PETITCODIAC RIVER CAUSEWAY PROJECT
STAGE 2 FOLLOW-UP PROGRAM RESULTS

YEAR 9 EXECUTIVE SUMMARY

Submitted to:

New Brunswick Department of Transportation and Infrastructure
Fredericton, New Brunswick

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1.0 INTRODUCTION

1.1 Purpose

This document is a summary of the results of Year 9 (April 1, 2018 – March 31, 2019) of the Stage 2 Follow-up Program (S2FUP) for the Petitcodiac Causeway Project ("the Project"). Year 9 results are compared to baseline conditions established during the Stage 1 Follow-up Program with respect to predictions and conclusions contained in the Environmental Impact Assessment (EIA) and provide a measure of the effectiveness of mitigation measures undertaken in Stage 1. The predictions and conclusions contained in the EIA are generally focused on conditions that will be present following completion of Stage 3. Thus, it is not possible to verify these during Stage 2 of this three stage Project. This document focuses on how the environmental effects observed during Year 9 of Stage 2 are trending as compared to the EIA predictions and conclusions specific to Stage 3 and beyond. The document presents the findings and conclusions relevant to the six Valued Ecosystem Components (VECs, see Section 1.4).

For a comprehensive description of background, methodology, references, program modifications and a more detailed presentation of the results, the reader is encouraged to refer to the main report, Stage 2 Follow-up Program Results for the Petitcodiac River Causeway Project Year 9 (April 1, 2018 – March 31, 2019) which is available from the New Brunswick Department of Transportation and Infrastructure (NBDTI) by contacting the Communications Director.

1.2 Follow-up Program Objectives

The S2FUP objectives are to:

- examine trends in environmental conditions for selected VECs to determine how environmental conditions are trending compared to the environmental effects predictions in the EIA;
- verify the effectiveness of mitigation measures to protect physical works installed during Stage 1 and Stage 2;
- provide an early indication of any unexpected change in environmental conditions; and
- improve understanding of environmental cause and effect relationships.

1.3 Transitioning from Stage 2 to Stage 3 Follow-up Program

Stage 2 was originally planned for at least two full seasons before proceeding with Stage 3. Although the exact Stage 2 duration was never specified, it is implicit in the EIA that Stage 3 would be initiated after two years of Stage 2, assuming the above-mentioned objectives had been satisfied. The implementation of Stage 3 had been delayed for reasons that are not related to the environmental effects that have occurred since the opening of the gates on April 2010. Thus, the S2FUP data collection continues to complement and support the results and conclusions of the first two years intended for the duration of Stage 2.

On December 16, 2016, the provincial government announced funding for Stage 3 of the Project, which includes the construction of a new bridge. Bridge construction began in May 2017 and is scheduled to be complete in 2021.

1.4 Scope

The S2FUP focuses on six VECs:

- Physical Characteristics of the Petitcodiac River and Estuary;
- Commercial Fisheries;
- Archaeology;
- Public Health and Safety – Surface Water;
- Fish Passage; and
- Engineered Environmental Protection Works.

1.5 Regulatory Context

The EIA required a Follow-up Program that would satisfy the objectives presented above. The S2FUP is a key component of the Environmental Management Plan (EMP) and is required as per Condition of EIA Approval #4 (CoA4). The S2FUP is divided into phases that correspond with the Implementation Plan, as per CoA5, and has been and will continue to be submitted to the New Brunswick Department of Environment and Local Government (NBDELG) for review and approval when required. The S2FUP is also required under the Canadian Environmental Assessment Act (CEAA) as a condition of the CEAA Screening undertaken by Fisheries and Oceans Canada (DFO). A Technical Review Committee (TRC), comprised of federal and provincial agency and department representatives, presided over the EIA process. The TRC was co-chaired by NBDELG, with DFO acting as the Federal Lead Responsible Authority. A similar TRC, chaired solely by NBDELG with input from DFO, was assembled to preside over the implementation of the Project.

