

Soil Erosion Survey of the Nashwaak River and the Tay, Penniac and Cross Creek Streams



Prepared For

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Executive Summary

Soil erosion was identified as a cause of concern on the Nashwaak River and some of its tributaries by the Nashwaak Watershed Association Incorporated (NWAI) during the water classification process (1998-2003). A survey of soil erosion conditions was undertaken to quantify and locate eroding areas within riparian zones of the Nashwaak River. Riverbanks that are eroding at increased rates due to landuse cause excessive sediment loading to enter the river; resulting in water quality degradation. Increased sedimentation has negative impacts on the ecology of the river and leads to the loss of valuable residential, commercial and agricultural land. This report presents the results of a survey of the extent of soil erosion within a significant portion of the Nashwaak River system.

This study involved examination of both shorelines of the Nashwaak River downstream of Currieburg, to its confluence with the Saint John River at Barker's Point, as well as the lower portions of three major tributaries; the Tay River, the Penniac Stream and the Cross Creek Stream. Seventy-two erosion sites, ranging in length from a few metres long to approximately two thousand metres long were identified (refer to Appendix A). Erosion sites, including large erosion sites, were observed in all sections of the surveyed area, except for the stretch of Nashwaak River from Nashwaak Bridge to Taymouth. The most severe soil erosion was found to be on the Nashwaak River from Taymouth to Penniac Bridge and on the lower portion of the Penniac Stream. Large and severe erosion sites were also observed on the Mainstem of the Nashwaak River at Barker's Point and Marysville, as well as on the Cross Creek Stream and Tay River.

Three point sources for contamination identified in the survey appeared to be constructed adequately from the perspective of soil erosion. Interpretation of water quality impacts from these point pollution sources is beyond the scope of this study. The data and photographic documentation of the point sources are presented in Appendix B.

Mammalian inputs were observed to be an issue, as a significant (> 3 300 m) amount of riverbank had inadequate fencing or fencing was absent. Both channels around Penniac Island, and upriver from Penniac Island for approximately 1 000 m were the most heavily effected areas (ER-22 through ER-29 and ER-53). Mammalian inputs were also observed on the Tay River (ER-39 and ER- 40).

These data will allow the prioritization of remediation efforts that may be undertaken to alleviate soil erosion problems in a sustainable and long term manner. In an effort to begin this process the local community was informed of the project through a watershed-wide newsletter mail out, which invited landowners to partner with the NWAI to complete riverbank stabilization projects. There was a significant community response to this project with eleven landowners and two community groups expressing interest in performing remedial work. In preparation for riverbank remediation projects an extensive internet search was conducted to identify organizations interested in funding riverbank stabilization projects (Appendix C). A general meeting was held in late November, 2004 to allow for discussion of the project and to further inform the community of the issue of soil erosion.

The amount and distribution of the erosion sites supported the supposition that soil erosion was a factor in water quality trends noted in the NWA water quality report (2002). While water quality was adequate at the time of the report, soil erosion in some areas of the lower Nashwaak River and the Penniac Stream has a negative effect on water quality. This survey is intended to assist in addressing the soil erosion issue at the watershed level in order to maintain and improve water quality into the future.

Acknowledgements

The NWAJ would like to thank all of the organizations and individuals who contributed to this project. Without the support of these organizations the activities of the 2004/2005 season of this project could not have been possible.

A word of thanks is expressed to the New Brunswick Environmental Trust Fund for providing the funding to allow the completion of this report. Thanks to Levis Theriault and the New Brunswick Department of Environment and Local Government (DELG) for their assistance with this project.

Special thanks are extended to The NWAJ executive for their support of the Eroding Bank Survey and to Gary Spencer and Peter Ashfield for conducting the field component of the survey.

The assistance and support of the Department of Fisheries and Oceans, Nexfor-Fraser Papers, The Atlantic Salmon Federation and the New Brunswick Council of the Atlantic Salmon Federation was greatly appreciated.

Finally, we would like to thank the community for their support of this project, especially the citizens who came forward to plan for riverbank stabilization. The interest and support expressed by the communities within the Nashwaak Watershed by their attendance at the general meeting and the response to the newsletter is essential to the success of this project.

Mission

The mission of the Nashwaak Watershed Association Inc. is to manage the Nashwaak River Watershed as a healthy ecosystem that balances a variety of economic, recreational, social and landowner interests. All stakeholders on the Nashwaak are committed to sustaining the scenic and serene nature of the area in a manner consistent with the pursuits of all user groups. The Nashwaak River should be a watershed that serves the community while maintaining a healthy resource for generations to come.

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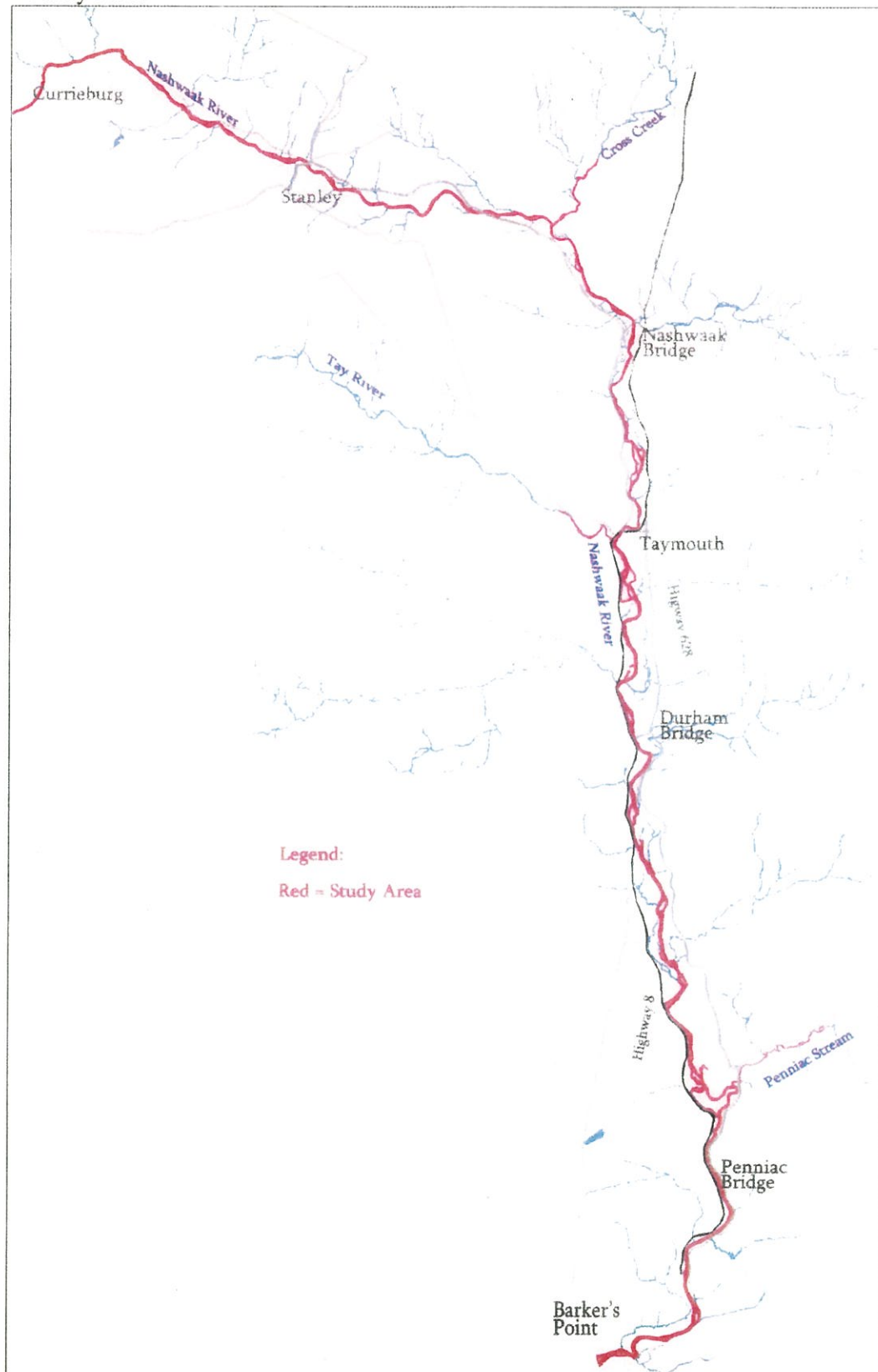
1.0 INTRODUCTION

1.1 Background

1.1.1 Study Area

Located in Central New Brunswick the Nashwaak River flows approximately 110 km in an easterly and southerly direction from Upper Nashwaak Lake (on the York/Carleton county line) to its confluence with the Saint John River at Fredericton with a drainage area of 1,700 km². The Study Area for this survey included the riverbanks and adjacent land along the river from Currieburg to the river's mouth in Barker's Point (60.75 km) and the lower 5.25 km of the Tay River, lower 3 km of the Cross Creek Stream and the lower 3 km of the Penniac Stream. Total distance studied was approximately 72 km. A review of land usage maps (Nwai 2002) indicated that shoreline development was concentrated in the lower Nashwaak River, the Tay River and the Penniac Stream. The Cross Creek Stream was assessed to serve as an "un-developed" or baseline area.

