4. Phase 2 – Identification and Evaluation of Alternative Solutions to the Problem

As part of the Class EA process, it is necessary to consider alternative solutions to the identified problem, which can be evaluated using criteria developed to establish the preferred solution. The following section provides a description of the alternative solutions identified for evaluation; summarizes the existing environmental conditions in the Study Area; describes the evaluation framework followed; establishes the preferred alternative solution; and documents the review agency and public consultation activities that were undertaken.

4.1 Identification and Description of the Alternative Solutions

Based on the identified problem and opportunities associated with the Humber Bridge Trail Bowstring Arch Bridge, six alternative solutions to address the deteriorating structural integrity of the bridge as well as improve access to the residence on the eastern bank of the Humber River have been determined for this assessment. These include:

Alternative #1 – Do Nothing
Alternative #2 – Rehabilitate the Bridge
Alternative #3 – Remove Existing Bridge and Build a New Concrete Bowstring Arch Bridge
Alternative #4 – Remove Existing Bridge and Build a New Precast Concrete Box Girder Bridge
Alternative #5 – Remove Existing Bridge and Build a New Structural Steel Girder Bridge
Alternative #6 – Remove the Bridge and Provide an Alternative Access Route to the Home on the Eastern Bank of the Humber River.

The following sections describe these alternatives in more detail.

4.1.1 Alternative #1 – Do Nothing

In the 'Do Nothing' alternative, no actions would be taken to improve the structural integrity of the Humber Bridge Trail Bowstring Arch Bridge. In short, Humber Bridge Trail Bridge would be unchanged.

Although this alternative does not address the Problem/Opportunity Statement, the *MEA Municipal Class EA* requires its consideration in all Class EAs as a means of providing a benchmark for evaluating the other alternatives.

It should be noted that transferring the Humber Bridge Trail Bridge to TRCA ownership would be a variation of this alternative; however, the implications of this scenario have not been explored in this study.

4.1.2 Alternative #2 – Rehabilitate the Bridge

This alternative would maintain the existing Humber Bridge Trail Bridge structure, while reinforcing and/or restoring deteriorating sections to improve the overall structural integrity of the bridge. Full rehabilitation would include replacement of the deck and handrails and the repair or reinforcement of other bridge components. Upon

completion, exposed bridge components would be coated with a coloured sealant in order to create a uniform appearance for the rehabilitated structure. Restoration would be sympathetic to the existing bridge design and efforts would be taken to preserve any original bridge features, where possible.

4.1.3 Alternative #3 – Decommission Existing Bridge and Build a New Concrete Bowstring Arch Bridge

The deteriorating structural integrity, as well as the issue of maintaining access to the residence on the eastern bank of the Main Humber River along Humber Bridge Trail, would be addressed through this alternative by removing the existing structure and erecting a new concrete bowstring arch bridge in the vicinity of the current bridge. The span of the new bridge would be increased from that of the existing bridge in order to permit construction of the abutments away from the watercourse.

4.1.4 Alternative #4 – Decommission Existing Bridge and Build a New Precast Concrete Girder Bridge

The deteriorating structural integrity, as well as the issue of maintaining access to the residence on the eastern bank of the Main Humber River along Humber Bridge Trail, would be addressed through this alternative by removing the existing structure and erecting a new precast concrete girder bridge in the vicinity of the current bridge. The span of the new bridge would be increased from that of the existing bridge in order to permit construction of the abutments away from the watercourse.

Figure 6. Example of a Concrete Box Girder Bridge

4.1.5 Alternative #5 – Decommission Existing Bridge and Build a New Structural Steel Girder Bridge

The deteriorating structural integrity, as well as the issue of maintaining access to the residence on the eastern bank of the Main Humber River along Humber Bridge Trail, would be addressed through this alternative by removing the existing structure and erecting a new structural steel girder bridge in the vicinity of the current bridge. The span of the new bridge would be increased from that of the existing bridge in order to permit construction of the abutments away from the watercourse.

4.1.6 Alternative #6 – Decommission the Bridge and Provide Alternative Access Route

This alternative would involve the removal of the existing Humber Bridge Trail Bridge and not constructing a new bridge in its place. Access to the residential property on the east bank of the Humber River along Humber Bridge Trail would be maintained instead by the creation of an alternative access route from St. Padre Pio Gardens extending west towards the property.

4.2 Description of the Study Area and Existing Structure

With the problem defined and the alternative solutions identified, a description of the Study Area was established through a review of secondary information sources, field investigations, an assessment of geomorphic conditions, and detailed hydrologic and hydraulic analyses. A summary of results and findings of these activities is provided in the following sections. Additional information can be found in the existing conditions reports in **Appendix B**.

4.2.1 Structural

This section documents the findings of the visual inspection and evaluation of the Humber Bridge Trail Bowstring Arch Bridge. The structure on Humber Bridge Trail is a single-span bridge, with a bowstring arch truss on either side of the deck. The entire bridge is constructed from cast-in-place concrete and the bridge is wide enough to carry one lane of traffic. The deck length is 19.5 metres and the deck width is 3.9 metres. Each concrete bowstring truss consists of a curved top chord and a straight bottom chord at deck level. The spandrel in-between the two chords consists of vertical and horizontal members. The bowstring trusses span onto abutments at each bank. Horizontal crossbeams span between the bottom chord members and the deck is supported on these cross beams. Overall the bridge is in poor condition with a Bridge Condition Index (BCI) of 49.0 (a BCI of below 60 is considered poor based on the Ministry of Transportation (MTO) methodology).

Figure 7. Cross Beams Showing Spalling

The deck top is in fair to poor condition, with roughly half of the deck area exhibiting large cracks and potholes (**Figure 3**). Deck curbs are in fair to good condition, with some scaling (flaking or peeling), especially in the areas where the curb meets the deck, while the deck crossbeams are in significantly worse shape, experiencing scaling to the side faces and most also showing delamination (separation of the concrete above and below reinforcing bars) to the bottom face, with corrosion of the bottom reinforcement bars as well. One beam in particular has experienced severe delamination, to the point of exposing the bottom reinforcement bars (**Figure 7**). The arches that make up the top chord of the truss are in fair to poor condition, with some minor scaling to all surfaces, as well as some areas of spalling (where the concrete essentially breaks off from the main structure in small pieces), especially at the point of connection between vertical spandrel members and the arch (**Figure 8**). The bottom chords of the trusses are both in very poor condition, with severe delamination and scaling, and the majority of reinforcement bars are exposed and heavily corroded (**Figure 4**). The vertical and horizontal spandrel members are in poor condition, each exhibiting varying degrees of delamination, many with their reinforcement bars exposed and heavily corroded (**Figures 9 and 10**). Handrails at either end of the bridge are in poor condition, suffering from delamination and spalling (**Figure 11**). Both abutments appear to be in good to fair condition, with some scaling but without serious cracks or delamination; however inspectors were unable to confirm erosion in front of the abutments, due to high water levels. The wingwalls are in good to fair condition, experiencing some scaling but no delamination, and there is no evidence of erosion to the concrete itself, although high water levels prevented confirmation of this. Serious erosion to the soil was observed behind the northwest wingwall.

Figure 8. Truss Top Chord Showing Spalling

Figure 9. Vertical Spandrel Member showing Severe Spalling

Figure 10. Vertical & Horizontal Spandrel Member showing Severe Spalling

Figure 11. Handrail showing Delamination

4.2.2 Natural Environment

This section provides an overview of the existing natural environment conditions associated with the Humber Bridge Trail Bowstring Arch Bridge, determined through background data collection; a review of secondary source information; and on-site investigation. The natural environment desktop study area extends 1 kilometre from the Humber Bridge Trail Bridge in all directions (**Figure 12**) and the site investigation study area focuses on the area within a 150 metre radius of the subject bridge, and along the access route from Highway 27 (Humber Bridge Trail) (**Figure 13**). The study areas were defined as such, in order to adequately assess the zone where potential effects from the bridge improvement could reasonably be expected to occur.

