ASSESSING THE POTENTIAL USE OF ENVISION IN THE SUSTAINABILITY
CERTIFICATION OF ROAD PROJECTS WITH CONSERVATION AUTHORITIES IN
ONTARIO

By

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Abstract

Conservation Authorities (CAs) in Ontario are challenged with improving the sustainability of road planning and design through their programs and policies under the Ontario Environmental Assessment Act (OEAA) and the CA Act. This study examines whether CAs should endorse the voluntary Envision Infrastructure Sustainability Rating System to supplement their roles under the OEAA and the CA Act and regulations.

This study applied Envision to a sample of 13 municipal road projects through a standardized document review. It found that Envision was able to differentiate between more and less sustainable road projects, that award achievement required sustainable actions beyond those which are standard practice, and that Envision is appropriate to apply to road projects that are planned through the Municipal Class Environmental Assessment process of the OEAA. This study concludes that the Envision framework has the potential to significantly improve the sustainability of road projects and should be endorsed by CAs.

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List of Abbreviations

ACEC: Association of Consulting Engineering Companies

CA: Conservation Authorities

CR: Climate & Risk

EA: Environmental Assessment

ECO: Environmental Commissioner of Ontario

Env SP: Environmental Sustainability Professional

FIDIC: International Federation of Consulting Engineers

GTHA: Greater Toronto and Hamilton Areas

IEA: Individual Environmental Assessment

ISI: Institute for Sustainable Infrastructure

ISRS: Infrastructure Sustainability Rating System

LCA: Life Cycle Assessment

LCCA: Life Cycle Carbon Analysis

LD: Leadership

LEED: Leadership in Energy and Environmental Designs

MCEA: Municipal Class Environmental Assessment

MOECC: Ontario Ministry of the Environment and Climate Change

MTRCA: Metro Toronto and Region Conservation Authority

NW: Natural World

OEAA: Ontario Environmental Assessment Act

QL: Quality of Life

RA: Resource Allocation

TRCA: Toronto and Region Conservation Authority

VEI: Voluntary Environmental Initiatives

Zofnass: Zofnass Program for Sustainable Infrastructure

1 Introduction

Conservation Authorities in Ontario are struggling to effectively advance sustainability in the planning and design of municipal road projects through their commenting role under the Ontario Environmental Assessment Act (OEAA) and their regulatory powers under the Conservation Authorities (CA) Act. The purpose of this study is to investigate the potential use of the Envision Infrastructure Sustainability Rating System (ISRS) in the sustainability certification of road projects in Ontario, and the opportunity such a system presents for Ontario Conservation Authorities (CAs) in supplementing the OEAA and CA Act to improve the sustainability of the planning and design of road projects. ISRSs provide a framework to analyse and recognize infrastructure project performance relative to a set of specified process and implementation requirements (Clevenger, Ozbek, & Simpson, 2013). Envision is a voluntary ISRS that is applied during the planning and design phases of infrastructure projects to improve the sustainability of infrastructure projects through construction, operation and decommissioning (Institute for Sustainable Infrastructure [ISI] and the Zofnass Program for Sustainable Infrastructure [Zofnass], 2015). The demand for road projects is being driven by the significant population growth planned for the Greater Toronto and Hamilton Areas (GTHA). For example, the population of Peel Region is anticipated to increase by 52.2% and Halton Region by 72% by 2041 (Ontario Ministry of Finance, 2014). Municipalities are making investments in constructing and re-constructing infrastructure to support the development needed to accommodate this growth. Roads have the potential to significantly impact sustainability in their construction, operation, and decommissioning phases.

Through their role as watershed-based natural resource management agencies in Ontario, CAs have program and policy interests in advancing sustainability in the planning, design, construction, operation, and decommissioning phases of roads. The OEAA and to a

lesser extent the CA Act, are 'command and control'. Cox (2016) defines 'command and control' as a highly centralized authoritative governance structure with a high degree of control. Webb (2007) notes one of the disadvantages of regulations is that there are few incentives to achieve more than the legal or minimum standards. Therefore, there is a benefit for CAs to explore a voluntary alternative motivating framework to encourage the advancement of the sustainable planning and design of roads to supplement the OEAA and the CA Act and regulations. This alternative motivating framework could be a 3rd party sustainability certification endorsed by CAs. Envision is an example of a 3rd party sustainability certification. As quasi-provincial agencies based on a model of municipal partnerships, CAs could play an important role in increasing both the awareness and use of Envision amongst municipalities in Ontario.

2 Research Questions and Objectives

This study addresses four research questions: how does Envision recognize and quantify the sustainability of a project? What is the gap between current practices and the best practices criteria of Envision with respect to road projects? Does Envision differentiate between more and less sustainable projects? Should Envision be endorsed by CAs to supplement their commenting role under the OEAA and the CA Act and regulations? These research questions are supported by five research objectives.

The objective derived from the first research question is: apply Envision to a sample set of road projects reviewed by a Conservation Authority (see Table 1). The objective derived from the second research questions is: understand the gap between current standard practice and the Envision framework. The objective derived from the third research question is: contrast categories and projects, including those that scored highest and lowest overall. The objective derived from the fourth research questions is critique the use of Envision in the advancement of sustainable municipal road design and planning in Ontario; and identify the implications of these for Municipalities and CAs.

Projects Assessed:

Location	Proponent	Municipality	Adjacent Land Uses	Description
Bayview Avenue (Elgin Mills Road to Stouffville Road)	York Region	Town of Richmond Hill	Existing suburban, agricultural (future suburban)	Road widening from 2 to 4 lanes with turning lanes; from rural to rural/urban cross-sections.
Bloomington Road (Bathurst Street to Highway 404)	York Region	Town of Richmond Hill	Existing suburban, future suburban, golf course, industrial, estate lot subdivision	Road widening from 2 to 4 lanes with turning lanes; from rural to rural and urban cross sections
Bramalea Road (Sandalwood Parkway to Mayfield Road)	City of Brampton	City of Brampton	Existing commercial & suburban, future suburban & commercial	Road widening from 2 lanes to 4 lanes; from rural & urban to urban cross sections
The Gore Road (Queen Street East to Highway 50)	City of Brampton	City of Brampton	Existing industrial, proposed industrial and residential, conservation area, estate lot subdivision	Road widening from 2 to 4 lanes with turning lanes; from rural to urban cross sections
Highway 50 (Steeles Avenue to Castlemore Road/Rutherford Road)	Peel Region	City of Brampton & City of Vaughan	Existing agricultural (future development), commercial, isolated homes	Road widening from 4 & 5 lanes to 6 & 7 lanes; from urban & rural to urban cross section.
Kirkhams Road	City of Toronto	City of Toronto	Existing large forested residential lots	Bridge elimination.
Leslie Street (Bethesda Sideroad to Bloomington Road)	York Region	Town of Richmond Hill	Existing farm, golf course, reception centre, estate lots, cemetery	Road reconstruction maintaining 2 lane rural cross-section.
Main Street Markham (Highway 407 to Major Mackenzie Drive)	City of Markham	City of Markham	Existing commercial, residential	Road widening. Part 1 from 2 lanes urban to 3 lanes urban cross-section cross-section, part 2 from 4 lanes urban 2 lanes urban cross-section, and part 3 from 2 lanes rural to 4 lanes urban cross-section.
Ninth Line (Highway 407 to	York Region	Town of Whitchurch-	Existing farms, suburban	Road widening. Part 1 from 2 lane rural to 4

Main Street (Stouffville)		Stouffville	residential	lane urban/rural cross-section, and part 2 reconstruction of 2 lane urban cross-section with intersection jog elimination.
Rossland Road (Brock Road to Westney Road)	Town of Ajax	Town of Ajax & City of Pickering	Existing agricultural (future residential), suburban residential, commercial	Road widening from 2 to 4 lanes and intersection jog elimination; from rural to urban cross-section.
16 th Avenue (Donald Cousens Parkway to York-Durham Line)	York Region	Town of Markham	Existing agricultural, one house	Road widening – part 1 from 2 lane rural to 4 lane urban, and part 2 reconstruction of 2 lane rural.
Torbram Road Grade Separation	City of Mississauga	City of Mississauga	Existing industrial	Grade separation at two rail tracks
Torbram Road (Father Tobin Road to Mayfield Road)	City of Brampton	City of Brampton	Existing suburban residential, commercial, farms (future development)	Road widening. From 2 lane rural to 4 lane urban cross-section

Table 1

3 Literature Review

3.1 Conservation Authorities

CAs in Ontario can trace their roots back to the naturalists, farmers, hunters, and anglers in the early 20th century concerned with drought, deforestation, soil erosion, and flooding (Toronto and Region Conservation Authority [TRCA], 2014). The *Conservation Authorities Act* of 1946 allowed municipalities to apply to create CAs to manage natural resources on a watershed basis (TRCA, 2014). The approach of allowing, but not mandating, the creation of CAs meant that all CA's created had local political support; the local municipality had to be willing to financially support the CA and to help run it through the board of the CA (Conservation Ontario, 2015).

Hurricane Hazel came to Ontario in October of 1954. In Toronto 81 people died and thousands were homeless in the aftermath. Following Hurricane Hazel four CAs amalgamated to form the Metropolitan Toronto and Region Conservation Authority (MTRCA) with a focus on flood control. Through to the 1970s, MTRCA, in partnership with other levels of government, ran a program of purchasing hazard flood hazard lands, building dams and reservoirs, engineering alterations to channels, and developing a flood warning system (TRCA, 2014). This engineered approach of the 1960s and 1970s shifted to a watershed-based, ecological approach in the 1980s with a focus on improving water quality (TRCA, 2014).

CA roles have expanded over the decades to include: regulatory authority under the *Conservation Authorities Act*; representative of delegated Provincial Interest on natural hazards; public commenting body under both the Planning Act and the Ontario Environmental Assessment Act; resource management agency; provider of planning and EA services to municipalities through memoranda of understanding; and landowners (TRCA, 2014). The

programs of each CA are flexible and geared to the challenges and needs of the local watershed(s) in the specific CA (Conservation Ontario, 2015). CAs comment on various sustainability aspects of roads through their programs, policies and regulations.

The *Conservation Authorities Act* was revised in 1990 to give CAs regulatory authority over development in hazard lands, floodplains and unstable slopes, including grading, new structures, and alterations to existing structures, and the alteration of watercourses (*Conservation Authorities Act*, 1990). The *Conservation Authorities Act* gave CAs the regulatory framework needed to more effectively comment on municipal EAs in the province, including roads. This change gave municipalities a strategic incentive to actively seek CA input to their EAs to resolve issues prior to seeking permits for development. In 2003 the *Conservation Authorities Act* was updated again to include the regulation of impacts to wetlands (*Conservation Authorities Act*, 2003).

The foundations of the CA model are municipal-provincial partnerships, locally based initiatives, and the watershed as a planning unit (Shrubsole, 1996). Since the vast majority of the funding to CAs was cut by the provincial Conservative government in the late 1990s, CAs have had to develop much closer partnerships with municipalities to secure the funding to continue their programs.

Additionally, CAs implement the Drinking Water Source Protection Program established under the *Clean Water Act, 2006* (Conservation Ontario, n.d.a). Some CAs were grouped together to form ten source protection regions, while nine CAs function as stand along source protection areas (Conservation Ontario, 2017). Each source protection region and area implements at least one source protection plan (Conservation Ontario, n.d.a). Eighteen CAs also implement Risk Management Services under the Clean Water Act to implement source protection plan policies requiring risk management (Conservation Ontario, n.d.a).

CAs are municipally funded and supported, quasi-provincial resource management agencies with a flexible, broad mandate. This allows CAs to develop locally relevant programs and policies. CAs are therefore appropriate agencies to advocate for municipal support for the Envision ISRS.

3.2 Ontario Environmental Assessment Act

Most municipal infrastructure projects, including roads, are subject to the *Ontario Environmental Assessment Act* (OEAA), first introduced in 1976. The OEAA applies to projects by provincial ministries and agencies, municipalities and public bodies, and some designated private sector undertakings (Ontario Ministry of the Environment and Climate Change [MOECC], 2014b). The purpose of the OEAA is to ensure that a chosen project has been assessed against alternatives and that the proponent shows, through a traceable, rational, and iterative process, that the chosen alternative is environmentally acceptable and needed to address the problem (Lindgren and Dunn, 2010).

The class EA process was introduced informally within a few years of the introduction of the OEAA with the support of the MOECC¹ and proponents (Environmental Commissioner of Ontario [ECO], 2008). The MOECC, other stakeholders, and proponents were concerned that the burden of time and resources of the full EA process on proponents would be too cumbersome and costly. They wanted to streamline the EA process for groups of similar projects while still meeting the requirements of the OEAA (ECO, 2008). The class environmental assessment was developed as a streamlined self-assessment process that applies to routine projects with predictable, mitigable environmental impacts (MOECC, 2014a).

¹ In 2014 the Ministry of the Environment (MOE) changed to the Ministry of the Environment and Climate Change (MOECC). For consistency, the MOE will be referred to as the MOECC, even for events prior to 2014.

Class EAs are now the dominant procedure for EAs in Ontario; by 1993 ninety percent of the undertakings subject to the OEAA were approved through a Class EA (ECO, 2008).

According to the Office of the Auditor General of Ontario (2016) there were 1877 class environmental assessments active at some point between 2011 and 2015. There are eleven approved class EAs, which are also known as parent class EAs. Projects are effectively pre-approved if they follow a class EA process (Lindgren & Dunn, 2010). Projects that proceed through the full EA process are referred to as Individual Environmental Assessments (IEAs).

Under the streamlined class EA process, planning and consultation is proponent-driven with reduced MOECC oversight as compared to individual EAs (ECO, 2008). Proponents are required only to submit a Notice of Completion to the MOECC for each project (MEA, 2011). There is no need for project-specific approval by the MOECC under the OEAA for class EA projects (MEA, 2011). As the class EA is a self-assessment process, proponents are responsible for ensuring the planning process in the class EA is followed. However, MOECC staff are supposed to enforce compliance with the OEAA under section 38 of the Act (MEA, 2011). The risk for a streamlined, pre-approved process is that it can stifle innovation, encouraging proponents to meet the minimum standards and repeat proven approaches rather than provide innovative new approaches and solutions.

The Municipal Engineer's Association has a class EA that captures most municipal infrastructure projects, including roads, storm sewers, watermains and sanitary sewers. In 1987, the MOECC approved two class EA documents created by the Municipal Engineer's Association: one for roads and one for water and wastewater projects, subject to a 5 year review (MOECC, 2014a). Class EAs were enabled through Regulation 334 (MEA, 2011). In 1993 the class EA documents were revised and their approval extended (MOECC, 2014a). The class EA process was entrenched in the OEAA in 1997 (Hanna, 2015). In 2000 the two class EAs for municipal infrastructure projects were consolidated to create the Municipal Class

Environmental Assessment (MCEA). Further amendments were made in 2004, 2007, 2011 and 2015 (MOECC, 2014a); however, the basic proponent-driven, pre-approval class EA process remains in place. As the vast majority of municipal roads projects fall under the MCEA process, the Envision ISRS was tested in this study against a set of roads projects that were planned under the MCEA process.

The purpose of the OEAA, as stated in the Act is the “betterment of the people of...Ontario by providing for the protection, conservation and wise management in Ontario of the Environment” (Ontario, 2003, c. E.18, s. 2). However, Gibson (2013) summarizes the state of EAs in Canada as not being “broad, innovative or forward-looking enough to foster a deep commitment to sustainability objectives”. EAs, particularly Class EAs, focus too much on mitigation, and not enough on impact avoidance; net impacts to the environment have been broadly accepted as the price of progress (Gibson, 2013). The Environmental Commissioner of Ontario (ECO), a frequent source of critiques of the OEAA, summarized the challenges in his 2008 report which stated that “we have lost the old vision for EA; a new vision is urgently needed” (ECO, 2008). The ECO (2014) report did not note any substantive changes by the MOECC to address concerns from its 2008 report, noting that the OEAA has not been reviewed since 2005 or had a major overhaul since 1997. The 2016 report of the Office of the Auditor General of Ontario, chapter 3.06 on Environmental Assessments, includes written responses from the MOECC to the various recommendations of the report; based on the MOECC responses in the Auditor General’s report, the MOECC is committed to examining alterations to the EA program within the existing legislative framework in the short-term and updates to the legislation in the long-term.

As a ‘command and control’ approach the OEAA is insufficient as a motivator to plan and design road projects in a manner that will ensure sustainable solutions are chosen. The alterations the MOECC is considering in the short-term may be insufficient to ensure the OEAA

supports sustainable road planning and design. Alternative motivating frameworks should be explored that can be implemented in conjunction with the OEAA.

3.3 Voluntary Environmental Initiatives

The literature lacks a universal definition of ‘command and control’ (Cox, 2016). As stated earlier Cox (2016) defines ‘command and control’ as a highly centralized authoritative governance structure with a high degree of control. Much of the literature, including Kotchen (2013) and Webb (2007), labels all regulations as ‘command and control’. For consistency, ‘command and control’ in this study is as per the definition of Cox (2016), while uses of ‘command and control’ that refer to regulations will use the term regulations in this study.

Kotchen (2013) describes three waves of environmental policy with the first being regulations, the second being market-based instruments, and the third being Voluntary Environmental Initiatives (VEIs). Webb (2007) notes that regulations have been the backbone of environmental management since the 1970s. However, Webb (2007) notes three main disadvantages of regulations: they are administratively intensive, they often create an adversarial relationship between regulators and the regulated, and there are few incentives to achieve more than the law. It is Webb’s last critique that is explored in this study.

The MCEA has most of the elements of ‘command and control’ based on Cox (2016): it is applied to complex, poorly understood systems; local citizens are often disempowered; decision making power is centralized with municipalities; EAs are undertaken by technical professionals; the MCEA encourages standardized approaches to different problems; and the analysis is simplified and focused on a small number of goals without sufficient regard to trade-offs. The CA Act and regulations have fewer of the elements of ‘command and control’ and to a lesser degree, but still suffer from the critiques of regulations from Webb (2007). CAs are therefore challenged with influencing the sustainability of the planning and design of roads

through their commenting role under the OEAA and MCEA, and through their regulatory role under the CA Act.

The term Voluntary Environmental Initiatives (VEIs), as used by Webb (2007), refers to all initiatives that a business takes to reduce or eliminate some environmental impact. ISRSs are akin to VEIs where the lower-tier government is acting like a business, undertaking initiatives that are generally beyond regulatory requirements.

Webb (2007) notes the rise in the last two decades of market-based, environmental, non-governmental organization-driven (ENGO) certification programs, such as the Forest Stewardship Council, and the Marine Stewardship Council. Through these certification programs, ENGOs have become leaders in policy innovation (Webb, 2007). Similarly, Envision is a certification program that is attempting to drive policy innovation, and is being led by an NGO (the Institute for Sustainable Infrastructure). It may be advantageous for CAs to advocate for and support their municipal partners in using Envision to supplement the OEAA, MCEA and CA Act and regulations.

3.4 Sustainability

Although a much older term in the biological sciences, sustainability arose in the context of public decision making mainly in response to two problems: the gap in quality of life between rich and poor individuals and the degradation of biospheric systems (Gibson, 2006). Sustainable development was first used as a term in the 1980 World Conservation Strategy, published by The International Union for the Conservation of Nature and Natural Resources, the United Nations Environmental Program, and the World Wildlife Fund for Nature, citing social, economic, and ecological factors (Moldan, Janouskova, & Hak, 2012). The Bruntland Report, *Our Common Future*, 1987, added intergenerational equity to the definition of sustainable development (Moldan et al., 2012). The now widely adopted three pillars approach, separating

sustainability into ecological, economic, and social factors, was formalized at the UN World Summit on Sustainable Development in 2002 (Moldan et al., 2012). Although the three pillars approach to sustainability is widely adopted in government and corporate sustainability policy in Canada, there is academic debate in the literature regarding its definition and application. Morelli, J. (2012) notes more than a decade of struggle with the definition and relevance of the term sustainability. Furthermore, Morelli, J (2012) notes a debate between whether there should be two pillars (ecological and social) or three pillars (ecological, social and economic). Hosseini and Kaneko (2012) note a fourth pillar: institutional. In contrast, Gibson (2006) challenges the appropriateness of a narrow definition of pillars on the basis that it encourages trade-offs between them.

Samberg, Bassok, and Holman (2012) note that the biggest hurdles to improving the sustainability of transportation are the absence of universally accepted definitions of sustainability and of sustainable transportation and their associated goals and objectives. Recognizing this challenge, Bueno, Vassallo, & Cheung (2015) set out that a project can be considered sustainable if it provides economic development and meets the transportation needs of society while staying consistent with natural laws and human values. Furthermore, they added that any measure of sustainability must be sensitive to the local economic, social, and environmental context, and must examine the whole life cycle of the project (Bueno et al., 2015). According to Bueno et al. the life cycle of transportation projects includes the construction, maintenance, operation, and the end-of-life recycling and reuse stages (2015).

This study does not rely on a definition of sustainability precise enough to identify whether a given project was sustainable. This study relies on an understanding of relative sustainability to identify improvements to sustainability within a project. The Envision criteria themselves create a comprehensive sustainability framework relevant to infrastructure, and were not tested in this study against any external definition or framework of sustainability.

3.5 Sustainability Impacts of Roads

Road construction, maintenance, and use could potentially have a significant negative effect on sustainability. For example, with respect to climate change, the construction industry constitutes 6% of the total greenhouse gas emissions in the U.S. (Clevenger et al., 2013). Transportation accounted for 57 Megatons or 34% of Ontario's greenhouse gas emissions in 2012 (MOECC, 2015).

One way to categorize the sustainability impacts of infrastructure is by the products, goods, and services provided; the operations, procedures, and practices through or by which it is provided; and the natural resources consumed (Andreas, G., Allen, J., Farley, L, Kao, J., and Mladenova, I., 2010). Another way to categorize sustainability impacts is by issues: the conservation of energy, water and materials; and the protection of the natural environment, health and safety, and human rights (International Federation of Consulting Engineers [FIDIC], 2013). The sustainability issues occur across the various project phases of construction, maintenance, operation, and the recycling/end of life stage (Bueno et al., 2015).

The field of road ecology provides some specific impacts of roads on the natural environment. From the perspective of road ecology, the core functions of roads include: a habitat for populations of flora and fauna (especially invasive species), a source for fauna that thrive along the roadway as compared to the adjacent habitat (especially invasive species), a population sink where fauna suffer high mortality rates compared to populations in adjacent habitats, and a barrier where roads disrupt wildlife movements (Clevenger & Hujser, 2011). These functions are species and context specific.

Roads have a relatively large impact on various aspects of sustainability, across all project phases. Therefore, if Envision is to improve the sustainability of infrastructure, it must improve the sustainability of road projects.

3.6 Infrastructure Sustainability Rating Systems

As there are limitations to the sustainability of road project planned through the MCEA and the CA Act and regulations, an alternative motivating framework for sustainable infrastructure planning and design in Ontario may be required to improve the sustainability of road projects. ISRSs offer variations on similar alternative motivation frameworks.

Clevenger et al. (2013) note that the majority of sustainable infrastructure ratings systems (ISRS) are exclusive to vertical infrastructure (buildings); horizontal infrastructure, especially roads, has been much slower in development and uptake. Many ISRS have been developed over the last decade, mostly in Europe and the United States, to meet the need to rate horizontal infrastructure. The International Federation of Consulting Engineers (FIDIC) noted over 85 sustainable infrastructure tools, systems, logbooks, calculators, and guidelines as of 2013 for vertical and horizontal infrastructure (FIDIC, 2013). ISRSs apply various criteria, and often a score, which corresponds to an overall sustainability level. Many of the ISRSs have the option of third party verification that provides the proponent with an official certification.

The various ISRSs developed are attempts to take a similar approach to infrastructure as has been done through the Leadership in Energy and Environmental Design (LEED) program for buildings. Clevenger et al. (2013) found that all the ISRSs attempted to provide a framework to analyse and recognize project performance relative to a set of specified process and implementation requirements. The result is a score for each factor that is then weighted and aggregated across all factors to provide a single number that can be used to provide an overall sustainability score for the project (Association of Consulting Engineering Companies [ACEC], 2014). Muench, Armstrong, and Allen (2012) set out succinctly the appeal of ISRSs in that:

- (i) they provide a common metric for the entire range of sustainable solutions, (ii) they measure sustainability and thus make it manageable, (iii) they allow for straightforward communication of sustainability goals, efforts and achievement,

and (iv) they provide a reasonable context within which designers, contractors and materials suppliers can be innovative in their solutions. (p.4)

GreenRoads is an ISRS specific to road projects. GreenRoads is a collection of sustainability best practices for road design and construction (Anderson & Muench, 2013). GreenRoads has third party verification to provide one of four levels of certification for projects (Anderson & Muench, 2013). Based on the GreenRoads website (greenroads.org) as of December 21, 2015, five individuals across Canada, including one from Ontario, had taken the training to use the GreenRoads certification. Based on a web search, none of the five appeared to work for an engineering consulting firm. A later search of the GreenRoads website February 12, 2017 found no individuals in Canada registered as trained to use GreenRoads. Furthermore, the website as of February 12, 2016 shows one certified project in Canada with no other projects currently registered. Although there has been some attempt to bring GreenRoads to Canada, GreenRoads does not appear to be supported by any municipalities or consulting firms in Canada.

3.7 Envision

No ISRS have been developed exclusively for Canada (Associate of Consulting Engineering Companies [ACEC], 2014). Developed in the U.S., Envision is an ISRS designed for use across the U.S. and Canada. Envision is the result of a partnership between the Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design and the Institute for Sustainable Infrastructure (ISI & Zofnass, 2015). ISI is a not-for-profit organization with the goal of developing and maintaining a sustainability rating system for civil infrastructure, and was founded by the American Council of Engineering Companies (ACEC), the American Public Works Association (APWA), and the American Society of Civil Engineers (ASCE) (ISI, 2015). ACEC represents engineers, architects, land surveyors and other

professionals from private industry throughout the United States with the goal of improving the business environment for their firms (American Council of Engineering Companies, n.d.). APWA is a not-for-profit organization that represents individuals, agencies, and corporations interested in public works and infrastructure issues in the United States and in Canada (American Public Works Association, n.d.). ASCE is a society that represents civil engineering professionals in 177 countries (American Society of Civil Engineers, n.d.). Envision was developed through a partnership of industry professionals and academics in the public, private and academic realms. The development of Envision was supported by an extensive textbook with input from a variety of academics and professionals that summarized the work in the Zofnas School of Design at Harvard University from 2008 through 2012 on developing the framework for ISRS (see Pollalis, S., Georgoulis, A., Ramos, S., and Daniel S., 2012); however, the development of Envision was not subject to formal peer reviewed papers, which may detract from its acceptance in academia. Nonetheless, the advantage of an ISRS with such wide ranging input is a greater buy in both private firms and government.

Envision is designed to be applied to all types of infrastructure, including roads, through the planning, design, construction, maintenance, and decommissioning phases. An individual trained and credentialed in the use of Envision is known as an Envision Sustainability Professionals (Env SP) (ISI & Zofnass, 2015). There were 66 individuals registered as Envision sustainability professionals in Ontario according to the Institute for Sustainable Infrastructure (ISI) website as January 29, 2017, up from 48 as of November 8, 2015, with the vast majority in consulting firms. Furthermore, as of January 29, 2017, the ISI website lists two projects awarded Envision certification in Canada: a wastewater treatment plant in Ontario and a road in B.C. Despite no projects having been awarded in Canada since 2015, momentum for Envision has had modest growth in the United States. According to the ISI website as of January 29,

2017, two projects were awarded in 2013, three in 2014, four in 2015, fourteen in 2016 and three as of January 29, 2017 (ISI, Project Awards, 2017).

More importantly, a second road project was awarded in 2017 – the reconstruction of 21 miles of the I-4 highway in Florida (ISI, 2017a). The project includes the reconstruction of 15 interchanges, widening of 13 bridges, replacement of 74 bridges, and addition of 53 bridges (ISI, 2017a). The project achieved the highest Envision rating of Platinum (ISI, 2017a). Nevertheless, both road projects assessed are far larger in scale and scope than those assessed through the MCEA process in Ontario, so there is a significant gap in practice that this study addresses.

Of particular note, on August 16, 2016 the Los Angeles County Board of Supervisors instructed their Director of Public Works, Chief Sustainability Officer and Chief Executive Officer to adopt Envision as a standard for infrastructure projects, including transportation projects (ISI, 2017b & Los Angeles County Department of Public Works [LACDPW], n.d.b). The City of Los Angeles, in collaboration with Los Angeles County, followed with a similar motion November 4, 2016 (ISI, 2016a). As of February 4, 2017, the Department of Public Works of Los Angeles County website lists two road projects assessed, but not verified. The first project is an expansion of an existing interchange, known as the Hasley I-5 Interchange Project, which was rated at 244 of 809 possible points or 30% for an achievement of Silver (LACDPW, n.d.b). The second project is the widening of an existing highway from 4 lanes to 6 lanes, known as the Old Road Widening, that achieved 164 of 809 possible points, or 20% for an achievement of Bronze (LACDPW, n.d.a).

Envision is unique from other ISRSs in several aspects. It covers the entire project life cycle of planning, design, construction, operation, and decommissioning. Envision addresses traps and vulnerabilities anticipated from climate change, such as extreme weather, that could

result in higher costs down the road for a community (ACEC, 2014). The criteria score is progressive, giving relatively more points for performance that is well above the standard, to encourage innovation and the setting of aggressive objectives (ACEC, 2014). ACEC (2014) set out eight questions that are important for a consulting engineering firm to answer prior to using an ISRS and Envision rates well for these questions relative to other ISRSs. Of the ISRSs studied in their paper, Clevenger et al. (2013) found that Envision allocated the highest number of criteria to what they defined as environmental issues, the highest percentage of all sub-criteria related to water quality, the highest percentage of sub-criteria related to energy, and a close second highest percentage of sub-criteria for the selection of materials, as compared to the other ISRS they examined. Clevenger et al. (2013) also found that Envision applies to the widest range of infrastructure projects, requires that an Envision credentialed employee be on the project team, and is the only ISRS that awards points for effective and collaborative leadership from the project team.

Bueno et al. (2015) rates Envision highly, but notes that it is not sensitive to the local context. This is a criticism common in the literature to many ISRSs. For Envision, aside from excluding criteria that are not relevant to the project, there is no process to adapt the criteria or to change the weighting to reflect local issues. The work of Lee, Edil, Benson, and Tinjum (2013) found that Envision, along with GreenRoads and three other ISRS, all suffer from a lack of objectivity in criteria selection and weighting. Furthermore, Lee et al. (2013) pondered whether in criterion-based certification systems achieving a certification may take precedence over achieving sustainability objectives. Envision does have a process to allow for bonus points for innovation, which many other ratings systems have, including GreenRoads, but the innovation bonus may not be sufficient to reflect local context. However, the lack of flexibility means that the expectations and metrics are specific and non-negotiable, setting out clear expectations that may be lacking in a regulatory approach.

Despite these challenges, it is important to note that Envision has the support of a number of consulting engineering companies in Ontario, based on the list of Envision Sustainability Professionals in Ontario on the ISI website. No other ISRS has the level of support that Envision has in Ontario, or in Canada. Given the aforementioned challenges in the existing 'command and control' and regulatory approaches in Ontario, this study explores the benefits to CAs endorsing Envision.

4 Using Envision

4.1 Project Evaluation

The Env SP evaluates a project using the Envision document. Figures 1a and 1b are from the Envision document. Each credit has the two pages with the same information. Note that some of the terminologies from Envision were altered in this study to provide consistency with the accepted terms in the literature. Credits in Envision are referred to as criteria in this study. The Evaluation Criteria in Envision are referred to as the Performance Metrics in this study. The description “Metric” in Envision is not referenced in this study.

The first step for the Env SP is to briefly review the Intent, the Description, and Advancing to Higher Achievement Levels to gain a general understanding of how what the criterion is attempting to achieve and how. The next step is to review the performance metrics, which are under the title Evaluation Criteria and Documentation in tables 1a and 1b.

The performance metrics mostly ask polar questions with a yes-no answer, based upon qualitative and/or quantitative requirements. The four types of polar questions are: whether an action had been taken or an outcome achieved; whether a specified target had been reached which may involve discrete or variable levels; whether a process had been undertaken or a commitment made to meet a specific objective; or whether a process had been undertaken with a general accomplishment (ISI & Zofnass, 2015). The fifth type of question is a non-polar question of the extent to which the project team undertook an action or process (ISI & Zofnass, 2015).

In the Envision document the performance metrics posit questions to the evaluator. The questions are a progression whereby the evaluator responds to the questions successively until the answer is negative. In the Envision document the performance metrics provide examples of

documentation that can be used to support the accomplishment of the metric. The documents listed are intended to provide assistance to the evaluator and do not comprise a comprehensive list.

The next step for the Env SP is to evaluate the Levels of Achievement. Each criterion contains two to five levels of achievement – improved, enhanced, superior, conserving, and restorative. As shown in Figure 1a, the criterion QL 1.1 has all five levels of achievement available. Similar to the performance metrics, the levels of achievement are progressive, requiring that a lower level of achievement be met before consideration is given to the next level. So the first step is to determine which levels of achievement are valid for the project based on the performance metrics met. In Figure 1a, the first three levels of achievement (Improved, Enhanced and Superior) require that the performance metrics A through D be met. The next level of Conserving requires that performance metrics A through E be met. The evaluator then assesses the project based upon the descriptions of the levels of achievement, starting with the lowest level of achievement. For example, for a project to achieve a rating of Enhanced for criterion QL 1.1, it must meet performance metrics A through D, and meet the description of achievement level Improved and achievement level Enhanced.

QL1.1 IMPROVE COMMUNITY QUALITY OF LIFE

INTENT:

Improve the net quality of life of all communities affected by the project and mitigate negative impacts to communities.

LEVELS OF ACHIEVEMENT

IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE
(2) Internal focus. The project team has located and reviewed the most recent community planning information. Some, but not systematic, outreach to stakeholders and decision makers has taken place. Some relatively easy, but not particularly important or meaningful, changes made to the project. No serious adverse community effects are caused by the project. (A, B, C, D)	(5) Community linkages. More efforts to locate, review, assess, and incorporate the needs, goals, and plans of the host community to the project. Most potential negative adverse impacts of the project on the host community are reduced or eliminated. Key stakeholders are involved in the project decision-making process. (A, B, C, D)	(10) Broad community alignment. All community plans are reviewed and verified through stakeholder input. The project team works to achieve good project alignment with community plans, recognizing that the scope of the project is a limiting factor. Potential negative impacts on nearby affected communities are reduced or eliminated. (A, B, C, D)	(20) Holistic assessment and collaboration. The project makes a positive contribution to the quality of life of the host and nearby affected communities. The project team makes a holistic assessment of community needs, goals, and plans, incorporating meaningful stakeholder input. Project meets or exceeds important identified community needs and long-term requirements for sustainability. Remaining adverse impacts are minimal, mostly accepted as reasonable trade-offs for benefits achieved. The project has broad community endorsement. (A, B, C, D, E)	(25) Community renaissance. Through rehabilitation of important community assets (e.g., upgraded and extended access, increased safety, improved environmental quality, and additional infrastructure capacity) the project substantially reinvigorates the host and nearby communities. Working in genuine collaboration with stakeholders and community decision makers, the project owner and the project team scope the project in a way that elevates community awareness and pride. Overall quality of life in these communities is markedly elevated. (A, B, C, D, E, F)

DESCRIPTION

This credit addresses the extent to which the project contributes to the quality of life of the host and affected communities. This determination is based on how well the project team has identified, assessed, and incorporated community needs, goals, and objectives into the project. Relevant community plans are assumed to be a viable expression of those needs, goals, objectives, and aspirations. In a real sense, they are the community's expression of their desired quality of life.

Communication and interactions with community stakeholders are essential to reaffirm and improve the assessment. The project team works closely with community stakeholders to identify and address issues and concerns. When operational, the completed project is expected to contribute to the efficiency and effectiveness of community infrastructure while having minimal impact on the environment. Its benefits should be seen as equitably distributed throughout the community.

A project designed to benefit one community may have adverse effects on others. The purpose of this credit is to recognize projects that provide significant benefits to affected communities and reduce or eliminate negative impacts. Because positive effects on all dimensions of performance may not be practical, the credit seeks a net positive impact.

If the project team can show that the affected community (or communities) has an existing project assessment and approval process that verifies that the project is in concert with community goals and objectives and that the project has gone through that process successfully, then that success will constitute achievement of this credit. The level of achievement will be

determined by the project team and is a function of the comprehensiveness of the process, the extent to which community stakeholders are engaged in collaborative dialogue (rather than merely outside input to the process), and the degree to which improvements were made and/or adverse impacts mitigated.

ADVANCING TO HIGHER ACHIEVEMENT LEVELS

Benchmark: The project team locates and reviews community plans, looking for possible project fatal flaws. The team complies with local regulations and policies for stakeholder involvement.

Performance Improvement: Give increased attention to community needs, goals, and plans as they relate to the project. Increase the thoroughness and participatory engagement by which community goals and plans are incorporated into the project. Give additional consideration to existing conditions and look for opportunities to rehabilitate community assets. Achieve strong endorsement by stakeholders and community leaders.

EVALUATION CRITERIA AND DOCUMENTATION

A. Has the project team identified and taken into account community needs, goals, and issues?

1. *Lists and examples of documents obtained and reviewed; minutes of meetings with key stakeholders, community leaders, and decision makers; letters; and memoranda.*

Figure 1A: ISI & Zofnass, 2015, page 20

25
POINTS

QUALITY OF LIFE

PURPOSE

METRIC:

Measures taken to assess community needs and improve quality of life while minimizing negative impacts.

B. Has the project team sought to align the project vision and goals to the needs and goals of the host and affected communities?

1. Evidence showing a comparison of the project vision and goals to the needs, goals, plans, and issues of the community.

C. Has the project team sought to identify and address potential adverse impacts to the host and affected communities?

1. Comprehensive impact assessments conducted, identifying and evaluating the positive and negative impacts of the project on affected communities. Planned actions for mitigating adverse impacts.

2. Minutes of meetings, letters, and memoranda with key stakeholders, community leaders, and decision makers for obtaining input and agreement regarding the impact assessment and planned actions.

D. Have the affected communities been meaningfully engaged in the project design process?

1. Reports and documented results of meetings, design charrettes, and other activities conducted with representatives of affected communities.

2. Evidence of project processes for collecting, evaluating, and incorporating community input into the project designs. Demonstration of the thoroughness of the evaluation and incorporation to the designs.

3. Evidence showing the extent to which options were identified, and any needed, reasonable changes to the project made in accordance with community needs or plans.

E. Are the affected communities satisfied that the project is addressing their immediate and long-term issues, needs, and goals?

1. Acknowledgments and endorsements by the community that the design participation process was helpful and that their input was appropriately assessed and incorporated into project design.

2. Evidence of community satisfaction and endorsement of plans.

F. Have the project owner and the project team designed the project in a way that improves existing community conditions and rehabilitates infrastructure assets?

1. Plans, designs, and meeting minutes with community stakeholders and decision makers demonstrating an understanding of community conditions and assets and substantive efforts to rehabilitate.

SOURCES

The Sustainable Sites Initiative: Guidelines and Performance Benchmarks 2009, Credit 6.1: Promote equitable site development, Credit 6.2: Promote equitable site use.

RELATED ENVISION CREDITS

QL1.2 Stimulate Sustainable Growth and Development

QL1.3 Develop Local Skills and Capabilities

QL2.2 Minimize Noise and Vibration

QL2.3 Minimize Light Pollution

QL2.4 Improve Community Mobility and Access

QL3.1 Preserve Historic and Cultural Resources

QL3.2 Preserve Views and Local Character

QL3.3 Enhance Public Space

LD1.4 Provide for Stakeholder Involvement

LD2.2 Improve Infrastructure Integration

RA1.4 Use Regional Materials

NW1.3 Preserve Prime Farmland

Figure 1B: ISI & Zofnass, 2015, page 21

4.2 Project Verification

The Envision rating system and tools are available free on the ISI website. Certification is only one use of Envision. ISI recognizes and supports many other uses of envision: as a communication tool with stakeholders, to prioritize a list of projects, to assess project alternatives, as a communication tool with the project team, to identify sustainability priorities, to quantify the value of sustainable practices, to evaluate project performance, and to recognize achievement (ISI, n.d.c).

The process of verifying a project is illustrated in Figure 2. Verification is optional and is provided as a way of increasing awareness of Envision and of motivating its use and higher achievement. The verification process starts with pre-registration whereby the project team, which must include an ENV SP, undertakes a self-assessment to understand whether the project is likely to achieve an award (ISI, n.d.c). The second step is registration whereby the ENV SP registers the project online with ISI, and ISI assigns a verifier; the ENV SP and the verifier then have a conference call to discuss the project and the Envision process (ISI, n.d.c). The third step is assessment whereby the ENV SP submits their assessment of the project using the online tool, along with the required documentation (ISI, n.d.c). The fourth step is verification, which can involve up to two chances to re-submit the assessment in response to comments from the verifier (ISI, Module 7, 2016). The last step is award whereby, if the project has achieved at least 20% of the available criteria, the project receives an award and plaque at a ceremony, with a press release (ISI, n.d.c).

Los Angeles County has endorsed Envision as official policy, but only verifies select projects. Los Angeles County staff undertake a self-assessment of their infrastructure projects and provide a brief summary of achievement under each of the five categories of Envision on their

website. The verification process increases the costs of a project both directly through the fee and indirectly through the requirement of additional documentation. CAs could endorse Envision and encourage and support municipalities in adopting it as policy, similar to Los Angeles County, which avoids the costs of verification.

Project Verification Process:

Figure 2

Table 2 shows the 55 criteria of Envision under the categories of Quality of Life (QL), Leadership (LD), Resource Allocation (RA), Natural World (NW), and Climate and Risk (CR) (ISI & Zofnass, 2015). Each criterion has one or more levels of achievement, listed in increasing order as: Improved, Enhanced, Superior, Conserving, and Restorative (ISI & Zofnass, 2015). The levels of achievement are based upon a set of clear and detailed evaluation metrics (ISI & Zofnass, 2015). Each of the levels of achievement has points weighted based upon an assessment by ISI and Zofnass of the relative contribution of the criterion and level of achievement towards sustainability (ISI & Zofnass, 2015). As illustrated in Table 2, criteria and

categories of criteria have different maximum points. Criteria can be omitted by a proponent if they are not applicable to the project, but the weighting cannot be altered (ISI & Zofnass, 2015). To encourage innovation, bonus points can be awarded where a project exceeds criterion requirements or uses an innovative method, application, or technology, as judged by the Envision Sustainability Professional and confirmed by the verifier (ISI & Zofnass, 2015).

ENVISION POINTS TABLE

		IMPROVED	ENHANCED	SUPERIOR	CONSERVING	RESTORATIVE	
QUALITY OF LIFE	PURPOSE	QL1.1 Improve community quality of life	2	5	10	20	25
		QL1.2 Stimulate sustainable growth and development	1	2	5	13	16
		QL1.3 Develop local skills and capabilities	1	2	5	12	15
	WELLBEING	QL2.1 Enhance public health and safety	2	—	—	16	
		QL2.2 Minimize noise and vibration	1	—	—	8	11
		QL2.3 Minimize light pollution	1	2	4	8	11
		QL2.4 Improve community mobility and access	1	4	7	14	
		QL2.5 Encourage alternative modes of transportation	1	3	6	12	15
		QL2.6 Improve site accessibility, safety and wayfinding	—	3	6	12	15
	COMMUNITY	QL3.1 Preserve historic and cultural resources	1	—	7	13	16
QL3.2 Preserve views and local character		1	3	6	11	14	
QL3.3 Enhance public space		1	3	6	11	13	
Maximum QL Points:					181*		
LEADERSHIP	COLLABORATION	LD1.1 Provide effective leadership and commitment	2	4	9	17	
		LD1.2 Establish a sustainability management system	1	4	7	14	
		LD1.3 Foster collaboration and teamwork	1	4	8	15	
		LD1.4 Provide for stakeholder involvement	1	5	9	14	
	MANAGEMENT	LD2.1 Pursue by-product synergy opportunities	1	3	6	12	15
		LD2.2 Improve infrastructure integration	1	3	7	13	16
	PLANNING	LD3.1 Plan for long-term monitoring and maintenance	1	3	—	10	
		LD3.2 Address conflicting regulations and policies	1	2	4	8	
		LD3.3 Extend useful life	1	3	6	12	
Maximum LD Points:					121*		
RESOURCE ALLOCATION	MATERIALS	RA1.1 Reduce net embodied energy	2	6	12	18	
		RA1.2 Support sustainable procurement practices	2	3	6	9	
		RA1.3 Use recycled materials	2	5	11	14	
		RA1.4 Use regional materials	3	6	9	10	
		RA1.5 Divert waste from landfills	3	6	8	11	
		RA1.6 Reduce excavated materials taken off site	2	4	5	6	
		RA1.7 Provide for deconstruction and recycling	1	4	8	12	
	ENERGY	RA2.1 Reduce energy consumption	3	7	12	18	
		RA2.2 Use renewable energy	4	6	13	16	20
		RA2.3 Commission and monitor energy systems	—	3	—	11	
	WATER	RA3.1 Protect fresh water availability	2	4	9	17	21
		RA3.2 Reduce potable water consumption	4	9	13	17	21
		RA3.3 Monitor water systems	1	3	6	11	
Maximum RA Points:					182*		
NATURAL WORLD	SITING	NW1.1 Preserve prime habitat	—	—	9	14	18
		NW1.2 Protect wetlands and surface water	1	4	9	14	18
		NW1.3 Preserve prime farmland	—	—	6	12	15
		NW1.4 Avoid adverse geology	1	2	3	5	
		NW1.5 Preserve floodplain functions	2	5	8	14	
		NW1.6 Avoid unsuitable development on steep slopes	1	—	4	6	
		NW1.7 Preserve greenfields	3	6	10	15	23
	LAND & WATER	NW2.1 Manage stormwater	—	4	9	17	21
		NW2.2 Reduce pesticide and fertilizer impacts	1	2	5	9	
		NW2.3 Prevent surface and groundwater contamination	1	4	9	14	18
	BIODIVERSITY	NW3.1 Preserve species biodiversity	2	—	—	13	16
		NW3.2 Control invasive species	—	—	5	9	11
		NW3.3 Restore disturbed soils	—	—	—	8	10
		NW3.4 Maintain wetland and surface water functions	3	6	9	15	19
Maximum NW Points:					203*		
CLIMATE & RISK	EMISSIONS	CR1.1 Reduce greenhouse gas emissions	4	7	13	18	25
		CR1.2 Reduce air pollutant emissions	2	6	—	12	15
		CR2.1 Assess climate threat	—	—	—	15	
	RESILIENCE	CR2.2 Avoid traps and vulnerabilities	2	6	12	16	20
		CR2.3 Prepare for long-term adaptability	—	—	—	16	20
		CR2.4 Prepare for short-term hazards	3	—	10	17	21
		CR2.5 Manage heat islands effects	1	2	4	6	
Maximum CR Points:					122*		
Maximum TOTAL Points:					809*		

* Not every credit has a restorative level. Therefore totals include the maximum possible points for each credit whether conserving or restorative.

* Not every credit has a restorative level. Therefore totals include the maximum possible points for each credit whether conserving or restorative.

Table 2: ISI & Zofnass, 2015, page 23

5 Supporting Research

This study adapts the approach of Anderson and Muench (2013). They undertook a study to measure sustainability trends in the U.S. using the GreenRoads rating system. Their study purpose was to understand the potential impact of the GreenRoads ratings system, or a similar system, on the U.S. transportation industry. This followed earlier research by Anderson. She took a pool of 40 projects she identified as sustainable and 65 projects she identified as typical (Anderson, 2012). The sample was not random, and required that the projects have available documentation and a representative from the project team available for an interview. Anderson's study team analysed each project through available reports, websites, and interviews and assigned a GreenRoads score based upon activities of the project that met the intention of the criteria. The study team gave a raw score based on a strict application of the GreenRoads criteria and a reasonable score that included the 'low fruit' the team defined as having low or no additional cost to the project. They then analysed trends between criteria categories and between the prior identified typical versus sustainable projects. This study took a similar approach to studying the Envision ISRS in Ontario, adapting their purpose, research questions, study objectives, and methodology. However, it was beyond the scope of this study to pre-identify project as sustainable, and to include interviews.

Furthermore, this study assesses the findings of Saville, Miller, and Brumbelow (2016) in their assessment of the Twin Oaks Aquifer Storage and Recovery Project using Envision. The authors came to five findings: the sustainable nature of the project itself was not directly addressed, there was no weighting of criteria based upon local needs, the project focus omitted a system scale, there was an uneven weighting of the three sustainability pillars, and that the positive scoring often overlooked negative aspects of the project (Saville et al., 2016). This

study investigates whether these conclusions held true for the 13 municipal transportation projects assessed.

6 Method

6.1 Selection of Cases

The first part of the research method was to select the cases for assessment. Through my employment at TRCA I had access to project files of reports and drawings covering the Environmental Assessment and detailed design for road projects within TRCA's jurisdiction that required a permit under Ontario Regulation 166/06. Ontario Regulation 16/06 is TRCA's regulation of development under the CA Act. The first step was to compile a list of all permits issued by TRCA under the CA Act that were associated with a schedule C MCEA for road works; most of the projects widened an existing road. The next step was to identify the associated list of EAs. Each EA was checked to ensure that each had been carried through to detailed design for the entire preferred solution of the EA. Projects where more than two permits were generally associated with the EA were excluded due to associated complexities when assessing the project. Projects that did not have a potential environmental impact on at least one watercourse or wetland were excluded. Projects deemed too difficult to assess, or too similar to another case study were excluded.

6.2 Document Review Method

6.2.1 Spreadsheet

Envision requires that each project be evaluated using the Envision ISRS. This study used a systematic approach developed for making post hoc subjective judgments about project performance using Envision. Table 3 is a simplified example of the spreadsheet for one criterion. The 13 projects each have their own worksheet with one row for each of the 55 Envision criteria. Each criterion has between one and six performance metrics, A through F. An

explanation of the achievement for each applicable performance metric for each project is provided in Appendix A; each applicable performance metric was given a level of confidence of it being met – generally no, maybe, likely, or yes.

The next columns summarizes the metrics met, separated into base and upper levels of confidence (explained below). The next columns provide the criterion level of achievement and associated score, separated into base, upper and ‘low fruit’ scores (explained below). ‘Low fruit score’ is a subjective rating that is intended to capture relatively low cost, relatively easily actions that could have been implemented. The final column contains an explanation of the scores given for each criterion.

Example Assessment Worksheet:

		Criterion	Performance Metrics						Metrics Achieved		Achievement Level			Score			Summary Notes
			A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base	Upper	Low Fruit	
Purpose	QL 1.1	Improve community quality of life	Yes	Possibly	Yes	Yes	No	—	A, C, D	A to D	None	Enhanced	Superior	0	5	10	Provide a rationale

Table 3

6.2.2 Perspective

I completed a series of online training modules and a final exam online through ISI in early 2016. Along with my work experience in reviewing Environmental Assessments and detailed design for infrastructure, I qualified as a Certified Envision Sustainability Professional (Env SP) and am listed on the ISI website.

Each project was assessed from the perspective of the Env SP on the team. To maintain consistency in approach, and thereby minimize bias, claims in the file documentation were not critiqued. Similarly, comments from Conservation Authority Staff in the file were not reviewed.

Generally only the final Environmental Study Report and appendices, detailed design technical reports, memorandums, and final detailed design drawings were reviewed. Landscape images were used to gain a general understanding of the context of the road. Grade level images were used if available post-construction to check what was actually constructed.

6.2.3 Evaluation Methods

Projects were assessed one at a time. Each of the performance metrics has a one sentence description and then lists examples of documentation that would prove the metric was met.

For each criterion in this study, the performance metrics were assessed sequentially to identify the performance metrics that in my opinion were met with a high degree of confidence (base metric met) and then with a lower degree of confidence (upper metric met). If a metric was clearly not met based on the assessment for the upper metric met, further metrics were assessed only if it would provide useful information in assessing the 'low fruit' score.

The 'base metric met' is the metric that, with a high degree of confidence, the project would have achieved. As projects completed with no knowledge of Envision were assessed, a high degree of latitude was applied in assessing whether the project met the specific examples of support for each performance metric, and some latitude in assessing whether the project met the core purpose of each criterion itself.

The 'upper metric met' is the performance metric that was met with a lower threshold of confidence. A higher degree of latitude was used in interpreting each performance metric in the upper metric met as compared to the base metric met. This includes situations where there are two interpretations of a metric and, where one interpretation leads to meeting the metric and the other to not meeting the metric, the upper evaluation criteria will list the metric as met.

The level of achievement was strictly assessed; all aspects of the description for a given level had to be met for achievement to be given. The criterion was then given the score associated with the level of achievement.

The 'base' level of achievement is the level of achievement that clearly met the required achievement descriptions and associated performance metrics, preferably with written evidence or a high degree of certainty based upon knowledge of standard practice.

The 'upper' level of achievement' is the higher level of achievement met with a lower level of confidence. For example, in instances where there was a lack of clarity on how to interpret and apply the level of achievement, the highly certain achievement was the base achievement while the less certain achievement was the upper.

'Low fruit' is a phrase borrowed from the supporting research of Anderson and Muench (2013) and is short for 'low hanging fruit'. The 'low fruit' level of achievement is a subjective rating that is intended to capture relatively low cost, relatively easy actions that most likely would have been implemented had an Env SP been on the project team from the beginning. The 'low fruit' score only included actions that did not require significant revisions to the preferred design. The 'low fruit' judgement is project specific, based upon the levels of achievement already undertaken. The notes for each criterion include the reasoning for the 'low fruit' score given.

6.3 Interpretations, Inferences and Assumptions

Envision was designed to be used for all types of infrastructure. This required the Envision document to use terms and processes that could be broadly interpreted for linear surface infrastructure, linear underground infrastructure, and site plans. Some terms and processes were more relevant to underground infrastructure or site plans, and their interpretation for roads was unclear. There were many examples of inconsistencies between the

performance metrics and the descriptions for the levels of achievement; for example, sometimes one of the performance metrics required for the lowest achievement level of Improved was a stricter test than the description of the Improved level of achievement. Key aspects of the systematic approach of this study were assumptions and interpretations, which improved the consistency of project ratings.

Envision was designed to be used during planning and design and some of the process and implementation metrics of the document are very specific. As all projects assessed in this study have already been through planning and design, a degree of latitude in interpreting project metrics was used. Interpretations and inferences were made to support a consistent approach in assessing project metrics. The key interpretations and inferences are laid out below.

Further, less important interpretations and inferences are described in each of the project assessment work sheets for each criterion. The project sheets also provide descriptions of assumptions that were made, especially where documentation was absent.

6.3.1 General

In the training to become an Env SP, the rule of thumb provided was that a maximum of three of the 55 criteria can be deemed not applicable. Therefore, only criteria that were completely irrelevant were deemed not applicable. Criteria that would not have been appropriate for a project to pursue were not excluded; for example many projects were adjacent to farmland that was in various stages of planning approvals for development. Although it would have made little sense to assess and protect farmland slated for development as per criterion NW 1.3, criterion NW 1.3 was only excluded where the project was not adjacent to any currently farmed lands.

Each of the five categories of criteria has a bonus criterion for innovation or exceeding criterion requirements. There is no clear method in the Envision document to systematically

assess the degree of innovation or exceedance of criterion metrics required for achievement. Achievement is on a case by case basis under the discretion of the Envision verifier. It was beyond the scope of this study to develop a systematic approach to assessing the exceedance of criterion metrics, and was not necessary to answering the research questions and objectives. Therefore, the five bonus criterion of innovation or exceeding project requirements were assumed to be 0 and were not included on the project assessment worksheets.

6.3.2 Criterion Specific Interpretations

1. The intent of criterion QL 1.1: Improve Community Quality of Life is to “improve the net quality of life of all communities affected by the project and mitigate negative impacts to communities” (ISI & Zofnass, 2015). The intent aligns with one of the key intents of the OEAA and as such it is one of the most important criteria in Envision for the projects assessed in this study which were all planned under the OEAA. It was also one of the more complex criteria to interpret with no clear definitions of key concepts and terms, such as ‘meaningful stakeholder engagement’, and the difference between the ‘host community’ and ‘nearby affected communities’.