Figure 1 - Study Area



1.1.2 Landuse

The predominant land cover type of the Nashwaak Watershed is forest cover at 92.3%. Other land cover types are agriculture (2.8%), wetlands (1.99%), linear features (1.15%), urban/residential (1.01%), water (0.44%) and other (0.13%). Residential and agricultural areas, which collectively occupy 3.8% of the total land area, are primarily found in the study area, the lower half of the Nashwaak River as well as the headwaters of the Cross Creek Stream, Tay River, and Penniac Stream. These landuse patterns have led to large scale removal of mature trees and shrubs for many decades, along extensive stretches of riverbank within the study area.

1.1.3 Water Quality Trends

Several trends were identified in the Water Quality report published in 2002 by the NWA, indicating a potential soil erosion problem within the Nashwaak River System. The Penniac Stream and the Nashwaak River below Durham were identified as areas of concern. These trends appeared to be the result of continuing soil erosion. Sediment accumulation and its effects on salmon egg survival have been studied on the lower portions of the Tay River and the Cross Creek Stream. Preliminary work in 2000/2001 revealed significant sediment loading on the studied streams (R.Cunjak, pers comm.). These data support the supposition that excessive soil erosion is occurring in the Study Area.

1.2 Terms of Reference

The NWA was awarded funding by the Environmental Trust Fund following the submission of a proposal to perform a survey of the banks of the Nashwaak River and its larger tributaries, with the purpose of physical observation and photographic documentation of bank erosion conditions and point source/mammalian inputs. This report contains information pertaining to the condition of eroding riverbanks and point source/mammalian inputs on the Nashwaak main stem below Currieburg and the lower portions of the Cross Creek Stream, the Tay River and the Penniac Stream. Project deliverables are documented in the New Brunswick Environmental Trust Fund Project # **040056**.

The work plan for the project was as follows:

- 1) Review of land use patterns in the watershed and their expected impact on soil erosion.
- 2) Review of trends noted in the NWA Water Quality Report (2002), relating to soil erosion.
- 3) Identify potential funding sources for riverbank stabilization projects.
- 4) Conduct a visual survey of all riverbanks in the Study Area.
- 5) Conduct a public meeting to inform the community of the project
- 6) Mail out a newsletter informing the residents of the watershed about the project and inviting them to enter into riverbank stabilization projects, with the NWA.
- 7) Prepare a report presenting the findings of the project.

2.0 - METHODOLOGY

2.1 Data Collection

Data was collected between September 5 and November 13, 2004. Riverbanks and associated channels (both sides of all islands) within the study area were visually observed. The majority of the data collection was performed from a canoe; with the remainder performed on foot. The data collection performed on foot was on the Cross Creek Stream, the Penniac Stream and the Nashwaak River from Penniac Bridge to Barker's point.

When an area of riverbank was observed with exposed earthen faces, undercuts and/or overhanging sod, it was identified as an erosion site. Mature trees at the edge of a normally eroding riverbank are usually curved upward as they have had a number of years to grow, as the soil beneath them is slowly eroded. When trees that were straight were observed to have fallen into the river it was used as an additional sign of accelerated soil erosion. An erosion site is an area where the riverbank appears to be eroding at an increased rate and is either a single site or sites proximal enough to be considered in one remediation effort. The following data was recorded for each erosion site:

- Photographic documentation (camera number, photograph number);
- channel location (eg. left hand channel, always from the downstream perspective);
- bank location (eg. right hand bank, always from the downstream perspective);
- landuse adjacent to the bank;
- approximate eroding bank height in metres;
- approximate eroding bank length in metres;
- erosion severity;
- GPS coordinates;
- general location on the river (eg. near petro-can in Nashwaak Village, or Fraser's Pool);
- recommended remedial action;
- any special location instructions required;
- and a diagram of the site when necessary.

The data and photographic documentation for each site is presented in Appendix A. When possible, GPS coordinates were taken at the start and the finish of the eroding area on longer sites. When assigning left or right hand designations to channels or riverbanks the downstream perspective was always taken. Lengths and heights of Erosion Sites are approximate only and were constructed by each team member estimating the length and performing a comparison of the estimates.

2.2 Data Interpretation

Erosion severity was rated as one of (or a combination of) three classes: major erosion, moderate erosion and minor erosion. The criteria for rating erosion severity were subjective and considered anticipated remediation strategies for the site. The criteria for determining classification of an eroding area are described in general terms below:

Major erosion: usually greater than a five-foot face of exposed soil, unstable bank with overhang present or developing. This classification would likely require an engineered solution.

Moderate erosion: Less than a five-foot face of exposed soil and an unstable bank. Planting of trees and other vegetation may improve the situation.

Minor erosion: some exposed soil visible on a stable bank. Minor planting of shrubs or grasses may improve the situation.

2.3 Identification of Interested Landowners

In an effort to identify stakeholders interested in partnering with the NWA I in remediation of soil erosion on their property, an article was published in the Fall 2004 NWA I newsletter describing this project. The newsletter was sent to approximately 4400 homes within the Nashwaak watershed. This newsletter article invited landowners of riverbanks with soil erosion challenges to partner with the NWA I in a remediation project. Riverbank stabilization and soil erosion was a major topic of discussion at the General Meeting held on November 25, 2004.

2.4 Identification of potential funding sources

An extensive search of the internet was conducted to identify organizations that are interested in riverbank stabilization projects. The funding sources identified are presented in appendix C

3.0 FINDINGS

3.1 Visual Observations

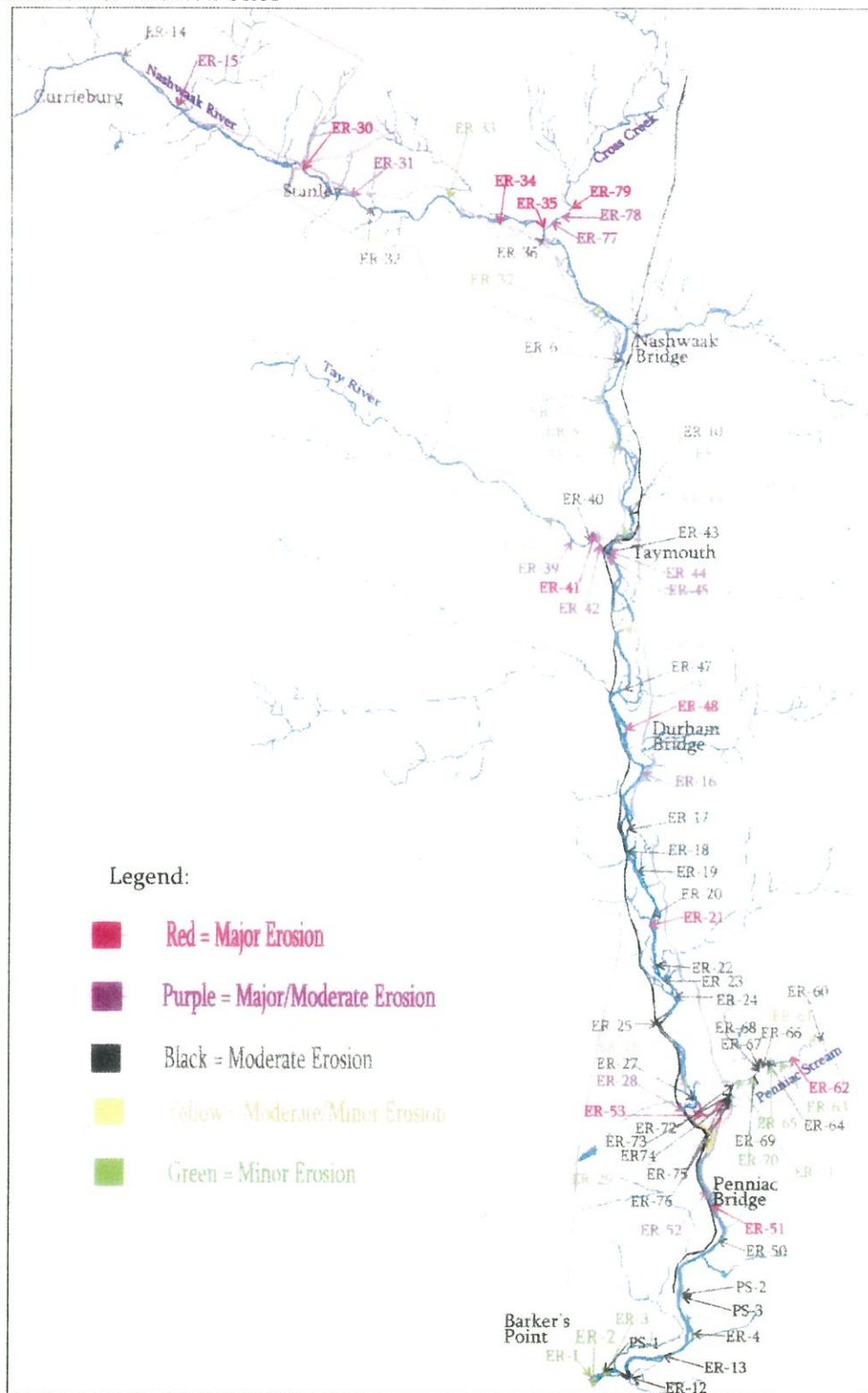
Eroding riverbanks can be clearly observed along significant percentage of the riparian zone on both sides of the Nashwaak River from Fredericton to Durham Bridge and on the lower portions of the Tay River, and the Penniac and Cross Creek Streams. Visual observations carried out during high water conditions following a significant summertime precipitation event revealed marked increase in turbidity in the Penniac Stream and below Durham Bridge (NWA I water quality report 2002).

