



City of Kingston Third Crossing of the Cataraqui River -
Parks Canada Environmental Impact Analysis
Detailed Impact Analysis Report - Section 8

December 2, 2019

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

Detailed Impact Analysis Report - Section 8

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8. Monitoring and Follow-Up

The following provides an outline of the pre- construction, construction and post construction, monitoring and follow-up commitments proposed to be undertaken to ensure quality control and quality assurance during the site preparation, construction, site restoration and rehabilitation, and operation phases of the Project.

The commitments proposed herein represent an integral part of the federal environmental assessment process, providing a mechanism to validate the pre-construction environmental conditions; that mitigation measures are working effectively and as intended; and confirm the significance and determination of residual adverse effects. The IPD Team (comprised of the City of Kingston, Kiewit, Hatch and Systra) understands and acknowledges that these important commitments will form part of the conditions of approval of the Project from PCA as a federal land manager, as well as in meeting their legal and mandated obligations to protect Canada's natural heritage; as well as the responsibilities of other relevant authorities. The IPD Team is committed to working with PCA and other relevant authorities, their specialists and scientists, as well as other subject matter experts, in finalizing the monitoring plans proposed herein within the timelines specified, prior to implementation.

8.1 Construction Environmental Management Plans

Twenty-three Environmental Management Plans (EMP)s and other plans will be compiled and submitted for approval by PCA and other relevant authorities, as required. Table 8.1-1 outlines the EMPs and other plans and provides a brief description. EMPs must be approved by the relevant authorities prior to construction. These plans will be site-specific with clear and concise directions to those working on-site.

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Table 8.1-1: Proposed Construction Environmental Management Plans

Plan	Description	Reviewing Authority	Timing
Environmental Management Plan	Details the proposed mitigation measures that will be implemented during construction.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Air Quality and Dust Management Plan	Identifies the specific mitigation measure to be implemented on-site.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Site Dewatering and Wastewater Plan	Provides a description on how wastewater from dewatering operations will be managed and mitigated on-site.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Spill Prevention and Response Plan	Provides prevention measures, a spill response protocol, as well a monitoring and reporting procedure in the event of a release to the environment.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Environmental Training and Awareness Plan	Outlines the training program that will be implemented and associated training topics.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.

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Plan	Description	Reviewing Authority	Timing
Fire Protection Plan	Provides procedures and communication protocol in the event of a fire onsite.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Aquatic Resources Management Plan	Outlines aquatic species and sensitive habitat relevant to the Project. It will provide mitigation measures, as well as procedures to be used and a proposed monitoring program.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Fuel Management Plan	Outlines how fuel will be stored and managed on site. It will also provide mitigation measures and re-fueling procedures.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Hazardous Materials Management Plan	Provides methods and procedures for the management, storage and disposal of hazardous materials on-site.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Heritage and Archaeological Resource Plan	Provides information on the cultural resources that are known within the Project Location, as well as to provide procedures on identifying and protecting heritage resources.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.



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Plan	Description	Reviewing Authority	Timing
Invasive Species Management Plan	Outlines the invasive species known onsite and provide procedures for the management of invasive species onsite.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Noise, Vibration, and Ambient Light Management Plan	Outlines potential impacts to the environment resulting from noise, vibration and ambient light, as well as to describe the site-specific mitigation measures.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Site Restoration Plan	Provides mitigation measures and procedures for all areas of the site that will be restored.	PCA	Developed prior to restoration phase. To be approved by PCA prior to construction.
Species at Risk Protection Plan	Identifies Species at Risk and their habitat, as well as provide strategies on how to protect and manage these species on site.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Surface Water Management, Erosion and Sediment Control Plan	Provides a description of the in-water works to take place and outline mitigation measures, erosion and sediment controls, and best management practices to minimize sediment entering into a waterbody. This plan will also provide a monitoring program to ensure measures are effective.	PCA; CRCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.

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Plan	Description	Reviewing Authority	Timing
Vegetation Protection Plan	Describes the vegetation communities that are present within the Project Location and outline mitigation measure for the protection of vegetation.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Transportation Management Plan	Provides provide a general overview of how transportation and traffic will be managed onsite, as well as federal, provincial and municipal guidelines.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Waste Management Plan	Provide Project objectives on how waste will be managed, stored and disposed of offsite.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Wildlife Protection and Management Plan	Outlines the Project activities that have the potential to affect wildlife, and will describe mitigation requirements, maintenance, and a monitoring program.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Lighting Plan	Supports Project lighting design. Specifically, to ensure Project operational requirements are met while minimizing adverse effects to wildlife, navigation and visitor experience.	PCA	To be approved by PCA during construction phase.



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Plan	Description	Reviewing Authority	Timing
Community Action Plan	Establishes protocols for use by the City for notifying the general public of any service interruptions, and addressing public issues and concerns arising from bridge construction activities and the subsequent use and maintenance of the bridge.	PCA	Prepared prior to site preparation phase. To be finalized prior to construction.
Visitor Safety Plan	Establishes measures and procedures to ensure visitor safety during the construction phase of the Project.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Soil Management Plan	Outlines the soil management procedures of the Project.	PCA	Developed prior to site preparation phase. To be approved by PCA prior to construction.
Stormwater Management Plan	Outlines the strategy and detailed design of the stormwater management works for the land features of the bridge crossing, which include the east and west roadway approaches, bridge structure and Highway 15 intersection improvements.	PCA; MECP; CRCA	Finalized prior to construction of stormwater management facilities

8.2 Components

8.2.1 Surface Water Quality

A summary of surface water quality results from upstream and downstream of the Project Location are summarized in Section 2.2.4. Prior to construction, samples will be collected immediately upstream and downstream of the Project Location and compared to the results outlined in Section 2.2.4. This will ensure that any changes in water quality are documented prior to any potentially affecting construction activities.

