



# RESILIENT INFRASTRUCTURE

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## ENCOUNTERING RAINBOW MUSSEL, A SPECIES AT RISK, DURING CONSTRUCTION OF A STORMWATER MANAGEMENT FACILITY

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### ABSTRACT

Many freshwater mussels in the Ontario-Great Lakes Area are considered Species at Risk (SAR) and these are increasingly influencing planning, implementation, and monitoring of infrastructure projects near watercourses. In 2010, the City of London commissioned an on-line Stormwater Management Facility in the Stoney Creek watershed in the form of an Erosion Control Wetland. Design objectives included: creation of additional water storage in the floodplain, prevent erosion in the downstream watercourse, and reclaim natural heritage features lost during infrastructure development. Erosion and sediment controls were applied during construction; however, storm events in December 2011 washed out a section of bank that had separated Stoney Creek from the active construction site. The washout released streambed sediments and mussels, including the previously unrecorded SAR Rainbow mussel, into the work area. An emergency mussel relocation protocol was developed, through a collaboration between applicable agencies, to relocate the mussels during the winter months. Ultimately, 16 of 70 mussels collected during the winter relocations were SAR. The timing of the bank collapse and mussel relocations provided a unique situation where recapture and growth comparisons could be made between mussels relocated in extreme weather conditions to mussels relocated during optimal handling temperatures. The Stoney Creek project demonstrated construction delays and costs associated with SAR mussel discovery. The project highlights the importance of detailed environmental assessments prior to project planning so appropriate mitigation measures and environmental monitoring requirements are implemented during construction.

Keywords: Species at Risk, Stormwater Management Facility, Erosion Control Wetland, Emergency Mussel Relocation, Post-Construction Monitoring, Erosion and Sediment Control

### 1. EXECUTIVE SUMMARY

In December of 2007 the City of London completed a Class Environmental Assessment Study for Storm/Drainage and Stormwater Management Servicing Works for Stoney Creek Undeveloped Lands. The primary objectives of the Stoney Creek Erosion Control Wetland (ECW) facility were to provide erosion control storage, on-line stormwater management, and prevent erosion in the downstream reaches of Stoney Creek. The Stoney Creek ECW was constructed between October 2011 and May 2012, adjacent to Stoney Creek near the northern limits of London.

Erosion and sediment control (ESC) mitigation measures were outlined in the Detailed Design Report and an ESC Plan was developed by the Contractor and incorporated into Contract plans and drawings. Standard ESC mitigation measures included silt fence around the perimeter of the work area, minimal vegetation removals, seed and cover with mulch, regular oversight monitoring by an Environmental Specialist, and retention of Stoney Creek banks during construction of the ECW. In addition, the ESC Plan stipulated additional mulch applications on exposed soils from October 15 to April 15. During construction, London received two major rainfall events (November 27-30, 2011 and December 4-5, 2011) that resulted in over 120 mm of rain. The rainfall drastically raised the water level in

Stoney Creek and overflowed into the adjacent work area. Despite the installation of ESC measures as per accepted plans the rain events resulted in a complete washout of the creek bank into the adjacent wetland construction site. The actual flow of Stoney Creek diverted into the ECW through the bank washout and entered back into the creek channel approximately 400 hundred metres downstream. The temporary lack of flow in the natural channel resulted in a dry section of Stoney Creek, approximately 400 m in length, which contained exposed mussels and required immediate relocation. The washed-out bank materials formed a sandbar in the ECW, which also contained mussels that needed relocation. Five freshwater mussel species, including Rainbow (*Villosa iris*), were collected.

Rainbow mussels were not previously known in Stoney Creek watershed. As of 2011, Rainbow mussel was listed as Threatened under the provincial *Endangered Species Act* (ESA) and under consideration for listing under the federal *Species at Risk Act* (SARA). The SAR discovery triggered the Ministry of Natural Resources and Forestry (MNRF) involvement. MNRF issued an *ESA* permit for the collection, relocation, and post-construction monitoring. Mussel relocations typically occur when water temperatures are above 16°C, as per the Fisheries and Oceans Canada (DFO) Mussel Relocation Protocol (Mackie *et al.* 2008). However, due to the bank failure timing, an Emergency Mussel Relocation Protocol was developed through consultation with MNRF, DFO, and Upper Thames River Conservation Authority (UTRCA). Survival and growth monitoring of the relocated mussels was delayed by seven months to limit disturbance and exposure. Relocated population surveys occurred in July 2012, July 2013, and July 2014.

In total, 70 mussels, including 16 SAR, were collected, tagged, and relocated to an upstream relocation site in January 2012. The mussels were re-collected from the relocation site in July 2012, for the delayed (seven-month) monitoring event. At that time an additional 76 mussels (native to the relocation site), including 11 SAR, were discovered. All mussels collected in July 2012 (including those already tagged during the January emergency relocation) were measured for length, width, and height to record growth during subsequent post-relocation monitoring events. To compare the growth of mussels originally relocated in January to mussels collected in July, only individuals that were recaptured multiple years could be used, which included 16% of winter-tagged mussels and 35% of the summer-tagged mussels. Two of the five species accounted for the multiple recaptured mussels, Rainbow and Wabash Pigtoe (*Fusconaia flava*). Shell length, width, and height measurements were compared using linear regressions for all species and it was determined that all growth indicators were positively correlated (Beneteau and Mackie, 2014). Growth comparisons between winter- and summer-tagged mussels were analyzed using shell length. Initial results revealed positive growth for both mussel classes, winter- vs summer-tagged (17.9% and 16.0%), when comparing Rainbow and Wabash Pigtoe measurements from July 2012 and July 2014. A Mann Whitney-U test was conducted in R (R Development Core Team, 2014) and determined no significant difference in relative growth of Rainbow ( $p = 0.476$ ) or Wabash Pigtoe ( $p = 0.181$ ) comparing winter to summer collections. Results suggest bank washout trauma and exposure in cold temperatures did not negatively affect mussel growth.

The Stoney Creek project provided a unique situation where recapture and growth comparisons could be made for mussels relocated in extreme weather conditions versus optimal handling temperatures. The project also demonstrates the importance of detailed environmental assessments during project planning to ensure appropriate permitting, mitigation, and environmental monitoring are in place during contract administration to avoid construction delays and unaccounted costs associated with SAR discovery. In Stoney Creek, early detection of the SAR mussel would have increased the sensitivity and mussel awareness during design and initiated a mussel relocation protocol to clear mussels away from the work areas prior to construction. However, extreme weather conditions that may arise in any project are unpredictable and unavoidable. The Stoney Creek ECW SWMF has naturalized and is now functioning to provide wildlife habitat and additional stormwater storage for flood control.

## REFERENCES

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