3.2 Eroding Riverbanks

A total of 72 sites were identified as eroding sites. These sites were classified as major (10), moderate (32) and minor (12). Residual sites were considered minor to moderate (7), or moderate to major (11). One Erosion Site (ER-53) was 2000 m long and was composed of major, moderate and minor areas (see Table 1, section 3.2.3). The data and photographic documentation of each Erosion Site is presented in Appendix A. A combination of severity designations were given to some of the Erosion Sites because of difficulties estimating heights and lengths under field conditions or because the site had severe erosion in proximity to lesser erosion.

3.2.1 Location of Erosion Sites

Figure 2 – Location of Erosion Sites

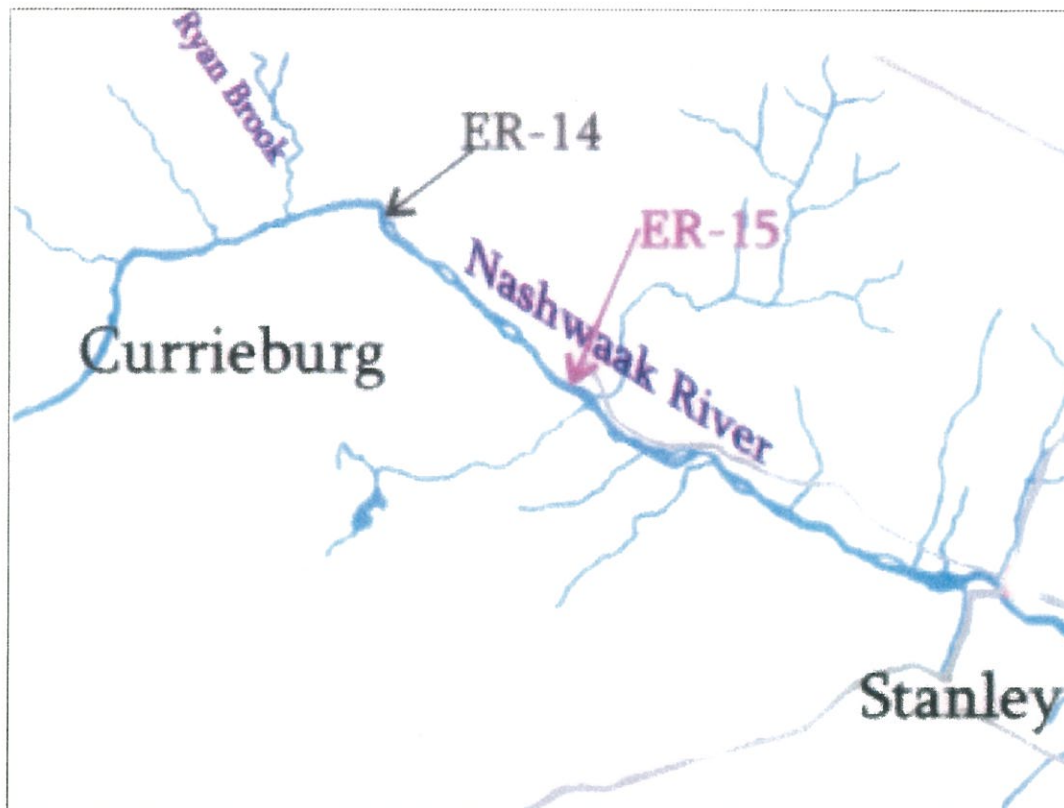


3.2.2 The distribution of the Erosion Sites

The study area was divided into 8 sections in order to demonstrate the distribution of eroding sites. A figure showing the location of the erosion sites in each section is presented below and table 1 (section 3.2.3, page 15) allows for comparison of the amount and severity of erosion.

Two erosion sites were noted on the Nashwaak River between Currieburg and Stanley, representing approximately 110 m of riverbank eroding at an increased rate.

Figure 3 – Erosion Sites from Currieburg to Stanley

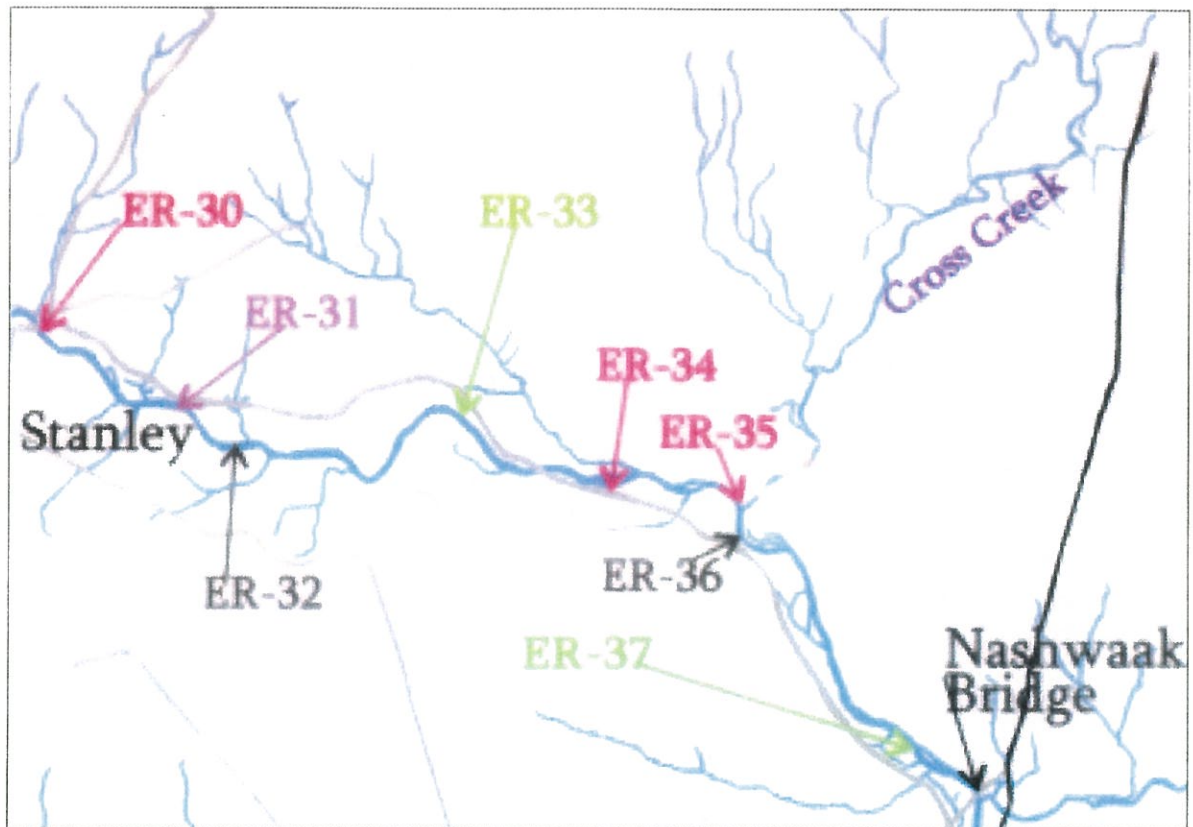


- Major = Red
- Moderate/Major = Purple
- Moderate = **Black**
- Moderate/Minor = Yellow
- Minor = Green

3.2.2 Continued

Eight erosion sites were noted from Stanley to Nashwaak Bridge, representing approximately 771 m of riverbanks eroding at increased rates.