In addition to the multi-parameter samples, real-time data loggers were deployed in September 2019. These units are set-up to collect hourly measurements of turbidity, pH, total suspended solids, temperature, dissolved oxygen and conductivity. Details on the data loggers and the sampling parameters are summarized below.

In addition to pre-construction sampling activities, additional hydraulic modelling activities will take place to predict the effect that the installation of the western and eastern causeways may have on water flow patterns and attempt to correlate those changes into potential water temperature effects within the Study Area. This study will utilize either Telemac 3d and/or Blue Kenue software to achieve industry standard, well-rounded predictions regarding potential effects on the water temperatures throughout the Study Area as a result of restrictions in water flow.

The Project has proposed a surface water monitoring program to be implemented during the construction period to monitor the water quality within the Study Area. Surface water will be monitored upstream and downstream of the Project Location and trigger adaptive management provisions as required. Monitoring and testing will be adaptable to changing site conditions and will capture any event/incident for the length and scope of that event. Parameters to be monitored in real time (continuous via dataloggers) include those most likely to be affected by construction activities: turbidity, pH, temperature, dissolved oxygen and conductivity. Table 8.2-1 outlines the CCME Quality Guidelines for the above parameters. Specifically, the construction surface water monitoring program will include the following activities:

- Monitoring dataloggers have been installed to provide a baseline of water quality parameters and to provide samples for development of total suspended solids versus turbidity relationship for use during construction;

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any TSS samples sent to the lab should be accompanied by a field turbidity measurement in order to develop the relationship curve.

- Prior to ice conditions on the river, the dataloggers will be retrieved and deployed in a more robust fashion for winter construction. The loggers can be horizontally mounted approximately 80 cm below the marine buoys center of gravity at the water surface level, in order to maintain the sonde below the ice, (accounting for 1:50 year ice thickness of 78 cm). The sondes will be protected by insertion into a 4" PVC tube that's perforated with adequate holes to allow flow and an aluminum well head cap. The will be on affixed to 5/16" chain with Working Load Limit (WLL) of 1900 lbs, and all connection point shackles 3/8" with 4000 lbs WLL and anchored using 15 lbs mud anchors or equivalent. The data loggers will be locked in place by the ice but will be protected within the Marine Buoy. The operating temperature range for the data logger is -20° to +70°, therefore transmission of the data could become problematic in climate extremes. The data loggers will be periodically spot checked at the install locations with GPS once ice begins to form on the river to ensure they aren't drifting with the ice flow. The ice break-up in the spring poses a potential to become problematic, however it is not expected to be problematic, given the flow rate of waters not found within the main channel, and potential ice flow protection provided by the causeway. If the data loggers due become problematic, an ice auger will be used to drill holes at select locations and handheld sondes will be used to confirm the conditions on a daily basis, with in-situ grab samples collected weekly.
- Additional loggers and/or handheld units will ensure at least daily in-situ sampling is occurring as construction progresses to monitor conditions during high risk work activities such (such as returning treated water to the river, trestle bridge installation, causeway installation, pile driving, etc.).
- When working in areas with potentially contaminated sediment, collect daily water samples to monitor water quality within the turbidity curtains, as well as upstream and downstream of the location. When measuring values outside of the curtain, a comparable instrument similar to the real-time data loggers will be used. Water quality samples for turbidity, pH and conductivity will be collected within the turbidity curtains to monitor the movement of any sediment within the turbidity curtain. This daily sampling data will be compared to the upstream and downstream data logger data

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and will be used as an early indicator to detect if sediment is migrating outside of the turbidity curtain. If a release of sediment from within the AETC occurs where the TSS within the AETC exceeds 25 mg/L, conduct sampling and analysis of the water upstream and downstream of the work area of total and dissolved metals, PAHs, pH, TSS and turbidity.

- Development of a weekly memo detailing the construction activities that were occurring during sampling and the results of the surface water quality sampling from the real-time data loggers.

Table 8.2-1: Water Quality Guidelines for Total Particulate Matter for the Protection of Aquatic Life

Parameter	CCME Guideline
Suspended Sediments	25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).
Turbidity	Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer-term exposure (e.g., 30-d period). Maximum increase of 8 NTUs from background levels at any one time when background levels are between 8 and 80 NTUs. Should not increase more than 10% of background levels when background is >80 NTUs. Note: it is proposed that the turbidity limits above only apply until a site specific TSS vs NTU correlation is approved.
pH	6 – 9
Dissolved Oxygen	6.0 mg/L
Temperature	Potential thermal effects will be monitored to ensure that thermal conditions are not altered from those existing prior to Project activities that may alter flows to a degree where thermal properties could be effect. The potential for this affect is most prevalent within the summer months of June through September Maximum Weekly Average Temperature: Thermal effects to receiving waters should be such that the maximum weekly average temperature is not exceeded.

