
City of Kingston - Third Crossing of the Cataraqui River -
Parks Canada Environmental Impact Analysis
Detailed Impact Analysis Report - Section 5

Project Report

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City of Kingston - Third Crossing of the Cataraqui River Parks Canada Environmental Impact Analysis

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5. Significance of Residual Adverse Effects

The approach for determining whether a project is likely to cause significant adverse environmental effects is central to the concept and practice of impact analysis. Section 3 of this DIA identified the effects that are likely to occur on the valued and secondary components as a result of implementing the Project, based on a characterization of the existing environmental conditions of the Study Area.

Section 4 of this DIA explores the identification of mitigation measures to eliminate, alleviate or avoid adverse effects that are likely to occur on the valued and secondary components; likely environmental effects from malfunctions and accidents (such as spills and fires) and effects of the environment on the Project (such as flooding and severe weather). Accordingly, Section 4 provides general mitigation measures to be employed during the various Project phases (Section 4.1) as well as addressing any additional valued, or secondary component-specific mitigation measures and identification of any residual (net) effects following mitigation (Section 4.2).

This Section outlines the likelihood of the Project to cause significant adverse environmental effects on those valued and secondary components where residual (net), adverse effects have been identified. The determination of significance is based on the Impact Assessment Agency's Determining Whether a Designated Project is Likely to Cause Significant Adverse Environmental Effects under the Canadian Environmental Assessment Act, 2012 Interim Technical Guidance (March 2018). Accordingly, the following criteria, taken directly from the IAA's Interim Technical Guidance were used to identify the significance of residual adverse effects.

Ecological and Social Context: should be taken into account when considering the key criteria above in relation to a particular component, as the context may help better characterize whether adverse effects are significant. For example, information on the context is useful when it reveals:

- A unique characteristic of the area (e.g., proximity to park lands, ecologically critical or fragile areas, valuable heritage resources).
- Unique values or customs of a community that influence the perception of an environmental effect (including cultural factors).

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- A component that is important to the functioning of an ecosystem, ecological community or community of people.
- A component for which a target has been established.

Magnitude: refers to the amount of change in a measurable parameter relative to baseline conditions or other standards, guidelines or objectives (e.g., proportion of species habitat affected, number of lost hunting days).

The magnitude of an environmental effect should be expressed in measurable or quantifiable terms, whenever possible. There may be multiple measurable parameters relevant to a VC. When using quantitative or qualitative descriptions of magnitude, clear definitions of terms should be provided. The definition of these terms may vary according to the component under consideration. For example, if using categories such as “low”, “moderate” or “high” each category should be clearly defined, and the rationale for identifying an environmental effect as being a low, moderate or high magnitude should be clearly documented.

Some considerations that may influence the evaluation of the magnitude of an effect include:

- Natural variability, normal fluctuations, or shifts in baseline conditions.
- Scale at which magnitude is considered (for example, the percentage of a population affected may represent 80% at a local level and 5% at the regional level).
- Resiliency of the component and surrounding area to change (for example, considering whether especially vulnerable segments of the component are affected).
- Whether the component has already been adversely affected by other physical activities or natural change.

Geographic Extent: refers to the spatial area over which the environmental effect is predicted to occur. Typical qualitative scales for characterizing geographic extent include site specific, local, regional, provincial, national or global. Prediction of the geographic extent should be quantitative whenever possible (e.g. hectares of habitat change). The traditional territories of

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potentially affected Indigenous communities should be considered where relevant.

Depending on the VC, it may be important to take into account the extent to which adverse environmental effects caused by the Project may occur in areas far removed from it (e.g. the long-range transportation of atmospheric pollutants).

Timing: considerations should be noted when it is important in the evaluation of the environmental effect (e.g. when the environmental effect could occur during breeding season, or during a period of species migration through the area). It may also be relevant to discuss variation in timing of Project activities.

For non-biophysical environmental effects, it is important to take into account seasonal aspects of land and resource use and whether timing is related to Indigenous spiritual and cultural considerations.

Frequency: describes how often the environmental effect occurs within a given time period (e.g., alteration of aquatic habitat will occur twice per year).

Frequency should be described using quantitative terms where possible, such as daily, weekly or number of times per year. It may also be described qualitatively as rare, sporadic, intermittent, continuous, or regular.

Duration: refers to the length of time that an environmental effect is discernible (e.g. day, month, year, decade, permanent). This can refer to the amount of time required for the component to return to baseline conditions, through mitigation or natural recovery (e.g. vegetation re-colonization, return of wildlife to an area where habitat was avoided due to disturbance).

The duration of the environmental effect may be longer than the duration of the activity that caused the environmental effect. For example, the discharge of a substance into a water body may occur only during operation of a project, but the environmental effect to aquatic biota may last beyond the operational lifespan of the project. In this example, if the discharge is continuous throughout operation and results in reduced fish populations, then the frequency of the environmental effect is continuous and the duration spans operation and post-operation up to the point where fish populations return to baseline.

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Environmental effects may not occur immediately following the activity causing them, but these effects still need to be considered. Similarly, the effect on the intergenerational transfer of knowledge in an Indigenous community may not be observed for many years after a project disrupts a specific traditional use of the land.

Reversibility: A reversible environmental effect is one where the component is expected to recover from the environmental effects caused by the Project. This would correspond to a return to baseline conditions or other target (e.g., a population management objective, remediation target), through mitigation or natural recovery within a reasonable timescale.

Reversibility is influenced by the resilience of the component to imposed stresses and the degree of existing stress on that component.

Table 5.1 provides the effects level definitions for each of the residual effects criteria describe above. The residual effects criteria are applied to each residual effect and a determination of level of effect is assigned. Significance is determined based on the results of this determination for each of the criteria. Where residual adverse effects have been deemed significant, a determination of likelihood is applied. The determination of likelihood is based on consideration of probability and uncertainty and is considered only when it is established that one or more predicted residual adverse effects are significant.

Table 5.1: Residual Effects Significance Criteria and Levels

Residual Effects Criteria	Effects Level Definition		
	Low	Moderate	High
Ecological and Social Context	Effect occurs in a region with low fragility (i.e., high resilience to effect).	Effect occurs in a region with moderate fragility (i.e., moderate resilience to effect).	Effect occurs in a region with high fragility (i.e., low resilience to effect).

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Residual Effects Criteria	Effects Level Definition		
	Low	Moderate	High
Magnitude	Effect is evident only at or nominally above baseline conditions.	Effect exceeds baseline conditions but is less than regulatory criteria or published guideline values.	Effect exceeds regulatory criteria or published guideline values.
Geographic Extent	Effect is limited to the Project Location	Effect extends beyond the Project Location limits into the adjacent local area (<500 m).	Effect extends beyond the Project Location and into the regional area (>500 m).
Timing	Effect does not occur during a sensitive time relevant to the specific component or during a time where few Project activities are ongoing concurrently.	Effect occurs during a moderately sensitive time relevant to the specific component or during a time where some Project activities are ongoing concurrently.	Effect occurs during a sensitive time relevant to the specific component or during a time where numerous Project activities are ongoing concurrently.
Frequency	Effect occurs rarely, or sporadically.	Effect occurs intermittently.	Effect occurs continuously or regularly.
Duration	Effect is evident only during pre-operation phases and occurs for short durations.	Effect is evident during the operational period and occurs infrequently and/or for short durations.	Effect is evident during the operational period and occurs frequently and for long durations.
Reversible/ Irreversible (of effect)	Defined as reversible (affected area returns to existing conditions (generally) immediately or over time) or irreversible (affected area never returns to existing conditions).		

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The results of the evaluation of significance of residual adverse effects are summarized in the following sections, with a summary provided at the end of this section in Table 5.2.

5.1 Determination of Significance of Residual Adverse Effects on Valued Components

5.1.1 Greater Cataraqui Marsh Provincially Significant Wetland

As discussed in Section 3.1.1, construction activities have the potential to affect feeding areas for migratory waterfowl and bird species, fish spawning and foraging grounds, reptile overwintering, and other habitat features. Construction activities also have the potential to cause habitat fragmentation, water quality impairments and overall loss of functionality of the wetland. These disruptions, alterations could lead to a decrease in biodiversity within the marsh and a reduction in sensitive species, including SAR, that could potentially change the usage and functionality of the wetland as a whole.

As there are many components that contribute to the overall functionality of the PSW, a number of residual effects will be discussed in each of the following sections. Overall a portion of the PSW will be lost from the piers following construction, therefore this has been carried through as a residual effect.

Overall a portion of the PSW will be lost from the piers for the duration of the pre-operation and operation phases as a result of implementation of the Project. The PSW is a protected habitat of importance to the aquatic and terrestrial environment and recreational users. Accordingly, the level of residual adverse effect is **High** in terms of its ecological context. In terms of the magnitude of this effect, the amount of wetland community lost during construction represents a 1% loss of the open water portion of the wetland and 0.7% loss of the total PSW area. During operation, as only the piers will occupy the wetland as opposed to the causeway, the amount of PSW loss would be significantly less; Accordingly, the magnitude is considered to be **Low**. The geographic extent of this residual effect is considered **High**, in that residual adverse effect of this loss of wetland habitat may extend beyond the immediate vicinity of the bridge, and beyond 500 m.

Although site preparation activities will be phased for the winter months to minimize the potential for off-site sedimentation, hydrological effects and

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adverse effects to most wildlife that may be utilizing the wetland and surrounding areas, activities will still overlap with turtle overwintering seasons. Accordingly, with respect to timing, the level of adverse effect of the installation of the bridge is considered to be **Moderate**.

With respect to frequency and duration of this residual effect, the loss of a small percentage of the PSW will occur throughout construction and for the duration of operation, dictating a level of residual effect of **High**, for both frequency and duration. Overall, this residual effect from the causeway is considered **Reversible**, given the construction footprint will be restored prior to operation. Upon completion however, a small percentage of the wetland community will remain occupied by the bridge itself (piers), therefore the effect is considered **Irreversible** during operation. Despite this, the Project's purchasing and decommissioning of the Music Marina is expected to increase the overall wetland size through the addition of approximately 437 m² of new wetted area along the western shoreline. The final area to be rehabilitated will be determined through negotiation with the DFO during the Fisheries Act Authorization process. Aquatic vegetation monitoring has been proposed in Section 8 to determine the rate and success of aquatic vegetation recolonizing the disturbed area below the temporary footprint of the causeway and newly created wetted area at the previous site of the music marina.

The 1990 evaluation of the Cataraqui wetland noted the dependency of many SAR on the wetland for their local survival. This dependence, combined with many other biological, social and hydrological benefits deemed this wetland to be a PSW. Many sections of this DIA (SAR, Hydrological Processes and Visitor Experience) echo the findings of the original evaluation and explore the potential effects of the Project, mitigation measures as well as their residual adverse effects. As noted in SAR sections, the Project has been designed and is being constructed in a way so as to reduce impacts to SAR to a degree where their usage of the wetland would persist through construction and operation, likely maintaining that contributing score to the overall wetland evaluation. Similarly, this DIA evaluates the potential effects to hydrological processes, showing a localized flow pattern change during construction. Additionally, substantial design criteria and construction planning has occurred to maintain social uses both during construction and operation. In alignment with both provincial and federal wetland objectives, the Project's

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purchasing and decommissioning of the Music Marina is expected to increase the overall wetland size and reduce fragmentation. An aquatic vegetation monitoring program has been proposed in Section 8 to determine the success of the aquatic vegetation recolonization of disturbed areas and compensation area.

Following the application of the residual effect's significance criteria to this residual adverse effect (the loss of a portion of the PSW for the duration of the pre-operation and operation phases), an overall significance determination has been made and is largely based on magnitude. While the PSW is considered highly valuable in terms of ecological context, and the geographic extent, frequency and duration of the effect is High, the overall determination is that this residual adverse effect is **Not-Significant**, given the wetland community lost represents only a small percentage (1%) of this 504-ha wetland with the goal of increase wetland size upon successful completion of post construction monitoring.

5.1.2 Fish and Fish Habitat

In total, 29 species of finned fish are known to inhabit or seasonally use the Study Area and to a lesser degree the Project Location. Additionally, 18 species are confirmed, or thought be using the Study Area for spawning and/or nursery; eight (8) are thought to use the habitat as general adult habitat likely spawning elsewhere; and three (3) are known not to spawn within the Study Area and use it primarily as a migration corridor to upstream or downstream spawning habitats. As the Project is scheduled to work through the spring spawning season, the Project has further potential to disrupt those 18 before mentioned species, with significance elevated for CRA species and therefore are included. Table 2-4 in Section 2.2.2 provides details in regard to which species are present, and how each is expected to make use of the Study Area.

Potential impacts to fish habitat and fish species documented within the Cataraqui River have been discussed in detail in Section 3.1.5. Key potential impacts include but are not limited to the following:

- Degradation of habitat quality due to the re-suspension of previously contaminated sediments within the Project Footprint.

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- Potential degradation of habitat quality due to accidental spills or increases in sediment deposition into the watercourse as a result of shoreline earth works.
- Temporary alteration of fish habitat during construction
- Permanent loss of fish habitat as a result of project components within the watercourse.

Mitigation measures, such as AETC, bubble curtains combined with monitoring levels of noise and vibration emitted during construction as proposed in Section 4.2.2 and Section 8, as well as the general mitigation measures including shoreline sediment and erosion controls and spill prevention measures outlined Section 4.1.1.7 all work to reduce these potential effects. It was determined potential effects resulting from accidental spills and increased levels of sediment deposition due to shoreline earth works could be mitigated to a degree where the risk no longer remains, assuming a responsibly contractor with a robust EMP. All other mitigation measures are expected to reduce the severity of the effects to fish and fish habitat however, the potential for residual effects still exist in all scenarios involving work in or above the water; or in the cases of permanent and temporary habitat loss, can not be avoided through mitigation, and therefore offset for.

Potential residual effects to fish and fish habitat have been categorized into four main categories based on the cause and Project phase they are most likely to occur in:

- Disturbance to fish and fish habitat during construction.
- Effects to fish and fish eggs as a result of construction noise.
- Effects to fish and fish eggs as a result of construction lighting.
- Alteration of fish habitat during construction.
- Permanent loss of fish habitat during operation.

The construction period represents the period of time where the highest potential for residual effects to fish and fish habitat exist. To better evaluate

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the severity of these potential residual effects, effects caused by construction noise, and the alteration of fish habitat will be evaluated in separate sections.

5.1.2.1 Disturbance to Fish and Fish Habitat During Construction

Despite mitigation proposed in Section 4, residual effects to fish and fish habitat are likely to remain present during the construction period. The fish removal methods discussed in Section 4.2.2 are imperfect, and it is possible that fish will remain within the exclusionary area regardless of the level of effort used to remove each individual. Additionally, in water sediment curtains are typically not completely effective at preventing sediment laden water from seeping outside of the work area or can be broken in severe weather or by careless operators or visitors. Sediment present within this reach of the Cataraqui River is known to contain elevated contaminant levels and would degrade water quality if un-controllably re-suspended within the Study Area. Further discussion regarding residual effects to water quality will be discussed separately within Section 5.1.4. Both of these residual effects are likely be of **moderate** ecological/social concern and magnitude, as fish present within the Project Footprint will be displaced from the immediate area, however similar undisturbed habitat is available up and down stream, further to this with the purchasing and decommission of the Music Marina the previously dredged channel (up to 2013) has recolonized with vegetation to a degree where it is providing similar habitat to those going to be lost during the construction period.

Both of these effects are expected to be limited to the Project Location and be limited to the causeway installation and removal during the pre-operation phases. Accordingly, this residual effect is expected to be of **low** frequency, duration, in a **low to high** sensitivity timing period, dependant on if release occurs within the restricted timing window and effect a relatively **low** geographic extent. Although the residual effects to habitat are expected to be **reversible**, the residual effects on the fish are **irreversible** based on the knowledge that any impacts to that have the potential to reduce productivity ripple through the subsequent generations, This as previously described this loss and subsequent ripple effect is low in geographical extent meaning the effect on the fish community of the Study Area is not likely to be measurable, especially when considering the decommissioning of the Music Marina. Based on that reasoning the overall determination is that the residual effects caused

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by disturbance to fish and fish habitat during construction is **not-significant**, provided the proposed mitigations are executed.

5.1.2.2 Effects to Fish Eggs as a Result of Noise Emissions During Construction

As previously documented in Section 3.1.2.4.1 some levels of noise and vibration are expected to be emitted into fish habitat during the Project construction phase. Modelling has shown that fish death or injury can occur up to 7 m away from the caisson and pile installation locations, as described in Section 3.1.2.4 and Appendix H. Section 4.2.2.1.2 proposes multiple mitigation measures that can be used to assist noise and vibration attenuation, including an adaptive management strategy based on noise level monitoring results given current noise modelling does not take into consideration the attenuation of noise by existing plants or the AETC. Given the adaptive management strategy and known mitigations available to reduce noise effects on fish, the potential for noise effects to fish during the allowable timing window is expected to be mitigated. However, noise effects during the restricted timing window remains unknown and is still considered a potential residual effect for spawning individuals and their eggs. A conservative evaluation of the effects is presented Section 3.1.2.5, these estimate the potential for disrupting Noise monitoring levels will be recorded to better determine the potential effects with results presented to DFO, MNRF and PCA to validate and refine the conservative estimates present within this DIA. Contrary to other Section 5 effects the below has two significance determinations, one for working only outside the restricted window the other for working within the restricted window. For the purpose of this DIA the restricted window is considered as March 15 – June 30. As shown in Section 3.1.2.5 the difference in significance rating is not necessarily the date rather a combination of date, construction schedule and construction progression, As stated previously noise monitoring results will be combined with the better-known construction schedule and progression in early 2019 for discussion with the regulatory agencies.

Overall, this residual effect during construction outside the restricted timing window is expected to be of **moderate** Ecological and Social Context, geographic extent and frequency as noise and vibration pose a threat to the functionality of fish spawning habitats within a 7 m of caisson and pile installations. Given adaptive management and monitoring of noise and

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vibration levels will occur throughout construction to ensure levels are within acceptable levels and do not pose a threat to fish beyond the AETC or alternative mitigation measure around piles planned to occur outside the AETC, the residual effects are considered of **low** magnitude. Effects from noise and vibration are not expected to continue past the pre-operation phase of the Project, therefore the residual effect is expected to be of **low** duration and will be **reversible**. Overall, the determination is that the residual effects caused by noise and vibrations during construction is **not-significant**.

Alternatively, the residual effect construction within the timing window is expected to be of **high** Ecological and Social Context, with **low** geographic extent as the and frequency as noise and vibration pose a threat to the functionality of fish spawning habitats within a 7 m of pile installations only during the spawning window with a **low** magnitude. Effects from in-water noise and vibration during the restricted would be expected to continue past the pre-operation phase of the Project, therefore the residual effect is expected to be of **moderate** in duration and are **irreversible**. Overall, the determination is that the residual effects caused by noise and vibrations during the restricted window is considered **Significant**.