Figure 12. Natural Environment Desktop Study Area

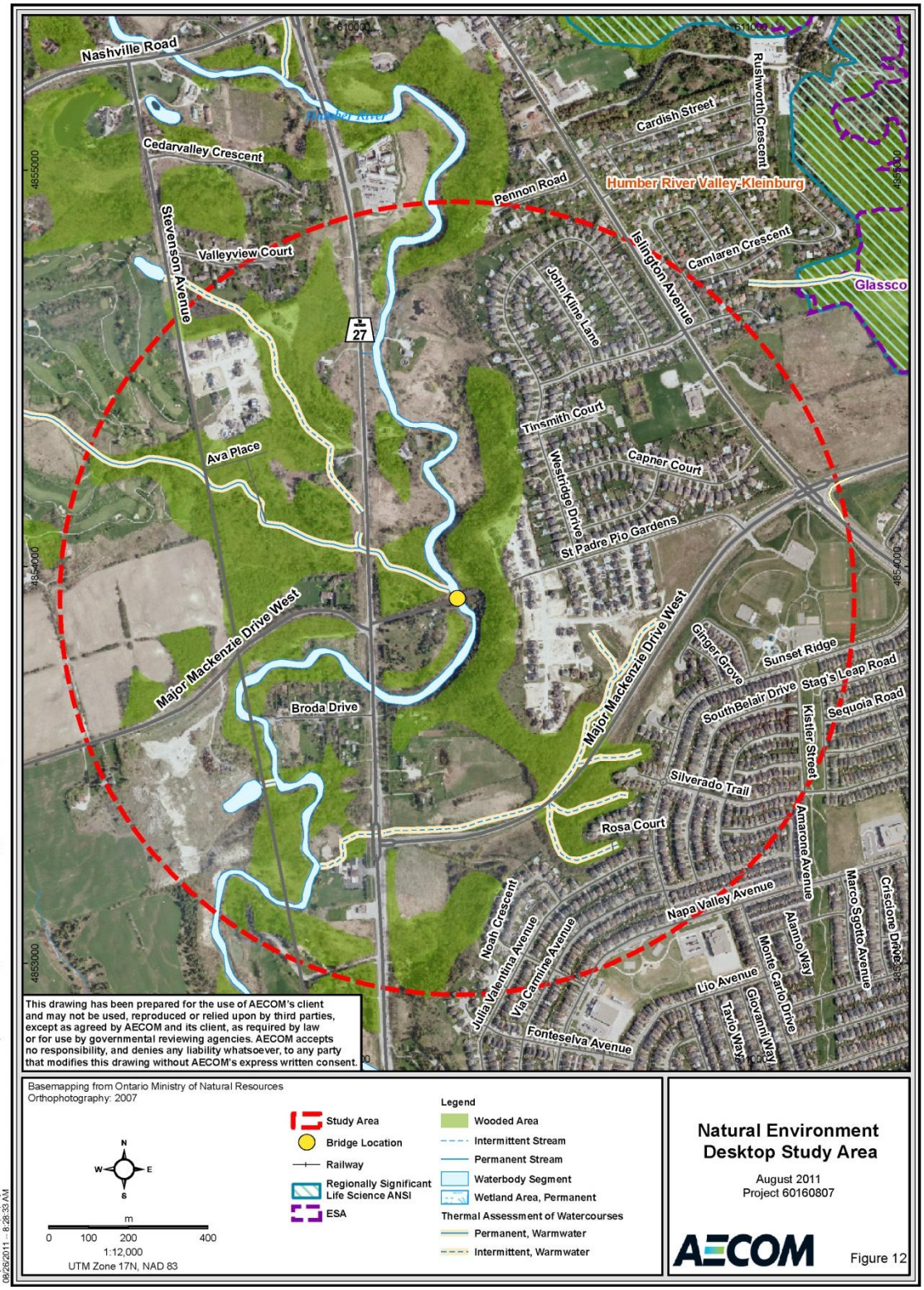
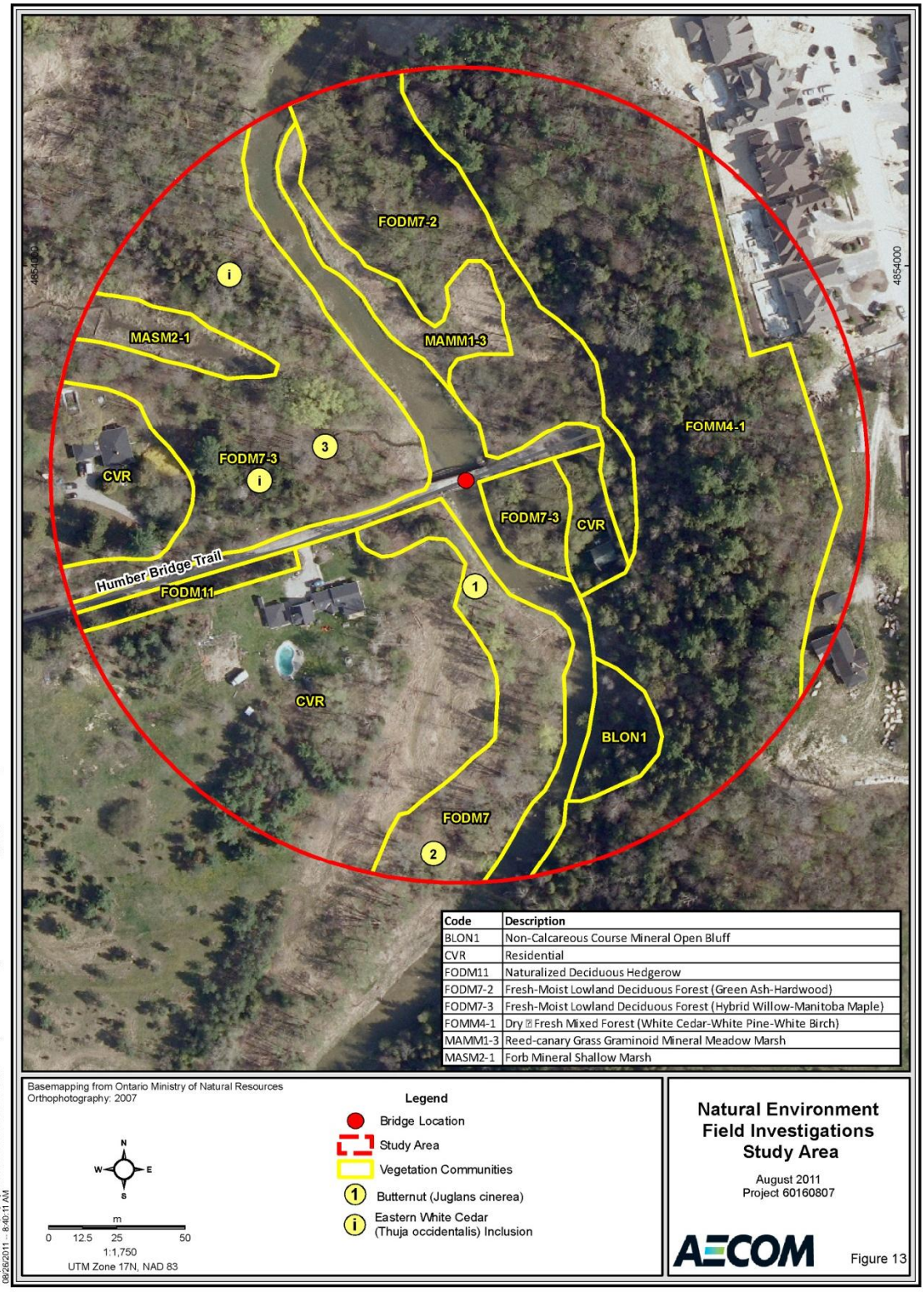


Figure 13. Natural Environment Field Investigations Study Area



4.2.2.1 Terrestrial Habitat

Vegetation and Flora

The study area falls within the Deciduous Forest Region, within which forest communities are dominated by broadleaved trees, primarily Beech and Sugar Maple, but also include Basswood, Red Maple, White Oak and Bur Oak populations, with poor representation of needle-leaved species.

Forest habitat extends for approximately 120 metres from the east bank of the Main Humber River within the study area, abutting residential areas to the east, as well as along the western bank, where it is interspersed with patches of cultural meadow habitat and agricultural fields. The vegetation communities in the vicinity of the bridge site (within 150 metres) were mapped using Ecological Land Classification (ELC) information obtained from TRCA, which was subsequently updated through a field investigation (refer to **Figure 13** for the location and spatial extent of each vegetation community).

Wildlife

Common mammal species of southern Ontario, such as White-tailed Deer (*Odocoileus virginianus*), Coyote (*Canis latrans*), Red Squirrel (*Tamiasciurus hudsonicus*), Eastern Gray Squirrel (Sciurus carolinensis), Eastern Chipmunk (*Tamias striatus*), Meadow Vole (*Microtus pennsylvanicus*), Red Fox (*Vulpes vulpes*), Striped Skunk (*Mephitis mephitis*) and Eastern Cottontail (*Sylvilagus floridanus*) are expected to occur in the study area.

Ontario Breeding Bird Atlas (2001-2005) point count data was used to generate a list of bird species recently recorded in the vicinity of the Humber Bridge Trail Bridge (**Table 4.1**). This list includes a number of bird species commonly found in southern Ontario, many of which are associated with human-modified landscapes, such as urban or suburban areas or agricultural fields. None of these birds are Species At Risk or considered rare in the province of Ontario (NHIC, 2010).

Table 4.1 Bird Species Recently Recorded Near the Humber Bridge Trail Bridge

Scientific Name	Common Name	Habitat Association
Agelaius phoeniceus	Red-winged Blackbird	Wetlands
Cardinalis cardinalis	Cardinal	Shrubs and Early Successional
Carduelis tristis	American Goldfinch	Shrubs and Early Successional
Corvus brachyrhynchos	American Crow	Urban and Suburban
Melospiza melodia	Song Sparrow	Shrubs and Early Successional
Passer domesticus	House Sparrow	Urban and Suburban
Pheucticus ludovicianus	Rose-breasted Grosbeak	Woods and Forests
Poecile atricapillus	Black-capped Chickadee	Urban and Suburban
Quiscalus quiscula	Common Grackle	Grassland, Agricultural, Open
Spizella passerina	Chipping Sparrow	Woods and Forests
Tachycineta bicolor	Tree Swallow	Grassland, Agricultural, Open
Turdus migratorius	American Robin	Urban and Suburban
Zenaida macroura	Mourning Dove	Urban and suburban

Designated Natural Areas

There are no Environmentally Significant Areas (ESAs), provincially or locally significant wetlands (PSWs or LSWs), or Areas of Natural and Scientific Interest (ANSI) present within the study area. Lands designated as

Regional Greenlands System do; however, occur within the study area, as does the Humber River, which has been designated as a Canadian Heritage River. The regionally significant Humber River Valley Life Science ANSI is located approximately 1.15 kilometres northeast of the study area, east of Islington Avenue and north of Major Mackenzie Drive West. The Glassco ESA is also located approximately 1.15 kilometres northeast of the bridge site, its boundary corresponding roughly with the Humber River Valley Life Science ANSI boundary. A description of each of these designated areas is provided below.

Regional Greenlands System

The Humber Bridge Trail Bridge site is located within the Regional Greenlands System, defined in the York Region Official Plan (2010), which is a remnant of an historical forested natural system that once covered most of York Region. This system has unique *functions*, *attributes and linkages*, thus development within the Greenlands System may require measures to maintain these, such as: protecting vegetative canopy cover; maintaining the permeability of soils, and preserving wildlife corridors.

Humber River

The Humber River was designated a Canadian Heritage River in 1999 by the Canadian Heritage Rivers System, Canada's national river conservation program. The goal of the Canadian Heritage Rivers System is to capture the diversity of Canada's river environments within one system and to celebrate the role these rivers have played in both Canadian history and society, by ensuring their continued flow and preservation of their heritage features. The designation of the Humber River was made on the basis of its geography, natural heritage, recreational value, and outstanding human heritage.

The situation of the Humber River, between the Great Lakes-St. Lawrence Forest Region to the north and the Carolinian or Deciduous Forest Region to the south, places it in a unique transition zone. As such, a variety of species common to both regions can be found within the Humber River. Several key natural heritage features occur within the Humber River watershed, including: the ORM; the Niagara Escarpment; the Humber Marshes; and High Park. Having supported human habitation since approximately 10,000 BC, the Humber River also holds high human heritage value, and continues to support a multitude of human recreation activities.

Further description of the Humber River is provided in **Section 4.2.2.2** below.

Humber River Valley Life Science ANSI

According to the Ministry of Natural Resources (MNR) Natural Heritage Information Centre (NHIC) Natural Areas Report (2010), the Humber River Life Science ANSI contains a flat bottomed section of the Humber River north of Boyd Conservation Area, and extends 4.5 kilometres to MacMichael Collection east of Kleinburg. This area contains Willow-Balsam Poplar-Ash-Elm floodplain, wet meadow, goldenrod fields, reforested areas and upland sugar maple mixed woods.

Glassco Environmentally Significant Area

According to the MNR NHIC Natural Areas Report (2010), the Glassco area contains high quality plant communities, including mature mixed forests of Sugar Maple and Eastern Hemlock, which dominate the mostly forested valley walls. This area also contains a forested area dominated by Black Cherry, which is unusual to find as a prevailing canopy species.

4.2.2.2 Aquatic Resources

Humber River Watershed

The Humber River watershed is the largest watershed in the Toronto region, covering an area of 908 square kilometres. It includes portions of the City of Toronto, the Regional Municipalities of York, Peel and Dufferin, and the County of Simcoe. The watershed is dominated by human land uses: urban areas cover approximately 26% of the total land area and agricultural and rural land uses account for an additional 40%. The headwaters and middle reaches of the Humber River generally support healthy aquatic habitats, while the lower, more urbanized reaches contain lower quality, more degraded aquatic habitats.

