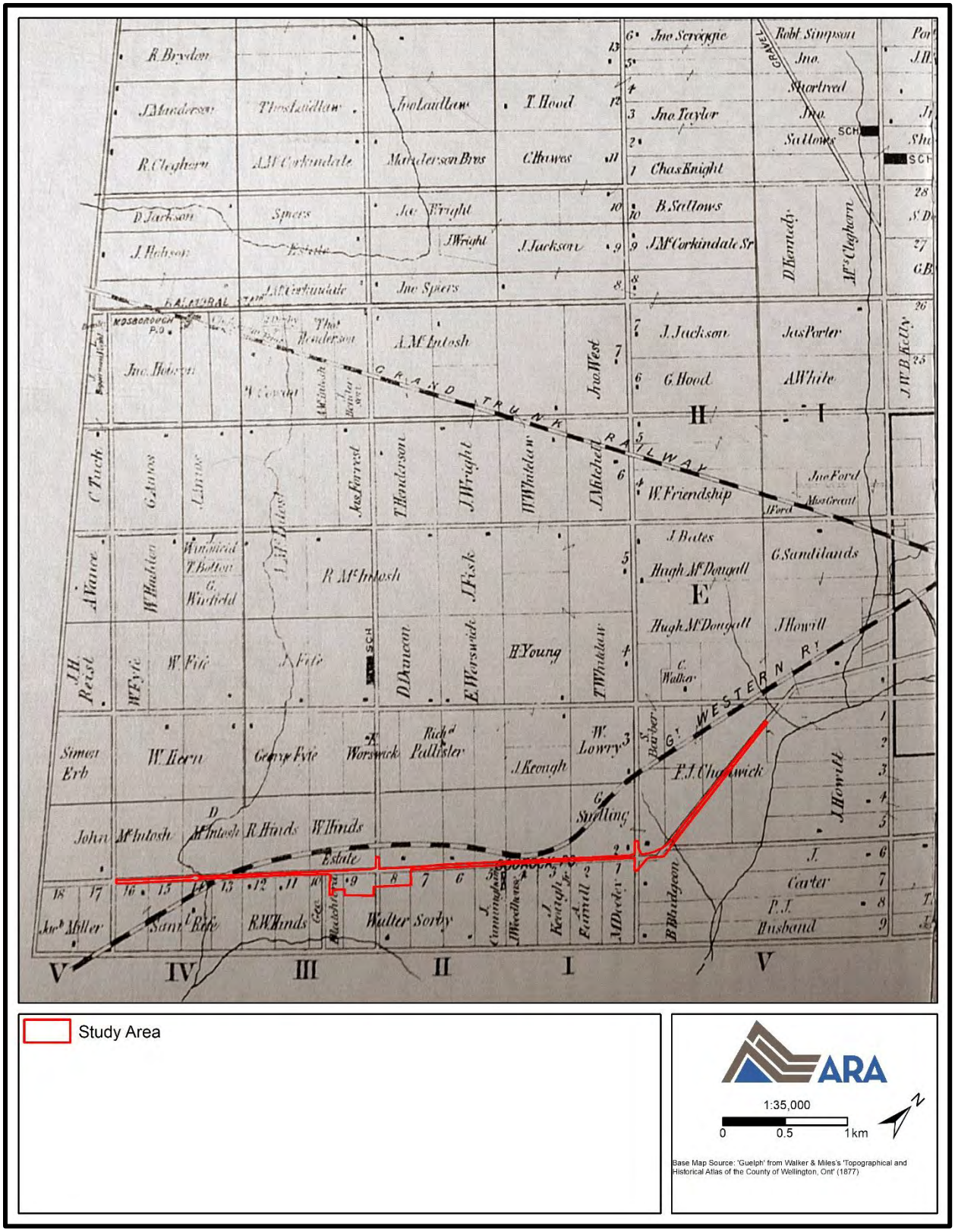
6.0 MAPS



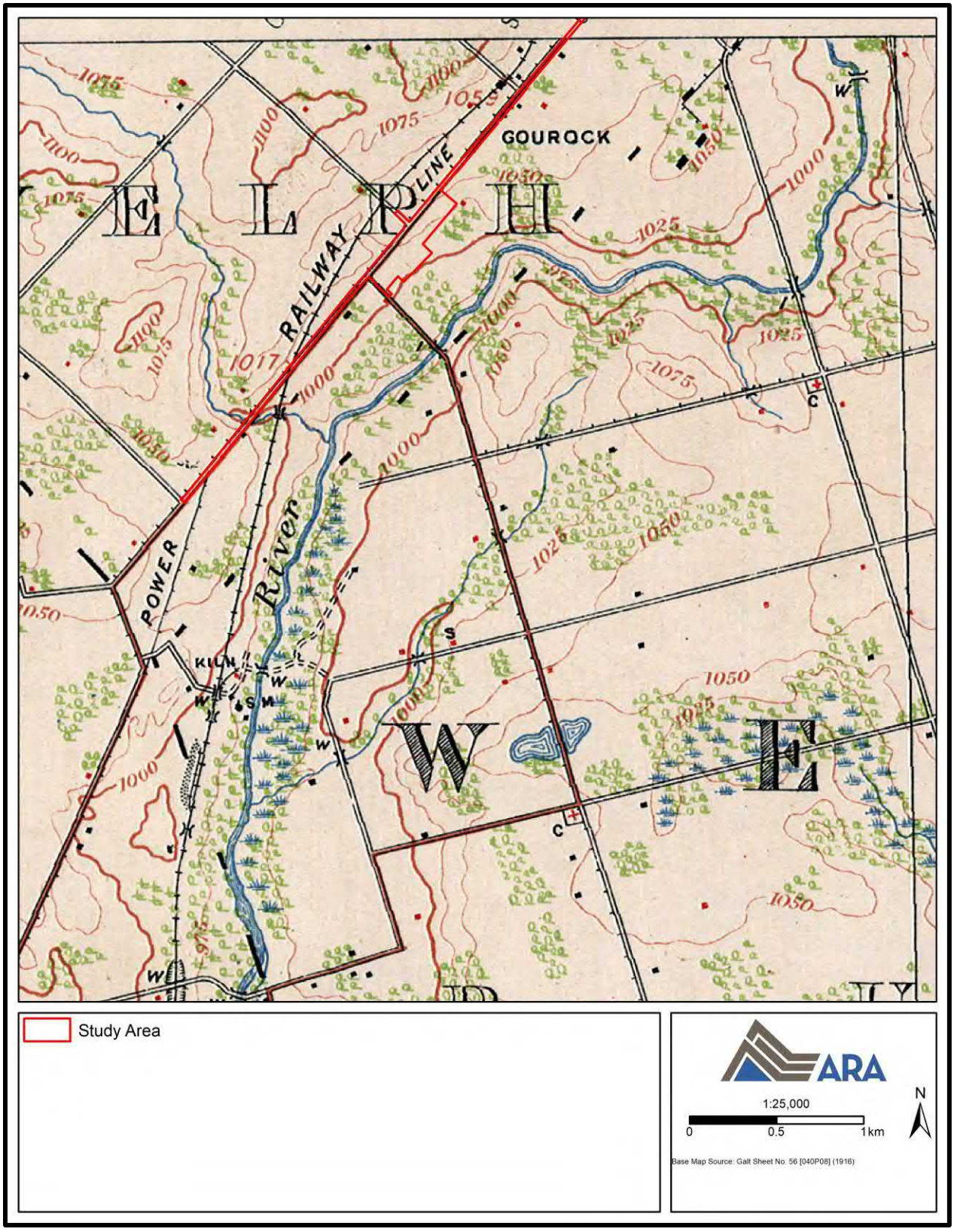
Map 1: Location of the Study Area
(Produced under licence using ArcGIS® software by Esri, © Esri)



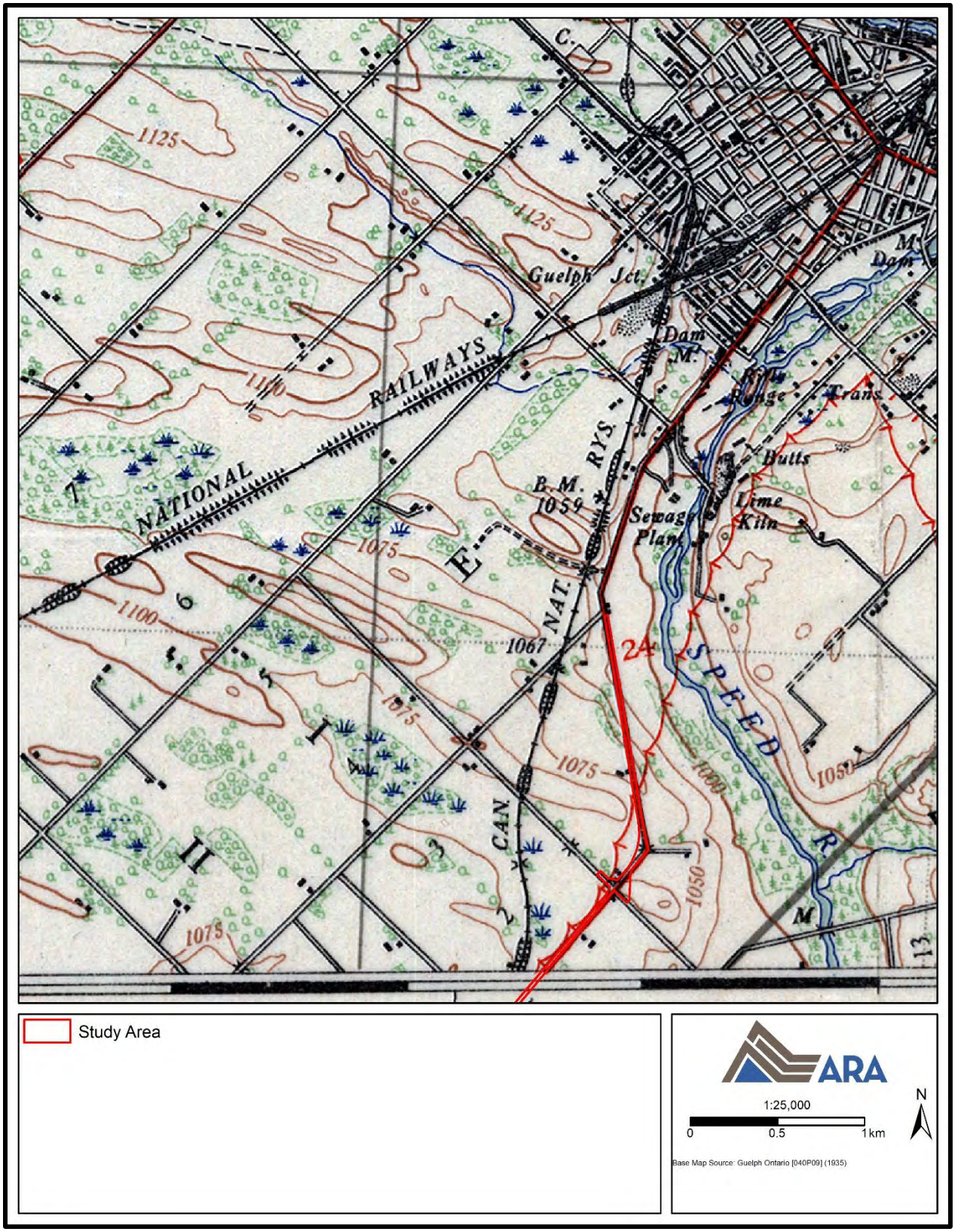
Map 2: Leslie and C.J. Wheelock's *Map of the County of Wellington, Canada West* (1861)
(Produced under licence using ArcGIS® software by Esri, © Esri; OHCMP 2018)



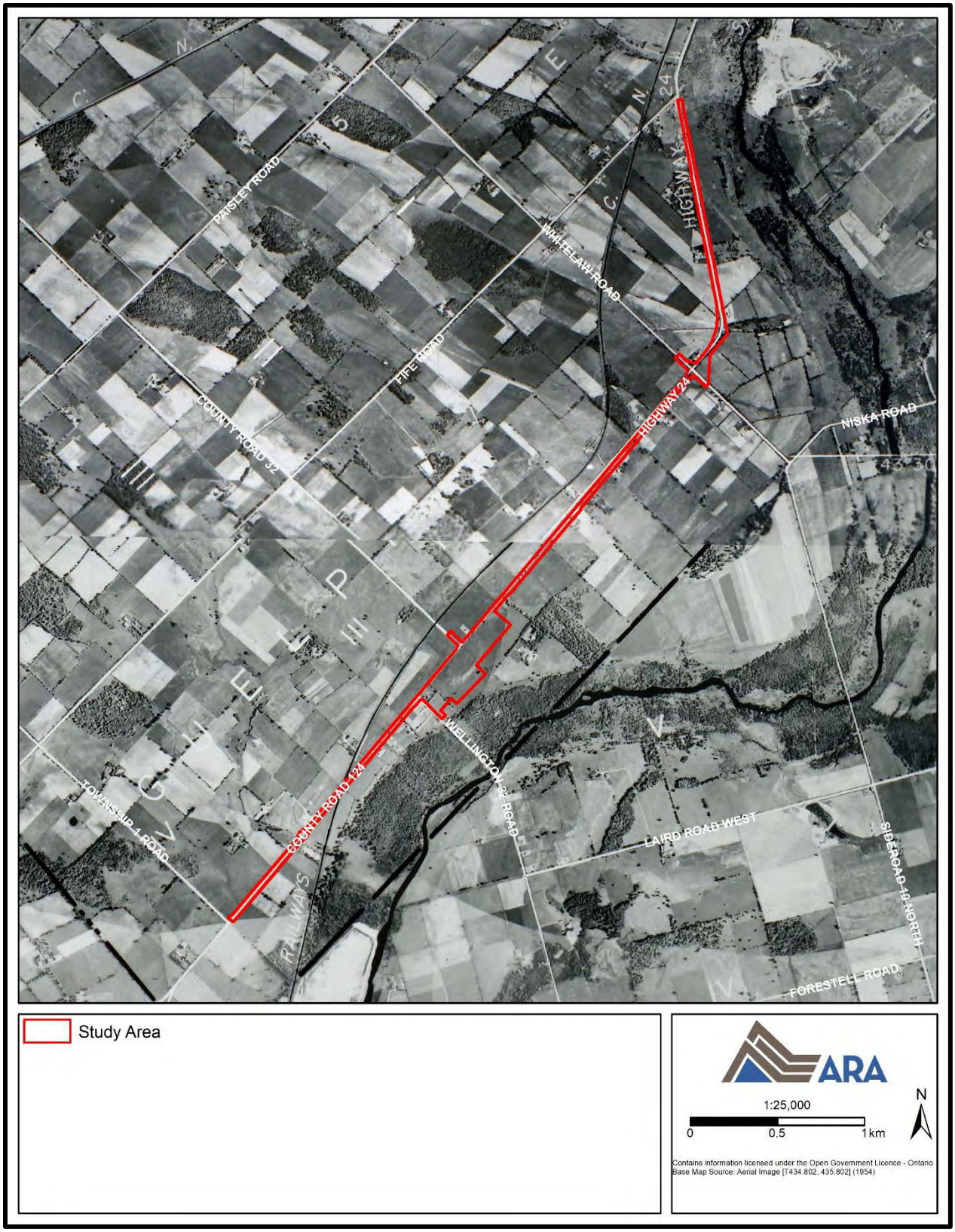
Map 3: Walker and Miles' *Illustrated Historical Atlas of the County of Wellington, Ontario* (1877)
(Produced under licence using ArcGIS® software by Esri, © Esri; McGill University 2001)



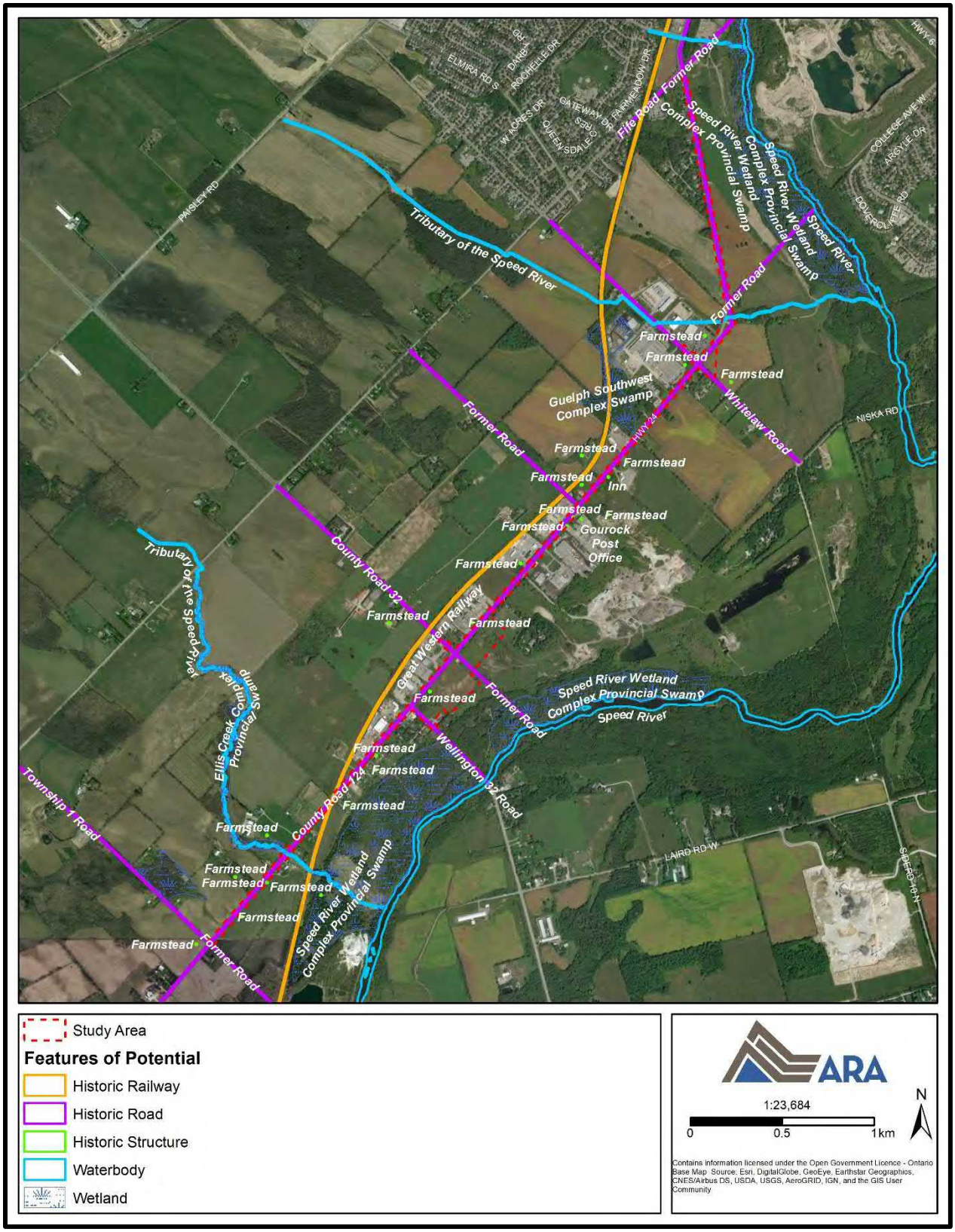
Map 4: Topographic Map (1916)
(Produced under licence using ArcGIS® software by Esri, © Esri; OCUL 2018)



Map 5: Topographic Map (1935)
(Produced under licence using ArcGIS® software by Esri, © Esri)



Map 6: Aerial Image (1954)
(Produced under licence using ArcGIS® software by Esri, © Esri; University of Toronto 2018)



Map 7: Features of Potential
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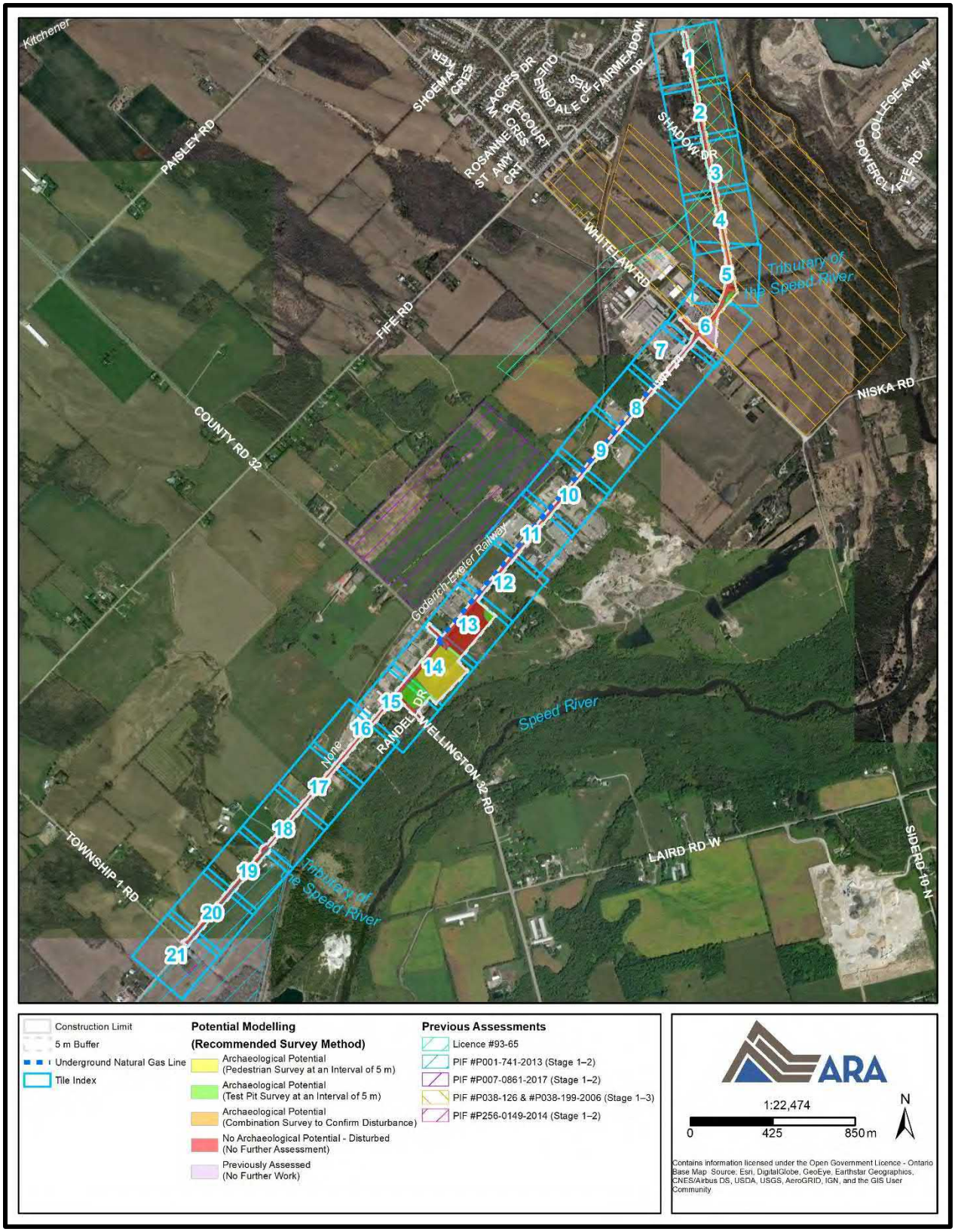
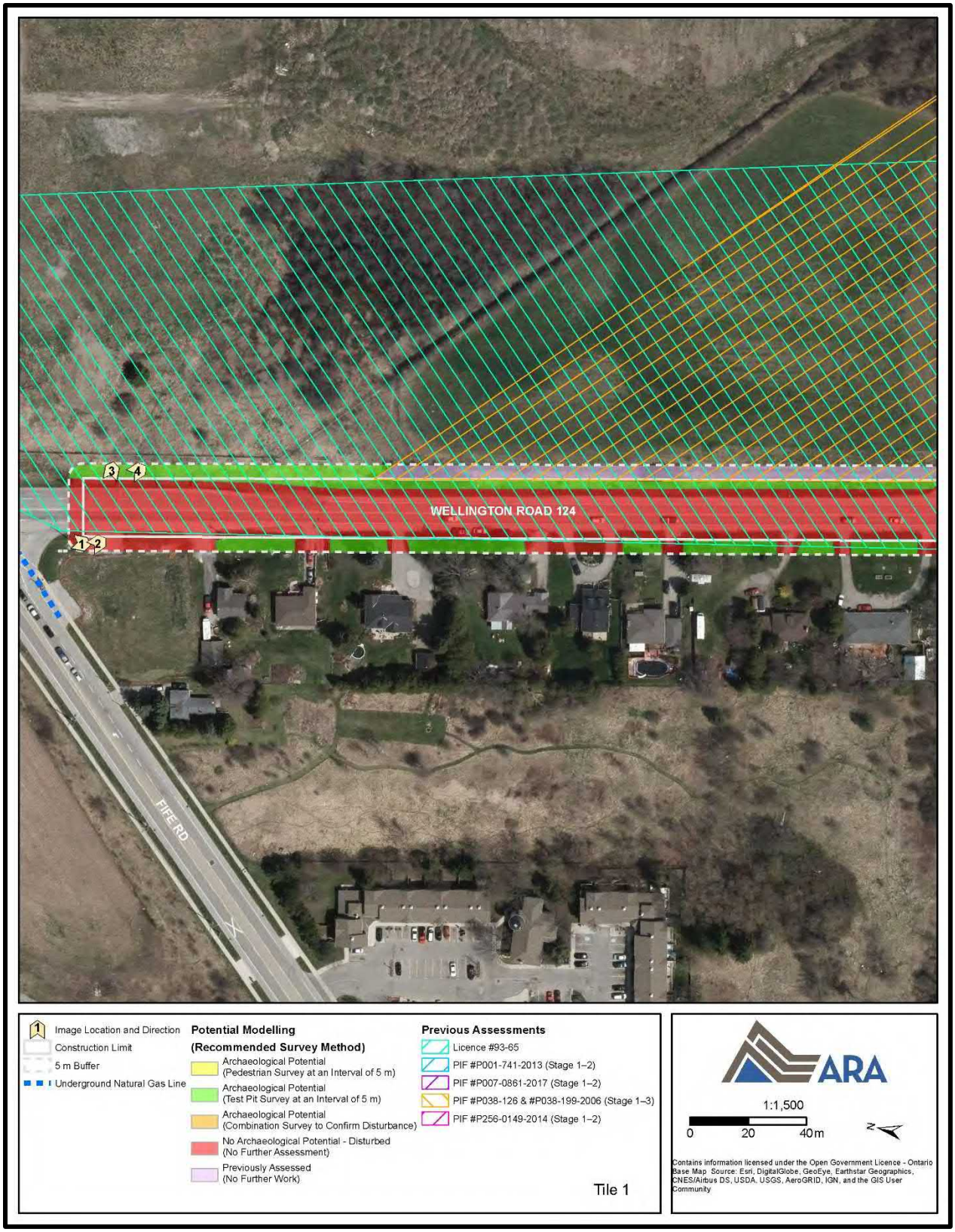


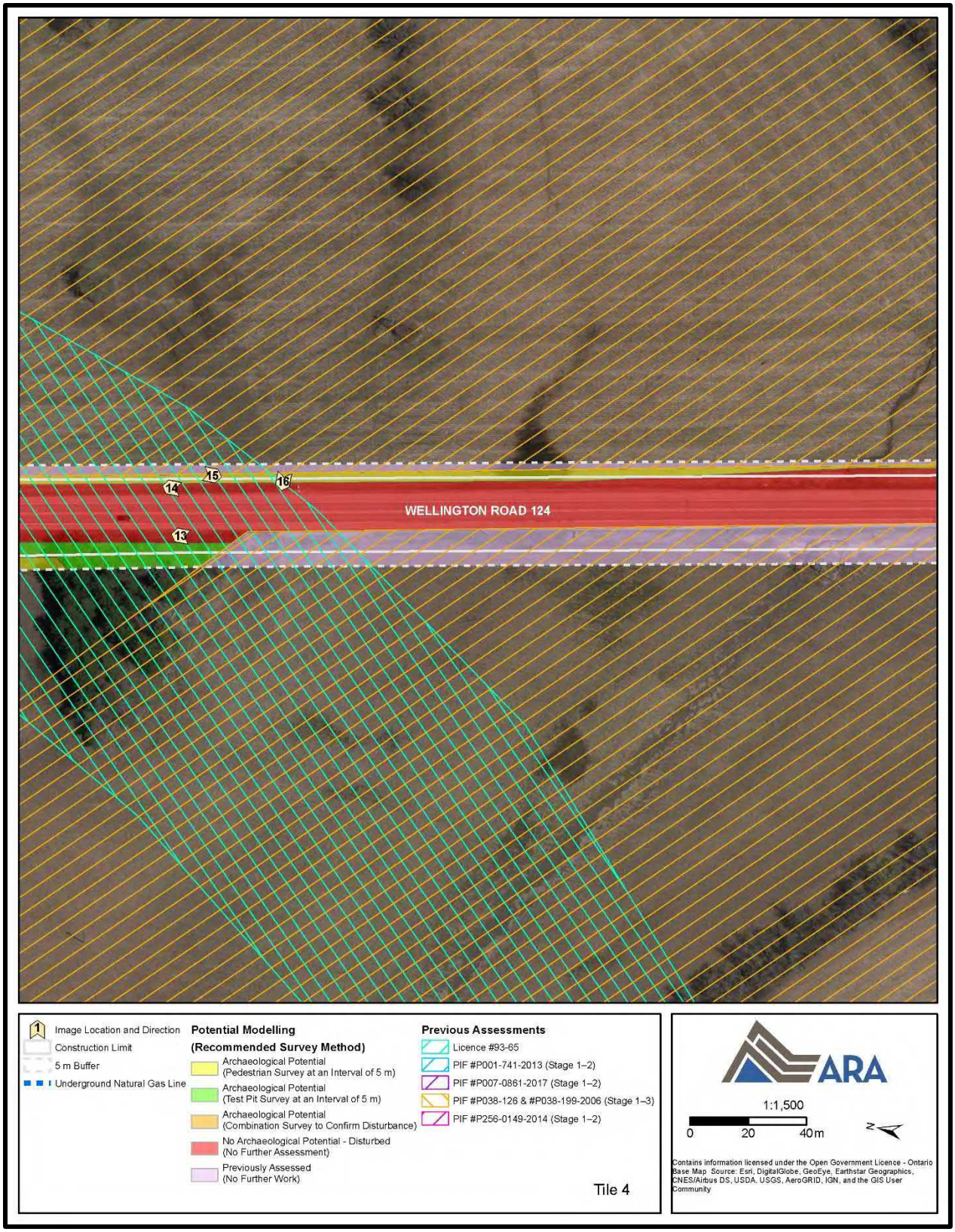
Map 8: Assessment Results – Overview
(Produced under licence using ArcGIS® software by Esri, © Esri)



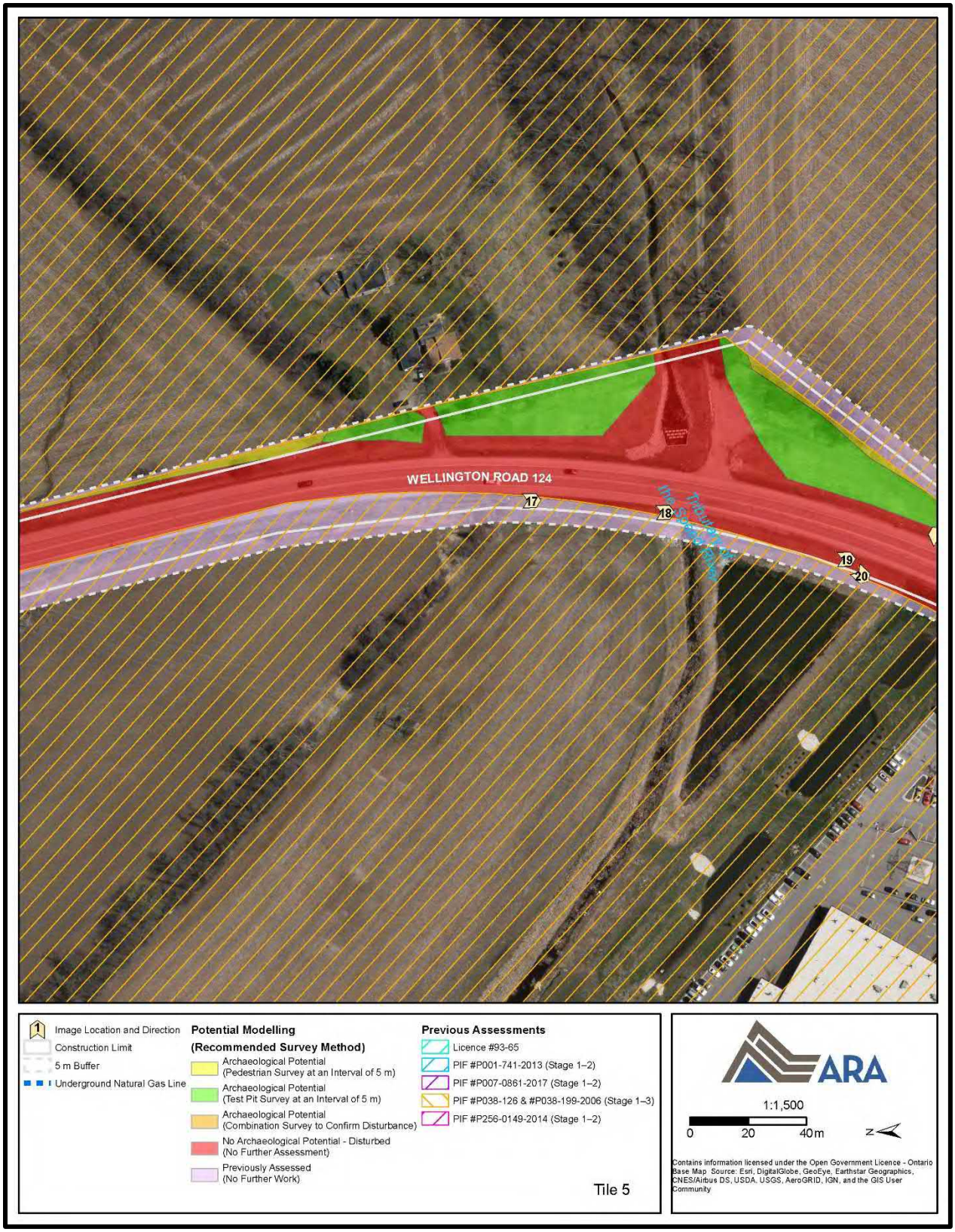
Map 9: Tile 1 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)

Map 10: Tile 2 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)

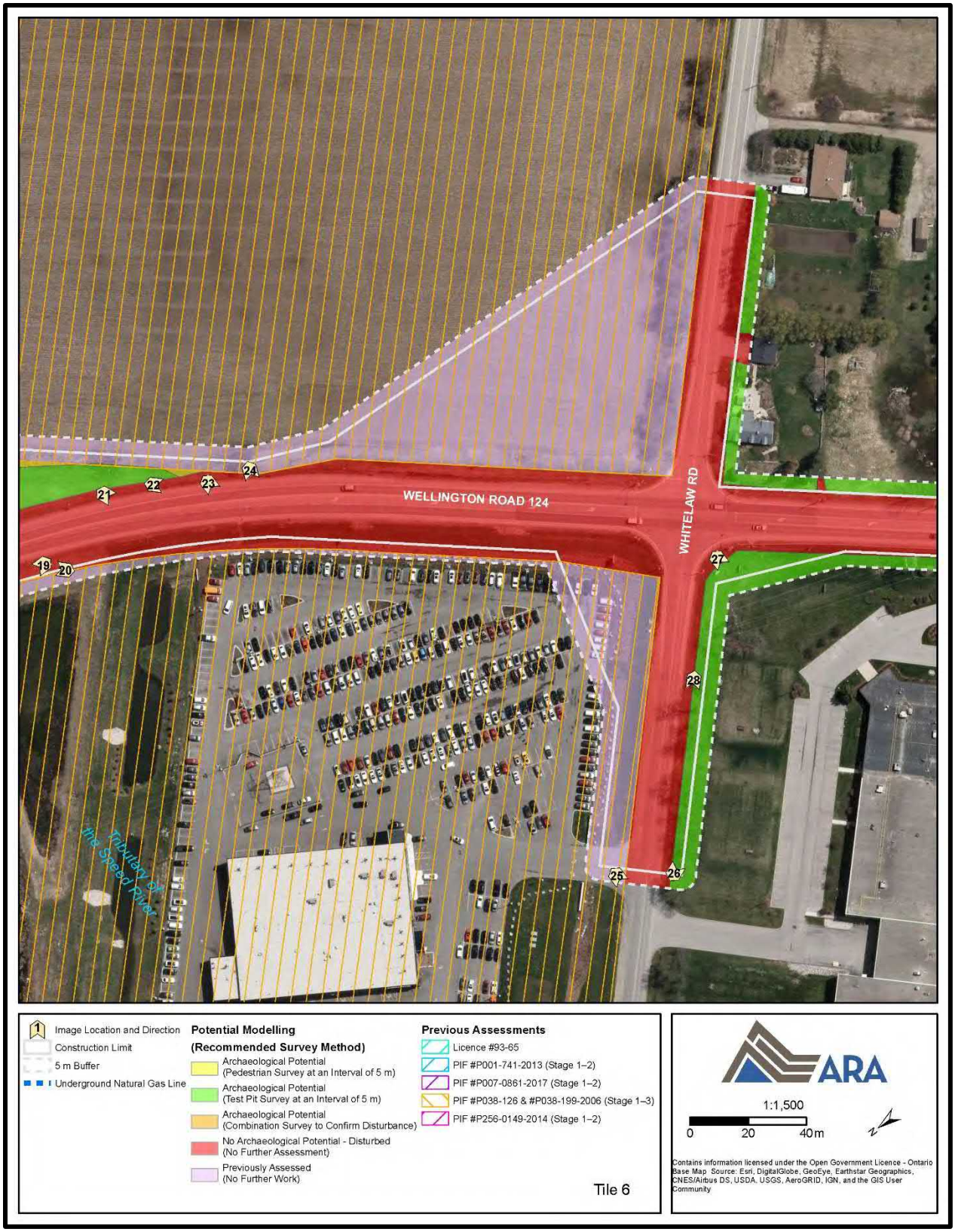
Map 11: Tile 3 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)



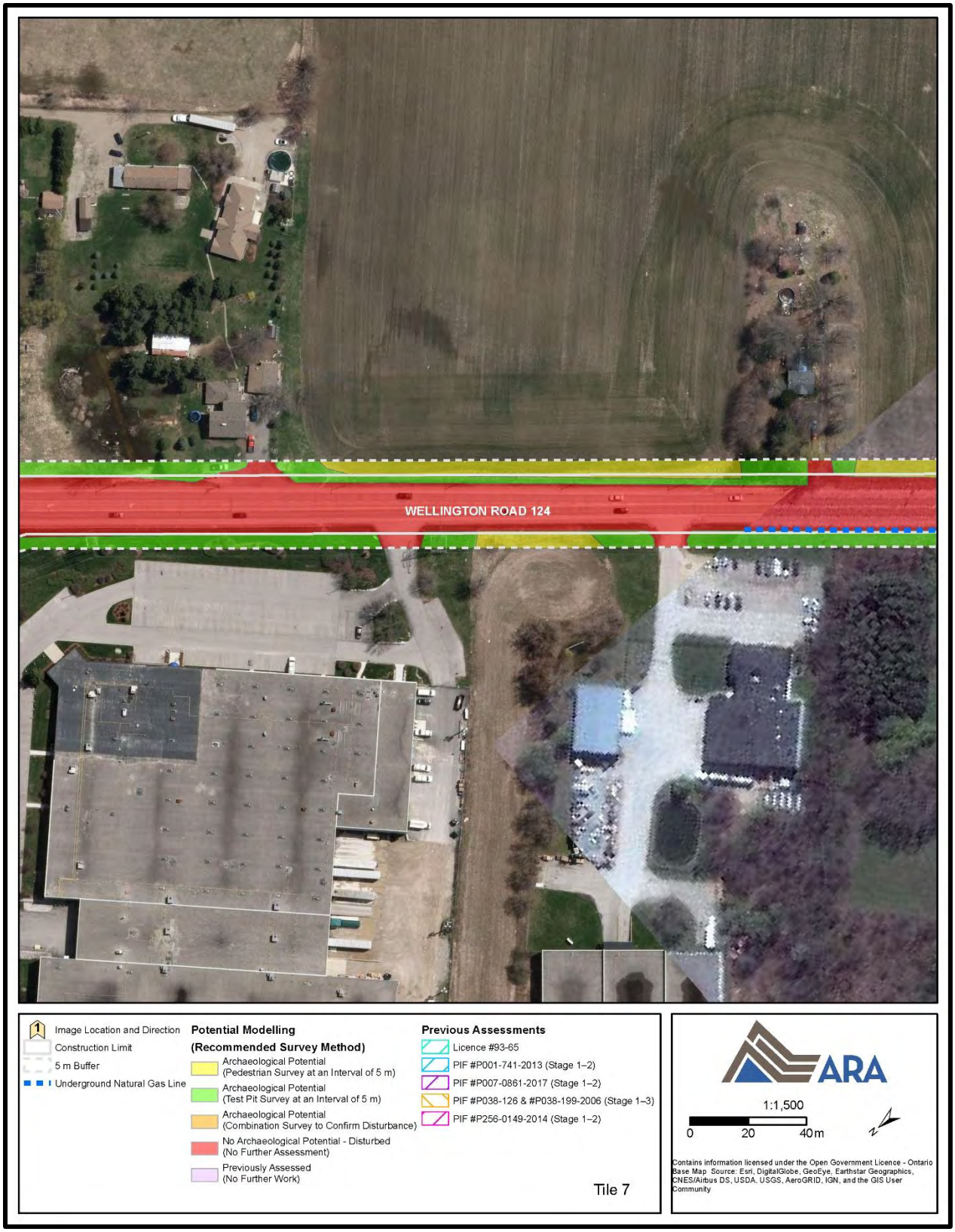
Map 12: Tile 4 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)



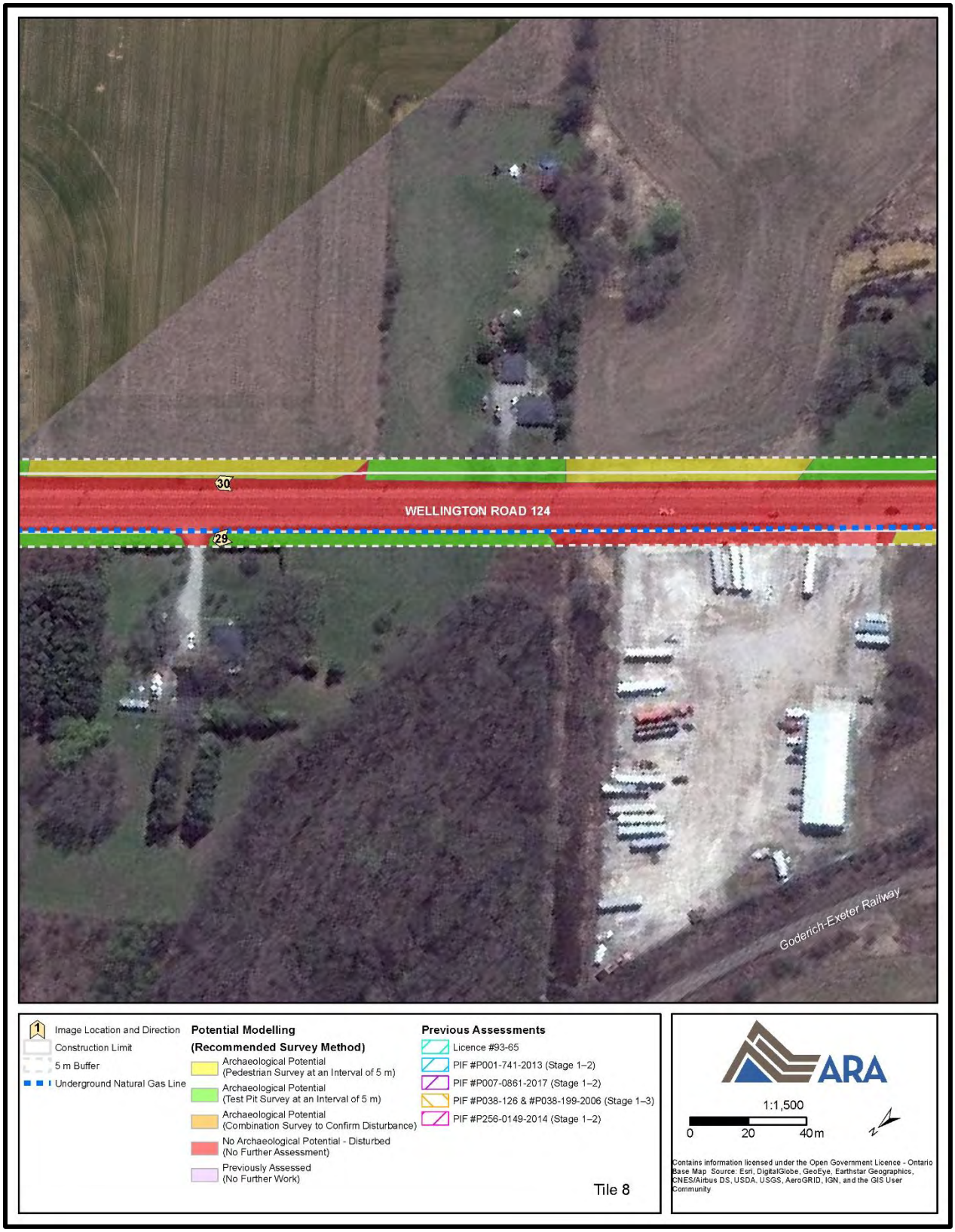
Map 13: Tile 5 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)



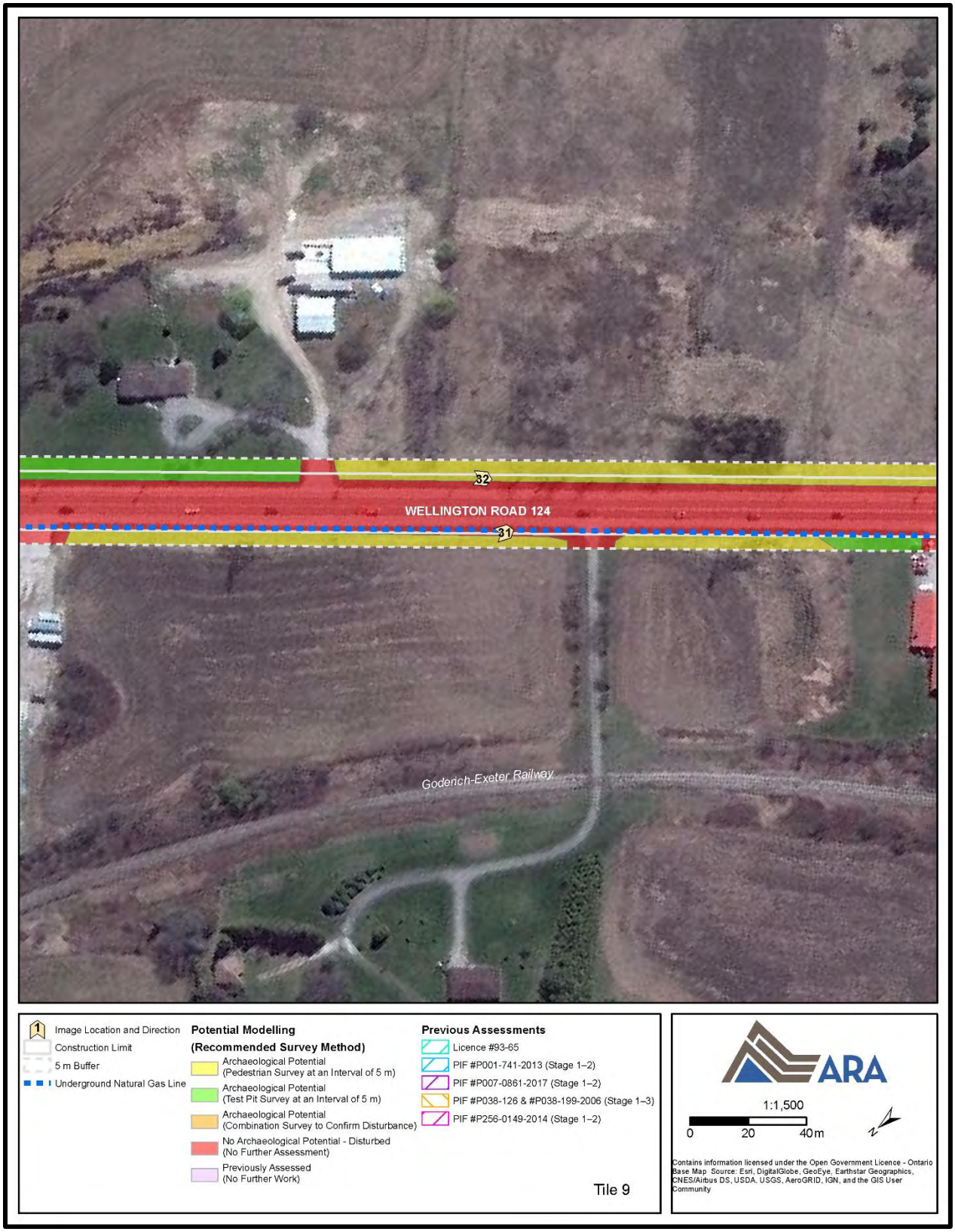
Map 14: Tile 6 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)



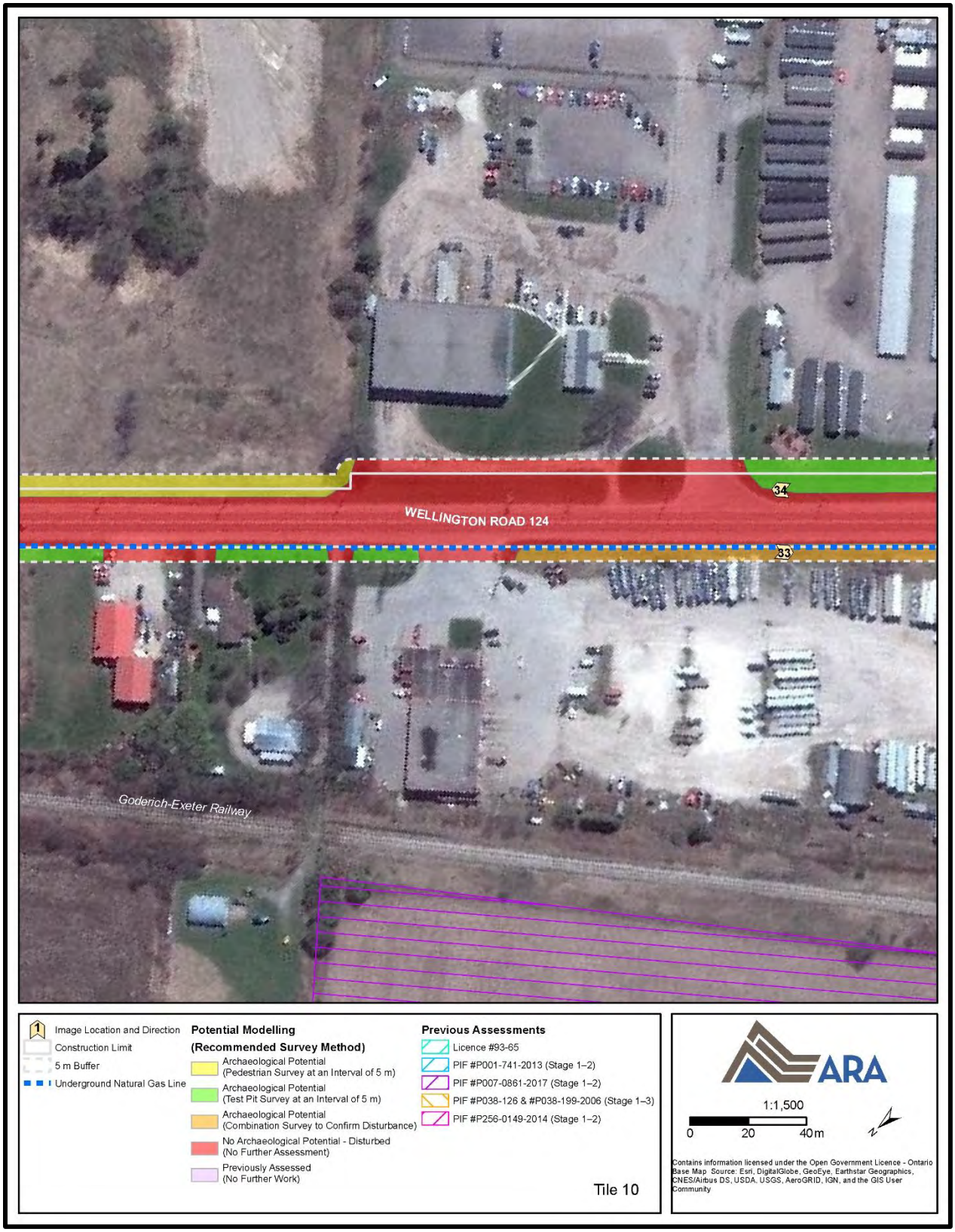
Map 15: Tile 7 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)



Map 16: Tile 8 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)



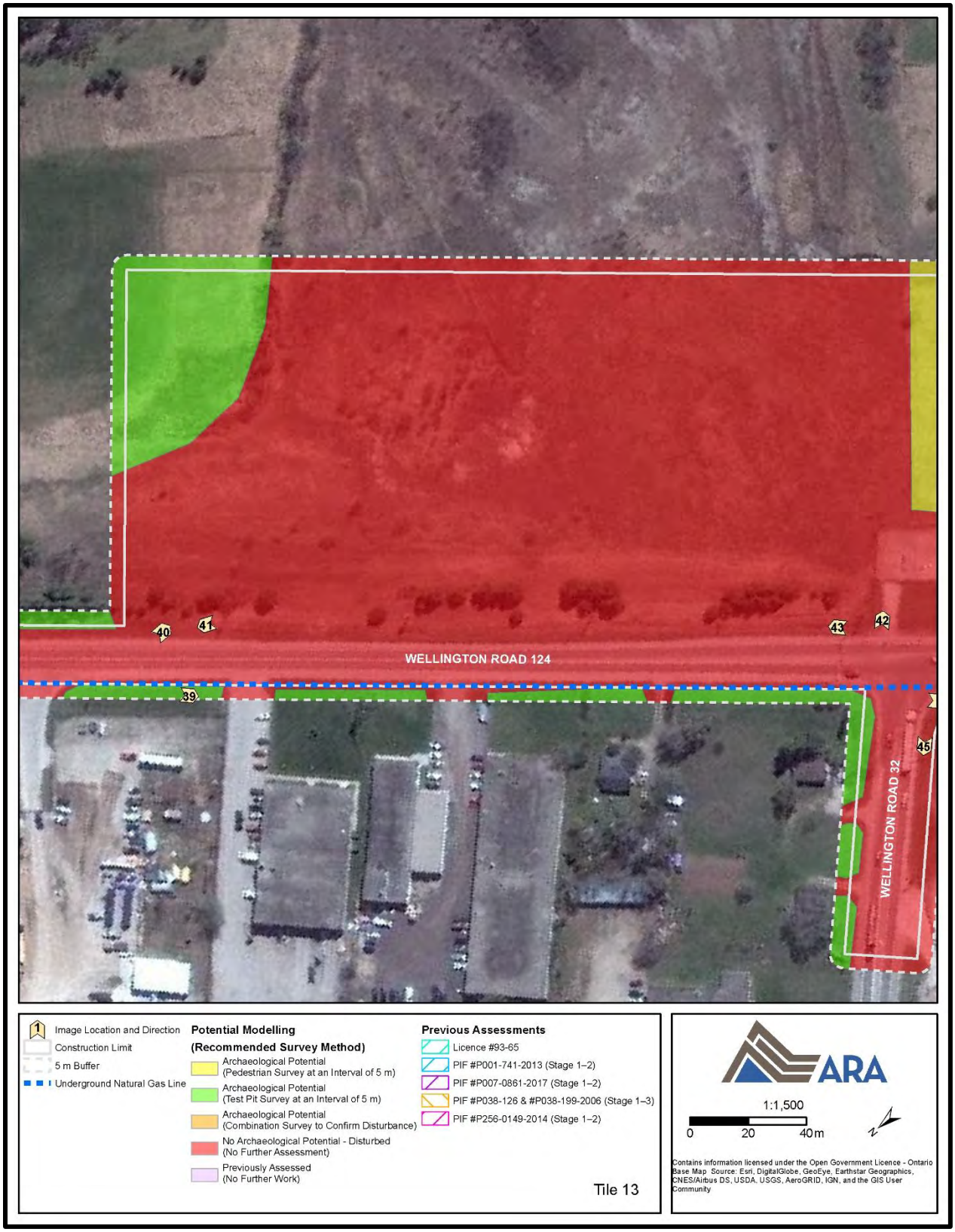
Map 17: Tile 9 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)



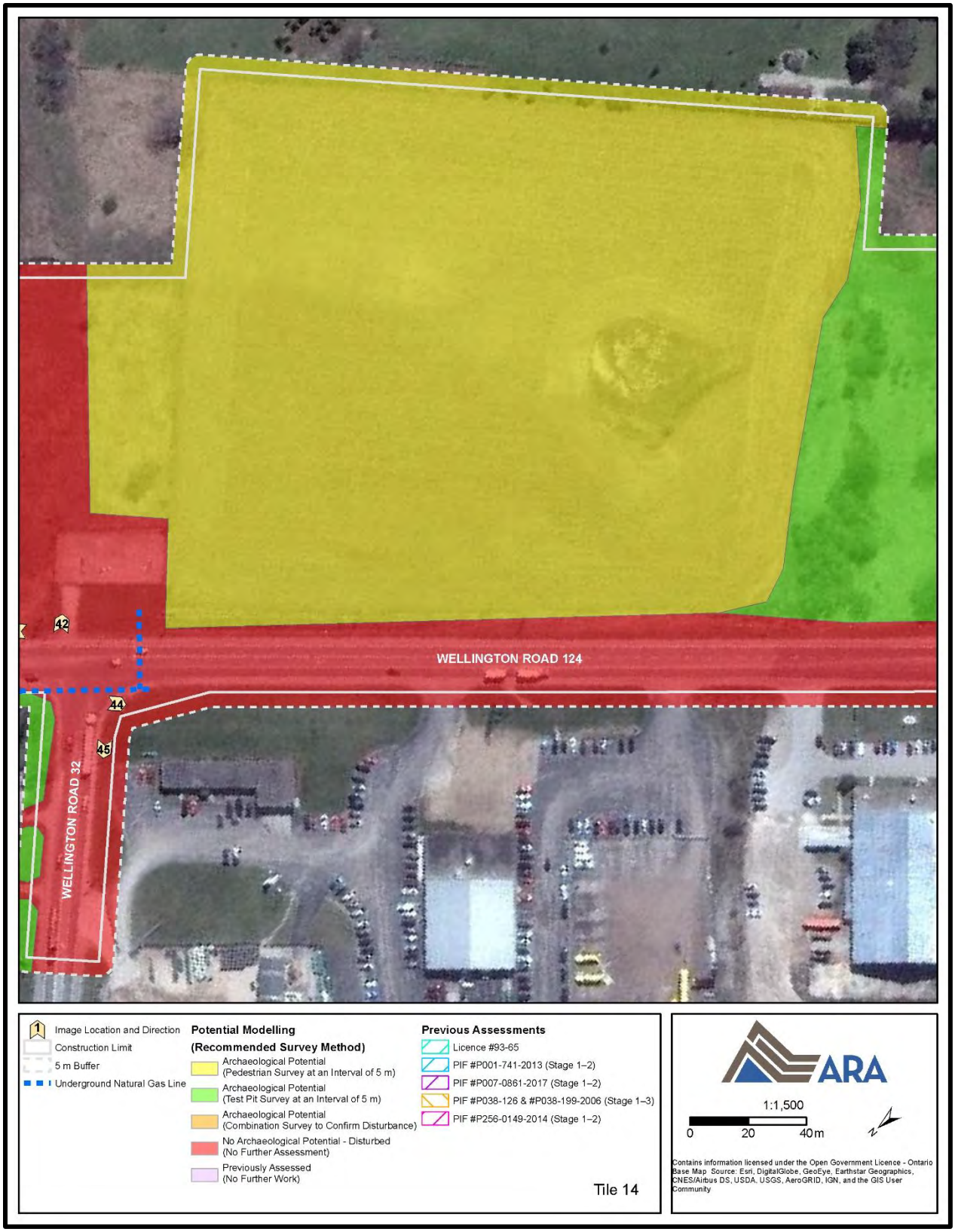
Map 18: Tile 10 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)

Map 19: Tile 11 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)

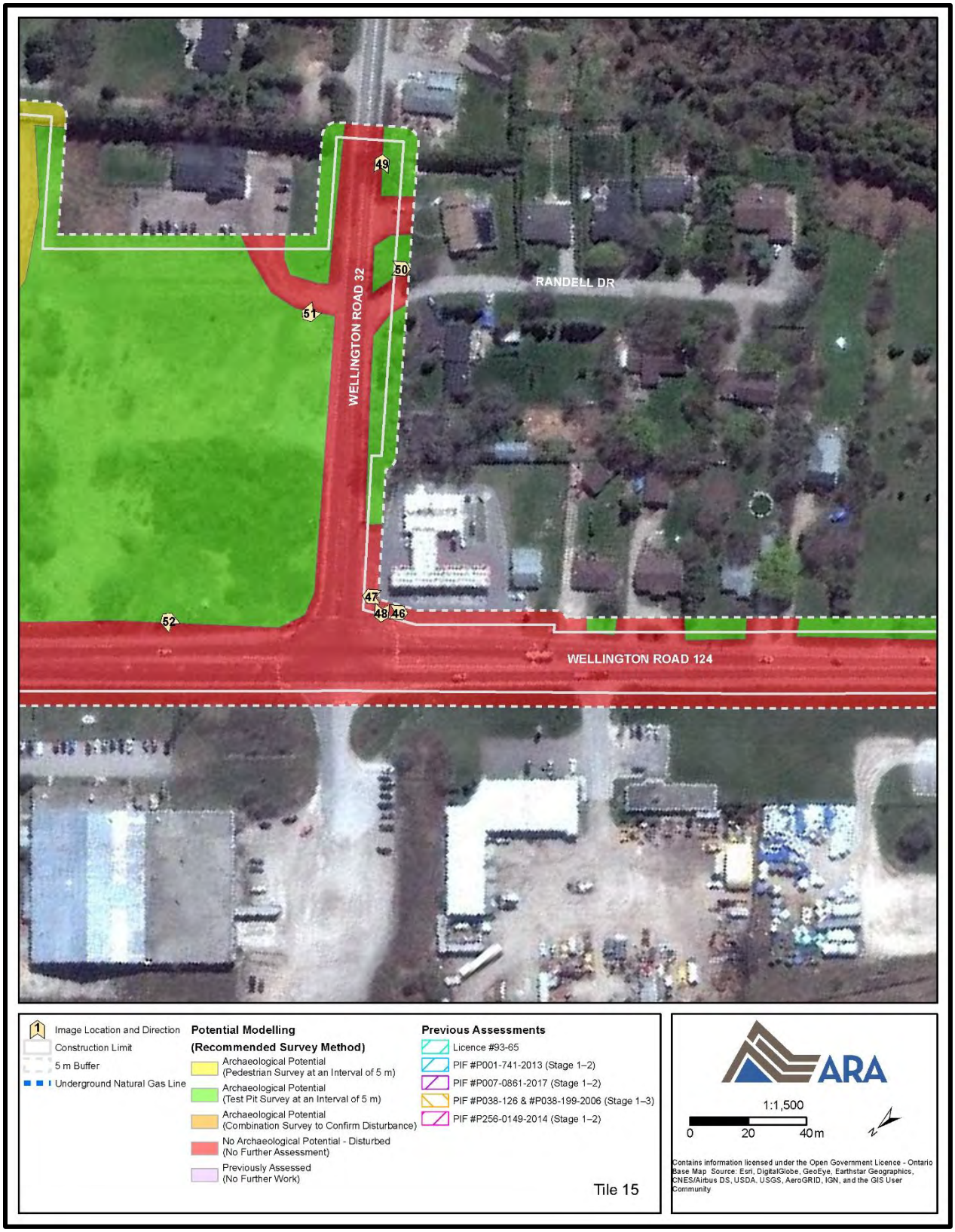
Map 20: Tile 12 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)



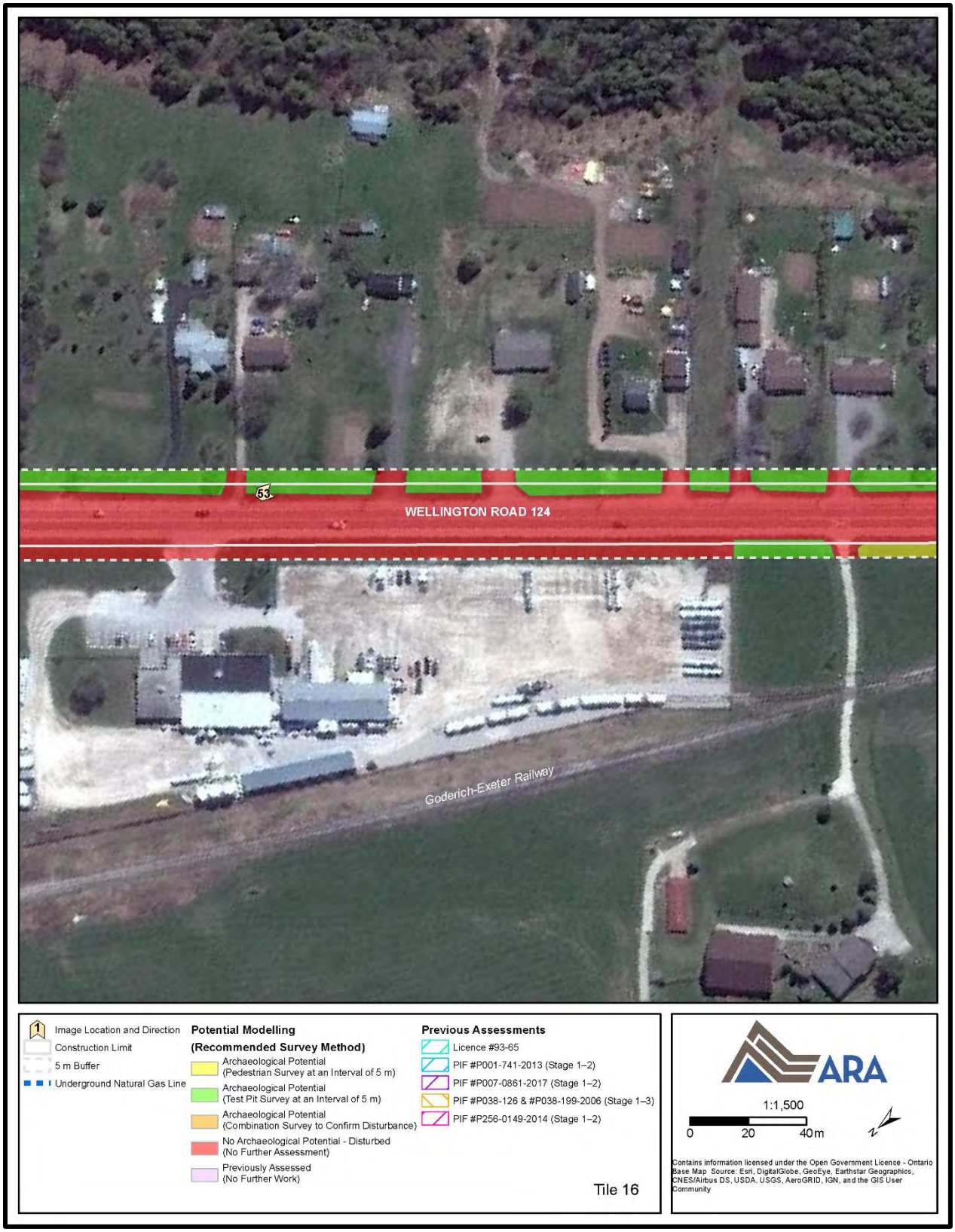
Map 21: Tile 13 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)



Map 22: Tile 14 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)

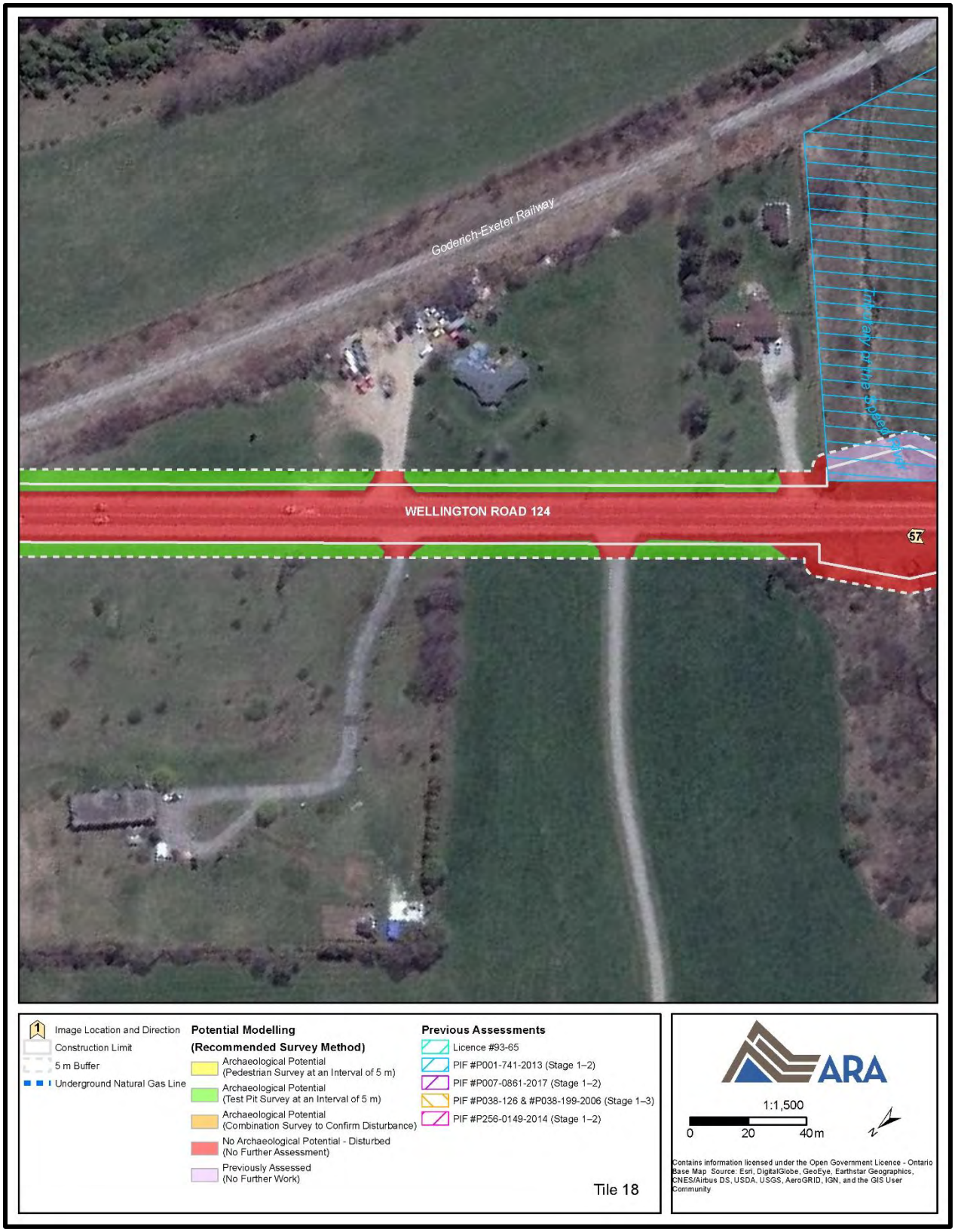


Map 23: Tile 15 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)

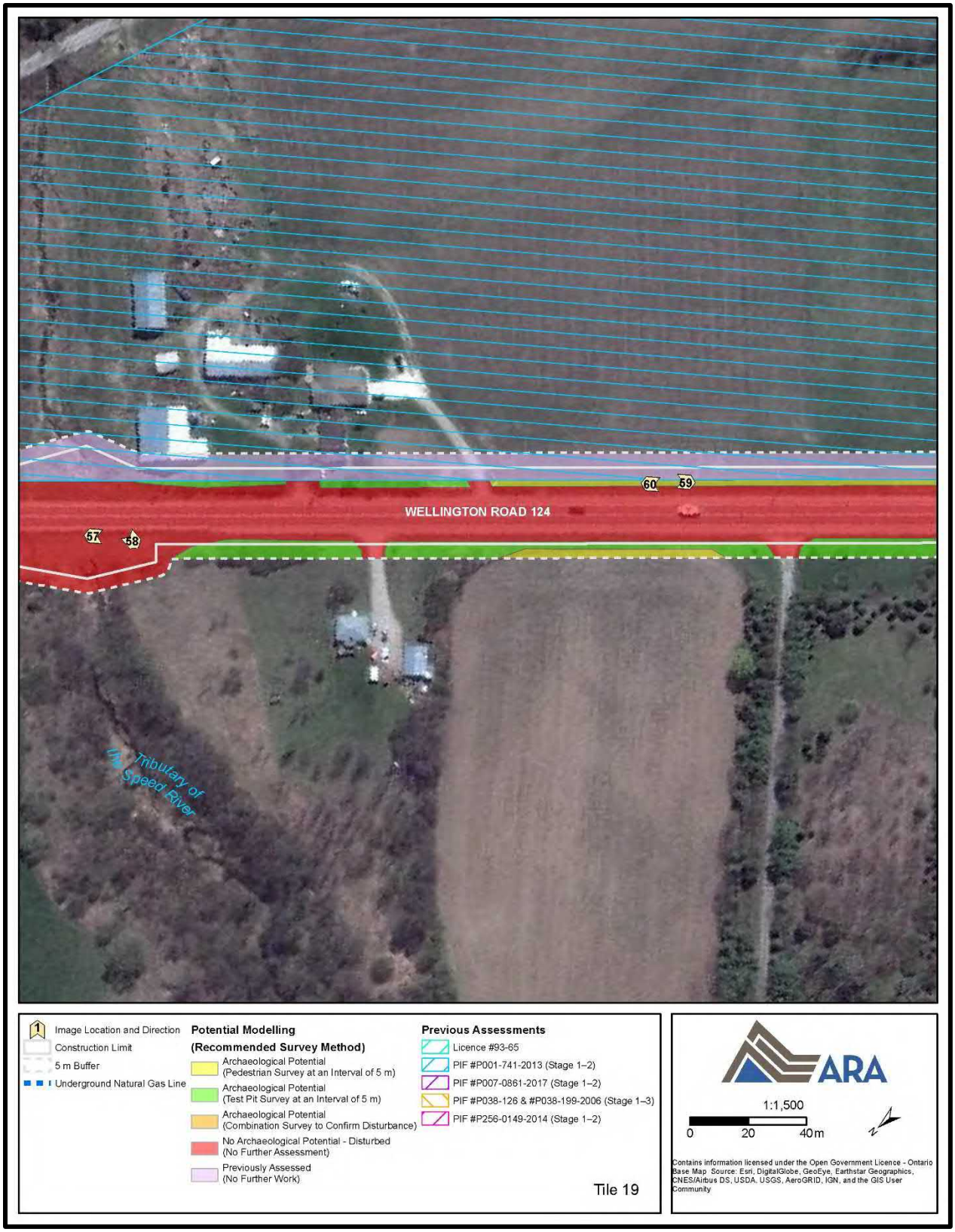


Map 24: Tile 16 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)

Map 25: Tile 17 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)

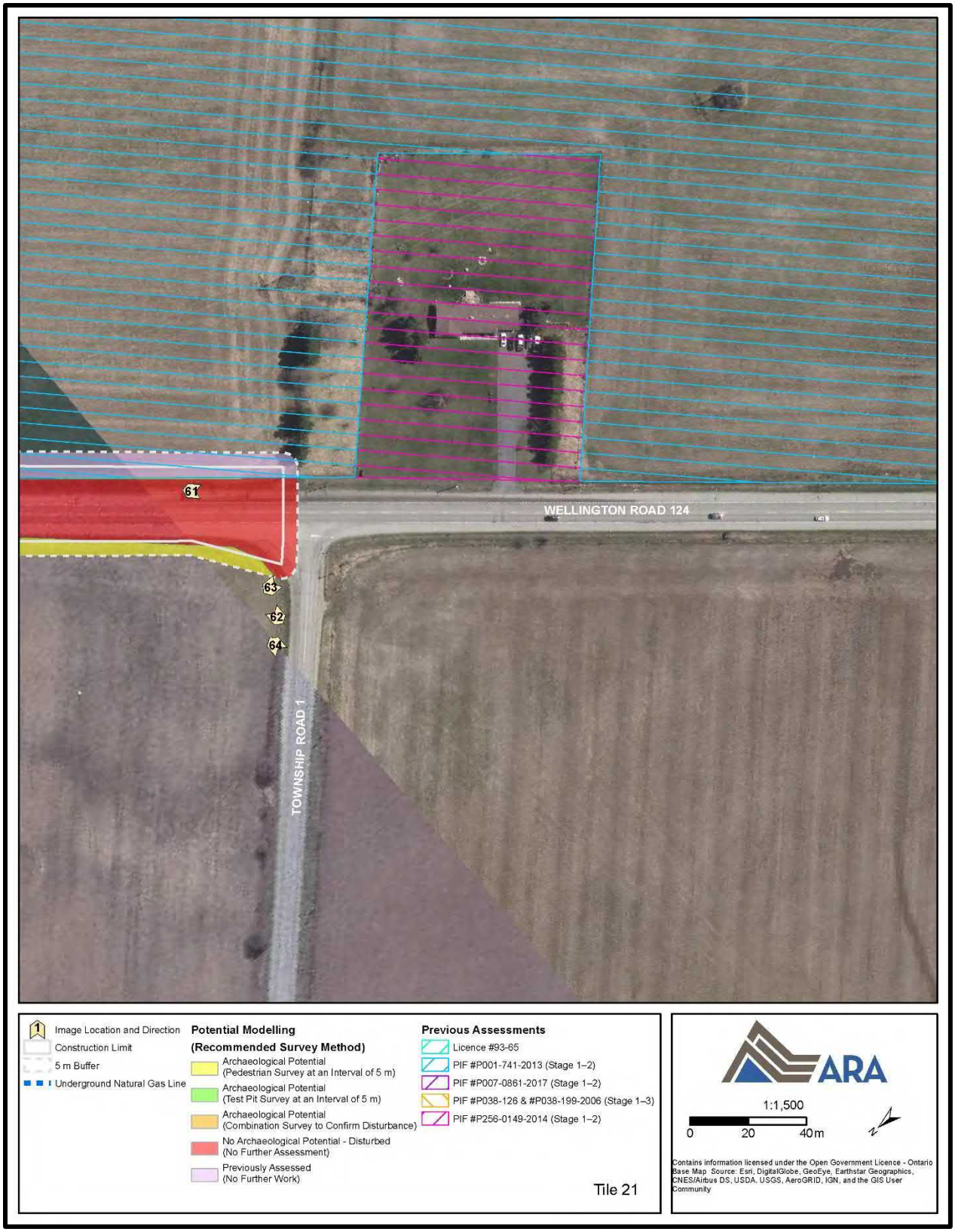


Map 26: Tile 18 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)



Map 27: Tile 19 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)

Map 28: Tile 20 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)



Map 29: Tile 21 – Assessment Results
(Produced under licence using ArcGIS® software by Esri, © Esri)

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APPENDIX B2

Record of Indigenous Engagement (Archaeological Research Associates Ltd, February 2019)

ARCHAEOLOGY | HERITAGE | OUTREACH | EDUCATION

13/02/2019

Archaeology Reports
Ministry of Tourism, Culture and Sport
Culture Programs Unit
Programs & Services Branch
401 Bay Street, Suite 1700
Toronto, ON M7A 0A7
Fax: (416) 314-7175

Record of Indigenous Engagement for original report entitled "Stage 1 Archaeological Assessment, Wellington Road 124 Improvements, Township Road 1 to Fife Road, Municipal Class Environmental Assessment, Township of Guelph/Eramosa, Part of Multiple Lots and Concessions, Geographic Township of Guelph, Wellington County, Ontario." PIF #P007-0916-2018.

The Haudenosaunee Development Institute (HDI) on behalf of the Haudenosaunee Confederacy Chiefs Council (HCCC), the Department of Consultation and Accommodation (DOCA) on behalf of the Mississaugas of the Credit First Nation (MCFN) and Six Nations Lands and Resources Department (L&R) on behalf of the Six Nations Elected Council (SNEC) were engaged at the outset of the Wellington Road 124 Improvements Project in Wellington County. In keeping with the requirements set out in Section 7.6.2 of the *Standards and Guidelines for Consultant Archaeologists*, a description of Archaeological Research Associates Ltd.'s (ARA's) involvement in the process of engagement appears below. The draft technical bulletin on *Engaging Aboriginal Communities in Archaeology* was consulted for guidance on reporting on the engagement process.

The initial engagement with the Haudenosaunee Confederacy Chiefs Council on behalf of the Haudenosaunee Development Institute, the Mississaugas of the New Credit First Nation and Six Nations of the Grand River was conducted for the overall all project by MTE Consultants Inc. with a Notice of Commencement of Study letter dated May 4, 2018. ARA's role in the engagement process began on May 29, 2018 with a PIF notification letter addressed to the archaeological coordinators at each First Nation (Appendix A). Subsequent to an inquiry to the planning consultant by MCFN requesting participation in the project, ARA followed up by providing a letter summarizing the work conducted to date, notified them that a draft report would be provided when available and asking how they would like to be involved in the Stage 1 background study (Appendix B). A summary of the major engagement events appears in Table 1.

Table 1: Summary of Engagement Events

Group	Date	Engagement Event	Nature
HCCC via HDI *Contact: Wayne Hill*	29-May-18	V. Cafik provided notification of ARA's PIF submission providing notification of the project and contact information for the proponent.	Email
MCFN via DOCA *Contact: Megan DeVries*	29-May-18	V. Cafik provided notification of ARA's PIF submission providing notification of the project and contact information for the proponent.	Email
	5-Jun-18	After MCFN contacted the proponent and requested to be involved in the assessment, V. Cafik provided a summary of the Site Visit including the date it took place and preliminary results. V. Cafik also asked MCFN how they wanted to participate in the Stage 1 assessment and added that the draft report would be provided for their review.	Email
	26-Jun-18	MCFN responded to note that they will require the Stage 1 archaeological report for review, as well as FLR participation in any required/upcoming Stage 2 fieldwork. They had no additional comments on the project from an archaeological perspective.	Email
	7-Dec-18	Circulated draft report for review.	Email
	12-Dec-18	M. DeVries confirmed that the MCFN was in agreement with the report as written and noted that the MCFN would require their FLRs on site for any Stage 2 fieldwork.	Email
SNEC via L&R *Contact: Dawn LaForme*	29-May-18	V. Cafik provided notification of ARA's PIF submission providing notification of the project and contact information for the proponent.	Email

Best regards,

Paul J. Racher, M.A., CAHP, Licence #P007
Principal – Management and Senior Review (MSR)
Archaeological Research Associates Ltd.
Tel: (519) 804-2291 ext. 100 | Cell: (519) 835-4427 | Fax: (519) 286-0493
pracher@arch-research.com

APPENDICES

Appendix A: PIF Notification Letter

ARCHAEOLOGY | HERITAGE | OUTREACH | EDUCATION

May 29, 2018

[ADDRESSEE]

RE: Notification of PIF Request for Stage 1 Archaeological Assessment of Wellington Road, Guelph - Eramosa

Dear,

Please accept this letter as notification of the Improvements to Wellington Road 124 between Guelph-Eramosa Township Road 1 and Fife Road. Archaeological Research Associates Ltd. is planning to carry out a Stage 1 assessment of lands with the potential to be impacted by the proposed project in the Township of Guelph-Eramosa. The assessment will be completed as a component of a Schedule "C" Class Environmental Assessment and was triggered by the requirements set out in the Environmental Assessment Act.

The project contact information is as below:

Dave Hallman, P. Eng
Consultant Project Manager
MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener ON, N2B 3X9
P: 519-743-6500 ext. 1336
E: dhallman@mte85.com

Mark Eby, P.Eng
Construction Manager
County of Wellington
74 Woolwich Street
Guelph ON, N1H 3T9
P: 519-837-2601 ext. 2270
E: marke@wellington.ca

Thank you,

Paul Racher, MA, CAHP, RPA (P007)
Archaeological Research Associates Ltd.

Appendix B: Summary of Work to Date and Invitation to Participate

ARCHAEOLOGY | HERITAGE | OUTREACH | EDUCATION

June 5, 2018

Megan DeVries, M.A.
Archaeological Coordinator
Department of Consultation and Accommodation (DOCA)
Mississaugas of the New Credit First Nation (MNCFN)
6 First Line Road, Unit 1, RR#6, Hagersville, ON N0A 1H0
P: 905-768-4260 | M: 289-527-2763

RE: Stage 1 Archaeological Assessment of Wellington County Road 124, Guelph-Eramosa

Dear Ms. DeVries,

Please accept this letter regarding the Improvements to Wellington Road 124 between Guelph-Eramosa Township Road 1 and Fife Road. The assessment will be completed as a component of a Schedule "C" Class Environmental Assessment and was triggered by the requirements set out in the Environmental Assessment Act. Archaeological Research Associates Ltd.(ARA) carried out a Stage 1 site visit on May 31, 2018 of lands with the potential to be impacted by the proposed project in the Township of Guelph/Eramosa.

Summary of Stage 1 Archaeological Assessment Results to Date

The Field Director that conducted the Stage 1 site visit determined that the study area comprises a mixture of areas of archaeological potential and areas of no archaeological potential. The associated mapping of these areas is currently being digitized. The digital mapping is due for completion on June 8, 2018 and report submission to the client is set for June 18, 2018. ARA is pleased to provide you with a copy of the report for your review. Can you advise ARA if there is any other way that MNCFN would like to participate in the Stage 1 assessment by contacting Victoria Cafik (vcafik@arch-research.com) to discuss?

We look forward to your response and working with you on this project.

Thank you,

Paul Racher, MA, CAHP, RPA
Principal - Management and Senior Review

APPENDIX C

Built Heritage and Cultural Heritage Landscape Assessment (Archaeological Research Associates Ltd, Aug. 2018)

ARCHAEOLOGY | HERITAGE | OUTREACH | EDUCATION

Built Heritage and Cultural Landscape Assessment
Wellington Road 124 Improvement
Township Road 1 to Fife Road
Class Environmental Assessment
Township of Guelph/Eramosa
Part of Multiple Lots and Concessions
Geographic Township of Guelph
County of Wellington, Ontario

Prepared for
MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener, ON N2B 3X9
Tel: (519) 743-6500 x1347

By
Archaeological Research Associates Ltd.
219-900 Guelph Street
Kitchener, ON N2H 5Z6
Tel: (519) 804-2291 Fax: (519) 286-0493
www.arch-research.com

HR-131-2018
ARA File #2018-0097

23/08/2018

Original Report

EXECUTIVE SUMMARY

Under a contract initiated in April 2018, Archaeological Research Associates Ltd. (ARA) was retained by MTE Consultants Inc. to complete a Built Heritage and Cultural Heritage Landscape Assessment of structures and landscapes with the potential to be impacted by the proposed improvements to Wellington County Road 124 between Guelph Eramosa Township Road 1 and Fife Road located in Guelph Eramosa Township, County of Wellington.

According to the Notice of Study Commencement, "Wellington County Road 124 has experienced growing congestion between Guelph Eramosa Township Road 1 and Fife Road. The County is therefore considering improvements to County Road 124 to address the congestion, road safety, intersection improvements and drainage." This project is being undertaken as part of a Schedule 'C' Municipal Class Environmental Assessment (EA).

The study area consists of approximately 5.73 km along County Road 124 within the existing road allowance, with the exception of two roundabouts requiring some additional lands, between Township Road 1 and Fife Road in the Geographic Township of Guelph, former Wellington County.

The approach for the Built Heritage and Cultural Heritage Landscape Assessment has specific tasks required for the EA process, and they include:

- Background research concerning the project context and historical context of the study areas;
- Consultation with the Township of Guelph/Eramosa and the Wellington County planners responsible for heritage matters;
- Identification of any designated or recognized properties within the limits of the study areas;
- On-site inspection and creation of an inventory of all properties with potential Built Heritage Resources (BHR) and Cultural Heritage Landscapes (CHL) within, adjacent and in proximity to the project areas;
- A description of the location and nature of potential cultural heritage resources;
- Evaluation of each potential cultural heritage resource against the criteria set out in Ontario Regulation 9/06, and 10/06, where applicable, for determining cultural heritage value or interest (CHVI);
- Evaluation of potential project impacts; and
- Provision of suggested strategies for the future conservation of identified cultural heritage resources.

A windshield survey of the study area was conducted, and all potential cultural heritage resources noted were evaluated against the criteria of Ontario Regulation 9/06. Of those, the following were identified within the study area as having potential cultural heritage value or interest (CHVI): 5050 Whitelaw Road (BHR 1), 6902 County Road 124 (BHR 2), 6920 County Road 124 (BHR 3), 6939 County Road 124 (BHR 4), 6974 County Road 124 (BHR 5), and 7144 County Road 124 (BHR 6). Three CHLs were identified in the study area:

7189 & 7263 County Road 124 (CHL 1), Speed River (CHL 2), and the G&GR Railway (CHL 3).

Preliminary potential impacts to the properties within the study area were evaluated for possible project impacts. The following conservation/mitigation strategies are suggested based on the results of this Built Heritage and Cultural Heritage Landscape Assessment:

- That during the planning and design phases, cultural heritage resources be avoided where possible and any construction staging areas be located on lands located well away from any of the candidate BHRs and CHLs;
- That during the design phases, the removal of mature trees on BHRs 1, 2, 3 and 6 should be avoided where possible. For any trees that cannot be saved during construction, replacement with similar trees should be examined;
- That the historic at-grade crossing of the G&GR Railway (CHL 3) be maintained during the detailed design phase and that the railway crossing be returned to its pre-construction condition;
- That if a roundabout is planned at Whitelaw Road, a Cultural Heritage Evaluation Report should be undertaken to fully examine and evaluate the CHVI of BHR 1 and CHL 1. If the properties are found to be worthy of conservation, a Heritage Impact Assessment should be undertaken to examine mitigation options consistent with the identified CHVI of the properties and local heritage policies (i.e., alternate design, relocation of the building, etc.);
- That consideration should be given to the type of construction techniques and machinery used in close proximity to cultural heritage resources (BHRs 1 and 4) to minimize any vibration impacts;
- That once a preferred alternative has been selected and design work has begun, a Heritage Impact Assessment report should be undertaken to confirm the anticipated impacts outlined in this report, evaluate any additional impact of the proposed design, as well as outline avoidance/mitigation measures to minimize the impact. The HIA may outline mitigation measures including additional landscaping that may be required to minimize visual impacts or design approaches may be suggested. Mitigation measures may be discussed with Planners at the County and the Township;
- That public consultation may result in additional potential cultural heritage resources being identified. These potential cultural heritage resources should be reviewed by a qualified heritage consultant to: 1) determine their CHVI, 2) evaluate potential project impacts, and 3) suggest strategies for future conservation of any candidate cultural heritage resources;
- That previously-unrecognized cultural heritage resources with CHVI discussed in this assessment *may* be worthy of inclusion on a Municipal Heritage Register; and
- That this Built Heritage and Cultural Heritage Landscape Assessment should be provided to staff/planners at the Township of Guelph/Eramosa and County of Wellington.

The EA process includes preliminary studies, an examination of alternatives, and the selection of a preferred alternative prior to the development of preliminary and detailed designs. Impacts to cultural heritage resources should be considered during all phases of the EA process. Further,

these preliminary mitigation recommendations are subject to review and confirmation during the detailed design phase, in consideration of the more through understanding of design and project constraints.

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GLOSSARY OF ABBREVIATIONS

ARA – Archaeological Research Associates Ltd.
BHR – Built Heritage Resource
CHER – Cultural Heritage Evaluation Report
CHVI – Cultural Heritage Value or Interest
CHL – Cultural Heritage Landscape
EA – Environmental Assessment
MCL – (Former) Ministry of Culture
MTC – (Former) Ministry of Tourism and Culture
MTCS – Ministry of Tourism, Culture and Sport
OHT – Ontario Heritage Trust
O. Reg. – Ontario Regulation
PPS – Provincial Policy Statement

PERSONNEL

Project Director: P.J. Racher, M.A. CAHP
Project Manager: K. Jonas Galvin M.A, CAHP
Site Visit: L. Benjamin, M.A.E.S., CAHP and P. Young, M.A., CAHP
Historical Research: S. Clarke. B.A.
Photography: L. Benjamin and P. Young
Cartographer: K. Brightwell (GIS)
Technical Writers: L. Benjamin, K. Jonas Galvin and P. Young

1.0 PROJECT CONTEXT

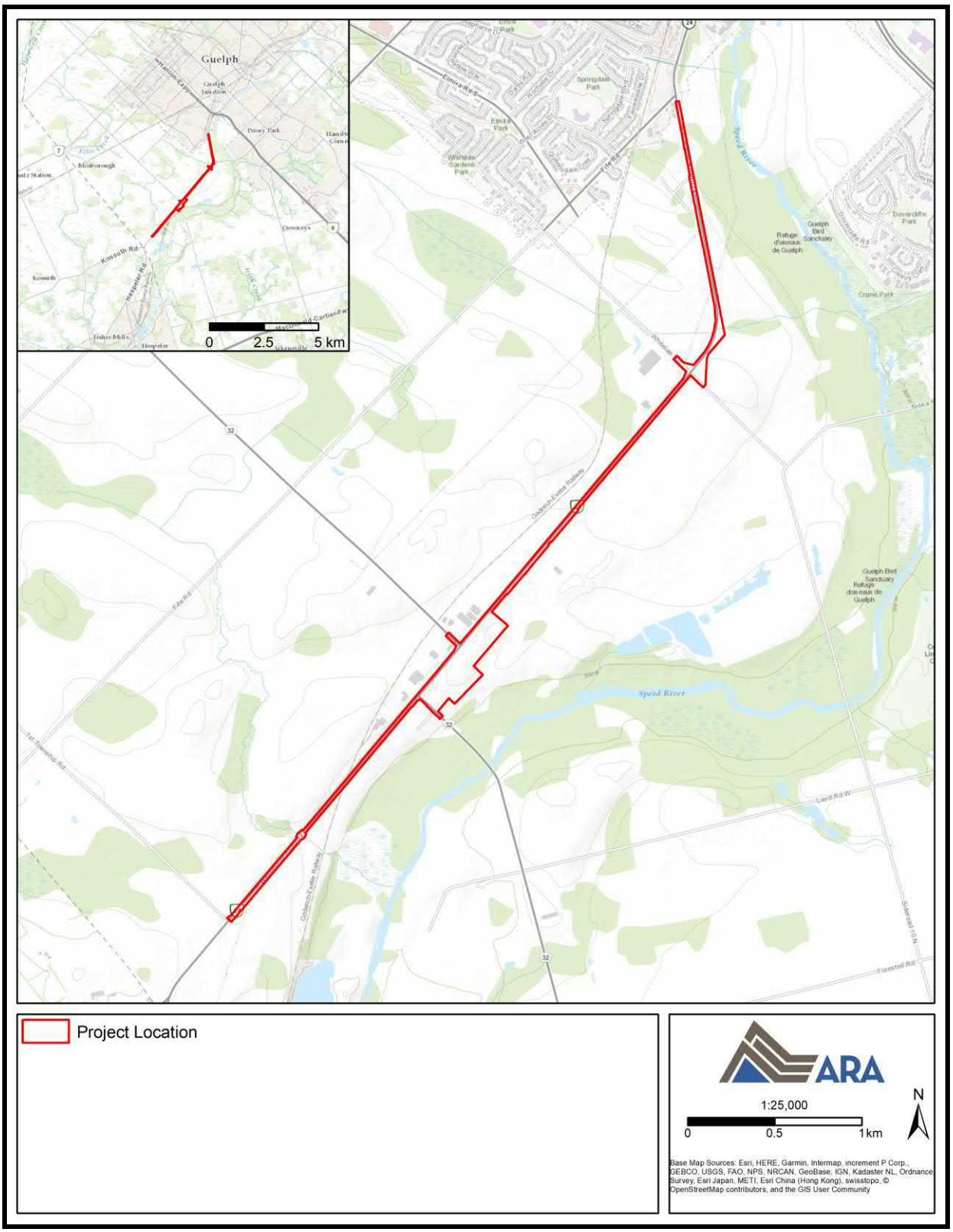
Under a contract initiated in April 2018, Archaeological Research Associates Ltd. (ARA) was retained by MTE Consultants Inc. to complete a Built Heritage and Cultural Heritage Landscape Assessment of structures and landscapes with the potential to be impacted by the proposed improvements to Wellington County Road 124 between Guelph Eramosa Township Road 1 and Fife Road located in the Township of Guelph Eramosa, County of Wellington.

According to the Notice of Study Commencement, "Wellington County Road 124 has experienced growing congestion between Guelph Eramosa Township Road 1 and Fife Road. The County is therefore considering improvements to County Road 124 to address the congestion, road safety, intersection improvements and drainage." This project is being undertaken as part of a Schedule 'C' Municipal Class Environmental Assessment (EA).

The project location consists of approximately 5.73 km along County Road 124 within the existing road allowance, with the exception of two roundabouts requiring some additional lands between Township Road 1 and Fife Road in the Township of Guelph/Eramosa. The project location comprises parts of Lots 2, Concession 1–4 Division B, Lots A–G, Division E and Lots 1–16, Division B South of Waterloo Road in the Geographic Township of Guelph, Wellington County (see Map 1).

The purpose of this assessment is to identify and evaluate the cultural heritage resources within the study area that may be impacted by the Municipal Class EA that is being conducted in relation to the improvements to Wellington County Road 124. This assessment was conducted in accordance with the aims of the *Environmental Assessment Act*, R.S.O. 1990, *Provincial Policy Statement* (2014), *Ontario Heritage Act*, R.S.O. 1990, c. O.18, and *County of Wellington Official Plan* (2017).

All notes, photographs and records pertaining to the heritage assessment are currently housed in ARA's processing facility located at 1480 Sandhill Drive – Unit 3, Ancaster, Ontario. Subsequent long-term storage will occur at the same location.



Map 1: Project Location in the Township of Guelph/Eramosa
(Produced by ARA under licence using ArcGIS® software by Esri, © Esri)

2.0 METHOD

The framework for this assessment report is provided by provincial environmental and planning legislation and policies as well as the regional Official Plan and guidelines. Within the *Environmental Assessment* (EA) *Act*, the environment is described as *"any building, structure, machine or other device or thing made by humans."* An Environmental Assessment is a study that evaluates both the potential positive and/or negative effects of a project on the environment. This study is conducted as part of a streamlined self-assessment EA process called a Class EA that applies to routine projects grouped into classes for the Municipal Class EA (MCEA). The classes range from A (minor undertakings) to C (construction of new large facilities). The Municipal Class EA applies to municipal infrastructure undertakings including roads, water and wastewater projects.

The *PPS* 2014 promotes the conservation of cultural heritage resources through polices in Section 2.6, such as policy 2.6.1 that states: "Significant built heritage resources and significant cultural heritage landscapes shall be conserved" (2014:29).

With respect to cultural heritage, the *County of Wellington Official Plan* states that: "Wellington County Council commits itself to ensuring that existing and future residents have access to an adequate supply and variety of: …cultural facilities and that the people of the County enjoy cultural heritage…" (2017:1). In terms of decision-making concerning land use, the OP states that: "Wellington County will promote land use decisions which provide an economically strong, healthy and socially responsible community and which protect our natural and cultural heritage for this and future generations" (2017:3). And section 4.1 of the *Official Plan* contains policies that address cultural heritage resources, with many specifically discussing the conservation of heritage.

The Township of Guelph/Eramosa does not have an Official Plan, so the *County of Wellington Official Plan* is used to guide long range planning for the Township.

Through careful analysis of the heritage values and attributes of an identified resource, coupled with an analysis of project impacts and an outline of potential mitigation measures, the aims of the *Environmental Assessment Act* and the *Official Plan* can be met.

2.1 Key Concepts

The following concepts require clear definition in advance of the methodological overview; proper understanding is fundamental for any discussion pertaining to cultural heritage resources:

- **Cultural Heritage Value or Interest** (CHVI), also referred to as Heritage Value, is identified if a property meets one of the criteria outlined in O. Reg. 9/06, namely historic or associate value, design or physical value and/or contextual value. Provincial significance is defined under *O. Reg*. 10/06 of the *Ontario Heritage Act* (*OHA*).

- **Built Heritage Resource** (BHR) is defined in the *PPS* as: "a building, structure, monument, installation or any manufactured remnant that contributes to a property's

cultural heritage value or interest as identified by a community, including an Aboriginal community. Built heritage resources are generally located on property that has been designated under Parts IV or V of the *OHA*, or included on local, provincial and/or federal registers" (MMAH 2014:39).

- **Cultural Heritage Landscape** (CHL) is defined in the *PPS* as: "a defined geographical area that may have been modified by human activity and is identified as having cultural heritage value or interest by a community, including an Aboriginal community. The area may involve features such as structures, spaces, archaeological sites or natural elements that are valued together for their interrelationship, meaning or association. Examples may include, but are not limited to, heritage conservation districts designated under the *Ontario Heritage Act*; villages, parks, gardens, battlefields, mainstreets and neighbourhoods, cemeteries, trailways, viewsheds, natural areas and industrial complexes of heritage significance; and areas recognized by federal or international designation authorities (i.e., a National Historic Site or District designation, or a UNESCO World Heritage Site)" (MMAH 2014:40).

  It is recognized that the heritage value of a CHL is often derived from its association with historical themes that characterize the development of human settlement in an area (Scheinman 2006). In Ontario, typical themes that may carry heritage value within a community include, but are not limited to: 1) Pre-Contact habitation, 2) early European exploration, 3) early European and First Nations contacts, 4) pioneer settlement, 5) development of transportation networks, agriculture and rural life, 6) early industry and commerce, and/or 7) urban development. Individual CHLs may be related to a number of these themes simultaneously.

  The *Operational Guidelines for the Implementation of the World Heritage Convention* defines several types of CHLs: 1) designed and created intentionally by man, 2) organically evolved landscapes that fall into two-subcategories (relic/fossil or continuing), and 3) associative cultural landscapes (UNESCO 2008:86). The (former) Ministry of Culture (MCL) *Information Sheet #2 Cultural Heritage Landscapes* (MCL 2006c) repeats these definitions to describe landscapes in Ontario.

- **Conserved** means "the identification, protection, management and use of built heritage resources, cultural heritage landscapes and archaeological resources in a manner that ensures their cultural heritage value or interest is retained under the *Ontario Heritage Act*. This may be achieved by the implementation of recommendations set out in a conservation plan, archaeological assessment, and/or heritage impact assessment. Mitigative measures and/or alternative development approaches can be included in these plans and assessments" (MMAH 2014:40).

- **Heritage Attributes** are defined in the *Ontario Heritage Act* as: "the principal features or elements that contribute to a protected heritage property's cultural heritage value or interest, and may include the property's built or manufactured elements, as well as natural landforms, vegetation, water features, and its visual setting (including significant views or vistas to or from a protected heritage property means, in relation to real property, and

to the buildings and structures on the real property, the attributes of the property, buildings and structures that contribute to their cultural heritage value or interest" (Government of Ontario 2009).

- **Protected Heritage Property** signifies "property designated under Parts IV, V or VI of the *Ontario Heritage Act*; property subject to a heritage conservation easement under Parts II or IV of the *Ontario Heritage Act*; property identified by the Province and prescribed public bodies as provincial heritage property under the Standards and Guidelines for Conservation of Provincial Heritage Properties; property protected under federal legislation, and UNESCO World Heritage Sites" (MMAH 2014:47).

- **Significant** in reference to cultural heritage is defined as: "resources that have been determined to have cultural heritage value or interest for the important contribution they make to our understanding of the history of a place, an event, or a people" (MMAH 2014:49).

Many of these definitions are similar to those found in the *County of Wellington Official Plan* (2017).

2.2 Types of Recognition

BHRs and CHLs are broadly referred to as cultural heritage resources. A variety of types of recognition exist to commemorate and/or protect cultural heritage resources in Ontario.

The National Historic Sites program commemorates important sites, people or events that had a nationally significant effect on, or illustrate a nationally important aspect of, the history of Canada. The Minister of Canadian Heritage, on the advice of the Historic Sites and Monuments Board of Canada (HSMBC), makes recommendations to the program. Another form of recognition at the federal level is the Canadian Heritage Rivers System program. It is a federal program to recognize and conserve rivers with outstanding natural, cultural and recreational heritage. It is important to note that neither of these federal commemoration programs offer protection from alteration or destruction.

The Ontario Heritage Trust (OHT) operates the Provincial Plaque Program, which has over 1,250 provincial plaques recognizing key people, places and events that have shaped the province (OHT 2018). Additionally, properties owned by the province may be recognized as a "provincial heritage property" (MTCS 2010). A cultural heritage resource may also be protected through an OHT or municipal easement. In addition, many municipal heritage committees and historical societies provide plaques for local places of interest.

Under *Section 27* of the *OHA*, a municipality must keep a Municipal Heritage Register. A Register lists designated properties (those protected by municipal by-law as Part IV (individual properties) or Part V (Heritage Conservation Districts) designations under the *OHA*, as well as other properties of cultural heritage value or interest in the municipality. Properties on this Register that are not formally designated are commonly referred to as "listed." Listed properties

are flagged for planning purposes and are afforded a 60-day delay in demolition, if a demolition request is received by the municipality.

2.3 Approach

The *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments* indicates a need to describe the "affected environment," which is defined as "a spatially defined area within which land will be altered as a result of the proponent's development" (MCL 1992:3). As such, ARA completes in-depth research and an evaluation of any potential cultural heritage resource within the project area. ARA's business practice also considers a larger study area that considers abutting properties. This ensures that every BHR and CHL that may be subject to potential indirect project impacts are identified.

A combination of background research, consultation with the local community and field survey is essential to identify and effectively evaluate properties with potential BHRs and CHLs in a meaningful and objective format. Properties identified as potential BHRs and CHLs through the above-mentioned research, consultation and survey may be considered candidate cultural heritage resources once they have been evaluated against the regulations under the *Ontario Heritage Act* (i.e., O. Reg. 9/06 and O. Reg. 10/06). See Section 2.4 Evaluation of Significance below for a discussion of the OHA Regulations.

2.3.1 Historical Research

Background information is obtained from aerial photographs, historical maps (i.e., illustrated atlases), archival sources (i.e., historical publications and records), published secondary sources (online and print) and local historical organizations.

2.3.2 Consultation

Consultation with the local community is essential for determining the community value of cultural heritage resources. At project commencement, ARA contacts the relevant local and regional municipalities to inquire about: 1) protected properties in the study area, 2) properties with other types of recognition in the study area, 3) previous studies relevant to the current study, and 4) other heritage concerns regarding the study area or project area. Where possible, information is also sought directly from the MTCS and OHT.

2.3.3 Field Survey

The field survey component of an assessment involves the collection of primary data through systematic photographic documentation of all potential cultural heritage resources within the study area, as identified through historical research and consultation. Generally, potential cultural heritage resources are identified by applying a 40-year rolling timeline. This timeline is considered an industry best practice (i.e., MTO 2008). A construction date of 40 years does not, however, automatically attribute CHVI to a resource; rather it indicates that it should be flagged as a potential resource and evaluated for CHVI.

Additional cultural heritage resources may also be identified during the survey itself (candidate cultural heritage resources). Photographs capturing all properties with potential BHRs and CHLs are taken, as are general views of the surrounding landscape. The field survey also assists in confirming the location of each potential cultural heritage resource and helps to determine the relationship between resources. Given that such surveys are limited to areas of public access (i.e., roadways, intersections, non-private lands, etc.), there is always the possibility that obscured cultural heritage resources may be missed or that heritage attributes may be refined upon closer inspection.

2.4 Evaluation of Significance

2.4.1 Heritage Value

In order to objectively identify cultural heritage resources, O. Reg. 9/06 made under the *OHA* sets out three principal criteria with nine sub-criteria, which are municipal criteria, for determining CHVI (MCL 2006a:20-27). The criteria set out in the regulation were developed to identify and evaluate properties for municipal designation under the *OHA*. Best practices in evaluating properties that are not yet protected employ O. Reg. 9/06 to determine if they have CHVI. These criteria include: design or physical value, historical or associative value, and contextual value.

Design or Physical Value manifests when a feature:

- is a rare, unique, representative or early example of a style, type, expression, material or construction method;
- displays a high degree of craftsmanship or artistic value; or
- displays a high degree of technical or scientific achievement.

Historical or Associative Value appears when a resource:

- has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to the community;
- yields or has the potential to yield information that contributes to the understanding of a community or culture; or
- demonstrates or reflects work or ideas of an architect, builder, artist, designer or theorist who is significant to the community.

Contextual Value is implied when a feature:

- is important in defining, maintaining or supporting the character of an area;
- is physically, functionally, visually or historically linked to its surroundings; or
- is a landmark.

If a potential cultural heritage resource property (BHR or CHL) identified during this study is found to have the potential to meet any one of these criteria, it may then be considered a candidate cultural heritage resource. A candidate cultural heritage resource meeting the above

criteria may be added to a Municipal Heritage Register as a property with CHVI that is either designated by municipal by-law or as a "listed" property (see Section 2.2 Types of Recognition). Additional work outside the scope of this report (i.e., Cultural Heritage Evaluation Report (CHER) or Heritage Impact Assessment (HIA) may be necessary to fully examine and evaluate a resources' CHVI.

2.4.2 Provincial Significance

Issued under the *OHA*, O. Reg. 10/06 outlines the criteria to determine if a property is of provincial significance. To be considered a "heritage property of provincial significance" a site must meet one or more of the following criteria:

- The property represents or demonstrates a theme or pattern in Ontario's history;
- The property yields, or has the potential to yield, information that contributes to an understanding of Ontario's history;
- The property demonstrates an uncommon, rare or unique aspect of Ontario's cultural heritage;
- The property is of aesthetic, visual or contextual importance to the province;
- The property demonstrates a high degree of excellence or creative, technical or scientific achievement at a provincial level in a given period;
- The property has a strong or special association with the entire province or with a community that is found in more than one part of the province. The association exists for historic, social, or cultural reasons or because of traditional use;
- The property has a strong or special association with the life or work of a person, group or organization of importance to the province or with an event of importance to the province; or
- The property is located in unorganized territory and the Minister determines that there is a provincial interest in the protection of the property. O. Reg. 10/06, s. 1 (2).

The determination that a property warrants evaluation against O. Reg. 10/06 is based on background research, consultation with the local community, field survey and the extensive experience of ARA staff.

2.5 Evaluation of Impacts

Any potential project impacts on identified BHRs or CHLs must be evaluated, including direct and indirect impacts. *InfoSheet #5: Heritage Impact Assessments and Conservation Plans* (2006b:3) provides an overview of several major types of negative impacts, including but not limited to:

- Destruction of any, or part of any, significant heritage attributes;
- Alteration that is not sympathetic, or is incompatible, with the historic fabric and appearance;
- Shadows created that alter the appearance of a heritage attribute or change the viability of a natural feature or plantings, such as a garden;

- Isolation of a heritage attribute from its surrounding environment, context or significant relationship;
- Direct or indirect obstruction of significant views or vistas within, from, or of built and natural features;
- A change in land use such as rezoning a battlefield from open space to residential use, allowing new development or site alteration to fill in the formerly open spaces; and
- Land disturbances such as a change in grade that alters soils, and drainage patterns that adversely affect an archaeological resource.

The above direct and indirect impacts are primarily negative impacts but there may also be positive effects as a result of an EA project. For example, more recent infrastructure may be removed to restore the original views to cultural heritage resources.

2.6 Mitigation Strategies

If potential impacts on identified heritage resources are determined, proposed conservation or mitigative/avoidance measures must be recommended.

The Ministry of Culture's *InfoSheet #5: Heritage Impact Assessments and Conservation Plans* (2006b:3) lists several specific methods of minimizing or avoiding a negative impact on a cultural heritage resource, including but not limited to:

- Alternative development approaches;
- Isolating development and site alteration from significant built and natural features and vistas;
- Design guidelines that harmonize mass, setback, setting, and materials;
- Limiting height and density;
- Allowing only compatible infill and additions;
- Reversible alterations; and
- Buffer zones, site plan control, and other planning mechanisms.

Strategies also may be developed to enhance positive environmental effects as a result of an EA undertaking.

2.7 Summary of Approach

The approach outlined herein is supported by the best practices, guidelines and policies of the following:

- The *Provincial Policy Statement* (2014);
- The *Ontario Heritage Act* (R.S.O. 1990);
- *Environmental Assessment Act* (R.S.O. 1990);
- *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments* (MCL 1992);
- The *Ontario Heritage Tool Kit* series (MCL 2006a) and

- *County of Wellington Official Plan* (2017).

The Built Heritage and Cultural Landscape Assessment Wellington County Road 124 Class EA was directed by P.J. Racher, M.A., CAHP. It was managed by K. Jonas Galvin, M.A, CHAP. The heritage evaluations were conducted by K. Jonas Galvin and L. Benjamin, M.A.E.S., CAHP. The field survey was completed by L. Benjamin and P. Young, M.A., CHAP and the historic research was completed by S. Clarke, B.A. Two-page Curriculum Vitae for key personnel can be found in Appendix B.

3.0 HISTORICAL CONTEXT

Wellington County has a long history of settlement including Pre-Contact and Post-Contact Indigenous campsites and villages. However, the cultural heritage resources located within the study area are tied to the history of the initial settlement and growth of Euro-Canadian populations in the County and Township. Accordingly, this historical context section spans the early Euro-Canadian settlement history through to the present. The early history of the study areas can be effectively discussed in terms of major historical events. The principal characteristics associated with these events are summarized in Table 1 below.

Table 1: Post-Contact Settlement History
(Smith 1846; Coyne 1895; Lajeunesse 1960; Cumming 1972; Ellis and Ferris 1990; Surtees 1994; AO 2015)

Historical Event	Timeframe	Characteristics
Early Contact	Early 17th century	Brûlé explores southern Ontario in 1610; Champlain travels through in 1613 and 1615/1616, encountering a variety of Indigenous groups (including both Iroquoian-speakers and Algonkian-speakers); European goods begin to replace traditional tools
	Mid- to late 17th century	Conflicts between various First Nations during the Beaver Wars result in numerous population shifts; European explorers continue to document the area, and many Indigenous groups trade directly with the French and English; 'The Great Peace of Montreal' treaty established between roughly 39 different First Nations and New France in 1701
Fur Trade Development	Early to mid-18th century	Growth and spread of the fur trade; Peace between the French and English with the Treaty of Utrecht in 1713; Ethnogenesis of the Métis; Hostilities between French and British lead to the Seven Years' War in 1754; French surrender in 1760
British Control	Mid-18th century	*Royal Proclamation* of 1763 recognizes the title of the First Nations to the land; Numerous treaties arranged by the Crown; First acquisition is the Seneca surrender of the west side of the Niagara River in August 1764
Loyalist Influx	Late 18th century	United Empire Loyalist influx after the American Revolutionary War (1775–1783); British develop interior communication routes and acquire additional lands; 'Between the Lakes Purchase' orchestrated by Haldimand in 1784 to obtain lands for Six Nations; *Constitutional Act* of 1791 creates Upper and Lower Canada
County Development	Late 18th to early 19th century	Became part of York County's 'West Riding' in 1792; Additional lands acquired in the second 'Between the Lakes Purchase' in 1792; Additional lands obtained in the 'Lake Simcoe-Nottawasaga Purchase' and 'Ajetance Purchase' in 1818, the 'Huron Tract Purchase' in 1827 and the 'Bond Head-Saugeen Treaty' in 1836; Wellington District and Waterloo County created in 1840; Wellington County created after the abolition of the district system in 1849
Township Formation	Early 19th century	Guelph was initially patented in a block to the 'Canada Company' in 1829; The first settlers arrived prior to the patent date, and included the Rifes, Hinds and Ryans in 1825 and a group of Scottish settlers in 1827; The 'Broad Road' (Waterloo Road) was begun by Absalom Shade in 1825 and was completed by the founding of Guelph in 1827; The township was fully surveyed by John McDonald in 1830 and comprised Divisions A–G; Many additional settlers arrived between 1829 and 1832
Township Development	Mid-19th to early 20th century	Guelph was one of the best settled townships in Ontario, with a population of 3,400 in 1845; The majority of settlers came from well-established and wealthy English families in Suffolk and Norfolk; 9,904 ha taken up by 1846, with 5,196 ha under cultivation; 3 grist mills and 2 saw mills in operation at that time; Traversed by the Grand Trunk Railway (1856), the Galt & Guelph Railway (1857), the Wellington, Grey & Bruce Railway (1870) and the Guelph Junction Railway (1888); The principal community was the Town/City of Guelph

3.1 The City of Guelph

The principle settlement in the Township of Guelph was the Town (later City) of Guelph itself, which was the District Seat of Wellington County. Guelph was founded on St. George's Day, April 23, 1827 by Scottish novelist and Canada Company man John Galt, an occasion marked by the ceremonial felling of a large maple tree. Galt remarked, "to me at least the moment was impressive – and the silence of the wood that echoed to the sound was as the sign of the solemn genius of the wilderness departing forever" (Historical Atlas Publishing Co. 1906:3). The town he established ranks amongst the first planned settlements in Upper Canada. In fact, Galt designed the town to appeal to and attract early settlers, with a series of streets radiating from one focal point in a manner similar to European city centres, complete with squares, broad main streets and narrow side streets. The name 'Guelph' stemmed from one of the ancestral family names of King George IV, and the 'Royal City' was born (City of Guelph 2010).

James McDonald surveyed the site, using the stump of the historic tree as a benchmark, and the town streets were laid out "like the ribs of a lady's fan" (Historical Atlas Publishing Co. 1906:3). The first months were spent erecting log houses in different parts of town and clearing the land, with the largest clearings opening up at Market Square and eastward on Waterloo Street as far as Gordon Street. A grand opening celebration took place on August 13th, and a market-house was erected and used for the festivities. Roughly 500 people attended, and ox, potatoes, bread, tea and whiskey were communally consumed. The first stone structures followed, with the founding of a bank and a school house. A store was erected late in 1827, and a saw mill was established by 1830. The Canada Company printed the following 'Instructions to Emigrants' in 1830:

> A town called Guelph has been built in a central situation on one of the most considerable of these blocks in the Gore District, and roads have been opened to the townships around; and one main road is now in operation from Guelph to Dundas, 24 miles, which latter place will become the depot for all grain raised in the back townships, fetching, with the mere difference of carriage, as high a price there as at Flamborough, which is 20 miles distant from Guelph, as at York, where it is shipped for the Montreal market. Upwards of 200 houses are now built; a first-rate stone grist mill will be in operation in January, 1831; there are several taverns where board and lodging may be procured on moderate terms; and tradesmen of most descriptions are among its inhabitants, which amount to about 800 (Historical Atlas Publishing Co. 1906:3-4).

Unfortunately for the Galt and the Canada Company, Guelph did not grow as rapidly as initially expected, but a substantial community did develop. Smith describes the settlement as being "in the midst of a finely undulating country ... high, dry and healthy" (1846:72). As District Seat, Guelph also had a jail and court house, both of which were stone built but situated somewhat outside of the heart of the settlement. Numerous government and District offices were also located here, including the Judge of the District Court, Sheriff, Clerk of Peace, Treasurer, Inspector of Licenses, District Clerk, Clerk of District Court and the Deputy Clerk of Crown (Smith 1846:72).

By the mid-19th century, three local newspapers were in circulation, including the 'Guelph and Galt Advertiser,' the 'Guelph Herald' and the 'Guelph Mercury.' Stages ran daily to Preston and

Galt, and the town had a population of some 1,240 (mainly English and Scottish with some Irish). At that time Guelph boasted some seven taverns (the British Hotel, Farmer's Arms and Ratcliffe's being the most prominent), five churches, four physicians, three grist mills, one saw mill, three tanneries, fifteen stores, six blacksmiths, six wagon makers, eight cabinet makers, ten tailors, thirteen shoemakers, two undertakers, two schools and two banks, plus dozens of other professions both large and small (Smith 1846:72).

In 1851, Guelph received a village charter, and on January 30, 1852 the first train arrived in Guelph from Toronto, ushering in an era of growth and prosperity. Significant developments then took place, and some of the town's most prominent buildings were erected, designed by both Toronto-based and local architects (City of Guelph 2010). In 1856, Guelph was incorporated into a town, and populations subsequently soared to nearly 5,000 in 1865, over 6,000 in 1870 and over 8,000 in 1875. In 1879, the Town was incorporated into a City with a population of 10,000. At the turn of the 20th century the City of Guelph boasted some 12,000 inhabitants, and it was a prosperous manufacturing and commercial centre and a key distribution point for trade (Historical Atlas Publishing Co. 1906:4).

3.2 Study Area

In an attempt to reconstruct the historic land uses of the project areas and study areas, ARA examined two historical maps that documented past residents, structures (i.e., homes, businesses and public buildings) and features between the mid-19th and early 20th centuries, and one aerial image from the mid-20th century. Specifically, the resources outlined in Table 2 were consulted.

Table 2: Historic Maps and Aerials Consulted

Year	Map Title	Reference
1861	Map of the County of Wellington, Canada West	Leslie & Wheelock
1877	Topographical and Historical Atlas of the County of Wellington, Ont.	McGill University
1916	Galt Sheet No. 56 [040P08]	
1935	Guelph, Ontario [040P08]	
1954	Aerial Photo	U of T

During Pre-Contact and Early Contact times, the vicinity of the study area, the entirety of which is located within the Geographic Township of Guelph, would have comprised a mixture of coniferous trees, deciduous trees and open areas. Indigenous communities would have managed the landscape to some degree. During the early 19th century, Euro-Canadian settlers arrived in the area and began to clear the forests for agricultural and settlement purposes. The vicinity of the study area was well-settled for the remainder of the Euro-Canadian period, being located southwest of the historic community of Guelph.

The project location and study area were relatively densely occupied by the mid-19th century, with a total of 22 farmsteads in proximity to the historically surveyed road that is contemporary

County Road 124. Registries of the era identified the area of Guelph as a bustling settlement with substantial surrounding agricultural properties and development. Located within the subject lands was the historic Gourock post office and an inn, attesting to the desirability of this area for residents and individuals transiting through the region, namely between the settlements at Galt and Guelph. Armstrong & Delion (1879:119) note that the Gourock post office is on the Guelph and Galt stage coach road in the Township of Guelph, at a distance of five miles from Guelph with daily mail delivery. Thomas David Thomas was the Post Master, while James Keough was the keeper of the adjacent inn. The Gourock Post Office Store advertised a "large and well selected stock" selling dry goods, groceries, hardware and crockery, among other goods, as well as repairing sewing and other machinery. It was also noted that farm produce was taken in exchange for goods "at the highest rates" (Armstrong & Delion 1879:119). Such historical accounts provide strong confirmation of the vibrant residency of the subject lands with a mixture of urban and rural populations involved in multifold enterprises from provisioning of goods and services to industry and agriculture.

The limits of the project location are shown on georeferenced versions of the consulted resources in Map 2 to Map 6. The study area is focused along modern Wellington Country Road 124, a roadway corridor that has been in use since at least the mid-19th century and adjacent to which properties developed. An overview summary of land occupancy and associated structural features for the subject lands is provided in Table 3.

Table 3: Occupational History and Past Land Uses

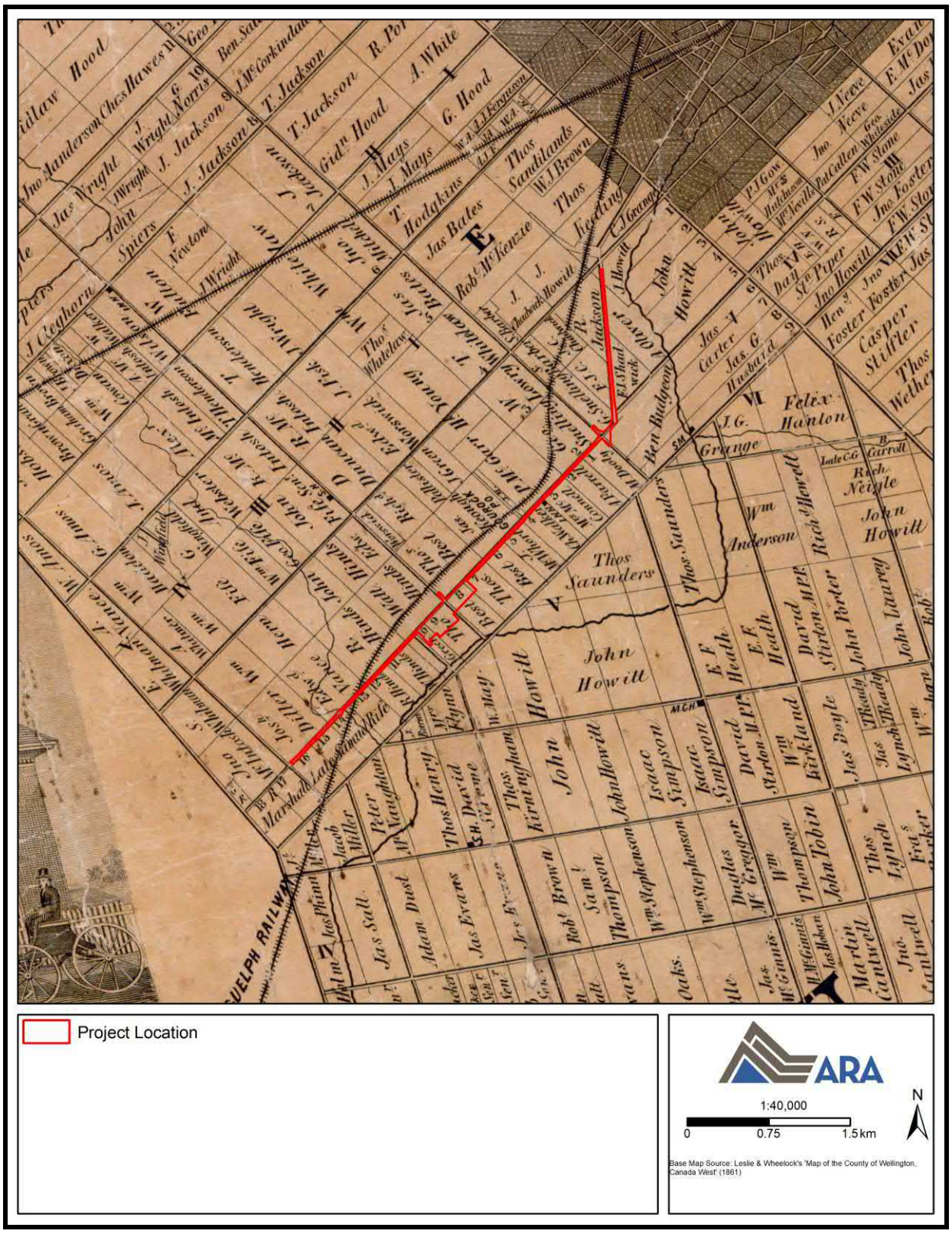
Lot	Concession and/or Division	Mid-19th Century Land Use	Late 19th Century Land Use	Mid-20th Century Land Use
16	Div. B, South of Waterloo Rd.	Part of Late Samuel Rife property; no structures indicated, Galt-Guelph Railway track bisects south part of lot	Part of Samuel Rife property; a structure is indicated on the NNW of the lot, Galt-Guelph Railway track bisects south part of lot	Part of Wellington Road 124 and an agricultural field on the southeast
2	Con. 4, Div. B	Part of Joshua Diller and Edward Vance properties, the latter being bisected by the Galt-Guelph Railway line; a creek bisects both properties, no structures indicated	Part of J. McIntosh, and D. McIntosh properties, no structures indicated; a creek bisects the lot NW-SE.	Part of Wellington Road 124; multiple agricultural fields along northwest; part of the Ellis Creek Complex Provincial Swamp and a tributary of the Speed River traverse the property
15	Div. B, South of Waterloo Rd	Part of Late Samuel Rife property; no structures indicated, Galt-Guelph Railway track bisects centre part of lot	Part of Samuel Rife property; no structures indicated, Galt-Guelph Railway track bisects centre part of lot.	Part of Wellington Road 124 and an agricultural field on the southeast.
14	Div. B, South of Waterloo Rd	Part of Late Samuel Rife property; no structures indicated, a creek bisects the lot NW-SE, Galt-Guelph Railway track bisects north part of lot	Part of Samuel Rife property; a structure is indicated in the middle of the lot, a creek bisects the lot NW-SE, Galt-Guelph Railway track bisects north part of lot	Part of Wellington Road 124, a residential area adjacent to the road, and an agricultural field on the southeast; part of the Ellis Creek Complex Provincial Swamp and a tributary of the Speed River traverse the property

Lot	Concession and/or Division	Mid-19th Century Land Use	Late 19th Century Land Use	Mid-20th Century Land Use
13	Div. B, South of Waterloo Rd	Part of Late Samuel Rife property; no structures indicated, Galt-Guelph Railway track bisects north part of lot	Part of Samuel Rife property; no structures indicated, Galt-Guelph Railway track bisects north part of lot	Part of Wellington Road 124, a railway line bisects the area SW-NE, agricultural field
12	Div. B, South of Waterloo Rd	R. Hinds property, a creek bisects the southern part of the lot; no structures indicated	R.W. Hinds property, a creek bisects the southern part of the lot; a structure is indicated in the WNW	Part of Wellington Road 124 and an agricultural field on the southeast; part of a railway line bisects the area SW-NE
2	Con. 3, Div. B	Part of R. Hinds and Watt. Hinds properties both bisected by the Galt-Guelph Railway line; a creek bisects the R. Hind property; no structures indicated.	Part of R. Hinds property and W. Hinds estate; Galt-Guelph Railway track bisects this lot along SE	Part of multiple agricultural fields along northwest
11	Div. B, South of Waterloo Rd	Part of W. Hinds property; no structures indicated; a creek bisects the southern part of the lot	R.W. Hinds property, a creek bisects the southern part of the lot; a structure is indicated in the WNW.	Part of Wellington Road 124, several building establishments
10	Div. B, South of Waterloo Rd	Part of Thomas Green property; no structures indicated; a creek bisects the SE part of the lot	Part of Geo. Blatchford property; no structures indicated; a creek bisects the SE part of the lot.	Part of Wellington Road 124 and Wellington Road 32, part of a treed and partially cultivated lot
9	Div. B, South of Waterloo Rd	Part of Thomas Green property; no structures indicated; a creek bisects the southern part of the lot	Part of Walter Sorby property; a creek bisects the SE part of the lot; a structure is indicated in the WNW of the lot.	Part of Wellington Road 124, part of a treed lot and agricultural lands
8	Div. B, South of Waterloo Rd	Part of Thomas Best property; no structures indicated; a creek bisects the southern part of the lot	Part of Walter Sorby property; a creek bisects the SE part of the lot; a structure is indicated in the SSE of the lot	Part of Wellington Road 124 and agricultural lands
2	Con. 2, Div. B	Part of Thomas Best and Jas. Keough properties, both are bisected by the Galt-Guelph Railway line, the label for the Gourock Post Office is in the ENE part of Jas. Keough property; no structures indicated.	No occupants identified (non-subscribers); Galt-Guelph Railway track bisects this lot along SE; two structures are identified in SE adjacent to Gourock Rd.	Part of Wellington Road 124 and agricultural lands
7	Div. B, South of Waterloo Rd	Part of Thomas Best property; no structures indicated.	Part of Walter Sorby property; no structures indicated	Part of Wellington Road 124, part of a treed lot and agricultural lands
6	Div. B, South of Waterloo Rd	Part of Thomas Best property; no structures indicated	Part of Walter Sorby property; a structure is indicated in the ENE of the lot	Part of Wellington Road 124, part of a treed lot and agricultural lands

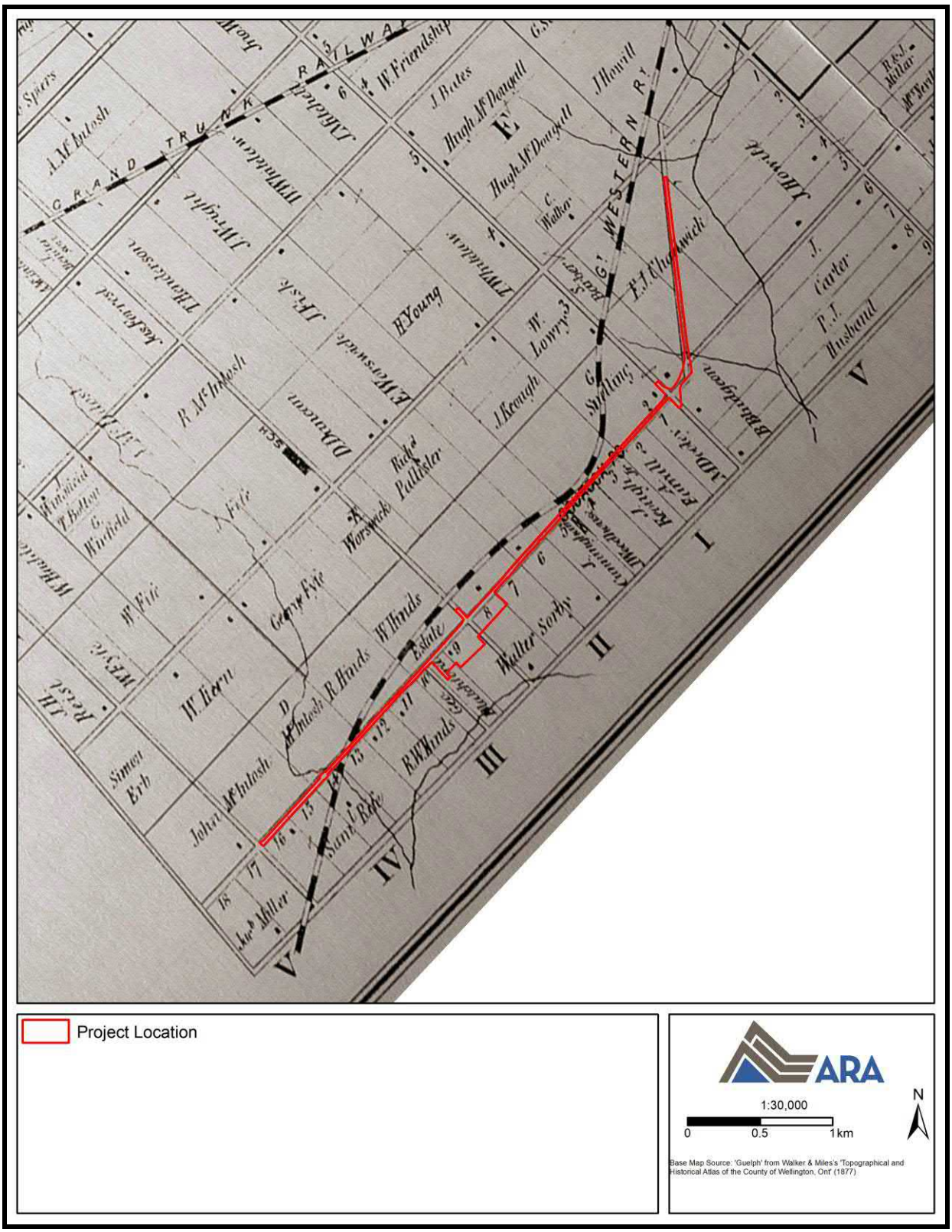
Lot	Concession and/or Division	Mid-19th Century Land Use	Late 19th Century Land Use	Mid-20th Century Land Use
5	Div. B, South of Waterloo Rd	Part of J. McWhort property; no structures indicated	Part of J. Cunningham (?) property; the Gourock Post Office is identified in the NNE of the lot, no other structures indicated.	Part of Wellington Road 124, part of a treed lot and agricultural lands
4	Div. B, South of Waterloo Rd	Part of Ch. Walker property; an inn is located at the NNE corner of the lot.	Part of J. Woodhouse property; no structures indicated	Part of Wellington Road 124, a treed lot with farmstead driveway and agricultural lands
2	Con. 1, Div. B	Part of J.M, P. McGarr and Geo. Snelling properties; the Galt-Guelph Railway line bisects all three properties; no structures indicated.	No occupants identified (non- subscribers) on several properties with G. Snelling property in east part; Galt-Guelph Railway track bisects this lot SE–NW; a structure is identified in the NE	Part of Wellington Road 124, a treed lot with several farmstead driveway and agricultural lands
3	Div. B, South of Waterloo Rd	Part of Mrs. McConnell property; no structures indicated	Part of J. Keough Jr. property; no structures indicated	Part of Wellington Road 124, a treed lot with farmstead driveway and agricultural lands
2	Div. B, South of Waterloo Rd	Part of A Farrell property; no structures indicated	Part of A. Farnall property; no structures indicated	Part of Wellington Road 124, a treed lot with farmstead driveway and agricultural lands
1	Div. B, South of Waterloo Rd	Part of M. Dooly property; no structures indicated	Part of M. Deely property; no structures indicated	Part of Wellington Road 124 and Whitelaw Road, a treed lot and agricultural lands
G	Div. E	Part of Ben Budgeon property; no structures indicated	Part of B. Bludgeon property; two structures are indicated in proximity, one on the WNW of the lot and another on the SSE of the lot	Part of Wellington Road 124 and Whitelaw Road, a treed lot and agricultural lands
A	Div. E	Part of G. Snelling property; the Galt-Guelph Railway line bisects the NW part of the property; no structures indicated	Part of S. Barber property; a structure is indicated in the SE of the lot; the Great Western Railway track bisects this lot.	Farmstead at corner of Wellington Road 124 and Whitelaw Road, a well treed lots
F	Div. E	Part of F.J. Shadwick property; no structures indicated	Part of F.J. Chadwick (Shadwick?) property; no structures indicated	Part of Wellington Road 124, a treed lot and agricultural lands with a structure in the southwest
B	Div. E	Part of F.J.C. (Chadwick?) property; no structures indicated	Part of F.J. Chadwick (Shadwick?) property; no structures indicated; the Great Western Railway track bisects this lot	Part of Wellington Road 124, a treed lot with farmstead driveway and agricultural land
E	Div. E	Part of A. Oliver property; no structures indicated	Part of F.J. Chadwick (Shadwick?) property; no structures indicated	Part of Wellington Road 124, a treed lot and agricultural

Lot	Concession and/or Division	Mid-19th Century Land Use	Late 19th Century Land Use	Mid-20th Century Land Use
C	Div. E	Part of R. Jackson property; the Galt-Guelph Railway line bisects the NW part of the property; no structures indicated	Part of F.J. Chadwick (Shadwick?) property; no structures indicated; the Great Western Railway track bisects this lot	Part of Wellington Road 124, a treed lot with farmstead driveway and agricultural land
D	Div. E	Part of J. Howitt property; no structures indicated	Part of J. Howitt property, no structures indicated.	Part of Wellington Road 124 and agricultural land

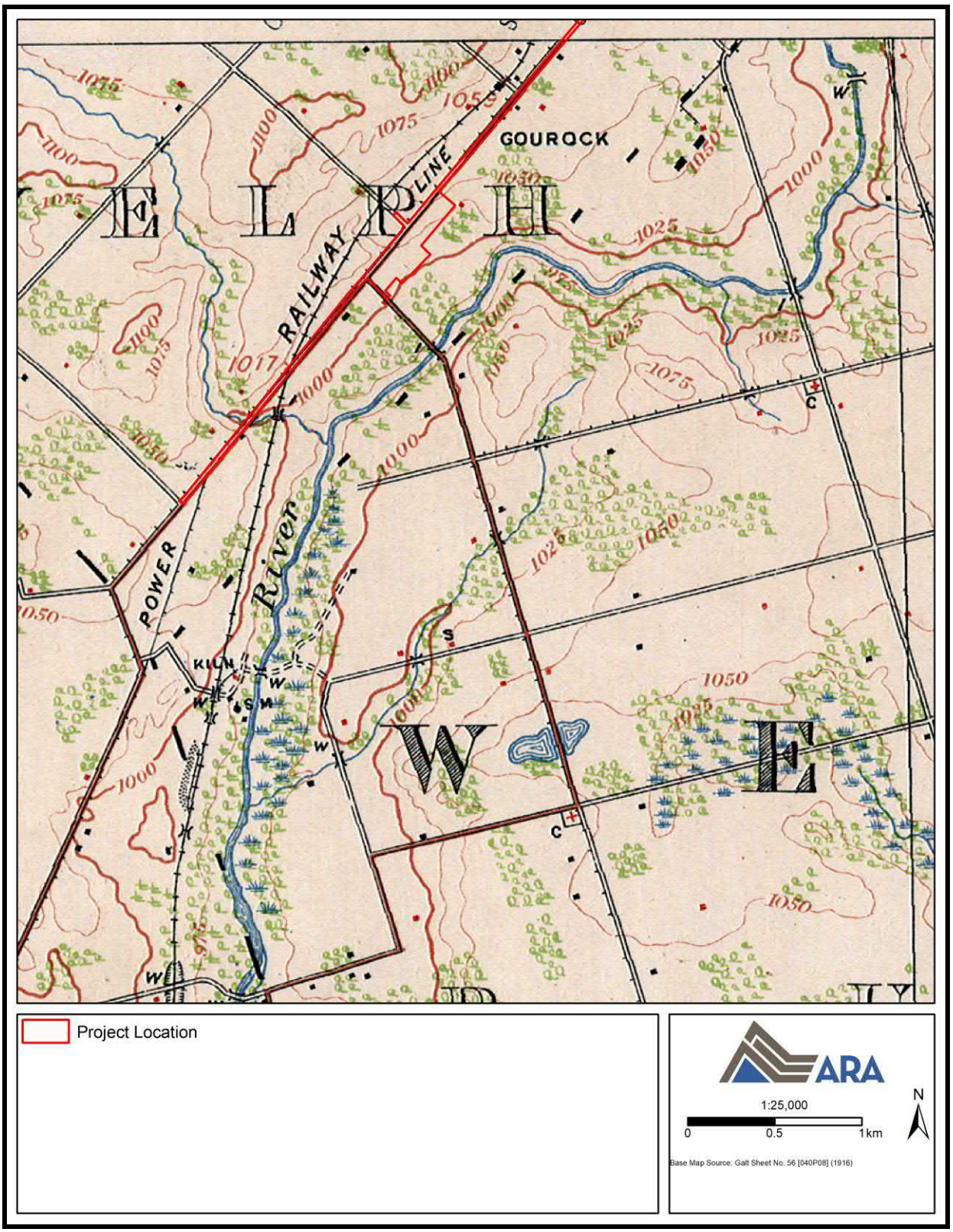
What is clear from the consideration of these historic resources is that the area around the modern subject lands, following closely along the course of Wellington Road 124, was well settled by the mid-19th century. The ample area for agricultural development, the presence of creeks and tributaries of the Speed River suitable for milling, several historically surveyed roads, as well as the Galt and Guelph Railway line, and superseding railways, would have made this area desirable for settlement. Such desirability is well evidence by the large number of structures, farms, an inn and post office identified on historic maps of the surrounding lands. Settlement of this area remained largely similar into the mid-20th century, with key enterprises remaining based in agriculture and industry. The main evident transition from the mid-19th to mid-20th century is the increased agglomeration of population into larger surrounding areas, in this case mainly Guelph, while the former inns and rural stores, such as the Post Office at Gourock, progressively transitioned towards increasingly agrarian environs, before once again becoming part of a larger urban settlement with the progressive expansion of the landscape footprint of Guelph in the second half of the 20th century. Land use at the time of assessment can be classified as a mixture of agricultural, industrial, commercial, and, to a comparatively lesser extent, residential areas.



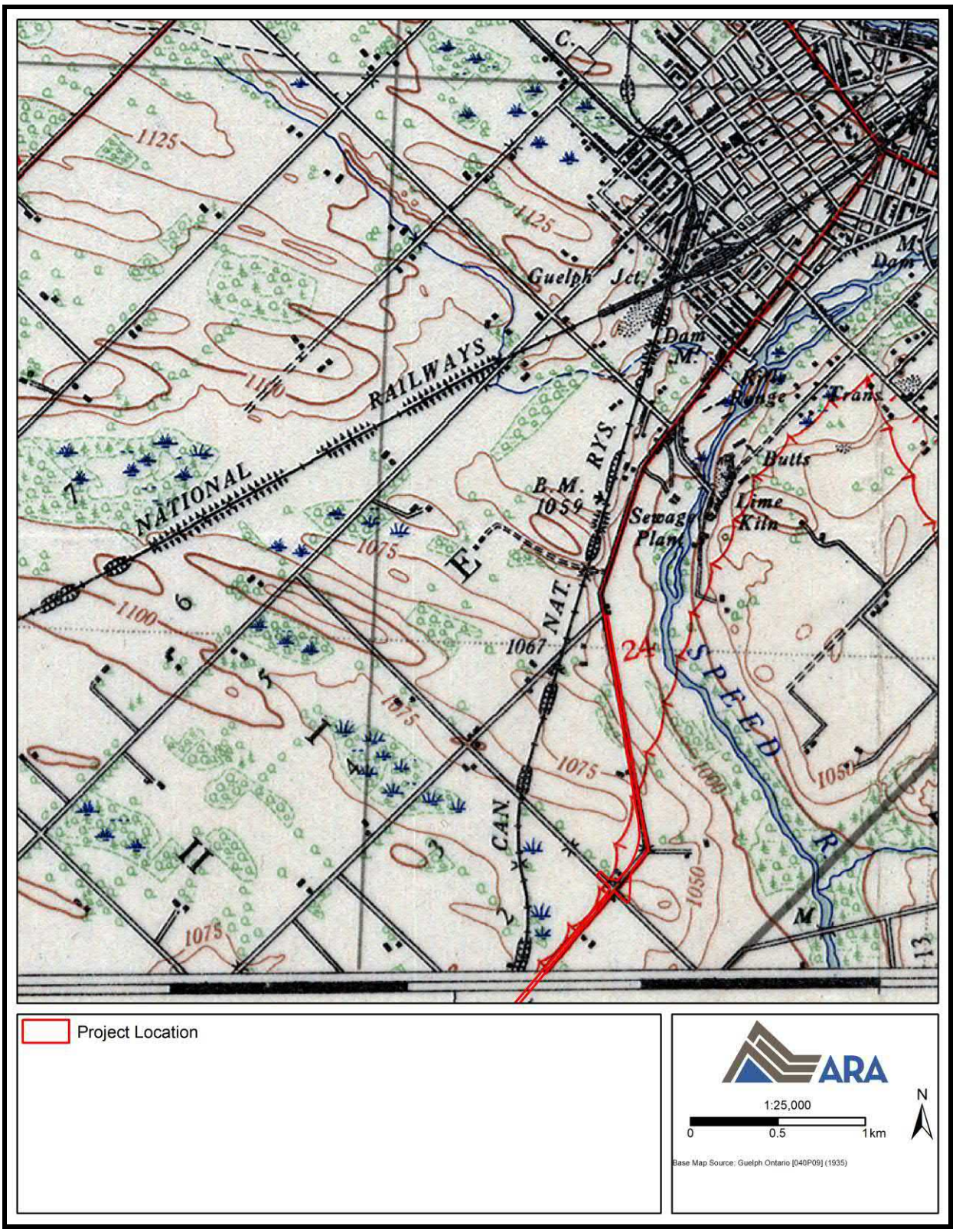
Map 2: Detail of Leslie and Wheelock's *Map of the County of Wellington, Canada West* (1861), Showing the Project Location
(Produced under licence using ArcGIS® software by Esri, © Esri; OHCMP 2018)



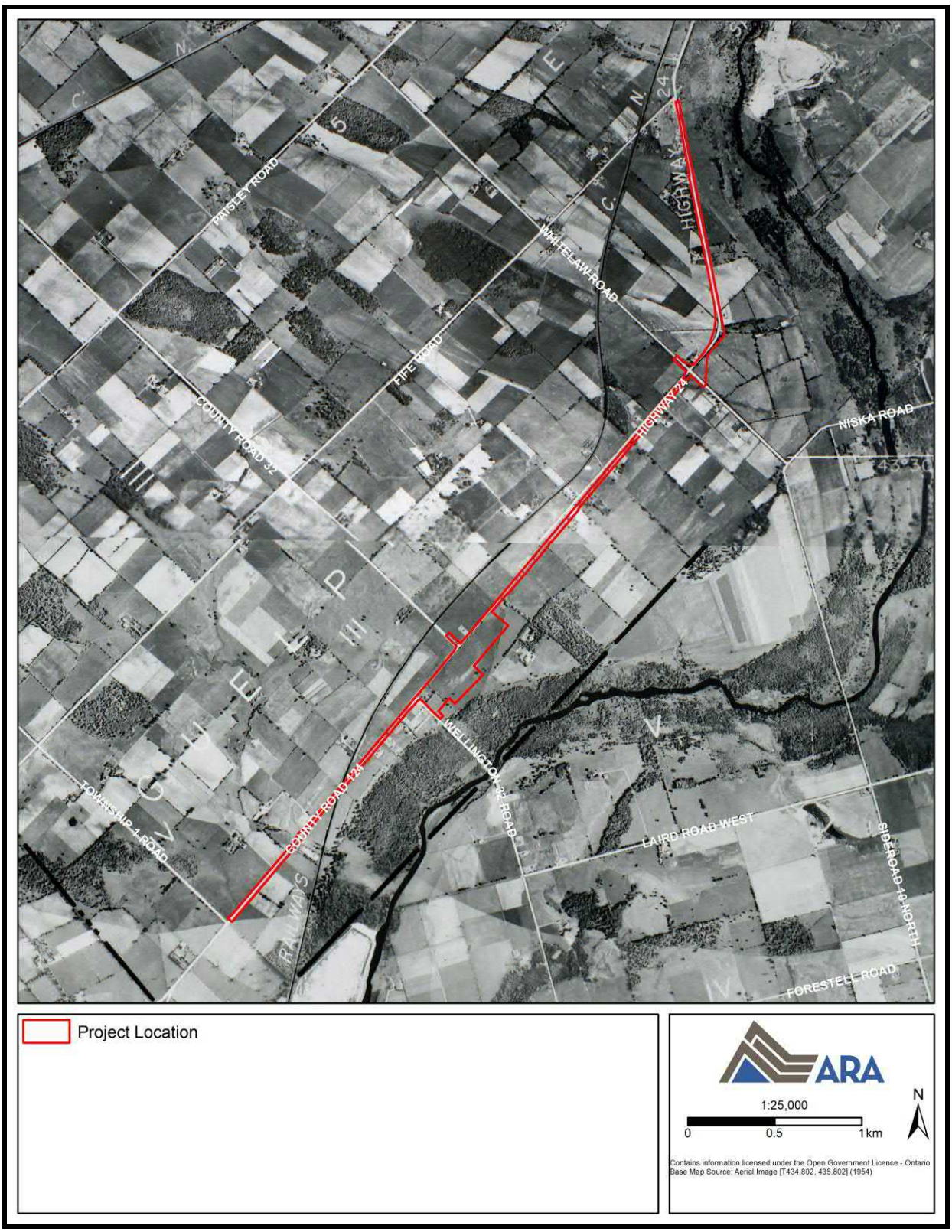
Map 3: Walker & Miles *Topographical and Historical Atlas of the County of Wellington, Ont. (*1877), Showing Project Location
(Produced under licence using ArcGIS® software by Esri, © Esri; McGill University 2001)



Map 4: Topographic Map (1916), Showing South Half of the Project Location
(Produced under licence using ArcGIS® software by Esri, © Esri; OCUL 2018)



Map 5: Topographic Map (1935), Showing North Half of Project Location
(Produced under licence using ArcGIS® software by Esri, © Esri; OCUL 2018)



Map 6: Historic Aerial Image (1954), Showing Project Location
(Produced under licence using ArcGIS® software by Esri, © Esri; University of Toronto 1954)

4.0 HERITAGE CONTEXT

To determine whether any previously-identified properties with CHVI are located within, adjacent to or in proximity to the limits of the study area, ARA consulted a number of heritage groups and online heritage resources as well as completed a field survey.