1.6 Year 9 Activities Completed

A summary of activities completed in Year 9 is provided in Table 1.1.

Table 1.1 Summary of Stage 2 Follow-up Program Activities Completed in Year 9

Program Component	Activities
Physical Characteristics of the Estuary Follow-up Program	• Vertical-stereo aerial photos. • Upstream LiDAR and downstream to Line 19, downstream cross-sections, no cross-sections in Shepody Bay. • Periodic fixed wing flyovers (ice monitoring, spring break-up, weather events). • 1 upstream scour monitoring event. • 1 downstream scour monitoring event. • Visual reconnaissance as required (max. ice accumulation, max. flows from land in spring and fall, max. sediment accumulation). • Monitoring of water level meters (3) and web cameras (3).
Engineered Land Protection Works Follow-up Program	• Regular inspections of traffic circle/starter dyke and related outfalls. • 1 aerial and 1 ground-based inspection of dykes and aboiteaux. • Inspection of shoreline protection.
Fish Passage and Fish Habitat Follow-up Program	• Picket trap operation. • Smolt wheel operation. • Electrofishing. • Redd survey. • Smelt survey.

2.0 PHYSICAL CHARACTERISTICS

2.1 Objectives

The objective of this component is to monitor and measure changes to the Petitcodiac River (“the River”), the Petitcodiac Estuary (“the Estuary”), and the Upper Bay of Fundy (“the UBoF”) after gate opening to understand effects on width, depth, and other physical characteristics as compared to baseline conditions.

2.2 Results

2.2.1 Cross-sections

All references to “right” or “left” are taken as looking upstream.

2.2.1.1 Downstream of the Causeway to Hopewell Cape

No hydrographic surveys were carried out downstream of the causeway in 2018. The next scheduled hydrographic survey is Fall 2019 or Spring 2020 to accommodate the bridge construction schedule. LiDAR surveys in 2018 extended downriver to line 19.

As during Stage 1 and the subsequent Stage 2 program, cross sections were surveyed approximately once a month in 2018 at the Gunningsville Bridge.

2.2.1.2 Upper Bay of Fundy (downstream of the causeway)

No surveys were carried out in 2018 and the next field work is scheduled for 2020-2021 prior to the opening of the new channel.

2.2.1.3 Development of the Scour Hole

Upstream of the control structure: Since there has been little change in the sections for several years, surveys were not carried out in 2018 and have been discontinued.

Downstream of the control structure: Data from the surveys indicate that this scour hole is stabilizing. The daily peak outflow at the site is related to the tidal volume upstream of the control structure. The repeated hydrographic surveys upstream of the control structure show that the tidal volume is decreasing over time as a result of sediment deposition in the developing tidal flats upstream. Based on these observations, it is expected that the peak tidal outflows will decrease over time, and thus the depth of the scour hole downstream of the control structure should not increase to any significant degree over time.

2.2.1.4 Tidal Flats Upstream of the Causeway

The data indicate that the rate of increase in the surface elevation of the developing tidal flats is decreasing with time. The upstream tidal flats are still rising at a rate of approximately 100 mm/year but the downstream rate of rise has slowed.

2.2.1.5 Channel Width Relationships

Upstream of the Control Structure: The width upstream near Turtle Creek has narrowed significantly between 2017 and 2018. There has also been some narrowing of the channel up at the railway bridge in Salisbury.

Downstream of the Control Structure: No hydrographic surveys were carried out in this section in 2018. However, the 2018 LiDAR survey was extended downstream to Outhouse Point. After an initial rapid widening over a period of 200 – 900 days since the gates were opened, the rate of widening has stabilized at the causeway and Hall's Creek. In general, the estuary is widening at the rate of 4-5 m/year. The widening has exposed an old masonry pier of the former Gunningsville Bridge on the north bank (Moncton side).

2.2.2 Ground-level Observations

Ground-level observations have been conducted on both banks of the River from Salisbury to Hopewell Cape seasonally from 2010 to 2018.