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In regard to post-construction monitoring, inquiries will be submitted to the Ontario Stream Monitoring Network as well as CRCA to determine if any monitoring plans are planned to continue within the lower reaches of the Cataraqui River. If not then sampling will occur in conjunction with the Aquatic Vegetation monitoring during Years 1, 3 and 6 to document any long-term or delayed Project effects to surface water quality in regard to the parameters described above. A report of the findings will be developed by January of the following year and include a summary of the year's findings and a comparison to pre-construction surface water quality data. The report will also detail any corrective measures, incidents and provide recommendations to further improve surface water quality in the area. A final post-construction monitoring plan will be developed within one year of DIA approval.

8.2.1.1 Cyanobacteria

As described in Section 3.1.4.1, the Project has the potential to increase Cyanobacteria within the Study Area. Visual surveys completed on foot and by drone are able to detect any cyanobacteria blooms, and any public or agency observations will be responded to immediately. Site visits will occur monthly from June through September during the construction phase of the Project and will be conducted visually throughout the Study Area from the shorelines and via boat or drone. Additional surveys will take place if elevated levels of Total Suspended Solids are detected via dataloggers.

8.2.2 Sediment Quality Sampling

As described in Section 2.2.4.2, sediment quality investigations have occurred in 2010, 2016 and 2018. To supplement those findings additional sediment quality collection and analysis will be undertaken in 2019. The following sampling program is proposed:

- In-water sediment sampling and testing will be undertaken at six proposed sampling locations within the previous Music Marina Site and 14 proposed additional sediment sampling locations within the Study Area (Figure 8.1).
- Baseline sediment sampling locations were selected based on the following criteria, (i) Music Marina - upstream and downstream of the former docks to determine potential impacts associated with the marina activities, (ii) Causeway - samples along the causeway and upstream and downstream to provide a snapshot of pre-construction conditions. Samples for the causeway were based on sediment transport modelling.

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- The testing program includes the following:
 - ◆ 20 grain size soil tests in sediment.
 - ◆ 20 environmental sediment sample tests will be undertaken and will include the following standard testing against CCME Interim Sediment Quality Guidelines (ISQG) and Probable Effect Level (PEL) – Sediment Standards: VOCs/Petroleum Hydrocarbons F1-F4, PAHs, Metals, Polychlorinated Biphenyls (PCBs) including Aroclors, total PCBs, Organochlorine Pesticides, Organochlorine Pesticides/Polychlorinated Biphenyls, Organophosphorus Pesticides, Carbamate Pesticides, Dioxins and Furans, PFAs (Standard List).
- Additional environmental lab testing will be completed on previously collected (2018) samples obtained below the riverbed to further investigate the in-water clay deposit.

Five samples will be selected from the upper clay strata, two in the mid clay strata and three in the lower clay strata; accordingly, these samples will be shipped to AGAT Laboratories located in Hamilton, Ontario, and tested for metals.

- Analysis Locations for Clay Strata Sample Areas by Borehole Number, Split Spoon Sample Number, Depth in metres below river bed:
 - ◆ Upper Clay Strata:
 - BH18-101 SS6 3.96 m
 - BH-18-104 SS6 3.66 m
 - BH-18-105 SS5 3.05 m
 - BH-18-107 SS6 3.96 m
 - BH-18-111 SS2 1.22 m
 - ◆ Mid Clay Strata:
 - BH-18-102 SS11 10.04 m
 - BH-18-110 SS8 5.49 m