Figure 4 – Erosion Sites from Stanley to Nashwaak Bridge

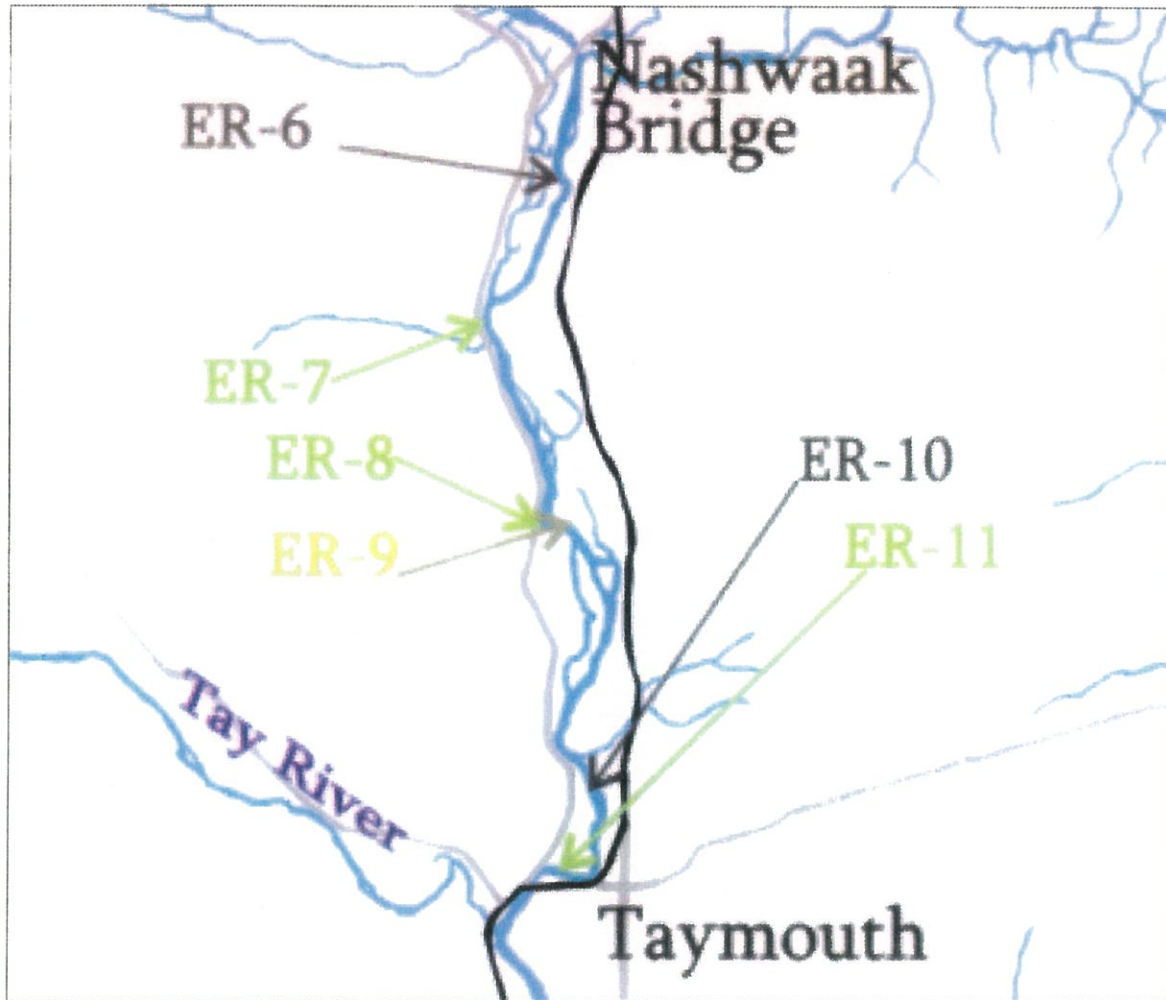


- Major = Red
- Moderate/Major = Purple
- Moderate = Black
- Moderate/Minor = Yellow
- Minor = Green

3.2.2 Continued

Six erosion sites were noted from Nashwaak Bridge to Taymouth representing approximately 276 m of riverbanks eroding at increased rates.

Figure 5 – Erosion Sites from Nashwaak Bridge to Taymouth

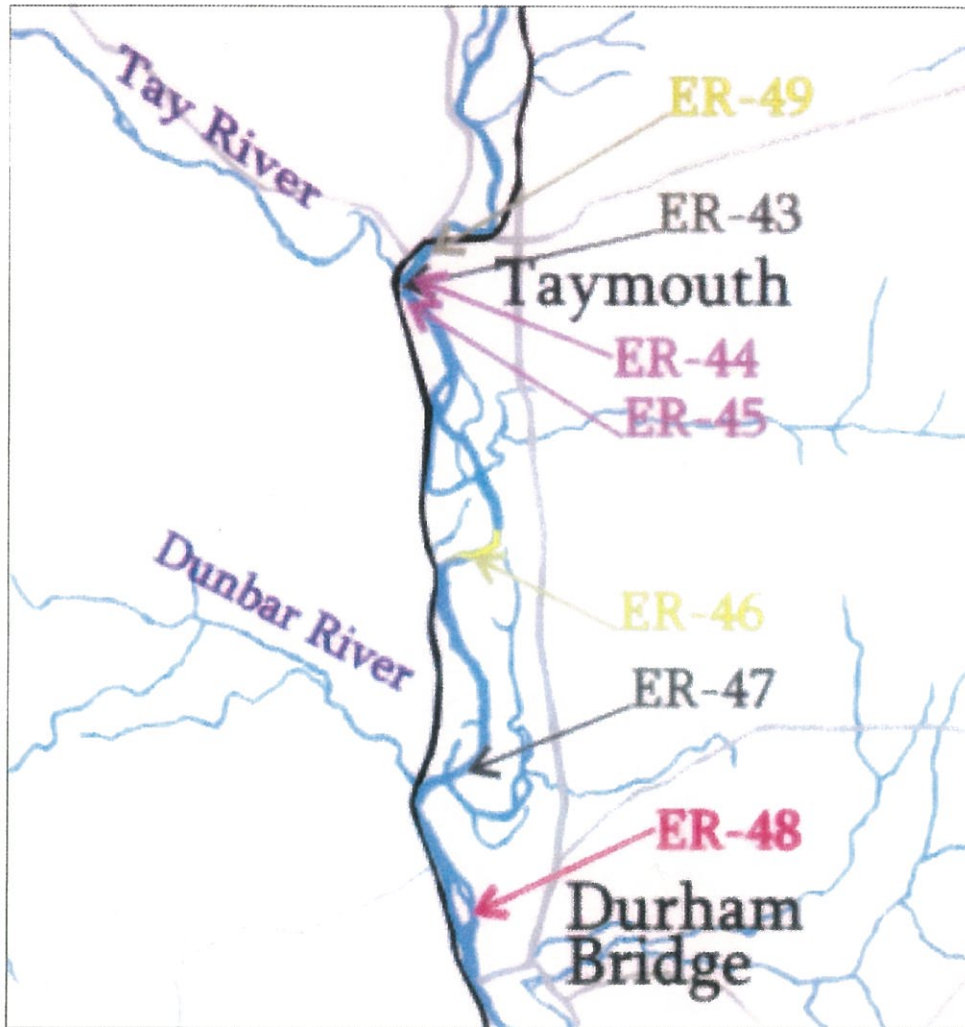


- Major = Red
- Moderate/Major = Purple
- Moderate = Black
- Moderate/Minor = Yellow
- Minor = Green

3.2.2 Continued

Seven erosion sites were noted on the Nashwaak River from Taymouth to Durham Bridge representing approximately 1 261 m of riverbanks eroding at increased rates.

Figure 6 – Erosion Sites From Taymouth to Durham Bridge.

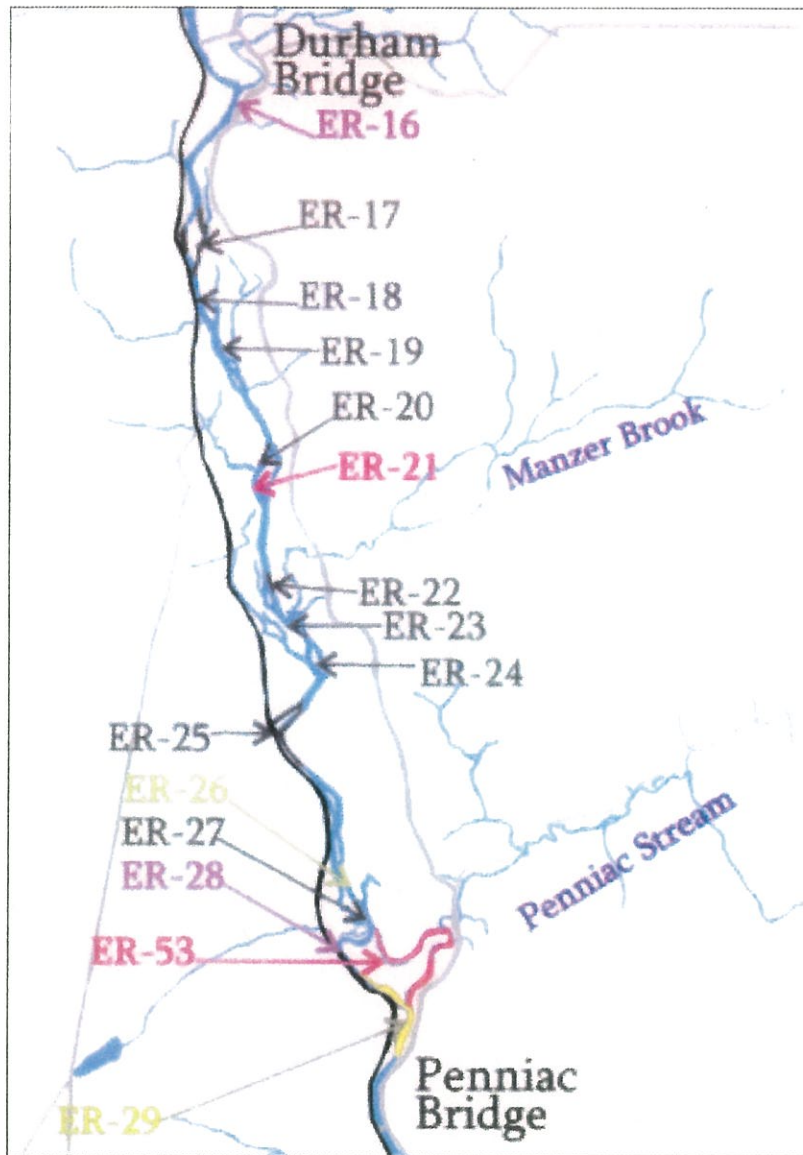


- Major = **Red**
- Moderate/Major = **Purple**
- Moderate = **Black**
- Moderate/Minor = **Yellow**
- Minor = **Green**

3.2.2 Continued

Fifteen erosion sites were noted on the Nashwaak River from Durham Bridge to Penniac Bridge representing approximately 7 027 m of riverbanks eroding at increased rates.