Winter conditions generally result in narrowing of the River along the City of Moncton and Town of Riverview shorelines, and even more prevalent upriver of the causeway. No problems with ice jamming were observed at the control structure, and the shore-fast ice built up downriver of the control structure continued to protect the shoreline and any infrastructure adjacent to the River, such as trails and viewing platforms, during the winter months.

Erosion continues to expose the old wharf structure at Steadman Street and continues to further deteriorate the wharf face of the City of Moncton's boardwalk near the Running Room. Widening of the River at the Gunningsville Bridge on the Moncton side of the River continues as well.

Upriver of the control structure, change is less evident as the mudflats have now established vegetation and are only flooded on the highest tides. No increased signs of erosion were observed upriver of the control structure and the exposed berm of the Salisbury sewage treatment facility appears unchanged.

2.2.3 Water Level Observations

2.2.3.1 Effect on Tide Levels

As noted in earlier follow-up monitoring reports, opening the gates had initially lowered high tide levels at the Gunningsville Bridge but, as sediment became permanently deposited in the tidal flats being formed upstream of the causeway after gate opening, the volume available for storing tidal water decreased during each tidal cycle. Data show that for each year from 2010 to 2018 the tides at Moncton, with the gates open, increase when compared to Saint John indicating that the total initial decrease in tide levels at Moncton, after opening the gates, was not likely to be permanent. High tides above the average level of +6 m are trending higher and are now approaching the elevations recorded when the gates were closed.

2.2.4 Sediment Deposition, Erosion and Net Accumulation

No downstream or bay cross sections were taken in 2018.

3.0 COMMERCIAL FISHERIES

3.1 Objectives

The objective of this component is to determine how the Project affects commercial fisheries landings; lobster and scallop in the UBoF.

3.2 Results

In March 2015, due to the prolongation of Stage 2 and in recognition of the extensive information collected to date, a temporary suspension of the Lobster and Scallop monitoring program was approved in May 2015. This monitoring program will be resumed in Stage 3.

4.0 ARCHAEOLOGICAL AND HERITAGE RESOURCES

4.1 Objectives

The objectives of this component are to ensure all areas of potential archaeological interest are identified and, where necessary, to mitigate risk to archaeological and heritage resources due to changes in flow patterns and erosion after the causeway gates were opened.

4.2 Results

It was recommended to the Archaeological Services Branch of New Brunswick that field surveys be removed from the Stage 2 program. This recommendation was accepted. However, while there are no more scheduled Stage 2 archaeological field surveys, it is still recommended that, should additional excavations be conducted on the historic marshlands associated with the Project, these activities should be monitored by a permitted Archaeologist. These future activities might include dyke “shaping” or expansion where additional indigenous soils may be impacted. In addition, it is still recommended that if erosion has negatively affected an archaeological site or cultural feature, the provincial regulator be notified and possible mitigation measures be considered.

5.0 PUBLIC HEALTH AND SAFETY: SURFACE WATER QUALITY

5.1 Objectives

The objective of sampling during Stage 2 is to continue the collection of interim surface water quality data following gate opening in order to provide an indication of how the environment is trending toward the predictions and conclusions contained in the EIA.

5.2 Conclusions

Given the general stability of surface water results, supplemental monitoring was suspended for the remainder of Stage 2 and no sampling events were conducted in 2018. Further data are not required to further understand how the surface water bacteria concentrations are trending in the River. The Stage 3 Follow-up Monitoring Plan proposes that the next surface water sampling event be resumed, in the first year following channel opening.

6.0 FISH PASSAGE

6.1 Objectives

The objective of this component is to measure the passage of the nine fish species that require access to the Estuary for life cycle purposes. Fish passage monitoring that was originally proposed for Stage 3 was moved forward to Stage 2 due to the delay in implementing Stage 3. With the new bridge construction now in progress, the 2018 fish monitoring results mark the end of a nine-year S2FUP monitoring program, with Stage 3 scheduled to begin in 2019.