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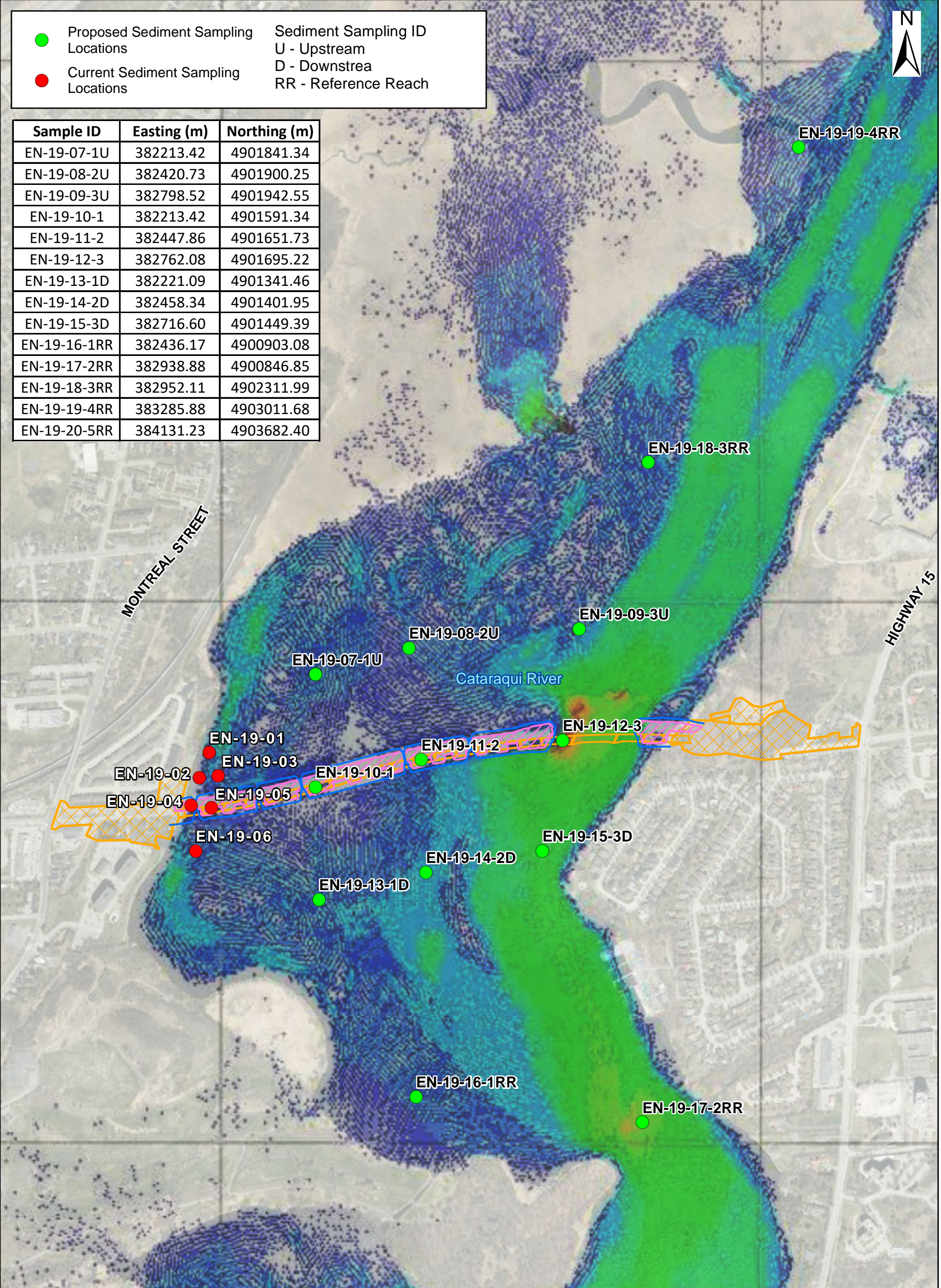
- ◆ Lower Clay Strata:
 - BH-18-102 SS19 34.44 m
 - BH-18-104 SS17 19.2 m
 - BH-18-110 SS15 35.96 m
- Testing will be carried out at three test pits in the peat removal area on the west shoreline to assess the condition of the peat strata. The sampling locations are planned to assess the peat to be excavated near the west abutment of the bridge. Sealed samples will be sent to AGAT Laboratories. Each of the three test pits will be sampled as follows:
 - ◆ One peat sample will be taken at a depth of ranging from approximately 2.0 to 2.5 m below surface and analyzed for PHC, PAH, PCB, EC, SAR, Metals & Inorganics and TCLP tests.
 - ◆ Three composite samples will be prepared of equal portions. One of the three composite samples will be submitted for testing. The remaining two samples will be kept in lab for one month as back up samples in the event additional tests are required. The design parameters to be tested for TCLP testing includes: TCLP VOC, TCLP PAH, TCLP PCB, TCLP Metals & Inorganics.
- Testing will also be completed along the east shoreline in three designated zones near the east abutment of the bridge where site stripping will take place, in order to investigate the surficial soft clay strata within top 0.5 m. Two samples per designated zones will be collected for a total of six samples. Within each designated zone one will be analyzed for PHC, PAH, PCB, EC, SAR, Metals & Inorganics, with remaining TCLP analyzed for TCLP VOC, TCLP PAH, TCLP PCB, TCLP Metals & Inorganics.

There is a future commitment to sample sediment quality post construction to determine whether construction has had an impact on the horizontal and vertical distribution of contaminated sediments. Post construction sampling will be completed at similar locations to baseline sampling locations for comparison purposes.

User Name: vlll77807

● Proposed Sediment Sampling Locations	Sediment Sampling ID
● Current Sediment Sampling Locations	U - Upstream
	D - Downstream
	RR - Reference Reach

Sample ID	Easting (m)	Northing (m)
EN-19-07-1U	382213.42	4901841.34
EN-19-08-2U	382420.73	4901900.25
EN-19-09-3U	382798.52	4901942.55
EN-19-10-1	382213.42	4901591.34
EN-19-11-2	382447.86	4901651.73
EN-19-12-3	382762.08	4901695.22
EN-19-13-1D	382221.09	4901341.46
EN-19-14-2D	382458.34	4901401.95
EN-19-15-3D	382716.60	4901449.39
EN-19-16-1RR	382436.17	4900903.08
EN-19-17-2RR	382938.88	4900846.85
EN-19-18-3RR	382952.11	4902311.99
EN-19-19-4RR	383285.88	4903011.68
EN-19-20-5RR	384131.23	4903682.40



Document Path: T:\Maps\GIS_Data\CityOfKingston\MXD\K3C_DIA_Fig8-1_Current&ProposedSedimentSampling_AODA.mxd

Legend

Project Location

- Aquatic Exclusionary Turbidity Curtain (AETC)
- ▨ Temporary Construction Components

DATA SOURCES:

- Spatial References: NAD 1983 UTM Zone 18N
- Sources: Roads, Wetland - Land Information Ontario
- Hydraulic Modelling, Normal Conditions, Hatch 2019.