Community was interpreted to be the local municipality. Therefore the ‘host community’ was the municipality in which the project was occurring and ‘nearby affected communities’ were the adjacent municipalities. Therefore, the relevant local community plans included the Official Plan and infrastructure Master Plans. The criterion description states:

“If the project team can show that the affected community (or communities) has an existing project assessment and approval process that verifies that the project is in concert with community goals and objectives and that the project has gone through that process successfully, then that success will constitute achievement of this [criterion]. The level of achievement will be determined by the project team and is a function of the comprehensiveness of the process, the extent to which community stakeholders are engaged in collaborative dialogue (rather than merely outside input to the process), and the degree to which

improvements were made and/or adverse impacts mitigated.” (ISI & Zofnass, 2015).

As Transportation Master Plans do not obtain local community input for every road improvement proposed, I deduced that the criterion requires that the project team for an EA verify through project level consultation, the recommendations from the higher level plans. As the lowest achievement level of Improved required satisfying performance metrics A through D, then the above test was read and understood along with metrics A through D. Performance metric D asks “have the affected communities been meaningfully engaged in the project design process?” (ISI & Zofnass, 2015). All projects assessed, with the exceptions of Main Street Markham and Leslie Street, used the standard two Public Information Centres (PICs) with information boards. Therefore, achievement of Improved or higher must prove that the standard two PICs of the MCEA process are sufficient to meet the criterion D test of meaningful engagement. If meaningful engagement is understood to mean collaborative dialogue as per the above quote then a meeting with information boards generally did not suffice; I therefore inferred a base score of 0 for all project with the exception of Main Street Markham and Leslie Street for criterion QL 1.1.

However, based on my work experience some degree of meaningful engagement can still occur in projects that held public meetings with information boards. I therefore inferred that a degree of meaningful engagement may have occurred in projects with some of the following: a list or summary of comments received from the community with responses that show the comments were appropriately considered by the project team, and separate meetings with landowners or other key community stakeholders. To achieve the level of Enhanced required a project team undertake meaningful alterations to the project design as a result of input from the public or stakeholders, but some adverse impacts could remain. To achieve the level of Superior

required all potential impacts be reduced or eliminated and that the project align with the higher order plans and other community plans. To achieve the level of Conserving required meaningful stakeholder input at which was inferred to include facilitated public meetings, design charrettes, stakeholder advisory groups, and evidence of community endorsement.

2. The intent of criterion QL 2.5 is to “improve accessibility to non-motorized transportation and public transit...[p]romote alternative transportation and reduce congestion.” (ISI & Zofnass, 2015). Performance metric B requires that the project restrict the parking of motorized vehicles. I deduced that because the metric does not specify intent that a project meets the metric if parking is restricted irrespective of whether this is a deliberate design choices or a result of other design choice (such as the addition of curbs). Furthermore, the lowest achievement level of Improved requires encouraging the use of non-motorized transportation. It was unclear the relevance of whether the project also encouraged motorized transportation. Most projects assessed added general purpose motorized travel lanes. As the criteria and levels of achievement speak to increasing use of alternative modes of transportation, and not in shifting modal split, I deduced that the project’s impacts on vehicular use is irrelevant.
3. The intent of criterion QL 3.3 is to “improve public spaces...to enhance community livability” (ISI & Zofnass, 2015). Performance metric A requires that the project add to public space, but it was not clear what constituted an addition to public space. I deduced that because the first four levels of achievement only described improvements to public space, and all required achievement of performance metric A, that therefore ‘addition’ to public space in metric A included improvements to the existing public space.
4. The intent of criterion NW 1.4 is to “avoid development on adverse geologic formations” (ISI & Zofnass, 2015). It is unclear at what geographic scale a criteria needs to not be

applicable in order to exclude it from the ratings. As per the Ontario Geological Survey (2008) there are no Karst formations in the GTA area. There are also no major earthquake fault lines or low lying coast areas in the GTA. I therefore conclusion criterion NW 1.4 was not applicable for any of the 13 projects assessed.

5. The intent of criterion NW 1.7 is to located projects on greyfields as opposed to greenfields (ISI & Zofnass, 2015). Metric A asked what percentage of the project was located on a site that was previously developed. Strictly speaking, 50% of a project that reconstructs a road and doubles its width is located on a site that was previously developed. The Enhanced level of achievement is given for locating 50% of the project on a greyfield. For the purposes of this criterion it only made sense to count an existing road as a greyfield if serious consideration was given in the planning stages to a new road route through a greenfield. Otherwise, a project that doubles the width of an existing road would be given achievement for 50% greyfield development, which is absurd, and clearly not the intent of the criterion.
6. The intent of criterion NW 2.1 is to “minimize the impact of infrastructure on stormwater runoff quantity and quality” (ISI & Zofnass, 2015). The levels of achievement provide targets as a percentage improvement over existing conditions for greyfield, brownfield and greenfield development. For the purposes of water quantity calculations the existing road was considered a greyfield. Criterion NW 2.1 requires that water storage capacity be maintained in the greenfield and must be improved in the greyfield (existing road) by at least 30% for an Enhanced achievement level. Therefore, a road widening project that is 50% greyfield and 50% greenfield must overall improve water storage and infiltration 65% over pre-development conditions for the Enhanced achievement level.
7. The Climate and Risk category contains 7 criteria under the sub-categories of Emissions and Resilience. All the criteria required studies for which there was no evidence in the

documents reviewed, so all 31 projects reviewed were assessed at scores of 0 for the base and upper levels of confidence. Without some degree of achievement, it was very difficult to assess what would constitute low cost, easy actions that a proponent would likely have undertaken had an Env SP been on the team. Therefore a 'low fruit' score of 0 was applied to all 7 criteria for all projects.

6.4 Control of Bias

Controlling bias throughout the project assessments was crucial in the support of data validity. Several approaches were used. While projects were assessed one at a time, the assessment of each criterion was preceded by a review of the previous assessments of that criterion. Ongoing notes were taken during the assessments of deductions and assumptions made as to the interpretation of criterion and metrics. Once all the projects and criterion were assessed, a careful review of each criterion and the notes were undertaken across the projects to ensure that a consistent approach was taken. Taking the perspective of the Env SP on the team and not critiquing the claims of the documentation further ensured consistency and the control of bias.

7 Analysis

7.1 Overall Summary

Tables 4a, 3b and 3c illustrate the base, upper and 'low fruit' scores achieved for each criterion under each of the thirteen projects assessed. The Climate and Risk category was not included as all criterion achievements were assessed at 0. Criteria that were deemed not applicable are illustrated with an N/A; the Torbram Road Grade Separation had the greater number of criteria deemed not applicable at five, followed by Kirkhams Road at four; however, Kirkhams Road had the lowest applicable total score. The other projects had either two or three criteria deemed not applicable.

Envision scoring is based on the percentage achievement of the applicable total scores. The lowest achievement is Bronze at 20%. Tables 4a, 3b and 3c provide at the bottom of the columns the percentage of applicable total scores achieved. The highest base score achievement was Leslie Street at 14.4%, 5.6% less than the 20% required for a Bronze recognition. The lowest base score was Bloomington Road at 3.5%. The highest upper score was 19.9% for Main Street Markham; assuming the score is rounded up to 20% Main Street Markham was the only project that may have achieved an Envision award. When considering the more subjective assessment of the 'low fruit' score, four project achieved the level of Bronze (Bayview Avenue, The Gore Road, Kirkhams Road, and Leslie Street), and Main Street Markham could have achieved Silver.

The sum of the possible points differs for each of the five categories of criteria - Quality of Life, Leadership, Resource Allocation, Natural World, and Climate and Risk. To provide an overall summary Table 5 and Figure 3 show the mean base and upper scores achieved for each

		Bayview Avenue			Bloomington Road			Bramalea Road			The Gore Road			
		Base	Upper	Low Fruit	Base	Upper	Low Fruit	Base	Upper	Low Fruit	Base	Upper	Low Fruit	
Quality of Life	Purpose	QL 1.1	0	10	10	0	10	10	0	0	10	0	0	10
		QL 1.2	0	0	0	0	0	0	0	0	0	0	0	0
		QL1.3	0	0	0	0	0	0	0	0	0	0	0	0
	Wellbeing	QL2.1	0	0	2	0	0	2	0	0	2	0	0	2
		QL 2.2	1	1	8	0	0	1	1	1	1	0	0	1
		QL 2.3	0	1	2	0	0	0	0	0	2	0	1	2
		QL 2.4	1	4	7	1	4	4	0	0	4	1	1	4
		QL 2.5	3	3	3	1	1	1	1	1	3	3	3	3
		QL 2.6	0	0	0	0	0	0	0	0	0	0	3	12
	Community	QL 3.1	0	0	0	0	0	0	0	0	0	16	16	16
		QL 3.2	0	0	6	0	0	0	0	0	1	0	0	6
		QL 3.3	0	0	6	0	0	0	0	0	0	1	1	1
		5	19	44	2	15	18	2	2	23	21	25	57	
Leadership	Collaboration	LD 1.1	4	4	4	4	4	4	4	4	4	4	4	4
		LD 1.2	0	0	0	0	0	0	0	0	0	0	0	0
		LD 1.3	1	4	4	1	4	4	1	4	4	4	4	4
		LD 1.4	1	5	5	1	5	5	1	1	5	5	5	5
	Management	LD 2.1	0	0	0	0	0	0	0	0	0	0	0	0
		LD 2.2	0	0	0	0	0	0	0	0	0	0	0	0
	Planning	LD 3.1	0	0	3	0	0	3	0	0	3	0	0	3
		LD 3.2	0	0	1	0	0	1	0	0	1	0	0	1
		LD 3.3	1	1	3	1	1	3	1	1	3	1	1	3
		7	14	20	7	14	20	7	10	20	14	14	20	
Resource Allocation	Materials	RA 1.1	0	0	0	0	0	0	0	0	0	0	0	0
		RA 1.2	0	0	2	0	0	2	0	0	2	0	0	2
		RA 1.3	0	5	11	0	5	11	0	2	5	0	5	11
		RA 1.4	0	3	6	0	3	6	0	3	6	0	3	6
		RA 1.5	0	0	6	0	0	6	0	0	6	0	0	6
		RA 1.6	6	6	6	6	6	6	6	6	6	6	6	6
		RA 1.7	1	1	8	1	1	8	1	1	8	1	1	8
	Energy	RA 2.1	0	0	0	0	0	0	0	0	0	0	0	0
		RA 2.2	0	0	0	0	0	0	0	0	0	0	0	0
		RA 2.3	0	3	3	N/A	N/A	N/A	0	3	3	0	3	3
	Water	RA 3.1	0	0	0	0	0	0	0	0	0	0	0	0
		RA 3.2	0	0	0	0	0	0	0	0	0	0	0	0
		RA 3.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		7	18	42	7	15	39	7	15	36	7	18	42	
Natural World	Siting	NW 1.1	0	0	0	0	0	0	0	0	0	0	0	0
		NW 1.2	0	0	0	0	0	0	0	0	0	0	0	0
		NW 1.3	0	0	0	0	0	0	0	0	0	0	0	0
		NW 1.4	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		NW 1.5	0	8	8	2	2	2	14	14	14	0	0	2
		NW 1.6	N/A	N/A	N/A	1	1	1	1	1	1	1	1	1
		NW 1.7	0	0	0	0	0	0	0	0	0	0	0	0
	Land & Water	NW 2.1	0	0	0	0	0	0	0	0	0	0	0	0
		NW 2.2	0	5	5	0	5	5	0	5	5	0	5	5
		NW 2.3	4	4	4	0	0	0	0	0	0	0	0	0
	Biodiversity	NW 3.1	16	16	16	0	0	0	16	16	16	13	13	16
		NW 3.2	11	11	11	5	5	5	5	5	5	5	5	5
		NW 3.3	0	0	10	0	0	0	0	0	0	0	0	0
		NW 3.4	15	15	19	3	3	9	9	9	9	19	19	19
		46	59	73	11	16	22	45	50	50	38	43	48	
Percentage Achieved:		8%	14%	23%	3%	8%	13%	8%	10%	16%	10%	13%	21%	
		Bronze									Bronze			

Table 4a

		Highway 50			Kirkham Road			Leslie Street			Main Street Markham			
		Criteria	Base	Upper	Low Fruit	Base	Upper	Low Fruit	Base	Upper	Low Fruit	Base	Upper	Low Fruit
Quality of Life	Purpose	QL 1.1	0	10	10	0	0	10	25	25	25	25	25	25
		QL 1.2	0	0	0	0	0	0	0	0	0	0	16	16
		QL1.3	0	0	0	0	0	0	0	0	0	0	0	0
	Wellbeing	QL2.1	0	0	2	0	0	2	0	0	2	0	0	2
		QL 2.2	1	1	8	1	1	1	1	1	8	1	1	8
		QL 2.3	0	0	2	0	0	0	0	0	0	0	1	2
		QL 2.4	1	1	4	0	0	0	0	0	0	14	14	14
		QL 2.5	3	3	3	0	0	0	0	0	0	3	3	12
		QL 2.6	0	0	3	0	0	0	0	0	0	0	0	15
	Community	QL 3.1	0	1	1	0	0	0	0	0	0	13	16	16
		QL 3.2	0	0	1	0	0	1	0	0	6	0	6	6
		QL 3.3	0	0	0	0	0	0	0	0	11	6	11	13
		5	16	34	1	1	14	26	26	52	62	93	129	
Leadership	Collaboration	LD 1.1	4	4	4	4	4	4	4	4	4	4	4	9
		LD 1.2	0	0	0	0	0	0	0	0	4	0	0	4
		LD 1.3	4	4	4	1	4	4	4	4	8	1	4	8
		LD 1.4	5	5	5	1	5	5	9	9	9	9	9	9
	Management	LD 2.1	0	0	0	0	0	0	0	0	0	0	0	0
		LD 2.2	0	0	0	0	0	0	0	0	0	0	0	0
	Planning	LD 3.1	0	0	3	0	0	3	0	0	3	0	0	3
		LD 3.2	0	0	1	0	0	1	0	0	1	0	0	1
		LD 3.3	1	1	3	1	1	1	1	1	3	1	1	3
		14	14	20	7	14	18	18	18	32	15	18	37	
Resource Allocation	Materials	RA 1.1	0	0	0	0	0	0	0	0	0	0	0	0
		RA 1.2	0	0	2	0	0	2	0	0	2	0	0	2
		RA 1.3	0	5	11	0	5	11	0	5	11	0	5	11
		RA 1.4	0	3	6	0	3	6	0	3	6	0	3	6
		RA 1.5	0	0	6	0	0	6	0	0	6	0	0	6
		RA 1.6	6	6	6	6	6	6	6	6	6	6	6	6
		RA 1.7	1	1	8	1	1	8	1	1	8	1	1	8
	Energy	RA 2.1	0	0	0	0	0	18	0	0	0	0	0	0
		RA 2.2	0	0	0	0	0	0	0	0	0	0	0	0
		RA 2.3	0	3	3	N/A	N/A	N/A	N/A	N/A	N/A	0	3	3
	Water	RA 3.1	0	0	0	0	0	0	0	0	0	0	0	0
		RA 3.2	0	0	0	0	0	0	0	0	13	0	0	0
		RA 3.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		7	18	42	7	15	57	7	15	52	7	18	42	
Natural World	Siting	NW 1.1	N/A	N/A	N/A	0	0	0	9	9	9	0	0	0
		NW 1.2	0	0	0	1	1	1	0	0	0	0	0	0
		NW 1.3	0	0	0	N/A	N/A	N/A	0	0	12	N/A	N/A	N/A
		NW 1.4	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		NW 1.5	0	2	2	14	14	14	14	14	14	0	0	14
		NW 1.6	N/A	N/A	N/A	8	8	8	1	1	1	1	1	1
		NW 1.7	0	0	0	0	0	0	6	6	6	0	0	0
	Land & Water	NW 2.1	0	0	0	0	4	4	0	0	4	0	0	0
		NW 2.2	0	5	5	0	5	5	0	5	5	0	5	5
		NW 2.3	0	0	0	0	0	0	0	0	0	0	0	0
	Biodiversity	NW 3.1	2	2	2	16	16	16	16	16	16	0	0	13
		NW 3.2	5	5	5	5	5	5	5	11	11	5	5	5
		NW 3.3	0	0	0	0	10	10	0	0	0	0	0	0
		NW 3.4	19	19	19	19	19	19	9	9	9	15	15	15
		26	33	33	63	82	82	60	71	87	21	26	53	
Percentage Achieved:		7%	11%	17%	10%	15%	23%	14%	17%	29%	13%	20%	34%	
					Bronze			Bronze			**Bronze Silver			

Table 4b

	Criteria	Ninth Line			Rossland Road			16th Avenue			Torbram Grade Separation			Torbram Road		
		Base	Upper	Low Fruit	Base	Upper	Low Fruit	Base	Upper	Low Fruit	Base	Upper	Low Fruit	Base	Upper	Low Fruit
Quality of Life	QL 1.1	0	0	10	0	0	5	0	0	10	0	0	10	0	0	5
	QL 1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QL 1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QL 2.1	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2
	QL 2.2	1	1	8	0	0	1	1	1	8	0	0	1	1	1	1
	QL 2.3	0	1	2	0	1	2	0	4	4	2	2	4	0	1	2
	QL 2.4	1	4	7	1	4	7	4	4	7	0	0	0	1	1	4
	QL 2.5	3	3	3	3	3	3	0	0	0	1	1	1	3	3	3
	QL 2.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	QL 3.1	0	0	0	0	1	1	7	7	7	0	0	0	0	1	1
	QL 3.2	0	0	3	0	0	1	0	0	0	0	0	0	0	0	1
	QL 3.3	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0
Leadership		5	9	35	4	9	22	12	19	41	3	3	18	5	7	19
	LD 1.1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	LD 1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LD 1.3	1	4	4	1	4	4	1	4	4	0	0	1	1	4	4
	LD 1.4	1	5	5	1	1	5	5	5	9	1	1	1	1	1	5
	LD 2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LD 2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	LD 3.1	0	0	3	0	3	3	0	0	3	0	0	3	0	0	3
	LD 3.2	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1
	LD 3.3	1	1	3	1	1	3	1	1	3	1	1	3	1	1	3
		7	14	20	7	13	20	11	14	24	6	6	13	7	10	20
Resource Allocation	RA 1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RA 1.2	0	0	2	0	0	2	0	0	2	0	0	2	0	0	2
	RA 1.3	0	5	11	0	5	11	0	5	11	0	5	11	0	2	5
	RA 1.4	0	3	6	0	3	6	0	3	6	0	3	6	0	3	6
	RA 1.5	0	0	6	0	0	6	0	0	6	0	0	6	0	0	6
	RA 1.6	6	6	6	6	6	6	6	6	6	2	4	4	6	6	6
	RA 1.7	1	1	8	1	1	8	1	1	8	1	1	8	1	1	8
	RA 2.1	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0
	RA 2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RA 2.3	0	3	3	0	3	3	0	3	3	0	11	11	0	3	3
	RA 3.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RA 3.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RA 3.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Natural World		7	18	42	7	18	42	7	18	42	3	27	51	7	15	36
	NW 1.1	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A
	NW 1.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NW 1.3	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	0	0	0
	NW 1.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	NW 1.5	2	2	2	14	14	14	5	5	5	14	14	14	14	14	14
	NW 1.6	1	1	1	1	1	6	4	4	4	N/A	N/A	N/A	1	1	1
	NW 1.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NW 2.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NW 2.2	0	5	5	0	5	5	0	5	5	0	5	5	0	5	5
	NW 2.3	0	0	4	0	0	0	0	0	4	0	0	0	0	0	0
	NW 3.1	16	16	16	16	16	16	2	2	2	16	16	16	16	16	16
	NW 3.2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	NW 3.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	NW 3.4	15	15	19	19	19	19	3	3	3	15	15	19	9	9	9
		39	44	52	55	60	65	19	24	28	50	55	59	45	50	50
		7%	11%	19%	9%	13%	19%	6%	9%	17%	8%	12%	18%	8%	11%	16%

Table 4c

of the five categories of criteria for all 13 projects assessed. The maximum score for the category is the sum of maximum possible points for each criterion of the category (see Table 2). The Applicable Score is the maximum possible points minus the criteria that are not applicable. In Table 5 and Figure 3, the Mean Applicable Score is the mean of the Applicable Scores by category. The last column in Table 5 shows the mean Applicable Scores by category as a percentage of the 'Overall Scores' per category. For the more conservative base score assessment, all projects scored zero on Climate and Risk, followed by Resource Allocation at 4%, Quality of Life at 6.5%, Leadership at 8.1% and Natural World at 21.0%. For the upper score, the next three are close at 10 to 11%, and Natural World remains the highest score at 24.8% of applicable points.

Summary Analysis of Criteria Categories:

Criteria Category	Mean Score			Mean Applicable Scores	Mean Percentage Achieved			Maximum Scores	Mean Applicable Scores as a Percentage of the Maximum Scores
	Base	Upper	Low Fruit		Base	Upper	Low Fruit		
Quality of Life	11.8	18.8	38.9	181.0	6.5%	10.4%	21.5%	181	100.0%
Leadership	9.8	13.3	21.8	121.0	8.1%	11.0%	18.1%	121	100.0%
Resource Allocation	6.7	17.5	43.5	168.5	4.0%	10.4%	25.8%	182	92.6%
Natural World	39.8	47.2	54.0	189.8	21.0%	24.8%	28.5%	203	93.5%
Climate & Risk	0.0	0.0	0.0	122.0	0.0%	0.0%	0.0%	122	100.0%

Table 5

Comparison of Applicable Scores by Category:

Figure 3

Table 6 illustrates variation through the deviation of the mean base and upper scores about the mean. The population calculation of the standard deviation was used as the 13 projects were not a statistically significant sample of a larger population. In Table 6, any standard deviation or mean larger than 3 is highlighted. As with Tables 4a, 3b and 3c, the seven criteria of the Climate and Risk category are not shown because all scores were 0. Twenty of the total of 55 criteria were assessed at 0 for the base and upper scores for all projects, shown as a mean of 0 with no standard deviation.

The last column of Table 6 is the coefficient of variation which is the ratio of the standard deviation to the mean. The coefficient of variation is one tool for comparing the variability between criteria. It is also a tool for testing the validity of the mean whereby the higher the

Project Score Variation:

	Criteria	Standard Deviation (Population)		Mean		Coefficient of Variation	
		Base Score	Upper Score	Base Score	Upper Score	Base Score	Upper Score
Quality of Life	QL 1.1: improve quality of life	9.0	9.0	3.8	6.2	2.3	1.5
	QL 1.2: stimulate sustainable growth and development	0.0	4.3	0.0	1.2	-	3.5
	QL 1.3: develop local skills and capabilities	0.0	0.0	0.0	0.0	-	-
	QL 2.1: enhance public health and safety	0.0	0.0	0.0	0.0	-	-
	QL 2.2: minimize noise and vibration	0.5	0.5	0.7	0.7	0.7	0.7
	QL 2.3: minimize light pollution	0.5	1.1	0.2	0.9	3.5	1.2
	QL 2.4: improve community mobility and access	3.6	3.7	1.9	2.8	1.9	1.3
	QL 2.5: encourage alternative modes of transportation	1.3	1.3	1.8	1.8	0.7	0.7
	QL 2.6: improve site accessibility, safety and wayfinding	0.0	0.8	0.0	0.2	-	3.5
	QL 3.1: preserve historic and cultural resources	5.4	5.7	2.8	3.2	1.9	1.8
	QL 3.2: preserve views and local character	0.0	1.6	0.0	0.5	-	3.5
	QL 3.3: enhance public space	1.6	3.0	0.5	1.2	3.0	2.6
		16.3	22.9	11.8	18.8	1.4	1.2
Leadership	LD 1.1: provide effective leadership and commitment	0.0	0.0	4.0	4.0	0.0	0.0
	LD 1.2: establish a sustainability management system	0.0	0.0	0.0	0.0	-	-
	LD 1.3: foster collaboration and teamwork	1.3	1.1	1.6	3.7	0.8	0.3
	LD 1.4: provide for stakeholder involvement	3.0	2.6	3.2	4.4	0.9	0.6
	LD 2.1: pursue by-product synergy opportunities	0.0	0.0	0.0	0.0	-	-
	LD 2.2: improve infrastructure integration	0.0	0.0	0.0	0.0	-	-
	LD 3.1: plan for long-term monitoring and maintenance	0.0	0.8	0.0	0.2	-	3.5
	LD 3.2: address conflicting regulations and policies	0.0	0.0	0.0	0.0	-	-
	LD 3.3 extend useful life	0.0	0.0	1.0	1.0	0.0	0.0
		3.9	3.1	9.8	13.3	0.4	0.2
Resource Allocation	RA 1.1: reduce net embodied energy	0.0	0.0	0.0	0.0	-	-
	RA 1.2: support sustainable procurement practices	0.0	0.0	0.0	0.0	-	-
	RA 1.3: use recycled materials	0.0	1.1	0.0	4.5	-	0.2
	RA 1.4: use regional materials	0.0	0.0	0.0	3.0	-	0.0
	RA 1.5: divert waste from landfills	0.0	0.0	0.0	0.0	-	-
	RA 1.6: reduce excavated materials taken off site	1.1	0.5	5.7	5.8	0.2	0.1
	RA 1.7: provide for deconstruction and recycling	0.0	0.0	1.0	1.0	0.0	0.0
	RA 2.1: reduce energy consumption	0.0	0.8	0.0	0.2	-	3.5
	RA 2.2: use renewable energy	0.0	0.0	0.0	0.0	-	-
	RA 2.3: commission and monitor energy systems	0.0	2.4	0.0	3.8	-	0.6
	RA 3.1: protect freshwater availability	0.0	0.0	0.0	0.0	-	-
	RA 3.2: reduce potable water consumption	0.0	0.0	0.0	0.0	-	-
	RA 3.3: monitor water systems	N/A	N/A	N/A	N/A	-	-
		1.1	3.1	6.7	17.5	0.2	0.2
Natural World	NW 1.1: preserve prime habitat	2.7	2.7	0.9	0.9	3.0	3.0
	NW 1.2: protect wetlands and surface water	0.3	0.3	0.1	0.1	3.5	3.5
	NW 1.3: preserve prime habitat	0.0	0.0	0.0	0.0	-	-
	NW 1.4: avoid adverse geology	-	-	-	-	-	-
	NW 1.5: preserve floodplain function	6.5	6.0	7.2	7.9	0.9	0.8
	NW 1.6: avoid unsuitable development on steep slopes	2.2	2.2	2.0	2.0	1.1	1.1
	NW 1.7: preserve greenfields	1.6	1.6	0.5	0.5	3.5	3.5
	NW 2.1: manage stormwater	0.0	1.1	0.0	0.3	-	3.5
	NW 2.2: reduce pesticide and fertilizer impacts	0.0	0.0	0.0	5.0	-	0.0
	NW 2.3: prevent surface and groundwater contamination	1.1	1.1	0.3	0.3	3.5	3.5
	NW 3.1: preserve species biodiversity	6.8	6.8	11.2	11.2	0.6	0.6
	NW 3.2: control invasive species	1.6	2.2	5.5	5.9	0.3	0.4
	NW 3.3: restore disturbed soils	0.0	2.7	0.0	0.8	-	3.5
	NW 3.4: maintain wetland and surface water functions	5.6	5.6	13.0	13.0	0.4	0.4
		15.6	18.3	39.8	47.2	0.4	0.4

Table 6

coefficient of variation, the lower the validity of the mean. The coefficient of variation is dimensionless, so it must be interpreted along with the mean as a high coefficient of variation could be due to a low mean.

7.2 Quality of Life

Under the Quality of Life category Table 6, criterion QL 1.1: Improve Community Quality of Life had the highest standard deviation at 9.0, around the highest mean of 3.8 for the base score and 6.2 for the upper score. However, Tables 4a, 3b and 3c reveal that for 11 of 13 projects the base score for criterion QL 1.1 was 0, while two projects (Leslie Street and Main Street Markham) were rated at a base score of 25. So the variation in the base score for criterion QL 1.1 can be attributed to two projects.

Criterion QL 2.4: Improve Community Mobility and Access appears to show some meaningful variation in Table 6. However, similar to criterion QL 1.1, an examination of the individual project score in Tables 4a, 3b and 3c reveals that 11 projects scored 0 or 1, while one project scored 4 and one scored 14.

Criterion QL 3.1: Preserve Historic and Cultural Resources repeats the pattern with only two projects pulling up the mean and standard deviation. The scores for the remaining criteria under the Quality of Life category are all low with a relatively low standard deviation.

Overall, Table 6 shows that the scores in the Quality of Life category had the greatest variability as compared to the other categories. The overall coefficient of variation for the category was calculated based on the mean of the base and upper scores for the 13 projects. The coefficient of variation was calculated to be 1.4 for the base score and 1.2 for the upper score, about means of 11.8 and 18.8 respectively. By comparison, the coefficient of variation is between 0.2 and 0.4 for the other categories (with the exception of Climate and Risk for which

the coefficient of variation cannot be calculated due to a mean of 0). Table 7 shows the median to be less than the mean at 5.0 and 6.0 for the base and upper scores, respectively. Tables 4a, 3b and 3c reveal that the high variability and the mean being much higher than the median are a result of most criteria in the Quality of Life category achieving very low scores of 0 or 1, with a small number achieving relatively higher scores of 14, 16 or 25, with a few scores in between.

Mean and Median Category Score Comparison:

Criteria Category	Mean			Median		
	Base	Upper	Fruit	Base	Upper	Fruit
Quality of Life	11.8	18.8	38.9	5.0	6.0	23.0
Leadership	9.8	13.3	21.8	7.0	14.0	20.0
Resource Allocation	6.7	17.5	44.3	7.0	18.0	42.0
Natural World	39.8	47.2	55.1	42.0	50.0	60.0
Climate & Risk	0.0	0.0	0.0	0.0	0.0	0.0

Table 7

7.3 Leadership

There are 9 criteria under the Leadership category. Overall, Table 6 reveals low variability for the Leadership category as compared with the Quality of Life category with a coefficient of variability of 0.4 for the base score and 0.2 for the upper scores around means of 9.8 and 13.3 respectively. Table 7 reveals a median of 7.0 and 14.0 for the base and upper scores respectively. The only criterion under the Leadership category with a mean and standard deviation greater than 1.6 is LD 1.4: Provide for Stakeholder Involvement. The base standard deviation was 3.0 with a mean of 3.0 as shown in Table 6. Tables 4a, 3b and 3c reveal that all thirteen projects scored 1, 5 or 9 so criterion LD 1.4 does contain meaningful variation with all projects attaining some level of achievement.

The remaining criteria under the Leadership category, as shown in Table 6, show little or no variation about a relatively insignificant mean. For four of the 9 criteria in the Leadership category, no projects received any points.

7.4 Resource Allocation

There are 13 criteria under the Resource Allocation category. Overall, the base score had the lowest variability based upon the coefficient of variation, at 0.2, as compared to the other category base scores (less the Climate and Risk Category). Table 6 shows that for 6 of 13 criteria all projects received a base and upper score of 0. Criterion RA 1.6: Reduce Excavated Materials Taken off Site has a standard deviation for the base score of 1.6 about a mean of 5.7 for a relatively low coefficient of variation of 0.2. All other criteria have a standard deviation of 0 for the base score. For criteria where the coefficient of variation can be calculated, it is between 0.0 and 0.6, showing very little variation. The one coefficient of variation of 3.5 is a mathematical result of a low mean of 0.2 for the mean upper score for criterion RA 2.1: Reduce Energy Consumption. The low variability is also evident in Table 7 through medians for the base and upper scores of 7.0 and 18.0, within 0.3 and 0.5 of the mean, respectively.

7.5 Natural World

There are 14 criteria under the Natural World category. Although there is relatively low variability of the category score between projects, the mean category score is far higher than the mean of the other categories. The coefficient of variation for the base and upper scores is 0.4, about a mean of 39.8 for the base score and 47.2 for the upper score. Figure 7 shows the median at 42.0 and 50.0 for the base and upper scores respectively. Four of the 14 criteria had mean base scores of between 5 and 14, which is far more than criteria in other categories. One criterion, NW 1.3: Preserve Wetlands and Habitat, was either not applicable or received a score

of 0 for all projects. Criterion NW 1.4: Avoid Adverse Geology was deemed not applicable for all projects. Therefore, 12 of the 14 criteria had some achievement in at least one project, more than the other four categories.

8 Discussion

8.1 Gap Analysis

Objective two is to understand the gap between current standard practice and the Envision framework. The gap analysis examines the gap for each category of criteria.

8.1.1 Quality of Life

The Quality of Life category “addresses a project’s impact on [the] host and affected communities, from the health and wellbeing of individuals to the wellbeing of the larger social fabric as a whole” (ISI & Zofnass, 2015). The analysis showed most projects achieved a very low score or no score at all for the 12 criteria in the Quality of Life Category. Higher achievement will be discussed through the three sub-categories of Purpose, Wellbeing, and Community.

Criterion QL 1.1: Improve Community Quality Of Life, is a criterion that an EA under the OEAA should be expected to score well on as it broadly covers ensuring the project meets a social need and the social impacts are identified and mitigated. The Envision guideline lists 12 related criteria which would benefit from high achievement in criterion QL 1.1. Criterion QL 1.1 ties for the most related criteria. Higher achievement comes through meaningful community engagement through the identifying and addressing community needs, goals and plans, and mitigated community impacts with the participation of local community stakeholders. Most of the projects rated did not score highly or at all on criterion QL 1.1. Higher achievement through Envision requires that project teams think outside the box of two standard PIC meetings with information boards; for the second higher score of Conserving, the project team must prove the project has broad community endorsement which requires both a breadth of stakeholder

engagement and a depth (quality) of that engagement. The top score of Restorative requires that the project rehabilitate community assets.

The vague definition of meaningful engagement in criterion QL 1.1 puts the onus on the project team in their Envision documentation to define and defend their engagement as meaningful. As discussed earlier, it is not clear in the documentation whether or how the engagement in Official Plans and Master Plans should be considered in the follow-up individual projects. It is also not clear the difference between the “host community” and the “nearby affected community” which are important distinctions regarding achievement levels regarding the geographic scope of the identification and mitigation of impacts. A municipality interested in Envision would likely need to have a project verified in order to clarify these terms.

The next two criteria are: QL 1.2: Stimulate Sustainable Growth and Development, and QL 1.3: Develop Local Skills and Capabilities. Of the 13 projects assessed, Main Street Markham was assessed with an Upper score of Restorative for criterion QL 1.2. No other projects received a score for either criterion. At the moment, these two criteria are generally not considered in schedule C MCEA projects for road reconstruction. Envision does not allow criteria to be deemed not applicable because they are out of the scope of a project; Envision tries to push the envelope. However, its unlikely most projects in southern Ontario at the scale of road reconstruction and widening will spend time and money assessing their contributions to jobs (QL 1.2) or improvements to the skills of the local workforce (QL 1.3). Supporting and training a local workforce, especially one that is economically disadvantaged, is most relevant to large projects near isolated communities with high barriers to employment or limited opportunities, such as First Nations communities in Ontario's north. In the context of relatively simple and frequent road reconstruction jobs, the most that could possibly be done is for the municipality to include a preference towards contractors and sub-contractors that have a policy of hiring and training economically disadvantaged workers in their tendering process. Even that

would only earn a score of 2; higher levels require a broader program in the project team to hire, support and train local workers/firms.

The next 6 criteria all fit under the subcategory of Wellbeing: QL 2.1: Enhance Public Health and Safety, QL 2.2: Minimize Noise and Vibration, QL 2.3: Minimize Light Pollution, QL 2.4: Improve Community Mobility and Access, QL 2.5: Encourage Alternative Modes of Transportation, and QL 2.6: Improve Site Accessibility, Safety and Wayfinding. The 13 projects were given low or no scores generally for these 6 criteria. All six are related mostly to social benefits and impacts from the project.

A score in criterion QL 2.1 can only be assessed and achieved if there is a new or non-standard technology proposed that will require new health and safety plans and programs. Higher achievement in criterion QL 2.2 requires reducing noise and vibration to acceptable levels that “improve community livability”. Generally, noise studies for road reconstruction projects show marginal increases in noise that are well below MTO thresholds for noise mitigation; municipalities will not want to spend money to mitigate marginal increases in noise so this criterion is not generally of much relevance to the types of projects assessed. Higher achievement in criterion QL 2.3 requires a lighting needs assessment with lighting zones, environmental design that limits light spillage from the road, and the use of energy efficient, dark sky preserving illumination.

Higher achievement in criterion QL 2.4 would be highly correlated with criterion QL 1.1 through consultation regarding mobility with local facility operators, consultation with the local community about mobility during and post construction, and supporting the use of alternative modes of transportation. A project that has strong community consultation, improves walking and cycling infrastructure, and supports public transit, with detailed plans to maintain such access during construction, should score highly.

Higher achievement in criterion QL 2.5 requires the road accommodate walking and cycling infrastructure that's connected to larger network, support and encourages transit use through well-lit stops with shelters, secure bike lockers and real-time information. The absolute requirement of bike lockers in the third level of Superior may unnecessarily discourage further investments in encouraging alternative modes of transportation associated with the Superior, Conserving and Restorative achievement levels. While bike stalls are sometimes added along busy routes to bus stops, municipalities would likely find the cost and space required by bike lockers to be difficult to justify, limiting achievement to the second level of Enhanced.

Achievement in criterion QL 2.6: Improve Site Accessibility, Safety, and Wayfinding was generally zero. The majority of the road projects assessed were designed as four or six lane arterial roads, and had low pedestrian and cycling traffic. It is difficult to imagine how wayfinding could be improved in a meaningful way for pedestrians in a street that lacks adjoining mixed uses that would encourage pedestrian use of the street.

The next three criteria, falling under the Community sub-category, are QL 3.1: Preserve Historic and Cultural Resources, QL 3.2: Preserve Views and Local Character, and QL 3.3: Enhance Public Space. Achievement varied between the projects assessed – for many projects achievement was limited by the lack of opportunities presented in the project for achievement.

8.1.2 Leadership

The Leadership category contains nine criteria, among three sub-categories. The criteria are mostly about how projects are delivered by the project team. There was generally little to no information in the project documentation related to the Leadership criteria, requiring more inferences and assumptions than was required for other categories.

Higher achievement under the four criteria under the first sub category of collaboration require that sustainability be a core value of project proponents, that a sustainability

management system be established for the project, multi-disciplinary teams working through whole systems design processes, and that stakeholders be meaningfully involved in the design and decision making processes (ISI & Zofnass, 2015). Higher achievement under the two criteria under the Management sub-category requires identifying and pursuing opportunities to use the by-products of nearby businesses in the project, and through integrating the project with other systems (ISI & Zofnass, 2015). Higher achievement under the three criteria under the Planning sub category involves a comprehensive long-term monitoring and maintenance plan of channel works and other natural systems, identifying and addressing conflicting regulations, and designing a project to be more long-lasting and resilient (ISI & Zofnass, 2015).

Most of the criteria under the leadership category do not improve project sustainability on their own - they support sustainability thinking and solutions in criteria under the other four categories. It would be challenging to achieve highly in the other subject areas without high achievement in the Leadership category in support.

8.1.3 Resource Allocation

The Resource Allocation category has thirteen criteria under three sub categories. Similar to the Leadership category, there was relatively little documentation to support achievement and a number of inferences and assumptions were required in the assessment of the thirteen projects. The Resource Allocation category contains 13 criteria under the three sub-categories of: Materials, Energy and Water.

The Materials sub-category contains 7 criteria. The first four criteria encourage proponents to connect associate the sustainability of their project with that of the inputs into the project. None of the project materials reviewed made any explicit reference to the impact of the materials on the sustainability of the project, which was expected; however, it is critical for

improving the sustainable outcome of projects that project teams broaden their perspectives and consider the sustainability of project inputs.

The first criterion is RA 1.1: Reduce Net Embodied Energy. The goal of RA 1.1 is to reduce the net embodied energy of a project over the life of the project (ISI & Zofnass, 2015). All projects were assessed at 0 for RA 1.1 because all the metrics required a life cycle energy assessment, which none of the projects undertook. A project can realize efficiencies by undertaking a scoped Life Cycle Assessment (LCA) of net embodied energy of project materials for criterion RA 1.1, of energy consumption during operation and maintenance for criterion RA 2.1, and of carbon dioxide equivalent emissions for criterion CR 1.1.

The next criterion in the Materials sub-category is RA 1.2: Support Sustainable Procurement Practices. The metrics for RA 1.2 are based on the percentage of manufacturers and suppliers for a project that implement sustainable practices, which both higher percentages and more stringent definitions of sustainable practices associated with higher achievement. No EAs referenced sustainable procurement, so all 13 projects received scores of 0.

The next four criteria are all similar. Criterion RA 1.3: Use Recycled Materials has metrics based on the percentage by weight or volume of recycled materials used during the project life cycle. Criterion RA 1.4: Use Regional Materials has metrics based on the percentage of materials sourced within specified distances of the project. Criterion RA 1.5 has metrics based on the percentage of materials during construction that are diverted from landfills over industry norms. Criterion RA 1.6: Reduce Excavated Materials Taken off Site has metrics based on the percentage of excavated materials *suitable for reuse* that are reused on site (ISI & Zofnass, 2015). Criterion RA 1.7: Provide For Deconstruction and Recycling has metrics based on the percentage of components that can be easily reused or recycled at their end of life. While all 13 projects likely had some level of achievement for last first four criteria in the Materials sub-

category, none of the project documentation supported any achievement. To improve project sustainability, target achievements and supporting actions should be specified starting in the EA, and carried through detailed design and into project specifications.

The next sub-category is Energy. The three criteria in the Energy sub-category are: RA 2.1: Reduce Energy Consumption, RA 2.2: Use Renewable Energy, and RA 2.3: Commission and Monitor Energy Systems. The criteria in the Energy sub-category are related to the energy used during the operation and maintenance phase. The majority of the energy used in road operation and maintenance is by the vehicles that use the road, over which the project team for a road reconstruction has no direct control. A relatively small amount of energy in operations and maintenance would be used by the road illumination; however, the project team has little control over whether or not the energy from the grid is renewable. These three criteria were therefore challenging to apply to the 13 road projects assessed and achievement was generally low or none. These criteria are more relevant to projects with a relatively larger energy consumption over which the project team has direct control such as a sewage pump station. Nonetheless, project teams do generally have control over illumination, and installing energy efficient illumination would provide for relatively easy scores in these criteria.

The last three criteria of the Resource Allocation category fall under the Water sub-category. The intent of criterion RA 3.1 is to reduce impacts on the availability, quantity and quality of fresh water (ISI & Zofnass, 2015). The intent of RA 3.2 is to reduce the consumption of potable water and encourage the use of greywater, recycled water and stormwater (ISI & Zofnass, 2015). The intent of the third criterion RA 3.3 is to monitor the performance of water systems, but this credit was deemed not applicable to all projects assessed. Similar to the Energy sub-category, the criteria in the Water sub-category were difficult to apply to the road projects assessed, and the base and upper score achievement was 0 for all projects assessed. Road widening projects generally require little water during construction, operation and

maintenance. Achievement in RA 3.2: Reduce Potable Water Consumption could be through the Low Impact Development (LID) approach of directing some of the stormwater to watering boulevard trees to minimize the need to use potable water.

8.1.4 Natural World

The Natural World category contains more criteria than the other four categories at 14. The three sub-categories are: Siting, Land and Water, and Biodiversity. The Natural World category also has the most available points as compared to the other four categories at 203. With the exception of Main Street Markham, the Natural World category was the highest achieving category for the projects assessed.

The first seven criteria fall under the sub-category Siting. Achievement in the Siting sub-category was generally low because the projects assessed generally had little flexibility in their alignment. For many of the projects assessed, some of the criteria were deemed Not Applicable because the feature being preserved or avoided was not present. The 'low fruit' score was generally the same as the upper score because of the limitations in adjusting the alignment. The Siting criteria are more relevant to new road alignments. The exception is criterion RA 1.5: Preserve Floodplain Function because the metrics allow achievement starting with a basic test of minimizing impacts to the floodplain function. All the projects assessed obtained permits from TRCA under Ontario Regulation 166/06 and one of the tests to obtain a permit is to avoid impacts to flood hydraulics based on the 100 year or Regional Flood, as appropriate.

The next three criteria are under the sub-category Land & Water. The criterion is NW 2.1, which, as discussed previously, required an improved of 65% in water storage capacity over existing conditions for the lowest metric for a road that doubles in width. Achievement in NW 2.1 was 0 for all base scores and most of the upper and 'low fruit' scores. Improving water storage capacity for new roads is crucial to avoid further degradation in our watersheds from

stream erosions due, especially in watersheds under pressure from urbanization. Achieving a 65% improvement would require planning starting in the EA to ensure sufficient property was obtained to add elements to the boulevard to store and infiltrate water, such as super pipes, and exfiltration LIDs, and exploring opportunities to coordinate with adjacent developments to direct road runoff to stormwater management ponds.

The intent of NW 2.3 is to preserve groundwater quantity and quality (ISI & Zofnass, 2015). Only Bayview Avenue included groundwater quality and quantity monitoring, due to the need for a sophisticated depressurization of an artesian aquifer to facilitate construction. None of the other projects achieved a base score in NW 2.3. Although infrastructure is generally exempt from the policies of the various Source Water Protection Plans in Ontario, the plans should nevertheless raise the awareness of the importance of protecting Ontario's groundwater resources. Criterion NW 2.3 supports the voluntary policies of the Source Water Protection Plans with metrics that require groundwater quantity and quality monitoring, and spills prevention and response plans.

The last sub-category is Biodiversity. The Biodiversity sub-category was the highest scoring sub-category of all fourteen Envision sub-categories for the base and upper scores for all 13 projects assessed in this study. Broadly, the four criteria relate to maintaining and improving natural system form and function. Achievement for the criterion in the Biodiversity sub-category may be higher than other sub-categories because each of the projects assessed had to obtain a permit under TRCA's Regulation under the Conservation Authorities Act. Through TRCA's policies and regulation, TRCA staff would have worked with the project teams through the EA and detailed design phases to minimize, mitigate and compensate for various impacts to natural system form and function. The only criterion under the Biodiversity sub-category where Envision is likely to motivate achievement much more than was already done is criterion NW 3.3: Restore Disturbed Soils. Soil disturbance, especially compaction, is a large

problem in road reconstruction projects; criterion NW 3.3 sets a high bar with the lowest metric requiring the restoration of 100% of soils disturbed during construction. While there was no documentation regarding soil restoration, because the metric set a high bar of achievement, it was assumed or inferred that none of the 13 projects assessed in this study achieved a score for criterion NW 3.3.

8.1.5 Climate and Risk

The Climate and Risk category contains 7 criteria under the sub-categories of Emissions and Resilience. All projects received scores of 0 for the base, upper and 'low fruit' scores for all 7 criteria. However, there is growing interest and expectations regarding the consideration of climate change mitigation and adaptation in infrastructure planning and design; 2016 provided many new and updated provincial documents emphasizing climate change mitigation and adaptation - the Climate Change Action Plan, the draft guidelines by the MOECC titled "Consideration of Climate Change in Environmental Assessments in Ontario," and the renewed emphasis on climate change in the draft four plans released in 2016 – the Growth Plan, the Greenbelt Plan, the Oak Ridges Moraine Conservation Plan and the Niagara Escarpment Plan. The Envision guideline can provide much needed direction to municipalities on how to plan and design infrastructure that contributes less to climate change and is more resilient to the exacerbated stressors of climate change.

The first criterion is CR: 1.1: Reduce Greenhouse Gas Emissions. CR 1.1 requires a proponent to undertake a life-cycle carbon assessment (LCCA). Recognizing that LCCAs are a new analysis that is rarely undertaken, Envision accepts a streamline LCCA that uses existing methodologies, focuses on the main contributors of emissions; measured, calculated or estimated data can be used. While some EAs recognize their relative contributions to carbon emissions through increased traffic, none of the EAs studied acknowledged the contributions of

the project to climate change during construction and decommissioning. It will be challenging for an EA to recognize and mitigate its contributions to climate change without the rigorous, defensible methodology of an LCCA. Furthermore, for the types of project being studied in this study, being mostly road widening projects, the methodology and data should be fairly similar between projects, allowing for efficiencies to be realized as LCCAs become a mainstream part of EAs. The draft guideline “Consideration of Climate Change in Environmental Assessments in Ontario” does include general descriptions of qualitative and quantitative assessments of a project’s contributions to climate change (MOECC, 2016). Especially if the final document contains further details and stronger language encouraging qualitative assessments, and depending on the language of the next update to the MCEAA document LCCAs may become a more common part of EAs in Ontario. Furthermore, an LCCA is more efficiently done as part of a comprehensive LCA with an assessment of net embodied energy (RA 1.1) and energy consumption (RA 2.1).

The next criterion is CR 1.2: Reduce Air Pollutant Emissions. This criterion pushes a project to meet California’s Ambient Air Quality Standards then the South Coast Quality Management rules then a net zero and ultimately improved air quality (ISI & Zofnass, 2015). For projects that increase the number of general purpose lanes, there is little that can be done to control or improve air quality.

The next five criteria are all related to increasing a project’s resilience to the exacerbated stressors of climate change. Criterion CR 2.1: Assess Climate Threat requires that a project undertake a comprehensive climate impact assessment and adaptation plan that includes a vulnerability assessment, risk assessment and adaptation assessment (ISI & Zofnass, 2015). A number of resources already exist that some municipalities are starting to implement, including: the Building Adaptive and Resilient Communities (BARC) tool by ICLEA – Local Governments for Sustainability Canada, and the Public Infrastructure Engineering Vulnerability Committee

(PIEVC) protocol. Criteria CR 2.2 to CR 2.4 each deals with aspects of the comprehensive climate impact assessment and adaptation plan of criterion CR 2.1.

Criterion CR 2.2: Avoid Traps and Vulnerabilities, builds on criterion CR 2.1. Criterion CR 2.2 requires an assessment of the long-term traps and vulnerabilities. This criterion rewards the anticipation of three types of traps: resource traps, which are a dependence on resources that could become scarce; configuration traps, which are designs vulnerable to extreme weather events, natural disasters, and anticipated economic conditions; and standards traps, which is designing a project using standards and methodologies anticipated to change (ISI & Zofnass, 2015).

Criterion CR 2.3: Prepare for Long-term Adaptability, builds further on criteria CR 2.1 and CR 2.2. Criterion CR 2.3 encourages a systems thinking approach to designing infrastructure to be resilient and adaptive; further achievement is given for rehabilitating existing impacts from climate change. Note that it is difficult to definitively prove cause and effect between climate change and a given impact; it is more appropriate to discuss impacts whose stressor is exacerbated by climate change. Criterion CR 2.4: Prepare For Short Term Hazards recognizes achievement for projects that undertake a hazards assessment for events with various return periods.

Criterion CR 2.5: Manage Heat Island Effects is most relevant in urban areas where the heat island effect is most chronic. Achievement is given based on the percentage of surfaces that meet a solar reflectance index of 29 or higher (ISI & Zofnass, 2015).

As the risks and vulnerabilities would be fairly similar between road projects in a municipality, it would be most efficient for a municipality to undertake such an assessment as a Strategic Environmental Assessment at the scale of the Region; the project level EA would then assess the risks and vulnerabilities relevant to the project and adapt the analysis as appropriate.

A single, comprehensive Regional scale assessment could cover criteria CR 2.1 to CR 2.4. Follow up EAs could then much more easily attain the higher Superior to Conserving levels of achievement in criteria CR 2.1 to CR 2.4. An achievement of Conserving in criteria CR 2.1 to 2.4 provides 64 points out of an average total number of applicable points of 782.3 based on the 13 projects assessed in this study.

8.2 Select Case Studies

8.2.1 Bloomington Road

The proponent was the Regional Municipality of York. The problem for the EA was to resolve anticipated traffic capacity constraints on Bloomington Road from Bathurst Street to Highway 404 (AECOM, 2011). The existing road was a two lane road with a rural cross section (AECOM, 2011). The preferred design was generally a widening to four lanes, with additional turning lanes in sections, from Bathurst Street to Highway 404 (AECOM, 2011). The design is a combination of urban and rural cross-sections. The EA was initiated in 2002, and the ESR was filed in 2004 (AECOM, 2011). The most significant natural heritage feature is a wetland complex bisected by Bloomington Road between Leslie Street and Highway 404.

Bloomington Road widening from Yonge Street to Highway 404 has the lowest base score by far, at 3%. The next lowest is Sixteenth Avenue at 6%. Bloomington Road achieves the lowest or second lowest sum of base scores in every category. In the key category of Natural World, Bloomington Road achieves a total of only 11 points, second only to 16th Avenue at 19 points. The mean score for the Natural World criteria for all projects assessed is 40.5. Oddly, the third lowest sum of scores for the base score is Main Street Markham at 21.

Despite the advanced landscape level analysis, at the detailed design stage of terrestrial movement and the installation of dedicated wildlife culverts and fencing where the road bisects

a Provincially Significant Wetland, the project scored very low overall. The lack of compensation for the lost wetland habitat prevented the project from claiming credit for the enhancements to wildlife passage in criteria NW 3.1 and NW 3.4, and the associated removal of peat prevented any achievement in criterion NW 3.3 and reduced achievement in criterion NW 3.4.

As the low population density does not support public transit and there is little demand potential for pedestrian and cycling traffic, the road project impacted the available options for achievement in various Quality of Life criteria.

8.2.2 Kirkhams Road Bridge, Toronto

The existing Kirkhams Road Bridge was constructed around 1955. It had deteriorated to the point where it was closed to vehicular traffic in 2005 (TSH, 2007). The bridge provided access to four residences, which now have access provided through a Toronto Zoo access road (TSH, 2007). The bridge supported a watermain that provided service to the four residences and to the Toronto Zoo (TSH, 2007).

The stated purpose of the EA was an assessment of the existing and future transportation needs in the area of the Kirkhams Road Bridge to determine the future need for the bridge and to determine alternatives for the watermain currently supported by the bridge (TSH, 2007).

Five alternatives to the undertaking were assessed: do nothing; close the Kirkhams Road and the bridge and relocate the watermain; rehabilitate the bridge; replace the bridge; and replace the bridge with a pedestrian bridge that would continue to support the watermain (TSH, 2007). The preferred solution was to close Kirkhams Road at either side of the bridge with a cul-de-sac and remove the bridge itself, provide gated access from the east cul-de-sac for maintenance to other existing infrastructure, and install the watermain under the Rouge River using a trenchless installation method (TSH, 2007).

The Kirkhams Road bridge project provided an interesting case study for sustainability assessment using Envision. There were a number of peculiarities with the Kirkhams Road study such that the project's sustainability was not accurately reflected in several criteria, reducing the overall score. The first example of inaccuracies is that despite a net decrease in impervious (paved) area by 500m², the project did have a couple of areas of expansion into the natural system at the cul-de-sacs and a maintenance road. Furthermore, a solid argument can be made that far more area was restored than was encroached into, and the encroachment was unavoidable. Nonetheless the project could not achieve a score in criterion NW 1.1: Preserve Prime Habitat; it did not matter whether the project provided a net gain to prime habitat as Envision did not allow any score in criterion NW 1.1 as long as the project encroached at any point into prime habitat. The project similarly lost the opportunity to score more points in criterion NW 1.2 Protect wetlands and Surface Water because the required maintenance road had to extend to within 65 feet of the watercourse, which was the metric of further achievement. Again, the extension in some areas into the Greenfield prevented points in criterion NW 1.7.