The Humber Bridge Trail Bridge is located within the Main Humber subwatershed. Land use in this subwatershed is predominantly agricultural (41% of total area), while urban areas cover only 12% of the total land area and are generally concentrated in the southern portion of the watershed. Natural areas make up approximately 46% of the land within the Main Humber subwatershed and include forest (28%), meadow (13%) successional (3%) and wetland (2%) habitats.

Water quality in the Upper Main Humber River subwatershed is relatively good, due to the lack of urbanization, groundwater inputs, and the abundance of well-vegetated natural areas that buffer runoff from lands under human use. The main causes of water quality impairment in this section of the Humber River watershed are: runoff from agricultural and urban areas; streambank erosion; livestock access to streams; and point sources, such as storm sewers, which increase the concentrations of suspended solids, bacteria and nutrients.

Fish and Fish Habitat

The section of the Humber River flowing through the study area is classified as intermediate riverine coldwater habitat, which is characterized by headwaters draining from the ORM and Niagara Escarpment, a proportionately high percentage of groundwater inputs, relatively high baseflow ratios, and relatively stable flows and water temperatures. Based on an Index of Biotic Integrity (IBI) the general health of the aquatic ecosystem within the study area is “fair” or intermediate.

Aquatic habitat features in the vicinity of the bridge (*i.e.*, from approximately 75 metres upstream to 75 metres downstream of the bridge) were mapped during the field investigation. This section of the Humber River generally exhibits a good pool-riffle sequence, with riffle, run and pool habitats present. The river bed material, consists predominantly of silt with overlying boulders and cobble, with the rocky substrates being generally concentrated in the riffle habitats. There is evidence of stream bank erosion both upstream and downstream of the bridge, where areas of undercut banks and exposed roots are present. Woody debris in the watercourse and submergent vegetation, together with the rocky substrates and undercut banks, contribute to in-stream cover in this section of the watercourse. Riparian vegetation consists of grasses and trees, including overhanging trees on the downstream portion of the watercourse, which provide a low to moderate amount of cover and shade. No barriers to fish migration were present at the time of the field survey. Possible sources of pollution include the road right-of-way (e.g., road salt) and manicured lawns associated with two residential properties on the downstream portion of the watercourse. A small creek discharges to the river on the left bank, approximately 15 metres upstream of the bridge. The creek bed material consists of cobble with abundant detritus.

According to fish collection records, a total of 28 species, predominantly intermediately tolerant, coolwater fish, have been recorded within the study area. The provincially Endangered Redside Dace has also been recorded in the study area, most recently in 1999; however, the MNR has confirmed that this site is not located within known occupied Redside Dace habitat[2].

4.2.2.3 Rare Species

A total of seven rare species have been recorded within approximately 1 kilometre of the Humber Bridge Trail Bridge (**Table 4.2**). Rare species include those with designations by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), those listed as Species at Risk in Ontario (SARO), as well as Provincially Ranked S1 to S3 species.

Table 4.2 Rare Species Records

Taxonomic Group	Common Name	Scientific Name	S Rank	COSEWIC	SARO
Birds	Cerulean Warbler	*Dendroica cerulea*	S3B	Special Concern	Special Concern
Insects	Rapids Clubtail	*Gomphus quadricolor*	S1	Endangered	Endangered
Plants	Scarlet Beebalm	*Monarda didyma*	S3		
Fish	Redside Dace	*Clinostomus elongatus*	S2	Endangered	Endangered
Reptiles and Amphibians	Blanding's Turtle	*Emydoidea blandingii*	S3	Threatened	Threatened
	Eastern Ribbon Snake	*Thamnophis sauritus*	S3	Special Concern	Special Concern
	Jefferson X Blue-spotted Salamander	*Ambystoma hybrid pop. 1*	S2		

Two of these species, Rapids Clubtail *(Gomphus quadricolor)* and Redside Dace *(Clinostomus elongatus)* are designated as Endangered both provincially and nationally. The Rapids Clubtail, recorded in the study area in 2005, is a relatively small (42 to 45 millimetres long) and brightly coloured dragonfly species that is typically found in clear, cool medium-to-large rivers with gravel shallows and muddy pools. The Redside Dace, as described in the previous section, was most recently recorded in the study area in 1999 and the area is not considered to be current habitat for this species.

Blanding's Turtle (*Emydoidea blandingii*), designated as Threatened, both provincially and nationally, was recorded in the study area in 1986. Blanding's Turtle is medium-sized, highly mobile (known to travel up to 7 km), and inhabits a network of lakes, streams, and wetlands, especially shallow wetland areas with abundant vegetation.

Historical records also identify two species designated as Special Concern both provincially and nationally: the Cerulean Warbler (*Dendroica cerulea*) and Eastern Ribbon Snake (*Thamnophis sauritus*), dating from 1962 and 1928, respectively. The Cerulean Warbler is an interior forest bird species that inhabits large, relatively undisturbed tracts of mature, semi-open deciduous forest. The Eastern Ribbon Snake is usually found near water, particularly in marshes, where it feeds on frogs and small fishes.

In addition, two provincially rare species were recorded in the study area. These include an amphibian species, the Jefferson x Blue-spotted Salamander hybrid (*Ambystoma* hybrid pop. 1), recorded in 1978, and a plant species, Scarlet Beebalm (*Monarda didyma*), recorded in 1948.

2. *Correspondence with the MNR on January 21, 2011 confirmed that no sites within the study area map are located within known occupied Redside Dace habitat.*

According to the TRCA, watercourses within the study area do not contain fish or mussel species protected under the federal *Species At Risk Act* (SARA), nor do they contain species designated as Special Concern (Schedules 1, 3 and newly listed) or species expected to be listed within the next year.

Information regarding locally rare ('L-ranked'[3]) species recorded in the vicinity of the bridge site (within a 150 metre radius) was obtained from TRCA. According to this information, two flora species; Northern Beech Fern (*Phegopteris connectilis*) and Butternut (*Juglans cinerea*), ranked as L3, have been recorded in this area. Northern Beech Fern commonly occurs both globally and in the province of Ontario and Butternut is designated as Endangered both federally and provincially.

Field investigations confirmed the presence of three Butternut specimens within 150 metres of the bridge (**Figure 13**). As this species receives protection under the *Endangered Species Act* (2007), a permit may therefore be required should the proposed undertaking pose a threat to this species. A general description of each Butternut specimen is provided in **Table 4.3** below. All three specimens exhibited signs of Butternut canker disease.

Table 4.3 Description of the Butternut Specimens Within 150 metres of the Bridge

Specimen No. (Refer to Figure 4)	Description
1	Less than 10 centimetre diameter at breast height (dbh); sooty canker present; well-developed buds.
2	Two trunks; 40 centimetre dbh and 20 centimetre dbh; large cankers present.
3	35 centimetre dbh; most canopy branches appear dead; some signs of sooty canker present.

4.2.3 Geology and Hydrogeology

This section provides an overview of the existing geologic and hydrogeologic conditions associated with the area extending 500 metres from the Humber Bridge Trail Bridge in all directions (**Figure 14**).

4.2.3.1 Physiography

The Humber Bridge Trail Bridge site is located on the southern flank of the ORM, within the South Slope physiographic region, which begins at a sharp break-in-slope on the south side of the ORM and slopes downward towards Lake Ontario. Gently rolling till, characterized by numerous drumlins oriented upslope comprise the South Slope. Meltwater streams cut sharp valleys in the till about 12,000 years ago, in some places exposing the underlying ORM aquifer materials within major river valleys, such as the Humber River valley. In these areas ORM aquifer materials generally contribute cold groundwater discharge to the surface water system.

4.2.3.2 Geology

As Shown in **Figure 14** the shallow subsurface stratigraphy within the study area is generally made of up of (in descending order):

- Approximately 1 to 2 metres of modern alluvial deposits of silt, sand and gravel; and
- Approximately 10 to 20 metres of clayey silt till from the Halton Till Formation.

3. *Locally rare or 'L-rankings' range from: L5 – Demonstrably widespread, abundant, and secure; L4 – Apparently Secure, L3 – Vulnerable to Threat or Extinction, L2 - Imperrilled, L1 – Critically imperilled, H – Possibly extinct, to X – Presumed extinct.*

Till deposits generally underlie the modern alluvium within the Humber River Valley and are present at surface beyond the river valley. Minor deposits of glaciolacustrine silt and clay are shown to be present at surface in the eastern portion of the 500 metre study area boundary. Deeper units, such as the ORM and the Thorncliffe Formation, may be present below the Halton Till.

Through visual observations along cut banks, scour pools and by hand-auguring shallow test holes, it can be confirmed that:

- Surficial soils on the east bank consist of Halton Till materials at surface;
- Surficial soils on the west bank consist of modern alluvium; and
- The Humber River rests on Halton Till in the vicinity of the Humber Bridge Trail Bridge.

4.2.3.3 Hydrogeology

Regional groundwater flows southwards towards Lake Ontario, while local shallow groundwater flows towards the Main Humber River. In the vicinity of the Humber Bridge Trail Bowstring Arch Bridge, the groundwater table is anticipated to be at a similar elevation as the Humber River.

The Halton Till is a major, regional aquitard, meaning it restricts groundwater flow and infiltration, and is estimated to have a hydraulic conductivity between 10^{-10} and 10^{-6} m/s. The presence of the Halton Till within the study area inhibits local groundwater recharge, reduces the exposure of underlying aquifers to contamination, and also provides little groundwater discharge to the Humber River.