6.2 Results

6.2.1 Presence of fish species

The S2Y9 results of the Fish Passage monitoring program using a picket trap (whose location was moved upstream in 2018) may be summarized as follows:

- **Gaspereau:** Gaspereau numbers continued to steadily rise since 2016, up to 88% of the total trap catch in 2018. To avoid outliers for different trap start-up dates, a standard period (May 30 - July 4) was chosen to compare the gaspereau catch rates from year to year. The overall number of gaspereau being caught on a daily basis was the largest since 2012. A narrow difference between the number of spawning adults and total gaspereau in 2015 and 2018 reveals that those counts were influenced partly by the paucity of YoY at the trap those years. The 2018 site relocation upstream is considered in examining the 2018 capture results. The tide rarely reached the nets at the new trap site in 2018, providing fewer opportunities to capture YoY. Results from 2018 together with Stage 3 follow-up monitoring will enable stronger, more meaningful comparisons of gaspereau numbers.

- **American shad:** Occasional captures of adult shad occurred in 2018. Shad show a high fidelity (97%) to their natal streams, so it is to be expected that a river lacking a resident population would require an extended period to be recolonized by strays. The capture of two mature shad at the trap during the spawning season is encouraging.

- **Striped bass:** Striped bass numbers in 2018 consisted of 65 individuals. This was the lowest catch since 2011, when 158 were caught. Although numbers of striped bass caught have varied over the years, there has been an overall upward trend. The decline in 2018 is probably attributable to relocation of the trap. Most striped bass seen every year tend to be YoY striped bass. In 2018 YOY and 1-year old striped bass accounted for 68% of the total number caught. The species may now be at a level that makes it a predatory danger to the recovery of the Petitcodiac River Atlantic salmon population.

- **American eel:** American eel numbers fell dramatically in 2018 to 64, the fewest detected at the head of tide since during the Stage 2 monitoring, which stands in stark contrast to the upward trend in numbers for the duration of the Program. Trap operations were limited to a single day (October 16) due to an unusually high river flow, but that loss could not entirely account for the decline.

- **White sucker:** The catch at the new trap site in 2018 (1,991 individuals) was noticeably higher than that of 2017 and exceeded every previous year with the exception of 2010; catches during both 2010 and 2018 were significantly higher in May and June than the remainder of the season. The 2018 numbers may be attributable to the trap's relocation upstream above the confluence of Little River, catching spawning migrants as they move from the base of the tributary and up the main stem at that time.

- **White perch:** Capture numbers (32) were lower in 2018 than the period of 2015 – 2017, where numbers had increased from 167 to 231. Consistently low capture rates at the former trap site suggest that by 2017 a plateau in white perch population density had been established. White perch tolerates estuarine level salinities and moved through the fishway prior to gate opening. Stage 2 monitoring results indicate that perch captures were strongly correlated with incoming tides; therefore, the low capture total may be attributable to the relocation of the trap upstream. The white perch tolerates estuarine-level salinities and moved through the fishway prior to gate opening.

- **Atlantic salmon:** There were 9 distinct individual Atlantic salmon (1 parr and 8 adults) captured at the trap during the 2018 season. Of these, one adult was a recapture from 2017, and another was captured on two occasions approximately one week apart. Although a lower capture than some past years, it is competitive with totals for most years considering the loss of multiple fishing days during high water in October. In part, it is a reflection of the large number of mature adults (916) released October 4 - November 2, 2018: 562 on the Pollett River; and 354 on the Little River. The lack of smolts captured at the trap in 2018 was neither surprising, nor cause for concern. Many of the individuals in the potential 2018 migratory smolt year class were captured the previous autumn and held at the Mactaquac Biodiversity Facility for subsequent distribution to the Recovery Sea Cage Site on Grand Manan. In addition, small downstream-migrating fish (including smolts) are caught by the trap when carried there by the incoming tide, whose amplitude is lower at the relocation area upstream. It has been conjectured that ever-increasing sizes of striped bass predators may be affecting smolt population, but gaspereau remains a plentiful food source and the largest striped bass was caught in late June after most smolt had already moved out to sea. Of note was the recapture from a previous year (2017) of one kelt. In addition, a precocious male parr was detected. All adult salmon caught so far (including 2018) have been recently released captively-reared fish with limited exposure to the wild.