Figure 7 – Erosion Sites from Durham Bridge to Penniac Bridge

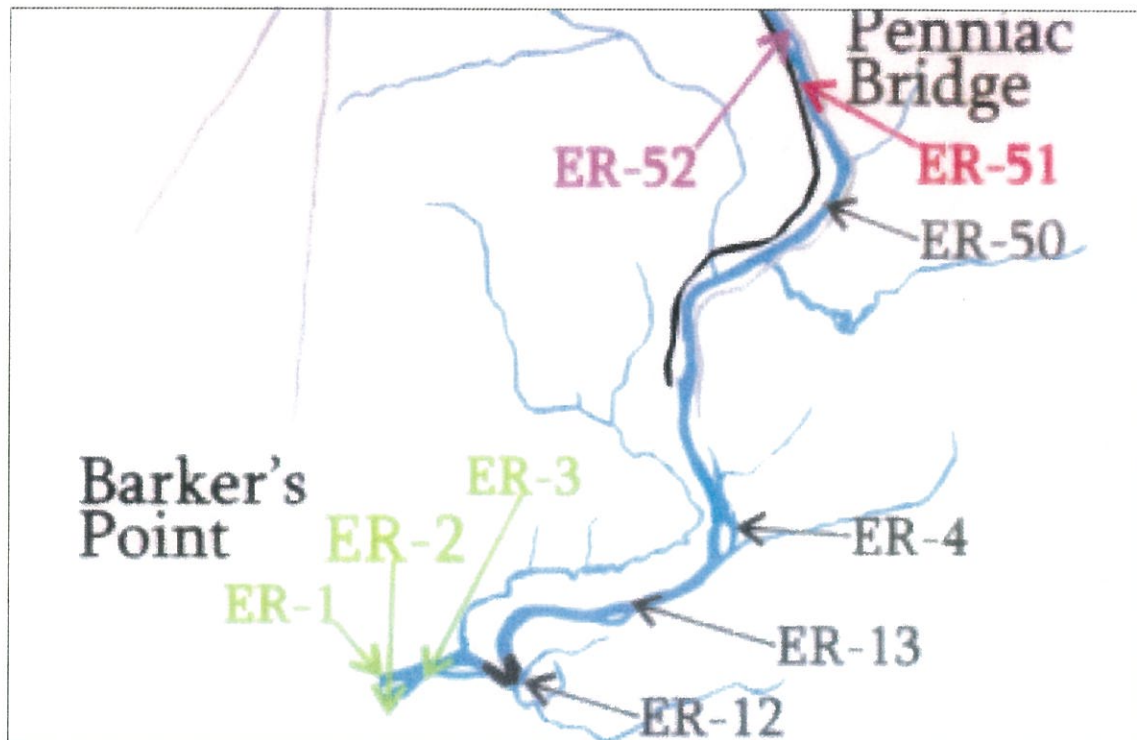


- Major = **Red**
- Moderate/Major = **Purple**
- Moderate = **Black**
- Moderate/Minor = **Yellow**
- Minor = **Green**

3.2.2 Continued

Nine erosion sites were noted on the Nashwaak River from Penniac Bridge to mouth of river representing approximately 875 m of riverbanks eroding at increased rates.

Figure 8 – Erosion Sites from Penniac Bridge to the Mouth of the River

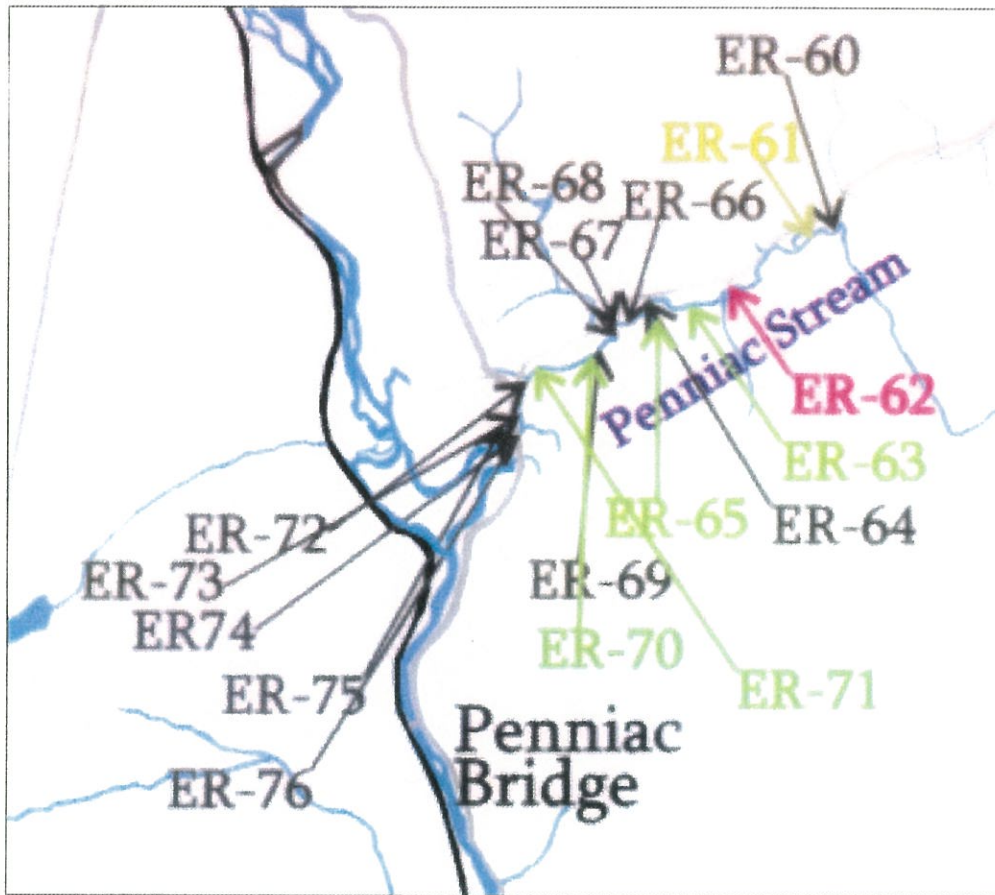


- Major = Red
- Moderate/Major = Purple
- Moderate = Black
- Moderate/Minor = Yellow
- Minor = Green

3.2.2 Continued

Seventeen erosion sites were noted on the lower 3 km of Penniac Stream representing 668 m of riverbanks eroding at increased rates.

Figure 9 - Erosion Sites on the Lower 3 km of Penniac Stream

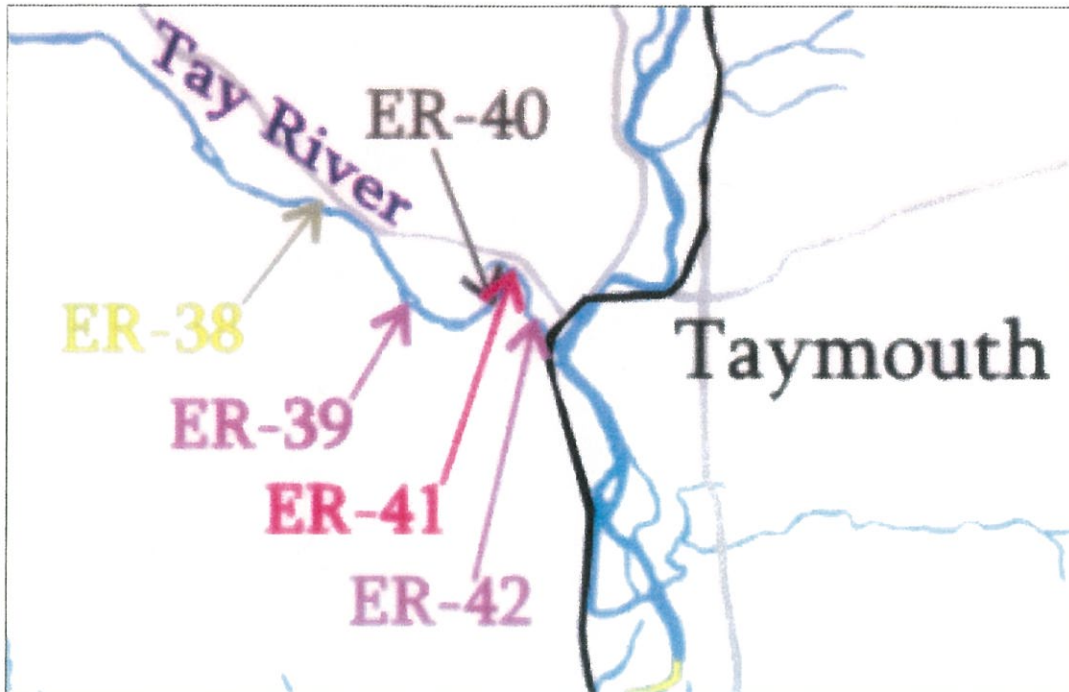


- Major = Red
- Moderate/Major = Purple
- Moderate = Black
- Moderate/Minor = Yellow
- Minor = Green

3.2.2 Continued

Five erosion sites were noted on the lower 5.25 km of the Tay River representing approximately 591 m of riverbanks eroding at increased rates.