5.1.2.3 Effects to Fish and Fish Eggs as a Result of Construction Lighting.

Despite the mitigation efforts discussed in Section 4 to reduce impacts from construction lighting, a residual effect will remain with the introduction of any new light source both on the causeway and other work areas and due to construction lighting and vehicle traffic lights.

Accordingly, the ecological context of the residual effect is **Moderate** as many sensitive life processes have the potential to be affected by construction lighting for both SAR and non-SAR species. As the AETC provides a buffer between fish habitat and the causeway following fish exclusion, the magnitude is **Low** as light will readily dissipate the further away from the causeway fish are located. The geographic context will be **Moderate** as the effect of construction lighting will likely extend beyond the Project Location but will be limited to the immediate vicinity of the Project Location. As safety requirements will require construction lighting to be used during all times when working in the dark is necessary and as construction is expected to occur throughout the restricted timing window, the timing the effect of

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construction lighting will be **Low** as the timing will only be a few hours per day with an assumed 16-hour work day similarly the duration will be **Low** . As construction lighting would only be required for a limited number of hours throughout the day and the effect would not be expected to occur simultaneously throughout the construction area, the significance rating for frequency is considered **Low**. As construction lighting is temporary and will be removed once construction ceases in the work area is, the effect is considered **Reversible**; operational lighting is assessed separately. When considering the residual effects criteria and the level of effect, alteration of behaviour as a result of increased artificial light during construction is expected to be **Not Significant** provided lighting mitigation is followed.

5.1.2.4 Alteration of Fish Habitat During Construction

The construction of causeway will cause alteration of fish habitat during construction. As described in Section 3.1.2.5 construction of the western causeway will result in the loss or alteration of 28,475 m² of highly vegetated littoral habitat and construction of the eastern causeway will result in the temporary loss of 3,690 m² of semi-vegetated littoral habitat. This loss and alteration of habitat is required for facilitating Project construction and can not be mitigated. Mitigation measures have been put in place to prevent the affected areas from increasing through careless construction, and efforts to minimize the volume of affected areas have influenced the overall Project design.

This loss of habitat is expected to be of **moderate** ecological and social context as over 3.2 ha of potential spawning habitat for CRA panfish, basses, and gars and foraging habitat for all finned fish species will be unavailable for use during the construction period. Although this sounds extensive, the surrounding Greater Cataraqui PSW offers 3,150,000 m² of similar habitat and is expected to be able to support these species during sensitive life stages throughout the construction period. Overall, the Projects causeways are expected to alter slightly over 1% of the area of the open water portion of the PSW within the Study Area. Accordingly, the magnitude of the residual effect and geographic extent is expected to be **low**. Additionally, the AETC was installed outside of the sensitive timing windows for fish species present as outlined by the OMNRF, connectivity will be maintained through five fish passages through the causeway in addition to the 220 m wide main opening.

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Construction is expected to fall within these boundaries and once constructed and will remain in place for a maximum of 37 months. Therefore, the residual effect is expected to be of **low** timing sensitivity, frequency and duration. The residual effect is **reversible**, as the causeway will be decommissioned and rockfill will be excavated to 100 mm below the riverbed. The area is expected to naturally restore itself as unconsolidated fine sediments infill the void and vegetation re-colonizes. Overall, it has been determined that the alteration of fish habitat during construction is **not significant** as a large volume of suitable habitat is available on both sides of the Project Footprint and will remain undisturbed throughout the Project, furthermore the decommissioning of the Music Marina is provided an increase in habitat suitability within the previously dredge navigation channel.

5.1.2.5 Permanent Loss of Fish Habitat During Operation

The Project requires the placement of 21 piers and 44 caissons below the highwater mark of the Cataraqui River. This will cause the loss of 92 m² of wetted area all of which will be within the littoral zone and thus 92 m² of fish habitat. While the western abutment will lead to a loss of an additional 86 m² of wetted area and littoral fish habitat. Similar to the temporary alterations to fish habitat discussed in the section above, largest impact would be expected to be on the CRA Panfish, Basses, and Gars as well as the Project Location dependent forage fish groups, although all species will experience a reduced volume of foraging habitat. The overall magnitude and geographic context of the residual effect are expected to be **low** as the surrounding PSW provides extensive undisturbed habitat, and effects are not likely to extend past the footprint of the caissons or abutment. Unlike the other impacts there is no timeframe associated with the impact other than the lifespan of the bridge itself (>100 years). There is no mitigation nor alternative use for the bridge components within the aquatic habitat for which it is being placed.

Accordingly, this residual effect is expected to be of **high** duration, frequency, timing and will be **irreversible**. Overall, the permanent footprint of the Project has been determined to be **Significant**, as the effects will persist throughout the lifespan of the Project. Accordingly, the area of Project components will be offset through the rehabilitation seawall north of the western abutment, the removal of the deposited material and debris adjacent the previous western

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boat launch as well as other initiatives to identify new enhancement opportunities within the City of Kingston.

5.1.3 Birds and Bird Habitat

As previously outlined a total of 174 bird species (excluding SAR) are known to use the Study Area, or surrounding area either seasonally or year-round, with fewer species utilizing the Project Location. The majority of birds identified are protected under the Migratory Bird Convention Act. To understand and evaluate the potential environmental effects of the Project on birds and their habitat, the 174 migratory bird species have been grouped into categories based on preferred predominant nesting habitat including: forest (98 species), wetland/riparian (37 species), grassland/open (15 species), shoreline (11 species), thicket/ravine (8 species), and urban/cliff (5 species).

Once General Mitigation Measures (Sections 4.1.1.4 and 4.1.1.5) and Project Specific Mitigation Measures for Construction (Sections 4.2.3.1) and Operations (Sections 4.2.3.2) are employed, the following residual effects are expected to remain.

Potential residual effects to bird and bird habitat have been categorized into five main categories based on the cause and Project phase they are most likely to occur in:

- Construction Effects to birds and bird habitat as a result of noise and vibration emissions (including potential auditory impairment or masking resulting in behavioural disturbance).
- Potential for vehicle or machinery strikes and nest disturbance (primarily for ground-nesting species) during construction.
- Permanent loss of 1.93 ha of woodland; and 0.2 ha of meadow/grassland habitat.
- Alteration of behaviour (such as foraging, predation events, reproduction and stress response) as a result of increased artificial light.
- Sensory disturbance as a result of noise emissions due to increased traffic and maintenance activities during operation.

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5.1.3.1 Construction Effects to Birds and Bird Habitat as a Result of Noise and Vibration Emissions

Auditory masking and behavioural disturbance is expected to occur at acoustic levels greater than 55 dBA, which corresponds to a maximum distance of approximately 1200 m. This residual effect would be considered significant if allowed to occur during the breeding bird season. Accordingly, mitigation measures are proposed to be implemented if onsite monitoring indicates that sound levels of ≥ 55 dBA are anticipated at sensitive bird receptor locations (i.e. Belle Island and the cattail marsh to the north). Acoustic modelling undertaken by the IPD Team indicates that mitigation measure can reduce the potential for adverse effects to approximately 450 m from the pile driving location over open water, with noise reducing quickly once making landfall.

The ecological context of the effect is **Moderate** as the Project is not located within an Important Bird Area (IBA) that would be highly sensitive to these residual effects. However, the Project Study Area does provide bird habitat to 174 species with many individuals nesting in the area. The level of noise/vibration during ramp-up and construction is likely to cause avoidance within the impairment injury zone, that is not expected to make landfall. Therefore, the magnitude of this effect will be **Low**, as there is abundant retreat/alternate habitat available within the Study Area. The geographic extent will be **Moderate** as the noise/vibration in excess of 55 dBA (minimum for auditory disturbance – masking) will be contained within the local area (<500 m) during the sensitive breeding periods. Construction activities, with the exception of vegetation clearing, will occur during the breeding season leading to **High** ranking. The frequency of the noise/vibration generating construction activities (i.e. pile driving) will be occurring intermittently over the one-year construction period and therefore, the effect will be **Moderate**. The duration of the use of pile-drivers will be limited to the construction period and thus, a **Low**. Once construction is completed, and the bridge enters the operations phase, the construction is **Reversible**. When considering the residual effects criteria and the level of effect, noise disturbance to the limited birds that will remain in the localized area during construction are expected to be **Not Significant**, provided the onsite noise monitoring as described in Section 8 is completed with mitigations measures employed as required.

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5.1.3.2 Potential for Vehicle or Machinery Strikes and Nest Disturbance During Construction

The planned implementation of Project specific mitigation measures during construction for potential vehicle or machinery strikes and nest disturbance (Section 4.2.3.1.2), including onsite worker education, site speed limits, daily monitoring of the site for bird activity and installation of signage to notify workers of nesting presence. Despite these efforts, birds that continue to reside in the Project Location during construction may be subject to the residual effect of potential vehicle/machinery strikes and nest disturbance.

Accordingly, the ecological context of the effect is **Low** as bird populations of migratory species are tolerant to low levels of mortality to individuals associated with strikes and disturbance. The magnitude of incidental take is expected to be nominally above baseline conditions following the implementation of mitigation measures and thus, is **Low**. The use of vehicles/machinery will be limited to the construction limits; therefore, the geographic extent of the effect will be **Low**. Due to the avoidance of the breeding bird window for vegetation clearing, the timing of construction activities within bird nesting habitat will not take place during this sensitive nesting period resulting in a **Low** ranking. As construction activities will require the use of vehicles/machinery continuously throughout the duration of the construction period, the frequency is **High**. Once the bridge construction is completed and enters the operations phase, use of construction vehicles and machinery will cease. Therefore, the duration is limited to pre-operation and the effect is **Low**. The use of construction vehicles/machinery will be removed once construction is complete. As such, the residual effect is **Reversible**; however, when considering incidental mortality this results in a dual-determination of **Reversible to Irreversible**. When considering the ripple effect of the loss of an individual has on future generation. Nonetheless this residual effect would be expected to be **Not Significant**, provided onsite monitoring and mitigation measures are followed.

5.1.3.3 Permanent Loss of Woodland and Meadow/Grassland/ Urban Habitat

The planned implementation of Project specific mitigation measures during construction for bird habitat loss due to tree and vegetation clearing include avoidance of the breeding bird nesting window and the use of exclusionary

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areas implemented around active nests. However, due to the requirement of land to build the structure there will be a permanent loss of 1.93 ha of woodland and 0.2 ha of meadow/grassland bird habitat.

The residual effect of this permanent loss impacts the bird species that rely predominately on woodland and meadow/grassland habitats. As presented in Section 3, a total of 129 bird species rely upon woodland and meadow/grassland/urban habitats. More specifically, 98 migratory bird species rely upon woodland/forest habitats; and a total of 31 migratory bird species rely on meadow/grassland/urban habitat (breakdown is as follows: grassland/open (15 species), shoreline (11 species), and urban/cliff (5 species)).

Accordingly, the ecological context of the effect is **Low** as the Project is not located within an Important Bird Area (IBA) that would be highly sensitive to the residual effects. In addition, the Study Area possesses a variety of habitat types potentially used by birds, including the PSW, riparian areas, woodlands, thickets, residential areas, and a limited amount of fragmented meadow. The Project Location will experience a reduction bird habitat for up to 129 bird species that rely upon forested/woodland and meadow/grassland/urban habitat. However, abundant retreat/alternative habitat is available within the Study Area. Therefore, the magnitude of this residual effect will be **Low**. The geographic extent will be **Low**, as the permanent loss of bird habitat will be restricted to the Project Location. The timing of vegetation clearing will take place outside of the breeding bird nesting window and thus, the residual effect will be **Low**. As the loss of habitat is permanent, occurring during construction and throughout the life of operation of the structure, the frequency and duration will be **High**. In addition, reduction of habitat will prevent portions of the Project Location from returning to baseline conditions and these residual effects are **Irreversible**. When considering the residual effects criteria and the level of effect, permanent loss of woodland and meadow/grassland/urban bird habitat is expected to be **Not Significant**.

5.1.3.4 Alteration of Behaviour as a Result of Increased Artificial Light

The proposed implementation of specific mitigation measures during construction, particularly during sensitive timing windows (i.e. the breeding period), to minimize the effects on behaviour from increased artificial light

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levels (Section 4.2.3.2.1), includes deploying mast lighting in localized work areas whenever practical, utilizing light shields to reduce the area of illumination and avoid upwards lighting, using an illumination colour along the red portion of the visual spectrum, and keeping illumination to the minimum practical level to complete work. Despite these measures, a residual effect will remain since artificial lighting is required to undertake construction activities before dawn and after dusk according to the proposed schedule.

The ecological and social context of the residual effect during construction is **Low** for activities that occur outside the breeding bird timing window, and **Low** for activities that occur within the breeding bird timing window (April 1 to August 31, annually). Due to the urban nature of the Study Area and factoring in existing light pollution from the city landscape (see Figure 2-24), the species composition within the vicinity of the Project Location is expected to consist mostly of tolerant species. Therefore, the anticipated magnitude of the residual effect is expected to be **Low**. The geographic context in this case is **Moderate**, as the effect of artificial construction lighting will extend beyond the Project Location but will largely be localized within the immediate vicinity. Safety requirements will ensure that sufficient illumination levels are in place during construction activities before and after dark, which infers that the effect level on timing will be **High** during the breeding bird window and **Low** outside of the breeding period. The residual effect frequency is **Moderate**, since artificial lighting will be regularly deployed daily however only for a few hours during the 16-hour work day. The duration of this residual effect will be **Low**, as lighting will only be deployed for relatively short periods of time but on a regular basis as dictated by the construction schedule. The effects on behaviour due to artificial lighting during construction are **Reversible**, since the use of additional illumination will be temporary and shall coincide with construction activities as required. When considering the residual effects criteria and the level of effect, the alteration of behaviour due to artificial lighting during construction is expected to be **Not Significant** provided that the appropriate mitigation measures are followed.

The planned implementation of Project specific mitigation measures during operations for alteration of behaviour as a result of increased artificial light (Section 4.2.3.2.1) include design considerations such as utilizing the lowest illumination levels required, reduction of upward lighting and the selection of

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colour least impactful to migratory birds. Despite these efforts, a residual effect will remain with the introduction of any new light source both on the structure and due to vehicular traffic lights.

Accordingly, the ecological context of the residual effect is **Low** as the Project is not located within an Important Bird Area (IBA) that would be highly sensitive to the residual effects. Due to the urban nature of the Study Area and the existing light pollution (Figure 2-24) the habitat usage is expected to be mostly tolerant migratory species. Depending on the species the artificial light may act as a deterrent or attractant to the Project Location, but no more so than the surrounding city landscape. Therefore, the magnitude is expected to be **Low**. The geographic context will be **Moderate** as the effect of artificial lighting of vehicular traffic will likely extend beyond the Project Location but will be limited to the immediate vicinity of the Project Location. As safety requirements will require the structure and vehicles to be lit constantly throughout the operations phase, the timing, frequency and duration of the effect of artificial light will be **High**. Once the operations phase begins, artificial lighting on the bridge will be **Irreversible** as a major infrastructure component to the City of Kingston's transportation system. When considering the residual effects criteria and the level of effect, alteration of behaviour as a result of increased artificial light during operations is expected to be **Not Significant** provided lighting design considerations are followed.

5.1.3.5 Sensory Disturbance as a Result of Noise Emissions as a Result of Traffic and Maintenance During Operation

Woodland, grassland or urban birds within the Study Area are expected to be well adapted and tolerance of the urban and traffic noise levels. Some shoreline or marsh birds would be considered less tolerant in proximity to the cattail marsh habitat north of the Project Location. Noise modelling indicates that no noise impacts to the marsh habitat are expected, resulting in limited residual potential effects as a result of auditory masking in the shoreline bird community.

The consideration of potential noise and vibration impacts as a result of increased traffic/maintenance activities during operations involved selecting an appropriate site for routing the bridge in relation to surrounding natural

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heritage features including areas of known bird concentrations or importance (i.e. wetlands and shorelines)

Accordingly, the ecological context of the residual effect is **Low** as the Project is not located within an Important Bird Area (IBA) that would be highly sensitive to the residual effects. Similarly, the magnitude is **Low** as a result of a similar habitat throughout the Study Area is currently surrounded by similar noise generating activities. The geographic extent of the residual effect is likely to be **Moderate** as it will extend beyond the Project Location but will be limited to the immediate vicinity (< 500 m). Since use of the structure will be constant throughout the operations phase, the timing, frequency and duration of the effect will be **High**. Once the operations phase begins, the resulting traffic noise emissions will be **Irreversible** as a major infrastructure component to the City of Kingston's transportation system. When considering the residual effects criteria and the level of effect, alteration of behaviour as a result of increased noise emissions as a result of increased traffic and maintenance during operations is expected to be **Not Significant**.

5.1.4 Surface Water and Sediment Quality

Results from the Ontario Provincial (Stream) Water Quality Monitoring Network at both the Kingston Mills Station and the Lasalle Causeway Station revealed elevated levels of both cadmium and silver, both exceeding either the PWQO or the CCME guidelines across various months. Additionally, though not in exceedance, phosphorus levels reached the PWQO of 30 ug/L. Similarly, chemical analyses of sediments within the Study Area were conducted in 2010, 2016 and 2018. In all three years, various metals and PAH's were shown to be in exceedance of the CCME guidelines.

Potential sources of contamination include, but are not limited to:

- Waste from industrial operations.
- Urban and agricultural runoff.
- Sewage and stormwater overflows.
- Leachates from the City's landfill at Belle Park.
- Pollution from boat traffic and Highway 401 surface waters.

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Construction of the Project is expected to result in several effects to surface water and sediment quality due to discharges and increased suspended sediments due to various in-water works. While mitigation measures described in Section 4 are expected to reduce many of the impacts to surface and sediment quality, several residual effects remain:

- Increases in the TSS and potential impacts on water quality leading to an increased likelihood of cyanobacteria blooms.
- Disturbed sediments may cause resuspension of sediment bound contaminants within the water column.
- Increases in the volume of stormwater into the Cataraqui River during operations.

The following sections will assess the significance of the residual effects to surface and sediment quality noted above. It should be noted that surface water and sediment quality have the potential to impact many of the other VC's that are discussed sections of this document. It should also be noted that a number of residual effects for this VC have the same rationale for various significance criteria, therefore the rationale found in the first residual effect (Increases in the TSS may cause impacts on water quality and increase the likelihood of Cyanobacteria blooms) will be referenced to avoid duplication.

5.1.4.1 Increases in the TSS and Potential Impacts on Water Quality Leading to an Increased Likelihood of Cyanobacteria Blooms

Some degree of increased TSS will occur as a result of the Project construction activities, despite the implementation of mitigation measures discussed in Section 4. Construction monitoring will ensure preventive measure are deployed to ensure TSS levels stay within the allowable limits are prescribed in Section 8 however, some form of increase (up to 5 mg/L over the long term) in TSS could be expected in close proximity to the Project Location. This slight increase may promote the establishment of cyanobacteria, due to their ability to outcompete other forms of algae in turbid waters.