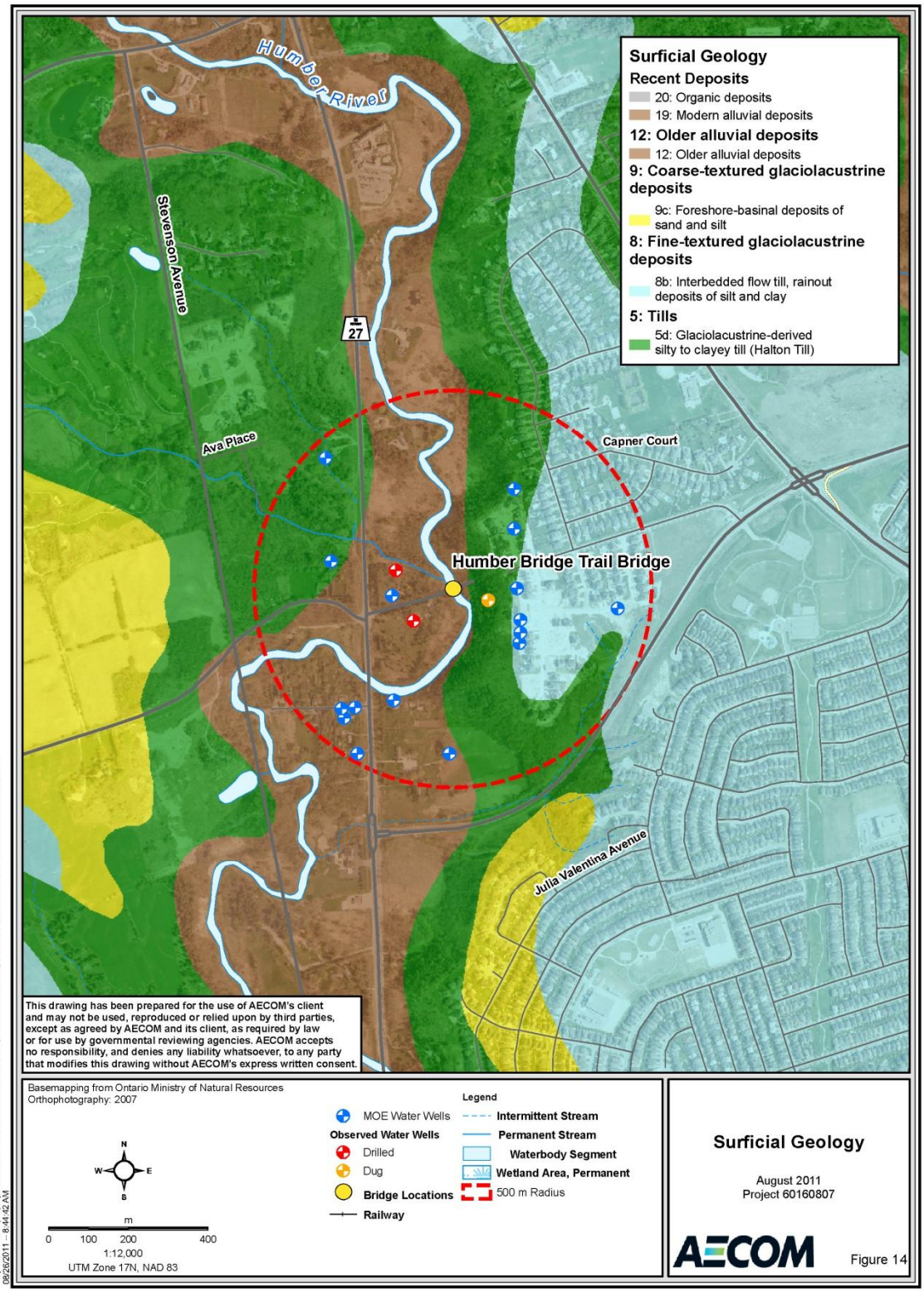
The modern alluvial deposits surrounding the Humber Bridge Trail Bridge, having relatively high hydraulic conductivity (between 10^{-7} and 10^{-4} m/s), coupled with the presence of a high water table in the Humber River valley, locally contribute to the baseflow of the Humber River. As such, excavations within these materials are anticipated to require groundwater control and may necessitate a Permit to Take Water (PTTW) from the MOE, should dewatering rates exceed 50,000 L/day.

Sixteen water wells are recorded to be within 500 metres of the Humber Bridge Trail Bridge. Seven of these wells, located on the eastern side of the Main Humber River, are anticipated to be no longer in use, due to municipal water servicing the subdivision in this area. A road-side well survey was conducted along Humber Bridge Trail and identified three active water wells (referred to as “observed wells” in **Figure 14**):

- #5789 Humber Bridge Trail – a 0.61 metre diameter dug well, likely less than 10 metres deep;
- #5840 Humber Bridge Trail – a 0.15 metre diameter drilled well; and
- #5821 Humber Bridge Trail – a 0.15 metre diameter drilled well.

No significant groundwater recharge or discharge areas were identified within 500 metres of the bridge, nor any significant surficial or shallow aquifers or wellhead protection areas. Additionally, no obvious groundwater springs were found during the site visit; however, sidebank seepage was observed from the alluvial deposits on the west side of the Main Humber River, to the north of the bridge.

Figure 14. Surficial Geology



4.2.3.4 Surface Water Features

The flow of the Main Humber River, as measured at the Elder Mills station, approximately 2 kilometres downstream of the Humber Bridge Trail Bowstring Arch Bridge, is 2.44 m^3/s.

As mentioned previously, the base of the Humber River, in the vicinity of the Humber Bridge Trail Bridge rests on Halton Till materials, therefore, it is not expected that significant groundwater inputs are entering the river in this area.

4.2.4 Social Environment

There are three residential properties located on Humber Bridge Trail, one of which falls on the eastern bank of the Humber River and can only be reached via the Humber Bridge Trail Bridge.

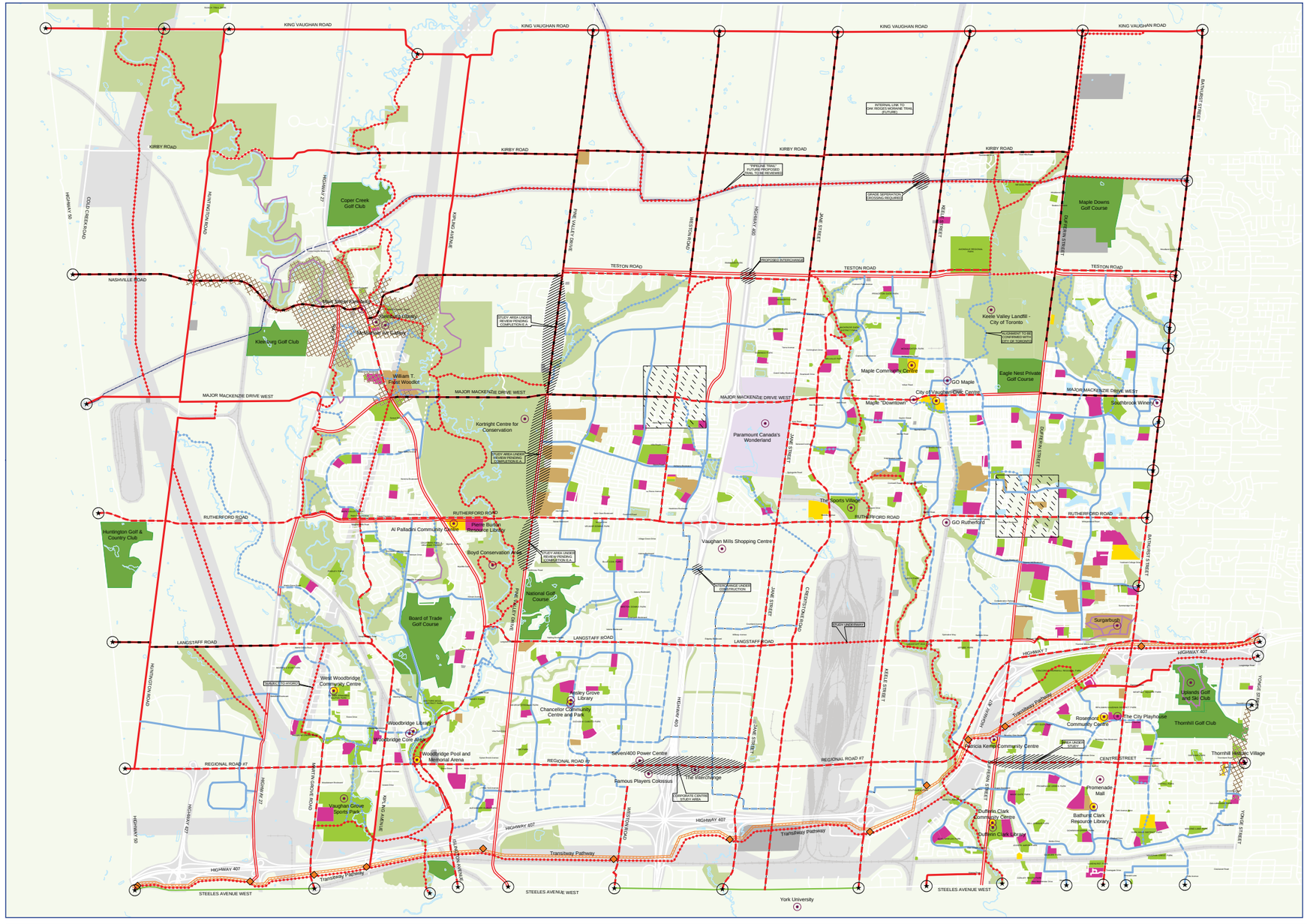
The bridge lies within the 'Settlement Area Outside the Greenbelt' land designation of the Ontario Greenbelt Plan (2005), linked to the 'Protected Countryside' to the north as part of the 'River Valley Connection.'

According to the *York Region Official Plan* (2010) the Humber Bridge Trail Bridge is situated within the 'Regional Greenlands System', comprised of natural areas with unique functions, attributes, and linkages. It is the policy of the York Region Official Plan to "identify, protect and restore the Regional Greenlands System," and, as such, approval for any proposed development within these lands will only be granted if it can be proven that there will be no "overall negative effect on the environmental functions, attributes or linkages for which the lands were identified" (York Region Official Plan, 2.1.7, 2010). Under the Official Plan, cultural heritage is promoted and conserved through policies that: "require local municipalities to adopt official plan policies to conserve significant cultural heritage resources; ensure that identified cultural heritage resources are evaluated and conserved in capital public works projects; [and] encourage local municipalities to use community improvement plans and programs to conserve cultural heritage resources" (York Region Official Plan, 3.4, 2010).

The designation of land surrounding the bridge on Humber Bridge Trail, according to *Vaughan Tomorrow* (2010), the City of Vaughan's Official Plan, is denoted as 'Natural Area and Countryside,' falling squarely within the urban boundary, and supports rural, residential, forested and meadow lands. Given that the land surrounding the Humber Bridge Trail Bridge includes woodlands and is part of the extensive valley and stream corridor in and around Vaughan, it is considered to be a 'Core Feature' of the City's Natural Heritage Network. Core Features are an interconnected system of natural features and the functions they perform, and, as such, have been identified for protection and enhancement.

Within the *Vaughan Pedestrian and Bicycle Master Plan* (2007) the Humber Bridge Trail right-of-way is intended to be extended easterly to St. Padre Pio Gardens and proposed to be designated a 'Neighbourhood Signed Bike Route,' making it part of the City's seamless, clearly marked and signed bicycle network, improving access and connectivity for pedestrians, hikers, and cyclists in and around the City. The construction of this bicycle route will serve to better connect the neighbourhoods in the vicinity of the Humber Bridge Trail Bridge to one another, as well as to the wider urban and rural areas. The Neighbourhood Signed Bike Route will also promote recreational activities and tourism. Appropriate policies are found in both *Vaughan Tomorrow* and the *Greenbelt Plan* (2005).