Figure 11 – Erosion Sites on the lower 5.25 km of the Tay River

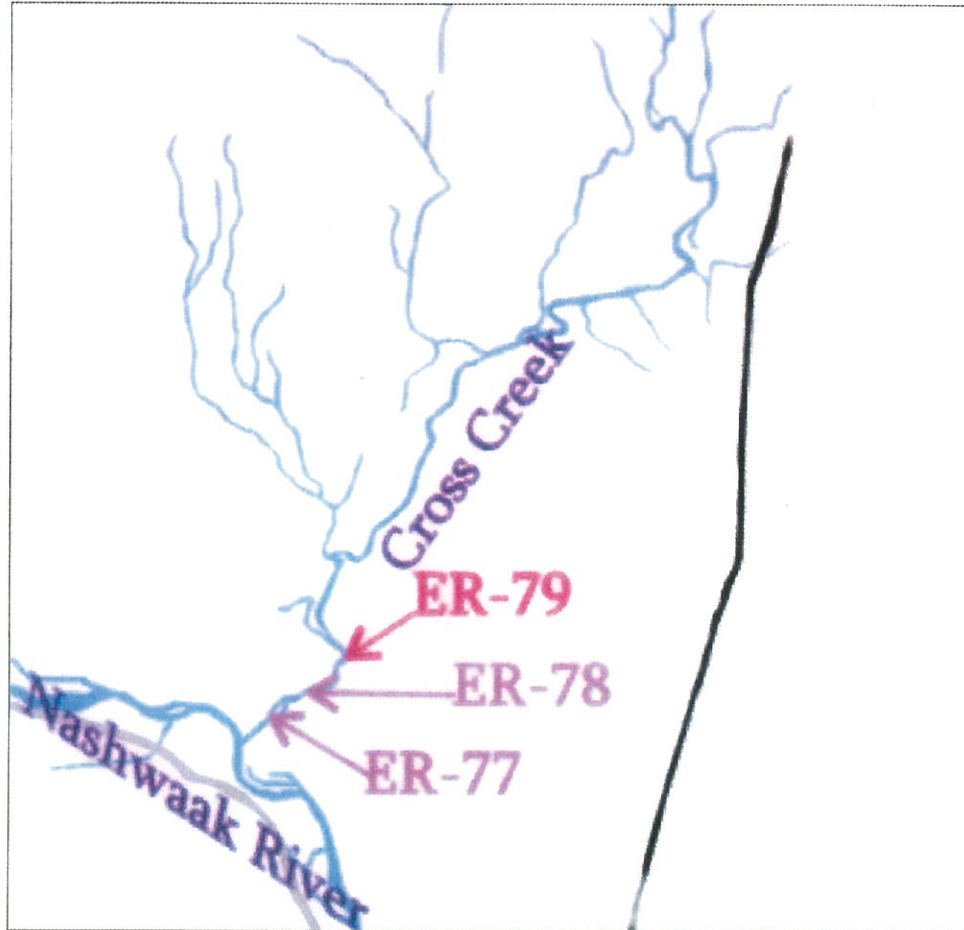


- Major = **Red**
- Moderate/Major = **Purple**
- Moderate = **Black**
- Moderate/Minor = **Yellow**
- Minor = **Green**

3.22 Continued

Three erosion sites were noted on the lower 3 km of the Cross Creek Stream, representing approximately 215 m of riverbanks eroding at increased rates.

Figure 12 – Erosion Sites on the Lower 3 km of the Cross Creek Stream



- Major = Red
- Moderate/Major = Purple
- Moderate = Black
- Moderate/Minor = Yellow
- Minor = Green

3.2.3 Distribution and Severity of Erosion Sites

Major erosion sites were distributed throughout the Study Area with at least one recorded in each section except Nashwaak Bridge to Taymouth and Currieburg to Stanley. Table 1 presents the distribution and severity of Erosion sites by section.

Table 1 – Severity and Distribution of Erosion Sites

Study Area Sections	Lenth of Eroding Riverbank (m)	No. of Sites	Maj	Mod	Min	Maj/Mod	Mod/Min
Currieburg to Stanley	110	2		1		1	
Stanley to Nashwaak Bridge	771	8	3	2	2	1	
Nashwaak Bridge to Taymouth	276	6		2	3		1
Taymouth to Durham Bridge	1261	7	1	2		2	2
Durham Bridge to Penniac Bridge	7,027	15	2	9		2	2
Penniac Bridge to Mouth of River	875	9	1	4	3	1	
Penniac Stream	668	17	1	11	4		1
Tay River	591	5	1	1		2	1
Cross Creek	215	3	1			2	
Total	11794	72	10	32	12	11	7

3.3 Point Sources

This study was limited to the observation of the existence and apparent effectiveness in terms of proper construction and erosion control and did not include interpretation of water quality impacts from these point sources of pollution. Three point sources were noted during the survey and appeared to be constructed properly with adequate erosion controls; although a large amount of loose soil was observed on the rip-rap around PS-2 and PS-3 (appendix B). It is likely that many point sources were missed, as they were difficult to observe from canoe.

3.4 Mammalian Inputs

There were two areas where mammalian inputs were observed: from Durham Bridge to Penniac Bridge, including both channels around Penniac Island, and on the Tay River. These areas correspond to erosion sites ER-22 through 29 and ER-53 on the Nashwaak River and ER-39 and 40 on the Tay River. Cattle fencing were either absent or inadequate in these areas. These eleven erosion sites represent approximately 3,310 m of riverbank where cattle have access to the river, usually resulting in erosion of the riverbank and potential pollution issues. There were other areas where it appeared that mammalian inputs likely occurred, as evidenced by grazing up to the river's edge, although though no direct observations of cattle were made.

3.5 Stakeholder Interest in Riverbank Stabilization Projects

Eleven stakeholders expressed interest in reducing erosion on their riverfront property. These stakeholders represent projects located in different sections of the Nashwaak River Watershed. Interest has been expressed by another local not-for-profit organization in partnering on a tree planting project on a badly eroded stretch of the Nashwaak River at Barker's Point.

4.0 DISCUSSION and CONCLUSIONS

During the survey, it was readily observed that riverbanks with established, mature vegetation were primarily stable while riverbanks without mature vegetation were primarily eroding. Due to their stabilizing affect, the composition of the flora on the riverbanks and the adjacent riparian zone appeared to be the most important factor influencing the rate of erosion of riverbanks throughout the study area. This supports the potential effectiveness of tree and shrub planting projects as a method of riverbank stabilization. Although a mature riparian flora will stabilize soil, erosion may still occur. However, soil erosion on riverbanks with mature vegetation is usually less severe than soil erosion on riverbanks lacking mature vegetation.

The area with the most extensive and severe erosion, from Taymouth to Penniac Bridge, is unstable for long stretches and may continue to erode at an increased rate for a considerable period of time. There are several areas with major erosion within this stretch, including the most severe and large scale erosion encountered, (west channel of Penniac Island). The Penniac Stream also displayed large scale moderate erosion and these two areas may be the largest contributors to future soil erosion and water quality issues. Serious erosion sites were found on the Tay River (ER - 39, 41, 42), between Marysville and Barkers Point (ER- 4), in Barker's Point (ER-12) and on the Cross Creek Stream (ER - 77, 78). The Tay River, near the English Settlement Road, may represent a "hazard land" with a significant soil stabilization issue.

The most severe and consistent soil erosion was found in sections that reinforce the hypotheses, raised in the Water Quality Report (NWA 2002), that soil erosion was the cause for the elevated turbidity, iron and manganese content detected in Penniac Stream, and the occasional raised levels of iron and turbidity detected at Barkers' Point. Barker's Point may be affected by soil erosion anywhere on the river as excessive sediment is swept downstream.

Point source inputs did not appear to be major issues in terms of problems with erosion; however, it is reasonable to assume that there were many point sources not encountered during the survey, due to limited visibility from a canoe. Three point sources of contaminants (two storm water outlets at Marysville and a wastewater treatment plant in Barker's Point), represent point source discharges not included in the 2003 NWA Water Quality report.

The encouraging response from landowner's representing diverse areas of the river system indicates that soil erosion is a visible and continuing problem which should be addressed. It is recognized that reducing the rate of erosion on some parts of the river will preserve valuable land and topsoil; as well as reduce the amount of sediment that enters the river. This helps to prevent water quality and environmental issues from developing or continuing.

This study allowed the NWA to quantify and document erosion in many parts of the river system. Observations were made of the ineffectiveness of grasses alone in preventing undercut banks, which result in large pieces of sod and tonnes of soil being deposited in the river each year. There is evidence that soil erosion has caused the deterioration of salmon spawning habitat (R.Cunjak, pers comm.) and excessive sedimentation inevitably has a negative impact on the river's ecosystem as a whole.

Remedial actions concentrated in high-priority areas, identified in the survey, could have a significant and long-lasting positive impact on the health of the Nashwaak River.