This impaired surface water quality can lead to many long term and short terms effects on the ecological community within the Study Area such as

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reduced water clarity for foraging, spawning and other life processes of both terrestrial and aquatic mammals. Additionally, increased TSS in the water column, and resulting cyanobacteria blooms, may result in decreased aquatic plant growth due to impaired photosynthesis, high levels of toxins available to various plants and animals, and further nutrient enrichment. Despite the damaging effects of cyanobacteria blooms and elevated TSS levels for the ecological communities, it should be noted that the Cataraqui Marsh experiences legacy issues with nutrient enrichment, and although cyanobacteria has not been previously noted it is likely some small-scale blooms have occurred, given upstream events have been documented. Due to the history of water quality in the area, the Ecological Significance is rated as **Moderate**, as baseline levels are representative of pristine conditions. The magnitude of change during construction activities will likely be above baseline levels, however it is anticipated that mitigation measures discussed in Section 4 (e.g. Turbidity curtains and sediment and erosion control) will prevent TSS levels from exceeding regulatory criteria. Accordingly, the significance rating for Magnitude has been set to **Moderate**. The increase of TSS levels within the Cataraqui with the potential to occur, are only during specified in-water works, performed intermittently throughout the project, therefore the Frequency significance rating has been set to **Moderate**. Although the increase in TSS is expected to occur primarily the Project Location (within the AETC) some will undoubtedly filter through the AETC or escape beyond the Project Location, accordingly, the geographic extent rating is **Moderate**. Based on the discussion to occur with the regulatory agencies on the applicability of working within the timing that has yet to be allowed the timing ranking has been set to **Low**. Additionally, the significance rating for Duration has also been set to **Low** as the increased TSS and subsequent potential for cyanobacteria blooms would be limited to the pre-operation phases of this project; Upon bridge completion, increased TSS and cyanobacteria blooms, would be dependant on the similar factors as baseline conditions. Consequentially, due to the expectation for TSS levels to return to baseline following construction, this residual effect is considered **Reversible**.

Following the application of the residual effects significance criteria to this residual adverse effect an overall significance determination has been made and is largely based on proven mitigations, suitable monitoring, reversibility and timing the residual effect is expected to be **Not-Significant**.

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5.1.4.2 Disturbed Sediments May Cause Resuspension of Sediment Bound
Contaminants within the Water Column

Though contaminants within the water column may be limited to cadmium and silver, a number of parameters within the sediment were found to be in exceedance of regulatory guidelines. Though they are currently bound to the sediment, disturbance would allow for the resuspension of sediment bound contaminants to the water column, potentially in their available form for plants and animals. These potential effects are mitigated almost exactly the same as the TSS noted above as a result of the contaminants being bounded to the TSS prior to release. Elevated heavy metal concentrations within the water column can result in deformities, impairment of critical life processes, illness and mortality. Additionally, elevated nutrient levels such as phosphorous can lead to algal blooms (see Section 5.1.4.1 for more information). Due to the history of sediment quality in the area, the Ecological Significance is rated as **Moderate**, as baseline levels were not representative of pristine conditions.

Due to the overlap between residual effects for this VC, rationale for the remaining significance ratings can be found in Section 5.1.4.1 and are as follows:

- Magnitude: **Moderate**
- Geographic Extent: **Moderate**
- Duration: **Low**
- Timing: **Low**
- Frequency: **Moderate**
- Irreversibility: **Irreversible.**

Following the application of the residual effects significance criteria to this residual adverse effect, an overall significance determination has been made and is largely based on the construction methods, proven mitigations, robust monitoring and relatively low duration, no significant timing concerns and the mixing factors that would occur if trace amounts were to be released the residual effect is **Not-Significant**.

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5.1.4.3 Increases in The Volume of Stormwater into the Cataraqui River during Operations

Though many design characteristics and mitigation measures are in place to prevent high volumes of stormwater from entering the river, it is not possible to fully mitigate due to the addition of bridge and associated infrastructure creating impermeable flat surfaces that increase runoff. Stormwater may contain various contaminants such as:

- Heavy metals and other metals from construction equipment.
- Road contaminants (i.e. petroleum hydrocarbons, road salts).
- Nutrients (i.e. fertilizers, pesticides).
- Bacteria from human and animal waste.

A stormwater pond is planned to be constructed on site to receive the majority of stormwater. The pond will provide the opportunity for sediments and non-soluble contaminants to settle to the bottom before waters are released back into the Cataraqui River. Impaired surface water quality due to contaminants from surface water can lead to many long term and short terms effects on the ecological community within the Study Area such as reduced water clarity , while elevated heavy metal concentrations within the water column can result in deformities, impairment of critical life processes, illness and mortality.

Stormwater management is an ongoing, regulated event for all cities, with set criteria, guidelines and best practices that this particular stormwater pond has been designed for (Appendix Q) as such the Ecological Significance is rated as **Low**. Despite the use of a stormwater pond, some soluble contaminants like salt are released back into the river therefore Magnitude significance is set to **Moderate**. Unlike the above residual effects that would take place only during in-water works, the release of stormwater into the Cataraqui River will be constant throughout operations, therefore the significance rating for Duration as well as Frequency is set as **High**. The stormwater pond will be sized appropriately and would not expected to be continuously releasing waters accordingly, the significance rating for Timing is set as **Low**.

Combining the discharge criteria with the relatively low volumes of water within the Cataraqui River the geographical extend is also expected to the **Low** as the mixing zone would not extend far. It is likely some form of the

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stormwater management will be required of the life of the bridge accordingly the effect is **Irreversible**.

Following the application of the residual effects significance criteria to this residual adverse effect, an overall significance determination of **Not-Significant**, has been made, based relatively small collection area, the general regulations surrounding storm water management, the design of the pond and the minimal ecological impacts it may have on the Cataraqui River.

5.1.5 Aquatic Wildlife and Vegetation

5.1.5.1 Herpetofauna

Within the Study Area, many aquatic herpetofauna have the potential to occur. The Project has been shown to have several residual effects to the herpetofauna community in terms of habitat loss, habitat fragmentation and impacts to life processes such as foraging and breeding. Aquatic breeders with high probability to exist within the Study Area are likely not affected by the footprint of the causeway as they prefer areas with no or low abundance fish, indicating that upstream and downstream habitat is likely more suitable. Aquatic residents (American Bullfrog and Green Frog) that utilize the area for general habitat and foraging likely use the aquatic areas closer to shore where vegetation is thicker and more prevalent. Both mudpuppy and Northern Watersnake would also utilize the area in the footprint of the bridge/causeway. While mitigation measures described in Section 4 are expected to reduce many of the impacts to herpetofauna species, some residual effects remain, these remaining residual impacts do not take into account any water quality effects previously evaluated.

- Loss of general and foraging habitat during construction.
- Permanent loss of habitat during operation.

The following sections will assess the significance of the residual effects to the herpetofauna. Greater detail of the residual effects concerning SAR will be discussed in sections below, therefore this section will focus on the general habitat loss of non-SAR species.

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5.1.5.1.1 Loss of General and Foraging Habitat during Construction

Construction activities (i.e. the installation of the causeway, bridge construction, site preparation) are expected to cause a residual effect primarily for the aquatic species noted above that may utilize the area. Though mitigation measures have been put in place (discussed in Section 4) the Project will still result in an overall loss of general and foraging habitat as result of the causeway and the AETC. As many of the species discussed may be likely reliant on the aquatic areas of the Study Area, much lesser so of Project Location, the significance rating for Ecological and Social Context is set to **Low**. The construction activities may result in movement away from the Project location, however there is abundant retreat/foraging habitat available within the Study Area (i.e. Upstream and downstream shoreline habitats), with ample passage areas designed into the causeway (five (5) openings in addition to the main opening) Due to the minimal effect the movement/relocation, the Magnitude significance rating is set as **Low**. This impact is expected to be isolated to the Project Location therefore the rating for Geographic Extent is also **Low**.

The timing rating is thought to be **Low**, the rating for Frequency is also **Low**. These effects are only expected to occur during construction therefore the rating for Duration is also **Low**. Additionally, the loss of general and foraging habitat loss during construction is considered **Reversible**, upon rehabilitation of the causeway footprint to be confirmed by monitoring as outlined in Section 8.

Following the application of the residual effects significance criteria the is thought to be **Not-Significant**, based on the relatively low value of habitat currently presence, the continued connectivity through the causeway, the amount of retained habitat, and reversibility of the effect.

5.1.5.1.2 Permanent Loss of Habitat During Operation.

Operation of the bridge is expected to cause a residual effect for the species noted above that utilize the area. Though mitigation measures have been put in place (discussed in Section 4) the Project will still result in an overall loss of general and foraging habitat as a result of the piers and abutments. As many of the species discussed may be reliant on the aquatic areas of the Study Area, lesser so the Project Location, the significance rating for Ecological and

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Social Context is set as **Low**. The effect is considered a permanent habitat lost of <0.004% of the total PSW habitat as a result the Magnitude significance is **Low**. The effects is only within the Project Location therefore the Geographic Extent is also **Low**.

The constructed bridge is a permanent structure predicted to last >100 years ratings for duration, frequency and timing are set as **High** and considered **Irreversible**. However, will be offset through the rehabilitation of the Music Marina that will result in a net gain in wetland habitat as well the fisheries offset that will also increase wetted areas. Based on this the and the above significance criteria to this residual adverse effect is **Not-Significant**.

5.1.5.2 Benthic Invertebrates

Study Area benthic invertebrates existing conditions were predicted in Section 2 based on regional and historical surveys. Regional studies showed the Project Location likely posses little species diversity likely dominated by 2-4 species. This is typical of many wetlands as benthic invertebrate diversity tends to increase in areas of coarser substrate and some type of water movement.

The Project is expected to result in several effects to the benthic community due to sediment disturbances, as well as alteration and loss of habitat. While mitigation measures described in Section 4, impart with the construction methodology are expected to reduce many of the impacts to the benthic community, several residual effects remain:

- Loss of the benthic invertebrate community currently present within the causeways footprint during construction.
- Shift in benthic community within the causeway footprints immediately after removal.
- Loss of Habitat from Permanent Project Components During Operation.

The following sections will assess the significance of the residual effects to the benthic community noted above.

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5.1.5.2.1 Loss of the Benthic Invertebrate Community Currently Present Within the Causeways Footprint During Construction

Construction activities (i.e. the installation of the causeway) are expected to cause a residual effect to the benthic invertebrate utilizing the area. As previous studies have documented the low diversity in the area, the significance rating for Ecological and Social Context is **Low**. As the loss of habitat in the footprint of the causeway is only a small fraction of the benthic habitat within the Study Area, the Magnitude significance rating is **Low**. Furthermore, the significance rating for geographic extent is **Low**, given that the loss of habitat will be limited to the Project Location. Benthic Invertebrates are either permanent or life cycle dependant residents of the Project Location therefor the Timing is set as **High**. As the habitat loss created by construction activities is a single occurrence, and it will not happen again in the future, significance rating for Frequency is set as **Low**. As the construction activities will only take place in the duration of the pre-operation phase and the species are likely to recolonize much of the area following stoppage, the significance rating for Duration is **Low**. The loss of the benthic invertebrate community during construction is considered **Irreversible**, based on the inability to recover the lost individual, that being known benthic invertebrates populations are known to fluctuate significantly depending on environmental factors. That stated and knowing the previously stated minimal percentage of wetland habitat being effect in relation to the remaining this effect is **Not-Significant**.

5.1.5.2.2 Shift in Benthic Community Within the Causeway Footprints Immediately After Removal

For a period of time following construction activity, the benthic community composition is expected to be altered due to a change in substrate size (i.e. granular B) from the existing fine sediments. Within the causeway footprint, the granular material will not only attract native invertebrates but also promote initial colonization of invasive Zebra and Quagga mussels. As the fine unconsolidated substrates infill the 100mm void, the benthic invertebrate relative abundance within the Project Footprint is expected to transition back to pre-construction conditions, therefore the significance rating for both Magnitude and Ecological and Social Context is **Low**. As the area within the causeway footprint is the only expected area to experience a change in

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substrate immediately following construction, the significance rating for Geographic Extent is also **Low**. Currently the infill is predicted to occur over the first few years with wetland reestablishment goals of six (6) years post construction (Section 8), given this variability and uncertainties the timing, duration and frequency are all expected to be **Moderate**. This effect is specifically referring to a slight (non measurable) overall change in the existing wetland benthic invertebrate community, with eventual change back to pre-construction levels the effect is considered **Reversible**. Accordingly, the overall determination is that this residual adverse effect is **Not-Significant**.

5.1.5.2.3 Loss of Habitat from Permanent Project Components During Operation

Operation of the bridge is expected to cause a residual habitat loss. This loss can be evaluated similar to the loss of non-SAR herpetofauna habitat (Section 5.1.5.1.2).

Following the application of the residual effects significance criteria to this residual adverse effect is **Not-Significant**, given the abundance of habitat surrounding the Project Location, the minimal percentage of habitat effected (178 m² of river to be occupied resulting in the loss of low value habitat or <0.004% of the PSW area), the net increase in wetland habitat as a result of the Music Marina decommissioning and the net increase in wetted area from the fisheries offset work.

5.1.5.3 Aquatic Vegetation

Within the Cataraqui River and Greater Cataraqui Marsh PSW there is an abundance of aquatic vegetation, primarily dominated by *Valisneria americana*, *Potamogeton crispus*, *Elodea canadensis*, and *Myriophyllum spicatum*. The wetland itself is was documented 100% capacity for vegetation, in many area as documented by Bowfin (2011) and observed onsite in 2019.

Both construction activities and operation will result in residual effects regarding aquatic vegetation within the Project Location. While mitigation measures and design considerations described in Section 4 are expected to reduce many of the impacts , several residual effects remain:

- Loss of submergent and shoreline vegetation during construction.

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- Alteration of vegetation density and composition following construction completion.
- Loss of vegetation associated with the permanent Project components during operation.

The following sections will assess the significance of the residual effects to the aquatic vegetation noted above.

5.1.5.3.1 Loss of Submergent And Shoreline Vegetation During Construction

The Project Location is currently dominated by four submergent macrophyte species known for their ability to withstand construction effects. Due to the Project Location being heavily dominated by these four, tolerant species, the significance rating for Ecological and Social Context is **Low**. Due to the sheer abundance of vegetation found within the wetland (100% capacity) the significance rating for Magnitude has been set to **Moderate** to account for the density within the area that will experience loss. Conversely the removal vegetation will be restricted to the construction footprints and associated lands, leading to a significance rating for Geographical Extent of **Low**.

Construction activities that include aquatic vegetation removal are scheduled to occur in the fall months, when vegetation is naturally reducing within the Cataraqui River. As peak season for both aquatic vegetation growth and reproduction are anticipated to be avoided, the significance rating for Timing has been set to **Low**. The loss of aquatic vegetation in these areas is due to the causeway and therefore will persist through construction (up to 37 months) therefore significance rating for Duration is **Moderate**. The act of removing the aquatic vegetation is expected to only occur once, prior to construction of the causeway, therefore the Frequency significance rating has been set to **Low**.

Overall, this residual effect is considered **Reversible**, given the construction footprint will be restored, leaving only a small percentage of the wetland community occupied by the bridge itself further assessed below.

Following the application of the residual effects significance criteria to this residual adverse effect, the overall determination is that this residual adverse effect is **Not-Significant**, based on the similar logic of many effects above, being the small percentage of vegetation effected, the gained vegetation

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within Music Marina in combination with the monitoring plan outlined in Section 8.

5.1.5.3.2 Alteration of Vegetation Density and Composition Following Construction

Upon construction completion and causeway removal the causeway footprint is expected to be void of aquatic vegetation with the exception of the five eco passages and the main causeway opening. Over the proceeding years this area is expected to recolonize, commencing at the peripheries and eco passage locations progressing inward. As previously described the causeway removal method will excavate to a depth 100 mm below to allow for sediment to accumulate to a degree near post construction densities. Nonetheless the vegetation density and composition will likely be altered to some degree.

As previously described the Project Location is currently dominated by four submergent macrophyte species known for their ability to withstand construction effects. Post construction these same four species are expected to persist and re-colonize the causeway footprint. However, with the new substrate environment it is reasonable to assume some form of competitive advantage could be gained by or more the regionally present species. However, it is not anticipated to change to a degree where the form (wetland) or function (various habitats) would change therefore the significance rating for Ecological and Social Context remains **Low**. As described in Section 8 when monitoring shows a return of the densities to approximately 70% coverage the effects would be expected to be negligible therefore the Magnitude is considered **Moderate** (30% change). This is only to occur within the Project Location as such the Geographical Extent is **Low**. As shown in Section 8 the predicted infill and subsequent vegetation re-colonization is expected to occur within six (6) years post construction. Given this time lapse which is based on monitoring and the adaptive management within the monitoring plan, ratings for Timing, Duration and Frequency is **High**. Based on the monitoring requirements and the associated the legislation ensuring the triggers and contingencies would be implemented in the event vegetation does not recover to the predicted levels this effect is considered **Reversible**.

Following the application of the residual effects significance criteria to this residual adverse effect, a **Not-Significant** determination has been made. This is largely based on reversibility, ecological context and the legislative

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requirements to return the vegetation community. Furthermore, this takes into considerations the plant species documented to withstand construction activities and recolonize a variety of habitats.

5.1.5.3.3 Loss of Vegetation Associated with The Permanent Project Components During Operation

Operation of the bridge is expected to cause a residual vegetation loss. This loss can be evaluated similar to the loss of non-SAR herpetofauna habitat as this vegetation represents that the habitat being lost. (Section 5.1.5.1.2).

Following the application of the residual effects significance criteria to this residual adverse effect is **Not-Significant**, given the abundance of habitat surrounding the Project Location, the minimal percentage of habitat effected, the net increase in wetland habitat as a result of the Music Marina decommissioning and the net increase in wetted area from the fisheries offset work.

5.1.6 Species at Risk Fish (American Eel)

One SAR fish, the American Eel, is known to inhabit the Study Area. As documented within Section 2.2.2.4, the America Eel likely utilizes the Study Area as a migration route between the upstream Cataraqui Watershed and the Saragossa Sea (Atlantic Ocean), as well as for general adult and juvenile foraging habitat. Potential effects to and appropriate mitigation measures for protecting the American Eel are similar to those posed for general finned fish species as described in Section 5.1.2. Of particular importance to the American Eel is the ability to pass through the Project Footprint and overall Study Area during migration. As documented within Table 2.4, peak migratory periods for the American Eel typically fall within July-September in the fall and June-August. The Project has been designed to facilitate safe passage for all fish and aquatic species through the Project Footprint. During construction this will be accomplished through the maintenance of five (5) passages through the causeway/AETC in addition to the 220 m opening between the western and eastern causeways. A swimming speed comparison of the American eel during a worst-case flow scenario (50-year event) show passage is possible through the 220 m and all 5 passages during any flow event, resulting in no effect to eel migration as a result of construction or operation.