The public was strongly opposed to the removal of the bridge without replacing it, voicing concerns on its recreational use by cyclists and safe egress in case of a local forest fire (TSH, 2007). As a result of community concerns, the project team added consideration of replacing the bridge with a cycling and pedestrian only bridge (TSH, 2007). Because Envision places a significant emphasis on 'meaningful' public and stakeholder consultation (CR 1.1 and LD 1.4), and because Envision also has criteria related to access (QL 2.4), wayfinding (QL 2.6) and encouraging alternative modes of transportation (QL 2.5), the best Envision solution may have been the compromise of replacing the existing structure with a pedestrian and cycling only bridge structure. Envision does not consider cost, which was the main reason not to proceed with the pedestrian and cycling only bridge structure. The bridge structure would likely have allowed the project to still have a net decrease in paved surface area due to the reduced

footprint of the path and would have allowed the bridge abutments to be reconstructed further from the slope hazard; although the net improvements to the natural environment would be fewer, it would not reduce the Envision score over the removal option for the criteria in the natural environment category. For the Envision criteria related to the natural system, the project only needs to prove a net improvement to various system functions.

If a higher Envision score would have gone to replacing the existing bridge with a longer bridge for pedestrians and cyclists, it is hard to discern if this would have been a more sustainable solution. The comparison between removing the bridge and the Envision preferred solution of replacing the bridge involves tradeoffs between the social, economic and natural environments. An assessment of the sustainability of the two solutions relies on the relative value placed on these 'pillars'. The choice the proponents made was preferred for natural environment and financial factors while the Envision preferred solution scored higher on social factors. It should be noted that the Envision guideline does not consider the financial cost of solutions. While Envision clearly would have provided a higher score for an alternative that ultimately was not chosen, it cannot be determined with certainty which is the more sustainable solution. However, this project was chosen for study precisely because it represented a unique situation, and whether the higher scoring Envision alternative is the more sustainable solution is less relevant than it is for the other projects assessed which represent more common situations.

8.2.3 Leslie Street, Richmond Hill

The EA proponent was the Regional Municipality of York. The EA was initiated in July 2005 (Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008a). The study purpose was to examine operational issues along Leslie Street from Bethesda Sideroad to Bloomington Road (Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008a). The EA examined a potential jog elimination at Bethesda Sideroad (Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008a).

Where Leslie Street is adjacent to Haynes Lake, issues included: steep road geometry, narrow pavement and minimal shoulders, high vehicular collision rates, high road maintenance costs, ice on the road, and regular flooding of the road in the spring (Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008a). The ice and flooding results from Berczy Creek backing up over the road due to minimal capacity in the road culvert and the low elevation of the road relative to the lake (Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008b).

The EA examined three distinct alternatives at Haynes Lake: relocate Leslie Street to the west around Haynes Lake, relocate Leslie Street further to the east from Haynes Lake, and reconstruct Leslie Street along its current alignment (Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008a). The western corridor alignment was eliminated early from consideration due to impacts to a wetland (Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008a). The eastern corridor was eliminated due to impacts to a landowner (Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008a). It should be noted that the documentation supports that serious consideration was given to the two alternative solutions. It is rare for a road reconstruction EA to seriously consider alternative routes.

The preferred alternative design was a reconstruction of Leslie Street that maintains the urban 2 lane cross section, with improved ditch drainage and paved road shoulders (Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008a). Adjacent to Haynes Lake the road alignment will have reduced curves and safer geometry (Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008a). The road will be raised 3m above the Haynes Lake water level (Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008a). The equalization culvert will be increased in size. A large wildlife culvert and two smaller amphibian culverts will be added to connect Haynes Lake on the west side of the road with the wetland and watercourse on the east side of Leslie Street (Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008a). The road will shift slightly east of its current alignment, requiring the removal of wetland vegetation and peat

(Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008a). Compensation planting will be provided on the west side of the new alignment (Dillon Consulting Ltd., & Ogilvie, Ogilvie & Company, 2008a). The Envision score for Leslie Street is compared and contrasted to Main Street Markham below.

8.2.4 Main Street Markham

The City of Markham hired McCormick Rankin to initiate an Environmental Assessment for Main Street Markham from Highway 407 to Donald Cousens Parkway. The EA was initiated in February of 2008, and the ESR filed in 2010 (McCormick Rankin Corporation, 2010). The existing Main Street Markham (formerly Highway 48) was a two lane urban road between Highway 407 and Highway 7, a 4 lane urban road between Highway 7 and 16th Avenue, and a 2 lane rural road from 16th Avenue to Major Mackenzie Drive (McCormick Rankin Corporation, 2010). The section from Highway 7 to 16th Avenue is also known as Markham Village, and is a heritage conservation district with on street parking and lots of 19th and 20th century commercial buildings (McCormick Rankin Corporation, 2010).

The EA drew from several previous studies: Main Street Markham: a Vision for the New Millennium (1999), Main Street Markham Streetscape and Traffic Management Plan (2003), and Highway 48: 16th Avenue to Major Mackenzie Drive Urban Design Study (2005) (McCormick Rankin Corporation, 2010). The problem and opportunity statement is “to address the existing and future needs of Main Street Markham to enhance community character, support commercial activities, respect and protect heritage, social and natural environmental features and address transportation needs within the study area” (McCormick Rankin Corporation, 2010).

A Community Advisory Group was formed that was comprised of members of various Markham heritage committees, ratepayers associations, and other interest groups. Seven

meetings were held with a professional facilitator (McCormick Rankin Corporation, 2010). Thorough summaries of all seven meetings were included in the final ESR.

The project also held Public Information Centres (PICs). 105 people attended the first PIC, and 109 attended the second PIC (McCormick Rankin Corporation, 2010). Again, summaries of comments received and responses were included in the ESR.

The preferred alternative from Highway 407 to Highway 7 was to widen to three lanes (2 southbound and 1 northbound). The design avoided impacts to two buildings with heritage designations. A 3m multi-use pathway was provided and a gateway feature to Markham Village (McCormick Rankin Corporation, 2010). The old bridge over the Rouge River was replaced with a 3 lane structure with a viewing platform (McCormick Rankin Corporation, 2010).

The preferred alternative from Highway 7 to 16th Avenue converted the outside 2 lanes to on street parking, reducing the road to 2 lanes (McCormick Rankin Corporation, 2010). Various streetscaping improvements were made to improve the pedestrian experience.

The preferred alternative from 16th Avenue to north of Major Mackenzie Drive was to widen to 4 lanes with a wide planted median (McCormick Rankin Corporation, 2010). The existing culvert at Mount Joy Creek was extended. The Envision score for Main Street Markham is compared to that of Leslie Street below.

8.2.5 16th Avenue

The proponent was the Regional Municipality of York. Both the EA and the detailed design were undertaken by iTrans Consulting Inc. The EA began in 2005 with a study area extending from Yonge Street to McCowan Road, then to York-Durham Line in 2006 (iTrans Consulting Inc., 2009). The EA was put on hold in 2008 at the request of the City of Markham as the City examined the need for 6 lane roads (iTrans Consulting Inc., 2009). Due to the deterioration of the 16th Avenue Bridge, the EA was split in 2008 and this project proceeded with

the reduced study area from Donald Cousens Parkway to the York Durham Line (iTrans Consulting Inc., 2009). The project purpose was to explore solutions to the deteriorating Bailey bridge that conveys 16th Avenue over the Little Rouge Creek, and future traffic, pedestrian and cycling capacity needs (iTrans Consulting Inc., 2009).

The alternatives considered were: do nothing, operational improvements, jog elimination at Reesor Road and Bridge replacement, and the closure of 16th Avenue (iTrans Consulting Inc., 2009). The preferred alternative solution was to eliminate the jog at Reesor Road and construct a new four lane bridge above the Old Bailey Bridge; the Old Bailey Bridge was retained for a future trail system in Rouge Park (iTrans Consulting Inc., 2009).

The first Public Information Centre held was prior to the project split so most of the public comments were not related to the Donald Cousens Parkway to York Durham Line stretch (iTrans Consulting Inc., 2009). There was only one private landowner with a rental property that abutted this section of 16TH Avenue (iTrans Consulting Inc., 2009). The traditional public engagement undertaken of two PICs was not likely to elicit much interest. This severely limited achievement of criteria QL 1.1: Improve quality of life and LD 1.4: Provide for Stakeholder Involvement. Outreach to additional stakeholders, such as road users, was not undertaken.

This section of 16th Avenue has very limited existing or potential cycling or pedestrian movement. There is no public transit along this section either. This directly limits achievement of criteria QL 2.4: Improve Community Mobility and Access, and QL 2.5: Encourage Alternative Forms of Transportation.

The existing 16th Avenue was conveyed over the Little Rouge River via a bailey bridge with historic significance. The old Baily Bridge was retained due to its historic significance and potential integration into a future trail network for Rouge Park (now the Rouge National Park). However, this means that the project added an additional crossing of the valley, rather than

replacing or expanding an existing crossing which is most often the case. The large new bridge had negative impacts on riparian vegetation- due to shadow impacts preventing vegetation growth, rip rap was proposed under the bridge. It is difficult to compensate for the impact from a new bridge crossing, limiting achievement under criterion NW 3.4: Maintain Wetland and Surface Water Functions.

Only two criteria were deemed not applicable as defined by Envision: NW 1.4 Avoid Adverse Geology and RA 3.3: Monitor Water Systems for a total potential of 15 points reduced from the total applicable score. The project scored between 6.2% and 9.5%, far below the minimum award threshold of 20%. This would be a challenging project for achievement of an Envision award based on standard practices. An award would require achievement in the Leadership, Resources Allocation, and the Climate and Risk categories, to compensate for the limitations in achievement for many criteria in the Quality of Life and Natural World criterion.

This project raises two issues relative to the effectiveness in Envision rewarding relatively more sustainable projects: trade-offs between social and natural environments, and limitations on achievement of some criterion achievement due to the project's circumstances. Similar to Kirkhams Road, 16th Avenue is another example of sustainability trade-offs; a bridge with historic significance was retained, but the bridge would impede flood flows and is an impediment to the movement of some wildlife, so from an ecological perspective, it would have been preferable to remove the bridge. The project gained 7 points in criterion QL 3.1 for preserving the Old Bailey Bridge and could have achieved another 3-8 points under criterion QL 3.3 if the proponent had provided access to the Old Bailey Bridge and restored it. The project sacrificed up to 9 points in criterion NW 1.5 for impacts and lost restoration opportunities to the natural system by keeping the Old Bailey Bridge. In this case the Envision framework would score the two competing options as roughly equal.

8.2.6 Torbram Road Grade Separation

The Environmental Assessment was prepared on behalf of the City of Mississauga and the City of Brampton, although the City of Mississauga was the lead agency. The EA purpose was to identify and assess alternatives for the construction of a grade separation of Torbram Road and the CN tracks (Acres International, 2005). Several previous studies were undertaken – a 1983 Functional Plan for the grade separation, a 1990 Preliminary Design Report, and a 1993 update to the Preliminary Design Report (Acres International, 2005).

Torbram Road in the study area is a major arterial road south of the crossings and a minor arterial road north of the crossings. It is an industrial area with two separate at-grade crossings of CN tracks. The existing vehicular traffic and trail traffic volumes warranted consideration of a grade separation at both crossings (Acres International, 2005).

The alternative designs considered for each of the two at-grade crossings were an overpass, an underpass, and a combination overpass and underpass (Acres International, 2005). The preferred design was a road underpass for each of the two rail crossings (Acres International, 2005). The road alignment was maintained, with 2 lanes in each direction and sidewalks provided (Acres International, 2005). A gravity drain storm sewer system handled storms up to the 25 year maximum, with pumps handling larger storms (Acres International, 2005). The existing culvert conveying the west tributary was replaced with a larger three cell box culvert and 35m of the tributary were realigned to improve storm flow conveyance (Acres International, 2005).

Criteria QL 1.1 and LD 1.4 achieved few points as there was little evidence to indicate that the community stakeholders were meaningfully engaged – only the standard two PICs were held with no evidence supporting that any comments were incorporated into the design. The scope of the project being limited to just the underpasses, rather than a longer extent of road,

combined with limited public transportation, cycling and pedestrian traffic, meant that many criteria that could encourage public transportation and active transportation were beyond the scope of this project.

The existing watercourse is of poor quality and the crossing culvert undersized, allowing for easy achievement of several criteria related to improved flood conveyance and other ecosystem functions. As noted elsewhere, Envision does not provide higher scores for greater quality improvement to the local natural system; criteria provide high scores as long as various functions are improved over existing conditions. This does mean that Envision has a bias towards improvements to natural system functions that are relatively cheap and easy because the existing system is so highly degraded.

It is interesting to note that TRCA was strongly concerned with an increase in flood risk to human life because the underpasses will flood in the 'Regional Storm' and there is the potential for individuals to become stranded on the road between the two underpasses with no safe escape route. Flood risk is not considered explicitly in any Envision criterion – the project only needs to decrease overall flood depths. This is an example of how difficult it is to word the criteria in such a way as to capture the subtle differences between projects that could have a huge impact on the sustainability of the project. While increasing flood risk could limit achievement in the resilience criteria CR 2.1 to CR 2.4, this is an example of a project not being penalized for a design that detracts from sustainability.

8.2.7 Leslie Street and Main Street Markham Envision Score Comparison

Leslie Street from Bloomington Road to Stouffville Road, and Main Street Markham received the highest Base, Upper and 'Low Fruit' Scores. Main Street Markham was the closest to achieving an award with an Upper Score of 19.55%, which rounds up to the 20% required for the lowest award of Bronze.

Both projects had exceptional public consultation, well beyond the industry norms. The more thorough public consultation was undertaken to manage the strong public interest in both projects. Both projects achieved the maximum scores in criterion QL 1.1 Improve Community Quality Of Life from the base to low fruit scores as a reflection of the exceptional public consultation. All other projects were given a base score of 0 and an upper and low fruit score of 0 to 10 for criterion QL 1.1, as they implemented the two standard Public Information Centres.

In a related criterion, LD 1.4 Provide for Stakeholder Involvement, both projects achieved the second highest score of 9. All other projects achieved between 1 and 5 for the base and upper score for criterion LD 1.4.

Beyond stakeholder consultation, both projects diverged in achieving further scores. The Main Street Markham project had clear economic benefits to local businesses, improved the walkability of Main Street and encouraged both active transportation and public transit use. This led to total scores of 62 and 93 for the base and upper scores respectively under the quality of life criteria, far exceeding the sum of the mean scores of all projects in the quality of life criteria of 12 and 19 respectively. 90 of the 155 points achieved for the Main Street Markham project in the upper score came from the 12 of 55 criteria in the Quality of Life category. Under the Leadership and Resource Allocation categories, Main Street Markham achieved only slightly higher than the average of the other projects. However, Main Street Markham achieved an upper score sum of only 26 in the Natural World criteria, as compared to a mean total score of 47.8 from all projects.

Leslie Street, by comparison, is a rural road that will remain a two lane rural road. There are no opportunities to provide any businesses with productivity improvements. Furthermore there is little cycling and pedestrian traffic existing and little potential for it, and there are no existing bus routes along the study area. As such, Leslie Street was limited to an achievement

of only 26 as an upper score under the Quality of Life criteria, 25 of which came from the first criterion 1.1. Leslie Street achieved an upper score of 71 for the criteria under Natural World, as compared to the mean of all projects of 47.8, for the extensive improvements to wetland and riparian habitat.

8.2.8 Summary

As compared to the other projects assessed, Bloomington Road was clearly among the least sustainable projects assessed. However, it is not clear that Bloomington Road was the least sustainable project. While Bloomington Road was given a base score of 3.5%, seven projects received base scores between 6.8% and 8.3%. For example, the Torbram Road Grade separation received a base score of 8.0%. Both projects had little opportunity to improve public transit or cycling with little demand for either. While the Torbram Road grade separation did not widen the road, the natural system was so degraded it would have made little difference, and the grade separation would still have the effect of increasing the capacity of the road by removing the at-grade crossing. However, it is difficult to compare the sustainability impact of the wetland loss in Bloomington Road to the increase in risk to life and property by putting two road underpasses in the Regional Storm Floodplain in the Torbram Road Grade Separation. While Bloomington Road received the lowest base score, it is not certain that it is the least sustainable project assessed because it is difficult to compare objectively the various sustainability trade-offs between the projects.

In the analysis, Envision more clearly provided the highest scores to the two most sustainable projects – Leslie Street and Main Street Markham. While both the Leslie Street and Main Street Markham projects achieved high scores in some criteria for their extensive consultation, they each had different areas of strength that pushed up their total scores. Both Leslie Street and Main Street Markham are clearly more sustainable than any of the other

projects reviewed. Leslie Street and Main Street Markham both lack the sustainability tradeoffs and impacts that are apparent in the other projects reviewed.

In summary, while it is not clear from the 13 projects assessed that the Envision protocol gave the lowest score to the least sustainable project, it most certainly gave the higher scores to the two most sustainable projects. One of the challenges with the data set in testing the ability of Envision to pick out the least sustainable projects is that there was an insufficient spread in scores. No project would have received an Envision award based on the conservative base scores and only one would have received an award based on the less conservative Upper scores.

8.3 The Findings of Saville, Miller, and Brumbelow

8.3.1 The Sustainable Nature of the Project Itself is not Directly Addressed

For 11 of the 13 projects assessed in this study, additional general use vehicular travel lanes were added across all or part of the study area. While criterion QL 1.1 encourages the proponent to ensure the project meets local needs, criteria QL 2.4 and QL 2.5 provide higher scores for projects that encourage alternative modes of transportation, and various criteria under the Resource Allocation and Natural World are more difficult to score higher on with the large footprint and materials needed for a wider road, no single criterion clearly and directly addresses the ‘elephant in the room’ of the sustainability of widening a road, especially to add general purpose lanes. Based on this study, a road widening could achieve the higher award of Platinum while adding general purpose lanes. The I-4 Highway in Florida achieved the highest rating of Platinum. Nevertheless, given that North American society is in the paradigm of individual car ownership requiring ever more and wider roads, a more sustainable road in all other aspects is still a benefit to society.

8.3.2 There is no Weighting of Criteria Based Upon Local Needs

The second conclusion of Saville, Miller and Brumbelow (2016) is that, like other ISRSs, Envision does not allow for adjustments to the weightings to reflect local sustainability needs. While it would be ideal for Envision to provide a mechanism for the criterion scores to be adjusted, there are trade-offs. While some accuracy is lost by not allowing for adjustments to reflect local sustainability priorities, the benefit is a more objective framework that is easier to implement. With 809 points spread across 55 criteria, each with 1 to 5 levels of achievement, adjusting the framework to reflect local sustainability priorities in an objective, transparent manner while minimizing the incentives to adjust the weighting in a way that maximizes the score of a project, would be very complicated. Envision is already a very detailed, demanding framework so further complicate it may impact the ability to gain buy-in from municipalities. Furthermore, while some criteria may be over-weighted relative to local sustainability priorities, others will be under-weighted, so the weighting should balance out. So while Saville, Miller, and Brumbelow (2016) are correct in the finding, their critique is overstated based on this study.

8.3.3 The Project Focus Omits a Systems Scale

Similar to their second conclusion, Saville, Miller, and Brumbelow (2016) also concluded that Envision has a project oriented focus and generally neglects a systems-level perspective. An example in the projects assessed is Kirkhams Road, which received a higher score for discouraging the use of the car (in this case a bridge was removed). However, while traffic on Kirkhams Road decreased marginally as a result of removing the bridge, those trips simply re-routed to adjacent roads. This is an issue that could be partially addressed in the next iteration of the Envision guideline through consideration of larger system effects associated with every criterion.

Similarly, a multi-use pathway and well-designed bus stops along arterial roads are only part of the solution in shifting the modal split. Smart land use planning and other programs are needed to encourage walking, cycling and public transportation use.

There is a trade-off between a project and systems level focus. Systems level thinking can be immensely complex and a revising Envision through systems level thinking will increase its complexity. The complexity of Envision is already such that it will be difficult to encourage its adoption. Revising Envision to reflect more systems level thinking risks may make it more difficult to get municipalities to support Envision.

8.3.4 There is an Uneven Weighting of the Three Sustainability Pillars

The Envision criteria are multi-disciplinary. Saville, Miller, and Brumbelow (2016) found that environmental sustainability is the focus of 57% of Envision points, contending that while the economic pillar is often the focus of EAs, the social environment should be weighted more heavily in the Envision criteria. While the natural environment is definitely the focus of many criteria, the criteria generally are designed to be interconnected and support various aspects of social, economic and environmental sustainability. The fourth conclusion of Saville, Miller, and Brumbelow is not supported by an explanation of why the weighting of the three pillars should be even. The more appropriate critique is that Envision the chosen weighting of criterion and pillars should be supported by peer reviewed research with published papers.

8.3.5 The Positive Scoring Often Overlooks Negative Aspects of the Project

While criteria are designed to reward sustainable processes and designs, they do not subtract from the score for processes and designs that detract from the project's sustainability. For example, while many criteria address various aspects of, and implications for, the sustainability of adding general purpose travel lanes to an existing road, no single criterion clearly and directly addresses whether it is sustainable to add more general purpose travel

lanes to an existing road. Another example is the financial implications of the project. While Envision rewards projects with local economic benefits in various criteria under Quality of Life, there is no consideration of the cost of the project. Kirkhams Road is an example where Envision would likely have provided a higher score to an alternative not ultimately chosen, in part due to the associated financial cost.

However, Envision does not purport to adhere to a strict definition of sustainability and does not state that achievement of a specific award level means a project is sustainable. Envision is designed to improve sustainability outcomes over existing standards; Envision rewards relative improvements, not absolute achievements. Integrating penalties for less sustainable projects would be complicated to design and weight and the Envision guideline is already very complex to use. Penalties would also risk discouraging projects that will go ahead regardless and that can be planned and designed to be relatively more sustainable.

8.4 Envision Endorsement

While there is little doubt that planning a project with the goal of certifying it through Envision will improve the sustainability of the construction, maintenance and decommissioning of the project, there are concerns. While a project that is planned through Envision is *more* sustainable than it would otherwise be, a project can achieve an award without being strictly sustainable. The Envision documentation defines the Conservative achievement level as having no net impacts and the Restorative level as a net improvement, implying that a project that achieves a Conserving or Restorative rating in criterion has achieved strict sustainability in that criterion; however, there is no claim in the Envision document that a project that achieves a specific award level should be considered sustainable. For example, the I-4 Highway in Florida achieved the highest award of Platinum. Although the I-4 project received the highest overall award, the main result of the project was to expand and support the existing growth paradigm of

individual car ownership through increasing the capacity of a road. Clearly the I-4 Highway project is not a strictly sustainable project. Irrespective of being less unsustainable than a standard road, the increase in capacity of vehicular traffic serves to further entrench an unsustainable paradigm of car travel and sprawling land development patterns. However, the purpose of the Envision framework is to improve project sustainability by challenging and advancing current standards of practice; aside from the challenges of identifying strictly sustainable projects, if Envision only provided awards to only strictly sustainable projects, it would risk limiting the range of projects to which the protocol could be applied. The greater the range of projects that apply Envision the less unsustainable roads will become.

In response to research question four, Envision should be endorsed by CAs to supplement their commend roles under the OEAA, and MCEA, and their regulatory roles under the CA Act. CAs are limited by the 'command and control' nature of the OEAA and MCEA and the limitations of regulations in advancing the sustainability of road projects in southern Ontario. Envision is a voluntary alternative motivation framework for undertaking comprehensive assessments of the sustainability of infrastructure projects. As shown in this study, the existing standard of practice for road reconstruction and widening projects is below the lowest Envision award level of Bronze. Whether Envision is endorsed as policy or for verifying projects, the Envision framework has great potential for improving project sustainability.

8.5 Preliminary Discussion of Options and Next Steps for CAs

Although Envision was developed as a framework to follow, ISI and Zofnass have made the guideline freely available, with low-cost and free training. ISI and Zofnass are primarily concerned with improving the sustainability of infrastructure and fully support the framework being used in various ways. Options CAs could consider for using the Envision framework are: endorsing Envision to be used by municipalities on their larger budget projects for verification

and encouraging and working with municipalities to develop their own protocol for following the Envision guideline and publishing self-ratings for all other projects; encouraging CA staff and municipal staff to undertake the Envision training, but not necessarily encourage municipalities to adopt Envision as policy; and working with municipalities to develop a best practices guideline for sustainable road planning and design, using Envision as one source of best practices.

Given the high cost of both added documentation and the fee for verification, municipalities are unlikely to pursue verification for most projects. The ideal approach may be for a municipality to have a few projects at various scales verified. This would aid in training its Project Managers and Env SPs on how to interpret the criteria for various scales of projects. Many questions have been raised previously about how to interpret various aspects of the Envision guideline. The knowledge gained from verification can be applied to setting expectations and a process for the assessment of non-verified projects.

The large number of municipal road projects means that the vast majority could not be officially certified by ISI. This study shows that many criteria were not prepared with a clear objective of use in the reconstruction of existing roads, as is the most common road project under the MCEA process. Many terms are highly, such as “meaningful consultation”, are subjective and their interpretation can have a large impact on the project’s overall score. It is not clear that a project team and municipality, without a peer review through ISI, would be able to provide a true, objective rating of their project, thus undermining both the credibility of the Envision system and its purpose. As a case in point, the two roads projects self-rated and listed on the Los Angeles County website would likely fall under the MCEA if done in Ontario. One project was self-rated just above the threshold of Bronze and the other just above the threshold of Silver. There could be a perception that both projects were adjusted just enough to push the overall ratings up to achieve the next rating.

It may be possible for CAs to fill the role of unofficial peer reviewer of Municipal projects under Envision. However, it would be an immense undertaking that would require additional staff and resources. Furthermore, it may put CAs in the awkward position of being under pressure by their municipal partners to inflate the ratings of their projects. Furthermore, CA staff may not necessarily have much expertise in many of the areas of Envision, undermining their ability and credibility in providing an effective peer review of those criteria. It would be best if municipalities were to develop their own internal process of checks and balances to ensure the Envision protocol was implemented correctly without ISI oversight. With their expertise in some of the areas of sustainability, CAs could provide valuable support to their municipal partners in implementing Envision as a policy requirement.

There will be significant resistance to getting municipalities to endorse Envision as policy or to undertake a case study of a project because municipalities would be concerned with added costs and delays to their planning and approvals processes. The first step would be for a CA to identify key individuals in their respective municipalities known for taking risks and pushing standards of practice. The CA could work with these key individuals to identify a few criteria of Envision and implement a case study. An example would be to find a Project Manager willing to undertake a Lifecycle Carbon Assessment, as per criterion CR 1.1. Many of these perceived barriers will become less daunting once there are new standards that can be followed to undertake these new procedures. If a municipality goes no further, this is still a key win for Envision.

The next step would be to encourage a municipality to undertake verification of a key project that already has the support to be advanced to a high standard of sustainability. This will get some support and recognition of Envision at a municipality. With a key project verified and some of the more daunting criteria already tested individually on projects, there may be sufficient momentum for a CA to encourage a municipality to endorse Envision as policy.

Alternatively, CAs could encourage their staff and municipal staff to undertake the Envision training as a learning tool. Envision could be very useful as a framework for driving the conversation and a deeper understanding in the project team about all aspects of sustainable road planning and design. As is apparent in the results, there are many aspects of sustainability related to roads that are given little thought at the moment.

The last option is for CAs, ideally in partnership with municipalities, to develop best practices guidelines for planning and designing sustainable infrastructure. The Envision framework could be used as a key source of best practices for such a guideline. The main benefit is that it can be customized to the sustainability needs of the CA; the risk is that its effectiveness is tied to the endorsements by municipalities. It may also be difficult for CAs to draw best practices from the Envision Quality of Life and Leadership categories as they are outside the CAs' main mandate as resource management agencies.

Encouraging CA and municipal staff to undertake the Envision training, and developing a best practices guideline for planning and designing sustainable infrastructure can both be used as first steps towards increasing the awareness and appreciation of CA and municipal staff towards Envision. With greater awareness and appreciation, it is more likely that projects will start following the Envision framework.

Lastly, as a result of this study I have a number of editorial suggestions to for ISI in their next iteration of the Envision document. These edits should also make the document clearer for all users and especially those applying it to routine road widening and reconstruction projects.

9 Conclusions

This study applied the Envision framework to a sample set of 13 road projects from across the jurisdiction of TRCA to understand how Envision recognizes and quantifies the sustainability of projects. The Envision framework challenges projects to be planned and designed more sustainably than they otherwise would, but does not identify whether a project is sustainable.

Through an analysis and discussion of the results of the application of Envision to the sample, this study identified the gaps between the current standard of practice and that of the Envision framework for road projects. The level of sustainability of the 11 of the 13 projects assessed is far lower than the lowest Envision award level of Bronze. To the extent that this result can be extrapolated to road planning and design in general in Ontario, the level of sustainability has much room for improvement. This study has shown that a project that pursues an Envision award should achievement higher sustainability in most of the 55 criteria as compared with the standards of practice. This study has also shown that for some criteria, the level of achievement was quite high due to various regulations, such as related to flood risk under the CA Act and regulations.

This study contrasted the categories and projects of the sample, including the projects that scored highest and lowest. This study has provided preliminary evidence that Envision can differentiate between more and less sustainable projects. A larger sample set with a greater spread in achievement would be needed to more strongly support this conclusion.

This study undertook a critique of the use of Envision in the advancement of sustainable road design and planning in Ontario to answer the key overall research question of whether CAs should endorse Envision to supplement their regulation. This study examined the five critiques

of Envision by Saville, Miller and Brumbelow (2016). This study found the critiques to be overstated.

Finally, this study identified and discussed the implications of these findings for municipalities and CAs to determine whether CAs should endorse Envision to supplement their commenting roles under the OEAA, MCEA, and their regulations under the CA Act. Based on the results of the objectives above, Envision should be endorsed by CAs who should work with municipalities to implement it. However, it was beyond the scope of this study to definitively suggest the mechanism for CAs to endorse, how they should work with municipalities and ultimately how municipalities should implement Envision.

Assuming there was a mechanism for doing so, it would be inappropriate for a CA to tie regulatory approvals to an Envision Assessment because most of the Envision criteria are not related to the CA Act. Furthermore, requiring an Envision rating risks undermining the creative problem solving resulting from a project team voluntarily pursuing higher sustainability achievement. However, CAs could take the approach of encouraging municipalities to follow Envision because doing so would facilitate obtaining CA sign-off on their EAs and facilitating obtaining permits under the appropriate regulation under the CA Act.

10 Research Limitations

In order to assess a large number of projects, the accuracy of the ratings was reduced, requiring a base and upper score to capture ranges of confidence. Some criteria had no supporting information and required assumptions to provide a score. Many criteria had only partial information in the documentation, requiring inferences or assumptions to provide a score. It was beyond the scope of this research to obtain the additional project documentation or undertake the interviews that would have filled in some of the assessment gaps. My knowledge of current industry practice is not as strong for all criteria, so some inferences and assumptions are stronger than others. Also, the interpretation of some criteria was unclear, impacting the accuracy of the project scores.

The thirteen road projects chosen were not a randomized, statistically significant sample and were all from within the jurisdiction of TRCA. As each CA has slightly different programs and policies, and faces slightly different development pressures within their watershed, extrapolation of the findings of this research to the jurisdiction of other CAs needs to be done with caution.

As stated earlier the development of Envision was not subject to formal peer reviewed papers, which may detract from its acceptance in academia. It also opens up the framework to various criticisms, such as in regards to how the weighting of the criterion was chosen.

11 Future Areas of Research

The focus of this study was on the appropriate use of Envision in Southern Ontario based on a variety of road reconstruction projects. The scope of the study did not allow for the detailed analysis of projects required to provide a single definitive score for each project. A future study could analyse additional project documentation such as the project specifications and contract documents, and undertake interviews with individuals from the EA, detailed design and construction teams to develop a single score with a higher level of confidence. Interviews with staff from ISI would also be required to obtain clarification on some credit interpretation. This higher level of analysis would provide additional insights into the mechanics of applying Envision to more routine road widening projects.

Additional research could be undertaken into understanding the perceptions, opportunities and challenges with bringing Envision into municipal policy. This research would require interviews with, or surveys of, various PMs and other municipal staff to gauge their current awareness of ISRS, including Envision, and to understand the biggest challenges to using Envision.

A1: Bayview Avenue (Elgin Mills Road to Stouffville Road)

			Performance Metrics						Metrics Achieved		Achievement Level			Score					
			Criterion	A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base	Upper		Low Fruit	
Quality of Life	Purpose	OL 1.1	Improve community quality of life	Likely - I assume that test of considering community needs goals and issues is satisfied by aligning project with ROP & 2002 TMP, local OP and TMP; 2 well attended PICs with partial summary comment table	Likely - project aligns the EA purpose with ROP & 2002 TMP, local OP and TMP	Yes- the EA process sought to identify and address potential impacts to the local community	possible - despite only having the standard 2 PIC meetings with info boards, a case could be made based on the attendance level and the EA public comment summary and response chart in the ESR, separate meetings with landowners and a modified alternative added based on public concern, that the public was meaningfully engaged.	possible - there's no recorded statement of community endorsement in the ESR, but a case could be made based on the attendance level and the EA public comment summary and response chart in the ESR	Unclear - its unclear if reconstructing and widening a road constitutes rehabilitating community assets for the purposes of this criterion	A to C	A to F	None	Superior	Superior	0	10	10	Unclear whether or not community was meaningully engaged as per criterion D for a base score of 0. If project successfully argues the public was meaningfully engaged, then an upper score of Superior was likely achieved given that York Region reviewed their OP, the local OPs and the 2002 TMP, and held 2 fairly well attended public meetings, that the ESR summarizes comments from both PICs and discusses them, that an additional modified alternative was added as a result of consultation, with improvements to adjacent watercourse (water quality, riparian plantings, natural channel design, protected corridor, improved crossings), and with support for public transit, walking and cycling. Its unliley that the next level of conserving could easily be achieved as it requires more thorough consultation to ensure the project met broad community endoresement and meets long-term sustainability goals	
		OL 1.2	Stimulate sustainable growth and development	Unlikely - design, construction and operation supports existing jobs, but unlikely to meet test of <i>significant</i> number of new jobs	Yes- project increased quality of recreational capacity with paved shoulder and multi-use paths for cycling	Yes - reduced congestion counts as improved community productivity as per Envision		-			B, C	B, C	None	None	None	0	0	0	No achievement given or possible without the creation of a significant number of new jobs during design, construction and operation.
		OL 1.3	Develop local skills and competencies	No - no commitments to local employment of needy or disadvantaged groups		-	-	-	-		none	none	none	none	none	0	0	0	My opinion is that a municipality would never and probably couldn not legally restrict a contractor to hiring local workers; the most that could probably be done is including a policy to look favourably in the tendering process of contractors with a policy of training and hiring needy or disadvantaged workers
	Wellbeing	OL 2.1	Enhance public health and safety	No - no new sustainability technologies, materials or equipment identified so no opportunity to assess associated Health and Safety implications		-	-	-		none	none	none	none	Improved	0	0	2	No new sustainability technologies have been proposed, so there's no opportunity to assess associated Health and Safety implications; therefore no achievement is given. As other low fruit score may require the use of new sustainability technologies, there would be an associated opportunity to assess the associated Health and Safey implications so a conservative low fruit score of Improved is given.	
		OL 2.2	Minimize noise and vibration	Yes - studies of noise during operation and minimal consideration of noise during construction	No - no mitigation and monitoring of noise proposed		-	-	-		A	A	Improved	Improved	Conserving	1	1	8	Achievement of Improved through consideration and study of noise during construction and operation. Achievement of Conserving would require determination of noise goals of community with mitigation and monitoring. With extensive involvement of community during well attended PICs, it would be low hanging fruit to have formalized this through approved proposals with community endorsement to monitor and mitigate noise impacts during construction - low hanging fruit of "Conserving".
		OL 2.3	Minimize light pollution	Likely - no evidence of assessment of lighting needs in available documentation, but TRCA's files are unlikely to have such documentation; some assessment likely done in detailed design	Uncertain - no evidence of analysis of efforts to reduce light energy requirements, but may have been done at detailed design.	Unlikely - no evidence of efforts to reduce light spillage and preserve night sky, but unlikely an explicit goal of the lighting design	-	-	-		A	A and B	None	Improved	enhanced	0	1	2	No base achievement as there's no evidence specific efforts were made to reduce lighting energy requirements; an upper score of improved reflects the uncertainty in assessing credit B. A low fruit score of Enhanced reflects a simple assessment of lighting needs, during and post-construction, installation of energy efficient light standards, and basic efforts to reduce light spillage.
		OL 2.4	Improve community mobility and access	Yes - safe to assume study of access and mobility would have been undertaken with Consultant and or contractor during detailed design	yes -team coordinated with local municipality, school, and residents and transit authorities	Yes - design supports active transportation through multi use paths and paved shoulders	likely - plans to limit traffic disruption likely undertaken with contractor	Yes - access to public transportation in support of transportation master plan	Uncertain - its unclear how to assess whether or not the project improves livability		A to E	A through F	Improved	Enhanced	Superior	1	4	7	study of access during EA and detailed design in consultation with local businesses and residents, a design that supports the 2008 Pedestrian and Cycling Master Plan and 2009 Transportation Master Plan, with a focused effort during the well attended PICs to discuss access and mobility with local businesses and residents should earn a rating of between Improved and Enhanced. Superior requires reducing traffic impacts during construction "well beyond construction norms."

Leadership	Community	QL 2.5	Encourage alternative modes of transportation	Yes - YRT bus route along Bayview to Finch station	Likely - no deliberate restriction of parking; however, no parking provided through urban cross section	Yes - design supports active transportation through multi use paths connected to Lake to Lake project	Yes - encouragement of active transportation through multi use path that is part of Lake to Lake trail, and adjacent to protected, restored stream channel	Uncertain - the project did not develop programs to encourage alternative transportation but the Region and local municipality have	A to D	A to E	Enhanced	Enhanced	enhanced	3	3	3	Achievement of Enhanced based upon buses along Bayview Avenue providing access to multi modal transit facilities, the restriction of parking, and support for cycling connected to a cycling network. An achievement of Superior requires secure bicycle lockers at the transit stops, which would be a tough sell for their expense relative to the bus stop use.
		QL 2.6	Improve site access, safety and wayfinding	No - no documentation of wayfinding signage considered at the EA or detailed design aside					None	none	None	None	none	0	0	0	No study of wayfinding and limited opportunity.
		QL 3.1	Preserve historic and cultural resources	No - no cultural or heritage resources within study area			-	-	none	none	none	none	none	0	0	0	No cultural or heritage resources identified within study area so no opportunity to preserve or enhance them.
	Community	QL 3.2	Preserve views and local character	Yes - determination of rural, but urbanizing character	No - no view plans developed	uncertain - final design recreates, rather than preserves, landscapes; no local community plans or guidelines			A	A, C	None	None	Superior	0	0	6	No public view plan was developed so no credit can be given; however, viewsheds and the maintenance of the rural character and enhancements to the channel and riparian zone adjacent to the road, in consultation with the community, makes a level of Superior low fruit.
		QL 3.3	Enhance public space	No - project does not add to public space			-	-	none	none	none	none	Superior	0	0	6	Current project enhances and expands the channel and riparian zone adjacent to the road; if trails were added within the natural buffer, an achievement of superior is possible.
														5	19	44	
	Collaboration	LD 1.1	Provide effective leadership and commitment	Yes - general sustainability statements in Official Plan, 2007 Sustainability Strategy and Vision statement	-	-	-	-	A	A	Enhanced	Enhanced	Enhanced	4	4	4	York Region has their 2007 Sustainability Strategy which informed their Vision 2051. No annual reporting of sustainability progress so achievement limited to Enhanced, with no low hanging fruit
		LD 1.2	Establish a sustainability management system	Unlikely - project did not specifically address sustainability based on documentation so its unlikely anyone on the project team was responsible for sustainability issues	Unlikely -project did not specifically address sustainability based on documentation so its unlikely a management policy was created for the project	no - based upon ESR the project did not set sustainability goals and targets			none	A	None	None	None	0	0	0	Although it can't be confirmed that no specific person was given the responsibility of sustainability, it is unlikely as sustainability is not addressed in the ESR, and its irrelevant because a project must meet criterion A through E for all levels of achievement. Meeting criterion A through E would require an extensive commitment to sustainability within the project team through various business sustainability processes, and given that sustainability as a concept is not considered in EAs for road projects in the GTA in my experience, such commitment is not considered low hanging fruit. No ESRs in any ESRs reviewed for this thesis even used the term sustainability except in reference to the title of another document.
		LD 1.3	Foster collaboration and teamwork	Yes - project team likely incorporated collaboration, teamwork and whole systems design to some degree	No - not likely meaningful risk and reward sharing between consultant and owner				A	A	Improved	Enhanced	Enhanced	1	4	4	The project documentation does not mention sustainability, however aspects of sustainable design are found. However, the incorporation of results of the Pedestrian and Cycling Master Plan and the Transportation Master Plan shows some degree of systems view. Low fruit is to more fully achieve Enhanced.
		LD 1.4	Provide for stakeholder involvement	Yes - to some extent stakeholders ID and key concerns addressed	Yes - extensive consultation with stakeholders	Yes - to some extent stakeholder input incorporated into plans	yes - stakeholding participation and communications program established		A to D	A to D	Improved	Enhanced	Enhanced	1	5	5	Documentation of some main comments from the public and responses from project team from PICs 1 and 2. Both PICs were well attended. A modified design alternative was analyzed based upon public input. It is likely that an improved level would be achieved due to standard PIC engagement and project management principles. Given the well attended PICs and that some effort was made to document public comments, more thorough documentation of public engagement and proof of design alterations from public input would constitute low hanging fruit of enhanced.
		LD 2.1	Pursue by-product synergy opportunities	no - no documentation of efforts to search for unwanted byproduct of nearby facilities & very unlikely to have occurred			-	-	None	None	None	None	None	0	0	0	No assessment of unwanted byproducts of nearby facilities. Therefore no achievement. Not likely relevant to road constuction so no low hanging fruit
	Management	LD 2.2	Improve infrastructure integration	No evidence project team sought to improve sustainability through project wide systems integtation			-	-	None	None	None	None	None	0	0	0	No evidence that project team sought to improve project sustainability through project wide systems integration;
		LD 3.1	Plan for long-term monitoring and maintenance	Likely - York Region would have developed a multt-year monitoring plan of the new channel works as part of their DFO Authorization	Likely - it should be assumed that in order for the monitoring plan to be accepted by DFO that sufficient resources for monitroing were set aside	-	-	-	None	None	None	None	Enhanced	0	0	3	No achievement because Improved required moniroting plan beyond regulatory requirements, but the monitoring plan is for this project would have been to satisfy DFO requirements. Adding an extra year of monitoring beyond the DFO Authorization requirements would achieve Enhanced.

Planning	LD 3.2	Address conflicting regulations and policies	No - no documentation of assessment of conflicting regulations and policies	-	-	-	-	none	A	none	None	Improved	0	0	1	No achievement since no documentation of assessment of conflicting regulations and policies and no evidence of sustainability objectives. Low hanging fruit of Improved through basic assessment of regulations and associated regulators and organizations and connection to sustainability objectives.
	LD 3.3	Extend useful life	yes - high likelihood of some consideration of durability, flexibility and resilience of project	No - no documentation of consideration of expansion or future reconfiguration of project, but may have occurred	-	-	-	A	A, B	Improved	Improved	Enhanced	1	1	3	Likely achieved Improved by considering to some degree the flexibility, durability and resilience of road, culverts and underpassesnew channel. Achieving Enhanced requires documentation of consideration of future expansion or reconfiguration which is given a low hanging fruit score.
													7	14	20	
Resource Allocation	Materials	RA 1.1	Reduce net embodied energy	No - no documentation of an LCA	-	-	-	none	none	none	none	None	0	0	0	No documentation of an LCA and reasonable assumption one was never done as I have never heard of one occurring in my career for a municipal EA; a LCA is very resource intensive so its not considered low hanging fruit.
		RA 1.2	Support sustainable procurement practices	No - no documentation of sustainable procurement			-	None	None	None	None	Improved	0	0	2	No documentation of sustainable procurement, and reasonable assumption this is not done in practice outside of LEED projects; as it has been done for LEED projects, it's a reasonable assumption that the lowest level of improved could have been achieved through <15% materials from suppliers with 'sustainability practice'
		RA 1.3	Use recycled materials	Unclear - no documentation of specification of recycled material undertaken in EA or detailed design. Contractor would have purchased materials with recycled content but not specified it, so its unclear this achieves the credit sustainability intent	-	-	-	A	A, B	None	Enhanced	Superior	0	5	11	No documentation of EA or detailed design project teams analyzing reuse of on site materials, but this was likely done by contractor to reduce expenses. No evidence of specifying materials with recycled content, but its likely the contractor still purchased materials with recycled content to reduce expenses. Its standard for pavement and granular subgrade to contain a significant percentage of recycled material, so its safe to assume 20% (by weight or volume) of materials on site are recycled. As credit may not be given, the base score is zero. An upper score of Superior is given based upon credit given for the contractor purchasing but not specifying materials with recycled content. A low fruit rating of Enhanced is given as it should be easily achieved for the municipality to specify materials with recycled content.
		RA 1.4	Use regional materials	Unclear - no documentation of specification of local materials, but with expense of transporting materials its likely contractor purchased local materials to save money. Its unclear if this meets the credit intent.	-	-	-	None	A	None	Improved	Enhanced	0	3	6	No documentation for the <i>specification</i> of local materials, but with the cost of transportation its likely a large percentage of materials were sourced within the specified distances. Its unclear if achievement of the credit requires explicit specification of local materials by the contractor. If credit is achieved, its conservatively assumed to be an upper achievement of Improved (30% local) and a low hanging fruit of Enhanced (60% local). Achievement could have been and could be much higher but I don't have evidence to accurately assess so I've used a conservative assessment.
		RA 1.5	Divert waste from landfills	Unlikely - There is no documentation in the EA or detailed design regarding a comprehensive waste management plan. Although the contractor likely diverted waste to save landfill charges and make money selling the materials its highly unlikely this was done through a comprehensive waste management strategy			-	None	None	None	None	Enhanced	0	0	6	No base or upper achievement since no comprehensive waste management plan likely implemented. With recyclability of asphalt, granular and concrete, its low hanging fruit to achieve 50% recycle/reuse of onsite materials which gives a level of enhanced. Actual low fruit achievement could be even higher, but a more detailed analysis would be required to support this.
		RA 1.6	Reduce excavated materials taken off site	Likely - although no documentation in materials I had available, it is standard to estimate cut and fill in detailed design or by the contractor to reduce costs of transporting and disposing of soils offsite.	-	-	-	A	A	Conserving	Conserving	Conserving	6	6	6	The level of achievement is based upon a percentage of excavated materials <i>suitable for reuse</i> that are reused on site. It is safe to assume that the vast majority (90%) of fill <i>suitable for reuse</i> was reused on site, giving an achievement of Conserving.
		RA 1.7	Provide for deconstruction and recycling	yes - although there's no documentation in the EA and detailed design of specifying materials specifically because of their recyclability asphalt, granular, and concrete are highly recyclable so credit can be given	Unlikely - no documentation in EA or detailed design of consideration of facilitating future disassembly and recycling of materials. Its unlikely the contractor would have constructed the project in a way that improved the recyclability of the materials.	-	-	A	A	Improved	Improved	Superior	1	1	8	As asphalt, granular and concrete are highly recyclable so evaluation criterion A is met which on its on leads to a maximum achievement of Improved. Higher levels of achievement require specific efforts to facilitate future recycling which is highly unlikely to have occurred, but with little extra effort due to the highly recyclable nature of many road materials would yield a rating of Superior for the low hanging fruit

	Energy	RA 2.1	Reduce energy consumption	No - no evidence in the EA or detailed design that the team assessed options for reducing energy consumption														Even if options to reduce energy consumption were considered, a basic Improved level requires a decrease of 10% of energy consumption during operation over industry norms, and must include energy consumed by vehicular traffic. As the project adds general purpose lanes to an existing road, this is unachievable so no credit is given or possible.
		RA 2.2	Use renewable energy	No - the vast majority of energy used in the operation and maintenance of the road will be fossil fuels for vehicles with a relatively smaller amount for the nuclear and natural gas for the light standards	-	-	-	-	-									No achievement since the vast majority of energy used in the operation and maintenance of the road will be fossil fuels. A very significant shift to electric vehicles would be required because Ontario's dominant Nuclear power is not a renewable resource as per Envision.
		RA 2.3	Commission and monitor energy systems	Unclear - although a sub-contractor would have installed and tested the light standards, and the municipality may have done its own check, its unclear either counts as an "independent commissioning" for the purposes of this criterion	Yes - the municipality would have sufficiently trained persons maintaining the light standards	Unclear - the Region would likely monitors the energy consumption of its lights but I don't have easy access to the information required to determine if this would constitute the advanced monitoring systems this criterion requires	-	-	-									There is no documentation in the files review for the EA or detailed design related to how the lighting systems would be commissioned, but such information isn't expected to sent to TRCA anyways. I don't have sufficient knowledge of standard practices in how municipalities commission and monitor lighting standards to properly assess this credit. The likely range of scores is too low to justify the effort required to more confidently score this credit. So a conservative range of none to Enhanced is given. The next achievement jumps to conserving and requires extensive commissioning and monitoring of systems and as Conservative for any credit is intended to be far beyond current standards of practice, I've assumed its not low hanging fruit.
	Water	RA 3.1	Protect fresh water availability	No -although the EA assessed dewatering requirements for construction it was not from the perspective of assessing water availability to support water use so things like recharge weren't considered.	No - although there is no documentation of assessment water taking requirements beyond construction, it wouldn't have been done for long -term impacts as the project doesn't require water takings during operation			-	-									No level of achievement. The project only assessed groundwater conditions for the purposes of assessing dewatering needs during construction which does not meet many of the requirements of a water availability assessment (criterion A). The project anticipated dewatering rates of 30,000L per day during construction. The project will not require water takings during operation (criterion B). Therefore no achievemetrn is given. No low fruit score is given since an analysis of groundwater and surface water from the perspective of availability is not relevant to this project.
		RA 3.2	Reduce potable water consumption	No - no documentation of identification of strategies to reduce potable water consumption during operation and maintenance					-	-								No level of achievement given as there is no evidence of a potable water reduction strategy and it can be assumed one wasn't done regardless as roads use little potable water generally during operation and maintenance. For roads, the only opportunity is the use of drought resistant plants in planted medians or boulevards to which stormwater is directed to eliminate the need to water plants with potable water; as such a redesign could be significant and I've assumed significant redesigns are no low hanging fruit, no low hanging fruit score given.
		RA 3.3	Monitor water systems	NA				-	-	-								Not applicable since project does not involve potable water systems in its operation that could be monitored. This criterion would apply if there was an associated watermain.
	71842																	
		NW 1.1	Preserve prime habitat	no - development in prime habitat is not avoided due to intrusions to PSW and regionally significant brook trout habitat				-	-	-								No acheivement given or possible due to intrusions into Provincially Significant Wetlands, and the regionally significant spawning habitat of Brook Trout.
		NW 1.2	Protect wetlands and surface water	No - project widening occurs within specified distance to a watercourse.				-	-	-								No achievement given or possible as the site relocates a watercourse
		NW 1.3	Preserve prime farmland	No - Prime farmland not protected				-	-	-								No achivement given or desirable as the project expands the road east onto farmland and creates a wider riparian zone for the adjacent watercourse. The new feature provides superior aquatic habitat and separation of stormwater runoff from the road.
		NW 1.4	Avoid adverse geology	NA	NA	NA				-	-							Credit excluded as not generally relevant for the region, with the exception of projects on the Niagara Escarpment.

Natural World	Siting	NW 1.5	Preserve floodplain function	Possible - project involves slight increases in the regional storm elevations in at least one area outside the road right of way; however, project team did obtain sign-off from affected landowner	Yes - although the project increases impervious area in the floodplain, the artesian groundwater conditions prevent infiltration anyways so this function isn't impacted by the project	Yes - riparian habitat enhancements within floodplain	Yes - a flood emergency plan would not have been prepared for the project, but will be for the local municipality	No - project does not improve habitat connectivity due to new culverts conveying watercourse										No base achievement given due to increases, however slight, in regional flood elevations outside right of way. However, the project team did obtain sign-off from the landowner for the increase which could be accepted as an argument so a high score of Superior is given. Low fruit if culverts, bridges and new channel designed to convey regional storm sufficient to maintain or reduce flood elevations.
		NW 1.6	Avoid unsuitable development on steep slopes	NA			-	-	-	NA	NA	NA	NA	NA				Not applicable as there are no valley slopes of concern within project area
		NW 1.7	Preserve greenfields	Yes - at least 50% of the project area, being the existing road, is already developed	No - project is not on a designated brownfield		-	-	-	A	A	none	none	None	0	0	0	Although more than 50% of the project is located on an already developed area, it only makes sense to count the existing road as a grey area if serious planning consideration was given to new road alignments entirely within greenfields. This is not the case here, so no achievement is given or possible.
	Land & Water	NW 2.1	Manage stormwater				-	-	-	None	None	None	None	None	0	0	0	For the purposes of water quantity calculations the existing road needs to be considered a greyfield. Credit requires that water storage capacity be maintained in the greenfield and must be improved in the greyfield (existing road) by at least 30% for an Enhanced rating. No achievement given as no implementation of water quantity improvement. No water storage or infiltration LIDs were provided. As an overall improvement water storage and infiltration over pre-development conditions is not achieved no credit is given. A significant redesign would be required to achieve this high standard and given my experience with the resistance to implementing LIDs for roads, no low hanging fruit score is given.
		NW 2.2	Reduce pesticide and fertilizer impacts	Unclear -operational policies to control the application of fertilizers and pesticides were not part of the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - runoff controls to minimize groundwater and surface water contamination during the application of fertilizers and pesticides were not discussed in the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - as per Cosmetic Pesticides Ban Act, most pesticides are already banned in Ontario, but fertilizers can still be used	Unclear - no consideration was given in the EA or detailed design documentation to plants that minimize the need for fertilizers and no discussion of integrated pest management, but these may have been considered by the contractor.	-	-	None	A to D	None	Superior	Superior	0	5	5	With the Cosmetic Pesticide Ban Act, most pesticides are banned in Ontario. Also, the project would have planted only native, non-invasive species that should reduce the need for fertilizer. With no documentation to support any achievement, the project is given a base of 0 but its possible they could have achieved a score of Superior with the right documentation. No low fruit achievement of conserving since an integrated pest management practice would require a whole new region wide program be developed.
		NW 2.3	Prevent surface and groundwater contamination	yes - groundwater and surface water monitoring of quantity, and quality	Yes - detailed design had some general aspects of a spills prevention plan in the standard notes and the contractor likely development their own detailed protocol			-	-	A and B	A and B	Enhanced	Enhanced	Enhanced	4	4	4	Achievement of Enhanced was achieved through the groundwater and surface water monitoring and spills prevention details.
	Biodiversity	NW 3.1	Preserve species biodiversity		Yes- project increases number of driveway crossings but mitigates these for target species by sizing them large with dry passage	Yes - project increases available habitat but and improves connectivity through enlarged culvert under Bayview north of 19th Avenue		-	-	A to C	A to C	Restorative	Restorative	Restorative	16	16	16	Existing ditch was relocated further east, designed as a natural channel with riparian plantings and natural corridor, and stormwater flows from the road were separated to improve water quality. The impacts of the additional driveway culverts on wildlife movement are mitigate through sizing and with dry passage. The upsized culvert under Bayview north of 19th reconnects habitats on either side of the road along the channel. Achievement of top score of Restorative.
		NW 3.2	Control invasive species	Yes - only native non-invasive species proposed	Yes - management plan for invasive species developed	Yes - project removes invasives		-	-	A to C	A to C	Restorative	Restorative	Restorative	11	11	11	Achievement of Restorative. Project removed several patches of invasive Phragmites, and project also includes multi year monitoring of new channel for DFO.
		NW 3.3	Restore disturbed soils	No - 100% of soils disturbed during construction have not been restored and reused properly				-	-	None	None	None	None	Restorative	0	0	10	No achievement since 100% of soils disturbed during construction have been restored and reused because the plans propose a landform feature of compacted soils. Despite my experience of strong push back in industry against soil restoration, the extensive restored natural corridor presents a low fruit opportunity to implement soil restoration.
		NW 3.4	Maintain wetland and surface water functions	Yes - new channel designed by geomorphologist will maintain hydrologic connection to floodplain	yes - maintains water quality	yes - enhances habitat	yes - maintains sediment transport	possible - its unclear whether or not all disturbed functions were restored	-	A to D	A to D	Conserving	Conserving	restorative	15	15	19	Project maintains or enhances four ecosystem functions for an achievement of conserving, and could achieve restorative by enhancing water quality and proving that the hydrologic connection and sediment transport were improved.