PEDESTRIAN AND BICYCLE MASTER PLAN STUDY



MAP 4
PEDESTRIAN AND BICYCLE NETWORK: FACILITY TYPES

Class 1 Multi-use Recreation or Boulevard Pathway

- Community Multi-use Recreational Pathway (CMRP)
- Neighbourhood Multi-use Recreational Pathway (NMRP)
- Community Multi-use Boulevard Pathway (CMBP)

Class 2 Bike Lane / Paved Shoulder / Sidewalk

- Community Bike Lane - Formal pavement marking and signing (CL- NO WIDENING)
- Community Bike Lane - Formal pavement marking and signing (CL - WIDENING)
- Neighbourhood Bike Lane - Formal pavenment marking and signing (NL - NO WIDENING)
- Neighbourhood Bike Lane - Formal pavenment marking and signing (NL - WIDENING)
- Community Paved Shoulder Bikeway - Signed as bike route (CSB)

Class 3 Bicycle Signed Route / Sidewalk

- Neighbourhood Signed Bike Route - No formal facility or pavement markings (NR)
- Community Signed Bike Route - No formal facility or pavement markings (CR)

Class 4 Trail Facility

- Footpath / Hiking Trail

Network Features

- Gateway
- Key destination
- Heritage Area
- District Centre
- Area Under Study
- Community Centre
- School
- Park
- Open Space
- Golf Course
- Woodlot
- Cemetery
- Paramount Canada's Wonderland
- Storm Water Management Area
- Hydro Utility Corridor
- Trans-Canada Pipe Line
- Proposed City of Toronto Bike Facility
- Proposed 407 Transitway
- Proposed 407 Transitway Station

1 0.5 0 1 2 3 KM

Marshall Macklin Monaghan
PROJECT MANAGERS • ENGINEERS • SURVEYORS • PLANNERS

Stantec

4.2.5 Cultural Environment

4.2.5.1 Cultural Heritage

The Humber Bridge Trail Bowstring Arch Bridge (formerly Bell Bridge) was built in 1918 and is one of only four concrete bowstring arch bridges that span the Humber River. The bridge was constructed by the firm Ritchie Construction Company of Beamsville, Ontario to the designs and specifications of Frank Barber, Consulting Engineer for a cost of $2,587. It originally served as a major river crossing until the Major Mackenzie Road alignment was moved to its present position in the late twentieth century. Documentation available for the Humber Bridge Trail Bridge indicates that no major rehabilitation or repair work has been undertaken to-date, thus the original features and design of the bridge are assumed to be intact.

The Humber Bridge Trail Bowstring Arch Bridge is currently listed on the Vaughan Heritage Inventory (VHI); however, it is not listed on the Listing of Structures of Heritage Significance (LSHS) which serves as the Heritage Register under Section 29 of the Ontario Heritage Act.

Specific criteria, outlined by the Ontario Heritage Bridge Program (OHBP), is used for the consistent and considered evaluation of heritage bridges to determine their heritage value and inclusion in the OHBP listing. Any bridge scoring higher than 60 points on this evaluation will automatically be considered for listing on the OHBP. Upon evaluation of these criteria for the Humber Bridge Trail Bowstring Arch Bridge, it was found to score a scored 70, with perfect scores received under the Designer, Structural Integrity, Location Integrity, Landmark, Character, and Historical criteria (see **Table 4.4** for full scoring details). The overall score indicates that the Humber Bridge Trail Bridge has high heritage significance and therefore grounds for inclusion on the OHBP list.

Table 4.4 Ontario Heritage Bridge Program (1991) Evaluation of the Humber River (West Branch) Bridge

Criteria (Max. Score)	Assigned Score	Comments
Builder or Designer (6)	6	Frank Barber, Consulting Engineer, is responsible for the design of bowstring arch bridges across Southern Ontario in the early twentieth century. He is noted for his involvement in the design of a number of early concrete bridges, many of which were prototypes (The Middle Road Bridge in 1909; the first open spandrel concrete arch at Weston in 1910).
Age (14)	12	According to the Township of Vaughan Council Minutes, the bridge was erected in 1918. The original drawings for this bridge are no longer available and have presumably been lost.
Materials (4)	0	Steel and concrete are common building materials from this time period.
Design and Style (16)	12	Concrete bowstring arch bridges were a favoured bridge type in the design and construction of water crossings in municipalities in southern Ontario during the early twentieth century. However, as roads were widened and graded throughout the twentieth century, the construction of this bridge type declined and the stock of concrete bowstring bridges has since been significantly reduced. In the City of Vaughan, this is one of three known concrete bowstring bridges to remain intact, and the only one that continues to serve vehicular traffic. The McEwen Bridge was built a few years after the subject bridge, and the Boyd Conservation Area structure was likely built around the same time as the Humber River (West Branch) Bridge.
Prototype (10)	0	It is not known to be a prototype.
Structural Integrity (10)	10	There does not appear to be any major modifications made to this bridge. No bridge rehabilitation records are available. As such, the original form of this bridge remains intact and it continues to serve vehicular traffic.
Visual Appeal (12)	6	While there is no notable decoration or ornamentation associated with this bridge, it still retains strong visual appeal given its arched design, picturesque setting, and appearance of floating above the river.
Location Integrity (4)	4	The structure is at its original location.

Criteria (Max. Score)	Assigned Score	Comments
Landmark (6)	6	The bridge is a prominent feature in the landscape, particularly when viewed from the Humber River and when experienced by pedestrians and drivers who use the bridge to cross the river. Additionally, given that it is listed on the municipal inventory of resources of cultural heritage interest, it is considered to have perceived importance and value within the community.
Gateway (4)	0	It is not a gateway structure.
Character (4)	4	The design, scale and general massing of the bridge was built to accommodate early rural vehicular traffic and agricultural machinery in the early twentieth century. This bridge continues to compliment the rural character of the area and contributes to the picturesque setting of the Humber River corridor.
Historical (10)	10	The bridge retains historical associations with former bridges at this location given that it has been a traditional water crossing point since the early to mid-nineteenth century. Further, it retains important associations with Major Mackenzie Road, an early surveyed thoroughfare which is directly related to nineteenth century settlement and development, as well as transportation improvements that occurred in this part of the former Township of Vaughan.
Total (100)	70	

4.2.5.2 Archaeological

The Humber River drainage basin in Vaughan is well known as an archaeological sensitive area, having been important for Aboriginal settlement for thousands of years, up to approximately the early 17th century. No archaeological sites have been registered immediately adjacent to the Humber Bridge Trail Bowstring Arch Bridge; however, fourteen sites have been registered within 1 km of the bridge (see **Table 4.5**).

Table 4.5 List of Registered Archaeological Sites within a 1 km Radius of Humber Bridge Trail Bridge

Borden #	Site Name	Cultural Affiliation	Site Type	Researcher
AkGv-29	Capner 1	Aboriginal – Archaic	Isolated Find	MPP 1987
AkGv-30	Capner 2	Aboriginal	Isolated Find	MPP 1987
AkGv-31	John Smith Jr.	Euro-Canadian	Cabin	MPP 1987
AkGv-131	Flak Jacket	Aboriginal – Woodland	Cabin	LMA 1995
AkGv-133	WEA 4	Euro-Canadian	Homestead	LMA 1997
AkGv-266		Aboriginal – Archaic, Woodland	Campsite	L. Parker 2006
AkGv-267		Aboriginal – Woodland	Isolated Find	L. Parker 2006
AkGv-268	Wardlaw	Euro-Canadian	Homestead	L. Parker 2006
AlGv-28	North Humber 1	Aboriginal	Isolated Find	MPP 1987
AlGv-29	North Humber 2	Aboriginal	Campsite	MPP 1987
AlGv-30	North Humber 3	Aboriginal	Isolated Find	MPP 1987
AlGv-31	North Humber 4	Aboriginal	Undetermined	MPP 1987
AlGv-32	North Humber 5	Aboriginal	Isolated Find	MPP 1987
AlGv-33	North Humber 6	Aboriginal	Isolated Find	MPP 1987

Soils at Humber Bridge Trail Bridge are a mix of well-drained sandy loam and imperfectly drained clay loam. The pockets of sandy loam make them attractive as locations for settlement or, during the Late Woodland period, for horticultural activity. Therefore, due to the proximity of the Humber River as a primary water source and, given the sensitive nature of this drainage basin, it may be concluded that there is potential for the recovery of Aboriginal cultural material within the study area.

A review of 1860 mapping of the area identified no structures located within the study area boundaries; however, one structure, most likely a homestead, was located to the southwest. Based on the proximity to early settlement roads, it may be concluded that there is potential for the recovery of historic cultural material within the Humber Bridge Trail Bridge study area.

The criteria identified above characterize the Humber Bridge Trail Bowstring Arch Bridge site as having potential for the identification of Aboriginal and Euro-Canadian archaeological sites. Based on the findings of a property inspection; however, it can be concluded that the existing footprint of the Humber Bridge Trail Bowstring Arch Bridge does not retain archaeological site potential due to previous ground disturbances. Additional archaeological assessment is therefore not required within the bridge footprint (see **Figure 16**).

4.3 Evaluation of the Alternative Solutions

Following the identification of the alternative solutions, and the inventory of the existing environment and structural condition of the bridge on Humber Bridge Trail, a comparative evaluation exercise was undertaken in order to identify the most appropriate alternative to address the problem/opportunity. The six alternative solutions were compared against 19 broad criteria that fall under the following 'Areas of Consideration': Technical, Natural Environment, Social Environment, Cultural Environment, and Financial. Using a reasoned argument approach, each alternative was then ranked based on how well it satisfied each of the 19 criteria. The results of the comparative evaluation exercise can be found in **Table 4.6.**

4.4 Identification of the Preferred Solution

In considering each of the key 'Areas of Consideration' (Technical, Natural Environment, Social Environment, Cultural Environment, and Financial) and weighing the potential tradeoffs, Full Rehabilitation of the bridge on Humber Bridge Trail was determined to be the only means of preserving its heritage potential, as well as improving its structural integrity and minimizing impacts on the surrounding environment and therefore addressing the problem/opportunity for the study.

4.5 Public and Agency Consultation During Phase 2

4.5.1 Public Information Centre

All appropriate review agencies, area property owners, relevant Aboriginal organizations, and interested members of the public were consulted during Phase 2 of the EA. This was achieved through a Public Information Centre (PIC), held on July 21, 2011 at the Kleinburg Public Library. Notification of this event was provided through the following means:

- An advertisement was placed in the *Vaughan Weekly* publication during the week of July 4, 2011; and
- An invitation was delivered via direct mail to a number of review agencies, adjacent property owners, relevant Aboriginal organizations, and individuals on the project mailing list on June 30, 2011.

Copies of the above-noted notification materials are provided in **Appendix A**.