0 87.5 175 350
 Meters
 1:8,000

Project: City of Kingston - Third Crossing

Figure Title: Current & Proposed Sediment Sampling Locations with Normal Conditions

Prepared By: HATCH SYSTRA
 Kiewit

Date: November 18, 2018

Figure: 8-1 **Page:** 1 of 1

8.2.3 Groundwater Quality/Quantity

Groundwater sampling was conducted during the validation Project phase. Two sets of monitoring well have been installed on the west (BH-19-102 and BH-19-103) and east (BH-19-405 and BH-19-501) in April 2019 to facilitate baseline groundwater monitoring and monitoring during construction. All have been sampled for VOCs, TPH and metals and will be compared to Provincial water quality standards (Ontario Regulation 169/03 Drinking Water Standard) and CCME Guidelines for Canadian Drinking Water Quality.

In addition to collecting the groundwater samples, the groundwater elevation will also be recorded to provide a baseline compared to the river/Lake Ontario water elevation to determine if the relationship between groundwater elevation described in Section 2.3.1 is still relevant. If it is, that loose relationship could be carried forward in the event there any unexpected groundwater level changes as a result the Project.

Groundwater on the west and east approaches could be affected by construction activities due to accidental spills. The two monitoring wells (BH-19-102 and BH-19-103) and (BH-19-405 and BH-19-501) located on the west and east approaches, will allow monitoring to occur over the duration of construction. Measurement of groundwater elevations will be recorded at each sampling time prior to any sampling or purging of the borehole. Groundwater sampling frequency will occur quarterly (Spring, Summer, Fall and Winter) until Project completion in order to determine if groundwater quality is affected by construction activities throughout the construction stage. If anomalies recorded in comparison to baseline or previous sample results the frequency will increase to monthly with applicable agencies informed. A quarterly memo will be prepared to communicate the results of the groundwater monitoring with comparisons to pre-construction values. If the monitoring plan increases to monthly sampling, a memo should instead be produced monthly throughout the duration of the construction phase.

8.2.4 Benthic Invertebrate Community

To document the temporary loss and provide a reference for post-construction monitoring, a benthic invertebrate sampling program is proposed. The objective of the monitoring program is to determine the actual specific composition of the community living in the Project Location and

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assess its biological characteristics (diversity, density). A sampling program is proposed to occur in the summer of 2020. An appropriate wetland sampling design will be developed prior to April 15, 2020 for submission and review by PCA. The program is expected to be based on the Provincial Ontario Benthos Biomonitoring (OBBN) or Federal Canadian Aquatic Biomonitoring Network (CABIN) protocols for wetland sampling but will likely require modifications to account of the water depth and non-wadable conditions the PSW presents. Appropriate reference areas upstream and downstream of Project Location will be selected with an appropriate number of samples or organisms collected for statistical analysis. Samples will be assessed for relative abundance, species richness with Simpson, Sampson Weaver and EPT Indices. 2020 upstream and downstream reference reaches will be placed using the hydraulic modelling to find locations with lower anticipated flow changes to better mimic baseline conditions.

Given the links between substrate infill, macrophyte growth, and invertebrate production all contributing to the overall productivity of fish, post-construction monitoring will be completed during the same intervals as described in the vegetation monitoring (Year 1, 3 and 6). A minimum of 2 sample locations per AETC cell will be assessed post construction with results compared the upstream and downstream reference reaches to determine if or when the causeway is contributing a non-significant difference then the reference reaches. Results will be presented within the annual post construction reporting, with recommendations and suggestions to improve invertebrate usage if results do not appear to be moving towards the ultimate goal of achieving similar productivity of the upstream or downstream reaches.

8.2.5 Aquatic Vegetation Wetland Documentation

To monitor the restoration of wetland area and aquatic vegetation affected by the Project, a drone-based vegetation survey was conducted in 2019 (pre-construction). The 2019 pre-construction survey documented the habitat along pre-determined transects in both the Project Location and potential areas impacted by flow alteration. To capture these images, a drone flew a grid pattern within the in-water portion of Project corridor. Following the collection of images, a photogrammetry software was used to process the imagery into orthophotos. The survey combined both drone photography with complimentary habitat transects (2019) documenting vegetation species,



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relative abundance and coverage within the upper portions of the water column; GIS software will be used to quantify the total surface coverage of aquatic vegetation.

Program timelines have been set to coincide with the Project's construction phase, and the vegetation recovery progression observed within the area of the former Music Marina (since it's purchase in support of the Project). The aerial surveys completed in conjunction with ground or water transects, will document vegetation species relative abundance and coverage within the upper portions of the water column for comparison to post construction to determine when the construction Project Location has re-colonized to an acceptable level.

Transitioning into post construction monitoring the drone imagery will act as photographic record of the vegetation. Over the course the monitoring program the vegetation extent documented in the orthophotos will be compared to determine how the vegetation has been impacted and is recovering following Project construction. Based on Music Marina results, vegetation is expected to recover to 50-70% surface coverage within 6 years, monitoring is proposed for Years 1, 3 and 6 after construction or until vegetation restoration goals have been met. Results of the 2019 pre-construction monitoring of Music Marina and navigational channel demonstrates that passive revegetation should occur within 6 years when substrate conditions are suitable for vegetation growth considering the Music Marina and navigational channel (where dredging activities ceased in 2013) were indistinguishable from the surrounding area in 2019. Similar to the construction footprints, the post construction program will also monitor the Seawall and point removal being completed to increased wetted areas and offset the loss of wetted areas by the permanent in-water Project components.