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As previously discussed, the American Eel is federally evaluated as a Threatened species by the COSEWIC, and provincially evaluated as Endangered under the Endangered Species Act. The American Eel is also known to be an important species in regard to Indigenous cultures. Accordingly, the potential residual impacts on American Eel have been evaluated as having **High** ecological and social importance. Although considered important the number of the American Eel within Project Location more so the effected areas of the Project Location are expected to be low and with proper mitigation/construction methods detrimental effects are considered unlikely as such the Magnitude is **Low**. Conversely given it's rarity any effects to American Eels (especially migrating adults) regardless of the location have the potential to extend beyond the regional area. Accordingly, Geographic extent of the potential residual effect is **High** as well. With proper mitigations described in Section 4 the potential for effects is minimal. The overall effect of the Project is expected to be limited to the dispersal of any individuals (low population) located within the Project Footprint into the adjacent suitable areas. Only if an individual avoids the mitigation measures proposed to disperse or remove the fish from the area, will a negatively residual effect take place, as fish passage is expected to be maintained through the area. The risk of this effect present during the installation of the causeway and other in-water project components. The installation of the AETC is expected to reduce this effect, furthermore the pushing of the causeway material into the water rather than end dumping as described in Appendix B should allow any Eel to avoid the danger areas. Accordingly, the residual effect to American Eels are expected to be **Low** for frequency and duration. As previously described the sensitive timing is in relation to spring and fall migration periods knowing migration routes will be maintained, timing this is also thought be posses a **Low** potential. The risk of residual effects will be **Reversed** upon the excavation of the causeways and completion of pre-operation phases. Overall, the risk of residual effects to American Eels was determined to be **Not Significant** for construction activities. Similar to all fish within the Study Area the permanent bridge will represent a loss in fish habitat inclusive of American Eel, accordingly this significance determination is identical to Section 5.1.2.4.

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5.1.7 Species at Risk Bats

Little Brown Myotis, Northern Myotis and Tri-colored Bat were identified to potentially be present within the Study Area, with Little Brown and Northern Myotis confirmed during acoustic monitoring surveys. Maternity roost habitats of the Little Brown Myotis and the Northern Myotis are described as live and dead trees with suitable attributes as well as buildings with access; the Tri-colored Bat prefers foliage in clumps of old leaves (primarily oak) and squirrel nests.

In order to mitigate again potential effects caused by the removal of identified snag trees General Mitigation Measures (Sections 4.1.1.1, 4.1.1.4 and 4.1.1.5) and Specific Mitigation Measures (Section 4.2.3), one residual effect will remain. This residual effect includes the loss of maternal roosting habitat; the significance of this residual effect is discussed below.

It was noted during ELC surveys of the woodland (FOD 5-8) located on the east approach north of Gore Road, would be effected via tree clearing and fragmentation. In total the Project is expected to clear 1.93 ha of the woodland and impact (clear or fragment) 2.15 ha.

Maternal Roost habitat (snags) density plots were conducted in conjunction with the arborist survey to inventory trees in the relevant portion of the Study Area associated within the Project Location. In total 1.93 ha of the 6.58 ha will require clearing resulting in an estimated total loss of 108 snags or 29% of the ELC woodland polygon, with 71% or 260 snags retained. From a habitat usage standpoint, it is anticipated 4.43 ha of the woodland or 248 snags will remain functioning bat roosting habitat while 2.15 ha or 120 snags will either be cleared or fragmented to a degree where usage is diminished. When expanded to include the entire “significant Woodland” along the east shore, shown to be continuous within the City’s Official Plan the effected area represents approximately 3% of the overall woodland. This effect is further reduced when taking into account the urban maternal roosting usage the two confirmed species (Little Brown and Northern Myotis) are known to utilize.

Based on the above the residual adverse effect is **High** in terms of it’s ecological context. In terms of the magnitude of this effect, the amount of maternal roosting habitat lost represents approximately 29% of the individual woodland compartment or 3% of the total woodlands and accordingly, the

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magnitude is considered to be **Moderate**. The geographic extent of this residual effect is considered **Low**, given tree clearing is limited to the Project Location.

Construction methodology, Project design and other mitigation measures will serve to reduce the potential for adverse effects on bat individuals by clearing any trees with suitable roosting characteristics outside the roosting period. Furthermore, bat boxes will be erected on site and throughout the city of Kingston to replace any lost habitat, these will be erected prior to the next subsequent breeding season. Accordingly, with respect to timing, the level of adverse effect of the clearing is considered to be **Low**.

With respect to frequency and duration of this residual effect, the loss the woodland portion is to occur during the construction phased dictating a level of residual effect of **Low**, for both frequency and duration. Overall, this residual effect is **Irreversible** as the cleared areas will become part of the permanent bridge components, however landscape plans are incorporating suitable roosting tree species wherever possible to reduce long-term effect. Based on the above and discussions with the MNRF the potential effect to SAR Bats was found to be **Not Significant**, with effects further lowered through the cities commitment to bat boxes.

5.1.8 Species at Risk Birds

5.1.8.1 Nightjars (Common Nighthawk)

5.1.8.1.1 Alteration of Behaviour as a Result of Increased Artificial Light

As presented in Section 4, the residual effects to Nightjars and nightjar habitat due to increased artificial light primarily includes behavioural alterations (feeding and migratory; reduction in foraging success; predation events; reproduction and stress response).

As presented in Sections 2 and 3, Common nighthawks are listed as special concern within the Province and threatened within Canada accordingly, the ecological context is **High** as there is a potential for Common Nighthawk to use the Project Location. Alterations to behaviour or habitat use as a result of light is not expected to be outside the individuals using the areas as they are likely already using urban environments, furthermore any alterations will be limited to Project Location as such the magnitude and geographic extent are

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Low. As safety requirements will require the structure and vehicles to be lit constantly throughout the operations phase, the timing, frequency and duration of the effect of artificial light will be **High**. Once the operations phase begins, the use of the bridge requiring artificial lighting will be **Irreversible** as a major infrastructure component to the City of Kingston's transportation system. When considering the residual effects criteria and the level of effect, alteration of behaviour as a result of increased artificial light during operations on Common Nighthawk is expected to be **Not Significant**.

5.1.8.1.2 Effects to Birds and Bird Habitat as A Result of Noise and Vibration Emissions During Construction

As presented in Section 4, the residual effects to birds and bird habitat from noise and vibration emissions during construction includes possible auditory impairment and masking resulting in behavioural disturbance. This residual effect will have a similar impact on SAR Nightjars and is discussed below.

Similar to Section 5.1.3.1, ecological context is **High** as the Study Area potentially hosts SAR Common Nighthawk. As noise/vibration will result in excess noise, potential causing auditory masking and behavioural disturbance up to 1200 m away (over open water) from the source during the non breeding season and approximately 450 m (over open water) during the mitigated breeding bird season, the noise masking magnitude is **Moderate**, along with the timing. During the sensitive breeding season, the geographic extent will be **Moderate** as the effect will only extend approximately 450 m over water and considerably less along the shorelines (Figure 4.3). The frequency is **Moderate** as the effect is expected to occur intermittently throughout construction. The duration is **Low** as the effect is limited to pre-operation phases as the noise is expected to be generated from pile-driving construction activities. Once construction is complete and the bridge enters the operations phase, noise/vibration levels will be reduced considerably and be more representative of the surrounding urban landscape and is therefore consider **Reversible** for on land portions and **Irreversible** in the quieter open water areas. When considering the residual effects criteria and the level of effect, noise and vibration disturbance to the Common Nighthawks will remain in the localized area during construction, are expected to be reduced through an adaptive monitoring/mitigation strategy, assuming these can reduce levels

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to the degree expected and shown in Figure 4.3 effects by noise on Common Nighthawk are expected to be **Not Significant**.

5.1.8.2 Woodland Birds

Effects to birds and bird habitat as a result of noise and vibration emissions as presented in Section 4, the residual effects to birds and bird habitat from noise and vibration emissions during construction includes possible auditory masking resulting in behavioural disturbance. This residual effect will have a similar impact on SAR Woodland Birds and is discussed below.

Similar to the Nighthawk section above the ecological context is **High** as the Study Area potentially hosts SAR Woodland Birds. As noise/vibration will result in excess noise, potential causing auditory masking and behavioural disturbance up to 1200 m away (over open water) from the source during the non breeding season and approximately 450 m (over open water) during the mitigated breeding bird season, the noise masking magnitude is **Moderate**. During the sensitive breeding season, the geographic extent will be **Low** as the effect is not expected to extend into the woodlands (to be confirmed through monitoring) (Figure 4.3). The frequency is **Moderate** as the effect is expected to occur intermittently throughout construction. The duration is **Low** as the effect is limited to pre-operation phases as the noise is expected to be generated from pile-driving construction activities. Once construction is complete and the bridge enters the operations phase, noise/vibration levels will be reduced considerably and be more representative of the surrounding urban landscape and is therefor consider **Reversible** for the woodland species. When considering the residual effects criteria and the level of effect, noise and vibration disturbance to woodland bird SAR will remain in the localized area during construction, are expected to be reduced through an adaptive monitoring / mitigation strategy, assuming these can reduce levels to the degree expected and shown in Figure 4.3 effects by noise on woodland bird SAR are expected to be **Not Significant**.

5.1.8.2.1 Potential for Vehicle or Machinery Strikes During Construction

The significance determination of Woodland SAR birds in relation to construction vehicle or machinery strikes and nest disturbance is identical to Section 5.1.3.2 with the exception of a change in the ecological and social context where all SAR are considered **High** in comparison to the general bird

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populations ranked as low. Nonetheless this is not expected to change the **Not Significant** determination as the mitigations are in place to reduce the potential to a negligible degree.

5.1.8.2.2 Permanent Loss Of 1.93 ha Of Woodland Habitat

As previously presented in Section 5.1.3.3 residual effects to birds and bird habitat includes the permanent loss of 1.93 ha of woodland. This residual effect will have a similar impact on woodland SAR Birds with the exception of ecological and social context where all SAR are considered **High** in comparison to the general bird populations ranked as low. Nonetheless this is not expected to change the **Not Significant** determination as the mitigations are in place to reduce the potential to a negligible degree. Furthermore, none of the SAR birds indicated are currently afforded habitat protection either on federal or provincial lands.

5.1.8.2.3 Alteration of Behaviour as a Result of Increased Artificial Light

As previously presented in Section 5.1.3.4 residual effects to birds and bird habitat includes the Alteration of behaviour as a result of increased artificial light. This residual effect will have a similar impact on woodland SAR Birds with the exception of ecological and social context where all SAR are considered **High** in comparison to the general bird populations ranked as low. Nonetheless this is not expected to change the **Not Significant** determination as presented within Section 2 ambient light within the Project Location exists currently, and as Presented in Sections 3 and 4 design have minimized lighting to the degree possible while following industry standards, all applicable lighting fixtures are to be shielded in a downward direction to minimize light trespass, within the adjacent environment.

5.1.8.3 Sensory Disturbance as a Result of Noise Emissions as a Result of Traffic and Maintenance During Operation

As previously presented in Section 5.1.3.5 residual effects to birds and bird habitat as a result of sensory disturbance as a result of noise emissions from operational traffic and maintenance are expected. These will have a similar effect on woodland SAR Birds with the exception of ecological and social context where all SAR are considered **High** in comparison to the general bird populations ranked as low. Nonetheless this is not expected to change the

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Not Significant determination, existing species usage of the woodland would be expected to be accustom and tolerant to urban usage given the urban environment. In reality most of the woodlands within the Study Area will currently and will continue to be influenced by other closer noise sources, then in the bridge (i.e. northern woodlands effected by the 401).

5.1.9 SAR Turtles

As described in Table 2.9, there are five SAR turtles (as per the SAR definition within this DIA) with potential to occur within the Study Area, they include:

- Blandings Turtle
- Eastern Musk Turtle
- Northern Map Turtle
- Midland Pained Turtle
- Snapping Turtle.

All of these species (with the exception of Blandings Turtles) have the potential to be affected by the Project as their habitat preferences match that which is present within the Project Location and have been documented throughout the Study Area. The habitat preferences of each species and an assessment of the likelihood of each species being impacted by the Project has been previously provided in Section 3.1.6.4.1. Mitigation to reduce the effects on SAR turtles has been designed into the Project. For instance, the causeway gap at the navigation channel that will remain un-impeded throughout construction to facilitate aquatic wildlife passage has been designed to match the width of the Cataraqui River between the eastern shoreline and Belle Island. Additionally, five approximately 2 m wide eco-passages will be maintained through the causeway/AETC cells, with effort placed to maintain existing vegetation and substrates within these passages to promote usage.

The AETC, in combination with on land exclusionary fencing will be the primary mitigation measure utilized to prevent effects to turtles. These will be combined with daily monitoring of the construction site, monitoring of the eco-passages, employee education and design considerations Despite mitigation,

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residual effects to turtles remain possible , and will be discussed in the following sections.

5.1.9.1.1 Potential for Vehicle or Machinery Strikes During Construction

Potential for vehicle or machinery strikes during construction is a common residual effect across many biotic VC's and is consistent among most construction projects in close proximity to wildlife. Exclusionary mitigations are expected to keep turtle out of the work area, however some large individuals may attempt to scale or pull down the, or others may find holes or access points. These occurrences should be negated through daily monitoring and dedicated environmental staff onsite. Furthermore, workers and vehicle operators will receive training, and the steps to take in event one is observed within the Project Location as per the OMNRF "Ontario Species at Risk Handling Manual". It is understood that all potential effects to SAR species hold **High** importance in both ecological and social contexts and despite the mitigation measures proposed, potential for residual effects from vehicle or machinery strikes to SAR turtles still exists, albeit at a **Low** magnitude due to the extensive mitigation provided. This residual effect is expected to only occur within the Project Location, therefore the geographical extent is **Low**. The AETC mitigation measures will be installed shortly before the expected turtle overwintering periods which will reduce the likelihood of passage obstruction while still providing adequate protection for species searching for safe overwintering locations. Accordingly, this residual effect is expected to be of **Low** timing sensitivity, frequency and duration. Depending on the severity of the strike the turtle may need transport and the care of professionals at the Ontario Turtle Trauma center the contingency measure will be part of the SAR EMP and could make those less severe strikes **Reversible**, conversely if the strike resulted in more serious injuries or death that would be considered **Irreversible**. The later is thought to be a low potential given the construction methods, monitoring, mitigations and plans in place, thus the effect is considered **Not Significant**.

5.1.9.1.2 Entrapment Within the Construction Area

Entrapment within the construction area is a lesser reduced residual effect and a precursor to the above described the vehicle strikes. Accordingly, it is significance determination is identical with the exception that all effect

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scenario's are **Reversible** by the onsite monitor removing the turtle from the construction area following MNRF handling guidelines, accordingly this is **Not Significant** effect.

5.1.9.1.3 Nest Excavation During Construction and Causeway Removal

Potential exists for SAR turtle nests to be excavated during construction earthworks and causeway removal. Causeway materials have been designed with less material suitable for turtle nests to reduce the likelihood of turtles utilizing the causeway for nesting purposes. Additionally, AETC, on land exclusionary measures, monitoring as well as adaptive monitoring in the form of covering suitable area potentially available to turtles should to reduce or eliminate SAR turtle access to these potential nesting areas. It is understood that all potential effects to SAR species hold **High** importance in both ecological and social contexts and the magnitude for SAR turtle nest would be equally **High**. Despite the mitigation measures proposed, potential for residual effects from to turtles from turtle nest excavation during construction and causeway removal, although due to the mitigation, the frequency and likelihood that SAR turtles are able to nest in these areas is expected to be **Low**. The residual effects to turtle nests will only occur within the Project Location as such the geographic extent is **Low**. With proper exclusionary and monitoring, sensitive timing windows would not apply as no turtles would have the opportunity to nest during the construction time frame, as such the frequencies, duration and timing are also considered **Low**. If turtle nesting is documented within the work area, the area will be protected until Hatch occurs if possible, otherwise the Ontario Turtle Trauma Center will be contacted to determine an appropriate course of action, which may include moving the eggs to their facility for incubation and hatching before being back and released within the wetland based on this the residual effects would be **Reversible** if detected in time, conversely if nesting occurs and it is not passively found, excavation with machinery may cause egg mortality which would be considered **Irreversible**. Overall, due to the mitigations, monitoring and contingency measures that will be put in place to reduce or eliminate the residual effect it is considered **Not Significant**.

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5.1.9.1.4 Crushing of Hibernating Individuals During Construction Activities

With causeway installation occurring within the winter months in close proximity to a presumed significant overwintering site (as documented in Section 3.1.6.4.1), potential for crushing of hibernating turtles has been raised as a potentially adverse effect of the Project. As discussed in Section 4 turtles have been excluded from the winter work area by the installation of the AETC and other on-land measures. The AETC was installed in seven discrete areas or “cells”, numbered from west to east (six cells are located west of the navigational channel with a single cell along the eastern shore), however construction has required a number of “field fits” or deviations from the original specifications. The IPD Team has been working with PCA and other relevant authorities to address the implications of these deviations, proposing additional actions to confirm the original intent of the design has been satisfied.

Appendix P contains a memo from Ecological Services, to comment on the potential for residual effect to turtles following the installation of the AETC, and subsequent causeway material placement. Based on the information provided by Ecological Services, the following determination has been reached in assessing the significance of residual adverse effects to turtles:

It is understood that all potential effects to SAR species hold **High** importance in both ecological and social context and the magnitude for effects to special concern SAR species would be considered **Moderate**. Effects are limited to the Project Location and accordingly the geographic extent is **Low**. Based on the mitigation measures that have been implemented and are further proposed, the frequency and duration of the activities are expected to be **Low**. Given the sensitive nature of overwintering, the timing of the effect has been determined to be **High**. Overall, the residual effect of potential hibernating turtles being crushed during construction is determined to be **Not Significant**, as supported by Ecological Services in Appendix P.

5.1.9.1.5 Effects to SAR Turtles from Construction Lighting

Despite the mitigation efforts discussed in Section 4 to reduce impacts from construction lighting, a residual effect will remain with the introduction of any new light source both on the causeway and other work areas and due to construction and vehicle lighting.

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Accordingly, the ecological and social context of the residual effect is **Moderate** as many turtles that have the potential to be impacted are special concern SAR. As the AETC provides a buffer between the work area/ causeway and the remainder of the River, the magnitude is **Low** as light will readily dissipate the further away from the causeway turtles are located. The geographic context will be **Moderate** as the effect of construction lighting will likely extend beyond the Project Location but will be limited to the immediate vicinity of the Project Location. As safety requirements will require construction lighting to be used when working in during the dark hours of the 16-hour work day throughout the length of construction, the duration of the effect of construction lighting will be **Low**. Construction is expected to occur throughout the overwintering period for turtles, however the exclusion zone will prevent turtles from being in the immediate vicinity of the causeway lighting. Additionally, as light is not expected to be a proximal cue for overwintering arousal (see Section 3 for details), the timing is considered **Low**. As construction lighting, would only be required for a limited number of hours throughout the day and the entire work area would not be expected to be lit simultaneously, the significance rating for frequency is considered **Low**. As construction lighting is temporary and will be removed once construction ceases in the work area is, the effect is considered **Reversible**. When considering the residual effects criteria and the level of effect, alteration of behaviour as a result of increased artificial light during construction is expected to be **Not Significant** provided lighting mitigation is followed.