												46	59	73			
Climate	Emission	CR 1.1	Reduce greenhouse gas emissions	No - no evidence of a life cycle carbon assessment having been undertaken, and this would not have been done regardless as its resouce intensive and not currently required by any agencies	-	-	-	-	None	None	None	None	None	0	0	0	No achievement without life cycle carbon assessment. A life cycle carbon analysis would require extensive resources and I have never heard of one being done for a municipal class EA. Its difficult to assess how likely it is I could have convinced a project team to have undertaken such an assessment, so I will assume a low fruit score of zero.
		CR 1.2	Reduce air pollutant emissions	No - no evidence in the EA or detailed design of an air quality analysis. Even if one were to be done a project that increases vehicular traffic won't meet the criterion objective of improving air quality	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no air quality analysis undertaken; no low fruit since its not realistic to reduce air pollution through a widened road.
	Resilience	CR 2.1	Assess climate threat	No - no evidence a climate impact assessment was undertaken, and it would not have been undertaken regardless as the discussion of incorporation of climate change into municipal class EAs only began in the fall of 2016 with the release of MOECC's Draft Guideline: <i>Consideration of Climate Change in Environmental Assessments in Ontario.</i>	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no climate impact assessments undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.2	Avoid traps and vulnerabilities	No - no evidence of identification and assessment of possible changes in key engineering design variables.	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no survey of future resource constraints and vulnerabilities undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.3	Prepare for long-term adaptability	No evidence that team researched long-term changes in operational or environmental conditions	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no plans and designs to prepare for long term climate change. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.4	Prepare for short-term hazards	No evidence that team researched short - term hazards and how they may change over the life time of the project	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no analysis of short term hazards. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.5	Manage heat island effects	No - project does not meet heat island requirements	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no evidence of consideration of solar reflectance. Addition of planted median likely required to achieve Improved of 10% shading; as this would require a major redesign of the road, no low hanging fruit score is given.
Overall total:													0 65	0 110	0 179		
Possible Total Score													787 8.26%	13.98%	22.74%		
Award:													None	None	Bronze		

A2: Bloomington Road (Bathurst Street to Highway 404)

		Performance Metrics						Metrics Achieved		Achievement Level			Score					
		Criterion	A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base	Upper		Low Fruit	
Quality of Life	Purpose	QL 1.1	Improve community quality of life				possible - despite only having the standard 2 PIC meetings with info boards, a case could be made based on the attendance level and the EA public comment summary and response chart in the ESR, that the public was meaningfully engaged.	possible - there's no recorded statement of community endorsement in the ESR, but a case could be made based on the attendance level and the EA public comment summary and response chart in the ESR									Unclear whether or not community was meaningully engaged as per criterion D for a base score of 0. If project successfully argues the public was meaningfully engaged, then an upper score of Superior was likely achieved given the 2 fairly well attended public meetings, incorporation of additional turning lanes for safety as a result of public input. A low fruit score of additional efforts at meaningful engagement to better support score of Superior.	
		QL 1.2	Stimulate sustainable growth and development	Unlikely - design, construction and operation supports existing jobs, but unlikely to meet test of <i>significant</i> number of new jobs	Yes- project increased quality of recreational capacity with paved shoulder for cycling	Yes - reduced congestion counts as improved community productivity as per Envision		-	B, C	B, C	None	None	None	0	0	0	No achievement given or possible without the creation of a significant number of new jobs during design, construction and operation.	
		QL 1.3	Develop local skills and competencies	No - no commitments to local employment of needy or disadvantaged groups		-	-	-	-	none	none	none	none	none	0	0	0	My opinion is that a municipality would never and probably couldn not legally restrict a contractor to hiring local workers; the most that could probably be done is including a policy to look favourably in the tendering process of contractors with a policy of training and hiring needy or disadvantaged workers
	Wellbeing	QL 2.1	Enhance public health and safety	No - no new sustainability technologies, materials or equipment identified so no opportunity to assess associated Health and Safety implications		-	-	-	none	none	none	none	Improved	0	0	2	No new sustainability technologies have been proposed, so there's no opportunity to assess associated Health and Safety implications; therefore no achievement is given. As other low fruit score may require the use of new sustainability technologies, there would be an associated opportunity to assess the associated Health and Safey implications so a conservative low fruit score of Improved is given.	
		QL 2.2	Minimize noise and vibration	No - noise study undertaken, but only covers operation, not construction	No - no mitigation proposed	-	-	-	None	None	None	none	Improved	0	0	1	Undertook noise analysis but no mitigation proposed since increase below MOE threshold. However, did not study construction noise, so no achievement. Low hanging fruit of improved by expanding baseline study to construction noise.	
		QL 2.3	Minimize light pollution	Likely - no evidence of assessment of lighting needs in available documentation, but TRCA's files are unlikely to have such documentation; some assessment likely done in detailed design	No - no efforts were made to reduce lighting energy requirements as no lights are proposed	-	-	-	A	A	None	None	None	0	0	0	No evidence of any analysis of lighting needs. No low hanging fruit as that would require efforts to reduce lighting energy requirements which is not relevant for a project that does not propose lighting. Street lights were likely never seriously considered as the existing street is not lit and is not being widened.	
		QL 2.4	Improve community mobility and access	likely - design adds bus stops and paved shoulders to bike lanes so discussions must have occurred during detailed design of access and mobility	Yes - owners of adjacent facilities were involved in some degree in the ESR	Yes - design supports active transportation through bike lanes and sidewalks and access to transit	likely - plans to limit traffic disruption likely undertaken with contractor	Yes - project designed to decrease congestion and improve access to alternate modes of transportation	Uncertain - its unclear how to assess whether or not the project improves livability	A to E	A to F	Improved	Enhanced	Enhanced	1	4	4	Limited consideration of transit and cycling in the EA/planning phase should be sufficient for Improved level. If engagement with adjacent facilities in planning mobility and access was better than documentation shows, a level of Enhanced was achieved. Enhanced is also given as low hanging fruit.
		QL 2.5	Encourage alternative modes of transportation	yes - the road incorporates a paved shoulder for bikes the entire length, a sidewalk where warranted and bus stops the entire length.	yes - restrictions on parking for sections with urban cross section, but parking still allowed on shoulder in other sections	no - the project does not provide easy access to multi-modal facilities			A, B	A, B	Improved	Improved	Improved	1	1	1	Only basic credit of Improved achieved and possible with sidewalks, bus stops and paved shoulders provided. But the road is too isolated with too low a density to support efficient, frequent transit, so no further credit is easily acheived.	
		QL 2.6	Improve site access, safety and wayfinding	No - no documentation of wayfinding signage considered at the EA or detailed design aside					none	none	none	none	None	0	0	0	Project is located on a rural road with limited pedestrian and cycling traffic to direct or locations to direct them to. No credit given.	

Leadership	Community	QL 3.1	Preserve historic and cultural resources	yes - the EA undertook a phase 1 and 2 archaeological investigation	No - no mitigation proposed	-	-	A	A	none	none	none	0	0	0	The investigation found no cultural or historic resources in the study are so no credit can be given nor is possible to achieve.
		QL 3.2	Preserve views and local character	yes - a basic discussion of the local project setting is in the EA	No - no view plans undertaken			A	A	none	none	none	0	0	0	No credit since no public view plan undertaken. Given the low pedestrian and cycling volumes and the lack of valleys, a view plan will be a tough sell to justify.
		QL 3.3	Enhance public space	No - project does not add to public space		-	-	none	none	none	none	none	0	0	0	No achievement and little opportunity within the project scope to create public space.
													2	15	18	
Leadership	Collaboration	LD 1.1	Provide effective leadership and commitment	Yes - general sustainability statements in Official Plan, 2007 Sustainability Strategy and Vision statement		-	-	A	A	Enhanced	Enhanced	Enhanced	4	4	4	York Region has their 2007 Sustainability Strategy which informed their Vision 2051. No annual reporting of sustainability progress so achievement limited to Enhanced, with no low hanging fruit
		LD 1.2	Establish a sustainability management system		Unlikely - project did not specifically address sustainability based on documentation so its unlikely anyone on the project team was responsible for sustainability issues	Unlikely -project did not specifically address sustainability based on documentation so its unlikely a management policy was created for the project	no - based upon ESR the project did not set sustainability goals and targets	none	A	None	None	None	0	0	0	Although it can't be confirmed that no specific person was given the responsibility of sustainability, it is unlikely as sustainability is not addressed in the ESR, and its irrelevant because a project must meet criterion A through E for all levels of achievement. Meeting criterion A through E would require an extensive commitment to sustainability within the project team through various business sustainability processes, and given that sustainability as a concept is not considered in EAs for road projects in the GTA in my experience, such commitment is not considered low hanging fruit. No ESRs in any ESRs reviewed for this thesis even used the term sustainability except in reference to the title of another document.
		LD 1.3	Foster collaboration and teamwork		Yes - project team likely incorporated collaboration, teamwork and whole systems design to some degree			A	A	Improved	Enhanced	Enhanced	1	4	4	The EA documentation does not directly address sustainability, but the detailed design natural impact assessment report was very thorough. The project integrates with water and wastewater systems upgrades, transit, cycling and pedestrian access, so credit of Enhanced for a systems view is given. No low fruit because the next level requires a much more involved stakeholder involvement.
		LD 1.4	Provide for stakeholder involvement	Yes - to some extent stakeholders ID and key concerns addressed	Yes - PICs with local residents held, and meetings with other stakeholders held (TRCA)	Yes - to some extent stakeholder input incorporated into plans	yes - stakeholding participation and communications program established	A to D	A to D	Improved	Enhanced	Enhanced	1	5	5	Fairly well attended PICs held. Stakeholder input summarized in EA with responses and design altered in response to some concerns. Credit of improved to enhanced given; superior would have required more frequent communication with stakeholders throughout project.
	Management	LD 2.1	Pursue by-product synergy opportunities	no - no documentation of efforts to search for unwanted byproduct of nearby facilities & very unlikely to have occurred			-	none	none	none	none	None	0	0	0	No assessment of unwanted byproducts of nearby facilities. Therefore no achievement. Not likely relevant to road construction so no low hanging fruit
		LD 2.2	Improve infrastructure integration	No evidence project team sought to improve sustainability through project wide systems integration			-	none	none	none	none	None	0	0	0	No evidence that project team sought to improve project sustainability through project wide systems integration;
	Planning	LD 3.1	Plan for long-term monitoring and maintenance	no - no documentation of plan for long-term monitoring		-	-	none	none	none	none	Enhanced	0	0	3	2 year monitoring of infrastructure is standard and likely to have occurred, but only monitoring of the bridges beyond 2 years is standard, so no credit given. Adding monitoring of the wetland for an additional 3-5 years should be achievable and would earn Enhanced.
		LD 3.2	Address conflicting regulations and policies	No - no documentation of assessment of conflicting regulations and policies		-	-	none	A	none	None	Improved	0	0	1	No achievement since no documentation of assessment of conflicting regulations and policies and no evidence of sustainability objectives. Low hanging fruit of Improved through basic assessment of regulations and associated regulators and organizations and connection to sustainability objectives.

Res	Energy	RA 1.7	Provide for deconstruction and recycling	yes - although there's no documentation in the EA and detailed design of specifying materials specifically because of their recyleability asphalt, granular, and concrete are highly recyclable so credit can be given	Unlikely - no documentation in EA or detailed design of consideration of facilitating future disassembly and recycling of materials. Its unlikely the contractor would have constructed the project in a way that improved the recyclability of the materials.	-	-	-	-	A	A	Improved	Improved	Superior	1	1	8	As asphalt, granular and concrete are highly recyclable so evalation criterion A is met which on its on leads to a maximum achivement of Improved. Higher levels of achievement require specific efforts to facilitate future recycling which is highly unlikely to have occurred, but with little extra effort due to the highly recyclable nature of many road materials would yield a rating of Superior for the low hanging fruit
		RA 2.1	Reduce energy consumption	No - no evidence in the EA or detailed design that the team assessed options for reducing energy consumption			-	-	-	None	None	None	None	None	0	0	0	Even if options to reduce energy consumption were considered, a basic Improved level requires a decrease of 10% of energy consumption during operation over industry norms, and must include energy consumed by vehicular traffic. As the project adds general purpose lanes to an existing road, this is unachievable so no credit is given or possible.
		RA 2.2	Use renewable energy	No - the vast majority of energy used in the operation and maintenance of the road will be fossil fuels for vehicles with a relatively smaller amount for the nuclear and natural gas for the light standards	-	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since the vast majority of energy used in the operation and maintenance of the road will be fossil fuels. A very significant shift to electric vehicles would be required because Ontario's dominant Nuclear power is not a renewable resource as per Envision.
		RA 2.3	Commission and monitor energy systems	NA			-	-	-									Exclude credit as this project does not propose any electrical systems.
	Water	RA 3.1	Protect fresh water availability	No -although the EA assessed dewatering requiremets for construction it was not from the perspective of assessing water availability to support water use so things like recharge weren't considered.	No - although there is no documentation of assessment water taking requirements beyond construction, it wouldn't have been done for long -term impacts as the project doesn't require water takings during operation			-	-	None	None	None	None	None	0	0	0	No level of achievement. The project only assessed groundwater conditions for the purposes of assessing dewatering needs during construction which does not meet many of the requirements of a water availability assessment (criterion A). The project will not require water takings during operation (criterion B). Therefore no achievemtn is given. No low fruit score is given since an analysis of groundwater and surface water from the perspective of availability is not relevant to this project.
		RA 3.2	Reduce potable water consumption	No - no documentation of identification of strategies to reduce potable water consumption during operation and maintenance				-	-	None	None	None	None	None	0	0	0	No level of achievement given as there is no evidence of a potable water reduction strategy and it can be assumed one wasn't done regardless as roads use little potable water generally during operation and maintenance. For roads, the only opportunity is the use of drought resistant plants in planted medians or boulevards to which stormwater is directed to eliminate the need to water plants with potable water; as such a redesign could be significant and I've assumed significant redesigns are no low hanging fruit, no low hanging fruit score given.
		RA 3.3	Monitor water systems	NA			-	-	-									Not applicable since project does not involve potable water systems in its operation that could be monitored. This criterion would apply if there was an associated watermain.
																7	15	39
		NW 1.1	Preserve prime habitat	No -project widened road through Provincially Significant Wetland complex			-	-	-	None	None	None	None	None	0	0	0	Project expanded the existing road within a PSW, negating any acheivement or potential achievement.
		NW 1.2	Protect wetlands and surface water	No - project expands beyond existing road footprint into wetland	No- the project does not establish the prescribed 50 foot buffer to the wetland feature		-	-	-	None	None	None	None	None	0	0	0	No achievement since road bisects PSW expands into PSW. Can't establish buffer as road bisects wetland, so no achievement possible.
		NW 1.3	Preserve prime farmland	No - no evidence that project team assessed prime farmland			-	-	-	None	None	None	None	None	0	0	0	No achievement as the project did not assess whether the soils are prime farmland. No potential since protecting the remaining farmland from encroachment from the road is irrelevant due to future development of the remaining farmland.

Natural World	Siting	NW 1.4	Avoid adverse geology	NA	NA	NA	–	–	NA	NA	NA	NA	NA				Credit excluded as not generally relevant for the region, with the exception of projects on the Niagara Escarpment.
		NW 1.5	Preserve floodplain function	Yes - floodplain impacts are minimized by design that increases size and number of culverts in floodplain conveying flow under road	No - Floodplain function is inhibited by increased impervious area within the floodplain	No - project results in net loss of riparian and wetland vegetation			A	A	Improved	Improved	Improved	2	2	2	Project is estimated floodplain modelling by Conservation Authority. Project improves flood conveyance across the road, but widening of road increases impervious area in the floodplain preventing achievement beyond Improved.
		NW 1.6	Avoid unsuitable development on steep slopes	Yes - project likely follows BMPs for slopes as informed by geotechnical investigation	No - road was not sited based on slope concerns		–	–	A	A	Improved	Improved	Improved	1	1	1	Achievement of Improved. Project follows BMPs for sections that parallel a slope. No opportunity to site the road minimize siting on the slope due to other site constraints
		NW 1.7	Preserve greenfields	Yes - at least 50% of the project area, being the existing road, is already developed	No - project is not on a designated brownfield		–	–	A	A	none	none	None	0	0	0	Although more than 50% of the project is located on an already developed area, it only makes sense to count the existing road as a grey area if serious planning consideration was given to new road alignments entirely within greenfields. This is not the case here, so no achievement is given or possible.
	Land & Water	NW 2.1	Manage stormwater				–	–	None	None	None	None	None	0	0	0	For the purposes of water quantity calculations the existing road needs to be considered a greyfield. Credit requires that water storage capacity be maintained in the greenfield and must be improved in the greyfield (existing road) by at least 30% for an Enhanced rating. No achievement given as no implementation of water quantity improvement. No water storage or infiltration LIDs were provided. As an overall improvement water storage and infiltration over pre-development conditions is not achieved no credit is given. A significant redesign would be required to achieve this high standard and given my experience with the resistance to implementing LIDs for roads, no low hanging fruit score is given.
		NW 2.2	Reduce pesticide and fertilizer impacts	Unclear -operational policies to control the application of fertilizers and pesticides were not part of the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - runoff controls to minimize groundwater and surface water contamination during the application of fertilizers and pesticides were not discussed in the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - as per Cosmetic Pesticides Ban Act, most pesticides are already banned in Ontario, but fertilizers can still be used	–	–	None	A to D	None	Superior	Superior	0	5	5	With the Cosmetic Pesticide Ban Act, most pesticides are banned in Ontario. Also, the project would have planted only native, non-invasive species that should reduce the need for fertilizer. With no documentation to support any achievement, the project is given a base of 0 but its possible they could have achieved a score of Superior with the right documentation. No low fruit achievement of conserving since an integrated pest management practice would require a whole new region wide program be developed.
		NW 2.3	Prevent surface and groundwater contamination	no - no groundwater quantity and quality monitoring systems used during or post-construction			–	–	None	None	None	None	None	0	0	0	No achievement given as no monitoring of groundwater quantity or quality during or post construction and no low hanging fruit as there is no compelling reason to undertake such monitoring for this project.
		NW 3.1	Preserve species biodiversity	No - no compensation for lost wetland habitat	Yes - improvements to wildlife connectivity across the road	No - no net increase in available habitat		–	none	none	none	none	None	0	0	0	With the loss of PSW habitat and no compensation for the loss, no credit can be given. As the project installed wildlife crossing structure and wildlife fencing where the road bisects the PSW, compensation for the lost wetland would allow achievement of Conserving. However, the wetland loss here is extensive and offsite compensation for wetlands is expensive and generally not supported by municipalities so no low fruit score given.

Biodiversity	NW 3.2	Control invasive species	Yes - only native non-invasive species proposed	Unlikely - no evidence of management plan for invasive species being developed	-	-	-	A	A	Superior	Superior	Superior	5	5	5	Achivement of Superior through planting of native non invasive species, but no discussion of invasive species in Environmental Impact Assessment report despite identifying some. No low hanging fruit since management of wetland invasives would require extending the area of impact far into the wetland beyond the road right of way
	NW 3.3	Restore disturbed soils	No - 100% of soils disturbed during construction have not been restored and reused properly on site	-	-	-	-	none	none	none	none	none	0	0	0	Project requires removal of large quantities of peat to facilitate road construction and there are no plans to re-use this material on site, so no achievement is given or possible.
	NW 3.4	Maintain wetland and surface water functions	No - removal of peat risks negatively impacting the subsurface hydraulic connection between wetland pockets	No - Paved area through wetland has doubled with no water quality controls	No - significant net wetland habitat loss	yes - the project restores sediment transportation between the wetland pockets through enlarged, functioning cross culverts	-	D	D	Improved	Improvcd	Enhanced	3	3	9	Only one ecosystem service, sediment transport, is maintained or enhanced for a score of Superior. The deep excavation of peat prevents achievement of maintaining the hydrologic cycle, and there were no feasible options for water quality control as ditches would eat further into the wetland and grades prevented the functioning of storm sewers, so no low hanging fruit.
													11	16	22	

Climate	Emission	CR 1.1	Reduce greenhouse gas emissions	No - no evidence of a life cycle carbon assessment having been undertaken, and this would not have been done regardless as its resouce intensive and not currently required by any agencies	-	-	-	-	None	None	None	None	None	0	0	0	No achievement without life cycle carbon assessment. A life cycle carbon analysis would require extensive resources and I have never heard of one being done for a municipal class EA. Its difficult to assess how likely it is I could have convinced a project team to have undertaken such an assessment, so I will assume a low fruit score of zero.
		CR 1.2	Reduce air pollutant emissions	No - no evidence in the EA or detailed design of an air quality analysis. Even if one were to be done a project that increases vehicular traffic won't meet the criterion objective of improving air quality	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no air quality analysis undertaken; no low fruit since its not realistic to reduce air pollution through a widened road.
	Resilience	CR 2.1	Assess climate threat	No - no evidence a climate impact assessment was undertaken, and it would not have been undertaken regardless as the discussion of incorporation of climate change into municipal class EAs only began in the fall of 2016 with the release of MOECC's Draft Guideline: <i>Consideration of Climate Change in Environmental Assessments in Ontario.</i>	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no climate impact assessments undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.2	Avoid traps and vulnerabilities	No - no evidence of identification and assessment of possible changes in key engineering design variables.	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no survey of future resource constraints and vulnerabilities undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.3	Prepare for long-term adaptability	No evidence that team researched long-term changes in operational or environmental conditions	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no plans and designs to prepare for long term climate change. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.

A3: Bramalea Road (Sandalwood Parkway to Mayfield Road)

			Criterion	Performance Metrics						Metrics Achieved		Achievement Level			Score			Summary Notes
				A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base	Upper	Low Fruit	
Quality of Life	Purpose	QL 1.1	Improve community quality of life	No - Although the ESR preferred solution aligns with and supports the Brampton Transportation and Transit Master Plan and Official Plan, there is no consideration of Provincial Policy and it does not align with Brampton Pathways Master Plan.	No - aligns with and supports the Brampton Transportation and Transit Master Plan and Official Plan. No consideration of Provincial Policy. Does not align with Brampton Pathways Master Plan.	Yes - impacts to local community have been identified and mitigated, where possible	No. Two PICs with summarized comments and responses, but no evidence of incorporation of input into design	No - no evidence of community endorsement	C	C	None	None	Superior	0	0	10	No achievement as the two standard PICs with no evidence of incorporation of comments do not suffice for meaningful engagement. Further effort to get out into the community to elicit comments and input would likely achieve Superior. Also needs to consider Provincial Policy and incorporate a multi-use off road pathway in support of the Pathways Master Plan.	
		QL 1.2	Stimulate sustainable growth and development	Unlikely - design, construction and operation supports existing jobs, but unlikely to meet test of <i>significant</i> number of new jobs	No - doesn't increase recreational capacity due to lack of multi use pathway	Yes - reduced congestion counts as improved community productivity as per Envision	No - Project does not improve community attractiveness	-	C	C	None	None	None	0	0	0	No achievement given or possible without the creation of a significant number of new jobs.	
		QL 1.3	Develop local skills and competencies	No - no commitments to local employment of needy or disadvantaged groups	-	-	-	-	none	none	none	none	none	0	0	0	My opinion is that a municipality would never and probably couldn't legally restrict a contractor to hiring local workers; the most that could probably be done is including a policy to look favourably in the tendering process of contractors with a policy of training and hiring needy or disadvantaged workers	
	Wellbeing	QL 2.1	Enhance public health and safety	No - no new sustainability technologies, materials or equipment identified so no opportunity to assess associated Health and Safety implications	-	-	-	none	none	none	none	Improved	0	0	2	No new sustainability technologies have been proposed, so there's no opportunity to assess associated Health and Safety implications; therefore no achievement is given. As other low fruit score may require the use of new sustainability technologies, there would be an associated opportunity to assess the associated Health and Safety implications so a conservative low fruit score of Improved is given.		
		QL 2.2	Minimize noise and vibration	No - no mitigation of noise in final design; only standard BMPs noted during construction and operation	-	-	-	A	A	Improved	Improved	Improved	1	1	1	Achievement of improved based on study of noise during construction and operation. No low hanging fruit since this would require much more detailed analysis and consultation to obtain resident's noise goals, and in this project the community is not engaged in the project		
		QL 2.3	Minimize light pollution	Likely - no evidence of assessment of lighting needs in available documentation, but TRCA's files are unlikely to have such documentation; some assessment likely done in detailed design	No- EA does not specify energy efficient lighting, and Google Streetview shows standard (non LED) light standards installed	Unlikely - no evidence of efforts to reduce light spillage and preserve night sky, but unlikely an explicit goal of the lighting design	-	-	A	A	None	None	enhanced	0	0	2	No base achievement as there's no evidence specific efforts were made to reduce lighting energy requirements. A low fruit score of Enhanced reflects a simple assessment of lighting needs, during and post-construction, installation of energy efficient light standards, and basic efforts to reduce light spillage.	
		QL 2.4	Improve community mobility and access	No - insufficient consideration of mobility during operation without a multi-use pathway or cycling lanes	Yes - consultation with Peel and Brampton transit and other stakeholders	No- design does not support active transportation through multi use paths	likely - plans to limit traffic disruption likely undertaken with contractor	No - access to public transportation maintained with final design, but no improvements to cycling facilities	None	B and D	None	None	Enhanced	0	0	4	No achievement given due to lack of cycling facilities, and limited improvements to transit facilities. Enhanced could be achieved with improved bus shelters, and cycling facilities.	
		QL 2.5	Encourage alternative modes of transportation	Yes - bus routes along Bramalea Road	Likely - no deliberate restriction of parking; however, no parking provided through urban cross section	No - doesn't support cycling	No - no cycling facilities	Uncertain - the project did not develop programs to encourage alternative transportation but the Region and local municipality have	A to D	A and B	Improved	Improved	Enhanced	1	1	3	Achievement of Improved based on buses operating on the road and parking restrictions. Low hanging fruit of Enhanced with addition of off road multi-use pathway.	
		QL 2.6	Improve site access, safety and wayfinding	No - no documentation of wayfinding signage considered at the EA or detailed design aside. No evidence of wayfinding on Google Streetview	-	-	-	None	none	None	None	none	0	0	0	No study of wayfinding and limited opportunity due to limited pedestrian, and cycling traffic		
	ty	QL 3.1	Preserve historic and cultural resources	Yes - stage 2 undertaken at detailed design	No - no cultural resources identified, so no opportunities to preserve	-	-	A	A	none	None	none	0	0	0	No achievement given or possible as no cultural resources identified, so no opportunities to preserve resources.		

	Communi	QL 3.2	Preserve views and local character Yes - determination of rural, but urbanizing character	No - no evidence in EA or detailed design materials of view plans or design guidelines developed		A	A	None	None	Improved	0	0	1	No public view plan was developed so no credit can be given; as the area is developing the only areas relevant for a viewshed may be the three watercourse crossings; a basic viewshed plan would achieve improved.
		QL 3.3	Enhance public space No - project does not add to public space	-	-	-	none	none	none	none	none	0	0	0

Leadership		Collaboration										Management		Planning					
		LD 1.1	LD 1.2	LD 1.3	LD 1.4	LD 2.1	LD 2.2	LD 3.1	LD 3.2	LD 3.3									
		Provide effective leadership and commitment	Yes - General statements can be found in the Brampton Go Green Master Plan with some basic ongoing metrics, sustainability framework in the Official Plan, limited consideration in the Transportation Master Plan	-	-	-	-	-	-	-									General statements can be found in the Brampton Go Green Master Plan with some basic ongoing metrics, sustainability framework in the Official Plan, limited consideration in the Transportation Master Plan. No low hanging fruit since it will be a challenge for the project team to have initiated annual sustainability reporting by Brampton.
		Establish a sustainability management system	Unlikely -project did not specifically address sustainability based on documentation so its unlikely anyone on the project team was responsible for sustainability issues	Unlikely - project did not specifically address sustainability based on documentation so its unlikely anyone on the project team was responsible for sustainability issues	Unlikely -project did not specifically address sustainability based on documentation so its unlikely anyone on the project team was responsible for sustainability issues	no - based upon ESR the project did not set sustainability goals and targets													Although it can't be confirmed that no specific person was given the responsibility of sustainability, it is unlikely as sustainability is not addressed in the ESR, and its irrelevant because a project must meet criterion A through E for all levels of achievement. Meeting criterion A through E would require an extensive commitment to sustainability within the project team through various business sustainability processes, and given that sustainability as a concept is not considered in EAs for road projects in the GTA in my experience, such commitment is not considered low hanging fruit. No ESRs in any ESRs reviewed for this thesis even used the term sustainability except in reference to the title of another document.
		Foster collaboration and teamwork	Yes - project team likely incorporated collaboration, teamwork and whole systems design to some degree	No - not likely meaningful risk and reward sharing between consultant and owner	-	-	-	-	-										The project documentation does not mention sustainability, however aspects of sustainable design are found. However, the incorporation of results of the Pedestrian and Cycling Master Plan and the Transportation Master Plan shows some degree of systems view. Low fruit is to more fully achieve Enhanced.
		Provide for stakeholder involvement	Yes - to some extent stakeholders ID and key concerns addressed	Yes - extensive consultation with TRCA, but sporadic, minimal outreach to other stakeholders	Yes - stakeholder input considered, but limited incorporation into design; i.e. most TRCA comments on Draft ESR dismissed.	No specific stakeholder participation and commication program evident in EA													Stakeholders consultation was sporadic, and public consultation was negligible with comments received but no input incorporated. An achievement of Improved is given. Enhanced would require broader consultation with stakeholders and the public and incorporation of input into the design.
		Pursue by-product synergy opportunities	no - no documentation of efforts to search for unwanted byproduct of nearby facilities & very unlikely to have occurred			-	-												No assessment of unwanted byproducts of nearby facilities. Therefore no achievement. Not likely relevant to road constuction so no low hanging fruit
		Improve infrastructure integration	No evidence project team sought to improve sustainability through project wide systems integtation			-	-												No evidence that project team sought to improve project sustainability through project wide systems integration;
		Plan for long-term monitoring and maintenance	no - no documentation of plan for long-term monitoring			-	-												2 year monitoring of infrastructure is standard and likely to have occurred, but only periodic monitoring of the culverts beyond 2 years is standard, so no credit given. Adding monitoring of the watercourse for an additional 3-5 years should be achievable and would earn Enhanced.
		Address conflicting regulations and policies	No - no documentation of assessment of conflicting regulations and policies			-	-												No achievement since no documentation of assessment of conflicting regulations and policies and no evidence of sustainability objectives. Low hanging fruit of Improved through basic assessment of regulations and associated regulators and organizations and connection to sustainability objectives.
		Extend useful life	yes - high likelihood of some consideration of durability, flexibility and resilience of project	No - no documentation of consideration of expansion or future reconfiguration of project, but may have occurred		-	-												Likely achieved Improved by considering to some degree the flexibility, durability and resilience of road, culverts and new channel. Achieving Enhanced requires documentation of consideration of future expansion or reconfiguration which is given a low hanging fruit score.

		RA 1.1	Reduce net embodied energy	No - no documentation of an LCA		-	-	-	-		none	none	none	none	None	0	0	0	No documentation of an LCA and reasonable assumption one was never done as I have never heard of one occuring in my career for a municipal EA; a LCA is very resource intensive so its not considered low hanging fruit.
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Ener	RA 2.3	Commission and monitor energy systems	Unclear - although a sub-contractor would have installed and tested the light standards, and the municipality may have done its own check, its unclear either counts as an "independent commissioning" for the purposes of this criterion	Yes - the municipality would have sufficiently trained persons maintaining the light standards	Unclear - the Region would likely monitors the energy consumption of its lights but I don't have easy access to the information required to determine if this would constitute the advanced monitoring systems this criterion requires	-	-	-	B	A to C	None	Enhanced	Enhanced	0	3	3	There is no documentation in the files review for the EA or detailed design related to how the lighting systems would be commissioned, but such information isn't expected to sent to TRCA anyways. I don't have sufficient knowledge of standard practices in how municipalities commission and monitor lighting standards to properly assess this credit. The likely range of scores is too low to justify the effort required to more confidently score this credit. So a conservative range of none to Enhanced is given. The next achievement jumps to conserving and requires extensive commissioning and monitoring of systems and as Conservative for any credit is intended to be far beyond current standards of practice, I've assumed its not low hanging fruit.	
	Water	RA 3.1	Protect fresh water availability	No -although the EA assessed dewatering requirements for construction it was not from the perspective of assessing water availability to support water use so things like recharge weren't considered.	No - although there is no documentation of assessment water taking requirements beyond construction, it wouldn't have been done for long -term impacts as the project doesn't require water takings during operation	-	-		None	None	None	None	None	0	0	0	No level of achievement. The project only assessed groundwater conditions for the purposes of assessing dewatering needs during construction which does not meet many of the requirements of a water availability assessment (criterion A). The project will not require water takings during operation (criterion B). Therefore no achievemetrn is given. No low fruit score is given since an analysis of groundwater and surface water from the perspective of availability is not relevant to this project.	
		RA 3.2	Reduce potable water consumption	No - no documentation of identification of strategies to reduce potable water consumption during operation and maintenance			-	-		None	None	None	None	None	0	0	0	No level of achievement given as there is no evidence of a potable water reduction strategy and it can be assumed one wasn't done regardless as roads use little potable water generally during operation and maintenance. For roads, the only opportunity is the use of drought resistant plants in planted medians or boulevards to which stormwater is directed to eliminate the need to water plants with potable water; as such a redesign could be significant and I've assumed significant redesigns are no low hanging fruit, no low hanging fruit score given.
		RA 3.3	Monitor water systems	NA			-	-	-									Not applicable since project does not involve potable water systems in its operation that could be monitored. This criterion would apply if there was an associated watermain.
7																		

Siting	NW 1.1	Preserve prime habitat	No - One tributary is managed for the endangered specied Redside Dace (present downstream) and for sensitive cold water species such as Brook Trout	No - no achievement since road expands across habitat	-	-	-		None	None	None	None	None	0	0	0	Redside Dace was uplisted to endangered after the ESR was file but before detailed design was undertaken. It is assumed that Redside Dace is sufficient to categorize the one watercourse as prime habitat. As the preferred design extends a culvert over this prime habitat, no achievement is given or possible.
	NW 1.2	Protect wetlands and surface water	No - project widening occurs within specified distance to a watercourse.		-	-	-		None	None	None	None	None	0	0	0	No achievement given or possible as the site realigns a watercourse.
	NW 1.3	Preserve prime farmland	No - site not assessed for prime farmland	No - Prime farmland not protected	-	-	-		None	None	None	None	None	0	0	0	No achivement given as the project expands the road west onto farmland; however the farmland is already slated for residential development making this credit irrelevant.
	NW 1.4	Avoid adverse geology	NA	NA	NA	-	-		NA	NA	NA	NA	NA				Credit excluded as not generally relevant for the region, with the exception of projects on the Niagara Escarpment.
	NW 1.5	Preserve floodplain function	Yes - The culverts will be sized to convey the regional storm	Yes - pre-development infiltration and water quality maintained by upsized culvert structures that convey the regional flood and keep the road out of the floodplain	Yes - project enhances riparian vegetation through natural channel design enhancements	Yes - a flood emergency plan would not have been prepared for the project, but will be for the local municipality	Yes - project enhances habitat connectivity and sediment transport	Yes - existing culverts in floodplain to be replaced	A to F	A to F	Conserving	Conserving	Conserving	14	14	14	Top score of Conserving achieved.
	NW 1.6	Avoid unsuitable development on steep slopes	Yes - project follows best management practices as informed by geotechnical investigations at the EA and detailed design for cultert designs crossing valleys	No - the alignment chosen did not consider slope hazard constraints	-	-	-		A	A	Improved	Improved	Improved	1	1	1	Only achievement of improved is given or possible as site does not contain hazard slopes.
	NW 1.7	Preserve greenfields	Yes - at least 50% of the project area, being the existing road, is already developed	No - project is not on a designated brownfield	-	-	-		A	A	none	none	None	0	0	0	Although more than 50% of the project is located on an already developed area, it only makes sense to count the existing road as a grey area if serious planning consideration was given to new road alignments entirely within greenfields. This is not the case here, so no acheivement is given or possible.

Natural World																						
Land & Water		NW 2.1	Manage stormwater	-		-		-		-								For the purposes of water quantity calculations the existing road needs to be considered a greyfield. Credit requires that water storage capacity be maintained in the greenfield and must be improved in the greyfield (existing road) by at least 30% for an Enhanced rating. No achievement given as no implementation of water quantity improvement. LIDs to improve water quantity were considered and dismissed in the EA; as an overall improvement water storage and infiltration over pre-development conditions is not achieved no credit is given. A significant redesign would be required to achieve this high standard and given my experience with the resistance to implementing LIDs for roads, no low hanging fruit score is given.				
		NW 2.2	Reduce pesticide and fertilizer impacts	Unclear -operational policies to control the application of fertilizers and pesticides were not part of the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - runoff controls to minimize groundwater and surface water contamination during the application of fertilizers and pesticides were not discussed in the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - as per Cosmetic Pesticides Ban Act, most pesticides are already banned in Ontario, but fertilizers can still be used	Unclear - no consideration was given in the EA or detailed design documentation to plants that minimize the need for fertilizers and no discussion of integrated pest management, but these may have been considered by the contractor.	-		-								With the Cosmetic Pesticide Ban Act, most pesticides are banned in Ontario. Also, the project would have planted only native, non-invasive species that should reduce the need for fertilizer. With no documentation to support any achievement, the project is given a base of 0 but its possible they could have achieved a score of Superior with the right documentation. No low fruit achievement of conserving since an integrated pest management practice would require a whole new region wide program be developed.				
		NW 2.3	Prevent surface and groundwater contamination	no - no groundwater quantity and quality monitoring systems used during or post-construction				-		-								No achievement given as no monitoring of groundwater quantity or quality during or post construction and no low hanging fruit as there is no compelling reason to undertake such monitoring for this project.				
Biodiversity		NW 3.1	Preserve species biodiversity	yes - project compensates for losses	Yes -project facilitates movement across road at watercourseS	yes - project increases available habitat and connectivity	-		-		-		A to C	A to C	Restorative	Restorative	Restorative	16	16	16		
		NW 3.2	Control invasive species	Yes - only native non-invasive species proposed	No - no management plan for invasive species		-		-		-		A	A	Superior	Superior	Superior	5	5	5	Achievement of Superior given for planting of native species. No further achievement possible due to lack of identified invasive species of concern to control.	
		NW 3.3	Restore disturbed soils	Unlikely - No evidence that 100% of soils disturbed during construction have been restored and reused properly		-		-		-		-		None	None	None	None	None	0	0	0	No achievement since no evidence that 100% of soils disturbed during construction have been restored and reused. My experience is that there is strong push back in industry against soil restoration, especially regarding compaction, so no low fruit score is given.
		NW 3.4	Maintain wetland and surface water functions	Yes - new channel designed by geomorphologist will maintain hydrologic connection to floodplain	No - only OGS proposed so no improvement of water quality outside of TSS	yes - enhances habitat	yes - maintains sediment transport	No - all disturbed functions were not restored		-		A, C, D		A, C, D	Superior	Superior	Superior	9	9	9	Only achievement of Superior is given. No low hanging fruit since further achievement would require water quality improvements which would require LIDS, which face stiff resistance in the industry.	
45																		50	50			
Emission		CR 1.1	Reduce greenhouse gas emissions	No - no evidence of a life cycle carbon assessment having been undertaken, and this would not have been done regardless as its resouce intensive and not currently required by any agencies		-		-		-		-		None	None	None	None	None	0	0	0	No achievement without life cycle carbon assessment. A life cycle carbon analysis would require extensive resources and I have never heard of one being done for a municipal class EA. Its difficult to assess how likely it is I could have convinced a project team to have undertaken such an assessment, so I will assume a low fruit score of zero.
		CR 1.2	Reduce air pollutant emissions	No - no evidence in the EA or detailed design of an air quality analysis. Even if one were to be done a project that increases vehicular traffic won't meet the criterion objective of improving air quality		-		-		-		-		None	None	None	None	None	0	0	0	No achievement since no air quality analysis undertaken; no low fruit since its not realistic to reduce air pollution through a widened road.
Climate		CR 2.1	Assess climate threat	No - no evidence a climate impact assessment was undertaken, and it would not have been undertaken regardless as the discussion of incorporation of climate change into municipal class EAs only began in the fall of 2016 with the release of MOECC's Draft Guideline: <i>Consideration of Climate Change in Environmental Assessments in Ontario</i> .		-		-		-		-		None	None	None	None	None	0	0	0	No achievement since no climate impact assessments undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.2	Avoid traps and vulnerabilities	No - no evidence of identification and assessment of possible changes in key engineering design variables.		-		-		-		-		None	None	None	None	None	0	0	0	No achievement since no survey of future resource constraints and vulnerabilities undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.

Resiliency															
CR 2.3	Prepare for long-term adaptability	No evidence that team researched long-term changes in operational or environmental conditions	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no plans and designs to prepare for long term climate change. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
	CR 2.4	Prepare for short-term hazards	No evidence that team researched short - term hazards and how they may change over the life time of the project	-	-	-	None	None	None	None	None	0	0	0	No achievement since no analysis of short term hazards. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
	CR 2.5	Manage heat island effects	No - project does not meet heat island requirements	-	-	-	-	None	None	None	None	None	0	0	0
												0	0	0	
												61	77	129	
Possible Total Score												793	7.69%	9.71%	16.27%
Award												None	None	None	

A4: The Gore Road (Queen Street East to Highway 50)

			Performance Metrics						Metrics Achieved		Achievement Level			Score				
			Criterion	A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base	Upper		Low Fruit
Quality of Life	Purpose	QL 1.1	Improve community quality of life	Likely - I assume that test of considering community needs goals and issues is satisfied by aligning project with ROP & TMP, local OP and TMP; sidewalk need ID in Brampton Pathways Master Plan; need for transit from Brampton AcceleRide BRT strategic implementation plan; 2 PICs with summary comment table - no table of how each addressed. Also looked at West Vaughan IEA and other 427 extension studies nearby;	Likely - project aligns the EA purpose with the Regional Official Plan and Transportation Master Plan	Yes- the EA process sought to identify and address potential impacts to the local community	Unlikely - its unlikely the standard 2 PIC meetings with info boards will suffice as meaningful engagement. ESR does not contain a table of public comments and responses which could have otherwise provided the public was engaged to some degree of meaningful	Unlikely - there is no evidence of endorsement by community	A to C	A to C	None	None		Superior	0	0	10	addressed capacity, multi use pathway, bus stop for rapid transit, sight lines at Manswood; no achievement given because there's no evidence to support that the local community was meaningfully engaged (criterion D). Achievemement of D requires communities be "meaningfully engaged" in the project. Superier requires D and that all negative impacts on the nearby community be reduced or eliminated. With evidence that some community input was incorporated into the design, then with a clear summary chart of impacts and actions in support and some further engagement achievement of D and Superior are possible.
		QL 1.2	Stimulate sustainable growth and development	Unlikely - design, construction and operation supports existing jobs, but unlikely to meet test of <i>significant</i> number of new jobs	Yes - project increases recreational capacity through new bike lanes	Yes - reduced congestion counts as improved community productivity as per Envision	Unlikely - The project does not clearly improve community attractiveness	-	B, C	B, C	None	None		None	0	0	0	No achievement given or possible without the creation of a significant number of new jobs during design, construction and operation.
		QL 1.3	Develop local skills and competencies	No - no commitments to local employment of needy or disadvantaged groups	-	-	-	-	none	none	none	none		none	0	0	0	My opinion is that a municipality would never and probably couldn not legally restrict a contractor to hiring local workers; the most that could probably be done is including a policy to look favourably in the tendering process of contractors with a policy of training and hiring needy or disadvantaged workers
	Wellbeing	QL 2.1	Enhance public health and safety	No - no new sustainability technologies, materials or equipment identified so no opportunity to assess associated Health and Safety implications	-	-	-	none	none	none	none		Improved	0	0	2	No new sustainability technologies have been proposed, so there's no opportunity to assess associated Health and Safety implications; therefore no achievement is given. As other low fruit score may require the use of new sustainability technologies, there would be an associated opportunity to assess the associated Health and Safey implications so a conservative low fruit score of Improved is given.	
		QL 2.2	Minimize noise and vibration	No - noise study undertaken, but only covers operation, not construction	No - no mitigation proposed	-	-	-	None	None	None	none		Improved	0	0	1	Undertook noise analysis but no mitigation proposed since increase below MOE threshold. However, did not study construction noise, so no achievement. Low hanging fruit of improved by expanding baseline study to construction noise.
		QL 2.3	Minimize light pollution	Likely - no evidence of assessment of lighting needs in available documentation, but TRCA's files are unlikely to have such documentation; some assessment likely done in detailed design	Uncertain - no evidence of analysis of efforts to reduce light energy requirements, but may have been done at detailed design.	Unlikely - no evidence of efforts to reduce light spillage and preserve night sky, but unlikely an explicit goal of the lighting design	-	-	A	A and B	None	Improved		enhanced	0	1	2	No base achievement as there's no evidence specific efforts were made to reduce lighting energy requirements; an upper score of improved reflects the uncertainty in assessing credit B. A low fruit score of Enhanced reflects a simple assessment of lighting needs, during and post-construction, installation of energy efficient light standards, and basic efforts to reduce light spillage.
		QL 2.4	Improve community mobility and access	Yes - safe to assume study of access and mobility would have been undertaken with Consultant and or contractor during detailed design	yes -limited coordinated with local businesses and residents	Yes - design supports active transportation through bike lanes and sidewalks and access to transit	likely - plans to limit traffic disruption likely undertaken with contractor	Yes - project designed to decrease congestion and improve access to alternate modes of transportation	A to E	A to F	Improved	Improved		Enhanced	1	1	4	Level of improved given due to evidence of only limited coordination with owners and operators of adjacent facilities. Enhanced level would need project specific, purposeful coordination with owners of adjacent facilities so is given as low hanging fruit.
		QL 2.5	Encourage alternative modes of transportation	Yes - road provides pedestrain and cycling access to new Rapidway bus stop at Queen Street	Yes - urban cross section limits parking of cars	Yes - support active transportation through bike lanes and sidewalk along the Gore	Yes - support active transportation through bike lanes and sidewalk along the Gore	Uncertain - the project did not develop programs to encourage alternative transportation but the Region and local municipality have	A to D	A to E	Enhanced	Enhanced		enhanced	3	3	3	Achievement of Enhanced based upon buses along Queen Street providing access to multi modal transit facilities, the restriction of parking, and support for cycling connected to a cycling network. An achievement of Superior requires secure bicycle lockers at the transit stops, which would be a tough sell for their expense relative to the bus stop use.
		QL 2.6	Improve site access, safety and wayfinding	No - no documentation of wayfinding signage considered at the EA or detailed design aside from identification of former homestead at relocated gate posts	unclear - reduced flood overtopping of Regional Storm to allow safe access for emergency personel is sufficient to	Yes - project provides accessibility and signage for adjacent former homestead site	-	-	B	A and B	None	Enhanced - wayfinding pedestrian signage is low hanging fruit that may have been done or could easily be done.		Conserving	0	3	12	No base achievement since no evidence of signage that makes it intuite to navigate site; however, it is possible that such signage has been installed so an upper rating of 3 was applied. A low fruit of Conserving was applied as there is ample opportunity to design the wayfinding to integrate with the local environmental and cultural resources.
		QL 3.1	Preserve historic and cultural resources	yes - phase 1 and 2 arch. Assessment;	yes - commitment to relocate and ID with signage gate posts of former homestead	yes - as per phase 1 assessments gate posts to be saved; rest of site cleared of further arch. Concern; cemetary avoided	yes - ornamental plantings that reflect heritage of former homestead	-	-	D	D	Restorative	Restorative	Restorative	16	16	16	existing resources (posts) were made visible and combined with hertiage plantings and signage at the location of former laneway to explain story of former homestead for pedestrians, cyclists

Community	QL 3.2	Preserve views and local character	yes - determination of importance of former farmstead and use of native plantings in creek realignment	No - no evidence of developing or adopting public view plans or design guidelines	No - final design may preserve local views and character, but no clear documentation to support	Yes - proponents worked with TRCA re: landscaping at watercourse and former farmstead	yes - preservation of Bur Oak, ESCs to limit impacts to watercourse and vegetation	no - no restoration of community character	A		none	None	Conserving	0	0	6	For this project clearly achieving the level of conserving constitutes low hanging fruit that could have been achieved with an analysis of viewscales and clear, documented consultation with local residents on viewscales and local character that would also support the low hanging fruit achievement of QL2.6. In this case a public view plan is explicitly required to even achieve the lowest level of improved, so no achievement for base or upper is given.
	QL 3.3	Enhance public space	yes - project improves cultural heritage recognition of former farmstead on adjacent public property	yes - local CA satisfied with moving significant farmgate posts, signage, natural channel design and landscaping	no - efforts are mitigation, not net restoration		-	-	A & B	A & B	Improved	improved	Improved	1	1	1	Credit applies as project adjacent to Clairville Conservation Area. Improved achieved due to accomodation of fence post resource and no long-term adverse effects. Enhanced not achieved since emphasis on mitigation of impacts, not avoidance, and no consideration of new public spaces. No low haning fruit given since achievement of Enhanced requires avoidance of impacts to resources which would require a complete redesign of the project.
															21	25	57

Leadership	Collaboration	LD 1.1	Provide effective leadership and commitment	-	-	-	-	-	A	A	Enhanced	Enhanced	Enhanced	4	4	4	Enhanced achieved due to integrated sustainability policies in Regional Official Plan and support by Peel Region for various sustainability projects. Superior not achieved due to lack of annual sustainability reporting by Peel Region. No low hanging fruit since it will be a challenge for the project team to have initiated annual sustainability reporting by Peel Region.
		LD 1.2	Establish a sustainability management system	Unlikely -project did not specifically address sustainability based on documentation so its unlikely a responsible for sustainability issues	Unlikely - project did not specifically address sustainability based on documentation so its unlikely a management policy was created for the project	no - based upon ESR the project did not set sustainability goals and targets			none	A	None	None	None	0	0	0	Although it can't be confirmed that no specific person was given the responsibility of sustainability, it is unlikely as sustainability is not addressed in the ESR, and its irrelevant because a project must meet criterion A through E for all levels of achievement. Meeting criterion A through E would require an extensive commitment to sustainability within the project team through various business sustainability processes, and given that sustainability as a concept is not considered in EAs for road projects in the GTA in my experience, such commitment is not considered low hanging fruit. No ESRs in any ESRs reviewed for this thesis even used the term sustainability except in reference to the title of another document.
		LD 1.3	Foster collaboration and teamwork	Yes - project team likely incorporated collaboration, teamwork and whole systems design to some degree	-	-	-	-	A	A	Enhanced	Enhanced	Enhanced	4	4	4	The project achieved at most an enhanced level as superior requires design charrettes with stakeholders that did not occur.
		LD 1.4	Provide for stakeholder involvement	Yes - to some extent stakeholders ID and key concerns addressed	Yes - PICs with local residents held, and meetings with other stakeholders held (TRCA)	Yes - to some extent stakeholder input incorporated into plans	likely - safe assumption that some type of stakeholding participation and communications program established		A to D	A to D	Enhanced	Enhanced	Enhanced	5	5	5	Difficult to assess degree of stakeholder impact on project due to lack of summary chart summarizing comments from stakeholders and responses to comments; It is likely that an enhanced level would be achieved due to standard PIC engagement and project management principles. Superior not achieved due to lack of clear documentation proving the public had meaningful input.
	Management	LD 2.1	Pursue by-product synergy opportunities	no - no documentation of efforts to search for unwanted byproduct of nearby facilities & very unlikely to have occurred			-	-	none	none	none	none	None	0	0	0	No assessment of unwanted byproducts of nearby facilities. Therefore no achievement. Not likely relevant to road constuction so no low hanging fruit
		LD 2.2	Improve infrastructure integration	No evidence project team sought to improve sustainability through project wide systems integtation		-	-	-	none	none	none	none	None	0	0	0	No evidence that project team sought to improve project sustainability through project wide systems integration;
	Planning	LD 3.1	Plan for long-term monitoring and maintenance	no - no documentation of plan for long-term monitoring	-	-	-	-	none	none	none	none	Enhanced	0	0	0	2 year monitoring of infrastructure is standard and likely to have occurred, but only monitoring of the bridges beyond 2 years is standard, so no credit given. Adding monitoring of the channel for an additional 3-5 years should be achievable and would earn Enhanced.
		LD 3.2	Address conflicting regulations and policies	No - no documentation of assessment of conflicting regulations and policies	-	-	-	-	none	A	none	None	Improved	0	0	1	No achievement since no documentation of assessment of conflicting regulations and policies and no evidence of sustainability objectives. Low hanging fruit of Improved through basic assessment of regulations and associated regulators and organizations and connection to sustainability objectives.

	Energy	RA 2.2	Use renewable energy	No - the vast majority of energy used in the operation and maintenance of the road will be fossil fuels for vehicles with a relatively smaller amount for the nuclear and natural gas for the light standards	-	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since the vast majority of energy used in the operation and maintenance of the road will be fossil fuels. A very significant shift to electric vehicles would be required because Ontario's dominant Nuclear power is not a renewable resource as per Envision.
		RA 2.3	Commission and monitor energy systems	Unclear - although a sub-contractor would have installed and tested the light standards, and the municipality may have done its own check, its unclear either counts as an "independent commissioning" for the purposes of this criterion	Yes - the municipality would have sufficiently trained persons maintaining the light standards	Unclear - the Region would likely monitors the energy consumption of its lights but I don't have easy access to the information required to determine if this would constitute the advanced monitoring systems this criterion requires	-	-	-	B	A to C	None	Enhanced	Enhanced	0	3	3	There is no documentation in the files review for the EA or detailed design related to how the lighting systems would be commissioned, but such information isn't expected to sent to TRCA anyways. I don't have sufficient knowledge of standard practices in how municipalities commission and monitor lighting standards to properly assess this credit. The likely range of scores is too low to justify the effort required to more confidently score this credit. So a conservative range of none to Enhanced is given. The next achievement jumps to conserving and requires extensive commissioning and monitoring of systems and as Conservative for any credit is intended to be far beyond current standards of practice, I've assumed its not low hanging fruit.
	Water	RA 3.1	Protect fresh water availability	No -although the EA assessed dewatering requirements for construction it was not from the perspective of assessing water availability to support water use so things like recharge weren't considered.	No - although there is no documentation of assessment water taking requirements beyond construction, it wouldn't have been done for long -term impacts as the project doesn't require water takings during operation	-	-	-	-	None	None	None	None	None	0	0	0	No level of achievement. The project only assessed groundwater conditions for the purposes of assessing dewatering needs during construction which does not meet many of the requirements of a water availability assessment (criterion A). The project will not require water takings during operation (criterion B). Therefore no achievemetrn is given. No low fruit score is given since an analysis of groundwater and surface water from the perspective of availability is not relevant to this project.
		RA 3.2	Reduce potable water consumption	No - no documentation of identification of strategies to reduce potable water consumption during operation and maintenance		-	-	-	-	None	None	None	None	None	0	0	0	No level of achievement given as there is no evidence of a potable water reduction strategy and it can be assumed one wasn't done regardless as roads use little potable water generally during operation and maintenance. For roads, the only opportunity is the use of drought resistant plants in planted medians or boulevards to which stormwater is directed to eliminate the need to water plants with potable water; as such a redesign could be significant and I've assumed significant redesigns are no low hanging fruit, no low hanging fruit score given.
		RA 3.3	Monitor water systems	NA		-	-	-	-									Not applicable since project does not involve potable water systems in its operation that could be monitored. This criterion would apply if there was an associated watermain.
																7	18	42

	Siting	NW 1.1	Preserve prime habitat	No - project does not avoid prime habitat	-	-	-	-	-	none	none	none	none	None	0	0	0	criterion applicable due to presence of regionally rare and L-Ranked species; No achievement since project developed in prime habitat. Avoiding habitat not low fruit since it would require major redesign and could limit number of lanes.
		NW 1.2	Protect wetlands and surface water	No - project widens road within specified distance of watercourse	-	-	-	-	-	None	None	None	None	None	0	0	0	No achievement given or possible since the project widens the road within the specified distance to a watercourse.
		NW 1.3	Preserve prime farmland	No - no evidence that project team assessed prime farmland	-	-	-	-	-	None	None	None	None	None	0	0	0	Adjacent conservation lands are classified as class 1 soils. Road expands into prime farmland so no achievement. Avoiding expansion into prime farmland would require major redesign so no low hanging fruit
		NW 1.4	Avoid adverse geology	NA	-	-	-	-	-	NA	NA	NA	NA	NA				earthquake faultlines, low lying coastal areas and Karst formations are not relevant concerns in our jurisdiction, generally, so the credit is excluded
		NW 1.5	Preserve floodplain function	Yes - project is water dependant infrastructure that is designed to improve floodplain function.	No - Floodplain infiltration is inhibited by increased impervious area within the floodplain	Yes - riparian habitat enhancements within floodplain	Yes - a flood emergency plan would not have been prepared for the project, but will be for the local municipality	Yes - existing bridges being replaced with larger structures that convey design flood		A, C to F	A, C to F	None	None	Improved	0	0	2	No achievement since test for improved strictly requires no increase in flood elevations - elevations increase 7cm in one area. Highest criterion of Conserving could likely have been achieved if project did not increase flood elevations and did not increase impervious area within floodplain due to improvements in riparian and in-stream habitat, and water quality, and removal of undersized culverts causing backwater during design flood. Low hanging fruit of Improved for increasing conveyance to avoid 7cm increase in one location.