Results will be presented within the annual post construction reporting for Years 1, 3 and 6 and will be completed by January of the following year. The report will include recommendations and suggestions to improve vegetation cover if results do not appear to be moving towards the ultimate goal of achieving similar vegetation abundance and diversity within the Project footprint.

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Table 8.2-2 below outlines the proposed monitoring and associated timeframes.

Table 8.2-2: Aquatic Vegetation Monitoring Plan Summary

Project Area or Component	Monitoring Task or Objective	Proposed Timeframe	Proposed Methodology
East and West Shorelines	Monitor shoreline reclamation progress and note any significant deficiency leading or potentially leading to sediment and erosion concerns	September of Years 1, 3 & 6	Transect the entire shoreline impacted during construction with a continuous photographic or video record, capturing from the waters edge to the top of bank or where natural pre-construction vegetation is encountered. Detailed Ecological Land Classification or Ontario Wetland Evaluation System type mapping of the shoreline and its vegetation communities extending from the waters edge to the top of bank or 100-yr flood level of 76.3 masl. Photograph or video the entire area and if possible, from a high vantage point such as the bridge or drone.
East and West Causeway Access	Monitor Naturalization of the Disturbed Area	September of Years 1, 3 & 6	Document sediment accumulation within the area with 9 established sediment measuring location (3 shoreline, 3 mid section and 3 off shore) to be place on Year 1 of monitoring. Estimate vegetation cover per square meter within the marina and delineate any areas differing by 25% of coverage or dominant community change.

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Project Area or Component	Monitoring Task or Objective	Proposed Timeframe	Proposed Methodology
			Photograph the entire area and if possible, from a high vantage point such as the bridge or drone.
Music Marina and Navigational Channel	Monitor Naturalization of the Music Marina and Navigational Channel	September of Years Pre, 1, 3 & 6	Estimate vegetation cover per square meter within the marina and delineate any areas differing by 25% of coverage or community change. Photograph the entire area and if possible, from a high vantage point.

8.2.6 Marsh Breeding Bird Monitoring

Supplemental data (Marsh Monitoring Program data points) has been requested from Bird Studies Canada in order to develop a baseline for construction and post-construction monitoring. If available, sample locations will be duplicated during construction as well as in Years 1 and 6 post construction following the below protocol. It is assumed that noise levels of <55 dba noise will be emitted upon the Mash during the breeding bird season as previously described within the DIA. Working under that assumption it is likely the first year of construction would be representative of baseline conditions.

Marsh Breeding Bird monitoring will take place twice yearly between May 15 and July 1 during construction, and during the first and sixth year during the post-construction operation phase of the Project. Surveys will follow Bird Canada’s Marsh Monitoring Program (MMP). Accordingly, surveys will be taking place a minimum of 10 days apart. Survey locations will be established near Belle Island, the northern cattail marsh and the eastern and western shorelines. Survey locations must be located over 250 m away from one another. Surveys can be conducted in either the morning or evening but must remain consistent once a time period is established for each track of stations. Morning surveys can begin as early as 30 minutes before sunrise and must

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be completed by 10:00 am. Evening surveys can begin as early as four hours before sunset and must be completed by the onset of darkness. All surveys will occur when the weather conditions are warm and dry with little wind, and otherwise favorable for bird observations.

Surveys are comprised of a five minute (passive) listening period, followed by 5 minutes of call broadcasting (using the broadcast CDs) to elicit calls, followed by a second 5-minute passive listening period, for a total of 15 minutes. Broadcasted bird calls are focused on species which normally remain quiet unless provoked via a calling:

- Virginia Rail
- Sora
- Least Bittern
- Common Moorhen
- American Coot
- Pied-Billed Grebe.

All bird species heard or seen within a 100 m semi-circle of the established station will be recorded. Aerial foragers and non-focal species will be tallied separately if observed flying outside the 100 m station boundaries. Focal species, as listed within the MMP are tallied regardless of the distance from the established stations. Table 8.2-3 below summarized the marsh breeding bird monitoring plan.

Table 8.2-3 : Marsh Breeding Bird Monitoring Plan Summary

Project Area or Component	Monitoring Task or Objective	Proposed Timeframe	Proposed Methodology
East and West Shorelines	Monitor existing sound levels during construction (year 0).	Twice between May 15 – July 1.	Year 0: Establish 2-3 survey stations on each shoreline. Can be completed during the morning or night depending on site preferences. Use handheld GPS to document each station established.

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Project Area or Component	Monitoring Task or Objective	Proposed Timeframe	Proposed Methodology
	Document present species in years 1 & 6	(Years 0, 1 and 6)	Document species as per MMP Year 1: Revisit established stations, document species Year 6: Revisit established stations document species
Northern Cattail marsh	Monitor existing sound levels during construction (year 0). Document present species in years 1 & 6	Twice between May 15 – July 1. (Years 0, 1 and 6)	Year 0: Establish 3-5 survey stations. Can be completed during the morning or night depending on site preferences. Use handheld GPS to document each station established. Document species as per MMP Year 1: Revisit established stations, document species Year 6: Revisit established stations document species
Marshes surrounding Belle Island.	Monitor existing sound levels in during construction (year 0). Document present species in years 1 & 6	Twice between May 15 – July 1. (Years 0, 1 and 6)	Year 0: Establish 1-2 survey stations. Can be completed during the morning or night depending on site preferences. Use handheld GPS to document each station established. Document species as per MMP Year 1: Revisit established stations, document species Year 6: Revisit established stations document species

Results will be presented within the annual post construction reporting for Years 1 and 6 and will be completed by January of the following year. The report will include recommendations and suggestions to improve bird abundance and diversity if results do not appear to be moving towards the

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ultimate goal of achieving similar populations to pre-construction within the Project footprint.