Appendix A

Erosion Sites

Data and Photographs

Eroding Site #1

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-1		
General Location:	Main Street Bridge - Fredericton		
GPS Coordinates:	Northerly	45	57.379
	Westerly	66	37.415
Erosion Severity:	Minor		
Recommended Remedial Action:	Grasses		
Eroding Bank Height (approx meters):	<1		
Eroding Bank Length (approx meters):	60		
Channel Location:	Right Hand Channel		
Bank Location:	Right Hand Bank		

Photo # ER-1a



Eroding Site #2

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-2		
General Location:	Main Street Bridge - Fredericton		
GPS Coordinates:	Northerly	45	57.282
	Westerly	66	37.377
Erosion Severity:	Minor		
Recommended Remedial Action:	Grasses		
Eroding Bank Height (approx meters):	<1		
Eroding Bank Length (approx meters):	60		
Channel Location:	Left Hand Channel		
Bank Location:	Left Hand Bank		

Photo # ER-2c



Photo # ER-2d



Eroding Site #3

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-3		
General Location:	Old Bridge abutment - Charles Ave - Fredericton		
GPS Coordinates:	Northerly	45	57.401
	Westerly	66	37.052
Erosion Severity:	Minor		
Recommended Remedial Action:	Grasses		
Eroding Bank Height (approx meters):	<1		
Eroding Bank Length (approx meters):	30		
Channel Location:	Left Hand Channel		
Bank Location:	Left Hand Bank		

Photo # ER-3a



Eroding Site #4

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-4		
General Location:	Top of 1st island below Cotton Mill		
GPS Coordinates:	Northerly	45	58.145
	Westerly	66	35.192
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	1 to 3		
Eroding Bank Length (approx meters):	270		
Channel Location:	Both - mostly on Left Hand Channel		
Bank Location:	Both - mostly on Left Hand Bank and island tip		

Photo # ER-4b



Photo # ER-4c



Photo # ER-4e



Photo # ER-4f



Eroding Site #6

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-6		
General Location:	Below Nashwaak Bridge		
GPS Coordinates:	Northerly	46	13.818
	Westerly	66	36.782
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	2 to 3		
Eroding Bank Length (approx meters):	180		
Channel Location:	Left Hand Channel		
Bank Location:	Left Hand Bank		
Special Location Instructions:	Marked in Pool below eroding bank		

Photo # ER-6a



Photo # ER-6b



Eroding Site #7

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-7		
General Location:	Below Ross Pool		
GPS Coordinates:	Northerly	46	12.973
	Westerly	66	37.079
Erosion Severity:	Minor		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	<1		
Eroding Bank Length (approx meters):	8		
Channel Location:	Main		
Bank Location:	Left Hand Bank		
Special Location Instructions:	Marked approx 200m below actual erosion		

Photo # ER-7



Erosion Site #8

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number	ER-8		
General Location	Below Encroachment on Nashwaak West Rd.		
GPS Coordinates	Northerly	46	12.438
	Westerly	66	36.797
Erosion Severity	Minor		
Recommended Remedial Action	Trees/shrubs		
Eroding Bank Height (approx meters)	<1		
Eroding Bank Length (approx meters)	40		
Channel Location	Main		
Bank Location	Left Hand Bank		

Photo # ER-8



Erosion Site #9

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number	ER-9		
General Location			
GPS Coordinates	Northerly	46	12.386
	Westerly	66	36.716
Erosion Severity	Minor - Moderate		
Recommended Remedial Action	Trees/shrubs		
Eroding Bank Height (approx meters)	1		
Eroding Bank Length (approx meters)	12		
Channel Location	Main		
Bank Location	Left Hand Bank		

Photo # ER-9a



Photo # ER-9b



Erosion Site #10

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number	ER-10		
General Location			
GPS Coordinates	Northerly	46	11.439
	Westerly	66	36.676
Erosion Severity	Moderate		
Recommended Remedial Action	Trees/shrubs		
Eroding Bank Height (approx meters)	3		
Eroding Bank Length (approx meters)	30		
Channel Location	Main		
Bank Location	Left Hand Bank		

Photo # ER-10



Erosion Site #11

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-11		
General Location:	Bottom of Cameron's Pool		
GPS Coordinates:	Northerly	46	10.979
	Westerly	66	36.710
Erosion Severity:	Minor		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	1.5		
Eroding Bank Length (approx meters):	6		
Channel Location:	Main		
Bank Location:	Right Hand Bank		

Photo # ER-11a



Photo # ER-11b



Eroding Site #12

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-12	180 degree turn above main Street Bridge --	
General Location:	Fredericton	Start	End
GPS Coordinates:	Northerly	45 57.427	57.633
	Westerly	66 36.749	36.636
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	1 to 3		
Eroding Bank Length (approx meters):	350		
Channel Location:	Main and Right Hand Channel		
Bank Location:	Right Hand Bank		

Photo # ER-12a



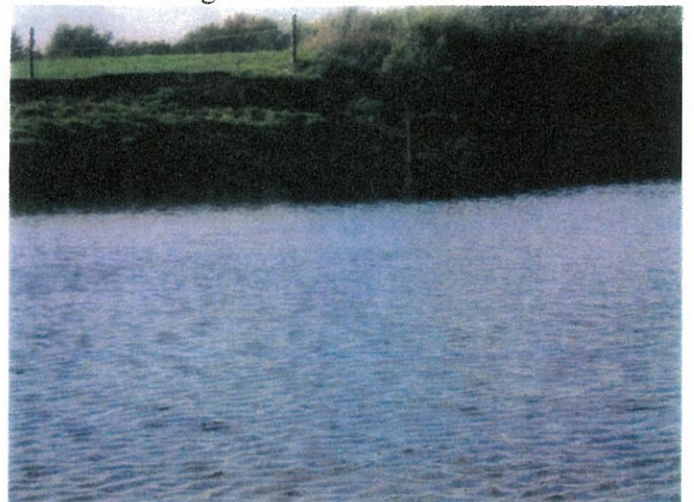
Photo # ER-12c



Photo # ER-12b



Photo # ER-12g



Eroding Site #13

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-13		
General Location:	Just above ER-12		
GPS Coordinates:	Northerly	45	57.690
	Westerly	66	35.965
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	1 to 2		
Eroding Bank Length (approx meters):	80		
Channel Location:	Main		
Bank Location:	Right Hand Bank		

Photo # ER-13a



Photo #ER-13b



Erosion Site #14

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-14		
General Location:	Above Rock Cut (Danny's)		
	Pool		
GPS Coordinates:	Northerly	46	18.831
	Westerly	66	48.517
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	3.5		
Eroding Bank Length (approx meters):	50		
Channel Location:	Main		
Bank Location:	Left Hand Bank		
Special Location Instructions:	GPS Marked on RHB @ Rock Cut, 50m downstream		

Photo #ER-14a

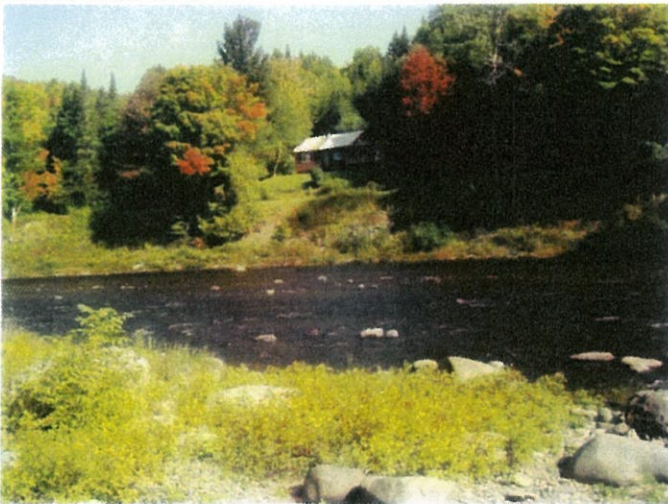


Photo # ER-14c



Photo #ER-14b



Photo #ER-14d



Erosion Site #15

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-15		
General Location:	Above encroachment to Road		
GPS Coordinates:	Northerly	46	17.937
	Westerly	66	47.059
Erosion Severity:	Moderate-Major		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	4.50		
Eroding Bank Length (approx meters):	60		
Channel Location:	Left Hand Channel		
Bank Location:	Left Hand Bank		
Special Location Instructions:	GPS Marked mid channel @ eroding bank		

Photo #ER-15b



Erosion Site #16

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-16		
General Location:	Church Pool		
GPS Coordinates:	Northerly	46	07.184
	Westerly	66	36.358
Erosion Severity:	Moderate - Major		
Recommended Remedial Action:	Trees/shrubs/geotextile?		
Eroding Bank Height (approx meters):	3		
Eroding Bank Length (approx meters):	80		
Channel Location:	Main		
Bank Location:	Left Hand Bank		
Special Location Instructions:	GPS Marked @ site		

Photo #ER-16a



Photo #ER-16b



Erosion Site #17

NWA I Eroding Bank Survey, ETF Project 2004/2005				
Eroding Bank Number:	ER-17			
General Location:	Golf Course		Start	End
GPS Coordinates:	Northerly	46	06.312	06.063
	Westerly	66	36.628	36.734
Erosion Severity:	Moderate			
Recommended Remedial Action:	Trees/shrubs			
Eroding Bank Height (approx meters):	2			
Eroding Bank Length (approx meters):	750			
Channel Location:	Main and Left Hand Channel			
Bank Location:	Left Hand Bank with some erosion on Right Hand Bank			
Special Location Instructions:	GPS Marked @ site			

Photo #ER-17a



Photo # ER-17c



Erosion Site #18

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-18		
General Location:	Behind former Robert's Restaurant		
GPS Coordinates:	Northerly	46	05.907
	Westerly	66	36.672
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	2.5		
Eroding Bank Length (approx meters):	15		
Channel Location:	Main		
Bank Location:	Right Hand Bank		
Special Location Instructions:	GPS Marked @ site		

Photo # ER-18a



Photo # ER-18b



Erosion Site #19

NWAI Eroding Bank Survey, ETF Project 2004/2005

Eroding Bank Number:	ER-19		
General Location:	Below former Robert's Restraunt		
GPS Coordinates:	Northerly	46	05.785
	Westerly	66	36.597
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	2		
Eroding Bank Length (approx meters):	210		
Channel Location:	Main		
Bank Location:	Left Hand Bank		
Special Location Instructions:	GPS Marked @ site		