4.1 Consultation

The former Ministry of Culture's current list of Heritage Conservation Districts was consulted. No designated districts were identified in the study area (MTCS 2018). The list of properties designated by the MTCS under Section 34.5 of the *OHA* was consulted. No properties in the study area are listed. The OHT *Plaque Database* and the Parks Canada *Directory of Federal Heritage Designations* were searched. Neither the project areas nor adjacent properties located within the study areas are commemorated with an OHT plaque, nor are any recognized as National Historic Sites (OHT 2018; Parks Canada 2018).

After a search on May 11, 2018, it was determined that the County of Wellington and the Township of Guelph/Eramosa do not have heritage inventories or Municipal Heritage Registers posted online.

MTE Consultants Inc. provided a contact at the County of Wellington with whom they had been working and ARA staff reached out to this individual via email on May 23, 2018 and June 5, 2018. At the time of writing this report, no response had been received. However, ARA had been in contact with the County of Wellington's Manager of Development Planning in 2017 related to a project in the Town of Erin and they indicated that they are not responsible for heritage as it is the responsibility of the lower tier municipality, and that the County does not have a heritage register.

ARA also reached out the Deputy Clerk at the Township of Guelph/Eramosa via email on June 5, 2018 to inquire about any heritage interests the Township or Municipal Heritage Committee may have related to the study area. The Township provided a response on June 6, 2018 and indicated that there are no participating or abutting properties recognized under the *Ontario Heritage Act* through listing on the Municipal Heritage Register or designation, or any other type of provincial or federal recognition in the study area; no known Cultural Heritage Landscapes in or adjacent to the study area; and no other known heritage interests in the study area.

4.2 Field Survey

A field survey was conducted on May 8, 2018 to photograph and document the study area surroundings, and to record any local features that could enhance ARA's understanding of their setting in the landscape and contribute to the cultural heritage evaluation process. As noted in Method Section 2.3.3, properties with potential cultural heritage resources were examined during the field survey and those that were determined at that time not to possess heritage interest were eliminated. This type of preliminary investigation (a windshield survey) was appropriate given the scale of the study area. The heritage staff conducting the assessments reached conclusions

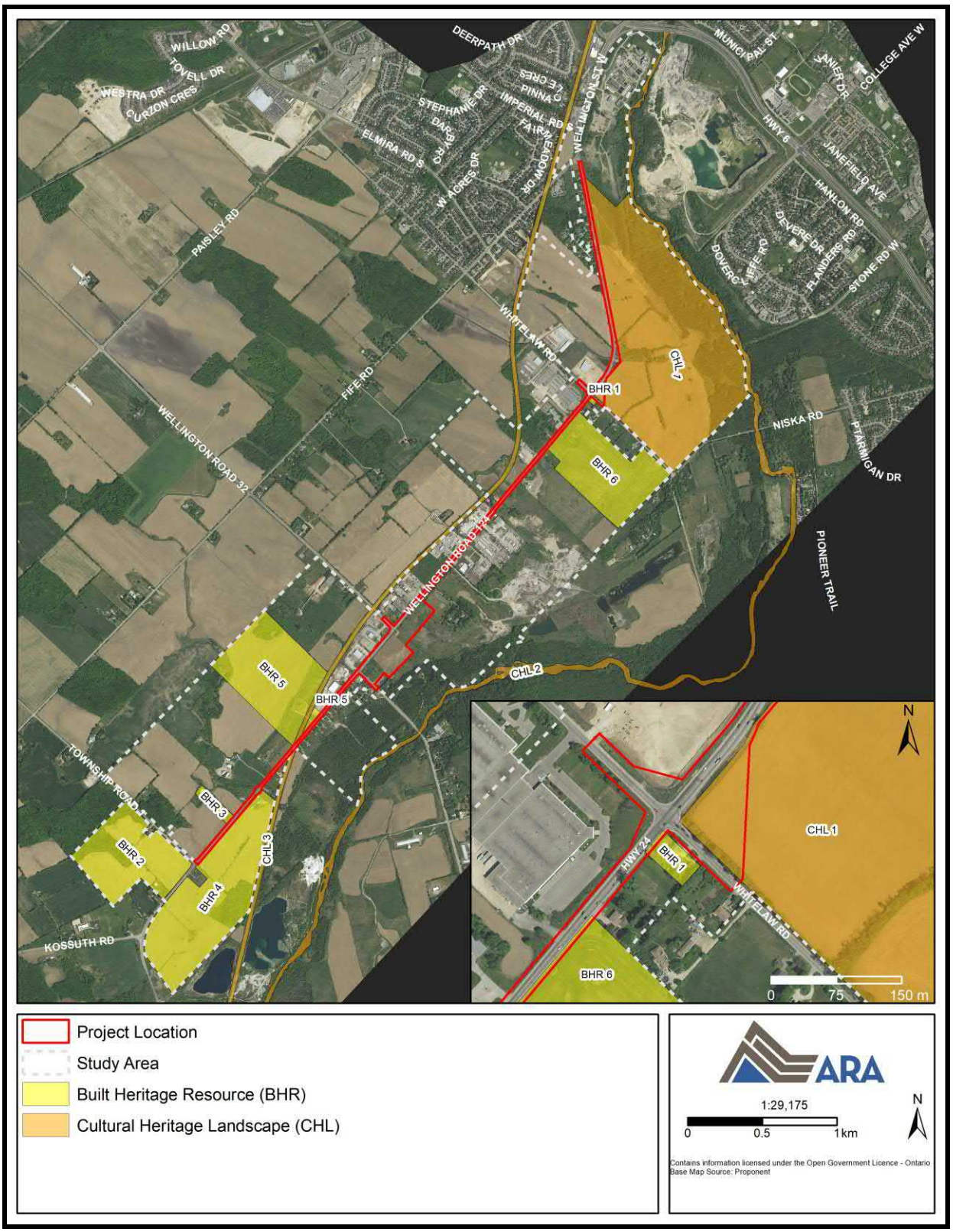
regarding potential CHVI based on visual evidence and on their significant experience evaluating BHRs and CHLs using the criteria outlined in O. Reg. 9/06 and O. Reg. 10/06 of the *OHA*. A standardized checklist based on O. Reg. 9/06 was created for all properties with potential cultural heritage resources. This checklist aided in the evaluation process and was used to judge whether a given resource (BHR or CHL) possessed design or physical value, historical or associative value, or contextual value. Once evaluated these potential cultural heritage resources were considered candidate cultural heritage resources.

5.0 HERITAGE ASSESSMENT

The County Road 124 Municipal Class EA project is to involve approximately 5.73 km length of County Road 124 within the existing road allowance, with the exception of two roundabouts requiring some additional lands between Township Road 1 and Fife Road. The following cultural heritage resources were identified within the study area as having potential CHVI: 5050 Whitelaw Road (BHR 1), 6902 County Road 124 (BHR 2), 6920 County Road 124 (BHR 3), 6939 County Road 124 (BHR 4), 6974 County Road 124 (BHR 5), and 7144 County Road 124 (BHR 6). Three CHLs were identified in the study area: 7189 & 7263 County Road 124 (CHL 1), Speed River (CHL 2), and the G&GR Railway (CHL 3).

A summary of the results of the evaluation of the BHRs and CHLs against the criteria set out in O. Reg. 9/06 (as no properties were deemed to require evaluation against O. Reg. 10/06) can be found in Table 4 and Table 5. Information sheets containing the evaluations for each cultural heritage resource can be found in Appendix A.

The assessment determined that all six BHRs and three CHLs met one or more of the O. Reg. 9/06 criteria. Accordingly, these can now be classified as candidate heritage properties - BHRs (BHR Nos. 1–6) and CHLs (CHL Nos. 1–3). The locations of all candidate BHRs and CHLs are illustrated on Map 7.



Map 7: Assessment Results
(Produced by ARA under licence using ArcGIS® software by Esri, © Esri)

Table 4: BHRs and CHLs with CHVI

Type and Number	Address/Name	CHVI (Y/N)	Criteria Met
BHR 1	5050 Whitelaw Road	Yes	Design or Physical Value
BHR 2	6902 County Road 124	Yes	Contextual Value
BHR 3	6920 County Road 124	Yes	Contextual Value
BHR 4	6939 County Road 124	Yes	Design or Physical Value and Contextual Value
BHR 5	6974 County Road 124	Yes	Design or Physical Value and Contextual Value
BHR 6	7133 County Road 124	Yes	Design or Physical Value
CHL 1	7189 & 7263 County Road 124	Yes	Design or Physical Value and Contextual Value
CHL 2	Speed River	Yes	Historical or Associative Value and Contextual Value
CHL 3	G&GR Railway	Yes	Historical or Associative Value

Table 5: Candidate BHRs and CHLs Value Statements and Heritage Attributes

Type and Number	Address/Name	Value Statement(s)	Heritage Attributes*
BHR 1	5050 Whitelaw Road	Good example of a stone farmhouse and associated with the farming community of Gourock, and the Dooley family.	Key heritage attributes include: two storey, three bay building with stone construction of two bays; two stone chimneys; datestone; and prominent location on the corner of Whitelaw Road and County Road 124.
BHR 2	6902 County Road 124	Barn and wood outbuilding contribute to the agricultural character of the area.	Key heritage attributes include: barn with gable roof and stone foundation; wood outbuilding with gable roof; location setback from road.
BHR 3	6920 County Road 124	Heavily treed lot and barn contributes to the rural character of the area.	Key heritage attributes include: barn with gable roof.
BHR 4	6939 County Road 124	Representative example of a Gothic Revival farmhouse and farm complex contributes to the agricultural character of the area.	Key heritage attributes include: Gothic Revival farmhouse with gable roof; lancet window opening in central gable; central entranceway flanked by a window on each side; rear addition; and barn with gable roof and stone foundation.

Type and Number	Address/Name	Value Statement(s)	Heritage Attributes*
BHR 5	6974 County Road 124	Good example of a bank barn with an extended forebay and barn contributes to the agricultural character of the area.	Key heritage attributes include: stone wall visible to the southeast of the modern house; bank barn with gable roof and stone foundation; extended forebay and four small windows in the side elevation; additional outbuildings; setback from the road on a rise of land; and situation adjacent to the G&GR Railway.
BHR 6	7133 County Road 124	Representative example of an Arts & Crafts style residential structure.	Key heritage attributes include: two-storey Arts & Crafts style house; large gable on façade; gable over front door supported by large brackets; dark bricks and wood accents; and placement setback from the road surrounded by mature trees.
CHL 1	7189 & 7263 County Road 124	Representative agricultural landscape and contributes to the agricultural character of the area.	Key heritage attributes include: agricultural fields; proximity to the Speed River; and views to the forested Speed River valley.
CHL 2	Speed River	Influenced the settlement of the area. Has been the ancestral home of First Nations peoples for 10,000 years; the Speed River CHL is important in defining, maintaining or supporting the character of an area as it dominates the landscape; the Speed River CHL is physically, functionally, visually and historically linked to its surroundings as it was a principle factor in influencing settlement patterns; the Speed River feeds into the Grand River, and the Grand River watershed is one of the best-known watersheds in southwestern Ontario and is nationally designated as a Canadian Heritage River; the Speed River CHL is a landmark in the community; views to and from the river represent important scenic landscapes.	Key heritage attributes include: dams, mill ponds and industrial buildings along the river; agricultural uses and settlement along the river; recreational access including public parks, natural areas and trails; and areas of archaeological potential.

Type and Number	Address/Name	Value Statement(s)	Heritage Attributes*
CHL 3	G&GR Railway	The G&GR CHL is a representative and early example of railway construction.	Key heritage attributes include: its original form and layout (i.e., length, width and construction methods); and its physical appearance and setting; views of the railway crossings and vistas along the trajectory of the historic route; and at grade crossing at County Road 124.

*Heritage Attributes may include, but are not limited to, those listed in this table.

6.0 DEVELOPMENT PLAN

According to the Notice of Commencement, "Wellington County Road 124 has experienced growing traffic congestion between Guelph Eramosa Township Road 1 and Fife Road. The County is therefore considering improvements to County Road 124 to address the congestion, road safety, intersection improvements and drainage" (County of Wellington 2018:1).

MTE Consultants Inc. provided additional information on the extent of the improvements, specifically noting that "the alternatives will be confined to within the existing Rd 124 road allowance, with the exception of between the two Road 32 intersections and at Whitelaw Road where new roundabouts will be examined" (Per. Comm Dave Hallman March 29, 2018). At the time of writing, detailed designs have not yet been developed.

7.0 ANALYSIS OF POTENTIAL IMPACTS

Municipal road projects have the potential to affect cultural heritage resources. The MTCS *InfoSheet #5: Heritage Impact Assessments and Conservation Plans* (MCL 2006b:3) provides a list of potential impacts to consider when evaluating any proposed development. Outlined in Section 2.0, impacts can be classified as either direct or indirect. Direct impacts (those that physically affect the heritage resources themselves) include, but are not limited to: initial project staging, excavation/levelling operations, construction of access roads and renovations or repairs over the life of the project.

Indirect impacts include but are not limited to: alterations that are not compatible with the historic fabric and appearance of the area, the creation of shadows that alter the appearance of an identified heritage attribute, the isolation of a heritage attribute from its surrounding environment, the obstruction of significant views and vistas, and other less-tangible impacts.

As outlined in Section 2.3, ARA considers a larger study area as part of its business practice and evaluates cultural heritage resources located within the project location and on all abutting properties to ensure that all potential direct and indirect impacts to resources are addressed. This project entails improvements to the road as part of the EA process. The proposed alternatives and detailed designs that would provide a better understanding of project impacts have not yet been developed. Therefore, the potential impacts and mitigation options related to the project will be discussed at a high level.

No shadows will be cast near any of the identified cultural heritage resources, as the proposed improvements will take place at ground level. None of the heritage attributes outlined in Appendix A will be isolated from their surrounding environment, context or significant relationship. No rezoning will occur. Archaeological and environmental impacts are to be addressed in separate environmental and archaeological reports.

The proposed "improvements" will not result in direct or indirect impacts to significant views or vistas within, from, or of built and natural features associated with BHRs as views are not heritage attributes of the BHRs (see Appendix A). Views and/or vistas are part of the CHVI of CHL 1 and CHL 3, but generally road improvements will not impact views to and from the

Speed River Valley (part of CHL 1), or vistas along the historic route of the G&GR Railway (CHL 3). Construction activities have the potential to create vibrations that could impact built cultural heritage resources located close the road (BHR 1 and 4).

If mature trees along County Road 124 are to be impacted/removed during the road "improvement" project activities, this may result in minor alterations to the rural setting and specifically to: the character of the existing frontage of BHRs 1 and 2; potentially directly impact the heavily treed lot of BHR 3; and tree-lined driveway of BHR 6. There is the potential to directly impact G&GR Railway (CHL 3) if the road improvements result in alteration of the "at grade" railway crossing.

There appear to be no cultural heritage resources at the two Road 32 intersections where roundabouts may be located. However, 5050 Whitelaw Road (BHR 1) is located close to the northwest corner of County Road 124 and Whitelaw Road, another intersection being examined for a potential roundabout. A roundabout at this location could have direct negative impacts on BHR 1 and may also alter the agricultural fields that are part of CHL 1.

The EA project and this associated report have the potential to have a positive impact on cultural heritage resource documentation in the Township. Previously-unrecognized cultural heritage resources (six BHRs and three CHLs) discussed in this assessment may be worthy of inclusion on a Municipal Heritage Register.

8.0 RECOMMENDATIONS AND CONCLUSIONS

The study area consists of approximately 5.73 km of County Road 124 within the existing road allowance between Township Road 1 and Fife Road as well as all adjacent properties. A windshield survey of the study area was conducted, and all potential cultural heritage resources noted were evaluated against the criteria of Ontario Regulation 9/06. Of those, the following were identified within the study area as having potential cultural heritage value or interest (CHVI): 5050 Whitelaw Road (BHR 1), 6902 County Road 124 (BHR 2), 6920 County Road 124 (BHR 3), 6939 County Road 124 (BHR 4), 6974 County Road 124 (BHR 5), and 7144 County Road 124 (BHR 6). Three CHLs were identified in the study area: 7189 & 7263 County Road 124 (CHL 1), Speed River (CHL 2), and the G&GR Railway (CHL 3).

Preliminary potential impacts were identified including: removal of mature trees that contribute to the rural setting along many of the property lines (BHRs 1 and 2) and as heritage attributes lining driveways or surrounding houses (BHRs 3 and 6); direct impacts to the "at grade" railway crossing for the G&GR Railway (CHL 3); a roundabout at the County Road 124 and Whitelaw Road intersection could have direct negative impacts on 5050 Whitelaw Road (BHR 1) and 7189 & 7263 County Road 124 (CHL 1); and construction activities have the potential to create vibrations that could impact built cultural heritage resources located close the road (BHR 1 and 4).

As a result of this Built Heritage Resource and Cultural Heritage Landscape Assessment, the following mitigation strategies are recommended to address the identified potential adverse impacts:

- That during the planning and design phases, cultural heritage resources be avoided where possible and any construction staging areas be located on lands located well away from any of the candidate BHRs and CHLs;
- That during the design phases, the removal of mature trees on BHRs 1, 2, 3 and 6 should be avoided where possible. For any trees that cannot be saved during construction, replacement with similar trees should be examined;
- That the historic at-grade crossing of the G&GR Railway (CHL 3) be maintained during the detailed design phase and that the railway crossing be returned to its pre-construction condition;
- That if a roundabout is planned at Whitelaw Road, a Cultural Heritage Evaluation Report should be undertaken to fully examine and evaluate the CHVI of BHR 1 and CHL 1. If the properties are found to be worthy of conservation, a Heritage Impact Assessment should be undertaken to examine mitigation options consistent with the identified CHVI of the properties and local heritage policies (i.e., alternate design, relocation of the building, etc.);
- That consideration should be given to the type of construction techniques and machinery used in close proximity to cultural heritage resources (BHRs 1 and 4) to minimize any vibration impacts;
- That once a preferred alternative has been selected and design work has begun, a Heritage Impact Assessment report should be undertaken to confirm the anticipated impacts outlined in this report, evaluate any additional impact of the proposed design, as well as outline avoidance/mitigation measures to minimize the impact. The HIA may outline mitigation measures including additional landscaping that may be required to minimize visual impacts or design approaches may be suggested. Mitigation measures may be discussed with Planners at the County and the Township;
- That public consultation may result in additional potential cultural heritage resources being identified. These potential cultural heritage resources should be reviewed by a qualified heritage consultant to: 1) determine their CHVI, 2) evaluate potential project impacts, and 3) suggest strategies for future conservation of any candidate cultural heritage resources;
- That previously-unrecognized cultural heritage resources with CHVI discussed in this assessment may be worthy of inclusion on a Municipal Heritage Register; and
- That this Built Heritage and Cultural Heritage Landscape Assessment should be provided to staff/planners at the Township of Guelph/Eramosa and County of Wellington.

The EA process includes preliminary studies, an examination of alternatives and selection of a preferred alternative prior to the development of preliminary and detailed designs. Impacts to cultural heritage resources should be considered during all phases of the EA process. Further, these preliminary mitigation recommendations are subject to review and confirmation during the detailed design phase, in consideration of the more detailed understanding of design and project constraints.

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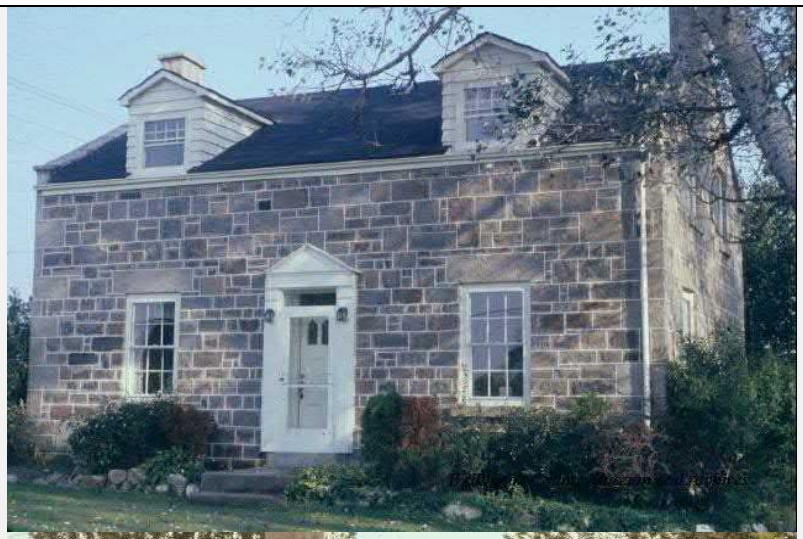
Appendix A: Identified Built Heritage Resources and Cultural Heritage Landscapes

BUILT HERITAGE RESOURCE NO. 1

DESCRIPTION OF PROPERTY	
Street Address	5050 Whitelaw Road
Name	n/a
Recognition	None
Location	Township of Guelph/Eramosa
Type of Property	Residential
Date(s)	1854 (Datestone; WCMA)
Description	• Two storey, three bay building • Side gable roof with a chimney at one end, three dormers on the facade, and a second chimney located between the second and third bays • Two-bays appear to be cut stone construction, • The third bay is an addition added post 1978 • Prominent location at the corner of Whitelaw Road and County Road 124 • Residence of Martin Dooley and family into the 1880s (LAC 1861–1881) • Dooley was an Irish Catholic farmer who was born ca. 1801 (LAC 1861)
Photo(s)	 **Datestone**
Date of Photo(s)	May 8, 2018; May 31, 2018

Historic Photo(s) (1970; 1978 WCMA)	

EVALUATION OF PROPERTY			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Good example of a stone farmhouse.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community	✓	Associated with the farming community of Gourock, and the Dooley family.
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area		

	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

RESULTS OF HERITAGE ASSESSMENT	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: two storey, three bay building with stone construction of two bays; two stone chimneys; datestone; and prominent location on the corner of Whitelaw Road and County Road 124.

BUILT HERITAGE RESOURCE NO. 2

DESCRIPTION OF PROPERTY	
Street Address	6902 County Road 124
Name	n/a
Recognition	None
Location	Township of Guelph/Eramosa
Type of Property	Residential
Date(s)	Unknown
Description	• Modern house • Barn with gable roof and stone foundation • Second wood outbuilding with gable roof and extension on the southeast elevation • House and outbuildings set back from road • Historic property of John McIntosh (Leslie & Wheelock 1861; Walker & Miles 1877)
Photo(s)	
Date of Photo(s)	May 8, 2018

EVALUATION OF PROPERTY			
Criteria	**Description**	✓	**Value Statement(s)**

Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method		
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Barn and wood outbuilding contribute to the agricultural character of the area.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

RESULTS OF HERITAGE ASSESSMENT	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: barn with gable roof and stone foundation; wood outbuilding with gable roof; location setback from road.

BUILT HERITAGE RESOURCE NO. 3

DESCRIPTION OF PROPERTY	
Street Address	6920 County Road 124
Name	n/a
Recognition	None
Location	Township of Guelph/Eramosa
Type of Property	Residential
Date(s)	Unknown
Description	• Barn with gable roof • House and outbuildings set back from the road • Tree-lined driveway • View of buildings obscured from road • Historic property of Joseph Diller (Leslie & Wheelock 1861); John McIntosh (Walker & Miles 1877)
Photo(s)	
Date of Photo(s)	May 8, 2018

EVALUATION OF PROPERTY			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method		
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual	Is important in defining, maintaining or	✓	Heavily treed lot and barn contributes to the

Value	supporting the character of an area		rural character of the area.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

RESULTS OF HERITAGE ASSESSMENT	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: barn with gable roof.

BUILT HERITAGE RESOURCE NO. 4

DESCRIPTION OF PROPERTY	
Street Address	6939 County Road 124
Name	n/a
Recognition	None
Location	Township of Guelph/Eramosa
Type of Property	Residential
Date(s)	Unknown
Description	• Representative example of a Gothic Revival farmhouse with gable roof, lancet window opening in central gable, and central entranceway flanked by a window on each side • House has addition on rear • Barn with gable roof and stone foundation • Has additional outbuildings not visible from the road • House and barn situated close to the road • Historic property of R. Marshall and Samuel Rife (Leslie & Wheelock 1861); Jacob Miller and Samuel Rife (Walker & Miles 1877)
Photo(s)	
Date of Photo(s)	May 8, 2018

EVALUATION OF PROPERTY			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of a Gothic Revival farmhouse.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Farm complex contributes to the agricultural character of the area.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

RESULTS OF HERITAGE ASSESSMENT	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: Gothic Revival farmhouse with gable roof, lancet window opening in central gable, central entranceway flanked by a window on each side, and rear addition; and barn with gable roof and stone foundation.

BUILT HERITAGE RESOURCE NO. 5

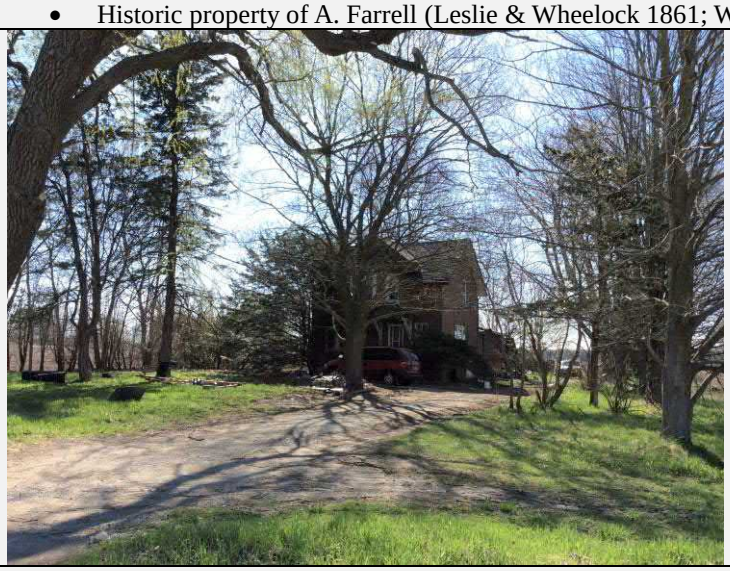
DESCRIPTION OF PROPERTY	
Street Address	6974 County Road 124
Name	n/a
Recognition	None
Location	Township of Guelph/Eramosa
Type of Property	Residential
Date(s)	Unknown
Description	• Appears to be a modern home • Stone foundations of previous structure or stone wall visible to the southeast of the modern house • Well preserved bank barn with gable roof and stone foundation • Second floor is extended, or cantilevered, over the first creating an extended forebay • Four small windows in side elevation of the barn • Some additional outbuildings are visible from the aerial photography but are not visible from the road • House and barn are setback from the road on a rise of land • G & GR Railway runs between the structures on the property and County Road 124 • Historic property of Ralph Hinds (Leslie & Wheelock 1861; Walker & Miles 1877)
Photo(s)	
Date of Photo(s)	May 8, 2018

EVALUATION OF PROPERTY			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Good example of a bank barn with an extended forebay.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		

	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Barn contributes to the agricultural character of the area.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

RESULTS OF HERITAGE ASSESSMENT	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: stone wall visible to the southeast of the modern house; bank barn with gable roof and stone foundation, extended forebay and four small windows in side elevation; additional outbuildings; setback from the road on a rise of land; and situation adjacent to the G & GR Railway.

BUILT HERITAGE RESOURCE NO. 6

DESCRIPTION OF PROPERTY	
Street Address	7133 County Road 124
Name	n/a
Recognition	None
Location	Township of Guelph/Eramosa
Type of Property	Residential
Date(s)	Unknown
Description	• Representative example of an Arts & Crafts house • Large gable on the façade • Gable over the front door supported by large brackets • Use of dark bricks and wood accents is typical of the Art & Crafts style • House is setback from the road surrounded by mature trees • Historic property of A. Farrell (Leslie & Wheelock 1861; Walker & Miles 1877)
Photo(s)	
Date of Photo(s)	May 8, 2018

EVALUATION OF PROPERTY			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative example of an Arts & Crafts style residential structure.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or		

	theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area		
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

RESULTS OF HERITAGE ASSESSMENT	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: two-storey Arts & Crafts style house; large gable on façade; gable over front door supported by large brackets; dark bricks and wood accents; and siting setback from the road surrounded by mature trees.

CULTURAL HERITAGE LANDSCAPE NO. 1

DESCRIPTION OF PROPERTY	
Street Address	7189 & 7263 County Road 124
Name	n/a
Recognition	None
Location	Township of Guelph/Eramosa
Type of Landscape	Agricultural
Description	• Agricultural landscape with rolling agricultural fields that overlook the Speed River • Views to forested Speed River Valley
Photo(s)	
Date of Photo(s)	May 8, 2018

EVALUATION OF PROPERTY			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	Representative agricultural landscape.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	Contributes to the agricultural character of the area.
	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

RESULTS OF HERITAGE ASSESSMENT	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: agricultural fields; proximity to the Speed River and views to the forested Speed River valley.

CULTURAL HERITAGE LANDSCAPE NO. 2

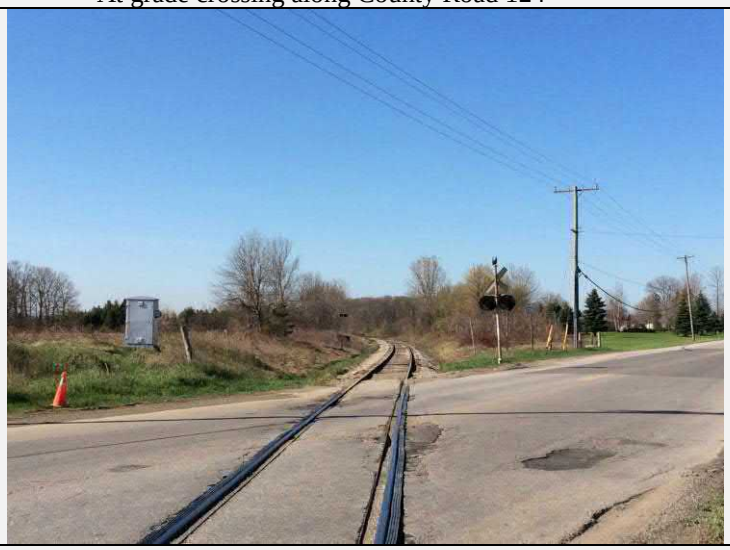
DESCRIPTION OF PROPERTY	
Street Address	n/a
Name	Speed River
Recognition	Part of the Grand River, a Canadian Heritage River
Location	Township of Guelph/Eramosa
Type of Landscape	River
Description	• The Speed River is a tributary of the Grand River and is part of its designation as a Canadian Heritage River. The river provided power for industry (i.e. mills in nearby Hespeler). Agriculture also sprang up along the river as it provided a reliable source of water. Urban centres such as Hespeler grew out of these early settlement patterns as areas where people congregated. • The Speed River is winding and provides many beautiful views as well as recreational opportunities.
Photo(s)	 Google, 2018
Date of Photo(s)	May 8, 2018

EVALUATION OF PROPERTY			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method		
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community	✓	Influenced the settlement of the area. Has been the ancestral home of First Nations peoples for 10,000 years.
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		

	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area	✓	The Speed River CHL is important in defining, maintaining or supporting the character of an area as it dominates the landscape.
	Is physically, functionally, visually or historically linked to its surroundings	✓	The Speed River CHL is physically, functionally, visually and historically linked to its surroundings and it was a principle factor in influencing settlement patterns.
	Is a landmark	✓	The Speed River is feeds into the Grand River, and the Grand River watershed is one of the best-known watersheds in southwestern Ontario and is nationally designated as a Canadian Heritage River. The Speed River CHL is a landmark in the community. The views to and from the river represent important scenic landscapes.

RESULTS OF HERITAGE ASSESSMENT	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: dams, mill ponds and industrial buildings along the river; agricultural uses and settlement along the river; recreational access including public parks, natural areas and trails; and areas of archaeological potential.

CULTURAL HERITAGE LANDSCAPE NO. 3

DESCRIPTION OF PROPERTY	
Street Address	n/a
Name	G&GR Railway
Recognition	None
Location	Township of Guelph/Eramosa
Type of Landscape	Rail line
Description	• According to the University of Toronto, this section of rail line was part of the G&GR (Galt and Guelph Railway) that was completed from Preston to Guelph in 1857 (2009) • By 1877 the line had come under the ownership of the Great Western Railway (Walker & Miles 1877) • It was acquired by the GEXR in 1998 (U of T 2009) • At grade crossing along County Road 124
Photo(s)	
Date of Photo(s)	May 8, 2018

EVALUATION OF PROPERTY			
Criteria	**Description**	✓	**Value Statement(s)**
Design or Physical Value	Is a rare, unique, representative or early example of a style, type, expression, material or construction method	✓	The G&GR CHL is a representative and early example of railway construction.
	Displays a high degree of craftsmanship or artistic value		
	Displays a high degree of technical or scientific achievement		
Historical or Associative Value	Has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community		
	Yields or has the potential to yield information that contributes to the understanding of a community or culture		
	Demonstrates or reflects the work or ideas of an architect, builder, artist, designer or theorist who is significant to a community		
Contextual Value	Is important in defining, maintaining or supporting the character of an area		

	Is physically, functionally, visually or historically linked to its surroundings		
	Is a landmark		

RESULTS OF HERITAGE ASSESSMENT	
CHVI Evaluation	Has CHVI.
Heritage Attributes	Key heritage attributes include: its original form and layout (i.e., length, width and construction methods); and its physical appearance and setting, specifically the views of the railway crossings and vistas along the trajectory of the historic route; and at grade crossing at County Road 124.

Appendix B: Key Team Member Two Page Curriculum Vitae

Curriculum Vitae

Paul J. Racher, M.A., CAHP
Principal - Management and Senior Review (MSR) Team
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Biography

Paul Racher is a Principal of ARA. He has a BA in Prehistoric Archaeology from WLU and an MA in anthropology from McMaster University. He began his career as a heritage professional in 1986. Over the three decades since, he has overseen the completion of several hundred archaeological and cultural heritage contracts. Paul has years of experience related to linear transportation and rail projects, notably through the ongoing work to complete a Cultural Heritage Inventory for the Region of Waterloo's Stage 2 LRT from Kitchener to Cambridge, Ontario. He holds professional license #P007 with the MTCS. Paul is a former lecturer in Cultural Resource Management at WLU. He is a professional member of the Canadian Association of Heritage Professionals (CAHP) and the President of the Ontario Archaeological Association (OAS).

Education

1992-1997	PhD Programme, Department of Anthropology, University of Toronto. Supervisors: E.B. Banning and B. Schroeder. Withdrawn.
1989-1992	M.A., Department of Anthropology, McMaster University, Hamilton, Ontario. Thesis titled: "The Archaeologist's 'Indian': Narrativity and Representation in Archaeological Discourse."
1985-1989	Honours B.A., Wilfrid Laurier University, Waterloo, Ontario. Major: Prehistoric Archaeology.

Professional Memberships and Accreditations

Current	Ministry of Tourism Culture and Sport Professional Licence (#P007). Professional Member of the Canadian Association of Heritage Professionals (CAHP), Volunteer on the ethics committee. Member of the Ontario Archaeological Society (OAS), Volunteer on the Professional Committee. Associate of the Heritage Resources Centre, University of Waterloo. RAQS registered with MTO.

Work Experience

Current	**Vice-President, Operations, Archaeological Research Associates Ltd.** Responsible for winning contracts, client liaison, project excellence, and setting the policies and priorities for a multi-million dollar heritage consulting firm.
2000-2011	**Project Manager/Principal Investigator, Archaeological Research Associates Ltd.** Managed projects for a heritage consulting firm. In 10 field seasons, managed hundreds of projects of varying size.
2008-2011	**Part-Time Faculty, Wilfrid Laurier University.** Lecturer for Cultural Resource Management course (AR 336). In charge of all teaching, coursework, and student evaluations.
1995	**Field Archaeologist, University of Toronto.** Served as a supervisor on a multinational archaeological project in northern Jordan.
1992-1995	**Teaching Assistant, University of Toronto.** Responsible for teaching and organizing weekly tutorials for a number of courses.
1991-1994	**Part-Time Faculty, Wilfrid Laurier University.** Lectured for several courses in anthropology. Held complete responsibility for all teaching, coursework, and student evaluations.
1992-1996	**Partner in Consulting Company, Cultural Management Associates Incorporated.** Supervised several archaeological contracts in Southern Ontario. Participated in a major (now published) archaeological potential modeling project for MTO.
1989-1991	**Partner in Consulting Company, Cultural Resource Consultants.** Managed the financial affairs of a consulting firm whilst supervising the completion of several contracts performed for heritage parks in central Ontario.
1988-1991	**Principal Investigator/Project Director, Archaeological Research Associates Ltd.** Oversaw the completion of large contracts, wrote reports, and was responsible for ensuring that contracts were completed within budget.
1988	**Assistant Director of Excavations, St. Marie among the Hurons, Midland, Ontario.** Duties included crew supervision, mapping, report writing and photography.
1986-1987	**Archaeological Crew Person, Archaeological Research Associates Ltd., Waterloo, Ontario.** Participated in background research, survey, and excavation on a number of Archaeological sites across Ontario.

Kayla Jonas Galvin, M.A., CAHP
Team Lead - Heritage
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Biography

Kayla Jonas Galvin, Archaeological Research Associates Ltd.'s Team Lead – Heritage, has extensive experience evaluating cultural heritage resources and landscapes for private and public-sector clients to fulfil the requirements of provincial and municipal legislation such as the *Environmental Assessment Act*, the *Standards & Guidelines for the Conservation of Provincial Heritage Properties* and municipal Official Plans. She served as Team Lead on the Ministry of Tourism, Culture and Sport Historic Places Initiative, which drafted over 850 Statements of Significance and for *Heritage Districts Work!*, a study of 64 heritage conservation districts in Ontario. Kayla was an editor *of Arch, Truss and Beam: The Grand River Watershed Heritage Bridge Inventory* and has worked on Municipal Heritage Registers in several municipalities. Kayla has drafted over 150 designation reports and by-laws for the City of Kingston, the City of Burlington, the Town of Newmarket, Municipality of Chatham-Kent, City of Brampton and the Township of Whitchurch-Stouffville. Kayla is the Heritage Team Lead for ARA's roster assignments for Infrastructure Ontario and oversees evaluation of properties according to *Standards & Guidelines for the Conservation of Provincial Heritage Properties*. Kayla is a professional member of the Canadian Association of Heritage Professionals and sits on the board of the Ontario Association of Heritage Professionals.

Education

2016	MA in Planning, University of Waterloo. Thesis Topic: *Goderich – A Case Study of Conserving Cultural Heritage Resources in a Disaster*
2003-2008	Honours BES University of Waterloo, Waterloo, Ontario Joint Major: Environment and Resource Studies and Anthropology

Professional Memberships and Accreditations

Current	Professional Member, Canadian Association of Heritage Professionals (CAHP) Board Member, Ontario Association of Heritage Professionals.

Work Experience

Current	**Team Lead – Heritage, Archaeological Research Associates Ltd.** Oversees business development for the Heritage Department, coordinates completion of designation by-laws, Heritage Impact Assessments, Built Heritage and Cultural Heritage Landscape Assessments, and Cultural Heritage Resource Evaluations.
2009-2013	**Heritage Planner, Heritage Resources Centre, University of Waterloo** Coordinated the completion of various contracts associated with built heritage including responding to grants, RFPs and initiating service proposals.

Work Experience (Continued)

2008-2009, 2012 **Project Coordinator–Heritage Conservation District Study, ACO**
Coordinated the field research and authored reports for the study of 32 Heritage Conservation Districts in Ontario. Managed the efforts of over 84 volunteers, four staff and municipal planners from 23 communities.

2007-2008 **Team Lead, Historic Place Initiative, Ministry of Culture**
Liaised with Ministry of Culture Staff, Centre's Director and municipal heritage staff to draft over 850 Statements of Significance for properties to be nominated to the Canadian Register of Historic Places. Managed a team of four people.

Selected Professional Development

2018 Indigenous Canada, University of Alberta
2017 Empowering Indigenous Voices in Impact Assessments, Webinar, International Association for Impact Assessments
2015 Introduction to Blacksmithing, One-Day
2015 Leadership Training for Managers Course, Dale Carnegie Training
2014 Heritage Preservation and Structural Recording in Historical and Industrial Archaeology, Wilfrid Laurier University, 12 weeks
2014 Conservation and Craftsmanship in Sustainable City Building Presented by the Hamilton Burlington Society of Architects
2012 Region of Waterloo Workshop on Heritage Impact Assessments, Half-Day
2012 Conducting Historic Building Assessments Workshop, One-Day
2012 Window Restoration Workshop, One-Day
2011 Lime Mortars for Traditionally Constructed Brickwork, Two-Day Workshop, ERA Architects and Historic Restoration Inc., Toronto
2011 Energy & Heritage Buildings Workshop Two-Day Workshop, Heritage Resources Centre
2010 Architectural Photography, Mohawk College
2010 Project Management Fundamentals, University of Waterloo Continuing Education
2009 Cultural Heritage Landscapes Two-Day Workshop, Heritage Resources Centre
2009 Urban Landscape and Documentary Photography, Mohawk College
2008 Introduction to Digital Photography, Mohawk College
2008 Heritage Planning Four-Day Workshop, Heritage Resources Centre

Selected Publications

2018 "Restoring Pioneer Cemeteries" *Ontario Association of Heritage Professionals Newsletter.* Spring 2018. *In print.*
2015 "Written in Stone: Cemeteries as Heritage Resources." *Municipal World*, September 2015.
2015 "Bringing History to Life." *Municipal World*, February 2015, pages 11-12.
2014 "Inventorying our History." *Ontario Planning Journal*, January/February 2015.
2014 "Mad about Modernism." *Municipal World*, September 2014.
2014 "Assessing the success of Heritage Conservation Districts: Insights from Ontario Canada." with R. Shipley and J. Kovacs. *Cities*.
2014 "Veevers Estate Hamilton: From Historic Farmhouse to Environmental Showpiece." *ACORN*, Spring 2014.

Lindsay Benjamin, MAES, CAHP
Heritage Team Member
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Biography

Lindsay Benjamin is practiced at providing professional planning recommendations and expertise on complex studies, research projects, cultural heritage impact and archaeological assessments. Through her work as a Cultural Heritage Planner, Lindsay researched, drafted and implemented policies for the Regional Official Plan and other planning documents regarding the recognition, review and conservation of cultural heritage resources, including archaeological resources, heritage bridges, cultural heritage landscapes and scenic roads. She served as a Team Lead on the MTCS Historic Places Initiative that drafted over 850 Statements of Significance, was Series Editor for Phase 2 of *Heritage Districts Work!* a study of 32 heritage districts, and was the Primary Author of *Arch, Truss and Beam: The Grand River Watershed Heritage Bridge Inventory*. Lindsay has developed heritage property tax relief programs, worked on Municipal Heritage Registers and drafted designation by-laws in several municipalities. She holds a Master of Applied Environmental Studies degree from the University of Waterloo School of Planning and is a Professional Member of the Canadian Association of Heritage Professionals (CAHP).

Education

2013	MAES, University of Waterloo, Waterloo, ON Focus: Planning
2009	Post-Graduate Diploma, Centennial College, Toronto, ON Publishing & Professional Writing
2007	Honours BES, University of Waterloo, Waterloo, ON Major: Urban Planning, Co-op Distinction: Dean's Honours List

Professional Development

2012-Present	Canadian Association of Heritage Professionals (CAHP), Professional Membership
2013-2017	Ontario Heritage Planners Network Workshops
2017, 2016	National Trust for Canada Conference
2016	Heritage Inventories Workshop, City of Hamilton & ERA Architects
2011-2015	Ontario Heritage Conference
2012	Heritage Impact Assessments Workshop, Region of Waterloo
2012	National Trust for Historic Preservation Conference, Spokane, WA
2012	Conducting Historic Building Assessments Workshop, National Trust for Historic Preservation Conference, Spokane, WA
2012	Canadian Institute of Planners National Conference, Banff, ON
2012	Historic Window Restoration Workshop, Ontario Heritage Conference
2011	Energy and Heritage Buildings Two-Day Workshop, Heritage Resources Centre
2011	Heritage Conservation Districts Workshop, Heritage Resources Centre

Awards

2014 Heritage River Award, Watershed Awards & Canadian Heritage River Celebration, Grand River Conservation Authority

2009 A. K. (Alice King) Sculthorpe Award for Advocacy - Architectural Conservancy of Ontario

Work Experience

2017-Present **Heritage Team Member, Archaeological Research Associates Ltd.**
Coordinate the completion of heritage projects, including the evaluation of the cultural heritage value or interest of a variety of cultural heritage resources.

2013-2017 **Cultural Heritage Planner, Region of Waterloo**
Planned and implemented Arts, Culture and Heritage initiatives that support creativity and quality of life in the Region of Waterloo. Researched, developed and implemented Regional cultural heritage policies and programs. Fulfilled Regional and Provincial cultural heritage and archaeological review responsibilities under the Planning Act and Ontario Heritage Act.

2009-2013 **Heritage Planner, Heritage Resources Centre, University of Waterloo**
Facilitate the completion of various cultural heritage contracts by undertaking archival research, site visits, report writing, liaising with municipal staff and stakeholders and coordinating project scheduling and budgetary responsibilities.

2006-2007 **Project Manager, Heritage Resources Centre, University of Waterloo**
Established the process of nominating heritage properties to the National Register of Historic Places. Primary liaison between all stakeholder groups, responsible for motivating each group to participate and provide funding. Drafted over 130 Statements of Significance for properties to be nominated to the National Register. Managed a team of five employees.

2005-2006 **Heritage Conservation Easement Planning Assistant, Ontario Heritage Trust**
Supported easement acquisitions through researching the historical and architectural value of potential acquisitions and extensive photo documentation. Screened and processed activity requests from property owners and stakeholders relating to the easement program. Conducted site visits to monitor conservation easement sites and prepared condition assessment reports.

Publications

2017 Historic Interpretive Plaque, Village of German Mills
2016 Historic Interpretive Plaque, Huron Road Bridge
2015 Region of Waterloo Public Building Inventory
2015 Cultivating Heritage Gardens & Landscapes Workshop
2014 Historic Interpretive Plaque, West Montrose Covered Bridge
2014 Series of 17 Practical Conservation Guides for Heritage Properties

Volunteer Experience

2017 Lieutenant Governor’s Ontario Heritage Awards Jury Member

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Biography

Penny Young has 27 years of cultural heritage management experience, 21 years working in government, as a Heritage Planner, Heritage Coordinator, Regional Archaeologist and Archaeological Database Coordinator where she managed and coordinated the impacts to cultural heritage resources including built heritage, archaeological sites and cultural heritage landscapes for compliance with municipal, provincial and federal legislation and policy. She has conducted results-driven and collaborative management of complex cultural heritage resource projects within the public sector involving developing project terms of reference, defining scope of work, preparation of budgets and conducting sites visits to monitor and provide heritage/archaeological and environmental advice and direction. At the Ministry of Transportation Penny revised, updated and developed policy, as part of a team, for the *Ontario Heritage Bridge Guidelines for Provincially Owned Bridge Guidelines for Provincially Owned Bridges*. She received the MTO Central Region Employee Recognition Award in 2001 and 2002. While at MTO she provided technical advice and input into the development of the *MTO Environmental Reference for Highway Design - Section 3.7 Built Heritage and Cultural Heritage Landscapes* and the *MTO Environmental Guide for Built Heritage and Cultural Heritage Landscapes.* She is a professional member of the Canadian Association of Heritage Planners (CAHP) and holds Professional License #P092 from MTCS. She also holds memberships in the Ontario Professional Planners Institute (OPPI) and the Ontario Archaeological Society (OAS).

Education

1990-1993 Master of Arts, Department of Anthropology McMaster University, Hamilton Ontario. Specializing in Mesoamerican and Ontario archaeology.

1983-1987 Honours Bachelor of Arts (English and Anthropology), McMaster University, Hamilton, Ontario.

Professional Memberships and Accreditations

Current Professional Member of the Canadian Association of Heritage Professionals (CAHP)
Member of Ontario Archaeological Society
Pre-Candidate Member of the Ontario Professional Planners Institute
Current Ministry of Tourism Culture and Sport Professional Licence (#P092)

Work Experience

Current **Project Manager, Archaeological Research Associates Ltd.**
Coordinates ARA project teams and conducts heritage assessment projects including Heritage Impact Assessments, Built Heritage and Cultural Heritage

Landscape Assessments, and Cultural Heritage Resource Evaluations. Additional responsibilities include the completion of designation by-laws and heritage inventories. Liaises with municipal staff, provincial ministries and Indigenous communities to solicit relevant project information and to build relationships.

2008-2016 **Heritage Planner, Culture Services Unit, Ministry of Tourism, Culture & Sport (MTCS)**

Responsible for advising and providing technical review for management of cultural heritage resources in environmental assessment undertakings and planning projects affecting provincial ministries, municipalities, private sector proponents and Indigenous communities. Advised on municipalities' Official Plan (OP) policies cultural heritage conservation policies. Provided guidance on compliance with the Public Work Class EA, other Class EA legislation and 2010 *Standards and Guidelines for Provincial Heritage Properties*.

2014 **Senior Heritage Planner, Planning and Building Department, City of Burlington** (temporary assignment)

Project manager of the study for a potential Heritage Conservation District. Provided guidance to a multiple company consultant team and reported to municipal staff and the public. Liaised with Municipal Heritage Committee and municipal heritage property owners approved heritage permits and provided direction on Indigenous engagement, archaeological site assessments and proposed development projects.

2011 **Heritage Coordinator, Building, Planning and Design Department, City of Brampton** (temporary assignment)

Project lead for new Heritage Conservation District Study. The assignment included directing consultants, managing budgets, organizing a Public Information Session, and reporting to Senior Management and Council. Reviewed development/planning documents for impacts to heritage including OP policies, OP Amendments, Plans of subdivision and Committee of Adjustment applications and Municipal Class EA undertakings.

2010-2011 **Senior Heritage Coordinator, Culture Division, City of Mississauga** (temporary assignment)

Provided advice to Senior Management and Municipal Council on heritage conservation of built heritage, archaeological sites and cultural heritage landscapes. Liaised with multiple municipal staff including the Clerks' office, Parks and development planners and the public. Supervised and directed project work for junior heritage planner.

1999-2008 **Regional Archaeologist, Planning and Environmental Section, Ministry of Transportation (MTO)**

Responsibilities included: project management and coordination of MTO archaeology and heritage program, managed multiple consultants, conducted and coordinated field assessments, surveys and excavations, liaised with First Nations' communities and Band Councils, estimated budgets including $200,000 retainer contracts.

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Biography

Sarah Clarke is Archaeological Research Associates Ltd.'s Heritage Research Manager. Sarah has over 12 years of experience in Ontario archaeology and 10 years of experience with background research. Her experience includes conducting archival research (both local and remote), artifact cataloguing and processing, and fieldwork at various stages in both the consulting and research-based realms. As Team Lead of Research, Sarah is responsible for conducting archival research in advance of ARA's archaeological and heritage assessments. In this capacity, she performs Stage 1 archaeological assessment site visits, conducts preliminary built heritage and cultural heritage landscape investigations and liaises with heritage resource offices and local community resources in order to obtain and process data. Sarah has in-depth experience in conducting historic research following the *Ontario Heritage Toolkit* series, and the *Standards and Guidelines for Provincial Heritage Properties*. Sarah holds an Honours B.A. in North American Archaeology, with a Historical/Industrial Option from Wilfrid Laurier University and is currently enrolled in Western University's Intensive Applied Archaeology MA program. She is a member of the Ontario Archaeological Society (OAS), the Society for Industrial Archaeology, the Ontario Genealogical Society (OGS), the Canadian Archaeological Association, and is a Council-appointed citizen volunteer on the Brantford Municipal Heritage Committee. Sarah holds an R-level archaeological license with the MTCS (#R446).

Education

Current	MA Intensive Applied Archaeology, Western University, London, ON. Proposed thesis topic: Archaeological Management at the Mohawk Village.
1999–2010	Honours BA, Wilfrid Laurier University, Waterloo, Ontario Major: North American Archaeology, Historical/Industrial Option

Professional Memberships and Accreditations

Current	Member of the Ontario Archaeological Society
Current	Member of the Society for Industrial Archaeology
Current	Member of the Brant Historical Society
Current	Member of the Ontario Genealogical Society
Current	Member of the Canadian Archaeological Association
Current	Member of the Archives Association of Ontario

Work Experience

Current	**Team Lead – Research; Team Lead – Archaeology, Archaeological Research Associates Ltd.** Manage and plan the research needs for archaeological and heritage projects. Research at offsite locations including land registry offices, local libraries and

local and provincial archives. Historic analysis for archaeological and heritage projects. Field Director conducting Stage 1 assessments.

2013-2015 **Heritage Research Manager; Archaeological Monitoring Coordinator, Archaeological Research Associates Ltd.**
Stage 1 archaeological field assessments, research at local and distant archives at both the municipal and provincial levels, coordination of construction monitors for archaeological project locations.

2010-2013 **Historic Researcher, Timmins Martelle Heritage Consultants Inc.**
Report preparation, local and offsite research (libraries, archives); correspondence with the Ministry of Tourism, Culture, and Sport; report submission to the MTCS and clients; and administrative duties (PIF and Borden form completion and submission, data requests).

2008-2009 **Field Technician, Archaeological Assessments Ltd.**
Participated in field excavation and artifact processing.

2008-2009 **Teaching Assistant, Wilfrid Laurier University.**
Responsible for teaching and evaluating first year student lab work.

2007-2008 **Field and Lab Technician, Historic Horizons.**
Participated in excavations at Dundurn Castle and Auchmar in Hamilton, Ontario. Catalogued artifacts from excavations at Auchmar.

2006-2010 **Archaeological Field Technician/Supervisor, Wilfrid Laurier University.**
Field school student in 2006, returned as a field school teaching assistant in 2008 and 2010.

Professional Development

2018 Grand River Watershed 21st Annual Heritage Day Workshop and Celebration (One day)
2018 Mississaugas of the New Credit First Nation Historical Gathering and Education Conference (One day)
2017 Ontario Genealogical Society Conference. (Two days)
2016 Ontario Archaeological Society Symposium (One day)
2015 Introduction to Blacksmithing Workshop, Milton Historical Society (One day)
2015 Applied Research License Workshop, MTCS (One day)
2014 Applied Research License Workshop, MTCS (One day)
2014 Heritage Preservation and Structural Recording in Historical and Industrial Archaeology. Four-month course taken at Wilfrid Laurier University, Waterloo, ON. Professor: Meagan Brooks

Presentations

2018 **The Early Black History of Brantford.** Brant Historical Society, City of Brantford.
2017 **Mush Hole Archaeology.** Ontario Archaeological Society Symposium, City of Brantford.
2017 **Urban Historical Archaeology: Exploring the Black Community in St. Catharines, Ontario.** Canadian Archaeological Association Conference, Gatineau, QC.

Volunteer Experience

Current **Council-appointed citizen volunteer for the Brantford Municipal Heritage Committee.**

APPENDIX D

Transportation Study (Paradigm Transportation Solutions Ltd, Aug. 2019)

Wellington Road 124 Improvements Environmental Assessment Transportation Study

Paradigm Transportation Solutions Limited

May 2019

ptsl.com

Project Summary

Project Number
180114

May 2019

Client
County of Wellington

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Wellington Road 124 Improvements Environmental Assessment Transportation Study

Signatures and Seals

Signature

Engineer's Seal

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Executive Summary

Content

The County of Wellington is undertaking a Schedule C Municipal Class Environmental Assessment (EA) for implementing improvements to Wellington Road 124 (WR 124), between Township Road 1 and Fife Road.

The County retained MTE Consultants as the main consultant for the EA Study, with Paradigm Transportation Solutions Limited (Paradigm) as sub-consultants to carry out the transportation review for the EA study.

The transportation review established and analysed current and future conditions corresponding to a) existing road cross-section and intersection configurations; b) improvement alternatives that were identified and evaluated to accommodate future traffic conditions; and c) road cross-section and intersection configurations of the preferred alternative.

Existing traffic conditions were developed based on traffic data gathered in 2018 as the base year. Future traffic conditions were forecast to the horizon year of 2041, to identify improvements that will accommodate traffic volume increases over a twenty-year period.

Conclusions

The main findings and conclusions of this study are as follows:

Existing Configurations

- Under existing (2018) conditions, the corridor is operating with very high levels of delay in the AM and PM peak hours.
- Under 2031 and 2041 traffic conditions, with no geometric improvements, the corridor is forecast to operate with very high levels of delay, and well beyond capacity, despite modifications to signal timings.

Improvement Alternatives

- A total of five design alternatives were reviewed, under 2041 traffic conditions, including:
  - **Alternative 1**: Existing cross-section, with side-by-side left-turn lanes between WR 32 (North) and WR 32 (South);
  - **Alternative 2**: Existing cross-section, with two-way-left-turn lane on WR 124 from Township Road 1 to Whitelaw Road;
  - **Alternative 3**: Four-lane cross-section with dual left-turn lanes between WR 32 (North) and WR 32 (South);

- **Alternative 4A**: Existing cross-section, with roundabouts at WR 124/WR 32 (North) and WR 124/WR 32 (South). Roundabout at WR 124/WR 32 (South) includes a northbound right-turn bypass; and
- **Alternative 4B**: Existing cross-section, with a roundabout at WR124/WR32 (North), and removal of the existing south leg at WR 124/WR 32 (South).

- Under Alternative 1, the corridor is forecast to operate with very high levels of delay at the intersections of WR 124/WR 32 (North) and WR 124/WR 32 (South). These intersections are also forecast to operate well beyond capacity during both peak hours.
- Under Alternative 2, the corridor is forecast to operate with very high levels of delay at the intersections of WR 124/WR 32 (North) and WR 124/WR 32 (South). These intersections are also forecast to operate well beyond capacity during both peak hours.
- Under Alternative 3, the corridor is forecast to operate with high levels of delay at the intersections of WR 124/WR 32 (South). Several intersections are forecast to operate at or near capacity; however, critical movements are confined to the intersection of WR 124/WR 32 (South).
- Under Alternative 4A, the corridor is forecast to operate with acceptable levels of service at most intersections.
- Under Alternative 4B, the corridor is forecast to operate with acceptable levels of service at most intersections.

Preferred Alternative

- Based on the review of the design alternatives, a preferred alternative comprising a three-lane cross-section of one travel lane per direction, and a centre two-way left-turn lane throughout the study corridor has been developed.
- Two lane roundabouts are proposed to replace the existing signalized intersections at WR 32 (South) and WR 32 (North), with a four-lane cross-section in between.
- Under 2041 traffic conditions, Wellington Road 124 is forecast to operate with generally acceptable levels of service in both peak hours.
- The intersection of WR 124 and Whitelaw Road will require geometric improvements to accommodate the increase traffic volumes on Whitelaw Road upon the completion of the Niska Road bridge.

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1 Introduction

1.1 Overview

The County of Wellington is undertaking a Schedule C Municipal Class Environmental Assessment (EA) for implementing improvements to Wellington Road 124 (WR 124), between Township Road 1 and Fife Road, as illustrated in **Figure 1.1.**

The County retained MTE Consultants as the main consultant for the EA Study, with Paradigm Transportation Solutions Limited (Paradigm) as sub-consultants to carry out the transportation component of the study.

1.2 Purpose and Scope

The purpose of the transportation component is to provide input to the EA Study by a) establishing and analysing current and future conditions; b) providing traffic analysis results for establishing Need & Justification and formulating Problem Statement; and c) using traffic analysis for identifying and evaluating improvement alternatives and in selecting the preferred alternative.

The anticipated improvements include modifications to the three WR 124 intersections at Whitelaw Road, and at the two legs of Wellington Road 32 (WR 32 North and WR 32 South). Based on a preliminary review of potential improvement options, the following have been identified for consideration in the EA study:

- widening to four lanes;
- two-way centre-turn lane;
- auxiliary lane additions at the three intersections; and
- roundabout modifications at the three intersections.

Intersection operations and potential improvements were reviewed at the following intersections within the study limits:

- WR 124 & Township Road 1;
- WR 124 & WR 32 (South Leg);
- WR 124 & WR 32 (North Leg);
- WR 124 & Whitelaw Road; and
- WR 124 & Fife Road.

The following traffic conditions were analyzed:

- Existing Traffic Conditions (2018): using intersection counts undertaken in 2018; and

- Future Traffic Conditions (2041): using traffic forecasting to the 2041 horizon year to identify improvements to accommodate traffic increases over a twenty-year period.

Location of Study Area

2 Existing Conditions

This section documents current traffic conditions, operational deficiencies, and constraints experienced by the public travelling at the intersections within the study area. The operational deficiencies and constraints identified at this stage are fundamental to the process of identifying improvement alternatives to address current and future requirements.

2.1 Road Network

The main roadways reviewed as part of this study, in addition to Wellington Road 124, include Wellington Road 32, Township Road 1, Whitelaw Road, and Fife Road. Fife Road east of Whitelaw Road and Wellington Road east of Fife Road are under the jurisdiction of the City of Guelph. WR 124 west of Fife Road and the other intersecting roads are under the jurisdiction of Wellington County. The characteristics of these roadways are as follows:

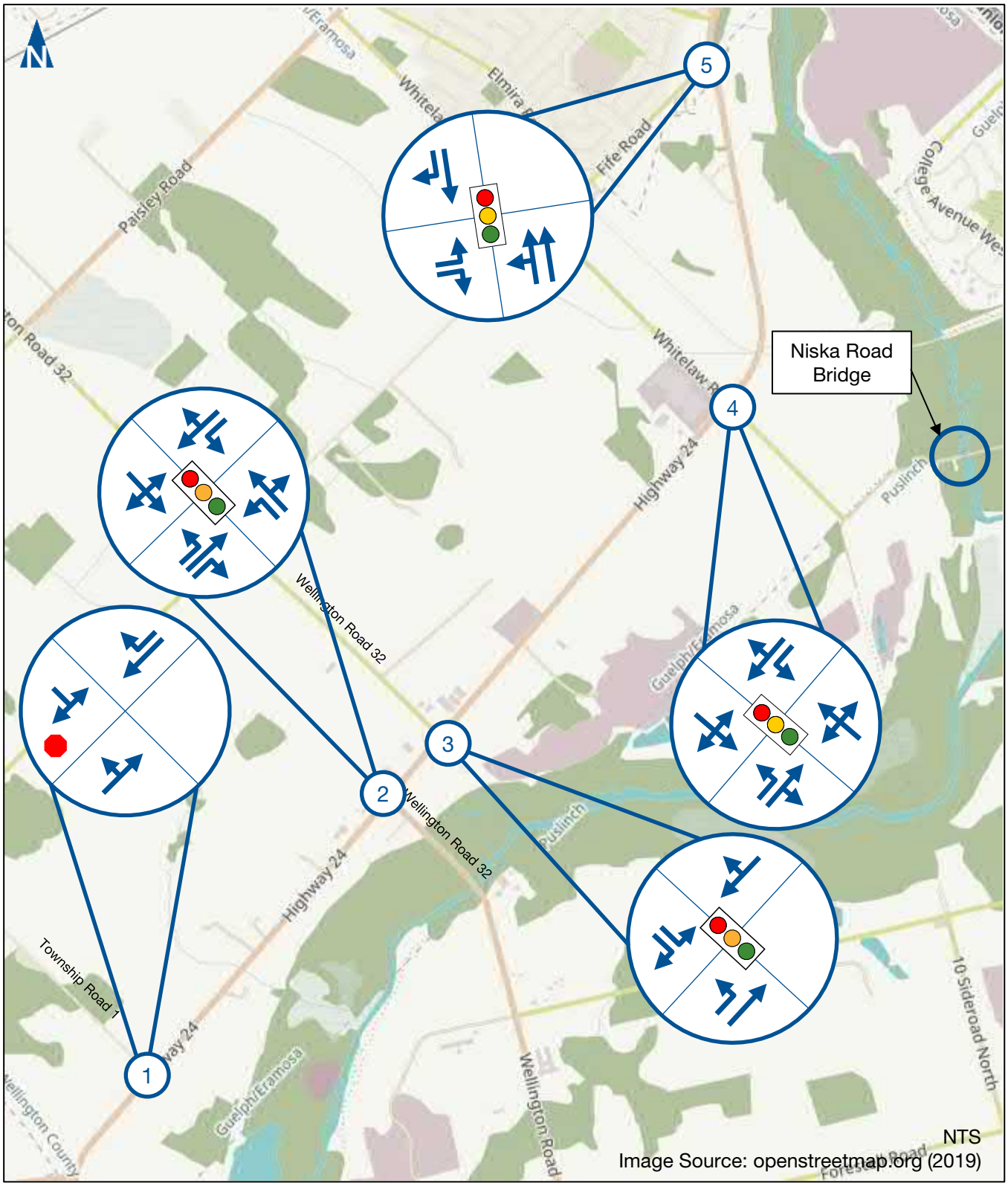
- **Wellington Road 124** is an east-west, two-lane roadway with a rural cross-section, and one travel lane per direction. The posted speed limit is 70 kilometres per hour, decreasing to 60 kilometres per hour east of Fife Road. The Wellington Road 124 intersection with Wellington Road 32 (South), Wellington Road 124 (North), Whitelaw Road, and Fife Road operate with traffic control signals.
- **Township Road 1** is a north-south, two-lane roadway with a rural cross-section and one travel lane per direction. The maximum speed limit is unposted and is assumed to be 50 kilometres per hour. The intersection at WR 124 is under minor street (Township Road) Stop sign control.
- **Wellington Road 32 (South)** is a north-south, two-lane roadway with a rural cross-section, and one travel lane per direction. The posted speed limit within the vicinity of Wellington Road 124 is 60 kilometres per hour. WR 32 South intersects WR124 at a T intersection to the west of Township Road 1. A private driveway is included as the north leg at the intersection, which is under traffic signal control.
- **Wellington Road 32 (North)** is a north-south, two-lane roadway with a rural cross-section, and one travel lane per direction. The posted speed limit within the vicinity of Wellington Road 124 is 80 kilometres per hour. WR 32 North intersects WR 124 at a T-intersection approximately 370 metres to the east of WR 32 South. The intersection is under traffic signal control.
- **Whitelaw Road** is a north-south, two-lane roadway with a rural cross-section and one travel lane per direction, and extending from Paisley Road in the north and to Niska Road to the southeast. At present, the Niska Road bridge over the Speed Rive is closed for replacement and a new bridge and road connection are expected to be completed in the short term. North of Wellington Road 124, the roadway has a posted speed limit of 60 kilometres per hour. South of

Wellington Road 124, the roadway has a posted speed limit of 50 kilometres per hour.

- **Fife Road** is an east-west, three-lane roadway with an urban cross-section and one travel lane per direction, and a centre two-way left-turn lane. The posted speed limit is 50 kilometres per hour. Pedestrian sidewalk facilities are provided on both sides of the roadway within the study area. Cycling facilities in the form of designated bike lanes are provided on both sides of the roadway.

Figure 2.1 details the existing lane configurations and traffic controls at the study area intersections as documented in mid 2018[1].

[1]At the commencement of the EA study, the intersection of Township Road 1/Wellington Road 124 comprised a shared southbound lane and a shared eastbound lane. Intersection improvements were undertaken in November 2018, and they included the addition of a southbound left-turn lane on Township Road 1, and an eastbound left-turn lane on Wellington Road 124.



Existing Lane Configurations and Traffic Control

2.2 Existing Traffic Conditions

2.2.1 Base Year (2018) Traffic Volumes

To establish base year traffic conditions, eight-hour turning movement counts were undertaken at the five study intersections, on Tuesday 5 June 2018 from 7:00 AM to 9:00 AM, 11:00 AM to 2:00 PM and 4:00 PM to 7:00 PM.

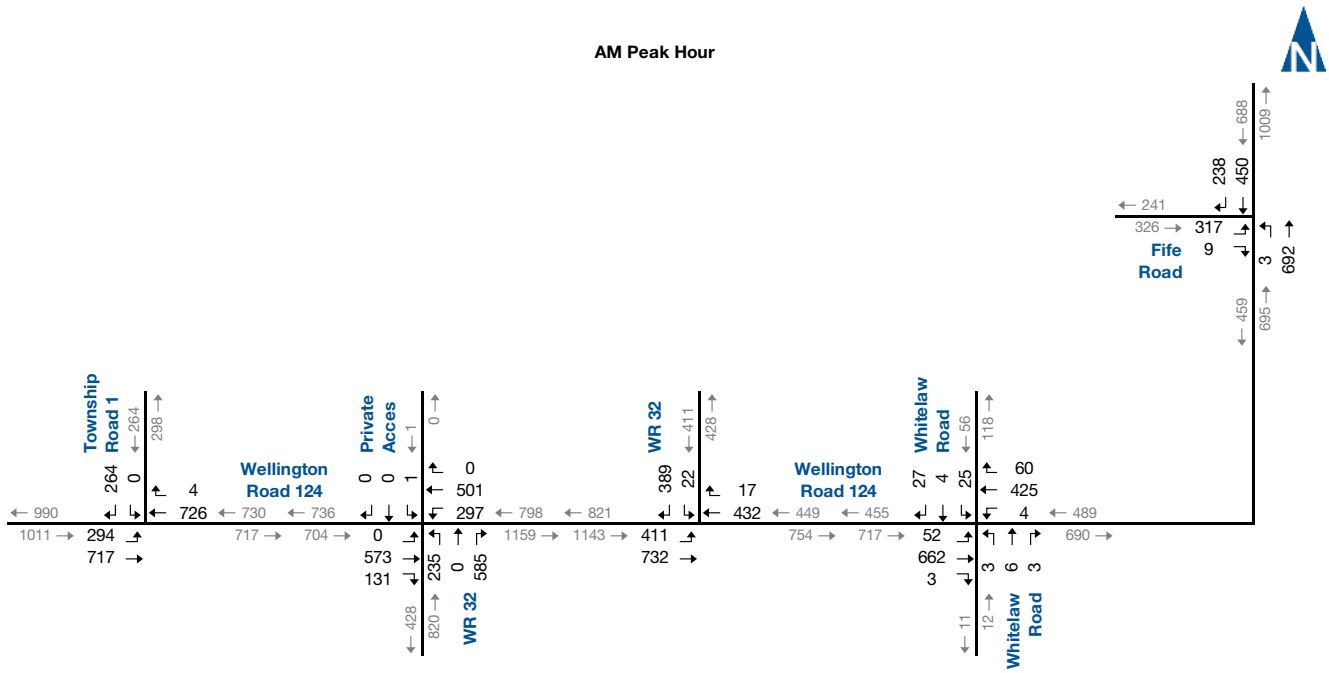
All traffic movements including pedestrian crossings were counted in 15-minute intervals and vehicles were classified by type. Due to the presence of several driveway connections between the study intersections, volume balancing between intersections has not been applied.

The morning and afternoon peak hours were generally identified as 7:30 AM to 8:30 AM and 4:30 PM to 5:30 PM, respectively.

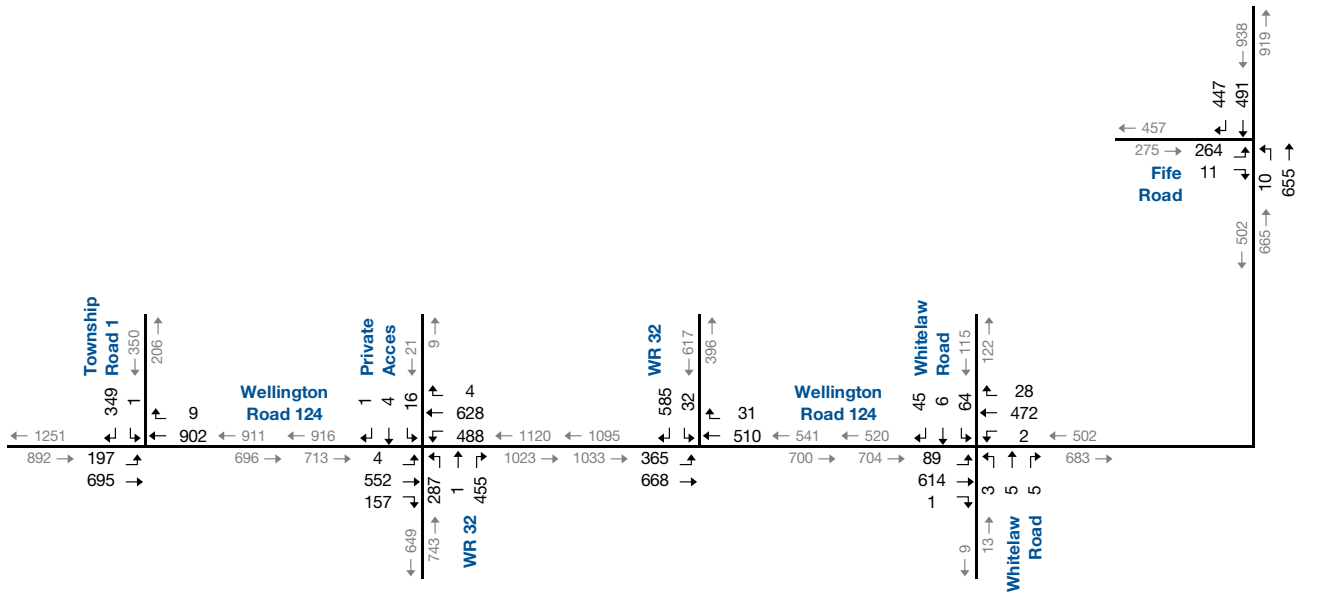
Figure 2.2 summarizes the existing weekday AM and PM peak hour traffic volumes.

Appendix A contains the raw traffic count data.

AM Peak Hour



PM Peak Hour



Existing Traffic Volumes

2.2.2 Intersection Operations

The operations of the Wellington Road 124 intersections were analysed using Synchro 9 with Highway Capacity Manual (HCM) 2000 procedures. The key parameters used in the analysis include:

- Existing (2018) traffic volumes shown in **Figure 2.2**
- Existing lane configurations as noted at the date of the traffic counts (June 2018) and shown in **Figure 2.1**;
- Signal timing data as provided by Wellington County, and the City of Guelph, included for reference in **Appendix B**;
- Heavy vehicle percentages, overall intersection peak hour factors (PHF) and conflicting pedestrian volumes as derived from the existing turning movement counts; and
- Synchro default values for all other inputs.

Intersection level of service (LOS) is a recognized method of quantifying the average delay experienced by drivers at intersections. It is based on the delay experienced by individual vehicles executing the various movements. The delay is related to the number of vehicles desiring to make a particular movement, compared to the estimated capacity for that movement. The capacity is based on a number of criteria related to opposing traffic flows, intersection geometry and traffic control.

Table 2.1 contains the level of service criteria for signalized and stop-controlled intersections. The highest possible rating is LOS A, under which the average total delay is equal or less than 10.0 seconds per vehicle. When the average delay exceeds 80 seconds for signalized intersections, 50 seconds for unsignalized intersections or when the volume to capacity ratio is greater than 1.00, the movement is classed as LOS F, and remedial measures are usually implemented, if they are feasible. LOS E is usually used as a guideline for the determination of road improvement needs on through lanes, while LOS F may be acceptable for left-turn movements at peak times, depending on delays.

TABLE 2.1: LEVEL OF SERVICE DEFINITIONS

Level of Service	Signalized Intersections Average Total Delay (sec/veh)	Unsignalized Intersections Average Total Delay (sec/veh)
A	< = 10	< = 10
B	> 10 & < = 20	> 10 & < = 15
C	> 20 & < = 35	> 15 & < = 25
D	> 35 & < = 55	> 25 & < = 35
E	> 55 & < = 80	> 35 & < = 50
F	> 80	> 50

The intersection analysis considered the following operational performance measures of effectiveness:

- The LOS, based on the average control delay for each vehicle, for each turning movement;
- The volume to capacity ratio for each movement, where applicable; and
- The estimated 95th percentile queue length.

Table 2.2 summarizes the operational performance measures for WR 124 intersections under existing (base year) traffic volumes for the weekday AM and PM peak hours. The following critical movements are noted:

WR 124 & Township Road 1

- In the PM peak hour, the southbound approach is operating at LOS F, with a v/c ratio of 1.15.

WR 124 & WR 32 (South)

- In the AM peak hour, the northbound left-turn movement is operating at LOS F, with a v/c ratio of 1.03, and with 95th percentile queues exceeding available lane storage by 56 metres;
- In the AM peak hour, the northbound shared through/right-turn movement is operating at LOS F, with a v/c ratio of 0.95;
- In the PM peak hour, the northbound left-turn movement is operating at LOS F, with a v/c ratio of 1.15 and with 95th percentile queues exceeding available lane storage by 73 metres; and
- In the PM peak hour, the whole intersection is approaching capacity, operating at LOS D with a v/c ratio of 0.96.

The analysis results indicate all other intersections and movements are operating with generally acceptable levels of service. **Appendix C** contains the detailed Synchro reports.

TABLE 2.2: EXISTING TRAFFIC OPERATIONS SUMMARY

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	<	A		A		A	A	A					<	D	>	D	
			Delay	<	9		9		0	0	0					<	31	>	31	
			V/C	<	0.37				0.45	0.00						<	0.69	>		
			Q	<	14				0	0						<	40	>		
			Ex	<	-				-	25						<	-	>		
			Avail.	<	-				-	25						<	-	>		
	2 - Wellington Road 124 & Wellington Road 32 (South)	TCS	LOS	A	C	B	C	B	A	>	B	F	F	>	F	<	D	>	D	D
			Delay	0	22	13	21	15	9	>	11	109	85	>	92	<	37	>	37	43
			V/C	0.00	0.70	0.14		0.69	0.48	>		1.03	0.95	>		<	0.01	>		0.78
			Q	0	176	22		33	73	>		116	130	>		<	2	>		
			Ex	40	-	25		55	-	>		60	-	>		<	-	>		
			Avail.	40	-	3		22	-	>		-56	-	>		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	TCS	LOS	B	A		A		B	>	B					D		D	D	B
			Delay	10	5		7		14	>	14					38		40	40	15
			V/C	0.70	0.58				0.51	>						0.13		0.31		0.67
			Q	56	121				103	>						12		27		
			Ex	215	-				-	>						90		-		
			Avail.	160	-				-	>						78		-		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	A	A	>	A	A	A	>	A	<	C	>	C	<	D	>	D	A
			Delay	3	7	>	6	3	5	>	5	<	35	>	35	<	37	>	37	8
			V/C	0.10	0.56	>		0.01	0.41	>		<	0.07	>		<	0.32	>		0.54
			Q	7	93	>		1	55	>		<	6	>		<	16	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	133	-	>		134	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	C		B	C					<	A		A		B	A	A	B
			Delay	27		17	27					<	9		9		11	8	10	13
			V/C	0.73		0.01						<	0.43				0.50	0.17		0.58
			Q	65		3						<	47				70	10		
			Ex	90		-						<	-				-	-		
			Avail.	25		-						<	-				-	-		
PM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	<	A		A		A	A	A					<	F	>	F	
			Delay	<	7		7		0	0	0					<	135	>	135	
			V/C	<	0.28				0.55	0.01						<	1.15	>		
			Q	<	9				0	0						<	121	>		
			Ex	<	-				-	25						<	-	>		
			Avail.	<	-				-	25						<	-	>		
	2 - Wellington Road 124 & Wellington Road 32 (South)	TCS	LOS	B	C	B	C	C	A	>	B	F	D	>	F	<	D	>	D	D
			Delay	15	24	16	22	26	9	>	17	149	40	>	82	<	39	>	39	37
			V/C	0.01	0.66	0.16		0.87	0.51	>		1.15	0.31	>		<	0.21	>		0.96
			Q	3	142	25		82	86	>		133	32	>		<	12	>		
			Ex	40	-	25		55	-	>		60	-	>		<	-	>		
			Avail.	37	-	0		-27	-	>		-73	-	>		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	TCS	LOS	B	A		B		B	>	B					C		D	D	C
			Delay	16	7		10		20	>	20					35		54	53	25
			V/C	0.71	0.52				0.58	>						0.11		0.78		0.75
			Q	70	127				143	>						14		87		
			Ex	215	-				-	>						90		-		
			Avail.	145	-				-	>						76		-		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	A	A	>	A	A	A	>	A	<	C	>	C	<	D	>	D	A
			Delay	5	7	>	7	4	6	>	6	<	32	>	32	<	36	>	36	9
			V/C	0.17	0.50	>		0.00	0.42	>		<	0.04	>		<	0.51	>		0.50
			Q	11	71	>		1	54	>		<	6	>		<	29	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	129	-	>		134	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	C		B	C					<	A		A		A	A	A	B
			Delay	25		18	25					<	8		8		10	8	9	11
			V/C	0.66		0.01						<	0.37				0.50	0.29		0.54
			Q	51		3						<	40				70	13		
			Ex	90		-						<	-				-	-		
			Avail.	39		-						<	-				-	-		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length (m)
Ex. - Existing Available Storage (m)
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control

<- Shared Left/Through Lane
>- Shared Right/Through Lane

2.3 WR 124 Intersection at Township Road 1

During the course of the EA study intersection improvements were undertaken at the intersection of WR 124 and Township Road 1. The improvements, which were completed in November 2018, included the addition of exclusive left-turn lane in the eastbound direction on WR 124, and separate right-turn and left-turn lanes in the southbound direction on Township Road 1. The traffic control at the intersection continues to be two-way Stop control, with Stop sign on Township Road 1.

As indicated in Section 2.2.1, the existing traffic volumes were analysed based on pre-improvement intersection configuration that included a shared left-through lane in the eastbound direction on WR 124, and a shared left-right lane in the southbound direction on Township Road 1, as shown in **Figure 2.1**. The intersection geometry includes a westbound right-turn lane on Highway 7.

As shown in **Table 2.2**, poor level of service and a long delay is experienced by the southbound, shared left-right movement under existing traffic conditions during the PM peak hour.

Intersection operations were re-analysed under existing traffic conditions with the above-noted geometric improvements in place. The results of the analysis are summarized in **Table 2.3**, and indicate continuing good levels of service for the east-west traffic on WR 124 during both AM and PM peak hours. For the southbound traffic on Township Road 1, the LOS continues to be F in the PM peak hour, but there is improvement in the v/c ratio for the southbound left-turn movement but not for the right-turn movements.

TABLE 2.3: EXISTING TRAFFIC OPERATIONS SUMMARY – TOWNSHIP ROAD 1

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	B	A		**A**		A	A	**A**					A		D	**D**	
			Delay	12	0		**3**		0	0	**0**					0		31	**31**	
			V/C	0.37	0.44				0.45	0.00		**Approach**				0.00		0.69		
			Q	14	0				0	0		**Not Applicable**				0		40		
			Ex	150	-				-	75						45		-		
			Avail.	137	-				-	75						45		-		
PM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	B	A		**A**		A	A	**A**					F		F	**F**	
			Delay	12	0		**3**		0	0	**0**					91		126	**126**	
			V/C	0.28	0.43				0.55	0.01		**Approach**				0.02		1.13		
			Q	9	0				0	0		**Not Applicable**				1		117		
			Ex	150	-				-	75						45		-		
			Avail.	141	-				-	75						44		-		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length (m)
Ex. - Existing Available Storage (m)
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control

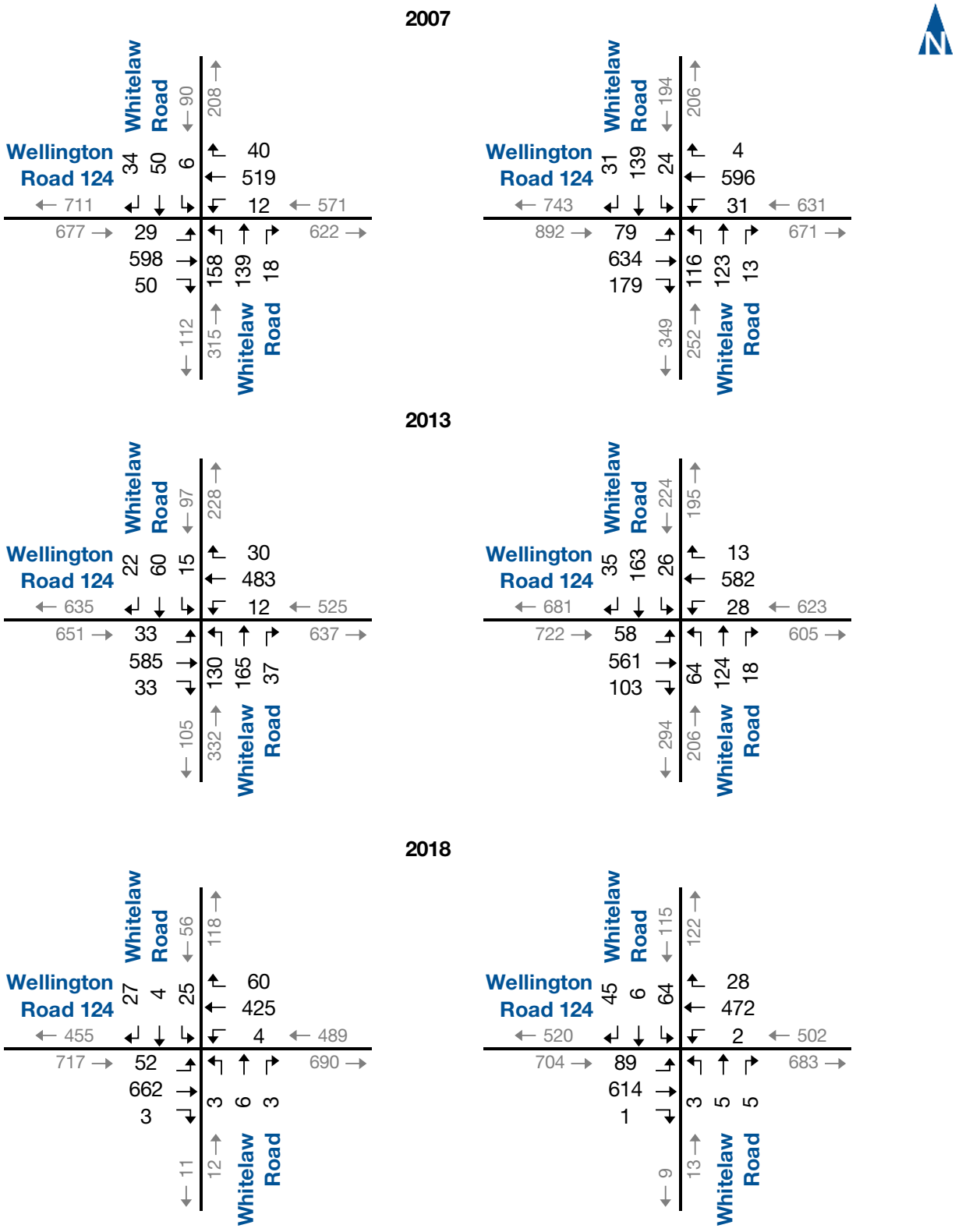
<- Shared Left/Through Lane
>- Shared Right/Through Lane

2.4 WR 124 Intersection at Whitelaw Road

As noted earlier, in **Section 2.1**, the Niska Road bridge at the southeasterly terminus of Whitelaw Road is currently closed. The low traffic volumes on Whitelaw Road south of WR 124, at the Whitelaw Road intersection, as shown in **Figure 2.2**, reflect the closure of the Niska Road Bridge.

Traffic data collected in 2007 and 2013, before the bridge was closed for maintenance and replacement, indicate higher volumes on Whitelaw Road than the current volumes, as shown in **Figure 2.3**.

For the purpose of the WR 124 EA study, future traffic projections assumed that the new Niska Road bridge would be in place, as discussed in **Section 5.2.**



Existing Traffic Volumes
Whitelaw Road & WR 124

2.5 Review of Collision History

2.5.1 Data Collection

Wellington County's Ontario Provincial Police (OPP) Detachment provided an inventory of all motor vehicle collisions (MVCs) on Wellington Road 124 from Township Road 1 to Fife Road for the period January 1, 2008 to December 31, 2017 (inclusive). The City of Guelph provided collision data for the intersection of Wellington Road 124 & Fife Road for the same period. A total of 550 motor vehicle collisions were recorded over this period. **Table 2.4** summarizes the general location and type of each collision.

TABLE 2.4: MOTOR VEHCLE COLLISION SUMMARY

Location	Motor Vehicle Collision Type						Total
	PD	PD (NR)	FTR	PI	PI (FTR)	Fatal	
WR 124 at Township Road 1	47	20	2	12	3	0	84
WR 124 between Township Road 1 and WR 32	37	16	0	6	1	0	60
WR 124 at WR 32	154	25	10	31	0	1	221
WR 124 between WR 32 and Whitelaw Road	28	3	3	8	0	0	42
WR 124 at Whitelaw Road	68	23	5	11	0	0	107
WR 124 between Whitelaw Road and Fife Road	9	6	0	5	0	1	21
WR 124 at Fife Road	9	4	0	2	0	0	15
Total	**352**	**97**	**20**	**75**	**4**	**2**	**550**

PD – Personal Damage
PD (NR) – Personal Damage, No Response
FTR – Fail to Remain
PI – Personal Injury
PI (FTR) – Personal Injury, Fail to Remain

2.5.2 Collision Trends

Of the 550 collisions, 82% involved property damage only, 14% involved a personal injury, and there were two fatalities (0.4%). The remaining 3.6% involved fail to remain collisions with no noted injuries. A total of 81 collisions involving injuries were reported (75 personal injury, four (4) failing to remain, and two (2) fatal).

Collision Locations

The largest number of collisions (221) were around the section of Wellington Road 124 at or between Wellington Road 32 North and Wellington Road 32

South. The records do not specify the locations relative to the North and South legs of Wellington Road 32, or the midblock between them. The second, third and the fourth largest locations (107, 84 and 60) were respectively at Whitelaw Road, at Township Road 1 and between Township Road 1 and Wellington Road 32. The number of collisions is under 50 between Wellington Road 32 and Whitelaw Road (42) and between Whitelaw Road and Fife Road (21). There have been 15 recorded collisions at Wellington Road 124 and Fife Road over the last ten years.

Fatal Collisions

The two (2) fatal collisions occurred on Wellington Road 124 between Whitelaw Road and Fife Road, and in the vicinity of Wellington Road 124 and Wellington Road 32. No further information related to time of day, day of week, weather or driver actions were provided in the dataset.

Personal Injury – Fail to Remain

The four (4) personal injury collisions involving a vehicle or vehicles failing to remain on scene occurred at the intersection of Wellington Road 124/Township Road 1, or midblock between Township Road 1 and Wellington Road 32 (South). No further information related to time of day, day of week, weather or driver actions were provided in the dataset.

Personal Injury

The 75 personal injury collisions occurred throughout the study area. It is noted that the frequency of personal injuries is higher at intersections as opposed to midblock. No further information related to time of day, day of week, weather or driver actions were provided in the dataset.

Other Trends

The information contained in the collision records provided by Wellington County OPP do not provide enough information to extract additional trends or conditions that may have affected collision patterns. Typical conditions including low light (nighttime), poor weather, winter driving, and driver behaviours (actions) were not provided as part of the dataset. The provision of additional environment information could assist in the identification of collisions factors and trends.

Collision information provided by the City of Guelph for the intersection of Wellington Road 124/Fife Road does not provide information in terms of driver action or condition. However, information related to time of day, collision type, lighting and environment conditions are provided. The following are noted from the dataset of 15 collisions:

- The majority of collisions included rear-end (7), turning movement (3) or single motor vehicle collisions (3). The remaining collisions comprised one approaching collision and one sideswipe collision;

- The majority of collisions (12) occurred under clear conditions. One collision occurred during snow, and the other two (2) during rain; and
- Ten (10) collisions occurred during daylight hours and two (2) occurred during night/dark conditions. The remaining collisions (3) occurred during dawn or dusk.

Overall, the data indicates the majority (81.6%) of the collisions involved property damage, 22% of which did not permit a response (i.e. self-reported collision). A total of 81 collisions involving injuries occurred, comprising two (2) fatal injuries, and 79 serious or minor injuries. The dataset and summary of collisions appear to indicate injuries were more frequent at intersections rather than midblocks. No other trends or patterns could be extracted from the dataset.

3 Future Traffic Conditions

The assessment of the future traffic conditions contained in this section includes the determination of future traffic volumes on Wellington Road 124 within the study limits.

3.1 Future Traffic Forecasts

Traffic projections for the 2031 and 2041 horizons are based on historic traffic growth on Wellington Road 124 and the general population growth in the County and the City of Guelph.

Historic traffic patterns were reviewed using traffic count data on Wellington Road 124 from 2013 to 2016. The year to year growth rates among the individual eastbound and westbound road sections was found to vary from road section to section. The variability in these growth rates can be partially attributed to the limited number of available traffic counts and the various times of year in which the data was collected.

When the data is considered directionally, eastbound volumes have grown at a daily average of 1.75% and westbound volumes have decreased at an average of 0.51% from 2013. The average daily growth rate between the project limits of Wellington Road 124 as a whole is 0.62%. **Table 3.1** summarizes the estimated average growth rates directionally and temporally.

TABLE 3.1: HISTORIC GROWTH RATES

Direction	AM Peak Hour	PM Peak Hour	Daily
Eastbound	2.09%	1.41%	1.75%
Westbound	-0.46%	-0.57%	-0.51%
Both Directions	0.82%	0.42%	0.62%

Based on the growth rates summarized in **Table 3.**1, a growth rate of 2% compounded per annum was assumed to forecast traffic volumes to 2031. A lower growth rate of 1.5% compounded per annum was assumed to forecast traffic volumes between 2031 and 2041.

The growth rates are noted to be conservative and align with industry standard growth rates when forecasting future traffic volumes. In addition, they are also consistent with the population growth projections in Wellington County and the City of Guelph from 2016 to 2031 and 2041.

3.1.1 2031 & 2041 Traffic Link Volumes

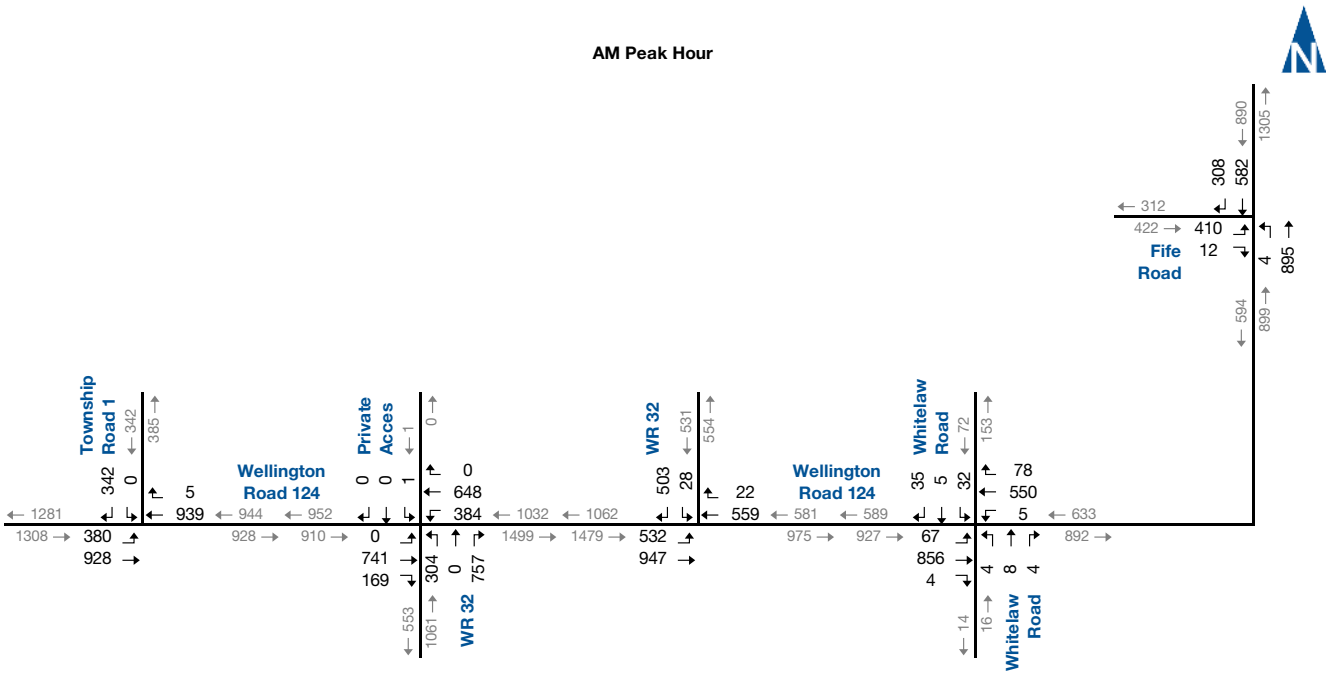
These growth rates have been applied to the base year (2018) link volumes. **Table 3.2** and **Table 3.3** summarize the AM peak hour and PM peak hour link volumes for 2018, 2031 and 2041. **Figure 3.1** and **Figure 3.2** illustrate the 2031 and 2041 intersection traffic volumes, respectively.

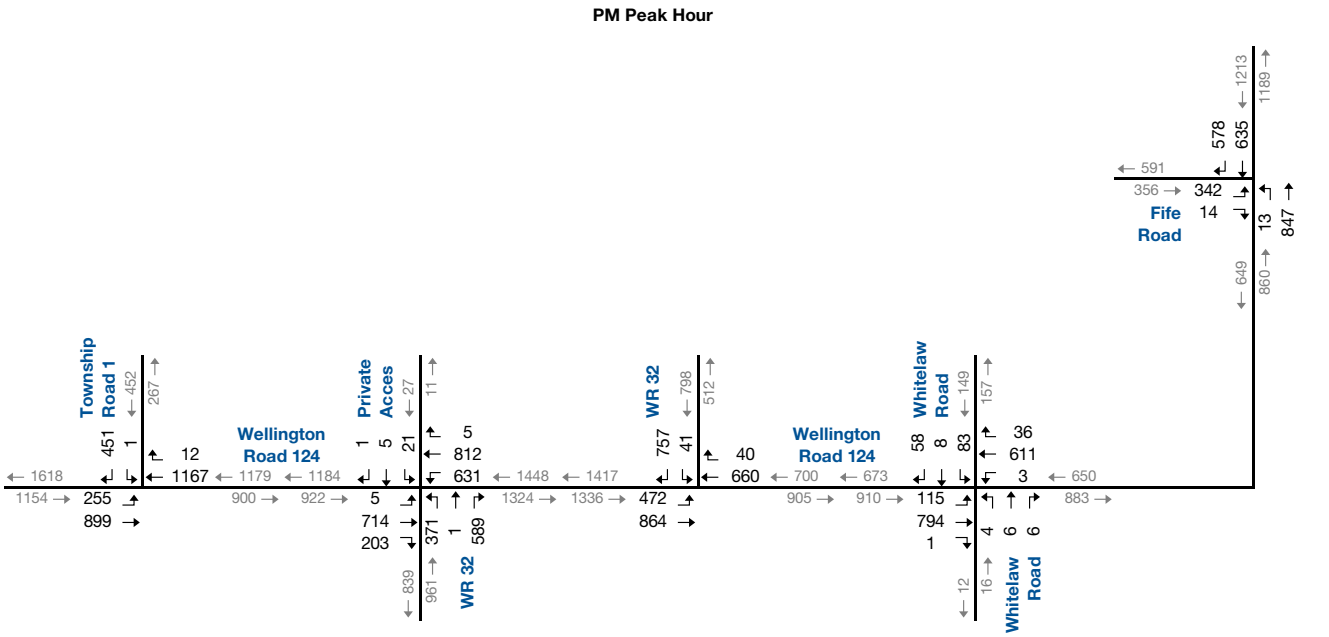
TABLE 3.2: EXISTING AND FUTURE LINK VOLUMES – AM PEAK HOUR

From	To	Direction	AM Peak Hour		
			2018	2031	2041
Regional Road 31	Township Road 1	EB	1,010	1,310	1,520
		WB	990	1,280	1,490
Township Road 1	WR 32 (South)	EB	710	920	1,070
		WB	730	940	1,090
WR 32 (South)	WR 32 (North)	EB	1,150	1,490	1,730
		WB	810	1,050	1,220
WR 32 (North)	Whitelaw Road	EB	740	960	1,110
		WB	450	580	670
Whitelaw Road	Fife Road	EB	690	890	1,030
		WB	470	610	710
Fife Road	Imperial Road	EB	1,010	1,310	1,520
		WB	690	890	1,030

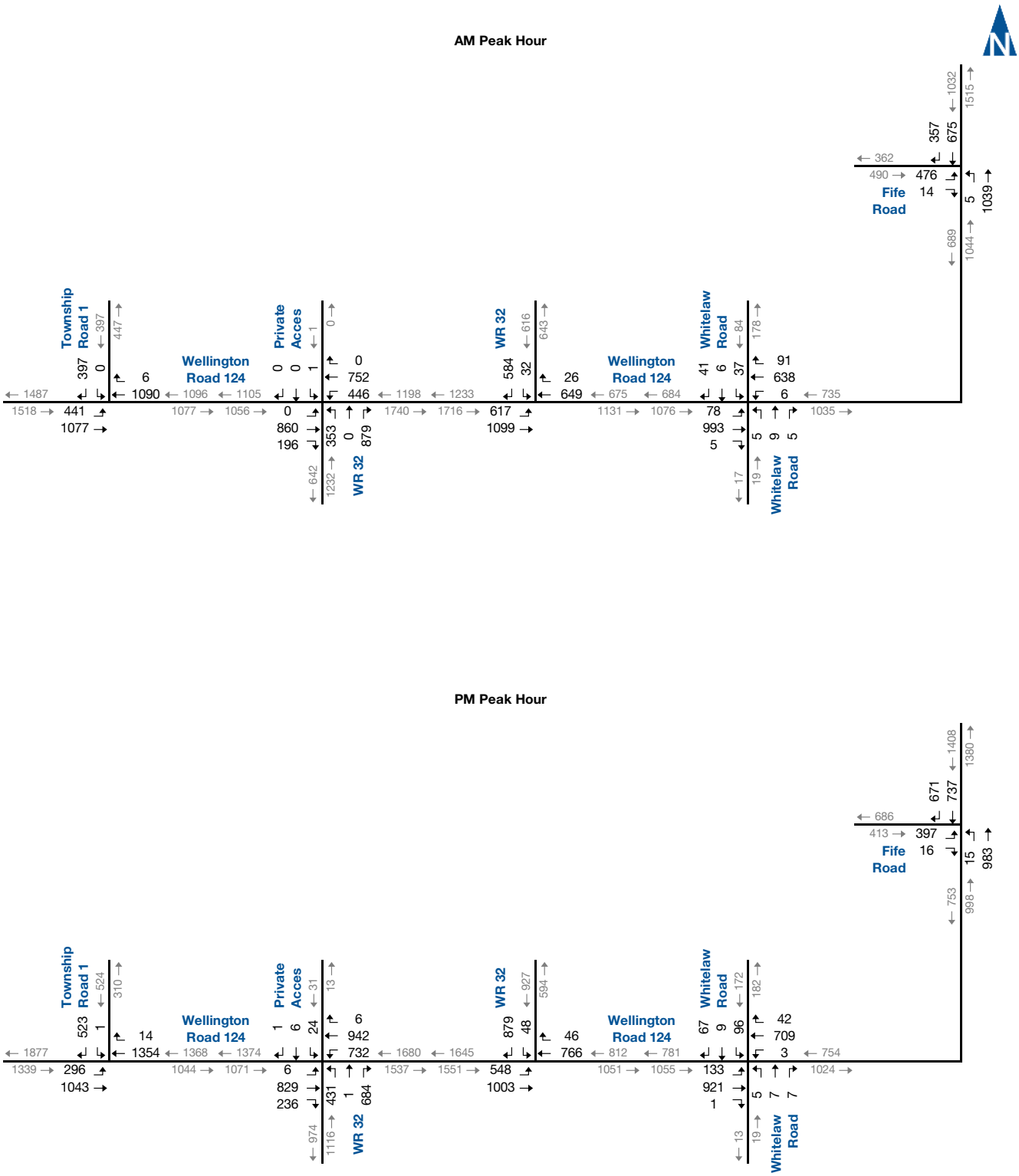
TABLE 3.3: EXISTING AND FUTURE LINK VOLUMES – PM PEAK HOUR

From	To	Direction	AM Peak Hour		
			2018	2031	2041
Regional Road 31	Township Road 1	EB	890	1,150	1,330
		WB	1,250	1620	1,880
Township Road 1	WR 32 (South)	EB	700	910	1,060
		WB	910	1,180	1,370
WR 32 (South)	WR 32 (North)	EB	1.030	1,330	1,540
		WB	1,110	1,440	1,670
WR 32 (North)	Whitelaw Road	EB	700	910	1,060
		WB	530	690	800
Whitelaw Road	Fife Road	EB	670	870	1,010
		WB	500	650	750
Fife Road	Imperial Road	EB	920	1,190	1,380
		WB	940	1,220	1,420





2031 Forecast Traffic Volumes



2041 Forecast Traffic Volumes

3.2 2031 Future Traffic Operations

The operations of Wellington Road 124 intersections were analysed at the 2031 horizon using the existing intersection configurations and the same assumptions and parameters as in the analysis of existing conditions; however, signal timing splits and cycle lengths were optimized to accommodate the forecast growth in traffic.

Table 3.4 summarizes the level of service conditions at the 2031 horizon and indicates the following:

- The intersection of WR 124 & Township Road 1 is forecast to operate with poor levels of service, and well beyond capacity on the southbound approach in both peak hours. This is due to the large volume of traffic on WR 124 which limits the number of gaps for side street traffic to enter the traffic stream;
- The intersection of WR 124 & WR 32 (South) is forecast to operate with several critical movements, and high levels of delay during both peak hours. Projected queue lengths exceed available storage for NB and WB left-turns;
- The intersection of WR 124 & WR 32 (North) is forecast to operate within capacity in the AM peak hour. However, in the PM peak hour, the intersection is forecast to operate beyond capacity;
- The intersection of WR 124 & Whitelaw Road is forecast to operate within capacity during both peak hours, with no critical movements; and
- The intersection of WR 124 & Fife Road is forecast to operate within capacity during both peak hours. The potential queue spillback in the AM peak hour could be accommodated within the existing two-way left turn lane on Fife Road.

Appendix D contains the detailed Synchro reports.

TABLE 3.4: 2031 FUTURE TRAFFIC OPERATIONS SUMMARY

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	C	A		A		A	A	A					A		F	F	
			Delay	17	0		5		0	0	0					0		152	152	
			V/C	0.57	0.57				0.58	0.00						0.00		1.20		
			Q	30	0				0	0						0		127		
			Ex	125	-				-	50						30		-		
			Avail.	96	-				-	50						30		-		
	2 - Wellington Road 124 & Wellington Road 32 (South)	TCS	LOS	A	F	C	F	F	B	>	E	E	F	>	F	<	D	>	D	F
			Delay	0	117	28	101	166	10	>	68	65	211	>	169	<	39	>	39	114
			V/C	0.00	1.13	0.23		1.25	0.69	>		0.84	1.32	>		<	0.02	>		1.31
			Q	0	379	41		214	84	>		154	321	>		<	2	>		
			Ex	40	-	25		55	-	>		60	-	>		<	-	>		
			Avail.	40	-	-16		-159	-	>		-94	-	>		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	TCS	LOS	D	A		B		D	>	D					E		E	E	C
			Delay	39	2		15		45	>	45					63		67	67	32
			V/C	0.84	0.70				0.83	>						0.20		0.40		0.80
			Q	94	33				272	>						19		40		
			Ex	215	-				-	>						90		-		
			Avail.	121	-				-	>						72		-		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	A	B	>	B	A	A	>	A	<	C	>	C	<	C	>	C	B
			Delay	5	13	>	12	4	8	>	8	<	33	>	33	<	35	>	35	12
			V/C	0.17	0.77	>		0.03	0.56	>		<	0.06	>		<	0.30	>		0.69
			Q	10	177	>		2	90	>		<	7	>		<	19	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	130	-	>		133	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	D		B	C					<	B		B		B	A	B	B
			Delay	35		16	35					<	12		12		15	9	13	17
			V/C	0.86		0.01		Approach				<	0.59				0.68	0.22		0.75
			Q	98		3		Not Applicable				<	60				93	11		
			Ex	90		-						<	-				-	-		
			Avail.	-8		-						<	-				-	-		
PM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	C	A		A		A	A	A					F		F	F	
			Delay	17	0		4		0	0	0					302		549	549	
			V/C	0.47	0.55				0.72	0.01						0.08		2.11		
			Q	20	0				0	0						2		287		
			Ex	125	-				-	50						30		-		
			Avail.	105	-				-	50						28		-		
	2 - Wellington Road 124 & Wellington Road 32 (South)	TCS	LOS	C	F	C	F	F	A	>	E	F	D	>	F	<	D	>	D	F
			Delay	29	109	33	92	165	5	>	75	162	54	>	96	<	47	>	47	85
			V/C	0.02	1.09	0.30		1.22	0.69	>		1.17	0.60	>		<	0.21	>		1.23
			Q	4	336	56		233	m46.6	>		208	86	>		<	17	>		
			Ex	40	-	25		55	-	>		60	-	>		<	-	>		
			Avail.	36	-	-31		-178	-	>		-148	-	>		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	TCS	LOS	E	A		C		F	>	F					D		F	F	E
			Delay	77	9		33		86	>	86					40		91	88	62
			V/C	1.06	0.72				1.02	>						0.10		0.98		1.05
			Q	173	88				318	>						21		209		
			Ex	215	-				-	>						90		-		
			Avail.	42	-				-	>						70		-		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	A	B	>	B	A	B	>	B	<	C	>	C	<	C	>	C	B
			Delay	9	13	>	13	5	11	>	11	<	24	>	24	<	27	>	27	13
			V/C	0.34	0.73	>		0.01	0.61	>		<	0.04	>		<	0.49	>		0.67
			Q	20	140	>		1	96	>		<	6	>		<	29	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	120	-	>		134	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	C		B	C					<	A		A		B	A	B	B
			Delay	29		17	29					<	10		10		14	9	12	13
			V/C	0.77		0.01		Approach				<	0.50				0.67	0.38		0.70
			Q	69		4		Not Applicable				<	51				95	14		
			Ex	90		-						<	-				-	-		
			Avail.	21		-						<	-				-	-		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length (m)
Ex. - Existing Available Storage (m)
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control

<- Shared Left/Through Lane
>- Shared Right/Through Lane

3.3 2041 Future Traffic Operations

The operations of Wellington Road 124 intersections were analysed at the 2041 horizon using the existing intersection configurations and the same assumptions and parameters as in the analysis of existing conditions; however, signal timing splits and cycle lengths were optimized to accommodate the forecast growth in traffic. **Table 3.5** summarizes the level of service conditions at the 2041 horizon and indicates the following:

- The intersection of WR 124 & Township Road 1 is forecast to operate with poor levels of service, and well beyond capacity on the southbound approach in both peak hours. This is due to the large volume of cross-traffic which limits the number of gaps for side street traffic to enter the traffic stream;
- The intersection of WR 124 & WR 32 (South) is forecast to operate with several critical movements, and high levels of delay during both peak hours. Projected queue lengths exceed available storage for NB and WB left-turns;
- The intersection of WR 124 & WR 32 (North) is forecast to operate with several critical movements, and high levels of delay during both peak hours;
- The intersection of WR 124 & Whitelaw Road is forecast to operate within capacity during both peak hours, with no critical movements; and
- The intersection of WR 124 & Fife Road is forecast to operate within capacity during both peak hours. The potential queue spillback in the AM peak hour could be accommodated within the existing two-way left turn lane on Fife Road.

Appendix E contains the detailed Synchro reports.

TABLE 3.5: 2041 FUTURE TRAFFIC OPERATIONS SUMMARY

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	D	A		A		A	A	A					A		F	F	
			Delay	28	0		8		0	0	0					0		375	375	
			V/C	0.77	0.67				0.67	0.00		Approach Not Applicable				0.00		1.72		
			Q	56	0				0	0						0		220		
			Ex	125	-				-	50						30		-		
			Avail.	69	-				-	50						30		-		
	2 - Wellington Road 124 & Wellington Road 32 (South)	TCS	LOS	A	F	C	F	F	B	>	F	F	F	>	F	<	D	>	D	F
			Delay	0	192	28	162	264	11	>	105	86	350	>	274	<	38	>	38	182
			V/C	0.00	1.31	0.28		1.50	0.81	>		0.96	1.64	>		<	0.02	>		1.59
			Q	0	467	50		195	82	>		190	424	>		<	2	>		
			Ex	40	-	25		55	-	>		60	-	>		<	-	>		
			Avail.	40	-	-25		-140	-	>		-130	-	>		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	TCS	LOS	F	A		C		F	>	F					E		F	F	E
			Delay	80	5		32		115	>	115					56		89	87	62
			V/C	1.06	0.87				1.11	>		Approach Not Applicable				0.16		0.84		1.05
			Q	121	33				346	>						21		114		
			Ex	215	-				-	>						90		-		
			Avail.	94	-				-	>						69		-		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	A	C	>	B	A	A	>	A	<	C	>	C	<	C	>	C	B
			Delay	6	21	>	20	5	10	>	10	<	33	>	33	<	35	>	35	17
			V/C	0.25	0.89	>		0.06	0.66	>		<	0.08	>		<	0.33	>		0.8
			Q	13	264	>		2	119	>		<	9	>		<	21	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	127	-	>		133	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	D		B	D					<	B		B		C	B	B	C
			Delay	42		15	42					<	15		15		22	10	18	21
			V/C	0.92		0.01		Approach Not Applicable				<	0.71				0.82	0.25		0.86
			Q	117		4						<	78				141	12		
			Ex	90		-						<	-				-	-		
			Avail.	-27		-						<	-				-	-		
PM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	D	A		A		A	A	A					F		F	F	
			Delay	25	0		6		0	0	0					931		Err	9982	
			V/C	0.64	0.64				0.83	0.01		Approach Not Applicable				0.22		3.18		
			Q	36	0				0	0						3		Err		
			Ex	125	-				-	50						30		-		
			Avail.	89	-				-	50						27		-		
	2 - Wellington Road 124 & Wellington Road 32 (South)	TCS	LOS	C	F	C	F	F	B	>	F	F	F	>	F	<	D	>	D	F
			Delay	31	159	32	130	275	13	>	127	223	100	>	148	<	47	>	47	133
			V/C	0.12	1.22	0.32		1.52	0.80	>		1.33	0.99	>		<	0.26	>		1.52
			Q	5	406	60		242	m101.2	>		248	193	>		<	19	>		
			Ex	40	-	25		55	-	>		60	-	>		<	-	>		
			Avail.	35	-	-35		-187	-	>		-188	-	>		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	TCS	LOS	F	A		E		F	>	F					D		F	F	F
			Delay	188	6		70		137	>	137					41		212	203	124
			V/C	1.26	0.84				1.17	>		Approach Not Applicable				0.12		1.31		1.30
			Q	174	59				392	>						23		307		
			Ex	215	-				-	>						90		-		
			Avail.	42	-				-	>						67		-		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	B	C	>	C	A	B	>	B	<	C	>	C	<	C	>	C	B
			Delay	17	21	>	20	6	15	>	15	<	24	>	24	<	29	>	29	19
			V/C	0.54	0.86	>		0.02	0.72	>		<	0.04	>		<	0.51	>		0.77
			Q	37	217	>		1	137	>		<	7	>		<	38	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	103	-	>		134	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	D		B	D					<	B		B		B	B	B	B
			Delay	39		17	38					<	11		11		18	10	14	17
			V/C	0.87		0.01		Approach Not Applicable				<	0.58				0.78	0.44		0.81
			Q	96		4						<	60				124	14		
			Ex	90		-						<	-				-	-		
			Avail.	-6		-						<	-				-	-		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length (m)
Ex. - Existing Available Storage (m)
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control

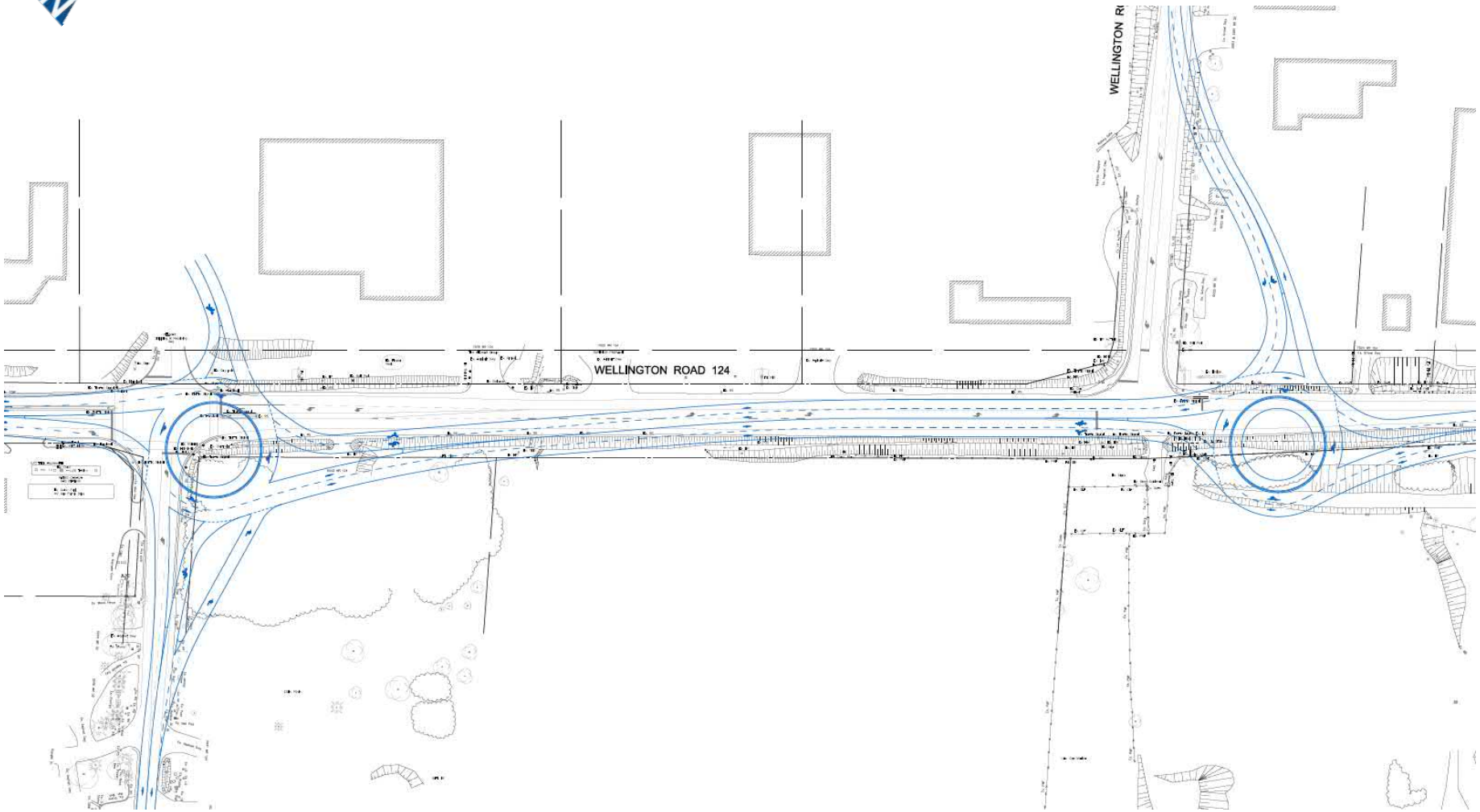
<- Shared Left/Through Lane
>- Shared Right/Through Lane

4 Design Alternatives

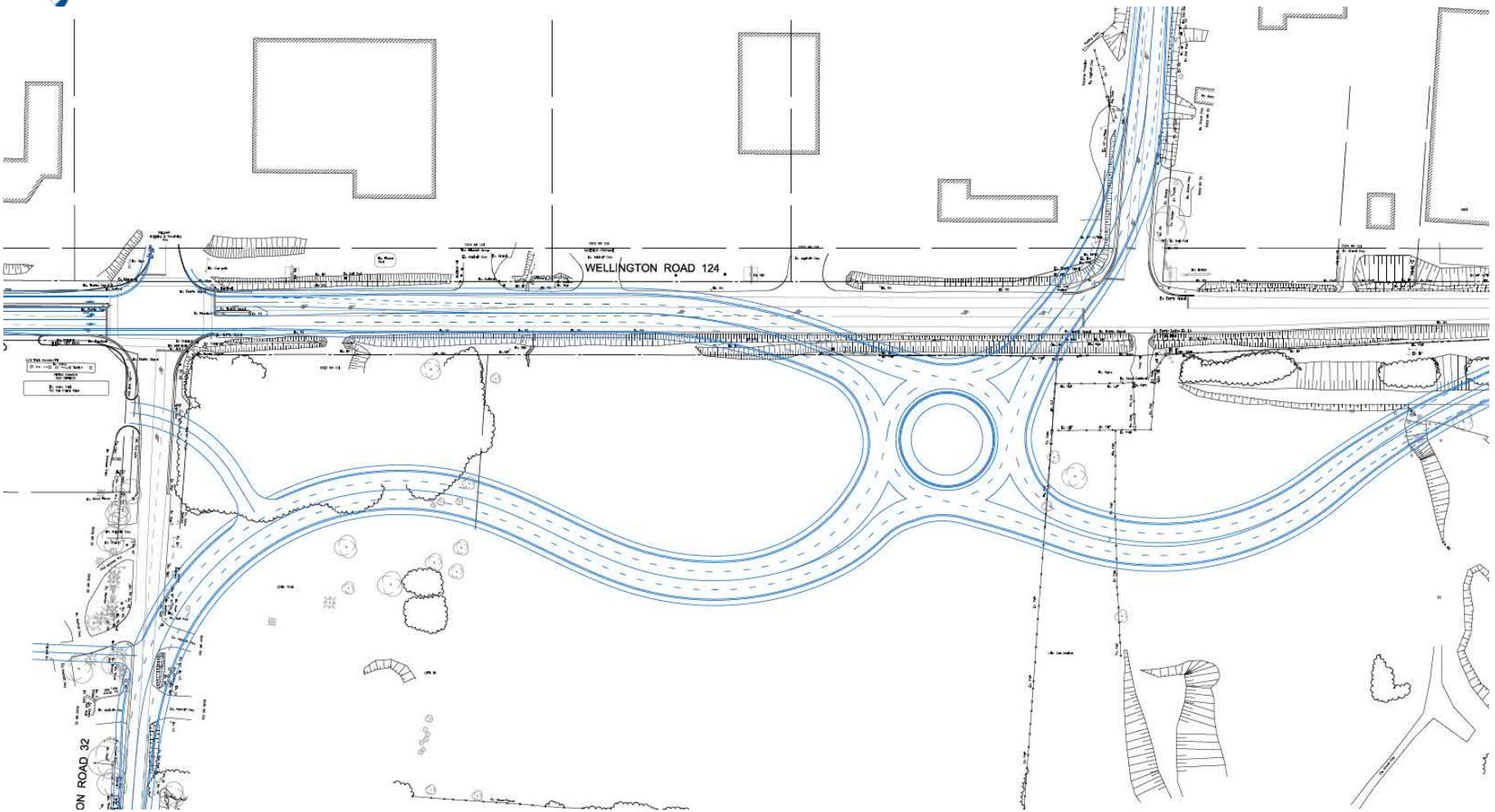
As indicated in **Section 3.2** and **Section 3.3,** the existing road cross-section intersection configurations on Wellington Road 124 cannot accommodate the forecast traffic volumes in the ten-year (2031) and twenty-year (2041) horizons. A number of road widening and intersection improvement alternatives were identified and analysed to accommodate the projected traffic volumes at the 2041 horizon. The five design alternatives reviewed in this study are as follows:

- **Alternative 1**: Existing cross-section, with side-by-side left-turn lanes between WR 32 (North) and WR 32 (South);
- **Alternative 2**: Existing cross-section, with two-way-left-turn lane on WR 124 from Township Road 1 to Whitelaw Road;
- **Alternative 3**: Four-lane cross-section with dual left-turn lanes between WR 32 (North) and WR 32 (South);
- **Alternative 4A**: Existing cross-section, with roundabouts at WR 124/WR 32 (North) and WR 124/WR 32 (South). Roundabout at WR 124/WR 32 (South) includes a northbound right-turn bypass; and
- **Alternative 4B**: Existing cross-section, with a roundabout at WR124/WR32 (North), and removal of the existing south leg at WR 124/WR 32 (South).

Figure 4.1 and **Figure 4.2** illustrate the proposed roundabout configurations for Alternative 4A and Alternative 4B, respectively.



Alternative 4A Roundabout Configuration



Alternative 4B Roundabout Configuration

4.1 Alternative 1 Traffic Operations

Table 4.1 summarizes the intersection level of service conditions at the 2041 horizon for Alternative 1 and indicates:

- WR 124 & Township Road 1: forecast to operate with poor levels of service, and well beyond capacity on the southbound approach in both peak hours. The poor LOS is due to the large volume of cross-traffic which limits the number of gaps for side street traffic to enter the traffic stream;
- WR 124 & WR 32 (South): forecast to operate with several critical movements, and high levels of delay during both peak hours. Projected queue lengths exceed available storage for NB and WB left-turns, and EB right-turns;
- WR 124 & WR 32 (North): forecast to operate with several critical movements, and high levels of delay during both peak hours;
- WR 124 & Whitelaw Road: forecast to operate within capacity, with no critical movements; and
- WR 124 & Fife Road: forecast to operate within capacity during both peak hours. The potential queue spillback in the AM peak hour could be accommodated within the existing two-way left turn lane on Fife Road.

Appendix F contains the detailed Synchro reports.

TABLE 4.1: 2041 TRAFFIC OPERATIONS SUMMARY – ALTERNATIVE 1

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	D	A		A		A	A	A					A		F	F	
			Delay	28	0		8		0	0	0					0		375	375	
			V/C	0.77	0.67				0.67	0.00						0.00		1.72		
			Q	56	0				0	0						0		220		
			Ex	125	-				-	50						30		-		
			Avail.	69	-				-	50						30		-		
	2 - Wellington Road 124 & Wellington Road 32 (South)	TCS	LOS	A	F	C	F	F	B	>	F	<	F	F	F	<	D	>	D	F
			Delay	0	149	25	126	196	19	>	85	<	190	233	221	<	45	>	45	145
			V/C	0.00	1.21	0.25		1.28	0.73	>		<	1.24	1.40		<	0.02	>		1.36
			Q	0	449	44		253	207	>		<	220	460		<	2	>		
			Ex	40	-	25		55	-	>		<	60	-		<	-	>		
			Avail.	40	-	-19		-198	-	>		<	-160	-		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	TCS	LOS	E	A		C		E	>	E					E		D	D	D
			Delay	71	6		30		61	>	61					64		46	47	40
			V/C	1.00	0.79				0.97	>						0.35		0.88		1.02
			Q	268	201				301	>						21		211		
			Ex	215	-				-	>						90		-		
			Avail.	-53	-				-	>						69		-		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	A	C	>	B	A	A	>	A	<	C	>	C	<	C	>	C	B
			Delay	6	21	>	20	5	8	>	8	<	32	>	32	<	34	>	34	16
			V/C	0.21	0.89	>		0.06	0.57	>		<	0.08	>		<	0.33	>		0.80
			Q	12	259	>		2	93	>		<	8	>		<	21	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	128	-	>		133	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	D		B	D					<	B		B		C	B	B	C
			Delay	42		15	42					<	15		15		22	10	18	21
			V/C	0.92		0.01		Approach				<	0.71				0.82	0.25		0.86
			Q	117		4		Not Applicable				<	78				141	12		
			Ex	90		-						<	-				-	-		
			Avail.	-27		-						<	-				-	-		
PM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	D	A		A		A	A	A					F		F	F	
			Delay	25	0		6		0	0	0					931		Err	9982	
			V/C	0.64	0.64				0.83	0.01						0.22		3.18		
			Q	36	0				0	0						3		Err		
			Ex	125	-				-	50						30		-		
			Avail.	89	-				-	50						27		-		
	2 - Wellington Road 124 & Wellington Road 32 (South)	TCS	LOS	C	F	C	F	F	C	>	F	<	F	D	F	<	D	>	D	F
			Delay	26	156	29	127	292	22	>	140	<	230	47	118	<	44	>	44	129
			V/C	0.03	1.22	0.23		1.52	0.80	>		<	1.35	0.90		<	0.21	>		1.51
			Q	4	384	35		368	256	>		<	236	221		<	17	>		
			Ex	40	-	25		55	-	>		<	60	-		<	-	>		
			Avail.	36	-	-10		-313	-	>		<	-176	-		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	TCS	LOS	D	A		B		E	>	E					E		F	F	E
			Delay	49	4		20		61	>	61					66		133	130	61
			V/C	0.87	0.65				0.98	>						0.45		1.18		1.11
			Q	212	129				339	>						27		371		
			Ex	215	-				-	>						90		-		
			Avail.	3	-				-	>						63		-		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	B	C	>	C	A	B	>	B	<	C	>	C	<	C	>	C	B
			Delay	14	21	>	20	6	14	>	13	<	24	>	24	<	28	>	28	18
			V/C	0.49	0.86	>		0.02	0.68	>		<	0.04	>		<	0.51	>		0.77
			Q	31	214	>		1	122	>		<	6	>		<	37	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	109	-	>		134	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	D		B	D					<	B		B		B	B	B	B
			Delay	43		19	42					<	11		11		17	10	14	17
			V/C	0.89		0.01		Approach				<	0.56				0.75	0.44		0.8
			Q	102		4		Not Applicable				<	61				120	14		
			Ex	90		-						<	-				-	-		
			Avail.	-12		-						<	-				-	-		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length (m)
Ex. - Existing Available Storage (m)
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control

<- Shared Left/Through Lane
>- Shared Right/Through Lane

4.2 Alternative 2 Traffic Operations

Table 4.2 summarizes the intersection level of service conditions at the 2041 horizon for Alternative 2 and indicates the following:

- WR 124 & Township Road 1: forecast to operate with poor levels of service, and well beyond capacity on the southbound approach in both peak hours. This poor LOS is due to the large volume of cross-traffic which limits the number of gaps for side street traffic to enter the traffic stream;
- WR 124 & WR 32 (South): forecast to operate with several critical movements, and high levels of delay during both peak hours. Projected queue lengths exceed available storage for NB and WB left-turns, and EB right-turns;
- WR 124 & WR 32 (North): forecast to operate with several critical movements, and high levels of delay during both peak hours;
- WR 124 & Whitelaw Road: forecast to operate within capacity, with no critical movements; and
- WR 124 & Fife Road: forecast to operate within capacity during both peak hours. The potential queue spillback in the AM peak hour could be accommodated within the existing two-way left turn lane on Fife Road.

Appendix G contains the detailed Synchro reports.

TABLE 4.2: 2041 TRAFFIC OPERATIONS SUMMARY – ALTERNATIVE 2

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	D	A		**A**		A	A	**A**					A		F	**F**	
			Delay	28	0		**8**		0	0	**0**					0		375	**375**	
			V/C	0.77	0.67				0.67	0.00			**Approach**			0.00		1.72		
			Q	56	0				0	0			**Not Applicable**			0		220		
			Ex	125	-				-	25						30		-		
			Avail.	69	-				-	25						30		-		
	2 - Wellington Road 124 & Wellington Road 32 (South)	TCS	LOS	A	F	C	**F**	F	B	>	**F**	<	F	F	**F**	<	D	>	**D**	**F**
			Delay	0	149	25	**126**	196	18	>	**84**	<	190	233	**221**	<	45	>	**45**	**145**
			V/C	0.00	1.21	0.25		1.28	0.73	>		<	1.24	1.40		<	0.02	>		**1.36**
			Q	0	449	44		253	207	>		<	220	460		<	2	>		
			Ex	40	-	25		55	-	>		<	60	-		<	-	>		
			Avail.	40	-	-19		-198	-	>		<	-160	-		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	TCS	LOS	E	A		**C**		E	>	**E**					E		D	**D**	**D**
			Delay	71	6		**30**		61	>	**61**					64		46	**47**	**40**
			V/C	1.00	0.79				0.97	>			**Approach**			0.35		0.88		**1.02**
			Q	268	201				301	>			**Not Applicable**			21		211		
			Ex	215	-				-	>						90		-		
			Avail.	-53	-				-	>						69		-		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	A	C	>	**B**	A	A	>	**A**	<	C	>	**C**	<	C	>	**C**	**B**
			Delay	6	20	>	**19**	5	8	>	**8**	<	33	>	**33**	<	35	>	**35**	**16**
			V/C	0.21	0.89	>		0.06	0.57	>		<	0.08	>		<	0.33	>		**0.80**
			Q	12	260	>		2	92	>		<	9	>		<	21	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	128	-	>		133	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	D		B	**D**					<	B		**B**		C	B	**B**	**C**
			Delay	42		15	**42**					<	15		**15**		22	10	**18**	**21**
			V/C	0.92		0.01			**Approach**			<	0.71				0.82	0.25		**0.86**
			Q	117		4			**Not Applicable**			<	78				141	12		
			Ex	90		-						<	-				-	-		
			Avail.	-27		-						<	-				-	-		
PM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	D	A		**A**		A	A	**A**					F		F	**F**	
			Delay	25	0		**6**		0	0	**0**					72		Err	**9981**	
			V/C	0.64	0.64				0.83	0.01			**Approach**			0.02		3.18		
			Q	36	0				0	0			**Not Applicable**			0		Err		
			Ex	125	-				-	25						30		-		
			Avail.	89	-				-	25						30		-		
	2 - Wellington Road 124 & Wellington Road 32 (South)	TCS	LOS	C	F	C	**F**	F	C	>	**F**	<	F	D	**F**	<	D	>	**D**	**F**
			Delay	26	156	29	**127**	292	22	>	**140**	<	230	47	**118**	<	44	>	**44**	**129**
			V/C	0.03	1.22	0.23		1.52	0.80	>		<	1.35	0.90		<	0.21	>		**1.51**
			Q	4	384	35		368	256	>		<	236	221		<	17	>		
			Ex	40	-	25		55	-	>		<	60	-		<	-	>		
			Avail.	36	-	-10		-313	-	>		<	-176	-		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	TCS	LOS	D	A		**B**		E	>	**E**					E		F	**F**	**E**
			Delay	49	4		**20**		61	>	**61**					66		133	**130**	**61**
			V/C	0.87	0.65				0.98	>			**Approach**			0.45		1.18		**1.11**
			Q	212	129				339	>			**Not Applicable**			27		371		
			Ex	215	-				-	>						90		-		
			Avail.	3	-				-	>						63		-		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	B	C	>	**C**	A	B	>	**B**	<	C	>	**C**	<	C	>	**C**	**B**
			Delay	14	21	>	**20**	6	14	>	**13**	<	24	>	**24**	<	28	>	**28**	**18**
			V/C	0.49	0.86	>		0.02	0.68	>		<	0.04	>		<	0.51	>		**0.77**
			Q	31	214	>		1	122	>		<	6	>		<	37	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	109	-	>		134	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	D		B	**D**					<	B		**B**		B	B	**B**	**B**
			Delay	39		17	**38**					<	11		**11**		18	10	**14**	**17**
			V/C	0.87		0.01			**Approach**			<	0.58				0.78	0.44		**0.81**
			Q	96		4			**Not Applicable**			<	60				124	14		
			Ex	90		-						<	-				-	-		
			Avail.	-6		-						<	-				-	-		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length (m)
Ex. - Existing Available Storage (m)
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control

<- Shared Left/Through Lane
>- Shared Right/Through Lane

4.3 Alternative 3 Traffic Operations

Table 4.3 summarizes the intersection level of service conditions at the 2041 horizon for Alternative 3 and indicates the following:

- WR 124 & Township Road 1: forecast to operate with poor levels of service, and well beyond capacity on the southbound approach in both peak hours. This poor LOS is due to the large volume of cross-traffic which limits the number of gaps for side street traffic to enter the traffic stream;
- WR 124 & WR 32 (South): forecast to operate with several critical movements, and high levels of delay during both peak hours. Projected queue lengths exceed available storage for NB and WB left-turns, and EB right-turns;
- WR 124 & WR 32 (North): forecast to operate within capacity with one critical movement (the southbound right-turn) in the PM peak hour.;
- WR 124 & Whitelaw Road: forecast to operate within capacity, with no critical movements; and
- WR 124 & Fife Road: forecast to operate within capacity during both peak hours. The potential queue spillback in the AM peak hour could be accommodated within the existing two-way left turn lane on Fife Road.

Appendix H contains the detailed Synchro reports.

TABLE 4.3: 2041 TRAFFIC OPERATIONS SUMMARY – ALTERNATIVE 3

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	D	A		A		A	A	A					A		F	F	
			Delay	28	0		8		0	0	0					0		51	51	
			V/C	0.77	0.33				0.45	0.23						0.00		0.90		
			Q	57	0				0	0						0		80		
			Ex	125	-				-	25						30		-		
			Avail.	68	-				-	25						30		-		
	2 - Wellington Road 124 & Wellington Road 32 (South)	TCS	LOS	A	E	A	E	D	B	>	C	<	F	F	F	<	C	>	C	F
			Delay	0	70	0	70	37	11	>	20	<	123	157	148	<	28	>	28	80
			V/C	0.00	1.04	0.00		0.65	0.43	>		<	1.12	1.27		<	0.01	>		1.17
			Q	0	177	0		65	55	>		<	151	307		<	2	>		
			Ex	40	-	25		55	-	>		<	60	-		<	-	>		
			Avail.	40	-	25		-10	-	>		<	-91	-		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	TCS	LOS	B	A		A		C	>	C					D		C	C	B
			Delay	19	3		9		23	>	23					38		27	27	16
			V/C	0.54	0.44				0.63	>						0.30		0.83		0.79
			Q	61	41				75	>						13		116		
			Ex	215	-				-	>						90		-		
			Avail.	155	-				-	>						77		-		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	A	A	>	A	A	A	>	A	<	C	>	C	<	C	>	C	A
			Delay	7	9	>	9	6	7	>	7	<	22	>	22	<	24	>	24	9
			V/C	0.21	0.54	>		0.03	0.35	>		<	0.06	>		<	0.26	>		0.48
			Q	13	62	>		2	35	>		<	6	>		<	15	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	127	-	>		133	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	D		B	D					<	B		B		C	B	B	C
			Delay	42		15	42					<	15		15		22	10	18	21
			V/C	0.92		0.01		Approach				<	0.71				0.82	0.25		0.86
			Q	117		4		Not Applicable				<	78				141	12		
			Ex	90		-						<	-				-	-		
			Avail.	-27		-						<	-				-	-		
PM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	D	A		A		A	A	A					F		F	F	
			Delay	25	0		6		0	0	0					527		232	232	
			V/C	0.64	0.32				0.41	0.01						0.13		1.42		
			Q	36	0				0	0						3		221		
			Ex	125	-				-	25						30		-		
			Avail.	89	-				-	25						27		-		
	2 - Wellington Road 124 & Wellington Road 32 (South)	TCS	LOS	C	D	C	D	E	B	>	D	<	F	C	D	<	C	>	C	D
			Delay	26	39	27	36	78	14	>	42	<	89	30	53	<	27	>	27	44
			V/C	0.03	0.80	0.16		1.01	0.50	>		<	1.03	0.85		<	0.09	>		0.93
			Q	4	116	18		130	82	>		<	169	163		<	12	>		
			Ex	40	-	25		55	-	>		<	60	-		<	-	>		
			Avail.	36	-	7		-75	-	>		<	-109	-		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	TCS	LOS	B	A		A		C	>	C					C		E	E	C
			Delay	14	2		7		23	>	23					32		57	56	24
			V/C	0.44	0.37				0.76	>						0.39		1.04		1.00
			Q	50	33				77	>						16		221		
			Ex	215	-				-	>						90		-		
			Avail.	165	-				-	>						74		-		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	B	B	>	B	A	A	>	A	<	B	>	B	<	C	>	C	B
			Delay	12	10	>	10	7	9	>	9	<	19	>	19	<	22	>	22	11
			V/C	0.40	0.50	>		0.01	0.40	>		<	0.04	>		<	0.43	>		0.48
			Q	24	55	>		1	40	>		<	6	>		<	30	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	116	-	>		134	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	D		B	D					<	B		B		B	B	B	B
			Delay	39		17	38					<	11		11		18	10	14	17
			V/C	0.87		0.01		Approach				<	0.58				0.78	0.44		0.81
			Q	96		4		Not Applicable				<	60				124	14		
			Ex	90		-						<	-				-	-		
			Avail.	-6		-						<	-				-	-		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length (m)
Ex. - Existing Available Storage (m)
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control

<- Shared Left/Through Lane
>- Shared Right/Through Lane

4.4 Alternative 4A Traffic Operations

Table 4.4 summarizes the intersection level of service conditions at the 2041 horizon for Alternative 4A and indicates the following:

- WR 124 & Township Road 1: forecast to operate with poor levels of service, and well beyond capacity on the southbound approach in both peak hours. This is due to the large volume of cross-traffic which limits the number of gaps for side street traffic to enter the traffic stream;
- WR 124 & WR 32 (South): forecast to operate with acceptable levels of service and within capacity. No critical movements are noted;
- WR 124 & WR 32 (North): forecast to operate with acceptable levels of service and within capacity. No critical movements are noted.
- WR 124 & Whitelaw Road: forecast to operate within capacity, with no critical movements; and
- WR 124 & Fife Road: forecast to operate within capacity during both peak hours. The potential queue spillback in the AM peak hour could be accommodated within the existing two-way left turn lane on Fife Road.

Appendix I contains the detailed Synchro and ARCADY reports.

TABLE 4.4: 2041 TRAFFIC OPERATIONS SUMMARY – ALTERNATIVE 4A

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	2 - Wellington Road 124 & Wellington Road 32 (South)	RBT	LOS	<	A	>	**A**	<	A	>	**A**	<	A	>	**A**	<	A	>	**A**	**A**
			Delay	<	5	>	**5**	<	6	>	**6**	<	10	>	**10**	<	0	>	**0**	**7**
			V/C	<	0.62	>		<	0.69	>		<	0.51	>		<	0.00	>		
			Q	<	2	>		<	2	>		<	1	>		<	0	>		
			Ex	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	RBT	LOS	<	B	>	**B**	<	A	>	**A**	**Approach Not Applicable**				<	A	>	**A**	**A**
			Delay	<	10	>	**10**	<	4	>	**4**					<	4	>	**4**	**8**
			V/C	<	0.84	>		<	0.47	>						<	0.45	>		
			Q	<	5	>		<	1	>						<	1	>		
			Ex	<	-	>		<	-	>						<	-	>		
			Avail.	<	-	>		<	-	>						<	-	>		
PM Peak Hour	2 - Wellington Road 124 & Wellington Road 32 (South)	RBT	LOS	<	A	>	**A**	<	C	>	**C**	<	A	>	**A**	<	D	>	**D**	**C**
			Delay	<	3	>	**3**	<	25	>	**25**	<	4	>	**4**	<	30	>	**30**	**16**
			V/C	<	0.17	>		<	0.94	>		<	0.36	>		<	0.22	>		
			Q	<	0	>		<	12	>		<	1	>		<	0	>		
			Ex	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	RBT	LOS	<	A	>	**A**	<	A	>	**A**	**Approach Not Applicable**				<	A	>	**A**	**A**
			Delay	<	7	>	**7**	<	4	>	**4**					<	7	>	**7**	**6**
			V/C	<	0.76	>		<	0.52	>						<	0.67	>		
			Q	<	3	>		<	1	>						<	2	>		
			Ex	<	-	>		<	-	>						<	-	>		
			Avail.	<	-	>		<	-	>						<	-	>		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length (m)
Ex. - Existing Available Storage (m)
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control

RBT - Roundabout
<- Shared Left/Through Lane
>- Shared Right/Through Lane

4.5 Alternative 4B Traffic Operations

Table 4.5 summarizes the intersection level of service conditions at the 2041 horizon for Alternative 4B and indicates the following:

- WR 124 & Township Road 1: forecast to operate with poor levels of service, and well beyond capacity on the southbound approach in both peak hours. This is due to the large volume of cross-traffic which limits the number of gaps for side street traffic to enter the traffic stream;
- WR 124 & WR 32 (South): forecast to operate with acceptable levels of service and within capacity. No critical movements are noted;
- WR 124 & WR 32 (North): forecast to operate with acceptable levels of service and within capacity. No critical movements are noted.
- WR 124 & Whitelaw Road: forecast to operate within capacity, with no critical movements; and
- WR 124 & Fife Road: forecast to operate within capacity during both peak hours. The potential queue spillback in the AM peak hour could be accommodated within the existing two-way left turn lane on Fife Road.

Appendix J contains the detailed Synchro and ARCADY reports.

TABLE 4.5: 2041 TRAFFIC OPERATIONS SUMMARY – ALTERNATIVE 4B

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	3 Wellington Road 124 & Wellington Road 32 (North)	RBT	LOS	<	A	>	**A**	<	A	>	**A**	<	C	>	**C**	<	A	>	**A**	**A**
			Delay	<	5	>	**5**	<	6	>	**6**	<	16	>	**16**	<	5	>	**5**	**9**
			V/C	<	0.63	>		<	0.55	>		<	0.86	>		<	0.50	>		
			Q	<	2	>		<	1	>		<	6	>		<	1	>		
			Ex	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
PM Peak Hour	3 Wellington Road 124 & Wellington Road 32 (North)	RBT	LOS	<	A	>	**A**	<	A	>	**A**	<	B	>	**B**	<	C	>	**C**	**A**
			Delay	<	6	>	**6**	<	7	>	**7**	<	11	>	**11**	<	15	>	**15**	**10**
			V/C	<	0.59	>		<	0.63	>		<	0.79	>		<	0.81	>		
			Q	<	1	>		<	2	>		<	4	>		<	4	>		
			Ex	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length (m)
Ex. - Existing Available Storage (m)
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control

RBT - Roundabout
<- Shared Left/Through Lane
>- Shared Right/Through Lane

5 Preferred Alternative

The results of the operational analyses conducted in **Section 4** indicate geometric improvements in the form of a roundabout at one or both of the WR 124/WR 32 intersections will improve traffic operations. The following section documents the preferred design alternative and the operational performance of the preferred design alternative under 2041 traffic conditions.