8.2.7 Amphibian Call Monitoring

Supplemental data (Marsh Monitoring Program data points) has been requested from Bird Studies Canada in order to develop a baseline for construction and post-construction monitoring. If available those locations will be duplicated.

Amphibian call monitoring will take place three times yearly between April 5 and July 5 during construction, and during the first and sixth year during the post-construction operation phase of the Project. Surveys will follow Bird Canada’s MPP for amphibian call surveys and take place with at least 15 days between each survey. Surveys will take place one-half hour after sunset and should be completed prior to midnight. Air temperatures surveys should meet the minimum temperatures of 5°C, 10°C and 17°C for each survey respectively. Monitoring stations will be established at least 500 m apart. Surveys will be conducted passively, without eliciting calls via playback and will last three minutes. Calls will be noted separately when heard inside or outside of a 100 m boundary. Call levels will be assigned to all calling frog/toad species. Table 8.2-4 below summarizes the proposed monitoring plan for Amphibians.

Table 8.2-4: Amphibian Call Monitoring Summary

Project Area or Component	Monitoring Task or Objective	Proposed Timeframe	Proposed Methodology
East and West Shorelines	Monitor existing sound levels in during construction (year 0). Document present species in years 1 & 6	Three site visits between April 5 – July 5. (Years 0, 1 and 6)	Year 0: Establish 1 survey stations on each shoreline. Can be completed during the morning or night depending on site preferences. Use handheld GPS to document each station established. Document species as per MMP Year 1: Revisit established stations, document species

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Project Area or Component	Monitoring Task or Objective	Proposed Timeframe	Proposed Methodology
			Year 6: Revisit established stations document species
Northern Cattail marsh	Monitor existing sound levels in during construction (year 0). Document present species in years 1 & 6	Three site visits between April 5 – July 5. (Years 0, 1 and 6)	Year 0: Establish 2 survey stations. Can be completed during the morning or night depending on site preferences. Use handheld GPS to document each station established. Document species as per MMP Year 1: Revisit established stations, document species Year 6: Revisit established stations document species
Marshes surrounding Belle Island.	Monitor existing sound levels in during construction (year 0). Document present species in years 1 & 6	Three site visits between April 5 – July 5. (Years 0, 1 and 6)	Year 0: Establish 2 survey stations. Can be completed during the morning or night depending on site preferences. Use handheld GPS to document each station established. Document species as per MMP Year 1: Revisit established stations, document species Year 6: Revisit established stations document species

Results will be presented within the annual post construction reporting for Years 1 and 6 and will be completed by January of the following year. The report will include recommendations and suggestions to improve bird abundance and diversity if results do not appear to be moving towards the ultimate goal of achieving similar populations to pre-construction within the Project footprint.

As baseline data has not been confirmed, the thresholds for determining success during post-construction monitoring will be developed within 1 year of

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DIA approval; this timeline will provide time to engage and reach consensus with relevant authorities who have expert knowledge on amphibians and their habitat.

8.2.8 Turtle Eco-Passage Usage Monitoring

Typically, incident observations are used during construction to monitor the relative success of constructed wildlife crossings (CVC, 2017). Incidental observations will be recorded during all construction monitoring and compliance monitoring activities. To supplement incidental observations, game trail cameras will be installed within each eco-passages on video mode to observe and tally the relative abundance of individuals utilizing eco-passages. Trail cameras will be set to take short video clips with motion capture.

Trail camera footage will be reviewed at least weekly during construction to determine relative success of eco-passage installations through the number of individuals captured on camera, and the diversity of fauna and species numbers using the different crossings. A weekly memo will be prepared detailing the observed usage of the eco-passage by various turtle species as well as any recommendations for increase turtle passage through the causeway.

8.2.9 Migratory Waterfowl Monitoring

Waterfowl species considered in this monitoring program are those listed within the Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E (OMNRF, 2015), under the Waterfowl stopover and staging areas (aquatic). The monitoring program will determine whether waterfowl usage within the Study Area persists into the operational phase. To document waterfowl usage of the Study Area post-construction, up to five bi-weekly site visits are proposed in each of the spring (ice melt through May 15) and fall (October 15-December 1) for a period of 2 years.

Stopover counts will be conducted as described in the OMNRF document "Bird and Bird Habitats: Guidelines for Wind Projects" (OMNRF, 2011). Viewing sites with adequate site lines of the Study Area will be established prior to surveys commencing. Various viewing sites will be utilized during each of the surveys to adequately cover the entirety of the Study Area. Biologists will move through the wetland via boat or a combination of road

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and shoreline travel to visit each established viewing area during each of the surveys. Surveyors will tally the relative abundance and number of waterfowl species within the Study Area. Incidental observations will be taken regarding waterfowls flying over, but not utilizing the Study Area.

Results will be presented within the annual post construction reporting for Years 1 and 2 and will be completed by January of the following year. The report will include recommendations and suggestions to improve bird abundance and diversity if results do not appear to be moving towards the ultimate goal of achieving similar populations to pre-construction within the Project footprint.