5.1.9.1.6 Potential Reduction in Available Nesting Habitat During Construction

As documented within Section 3.1.6.4.1 the Cataraqui River is known to provide turtle nesting habit within open, sunny areas along the shorelines of the river. Based on this, it is possible that SAR turtle species may utilize either shoreline of the Project Location. During the construction phase of the Project, turtle exclusionary fencing will be installed to prevent SAR turtles from entering dangerous shoreline construction areas. Although necessary for the protection of the individuals, this can be seen as a reduction of potential nesting habitat for turtle species and must be considered as a residual effect. However, the shorelines of the Study Area south of the Project Location, as well as some areas north of the Project Location will remain suitable for nesting. It should be noted that the eastern Musk Turtle has unique nesting

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preferences to the other SAR turtles documented within the Study Area and prefers to nest in dead or decaying plant material and mud. Accordingly, as noted before the ecological and social rating if **High**, the loss of potential turtle nesting habitat as a result of the Project is expected to be of a **Low** geographical extent as the residual effect is limited to the eastern and western abutments of the Project Location, with a **Moderate** magnitude, as suitable nesting habitat will be lost, but additional suitable areas exist for nesting along the Cataraqui River and the Study Area. Similarly, the duration of the residual effect is expected to be **Moderate**, as it will persist throughout the full construction period. The timing and frequency of the effect are considered **High** as the restricted access for turtles will occur during several sensitive time periods in the turtles life cycles and will persist for more than one nesting period. Once construction is complete, areas of the western and eastern Project Location may once again become suitable for turtle nesting, and the exclusionary fencing will be decommissioned, therefore the residual effect is **Reversible**. Considering there is suitable nesting areas in close proximity to the Project and that nesting habitat is not expected to be a limiting factor (PCA personal communication), the overall turtle nesting potential in the Study Area are not likely to be impacted to a significant degree. Accordingly, the potential reduction of turtle nesting habitat during construction was determined to be **Not Significant**.

5.1.9.1.7 Potential Loss in Overwintering Habitat During Construction and Years Following

The Project Location is within the vicinity of a significant overwintering site for some turtle species as documented in Section 3.1.6.4.1. Potential exists for SAR turtle species to utilize the Project Location as overwintering habitat. During the construction phase of the Project, turtle exclusionary fencing will be installed to prevent SAR turtles from entering dangerous construction areas. Although necessary for the protection of the individuals, this can be seen as a reduction of potential overwintering habitat for turtle species and must be considered as a residual effect. However, the entirety of the Study Area found within the Greater Cataraqui Marsh has similar conditions to that of the area and will remain equally as suitable for overwintering activities. As before all SAR are considered ecologically and socially important are rated **High** accordingly. The loss of potential turtle overwintering habitat is expected

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to be limited to the Project Location therefore is a **Low** geographical extent with a **Moderate** magnitude, as suitable overwintering habitat will be lost, but additional suitable areas exist for nesting along the Cataraqui River and the Study Area. Similarly, the duration of the residual effect is expected to be **Moderate**, as it will persist throughout the full construction period. The timing and frequency of the effect are considered **High** as the restricted access for turtles will occur during a sensitive time period in the turtles life cycle and will persist for more than one overwintering period. Once construction is complete, areas within the Project Location are expected to become suitable for turtle overwintering. The speed of which the habitat will return is species dependent with non-burying, partial burying and full burying over winter species with the return of function occurring sooner progressing to later respectively as the 100mm infill occurs. This effect is expected to be **Reversible** for all non and partial burying species with some **Irreversibility** for the larger snapping turtles who may wish to fully bury. Considering there is an abundance of overwintering habitat in close proximity to the Project, overall overwintering areas the effect is expected to be reversed in most cases it was determined to be **Not Significant** residual effect, this is reliant on the infill of the 100 mm occurring which will be monitored during post construction as outlined in Section 8.

5.1.10 Other SAR

5.1.10.1 Monarch Butterfly

Monarch are known to occur within the Project Location; as stated in Section 3.1.6.4.4 Monarchs have a life cycle composed of four stages: egg, larvae (or caterpillar), pupa (or chrysalis), and adult. To successfully complete these four stages the Monarch has four habitat types: breeding, nectaring, staging and overwintering (ECCC, 2016a). The Project is expected to affect two of the four habitat types (breeding and nectaring) however, not to a measurable degree. Milkweed species are known to occur within the Project Location and would be considered a loss of breeding habitat whereas, any removal of natural flowers vegetation also would constitute a potential impact to nectaring habitat. Given the majority of vegetated habitat to be impacted is woodland, both breeding and nectaring habitat effects are minimal.

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In order to mitigate again potential effects caused by the removal of milkweed species, General Mitigation Measures (Sections 4.1.1.1, 4.1.1.4, 4.1.1.5, and 4.1.1.6) and Specific Mitigation Measures (Section 4.2.1, 4.2.3 and 4.2.5), two residual effects will remain. This residual effects include the potential for vehicle or machinery strikes during construction and reduced habitat availability. The significance of these residual effects is discussed below.

5.1.10.1.1 Potential for Vehicle or Machinery Strikes During Construction

Overall there is a potential for vehicle or machinery strikes during construction, similar to other SAR the ecological and social context remains **High** even though populations are tolerant to mortality, such as those associated with strikes. The magnitude of potential strikes is considered **Low** as incidental takes are expected to be nominally above baseline conditions. As construction activities will be confined to the Project Location, the effect of geographic extent would be **Low** as it would be limits to the Project Location.

As a result of construction, the effects of both timing and frequency would be considered **High**; timing would be considered throughout construction extending for more than one full year as loss of habitat would require new regrowth before individuals could occupy the area. Conversely the duration effect would be **Low** as it is confined to the pre-construction phase where clearing is occurring. Finally, this residual effect would be considered **Irreversible** as incidental take of wildlife still cannot be undone. Although the strikes during construction are considered a high probability and are irreversible the loss to the regional population wouldn't expect to be significant when compared to the other effects. The Study Area is not a known staging area and therefore would be not be overly susceptible to large mortalities beyond those normally seen in Urban areas, for these reason it effect is **Not Significant**.

5.1.10.1.2 Reduced Habitat Availability

As stated in Section 5.1.10.1 there are recent records of Monarchs within the study area; the ecological and social context is considered **High** as there is also suitable habitat present within the Study Area. The magnitude of the disturbance is considered **Moderate** as it will remove habitat currently available albeit in relatively low abundance with relatively abundant retreat/alternate habitat available within the Study Area; as this is the case,

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the geographic extent will be **Low** as the effects will only be limited to the Project Location.

As habitat removal will affect the two life cycle stages moving forward timing is considered to be **High**. Frequency of the effect will be **High** as it will occur throughout both construction and for the duration of operation; duration will also be considered **High** as it continues throughout operations. Finally, the residual effect is considered **Irreversible** as the project is expected to persist for >100 years. However, milkweed commonly grows on previously disturbed sites and native vegetation will be managed for post construction, meaning this could lead to an increase in habitat as a result of increased disturbed sites in comparison to the previous predominantly woodland (not suitable) habitat. In general terms the exact end result of habitat availability pre and post project is unknown, however the effected habitat is nominal and not expected to be a scale that may effect Monarch butterflies to any measure degree, as such the residual effect is considered **Not Significant**.

5.1.11 Archaeological and Cultural Heritage Resources

5.1.11.1 80 Gore Road Property

The property at 80 Gore Road, immediately north of the Project Footprint includes important archaeological and cultural heritage resources such as the Pittsburgh Branch of the Kingston Frontenac Public Library, Hawthorn Cottage, and a Dry-Stone Wall feature that extends into the Gore Road right-of-way. These resources constitute important historical and cultural value, and the property is protected under part VI of the Ontario Heritage Act. A detailed Cultural Heritage and Protection Plan has been developed for the Project and is included as Appendix E.

After assessing the potentially adverse effects as discussed in Section 3.1.8.1 and in Appendix E, a series of mitigation measures have been developed and detailed in Section 4.2.7. Despite these mitigation strategies, it has been determined that there remains a risk of residual adverse effects to the 80 Gore Road property. These three include:

- Use of the library and library property as a library, community centre and event facility may be constrained or disturbed by noise and construction activities.

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- Vibration from construction could damage Hawthorn Cottage and the Dry-Stone Wall on the property.
- Use of the library and library property could be constrained or disturbed by bridge traffic during operation.

The significance of these residual effects has been evaluated based on the criteria identified in Table 5.1, and the result of the evaluation for each residual effect is discussed in separate sections, below.

5.1.11.1.1 Use of The Library and Library Property as a Library, Community Centre and Event Facility May Be Constrained or Disturbed by Noise and Construction Activities

The function of the 80 Gore Road property as an important site for community gatherings and social events is threatened by the pre-operation phases of the Project due to elevated noise levels and other disturbances resulting from construction activities. The level of ecological and social residual effect is therefore considered **high** as features on the property such as Hawthorn Cottage and the Dry-Stone Wall are identified as cultural heritage resources, and the entire property is protected under Part IV of the Ontario Heritage Act.

Numerous mitigation measures have been developed to reduce the magnitude of adverse effects on the 80 Gore Road property during pre-operation phases, such as designing the bridge as far south from the property as possible to reduce the impact of construction activities on activities taking place on the property. Furthermore, mitigation measures have been proposed by a licensed archaeologist to protect cultural heritage resources at this location from sustaining damages during construction. While the potential for disturbance is acknowledged, the magnitude of the residual adverse effect has been determined to be **low** following the implementation of the mitigation measures outlined in Section 4.2.7.1. While residual adverse effects will likely extend beyond the Project Footprint into the surrounding property, it is unlikely to have any effect beyond the immediate vicinity of construction activities within the Project Footprint, and this effect is therefore considered **moderate** in terms of geographic extent.

The effect of anticipated disruption of community activities and use of cultural resources at 80 Gore Road is considered to be **high** in terms of timing,

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frequency, and duration. This is because these disruptions will be constant throughout the duration of construction activities on the eastern shore of the Project Area. Furthermore, the effects of construction on library use and other community activities will occur continuously, and during the operational hours of these cultural resources. Despite the continuous nature of this effect, it is important to note that noise disturbances and other pre-operation effects of the Project will desist entirely once construction is complete, thus rendering this effect entirely temporary and **reversible**.

As a result of strong mitigation strategies and the temporary nature of disruption caused by construction activities, this effect is **not significant**. The community use of the property at 80 Gore Road will be temporarily impacted beyond baseline conditions by construction activities, but the effects of these pre-operational activities will cease once the source emissions are discontinued with the completion of construction.

5.1.11.1.2 Vibration from Construction Activity Could Damage Hawthorn Cottage and the Dry-Stone Wall on the Property

Within the 80 Gore Road property, historic Hawthorn Cottage and the traditional Dry-Stone Wall landmarks are distinct cultural heritage resources and contribute meaningfully to the property's historical and community significance. While mitigation measures have been developed to reduce the likelihood for bridge construction activities to cause damage to historical infrastructure, the potential for damage to Hawthorn Cottage and the Dry-Stone Wall cannot be fully eliminated. While both features fall outside of the Project footprint, it is possible that vibration from bridge construction could cause damage to these structures. This residual adverse effect is therefore considered to be **high** in terms of ecological and social context.

Numerous mitigation strategies have been developed to reduce the likelihood of damage to Hawthorn Cottage and the Dry-Stone Wall. As discussed in Section 4.2.7.1, a minimal intervention approach has been adopted to reduce the likelihood of this residual adverse effect occurring. The pre-construction condition of both the Dry-Stone Wall and Hawthorn Cottage will be assessed and documented by a heritage stonemason or other professional so that any damage resultant from construction activities may be immediately identified and repaired, and further damage can be discontinued. Such mitigation

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strategies have been proposed by a licensed archaeologist, and the magnitude of this potential residual adverse effect is therefore considered **low**. The geographic extent of this effect is considered **moderate** as the impacts of vibration from construction activity extends outside of the Project footprint, but not beyond the immediate vicinity of the Project Location. While techniques for preliminary evaluation and continued monitoring of the structures at 80 Gore Road have been developed, it is important to note that significant damage resulting from vibration caused by construction activities would be **irreversible**.

Any potential adverse effects to the Hawthorn Cottage or Dry-Stone Wall structures resulting from vibration caused by bridge construction are not time-sensitive, as these structures are equally vulnerable year-round. Preliminary evaluation and documentation of the state of these structures will occur prior to any bridge construction activity regardless, and the level of adverse residual effect is considered **low** with respect to timing. Likewise, the potential for damage to these historical structures will be infrequent and will occur only during the pre-operation phases of the Project; therefore, the level of adverse residual effect is considered **low** in terms of both frequency and duration.

Primarily due to the low magnitude of potential disturbance, this residual adverse effect is **not significant**. The design of the bridge approach along Gore Road has been created to reduce the likelihood of this effect occurring as much as possible, and to quickly identify any damage that does occur. Furthermore, methods for preliminary evaluation, continued monitoring, and restoration activities for Hawthorn Cottage and the Dry-Stone Wall have been proposed by a licensed archaeologist to ensure the integrity of these structures is maintained.

5.1.11.1.3 Use of The Library and Library Property as a Library, Community Centre and Event Facility May Be Constrained or Disturbed by Bridge Traffic During Operation

The southern boundary of the 80 Gore Road property is coincident with the Project Footprint and will inevitably be impacted by bridge operation. The widening of Gore Road along this southern boundary will infringe slightly into the existing library property, increasing the proximity of the road to the library. Furthermore, the bridge structure will increase traffic past the library property

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along Gore Road. Both factors will contribute to increased noise at the library and surrounding library property during bridge operation and will have the potential to adversely effect the use and enjoyment of these cultural resources by the community. Due to the significance of the 80 Gore Road property as a cultural heritage resource, the ecological and social context of this effect is considered **high**.

While there will be increased traffic along Gore Road to the south of the property, mitigation measures have been developed to reduce the impact of this eventuality. The bridge approaches and Gore Road itself have been designed to remain as far from the property as possible, in order to minimize the increase in proximity between road traffic and the library. It is important to note that Highway 15, which runs along the eastern boundary of the 80 Gore Road property, will remain the closest road to the library in terms of proximity. Therefore, noise from traffic along Gore Road can be reasonably expected to remain lower than the already existing traffic noise caused by Highway 15, and operational noise mitigation strategies such as the installation of a vegetation screen have been developed and detailed in Section 4.2.7.1. Due to the noise and traffic increase along Gore Road likely resulting in similar or less severe conditions than those already existing conditions along Highway 15, the magnitude of this residual effect is **low**.

Similar to the other residual effects at the 80 Gore Road property, the impacts of this residual effect will extend beyond the Project footprint but will be limited to the immediate vicinity of the Project Location and are therefore considered **moderate** in terms of geographic extent. The changes in noise and traffic along Gore Road as a result of the Project will continue consistently for the duration of bridge operation, and as such the timing, frequency, and duration of this residual effect are all considered to be of a **high** level. The changes to traffic and noise level will be **irreversible** upon completion of the Project.

Given the mitigation measures developed to reduce the impact of bridge construction and operation on the function of the 80 Gore Road property library and community centre, this residual effect is considered **not significant**. The widening of Gore Road and increase in traffic resultant from bridge construction are not anticipated to significantly alter the existing noise and traffic conditions near the property that already exist from the operation of Highway 15.

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5.1.11.2 Archaeological Site BbGc-127

Archaeological Site BbGc-127 is located along the eastern shore of the Cataraqui River on the 80 Gore Road property within the Project Location. Archaeological materials were recovered from this site during Stage 2 and Stage 3 testing of the east side of the Project Location which identified this location as the site of a small dwelling area dating back to the end of the 18th century. As discussed in Section 4.2.7.2, the existing site will be protected from disturbance by a barrier installed in the pre-operation phases of the Project. However, it is possible that previously undiscovered archaeological or cultural heritage sites may be unearthed during pre-operation phases of the Project, and therefore a protocol for addressing such discoveries has also been detailed in Section 4.2.7.2.

While the risk of adverse effects to Site BbGc-12 will be mitigated by the installation of a protective barrier, it is not possible to eliminate the risk of damage to this archaeological resource, or any other potential archaeological resources in the Project Location that may be currently undiscovered. This site may be disturbed by site preparation or construction activities. The significance of the adverse effect is evaluated below.

5.1.11.2.1 Site May Be Disturbed by Site Preparation or Construction Activities

Archaeological Site BbGc-127 located along the eastern shore of the Cataraqui River may be disturbed by site preparation or construction activities of the Project. Furthermore, the existence of this site presents the possibility that undiscovered sites may exist within the Project Location and could be unearthed or disturbed by Project activities. Due to the presence of archaeological and cultural heritage resources, this residual adverse effect is of **high** level in terms of ecological and social context. Disturbance to an archaeological site would result in immediate loss of cultural heritage resources.

Mitigation strategies for the prevention of such disturbances include the installation of a barrier over Site BbGc-127 prior to any Project preparation or construction activity. Other mitigation strategies are discussed in Section 4.2.7.2 and include an overview of how to proceed should previously undiscovered archaeological resources be uncovered during construction. If this situation should develop, all construction around the location of discovery

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would immediately be suspended until the archaeologist, cultural heritage specialist, or other professional had been contacted, assessed the discovery, and determined how to proceed. While the possibility of disturbance is acknowledged, the existence of comprehensive mitigation strategies developed by a licensed archaeologist prompt this adverse residual effect to be **low** in terms of magnitude.

The possibility of the Project to disturb archaeological and cultural heritage sites extends beyond the Project footprint but is limited to the immediate vicinity of the Project Location and is therefore **moderate** in geographic extent. The sensitivity of Site BbGc-127 and other archaeological and cultural heritage resources will remain constant after the installation of the protective barrier around Site BbGc-127 and is therefore **low** level in terms of timing. The risk of disturbance will persist continuously throughout all construction phases in the area and is **high** level in terms of frequency but will terminate altogether after construction is completed and is therefore **low** in terms of duration. Any disturbance to archaeological resources resultant from Project activities would be **irreversible**.

Although the risk of disturbance to Archaeological Site BbGc-127 and other possible archaeological and cultural heritage resources within the Project Location is impossible to mitigate entirely, this adverse residual effect is considered **not significant**. This is primarily due to the comprehensive mitigation strategy developed in Section 4.2.7.2, as well as the duration of risk for this potential effect being limited to pre-operation phases.