- **Atlantic tomcod:** Captures fell to 26 in 2018 (down from 1,609 in 2017). A lower number of tomcod captures resulted at the trap in 2018, possibly due to the species' staging in the vicinity of the former trap site below the head-of-tide.

- **Brook trout:** Half the trout in 2018 were caught during October. Throughout S2FUP monitoring there has been a consistent result of very few trout being caught in contrast to numbers seen by anglers, during electrofishing, and during snorkel surveys. Brook trout may simply be skilled at evading the traps or are most active at the head-of-tide monitoring site outside of the trap season.

- **Smallmouth Bass:** There was an increase to 11 smallmouth bass caught at the trap in 2018 – the most since 2012. Illegal introduction continues to be of concern. It was thought that the saline-intolerant bass may have found the trap site too estuarine by 2014. The increased catch upon the 2018 relocation upstream would support that conclusion.

7.0 ENGINEERED ENVIRONMENTAL PROTECTION WORKS

7.1 Objectives

The objective of this component is to ensure that the physical works completed during Stage 1, prior to gate opening, are working as intended, and to identify potential maintenance requirements. These works include:

- Armoured areas for tidal surge and erosion protection at the former Moncton landfill, the TransAqua outfall, along the Riverview riverfront, along the Moncton riverfront near Westmorland Street, and along the Chateau Moncton shoreline.
- Drainage improvements at the traffic circle and starter dyke.
- Re-alignment of the underground 750 mm watermain crossing the Petitcodiac River.

7.2 Results

7.2.1 Armoured Areas

Generally, the erosion protection has been observed to function as was anticipated, providing adequate protection to areas of concern. In Year 9, no significant changes to existing erosion protection was required at any of the locations.

7.2.2 Traffic Circle Drainage Improvement and Starter Dyke

During Year 9 inspections, water within the drainage channel was found to continue to flow correctly, despite some silt build-up in the channel immediately downstream of the traffic circle flap gate. Visual inspections in past years indicated that the flap gate on the drainage outfall to the former headpond was intermittently not operational due to silt and mud deposits. No immediate action is required; however, monitoring will continue in this area and repairs will be recommended if required. The starter dyke flap gate structure at the drainage channel was repaired in 2012 and replaced by NBDTI in late 2014. Visual inspections in 2017 and 2018 reported that the flap gate continues to show signs of leakage despite replacement. No immediate action is required; however, this gate will be replaced with a permanent structure as part of Stage 3 construction.

7.2.3 Watermain

No issues were noted during Year 9 inspections. Overall, the watermain and associated infrastructure is functioning as planned and no issues are anticipated.

7.2.4 Additional Observed Erosional Areas

The following areas of shoreline were inspected as part of the Year 9 inspections:

- downstream from existing riprap at the TransAqua outfall;
- southern shoreline immediately upstream of the causeway;
- between Chateau Moncton and Rogers Building; and
- upstream of Chateau Moncton adjacent to and underneath the boardwalk.

TransAqua outfall: Overall, no significant change was observed in Year 9. As such, no additional erosion protection has been installed and no additional erosion protection is necessary.

Southern shoreline: No significant changes to the shoreline were identified in this area during Year 9. At this time, there appears to be no risk to infrastructure from erosion in this area, and therefore no mitigation has been recommended.

Between Chateau Moncton and the Rogers building: In Year 9, as in previous years, it was revealed that an old wharf structure is becoming increasingly visible. Although no infrastructure has been identified as being at risk, the installation of additional erosion protection was recommended along this 310 m stretch of shoreline in Year 3 but has not been implemented at the request of the City of Moncton.

Upstream of Chateau Moncton: Monitoring undertaken in Year 9 indicates that the erosion protection in this location continues to function as expected.