Figure 16. Humber Bridge Trail Bridge - Results of the Stage 1 Archaeological Assessment

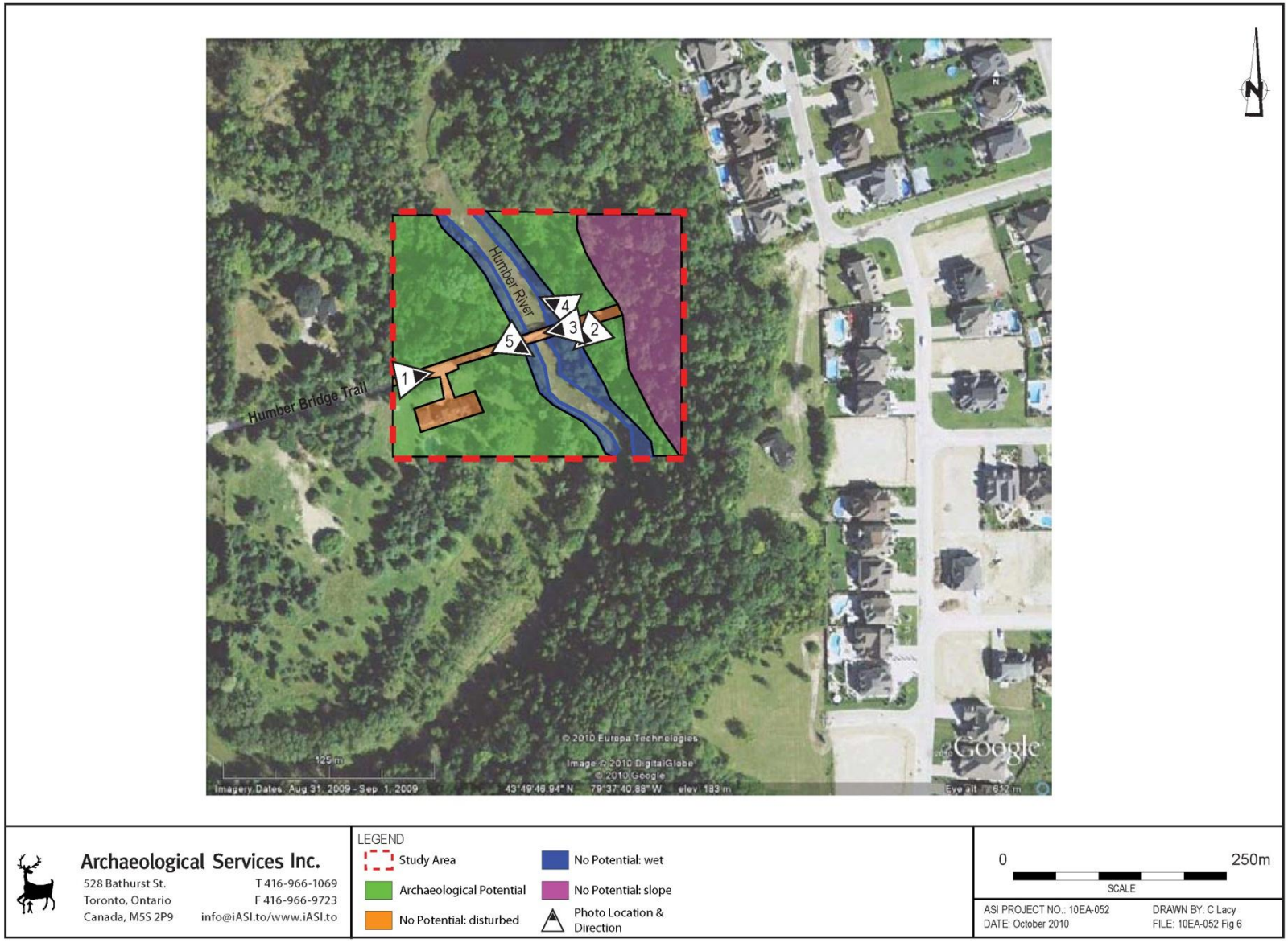


Table 4.6 Comparative Evaluation Summary of Alternative Solutions for the Humber Bridge Trail Bowstring Arch Bridge Class EA

Areas of Consideration/ Criteria	Alternative No. 1 Do Nothing	Alternative No. 2 Rehabilitate the Bridge	Alternative No. 3 Remove Existing Bridge and Build a New Concrete Bowstring Arch Bridge	Alternative No. 4 Remove Existing Bridge and Build a New Precast Concrete Box Girder Bridge	Alternative No. 5 Remove Existing Bridge and Build a New Structural Steel Girder Bridge	Alternative No. 6 Remove Bridge and Provide Alternative Access Road to house #5789
Description of Alternative	**Bridge is left as is.** *Note: Transferring the bridge to TRCA/Private ownership, or buying out the property owner at house #5789 are variations of this alternative, but their implications are not explored in this analysis.*	**The existing bridge structure on Humber Bridge Trail would be maintained, while reinforcing and/or restoring the deteriorating sections to improve the overall structural integrity of the bridge.**	**Complete removal of the existing bridge structure on Humber Bridge Trail and construction of a new 2-lane concrete bowstring arch bridge in the same vicinity.**	**Complete removal of the existing bridge structure on Humber Bridge Trail and construction of a new 2-lane precast concrete box girder bridge in the same vicinity.**	**Complete removal of the existing bridge structure on Humber Bridge Trail and construction of a new 2-lane structural steel girder bridge in the same vicinity.**	**Removal of the existing Humber Bridge Trail Bridge and construction of an alternative access road to Padre Pio Gardens to the east to service house #5789.**
1. Technical						
1.1 Potential to improve safety for bridge users.	The 'Do Nothing' alternative does not improve safety for bridge users. **NONE**	High potential for improvement to the safety of bridge users due to the enhanced structural integrity of the bridge. **HIGH (POSITIVE)**	High potential for improvement to the safety of bridge users due to the construction of the new bridge and the removal of the existing structure. **HIGH (POSITIVE)**	High potential for improvement to the safety of bridge users due to the construction of the new bridge and the removal of the existing structure. **HIGH (POSITIVE)**	High potential for improvement to the safety of bridge users due to the construction of the new bridge and the removal of the existing structure. **HIGH (POSITIVE)**	High potential for improvement to the safety of bridge users due to the construction of a new access route and the removal of the existing bridge. **HIGH (POSITIVE)**
1.2 Constructability of proposed infrastructure.	No infrastructure is required for the 'Do Nothing' alternative. **NONE**	Implementation will be difficult as rehabilitation will require the employment of unconventional construction methods. **LOW/MODERATE CONSTRUCTABILITY**	Implementation will be easier as conventional construction methods will be employed. **HIGH CONSTRUCTABILITY**	Implementation will be easier as conventional construction methods will be employed. **HIGH CONSTRUCTABILITY**	Implementation will be easier as conventional construction methods will be employed. **HIGH CONSTRUCTABILITY**	Implementation will be easier as conventional construction methods will be employed. **HIGH CONSTRUCTABILITY**
1.3 Potential for future maintenance requirements.	High potential for future maintenance requirements due to the continued deterioration of the bridge. **HIGH**	Moderate potential for future maintenance requirements for a standard/typical bridge structure. **MODERATE**	Moderate potential for future maintenance requirements for a standard/typical bridge structure. **MODERATE**	Moderate potential for future maintenance requirements for a standard/typical bridge structure. **MODERATE**	Moderate potential for future maintenance requirements for a standard/typical bridge structure. **MODERATE**	Moderate potential for future maintenance requirements for a standard/typical municipal rural roadway. **MODERATE**
2. Natural Environment						
2.1 Potential for short-term construction related effects on the aquatic environment.	No potential for short-term construction related effects on the aquatic environment. **NONE**	High potential for short-term disturbance to riparian vegetation, as well as sediment erosion and transport to the Humber River during construction. In-water works are likely required to rehabilitate the existing bridge footings, posing a risk to fish associated with harmful alteration, disruption or destruction of fish habitat. However, the implementation of Best Management Practices, in addition to compensation and restoration of disturbed areas, will serve to mitigate and minimize the overall effect. **HIGH**	High potential for short-term disturbance to riparian vegetation, as well as sediment erosion and transport to the Humber River during bridge decommissioning and construction. In-water works are required to remove existing bridge footings, and may be required to construct new bridge footings, posing a risk to fish associated with harmful alteration, disruption or destruction of fish habitat. However, the implementation of Best Management Practices, in addition to compensation and restoration of disturbed areas, will serve to mitigate and minimize the overall effect. **HIGH**	High potential for short-term disturbance to riparian vegetation, as well as sediment erosion and transport to the Humber River during bridge decommissioning and construction. In-water works are required to remove existing bridge footings, and may be required to construct new bridge footings, posing a risk to fish associated with harmful alteration, disruption or destruction of fish habitat. However, the implementation of Best Management Practices, in addition to compensation and restoration of disturbed areas, will serve to mitigate and minimize the overall effect. **HIGH**	High potential for short-term disturbance to riparian vegetation, as well as sediment erosion and transport to the Humber River during bridge decommissioning and construction. In-water works are required to remove existing bridge footings, and may be required to construct new bridge footings, posing a risk to fish associated with harmful alteration, disruption or destruction of fish habitat. However, the implementation of Best Management Practices, in addition to compensation and restoration of disturbed areas, will serve to mitigate and minimize the overall effect. **HIGH**	High potential for short-term disturbance to riparian vegetation, as well as sediment erosion and transport to the Humber River during bridge decommissioning. In-water works are required to remove existing bridge footings, posing a risk to fish associated with harmful alteration, disruption or destruction of fish habitat. However, the implementation of Best Management Practices, in addition to compensation and restoration of disturbed areas, will serve to mitigate and minimize the overall effect. **HIGH**
2.2 Potential for short-term construction related effects on the terrestrial environment.	No potential for short-term construction related effects on the terrestrial environment. **NONE**	Removal of terrestrial habitat required within the construction envelope and along the access route, including some mature trees and potential removal of rare species and SAR habitat. Design should avoid sensitive habitat features to the extent possible. **HIGH**	Removal of terrestrial habitat required within the construction envelope and along the access route, including some mature trees and potential removal of rare species and SAR habitat. Design should avoid sensitive habitat features to the extent possible. **HIGH**	Removal of terrestrial habitat required within the construction envelope and along the access route, including some mature trees and potential removal of rare species and SAR habitat. Design should avoid sensitive habitat features to the extent possible. **HIGH**	Removal of terrestrial habitat required within the construction envelope and along the access route, including some mature trees and potential removal of rare species and SAR habitat. Design should avoid sensitive habitat features to the extent possible. **HIGH**	Removal of terrestrial habitat required within the construction envelope (to decommission the existing bridge) and alternative access route, including intact forest, mature trees and potential removal of rare species and SAR habitat. Design should avoid sensitive habitat features to the extent possible. **HIGH**

Table 4.6 Comparative Evaluation Summary of Alternative Solutions for the Humber Bridge Trail Bowstring Arch Bridge Class EA