5.1.12 Visitor Experience and Recreational Opportunities

The Cataraqui River and surrounding area is a valuable economic and cultural resource in terms of visitor experience and recreational opportunities. As detailed in Section 2.2.10 the Rideau Canal spans the length of Cataraqui River including the segment within the Project Location and is a valuable resource to the economy of eastern Ontario and promotes a variety of recreational opportunities in the area. PCA's management strategies for the lower Cataraqui section of the Rideau Canal south from Highway 401 to the northern entrance of Kingston's Inner Harbour near Belle Island have focused on protecting the natural character of its lands and waters and managing change on the landscape. This section is a rare example of the waterway where the natural environment was not altered during construction of the

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Rideau Canal. Over the intervening years, the extensive wetlands of the Great Cataraqui Marsh, as well as the river valley's sloped physiography and forested landscapes adjacent to the navigable channel have remained largely intact. This natural setting has contributed to the unique environment of this section of the waterway. The NHSC Plan for the canal appended as Appendix E further describes the importance of the canal as a destination for visitors and source of recreation.

Bridge construction is anticipated to result in three adverse residual effects to visitor experience and recreational opportunities that cannot be mitigated through General Mitigation Measures or Project Specific Mitigation Measures. All three adverse residual effects are limited to pre-operational phases of the Project, and are as follows:

- Noise and particulate emissions during construction.
- Restricted area access which may deter visitation from prospective or established visitors during construction.
- Reduced visitor safety during construction.

The residual effects are evaluated for their significance in separate sections below.

5.1.12.1 Noise and Particulate Emissions During Construction

Project construction will result in increased noise and particulate emissions around the Rideau Canal corridor and within the recreational spaces enjoyed by visitors, both on the water and in the surrounding Greater Cataraqui Marsh wetland area. The unique historical, ecological, and visual environment of the Rideau Canal in the Cataraqui River, as well as the largely intact surrounding forested landscape cause this residual effect to be **high** level in terms of ecological and social context.

While there are urban areas that surround the Cataraqui River and its recreational spaces, the Project Location spans coastal and aquatic areas previously unaffected by such extensive development. The City of Kingston Noise By-Law (2004-52) prohibits heavy equipment to be used without functional mufflers or outside of acceptable working hours, but there are exceptions to this By-Law that prevent the effects of increased noise emission

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from being entirely mitigated. Section 3.1.10.1 elaborates on By-Law 2004-52 and these exceptions. Particulate emissions likewise cannot be completely mitigated but will be reduced to the extent possible through General Mitigation Measures detailed in Section 4.1.1.1. Noise and particulate emissions will be above baseline conditions for this area but will not exceed regulatory criteria, and the magnitude of this effect is therefore **moderate**.

The effects of increased noise and particulate emissions will impact areas outside of the Project Location but are not anticipated to impact areas beyond the immediate vicinity of the Project Location. This residual effect is **moderate** in terms of geographic extent. The effect of increased noise and particulate emissions will be a **high-level** effect in terms of timing, as construction activities will occur over the course of the tourist season when watersports and other outdoor activities are typically enjoyed in the surrounding area. Furthermore, the impact of this effect will be **high** frequency, as the increases to noise and particulate emissions will be continuous throughout construction. However, once construction is completed these increases will cease to exist and can therefore be considered **low** duration, and fully **reversible**.

Due to the temporary nature of the effects of increased noise and particulate emissions during construction on visitor experience and recreation, this residual effect is considered **not significant**.

5.1.12.2 Restricted Area Access Which May Deter Visitation from Prospective or Established Visitors During Construction

During bridge construction, access to the Project Location will be restricted to the public to ensure the safety of visitors and the security of the Project. The specific limitations of these restrictions will vary over the course of construction but will limit the ability of visitors to access areas that would otherwise be usable. Due to the unique natural setting of the waterway and the well-preserved surrounding forest and marsh area, this is a **high-level** residual effect in terms of ecological and social context. These restrictions will affect both aquatic and terrestrial areas.

Mitigation techniques have been developed to minimize the impacts of this effect on the public. In order to reduce the effect of restricted access as much as possible, a website and telephone hotline will be developed to notify visitors of the details of the restrictions, and to receive and respond to public

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complaints. Furthermore, the on-water restrictions will be timed in order to leave the navigable channel and rowing lanes open during the boating season. These mitigation strategies and others are detailed in Section 4.2.8. While restrictions will strive to limit inconvenience to the public to the extent possible, visitors will not have the unimpeded access available during baseline conditions and therefore the magnitude of this residual effect is **moderate**.

Despite mitigation strategies developed to reduce the effect of restricted access to boaters, any closures to the navigable waterway could potentially extend to the full Rideau Canal system and therefore this effect is **high** level in terms of geographic extent. The closures will occur continuously throughout construction activities including during the peak tourism season, therefore the effect is **high** level in terms of both timing and frequency. This effect will persist for the duration of pre-operation phases only; once construction has ended, and the bridge is complete, full public access to both terrestrial and aquatic areas will be re-established meaning the duration of this effect is **low** level. Furthermore, the effect of closures to the public is fully **reversible**, and access will be reinstated following the completion of construction activities.

Because the impacts of this effect are temporary in nature and do not present the potential to cause adverse effects to the access of tourists to public areas after the completion of the pre-operation phases of the Project, this residual effect is **not significant**.

5.1.12.3 Reduced Visitor Safety During Construction

Construction activities reduce the safety of visitors to surrounding areas, including the safety of rowers and other people aboard watercraft in the navigable channel during construction over and around these areas. As with all residual effects pertaining to the Rideau Canal waterway and surrounding conserved areas, this impact is of **high** level in terms of ecological and social context.

Mitigation strategies to reduce this effect to the greatest possible extent are detailed in Section 4.2.8. These strategies include the installation of on-land and on-water signage notifying the public of the boundaries of construction zones and launching boat crews on-water to direct the public away from areas of water work. Furthermore, the Bridge Design and Construction Methodology

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included as Appendix B has been developed with considerations for visitor safety throughout. While these mitigation strategies will decrease the risks to visitor safety, this effect is **moderate** in magnitude, as the safety of visitors will be at higher risk than baseline levels.

Visitor safety will be reduced within the Project Location, and in some cases in the immediate vicinity of the Project Location. This residual effect is therefore of **moderate** geographic extent. This effect is also **moderate** with respect to timing, as various construction activities will be concurrent and likely occurring across several different areas of the Project Location at once. While this effect will be ongoing throughout construction activities and is considered **high** frequency, it will be **low** in duration because visitor safety will only be reduced while construction phases are actively underway. Once construction is complete, visitor safety will revert to baseline levels, making this effect fully **reversible**.

As a result of mitigation strategies to ensure visitor safety to the fullest extent possible during the construction phases of the Project, as well as the temporary and reversible nature of reduced visitor safety, this effect is **not significant**.

5.1.13 Navigation

The Project Location crosses the Cataraqui River and is transected by the Rideau Canal, which passes through the middle of the river along the navigable channel. The Rideau Canal is a Federally regulated waterway and provides an important route of transportation between Kingston and Ottawa. While northern portions of the Canal are only open from late May until mid-October of each year, the navigable channel that passes through the Project Location is open outside of the lock operational season as it is accessible from Lake Ontario. Adjacent to the navigable waterway is a rowing course that is 2 km long and seven lanes wide and is utilized by the Kingston Rowing Club and the Queens University rowing team when the river is not frozen, and conditions permit for on-water rowing.

Bridge design has ensured that navigation will not be impeded during the operational phases of the Project, but adverse effects to navigation may result from Project construction and cannot be entirely mitigated. The mitigation measures designed to prevent any adverse effects during the operational

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phase of the Project are discussed in Section 4.2.11. The adverse effect of disruption to navigation during construction is detailed below.

5.1.13.1 Disruption to Navigation During Construction

Navigation through the Cataraqui River and Rideau Canal will be impacted during Project construction activities by the transport of materials across the waterway and the construction of a temporary trestle lift span necessary for bridge construction. As the Rideau Canal and navigation of the Cataraqui River are extremely important functions of the Project Location, this residual effect is **high** level in terms of its ecological and social context.

Extensive mitigation strategies have been developed and incorporated into the Bridge Design and Construction Methodology (Appendix B) and are discussed in Section 4.2.11. These mitigation strategies include scheduling construction activities that impact the navigable waterway Outside of the PCA Navigation Period, and designing the trestle lift span to accommodate the Kawartha Voyageur, which is the largest ship known to use the waterway. Construction materials will be transported across the waterway using barges to allow the navigable channel to remain open during PCA Navigation Period (during operating hours), and construction activities requiring the trestle lift span will primarily be scheduled during PCA Navigation Period (outside of operating hours to minimize any delays caused to marine traffic. The mitigation measures will cause only small adverse impacts to typical routine marine navigation, and the adverse effects will be of **low** magnitude.

The adverse effects of bridge construction to marine navigation will impact only the portion of the navigable waterway that intersects the Project Location, and watercraft will experience only small delays through this segment of the canal. The geographic extent of this adverse effect is therefore **low**. Despite the Bridge Design and Construction Methodology being developed so as to minimize the effects of construction to navigation during boating season, this effect will occur during tourist season and the adverse effect is therefore considered **high** level with regard to timing. Furthermore, the effect will be continuous during the construction phases of the Project occurring on the water, and the frequency of this effect will be ongoing, therefore considered **high**. The changes to existing navigation conditions will occur during pre-operation construction phases only and are therefore **low** duration. Upon completion of bridge construction, the navigation

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of the waterway will return to baseline conditions as this adverse effect of the Project on navigation is **reversible**.

While the adverse effects of the Project on marine navigation have the potential to cause short delays to watercraft passing through the Project Location, this effect is **not significant** as the construction methodology has been designed to ensure such disruption to navigation is minimal. Following the completion of the bridge, navigation will be fully unimpeded and return to current state.

5.1.14 Hydrologic Processes

The Cataraqui River is a slow-moving channel characterized by relatively low flow that is regulated at Kingston Mills. The variation in flow velocity and depth within the Project Area is heavily influenced by wind and surges in Lake Ontario levels. Predominant winds are the from the south to west direction; the orientation of the Project makes the site particularly sensitive to wind influenced water movement. Large currents may be induced through wind and surges in lake level and these factors when combined, can produced significantly higher velocities and water levels within the Project Area. Additionally, the river bed in the vicinity of the bridge consists of very loose, fibrous silty peat to fibrous peat and organic silt.

An analysis of river hydraulics was conducted for the proposed bridge on the Cataraqui River (Section 3.1.13). The purpose of the assessment was to quantify potential changes, specifically to water velocities, water depths, sediment erosion and transport, and river ice and spring flooding within the Project area between Highway 401 in the north and the LaSalle Causeway in the south. A summary of the effects derived from the hydraulic assessment are listed below:

- Potential changes to the water level and velocity are estimated to be relatively small under open water conditions during the post-construction (bridge in place) case with little to know change in location and magnitude.
- The presence of the causeway will temporarily change the regime of the study area under open water conditions; specifically, water velocity through the bridge alignment (north-south) will progressively increase as the opening in the causeway decreases.

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- With the temporary causeway in place, the open water velocity (under the design event) was estimated to be higher near the navigation channel and lower generally west of the navigation channel, both north and south of the temporary causeways.
- Water depths were relatively unchanged when comparing pre-construction conditions to adding the causeway.
- Under the design conditions, the presence of the causeway will increase the velocity of the navigation channel beyond what is normally experienced and potentially increase erosion of the channel bed.
- Bed surface changes resulting from the presence of the causeway is expected to be most prominent immediately north and south of the west component of the causeway and within the opening between the west and east causeway components; the change in bed elevation is expected to be relatively small with differences in the amount of centimeters.
- The potential for ice jam flooding during either temporary works or post-construction (bridge in place) cases is extremely low.

There were no mitigation measures proposed in relation to hydrologic processes, however this was the main design consideration for the causeway design as the opening within the causeway was designed to match the river widths located at Belle Island, as was modelled in Section 3.1.13.

Though the opening does not influence the water levels in a significant way, it does effect water velocities and direction within the Study Area which in turn could affect erosional (scouring) and depositional areas. As there is no mitigation for this possible effect, it is being evaluated as a residual effect; determinations are presented below.

5.1.14.1 Openings Within the Causeway During Construction Will Affect Water Velocities and Direction Within the Study Area with The Potential to Affect Erosional (Scouring) And Depositional Areas

As stated above, there is one residual effect related to hydrologic processes: openings within the causeway during construction and their affect on water velocities and direction within the Study Area with the potential to affect erosional (scouring) and depositional areas. No mitigation was identified for

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this residual effect, accordingly, it was determined that there are no mitigation measures identified for this residual effect. The ecological and social context was determined to be **Low** as the hydrologic processes within the Project Location contribute to the overall hydrology of this section of the waterway. In terms of the magnitude of this effect, the local area that will be impacted is anticipated to have a high resilience to the effect of local changes in hydrology and therefore it is considered to be **Low**. The geographic extent of this residual effect is considered **High** as it is likely to extend beyond the Project Location but is limited to the immediate vicinity of the Study Area.

With respect to timing and frequency, the increased water velocities will occur continuous throughout the construction events until the causeway is removed, therefore this would be considered **High**. The effects of the increased velocities will occur for the duration of the full causeway installation but are expected to normalize once the causeway is removed and therefore duration is expected to be **Low** for the duration. However, the residual effect will remain **Irreversible** as it is unlikely that the depositional areas will return to their original state even when flows normalize once the causeway is removed.

5.2 Determination of Significance of Residual Adverse Effects on Secondary Components

5.2.1 Terrestrial Wildlife

Many types of terrestrial wildlife have the potential to occupy the Study Area, including terrestrial snakes, semi-aquatic mammals and other terrestrial mammals described in Section 2. The following sections outline the significance of residual effects associated with each grouping of terrestrial wildlife.

5.2.1.1 Eastern Gartersnake and Dekay's Brownsake

Both Eastern Gartersnake and Dekay's Brownsake have a high potential to utilize the Study Area, with the Project potentially resulting in habitat loss, habitat fragmentation and impacts to life processes such as foraging and breeding. While mitigation measures described in Section 4 are expected to reduce many of the impacts to herpetofauna species, one residual effect remains.

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The following section will assess the significance of this residual effect to the terrestrial snakes noted above.

5.2.1.1.1 Potential Loss of Hibernacula, Basking Areas, Shedding Sites and Foraging Grounds Due to Tree Clearing

Construction activities (i.e. tree clearing) is expected to cause a residual effect for the species noted above that utilize the area. Though mitigation measures have been put in place (discussed in Section 4) the Project may result in an overall loss of hibernacula, basking areas, shedding sites and foraging grounds in the Study Area. Although no hibernacula have been found on site, there is still potential for habitat features to exist, but has been assumed to be absence for this evaluation, therefore the significance rating for Ecological and Social Context is set as **Low**. The construction activities may result in movement away from the Project Location, however there ample similar habitat within the Study Area. Due to the minimal effect the movement/relocation would have within the Study Area and that the loss of habitat represents a small fraction of the wildlife habitat in the area, the Magnitude significance rating is set as **Low**. As previously described, the woodland clearing represents approximately 3% of the eastern woodland with a lesser percentage when including all greenspace that could be used by the two snake species. The clearing is limited to the Project Location therefore the significant rating for geographic extent is set as **Low**.

Construction activities will occur throughout the year and will not be able to avoid the sensitive timing windows (i.e. Summer months for breeding and winter months for overwintering/hibernation) for snakes. As such, exclusionary mitigation presented in Section 4 will serve to prevent species from entering the site. Combining the inability to avoid the sensitive timing windows with the assumption there is no hibernacula within the Project Location Timing is conservatively set at **Moderate**. As the majority of the habitat loss occurring as a result of construction activities will be permanent and will occur for the duration of the operational phase, significance rating for both Duration and Frequency is **High**. As the bridge is not expected to be decommissioned, the structure would result in a permanent loss that is **Irreversible**.

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Following the application of the residual effects significance criteria to this residual adverse effect an overall significance determination has been made and is largely based on magnitude and ecological significance. While habitat loss can in some instances be detrimental to ecosystems, the overall determination is that this residual adverse effect is **Not-Significant**, given the suitable of habitat surrounding the Project Location and that no hibernacula have been observed on the Project Location.

5.2.1.1.2 Vehicle Collisions with Snakes During Construction

Vehicle strike is a common residual effect across many biotic VC's and is consistent among most construction projects in close proximity to any wildlife. Exclusionary measures such as herpetofauna exclusionary fencing would be expected to exclude some snakes from the site, however the potential for some vehicle strikes is still present. The significance rating for ecological and social context is **Low** due to both Eastern Gartersnake and Dekay's Brownsnake being common species within the province of Ontario. Despite the potential mortality, populations are tolerant of low levels of mortality. Additionally, the exclusionary fencing will prevent a majority of collisions within the Project Location, therefore the significance rating for magnitude is **Low**. This residual effect is expected to occur only within Project Location, as these are the only areas where strikes would occur; Accordingly, the significance rating for geographic extent is set as **Low**.

Construction activities cannot avoid any peak seasons for animal-vehicle collisions, therefore the significance rating for timing is **High**. As construction activities, will only take place during the pre-operational phase the significance rating for both frequency and duration are **Low**. Although any terrestrial wildlife collisions are **Irreversible**, the residual effect has been determined to be **Not Significant**, based on the low frequency or likelihood of strikes occurring.

5.2.1.1.3 Vehicle Collisions with Snakes During Operation

Similar to the construction Section 5.2.1.2.2 above collision with snakes during operations is similar in all regards with the exception of elevated frequency and duration. Under operations the frequency would be considered **Moderate** as mitigations such as construction speed limits, driver education or onsite environmental staff to remove the animal will not be in effect and

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rather the animal will be in direct contact with regular citizens that may or may not respond properly. Furthermore, the duration is elevated to **High** as the bridge is a permanent structure. In either case the determination of **Not Significant** remains as a result of the species commonality.

5.2.1.2 Semi-Aquatic Species

Some semi-aquatic species have the potential to occur within the Study Area, including: Beaver, Mink, Muskrat and River Otter. Semi aquatic species spend a significant amount of time in the water, however still depend on terrestrial habitat for many life processes.

The Project is expected to result in several effects to semi-aquatic species, described in Section 3. While mitigation measures described in Section 4 are expected to reduce many of the impacts to semi-aquatic species, several residual effects remain:

- Potential reduction in continuous aquatic habitat connectivity and fragmentation of riparian areas.
- Vehicle collisions with semi-aquatic species throughout construction activities.
- Vehicle collisions with semi-aquatic species during operation.
- The following sections will assess the significance of the residual effects to the species noted above.

5.2.1.2.1 Potential Reduction in Continuous Aquatic Habitat Connectivity and Fragmentation of Riparian

As discussed in Section 3.2.3.2, construction activities have the potential to affect semi-aquatic mammals due to a potential reduction in continuous aquatic habitat connectivity and fragmentation of riparian areas, despite ecopassages through the causeway. Exclusionary fencing in aquatic and terrestrial areas for herpetofauna however, is not expected to be able to exclude mammals, and therefore makes them susceptible to vehicle strike. Mitigation measures noted within Section 4.1.1.4 is expected to minimize collisions with wildlife, by reducing / enforcing speed limits and site sweeps during construction activities, however would not eliminate the potential.