5.1 Preferred Design Alternative

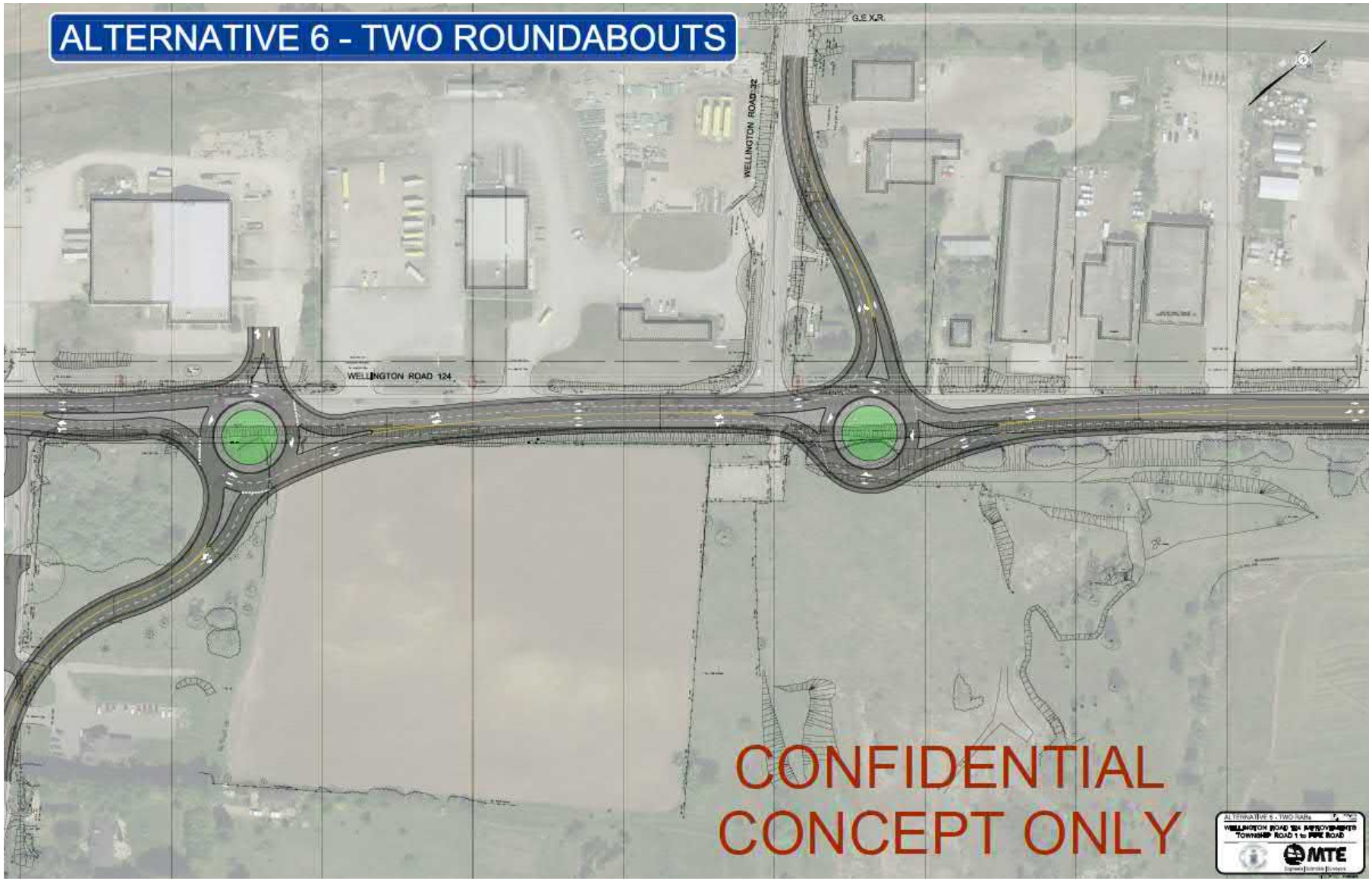
The 2041 traffic volumes were analysed for the Preferred Design Alternative for Wellington Road 124 improvements. **Figure 5.1** illustrates the preferred design alternative. The preferred alternative comprises a three-lane cross-section of one travel lane per direction, and a centre two-way left-turn lane throughout the study corridor. Two lane roundabouts are proposed to replace the existing signalized intersections at WR 32 (South) and WR 32 (North), with a four-lane cross-section in between.

5.2 2041 Traffic Forecast Changes

As noted in **Section 2.4**, the current closure of the Niska Road bridge has led to a reduction in the traffic volumes on Whitelaw Road south of Wellington Road 124. **Figure 2.3** shows the higher traffic volumes on Whitelaw Road based on traffic counts taken in 2007 and 2013, before the closure of the Niska Road bridge.

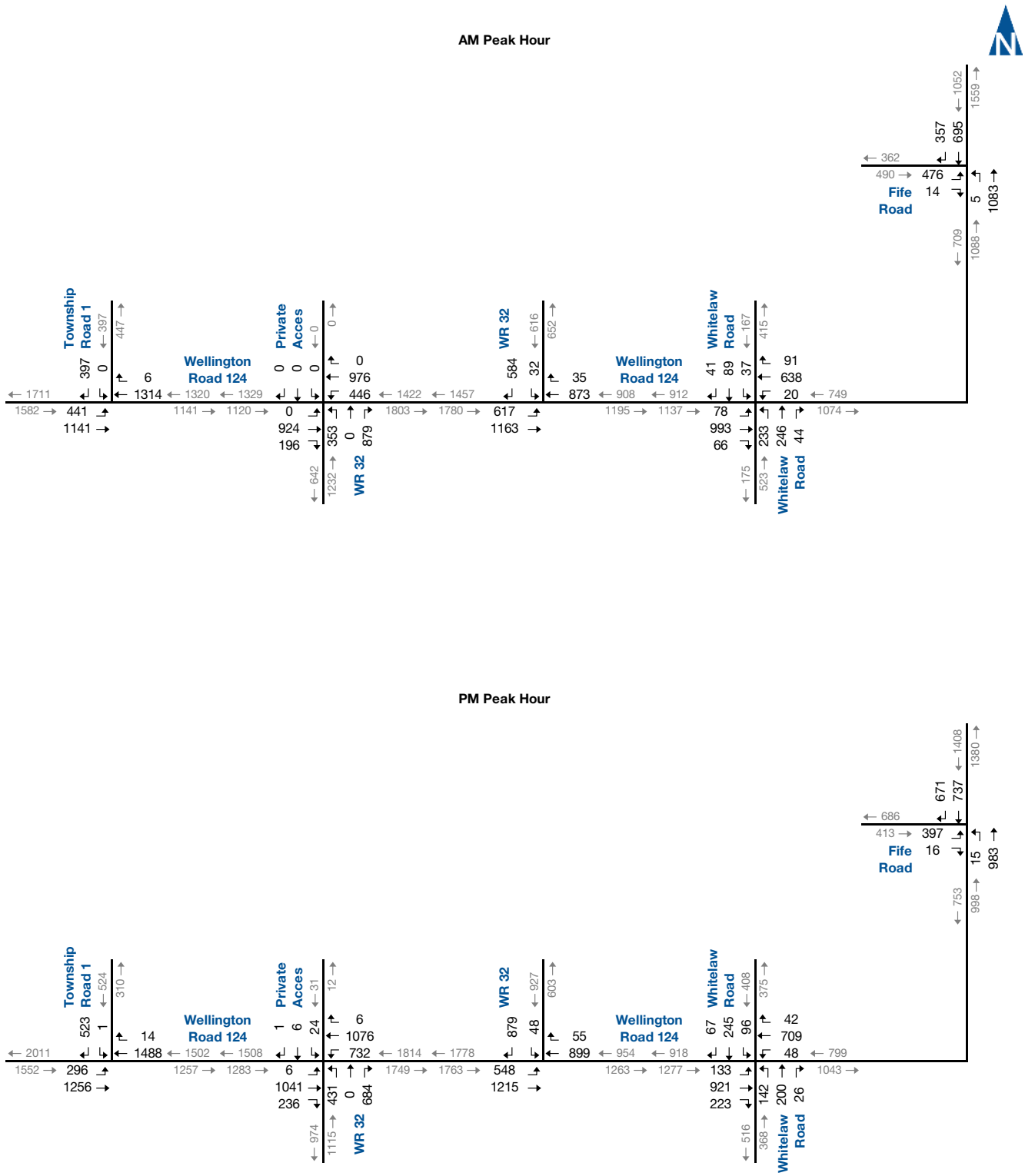
To analyse the Preferred Alternative improvements under 2041 traffic conditions, the 2041 AM and PM traffic forecasts on Wellington Road 124, outlined in **Section 3**, were updated to reflect future traffic changes on Whitelaw Road following the anticipated new Niska Road bridge. The same methodology used in **Section 3** was applied for updating the 2041 traffic projections, while using the 2007 and 2013 traffic counts to determine the distribution of turning movements at the Whitelaw Road intersection in 2041.

Figure 5.2 illustrates the updated 2041 future traffic volumes reflecting the future completion of the Niska Road bridge and the resulting changes to traffic patterns.



paradigm TRANSPORTATION SOLUTIONS LIMITED

Preferred Design Alternative



2041 Forecast Traffic Volumes

5.3 Traffic Operations

The future traffic operations along the WR 124 corridor were analyzed for the Preferred Design Alternative, using ARCADY and Synchro. The existing intersection configurations were assumed at Township Road 1(including recent improvements), at Whitelaw Road and at Fife Road.

Table 5.1 summarizes the level of service conditions at the 2041 horizon for all intersections in the study corridor and indicates the following:

- WR 124 & Township Road 1: forecast to operate with poor levels of service and well beyond capacity especially on the southbound approach in both peak hours;
- WR 124 & WR 32 (South): forecast to operate with acceptable levels of service and within capacity. No critical movements are noted;
- WR 124 & WR 32 (North): forecast to operate with acceptable levels of service and within capacity. No critical movements are noted;
- WR 124 & Whitelaw Road: forecast to generally operate within capacity; however, the eastbound through movement is forecast to operate beyond capacity in the AM peak hour, and the northbound and southbound approaches are forecast to operate beyond capacity in the PM peak hour and partially in the AM peak hour; and
- WR 124 & Fife Road: forecast to operate within capacity during both peak hours. The potential queue spillback in the AM and PM peak hours could be accommodated through pavement marking modifications to the existing two-way left-turn lane on Fife Road

Appendix K contains the detailed traffic analysis reports.

Table 5.1 also indicates poor level of service for the eastbound left-turn movement on WR 124 during the AM peak hour and for the southbound right-turn movement on Township Road 1 during both AM and PM peak hours. As noted earlier, geometric improvements were recently completed at this intersection, and the eastbound left-turn lane storage length is adequate to accommodate the projected eastbound left-turn movements. The intersection is currently under Stop sign control on Township Road 1. Potential traffic control changes involving either traffic signal control or roundabout conversion, could be considered based on future changes in traffic patterns at this intersection following the proposed changes to Wellington Road 124 as recommended in the EA.

It is noted that the existing intersection configuration at Fife Road can accommodate the forecast 2041 traffic volumes at acceptable levels of service, although the queue length for the eastbound left-turn movement on WR 124 is forecast to exceed the available storage primarily during the AM peak hour.

TABLE 5.1: 2041 TRAFFIC OPERATIONS SUMMARY

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																Overall
				Eastbound				Westbound				Northbound				Southbound				
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	F	A		C		A	A	A					A		F	F	
			Delay	56	0		16		0	0	0					0		672	672	
			V/C	0.94	0.71				0.81	0.00			Approach			0.00		2.36		
			Q	92	0				0	0			Not Applicable			0		277		
			Ex	125	-				-	25						30		-		
			Avail.	33	-				-	25						30		-		
	2 - Wellington Road 124 & Wellington Road 32 (South)	RBT	LOS	<	A	>	A	<	A	>	A	<	B	>	B	<	A	>	A	A
			Delay	<	5	>	5	<	7	>	7	<	11	>	11	<	0	>	0	8
			V/C	<	0.59	>		<	0.73	>		<	0.80	>		<	0.00	>		
			Q	<	1	>		<	4	>		<	11	>		<	0	>		
			Ex	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	RBT	LOS	<	B		B		A	>	A					<	A	>	A	A
			Delay	<	13		13		6	>	6					<	5	>	5	9
			V/C	<	0.88				0.63	>			Approach			<	0.50	>		
			Q	<	7				2	>			Not Applicable			<	1	>		
			Ex	<	-				-	>						<	-	>		
			Avail.	<	-				-	>						<	-	>		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	B	E	>	E	C	B	>	B	<	F	>	F	<	C	>	C	F
			Delay	12	64	>	57	22	16	>	15	<	371	>	371	<	30	>	30	107
			V/C	0.30	1.06	>		0.33	0.67	>		<	1.72	>		<	0.52	>		1.26
			Q	17	300	>		10	122	>		<	224	>		<	48	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	123	-	>		125	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	D		B	D					<	B		B		C	B	C	C
			Delay	37		16	37					<	17		17		25	11	20	22
			V/C	0.89		0.01			Approach			<	0.74				0.85	0.25		0.86
			Q	119		4			Not Applicable			<	91				157	13		
			Ex	90		-						<	-				-	-		
			Avail.	-29		-						<	-				-	-		
PM Peak Hour	1 - Wellington Road 124 & Township Road 1	TWSC	LOS	D	A		A	<	A	A	A					F		F	F	
			Delay	33	0		6	<	0	0	0					117		Err	9981	
			V/C	0.73	0.77			<	0.91	0.01			Approach			0.03		3.85		
			Q	46	0			<	0	0			Not Applicable			1		Err		
			Ex	125	-			<	-	25						30		-		
			Avail.	79	-			<	-	25						29		-		
	2 - Wellington Road 124 & Wellington Road 32 (South)	RBT	LOS	<	A	>	A	<	C	>	C	<	A	>	A	<	D	>	D	C
			Delay	<	9	>	9	<	31	>	31	<	10	>	10	<	41	>	41	19
			V/C	<	0.76	>		<	0.95	>		<	0.77	>		<	0.28	>		
			Q	<	5	>		<	66	>		<	8	>		<	1	>		
			Ex	<	-	>		<	-	>		<	-	>		<	-	>		
			Avail.	<	-	>		<	-	>		<	-	>		<	-	>		
	3 Wellington Road 124 & Wellington Road 32 (North)	RBT	LOS	<	A		A		A	>	A					<	A	>	A	A
			Delay	<	12		12		5	>	5					<	9	>	9	9
			V/C	<	0.87				0.61	>			Approach			<	0.72	>		
			Q	<	6				2	>			Not Applicable			<	2	>		
			Ex	<	-				-	>						<	-	>		
			Avail.	<	-				-	>						<	-	>		
	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	C	D	>	C	C	C	>	C	<	F	>	F	<	F	>	F	D
			Delay	32	41	>	34	32	21	>	21	<	137	>	137	<	82	>	82	51
			V/C	0.69	0.97	>		0.54	0.77	>		<	1.18	>		<	1.03	>		1.04
			Q	48	231	>		24	136	>		<	130	>		<	130	>		
			Ex	140	-	>		135	-	>		<	-	>		<	-	>		
			Avail.	92	-	>		112	-	>		<	-	>		<	-	>		
	5 - Wellington Road 124 & Fife Road	TCS	LOS	D		B	D					<	B		B		B	B	B	B
			Delay	39		17	38					<	11		11		18	10	14	17
			V/C	0.87		0.01			Approach			<	0.58				0.78	0.44		0.81
			Q	96		4			Not Applicable			<	60				124	14		
			Ex	90		-						<	-				-	-		
			Avail.	-6		-						<	-				-	-		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length (m)
Ex. - Existing Available Storage (m)
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control

RBT - Roundabout
<- Shared Left/Through Lane
>- Shared Right/Through Lane

5.4 Whitelaw Road Intersection

The results of the intersection operational analysis for the Preferred Alternative improvements indicate critical movements with poor levels of service at the intersection of Wellington Road 124 at Whitelaw Road. Additional improvements were reviewed for the Whitelaw Road intersection, as discussed below.

As shown in **Table 5.1,** poor levels of service, high v/c ratios and delays are forecast for the northbound traffic during both AM and PM peak hours, for the southbound traffic during the PM peak hour, and for the eastbound through-right turn movements during the AM peak hour. The noted problems are attributable to the existing single approach lanes for all northbound and southbound movements on Whitelaw Road, and the shared through-right turn lane in the eastbound direction on Wellington Road 124.

As the percentage of left-turning vehicles on the northbound approach is approximately 40 to 45 percent of all volume on the approach, the need for an exclusive left-turn lane on Whitelaw Road was reviewed. The methodology contained in the Ministry of Transportation's Geometric Design Standards Manual[2] indicates the storage length of a left-turn lane at a signalized intersection should seek to accommodate all left-turn arrivals during a cycle. To reduce the potential for left-turning vehicles to spillback into the adjacent through lane, the storage length shall be calculated to store the average arrivals 95% of the time (LOS A).

Table 5.2 summarizes the northbound and southbound left-turn storage requirements at the WR 124/Whitelaw Road intersection at the 2041 horizon.

TABLE 5.2: LEFT-TURN STORAGE LANE REQUIREMENTS

Horizon	Intersection	Movement	Cycle Length		Left Turn Counts		m_u max	Calc'd Length
			AM Peak	PM Peak	AM Peak	PM Peak		
2041 Total	Wellington Road 124 & Whitelaw Road	NBL	80	90	233	142	5.2	67.5
		SBL			37	96	2.4	37.5

Although right-turn lanes are generally made more efficiently than left-turn movements, exclusive right-turn lanes are often provided for many of the same reasons that left-turn lanes are provided. In general, an exclusive right-turn lane should be considered when the volume of right-turning vehicles is between 10 and 20 percent of the through volume, subject to a minimum of 60 right-turning vehicles per hour (vph) in the design hour.

Based on these criteria, eastbound and westbound right-turn lanes are warranted under 2041 traffic conditions.

[2] Ministry of Transportation (Ontario). *Geometric Design Standards for Ontario Highways (Chapter B – Signalized Intersections and Signal Timing), § B.7.8.5 (Length of Left-Turn Storage Length).* 1985.

As a sensitivity analysis, the intersection of WR 124/Whitelaw Road was reanalyzed assuming the addition of auxiliary left-turn lanes on Whitelaw Road and auxiliary right-turn lanes on WR 124.

Table 5.3 summarizes the level of service conditions and indicates the provision of exclusive left-turn lanes on Whitelaw Road would improve operations to within LOS E and LOS D. Additional improvements such as protected-permissive left-turn phasing could also be considered to improve intersections operations subject to traffic volume monitoring throughout the WR 124 corridor. **Appendix L** contains the detailed traffic analyses reports.

While the operational analysis was undertaken for the forecast volumes in 2041, it is noted that the traffic volumes on Whitelaw Road including the turning movements at the intersection at WR 124 will significantly increase with the anticipated completion of the Niska Road bridge in the short term. For this reason, the intersection improvements involving the addition auxiliary turn lanes should be considered for implementation along with the recommended widening of WR 124 and intersection improvements at the north and south legs of WR 32.

TABLE 5.3: 2041 TRAFFIC OPERATIONS SUMMARY (IMPROVEMENTS)

Analysis Period	Intersection	Control Type	MOE	Direction / Movement / Approach																
				Eastbound				Westbound				Northbound				Southbound				Overall
				Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	Left	Through	Right	Approach	
AM Peak Hour	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	B	D	>	**D**	C	B	>	**B**	D	D	>	**D**	C	C	>	**C**	**D**
			Delay	11	54	>	**48**	20	15	>	**14**	54	44	>	**49**	29	28	>	**28**	**37**
			V/C	0.28	1.03	>		0.32	0.66	>		0.86	0.82	>		0.34	0.32	>		**0.98**
			Q	17	300	>		10	122	>		84	93	>		16	34	>		
			Ex	140	-	>		135	-	>		75	-	>		38	-	>		
			Avail.	123	-	>		125	-	>		-9	-	>		22	-	>		
PM Peak Hour	4 - Wellington Road 124 & Whitelaw Road	TCS	LOS	B	C	>	**C**	C	B	>	**B**	E	C	>	**D**	C	C	>	**C**	**C**
			Delay	19	27	>	**23**	26	17	>	**17**	59	27	>	**40**	27	33	>	**32**	**25**
			V/C	0.56	0.90	>		0.50	0.71	>		0.85	0.50	>		0.42	0.70	>		**0.88**
			Q	44	256	>		25	153	>		24	54	>		28	75	>		
			Ex	140	-	>		135	-	>		75	-	>		38	-	>		
			Avail.	96	-	>		110	-	>		52	-	>		10	-	>		

MOE - Measure of Effectiveness
LOS - Level of Service
Delay - Average Delay per Vehicle in Seconds

Q - 95th Percentile Queue Length (m)
Ex. - Existing Available Storage (m)
Avail. - Available Storage (m)

TCS - Traffic Control Signal
TWSC - Two-Way Stop Control
AWSC - All-Way Stop Control

RBT - Roundabout
<- Shared Left/Through Lane
>- Shared Right/Through Lane

6 Conclusions

The main findings and conclusions of this study are as follows:

Existing Configurations

- Under existing (2018) conditions, the corridor is operating with very high levels of delay in the AM and PM peak hours.
- Under 2031 and 2041 traffic conditions, with no geometric improvements, the corridor is forecast to operate with very high levels of delay, and well beyond capacity, despite modifications to signal timings.

Improvement Alternatives

- A total of five design alternatives were reviewed, under 2041 traffic conditions, including:
  - **Alternative 1**: Existing cross-section, with side-by-side left-turn lanes between WR 32 (North) and WR 32 (South);
  - **Alternative 2**: Existing cross-section, with two-way-left-turn lane on WR 124 from Township Road 1 to Whitelaw Road;
  - **Alternative 3**: Four-lane cross-section with dual left-turn lanes between WR 32 (North) and WR 32 (South);
  - **Alternative 4A**: Existing cross-section, with roundabouts at WR 124/WR 32 (North) and WR 124/WR 32 (South). Roundabout at WR 124/WR 32 (South) includes a northbound right-turn bypass; and
  - **Alternative 4B**: Existing cross-section, with a roundabout at WR124/WR32 (North), and removal of the existing south leg at WR 124/WR 32 (South).
- Under Alternative 1, the corridor is forecast to operate with very high levels of delay at the intersections of WR 124/WR 32 (North) and WR 124/WR 32 (South). These intersections are also forecast to operate well beyond capacity during both peak hours.
- Under Alternative 2, the corridor is forecast to operate with very high levels of delay at the intersections of WR 124/WR 32 (North) and WR 124/WR 32 (South). These intersections are also forecast to operate well beyond capacity during both peak hours.
- Under Alternative 3, the corridor is forecast to operate with high levels of delay at the intersections of WR 124/WR 32 (South). Several intersections are forecast to operate at or near capacity; however, critical movements are confined to the intersection of WR 124/WR 32 (South).
- Under Alternative 4A, the corridor is forecast to operate with acceptable levels of service at most intersections.

- Under Alternative 4B, the corridor is forecast to operate with acceptable levels of service at most intersections.

Preferred Alternative

- Based on the review of the design alternatives, a preferred alternative comprising a three-lane cross-section of one travel lane per direction, and a centre two-way left-turn lane throughout the study corridor has been developed.
- Two lane roundabouts are proposed to replace the existing signalized intersections at WR 32 (South) and WR 32 (North), with a four-lane cross-section in between.
- Under 2041 traffic conditions, Wellington Road 124 is forecast to operate with generally acceptable levels of service in both peak hours.
- The intersection of WR 124 and Whitelaw Road will require geometric improvements to accommodate the increase traffic volumes on Whitelaw Road upon the completion of the Niska Road bridge.

Appendix A

Turning Movement Count Data Sheets

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Township Road 1
Site Code:
Start Date: 06/05/2018

Turning Movement Data

Start Time	Wellington Road 124 Eastbound					Wellington Road 124 Westbound					Township Road 1 Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
7:00 AM	42	143	0	0	185	158	0	0	0	158	0	38	0	0	38	381
7:15 AM	66	183	0	0	249	160	1	0	0	161	0	66	0	0	66	476
7:30 AM	71	201	0	0	272	181	1	0	0	182	0	73	0	0	73	527
7:45 AM	85	159	1	0	245	208	1	0	0	209	0	70	0	0	70	524
Hourly Total	264	686	1	0	951	707	3	0	0	710	0	247	0	0	247	1908
8:00 AM	72	174	1	0	247	177	1	0	0	178	0	55	0	1	55	480
8:15 AM	56	169	0	0	225	130	1	0	0	131	0	47	0	0	47	403
8:30 AM	46	160	0	0	206	157	2	0	0	159	1	36	0	0	37	402
8:45 AM	36	171	0	0	207	155	2	0	0	157	0	36	0	0	36	400
Hourly Total	210	674	1	0	885	619	6	0	0	625	1	174	0	1	175	1685
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11:00 AM	20	78	0	0	98	118	2	0	0	120	1	11	0	0	12	230
11:15 AM	12	85	0	0	97	122	0	0	0	122	0	20	0	0	20	239
11:30 AM	15	85	0	0	100	111	4	0	0	115	0	15	0	0	15	230
11:45 AM	14	115	0	0	129	146	1	0	0	147	0	16	0	0	16	292
Hourly Total	61	363	0	0	424	497	7	0	0	504	1	62	0	0	63	991
12:00 PM	15	124	0	0	139	115	0	0	0	115	0	10	0	0	10	264
12:15 PM	15	110	0	0	125	118	2	0	0	120	0	20	0	0	20	265
12:30 PM	10	127	0	0	137	136	1	0	0	137	0	24	0	0	24	298
12:45 PM	13	91	0	0	104	128	0	0	0	128	0	12	0	0	12	244
Hourly Total	53	452	0	0	505	497	3	0	0	500	0	66	0	0	66	1071
1:00 PM	8	126	0	0	134	123	3	0	1	126	2	15	0	0	17	277
1:15 PM	16	124	0	0	140	116	0	0	0	116	1	21	0	0	22	278
1:30 PM	14	99	1	0	114	113	1	0	0	114	1	18	0	0	19	247
1:45 PM	16	148	0	0	164	127	2	0	0	129	0	16	0	0	16	309
Hourly Total	54	497	1	0	552	479	6	0	1	485	4	70	0	0	74	1111
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00 PM	37	143	0	0	180	189	1	0	0	190	2	54	0	0	56	426
4:15 PM	52	200	0	0	252	205	3	0	0	208	0	81	0	0	81	541
4:30 PM	41	170	0	0	211	243	4	0	0	247	1	90	0	0	91	549
4:45 PM	44	179	0	0	223	227	2	0	0	229	0	85	0	0	85	537
Hourly Total	174	692	0	0	866	864	10	0	0	874	3	310	0	0	313	2053
5:00 PM	54	168	0	0	222	208	3	0	0	211	0	75	0	0	75	508
5:15 PM	58	178	0	0	236	224	0	0	0	224	0	99	0	0	99	559
5:30 PM	63	198	0	0	261	208	3	0	0	211	0	56	0	0	56	528
5:45 PM	23	149	0	0	172	215	4	0	0	219	0	42	0	0	42	433

Hourly Total	198	693	0	0	891	855	10	0	0	865	0	272	0	0	272	2028
6:00 PM	27	148	0	0	175	165	3	0	0	168	0	38	0	0	38	381
6:15 PM	23	125	0	0	148	155	0	0	0	155	0	21	0	0	21	324
6:30 PM	17	119	0	0	136	134	1	0	0	135	0	29	0	0	29	300
6:45 PM	11	102	0	0	113	108	0	0	0	108	1	24	0	0	25	246
Hourly Total	78	494	0	0	572	562	4	0	0	566	1	112	0	0	113	1251
Grand Total	1092	4551	3	0	5646	5080	49	0	1	5129	10	1313	0	1	1323	12098
Approach %	19.3	80.6	0.1	-	-	99.0	1.0	0.0	-	-	0.8	99.2	0.0	-	-	-
Total %	9.0	37.6	0.0	-	46.7	42.0	0.4	0.0	-	42.4	0.1	10.9	0.0	-	10.9	-
Lights	1075	4089	3	-	5167	4577	46	0	-	4623	9	1295	0	-	1304	11094
% Lights	98.4	89.8	100.0	-	91.5	90.1	93.9	-	-	90.1	90.0	98.6	-	-	98.6	91.7
Mediums	16	173	0	-	189	183	2	0	-	185	1	17	0	-	18	392
% Mediums	1.5	3.8	0.0	-	3.3	3.6	4.1	-	-	3.6	10.0	1.3	-	-	1.4	3.2
Articulated Trucks	1	289	0	-	290	320	1	0	-	321	0	1	0	-	1	612
% Articulated Trucks	0.1	6.4	0.0	-	5.1	6.3	2.0	-	-	6.3	0.0	0.1	-	-	0.1	5.1
Pedestrians	-	-	-	0	-	-	-	-	1	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	-	-	-	-	100.0	-	-	-	-	100.0	-	-

Paradigm Transportation Solutions Limited
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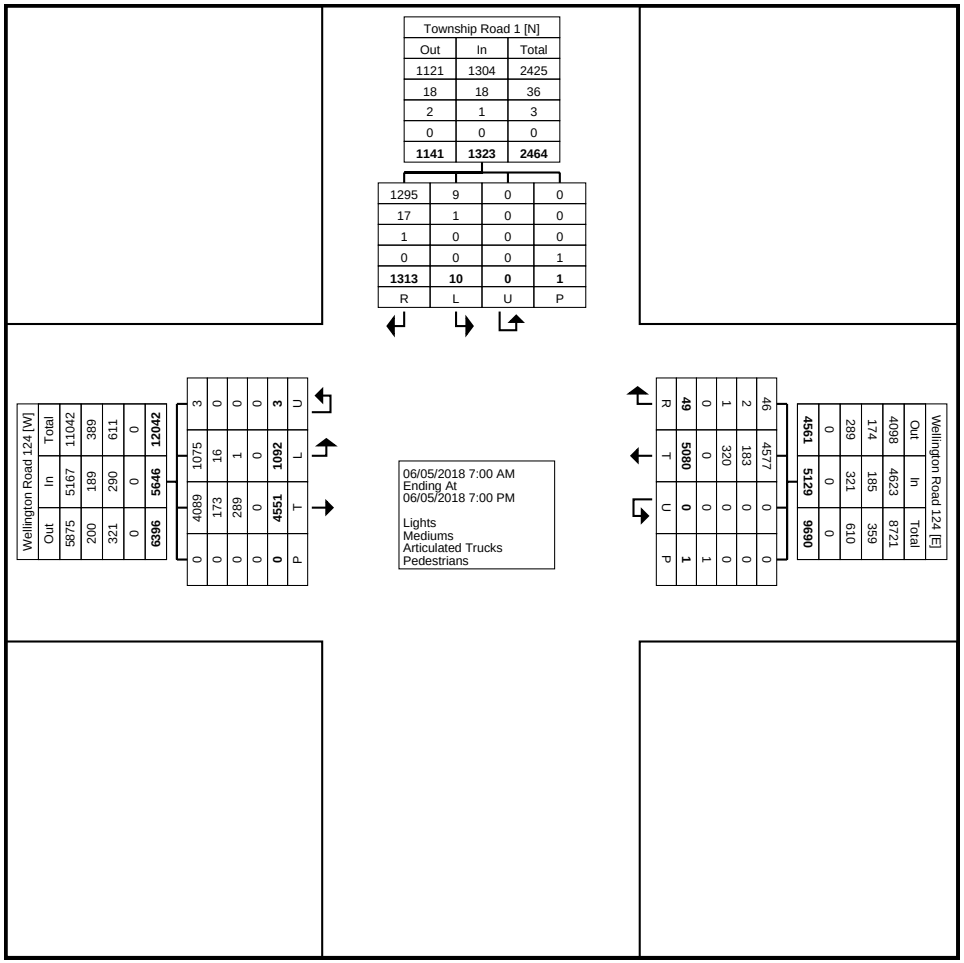
Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Township Road 1
Site Code:
Start Date: 06/05/2018



Turning Movement Data Plot

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Township Road 1
Site Code:
Start Date: 06/05/2018

Turning Movement Peak Hour Data (7:15 AM)

Start Time	Wellington Road 124 Eastbound					Wellington Road 124 Westbound					Township Road 1 Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
7:15 AM	66	183	0	0	249	160	1	0	0	161	0	66	0	0	66	476
7:30 AM	71	201	0	0	272	181	1	0	0	182	0	73	0	0	73	527
7:45 AM	85	159	1	0	245	208	1	0	0	209	0	70	0	0	70	524
8:00 AM	72	174	1	0	247	177	1	0	0	178	0	55	0	1	55	480
Total	294	717	2	0	1013	726	4	0	0	730	0	264	0	1	264	2007
Approach %	29.0	70.8	0.2	-	-	99.5	0.5	0.0	-	-	0.0	100.0	0.0	-	-	-
Total %	14.6	35.7	0.1	-	50.5	36.2	0.2	0.0	-	36.4	0.0	13.2	0.0	-	13.2	-
PHF	0.865	0.892	0.500	-	0.931	0.873	1.000	0.000	-	0.873	0.000	0.904	0.000	-	0.904	0.952
Lights	289	655	2	-	946	655	2	0	-	657	0	262	0	-	262	1865
% Lights	98.3	91.4	100.0	-	93.4	90.2	50.0	-	-	90.0	-	99.2	-	-	99.2	92.9
Mediums	4	24	0	-	28	30	2	0	-	32	0	2	0	-	2	62
% Mediums	1.4	3.3	0.0	-	2.8	4.1	50.0	-	-	4.4	-	0.8	-	-	0.8	3.1
Articulated Trucks	1	38	0	-	39	41	0	0	-	41	0	0	0	-	0	80
% Articulated Trucks	0.3	5.3	0.0	-	3.8	5.6	0.0	-	-	5.6	-	0.0	-	-	0.0	4.0
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	1	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-

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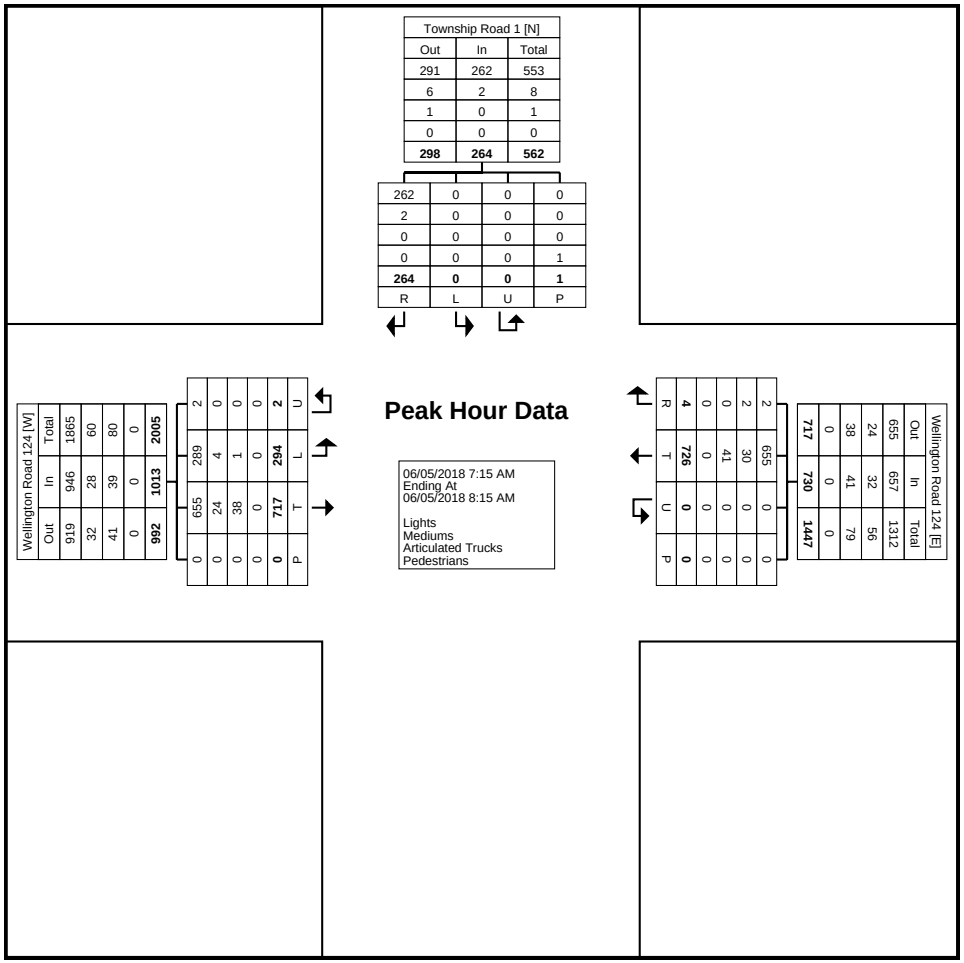
Count Name: Wellington Road 124 & Township Road 1
Site Code:
Start Date: 06/05/2018



Turning Movement Peak Hour Data Plot (7:15 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Township Road 1
Site Code:
Start Date: 06/05/2018

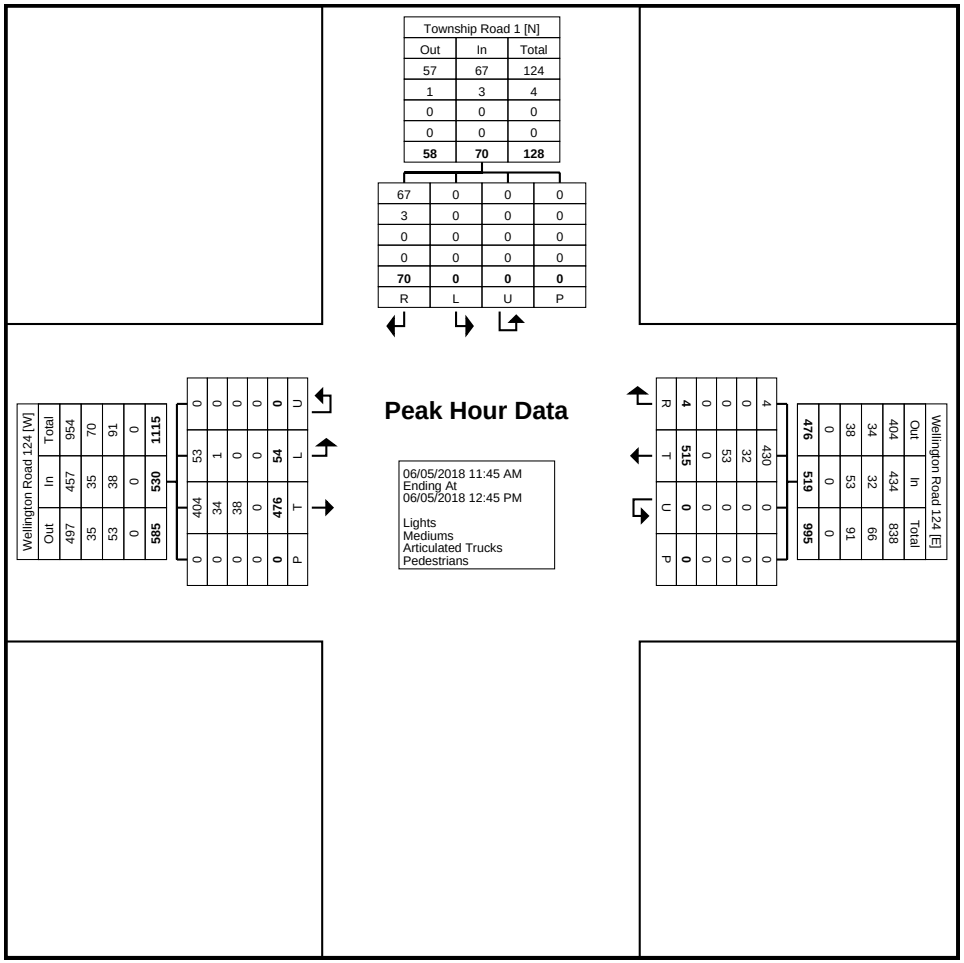
Turning Movement Peak Hour Data (11:45 AM)

Start Time	Wellington Road 124 Eastbound					Wellington Road 124 Westbound					Township Road 1 Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
11:45 AM	14	115	0	0	129	146	1	0	0	147	0	16	0	0	16	292
12:00 PM	15	124	0	0	139	115	0	0	0	115	0	10	0	0	10	264
12:15 PM	15	110	0	0	125	118	2	0	0	120	0	20	0	0	20	265
12:30 PM	10	127	0	0	137	136	1	0	0	137	0	24	0	0	24	298
Total	54	476	0	0	530	515	4	0	0	519	0	70	0	0	70	1119
Approach %	10.2	89.8	0.0	-	-	99.2	0.8	0.0	-	-	0.0	100.0	0.0	-	-	-
Total %	4.8	42.5	0.0	-	47.4	46.0	0.4	0.0	-	46.4	0.0	6.3	0.0	-	6.3	-
PHF	0.900	0.937	0.000	-	0.953	0.882	0.500	0.000	-	0.883	0.000	0.729	0.000	-	0.729	0.939
Lights	53	404	0	-	457	430	4	0	-	434	0	67	0	-	67	958
% Lights	98.1	84.9	-	-	86.2	83.5	100.0	-	-	83.6	-	95.7	-	-	95.7	85.6
Mediums	1	34	0	-	35	32	0	0	-	32	0	3	0	-	3	70
% Mediums	1.9	7.1	-	-	6.6	6.2	0.0	-	-	6.2	-	4.3	-	-	4.3	6.3
Articulated Trucks	0	38	0	-	38	53	0	0	-	53	0	0	0	-	0	91
% Articulated Trucks	0.0	8.0	-	-	7.2	10.3	0.0	-	-	10.2	-	0.0	-	-	0.0	8.1
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Township Road 1
Site Code:
Start Date: 06/05/2018



Turning Movement Peak Hour Data Plot (11:45 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Township Road 1
Site Code:
Start Date: 06/05/2018

Turning Movement Peak Hour Data (4:30 PM)

Start Time	Wellington Road 124 Eastbound					Wellington Road 124 Westbound					Township Road 1 Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
4:30 PM	41	170	0	0	211	243	4	0	0	247	1	90	0	0	91	549
4:45 PM	44	179	0	0	223	227	2	0	0	229	0	85	0	0	85	537
5:00 PM	54	168	0	0	222	208	3	0	0	211	0	75	0	0	75	508
5:15 PM	58	178	0	0	236	224	0	0	0	224	0	99	0	0	99	559
Total	197	695	0	0	892	902	9	0	0	911	1	349	0	0	350	2153
Approach %	22.1	77.9	0.0	-	-	99.0	1.0	0.0	-	-	0.3	99.7	0.0	-	-	-
Total %	9.2	32.3	0.0	-	41.4	41.9	0.4	0.0	-	42.3	0.0	16.2	0.0	-	16.3	-
PHF	0.849	0.971	0.000	-	0.945	0.928	0.563	0.000	-	0.922	0.250	0.881	0.000	-	0.884	0.963
Lights	195	641	0	-	836	862	9	0	-	871	1	348	0	-	349	2056
% Lights	99.0	92.2	-	-	93.7	95.6	100.0	-	-	95.6	100.0	99.7	-	-	99.7	95.5
Mediums	2	22	0	-	24	14	0	0	-	14	0	1	0	-	1	39
% Mediums	1.0	3.2	-	-	2.7	1.6	0.0	-	-	1.5	0.0	0.3	-	-	0.3	1.8
Articulated Trucks	0	32	0	-	32	26	0	0	-	26	0	0	0	-	0	58
% Articulated Trucks	0.0	4.6	-	-	3.6	2.9	0.0	-	-	2.9	0.0	0.0	-	-	0.0	2.7
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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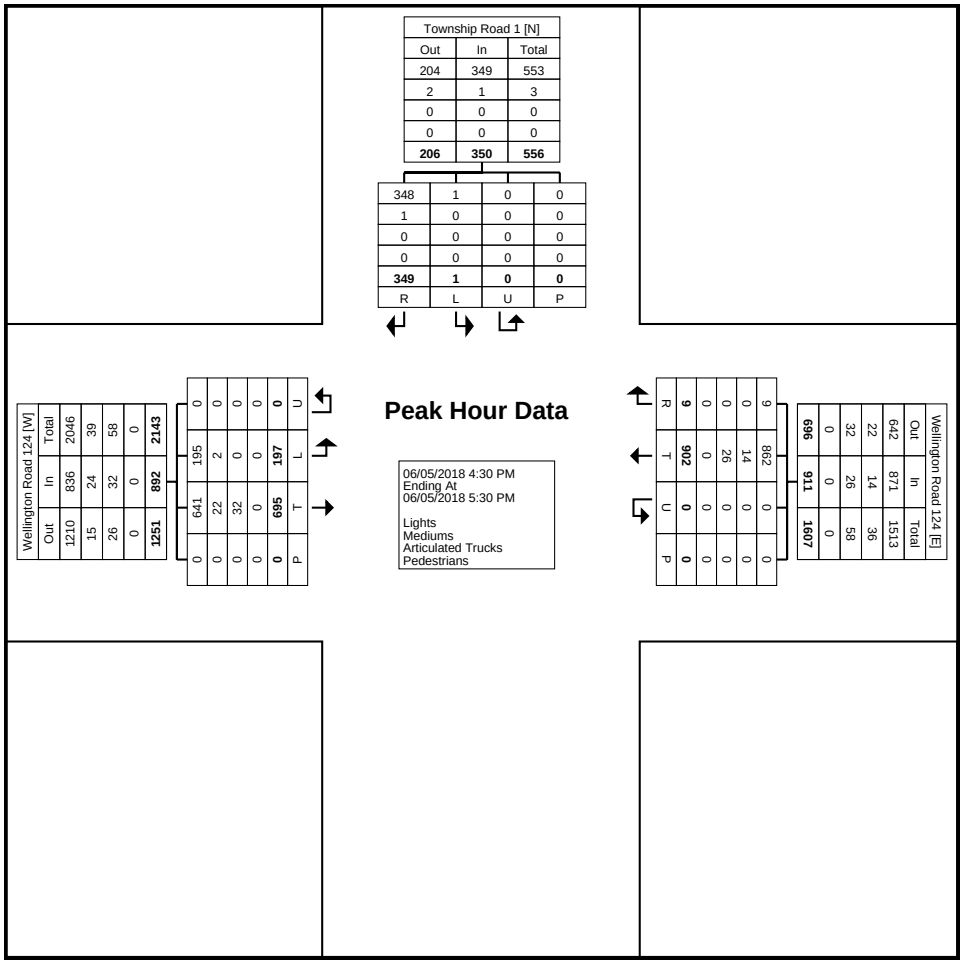
Count Name: Wellington Road 124 & Township Road 1
Site Code:
Start Date: 06/05/2018



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

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Township Road 1
Site Code:
Start Date: 06/05/2018

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (South)
Site Code:
Start Date: 06/05/2018

Turning Movement Data

Start Time	Wellington Road 124 Eastbound						Wellington Road 124 Westbound						Wellington Road 32 (South) Northbound						Driveway Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:00 AM	0	126	22	0	0	148	65	135	0	0	0	200	32	0	86	0	0	118	1	1	0	0	0	2	468
7:15 AM	0	137	27	0	0	164	81	127	0	0	0	208	33	0	97	0	0	130	0	0	0	0	0	0	502
7:30 AM	0	156	39	0	0	195	88	150	0	0	0	238	56	0	155	1	0	212	0	0	0	0	0	0	645
7:45 AM	0	127	38	0	0	165	74	130	0	0	0	204	86	0	150	0	0	236	0	0	0	0	0	0	605
Hourly Total	0	546	126	0	0	672	308	542	0	0	0	850	207	0	488	1	0	696	1	1	0	0	0	2	2220
8:00 AM	0	146	22	0	0	168	71	126	0	0	0	197	49	0	138	0	2	187	0	0	0	0	0	0	552
8:15 AM	0	144	32	0	0	176	64	95	0	0	0	159	44	0	142	0	0	186	1	0	0	0	0	1	522
8:30 AM	0	130	16	0	0	146	66	112	1	0	0	179	52	0	95	0	0	147	0	0	0	0	0	0	472
8:45 AM	1	128	18	0	0	147	79	106	0	0	0	185	37	0	75	0	0	112	1	0	0	0	0	1	445
Hourly Total	1	548	88	0	0	637	280	439	1	0	0	720	182	0	450	0	2	632	2	0	0	0	0	2	1991
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00 AM	0	71	8	1	0	80	35	111	1	0	0	147	11	0	52	0	0	63	0	0	0	0	0	0	290
11:15 AM	0	111	7	0	0	118	34	103	0	0	0	137	10	0	42	0	0	52	0	0	0	0	0	0	307
11:30 AM	1	87	15	0	0	103	48	116	1	0	0	165	11	0	35	0	0	46	1	0	0	0	0	1	315
11:45 AM	0	119	11	0	0	130	43	131	0	0	0	174	11	0	47	0	0	58	0	0	0	0	0	0	362
Hourly Total	1	388	41	1	0	431	160	461	2	0	0	623	43	0	176	0	0	219	1	0	0	0	0	1	1274
12:00 PM	1	104	18	0	0	123	42	107	0	0	0	149	8	0	48	0	0	56	1	0	0	0	0	1	329
12:15 PM	0	92	18	0	0	110	36	111	0	0	0	147	15	0	46	0	0	61	0	0	0	0	0	0	318
12:30 PM	1	122	9	0	3	132	48	129	1	0	0	178	17	0	49	0	0	66	2	0	0	0	0	2	378
12:45 PM	0	79	11	0	1	90	46	114	1	0	0	161	15	0	45	0	0	60	1	0	0	0	0	1	312
Hourly Total	2	397	56	0	4	455	172	461	2	0	0	635	55	0	188	0	0	243	4	0	0	0	0	4	1337
1:00 PM	0	116	4	0	0	120	38	113	1	0	0	152	14	0	23	0	0	37	1	1	0	0	0	2	311
1:15 PM	0	110	14	0	0	124	53	108	0	0	0	161	13	0	25	0	0	38	2	0	0	0	0	2	325
1:30 PM	0	102	12	0	0	114	57	102	0	0	0	159	16	0	61	0	0	77	0	0	0	0	0	0	350
1:45 PM	0	124	22	0	0	146	45	110	1	0	0	156	20	0	35	0	0	55	0	0	1	0	0	1	358
Hourly Total	0	452	52	0	0	504	193	433	2	0	0	628	63	0	144	0	0	207	3	1	1	0	0	5	1344
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00 PM	1	118	34	0	0	153	107	155	0	0	0	262	45	0	71	0	0	116	7	0	0	0	0	7	538
4:15 PM	0	137	24	0	0	161	127	151	0	0	0	278	60	0	80	0	0	140	0	0	0	0	0	0	579
4:30 PM	2	142	37	0	0	181	113	175	2	0	0	290	73	0	101	0	0	174	4	1	0	0	0	5	650
4:45 PM	1	137	41	0	0	179	123	149	1	0	0	273	68	0	118	0	0	186	1	1	0	0	0	2	640
Hourly Total	4	534	136	0	0	674	470	630	3	0	0	1103	246	0	370	0	0	616	12	2	0	0	0	14	2407
5:00 PM	0	136	41	0	0	177	116	149	1	0	0	266	75	1	121	0	0	197	5	1	0	0	0	6	646

5:15 PM	1	137	38	0	0	176	136	155	0	0	0	291	71	0	115	0	0	186	6	1	1	0	0	8	661
5:30 PM	2	130	47	0	0	179	127	142	0	0	0	269	66	0	92	0	0	158	0	0	2	0	0	2	608
5:45 PM	0	139	36	0	0	175	102	164	0	0	0	266	49	0	84	0	0	133	1	0	0	0	0	1	575
Hourly Total	3	542	162	0	0	707	481	610	1	0	0	1092	261	1	412	0	0	674	12	2	3	0	0	17	2490
6:00 PM	0	138	29	0	0	167	77	135	0	0	0	212	36	0	84	0	0	120	0	0	0	0	0	0	499
6:15 PM	0	111	20	0	0	131	57	127	0	0	0	184	24	0	52	0	0	76	0	0	0	0	0	0	391
6:30 PM	1	103	12	0	0	116	52	108	0	0	0	160	28	0	48	0	0	76	1	0	0	0	0	1	353
6:45 PM	0	98	15	0	0	113	42	97	0	0	0	139	19	0	41	0	1	60	0	0	0	0	0	0	312
Hourly Total	1	450	76	0	0	527	228	467	0	0	0	695	107	0	225	0	1	332	1	0	0	0	0	1	1555
7:00 PM	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Grand Total	12	3857	737	1	4	4607	2292	4044	11	0	0	6347	1164	1	2453	1	3	3619	36	6	4	0	0	46	14619
Approach %	0.3	83.7	16.0	0.0	-	-	36.1	63.7	0.2	0.0	-	-	32.2	0.0	67.8	0.0	-	-	78.3	13.0	8.7	0.0	-	-	-
Total %	0.1	26.4	5.0	0.0	-	31.5	15.7	27.7	0.1	0.0	-	43.4	8.0	0.0	16.8	0.0	-	24.8	0.2	0.0	0.0	0.0	-	0.3	-
Lights	11	3419	691	1	-	4122	2155	3586	9	0	-	5750	1112	1	2332	0	-	3445	34	6	4	0	-	44	13361
% Lights	91.7	88.6	93.8	100.0	-	89.5	94.0	88.7	81.8	-	-	90.6	95.5	100.0	95.1	0.0	-	95.2	94.4	100.0	100.0	-	-	95.7	91.4
Mediums	0	156	33	0	-	189	82	173	0	0	-	255	37	0	77	1	-	115	0	0	0	0	-	0	559
% Mediums	0.0	4.0	4.5	0.0	-	4.1	3.6	4.3	0.0	-	-	4.0	3.2	0.0	3.1	100.0	-	3.2	0.0	0.0	0.0	-	-	0.0	3.8
Articulated Trucks	1	282	13	0	-	296	55	285	2	0	-	342	15	0	44	0	-	59	2	0	0	0	-	2	699
% Articulated Trucks	8.3	7.3	1.8	0.0	-	6.4	2.4	7.0	18.2	-	-	5.4	1.3	0.0	1.8	0.0	-	1.6	5.6	0.0	0.0	-	-	4.3	4.8
Pedestrians	-	-	-	-	4	-	-	-	-	-	0	-	-	-	-	-	3	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

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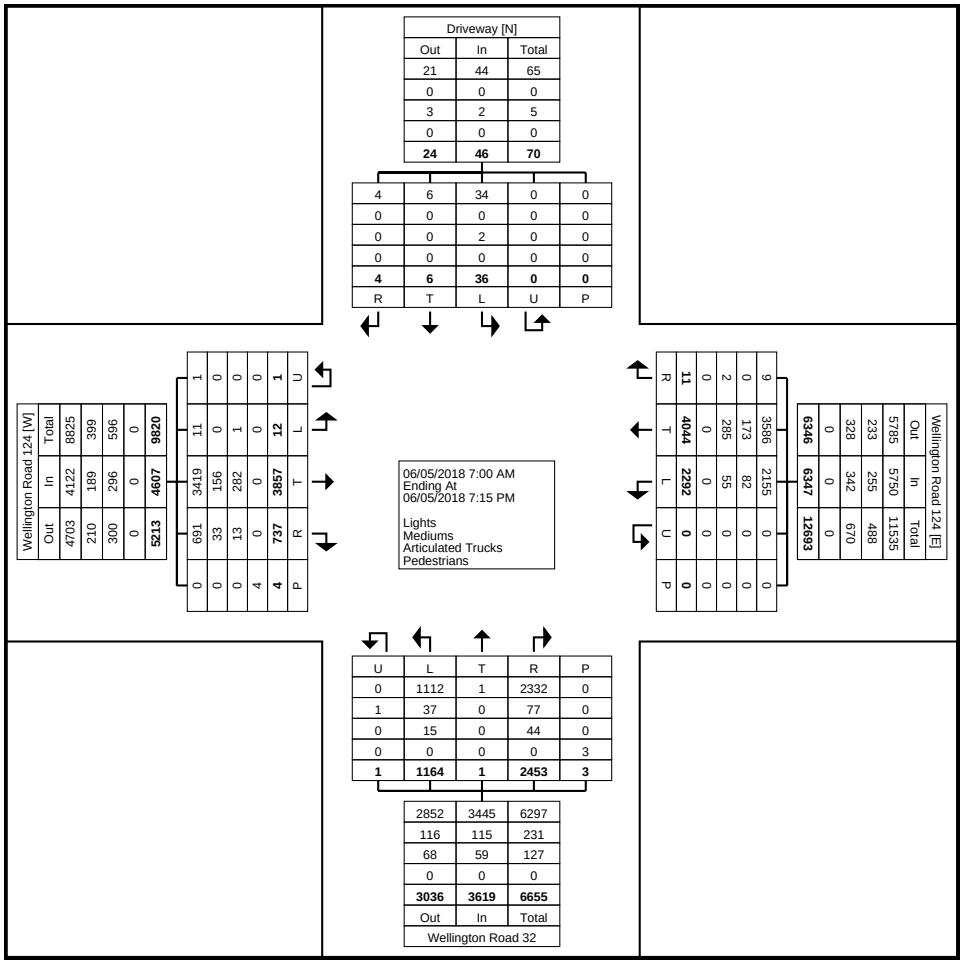
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (South)
Site Code:
Start Date: 06/05/2018



Turning Movement Data Plot

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (South)
Site Code:
Start Date: 06/05/2018

Turning Movement Peak Hour Data (7:30 AM)

Start Time	Wellington Road 124 Eastbound						Wellington Road 124 Westbound						Wellington Road 32 (South) Northbound						Driveway Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:30 AM	0	156	39	0	0	195	88	150	0	0	0	238	56	0	155	1	0	212	0	0	0	0	0	0	645
7:45 AM	0	127	38	0	0	165	74	130	0	0	0	204	86	0	150	0	0	236	0	0	0	0	0	0	605
8:00 AM	0	146	22	0	0	168	71	126	0	0	0	197	49	0	138	0	2	187	0	0	0	0	0	0	552
8:15 AM	0	144	32	0	0	176	64	95	0	0	0	159	44	0	142	0	0	186	1	0	0	0	0	1	522
Total	0	573	131	0	0	704	297	501	0	0	0	798	235	0	585	1	2	821	1	0	0	0	0	1	2324
Approach %	0.0	81.4	18.6	0.0	-	-	37.2	62.8	0.0	0.0	-	-	28.6	0.0	71.3	0.1	-	-	100.0	0.0	0.0	0.0	-	-	-
Total %	0.0	24.7	5.6	0.0	-	30.3	12.8	21.6	0.0	0.0	-	34.3	10.1	0.0	25.2	0.0	-	35.3	0.0	0.0	0.0	0.0	-	0.0	-
PHF	0.000	0.918	0.840	0.000	-	0.903	0.844	0.835	0.000	0.000	-	0.838	0.683	0.000	0.944	0.250	-	0.870	0.250	0.000	0.000	0.000	-	0.250	0.901
Lights	0	508	120	0	-	628	278	430	0	0	-	708	227	0	566	0	-	793	1	0	0	0	-	1	2130
% Lights	-	88.7	91.6	-	-	89.2	93.6	85.8	-	-	-	88.7	96.6	-	96.8	0.0	-	96.6	100.0	-	-	-	-	100.0	91.7
Mediums	0	30	7	0	-	37	13	27	0	0	-	40	7	0	12	1	-	20	0	0	0	0	-	0	97
% Mediums	-	5.2	5.3	-	-	5.3	4.4	5.4	-	-	-	5.0	3.0	-	2.1	100.0	-	2.4	0.0	-	-	-	-	0.0	4.2
Articulated Trucks	0	35	4	0	-	39	6	44	0	0	-	50	1	0	7	0	-	8	0	0	0	0	-	0	97
% Articulated Trucks	-	6.1	3.1	-	-	5.5	2.0	8.8	-	-	-	6.3	0.4	-	1.2	0.0	-	1.0	0.0	-	-	-	-	0.0	4.2
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	2	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-

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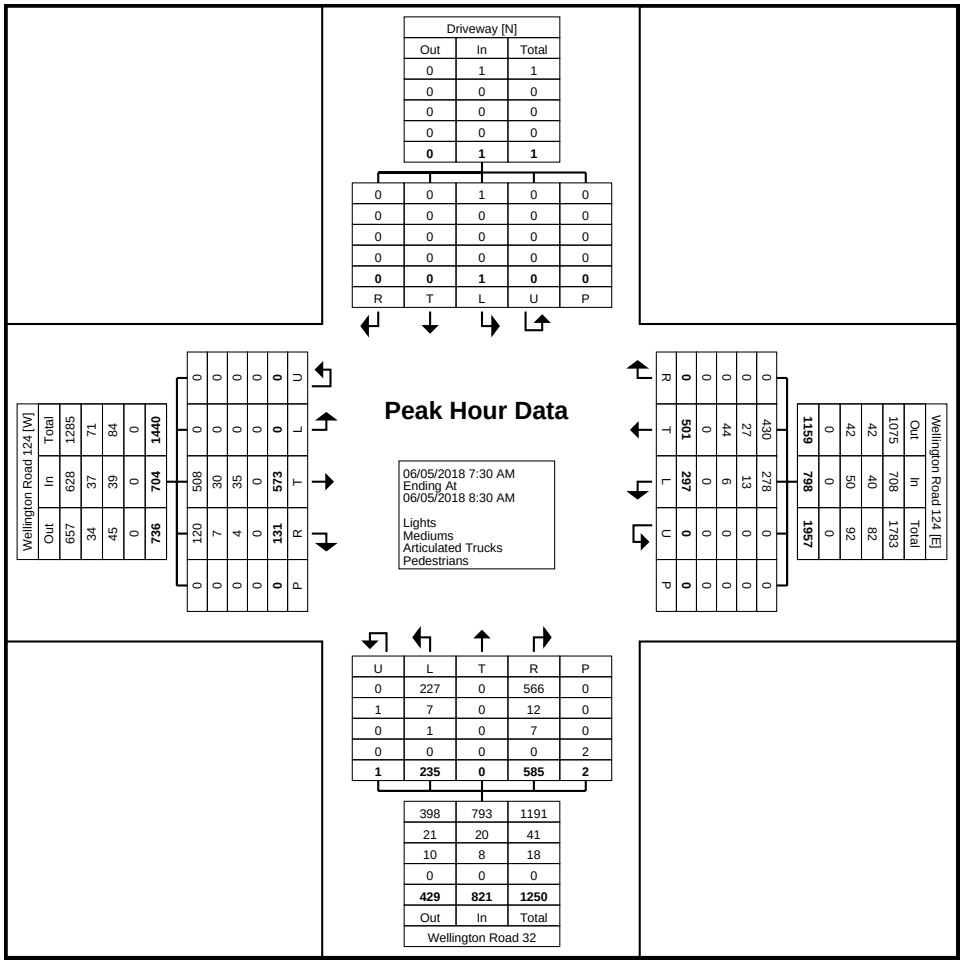


Turning Movement Peak Hour Data Plot (7:30 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (South)
Site Code:
Start Date: 06/05/2018

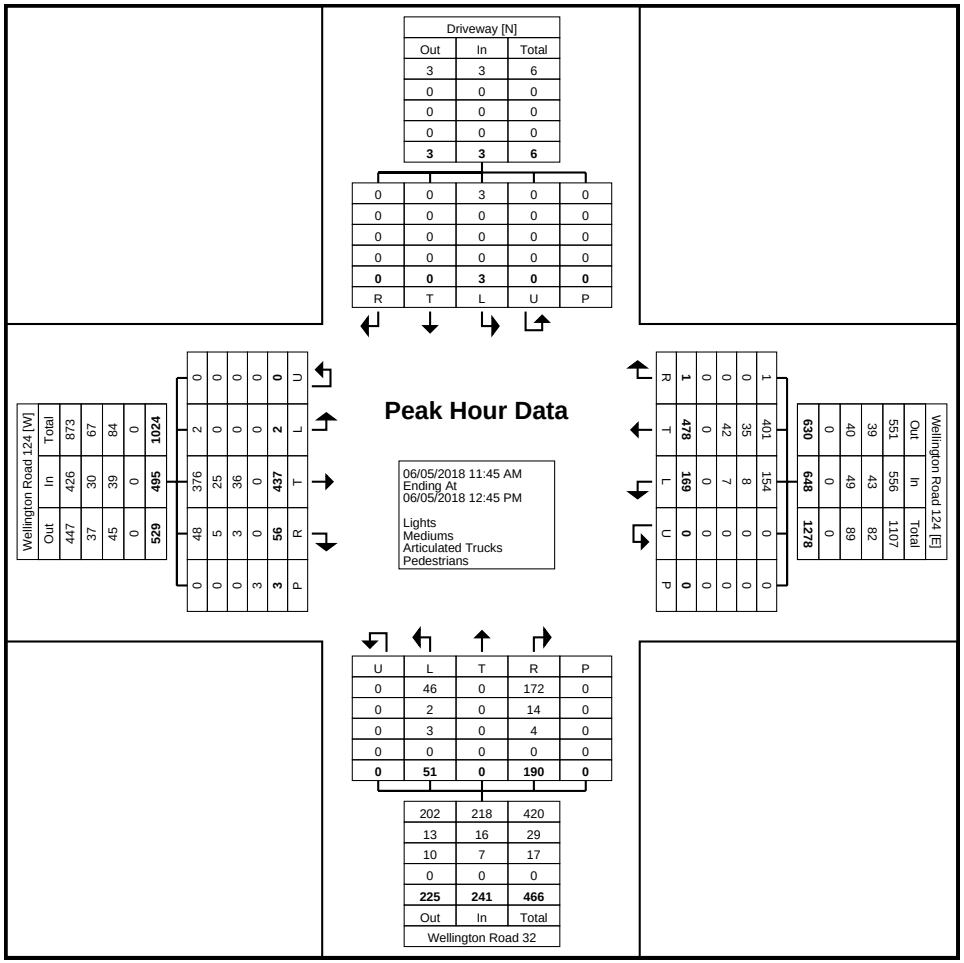
Turning Movement Peak Hour Data (11:45 AM)

Start Time	Wellington Road 124 Eastbound						Wellington Road 124 Westbound						Wellington Road 32 (South) Northbound						Driveway Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
11:45 AM	0	119	11	0	0	130	43	131	0	0	0	174	11	0	47	0	0	58	0	0	0	0	0	0	362
12:00 PM	1	104	18	0	0	123	42	107	0	0	0	149	8	0	48	0	0	56	1	0	0	0	0	1	329
12:15 PM	0	92	18	0	0	110	36	111	0	0	0	147	15	0	46	0	0	61	0	0	0	0	0	0	318
12:30 PM	1	122	9	0	3	132	48	129	1	0	0	178	17	0	49	0	0	66	2	0	0	0	0	2	378
Total	2	437	56	0	3	495	169	478	1	0	0	648	51	0	190	0	0	241	3	0	0	0	0	3	1387
Approach %	0.4	88.3	11.3	0.0	-	-	26.1	73.8	0.2	0.0	-	-	21.2	0.0	78.8	0.0	-	-	100.0	0.0	0.0	0.0	-	-	-
Total %	0.1	31.5	4.0	0.0	-	35.7	12.2	34.5	0.1	0.0	-	46.7	3.7	0.0	13.7	0.0	-	17.4	0.2	0.0	0.0	0.0	-	0.2	-
PHF	0.500	0.895	0.778	0.000	-	0.938	0.880	0.912	0.250	0.000	-	0.910	0.750	0.000	0.969	0.000	-	0.913	0.375	0.000	0.000	0.000	-	0.375	0.917
Lights	2	376	48	0	-	426	154	401	1	0	-	556	46	0	172	0	-	218	3	0	0	0	-	3	1203
% Lights	100.0	86.0	85.7	-	-	86.1	91.1	83.9	100.0	-	-	85.8	90.2	-	90.5	-	-	90.5	100.0	-	-	-	-	100.0	86.7
Mediums	0	25	5	0	-	30	8	35	0	0	-	43	2	0	14	0	-	16	0	0	0	0	-	0	89
% Mediums	0.0	5.7	8.9	-	-	6.1	4.7	7.3	0.0	-	-	6.6	3.9	-	7.4	-	-	6.6	0.0	-	-	-	-	0.0	6.4
Articulated Trucks	0	36	3	0	-	39	7	42	0	0	-	49	3	0	4	0	-	7	0	0	0	0	-	0	95
% Articulated Trucks	0.0	8.2	5.4	-	-	7.9	4.1	8.8	0.0	-	-	7.6	5.9	-	2.1	-	-	2.9	0.0	-	-	-	-	0.0	6.8
Pedestrians	-	-	-	-	3	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (South)
Site Code:
Start Date: 06/05/2018



Turning Movement Peak Hour Data Plot (11:45 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (South)
Site Code:
Start Date: 06/05/2018

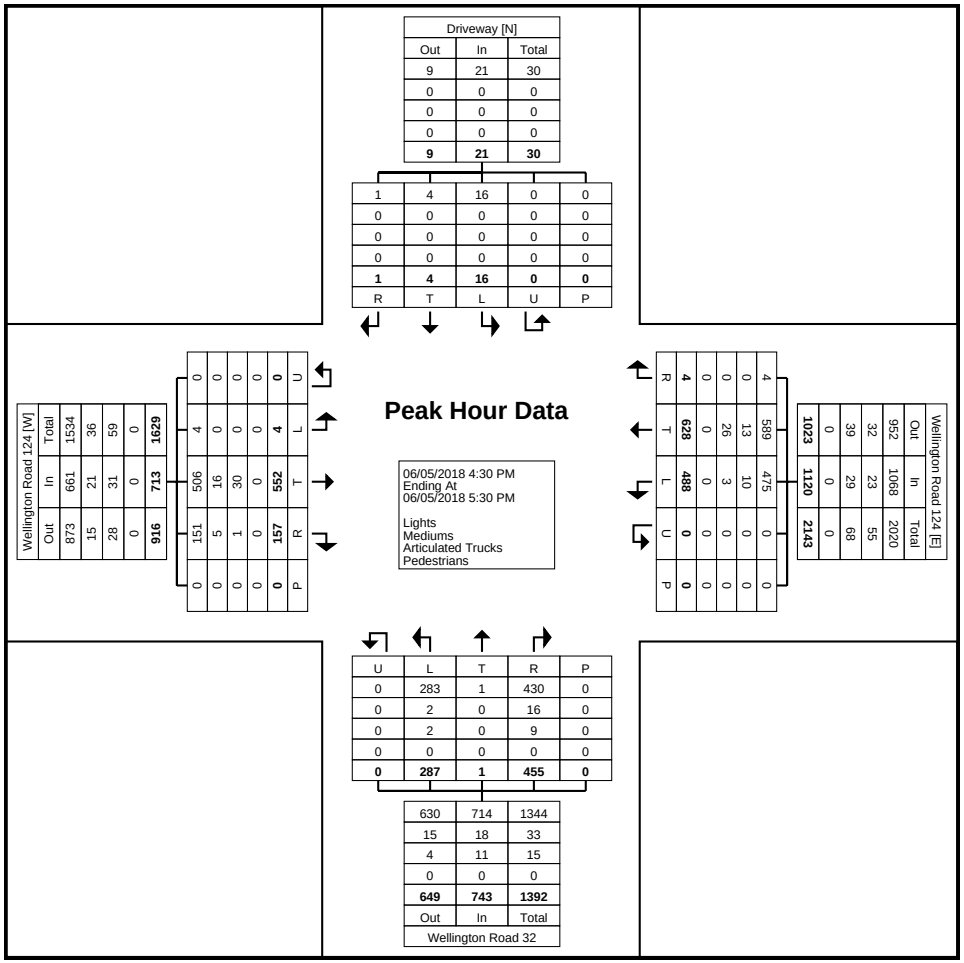
Turning Movement Peak Hour Data (4:30 PM)

Start Time	Wellington Road 124 Eastbound						Wellington Road 124 Westbound						Wellington Road 32 (South) Northbound						Driveway Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
4:30 PM	2	142	37	0	0	181	113	175	2	0	0	290	73	0	101	0	0	174	4	1	0	0	0	5	650
4:45 PM	1	137	41	0	0	179	123	149	1	0	0	273	68	0	118	0	0	186	1	1	0	0	0	2	640
5:00 PM	0	136	41	0	0	177	116	149	1	0	0	266	75	1	121	0	0	197	5	1	0	0	0	6	646
5:15 PM	1	137	38	0	0	176	136	155	0	0	0	291	71	0	115	0	0	186	6	1	1	0	0	8	661
Total	4	552	157	0	0	713	488	628	4	0	0	1120	287	1	455	0	0	743	16	4	1	0	0	21	2597
Approach %	0.6	77.4	22.0	0.0	-	-	43.6	56.1	0.4	0.0	-	-	38.6	0.1	61.2	0.0	-	-	76.2	19.0	4.8	0.0	-	-	-
Total %	0.2	21.3	6.0	0.0	-	27.5	18.8	24.2	0.2	0.0	-	43.1	11.1	0.0	17.5	0.0	-	28.6	0.6	0.2	0.0	0.0	-	0.8	-
PHF	0.500	0.972	0.957	0.000	-	0.985	0.897	0.897	0.500	0.000	-	0.962	0.957	0.250	0.940	0.000	-	0.943	0.667	1.000	0.250	0.000	-	0.656	0.982
Lights	4	506	151	0	-	661	475	589	4	0	-	1068	283	1	430	0	-	714	16	4	1	0	-	21	2464
% Lights	100.0	91.7	96.2	-	-	92.7	97.3	93.8	100.0	-	-	95.4	98.6	100.0	94.5	-	-	96.1	100.0	100.0	100.0	-	-	100.0	94.9
Mediums	0	16	5	0	-	21	10	13	0	0	-	23	2	0	16	0	-	18	0	0	0	0	-	0	62
% Mediums	0.0	2.9	3.2	-	-	2.9	2.0	2.1	0.0	-	-	2.1	0.7	0.0	3.5	-	-	2.4	0.0	0.0	0.0	-	-	0.0	2.4
Articulated Trucks	0	30	1	0	-	31	3	26	0	0	-	29	2	0	9	0	-	11	0	0	0	0	-	0	71
% Articulated Trucks	0.0	5.4	0.6	-	-	4.3	0.6	4.1	0.0	-	-	2.6	0.7	0.0	2.0	-	-	1.5	0.0	0.0	0.0	-	-	0.0	2.7
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (South)
Site Code:
Start Date: 06/05/2018



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

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (South)
Site Code:
Start Date: 06/05/2018

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (North)
Site Code:
Start Date: 06/05/2018

Turning Movement Data

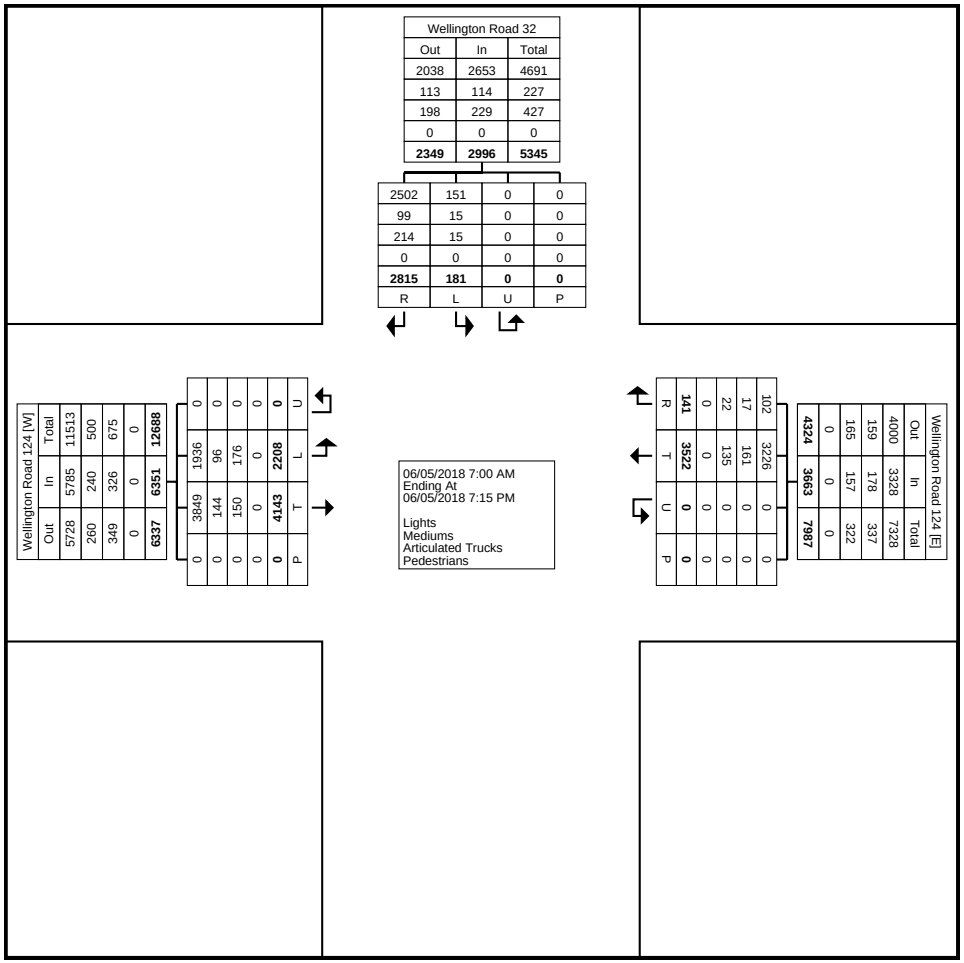
Start Time	Wellington Road 124 Eastbound					Wellington Road 124 Westbound					Wellington Road 32 (North) Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
7:00 AM	77	120	0	0	197	115	3	0	0	118	1	83	0	0	84	399
7:15 AM	96	141	0	0	237	119	2	0	0	121	6	95	0	0	101	459
7:30 AM	121	187	0	0	308	121	6	0	0	127	6	125	0	0	131	566
7:45 AM	88	171	0	0	259	121	4	0	0	125	3	99	0	0	102	486
Hourly Total	382	619	0	0	1001	476	15	0	0	491	16	402	0	0	418	1910
8:00 AM	93	186	0	0	279	98	5	0	0	103	8	90	0	0	98	480
8:15 AM	109	188	0	0	297	92	2	0	0	94	5	75	0	0	80	471
8:30 AM	60	169	0	0	229	117	5	0	0	122	2	75	0	0	77	428
8:45 AM	84	127	0	0	211	117	4	0	0	121	3	71	0	0	74	406
Hourly Total	346	670	0	0	1016	424	16	0	0	440	18	311	0	0	329	1785
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
11:00 AM	54	72	0	0	126	86	4	0	0	90	7	61	0	0	68	284
11:15 AM	47	103	0	0	150	85	1	0	0	86	6	54	0	0	60	296
11:30 AM	42	79	0	0	121	109	2	0	0	111	6	66	0	0	72	304
11:45 AM	67	108	0	0	175	96	5	0	0	101	11	70	0	0	81	357
Hourly Total	210	362	0	0	572	376	12	0	0	388	30	251	0	0	281	1241
12:00 PM	57	97	0	0	154	98	8	0	0	106	7	52	0	0	59	319
12:15 PM	61	88	0	0	149	101	1	0	0	102	7	53	0	0	60	311
12:30 PM	52	121	0	0	173	110	3	0	0	113	8	61	0	0	69	355
12:45 PM	42	74	0	0	116	104	6	0	0	110	3	73	0	0	76	302
Hourly Total	212	380	0	0	592	413	18	0	0	431	25	239	0	0	264	1287
1:00 PM	41	97	0	0	138	83	3	0	0	86	9	60	0	0	69	293
1:15 PM	45	91	0	0	136	84	7	0	0	91	2	68	0	0	70	297
1:30 PM	61	97	0	0	158	107	4	0	0	111	6	64	0	0	70	339
1:45 PM	53	105	0	0	158	90	4	0	0	94	6	61	0	0	67	319
Hourly Total	200	390	0	0	590	364	18	0	0	382	23	253	0	0	276	1248
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4:00 PM	60	137	0	0	197	146	5	0	0	151	6	109	0	0	115	463
4:15 PM	71	148	0	0	219	122	8	0	0	130	5	153	0	0	158	507
4:30 PM	90	168	0	0	258	132	4	0	0	136	8	149	0	0	157	551
4:45 PM	99	158	0	0	257	134	14	0	0	148	7	122	0	0	129	534
Hourly Total	320	611	0	0	931	534	31	0	0	565	26	533	0	0	559	2055
5:00 PM	91	162	0	0	253	127	8	0	0	135	13	145	0	0	158	546
5:15 PM	85	180	0	0	265	117	5	0	0	122	4	169	0	0	173	560
5:30 PM	71	160	0	0	231	111	2	0	0	113	7	155	0	0	162	506
5:45 PM	74	153	0	0	227	130	2	0	0	132	3	109	0	0	112	471

Hourly Total	321	655	0	0	976	485	17	0	0	502	27	578	0	0	605	2083
6:00 PM	72	140	0	0	212	141	3	0	0	144	5	77	0	0	82	438
6:15 PM	55	117	0	0	172	117	2	0	0	119	3	71	0	0	74	365
6:30 PM	48	105	0	0	153	91	3	0	0	94	6	56	0	0	62	309
6:45 PM	42	94	0	0	136	101	6	0	0	107	2	43	0	0	45	288
Hourly Total	217	456	0	0	673	450	14	0	0	464	16	247	0	0	263	1400
7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	2208	4143	0	0	6351	3522	141	0	0	3663	181	2815	0	0	2996	13010
Approach %	34.8	65.2	0.0	-	-	96.2	3.8	0.0	-	-	6.0	94.0	0.0	-	-	-
Total %	17.0	31.8	0.0	-	48.8	27.1	1.1	0.0	-	28.2	1.4	21.6	0.0	-	23.0	-
Lights	1936	3849	0	-	5785	3226	102	0	-	3328	151	2502	0	-	2653	11766
% Lights	87.7	92.9	-	-	91.1	91.6	72.3	-	-	90.9	83.4	88.9	-	-	88.6	90.4
Mediums	96	144	0	-	240	161	17	0	-	178	15	99	0	-	114	532
% Mediums	4.3	3.5	-	-	3.8	4.6	12.1	-	-	4.9	8.3	3.5	-	-	3.8	4.1
Articulated Trucks	176	150	0	-	326	135	22	0	-	157	15	214	0	-	229	712
% Articulated Trucks	8.0	3.6	-	-	5.1	3.8	15.6	-	-	4.3	8.3	7.6	-	-	7.6	5.5
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (North)
Site Code:
Start Date: 06/05/2018



Turning Movement Data Plot

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (North)
Site Code:
Start Date: 06/05/2018

Turning Movement Peak Hour Data (7:30 AM)

Start Time	Wellington Road 124 Eastbound					Wellington Road 124 Westbound					Wellington Road 32 (North) Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
7:30 AM	121	187	0	0	308	121	6	0	0	127	6	125	0	0	131	566
7:45 AM	88	171	0	0	259	121	4	0	0	125	3	99	0	0	102	486
8:00 AM	93	186	0	0	279	98	5	0	0	103	8	90	0	0	98	480
8:15 AM	109	188	0	0	297	92	2	0	0	94	5	75	0	0	80	471
Total	411	732	0	0	1143	432	17	0	0	449	22	389	0	0	411	2003
Approach %	36.0	64.0	0.0	-	-	96.2	3.8	0.0	-	-	5.4	94.6	0.0	-	-	-
Total %	20.5	36.5	0.0	-	57.1	21.6	0.8	0.0	-	22.4	1.1	19.4	0.0	-	20.5	-
PHF	0.849	0.973	0.000	-	0.928	0.893	0.708	0.000	-	0.884	0.688	0.778	0.000	-	0.784	0.885
Lights	370	690	0	-	1060	390	10	0	-	400	18	337	0	-	355	1815
% Lights	90.0	94.3	-	-	92.7	90.3	58.8	-	-	89.1	81.8	86.6	-	-	86.4	90.6
Mediums	17	25	0	-	42	21	3	0	-	24	3	16	0	-	19	85
% Mediums	4.1	3.4	-	-	3.7	4.9	17.6	-	-	5.3	13.6	4.1	-	-	4.6	4.2
Articulated Trucks	24	17	0	-	41	21	4	0	-	25	1	36	0	-	37	103
% Articulated Trucks	5.8	2.3	-	-	3.6	4.9	23.5	-	-	5.6	4.5	9.3	-	-	9.0	5.1
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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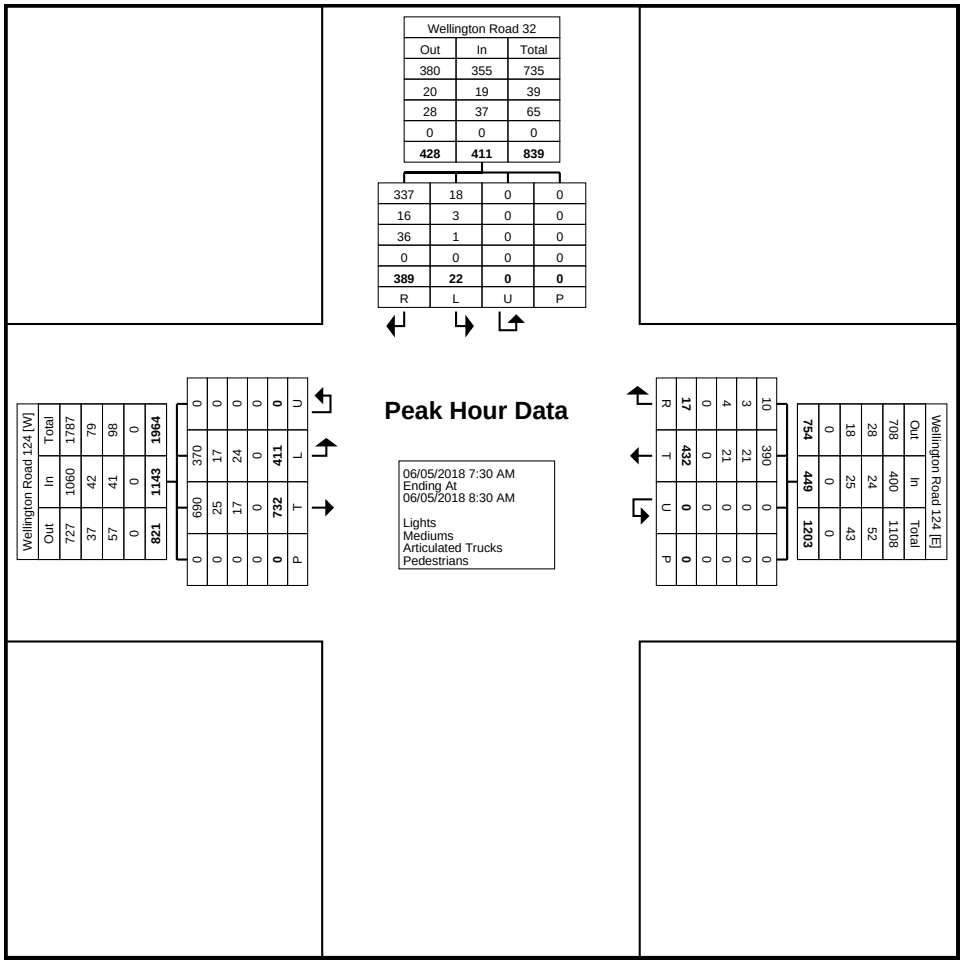
Count Name: Wellington Road 124 & Wellington Road 32 (North)
Site Code:
Start Date: 06/05/2018



Turning Movement Peak Hour Data Plot (7:30 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (North)
Site Code:
Start Date: 06/05/2018

Turning Movement Peak Hour Data (11:45 AM)

Start Time	Wellington Road 124 Eastbound					Wellington Road 124 Westbound					Wellington Road 32 (North) Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
11:45 AM	67	108	0	0	175	96	5	0	0	101	11	70	0	0	81	357
12:00 PM	57	97	0	0	154	98	8	0	0	106	7	52	0	0	59	319
12:15 PM	61	88	0	0	149	101	1	0	0	102	7	53	0	0	60	311
12:30 PM	52	121	0	0	173	110	3	0	0	113	8	61	0	0	69	355
Total	237	414	0	0	651	405	17	0	0	422	33	236	0	0	269	1342
Approach %	36.4	63.6	0.0	-	-	96.0	4.0	0.0	-	-	12.3	87.7	0.0	-	-	-
Total %	17.7	30.8	0.0	-	48.5	30.2	1.3	0.0	-	31.4	2.5	17.6	0.0	-	20.0	-
PHF	0.884	0.855	0.000	-	0.930	0.920	0.531	0.000	-	0.934	0.750	0.843	0.000	-	0.830	0.940
Lights	194	373	0	-	567	355	11	0	-	366	27	191	0	-	218	1151
% Lights	81.9	90.1	-	-	87.1	87.7	64.7	-	-	86.7	81.8	80.9	-	-	81.0	85.8
Mediums	18	22	0	-	40	28	2	0	-	30	2	18	0	-	20	90
% Mediums	7.6	5.3	-	-	6.1	6.9	11.8	-	-	7.1	6.1	7.6	-	-	7.4	6.7
Articulated Trucks	25	19	0	-	44	22	4	0	-	26	4	27	0	-	31	101
% Articulated Trucks	10.5	4.6	-	-	6.8	5.4	23.5	-	-	6.2	12.1	11.4	-	-	11.5	7.5
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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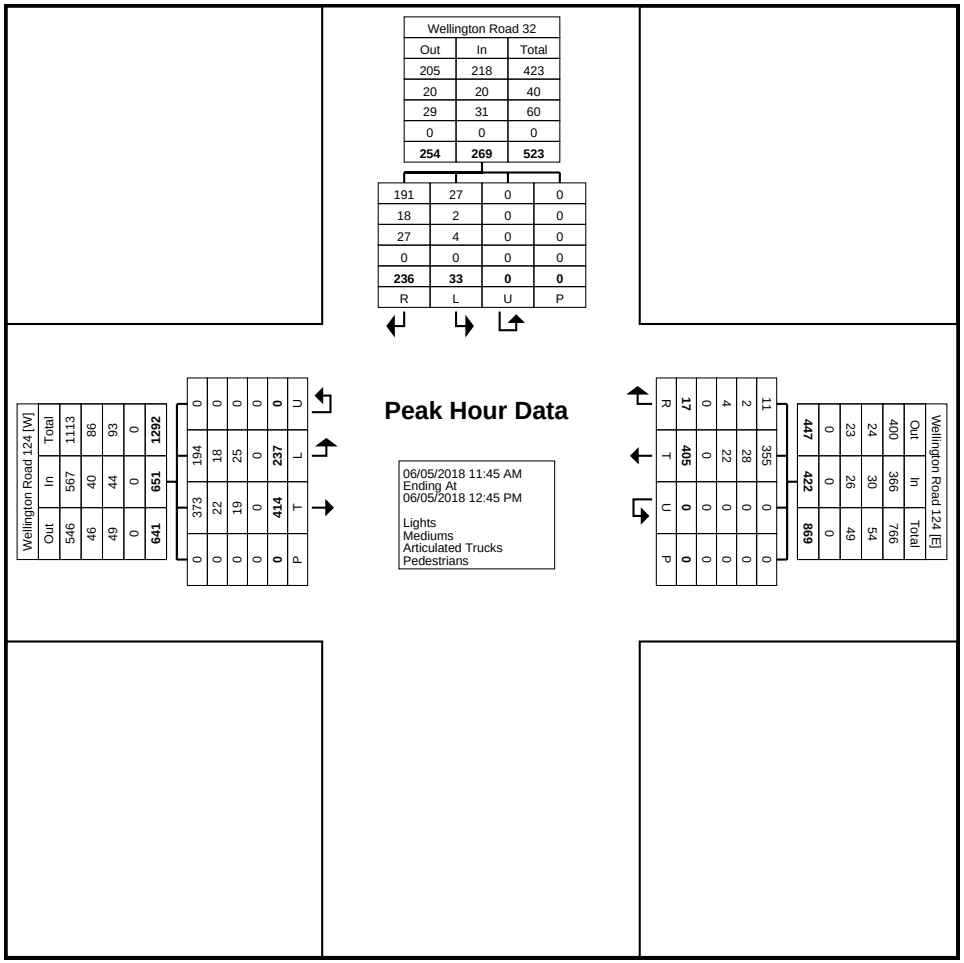

Turning Movement Peak Hour Data Plot (11:45 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (North)
Site Code:
Start Date: 06/05/2018

Turning Movement Peak Hour Data (4:30 PM)

Start Time	Wellington Road 124 Eastbound					Wellington Road 124 Westbound					Wellington Road 32 (North) Southbound					
	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Left	Right	U-Turn	Peds	App. Total	Int. Total
4:30 PM	90	168	0	0	258	132	4	0	0	136	8	149	0	0	157	551
4:45 PM	99	158	0	0	257	134	14	0	0	148	7	122	0	0	129	534
5:00 PM	91	162	0	0	253	127	8	0	0	135	13	145	0	0	158	546
5:15 PM	85	180	0	0	265	117	5	0	0	122	4	169	0	0	173	560
Total	365	668	0	0	1033	510	31	0	0	541	32	585	0	0	617	2191
Approach %	35.3	64.7	0.0	-	-	94.3	5.7	0.0	-	-	5.2	94.8	0.0	-	-	-
Total %	16.7	30.5	0.0	-	47.1	23.3	1.4	0.0	-	24.7	1.5	26.7	0.0	-	28.2	-
PHF	0.922	0.928	0.000	-	0.975	0.951	0.554	0.000	-	0.914	0.615	0.865	0.000	-	0.892	0.978
Lights	322	643	0	-	965	492	25	0	-	517	24	549	0	-	573	2055
% Lights	88.2	96.3	-	-	93.4	96.5	80.6	-	-	95.6	75.0	93.8	-	-	92.9	93.8
Mediums	14	14	0	-	28	11	3	0	-	14	5	13	0	-	18	60
% Mediums	3.8	2.1	-	-	2.7	2.2	9.7	-	-	2.6	15.6	2.2	-	-	2.9	2.7
Articulated Trucks	29	11	0	-	40	7	3	0	-	10	3	23	0	-	26	76
% Articulated Trucks	7.9	1.6	-	-	3.9	1.4	9.7	-	-	1.8	9.4	3.9	-	-	4.2	3.5
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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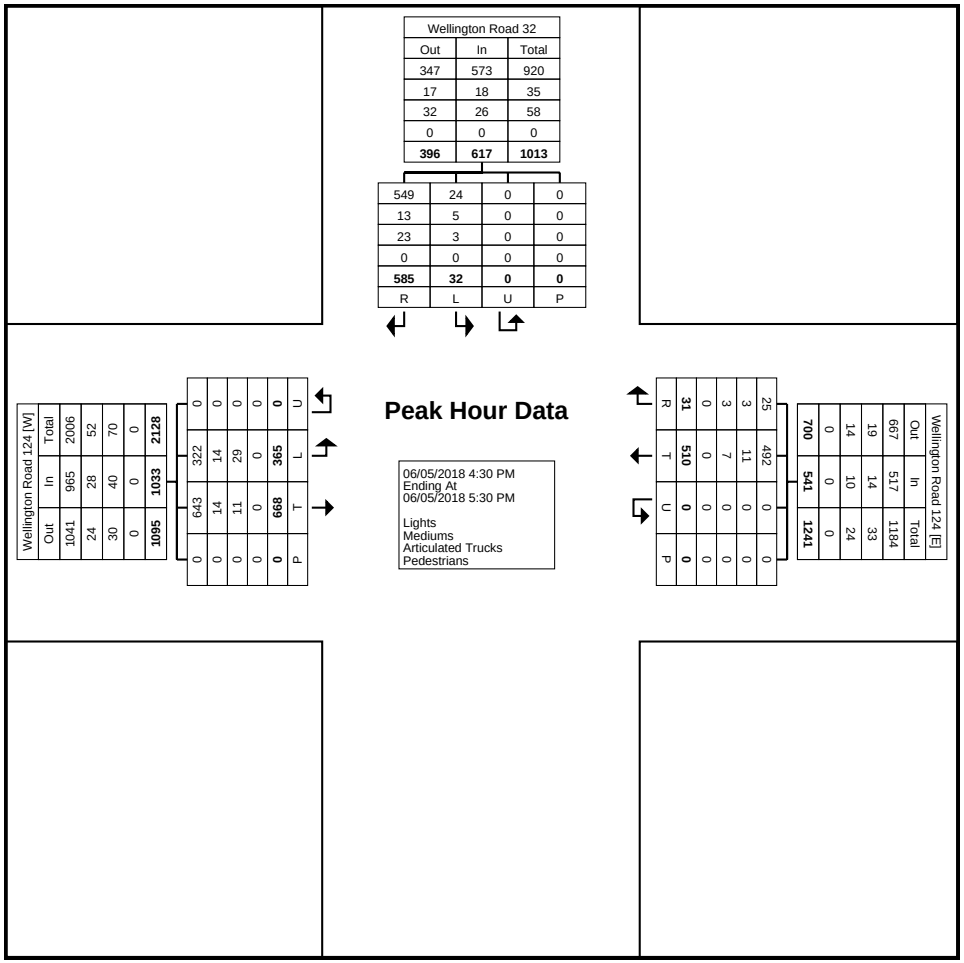
Site Code:
Start Date: 06/05/2018



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

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Wellington Road 32 (North)
Site Code:
Start Date: 06/05/2018

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Whitelaw Road
Site Code:
Start Date: 06/05/2018

Turning Movement Data

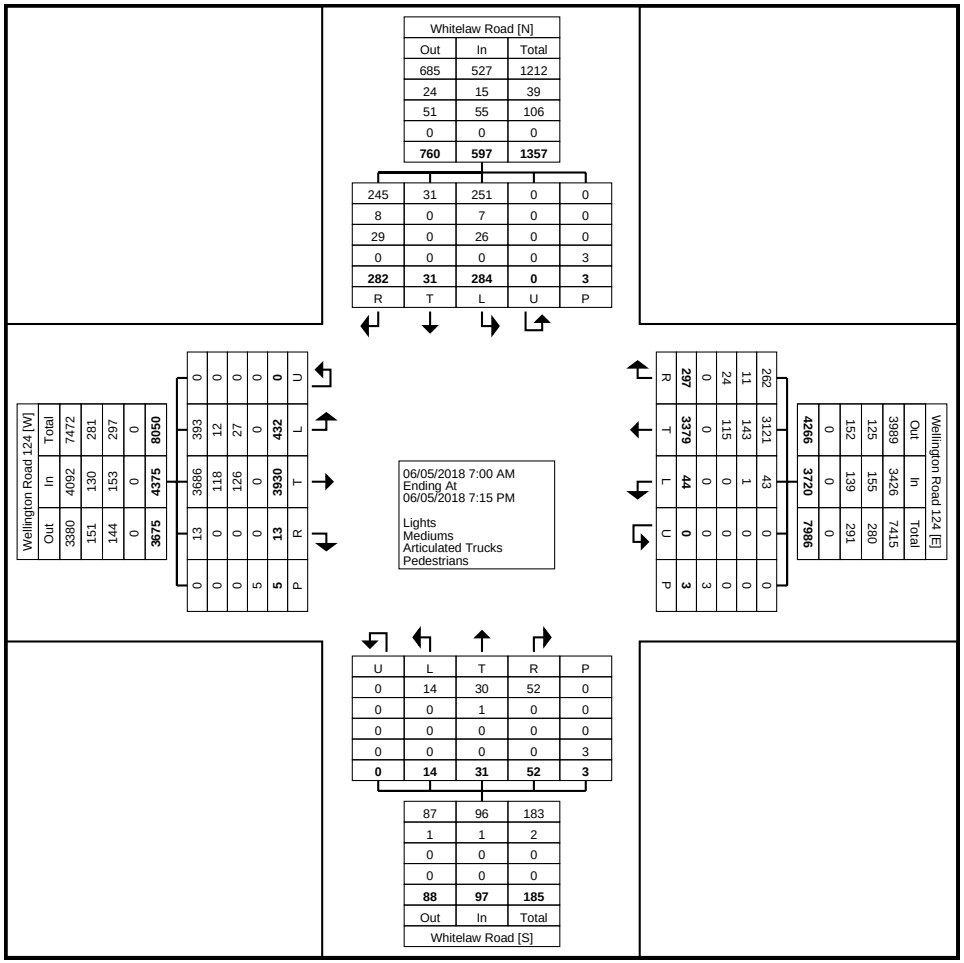
Start Time	Wellington Road 124 Eastbound						Wellington Road 124 Westbound						Whitelaw Road Northbound						Whitelaw Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:00 AM	16	94	2	0	0	112	1	123	12	0	0	136	0	0	0	0	0	0	1	0	8	0	0	9	257
7:15 AM	9	130	0	0	0	139	0	160	11	0	0	171	1	0	1	0	0	2	1	1	11	0	0	13	325
7:30 AM	14	155	0	0	0	169	1	152	18	0	0	171	2	0	0	0	0	2	6	0	6	0	0	12	354
7:45 AM	18	156	2	0	0	176	0	77	20	0	0	97	0	1	1	0	0	2	8	1	4	0	0	13	288
Hourly Total	57	535	4	0	0	596	2	512	61	0	0	575	3	1	2	0	0	6	16	2	29	0	0	47	1224
8:00 AM	7	155	0	0	0	162	2	98	14	0	0	114	0	4	0	0	0	4	7	1	4	0	0	12	292
8:15 AM	13	196	1	0	0	210	1	98	8	0	0	107	1	1	2	0	0	4	4	2	13	0	0	19	340
8:30 AM	10	168	1	0	0	179	0	123	11	0	0	134	1	3	6	0	0	10	3	1	6	0	0	10	333
8:45 AM	15	119	0	0	0	134	2	110	22	0	0	134	0	2	2	0	0	4	11	1	5	0	0	17	289
Hourly Total	45	638	2	0	0	685	5	429	55	0	0	489	2	10	10	0	0	22	25	5	28	0	0	58	1254
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00 AM	9	66	1	0	0	76	3	85	5	0	0	93	0	2	4	0	0	6	3	2	10	0	0	15	190
11:15 AM	11	85	0	0	0	96	2	83	11	0	0	96	0	2	0	0	0	2	6	0	7	0	0	13	207
11:30 AM	11	83	1	0	0	95	3	109	10	0	0	122	0	1	3	0	0	4	6	4	4	0	0	14	235
11:45 AM	15	90	0	0	0	105	1	89	4	0	0	94	0	2	4	0	0	6	14	0	14	0	0	28	233
Hourly Total	46	324	2	0	0	372	9	366	30	0	0	405	0	7	11	0	0	18	29	6	35	0	0	70	865
12:00 PM	17	103	0	0	3	120	0	101	9	0	0	110	0	2	0	0	3	2	11	0	8	0	0	19	251
12:15 PM	6	98	1	0	0	105	1	98	11	0	0	110	0	0	1	0	0	1	11	1	3	0	0	15	231
12:30 PM	13	95	0	0	2	108	2	108	12	0	0	122	1	0	2	0	0	3	14	2	8	0	0	24	257
12:45 PM	9	86	0	0	0	95	3	94	23	0	0	120	0	1	2	0	0	3	7	1	13	0	0	21	239
Hourly Total	45	382	1	0	5	428	6	401	55	0	0	462	1	3	5	0	3	9	43	4	32	0	0	79	978
1:00 PM	22	95	0	0	0	117	0	88	16	0	0	104	0	0	1	0	0	1	9	1	7	0	0	17	239
1:15 PM	11	82	0	0	0	93	1	83	12	0	0	96	2	1	3	0	0	6	12	1	12	0	0	25	220
1:30 PM	12	100	0	0	0	112	0	112	6	0	3	118	0	2	2	0	0	4	5	2	11	0	3	18	252
1:45 PM	4	102	0	0	0	106	1	91	5	0	0	97	1	0	2	0	0	3	7	1	9	0	0	17	223
Hourly Total	49	379	0	0	0	428	2	374	39	0	3	415	3	3	8	0	0	14	33	5	39	0	3	77	934
2:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:00 PM	14	125	0	0	0	139	2	125	6	0	0	133	0	0	1	0	0	1	28	1	11	0	0	40	313
4:15 PM	27	146	0	0	0	173	1	148	8	0	0	157	1	2	2	0	0	5	6	0	10	0	0	16	351
4:30 PM	26	140	1	0	0	167	1	133	5	0	0	139	0	1	0	0	0	1	16	1	8	0	0	25	332
4:45 PM	15	169	0	0	0	184	0	88	5	0	0	93	0	1	1	0	0	2	10	1	10	0	0	21	300
Hourly Total	82	580	1	0	0	663	4	494	24	0	0	522	1	4	4	0	0	9	60	3	39	0	0	102	1296
5:00 PM	21	159	0	0	0	180	0	103	10	0	0	113	2	1	2	0	0	5	32	4	17	0	0	53	351

5:15 PM	23	163	0	0	0	186	0	111	4	0	0	115	0	1	1	0	0	2	10	0	10	0	0	20	323
5:30 PM	17	153	0	0	0	170	2	102	5	0	0	109	0	0	1	0	0	1	7	0	7	0	0	14	294
5:45 PM	9	148	2	0	0	159	1	99	5	0	0	105	0	1	1	0	0	2	8	1	15	0	0	24	290
Hourly Total	70	623	2	0	0	695	3	415	24	0	0	442	2	3	5	0	0	10	57	5	49	0	0	111	1258
6:00 PM	12	139	1	0	0	152	3	111	1	0	0	115	1	0	1	0	0	2	4	0	10	0	0	14	283
6:15 PM	5	130	0	0	0	135	1	99	3	0	0	103	1	0	3	0	0	4	8	0	8	0	0	16	258
6:30 PM	12	100	0	0	0	112	5	92	3	0	0	100	0	0	1	0	0	1	7	1	4	0	0	12	225
6:45 PM	9	100	0	0	0	109	4	86	2	0	0	92	0	0	2	0	0	2	2	0	9	0	0	11	214
Hourly Total	38	469	1	0	0	508	13	388	9	0	0	410	2	0	7	0	0	9	21	1	31	0	0	53	980
7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	432	3930	13	0	5	4375	44	3379	297	0	3	3720	14	31	52	0	3	97	284	31	282	0	3	597	8789
Approach %	9.9	89.8	0.3	0.0	-	-	1.2	90.8	8.0	0.0	-	-	14.4	32.0	53.6	0.0	-	-	47.6	5.2	47.2	0.0	-	-	-
Total %	4.9	44.7	0.1	0.0	-	49.8	0.5	38.4	3.4	0.0	-	42.3	0.2	0.4	0.6	0.0	-	1.1	3.2	0.4	3.2	0.0	-	6.8	-
Lights	393	3686	13	0	-	4092	43	3121	262	0	-	3426	14	30	52	0	-	96	251	31	245	0	-	527	8141
% Lights	91.0	93.8	100.0	-	-	93.5	97.7	92.4	88.2	-	-	92.1	100.0	96.8	100.0	-	-	99.0	88.4	100.0	86.9	-	-	88.3	92.6
Mediums	12	118	0	0	-	130	1	143	11	0	-	155	0	1	0	0	-	1	7	0	8	0	-	15	301
% Mediums	2.8	3.0	0.0	-	-	3.0	2.3	4.2	3.7	-	-	4.2	0.0	3.2	0.0	-	-	1.0	2.5	0.0	2.8	-	-	2.5	3.4
Articulated Trucks	27	126	0	0	-	153	0	115	24	0	-	139	0	0	0	0	-	0	26	0	29	0	-	55	347
% Articulated Trucks	6.3	3.2	0.0	-	-	3.5	0.0	3.4	8.1	-	-	3.7	0.0	0.0	0.0	-	-	0.0	9.2	0.0	10.3	-	-	9.2	3.9
Pedestrians	-	-	-	-	5	-	-	-	-	-	3	-	-	-	-	-	3	-	-	-	-	-	3	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-	-	-	-	100.0	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Whitelaw Road
Site Code:
Start Date: 06/05/2018



Turning Movement Data Plot

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Whitelaw Road
Site Code:
Start Date: 06/05/2018

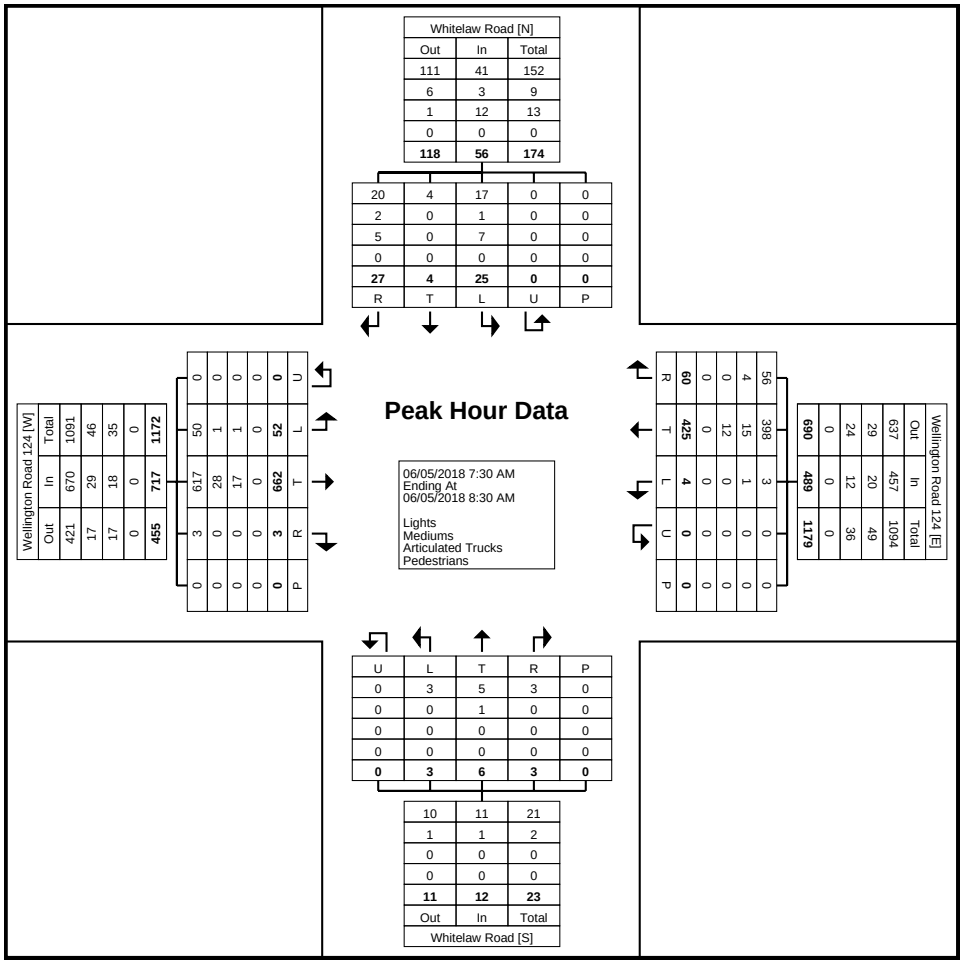
Turning Movement Peak Hour Data (7:30 AM)

Start Time	Wellington Road 124 Eastbound						Wellington Road 124 Westbound						Whitelaw Road Northbound						Whitelaw Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
7:30 AM	14	155	0	0	0	169	1	152	18	0	0	171	2	0	0	0	0	2	6	0	6	0	0	12	354
7:45 AM	18	156	2	0	0	176	0	77	20	0	0	97	0	1	1	0	0	2	8	1	4	0	0	13	288
8:00 AM	7	155	0	0	0	162	2	98	14	0	0	114	0	4	0	0	0	4	7	1	4	0	0	12	292
8:15 AM	13	196	1	0	0	210	1	98	8	0	0	107	1	1	2	0	0	4	4	2	13	0	0	19	340
Total	52	662	3	0	0	717	4	425	60	0	0	489	3	6	3	0	0	12	25	4	27	0	0	56	1274
Approach %	7.3	92.3	0.4	0.0	-	-	0.8	86.9	12.3	0.0	-	-	25.0	50.0	25.0	0.0	-	-	44.6	7.1	48.2	0.0	-	-	-
Total %	4.1	52.0	0.2	0.0	-	56.3	0.3	33.4	4.7	0.0	-	38.4	0.2	0.5	0.2	0.0	-	0.9	2.0	0.3	2.1	0.0	-	4.4	-
PHF	0.722	0.844	0.375	0.000	-	0.854	0.500	0.699	0.750	0.000	-	0.715	0.375	0.375	0.375	0.000	-	0.750	0.781	0.500	0.519	0.000	-	0.737	0.900
Lights	50	617	3	0	-	670	3	398	56	0	-	457	3	5	3	0	-	11	17	4	20	0	-	41	1179
% Lights	96.2	93.2	100.0	-	-	93.4	75.0	93.6	93.3	-	-	93.5	100.0	83.3	100.0	-	-	91.7	68.0	100.0	74.1	-	-	73.2	92.5
Mediums	1	28	0	0	-	29	1	15	4	0	-	20	0	1	0	0	-	1	1	0	2	0	-	3	53
% Mediums	1.9	4.2	0.0	-	-	4.0	25.0	3.5	6.7	-	-	4.1	0.0	16.7	0.0	-	-	8.3	4.0	0.0	7.4	-	-	5.4	4.2
Articulated Trucks	1	17	0	0	-	18	0	12	0	0	-	12	0	0	0	0	-	0	7	0	5	0	-	12	42
% Articulated Trucks	1.9	2.6	0.0	-	-	2.5	0.0	2.8	0.0	-	-	2.5	0.0	0.0	0.0	-	-	0.0	28.0	0.0	18.5	-	-	21.4	3.3
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Whitelaw Road
Site Code:
Start Date: 06/05/2018



Turning Movement Peak Hour Data Plot (7:30 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Whitelaw Road
Site Code:
Start Date: 06/05/2018

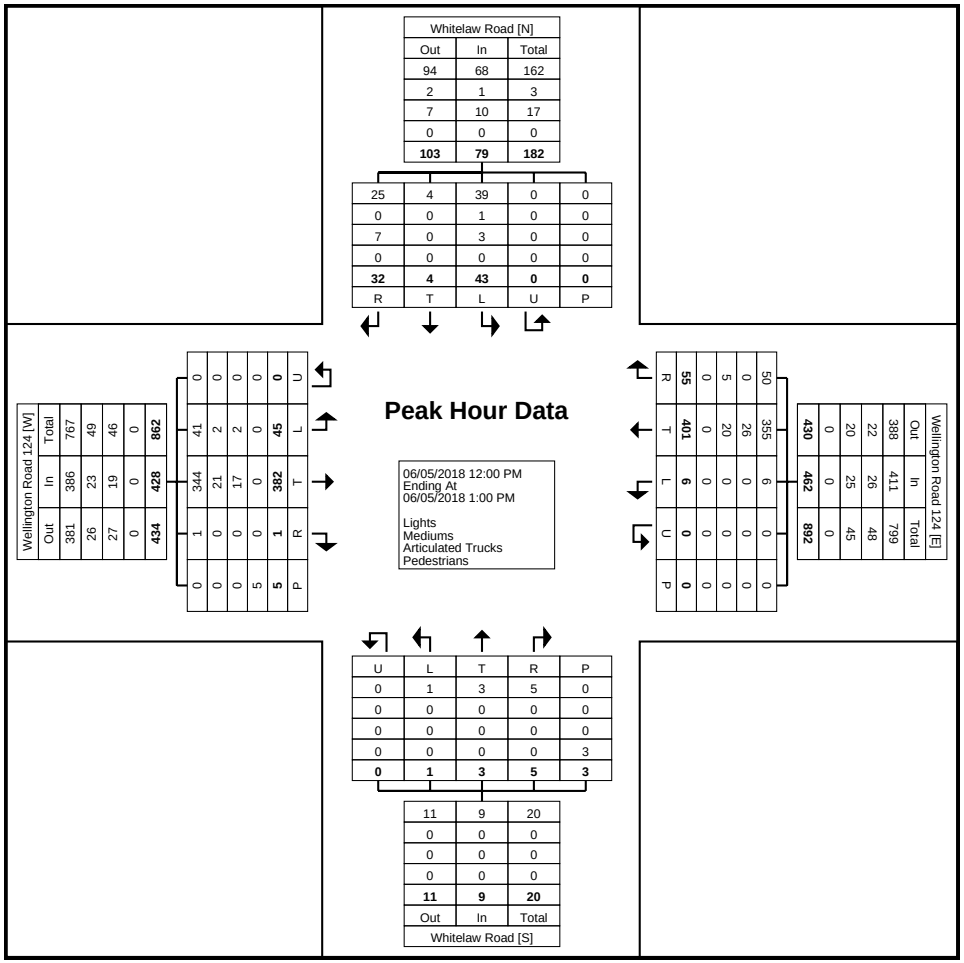
Turning Movement Peak Hour Data (12:00 PM)

Start Time	Wellington Road 124 Eastbound						Wellington Road 124 Westbound						Whitelaw Road Northbound						Whitelaw Road Southbound						Int. Total
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	
12:00 PM	17	103	0	0	3	120	0	101	9	0	0	110	0	2	0	0	3	2	11	0	8	0	0	19	251
12:15 PM	6	98	1	0	0	105	1	98	11	0	0	110	0	0	1	0	0	1	11	1	3	0	0	15	231
12:30 PM	13	95	0	0	2	108	2	108	12	0	0	122	1	0	2	0	0	3	14	2	8	0	0	24	257
12:45 PM	9	86	0	0	0	95	3	94	23	0	0	120	0	1	2	0	0	3	7	1	13	0	0	21	239
Total	45	382	1	0	5	428	6	401	55	0	0	462	1	3	5	0	3	9	43	4	32	0	0	79	978
Approach %	10.5	89.3	0.2	0.0	-	-	1.3	86.8	11.9	0.0	-	-	11.1	33.3	55.6	0.0	-	-	54.4	5.1	40.5	0.0	-	-	-
Total %	4.6	39.1	0.1	0.0	-	43.8	0.6	41.0	5.6	0.0	-	47.2	0.1	0.3	0.5	0.0	-	0.9	4.4	0.4	3.3	0.0	-	8.1	-
PHF	0.662	0.927	0.250	0.000	-	0.892	0.500	0.928	0.598	0.000	-	0.947	0.250	0.375	0.625	0.000	-	0.750	0.768	0.500	0.615	0.000	-	0.823	0.951
Lights	41	344	1	0	-	386	6	355	50	0	-	411	1	3	5	0	-	9	39	4	25	0	-	68	874
% Lights	91.1	90.1	100.0	-	-	90.2	100.0	88.5	90.9	-	-	89.0	100.0	100.0	100.0	-	-	100.0	90.7	100.0	78.1	-	-	86.1	89.4
Mediums	2	21	0	0	-	23	0	26	0	0	-	26	0	0	0	0	-	0	1	0	0	0	-	1	50
% Mediums	4.4	5.5	0.0	-	-	5.4	0.0	6.5	0.0	-	-	5.6	0.0	0.0	0.0	-	-	0.0	2.3	0.0	0.0	-	-	1.3	5.1
Articulated Trucks	2	17	0	0	-	19	0	20	5	0	-	25	0	0	0	0	-	0	3	0	7	0	-	10	54
% Articulated Trucks	4.4	4.5	0.0	-	-	4.4	0.0	5.0	9.1	-	-	5.4	0.0	0.0	0.0	-	-	0.0	7.0	0.0	21.9	-	-	12.7	5.5
Pedestrians	-	-	-	-	5	-	-	-	-	-	0	-	-	-	-	-	3	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	100.0	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Whitelaw Road
Site Code:
Start Date: 06/05/2018



Turning Movement Peak Hour Data Plot (12:00 PM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Road 124 & Whitelaw Road
Site Code:
Start Date: 06/05/2018

Turning Movement Peak Hour Data (4:15 PM)

Start Time	Wellington Road 124 Eastbound						Wellington Road 124 Westbound						Whitelaw Road Northbound						Whitelaw Road Southbound						
	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Left	Thru	Right	U-Turn	Peds	App. Total	Int. Total
4:15 PM	27	146	0	0	0	173	1	148	8	0	0	157	1	2	2	0	0	5	6	0	10	0	0	16	351
4:30 PM	26	140	1	0	0	167	1	133	5	0	0	139	0	1	0	0	0	1	16	1	8	0	0	25	332
4:45 PM	15	169	0	0	0	184	0	88	5	0	0	93	0	1	1	0	0	2	10	1	10	0	0	21	300
5:00 PM	21	159	0	0	0	180	0	103	10	0	0	113	2	1	2	0	0	5	32	4	17	0	0	53	351
Total	89	614	1	0	0	704	2	472	28	0	0	502	3	5	5	0	0	13	64	6	45	0	0	115	1334
Approach %	12.6	87.2	0.1	0.0	-	-	0.4	94.0	5.6	0.0	-	-	23.1	38.5	38.5	0.0	-	-	55.7	5.2	39.1	0.0	-	-	-
Total %	6.7	46.0	0.1	0.0	-	52.8	0.1	35.4	2.1	0.0	-	37.6	0.2	0.4	0.4	0.0	-	1.0	4.8	0.4	3.4	0.0	-	8.6	-
PHF	0.824	0.908	0.250	0.000	-	0.957	0.500	0.797	0.700	0.000	-	0.799	0.375	0.625	0.625	0.000	-	0.650	0.500	0.375	0.662	0.000	-	0.542	0.950
Lights	84	598	1	0	-	683	2	448	26	0	-	476	3	5	5	0	-	13	61	6	42	0	-	109	1281
% Lights	94.4	97.4	100.0	-	-	97.0	100.0	94.9	92.9	-	-	94.8	100.0	100.0	100.0	-	-	100.0	95.3	100.0	93.3	-	-	94.8	96.0
Mediums	0	3	0	0	-	3	0	9	0	0	-	9	0	0	0	0	-	0	0	0	0	0	-	0	12
% Mediums	0.0	0.5	0.0	-	-	0.4	0.0	1.9	0.0	-	-	1.8	0.0	0.0	0.0	-	-	0.0	0.0	0.0	0.0	-	-	0.0	0.9
Articulated Trucks	5	13	0	0	-	18	0	15	2	0	-	17	0	0	0	0	-	0	3	0	3	0	-	6	41
% Articulated Trucks	5.6	2.1	0.0	-	-	2.6	0.0	3.2	7.1	-	-	3.4	0.0	0.0	0.0	-	-	0.0	4.7	0.0	6.7	-	-	5.2	3.1
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Paradigm Transportation Solutions Limited
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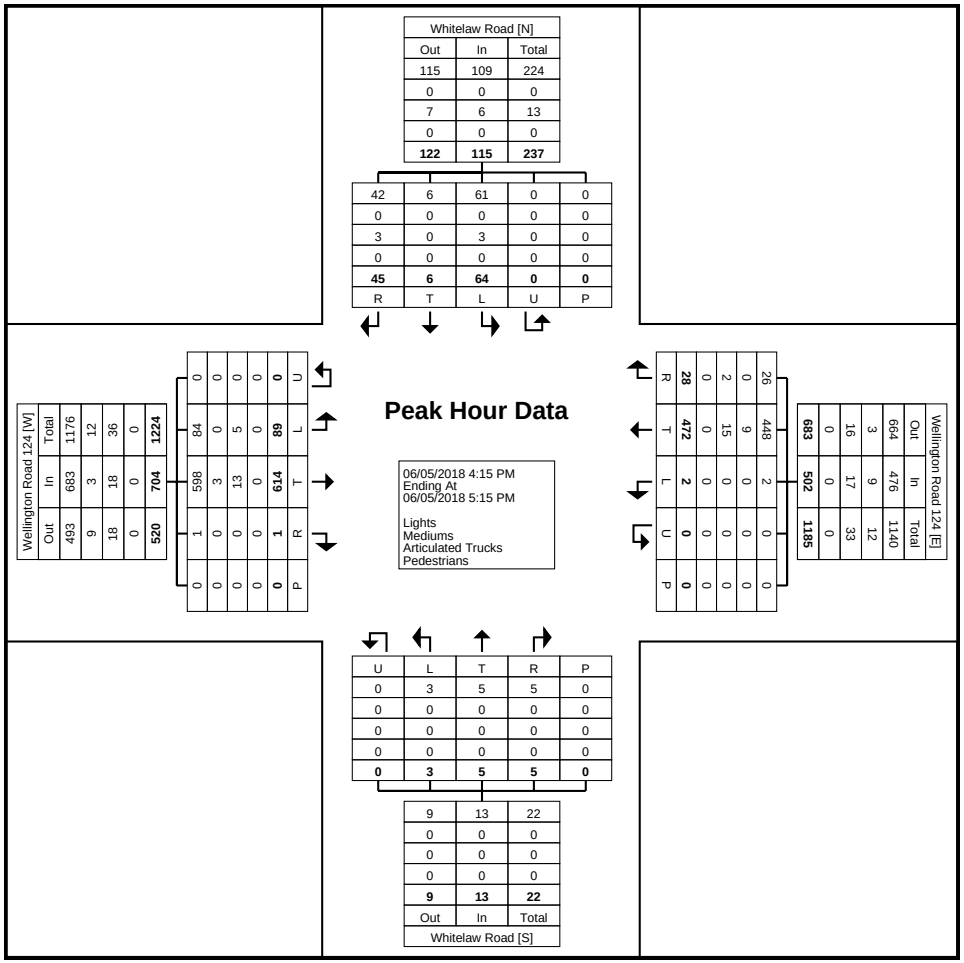
Count Name: Wellington Road 124 & Whitelaw Road
Site Code:
Start Date: 06/05/2018



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

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Start Date: 06/05/2018

Paradigm Transportation Solutions Limited
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Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Street & Fife Road
Site Code:
Start Date: 06/05/2018

Turning Movement Data

Start Time	Fife Road Eastbound					Wellington Street Northbound					Wellington Street Southbound					
	Left	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Int. Total
7:00 AM	37	4	0	3	41	0	86	0	0	86	129	27	0	0	156	283
7:15 AM	41	0	0	1	41	0	117	0	0	117	184	48	0	0	232	390
7:30 AM	42	1	0	2	43	0	152	0	0	152	150	76	0	0	226	421
7:45 AM	63	3	0	0	66	0	163	0	0	163	105	77	0	0	182	411
Hourly Total	183	8	0	6	191	0	518	0	0	518	568	228	0	0	796	1505
8:00 AM	71	2	0	0	73	0	158	0	0	158	98	55	0	0	153	384
8:15 AM	94	3	0	0	97	2	195	0	0	197	118	53	0	0	171	465
8:30 AM	89	1	0	0	90	1	176	0	0	177	129	53	0	0	182	449
8:45 AM	70	0	0	1	70	2	126	0	0	128	116	37	0	0	153	351
Hourly Total	324	6	0	1	330	5	655	0	0	660	461	198	0	0	659	1649
9:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00 AM	28	2	0	0	30	0	75	0	0	75	102	29	0	0	131	236
11:15 AM	31	1	0	0	32	0	93	0	0	93	95	31	0	0	126	251
11:30 AM	41	2	0	0	43	0	89	0	0	89	115	36	0	0	151	283
11:45 AM	41	1	0	0	42	0	109	0	0	109	93	39	0	0	132	283
Hourly Total	141	6	0	0	147	0	366	0	0	366	405	135	0	0	540	1053
12:00 PM	37	0	0	0	37	0	115	0	0	115	109	39	0	0	148	300
12:15 PM	38	1	0	0	39	3	110	0	0	113	109	23	0	0	132	284
12:30 PM	33	2	0	0	35	3	113	0	0	116	116	25	0	0	141	292
12:45 PM	27	2	0	0	29	0	95	0	0	95	126	34	0	0	160	284
Hourly Total	135	5	0	0	140	6	433	0	0	439	460	121	0	0	581	1160
1:00 PM	21	2	0	1	23	1	109	0	0	110	106	24	0	0	130	263
1:15 PM	36	0	0	0	36	0	95	0	0	95	100	24	0	0	124	255
1:30 PM	29	3	0	0	32	1	105	0	0	106	108	33	0	0	141	279
1:45 PM	35	3	0	0	38	1	108	0	0	109	90	34	0	0	124	271
Hourly Total	121	8	0	1	129	3	417	0	0	420	404	115	0	0	519	1068
2:00 PM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
*** BREAK ***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hourly Total	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
4:00 PM	49	0	0	1	49	1	151	0	0	152	135	82	0	0	217	418
4:15 PM	50	7	0	1	57	1	152	0	0	153	152	126	0	0	278	488
4:30 PM	61	2	0	2	63	2	146	0	0	148	129	117	0	0	246	457
4:45 PM	74	2	0	0	76	6	170	0	0	176	92	106	0	0	198	450
Hourly Total	234	11	0	4	245	10	619	0	0	629	508	431	0	0	939	1813
5:00 PM	79	0	0	1	79	1	187	0	0	188	118	98	0	0	216	483
5:15 PM	73	1	0	1	74	1	178	0	0	179	132	71	0	0	203	456

5:30 PM	82	2	0	2	84	1	152	0	0	153	104	80	0	0	184	421
5:45 PM	58	1	0	1	59	0	154	0	0	154	105	61	0	0	166	379
Hourly Total	292	4	0	5	296	3	671	0	0	674	459	310	0	0	769	1739
6:00 PM	50	1	0	0	51	0	141	0	0	141	122	51	0	0	173	365
6:15 PM	42	0	0	0	42	4	142	0	0	146	106	45	0	0	151	339
6:30 PM	41	3	0	0	44	1	105	0	0	106	90	32	0	0	122	272
6:45 PM	23	1	0	0	24	3	106	0	0	109	87	36	0	0	123	256
Hourly Total	156	5	0	0	161	8	494	0	0	502	405	164	0	0	569	1232
7:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	1586	53	0	17	1639	35	4174	0	0	4209	3670	1702	0	0	5372	11220
Approach %	96.8	3.2	0.0	-	-	0.8	99.2	0.0	-	-	68.3	31.7	0.0	-	-	-
Total %	14.1	0.5	0.0	-	14.6	0.3	37.2	0.0	-	37.5	32.7	15.2	0.0	-	47.9	-
Lights	1545	47	0	-	1592	34	3901	0	-	3935	3383	1646	0	-	5029	10556
% Lights	97.4	88.7	-	-	97.1	97.1	93.5	-	-	93.5	92.2	96.7	-	-	93.6	94.1
Mediums	41	6	0	-	47	1	123	0	-	124	145	55	0	-	200	371
% Mediums	2.6	11.3	-	-	2.9	2.9	2.9	-	-	2.9	4.0	3.2	-	-	3.7	3.3
Articulated Trucks	0	0	0	-	0	0	150	0	-	150	142	1	0	-	143	293
% Articulated Trucks	0.0	0.0	-	-	0.0	0.0	3.6	-	-	3.6	3.9	0.1	-	-	2.7	2.6
Pedestrians	-	-	-	17	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	-

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Count Name: Wellington Street & Fife Road
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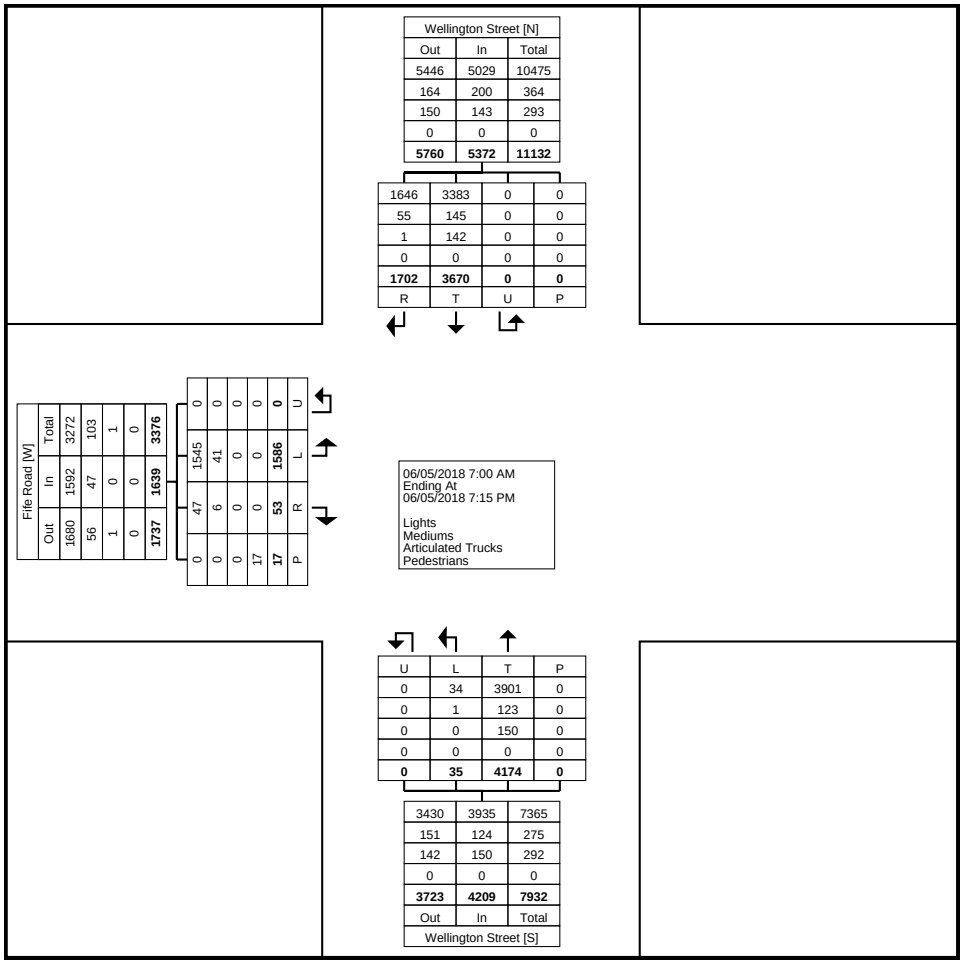

Turning Movement Data Plot

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Street & Fife Road
Site Code:
Start Date: 06/05/2018

Turning Movement Peak Hour Data (7:45 AM)

Start Time	Fife Road Eastbound					Wellington Street Northbound					Wellington Street Southbound					
	Left	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Int. Total
7:45 AM	63	3	0	0	66	0	163	0	0	163	105	77	0	0	182	411
8:00 AM	71	2	0	0	73	0	158	0	0	158	98	55	0	0	153	384
8:15 AM	94	3	0	0	97	2	195	0	0	197	118	53	0	0	171	465
8:30 AM	89	1	0	0	90	1	176	0	0	177	129	53	0	0	182	449
Total	317	9	0	0	326	3	692	0	0	695	450	238	0	0	688	1709
Approach %	97.2	2.8	0.0	-	-	0.4	99.6	0.0	-	-	65.4	34.6	0.0	-	-	-
Total %	18.5	0.5	0.0	-	19.1	0.2	40.5	0.0	-	40.7	26.3	13.9	0.0	-	40.3	-
PHF	0.843	0.750	0.000	-	0.840	0.375	0.887	0.000	-	0.882	0.872	0.773	0.000	-	0.945	0.919
Lights	310	6	0	-	316	3	646	0	-	649	421	229	0	-	650	1615
% Lights	97.8	66.7	-	-	96.9	100.0	93.4	-	-	93.4	93.6	96.2	-	-	94.5	94.5
Mediums	7	3	0	-	10	0	28	0	-	28	12	8	0	-	20	58
% Mediums	2.2	33.3	-	-	3.1	0.0	4.0	-	-	4.0	2.7	3.4	-	-	2.9	3.4
Articulated Trucks	0	0	0	-	0	0	18	0	-	18	17	1	0	-	18	36
% Articulated Trucks	0.0	0.0	-	-	0.0	0.0	2.6	-	-	2.6	3.8	0.4	-	-	2.6	2.1
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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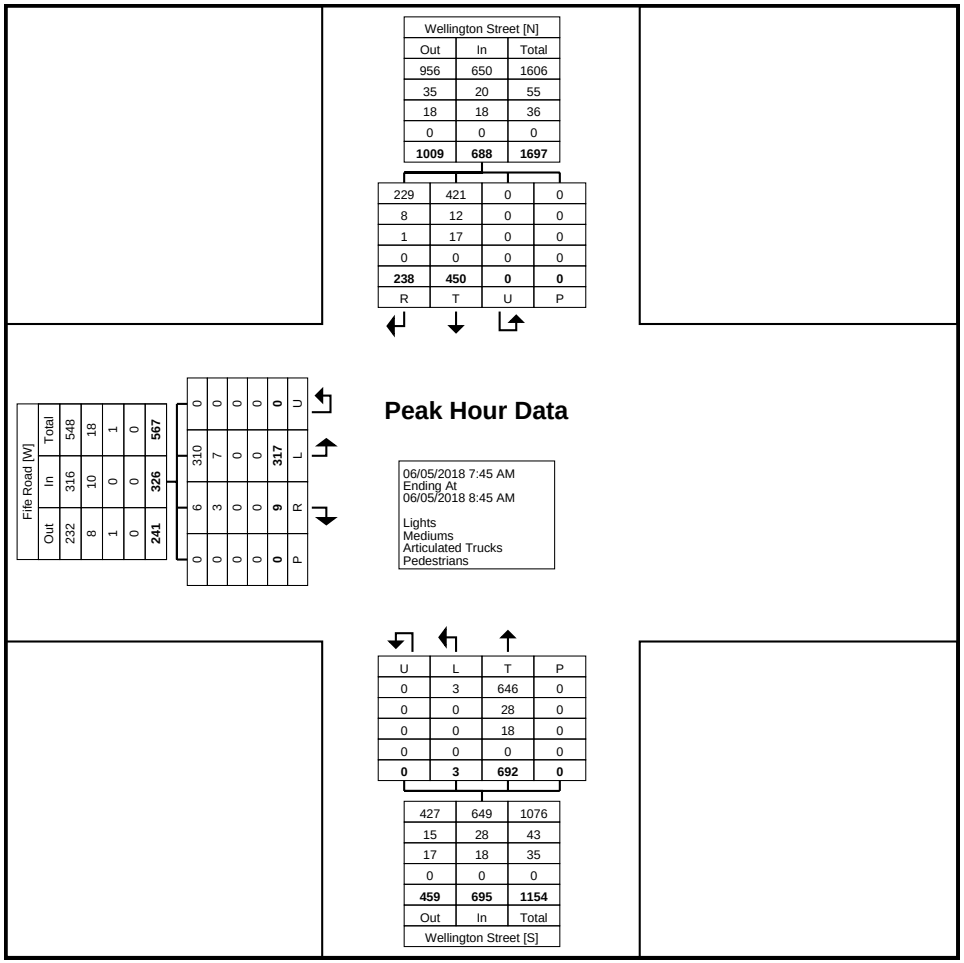

Turning Movement Peak Hour Data Plot (7:45 AM)

Paradigm Transportation Solutions Limited
22 King Street South, Suite 300

Waterloo, Ontario, Canada N2J 1N8
519-896-3163 cbowness@ptsl.com

Count Name: Wellington Street & Fife Road
Site Code:
Start Date: 06/05/2018

Turning Movement Peak Hour Data (12:00 PM)

Start Time	Fife Road Eastbound					Wellington Street Northbound					Wellington Street Southbound					
	Left	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Int. Total
12:00 PM	37	0	0	0	37	0	115	0	0	115	109	39	0	0	148	300
12:15 PM	38	1	0	0	39	3	110	0	0	113	109	23	0	0	132	284
12:30 PM	33	2	0	0	35	3	113	0	0	116	116	25	0	0	141	292
12:45 PM	27	2	0	0	29	0	95	0	0	95	126	34	0	0	160	284
Total	135	5	0	0	140	6	433	0	0	439	460	121	0	0	581	1160
Approach %	96.4	3.6	0.0	-	-	1.4	98.6	0.0	-	-	79.2	20.8	0.0	-	-	-
Total %	11.6	0.4	0.0	-	12.1	0.5	37.3	0.0	-	37.8	39.7	10.4	0.0	-	50.1	-
PHF	0.888	0.625	0.000	-	0.897	0.500	0.941	0.000	-	0.946	0.913	0.776	0.000	-	0.908	0.967
Lights	130	4	0	-	134	6	389	0	-	395	406	115	0	-	521	1050
% Lights	96.3	80.0	-	-	95.7	100.0	89.8	-	-	90.0	88.3	95.0	-	-	89.7	90.5
Mediums	5	1	0	-	6	0	25	0	-	25	28	6	0	-	34	65
% Mediums	3.7	20.0	-	-	4.3	0.0	5.8	-	-	5.7	6.1	5.0	-	-	5.9	5.6
Articulated Trucks	0	0	0	-	0	0	19	0	-	19	26	0	0	-	26	45
% Articulated Trucks	0.0	0.0	-	-	0.0	0.0	4.4	-	-	4.3	5.7	0.0	-	-	4.5	3.9
Pedestrians	-	-	-	0	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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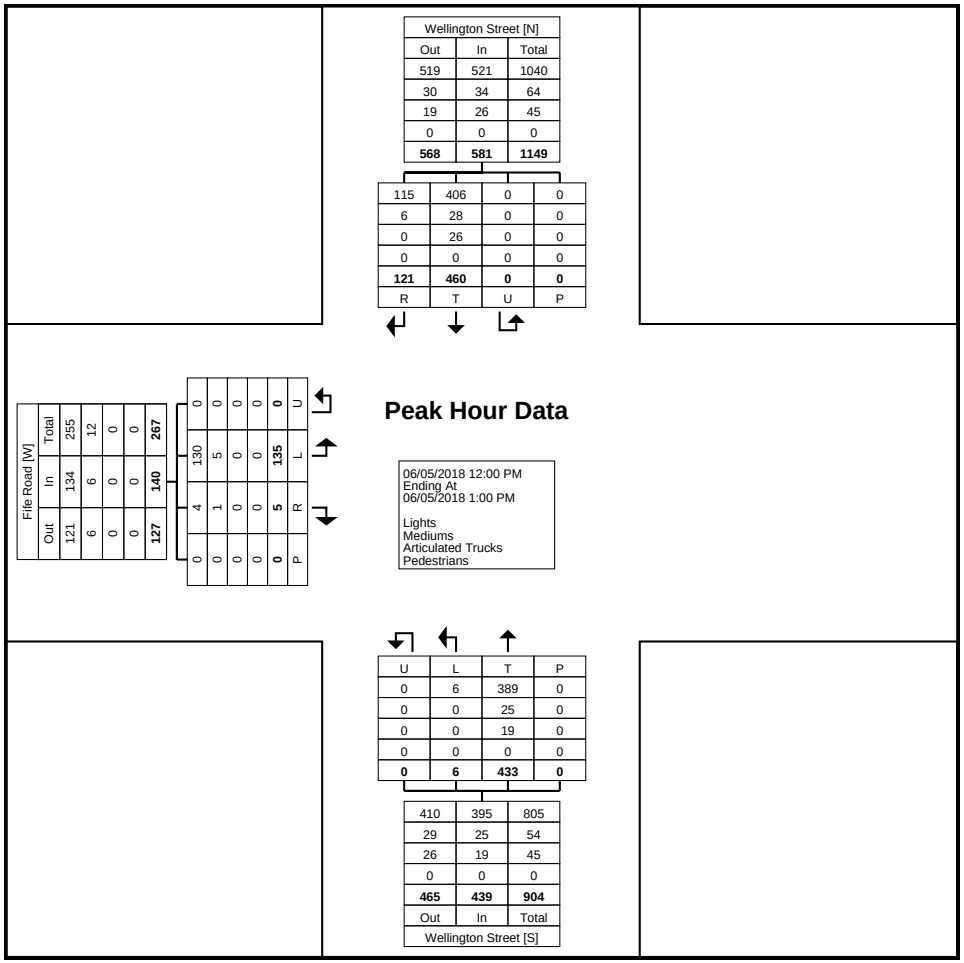

Turning Movement Peak Hour Data Plot (12:00 PM)

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Count Name: Wellington Street & Fife Road
Site Code:
Start Date: 06/05/2018

Turning Movement Peak Hour Data (4:15 PM)

Start Time	Fife Road Eastbound					Wellington Street Northbound					Wellington Street Southbound					
	Left	Right	U-Turn	Peds	App. Total	Left	Thru	U-Turn	Peds	App. Total	Thru	Right	U-Turn	Peds	App. Total	Int. Total
4:15 PM	50	7	0	1	57	1	152	0	0	153	152	126	0	0	278	488
4:30 PM	61	2	0	2	63	2	146	0	0	148	129	117	0	0	246	457
4:45 PM	74	2	0	0	76	6	170	0	0	176	92	106	0	0	198	450
5:00 PM	79	0	0	1	79	1	187	0	0	188	118	98	0	0	216	483
Total	264	11	0	4	275	10	655	0	0	665	491	447	0	0	938	1878
Approach %	96.0	4.0	0.0	-	-	1.5	98.5	0.0	-	-	52.3	47.7	0.0	-	-	-
Total %	14.1	0.6	0.0	-	14.6	0.5	34.9	0.0	-	35.4	26.1	23.8	0.0	-	49.9	-
PHF	0.835	0.393	0.000	-	0.870	0.417	0.876	0.000	-	0.884	0.808	0.887	0.000	-	0.844	0.962
Lights	258	11	0	-	269	10	633	0	-	643	465	440	0	-	905	1817
% Lights	97.7	100.0	-	-	97.8	100.0	96.6	-	-	96.7	94.7	98.4	-	-	96.5	96.8
Mediums	6	0	0	-	6	0	6	0	-	6	8	7	0	-	15	27
% Mediums	2.3	0.0	-	-	2.2	0.0	0.9	-	-	0.9	1.6	1.6	-	-	1.6	1.4
Articulated Trucks	0	0	0	-	0	0	16	0	-	16	18	0	0	-	18	34
% Articulated Trucks	0.0	0.0	-	-	0.0	0.0	2.4	-	-	2.4	3.7	0.0	-	-	1.9	1.8
Pedestrians	-	-	-	4	-	-	-	-	0	-	-	-	-	0	-	-
% Pedestrians	-	-	-	100.0	-	-	-	-	-	-	-	-	-	-	-	-

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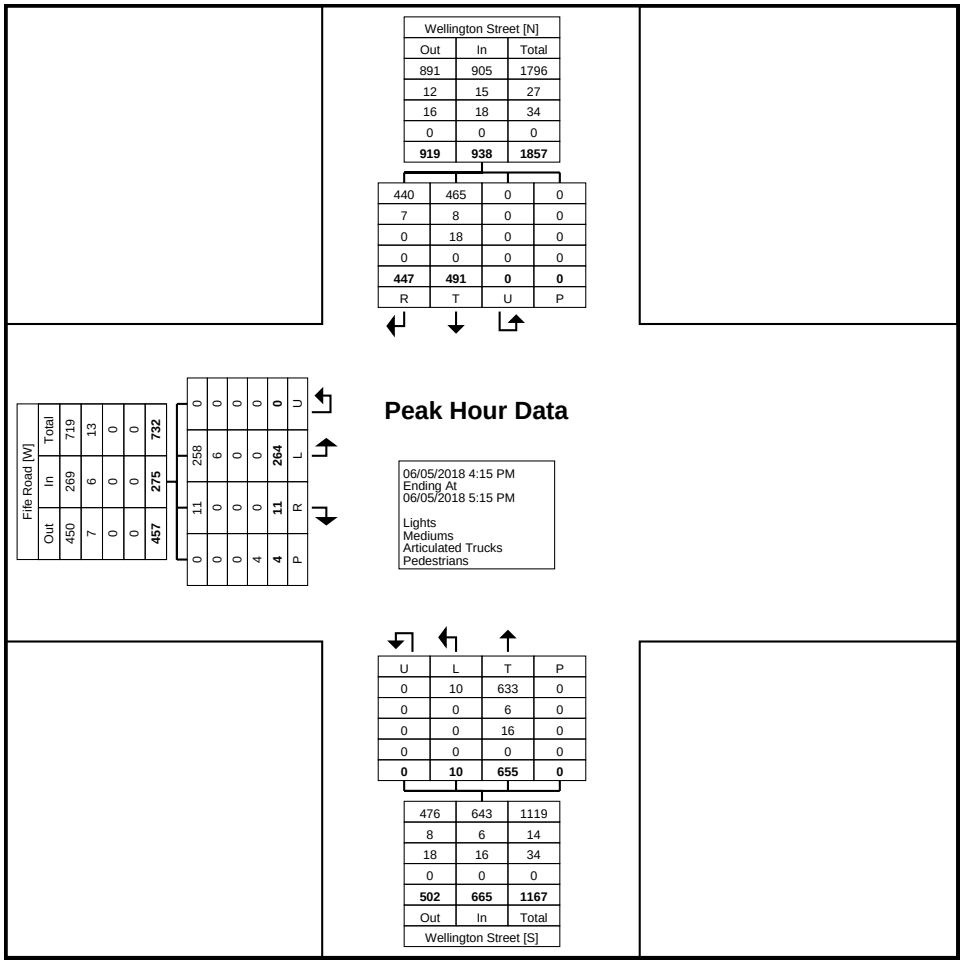

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Count Name: Wellington Street & Fife Road
Site Code:
Start Date: 06/05/2018

Appendix B

Signal Timing Plans

Wellington county 12 -24 124 & 32 7/4/2013 6:20

Configuration

Controller Sequence Priority

	1	2	3	4	5	6	7	8	9	10	11	12
Ring 1 Phases . .	1	2	3	4	9	10	0	0	0	0	0	0
Ring 2 Phases . .	5	6	7	8	11	12	0	0	0	0	0	0

	Phase 1	2	3	4	5	6	7	8	9	10	11	12
In Use.	X	X	X	X	X	X	X	X	X	X	X	X
Exclusive Ped . .	.	.	.	.	.	.	.	.	.	.	.	.
Direction												

	Overlap A	B	C	D
Direction . . .				