Natural World	Land & Water	NW 1.6	Avoid unsuitable development on steep slopes	Yes - project likely follows BMPs for slopes as informed by geotechnical investigations	No - road was not sited based on slope concerns	-	-	-	A	A	Improved	Improved	Improved	1	1	1	Achievement of Improved. Project follows BMPs for sections that parallel a slope. No opportunity to site the road minimize siting on the slope due to other site constraints	
		NW 1.7	Preserve greenfields	Yes - at least 50% of the project area, being the existing road, is already developed	No - project is not on a designated brownfield	-	-	-	A	A	none	none	None	0	0	0	Although more than 50% of the project is located on an already developed area, it only makes sense to count the existing road as a grey area if serious planning consideration was given to new road alignments entirely within greenfields. This is not the case here, so no acheivement is given or possible.	
		NW 2.1	Manage stormwater	No - no net improvement of water storage, and infiltration is achieved.	-	-	-	-	None	None	None	None	None	0	0	0	For the purposes of water quantity calculations the existing road needs to be considered a greyfield. Credit requires that water storage capacity be maintained in the greenfield and must be improved in the greyfield (existing road) by at least 30% for an Enhanced rating. No achievement given as no implementation of water quantity improvement. No water storage or infiltration LIDs were provided. As an overall improvement water storage and infiltration over pre-development conditions is not achieved no credit is given. A significant redesign would be required to achieve this high standard and given my experience with the resistance to implementing LIDs for roads, no low hanging fruit score is given.	
	NW 2.2	Reduce pesticide and fertilizer impacts	Unclear -operational policies to control the application of fertilizers and pesticides were not part of the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - runoff controls to minimize groundwater and surface water contamination during the application of fertilizers and pesticides were not discussed in the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - as per Cosmetic Pesticides Ban Act, most pesticides are already banned in Ontario, but fertilizers can still be used	Unclear - no consideration was given in the EA or detailed design documentation to plants that minimize the need for fertilizers and no discussion of integrated pest management, but these may have been considered by the contractor.	-	-	None	A to D	None	Superior	Superior	0	5	5	With the Cosmetic Pesticide Ban Act, most pesticides are banned in Ontario. Also, the project would have planted only native, non-invasive species that should reduce the need for fertilizer. With no documentation to support any achivement, the project is given a base of 0 but its possible they could have achieved a score of Superior with the right documentation. No low fruit achievement of conserving since an integrated pest management practice would require a whole new region wide program be developed.	
	NW 2.3	Prevent surface and groundwater contamination	no - no groundwater quantity and quality monitoring systems used during or post-construction	-	-	-	None	None	None	None	None	None	0	0	0	No achievement given as no monitoring of groundwater quantity or quality during or post construction and no low hanging fruit as there is no compelling reason to undertake such monitoring for this project.		
	Biodiversity	NW 3.1	Preserve species biodiversity	Yes - development mitigates impacts of development	Yes - facilitates wildlife movement	No - project increases habitat connectivity but not total available habitat	-	-	-	A, B	A, B	Conserving	Conserving	Restorative	13	13	16	Conserving level is achieved through improved wildlife connectivity under two road bridges, natural channel design, improved in-stream habitat and increased stream length compensate for stream relocation with compensation plantings of native, non-invasive species. A low fruit achievement of Restorative is likely with some off site compensation in adjacent conservation lands.
		NW 3.2	Control invasive species	Yes - only native, non-invasive species used	Unlikely - no evidence of a multi year invasive species management plan being contemplated during the EA or detailed design.	-	-	-	A	A	Superior	Superior	Superior	5	5	5	No achievement since no evidence of multi year invasive species management plan. Not low hanging fruit since multi year invasive species management plan would require creation of new region wide program; due to the extensive spread of invasive species in Ontario, only a Region wide program makes sense.	
		NW 3.3	Restore disturbed soils	Unlikely - No evidence that 100% of soils disturbed during construction have been restored and reused properly	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no evidence that 100% of soils disturbed during construction have been restored and reused. My experience is that there is strong push back in industry against soil restoration, especially regarding compaction, so no low fruit score is given.	
		NW 3.4	Maintain wetland and surface water functions	Yes - hydrologic connection maintained	Yes - water quality improved with 80% TSS removal of all surface runoff	Yes - riparian and aquatic habitat improvements with natural channel design	Yes - sediment transport maintained with no in stream barriers and natural channel design	Yes - water quality enhanced, habitat enhanced	-	A to E	A to E	Restorative	Restorative	Restorative	19	19	19	Restorative achieved with maintenance of 2 ecosystem functions and enhancements to 2 ecosystem functions.
																38	43	48
mission	CR 1.1	Reduce greenhouse gas emissions	No - no evidence of a life cycle carbon assessment having been undertaken, and this would not have been done regardless as its resouce intensive and not currently required by any agencies	-	-	-	-	None	None	None	None	None	None	0	0	0	No achievement without life cycle carbon assessment. A life cycle carbon analysis would require extensive resources and I have never heard of one being done for a municipal class EA. Its difficult to assess how likely it is I could have convinced a project team to have undertaken such an assessment, so I will assume a low fruit score of zero.	

Climate	E	CR 1.2	Reduce air pollutant emissions	No - no evidence in the EA or detailed design of an air quality analysis. Even if one were to be done a project that increases vehicular traffic won't meet the criterion objective of improving air quality	-	-	-	None	None	None	None	None	0	0	0	No achievement since no air quality analysis undertaken; no low fruit since its not realistic to reduce air pollution through a widened road.
	Resilience	CR 2.1	Assess climate threat	No - no evidence a climate impact assessment was undertaken, and it would not have been undertaken regardless as the discussion of incorporation of climate change into municipal class EAs only began in the fall of 2016 with the release of MOECC's Draft Guideline: <i>Consideration of Climate Change in Environmental Assessments in Ontario.</i>	-	-	-	None	None	None	None	None	0	0	0	No achievement since no climate impact assessments undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.2	Avoid traps and vulnerabilities	No - no evidence of identification and assessment of possible changes in key engineering design variables.	-	-	-	None	None	None	None	None	0	0	0	No achievement since no survey of future resource constraints and vulnerabilities undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.3	Prepare for long-term adaptability	No evidence that team researched long-term changes in operational or environmental conditions	-	-	-	None	None	None	None	None	0	0	0	No achievement since no plans and designs to prepare for long term climate change. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.4	Prepare for short-term hazards	No evidence that team researched short -term hazards and how they may change over the life time of the project	-	-	-	None	None	None	None	None	0	0	0	No achievement since no analysis of short term hazards. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.5	Manage heat island effects	No - project does not meet heat island requirements	-	-	-	None	None	None	None	None	0	0	0	No achievement since no evidence of consideration of solar reflectance. Addition of planted median likely required to achieve Improved of 10% shading; as this would require a major redesign of the road, no low hanging fruit score is given.
													0	0	0	

80100167

Possible Total
Score
Award:793
10.09%12.61%21.06%
NoneNoneBronze

A5: Highway 50 (Castlemore Road/Rutherford Road to Steeles Avenue)

			Performance Metrics						Metrics Achieved		Achievement Level			Score			Summary Notes
			Criterion	A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base	Upper	
Quality of Life	Purpose	QL 1.1	Improve community quality of life	Likely - I assume that test of considering community needs goals and issues is satisfied by aligning project with York Region and Peel Region Official Plans, and the York-Peel Boundary Area Transportation Study (BATS) (approved in 2003); 2 PICs with summary of comments and responses.	Likely - project aligns the EA purpose with policies of both Regional Official Plans and the BATS	Yes- the EA process sought to identify and address potential impacts to the local community	Possible - despite only having the standard 2 PIC meetings with info boards, a case could be made based on the attendance level and the EA public comment summary and response in the ESR, that the public was meaningfully engaged.	Possible - on page 49 of the ESR, the team claims that in general the public at the second public meeting supports the preferred design. Its unclear if the 39 people in attendance are sufficient to claim community support for this criterion	A to C	A to E	None	Superior	Superior	0	10	10	Unclear whether or not community was meaningully engaged as per criterion D for a base score of 0. If project successfully argues the public was meaningfully engaged, then an upper score of Superior was likely achieved given the 2 fairly well attended public meetings, incorporation of additional turning lanes for safety as a result of public input. A low fruit score of additional efforts at meaningful engagement to better support score of Superior.
		QL 1.2	Stimulate sustainable growth and development	Unlikely - design, construction and operation supports existing jobs, but unlikely to meet test of <i>significant</i> number of new jobs	Yes - project increases recreational capacity through a new Multi Use pathway as per detailed design plans	Yes - reduced congestion counts as improved community productivity as per Envision	Unlikely - The project does not clearly improve community attractiveness	-	B, C	B, C	None	None	None	0	0	0	No achievement given or possible without the creation of a significant number of new jobs during design, construction and operation.
		QL 1.3	Develop local skills and competencies	No - no commitments to local employment of needy or disadvantaged groups	-	-	-	-	none	none	none	none	none	0	0	0	My opinion is that a municipality would never and probably couldn not legally restrict a contractor to hiring local workers; the most that could probably be done is including a policy to look favourably in the tendering process of contractors with a policy of training and hiring needy or disadvantaged workers
	Wellbeing	QL 2.1	Enhance public health and safety	No - no new sustainability technologies, materials or equipment identified so no opportunity to assess associated Health and Safety implications	-	-	-	none	none	none	none	Improved	0	0	2	No new sustainability technologies have been proposed, so there's no opportunity to assess associated Health and Safety implications; therefore no achievement is given. As other low fruit score may require the use of new sustainability technologies, there would be an associated opportunity to assess the associated Health and Safey implications so a conservative low fruit score of Improved is given.	
		QL 2.2	Minimize noise and vibration	Yes - studies of noise during operation and additional consideration in ESR of noise during construction	No - no mitigation and monitoring of noise proposed	-	-	-	A	A	Improved	Improved	Conserving	1	1	8	Achievement of Improved through consideration and study of noise during construction and operation. Achievement of Conserving would require determination of noise goals of community with mitigation and monitoring. With extensive involvement of community during well attended PICs, it would be low hanging fruit to have formalized this through approved proposals with community endorsement to monitor and mitigate noise impacts during construction - low hanging fruit of "Conserving".
		QL 2.3	Minimize light pollution	Likely - no evidence of assessment of lighting needs in available documentation, but TRCA's files are unlikely to have such documentation; some assessment likely done in detailed design	No- EA does not specify energy efficient lighting, and Google Streetview shows standard (non LED) light standards installed	Unlikely - no evidence of efforts to reduce light spillage and preserve night sky, but unlikely an explicit goal of the lighting design	-	-	A	A	None	None	enhanced	0	0	2	No base achievement as there's no evidence specific efforts were made to reduce lighting energy requirements. A low fruit score of Enhanced reflects a simple assessment of lighting needs, during and post-construction, installation of energy efficient light standards, and basic efforts to reduce light spillage.
		QL 2.4	Improve community mobility and access	Yes - safe to assume study of access and mobility would have been undertaken with Consultant and or contractor during detailed design	yes -limited coordinated with local businesses and residents	Yes - design supports active transportation through bike lanes and sidewalks and access to transit	likely - plans to limit traffic disruption likely undertaken with contractor	Yes - project designed to decrease congestion and improve access to alternate modes of transportation Uncertain - its unclear how to assess whether or not the project improves livability	A to E	A to F	Improved	Improved	Enhanced	1	1	4	Level of improved given due to evidence of only limited coordination with owners and operators of adjacent facilities. Enhanced level would need project specific, purposeful coordination with owners of adjacent facilities so is given as low hanging fruit.

			QL 2.5	Encourage alternative modes of transportation	Yes - bus routes along Highway 50 that would provide transit access to multi-modal hubs	Yes - urban cross section limits parking of cars	Yes - support active transportation through bike lanes and sidewalk along the Hwy 50	Yes - support active transportation through bike lanes and sidewalk along Hwy 50	Uncertain - the project did not develop programs to encourage alternative transportation but the Region and local municipality have programs	A to D	A to E	Enhanced	Enhanced	enhanced	3	3	3	Achievement of Enhanced based upon buses along Hwy 50 providing access to multi modal transit facilities, the restriction of parking, and support for cycling connected to a cycling network. An achievement of Superior requires secure bicycle lockers at the transit stops, which would be a tough sell for their expense relative to the bus stop use.
			QL 2.6	Improve site access, safety and wayfinding	No - no documentation of wayfinding signage considered at the EA or detailed design. Based upon Google Earth, the multi-use pathway is unsigned.	unclear - its unclear what is required to consider safety and accessibility for emergency personel as it relates to a road widening				None	None	None	None	Enhanced	0	0	3	No base achievement since no evidence of signage that makes it intuitive to navigate site; based on Google Earth, even basic signage identifying the multi use pathway as a shared space is missing. A low fruit score of enhanced for basic signage.
	Community		QL 3.1	Preserve historic and cultural resources	yes - achaeology stage 1 done at EA, and stage 2 at detailed design with culvert heritage study as well at EA	No - achaeological resources unlikely to be preserved as sites are located within preferred alignment; build resources avoided	Unclear - if archaeological resources were found, they would not have been avoided, but the built heritage was avoided	No - no evidence of enhancements to resources	-	A	A to C	None	Improved	Improved	0	1	1	existing resources were 3 buildings avoided by the road. I don't have access to the stage 2 archaeological report but assuming no resources were found then an achievement of Improved can be given based on avoiding the built heritage. Further achievement would require a sensitive design approach. Based upon Google Earth 2 of the 3 heritage buildings were demolished or relocated to accomodate a development site, so its unlikely any resouces would have been approved during the road design for a sensitive approach that incorporated these resources. Therefore no low hanging fruit score
			QL 3.2	Preserve views and local character	yes - determination of importance of former farmstead and use of native plantings in creek realignment	No - no evidence in EA or detailed design materials of view plans or design guidelines developed				A	A	None	None	Improved	0	0	1	No public view plan was developed so no credit can be given; as the area is developing the only areas relevant for a viewshed may be the three watercourse crossings; a basic viewshed plan would achieve improved.
			QL 3.3	Enhance public space	No - project does not add to public space		-	-	-	none	none	none	none	none	0	0	0	No achievement and little opportunity within the project scope to create public space.
																		5
																		16
																		34

Collaboration	LD 1.1	Provide effective leadership and commitment	yes - General sustainability policies in Regional Official Plan, but limited support in Transportation Master Plan	-	-	-	-	-	A	A	Enhanced	Enhanced	Enhanced	4	4	4	Enhanced achieved due to integrated sustainability policies in Regional Official Plan and support by Peel Region for various sustainability projects. Superior not achieved due to lack of annual sustainability reporting by Peel Region. No low hanging fruit since it will be a challenge for the project team to have initiated annual sustainability reporting by Peel Region.
	LD 1.2	Establish a sustainability management system	Unlikely - project did not specifically address sustainability based on documentation so its unlikely anyone on the project team was responsible for sustainability issues	Unlikely -project did not specifically address sustainability based on documentation so its unlikely a management policy was created for the project	no - based upon ESR the project did not set sustainability goals and targets	-	none	A	None	None	None	None	0	0	0	Although it can't be confirmed that no specific person was given the responsibility of sustainability, it is unlikely as sustainability is not addressed in the ESR, and its irrelevant because a project must meet criterion A through E for all levels of achievement. Meeting criterion A through E would require an extensive commitment to sustainability within the project team through various business sustainability processes, and given that sustainability as a concept is not considered in EAs for road projects in the GTA in my experience, such commitment is not considered low hanging fruit. No ESRs in any ESRs reviewed for this thesis even used the term sustainability except in reference to the title of another document.	
	LD 1.3	Foster collaboration and teamwork	Yes - project team likely incorporated collaboration, teamwork and whole systems design to some degree	-	-	-	-	A	A	Enhanced	Enhanced	Enhanced	4	4	4	The project achieved at most an enhanced level as superior requires design charrettes with stakeholders that did not occur.	

Leadership		LD 1.4	Provide for stakeholder involvement	Yes - to some extent stakeholders ID and key concerns addressed	Yes - PICs with local residents held, and meetings with other stakeholders held (TRCA)	Yes - to some extent stakeholder input incorporated into plans	likely - safe assumption that some type of stakeholding participation and communications program established	A to D	A to D	Enhanced	Enhanced	Enhanced	5	5	5	Difficult to assess degree of stakeholder impact on project due to lack of summary chart summarizing comments from stakeholders and responses to comments; It is likely that an enhanced level would be achieved due to standard PIC engagement and project management principles. Superior not achieved due to lack of clear documentation proving the public had meaningful input.		
	Management	LD 2.1	Pursue by-product synergy opportunities	no - no documentation of efforts to search for unwanted byproduct of nearby facilities & very unlikely to have occurred		-	-	none	none	none	none	None	0	0	0	No assessment of unwanted byproducts of nearby facilities. Therefore no achievement. Not likely relevant to road construction so no low hanging fruit		
		LD 2.2	Improve infrastructure integration	No evidence project team sought to improve sustainability through project wide systems integration			-	-	none	none	none	none	None	0	0	0	No evidence that project team sought to improve project sustainability through project wide systems integration;	
	Planning	LD 3.1	Plan for long-term monitoring and maintenance	no - no documentation of plan for long-term monitoring	-		-	-	none	none	none	none	Enhanced	0	0	3	2 year monitoring of infrastructure is standard and likely to have occurred, but only monitoring of the bridges beyond 2 years is standard, so no credit given. Adding monitoring of the channel for an additional 3-5 years should be achievable and would earn Enhanced.	
		LD 3.2	Address conflicting regulations and policies	No - no documentation of assessment of conflicting regulations and policies	-		-	-	none	A	none	None	Improved	0	0	1	No achievement since no documentation of assessment of conflicting regulations and policies and no evidence of sustainability objectives. Low hanging fruit of Improved through basic assessment of regulations and associated regulators and organizations and connection to sustainability objectives.	
		LD 3.3	Extend useful life	yes - high likelihood of some consideration of durability, flexibility and resilience of project	No - no documentation of consideration of expansion or future reconfiguration of project, but may have occurred		-	-	A	A, B	Improved	Improved	Enhanced	1	1	3	Likely achieved Improved by considering to some degree the flexibility, durability and resilience of road. Achieving Enhanced requires documentation of consideration of future expansion or reconfiguration which is given a low hanging fruit score.	
														14	14	20		
			RA 1.1	Reduce net embodied energy	No - no documentation of an LCA	-		-	none	none	none	none	None	0	0	0	No documentation of an LCA and reasonable assumption one was never done as I have never heard of one occurring in my career for a municipal EA; a LCA is very resource intensive so its not considered low hanging fruit.	
			RA 1.2	Support sustainable procurement practices	No - no documentation of sustainable procurement		-	-	None	None	None	None	Improved	0	0	2	No documentation of sustainable procurement, and reasonable assumption this is not done in practice outside of LEED projects; as it has been done for LEED projects, it's a reasonable assumption that the lowest level of improved could have been achieved through <15% materials from suppliers with 'sustainability practice'	

Resource Allocation																	
Materials																	
	RA 1.3	Use recycled materials	Likely - no documentation of assessment at EA or detailed design of on site reuse. Likely done by contractor in effort to save money.	Unclear - no documentation of specification of recycled material undertaken in EA or detailed design. Contractor would have purchased materials with recycled content but not specified it, so its unclear this acheives the credit sustainability intent	–	–	–	–	A	A, B	None	Enhanced	Superior	0	5	11	No documentation of EA or detailed design project teams analyzing reuse of on site materials, but this was likely done by contractor to reduce expenses. No evidence of specifying materials with recycled content, but its likely the contractor still purchased materials with recycled content to reduce expenses. Its standard for pavement and granular subgrade to contain a significant percentage of recycled material, so its safe to assume 20% (by weight or volume) of materials on site are recycled. As credit may not be given, the base score is zero. An upper score of Superior is given based upon credit given for the contractor purchasing but not specifying materials with recycled content. A low fruit rating of Enhanced is given as it should be easily acheived for the municipality to specify materials with recycled contact.
	RA 1.4	Use regional materials	Unclear - no documentation of specification of local materials, but with expense of transporting materials its likely contractor purchased local materials to save money. Its unclear if this meets the credit intent.	–	–	–	–	–	None	A	None	Improved	Enhanced	0	3	6	No documentation for the <i>specification</i> of local materials, but with the cost of transportation its likely a large percentage of materials were sourced within the specified distances. Its unclear if achievement of the credit requires explicit specification of local materials by the contractor. If credit is acheived, its conservatively assumed to be an upper acheivement of Improved (30% local) and a low hanging fruit of Enhanced (60% local). Achievement could have been and could be much higher but I don't have evidence to accurately assess so I've used a conservative assessment.
	RA 1.5	Divert waste from landfills	Unlikely - There is no documentation in the EA or detailed design regarding a comprehensive waste management plan. Although the contractor likely diverted waste to save landfill charges and make money selling the materials its highly unlikely this was done through a comprehensive waste management strategy	–	–	–	–	–	None	None	None	None	Enhanced	0	0	6	No base or upper achievement since no comprehensive waste management plan likely implemented. With recyclability of asphalt, granular and concrete, its low hanging fruit to achieve 50% recycle/reuse of onsite materials which gives a level of enhanced. Actual low fruit achievement could be even higher, but a more detailed analysis would be required to support this.
	RA 1.6	Reduce excavated materials taken off site	Likely - although no documentation in materials I had available, it is standard to estimate cut and fill in detailed design or by the contractor to reduce costs of transportating and disposing of soils offsite.	–	–	–	–	–	A	A	Conserving	Conserving	Conserving	6	6	6	The level of achievement is based upon a percentage of excavated materials <i>suitable for reuse</i> that are reused on site. It is safe to assume that the vast majority (90%) of fill <i>suitable for reuse</i> was reused on site, giving an achievement of Conserving.
	RA 1.7	Provide for deconstruction and recycling	yes - although there's no documentation in the EA and detailed design of specifying materials specifically because of their recyleability asphalt, granular, and concrete are highly recyclable so credit can be given	Unlikely - no documentation in EA or detailed design of consideration of facilitating future disassembly and recycling of materials. Its unlikely the contractor would have constructed the project in a way that improved the recyclability of the materials.	–	–	–	–	A	A	Improved	Improved	Superior	1	1	8	As asphalt, granular and concrete are highly recyclable so evalation criterion A is met which on its on leads to a maximum achivement of Improved. Higher levels of achievement require specific efforts to facilitate future recycling which is highly unlikely to have occurred, but with little extra effort due to the highly recyclable nature of many road materials would yield a rating of Superior for the low hanging fruit

Energy	RA 2.1	Reduce energy consumption	No - no evidence in the EA or detailed design that the team assessed options for reducing energy consumption				—		—		—	None	None	None	None	None	0	0	0	Even if options to reduce energy consumption were considered, a basic Improved level requires a decrease of 10% of energy consumption during operation over industry norms, and must include energy consumed by vehicular traffic. As the project adds general purpose lanes to an existing road, this is unachievable so no credit is given or possible.
	RA 2.2	Use renewable energy	No - the vast majority of energy used in the operation and maintenance of the road will be fossil fuels for vehicles with a relatively smaller amount for the nuclear and natural gas for the light standards	—			—		—		—	None	None	None	None	None	0	0	0	No achievement since the vast majority of energy used in the operation and maintenance of the road will be fossil fuels. A very significant shift to electric vehicles would be required because Ontario's dominant Nuclear power is not a renewable resource as per Envision.
	RA 2.3	Commission and monitor energy systems	Unclear - although a sub-contractor would have installed and tested the light standards, and the municipality may have done its own check, its unclear either counts as an "independent commissioning" for the purposes of this criterion	Yes - the municipality would have sufficiently trained persons maintaining the light standards	Unclear - the Region would likely monitors the energy consumption of its lights but I don't have easy access to the information required to determine if this would constitute the advanced monitoring systems this criterion requires		—		—		—	B	A to C	None	Enhanced	Enhanced	0	3	3	There is no documentation in the files review for the EA or detailed design related to how the lighting systems would be commissioned, but such information isn't expected to sent to TRCA anyways. I don't have sufficient knowledge of standard practices in how municipalities commission and monitor lighting standards to properly assess this credit. The likely range of scores is too low to justify the effort required to more confidently score this credit. So a conservative range of none to Enhanced is given. The next achievement jumps to conserving and requires extensive commissioning and monitoring of systems and as Conservative for any credit is intended to be far beyond current standards of practice, I've assumed its not low hanging fruit.
	RA 3.1	Protect fresh water availability	No -no dewatering required for construction as no structures requiring excavations are proposed	No - no documentation of assessment impacts of water takings as none proposed as per EA					—		—	None	None	None	None	None	0	0	0	No level of achievement given or possible as no water takings required or proposed as per EA.
	RA 3.2	Reduce potable water consumption	No - no documentation of identification of strategies to reduce potable water consumption during operation and maintenance						—		—	None	None	None	None	None	0	0	0	No level of achievement given as there is no evidence of a potable water reduction strategy and it can be assumed one wasn't done regardless as roads use little potable water generally during operation and maintenance. For roads, the only opportunity is the use of drought resistant plants in planted medians or boulevards to which stormwater is directed to eliminate the need to water plants with potable water; as such a redesign could be significant and I've assumed significant redesigns are no low hanging fruit, no low hanging fruit score given.
	RA 3.3	Monitor water systems	NA				—		—		—	None								Not applicable since project does not involve potable water systems in its operation that could be monitored. This criterion would apply if there was an associated watermain.
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	NW 1.1	Preserve prime habitat	NA				—		—		—	NA	NA	NA	NA	NA				Credit not relevant as no prime habitat within study area as per EA
	NW 1.2	Protect wetlands and surface water	Yes - there is a buffer between project and nearest wetland	No - a Vegetetation projection zone is not relevant as there are no adjacent wetlands			—		—		—	None	None	None	None	None	0	0	0	No achievement given or possible since the project is not adjacent to any wetlands
	NW 1.3	Preserve prime farmland	No - no evidence that project team assessed prime farmland				—		—		—	None	None	None	None	None	0	0	0	Adjacent conservation lands are classified as class 1 soils. Road expands into prime farmland so no achievement. Avoiding expansion into prime farmland would require major redesign so no low hanging fruit
	NW 1.4	Avoid adverse geology	Not relevant - excluded						—		—	NA	NA	NA	NA	NA				earthquake faultlines, low lying coastal areas and Karst formations are not relevant concerns in our jurisdiction, generally, so the credit is excluded

Natural World	Siting	NW 1.5	Preserve floodplain function	Unclear - although the project does not alter the existing culverts, it does expand the road into the floodplain so its unclear if the test of minimizing floodplain impacts has been met	No - Floodplain infiltration is inhibited by increased impervious area within the floodplain	Yes - riparian habitat enhancements within floodplain	Yes - a flood emergency plan would not have been prepared for the project, but will be for the local municipality	Yes - existing bridges being replaced with larger structures that convey design flood										Range of achievement of none to Improved as its unclear if criterion A was met. However further achievement can't be met as the road increases impervious area within the floodplain by expanding into it.
		NW 1.6	Avoid unsuitable development on steep slopes	NA			-	-	-	NA	NA	NA	NA	NA				Not Applicable as there are no slopes of concern present and no replacement of culvert or bridge infrastructure that would typically warrant a geotechnical investigation with slope BMPs
		NW 1.7	Preserve greenfields	Yes - at least 50% of the project area, being the existing road, is already developed	No - project is not on a designated brownfield		-	-	-	A	A	none	none	None	0	0	0	Although more than 50% of the project is located on an already developed area, it only makes sense to count the existing road as a grey area if serious planning consideration was given to new road alignments entirely within greenfields. This is not the case here, so no acheivement is given or possible.
	Land & Water	NW 2.1	Manage stormwater			-	-	-	-	None	None	None	None	None	0	0	0	For the purposes of water quantity calculations the existing road needs to be considered a greyfield. Credit requires that water storage capacity be maintained in the greenfield and must be improved in the greyfield (existing road) by at least 30% for an Enhanced rating. No achievement given as no implementation of water quantity improvement. No water storage or infiltration LIDs were provided. As an overall improvement water storage and infiltration over pre-development conditions is not achieved no credit is given. A significant redesign would be required to achieve this high standard and given my experience with the resistance to implementing LIDs for roads, no low hanging fruit score is given.
		NW 2.2	Reduce pesticide and fertilizer impacts	Unclear -operational policies to control the application of fertilizers and pesticides were not part of the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - runoff controls to minimize groundwater and surface water contamination during the application of fertilizers and pesticides were not discussed in the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - as per Cosmetic Pesticides Ban Act, most pesticides are already banned in Ontario, but fertilizers can still be used	Unclear - no consideration was given in the EA or detailed design documentation to plants that minimize the need for fertilizers and no discussion of integrated pest management, but these may have been considered by the contractor.	-	-	None	A to D	None	Superior	Superior	0	5	5	With the Cosmetic Pesticide Ban Act, most pesticides are banned in Ontario. Also, the project would have planted only native, non-invasive species that should reduce the need for fertilizer. With no documentation to support any achivement, the project is given a base of 0 but its possible they could have achieved a score of Superior with the right documentation. No low fruit achievement of conserving since an integrated pest management practice would require a whole new region wide program be developed.
		NW 2.3	Prevent surface and groundwater contamination	no - no groundwater quantity and quality monitoring systems used during or post-construction				-	-	None	None	None	None	None	0	0	0	No achievement given as no monitoring of groundwater quantity or quality during or post construction and no low hanging fruit as there is no compelling reason to undertake such monitoring for this project.
	iversity	NW 3.1	Preserve species biodiversity	Yes - development mitigates impacts of development	No - no facilitation of wildlife movement	No - project does not increase habitat connectivity or total available habitat	-	-	-	A	A	Improved	Improved	Improved	2	2	2	Only Improved achieved or possible as any improvements to wildlife passage would require replacing the existing culverts at Rainbow Creek.
		NW 3.2	Control invasive species	Yes - only native, non-invasive species used	Unlikely - no evidence of a multi year invasive species management plan being contemplated during the EA or detailed design.		-	-	-	A	A	Superior	Superior	Superior	5	5	5	No achievement since no evidence of multi year invasive species management plan. Not low hanging fruit since multi year invasive species management plan would require creation of new region wide program; due to the extensive spread of invasive species in Ontario, only a Region wide program makes sense.

	Biodiv	NW 3.3	Restore disturbed soils	Unlikely - No evidence that 100% of soils disturbed during construction have been restored and reused properly	—	—	—	—	None	None	None	None	None	0	0	0	No achievement since no evidence that 100% of soils disturbed during construction have been restored and reused. My experience is that there is strong push back in industry against soil restoration, especially regarding compaction, so no low fruit score is given.
		NW 3.4	Maintain wetland and surface water functions	Yes - hydrologic connection maintained	Yes - water quality improved with OGS units and use of an existing SWM pond facility	Yes - riparian and aquatic habitat improvements	Yes - sediment transport maintained with no in stream barriers and natural channel design	Yes - water quality enhanced, habitat enhanced	—	A to E	A to E	Restorative	Restorative	Restorative	19	19	19
26333																	

Climate	Emission																
	CR 1.1	Reduce greenhouse gas emissions	No - no evidence of a life cycle carbon assessment having been undertaken, and this would not have been done regardless as its resouce intensive and not currently required by any agencies	-	-	-	-	None	None	None	None	None	0	0	0	No achievement without life cycle carbon assessment. A life cycle carbon analysis would require extensive resources and I have never heard of one being done for a municipal class EA. Its difficult to assess how likely it is I could have convinced a project team to have undertaken such an assessment, so I will assume a low fruit score of zero.	
	CR 1.2	Reduce air pollutant emissions	No - no evidence in the EA or detailed design of an air quality analysis. Even if one were to be done a project that increases vehicular traffic won't meet the criterion objective of improving air quality		-	-	-	None	None	None	None	None	0	0	0	No achievement since no air quality analysis undertaken; no low fruit since its not realistic to reduce air pollution through a widened road.	
	Resilience	CR 2.1	Assess climate threat	No - no evidence a climate impact assessment was undertaken, and it would not have been undertaken regardless as the discussion of incorporation of climate change into municipal class EAs only began in the fall of 2016 with the release of MOECC's Draft Guideline: <i>Consideration of Climate Change in Environmental Assessments in Ontario.</i>	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no climate impact assessments undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.2	Avoid traps and vulnerabilities	No - no evidence of identification and assessment of possible changes in key engineering design variables.		-	-	-	None	None	None	None	None	0	0	0	No achievement since no survey of future resource constraints and vulnerabilities undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
CR 2.3		Prepare for long-term adaptability	No evidence that team researched long-term changes in operational or environmental conditions	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no plans and designs to prepare for long term climate change. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.	
CR 2.4		Prepare for short-term hazards	No evidence that team researched short -term hazards and how they may change over the life time of the project		-	-	-	None	None	None	None	None	0	0	0	No achievement since no analysis of short term hazards. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.	

A6: Kirkhams Road Bridge

				Performance Metrics						Metrics Achieved		Achievement Level			Score			Summary Notes
				Criterion	A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base	Upper	
Quality of Life	Purpose	QL 1.1	Improve community quality of life	Unclear -it is unclear whether or not the test of considering community needs goals and issues was satisfied. - although there was consideration of Toronto Official Plan and Greenbelt policies in the ESR, there was strong local community opposition to preferred solution	Unclear - its unclear whether or not the vision and goals of project align with those of local community as the Torongot Official Plan policies wewre considered but there was also strong opposition of the local communtiy to the preferred solution	Yes - impacts to local community have been identified and mitigated, where possible	No; the local community was not meaningfully engaged through the standard 2 public meetings as evidenced by the continuing strong opposition to the preferred solution	No - community endorsement was not achieved as evidenced by the strong community opposition to the preferred solution	None	A to C	None	None	Superior	0	0	10	Achievement of improved would require earlier and more involved, open engagement with the local community. Community endoresement by the local community would be difficult given they're losing a local asset, so achievement beyond Superior would be difficult	
		QL 1.2	Stimulate sustainable growth and development	Unlikely - design, construction and operation supports existing jobs, but unlikely to meet test of <i>significant</i> number of new jobs	No - the project has no effect on industry or business, but will limit public access across the Rouge River for recreation.	No - project will have no effect on local productivity	-	-	-	None	None	None	None	None	0	0	0	No achievement given or possible without the creation of a significant number of new jobs during design, construction and operation. Will also be difficult to achieve higher levels with proposed alternative of removing bridge because the bridge provides pedestrian and cycling access to and across the Rouge River thereby reducing recreational capacity (criterion B).
		QL 1.3	Develop local skills and competencies	No - no commitments to local employment of needy or disadvantaged groups	-	-	-	-	-	none	none	none	none	none	0	0	0	My opinion is that a municipality would never and probably couldn not legally restrict a contractor to hiring local workers; the most that could probably be done is including a policy to look favourably in the tendering process of contractors with a policy of training and hiring needy or disadvantaged workers
	Wellbeing	QL 2.1	Enhance public health and safety	No - no new sustainability technologies, materials or equipment identified so no opportunity to assess associated Health and Safety implications	-	-	-	-	-	none	none	none	none	Improved	0	0	2	No new sustainability technologies have been proposed, so there's no opportunity to assess associated Health and Safety implications; therefore no achievement is given. As other low fruit score may require the use of new sustainability technologies, there would be an associated opportunity to assess the associated Health and Safey implications so a conservative low fruit score of Improved is given.
		QL 2.2	Minimize noise and vibration	Yes - studies of noise during operation, and consideration of noise during construction	No - no mitigation of noise in final design because removing the road should reduce road noise from traffic	No - existing traffic levels are so low that the small reducting through removing the bridge will have little effect on the local community liveability	-	-	-	A	A	Improved	Improved	Improved	1	1	1	Achievement of improved based on study of noise during construcion and operation. No low hanging fruit since the road accomodated such low traffic volumes that eliminating the bridge will have little impact on community liveability.
		QL 2.3	Minimize light pollution	Yes, an assessment of lighting needs for bridge alternatives was included in the EA	No - no efforts were made to reduce lighting energy requirements as no lights are proposed	-	-	-	-	A	A	none	None	none	0	0	0	No low hanging fruit as that would require efforts to reduce lighting energy requirements which is not relevant for a project that does not propose lighting. Street lights were likely never seriously considered.
		QL 2.4	Improve community mobility and access	No - the project eliminates access and mobility	-	-	-	-	-	None	None	none	None	none	0	0	0	No achievement given or possible because the preferred option limits community access and mobility
		QL 2.5	Encourage alternative modes of transportation	No - location relevant to transit isn't relevant for a bridge removal	No - parking is facilitated in the cul-de-sac, not restricted	Not relevant	No - the project restricts pedestrian and cycling	No	No	none	None	None	None	none	0	0	0	No achievement given or possible because most of the evaluation require don't make sense for a bridge removal.
		QL 2.6	Improve site access, safety and wayfinding	No - no documentation of wayfinding signage considered at the EA or detailed design aside	-	-	-	-	-	None	none	None	None	none	0	0	0	No study of wayfinding and limited opportunity due to limited pedestrian, and cycling traffic; the cul-de-sacs at either end of the removed bridge don't connect to any trails, so there's no need for signage.
unity	QL 3.1	Preserve historic and cultural resources	Yes - proponent worked with local conservation authority and municipality, and undertook stage 1 & 2 archaeological investigations to identify resources, and a built heritage and cultural landscapes assessment	No - no feasibility assessment of preserving resources undertaken because none found within study area	No	No	-	-	A	A	none	None	none	0	0	0	No achievement given or possible because no cultural resources within study area.	

	Comm	QL 3.2	Preserve views and local character	No -limited determination of local character	No		none	None	None	None	Improved	0	0	1	No public view plan was developed so no credit can be given; as the area is developing the only areas relevant for a viewshed may be the two watercourse crossings; a basic viewshed plan would achieve improved.
		QL 3.3	Enhance public space	No - project limits public access	-	-	-	none	none	none	none	none	0	0	0

Leadership																		
Collaboration	LD 1.1	Provide effective leadership and commitment	Yes - Goals and objectives can be found in the Toronto Official Plan, and 2007 Climate Change Action Plan	-	-	-	-	-	A	A	Enhanced	Enhanced	Enhanced	4	4	4	Goals and objectives of sustainability can be found in many Toronto documents and initiatives with regular reporting. Toronto expanding sustainability across the organization, so future projects will be able to claim a superior rating.	
	LD 1.2	Establish a sustainability management system	Unlikely - project did not specifically address sustainability based on documentation so its unlikely anyone on the project team was responsible for sustainability issues	Unlikely -project did not specifically address sustainability based on documentation so its unlikely a management policy was created for the project	no - based upon ESR the project did not set sustainability goals and targets	-	-	-	none	A	None	None	None	0	0	0	Although it can't be confirmed that no specific person was given the responsibility of sustainability, it is unlikely as sustainability is not addressed in the ESR, and its irrelevant because a project must meet criterion A through E for all levels of achievement. Meeting criterion A through E would require an extensive commitment to sustainability within the project team through various business sustainability processes, and given that sustainability as a concept is not considered in EAs for road projects in the GTA in my experience, such commitment is not considered low hanging fruit. No ESRs in any ESRs reviewed for this thesis even used the term sustainability except in reference to the title of another document.	
	LD 1.3	Foster collaboration and teamwork	Yes - project team likely incorporated collaboration, teamwork and whole systems design to some degree	No - not likely meaningful risk and reward sharing between consultant and owner	-	-	-	-	A	A	Improved	Enhanced	Enhanced	1	4	4	The project documentation does not mention sustainability, however aspects of sustainable design are found. However, the incorporation of results of the Pedestrian and Cycling Master Plan and the Transportation Master Plan shows some degree of systems view. Low fruit is to more fully achieve Enhanced.	
	LD 1.4	Provide for stakeholder involvement	Yes - to some extent stakeholders ID and key concerns addressed	Yes - consultation with stakeholders through correspondence and 5 Technical Advisory Committee (TAC) meetngs	Yes - to some degree stakeholders comments incorporated	Yes - consultation with stakeholders through correspondence and 5 Technical Advisory Committee (TAC) meetngs	-	-	A to D	A to D	Improved	Enhanced	Enhanced	1	5	5	Stakeholders consulatation was throughtout project. Public consultation was through standard 2 PICs; however the public was generally opposed to the preferred option. An additional option of a pedestrain and cycling only bridge was assessed as a result of public input . An achievement of Improved to Enhanced with low hanging fruit of Enhanced.	
	Management	LD 2.1	Pursue by-product synergy opportunities	no - no documentation of efforts to search for unwanted byproduct of nearby facilities & very unlikely to have occurred	-	-	-	-	None	None	None	None	None	0	0	0	No assessment of unwanted byproducts of nearby facilities. Therefore no achievement. Not likely relevant to road constuction so no low hanging fruit	
		LD 2.2	Improve infrastructure integration	No evidence project team sought to improve sustainability through project wide systems integtation	-	-	-	-	None	None	None	None	None	0	0	0	No evidence that project team sought to improve project sustainability through project wide systems integration;	
	Planning	LD 3.1	Plan for long-term monitoring and maintenance	no - no documentation of plan for long-term monitoring	-	-	-	-	none	none	none	none	Enhanced	0	0	3	2 year monitoring of infrastructure is standard and likely to have occurred, but only periodic monitoring of the bank stability beyond 2 years is standard, so no credit given. Adding monitoring of the watercourse for an additional 3-5 years should be achievable and would earn Enhanced.	
		LD 3.2	Address conflicting regulations and policies	No - no documentation of assessment of conflicting regulations and policies	-	-	-	-	none	A	none	None	Improved	0	0	1	No achievement since no documentation of assessment of conflicting regulations and policies and no evidence of sustainability objectives. Low hanging fruit of Improved through basic assessment of regulations and associated regulators and organizations and connection to sustainability objectives.	
		LD 3.3	Extend useful life	yes - high likelihood of some consideration of durability, flexibility and reslience of project	No - no documentation of consideration of expansion or future reconfiguration of project, but may have occurred	-	-	-	-	A	A	Improved	Improved	Improved	1	1	1	Likely achieved Improved by considering to some degree the flexibility, durability and resilience of bank restoration. Achieving Enhanced requires documentation of consideration of future expansion or reconfiguration which is not as relevant for a project that removes a bridge.
													7	14	18			

Resource Allocation	Materials	RA 1.1	Reduce net embodied energy		-	-	-	-	none	none	none	none	None	0	0	0	No documentation of an LCA and reasonable assumption one was never done as I have never heard of one occurring in my career for a municipal EA; a LCA is very resource intensive so its not considered low hanging fruit.
		RA 1.2	Support sustainable procurement practices	No - no documentation of sustainable procurement			-	-	None	None	None	None	Improved	0	0	2	No documentation of sustainable procurement, and reasonable assumption this is not done in practice outside of LEED projects; as it has been done for LEED projects, it's a reasonable assumption that the lowest level of improved could have been achieved through <15% materials from suppliers with 'sustainability practice'
		RA 1.3	Use recycled materials	Unclear - no documentation of specification of recycled material undertaken in EA or detailed design. Contractor would have purchased materials with recycled content but not specified it, so its unclear this acheives the credit sustainability intent	-	-	-	-	A	A, B	None	Enhanced	Superior	0	5	11	No documentation of EA or detailed design project teams analyzing reuse of on site materials, but this was likely done by contractor to reduce expenses. No evidence of specifying materials with recycled content, but its likely the contractor still purchased materials with recycled content to reduce expenses. Its standard for pavement and granular subgrade to contain a significant percentage of recycled material, so its safe to assume 20% (by weight or volume) of materials on site are recycled. As credit may not be given, the base score is zero. An upper score of Superior is given based upon credit given for the contractor purchasing but not specifying materials with recycled content. A low fruit rating of Enhanced is given as it should be easily acheived for the municipality to specify materials with recycled contact.
		RA 1.4	Use regional materials	Unclear - no documentation of specification of local materials, but with expense of transporting materials its likely contractor purchased local materials to save money. Its unclear if this meets the credit intent.	-	-	-	-	None	A	None	Improved	Enhanced	0	3	6	No documentation for the <i>specification</i> of local materials, but with the cost of transportation its likely a large percentage of materials were sourced within the specified distances. Its unclear if achievement of the credit requires explicit specification of local materials by the contractor. If credit is acheived, its conservatively assumed to be an upper acheivement of Improved (30% local) and a low hanging fruit of Enhanced (60% local). Achievement could have been and could be much higher but I don't have evidence to accurately assess so I've used a conservative assessment.
		RA 1.5	Divert waste from landfills	Unlikely - There is no documentation in the EA or detailed design regarding a comprehensive waste management plan. Although the contractor likely diverted waste to save landfill charges and make money selling the materials its highly unlikely this was done through a comprehensive waste management strategy		-	-	-	None	None	None	None	Enhanced	0	0	6	No base or upper achievement since no comprehensive waste management plan likely implemented. With recyclability of asphalt, granular and concrete, its low hanging fruit to achieve 50% recycle/reuse of onsite materials which gives a level of enhanced. Actual low fruit achievement could be even higher, but a more detailed analysis would be required to support this.
		RA 1.6	Reduce excavated materials taken off site	Likely - although no documentation in materials I had available, it is standard to estimate cut and fill in detailed design or by the contractor to reduce costs of transportating and disposing of soils offsite.	-	-	-	-	A	A	Conserving	Conserving	Conserving	6	6	6	The level of achievement is based upon a percentage of excavated materials <i>suitable for reuse</i> that are reused on site. It is safe to assume that the vast majority (90%) of fill <i>suitable for reuse</i> was reused on site, giving an achievement of Conserving.
		RA 1.7	Provide for deconstruction and recycling	yes - although there's no documentation in the EA and detailed design of specifying materials specifically because of their recyleability asphalt, granular, and concrete are highly recyclable so credit can be given	Unlikely - no documentation in EA or detailed design of consideration of facilitating future disassembly and recycling of materials. Its unlikely the contractor would have constructed the project in a way that improved the recyclability of the materials.	-	-	-	A	A	Improved	Improved	Superior	1	1	8	As asphalt, granular and concrete are highly recyclable so evalation criterion A is met which on its on leads to a maximum achivement of Improved. Higher levels of achievement require specific efforts to facilitate future recycling which is highly unlikely to have occurred, but with little extra effort due to the highly recyclable nature of many road materials would yield a rating of Superior for the low hanging fruit

Natural World	Land & Water	NW 1.5	Preserve floodplain function	Yes - project design is outside floodplain	Yes - project improves pre-development infiltration and water quality	Yes - project enhances riparian vegetation	Yes - a flood emergency plan would not have been prepared for the project, but will be for the local municipality	Yes - project enhances habitat connectivity and at least maintains sediment transport	Yes - degraded bridge structure and abutments were removed	A to F	A to F	Conserving	Conserving	Conserving	14	14	14	Project achieves top score of Conserving
		NW 1.6	Avoid unsuitable development on steep slopes	Yes - project follows BMPs for slope erosion as informed by the geotechnical investigation	Yes - site is optimally located to avoid erosion in that it removes infrastructure from the slope	Yes - project avoids slopes	-	-	-	A to C	A to C	Conserving	Conserving	Conserving	8	8	8	Achievement of Conserving because project removes infrastructure from slopes susceptible to erosion.
		NW 1.7	Preserve greenfields	Yes - at least 25% of the project area, being the existing road, is already developed	No - project is not on a designated brownfield	-	-	-	A	A	none	none	None	0	0	0	Although more than 25% of the project is located on an already developed area, it only makes sense to count the existing road as a grey area if serious planning consideration was given to new road alignments entirely within greenfields. This is not the case here, so no acheivement is given or possible.	
	Land & Water	NW 2.1	Manage stormwater	yes - some water quantity improvements	-	-	-	-	A	A	None	Enhanced	Enhanced	0	4	4	This is a difficult criterion to analyze in the absence of specific calculations for water quantity improvements. With a net 500m^2 m decrease in impervious area and the addition of enhanced swales its reasonable to assume up to Enhanced may have been achieved or could be achieved.	
		NW 2.2	Reduce pesticide and fertilizer impacts	Unclear -operational policies to control the application of fertilizers and pesticides were not part of the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - runoff controls to minimize groundwater and surface water contamination during the application of fertilizers and pesticides were not discussed in the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - as per Cosmetic Pesticides Ban Act, most pesticides are already banned in Ontario, but fertilizers can still be used	Unclear - no consideration was given in the EA or detailed design documentation to plants that minimize the need for fertilizers and no discussion of integrated pest management, but these may have been considered by the contractor.	-	-	None	A to D	None	Superior	Superior	0	5	5	With the Cosmetic Pesticide Ban Act, most pesticides are banned in Ontario. Also, the project would have planted only native, non-invasive species that should reduce the need for fertilizer. With no documentation to support any achivement, the project is given a base of 0 but its possible they could have achieved a score of Superior with the right documentation. No low fruit achievement of conserving since an integrated pest management practice would require a whole new region wide program be developed.
		NW 2.3	Prevent surface and groundwater contamination	no - no groundwater quantity and quality monitoring systems used during or post-construction	-	-	-	-	None	None	None	None	None	0	0	0	No achievement given as no monitoring of groundwater quantity or quality during or post construction and no low hanging fruit as there is no compelling reason to undertake such monitoring for this project.	
	Biodiversity	NW 3.1	Preserve species biodiversity	yes - project compensates for losses	Yes - project removes barrier of bridge and abutments	yes - project increases connectivity and available habitat	-	-	-	A to C	A to C	Restorative	Restorative	Restorative	16	16	16	Achievement of Conserving by removing bridge and abutments to improve wildlife movement and by planting and restoring banks and riparian zone.
		NW 3.2	Control invasive species	Yes - only native non-invasive species proposed	No - no control of invasive species identified in EA	No - project does not actively eliminate invasives	-	-	-	A	A	Superior	Superior	Superior	5	5	5	Achievement of Superior for planting of native, non-invasive species. No further opportunities based on Environmental Report at EA that did not identify an invasive species requiring active management.
		NW 3.3	Restore disturbed soils	Possibly - its possible that 100% of soils disturbed during construction were restored	Possibly - its possible that 100% of previously disturbed soils have been restored	-	-	-	-	None	A and B	None	Restorative	Restorative	0	10	10	There's no direct evidence in the EA or detailed design materials of soil restoration but the project does present a good opportunity to restore soils previously compacted by the existing sections of road that were removed and planted, so it may have been done or is otherwise low hanging fruit.
		NW 3.4	Maintain wetland and surface water functions	Yes - new channel will maintain hydrologic connection to floodplain	Yes - project enhanced water quality through 500^2 m less impervious area and addition of enhanced swales	yes - enhances habitat	yes - maintains sediment transport	Yes - project restored functions disturbed by previous bridge and abutments	-	A to D	A to D	Restorative	Restorative	Restorative	19	19	19	Project maintains or enhances all four ecosystem functions.
															63	82	82	
ision	CR 1.1	Reduce greenhouse gas emissions	No - no evidence of a life cycle carbon assessment having been undertaken, and this would not have been done regardless as its resouce intensive and not currently required by any agencies	-	-	-	-	None	None	None	None	None	0	0	0	No achievement without life cycle carbon assessment. A life cycle carbon analysis would require extensive resources and I have never heard of one being done for a municipal class EA. Its difficult to assess how likely it is I could have convinced a project team to have undertaken such an assessment, so I will assume a low fruit score of zero.		

Climate	Emis	CR 1.2	Reduce air pollutant emissions	No - no evidence in the EA or detailed design of an air quality analysis. Even if one were to be done a project that maintains vehicular traffic without increasing alternative transportation won't meet the criterion objective of improving air quality	-	-	-	None	None	None	None	None	0	0	0	No achievement since no air quality analysis undertaken; no low fruit since the improvements to local air quality will be negligible as so little vehicular traffic used the previous bridge.
	Resilience	CR 2.1	Assess climate threat	No - no evidence a climate impact assessment was undertaken, and it would not have been undertaken regardless as the discussion of incorporation of climate change into municipal class EAs only began in the fall of 2016 with the release of MOECC's Draft Guideline: <i>Consideration of Climate Change in Environmental Assessments in Ontario.</i>	-	-	-	None	None	None	None	None	0	0	0	No achievement since no climate impact assessments undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.2	Avoid traps and vulnerabilities	No - no evidence of identification and assessment of possible changes in key engineering design variables.	-	-	-	None	None	None	None	None	0	0	0	No achievement since no survey of future resource constraints and vulnerabilities undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.3	Prepare for long-term adaptability	No evidence that team researched long-term changes in operational or environmental conditions	-	-	-	None	None	None	None	None	0	0	0	No achievement since no plans and designs to prepare for long term climate change. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.4	Prepare for short-term hazards	No evidence that team researched short -term hazards and how they may change over the life time of the project	-	-	-	None	None	None	None	None	0	0	0	No achievement since no analysis of short term hazards. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.5	Manage heat island effects	No - project does not meet heat island requirements	-	-	-	None	None	None	None	None	0	0	0	No achievement since no evidence of consideration of solar reflectance. Addition of planted median likely required to achieve Improved of 10% shading; as this would require a major redesign of the road, no low hanging fruit score is given.