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Construction activities are expected to cause a residual effect for the species noted above that utilize the Study Area however all are common species and as such have an ecological context of **Low**, however the listed aquatic species are fur bearing animals and are known to have a greater social and indigenous value in many areas of the Province. Project will still result in habitat fragmentation and connectivity issues along the shoreline and within the Cataraqui River beyond baseline conditions as such the magnitude is **Moderate** but is limited to the Project Location therefore the geographical extent is **Low**.

Shoreline construction will extend approximately 37 months and current use of the shorelines by aquatic mammals is unknown so conservatively timing, frequency and duration are all assumed **High**. Transitioning into operations the shoreline habitat fragmentation is expected to remain therefore the effect is **Irreversible**. All listed species would be expected to remain within the Study Area during and after construction, passage through the construction site or around it via the Eco passages or main causeway opening will be maintained as exclusionary mitigation would not be expected to exclude these species. This combined with the ample habitat retained, the abundance of the species regionally has lead to a **Not Significant** determination.

5.2.1.2.2 Vehicle Collisions with Semi-Aquatic Mammals During Construction.

As previously stated, exclusionary measure would not be expected to exclude aquatic mammals therefore the potential for vehicle or machinery strikes during construction is present. Vehicle strike is a common residual effect across many biotic VC's and is consistent among most construction projects in close proximity to any wildlife. As before the significance rating for ecological and social context is **Low**. Despite the potential mortality, the species, populations are tolerant of low levels of mortality as all are harvested for fur within the Province of Ontario, therefore the significance rating for magnitude is **Low**. This residual effect is expected to occur within Project Location, as these are the only areas where strikes would occur; Accordingly, the significance rating for geographic extent is set as **Low**.

Construction activities cannot avoid any peak seasons for animal-vehicle collisions, therefore the significance rating for timing is **High**. As construction activities, will only take place during the pre-operational phase and strikes will

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be infrequent due speed limits, driver education, onsite monitors and the general mobility of the species, the significance rating for both frequency and duration are **Low**. Although any terrestrial wildlife collisions are **Irreversible**, the residual effect has been determined to be **Not Significant**, based on the low frequency or likelihood of strikes occurring.

5.2.1.2.3 Vehicle Collisions with Semi-Aquatic Mammals During Operation

Similar to the construction Section 5.2.1.2.2 above collision with semi aquatic mammals during operations is similar in all regards with the exception of elevated frequency and duration. Under operations the frequency would be consider **Moderate** as mitigations such as construction speed limits, driver education or onsite environmental staff to remove the animal, rather the animal will be in direct contact with regular citizens that may or may not respond properly. Furthermore, the duration is elevated **High** as a permanent structure. In either case the determination of **Not Significant** remains as a result of the species commonality.

5.2.1.3 Other Terrestrial Mammals

Many other terrestrial wildlife has the potential to occur within the Study Area and by association the Project Location including: Coyote, Eastern Chipmunk, Eastern Cottontail, Eastern Grey Squirrel, European Hare, Longtail Weasel, Masked Shrew, Meadow Jumping Mouse, Meadow Vole, Norway rat, Porcupine, Raccoon, Red Fox, Red Squirrel, Short-tailed Shrew, Striped Skunk, White-footed Mouse, White-tailed Deer, and Woodchuck.

The Project is expected to result in several effects to terrestrial mammals, described in Section 3. While mitigation measures described in Section 4 are expected to reduce many of the impacts to terrestrial wildlife, several residual effects remain:

- Loss of general habitat, breeding grounds, foraging grounds, hibernation areas, and dens.
- Vehicle collisions with other terrestrial mammals throughout construction activities.
- Vehicle collisions with other terrestrial mammals during operation.

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The following sections will assess the significance of the residual effects to the terrestrial mammals noted above.

5.2.1.3.1 Loss of General Habitat, Breeding Grounds, Foraging Grounds, Hibernation Areas, and Dens

Construction activities (i.e. tree clearing, site preparation, etc.) is expected to cause a residual effect for the species noted above that utilize the area. Though mitigation measures have been put in place (discussed in Section 4) the Project will still result in an overall loss of habitat, within the Study Area. Due to the ability of the populations to recover from low levels of disturbances and that the species are non-SAR, the significance rating for ecological and social context is **Low**. The construction activities would result in movement away from the Project Location, however there is suitable habitat for terrestrial mammals within the Study Area. Due to the minimal effect the movement/relocation would have within the Study Area and that the loss of habitat represents a small percentage of the wildlife habitat in the area but does represent a deviation for the baseline levels as such the magnitude significance rating is **Moderate**. Geographic extent is limited to the Project Location and is therefore set to **Low**.

There is no known time sensitive habitat for terrestrial mammals within the Project Location therefore the significance rating for Timing is set as **Low**. The construction driven habitat loss will be permanent and will occur for the duration of the operational phase, significance rating for both Duration and Frequency is **High**. As the bridge is not expected to be decommissioned, the structure would result in a permanent loss of habitat for terrestrial mammals that is **Irreversible**.

Following the application of the residual effects significance criteria to this residual adverse effect, an overall significance determination has been made and is largely based on magnitude, geographic extent and ecological significance, combined with the Study Areas urban nature and the ability of the listed species to persist within an urban environment, the overall determination is that this residual adverse effect is **Not-Significant**.

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5.2.1.3.2 Vehicle Collisions with Other Terrestrial Mammals During Construction

Exclusionary measure would not be expected to exclude mammals therefore the potential for vehicle or machinery strikes during construction is present. Vehicle strike is a common residual effect across many biotic VC's and is consistent among most construction projects in close proximity to any wildlife. As before the significance rating for ecological and social context is **Low** for common terrestrial mammals. Despite the potential mortality, the species, populations are tolerant of low levels of mortality with many regulated for hunting or fur bearing as such the significance rating for magnitude is **Low**. This residual effect is expected to only occur within the Project Location, as these are the only areas where strikes would occur; Accordingly, the significance rating for geographic extent is set as **Low**.

Construction activities cannot avoid any peak seasons for animal-vehicle collisions, therefore the significance rating for timing is **High**. As construction activities will only take place during the pre-operational phase and strikes will be infrequent due to speed limits, driver education, onsite monitors and the general mobility of the species, the significance rating for both frequency and duration are **Low**. Although any terrestrial wildlife collisions are **Irreversible**, the residual effect has been determined to be **Not Significant**, based on the low frequency or likelihood of strikes occurring.

5.2.1.3.3 Vehicle Collisions with Other Terrestrial Mammals During Operation.

Similar to the construction Section 5.2.1.3.3 above, collision with terrestrial mammals during operations is similar in all regards with the exception of elevated frequency and duration. Under operations the frequency would be considered **High** as mitigations such as construction speed limits, driver education or onsite environmental staff to remove the animal, rather the animal will be in direct contact with regular citizens that may or may not respond properly. Furthermore, the duration is elevated **High** as a permanent structure. In either case the determination of **Not Significant** remains as a result of the species commonality and the overall urban nature of the Project.

5.2.2 Terrestrial Vegetation

This significance determination is in relation to the loss or reduction of known significant woodland within the Study Area. As documented in Section 3.2.4, construction activities will affect terrestrial vegetation, which will

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be cleared for the construction. This includes some areas of permanent clearance within the Project Location as well as temporary vegetation disturbance and clearance to facilitate construction activities. Mitigation and Project designs have been produced to reduce the area of vegetation removal where possible. Some level of vegetation clearing will persist throughout the Project to facilitate the safe operation of the bridge, and to remove potential issues regarding vegetation growth into wiring and other health and safety issues. A portion of the vegetation to be cleared on the eastern edge of the Project Location is associated with a significant woodland, as evaluated by the City of Kingston Official Plan. Accordingly, this is expected to be of **High** ecological and social importance. Magnitude would be expected to be **Low** as it nominally exceeds baseline conditions with approximately 97% retained. The effects of the vegetation removal will be limited to the Project Location and therefore is considered as a **Low** geographical extent. The timing, frequency and duration of the effects are considered **High** and the effect is **Irreversible**. Overall, the loss of terrestrial vegetation has been evaluated as **Not Significant** given the natural heritage usage studies in combination with the arborist reporting and consultation with the City's forestry department.

5.2.3 Air Quality

The primary indicator used for air quality in Ontario is the Air Quality Index (AQI) which is a calculated index developed by the MECP. The AQI is based on the following pollutants that adversely affect human health and the environment: ozone, particulate matter (aerosols, smoke, fumes, dust, fly ash, and pollen), nitrogen dioxide and carbon monoxide.

Based on measurements in the 2015 'Air Quality in Ontario' report taken at the Kingston site located at 23 Beechgrove Lane, approximately 6 km southwest of the Study Area, there were zero occurrences in which the AQI for the aforementioned pollutants exceeded the standard. Additionally, in regard to real-time measurements recorded by the City, low risk air quality was present 95.8% of the time, moderate risk air quality was present 4.2% of the time, and high-risk air quality was present 0% of the time.

As part of the City's Climate Action Plan, a Carbon Life Cycle Assessment was prepared in support of the Preliminary Design (Appendix N). It expresses energy use and greenhouse gas emissions with an upper limit [or standard

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practice - Unmitigated – as informed by the Ontario Province Standard Specifications (OPSS)] and lower limit (or Mitigated). It was found that adverse effects to air quality from the site preparation, construction and site restoration / rehabilitation phases are possible. However, once general mitigation measures (Section 4.1.1.1) and Specific Mitigation Measures (Section 4.3.5) are employed, one residual effect will remain. This residual effect includes limited effects to construction workers, recreational workers, surface water quality and aquatic habitat as a result of air emissions including dust during construction; the significance of this residual effect is discussed below.

5.2.3.1 Limited Effects to Construction Workers, Recreational Users, Surface Water Quality and Aquatic Habitat as a Result of Air Emissions Including Dust During Construction

Overall, there will be limited effects to construction workers, recreation users, surface water quality and aquatic habitat as a result of air emissions including dust during construction. Accordingly, the level of residual effect is **High** in terms of its ecological and social context as air quality is an important contributor to the use and enjoyment of the property, including the Rideau Canal system. In terms of the magnitude of this effect, the air emissions including fugitive dust emissions are anticipated to be **Low**. The geographic extent of this residual effect is considered **Moderate** as the effect is likely to extend beyond the Project Location but is limited to the immediate vicinity of the Study Area.

Site preparation, construction methodology and other mitigation measures will serve to reduce the potential for adverse effects on the air quality, specifically the use of: Alternative Fuels & Vehicle Hybridization, In-Place Roadway Recycling, Warm Mix Asphalt, and Recycled and Reclaimed Materials. Accordingly, with respect to timing, multiple construction activities will occur concurrently and therefore the level of adverse effect of the installation of the bridge is considered **Moderate**.

With respect to the frequency of this residual effect, increased air emissions will occur continuous throughout construction, dictating that the effect is **High**. Effects of increased air emissions are not expected to extend past the pre-operation phase of the Project and therefore the residual effect is expected to



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be **Low** for the duration and will be **Reversible**. The overall determination is that the residual effect caused by increased air emissions during construction is **Not Significant** as the adverse effects due to fugitive dust can be reversed once the source of dust is eliminated.

Table 5.2: Significance of Residual Adverse Effects Summary

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
Greater Cataraqui Marsh PSW	Loss of PSW During Construction and Operations.	High	Low	High	Moderate	High	High	High	Reversible – Construction	Not Significant	<ul style="list-style-type: none"> Wetland appears stable and resilient to changes, (little change since 1990) Causeway footprint predicted to regenerate back to wetland, within 6 yrs. of post-construction.
									Irreversible - Operations		<ul style="list-style-type: none"> Monitoring plan with triggers and contingency in place to ensure regeneration occurs (Section 8) Net gain in wetland area from Music Marina Decommissioning and Fish habitat offsets Mitigation in place to protect SAR which are the driving force behind Significant Wetland designation.
Fish and Fish Habitat	Disturbance to Fish and Fish Habitat During Construction	Moderate	Low	Low	Low to High	Low	Low	Low	Reversible	Not Significant	<ul style="list-style-type: none"> Abundant habitat available during construction, including the now vegetated Music Marina navigation channel Majority of fish species are prolific and withstand are known to withstand population reductions
									Irreversible		<ul style="list-style-type: none"> Proper mitigations in place to ensure effects are localized to Project Location

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
											<ul style="list-style-type: none"> Currently no in-water work proposed during spring spawning seasons unless agreed upon by agencies
		Effects to Fish Eggs as a Result of Noise Emissions During Construction (Outside Restricted Timing Window)	Moderate	Low	Low	Low	Low	Low	Reversible	Not Significant	<ul style="list-style-type: none"> Standard mitigations to reduce noise at source or lessen transmission distance Standard monitoring to ensure noise is contained.
		Effects to Fish Eggs as a Result of Noise Emissions During Construction (During Restricted Timing Window)	High	Low	Low	Low	Low	Moderate	Irreversible	Significant	<ul style="list-style-type: none"> Noise and vibration pose a threat to the functionality of fish spawning habitats within a 7 m of pile installations
		Effects to Fish and Fish Eggs as a Result of Construction Lighting.	Moderate	Low	Moderate	Low	Low	Low	Reversible	Not Significant	<ul style="list-style-type: none"> AETC provides a buffer between fish habitat and the causeway following fish exclusion Timing will only be a few hours per day within an assumed 16-hour work day
		Alteration of fish habitat during construction	Moderate	Low	Low	Low	Low	Low	Reversible	Not Significant	<ul style="list-style-type: none"> Abundant habitat available during construction, including

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
											the now vegetated Music Marina navigation channel <ul style="list-style-type: none"> Robust monitoring plan in place to ensure habitat returns and is being used
		Permanent loss of fish habitat as a result of project components within the watercourse	Moderate	Low	Low	High	High	High	Irreversible	Significant – Offset Required	<ul style="list-style-type: none"> 178 m² of river to be occupied resulting in the loss of Fish Habitat Habitat known to support commercial, recreation and aboriginal fishes resulting in a significant residual effect requiring offsetting Offset includes work along western to shore to remove seawall from old Music Marina as well as remove historical placed fill or dredged material adjacent boat launch Decommissioning of Music Marina to increase habitat suitability (net gain in wetland habitat)
		Construction Effects to birds and bird habitat as a result of noise and vibration emissions	Moderate	Low	Moderate	High	Moderate	Low	Reversible	Not Significant	<ul style="list-style-type: none"> Impact Hammering limited to ensure bedrock contact only on the temporary piles. Impact driving to be timed to the extent possible to avoid breeding bird season Monitoring prior to breeding bird season to determine if or

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
											where effect needs to be mitigated <ul style="list-style-type: none"> Proven mitigations measures available to reduce if or when needed.
	Potential for vehicle or machinery strikes and nest disturbance during construction	Low	Low	Low	Low	Low	High	Low	Reversible- Machinery will be removed	Not Significant	<ul style="list-style-type: none"> Re-occurring effect on any construction project Limited avoidance potential, however general mitigations such as employee education and speed limits combined with daily monitoring reduce potential. Adaptive management if death of individuals becomes re-occurring outcome
									Irreversible- Death of individuals would not be reversible		
	Permanent loss of 1.93 ha of woodland; and 0.2 ha of meadow/grassland/urban bird habitat.	Low	Low	Low	Low	Low	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> Ecological effect taken into account during routing, this route possess the least amount woodland/grassland loss. Represents approx. 3% of the total woodland with a fraction of a percent regionally Loss of Woodlands/ Grasslands not expected to effect Provincial SAR habitat (MNRF 2019) Landscape Plan to re-instate as much greenspace as possible using native species

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
		Alteration of behaviour as a result of increased artificial light during construction (during breeding bird timing window)	Low	Low	Moderate	High	Moderate	Low	Reversible	Not Significant	<ul style="list-style-type: none"> Project within urban area with existing artificial light, with most present species tolerant Light to be limited to meet safety standards (no excessive lighting) Lights to be shielded to focus within construction site. Effect of artificial construction lighting will extend beyond the Project Location, but will largely be localized within the immediate vicinity Lighting will only be deployed for relatively short periods of time but on a regular basis as dictated by the construction schedule
		Alteration of behaviour as a result of increased artificial light during construction (outside of breeding bird timing window)	Low	Low	Moderate	Low	Moderate	Low	Reversible	Not Significant	<ul style="list-style-type: none"> Project within urban area with existing artificial light, with most present species tolerant Light to be limited to meet safety standards (no excessive lighting) Lights to be shielded to focus within construction site. Effect of artificial construction lighting will extend beyond the Project Location, but will

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
											largely be localized within the immediate vicinity <ul style="list-style-type: none"> Lighting will only be deployed for relatively short periods of time but on a regular basis as dictated by the construction schedule
	Alteration of behaviour as a result of increased artificial light during Operation		Low	Low	Moderate	High	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> Project within urban area with existing artificial light, with most present species tolerant Light to be limited to meet safety standards (no excessive lighting) Lights to be shielded to focus light downward Least disruptive light color to be chosen Post Construction Monitoring to assess the effects of light trespass and determine if any additional mitigation is needed/ feasible
	Sensory disturbance as a result of noise emissions due to increased traffic and maintenance activities during operation		Low	Low	Moderate	High	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> Project within Urban area with existing urban noises, with most present species tolerant Ecological considerations during routing selection Conservative noise modelling (Jasco 2017) shows limited excessive noise distribution, with greatest distance over

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
											the waters <197 m where limited nesting habitat is present, noise quickly dissipates when making landfall.
Surface Water and Sediment Quality		Increases in the TSS and Potential Impacts on Water Quality Leading to an Increased Likelihood of Cyanobacteria Blooms	Moderate	Moderate	Moderate	Low	Moderate	Low	Reversible	Not Significant	<ul style="list-style-type: none"> No document large cyanobacteria blooms in past TSS to be managed in accordance with CCME guidelines with real-time monitoring, allow quick response to any spikes in TSS Real-Time water temperature (cyanobacteria influencer) Daily construction monitoring for cyanobacteria blooms within AETC where potential is elevated Potential limited to summer months, main TSS generating activities (causeway installation to be completed by Summer 2020)
		Disturbed sediments may cause resuspension of sediment bound contaminants within the water column	Moderate	Moderate	Moderate	Low	Moderate	Low	Irreversible	Not Significant	<ul style="list-style-type: none"> Geotechnical investigations to understand vertical and horizontal distributions of concern elements Project construction method changed to eliminate/reduce dredging

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
											<ul style="list-style-type: none"> AETC expected to maintain TSS levels within CCME allowable limits Monitoring plan to track physical and chemical characteristic of water within Study Area.
		Increases in the volume of stormwater into the Cataraqui River during operations	Low	Moderate	Low	Low	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> Stormwaters to be collected from all hard surfaces (bridge, roads, etc.) and sent to management pond prior to release Discharge water quality criteria to be set by MECP and Parks Canada Common and regulated effect to the environment
Aquatic Wildlife and Vegetation	Herpetofauna	Loss of general and foraging habitat during construction.	Low	Low	Low	Low	Low	Low	Reversible	Not Significant	<ul style="list-style-type: none"> Relatively low habitat usage/value within Project Location Connectivity to be maintained through eco-passages and causeway opening Abundant and higher quality habitat to the north and south Naturalization of the Music Marina navigation channel to offset causeway footprint Supplemental information to be collected during construction (Section 8) to