Areas of Consideration/ Criteria	Alternative No. 1 Do Nothing	Alternative No. 2 Rehabilitate the Bridge	Alternative No. 3 Remove Existing Bridge and Build a New Concrete Bowstring Arch Bridge	Alternative No. 4 Remove Existing Bridge and Build a New Precast Concrete Box Girder Bridge	Alternative No. 5 Remove Existing Bridge and Build a New Structural Steel Girder Bridge	Alternative No. 6 Remove Bridge and Provide Alternative Access Road to house #5789
2.3 Potential for short-term construction related effects on baseflow and/or groundwater.	No potential short-term effects on baseflow and/or groundwater resources. **NONE**	Low potential for short-term effects on baseflow and groundwater as the rehabilitated structure will remain within the existing bridge footprint. **LOW**	Moderate potential for short-term effects on baseflow and groundwater due to the potential need for construction dewatering. Design should minimize work below the water table. Water taken during construction dewatering should be returned to the watercourse quickly following temperature and clarity controls. **MODERATE**	Moderate potential for short-term effects on baseflow and groundwater due to the potential need for construction dewatering. Design should minimize work below the water table. Water taken during construction dewatering should be returned to the watercourse quickly following temperature and clarity controls. **MODERATE**	Moderate potential for short-term effects on baseflow and groundwater due to the potential need for construction dewatering. Design should minimize work below the water table. Water taken during construction dewatering should be returned to the watercourse quickly following temperature and clarity controls. **MODERATE**	Low potential for effects on baseflow and groundwater as the decommissioned structure will remain within the existing bridge footprint. **MODERATE**
2.4 Potential for long-term effects on the aquatic environment.	No potential long-term effects on the aquatic environment. **NONE**	Low potential for long-term effects on the aquatic environment as the rehabilitated structure will remain within the existing bridge footprint and post-construction restoration methods are available to rehabilitate riparian and in-stream habitats following temporary disturbance. **LOW**	High potential for long-term effects as there is a possibility of permanent removal of fish habitat if the new bridge occupies a different footprint than the existing bridge within the 2 year storm elevation. Design should minimize or maintain a bridge footprint consistent with the existing structure to the extent possible. It would be optimal to clear span the watercourse, resulting in a net gain in fish habitat. **HIGH**	High potential for long-term effects as there is a possibility of permanent removal of fish habitat if the new bridge occupies a different footprint than the existing bridge within the 2 year storm elevation. Design should minimize or maintain a bridge footprint consistent with the existing structure to the extent possible. It would be optimal to clear span the watercourse, resulting in a net gain in fish habitat. **HIGH**	High potential for long-term effects as there is a possibility of permanent removal of fish habitat if the new bridge occupies a different footprint than the existing bridge within the 2 year storm elevation. Design should minimize or maintain a bridge footprint consistent with the existing structure to the extent possible. It would be optimal to clear span the watercourse, resulting in a net gain in fish habitat. **HIGH**	Low potential for long-term effects on the aquatic environment as post-construction restoration methods are available to rehabilitate riparian and in-stream habitats following temporary disturbance. **LOW**
2.5 Potential for long-term effects on the terrestrial environment.	No potential long-term effects on the terrestrial environment. **NONE**	Low potential for long-term effects on the terrestrial environment as post-construction restoration methods are available to compensate for temporary loss of habitat. **LOW**	Low potential for long-term effects on the terrestrial environment as post-construction restoration methods are available to compensate for temporary loss of habitat. **LOW**	Low potential for long-term effects on the terrestrial environment as post-construction restoration methods are available to compensate for temporary loss of habitat. **LOW**	Low potential for long-term effects on the terrestrial environment as post-construction restoration methods are available to compensate for temporary loss of habitat. **LOW**	High potential for long-term effects on the terrestrial environment, including permanent removal of intact forest habitat to accommodate a new residential access route. **HIGH**
2.6 Potential for long-term effects on baseflow and/or groundwater.	No potential long-term effects on baseflow and/or groundwater resources. **NONE**	Low potential for long-term effects on baseflow and groundwater as the rehabilitated structure will remain within the existing bridge footprint. **LOW**	Low potential for long-term effects on baseflow and groundwater as active water taking will end following the construction of a new bridge. **LOW**	Low potential for long-term effects on baseflow and groundwater as active water taking will end following the construction of a new bridge. **LOW**	Low potential for long-term effects on baseflow and groundwater as active water taking will end following the construction of a new bridge. **LOW**	Low potential for long-term effects on baseflow and groundwater as the decommissioned structure will remain within the existing bridge footprint. **LOW**
3. Social Environment						
3.1 Potential for disturbing existing residences, community, and recreation facilities through temporary effects (i.e., construction noise, dust, property access disruption, etc.).	No potential to disturb existing residences, community, and recreation facilities through temporary effects. **NONE**	Moderate potential for temporary disturbance due to bridge access restrictions during construction. **MODERATE**	Moderate potential for temporary disturbance due to bridge access restrictions during decommissioning of the existing bridge and construction of the new bridge. **MODERATE**	Moderate potential for temporary disturbance due to bridge access restrictions during decommissioning of the existing bridge and construction of the new bridge. **MODERATE**	Moderate potential for temporary disturbance due to bridge access restrictions during decommissioning of the existing bridge and construction of the new bridge. **MODERATE**	Moderate potential for disturbance due to bridge access restrictions during decommissioning and the construction of the new access road. **MODERATE**
3.2 Potential to maintain and improve access to the resident on the eastern bank of the Humber River along Humber Bridge Trail.	Moderate potential to maintain access to the resident on the eastern bank of the Humber River along Humber Bridge Trail. No potential to improve access to resident on the eastern bank of the Humber River along Humber Bridge Trail. **MODERATE/NONE**	High potential to maintain and improve access to the resident on the eastern bank of the Humber River along Humber Bride Trail. **HIGH (POSITIVE EFFECT)**	High potential to maintain and improve access to the resident on the eastern bank of the Humber River along Humber Bridge Trail through the construction of the new bridge. **HIGH (POSITIVE EFFECT)**	High potential to maintain and improve access to the resident on the eastern bank of the Humber River along Humber Bridge Trail through the construction of the new bridge. **HIGH (POSITIVE EFFECT)**	High potential to maintain and improve access to the resident on the eastern bank of the Humber River along Humber Bridge Trail through the construction of the new bridge. **HIGH (POSITIVE EFFECT)**	High potential to maintain and improve access to the resident on the eastern bank of the Humber River along Humber Bridge Trail through the construction of the new access route. **HIGH (POSITIVE EFFECT)**

Table 4.6 Comparative Evaluation Summary of Alternative Solutions for the Humber Bridge Trail Bowstring Arch Bridge Class EA

Areas of Consideration/ Criteria	Alternative No. 1 Do Nothing	Alternative No. 2 Rehabilitate the Bridge	Alternative No. 3 Remove Existing Bridge and Build a New Concrete Bowstring Arch Bridge	Alternative No. 4 Remove Existing Bridge and Build a New Precast Concrete Box Girder Bridge	Alternative No. 5 Remove Existing Bridge and Build a New Structural Steel Girder Bridge	Alternative No. 6 Remove Bridge and Provide Alternative Access Road to house #5789
3.3 Potential for requiring the acquisition of private property.	No private property required. **NONE**	Moderate potential for requiring the acquisition of private property. **MODERATE**	High potential for requiring private property for the construction of the new bridge. **HIGH**	High potential for requiring private property for the construction of the new bridge. **HIGH**	High potential for requiring private property for the construction of the new bridge. **HIGH**	High potential for requiring private property for the construction of the new access route. **HIGH**
3.4 Degree of compatibility with Regional and Local Official Plans (OP), Pedestrian and Bicycle Plans, and other relevant policies and plans.	Through the conservation of a cultural heritage resource, as well being part of the active transportation system for pedestrians and cyclists, the 'Do Nothing' alternative conforms with the *York Region Official Plan*. The 'Do Nothing' alternative satisfies the *Vaughan Pedestrian and Bicycle Master Plan* by maintaining the connection along Humber Bridge Trail, as this road has been proposed as a designated a Neighbourhood Signed Bike Route. **HIGH COMPATABILITY**	Through the conservation of a cultural heritage resource, as well being part of the active transportation system for pedestrians and cyclists, the rehabilitation of the bridge conforms with the policies of the *York Region Official Plan*. Rehabilitation of the bridge conforms with the policies of the *Vaughan Pedestrian and Bicycle Master Plan* by maintaining the connection along Humber Bridge Trail, as this road has been proposed as a designated a Neighbourhood Signed Bike Route. **HIGH COMPATABILITY**	As part of the active transportation system for pedestrians and cyclists, the replacement of the bridge conforms with the policies of the *York Region Official Plan*. The decommissioning of the existing bridge does not; however, preserve a cultural heritage resource, as per the *Official Plan*. Replacement of the bridge satisfies the *Vaughan Pedestrian and Bicycle Master Plan* by maintaining the connection along Humber Bridge Trail, as this road has been proposed as a designated a Neighbourhood Signed Bike Route. **HIGH COMPATABILITY**	As part of the active transportation system for pedestrians and cyclists, the replacement of the bridge conforms with the policies of the *York Region Official Plan*. The decommissioning of the existing bridge does not; however, preserve a cultural heritage resource, as per the *Official Plan*. Replacement of the bridge satisfies the *Vaughan Pedestrian and Bicycle Master Plan* by maintaining the connection along Humber Bridge Trail, as this road has been proposed as a designated a Neighbourhood Signed Bike Route. **HIGH COMPATABILITY**	As part of the active transportation system for pedestrians and cyclists, the replacement of the bridge conforms with the policies of the *York Region Official Plan*. The decommissioning of the existing bridge does not; however, preserve a cultural heritage resource, as per the *Official Plan*. Replacement of the bridge satisfies the *Vaughan Pedestrian and Bicycle Master Plan* by maintaining the connection along Humber Bridge Trail, as this road has been proposed as a designated a Neighbourhood Signed Bike Route. **HIGH COMPATABILITY**	The provision of an alternative access route does not preserve a cultural heritage resource, as per the *York Region Official Plan*. Elimination of the bridge, and therefore access across the Humber River along Humber Bridge Trail, does not support the active transportation system for pedestrians and cyclists and thus does not conform with the *Official Plan* policy. The provision of an alternative access route does not conform with the policies of the *Vaughan Pedestrian and Bicycle Master Plan* as it does not maintain the connection along the Humber Bridge Trail, proposed as a designated as a Neighbourhood Signed Bike Route. **LOW COMPATABILITY**
3.5 Potential for creating a visually appealing structure.	Low potential for creating a visually appealing structure, as the existing bridge retains some visual appeal. **LOW**	High potential for creating a visually appealing structure, by applying rehabilitation techniques that are sympathetic to the design of the existing structure. **HIGH (POSITIVE EFFECT)**	Moderate potential for creating a visually appealing structure when constructing the new bridge. **MODERATE**	Moderate potential for creating a visually appealing structure when constructing the new bridge. **MODERATE**	Moderate potential for creating a visually appealing structure when constructing the new bridge. **MODERATE**	No potential to create a visually appealing structure. **NONE**
4. Cultural Environment						
4.1 Potential for effects on archaeological resources.	No effects on archaeological resources. **NONE**	Low potential for effects on archaeological resources as rehabilitation will not require area beyond the existing bridge footprint. **LOW**	Low potential for effects on archaeological resources as decommissioning and new bridge will not require area beyond the existing bridge footprint. Moderate potential for effects on archaeological resources for construction staging areas. **MODERATE**	Low potential for effects on archaeological resources as decommissioning and new bridge will not require area beyond the existing bridge footprint. Moderate potential for effects on archaeological resources for construction staging areas. **MODERATE**	Low potential for effects on archaeological resources as decommissioning and new bridge will not require area beyond the existing bridge footprint. Moderate potential for effects on archaeological resources for construction staging areas. **MODERATE**	High potential for effects on archaeological resources as a new access route will require area beyond the existing bridge footprint. High potential for effects on archaeological resources for construction staging areas. **HIGH**
4.2 Potential for effects on built heritage resources.	No effects on built heritage resources. **NONE**	Despite not being included on the City of Vaughan's Listing of Structures of Heritage Significance, the cultural heritage study concluded that Humber Bridge Trail Bridge retains high heritage significance. Thus, there is moderate potential for effects on built heritage resources due to the rehabilitation of the existing bridge. However, because the design would be sympathetic to the original, the effects would be minimized. **LOW**	Despite not being included on the City of Vaughan's Listing of Structures of Heritage Significance, the cultural heritage study concluded that Humber Bridge Trail Bridge retains high heritage significance. Thus, there is high potential for effects on built heritage resources due to the removal of the existing bridge. However, because the design would be sympathetic to the original, the effects would be minimized. **MODERATE**	Despite not being included on the City of Vaughan's Listing of Structures of Heritage Significance, the cultural heritage study concluded that Humber Bridge Trail Bridge retains high heritage significance. Thus, there is high potential for effects on built heritage resources due to the removal of the existing bridge. **HIGH**	Despite not being included on the City of Vaughan's Listing of Structures of Heritage Significance, the cultural heritage study concluded that Humber Bridge Trail Bridge retains high heritage significance. Thus, there is high potential for effects on built heritage resources due to the removal of the existing bridge. **HIGH**	Despite not being included on the City of Vaughan's Listing of Structures of Heritage Significance, the cultural heritage study concluded that Humber Bridge Trail Bridge retains high heritage significance. Thus, there is high potential for effects on built heritage resources due to the removal of the existing bridge. **HIGH**