0

78

0

112

0

171

Possible Total

Score

Award:

758

10.29%

None

14.78%

None

22.56%

Bronze

A7: Leslie Street (Bethesda Sideroad to Bloomington Road)

			Performance Metrics					Metrics Achieved		Achievement Level			Score					
			Criterion	A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base		Upper	Low Fruit
Quality of Life	Purpose	QL 1.1	Improve community quality of life	Yes - test of considering community needs goals and issues is satisfied by aligning project with ROP & TMP, local OP and TMP;	Yes - needs and goals of project from TMP, council, and early meetings with Stakeholder Advisory Group	Yes- the EA process sought to identify and address potential impacts to the local community	yes - chart of comments from stakeholder and the public with responses	yes - support of public and stakeholders sought	yes- project improves community and rehabs existing road. As the project does not widen alter the existing asset (i.e. widen the road) then I have assumed it counts as rehabilitating the asset and improves the local community conditions	A to F	A to F	Restorative	Restorative	Restorative	25	25	25	pre - EA consultation with Stakeholders, then through EA two facilitated Public meetings, and facilitated meetings with Community Liaison Committee (key stakeholder groups, residents, and regulatory agencies). Deep collaboration combined with a restoration of community assets (road and natural environment) achieved Restorative.
		QL 1.2	Stimulate sustainable growth and development	Unlikely - design, construction and operation supports existing jobs, but unlikely to meet test of <i>significant</i> number of new jobs	Yes- project increased quality of recreational capacity with paved shoulder for cycling	No - project does not increase community productivity			-	B	B	None	None	None	0	0	0	No achievement given or possible without the creation of a significant number of new jobs during design, construction and operation.
		QL 1.3	Develop local skills and competencies	No - no commitments to local employment of needy or disadvantaged groups		-	-	-	-	none	none	none	none	none	0	0	0	My opinion is that a municipality would never and probably couldn not legally restrict a contractor to hiring local workers; the most that could probably be done is including a policy to look favourably in the tendering process of contractors with a policy of training and hiring needy or disadvantaged workers
	Wellbeing	QL 2.1	Enhance public health and safety	No - no new sustainability technologies, materials or equipment identified so no opportunity to assess associated Health and Safety implications			-	-	-	none	none	none	none	Improved	0	0	2	No new sustainability technologies have been proposed, so there's no opportunity to assess associated Health and Safety implications; therefore no achievement is given. As other low fruit score may require the use of new sustainability technologies, there would be an associated opportunity to assess the associated Health and Safey implications so a conservative low fruit score of Improved is given.
		QL 2.2	Minimize noise and vibration	Yes - studies of noise during operation and additional consideration in ESR of noise during construction	No - no mitigation and monitoring of noise proposed		-	-	-	A	A	Improved	Improved	Conserving	1	1	8	Achievement of Improved through consideration and study of noise during construction and operation. Achievement of Conserving would require determination of noise goals of community with mitigation and monitoring. With extensive involvement of community with contractor already done, it would be low hanging fruit to have formalized this through approved proposals with community endorsement to monitor and mitigate noise impacts during construction - low hanging fruit of "Conserving".
		QL 2.3	Minimize light pollution	Likely - no evidence of assessment of lighting needs in available documentation, but TRCA's files are unlikely to have such documentation; some assessment likely done in detailed design	No - no efforts were made to reduce lighting energy requirements as no lights are proposed		-	-	-	A	A	None	None	None	0	0	0	No evidence of any analysis of lighting needs. No low hanging fruit as that would require efforts to reduce lighting energy requirements which is not relevant for a project that does not propose lighting. Street lights were likely never seriously considered as the existing street is not lit and is not being widened.
		QL 2.4	Improve community mobility and access	No - mobility and access during operation were not considered in project planning	Yes, coordination with local owners through advisory group and PICs.	Yes - paved shoulder supports cycling	likely - plans to limit traffic disruption likely undertaken with contractor	No - project not designed to reduce traffic congestion or improve access to alternative modes of transportation	B to D	B to D	None	None	None	0	0	0	Limited opportunity for and consideration of mobility and access in this rural context. Improvements limited to a paved shoulder for cycling. No credit given or possible.	
		QL 2.5	Encourage alternative modes of transportation	No- project is not located within walking distance of multi modal transit facility					none	none	None	None	None	0	0	0	Project is located on a rural road with no plans or opportunities for multi modal transit stations or transit access to stations nearby. No credit given and no low hanging fruit.	
		QL 2.6	Improve site access, safety and wayfinding	No - no documentation of wayfinding signage considered at the EA or detailed design aside					none	none	none	none	None	0	0	0	Project is located on a rural road with limited pedestrian and cycling traffic to direct or locations to direct them to. No credit given.	

Community	QL 3.1	Preserve historic and cultural resources	No - no cultural or heritage resources within study area	-	-	none	none	none	none	none	0	0	0	No cultural or heritage resources identified within study area so no opportunity to preserve or enhance them.		
	QL 3.2	Preserve views and local character	Yes - determination of rural character	No - no view plans developed, but did create illustrations of wetland restoration	yes - preservation of local views & character i.e. with wetland restoration & rural road	Yes - worked with local stakeholders through liaison committee and public meetings	Yes - construction contract can be assumed to contain clauses pertaining to protection of vegetation outside the project boundaries	A	A	None	None	Superior	0	0	6	No public view plan was developed so no credit can be given; however, viewsheds and the maintenance of the rural character and enhancements to the wetlands adjacent to the road, in consultation with the community, makes a level of Superior low fruit.
	QL 3.3	Enhance public space	No - project does not add to public space	-	-	-	-	none	none	none	none	Conserving	0	0	11	Current project raises barriers for the public to access Haynes Lake for fishing, so no credit is given. The project could easily have incorporated some limited, well design access off the paved shoulder to Haynes Lake for a low fruit of Conserving though support from the local residents would be difficult to obtain given current conflicts with individuals parking on the should to access the lake.

Leadership	Collaboration	LD 1.1	Provide effective leadership and commitment	Yes - general sustainability statements in Official Plan, 2007 Sustainability Strategy and Vision statement	-	-	-	-	-	A	A	Enhanced	Enhanced	Enhanced	4	4	4	York Region has their 2007 Sustainability Strategy which informed their Vision 2051. No annual reporting of sustainability progress so achievement limited to Enhanced, with no low hanging fruit
		LD 1.2	Establish a sustainability management system	Possible- project had sustainability related goals in problem/opportunity statement so its possible someone on the project team was responsible for sustainability issues	Possible - project had sustainability related goals in problem/opportunity statement so its possible a management policy was created for the project	Yes - project did prioritize sustainability related goals in problem/opportunity statement, ahead of transportation goals	Unlikely - As ESR did not have sustainability as an explicit goal, its unlikely the project team had robust business mechanisms and processes in support of sustainability goals	Unlikely - As ESR did not have sustainability as an explicit goal, its unlikely the project had a sustainability management system in place	-	C	A to C	None	None	Enhanced	0	0	4	Sustainability as a term does not appear in the ESR, so I've assumed no sustainability management system and associated processes were in place for the project team (credits D and E) and no credit is given. Given the prioritization of the reducing impacts to the social and natural environments over achieving transportation capacity goals, I've assumed a simple environmental management system would be low hanging fruit of Enhanced. I've given Enhanced or Improved as low hanging fruit on the basis that if a team is to put some effort into a EMS they might as well create one to the level needed for Enhanced.
		LD 1.3	Foster collaboration and teamwork	Yes - project team likely incorporated collaboration, teamwork and whole systems design to some degree	-	-	-	-	-	A	A	Enhanced	Enhanced	Superior	4	4	8	The project documentation does not mention sustainability. However, the thorough enviornmental enhancements suggest sustainability was given due consideration, so credit of Enhanced given. Given the advanced stakeholder involvement and the emphasis on environmental enhancements, an achievement of Superior would be low hanging fruit
		LD 1.4	Provide for stakeholder involvement	Yes - to some extent stakeholders ID and key concerns addressed	Yes - extensive consultation with stakeholders	Yes - to some extent stakeholder input incorporated into plans	yes - stakeholding participation and communications program established			A to D	A to D	Superior	Superior	Superior	9	9	9	Facilitated stakeholder involvement through advisory group, and clear documentation of concerns and actions taken/not taken and why - achieves Superior. Achievement of Conserving requires stakeholders to be an equal player at decisions which is difficult to achieve so no low hanging fruit score given beyond Superior
	Management	LD 2.1	Pursue by-product synergy opportunities	no - no documentation of efforts to search for unwanted byproduct of nearby facilities & very unlikely to have occurred			-	-	None	None	None	None	None	None	0	0	0	No assessment of unwanted byproducts of nearby facilities. Therefore no achievement. Not likely relevant to road constuction so no low hanging fruit
		LD 2.2	Improve infrastructure integration	No evidence project team sought to improve sustainability through project wide systems integtation		-	-	-	None	None	None	None	None	None	0	0	0	No evidence that project team sought to improve project sustainability through project wide systems integration;

Planning	LD 3.1	Plan for long-term monitoring and maintenance no - no documentation of plan for long-term monitoring	-	-	-	-	None	None	None	None	None	0	0	3	2 year monitoring of infrastructure is standard and likely to have occurred, but only monitoring of the bridges beyond 2 years is standard, so no credit given. Adding monitoring of the channel for an additional 3-5 years should be achievable and would earn Enhanced.
	LD 3.2	Address conflicting regulations and policies No - no documentation of assessment of conflicting regulations and policies	-	-	-	-	None	None	None	None	None	0	0	1	No achievement since no documentation of assessment of conflicting regulations and policies and no evidence of sustainability objectives. Low hanging fruit of Improved through basic assessment of regulations and associated regulators and organizations and connection to sustainability objectives.
	LD 3.3	Extend useful life yes - high likelihood of some consideration of durability, flexibility and resilience of project	No - no documentation of consideration of expansion or future reconfiguration of project, but may have occurred	-	-	-	A	A, B	Improved	Improved	Enhanced	1	1	3	Likely achieved Improved by considering to some degree the flexibility, durability and resilience of road, culverts, and bridge. Achieving Enhanced requires documentation of consideration of future expansion or reconfiguration which is given a low hanging fruit score.
	181832														
Materials	RA 1.1	Reduce net embodied energy No - no documentation of an LCA	-	-	-	-	none	none	none	none	None	0	0	0	No documentation of an LCA and reasonable assumption one was never done as I have never heard of one occurring in my career for a municipal EA; a LCA is very resource intensive so its not considered low hanging fruit.
	RA 1.2	Support sustainable procurement practices No - no documentation of sustainable procurement			-	-	None	None	None	None	Improved	0	0	2	No documentation of sustainable procurement, and reasonable assumption this is not done in practice outside of LEED projects; as it has been done for LEED projects, it's a reasonable assumption that the lowest level of improved could have been achieved through <15% materials from suppliers with 'sustainability practice'
	RA 1.3	Use recycled materials Likely - no documentation of assessment at EA or detailed design of on site reuse. Likely done by contractor in effort to save money.	Unclear - no documentation of specification of recycled material undertaken in EA or detailed design. Contractor would have purchased materials with recycled content but not specified it, so its unclear this acheives the credit sustainability intent	-	-	-	A	A, B	None	Enhanced	Superior	0	5	11	No documentation of EA or detailed design project teams analyzing reuse of on site materials, but this was likely done by contractor to reduce expenses. No evidence of specifying materials with recycled content, but its likely the contractor still purchased materials with recycled content to reduce expenses. Its standard for pavement and granular subgrade to contain a significant percentage of recycled material, so its safe to assume 20% (by weight or volume) of materials on site are recycled. As credit may not be given, the base score is zero. An upper score of Superior is given based upon credit given for the contractor purchasing but not specifying materials with recycled content. A low fruit rating of Enhanced is given as it should be easily acheived for the municipality to specify materials with recycled contact.
	RA 1.4	Use regional materials Unclear - no documentation of specification of local materials, but with expense of transporting materials its likely contractor purchased local materials to save money. Its unclear if this meets the credit intent.	-	-	-	-	None	A	None	Improved	Enhanced	0	3	6	No documentation for the <i>specification</i> of local materials, but with the cost of transportation its likely a large percentage of materials were sourced within the specified distances. Its unclear if achievement of the credit requires explicit specification of local materials by the contractor. If credit is acheived, its conservatively assumed to be an upper acheivement of Improved (30% local) and a low hanging fruit of Enhanced (60% local). Achievement could have been and could be much higher but I don't have evidence to accurately assess so I've used a conservative assessment.

Resource Allocation																	
	RA 1.5	Divert waste from landfills	Unlikely - There is no documentation in the EA or detailed design regarding a comprehensive waste management plan. Although the contractor likely diverted waste to save landfill charges and make money selling the materials its highly unlikely this was done through a comprehensive waste management strategy			-	-	-	None	None	None	None	Enhanced	0	0	6	No base or upper achievement since no comprehensive waste management plan likely implemented. With recyclability of asphalt, granular and concrete, its low hanging fruit to achieve 50% recycle/reuse of onsite materials which gives a level of enhanced. Actual low fruit achievement could be even higher, but a more detailed analysis would be required to support this.
	RA 1.6	Reduce excavated materials taken off site	Likely - although no documentation in materials I had available, it is standard to estimate cut and fill in detailed design or by the contractor to reduce costs of transportating and disposing of soils offsite.			-	-	-	A	A	Conserving	Conserving	Conserving	6	6	6	The level of achievement is based upon a percentage of excavated materials <i>suitable for reuse</i> that are reused on site. It is safe to assume that the vast majority (90%) of fill <i>suitable for reuse</i> was reused on site, giving an achievement of Conserving.
	RA 1.7	Provide for deconstruction and recycling	Unlikely - no documentation in EA or detailed design of consideration of facilitating future disassembly and recycling of materials. Its unlikely the contractor would have constructed the project in a way that improved the recyclability of the materials. yes - although there's no documentation in the EA and detailed design of specifying materials specifically because of their recyleability asphalt, granular, and concrete are highly recyclable so credit can be given			-	-	-	A	A	Improved	Improved	Superior	1	1	8	As asphalt, granular and concrete are highly recyclable so evalation criterion A is met which on its on leads to a maximum achivement of Improved. Higher levels of achievement require specific efforts to facilitate future recycling which is highly unlikely to have occurred, but with little extra effort due to the highly recyclable nature of many road materials would yield a rating of Superior for the low hanging fruit
Energy	RA 2.1	Reduce energy consumption	No - no evidence in the EA or detailed design that the team assessed options for reducing energy consumption			-	-	-	None	None	None	None	None	0	0	0	Basic improved level requires a decrease of 10% of energy consumption during operation over industry norms, and must include energy consumed by vehicular traffic. No achievement is given as there's no evidence energy consumption was considered. No low fruit score is given as the project is in a rural area with little demand for alternate transportation so reducing the associated energy demand by 10% is unrealistic.
	RA 2.2	Use renewable energy	No - the vast majority of energy used in the operation and maintenance of the road will be fossil fuels for vehicles			-	-	-	None	None	None	None	None	0	0	0	No achievement since the vast majority of energy used in the operation and maintenance of the road will be fossil fuels. A very significant shift to electric vehicles would be required because Ontario's dominant Nuclear power is not a renewable resource as per Envision.
	RA 2.3	Commission and monitor energy systems	NA			-	-	-									Exclude credit as this project does not propose any electical systems.
	RA 3.1	Protect fresh water availability	No - although there is no documentation of assessment water taking requirements beyond construction, it wouldn't have been done for long -term impacts as the project doesn't require water takings during operation No -although the EA assessed dewatering requirements for construction it was not from the perspective of assessing water availability to support water use so things like recharge weren't considered.			-	-	-	None	None	None	None	None	0	0	0	No level of achievement. The project only assessed groundwater conditions for the purposes of assessing dewatering needs during construction which does not meet many of the requirements of a water availability assessment (criterion A). The project will not require water takings during operation (criterion B). Therefore no achievemtn is given. No low fruit score is given since an analysis of groundwater and surface water from the perspective of availability is not relevant to this project.

Natural World		NW 1.7	Preserve greenfields	Yes - a good argument can be made that the existing road here counts as greyfield and more than 50% of the project area is greyfield	No - project is not on a designated brownfield	-	-	-	A	A	Enhanced	Enhanced	Enhanced	6	6	6	Achievement of Enhanced since at least 50% of developed area on greyfield. In this case the existing road should count as a grey area as serious planning consideration was given to new road alignments entirely within greenfields.		
	Land & Water	NW 2.1	Manage stormwater			-	-	-										The project paves the existing gravel shoulders on both sides of road and maintains, relocates or improves the existing ditches on both sides of the road. However the ditches weren't designed for quantity control, so no achievement is given and the lowest achievement of Enhanced still sets a high bar of 30% improvement over existing conditions. In the absense of any calculations to support what could be achieved, I have made a conservative assumption that with enhancements to the swales to improve infiltration and capacity an overall increased water storage of 30% over existing conditions could be achieved for a rating of Enhanced.	
			No							none	none	none	none	Enhanced	0	0	4		
		NW 2.2	Reduce pesticide and fertilizer impacts	Unclear -operational policies to control the application of fertilizers and pesticides were not part of the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - runoff controls to minimize groundwater and surface water contamination during the application of fertilizers and pesticides were not discussed in the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - as per Cosmetic Pesticides Ban Act, most pesticides are already banned in Ontario, but fertilizers can still be used	Unclear - no consideration was given in the EA or detailed design documentation to plants that minimize the need for fertilizers and no discussion of integrated pest management, but these may have been considered by the contractor.	-	-	None	A to D	None	Superior	Superior	0	5	5	With the Cosmetic Pesticide Ban Act, most pesticides are banned in Ontario. Also, the project would have planted only native, non-invasive species that should reduce the need for fertilizer. With no documentation to support any achivement, the project is given a base of 0 but its possible they could have achieved a score of Superior with the right documentation. No low fruit achievement of conserving since an integrated pest management practice would require a whole new region wide program be developed.	
	NW 2.3	Prevent surface and groundwater contamination	no - no groundwater quantity and quality monitoring systems used during or post-construction				-	-	None	None	None	None	None	0	0	0	No achievement given as no monitoring of groundwater quantity or quality during or post construction and no low hanging fruit as there is no compelling reason to undertake such monitoring for this project.		
	Biodiversity	NW 3.1	Preserve species biodiversity	Yes - project mitigates adverse impacts of development	yes - project facilitates wildlife and amphibian movement	Yes - project increases available habitat and connectivity	-	-	-	A to C	A to C	Restorative	Restorative	Restorative	16	16	16	Project removes a low functioning wetland of phragmites and replaces it with a higher functioning wetland and terrestrial habitat of native vegetation with appropriate wildlife culverts, and improves water quality through reduced salt usage on the road	
		NW 3.2	Control invasive species				Possible - no evidnec on the EA or detailed desing of strategies to manage invasive species from re-establishing after removal, but its likely they will be established after the extensive effort required to remove Phragmites from the site during construction.	-	-	-	A	A, B	Superior	Restorative	Restorative	5	11	11	Achievement of Superior through landscape plans that only propose native non-invasive species. The project will remove the invasive phragmites from the wetland but a detailed methodology and management plan has not been established; such a plan is likely to be established during construction due to the extensive efforts required to remove the Phragmites or would otherwise be low hanging fruit.
		NW 3.3	Restore disturbed soils	No - 100% of soils disturbed during construction have not been restored and reused properly on site				-	-	-	none	none	none	none	none	0	0	0	Project requires removal of large quantities of peat and marl to facilitate road construction and there are no plans to re-use this material on site so no achievement is given or possible.
		NW 3.4	Maintain wetland and surface water functions	No - removal of peat risks negatively impacting the subsurface hydraulic connection to the adjacent lake	yes - water quality will be enhanced through reduced salting of the road and increased riparian buffer between the road and lake	yes - habitat will generally be enhanced	yes - the project restores sediment transportation between the wetland and adjacent lake through replacing the currently blocked culvert with a larger, functioning culvert		-		B, C and D	B, C and D	Superior	Superior	Superior	9	9	9	Three ecosystem functions are maintained or enhanced for a rating of Superior. Conserving or Restorative will require that the subsurface hydraulic connection to the lake and deeper groundwater upwellings not be negatively impacted by the removal of large quantities of peat and marl under the road, which is not easy; no low fruit score.
															60	71	87		

		Emission		Climate													
				Resilience													
	CR 1.1	Reduce greenhouse gas emissions	No - no evidence of a life cycle carbon assessment having been undertaken, and this would not have been done regardless as its resouce intensive and not currently required by any agencies	-	-	-	-	None	None	None	None	None	0	0	0	No achievement without life cycle carbon assessment. A life cycle carbon analysis would require extensive resources and I have never heard of one being done for a municipal class EA. Its difficult to assess how likely it is I could have convinced a project team to have undertaken such an assessment, so I will assume a low fruit score of zero.	
	CR 1.2	Reduce air pollutant emissions	No - no evidence in the EA or detailed design of an air quality analysis. Even if one were to be done a project that maintains vehicular traffic without increasing alternative transportation won't meet the criterion objective of improving air quality		-	-	-	None	None	None	None	None	0	0	0	No achievement since no air quality analysis undertaken; no low fruit since its not realistic to reduce air pollution even if the road isn't being widened as the project isn't designed to encourage alternative modes of transportation.	
	CR 2.1	Assess climate threat	No - no evidence a climate impact assessment was undertaken, and it would not have been undertaken regardless as the discussion of incorporation of climate change into municipal class EAs only began in the fall of 2016 with the release of MOECC's Draft Guideline: <i>Consideration of Climate Change in Environmental Assessments in Ontario</i> .	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no climate impact assessments undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.	
	CR 2.2	Avoid traps and vulnerabilities	No - no evidence of identification and assessment of possible changes in key engineering design variables.		-	-	-	None	None	None	None	None	0	0	0	No achievement since no survey of future resource constraints and vulnerabilities undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.	
	CR 2.3	Prepare for long-term adaptability	No evidence that team researched long-term changes in operational or environmental conditions	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no plans and designs to prepare for long term climate change. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.	
	CR 2.4	Prepare for short-term hazards	No evidence that team researched short - term hazards and how they may change over the life time of the project		-	-	-	None	None	None	None	None	0	0	0	No achievement since no analysis of short term hazards. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.	
	CR 2.5	Manage heat island effects	No - project does not meet heat island requirements	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no evidence of consideration of solar reflectance. Addition of planted median likely required to achieve Improved of 10% shading; as this would require a major redesign of the road, no low hanging fruit score is given.	
														0	0	0	
														111	130	223	
														Possible Total Score Award			773
														14.36%	16.82%	28.85%	
														None	None	Bronze	

A8: Main Street Markham (Highway 407 to Donald Cousens Parkway)

			Criterion	Performance Metrics						Metrics Achieved		Achievement Level			Score			Summary Notes
				A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base	Upper	Low Fruit	
Quality of Life	Purpose	QL 1.1	Improve community quality of life	Yes (see summary comments)	Yes (see summary comments)	Yes (see summary comments)	Yes (see summary comments)	Yes (see summary comments)	Yes (see summary comments)	A to F	A to F	Restorative	Restorative	Restorative	25	25	25	7 professionally facilitated meetings throughout EA process with advisory group made up of local residents, ratepayers, business owners, environmental groups and heritage groups, clearly achieving eval criterion A to F. Considered previous work by Main Street Markham Committe (similarly diverse in makeup). OP & Traffic studies considered. Advisory Group endorsement of preferred alterntaves (3 sessions).
		QL 1.2	Stimulate sustainable growth and development	Possible - additional analysis is required to show that the project created a significant number of new jobs in the Main Street businesses during its operation.	Yes, project increases quality of capacity for busiesses through better traffic flow, more inviting env't for pedestrians and cyclists, and permanent parking bays	Yes, improves community productivity (see B)	Yes, improves community attractiveness for business (see B)	Yes, repurposes 2 lanes of exising road to permanent parking bays, width for cycling, streetscaping and more room for pedestrians	-	B to F	A to F	None	Restorative	Restorative	0	16	16	Achievement of Restorative hinges on an analysis that the new street design will improve the local economy of Main Street Markham sufficiently to support a significant number of new jobs. I could not find evidence of any such analysis so I've given a base score of zero.
		QL 1.3	Develop local skills and competencies	No - no commitments to local employment of needy or disadvantaged groups	-	-	-	-	-	none	none	none	none	none	0	0	0	My opinion is that a municipality would never and probably couldn not legally restrict a contractor to hiring local workers; the most that could probably be done is including a policy to look favourably in the tendering process of contractors with a policy of training and hiring needy or disadvantaged workers
	Wellbeing	QL 2.1	Enhance public health and safety	No - no new sustainability technologies, materials or equipment identified so no opportunity to assess associated Health and Safety implications	-	-	-	-	-	none	none	none	none	Improved	0	0	2	No new sustainability technologies have been proposed, so there's no opportunity to assess associated Health and Safety implications; therefore no achievement is given. As other low fruit score may require the use of new sustainability technologies, there would be an associated opportunity to assess the associated Health and Safey implications so a conservative low fruit score of Improved is given.
		QL 2.2	Minimize noise and vibration	Yes - studies of noise during operation and additional consideration in ESR of noise during construction	No - no mitigation and monitoring of noise proposed	-	-	-	-	A	A	Improved	Improved		1	1	8	Achievement of Improved through consideration and study of noise during construction and operation. Achievement of Conserving would require determination of noise goals of community with mitigation and monitoring. With extensive involvement of community with contractor already done, it would be low hanging fruit to have formalized this through approved proposrals with community endorsement to monitor and mitigate noise impacts during construction - low hanging fruit of "Conserving".
		QL 2.3	Minimize light pollution	Likely - no evidence of assessment of lighting needs in available documentation, but TRCA's files are unlikely to have such documentation; some assessment likely done in detailed design	Uncertain - no evidence of analysis of efforts to reduce light energy requirements, but may have been done at detailed design.	Unlikely - no evidence of efforts to reduce light spillage and preserve night sky, but unlikely an explicit goal of the lighting design	-	-	-	A	A and B	None	Improved	enhanced	0	1	2	No base achievement as there's no evidence specific efforts were made to reduce lighting energy requirements; an upper score of improved reflects the uncertainty in assessing credit B. A low fruit score of Enhanced reflects a simple assessment of lighting needs, during and post-construction, installation of energy efficient light standards, and basic efforts to reduce light spillage.
		QL 2.4	Improve community mobility and access	Yes -study of access during construction with contractor evident documentation for design phase	Yes - coordination with local owners through advisory group and PICs.	Yes - project improves pedestrian and cycling movement and accomodates buses.	Yes, developed traffic management plan with stakeholders for construction	Yes, mobility design strategies incorporated	Yes, improves livability and walkability	A through F	A through F	A through F	Conserving	Conserving	14	14	14	Achievement of Conserving through working with local community to improve mobility and access, especially during operation. Low hanging fruit to better support the Conserving achievement could be met through improved wayfinding to and from the natural areas and trails of the Rouge valley system that parallels main street to the west.

Quality		QL 2.5	Encourage alternative modes of transportation	Yes, project has access to multi modal transportation	Yes, availability of street parking is reduced over existing	Yes, project is designed for convenient access to multi modal transportation	Users are encouraged to use non-motorized transportation through inviting pedestrian environment, traffic calming, traffic lanes kept at 2, reduction in parking spaces, width for on street cycling	Uncertain - the project did not develop programs to encourage alternative transportation but the Region and local municipality have	A to D	A to E	Enhanced	Enhanced	Conserving	3	3	12	Achievement of Enhanced based on convenient access to transit along route and road as part of a bike friendly network. However, need separate bike path and bike lockers to achieve Superior. In time this project could achieve a conserving level with bike paths and upgraded, visible transit stopes with real-time transit info. These extra items are low hanging fruit that could have been achieved given the project location as a potential destination for cycling and pedestrians. Low hanging fruit of Conserving.	
		QL 2.6	Improve site access, safety and wayfinding	No, no evidence that project team developed appropriate wayfinding signage. No evidence in planning or post-construction google streetview						None	None	None	None	Restorative	0	0	15	No evidence of wayfinding measures planned or added so no achievement. Wayfinding is low hanging fruit. Low hanging fruit rating of restorative, because extensive community consultation was already done, so it just would have needed to be slightly modified to deal explicitly with safety through environmental design with appropriate wayfinding
	Community	QL 3.1	Preserve historic and cultural resources	Yes - worked with agencies and community groups to ID historic and cultural resources	yes - focus on avoidance and preservation of resources	Yes - avoidance of all impacts to built cultural resources	Possibly - landscape compensation/enhancements undertaken, but not enhancements to physical built resources themselves	-	-	A to C	A to D	Conserving	Restorative	Restorative	13	16	16	As the ENV SP on the project I would have consulted with the Projec verifier to get clarification on "significance" of enhancement required to achieve Restorative. The project at least achieved Conserving. By extension, Restorative would definitely be considered low hanging fruit.
		QL 3.2	Preserve views and local character	Yes, extensive consultation and planning to determine local character	Yes - project has adopted the current design guidelines for the Markham Heritage District	Yes - although no systematic checklist of achievements of objectives of design guidelines, I'll assume they were met based upon extensive consultation with hertiage interest groups	Yes - extensive involvement of local heritage groups and stakeholders	possibly - the contract likely have contained clauses for the preservation of high valued landscape features	No - project did not develop or improve local policies and regulations regarding views	A to D	A to E	None	Superior	Superior	0	6	6	Despite meeting the intent of evaluation criterion A through D, achievement could not clearly be granted as the core of the Improved rating requires a public view plan be developed; there would need to be clarification from the Project Verifier whether or not the existing heritage district design guidelines would achieve the Improved level, in which case the project as is would likely acheive a Superior rating. The low hanging fruit rating of Superior recognizes that aspects of the criterion could be more clearly achieved easily if the project were redone to clearly acheive Superior.
		QL 3.3	Enhance public space	Yes - The project adds to public space by increasing the sidewalk width, and by adding sitting areas with benches between the road and sidewalk; a small traffic island with sculpture, landscaping and paths at entrance to Main Street	Yes - through extensive consultation it is a reasonable assumption that broadly stakeholders are satisfied with the plans for public space	Yes - meaningful and beneficial restoration of public space has occurred	-	-	-	A to C	A to C	Superior	Conserving	Restorative	6	11	13	With the project as is , it would likely achieve Superior; I am fairly confidednt that the sidewalk improvements, landscaping, additional benches and small entrance gateway feature meet the test of "meaningful" for a superior level but am not confident it would meet the test of "significantly improving" needed to achieve Conserving. In order to better justify achieve a rating of Conserving, the project would have to make the case that in a historic downtown that functions as a destination that sidewalks count as public space and that improvements to sidewalks count therefore as an improvement to public space. With the extensive public consultation undertaken, it would be relatively low hanging fruit to add some more small public gathering spaces to achieve the Restorative rating.
														62	93	129		
		LD 1.1	Provide effective leadership and commitment	Yes - sustainability plan in place for Markham					A	A	Enhanced	Enhanced	Superior	4	4	9	Markham has the Greenprint Sustainability Plan and a Climate Change Action Plan, with a dedicated web page and clear actions undertaken; therefore a base and upper score of Enhanced. The low fruit of Superior will require annual reporting of sustainability, which is planned for but not yet implemented.	

Leadership																			
Collaboration		LD 1.2	Establish a sustainability management system	Possible- project had sustainability related goals in problem/opportunity statement so its possible someone on the project team was responsible for sustainability issues	Possible - project had sustainability related goals in problem/opportunity statement so its possible a management policy was created for the project	Yes - project did prioritize sustainability related goals in problem/opportunity statement, ahead of transportation capacity goals	Unlikely - As ESR did not have sustainability as an explicit goal, its unlikely the project team had robust business mechanisms and processes in support of sustainability goals	Unlikely - As ESR did not have sustainability as an explicit goal, its unlikely the project had a sustainability management system in place	-		C	A to C	None	None	Enhanced	0	0	4	Sustainability as a term does not appear in the ESR, so I've assumed no sustainability management system and associated processes were in place for the project team (credits D and E) and no credit is given. Given the prioritization of the reducing impacts to the social and natural environments over achieving transportation capacity goals, I've assumed a simple environmental management system would be low hanging fruit of Enhanced. I've given Enhanced or Improved as low hanging fruit on the basis that if a team is to put some effort into a EMS they might as well create one to the level needed for Enhanced.
		LD 1.3	Foster collaboration and teamwork	Yes - project team likely incorporated collaboration, teamwork and whole systems design to some degree	-	-	-	-	-	-	A	A	improved	Enhanced	Superior	1	4	8	The project documentation does not mention sustainability, however aspects of sustainable design are found. The incorporation of various plans shows some degree of systems view was taken. Given the advanced stakeholder involvement, an achievement of Superior would be low hanging fruit
		LD 1.4	Provide for stakeholder involvement	Yes - to some extent stakeholders ID and key concerns addressed	Yes - extensive consultation with stakeholders	Yes - to some extent stakeholder input incorporated into plans	yes - stakeholding participation and communications program established	-	-	-	A to D	A to D	Superior	Superior	Superior	9	9	9	Facilitated stakeholder involvement through advisory group, and clear documentation of concerns and actions taken/not taken and why - achieves Superior. Achievement of Conserving requires stakeholders to be an equal player at decisions which is difficult to achieve so no low hanging fruit score given beyond Superior
		Management		LD 2.1	Pursue by-product synergy opportunities	no - no documentation of efforts to search for unwanted byproduct of nearby facilities & very unlikely to have occurred	-	-	-	-	None	None	None	None	None	0	0	0	No assessment of unwanted byproducts of nearby facilities. Therefore no achievement. Not likely relevant to road constuction so no low hanging fruit
		LD 2.2	Improve infrastructure integration	No evidence project team sought to improve sustainability through project wide systems integtation	-	-	-	-	-	None	None	None	None	None	0	0	0	No evidence that project team sought to improve project sustainability through project wide systems integration;	
Planning		LD 3.1	Plan for long-term monitoring and maintenance	no - no documentation of plan for long-term monitoring	-	-	-	-	-	None	None	None	None	None	0	0	3	2 year monitoring of infrastructure is standard and likely to have occurred, but only monitoring of the bridges beyond 2 years is standard, so no credit given. Adding monitoring of the channel for an additional 3-5 years should be achievable and would earn Enhanced.	
		LD 3.2	Address conflicting regulations and policies	No - no documentation of assessment of conflicting regulations and policies	-	-	-	-	-	None	None	None	None	None	0	0	1	No achievement since no documentation of assessment of conflicting regulations and policies and no evidence of sustainability objectives. Low hanging fruit of Improved through basic assessment of regulations and associated regulators and organizations and connection to sustainability objectives.	
		LD 3.3	Extend useful life	yes - high likelihood of some consideration of durability, flexibility and resilience of project	No - no documentation of consideration of expansion or future reconfiguration of project, but may have occurred	-	-	-	-	-	A	A, B	Improved	Improved	Enhanced	1	1	3	Likely achieved Improved by considering to some degree the flexibility, durability and resilience of road, culverts, and bridge. Achieving Enhanced requires documentation of consideration of future expansion or reconfiguration which is given a low hanging fruit score.
															15	18	37		
		RA 1.1	Reduce net embodied energy	No - no documentation of an LCA	-	-	-	-	-	none	none	none	none	None	0	0	0	No documentation of an LCA and reasonable assumption one was never done as I have never heard of one occurring in my career for a municipal EA; a LCA is very resource intensive so its not considered low hanging fruit.	
		RA 1.2	Support sustainable procurement practices	No - no documentation of sustainable procurement	-	-	-	-	-	None	None	None	None	Improved	0	0	2	No documentation of sustainable procurement, and reasonable assumption this is not done in practice outside of LEED projects; as it has been done for LEED projects, it's a reasonable assumption that the lowest level of improved could have been achieved through <15% materials from suppliers with 'sustainability practice'	

Resource Allocation																
Materials																
RA 1	RA 1.3	Use recycled materials	Unclear - no documentation of specification of recycled material undertaken in EA or detailed design. Contractor would have purchased materials with recycled content but not specified it, so its unclear this acheives the credit sustainability intent	-	-	-	-	A	A, B	None	Enhanced	Superior	0	5	11	No documentation of EA or detailed design project teams analyzing reuse of on site materials, but this was likely done by contractor to reduce expenses. No evidence of specifying materials with recycled content, but its likely the contractor still purchased materials with recycled content to reduce expenses. Its standard for pavement and granular subgrade to contain a significant percentage of recycled material, so its safe to assume 20% (by weight or volume) of materials on site are recycled. As credit may not be given, the base score is zero. An upper score of Superior is given based upon credit given for the contractor purchasing but not specifying materials with recycled content. A low fruit rating of Enhanced is given as it should be easily acheived for the municipality to specify materials with recycled contact.
	RA 1.4	Use regional materials	Unclear - no documentation of specification of local materials, but with expense of transporting materials its likely contractor purchased local materials to save money. Its unclear if this meets the credit intent.	-	-	-	-	None	A	None	Improved	Enhanced	0	3	6	No documentation for the <i>specification</i> of local materials, but with the cost of transportation its likely a large percentage of materials were sourced within the specified distances. Its unclear if achievement of the credit requires explicit specification of local materials by the contractor. If credit is acheived, its conservatively assumed to be an upper acheivement of Improved (30% local) and a low hanging fruit of Enhanced (60% local). Achievement could have been and could be much higher but I don't have evidence to accurately assess so I've used a conservative assessment.
	RA 1.5	Divert waste from landfills	Unlikely - There is no documentation in the EA or detailed design regarding a comprehensive waste management plan. Although the contractor likely diverted waste to save landfill charges and make money selling the materials its highly unlikely this was done through a comprehensive waste management strategy	-	-	-	-	None	None	None	None	Enhanced	0	0	6	No base or upper achievement since no comprehensive waste management plan likely implemented. With recyclability of asphalt, granular and concrete, its low hanging fruit to achieve 50% recycle/reuse of onsite materials which gives a level of enhanced. Actual low fruit achievement could be even higher, but a more detailed analysis would be required to support this.
	RA 1.6	Reduce excavated materials taken off site	Likely - although no documentation in materials I had available, it is standard to estimate cut and fill in detailed design or by the contractor to reduce costs of transportating and disposing of soils offsite.	-	-	-	-	A	A	Conserving	Conserving	Conserving	6	6	6	The level of achievement is based upon a percentage of excavated materials <i>suitable for reuse</i> that are reused on site. It is safe to assume that the vast majority (90%) of fill <i>suitable for reuse</i> was reused on site, giving an achievement of Conserving.
	RA 1.7	Provide for deconstruction and recycling	yes - although there's no documentation in the EA and detailed design of specifying materials specifically because of their recyleability asphalt, granular, and concrete are highly recylable so credit can be given	Unlikely - no documentation in EA or detailed design of consideration of facilitating future disassembly and recycling of materials. Its unlikely the contractor would have constructed the project in a way that improved the recyclability of the materials.	-	-	-	-	A	A	Improved	Improved	Superior	1	1	8
RA 2	RA 2.1	Reduce energy consumption	No - no evidence in the EA or detailed design that the team assessed options for reducing energy consumption	-	-	-	-	None	None	None	None	None	0	0	0	Even if options to reduce energy consumption were considered, a basic Improved level requires a decrease of 10% of energy consumption during operation over industry norms, and must include energy consumed by vehicular traffic. As the project adds general purpose lanes to an existing road, this is unachievable so no credit is given or possible.
	RA 2.2	Use renewable energy	No - the vast majority of energy used in the operation and maintenance of the road will be fossil fuels for vehicles with a relatively smaller amount for the nuclear and natural gas for the light standards	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since the vast majority of energy used in the operation and maintenance of the road will be fossil fuels. A very significant shift to electric vehicles would be required because Ontario's dominant Nuclear power is not a renewable resource as per Envision.

Energy	RA 2.3	Commission and monitor energy systems	Unclear - although a sub-contractor would have installed and tested the light standards, and the municipality may have done its own check, its unclear either counts as an "independent commissioning" for the purposes of this criterion	Yes - the municipality would have sufficiently trained persons maintaining the light standards	Unclear - the Region would likely monitors the energy consumption of its lights but I don't have easy access to the information required to determine if this would constitute the advanced monitoring systems this criterion requires	-	-	-	B	A to C	None	Enhanced	Enhanced	0	3	3	There is no documentation in the files review for the EA or detailed design related to how the lighting systems would be commissioned, but such information isn't expected to sent to TRCA anyways. I don't have sufficient knowledge of standard practices in how municipalities commission and monitor lighting standards to properly assess this credit. The likely range of scores is too low to justify the effort required to more confidently score this credit. So a conservative range of none to Enhanced is given. The next achievement jumps to conserving and requires extensive commissioning and monitoring of systems and as Conservative for any credit is intended to be far beyond current standards of practice, I've assumed its not low hanging fruit.
	RA 3.1	Protect fresh water availability	No -although the EA assessed dewatering requirements for construction it was not from the perspective of assessing water availability to support water use so things like recharge weren't considered.	No - although there is no documentation of assessment water taking requirements beyond construction, it wouldn't have been done for long -term impacts as the project doesn't require water takings during operation		-	-		None	None	None	None	None	0	0	0	No level of achievement. The project only assessed groundwater conditions for the purposes of assessing dewatering needs during construction which does not meet many of the requirements of a water availability assessment (criterion A). The project will not require water takings during operation (criterion B). Therefore no achievemetrn is given. No low fruit score is given since an analysis of groundwater and surface water from the perspective of availability is not relevant to this project.
	RA 3.2	Reduce potable water consumption	No - no documentation of identification of strategies to reduce potable water consumption during operation and maintenance			-	-		None	None	None	None	None	0	0	0	No level of achievement given as there is no evidence of a potable water reduction strategy and it can be assumed one wasn't done regardless as roads use little potable water generally during operation and maintenance. For roads, the only opportunity is the use of drought resistant plants in planted medians or boulevards to which stormwater is directed to eliminate the need to water plants with potable water; as such a redesign could be significant and I've assumed significant redesigns are no low hanging fruit, no low hanging fruit score given.
	RA 3.3	Monitor water systems	NA			-	-	-									Not applicable since project does not involve potable water systems in its operation that could be monitored. This criterion would apply if there was an associated watermain.

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Siting	NW 1.1	Preserve prime habitat				-	-	-	None	None	None	None	None	0	0	0	Some instances of S1, S2, S3 ranked species in vicinity of Rouge crossings & ESA upstream. Redside Dace habitat at Rouge crossing. Therefore the habitat loss at the crossing is considered a loss of prime habitat and an achievement cannot be given. Furthermore, encroachment into prime habitat would be difficult to avoid so there is no low hanging fruit to achieve
	NW 1.2	Protect wetlands and surface water	No - project widens road within specified distance of watercourse			-	-	-	None	None	None	None	None	0	0	0	No achievement given or possible since the project widens the road within the specified distance to a watercourse.
	NW 1.3	Preserve prime farmland	NA			-	-	-	NA	NA	NA	NA	NA				Not applicable as there were no serious options considered that would impact farmland.
	NW 1.4	Avoid adverse geology	NA	NA	NA		-	-	NA	NA	NA	NA	NA				Credit excluded as not generally relevant for the region, with the exception of projects on the Niagara Escarpment.
	NW 1.5	Preserve floodplain function	No - no impacts to Regional (design) flood plain at bridge, but impacts where culvert conveying Mount Joy creek is extended	No - large bridge crossing and fill outside Regional floodplain, so infiltration maintainted. But floodplain infiltration impacted at Mount Joy Creek where impervious area in floodplain is increased	No - evidence to support that project at least maintains riparian vegetation as shadow impacts from the increased bridge crossing may cause dye- Yes - a flood emergency plan off of some riparian vegetation, and culvert extension at Mount Joy creek removes some vegetation	would not have been prepared for the project, but will be for the local municipality	No - project maintains connectivity at bridge but reduces it at Mount Joy Creek through culvert extension	No - culvert at Mount Joy Creek is being extended, not replaced	D	D	None	None	Conserving	0	0	14	No achievement can be given because of the culvert extension and road widening in the floodplain at Mount Joy Creek. If the culvert were upsized at Mount Joy Creek thereby reducing or eliminating the impervious road surface from the floodplain, and if the poor riparian vegetation were enhanced for a net gain then Conserving could be achieved.

Natural World		NW 1.6	Avoid unsuitable development on steep slopes	Yes - project likely followed BMPs for erosion on Rouge valley slopes as informed by geotechnical investigation	No - no opportunity to site optimally as bridge over Rouge valley is existing	-	-	-	A	A	Improved	Improved	Improved	1	1	1	Achievement of Improved through following BMPs; no further acheivement possible since no flexibility in siting.		
		NW 1.7	Preserve greenfields	Yes - but less than 25% located on greyfield		-	-	-	none	none	none	none	None	0	0	0	No achievement since less than 25% of developed area on possible greyfield. Also it only makes sense to count the existing road as a grey area if serious planning consideration was given to new road alignments entirely within greenfields. This is not the case here, so no acheivement is given or possible.		
	Land & Water	NW 2.1	Manage stormwater			-	-	-	-	None	None	None	None	None	0	0	0	For the purposes of water quantity calculations the existing road needs to be considered a greyfield. Credit requires that water storage capacity be maintained in the greenfield and must be improved in the greyfield (existing road) by at least 30% for an Enhanced rating. No achievement given as no implementation of water quantity improvement. No water storage or infiltration LIDs were provided. As an overall improvement water storage and infiltration over pre-development conditions is not achieved no credit is given. A significant redesign would be required to achieve this high standard and given my experience with the resistance to implementing LIDs for roads, no low hanging fruit score is given.	
		NW 2.2	Reduce pesticide and fertilizer impacts	Unclear -operational policies to control the application of fertilizers and pesticides were not part of the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - runoff controls to minimize groundwater and surface water contamination during the application of fertilizers and pesticides were not discussed in the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - as per Cosmetic Pesticides Ban Act, most pesticides are already banned in Ontario, but fertilizers can still be used	Unclear - no consideration was given in the EA or detailed design documentation to plants that minimize the need for fertilizers and no discussion of integrated pest management, but these may have been considered by the contractor.	-	-	None	A to D	None	Superior	Superior	0	5	5	With the Cosmetic Pesticide Ban Act, most pesticides are banned in Ontario. Also, the project would have planted only native, non-invasive species that should reduce the need for fertilizer. With no documentation to support any achievement, the project is given a base of 0 but its possible they could have achieved a score of Superior with the right documentation. No low fruit achievement of conserving since an integrated pest management practice would require a whole new region wide program be developed.	
		NW 2.3	Prevent surface and groundwater contamination	no - no groundwater quantity and quality monitoring systems used during or post-construction				-	-	None	None	None	None	None	0	0	0	No achievement given as no monitoring of groundwater quantity or quality during or post construction and no low hanging fruit as there is no compelling reason to undertake such monitoring for this project.	
	Biodiversity	NW 3.1	Preserve species biodiversity	No - detailed design documentation does not support that impacts to habitat at the two crossings were fully mitigated	No - no improvements to wildlife movement	No - project does not increase total available habitat or improve connectivity		-	-	-	None	None	None	None	Conserving	0	0	13	No achievement given since no quanification of vegetation loss or plantings provided, compensation can't be effectively assessed. Low hanging fruit of Conserving by quantifying loss and proposed plantings and through channel improvements at the highly degraded Mount Joy Creek crossing just south of Major Mackenzie.
		NW 3.2	Control invasive species	Yes - only native, non-invasive species used	Unlikely - no evidence of a multi year invasive species management plan being contemplated during the EA or detailed design.			-	-	-	A	A	Superior	Superior	Superior	5	5	5	No achievement since no evidence of multi year invasive species management plan. Not low hanging fruit since multi year invasive species management plan would require creation of new region wide program; due to the extensive spread of invasive species in Ontario, only a City/Region wide program makes sense.
		NW 3.3	Restore disturbed soils	Unlikely - No evidence that 100% of soils disturbed during construction have been restored and reused properly				-	-	-	None	None	None	None	None	0	0	0	No achievement since no evidence that 100% of soils disturbed during construction have been restored and reused. My experience is that there is strong push back in industry against soil restoration, especially regarding compaction, so no low fruit score is given.
		NW 3.4	Maintain wetland and surface water functions	Yes - hydrologic connection maintained	Yes - water quality improved with 80% TSS removal of all surface runoff	Yes - riparian and aquatic habitat maintained	Yes - sediment transport maintained with no in stream impacts	No restoration of functions	-	A to E	A to E	Conserving	Conserving	Conserving	15	15	15	Conserving achieved by maintaining or enhancing 4 ecosystem functions. Low fruit would be to strengthen achievement of Conserving through further resportoration of functions	
																21	26	53	

Climate	Emission	CR 1.1 Reduce greenhouse gas emissions	-				None	None	None	None	None	0	0	0	No achievement without life cycle carbon assessment. A life cycle carbon analysis would require extensive resources and I have never heard of one being done for a municipal class EA. Its difficult to assess how likely it is I could have convinced a project team to have undertaken such an assessment, so I will assume a low fruit score of zero.
							None	None	None	None	None	0	0	0	
							None	None	None	None	None	0	0	0	No achievement since no air quality analysis undertaken; no low fruit since its not realistic to reduce air pollution through a widened road (recognizing only a section of the road will be widened).
Resilience	CR 2.1 Assess climate threat	No - no evidence a climate impact assessment was undertaken, and it would not have been undertaken regardless as the discussion of incorporation of climate change into municipal class EAs only began in the fall of 2016 with the release of MOECC's Draft Guideline: <i>Consideration of Climate Change in Environmental Assessments in Ontario</i> .	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no climate impact assessments undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
							None	None	None	None	None	0	0	0	No achievement since no survey of future resource constraints and vulnerabilities undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
							None	None	None	None	None	0	0	0	No achievement since no plans and designs to prepare for long term climate change. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
							None	None	None	None	None	0	0	0	No achievement since no analysis of short term hazards. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
							None	None	None	None	None	0	0	0	No achievement since no evidence of consideration of solar reflectance. Addition of planted median likely required to achieve Improved of 10% shading; as this would require a major redesign of the road, no low hanging fruit score is given.
Resilience	CR 2.2 Avoid traps and vulnerabilities	No - no evidence of identification and assessment of possible changes in key engineering design variables.					None	None	None	None	None	0	0	0	No achievement since no evidence of consideration of solar reflectance. Addition of planted median likely required to achieve Improved of 10% shading; as this would require a major redesign of the road, no low hanging fruit score is given.
							None	None	None	None	None	0	0	0	
							None	None	None	None	None	0	0	0	
							None	None	None	None	None	0	0	0	
							None	None	None	None	None	0	0	0	
Resilience	CR 2.3 Prepare for long-term adaptability	No evidence that team researched long-term changes in operational or environmental conditions	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no evidence of consideration of solar reflectance. Addition of planted median likely required to achieve Improved of 10% shading; as this would require a major redesign of the road, no low hanging fruit score is given.
							None	None	None	None	None	0	0	0	
							None	None	None	None	None	0	0	0	
							None	None	None	None	None	0	0	0	
							None	None	None	None	None	0	0	0	
Resilience	CR 2.4 Prepare for short-term hazards	No evidence that team researched short - term hazards and how they may change over the life time of the project	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no evidence of consideration of solar reflectance. Addition of planted median likely required to achieve Improved of 10% shading; as this would require a major redesign of the road, no low hanging fruit score is given.
							None	None	None	None	None	0	0	0	
							None	None	None	None	None	0	0	0	
							None	None	None	None	None	0	0	0	
							None	None	None	None	None	0	0	0	
Resilience	CR 2.5 Manage heat island effects	No - project does not meet heat island requirements	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no evidence of consideration of solar reflectance. Addition of planted median likely required to achieve Improved of 10% shading; as this would require a major redesign of the road, no low hanging fruit score is given.
							None	None	None	None	None	0	0	0	
							None	None	None	None	None	0	0	0	
							None	None	None	None	None	0	0	0	
							None	None	None	None	None	0	0	0	

0 0 0
105 155 261

Possible Total 778
Score 13.50% 19.92% 33.55%
Award: None Bronze Silver

A9: Ninth Line (Highway 407 to Main Street Stouffville)

			Performance Metrics					Metrics Achieved		Achievement Level			Score					
			Criterion	A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base		Upper	Low Fruit
Quality of Life	Purpose	QL 1.1	Improve community quality of life	Likely - I assume that test of considering community needs goals and issues is satisfied by aligning with ROP &TMP, Pedestrian and Cycling Master Plan, Markham Pathway and Trails Master Plan; 2 well attended PICs with partial summary comment table	Likely - project aligns the EA purpose with ROP &TMP, Pedestrian and Cycling Master Plan, Markham Pathway and Trails Master Plan; 2 well attended PICs with partial summary comment table	Yes- the EA process sought to identify and address potential impacts to the local community	Unlikely. No clear test of "meaningfully" engaged. Could have been satisfied through plans reviewed and PICs held. Separate meetings with impacted property owner.	Unlikely affected community is satisfied since only standard PIC process followed and no evidence of community endorsement	A to C	A to C	None	None	Superior	0	0	10	York Region reviewed their OP, the local OPs and the 2002 TMP, and held 2 fairly well attended public meetings. However, although a summary table of some of the comments received from PICs 1 and 2 and responses was provided there was no clear alteration to project as a result of public input. No achievement given because there's no evidence to support that the local community was meaningfully engaged (criterion D). Achievement of D requires communities be "meaningfully engaged" the project. Superier requires D and that all negative impacts on the nearby community be reduced or eliminated.	
		QL 1.2	Stimulate sustainable growth and development	Unlikely - design, construction and operation supports existing jobs, but unlikely to meet test of <i>significant</i> number of new jobs	Yes- project increased quality of recreational capacity with paved shoulder and multi-use paths for cycling	Yes - reduced congestion counts as improved community productivity as per Envision		-	B, C	B, C	None	None	None	0	0	0	No achievement given or possible without the creation of a significant number of new jobs during design, construction and operation.	
		QL 1.3	Develop local skills and competencies	No - no commitments to local employment of needy or disadvantaged groups		-	-	-	-	none	none	none	none	none	0	0	0	My opinion is that a municipality would never and probably couldn not legally restrict a contractor to hiring local workers; the most that could probably be done is including a policy to look favourably in the tendering process of contractors with a policy of training and hiring needy or disadvantaged workers
	Wellbeing	QL 2.1	Enhance public health and safety	No - no new sustainability technologies, materials or equipment identified so no opportunity to assess associated Health and Safety implications		-	-	-	none	none	none	none	Improved	0	0	2	No new sustainability technologies have been proposed, so there's no opportunity to assess associated Health and Safety implications; therefore no achievement is given. As other low fruit score may require the use of new sustainability technologies, there would be an associated opportunity to assess the associated Health and Safey implications so a conservative low fruit score of Improved is given.	
		QL 2.2	Minimize noise and vibration	Yes - studies of noise during operation and additional consideration in ESR of noise during construction	No - no mitigation and monitoring of noise proposed		-	-	-	A	A	Improved	Improved	Conserving	1	1	8	Achievement of Improved through consideration and study of noise during construction and operation. Achievement of Conserving would require determination of noise goals of community with mitigation and monitoring. With extensive involvement of community during well attended PICs, it would be low hanging fruit to have formalized this through approved proposals with community endorsement to monitor and mitigate noise impacts during construction - low hanging fruit of "Conserving".
		QL 2.3	Minimize light pollution	Likely - no evidence of assessment of lighting needs in available documentation, but TRCA's files are unlikely to have such documentation; some assessment likely done in detailed design	Uncertain - no evidence of analysis of efforts to reduce light energy requirements, but may have been done at detailed design. Google Streetview shows typical non LED light standards installed	Unlikely - no evidence of efforts to reduce light spillage and preserve night sky, but unlikely an explicit goal of the lighting design	-	-	-	A	A and B	None	Improved	enhanced	0	1	2	No base achievement as there's no evidence specific efforts were made to reduce lighting energy requirements; an upper score of improved reflects the uncertainty in assessing credit B. A low fruit score of Enhanced reflects a simple assessment of lighting needs, during and post-construction, installation of energy efficient light standards, and basic efforts to reduce light spillage.
		QL 2.4	Improve community mobility and access	Yes - safe to assume study of access and mobility would have been undertaken with Consultant and or contractor during detailed design	yes -team coordinated with local municipality, school, and residents and transit authorities	Yes - design supports active transportation through multi use paths and paved shoulders	likely - plans to limit traffic disruption likely undertaken with contractor	Yes - access to public transportation in support of transportation master plan	Uncertain - its unclear how to assess whether or not the project improves livability	A to E	A through F	Improved	Enhanced	Superior	1	4	7	study of access during EA and detailed design in consultation with local businesses and residents, a design that supports the 2008 Pedestrian and Cycling Master Plan and 2009 Transportation Master Plan, with a focused effort during the well attended PICs to discuss access and mobility with local businesses and residents should earn a rating of between Improved and Enhanced. Superior requires reducing traffic impacts during construction "well beyond construction norms."
		QL 2.5	Encourage alternative modes of transportation	Yes - rush hour buses run along Ninth Line	Likely - no deliberate restriction of parking; however, no parking provided through urban cross section	Yes - design supports active transportation through multi use paths and paved shoulders	Yes - encouragement of use of alternative modes of transportation	No programs specific to the project to encourage alternative transportation		A to D	A to E	Enhanced	Enhanced	Enhanced	3	3	3	Achievement of Enhanced based upon buses along 9th Line providing access to multi modal transit facilities, the restriction of parking, and support for cycling connected to a cycling network. An achievement of Superior requires secure bicycle lockers at the transit stops, which would be a tough sell for their expense relative to the bus stop use.
		QL 2.6	Improve site access, safety and wayfinding	No - no documentation of wayfinding signage considered at the EA or detailed design aside						None	none	None	None	none	0	0	0	No study of wayfinding and limited opportunity.