Load Switch Channel/Driver Group Assign (Info Only):

Load Switch (MMU) Channel	Signal Driver Phase/ Ovlap	Group Ped
1	1	.
2	2	.
3	3	.
4	4	.
5	5	.
6	6	.
7	7	.
8	8	.
9	2	X
10	4	X
11	6	X
12	8	X
13	A	.
14	B	.
15	C	.
16	D	.

Configuration Continued

Enable BIU:	1	2	3	4	5	6	7	8
Terminal/Facilities.								
Detector Rack.								

Type 2 Runs as Type 1. . .	
MMU Disable.	X
Diagnostic Enable.	
Peer-Peer Comm Enable. . .	

Peer To Peer Addresses . .	1	2	3	4	5	6	7	8	9	10
	0	0	0	0	0	0	0	0	0	0

Port 2:

Port 2 Protocol	Terminal
Port 2 Enable	NO
AB3418 Address.	0
AB3418 Group Address.	0
AB3418 Response Delay	0
AB3418 Single Flag Enable . . .	NO
AB3418 Drop-Out Time.	0
AB3418 TOD SF Select.	0
Data Rate	1200 bps
Data, Parity, Stop.	8, 0, 1

Port 3:

Port 3 Protocol	Telemetry
Port 3 Enable	NO
Telemetry Address	0
System Detector 9-16 Address. .	0
Telemetry Response Delay. . . .	0
AB3418 Address.	0
AB3418 Group Address.	0
AB3418 Response Delay	0
AB3418 Single Flag Enable . . .	NO
AB3418 Drop-Out Time.	0
AB3418 TOD SF Select.	0
Duplex.	Full
Data Rate	1200 bps
Data, Parity, Stop.	8, 0, 1

Configuration Continued

Event Enabling	Alarm Enabling
Critical RFE'S (MMU/TF)	ALARM 1 . . . . .
Non-Critical RFE'S (DET/TEST) . . .	ALARM 2 . . . . .
Detector Errors	ALARM 3 . . . . .
Coordination Errors	ALARM 4 . . . . .
MMU Flash Faults.	ALARM 5 . . . . .
Local Flash Faults.	ALARM 6 . . . . .
Preempt	ALARM 7 . . . . .
Power On/Off.	ALARM 8 . . . . .
Low Battery	ALARM 9 . . . . .
	ALARM 10. . . . .
	ALARM 11. . . . .
	ALARM 12. . . . .
	ALARM 13. . . . .
	ALARM 14. . . . .
	ALARM 15. . . . .
	ALARM 16. . . . .

Supervisor Access Code. . . ****
Data Change Access Code . . ****

MMU Compatibility Program (Info Only)

Channel Is Allowed to Time With Channel

Channel	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
3	.	.	.	.	.	.	.	.	.	.	.	.	.		
4	.	.	.	.	.	.	.	.	.	.	.	.			
5	.	.	.	.	.	.	.	.	.	.	.				
6	.	.	.	.	.	.	.	.	.	.					
7	.	.	.	.	.	.	.	.	.						
8	.	.	.	.	.	.	.	.							
9	.	.	.	.	.	.	.								
10	.	.	.	.	.	.									
11	.	.	.	.	.										
12	.	.	.	.											
13	.	.	.												
14	.	.													
15	.														

Version Info:

Software Assy.	Part No.	Version
Boot		.
Program		.
Application		.
Help		.
Configuration		C ⌐

Wellington county 12 -24 124 & 32 7/4/2013 6:20

By-Phase Timing Data

	Phase											
Direction	1	2	3	4	5	6	7	8	9	10	11	12
Minimum Green	5	5	5	5	5	5	5	5	5	5	5	5
Bike Min Green	0	0	0	0	0	0	0	0	0	0	0	0
Cond Serv Min Grn	0	0	0	0	0	0	0	0	0	0	0	0
Walk	0	10	0	10	0	10	0	10	0	10	0	10
Ped Clearance	0	16	0	16	0	16	0	16	0	16	0	16
Veh Extension	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Alt Veh Exten	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Extension	0	0	0	0	0	0	0	0	0	0	0	0
Max 1	35	35	35	35	35	35	35	35	35	35	35	35
Max 2	40	40	40	40	40	40	40	40	40	40	40	40
Max 3	0	0	0	0	0	0	0	0	0	0	0	0
Det. Fail Max	0	0	0	0	0	0	0	0	0	0	0	0
Yellow Change	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Red Clearance	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Red Revert	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Act. B4 Init	0	0	0	0	0	0	0	0	0	0	0	0
Sec/Actuation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Initial	30	30	30	30	30	30	30	30	30	30	30	30
Time B4 Reduction	0	0	0	0	0	0	0	0	0	0	0	0
Cars Waiting	0	0	0	0	0	0	0	0	0	0	0	0
Time To Reduce	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Gap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Wellington County 24-36 124 & 32 Petro Can 7/4/2013 6:27

Configuration

Controller Sequence Priority

	1	2	3	4	5	6	7	8	9	10	11	12
Ring 1 Phases . .	1	2	3	4	9	10	0	0	0	0	0	0
Ring 2 Phases . .	5	6	7	8	11	12	0	0	0	0	0	0

	Phase 1	2	3	4	5	6	7	8	9	10	11	12
In Use.		X	.	X	X	X	.	X	.	.	.	.
Exclusive Ped . .		.	.	.	.	.	.	.	.	.	.	.
Direction												

	Overlap A	B	C	D
Direction . . .				

Load Switch Channel/Driver Group Assign (Info Only):

Load Switch (MMU) Channel	Signal Driver Phase/ Ovlap	Group Ped
1	1	.
2	2	.
3	3	.
4	4	.
5	5	.
6	6	.
7	7	.
8	8	.
9	2	X
10	4	X
11	6	X
12	8	X
13	A	.
14	B	.
15	C	.
16	D	.

Configuration Continued

Enable BIU:	1	2	3	4	5	6	7	8
Terminal/Facilities. . . .	X	X	.	.	.	.	.	.
Detector Rack.	X	.	.	.	.	.	.	.

Type 2 Runs as Type 1. . . .
MMU Disable. . . . . .
Diagnostic Enable. . . . . .
Peer-Peer Comm Enable. . . .

	1	2	3	4	5	6	7	8	9	10
Peer To Peer Addresses . .	255	255	255	255	255	255	255	255	255	255

Port 2:

Port 2 Protocol . . . . . Terminal
Port 2 Enable . . . . . YES
AB3418 Address. 0
AB3418 Group Address. 0
AB3418 Response Delay 0
AB3418 Single Flag Enable . . . NO
AB3418 Drop-Out Time. 0
AB3418 TOD SF Select. 0
Data Rate . . . . . 1200 bps
Data, Parity, Stop. 8, 0, 1

Port 3:

Port 3 Protocol . . . . . Telemetry
Port 3 Enable . . . . . YES
Telemetry Address 1
System Detector 9-16 Address. . 0
Telemetry Response Delay. . . . 8700
AB3418 Address. 0
AB3418 Group Address. 0
AB3418 Response Delay 0
AB3418 Single Flag Enable . . . NO
AB3418 Drop-Out Time. 0
AB3418 TOD SF Select. 0
Duplex. . . . . Full
Data Rate . . . . . 1200 bps
Data, Parity, Stop. 8, 0, 1

Configuration Continued

Event Enabling

Critical RFE'S (MMU/TF)	X
Non-Critical RFE'S (DET/TEST)	.
Detector Errors	.
Coordination Errors	.
MMU Flash Faults.	X
Local Flash Faults.	X
Preempt	.
Power On/Off.	X
Low Battery	X

Alarm Enabling

ALARM 1	X
ALARM 2	.
ALARM 3	.
ALARM 4	X
ALARM 5	X
ALARM 6	X
ALARM 7	X
ALARM 8	X
ALARM 9	X
ALARM 10.	X
ALARM 11.	X
ALARM 12.	X
ALARM 13.	X
ALARM 14.	X
ALARM 15.	X
ALARM 16.	X

Supervisor Access Code. . . ****
Data Change Access Code . . ****

MMU Compatibility Program (Info Only)

Channel Is Allowed to Time With Channel

Channel	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	X	.	X	.	.	X	X	.	.	
3	.	.	.	.	.	.	.	.	.	.	.	.	.		
4	.	.	.	.	X	.	X	.	X	.	.	.			
5	.	.	.	.	.	.	.	X	.	.	.				
6	.	.	.	.	.	X	.	X	.	.					
7	.	.	.	.	.	.	.	.	.						
8	.	.	.	.	X	.	X	.							
9	.	.	.	.	.	X	.								
10	.	.	.	.	X	.									
11	.	.	.	.	.										
12	.	.	.	.											
13	.	.	.												
14	.	.													
15	.														

Version Info:

Software Assy.	Part No.	Version
Boot	27831	2.83
Program	45561	8.0
Application		. 3
Help	27891	6.43
Configuration	27918	C000

Wellington County 24-36 124 & 32 Petro Can 7/4/2013 6:27

By-Phase Timing Data

	Phase											
Direction	1	2	3	4	5	6	7	8	9	10	11	12
Minimum Green	0	35	0	12	8	35	0	12	5	5	5	5
Bike Min Green	0	0	0	0	0	0	0	0	0	0	0	0
Cond Serv Min Grn	0	0	0	0	0	0	0	0	0	0	0	0
Walk	0	23	0	7	0	23	0	7	0	10	0	10
Ped Clearance	0	12	0	13	0	12	0	13	0	16	0	16
Veh Extension	0.0	5.0	0.0	3.0	3.0	5.0	0.0	3.0	5.0	5.0	5.0	5.0
Alt Veh Exten	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Extension	0	0	0	0	0	0	0	0	0	0	0	0
Max 1	0	50	0	20	23	50	0	20	35	35	35	35
Max 2	0	60	0	40	25	60	0	40	40	40	40	40
Max 3	0	0	0	0	0	0	0	0	0	0	0	0
Det. Fail Max	0	0	0	0	0	0	0	0	0	0	0	0
Yellow Change	3.0	5.0	3.0	4.0	3.0	5.0	3.0	4.0	3.0	3.0	3.0	3.0
Red Clearance	1.0	2.0	2.0	2.0	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0
Red Revert	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Act. B4 Init	0	0	0	0	0	0	0	0	0	0	0	0
Sec/Actuation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Initial	30	30	30	30	30	30	30	30	30	30	30	30
Time B4 Reduction	0	0	0	0	0	0	0	0	0	0	0	0
Cars Waiting	0	0	0	0	0	0	0	0	0	0	0	0
Time To Reduce	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Gap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Wellington County 1-12 124& Whitelaw 11/4/2013 15:33

Configuration

Controller Sequence Priority

	1	2	3	4	5	6	7	8	9	10	11	12
Ring 1 Phases . .	1	2	3	4	9	10	0	0	0	0	0	0
Ring 2 Phases . .	5	6	7	8	11	12	0	0	0	0	0	0

	Phase 1	2	3	4	5	6	7	8	9	10	11	12
In Use.		X	.	X	.	X	.	X	.	.	.	.
Exclusive Ped . . .		.	.	.	.	.	.	.	.	.	.	.
Direction												

	Overlap A	B	C	D
Direction . . .				

Load Switch Channel/Driver Group Assign (Info Only):

Load Switch (MMU) Channel	Signal Driver Phase/ Ovlap	Group Ped
1	1	.
2	2	.
3	3	.
4	4	.
5	5	.
6	6	.
7	7	.
8	8	.
9	2	X
10	4	X
11	6	X
12	8	X
13	A	.
14	B	.
15	C	.
16	D	.

Configuration Continued

Enable BIU:	1	2	3	4	5	6	7	8
Terminal/Facilities. . . .	X	X	.	.	.	.	.	.
Detector Rack.	X	.	.	.	.	.	.	.

Type 2 Runs as Type 1. . . .
MMU Disable. . . . . .
Diagnostic Enable. . . . . .
Peer-Peer Comm Enable. . . .

	1	2	3	4	5	6	7	8	9	10
Peer To Peer Addresses . .	255	255	255	255	255	255	255	255	255	255

Port 2:

Port 2 Protocol . . . . . Terminal
Port 2 Enable . . . . . YES
AB3418 Address. 0
AB3418 Group Address. 0
AB3418 Response Delay 0
AB3418 Single Flag Enable . . . NO
AB3418 Drop-Out Time. 0
AB3418 TOD SF Select. 0
Data Rate . . . . . 1200 bps
Data, Parity, Stop. 8, 0, 1

Port 3:

Port 3 Protocol . . . . . Telemetry
Port 3 Enable . . . . . NO
Telemetry Address 0
System Detector 9-16 Address. . 0
Telemetry Response Delay. . . . 8000
AB3418 Address. 0
AB3418 Group Address. 0
AB3418 Response Delay 0
AB3418 Single Flag Enable . . . NO
AB3418 Drop-Out Time. 0
AB3418 TOD SF Select. 0
Duplex. . . . . Full
Data Rate . . . . . 1200 bps
Data, Parity, Stop. 8, 0, 1

Wellington County 1-12 124& Whitelaw 11/4/2013 15:33

Configuration Continued

Event Enabling		Alarm Enabling	
Critical RFE'S (MMU/TF)	X	ALARM 1	X
Non-Critical RFE'S (DET/TEST)	X	ALARM 2	X
Detector Errors	X	ALARM 3	X
Coordination Errors	X	ALARM 4	X
MMU Flash Faults.	X	ALARM 5	X
Local Flash Faults.	X	ALARM 6	X
Preempt	X	ALARM 7	X
Power On/Off.	X	ALARM 8	X
Low Battery	X	ALARM 9	X
		ALARM 10.	X
		ALARM 11.	X
		ALARM 12.	X
		ALARM 13.	X
		ALARM 14.	X
		ALARM 15.	X
		ALARM 16.	X

Supervisor Access Code. . . ****
Data Change Access Code . . ****

MMU Compatibility Program (Info Only)

Channel	Is Allowed to Time With Channel														
	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2
1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
3	.	.	.	.	.	.	.	.	.	.	.	.	.		
4	.	.	.	.	.	.	.	.	.	.	.	.			
5	.	.	.	.	.	.	.	.	.	.	.				
6	.	.	.	.	.	.	.	.	.	.					
7	.	.	.	.	.	.	.	.	.						
8	.	.	.	.	.	.	.	.							
9	.	.	.	.	.	.	.								
10.	.	.	.	.	.	.									
11.	.	.	.	.	.										
12.	.	.	.	.											
13.	.	.	.												
14.	.	.													
15.	.														

Version Info:

Software Assy.	Part No.	Version
Boot	27831	2.83
Program	45561	7.9
Application		. 3
Help	27891	6.33
Configuration	27913	C097┌

Wellington County 1-12 124& Whitelaw 11/4/2013 15:33

By-Phase Timing Data

	Phase											
Direction	1	2	3	4	5	6	7	8	9	10	11	12
Minimum Green	5	30	5	15	5	30	5	15	5	5	5	5
Bike Min Green	0	0	0	0	0	0	0	0	0	0	0	0
Cond Serv Min Grn	0	0	0	0	0	0	0	0	0	0	0	0
Walk	0	15	0	11	0	15	0	11	0	10	0	10
Ped Clearance	0	7	0	7	0	7	0	7	0	16	0	16
Veh Extension	5.0	4.5	5.0	3.0	5.0	4.5	5.0	3.0	5.0	5.0	5.0	5.0
Alt Veh Exten	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Extension	0	0	0	0	0	0	0	0	0	0	0	0
Max 1	35	60	35	20	35	60	35	20	35	35	35	35
Max 2	40	0	40	20	40	0	40	20	40	40	40	40
Max 3	0	0	0	0	0	0	0	0	0	0	0	0
Det. Fail Max	0	0	0	0	0	0	0	0	0	0	0	0
Yellow Change	3.0	5.9	3.0	5.9	3.0	5.9	3.0	5.9	3.0	3.0	3.0	3.0
Red Clearance	1.0	1.3	1.0	1.0	1.0	1.3	1.0	1.0	1.0	1.0	1.0	1.0
Red Revert	2.0	5.0	2.0	2.0	2.0	5.0	2.0	2.0	2.0	2.0	2.0	2.0
Act. B4 Init	0	0	0	0	0	0	0	0	0	0	0	0
Sec/Actuation	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Initial	30	30	30	30	30	30	30	30	30	30	30	30
Time B4 Reduction	0	0	0	0	0	0	0	0	0	0	0	0
Cars Waiting	0	0	0	0	0	0	0	0	0	0	0	0
Time To Reduce	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Gap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

CITY OF GUELPH

Traffic Signal Timing Parameters

Database Date Field			Prepared Date:	May 30, 2018
Database Rev Field			Completed By:	I.T.
Timing Card / Field rev	From Controller		Checked By:	

Location: Wellintron Street at Fife Road

Phase #	Direction	Vehicle Minimum (sec.)	Pedestrian Minimum (sec.)		Amber (sec.)	All Red (sec.)	TIME PERIOD (sec.) (Green+Amber+All Red)		
			WALK	FDWALK			AM MAX	OFF MAX	PM MAX
1	Not in use								
2	EB Wellington St.	20.0	20.0	10.0	4.0	2.0	41.0	51.0	41.0
3	Not in use								
4	Not in use								
5	Not in use								
6	WB Wellington St.	20.0	20.0	10.0	4.0	2.0	41.0	51.0	41.0
7	Not in use								
8	EB Fife Rd.	7.0	7.0	11.0	4.0	2.0	29.0	26.0	29.0

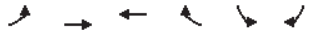
System Control	Yes
Local Control	No
Semi-Actuated Mode	Yes

Note: P+P = Protected Permissive Phase
Prot. = Fully Protected Phase

TIME (M-F)	PEAK	CYCLE LENGTH (sec.)	OFFSET (sec.)
06:00-07:30	AM	70	1
7:30 - 9:00	OFF	80	7
9:00 - 20:00	PM	70	1

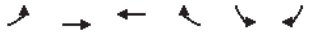
Appendix C

Existing Traffic Operations Reports



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	294	717	726	4	0	264
Future Volume (vph)	294	717	726	4	0	264
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0			25.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.850	0.865	
Flt Protected		0.986				
Satd. Flow (prot)	0	1751	1743	1077	1627	0
Flt Permitted		0.986				
Satd. Flow (perm)	0	1751	1743	1077	1627	0
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	2%	9%	9%	50%	0%	1%
Adj. Flow (vph)	309	755	764	4	0	278
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	1064	764	4	278	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	118.6%	ICU Level of Service	H
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	294	717	726	4	0	264
Future Volume (Veh/h)	294	717	726	4	0	264
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)	309	755	764	4	0	278
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	768				2137	764
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	768				2137	764
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	63				100	31
cM capacity (veh/h)	846				35	405

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	1064	764	4	278
Volume Left	309	0	0	0
Volume Right	0	0	4	278
cSH	846	1700	1700	405
Volume to Capacity	0.37	0.45	0.00	0.69
Queue Length 95th (m)	13.5	0.0	0.0	39.9
Control Delay (s)	8.8	0.0	0.0	31.2
Lane LOS	A			D
Approach Delay (s)	8.8	0.0		31.2
Approach LOS				D

Intersection Summary				
Average Delay	8.6			
Intersection Capacity Utilization	118.6%	ICU Level of Service		H
Analysis Period (min)	15			

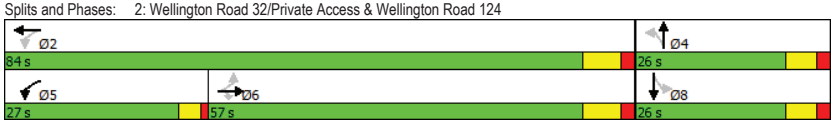
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	573	131	297	501	0	235	0	585	1	0	0
Future Volume (vph)	0	573	131	297	501	0	235	0	585	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	40.0		25.0	55.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		1	1		0	1		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850					0.850				
Flt Protected				0.950			0.950				0.950	
Satd. Flow (prot)	1900	1712	1495	1703	1667	0	1752	1568	0	0	1805	0
Flt Permitted				0.252			0.757				0.200	
Satd. Flow (perm)	1900	1712	1495	452	1667	0	1396	1568	0	0	380	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			69					462				
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
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%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Adj. Flow (vph)	0	637	146	330	557	0	261	0	650	1	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	637	146	330	557	0	261	650	0	0	1	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)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	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	
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		6		5	2			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2			4			8		
Detector Phase	6	6	6	5	2		4	4		8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0	35.0	8.0	35.0		12.0	12.0		12.0	12.0	
Minimum Split (s)	42.0	42.0	42.0	12.0	42.0		26.0	26.0		26.0	26.0	
Total Split (s)	57.0	57.0	57.0	27.0	84.0		26.0	26.0		26.0	26.0	
Total Split (%)	51.8%	51.8%	51.8%	24.5%	76.4%		23.6%	23.6%		23.6%	23.6%	
Maximum Green (s)	50.0	50.0	50.0	23.0	77.0		20.0	20.0		20.0	20.0	
Yellow Time (s)	5.0	5.0	5.0	3.0	5.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	7.0	7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Lead/Lag	Lag	Lag	Lag	Lead								
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	Max		None	None		None	None	
Walk Time (s)	23.0	23.0	23.0		23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0	12.0		12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0	0		0		0	0		0	0	
Act Effct Green (s)		58.5	58.5	80.0	77.0		20.0	20.0			20.0	
Actuated g/C Ratio		0.53	0.53	0.73	0.70		0.18	0.18			0.18	
v/c Ratio		0.70	0.18	0.67	0.48		1.03	0.98			0.01	
Control Delay		25.7	8.7	12.5	9.1		110.1	44.4			38.0	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay		25.7	8.7	12.5	9.1		110.1	44.4			38.0	
LOS		C	A	B	A		F	D			D	
Approach Delay		22.5			10.4			63.2			38.0	
Approach LOS		C			B			E			D	

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.03
Intersection Signal Delay: 32.7 Intersection LOS: C
Intersection Capacity Utilization 111.2% ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124



Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	637	146	330	557	261	650	1
v/c Ratio	0.70	0.18	0.67	0.48	1.03	0.98	0.01
Control Delay	25.7	8.7	12.5	9.1	110.1	44.4	38.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.7	8.7	12.5	9.1	110.1	44.4	38.0
Queue Length 50th (m)	98.6	7.9	21.9	50.2	~63.2	49.5	0.2
Queue Length 95th (m)	#175.7	22.2	32.8	72.7	#115.5	#130.1	1.7
Internal Link Dist (m)	1665.7			343.4		471.1	37.2
Turn Bay Length (m)		25.0	55.0		60.0		
Base Capacity (vph)	910	827	590	1166	253	663	69
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.18	0.56	0.48	1.03	0.98	0.01

Intersection Summary

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

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	573	131	297	501	0	235	0	585	1	0	0
Future Volume (vph)	0	573	131	297	501	0	235	0	585	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Lane Util. Factor		1.00	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			1.00	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00			0.95	
Satd. Flow (prot)		1712	1495	1703	1667		1752	1568			1805	
Flt Permitted		1.00	1.00	0.25	1.00		0.76	1.00			0.20	
Satd. Flow (perm)		1712	1495	452	1667		1397	1568			380	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	637	146	330	557	0	261	0	650	1	0	0
RTOR Reduction (vph)	0	0	32	0	0	0	0	378	0	0	0	0
Lane Group Flow (vph)	0	637	114	330	557	0	261	272	0	0	1	0
Heavy Vehicles (%)	0%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		6		5	2			4			8	
Permitted Phases	6		6	2			4			8		
Actuated Green, G (s)		58.5	58.5	77.0	77.0		20.0	20.0			20.0	
Effective Green, g (s)		58.5	58.5	77.0	77.0		20.0	20.0			20.0	
Actuated g/C Ratio		0.53	0.53	0.70	0.70		0.18	0.18			0.18	
Clearance Time (s)		7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Vehicle Extension (s)		5.0	5.0	3.0	5.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		910	795	481	1166		254	285			69	
v/s Ratio Prot		0.37		c0.09	0.33			0.17				
v/s Ratio Perm			0.08	c0.39			c0.19				0.00	
v/c Ratio		0.70	0.14	0.69	0.48		1.03	0.95			0.01	
Uniform Delay, d1		19.2	13.0	11.3	7.4		45.0	44.5			36.9	
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2		3.0	0.2	4.0	1.4		63.8	40.7			0.1	
Delay (s)		22.2	13.2	15.3	8.8		108.8	85.3			37.0	
Level of Service		C	B	B	A		F	F			D	
Approach Delay (s)		20.5			11.2			92.0			37.0	
Approach LOS		C			B			F			D	

Intersection Summary				
HCM 2000 Control Delay	42.6	HCM 2000 Level of Service	D	
HCM 2000 Volume to Capacity ratio	0.78			
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	111.2%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

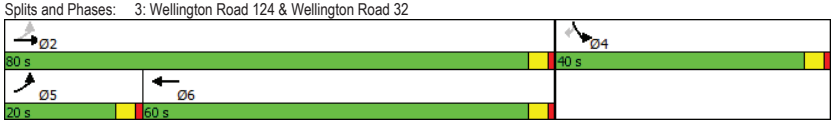
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	411	732	432	17	22	389
Future Volume (vph)	411	732	432	17	22	389
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	215.0			0.0	90.0	0.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.995			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1641	1792	1701	0	1530	1429
Flt Permitted	0.354				0.950	
Satd. Flow (perm)	611	1792	1701	0	1530	1429
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			2			437
Link Speed (k/h)		70	70		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		18.9	105.7		23.1	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Adj. Flow (vph)	462	822	485	19	25	437
Shared Lane Traffic (%)						
Lane Group Flow (vph)	462	822	504	0	25	437
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	2					4
Detector Phase	5	2	6		4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	30.0
Total Split (s)	20.0	80.0	60.0		40.0	40.0
Total Split (%)	16.7%	66.7%	50.0%		33.3%	33.3%
Maximum Green (s)	16.0	76.0	56.0		36.0	36.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	None	Max		None	None
Walk Time (s)		10.0	10.0		10.0	10.0
Flash Dont Walk (s)		16.0	16.0		16.0	16.0
Pedestrian Calls (#/hr)		0	0		0	0
Act Effct Green (s)	76.3	76.3	56.2		12.1	12.1
Actuated g/C Ratio	0.79	0.79	0.58		0.13	0.13
v/c Ratio	0.71	0.58	0.51		0.13	0.78
Control Delay	11.0	6.9	15.2		37.5	14.2
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	11.0	6.9	15.2		37.5	14.2
LOS	B	A	B		D	B
Approach Delay		8.4	15.2		15.5	
Approach LOS		A	B		B	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 96.4
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 11.4 — Intersection LOS: B
Intersection Capacity Utilization 60.7% — ICU Level of Service B
Analysis Period (min) 15

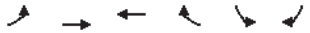
Splits and Phases: 3: Wellington Road 124 & Wellington Road 32



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	462	822	504	25	437
v/c Ratio	0.71	0.58	0.51	0.13	0.78
Control Delay	11.0	6.9	15.2	37.5	14.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	11.0	6.9	15.2	37.5	14.2
Queue Length 50th (m)	15.7	37.0	49.0	4.4	0.0
Queue Length 95th (m)	#55.5	121.2	103.1	11.8	27.4
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)	215.0			90.0	
Base Capacity (vph)	655	1417	992	573	808
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.71	0.58	0.51	0.04	0.54

Intersection Summary

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



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	411	732	432	17	22	389
Future Volume (vph)	411	732	432	17	22	389
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1641	1792	1700		1530	1429
Flt Permitted	0.35	1.00	1.00		0.95	1.00
Satd. Flow (perm)	612	1792	1700		1530	1429
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	462	822	485	19	25	437
RTOR Reduction (vph)	0	0	1	0	0	382
Lane Group Flow (vph)	462	822	503	0	25	55
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases	2					4
Actuated Green, G (s)	76.3	76.3	56.2		12.1	12.1
Effective Green, g (s)	76.3	76.3	56.2		12.1	12.1
Actuated g/C Ratio	0.79	0.79	0.58		0.13	0.13
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	656	1418	991		192	179
v/s Ratio Prot	c0.12	0.46	0.30		0.02	
v/s Ratio Perm	c0.44					c0.04
v/c Ratio	0.70	0.58	0.51		0.13	0.31
Uniform Delay, d1	5.8	3.9	11.9		37.5	38.3
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	4.3	0.6	1.9		0.6	2.0
Delay (s)	10.1	4.5	13.8		38.1	40.4
Level of Service	B	A	B		D	D
Approach Delay (s)		6.5	13.8		40.2	
Approach LOS		A	B		D	

Intersection Summary

HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	96.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	52	662	3	4	425	60	3	6	3	25	4	27
Future Volume (vph)	52	662	3	4	425	60	3	6	3	25	4	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	140.0		0.0	135.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999			0.981			0.969			0.935	
Flt Protected	0.950			0.950				0.989			0.978	
Satd. Flow (prot)	1736	1774	0	1444	1756	0	0	1668	0	0	1368	0
Flt Permitted	0.447			0.335				0.902			0.849	
Satd. Flow (perm)	817	1774	0	509	1756	0	0	1521	0	0	1187	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1			19			3			30	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
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 (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Adj. Flow (vph)	58	736	3	4	472	67	3	7	3	28	4	30
Shared Lane Traffic (%)												
Lane Group Flow (vph)	58	739	0	4	539	0	0	13	0	0	62	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	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	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			4			8		
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2		37.2	37.2		28.9	28.9		28.9	28.9	
Total Split (s)	60.0	60.0		60.0	60.0		20.0	20.0		20.0	20.0	
Total Split (%)	75.0%	75.0%		75.0%	75.0%		25.0%	25.0%		25.0%	25.0%	
Maximum Green (s)	52.8	52.8		52.8	52.8		13.1	13.1		13.1	13.1	
Yellow Time (s)	5.9	5.9		5.9	5.9		5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3		1.3	1.3		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5		4.5	4.5		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		None	None		None	None	
Walk Time (s)	15.0	15.0		15.0	15.0		11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	64.4	64.4		64.4	64.4			13.2			13.2	
Actuated g/C Ratio	0.80	0.80		0.80	0.80			0.16			0.16	
v/c Ratio	0.09	0.52		0.01	0.38			0.05			0.28	
Control Delay	4.9	7.4		4.8	5.6			26.5			22.2	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	4.9	7.4		4.8	5.6			26.5			22.2	
LOS	A	A		A	A			C			C	
Approach Delay		7.2			5.6			26.5			22.2	
Approach LOS		A			A			C			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80.1			
Natural Cycle: 70			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.52			
Intersection Signal Delay: 7.4		Intersection LOS: A	
Intersection Capacity Utilization 67.5%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	58	739	4	539	13	62
v/c Ratio	0.09	0.52	0.01	0.38	0.05	0.28
Control Delay	4.9	7.4	4.8	5.6	26.5	22.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.9	7.4	4.8	5.6	26.5	22.2
Queue Length 50th (m)	3.0	59.6	0.2	35.1	1.6	5.2
Queue Length 95th (m)	7.2	93.1	1.1	55.1	6.3	15.5
Internal Link Dist (m)		2030.4		1551.0	355.0	437.0
Turn Bay Length (m)	140.0		135.0			
Base Capacity (vph)	657	1426	409	1415	252	220
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.52	0.01	0.38	0.05	0.28

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	52	662	3	4	425	60	3	6	3	25	4	27
Future Volume (vph)	52	662	3	4	425	60	3	6	3	25	4	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	0.98			0.97			0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.98	
Satd. Flow (prot)	1736	1775		1444	1757			1667			1367	
Flt Permitted	0.45	1.00		0.34	1.00			0.90			0.85	
Satd. Flow (perm)	818	1775		509	1757			1522			1187	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	58	736	3	4	472	67	3	7	3	28	4	30
RTOR Reduction (vph)	0	0	0	0	5	0	0	3	0	0	27	0
Lane Group Flow (vph)	58	739	0	4	534	0	0	10	0	0	35	0
Heavy Vehicles (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	61.3	61.3		61.3	61.3			7.6			7.6	
Effective Green, g (s)	61.3	61.3		61.3	61.3			7.6			7.6	
Actuated g/C Ratio	0.74	0.74		0.74	0.74			0.09			0.09	
Clearance Time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Vehicle Extension (s)	4.5	4.5		4.5	4.5			3.0			3.0	
Lane Grp Cap (vph)	604	1310		375	1297			139			108	
v/s Ratio Prot		c0.42			0.30							
v/s Ratio Perm	0.07			0.01				0.01			c0.03	
v/c Ratio	0.10	0.56		0.01	0.41			0.07			0.32	
Uniform Delay, d1	3.1	4.9		2.9	4.1			34.5			35.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.3	1.8		0.1	1.0			0.2			1.7	
Delay (s)	3.4	6.6		2.9	5.0			34.7			37.0	
Level of Service	A	A		A	A			C			D	
Approach Delay (s)		6.4			5.0			34.7			37.0	
Approach LOS		A			A			C			D	

Intersection Summary				
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.54			
Actuated Cycle Length (s)	83.0	Sum of lost time (s)	14.1	
Intersection Capacity Utilization	67.5%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

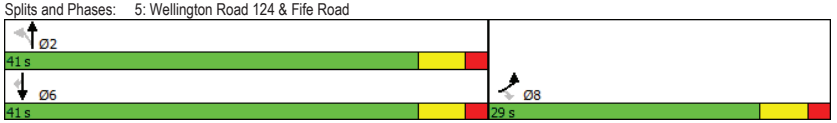
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	317	9	3	692	450	238
Future Volume (vph)	317	9	3	692	450	238
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950					
Satd. Flow (prot)	1770	1214	0	3375	1792	1553
Flt Permitted	0.950			0.954		
Satd. Flow (perm)	1770	1214	0	3219	1792	1553
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		10				259
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Adj. Flow (vph)	345	10	3	752	489	259
Shared Lane Traffic (%)						
Lane Group Flow (vph)	345	10	0	755	489	259
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	29.0	29.0	41.0	41.0	41.0	41.0
Total Split (%)	41.4%	41.4%	58.6%	58.6%	58.6%	58.6%
Maximum Green (s)	23.0	23.0	35.0	35.0	35.0	35.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	17.1	17.1		35.2	35.2	35.2
Actuated g/C Ratio	0.27	0.27		0.55	0.55	0.55
v/c Ratio	0.74	0.03		0.43	0.50	0.27
Control Delay	31.4	9.6		10.3	12.3	2.2
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	31.4	9.6		10.3	12.3	2.2
LOS	C	A		B	B	A
Approach Delay	30.7			10.3	8.8	
Approach LOS	C			B	A	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 64.3
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 13.6 — Intersection LOS: B
Intersection Capacity Utilization 51.2% — ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road

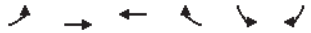


Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	345	10	755	489	259
v/c Ratio	0.74	0.03	0.43	0.50	0.27
Control Delay	31.4	9.6	10.3	12.3	2.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	31.4	9.6	10.3	12.3	2.2
Queue Length 50th (m)	39.1	0.0	27.0	35.1	0.0
Queue Length 95th (m)	65.0	3.0	47.2	69.8	10.3
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	636	442	1760	980	966
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.54	0.02	0.43	0.50	0.27

Intersection Summary

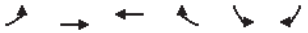
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	317	9	3	692	450	238
Future Volume (vph)	317	9	3	692	450	238
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1214		3374	1792	1553
Flt Permitted	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1214		3218	1792	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	345	10	3	752	489	259
RTOR Reduction (vph)	0	7	0	0	0	117
Lane Group Flow (vph)	345	3	0	755	489	142
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	17.1	17.1		35.2	35.2	35.2
Effective Green, g (s)	17.1	17.1		35.2	35.2	35.2
Actuated g/C Ratio	0.27	0.27		0.55	0.55	0.55
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	470	322		1761	981	850
v/s Ratio Prot	c0.19				c0.27	
v/s Ratio Perm		0.00		0.23		0.09
v/c Ratio	0.73	0.01		0.43	0.50	0.17
Uniform Delay, d1	21.5	17.4		8.6	9.1	7.2
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.9	0.0		0.8	1.8	0.4
Delay (s)	27.4	17.4		9.4	10.9	7.7
Level of Service	C	B		A	B	A
Approach Delay (s)	27.1			9.4	9.8	
Approach LOS	C			A	A	

Intersection Summary				
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.58			
Actuated Cycle Length (s)	64.3	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	51.2%	ICU Level of Service	A	
Analysis Period (min)	15			
c Critical Lane Group				



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	197	695	902	9	1	349
Future Volume (vph)	197	695	902	9	1	349
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0			25.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.850	0.865	
Flt Protected		0.989				
Satd. Flow (prot)	0	1765	1827	1615	1644	0
Flt Permitted		0.989				
Satd. Flow (perm)	0	1765	1827	1615	1644	0
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Heavy Vehicles (%)	1%	8%	4%	0%	0%	0%
Adj. Flow (vph)	205	724	940	10	1	364
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	929	940	10	365	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	126.6%	ICU Level of Service	H
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	197	695	902	9	1	349
Future Volume (Veh/h)	197	695	902	9	1	349
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Hourly flow rate (vph)	205	724	940	10	1	364
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	950				2074	940
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	950				2074	940
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	72				98	0
cM capacity (veh/h)	727				43	322

Direction, Lane #	EB 1	WB 1	WB 2	SB 1
Volume Total	929	940	10	365
Volume Left	205	0	0	1
Volume Right	0	0	10	364
cSH	727	1700	1700	317
Volume to Capacity	0.28	0.55	0.01	1.15
Queue Length 95th (m)	9.3	0.0	0.0	120.7
Control Delay (s)	7.2	0.0	0.0	134.6
Lane LOS	A			F
Approach Delay (s)	7.2	0.0		134.6
Approach LOS				F

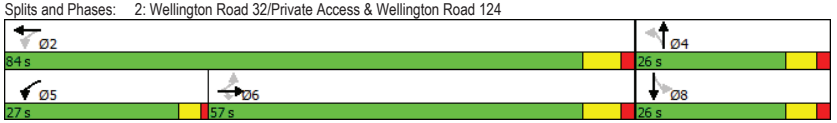
Intersection Summary				
Average Delay		24.9		
Intersection Capacity Utilization		126.6%	ICU Level of Service	H
Analysis Period (min)		15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	552	157	488	628	4	287	1	455	16	4	1
Future Volume (vph)	4	552	157	488	628	4	287	1	455	16	4	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	40.0		25.0	55.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		1	1		0	1		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.999			0.850			0.994	
Flt Protected	0.950			0.950			0.950				0.963	
Satd. Flow (prot)	1805	1759	1553	1752	1791	0	1787	1524	0	0	1819	0
Flt Permitted	0.420			0.275			0.744				0.278	
Satd. Flow (perm)	798	1759	1553	507	1791	0	1400	1524	0	0	525	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			70		1			464			1	
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Adj. Flow (vph)	4	563	160	498	641	4	293	1	464	16	4	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	4	563	160	498	645	0	293	465	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)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	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	
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		6		5	2			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2			4			8		
Detector Phase	6	6	6	5	2		4	4		8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0	35.0	8.0	35.0		12.0	12.0		12.0	12.0	
Minimum Split (s)	42.0	42.0	42.0	12.0	42.0		26.0	26.0		26.0	26.0	
Total Split (s)	57.0	57.0	57.0	27.0	84.0		26.0	26.0		26.0	26.0	
Total Split (%)	51.8%	51.8%	51.8%	24.5%	76.4%		23.6%	23.6%		23.6%	23.6%	
Maximum Green (s)	50.0	50.0	50.0	23.0	77.0		20.0	20.0		20.0	20.0	
Yellow Time (s)	5.0	5.0	5.0	3.0	5.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	7.0	7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Lead/Lag	Lag	Lag	Lag	Lead								
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	Max		None	None		None	None	
Walk Time (s)	23.0	23.0	23.0		23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0	12.0		12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0	0		0		0	0		0	0	
Act Effct Green (s)	53.7	53.7	53.7	80.0	77.0		20.0	20.0			20.0	
Actuated g/C Ratio	0.49	0.49	0.49	0.73	0.70		0.18	0.18			0.18	
v/c Ratio	0.01	0.66	0.20	0.85	0.51		1.15	0.71			0.22	
Control Delay	16.5	26.7	10.4	23.6	9.5		145.6	10.5			43.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay	16.5	26.7	10.4	23.6	9.5		145.6	10.5			43.7	
LOS	B	C	B	C	A		F	B			D	
Approach Delay		23.0			15.6			62.7			43.7	
Approach LOS		C			B			E			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Natural Cycle: 90			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 1.15			
Intersection Signal Delay: 31.4		Intersection LOS: C	
Intersection Capacity Utilization 107.4%		ICU Level of Service G	
Analysis Period (min) 15			

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	4	563	160	498	645	293	465	21
v/c Ratio	0.01	0.66	0.20	0.85	0.51	1.15	0.71	0.22
Control Delay	16.5	26.7	10.4	23.6	9.5	145.6	10.5	43.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.5	26.7	10.4	23.6	9.5	145.6	10.5	43.7
Queue Length 50th (m)	0.5	95.0	11.0	37.1	60.5	~78.1	0.2	3.9
Queue Length 95th (m)	2.6	142.0	24.9	#82.3	86.0	#132.8	32.0	12.0
Internal Link Dist (m)		1665.7			343.4		471.1	37.2
Turn Bay Length (m)	40.0		25.0	55.0		60.0		
Base Capacity (vph)	389	858	793	629	1254	254	656	96
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.66	0.20	0.79	0.51	1.15	0.71	0.22

Intersection Summary

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

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	4	552	157	488	628	4	287	1	455	16	4	1
Future Volume (vph)	4	552	157	488	628	4	287	1	455	16	4	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.85			0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.96	
Satd. Flow (prot)	1805	1759	1553	1752	1791		1787	1524			1819	
Flt Permitted	0.42	1.00	1.00	0.28	1.00		0.74	1.00			0.28	
Satd. Flow (perm)	798	1759	1553	508	1791		1399	1524			525	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	4	563	160	498	641	4	293	1	464	16	4	1
RTOR Reduction (vph)	0	0	36	0	0	0	0	380	0	0	1	0
Lane Group Flow (vph)	4	563	124	498	645	0	293	85	0	0	20	0
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		6		5	2			4			8	
Permitted Phases	6		6	2			4			8		
Actuated Green, G (s)	53.7	53.7	53.7	77.0	77.0		20.0	20.0			20.0	
Effective Green, g (s)	53.7	53.7	53.7	77.0	77.0		20.0	20.0			20.0	
Actuated g/C Ratio	0.49	0.49	0.49	0.70	0.70		0.18	0.18			0.18	
Clearance Time (s)	7.0	7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	389	858	758	573	1253		254	277			95	
v/s Ratio Prot		0.32		c0.15	0.36			0.06				
v/s Ratio Perm	0.01		0.08	c0.46			c0.21				0.04	
v/c Ratio	0.01	0.66	0.16	0.87	0.51		1.15	0.31			0.21	
Uniform Delay, d1	14.5	21.2	15.7	12.7	7.7		45.0	39.0			38.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.0	2.4	0.2	13.2	1.5		104.3	0.6			1.1	
Delay (s)	14.5	23.6	15.9	25.9	9.2		149.3	39.6			39.4	
Level of Service	B	C	B	C	A		F	D			D	
Approach Delay (s)		21.9			16.5			82.0			39.4	
Approach LOS		C			B			F			D	

Intersection Summary

HCM 2000 Control Delay	36.9	HCM 2000 Level of Service		D	
HCM 2000 Volume to Capacity ratio	0.96				
Actuated Cycle Length (s)	110.0	Sum of lost time (s)		17.0	
Intersection Capacity Utilization	107.4%	ICU Level of Service		G	
Analysis Period (min)	15				

c Critical Lane Group

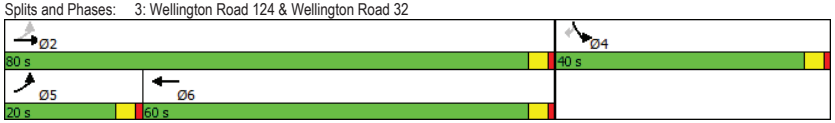
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	365	668	510	31	32	585
Future Volume (vph)	365	668	510	31	32	585
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	215.0			0.0	90.0	0.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.992			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1612	1827	1797	0	1444	1524
Flt Permitted	0.289				0.950	
Satd. Flow (perm)	490	1827	1797	0	1444	1524
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			3			441
Link Speed (k/h)		70	70		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		18.9	105.7		23.1	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Adj. Flow (vph)	372	682	520	32	33	597
Shared Lane Traffic (%)						
Lane Group Flow (vph)	372	682	552	0	33	597
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	2					4
Detector Phase	5	2	6		4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	30.0
Total Split (s)	20.0	80.0	60.0		40.0	40.0
Total Split (%)	16.7%	66.7%	50.0%		33.3%	33.3%
Maximum Green (s)	16.0	76.0	56.0		36.0	36.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	None	Max		None	None
Walk Time (s)		10.0	10.0		10.0	10.0
Flash Dont Walk (s)		16.0	16.0		16.0	16.0
Pedestrian Calls (#/hr)		0	0		0	0
Act Effct Green (s)	76.7	76.7	56.5		22.2	22.2
Actuated g/C Ratio	0.72	0.72	0.53		0.21	0.21
v/c Ratio	0.72	0.52	0.58		0.11	0.90
Control Delay	17.0	10.6	22.4		32.8	27.9
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	17.0	10.6	22.4		32.8	27.9
LOS	B	B	C		C	C
Approach Delay		12.8	22.4		28.2	
Approach LOS		B	C		C	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 107
Natural Cycle: 80
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.90
Intersection Signal Delay: 19.5 — Intersection LOS: B
Intersection Capacity Utilization 71.6% — ICU Level of Service C
Analysis Period (min) 15

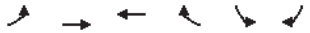
Splits and Phases: 3: Wellington Road 124 & Wellington Road 32



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	372	682	552	33	597
v/c Ratio	0.72	0.52	0.58	0.11	0.90
Control Delay	17.0	10.6	22.4	32.8	27.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	17.0	10.6	22.4	32.8	27.9
Queue Length 50th (m)	27.0	60.9	79.5	5.9	34.9
Queue Length 95th (m)	#70.0	127.1	143.1	14.1	87.3
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)	215.0			90.0	
Base Capacity (vph)	520	1310	951	490	808
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.72	0.52	0.58	0.07	0.74

Intersection Summary

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



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	365	668	510	31	32	585
Future Volume (vph)	365	668	510	31	32	585
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1612	1827	1798		1444	1524
Flt Permitted	0.29	1.00	1.00		0.95	1.00
Satd. Flow (perm)	490	1827	1798		1444	1524
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	372	682	520	32	33	597
RTOR Reduction (vph)	0	0	1	0	0	349
Lane Group Flow (vph)	372	682	551	0	33	248
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases	2					4
Actuated Green, G (s)	76.7	76.7	56.5		22.2	22.2
Effective Green, g (s)	76.7	76.7	56.5		22.2	22.2
Actuated g/C Ratio	0.72	0.72	0.53		0.21	0.21
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	521	1310	950		299	316
v/s Ratio Prot	c0.11	0.37	0.31		0.02	
v/s Ratio Perm	c0.40					c0.16
v/c Ratio	0.71	0.52	0.58		0.11	0.78
Uniform Delay, d1	10.0	6.8	17.1		34.3	40.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	5.7	0.4	2.6		0.3	13.7
Delay (s)	15.7	7.2	19.7		34.7	53.8
Level of Service	B	A	B		C	D
Approach Delay (s)		10.2	19.7		52.8	
Approach LOS		B	B		D	

Intersection Summary				
HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	106.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	89	614	1	2	472	28	3	5	5	64	6	45
Future Volume (vph)	89	614	1	2	472	28	3	5	5	64	6	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	140.0		0.0	135.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.992			0.948			0.947	
Flt Protected	0.950			0.950				0.989			0.973	
Satd. Flow (prot)	1703	1863	0	1805	1793	0	0	1781	0	0	1659	0
Flt Permitted	0.445			0.372				0.919			0.820	
Satd. Flow (perm)	798	1863	0	707	1793	0	0	1655	0	0	1398	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					8			5			35	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Adj. Flow (vph)	94	646	1	2	497	29	3	5	5	67	6	47
Shared Lane Traffic (%)												
Lane Group Flow (vph)	94	647	0	2	526	0	0	13	0	0	120	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	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	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			4			8		
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2		37.2	37.2		28.9	28.9		28.9	28.9	
Total Split (s)	60.0	60.0		60.0	60.0		20.0	20.0		20.0	20.0	
Total Split (%)	75.0%	75.0%		75.0%	75.0%		25.0%	25.0%		25.0%	25.0%	
Maximum Green (s)	52.8	52.8		52.8	52.8		13.1	13.1		13.1	13.1	
Yellow Time (s)	5.9	5.9		5.9	5.9		5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3		1.3	1.3		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5		4.5	4.5		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		None	None		None	None	
Walk Time (s)	15.0	15.0		15.0	15.0		11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	59.2	59.2		59.2	59.2			13.1			13.1	
Actuated g/C Ratio	0.73	0.73		0.73	0.73			0.16			0.16	
v/c Ratio	0.16	0.47		0.00	0.40			0.05			0.47	
Control Delay	6.0	7.7		4.5	6.8			23.4			28.9	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	6.0	7.7		4.5	6.8			23.4			28.9	
LOS	A	A		A	A			C			C	
Approach Delay		7.5			6.8			23.4			28.9	
Approach LOS		A			A			C			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80.6			
Natural Cycle: 70			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.47			
Intersection Signal Delay: 9.2		Intersection LOS: A	
Intersection Capacity Utilization 88.4%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	94	647	2	526	13	120
v/c Ratio	0.16	0.47	0.00	0.40	0.05	0.47
Control Delay	6.0	7.7	4.5	6.8	23.4	28.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.0	7.7	4.5	6.8	23.4	28.9
Queue Length 50th (m)	5.0	46.7	0.1	34.4	1.1	12.3
Queue Length 95th (m)	11.0	71.4	0.8	53.5	6.0	28.6
Internal Link Dist (m)		2030.4		1551.0	355.0	437.0
Turn Bay Length (m)	140.0		135.0			
Base Capacity (vph)	585	1367	519	1318	274	257
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.47	0.00	0.40	0.05	0.47

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	89	614	1	2	472	28	3	5	5	64	6	45
Future Volume (vph)	89	614	1	2	472	28	3	5	5	64	6	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	0.99			0.95			0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.97	
Satd. Flow (prot)	1703	1862		1805	1793			1781			1659	
Flt Permitted	0.45	1.00		0.37	1.00			0.92			0.82	
Satd. Flow (perm)	798	1862		707	1793			1656			1397	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	94	646	1	2	497	29	3	5	5	67	6	47
RTOR Reduction (vph)	0	0	0	0	2	0	0	4	0	0	31	0
Lane Group Flow (vph)	94	647	0	2	524	0	0	9	0	0	89	0
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	57.6	57.6		57.6	57.6			10.3			10.3	
Effective Green, g (s)	57.6	57.6		57.6	57.6			10.3			10.3	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.13			0.13	
Clearance Time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Vehicle Extension (s)	4.5	4.5		4.5	4.5			3.0			3.0	
Lane Grp Cap (vph)	560	1307		496	1259			208			175	
v/s Ratio Prot		c0.35			0.29							
v/s Ratio Perm	0.12			0.00				0.01			c0.06	
v/c Ratio	0.17	0.50		0.00	0.42			0.04			0.51	
Uniform Delay, d1	4.1	5.6		3.6	5.1			31.5			33.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.6	1.3		0.0	1.0			0.1			2.5	
Delay (s)	4.8	6.9		3.7	6.1			31.6			36.0	
Level of Service	A	A		A	A			C			D	
Approach Delay (s)		6.6			6.1			31.6			36.0	
Approach LOS		A			A			C			D	

Intersection Summary				
HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.50			
Actuated Cycle Length (s)	82.0	Sum of lost time (s)	14.1	
Intersection Capacity Utilization	88.4%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

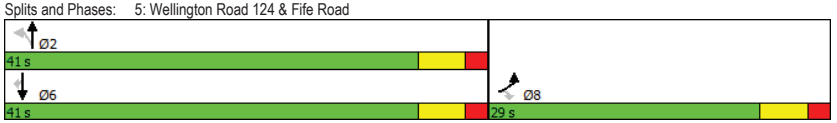
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	264	11	10	655	491	447
Future Volume (vph)	264	11	10	655	491	447
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950			0.999		
Satd. Flow (prot)	1770	1615	0	3503	1810	1583
Flt Permitted	0.950			0.947		
Satd. Flow (perm)	1770	1615	0	3320	1810	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		11				466
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Adj. Flow (vph)	275	11	10	682	511	466
Shared Lane Traffic (%)						
Lane Group Flow (vph)	275	11	0	692	511	466
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	29.0	29.0	41.0	41.0	41.0	41.0
Total Split (%)	41.4%	41.4%	58.6%	58.6%	58.6%	58.6%
Maximum Green (s)	23.0	23.0	35.0	35.0	35.0	35.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	14.6	14.6		35.1	35.1	35.1
Actuated g/C Ratio	0.24	0.24		0.57	0.57	0.57
v/c Ratio	0.66	0.03		0.37	0.50	0.42
Control Delay	29.1	9.7		8.7	11.1	2.3
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	29.1	9.7		8.7	11.1	2.3
LOS	C	A		A	B	A
Approach Delay	28.3			8.7	6.9	
Approach LOS	C			A	A	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 61.8
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 10.7 — Intersection LOS: B
Intersection Capacity Utilization 56.1% — ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road



Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	275	11	692	511	466
v/c Ratio	0.66	0.03	0.37	0.50	0.42
Control Delay	29.1	9.7	8.7	11.1	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	29.1	9.7	8.7	11.1	2.3
Queue Length 50th (m)	29.7	0.0	21.1	32.7	0.0
Queue Length 95th (m)	51.1	3.3	39.6	69.6	12.8
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	661	610	1887	1029	1100
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.42	0.02	0.37	0.50	0.42

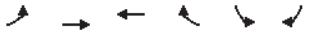
Intersection Summary

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	264	11	10	655	491	447
Future Volume (vph)	264	11	10	655	491	447
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1615		3504	1810	1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1615		3322	1810	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	275	11	10	682	511	466
RTOR Reduction (vph)	0	8	0	0	0	201
Lane Group Flow (vph)	275	3	0	692	511	265
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	14.6	14.6		35.2	35.2	35.2
Effective Green, g (s)	14.6	14.6		35.2	35.2	35.2
Actuated g/C Ratio	0.24	0.24		0.57	0.57	0.57
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	418	381		1892	1030	901
v/s Ratio Prot	c0.16				c0.28	
v/s Ratio Perm		0.00		0.21		0.17
v/c Ratio	0.66	0.01		0.37	0.50	0.29
Uniform Delay, d1	21.3	18.1		7.2	8.0	6.9
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.7	0.0		0.5	1.7	0.8
Delay (s)	25.1	18.1		7.8	9.7	7.7
Level of Service	C	B		A	A	A
Approach Delay (s)	24.8			7.8	8.7	
Approach LOS	C			A	A	

Intersection Summary				
HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.54			
Actuated Cycle Length (s)	61.8	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	56.1%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

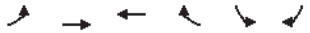
Appendix D

Traffic Operations Reports – 2031 Traffic Conditions



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	380	928	939	5	0	342
Future Volume (vph)	380	928	939	5	0	342
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	125.0			50.0	30.0	0.0
Storage Lanes	1			1	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.850		0.850
Flt Protected	0.950					
Satd. Flow (prot)	1770	1743	1743	1077	1900	1599
Flt Permitted	0.950					
Satd. Flow (perm)	1770	1743	1743	1077	1900	1599
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	2%	9%	9%	50%	0%	1%
Adj. Flow (vph)	400	977	988	5	0	360
Shared Lane Traffic (%)						
Lane Group Flow (vph)	400	977	988	5	0	360
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	380	928	939	5	0	342
Future Volume (Veh/h)	380	928	939	5	0	342
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)	400	977	988	5	0	360
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	993				2765	988
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	993				2765	988
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	43				100	0
cM capacity (veh/h)	696				9	301

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	400	977	988	5	0	360
Volume Left	400	0	0	0	0	0
Volume Right	0	0	0	5	0	360
cSH	696	1700	1700	1700	1700	301
Volume to Capacity	0.57	0.57	0.58	0.00	0.00	1.20
Queue Length 95th (m)	29.5	0.0	0.0	0.0	0.0	126.9
Control Delay (s)	16.9	0.0	0.0	0.0	0.0	152.3
Lane LOS	C				A	F
Approach Delay (s)	4.9		0.0		152.3	
Approach LOS					F	

Intersection Summary				
Average Delay		22.6		
Intersection Capacity Utilization		77.3%	ICU Level of Service	D
Analysis Period (min)		15		

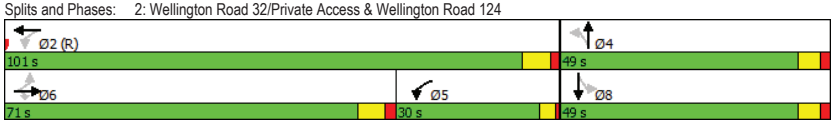
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	741	169	384	648	0	304	0	757	1	0	0
Future Volume (vph)	0	741	169	384	648	0	304	0	757	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	40.0		25.0	55.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		1	1		0	1		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850					0.850				
Flt Protected				0.950			0.950				0.950	
Satd. Flow (prot)	1900	1712	1495	1703	1667	0	1752	1568	0	0	1805	0
Flt Permitted				0.056			0.757				0.093	
Satd. Flow (perm)	1900	1712	1495	100	1667	0	1396	1568	0	0	177	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			73					350				
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
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%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Adj. Flow (vph)	0	823	188	427	720	0	338	0	841	1	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	823	188	427	720	0	338	841	0	0	1	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)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	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	
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		6		5	2			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2			4			8		
Detector Phase	6	6	6	5	2		4	4		8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0	35.0	8.0	35.0		12.0	12.0		12.0	12.0	
Minimum Split (s)	42.0	42.0	42.0	12.0	42.0		26.0	26.0		26.0	26.0	
Total Split (s)	71.0	71.0	71.0	30.0	101.0		49.0	49.0		49.0	49.0	
Total Split (%)	47.3%	47.3%	47.3%	20.0%	67.3%		32.7%	32.7%		32.7%	32.7%	
Maximum Green (s)	64.0	64.0	64.0	26.0	94.0		43.0	43.0		43.0	43.0	
Yellow Time (s)	5.0	5.0	5.0	3.0	5.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	7.0	7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Lead/Lag	Lead	Lead	Lead	Lag								
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	C-Max		None	None		None	None	
Walk Time (s)	23.0	23.0	23.0		23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0	12.0		12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0	0		0		0	0		0	0	
Act Effct Green (s)		64.0	64.0	97.0	94.0		43.0	43.0			43.0	
Actuated g/C Ratio		0.43	0.43	0.65	0.63		0.29	0.29			0.29	
v/c Ratio		1.13	0.28	1.25	0.69		0.84	1.20			0.02	
Control Delay		113.8	17.8	160.0	10.7		70.1	131.5			40.0	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay		113.8	17.8	160.0	10.7		70.1	131.5			40.0	
LOS		F	B	F	B		E	F			D	
Approach Delay		96.0			66.2			113.9			40.0	
Approach LOS		F			E			F			D	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 134 (89%), Referenced to phase 2:WBTL, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.25
Intersection Signal Delay: 92.1 Intersection LOS: F
Intersection Capacity Utilization 126.8% ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124



Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	823	188	427	720	338	841	1
v/c Ratio	1.13	0.28	1.25	0.69	0.84	1.20	0.02
Control Delay	113.8	17.8	160.0	10.7	70.1	131.5	40.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	113.8	17.8	160.0	10.7	70.1	131.5	40.0
Queue Length 50th (m)	~297.2	22.3	~151.7	49.8	100.1	~237.0	0.2
Queue Length 95th (m)	#378.9	41.1	m#214.4	83.5	#153.8	#320.6	1.9
Internal Link Dist (m)	1665.7			343.4		471.1	37.2
Turn Bay Length (m)		25.0	55.0		60.0		
Base Capacity (vph)	730	679	342	1044	400	699	50
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.13	0.28	1.25	0.69	0.84	1.20	0.02

Intersection Summary

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

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	741	169	384	648	0	304	0	757	1	0	0
Future Volume (vph)	0	741	169	384	648	0	304	0	757	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Lane Util. Factor		1.00	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			1.00	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00			0.95	
Satd. Flow (prot)		1712	1495	1703	1667		1752	1568			1805	
Flt Permitted		1.00	1.00	0.06	1.00		0.76	1.00			0.09	
Satd. Flow (perm)		1712	1495	101	1667		1397	1568			177	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	823	188	427	720	0	338	0	841	1	0	0
RTOR Reduction (vph)	0	0	42	0	0	0	0	250	0	0	0	0
Lane Group Flow (vph)	0	823	146	427	720	0	338	591	0	0	1	0
Heavy Vehicles (%)	0%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		6		5	2			4			8	
Permitted Phases	6		6	2			4			8		
Actuated Green, G (s)		64.0	64.0	97.0	94.0		43.0	43.0			43.0	
Effective Green, g (s)		64.0	64.0	97.0	94.0		43.0	43.0			43.0	
Actuated g/C Ratio		0.43	0.43	0.65	0.63		0.29	0.29			0.29	
Clearance Time (s)		7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Vehicle Extension (s)		5.0	5.0	3.0	5.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		730	637	342	1044		400	449			50	
v/s Ratio Prot		0.48		c0.22	0.43			c0.38				
v/s Ratio Perm			0.10	c0.59			0.24				0.01	
v/c Ratio		1.13	0.23	1.25	0.69		0.84	1.32			0.02	
Uniform Delay, d1		43.0	27.3	57.3	18.4		50.4	53.5			38.4	
Progression Factor		1.00	1.00	0.71	0.45		1.00	1.00			1.00	
Incremental Delay, d2		74.2	0.4	125.2	2.1		15.0	157.7			0.2	
Delay (s)		117.2	27.7	165.7	10.4		65.4	211.2			38.5	
Level of Service		F	C	F	B		E	F			D	
Approach Delay (s)		100.6			68.2			169.4			38.5	
Approach LOS		F			E			F			D	

Intersection Summary

HCM 2000 Control Delay	113.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.31		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	126.8%	ICU Level of Service	H
Analysis Period (min)	15		

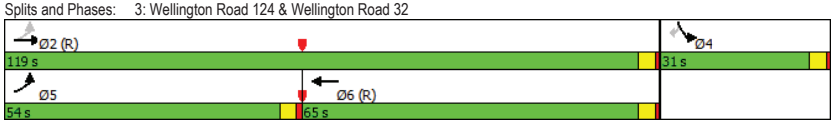
c Critical Lane Group

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	532	947	559	22	28	503
Future Volume (vph)	532	947	559	22	28	503
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	215.0			0.0	90.0	0.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.995			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1641	1792	1700	0	1530	1429
Flt Permitted	0.158				0.950	
Satd. Flow (perm)	273	1792	1700	0	1530	1429
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			2			565
Link Speed (k/h)		70	70		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		18.9	105.7		23.1	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Adj. Flow (vph)	598	1064	628	25	31	565
Shared Lane Traffic (%)						
Lane Group Flow (vph)	598	1064	653	0	31	565
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	2					4
Detector Phase	5	2	6		4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	30.0
Total Split (s)	54.0	119.0	65.0		31.0	31.0
Total Split (%)	36.0%	79.3%	43.3%		20.7%	20.7%
Maximum Green (s)	50.0	115.0	61.0		27.0	27.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	C-Max	C-Max		None	None
Walk Time (s)		10.0	10.0		10.0	10.0
Flash Dont Walk (s)		16.0	16.0		16.0	16.0
Pedestrian Calls (#/hr)		0	0		0	0
Act Effct Green (s)	126.9	126.9	69.7		15.1	15.1
Actuated g/C Ratio	0.85	0.85	0.46		0.10	0.10
v/c Ratio	0.84	0.70	0.83		0.20	0.87
Control Delay	33.3	2.2	46.6		61.1	19.0
Queue Delay	0.0	0.4	0.0		0.0	0.0
Total Delay	33.3	2.6	46.6		61.1	19.0
LOS	C	A	D		E	B
Approach Delay		13.7	46.6		21.2	
Approach LOS		B	D		C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 150			
Actuated Cycle Length: 150			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green			
Natural Cycle: 130			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.87			
Intersection Signal Delay: 22.6		Intersection LOS: C	
Intersection Capacity Utilization 74.4%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 3: Wellington Road 124 & Wellington Road 32



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	598	1064	653	31	565
v/c Ratio	0.84	0.70	0.83	0.20	0.87
Control Delay	33.3	2.2	46.6	61.1	19.0
Queue Delay	0.0	0.4	0.0	0.0	0.0
Total Delay	33.3	2.6	46.6	61.1	19.0
Queue Length 50th (m)	103.1	28.3	176.5	9.3	0.0
Queue Length 95th (m)	m93.9	m33.1	#272.1	18.5	39.5
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)	215.0			90.0	
Base Capacity (vph)	722	1515	791	275	720
Starvation Cap Reductn	0	130	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.83	0.77	0.83	0.11	0.78

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	532	947	559	22	28	503
Future Volume (vph)	532	947	559	22	28	503
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1641	1792	1700		1530	1429
Flt Permitted	0.16	1.00	1.00		0.95	1.00
Satd. Flow (perm)	273	1792	1700		1530	1429
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	598	1064	628	25	31	565
RTOR Reduction (vph)	0	0	1	0	0	508
Lane Group Flow (vph)	598	1064	652	0	31	57
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases	2					4
Actuated Green, G (s)	126.9	126.9	69.7		15.1	15.1
Effective Green, g (s)	126.9	126.9	69.7		15.1	15.1
Actuated g/C Ratio	0.85	0.85	0.46		0.10	0.10
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	716	1516	789		154	143
v/s Ratio Prot	c0.30	0.59	0.38		0.02	
v/s Ratio Perm	c0.41					c0.04
v/c Ratio	0.84	0.70	0.83		0.20	0.40
Uniform Delay, d1	30.5	4.4	34.9		61.9	63.2
Progression Factor	1.25	0.32	1.00		1.00	1.00
Incremental Delay, d2	0.9	0.3	9.7		1.4	3.8
Delay (s)	39.1	1.6	44.5		63.3	67.0
Level of Service	D	A	D		E	E
Approach Delay (s)		15.1	44.5		66.8	
Approach LOS		B	D		E	

Intersection Summary				
HCM 2000 Control Delay	32.3	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.80			
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	74.4%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	856	4	5	550	78	4	8	4	32	5	35
Future Volume (vph)	67	856	4	5	550	78	4	8	4	32	5	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	140.0		0.0	135.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999			0.981			0.968			0.935	
Flt Protected	0.950			0.950				0.988			0.978	
Satd. Flow (prot)	1736	1774	0	1444	1756	0	0	1667	0	0	1371	0
Flt Permitted	0.340			0.201				0.919			0.849	
Satd. Flow (perm)	621	1774	0	306	1756	0	0	1551	0	0	1190	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					14			4			39	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
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 (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Adj. Flow (vph)	74	951	4	6	611	87	4	9	4	36	6	39
Shared Lane Traffic (%)												
Lane Group Flow (vph)	74	955	0	6	698	0	0	17	0	0	81	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	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	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			4			8		
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2		37.2	37.2		28.9	28.9		28.9	28.9	
Total Split (s)	61.1	61.1		61.1	61.1		28.9	28.9		28.9	28.9	
Total Split (%)	67.9%	67.9%		67.9%	67.9%		32.1%	32.1%		32.1%	32.1%	
Maximum Green (s)	53.9	53.9		53.9	53.9		22.0	22.0		22.0	22.0	
Yellow Time (s)	5.9	5.9		5.9	5.9		5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3		1.3	1.3		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5		4.5	4.5		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		None	None		None	None	
Walk Time (s)	15.0	15.0		15.0	15.0		11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	62.4	62.4		62.4	62.4			15.1			15.1	
Actuated g/C Ratio	0.73	0.73		0.73	0.73			0.18			0.18	
v/c Ratio	0.16	0.74		0.03	0.54			0.06			0.33	
Control Delay	6.8	14.5		5.6	9.2			24.7			22.4	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	6.8	14.5		5.6	9.2			24.7			22.4	
LOS	A	B		A	A			C			C	
Approach Delay		13.9			9.1			24.7			22.4	
Approach LOS		B			A			C			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 85.2			
Natural Cycle: 90			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.74			
Intersection Signal Delay: 12.6		Intersection LOS: B	
Intersection Capacity Utilization 79.9%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124

Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	74	955	6	698	17	81
v/c Ratio	0.16	0.74	0.03	0.54	0.06	0.33
Control Delay	6.8	14.5	5.6	9.2	24.7	22.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.8	14.5	5.6	9.2	24.7	22.4
Queue Length 50th (m)	4.3	106.4	0.3	58.1	1.9	6.3
Queue Length 95th (m)	10.2	#176.7	1.7	90.2	7.4	18.9
Internal Link Dist (m)		2030.4		1551.0	355.0	437.0
Turn Bay Length (m)	140.0		135.0			
Base Capacity (vph)	455	1299	224	1290	406	338
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.74	0.03	0.54	0.04	0.24

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	856	4	5	550	78	4	8	4	32	5	35
Future Volume (vph)	67	856	4	5	550	78	4	8	4	32	5	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	0.98			0.97			0.94	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.98	
Satd. Flow (prot)	1736	1775		1444	1757			1668			1371	
Flt Permitted	0.34	1.00		0.20	1.00			0.92			0.85	
Satd. Flow (perm)	620	1775		305	1757			1551			1190	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	74	951	4	6	611	87	4	9	4	36	6	39
RTOR Reduction (vph)	0	0	0	0	4	0	0	3	0	0	34	0
Lane Group Flow (vph)	74	955	0	6	694	0	0	14	0	0	47	0
Heavy Vehicles (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	60.8	60.8		60.8	60.8			11.7			11.7	
Effective Green, g (s)	60.8	60.8		60.8	60.8			11.7			11.7	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.14			0.14	
Clearance Time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Vehicle Extension (s)	4.5	4.5		4.5	4.5			3.0			3.0	
Lane Grp Cap (vph)	435	1246		214	1233			209			160	
v/s Ratio Prot		c0.54			0.39							
v/s Ratio Perm	0.12			0.02				0.01			c0.04	
v/c Ratio	0.17	0.77		0.03	0.56			0.06			0.30	
Uniform Delay, d1	4.4	8.3		3.9	6.4			32.7			33.7	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.8	4.5		0.2	1.9			0.1			1.0	
Delay (s)	5.2	12.9		4.2	8.2			32.8			34.8	
Level of Service	A	B		A	A			C			C	
Approach Delay (s)		12.3			8.2			32.8			34.8	
Approach LOS		B			A			C			C	

Intersection Summary				
HCM 2000 Control Delay	11.9	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.69			
Actuated Cycle Length (s)	86.6	Sum of lost time (s)	14.1	
Intersection Capacity Utilization	79.9%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

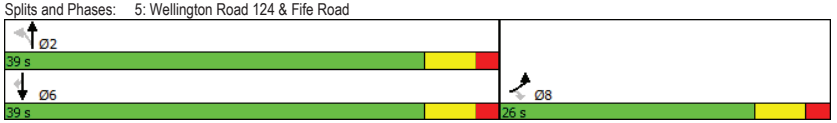
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	410	12	4	895	582	308
Future Volume (vph)	410	12	4	895	582	308
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950					
Satd. Flow (prot)	1770	1214	0	3375	1792	1553
Flt Permitted	0.950			0.953		
Satd. Flow (perm)	1770	1214	0	3216	1792	1553
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		13				335
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Adj. Flow (vph)	446	13	4	973	633	335
Shared Lane Traffic (%)						
Lane Group Flow (vph)	446	13	0	977	633	335
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	26.0	26.0	39.0	39.0	39.0	39.0
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Maximum Green (s)	20.0	20.0	33.0	33.0	33.0	33.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	18.6	18.6		33.1	33.1	33.1
Actuated g/C Ratio	0.29	0.29		0.52	0.52	0.52
v/c Ratio	0.86	0.04		0.59	0.68	0.35
Control Delay	40.2	9.0		12.7	16.5	2.3
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	40.2	9.0		12.7	16.5	2.3
LOS	D	A		B	B	A
Approach Delay	39.3			12.7	11.6	
Approach LOS	D			B	B	

Intersection Summary

Area Type: Other
Cycle Length: 65
Actuated Cycle Length: 63.7
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 17.3 — Intersection LOS: B
Intersection Capacity Utilization 63.3% — ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road



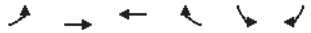
Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	446	13	977	633	335
v/c Ratio	0.86	0.04	0.59	0.68	0.35
Control Delay	40.2	9.0	12.7	16.5	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	40.2	9.0	12.7	16.5	2.3
Queue Length 50th (m)	51.7	0.0	42.6	56.6	0.0
Queue Length 95th (m)	#98.4	3.4	60.0	92.9	10.9
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	556	390	1668	929	967
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.80	0.03	0.59	0.68	0.35

Intersection Summary

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

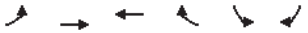
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	410	12	4	895	582	308
Future Volume (vph)	410	12	4	895	582	308
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1214		3374	1792	1553
Flt Permitted	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1214		3216	1792	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	446	13	4	973	633	335
RTOR Reduction (vph)	0	9	0	0	0	161
Lane Group Flow (vph)	446	4	0	977	633	174
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	18.6	18.6		33.0	33.0	33.0
Effective Green, g (s)	18.6	18.6		33.0	33.0	33.0
Actuated g/C Ratio	0.29	0.29		0.52	0.52	0.52
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	517	355		1668	929	805
v/s Ratio Prot	c0.25				c0.35	
v/s Ratio Perm		0.00		0.30		0.11
v/c Ratio	0.86	0.01		0.59	0.68	0.22
Uniform Delay, d1	21.3	16.0		10.6	11.4	8.3
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	13.9	0.0		1.5	4.0	0.6
Delay (s)	35.2	16.0		12.1	15.4	8.9
Level of Service	D	B		B	B	A
Approach Delay (s)	34.6			12.1	13.2	
Approach LOS	C			B	B	

Intersection Summary				
HCM 2000 Control Delay	16.8	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.75			
Actuated Cycle Length (s)	63.6	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	63.3%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	255	899	1167	12	1	451
Future Volume (vph)	255	899	1167	12	1	451
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	125.0			50.0	30.0	0.0
Storage Lanes	1			1	1	1
Taper Length (m)	7.5				7.5	
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)	1787	1759	1827	1615	1805	1615
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1787	1759	1827	1615	1805	1615
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Heavy Vehicles (%)	1%	8%	4%	0%	0%	0%
Adj. Flow (vph)	266	936	1216	14	1	470
Shared Lane Traffic (%)						
Lane Group Flow (vph)	266	936	1216	14	1	470
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	96.0%	ICU Level of Service	F
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	255	899	1167	12	1	451
Future Volume (Veh/h)	255	899	1167	12	1	451
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Hourly flow rate (vph)	266	936	1216	14	1	470
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	1230				2684	1216
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1230				2684	1216
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	53				92	0
cM capacity (veh/h)	570				13	223

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	266	936	1216	14	1	470
Volume Left	266	0	0	0	1	0
Volume Right	0	0	0	14	0	470
cSH	570	1700	1700	1700	13	223
Volume to Capacity	0.47	0.55	0.72	0.01	0.08	2.11
Queue Length 95th (m)	19.7	0.0	0.0	0.0	1.7	286.5
Control Delay (s)	16.7	0.0	0.0	0.0	301.8	549.1
Lane LOS	C				F	F
Approach Delay (s)	3.7		0.0		548.6	
Approach LOS					F	

Intersection Summary				
Average Delay	90.5			
Intersection Capacity Utilization	96.0%	ICU Level of Service		F
Analysis Period (min)	15			

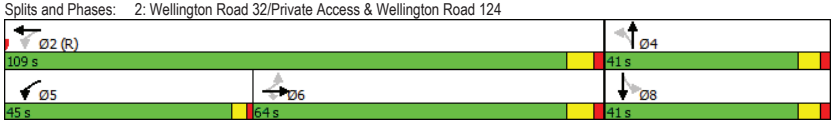
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	714	203	631	812	5	371	1	589	21	5	1
Future Volume (vph)	5	714	203	631	812	5	371	1	589	21	5	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	40.0		25.0	55.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		1	1		0	1		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.999			0.850			0.995	
Flt Protected	0.950			0.950			0.950				0.963	
Satd. Flow (prot)	1805	1759	1553	1752	1791	0	1787	1524	0	0	1821	0
Flt Permitted	0.352			0.066			0.740				0.282	
Satd. Flow (perm)	669	1759	1553	122	1791	0	1392	1524	0	0	533	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			51					506			1	
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Adj. Flow (vph)	5	729	207	644	829	5	379	1	601	21	5	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	5	729	207	644	834	0	379	602	0	0	27	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)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	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	
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		6		5	2			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2			4			8		
Detector Phase	6	6	6	5	2		4	4		8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0	35.0	8.0	35.0		12.0	12.0		12.0	12.0	
Minimum Split (s)	42.0	42.0	42.0	12.0	42.0		26.0	26.0		26.0	26.0	
Total Split (s)	64.0	64.0	64.0	45.0	109.0		41.0	41.0		41.0	41.0	
Total Split (%)	42.7%	42.7%	42.7%	30.0%	72.7%		27.3%	27.3%		27.3%	27.3%	
Maximum Green (s)	57.0	57.0	57.0	41.0	102.0		35.0	35.0		35.0	35.0	
Yellow Time (s)	5.0	5.0	5.0	3.0	5.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	7.0	7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Lead/Lag	Lag	Lag	Lag	Lead								
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	C-Max		None	None		None	None	
Walk Time (s)	23.0	23.0	23.0		23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0	12.0		12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0	0		0		0	0		0	0	
Act Effct Green (s)	57.0	57.0	57.0	105.0	102.0		35.0	35.0			35.0	
Actuated g/C Ratio	0.38	0.38	0.38	0.70	0.68		0.23	0.23			0.23	
v/c Ratio	0.02	1.09	0.33	1.22	0.69		1.17	0.81			0.22	
Control Delay	29.6	105.7	26.2	149.1	5.2		153.5	18.9			50.5	
Queue Delay	0.0	0.0	0.0	0.0	0.3		0.0	0.0			0.0	
Total Delay	29.6	105.7	26.2	149.1	5.4		153.5	18.9			50.5	
LOS	C	F	C	F	A		F	B			D	
Approach Delay		87.8			68.1			70.9			50.5	
Approach LOS		F			E			E			D	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 32 (21%), Referenced to phase 2:WBTL, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.22
Intersection Signal Delay: 74.2 Intersection LOS: E
Intersection Capacity Utilization 125.4% ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	5	729	207	644	834	379	602	27
v/c Ratio	0.02	1.09	0.33	1.22	0.69	1.17	0.81	0.22
Control Delay	29.6	105.7	26.2	149.1	5.2	153.5	18.9	50.5
Queue Delay	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
Total Delay	29.6	105.7	26.2	149.1	5.4	153.5	18.9	50.5
Queue Length 50th (m)	1.0	~256.3	34.0	~232.6	48.1	~140.6	27.3	6.6
Queue Length 95th (m)	4.2	#336.1	56.2	m#232.7	m46.6	#207.5	85.6	16.7
Internal Link Dist (m)		1665.7			343.4		471.1	37.2
Turn Bay Length (m)	40.0		25.0	55.0		60.0		
Base Capacity (vph)	254	668	621	530	1217	324	743	125
Starvation Cap Reductn	0	0	0	0	70	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.02	1.09	0.33	1.22	0.73	1.17	0.81	0.22

Intersection Summary

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

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	714	203	631	812	5	371	1	589	21	5	1
Future Volume (vph)	5	714	203	631	812	5	371	1	589	21	5	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.85			0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.96	
Satd. Flow (prot)	1805	1759	1553	1752	1791		1787	1524			1820	
Flt Permitted	0.35	1.00	1.00	0.07	1.00		0.74	1.00			0.28	
Satd. Flow (perm)	669	1759	1553	121	1791		1391	1524			533	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	5	729	207	644	829	5	379	1	601	21	5	1
RTOR Reduction (vph)	0	0	32	0	0	0	0	388	0	0	1	0
Lane Group Flow (vph)	5	729	175	644	834	0	379	214	0	0	26	0
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		6		5	2			4			8	
Permitted Phases	6		6	2			4			8		
Actuated Green, G (s)	57.0	57.0	57.0	102.0	102.0		35.0	35.0			35.0	
Effective Green, g (s)	57.0	57.0	57.0	102.0	102.0		35.0	35.0			35.0	
Actuated g/C Ratio	0.38	0.38	0.38	0.68	0.68		0.23	0.23			0.23	
Clearance Time (s)	7.0	7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	254	668	590	528	1217		324	355			124	
v/s Ratio Prot		0.41		c0.33	0.47			0.14				
v/s Ratio Perm	0.01		0.11	c0.50			c0.27				0.05	
v/c Ratio	0.02	1.09	0.30	1.22	0.69		1.17	0.60			0.21	
Uniform Delay, d1	29.0	46.5	32.5	47.9	14.4		57.5	51.3			46.4	
Progression Factor	1.00	1.00	1.00	1.29	0.29		1.00	1.00			1.00	
Incremental Delay, d2	0.1	62.3	0.6	103.7	0.8		104.4	2.9			0.9	
Delay (s)	29.1	108.8	33.1	165.4	5.0		161.9	54.2			47.2	
Level of Service	C	F	C	F	A		F	D			D	
Approach Delay (s)		91.7			74.9			95.8			47.2	
Approach LOS		F			E			F			D	

Intersection Summary				
HCM 2000 Control Delay	85.3	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.23			
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	125.4%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

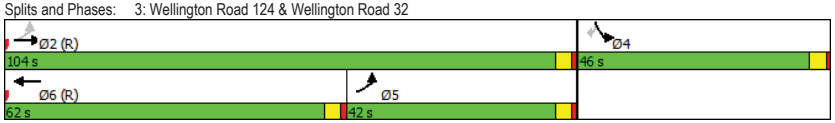
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	472	864	660	40	41	757
Future Volume (vph)	472	864	660	40	41	757
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	215.0			0.0	90.0	0.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.992			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1612	1827	1797	0	1444	1524
Flt Permitted	0.064				0.950	
Satd. Flow (perm)	109	1827	1797	0	1444	1524
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			2			497
Link Speed (k/h)		70	70		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		18.9	105.7		23.1	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Adj. Flow (vph)	482	882	673	41	42	772
Shared Lane Traffic (%)						
Lane Group Flow (vph)	482	882	714	0	42	772
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	2					4
Detector Phase	5	2	6		4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	30.0
Total Split (s)	42.0	104.0	62.0		46.0	46.0
Total Split (%)	28.0%	69.3%	41.3%		30.7%	30.7%
Maximum Green (s)	38.0	100.0	58.0		42.0	42.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	C-Max	C-Max		None	None
Walk Time (s)		10.0	10.0		10.0	10.0
Flash Dont Walk (s)		16.0	16.0		16.0	16.0
Pedestrian Calls (#/hr)		0	0		0	0
Act Effct Green (s)	100.2	100.2	58.2		41.8	41.8
Actuated g/C Ratio	0.67	0.67	0.39		0.28	0.28
v/c Ratio	1.06	0.72	1.02		0.10	0.99
Control Delay	76.6	9.6	84.5		41.1	48.0
Queue Delay	0.0	0.3	0.0		0.0	0.0
Total Delay	76.6	10.0	84.5		41.1	48.0
LOS	E	A	F		D	D
Approach Delay		33.5	84.5		47.6	
Approach LOS		C	F		D	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 56 (37%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.06
Intersection Signal Delay: 50.1 Intersection LOS: D
Intersection Capacity Utilization 90.7% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 3: Wellington Road 124 & Wellington Road 32



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	482	882	714	42	772
v/c Ratio	1.06	0.72	1.02	0.10	0.99
Control Delay	76.6	9.6	84.5	41.1	48.0
Queue Delay	0.0	0.3	0.0	0.0	0.0
Total Delay	76.6	10.0	84.5	41.1	48.0
Queue Length 50th (m)	~153.1	71.0	~237.3	9.8	112.9
Queue Length 95th (m)	m#173.2	m87.9	#317.6	20.5	#208.7
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)	215.0			90.0	
Base Capacity (vph)	453	1220	698	404	784
Starvation Cap Reductn	0	65	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.06	0.76	1.02	0.10	0.98

Intersection Summary

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

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	472	864	660	40	41	757
Future Volume (vph)	472	864	660	40	41	757
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1612	1827	1798		1444	1524
Flt Permitted	0.06	1.00	1.00		0.95	1.00
Satd. Flow (perm)	109	1827	1798		1444	1524
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	482	882	673	41	42	772
RTOR Reduction (vph)	0	0	1	0	0	359
Lane Group Flow (vph)	482	882	713	0	42	413
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases	2					4
Actuated Green, G (s)	100.2	100.2	58.2		41.8	41.8
Effective Green, g (s)	100.2	100.2	58.2		41.8	41.8
Actuated g/C Ratio	0.67	0.67	0.39		0.28	0.28
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	453	1220	697		402	424
v/s Ratio Prot	c0.27	0.48	0.40		0.03	
v/s Ratio Perm	c0.44					c0.27
v/c Ratio	1.06	0.72	1.02		0.10	0.98
Uniform Delay, d1	51.9	16.0	45.9		40.2	53.6
Progression Factor	0.64	0.50	1.00		1.00	1.00
Incremental Delay, d2	43.5	1.3	39.9		0.2	37.3
Delay (s)	77.0	9.3	85.8		40.4	90.9
Level of Service	E	A	F		D	F
Approach Delay (s)		33.2	85.8		88.3	
Approach LOS		C	F		F	

Intersection Summary

HCM 2000 Control Delay	61.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.7%	ICU Level of Service	E
Analysis Period (min)	15		

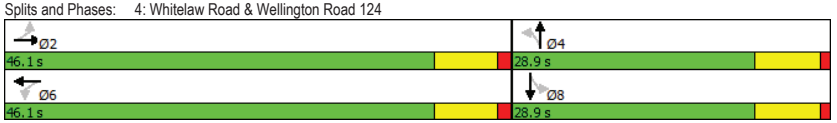
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	794	1	3	611	36	4	6	6	83	8	58
Future Volume (vph)	115	794	1	3	611	36	4	6	6	83	8	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	140.0		0.0	135.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.992			0.949			0.947	
Flt Protected	0.950			0.950				0.988			0.973	
Satd. Flow (prot)	1703	1863	0	1805	1793	0	0	1781	0	0	1659	0
Flt Permitted	0.323			0.223				0.902			0.818	
Satd. Flow (perm)	579	1863	0	424	1793	0	0	1626	0	0	1395	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					6			6			44	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Adj. Flow (vph)	121	836	1	3	643	38	4	6	6	87	8	61
Shared Lane Traffic (%)												
Lane Group Flow (vph)	121	837	0	3	681	0	0	16	0	0	156	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	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	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			4			8		
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2		37.2	37.2		28.9	28.9		28.9	28.9	
Total Split (s)	46.1	46.1		46.1	46.1		28.9	28.9		28.9	28.9	
Total Split (%)	61.5%	61.5%		61.5%	61.5%		38.5%	38.5%		38.5%	38.5%	
Maximum Green (s)	38.9	38.9		38.9	38.9		22.0	22.0		22.0	22.0	
Yellow Time (s)	5.9	5.9		5.9	5.9		5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3		1.3	1.3		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5		4.5	4.5		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		None	None		None	None	
Walk Time (s)	15.0	15.0		15.0	15.0		11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	43.8	43.8		43.8	43.8			15.3			15.3	
Actuated g/C Ratio	0.65	0.65		0.65	0.65			0.23			0.23	
v/c Ratio	0.32	0.69		0.01	0.58			0.04			0.44	
Control Delay	11.2	14.8		6.7	11.8			17.1			21.0	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	11.2	14.8		6.7	11.8			17.1			21.0	
LOS	B	B		A	B			B			C	
Approach Delay		14.3			11.8			17.1			21.0	
Approach LOS		B			B			B			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 75			
Actuated Cycle Length: 66.9			
Natural Cycle: 75			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.69			
Intersection Signal Delay: 14.0		Intersection LOS: B	
Intersection Capacity Utilization 99.8%		ICU Level of Service F	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	121	837	3	681	16	156
v/c Ratio	0.32	0.69	0.01	0.58	0.04	0.44
Control Delay	11.2	14.8	6.7	11.8	17.1	21.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.2	14.8	6.7	11.8	17.1	21.0
Queue Length 50th (m)	7.8	78.2	0.2	55.8	1.1	12.7
Queue Length 95th (m)	20.2	#140.3	1.3	95.7	5.5	29.2
Internal Link Dist (m)		2030.4		1551.0	355.0	437.0
Turn Bay Length (m)	140.0		135.0			
Base Capacity (vph)	379	1220	277	1177	540	489
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.69	0.01	0.58	0.03	0.32

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	794	1	3	611	36	4	6	6	83	8	58
Future Volume (vph)	115	794	1	3	611	36	4	6	6	83	8	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	0.99			0.95			0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.97	
Satd. Flow (prot)	1703	1862		1805	1792			1782			1659	
Flt Permitted	0.32	1.00		0.22	1.00			0.90			0.82	
Satd. Flow (perm)	578	1862		423	1792			1626			1395	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	121	836	1	3	643	38	4	6	6	87	8	61
RTOR Reduction (vph)	0	0	0	0	2	0	0	5	0	0	36	0
Lane Group Flow (vph)	121	837	0	3	679	0	0	11	0	0	120	0
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	42.3	42.3		42.3	42.3			12.0			12.0	
Effective Green, g (s)	42.3	42.3		42.3	42.3			12.0			12.0	
Actuated g/C Ratio	0.62	0.62		0.62	0.62			0.18			0.18	
Clearance Time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Vehicle Extension (s)	4.5	4.5		4.5	4.5			3.0			3.0	
Lane Grp Cap (vph)	357	1151		261	1108			285			244	
v/s Ratio Prot		c0.45			0.38							
v/s Ratio Perm	0.21			0.01				0.01			c0.09	
v/c Ratio	0.34	0.73		0.01	0.61			0.04			0.49	
Uniform Delay, d1	6.3	9.0		5.0	8.0			23.4			25.4	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	2.6	4.0		0.1	2.5			0.1			1.6	
Delay (s)	8.9	13.1		5.1	10.5			23.5			27.0	
Level of Service	A	B		A	B			C			C	
Approach Delay (s)		12.6			10.5			23.5			27.0	
Approach LOS		B			B			C			C	

Intersection Summary					
HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B		
HCM 2000 Volume to Capacity ratio	0.67				
Actuated Cycle Length (s)	68.4	Sum of lost time (s)	14.1		
Intersection Capacity Utilization	99.8%	ICU Level of Service	F		
Analysis Period (min)	15				
c Critical Lane Group					

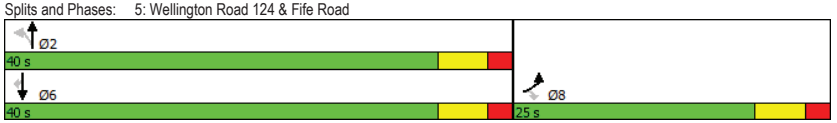
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	342	14	13	847	635	578
Future Volume (vph)	342	14	13	847	635	578
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950			0.999		
Satd. Flow (prot)	1770	1615	0	3503	1810	1583
Flt Permitted	0.950			0.943		
Satd. Flow (perm)	1770	1615	0	3307	1810	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		15				602
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Adj. Flow (vph)	356	15	14	882	661	602
Shared Lane Traffic (%)						
Lane Group Flow (vph)	356	15	0	896	661	602
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	25.0	25.0	40.0	40.0	40.0	40.0
Total Split (%)	38.5%	38.5%	61.5%	61.5%	61.5%	61.5%
Maximum Green (s)	19.0	19.0	34.0	34.0	34.0	34.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	16.2	16.2		34.1	34.1	34.1
Actuated g/C Ratio	0.26	0.26		0.55	0.55	0.55
v/c Ratio	0.77	0.03		0.50	0.67	0.53
Control Delay	33.9	9.0		10.5	15.0	2.8
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	33.9	9.0		10.5	15.0	2.8
LOS	C	A		B	B	A
Approach Delay	32.9			10.5	9.2	
Approach LOS	C			B	A	

Intersection Summary

Area Type: Other
Cycle Length: 65
Actuated Cycle Length: 62.3
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 13.1 — Intersection LOS: B
Intersection Capacity Utilization 69.6% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road



Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	356	15	896	661	602
v/c Ratio	0.77	0.03	0.50	0.67	0.53
Control Delay	33.9	9.0	10.5	15.0	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	33.9	9.0	10.5	15.0	2.8
Queue Length 50th (m)	39.6	0.0	34.4	55.4	0.0
Queue Length 95th (m)	#68.9	3.8	50.6	94.9	13.5
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	541	503	1808	989	1138
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.66	0.03	0.50	0.67	0.53

Intersection Summary

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

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	342	14	13	847	635	578
Future Volume (vph)	342	14	13	847	635	578
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1615		3504	1810	1583
Flt Permitted	0.95	1.00		0.94	1.00	1.00
Satd. Flow (perm)	1770	1615		3306	1810	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	356	15	14	882	661	602
RTOR Reduction (vph)	0	11	0	0	0	272
Lane Group Flow (vph)	356	4	0	896	661	330
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	16.2	16.2		34.1	34.1	34.1
Effective Green, g (s)	16.2	16.2		34.1	34.1	34.1
Actuated g/C Ratio	0.26	0.26		0.55	0.55	0.55
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	460	419		1809	990	866
v/s Ratio Prot	c0.20				c0.37	
v/s Ratio Perm		0.00		0.27		0.21
v/c Ratio	0.77	0.01		0.50	0.67	0.38
Uniform Delay, d1	21.4	17.1		8.8	10.1	8.1
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	7.9	0.0		1.0	3.6	1.3
Delay (s)	29.3	17.1		9.7	13.6	9.3
Level of Service	C	B		A	B	A
Approach Delay (s)	28.8			9.7	11.6	
Approach LOS	C			A	B	

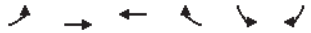
Intersection Summary

HCM 2000 Control Delay	13.4	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.70			
Actuated Cycle Length (s)	62.3	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	69.6%	ICU Level of Service	C	
Analysis Period (min)	15			

c Critical Lane Group

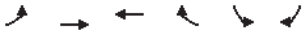
Appendix E

Traffic Operations Reports – 2041 Traffic Conditions



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	441	1077	1090	6	0	397
Future Volume (vph)	441	1077	1090	6	0	397
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	125.0			50.0	30.0	0.0
Storage Lanes	1			1	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.850		0.850
Flt Protected	0.950					
Satd. Flow (prot)	1770	1743	1743	1077	1900	1599
Flt Permitted	0.950					
Satd. Flow (perm)	1770	1743	1743	1077	1900	1599
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	2%	9%	9%	50%	0%	1%
Adj. Flow (vph)	464	1134	1147	6	0	418
Shared Lane Traffic (%)						
Lane Group Flow (vph)	464	1134	1147	6	0	418
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	88.6%	ICU Level of Service	E
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	441	1077	1090	6	0	397
Future Volume (Veh/h)	441	1077	1090	6	0	397
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)	464	1134	1147	6	0	418
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	1153				3209	1147
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1153				3209	1147
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	23				100	0
cM capacity (veh/h)	606				3	243

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	464	1134	1147	6	0	418
Volume Left	464	0	0	0	0	0
Volume Right	0	0	0	6	0	418
cSH	606	1700	1700	1700	1700	243
Volume to Capacity	0.77	0.67	0.67	0.00	0.00	1.72
Queue Length 95th (m)	56.2	0.0	0.0	0.0	0.0	220.2
Control Delay (s)	27.7	0.0	0.0	0.0	0.0	374.8
Lane LOS	D				A	F
Approach Delay (s)	8.0		0.0		374.8	
Approach LOS					F	

Intersection Summary				
Average Delay		53.5		
Intersection Capacity Utilization		88.6%	ICU Level of Service	E
Analysis Period (min)		15		

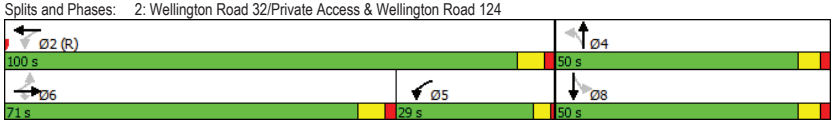
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Future Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	40.0		25.0	55.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		1	1		0	1		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850					0.850				
Flt Protected				0.950			0.950				0.950	
Satd. Flow (prot)	1900	1712	1495	1703	1667	0	1752	1568	0	0	1805	0
Flt Permitted				0.056			0.757				0.091	
Satd. Flow (perm)	1900	1712	1495	100	1667	0	1396	1568	0	0	173	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			73					319				
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
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%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Adj. Flow (vph)	0	956	218	496	836	0	392	0	977	1	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	956	218	496	836	0	392	977	0	0	1	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)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	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	
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		6		5	2			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2			4			8		
Detector Phase	6	6	6	5	2		4	4		8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0	35.0	8.0	35.0		12.0	12.0		12.0	12.0	
Minimum Split (s)	42.0	42.0	42.0	12.0	42.0		26.0	26.0		26.0	26.0	
Total Split (s)	71.0	71.0	71.0	29.0	100.0		50.0	50.0		50.0	50.0	
Total Split (%)	47.3%	47.3%	47.3%	19.3%	66.7%		33.3%	33.3%		33.3%	33.3%	
Maximum Green (s)	64.0	64.0	64.0	25.0	93.0		44.0	44.0		44.0	44.0	
Yellow Time (s)	5.0	5.0	5.0	3.0	5.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	7.0	7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Lead/Lag	Lead	Lead	Lead	Lag								
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	C-Max		None	None		None	None	
Walk Time (s)	23.0	23.0	23.0		23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0	12.0		12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0	0		0		0	0		0	0	
Act Effct Green (s)		64.0	64.0	96.0	93.0		44.0	44.0			44.0	
Actuated g/C Ratio		0.43	0.43	0.64	0.62		0.29	0.29			0.29	
v/c Ratio		1.31	0.32	1.50	0.81		0.96	1.43			0.02	
Control Delay		184.9	19.9	255.4	11.9		87.0	226.7			39.0	
Queue Delay		0.0	0.0	0.0	0.1		0.0	0.0			0.0	
Total Delay		184.9	19.9	255.4	12.0		87.0	226.7			39.0	
LOS		F	B	F	B		F	F			D	
Approach Delay		154.3			102.6			186.7			39.0	
Approach LOS		F			F			F			D	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 134 (89%), Referenced to phase 2:WBTL, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.50
Intersection Signal Delay: 148.0 Intersection LOS: F
Intersection Capacity Utilization 139.8% ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124



Lane Group	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	956	218	496	836	392	977	1
v/c Ratio	1.31	0.32	1.50	0.81	0.96	1.43	0.02
Control Delay	184.9	19.9	255.4	11.9	87.0	226.7	39.0
Queue Delay	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Total Delay	184.9	19.9	255.4	12.0	87.0	226.7	39.0
Queue Length 50th (m)	~383.5	29.1	~198.8	78.3	121.1	~339.2	0.2
Queue Length 95th (m)	#467.2	50.1	m#195.0	m82.2	#189.7	#424.0	1.9
Internal Link Dist (m)	1665.7			343.4		471.1	37.2
Turn Bay Length (m)		25.0	55.0		60.0		
Base Capacity (vph)	730	679	331	1033	409	685	50
Starvation Cap Reductn	0	0	0	5	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.31	0.32	1.50	0.81	0.96	1.43	0.02

Intersection Summary

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

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

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Future Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Lane Util. Factor		1.00	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			1.00	
Flt Protected		1.00	1.00	0.95	1.00		0.95	1.00			0.95	
Satd. Flow (prot)		1712	1495	1703	1667		1752	1568			1805	
Flt Permitted		1.00	1.00	0.06	1.00		0.76	1.00			0.09	
Satd. Flow (perm)		1712	1495	101	1667		1397	1568			173	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	956	218	496	836	0	392	0	977	1	0	0
RTOR Reduction (vph)	0	0	42	0	0	0	0	225	0	0	0	0
Lane Group Flow (vph)	0	956	176	496	836	0	392	752	0	0	1	0
Heavy Vehicles (%)	0%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		6		5	2			4			8	
Permitted Phases	6		6	2			4			8		
Actuated Green, G (s)		64.0	64.0	96.0	93.0		44.0	44.0			44.0	
Effective Green, g (s)		64.0	64.0	96.0	93.0		44.0	44.0			44.0	
Actuated g/C Ratio		0.43	0.43	0.64	0.62		0.29	0.29			0.29	
Clearance Time (s)		7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Vehicle Extension (s)		5.0	5.0	3.0	5.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		730	637	331	1033		409	459			50	
v/s Ratio Prot		0.56		c0.25	0.50			c0.48				
v/s Ratio Perm			0.12	c0.71			0.28				0.01	
v/c Ratio		1.31	0.28	1.50	0.81		0.96	1.64			0.02	
Uniform Delay, d1		43.0	28.0	57.8	21.7		52.1	53.0			37.7	
Progression Factor		1.00	1.00	0.66	0.49		1.00	1.00			1.00	
Incremental Delay, d2		149.1	0.5	225.8	0.7		33.5	296.6			0.2	
Delay (s)		192.1	28.4	263.9	11.4		85.6	349.6			37.8	
Level of Service		F	C	F	B		F	F			D	
Approach Delay (s)		161.7			105.4			274.0			37.8	
Approach LOS		F			F			F			D	

Intersection Summary

HCM 2000 Control Delay	182.0	HCM 2000 Level of Service	F			
HCM 2000 Volume to Capacity ratio	1.59					
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	17.0			
Intersection Capacity Utilization	139.8%	ICU Level of Service	H			
Analysis Period (min)	15					

c Critical Lane Group

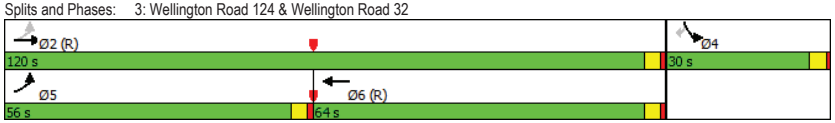
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	617	1099	649	26	32	584
Future Volume (vph)	617	1099	649	26	32	584
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	215.0			0.0	90.0	0.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.995			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1641	1792	1700	0	1530	1429
Flt Permitted	0.062				0.950	
Satd. Flow (perm)	107	1792	1700	0	1530	1429
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			2			559
Link Speed (k/h)		70	70		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		18.9	105.7		23.1	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Adj. Flow (vph)	693	1235	729	29	36	656
Shared Lane Traffic (%)						
Lane Group Flow (vph)	693	1235	758	0	36	656
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	2					4
Detector Phase	5	2	6		4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	30.0
Total Split (s)	56.0	120.0	64.0		30.0	30.0
Total Split (%)	37.3%	80.0%	42.7%		20.0%	20.0%
Maximum Green (s)	52.0	116.0	60.0		26.0	26.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	C-Max	C-Max		None	None
Walk Time (s)		10.0	10.0		10.0	10.0
Flash Dont Walk (s)		16.0	16.0		16.0	16.0
Pedestrian Calls (#/hr)		0	0		0	0
Act Effct Green (s)	119.3	119.3	60.0		22.7	22.7
Actuated g/C Ratio	0.80	0.80	0.40		0.15	0.15
v/c Ratio	1.07	0.87	1.11		0.16	0.95
Control Delay	75.8	6.1	111.3		55.1	34.3
Queue Delay	0.0	2.7	0.0		0.0	0.0
Total Delay	75.8	8.8	111.3		55.1	34.3
LOS	E	A	F		E	C
Approach Delay		32.9	111.3		35.4	
Approach LOS		C	F		D	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.11
Intersection Signal Delay: 51.0 Intersection LOS: D
Intersection Capacity Utilization 84.1% ICU Level of Service E
Analysis Period (min) 15

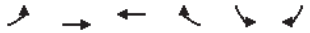
Splits and Phases: 3: Wellington Road 124 & Wellington Road 32



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	693	1235	758	36	656
v/c Ratio	1.07	0.87	1.11	0.16	0.95
Control Delay	75.8	6.1	111.3	55.1	34.3
Queue Delay	0.0	2.7	0.0	0.0	0.0
Total Delay	75.8	8.8	111.3	55.1	34.3
Queue Length 50th (m)	~235.0	47.8	~271.2	9.7	33.4
Queue Length 95th (m)	m121.2	m33.2	#346.2	20.7	#114.0
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)	215.0			90.0	
Base Capacity (vph)	650	1425	681	265	709
Starvation Cap Reductn	0	106	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.07	0.94	1.11	0.14	0.93

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	617	1099	649	26	32	584
Future Volume (vph)	617	1099	649	26	32	584
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1641	1792	1700		1530	1429
Flt Permitted	0.06	1.00	1.00		0.95	1.00
Satd. Flow (perm)	108	1792	1700		1530	1429
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	693	1235	729	29	36	656
RTOR Reduction (vph)	0	0	1	0	0	474
Lane Group Flow (vph)	693	1235	757	0	36	182
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases	2					4
Actuated Green, G (s)	119.3	119.3	60.0		22.7	22.7
Effective Green, g (s)	119.3	119.3	60.0		22.7	22.7
Actuated g/C Ratio	0.80	0.80	0.40		0.15	0.15
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	651	1425	680		231	216
v/s Ratio Prot	c0.39	0.69	c0.45		0.02	
v/s Ratio Perm	0.45					c0.13
v/c Ratio	1.06	0.87	1.11		0.16	0.84
Uniform Delay, d1	43.1	10.1	45.0		55.3	61.9
Progression Factor	1.11	0.40	1.00		1.00	1.00
Incremental Delay, d2	32.7	0.7	69.8		0.7	26.6
Delay (s)	80.4	4.8	114.8		56.0	88.5
Level of Service	F	A	F		E	F
Approach Delay (s)		32.0	114.8		86.8	
Approach LOS		C	F		F	

Intersection Summary				
HCM 2000 Control Delay	61.8	HCM 2000 Level of Service	E	
HCM 2000 Volume to Capacity ratio	1.05			
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	84.1%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

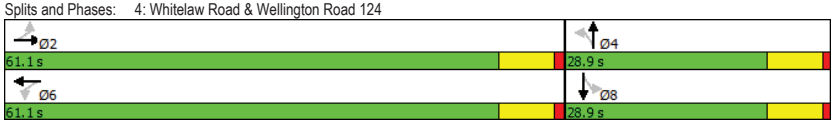
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Future Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	140.0		0.0	135.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.999			0.981			0.963			0.934	
Flt Protected	0.950			0.950				0.987			0.979	
Satd. Flow (prot)	1736	1775	0	1444	1756	0	0	1676	0	0	1371	0
Flt Permitted	0.276			0.116				0.900			0.849	
Satd. Flow (perm)	504	1775	0	176	1756	0	0	1529	0	0	1189	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		1			14			6			46	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
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 (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Adj. Flow (vph)	87	1103	6	7	709	101	6	10	6	41	7	46
Shared Lane Traffic (%)												
Lane Group Flow (vph)	87	1109	0	7	810	0	0	22	0	0	94	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	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	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			4			8		
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2		37.2	37.2		28.9	28.9		28.9	28.9	
Total Split (s)	61.1	61.1		61.1	61.1		28.9	28.9		28.9	28.9	
Total Split (%)	67.9%	67.9%		67.9%	67.9%		32.1%	32.1%		32.1%	32.1%	
Maximum Green (s)	53.9	53.9		53.9	53.9		22.0	22.0		22.0	22.0	
Yellow Time (s)	5.9	5.9		5.9	5.9		5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3		1.3	1.3		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5		4.5	4.5		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		None	None		None	None	
Walk Time (s)	15.0	15.0		15.0	15.0		11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	61.6	61.6		61.6	61.6			15.1			15.1	
Actuated g/C Ratio	0.73	0.73		0.73	0.73			0.18			0.18	
v/c Ratio	0.24	0.86		0.05	0.63			0.08			0.38	
Control Delay	8.1	21.3		6.7	11.0			23.9			22.4	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	8.1	21.3		6.7	11.0			23.9			22.4	
LOS	A	C		A	B			C			C	
Approach Delay		20.4			11.0			23.9			22.4	
Approach LOS		C			B			C			C	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 84.4
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 16.9 — Intersection LOS: B
Intersection Capacity Utilization 89.1% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 4: Whitelaw Road & Wellington Road 124



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	87	1109	7	810	22	94
v/c Ratio	0.24	0.86	0.05	0.63	0.08	0.38
Control Delay	8.1	21.3	6.7	11.0	23.9	22.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.1	21.3	6.7	11.0	23.9	22.4
Queue Length 50th (m)	5.4	151.9	0.4	75.5	2.2	6.9
Queue Length 95th (m)	13.1	#263.7	2.0	118.8	8.6	20.9
Internal Link Dist (m)		2030.4		1551.0	355.0	437.0
Turn Bay Length (m)	140.0		135.0			
Base Capacity (vph)	367	1295	128	1285	405	345
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.86	0.05	0.63	0.05	0.27

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Future Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	0.98			0.96			0.93	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.98	
Satd. Flow (prot)	1736	1775		1444	1757			1676			1371	
Flt Permitted	0.28	1.00		0.12	1.00			0.90			0.85	
Satd. Flow (perm)	504	1775		176	1757			1528			1189	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	87	1103	6	7	709	101	6	10	6	41	7	46
RTOR Reduction (vph)	0	0	0	0	4	0	0	5	0	0	40	0
Lane Group Flow (vph)	87	1109	0	7	806	0	0	17	0	0	54	0
Heavy Vehicles (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	60.0	60.0		60.0	60.0			11.8			11.8	
Effective Green, g (s)	60.0	60.0		60.0	60.0			11.8			11.8	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.14			0.14	
Clearance Time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Vehicle Extension (s)	4.5	4.5		4.5	4.5			3.0			3.0	
Lane Grp Cap (vph)	352	1239		122	1227			209			163	
v/s Ratio Prot		c0.62			0.46							
v/s Ratio Perm	0.17			0.04				0.01			c0.05	
v/c Ratio	0.25	0.89		0.06	0.66			0.08			0.33	
Uniform Delay, d1	4.7	10.4		4.1	7.2			32.3			33.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	1.7	10.2		0.9	2.8			0.2			1.2	
Delay (s)	6.4	20.6		5.0	10.0			32.5			34.7	
Level of Service	A	C		A	A			C			C	
Approach Delay (s)		19.6			9.9			32.5			34.7	
Approach LOS		B			A			C			C	

Intersection Summary

HCM 2000 Control Delay	16.7	HCM 2000 Level of Service	B			
HCM 2000 Volume to Capacity ratio	0.80					
Actuated Cycle Length (s)	85.9	Sum of lost time (s)	14.1			
Intersection Capacity Utilization	89.1%	ICU Level of Service	E			
Analysis Period (min)	15					
c Critical Lane Group						

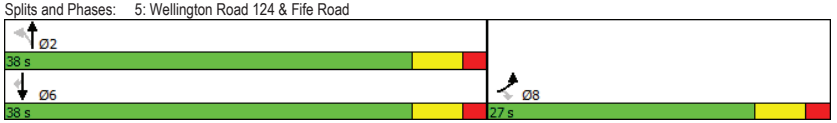
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	476	14	5	1039	675	357
Future Volume (vph)	476	14	5	1039	675	357
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950					
Satd. Flow (prot)	1770	1214	0	3375	1792	1553
Flt Permitted	0.950			0.952		
Satd. Flow (perm)	1770	1214	0	3213	1792	1553
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		15				388
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Adj. Flow (vph)	517	15	5	1129	734	388
Shared Lane Traffic (%)						
Lane Group Flow (vph)	517	15	0	1134	734	388
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	27.0	27.0	38.0	38.0	38.0	38.0
Total Split (%)	41.5%	41.5%	58.5%	58.5%	58.5%	58.5%
Maximum Green (s)	21.0	21.0	32.0	32.0	32.0	32.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	20.4	20.4		32.0	32.0	32.0
Actuated g/C Ratio	0.32	0.32		0.50	0.50	0.50
v/c Ratio	0.92	0.04		0.71	0.82	0.40
Control Delay	47.1	8.4		15.9	24.3	2.6
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	47.1	8.4		15.9	24.3	2.6
LOS	D	A		B	C	A
Approach Delay	46.0			15.9	16.8	
Approach LOS	D			B	B	

Intersection Summary

Area Type: Other
Cycle Length: 65
Actuated Cycle Length: 64.4
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 22.0 — Intersection LOS: C
Intersection Capacity Utilization 71.9% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road



Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	517	15	1134	734	388
v/c Ratio	0.92	0.04	0.71	0.82	0.40
Control Delay	47.1	8.4	15.9	24.3	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	47.1	8.4	15.9	24.3	2.6
Queue Length 50th (m)	61.7	0.0	55.5	74.6	0.0
Queue Length 95th (m)	#116.7	3.6	77.5	#140.5	12.1
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	576	406	1596	890	966
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.90	0.04	0.71	0.82	0.40

Intersection Summary

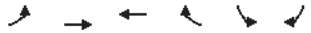
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	476	14	5	1039	675	357
Future Volume (vph)	476	14	5	1039	675	357
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1214		3374	1792	1553
Flt Permitted	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1214		3213	1792	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	517	15	5	1129	734	388
RTOR Reduction (vph)	0	10	0	0	0	195
Lane Group Flow (vph)	517	5	0	1134	734	193
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	20.4	20.4		32.0	32.0	32.0
Effective Green, g (s)	20.4	20.4		32.0	32.0	32.0
Actuated g/C Ratio	0.32	0.32		0.50	0.50	0.50
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	560	384		1596	890	771
v/s Ratio Prot	c0.29				c0.41	
v/s Ratio Perm		0.00		0.35		0.12
v/c Ratio	0.92	0.01		0.71	0.82	0.25
Uniform Delay, d1	21.2	15.1		12.6	13.8	9.3
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	21.0	0.0		2.7	8.6	0.8
Delay (s)	42.2	15.1		15.3	22.4	10.1
Level of Service	D	B		B	C	B
Approach Delay (s)	41.5			15.3	18.1	
Approach LOS	D			B	B	

Intersection Summary

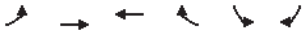
HCM 2000 Control Delay	21.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	64.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	296	1043	1354	14	1	523
Future Volume (vph)	296	1043	1354	14	1	523
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	125.0			50.0	30.0	0.0
Storage Lanes	1			1	1	1
Taper Length (m)	7.5				7.5	
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)	1787	1759	1827	1615	1805	1615
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1787	1759	1827	1615	1805	1615
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Heavy Vehicles (%)	1%	8%	4%	0%	0%	0%
Adj. Flow (vph)	308	1086	1410	16	1	545
Shared Lane Traffic (%)						
Lane Group Flow (vph)	308	1086	1410	16	1	545
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 110.3%		ICU Level of Service H	
Analysis Period (min) 15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	296	1043	1354	14	1	523
Future Volume (Veh/h)	296	1043	1354	14	1	523
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Hourly flow rate (vph)	308	1086	1410	16	1	545
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	1426				3112	1410
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1426				3112	1410
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	36				78	0
cM capacity (veh/h)	480				5	171

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	308	1086	1410	16	1	545
Volume Left	308	0	0	0	1	0
Volume Right	0	0	0	16	0	545
cSH	480	1700	1700	1700	5	171
Volume to Capacity	0.64	0.64	0.83	0.01	0.22	3.18
Queue Length 95th (m)	35.6	0.0	0.0	0.0	3.4	Err
Control Delay (s)	25.0	0.0	0.0	0.0	931.0	Err
Lane LOS	C				F	F
Approach Delay (s)	5.5		0.0		9982.4	
Approach LOS					F	

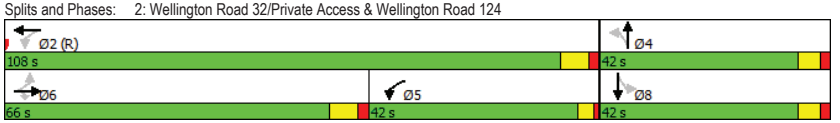
Intersection Summary				
Average Delay		1621.5		
Intersection Capacity Utilization		110.3%	ICU Level of Service	H
Analysis Period (min)		15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	829	236	732	942	6	431	1	684	24	6	1
Future Volume (vph)	6	829	236	732	942	6	431	1	684	24	6	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	40.0		25.0	55.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		1	1		0	1		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.999			0.850			0.996	
Flt Protected	0.950			0.950			0.950				0.963	
Satd. Flow (prot)	1805	1759	1553	1752	1791	0	1787	1524	0	0	1822	0
Flt Permitted	0.068			0.061			0.737				0.256	
Satd. Flow (perm)	129	1759	1553	113	1791	0	1386	1524	0	0	484	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			73					445			1	
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Adj. Flow (vph)	6	846	241	747	961	6	440	1	698	24	6	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	6	846	241	747	967	0	440	699	0	0	31	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)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2		1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	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	
Detector 1 Size(m)	2.0	0.6	2.0	2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		6		5	2			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2			4			8		
Detector Phase	6	6	6	5	2		4	4		8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0	35.0	8.0	35.0		12.0	12.0		12.0	12.0	
Minimum Split (s)	42.0	42.0	42.0	12.0	42.0		26.0	26.0		26.0	26.0	
Total Split (s)	66.0	66.0	66.0	42.0	108.0		42.0	42.0		42.0	42.0	
Total Split (%)	44.0%	44.0%	44.0%	28.0%	72.0%		28.0%	28.0%		28.0%	28.0%	
Maximum Green (s)	59.0	59.0	59.0	38.0	101.0		36.0	36.0		36.0	36.0	
Yellow Time (s)	5.0	5.0	5.0	3.0	5.0		4.0	4.0		4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	7.0	7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Lead/Lag	Lead	Lead	Lead	Lag								
Lead-Lag Optimize?	Yes	Yes	Yes	Yes								
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None	None	None	C-Max		None	None		None	None	
Walk Time (s)	23.0	23.0	23.0		23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0	12.0		12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0	0		0		0	0		0	0	
Act Effct Green (s)	59.0	59.0	59.0	104.0	101.0		36.0	36.0			36.0	
Actuated g/C Ratio	0.39	0.39	0.39	0.69	0.67		0.24	0.24			0.24	
v/c Ratio	0.12	1.22	0.37	1.52	0.80		1.33	0.99			0.27	
Control Delay	36.3	152.8	23.8	264.4	13.5		209.3	53.0			52.4	
Queue Delay	0.0	0.0	0.0	0.0	0.7		0.0	0.0			0.0	
Total Delay	36.3	152.8	23.8	264.4	14.2		209.3	53.0			52.4	
LOS	D	F	C	F	B		F	D			D	
Approach Delay		123.7			123.3			113.4			52.4	
Approach LOS		F			F			F			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 150			
Actuated Cycle Length: 150			
Offset: 126 (84%), Referenced to phase 2:WBTL, Start of Green			
Natural Cycle: 150			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.52			
Intersection Signal Delay: 120.0		Intersection LOS: F	
Intersection Capacity Utilization 140.8%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBT
Lane Group Flow (vph)	6	846	241	747	967	440	699	31
v/c Ratio	0.12	1.22	0.37	1.52	0.80	1.33	0.99	0.27
Control Delay	36.3	152.8	23.8	264.4	13.5	209.3	53.0	52.4
Queue Delay	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0
Total Delay	36.3	152.8	23.8	264.4	14.2	209.3	53.0	52.4
Queue Length 50th (m)	1.2	~324.6	36.4	~311.7	121.7	~177.7	101.7	7.7
Queue Length 95th (m)	5.3	#406.4	60.1	m#242.4	m101.2	#247.8	#192.7	18.7
Internal Link Dist (m)		1665.7			343.4		471.1	37.2
Turn Bay Length (m)	40.0		25.0	55.0		60.0		
Base Capacity (vph)	50	691	655	493	1205	332	703	116
Starvation Cap Reductn	0	0	0	0	61	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.12	1.22	0.37	1.52	0.85	1.33	0.99	0.27

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	829	236	732	942	6	431	1	684	24	6	1
Future Volume (vph)	6	829	236	732	942	6	431	1	684	24	6	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.85			1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.96	
Satd. Flow (prot)	1805	1759	1553	1752	1791		1787	1524			1821	
Flt Permitted	0.07	1.00	1.00	0.06	1.00		0.74	1.00			0.26	
Satd. Flow (perm)	129	1759	1553	112	1791		1386	1524			485	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	6	846	241	747	961	6	440	1	698	24	6	1
RTOR Reduction (vph)	0	0	44	0	0	0	0	338	0	0	1	0
Lane Group Flow (vph)	6	846	197	747	967	0	440	361	0	0	30	0
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases		6		5	2			4			8	
Permitted Phases	6		6	2			4			8		
Actuated Green, G (s)	59.0	59.0	59.0	104.0	101.0		36.0	36.0			36.0	
Effective Green, g (s)	59.0	59.0	59.0	104.0	101.0		36.0	36.0			36.0	
Actuated g/C Ratio	0.39	0.39	0.39	0.69	0.67		0.24	0.24			0.24	
Clearance Time (s)	7.0	7.0	7.0	4.0	7.0		6.0	6.0			6.0	
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0			3.0	
Lane Grp Cap (vph)	50	691	610	493	1205		332	365			116	
v/s Ratio Prot		0.48		c0.38	0.54			0.24				
v/s Ratio Perm	0.05		0.13	c0.67			c0.32				0.06	
v/c Ratio	0.12	1.22	0.32	1.52	0.80		1.33	0.99			0.26	
Uniform Delay, d1	29.0	45.5	31.6	51.5	17.4		57.0	56.8			46.2	
Progression Factor	1.00	1.00	1.00	0.82	0.71		1.00	1.00			1.00	
Incremental Delay, d2	2.2	113.6	0.6	232.8	0.5		165.9	43.6			1.2	
Delay (s)	31.2	159.1	32.3	275.2	12.9		222.9	100.4			47.4	
Level of Service	C	F	C	F	B		F	F			D	
Approach Delay (s)		130.4			127.2			147.7			47.4	
Approach LOS		F			F			F			D	

Intersection Summary

HCM 2000 Control Delay	133.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.52		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	140.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

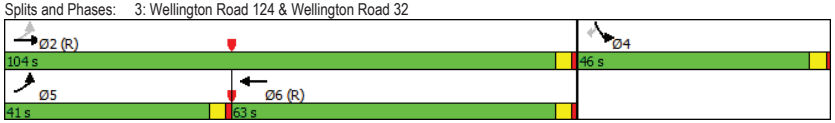
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	548	1003	766	46	48	879
Future Volume (vph)	548	1003	766	46	48	879
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	215.0			0.0	90.0	0.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.992			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1612	1827	1798	0	1444	1524
Flt Permitted	0.063				0.950	
Satd. Flow (perm)	107	1827	1798	0	1444	1524
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			2			468
Link Speed (k/h)		70	70		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		18.9	105.7		23.1	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Adj. Flow (vph)	559	1023	782	47	49	897
Shared Lane Traffic (%)						
Lane Group Flow (vph)	559	1023	829	0	49	897
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	2					4
Detector Phase	5	2	6		4	4
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	30.0
Total Split (s)	41.0	104.0	63.0		46.0	46.0
Total Split (%)	27.3%	69.3%	42.0%		30.7%	30.7%
Maximum Green (s)	37.0	100.0	59.0		42.0	42.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	C-Max	C-Max		None	None
Walk Time (s)		10.0	10.0		10.0	10.0
Flash Dont Walk (s)		16.0	16.0		16.0	16.0
Pedestrian Calls (#/hr)		0	0		0	0
Act Effct Green (s)	100.0	100.0	59.0		42.0	42.0
Actuated g/C Ratio	0.67	0.67	0.39		0.28	0.28
v/c Ratio	1.26	0.84	1.17		0.12	1.18
Control Delay	169.8	6.3	132.0		41.4	115.1
Queue Delay	0.0	1.8	0.0		0.0	0.0
Total Delay	169.8	8.0	132.0		41.4	115.1
LOS	F	A	F		D	F
Approach Delay		65.2	132.0		111.3	
Approach LOS		E	F		F	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.26
Intersection Signal Delay: 94.7 Intersection LOS: F
Intersection Capacity Utilization 104.2% ICU Level of Service G
Analysis Period (min) 15

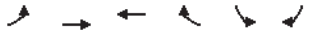
Splits and Phases: 3: Wellington Road 124 & Wellington Road 32



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	559	1023	829	49	897
v/c Ratio	1.26	0.84	1.17	0.12	1.18
Control Delay	169.8	6.3	132.0	41.4	115.1
Queue Delay	0.0	1.8	0.0	0.0	0.0
Total Delay	169.8	8.0	132.0	41.4	115.1
Queue Length 50th (m)	~207.2	74.6	~308.9	11.5	~223.3
Queue Length 95th (m)	m#173.5	m58.5	#391.7	23.1	#306.8
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)	215.0			90.0	
Base Capacity (vph)	442	1218	708	404	763
Starvation Cap Reductn	0	84	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.26	0.90	1.17	0.12	1.18

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	548	1003	766	46	48	879
Future Volume (vph)	548	1003	766	46	48	879
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1612	1827	1798		1444	1524
Flt Permitted	0.06	1.00	1.00		0.95	1.00
Satd. Flow (perm)	108	1827	1798		1444	1524
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	559	1023	782	47	49	897
RTOR Reduction (vph)	0	0	1	0	0	337
Lane Group Flow (vph)	559	1023	828	0	49	560
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Turn Type	pm+pt	NA	NA		Prot	Perm
Protected Phases	5	2	6		4	
Permitted Phases	2					4
Actuated Green, G (s)	100.0	100.0	59.0		42.0	42.0
Effective Green, g (s)	100.0	100.0	59.0		42.0	42.0
Actuated g/C Ratio	0.67	0.67	0.39		0.28	0.28
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	442	1218	707		404	426
v/s Ratio Prot	c0.31	0.56	0.46		0.03	
v/s Ratio Perm	c0.53					c0.37
v/c Ratio	1.26	0.84	1.17		0.12	1.31
Uniform Delay, d1	49.3	18.9	45.5		40.2	54.0
Progression Factor	1.36	0.28	1.00		1.00	1.00
Incremental Delay, d2	120.8	0.7	91.5		0.3	157.5
Delay (s)	187.8	5.9	137.0		40.5	211.5
Level of Service	F	A	F		D	F
Approach Delay (s)		70.2	137.0		202.6	
Approach LOS		E	F		F	

Intersection Summary				
HCM 2000 Control Delay	124.0	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.30			
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	104.2%	ICU Level of Service	G	
Analysis Period (min)	15			

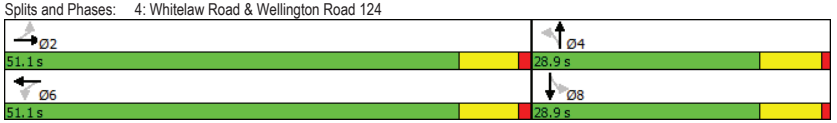
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Future Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	140.0		0.0	135.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt					0.992			0.950			0.947	
Flt Protected	0.950			0.950				0.987			0.973	
Satd. Flow (prot)	1703	1863	0	1805	1793	0	0	1782	0	0	1659	0
Flt Permitted	0.238			0.124				0.908			0.816	
Satd. Flow (perm)	427	1863	0	236	1793	0	0	1639	0	0	1391	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					6			7			40	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Adj. Flow (vph)	140	969	1	3	746	44	5	7	7	101	9	71
Shared Lane Traffic (%)												
Lane Group Flow (vph)	140	970	0	3	790	0	0	19	0	0	181	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
Trailing Detector (m)	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	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			4			8		
Detector Phase	2	2		6	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0		30.0	30.0		15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2		37.2	37.2		28.9	28.9		28.9	28.9	
Total Split (s)	51.1	51.1		51.1	51.1		28.9	28.9		28.9	28.9	
Total Split (%)	63.9%	63.9%		63.9%	63.9%		36.1%	36.1%		36.1%	36.1%	
Maximum Green (s)	43.9	43.9		43.9	43.9		22.0	22.0		22.0	22.0	
Yellow Time (s)	5.9	5.9		5.9	5.9		5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3		1.3	1.3		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5		4.5	4.5		3.0	3.0		3.0	3.0	
Recall Mode	Max	Max		Max	Max		None	None		None	None	
Walk Time (s)	15.0	15.0		15.0	15.0		11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	46.8	46.8		46.8	46.8			16.1			16.1	
Actuated g/C Ratio	0.61	0.61		0.61	0.61			0.21			0.21	
v/c Ratio	0.54	0.86		0.02	0.72			0.05			0.56	
Control Delay	19.5	23.0		7.3	16.0			18.3			27.6	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	19.5	23.0		7.3	16.0			18.3			27.6	
LOS	B	C		A	B			B			C	
Approach Delay		22.6			16.0			18.3			27.6	
Approach LOS		C			B			B			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 77			
Natural Cycle: 80			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.86			
Intersection Signal Delay: 20.5		Intersection LOS: C	
Intersection Capacity Utilization 107.8%		ICU Level of Service G	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	140	970	3	790	19	181
v/c Ratio	0.54	0.86	0.02	0.72	0.05	0.56
Control Delay	19.5	23.0	7.3	16.0	18.3	27.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.5	23.0	7.3	16.0	18.3	27.6
Queue Length 50th (m)	10.7	104.2	0.2	71.9	1.4	18.1
Queue Length 95th (m)	#36.9	#216.6	1.4	137.2	6.5	37.5
Internal Link Dist (m)		2030.4		1551.0	355.0	437.0
Turn Bay Length (m)	140.0		135.0			
Base Capacity (vph)	259	1131	143	1091	475	428
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.86	0.02	0.72	0.04	0.42

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Future Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	0.99			0.95			0.95	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.97	
Satd. Flow (prot)	1703	1862		1805	1793			1782			1659	
Flt Permitted	0.24	1.00		0.12	1.00			0.91			0.82	
Satd. Flow (perm)	427	1862		235	1793			1639			1392	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	140	969	1	3	746	44	5	7	7	101	9	71
RTOR Reduction (vph)	0	0	0	0	2	0	0	6	0	0	32	0
Lane Group Flow (vph)	140	970	0	3	788	0	0	13	0	0	149	0
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	46.8	46.8		46.8	46.8			16.1			16.1	
Effective Green, g (s)	46.8	46.8		46.8	46.8			16.1			16.1	
Actuated g/C Ratio	0.61	0.61		0.61	0.61			0.21			0.21	
Clearance Time (s)	7.2	7.2		7.2	7.2			6.9			6.9	
Vehicle Extension (s)	4.5	4.5		4.5	4.5			3.0			3.0	
Lane Grp Cap (vph)	259	1131		142	1089			342			291	
v/s Ratio Prot		c0.52			0.44							
v/s Ratio Perm	0.33			0.01				0.01			c0.11	
v/c Ratio	0.54	0.86		0.02	0.72			0.04			0.51	
Uniform Delay, d1	8.8	12.4		6.0	10.6			24.3			27.0	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	7.9	8.5		0.3	4.2			0.0			1.5	
Delay (s)	16.7	20.8		6.3	14.7			24.3			28.5	
Level of Service	B	C		A	B			C			C	
Approach Delay (s)		20.3			14.7			24.3			28.5	
Approach LOS		C			B			C			C	

Intersection Summary					
HCM 2000 Control Delay	18.9	HCM 2000 Level of Service	B		
HCM 2000 Volume to Capacity ratio	0.77				
Actuated Cycle Length (s)	77.0	Sum of lost time (s)	14.1		
Intersection Capacity Utilization	107.8%	ICU Level of Service	G		
Analysis Period (min)	15				
c Critical Lane Group					

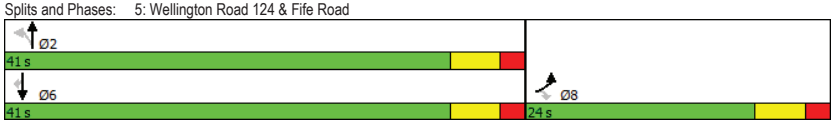
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	397	16	15	983	737	671
Future Volume (vph)	397	16	15	983	737	671
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950			0.999		
Satd. Flow (prot)	1770	1615	0	3503	1810	1583
Flt Permitted	0.950			0.940		
Satd. Flow (perm)	1770	1615	0	3296	1810	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		17				699
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Adj. Flow (vph)	414	17	16	1024	768	699
Shared Lane Traffic (%)						
Lane Group Flow (vph)	414	17	0	1040	768	699
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	24.0	24.0	41.0	41.0	41.0	41.0
Total Split (%)	36.9%	36.9%	63.1%	63.1%	63.1%	63.1%
Maximum Green (s)	18.0	18.0	35.0	35.0	35.0	35.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	17.2	17.2		35.0	35.0	35.0
Actuated g/C Ratio	0.27	0.27		0.55	0.55	0.55
v/c Ratio	0.87	0.04		0.58	0.78	0.59
Control Delay	44.1	9.1		11.5	19.1	3.1
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	44.1	9.1		11.5	19.1	3.1
LOS	D	A		B	B	A
Approach Delay	42.8			11.5	11.5	
Approach LOS	D			B	B	

Intersection Summary

Area Type: Other
Cycle Length: 65
Actuated Cycle Length: 64.2
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 16.1 Intersection LOS: B
Intersection Capacity Utilization 79.2% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road



Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	414	17	1040	768	699
v/c Ratio	0.87	0.04	0.58	0.78	0.59
Control Delay	44.1	9.1	11.5	19.1	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	44.1	9.1	11.5	19.1	3.1
Queue Length 50th (m)	49.3	0.0	42.7	71.3	0.0
Queue Length 95th (m)	#95.5	4.0	59.7	#124.2	13.8
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	496	465	1796	986	1181
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.83	0.04	0.58	0.78	0.59

Intersection Summary

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

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	397	16	15	983	737	671
Future Volume (vph)	397	16	15	983	737	671
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1615		3504	1810	1583
Flt Permitted	0.95	1.00		0.94	1.00	1.00
Satd. Flow (perm)	1770	1615		3295	1810	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	414	17	16	1024	768	699
RTOR Reduction (vph)	0	12	0	0	0	318
Lane Group Flow (vph)	414	5	0	1040	768	381
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	17.2	17.2		35.0	35.0	35.0
Effective Green, g (s)	17.2	17.2		35.0	35.0	35.0
Actuated g/C Ratio	0.27	0.27		0.55	0.55	0.55
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	474	432		1796	986	863
v/s Ratio Prot	c0.23				c0.42	
v/s Ratio Perm		0.00		0.32		0.24
v/c Ratio	0.87	0.01		0.58	0.78	0.44
Uniform Delay, d1	22.5	17.3		9.7	11.5	8.7
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	16.2	0.0		1.4	6.1	1.6
Delay (s)	38.6	17.3		11.1	17.6	10.4
Level of Service	D	B		B	B	B
Approach Delay (s)	37.8			11.1	14.2	
Approach LOS	D			B	B	

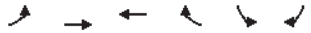
Intersection Summary

HCM 2000 Control Delay	16.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	64.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

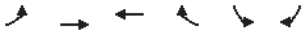
Appendix F

Traffic Operations Reports – Alternative 1



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	441	1077	1090	6	0	397
Future Volume (vph)	441	1077	1090	6	0	397
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	125.0			50.0	30.0	0.0
Storage Lanes	1			1	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.850		0.850
Flt Protected	0.950					
Satd. Flow (prot)	1770	1743	1743	1077	1900	1599
Flt Permitted	0.950					
Satd. Flow (perm)	1770	1743	1743	1077	1900	1599
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	2%	9%	9%	50%	0%	1%
Adj. Flow (vph)	464	1134	1147	6	0	418
Shared Lane Traffic (%)						
Lane Group Flow (vph)	464	1134	1147	6	0	418
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	L NA	R NA	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	88.6%	ICU Level of Service	E
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	441	1077	1090	6	0	397
Future Volume (Veh/h)	441	1077	1090	6	0	397
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)	464	1134	1147	6	0	418
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	1153				3209	1147
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1153				3209	1147
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	23				100	0
cM capacity (veh/h)	606				3	243

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	464	1134	1147	6	0	418
Volume Left	464	0	0	0	0	0
Volume Right	0	0	0	6	0	418
cSH	606	1700	1700	1700	1700	243
Volume to Capacity	0.77	0.67	0.67	0.00	0.00	1.72
Queue Length 95th (m)	56.2	0.0	0.0	0.0	0.0	220.2
Control Delay (s)	27.7	0.0	0.0	0.0	0.0	374.8
Lane LOS	D				A	F
Approach Delay (s)	8.0		0.0		374.8	
Approach LOS					F	

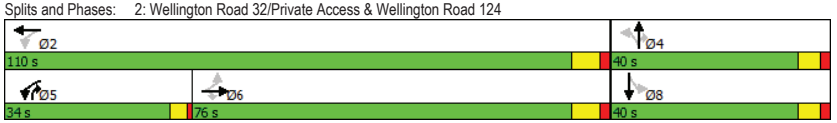
Intersection Summary				
Average Delay		53.5		
Intersection Capacity Utilization		88.6%	ICU Level of Service	E
Analysis Period (min)		15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Future Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	60.0		60.0	0.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		1	1		0	1		1	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850						0.850			
Flt Protected				0.950				0.950			0.950	
Satd. Flow (prot)	1900	1712	1495	1703	1667	0	0	1752	1568	0	1805	0
Flt Permitted				0.055				0.757			0.120	
Satd. Flow (perm)	1900	1712	1495	99	1667	0	0	1396	1568	0	228	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			86						68			
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
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%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Adj. Flow (vph)	0	956	218	496	836	0	392	0	977	1	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	956	218	496	836	0	0	392	977	0	1	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2		1	2	1	1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0		0.0	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)	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2			4		4	8		
Detector Phase	6	6	6	5	2		4	4	5	8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0	35.0	8.0	35.0		12.0	12.0	8.0	12.0	12.0	
Minimum Split (s)	42.0	42.0	42.0	12.0	42.0		26.0	26.0	12.0	26.0	26.0	
Total Split (s)	76.0	76.0	76.0	34.0	110.0		40.0	40.0	34.0	40.0	40.0	
Total Split (%)	50.7%	50.7%	50.7%	22.7%	73.3%		26.7%	26.7%	22.7%	26.7%	26.7%	
Maximum Green (s)	69.0	69.0	69.0	30.0	103.0		34.0	34.0	30.0	34.0	34.0	
Yellow Time (s)	5.0	5.0	5.0	3.0	5.0		4.0	4.0	3.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0		2.0	2.0	1.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Lead/Lag	Lag	Lag	Lag	Lead					Lead			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes					Yes			
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	None	Max		None	None	None	None	None	
Walk Time (s)	23.0	23.0	23.0		23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0	12.0		12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0	0		0		0	0		0	0	
Act Effct Green (s)		69.0	69.0	106.0	103.0			34.0	70.0		34.0	
Actuated g/C Ratio		0.46	0.46	0.71	0.69			0.23	0.47		0.23	
v/c Ratio		1.21	0.30	1.27	0.73			1.24	1.27		0.02	
Control Delay		144.3	16.0	180.3	19.6			179.1	165.2		47.0	
Queue Delay		0.0	0.0	0.0	0.4			0.0	0.0		0.0	
Total Delay		144.3	16.0	180.3	20.0			179.1	165.2		47.0	
LOS		F	B	F	B			F	F		D	
Approach Delay		120.5			79.7			169.2			47.0	
Approach LOS		F			E			F			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 150			
Actuated Cycle Length: 150			
Natural Cycle: 150			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 1.27			
Intersection Signal Delay: 123.6		Intersection LOS: F	
Intersection Capacity Utilization 123.9%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124



Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	956	218	496	836	392	977	1
v/c Ratio	1.21	0.30	1.27	0.73	1.24	1.27	0.02
Control Delay	144.3	16.0	180.3	19.6	179.1	165.2	47.0
Queue Delay	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Total Delay	144.3	16.0	180.3	20.0	179.1	165.2	47.0
Queue Length 50th (m)	~365.0	24.4	~179.4	152.8	~151.8	~374.7	0.3
Queue Length 95th (m)	#448.7	44.0	#253.0	207.3	#219.9	#459.6	2.0
Internal Link Dist (m)	1665.7			343.4	471.1		37.2
Turn Bay Length (m)		60.0					
Base Capacity (vph)	787	734	390	1144	316	768	51
Starvation Cap Reductn	0	0	0	63	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.21	0.30	1.27	0.77	1.24	1.27	0.02

Intersection Summary

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

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Future Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Lane Util. Factor		1.00	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		1.00	
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00		0.95	
Satd. Flow (prot)		1712	1495	1703	1667			1752	1568		1805	
Flt Permitted		1.00	1.00	0.05	1.00			0.76	1.00		0.12	
Satd. Flow (perm)		1712	1495	98	1667			1397	1568		228	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	956	218	496	836	0	392	0	977	1	0	0
RTOR Reduction (vph)	0	0	46	0	0	0	0	0	39	0	0	0
Lane Group Flow (vph)	0	956	172	496	836	0	0	392	938	0	1	0
Heavy Vehicles (%)	0%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	
Permitted Phases	6		6	2			4		4	8		
Actuated Green, G (s)		69.0	69.0	103.0	103.0			34.0	64.0		34.0	
Effective Green, g (s)		69.0	69.0	103.0	103.0			34.0	64.0		34.0	
Actuated g/C Ratio		0.46	0.46	0.69	0.69			0.23	0.43		0.23	
Clearance Time (s)		7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Vehicle Extension (s)		5.0	5.0	3.0	5.0			3.0	3.0		3.0	
Lane Grp Cap (vph)		787	687	388	1144			316	669		51	
v/s Ratio Prot		0.56		0.26	0.50				c0.28			
v/s Ratio Perm			0.11	c0.62				0.28	0.32		0.00	
v/c Ratio		1.21	0.25	1.28	0.73			1.24	1.40		0.02	
Uniform Delay, d1		40.5	24.7	52.1	14.8			58.0	43.0		45.1	
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2		108.2	0.4	143.8	4.1			132.3	189.9		0.2	
Delay (s)		148.7	25.1	195.9	18.9			190.3	232.9		45.2	
Level of Service		F	C	F	B			F	F		D	
Approach Delay (s)		125.7			84.8			220.7			45.2	
Approach LOS		F			F			F			D	

Intersection Summary

HCM 2000 Control Delay	145.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.36		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	123.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

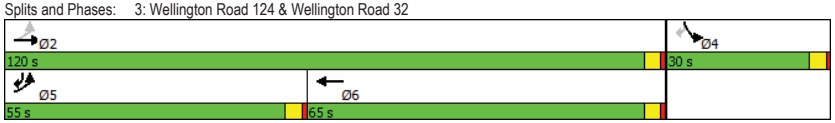
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	617	1099	649	26	32	584
Future Volume (vph)	617	1099	649	26	32	584
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0			0.0	90.0	0.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.995			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1641	1792	1700	0	1530	1429
Flt Permitted	0.074				0.950	
Satd. Flow (perm)	128	1792	1700	0	1530	1429
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			2			101
Link Speed (k/h)		70	70		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		18.9	105.7		23.1	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Adj. Flow (vph)	693	1235	729	29	36	656
Shared Lane Traffic (%)						
Lane Group Flow (vph)	693	1235	758	0	36	656
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	2					4
Detector Phase	5	2	6		4	5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	9.0
Total Split (s)	55.0	120.0	65.0		30.0	55.0
Total Split (%)	36.7%	80.0%	43.3%		20.0%	36.7%
Maximum Green (s)	51.0	116.0	61.0		26.0	51.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lead		Lag			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	None	Max		None	None
Walk Time (s)		10.0	10.0		10.0	
Flash Dont Walk (s)		16.0	16.0		16.0	
Pedestrian Calls (#/hr)		0	0		0	
Act Effct Green (s)	116.3	117.2	61.2		10.5	63.1
Actuated g/C Ratio	0.88	0.89	0.46		0.08	0.48
v/c Ratio	0.99	0.78	0.96		0.30	0.89
Control Delay	67.3	8.7	59.9		64.7	42.4
Queue Delay	0.0	0.7	0.0		0.0	0.0
Total Delay	67.3	9.4	59.9		64.7	42.4
LOS	E	A	E		E	D
Approach Delay		30.2	59.9		43.6	
Approach LOS		C	E		D	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 132.3
Natural Cycle: 150
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 39.6 — Intersection LOS: D
Intersection Capacity Utilization 84.1% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 3: Wellington Road 124 & Wellington Road 32



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	693	1235	758	36	656
v/c Ratio	0.99	0.78	0.96	0.30	0.89
Control Delay	67.3	8.7	59.9	64.7	42.4
Queue Delay	0.0	0.7	0.0	0.0	0.0
Total Delay	67.3	9.4	59.9	64.7	42.4
Queue Length 50th (m)	~179.4	110.7	204.6	9.7	141.3
Queue Length 95th (m)	#268.2	201.4	#300.5	21.3	#210.5
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)				90.0	
Base Capacity (vph)	697	1587	787	301	734
Starvation Cap Reductn	0	112	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.99	0.84	0.96	0.12	0.89

Intersection Summary

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

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

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	617	1099	649	26	32	584
Future Volume (vph)	617	1099	649	26	32	584
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1641	1792	1700		1530	1429
Flt Permitted	0.07	1.00	1.00		0.95	1.00
Satd. Flow (perm)	128	1792	1700		1530	1429
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	693	1235	729	29	36	656
RTOR Reduction (vph)	0	0	1	0	0	56
Lane Group Flow (vph)	693	1235	757	0	36	600
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Turn Type	pm+pt	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5
Permitted Phases	2					4
Actuated Green, G (s)	116.3	116.3	61.2		8.9	60.0
Effective Green, g (s)	116.3	116.3	61.2		8.9	60.0
Actuated g/C Ratio	0.87	0.87	0.46		0.07	0.45
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	692	1564	781		102	686
v/s Ratio Prot	c0.38	0.69	0.45		0.02	c0.34
v/s Ratio Perm	c0.49					0.08
v/c Ratio	1.00	0.79	0.97		0.35	0.88
Uniform Delay, d1	36.6	3.5	35.1		59.4	33.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	34.6	2.7	25.5		4.4	12.9
Delay (s)	71.2	6.2	60.6		63.8	46.1
Level of Service	E	A	E		E	D
Approach Delay (s)		29.5	60.6		47.1	
Approach LOS		C	E		D	

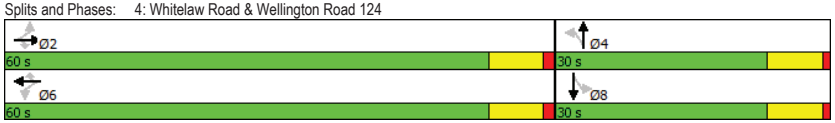
Intersection Summary				
HCM 2000 Control Delay	40.1	HCM 2000 Level of Service	D	
HCM 2000 Volume to Capacity ratio	1.02			
Actuated Cycle Length (s)	133.2	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	84.1%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Future Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	140.0		130.0	0.0		0.0	0.0		0.0
Storage Lanes	1		1	1		1	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.963			0.934	
Flt Protected	0.950			0.950				0.987			0.979	
Satd. Flow (prot)	1736	1776	1615	1444	1792	1509	0	1676	0	0	1371	0
Flt Permitted	0.331			0.117				0.900			0.849	
Satd. Flow (perm)	605	1776	1615	178	1792	1509	0	1529	0	0	1189	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			47			101		6			46	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
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 (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Adj. Flow (vph)	87	1103	6	7	709	101	6	10	6	41	7	46
Shared Lane Traffic (%)												
Lane Group Flow (vph)	87	1103	6	7	709	101	0	22	0	0	94	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	
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)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	
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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		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			8		
Detector Phase	2	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2	37.2	37.2	37.2	37.2	28.9	28.9		28.9	28.9	
Total Split (s)	60.0	60.0	60.0	60.0	60.0	60.0	30.0	30.0		30.0	30.0	
Total Split (%)	66.7%	66.7%	66.7%	66.7%	66.7%	66.7%	33.3%	33.3%		33.3%	33.3%	
Maximum Green (s)	52.8	52.8	52.8	52.8	52.8	52.8	23.1	23.1		23.1	23.1	
Yellow Time (s)	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3	1.3	1.3	1.3	1.3	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Lost Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0		3.0	3.0	
Recall Mode	Max	Max	Max	Max	Max	Max	None	None		None	None	
Walk Time (s)	15.0	15.0	15.0	15.0	15.0	15.0	11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	60.5	60.5	60.5	60.5	60.5	60.5		15.1			15.1	
Actuated g/C Ratio	0.73	0.73	0.73	0.73	0.73	0.73		0.18			0.18	
v/c Ratio	0.20	0.86	0.01	0.05	0.54	0.09		0.08			0.37	
Control Delay	7.4	21.4	0.0	6.7	9.5	1.5		23.4			22.0	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Delay	7.4	21.4	0.0	6.7	9.5	1.5		23.4			22.0	
LOS	A	C	A	A	A	A		C			C	
Approach Delay		20.3			8.5			23.4			22.0	
Approach LOS		C			A			C			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 83.3			
Natural Cycle: 90			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.86			
Intersection Signal Delay: 15.9		Intersection LOS: B	
Intersection Capacity Utilization 89.1%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	87	1103	6	7	709	101	22	94
v/c Ratio	0.20	0.86	0.01	0.05	0.54	0.09	0.08	0.37
Control Delay	7.4	21.4	0.0	6.7	9.5	1.5	23.4	22.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.4	21.4	0.0	6.7	9.5	1.5	23.4	22.0
Queue Length 50th (m)	5.2	149.6	0.0	0.4	60.3	0.0	2.2	6.8
Queue Length 95th (m)	12.2	#258.6	0.0	2.0	92.6	4.9	8.4	20.6
Internal Link Dist (m)		2030.4			1551.0		355.0	437.0
Turn Bay Length (m)	100.0		100.0	140.0		130.0		
Base Capacity (vph)	439	1289	1185	129	1301	1123	430	365
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.86	0.01	0.05	0.54	0.09	0.05	0.26