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
											further knowledge of frog and toad breeding
		Permanent loss of habitat during operation.	Low	Low	Low	High	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> 178 m² of River to be occupied resulting in the loss of low value habitat or <0.004% of the PSW area Fish habitat offset planned to improve/restore shoreline areas that are considered better suited for herpetofauna Decommissioning of Music Marina to increase habitat suitability (net gain in wetland habitat) Long term monitoring planned (Section 8)
	Benthic Invertebrates	Loss of the benthic invertebrate community currently present within the causeways footprint during construction	Low	Low	Low	High	Low	Low	Irreversible	Not Significant	<ul style="list-style-type: none"> Population naturally variable in abundance and dependent on water levels <1% of PSW area effected Little to no social value, however does provided important forage base for many higher trophic groups Predicted to be low diversity and low abundance within causeway with sampling occurring prior to construction to evaluate predictions (Section 8)

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
		Shift in benthic community within the causeway footprints immediately after removal	Low	Low	Low	Moderate	Moderate	Moderate	Reversible	Not Significant	<ul style="list-style-type: none"> <1% of PSW area effected, shift in naturally occurring species diversity not expected to measurable on PSW scale Not expected to be significant enough to influence higher trophic species within the timeframe associated with infill
		Loss of Habitat from Permanent Project Components During Operation.	Low	Low	Low	High	Moderate	High	Irreversible	Not Significant	<ul style="list-style-type: none"> 178 m² of River to be occupied resulting in the loss of low value habitat or <0.004% of the PSW area Fish habitat offset planned to increase river area thus will increase benthic invertebrate production Long term monitoring planned (Section 8)
	Aquatic Vegetation	Loss of submergent and shoreline vegetation during construction.	Low	Moderate	Low	Low	Low	Moderate	Reversible	Not Significant	<ul style="list-style-type: none"> Area dominated by four (4) common or non-native species <1% of the overall wetland vegetation area Abundant vegetation to the north and south Naturalization of the Music Marina navigation channel to offset causeway footprint (confirmed during the 2019 preconstruction vegetation surveys (Section 8)

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
		Alteration of vegetation density and composition following construction completion.	Low	Moderate	Low	High	High	High	Reversible	Not Significant	<ul style="list-style-type: none"> Four present species aggressive colonizers on a variety of habitats Existing variations of species composition percentages, with likely annual variations depending on environmental conditions favoring different species Densities expected to return to providing similar habitat functions Detailed monitoring plan to track recovery with triggers and contingencies set for supplementary works to ensure end targets are met (Section 8)
		Loss of vegetation associated with the permanent Project components during operation.	Low	Low	Low	High	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> 178 m² of river to be occupied resulting in the loss of <0.004% of the PSW area Decommissioning of Music Maria to increase PSW area (net gain of vegetation) Fish habitat offset planned to increase river area thus will increase vegetated area, also will provide better connectivity of riparian and aquatic vegetation communities Long term monitoring planned (Section 8)

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
SAR Fish	American Eel	Loss of low-use habitat within the Project Location during construction and Operations	High	Low	High	Low	Low	Low	Reversible	Not Significant	<ul style="list-style-type: none"> American Eel migration maintained through causeway opening and eco-passages Low-use habitat (wetland) to be fully restored Fish habitat offset to benefit American Eel Little Cataraqui Creek initiative with CRCA likely to benefit through the identification of any movement barriers.
SAR Bats	Little Brown Myotis, Northern Myotis and Tri-colored Bat	Loss of maternal roosting habitat	High	Moderate	Low	Low	Low	Low	Irreversible	Not Significant	<ul style="list-style-type: none"> Approvals process with MNRF deemed impacts to be not-significant Sufficient habitat retained within woodlands and urban areas City to erect 22 bat boxes to help in recovery of the species Landscape Plan to use native oaks to help increase habitat long-term
SAR Birds	Nightjars (Common Nighthawk)	Alteration of Behaviour as a Result of Increased Artificial Light	High	Low	Low	High	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> Urban specialist species, commonly found breeding in cities to be limited to meet safety standards (no excessive lighting)

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
											<ul style="list-style-type: none"> Lights to be shielded to focus light downward Least disruptive light color to be chosen Post Construction Monitoring to assess the effects of light trespass and determine if any additional mitigation are needed/ feasible
		Effects to Birds and Bird Habitat as a Result of Noise and Vibration Emissions During Construction	High	Moderate	Moderate	Moderate	Moderate	Low	Reversible- On land portions	Not Significant	<ul style="list-style-type: none"> Impact Hammering limited to ensure bedrock contact only on the temporary piles. Impact driving to be timed to the extent possible to avoid breeding bird season Monitoring prior to breeding bird season to determine if or where effect needs to be mitigated Proven mitigations measures available to reduce if or when needed.
									Irreversible- Open water areas		
	Woodland Birds	Noise and vibration emissions during construction	High	Moderate	Low	High	Moderate	Low	Reversible	Not Significant	<ul style="list-style-type: none"> Impact Hammering limited to ensure bedrock contact only on the temporary piles. Impact driving to be timed to the extent possible to avoid breeding bird season Monitoring prior to breeding bird season to determine if or

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
											where effect needs to be mitigated <ul style="list-style-type: none"> Proven mitigations measures available to reduce if or when needed.
		Potential for vehicle or machinery strikes during construction.	High	Low	Low	Low	High	Low	Reversible- Machinery will be removed	Not Significant	<ul style="list-style-type: none"> Similar to general bird effect rationale, however reduced further given the species are woodland specialist and less likely to be encountered Limited avoidance potential, however general mitigations such as employee education and speed limits combined with daily monitoring reduce potential. Adaptive management if death of individuals becomes re-occurring outcome
									Irreversible- Death of individuals would not be reversible		
		Permanent loss of 1.93 ha of woodland habitat	High	Low	Low	Low	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> Represents approx. 3% of the total woodland with a fraction of a percent regionally Discussion with MNRF determined loss of woodlands not expected to significantly effect Provincial SAR Landscape Plan to re-instate as much greenspace as possible using native species
		Alteration of Behaviour as a	High	Low	Moderate	High	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> Existing woodland SAR expected to be tolerant of Urban ambient lights, as they

Valued/ Secondary Component	Sub- Component	Residual Adverse Effect	Ecological and Social Rating	Magnitude Rating	Geographic Rating	Timing Rating	Frequency Rating	Duration Rating	Irreversibility Rating	Significance	Rationale
		Result of Increased Artificial Light									are currently present within an Urban area <ul style="list-style-type: none"> • Light to be limited to meet safety standards (no excessive lighting) • Lights to be shielded to focus light downward, majority of new lighting sources not adjacent to woodland • Least disruptive light color to be chosen • Post Construction Monitoring to assess the effects of light trespass and determine if any additional mitigation are needed/ feasible
		Sensory Disturbance as a Result of Noise Emissions as a Result of Traffic and Maintenance During Operation	High	Low	Moderate	High	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> • Hwy 15 immediately east of woodland in question with Hwy 401 to the north and urban roads throughout, Woodland SAR present expected to be tolerant of traffic noise. • Conservative noise modelling (Jasco 2017) shows limited excessive noise distribution, with greatest distance over the waters <197 m where limited nesting habitat is present, noise quickly dissipates when making landfall.

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	SAR Turtles	Potential for vehicle or machinery strikes during construction.	High	Low	Low	Low	Low	Low	Reversible- Less severe strikes	Not Significant	<ul style="list-style-type: none"> Exclusionary measures to be installed and monitored to ensure properly functioning Daily monitoring with environment professional on site to remove any wayward turtles Worker education and speed limits to reduce potential if turtle gains access. Strict stand-down policy if Turtles are spotted within the construction site. Plan in place in the event turtle is struck and requires treatment If SAR protected species struck, all activities stopped until Parks Canada and/or MNRF can assess the situation and determine if corrective actions are required.
									Irreversible- More serious strikes resulting in severe injury or death		
		Entrapment within the construction Area.	High	Low	Low	Low	Low	Low	Reversible	Not Significant	<ul style="list-style-type: none"> Exclusionary measures to be installed and monitored to ensure properly functioning Daily monitoring with environment professional on site to remove any wayward turtles Worker education and speed limits to reduce potential if

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											turtle gains access. Strict stand-down policy if Turtles are spotted within the construction site
		Nest excavation during construction and causeway removal.	High	High	Low	Low	Low	Low	Reversible- where nests are documented	Not Significant	<ul style="list-style-type: none"> AETC to exclude turtles Main causeway alignment to be of coarser materials then turtle nesting preference Causeway work platforms may be of suitable material, post installation assessment (prior to nesting seasons) by regulators to determine is additional measures are needed to avoid nesting
									Irreversible- were nests are not detected prior to excavation		<ul style="list-style-type: none"> Daily monitoring to ensure exclusionary barriers are functioning and remove any individuals from construction area. Plan in place if nest is discovered (isolate for suitable duration or transport to appropriate facility)
		Crushing of hibernating individuals during construction activities.	High	Moderate	Low	High	Low	Low	Irreversible	Not Significant	<ul style="list-style-type: none"> AETC to exclude turtles prior to winter placement of materials.
		Effects to SAR Turtles from	Moderate	Low	Moderate	High	Low	Low	Irreversible	Not Significant	<ul style="list-style-type: none"> The AETC provides a buffer between the work

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		Construction Lighting									area/causeway and the remainder of the River <ul style="list-style-type: none"> Light is not expected to be a proximal cue for overwintering arousal.
		Potential reduction in available nesting habitat during construction.	High	Moderate	Low	High	High	Moderate	Reversible	Not Significant	<ul style="list-style-type: none"> Small percentage of available nesting habitat to be unavailable during construction ECCC indicated nesting habitat availability not a limiting factor for Cataraqui turtle populations
		Potential loss in overwintering habitat during construction and years following	High	Moderate	Low	High	High	Moderate	Reversible- Non and partial burying species	Not Significant	<ul style="list-style-type: none"> Overwinter habitat expected to be available immediately after constriction for non-burying species With infill of the 100 mm void overwintering habitat to become available for smaller burying species and larger partial burying species Potential permanent loss of habitat for large snapping turtles wanting to fully bury, however footprint is <1% of the other suitable habitat within PSW. Not expected to be a measurable effect on any turtle species
									Irreversible- burying species		

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Other SAR	Monarch Butterfly	Potential for vehicle or machinery strikes during construction.	High	Low	Low	High	High	Low	Irreversible	Not Significant	<ul style="list-style-type: none"> Re-occurring effect on any Southern Ontario construction project Reduced potential as Study Area is not a staging area Limited avoidance potential, however general mitigations such as employee education and speed limits
		Reduced habitat availability	High	Moderate	Low	High	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> Limited milkweed habitat within woodland or urban areas Milkweeds known to colonize disturbed areas Exact relationship between pre-post milkweed abundance is unknown but not expected to be influence regional or provincial populations.
Archaeological and Cultural Heritage Resources	80 Gore Road Property	Use of the library and library property as a library, community centre and event facility may be constrained or disturbed by noise and construction activities	High	Low	Moderate	High	High	High	Reversible	Not Significant	<ul style="list-style-type: none"> features on the property such as Hawthorn Cottage and the Dry-Stone Wall are identified as cultural heritage resources, and the entire property is protected under Part IV of the Ontario Heritage Act mitigation measures have been proposed by a licensed archaeologist to protect cultural heritage resources at this location from sustaining damages during construction

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											<ul style="list-style-type: none"> noise disturbances and other pre-operation effects of the Project will desist entirely once construction is complete
		Vibration from construction activity could damage Hawthorn Cottage and the Dry-Stone Wall on the property	High	Low	Moderate	Low	Low	Low	Irreversible	Not Significant	<ul style="list-style-type: none"> Hawthorn Cottage and the traditional Dry-Stone Wall landmarks are distinct cultural heritage resources and contribute meaningfully to the property's historical and community significance The design of the bridge approach along Gore Road has been created to reduce the likelihood of this effect occurring as much as possible, and to quickly identify any damage that does occur. Methods for preliminary evaluation, continued monitoring, and restoration activities for Hawthorn Cottage and the Dry-Stone Wall have been proposed by a licensed archaeologist to ensure the integrity of these structures is maintained.
		Use of the library and library property as a library, community centre and event facility	High	Low	Moderate	High	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> The widening of Gore Road will infringe slightly into the existing library property, increasing the proximity of the road to the library.

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		may be constrained or disturbed by bridge traffic during operation									<ul style="list-style-type: none"> The bridge approaches and Gore Road itself have been designed to remain as far from the property as possible, in order to minimize the increase in proximity between road traffic and the library. The widening of Gore Road and increase in traffic resultant from bridge construction are not anticipated to significantly alter the existing noise and traffic conditions near the property that already exist from the operation of Highway 15.
	Archaeological Site BbGc-127	Site may be disturbed by site preparation or construction activities.	High	Low	Moderate	Low	High	Low	Irreversible	Not Significant	<ul style="list-style-type: none"> Archaeological Site BbGc-127 located along the eastern shore of the Cataraqui River may be disturbed by site preparation or construction activities of the Project. Mitigation strategies for the prevention of such disturbances developed by a licensed archaeologist include the installation of a barrier over Site BbGc-127 prior to any Project preparation or construction activity.

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											<ul style="list-style-type: none"> Duration of risk for this potential effect limited to pre-operation phases.
Visitor Experience and Recreational Opportunities		Noise and particulate emissions during construction.	High	Moderate	Moderate	High	High	Low	Reversible	Not Significant	<ul style="list-style-type: none"> The Cataraqui River and surrounding area is a valuable economic and cultural resource in terms of visitor experience and recreational opportunities. While there are urban areas that surround the Cataraqui River and its recreational spaces, the Project Location spans coastal and aquatic areas previously unaffected by such extensive development. The effects of increased noise and particulate emissions will impact areas outside of the Project Location but are not anticipated to impact areas beyond the immediate vicinity of the Project Location. effects of increased noise and particulate emissions temporary during construction.
		Restricted area access which may deter visitation from prospective or	High	Moderate	High	High	High	Low	Reversible	Not Significant	<ul style="list-style-type: none"> During bridge construction, access to the Project Location will be restricted to the public to ensure the safety of visitors

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		established visitors during construction.									and the security of the Project. <ul style="list-style-type: none"> While restrictions will strive to limit inconvenience to the public as much as possible, visitors will not have the unimpeded access available during baseline conditions. Effect will persist for the duration of pre-operation phases only; once construction has ended, and the bridge is complete, full public access to both terrestrial and aquatic areas will be re-established.
		Reduced visitor safety during construction.	High	Moderate	Moderate	Moderate	High	Low	Reversible	Not Significant	<ul style="list-style-type: none"> Mitigation strategies will reduce the risk to safety of visitors to surrounding areas, including the safety of rowers and other people aboard watercraft in the navigable channel during construction over and around these areas. Strategies include the installation of on-land and on-water signage notifying the public of the boundaries of construction zones and launching boat crews on-water to direct the public away from areas of water work.

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											<ul style="list-style-type: none"> Bridge Design and Construction Methodology included as Appendix B has been developed with considerations for visitor safety throughout.
Navigation		Disruption to navigation during construction	High	Low	Low	High	High	Low	Reversible	Not Significant	<ul style="list-style-type: none"> Extensive mitigation strategies have been developed and incorporated into the Bridge Design and Construction Methodology (Appendix B) Potential to cause short delays to watercraft passing through the Project Location Following the completion of the bridge, navigation will be fully unimpeded and return to current state.
Hydrologic Processes		Openings within the causeway during construction will affect water velocities and direction within the Study Area with the potential to affect erosional (scouring) and depositional areas.	Low	Low	High	High	High	Low	Irreversible	Not Significant	<ul style="list-style-type: none"> local area that will be impacted is anticipated to have a high resilience to the effect of local changes in hydrology The effects of the increased velocities will occur for the duration of the full causeway installation but are expected to normalize once the causeway is removed.

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Terrestrial Wildlife	Eastern Gartersnake and Dekay's Brownsake	Potential loss of hibernacula, basking areas, shedding sites and foraging grounds due to tree clearing within the Project Location.	Low	Low	Low	Moderate	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> No known Hibernacula's within Project Location or Study Area Unlikely Large concentrations of snakes occurring within the Urban Area as a result of historic road mortalities
		Vehicle collisions during construction	Low	Low	Low	High	Low	Low	Irreversible	Not Significant	<ul style="list-style-type: none"> Despite the potential mortality, populations are tolerant of low levels of mortality. Exclusionary fencing will prevent a majority of collisions Construction activities cannot avoid any peak seasons for animal-vehicle collisions
		Vehicle collisions during operation	Low	Low	Low	High	Moderate	High	Irreversible	Not Significant	<ul style="list-style-type: none"> Collision with snakes during operations is similar to construction in all regards with the exception of elevated frequency and duration
	Semi-Aquatic Mammal Species	Potential reduction in continuous aquatic habitat connectivity and fragmentation of riparian areas during construction.	Low	Moderate	Low	High	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> Eco-passages and causeway opening to maintain connectivity Current habitat of low value
		Vehicle collisions with semi-aquatic mammals during operation.	Low	Low	Low	High	Low	Low	Irreversible	Not Significant	<ul style="list-style-type: none"> Common fur bearing species, tolerant to accidental or regulated (trapping) loss

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											<ul style="list-style-type: none"> • Mobil species, that should be protected by construction speed limits with onsite monitoring detecting any re-occurring problem
	Other Terrestrial Mammals	Loss of general habitat, breeding grounds, foraging grounds, hibernation areas, and dens; and vehicle-animal collisions throughout construction activities.	Low	Moderate	Low	Low	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> • Natural areas within Project Location represents small percentage <3% of the Study Area and lesser percentage of Regional Area. • No overwinter congregations occurring (deer overwintering) • Relatively low value habitat • Construction speed limits and daily monitoring to avoid/report any re-occurring problems
		Vehicle collisions with other terrestrial mammals during operation.	Low	Low	Low	High	Low	Low	Irreversible	Not Significant	<ul style="list-style-type: none"> • Common effect throughout the Province • Primarily an Aquatic Project, with potential limited to eastern shoreline area.

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Terrestrial Vegetation		The loss or reduction of known significant woodland within the Project Area.	High	Low	Low	High	High	High	Irreversible	Not Significant	<ul style="list-style-type: none"> • <3% of the Significant Woodland are • City designated Significant Woodland, with this designation built into the routing criteria during project planning • All tree removal permits issued through the City.
Air Quality		Limited effects to construction workers, recreational users, surface water quality and aquatic habitat as a result of air emissions including dust during construction.	High	Low	Moderate	Moderate	High	Low	Reversible	Not Significant	<ul style="list-style-type: none"> • Overall, there will be limited effects to construction workers, recreation users, surface water quality and aquatic habitat as a result of air emissions including dust during construction • Site preparation, construction methodology and other mitigation measures will serve to reduce the potential for adverse effects on the air quality.