Community	QL 3.1	Preserve historic and cultural resources	Yes- phases 1 and 2 at EA and 3 and 4 at detailed design	No - resources cannot be preserved as sites are located within preferred alignment	-	-	A	A	None	None	None	0	0	0	No achievement given or possible since two site with artifacts must be disturbed due to the proposed alignment.
	QL 3.2	Preserve views and local character	Yes - simple description of local character in ESR	No view plans or design guidelines			A	A	None	None	Enhanced	0	0	3	No achievement given as no view plan was undertaken. Achievement of Enhanced may have been possible for the section north of 19th Avenue as local residents could have been engaged as residents live in this suburban section of the road.
	QL 3.3	Enhance public space	No, no additions or improvements to publicly accessible space		-	-	none	none	None	None	none	0	0	0	No achievement since no new public space and no low hanging fruit since adding public space will challenging within the proposed right of way.
												5	9	35	

Leadership	Collaboration	LD 1.1	Provide effective leadership and commitment	Yes - general sustainability statements in Official Plan, 2007 Sustainability Strategy and Vision statement	-	-	-	-	-	A	A	Enhanced	Enhanced	Superior	4	4	4	York Region has their 2007 Sustainability Strategy which informed their Vision 2051. No annual reporting of sustainability progress so achievement limited to Enhanced, with no low hanging fruit
		LD 1.2	Establish a sustainability management system	Unlikely - project did not specifically address sustainability based on documentation so its unlikely anyone on the project team was responsible for sustainability issues	Unlikely - project did not specifically address sustainability based on documentation so its unlikely a management policy was created for the project	no - based upon ESR the project did not set sustainability goals and targets				none	A	None	None	None	0	0	0	Although it can't be confirmed that no specific person was given the responsibility of sustainability, it is unlikely as sustainability is not addressed in the ESR, and its irrelevant because a project must meet criterion A through E for all levels of achievement. Meeting criterion A through E would require an extensive commitment to sustainability within the project team through various business sustainability processes, and given that sustainability as a concept is not considered in EAs for road projects in the GTA in my experience, such commitment is not considered low hanging fruit. No ESRs in any ESRs reviewed for this thesis even used the term sustainability except in reference to the title of another document.
		LD 1.3	Foster collaboration and teamwork	Yes - project team likely incorporated collaboration, teamwork and whole systems design to some degree	No - not likely meaningful risk and reward sharing between consultant and owner		-	-	-	A	A	Improved	Enhanced	Enhanced	1	4	4	The project documentation does not mention sustainability, however aspects of sustainable design are found. However, the incorporation of results of the Pedestrian and Cycling Master Plan and the Transportation Master Plan shows some degree of systems view. Low fruit is to more fully achieve Enhanced.
		LD 1.4	Provide for stakeholder involvement	Yes - to some extent stakeholders ID and key concerns addressed	Yes - extensive consultation with stakeholders	Yes - to some extent stakeholder input incorporated into plans	yes - stakeholding participation and communications program established			A to D	A to D	Improved	Enhanced	Enhanced	1	5	5	Documentation of some main comments from the public and responses from project team from PICs 1 and 2. Both PICs were well attended. No evidence of any design alteration as a resut of public input. It is likely that an improved level would be achieved due to standard PIC engagement and project management principles. Given the well attended PICs and that some effort was made to document public comments, more thorough documentation of public engagement and proof of design alterations from public input would constitute low hanging fruit of enhanced.
	Management	LD 2.1	Pursue by-product synergy opportunities	no - no documentation of efforts to search for unwanted byproduct of nearby facilities & very unlikely to have occurred		-	-			None	None	None	None	None	0	0	0	No assessment of unwanted byproducts of nearby facilities. Therefore no achievement. Not likely relevant to road constuction so no low hanging fruit
		LD 2.2	Improve infrastructure integration	No evidence project team sought to improve sustainability through project wide systems integtation		-	-			None	None	None	None	None	0	0	0	No evidence that project team sought to improve project sustainability through project wide systems integration;
	Planning	LD 3.1	Plan for long-term monitoring and maintenance	Likely - York Region would have developed a multit-year monitoring plan of the new channel works as part of their DFO Authorization	Likely - it should be assumed the in order for the monitoring plan to be accepted by DFO that sufficient resources for monitroing were set aside	-	-	-	-	None	None	None	None	Enhanced	0	0	3	No achievement because Improved required moniroting plan beyond regulatory requirements, but the monitoring plan is for this project would have been to satisfy DFO requirements. Adding an extra year of monitoring beyond the DFO Authorization requirements would achieve Enhanced.
		LD 3.2	Address conflicting regulations and policies	No - no documentation of assessment of conflicting regulations and policies		-	-	-	-	none	A	none	None	Improved	0	0	1	No achievement since no documentation of assessment of conflicting regulations and policies and no evidence of sustainability objectives. Low hanging fruit of Improved through basic assessment of regulations and associated regulators and organizations and connection to sustainability objectives.
		LD 3.3	Extend useful life	yes - high likelihood of some consideration of durability, flexibility and reslience of project	No - no documentation of consideration of expansion or future reconfiguration of project, but may have occurred	-	-	-	-	A	A, B	Improved	Improved	Enhanced	1	1	3	Likely achieved Improved by considering to some degree the flexibility, durability and resilience of road, culverts and underpassesnew channel. Achieving Enhanced requires documentation of consideration of future expansion or reconfiguration which is given a low hanging fruit score.

												7	14	20						
Resource Allocation	Materials	RA 1.1	Reduce net embodied energy		-	-	-	-									No documentation of an LCA and reasonable assumption one was never done as I have never heard of one occurring in my career for a municipal EA; a LCA is very resource intensive so its not considered low hanging fruit.			
			No - no documentation of an LCA										none	none	none	none	None	0	0	0
		RA 1.2	Support sustainable procurement practices					-	-									No documentation of sustainable procurement, and reasonable assumption this is not done in practice outside of LEED projects; as it has been done for LEED projects, it's a reasonable assumption that the lowest level of improved could have been achieved through <15% materials from suppliers with 'sustainability practice'		
			No - no documentation of sustainable procurement										None	None	None	None	Improved	0	0	2
		RA 1.3	Use recycled materials					-	-	-	-							No documentation of EA or detailed design project teams analyzing reuse of on site materials, but this was likely done by contractor to reduce expenses. No evidence of specifying materials with recycled content, but its likely the contractor still purchased materials with recycled content to reduce expenses. Its standard for pavement and granular subgrade to contain a significant percentage of recycled material, so its safe to assume 20% (by weight or volume) of materials on site are recycled. As credit may not be given, the base score is zero. An upper score of Superior is given based upon credit given for the contractor purchasing but not specifying materials with recycled content. A low fruit rating of Enhanced is given as it should be easily acheived for the municipality to specify materials with recycled contact.		
			Likely - no documentation of assessment at EA or detailed design of on site reuse. Likely done by contractor in effort to save money.	Unclear - no documentation of specification of recycled material undertaken in EA or detailed design. Contractor would have purchased materials with recycled content but not specified it, so its unclear this acheives the credit sustainability intent								A	A, B	None	Enhanced	Superior	0	5	11	
		RA 1.4	Use regional materials		-	-		-	-	-	-								No documentation for the <i>specification</i> of local materials, but with the cost of transportation its likely a large percentage of materials were sourced within the specified distances. Its unclear if achievement of the credit requires explicit specification of local materials by the contractor. If credit is acheived, its conservatively assumed to be an upper acheivement of Improved (30% local) and a low hanging fruit of Enhanced (60% local). Achievement could have been and could be much higher but I don't have evidence to accurately assess so I've used a conservative assessment.	
			Unclear - no documentation of specification of local materials, but with expense of transporting materials its likely contractor purchased local materials to save money. Its unclear if this meets the credit intent.								None	A	None	Improved	Enhanced	0	3	6		
RA 1.5	Divert waste from landfills		Unlikely - There is no documentation in the EA or detailed design regarding a comprehensive waste management plan. Although the contractor likely diverted waste to save landfill charges and make money selling the materials its highly unlikely this was done through a comprehensive waste management strategy				-	-	-								No base or upper achievement since no comprehensive waste management plan likely implemented. With recyclability of asphalt, granular and concrete, its low hanging fruit to achieve 50% recycle/reuse of onsite materials which gives a level of enhanced. Actual low fruit achievement could be even higher, but a more detailed analysis would be required to support this.			
			Unlikely - There is no documentation in the EA or detailed design regarding a comprehensive waste management plan. Although the contractor likely diverted waste to save landfill charges and make money selling the materials its highly unlikely this was done through a comprehensive waste management strategy				-	-	-								No base or upper achievement since no comprehensive waste management plan likely implemented. With recyclability of asphalt, granular and concrete, its low hanging fruit to achieve 50% recycle/reuse of onsite materials which gives a level of enhanced. Actual low fruit achievement could be even higher, but a more detailed analysis would be required to support this.			
RA 1.6	Reduce excavated materials taken off site		Yes -ESR states that suitable soils will be reused on site. Although I had no documentation in materials I had available at detailed design, it is standard to estimate cut and fill in detailed design or by the contractor to reduce costs of transportating and disposing of soils offsite.		-	-		-	-								The level of achievement is based upon a percentage of excavated materials <i>suitable for reuse</i> that are reused on site. It is safe to assume that the vast majority (90%) of fill <i>suitable for reuse</i> was reused on site, giving an achievement of Conserving.			
			Unlikely - no documentation in EA or detailed design of consideration of facilitating future disassembly and recycling of materials. Its unlikely the contractor would have constructed the project in a way that improved the recyclability of the materials.																	
RA 1.7	Provide for deconstruction and recycling		yes - although there's no documentation in the EA and detailed design of specifying materials specifically because of their recycleability asphalt, granular, and concrete are highly recyclable so credit can be given	Unlikely - no documentation in EA or detailed design of consideration of facilitating future disassembly and recycling of materials. Its unlikely the contractor would have constructed the project in a way that improved the recyclability of the materials.		-	-		-	-							As asphalt, granular and concrete are highly recyclable so evalation criterion A is met which on its on leads to a maximum achivement of Improved. Higher levels of achievement require specific efforts to facilitate future recycling which is highly unlikely to have occurred, but with little extra effort due to the highly recyclable nature of many road materials would yield a rating of Superior for the low hanging fruit			
RA 2.1	Reduce energy consumption		No - no evidence in the EA or detailed design that the team assessed options for reducing energy consumption				-	-	-	-							Even if options to reduce energy consumption were considered, a basic Improved level requires a decrease of 10% of energy consumption during operation over industry norms, and must include energy consumed by vehicular traffic. As the project adds general purpose lanes to an existing road, this is unachievable so no credit is given or possible.			

Energy	RA 2.2	Use renewable energy	No - the vast majority of energy used in the operation and maintenance of the road will be fossil fuels for vehicles with a relatively smaller amount for the nuclear and natural gas for the light standards			-	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since the vast majority of energy used in the operation and maintenance of the road will be fossil fuels. A very significant shift to electric vehicles would be required because Ontario's dominant Nuclear power is not a renewable resource as per Envision.	
	RA 2.3	Commission and monitor energy systems	Unclear - the Region would likely monitors the energy consumption of its lights but I don't have easy access to the information required to determine if this would constitute the advanced monitoring systems this criterion requires			-	-	-	-	-	B	A to C	None	Enhanced	Enhanced	0	3	3	There is no documentation in the files review for the EA or detailed design related to how the lighting systems would be commissioned, but such information isn't expected to sent to TRCA anyways. I don't have sufficient knowledge of standard practices in how municipalities commission and monitor lighting standards to properly assess this credit. The likely range of scores is too low to justify the effort required to more confidently score this credit. So a conservative range of none to Enhanced is given. The next achievement jumps to conserving and requires extensive commissioning and monitoring of systems and as Conservative for any credit is intended to be far beyond current standards of practice, I've assumed its not low hanging fruit.	
	RA 3.1	Protect fresh water availability	No -although the EA assessed dewatering requirements for construction it was not from the perspective of assessing water availability to support water use so things like recharge weren't considered.			No - although there is no documentation of assessment water taking requirements beyond construction, it wouldn't have been done for long -term impacts as the project doesn't require water takings during operation	-	-	-	-	None	None	None	None	None	0	0	0	No level of achievement. The project only assessed groundwater conditions for the purposes of assessing dewatering needs during construction which does not meet many of the requirements of a water availability assessment (criterion A). The project will not require water takings during operation (criterion B). Therefore no achievemtn is given. No low fruit score is given since an analysis of groundwater and surface water from the perspective of availability is not relevant to this project.	
	RA 3.2	Reduce potable water consumption	No - no documentation of identification of strategies to reduce potable water consumption during operation and maintenance			-	-	-	-	-	None	None	None	None	None	0	0	0	No level of achievement given as there is no evidence of a potable water reduction strategy and it can be assumed one wasn't done regardless as roads use little potable water generally during operation and maintenance. For roads, the only opportunity is the use of drought resistant plants in planted medians or boulevards to which stormwater is directed to eliminate the need to water plants with potable water; as such a redesign could be significant and I've assumed significant redesigns are no low hanging fruit, no low hanging fruit score given.	
RA 3.3	Monitor water systems	NA			-	-	-	-	-	-									Not applicable since project does not involve potable water systems in its operation that could be monitored. This criterion would apply if there was an associated watermain.	
7																			18	42
Siting	NW 1.1	Preserve prime habitat	no - development in prime habitat is not avoided due to the Little Rouge containing records of the endagered species Redside Dace			-	-	-	-	-	None	None	None	None	None	0	0	0	The Little Rouge, over which the bridge was recontructed and widened, is identified as Redside Dace habitat in the EA. As Redside Dace is an engandered species this makes its habitat Prime Habitat as per the Envision definition, and no credit is possible.	
	NW 1.2	Protect wetlands and surface water	No - project widening occurs within specified distance to a watercourse.			-	-	-	-	-	None	None	None	None	None	0	0	0	No achievement given or possible as the site crosses over several watercourses.	
	NW 1.3	Preserve prime farmland	No - site not assessed for prime farmland			No - Prime farmland not protected	-	-	-	-	None	None	None	None	None	0	0	0	No achivement given or desirable as the project expands the road east onto farmland and creates a wider riparian zone for the adjacent watercoure. The new feature provides superior aquatic habitat and separation of stormwater runoff from the road.	
	NW 1.4	Avoid adverse geology	NA			NA	NA	-	-	-	NA	NA	NA	NA	NA				Credit excluded as not generally relevant for the region, with the exception of projects on the Niagara Escarpment.	
	NW 1.5	Preserve floodplain function	Yes - floodplain function is maintained or enhanced at all crossings through increased crossing capacities			No - Floodplain infiltration is inhibited by increased impervious area within the floodplain	Yes - riparian habitat enhancements within floodplain	Yes - a flood emergency plan would not have been prepared for the project, but will be for the local municipality	Yes - existing culvert is being replaced with much larger culvert to eliminate overtopping of road	Yes - existing culverts and bridges being replaced	A	A	Improved	Improved	Improved	2	2	2	Achievement of improved through maintaining or improving flood conveyance. No further achievement is possible with the current design due to extensive increases in impervious areas within the floodplain.	
	NW 1.6	Avoid unsuitable development on steep slopes	Yes - project likely follows BMPs for slopes as informed by geotechnical investigations			No - road was not sited based on slope concerns	-	-	-	-	A	A	Improved	Improved	Improved	1	1	1	Achievement of Improved. Project follows BMPs for sections that parallel a slope. No opportunity to site the road minimize siting on the slope due to other site constraints	

Natural World	Land & Water	NW 1.7	Preserve greenfields	Yes - at least 50% of the project area, being the existing road, is already developed	No - project is not on a designated brownfield	-	-	-	A	A	none	none	None	0	0	0	Although more than 50% of the project is located on an already developed area, it only makes sense to count the existing road as a grey area if serious planning consideration was given to new road alignments entirely within greenfields. This is not the case here, so no achievement is given or possible.
		NW 2.1	Manage stormwater	-	-	-	-	-	None	None	None	None	None	0	0	0	For the purposes of water quantity calculations the existing road needs to be considered a greyfield. Credit requires that water storage capacity be maintained in the greenfield and must be improved in the greyfield (existing road) by at least 30% for an Enhanced rating. No achievement given as no implementation of water quantity improvement. No water storage or infiltration LIDs were provided. As an overall improvement water storage and infiltration over pre-development conditions is not achieved no credit is given. A significant redesign would be required to achieve this high standard and given my experience with the resistance to implementing LIDs for roads, no low hanging fruit score is given.
		NW 2.2	Reduce pesticide and fertilizer impacts	Unclear - operational policies to control the application of fertilizers and pesticides were not part of the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - runoff controls to minimize groundwater and surface water contamination during the application of fertilizers and pesticides were not discussed in the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - as per Cosmetic Pesticides Ban Act, most pesticides are already banned in Ontario, but fertilizers can still be used	Unclear - no consideration was given in the EA or detailed design documentation to plants that minimize the need for fertilizers and no discussion of integrated pest management, but these may have been considered by the contractor.	-	None	A to D	None	Superior	Superior	0	5	5	With the Cosmetic Pesticide Ban Act, most pesticides are banned in Ontario. Also, the project would have planted only native, non-invasive species that should reduce the need for fertilizer. With no documentation to support any achievement, the project is given a base of 0 but its possible they could have achieved a score of Superior with the right documentation. No low fruit achievement of conserving since an integrated pest management practice would require a whole new region wide program be developed.
		NW 2.3	Prevent surface and groundwater contamination	No - groundwater monitoring of quantity, but not quality	Yes - detailed design had some general aspects of a spills prevention plan in the standard notes and the contractor likely development their own detailed protocol	-	-	-	B	B	None	None	Enhanced	0	0	4	No achievement since no monitoring of water quality. However, with the extensive water quantity monitoring plan in place (surface and groundwater), its low hanging fruit to also monitor for water quality, in combination with a spills prevention plan which was probably developed by the contractor.
	Biodiversity	NW 3.1	Preserve species biodiversity	yes - project compensates for losses	Yes - improved wildlife movement	-	-	-	A, B, C	A, B, C	Restorative	Restorative	Restorative	16	16	16	Existing ditch was relocated further east, designed as a natural channel with riparian plantings and natural corridor, and stormwater flows from the road were separated to improve water quality. The culvert under Ninth Line was increased in size to facilitate wildlife passage. Achievement of top score of Restorative.
		NW 3.2	Control invasive species	Yes - only native, non-invasive species used	Unlikely - no evidence of a multi year invasive species management plan being contemplated during the EA or detailed design.	-	-	-	A	A	Superior	Superior	Superior	5	5	5	No achievement since no evidence of multi year invasive species management plan. Not low hanging fruit since multi year invasive species management plan would require creation of new region wide program; due to the extensive spread of invasive species in Ontario, only a City/Region wide program makes sense.
		NW 3.3	Restore disturbed soils	Unlikely - No evidence that 100% of soils disturbed during construction have been restored and reused properly	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no evidence that 100% of soils disturbed during construction have been restored and reused. My experience is that there is strong push back in industry against soil restoration, especially regarding compaction, so no low fruit score is given.
		NW 3.4	Maintain wetland and surface water functions	Yes - new channel designed by geomorphologist will maintain hydrologic connection to floodplain	yes - maintains water quality	yes - enhances habitat	yes - maintains sediment transport	possible - its unclear whether or not all disturbed functions were restored	A to D	A to D	Conserving	Conserving	restorative	15	15	19	Project maintains or enhances four ecosystem functions for an achievement of conserving, and could achieve restorative by enhancing water quality and proving that the hydrologic connection and sediment transport were improved.
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	Emission	CR 1.1	Reduce greenhouse gas emissions	No - no evidence of a life cycle carbon assessment having been undertaken, and this would not have been done regardless as its resouce intensive and not currently required by any agencies	-	-	-	-	None	None	None	None	None	0	0	0	No achievement without life cycle carbon assessment. A life cycle carbon analysis would require extensive resources and I have never heard of one being done for a municipal class EA. Its difficult to assess how likely it is I could have convinced a project team to have undertaken such an assessment, so I will assume a low fruit score of zero.
		CR 1.2	Reduce air pollutant emissions	No - no evidence in the EA or detailed design of an air quality analysis. Even if one were to be done a project that increases vehicular traffic won't meet the criterion objective of improving air quality	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no air quality analysis undertaken; no low fruit since its not realistic to reduce air pollution through a widened road.

Climate	Resilience	CR 2.1	Assess climate threat	No - no evidence a climate impact assessment was undertaken, and it would not have been undertaken regardless as the discussion of incorporation of climate change into municipal class EAs only began in the fall of 2016 with the release of MOECC's Draft Guideline: <i>Consideration of Climate Change in Environmental Assessments in Ontario.</i>	-	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since no climate impact assessments undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.	
		CR 2.2	Avoid traps and vulnerabilities	No - no evidence of identification and assessment of possible changes in key engineering design variables.			-		-	-	None	None	None	None	None	0	0	0	No achievement since no survey of future resource constraints and vulnerabilities undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.3	Prepare for long-term adaptability	No evidence that team researched long-term changes in operational or environmental conditions		-	-		-	-	None	None	None	None	None	0	0	0	No achievement since no plans and designs to prepare for long term climate change. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.4	Prepare for short-term hazards	No evidence that team researched short -term hazards and how they may change over the life time of the project			-		-	-	None	None	None	None	None	0	0	0	No achievement since no analysis of short term hazards. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.5	Manage heat island effects	No - project does not meet heat island requirements	-	-	-		-	-	None	None	None	None	None	0	0	0	No achievement since no evidence of consideration of solar reflectance. Addition of planted median likely required to achieve Improved of 10% shading; as this would require a major redesign of the road, no low hanging fruit score is given.
		0																	0
58																	85	149	
Possible Total																	793		
Score																	7.31%	10.72%	18.79%
Award:																	None	None	None

A10: Rossland Road (Brock Road to Westney Road)

			Performance Metrics						Metrics Achieved		Achievement Level			Score						
			Criterion	A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base	Upper		Low Fruit		
Quality of Life	Purpose	QL 1.1	Improve community quality of life	Unlikely - I assume that test of considering community needs goals and issues was not satisfied. Although it aligns with the 2007 Ajax Transportation Master Plan, Durham Transportation Master Plan, there was limited consideration of Official Plans and no consideration of Provincial Policy. Two well attended PICs with partial comments summary	Unlikely - aligns with 2007 Ajax Transportation Master Plan, Durham Transportation Master Plan, but limited consideration of Official Plans or and no consideration of Provincial Policy 2 well attended PICs with partial comments summary.	Yes- the EA process sought to identify and address potential impacts to the local community	No - the standard 2 PIC meetings with info boards will not suffice as meaningful engagement. Also, the community generally opposed project at PICs as per the records in the ESR.	As the communit generally opposed the project, community endoresement was not achieved	C	A to C	None	None	Enhanced	0	0	5	Ajax reviewed their local and regional TMPs, and held 2 fairly well attended public meetings. There's no discussion in the ESR of Provincial Policy or Official Plans, so the project may not have achieved any rating. ESR discusses comments from both PICs and discusses them. There's no evidence that public comments from project consultation resulted in any alterations to the project, which would be a basic tenant of "meaningful consultation". With broader, more meaningful consultation, a rating of enhanced could have been achieved.			
		QL 1.2	Stimulate sustainable growth and development	Unlikely - design, construction and operation supports existing jobs, but unlikely to meet test of <i>significant</i> number of new jobs	Yes- project increased quality of recreational capacity with multi-use paths for cycling	Yes - reduced congestion counts as improved community productivity as per Envision	-			B, C	B, C	None	None	None	0	0	0	No achievement given or possible without the creation of a significant number of new jobs during design, construction and operation.		
		QL 1.3	Develop local skills and competencies	No - no commitments to local employment of needy or disadvantaged groups	-			-	-	-	-	none	none	none	none	0	0	0	My opinion is that a municipality would never and probably couldn not legally restrict a contractor to hiring local workers; the most that could probably be done is including a policy to look favourably in the tendering process of contractors with a policy of training and hiring needy or disadvantaged workers	
	Wellbeing	QL 2.1	Enhance public health and safety	No - no new sustainability technologies, materials or equipment identified so no opportunity to assess associated Health and Safety implications	-			-	-	-	none	none	none	none	Improved	0	0	2	No new sustainability technologies have been proposed, so there's no opportunity to assess associated Health and Safety implications; therefore no achievement is given. As other low fruit score may require the use of new sustainability technologies, there would be an associated opportunity to assess the associated Health and Safey implications so a conservative low fruit score of Improved is given.	
		QL 2.2	Minimize noise and vibration	No - studies of noise during operation, but no consideration of noise during construction	No - no mitigation and monitoring of noise proposed	-			-	-	None	None	None	None	Improved	0	0	1	No achievement since no consideration of noise impacts during construction. Low hanging fruit of Improved if noise during construction considered.	
		QL 2.3	Minimize light pollution	Likely - no evidence of assessment of lighting needs in available documentation, but TRCA's files are unlikely to have such documentation; some assessment likely done in detailed design	Uncertain - no evidence of analysis of efforts to reduce light energy requirements, but may have been done at detailed design.	Unlikely - no evidence of efforts to reduce light spillage and preserve night sky, but unlikely an explicit goal of the lighting design	-			-	-	A	A and B	None	Improved	enhanced	0	1	2	No base achievement as there's no evidence specific efforts were made to reduce lighting energy requirements; an upper score of improved reflects the uncertainty in assessing credit B. A low fruit score of Enhanced reflects a simple assessment of lighting needs, during and post-construction, installation of energy efficient light standards, and basic efforts to reduce light spillage.
		QL 2.4	Improve community mobility and access	Yes - safe to assume study of access and mobility would have been undertaken with Consultant and or contractor during detailed design	yes -team coordinated with local municipality, residents and transit authorities	Yes - design supports active transportation through multi use paths connected to trail system to Lake Ontario	likely - plans to limit traffic disruption likely undertaken with contractor	Yes - access to public transportation with additional stops and extended transit route	Uncertain - its unclear how to assess whether or not the project improves livability	A to E	A through E	Improved	Enhanced	Superior	1	4	7	Achievement of improved to Enhanced based on limited to satisfactory consideration of access and mobility during planning and construction. Study of access during EA and detailed design in consultation with local businesses and residents, a detailed design that supports the Durham Regional Cycling Plan, Transportation Master Plans, and Official Plans with a focused effort during the well attended PICs to discuss access and mobility with local businesses and residents should earn a rating of Superior.		
		QL 2.5	Encourage alternative modes of transportation	Yes - 4 routes bus routes along Rossland Road at the time of the EA.	Likely - no deliberate restriction of parking; however, no parking provided through urban cross section	Yes - design supports active transportation through multi use paths connected to Lake Ontario	Yes - encouragement of active transportation through multi use path that is part of Lake to Lake trail	Uncertain - the project did not develop programs to encourage alternative transportation but the Region and local municipality have		A to D	A to E	Enhanced	Enhanced	Enhanced	3	3	3	Achievement of Enhanced based upon buses along Rossland providing access to multi modal transit facilities, the restriction of parking, and support for cycling connected to a cycling network. An achievement of Superior requires secure bicycle lockers at the transit stops, which would be a tough sell for their expense relative to the bus stop use.		
		QL 2.6	Improve site access, safety and wayfinding	No - no documentation of wayfinding signage considered at the EA or detailed design aside							None	none	None	None	none	0	0	0	No study of wayfinding and limited opportunity.	
	Community	QL 3.1	Preserve historic and cultural resources	Yes - proponent worked with local conservation authority and municipality, and undertook stage 1 and 2 archaeological investigation to identify resources	Unknown - no feasibility analysis done at EA to incorporate preservation or enhancement of cultural resources, but EA does direct a study of a historic post to be undertaken at detailed design			-		-	A	A, B	none	Improved	Improved	0	1	1	Some build and buried cultural resources along study corridor. Feasibility analysis of preservation or enhancement of resources (regardless of implementation) would have achieved a level of 'improved'. It may have been done at detailed design so an upper score of improved given.	
		QL 3.2	Preserve views and local character	Yes - determination of rural, but urbanizing character	No - no view plans developed						A	A	None	None	Improved	0	0	1	No public view plan was developed so no credit can be given; as the area is developing the only areas relevant for a viewshed may be the two watercourse crossings; a basic viewshed plan would achieve improved.	
		QL 3.3	Enhance public space	No - project does not add to public space				-	-	-	none	none	none	none	none	0	0	0	No achievement and little opportunity within the project scope to create public space.	

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Leadership	Collaboration	LD 1.1	Provide effective leadership and commitment	yes - general sustainability statements can be found in the 2015 to 2019 Strategic Plan, and 2015 Consolidated Official Plan	—	—	—	—	—	A	A	Enhanced	Enhanced	Superior	4	4	4	Durham Region has their strategic plan and Official Plan with general sustainability statements. No annual reporting of sustainability progress so achievement limited to Enhanced, with no low hanging fruit				
		LD 1.2	Establish a sustainability management system	Unlikely - project did not specifically address sustainability based on documentation so its unlikely anyone on the project team was responsible for sustainability issues	Unlikely -project did not specifically address sustainability based on documentation so its unlikely a management policy was created for the project	no - based upon ESR the project did not set sustainability goals and targets	—	—	—	—	none	A	None	None	None	0	0	0	Although it can't be confirmed that no specific person was given the responsibility of sustainability, it is unlikely as sustainability is not addressed in the ESR, and its irrelevant because a project must meet criterion A through E for all levels of achievement. Meeting criterion A through E would require an extensive commitment to sustainability within the project team through various business sustainability processes, and given that sustainability as a concept is not considered in EAs for road projects in the GTA in my experience, such commitment is not considered low hanging fruit. No ESRs in any ESRs reviewed for this thesis even used the term sustainability except in reference to the title of another document.			
		LD 1.3	Foster collaboration and teamwork	Yes - project team likely incorporated collaboration, teamwork and whole systems design to some degree	No - not likely meaningful risk and reward sharing between consultant and owner	—	—	—	—	A	A	Improved	Enhanced	Enhanced	1	4	4	The project documentation does not mention sustainability, however aspects of sustainable design are found. However, the incorporation of results of the Pedestrian and Cycling Master Plan and the Transportation Master Plan shows some degree of systems view. Low fruit is to more fully achieve Enhanced.				
		LD 1.4	Provide for stakeholder involvement	Yes - to some extent stakeholders ID and key concerns addressed	Yes - extensive consultation with main stakeholders	No - at project level, no evidence of incorporation of comments from public into design	—	—	—	A, B	A, B	Improved	Improved	Enhanced	1	1	5	Documentation of some main comments from the public and responses from project team from PICs 1 and 2. Both PICs were well attended. Public involved consultation generally opposed to project at both PICs and petition to local council. Give broad and generally negative public views of project during consultation and that no alterations to the project were made as a result of public input, an acheivement of improved can be given. With earlier, broader and more open consultation the project may have been able to acheive a level of enhanced.				
	Management	LD 2.1	Pursue by-product synergy opportunities	no - no documentation of efforts to search for unwanted byproduct of nearby facilities & very unlikely to have occurred	—	—	—	—	—	None	None	None	None	None	0	0	0	No assessment of unwanted byproducts of nearby facilities. Therefore no achievement. Not likely relevant to road constuction so no low hanging fruit				
		LD 2.2	Improve infrastructure integration	No evidence project team sought to improve sustainability through project wide systems integtation	—	—	—	—	—	None	None	None	None	None	0	0	0	No evidence that project team sought to improve project sustainability through project wide systems integration;				
	Planning	LD 3.1	Plan for long-term monitoring and maintenance	Likely - 10 year monitoring of channel realignment at Urfe Creek and tribs	Likely - it should be assumed that in order for the monitoring plan to be accepted by DFO that sufficient resources for monitroing were set aside	—	—	—	—	—	None	None	None	Enhanced	Enhanced	0	3	3	No achievement because Improved requires monitoring plan beyond regulatory requirements. However, if the argument can be made that the 10 years was more than the minium required for regulator approvals, then enhanced should be achieved. Adding an extra year of monitoring beyond the DFO Authorization requirements should achieve Enhanced.			
		LD 3.2	Address conflicting regulations and policies	No - no documentation of assessment of conflicting regulations and policies	—	—	—	—	—	—	none	A	none	None	Improved	0	0	1	No achievement since no documentation of assessment of conflicting regulations and policies and no evidence of sustainability objectives. Low hanging fruit of Improved through basic assessment of regulations and associated regulators and organizations and connection to sustainability objectives.			
		LD 3.3	Extend useful life	yes - high likelihood of some consideration of durability, flexibility and resilience of project	No - no documentation of consideration of expansion or future reconfiguration of project, but may have occurred	—	—	—	—	—	A	A, B	Improved	Improved	Enhanced	1	1	3	Likely achieved Improved by considering to some degree the flexibility, durability and resilience of road, culverts and underpassesnew channel. Achieving Enhanced requires documentation of consideration of future expansion or reconfiguration which is given a low hanging fruit score.			
	7																		13		20	
			RA 1.1	Reduce net embodied energy	No - no documentation of an LCA	—	—	—	—	—	none	none	none	none	None	0	0	0	No documentation of an LCA and reasonable assumption one was never done as I have never heard of one occurring in my career for a municipal EA; a LCA is very resource intensive so its not considered low hanging fruit.			
			RA 1.2	Support sustainable procurement practices	No - no documentation of sustainable procurement	—	—	—	—	—	—	None	None	None	None	Improved	0	0	2	No documentation of sustainable procurement, and reasonable assumption this is not done in practice outside of LEED projects; as it has been done for LEED projects, it's a reasonable assumption that the lowest level of improved could have been achieved through <15% materials from suppliers with 'sustainability practice'		

Resource Allocation																
Materials																
	RA 1.3	Use recycled materials	Unclear - no documentation of specification of recycled material undertaken in EA or detailed design. Contractor would have purchased materials with recycled content but not specified it, so its unclear this acheives the credit sustainability intent	-	-	-	-	A	A, B	None	Enhanced	Superior	0	5	11	No documentation of EA or detailed design project teams analyzing reuse of on site materials, but this was likely done by contractor to reduce expenses. No evidence of specifying materials with recycled content, but its likely the contractor still purchased materials with recycled content to reduce expenses. Its standard for pavement and granular subgrade to contain a significant percentage of recycled material, so its safe to assume 20% (by weight or volume) of materials on site are recycled. As credit may not be given, the base score is zero. An upper score of Superior is given based upon credit given for the contractor purchasing but not specifying materials with recycled content. A low fruit rating of Enhanced is given as it should be easily acheived for the municipality to specify materials with recycled contact.
	RA 1.4	Use regional materials	Unclear - no documentation of specification of local materials, but with expense of transporting materials its likely contractor purchased local materials to save money. Its unclear if this meets the credit intent.	-	-	-	-	None	A	None	Improved	Enhanced	0	3	6	No documentation for the <i>specification</i> of local materials, but with the cost of transportation its likely a large percentage of materials were sourced within the specified distances. Its unclear if achievement of the credit requires explicit specification of local materials by the contractor. If credit is acheived, its conservatively assumed to be an upper acheivement of Improved (30% local) and a low hanging fruit of Enhanced (60% local). Achievement could have been and could be much higher but I don't have evidence to accurately assess so I've used a conservative assessment.
	RA 1.5	Divert waste from landfills	Unlikely - There is no documentation in the EA or detailed design regarding a comprehensive waste management plan. Although the contractor likely diverted waste to save landfill charges and make money selling the materials its highly unlikely this was done through a comprehensive waste management strategy	-	-	-	-	None	None	None	None	Enhanced	0	0	6	No base or upper achievement since no comprehensive waste management plan likely implemented. With recyclability of asphalt, granular and concrete, its low hanging fruit to achieve 50% recycle/reuse of onsite materials which gives a level of enhanced. Actual low fruit achievement could be even higher, but a more detailed analysis would be required to support this.
	RA 1.6	Reduce excavated materials taken off site	Likely - although no documentation in materials I had available, it is standard to estimate cut and fill in detailed design or by the contractor to reduce costs of transportating and disposing of soils offsite.	-	-	-	-	A	A	Conserving	Conserving	Conserving	6	6	6	The level of achievement is based upon a percentage of excavated materials <i>suitable for reuse</i> that are reused on site. It is safe to assume that the vast majority (90%) of fill <i>suitable for reuse</i> was reused on site, giving an achievement of Conserving.
	RA 1.7	Provide for deconstruction and recycling	Unlikely - no documentation in EA or detailed design of consideration of facilitating future disassembly and recycling of materials. Its unlikely the contractor would have constructed the project in a way that improved the recyclability of the materials. yes - although there's no documentation in the EA and detailed design of specifying materials specifically because of their recyleability asphalt, granular, and concrete are highly recyclable so credit can be given	-	-	-	-	A	A	Improved	Improved	Superior	1	1	8	As asphalt, granular and concrete are highly recyclable so evaluation criterion A is met which on its on leads to a maximum achivement of Improved. Higher levels of achievement require specific efforts to facilitate future recycling which is highly unlikely to have occurred, but with little extra effort due to the highly recyclable nature of many road materials would yield a rating of Superior for the low hanging fruit
Energy																
	RA 2.1	Reduce energy consumption	No - no evidence in the EA or detailed design that the team assessed options for reducing energy consumption	-	-	-	-	None	None	None	None	None	0	0	0	Even if options to reduce energy consumption were considered, a basic Improved level requires a decrease of 10% of energy consumption during operation over industry norms, and must include energy consumed by vehicular traffic. As the project adds general purpose lanes to an existing road, this is unachievable so no credit is given or possible.
	RA 2.2	Use renewable energy	No - the vast majority of energy used in the operation and maintenance of the road will be fossil fuels for vehicles with a relatively smaller amount for the nuclear and natural gas for the light standards	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since the vast majority of energy used in the operation and maintenance of the road will be fossil fuels. A very significant shift to electric vehicles would be required because Ontario's dominant Nuclear power is not a renewable resource as per Envision.
	RA 2.3	Commission and monitor energy systems	Unclear - the Region would likely monitors the energy consumption of its lights but I don't have easy access to the information required to determine if this would constitute the advanced monitoring systems this criterion requires Unclear - although a sub-contractor would have installed and tested the light standards, and the municipality may have done its own check, its unclear either counts as an "independent commissioning" for the purposes of this criterion Yes - the municipality would have sufficiently trained persons maintaining the light standards	-	-	-	-	B	A to C	None	Enhanced	Enhanced	0	3	3	There is no documentation in the files review for the EA or detailed design related to how the lighting systems would be commissioned, but such information isn't expected to sent to TRCA anyways. I don't have sufficient knowledge of standard practices in how municipalities commission and monitor lighting standards to properly assess this credit. The likely range of scores is too low to justify the effort required to more confidently score this credit. So a conservative range of none to Enhanced is given. The next achievement jumps to conserving and requires extensive commissioning and monitoring of systems and as Conservative for any credit is intended to be far beyond current standards of practice, I've assumed its not low hanging fruit.

Water	RA 3.1	Protect fresh water availability	No -although the EA assessed dewatering requirements for construction it was not from the perspective of assessing water availability to support water use so things like recharge weren't considered.	No - although there is no documentation of assessment water taking requirements beyond construction, it wouldn't have been done for long -term impacts as the project doesn't require water takings during operation	-	-		None	None	None	None	None	0	0	0	No level of achievement. The project only assessed groundwater conditions for the purposes of assessing dewatering needs during construction which does not meet many of the requirements of a water availability assessment (criterion A). The project will not require water takings during operation (criterion B). Therefore no achievemetrn is given. No low fruit score is given since an analysis of groundwater and surface water from the perspective of availability is not relevant to this project.
	RA 3.2	Reduce potable water consumption			-	-		None	None	None	None	None	0	0	0	No level of achievement given as there is no evidence of a potable water reduction strategy and it can be assumed one wasn't done regardless as roads use little potable water generally during operation and maintenance. For roads, the only opportunity is the use of drought resistant plants in planted medians or boulevards to which stormwater is directed to eliminate the need to water plants with potable water; as such a redesign could be significant and I've assumed significant redesigns are no low hanging fruit, no low hanging fruit score given.
	RA 3.3	Monitor water systems	NA		-	-	-									Not applicable since project does not involve potable water systems in its operation that could be monitored. This criterion would apply if there was an associated watermain.
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Natural World	Sting	NW 1.1	Preserve prime habitat	no - development in prime habitat is not avoided due to intrusions into habitat of endangered species (Redside Dace)	-	-	-		None	None	None	None	None	0	0	0	No achievement is given or possible with the chosen preferred solution of widening the road because both creek crossings are habitat for the endangered species Redside Dace, making them "prime habitat" as per the Envision criterion.	
		NW 1.2	Protect wetlands and surface water	No - project widening occurs within specified distance to a watercourse.	-	-	-		None	None	None	None	None	0	0	0	No achievement given or possible as the site realigns a watercourse (Urfe Creek).	
		NW 1.3	Preserve prime farmland	No - site not assessed for prime farmland	No - Prime farmland not protected	-	-	-		None	None	None	None	None	0	0	0	No achivement given as the project expands the road north onto farmland; however the farmland is already slated for residential development making this credit irrelevant.
		NW 1.4	Avoid adverse geology	NA	NA	NA	-	-		NA	NA	NA	NA	NA				Credit excluded as not generally relevant for the region, with the exception of projects on the Niagara Escarpment.
		NW 1.5	Preserve floodplain function	Yes - project elevates road above Regional Flood and has no impact to flood elevations at one crossings and lowers them marginally at the other crossing.	Yes - pre-development infiltration and water quality maintained by upsized bridge structures that convey the regional flood and keep the road out of the floodplain	Yes - project enhances riparian vegetation through natural channel design enhancements	Yes - a flood emergency plan would not have been prepared for the project, but will be for the local municipality	Yes - project enhances habitat connectivity and sediment transport	Yes - two crossing structures vulnerable to Regional flood have been upsized to remove overtopping of the road during the regional flood	A to F	A to F	Conserving	Conserving	Conserving	14	14	14	Achievement of top score of Conserving
		NW 1.6	Avoid unsuitable development on steep slopes	Yes - project follows best management practices as informed by geotechnical investigations at the EA and detailed design for bridge designs crossing valleys	No - the alignment chosen did not consider slope hazard constraints					A	A	Improved	Improved	Conserving	1	1	6	The East Duffins Creek Crossing is across a defined valley with sections of steep slopes. The elimination of the intersection jog to the east requires a new crossing of Duffins Creek associated with a new road alignment, south of the existing alignment. The geotechnical investigations at the EA and detailed design should suffice as requiring BMPs for work on the slopes for an achievement of Improved. Conserving would require that the alignment alternatives and design explicitly discuss the slope hazard (or lack of hazard) at the various alignments considered and that there be a confirmation of avoidance of high risk slopes.
		NW 1.7	Preserve greenfields	Yes - at least 50% of the project area, being the existing road, is already developed	No - project is not on a designated brownfield	-	-	-		A	A	none	none	None	0	0	0	Although more than 50% of the project is located on an already developed area, it only makes sense to count the existing road as a grey area if serious planning consideration was given to new road alignments entirely within greenfields. This is not the case here, so no acheivement is given or possible.
		NW 2.1	Manage stormwater	no - storage capacity maintained to pre-development levels, not improved		-	-	-		None	None	None	None	None	0	0	0	Water quantity: project meets 2 to 100 post to pre (water quantity test) for runoff to Urfe Creek; project meets retention of 5mm for both Urfe and Duffins Creeks (erosion test). No credit given as the credit requires improvements in water storage capacity where this project can only maintain storage and only for dishcharge to Urfe Creek, not Duffins. Given the pushback in the industry on LIDs for roads, going beyond regulatory requests would be difficult so no low hanging fruit score given.

Land & Water	NW 2.2	Reduce pesticide and fertilizer impacts	Unclear -operational policies to control the application of fertilizers and pesticides were not part of the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - runoff controls to minimize groundwater and surface water contamination during the application of fertilizers and pesticides were not discussed in the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - as per Cosmetic Pesticides Ban Act, most pesticides are already banned in Ontario, but fertilizers can still be used	Unclear - no consideration was given in the EA or detailed design documentation to plants that minimize the need for fertilizers and no discussion of integrated pest management, but these may have been considered by the contractor.	–	–	None	A to D	None	Superior	Superior	0	5	5	With the Cosmetic Pesticide Ban Act, most pesticides are banned in Ontario. Also, the project would have planted only native, non-invasive species that should reduce the need for fertilizer. With no documentation to support any achievement, the project is given a base of 0 but its possible they could have achieved a score of Superior with the right documentation. No low fruit achievement of conserving since an integrated pest management practice would require a whole new region wide program be developed.
	NW 2.3	Prevent surface and groundwater contamination	no - no groundwater quantity and quality monitoring systems used during or post-construction				–	–	None	None	None	None	None	0	0	0	No achievement given as no monitoring of groundwater quantity or quality during or post construction and no low hanging fruit as there is no compelling reason to undertake such monitoring for this project.
	NW 3.1	Preserve species biodiversity	yes - project compensates for losses	Yes project upsizes two crossing structures.	yes - project increases connectivity and available habitat		–	–	A to C	A to C	Restorative	Restorative	Restorative	16	16	16	Achievement of Restorative through upsizing of two crossing structures to improve habitat connectivity, including natural channel design and riparian plantings at main watercourse.
	NW 3.2	Control invasive species	Yes - only native non-invasive species proposed	No - no control of invasive species identified in EA	No - project does not actively eliminate invasives		–	–	A	A	Superior	Superior	Superior	5	5	5	Achievement of Superior for planting of native, non-invasive species. No further opportunities based on Environmental Report at EA that did not identify an invasive species requiring active management.
	NW 3.3	Restore disturbed soils	Unlikely - No evidence that 100% of soils disturbed during construction have been restored and reused properly				–	–	None	None	None	None	None	0	0	0	No achievement since no evidence that 100% of soils disturbed during construction have been restored and reused. My experience is that there is strong push back in industry against soil restoration, especially regarding compaction, so no low fruit score is given.
	NW 3.4	Maintain wetland and surface water functions	Yes - new channel designed by geomorphologist will maintain hydrologic connection to floodplain	Yes - water quality improvement through OGS, storm ponds, and exfiltration trenches	yes - enhances habitat	yes - maintains sediment transport	Yes - all disturbed functions were restored	–	A to E	A to E	Restorative	Restorative	Restorative	19	19	19	
														55	60	65	

Climate	Emission	CR 1.1	Reduce greenhouse gas emissions	No - no evidence of a life cycle carbon assessment having been undertaken, and this would not have been done regardless as its resouce intensive and not currently required by any agencies	–	–	–	–	None	None	None	None	None	0	0	0	No achievement without life cycle carbon assessment. A life cycle carbon analysis would require extensive resources and I have never heard of one being done for a municipal class EA. Its difficult to assess how likely it is I could have convinced a project team to have undertaken such an assessment, so I will assume a low fruit score of zero.
		CR 1.2	Reduce air pollutant emissions	No - no evidence in the EA or detailed design of an air quality analysis. Even if one were to be done a project that increases vehicular traffic won't meet the criterion objective of improving air quality		–	–	–	None	None	None	None	None	0	0	0	No achievement since no air quality analysis undertaken; no low fruit since its not realistic to reduce air pollution through a widened road.
	Resilience	CR 2.1	Assess climate threat	No - no evidence a climate impact assessment was undertaken, and it would not have been undertaken regardless as the discussion of incorporation of climate change into municipal class EAs only began in the fall of 2016 with the release of MOECC's Draft Guideline: <i>Consideration of Climate Change in Environmental Assessments in Ontario.</i>	–	–	–	–	None	None	None	None	None	0	0	0	No achievement since no climate impact assessments undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.2	Avoid traps and vulnerabilities	No - no evidence of identification and assessment of possible changes in key engineering design variables.		–	–	–	None	None	None	None	None	0	0	0	No achievement since no survey of future resource constraints and vulnerabilities undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.3	Prepare for long-term adaptability	No evidence that team researched long-term changes in operational or environmental conditions	–	–	–	–	None	None	None	None	None	0	0	0	No achievement since no plans and designs to prepare for long term climate change. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.4	Prepare for short-term hazards	No evidence that team researched short -term hazards and how they may change over the life time of the project		–	–	–	None	None	None	None	None	0	0	0	No achievement since no analysis of short term hazards. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
		CR 2.5	Manage heat island effects	No - project does not meet heat island requirements	–	–	–	–	None	None	None	None	None	0	0	0	No achievement since no evidence of consideration of solar reflectance. Addition of planted median likely required to achieve Improved of 10% shading; as this would require a major redesign of the road, no low hanging fruit score is given.
														0	0	0	

	73	100	149
Possible			
Total	773		
Score	9.44%	12.94%	19.28%
Award:	None	None	None

A11: 16th Avenue (Donald Cousens Parkway to York-Durham Line)

			Criterion	Performance Metrics						Metrics Achieved		Achievement Level			Score			Summary Notes		
				A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base	Upper	Low Fruit			
Quality of Life	Purpose	QL 1.1	Improve community quality of life	Likely - aligns with ROP & 2002 TMP, local OP and TMP; 2 well attended PICs with partial summary comment table	Likely - project aligns the EA purpose with the Regional Official Plan and Transportation Master Plan	Yes- the EA process sought to identify and address potential impacts to the local community	Unlikely - its unlikely the standard 2 PIC meetings with info boards will suffice as meaningful engagement.	Unlikely - there is no evidence of endorsement by community		A to C	A to C	None	None	Sup	0	0	10	No achievement given; the two standard PICs with only 2 comments received do not suffice as meaningful engagement. Given the few residents live in the study area, achievement of criterion D would require creative engagement of residents that use but don't live on the road and early empowering engagement of agencies for a low hanging fruit score of Superior.		
		QL 1.2	Stimulate sustainable growth and development	Unlikely - design, construction and operation supports existing jobs, but unlikely to meet test of <i>significant</i> number of new jobs	Yes- project increased quality of recreational capacity with paved shoulder and multi-use paths for cycling	Yes - reduced congestion through improved traffic flow at bridge counts as improved community productivity as per Envision		-		B, C	B, C	None	None	None	0	0	0	No achievement given or possible without the creation of a significant number of new jobs during design, construction and operation.		
		QL 1.3	Develop local skills and competencies	No - no commitments to local employment of needy or disadvantaged groups		-		-	-	-	none	none	none	none	none	0	0	0	My opinion is that a municipality would never and probably couldn't not legally restrict a contractor to hiring local workers; the most that could probably be done is including a policy to look favourably in the tendering process of contractors with a policy of training and hiring needy or disadvantaged workers	
	Wellbeing	QL 2.1	Enhance public health and safety	No - no new sustainability technologies, materials or equipment identified so no opportunity to assess associated Health and Safety implications			-		-	-	none	none	none	none	Imp	0	0	2	No new sustainability technologies have been proposed, so there's no opportunity to assess associated Health and Safety implications; therefore no achievement is given. As other low fruit score may require the use of new sustainability technologies, there would be an associated opportunity to assess the associated Health and Safey implications so a conservative low fruit score of Improved is given.	
		QL 2.2	Minimize noise and vibration	Yes - studies of noise during operation and additional consideration in ESR of noise during construction	No - no mitigation and monitoring of noise proposed			-		-	-	A	A	Imp	Imp	Cons	1	1	8	Achievement of Improved through consideration and study of noise during construction and operation. Achievement of Conserving would require determination of noise goals of community with mitigation and monitoring. With extensive involvement of community during well attended PICs, it would be low hanging fruit to have formalized this through approved proposals with community endorsement to monitor and mitigate noise impacts during construction - low hanging fruit of "Conserving".
		QL 2.3	Minimize light pollution	Likely -EA only assessed that light required at 16th Ave-Reesor intersection. Further assessment of type of illumuniation done at detailed design.	Uncertain - no evidence of analysis of efforts to reduce light energy requirements, but may have been done at detailed design. Its unclear from Google Streetview if LED or Standard lights installed	Uncertain - can't be determined with available documentation			-	-	-	A	A to C	None	Sup	Sup	0	4	4	No base achievement as there's no evidence specific efforts were made to reduce lighting energy requirements; an upper score of Superior reflects the uncertainty in assessing credits B and C. Lighting only provided at intersection so study area was divided into lighting zones to determine needs (Superior). A low fruit score of Superior would require LED, night sky preserving lights.
		QL 2.4	Improve community mobility and access	Yes - safe to assume study of access and mobility would have been undertaken with Consultant and or contractor during detailed design	Likely - team likely coordinated construction with only adjacent landowner	Yes - design supports active transportation through multi use paths and paved shoulders	likely - plans to limit traffic disruption likely undertaken with contractor	Yes - considered congestion and access to cycling in EA	Uncertain - its unclear how to assess whether or not the project improves livability	A to E	A through F	Enh	Enh	Sup	4	4	7	With only one local landowner, coordination of construction access should have been relatively easy for a rating of Enhanced. Superior requires reducing traffic impacts during construction "well beyond construction norms."		
		QL 2.5	Encourage alternative modes of transportation	No - study area does not contain a bus route to provide access to multi modal transportation hubs	Likely - no deliberate restriction of parking; however, no parking provided in sectinos with urban cross section	Yes - design supports active transportation through multi use paths and paved shoulders	Yes - encouragement of use of alternative modes of transportation	No programs specific to the project to encourage public transit use as no public transit is accomodated along the study corridor		B to D	B to D	None	None	None	0	0	0	No achivement given or possible without public transit. With no residents along the road there's no demand for public transit so no low hanging fruit.		
		QL 2.6	Improve site access, safety and wayfinding	No - no documentation of wayfinding signage considered at the EA or detailed design aside. Only wayfinding signage based on Google Streetview is of road names at intersection. Not even a sign identifying the Little Rouge watercourse crossing.						None	none	None	None	none	0	0	0	No study of wayfinding and limited opportunity as EA identified very limited pedestrian and cycling traffic.		
	Immunity	QL 3.1	Preserve historic and cultural resources	Yes- stage 1 assessment at EA and stage 2 at detailed design	Yes - 6 build heritage features will be preserved	Yes - worked with TRCA and local municipality especially regarding preservation of old Bailey Bridge		-	-	A to C	A to C	Sup	Sup	Sup	7	7	7	Superior achieved based on preservation of all resources and working with local municality and conservation authority. No further acheivement since character definign features of Bailey bridge will be lost through building the replacement structure ontop of the old bridge.		
		QL 3.2	Preserve views and local character	Yes - simple description of local character in ESR	No - simple renderings in ESR, not detailed view plans or design guidelines					A	A	None	None	None	0	0	0	No achievement given as no view plan was undertaken. Achievement not likely with preferred design which eliminates 16th Avenue from dipping down into valley across old Bailey Bridge. The existing design was a safety concern and safety trumps views so no low hanging fruit score given.		