Table 4.6 Comparative Evaluation Summary of Alternative Solutions for the Humber Bridge Trail Bowstring Arch Bridge Class EA

Areas of Consideration/ Criteria	Alternative No. 1 Do Nothing	Alternative No. 2 Rehabilitate the Bridge	Alternative No. 3 Remove Existing Bridge and Build a New Concrete Bowstring Arch Bridge	Alternative No. 4 Remove Existing Bridge and Build a New Precast Concrete Box Girder Bridge	Alternative No. 5 Remove Existing Bridge and Build a New Structural Steel Girder Bridge	Alternative No. 6 Remove Bridge and Provide Alternative Access Road to house #5789
5. Financial						
5.1 Potential cost for acquiring property.	No potential costs for property acquisition. **NONE**	Moderate cost associated with temporary working easements for construction during rehabilitation. **MODERATE**	Moderate cost associated with temporary working easements for the decommissioning of the existing bridge and construction of the new bridge. Moderate costs associated with property acquisition for the land upon which the new bridge will be constructed. **MODERATE**	Moderate cost associated with temporary working easements for the decommissioning of the existing bridge and construction of the new bridge. Moderate costs associated with property acquisition for the land upon which the new bridge will be constructed. **MODERATE**	Moderate cost associated with temporary working easements for the decommissioning of the existing bridge and construction of the new bridge. Moderate costs associated with property acquisition for the land upon which the new bridge will be constructed. **MODERATE**	High cost associated with temporary working easements for the decommissioning of the existing bridge and construction of a new access route. Moderate costs associated with property acquisition for the new access route. **HIGH**
5.2 Potential Capital costs to the City of Vaughan for implementation.	No potential Capital costs for implementation. **NONE**	Approximately $793,000. **MODERATE COST**	Approximately $1,696,000. **HIGH COST**	Approximately $1,345,000. **HIGH COST**	Approximately $1,280,000. **HIGH COST**	Approximately $284,000 for decommissioning and between $700,000 to $1,000,000 for new access/structure. **HIGH COST**
5.3 Potential future maintenance costs.	Future maintenance costs would remain the same or potentially increase as the bridge continues to deteriorate. **HIGH**	Moderate annual maintenance costs for a standard/typical bridge structure. **MODERATE COST**	Moderate annual maintenance costs for a standard/typical bridge structure. **MODERATE COST**	Moderate annual maintenance costs for a standard/typical bridge structure. **MODERATE COST**	Moderate annual maintenance costs for a standard/typical bridge structure. **MODERATE COST**	Moderate annual maintenance costs for a standard/typical municipal roadway/bridge. **MODERATE COST**
Ranking of Alternative Solutions	**Pros** • low immediate cost	**Pros** • preserves cultural heritage • improves safety • best protects environment • moderately high cost	**Pros** • preserves cultural heritage • improves safety • provides 2-lane bridge	**Pros** • improves safety • provides 2-lane bridge	**Pros** • improves safety • provides 2-lane bridge	**Pros** • improves safety
	Cons • Does not address problem/opportunity statement • Conflicts with City's Pedestrian and Cycling Master Plan • Liability issues continue to exist	**Cons** • provides only 1-lane vehicular access	**Cons** • highest cost	**Cons** • high cost • loss of cultural heritage	**Cons** • high cost • loss of cultural heritage	**Cons** • loss of cultural heritage • loss of recreational use • high cost • high disruption to environment due to vegetation removal along new access route
	6th	**1st**	**2nd**	**4th**	**3rd**	**5th**

Note: *Recommended Solution*

The purpose of the PIC was to present the existing environmental conditions in and around the bridge on Humber Bridge Trail, provide the results of the comparative evaluation of the alternative solutions, and present the recommended alternative solution for the bridge. The event was held in the Basement Meeting Room of the Kleinburg Public Library on July 21, 2011 from 6 p.m. to 9 p.m. The first hour of the PIC was an open house format, allowing participants to browse through display panels arranged around the room outlining the progress of the project to-date, and to ask questions of the Project Team members in attendance. A reference table including a binder with all of the existing conditions reports, the comparative evaluation matrix, and relevant articles on other bowstring arch bridges was also set up in a corner of the room for perusal. A presentation was delivered at 7 p.m. providing a more detailed summary of the project, including the rationale; problem/opportunity statement; outline of the existing conditions; the comparative evaluation process; and the recommended alternative solution. Following the presentation, attendees were given the opportunity to ask questions.

A total of 19 people attended the PIC, most of who stayed for the duration of the evening. All attendees were asked to sign-in and were given the option to have their names added to the project-specific contact list to be notified of any project news. Each participant was given a comment sheet and encouraged to provide their comments on the event, the EA process, and recommended alternative solution. One comment sheet was received at the end of the PIC.

Copies of the display boards, presentation, reference materials, and comment sheet are provided in **Appendix A**.

4.5.2 Comments Received and their Consideration in the Project

Government Review Team and Public Comments

Eight formal comments were received from the Government Review Team and the Public during Phase 2 of the EA. A summary of the comments received is provided in **Table 4.7**.

Table 4.7 Summary of Comments Received from the Government Review Team and the Public During Class EA Phase 2

Review Agency/ Public Member	Summary of Comments Received	Consideration of Comments Received
Toronto and Region Conservation Authority	• Letter indicates that, while staff are unable to attend the meeting, TRCA maintain their interest in the project and request a copy of all handouts and display materials.	• Comments noted. Materials have been forwarded and will notify for continued involvement.
Ministry of the Environment	• Letter indicates that, while staff are unable to attend the meeting, MOE maintain their interest in the project.	• Comments noted, will notify for continued involvement.
Ministry of Tourism and Culture	• Letter informs that MTC has an interest in the conservation of cultural heritage resources • (archaeological resources, built heritage resources, and cultural heritage landscapes) and would like to remain on the circulation list. • Would like to be forwarded any formal Assessments or Evaluations that have been completed for the bridge.	• Reports have been forwarded and will notify for continued involvement.
Ministry of Aboriginal Affairs	• Advises that the project appears to be located in an area where First Nations may have existing or asserted rights or claims in MAA's land claims process or litigation that could be impacted by the project and recommends contacting the Mississaugas of the New Credit First Union. Also suggests contacting Indian and Northern Affairs Canada (INAC).	• Comments noted. The Mississaugas of the New Credit First Union and INAC have been included in the contact database from the project outset.
Regional Municipality of York – Emergency Medical Services	• Letter requests any information regarding: access routes; egress routes; duration of impediments; possible impact(s), if any, on the Emergency Services Sector.	• Comments noted, will notify for continued involvement.

Review Agency/ Public Member	Summary of Comments Received	Consideration of Comments Received
Heritage Vaughan	• Request that the identification of Humber Bridge Trail Bridge's character-defining elements and attributes be included in the assessment in order for them to be protected and maintained throughout any physical maintenance intervention, as the bridge is included in the Vaughan Inventory of Structures with Cultural Interest. • Request that the plan for the continued use of the structure comprehends a solution that is sensitive to its heritage character. • Request to be included in the circulation of the final report so that it can be shared with the Heritage Vaughan Committee.	• Comments noted. The heritage value of the bridge has been taken into account in the assessment of the alternative solutions. Will notify for continued involvement.
Public Comment	• Has an interest in the continued use of the bridge as President of the Humber Valley Heritage Trail Association (HVHTA) in Kleinburg. The bridge is a vital link for our hiking trail and the ability for hikers to cross over the Humber River allows for a network of trails that would otherwise be impossible. • The two other bowstring arch bridges in Vaughan should also be preserved for their historical significance. We need to preserve all aging structures whenever possible in order to pass history and culture to future generations. • Will be in attendance July 21 for the public meeting on these bridges and would like to be kept informed of any updates.	• Comments noted. The issues of connectivity and heritage value have been included in the assessment of the alternative solutions. Will notify for continued involvement.
Public Comment	• A great presentation of a very comprehensive piece of work.	• Comments noted, will notify for continued involvement.

First Nation and Aboriginal Organization Comments

Two comments were received from First Nation and Aboriginal Organizations during Phase 2 of the EA. A summary of the comments received is provided in **Table 4.8**. Copies of the original letters can be found in **Appendix A**.

Table 4.8 Summary of Comments Received First Nation and Aboriginal Organizations During Class EA Phase 2

First Nation/Aboriginal Organization	Summary of Comments Received	Consideration of Comments Received
Alderville First Nation	• Classify this project as a 'Level 3' according to the Alderville First Nation Consultation Protocol, having minimal potential to impact First Nations' rights. • Request to be kept informed of archaeological findings, burial sites, or any environmental impacts.	• Comments noted and will be notified for continued involvement and appraised of any archaeological findings, burial sites, or environmental impacts.
Curve Lake First Nation	• Informs that the study area is situated within the Traditional Territory of Curve Lake First Nation and is the subject of a claim under Canada's Specific Claims Policy. • Requests that Karry Sandy-Mackenzie, Williams Treaty First Nation Claims Co-ordinator, be provided with a copy of the proposal. • Identifies that, in the absence of exhaustive research, Curve Lake First Nation is not currently aware of any issues that would cause concern with respect to Traditional Aboriginal and Treaty rights. • Wish to be kept appraised of archaeological findings, burial sites, or environmental impacts.	• Comments noted. Karry Sandy-Mackenzie has been added to the contact list and he and Curve Lake First Nation will be notified for continued involvement and apprised of any archaeological findings, burial sites, or environmental impacts.