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Future Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.96			0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.98	
Satd. Flow (prot)	1736	1776	1615	1444	1792	1509		1676			1371	
Flt Permitted	0.33	1.00	1.00	0.12	1.00	1.00		0.90			0.85	
Satd. Flow (perm)	605	1776	1615	177	1792	1509		1528			1189	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	87	1103	6	7	709	101	6	10	6	41	7	46
RTOR Reduction (vph)	0	0	2	0	0	31	0	5	0	0	40	0
Lane Group Flow (vph)	87	1103	4	7	709	70	0	17	0	0	54	0
Heavy Vehicles (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2		2	6		6	4			8		
Actuated Green, G (s)	58.9	58.9	58.9	58.9	58.9	58.9		11.8			11.8	
Effective Green, g (s)	58.9	58.9	58.9	58.9	58.9	58.9		11.8			11.8	
Actuated g/C Ratio	0.69	0.69	0.69	0.69	0.69	0.69		0.14			0.14	
Clearance Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5		3.0			3.0	
Lane Grp Cap (vph)	420	1233	1121	122	1244	1048		212			165	
v/s Ratio Prot		c0.62			0.40							
v/s Ratio Perm	0.14		0.00	0.04		0.05		0.01			c0.05	
v/c Ratio	0.21	0.89	0.00	0.06	0.57	0.07		0.08			0.33	
Uniform Delay, d1	4.6	10.4	4.0	4.1	6.5	4.1		31.8			32.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	1.1	10.2	0.0	0.9	1.9	0.1		0.2			1.2	
Delay (s)	5.7	20.6	4.0	5.0	8.4	4.3		31.9			34.1	
Level of Service	A	C	A	A	A	A		C			C	
Approach Delay (s)		19.5			7.9			31.9			34.1	
Approach LOS		B			A			C			C	

Intersection Summary				
HCM 2000 Control Delay	15.8	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.80			
Actuated Cycle Length (s)	84.8	Sum of lost time (s)	14.1	
Intersection Capacity Utilization	89.1%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

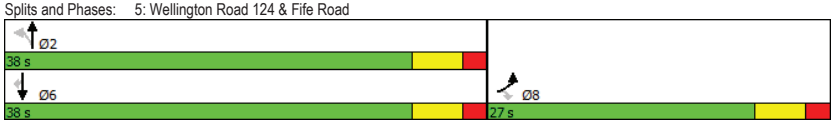
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	476	14	5	1039	675	357
Future Volume (vph)	476	14	5	1039	675	357
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950					
Satd. Flow (prot)	1770	1214	0	3375	1792	1553
Flt Permitted	0.950			0.952		
Satd. Flow (perm)	1770	1214	0	3213	1792	1553
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		15				388
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Adj. Flow (vph)	517	15	5	1129	734	388
Shared Lane Traffic (%)						
Lane Group Flow (vph)	517	15	0	1134	734	388
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	27.0	27.0	38.0	38.0	38.0	38.0
Total Split (%)	41.5%	41.5%	58.5%	58.5%	58.5%	58.5%
Maximum Green (s)	21.0	21.0	32.0	32.0	32.0	32.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	20.4	20.4		32.0	32.0	32.0
Actuated g/C Ratio	0.32	0.32		0.50	0.50	0.50
v/c Ratio	0.92	0.04		0.71	0.82	0.40
Control Delay	47.1	8.4		15.9	24.3	2.6
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	47.1	8.4		15.9	24.3	2.6
LOS	D	A		B	C	A
Approach Delay	46.0			15.9	16.8	
Approach LOS	D			B	B	

Intersection Summary

Area Type: Other
Cycle Length: 65
Actuated Cycle Length: 64.4
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 22.0 — Intersection LOS: C
Intersection Capacity Utilization 71.9% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road



Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	517	15	1134	734	388
v/c Ratio	0.92	0.04	0.71	0.82	0.40
Control Delay	47.1	8.4	15.9	24.3	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	47.1	8.4	15.9	24.3	2.6
Queue Length 50th (m)	61.7	0.0	55.5	74.6	0.0
Queue Length 95th (m)	#116.7	3.6	77.5	#140.5	12.1
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	576	406	1596	890	966
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.90	0.04	0.71	0.82	0.40

Intersection Summary

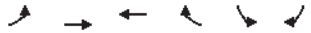
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	476	14	5	1039	675	357
Future Volume (vph)	476	14	5	1039	675	357
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1214		3374	1792	1553
Flt Permitted	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1214		3213	1792	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	517	15	5	1129	734	388
RTOR Reduction (vph)	0	10	0	0	0	195
Lane Group Flow (vph)	517	5	0	1134	734	193
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	20.4	20.4		32.0	32.0	32.0
Effective Green, g (s)	20.4	20.4		32.0	32.0	32.0
Actuated g/C Ratio	0.32	0.32		0.50	0.50	0.50
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	560	384		1596	890	771
v/s Ratio Prot	c0.29				c0.41	
v/s Ratio Perm		0.00		0.35		0.12
v/c Ratio	0.92	0.01		0.71	0.82	0.25
Uniform Delay, d1	21.2	15.1		12.6	13.8	9.3
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	21.0	0.0		2.7	8.6	0.8
Delay (s)	42.2	15.1		15.3	22.4	10.1
Level of Service	D	B		B	C	B
Approach Delay (s)	41.5			15.3	18.1	
Approach LOS	D			B	B	

Intersection Summary

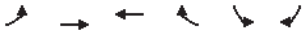
HCM 2000 Control Delay	21.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	64.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	296	1043	1354	14	1	523
Future Volume (vph)	296	1043	1354	14	1	523
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	125.0			50.0	30.0	0.0
Storage Lanes	1			1	1	1
Taper Length (m)	7.5				7.5	
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)	1787	1759	1827	1615	1805	1615
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1787	1759	1827	1615	1805	1615
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Heavy Vehicles (%)	1%	8%	4%	0%	0%	0%
Adj. Flow (vph)	308	1086	1410	16	1	545
Shared Lane Traffic (%)						
Lane Group Flow (vph)	308	1086	1410	16	1	545
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	L NA	R NA	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 110.3%		ICU Level of Service H	
Analysis Period (min) 15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	296	1043	1354	14	1	523
Future Volume (Veh/h)	296	1043	1354	14	1	523
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Hourly flow rate (vph)	308	1086	1410	16	1	545
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	1426				3112	1410
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1426				3112	1410
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	36				78	0
cM capacity (veh/h)	480				5	171

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	308	1086	1410	16	1	545
Volume Left	308	0	0	0	1	0
Volume Right	0	0	0	16	0	545
cSH	480	1700	1700	1700	5	171
Volume to Capacity	0.64	0.64	0.83	0.01	0.22	3.18
Queue Length 95th (m)	35.6	0.0	0.0	0.0	3.4	Err
Control Delay (s)	25.0	0.0	0.0	0.0	931.0	Err
Lane LOS	C				F	F
Approach Delay (s)	5.5		0.0		9982.4	
Approach LOS					F	

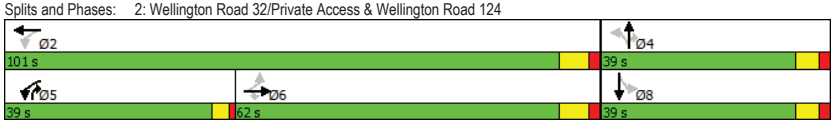
Intersection Summary				
Average Delay		1621.5		
Intersection Capacity Utilization		110.3%	ICU Level of Service	H
Analysis Period (min)		15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	829	236	732	942	6	431	0	684	24	6	1
Future Volume (vph)	6	829	236	732	942	6	431	0	684	24	6	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	0.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		1	1		0	1		1	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.999				0.850		0.996	
Flt Protected	0.950			0.950				0.950			0.963	
Satd. Flow (prot)	1805	1759	1553	1752	1791	0	0	1787	1524	0	1822	0
Flt Permitted	0.269			0.068				0.737			0.327	
Satd. Flow (perm)	511	1759	1553	125	1791	0	0	1386	1524	0	619	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			163						61		1	
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Adj. Flow (vph)	6	846	241	747	961	6	440	0	698	24	6	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	6	846	241	747	967	0	0	440	698	0	31	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2		1	2	1	1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0		0.0	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)	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2			4		4	8		
Detector Phase	6	6	6	5	2		4	4	5	8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0	35.0	8.0	35.0		12.0	12.0	8.0	12.0	12.0	
Minimum Split (s)	42.0	42.0	42.0	12.0	42.0		26.0	26.0	12.0	26.0	26.0	
Total Split (s)	62.0	62.0	62.0	39.0	101.0		39.0	39.0	39.0	39.0	39.0	
Total Split (%)	44.3%	44.3%	44.3%	27.9%	72.1%		27.9%	27.9%	27.9%	27.9%	27.9%	
Maximum Green (s)	55.0	55.0	55.0	35.0	94.0		33.0	33.0	35.0	33.0	33.0	
Yellow Time (s)	5.0	5.0	5.0	3.0	5.0		4.0	4.0	3.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0		2.0	2.0	1.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Lead/Lag	Lag	Lag	Lag	Lead					Lead			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes					Yes			
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	None	Max		None	None	None	None	None	
Walk Time (s)	23.0	23.0	23.0		23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0	12.0		12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0	0		0		0	0		0	0	
Act Effct Green (s)	55.0	55.0	55.0	97.0	94.0			33.0	74.0		33.0	
Actuated g/C Ratio	0.39	0.39	0.39	0.69	0.67			0.24	0.53		0.24	
v/c Ratio	0.03	1.22	0.34	1.52	0.80			1.35	0.84		0.21	
Control Delay	27.0	150.8	11.1	274.0	23.1			217.2	36.0		46.5	
Queue Delay	0.0	0.0	0.0	0.0	0.6			0.0	0.0		0.0	
Total Delay	27.0	150.8	11.1	274.0	23.7			217.2	36.0		46.5	
LOS	C	F	B	F	C			F	D		D	
Approach Delay		119.3			132.8			106.0			46.5	
Approach LOS		F			F			F			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Natural Cycle: 140			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 1.52			
Intersection Signal Delay: 120.8		Intersection LOS: F	
Intersection Capacity Utilization 126.7%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	6	846	241	747	967	440	698	31
v/c Ratio	0.03	1.22	0.34	1.52	0.80	1.35	0.84	0.21
Control Delay	27.0	150.8	11.1	274.0	23.1	217.2	36.0	46.5
Queue Delay	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
Total Delay	27.0	150.8	11.1	274.0	23.7	217.2	36.0	46.5
Queue Length 50th (m)	1.1	~302.6	14.4	~287.5	187.1	~167.3	155.2	7.1
Queue Length 95th (m)	4.2	#383.7	35.3	#367.9	255.5	#236.2	221.2	17.2
Internal Link Dist (m)		1665.7			343.4	471.1		37.2
Turn Bay Length (m)	100.0		100.0					
Base Capacity (vph)	200	691	709	493	1202	326	834	146
Starvation Cap Reductn	0	0	0	0	51	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	1.22	0.34	1.52	0.84	1.35	0.84	0.21

Intersection Summary

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

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	829	236	732	942	6	431	0	684	24	6	1
Future Volume (vph)	6	829	236	732	942	6	431	0	684	24	6	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	
Satd. Flow (prot)	1805	1759	1553	1752	1791			1787	1524		1821	
Flt Permitted	0.27	1.00	1.00	0.07	1.00			0.74	1.00		0.33	
Satd. Flow (perm)	511	1759	1553	125	1791			1386	1524		618	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	6	846	241	747	961	6	440	0	698	24	6	1
RTOR Reduction (vph)	0	0	99	0	0	0	0	0	31	0	1	0
Lane Group Flow (vph)	6	846	142	747	967	0	0	440	667	0	30	0
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	
Permitted Phases	6		6	2			4		4	8		
Actuated Green, G (s)	55.0	55.0	55.0	94.0	94.0			33.0	68.0		33.0	
Effective Green, g (s)	55.0	55.0	55.0	94.0	94.0			33.0	68.0		33.0	
Actuated g/C Ratio	0.39	0.39	0.39	0.67	0.67			0.24	0.49		0.24	
Clearance Time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	200	691	610	490	1202			326	740		145	
v/s Ratio Prot		0.48		c0.38	0.54				0.23			
v/s Ratio Perm	0.01		0.09	c0.64				c0.32	0.21		0.05	
v/c Ratio	0.03	1.22	0.23	1.52	0.80			1.35	0.90		0.21	
Uniform Delay, d1	26.1	42.5	28.4	45.4	16.4			53.5	32.9		43.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.1	113.6	0.4	246.3	5.8			176.4	14.1		0.7	
Delay (s)	26.2	156.1	28.8	291.7	22.2			229.9	47.0		43.7	
Level of Service	C	F	C	F	C			F	D		D	
Approach Delay (s)		127.3			139.7			117.7			43.7	
Approach LOS		F			F			F			D	

Intersection Summary				
HCM 2000 Control Delay	129.2	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.51			
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	126.7%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

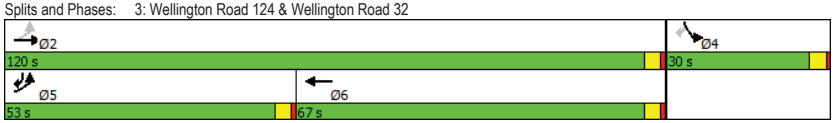
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	548	1003	766	46	48	879
Future Volume (vph)	548	1003	766	46	48	879
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	0.0			0.0	90.0	0.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.992			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1612	1827	1798	0	1444	1524
Flt Permitted	0.060				0.950	
Satd. Flow (perm)	102	1827	1798	0	1444	1524
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			2			92
Link Speed (k/h)		70	70		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		18.9	105.7		23.1	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Adj. Flow (vph)	559	1023	782	47	49	897
Shared Lane Traffic (%)						
Lane Group Flow (vph)	559	1023	829	0	49	897
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	2					4
Detector Phase	5	2	6		4	5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	9.0
Total Split (s)	53.0	120.0	67.0		30.0	53.0
Total Split (%)	35.3%	80.0%	44.7%		20.0%	35.3%
Maximum Green (s)	49.0	116.0	63.0		26.0	49.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lead		Lag			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	None	Min		None	None
Walk Time (s)		10.0	10.0		10.0	
Flash Dont Walk (s)		16.0	16.0		16.0	
Pedestrian Calls (#/hr)		0	0		0	
Act Effct Green (s)	116.4	117.3	63.2		11.8	62.4
Actuated g/C Ratio	0.87	0.88	0.47		0.09	0.47
v/c Ratio	0.87	0.64	0.97		0.39	1.18
Control Delay	48.9	5.6	60.6		67.2	124.5
Queue Delay	0.0	0.4	0.0		0.0	0.0
Total Delay	48.9	5.9	60.6		67.2	124.5
LOS	D	A	E		E	F
Approach Delay		21.1	60.6		121.5	
Approach LOS		C	E		F	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 133.6
Natural Cycle: 150
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.18
Intersection Signal Delay: 59.1 — Intersection LOS: E
Intersection Capacity Utilization 104.2% — ICU Level of Service G
Analysis Period (min) 15

Splits and Phases: 3: Wellington Road 124 & Wellington Road 32

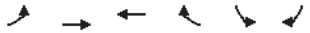


Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	559	1023	829	49	897
v/c Ratio	0.87	0.64	0.97	0.39	1.18
Control Delay	48.9	5.6	60.6	67.2	124.5
Queue Delay	0.0	0.4	0.0	0.0	0.0
Total Delay	48.9	5.9	60.6	67.2	124.5
Queue Length 50th (m)	130.6	72.0	228.2	13.3	~285.1
Queue Length 95th (m)	#211.9	129.1	#338.6	27.0	#370.6
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)				90.0	
Base Capacity (vph)	644	1603	851	281	760
Starvation Cap Reductn	0	178	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.87	0.72	0.97	0.17	1.18

Intersection Summary

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

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



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	548	1003	766	46	48	879
Future Volume (vph)	548	1003	766	46	48	879
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1612	1827	1798		1444	1524
Flt Permitted	0.06	1.00	1.00		0.95	1.00
Satd. Flow (perm)	101	1827	1798		1444	1524
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	559	1023	782	47	49	897
RTOR Reduction (vph)	0	0	1	0	0	51
Lane Group Flow (vph)	559	1023	828	0	49	846
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Turn Type	pm+pt	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5
Permitted Phases	2					4
Actuated Green, G (s)	116.3	116.3	63.2		10.1	59.2
Effective Green, g (s)	116.3	116.3	63.2		10.1	59.2
Actuated g/C Ratio	0.87	0.87	0.47		0.08	0.44
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	639	1580	845		108	716
v/s Ratio Prot	0.32	0.56	c0.46		0.03	c0.43
v/s Ratio Perm	0.44					0.12
v/c Ratio	0.87	0.65	0.98		0.45	1.18
Uniform Delay, d1	35.7	2.8	35.0		59.5	37.6
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	13.7	0.9	25.7		6.2	95.4
Delay (s)	49.4	3.7	60.7		65.7	133.0
Level of Service	D	A	E		E	F
Approach Delay (s)		19.8	60.7		129.5	
Approach LOS		B	E		F	

Intersection Summary				
HCM 2000 Control Delay	60.8	HCM 2000 Level of Service	E	
HCM 2000 Volume to Capacity ratio	1.11			
Actuated Cycle Length (s)	134.4	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	104.2%	ICU Level of Service	G	
Analysis Period (min)	15			

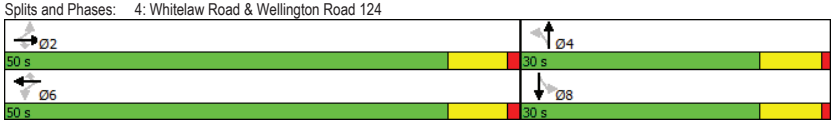
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Future Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	140.0		130.0	0.0		0.0	0.0		0.0
Storage Lanes	1		1	1		1	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.950			0.947	
Flt Protected	0.950			0.950				0.987			0.973	
Satd. Flow (prot)	1703	1863	1615	1805	1810	1509	0	1782	0	0	1659	0
Flt Permitted	0.265			0.121				0.907			0.816	
Satd. Flow (perm)	475	1863	1615	230	1810	1509	0	1637	0	0	1391	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			53			53		7			41	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Adj. Flow (vph)	140	969	1	3	746	44	5	7	7	101	9	71
Shared Lane Traffic (%)												
Lane Group Flow (vph)	140	969	1	3	746	44	0	19	0	0	181	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	
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)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	
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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		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			8		
Detector Phase	2	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2	37.2	37.2	37.2	37.2	28.9	28.9		28.9	28.9	
Total Split (s)	50.0	50.0	50.0	50.0	50.0	50.0	30.0	30.0		30.0	30.0	
Total Split (%)	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%	37.5%	37.5%		37.5%	37.5%	
Maximum Green (s)	42.8	42.8	42.8	42.8	42.8	42.8	23.1	23.1		23.1	23.1	
Yellow Time (s)	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3	1.3	1.3	1.3	1.3	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Lost Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0		3.0	3.0	
Recall Mode	Max	Max	Max	Max	Max	Max	None	None		None	None	
Walk Time (s)	15.0	15.0	15.0	15.0	15.0	15.0	11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	45.7	45.7	45.7	45.7	45.7	45.7		15.9			15.9	
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.60	0.60		0.21			0.21	
v/c Ratio	0.49	0.86	0.00	0.02	0.68	0.05		0.05			0.56	
Control Delay	16.6	23.6	0.0	7.3	14.8	2.1		17.9			26.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Delay	16.6	23.6	0.0	7.3	14.8	2.1		17.9			26.9	
LOS	B	C	A	A	B	A		B			C	
Approach Delay		22.7			14.0			17.9			26.9	
Approach LOS		C			B			B			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 75.8			
Natural Cycle: 80			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.86			
Intersection Signal Delay: 19.7		Intersection LOS: B	
Intersection Capacity Utilization 107.8%		ICU Level of Service G	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	140	969	1	3	746	44	19	181
v/c Ratio	0.49	0.86	0.00	0.02	0.68	0.05	0.05	0.56
Control Delay	16.6	23.6	0.0	7.3	14.8	2.1	17.9	26.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.6	23.6	0.0	7.3	14.8	2.1	17.9	26.9
Queue Length 50th (m)	10.2	103.9	0.0	0.2	65.4	0.0	1.4	17.6
Queue Length 95th (m)	31.4	#213.8	0.0	1.4	121.9	3.4	6.3	36.7
Internal Link Dist (m)		2030.4			1551.0		355.0	437.0
Turn Bay Length (m)	100.0		100.0	140.0		130.0		
Base Capacity (vph)	285	1122	993	138	1090	930	506	454
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.86	0.00	0.02	0.68	0.05	0.04	0.40

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Future Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.95			0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.97	
Satd. Flow (prot)	1703	1863	1615	1805	1810	1509		1782			1659	
Flt Permitted	0.26	1.00	1.00	0.12	1.00	1.00		0.91			0.82	
Satd. Flow (perm)	474	1863	1615	230	1810	1509		1638			1392	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	140	969	1	3	746	44	5	7	7	101	9	71
RTOR Reduction (vph)	0	0	0	0	0	17	0	6	0	0	32	0
Lane Group Flow (vph)	140	969	1	3	746	27	0	13	0	0	149	0
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2		2	6		6	4			8		
Actuated Green, G (s)	45.6	45.6	45.6	45.6	45.6	45.6		15.9			15.9	
Effective Green, g (s)	45.6	45.6	45.6	45.6	45.6	45.6		15.9			15.9	
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.60	0.60		0.21			0.21	
Clearance Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5		3.0			3.0	
Lane Grp Cap (vph)	285	1123	974	138	1091	910		344			292	
v/s Ratio Prot		c0.52			0.41							
v/s Ratio Perm	0.30		0.00	0.01		0.02		0.01			c0.11	
v/c Ratio	0.49	0.86	0.00	0.02	0.68	0.03		0.04			0.51	
Uniform Delay, d1	8.5	12.4	6.0	6.0	10.1	6.1		23.8			26.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	5.9	8.8	0.0	0.3	3.5	0.1		0.0			1.4	
Delay (s)	14.4	21.2	6.0	6.3	13.6	6.1		23.8			27.8	
Level of Service	B	C	A	A	B	A		C			C	
Approach Delay (s)		20.4			13.2			23.8			27.8	
Approach LOS		C			B			C			C	

Intersection Summary				
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.77			
Actuated Cycle Length (s)	75.6	Sum of lost time (s)	14.1	
Intersection Capacity Utilization	107.8%	ICU Level of Service	G	
Analysis Period (min)	15			
c Critical Lane Group				

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	397	16	15	983	737	671
Future Volume (vph)	397	16	15	983	737	671
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950			0.999		
Satd. Flow (prot)	1770	1615	0	3503	1810	1583
Flt Permitted	0.950			0.940		
Satd. Flow (perm)	1770	1615	0	3296	1810	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		17				699
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Adj. Flow (vph)	414	17	16	1024	768	699
Shared Lane Traffic (%)						
Lane Group Flow (vph)	414	17	0	1040	768	699
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	25.0	25.0	45.0	45.0	45.0	45.0
Total Split (%)	35.7%	35.7%	64.3%	64.3%	64.3%	64.3%
Maximum Green (s)	19.0	19.0	39.0	39.0	39.0	39.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	18.2	18.2		39.0	39.0	39.0
Actuated g/C Ratio	0.26	0.26		0.56	0.56	0.56
v/c Ratio	0.89	0.04		0.56	0.75	0.58
Control Delay	48.3	9.8		11.3	17.8	3.0
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	48.3	9.8		11.3	17.8	3.0
LOS	D	A		B	B	A
Approach Delay	46.8			11.3	10.7	
Approach LOS	D			B	B	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 69.3
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 16.2 — Intersection LOS: B
Intersection Capacity Utilization 79.2% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road

Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	414	17	1040	768	699
v/c Ratio	0.89	0.04	0.56	0.75	0.58
Control Delay	48.3	9.8	11.3	17.8	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	48.3	9.8	11.3	17.8	3.0
Queue Length 50th (m)	54.1	0.0	44.4	74.2	0.0
Queue Length 95th (m)	#102.4	4.3	61.0	120.4	13.6
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	485	455	1856	1019	1197
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.85	0.04	0.56	0.75	0.58

Intersection Summary

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

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	397	16	15	983	737	671
Future Volume (vph)	397	16	15	983	737	671
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1615		3504	1810	1583
Flt Permitted	0.95	1.00		0.94	1.00	1.00
Satd. Flow (perm)	1770	1615		3296	1810	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	414	17	16	1024	768	699
RTOR Reduction (vph)	0	13	0	0	0	305
Lane Group Flow (vph)	414	4	0	1040	768	394
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	18.2	18.2		39.0	39.0	39.0
Effective Green, g (s)	18.2	18.2		39.0	39.0	39.0
Actuated g/C Ratio	0.26	0.26		0.56	0.56	0.56
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	465	424		1857	1020	892
v/s Ratio Prot	c0.23				c0.42	
v/s Ratio Perm		0.00		0.32		0.25
v/c Ratio	0.89	0.01		0.56	0.75	0.44
Uniform Delay, d1	24.5	18.8		9.6	11.4	8.8
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	18.8	0.0		1.2	5.1	1.6
Delay (s)	43.3	18.9		10.9	16.6	10.4
Level of Service	D	B		B	B	B
Approach Delay (s)	42.3			10.9	13.6	
Approach LOS	D			B	B	

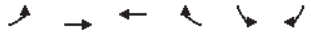
Intersection Summary

HCM 2000 Control Delay	16.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	69.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

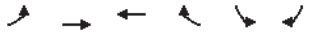
Appendix G

Traffic Operations Reports – Alternative 2



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	441	1077	1090	6	0	397
Future Volume (vph)	441	1077	1090	6	0	397
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	125.0			60.0	30.0	0.0
Storage Lanes	1			1	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.850		0.850
Flt Protected	0.950					
Satd. Flow (prot)	1770	1743	1743	1077	1900	1599
Flt Permitted	0.950					
Satd. Flow (perm)	1770	1743	1743	1077	1900	1599
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	2%	9%	9%	50%	0%	1%
Adj. Flow (vph)	464	1134	1147	6	0	418
Shared Lane Traffic (%)						
Lane Group Flow (vph)	464	1134	1147	6	0	418
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane			Yes			
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization	88.6%	ICU Level of Service	E
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	441	1077	1090	6	0	397
Future Volume (Veh/h)	441	1077	1090	6	0	397
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)	464	1134	1147	6	0	418
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1153				3209	1147
vC1, stage 1 conf vol					1147	
vC2, stage 2 conf vol					2062	
vCu, unblocked vol	1153				3209	1147
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	23				100	0
cM capacity (veh/h)	606				25	243

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	464	1134	1147	6	0	418
Volume Left	464	0	0	0	0	0
Volume Right	0	0	0	6	0	418
cSH	606	1700	1700	1700	1700	243
Volume to Capacity	0.77	0.67	0.67	0.00	0.00	1.72
Queue Length 95th (m)	56.2	0.0	0.0	0.0	0.0	220.2
Control Delay (s)	27.7	0.0	0.0	0.0	0.0	374.8
Lane LOS	D				A	F
Approach Delay (s)	8.0		0.0		374.8	
Approach LOS					F	

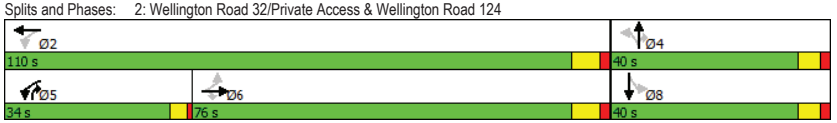
Intersection Summary				
Average Delay	53.5			
Intersection Capacity Utilization	88.6%	ICU Level of Service		E
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Future Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	60.0		60.0	180.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		1	1		0	1		1	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850						0.850			
Flt Protected				0.950				0.950			0.950	
Satd. Flow (prot)	1900	1712	1495	1703	1667	0	0	1752	1568	0	1805	0
Flt Permitted				0.055				0.757			0.120	
Satd. Flow (perm)	1900	1712	1495	99	1667	0	0	1396	1568	0	228	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			86						68			
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
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%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Adj. Flow (vph)	0	956	218	496	836	0	392	0	977	1	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	956	218	496	836	0	0	392	977	0	1	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane		Yes			Yes							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2		1	2	1	1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0		0.0	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)	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2			4		4	8		
Detector Phase	6	6	6	5	2		4	4	5	8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0	35.0	8.0	35.0		12.0	12.0	8.0	12.0	12.0	
Minimum Split (s)	42.0	42.0	42.0	12.0	42.0		26.0	26.0	12.0	26.0	26.0	
Total Split (s)	76.0	76.0	76.0	34.0	110.0		40.0	40.0	34.0	40.0	40.0	
Total Split (%)	50.7%	50.7%	50.7%	22.7%	73.3%		26.7%	26.7%	22.7%	26.7%	26.7%	
Maximum Green (s)	69.0	69.0	69.0	30.0	103.0		34.0	34.0	30.0	34.0	34.0	
Yellow Time (s)	5.0	5.0	5.0	3.0	5.0		4.0	4.0	3.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0		2.0	2.0	1.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Lead/Lag	Lag	Lag	Lag	Lead					Lead			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes					Yes			
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	None	None		None	None	None	None	None	
Walk Time (s)	23.0	23.0	23.0		23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0	12.0		12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0	0		0		0	0		0	0	
Act Effct Green (s)		69.0	69.0	106.0	103.0			34.0	70.0		34.0	
Actuated g/C Ratio		0.46	0.46	0.71	0.69			0.23	0.47		0.23	
v/c Ratio		1.21	0.30	1.27	0.73			1.24	1.27		0.02	
Control Delay		144.3	16.0	180.3	19.6			179.1	165.2		47.0	
Queue Delay		0.0	0.0	0.0	0.4			0.0	0.0		0.0	
Total Delay		144.3	16.0	180.3	20.0			179.1	165.2		47.0	
LOS		F	B	F	B			F	F		D	
Approach Delay		120.5			79.7			169.2			47.0	
Approach LOS		F			E			F			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 150			
Actuated Cycle Length: 150			
Natural Cycle: 150			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 1.27			
Intersection Signal Delay: 123.6		Intersection LOS: F	
Intersection Capacity Utilization 123.9%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124



Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	956	218	496	836	392	977	1
v/c Ratio	1.21	0.30	1.27	0.73	1.24	1.27	0.02
Control Delay	144.3	16.0	180.3	19.6	179.1	165.2	47.0
Queue Delay	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Total Delay	144.3	16.0	180.3	20.0	179.1	165.2	47.0
Queue Length 50th (m)	~365.0	24.4	~179.4	152.8	~151.8	~374.7	0.3
Queue Length 95th (m)	#448.7	44.0	#253.0	207.3	#219.9	#459.6	2.0
Internal Link Dist (m)	1665.7			343.4	471.1		37.2
Turn Bay Length (m)		60.0	180.0				
Base Capacity (vph)	787	734	390	1144	316	768	51
Starvation Cap Reductn	0	0	0	63	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	1.21	0.30	1.27	0.77	1.24	1.27	0.02

Intersection Summary

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

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Future Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Lane Util. Factor		1.00	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		1.00	
Flt Protected		1.00	1.00	0.95	1.00			0.95	1.00		0.95	
Satd. Flow (prot)		1712	1495	1703	1667			1752	1568		1805	
Flt Permitted		1.00	1.00	0.05	1.00			0.76	1.00		0.12	
Satd. Flow (perm)		1712	1495	98	1667			1397	1568		228	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	956	218	496	836	0	392	0	977	1	0	0
RTOR Reduction (vph)	0	0	46	0	0	0	0	0	39	0	0	0
Lane Group Flow (vph)	0	956	172	496	836	0	0	392	938	0	1	0
Heavy Vehicles (%)	0%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	
Permitted Phases	6		6	2			4		4	8		
Actuated Green, G (s)		69.0	69.0	103.0	103.0			34.0	64.0		34.0	
Effective Green, g (s)		69.0	69.0	103.0	103.0			34.0	64.0		34.0	
Actuated g/C Ratio		0.46	0.46	0.69	0.69			0.23	0.43		0.23	
Clearance Time (s)		7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Vehicle Extension (s)		5.0	5.0	3.0	5.0			3.0	3.0		3.0	
Lane Grp Cap (vph)		787	687	388	1144			316	669		51	
v/s Ratio Prot		0.56		0.26	0.50				c0.28			
v/s Ratio Perm			0.11	c0.62				0.28	0.32		0.00	
v/c Ratio		1.21	0.25	1.28	0.73			1.24	1.40		0.02	
Uniform Delay, d1		40.5	24.7	52.1	14.8			58.0	43.0		45.1	
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2		108.2	0.4	143.8	3.0			132.3	189.9		0.2	
Delay (s)		148.7	25.1	195.9	17.7			190.3	232.9		45.2	
Level of Service		F	C	F	B			F	F		D	
Approach Delay (s)		125.7			84.1			220.7			45.2	
Approach LOS		F			F			F			D	

Intersection Summary

HCM 2000 Control Delay	144.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.36		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	123.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

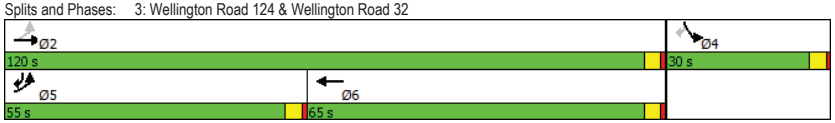
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	617	1099	649	26	32	584
Future Volume (vph)	617	1099	649	26	32	584
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	180.0			0.0	90.0	0.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.995			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1641	1792	1700	0	1530	1429
Flt Permitted	0.074				0.950	
Satd. Flow (perm)	128	1792	1700	0	1530	1429
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			2			101
Link Speed (k/h)		70	70		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		18.9	105.7		23.1	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Adj. Flow (vph)	693	1235	729	29	36	656
Shared Lane Traffic (%)						
Lane Group Flow (vph)	693	1235	758	0	36	656
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane		Yes	Yes			
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	2					4
Detector Phase	5	2	6		4	5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	9.0
Total Split (s)	55.0	120.0	65.0		30.0	55.0
Total Split (%)	36.7%	80.0%	43.3%		20.0%	36.7%
Maximum Green (s)	51.0	116.0	61.0		26.0	51.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lead		Lag			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	None	Max		None	None
Walk Time (s)		10.0	10.0		10.0	
Flash Dont Walk (s)		16.0	16.0		16.0	
Pedestrian Calls (#/hr)		0	0		0	
Act Effct Green (s)	116.3	117.2	61.2		10.5	63.1
Actuated g/C Ratio	0.88	0.89	0.46		0.08	0.48
v/c Ratio	0.99	0.78	0.96		0.30	0.89
Control Delay	67.3	8.7	59.9		64.7	42.4
Queue Delay	0.0	0.7	0.0		0.0	0.0
Total Delay	67.3	9.4	59.9		64.7	42.4
LOS	E	A	E		E	D
Approach Delay		30.2	59.9		43.6	
Approach LOS		C	E		D	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 132.3
Natural Cycle: 150
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 39.6 — Intersection LOS: D
Intersection Capacity Utilization 84.1% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 3: Wellington Road 124 & Wellington Road 32



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	693	1235	758	36	656
v/c Ratio	0.99	0.78	0.96	0.30	0.89
Control Delay	67.3	8.7	59.9	64.7	42.4
Queue Delay	0.0	0.7	0.0	0.0	0.0
Total Delay	67.3	9.4	59.9	64.7	42.4
Queue Length 50th (m)	~179.4	110.7	204.6	9.7	141.3
Queue Length 95th (m)	#268.2	201.4	#300.5	21.3	#210.5
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)	180.0			90.0	
Base Capacity (vph)	697	1587	787	301	734
Starvation Cap Reductn	0	112	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.99	0.84	0.96	0.12	0.89

Intersection Summary

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

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

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	617	1099	649	26	32	584
Future Volume (vph)	617	1099	649	26	32	584
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1641	1792	1700		1530	1429
Flt Permitted	0.07	1.00	1.00		0.95	1.00
Satd. Flow (perm)	128	1792	1700		1530	1429
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	693	1235	729	29	36	656
RTOR Reduction (vph)	0	0	1	0	0	56
Lane Group Flow (vph)	693	1235	757	0	36	600
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Turn Type	pm+pt	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5
Permitted Phases	2					4
Actuated Green, G (s)	116.3	116.3	61.2		8.9	60.0
Effective Green, g (s)	116.3	116.3	61.2		8.9	60.0
Actuated g/C Ratio	0.87	0.87	0.46		0.07	0.45
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	692	1564	781		102	686
v/s Ratio Prot	c0.38	0.69	0.45		0.02	c0.34
v/s Ratio Perm	c0.49					0.08
v/c Ratio	1.00	0.79	0.97		0.35	0.88
Uniform Delay, d1	36.6	3.5	35.1		59.4	33.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	34.6	2.7	25.5		4.4	12.9
Delay (s)	71.2	6.2	60.6		63.8	46.1
Level of Service	E	A	E		E	D
Approach Delay (s)		29.5	60.6		47.1	
Approach LOS		C	E		D	

Intersection Summary				
HCM 2000 Control Delay	40.1	HCM 2000 Level of Service	D	
HCM 2000 Volume to Capacity ratio	1.02			
Actuated Cycle Length (s)	133.2	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	84.1%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Future Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	140.0		130.0	0.0		0.0	0.0		0.0
Storage Lanes	1		1	1		1	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.963			0.934	
Flt Protected	0.950			0.950				0.987			0.979	
Satd. Flow (prot)	1736	1776	1615	1444	1792	1509	0	1676	0	0	1371	0
Flt Permitted	0.332			0.119				0.900			0.849	
Satd. Flow (perm)	607	1776	1615	181	1792	1509	0	1529	0	0	1189	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			47			101		6			46	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
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 (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Adj. Flow (vph)	87	1103	6	7	709	101	6	10	6	41	7	46
Shared Lane Traffic (%)												
Lane Group Flow (vph)	87	1103	6	7	709	101	0	22	0	0	94	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane		Yes										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	
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)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	
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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		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			8		
Detector Phase	2	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2	37.2	37.2	37.2	37.2	28.9	28.9		28.9	28.9	
Total Split (s)	61.1	61.1	61.1	61.1	61.1	61.1	28.9	28.9		28.9	28.9	
Total Split (%)	67.9%	67.9%	67.9%	67.9%	67.9%	67.9%	32.1%	32.1%		32.1%	32.1%	
Maximum Green (s)	53.9	53.9	53.9	53.9	53.9	53.9	22.0	22.0		22.0	22.0	
Yellow Time (s)	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3	1.3	1.3	1.3	1.3	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Lost Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0		3.0	3.0	
Recall Mode	Max	Max	Max	Max	Max	Max	None	None		None	None	
Walk Time (s)	15.0	15.0	15.0	15.0	15.0	15.0	11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	61.6	61.6	61.6	61.6	61.6	61.6		15.1			15.1	
Actuated g/C Ratio	0.73	0.73	0.73	0.73	0.73	0.73		0.18			0.18	
v/c Ratio	0.20	0.85	0.01	0.05	0.54	0.09		0.08			0.38	
Control Delay	7.2	21.0	0.0	6.5	9.4	1.4		23.9			22.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Delay	7.2	21.0	0.0	6.5	9.4	1.4		23.9			22.4	
LOS	A	C	A	A	A	A		C			C	
Approach Delay		19.9			8.4			23.9			22.4	
Approach LOS		B			A			C			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 84.4			
Natural Cycle: 90			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.85			
Intersection Signal Delay: 15.6		Intersection LOS: B	
Intersection Capacity Utilization 89.1%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	87	1103	6	7	709	101	22	94
v/c Ratio	0.20	0.85	0.01	0.05	0.54	0.09	0.08	0.38
Control Delay	7.2	21.0	0.0	6.5	9.4	1.4	23.9	22.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	7.2	21.0	0.0	6.5	9.4	1.4	23.9	22.4
Queue Length 50th (m)	5.2	149.6	0.0	0.4	60.3	0.0	2.2	6.9
Queue Length 95th (m)	12.0	#260.1	0.0	2.0	92.4	4.8	8.6	20.9
Internal Link Dist (m)		2030.4			1551.0		355.0	437.0
Turn Bay Length (m)	100.0		100.0	140.0		130.0		
Base Capacity (vph)	443	1296	1191	132	1307	1128	405	345
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.85	0.01	0.05	0.54	0.09	0.05	0.27

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Future Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.96			0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.98	
Satd. Flow (prot)	1736	1776	1615	1444	1792	1509		1676			1371	
Flt Permitted	0.33	1.00	1.00	0.12	1.00	1.00		0.90			0.85	
Satd. Flow (perm)	607	1776	1615	181	1792	1509		1528			1189	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	87	1103	6	7	709	101	6	10	6	41	7	46
RTOR Reduction (vph)	0	0	2	0	0	30	0	5	0	0	40	0
Lane Group Flow (vph)	87	1103	4	7	709	71	0	17	0	0	54	0
Heavy Vehicles (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2		2	6		6	4			8		
Actuated Green, G (s)	60.0	60.0	60.0	60.0	60.0	60.0		11.8			11.8	
Effective Green, g (s)	60.0	60.0	60.0	60.0	60.0	60.0		11.8			11.8	
Actuated g/C Ratio	0.70	0.70	0.70	0.70	0.70	0.70		0.14			0.14	
Clearance Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5		3.0			3.0	
Lane Grp Cap (vph)	423	1240	1128	126	1251	1054		209			163	
v/s Ratio Prot		c0.62			0.40							
v/s Ratio Perm	0.14		0.00	0.04		0.05		0.01			c0.05	
v/c Ratio	0.21	0.89	0.00	0.06	0.57	0.07		0.08			0.33	
Uniform Delay, d1	4.6	10.3	3.9	4.1	6.5	4.1		32.3			33.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	1.1	9.8	0.0	0.8	1.9	0.1		0.2			1.2	
Delay (s)	5.7	20.1	3.9	4.9	8.3	4.2		32.5			34.7	
Level of Service	A	C	A	A	A	A		C			C	
Approach Delay (s)		18.9			7.8			32.5			34.7	
Approach LOS		B			A			C			C	

Intersection Summary				
HCM 2000 Control Delay	15.5	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.80			
Actuated Cycle Length (s)	85.9	Sum of lost time (s)	14.1	
Intersection Capacity Utilization	89.1%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

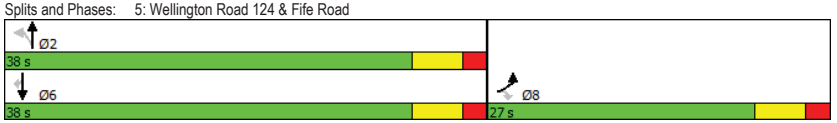
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	476	14	5	1039	675	357
Future Volume (vph)	476	14	5	1039	675	357
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950					
Satd. Flow (prot)	1770	1214	0	3375	1792	1553
Flt Permitted	0.950			0.952		
Satd. Flow (perm)	1770	1214	0	3213	1792	1553
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		15				388
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Adj. Flow (vph)	517	15	5	1129	734	388
Shared Lane Traffic (%)						
Lane Group Flow (vph)	517	15	0	1134	734	388
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	27.0	27.0	38.0	38.0	38.0	38.0
Total Split (%)	41.5%	41.5%	58.5%	58.5%	58.5%	58.5%
Maximum Green (s)	21.0	21.0	32.0	32.0	32.0	32.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	20.4	20.4		32.0	32.0	32.0
Actuated g/C Ratio	0.32	0.32		0.50	0.50	0.50
v/c Ratio	0.92	0.04		0.71	0.82	0.40
Control Delay	47.1	8.4		15.9	24.3	2.6
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	47.1	8.4		15.9	24.3	2.6
LOS	D	A		B	C	A
Approach Delay	46.0			15.9	16.8	
Approach LOS	D			B	B	

Intersection Summary

Area Type: Other
Cycle Length: 65
Actuated Cycle Length: 64.4
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 22.0 — Intersection LOS: C
Intersection Capacity Utilization 71.9% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road



Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	517	15	1134	734	388
v/c Ratio	0.92	0.04	0.71	0.82	0.40
Control Delay	47.1	8.4	15.9	24.3	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	47.1	8.4	15.9	24.3	2.6
Queue Length 50th (m)	61.7	0.0	55.5	74.6	0.0
Queue Length 95th (m)	#116.7	3.6	77.5	#140.5	12.1
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	576	406	1596	890	966
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.90	0.04	0.71	0.82	0.40

Intersection Summary

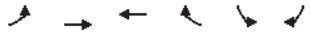
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	476	14	5	1039	675	357
Future Volume (vph)	476	14	5	1039	675	357
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1214		3374	1792	1553
Flt Permitted	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1214		3213	1792	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	517	15	5	1129	734	388
RTOR Reduction (vph)	0	10	0	0	0	195
Lane Group Flow (vph)	517	5	0	1134	734	193
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	20.4	20.4		32.0	32.0	32.0
Effective Green, g (s)	20.4	20.4		32.0	32.0	32.0
Actuated g/C Ratio	0.32	0.32		0.50	0.50	0.50
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	560	384		1596	890	771
v/s Ratio Prot	c0.29				c0.41	
v/s Ratio Perm		0.00		0.35		0.12
v/c Ratio	0.92	0.01		0.71	0.82	0.25
Uniform Delay, d1	21.2	15.1		12.6	13.8	9.3
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	21.0	0.0		2.7	8.6	0.8
Delay (s)	42.2	15.1		15.3	22.4	10.1
Level of Service	D	B		B	C	B
Approach Delay (s)	41.5			15.3	18.1	
Approach LOS	D			B	B	

Intersection Summary

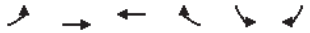
HCM 2000 Control Delay	21.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	64.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	296	1043	1354	14	1	523
Future Volume (vph)	296	1043	1354	14	1	523
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	125.0			60.0	30.0	0.0
Storage Lanes	1			1	1	1
Taper Length (m)	7.5				7.5	
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)	1787	1759	1827	1615	1805	1615
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1787	1759	1827	1615	1805	1615
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Heavy Vehicles (%)	1%	8%	4%	0%	0%	0%
Adj. Flow (vph)	308	1086	1410	16	1	545
Shared Lane Traffic (%)						
Lane Group Flow (vph)	308	1086	1410	16	1	545
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	L NA	R NA	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane			Yes			
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 110.3%		ICU Level of Service H	
Analysis Period (min) 15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	296	1043	1354	14	1	523
Future Volume (Veh/h)	296	1043	1354	14	1	523
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Hourly flow rate (vph)	308	1086	1410	16	1	545
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1426				3112	1410
vC1, stage 1 conf vol					1410	
vC2, stage 2 conf vol					1702	
vCu, unblocked vol	1426				3112	1410
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	36				98	0
cM capacity (veh/h)	480				55	171

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	308	1086	1410	16	1	545
Volume Left	308	0	0	0	1	0
Volume Right	0	0	0	16	0	545
cSH	480	1700	1700	1700	55	171
Volume to Capacity	0.64	0.64	0.83	0.01	0.02	3.18
Queue Length 95th (m)	35.6	0.0	0.0	0.0	0.4	Err
Control Delay (s)	25.0	0.0	0.0	0.0	71.7	Err
Lane LOS	C				F	F
Approach Delay (s)	5.5		0.0		9980.8	
Approach LOS					F	

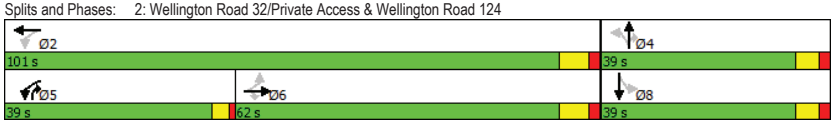
Intersection Summary				
Average Delay		1621.3		
Intersection Capacity Utilization		110.3%	ICU Level of Service	H
Analysis Period (min)		15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	829	236	732	942	6	431	0	684	24	6	1
Future Volume (vph)	6	829	236	732	942	6	431	0	684	24	6	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	180.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		1	1		0	1		1	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.999				0.850		0.996	
Flt Protected	0.950			0.950				0.950			0.963	
Satd. Flow (prot)	1805	1759	1553	1752	1791	0	0	1787	1524	0	1822	0
Flt Permitted	0.269			0.068				0.737			0.327	
Satd. Flow (perm)	511	1759	1553	125	1791	0	0	1386	1524	0	619	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			163						61		1	
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Adj. Flow (vph)	6	846	241	747	961	6	440	0	698	24	6	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	6	846	241	747	967	0	0	440	698	0	31	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane		Yes			Yes							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2		1	2	1	1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0		0.0	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)	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2			4		4	8		
Detector Phase	6	6	6	5	2		4	4	5	8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0	35.0	8.0	35.0		12.0	12.0	8.0	12.0	12.0	
Minimum Split (s)	42.0	42.0	42.0	12.0	42.0		26.0	26.0	12.0	26.0	26.0	
Total Split (s)	62.0	62.0	62.0	39.0	101.0		39.0	39.0	39.0	39.0	39.0	
Total Split (%)	44.3%	44.3%	44.3%	27.9%	72.1%		27.9%	27.9%	27.9%	27.9%	27.9%	
Maximum Green (s)	55.0	55.0	55.0	35.0	94.0		33.0	33.0	35.0	33.0	33.0	
Yellow Time (s)	5.0	5.0	5.0	3.0	5.0		4.0	4.0	3.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0		2.0	2.0	1.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Lead/Lag	Lag	Lag	Lag	Lead					Lead			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes					Yes			
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	None	Max		None	None	None	None	None	
Walk Time (s)	23.0	23.0	23.0		23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0	12.0		12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0	0		0		0	0		0	0	
Act Effct Green (s)	55.0	55.0	55.0	97.0	94.0			33.0	74.0		33.0	
Actuated g/C Ratio	0.39	0.39	0.39	0.69	0.67			0.24	0.53		0.24	
v/c Ratio	0.03	1.22	0.34	1.52	0.80			1.35	0.84		0.21	
Control Delay	27.0	150.8	11.1	274.0	23.1			217.2	36.0		46.5	
Queue Delay	0.0	0.0	0.0	0.0	0.6			0.0	0.0		0.0	
Total Delay	27.0	150.8	11.1	274.0	23.7			217.2	36.0		46.5	
LOS	C	F	B	F	C			F	D		D	
Approach Delay		119.3			132.8			106.0			46.5	
Approach LOS		F			F			F			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Natural Cycle: 140			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 1.52			
Intersection Signal Delay: 120.8		Intersection LOS: F	
Intersection Capacity Utilization 126.7%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	6	846	241	747	967	440	698	31
v/c Ratio	0.03	1.22	0.34	1.52	0.80	1.35	0.84	0.21
Control Delay	27.0	150.8	11.1	274.0	23.1	217.2	36.0	46.5
Queue Delay	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0
Total Delay	27.0	150.8	11.1	274.0	23.7	217.2	36.0	46.5
Queue Length 50th (m)	1.1	~302.6	14.4	~287.5	187.1	~167.3	155.2	7.1
Queue Length 95th (m)	4.2	#383.7	35.3	#367.9	255.5	#236.2	221.2	17.2
Internal Link Dist (m)		1665.7			343.4	471.1		37.2
Turn Bay Length (m)	100.0		100.0	180.0				
Base Capacity (vph)	200	691	709	493	1202	326	834	146
Starvation Cap Reductn	0	0	0	0	51	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	1.22	0.34	1.52	0.84	1.35	0.84	0.21

Intersection Summary

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

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	829	236	732	942	6	431	0	684	24	6	1
Future Volume (vph)	6	829	236	732	942	6	431	0	684	24	6	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	
Satd. Flow (prot)	1805	1759	1553	1752	1791			1787	1524		1821	
Flt Permitted	0.27	1.00	1.00	0.07	1.00			0.74	1.00		0.33	
Satd. Flow (perm)	511	1759	1553	125	1791			1386	1524		618	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	6	846	241	747	961	6	440	0	698	24	6	1
RTOR Reduction (vph)	0	0	99	0	0	0	0	0	31	0	1	0
Lane Group Flow (vph)	6	846	142	747	967	0	0	440	667	0	30	0
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	
Permitted Phases	6		6	2			4		4	8		
Actuated Green, G (s)	55.0	55.0	55.0	94.0	94.0			33.0	68.0		33.0	
Effective Green, g (s)	55.0	55.0	55.0	94.0	94.0			33.0	68.0		33.0	
Actuated g/C Ratio	0.39	0.39	0.39	0.67	0.67			0.24	0.49		0.24	
Clearance Time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	200	691	610	490	1202			326	740		145	
v/s Ratio Prot		0.48		c0.38	0.54				0.23			
v/s Ratio Perm	0.01		0.09	c0.64				c0.32	0.21		0.05	
v/c Ratio	0.03	1.22	0.23	1.52	0.80			1.35	0.90		0.21	
Uniform Delay, d1	26.1	42.5	28.4	45.4	16.4			53.5	32.9		43.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.1	113.6	0.4	246.3	5.8			176.4	14.1		0.7	
Delay (s)	26.2	156.1	28.8	291.7	22.2			229.9	47.0		43.7	
Level of Service	C	F	C	F	C			F	D		D	
Approach Delay (s)		127.3			139.7			117.7			43.7	
Approach LOS		F			F			F			D	

Intersection Summary				
HCM 2000 Control Delay	129.2	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.51			
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	126.7%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

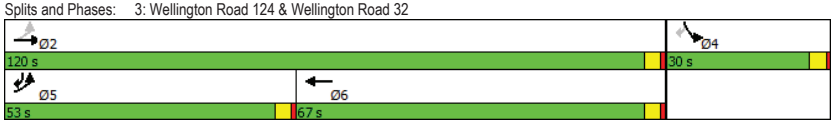
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	548	1003	766	46	48	879
Future Volume (vph)	548	1003	766	46	48	879
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	180.0			0.0	90.0	0.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.992			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1612	1827	1798	0	1444	1524
Flt Permitted	0.060				0.950	
Satd. Flow (perm)	102	1827	1798	0	1444	1524
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			2			92
Link Speed (k/h)		70	70		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		18.9	105.7		23.1	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Adj. Flow (vph)	559	1023	782	47	49	897
Shared Lane Traffic (%)						
Lane Group Flow (vph)	559	1023	829	0	49	897
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane		Yes	Yes			
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	2					4
Detector Phase	5	2	6		4	5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	9.0
Total Split (s)	53.0	120.0	67.0		30.0	53.0
Total Split (%)	35.3%	80.0%	44.7%		20.0%	35.3%
Maximum Green (s)	49.0	116.0	63.0		26.0	49.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lead		Lag			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	None	Max		None	None
Walk Time (s)		10.0	10.0		10.0	
Flash Dont Walk (s)		16.0	16.0		16.0	
Pedestrian Calls (#/hr)		0	0		0	
Act Effct Green (s)	116.4	117.3	63.2		11.8	62.4
Actuated g/C Ratio	0.87	0.88	0.47		0.09	0.47
v/c Ratio	0.87	0.64	0.97		0.39	1.18
Control Delay	48.9	5.6	60.6		67.2	124.5
Queue Delay	0.0	0.4	0.0		0.0	0.0
Total Delay	48.9	5.9	60.6		67.2	124.5
LOS	D	A	E		E	F
Approach Delay		21.1	60.6		121.5	
Approach LOS		C	E		F	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 133.6
Natural Cycle: 150
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.18
Intersection Signal Delay: 59.1 — Intersection LOS: E
Intersection Capacity Utilization 104.2% — ICU Level of Service G
Analysis Period (min) 15

Splits and Phases: 3: Wellington Road 124 & Wellington Road 32



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	559	1023	829	49	897
v/c Ratio	0.87	0.64	0.97	0.39	1.18
Control Delay	48.9	5.6	60.6	67.2	124.5
Queue Delay	0.0	0.4	0.0	0.0	0.0
Total Delay	48.9	5.9	60.6	67.2	124.5
Queue Length 50th (m)	130.6	72.0	228.2	13.3	~285.1
Queue Length 95th (m)	#211.9	129.1	#338.6	27.0	#370.6
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)	180.0			90.0	
Base Capacity (vph)	644	1603	851	281	760
Starvation Cap Reductn	0	178	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.87	0.72	0.97	0.17	1.18

Intersection Summary

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

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

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	548	1003	766	46	48	879
Future Volume (vph)	548	1003	766	46	48	879
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1612	1827	1798		1444	1524
Flt Permitted	0.06	1.00	1.00		0.95	1.00
Satd. Flow (perm)	101	1827	1798		1444	1524
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	559	1023	782	47	49	897
RTOR Reduction (vph)	0	0	1	0	0	51
Lane Group Flow (vph)	559	1023	828	0	49	846
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Turn Type	pm+pt	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5
Permitted Phases	2					4
Actuated Green, G (s)	116.3	116.3	63.2		10.1	59.2
Effective Green, g (s)	116.3	116.3	63.2		10.1	59.2
Actuated g/C Ratio	0.87	0.87	0.47		0.08	0.44
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	639	1580	845		108	716
v/s Ratio Prot	0.32	0.56	c0.46		0.03	c0.43
v/s Ratio Perm	0.44					0.12
v/c Ratio	0.87	0.65	0.98		0.45	1.18
Uniform Delay, d1	35.7	2.8	35.0		59.5	37.6
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	13.7	0.9	26.4		6.2	95.4
Delay (s)	49.4	3.7	61.4		65.7	133.0
Level of Service	D	A	E		E	F
Approach Delay (s)		19.8	61.4		129.5	
Approach LOS		B	E		F	

Intersection Summary

HCM 2000 Control Delay	61.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	134.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	104.2%	ICU Level of Service	G
Analysis Period (min)	15		

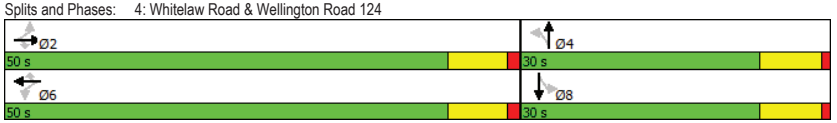
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Future Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	140.0		130.0	0.0		0.0	0.0		0.0
Storage Lanes	1		1	1		1	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.950			0.947	
Flt Protected	0.950			0.950				0.987			0.973	
Satd. Flow (prot)	1703	1863	1615	1805	1810	1509	0	1782	0	0	1659	0
Flt Permitted	0.265			0.121				0.907			0.816	
Satd. Flow (perm)	475	1863	1615	230	1810	1509	0	1637	0	0	1391	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			53			53		7			41	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Adj. Flow (vph)	140	969	1	3	746	44	5	7	7	101	9	71
Shared Lane Traffic (%)												
Lane Group Flow (vph)	140	969	1	3	746	44	0	19	0	0	181	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane		Yes			Yes							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	
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)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	
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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		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			8		
Detector Phase	2	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2	37.2	37.2	37.2	37.2	28.9	28.9		28.9	28.9	
Total Split (s)	50.0	50.0	50.0	50.0	50.0	50.0	30.0	30.0		30.0	30.0	
Total Split (%)	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%	37.5%	37.5%		37.5%	37.5%	
Maximum Green (s)	42.8	42.8	42.8	42.8	42.8	42.8	23.1	23.1		23.1	23.1	
Yellow Time (s)	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3	1.3	1.3	1.3	1.3	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Lost Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0		3.0	3.0	
Recall Mode	Max	Max	Max	Max	Max	Max	None	None		None	None	
Walk Time (s)	15.0	15.0	15.0	15.0	15.0	15.0	11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	45.7	45.7	45.7	45.7	45.7	45.7		15.9			15.9	
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.60	0.60		0.21			0.21	
v/c Ratio	0.49	0.86	0.00	0.02	0.68	0.05		0.05			0.56	
Control Delay	16.6	23.6	0.0	7.3	14.8	2.1		17.9			26.9	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Delay	16.6	23.6	0.0	7.3	14.8	2.1		17.9			26.9	
LOS	B	C	A	A	B	A		B			C	
Approach Delay		22.7			14.0			17.9			26.9	
Approach LOS		C			B			B			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 75.8			
Natural Cycle: 80			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.86			
Intersection Signal Delay: 19.7		Intersection LOS: B	
Intersection Capacity Utilization 107.8%		ICU Level of Service G	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	140	969	1	3	746	44	19	181
v/c Ratio	0.49	0.86	0.00	0.02	0.68	0.05	0.05	0.56
Control Delay	16.6	23.6	0.0	7.3	14.8	2.1	17.9	26.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.6	23.6	0.0	7.3	14.8	2.1	17.9	26.9
Queue Length 50th (m)	10.2	103.9	0.0	0.2	65.4	0.0	1.4	17.6
Queue Length 95th (m)	31.4	#213.8	0.0	1.4	121.9	3.4	6.3	36.7
Internal Link Dist (m)		2030.4			1551.0		355.0	437.0
Turn Bay Length (m)	100.0		100.0	140.0		130.0		
Base Capacity (vph)	285	1122	993	138	1090	930	506	454
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.86	0.00	0.02	0.68	0.05	0.04	0.40

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Future Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.95			0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.97	
Satd. Flow (prot)	1703	1863	1615	1805	1810	1509		1782			1659	
Flt Permitted	0.26	1.00	1.00	0.12	1.00	1.00		0.91			0.82	
Satd. Flow (perm)	474	1863	1615	230	1810	1509		1638			1392	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	140	969	1	3	746	44	5	7	7	101	9	71
RTOR Reduction (vph)	0	0	0	0	0	17	0	6	0	0	32	0
Lane Group Flow (vph)	140	969	1	3	746	27	0	13	0	0	149	0
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2		2	6		6	4			8		
Actuated Green, G (s)	45.6	45.6	45.6	45.6	45.6	45.6		15.9			15.9	
Effective Green, g (s)	45.6	45.6	45.6	45.6	45.6	45.6		15.9			15.9	
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.60	0.60		0.21			0.21	
Clearance Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5		3.0			3.0	
Lane Grp Cap (vph)	285	1123	974	138	1091	910		344			292	
v/s Ratio Prot		c0.52			0.41							
v/s Ratio Perm	0.30		0.00	0.01		0.02		0.01			c0.11	
v/c Ratio	0.49	0.86	0.00	0.02	0.68	0.03		0.04			0.51	
Uniform Delay, d1	8.5	12.4	6.0	6.0	10.1	6.1		23.8			26.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	5.9	8.8	0.0	0.3	3.5	0.1		0.0			1.4	
Delay (s)	14.4	21.2	6.0	6.3	13.6	6.1		23.8			27.8	
Level of Service	B	C	A	A	B	A		C			C	
Approach Delay (s)		20.4			13.2			23.8			27.8	
Approach LOS		C			B			C			C	

Intersection Summary				
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.77			
Actuated Cycle Length (s)	75.6	Sum of lost time (s)	14.1	
Intersection Capacity Utilization	107.8%	ICU Level of Service	G	
Analysis Period (min)	15			
c Critical Lane Group				

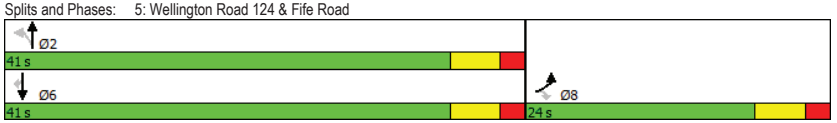
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	397	16	15	983	737	671
Future Volume (vph)	397	16	15	983	737	671
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950			0.999		
Satd. Flow (prot)	1770	1615	0	3503	1810	1583
Flt Permitted	0.950			0.940		
Satd. Flow (perm)	1770	1615	0	3296	1810	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		17				699
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Adj. Flow (vph)	414	17	16	1024	768	699
Shared Lane Traffic (%)						
Lane Group Flow (vph)	414	17	0	1040	768	699
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	24.0	24.0	41.0	41.0	41.0	41.0
Total Split (%)	36.9%	36.9%	63.1%	63.1%	63.1%	63.1%
Maximum Green (s)	18.0	18.0	35.0	35.0	35.0	35.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	17.2	17.2		35.0	35.0	35.0
Actuated g/C Ratio	0.27	0.27		0.55	0.55	0.55
v/c Ratio	0.87	0.04		0.58	0.78	0.59
Control Delay	44.1	9.1		11.5	19.1	3.1
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	44.1	9.1		11.5	19.1	3.1
LOS	D	A		B	B	A
Approach Delay	42.8			11.5	11.5	
Approach LOS	D			B	B	

Intersection Summary

Area Type: Other
Cycle Length: 65
Actuated Cycle Length: 64.2
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 16.1 Intersection LOS: B
Intersection Capacity Utilization 79.2% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road



Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	414	17	1040	768	699
v/c Ratio	0.87	0.04	0.58	0.78	0.59
Control Delay	44.1	9.1	11.5	19.1	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	44.1	9.1	11.5	19.1	3.1
Queue Length 50th (m)	49.3	0.0	42.7	71.3	0.0
Queue Length 95th (m)	#95.5	4.0	59.7	#124.2	13.8
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	496	465	1796	986	1181
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.83	0.04	0.58	0.78	0.59

Intersection Summary

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

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	397	16	15	983	737	671
Future Volume (vph)	397	16	15	983	737	671
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1615		3504	1810	1583
Flt Permitted	0.95	1.00		0.94	1.00	1.00
Satd. Flow (perm)	1770	1615		3295	1810	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	414	17	16	1024	768	699
RTOR Reduction (vph)	0	12	0	0	0	318
Lane Group Flow (vph)	414	5	0	1040	768	381
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	17.2	17.2		35.0	35.0	35.0
Effective Green, g (s)	17.2	17.2		35.0	35.0	35.0
Actuated g/C Ratio	0.27	0.27		0.55	0.55	0.55
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	474	432		1796	986	863
v/s Ratio Prot	c0.23				c0.42	
v/s Ratio Perm		0.00		0.32		0.24
v/c Ratio	0.87	0.01		0.58	0.78	0.44
Uniform Delay, d1	22.5	17.3		9.7	11.5	8.7
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	16.2	0.0		1.4	6.1	1.6
Delay (s)	38.6	17.3		11.1	17.6	10.4
Level of Service	D	B		B	B	B
Approach Delay (s)	37.8			11.1	14.2	
Approach LOS	D			B	B	

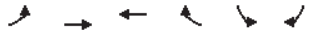
Intersection Summary

HCM 2000 Control Delay	16.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	64.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

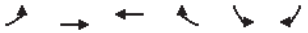
Appendix H

Traffic Operations Reports – Alternative 3



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	441	1077	1090	6	0	397
Future Volume (vph)	441	1077	1090	6	0	397
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	125.0			60.0	30.0	0.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	0.95	0.95	0.95	1.00	1.00
Frt			0.999			0.850
Flt Protected	0.950					
Satd. Flow (prot)	1593	2981	2972	0	1710	1439
Flt Permitted	0.950					
Satd. Flow (perm)	1593	2981	2972	0	1710	1439
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	2%	9%	9%	50%	0%	1%
Adj. Flow (vph)	464	1134	1147	6	0	418
Shared Lane Traffic (%)						
Lane Group Flow (vph)	464	1134	1153	0	0	418
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	R NA	Left	R NA	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.14	1.14	1.14	1.14	1.14	1.14
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	CBD		
Control Type: Unsignalized			
Intersection Capacity Utilization 67.7%		ICU Level of Service C	
Analysis Period (min) 15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	441	1077	1090	6	0	397
Future Volume (Veh/h)	441	1077	1090	6	0	397
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)	464	1134	1147	6	0	418
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	1153				2645	576
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1153				2645	576
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	23				100	10
cM capacity (veh/h)	602				4	463

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1	SB 2
Volume Total	464	567	567	765	388	0	418
Volume Left	464	0	0	0	0	0	0
Volume Right	0	0	0	0	6	0	418
cSH	602	1700	1700	1700	1700	1700	463
Volume to Capacity	0.77	0.33	0.33	0.45	0.23	0.00	0.90
Queue Length 95th (m)	57.2	0.0	0.0	0.0	0.0	0.0	80.3
Control Delay (s)	28.2	0.0	0.0	0.0	0.0	0.0	51.4
Lane LOS	D					A	F
Approach Delay (s)	8.2			0.0		51.4	
Approach LOS						F	

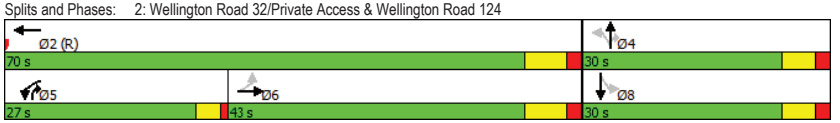
Intersection Summary				
Average Delay	10.9			
Intersection Capacity Utilization	67.7%	ICU Level of Service		C
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Future Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	60.0		60.0	180.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		0	2		0	1		1	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	0.95	0.97	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.972							0.850			
Flt Protected				0.950				0.950			0.950	
Satd. Flow (prot)	1900	3177	0	3303	3167	0	0	1752	1568	0	1805	0
Flt Permitted				0.950				0.757			0.195	
Satd. Flow (perm)	1900	3177	0	3303	3167	0	0	1396	1568	0	370	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		31							44			
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
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%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Adj. Flow (vph)	0	956	218	496	836	0	392	0	977	1	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1174	0	496	836	0	0	392	977	0	1	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	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	
Detector 1 Size(m)	2.0	0.6		2.0	0.6		2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	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	
Detector 1 Queue (s)	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	
Detector 2 Position(m)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Prot	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6						4		4	8		
Detector Phase	6	6		5	2		4	4	5	8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0		8.0	35.0		12.0	12.0	8.0	12.0	12.0	
Minimum Split (s)	42.0	42.0		12.0	42.0		26.0	26.0	12.0	26.0	26.0	
Total Split (s)	43.0	43.0		27.0	70.0		30.0	30.0	27.0	30.0	30.0	
Total Split (%)	43.0%	43.0%		27.0%	70.0%		30.0%	30.0%	27.0%	30.0%	30.0%	
Maximum Green (s)	36.0	36.0		23.0	63.0		24.0	24.0	23.0	24.0	24.0	
Yellow Time (s)	5.0	5.0		3.0	5.0		4.0	4.0	3.0	4.0	4.0	
All-Red Time (s)	2.0	2.0		1.0	2.0		2.0	2.0	1.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	7.0	7.0		4.0	7.0			6.0	4.0		6.0	
Lead/Lag	Lag	Lag		Lead					Lead			
Lead-Lag Optimize?	Yes	Yes		Yes					Yes			
Vehicle Extension (s)	5.0	5.0		3.0	5.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	C-Max		None	None	None	None	None	
Walk Time (s)	23.0	23.0			23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0			12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0			0		0	0		0	0	
Act Effct Green (s)		36.0		23.0	63.0			24.0	53.0		24.0	
Actuated g/C Ratio		0.36		0.23	0.63			0.24	0.53		0.24	
v/c Ratio		1.01		0.65	0.42			1.17	1.15		0.01	
Control Delay		60.7		39.6	10.1			139.6	104.2		30.0	
Queue Delay		0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay		60.7		39.6	10.1			139.6	104.2		30.0	
LOS		E		D	B			F	F		C	
Approach Delay		60.7			21.1			114.3			30.0	
Approach LOS		E			C			F			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 100			
Actuated Cycle Length: 100			
Offset: 0 (0%), Referenced to phase 2:WBT, Start of Green			
Natural Cycle: 100			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.17			
Intersection Signal Delay: 66.0		Intersection LOS: E	
Intersection Capacity Utilization 108.6%		ICU Level of Service G	
Analysis Period (min) 15			

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124



Lane Group	EBT	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	1174	496	836	392	977	1
v/c Ratio	1.01	0.65	0.42	1.17	1.15	0.01
Control Delay	60.7	39.6	10.1	139.6	104.2	30.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.7	39.6	10.1	139.6	104.2	30.0
Queue Length 50th (m)	~124.7	47.5	41.2	~95.8	~231.8	0.2
Queue Length 95th (m)	#173.6	65.1	53.6	#153.9	#310.2	1.6
Internal Link Dist (m)	1665.7		343.4	471.1		37.2
Turn Bay Length (m)		180.0				
Base Capacity (vph)	1163	759	1995	335	851	88
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.01	0.65	0.42	1.17	1.15	0.01

Intersection Summary

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

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Future Volume (vph)	0	860	196	446	752	0	353	0	879	1	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0		4.0	7.0			6.0	4.0		6.0	
Lane Util. Factor		0.95		0.97	0.95			1.00	1.00		1.00	
Frt		0.97		1.00	1.00			1.00	0.85		1.00	
Flt Protected		1.00		0.95	1.00			0.95	1.00		0.95	
Satd. Flow (prot)		3178		3303	3167			1752	1568		1805	
Flt Permitted		1.00		0.95	1.00			0.76	1.00		0.20	
Satd. Flow (perm)		3178		3303	3167			1397	1568		371	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	956	218	496	836	0	392	0	977	1	0	0
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	23	0	0	0
Lane Group Flow (vph)	0	1154	0	496	836	0	0	392	954	0	1	0
Heavy Vehicles (%)	0%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Turn Type	Perm	NA		Prot	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	
Permitted Phases	6						4		4	8		
Actuated Green, G (s)		36.0		23.0	63.0			24.0	47.0		24.0	
Effective Green, g (s)		36.0		23.0	63.0			24.0	47.0		24.0	
Actuated g/C Ratio		0.36		0.23	0.63			0.24	0.47		0.24	
Clearance Time (s)		7.0		4.0	7.0			6.0	4.0		6.0	
Vehicle Extension (s)		5.0		3.0	5.0			3.0	3.0		3.0	
Lane Grp Cap (vph)		1144		759	1995			335	736		89	
v/s Ratio Prot		c0.36		0.15	0.26				c0.30			
v/s Ratio Perm								0.28	0.31		0.00	
v/c Ratio		1.01		0.65	0.42			1.17	1.30		0.01	
Uniform Delay, d1		32.0		34.9	9.3			38.0	26.5		29.0	
Progression Factor		1.00		1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2		28.8		2.0	0.6			103.8	143.1		0.1	
Delay (s)		60.8		36.9	9.9			141.8	169.6		29.0	
Level of Service		E		D	A			F	F		C	
Approach Delay (s)		60.8			20.0			161.6			29.0	
Approach LOS		E			B			F			C	

Intersection Summary

HCM 2000 Control Delay	82.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	108.6%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

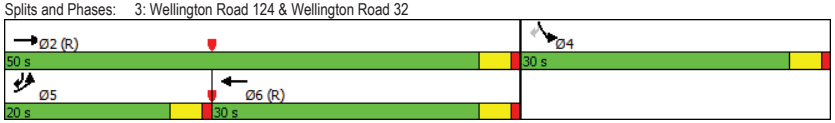
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	617	1099	649	26	32	584
Future Volume (vph)	617	1099	649	26	32	584
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	180.0			0.0	90.0	0.0
Storage Lanes	2			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	0.97	0.95	0.95	0.95	1.00	1.00
Frt			0.994			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3183	3406	3227	0	1530	1429
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3183	3406	3227	0	1530	1429
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			5			54
Link Speed (k/h)		70	70		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		18.9	105.7		23.1	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Adj. Flow (vph)	693	1235	729	29	36	656
Shared Lane Traffic (%)						
Lane Group Flow (vph)	693	1235	758	0	36	656
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		7.2	7.2		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	Prot	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases						4
Detector Phase	5	2	6		4	5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	9.0
Total Split (s)	20.0	50.0	30.0		30.0	20.0
Total Split (%)	25.0%	62.5%	37.5%		37.5%	25.0%
Maximum Green (s)	16.0	46.0	26.0		26.0	16.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lead		Lag			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	C-Max	C-Max		None	None
Walk Time (s)		10.0	10.0		10.0	
Flash Dont Walk (s)		16.0	16.0		16.0	
Pedestrian Calls (#/hr)		0	0		0	
Act Effct Green (s)	32.0	68.9	31.4		9.4	40.6
Actuated g/C Ratio	0.40	0.86	0.39		0.12	0.51
v/c Ratio	0.55	0.42	0.60		0.20	0.87
Control Delay	20.7	2.9	23.0		33.9	29.2
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	20.7	2.9	23.0		33.9	29.2
LOS	C	A	C		C	C
Approach Delay		9.3	23.0		29.4	
Approach LOS		A	C		C	

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 16.5 Intersection LOS: B
Intersection Capacity Utilization 61.6% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 3: Wellington Road 124 & Wellington Road 32



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	693	1235	758	36	656
v/c Ratio	0.55	0.42	0.60	0.20	0.87
Control Delay	20.7	2.9	23.0	33.9	29.2
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	20.7	2.9	23.0	33.9	29.2
Queue Length 50th (m)	44.4	25.4	52.2	5.3	74.6
Queue Length 95th (m)	60.5	40.6	74.6	13.4	115.7
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)	180.0			90.0	
Base Capacity (vph)	1271	2935	1268	497	752
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.55	0.42	0.60	0.07	0.87

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	617	1099	649	26	32	584
Future Volume (vph)	617	1099	649	26	32	584
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	0.97	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3183	3406	3228		1530	1429
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3183	3406	3228		1530	1429
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	693	1235	729	29	36	656
RTOR Reduction (vph)	0	0	3	0	0	28
Lane Group Flow (vph)	693	1235	755	0	36	628
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Turn Type	Prot	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5
Permitted Phases						4
Actuated Green, G (s)	32.0	65.7	29.7		6.3	38.3
Effective Green, g (s)	32.0	65.7	29.7		6.3	38.3
Actuated g/C Ratio	0.40	0.82	0.37		0.08	0.48
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	1273	2797	1198		120	755
v/s Ratio Prot	0.22	0.36	c0.23		0.02	c0.33
v/s Ratio Perm						0.11
v/c Ratio	0.54	0.44	0.63		0.30	0.83
Uniform Delay, d1	18.4	2.0	20.6		34.8	18.1
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.8	0.5	2.5		2.9	8.6
Delay (s)	19.2	2.5	23.2		37.7	26.7
Level of Service	B	A	C		D	C
Approach Delay (s)		8.5	23.2		27.3	
Approach LOS		A	C		C	

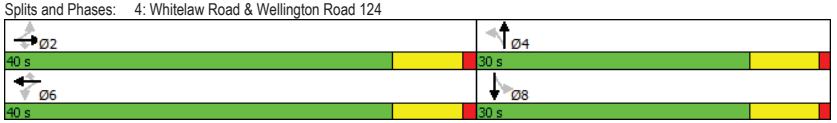
Intersection Summary				
HCM 2000 Control Delay	15.6	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.79			
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	61.6%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Future Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	140.0		130.0	0.0		0.0	0.0		0.0
Storage Lanes	1		1	1		1	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.963			0.934	
Flt Protected	0.950			0.950				0.987			0.979	
Satd. Flow (prot)	1736	3374	1615	1444	3406	1509	0	1676	0	0	1371	0
Flt Permitted	0.382			0.225				0.903			0.849	
Satd. Flow (perm)	698	3374	1615	342	3406	1509	0	1534	0	0	1189	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			61			101		6			46	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
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 (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Adj. Flow (vph)	87	1103	6	7	709	101	6	10	6	41	7	46
Shared Lane Traffic (%)												
Lane Group Flow (vph)	87	1103	6	7	709	101	0	22	0	0	94	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	
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)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	
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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		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			8		
Detector Phase	2	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2	37.2	37.2	37.2	37.2	28.9	28.9		28.9	28.9	
Total Split (s)	40.0	40.0	40.0	40.0	40.0	40.0	30.0	30.0		30.0	30.0	
Total Split (%)	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	42.9%	42.9%		42.9%	42.9%	
Maximum Green (s)	32.8	32.8	32.8	32.8	32.8	32.8	23.1	23.1		23.1	23.1	
Yellow Time (s)	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3	1.3	1.3	1.3	1.3	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Lost Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0		3.0	3.0	
Recall Mode	Max	Max	Max	Max	Max	Max	None	None		None	None	
Walk Time (s)	15.0	15.0	15.0	15.0	15.0	15.0	11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	40.8	40.8	40.8	40.8	40.8	40.8		15.2			15.2	
Actuated g/C Ratio	0.64	0.64	0.64	0.64	0.64	0.64		0.24			0.24	
v/c Ratio	0.19	0.51	0.01	0.03	0.32	0.10		0.06			0.30	
Control Delay	9.2	9.8	0.0	7.7	8.0	2.2		15.5			14.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Delay	9.2	9.8	0.0	7.7	8.0	2.2		15.5			14.6	
LOS	A	A	A	A	A	A		B			B	
Approach Delay		9.7			7.2			15.5			14.6	
Approach LOS		A			A			B			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 70			
Actuated Cycle Length: 63.5			
Natural Cycle: 70			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.51			
Intersection Signal Delay: 9.0		Intersection LOS: A	
Intersection Capacity Utilization 82.7%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	87	1103	6	7	709	101	22	94
v/c Ratio	0.19	0.51	0.01	0.03	0.32	0.10	0.06	0.30
Control Delay	9.2	9.8	0.0	7.7	8.0	2.2	15.5	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.2	9.8	0.0	7.7	8.0	2.2	15.5	14.6
Queue Length 50th (m)	5.1	44.3	0.0	0.4	24.2	0.0	1.5	4.6
Queue Length 95th (m)	12.9	62.3	0.0	2.1	35.1	5.7	6.4	15.4
Internal Link Dist (m)		2030.4			1551.0		355.0	437.0
Turn Bay Length (m)	100.0		100.0	140.0		130.0		
Base Capacity (vph)	448	2166	1059	219	2187	1005	568	466
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.51	0.01	0.03	0.32	0.10	0.04	0.20

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Future Volume (vph)	78	993	5	6	638	91	5	9	5	37	6	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.96			0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.98	
Satd. Flow (prot)	1736	3374	1615	1444	3406	1509		1676			1371	
Flt Permitted	0.38	1.00	1.00	0.23	1.00	1.00		0.90			0.85	
Satd. Flow (perm)	698	3374	1615	342	3406	1509		1534			1189	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	87	1103	6	7	709	101	6	10	6	41	7	46
RTOR Reduction (vph)	0	0	2	0	0	40	0	5	0	0	38	0
Lane Group Flow (vph)	87	1103	4	7	709	61	0	17	0	0	56	0
Heavy Vehicles (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2		2	6		6	4			8		
Actuated Green, G (s)	39.1	39.1	39.1	39.1	39.1	39.1		11.7			11.7	
Effective Green, g (s)	39.1	39.1	39.1	39.1	39.1	39.1		11.7			11.7	
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.60	0.60		0.18			0.18	
Clearance Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5		3.0			3.0	
Lane Grp Cap (vph)	420	2032	972	206	2051	909		276			214	
v/s Ratio Prot		c0.33			0.21							
v/s Ratio Perm	0.12		0.00	0.02		0.04		0.01			c0.05	
v/c Ratio	0.21	0.54	0.00	0.03	0.35	0.07		0.06			0.26	
Uniform Delay, d1	5.9	7.6	5.1	5.2	6.5	5.3		22.1			22.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	1.1	1.0	0.0	0.3	0.5	0.1		0.1			0.7	
Delay (s)	7.0	8.7	5.1	5.5	6.9	5.5		22.1			23.5	
Level of Service	A	A	A	A	A	A		C			C	
Approach Delay (s)		8.5			6.7			22.1			23.5	
Approach LOS		A			A			C			C	

Intersection Summary				
HCM 2000 Control Delay	8.6	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.48			
Actuated Cycle Length (s)	64.9	Sum of lost time (s)	14.1	
Intersection Capacity Utilization	82.7%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

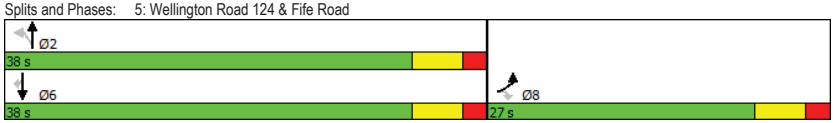
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	476	14	5	1039	675	357
Future Volume (vph)	476	14	5	1039	675	357
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950					
Satd. Flow (prot)	1770	1214	0	3375	1792	1553
Flt Permitted	0.950			0.952		
Satd. Flow (perm)	1770	1214	0	3213	1792	1553
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		15				388
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Adj. Flow (vph)	517	15	5	1129	734	388
Shared Lane Traffic (%)						
Lane Group Flow (vph)	517	15	0	1134	734	388
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	27.0	27.0	38.0	38.0	38.0	38.0
Total Split (%)	41.5%	41.5%	58.5%	58.5%	58.5%	58.5%
Maximum Green (s)	21.0	21.0	32.0	32.0	32.0	32.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	20.4	20.4		32.0	32.0	32.0
Actuated g/C Ratio	0.32	0.32		0.50	0.50	0.50
v/c Ratio	0.92	0.04		0.71	0.82	0.40
Control Delay	47.1	8.4		15.9	24.3	2.6
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	47.1	8.4		15.9	24.3	2.6
LOS	D	A		B	C	A
Approach Delay	46.0			15.9	16.8	
Approach LOS	D			B	B	

Intersection Summary

Area Type: Other
Cycle Length: 65
Actuated Cycle Length: 64.4
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 22.0 — Intersection LOS: C
Intersection Capacity Utilization 71.9% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road



Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	517	15	1134	734	388
v/c Ratio	0.92	0.04	0.71	0.82	0.40
Control Delay	47.1	8.4	15.9	24.3	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	47.1	8.4	15.9	24.3	2.6
Queue Length 50th (m)	61.7	0.0	55.5	74.6	0.0
Queue Length 95th (m)	#116.7	3.6	77.5	#140.5	12.1
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	576	406	1596	890	966
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.90	0.04	0.71	0.82	0.40

Intersection Summary

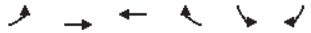
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	476	14	5	1039	675	357
Future Volume (vph)	476	14	5	1039	675	357
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1214		3374	1792	1553
Flt Permitted	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1214		3213	1792	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	517	15	5	1129	734	388
RTOR Reduction (vph)	0	10	0	0	0	195
Lane Group Flow (vph)	517	5	0	1134	734	193
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	20.4	20.4		32.0	32.0	32.0
Effective Green, g (s)	20.4	20.4		32.0	32.0	32.0
Actuated g/C Ratio	0.32	0.32		0.50	0.50	0.50
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	560	384		1596	890	771
v/s Ratio Prot	c0.29				c0.41	
v/s Ratio Perm		0.00		0.35		0.12
v/c Ratio	0.92	0.01		0.71	0.82	0.25
Uniform Delay, d1	21.2	15.1		12.6	13.8	9.3
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	21.0	0.0		2.7	8.6	0.8
Delay (s)	42.2	15.1		15.3	22.4	10.1
Level of Service	D	B		B	C	B
Approach Delay (s)	41.5			15.3	18.1	
Approach LOS	D			B	B	

Intersection Summary

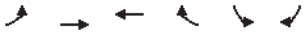
HCM 2000 Control Delay	21.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	64.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	296	1043	1354	14	1	523
Future Volume (vph)	296	1043	1354	14	1	523
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	125.0			60.0	30.0	0.0
Storage Lanes	1			1	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1787	3343	3471	1615	1805	1615
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1787	3343	3471	1615	1805	1615
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Heavy Vehicles (%)	1%	8%	4%	0%	0%	0%
Adj. Flow (vph)	308	1086	1410	16	1	545
Shared Lane Traffic (%)						
Lane Group Flow (vph)	308	1086	1410	16	1	545
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	L NA	R NA	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 76.5%		ICU Level of Service D	
Analysis Period (min) 15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	296	1043	1354	14	1	523
Future Volume (Veh/h)	296	1043	1354	14	1	523
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Hourly flow rate (vph)	308	1086	1410	16	1	545
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	1426				2569	705
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1426				2569	705
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	36				87	0
cM capacity (veh/h)	478				8	383

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1	SB 2
Volume Total	308	543	543	705	705	16	1	545
Volume Left	308	0	0	0	0	0	1	0
Volume Right	0	0	0	0	0	16	0	545
cSH	478	1700	1700	1700	1700	1700	8	383
Volume to Capacity	0.64	0.32	0.32	0.41	0.41	0.01	0.13	1.42
Queue Length 95th (m)	35.9	0.0	0.0	0.0	0.0	0.0	2.6	220.8
Control Delay (s)	25.2	0.0	0.0	0.0	0.0	0.0	527.4	231.6
Lane LOS	D						F	F
Approach Delay (s)	5.6			0.0			232.1	
Approach LOS							F	

Intersection Summary				
Average Delay		40.0		
Intersection Capacity Utilization		76.5%	ICU Level of Service	D
Analysis Period (min)		15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	829	236	732	942	6	431	0	684	24	6	1
Future Volume (vph)	6	829	236	732	942	6	431	0	684	24	6	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	180.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		1	2		0	1		1	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.999				0.850		0.996	
Flt Protected	0.950			0.950				0.950			0.963	
Satd. Flow (prot)	1805	3343	1553	3400	3403	0	0	1787	1524	0	1822	0
Flt Permitted	0.296			0.950				0.737			0.555	
Satd. Flow (perm)	562	3343	1553	3400	3403	0	0	1386	1524	0	1050	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			241		1				40		1	
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Adj. Flow (vph)	6	846	241	747	961	6	440	0	698	24	6	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	6	846	241	747	967	0	0	440	698	0	31	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		7.2			7.2			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2		1	2	1	1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0		0.0	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)	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Prot	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6				4		4	8		
Detector Phase	6	6	6	5	2		4	4	5	8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0	35.0	8.0	35.0		12.0	12.0	8.0	12.0	12.0	
Minimum Split (s)	42.0	42.0	42.0	12.0	42.0		26.0	26.0	12.0	26.0	26.0	
Total Split (s)	42.0	42.0	42.0	28.0	70.0		40.0	40.0	28.0	40.0	40.0	
Total Split (%)	38.2%	38.2%	38.2%	25.5%	63.6%		36.4%	36.4%	25.5%	36.4%	36.4%	
Maximum Green (s)	35.0	35.0	35.0	24.0	63.0		34.0	34.0	24.0	34.0	34.0	
Yellow Time (s)	5.0	5.0	5.0	3.0	5.0		4.0	4.0	3.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0		2.0	2.0	1.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Lead/Lag	Lag	Lag	Lag	Lead					Lead			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes					Yes			
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	None	Min		None	None	None	None	None	
Walk Time (s)	23.0	23.0	23.0		23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0	12.0		12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0	0		0		0	0		0	0	
Act Effct Green (s)	35.0	35.0	35.0	24.0	63.0			34.0	64.0		34.0	
Actuated g/C Ratio	0.32	0.32	0.32	0.22	0.57			0.31	0.58		0.31	
v/c Ratio	0.03	0.80	0.37	1.01	0.50			1.03	0.77		0.10	
Control Delay	26.8	40.9	5.3	78.4	15.1			89.3	23.7		27.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0	0.0		0.0	
Total Delay	26.8	40.9	5.3	78.4	15.1			89.3	23.7		27.5	
LOS	C	D	A	E	B			F	C		C	
Approach Delay		32.9			42.7			49.0			27.5	
Approach LOS		C			D			D			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Natural Cycle: 100			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 1.03			
Intersection Signal Delay: 41.7		Intersection LOS: D	
Intersection Capacity Utilization 103.4%		ICU Level of Service G	
Analysis Period (min) 15			

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	6	846	241	747	967	440	698	31
v/c Ratio	0.03	0.80	0.37	1.01	0.50	1.03	0.77	0.10
Control Delay	26.8	40.9	5.3	78.4	15.1	89.3	23.7	27.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.8	40.9	5.3	78.4	15.1	89.3	23.7	27.5
Queue Length 50th (m)	0.9	91.4	0.0	~88.5	64.8	~106.4	107.1	4.8
Queue Length 95th (m)	4.2	116.4	17.6	#129.5	81.5	#169.1	162.6	12.4
Internal Link Dist (m)		1665.7			343.4	471.1		37.2
Turn Bay Length (m)	100.0		100.0	180.0				
Base Capacity (vph)	178	1063	658	741	1949	428	903	325
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.80	0.37	1.01	0.50	1.03	0.77	0.10

Intersection Summary

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

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	829	236	732	942	6	431	0	684	24	6	1
Future Volume (vph)	6	829	236	732	942	6	431	0	684	24	6	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95			1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	
Satd. Flow (prot)	1805	3343	1553	3400	3404			1787	1524		1821	
Flt Permitted	0.30	1.00	1.00	0.95	1.00			0.74	1.00		0.55	
Satd. Flow (perm)	563	3343	1553	3400	3404			1386	1524		1049	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	6	846	241	747	961	6	440	0	698	24	6	1
RTOR Reduction (vph)	0	0	164	0	0	0	0	0	19	0	1	0
Lane Group Flow (vph)	6	846	77	747	967	0	0	440	679	0	30	0
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Turn Type	Perm	NA	Perm	Prot	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	
Permitted Phases	6		6				4		4	8		
Actuated Green, G (s)	35.0	35.0	35.0	24.0	63.0			34.0	58.0		34.0	
Effective Green, g (s)	35.0	35.0	35.0	24.0	63.0			34.0	58.0		34.0	
Actuated g/C Ratio	0.32	0.32	0.32	0.22	0.57			0.31	0.53		0.31	
Clearance Time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	179	1063	494	741	1949			428	803		324	
v/s Ratio Prot		c0.25		c0.22	0.28				0.18			
v/s Ratio Perm	0.01		0.05					c0.32	0.26		0.03	
v/c Ratio	0.03	0.80	0.16	1.01	0.50			1.03	0.85		0.09	
Uniform Delay, d1	25.8	34.2	26.9	43.0	14.0			38.0	22.2		27.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.2	4.8	0.3	35.1	0.4			50.9	8.2		0.1	
Delay (s)	26.0	39.1	27.2	78.1	14.4			88.9	30.4		27.2	
Level of Service	C	D	C	E	B			F	C		C	
Approach Delay (s)		36.4			42.2			53.0			27.2	
Approach LOS		D			D			D			C	

Intersection Summary				
HCM 2000 Control Delay	43.6	HCM 2000 Level of Service	D	
HCM 2000 Volume to Capacity ratio	0.93			
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	103.4%	ICU Level of Service	G	
Analysis Period (min)	15			
c Critical Lane Group				

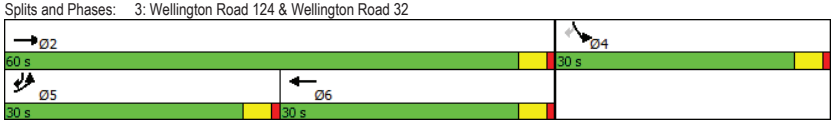
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	548	1003	766	46	48	879
Future Volume (vph)	548	1003	766	46	48	879
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	180.0			0.0	90.0	0.0
Storage Lanes	2			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	0.97	0.95	0.95	0.95	1.00	1.00
Frt			0.991			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	3127	3471	3412	0	1444	1524
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	3127	3471	3412	0	1444	1524
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			7			28
Link Speed (k/h)		50	50		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		26.5	147.9		23.1	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Adj. Flow (vph)	559	1023	782	47	49	897
Shared Lane Traffic (%)						
Lane Group Flow (vph)	559	1023	829	0	49	897
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		7.2	7.2		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	Prot	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases						4
Detector Phase	5	2	6		4	5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	9.0
Total Split (s)	30.0	60.0	30.0		30.0	30.0
Total Split (%)	33.3%	66.7%	33.3%		33.3%	33.3%
Maximum Green (s)	26.0	56.0	26.0		26.0	26.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lead		Lag			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	None	Min		None	None
Walk Time (s)		10.0	10.0		10.0	
Flash Dont Walk (s)		16.0	16.0		16.0	
Pedestrian Calls (#/hr)		0	0		0	
Act Effct Green (s)	27.1	54.2	20.8		9.9	35.0
Actuated g/C Ratio	0.42	0.85	0.32		0.15	0.55
v/c Ratio	0.42	0.35	0.75		0.22	1.06
Control Delay	17.3	2.9	24.6		30.0	67.1
Queue Delay	0.0	0.0	0.0		0.0	0.0
Total Delay	17.3	2.9	24.6		30.0	67.1
LOS	B	A	C		C	E
Approach Delay		8.0	24.6		65.1	
Approach LOS		A	C		E	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 64.1
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.06
Intersection Signal Delay: 28.2 Intersection LOS: C
Intersection Capacity Utilization 83.7% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 3: Wellington Road 124 & Wellington Road 32



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	559	1023	829	49	897
v/c Ratio	0.42	0.35	0.75	0.22	1.06
Control Delay	17.3	2.9	24.6	30.0	67.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	17.3	2.9	24.6	30.0	67.1
Queue Length 50th (m)	30.3	20.0	53.1	6.2	~136.1
Queue Length 95th (m)	49.8	33.4	77.4	16.1	#220.5
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)	180.0			90.0	
Base Capacity (vph)	1323	2962	1448	611	844
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.42	0.35	0.57	0.08	1.06

Intersection Summary

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

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

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	548	1003	766	46	48	879
Future Volume (vph)	548	1003	766	46	48	879
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	0.97	0.95	0.95		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3127	3471	3414		1444	1524
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3127	3471	3414		1444	1524
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	559	1023	782	47	49	897
RTOR Reduction (vph)	0	0	5	0	0	14
Lane Group Flow (vph)	559	1023	824	0	49	883
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Turn Type	Prot	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5
Permitted Phases						4
Actuated Green, G (s)	27.1	52.1	21.0		5.8	32.9
Effective Green, g (s)	27.1	52.1	21.0		5.8	32.9
Actuated g/C Ratio	0.41	0.79	0.32		0.09	0.50
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	1285	2744	1087		127	853
v/s Ratio Prot	0.18	0.29	c0.24		0.03	c0.43
v/s Ratio Perm						0.15
v/c Ratio	0.44	0.37	0.76		0.39	1.04
Uniform Delay, d1	13.9	2.0	20.2		28.4	16.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	0.5	0.1	3.1		4.0	40.2
Delay (s)	14.4	2.1	23.3		32.4	56.7
Level of Service	B	A	C		C	E
Approach Delay (s)		6.5	23.3		55.5	
Approach LOS		A	C		E	

Intersection Summary

HCM 2000 Control Delay	24.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	65.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

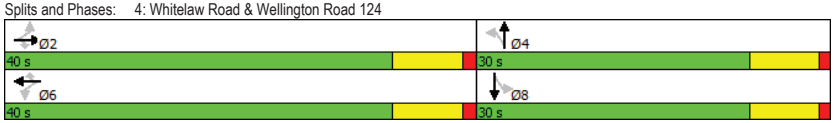
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Future Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	140.0		130.0	0.0		0.0	0.0		0.0
Storage Lanes	1		1	1		1	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.950			0.947	
Flt Protected	0.950			0.950				0.987			0.973	
Satd. Flow (prot)	1703	3539	1615	1805	3438	1509	0	1782	0	0	1659	0
Flt Permitted	0.357			0.258				0.908			0.816	
Satd. Flow (perm)	640	3539	1615	490	3438	1509	0	1639	0	0	1391	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			61			61		7			50	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Adj. Flow (vph)	140	969	1	3	746	44	5	7	7	101	9	71
Shared Lane Traffic (%)												
Lane Group Flow (vph)	140	969	1	3	746	44	0	19	0	0	181	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	
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)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	
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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		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			8		
Detector Phase	2	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2	37.2	37.2	37.2	37.2	28.9	28.9		28.9	28.9	
Total Split (s)	40.0	40.0	40.0	40.0	40.0	40.0	30.0	30.0		30.0	30.0	
Total Split (%)	57.1%	57.1%	57.1%	57.1%	57.1%	57.1%	42.9%	42.9%		42.9%	42.9%	
Maximum Green (s)	32.8	32.8	32.8	32.8	32.8	32.8	23.1	23.1		23.1	23.1	
Yellow Time (s)	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3	1.3	1.3	1.3	1.3	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Lost Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0		3.0	3.0	
Recall Mode	Max	Max	Max	Max	Max	Max	None	None		None	None	
Walk Time (s)	15.0	15.0	15.0	15.0	15.0	15.0	11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	35.6	35.6	35.6	35.6	35.6	35.6		15.5			15.5	
Actuated g/C Ratio	0.55	0.55	0.55	0.55	0.55	0.55		0.24			0.24	
v/c Ratio	0.40	0.50	0.00	0.01	0.40	0.05		0.05			0.49	
Control Delay	13.5	10.6	0.0	7.7	9.6	1.9		14.6			19.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Delay	13.5	10.6	0.0	7.7	9.6	1.9		14.6			19.6	
LOS	B	B	A	A	A	A		B			B	
Approach Delay		11.0			9.2			14.6			19.6	
Approach LOS		B			A			B			B	

Intersection Summary			
Area Type:	Other		
Cycle Length: 70			
Actuated Cycle Length: 65.3			
Natural Cycle: 70			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.50			
Intersection Signal Delay: 11.1		Intersection LOS: B	
Intersection Capacity Utilization 84.8%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	140	969	1	3	746	44	19	181
v/c Ratio	0.40	0.50	0.00	0.01	0.40	0.05	0.05	0.49
Control Delay	13.5	10.6	0.0	7.7	9.6	1.9	14.6	19.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.5	10.6	0.0	7.7	9.6	1.9	14.6	19.6
Queue Length 50th (m)	9.2	36.1	0.0	0.2	25.7	0.0	1.1	13.2
Queue Length 95th (m)	24.0	54.6	0.0	1.3	40.1	3.0	5.6	29.8
Internal Link Dist (m)		2030.4			1551.0		355.0	437.0
Turn Bay Length (m)	100.0		100.0	140.0		130.0		
Base Capacity (vph)	348	1928	907	266	1873	850	588	527
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.50	0.00	0.01	0.40	0.05	0.03	0.34

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Future Volume (vph)	133	921	1	3	709	42	5	7	7	96	9	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.95			0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.99			0.97	
Satd. Flow (prot)	1703	3539	1615	1805	3438	1509		1782			1659	
Flt Permitted	0.36	1.00	1.00	0.26	1.00	1.00		0.91			0.82	
Satd. Flow (perm)	641	3539	1615	491	3438	1509		1639			1392	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	140	969	1	3	746	44	5	7	7	101	9	71
RTOR Reduction (vph)	0	0	0	0	0	20	0	5	0	0	38	0
Lane Group Flow (vph)	140	969	1	3	746	24	0	14	0	0	143	0
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2		2	6		6	4			8		
Actuated Green, G (s)	35.6	35.6	35.6	35.6	35.6	35.6		15.5			15.5	
Effective Green, g (s)	35.6	35.6	35.6	35.6	35.6	35.6		15.5			15.5	
Actuated g/C Ratio	0.55	0.55	0.55	0.55	0.55	0.55		0.24			0.24	
Clearance Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5		3.0			3.0	
Lane Grp Cap (vph)	349	1932	881	268	1877	823		389			330	
v/s Ratio Prot		c0.27			0.22							
v/s Ratio Perm	0.22		0.00	0.01		0.02		0.01			c0.10	
v/c Ratio	0.40	0.50	0.00	0.01	0.40	0.03		0.04			0.43	
Uniform Delay, d1	8.6	9.3	6.7	6.8	8.6	6.8		19.1			21.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	3.4	0.9	0.0	0.1	0.6	0.1		0.0			0.9	
Delay (s)	12.0	10.2	6.7	6.8	9.2	6.9		19.1			22.0	
Level of Service	B	B	A	A	A	A		B			C	
Approach Delay (s)		10.4			9.1			19.1			22.0	
Approach LOS		B			A			B			C	

Intersection Summary				
HCM 2000 Control Delay	11.0	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.48			
Actuated Cycle Length (s)	65.2	Sum of lost time (s)	14.1	
Intersection Capacity Utilization	84.8%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

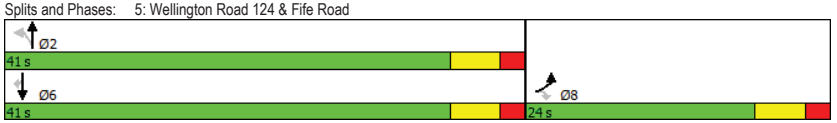
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	397	16	15	983	737	671
Future Volume (vph)	397	16	15	983	737	671
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950			0.999		
Satd. Flow (prot)	1770	1615	0	3503	1810	1583
Flt Permitted	0.950			0.940		
Satd. Flow (perm)	1770	1615	0	3296	1810	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		17				699
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Adj. Flow (vph)	414	17	16	1024	768	699
Shared Lane Traffic (%)						
Lane Group Flow (vph)	414	17	0	1040	768	699
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	24.0	24.0	41.0	41.0	41.0	41.0
Total Split (%)	36.9%	36.9%	63.1%	63.1%	63.1%	63.1%
Maximum Green (s)	18.0	18.0	35.0	35.0	35.0	35.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	17.2	17.2		35.0	35.0	35.0
Actuated g/C Ratio	0.27	0.27		0.55	0.55	0.55
v/c Ratio	0.87	0.04		0.58	0.78	0.59
Control Delay	44.1	9.1		11.5	19.1	3.1
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	44.1	9.1		11.5	19.1	3.1
LOS	D	A		B	B	A
Approach Delay	42.8			11.5	11.5	
Approach LOS	D			B	B	

Intersection Summary

Area Type: Other
Cycle Length: 65
Actuated Cycle Length: 64.2
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 16.1 Intersection LOS: B
Intersection Capacity Utilization 79.2% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road



Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	414	17	1040	768	699
v/c Ratio	0.87	0.04	0.58	0.78	0.59
Control Delay	44.1	9.1	11.5	19.1	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	44.1	9.1	11.5	19.1	3.1
Queue Length 50th (m)	49.3	0.0	42.7	71.3	0.0
Queue Length 95th (m)	#95.5	4.0	59.7	#124.2	13.8
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	496	465	1796	986	1181
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.83	0.04	0.58	0.78	0.59

Intersection Summary

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

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	397	16	15	983	737	671
Future Volume (vph)	397	16	15	983	737	671
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1615		3504	1810	1583
Flt Permitted	0.95	1.00		0.94	1.00	1.00
Satd. Flow (perm)	1770	1615		3295	1810	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	414	17	16	1024	768	699
RTOR Reduction (vph)	0	12	0	0	0	318
Lane Group Flow (vph)	414	5	0	1040	768	381
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	17.2	17.2		35.0	35.0	35.0
Effective Green, g (s)	17.2	17.2		35.0	35.0	35.0
Actuated g/C Ratio	0.27	0.27		0.55	0.55	0.55
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	474	432		1796	986	863
v/s Ratio Prot	c0.23				c0.42	
v/s Ratio Perm		0.00		0.32		0.24
v/c Ratio	0.87	0.01		0.58	0.78	0.44
Uniform Delay, d1	22.5	17.3		9.7	11.5	8.7
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	16.2	0.0		1.4	6.1	1.6
Delay (s)	38.6	17.3		11.1	17.6	10.4
Level of Service	D	B		B	B	B
Approach Delay (s)	37.8			11.1	14.2	
Approach LOS	D			B	B	

Intersection Summary				
HCM 2000 Control Delay	16.5	HCM 2000 Level of Service	B	
HCM 2000 Volume to Capacity ratio	0.81			
Actuated Cycle Length (s)	64.2	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	79.2%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

Appendix I

Traffic Operations Reports – Alternative 4A

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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Filename: A - 124 & 32 E.arc8
Path: C:\Users\MattBrouwer\OneDrive - Paradigm\Projects\Arcady Projects\180114
Report generation date: 15/11/2018 1:50:06 PM

Summary of intersection performance

	AM					
	Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	A1 - 2041					
Leg North	0.80	4.26	0.45	A	7.63	A
Leg West	5.23	10.24	0.84	B		
Leg East	0.88	4.30	0.47	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - 2041, AM " model duration: 8:00 AM - 9:30 AM
"D2 - 2041, PM" model duration: 4:00 PM - 5:30 PM

Run using Junctions 8.0.6.541 at 15/11/2018 1:50:05 PM

File summary

Title	Wellington Road 124 & 32 (East)
Location	
Site Number	
Date	30/10/2018
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	MattBrouwer
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

(Default Analysis Set) - 2041, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Geometry	Leg North - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Geometry	Leg East - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set (s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2041, AM	2041	AM		ONE HOUR	08:00	09:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,East				7.63	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Wellington Road 32 SB	
West	West	Wellington Road 124	
East	East	Wellington Road 132 WB	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	I' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	8.00	84.00	20.00	50.00	25.00	
West	7.00	8.00	30.00	20.00	50.00	25.00	
East	3.50	8.00	107.00	20.00	50.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)

North		(calculated)	(calculated)	0.720	2263.058
West		(calculated)	(calculated)	0.753	2436.345
East		(calculated)	(calculated)	0.727	2301.517

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	616.00	100.000
West	ONE HOUR	✓	1716.00	100.000
East	ONE HOUR	✓	675.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	0.000	584.000	32.000
	West	617.000	0.000	1099.000
	East	26.000	649.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	0.00	0.95	0.05
	West	0.36	0.00	0.64
	East	0.04	0.96	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	1.000	1.110	1.180
	West	1.100	1.000	1.060
	East	1.410	1.100	1.000

Truck Percentages - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	0.0	11.0	18.0
	West	10.0	0.0	6.0
	East	41.0	10.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Intersection Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)	Inclusive Total Queueing Delay (Veh-min)	Inclusive Average Queueing Delay (s)
North	0.45	4.26	0.80	1.00	A	565.25	847.88	50.62	3.58	0.56	50.62	3.58
West	0.84	10.24	5.23	15.00	B	1574.63	2361.95	253.35	6.44	2.82	253.38	6.44
East	0.47	4.30	0.88	1.00	A	619.39	929.09	55.58	3.59	0.62	55.58	3.59

Main Results for each time segment

Main results: (08:00-08:15)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	463.76	115.94	462.24	482.09	487.02	0.00	1685.73	1010.18	0.275	0.00	0.38	2.938	A
West	1291.90	322.97	1286.54	925.25	24.01	0.00	2247.82	2224.28	0.575	0.00	1.34	3.723	A
East	508.18	127.04	506.53	847.97	462.59	0.00	1736.96	1494.35	0.293	0.00	0.41	2.922	A

Main results: (08:15-08:30)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	553.77	138.44	553.21	576.84	582.84	0.00	1617.57	1010.18	0.342	0.38	0.52	3.380	A
West	1542.65	385.66	1539.36	1107.31	28.74	0.00	2243.91	2224.28	0.687	1.34	2.16	5.085	A
East	606.81	151.70	606.19	1014.61	553.49	0.00	1671.56	1494.35	0.363	0.41	0.57	3.377	A

Main results: (08:30-08:45)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	678.23	169.56	677.12	703.73	713.37	0.00	1524.73	1010.18	0.445	0.52	0.79	4.242	A
West	1889.36	472.34	1877.74	1355.31	35.18	0.00	2238.59	2224.28	0.844	2.16	5.07	9.675	A
East	743.19	185.80	741.95	1237.76	675.15	0.00	1584.01	1494.35	0.469	0.57	0.88	4.269	A

Main results: (08:45-09:00)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	678.23	169.56	678.21	707.72	714.54	0.00	1523.90	1010.18	0.445	0.79	0.80	4.256	A
West	1889.36	472.34	1888.71	1357.52	35.23	0.00	2238.54	2224.28	0.844	5.07	5.23	10.238	B
East	743.19	185.80	743.16	1244.84	679.10	0.00	1581.17	1494.35	0.470	0.88	0.88	4.295	A

Main results: (09:00-09:15)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	553.77	138.44	554.87	582.39	584.62	0.00	1616.31	1010.18	0.343	0.80	0.52	3.394	A
West	1542.65	385.66	1554.60	1110.66	28.82	0.00	2243.84	2224.28	0.688	5.23	2.24	5.312	A
East	606.81	151.70	608.04	1024.45	558.97	0.00	1667.61	1494.35	0.364	0.88	0.58	3.403	A

Main results: (09:15-09:30)

Leg	Total		Entry			Pedestrian		Saturation		Start	End		

Leg	Demand (Veh/hr)	Intersection Arrivals (Veh)	Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Demand (Ped/hr)	Capacity (Veh/hr)	Capacity (Veh/hr)	V/C Ratio	Queue (Veh)	Queue (Veh)	Delay (s)	LOS
North	463.76	115.94	464.33	485.37	489.21	0.00	1684.16	1010.18	0.275	0.52	0.38	2.954	A
West	1291.90	322.97	1295.40	929.42	24.12	0.00	2247.73	2224.28	0.575	2.24	1.36	3.795	A
East	508.18	127.04	508.81	853.75	465.77	0.00	1734.67	1494.35	0.293	0.58	0.42	2.937	A

Queueing Delay Results for each time segment

Queueing Delay results: (08:00-08:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	5.56	0.37	2.938	A	A
West	19.40	1.29	3.723	A	A
East	6.05	0.40	2.922	A	A

Queueing Delay results: (08:15-08:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	7.64	0.51	3.380	A	A
West	31.15	2.08	5.085	A	A
East	8.35	0.56	3.377	A	A

Queueing Delay results: (08:30-08:45)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	11.64	0.78	4.242	A	A
West	68.66	4.58	9.675	A	A
East	12.82	0.85	4.269	A	A

Queueing Delay results: (08:45-09:00)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	11.95	0.80	4.256	A	A
West	77.44	5.16	10.238	B	B
East	13.20	0.88	4.295	A	A

Queueing Delay results: (09:00-09:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	8.02	0.53	3.394	A	A
West	35.60	2.37	5.312	A	A
East	8.81	0.59	3.403	A	A

Queueing Delay results: (09:15-09:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	5.81	0.39	2.954	A	A
West	21.09	1.41	3.795	A	A
East	6.34	0.42	2.937	A	A

Queue Variation Results for each time segment

Queue Variation results: (08:00-08:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.38	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	1.34	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.41	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:15-08:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.52	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	2.16	0.00	0.00	4.00	7.00			N/A	N/A
East	0.57	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:30-08:45)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.79	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	5.07	0.00	0.00	3.00	15.00			N/A	N/A
East	0.88	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:45-09:00)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.80	0.00	0.00	0.00	1.00			N/A	N/A
West	5.23	0.00	0.00	0.00	6.00			N/A	N/A
East	0.88	0.00	0.00	0.00	1.00			N/A	N/A

Queue Variation results: (09:00-09:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.52	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	2.24	0.00	0.00	5.00	7.00			N/A	N/A
East	0.58	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (09:15-09:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.38	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	1.36	0.00	0.00	2.00	4.00			N/A	N/A
East	0.42	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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Filename: A - 124 & 32 W.arc8
Path: C:\Users\MattBrouwer\OneDrive - Paradigm\Projects\Arcady Projects\180114
Report generation date: 15/11/2018 1:55:28 PM

Summary of intersection performance

	AM					
	Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	2041					
Leg North	0.00	0.00	0.00	A	6.97	A
Leg West	1.64	5.11	0.62	A		
Leg South	1.04	9.74	0.51	A		
Leg East	2.16	5.96	0.69	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - 2041, AM " model duration: 8:00 AM - 9:30 AM
"D2 - 2041, PM" model duration: 4:00 PM - 5:30 PM

Run using Junctions 8.0.6.541 at 15/11/2018 1:55:28 PM

File summary

Title	124& 32 (West)
Location	
Site Number	
Date	30/10/2018
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	MattBrouwer
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

2041, AM

Data Errors and Warnings

Severity	Area	Item	Description
		Leg West - Roundabout	

Warning	Geometry	Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set(s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2041, AM	2041	AM		ONE HOUR	08:00	09:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	untitled	Roundabout	North,West,South,East				6.97	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Private Access SB	
West	West	Wellington Road 124 EB	
South	South	Wellington Road 32 NB	
East	East	Wellington Road 124 WB	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
South	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	5.40	30.00	20.00	50.00	25.00	
West	7.00	8.00	100.00	20.00	50.00	25.00	
South	3.50	4.50	30.00	20.00	50.00	25.00	
East	7.00	8.00	30.00	20.00	50.00	25.00	

Bypass

Leg	Leg Has Bypass	Bypass Utilisation (%)
North		
West		
South	✓	100
East		

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
North		(calculated)	(calculated)	0.588	1565.891
West		(calculated)	(calculated)	0.757	2456.498
South		(calculated)	(calculated)	0.549	1357.445
East		(calculated)	(calculated)	0.753	2436.345

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	1.00	100.000
West	ONE HOUR	✓	1056.00	100.000
South	ONE HOUR	✓	1232.00	100.000
East	ONE HOUR	✓	1198.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.000	0.000	0.000	1.000
	West	0.000	0.000	196.000	860.000
	South	0.000	353.000	0.000	879.000
	East	0.000	752.000	446.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.00	0.00	0.00	1.00
	West	0.00	0.00	0.19	0.81
	South	0.00	0.29	0.00	0.71
	East	0.00	0.63	0.37	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	1.000	1.000	1.000	1.000
	West	1.000	1.000	1.080	1.110
	South	1.000	1.030	1.000	1.030
	East	1.000	1.140	1.060	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.0	0.0	0.0	0.0
	West	0.0	0.0	8.0	11.0
	South	0.0	3.0	0.0	3.0
	East	0.0	14.0	6.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Intersection Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)	Inclusive Total Queueing Delay (Veh-min)	Inclusive Average Queueing Delay (s)
North	0.00	0.00	0.00	~1	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
West	0.62	5.11	1.64	2.00	A	969.01	1453.51	97.08	4.01	1.08	97.08	4.01
South	0.51	9.74	1.04	2.00	A	1130.50	485.88	59.69	7.37	0.66	59.70	7.37
East	0.69	5.96	2.16	3.00	A	1099.30	1648.95	123.47	4.49	1.37	123.48	4.49

Main Results for each time segment

Main results: (08:00-08:15)

Leg	Total Demand (Veh/hr)	Intersection Demand (Veh/hr)	Intersection Arrivals (Veh)	Bypass Demand (Veh/hr)	Bypass Exit Flow (Veh/hr)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1162.87	0.00	819.06	61.64	0.000	0.00	0.00	0.000	A
West	795.01	795.01	198.75	0.00	0.00	792.35	828.30	334.57	0.00	1981.24	1678.67	0.401	0.00	0.67	3.022	A
South	927.51	265.76	66.44	661.76	0.00	264.18	481.63	645.28	0.00	936.36	476.71	0.284	0.00	0.39	5.344	A
East	901.91	901.91	225.48	0.00	661.76	898.68	645.28	264.18	0.00	2009.94	1861.49	0.449	0.00	0.81	3.230	A

Main results: (08:15-08:30)

Leg	Total Demand (Veh/hr)	Intersection Demand (Veh/hr)	Intersection Arrivals (Veh)	Bypass Demand (Veh/hr)	Bypass Exit Flow (Veh/hr)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1392.06	0.00	671.88	61.64	0.000	0.00	0.00	0.000	A
West	949.32	949.32	237.33	0.00	0.00	948.16	991.68	400.38	0.00	1933.44	1678.67	0.491	0.67	0.96	3.648	A
South	1107.54	317.34	79.33	790.20	0.00	316.60	576.36	772.18	0.00	861.32	476.71	0.368	0.39	0.58	6.601	A
East	1076.97	1076.97	269.24	0.00	790.20	1075.45	772.18	316.60	0.00	1973.33	1861.49	0.546	0.81	1.19	4.003	A

Main results: (08:30-08:45)

Leg	Total Demand (Veh/hr)	Intersection Demand (Veh/hr)	Intersection Arrivals (Veh)	Bypass Demand (Veh/hr)	Bypass Exit Flow (Veh/hr)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1702.11	0.00	472.75	61.64	0.000	0.00	0.00	0.000	A
West	1162.68	1162.68	290.67	0.00	0.00	1160.02	1212.46	489.65	0.00	1868.61	1678.67	0.622	0.96	1.62	5.061	A
South	1356.46	388.66	97.17	967.80	0.00	386.86	704.95	944.71	0.00	759.31	476.71	0.512	0.58	1.03	9.619	A
East	1319.02	1319.02	329.75	0.00	967.80	1315.24	944.71	386.86	0.00	1924.25	1861.49	0.685	1.19	2.14	5.875	A

Main results: (08:45-09:00)

Leg	Total Demand (Veh/hr)	Intersection Demand (Veh/hr)	Intersection Arrivals (Veh)	Bypass Demand (Veh/hr)	Bypass Exit Flow (Veh/hr)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1707.53	0.00	469.29	61.64	0.000	0.00	0.00	0.000	A
West	1162.68	1162.68	290.67	0.00	0.00	1162.63	1216.51	491.02	0.00	1867.61	1678.67	0.623	1.62	1.64	5.106	A
South	1356.46	388.66	97.17	967.80	0.00	388.61	706.81	946.83	0.00	758.05	476.71	0.513	1.03	1.04	9.741	A
East	1319.02	1319.02	329.75	0.00	967.80	1318.92	946.83	388.61	0.00	1923.03	1861.49	0.686	2.14	2.16	5.957	A

Main results: (09:00-09:15)

Leg	Total Demand (Veh/hr)	Intersection Demand (Veh/hr)	Intersection Arrivals (Veh)	Bypass Demand (Veh/hr)	Bypass Exit Flow (Veh/hr)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1399.89	0.00	666.89	61.64	0.000	0.00	0.00	0.000	A
West	949.32	949.32	237.33	0.00	0.00	951.98	997.53	402.35	0.00	1932.01	1678.67	0.491	1.64	0.97	3.682	A
South	1107.54	317.34	79.33	790.20	0.00	319.13	579.05	775.28	0.00	859.49	476.71	0.369	1.04	0.59	6.685	A
East	1076.97	1076.97	269.24	0.00	790.20	1080.75	775.28	319.13	0.00	1971.56	1861.49	0.546	2.16	1.22	4.057	A

Main results: (09:15-09:30)

Leg	Total Demand (Veh/hr)	Intersection Demand (Veh/hr)	Intersection Arrivals (Veh)	Bypass Demand (Veh/hr)	Bypass Exit Flow (Veh/hr)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1170.02	0.00	814.50	61.64	0.000	0.00	0.00	0.000	A
West	795.01	795.01	198.75	0.00	0.00	796.21	833.66	336.36	0.00	1979.93	1678.67	0.402	0.97	0.67	3.046	A
South	927.51	265.76	66.44	661.76	0.00	266.52	484.14	648.43	0.00	934.50	476.71	0.284	0.59	0.40	5.395	A
East	901.91	901.91	225.48	0.00	661.76	903.50	648.43	266.52	0.00	2008.31	1861.49	0.449	1.22	0.82	3.262	A

Queueing Delay Results for each time segment

Queueing Delay results: (08:00-08:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.00	0.00	0.000	A	A
West	9.77	0.65	3.022	A	A
South	5.71	0.38	5.344	A	A
East	11.82	0.79	3.230	A	A

Queueing Delay results: (08:15-08:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.00	0.00	0.000	A	A
West	14.05	0.94	3.648	A	A
South	8.41	0.56	6.601	A	A
East	17.40	1.16	4.003	A	A

Queueing Delay results: (08:30-08:45)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.00	0.00	0.000	A	A
West	23.48	1.57	5.061	A	A
South	14.68	0.98	9.619	A	A
East	30.59	2.04	5.875	A	A

Queueing Delay results: (08:45-09:00)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.00	0.00	0.000	A	A
West	24.47	1.63	5.106	A	A
South	15.52	1.03	9.741	A	A
East	32.26	2.15	5.957	A	A

Queueing Delay results: (09:00-09:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.00	0.00	0.000	A	A
West	15.00	1.00	3.682	A	A
South	9.20	0.61	6.685	A	A
East	18.81	1.25	4.057	A	A

Queueing Delay results: (09:15-09:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.00	0.00	0.000	A	A
West	10.31	0.69	3.046	A	A

South	6.16	0.41	5.395	A	A
East	12.57	0.84	3.262	A	A

Queue Variation Results for each time segment

Queue Variation results: (08:00-08:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.00	~1	~1	~1	~1			N/A	N/A
West	0.67	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.39	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.81	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:15-08:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.00	~1	~1	~1	~1			N/A	N/A
West	0.96	0.00	0.00	1.00	2.00			N/A	N/A
South	0.58	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	1.19	0.00	0.00	2.00	3.00			N/A	N/A

Queue Variation results: (08:30-08:45)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.00	~1	~1	~1	~1			N/A	N/A
West	1.62	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	1.03	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	2.14	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:45-09:00)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.00	~1	~1	~1	~1			N/A	N/A
West	1.64	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	1.04	0.00	0.00	0.00	2.00			N/A	N/A
East	2.16	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (09:00-09:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.00	~1	~1	~1	~1			N/A	N/A
West	0.97	0.00	0.00	1.00	1.00			N/A	N/A
South	0.59	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	1.22	0.00	0.00	1.00	2.00			N/A	N/A

Queue Variation results: (09:15-09:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.00	~1	~1	~1	~1			N/A	N/A
West	0.67	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.40	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.82	0.00	0.00	1.00	1.00			N/A	N/A

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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Filename: A - 124 & 32 E.arc8
Path: C:\Users\MattBrouwer\OneDrive - Paradigm\Projects\Arcady Projects\180114
Report generation date: 15/11/2018 1:51:14 PM

Summary of intersection performance

	PM					
	Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	A1 - 2041					
Leg North	2.00	7.13	0.67	A	6.31	A
Leg West	3.19	6.83	0.76	A		
Leg East	1.07	4.32	0.52	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - 2041, AM" model duration: 8:00 AM - 9:30 AM
"D2 - 2041, PM " model duration: 4:00 PM - 5:30 PM

Run using Junctions 8.0.6.541 at 15/11/2018 1:51:14 PM

File summary

Title	Wellington Road 124 & 32 (East)
Location	
Site Number	
Date	30/10/2018
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	MattBrouwer
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

(Default Analysis Set) - 2041, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Geometry	Leg North - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Geometry	Leg East - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set (s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2041, PM	2041	PM		ONE HOUR	16:00	17:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,East				6.31	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Wellington Road 32 SB	
West	West	Wellington Road 124	
East	East	Wellington Road 132 WB	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	I' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	8.00	84.00	20.00	50.00	25.00	
West	7.00	8.00	30.00	20.00	50.00	25.00	
East	3.50	8.00	107.00	20.00	50.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)

North		(calculated)	(calculated)	0.720	2263.058
West		(calculated)	(calculated)	0.753	2436.345
East		(calculated)	(calculated)	0.727	2301.517

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	927.00	100.000
West	ONE HOUR	✓	1551.00	100.000
East	ONE HOUR	✓	812.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	0.000	879.000	48.000
	West	548.000	0.000	1003.000
	East	46.000	766.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	0.00	0.95	0.05
	West	0.35	0.00	0.65
	East	0.06	0.94	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	1.000	1.060	1.250
	West	1.120	1.000	1.040
	East	1.190	1.040	1.000

Truck Percentages - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	0.0	6.0	25.0
	West	12.0	0.0	4.0
	East	19.0	4.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Intersection Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)	Inclusive Total Queueing Delay (Veh-min)	Inclusive Average Queueing Delay (s)
North	0.67	7.13	2.00	2.00	A	850.63	1275.94	109.97	5.17	1.22	109.98	5.17
West	0.76	6.83	3.19	5.00	A	1423.22	2134.83	173.89	4.89	1.93	173.91	4.89
East	0.52	4.32	1.07	?	A	745.10	1117.66	66.27	3.56	0.74	66.27	3.56

Main Results for each time segment

Main results: (16:00-16:15)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	697.89	174.47	695.16	445.57	574.87	0.00	1712.91	1070.34	0.407	0.00	0.68	3.529	A
West	1167.67	291.92	1163.38	1234.04	36.00	0.00	2248.93	2231.82	0.519	0.00	1.07	3.306	A
East	611.31	152.83	609.39	788.33	411.05	0.00	1875.68	1582.38	0.326	0.00	0.48	2.839	A

Main results: (16:15-16:30)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	833.35	208.34	831.96	533.17	687.91	0.00	1633.79	1070.40	0.510	0.68	1.03	4.483	A
West	1394.31	348.58	1392.10	1476.80	43.08	0.00	2242.69	2231.82	0.622	1.07	1.62	4.221	A
East	729.97	182.49	729.21	943.33	491.86	0.00	1812.90	1582.38	0.403	0.48	0.67	3.320	A

Main results: (16:30-16:45)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	1020.64	255.16	1016.87	651.77	841.90	0.00	1525.99	1070.40	0.669	1.03	1.97	7.020	A
West	1707.68	426.92	1701.59	1806.12	52.65	0.00	2234.26	2231.82	0.764	1.62	3.15	6.683	A
East	894.03	223.51	892.46	1153.04	601.21	0.00	1727.94	1582.38	0.517	0.67	1.06	4.301	A

Main results: (16:45-17:00)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	1020.64	255.16	1020.54	653.94	843.36	0.00	1524.97	1070.40	0.669	1.97	2.00	7.134	A
West	1707.68	426.92	1707.49	1811.05	52.84	0.00	2234.09	2231.82	0.764	3.15	3.19	6.829	A
East	894.03	223.51	894.00	1157.05	603.29	0.00	1726.32	1582.38	0.518	1.06	1.07	4.325	A

Main results: (17:00-17:15)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	833.35	208.34	837.13	536.24	690.09	0.00	1632.26	1070.40	0.511	2.00	1.05	4.550	A
West	1394.31	348.58	1400.43	1483.87	43.35	0.00	2242.46	2231.82	0.622	3.19	1.66	4.305	A
East	729.97	182.49	731.52	948.98	494.80	0.00	1810.61	1582.38	0.403	1.07	0.68	3.342	A

Main results: (17:15-17:30)

Leg	Total		Entry			Pedestrian		Saturation		Start	End		

Leg	Demand (Veh/hr)	Intersection Arrivals (Veh)	Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Demand (Ped/hr)	Capacity (Veh/hr)	Capacity (Veh/hr)	V/C Ratio	Queue (Veh)	Queue (Veh)	Delay (s)	LOS
North	697.89	174.47	699.33	448.05	577.41	0.00	1711.13	1070.34	0.408	1.05	0.69	3.564	A
West	1167.67	291.92	1169.97	1240.54	36.21	0.00	2248.74	2231.82	0.519	1.66	1.09	3.346	A
East	611.31	152.83	612.09	792.81	413.38	0.00	1873.88	1582.38	0.326	0.68	0.49	2.854	A

Queueing Delay Results for each time segment

Queueing Delay results: (16:00-16:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	9.98	0.67	3.529	A	A
West	15.62	1.04	3.306	A	A
East	7.08	0.47	2.839	A	A

Queueing Delay results: (16:15-16:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	15.06	1.00	4.483	A	A
West	23.63	1.58	4.221	A	A
East	9.87	0.66	3.320	A	A

Queueing Delay results: (16:30-16:45)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	28.13	1.88	7.020	A	A
West	44.38	2.96	6.683	A	A
East	15.50	1.03	4.301	A	A

Queueing Delay results: (16:45-17:00)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	29.84	1.99	7.134	A	A
West	47.62	3.17	6.829	A	A
East	15.99	1.07	4.325	A	A

Queueing Delay results: (17:00-17:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	16.33	1.09	4.550	A	A
West	25.91	1.73	4.305	A	A
East	10.41	0.69	3.342	A	A

Queueing Delay results: (17:15-17:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	10.63	0.71	3.564	A	A
West	16.72	1.11	3.346	A	A
East	7.41	0.49	2.854	A	A

Queue Variation Results for each time segment

Queue Variation results: (16:00-16:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.68	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	1.07	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.48	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:15-16:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	1.03	0.00	0.00	1.00	2.00			N/A	N/A
West	1.62	0.00	0.00	3.00	5.00			N/A	N/A
East	0.67	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:30-16:45)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	1.97	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	3.15	0.00	0.00	0.00	4.00			N/A	N/A
East	1.06	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:45-17:00)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	2.00	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	3.19	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	1.07	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (17:00-17:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	1.05	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	1.66	0.00	0.00	3.00	4.00			N/A	N/A
East	0.68	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (17:15-17:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.69	0.00	0.00	1.00	1.00			N/A	N/A
West	1.09	0.00	0.00	2.00	3.00			N/A	N/A
East	0.49	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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Filename: A - 124 & 32 W.arc8
Path: C:\Users\MattBrouwer\OneDrive - Paradigm\Projects\Arcady Projects\180114
Report generation date: 15/11/2018 2:26:45 PM

Summary of intersection performance

	PM					
	Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	2041					
Leg North	0.28	30.30	0.22	D	15.65	C
Leg West	0.21	2.51	0.17	A		
Leg South	0.57	4.33	0.36	A		
Leg East	12.05	24.99	0.94	C		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - 2041, AM" model duration: 8:00 AM - 9:30 AM
"D2 - 2041, PM " model duration: 4:00 PM - 5:30 PM

Run using Junctions 8.0.6.541 at 15/11/2018 2:26:44 PM

File summary

Title	124& 32 (West)
Location	
Site Number	
Date	30/10/2018
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	MattBrouwer
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

2041, PM

Data Errors and Warnings

Severity	Area	Item	Description
		Leg West - Roundabout	

Warning	Geometry	Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set(s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2041, PM	2041	PM		ONE HOUR	16:00	17:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	untitled	Roundabout	North,West,South,East				15.65	C

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Private Access SB	
West	West	Wellington Road 124 EB	
South	South	Wellington Road 32 NB	
East	East	Wellington Road 124 WB	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
South	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	5.40	30.00	20.00	50.00	25.00	
West	7.00	8.00	100.00	20.00	50.00	25.00	
South	3.50	4.50	30.00	20.00	50.00	25.00	
East	7.00	8.00	30.00	20.00	50.00	25.00	

Bypass

Leg	Leg Has Bypass	Bypass Utilisation (%)
North		
West		
South	✓	100
East		

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
North		(calculated)	(calculated)	0.588	1565.891
West		(calculated)	(calculated)	0.757	2456.498
South		(calculated)	(calculated)	0.549	1357.445
East		(calculated)	(calculated)	0.753	2436.345

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	31.00	100.000
West	ONE HOUR	✓	271.00	100.000
South	ONE HOUR	✓	1116.00	100.000
East	ONE HOUR	✓	1680.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.000	1.000	6.000	24.000
	West	6.000	0.000	236.000	29.000
	South	1.000	431.000	0.000	684.000
	East	6.000	942.000	732.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.00	0.03	0.19	0.77
	West	0.02	0.00	0.87	0.11
	South	0.00	0.39	0.00	0.61
	East	0.00	0.56	0.44	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	1.000	1.000	1.000	1.000
	West	1.000	1.000	1.040	1.080
	South	1.000	1.010	1.000	1.060
	East	1.000	1.060	1.030	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.0	0.0	0.0	0.0
	West	0.0	0.0	4.0	8.0
	South	0.0	1.0	0.0	6.0
	East	0.0	6.0	3.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Intersection Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)	Inclusive Total Queueing Delay (Veh-min)	Inclusive Average Queueing Delay (s)
North	0.22	30.30	0.28	~1	D	28.45	42.67	10.93	15.36	0.12	10.93	15.36
West	0.17	2.51	0.21	~1	A	248.68	373.01	14.31	2.30	0.16	14.31	2.30
South	0.36	4.33	0.57	1.00	A	1055.14	594.61	39.27	3.96	0.44	39.27	3.96
East	0.94	24.99	12.05	48.00	C	1541.60	2312.41	437.33	11.35	4.86	437.37	11.35

Main Results for each time segment

Main results: (16:00-16:15)

Leg	Total Demand (Veh/hr)	Intersection Demand (Veh/hr)	Intersection Arrivals (Veh)	Bypass Demand (Veh/hr)	Bypass Exit Flow (Veh/hr)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	23.34	23.34	5.83	0.00	0.00	23.18	9.75	1577.41	0.00	601.68	0.00	0.039	0.00	0.04	6.221	A
West	204.02	204.02	51.01	0.00	0.00	203.55	1029.72	570.88	0.00	1928.39	1890.90	0.106	0.00	0.12	2.087	A
South	865.69	325.23	81.31	514.95	0.00	323.93	730.20	44.23	0.00	1319.06	1202.57	0.247	0.00	0.33	3.612	A
East	1264.80	1264.80	316.20	0.00	514.95	1258.73	39.73	328.44	0.00	2089.06	1423.88	0.605	0.00	1.52	4.305	A

Main results: (16:15-16:30)

Leg	Total Demand (Veh/hr)	Intersection Demand (Veh/hr)	Intersection Arrivals (Veh)	Bypass Demand (Veh/hr)	Bypass Exit Flow (Veh/hr)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	27.87	27.87	6.97	0.00	0.00	27.74	11.67	1887.00	0.00	412.45	0.00	0.068	0.04	0.07	9.354	A
West	243.62	243.62	60.91	0.00	0.00	243.49	1232.02	682.72	0.00	1844.93	1890.90	0.132	0.12	0.15	2.247	A
South	1033.71	388.36	97.09	614.90	0.00	387.99	873.29	52.92	0.00	1314.15	1202.57	0.296	0.33	0.42	3.885	A
East	1510.29	1510.29	377.57	0.00	614.90	1505.30	47.53	393.38	0.00	2041.88	1423.88	0.740	1.52	2.76	6.647	A

Main results: (16:30-16:45)

Leg	Total Demand (Veh/hr)	Intersection Demand (Veh/hr)	Intersection Arrivals (Veh)	Bypass Demand (Veh/hr)	Bypass Exit Flow (Veh/hr)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	34.13	34.13	8.53	0.00	0.00	33.44	14.19	2285.57	0.00	168.95	0.00	0.202	0.07	0.24	26.439	D
West	298.38	298.38	74.59	0.00	0.00	298.16	1494.46	824.54	0.00	1739.12	1890.90	0.172	0.15	0.21	2.498	A
South	1266.04	475.64	118.91	753.10	0.00	475.04	1058.30	64.40	0.00	1307.66	1202.57	0.364	0.42	0.57	4.321	A
East	1849.72	1849.72	462.43	0.00	753.10	1818.12	57.80	481.64	0.00	1977.77	1423.88	0.935	2.76	10.66	19.571	C

Main results: (16:45-17:00)

Leg	Total Demand (Veh/hr)	Intersection Demand (Veh/hr)	Intersection Arrivals (Veh)	Bypass Demand (Veh/hr)	Bypass Exit Flow (Veh/hr)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	34.13	34.13	8.53	0.00	0.00	34.00	14.29	2312.12	0.00	152.61	0.00	0.224	0.24	0.28	30.303	D
West	298.38	298.38	74.59	0.00	0.00	298.37	1509.68	836.43	0.00	1730.25	1890.90	0.172	0.21	0.21	2.513	A
South	1266.04	475.64	118.91	753.10	0.00	475.63	1069.95	64.85	0.00	1307.41	1202.57	0.364	0.57	0.57	4.327	A
East	1849.72	1849.72	462.43	0.00	753.10	1844.17	58.25	482.24	0.00	1977.34	1423.88	0.935	10.66	12.05	24.985	C

Main results: (17:00-17:15)

Leg	Total Demand (Veh/hr)	Intersection Demand (Veh/hr)	Intersection Arrivals (Veh)	Bypass Demand (Veh/hr)	Bypass Exit Flow (Veh/hr)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	27.87	27.87	6.97	0.00	0.00	28.67	11.82	1929.31	0.00	386.43	0.00	0.072	0.28	0.08	10.083	B
West	243.62	243.62	60.91	0.00	0.00	243.84	1256.27	701.70	0.00	1830.78	1890.90	0.133	0.21	0.15	2.270	A
South	1033.71	388.36	97.09	614.90	0.00	388.95	891.85	53.69	0.00	1313.73	1202.57	0.296	0.57	0.42	3.896	A
East	1510.29	1510.29	377.57	0.00	614.90	1546.78	48.29	394.35	0.00	2041.18	1423.88	0.740	12.05	2.93	7.796	A

Main results: (17:15-17:30)

Leg	Total Demand (Veh/hr)	Intersection Demand (Veh/hr)	Intersection Arrivals (Veh)	Bypass Demand (Veh/hr)	Bypass Exit Flow (Veh/hr)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	23.34	23.34	5.83	0.00	0.00	23.49	9.81	1590.60	0.00	593.60	0.00	0.039	0.08	0.04	6.315	A
West	204.02	204.02	51.01	0.00	0.00	204.16	1037.87	576.21	0.00	1924.41	1890.90	0.106	0.15	0.12	2.092	A
South	865.69	325.23	81.31	514.95	0.00	325.60	735.82	44.55	0.00	1318.88	1202.57	0.247	0.42	0.33	3.624	A
East	1264.80	1264.80	316.20	0.00	514.95	1270.29	40.03	330.13	0.00	2087.83	1423.88	0.606	2.93	1.56	4.433	A

Queueing Delay Results for each time segment

Queueing Delay results: (16:00-16:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.58	0.04	6.221	A	A
West	1.75	0.12	2.087	A	A
South	4.77	0.32	3.612	A	A
East	21.85	1.46	4.305	A	A

Queueing Delay results: (16:15-16:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	1.04	0.07	9.354	A	A
West	2.25	0.15	2.247	A	A
South	6.15	0.41	3.885	A	A
East	39.20	2.61	6.647	A	A

Queueing Delay results: (16:30-16:45)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	3.38	0.23	26.439	D	C
West	3.06	0.20	2.498	A	A
South	8.34	0.56	4.321	A	A
East	127.37	8.49	19.571	C	B

Queueing Delay results: (16:45-17:00)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	4.04	0.27	30.303	D	C
West	3.11	0.21	2.513	A	A
South	8.53	0.57	4.327	A	A
East	171.99	11.47	24.985	C	C

Queueing Delay results: (17:00-17:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	1.25	0.08	10.083	B	B
West	2.33	0.16	2.270	A	A
South	6.45	0.43	3.896	A	A
East	52.71	3.51	7.796	A	A

Queueing Delay results: (17:15-17:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.64	0.04	6.315	A	A
West	1.80	0.12	2.092	A	A

South	5.01	0.33	3.624	A	A
East	24.21	1.61	4.433	A	A

Queue Variation Results for each time segment

Queue Variation results: (16:00-16:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.04	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.12	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.33	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	1.52	0.00	0.00	1.00	2.00			N/A	N/A

Queue Variation results: (16:15-16:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.07	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.15	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.42	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	2.76	0.00	0.00	6.00	10.00			N/A	N/A

Queue Variation results: (16:30-16:45)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.24	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.21	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.57	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	10.66	0.00	0.00	26.00	43.00			N/A	N/A

Queue Variation results: (16:45-17:00)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.28	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.21	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.57	0.00	0.00	0.00	1.00			N/A	N/A
East	12.05	0.00	0.00	22.00	48.00			N/A	N/A

Queue Variation results: (17:00-17:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.08	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.15	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.42	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	2.93	0.00	0.00	6.00	10.00			N/A	N/A

Queue Variation results: (17:15-17:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.04	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.12	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.33	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	1.56	0.00	0.00	1.00	5.00			N/A	N/A

Appendix J

Traffic Operations Reports – Alternative 4B

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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Filename: B - 124 & 32.arc8
Path: C:\Users\MattBrouwer\OneDrive - Paradigm\Projects\Arcady Projects\180114
Report generation date: 15/11/2018 2:31:33 PM

Summary of intersection performance

	AM					
	Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	A1 - 2041					
Leg North	0.99	5.30	0.50	A	8.93	A
Leg West	1.69	5.27	0.63	A		
Leg South	5.72	15.83	0.86	C		
Leg East	1.24	6.04	0.55	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - 2041, AM " model duration: 8:00 AM - 9:30 AM
"D2 - 2041, PM" model duration: 4:00 PM - 5:30 PM

Run using Junctions 8.0.6.541 at 15/11/2018 2:31:33 PM

File summary

Title	Wellington Road 124 & 32
Location	
Site Number	
Date	30/10/2018
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	MattBrouwer
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

(Default Analysis Set) - 2041, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Geometry	Leg North - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Geometry	Leg East - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set (s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2041, AM	2041	AM		ONE HOUR	08:00	09:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,South,East				8.93	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Wellington Road 32 SB	
West	West	Wellington Road 124 EB	
South	South	Wellington Road 32 NB	
East	East	Wellington Road 124 WB	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
South	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	I' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	8.00	96.00	20.00	50.00	25.00	
West	7.00	8.00	30.00	20.00	50.00	25.00	
South	7.00	8.00	30.00	20.00	50.00	25.00	
East	3.50	8.00	103.00	20.00	50.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
North		(calculated)	(calculated)	0.724	2285.123
West		(calculated)	(calculated)	0.753	2436.345
South		(calculated)	(calculated)	0.753	2436.345
East		(calculated)	(calculated)	0.726	2295.911

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	616.00	100.000
West	ONE HOUR	✓	1056.00	100.000
South	ONE HOUR	✓	1232.00	100.000
East	ONE HOUR	✓	675.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.000	368.000	216.000	32.000
	West	310.000	0.000	196.000	550.000
	South	316.000	353.000	0.000	563.000
	East	26.000	409.000	240.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.00	0.60	0.35	0.05
	West	0.29	0.00	0.19	0.52
	South	0.26	0.29	0.00	0.46
	East	0.04	0.61	0.36	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		North	West	South	East

From	North	1.000	1.050	1.050	1.180
	West	1.120	1.000	1.000	1.100
	South	1.020	1.030	1.000	1.020
	East	1.410	1.100	1.060	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.0	5.0	5.0	18.0
	West	12.0	0.0	0.0	10.0
	South	2.0	3.0	0.0	2.0
	East	41.0	10.0	6.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Intersection Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)	Inclusive Total Queueing Delay (Veh-min)	Inclusive Average Queueing Delay (s)
North	0.50	5.30	0.99	1.00	A	565.25	847.88	58.76	4.16	0.65	58.77	4.16
West	0.63	5.27	1.69	2.00	A	969.00	1453.51	99.22	4.10	1.10	99.23	4.10
South	0.86	15.83	5.72	20.00	C	1130.50	1695.75	240.47	8.51	2.67	240.48	8.51
East	0.55	6.04	1.24	?	A	619.39	929.09	71.32	4.61	0.79	71.32	4.61

Main Results for each time segment

Main results: (08:00-08:15)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	463.76	115.94	462.15	488.96	751.38	0.00	1613.56	995.01	0.287	0.00	0.40	3.122	A
West	795.01	198.75	792.32	847.46	366.08	0.00	1971.14	1612.30	0.403	0.00	0.67	3.048	A
South	927.51	231.88	923.46	489.13	669.27	0.00	1835.15	1266.88	0.505	0.00	1.01	3.931	A
East	508.17	127.04	506.29	858.68	734.05	0.00	1578.98	1274.09	0.322	0.00	0.47	3.350	A

Main results: (08:15-08:30)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	553.77	138.44	553.07	584.99	899.09	0.00	1505.67	995.01	0.368	0.40	0.58	3.778	A
West	949.32	237.33	948.12	1014.04	438.11	0.00	1918.10	1612.30	0.495	0.67	0.97	3.706	A
South	1107.54	276.88	1104.57	585.35	800.88	0.00	1727.64	1266.88	0.641	1.01	1.76	5.750	A
East	606.81	151.70	605.93	1027.31	878.14	0.00	1478.38	1274.09	0.410	0.47	0.69	4.122	A

Main results: (08:30-08:45)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	678.23	169.56	676.61	713.20	1097.00	0.00	1361.03	995.01	0.498	0.58	0.98	5.247	A
West	1162.68	290.67	1159.87	1237.71	535.90	0.00	1846.09	1612.30	0.630	0.97	1.68	5.223	A
South	1356.45	339.11	1341.79	716.03	979.74	0.00	1581.53	1266.88	0.858	1.76	5.42	14.227	B
East	743.19	185.80	741.08	1252.42	1069.12	0.00	1344.92	1274.09	0.553	0.69	1.22	5.942	A

Main results: (08:45-09:00)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS

North	678.23	169.56	678.19	717.54	1102.80	0.00	1356.86	995.01	0.500	0.98	0.99	5.304	A
West	1162.68	290.67	1162.62	1243.73	537.26	0.00	1845.09	1612.30	0.630	1.68	1.69	5.274	A
South	1356.45	339.11	1355.24	717.81	982.06	0.00	1579.64	1266.88	0.859	5.42	5.72	15.832	C
East	743.19	185.80	743.12	1260.08	1077.22	0.00	1339.37	1274.09	0.555	1.22	1.24	6.037	A

Main results: (09:00-09:15)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	553.77	138.44	555.39	591.04	907.27	0.00	1499.78	995.01	0.369	0.99	0.59	3.817	A
West	949.32	237.33	952.13	1022.55	440.10	0.00	1916.63	1612.30	0.495	1.69	0.99	3.745	A
South	1107.54	276.88	1123.13	587.97	804.26	0.00	1724.88	1266.88	0.642	5.72	1.83	6.131	A
East	606.81	151.70	608.92	1038.00	889.38	0.00	1470.67	1274.09	0.413	1.24	0.71	4.187	A

Main results: (09:15-09:30)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	463.76	115.94	464.49	492.07	756.15	0.00	1610.09	995.01	0.288	0.59	0.41	3.143	A
West	795.01	198.75	796.25	852.63	368.01	0.00	1969.72	1612.30	0.404	0.99	0.68	3.070	A
South	927.51	231.88	930.68	491.67	672.59	0.00	1832.44	1266.88	0.506	1.83	1.03	4.005	A
East	508.17	127.04	509.09	864.15	739.13	0.00	1575.47	1274.09	0.323	0.71	0.48	3.380	A

Queueing Delay Results for each time segment

Queueing Delay results: (08:00-08:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	5.90	0.39	3.122	A	A
West	9.85	0.66	3.048	A	A
South	14.72	0.98	3.931	A	A
East	6.92	0.46	3.350	A	A

Queueing Delay results: (08:15-08:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	8.50	0.57	3.778	A	A
West	14.26	0.95	3.706	A	A
South	25.27	1.68	5.750	A	A
East	10.14	0.68	4.122	A	A

Queueing Delay results: (08:30-08:45)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	14.28	0.95	5.247	A	A
West	24.19	1.61	5.223	A	A
South	70.74	4.72	14.227	B	B
East	17.60	1.17	5.942	A	A

Queueing Delay results: (08:45-09:00)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	14.83	0.99	5.304	A	A
West	25.27	1.68	5.274	A	A
South	84.05	5.60	15.832	C	B
East	18.43	1.23	6.037	A	A

Queueing Delay results: (09:00-09:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	9.05	0.60	3.817	A	A
West	15.25	1.02	3.745	A	A

South	29.73	1.98	6.131	A	A
East	10.91	0.73	4.187	A	A

Queueing Delay results: (09:15-09:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	6.20	0.41	3.143	A	A
West	10.40	0.69	3.070	A	A
South	15.97	1.06	4.005	A	A
East	7.32	0.49	3.380	A	A

Queue Variation Results for each time segment

Queue Variation results: (08:00-08:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.40	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.67	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	1.01	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.47	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:15-08:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.58	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.97	0.00	0.00	1.00	2.00			N/A	N/A
South	1.76	0.00	0.00	3.00	6.00			N/A	N/A
East	0.69	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:30-08:45)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.98	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	1.68	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	5.42	0.00	0.00	8.00	20.00			N/A	N/A
East	1.22	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:45-09:00)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.99	0.00	0.00	0.00	1.00			N/A	N/A
West	1.69	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	5.72	0.00	0.00	2.00	15.00			N/A	N/A
East	1.24	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (09:00-09:15)

Leg	Mean	Q05	Q50	Q90	Q95	Percentile Message	Marker	Probability Of Reaching	Probability Of Exactly

	(Veh)	(Veh)	(Veh)	(Veh)	(Veh)		Message	Or Exceeding Marker	Reaching Marker
North	0.59	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.99	0.00	0.00	1.00	1.00			N/A	N/A
South	1.83	0.00	0.00	4.00	6.00			N/A	N/A
East	0.71	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (09:15-09:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.41	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.68	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	1.03	0.00	0.00	1.00	3.00			N/A	N/A
East	0.48	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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Filename: B - 124 & 32.arc8
Path: C:\Users\MattBrouwer\OneDrive - Paradigm\Projects\Arcady Projects\180114
Report generation date: 15/11/2018 2:31:55 PM

Summary of intersection performance

	PM					
	Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	A1 - 2041					
Leg North	4.18	15.27	0.81	C	9.74	A
Leg West	1.44	5.59	0.59	A		
Leg South	3.57	10.72	0.79	B		
Leg East	1.68	6.82	0.63	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - 2041, AM" model duration: 8:00 AM - 9:30 AM
"D2 - 2041, PM " model duration: 4:00 PM - 5:30 PM

Run using Junctions 8.0.6.541 at 15/11/2018 2:31:54 PM

File summary

Title	Wellington Road 124 & 32
Location	
Site Number	
Date	30/10/2018
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	MattBrouwer
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

(Default Analysis Set) - 2041, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Geometry	Leg North - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Geometry	Leg East - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set (s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2041, PM	2041	PM		ONE HOUR	16:00	17:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,South,East				9.74	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Wellington Road 32 SB	
West	West	Wellington Road 124 EB	
South	South	Wellington Road 32 NB	
East	East	Wellington Road 124 WB	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
South	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	I' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	8.00	96.00	20.00	50.00	25.00	
West	7.00	8.00	30.00	20.00	50.00	25.00	
South	7.00	8.00	30.00	20.00	50.00	25.00	
East	3.50	8.00	103.00	20.00	50.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
North		(calculated)	(calculated)	0.724	2285.123
West		(calculated)	(calculated)	0.753	2436.345
South		(calculated)	(calculated)	0.753	2436.345
East		(calculated)	(calculated)	0.726	2295.911

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	927.00	100.000
West	ONE HOUR	✓	853.00	100.000
South	ONE HOUR	✓	1115.00	100.000
East	ONE HOUR	✓	812.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To			
		North	**West**	**South**	**East**
From	**North**	0.000	492.000	387.000	48.000
	West	290.000	0.000	0.000	563.000
	South	239.000	431.000	0.000	445.000
	East	46.000	429.000	337.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To			
		North	**West**	**South**	**East**
From	**North**	0.00	0.53	0.42	0.05
	West	0.34	0.00	0.00	0.66
	South	0.21	0.39	0.00	0.40
	East	0.06	0.53	0.42	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

	To				
		North	**West**	**South**	**East**

From	North	1.000	1.030	1.030	1.250
	West	1.150	1.000	1.000	1.100
	South	1.030	1.010	1.000	1.030
	East	1.190	1.040	1.030	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.0	3.0	3.0	25.0
	West	15.0	0.0	0.0	10.0
	South	3.0	1.0	0.0	3.0
	East	19.0	4.0	3.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Intersection Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)	Inclusive Total Queueing Delay (Veh-min)	Inclusive Average Queueing Delay (s)
North	0.81	15.27	4.18	13.00	C	850.63	1275.95	182.02	8.56	2.02	182.03	8.56
West	0.59	5.59	1.44	1.00	A	782.73	1174.09	84.19	4.30	0.94	84.19	4.30
South	0.79	10.72	3.57	9.00	B	1023.14	1534.71	168.83	6.60	1.88	168.85	6.60
East	0.63	6.82	1.68	1.00	A	745.10	1117.66	92.38	4.96	1.03	92.38	4.96

Main Results for each time segment

Main results: (16:00-16:15)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	697.90	174.47	694.66	431.27	897.69	0.00	1553.50	991.68	0.449	0.00	0.81	4.176	A
West	642.18	160.55	639.93	1013.61	578.73	0.00	1774.03	1470.19	0.362	0.00	0.56	3.167	A
South	839.43	209.86	836.04	542.76	675.89	0.00	1823.72	1126.54	0.460	0.00	0.85	3.633	A
East	611.31	152.83	609.02	792.00	719.93	0.00	1669.04	1319.80	0.366	0.00	0.57	3.389	A

Main results: (16:15-16:30)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	833.36	208.34	831.07	516.03	1074.13	0.00	1427.55	991.68	0.584	0.81	1.38	6.013	A
West	766.83	191.71	765.80	1212.75	692.46	0.00	1694.03	1470.19	0.453	0.56	0.82	3.874	A
South	1002.36	250.59	1000.18	649.42	808.84	0.00	1713.66	1126.54	0.585	0.85	1.39	5.031	A
East	729.97	182.49	728.80	947.65	861.37	0.00	1565.04	1319.80	0.466	0.57	0.87	4.298	A

Main results: (16:30-16:45)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	1020.65	255.16	1010.27	630.31	1311.76	0.00	1257.91	991.68	0.811	1.38	3.97	13.989	B
West	939.17	234.79	936.74	1478.21	843.82	0.00	1587.57	1470.19	0.592	0.82	1.43	5.510	A
South	1227.64	306.91	1219.34	791.51	989.06	0.00	1564.49	1126.54	0.785	1.39	3.46	10.193	B
East	894.03	223.51	890.89	1157.23	1051.17	0.00	1425.40	1319.80	0.627	0.87	1.65	6.697	A

Main results: (16:45-17:00)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	1020.65	255.16	1019.84	632.97	1317.67	0.00	1253.71	991.68	0.814	3.97	4.18	15.268	C
West	939.17	234.79	939.10	1487.93	849.57	0.00	1583.51	1470.19	0.593	1.43	1.44	5.586	A
South	1227.64	306.91	1227.22	796.76	991.91	0.00	1562.10	1126.54	0.786	3.46	3.57	10.716	B
East	894.03	223.51	893.92	1162.42	1056.70	0.00	1421.41	1319.80	0.629	1.65	1.68	6.822	A

Main results: (17:00-17:15)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	833.36	208.34	844.31	519.74	1082.35	0.00	1421.70	991.68	0.586	4.18	1.44	6.351	A
West	766.83	191.71	769.25	1226.19	700.46	0.00	1688.37	1470.19	0.454	1.44	0.84	3.926	A
South	1002.36	250.59	1010.89	656.74	812.97	0.00	1710.19	1126.54	0.586	3.57	1.44	5.208	A
East	729.97	182.49	733.12	954.90	868.97	0.00	1559.55	1319.80	0.468	1.68	0.89	4.372	A

Main results: (17:15-17:30)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	697.90	174.47	700.35	433.81	903.20	0.00	1549.57	991.68	0.450	1.44	0.83	4.252	A
West	642.18	160.55	643.25	1020.68	582.86	0.00	1771.12	1470.19	0.363	0.84	0.57	3.194	A
South	839.43	209.86	841.72	546.59	679.51	0.00	1820.71	1126.54	0.461	1.44	0.86	3.687	A
East	611.31	152.83	612.53	796.76	724.48	0.00	1665.72	1319.80	0.367	0.89	0.58	3.423	A

Queueing Delay Results for each time segment

Queueing Delay results: (16:00-16:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	11.76	0.78	4.176	A	A
West	8.27	0.55	3.167	A	A
South	12.34	0.82	3.633	A	A
East	8.41	0.56	3.389	A	A

Queueing Delay results: (16:15-16:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	19.93	1.33	6.013	A	A
West	12.04	0.80	3.874	A	A
South	20.17	1.34	5.031	A	A
East	12.68	0.85	4.298	A	A

Queueing Delay results: (16:30-16:45)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	52.97	3.53	13.989	B	B
West	20.63	1.38	5.510	A	A
South	47.50	3.17	10.193	B	B
East	23.63	1.58	6.697	A	A

Queueing Delay results: (16:45-17:00)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	61.49	4.10	15.268	C	B
West	21.58	1.44	5.586	A	A
South	52.92	3.53	10.716	B	B
East	24.99	1.67	6.822	A	A

Queueing Delay results: (17:00-17:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	23.12	1.54	6.351	A	A
West	12.92	0.86	3.926	A	A

South	22.64	1.51	5.208	A	A
East	13.73	0.92	4.372	A	A

Queueing Delay results: (17:15-17:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	12.75	0.85	4.252	A	A
West	8.74	0.58	3.194	A	A
South	13.26	0.88	3.687	A	A
East	8.93	0.60	3.423	A	A

Queue Variation Results for each time segment

Queue Variation results: (16:00-16:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.81	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.56	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.85	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.57	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:15-16:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	1.38	0.00	0.00	2.00	4.00			N/A	N/A
West	0.82	0.00	0.00	1.00	1.00			N/A	N/A
South	1.39	0.00	0.00	2.00	4.00			N/A	N/A
East	0.87	0.00	0.00	1.00	1.00			N/A	N/A

Queue Variation results: (16:30-16:45)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	3.97	0.00	0.00	4.00	13.00			N/A	N/A
West	1.43	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	3.46	0.00	0.00	1.00	9.00			N/A	N/A
East	1.65	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:45-17:00)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	4.18	0.00	0.00	1.00	9.00			N/A	N/A
West	1.44	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	3.57	0.00	0.00	0.00	4.00			N/A	N/A
East	1.68	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (17:00-17:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	1.44	0.00	0.00	3.00	4.00			N/A	N/A
West	0.84	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

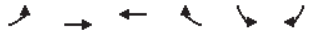
South	1.44	0.00	0.00	3.00	4.00			N/A	N/A
East	0.89	0.00	0.00	1.00	1.00			N/A	N/A

Queue Variation results: (17:15-17:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.83	0.00	0.00	1.00	2.00			N/A	N/A
West	0.57	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.86	0.00	0.00	1.00	2.00			N/A	N/A
East	0.58	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

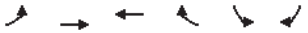
Appendix K

Traffic Operations Reports – Preferred Alternative



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	441	1141	1314	6	0	397
Future Volume (vph)	441	1141	1314	6	0	397
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	125.0			60.0	30.0	0.0
Storage Lanes	1			1	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.850		0.850
Flt Protected	0.950					
Satd. Flow (prot)	1770	1743	1743	1077	1900	1599
Flt Permitted	0.950					
Satd. Flow (perm)	1770	1743	1743	1077	1900	1599
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	2%	9%	9%	50%	0%	1%
Adj. Flow (vph)	464	1201	1383	6	0	418
Shared Lane Traffic (%)						
Lane Group Flow (vph)	464	1201	1383	6	0	418
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane			Yes			
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 100.4%		ICU Level of Service G	
Analysis Period (min) 15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	441	1141	1314	6	0	397
Future Volume (Veh/h)	441	1141	1314	6	0	397
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)	464	1201	1383	6	0	418
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1389				3512	1383
vC1, stage 1 conf vol					1383	
vC2, stage 2 conf vol					2129	
vCu, unblocked vol	1389				3512	1383
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	6				100	0
cM capacity (veh/h)	493				6	177

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	464	1201	1383	6	0	418
Volume Left	464	0	0	0	0	0
Volume Right	0	0	0	6	0	418
cSH	493	1700	1700	1700	1700	177
Volume to Capacity	0.94	0.71	0.81	0.00	0.00	2.36
Queue Length 95th (m)	92.1	0.0	0.0	0.0	0.0	277.3
Control Delay (s)	56.3	0.0	0.0	0.0	0.0	672.2
Lane LOS	F				A	F
Approach Delay (s)	15.7		0.0		672.2	
Approach LOS					F	

Intersection Summary				
Average Delay		88.5		
Intersection Capacity Utilization		100.4%	ICU Level of Service	G
Analysis Period (min)		15		

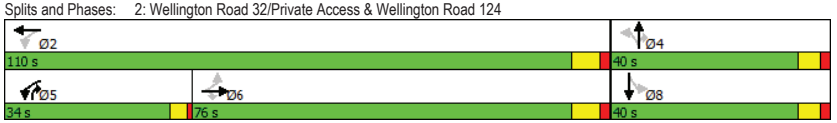
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	924	196	446	976	0	353	0	879	0	0	0
Future Volume (vph)	0	924	196	446	976	0	353	0	879	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	60.0		60.0	180.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		1	1		0	1		1	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850						0.850			
Flt Protected				0.950				0.950				
Satd. Flow (prot)	1900	1712	1495	1703	1667	0	0	1752	1568	0	1900	0
Flt Permitted				0.055				0.757				
Satd. Flow (perm)	1900	1712	1495	99	1667	0	0	1396	1568	0	1900	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			80						55			
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
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%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Adj. Flow (vph)	0	1027	218	496	1084	0	392	0	977	0	0	0
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	1027	218	496	1084	0	0	392	977	0	0	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane		Yes			Yes							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2		1	2	1	1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0		0.0	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)	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pm+ov			
Protected Phases		6		5	2			4	5		8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2			4		4	8		
Detector Phase	6	6	6	5	2		4	4	5	8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0	35.0	8.0	35.0		12.0	12.0	8.0	12.0	12.0	
Minimum Split (s)	42.0	42.0	42.0	12.0	42.0		26.0	26.0	12.0	26.0	26.0	
Total Split (s)	76.0	76.0	76.0	34.0	110.0		40.0	40.0	34.0	40.0	40.0	
Total Split (%)	50.7%	50.7%	50.7%	22.7%	73.3%		26.7%	26.7%	22.7%	26.7%	26.7%	
Maximum Green (s)	69.0	69.0	69.0	30.0	103.0		34.0	34.0	30.0	34.0	34.0	
Yellow Time (s)	5.0	5.0	5.0	3.0	5.0		4.0	4.0	3.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0		2.0	2.0	1.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Lead/Lag	Lag	Lag	Lag	Lead					Lead			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes					Yes			
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	None	None		None	None	None	None	None	
Walk Time (s)	23.0	23.0	23.0		23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0	12.0		12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0	0		0		0	0		0	0	
Act Effct Green (s)		69.0	69.0	106.0	103.0			34.0	70.0			
Actuated g/C Ratio		0.46	0.46	0.71	0.69			0.23	0.47			
v/c Ratio		1.30	0.30	1.27	0.95			1.24	1.28			
Control Delay		180.9	16.8	180.3	38.6			179.1	170.5			
Queue Delay		0.0	0.0	0.0	4.9			0.0	0.0			
Total Delay		180.9	16.8	180.3	43.4			179.1	170.5			
LOS		F	B	F	D			F	F			
Approach Delay		152.2			86.4			172.9				
Approach LOS		F			F			F				

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 150
Natural Cycle: 150
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.30
Intersection Signal Delay: 134.2 Intersection LOS: F
Intersection Capacity Utilization 116.8% ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124



Lane Group	EBT	EBR	WBL	WBT	NBT	NBR
Lane Group Flow (vph)	1027	218	496	1084	392	977
v/c Ratio	1.30	0.30	1.27	0.95	1.24	1.28
Control Delay	180.9	16.8	180.3	38.6	179.1	170.5
Queue Delay	0.0	0.0	0.0	4.9	0.0	0.0
Total Delay	180.9	16.8	180.3	43.4	179.1	170.5
Queue Length 50th (m)	~411.0	25.7	~179.4	282.7	~151.8	~379.3
Queue Length 95th (m)	#495.4	45.3	#253.0	#416.5	#219.9	#464.2
Internal Link Dist (m)	1665.7			343.4	471.1	
Turn Bay Length (m)		60.0	180.0			
Base Capacity (vph)	787	730	390	1144	316	761
Starvation Cap Reductn	0	0	0	42	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.30	0.30	1.27	0.98	1.24	1.28

Intersection Summary

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

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	924	196	446	976	0	353	0	879	0	0	0
Future Volume (vph)	0	924	196	446	976	0	353	0	879	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0	7.0	4.0	7.0			6.0	4.0			
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		1.00	1.00	0.95	1.00			0.95	1.00			
Satd. Flow (prot)		1712	1495	1703	1667			1752	1568			
Flt Permitted		1.00	1.00	0.05	1.00			0.76	1.00			
Satd. Flow (perm)		1712	1495	98	1667			1397	1568			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1027	218	496	1084	0	392	0	977	0	0	0
RTOR Reduction (vph)	0	0	43	0	0	0	0	0	32	0	0	0
Lane Group Flow (vph)	0	1027	175	496	1084	0	0	392	945	0	0	0
Heavy Vehicles (%)	0%	11%	8%	6%	14%	0%	3%	0%	3%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pm+ov			
Protected Phases		6		5	2			4	5		8	
Permitted Phases	6		6	2			4		4	8		
Actuated Green, G (s)		69.0	69.0	103.0	103.0			34.0	64.0			
Effective Green, g (s)		69.0	69.0	103.0	103.0			34.0	64.0			
Actuated g/C Ratio		0.46	0.46	0.69	0.69			0.23	0.43			
Clearance Time (s)		7.0	7.0	4.0	7.0			6.0	4.0			
Vehicle Extension (s)		5.0	5.0	3.0	5.0			3.0	3.0			
Lane Grp Cap (vph)		787	687	388	1144			316	669			
v/s Ratio Prot		0.60		0.26	0.65				c0.28			
v/s Ratio Perm			0.12	c0.62				0.28	0.32			
v/c Ratio		1.30	0.25	1.28	0.95			1.24	1.41			
Uniform Delay, d1		40.5	24.8	52.1	21.1			58.0	43.0			
Progression Factor		1.00	1.00	1.00	1.00			1.00	1.00			
Incremental Delay, d2		146.4	0.4	143.8	15.9			132.3	194.8			
Delay (s)		186.9	25.2	195.9	37.0			190.3	237.8			
Level of Service		F	C	F	D			F	F			
Approach Delay (s)		158.6			86.9			224.2			0.0	
Approach LOS		F			F			F			A	

Intersection Summary			
HCM 2000 Control Delay	153.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.37		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	116.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

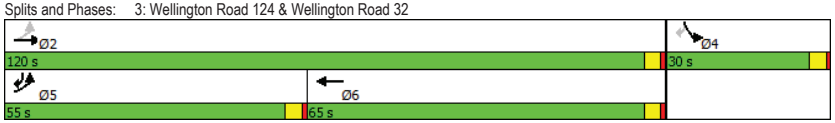
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	617	1163	873	35	32	584
Future Volume (vph)	617	1163	873	35	32	584
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	180.0			0.0	90.0	0.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.995			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1641	1792	1700	0	1530	1429
Flt Permitted	0.061				0.950	
Satd. Flow (perm)	105	1792	1700	0	1530	1429
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			2			42
Link Speed (k/h)		70	70		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		18.9	105.7		23.1	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Adj. Flow (vph)	693	1307	981	39	36	656
Shared Lane Traffic (%)						
Lane Group Flow (vph)	693	1307	1020	0	36	656
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane		Yes	Yes			
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	2					4
Detector Phase	5	2	6		4	5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	9.0
Total Split (s)	55.0	120.0	65.0		30.0	55.0
Total Split (%)	36.7%	80.0%	43.3%		20.0%	36.7%
Maximum Green (s)	51.0	116.0	61.0		26.0	51.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lead		Lag			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	None	Max		None	None
Walk Time (s)		10.0	10.0		10.0	
Flash Dont Walk (s)		16.0	16.0		16.0	
Pedestrian Calls (#/hr)		0	0		0	
Act Effct Green (s)	116.3	117.2	61.2		10.5	63.1
Actuated g/C Ratio	0.88	0.89	0.46		0.08	0.48
v/c Ratio	1.01	0.82	1.30		0.30	0.93
Control Delay	72.7	10.9	174.5		64.7	51.9
Queue Delay	0.0	0.9	0.0		0.0	0.0
Total Delay	72.7	11.8	174.5		64.7	51.9
LOS	E	B	F		E	D
Approach Delay		32.9	174.5		52.5	
Approach LOS		C	F		D	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 132.3
Natural Cycle: 150
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.30
Intersection Signal Delay: 75.4 — Intersection LOS: E
Intersection Capacity Utilization 96.4% — ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 3: Wellington Road 124 & Wellington Road 32



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	693	1307	1020	36	656
v/c Ratio	1.01	0.82	1.30	0.30	0.93
Control Delay	72.7	10.9	174.5	64.7	51.9
Queue Delay	0.0	0.9	0.0	0.0	0.0
Total Delay	72.7	11.8	174.5	64.7	51.9
Queue Length 50th (m)	~191.9	134.3	~369.7	9.7	158.1
Queue Length 95th (m)	#274.8	254.1	#461.2	21.3	#236.5
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)	180.0			90.0	
Base Capacity (vph)	685	1587	787	301	703
Starvation Cap Reductn	0	95	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	1.01	0.88	1.30	0.12	0.93

Intersection Summary

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

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

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	617	1163	873	35	32	584
Future Volume (vph)	617	1163	873	35	32	584
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1641	1792	1700		1530	1429
Flt Permitted	0.06	1.00	1.00		0.95	1.00
Satd. Flow (perm)	106	1792	1700		1530	1429
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	693	1307	981	39	36	656
RTOR Reduction (vph)	0	0	1	0	0	23
Lane Group Flow (vph)	693	1307	1019	0	36	633
Heavy Vehicles (%)	10%	6%	10%	41%	18%	13%
Turn Type	pm+pt	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5
Permitted Phases	2					4
Actuated Green, G (s)	116.3	116.3	61.2		8.9	60.0
Effective Green, g (s)	116.3	116.3	61.2		8.9	60.0
Actuated g/C Ratio	0.87	0.87	0.46		0.07	0.45
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	681	1564	781		102	686
v/s Ratio Prot	c0.39	0.73	c0.60		0.02	c0.35
v/s Ratio Perm	0.50					0.09
v/c Ratio	1.02	0.84	1.30		0.35	0.92
Uniform Delay, d1	37.7	4.0	36.0		59.4	34.4
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	39.0	4.0	146.3		4.4	18.7
Delay (s)	76.6	8.0	182.3		63.8	53.1
Level of Service	E	A	F		E	D
Approach Delay (s)		31.8	182.3		53.7	
Approach LOS		C	F		D	

Intersection Summary				
HCM 2000 Control Delay	77.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	133.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.4%	ICU Level of Service	F
Analysis Period (min)	15		

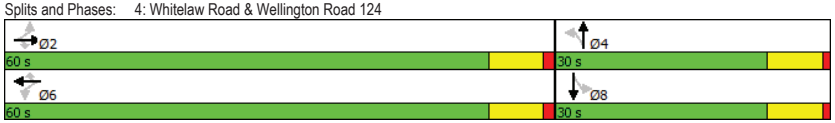
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	993	66	20	638	91	233	246	44	37	89	41
Future Volume (vph)	78	993	66	20	638	91	233	246	44	37	89	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	140.0		130.0	0.0		0.0	0.0		0.0
Storage Lanes	1		1	1		1	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.989			0.967	
Flt Protected	0.950			0.950				0.978			0.989	
Satd. Flow (prot)	1736	1776	1615	1444	1792	1509	0	1702	0	0	1601	0
Flt Permitted	0.268			0.076				0.752			0.808	
Satd. Flow (perm)	490	1776	1615	116	1792	1509	0	1309	0	0	1308	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			73			101		5			18	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
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 (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Adj. Flow (vph)	87	1103	73	22	709	101	259	273	49	41	99	46
Shared Lane Traffic (%)												
Lane Group Flow (vph)	87	1103	73	22	709	101	0	581	0	0	186	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane		Yes										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	
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)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	
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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		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			8		
Detector Phase	2	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2	37.2	37.2	37.2	37.2	28.9	28.9		28.9	28.9	
Total Split (s)	60.0	60.0	60.0	60.0	60.0	60.0	30.0	30.0		30.0	30.0	
Total Split (%)	66.7%	66.7%	66.7%	66.7%	66.7%	66.7%	33.3%	33.3%		33.3%	33.3%	
Maximum Green (s)	52.8	52.8	52.8	52.8	52.8	52.8	23.1	23.1		23.1	23.1	
Yellow Time (s)	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3	1.3	1.3	1.3	1.3	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Lost Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0		3.0	3.0	
Recall Mode	Max	Max	Max	Max	Max	Max	None	None		None	None	
Walk Time (s)	15.0	15.0	15.0	15.0	15.0	15.0	11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	52.8	52.8	52.8	52.8	52.8	52.8		23.1			23.1	
Actuated g/C Ratio	0.59	0.59	0.59	0.59	0.59	0.59		0.26			0.26	
v/c Ratio	0.30	1.06	0.07	0.32	0.67	0.11		1.71			0.53	
Control Delay	12.9	65.8	2.3	25.2	16.8	2.1		359.3			32.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Delay	12.9	65.8	2.3	25.2	16.8	2.1		359.3			32.4	
LOS	B	E	A	C	B	A		F			C	
Approach Delay		58.5			15.2			359.3			32.4	
Approach LOS		E			B			F			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Natural Cycle: 150			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 1.71			
Intersection Signal Delay: 105.3		Intersection LOS: F	
Intersection Capacity Utilization 123.3%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	87	1103	73	22	709	101	581	186
v/c Ratio	0.30	1.06	0.07	0.32	0.67	0.11	1.71	0.53
Control Delay	12.9	65.8	2.3	25.2	16.8	2.1	359.3	32.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.9	65.8	2.3	25.2	16.8	2.1	359.3	32.4
Queue Length 50th (m)	7.3	~222.6	0.0	1.9	81.4	0.0	~158.6	26.2
Queue Length 95th (m)	17.4	#299.5	5.3	9.9	121.9	6.2	#224.4	48.1
Internal Link Dist (m)		2030.4			1551.0		355.0	437.0
Turn Bay Length (m)	100.0		100.0	140.0		130.0		
Base Capacity (vph)	287	1041	977	68	1051	927	339	349
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.30	1.06	0.07	0.32	0.67	0.11	1.71	0.53

Intersection Summary

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

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	993	66	20	638	91	233	246	44	37	89	41
Future Volume (vph)	78	993	66	20	638	91	233	246	44	37	89	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.99			0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98			0.99	
Satd. Flow (prot)	1736	1776	1615	1444	1792	1509		1701			1601	
Flt Permitted	0.27	1.00	1.00	0.08	1.00	1.00		0.75			0.81	
Satd. Flow (perm)	490	1776	1615	115	1792	1509		1308			1308	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	87	1103	73	22	709	101	259	273	49	41	99	46
RTOR Reduction (vph)	0	0	30	0	0	42	0	4	0	0	13	0
Lane Group Flow (vph)	87	1103	43	22	709	59	0	577	0	0	173	0
Heavy Vehicles (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2		2	6		6	4			8		
Actuated Green, G (s)	52.8	52.8	52.8	52.8	52.8	52.8		23.1			23.1	
Effective Green, g (s)	52.8	52.8	52.8	52.8	52.8	52.8		23.1			23.1	
Actuated g/C Ratio	0.59	0.59	0.59	0.59	0.59	0.59		0.26			0.26	
Clearance Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5		3.0			3.0	
Lane Grp Cap (vph)	287	1041	947	67	1051	885		335			335	
v/s Ratio Prot		c0.62			0.40							
v/s Ratio Perm	0.18		0.03	0.19		0.04		c0.44			0.13	
v/c Ratio	0.30	1.06	0.05	0.33	0.67	0.07		1.72			0.52	
Uniform Delay, d1	9.4	18.6	7.9	9.5	12.7	8.0		33.5			28.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	2.7	45.1	0.1	12.6	3.5	0.1		337.8			1.3	
Delay (s)	12.1	63.7	8.0	22.1	16.2	8.1		371.2			30.0	
Level of Service	B	E	A	C	B	A		F			C	
Approach Delay (s)		56.9			15.4			371.2			30.0	
Approach LOS		E			B			F			C	

Intersection Summary					
HCM 2000 Control Delay	106.9	HCM 2000 Level of Service	F		
HCM 2000 Volume to Capacity ratio	1.26				
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	14.1		
Intersection Capacity Utilization	123.3%	ICU Level of Service	H		
Analysis Period (min)	15				
c Critical Lane Group					

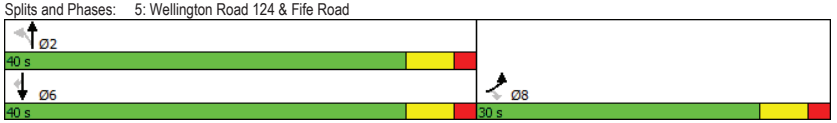
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	476	14	5	1083	695	357
Future Volume (vph)	476	14	5	1083	695	357
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950					
Satd. Flow (prot)	1770	1214	0	3375	1792	1553
Flt Permitted	0.950			0.952		
Satd. Flow (perm)	1770	1214	0	3213	1792	1553
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		15				388
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Adj. Flow (vph)	517	15	5	1177	755	388
Shared Lane Traffic (%)						
Lane Group Flow (vph)	517	15	0	1182	755	388
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	30.0	30.0	40.0	40.0	40.0	40.0
Total Split (%)	42.9%	42.9%	57.1%	57.1%	57.1%	57.1%
Maximum Green (s)	24.0	24.0	34.0	34.0	34.0	34.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	22.4	22.4		34.0	34.0	34.0
Actuated g/C Ratio	0.33	0.33		0.50	0.50	0.50
v/c Ratio	0.89	0.04		0.74	0.85	0.40
Control Delay	42.2	8.4		17.7	27.1	2.6
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	42.2	8.4		17.7	27.1	2.6
LOS	D	A		B	C	A
Approach Delay	41.2			17.7	18.8	
Approach LOS	D			B	B	

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 68.5
Natural Cycle: 70
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 22.5 — Intersection LOS: C
Intersection Capacity Utilization 73.0% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road



Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	517	15	1182	755	388
v/c Ratio	0.89	0.04	0.74	0.85	0.40
Control Delay	42.2	8.4	17.7	27.1	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	42.2	8.4	17.7	27.1	2.6
Queue Length 50th (m)	64.9	0.0	65.7	87.0	0.0
Queue Length 95th (m)	#118.5	3.7	90.5	#157.3	12.8
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	620	435	1596	890	966
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.83	0.03	0.74	0.85	0.40

Intersection Summary

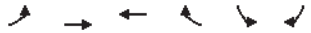
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	476	14	5	1083	695	357
Future Volume (vph)	476	14	5	1083	695	357
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1214		3374	1792	1553
Flt Permitted	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1214		3213	1792	1553
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	517	15	5	1177	755	388
RTOR Reduction (vph)	0	10	0	0	0	195
Lane Group Flow (vph)	517	5	0	1182	755	193
Heavy Vehicles (%)	2%	33%	0%	7%	6%	4%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	22.5	22.5		34.0	34.0	34.0
Effective Green, g (s)	22.5	22.5		34.0	34.0	34.0
Actuated g/C Ratio	0.33	0.33		0.50	0.50	0.50
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	581	398		1594	889	770
v/s Ratio Prot	c0.29				c0.42	
v/s Ratio Perm		0.00		0.37		0.12
v/c Ratio	0.89	0.01		0.74	0.85	0.25
Uniform Delay, d1	21.8	15.5		13.7	15.0	9.9
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	15.4	0.0		3.2	9.9	0.8
Delay (s)	37.2	15.5		16.9	25.0	10.7
Level of Service	D	B		B	C	B
Approach Delay (s)	36.6			16.9	20.1	
Approach LOS	D			B	C	

Intersection Summary

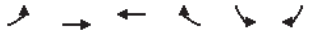
HCM 2000 Control Delay	21.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	68.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	296	1256	1488	14	1	523
Future Volume (vph)	296	1256	1488	14	1	523
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	125.0			60.0	30.0	0.0
Storage Lanes	1			1	1	1
Taper Length (m)	7.5				7.5	
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)	1787	1759	1827	1615	1805	1615
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1787	1759	1827	1615	1805	1615
Link Speed (k/h)		70	70		50	
Link Distance (m)		296.6	1689.7		495.1	
Travel Time (s)		15.3	86.9		35.6	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Heavy Vehicles (%)	1%	8%	4%	0%	0%	0%
Adj. Flow (vph)	308	1308	1550	16	1	545
Shared Lane Traffic (%)						
Lane Group Flow (vph)	308	1308	1550	16	1	545
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	L NA	R NA	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane			Yes			
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 117.4%		ICU Level of Service H	
Analysis Period (min) 15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	296	1256	1488	14	1	523
Future Volume (Veh/h)	296	1256	1488	14	1	523
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.96	0.96	0.96	0.86	0.96	0.96
Hourly flow rate (vph)	308	1308	1550	16	1	545
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1566				3474	1550
vC1, stage 1 conf vol					1550	
vC2, stage 2 conf vol					1924	
vCu, unblocked vol	1566				3474	1550
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	27				97	0
cM capacity (veh/h)	424				33	142

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	308	1308	1550	16	1	545
Volume Left	308	0	0	0	1	0
Volume Right	0	0	0	16	0	545
cSH	424	1700	1700	1700	33	142
Volume to Capacity	0.73	0.77	0.91	0.01	0.03	3.85
Queue Length 95th (m)	45.6	0.0	0.0	0.0	0.7	Err
Control Delay (s)	32.9	0.0	0.0	0.0	116.8	Err
Lane LOS	D				F	F
Approach Delay (s)	6.3		0.0		9980.9	
Approach LOS					F	

Intersection Summary				
Average Delay		1464.5		
Intersection Capacity Utilization		117.4%	ICU Level of Service	H
Analysis Period (min)		15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	1041	236	732	1076	6	431	1	684	24	6	1
Future Volume (vph)	6	1041	236	732	1076	6	431	1	684	24	6	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	180.0		0.0	60.0		0.0	0.0		0.0
Storage Lanes	1		1	1		0	1		1	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850		0.999				0.850		0.996	
Flt Protected	0.950			0.950				0.952			0.963	
Satd. Flow (prot)	1805	1759	1553	1752	1791	0	0	1791	1524	0	1822	0
Flt Permitted	0.139			0.068				0.704			0.325	
Satd. Flow (perm)	264	1759	1553	125	1791	0	0	1324	1524	0	615	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			130						31		1	
Link Speed (k/h)		70			70			60			50	
Link Distance (m)		1689.7			367.4			495.1			61.2	
Travel Time (s)		86.9			18.9			29.7			4.4	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Adj. Flow (vph)	6	1062	241	747	1098	6	440	1	698	24	6	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	6	1062	241	747	1104	0	0	441	698	0	31	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane		Yes			Yes							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2		1	2	1	1	2	
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0		2.0	10.0	2.0	2.0	10.0	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0		0.0	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)	2.0	0.6	2.0	2.0	0.6		2.0	0.6	2.0	2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	6		6	2			4		4	8		
Detector Phase	6	6	6	5	2		4	4	5	8	8	
Switch Phase												
Minimum Initial (s)	35.0	35.0	35.0	8.0	35.0		12.0	12.0	8.0	12.0	12.0	
Minimum Split (s)	42.0	42.0	42.0	12.0	42.0		26.0	26.0	12.0	26.0	26.0	
Total Split (s)	62.0	62.0	62.0	39.0	101.0		39.0	39.0	39.0	39.0	39.0	
Total Split (%)	44.3%	44.3%	44.3%	27.9%	72.1%		27.9%	27.9%	27.9%	27.9%	27.9%	
Maximum Green (s)	55.0	55.0	55.0	35.0	94.0		33.0	33.0	35.0	33.0	33.0	
Yellow Time (s)	5.0	5.0	5.0	3.0	5.0		4.0	4.0	3.0	4.0	4.0	
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0		2.0	2.0	1.0	2.0	2.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Lead/Lag	Lag	Lag	Lag	Lead					Lead			
Lead-Lag Optimize?	Yes	Yes	Yes	Yes					Yes			
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	None	Max		None	None	None	None	None	
Walk Time (s)	23.0	23.0	23.0		23.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	12.0	12.0	12.0		12.0		13.0	13.0		13.0	13.0	
Pedestrian Calls (#/hr)	0	0	0		0		0	0		0	0	
Act Effct Green (s)	55.0	55.0	55.0	97.0	94.0			33.0	74.0		33.0	
Actuated g/C Ratio	0.39	0.39	0.39	0.69	0.67			0.24	0.53		0.24	
v/c Ratio	0.06	1.54	0.35	1.52	0.92			1.41	0.85		0.21	
Control Delay	28.7	280.5	14.7	274.0	33.3			243.2	38.7		46.6	
Queue Delay	0.0	0.0	0.0	0.0	2.4			0.0	0.0		0.0	
Total Delay	28.7	280.5	14.7	274.0	35.7			243.2	38.7		46.6	
LOS	C	F	B	F	D			F	D		D	
Approach Delay		230.4			131.9			117.9			46.6	
Approach LOS		F			F			F			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 140			
Actuated Cycle Length: 140			
Natural Cycle: 150			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 1.54			
Intersection Signal Delay: 157.4		Intersection LOS: F	
Intersection Capacity Utilization 137.9%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 2: Wellington Road 32/Private Access & Wellington Road 124

Lane Group	EBL	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	6	1062	241	747	1104	441	698	31
v/c Ratio	0.06	1.54	0.35	1.52	0.92	1.41	0.85	0.21
Control Delay	28.7	280.5	14.7	274.0	33.3	243.2	38.7	46.6
Queue Delay	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0
Total Delay	28.7	280.5	14.7	274.0	35.7	243.2	38.7	46.6
Queue Length 50th (m)	1.1	~433.2	21.0	~287.5	256.3	~172.3	163.4	7.1
Queue Length 95th (m)	4.4	#517.3	43.2	#367.9	#388.1	#240.6	#234.7	17.2
Internal Link Dist (m)		1665.7			343.4	471.1		37.2
Turn Bay Length (m)	100.0		100.0	180.0				
Base Capacity (vph)	103	691	689	493	1202	312	820	145
Starvation Cap Reductn	0	0	0	0	42	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.06	1.54	0.35	1.52	0.95	1.41	0.85	0.21

Intersection Summary

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

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	1041	236	732	1076	6	431	1	684	24	6	1
Future Volume (vph)	6	1041	236	732	1076	6	431	1	684	24	6	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Frt	1.00	1.00	0.85	1.00	1.00			1.00	0.85		1.00	
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.95	1.00		0.96	
Satd. Flow (prot)	1805	1759	1553	1752	1792			1792	1524		1821	
Flt Permitted	0.14	1.00	1.00	0.07	1.00			0.70	1.00		0.33	
Satd. Flow (perm)	264	1759	1553	125	1792			1324	1524		615	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	6	1062	241	747	1098	6	440	1	698	24	6	1
RTOR Reduction (vph)	0	0	79	0	0	0	0	0	16	0	1	0
Lane Group Flow (vph)	6	1062	162	747	1104	0	0	441	682	0	30	0
Heavy Vehicles (%)	0%	8%	4%	3%	6%	0%	1%	0%	6%	0%	0%	0%
Turn Type	Perm	NA	Perm	pm+pt	NA		Perm	NA	pm+ov	Perm	NA	
Protected Phases		6		5	2			4	5		8	
Permitted Phases	6		6	2			4		4	8		
Actuated Green, G (s)	55.0	55.0	55.0	94.0	94.0			33.0	68.0		33.0	
Effective Green, g (s)	55.0	55.0	55.0	94.0	94.0			33.0	68.0		33.0	
Actuated g/C Ratio	0.39	0.39	0.39	0.67	0.67			0.24	0.49		0.24	
Clearance Time (s)	7.0	7.0	7.0	4.0	7.0			6.0	4.0		6.0	
Vehicle Extension (s)	5.0	5.0	5.0	3.0	5.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	103	691	610	490	1203			312	740		144	
v/s Ratio Prot		0.60		c0.38	0.62				0.23			
v/s Ratio Perm	0.02		0.10	c0.64				c0.33	0.22		0.05	
v/c Ratio	0.06	1.54	0.27	1.52	0.92			1.41	0.92		0.21	
Uniform Delay, d1	26.4	42.5	28.8	45.4	19.7			53.5	33.5		43.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	
Incremental Delay, d2	0.5	248.8	0.5	246.3	12.5			204.0	16.9		0.7	
Delay (s)	26.9	291.3	29.3	291.7	32.2			257.5	50.4		43.7	
Level of Service	C	F	C	F	C			F	D		D	
Approach Delay (s)		241.9			136.9			130.6			43.7	
Approach LOS		F			F			F			D	

Intersection Summary				
HCM 2000 Control Delay	166.3	HCM 2000 Level of Service	F	
HCM 2000 Volume to Capacity ratio	1.53			
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.0	
Intersection Capacity Utilization	137.9%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

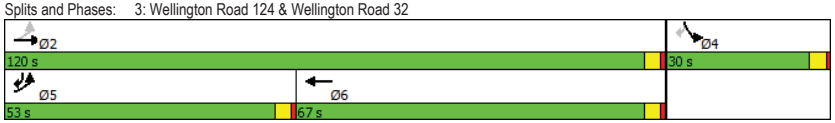
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	548	1215	899	55	48	879
Future Volume (vph)	548	1215	899	55	48	879
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	180.0			0.0	90.0	0.0
Storage Lanes	1			0	1	1
Taper Length (m)	7.5				7.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.992			0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1612	1827	1797	0	1444	1524
Flt Permitted	0.060				0.950	
Satd. Flow (perm)	102	1827	1797	0	1444	1524
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)			3			59
Link Speed (k/h)		70	70		80	
Link Distance (m)		367.4	2054.4		513.0	
Travel Time (s)		18.9	105.7		23.1	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Adj. Flow (vph)	559	1240	917	56	49	897
Shared Lane Traffic (%)						
Lane Group Flow (vph)	559	1240	973	0	49	897
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.6	3.6		3.6	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		4.8	4.8		4.8	
Two way Left Turn Lane		Yes	Yes			
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25			15	25	15
Number of Detectors	1	2	2		1	1
Detector Template	Left	Thru	Thru		Left	Right
Leading Detector (m)	2.0	10.0	10.0		2.0	2.0
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)	2.0	0.6	0.6		2.0	2.0
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)		9.4	9.4			
Detector 2 Size(m)		0.6	0.6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	2					4
Detector Phase	5	2	6		4	5
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0		5.0	5.0
Minimum Split (s)	9.0	30.0	30.0		30.0	9.0
Total Split (s)	53.0	120.0	67.0		30.0	53.0
Total Split (%)	35.3%	80.0%	44.7%		20.0%	35.3%
Maximum Green (s)	49.0	116.0	63.0		26.0	49.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	1.0		1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0		4.0	4.0
Lead/Lag	Lead		Lag			Lead
Lead-Lag Optimize?	Yes		Yes			Yes
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Recall Mode	None	None	Max		None	None
Walk Time (s)		10.0	10.0		10.0	
Flash Dont Walk (s)		16.0	16.0		16.0	
Pedestrian Calls (#/hr)		0	0		0	
Act Effct Green (s)	116.4	117.3	63.2		11.8	62.4
Actuated g/C Ratio	0.87	0.88	0.47		0.09	0.47
v/c Ratio	0.87	0.77	1.14		0.39	1.21
Control Delay	48.9	9.1	111.9		67.2	136.9
Queue Delay	0.0	0.7	0.0		0.0	0.0
Total Delay	48.9	9.8	111.9		67.2	136.9
LOS	D	A	F		E	F
Approach Delay		22.0	111.9		133.2	
Approach LOS		C	F		F	

Intersection Summary

Area Type: Other
Cycle Length: 150
Actuated Cycle Length: 133.6
Natural Cycle: 150
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.21
Intersection Signal Delay: 73.8 — Intersection LOS: E
Intersection Capacity Utilization 111.7% — ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 3: Wellington Road 124 & Wellington Road 32



Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Group Flow (vph)	559	1240	973	49	897
v/c Ratio	0.87	0.77	1.14	0.39	1.21
Control Delay	48.9	9.1	111.9	67.2	136.9
Queue Delay	0.0	0.7	0.0	0.0	0.0
Total Delay	48.9	9.8	111.9	67.2	136.9
Queue Length 50th (m)	130.6	119.5	~326.6	13.3	~295.5
Queue Length 95th (m)	#211.9	229.4	#429.3	27.0	#381.0
Internal Link Dist (m)		343.4	2030.4	489.0	
Turn Bay Length (m)	180.0			90.0	
Base Capacity (vph)	644	1603	851	281	743
Starvation Cap Reductn	0	124	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.87	0.84	1.14	0.17	1.21

Intersection Summary

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

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

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	548	1215	899	55	48	879
Future Volume (vph)	548	1215	899	55	48	879
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1612	1827	1798		1444	1524
Flt Permitted	0.06	1.00	1.00		0.95	1.00
Satd. Flow (perm)	101	1827	1798		1444	1524
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	559	1240	917	56	49	897
RTOR Reduction (vph)	0	0	2	0	0	33
Lane Group Flow (vph)	559	1240	971	0	49	864
Heavy Vehicles (%)	12%	4%	4%	19%	25%	6%
Turn Type	pm+pt	NA	NA		Prot	pm+ov
Protected Phases	5	2	6		4	5
Permitted Phases	2					4
Actuated Green, G (s)	116.3	116.3	63.2		10.1	59.2
Effective Green, g (s)	116.3	116.3	63.2		10.1	59.2
Actuated g/C Ratio	0.87	0.87	0.47		0.08	0.44
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	5.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	639	1580	845		108	716
v/s Ratio Prot	0.32	0.68	c0.54		0.03	c0.44
v/s Ratio Perm	0.44					0.13
v/c Ratio	0.87	0.78	1.15		0.45	1.21
Uniform Delay, d1	35.8	3.8	35.6		59.5	37.6
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	13.7	2.6	80.9		6.2	105.9
Delay (s)	49.5	6.4	116.5		65.7	143.5
Level of Service	D	A	F		E	F
Approach Delay (s)		19.8	116.5		139.5	
Approach LOS		B	F		F	

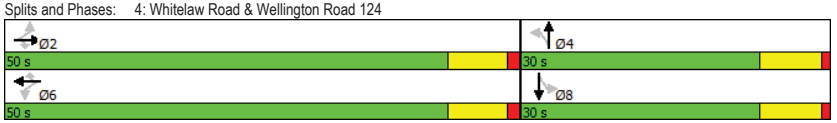
Intersection Summary				
HCM 2000 Control Delay	75.6	HCM 2000 Level of Service	E	
HCM 2000 Volume to Capacity ratio	1.22			
Actuated Cycle Length (s)	134.4	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	111.7%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	921	223	48	709	42	142	200	26	96	245	67
Future Volume (vph)	133	921	223	48	709	42	142	200	26	96	245	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	140.0		130.0	0.0		0.0	0.0		0.0
Storage Lanes	1		1	1		1	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.991			0.978	
Flt Protected	0.950			0.950				0.981			0.988	
Satd. Flow (prot)	1703	1863	1615	1805	1810	1509	0	1847	0	0	1794	0
Flt Permitted	0.211			0.093				0.599			0.778	
Satd. Flow (perm)	378	1863	1615	177	1810	1509	0	1128	0	0	1413	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			235			53		5			13	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Adj. Flow (vph)	140	969	235	51	746	44	149	211	27	101	258	71
Shared Lane Traffic (%)												
Lane Group Flow (vph)	140	969	235	51	746	44	0	387	0	0	430	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)		3.6			3.6			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane		Yes			Yes							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	
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)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	
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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		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			8		
Detector Phase	2	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2	37.2	37.2	37.2	37.2	28.9	28.9		28.9	28.9	
Total Split (s)	50.0	50.0	50.0	50.0	50.0	50.0	30.0	30.0		30.0	30.0	
Total Split (%)	62.5%	62.5%	62.5%	62.5%	62.5%	62.5%	37.5%	37.5%		37.5%	37.5%	
Maximum Green (s)	42.8	42.8	42.8	42.8	42.8	42.8	23.1	23.1		23.1	23.1	
Yellow Time (s)	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3	1.3	1.3	1.3	1.3	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Lost Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0		3.0	3.0	
Recall Mode	Max	Max	Max	Max	Max	Max	None	None		None	None	
Walk Time (s)	15.0	15.0	15.0	15.0	15.0	15.0	11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	42.8	42.8	42.8	42.8	42.8	42.8		23.1			23.1	
Actuated g/C Ratio	0.54	0.54	0.54	0.54	0.54	0.54		0.29			0.29	
v/c Ratio	0.69	0.97	0.24	0.54	0.77	0.05		1.18			1.03	
Control Delay	35.8	42.8	2.1	38.9	21.5	2.5		135.7			82.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0			0.0	
Total Delay	35.8	42.8	2.1	38.9	21.5	2.5		135.7			82.5	
LOS	D	D	A	D	C	A		F			F	
Approach Delay		34.9			21.6			135.7			82.5	
Approach LOS		C			C			F			F	

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Natural Cycle: 100			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 1.18			
Intersection Signal Delay: 51.0		Intersection LOS: D	
Intersection Capacity Utilization 124.4%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	140	969	235	51	746	44	387	430
v/c Ratio	0.69	0.97	0.24	0.54	0.77	0.05	1.18	1.03
Control Delay	35.8	42.8	2.1	38.9	21.5	2.5	135.7	82.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.8	42.8	2.1	38.9	21.5	2.5	135.7	82.5
Queue Length 50th (m)	15.4	140.3	0.0	5.0	88.1	0.0	~75.1	~73.3
Queue Length 95th (m)	#48.3	#231.1	9.7	#23.5	136.4	3.8	#129.5	#129.8
Internal Link Dist (m)		2030.4			1551.0		355.0	437.0
Turn Bay Length (m)	100.0		100.0	140.0		130.0		
Base Capacity (vph)	202	996	973	94	968	831	329	417
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.97	0.24	0.54	0.77	0.05	1.18	1.03

Intersection Summary

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

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	921	223	48	709	42	142	200	26	96	245	67
Future Volume (vph)	133	921	223	48	709	42	142	200	26	96	245	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.99			0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98			0.99	
Satd. Flow (prot)	1703	1863	1615	1805	1810	1509		1847			1794	
Flt Permitted	0.21	1.00	1.00	0.09	1.00	1.00		0.60			0.78	
Satd. Flow (perm)	379	1863	1615	178	1810	1509		1127			1412	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	140	969	235	51	746	44	149	211	27	101	258	71
RTOR Reduction (vph)	0	0	109	0	0	20	0	4	0	0	9	0
Lane Group Flow (vph)	140	969	126	51	746	24	0	383	0	0	421	0
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2		2	6		6	4			8		
Actuated Green, G (s)	42.8	42.8	42.8	42.8	42.8	42.8		23.1			23.1	
Effective Green, g (s)	42.8	42.8	42.8	42.8	42.8	42.8		23.1			23.1	
Actuated g/C Ratio	0.53	0.53	0.53	0.53	0.53	0.53		0.29			0.29	
Clearance Time (s)	7.2	7.2	7.2	7.2	7.2	7.2		6.9			6.9	
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5		3.0			3.0	
Lane Grp Cap (vph)	202	996	864	95	968	807		325			407	
v/s Ratio Prot		c0.52			0.41							
v/s Ratio Perm	0.37		0.08	0.29		0.02		c0.34			0.30	
v/c Ratio	0.69	0.97	0.15	0.54	0.77	0.03		1.18			1.03	
Uniform Delay, d1	13.7	18.0	9.4	12.1	14.7	8.8		28.4			28.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	17.8	22.7	0.4	20.0	5.9	0.1		108.1			53.6	
Delay (s)	31.6	40.7	9.7	32.2	20.6	8.9		136.6			82.0	
Level of Service	C	D	A	C	C	A		F			F	
Approach Delay (s)		34.3			20.7			136.6			82.0	
Approach LOS		C			C			F			F	

Intersection Summary				
HCM 2000 Control Delay	50.5	HCM 2000 Level of Service	D	
HCM 2000 Volume to Capacity ratio	1.04			
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	14.1	
Intersection Capacity Utilization	124.4%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

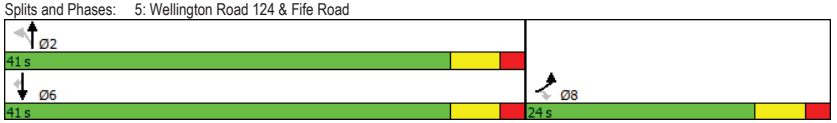
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	397	16	15	983	737	671
Future Volume (vph)	397	16	15	983	737	671
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	95.0	0.0	0.0			0.0
Storage Lanes	1	1	0			1
Taper Length (m)	7.5		7.5			
Lane Util. Factor	1.00	1.00	0.95	0.95	1.00	1.00
Frt		0.850				0.850
Flt Protected	0.950			0.999		
Satd. Flow (prot)	1770	1615	0	3503	1810	1583
Flt Permitted	0.950			0.940		
Satd. Flow (perm)	1770	1615	0	3296	1810	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		17				699
Link Speed (k/h)	50			50	50	
Link Distance (m)	658.0			95.0	404.5	
Travel Time (s)	47.4			6.8	29.1	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Adj. Flow (vph)	414	17	16	1024	768	699
Shared Lane Traffic (%)						
Lane Group Flow (vph)	414	17	0	1040	768	699
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.6			0.0	0.0	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.8			4.8	4.8	
Two way Left Turn Lane	Yes					
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25	15	25			15
Number of Detectors	1	1	1	2	2	1
Detector Template	Left	Right	Left	Thru	Thru	Right
Leading Detector (m)	2.0	2.0	2.0	10.0	10.0	2.0
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	2.0	2.0	2.0	0.6	0.6	2.0
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)				9.4	9.4	
Detector 2 Size(m)				0.6	0.6	
Detector 2 Type				Cl+Ex	Cl+Ex	
Detector 2 Channel						
Detector 2 Extend (s)				0.0	0.0	
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Permitted Phases		8	2			6
Detector Phase	8	8	2	2	6	6
Switch Phase						
Minimum Initial (s)	7.0	7.0	20.0	20.0	20.0	20.0
Minimum Split (s)	24.0	24.0	37.0	37.0	37.0	37.0
Total Split (s)	24.0	24.0	41.0	41.0	41.0	41.0
Total Split (%)	36.9%	36.9%	63.1%	63.1%	63.1%	63.1%
Maximum Green (s)	18.0	18.0	35.0	35.0	35.0	35.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0		6.0	6.0	6.0
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None	Max	Max	Max	Max
Walk Time (s)	7.0	7.0	20.0	20.0	20.0	20.0
Flash Dont Walk (s)	11.0	11.0	10.0	10.0	10.0	10.0
Pedestrian Calls (#/hr)	0	0	0	0	0	0
Act Effct Green (s)	17.2	17.2		35.0	35.0	35.0
Actuated g/C Ratio	0.27	0.27		0.55	0.55	0.55
v/c Ratio	0.87	0.04		0.58	0.78	0.59
Control Delay	44.1	9.1		11.5	19.1	3.1
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	44.1	9.1		11.5	19.1	3.1
LOS	D	A		B	B	A
Approach Delay	42.8			11.5	11.5	
Approach LOS	D			B	B	

Intersection Summary

Area Type: Other
Cycle Length: 65
Actuated Cycle Length: 64.2
Natural Cycle: 65
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 16.1 Intersection LOS: B
Intersection Capacity Utilization 79.2% ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 5: Wellington Road 124 & Fife Road



Lane Group	EBL	EBR	NBT	SBT	SBR
Lane Group Flow (vph)	414	17	1040	768	699
v/c Ratio	0.87	0.04	0.58	0.78	0.59
Control Delay	44.1	9.1	11.5	19.1	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	44.1	9.1	11.5	19.1	3.1
Queue Length 50th (m)	49.3	0.0	42.7	71.3	0.0
Queue Length 95th (m)	#95.5	4.0	59.7	#124.2	13.8
Internal Link Dist (m)	634.0		71.0	380.5	
Turn Bay Length (m)	95.0				
Base Capacity (vph)	496	465	1796	986	1181
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.83	0.04	0.58	0.78	0.59

Intersection Summary

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

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	397	16	15	983	737	671
Future Volume (vph)	397	16	15	983	737	671
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	1.00		0.95	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	0.95	1.00		1.00	1.00	1.00
Satd. Flow (prot)	1770	1615		3504	1810	1583
Flt Permitted	0.95	1.00		0.94	1.00	1.00
Satd. Flow (perm)	1770	1615		3295	1810	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	414	17	16	1024	768	699
RTOR Reduction (vph)	0	12	0	0	0	318
Lane Group Flow (vph)	414	5	0	1040	768	381
Heavy Vehicles (%)	2%	0%	0%	3%	5%	2%
Turn Type	Prot	Perm	Perm	NA	NA	Perm
Protected Phases	8			2	6	
Permitted Phases		8	2			6
Actuated Green, G (s)	17.2	17.2		35.0	35.0	35.0
Effective Green, g (s)	17.2	17.2		35.0	35.0	35.0
Actuated g/C Ratio	0.27	0.27		0.55	0.55	0.55
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	474	432		1796	986	863
v/s Ratio Prot	c0.23				c0.42	
v/s Ratio Perm		0.00		0.32		0.24
v/c Ratio	0.87	0.01		0.58	0.78	0.44
Uniform Delay, d1	22.5	17.3		9.7	11.5	8.7
Progression Factor	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	16.2	0.0		1.4	6.1	1.6
Delay (s)	38.6	17.3		11.1	17.6	10.4
Level of Service	D	B		B	B	B
Approach Delay (s)	37.8			11.1	14.2	
Approach LOS	D			B	B	

Intersection Summary

HCM 2000 Control Delay	16.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	64.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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Filename: A - 124 & 32 W - 2019-04-03.arc8
Path: C:\Users\AdamMorrison\Paradigm\Projects - 180114 Wellington Rd 124\C5 - Analysis and Evaluation\Arcady
Report generation date: 2019-04-10 9:36:03 AM

Summary of intersection performance

	AM							PM						
	Queue (PCE)	95% Queue (PCE)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS	Queue (PCE)	95% Queue (PCE)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	2041													
Leg North	0.00	~1	0.00	0.00	A	7.57	A	0.37	~1	40.62	0.28	E	18.93	C
Leg West	1.59	1.10	4.67	0.59	A			3.27	5.36	8.70	0.76	A		
Leg South	4.10	11.33	11.17	0.80	B			3.46	8.32	10.37	0.77	B		
Leg East	2.90	4.45	6.75	0.73	A			16.12	65.99	30.89	0.95	D		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - 2041, AM " model duration: 8:00 AM - 9:30 AM
"D2 - 2041, PM" model duration: 4:00 PM - 5:30 PM

Run using Junctions 8.0.6.541 at 2019-04-10 9:36:02 AM

File summary

Title	(untitled)
Location	
Site Number	
Date	2019-04-03
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	AdamMorrison
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
7.50	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	PCE	PCE	perHour	s	-Min	perMin

2041, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Geometry	Leg West - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Geometry	Leg South - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Geometry	Leg East - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set(s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2041, AM	2041	AM		ONE HOUR	08:00	09:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,South,East				7.57	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	(untitled)	
West	West	(untitled)	
South	South	(untitled)	
East	East	(untitled)	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
South	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	I' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	5.40	30.00	20.00	50.00	25.00	
West	7.00	8.00	100.00	20.00	50.00	25.00	
South	7.00	8.00	100.00	20.00	50.00	25.00	
East	7.00	8.00	100.00	20.00	50.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
North		(calculated)	(calculated)	0.588	1565.891
West		(calculated)	(calculated)	0.757	2456.498
South		(calculated)	(calculated)	0.757	2456.498
East		(calculated)	(calculated)	0.757	2456.498

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (PCE/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	0.00	100.000
West	ONE HOUR	✓	1120.00	100.000
South	ONE HOUR	✓	1232.00	100.000
East	ONE HOUR	✓	1425.00	100.000

Turning Proportions

Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.000	0.000	0.000	0.000
	West	0.000	0.000	196.000	924.000
	South	0.000	353.000	0.000	879.000
	East	0.000	979.000	446.000	0.000

Turning Proportions (PCE) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.25	0.25	0.25	0.25
	West	0.00	0.00	0.18	0.83
	South	0.00	0.29	0.00	0.71
	East	0.00	0.69	0.31	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		North	West	South	East
	North	1.000	1.000	1.000	1.000
	West	1.000	1.000	1.080	1.110
From	South	1.000	1.030	1.000	1.030
	East	1.000	1.140	1.060	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.0	0.0	0.0	0.0
	West	0.0	0.0	8.0	11.0
	South	0.0	3.0	0.0	3.0
	East	0.0	14.0	6.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (PCE)	Max 95th percentile Queue (PCE)	Max LOS	Average Demand (PCE/hr)	Total Intersection Arrivals (PCE)	Total Queueing Delay (PCE-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (PCE-min/min)	Inclusive Total Queueing Delay (PCE-min)	Inclusive Average Queueing Delay (s)
North	0.00	0.00	0.00	~1	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
West	0.59	4.67	1.59	1.10	A	1027.73	1541.60	96.38	3.75	1.07	96.39	3.75
South	0.80	11.17	4.10	11.33	B	1130.50	1695.76	191.54	6.78	2.13	191.56	6.78
East	0.73	6.75	2.90	4.45	A	1307.60	1961.41	160.14	4.90	1.78	160.15	4.90

Main Results for each time segment

Main results: (08:00-08:15)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	0.00	0.00	0.00	0.00	1333.48	0.00	781.63	79.02	0.000	0.00	0.00	0.000	A
West	843.19	210.80	840.47	998.96	334.52	0.00	2203.37	1897.19	0.383	0.00	0.68	2.911	A
South	927.51	231.88	923.74	481.60	693.39	0.00	1931.80	1242.21	0.480	0.00	0.94	3.665	A
East	1072.81	268.20	1068.80	1352.45	264.68	0.00	2256.22	2172.22	0.475	0.00	1.00	3.365	A

Main results: (08:15-08:30)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	0.00	0.00	0.00	0.00	1595.66	0.00	627.44	79.02	0.000	0.00	0.00	0.000	A
West	1006.86	251.71	1005.73	1195.35	400.31	0.00	2153.58	1897.19	0.468	0.68	0.96	3.461	A
South	1107.54	276.89	1105.08	576.31	829.73	0.00	1828.64	1242.21	0.606	0.94	1.56	5.107	A
East	1281.05	320.26	1279.02	1618.17	316.63	0.00	2216.90	2172.22	0.578	1.00	1.51	4.265	A

Main results: (08:30-08:45)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	0.00	0.00	0.00	0.00	1949.44	0.00	419.37	79.02	0.000	0.00	0.00	0.000	A
West	1233.14	308.29	1230.69	1460.08	489.36	0.00	2086.19	1897.19	0.591	0.96	1.58	4.635	A
South	1356.46	339.11	1346.79	704.73	1015.32	0.00	1688.20	1242.21	0.803	1.56	3.98	10.574	B
East	1568.95	392.24	1563.55	1976.22	385.89	0.00	2164.49	2172.22	0.725	1.51	2.86	6.613	A

Main results: (08:45-09:00)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	0.00	0.00	0.00	0.00	1957.30	0.00	414.75	79.02	0.000	0.00	0.00	0.000	A

West	1233.14	308.29	1233.10	1466.30	491.00	0.00	2084.95	1897.19	0.591	1.58	1.59	4.668	A
South	1356.46	339.11	1355.96	706.79	1017.31	0.00	1686.69	1242.21	0.804	3.98	4.10	11.168	B
East	1568.95	392.24	1568.78	1984.75	388.52	0.00	2162.50	2172.22	0.726	2.86	2.90	6.748	A

Main results: (09:00-09:15)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	0.00	0.00	0.00	0.00	1606.67	0.00	620.96	79.02	0.000	0.00	0.00	0.000	A
West	1006.86	251.71	1009.30	1204.02	402.64	0.00	2151.81	1897.19	0.468	1.59	0.98	3.487	A
South	1107.54	276.89	1117.50	579.27	832.67	0.00	1826.41	1242.21	0.606	4.10	1.61	5.301	A
East	1281.05	320.26	1286.47	1629.98	320.19	0.00	2214.20	2172.22	0.579	2.90	1.55	4.346	A

Main results: (09:15-09:30)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	0.00	0.00	0.00	0.00	1341.43	0.00	776.96	79.02	0.000	0.00	0.00	0.000	A
West	843.19	210.80	844.35	1004.99	336.43	0.00	2201.92	1897.19	0.383	0.98	0.69	2.933	A
South	927.51	231.88	930.11	484.19	696.59	0.00	1929.38	1242.21	0.481	1.61	0.96	3.722	A
East	1072.81	268.20	1074.93	1360.20	266.50	0.00	2254.83	2172.22	0.476	1.55	1.02	3.403	A

Queueing Delay Results for each time segment

Queueing Delay results: (08:00-08:15)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.00	0.00	0.000	A	A
West	10.00	0.67	2.911	A	A
South	13.75	0.92	3.665	A	A
East	14.63	0.98	3.365	A	A

Queueing Delay results: (08:15-08:30)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.00	0.00	0.000	A	A
West	14.16	0.94	3.461	A	A
South	22.59	1.51	5.107	A	A
East	21.99	1.47	4.265	A	A

Queueing Delay results: (08:30-08:45)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.00	0.00	0.000	A	A
West	22.91	1.53	4.635	A	A
South	54.14	3.61	10.574	B	B
East	40.59	2.71	6.613	A	A

Queueing Delay results: (08:45-09:00)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.00	0.00	0.000	A	A
West	23.76	1.58	4.668	A	A
South	60.77	4.05	11.168	B	B
East	43.29	2.89	6.748	A	A

Queueing Delay results: (09:00-09:15)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.00	0.00	0.000	A	A
West	15.04	1.00	3.487	A	A
South	25.49	1.70	5.301	A	A
East	24.01	1.60	4.346	A	A

Queueing Delay results: (09:15-09:30)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.00	0.00	0.000	A	A
West	10.52	0.70	2.933	A	A
South	14.80	0.99	3.722	A	A
East	15.63	1.04	3.403	A	A

Queue Variation Results for each time segment

Queue Variation results: (08:00-08:15)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.00	~1	~1	~1	~1			N/A	N/A
West	0.68	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.94	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	1.00	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:15-08:30)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.00	~1	~1	~1	~1			N/A	N/A
West	0.96	0.00	0.00	1.10	1.10			N/A	N/A
South	1.56	0.00	0.00	3.09	5.15			N/A	N/A
East	1.51	0.00	0.00	2.23	4.45			N/A	N/A

Queue Variation results: (08:30-08:45)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.00	~1	~1	~1	~1			N/A	N/A
West	1.58	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	3.98	0.00	0.00	2.06	11.33			N/A	N/A
East	2.86	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:45-09:00)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.00	~1	~1	~1	~1			N/A	N/A
West	1.59	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	4.10	0.00	0.00	0.00	5.15			N/A	N/A
East	2.90	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (09:00-09:15)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.00	~1	~1	~1	~1			N/A	N/A
West	0.98	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	1.61	0.00	0.00	3.09	4.12			N/A	N/A
East	1.55	0.00	0.00	2.23	3.34			N/A	N/A

Queue Variation results: (09:15-09:30)

Leg	Mean	Q05	Q50	Q90	Q95	Percentile Message	Marker	Probability Of Reaching	Probability Of Exactly

	(PCE)	(PCE)	(PCE)	(PCE)	(PCE)		Message	Or Exceeding Marker	Reaching Marker
North	0.00	~1	~1	~1	~1			N/A	N/A
West	0.69	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.96	0.00	0.00	1.03	2.06			N/A	N/A
East	1.02	0.00	0.00	1.11	2.23			N/A	N/A

2041, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Geometry	Leg West - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Geometry	Leg South - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Geometry	Leg East - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set(s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2041, PM	2041	PM		ONE HOUR	16:00	17:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,South,East				18.93	C

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	(untitled)	
West	West	(untitled)	
South	South	(untitled)	
East	East	(untitled)	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
South	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	5.40	30.00	20.00	50.00	25.00	
West	7.00	8.00	100.00	20.00	50.00	25.00	
South	7.00	8.00	100.00	20.00	50.00	25.00	
East	7.00	8.00	100.00	20.00	50.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
North		(calculated)	(calculated)	0.588	1565.891
West		(calculated)	(calculated)	0.757	2456.498
South		(calculated)	(calculated)	0.757	2456.498
East		(calculated)	(calculated)	0.757	2456.498

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (PCE/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	31.00	100.000
West	ONE HOUR	✓	1256.00	100.000
South	ONE HOUR	✓	1115.00	100.000
East	ONE HOUR	✓	1814.00	100.000

Turning Proportions

Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

		To			
		North	**West**	**South**	**East**
From	**North**	0.000	1.000	6.000	24.000
	West	6.000	0.000	236.000	1014.000
	South	0.000	431.000	0.000	684.000
	East	6.000	1076.000	732.000	0.000

Turning Proportions (PCE) - Intersection 1 (for whole period)

		To			
		North	**West**	**South**	**East**
From	**North**	0.00	0.03	0.19	0.77
	West	0.00	0.00	0.19	0.81

	South	0.00	0.39	0.00	0.61
	East	0.00	0.59	0.40	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	1.000	1.000	1.000	1.000
	West	1.000	1.000	1.040	1.080
	South	1.000	1.010	1.000	1.060
	East	1.000	1.060	1.030	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.0	0.0	0.0	0.0
	West	0.0	0.0	4.0	8.0
	South	0.0	1.0	0.0	6.0
	East	0.0	6.0	3.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (PCE)	Max 95th percentile Queue (PCE)	Max LOS	Average Demand (PCE/hr)	Total Intersection Arrivals (PCE)	Total Queueing Delay (PCE-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (PCE-min/min)	Inclusive Total Queueing Delay (PCE-min)	Inclusive Average Queueing Delay (s)
North	0.28	40.62	0.37	~1	E	28.45	42.67	13.16	18.50	0.15	13.16	18.50
West	0.76	8.70	3.27	5.36	A	1152.53	1728.79	166.54	5.78	1.85	166.55	5.78
South	0.77	10.37	3.46	8.32	B	1023.14	1534.72	165.58	6.47	1.84	165.59	6.47
East	0.95	30.89	16.12	65.99	D	1664.56	2496.84	541.47	13.01	6.02	541.51	13.01

Main Results for each time segment

Main results: (16:00-16:15)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	23.34	5.83	23.17	8.99	1677.65	0.00	579.22	55.60	0.040	0.00	0.04	6.472	A
West	945.58	236.40	941.85	1130.01	570.81	0.00	2024.56	1786.11	0.467	0.00	0.93	3.552	A
South	839.43	209.86	836.05	729.84	782.82	0.00	1864.13	1326.31	0.450	0.00	0.85	3.630	A
East	1365.67	341.42	1358.97	1291.20	327.67	0.00	2208.55	2062.09	0.618	0.00	1.68	4.405	A

Main results: (16:15-16:30)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	27.87	6.97	27.73	10.76	2006.18	0.00	386.00	55.60	0.072	0.04	0.08	10.041	B
West	1129.12	282.28	1126.95	1351.37	682.54	0.00	1940.02	1786.11	0.582	0.93	1.47	4.733	A
South	1002.36	250.59	1000.22	872.82	936.67	0.00	1747.71	1326.31	0.574	0.85	1.38	4.995	A
East	1630.75	407.69	1624.92	1544.87	392.02	0.00	2159.86	2062.09	0.755	1.68	3.13	6.972	A

Main results: (16:30-16:45)

Leg	Total		Entry			Pedestrian		Saturation		Start	End		

Leg	Demand (PCE/hr)	Intersection Arrivals (PCE)	Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Demand (Ped/hr)	Capacity (PCE/hr)	Capacity (PCE/hr)	V/C Ratio	Queue (PCE)	Queue (PCE)	Delay (s)	LOS
North	34.13	8.53	33.23	13.04	2420.56	0.00	142.29	55.60	0.240	0.08	0.30	32.757	D
West	1382.88	345.72	1376.13	1632.52	821.27	0.00	1835.03	1786.11	0.754	1.47	3.16	8.288	A
South	1227.64	306.91	1219.76	1054.12	1143.29	0.00	1591.36	1326.31	0.771	1.38	3.35	9.873	A
East	1997.25	499.31	1955.53	1884.98	478.07	0.00	2094.74	2062.09	0.953	3.13	13.56	22.401	C

Main results: (16:45-17:00)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	34.13	8.53	33.86	13.18	2454.82	0.00	122.14	55.60	0.279	0.30	0.37	40.621	E
West	1382.88	345.72	1382.43	1654.10	834.59	0.00	1824.96	1786.11	0.758	3.16	3.27	8.700	A
South	1227.64	306.91	1227.22	1068.13	1148.89	0.00	1587.12	1326.31	0.774	3.35	3.46	10.374	B
East	1997.25	499.31	1987.02	1895.13	480.98	0.00	2092.53	2062.09	0.954	13.56	16.12	30.893	D

Main results: (17:00-17:15)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	27.87	6.97	28.99	10.99	2066.83	0.00	350.32	55.60	0.080	0.37	0.09	11.240	B
West	1129.12	282.28	1136.03	1389.11	706.71	0.00	1921.72	1786.11	0.588	3.27	1.55	4.954	A
South	1002.36	250.59	1010.47	897.72	945.02	0.00	1741.39	1326.31	0.576	3.46	1.43	5.177	A
East	1630.75	407.69	1681.80	1559.47	396.02	0.00	2156.82	2062.09	0.756	16.12	3.36	8.756	A

Main results: (17:15-17:30)

Leg	Total Demand (PCE/hr)	Intersection Arrivals (PCE)	Entry Flow (PCE/hr)	Exit Flow (PCE/hr)	Circulating Flow (PCE/hr)	Pedestrian Demand (Ped/hr)	Capacity (PCE/hr)	Saturation Capacity (PCE/hr)	V/C Ratio	Start Queue (PCE)	End Queue (PCE)	Delay (s)	LOS
North	23.34	5.83	23.52	9.07	1693.03	0.00	570.17	55.60	0.041	0.09	0.04	6.589	A
West	945.58	236.40	947.97	1140.06	576.49	0.00	2020.27	1786.11	0.468	1.55	0.95	3.605	A
South	839.43	209.86	841.70	736.40	788.05	0.00	1860.17	1326.31	0.451	1.43	0.86	3.686	A
East	1365.67	341.42	1372.22	1299.87	329.89	0.00	2206.87	2062.09	0.619	3.36	1.72	4.552	A

Queueing Delay Results for each time segment

Queueing Delay results: (16:00-16:15)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.61	0.04	6.472	A	A
West	13.60	0.91	3.552	A	A
South	12.34	0.82	3.630	A	A
East	24.11	1.61	4.405	A	A

Queueing Delay results: (16:15-16:30)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	1.12	0.07	10.041	B	B
West	21.43	1.43	4.733	A	A
South	20.05	1.34	4.995	A	A
East	44.22	2.95	6.972	A	A

Queueing Delay results: (16:30-16:45)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	4.10	0.27	32.757	D	C
West	44.20	2.95	8.288	A	A
South	46.19	3.08	9.873	A	A
East	155.82	10.39	22.401	C	C

Queueing Delay results: (16:45-17:00)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	5.26	0.35	40.621	E	D

West	48.51	3.23	8.700	A	A
South	51.25	3.42	10.374	B	B
East	225.18	15.01	30.893	D	C

Queueing Delay results: (17:00-17:15)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	1.40	0.09	11.240	B	B
West	24.19	1.61	4.954	A	A
South	22.49	1.50	5.177	A	A
East	65.28	4.35	8.756	A	A

Queueing Delay results: (17:15-17:30)

Leg	Queueing Total Delay (PCE-min)	Queueing Rate Of Delay (PCE-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	0.66	0.04	6.589	A	A
West	14.61	0.97	3.605	A	A
South	13.25	0.88	3.686	A	A
East	26.85	1.79	4.552	A	A

Queue Variation Results for each time segment

Queue Variation results: (16:00-16:15)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.04	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.93	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.85	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	1.68	0.00	0.00	2.09	2.09			N/A	N/A

Queue Variation results: (16:15-16:30)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.08	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	1.47	0.00	0.00	2.14	4.29			N/A	N/A
South	1.38	0.00	0.00	2.08	4.16			N/A	N/A
East	3.13	0.00	0.00	6.28	11.52			N/A	N/A

Queue Variation results: (16:30-16:45)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.30	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	3.16	0.00	0.00	0.00	5.36			N/A	N/A
South	3.35	0.00	0.00	1.04	8.32			N/A	N/A
East	13.56	0.00	1.05	35.61	54.47			N/A	N/A

Queue Variation results: (16:45-17:00)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.37	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	3.27	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	3.46	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

East	16.12	0.00	0.00	37.71	65.99			N/A	N/A

Queue Variation results: (17:00-17:15)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.09	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	1.55	0.00	0.00	2.14	4.29			N/A	N/A
South	1.43	0.00	0.00	2.08	4.16			N/A	N/A
East	3.36	0.00	0.00	6.28	12.57			N/A	N/A

Queue Variation results: (17:15-17:30)

Leg	Mean (PCE)	Q05 (PCE)	Q50 (PCE)	Q90 (PCE)	Q95 (PCE)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.04	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.95	0.00	0.00	1.07	2.14			N/A	N/A
South	0.86	0.00	0.00	1.04	2.08			N/A	N/A
East	1.72	0.00	0.00	1.05	5.24			N/A	N/A

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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Filename: A - 124 & 32 E.arc8
Path: C:\Users\AdamMorrison\Paradigm\Projects - 180114 Wellington Rd 124\C5 - Analysis and Evaluation\Arcady
Report generation date: 2019-04-10 9:39:41 AM

Summary of intersection performance

	AM						PM					
	Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS	Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	A1 - 2041											
Leg North	1.01	5.37	0.50	A	9.47	A	2.49	8.94	0.72	A	9.42	A
Leg West	6.65	12.67	0.88	B			6.17	11.85	0.87	B		
Leg East	1.70	6.19	0.63	A			1.54	5.33	0.61	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - 2041, AM " model duration: 8:00 AM - 9:30 AM
"D2 - 2041, PM" model duration: 4:00 PM - 5:30 PM

Run using Junctions 8.0.6.541 at 2019-04-10 9:39:40 AM

File summary

Title	Wellington Road 124 & 32 (East)
Location	
Site Number	
Date	2018-10-30
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	MattBrouwer
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

(Default Analysis Set) - 2041, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Geometry	Leg North - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Geometry	Leg East - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set (s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2041, AM	2041	AM		ONE HOUR	08:00	09:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,East				9.47	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Wellington Road 32 SB	
West	West	Wellington Road 124	
East	East	Wellington Road 132 WB	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	I' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	8.00	84.00	20.00	50.00	25.00	
West	7.00	8.00	30.00	20.00	50.00	25.00	
East	3.50	8.00	107.00	20.00	50.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)

North		(calculated)	(calculated)	0.720	2263.058
West		(calculated)	(calculated)	0.753	2436.345
East		(calculated)	(calculated)	0.727	2301.517

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	616.00	100.000
West	ONE HOUR	✓	1780.00	100.000
East	ONE HOUR	✓	908.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	0.000	584.000	32.000
	West	617.000	0.000	1163.000
	East	35.000	873.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	0.00	0.95	0.05
	West	0.35	0.00	0.65
	East	0.04	0.96	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	1.000	1.110	1.180
	West	1.100	1.000	1.060
	East	1.410	1.100	1.000

Truck Percentages - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	0.0	11.0	18.0
	West	10.0	0.0	6.0
	East	41.0	10.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Intersection Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)	Inclusive Total Queueing Delay (Veh-min)	Inclusive Average Queueing Delay (s)
North	0.50	5.37	1.01	?	A	565.25	847.88	60.25	4.26	0.67	60.26	4.26
West	0.88	12.67	6.65	23.00	B	1633.35	2450.03	301.77	7.39	3.35	301.80	7.39
East	0.63	6.19	1.70	2.00	A	833.20	1249.79	97.79	4.69	1.09	97.80	4.70

Main Results for each time segment

Main results: (08:00-08:15)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	463.76	115.94	462.08	488.74	654.76	0.00	1566.42	996.35	0.296	0.00	0.42	3.256	A
West	1340.07	335.02	1334.24	1092.84	24.00	0.00	2248.89	2225.93	0.596	0.00	1.46	3.911	A
East	683.59	170.90	681.01	895.76	462.49	0.00	1737.02	1514.61	0.394	0.00	0.64	3.400	A

Main results: (08:15-08:30)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	553.77	138.44	553.05	584.74	783.65	0.00	1474.74	996.35	0.376	0.42	0.60	3.900	A
West	1600.18	400.04	1596.29	1307.98	28.73	0.00	2244.98	2225.93	0.713	1.46	2.43	5.517	A
East	816.27	204.07	815.07	1071.70	553.32	0.00	1671.66	1514.61	0.488	0.64	0.95	4.196	A

Main results: (08:30-08:45)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	678.23	169.56	676.63	712.32	958.37	0.00	1350.46	996.35	0.502	0.60	1.00	5.329	A
West	1959.81	489.95	1944.12	1599.85	35.15	0.00	2239.67	2225.93	0.875	2.43	6.35	11.606	B
East	999.73	249.93	996.80	1305.39	673.89	0.00	1584.90	1514.61	0.631	0.95	1.68	6.091	A

Main results: (08:45-09:00)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	678.23	169.56	678.19	717.45	961.10	0.00	1348.52	996.35	0.503	1.00	1.01	5.370	A
West	1959.81	489.95	1958.63	1604.07	35.23	0.00	2239.61	2225.93	0.875	6.35	6.65	12.674	B
East	999.73	249.93	999.63	1314.95	678.92	0.00	1581.28	1514.61	0.632	1.68	1.70	6.187	A

Main results: (09:00-09:15)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	553.77	138.44	555.36	591.95	787.63	0.00	1471.91	996.35	0.376	1.01	0.61	3.934	A
West	1600.18	400.04	1616.62	1314.13	28.85	0.00	2244.88	2225.93	0.713	6.65	2.53	5.875	A
East	816.27	204.07	819.20	1085.11	560.37	0.00	1666.59	1514.61	0.490	1.70	0.97	4.262	A

Main results: (09:15-09:30)

	Total		Entry			Pedestrian		Saturation		Start	End		

Leg	Demand (Veh/hr)	Intersection Arrivals (Veh)	Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Demand (Ped/hr)	Capacity (Veh/hr)	Capacity (Veh/hr)	V/C Ratio	Queue (Veh)	Queue (Veh)	Delay (s)	LOS
North	463.76	115.94	464.49	492.36	658.45	0.00	1563.79	996.35	0.297	0.61	0.42	3.276	A
West	1340.07	335.02	1344.25	1098.81	24.13	0.00	2248.79	2225.93	0.596	2.53	1.49	3.997	A
East	683.59	170.90	684.85	902.42	465.96	0.00	1734.52	1514.61	0.394	0.97	0.65	3.435	A

Queueing Delay Results for each time segment

Queueing Delay results: (08:00-08:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	6.14	0.41	3.256	A	A
West	21.10	1.41	3.911	A	A
East	9.44	0.63	3.400	A	A

Queueing Delay results: (08:15-08:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	8.78	0.59	3.900	A	A
West	34.86	2.32	5.517	A	A
East	13.85	0.92	4.196	A	A

Queueing Delay results: (08:30-08:45)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	14.50	0.97	5.329	A	A
West	83.81	5.59	11.606	B	B
East	24.12	1.61	6.091	A	A

Queueing Delay results: (08:45-09:00)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	15.03	1.00	5.370	A	A
West	97.92	6.53	12.674	B	B
East	25.39	1.69	6.187	A	A

Queueing Delay results: (09:00-09:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	9.33	0.62	3.934	A	A
West	41.00	2.73	5.875	A	A
East	14.97	1.00	4.262	A	A

Queueing Delay results: (09:15-09:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	6.47	0.43	3.276	A	A
West	23.10	1.54	3.997	A	A
East	10.02	0.67	3.435	A	A

Queue Variation Results for each time segment

Queue Variation results: (08:00-08:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.42	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	1.46	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.64	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:15-08:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.60	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	2.43	0.00	0.00	5.00	8.00			N/A	N/A
East	0.95	0.00	0.00	1.00	2.00			N/A	N/A

Queue Variation results: (08:30-08:45)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	1.00	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	6.35	0.00	0.00	8.00	23.00			N/A	N/A
East	1.68	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:45-09:00)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	1.01	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	6.65	0.00	0.00	1.00	15.00			N/A	N/A
East	1.70	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (09:00-09:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.61	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	2.53	0.00	0.00	5.00	9.00			N/A	N/A
East	0.97	0.00	0.00	1.00	1.00			N/A	N/A

Queue Variation results: (09:15-09:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.42	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	1.49	0.00	0.00	2.00	5.00			N/A	N/A
East	0.65	0.00	0.00	0.00	1.00			N/A	N/A

(Default Analysis Set) - 2041, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Geometry	Leg North - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.
Warning	Geometry	Leg East - Roundabout Geometry	Effective flare length is over 30m, which is outside the normal range. Treat capacities with increasing caution.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set (s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2041, PM	2041	PM		ONE HOUR	16:00	17:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Do Geometric Delay	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,East				9.42	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Wellington Road 32 SB	
West	West	Wellington Road 124	
East	East	Wellington Road 132 WB	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)	Assume Flat Start Profile	Initial Queue (PCE)
North	0.00	99999.00		0.00
West	0.00	99999.00		0.00
East	0.00	99999.00		0.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	8.00	84.00	20.00	50.00	25.00	
West	7.00	8.00	30.00	20.00	50.00	25.00	
East	3.50	8.00	107.00	20.00	50.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
North		(calculated)	(calculated)	0.720	2263.058
West		(calculated)	(calculated)	0.753	2436.345
East		(calculated)	(calculated)	0.727	2301.517

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default	Vehicle	Vehicle	Vehicle Mix	Vehicle Mix	PCE Factor for	Default	Estimate from	Turning	Turning	Turning

Vehicle Mix	Mix Varies Over Time	Mix Varies Over Turn	Varies Over Entry	Source	a Truck (PCE)	Turning Proportions	entry/exit counts	Proportions Vary Over Time	Proportions Vary Over Turn	Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	927.00	100.000
West	ONE HOUR	✓	1763.00	100.000
East	ONE HOUR	✓	954.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	0.000	879.000	48.000
	West	548.000	0.000	1215.000
	East	55.000	899.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	0.00	0.95	0.05
	West	0.31	0.00	0.69
	East	0.06	0.94	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	1.000	1.060	1.250
	West	1.120	1.000	1.040
	East	1.190	1.040	1.000

Truck Percentages - Intersection 1 (for whole period)

		To		
		North	West	East
From	North	0.0	6.0	25.0
	West	12.0	0.0	4.0
	East	19.0	4.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Intersection Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)	Inclusive Total Queueing Delay (Veh-min)	Inclusive Average Queueing Delay (s)
North	0.72	8.94	2.49	3.00	A	850.63	1275.94	128.77	6.06	1.43	128.78	6.06

West	0.87	11.85	6.17	20.00	B	1617.75	2426.63	285.56	7.06	3.17	285.59	7.06
East	0.61	5.33	1.54	1.00	A	875.41	1313.11	90.75	4.15	1.01	90.75	4.15

Main Results for each time segment

Main results: (16:00-16:15)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	697.89	174.47	694.96	452.07	674.49	0.00	1643.18	1024.54	0.425	0.00	0.73	3.786	A
West	1327.27	331.82	1321.62	1333.47	35.99	0.00	2256.12	2241.04	0.588	0.00	1.41	3.830	A
East	718.22	179.55	715.75	946.80	410.80	0.00	1875.61	1653.59	0.383	0.00	0.62	3.097	A

Main results: (16:15-16:30)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	833.35	208.34	831.69	540.87	807.15	0.00	1550.31	1024.54	0.538	0.73	1.15	4.999	A
West	1584.90	396.22	1581.20	1595.78	43.06	0.00	2249.87	2241.04	0.704	1.41	2.34	5.353	A
East	857.62	214.41	856.53	1132.78	491.49	0.00	1812.92	1653.59	0.473	0.62	0.89	3.761	A

Main results: (16:30-16:45)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	1020.64	255.16	1015.45	659.31	987.43	0.00	1424.12	1024.54	0.717	1.15	2.45	8.700	A
West	1941.09	485.27	1926.73	1950.31	52.58	0.00	2241.46	2241.04	0.866	2.34	5.93	10.966	B
East	1050.37	262.59	1047.84	1380.42	598.89	0.00	1729.49	1653.59	0.607	0.89	1.52	5.261	A

Main results: (16:45-17:00)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	1020.64	255.16	1020.46	663.60	989.75	0.00	1422.49	1024.54	0.718	2.45	2.49	8.944	A
West	1941.09	485.27	1940.11	1957.37	52.84	0.00	2241.23	2241.04	0.866	5.93	6.17	11.853	B
East	1050.37	262.59	1050.30	1389.91	603.05	0.00	1726.25	1653.59	0.608	1.52	1.54	5.325	A

Main results: (17:00-17:15)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	833.35	208.34	838.61	546.88	810.56	0.00	1547.92	1024.54	0.538	2.49	1.18	5.111	A
West	1584.90	396.22	1599.87	1605.76	43.42	0.00	2249.55	2241.04	0.705	6.17	2.43	5.665	A
East	857.62	214.41	860.15	1146.00	497.29	0.00	1808.42	1653.59	0.474	1.54	0.91	3.808	A

Main results: (17:15-17:30)

Leg	Total Demand (Veh/hr)	Intersection Arrivals (Veh)	Entry Flow (Veh/hr)	Exit Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	Saturation Capacity (Veh/hr)	V/C Ratio	Start Queue (Veh)	End Queue (Veh)	Delay (s)	LOS
North	697.89	174.47	699.63	455.26	677.88	0.00	1640.80	1024.54	0.425	1.18	0.75	3.834	A
West	1327.27	331.82	1331.23	1341.29	36.23	0.00	2255.91	2241.04	0.588	2.43	1.44	3.909	A
East	718.22	179.55	719.36	953.66	413.79	0.00	1873.28	1653.59	0.383	0.91	0.63	3.122	A

Queueing Delay Results for each time segment

Queueing Delay results: (16:00-16:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	10.69	0.71	3.786	A	A
West	20.47	1.36	3.830	A	A

East	9.05	0.60	3.097	A	A

Queueing Delay results: (16:15-16:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	16.72	1.11	4.999	A	A
West	33.57	2.24	5.353	A	A
East	13.07	0.87	3.761	A	A

Queueing Delay results: (16:30-16:45)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	34.34	2.29	8.700	A	A
West	78.91	5.26	10.966	B	B
East	22.04	1.47	5.261	A	A

Queueing Delay results: (16:45-17:00)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	37.15	2.48	8.944	A	A
West	91.15	6.08	11.853	B	B
East	23.02	1.53	5.325	A	A

Queueing Delay results: (17:00-17:15)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	18.42	1.23	5.111	A	A
West	39.10	2.61	5.665	A	A
East	14.00	0.93	3.808	A	A

Queueing Delay results: (17:15-17:30)

Leg	Queueing Total Delay (Veh-min)	Queueing Rate Of Delay (Veh-min/min)	Average Delay Per Arriving Vehicle (s)	Unsignalised Level Of Service	Signalised Level Of Service
North	11.46	0.76	3.834	A	A
West	22.35	1.49	3.909	A	A
East	9.56	0.64	3.122	A	A

Queue Variation Results for each time segment

Queue Variation results: (16:00-16:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.73	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	1.41	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.62	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:15-16:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	1.15	0.00	0.00	2.00	3.00			N/A	N/A
West	2.34	0.00	0.00	5.00	8.00			N/A	N/A
East	0.89	0.00	0.00	1.00	1.00			N/A	N/A

Queue Variation results: (16:30-16:45)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	2.45	0.00	0.00	0.00	3.00			N/A	N/A

West	5.93	0.00	0.00	7.00	20.00			N/A	N/A
East	1.52	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:45-17:00)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	2.49	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	6.17	0.00	0.00	0.00	12.00			N/A	N/A
East	1.54	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (17:00-17:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	1.18	0.00	0.00	2.00	2.00			N/A	N/A
West	2.43	0.00	0.00	5.00	8.00			N/A	N/A
East	0.91	0.00	0.00	0.00	1.00			N/A	N/A

Queue Variation results: (17:15-17:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.75	0.00	0.00	1.00	1.00			N/A	N/A
West	1.44	0.00	0.00	2.00	4.00			N/A	N/A
East	0.63	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Appendix L

Traffic Operations Reports – Whitelaw Road Improvements

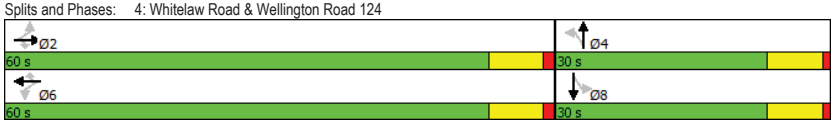
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	993	66	20	638	91	233	246	44	37	89	41
Future Volume (vph)	78	993	66	20	638	91	233	246	44	37	89	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	140.0		130.0	75.0		0.0	37.5		0.0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.977			0.952	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1736	1776	1615	1444	1792	1509	1805	1622	0	1367	1671	0
Flt Permitted	0.279			0.076			0.665			0.357		
Satd. Flow (perm)	510	1776	1615	116	1792	1509	1264	1622	0	514	1671	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			73			101		10			25	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
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 (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Adj. Flow (vph)	87	1103	73	22	709	101	259	273	49	41	99	46
Shared Lane Traffic (%)												
Lane Group Flow (vph)	87	1103	73	22	709	101	259	322	0	41	145	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)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane		Yes										
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	
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)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	
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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		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			8		
Detector Phase	2	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2	37.2	37.2	37.2	37.2	28.9	28.9		28.9	28.9	
Total Split (s)	60.0	60.0	60.0	60.0	60.0	60.0	30.0	30.0		30.0	30.0	
Total Split (%)	66.7%	66.7%	66.7%	66.7%	66.7%	66.7%	33.3%	33.3%		33.3%	33.3%	
Maximum Green (s)	52.8	52.8	52.8	52.8	52.8	52.8	23.1	23.1		23.1	23.1	
Yellow Time (s)	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3	1.3	1.3	1.3	1.3	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	7.2	7.2	7.2	7.2	7.2	7.2	6.9	6.9		6.9	6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0		3.0	3.0	
Recall Mode	Max	Max	Max	Max	Max	Max	None	None		None	None	
Walk Time (s)	15.0	15.0	15.0	15.0	15.0	15.0	11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	52.9	52.9	52.9	52.9	52.9	52.9	20.9	20.9		20.9	20.9	
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.60	0.60	0.24	0.24		0.24	0.24	
v/c Ratio	0.28	1.03	0.07	0.31	0.66	0.11	0.86	0.82		0.34	0.35	
Control Delay	12.3	56.6	2.3	24.6	15.8	2.1	60.0	48.8		36.1	25.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	12.3	56.6	2.3	24.6	15.8	2.1	60.0	48.8		36.1	25.2	
LOS	B	E	A	C	B	A	E	D		D	C	
Approach Delay		50.4			14.3			53.8			27.6	
Approach LOS		D			B			D			C	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 87.9
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.03
Intersection Signal Delay: 39.1 — Intersection LOS: D
Intersection Capacity Utilization 110.4% — ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 4: Whitelaw Road & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	87	1103	73	22	709	101	259	322	41	145
v/c Ratio	0.28	1.03	0.07	0.31	0.66	0.11	0.86	0.82	0.34	0.35
Control Delay	12.3	56.6	2.3	24.6	15.8	2.1	60.0	48.8	36.1	25.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.3	56.6	2.3	24.6	15.8	2.1	60.0	48.8	36.1	25.2
Queue Length 50th (m)	7.3	~222.6	0.0	1.9	81.4	0.0	44.1	52.5	6.0	17.5
Queue Length 95th (m)	17.1	#299.5	5.3	9.9	121.9	6.2	#84.4	#93.0	16.2	34.2
Internal Link Dist (m)		2030.4			1551.0			355.0		437.0
Turn Bay Length (m)	100.0		100.0	140.0		130.0	75.0		37.5	
Base Capacity (vph)	307	1068	1000	70	1078	948	332	434	134	458
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.28	1.03	0.07	0.31	0.66	0.11	0.78	0.74	0.31	0.32

Intersection Summary

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

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	78	993	66	20	638	91	233	246	44	37	89	41
Future Volume (vph)	78	993	66	20	638	91	233	246	44	37	89	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2	7.2	7.2	7.2	7.2	6.9	6.9		6.9	6.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	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	0.98		1.00	0.95	
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)	1736	1776	1615	1444	1792	1509	1805	1623		1367	1672	
Flt Permitted	0.28	1.00	1.00	0.08	1.00	1.00	0.66	1.00		0.36	1.00	
Satd. Flow (perm)	510	1776	1615	115	1792	1509	1263	1623		514	1672	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	87	1103	73	22	709	101	259	273	49	41	99	46
RTOR Reduction (vph)	0	0	29	0	0	40	0	8	0	0	19	0
Lane Group Flow (vph)	87	1103	44	22	709	61	259	314	0	41	126	0
Heavy Vehicles (%)	4%	7%	0%	25%	6%	7%	0%	17%	0%	32%	0%	26%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2		2	6		6	4			8		
Actuated Green, G (s)	52.9	52.9	52.9	52.9	52.9	52.9	20.9	20.9		20.9	20.9	
Effective Green, g (s)	52.9	52.9	52.9	52.9	52.9	52.9	20.9	20.9		20.9	20.9	
Actuated g/C Ratio	0.60	0.60	0.60	0.60	0.60	0.60	0.24	0.24		0.24	0.24	
Clearance Time (s)	7.2	7.2	7.2	7.2	7.2	7.2	6.9	6.9		6.9	6.9	
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	306	1068	971	69	1078	908	300	385		122	397	
v/s Ratio Prot		c0.62			0.40			0.19			0.08	
v/s Ratio Perm	0.17		0.03	0.19		0.04	c0.21			0.08		
v/c Ratio	0.28	1.03	0.05	0.32	0.66	0.07	0.86	0.82		0.34	0.32	
Uniform Delay, d1	8.4	17.5	7.2	8.6	11.5	7.3	32.1	31.7		27.8	27.6	
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	2.3	36.3	0.1	11.8	3.1	0.1	21.7	12.6		1.6	0.5	
Delay (s)	10.7	53.8	7.3	20.4	14.7	7.4	53.9	44.3		29.4	28.1	
Level of Service	B	D	A	C	B	A	D	D		C	C	
Approach Delay (s)		48.2			13.9			48.5			28.4	
Approach LOS		D			B			D			C	

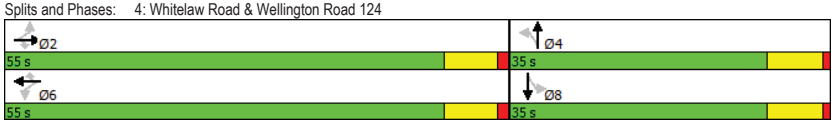
Intersection Summary				
HCM 2000 Control Delay	37.0	HCM 2000 Level of Service	D	
HCM 2000 Volume to Capacity ratio	0.98			
Actuated Cycle Length (s)	87.9	Sum of lost time (s)	14.1	
Intersection Capacity Utilization	110.4%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	921	223	48	709	42	142	200	26	96	245	67
Future Volume (vph)	133	921	223	48	709	42	142	200	26	96	245	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	100.0		100.0	140.0		130.0	75.0		0.0	37.5		0.0
Storage Lanes	1		1	1		1	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.983			0.968	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1703	1863	1615	1805	1810	1509	1805	1868	0	1719	1812	0
Flt Permitted	0.243			0.094			0.372			0.535		
Satd. Flow (perm)	436	1863	1615	179	1810	1509	707	1868	0	968	1812	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			235			47		7			16	
Link Speed (k/h)		70			70			50			60	
Link Distance (m)		2054.4			1575.0			379.0			461.0	
Travel Time (s)		105.7			81.0			27.3			27.7	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Adj. Flow (vph)	140	969	235	51	746	44	149	211	27	101	258	71
Shared Lane Traffic (%)												
Lane Group Flow (vph)	140	969	235	51	746	44	149	238	0	101	329	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)		3.6			3.6			3.6			3.6	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane		Yes			Yes							
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2	1	1	2	1	1	2		1	2	
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0	2.0	2.0	10.0	2.0	2.0	10.0		2.0	10.0	
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)	2.0	0.6	2.0	2.0	0.6	2.0	2.0	0.6		2.0	0.6	
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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		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			8		
Detector Phase	2	2	2	6	6	6	4	4		8	8	
Switch Phase												
Minimum Initial (s)	30.0	30.0	30.0	30.0	30.0	30.0	15.0	15.0		15.0	15.0	
Minimum Split (s)	37.2	37.2	37.2	37.2	37.2	37.2	28.9	28.9		28.9	28.9	
Total Split (s)	55.0	55.0	55.0	55.0	55.0	55.0	35.0	35.0		35.0	35.0	
Total Split (%)	61.1%	61.1%	61.1%	61.1%	61.1%	61.1%	38.9%	38.9%		38.9%	38.9%	
Maximum Green (s)	47.8	47.8	47.8	47.8	47.8	47.8	28.1	28.1		28.1	28.1	
Yellow Time (s)	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9		5.9	5.9	
All-Red Time (s)	1.3	1.3	1.3	1.3	1.3	1.3	1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)	7.2	7.2	7.2	7.2	7.2	7.2	6.9	6.9		6.9	6.9	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0		3.0	3.0	
Recall Mode	Max	Max	Max	Max	Max	Max	None	None		None	None	
Walk Time (s)	15.0	15.0	15.0	15.0	15.0	15.0	11.0	11.0		11.0	11.0	
Flash Dont Walk (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0		7.0	7.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0		0	0	
Act Effct Green (s)	48.0	48.0	48.0	48.0	48.0	48.0	20.7	20.7		20.7	20.7	
Actuated g/C Ratio	0.58	0.58	0.58	0.58	0.58	0.58	0.25	0.25		0.25	0.25	
v/c Ratio	0.56	0.90	0.23	0.50	0.71	0.05	0.85	0.50		0.42	0.71	
Control Delay	23.5	29.9	2.1	33.8	18.5	3.1	67.8	29.4		31.2	35.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	23.5	29.9	2.1	33.8	18.5	3.1	67.8	29.4		31.2	35.6	
LOS	C	C	A	C	B	A	E	C		C	D	
Approach Delay		24.4			18.6			44.2			34.6	
Approach LOS		C			B			D			C	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 82.8			
Natural Cycle: 90			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.90			
Intersection Signal Delay: 26.8		Intersection LOS: C	
Intersection Capacity Utilization 126.4%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 4: Whitelaw Road & Wellington Road 124



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	140	969	235	51	746	44	149	238	101	329
v/c Ratio	0.56	0.90	0.23	0.50	0.71	0.05	0.85	0.50	0.42	0.71
Control Delay	23.5	29.9	2.1	33.8	18.5	3.1	67.8	29.4	31.2	35.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.5	29.9	2.1	33.8	18.5	3.1	67.8	29.4	31.2	35.6
Queue Length 50th (m)	12.9	126.7	0.0	4.5	79.7	0.0	23.5	32.8	14.0	47.3
Queue Length 95th (m)	#44.1	#256.0	10.5	#25.1	153.2	4.6	#52.6	54.1	28.4	74.9
Internal Link Dist (m)		2030.4			1551.0			355.0		437.0
Turn Bay Length (m)	100.0		100.0	140.0		130.0	75.0		37.5	
Base Capacity (vph)	252	1079	1034	103	1048	894	240	641	329	627
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.90	0.23	0.50	0.71	0.05	0.62	0.37	0.31	0.52

Intersection Summary

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

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	921	223	48	709	42	142	200	26	96	245	67
Future Volume (vph)	133	921	223	48	709	42	142	200	26	96	245	67
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.2	7.2	7.2	7.2	7.2	7.2	6.9	6.9		6.9	6.9	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	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	0.98		1.00	0.97	
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)	1703	1863	1615	1805	1810	1509	1805	1868		1719	1811	
Flt Permitted	0.24	1.00	1.00	0.09	1.00	1.00	0.37	1.00		0.54	1.00	
Satd. Flow (perm)	436	1863	1615	179	1810	1509	707	1868		968	1811	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	140	969	235	51	746	44	149	211	27	101	258	71
RTOR Reduction (vph)	0	0	99	0	0	18	0	5	0	0	12	0
Lane Group Flow (vph)	140	969	136	51	746	26	149	233	0	101	317	0
Heavy Vehicles (%)	6%	2%	0%	0%	5%	7%	0%	0%	0%	5%	0%	7%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2		2	6		6	4			8		
Actuated Green, G (s)	48.0	48.0	48.0	48.0	48.0	48.0	20.7	20.7		20.7	20.7	
Effective Green, g (s)	48.0	48.0	48.0	48.0	48.0	48.0	20.7	20.7		20.7	20.7	
Actuated g/C Ratio	0.58	0.58	0.58	0.58	0.58	0.58	0.25	0.25		0.25	0.25	
Clearance Time (s)	7.2	7.2	7.2	7.2	7.2	7.2	6.9	6.9		6.9	6.9	
Vehicle Extension (s)	4.5	4.5	4.5	4.5	4.5	4.5	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	252	1080	936	103	1049	874	176	467		242	452	
v/s Ratio Prot		c0.52			0.41			0.12			0.18	
v/s Ratio Perm	0.32		0.08	0.28		0.02	c0.21			0.10		
v/c Ratio	0.56	0.90	0.15	0.50	0.71	0.03	0.85	0.50		0.42	0.70	
Uniform Delay, d1	10.8	15.2	8.0	10.3	12.4	7.4	29.5	26.6		26.0	28.2	
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	8.6	11.6	0.3	16.0	4.1	0.1	29.4	0.8		1.2	4.9	
Delay (s)	19.3	26.9	8.3	26.3	16.5	7.5	59.0	27.4		27.2	33.1	
Level of Service	B	C	A	C	B	A	E	C		C	C	
Approach Delay (s)		22.8			16.7			39.6			31.7	
Approach LOS		C			B			D			C	

Intersection Summary				
HCM 2000 Control Delay	24.5	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.88			
Actuated Cycle Length (s)	82.8	Sum of lost time (s)	14.1	
Intersection Capacity Utilization	126.4%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

Memorandum

06 December 2019
Project: 180114
5A-150 Pinebush Road
Cambridge ON N1R 8J8

To

Dave Hallman
Senior Project Manager/Advisor
MTE Consultants Inc.

From

Rajan Philips, M.Sc., P.Eng.
Senior Transportation Engineer
Paradigm Transportation Solutions Limited

RE: WELLINGTON ROAD 124 IMPROVEMENTS, EA TRANSPORTATION STUDY, MEMO ON AGENCY REVIEW COMMENTS

In October 2019, Paradigm Transportation Solutions Limited completed the Transportation Study for the Wellington Road 124 Improvements EA.

Review comments have been provided by the City of Guelph Engineering and Transportation Services staff on June 13, 2019, and again on December 2, 2019. This memorandum addresses City staff's review comments provided on December 2.

1. Base Year Traffic Counts: Base year traffic conditions were based on the most recent (2018) intersection counts consistent throughout the road corridor. These were analysed as existing traffic conditions in the Transportation Study while noting that the bridge over Speed River connecting Niska Road to Whitelaw Road was closed at that time. The final report of the Transportation Study provides (Section 2.4) a comparison of the changes in traffic volumes at the Whitelaw Road intersection before and after the closure of the Niska Road Bridge. As described in Section 5.2 of the report, future projections and analysis for the entire corridor were carried out using the traffic count data at the Whitelaw Road intersection collected in 2007 and 2013 before the closure of the Niska Road bridge.

2. Traffic Annual Growth Rate: As discussed in Section 3.1 of the Transportation Study report, historical growth rates on Wellington Road 124 were reviewed, and conservative growth rates of 2% (2018-2031) and 1.5% (2031-2041) were used in traffic forecasting. It is also noted that the traffic on Wellington Road 124 involves origins and destinations in multiple jurisdictions with varying population changes. Specific to the intersection of Wellington Road 124 and Whitelaw Road, in Section 5.4 of the report, auxiliary left-turn lanes are identified as required improvements for the northbound and southbound turning movements, and both left-turn and right-turn lanes are identified for the eastbound and westbound turning movements.

3. Capacity: The 2005 Guelph-Wellington Transportation Study (GWTS) was jointly undertaken by the City of Guelph and the County of Wellington. The recommendation of the study for Wellington Road 124 was predicated on the 1997 Provincial EA recommendation

for what was then Highway 24. The 1997 Provincial EA had recommended a four-lane access- controlled expressway between Highway 401 and the Hanlon Expressway, including a new alignment, within Wellington County, to the south of the existing road alignment. After the 1997 EA, Highway 24 north of Highway 401 was transferred to the Region of Waterloo and the County of Wellington, within their respective jurisdictions. The 2005 GWTS recommendation was made in the context of the County, supported by the City, requesting the Province to complete the improvements recommended by the 1997 EA involving a new road alignment, which was identified to avoid the property access constraints on the existing corridor to significant road widening to accommodate four lanes.

The purpose of the present Wellington Road 124 Improvements EA is to identify improvements within the existing corridor, and specifically to address turning movement capacity constraints at the two legs of Wellington Road 32. The recommended improvements in the EA address these constraints satisfactorily under conservatively projected 2041 traffic conditions, for turning movements at the two legs of Wellington Road 32 and for eastbound and westbound through movements at all the study area intersections. Additional intersection improvements are identified in the EA for the intersection at Whitelaw Road, which may have to be implemented in consultation with the Guelph-Eramosa Township. The EA also notes that in November 2018 geometric improvements were undertaken at the intersection of Township Road 1 and Wellington Road 124.

We trust that this Memo addresses the review comments on the October 2019 Transportation Report. Please let us know if you need additional information or clarification from us.

Yours very truly,

PARADIGM TRANSPORTATION SOLUTIONS LIMITED

Rajan Philips
M.Sc., P.Eng.
Senior Transportation Consultant

APPENDIX E

Public Consultation

APPENDIX E1

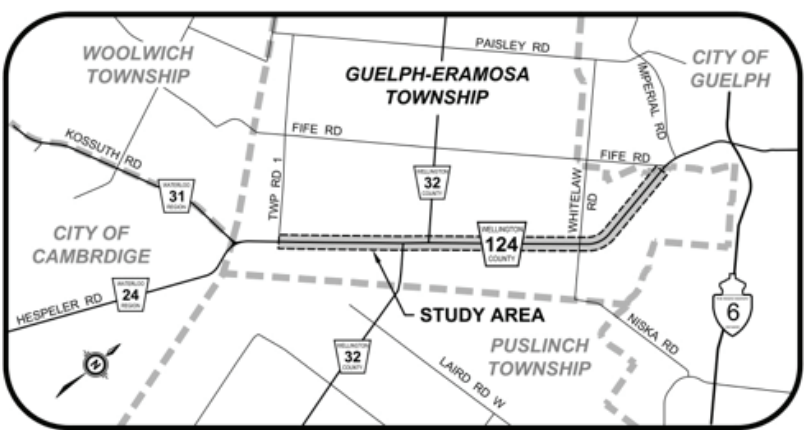
Notice of Study Commencement

COUNTY OF WELLINGTON
SCHEDULE C – CLASS ENVIRONMENTAL ASSESSMENT
WELLINGTON ROAD 124 IMPROVEMENTS
TOWNSHIP ROAD 1 TO FIFE ROAD

NOTICE OF STUDY COMMENCEMENT
PUBLIC COMMENT INVITED

The Study

Wellington County Road 124 has experienced growing traffic congestion between Guelph Eramosa Township Road 1 and Fife Road. The County is therefore considering improvements to County Road 124 to address the congestion, road safety, intersection improvements and drainage.



The Process

In accordance with the requirements for Schedule C projects of the Municipal Class Environmental Assessment, the Study will define the problem, identify and evaluate alternative solutions and design concepts, recommend a design, assess potential impacts and identify mitigation measures associated with the preferred design.

A key component of the study will be consultation with interested stakeholders including public agencies and Aboriginal communities. At least one Public information Centre will be held to present and review the study findings and alternatives, and discuss issues related to impacts of the design and mitigation measures. At the conclusion of the study, the EA process and findings will be documented in an Environmental Study Report (ESR) which will be made available for 30 days for public review and comment.

Comments Invited

If you have any questions or comments regarding the Study or wish to be added to the Study mailing list, please contact either of the project team members:

Mark Eby, P.Eng
Construction Manager
County of Wellington
74 Woolwich Street
Guelph, ON N1H 3T9
T: 519-837-2601 x 2270
F: 519-837-8138
E: marke@wellington.ca

Dave Hallman, P.Eng
Consultant Project Manager
MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener ON N2B 3X9
T: 519-743-6500 x 1336
F: 519-743-6513
E: dhallman@mte85.com

For more information on this project, please visit www.wellington.ca

Information will be collected in accordance with the Freedom of Information and Protection of Privacy Act and will become part of the public record.

This notice first issued on April 20, 2018

Alternate formats available upon request

APPENDIX E2

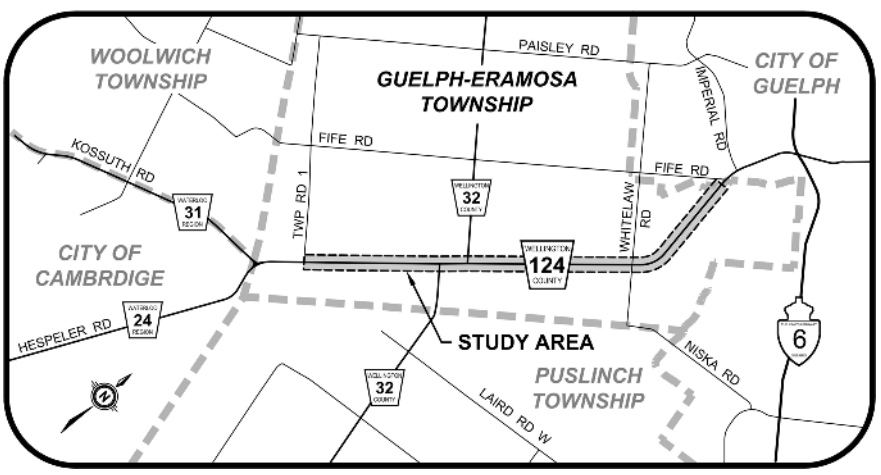
Public Information Centre No. 1

THE CORPORATION OF THE COUNTY OF WELLINGTON
Engineering Services Department
Roads Division

Municipal Class Environmental Assessment Study
Wellington Road 124 Improvements
Township Road 1 to Fife Road

NOTICE OF PUBLIC INFORMATION CENTRE

The County of Wellington is conducting a Schedule C Municipal Class Environmental Assessment (EA) Study for improvements to Wellington Road 124 between Guelph Eramosa Township Road 1 and Fife Road. The improvements aim to address the growing traffic congestion along the corridor as well as road safety, intersection functionality and drainage. The study will define the problem, identify and evaluate alternative solutions and design concepts, recommend a design, assess potential impacts and identify mitigation measures associated with the preferred design. The County of Wellington has retained MTE Consultants to complete the EA Study.



In accordance with the requirements for Schedule C projects of the Municipal Class EA process, Wellington County will be hosting a Public Information Centre where the public is invited to review the proposed alternatives and provide comments.

The Public Information Centre will be an "Open House" format and will be held on **Thursday, November 29, 2018 from 5:00 pm to 8:00 pm at:**

Sanimax Offices
5068 Whitelaw Road (Corner of County Road 124)
Guelph, Ontario

Representatives from the County of Wellington and MTE Consultants will be present at the Public Information Centre to help you review the plans and answer questions regarding the Municipal Class EA process. If you have any questions or comments regarding the Study or wish to be added to the Study mailing list, please contact either of the following project team members:

Don Kudo, P. Eng
County Engineer
County of Wellington
74 Woolwich Street
Guelph, ON N1H 3T9
T: 519.837.2601 x2280
F: 519.837.8138
E: donk@wellington.ca

Dave Hallman, P. Eng
Consultant Project Manager
MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener ON N2B 3X9
T: 519.743.6500 x1336
F: 519.743.6513
E: dhallman@mte85.com

For more information on this project, please visit www.wellington.ca

This notice first issued on November 16, 2018

Information will be collected in accordance with the Freedom of Information and Protection of Privacy Act and will become part of the public record.

Alternate formats available upon request

PUBLIC INFORMATION CENTRE

WELLINGTON ROAD 124 ENVIRONMENTAL ASSESSMENT
November 29, 2018
5:00 p.m. to 8:00 p.m.

Sanimax Offices
5068 Whitelaw Road
Guelph

COMMENT SHEET

Please complete and hand in this sheet so that your views can be considered for this project. If you cannot complete your comments today, please take this home and mail, fax or email your comments by **December 13, 2018** to either Mr. Don Kudo or Mr. Dave Hallman (contact information on the last page).

1. Which road cross-section do you prefer?

Rural ☐ Urban ☐ Rural/Urban Hybrid (describe below) ☐

_____

_____

2. How many lanes do you prefer?

2 Lanes ☐ 3 Lanes (Centre Left Turn Lane) ☐ 4 Lanes ☐ Other (describe below) ☐

_____

_____

3. What intersection improvements do you prefer at the Road 32 Intersections?

Signalized with turn lanes ☐ Two Roundabouts ☐ One Roundabout ☐

4. Are there any other general comments you have on this project (continued on back)?

_____

_____

_____

_____

_____

5. Do you wish to be placed on the mailing list for this project? Yes ☐ No ☐

Name: _____

Address: _____

Postal Code: _____

Phone & Email: _____

Thank you for your interest and time.

Please return this comment sheet to either:

Mr. Don Kudo, P.Eng.
County Engineer
County of Wellington
74 Woolwich Street
Guelph, ON N1H 3T9
Telephone: (519) 837-2601 x2280
Fax: (519) 837-8138
Email: donk@wellington.ca

Mr. Dave Hallman, P. Eng.
Consultant Project Manager
MTE Consultants Inc.
502 Bingemans Centre Drive
Kitchener, ON N2B 3X9
Telephone: (519) 743-6500 x1336
Fax: (519) 743-6513
Email: dhallman@mte85.com

Collection Notice

Personal information requested on this form is collected under the authority of the "Municipal Act" and will be used to assist the County of Wellington in making a decision on this project. Any personal information such as name, address, telephone number and/or property location included in a submission from the public may become part of the public record file for this matter. Questions regarding this collection should be forwarded to the County Engineer, Don Kudo by phone at (519) 837-2601 x2280 or email at donk@wellington.ca

WELLINGTON COUNTY

ROAD 124

TOWNSHIP ROAD 1 TO FIFE ROAD

PUBLIC INFORMATION CENTRE

WELLINGTON COUNTY ROAD 124 CLASS EA

Welcome

Welcome to the **Public Information Centre for Wellington County Road 124** Between Township Road 1 and Fife Road

The Project is being planned under Schedule C of the Municipal Class Environmental Assessment (EA) Act.

We ask that you:

- *Review the Display Boards*
- *Ask any questions you have of the Project Team*
- *Fill out a Comment Sheet with your preferred alternatives and any other comments or concerns*.

WELLINGTON COUNTY ROAD 124 CLASS EA

What is the Purpose of this Pubic Information Centre

- Present the Various Alternatives to address the existing congestion and pavement condition on County Road 124.
- Obtain feedback on the various alternatives being presented.
- Address any questions or concerns you may have regarding this project.

What Problem(s) Are Being Solved

Each Class EA must have a Problem or Opportunity Statement.

County Road 124 – Problem/Opportunity Statement

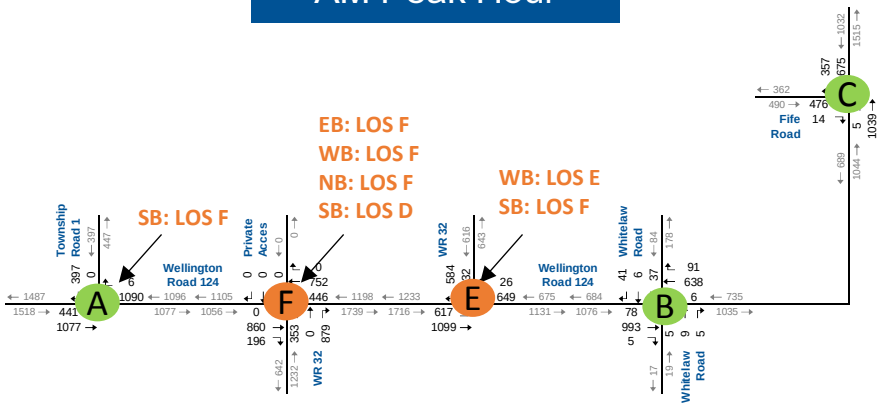
Wellington County Road 124 from Township Road 1 to Fife Road is in need of improvements to address existing traffic deficiencies including poor/deteriorating levels of service at the intersections with Wellington Road 32 North and 32 South, as well as plan for future growth along this important corridor. Improvements must also address the existing pavement condition while providing safe public access to the greatest possible extent.

LEVEL OF SERVICE (2041)

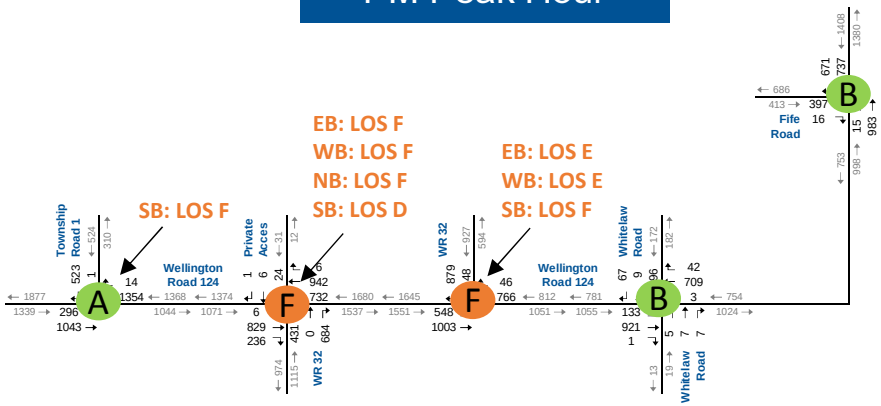
EXISTING LANE CONFIGURATIONS – NO IMPROVEMENTS

LOS (Delay) (s)	DESCRIPTION	LOS (Delay) (s)	DESCRIPTION
A (<10)	Little to no delay	D (35 – 55)	Frequent queuing and delay
B (10-20)	Minimal delay	E (55 – 80)	Increased queuing and delay
C (20–35)	Some queuing and delay	F (>80)	Significant queuing and delay

AM Peak Hour



PM Peak Hour



What Studies Have Been Completed?

- ✓ Traffic Study
- ✓ Natural Environment Constraints Report
- ✓ Stage 1 Archaeological Assessment
- ✓ Built Heritage and Cultural Landscape Assessment

What Alternatives Are Being Considered?

There are three Main Categories of Alternatives being considered:

CROSS SECTION

- **Rural** – Similar to existing cross-sections with paved shoulders and ditches
- **Urban** – Mountable Curb separating the traffic lanes and paved shoulders.

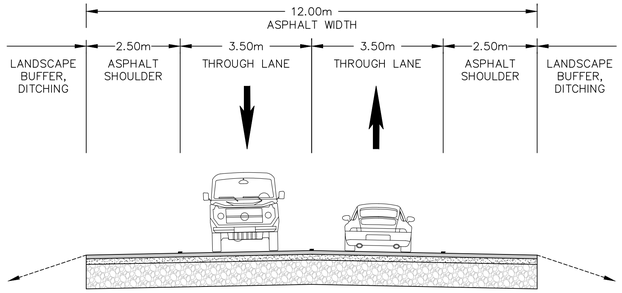
NUMBER OF LANES

- **2 Lane** – one lane in each direction with turn lanes at intersections as required.
- **3 Lane** – one lane in each direction with a centre turn way left turn in selected area.
- **4 Lane** – two lanes in each direction with turn lanes at intersections as required.

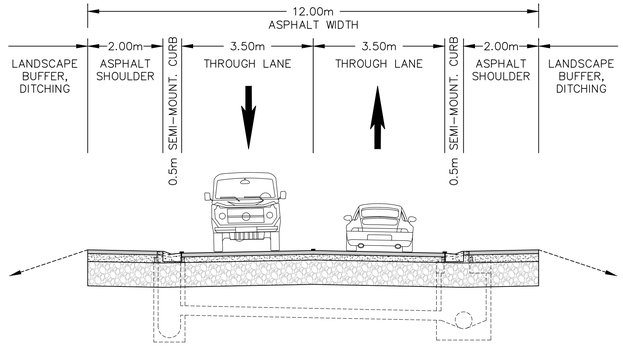
INTERSECTION IMPROVEMENTS

- **Signalized Intersections with Turn Lanes**
- **Roundabouts**

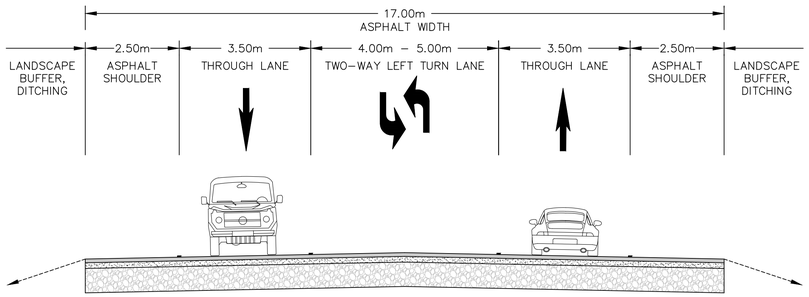
CROSS SECTION ALTERNATIVES



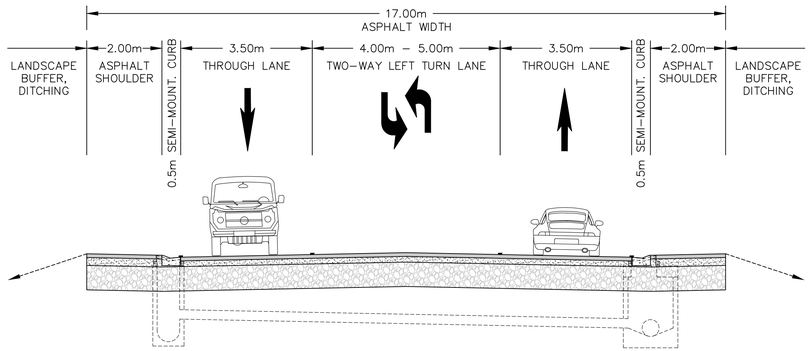
RURAL 2 LANE SECTION



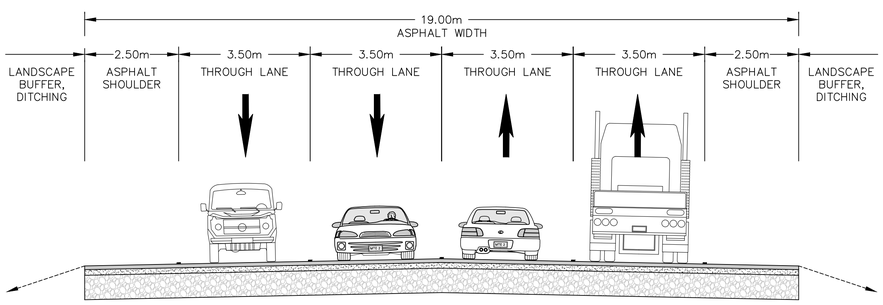
URBAN 2 LANE SECTION



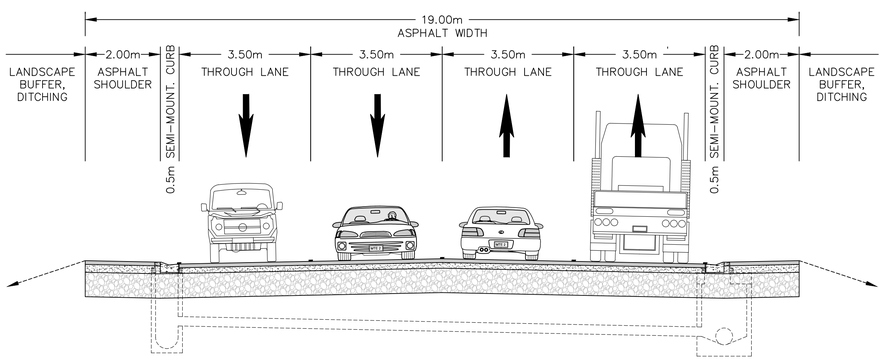
RURAL 3 LANE SECTION



URBAN 3 LANE SECTION



RURAL 4 LANE SECTION



URBAN 4 LANE SECTION

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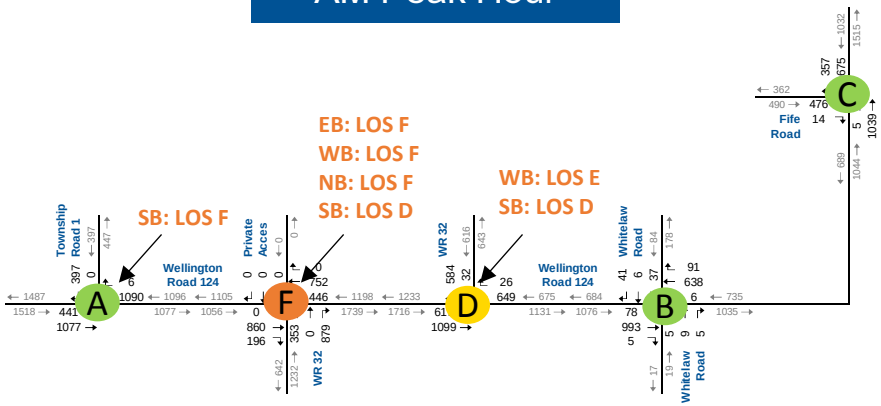
November 28, 2018 – 12:31 p.m. – Plotted By: nduimering

LEVEL OF SERVICE (2041)

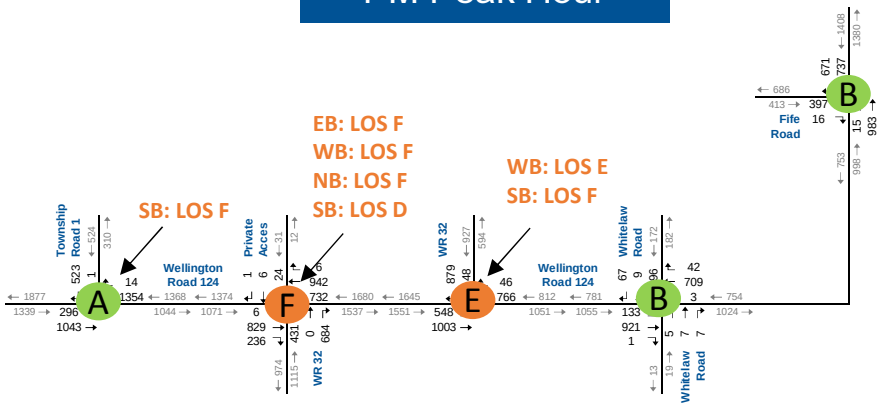
ALTERNATIVE 1 – TWO LANES

LOS (Delay) (s)	DESCRIPTION	LOS (Delay) (s)	DESCRIPTION
A (<10)	Little to no delay	D (35 – 55)	Frequent queuing and delay
B (10-20)	Minimal delay	E (55 – 80)	Increased queuing and delay
C (20–35)	Some queuing and delay	F (>80)	Significant queuing and delay

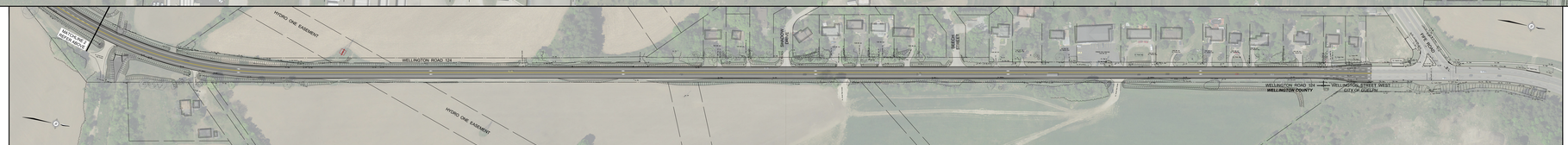
AM Peak Hour

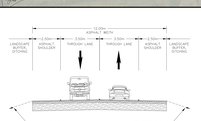


PM Peak Hour

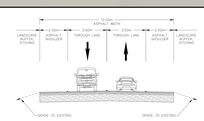


ALTERNATIVE 1 - TWO LANES





RURAL 2 LANE SECTION



RURAL 2 LANE SECTION

WELLINGTON ROAD 124 / WHITELAW ROAD
WELLINGTON ROAD 32 IMPROVEMENTS
TOWNSHIP ROAD 7 to PPE ROAD

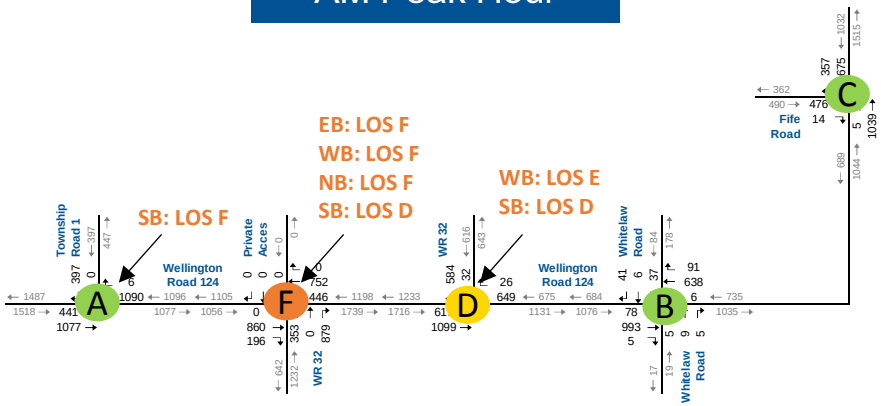
MTE

LEVEL OF SERVICE (2041)

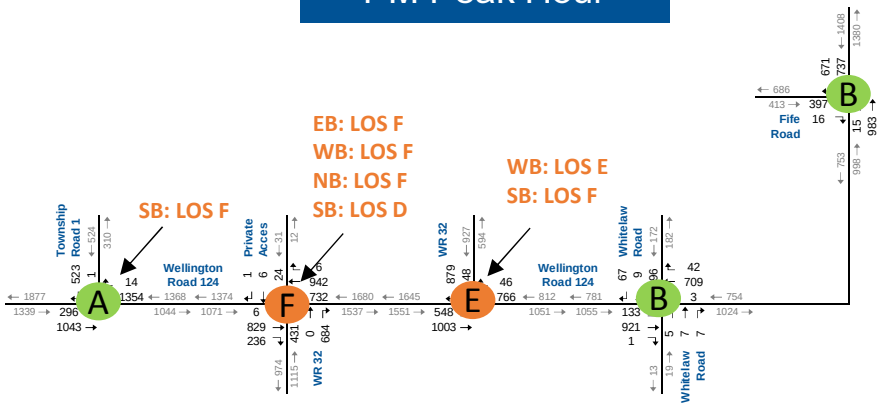
ALTERNATIVE 2 – THREE LANES

LOS (Delay) (s)	DESCRIPTION	LOS (Delay) (s)	DESCRIPTION
A (<10)	Little to no delay	D (35 – 55)	Frequent queuing and delay
B (10-20)	Minimal delay	E (55 – 80)	Increased queuing and delay
C (20–35)	Some queuing and delay	F (>80)	Significant queuing and delay

AM Peak Hour



PM Peak Hour



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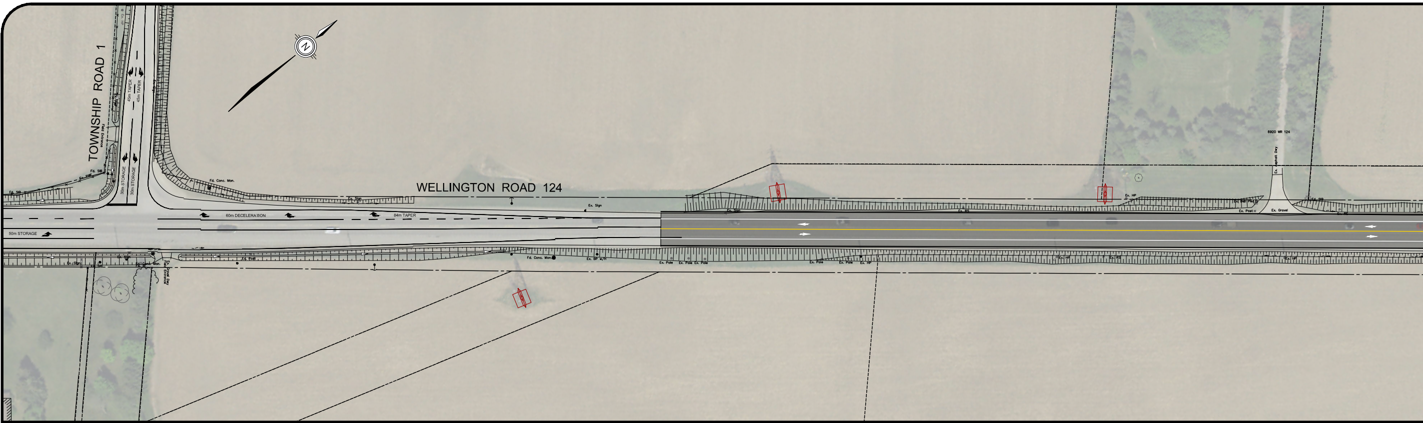
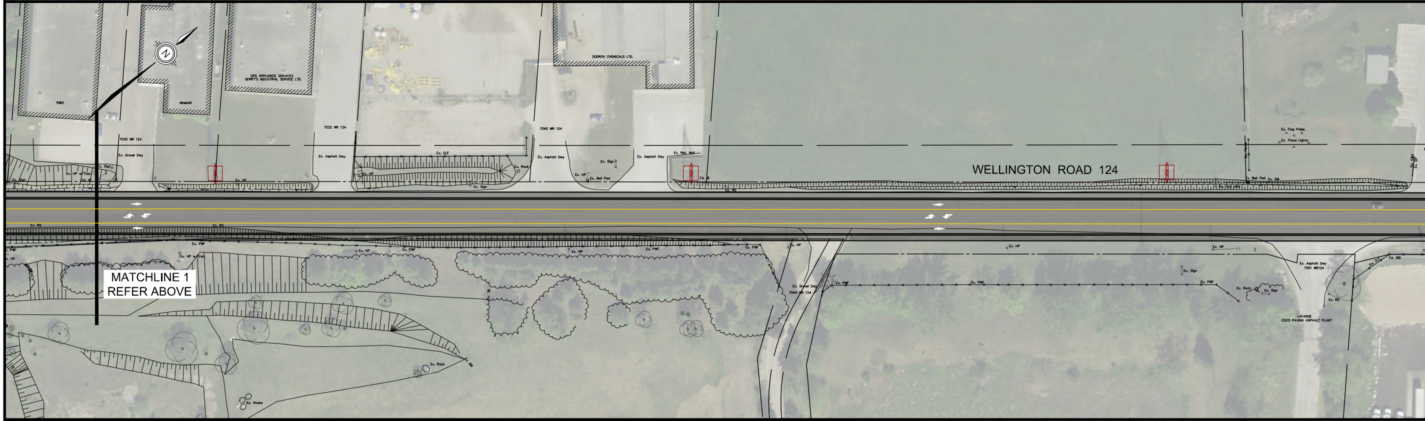
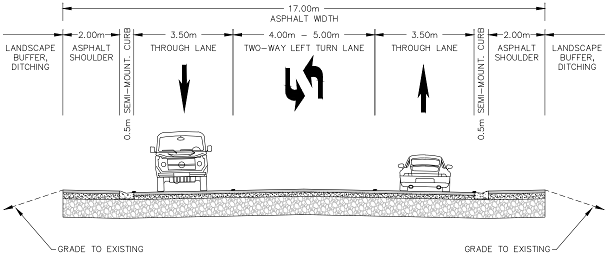

TOWNSHIP ROAD 1
WELLINGTON ROAD 124
60m DECELERATION
64m TAPER
50m STORAGE
30m STORAGE
45m TAPER
6920 WR 124


WELLINGTON ROAD 124
MATCHLINE 1
REFER ABOVE
GPS APPLIANCE SERVICES
GERRY'S INDUSTRIAL SERVICE LTD.
SODROX CHEMICALS LTD.
7030 WR 124
7032 WR 124
7040 WR 124
LAFARGE
COCO PAVING ASPHALT PLANT


17.00m
ASPHALT WIDTH
2.00m
3.50m
4.00m – 5.00m
3.50m
2.00m
LANDSCAPE BUFFER, DITCHING
ASPHALT SHOULDER
SEMI-MOUNT. CURB
THROUGH LANE
TWO-WAY LEFT TURN LANE
THROUGH LANE
SEMI-MOUNT. CURB
ASPHALT SHOULDER
LANDSCAPE BUFFER, DITCHING
0.5m
0.5m
GRADE TO EXISTING
GRADE TO EXISTING

URBAN 3 LANE SECTION

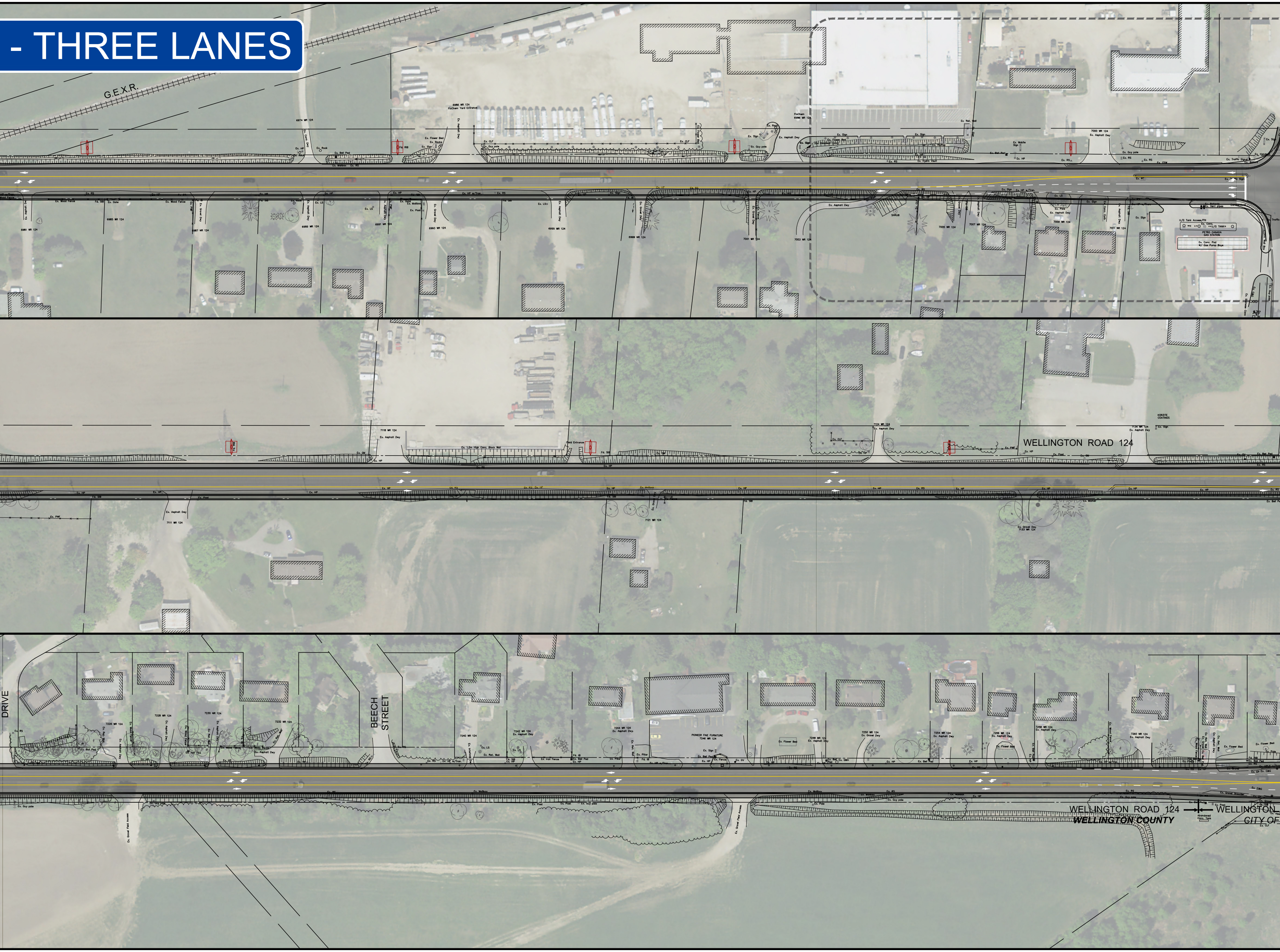
MATCHLINE 2
REFER ABOVE

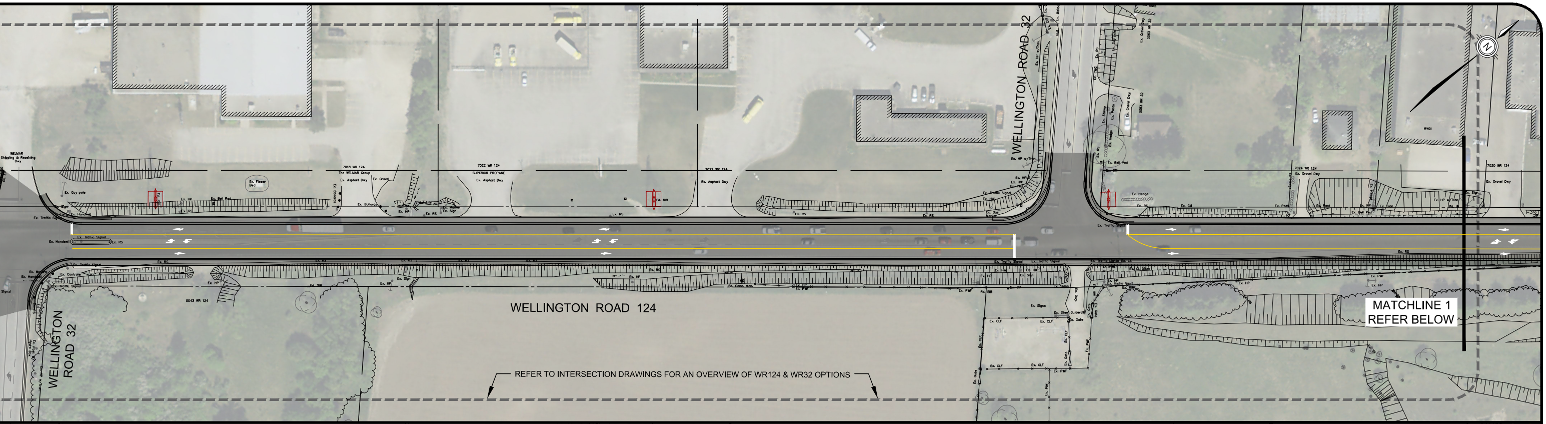
November 28, 2018 – 4:05 p.m. – Plotted By: nduimering

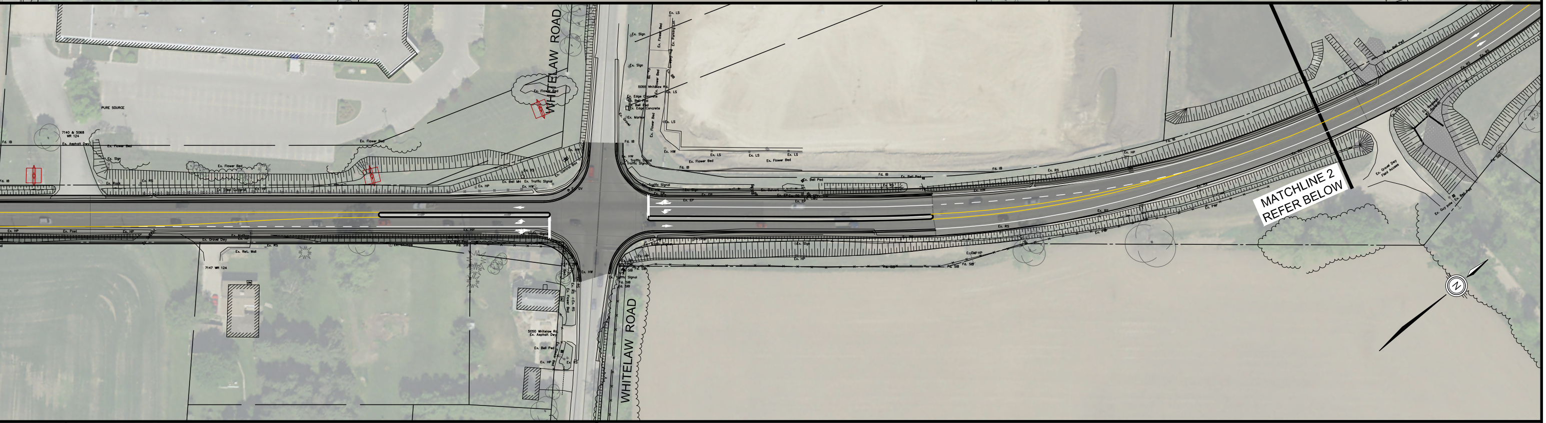
ALTERNATIVE 2

ELLIS CREEK
6932 WR 124
6939 WR 124
6955 WR 124
6961 WR 124
6964 WR 124
G.E.X.R.
UPI ENERGY GAS STATION
UPI ENERGY GAS STATION
7060 WR 124
Ex. Asphalt Dwy
Ex. Propane Tank
Ex. Asphalt Dwy
7061 WR 124
CORMAKYE TRANSPORT
Ex. Asphalt Dwy
7077 WR 124
CLARKS MOBILE HOMES AND MINI STORAGE
ROYAL STAINLESS STEEL TANK & TRUCK
7076 WR 124
Ex. Asphalt Dwy
Ex. Asphalt Dwy
7079 WR 124
FORTRESS WASTE MANAGEMENT SERVICES
7088 WR 124
Ex. Asphalt Dwy
BODYWORKS
7096 WR 124
Ex. Gravel Dwy
7106 WR 124
Ex. Asphalt Dwy
HYDRO ONE EASEMENT
WELLINGTON ROAD 124
HYDRO ONE EASEMENT
7079 WR 124
7218 WR 124
7218 WR 124
SHADOW

- THREE LANES


G.E.X.R.
PETRO CANADA
GAS STATION
U/G Tank Access/Fill
Ex. Conc.
U/G TANK
Ex. Conc. Pad
W/ Gas Pump Bays
Ex. Vent pipes
Ex. Traffic Signal
WELLINGTON ROAD 124
DRIVE
BEECH
STREET
PIONEER FINE FURNITURE
7246 WR 124
Ex. Sign
Ex. Bell Ped
Ex. Fence
Ex. HP
Ex. GV
WELLINGTON ROAD 124
WELLINGTON COUNTY
Abandoned
Conc. Tank
WELLINGTON
CITY OF
Ex. Gravel Shoulder
Ex. Guy pole
Ex. RS
Ex. C&G
Ex. CLF
Ex. Post


WELLINGTON ROAD 32
WELLINGTON ROAD 124
WELLINGTON ROAD 32
REFER TO INTERSECTION DRAWINGS FOR AN OVERVIEW OF WR124 & WR32 OPTIONS
MATCHLINE 1
REFER BELOW
N


WHITELAW ROAD
WHITELAW ROAD
PURE SOURCE
MATCHLINE 2
REFER BELOW
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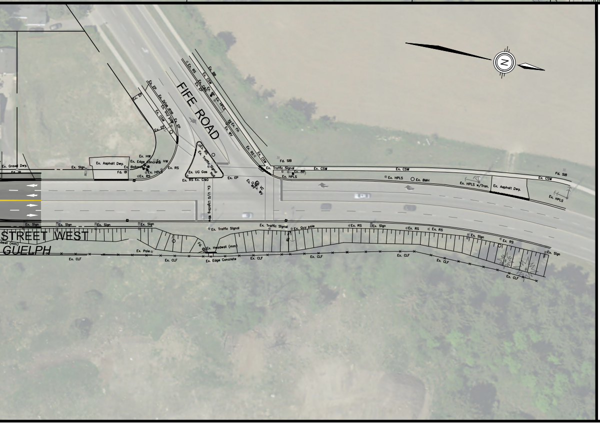
FIFE ROAD
STREET WEST
GUELPH
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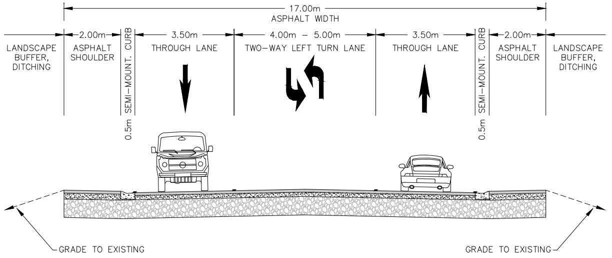

17.00m
ASPHALT WIDTH
LANDSCAPE BUFFER, DITCHING
2.00m
ASPHALT SHOULDER
0.5m SEMI-MOUNT. CURB
3.50m
THROUGH LANE
4.00m – 5.00m
TWO-WAY LEFT TURN LANE
3.50m
THROUGH LANE
0.5m SEMI-MOUNT. CURB
2.00m
ASPHALT SHOULDER
LANDSCAPE BUFFER, DITCHING
GRADE TO EXISTING
GRADE TO EXISTING

URBAN 3 LANE SECTION

ALTERNATIVE 2 - THREE LANES
Date: NOV.29/18
Scale: 1:500

WELLINGTON ROAD 124 IMPROVEMENTS
TOWNSHIP ROAD 1 to FIFE ROAD

The Corporation of the County of Wellington

MTE
Engineers | Scientists | Surveyors

Project No.: 41093-200

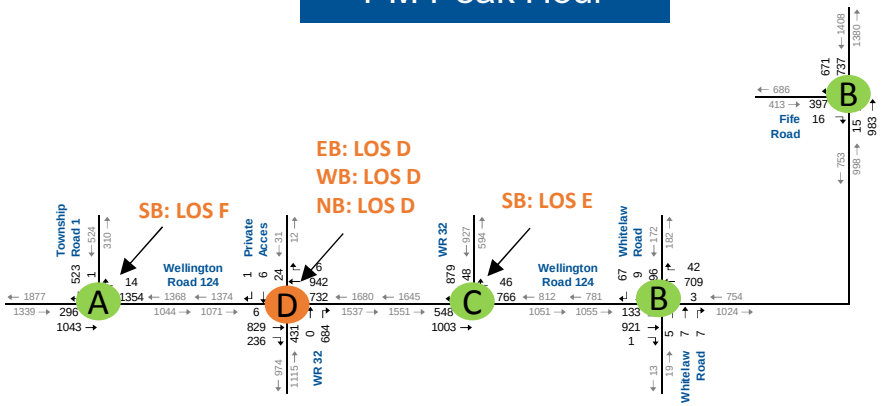
LEVEL OF SERVICE (2041)

ALTERNATIVE 3 – FOUR LANES

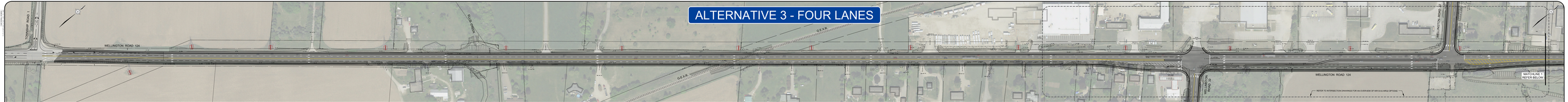
LOS (Delay) (s)	DESCRIPTION	LOS (Delay) (s)	DESCRIPTION
A (<10)	Little to no delay	D (35 – 55)	Frequent queuing and delay
B (10-20)	Minimal delay	E (55 – 80)	Increased queuing and delay
C (20–35)	Some queuing and delay	F (>80)	Significant queuing and delay

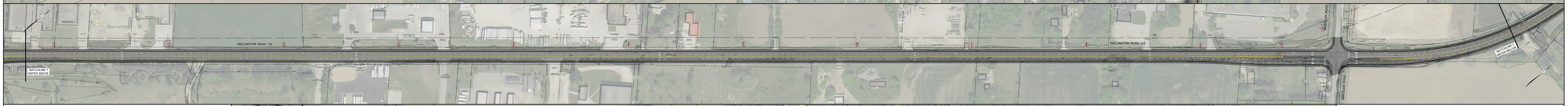
AM Peak Hour

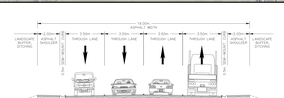
PM Peak Hour



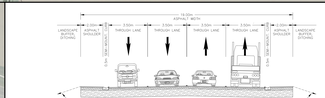
ALTERNATIVE 3 - FOUR LANES







URBAN 4 LANE SECTION



URBAN 4 LANE SECTION

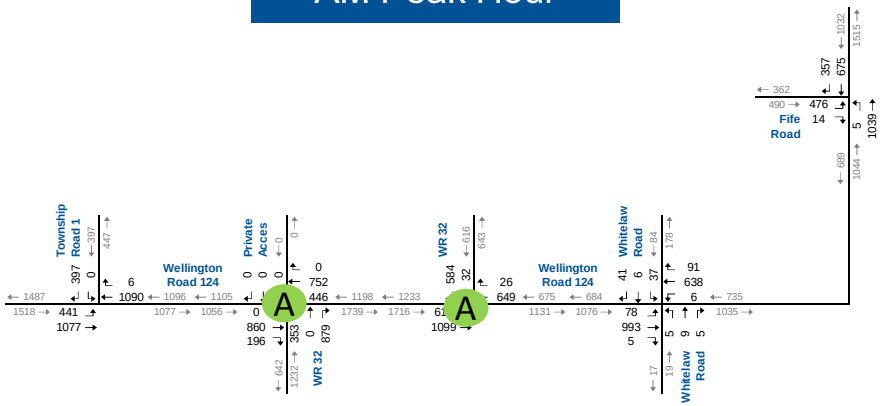
WELLINGTON COUNTY AND CITY OF GUELPH
WELLINGTON ROAD 32a IMPROVEMENTS
TOWNSHIP ROAD 7 to FIFE ROAD
MTE

LEVEL OF SERVICE (2041)

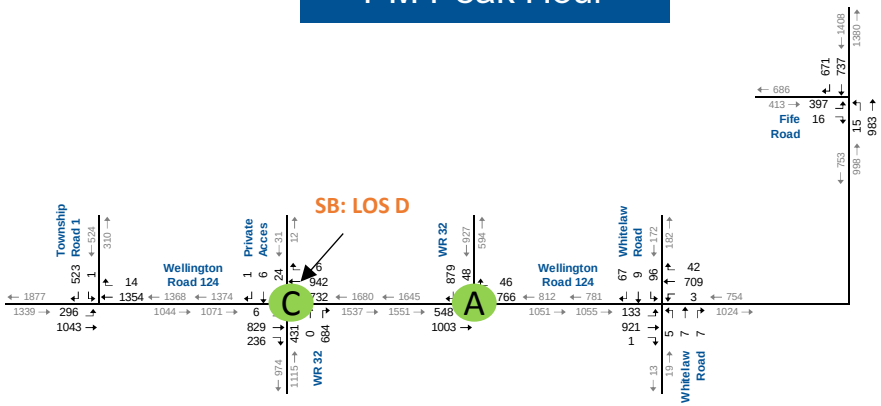
ALTERNATIVE 4 – TWO ROUNDABOUTS

LOS (Delay) (s)	DESCRIPTION	LOS (Delay) (s)	DESCRIPTION
A (<10)	Little to no delay	D (35 – 55)	Frequent queuing and delay
B (10-20)	Minimal delay	E (55 – 80)	Increased queuing and delay
C (20–35)	Some queuing and delay	F (>80)	Significant queuing and delay

AM Peak Hour



PM Peak Hour



- Alternative 5 is specific to improvements at Wellington Road 124 & Wellington Road 32 (North and South) only.