	Corr	QL 3.3	Enhance public space	Likely - team had frequent meetings with the City of Markham, Rouge Park and TRCA,many of which discussed the old Bailey Bridge, its likely all 3 agencies were satisfied although there's no explicit statement as such from each	No - no restoration efforts of the Old Bailey Bridge	-	-	-	B	A and B	None	Enh	Enh	0	3	3	No base achievement since its unclear if credit can be given to this project for adding to public space for retaining the Old Bailey Bridge because access to the bridge is not being provided- that will be for Rouge Park to undertake in the future. If this project can be given credit for the Old Bailey Bridge its likely an achievement of Enhanced was met for avoiding impacts to the resource. No further achievement is likely as Rouge Park would want to retain control over any enhancements or alterations to the Old Bailey Bridge.
															12	19	41

Leadership	Collaboration	LD 1.1	Provide effective leadership and commitment	Yes - general sustainability statements in Official Plan, 2007 Sustainability Strategy and Vision statement	—	—	—	—	—	A	A	Enh	Enh	Sup	4	4	4	York Region has their 2007 Sustainability Strategy which informed their Vision 2051. No annual reporting of sustainability progress so achievement limited to Enhanced, with no low hanging fruit
		LD 1.2	Establish a sustainability management system	Unlikely - project did not specifically address sustainability based on documentation so its unlikely anyone on the project team was responsible for sustainability issues	Unlikely -project did not specifically address sustainability based on documentation so its unlikely a management policy was created for the project	no - based upon ESR the project did not set sustainability goals and targets	—	none	A	None	None	None	None	0	0	0	Although it can't be confirmed that no specific person was given the responsibility of sustainability, it is unlikely as sustainability is not addressed in the ESR, and its irrelevant because a project must meet criterion A through E for all levels of achievement. Meeting criterion A through E would require an extensive commitment to sustainability within the project team through various business sustainability processes, and given that sustainability as a concept is not considered in EAs for road projects in the GTA in my experience, such commitment is not considered low hanging fruit. No ESRs in any ESRs reviewed for this thesis even used the term sustainability except in reference to the title of another document.	
		LD 1.3	Foster collaboration and teamwork	Yes - project team likely incorporated collaboration, teamwork and whole systems design to some degree	No - not likely meaningful risk and reward sharing between consultant and owner	—	—	—	A	A	Imp	Enh	Enh		1	4	4	The project documentation does not mention sustainability, however aspects of sustainable design are found. However, the incorporation of results of the Pedestrian and Cycling Master Plan and the Transportation Master Plan shows some degree of systems view. Low fruit is to more fully achieve Enhanced.
		LD 1.4	Provide for stakeholder involvement	Yes - to some extent through ESR key stakeholders identified and key concerns addressed	Yes - extensive consultation with stakeholders, including a meeting with the private landowner, and meetings throughout the EA and detailed design with agencies and the City of Markham	Yes - to some extent stakeholder input incorporated into plans	yes - stakeholding participation and communications program established	A to D	A to D	Enh	Enh	Sup		5	5	9	Achievement of Enhanced through meetings with stakeholders throughout EA and detailed design. Achievement of Superior requires broader public engagement, such as of road users.	
		LD 2.1	Pursue by-product synergy opportunities	no - no documentation of efforts to search for unwanted byproduct of nearby facilities & very unlikely to have occurred	—	—	—	None	None	None	None	None		0	0	0	No assessment of unwanted byproducts of nearby facilities. Therefore no achievement. Not likely relevant to road constuction so no low hanging fruit	
	Management	LD 2.2	Improve infrastructure integration	No evidence project team sought to improve sustainability through project wide systems integtation	—	—	—	None	None	None	None	None		0	0	0	No evidence that project team sought to improve project sustainability through project wide systems integration;	
		LD 3.1	Plan for long-term monitoring and maintenance	Likely - York Region would have developed a multt-year monitoring plan of the new channel works as part of their DFO Authorization	Likely - it should be assumed the in order for the monitoring plan to be accepted by DFO that sufficient resources for monitroing were set aside	—	—	—	None	None	None	None	Enh		0	0	3	No achievement because Improved required moniroting plan beyond regulatory requirements, but the monitoring plan is for this project would have been to satisfy DFO requirements. Adding an extra year of monitoring beyond the DFO Authorization requirements would achieve Enhanced.
	Planning	LD 3.2	Address conflicting regulations and policies	No - no documentation of assessment of conflicting regulations and policies	—	—	—	—	none	A	none	None	Imp		0	0	1	No achievement since no documentation of assessment of conflicting regulations and policies and no evidence of sustainability objectives. Low hanging fruit of Improved through basic assessment of regulations and associated regulators and organizations and connection to sustainability objectives.
		LD 3.3	Extend useful life	yes - high likelihood of some consideration of durability, flexibility and reslience of project	No - no documentation of consideration of expansion or future reconfiguration of project, but may have occurred	—	—	—	A	A, B	Imp	Imp	Enh		1	1	3	Likely achieved Improved by considering to some degree the flexibility, durability and resilience of road, culverts and underpassesnew channel. Achieving Enhanced requires documentation of consideration of future expansion or reconfiguration which is given a low hanging fruit score.

		RA 1.1	Reduce net embodied energy	No - no documentation of an LCA	-	-	-	-	none	none	none	none	None		0	0	0	No documentation of an LCA and reasonable assumption one was never done as I have never heard of one occuring in my career for a municipal EA; a LCA is very resource intensive so its not considered low hanging fruit.
		RA 1.2	Support sustainable procurement practices	No - no documentation of sustainable procurement	-	-	-	None	None	None	None	Imp			0	0	2	No documentation of sustainable procurement, and reasonable assumption this is not done in practice outside of LEED projects; as it has been done for LEED projects, it's a reasonable assumption that the lowest level of improved could have been achieved through <15% materials from suppliers with 'sustainability practice'

Resource Allocation																
Materials	RA 1.3	Use recycled materials	Unclear - no documentation of specification of recycled material undertaken in EA or detailed design. Contractor would have purchased materials with recycled content but not specified it, so its unclear this acheives the credit sustainability intent	—	—	—	—	A	A, B	None	Enh	Sup	0	5	11	No documentation of EA or detailed design project teams analyzing reuse of on site materials, but this was likely done by contractor to reduce expenses. No evidence of specifying materials with recycled content, but its likely the contractor still purchased materials with recycled content to reduce expenses. Its standard for pavement and granular subgrade to contain a significant percentage of recycled material, so its safe to assume 20% (by weight or volume) of materials on site are recycled. As credit may not be given, the base score is zero. An upper score of Superior is given based upon credit given for the contractor purchasing but not specifying materials with recycled content. A low fruit rating of Enhanced is given as it should be easily acheived for the municipality to specify materials with recycled contact.
	RA 1.4	Use regional materials	Unclear - no documentation of specification of local materials, but with expense of transporting materials its likely contractor purchased local materials to save money. Its unclear if this meets the credit intent.	—	—	—	—	None	A	None	Imp	Enh	0	3	6	No documentation for the <i>specification</i> of local materials, but with the cost of transportation its likely a large percentage of materials were sourced within the specified distances. Its unclear if achievement of the credit requires explicit specification of local materials by the contractor. If credit is acheived, its conservatively assumed to be an upper acheivement of Improved (30% local) and a low hanging fruit of Enhanced (60% local). Achievement could have been and could be much higher but I don't have evidence to accurately assess so I've used a conservative assessment.
	RA 1.5	Divert waste from landfills	Unlikely - There is no documentation in the EA or detailed design regarding a comprehensive waste management plan. Although the contractor likely diverted waste to save landfill charges and make money selling the materials its highly unlikely this was done through a comprehensive waste management strategy	—	—	—	—	None	None	None	None	Enh	0	0	6	No base or upper achievement since no comprehensive waste management plan likely implemented. With recyclability of asphalt, granular and concrete, its low hanging fruit to achieve 50% recycle/reuse of onsite materials which gives a level of enhanced. Actual low fruit achievement could be even higher, but a more detailed analysis would be required to support this.
	RA 1.6	Reduce excavated materials taken off site	Yes -ESR states that suitable soils will be reused on site. Although I had no documentation in materials I had available at detailed design, it is standard to estimate cut and fill in detailed design or by the contractor to reduce costs of transportating and disposing of soils offsite.	—	—	—	—	A	A	Cons	Cons	Cons	6	6	6	The level of achievement is based upon a percentage of excavated materials <i>suitable for reuse</i> that are reused on site. It is safe to assume that the vast majority (90%) of fill <i>suitable for reuse</i> was reused on site, giving an achievement of Conserving.
	RA 1.7	Provide for deconstruction and recycling	Unlikely - no documentation in EA or detailed design of consideration of facilitating future disassembly and recycling of materials. Its unlikely the contractor would have constructed the project in a way that improved the recyclability of the materials.	—	—	—	—	A	A	Imp	Imp	Sup	1	1	8	As asphalt, granular and concrete are highly recyclable so evalation criterion A is met which on its on leads to a maximum achivement of Improved. Higher levels of achievement require specific efforts to facilitate future recycling which is highly unlikely to have occurred, but with little extra effort due to the highly recyclable nature of many road materials would yield a rating of Superior for the low hanging fruit
	Energy	RA 2.1	Reduce energy consumption	No - no evidence in the EA or detailed design that the team assessed options for reducing energy consumption	—	—	—	—	None	None	None	None	None	0	0	0
RA 2.2		Use renewable energy	No - the vast majority of energy used in the operation and maintenance of the road will be fossil fuels for vehicles with a relatively smaller amount for the nuclear and natural gas for the light standards	—	—	—	—	None	None	None	None	None	0	0	0	No achievement since the vast majority of energy used in the operation and maintenance of the road will be fossil fuels. A very significant shift to electric vehicles would be required because Ontario's dominant Nuclear power is not a renewable resource as per Envision.
RA 2.3		Commission and monitor energy systems	Unclear - although a sub-contractor would have installed and tested the light standards, and the municipality may have done its own check, its unclear either counts as an "independent commissioning" for the purposes of this criterion standards	Unclear - the Region would likely monitors the energy consumption of its lights but I don't have easy access to the information required to determine if this would constitute the advanced monitoring systems this criterion requires	—	—	—	B	A to C	None	Enh	Enh	0	3	3	There is no documentation in the files review for the EA or detailed design related to how the lighting systems would be commissioned, but such information isn't expected to sent to TRCA anyways. I don't have sufficient knowledge of standard practices in how municipalities commission and monitor lighting standards to properly assess this credit. The likely range of scores is too low to justify the effort required to more confidently score this credit. So a conservative range of none to Enhanced is given. The next achievement jumps to conserving and requires extensive commissioning and monitoring of systems and as Conservative for any credit is intended to be far beyond current standards of practice, I've assumed its not low hanging fruit.

Water	RA 3.1	Protect fresh water availability	No -although the EA assessed dewatering requirements for construction it was not from the perspective of assessing water availability to support water use so things like recharge weren't considered.	No - although there is no documentation of assessment water taking requirements beyond construction, it wouldn't have been done for long -term impacts as the project doesn't require water takings during operation	-	-										No level of achievement. The project only assessed groundwater conditions for the purposes of assessing dewatering needs during construction which does not meet many of the requirements of a water availability assessment (criterion A). The project will not require water takings during operation (criterion B). Therefore no achievemtn is given. No low fruit score is given since an analysis of groundwater and surface water from the perspective of availability is not relevant to this project.
	RA 3.2	Reduce potable water consumption	No - no documentation of identification of strategies to reduce potable water consumption during operation and maintenance		-	-										No level of achievement given as there is no evidence of a potable water reduction strategy and it can be assumed one wasn't done regardless as roads use little potable water generally during operation and maintenance. For roads, the only opportunity is the use of drought resistant plants in planted medians or boulevards to which stormwater is directed to eliminate the need to water plants with potable water; as such a redesign could be significant and I've assumed significant redesigns are no low hanging fruit, no low hanging fruit score given.
	RA 3.3	Monitor water systems	NA		-	-	-									Not applicable since project does not involve potable water systems in its operation that could be monitored. This criterion would apply if there was an associated watermain.

Natural World	Siting	NW 1.1	Preserve prime habitat	no - development in prime habitat is not avoided as the this section of the Little Rouge is identified in the Markham Official Plan as being a Locally Significant Area	-	-	-	None	None	None	None	None	0	0	0	The Little Rouge, over which the new bridge was constructed, is identified as locally significant area in the Markham Official Plan as per the EA. This make the crossing Prime Habitat as per the Envision definition, and no credit is possible.		
		NW 1.2	Protect wetlands and surface water	No - project widening occurs within specified distance to a watercourse.	-	-	-	None	None	None	None	None	0	0	0	No achievement given or possible as the site crosses over several watercourses.		
		NW 1.3	Preserve prime farmland	No - site not assessed for prime farmland but it is recognized in the EA that land adjacent to the road is actively farmed.	No - Prime farmland not protected	-	-	-	None	None	None	None	None	0	0	0	No achivement given as the project shifts the road alignment north onto farmland east of the Little Rouge crossing. No low hanging fruit without altering preferred design.	
		NW 1.4	Avoid adverse geology	NA	NA	NA	-	-	NA	NA	NA	NA	NA				Credit excluded as not generally relevant for the region, with the exception of projects on the Niagara Escarpment.	
		NW 1.5	Preserve floodplain function	Yes - floodplain function is maintained or at the Little Rouge River crossing	Yes - maintains floodplain infiltration through no increase in impervious area in floodplain	No - net impacts to riparian habitat through large additional crossing structure and abutments at Little Rouge River crossing	Yes - a flood emergency plan would not have been prepared for the project, but will be for the local municipality	Yes - large bridge structure will maintain sediment transport and connectivity	No - existing Bailey bridge is being maintained for heritage value	A, B, D, E	A, B, D, E	Enh	Enh	Enh	5	5	5	Achievement of enhanced as large crossing structure avoids impacts to floodplain function; however, impacts to riparian vegetation from construction and bridge shadow are not mitigable.
		NW 1.6	Avoid unsuitable development on steep slopes	Yes - project likely follows BMPs for slopes as informed by geotechnical investigations	Yes - bridge alignment supported by geotechnical investigation	No - alignment does cross steep valley slope	-	-	-	A to B	A to B	Sup	Sup	Sup	4	4	4	Achievement of Superior as large bridge structure spans Little Rouge Valley to minimize impacts to slopes. No further achievement possible as alignment is across steep valley slope and Conserving requires avoiding all steep slopes
		NW 1.7	Preserve greenfields	Yes - at least 50% of the project area, being the existing road, is already developed	No - project is not on a designated brownfield	-	-	-	A	A	none	none	None	0	0	0	Although more than 50% of the project is located on an already developed area, it only makes sense to count the existing road as a grey area if serious planning consideration was given to new road alignments entirely within greenfields. This is not the case here, so no acheivement is given or possible.	
	Land & Water	NW 2.1	Manage stormwater	No - no net improvement of water storage, and infiltration is achieved.	-	-	-	None	None	None	None	None	0	0	0	For the purposes of water quantity calculations the existing road needs to be considered a greyfield. Credit requires that water storage capacity be maintained in the greenfield and must be improved in the greyfield (existing road) by at least 30% for an Enhanced rating. No achievement given as no implementation of water quantity improvement. No water storage or infiltration LIDs were provided. As an overall improvement water storage and infiltration over pre-development conditions is not achieved no credit is given. A significant redesign would be required to achieve this high standard and given my experience with the resistance to implementing LIDs for roads, no low hanging fruit score is given.		
		NW 2.2	Reduce pesticide and fertilizer impacts	Unclear -operational policies to control the application of fertilizers and pesticides were not part of the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - runoff controls to minimize groundwater and surface water contamination during the application of fertilizers and pesticides were not discussed in the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - as per Cosmetic Pesticides Ban Act, most pesticides are already banned in Ontario, but fertilizers can still be used	Unclear - no consideration was given in the EA or detailed design documentation to plants that minimize the need for fertilizers and no discussion of integrated pest management, but these may have been considered by the contractor.	-	-	None	A to D	None	Sup	Sup	0	5	5	With the Cosmetic Pesticide Ban Act, most pesticides are banned in Ontario. Also, the project would have planted only native, non-invasive species that should reduce the need for fertilizer. With no documentation to support any achivement, the project is given a base of 0 but its possible they could have achieved a score of Superior with the right documentation. No low fruit achievement of conserving since an integrated pest management practice would require a whole new region wide program be developed.

Possible			
Total	793		
Score	6.18%	9.46%	17.02%
Award	None	None	None

A12: Torbram Road Grade Separation (at Go Metrolinx and CN Halton Subdivision)

				Performance Metrics						Metrics Achieved		Achievement Level			Score			Summary Notes
		Criterion		A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base	Upper	Low Fruit	
Quality of Life	Purpose	QL 1.1	Improve community quality of life	Likely - I assume that test of considering community needs goals and issues is satisfied by aligning project with Official Plan and 2 previous studies	Likely - project aligns the EA purpose with the Regional Official Plan	Yes- the EA process sought to identify and address potential impacts to the local community	Unlikely - its unlikely the standard 2 PIC meetings with info boards will suffice as meaningful engagement. ESR does not contain a table of public comments and responses which could have otherwise provided the public was engaged to some degree of meaningful	Unlikely - there is no evidence of endorsement by community	A to C	A to C	None	None	Sup	0	0	10	No achievement as the two standard PICs with no evidence of incorporation of comments do not suffice for meaningful engagement. Further effort to get out into the community to elicit comments and input would likely achieve Superior.	
		QL 1.2	Stimulate sustainable growth and development	Unlikely - design, construction and operation supports existing jobs, but unlikely to meet test of <i>significant</i> number of new jobs	Yes, increases local business capacity through decreased delays crossing the railway	Yes - reduced delays for automotive and train traffic	No improved recreation	-	B, C	B, C	None	None	none	0	0	0	No achievement given or possible without the creation of a significant number of new jobs during design, construction and operation.	
		QL 1.3	Develop local skills and competencies	No - no commitments to local employment of needy or disadvantaged groups	-	-	-	-	none	none	none	none	none	0	0	0	My opinion is that a municipality would never and probably couldn not legally restrict a contractor to hiring local workers; the most that could probably be done is including a policy to look favourably in the tendering process of contractors with a policy of training and hiring needy or disadvantaged workers	
	Wellbeing	QL 2.1	Enhance public health and safety	No - no new sustainability technologies, materials or equipment identified so no opportunity to assess associated Health and Safety implications	-	-	-	-	none	none	none	none	Imp	0	0	2	No new sustainability technologies have been proposed, so there's no opportunity to assess associated Health and Safety implications; therefore no achievement is given. As other low fruit score may require the use of new sustainability technologies, there would be an associated opportunity to assess the associated Health and Safey implications so a conservative low fruit score of Improved is given.	
		QL 2.2	Minimize noise and vibration	No - No evidence of noise analysis is ESR or detailed design	-	-	-	-	none	none	none	none	Imp	0	0	1	no achievement since no noise analysis; analysis would achieve improved	
		QL 2.3	Minimize light pollution	Likely - no evidence of assessment of lighting needs in available documentation, but TRCA's files are unlikely to have such documentation; some assessment likely done in detailed design	Likely - no evidence of analysis of efforts to reduce light energy requirements, but Mississauga supports LED street lights	Likely - no evidence of efforts to reduce light spillage and preserve night sky, but is one goal of Mississauga's LED street light conversion programan	-	-	-	A, B and C	A, B and C	Enh	Enh	Sup	2	2	4	With Mississauga's new LED light standard conversion project support, which began in 2013, its a safe assumption that the project considered lighting needs, reducing energy consumption from lighting and reducing light spillage, for a score of Enhanced. Extra efforts to analyze lighting needs based on zones would earn Superior.
		QL 2.4	Improve community mobility and access	No study of access during construction evident in Planning and Design phases	-	-	-	-	none	none	None	None	none	0	0	0	No achievement given as there is no evidence that mobility and access were considered in the EA or detailed design. No low fruit score because the project scope was limited to a short stretch of Torbram Road so the team could not be expected to deal with mobility and access issues.	
		QL 2.5	Encourage alternative modes of transportation	Yes - two bus routes along road	Yes - project maintains current additional restriction of parking with urban cross section	No - no support for active transportation	-	-	A and B	A and B	Imp	Imp	Imp	1	1	1	Achievement of improved based upon buses along Torbram Road providing access to multi modal transit facilities and the restriction of parking. An achievement of Enhanced would require the addition of cycling facilities as part of a network which is beyond the scope of this project.	
		QL 2.6	Improve site access, safety and wayfinding	No - no documentation of wayfinding signage considered at the EA or detailed design aside	-	-	-	-	None	none	None	None	none	0	0	0	Project is within an industrial area with sidewalks but no cycling facilities and very limited pedestrian or cycling traffic to direct with wayfinding. Therefore it would be difficult to garner support for studies on wayfinding.	
	Community	QL 3.1	Preserve historic and cultural resources	Yes - Identified possible resources through a stage 1 to 3 assessment	No since no resources found	-	-	-	none	none	None	None	none	0	0	0	No resources so no credit given nor possible.	
		QL 3.2	Preserve views and local character	Yes - simple description of local character	No view plans or design guides	-	-	-	A	A	none	none	none	0	0	0	Given the industrial setting and low pedestrian and cycling volumes a view plan will be a tough sell.	

Resource Allocation																	
Materials																	
	RA 1.3	Use recycled materials	Likely - no documentation of assessment at EA or detailed design of on site reuse. Likely done by contractor in effort to save money.	Unclear - no documentation of specification of recycled material undertaken in EA or detailed design. Contractor would have purchased materials with recycled content but not specified it, so its unclear this acheives the credit sustainability intent	—	—	—	—	A	A, B	None	Enh	Sup	0	5	11	No documentation of EA or detailed design project teams analyzing reuse of on site materials, but this was likely done by contractor to reduce expenses. No evidence of specifying materials with recycled content, but its likely the contractor still purchased materials with recycled content to reduce expenses. Its standard for pavement and granular subgrade to contain a significant percentage of recycled material, so its safe to assume 20% (by weight or volume) of materials on site are recycled. As credit may not be given, the base score is zero. An upper score of Superior is given based upon credit given for the contractor purchasing but not specifying materials with recycled content. A low fruit rating of Enhanced is given as it should be easily acheived for the municipality to specify materials with recycled contact.
	RA 1.4	Use regional materials	Unclear - no documentation of specification of local materials, but with expense of transporting materials its likely contractor purchased local materials to save money. Its unclear if this meets the credit intent.	—	—	—	—	—	None	A	None	Imp	Enh	0	3	6	No documentation for the <i>specification</i> of local materials, but with the cost of transportation its likely a large percentage of materials were sourced within the specified distances. Its unclear if achievement of the credit requires explicit specification of local materials by the contractor. If credit is acheived, its conservatively assumed to be an upper acheivement of Improved (30% local) and a low hanging fruit of Enhanced (60% local). Achievement could have been and could be much higher but I don't have evidence to accurately assess so I've used a conservative assessment.
	RA 1.5	Divert waste from landfills	Unlikely - There is no documentation in the EA or detailed design regarding a comprehensive waste management plan. Although the contractor likely diverted waste to save landfill charges and make money selling the materials its highly unlikely this was done through a comprehensive waste management strategy	—	—	—	—	—	None	None	None	None	Enh	0	0	6	No base or upper achievement since no comprehensive waste management plan likely implemented. With recyclability of asphalt, granular and concrete, its low hanging fruit to achieve 50% recycle/reuse of onsite materials which gives a level of enhanced. Actual low fruit achievement could be even higher, but a more detailed analysis would be required to support this.
	RA 1.6	Reduce excavated materials taken off site	Likely - although no documentation in materials I had available, it is standard to estimate cut and fill in detailed design or by the contractor to reduce costs of transporting and disposing of soils offsite.	—	—	—	—	—	A	A	Imp	Enh	Enh	2	4	4	The level of achievement is based upon a percentage of excavated materials <i>suitable for reuse</i> that are reused on site. As this road project will require a net cut of materials, achievement is assumed to be between 30% reuse (improved) to 50% reuse (enhanced). Its unlikely that will be much room for improved for a low fruit score.
	RA 1.7	Provide for deconstruction and recycling	yes - although there's no documentation in the EA and detailed design of specifying materials specifically because of their recyleability asphalt, granular, and concrete are highly recyclable so credit can be given	Unlikely - no documentation in EA or detailed design of consideration of facilitating future disassembly and recycling of materials. Its unlikely the contractor would have constructed the project in a way that improved the recyclability of the materials.	—	—	—	—	A	A	Imp	Imp	Sup	1	1	8	As asphalt, granular and concrete are highly recyclable so evalation criterion A is met which on its on leads to a maximum achivement of Improved. Higher levels of achievement require specific efforts to facilitate future recycling which is highly unlikely to have occurred, but with little extra effort due to the highly recyclable nature of many road materials would yield a rating of Superior for the low hanging fruit
	RA 2.1	Reduce energy consumption	Yes - energey consumption was considered in the EA inasmuch as vehicular idling is reduced. The proponent, Mississauga, considered energy consumption in its City wide support of LED street lighting	Unclear - its unclear if the analysis by the City for its LED street light conversion program is sufficient for this criterion. Also I have not documentation of any analysis of energy savings from a reduction in idling but this may have been done.	Unclear - the City claims that the LED lights will reduce energy costs by 55% over standard lights, and idling at the track will be reduced while not adding any capacity to the road.	—	—	—	A	A to C	None	Imp	Imp	0	3	3	Basic improved level requires a decrease of 10% of energy consumption during operation over industry norms, and must include energy consumed by vehicular traffic. As the project does not increase the capacity of the road and will reduce engine idling at train crossings and lighting energy needs, an upper acheivement of improved is given. The next level of achievement requires a 30% reduction in energy and my educated guess is this was not and could not be achieved based on what the project has ability to influence.

	Energy	RA 2.2	Use renewable energy	No - the vast majority of energy used in the operation and maintenance of the road will be fossil fuels for vehicles with a relatively smaller amount for the nuclear and natural gas for the light standards	-	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since the vast majority of energy used in the operation and maintenance of the road will be fossil fuels. A very significant shift to electric vehicles would be required because Ontario's dominant Nuclear power is not a renewable resource as per Envision.
		RA 2.3	Commission and monitor energy systems	Unclear - there is no evidence of an independent commissioning of pump systems and LED lighting, but it may have been done. Although a sub-contractor would have installed and tested the light standards and pump, and the municipality may have done its own check, its unclear either counts as an "independent commissioning" for the purposes of this criterion	Likely that team assembled info for operation of pump system and Mississauga would have done this for LED lighting across the City	Yes - Highly unlikely advanced energy monitored was installed for sump pump system, but is done for LED lighting in Mississauga	-	-	-	B to C	A to C	None	Cons	Cons	0	11	11	Project involves two separate electrical systems. The underpasses both run on sump pump systems that handle 50 year storm. The LED lighting system in Mississauga is a system implemented and monitored by the City. The City does monitor the energy consumption of its LED lighting system. Achievement of top score of Conserving is possible if the project meets the Envision test of an independant commissioning of "the project". Its not clear what constitutes an independant commissioning of the electrical systems.
	Water	RA 3.1	Protect fresh water availability	No -although the EA assessed dewatering requirements for construction it was not from the perspective of assessing water availability to support water use so things like recharge weren't considered.	No - although there is no documentation of assessment water taking requirements beyond construction, it wouldn't have been done for long -term impacts as the project doesn't require water takings during operation	-	-	-	-	None	None	None	None	None	0	0	0	No level of achievement. The project only assessed groundwater conditions for the purposes of assessing dewatering needs during construction which does not meet many of the requirements of a water availability assessment (criterion A). The project will not require water takings during operation (criterion B). Therefore no achievemeth is given. No low fruit score is given since an analysis of groundwater and surface water from the perspective of availability is not relevant to this project.
		RA 3.2	Reduce potable water consumption	No - no documentation of identification of strategies to reduce potable water consumption during operation and maintenance	-	-	-	-	-	None	None	None	None	None	0	0	0	No level of achievement given as there is no evidence of a potable water reduction strategy and it can be assumed one wasn't done regardless as roads use little potable water generally during operation and maintenance. For roads, the only opportunity is the use of drought resistant plants in planted medians or boulevards to which stormwater is directed to eliminate the need to water plants with potable water; as such a redesign could be significant and I've assumed significant redesigns are no low hanging fruit, no low hanging fruit score given.
		RA 3.3	Monitor water systems	NA	-	-	-	-	-									Not applicable since project does not involve potable water systems in its operation that could be monitored. This criterion would apply if there was an associated watermain.
	3 27 51																	

	Siting	NW 1.1	Preserve prime habitat	NA	-	-	-											NA since no prime habitat within the vicinity of the project
		NW 1.2	Protect wetlands and surface water	No - project widening occurs within specified distance to a watercourse.	-	-	-	None	None	None	None	None	None	0	0	0	0	Achievement can't be given, due to a relocation of a watercourse.
		NW 1.3	Preserve prime farmland	NA	-	-	-	NA	NA	NA	NA	NA	NA					Not applicable as there were no serious options considered that would impact farmland.
		NW 1.4	Avoid adverse geology	NA	NA	NA	-	NA	NA	NA	NA	NA	NA					Credit excluded as not generally relevant for the region, with the exception of projects on the Niagara Escarpment.
		NW 1.5	Preserve floodplain function	Yes - project maintains or improves Regional flood elevations outside road right of way	Yes - project maintains impervious area in within floodplain	Yes - project improves riparian areas	Yes - an emergency management plan was created specifically for this project as it increases flood risk due to flooding in the new underpasses	Yes - project increases the culvert width at same lenth thereby improving connectivity to some degree	Yes - project replaces existing culvert in floodplain	A to F	A to F	Cons	Cons	Cons	14	14	14	Despite increase in flood risk due to flooding in two new underpasses, the project achieves Conserving.

Natural World		NW 1.6	Avoid unsuitable development on steep slopes	NA													Not applicable as there are no valley slopes of concern within project area	
		NW 1.7	Preserve greenfields	Yes - at least 75% of the project area, being the existing road, is already developed	No - project is not on a designated brownfield												Although more than 75% of the project is located on an already developed area, it only makes sense to count the existing road as a grey area if serious planning consideration was given to new road alignments entirely within greenfields. This is not the case here, so no acheivement is given or possible.	
	Land & Water	NW 2.1	Manage stormwater														For the purposes of water quantity calculations the existing road needs to be considered a greyfield. Credit requires that water storage capacity be maintained in the greenfield and must be improved in the greyfield (existing road) by at least 30% for an Enhanced rating. No achievement given as no implementation of water quantity improvement. No water storage or infiltration LIDs were provided. As an overall improvement water storage and infiltration over pre-development conditions is not achieved no credit is given. A significant redesign would be required to achieve this high standard and given my experience with the resistance to implementing LIDs for roads, no low hanging fruit score is given.	
		NW 2.2	Reduce pesticide and fertilizer impacts	Unclear -operational policies to control the application of fertilizers and pesticides were not part of the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - runoff controls to minimize groundwater and surface water contamination during the application of fertilizers and pesticides were not discussed in the EA or detailed design documentation. These may have been considered by the contractor during construction.	Unclear - as per Cosmetic Pesticides Ban Act, most pesticides are already banned in Ontario, but fertilizers can still be used	Unclear - no consideration was given in the EA or detailed design documentation to plants that minimize the need for fertilizers and no discussion of integrated pest management, but these may have been considered by the contractor.										With the Cosmetic Pesticide Ban Act, most pesticides are banned in Ontario. Also, the project would have planted only native, non-invasive species that should reduce the need for fertilizer. With no documentation to support any achivement, the project is given a base of 0 but its possible they could have achieved a score of Superior with the right documentation. No low fruit achievement of conserving since an integrated pest management practice would require a whole new region wide program be developed.	
		NW 2.3	Prevent surface and groundwater contamination	no - no groundwater quantity and quality monitoring systems used during or post-construction														No achievement given as no monitoring of groundwater quantity or quality during or post construction and no low hanging fruit as there is no compelling reason to undertake such monitoring for this project.
	Biodiversity	NW 3.1	Preserve species biodiversity	Yes - mitigates adverse impacts of development	yes - improves habitat	yes - increases available habitat and connectivity												Existing watercourse and riparian habitat are of poor quality. Relocation provides opportunity to increase channel length, improve in-stream and riparian habitat and improve connectivity under the road for a score of restorative.
		NW 3.2	Control invasive species	Yes - only native non-invasive species proposed	Unlikely - no evidence of management plan for invasive species being developed													Achivement of Superior through planting of native non invasive species, but no discussion of invasive species in Environmental Impact Assessment report despite identifying some. No low hanging fruit since management of invasives would require extending the study area far up stream and downstream due to the proliferation of non native and invasive species along the stream reach.
		NW 3.3	Restore disturbed soils	Unlikely - No evidence that 100% of soils disturbed during construction have been restored and reused properly														No achievement since no evidence that 100% of soils disturbed during construction have been restored and reused. My experience is that there is strong push back in industry against soil restoration, especially regarding compaction, so no low fruit score is given.
		NW 3.4	Maintain wetland and surface water functions	Yes - new channel designed by geomorphologist will maintain hydrologic connection to floodplain	yes - maintains water quality	yes - enhances habitat	yes - maintains sediment transport	possible - its unclear whether or not all disturbed functions were restored										Project maintains or enhances four ecosystem functions for an achievement of conserving, and could achieve restorative by enhancing water quality and proving that the hydrologic connection and sediment transport were improved.
													50	55	59			

Climate													
Climate	Emission												
	CR 1.1	Reduce greenhouse gas emissions	No - no evidence of a life cycle carbon assessment having been undertaken, and this would not have been done regardless as its resouce intensive and not currently required by any agencies	-		-		-		-		None	No achievement without life cycle carbon assessment. A life cycle carbon analysis would require extensive resources and I have never heard of one being done for a municipal class EA. Its difficult to assess how likely it is I could have convinced a project team to have undertaken such an assessment, so I will assume a low fruit score of zero.
	CR 1.2	Reduce air pollutant emissions	No - no evidence in the EA or detailed design of an air quality analysis. Even if one were to be done a project that maintains vehicular traffic without increasing alternative transportation won't meet the criterion objective of improving air quality			-		-		-		None	No achievement since no air quality analysis undertaken; no low fruit since its not realistic to reduce air pollution even if the road isn't being widened as the project isn't designed to encourage alternative modes of transportation.
	Resilience												
	CR 2.1	Assess climate threat	No - no evidence a climate impact assessment was undertaken, and it would not have been undertaken regardless as the discussion of incorporation of climate change into municipal class EAs only began in the fall of 2016 with the release of MOECC's Draft Guideline: <i>Consideration of Climate Change in Environmental Assessments in Ontario.</i>	-		-		-		-		None	No achievement since no climate impact assessments undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
	CR 2.2	Avoid traps and vulnerabilities	No - no evidence of identification and assessment of possible changes in key engineering design variables.			-		-		-		None	No achievement since no survey of future resource constraints and vulnerabilities undertaken. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
	CR 2.3	Prepare for long-term adaptability	No evidence that team researched long-term changes in operational or environmental conditions	-		-		-		-		None	No achievement since no plans and designs to prepare for long term climate change. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
	CR 2.4	Prepare for short-term hazards	No evidence that team researched short -term hazards and how they may change over the life time of the project			-		-		-		None	No achievement since no analysis of short term hazards. No low fruit because the most efficient, and appropriate level of this analysis is at the Regional scale through a strategic environmental assessment (SEA) with policies and actions incorporated into Transportation Master Plans; individual projects can then adhere to the policies and actions of the appropriate SEA.
	CR 2.5	Manage heat island effects	No - project does not meet heat island requirements	-		-		-		-		None	No achievement since no evidence of consideration of solar reflectance. Addition of planted median likely required to achieve Improved of 10% shading; as this would require a major redesign of the road, no low hanging fruit score is given.
										0	0	0	
										62	91	141	

Possible
Total
Score
Award

772
11.79% #####
None None None

A13: Torbram Road (Father Tobin Road to Mayfield Road)

			Performance Metrics						Metrics Met		Achievement Level			Score					
			Criterion	A	B	C	D	E	F	Base	Upper	Base	Upper	Low Fruit	Base	Upper	Low Fruit	Summary Notes	
Quality of Life	Purpose	QL 1.1	Improve community quality of life	No - I assume that test of considering community needs goals and issues was not satisfied. Although the ESR aligns with 2009 Brampton Transportation Master Plan, and adjacent Environmental Assessments, there was limited consideration of Brampton Official Plan or and no consideration of Provincial Policy in the ESR. Two poorly attended PICs (not clear in the ESR if anyone came; possibly one person came to the first).	No - aligns with 2009 Brampton Transportation Master Plan, and adjacent Environmental Assessments, but limited consideration of Brampton Official Plan or and no consideration of Provincial Policy. Two poorly attended PICs (not clear if anyone came; possibly one person came to the first).	Yes- the EA process sought to identify and address potential impacts to the local community	No - the standard 2 PIC meetings with info boards will not suffice as meaningful engagement as they were poorly attended or unattended with no comments recorded from either	No. The two poorly attended or unattended PICs with no comments recorded from either will not suffice as community endorsement		None	C	None	None	Enh	0	0	5	No base or upper achievement given there evidence in the ESR that no only once person came to the first PIC and possibly no one came to the second PIC, so the community was definitely not "meaningfully engaged". A low fruit achievement of improved would require a more thorough review of the Brampton Official Plan, consideration of the Peel Official Plan, and consideration of relevant Provincial Policies, and a more creative approach to community engagement, which should have been apparent after only one person showed up at the first public meeting.	
		QL 1.2	Stimulate sustainable growth and development	Unlikely - design, construction and operation supports existing jobs, but unlikely to meet test of <i>significant</i> number of new jobs	Yes- project increased quality of recreational capacity with multi-use paths for cycling	Yes - reduced congestion counts as improved community productivity as per Envision		-		B, C	B, C	None	None	None	0	0	0	No achievement given or possible without the creation of a significant number of new jobs during design, construction and operation.	
		QL 1.3	Develop local skills and competencies	No - no commitments to local employment of needy or disadvantaged groups		-	-	-	-		None	None	None	None	None	0	0	0	My opinion is that a municipality would never and probably couldn not legally restrict a contractor to hiring local workers; the most that could probably be done is including a policy to look favourably in the tendering process of contractors with a policy of training and hiring needy or disadvantaged workers
	Wellbeing	QL 2.1	Enhance public health and safety	No - no new sustainability technologies, materials or equipment identified so no opportunity to assess associated Health and Safety implications			-	-	-		None	None	None	None	Imp	0	0	2	No new sustainability technologies have been proposed, so there's no opportunity to assess associated Health and Safety implications; therefore no achievement is given. As other low fruit score may require the use of new sustainability technologies, there would be an associated opportunity to assess the associated Health and Safety implications so a conservative low fruit score of Improved is given.
		QL 2.2	Minimize noise and vibration	Yes - studies of noise during operation, and consideration of noise during construction	No - no mitigation of noise in final design; some general recommendations of mitigation during construction		-	-	-		A	A	Imp	Imp	Imp	1	1	1	Achievement of improved based on study of noise during construcion and operation. No low hanging fruit since this would require much more detailed analysis and consultation to obtain resident's noise goals, and in this project the community is not engaged in the project
		QL 2.3	Minimize light pollution	Likely - no evidence of assessment of lighting needs in available documentation, but TRCA's files are unlikely to have such documentation; some assessment likely done in detailed design	Uncertain - no evidence of analysis of efforts to reduce light energy requirements, but may have been done at detailed design. Google Streetview shows typical non LED light standards installed	Unlikely - no evidence of efforts to reduce light spillage and preserve night sky, but unlikely an explicit goal of the lighting design		-	-	-	A	A and B	None	Imp	Enh	0	1	2	No base achievement as there's no evidence specific efforts were made to reduce lighting energy requirements; an upper score of improved reflects the uncertainty in assessing credit B. A low fruit score of Enhanced reflects a simple assessment of lighting needs, during and post-construction, installation of energy efficient light standards, and basic efforts to reduce light spillage.
		QL 2.4	Improve community mobility and access	Yes - safe to assume study of access and mobility would have been undertaken with Consultant and or contractor during detailed design	yes - some, but limited, coordination with Peel. No coordination apparent with Brampton Transit. Limited evidence of discussion with Metrus, the landowner of adjacent lands to be developed	Yes - design supports active transportation through multi use paths	likely - plans to limit traffic disruption likely undertaken with contractor	Yes - access to public transportation maintained with final design, but limited improvements over existing	Uncertain - its unclear how to assess whether or not the project improves livability		A to E	A through F	Imp	Imp	Enh	1	1	4	Achievement of improved based on limited consideration of access and mobility. Further discussions with Peel and Brampton regarding Transit and Active Transportation, and improved consultation with local residents on these issues could have earned Enhanced.

		QL 2.5	Encourage alternative modes of transportation	Yes - 1 bus routes along Torbram road, and 1 route crosses Torbram along Father Tobin Road	Likely - no deliberate restriction of parking; however, no parking provided through urban cross section	Yes - design supports active transportation through multi use path	Yes - encouragement of active transportation through multi use path	Uncertain - the project did not develop programs to encourage alternative transportation but the Region and local municipality have	A to D	A to E	Enh	Enh	Enh	3	3	3	Achievement of Enhanced based upon buses along Torbram Road providing access to multi modal transit facilities, the restriction of parking, and support for cycling connected to a cycling network. An achievement of Superior requires secure bicycle lockers at the transit stops, which would be a tough sell for their expense relative to the bus stop use.
		QL 2.6	Improve site access, safety and wayfinding	No - no documentation of wayfinding signage considered at the EA or detailed design aside					None	None	None	None	None	0	0	0	No study of wayfinding and limited opportunity due to limited pedestrian, and cycling traffic
	Community	QL 3.1	Preserve historic and cultural resources	Yes - proponent worked with local conservation authority and municipality, and undertook stage 1 archaeological investigation to identify resources, and a built heritage and cultural landscapes assessment	Unclear - historic house, but not fence, protected. No documentation of feasibility analysis, but may have occurred.	No - historic fence, laneway and associated landscaping not protected.	-	-	A	A, B	None	Imp	Imp	0	1	1	Some built and buried cultural resources along study corridor. Feasibility analysis of preservation or enhancement of resources (regardless of implementation) would have achieved a level of 'improved'. It may have been done at detailed design so an upper score of improved given.
		QL 3.2	Preserve views and local character	Yes - determination of rural, but urbanizing character	No - no view plans developed				A	A	None	None	Imp	0	0	1	No public view plan was developed so no credit can be given; as the area is developing the only areas relevant for a viewshed may be the two watercourse crossings; a basic viewshed plan would achieve improved.
		QL 3.3	Enhance public space	No - project does not add to public space			-	-	None	None	None	None	None	0	0	0	No achievement and little opportunity within the project scope to create public space.
															5	7	19

	Collaboration	LD 1.1	Provide effective leadership and commitment	Yes - General statements can be found in the Brampton Go Green Master Plan with some basic ongoing metrics, sustainability framework in the Official Plan, limited consideration in the Transportation Master Plan			-	-	-	-	-	A	A	Enh	Enh	Enh	4	4	4	General statements can be found in the Brampton Go Green Master Plan with some basic ongoing metrics, sustainability framework in the Official Plan, limited consideration in the Transportation Master Plan. No low hanging fruit since it will be a challenge for the project team to have initiated annual sustainability reporting by Brampton.
		LD 1.2	Establish a sustainability management system	Unlikely - project did not specifically address sustainability based on documentation so its unlikely anyone on the project team was responsible for sustainability issues			Unlikely -project did not specifically address sustainability based on documentation so its unlikely a management policy was created for the project	no - based upon ESR the project did not set sustainability goals and targets			-	None	A	None	None	None	0	0	0	Although it can't be confirmed that no specific person was given the responsibility of sustainability, it is unlikely as sustainability is not addressed in the ESR, and its irrelevant because a project must meet criterion A through E for all levels of achievement. Meeting criterion A through E would require an extensive commitment to sustainability within the project team through various business sustainability processes, and given that sustainability as a concept is not considered in EAs for road projects in the GTA in my experience, such commitment is not considered low hanging fruit. No ESRs in any ESRs reviewed for this thesis even used the term sustainability except in reference to the title of another document.
		LD 1.3	Foster collaboration and teamwork	Yes - project team likely incorporated collaboration, teamwork and whole systems design to some degree			No - not likely meaningful risk and reward sharing between consultant and owner	-	-	-	-	A	A	Imp	Enh	Enh	1	4	4	The project documentation does not mention sustainability, however aspects of sustainable design are found. However, the incorporation of results of the Pedestrian and Cycling Master Plan and the Transportation Master Plan shows some degree of systems view. Low fruit is to more fully achieve Enhanced.

Leadership	Management	LD 1.4	Provide for stakeholder involvement	Yes - to some extent stakeholders ID and key concerns addressed	Yes - extensive consultation with TRCA, but sporadic, minimal outreach to other stakeholders	Yes - evidence of alterations to intersection design at Mayfield through consultation with Peel Region, and alterations to low flow channel and pools for watercourse as per TRCA comments	-	-	A to C	A to C	Imp	Imp	Enh	1	1	5	Stakeholders consulatation was sporadic, and public consultation was negligible with no comments recorded from the PICs and only 1 attendee at the first meeting. An achievement of Improved is given. Enhanced would require broader consultation with stakeholders and the public.		
		LD 2.1	Pursue by-product synergy opportunities	no - no documentation of efforts to search for unwanted byproduct of nearby facilities & very unlikely to have occurred				-	-	None	None	None	None	None	0	0	0	No assessment of unwanted byproducts of nearby facilities. Therefore no achievement. Not likely relevant to road constuction so no low hanging fruit	
		LD 2.2	Improve infrastructure integration	No evidence project team sought to improve sustainability through project wide systems integtation		-		-	-	None	None	None	None	None	0	0	0	No evidence that project team sought to improve project sustainability through project wide systems integration;	
	Planning	LD 3.1	Plan for long-term monitoring and maintenance	no - no documentation of plan for long-term monitoring		-		-	-	None	None	None	None	Enh	0	0	3	2 year monitoring of infrastructure is standard and likely to have occurred, but only periodic monitoring of the culverts beyond 2 years is standard, so no credit given. Adding monitoring of the watercourse for an additional 3-5 years should be achievable and would earn Enhanced.	
		LD 3.2	Address conflicting regulations and policies	No - no documentation of assessment of conflicting regulations and policies		-		-	-	None	A	None	None	Imp	0	0	1	No achievement since no documentation of assessment of conflicting regulations and policies and no evidence of sustainability objectives. Low hanging fruit of Improved through basic assessment of regulations and associated regulators and organizations and connection to sustainability objectives.	
		LD 3.3	Extend useful life	yes - high likelihood of some consideration of durability, flexibility and resilience of project	No - no documentation of consideration of expansion or future reconfiguration of project, but may have occurred		-		-	A	A, B	Imp	Imp	Enh	1	1	3	Likely achieved Improved by considering to some degree the flexibility, durability and resilience of road, culverts and new channel. Achieving Enhanced requires documentation of consideration of future expansion or reconfiguration which is given a low hanging fruit score.	
	71020																		
			RA 1.1	Reduce net embodied energy	No - no documentation of an LCA		-		-	-	None	None	None	None	None	0	0	0	No documentation of an LCA and reasonable assumption one was never done as I have never heard of one occurring in my career for a municipal EA; a LCA is very resource intensive so its not considered low hanging fruit.
			RA 1.2	Support sustainable procurement practices	No - no documentation of sustainable procurement				-	-	None	None	None	None	Imp	0	0	2	No documentation of sustainable procurement, and reasonable assumption this is not done in practice outside of LEED projects; as it has been done for LEED projects, it's a reasonable assumption that the lowest level of improved could have been achieved through <15% materials from suppliers with 'sustainability practice'
			RA 1.3	Use recycled materials	Yes - Assesement in EA states that existing pavement and granular road bed not suitable for reuse on site. Contractor may have identified other minor road components that could be reused.	Unclear - no documentation of specification of recycled material undertaken in EA or detailed design. Contractor would have purchased materials with recycled content but not specified it, so its unclear this acheives the credit sustainability intent	-		-	-	-	A	A, B	None	Imp	Enh	0	2	5

Resource Allocation	Materials																	
	RA 1.4	Use regional materials	Unclear - no documentation of specification of local materials, but with expense of transporting materials its likely contractor purchased local materials to save money. Its unclear if this meets the credit intent.	-	-	-	-	-	None	A	None	Imp	Enh	0	3	6	No documentation for the <i>specification</i> of local materials, but with the cost of transportation its likely a large percentage of materials were sourced within the specified distances. Its unclear if achievement of the credit requires explicit specification of local materials by the contractor. If credit is acheived, its conservatively assumed to be an upper acheivement of Improved (30% local) and a low hanging fruit of Enhanced (60% local). Achievement could have been and could be much higher but I don't have evidence to accurately assess so I've used a conservative assessment.	
	RA 1.5	Divert waste from landfills	Unlikely - There is no documentation in the EA or detailed design regarding a comprehensive waste management plan. Although the contractor likely diverted waste to save landfill charges and make money selling the materials its highly unlikely this was done through a comprehensive waste management strategy	-	-	-	-	-	None	None	None	None	Enh	0	0	6	No base or upper achievement since no comprehensive waste management plan likely implemented. With recyclability of asphalt, granular and concrete, its low hanging fruit to achieve 50% recycle/reuse of onsite materials which gives a level of enhanced. Actual low fruit achievement could be even higher, but a more detailed analysis would be required to support this.	
	RA 1.6	Reduce excavated materials taken off site	Likely - although no documentation in materials I had available, it is standard to estimate cut and fill in detailed design or by the contractor to reduce costs of transportating and disposing of soils offsite.	-	-	-	-	-	A	A	Cons	Cons	Cons	6	6	6	The level of achievement is based upon a percentage of excavated materials <i>suitable for reuse</i> that are reused on site. It is safe to assume that the vast majority (90%) of fill <i>suitable for reuse</i> was reused on site, giving an achievement of Conserving.	
	RA 1.7	Provide for deconstruction and recycling	yes - although there's no documentation in the EA and detailed design of specifying materials specifically because of their recyleability asphalt, granular, and concrete are highly recylable so credit can be given	Unlikely - no documentation in EA or detailed design of consideration of facilitating future disassembly and recycling of materials. Its unlikely the contractor would have constructed the project in a way that improved the recyclability of the materials.	-	-	-	-	A	A	Imp	Imp	Sup	1	1	8	As asphalt, granular and concrete are highly recyclable so evalation criterion A is met which on its on leads to a maximum achivement of Improved. Higher levels of achievement require specific efforts to facilitate future recycling which is highly unlikely to have occurred, but with little extra effort due to the highly recyclable nature of many road materials would yield a rating of Superior for the low hanging fruit	
	Energy	RA 2.1	Reduce energy consumption	No - no evidence in the EA or detailed design that the team assessed options for reducing energy consumption	-	-	-	-	None	None	None	None	None	None	0	0	0	Even if options to reduce energy consumption were considered, a basic Improved level requires a decrease of 10% of energy consumption during operation over industry norms, and must include energy consumed by vehicular traffic. As the project adds general purpose lanes to an existing road, this is unachievable so no credit is given or possible.
		RA 2.2	Use renewable energy	No - the vast majority of energy used in the operation and maintenance of the road will be fossil fuels for vehicles with a relatively smaller amount for the nuclear and natural gas for the light standards	-	-	-	-	-	None	None	None	None	None	0	0	0	No achievement since the vast majority of energy used in the operation and maintenance of the road will be fossil fuels. A very significant shift to electric vehicles would be required because Ontario's dominant Nuclear power is not a renewable resource as per Envision.
		RA 2.3	Commission and monitor energy systems	Unclear - although a sub-contractor would have installed and tested the light standards, and the municipality may have done its own check, its unclear either counts as an "independent commissioning" for the purposes of this criterion	Yes - the municipality would have sufficiently trained persons maintaining the light standards	Unclear - the Region would likely monitors the energy consumption of its lights but I don't have easy access to the information required to determine if this would constitute the advanced monitoring systems this criterion requires	-	-	-	B	A to C	None	Enh	Enh	0	3	3	There is no documentation in the files review for the EA or detailed design related to how the lighting systems would be commissioned, but such information isn't expected to sent to TRCA anyways. I don't have sufficient knowledge of standard practices in how municipalities commission and monitor lighting standards to properly assess this credit. The likely range of scores is too low to justify the effort required to more confidently score this credit. So a conservative range of none to Enhanced is given. The next achievement jumps to conserving and requires extensive commissioning and monitoring of systems and as Conservative for any credit is intended to be far beyond current standards of practice, I've assumed its not low hanging fruit.

Water	RA 3.1	Protect fresh water availability	No -although the EA assessed dewatering requirements for construction it was not from the perspective of assessing water availability to support water use so things like recharge weren't considered.	No - although there is no documentation of assessment water taking requirements beyond construction, it wouldn't have been done for long -term impacts as the project doesn't require water takings during operation	-	-	None	None	None	None	None	0	0	0	No level of achievement. The project only assessed groundwater conditions for the purposes of assessing dewatering needs during construction which does not meet many of the requirements of a water availability assessment (criterion A). The project anticipated "significant seepage of groundwater" as per the Geotechnical Report for the EA. The project will not require water takings during operation (criterion B). Therefore no achievemtn is given. No low fruit score is given since an analysis of groundwater and surface water from the perspective of availability is not relevant to this project.
	RA 3.2	Reduce potable water consumption	No - no documentation of identification of strategies to reduce potable water consumption during operation and maintenance		-	-	None	None	None	None	None	0	0	0	No level of achievement given as there is no evidence of a potable water reduction strategy and it can be assumed one wasn't done regardless as roads use little potable water generally during operation and maintenance. For roads, the only opportunity is the use of drought resistant plants in planted medians or boulevards to which stormwater is directed to eliminate the need to water plants with potable water; as such a redesign could be significant and I've assumed significant redesigns are no low hanging fruit, no low hanging fruit score given.
	RA 3.3	Monitor water systems	NA		-	-	-								Not applicable since project does not involve potable water systems in its operation that could be monitored. This criterion would apply if there was an associated watermain.
7 15 36															

Siting	NW 1.1	Preserve prime habitat	NA				—	—	—	NA	NA	NA	NA	NA				Not applicable because there's no prime habitat within the study area
	NW 1.2	Protect wetlands and surface water	No - project widening occurs within specified distance to a watercourse.				—	—	—	None	None	None	None	None	0	0	0	No achievement given or possible as the site realigns a watercourse.
	NW 1.3	Preserve prime farmland	No - site not assessed for prime farmland	No - Prime farmland not protected			—	—	—	None	None	None	None	None	0	0	0	No achivement given as the project expands the road east and west onto farmland; however the farmland is already slated for residential development making this credit irrelevant.
	NW 1.4	Avoid adverse geology	NA	NA	NA	NA			—	—	NA	NA	NA	NA				Credit excluded as not generally relevant for the region, with the exception of projects on the Niagara Escarpment.
	NW 1.5	Preserve floodplain function	Yes - The culvert at the main watercourse will be upsized to convey the regional storm	Yes - pre-development infiltration and water quality maintained by upsized culvert structure that convey the regional flood and keep the road out of the floodplain	Yes - project enhances riparian vegetation through natural channel design enhancements	Yes - a flood emergency plan would not have been prepared for the project, but will be for the local municipality	Yes - project enhances habitat connectivity and sediment transport	Yes - existing culvert in flood plain will be replaced	A to F	A to F	Cons	Cons	Cons	14	14	14	Achivement of top score of Conserving.	
	NW 1.6	Avoid unsuitable development on steep slopes	Yes - project follows best management practices as informed by geotechnical investigations at the EA and detailed design for bridge designs crossing valleys	No - the alignment chosen did not consider slope hazard constraints		—	—	—	A	A	Imp	Imp	Imp	1	1	1	Only achievement of improved is given or possible as site does not contain hazard slopes.	
	NW 1.7	Preserve greenfields	Yes - at least 50% of the project area, being the existing road, is already developed	No - project is not on a designated brownfield		—	—	—	A	A	None	None	None	0	0	0	Although more than 50% of the project is located on an already developed area, it only makes sense to count the existing road as a grey area if serious planning consideration was given to new road alignments entirely within greenfields. This is not the case here, so no acheivement is given or possible.	

Climate												
Resilience												
CR 2.1	Assess climate threat	No - no evidence a climate impact assessment was undertaken, and it would not have been undertaken regardless as the discussion of incorporation of climate change into municipal class EAs only began in the fall of 2016 with the release of MOECC's Draft Guideline: <i>Consideration of Climate Change in Environmental Assessments in Ontario.</i>	-	-	-	-	-	None	None	None	None	None
CR 2.2	Avoid traps and vulnerabilities	No - no evidence of identification and assessment of possible changes in key engineering design variables.			-	-	-	None	None	None	None	None
CR 2.3	Prepare for long-term adaptability	No evidence that team researched long-term changes in operational or environmental conditions		-	-	-	-	None	None	None	None	None
CR 2.4	Prepare for short-term hazards	No evidence that team researched short -term hazards and how they may change over the life time of the project			-	-	-	None	None	None	None	None
CR 2.5	Manage heat island effects	No - project does not meet heat island requirements	-	-	-	-	-	None	None	None	None	None

0
64 0
82 0
125

Possible
Total 775

Score #####

Award None None None

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