As baseline data has not been confirmed, the thresholds for determining success during post-construction monitoring will be developed within 1 year of DIA approval; this timeline will provide time to engage and reach consensus with relevant authorities who have expert knowledge on migratory waterfowl.

8.2.10 Fish Community

A detailed offsetting plan, which includes monitoring plans has been submitted as part of the DFO Fisheries Act Authorization submission; some components of the construction and post-construction monitoring plans outlined in the FAA submission overlap with the monitoring detailed above. It is anticipated the monitoring plan described below will be reviewed by, and comments will be received from, all relevant agencies. Upon agreement by all parties, the monitoring plan will be a binding legal agreement, and is expected to satisfy monitoring and follow-up requirements. A summary of the proposed post-construction monitoring is described below in Table 8.2-5.

Table 8.2-5 : Fish Community Monitoring Plan Summary

Project Area or Component	Monitoring Task or Objective	Proposed Timeframe	Proposed Methodology
East and West Shorelines (Inclusive of the Music Marina Area and	Document Fish Usage	August of Years 1, 3 & 6	A 4-foot trap net to be set off the east and western shorelines for 48 hours checked once daily. To document large fish usage within the reclamation areas. In addition to the two netting



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Project Area or Component	Monitoring Task or Objective	Proposed Timeframe	Proposed Methodology
Shorelines, Seawall Offset and Causeway Access Ramps)			<p>locations within the Project Area. Two additional reference reaches will also be netted, one approximately 250 m upstream along the western shore the other approx. 500 m upstream on the eastern shore. Netting will occur in September of each year.</p> <p>Electro-Fish along restored shoreline to determine any fish usage, in particular if juvenile American eel have taken up residence. Electro-fishing will occur prior to any netting as to not skew any results. Similarly, the above netting, reference locations will also be fished, ideally these will be the same as the netting locations, however water levels or substrate depth may require alternate locations to be chosen. Regardless of the location chosen, the same location will be used through the years of monitoring.</p>
Restricted Window Offset Commitment	To ensure lost productivity experienced in during the 2020 spring spawning window is offset by 2030	2020 – 2030 (at least three years of monitoring of constructed or enhanced habitat)	To be determined, but likely to involves combination of spring and/or summer assessments to show spawning adults or YOY presence.

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Results will be presented within the annual post construction reporting for Years 1, 3 and 6 and will be completed by January of the following year. The report will include recommendations and suggestions to improve fish habitat if results do not appear to be moving towards the ultimate goal of achieving similar populations to pre-construction within the Project footprint. Once the constructed habitat in the offset area has been completed, a post-construction report should be developed for each of the three years of monitoring by January of the following year. The report will summarize the findings regarding usage, species composition and abundance and provide recommendations to further enhance habitat in the area if the results are not consistent with the offsetting goals for the area.

Information gathered during post construction monitoring will be compared to baseline data. Thresholds for determining success during post-construction monitoring will be developed within 6 months of DIA approval; this timeline will provide time to engage and reach consensus with relevant authorities who have expert knowledge on fish community in the area.

8.2.11 Noise Monitoring

8.2.11.1 Underwater Noise Monitoring

Construction noise monitoring will be completed to record actual noise levels, given current noise modelling does not take into consideration the attenuation of noise by existing plants or the Aquatics Exclusionary Turbidity Curtain (AETC); the report, included as Appendix G, found that the maximum distance for mortality or potential mortal injury to fish caused by noise or vibration was between 2 and 3 m; to fish eggs and larvae was 5 m; and 7 m for injury (including recoverable injury) for impact hammer installation. Noise monitoring will occur during the installation of each in-water caisson as well as during the installation of one pile per day in order to evaluate the extent of underwater noise. A weekly noise memo will be developed to summarize the findings and indicate if corrective measures are needed throughout any time in the construction phase.

8.2.11.2 Noise Monitoring for Migratory Birds

Noise monitoring will take place during the first year of construction to determine if noise modelling activities accurately represent the real-time noise levels at sensitive ecological receptor points. Monitoring will be conducted at

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the northern cattail marsh, the northern shoreline of Belle Island, as well as at both the western and eastern shorelines. A handheld decibel meter will be used in each location to determine the level of noise emitted from various construction activities. This will occur prior to the breeding bird season to allow mitigations to be added and subsequent monitoring to occur to ensure 55 dBA levels are achieved where applicable. Noise monitoring will occur during each caisson installation as well as at one pile per day in order to evaluate the extent of the noise. A weekly noise memo will be developed to summarize the findings and indicate if corrective measures we're needed throughout any time in the construction phase.

8.2.12 Lighting

As discussed in Section 3.3.2, a change in light level is expected to occur through the addition of the bridge deck lighting. Development of the lighting design is expected to minimize the extent of light trespass, but some light may reach the river surface in the direct vicinity of the bridge.

The Proponent is committed to working with PCA and ECCC to develop an appropriate protocol to confirm the amount of light trespass beneath and adjacent to the bridge structure with a mechanism for the implementation of additional mitigation measures, if required. Monitoring will be completed in year one of operation to confirm the accuracy of the anticipated effect and determine if any additional mitigations are required to reduce ambient light.

Results will be presented within the annual post construction reporting for Year 1 and will be completed by January of the following year. The report will include recommendations and suggestions to improve lighting on the bridge in terms of safety and ecological health, if deemed necessary.