MTE FILE No: 41093-200-FD1.6
FUNCTIONAL DESIGN 1
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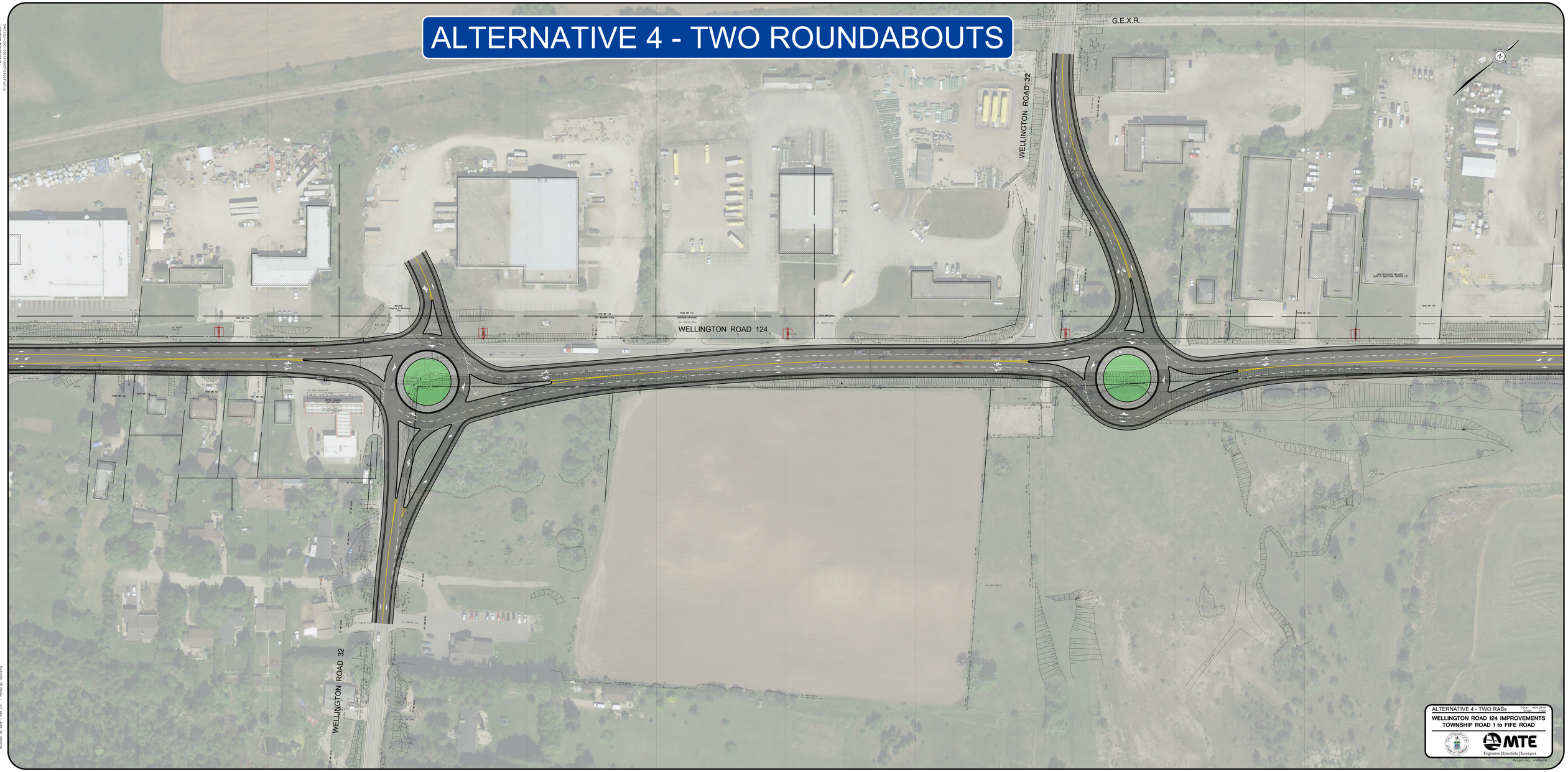
November 28, 2018 – 4:05 p.m. – Plotted By: Jaydenberg

ALTERNATIVE 4 - TWO ROUNDABOUTS



ALTERNATIVE 4 - TWO RABs
Date: NOV.2018
Scale: 1:500

WELLINGTON ROAD 124 IMPROVEMENTS
TOWNSHIP ROAD 1 to FIFE ROAD

MTE
Engineers |Scientists |Surveyors

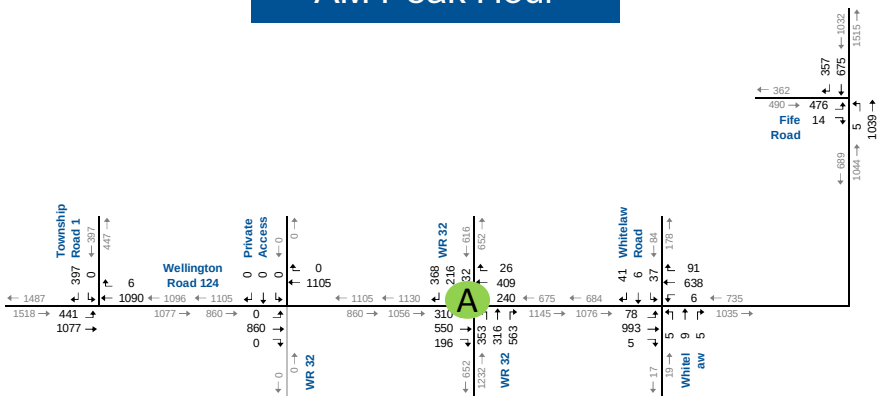
Project No.: 41093-200

LEVEL OF SERVICE (2041)

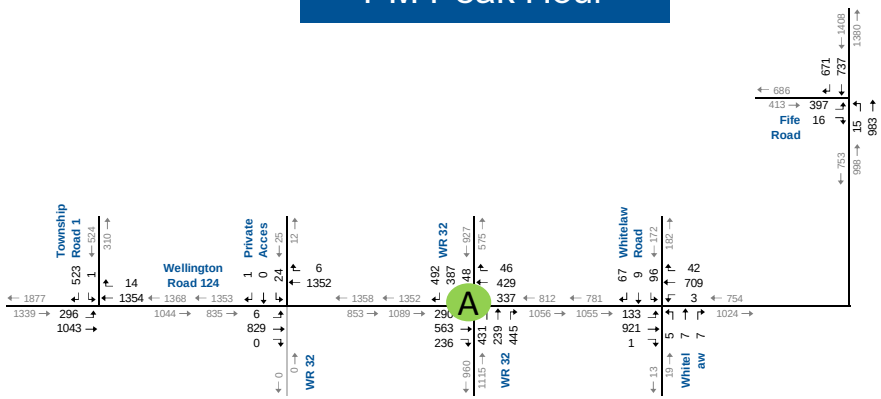
ALTERNATIVE 5 – SINGLE ROUNDABOUT

LOS (Delay) (s)	DESCRIPTION	LOS (Delay) (s)	DESCRIPTION
A (<10)	Little to no delay	D (35 – 55)	Frequent queuing and delay
B (10-20)	Minimal delay	E (55 – 80)	Increased queuing and delay
C (20–35)	Some queuing and delay	F (>80)	Significant queuing and delay

AM Peak Hour



PM Peak Hour



- Alternative 5 is specific to improvements at Wellington Road 124 & Wellington Road 32 (North) only.

MTE FILE No: 41093-200-FD1.7
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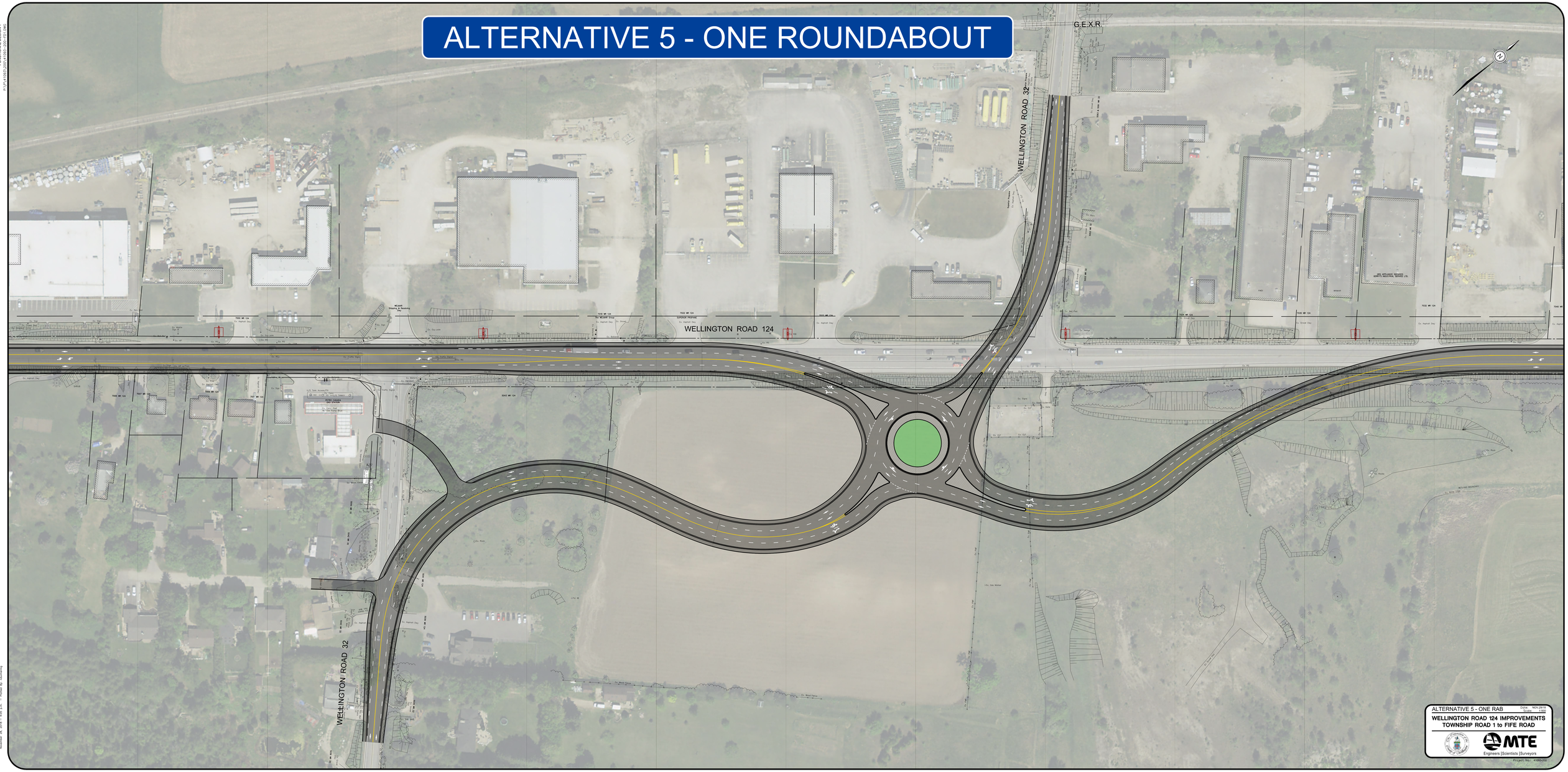
November 28, 2018 – 4:05 p.m. – Plotted By: Jaydenberg

ALTERNATIVE 5 - ONE ROUNDABOUT



ALTERNATIVE 5 - ONE RAB
Date: NOV.2018
Scale: 1:500

WELLINGTON ROAD 124 IMPROVEMENTS
TOWNSHIP ROAD 1 to FIFE ROAD

MTE
Engineers |Scientists |Surveyors

Project No.: 41093-200

WELLINGTON COUNTY ROAD 124 CLASS EA

Evaluation Matrix

Alternatives	Criteria				
	Social/Cultural Environment	**Natural Environment**	**Heritage/Archaeological Environment**	**Traffic Considerations**	**Costs**
Do nothing	Traffic congestion will continue to cause delays. No property required	No additional impacts to Natural Environment	No Heritage or Archaeological impacts	No improvements to current traffic conditions – congestion will continue/get worse (2041 LOS E-F)	Ongoing maintenance costs
Two lanes (One lane each direction)	Addresses congestion somewhat. Minimal Property required. Access issues remain, plus no left turn access between 32's Property widenings required at 6 properties	Very Minor impacts to Natural Environment. Ellis Creek Culvert requires minor widening	No Direct Heritage or Archaeological impacts	Improves Turn lanes at Rd 32 Intersections. 2014 LOS D-F. Paved shoulder provides area for pedestrians, cyclists and disabled vehicles	Lowest Capital Cost (approx. 10% cheaper than 3 lane option)
Three lanes (One lane each direction plus centre left turn lane)	Addresses congestion somewhat. Convenient left turn access to properties except between "32's". Property widenings required at 24 properties	Very Minor impacts to Natural Environment. Ellis Creek culvert and other culverts will require widening of approx. 4m.	No Direct Heritage or Archaeological impacts	Improves Turn lanes at Rd 32 Intersections. Reduces Congestion/delays 2041 LOS D-F. Paved shoulder provides area for pedestrians, cyclists and disabled vehicles	Estimated Capital Costs of approx. $10M plus HST
Four lanes (Two lanes each direction)	Addresses congestion somewhat. Property widenings required at 34 properties.	Minor impacts to Natural Environment. Ellis Creek culvert and other culverts will require widening of approx. 8m.	No Direct Heritage or Archaeological impacts	Improves Turn lanes at Rd 32 Intersections. Reduces congestion/delays 2041 LOS B-F. Paved shoulder provides area for pedestrians, cyclists and disabled vehicles	Highest Capital Cost (approx. 40% more expensive than 3 lane option)

WELLINGTON COUNTY ROAD 124 CLASS EA

Evaluation Matrix

Alternatives	Criteria				
	Social/Cultural Environment	**Natural Environment**	**Heritage/Archaeological Environment**	**Traffic Considerations**	**Costs**
***Two roundabouts** at WR 32 North and South with 3 lanes east and west of Road 32	Addresses congestion. Property widenings required at 27 properties including 1 potential "buyout". Some access issues near roundabout	Minor impacts to Natural Environment. Ellis Creek culvert and other culverts will require widening of approx. 4m.	No Direct Heritage Impacts. Potential Archaeological Impact between "the 32's" south of Rd 124	Roundabouts decrease severe collisions. Significantly reduces congestion/delays 2041 LOS A-C. Paved shoulder provides area for pedestrians, cyclists and disabled vehicles	Estimated Capital Costs approx. 20% higher than 3 lane signalized option
***Single roundabout** between WR 32 North and South with 3 lanes east and west of Road 32	Addresses congestion. Property widenings required at 29 properties including 1 large potential buyout. Some access issues near roundabout	Minor impacts to Natural Environment. Pot. Snake Habitat. Ellis Creek culvert and other culverts will require widening of approx. 4m.	No Direct Heritage impacts. Potential Archaeological Impact between "the 32's" south of Rd 124	Roundabouts decrease severe collisions. Significantly reduces congestion/delays 2041 LOS A. Paved shoulder provides area for pedestrians, cyclists and disabled vehicles	Estimated Capital Costs approx. 25% higher than the 3 lane signalized option including Engineering $

*** Preliminary Preferred Alternative is Alternative 4 or 5 – Two Roundabouts at the Road 32's or a Single Roundabout plus a three lane cross section in selected areas due to providing a superior traffic Level of Service (LOS).**

NEXT STEPS

- ✓ Please **fill out a comment Sheet, and place in the comment box**, or send them to Don Kudo/Dave Hallman.
- ✓ Project Team will review and address comments from this Public Information Centre as they refine the study and design.
- ✓ After consideration of all comments received from the public and agencies, and in conjunction with all other relevant information and design standards, the Project Team will review the Evaluation and confirm a Recommended Solution in Winter/Spring 2019.
- ✓ After project approval by Wellington County, the project will be "filed" for a public review for 30 days under the Municipal Class EA process. *(All people on the mailing list or signed in tonight will receive a notice of Completion identifying the recommended alternative*).

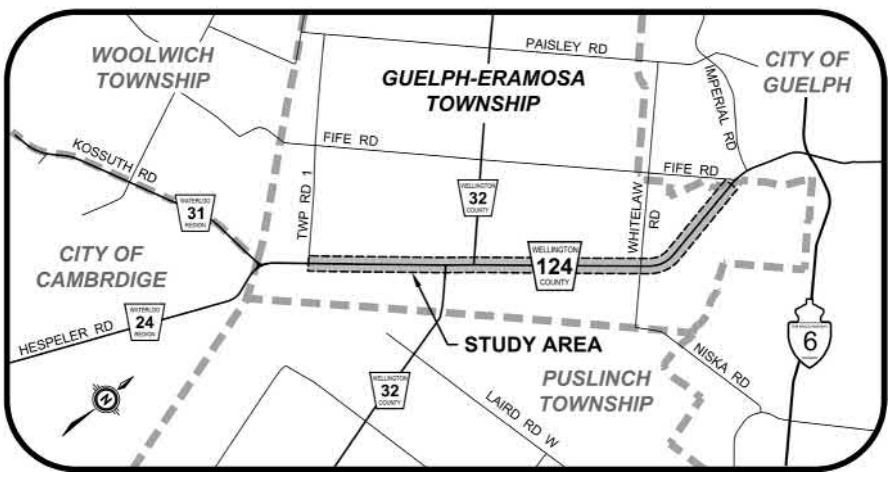
APPENDIX E3

Public Information Centre No. 2

COUNTY OF WELLINGTON
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT STUDY
WELLINGTON ROAD 124 IMPROVEMENTS
TOWNSHIP ROAD 1 TO FIFE ROAD

NOTICE OF PUBLIC INFORMATION CENTRE #2

The County of Wellington is conducting a Schedule C Municipal Class Environmental Assessment (Class EA) Study for improvements to Wellington Road 124 between Guelph Eramosa Township Road 1 and Fife Road. The improvements aim to address the growing traffic congestion along the corridor as well as road safety, intersection functionality and drainage. The study will define the problem, identify and evaluate alternative solutions and design concepts, recommend a design, assess potential impacts and identify mitigation measures associated with the preferred design. MTE has been retained by the County of Wellington to complete the EA Study.



In accordance with the requirements for Schedule C projects of the Municipal Class EA process, Wellington County will be hosting a second Public Information Centre where the public is invited to review the proposed preferred design alternative and provide comments.

The Public Information Centre will be an "Open House" format and will be held on **Wednesday, June 19, 2019 from 5:00 to 8:00 pm** at:

Sanimax Offices
5068 Whitelaw Road (Corner of County Road 124)
Guelph, Ontario

Representatives from the County of Wellington and MTE Consultants will be present at the Public Information Centre to help you review the plans and answer questions regarding the Municipal Class EA process and the preferred design alternative. If you have any questions or comments regarding the Study or wish to be added to the Study mailing list, please contact either of the following project team members:

Don Kudo. P. Eng
County Engineer
County of Wellington
74 Woolwich Street
Guelph ON N1H 3T9
T: 519.837.2601 x 2280
F: 519.837.8138
E: donk@wellington.ca

Dave Hallman, P. Eng
Consultant Project Manager
MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener ON N2B 3X9
T: 519.743.6500 x 1336
F: 519.743.6513
E: dhallman@mte85.com

This notice first issued on June 6, 2019
For more information on this project, please visit www.wellington.ca

Information will be collected in accordance with the Freedom of Information and Protection of Privacy Act and will become part of the public record.

Alternate formats available upon request

PUBLIC INFORMATION CENTRE

WELLINGTON ROAD 124 ENVIRONMENTAL ASSESSMENT
June 19, 2019
5:00 p.m. to 8:00 p.m.

Sanimax Offices
5068 Whitelaw Road
Guelph

COMMENT SHEET

Please complete and hand in this sheet so that your views can be considered for this project. If you cannot complete your comments today, please take this home and mail, fax or email your comments by **July 5, 2019** to either Mr. Don Kudo or Mr. Dave Hallman (contact information on the back of page).

1. Is there a roundabout option you prefer?

6A ☐ 6B ☐ 6C ☐ Other (describe below) ☐ No Preference ☐

2. Are there any other general comments you have on this project (continued on back)?

3. Do you wish to be placed on the mailing list for this project? Yes ☐ No ☐

Name: _____

Address: _____

Postal Code: _____

Phone & Email: _____

Thank you for your interest and time.

Please return this comment sheet to either:

Mr. Don Kudo, P.Eng.
County Engineer
County of Wellington
74 Woolwich Street
Guelph, ON N1H 3T9
Telephone: (519) 837-2601 x2280
Fax: (519) 837-8138
Email: donk@wellington.ca

Mr. Dave Hallman, P. Eng.
Consultant Project Manager
MTE Consultants Inc.
502 Bingemans Centre Drive
Kitchener, ON N2B 3X9
Telephone: (519) 743-6500 x1336
Fax: (519) 743-6513
Email: dhallman@mte85.com

Collection Notice

Personal information requested on this form is collected under the authority of the "Municipal Act" and will be used to assist the County of Wellington in making a decision on this project. Any personal information such as name, address, telephone number and/or property location included in a submission from the public may become part of the public record file for this matter. Questions regarding this collection should be forwarded to the County Engineer, Don Kudo by phone at (519) 837-2601 x2280 or email at donk@wellington.ca

MTE FILE No: 41093-200-FD4.1
DESIGN ALTERNATIVE 6 - PREFERED
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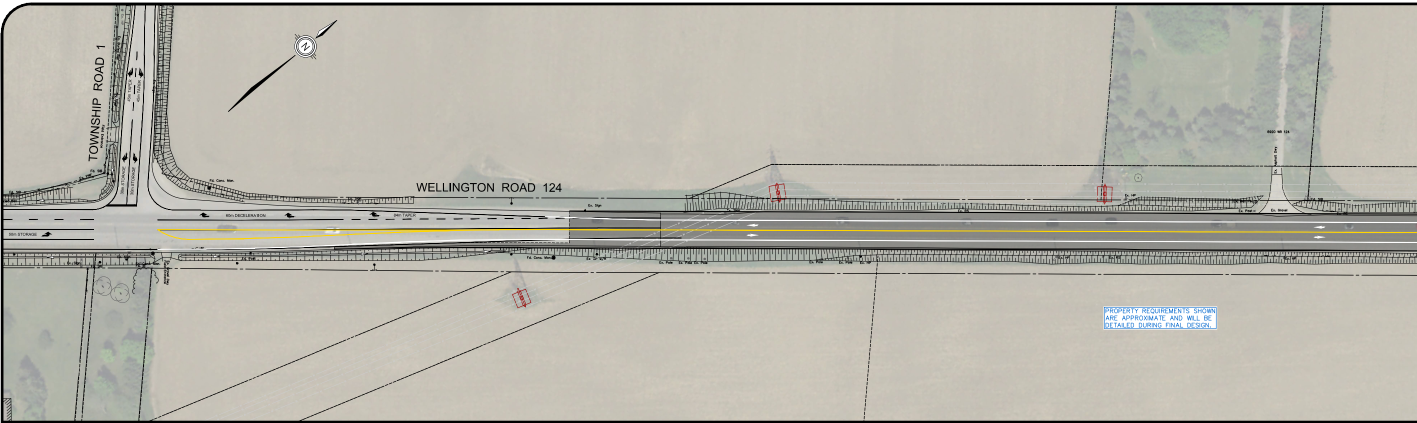
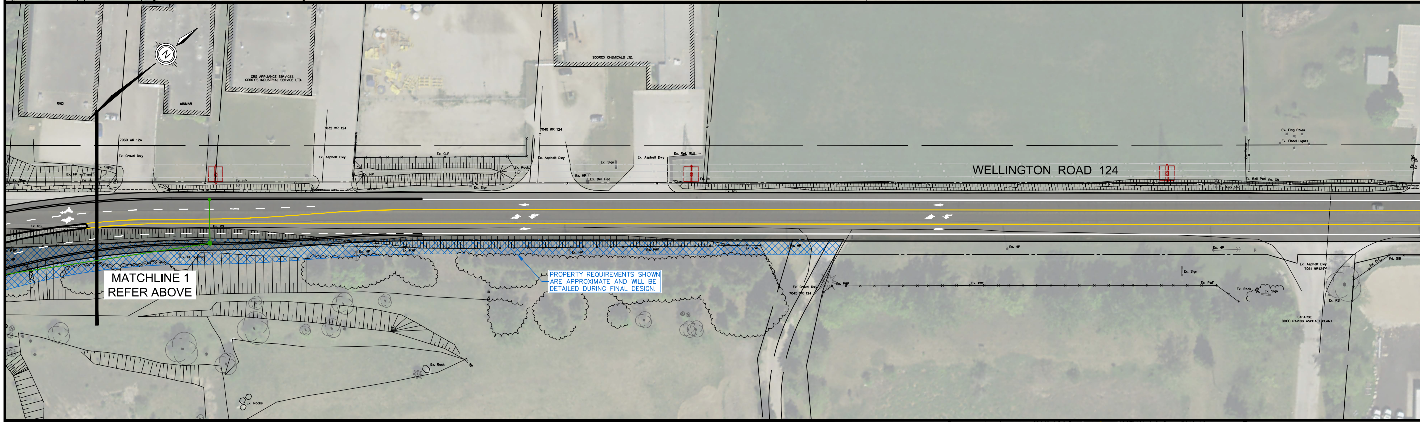
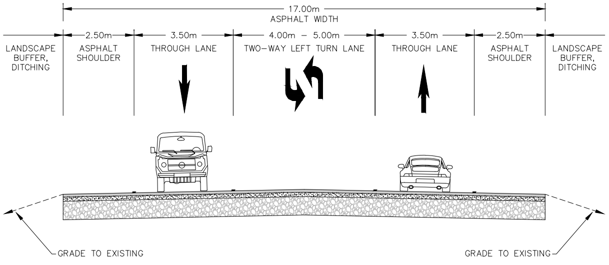

N
TOWNSHIP ROAD 1
45m TAPER
45m TAPER
30m STORAGE
30m STORAGE
WELLINGTON ROAD 124
60m DECELERATION
64m TAPER
50m STORAGE
Fd. Conc. Mon.
Ex. Sign
Ex. Pole
6920 WR 124
PROPERTY REQUIREMENTS SHOWN ARE APPROXIMATE AND WILL BE DETAILED DURING FINAL DESIGN.

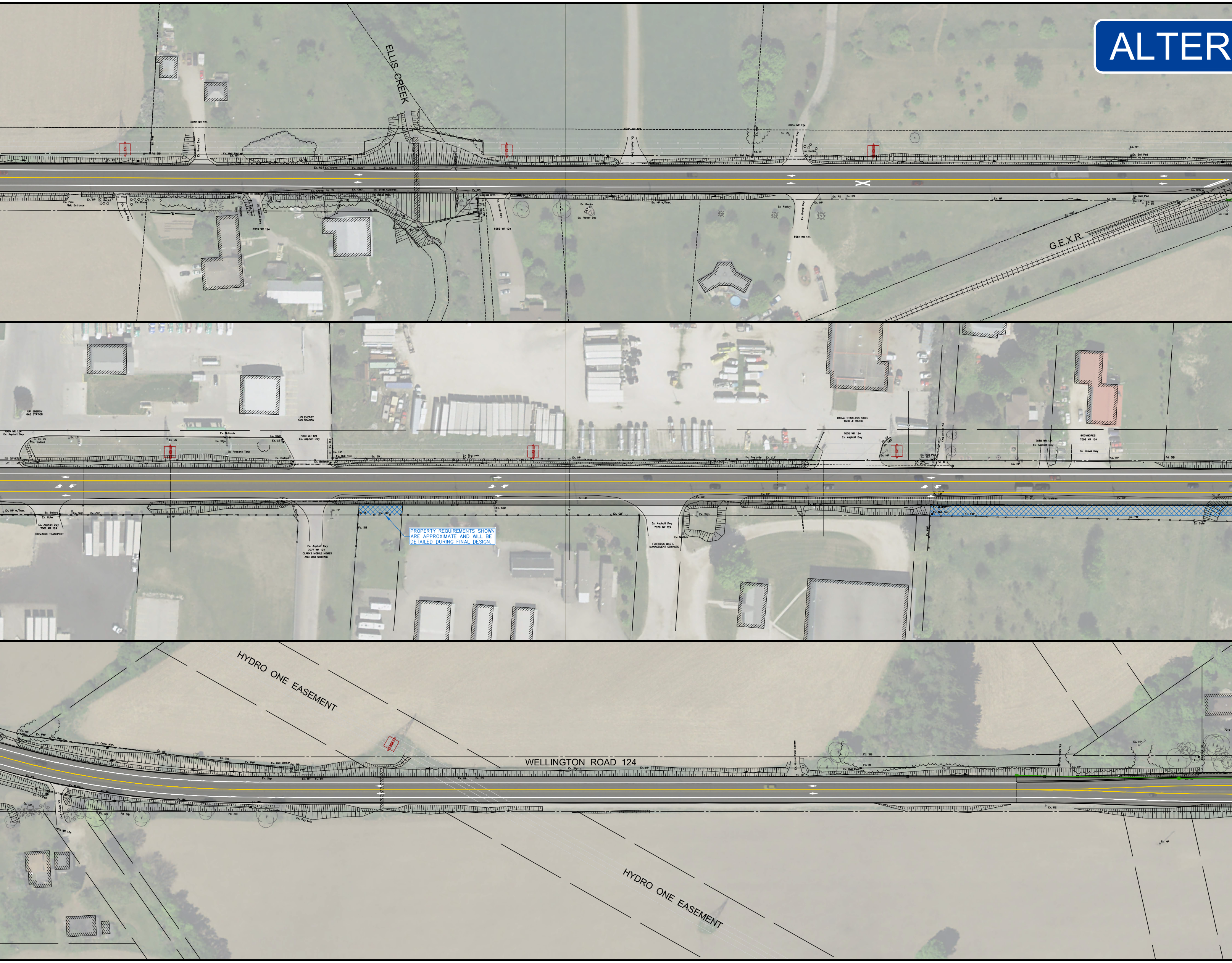

N
QRS APPLIANCE SERVICES GERRY'S INDUSTRIAL SERVICE LTD.
SODROX CHEMICALS LTD.
7030 WR 124
7032 WR 124
7040 WR 124
Ex. Gravel Dwy
Ex. Asphalt Dwy
Ex. Sign
Ex. Bell Ped
Ex. Flag Poles
Ex. Flood Lights
WELLINGTON ROAD 124
MATCHLINE 1
REFER ABOVE
PROPERTY REQUIREMENTS SHOWN ARE APPROXIMATE AND WILL BE DETAILED DURING FINAL DESIGN.
Ex. HP
Ex. Rock
Ex. Rocks
Ex. Gravel Dwy
7045 WR 124
Ex. Asphalt Dwy
7051 WR124
LAFARGE
COCO PAVING ASPHALT PLANT


17.00m
ASPHALT WIDTH
LANDSCAPE BUFFER, DITCHING
2.50m
ASPHALT SHOULDER
3.50m
THROUGH LANE
4.00m – 5.00m
TWO–WAY LEFT TURN LANE
3.50m
THROUGH LANE
2.50m
ASPHALT SHOULDER
LANDSCAPE BUFFER, DITCHING
GRADE TO EXISTING
GRADE TO EXISTING

RURAL 3 LANE SECTION

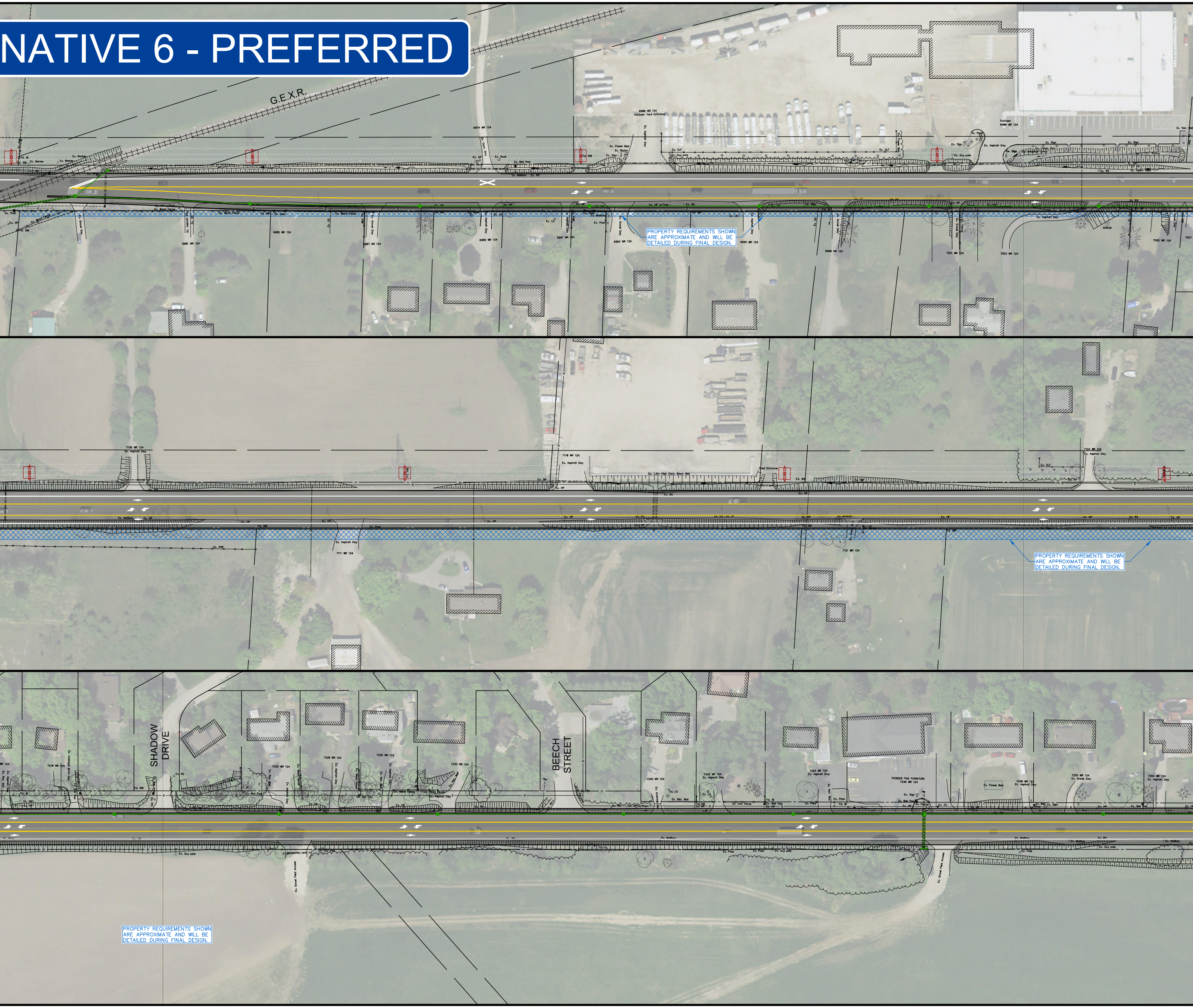
MATCHLINE 2
REFER ABOVE
Ex. Gravel Dwy Field Access
Ex. Bell Ped
N

June 19, 2019 — 10:30 a.m. — Plotted By: nduimering


ALTER
ELLIS CREEK
6932 WR 124
6939 WR 124
6944 WR 124
6954 WR 124
6955 WR 124
6961 WR 124
Ex. Pole Field Entrance
Ex. Gravel Dwy
Ex. Asphalt Dwy
Ex. Propane Tank
Ex. Ret. Wall
Ex. RS
Ex. Gravel
Ex. C&G
Ex. Steel Guiderail
Ex. Bell Ped
Ex. HP
Ex. HP w/Tran.
Ex. PWF
Ex. Mailbox
Ex. Rocks
Ex. Flower Bed
Ex. LS
Fd. SIB
Fd. IB
Fd. Conc. Mon.
G.E.X.R.
UPI ENERGY GAS STATION
7060 WR 124
Ex. Asphalt Dwy
Ex. Bollard
Ex. Bollards
Ex. Sign
Ex. Propane Tank
Ex. C&G
Ex. CLF
Ex. GM
Ex. Guy pole
Ex. Gate
Ex. Asphalt Dwy
7061 WR 124
CORMAKYE TRANSPORT
Ex. Asphalt Dwy
7077 WR 124
CLARKS MOBILE HOMES AND MINI STORAGE
Ex. Asphalt Dwy
7079 WR 124
FORTRESS WASTE MANAGEMENT SERVICES
ROYAL STAINLESS STEEL TANK & TRUCK
7076 WR 124
Ex. Asphalt Dwy
Ex. Gravel Dwy
7088 WR 124
Ex. Asphalt Dwy
BODYWORKS
7096 WR 124
Ex. Gravel Dwy
Ex. Post
Ex. Mailbox
Ex. PWF
Ex. Gate
HYDRO ONE EASEMENT
WELLINGTON ROAD 124
HYDRO ONE EASEMENT

PROPERTY REQUIREMENTS SHOWN ARE APPROXIMATE AND WILL BE DETAILED DURING FINAL DESIGN.

NATIVE 6 - PREFERRED

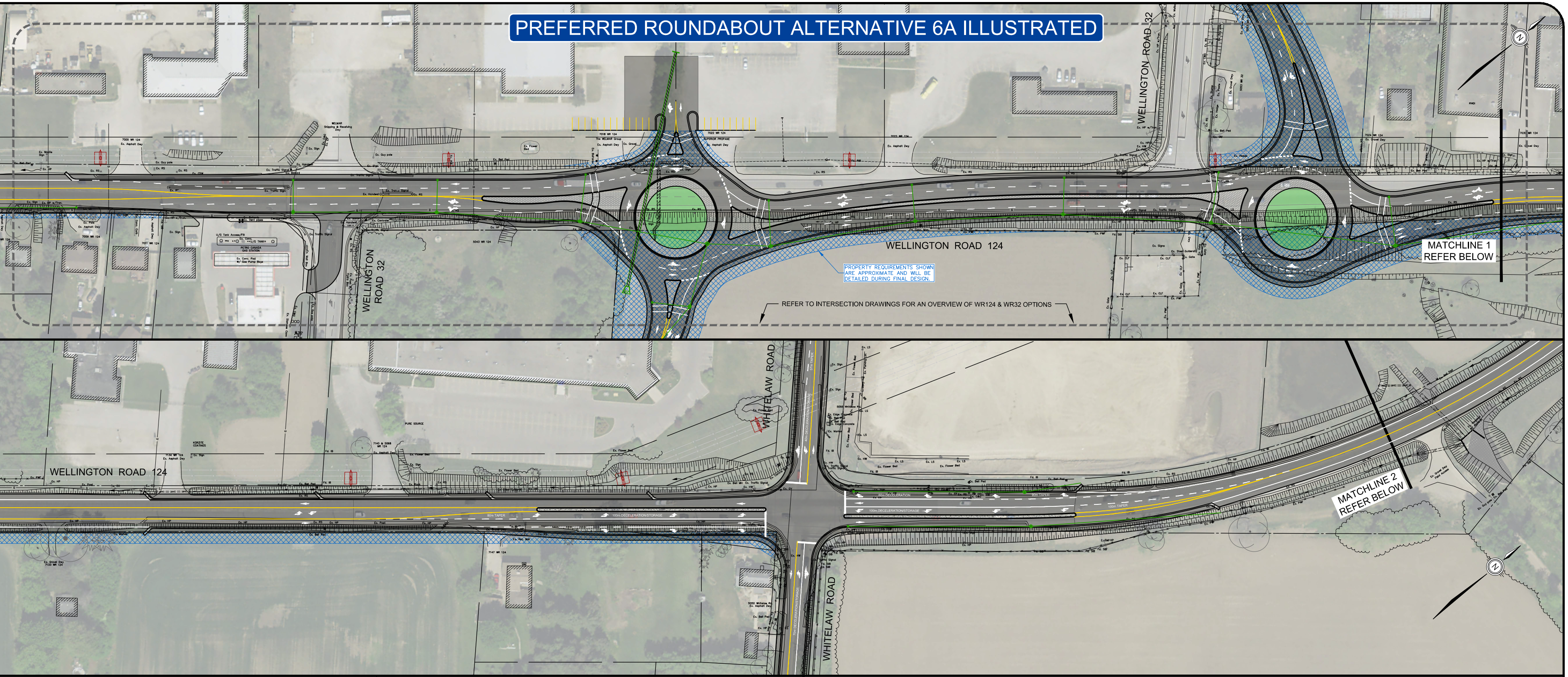

G.E.X.R.
6974 WR 124
6966 WR 124
FloChem Yard Entrance
6981 WR 124
6985 WR 124
6987 WR 124
6989 WR 124
6991 WR 124
6993 WR 124
6995 WR 124
6999 WR 124
7001 WR 124
7003 WR 124
7005 WR 124
7106 WR 124
Ex. Asphalt Dwy
7111 WR 124
7118 WR 124
7121 WR 124
7124 WR 124
SHADOW DRIVE
BEECH STREET
7218 WR 124
7226 WR 124
7228 WR 124
7230 WR 124
7232 WR 124
7240 WR 124
7242 WR 124
7244 WR 124
Ex. Asphalt Dwy.
PIONEER FINE FURNITURE
7246 WR 124
Ex. Flower Bed
7248 WR 124
7250 WR 124
7254 WR 124

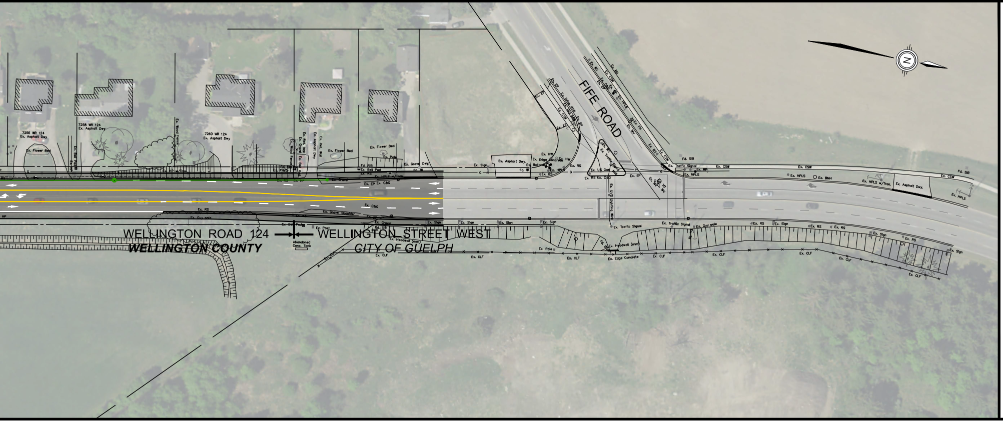
PROPERTY REQUIREMENTS SHOWN ARE APPROXIMATE AND WILL BE DETAILED DURING FINAL DESIGN.

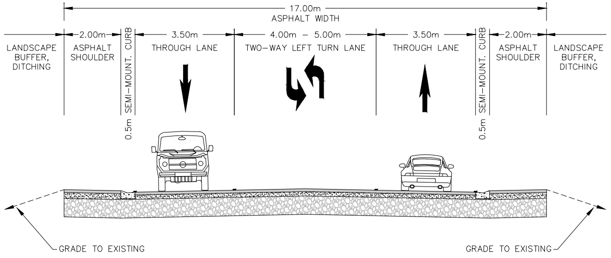
PROPERTY REQUIREMENTS SHOWN ARE APPROXIMATE AND WILL BE DETAILED DURING FINAL DESIGN.

PROPERTY REQUIREMENTS SHOWN ARE APPROXIMATE AND WILL BE DETAILED DURING FINAL DESIGN.

PREFERRED ROUNDABOUT ALTERNATIVE 6A ILLUSTRATED


WELLINGTON ROAD 32
WELLINGTON ROAD 124
WELLINGTON ROAD 32
PROPERTY REQUIREMENTS SHOWN ARE APPROXIMATE AND WILL BE DETAILED DURING FINAL DESIGN.
REFER TO INTERSECTION DRAWINGS FOR AN OVERVIEW OF WR124 & WR32 OPTIONS
MATCHLINE 1
REFER BELOW
WELLINGTON ROAD 124
WHITELAW ROAD
WHITELAW ROAD
MATCHLINE 2
REFER BELOW


FIFE ROAD
WELLINGTON ROAD 124
WELLINGTON COUNTY
WELLINGTON STREET WEST
CITY OF GUELPH


17.00m
ASPHALT WIDTH
2.00m
3.50m
4.00m – 5.00m
3.50m
2.00m
LANDSCAPE BUFFER, DITCHING
ASPHALT SHOULDER
SEMI-MOUNT. CURB
THROUGH LANE
TWO-WAY LEFT TURN LANE
THROUGH LANE
SEMI-MOUNT. CURB
ASPHALT SHOULDER
LANDSCAPE BUFFER, DITCHING
0.5m
0.5m
GRADE TO EXISTING
GRADE TO EXISTING

URBAN 3 LANE SECTION

ALTERNATIVE 6 - PREFERED

Date: JUN.19/19
Scale: 1:500

WELLINGTON ROAD 124 IMPROVEMENTS
TOWNSHIP ROAD 1 to FIFE ROAD

The Corporation of the County of Wellington

MTE
Engineers | Scientists | Surveyors

Project No.: 41093-200

ALTERNATIVE 6A - PREFERRED

WELLINGTON ROAD 124

WELLINGTON ROAD 32

RANDELL DRIVE

R800

R750

PROPERTY REQUIREMENTS SHOWN ARE APPROXIMATE AND WILL BE DETAILED DURING FINAL DESIGN.

ALTERNATIVE 6A — Date: JUN/5/19 — Scale: 1:500

WELLINGTON ROAD 124 IMPROVEMENTS
WR 124 & WR 32 SOUTH

MTE Engineers | Scientists | Surveyors

Project No.: 41093-200

MTE FILE No: 41093-200-FD4.2
ALTERNATIVE 6A - TWO ROUNDABOUTS
P:\41093\200\41093-200-FD4.DWG

June 19, 2019 - 10:53 a.m. — Plotted By: mbohning

MTE FILE No. 41093-200-FD4.3
ALTERNATIVE 6B - TWO ROUNDABOUTS
P:\LY\41093\200\41093-200-FD4.DWG

ALTERNATIVE 6B

WELLINGTON ROAD 124

WELLINGTON ROAD 124

WELLINGTON ROAD 124

RANDELL DRIVE

WELLINGTON ROAD 32

R60.0

R75.0

ALTERNATIVE 6B — Date: JUN/19 — Scale: 1:500

WELLINGTON ROAD 124 IMPROVEMENTS
WR 124 & WR 32 SOUTH

MTE Engineers | Scientists | Surveyors

Project No.: 41093-200

June 19, 2019 - 10:50 a.m. - Plotted By: mdunning

ALTERNATIVE 6C

WELLINGTON ROAD 124

WELLINGTON ROAD 124

RANDELL DRIVE

WELLINGTON ROAD 32

R60.0

R75.0

ALTERNATIVE 6C
Date: JUN/19
Scale: 1:500

WELLINGTON ROAD 124 IMPROVEMENTS
WR 124 & WR 32 SOUTH

MTE
Engineers | Scientists | Surveyors

Project No.: 41093-200

WP. FILE No.: 41093-200-FD4.4
ALTERNATIVE 6C - TWO ROUNDABOUTS
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June 19, 2019 - 10:50 a.m. — Plotted By: rebohaning

Welcome

Welcome to **Public Information Centre No. 2 for Wellington County Road 124** Between Township Road 1 and Fife Road

The Project is being planned under Schedule C of the Municipal Class Environmental Assessment (EA) Act.

We ask that you:

- ***Review*** *the Display Boards*
- *Ask any* ***questions*** *you have of the Project Team*
- *Fill out a* ***Comment Sheet*** *with your comments or concerns about the project and the Preferred Alternative*.

WELLINGTON COUNTY ROAD 124 CLASS EA – PIC #2

What is the Purpose of this Pubic Information Centre

- Present the ***Preferred Alternative*** developed based on public and agency feedback, to address the existing congestion and pavement condition on County Road 124.
- To obtain ***feedback*** on the Preferred Alternative, prior to approval by County of Wellington Roads Committee and Council.
- ***Address*** any questions or concerns you may have regarding this project, prior to filing the Environmental Study Report.

What Problem(s) Are Being Solved

Each Class EA must have a Problem or Opportunity Statement.

County Road 124 – Problem/Opportunity Statement

Wellington County Road 124 from Township Road 1 to Fife Road is in need of improvements to address existing traffic deficiencies including poor/deteriorating levels of service at the intersections with Wellington Road 32 North and Road 32 South, as well as plan for future traffic growth along this important corridor. Improvements must also address the existing pavement condition while providing safe public access to the greatest possible extent.

What Studies Have Been Completed?

- ✓ Traffic Study
- ✓ Natural Environment Constraints Report
- ✓ Stage 1 Archaeological Assessment
- ✓ Built Heritage and Cultural Landscape Assessment

What Alternatives Have Been Considered?

There are three Main Categories of Alternatives that have been considered:

CROSS SECTION

- **Rural** – Similar to existing cross-sections with paved shoulders and ditches
- **Urban** – Mountable Curb separating the traffic lanes and paved shoulders.

NUMBER OF LANES

- **2 Lane** – one lane in each direction with turn lanes at intersections as required.
- **3 Lane** – one lane in each direction with a centre two way left turn in selected areas.
- **4 Lane** – two lanes in each direction with turn lanes at intersections as required.

INTERSECTION IMPROVEMENTS

- **Signalized Intersections with Turn Lanes**
- **Roundabouts**

What is the Preferred Alternative?

A preferred alternative has been developed based on public and agency feedback and additional technical review. The "Preferred Alternative" drawing is illustrated as "***Preferred Alternative 6***". In general, the Preferred Alternative is described as:

- ✓ The preferred ***road cross-section*** is a combination of two and three lane rural or urban cross section, with a four lane urban cross section including a centre median between the Road 32 Intersections. A three lane cross-section is shown in areas with multiple driveway accesses to improve safety for turning vehicles and reduce congestion for through vehicles.
- ✓ The ***Road 32 Intersections*** consist of a Roundabout at Road 32 North and at Road 32 South (i.e. two Roundabouts, similar to Alternative 5 at PIC No. 1). The ***Road 32 Roundabouts*** in the Preferred Alternative 6 have been modified somewhat from what was shown at PIC No. 1, to address public comments including private property and driveway access issues.
- ✓ For the ***Road 32 South Roundabout,*** there are three proposed options or alternatives (Alternatives 6A, 6B and 6C) presented for additional comment. Each alternative has different property impacts and access requirements.

Why is Alternative No. 6 Preferred?

- ✓ Areas with a ***centre two way left turn lane*** provide an area to turn in and out of properties in areas with multiple driveways. It provides safety benefits for turning vehicles and reduces delays for through traffic.
- ✓ Two lanes with areas of a center left turn lane will provide ***sufficient capacity*** for the anticipated volumes of traffic within the project limits.
- ✓ Although through traffic will experience less delays due to left turning vehicles not being in the through lanes as well as provide increased capacity, there are clear safety benefits of a centre left turn lane. ***The existing 70 km/h speed limit is not proposed to be changed***
- ✓ A signalized intersection at the two Road 32 intersections have, or will reach their ultimate capacity due to the volumes and type of turning movements required. The two Roundabouts at the Road 32 Intersections, perform best with respect to ***capacity, congestion and delays*** on Road 124 and Road 32.

Why is Alternative No. 6 Preferred?

- ✓ Road 124 and ***Whitelaw Road intersection will remain signalized*** with upgrades and revised turn lanes, which will accommodate the forecasted traffic volumes and turning movements.
- ✓ Two Roundabouts at Road 32 are ***slightly less expensive*** than the Single Roundabout alternative, due to less pavement and less overall private property requirements.
- ✓ One of the important benefits of Roundabouts, is ***improved safety*** especially with respect to reducing high speeds and fatal/injury collisions. In concert with the roundabout alternatives, a center median between the two roundabouts is included to address access safety issues. Although only "right-in/right-out" movements are provided between the two roundabouts, "left turn" movements are provided by utilizing the roundabouts.
- ✓ The roundabouts will also ***provide traffic flow benefits*** at the Road 32 and Road 124 intersections due to their increase capacity compared to signalized intersections.

How will some of the issues be addressed?

Will Speed Limits be increased?

There are no plans to increase the current speed limits. In the area of the roundabouts, speed limit reductions will be considered as part of detail design.

If property is required, how will the County obtain my property?

Once the project is approved, property impact plans will be developed detailing the exact property requirements. The County will meet with the property owners to initiate a process for a fair and equitable agreement for property acquisition for the property owners and the County. Most property acquisition agreements need to be approved by County Council as part of the Expropriations Act.

How are potential impacts to the natural environment being addressed?

A natural environment study has been completed as part of this study. Although the design has attempted to reduce or minimize impacts to the natural environment, some culvert extensions and replacements will be required. The Grand River Conservation Authority (GRCA), Ministry of Natural Resources and Forestry (MNRF) and Fisheries and Ocean Canada (DFO) are aware of this study and approvals will be required from them prior to construction.

NEXT STEPS

- ✓ Please **fill out a comment Sheet, and place in the comment box**, or send them to Don Kudo/Dave Hallman.
- ✓ After consideration of all comments received from the public and agencies in conjunction with other relevant approval and design standards, the Project Team will review the Evaluation and **present the Recommended Solution to Wellington County Roads Committee and Council in the Fall of 2019.**
- ✓ **Construction timing and staging** will be determined after project approval, and property acquisition timing is finalized.
- ✓ After project approval by Wellington County, the project will be **"filed" for public review for 30 days** under the Municipal Class EA process. *(All people on the mailing list or signed in tonight will receive a notice of Completion identifying the recommended alternative*).

PUBLIC INFORMATION CENTRE

WELLINGTON ROAD 124 ENVIRONMENTAL ASSESSMENT

June 19, 2019
5:00 p.m. to 8:00 p.m.

Sanimax Offices
5068 Whitelaw Road
Guelph

SIGN-IN SHEET

	Name (Please Print)	Address
1	susan.frasson@woodplc.com Susan Frasson	5068 whitelaw Rd - Unit #1
2	Peter Bernardi	4494 Wellington Rd 35 - N0B 2J0
3	Scott Robinson	4526 Side Rd 20th N1H6J3
4	BRUCE DICKIESON	5204 WELL RD 32
5	RANDY BELLAMY	5129 TWSP RD 1
6	Joseph Koch	7068 Hwy 124 / Towcon Holdings
7	Dave Walden	5081 County Rd 32
8	JAGDEEP CHAKICAL	5053 Wellington Rd. 32.
9	IAN PANABAKER	5068 WHITELAW RD. Unit.
10	Margaret Paul	6920 Wellington Rd 124

Collection Notice

Personal information requested on this form is collected under the authority of the "Municipal Act" and will be used to assist the County of Wellington in making a decision on this project. Any personal information such as name, address, telephone number and/or property location included in a submission from the public may become part of the public record file for this matter. Questions regarding this collection should be forwarded to the County Engineer, Don Kudo by phone at (519) 837-2601 x2280 or email at donk@wellington.ca

	Name (Please Print)	Address
11	ASTRID CLOS	AJC PLANNING
12	Roy PAUL	6920 Wellington Rd 124
13	Patricia Spedaler	7091 Fife Road
14	Jake Bakelaar	6638 Wellington Rd 34
15	CHRIS WHITE	GUELPH/ERAMOSA.
16	Christine Billings	City of Guelph Councillor
17	Kate Hoffman	5041 Wellington Rd 32
18	Blair & Spedaler	7091 Fife Rd.
19	Janice Richards	7018 Wellington Rd 124
20	Brian Richards	" " " "
21	LINDA HOFFMAN	7098 Wellington Rd #124
22	BRIAN HOFFMAN	7098 WELLINGTON RD #124
23	SUSAN McSHERRY	13 SHARON DR. RR6 GUELPH.
24	Nancy Wilson	5035 Wellington Rd 32
25	Neil Whitehall	5036 Wellington Rd 32
26	Amy Strom	5089 Wellington Rd 32
27	Channing Strom	" "
28	Jeff Schwaitz	7007 Wellington Rd. #124
29	Mike Boden	13 Randell Dr.
30	Dave White	6844 Wellington Rd 124

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	Name (Please Print)	Address
31	TANYA OLSEN	6999 Wellington Rd 124 Elora ON.
32	DON SCHWARTZENTRUBER	7118 WELLINGTON RD 124
33	Jean Stahlbaum	5134 Wellington Rd. 32 RR#7
34	David Brandon	5050 Whitelaw Rd
35	Carrie Brandon	5050 Whitelaw Rd
36	Fred Stahlbaum	5134 Wellington Rd 32 RR#7
37	JEFF MAY	7118 WELLINGTON RD 124.
38	Agnes Belosic	7086 FIFE RD Guelph, ON.
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APPENDIX E4

Public Information Centre No. 1 and 2 - Comments and Responses

Comment Tracking Form PIC No. 1
Wellington Road 124 Class EA

	First Name	Last Name	Cross-Section			Number of Lanes				Intersections			Comments	Wish to be on mailing list	Initial Written Response and Date	Project Team Response
			Rural	Urban	Hybrid	2	3	4	Other	Signalized	2 RABs	1 RAB				
1	Kevin	Cowbrough	X					X				X	Roundabouts need to be larger to accommodate trucks and farm equipment	Yes		- RABs will be sized appropriately with semi-mountable or mountable curbs to allow for larger vehicles and farm equipment
2					X				X			X				
3					X		X					X				
4	Patty	Bell	X			X						X	Why not add a right hand turn lane westbound on 124 at Beech St. (fatal accident 2 yrs ago because of this exact situation)? Perhaps take all the land to widen 124 from Fife to Shadow on south side (farmland) instead of impacting dozens of houses (incl. driveways being more severe angle, septic systems, not to mention noise). What about a pedestrian path or sidewalk from Fife to Shadow. Currently people walking along highway have to deal with dangerously close vehicles, esp. at night as there is no lighting. Consideration to decrease speed limit from Fife to Whitelaw? 70 km is too fast for vehicles in front of residential area. Easy to change a speed limit sign.	Yes		- Insufficient right turns to warrant its own lane. The centre left turn lane option can address this issue as well as allowing for left turn movements in and out of the subdivision at Beech and Shadow. Cars have the option of using a wider paved shoulder to slow down out of the way of through traffic. - the plan is to widen to the south for less residential property impacts - we are looking at ways to incorporate active transportation i.e. walking and biking and this will be addressed in detailed design. A paved shoulder will allow for cyclists, and possibly for pedestrians. Opportunities to include a sidewalk on the north side in this residential area will be explored. - attempting to balance the needs of all road users when looking at speed limits and consider how well they can be enforced
5	Steve	Knight	X			X				X			Traffic flow is sufficient so far, and already fast enough, school buses between Beech, Shadow. 24 is not policed enough as it is, 3 & 4 lanes is just an advert for speeding more than it is.	Yes		- RAB solution attempts to address this issue by keeping lanes narrow as opposed to signalized which requires more lanes to handle traffic - attempting to balance the needs of all road users when looking at speed limits. OPP will be advised of your enforcement comments.
6	Susan	Frasson		X				X			X		This has been a debated topic for more than 30 years. It's time to expand 24 to 4 lanes.	Yes		- 4 lanes is an option we are considering and justification will be based on a number of evaluation factors including addressing congestion etc. May be implemented in stages or at certain locations along the road.
7	Scott	Robinson		X			X				X			Yes		
8	Fred	Stahlbaum	X			X							No right turns on red lights. "None" preferred for intersection improvements. This study is being done without Niska Rd Bridge being completed.	Yes		- the traffic study will guide choices with respect to potential signal operations and lane configurations, as well as Roundabouts. - EA study is attempting to improve traffic conditions such as congestion and safety for the next 20 years - traffic consultant will review the Niska Road traffic volumes and whether the bridge closure is affecting the results
9	Agnes	Belosic	X				X					X	For one roundabout, I would like to suggest to move the roundabout more to the west. Drivers from Cambridge turning south on Cty. Rd 32 would not have to drive there and back on a large curve. Once Niska Bridge is reopened, there'll be many more cars crossing at Whitelaw Rd & 124 going south across the bridge. More by email.	Yes		- if the one roundabout option is preferred the location will be reviewed in further design stages. Moving the roundabout further west may result in significant impacts (i.e. removal/relocation) to the building on the northwest corner of County Rd 124 and County Rd 32N. Accesses to existing gas station and driveways and incoming road alignments are all considered. - traffic consultant will review the Niska Road traffic volumes and whether the bridge closure is affecting the results

	First Name	Last Name	Cross-Section			Number of Lanes				Intersections			Comments	Wish to be on mailing list	Initial Written Response and Date	Project Team Response
			Rural	Urban	Hybrid	2	3	4	Other	Signalized	2 RABs	1 RAB				
10	Neil	Whitehall	X				X				X		2 roundabouts with traffic control of speed. Speed control at 32 & 124, what happens to the land near the roundabouts. What will be done for noise control for people closest to the roundabouts.	Yes		- speed will be limited (lowered) in the roundabout and approaches - once it is determined how much land is needed (differs for various options) land will be purchased from the property owners. - noise control and mitigation will be studied and incorporated into the final design option. However noise cannot be mitigated for front lotted properties with driveway openings.
11	Linda	Parolin		X			X					X	From the one roundabout on Wellington 32 N the new 4 lane highway 124 goes south of the present highway and connects to the existing highway and turns into 3 lanes. Keep the new 4 lane highway south of the present highway and connect at Fife Rd. This way all houses along # 124 between Whitelaw and Fife will not have to enter the highway at all. The section between Whitelaw and Fife will become a dead end street. Much safer for the 25 homes along this area. Two years ago there was a fatal accident at Beech St and # 124. A third lane between Whitelaw and Fife will become a suicide lane and not improve safety - simply bandage the problem.	Yes		- The option to build a new roadway on a different alignment will require significant additional study and Class EA. A new alignment is not deemed required when improvements to the existing County Road 124 road allowance will address the congestion and safety issues until at least 2041. A new alignment will also potentially require property from farmland and significant natural environment areas including a potential new crossing of the Speed River. - 'There are insufficient right turns to warrant its own lane. The centre left turn lane option can address this issue as well as allowing for left turn movements in and out of the subdivision at Beech and Shadow. Cars have the option of using a wider paved shoulder to slow down out of the way of through traffic.
12							X					X	Reduced speed limit between Fife and Whitelaw to accommodate residential area and turning lane. There was a fatal accident at 124 and Beech ~ Dec 2016?	No		- attempting to balance the needs of all road users when looking at speed limits and will advsie the OPP of your comments. A center left turn lane can be used to provide safer turning movements in this area.
13	Robin-Lee	Norris		X				X			X			Yes		
14	Susan	McSherry	X					X				X	Farm equipment/machinery movement must be taken into consideration. 3 lanes are dangerous, 2 lanes are no longer able to handle volume of traffic. (1) Would like more information about zoning and land expropriation. (2) Have concerns about bridge on Cty Rd 32 south + the new bridge on Niska Road as far as truck traffic is concerned. How will it be controlled? (3) Very concerned about blind "boomerang" corner leading to hill (past Whitelaw Rd, heading toward Guelph). For people living in Shadow Dr/Beech St/Hwy 124 this part of 124 is dangerous. Controls? Turning left off hwy 124 onto Shadow or Beech or into a driveway is dangerous. Being unable to see what is happening down or up the 124 hill is also dangerous given the speed autos/trucks are travelling.	Yes		- RABs will be sized appropriately with semi-mountable or mountable curbs to allow for larger vehicles and farm equipment - send more info? exact property impacts will depend on the preferred option but those who would be impacted the most have already been contacted - attempting to balance the needs of all road users when looking at speed limits and consider how well they can be enforced - a centre left turn lane will give cars a safer place to wait when making their turn however speed and sight lines will be considered during detailed design
15	Margaret	Paul	X									X	If option 5 - would our mailboxes be moved? Short term help you could install a right turn signal at 32N so traffic could flow while 124 has the left turn signal. That would allow the through traffic signal on 124 to be longer and hopefully reduce some of the backlog. A right turn signal could be added for 32 S also. Thank you for addressing this most frustrating traffic issue.	Yes		- It is unclear where the mailboxes for this area are currently located - the traffic study will guide choices with respect to signal operations and restrictions
16			X				X					X				
17	Melinda	Varnai		X			X	X			X		I believe the road improvements/upgrades are absolutely necessary. Long overdue.	Yes		
18	G.	Gartner (Koopmans)	X				X					X	Proper drainage ditches. Water run-off from Hwy floods and washes out our driveway. A berm for noise reduction.	Yes		- drainage and noise issues will be looked at during detailed design once the preferred option is selected noise control and mitigation will be studied and incorporated into the final design option. However noise cannot be mitigated for front lotted properties with driveway openings.

	First Name	Last Name	Cross-Section			Number of Lanes				Intersections			Comments	Wish to be on mailing list	Initial Written Response and Date	Project Team Response
			Rural	Urban	Hybrid	2	3	4	Other	Signalized	2 RABs	1 RAB				
19	David	Brandow	X				X					X	Lane question is poorly worded (how many lanes outside the roundabouts?) 4 lanes is overkill - outside the area between the 32s traffic is fine, even with the massive delay in the middle. Preface: We live at Whitelaw and 124, right on the corner. 1) The estimates for the traffic going south on Whitelaw from 124 are really, really bad. Right now, the bridge is closed. The estimate reads 19 - it should be closer to 500 or a thousand. That road is very, very busy when the bridge is open. 2) 124 and Whitelaw have no drainage ditches. They badly need them. 3) Most of the plans involve taking a substantial chunk out of our north yard. As per my understanding, we are already too close. 4) Most of the plans involve wiping out our well. This would need to be addressed. 5) Instead of eating into our property, you could easily eat into the farmer's field east of Whitelaw. 6) For the single roundabout, which I prefer, I would make it larger to accommodate large trucks (there are 2 trucking businesses on Whitelaw, north of 124). 7) I'm concerned that since question #2 is unclear (not differentiating between different sections of the road), you will get highly misleading results 8) Would construction be done all at once, or in stages? If the latter, what/when would those stages be? 9) What is the plan for traffic during construction? Rerouting? 10) We should have a fence/berm for safety, given how close the road would be.	Yes		- RAB solution attempts to address this issue by keeping lanes narrow as opposed to signalized which requires more lanes to handle traffic - 4 lanes is an option we are considering and justification will be based on a number of evaluation factors. May be implemented in stages or at certain locations along the road. - traffic consultant will review numbers and whether bridge closure is affecting the results - exact property impacts will depend on the preferred option and will be discussed with the owners - RABs will be sized appropriately with semi-mountable or mountable curbs to allow for larger vehicles and farm equipment - PIC is meant to get a general overview of public opinions as to what aspects are preferred, comments are very helpful in pointing out specific issues - project timeline spans approx. 5 years beginning in 2020 with the 32s - construction staging and bypass/detour plans will be looked at as part of detailed design
20	Katherine	Hoffman				X				X			Not sure on first question - would prefer rural but urban may be more safe in terms of accommodating farm machinery (with mountable curb). Question 2 is difficult to answer when I understand that the roundabout proposal for the 32's would dictate the number of lanes. Concern with speed of traffic approaching and exiting roundabouts affecting ability for residents and business clients to safely enter and exit 32 (South of 24). Not obvious what access is available to the Petro Canada. Access to private homes along 32 and 24 in vicinity of proposed roundabouts - not obvious. Did EA consider drainage off of 24 and impact south towards speed river? What consideration given to wildlife - fox, coyote, deer. What is the timeline for this project? Will there be another opportunity for a public meeting/consultation?	Y		- accesses will be further detailed in design of preferred option - drainage issues will be considered during detailed design - natural environment report will provide further study and mitigation recommendations once preferred option is selected - project timeline spans approx. 5 years beginning in 2020 with the 32s - another PIC during EA phase? or not until detailed design/construction?
21	Rob	Close		X	X		X					X	I like the idea of curbs to discourage traffic from going on the shoulders. Put traffic light at 32 and Fife before construction. It will help deal with over flow traffic during construction.	Y		- benefits of urban and rural will be evaluated to consider where different cross-sections make the most sense - construction staging and bypass/detour plans will be looked at as part of detailed design

	First Name	Last Name	Cross-Section			Number of Lanes				Intersections			Comments	Wish to be on mailing list	Initial Written Response and Date	Project Team Response
			Rural	Urban	Hybrid	2	3	4	Other	Signalized	2 RABs	1 RAB				
22	Patricia	Spedaler	X								X		public input does not usually hold much weight, but as the County has been responsible for this road since 1999, it is critical to have it meet long term needs now. The 3 lanes with a centre turn lane would support a limited number of people. The present businesses are not businesses that have a heavy consistent daily customer count. This is specifically a commuter road moving cars between two major city centres that reached its effective capacity 10 years ago. I feel the traffic count has some inaccuracies due to the following reasons: Presently south Guelph are not using the Bailey Bridge access at Whitelaw and 124. This will return to its high volume and increase due to improved road conditions. Potential greater increase of commuters from Paisley Park proposal of 800 units at Paisley and Whitelaw, then a 500 unit complex directly across the street once Paisley Park is completed. With a conceivable number of 2 adults per unit, those numbers could be doubled. Lastly there is an immense number of commuters using surrounding secondary roads to avoid 124. This consistent traffic use will not abate if the design doesn't properly address the issue. The design of 2 roundabouts impinges on fewer properties and has about the same cost as 1 roundabout, so I feel it is adequate. Your introduction indicated your focus was to address existing traffic deficiencies and plan for future growth along this important corridor. So I have attempted to share some aspects that would never have registered on the traffic count that are occurring or will occur in a not too long future. They speak well the present and	Yes		- In order to talke into account future and long term raod requirements, traffic volumes have been forecasted to the year 2041; '- 4 lanes is an option we are considering and justification will be based on a number of evaluation factors. May be implemented in stages or at certain locations along the road. - EA study is attempting to improve traffic conditions for the next 20 years - traffic consultant will review numbers and whether bridge closure is affecting the results, effect of new development
			12	6	3	4	11	5	1	2	6	13				

	First Name	Last Name	Cross-Section			Number of Lanes				Intersections			Comments	Wish to be on mailing list	Initial Written Response and Date	Project Team Response
			Rural	Urban	Hybrid	2	3	4	Other	Signalized	2 RABs	1 RAB				
Emails/calls																
23	Sandy	Nicholls											please send me photos of the snakes found at 124 and 32. please send me the contractor s contact information. Mr. Johnston who found the snakes in the metal structure.	Yes	Dave H, Dec 14 - County employee, not contractor found a snake in the traffic signal controller box, they thought it was a garter snake. The natural environment report does state a garter snake was identified within the project boundaries and potential snake habitat at 32S and 124. Clarified that the report only identifies potential areas of concern at this stage.	
24	Linda	Hoffman											proposed improvements to levels of service for 2041 seem to only take into consideration the flow of traffic. It doesn't appear to address the vehicles trying to access businesses and homes along that stretch of roadway. Traffic circles will allow the through traffic to flow more smoothly, but will make trying to enter or exit the roadway much more difficult, especially during peak traffic times. At least with the traffic lights at 32 and Whitelaw, there might be a chance that traffic will be stopped in one direction.	Yes	Dave H, Dec 4 - forwarded address of County website where information package posted	- access issues will be addressed further during detailed design - a centre left turn lane may be able to address this issue by giving cars a place to turn before entering the lane of traffic
25	Laura	Murr											Unable to download the PIC package from the web page - please forward it to me? Also I would like to receive the traffic data for Whitelaw and 124. current and projected. Was the current data collected while the Niska bridge was closed? From the perspective of the residents in Kortright Hills especially those living on Niska Rd. We would like to request better signage for the truck ban on Niska. Much like the advance truck sign for Fife Rd. The Kortright Hills truck ban is part of the exclusionary truck mapping passed by Guelph City Council as part of our OMB settlement agreement. I have visited and spoken to many of the residents who live on the Whitelaw and Niska portions of the road south of 124 in the County and all support the truck ban on the rural portion of the road. It is my understanding that the city is currently reviewing the truck exclusionary area to extend the ban to the new bridge. In the past there have been very unsafe instances where large transport trucks reached the old Bailey bridge and had to back up to the corner of Whitelaw and Niska to get back onto 124. it is also my hope that the county will consider including wildlife tunnels with exclusionary fencing where the 124 crosses the 2 creeks.	Yes	Dave H, Dec 17 - forwarded PIC information package by email. Traffic consultant to review numbers at Whitelaw/Niska Bridge	- Dave to forward traffic comments, Don to get City's input on trucks - more detailed environmental study and mitigation recommendations will be incorporated into the preferred design

Comment Tracking Form PIC No. 2
Wellington Road 124 Class EA

	First Name	Last Name	Roundabout Option Preferred					Comments	Wish to be on mailing list	Initial Written Response and Date	Project Team Response
			6A	6B	6C	Other	No Pref.				
1	David & Carrie	Brandon					X	As the property owner of 5050 Whitelaw Road, I am very concerned with the westward extension of Whitelaw. As per a legal agreement, we entered into with the Municipality when we purchased it, we were informed that the road was already as close to the house, as it was legally allowed to be. Actually, to be more precise, the road was six inches closer than it was allowed to be. and the fence was six feet closer. The legal agreement we entered into with the municipality allowed these exceptions to continue. By widening the road and moving it closer to the house, you would, to my understanding, be violating both the legal setback and our legal agreement with the municipality.	Yes		As part of the 30% design we have shifted Whitelaw Road slightly further away from 5050 Whitelaw Road. Ina addition, as part of detail design and prior to construction, confirmation on property setbacks and agreements will be undertaken to determine the design requirements at this location.
								As another note on the north corner of the property the proposal would remove our well, so obviously that would need to be addressed to our satisfaction as well.			Impacts on the well will be reviewed as part of detail design. If necessary, the well can be monitored during construction and after construction to determine any impacts to the well.
								Addendum: we had an in person talk which explained road allowance issue. We expressed our firm desire to have Whitelaw be widened to the east towards the empty farmers field, to the extent possible, rather than towards our house.			As noted moving the widening of Whitelaw Road further east on the south side will be reviewed as part of detail design.
2	Channing & Amy	Strom					X	Main concern is construction staging - our season goes from July 20 to October 31.	Yes		Construction timing and staging has not been finalized and will be determined as part of detail design. It is intended to keep the intersection of WR 124 and WR 32N open during the majority, if not all of the construction period.
								Drive by Traffic is most important from July 20 to Sept. 15. Concern:			
								#1 - Open road access up thru 32 N in both directions			See above note.
								#2 - temporary signs directing to Stroms Farm and Bakery			Business signage during construction will be considered as part of detail design. It is intended to also have a "pre-construction" PIC to notify the public of construction and signage can be further reviewed.
								#3 - if roads have to be closed, Mondays and Tuesdays, are slower for business than Wednesdays and Fridays.			This is noted and can be discussed during detail design prior to construction
								Future consideration - Roundabout at Fife Road and Wellington Road 32.			Fife Rd and WR 124 is outside these study limits, but the County regularly reviews the need for intersection upgrades.
3	Neil	Whitehall	X					Our main concern is the water run off from the hill on the south side of the roundabouts. As it is when it rains our property floods from the runoff and spring melt.	Yes		This item is noted and will be reviewed as part of detail design and the need for stormwater management facilities. It appears that not all the water flowing south of WR 124 is from WR124 and is also from private property drawings. This drainage concern will be reviewed as part of detail design

	First Name	Last Name	Roundabout Option Preferred					Comments	Wish to be on mailing list	Initial Written Response and Date	Project Team Response
			6A	6B	6C	Other	No Pref.				
								Don't close off road to gas station. Don't allow left turn (right only) to deter people trying to take short cut turning into our property at 5055 Wellington Road.			A portion of WR Rd 32S will remain open for access to the Petro Canada Station.
								May be a concern as it is now off 32 we often have near misses, rear end collisions.			A portion of WR 124 will be closed off, with access to Randall Drive/WR 32S maintained. WR 32S through traffic will not be travelling in this area.
4	Katherine	Hoffman	X					Choice of 6A - based on very subtle differences between the A/B/C Options	Yes		Option 6B is being recommended, based on detailed discussions with the property owners.
								1. Drainage off of highway 24 south is a big concern - with any rain there is runoff that floods the bottom corner of the field behind highway 24 vet clinic - the roundabout and extensive paving will exacerbate this problem.			This item is noted and will be reviewed as part of detail design and the need for stormwater management facilities. It appears that not all the water flowing south of WR 124 is from WR124 and is also from private property drawings. This drainage concern will be reviewed as part of detail design
								2. Still have concerns with the speed with which drivers approach and leave roundabouts - create a major concern with turning into private properties and businesses along 32S.			At roundabouts, all drivers will have to at least slow down, as opposed to not having to yield or stop if it is a green light.
								3. Mailboxes - currently located opposite Randel Road on 32S. Huge safety issue if these remain at that location.			Location of mailboxes will be reviewed with Canada Post as part of detail design and construction.
								4. Wildlife - what considerations have been given to local wildlife population? Safety for animals and vehicles - deer do cross the farm field and shelter in the bush at corner of 32 & 24.			A natural environment study has been undertaken for this study. As part of detail, design additional signage regrading deer crossings etc. will be considered.
6	Brian	Richards	X					Superior propane elevation is higher than Welmar. When the ditch is filled in drainage will need to be considered. Keep center lane divider as drain so that people can turn right or left out of Welmar's east exit. Extend paved "Ditch Cover" to minimize congestion when leaving Welmar and Superior Propane at peak times.	Yes		With the recommended alternative, full access at the WR 32S roundabouts will be provided at the Welmar west access. Drainage will be reviewed as part of detail design.
									The Welmar Group		
7	Margaret	Paul	X					Choice of 6A - Makes Sense to service both businesses	Yes		Based on discussion with both property owners, the Recommended alternative is Option 6B, with direct access to the Welmar west entrance.
								I have noticed increase in speeds as people try to race ahead of transports.			This concern can be passed on o the OPP as well as Waterloo Regional Police.
								We need police presence at the roundabout at Kossuth for a time to slow down the traffic and make it safer.			This concern can be passed on o the OPP as well as Waterloo Regional Police.

	First Name	Last Name	Roundabout Option Preferred					Comments	Wish to be on mailing list	Initial Written Response and Date	Project Team Response
			6A	6B	6C	Other	No Pref.				
								What about a center turn lane all the way from Township Road 1? As a resident on 24, when a transport comes bearing down on you while making a left turn into your driveway it is very scary. Try it!			The Recommended alternative consists of a two way Centre left turn lane in areas with multiple driveways such that left turning vehicles can pull out of the through lanes.
8	Patricia	Spedaler	X					Choice of 6A -This, as explained to me, provides a shared driveway for 2 businesses (i.e.. Equal status). It also avoids purchase (or movement) of hydro poles which is way too costly.			Based on discussion with both property owners, the Recommended alternative is Option 6B, with direct access to the Welmar west entrance. No Hydro towers have to be relocated with Option 6B.
								1. As the Bailey Bridge road will be reopening soon, the quicker approval is done, the happier residents will be to see it begin.			Noted
								2. Critical thought is how will detours be handled? Local township roads are at capacity handing the "take a short cut" drivers			As part of detail design and construction staging, it is intended to keep WR 124 open most, if not all times. WR124 traffic may still choose to use alternate routes. This can be monitored during construction and steps taken if required.
9	Roy M	Paul	X					One observation since the roundabout went in at Kossuth is the increase in traffic speed approaching the roundabout. Cars are racing to beat transports, well in excess of the posted 60km limit. So there is a concern the same race track mentally will exist with the new ones.	Yes		Roundabouts are designed to slow down traffic as they approach and enter roundabouts. The two WR32 roundabouts will differ in that: 1. there will be two roundabouts that will mean that drivers will have to slow down regardless; 2. the approaches to the roundabouts will be urbanized which tends to "calm" (i.e. slow down) traffic.
								Also level crossing at Flochem's a serious need of attention. Cars and transports are veering off the shoulder and back on. Sometimes into the oncoming lane.			Assuming this comment refers to the intersection and vehicles veering onto the gravel shoulder, it is proposed to install curb and gutter at the intersection to confine traffic on the roadway. Ina addition, on the approaches to the intersection the shoulders will be paved such that returning onto the pavement from a gravel shoulder will not be an issue.
								The middle turn lane needs to be extended to Twp Road 1 and not just to the RR tracks. There are active farms and residences along that stretch and when trying to turn into the driveway from 124 cars and transports are passing around on the shoulders.			The Recommended alternative consists of a two way Centre left turn lane in areas with multiple driveways such that left turning vehicles can pull out of the through lanes.
10	Susan	McSherry						Like Roundabouts - Dislike the impact on land, eco-systems and topography	Yes		Private property will have to be purchased to construct the roundabouts. Roundabouts also reduce severe collisions and reduce emissions due to less idling at a traffic signal
								1. Speed levels - 70km between Fife Road and Whitelaw is too fast. It's a residential area with children on foot and bikes. Speed limit should be reduced from 70 to 50km between Fife and Whitelaw and be Enforced.			West of Fife Road in the residential area on the north side of WR 124, an urban section will be installed on the north side (i.e. curb, gutter, storm sewer). Urbanizing a road tends to calm traffic somewhat. The speed limit can also be reviewed as part of detail design.
								Niska - Whitelaw Increase in traffic on Whitelaw, Highway 124 + Niska, Volume of traffic on Hwy 124 (both directions), Whitelaw + Niska will increase once the 2-lane bridge is re-opened. This will create additional safety issues, pose additional issues for 3rd lane usage, and negatively impact the still essentially rural character of the road between side road 1 and Fife Road.			Traffic volumes as a result of the Niska Road Bridge being opened have been included in the traffic projections. The turn lane requirements at WR 124 and Whitelaw Road have been designed to incorporate this traffic. During detail design of this intersection, the turn lane requirements can be reviewed and adjusted based on current and projected traffic at the time of construction.

	First Name	Last Name	Roundabout Option Preferred					Comments	Wish to be on mailing list	Initial Written Response and Date	Project Team Response
			6A	6B	6C	Other	No Pref.				
11	Jake	Bakelam						Cloverleaf and Bridge			
								To fix the traffic problems on 124 you have to be bold and build a long bridge on Road 32 - over the railroad and across 124 then curve 32 to the south and across the Speed River with a new bridge (which is needed) and then join 32 again at or just past the first corner. Access to 124 would be a full cloverleaf. This would fix (1) new bridge on 32 (2) people living on 32 would get their traffic gone (it would be behind them and (3) traffic would move freely on 124 and 32.			This area is outside the study limits for the WR 124 study. Based on the traffic projections, the expense of building a cloverleaf etc. as suggested is not warranted at this time. A "cloverleaf" solution will also have significant environmental impacts, which would be very difficult to justify given the need for this solution is not warranted.
12	Fred	Stahlbaum					X	Make roundabout bigger so big truck rigs can stay in their own lane.	Yes		Roundabouts are designed to slow down traffic, and vehicles should not pass other vehicles within a roundabout. Vehicles must also yield right of way to other vehicles within a roundabout for safety reasons.
								Did you take into account the extra traffic once Niska Road opens up.			The final traffic study took into account the traffic on Whitelaw Road once the Niska Road bridge is reopened.
								Cut speed down on County Road 32 from Highway 7 to Highway 124 for safety and to give people who live on the road a chance to come and go at a reasonable amount of time.			WR 32 is outside the study limits. However County staff has been made aware of your concern with the speed limit.
								Trucks to avoid use of jake brakes along County Road 32.			WR 32 is outside the study limits. However County staff has been made aware of your concern with the speed limit.
								Thanks for your time and information.			Thank you.

APPENDIX E5

Roads Committee and Council Report

The Corporation of the County of Wellington

County Council

Agenda

Thursday, November 28, 2019

10:00 am

County Administration Centre

Council Chambers

Pages

1. Call to Order

2. O Canada

3. Warden's Remarks

4. Roll Call

5. Declaration of Pecuniary Interest

6. Confirmation of Council Minutes - Councillor Campbell

6.1 October 31, 2019 4 - 13

7. Resolution to Permit Delegations - Councillor Seeley

7.1 Green Legacy Awards of Excellence Presentation

Warden Kelly Linton and Rob Johnson, Green Legacy Manager presented the Green Legacy Awards of Excellence as follows:

Individual: Ruth Robinson and Greg Boland

Group: The Hartog Family

Agricultural: Liz and Reg Samis

7.2 Certified Municipal Manager Designation Presentation

Executive Director Bill McKim from the Ontario Municipal Management Institute presented awards to the following employees:

New:

- Emma Lahay, Human Resources Generalist, Human Resources - CMM
- Justyn Frizzell, Collections Assistant, Engineering Services - CMM I

- Mark England, Traffic Services Foreman, Roads, Engineering Services - CMM I
- Alessia Bottos, Human Resources Generalist, Human Resources - CMM I HR Specialist
- Kala Flannery, Maintenance Coordinator, Housing Services, Social Services - CMM II Housing Management Professional

Employees with updated CMM's (No Presentations):

- Anita de Haan, Transfer Operations Supervisor, Solid Waste Services, Engineering Services - CMM II to CMM III
- Jennifer Adams, Manager of Privacy and Information, County Clerk's Office, Office of the CAO - CMM II to CMM III

7.3 Wellington County Housing Strategy

Peter Weston, Principal, Weston Consulting

8. Resolution First and Second Reading of By-Laws - Councillor Ballantyne

5634-19 A by-law to authorize user fees and charges for the Roads Department at the County of Wellington and to repeal By-Law 5594-18.

5635-19 A by-law to authorize user fees and charges for Solid Waste Services provided by the County of Wellington and to repeal By-Law 5595-18.

5636-19 A by-law to authorize user fees and charges for services at the Wellington County Museum and Archives provided by the County of Wellington and to repeal By-Law 5369-13.

5637-19 A by-law to establish user fees and charges for library services provided by the County of Wellington and to repeal By-Law 5596-18.

5638-19 A by-law to authorize user fees and charges for services provided by the Planning Department at the County of Wellington and to repeal By-Law 5592-18.

5639-19 A by-law to authorize user fees and charges for the Police Services Board at the County of Wellington and to repeal By-Law 4960-08

5640-19 A by-law to adopt Amendment No. 110 - Farhi Holdings Corporations to the Official Plan of the County of Wellington.

5641-19 A by-law to authorize the purchase of land from the Grand River Conservation Authority (Belwood Closed Landfill)

5642-19 A by-law to establish user fees and charges for administrative services provided by the County of Wellington and to repeal By-Law 5334-17.

5643-19 A by-law to authorize the purchase of land from the Trustees of the Crown Cemetery of the Township of Puslinch.

5644-19 A by-law to confirm the proceedings of the Council of the Corporation of the County of Wellington at its meeting held November 28, 2019.

9. **Resolution Moving Council into Committee of the Whole - Councillor O'Neill**

10. **Closed Meeting - Councillor Breen**

(Agenda emailed under separate cover)

11. **Report from Closed Meeting - Warden Linton**

12. **Committee Minutes and By-Laws For Action**

12.1	Roads Committee - November 12	14 - 56
12.2	Solid Waste Services Committee - November 12	57 - 129
12.3	Police Services Board - November 13	130 - 161
12.4	Social Services Committee - November 13	162 - 529
12.5	Information, Heritage and Seniors Committee - November 13	530 - 587
12.6	RFP Architectural Services for Continuum of Care	588 - 589
12.7	Planning Committee - November 14	590 - 667
12.8	Economic Development Committee - November 19	668 - 767
12.9	Administration, Finance and Human Resources - November 19	768 - 838

13. **Proposed By-Laws Resolution to Refer to Council - Councillor Cork**

14. **Reports from Staff**

15. **Correspondence for Council's Information**

16. **Resolution that the Committee of the Whole Rise and Report - Councillor Duncan**

17. **Resolution to Adopt Action of Council in Committee of the Whole - Councillor Seeley**

18. **Resolution for Third Reading of By-Laws - Councillor McKay**

19. **Notice of Motion**

20. **Recess until 1:00 pm**

21. **Final Service Efficiency Review Report** 839 - 908

Bruce Peever, Partner, KPMG Canada

22. **Resolution - Modernization Grant Application for IT Services**

23. **Adjournment**

Corporation of the County of Wellington

Roads Committee

Minutes

November 12, 2019
County Administration Centre
Keith Room

Present:	Warden Kelly Linton Councillor Andy Lennox (Chair) Councillor Allan Alls Councillor Doug Breen Councillor James Seeley
Also Present:	Councillor Campbell Cork Councillor Gregg Davidson Councillor Jeff Duncan Councillor Steve O'Neill
Staff:	Donna Bryce, County Clerk Pasquale Costanzo, Technical Services Supervisor Ken DeHart, County Treasurer Joe deKoning, Construction Manager Paul Johnson, Operations Manager Don Kudo, County Engineer Scott Wilson, CAO

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1. Call to Order

At 9:00 am, the Chair called the meeting to order.

2. Declaration of Pecuniary Interest

There were no declarations of pecuniary interest.

3. Delegation:

3.1 Astrid Clos, AJC Planning Consultants

1/8/19

Moved by: Councillor Seeley
Seconded by: Councillor Alls

That the presentation by Ms. Astrid Clos, AJC Planning Consultants regarding the Wellington Road 124 Environmental Assessment, Recommended Design and Notice of Study Completion be received for information.

Carried

4. Wellington Road 124 - Guelph Eramosa Township Line 1 to Fife Road - Schedule C Class Environmental Assessment - Recommended Design and Notice of Study Completion

2/8/19

Moved by: Councillor Alls
Seconded by: Councillor Breen

That the Recommended Design for Wellington Road 124 as outlined in the staff report be approved; and

That staff be authorized to issue the Municipal Class Environmental Assessment Notice of Study Completion for the Wellington Road 124 Guelph Eramosa Township Line 1 to Fife Road, Schedule C Class Environmental Assessment, October 2019 and that the Class EA proceed to the mandatory 30 day public review period; and

That upon completion of the public review period, staff proceed with the detailed design of the Recommended Design as outlined in the report.

Carried

5. Roads Financial Statements as of October 31, 2019

3/8/19

Moved by: Councillor Seeley
Seconded by: Warden Linton

That the Roads and Engineering Financial Statements as of October 31, 2019 be approved.

Carried

6. Roads 2020 User Fees and Charges

4/8/19

Moved by: Councillor Breen
Seconded by: Councillor Seeley

That the 2020 User Fees and Charges report for Roads be approved.

Carried

7. Preliminary 2020-2029 Ten-Year Plan: Roads

5/8/19

Moved by: Councillor Seeley
Seconded by: Warden Linton

That the preliminary 2020-2029 Roads capital plan and major operating budget impacts as set out in the staff report be endorsed and forwarded to the Administration, Finance and Human Resources Committee for inclusion in the County of Wellington's Preliminary Ten-Year Plan.

Carried

8. Memorandum of Agreement - Wilson Quarry

6/8/19

Moved by: Councillor Alls
Seconded by: Councillor Breen

That staff be directed to enter into an agreement between the Corporation of the County of Wellington and Mr. Alfred Wilson (Wilson Quarry) for entrance improvements as outlined in the staff report; and

That the Warden and Clerk be authorized to execute the agreement.

Carried

10. Adjournment

At 10:06 am, the Chair adjourned the meeting until January 14, 2020 or at the call of the Chair.

_____

Andy Lennox
Chair
Roads Committee

ASTRID J. CLOS

PLANNING CONSULTANTS

November 12, 2019 Project No. 1917

Attention: Chairman Lennox and Member of the Roads Committee

Re: Wellington Road 124 – Guelph Eramosa Township Line to Fife Road
Schedule C Class Environmental Assessment
Recommended Design and Notice of Study Completion

Thank you for the opportunity to provide these comments to the County Roads Committee with respect to the Wellington Road 124 Environmental Assessment on behalf of the Bernardi family. This property is legally described as Part of Lot 9 Southeast/South of Road from Guelph to Waterloo Division B (formerly Guelph Township) Township of Guelph-Eramosa, County of Wellington and is located at the southeast corner of the current Road 124 and Road 32 South intersection. Together with my client I attended the Public Information Centre No. 2.

Attached to this letter is the "Recommended Alternative" which has been amended from the "Recommended" version included on page 14 of the Committee Report which is included in the agenda for the meeting today. The changes made in the "Recommended Alternative" being recommended for approval to the Committee by the County Engineer include the following;

1. As a result of the existing entrance to County Road 124 from the Bernardi property needing to be closed due to its proximity to the proposed new roundabout, a new entrance is being shown on the "North Stub" of "old" Road 32S opposite the proposed entrance to the Petro Canada Station on the west side of Road 32S. This will provide access to County Rd 32S to Road 124 when the existing Road 124 entrance is closed.

2. A new entrance is shown on the "south stub" of old Road 32S, lining up approximately with the "hammerhead" turnaround, which will line up with your existing Road 32S entrance.

3. The dashed cul-de-sac shown on the original drawing in the vicinity of the hammerhead has been removed.

4. A note at the north leg of the roundabout has been included indicating that the roundabout will be reviewed to better line up with the existing Welmar entrance. The result of this review will also have the intention of moving the roundabout slightly further east if the geometrics and on-site circulation requirements for Welmar can be met.

423 Woolwich Street, Suite 201, Guelph, Ontario N1H 3X3 - 519-836-7526 - astrid.clos@ajcplanning.ca

It has been noted to us that the ownership or jurisdiction of the remaining “stub” of old Road 32S, as illustrated, will be confirmed as part of the detail design and property acquisition/negotiation process. This “stub” will likely not remain under County jurisdiction, and will either come under Township jurisdiction or become part of a private access under a site plan approval process. The Bernardi’s wish to be on the record that their preference is that this old Road 32S road stub remain a municipal road for the provision of access to their property. They do not wish to be forced into sharing an access with the existing gas station use and are unsure of the mechanism to successfully achieve this along with maintenance and any potential liability associated with this gas station use. While they wish to be a good neighbour, they see potential ongoing issues with a shared private access and prefer that old 32 remain a municipal road.

We have been advised that the attached “Recommended Alternative” will be recommended to the Roads Committee for approval and that subject to the Roads Committee approving the attached design, the report to County Council for final approval and to be published in the Notice of Study Completion of the EA will reflect these changes.

The Bernardi family is appreciative of the dialogue that has occurred to result in these changes to the “Recommended Alternative” and look forward to reviewing the revised roundabout design to be presented to County Council for approval, subject the Committee’s approval being granted. They would also like to use this opportunity to explore with the County the possibility of a new Road 32 South alignment that will more equitably distribute the road location between property owners.

The proposed Road 124 project will have a significant impact and reduce the area of the Bernardi property which is not desirable to these landowners. The owners would like to continue to work with the County to reduce the impacts to their property before the final plan is presented to County Council and before the Notice of Completion of the EA is published. Thank you once again for the opportunity to provide these comments.

Yours truly,

Astrid Clos, MCIP, RPP

cc: Don Kudo, County Engineer
Kim Courts, Deputy Clerk
David Hallman, MTE Consulting
Joe Bernardi
Peter Bernardi
Paul Bernardi

Attachment: Recommended Alternative

RECOMMENDED ALTERNATIVE

WELLINGTON ROAD 124

WELLINGTON ROAD 32

RANDELL DRIVE

Roundabout location to be reviewed to provide appropriate driveway alignment and onsite truck circulation

RECOMMENDED ALTERNATIVE Date: NOV.5/19
Scale: 1:500

WELLINGTON ROAD 124 IMPROVEMENTS
WR 124 & WR 32 SOUTH

MTE
Engineers, Scientists, Surveyors

Project No.: 41093-200

MTE FILE No: 41093-200-FD5.2
RECOMMENDED ALTERNATIVE
P:\41093\200\41093-200-FD5.DWG

November 8, 2019 - 8:47 am. - Plotted By: printshop

COUNTY OF WELLINGTON

COMMITTEE REPORT

To: Chair and Members of the Roads Committee
From: Don Kudo, County Engineer
Date: Tuesday, November 12, 2019
Subject: **Wellington Road 124 – Guelph Eramosa Township Line 1 to Fife Road – Schedule C Class Environmental Assessment – Recommended Design and Notice of Study Completion**

Background:

The County has undertaken a Schedule C Municipal Class Environmental Assessment (Class EA) study in Guelph Eramosa Township (GET) for Wellington Road 124 (WR124) between GET Road 1 and Fife Road. The Municipal Class EA applies to municipal infrastructure projects. These projects can vary in their environmental impact and are classified in terms of schedules. A Schedule C assessment is for complex projects that require the highest level of review for a Class EA. Overall, the purpose of the WR124 Schedule C Class EA study was to address existing traffic-carrying deficiencies, plan for future growth, address the existing pavement condition and provide safe public access.

In January 1998, the portion of the Province's Highway 24 north of Cambridge to west of Caledon was transferred to the County of Wellington and became Wellington Road 124. The Guelph Wellington Transportation Study completed in 2005 identified a need to realign and upgrade WR 124 as a divided, four lane expressway, in agreement with the recommendations of an Environmental Assessment study completed by the Ministry of Transportation before the transfer of the road from the Province to the County. However, due to the cost estimated to be well over $50 million (in 2005), the County was not in a position to implement the proposed roadway without significant support from upper levels of government.

The WR124 Class EA was initiated in 2018, and included notification and contact with various agencies, utility companies and the public/property owners. Two Public Information Centres (PICs) were also held along with direct consultation with property owners who would be impacted by the proposed design alternatives. A number of background studies were also undertaken and the study findings were presented at PICs along with the studies being posted on the Class EA project website. Comments from the PICs and the direct consultation with property owners were used to help develop the design alternatives and form part of the Environmental Study Report (ESR).

In the Class EA process, all feasible and reasonable planning solutions to address the study purpose were considered. In this case, a number of alternative solutions were reviewed and screened. In scoping the options, alternative design concepts for WR 124 improvements included two main components of intersection improvements and road lane configurations/cross sections.

The Class EA Study documented current traffic conditions, operational deficiencies, and constraints experienced by the road users within the study area. The operational deficiencies and constraints identified were fundamental to the process of identifying what traffic and operational problems exist and to identify alternatives to address current and future requirements.

Wellington County's Ontario Provincial Police (OPP) detachment provided an inventory of all motor vehicle collisions (MVCs) on WR 124 from Township Road 1 to Fife Road for the period January 1, 2008 to December 31, 2017 (inclusive). Of the 550 collisions documented, the largest number of collisions (221) were around the section of WR 124 at or between WR 32 North and WR 32 South.

Hydro One has high voltage transmission and distribution facilities within the study area. There are hydro towers and a transmission line running along the north side of WR 124. Any transmission line or tower replacement and/or relocation would require a Class Environmental Assessment for Minor Transmission Facilities be completed. The estimated cost to relocate a Hydro One tower is a minimum of $1,000,000 each.

The existing pavement is in deteriorated condition, with many locations showing cracking and disintegration of the pavement surface. Heavy traffic loading and poor drainage are contributing factors to the current pavement condition. There are sections of longitudinal cracking through the intersections, rutting and "alligator cracking" at the edge of lanes, and disintegration of shoulders and transverse cracking across the lanes.

Most regular users of WR 124 within the study area, experience regular problems with congestion, especially during peak hours. Based on the traffic analysis, the pavement and drainage conditions, road corridor constraints and the collision history, the following Problem Statement was developed for the WR 124 Class EA study:

> "WR 124 from Township Road 1 to Fife Road is in need of improvements in order to address existing traffic-carrying deficiencies including poor/deteriorating levels of service at the intersections with WR 32 North and 32 South as well as plan for future growth along this important corridor. Improvements must also address the existing pavement condition while providing safe public access to the greatest possible extent."

Public Information Centre 1:

All the initial alternatives design concepts developed for the study were displayed at PIC No. 1 along with a preliminary evaluation of the concepts. In summary, these alternatives were:

- Alternative No. 1: Two lanes with signalized intersections;
- Alternative No. 2: Three lanes with signalized intersections;
- Alternative No. 3: Four lanes with signalized intersections;
- Alternative No. 4: Two Roundabouts – one roundabout at WR 124 and WR 32N, and one roundabout at WR 32S;
- Alternative No. 5: One Roundabout – eliminate the two "Tee" intersections at WR 124 and WR 32N and WR 32S, and replace with a single roundabout intersection.

Consultation with Property Owners:

After PIC No. 1, individual meetings were held with private property owners, mostly in the vicinity of WR 32 and WR 124 to obtain their input due to the impacts the roundabout alternatives would have on their property and to determine if any adjustments could be made to the design to minimize possible impacts to their property.

Public Information Centre 2:

At PIC No. 2, the preferred Design Concept was presented including three proposed roundabout options for the WR 32 and WR 124 intersections. The preferred alternative presented at PIC No. 2 included:

- Two roundabouts – one at WR 124 and WR 32N, and one at WR 124 and WR 32S;
- Lane configurations varying through the corridor to accommodate the various needs including four lanes between the two roundabouts, three lanes (two through lanes with one centre turn lane) at three locations and two lanes along the remaining roadway;
- Rural cross section and urban cross section at different locations through the corridor.

The three alternatives for the WR 124 and WR 32S roundabouts presented were:

- North leg aligns with the Welmar (7018 WR 124) east entrance;
- North leg aligns with the Superior Propane (7022 WR 124) west entrance;
- North leg would align with a new shared entrance on the property line between the Welmar and Superior Propane property.

The difference between the three roundabout options was where they intersected with WR 124. The roundabout was shifted eastward from WR 32S, to avoid access issues with the Petro Canada Station. This would result in closing a short portion of WR 32S immediately south of WR 32S but access would be maintained to the existing residences, Petro Canada and the private property on the SE corner of WR 124 and WR 32S

After PIC No. 2, additional meetings were held with the owners of Welmar Industries and Superior Propane. Superior Propane indicated that they preferred not to have a direct link to their property at a roundabout, due to concerns with the travelling public mistakenly entering their property. Their concerns were safety related with potentially mixing public traffic which may enter their property and mix with their propane operations and trucking. Welmar Industries had no problem with the north leg of the WR 32S roundabout being located at their current east entrance.

Comments were also received from the property owners at the SE corner of WR 124 and WR 32S, who were concerned about the remnant property created by the preferred alternative for the intersection of WR 124 and WR32S. With the intersection moving east of the existing intersection, some of the approach roads to the roundabout would cut through their property not allowing the full property to be developed.

Recommended Design:

Based on the engineering design, background studies, public consultation and comments, a recommended design was completed. Key elements of the Recommended Design for WR 124 include:

- New roundabouts at the intersections of WR 124 and WR 32N and WR 32S (ie. two roundabouts);
- All other existing intersections will remain the same with modifications to turn lanes as required;
- A twenty (20) metre wide right-of-way (except in areas where additional property is required for turn lanes or roundabouts);
- Required road widenings for the three and four lane sections and roundabout construction, will be to the south, holding the existing north edge of pavement such that the construction will not require any modifications or relocations to the existing Hydro One towers and transmission lines;

- A minimum of two (2) lanes of through traffic; additional two way centre left turn lane to address the multiple driveway accesses between:
    - o Fife Road and 350m east of Fife Road;
    - o Whitelaw Road to WR 32N;
    - o WR 32S to CN Rail crossing.
- Four (4) lanes between the two roundabouts at WR 32N and WR 32S;
- Rural cross section with paved shoulders, with the exception of at intersections and at the approaches to and between the two roundabouts at WR 32N and WR32S where an urban cross section with a 0.5m rollover curb will be installed with a paved area behind the curb;
- Paved shoulder and paved area behind the curb and gutter to accommodate disabled vehicles, cyclists and pedestrians;
- Raised median between the two roundabouts;
- Storm sewers installed in the urban cross section areas;
- Grading on private property

Project Cost Estimate:

A cost estimate has been prepared for the Recommended Design for WR 124, based on 30% (Preliminary) Design Drawings that utilize 2019 estimated construction costs. The total project cost was estimated to be approximately $15,810,000. It should be noted that future project budget cost estimates will be based on detailed design, construction timing and staging and does not include property acquisition costs.

As part of the evaluation of the various alternatives, estimated relative costs were reviewed versus the preferred three lane alternative as follows:

- Two Lanes – lowest capital cost 10% lower than three lanes
- Four Lanes – highest capital cost 40% higher than three lanes
- Two Roundabouts at WR 32 intersections – 20% higher than three lanes with signalized intersections
- One Roundabout at WR 32 intersections – 25% higher than three lanes with signalized intersections

Next Steps:

The next step for the Class EA is for a Notice of Study Completion to be issued, the project Environmental Study Report be made available and the mandatory 30 day public review period to occur. At the end of the review period, should there be no objections to the project received by Ministry of Environment, Conservation and Parks, the County may proceed with the detailed design and construction of the Recommended Design.

An Executive Summary for the Schedule C Class Environmental Assessment Study for WR 124 Guelph Eramosa Township Line 1 to Fife Road, October 2019 is attached to this report. The full Environmental Study Report and Appendices will be available on the project website prior to the publishing of the Notice of Study Completion.

Recommendation:

That the Recommended Design as outlined in this report be approved;

And that staff be authorized to issue the Municipal Class Environmental Assessment Notice of Study Completion for the Wellington Road 124 Guelph Eramosa Township Line 1 to Fife Road, Schedule C Class Environmental Assessment, October 2019 and that the Class EA proceed to the mandatory 30 day public review period;

And that upon completion of the public review period, staff proceed with the detailed design of the Recommended Design as outlined in the report.

Respectfully submitted,

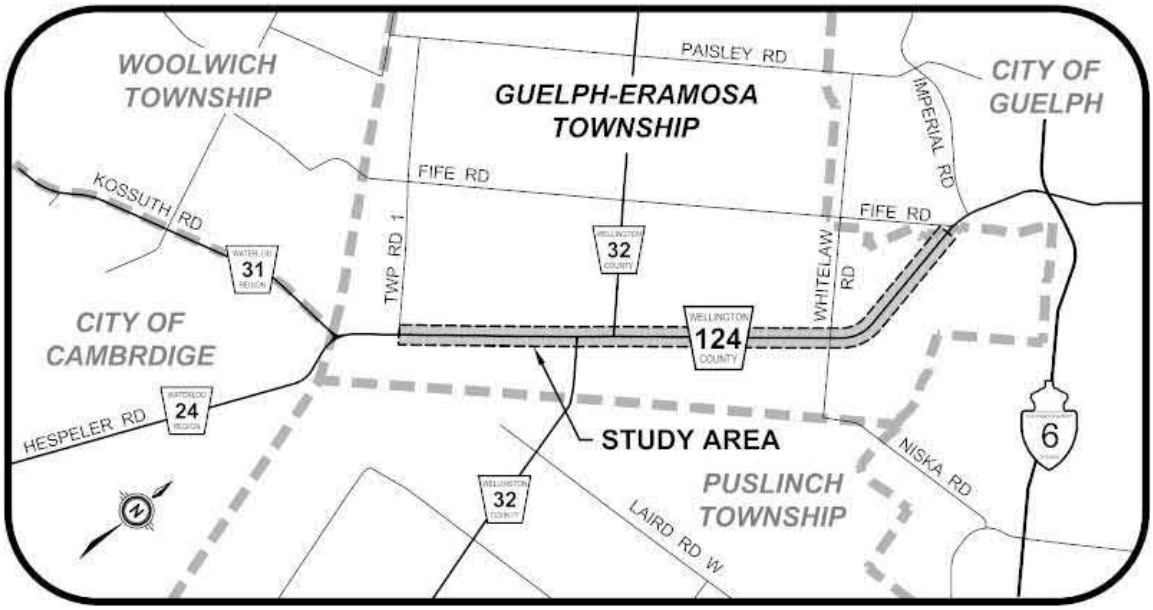
Don Kudo, P. Eng.
County Engineer

Attachment: Executive Summary – Environmental Study Report - Class C EA Wellington Road 124 - Guelph Eramosa Township Line 1 to Fife Road

Executive Summary

The County of Wellington has undertaken a Schedule C Class Environmental Assessment (Class EA) study in Guelph Eramosa Township (GET) for Wellington Road 124 (WR124) between GET Road 1 and Fife Road. The Study Area for the WR124 Class EA is illustrated in **Figure ES1**.

Figure ES1 - Study Area



The following Problem Statement outlines the purpose of this WR124 Class EA study:

> *WR 124 from Township Road 1 to Fife Road is in need of improvements in order to address existing traffic-carrying deficiencies, including poor/deteriorating levels of service at the intersections with WR 32 North and 32 South as well as plan for future growth along this important corridor. Improvements must also address the existing pavement condition while providing safe public access to the greatest possible extent.*

The WR124 Class EA was initiated in 2018, and included notification and contact with various agencies, utility companies and the public/property owners. Two Public Information Centres (PIC's) were also held. A number of background studies were also undertaken including:

- ✓ Natural Environment Report
- ✓ Stage 1 Archaeological Assessment
- ✓ Built Heritage and Cultural Heritage Assessment
- ✓ Transportation Study

Alternative solutions to address the problem statement were reviewed and screened:

- ✓ Do Nothing;
- ✓ Non-Structural Improvements (Development/Improvements to Alternate Modes of Transportation);
- ✓ Improvements to other Roads (to provide an alternative to WR 124);
- ✓ Construct WR 124 on a new Alignment;
- ✓ Improvements to WR 124.

Since implementing most of these alternative solutions do not fully address the problem statement for WR 124 and would still require improvements to WR 124, only the Do Nothing and Improvements to WR 124 alternative solutions were carried forward. The Alternative Design Concepts for WR 124 Improvements included two main components:

- ✓ Intersection Improvements:
  - Unsignalized Intersections (with turn lanes as required);
  - Signalized Intersections (with turn lanes as required);
  - Roundabouts (i.e. 1 roundabout at WR 32 and WR 124, or 2 roundabouts at each of WR 32S and WR 32N at WR 124).

- ✓ WR 124 Cross Section:
  - Two Lanes (one lane in direction);
  - Three Lanes (one lane in each direction, with centre two way left turn lane);
  - Four Lanes (two lanes in each direction);
  - Urban Cross Section (with paved area behind rollover curb);
  - Rural Cross Section (paved shoulder).

Copies of the Cross Section alternatives are illustrated in **Figure ES2** and the two (2) Roundabout Alternatives are shown in **Figures ES3 and ES4.**

These alternatives and their evaluations were presented to the public and stakeholders at Public Information Centre (PIC) No. 1 held on November 29, 2018. In addition, several meetings were held with property owners and businesses near the intersections of WR 124 and WR 32, as construction of the roundabout(s) would result in impacts to their property. The comments received from the public and agencies and technical studies was reviewed and evaluated, and PIC No. 2 was held on June 26, 2019 to present a preferred alternative to the public.

Figure ES2 - Cross Section Alternatives

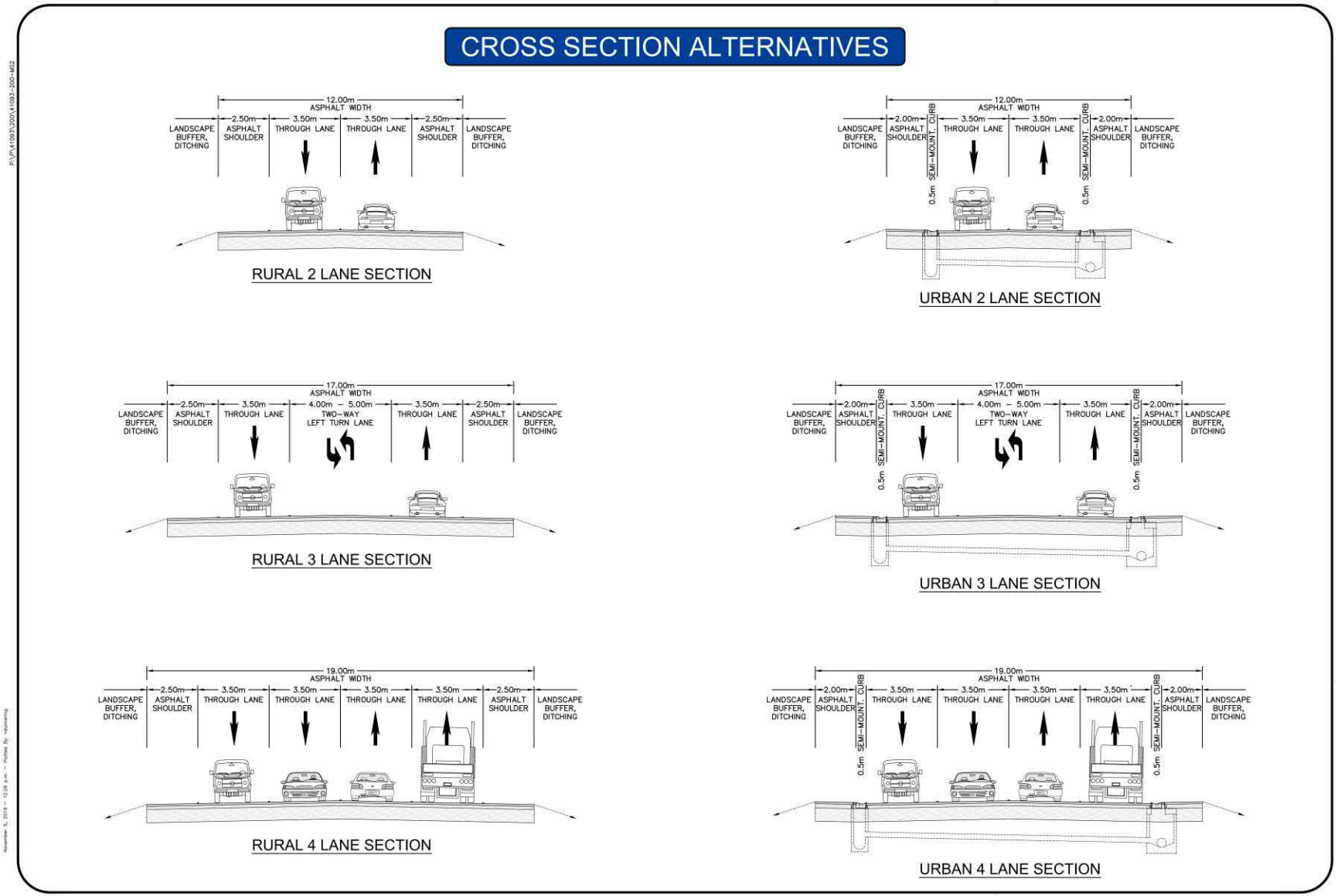


Figure ES3 – One Roundabout Alternative (PIC#1)

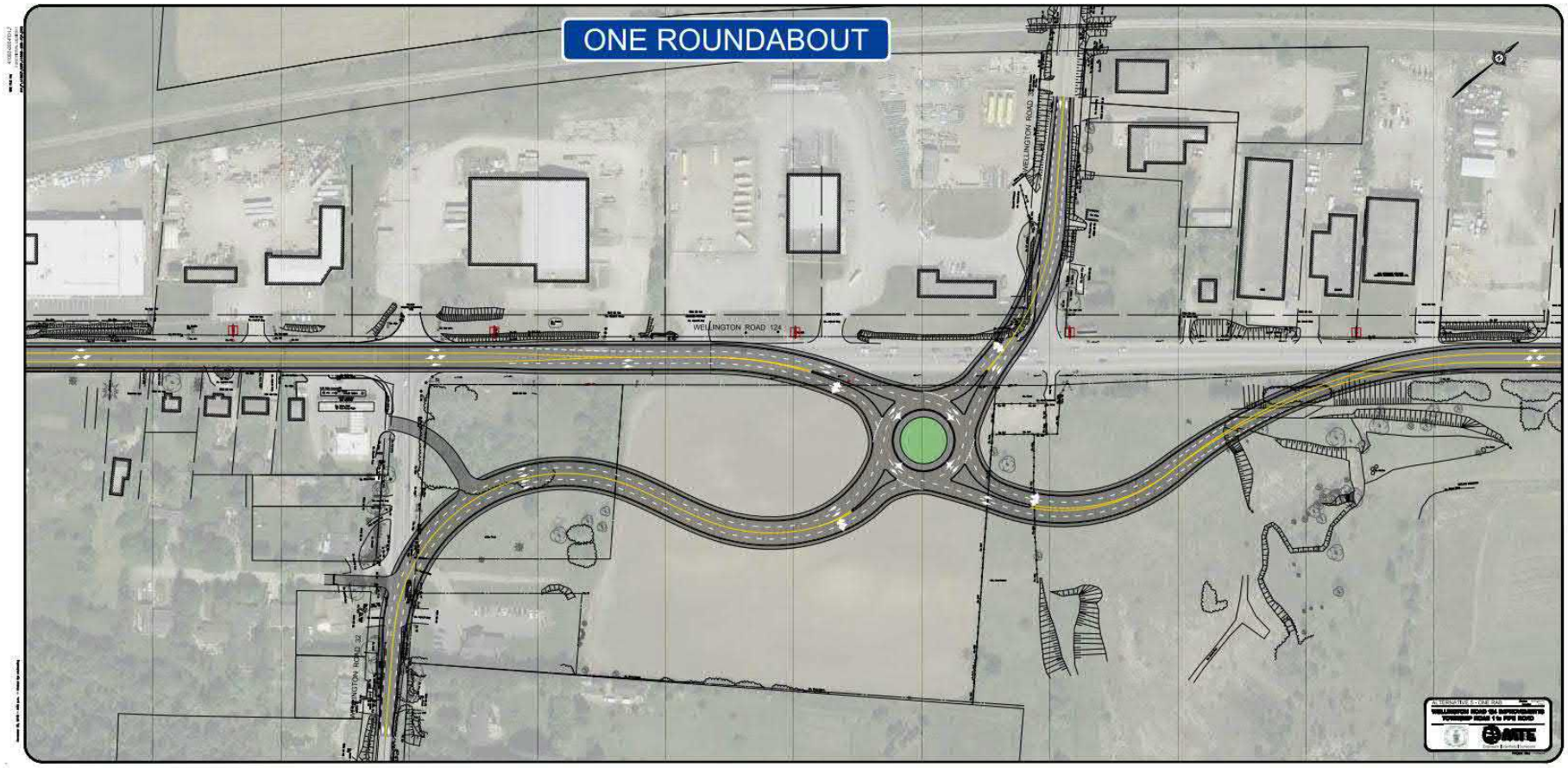
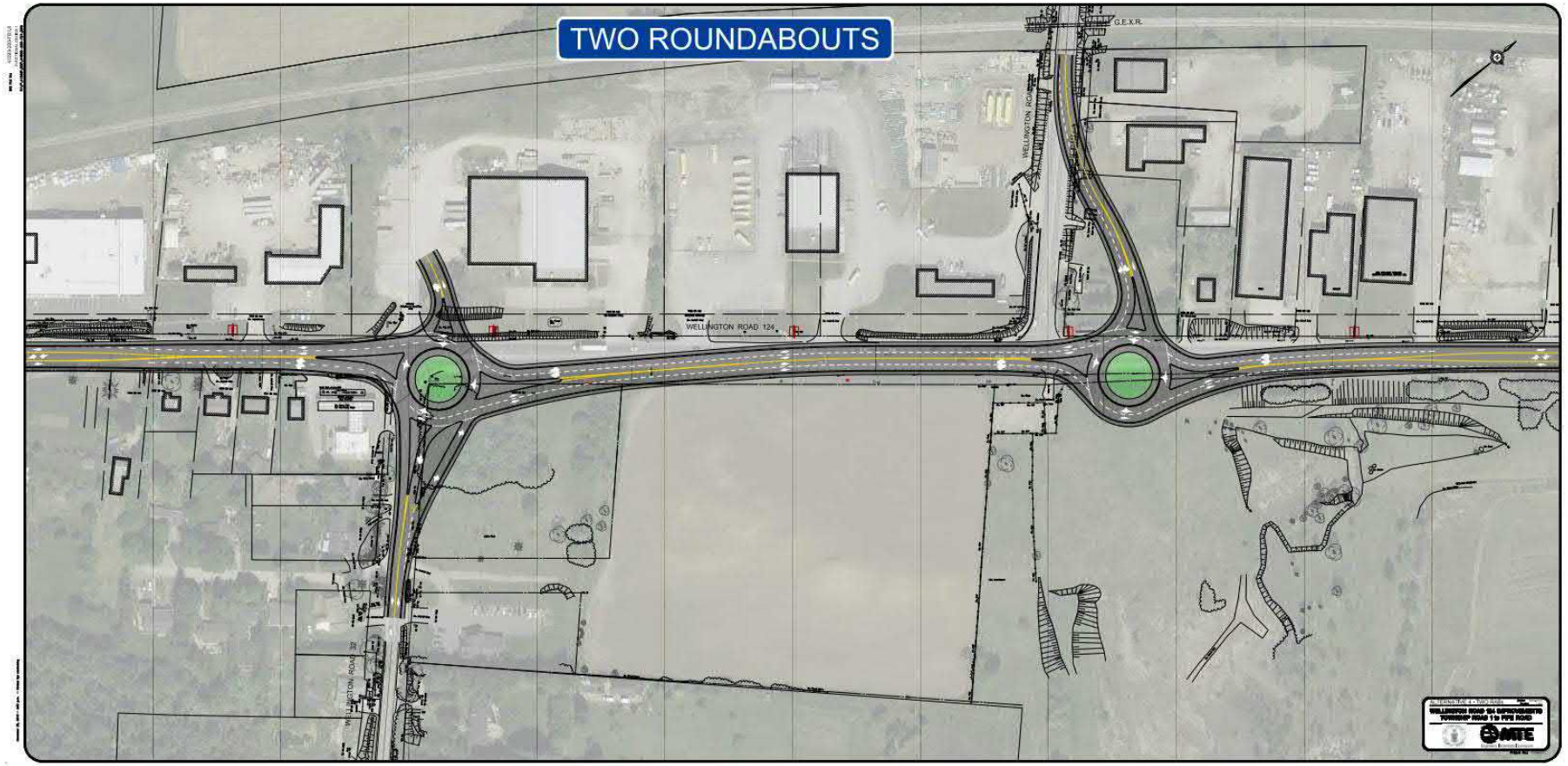


Figure ES4 – Two Roundabout Alternative (PIC#1)



The preferred alternative presented at PIC No. 2 included:

- ✓ Two roundabouts – 1 at WR 124 and WR 32N, and 1 at WR 124 and WR 32S;
- ✓ 4 lanes between the two roundabouts, with a centre median;
- ✓ 3 lanes between the rail crossing and the WR 32S roundabout, between the WR 32N roundabout and Whitelaw Road;
- ✓ 3 lanes between Fife Road and 350m west of Fife Road;
- ✓ 2 lanes between Township Rd 1 and the rail crossing;
- ✓ 2 lanes between Whitelaw Road and 350m west of Fife Road;
- ✓ Rural cross section - except at, and between, the roundabouts and at all intersections where an urban cross section would be implemented.

At PIC No. 2, three alternatives for the WR 124 and WR 32S roundabout were also presented for comment, namely:

- ✓ North leg aligns with the Welmar (7018 WR 124) east entrance;
- ✓ North leg aligns with the Superior Propane (7022 WR 124) west entrance;
- ✓ North leg would align with a new shared entrance on the property line between the Welmar and Superior Propane property.

Comments received from the public and agencies were reviewed and additional meetings were held with some of the property owners near the WR 124 and WR 32 roundabout intersections. Meetings with Welmar and Superior Propane determined that they preferred the roundabout alternative where the north leg of the WR 124 and WR 32S roundabout lines up with the existing Welmar east entrance. This roundabout alternative best suited both their safety and on site operations/access concerns.

In consideration of the technical information, and public and agency comments gathered during this study, the Recommended Design Alternative is similar to what was presented at PIC No. 2 and include the following key elements:

- New roundabouts at the intersections of WR 124 and WR 32N and WR 32S (i.e. two roundabouts – Figure ES5);
- All other existing intersections will remain the same with modifications to turn lanes as required;
- A twenty (20) metre wide right-of-way (except in areas where additional property is required for turn lanes or roundabouts);
- Required road widenings for the three and four lane sections and roundabout construction, will be to the south, holding the existing north edge of pavement such that the construction will not require any modifications or relocations to the existing Hydro One towers and transmission lines;
- A minimum of two (2) lanes of through traffic;
- Additional two way centre left turn lane to address the multiple driveway accesses between:

    - Fife Road and 350m east of Fife Road;
    - Whitelaw Road to WR 32N;
    - WR 32S to CN Rail crossing.

- Four (4) lanes between the two roundabouts at WR 32N and WR 32S;
- Rural cross section with paved shoulders, with the exception of at intersections and at the approaches to and between the two roundabouts at WR 32N and WR32S where a urban cross section with a 0.5m rollover curb will be installed with a paved area behind the curb;
- The paved shoulder and paved area behind the curb and gutter can accommodate disabled vehicles, cyclists and pedestrians;
- A raised median between the two roundabouts; and
- Storm sewers installed in the urban cross section areas;

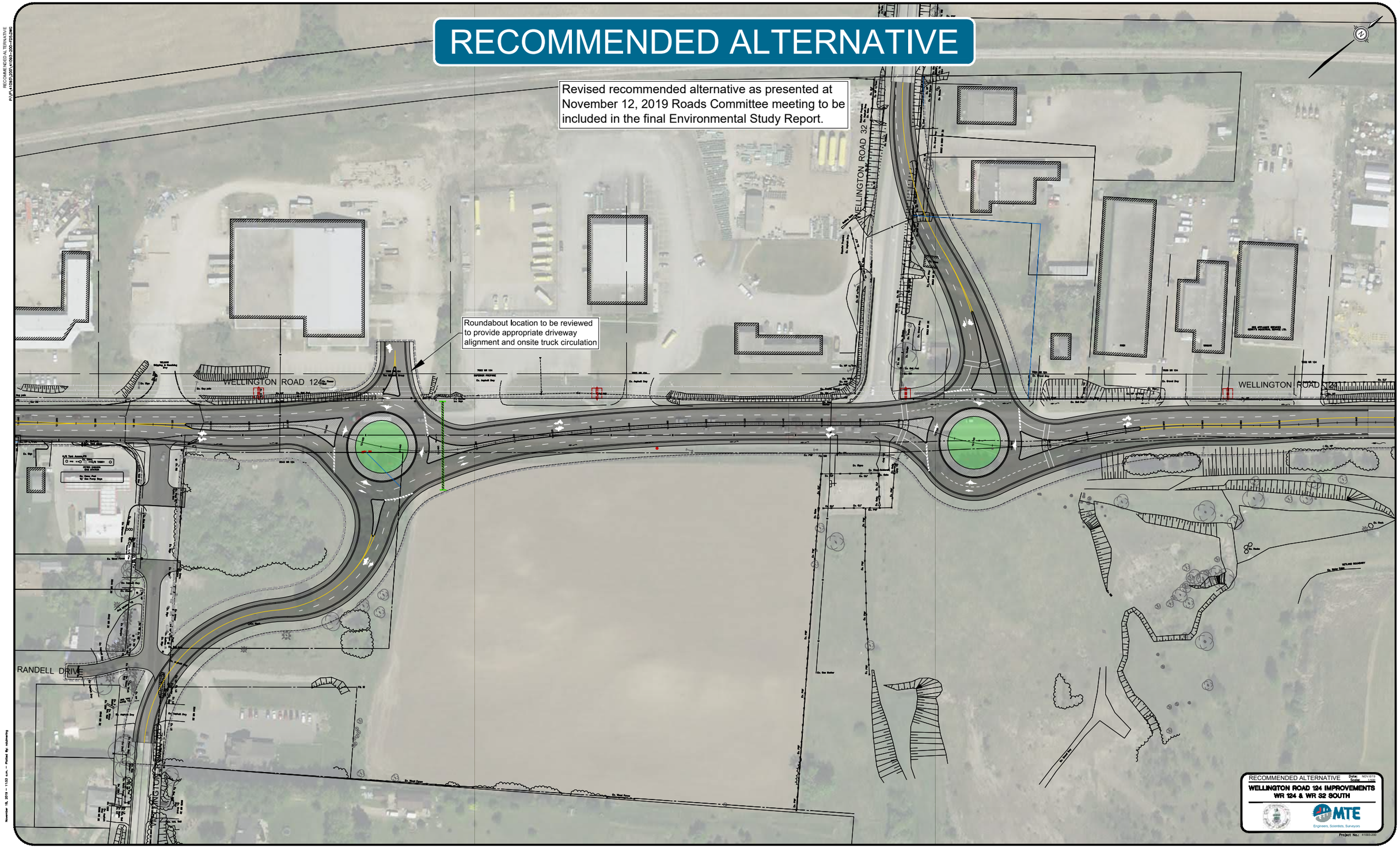
A preliminary cost estimate to complete the Recommended Alternative Alignment B4 is approximately $15.8 million and will depend on construction timing and does not include property acquisition costs.

A Notice of Study Completion for this Class EA is anticipated to be filed on or about December 19, 2019 with the Ministry of Environment, Conservation and Parks (MECP, formerly MOECC), as well as provided to the public, agencies, and stakeholders by means of advertisements in local newspapers and mailings to adjacent property owners, tenants, and review agencies, with the Environmental Study Report (ESR) placed on public record for a thirty (30) day review period. Copies of the ESR will be made available at the Clerks' office in Wellington County, Guelph-Eramosa Township, and City of Guelph for the review period, as noted in the Notice of Study Completion.

Figure ES5 – Recommended Roundabout Alternative

RECOMMENDED ALTERNATIVE

Revised recommended alternative as presented at November 12, 2019 Roads Committee meeting to be included in the final Environmental Study Report.



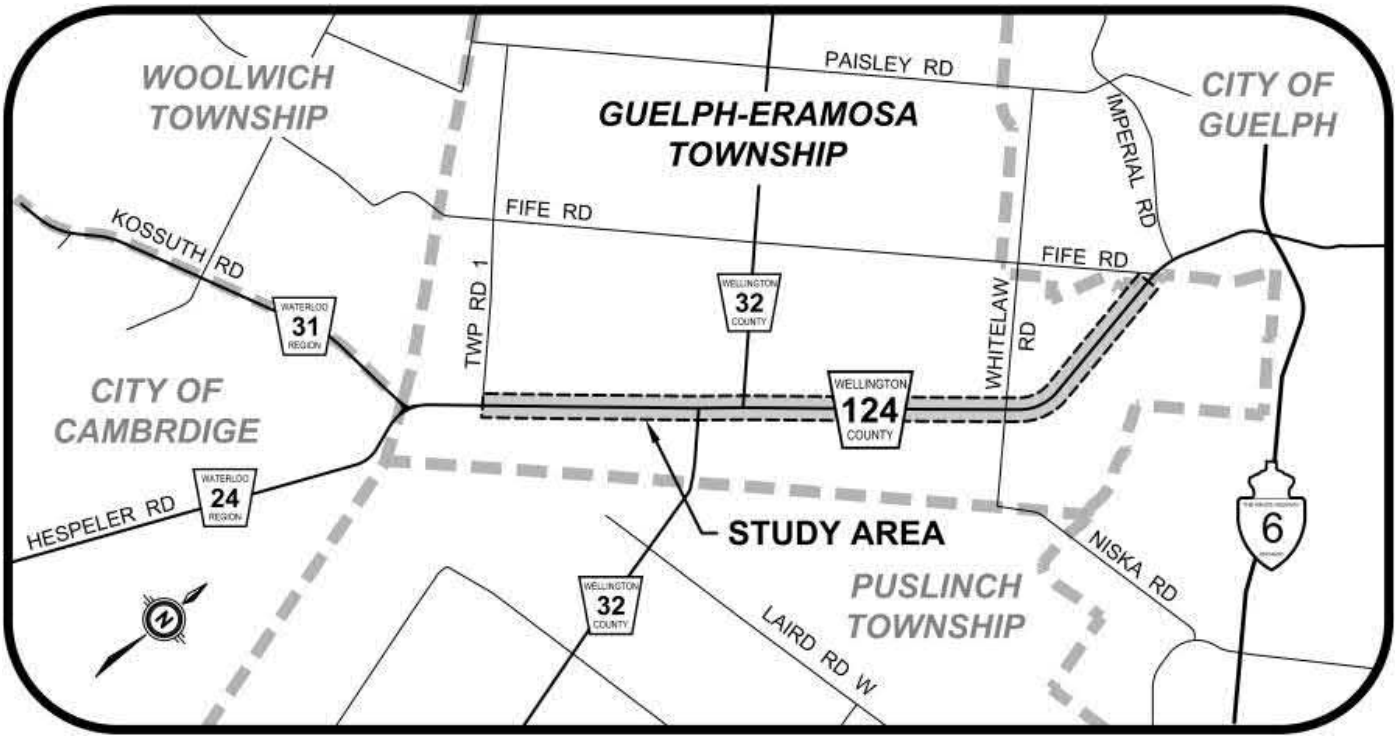
RECOMMENDED ALTERNATIVE
Date: NOV 6/19
Scale: 1:500
WELLINGTON ROAD 124 IMPROVEMENTS
WR 124 & WR 32 SOUTH
MTE
Engineers, Scientists, Surveyors
Project No.: 41093-200

APPENDIX E6

Notice of Study Completion

Notice of Completion
Wellington Road 124
Guelph-Eramosa Township Road 1 to Fife Road Study
Guelph-Eramosa Township
Schedule 'C' Municipal Class Environmental Assessment

The County of Wellington has undertaken a study following the approved process for Schedule 'C' projects under the "Municipal Class Environmental Assessment" to address improvements to Wellington Road (WR) 124 between Township Road 1 and Fife Road.



The Recommended Design Alternative includes the following key elements:

- Two roundabouts – one at WR 124 and WR 32N, and one at WR 124 and WR 32S;
- Four lanes between the two roundabouts, with a centre median
- Three lanes
    - between the rail crossing and the WR 32S roundabout,
    - between the WR32N roundabout and Whitelaw Road, and
    - between Fife Road and 350m west of Fife Road
- Two lanes for the remainder of the road with lane modifications at other intersections

By this Notice, the Environmental Study Report is being placed on the public record until January 31, 2020 for a 50-day review period in accordance with the requirements of the Municipal Class Environmental Assessment (minimum 30-day review period required). Subject to comments received as a result of this Notice, and receipt of necessary approvals, the project may proceed to construction.

An electronic version of the Environmental Study Report is available for review online at https://www.wellington.ca/en/resident-services/rd-wellingtonroad124ea.aspx.

A printed copy of the Environmental Study Report is available for review at each of the following locations during regular business hours:

County of Wellington	**Guelph-Eramosa Township**	**City of Guelph**
74 Woolwich Street, Guelph, ON	8348 Wellington Rd. 124, Rockwood, ON	1 Carden Street, Guelph ON

Interested persons may provide written comments to the County of Wellington's Engineering Services within 50 calendar days from the date of this Notice (January 31, 2020). If concerns regarding this project cannot be resolved in discussion with the County of Wellington, a person or party may request that the Minister of Environment, Conservation and Parks make an order for the project to comply with Part II of the Environmental Assessment Act (referred to as a Part II Order). Part II Order requests must be made using a Part II Order Request Form, available online at http://www.forms.ssb.gov.on.ca and search for "Part II Order Request". Requests for a Part II Order must be received by the Minister of Environment, Conservation and Parks, 77 Wellesley Street West, 11th Floor, Ferguson Block, Toronto, Ontario, M7A 2T5, email Minister.mecp@ontario.ca, and the Director of the Environmental Assessment and Permissions Branch, Ministry of the Environment, Conservation and Parks, 135 St. Clair Avenue West, 1st Floor, Toronto, Ontario, M4V 1P5, email enviropermissions@ontario.ca by Friday, January 31, 2020. A copy of the request must also be sent to the County and Consultant Project Managers:

Don Kudo, P.Eng.
County Engineer
County of Wellington
74 Woolwich Street
Guelph, Ontario N1H 3T9
Telephone: 519-837-2601 Ext. 2280
Email: donk@wellington.ca

Dave Hallman, P.Eng.
Senior Project Manager / Advisor
MTE Consultants Inc.
520 Bingemans Centre Drive
Kitchener, ON N2B 3X9
Telephone: 519-743-6500 Ext. 1336
Email: dhallman@mte85.com

This Notice was first issued Thursday December 12, 2019.
All comments and information received from individuals, stakeholder groups, and agencies regarding this project are being collected to assist Wellington County in making a decision. Under the "Municipal Act", personal information such as name, address, telephone number, and property location that may be included in a submission becomes part of the public record. Questions regarding the collection of this information should be referred to the person indicated above.

This notice is being provided pursuant to the Ontario Environmental Assessment Act, the Municipal Engineers Association's Municipal Class Environmental Assessment, dated October 2000, as amended in 2007, 2011, and 2015, and the direction of the Ministry of the Environment, Conservation and Parks.

APPENDIX F

Preliminary Design

MTE FILE No: 41093-200-PP1.1

PROPOSED CONDITIONS TOWNSHIP ROAD 1 TO STA: 10+840

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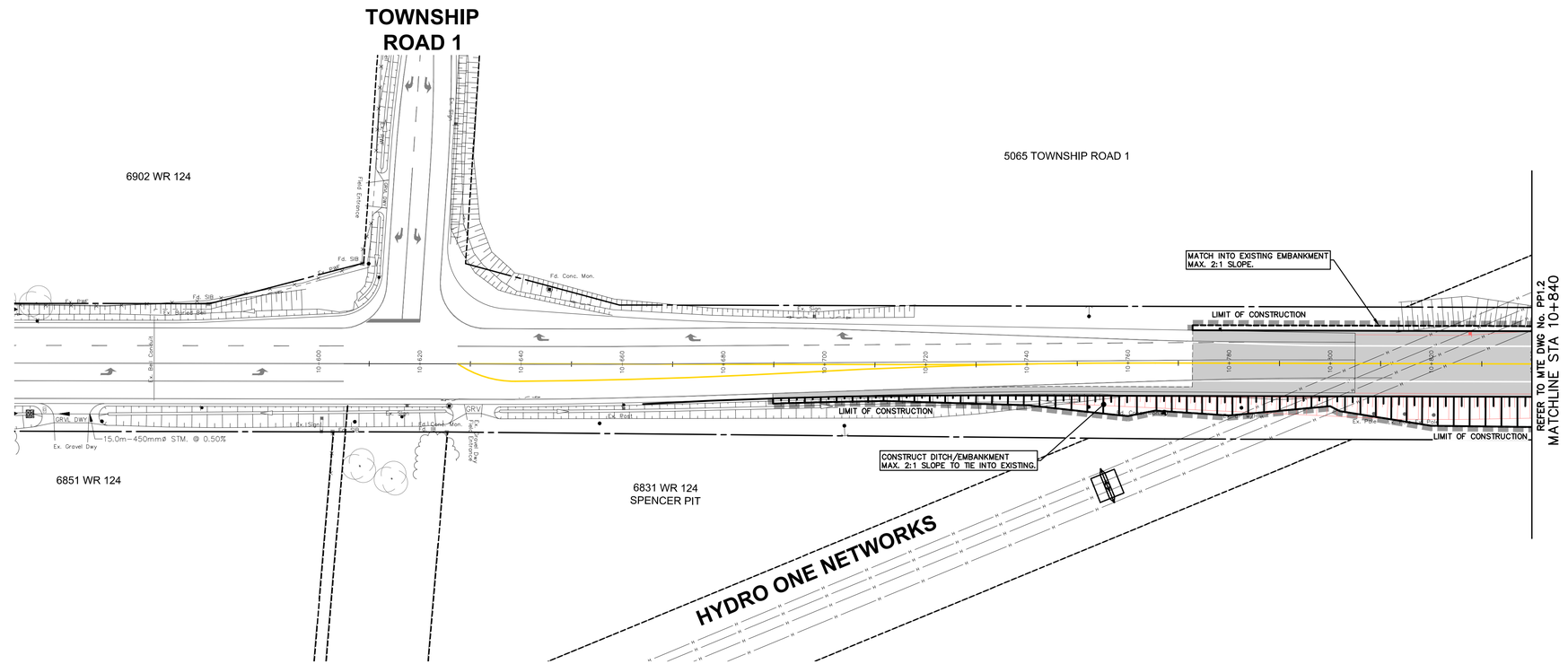
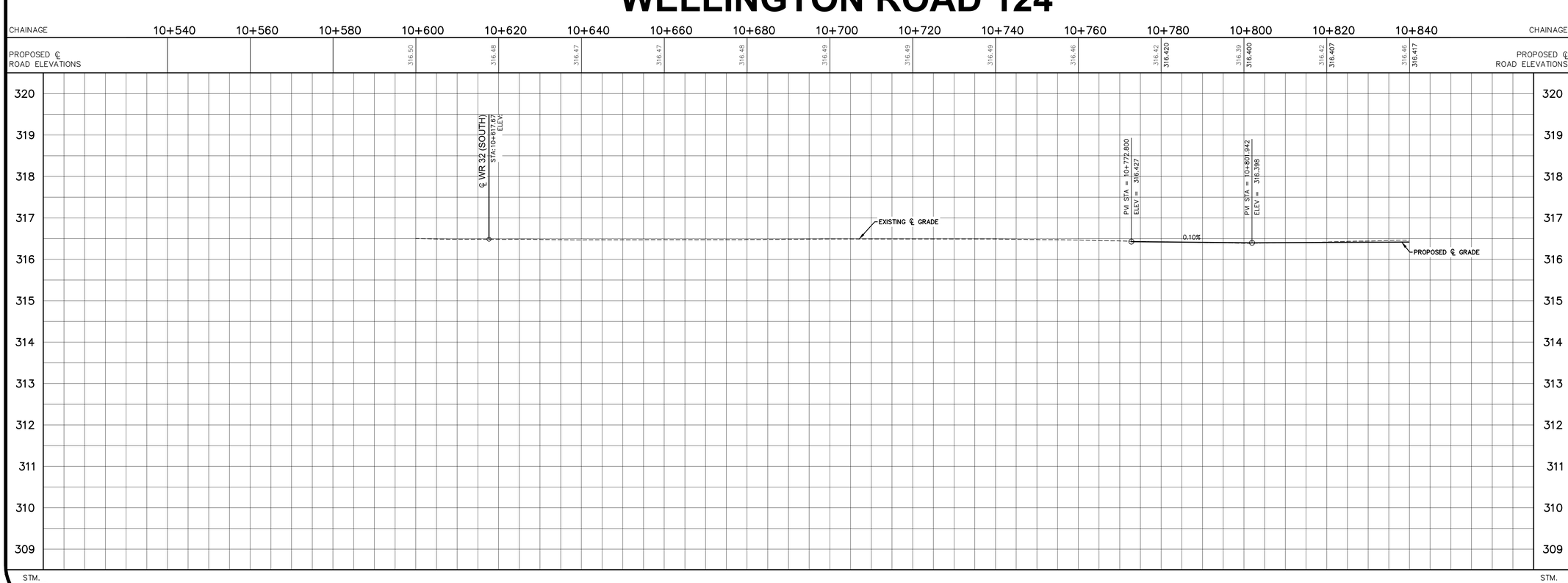
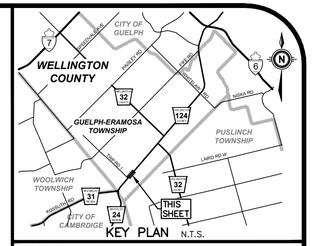


WELLINGTON ROAD 124





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LEGEND

- REMOVALS
- PROPOSED
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- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

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1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19

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Engineers, Scientists, Surveyors

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OWNER

COUNTY OF WELLINGTON

74 WOOLWICH ST. GUELPH

PROJECT

WELLINGTON ROAD 124 RECONSTRUCTION

TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING

PROPOSED CONDITIONS WELLINGTON ROAD 124

TOWNSHIP ROAD 1 TO STA 10+840

Project Manager	D.HALLMAN	Project No.	41093-200
Design By	NPD	Checked By	.
Drawn By	NPD	Checked By	.
Surveyed By		Drawing No.	PP1.1
Date	Jul.25/19		
Scale	1:1000H 1:100V	Sheet 1 of 23	

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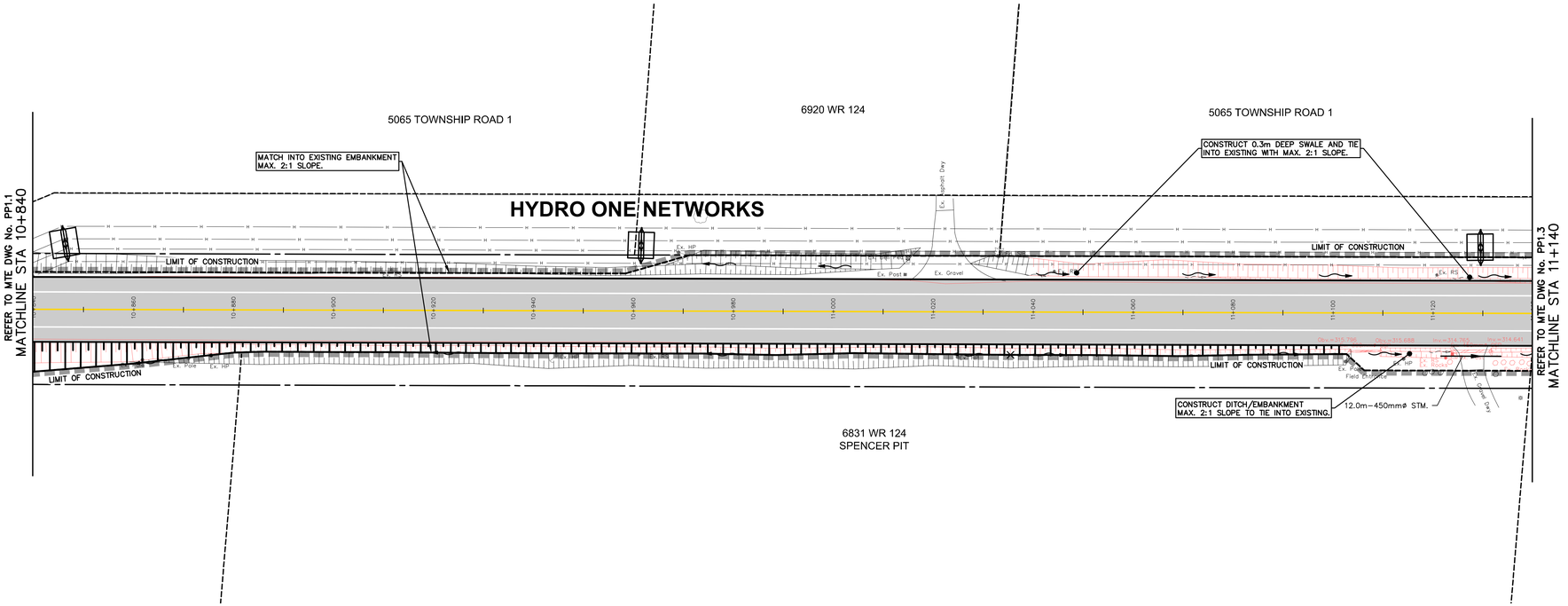
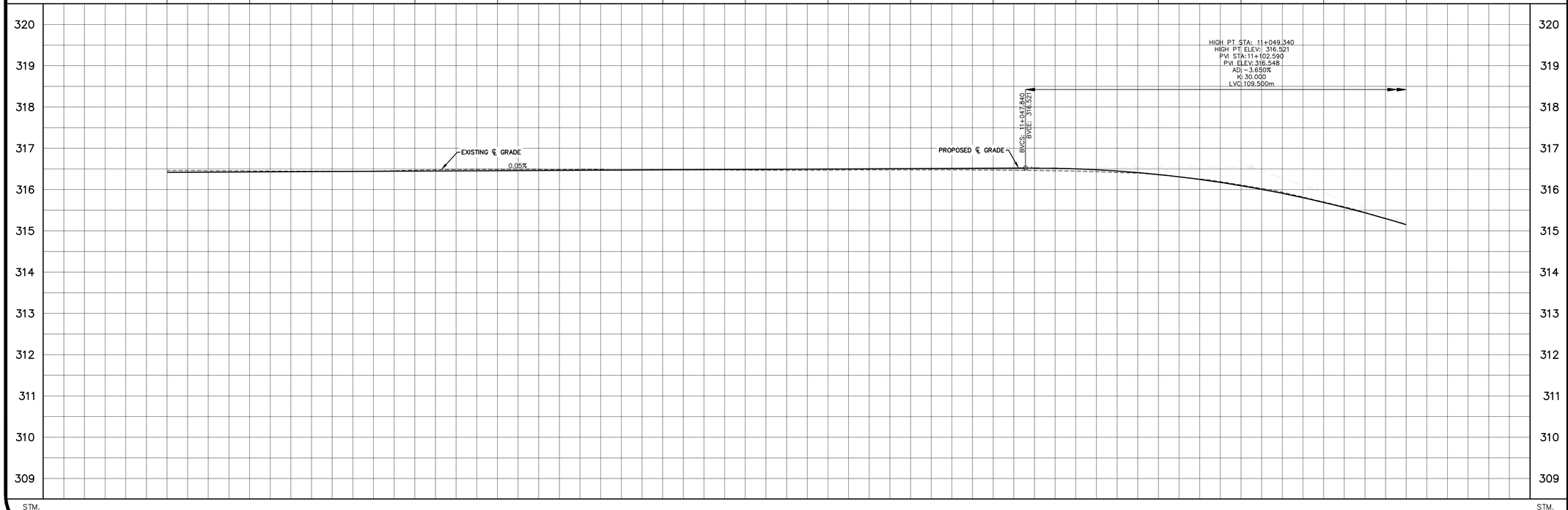
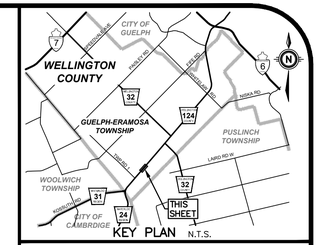


WELLINGTON ROAD 124





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- RIGHT OF WAY
- PROP. ASPHALT

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PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 10+840 TO STA 11+140

Project Manager: D.HALLMAN	Project No.: 41093-200
Design By: NPD	Checked By:
Drawn By: NPD	Checked By:
Surveyed By:	Drawing No.: PP1.2
Date: Jul.25/19	
Scale: 1:1000H 1:100V	Sheet 2 of 23

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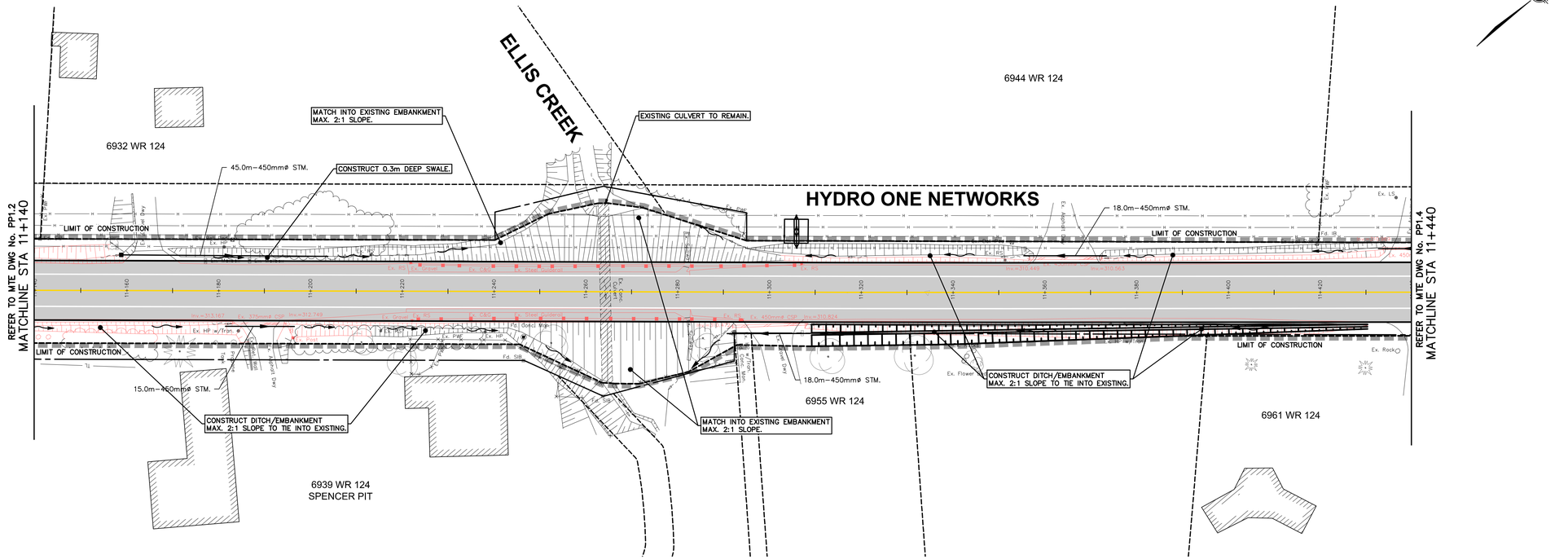

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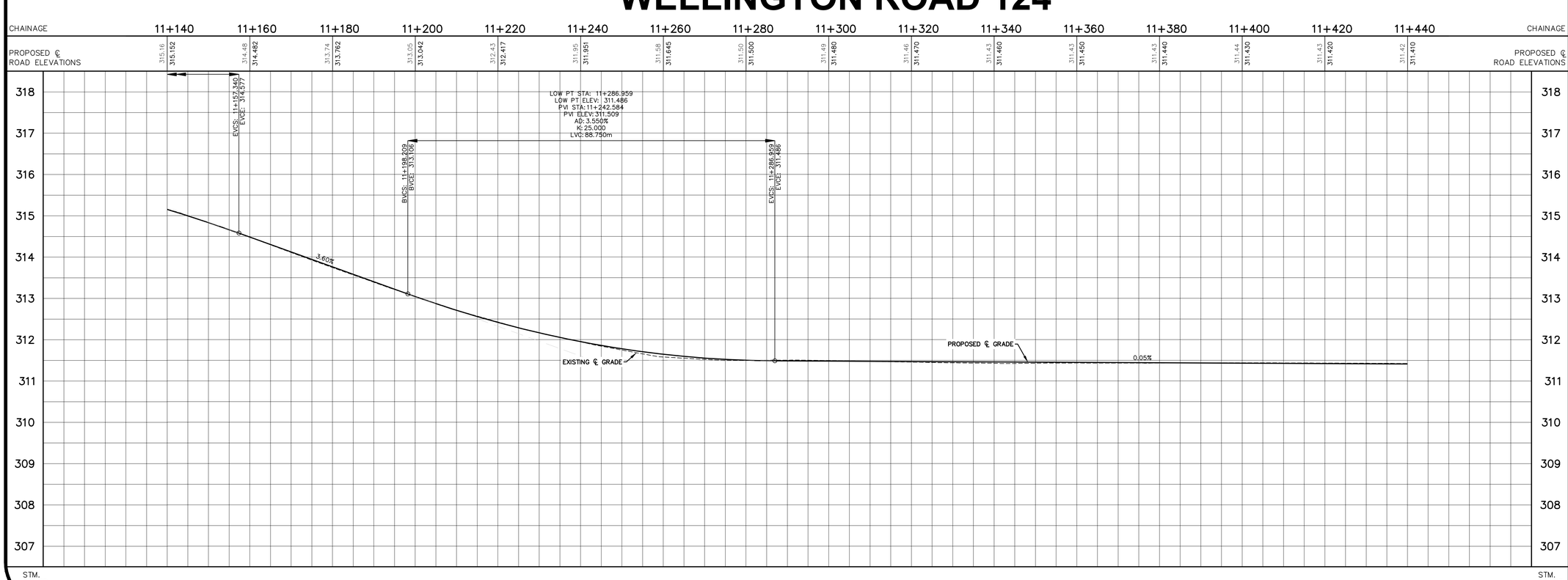

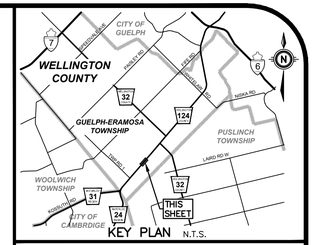

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TR 1 TO FIFE RD TOWNSHIP OF GUELPH–ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 11+140 TO STA 11+440

Project Manager: D.HALLMAN	Project No.: 41093-200
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Drawn By: NPD	Checked By:
Surveyed By:	Drawing No.: PP1.3
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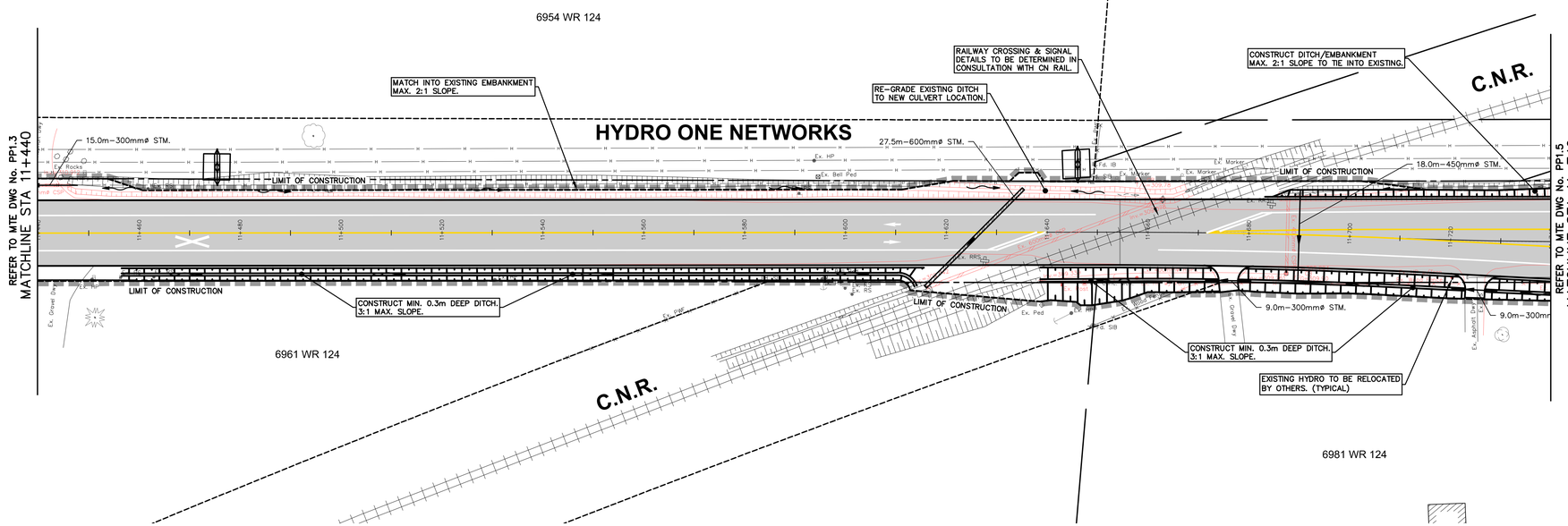

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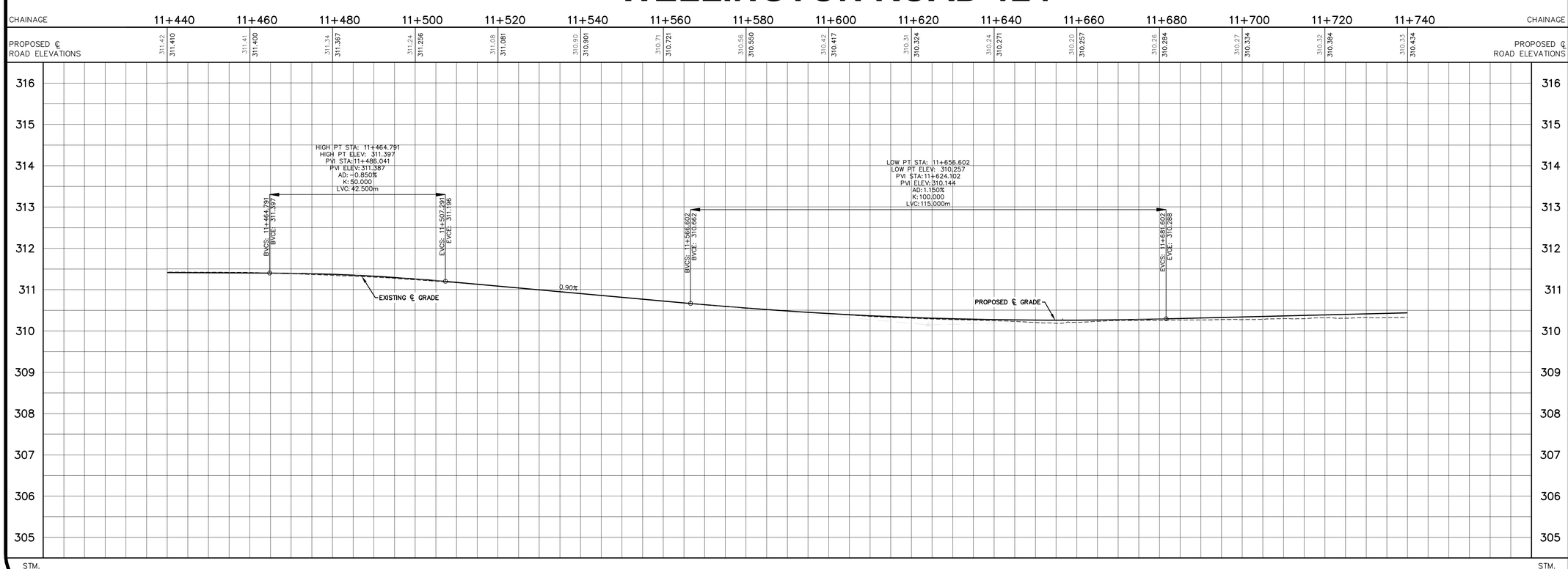

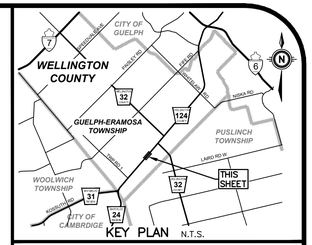

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LEGEND

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COUNTY OF WELLINGTON
74 WOOLWICH ST. GUELPH

PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 11+440 TO STA 11+740

Project Manager D.HALLMAN	Project No. 41093-200
Design By NPD	Checked By .
Drawn By NPD	Checked By .
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PROPOSED CONDITIONS STA: 11+740-12+040

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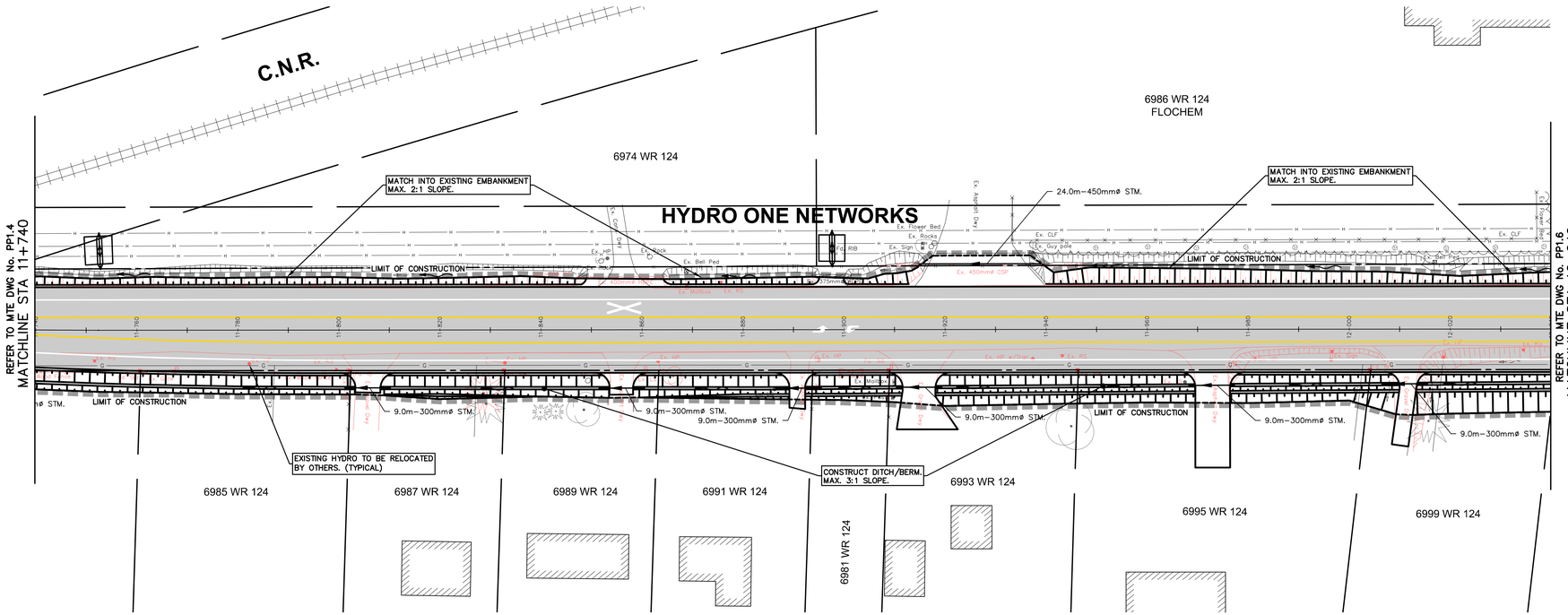

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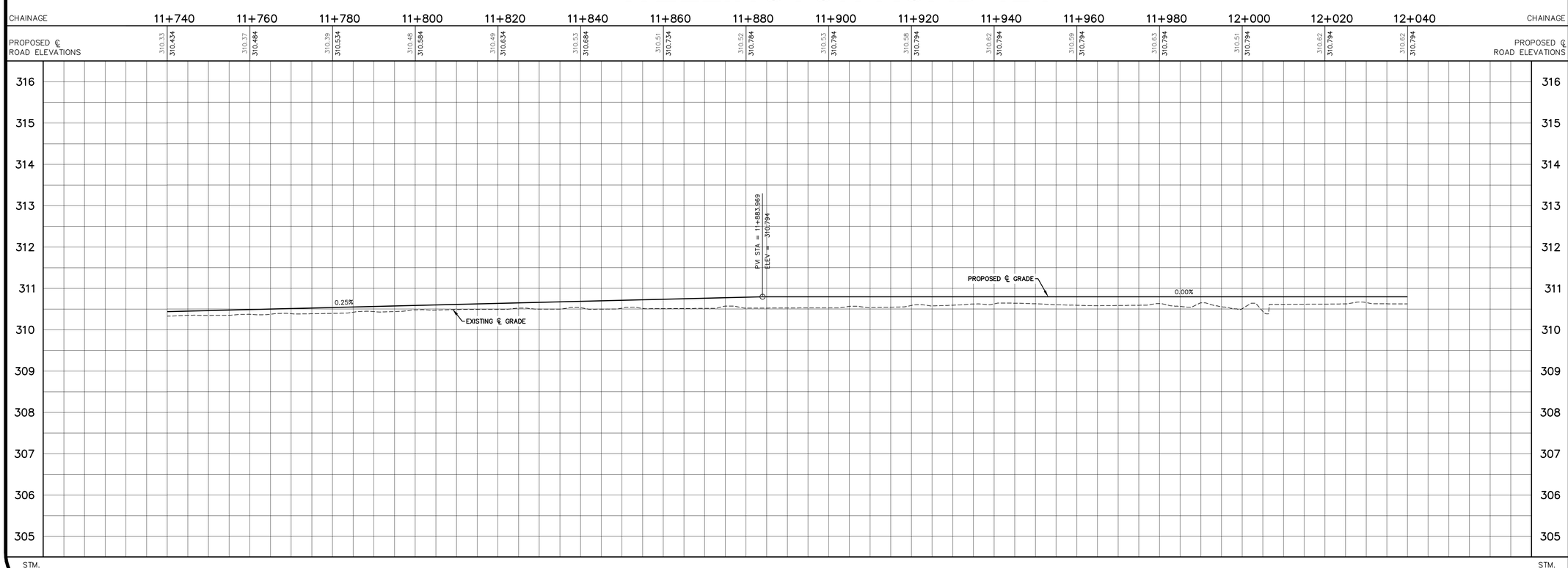

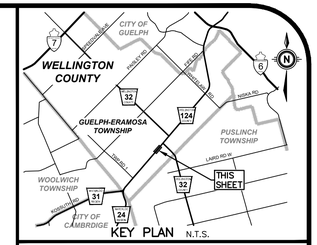

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The Corporation of the County of Wellington

OWNER
COUNTY OF WELLINGTON
74 WOOLWICH ST. GUELPH

PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 11+740 TO STA 12+040

Project Manager: D.HALLMAN	Project No.: 41093-200
Design By: NPD	Checked By:
Drawn By: NPD	Checked By:
Surveyed By:	Drawing No.: PP1.5
Date: Jul.25/19	
Scale: 1:1000H 1:100V	Sheet 5 of 23

December 5, 2019 1:51 p.m. Plotted By: ndumering

41093-200-PP1.6

MTE FILE No:

PROPOSED CONDITIONS STA: 12+040-12+340

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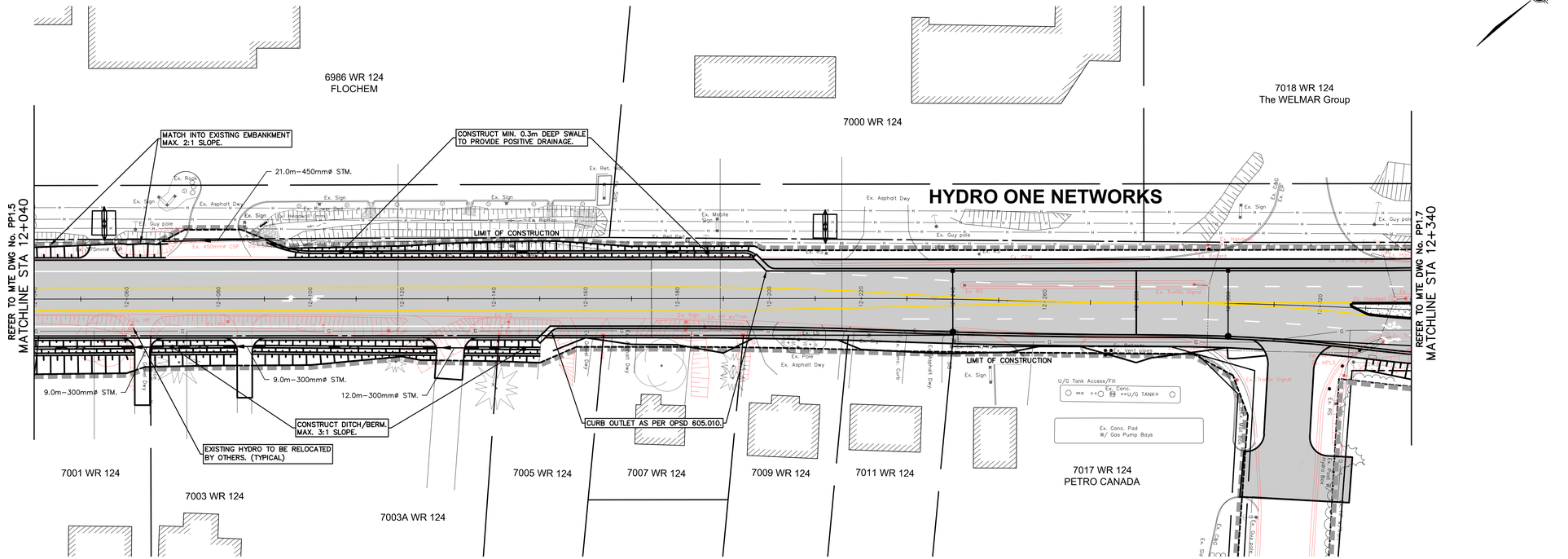
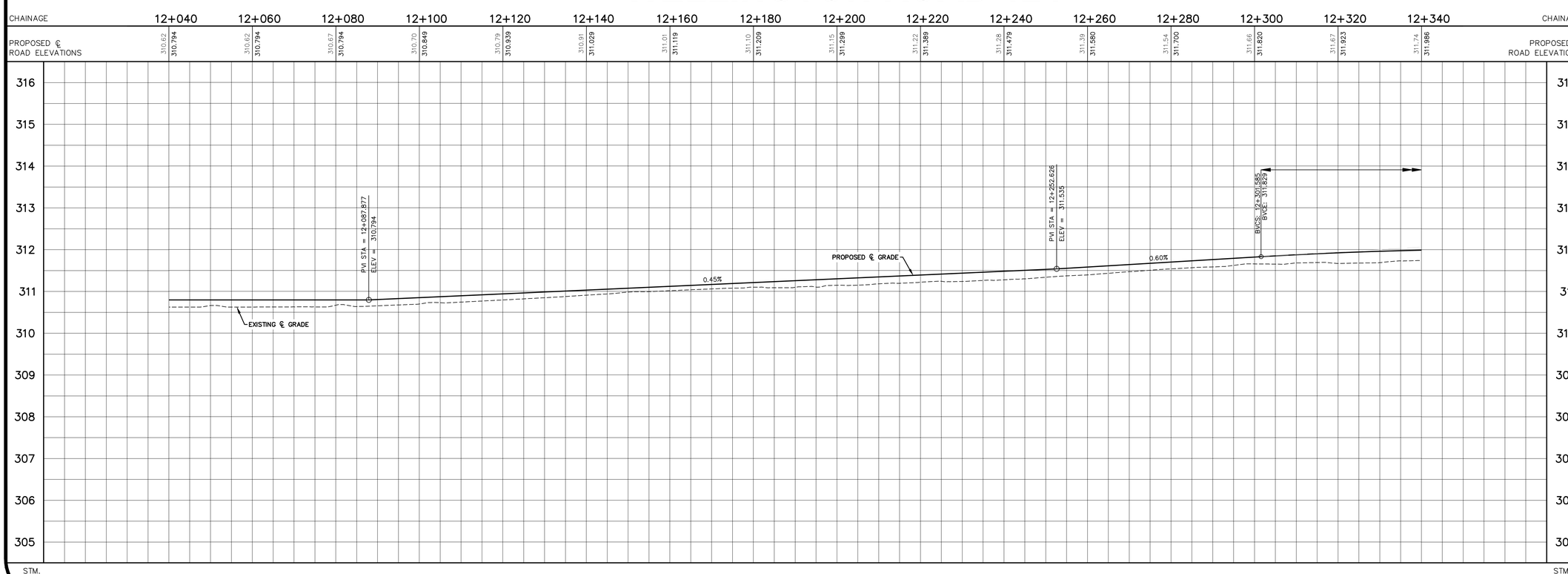
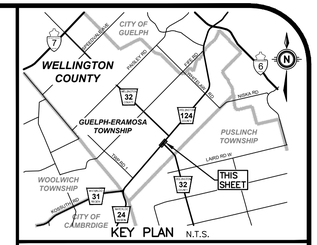


WELLINGTON ROAD 124





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
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1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19

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OWNER
COUNTY OF WELLINGTON
74 WOOLWICH ST. GUELPH

PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 12+040 TO STA 12+340

Project Manager: D.HALLMAN	Project No.: 41093-200
Design By: NPD	Checked By: .
Drawn By: NPD	Checked By: .
Surveyed By:	Drawing No.: PP1.6
Date: Jul.25/19	
Scale: 1:1000H 1:100V	Sheet 6 of 23

December 5, 2019 1:51 p.m. Plotted By: nduimering

MTE FILE No: 41093-200-PP1.7

PROPOSED CONDITIONS STA: 12+340-12+640

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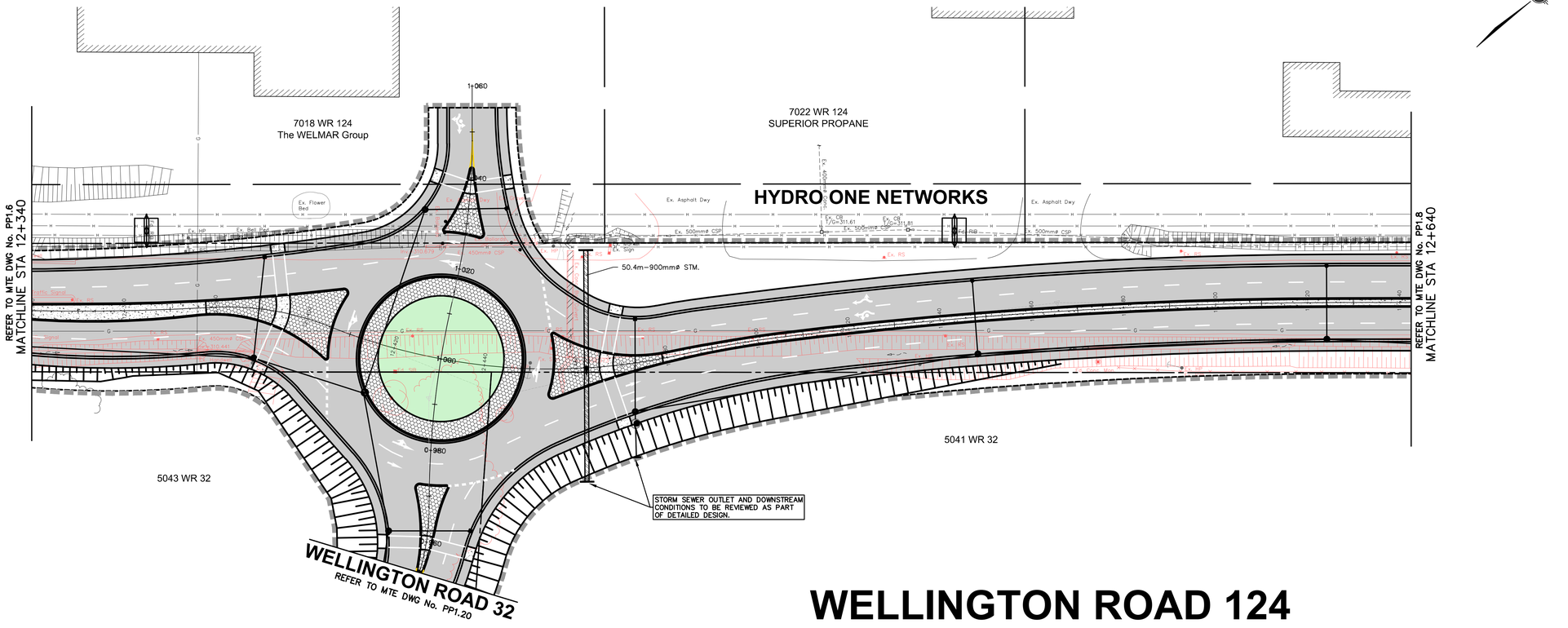
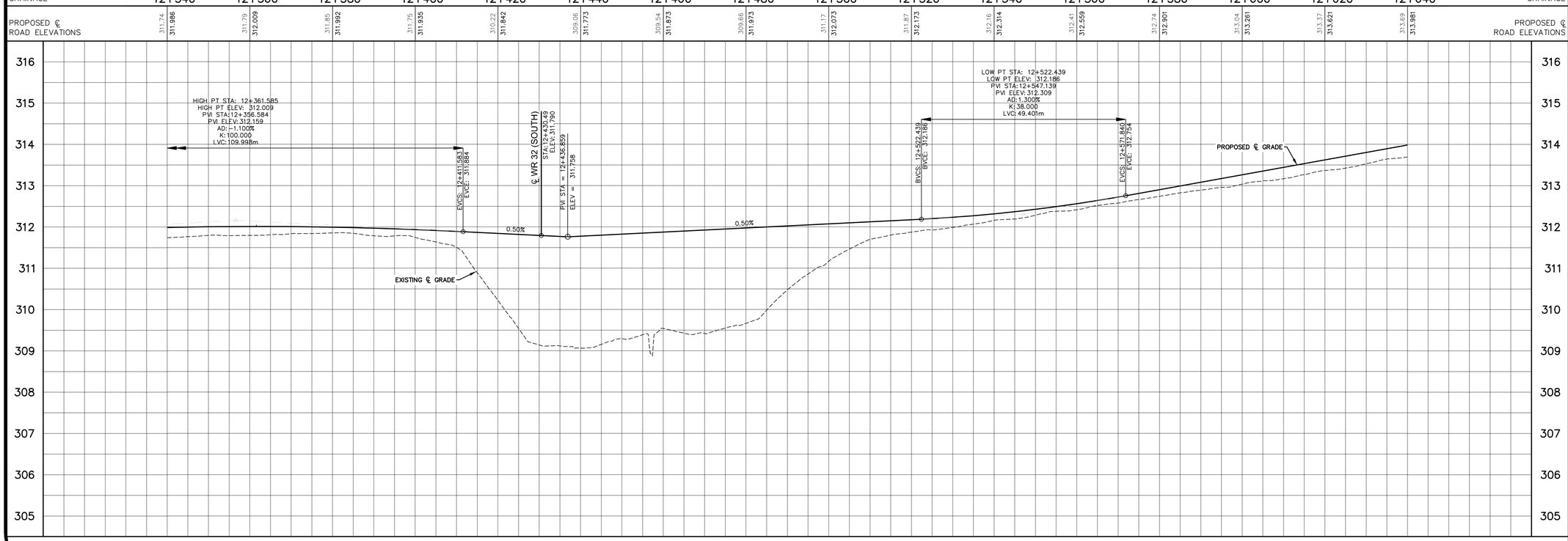
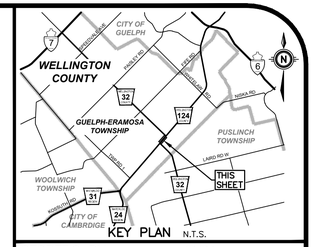


WELLINGTON ROAD 124





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19
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74 WOOLWICH ST. GUELPH

PROJECT

WELLINGTON ROAD 124 RECONSTRUCTION

TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING

PROPOSED CONDITIONS WELLINGTON ROAD 124

STA 12+340 TO STA 12+640

Project Manager D.HALLMAN	Project No. 41093-200
Design By NPD	Checked By .
Drawn By NPD	Checked By .
Surveyed By	Drawing No. PP1.7
Date Jul.25/19	
Scale 1:1000H 1:100V	Sheet 7 of 23

Plotted By: ndulmering

December 5, 2019 1:51 p.m.

41093-200-PP1.8

MTE FILE No:

PROPOSED CONDITIONS STA: 12+640-12+960

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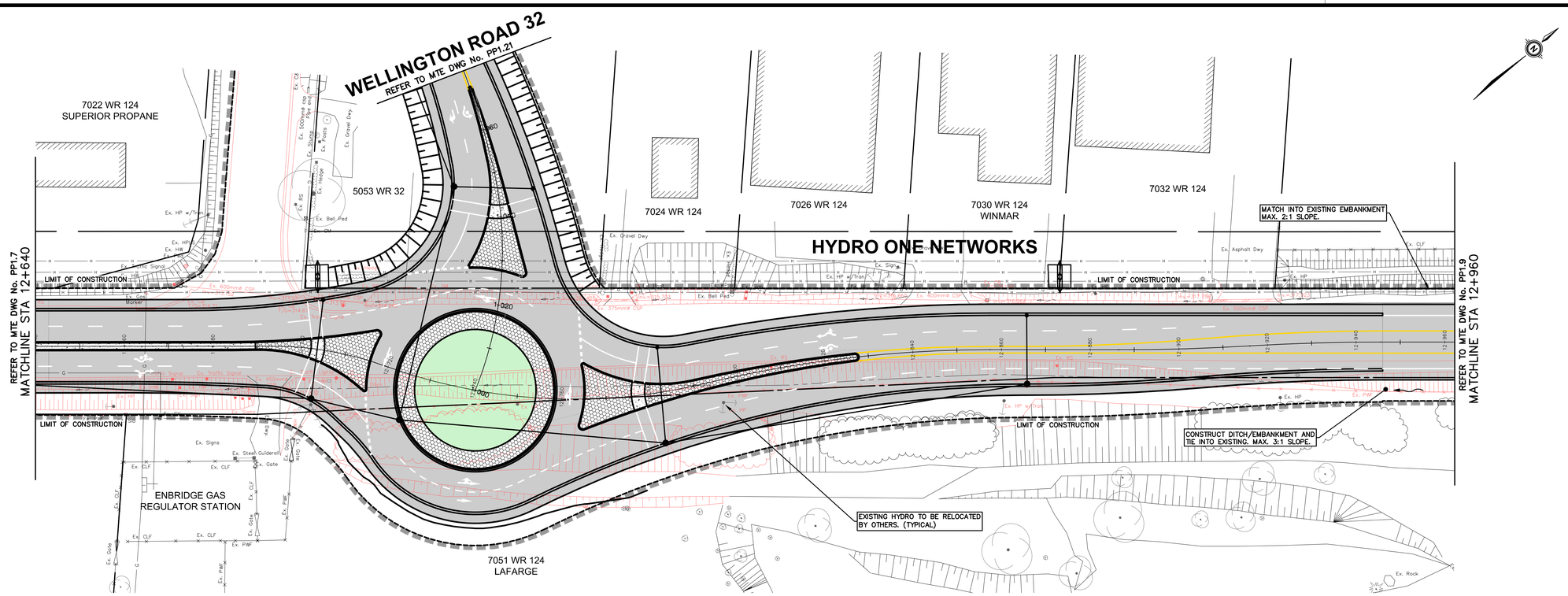
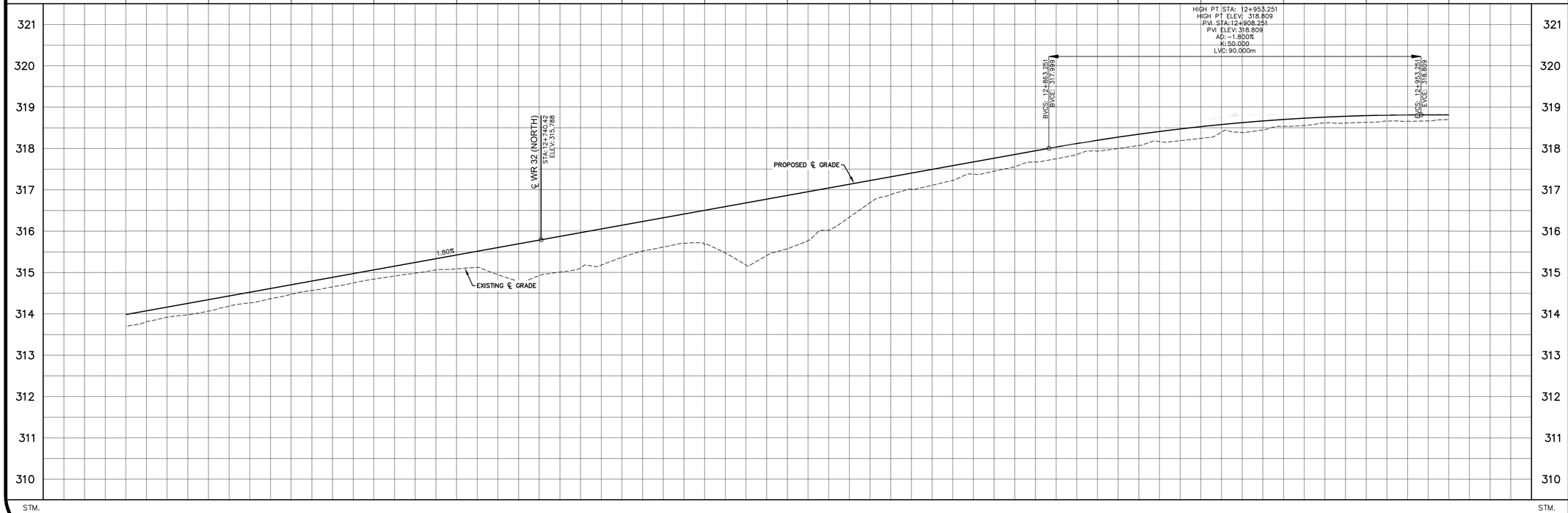
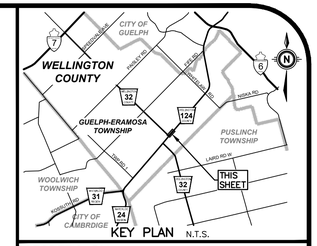


WELLINGTON ROAD 124





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
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1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19

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PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 12+640 TO STA 12+960

Project Manager: D.HALLMAN	Project No.: 41093-200
Design By: NPD	Checked By:
Drawn By: NPD	Checked By:
Surveyed By:	Drawing No.: PP1.8
Date: Jul.25/19	
Scale: 1:1000H 1:100V	Sheet 8 of 23

December 5, 2019 1:51 p.m. Plotted By: ndumering

41093-200-PP1.9

MTE FILE No:
PROPOSED CONDITIONS STA: 12+960-13+280
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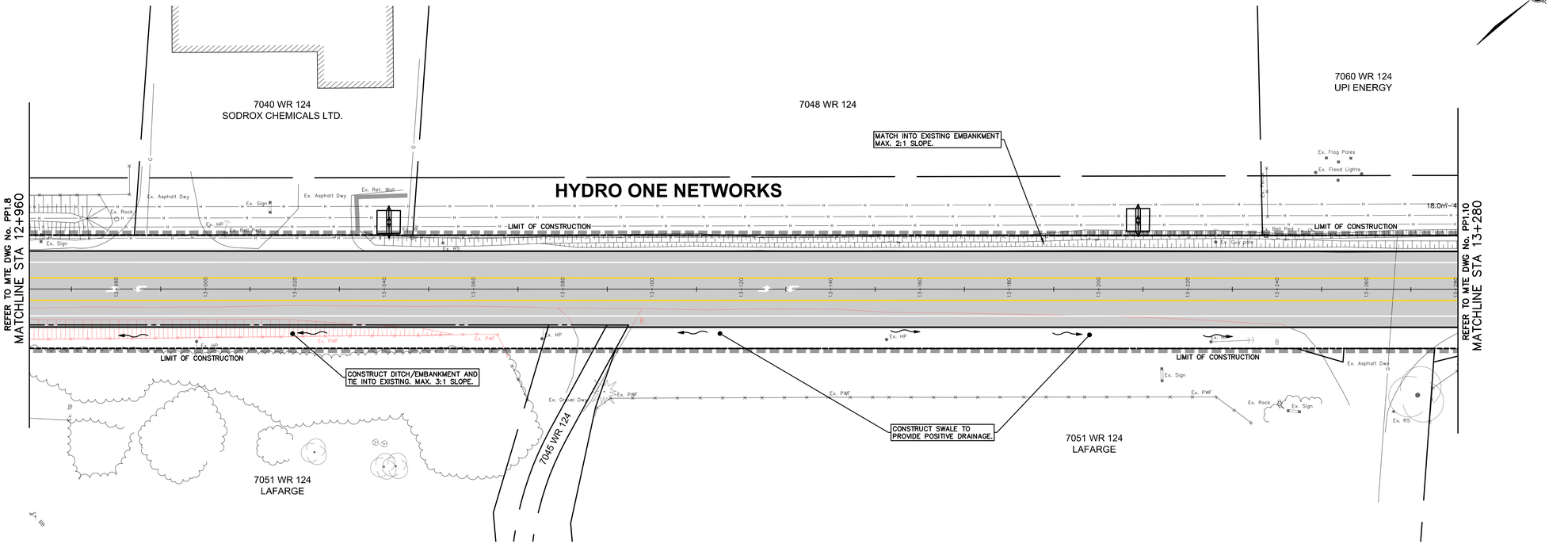
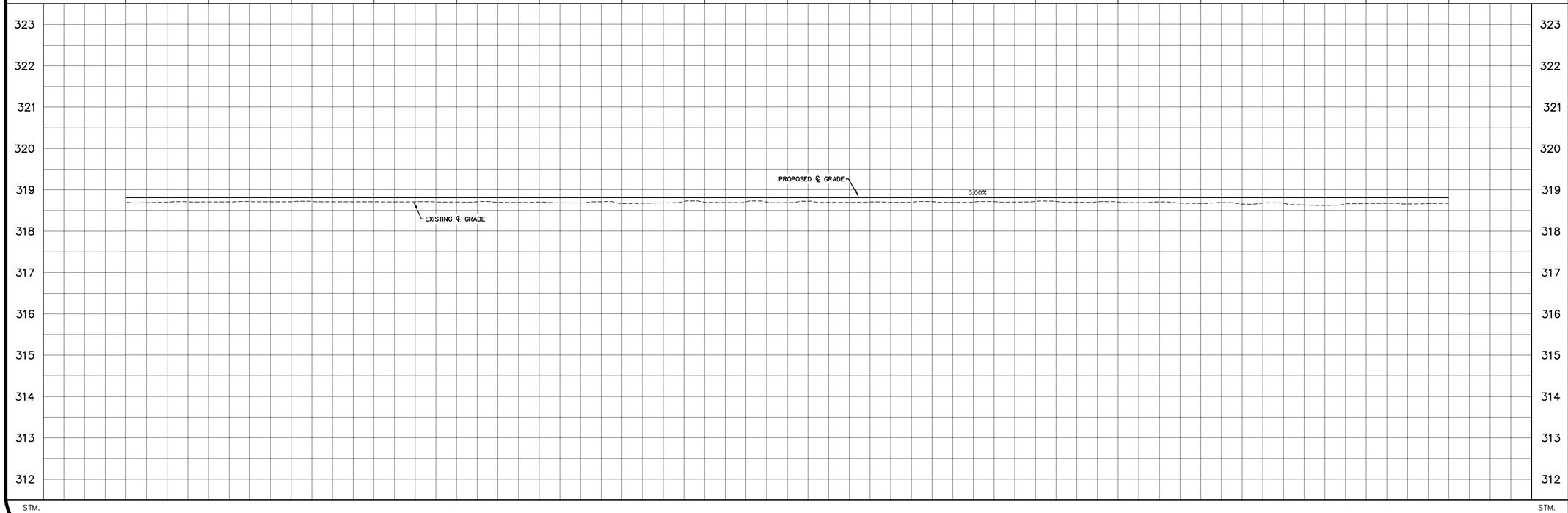
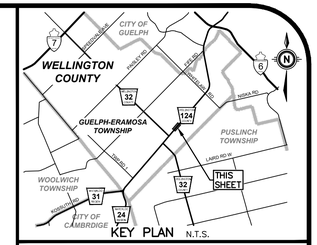


WELLINGTON ROAD 124





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
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1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19

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PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 12+960 TO STA 13+280

Project Manager D.HALLMAN	Project No. 41093-200
Design By NPD	Checked By
Drawn By NPD	Checked By
Surveyed By	Drawing No. PP1.9
Date Jul.25/19	
Scale 1:1000H 1:100V	Sheet 9 of 23

December 5, 2019 1:51 p.m. Plotted By: nduimering

MTE FILE No: 41093-200-PP1.10
PROPOSED CONDITIONS STA: 13+280-13+600
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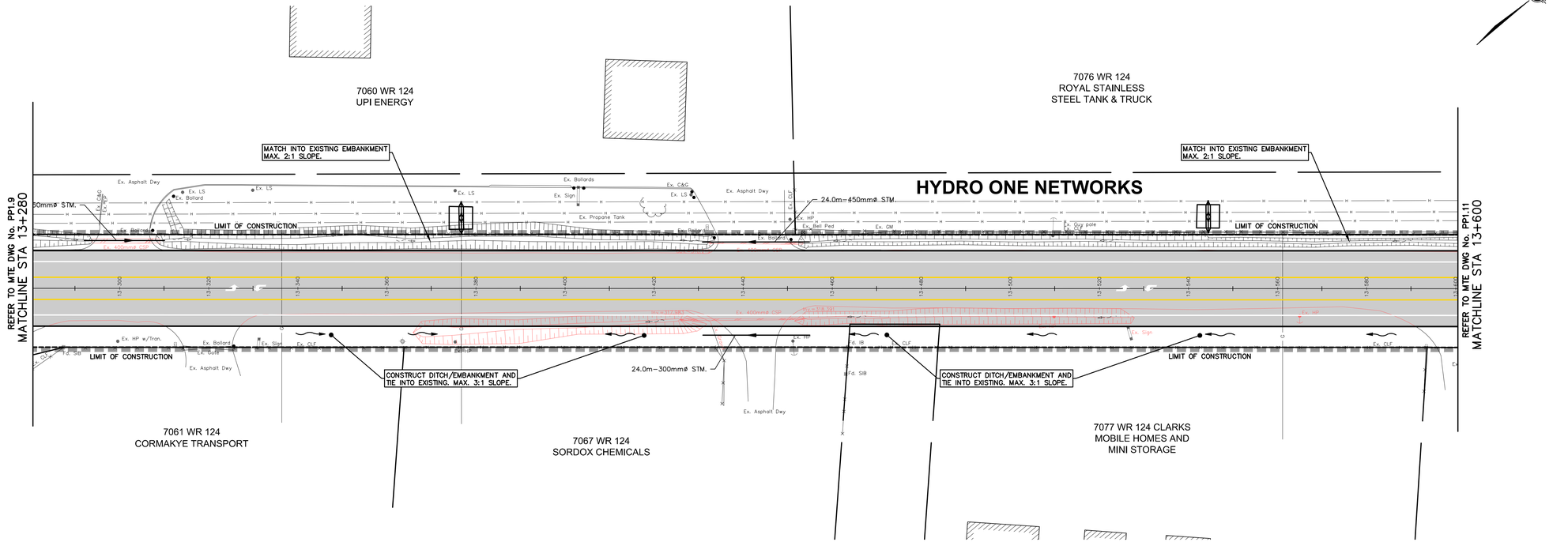
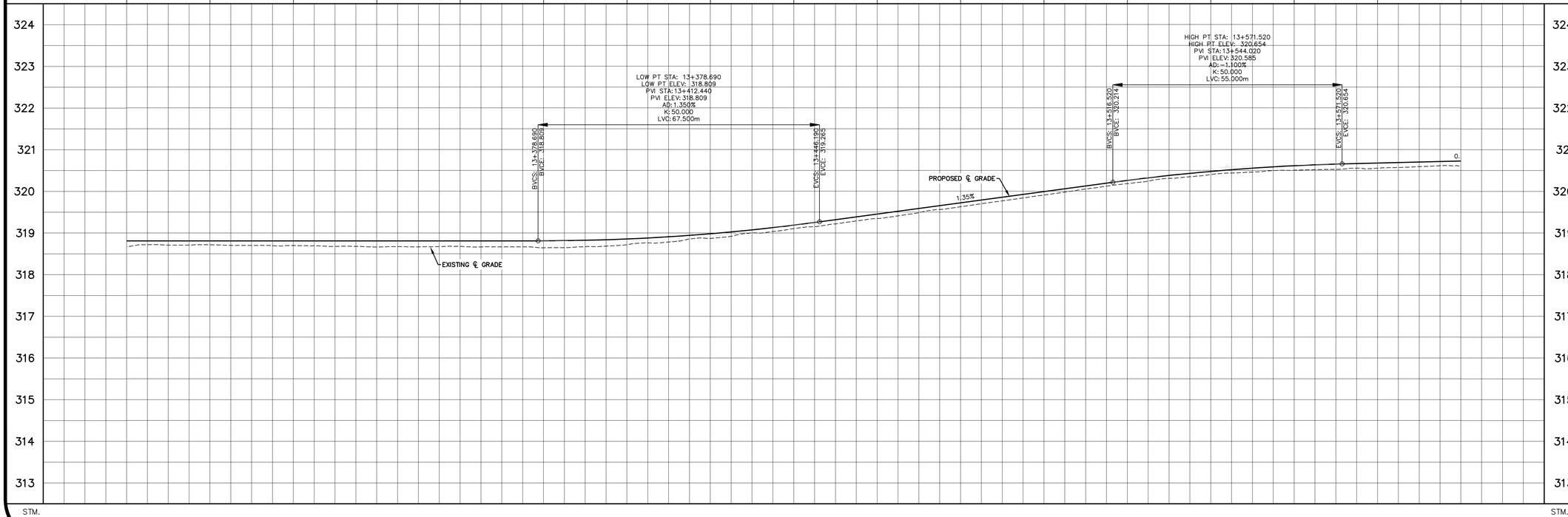
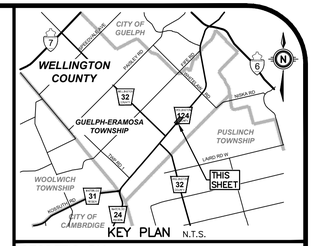


WELLINGTON ROAD 124

CHAINAGE	13+280	13+300	13+320	13+340	13+360	13+380	13+400	13+420	13+440	13+460	13+480	13+500	13+520	13+540	13+560	13+580	13+600	CHAINAGE
PROPOSED ℄ ROAD ELEVATIONS	318.67	318.71	318.70	318.66	318.68	318.64	318.72	318.87	319.10	319.34	319.63	319.91	320.18	320.40	320.50	320.55	320.59	PROPOSED ℄ ROAD ELEVATIONS
	318.809	318.809	318.809	318.809	318.809	318.809	318.855	318.980	319.185	319.451	319.721	319.991	320.280	320.476	320.612	320.675	320.725	





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
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1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19

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PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 13+280 TO STA 13+600

Project Manager D.HALLMAN	Project No. 41093-200
Design By NPD	Checked By .
Drawn By NPD	Checked By .
Surveyed By	Drawing No. PP1.10
Date Jul.25/19	
Scale 1:1000H 1:100V	Sheet 10 of 23

December 5, 2019 1:51 p.m. Plotted By: ndulmering

41093-200-PP1.11

MTE FILE No:
PROPOSED CONDITIONS STA. 13+600-13+920
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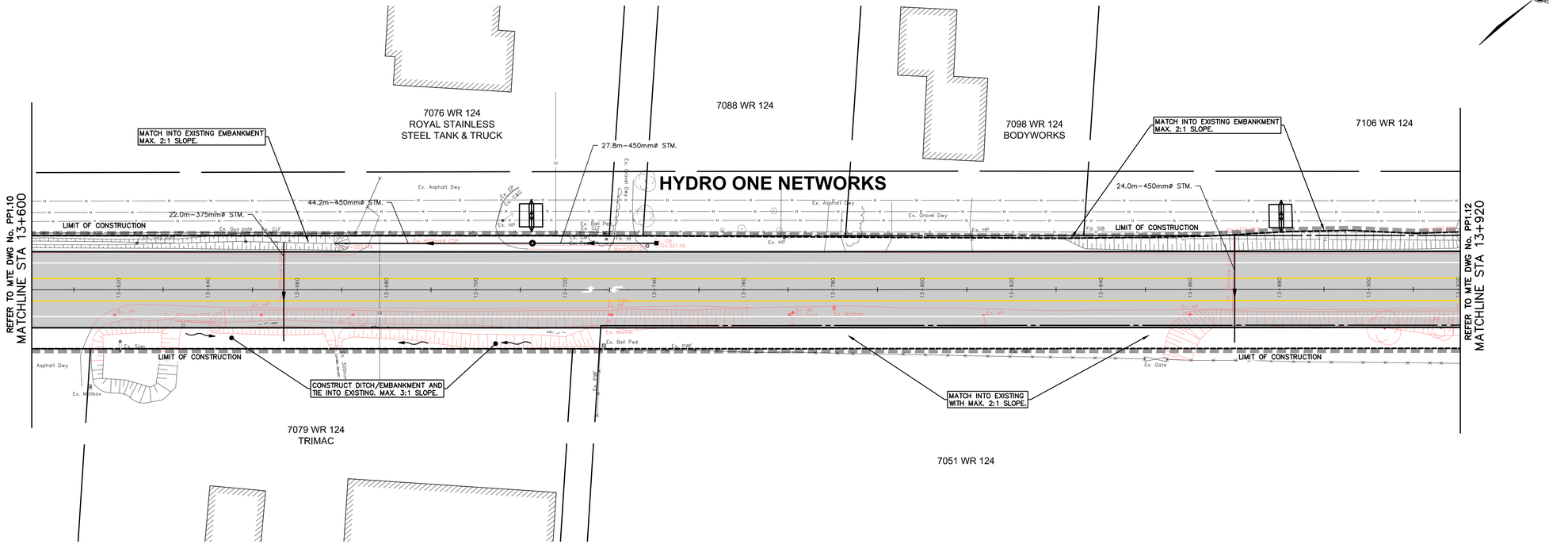
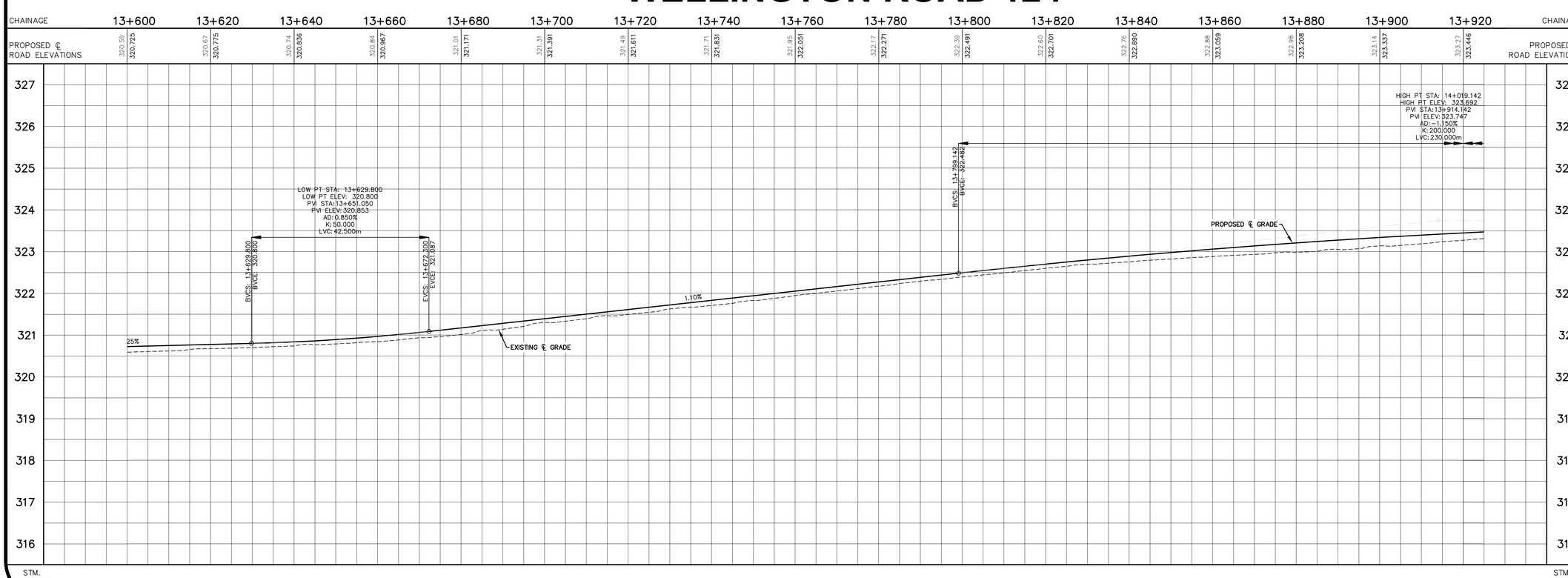
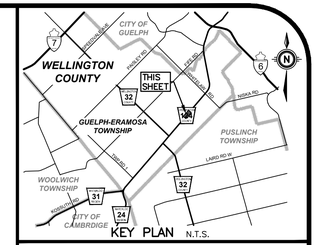


WELLINGTON ROAD 124





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
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1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19

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PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 13+600 TO STA 13+920

Project Manager: D.HALLMAN	Project No.: 41093-200
Design By: NPD	Checked By: .
Drawn By: NPD	Checked By: .
Surveyed By:	Drawing No.: PP1.11
Date: Jul.25/19	
Scale: 1:1000H 1:100V	Sheet 11 of 23

December 5, 2019 1:51 p.m. Plotted By: ndulmering

41093-200-PP1.12

MTE FILE No:

PROPOSED CONDITIONS STA: 13+920-14+240

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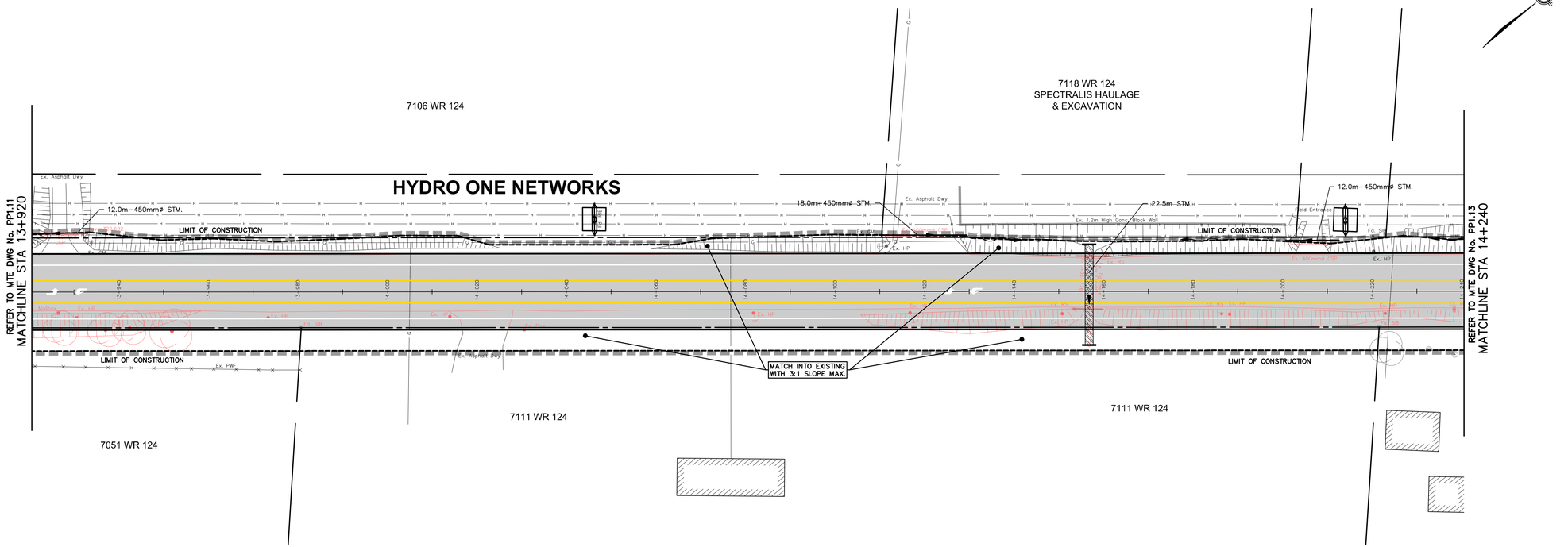
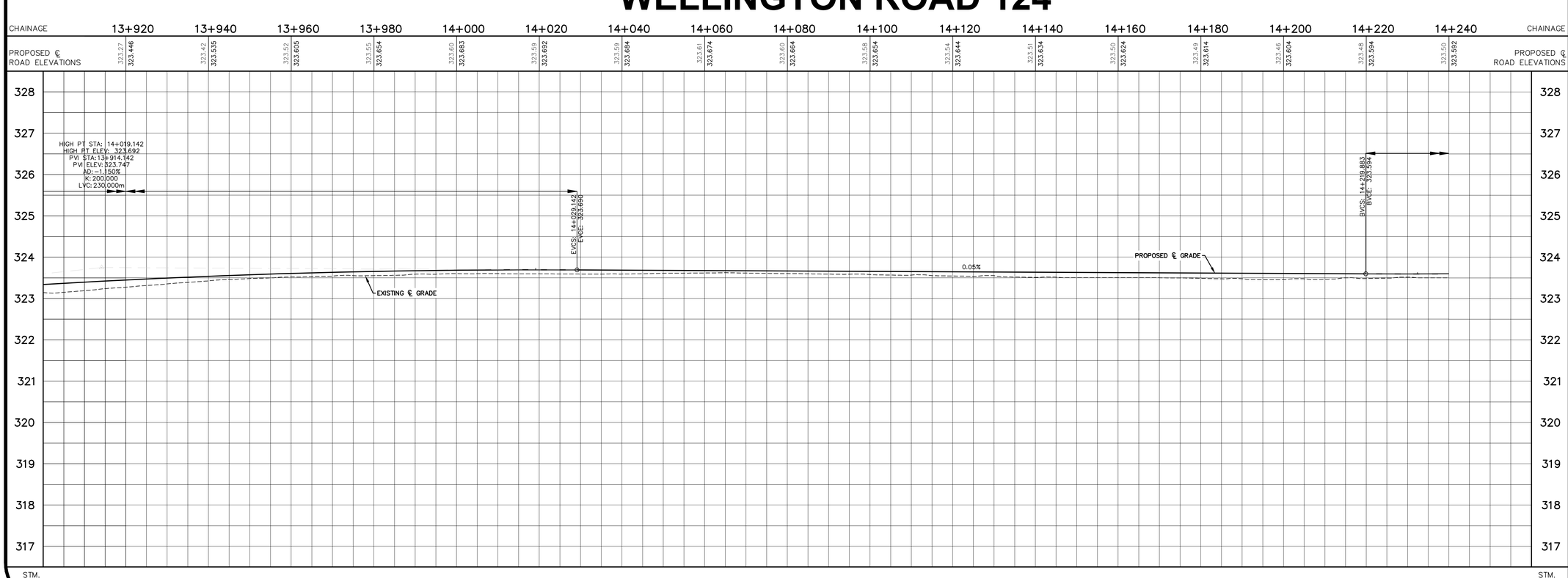
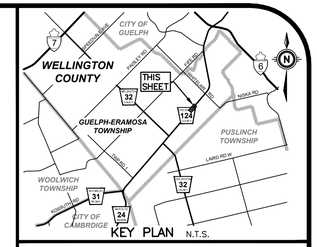


WELLINGTON ROAD 124





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
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1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19

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PROJECT

WELLINGTON ROAD 124 RECONSTRUCTION

TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING

PROPOSED CONDITIONS WELLINGTON ROAD 124

STA 13+920 TO STA 14+240

Project Manager: D.HALLMAN	Project No.: 41093-200
Design By: NPD	Checked By: .
Drawn By: NPD	Checked By: .
Surveyed By:	Drawing No.: PP1.12
Date: Jul.25/19	
Scale: 1:1000H 1:100V	Sheet 12 of 23

December 5, 2019 1:51 p.m. Plotted By: ndulmering

MTE FILE No: 41093-200-PP1.13

PROPOSED CONDITIONS STA: 14+240-14+560

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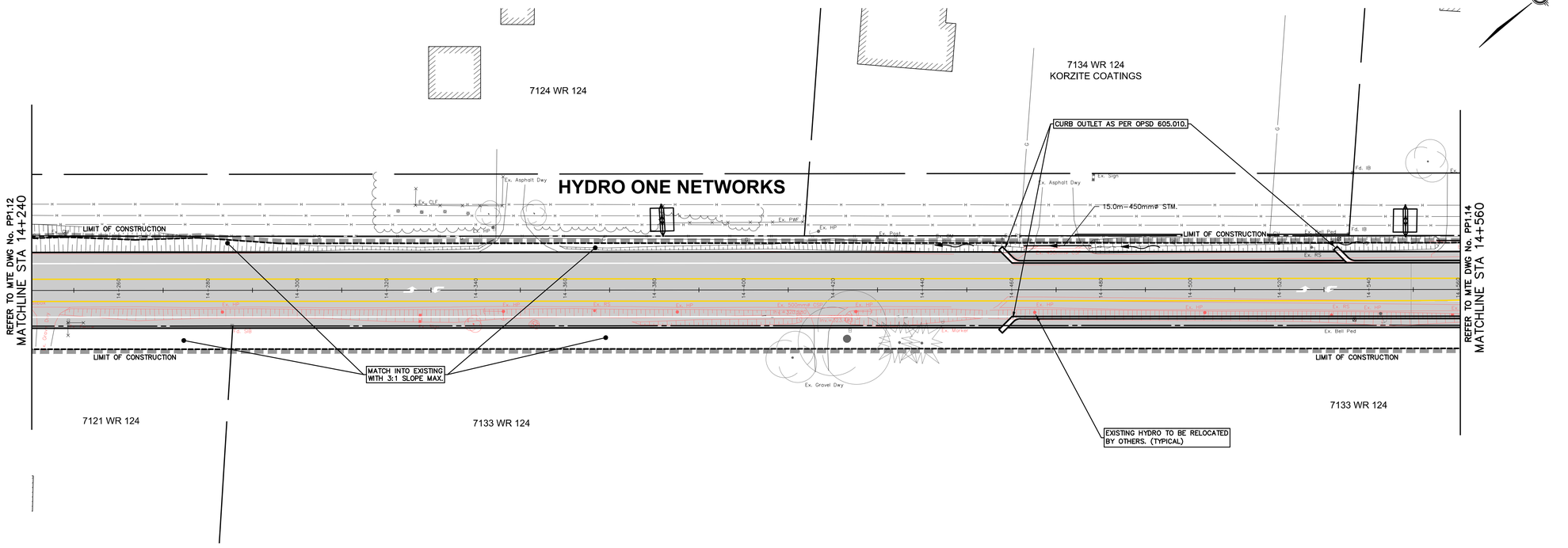
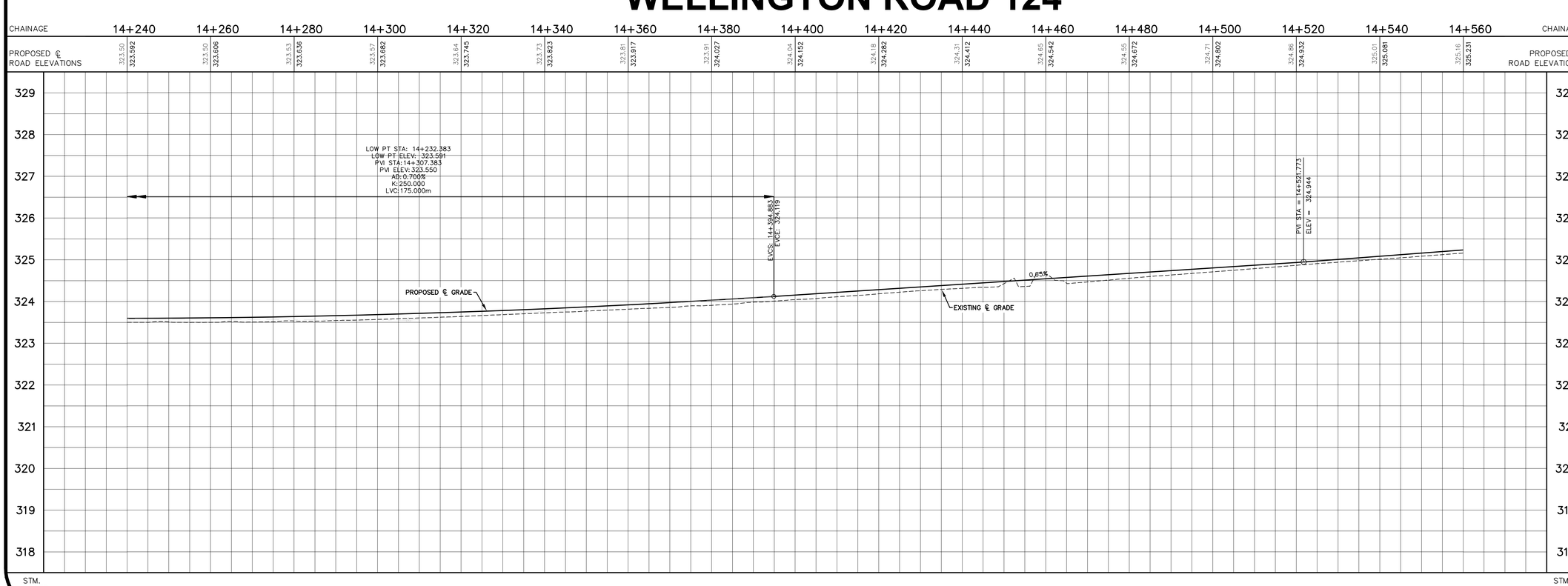
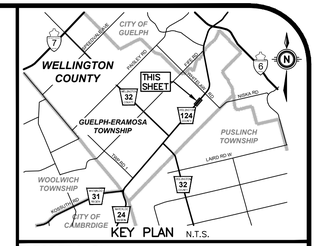


WELLINGTON ROAD 124





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
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74 WOOLWICH ST. GUELPH

PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 14+240 TO STA 14+560

Project Manager: D.HALLMAN	Project No.: 41093-200
Design By: NPD	Checked By:
Drawn By: NPD	Checked By:
Surveyed By:	Drawing No.: PP1.13
Date: Jul.25/19	
Scale: 1:1000H 1:100V	Sheet 13 of 23

December 5, 2019 1:51 p.m. Plotted By: ndunmering

MTE FILE No: 41093-200-PP1.14

PROPOSED CONDITIONS STA: 14+560-14+880

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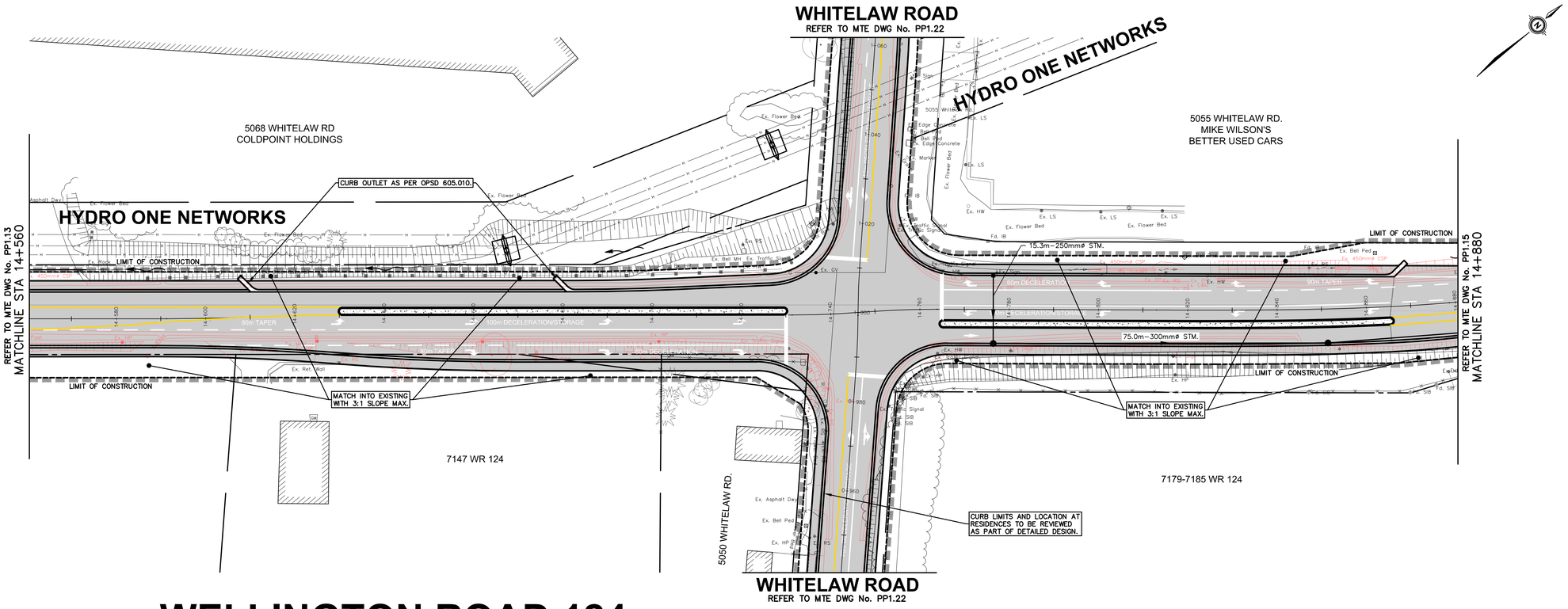
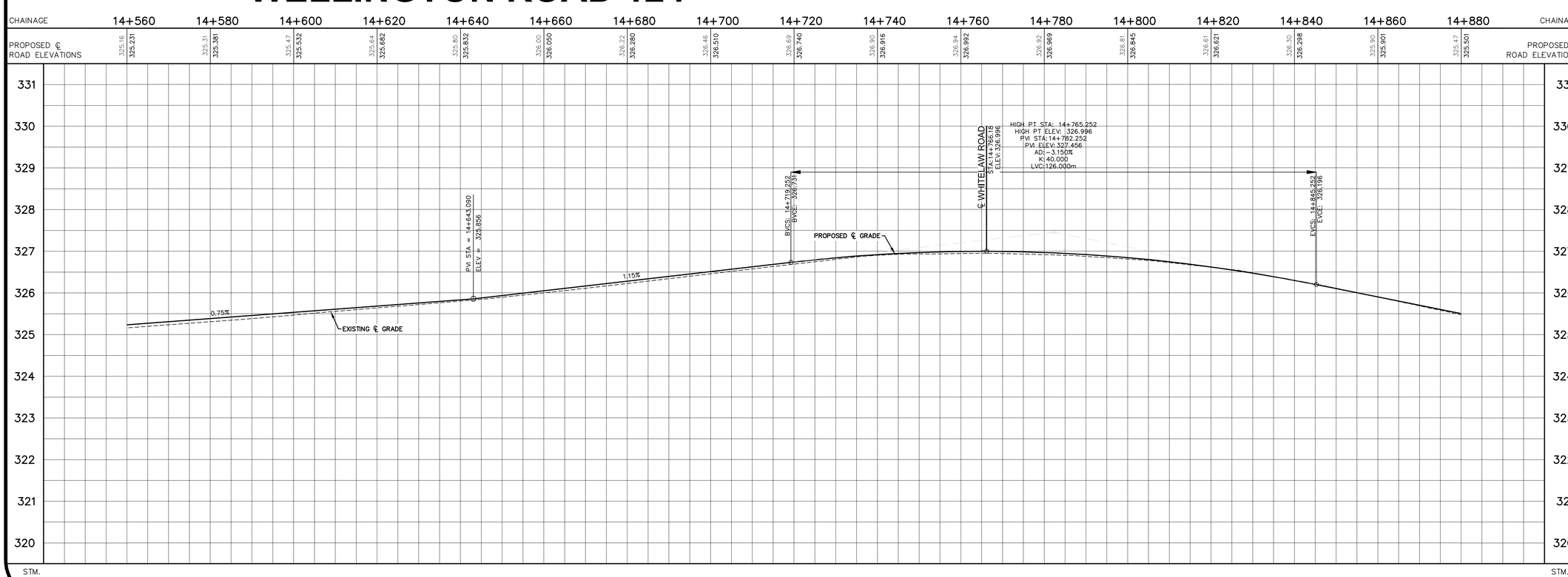
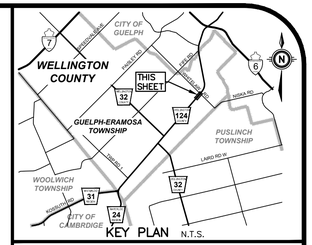


WELLINGTON ROAD 124





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19
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PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 14+560 TO STA 14+880

Project Manager: D.HALLMAN	Project No.: 41093-200
Design By: NPD	Checked By:
Drawn By: NPD	Checked By:
Surveyed By:	Drawing No.: PP1.14
Date: Jul.25/19	
Scale: 1:1000H 1:100V	Sheet 14 of 23

December 5, 2019 1:51 p.m. Plotted By: ndumering

MTE FILE No: 41093-200-PP1.15

PROPOSED CONDITIONS STA: 14+880-15+200

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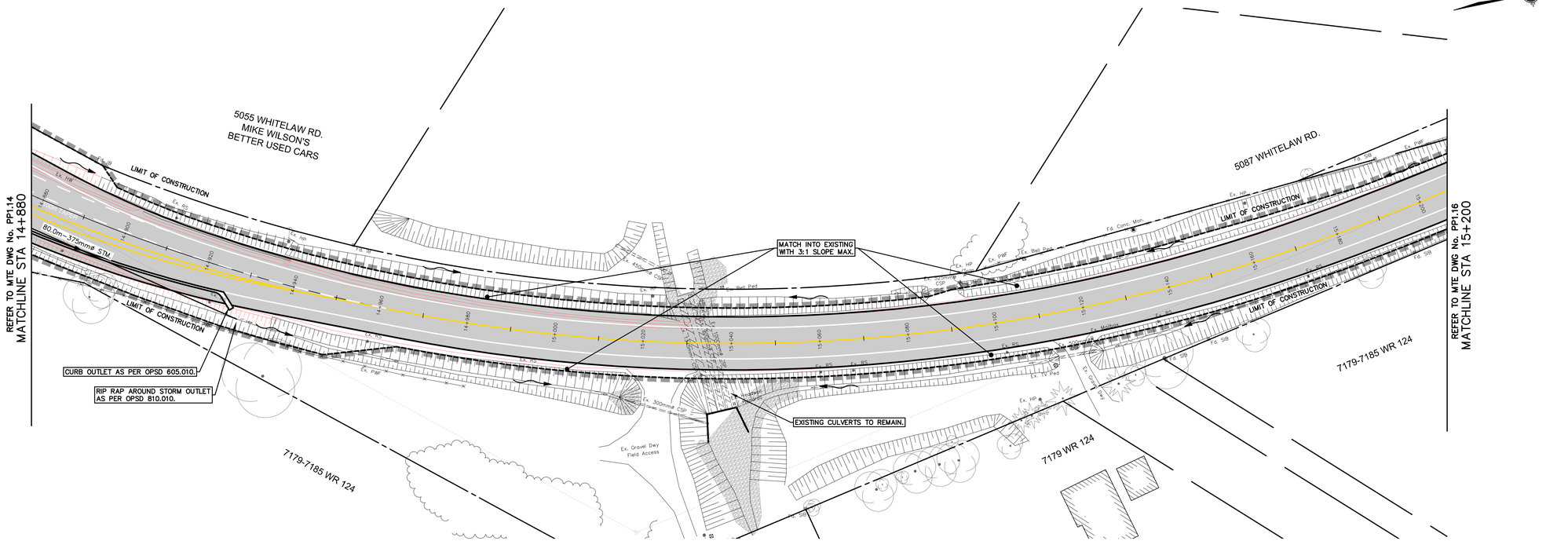
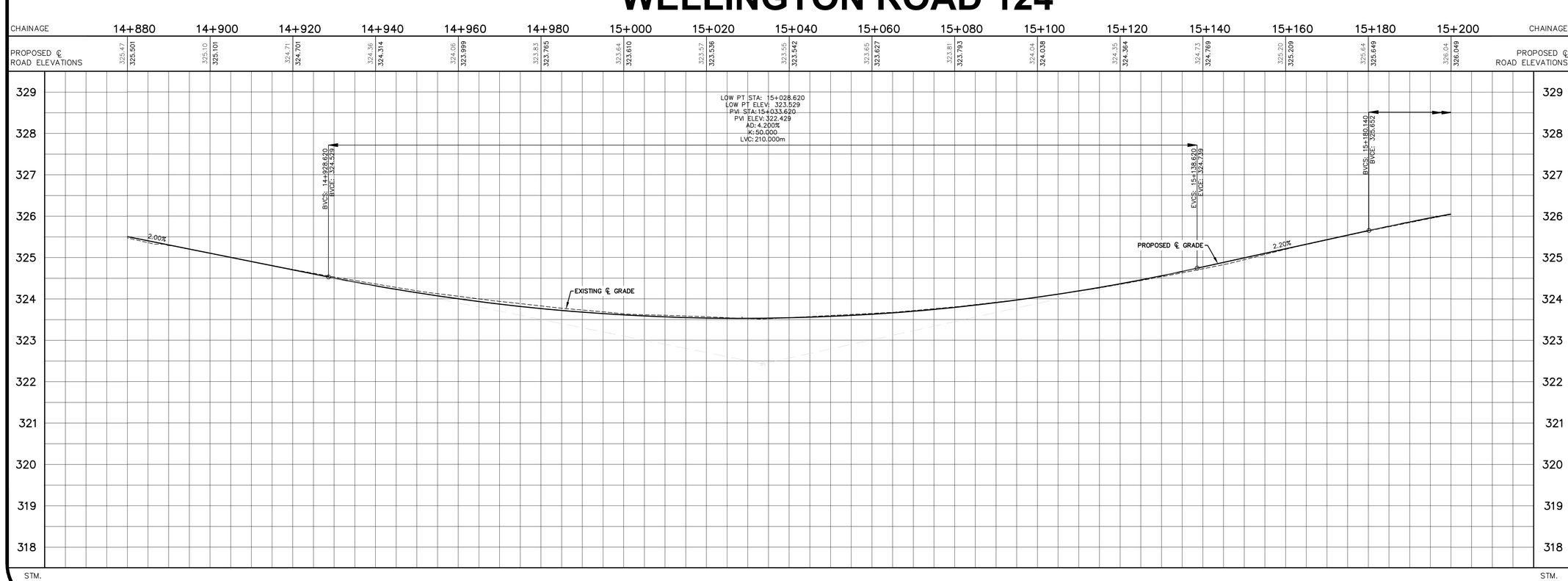
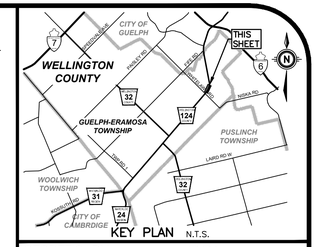


WELLINGTON ROAD 124





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19
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The Corporation of the County of Wellington

OWNER
COUNTY OF WELLINGTON
74 WOOLWICH ST. GUELPH

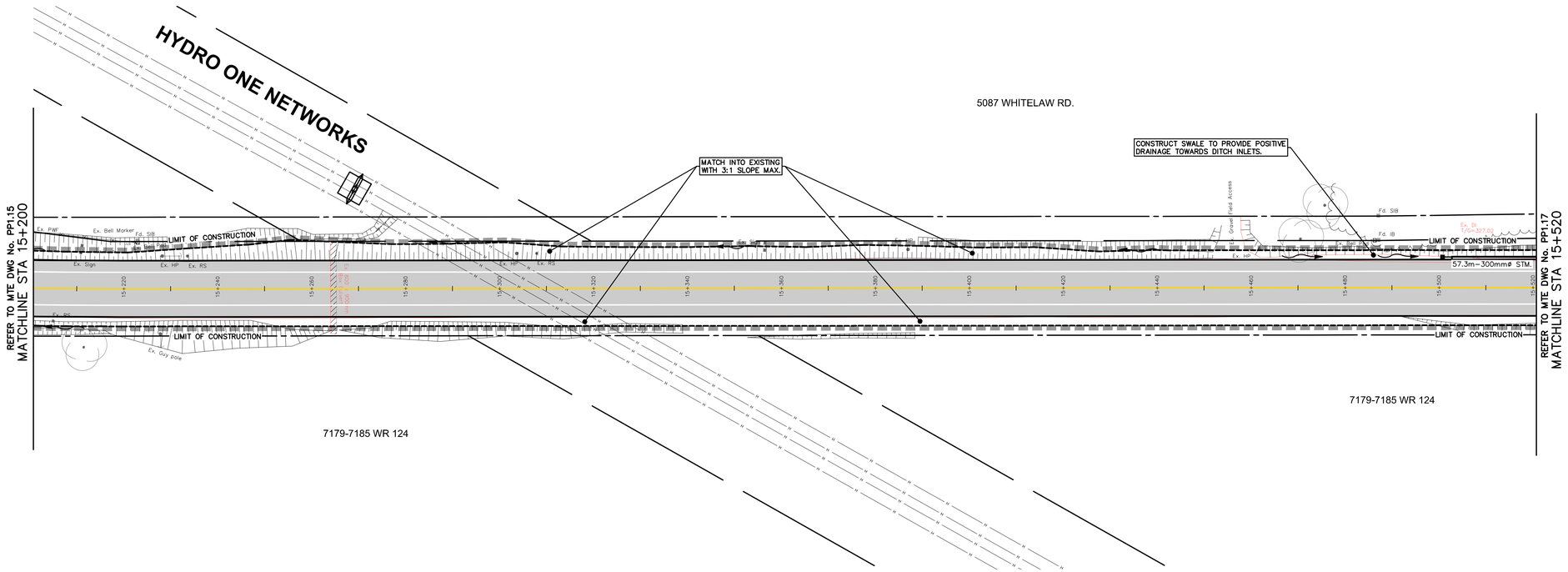
PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 14+880 TO STA 15+200

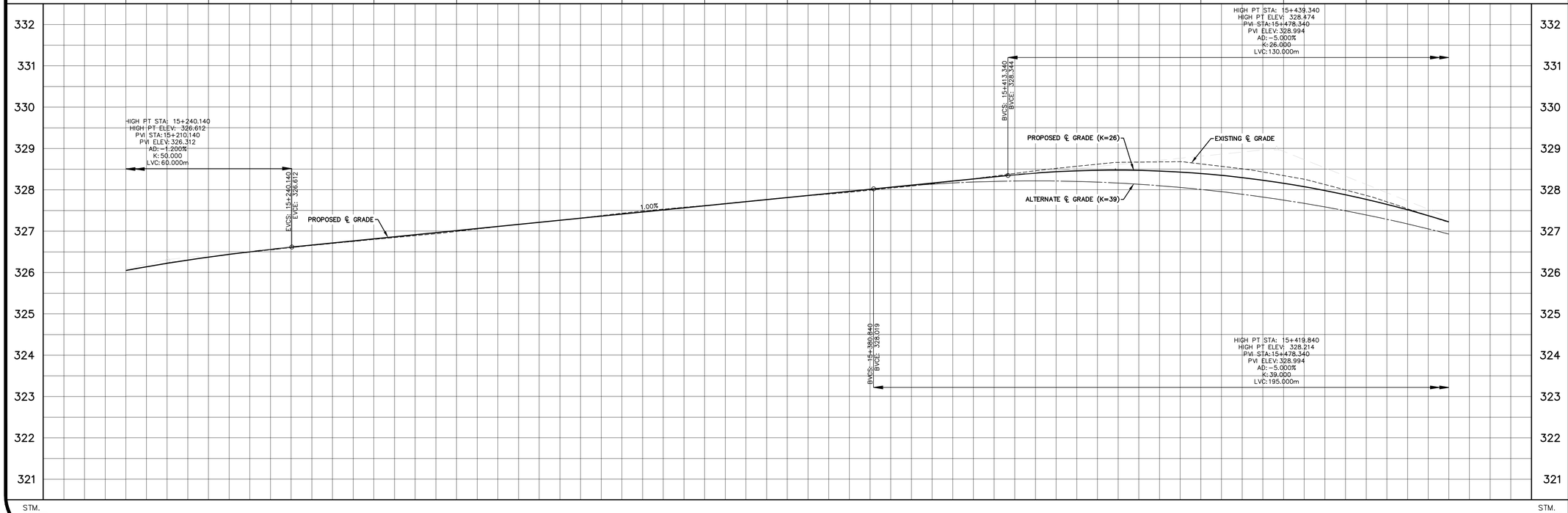
Project Manager: D.HALLMAN	Project No.: 41093-200
Design By: NPD	Checked By:
Drawn By: NPD	Checked By:
Surveyed By:	Drawing No.: PP1.15
Date: Jul.25/19	
Scale: 1:1000H 1:100V	Sheet 15 of 23

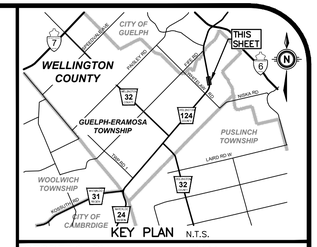
December 5, 2019 1:51 p.m. Plotted By: ndulmering

MTE FILE No: 41093-200-PP1.16
PROPOSED CONDITIONS STA. 15+200-15+520
P:\P\41093\200\41093-200-PP1



WELLINGTON ROAD 124





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19
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PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 15+200 TO STA 15+520

Project Manager: D.HALLMAN	Project No.: 41093-200
Design By: NPD	Checked By:
Drawn By: NPD	Checked By:
Surveyed By:	Drawing No.: PP1.16
Date: Jul.25/19	
Scale: 1:1000H 1:100V	Sheet 16 of 23

December 5, 2019 1:51 p.m. Plotted By: ndunnering

41093-200-PP1.17

MTE FILE No:
PROPOSED CONDITIONS STA: 15+520-15+840
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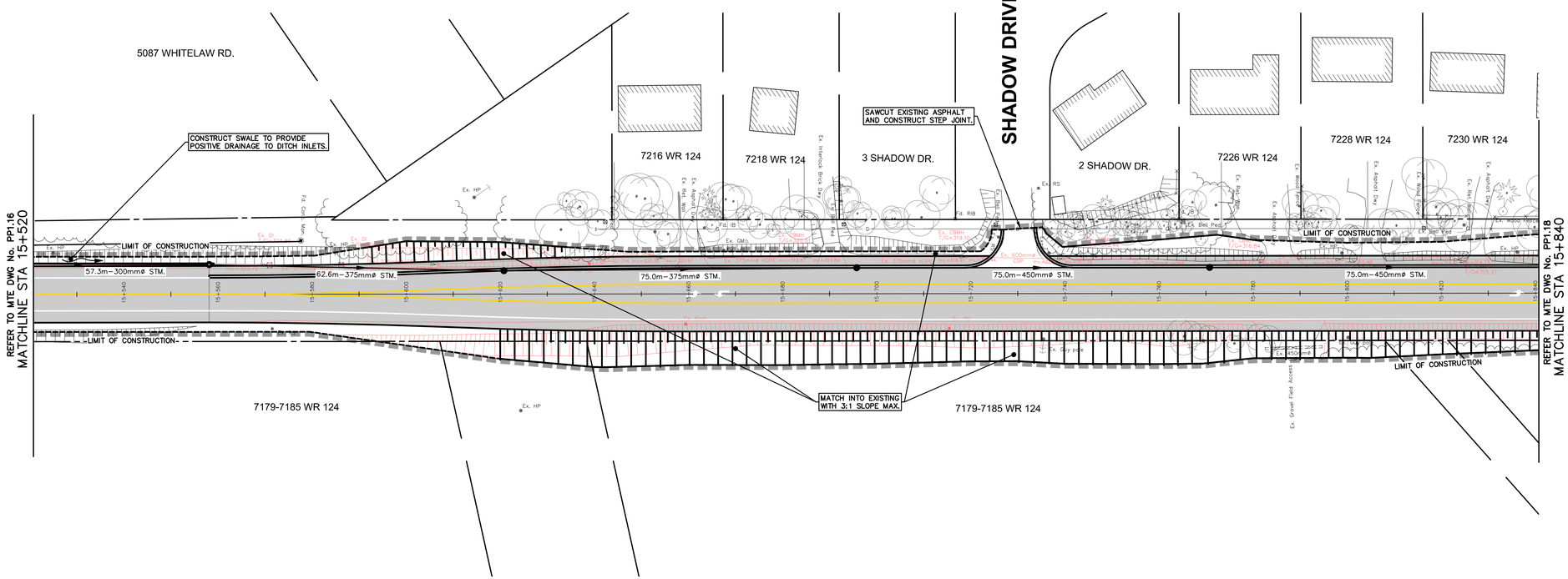
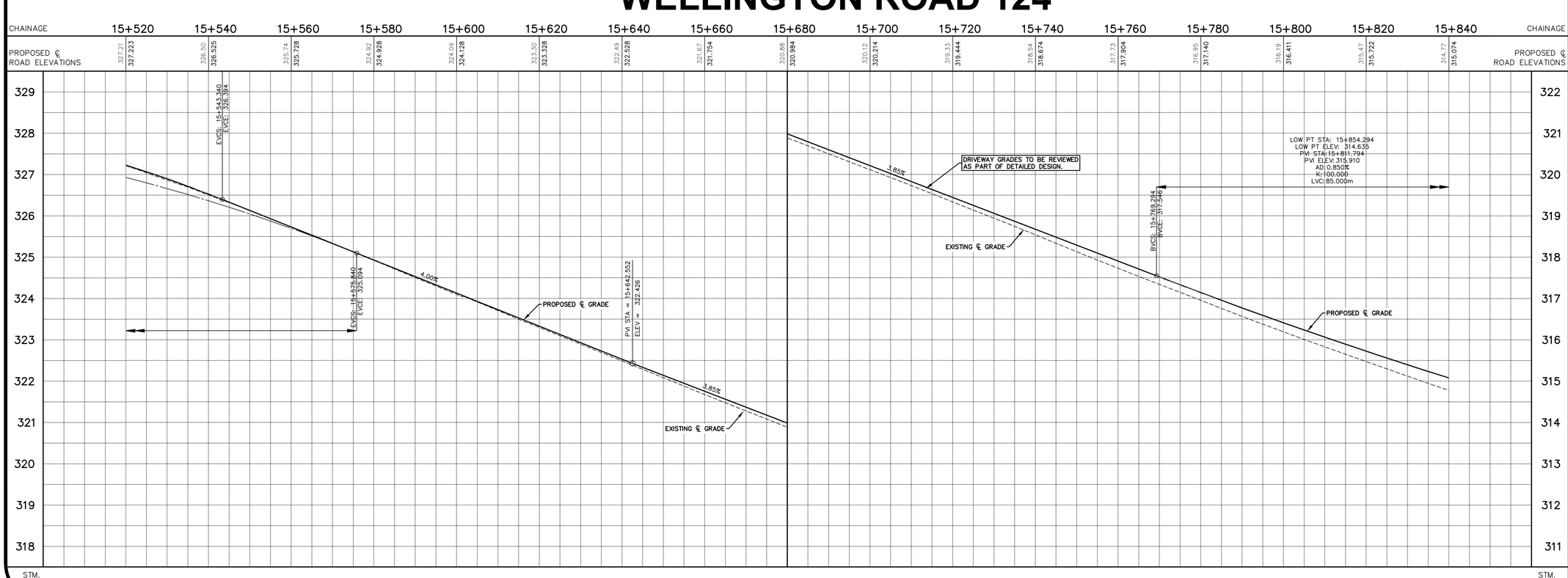
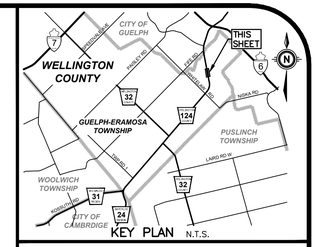


WELLINGTON ROAD 124





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
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1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19

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PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 15+520 TO STA 15+840

Project Manager	D.HALLMAN	Project No.	41093-200
Design By	NPD	Checked By	.
Drawn By	NPD	Checked By	.
Surveyed By		Drawing No.	PP1.17
Date	Jul.25/19		
Scale	1:1000H 1:100V	Sheet 17 of 23	

December 5, 2019 1:51 p.m. Plotted By: ndunmering

41093-200-PP1.18

MTE FILE No:

PROPOSED CONDITIONS STA: 15+840-16+160

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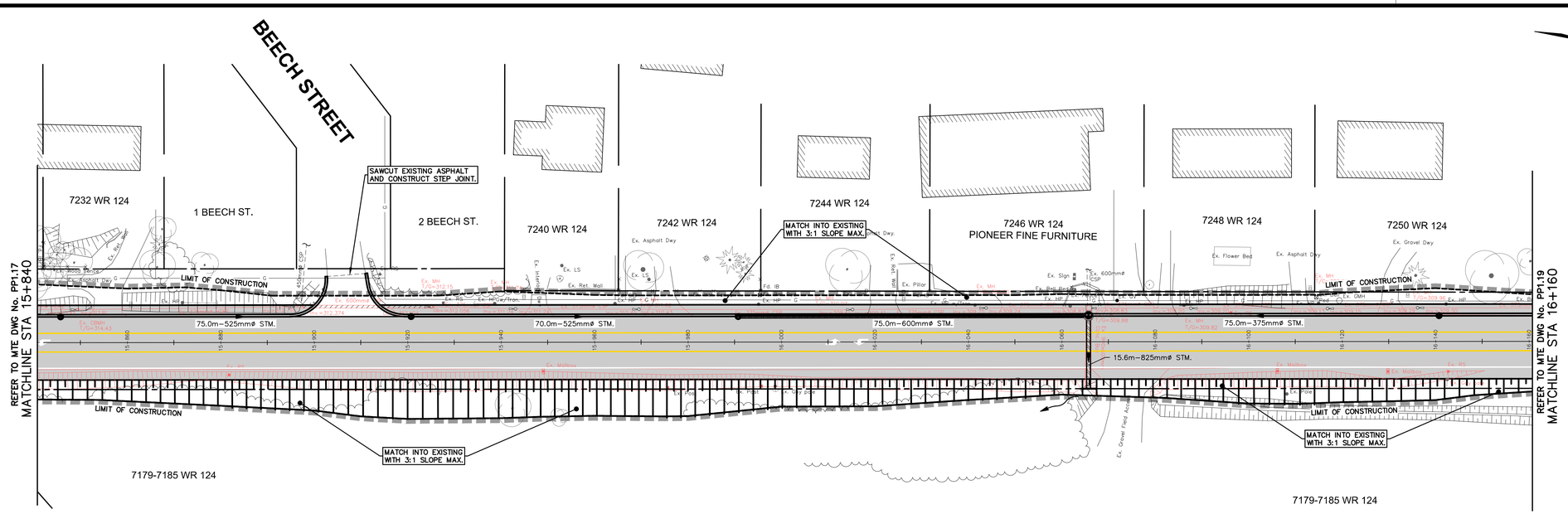
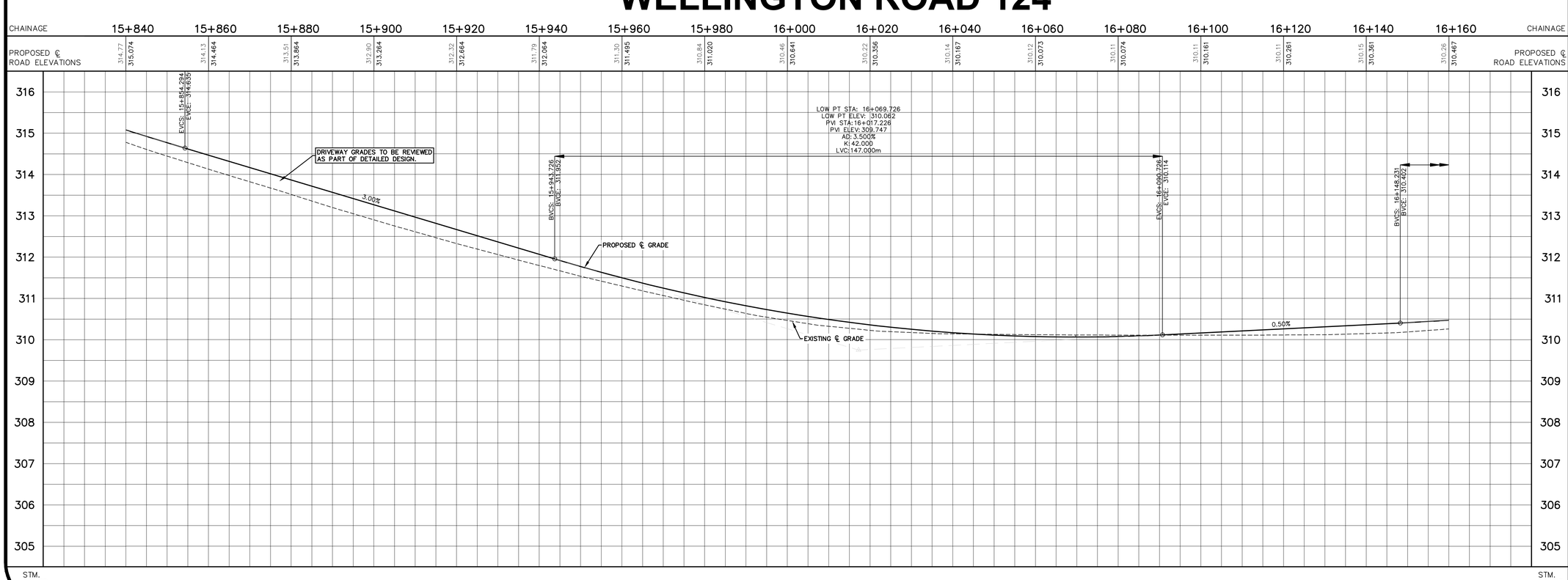
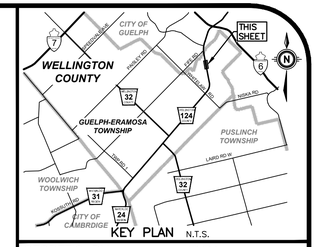


WELLINGTON ROAD 124





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
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1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19

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PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 15+840 TO STA 16+160

Project Manager D.HALLMAN	Project No. 41093-200
Design By NPD	Checked By .
Drawn By NPD	Checked By .
Surveyed By	Drawing No. PP1.18
Date Jul.25/19	
Scale 1:1000H 1:100V	Sheet 18 of 23

December 5, 2019 1:51 p.m. Plotted By: ndulmering

MTE FILE No: 41093-200-PP1.19

PROPOSED CONDITIONS STA 16+160 TO FIFE ROAD

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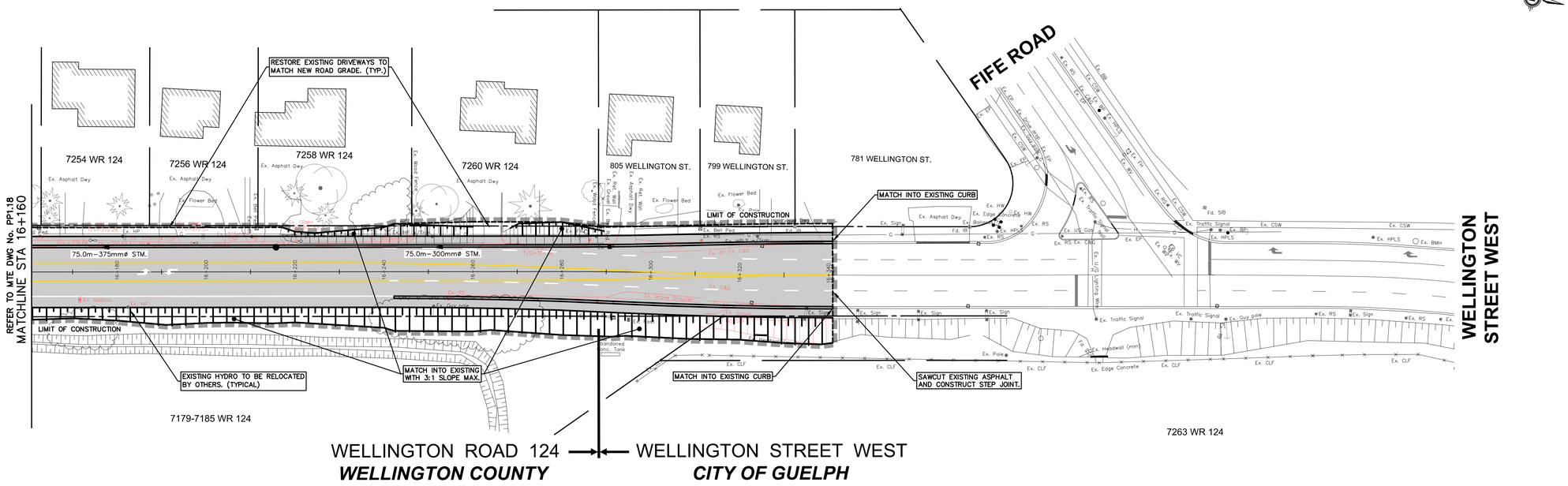
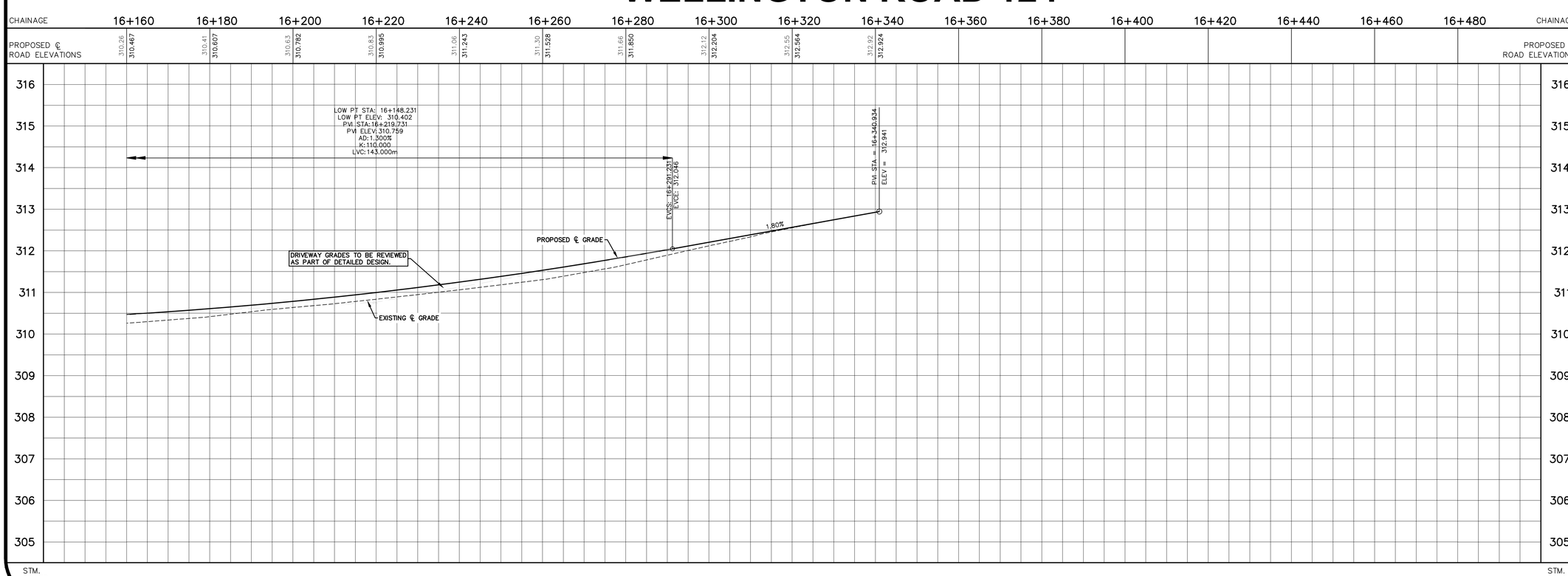
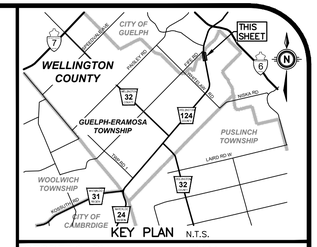


WELLINGTON ROAD 124





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
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1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19

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PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WELLINGTON ROAD 124
STA 16+160 TO FIFE ROAD

Project Manager D.HALLMAN	Project No. 41093-200
Design By NPD	Checked By .
Drawn By NPD	Checked By .
Surveyed By	Drawing No. PP1.19
Date Jul.25/19	
Scale 1:1000H 1:100V	Sheet 19 of 23

December 5, 2019 1:51 p.m. Plotted By: ndulmering

MTE FILE No: 41093-200-PP1.20

PROPOSED CONDITIONS STA 16+160 TO FIFE ROAD

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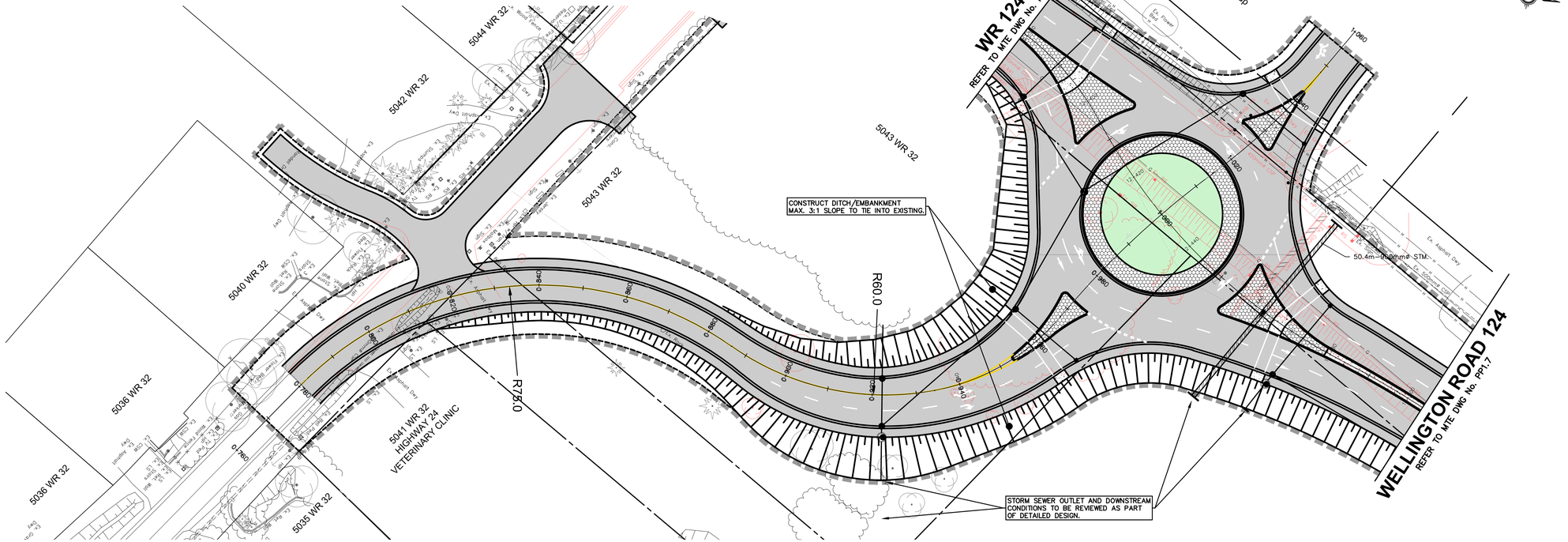
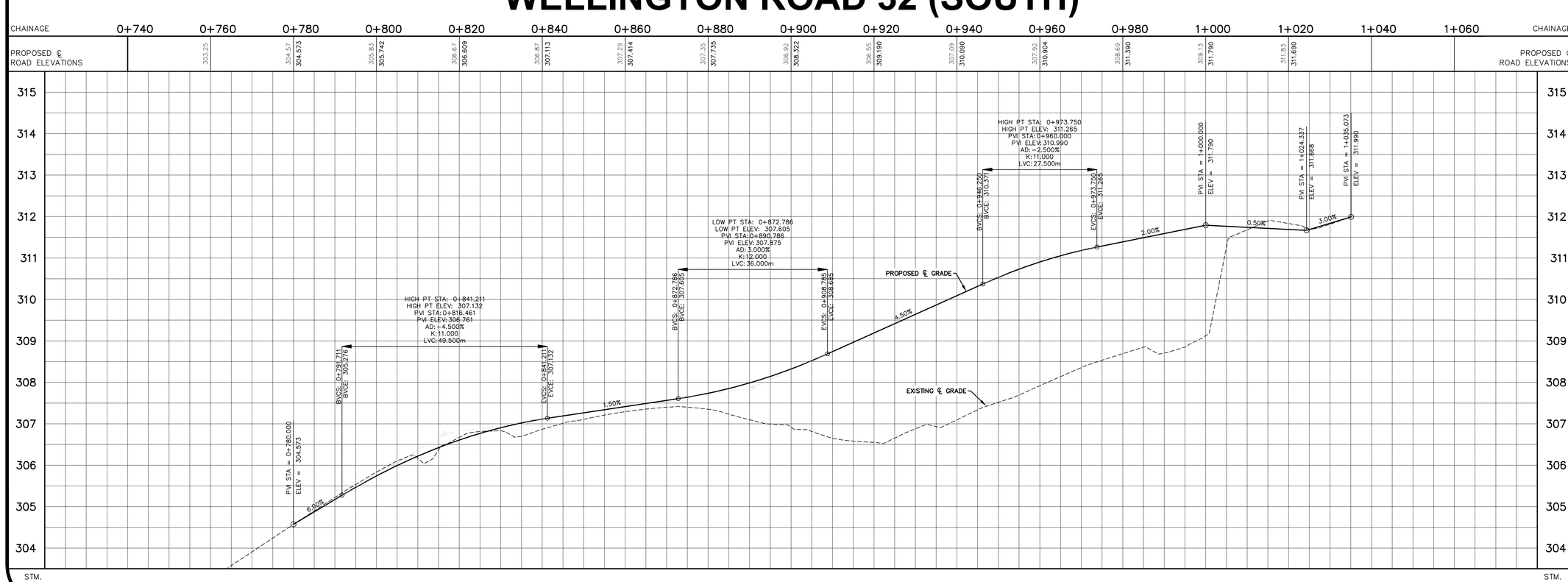
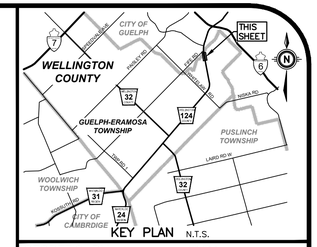


WELLINGTON ROAD 32 (SOUTH)





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19
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PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH–ERAMOSA

DRAWING
PROPOSED CONDITIONS WHITELAW ROAD
STA 16+160 TO FIFE ROAD

Project Manager: D.HALLMAN	Project No.: 41093-200
Design By: NPD	Checked By: .
Drawn By: NPD	Checked By: .
Surveyed By:	Drawing No.: PP1.20
Date: Jul.25/19	
Scale: 1:1000H 1:100V	Sheet 20 of 23

December 5, 2019 1:51 p.m. Plotted By: ndulmering

MTE FILE No: 41093-200-PP1.21

PROPOSED CONDITIONS STA 16+160 TO FIFE ROAD

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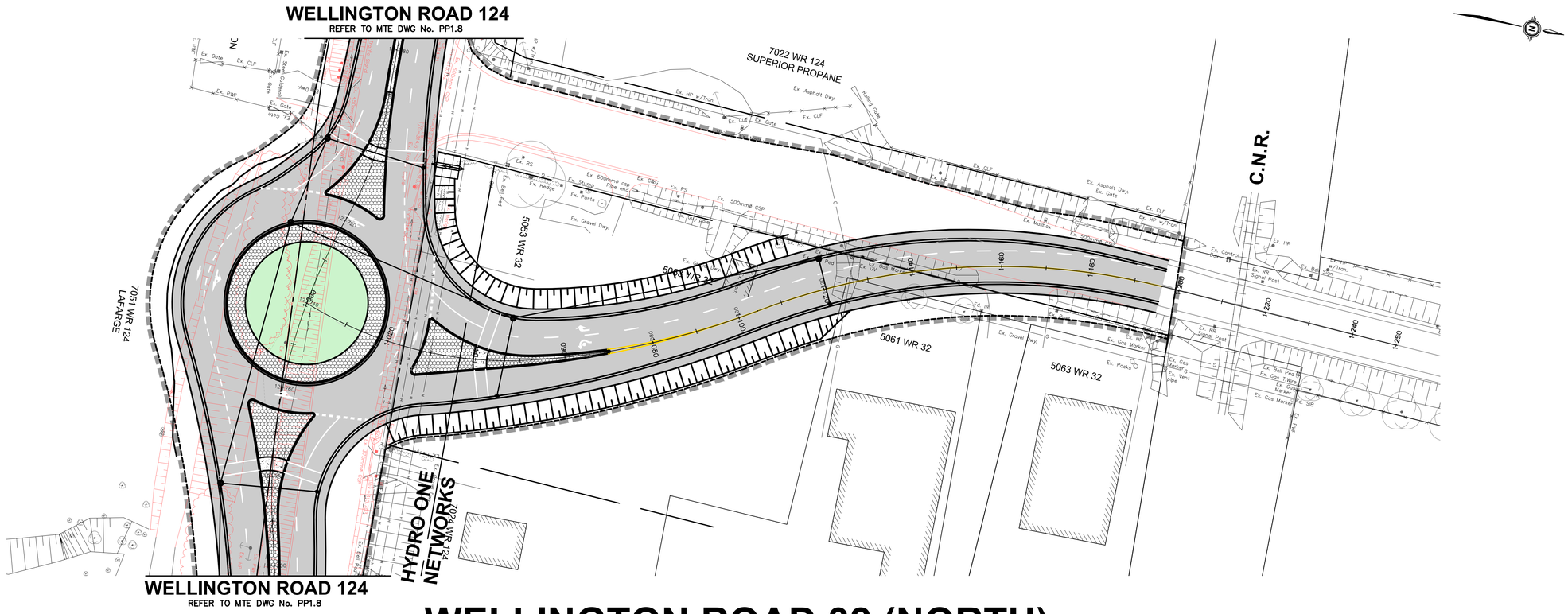
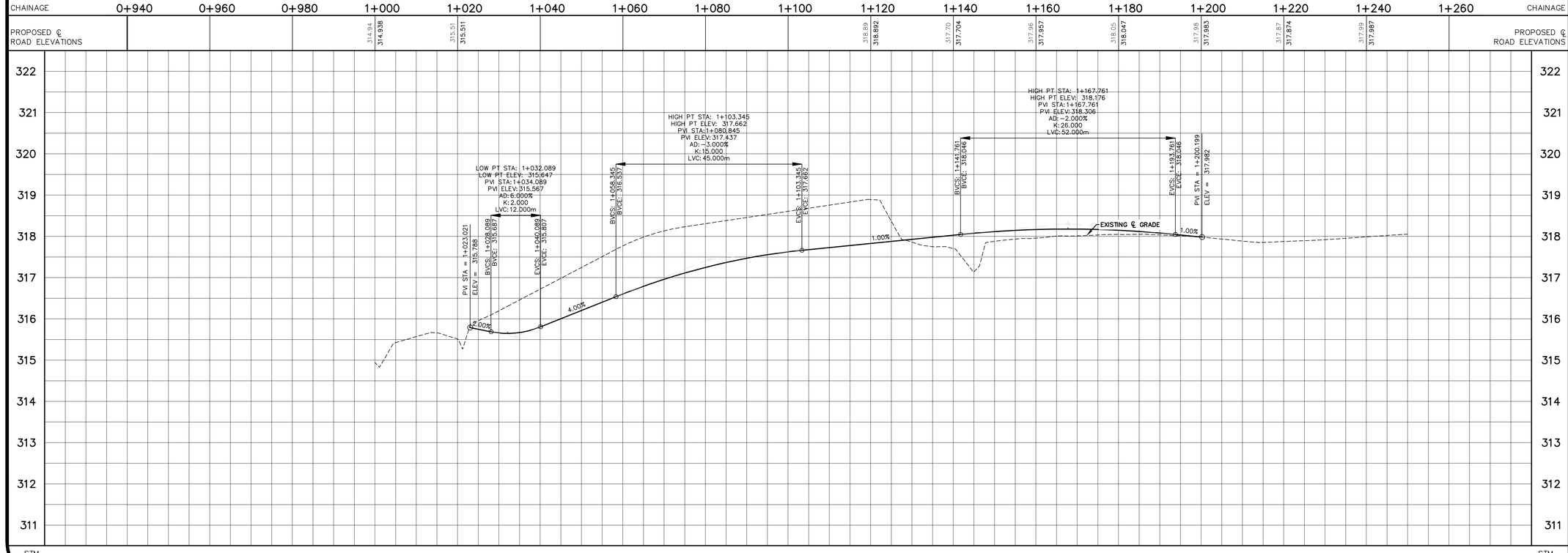
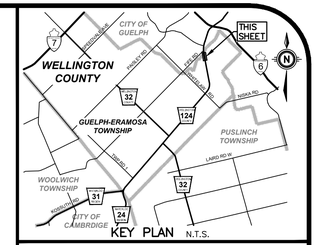


WELLINGTON ROAD 32 (NORTH)





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
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1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19

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COUNTY OF WELLINGTON

74 WOOLWICH ST. GUELPH

PROJECT

WELLINGTON ROAD 124 RECONSTRUCTION

TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING

PROPOSED CONDITIONS WHITELAW ROAD

STA 16+160 TO FIFE ROAD

Project Manager D.HALLMAN	Project No. 41093-200
Design By NPD	Checked By .
Drawn By NPD	Checked By .
Surveyed By	Drawing No. PP1.21
Date Jul.25/19	
Scale 1:1000H 1:100V	Sheet 21 of 23

December 5, 2019 1:51 p.m. Plotted By: ndulmering

MTE FILE No: 41093-200-PP1.22

PROPOSED CONDITIONS STA 16+160 TO FIFE ROAD

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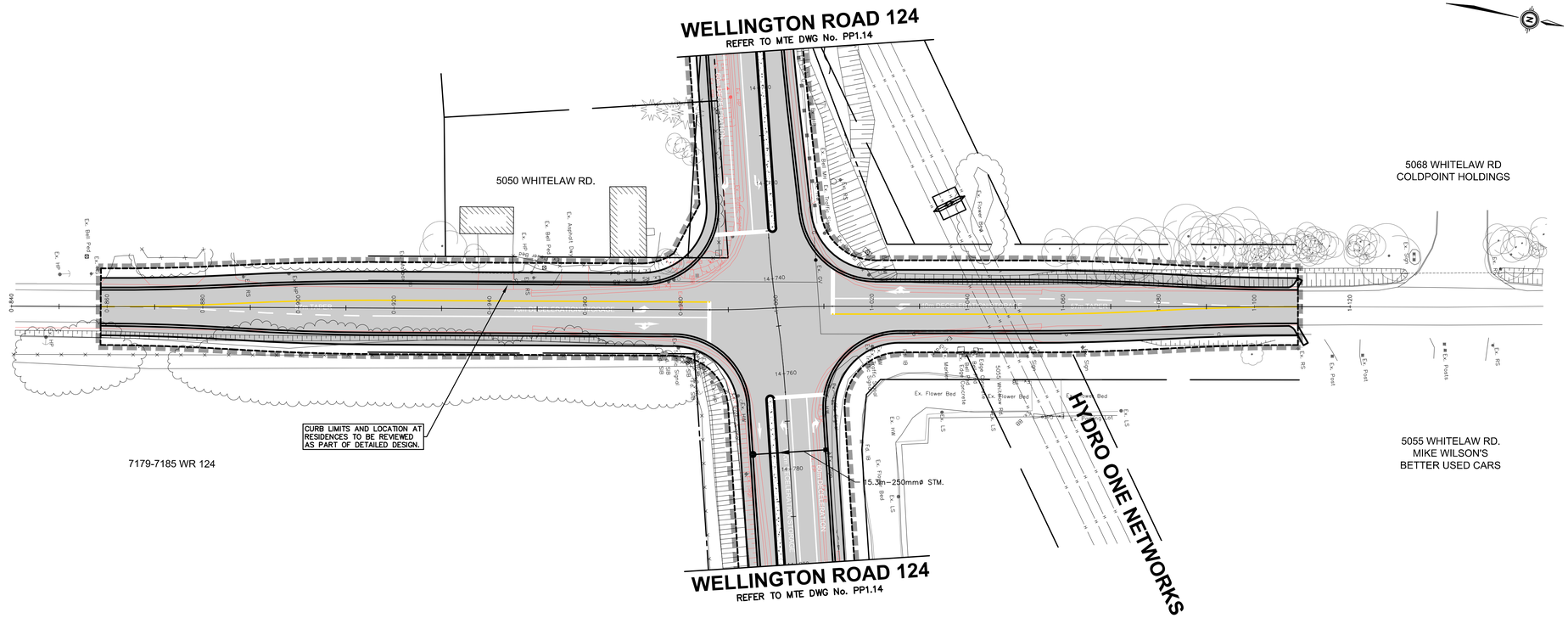
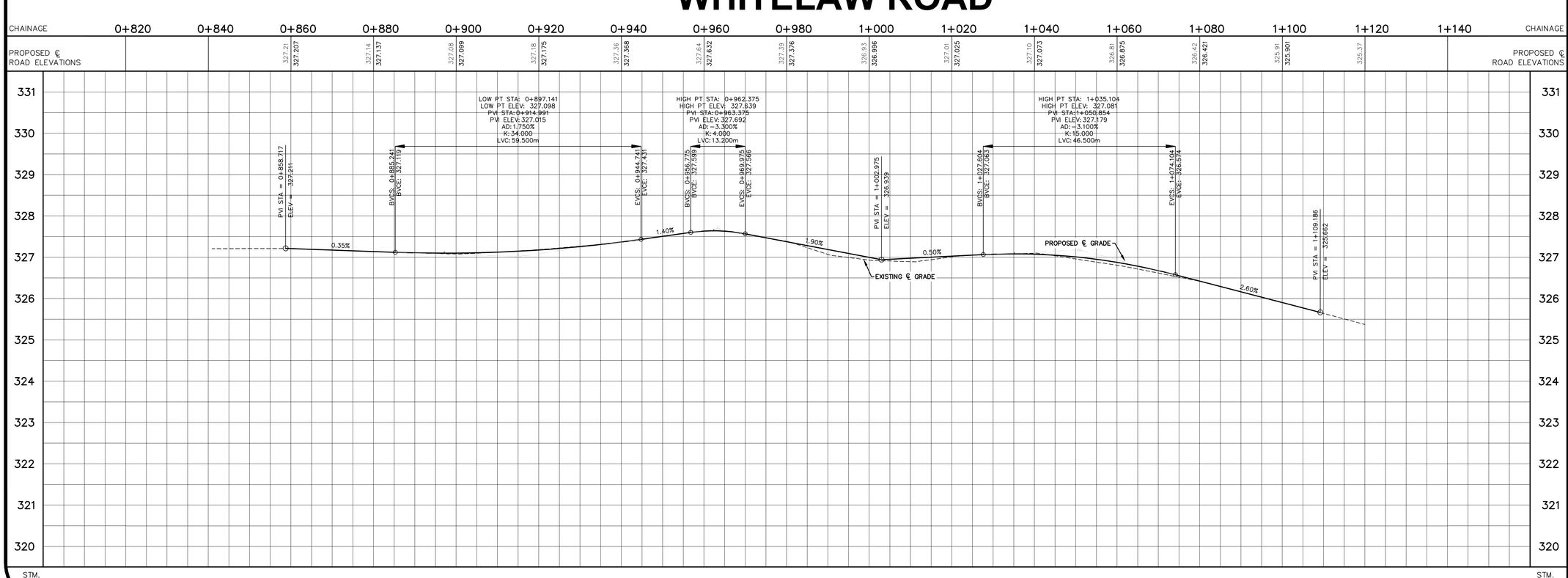
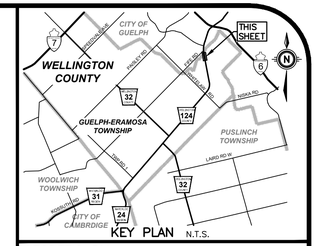


WHITELAW ROAD





GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19
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74 WOOLWICH ST. GUELPH

PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH-ERAMOSA

DRAWING
PROPOSED CONDITIONS WHITELAW ROAD
STA 16+160 TO FIFE ROAD

Project Manager D.HALLMAN	Project No. 41093-200
Design By NPD	Checked By .
Drawn By NPD	Checked By .
Surveyed By	Drawing No. PP1.22
Date Jul.25/19	
Scale 1:1000H 1:100V	Sheet 22 of 23

December 5, 2019 1:51 p.m. Plotted By: ndulmering

41093-200-PP1.23
MTE FILE No:
PROPOSED TYPICAL CROSS SECTIONS
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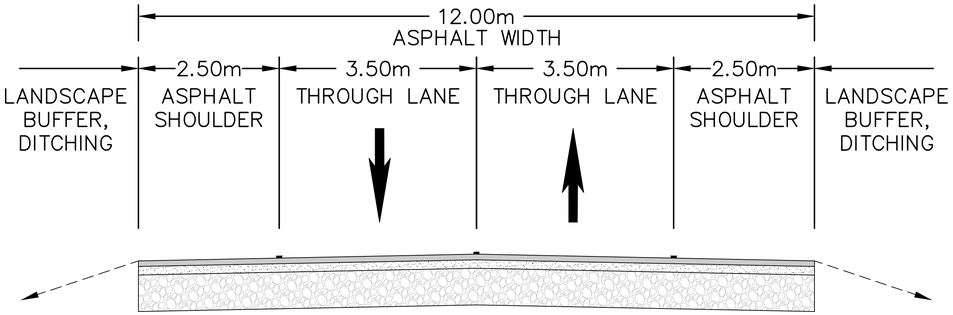
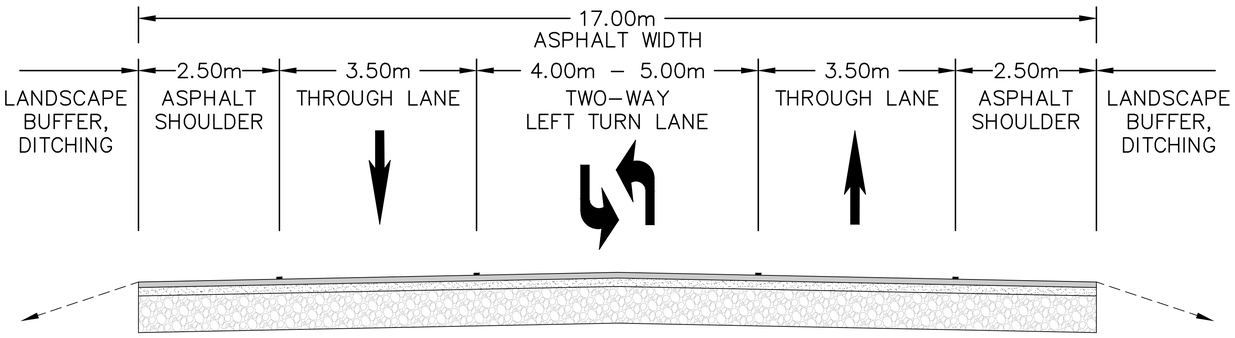
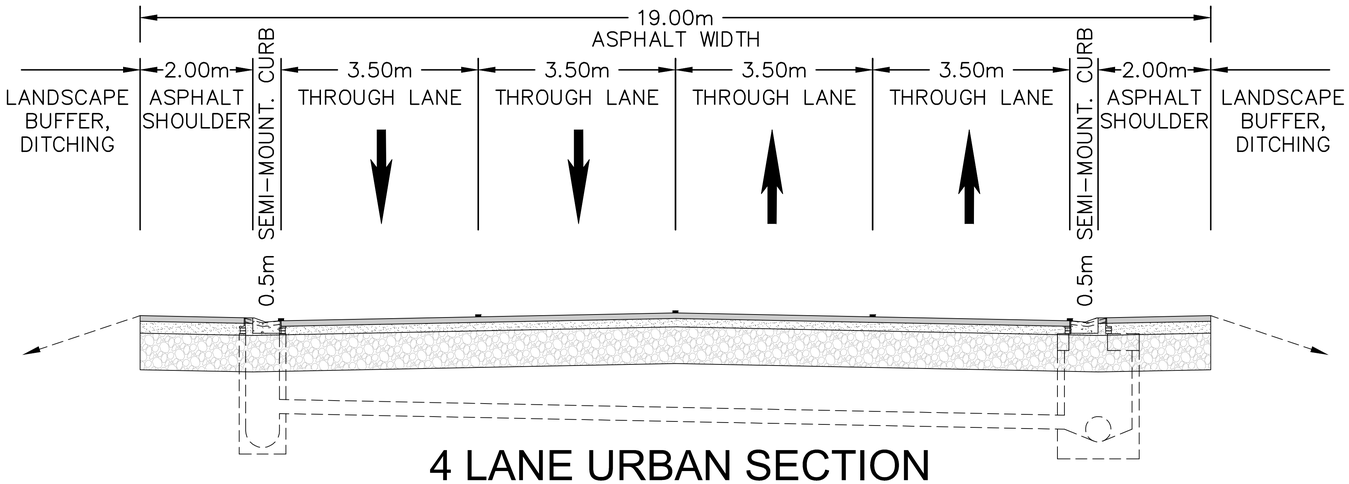


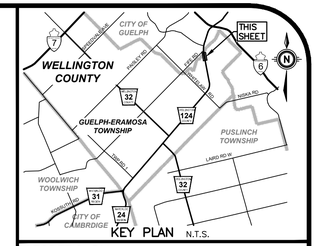
2 LANE RURAL SECTION



3 LANE RURAL SECTION



4 LANE URBAN SECTION



GEODETIC BM ELEV. = m

SITE BENCHMARK ELEV. = m

LEGEND

- REMOVALS
- PROPOSED
- LIMIT OF CONST.
- RIGHT OF WAY
- PROP. ASPHALT

REFER TO TYPICAL CROSS SECTIONS ON SHEET PP1.23.

No.	REVISION	BY	DATE
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1.	ISSUED FOR 30% SUBMISSION	DJH	DEC.5/19

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OWNER
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74 WOOLWICH ST. GUELPH

PROJECT
WELLINGTON ROAD 124 RECONSTRUCTION
TR 1 TO FIFE RD TOWNSHIP OF GUELPH–ERAMOSA

DRAWING
PROPOSED TYPICAL CROSS SECTIONS

Project Manager D.HALLMAN	Project No. 41093-200
Design By NPD	Checked By .
Drawn By NPD	Checked By .
Surveyed By	Drawing No. PP1.23
Date Jul.25/19	
Scale 1:50	Sheet 23 of 23

December 5, 2019 1:51 p.m. Plotted By: ndulmering