Photo # ER-19



Erosion Site #20

Nwai Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-20		
General Location:	Just below high voltage power lines		
GPS Coordinates:	Northerly	46	04.817
	Westerly	66	36.099
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	1.4		
Eroding Bank Length (approx meters):	30		
Channel Location:	Right Hand Channel		
Bank Location:	Right Hand Bank		
Special Location Instructions:	GPS Marked @ site		

Photo # ER-20



Erosion Site #21

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-21		
General Location:			
GPS Coordinates:	Northerly	46	04.682
	Westerly	66	36.170
Erosion Severity:	Major		
Recommended Remedial Action:	Uncertain		
Eroding Bank Height (approx meters):	4.2		
Eroding Bank Length (approx meters):	90		
Channel Location:	Right Hand Channel		
Bank Location:	Right Hand Bank		
Special Location Instructions:	GPS Marked @ site		

Photo # ER-21a



Photo # ER-21c



Photo ER-21b



Photo # ER-21d



Erosion Site #22

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-22		
General Location:			
GPS Coordinates:	Northerly	46	04.102
	Westerly	66	36.030
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/Shrubs		
Eroding Bank Height (approx meters):	1.5		
Eroding Bank Length (approx meters):	450		
Channel Location:	Main		
Bank Location:	Left Hand Bank		
Special Location Instructions:	Mammalian inputs from here to bottom of ER-29		

Photo # ER-22a



Photo # ER-22c



Photo # ER-22b



Photo # ER-22d



Erosion Site #23

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-23		
General Location:	Just above mouth of Manzer Bk.		
GPS Coordinates:	Northerly	46	03.797
	Westerly	66	35.861
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/Shrubs		
Eroding Bank Height (approx meters):	1.10		
Eroding Bank Length (approx meters):	250		
Channel Location:	Main		
Bank Location:	Right Hand Bank		
Special Location Instructions:	GPS Marked @ site		

Photo # ER-23a



Photo # ER-23b



Erosion Site #24

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-24		
General Location:	Cell tower visible		
GPS Coordinates:	Northerly	46	03.578
	Westerly	66	35.643
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/Shrubs		
Eroding Bank Height (approx meters):	2.80		
Eroding Bank Length (approx meters):	90		
Channel Location:	Left Hand Channel		
Bank Location:	Right Hand Bank		
Special Location Instructions:	GPS Marked @ site		

Photo # ER-24a



Photo # ER-24b



Erosion Site #25

NWA I Eroding Bank Survey, ETF Project 2004/2005				
Eroding Bank Number:	ER-25			
General Location:	Cell tower visible		Start	End
GPS Coordinates:	Northerly	46	03.263	02.570
	Westerly	66	35.693	35.343
Erosion Severity:	Moderate			
Recommended Remedial Action:	Trees/Shrubs			
Eroding Bank Height (approx meters):	1 – 3			
Eroding Bank Length (approx meters):	1 480			
Channel Location:	LHC & RHC (RHC observed @ start/end of island)			
Bank Location:	LHB for 2000m and all around island (less @ RHC-LHB near bottom)			
Special Location Instructions:	GPS Marked @ start and finish			

Photo # ER-25d



Photo # ER-25f



Photo # ER-25e



Photo # ER-25h



Eroding Site #26

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number	ER-26		
General Location		Start	End
GPS Coordinates	Northerly	46 02.162	01.968
	Westerly	66 35.306	35.145
Erosion Severity	Moderate & minor		
Recommended Remedial Action	Trees/Shrubs		
Eroding Bank Height (approx meters)	2.4		
Eroding Bank Length (approx meters)	170		
Channel Location	Left Hand Channel near top of island		
Bank Location	Left Hand Bank then Right Hand Bank		
Special Location Instructions	GPS Marked @ top/bottom of site		

Photo # ER-26b



Photo # ER-26c



Eroding Site #27

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number	ER-27		
General Location	Top of Penniac Island (at split)		
GPS Coordinates	Northerly	46	01.829
	Westerly	66	35.017
Erosion Severity	Moderate		
Recommended Remedial Action	Trees/Shrubs		
Eroding Bank Height (approx meters)	2.4		
Eroding Bank Length (approx meters)	150		
Channel Location	Main and Left Hand Channel		
Bank Location	Main -Left Hand Bank, Left Hand Channel - Left Hand Bank		
Special Location Instructions	GPS Marked @ top of site		

Photo # ER-27a



Photo # ER-27c



Photo # ER-27b



Photo # ER-27d



Eroding Site #28

NWAI Eroding Bank Survey, ETF Project 2004/2005

Eroding Bank Number	ER-28	
General Location	at Hwy 8	
GPS Coordinates	Northerly	46 01.758
	Westerly	66 35.355
Erosion Severity	Moderate to major	
Recommended Remedial Action	Trees/Shrubs, possibly Engineered	
Eroding Bank Height (approx meters)	3	
Eroding Bank Length (approx meters)	120	
Channel Location	Right Hand Channel	
Bank Location	Right Hand Bank	
Special Location Instructions	GPS Marked @ top of site	

Photo # ER-28a



Photo # Er-29b



Erosion Site #29

NWAI Eroding Bank Survey, ETF Project 2004/2005

Eroding Bank Number:	ER-29		
General Location:	Long stretch ending bottom of Penniac Island	Start	End
GPS Coordinates:	Northerly	46 01.636	01.191
	Westerly	66 35.287	34.706
Erosion Severity:	Moderate, minor in small places		
Recommended Remedial Action:	Trees/Shrubs		
Eroding Bank Height (approx meters):	1 to 2		
Eroding Bank Length (approx meters):	1 142		
Channel Location:	Right Hand Channel		
Bank Location:	Both sides, also RHB of LHC re-joining at bottom of P. Island		
Special Location Instructions:	GPS Marked @ top/bottom		

Photo # ER-29a



Photo # ER-29c



Erosion Site #30

NWAI Eroding Bank Survey, ETF Project 2004/2005

Eroding Bank Number:	ER-30		
General Location:	Sewage lagoon – Stanley		
GPS Coordinates:	Northerly	46	16.840
	Westerly	66	44.092
Erosion Severity:	Major		
Recommended Remedial Action:	Engineered?		
Eroding Bank Height (approx meters):	4.2 (stable) and 1.2 erosion under trees		
Eroding Bank Length (approx meters):	45 (stable) 8 m eroding under trees		
Channel Location:	Main		
Bank Location:	Right Hand Bank		
Special Location Instructions:	GPS marked at top of site. Appears to have been stable for > 25 years		

Photo # ER-30



Erosion Site #31

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-31		
General Location:	Across from NB Hwy 107		
GPS Coordinates:	Northerly	46	16.549
	Westerly	66	43.157
Erosion Severity:	Moderate - Major		
Recommended Remedial Action:	Trees/shrubs, perhaps engineered		
Eroding Bank Height (approx meters):	0.9		
Eroding Bank Length (approx meters):	45		
Channel Location:	Main		
Bank Location:	Right Hand Bank		
Special Location Instructions:	GPS Marked at site		

Photo # ER-31a



Photo # ER-31b



Erosion Site #32

Nwai Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-32		
General Location:	Near camps		
GPS Coordinates:	Northerly	46	16.346
	Westerly	66	42.519
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	3.9		
Eroding Bank Length (approx meters):	3		
Channel Location:	Main		
Bank Location:	Left Hand Bank		
Special Location Instructions:	GPS Marked at site		

Photo # ER-32a



Photo # ER-32b



Erosion Site #33

NWA I Eroding Bank Survey, ETF Project 2004/2005				
Eroding Bank Number:	ER-33			
General Location:		Start	End	
GPS Coordinates:	Northerly	46	16.335	16.200
	Westerly	66	40.698	40.413
Erosion Severity:	Minor			
Recommended Remedial Action:	Trees?, Additional filter fabric			
Eroding Bank Height (approx meters):	1.8			
Eroding Bank Length (approx meters):	480			
Channel Location:	Main			
Bank Location:	Left Hand Bank			
Special Location Instructions:	Can't save "major" upper end -- potential for more erosion			

Photo # ER-33a



Photo # ER-33d



Photo # ER-33c



Photo # ER-33e



Erosion Site #34

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-34		
General Location:	Beside Hwy 107 @ MacGlaggon Straight		
GPS Coordinates:	Northerly	46	16.087
	Westerly	66	39.716
Erosion Severity:	Major		
Recommended Remedial Action:	Engineered		
Eroding Bank Height (approx meters):	1.5 – 3		
Eroding Bank Length (approx meters):	40		
Channel Location:	Main		
Bank Location:	Right Hand Bank		
Special Location Instructions:	GPS Marked at site		

Photo ER-34



Erosion Site #35

NWAJ Eroding Bank Survey, ETF Project 2004/2005	
Eroding Bank Number:	ER-35
General Location:	Above confluence of Cross Creek Stream
GPS Coordinates:	Northerly 46 16.112 Westerly 66 38.808
Erosion Severity:	Major at top 15m and Minor for bottom 30m
Recommended Remedial Action:	Engineered/trees
Eroding Bank Height (approx meters):	6
Eroding Bank Length (approx meters):	15 with 30 minor below
Channel Location:	Main
Bank Location:	Left Hand Bank
Special Location Instructions:	GPS Marked at site

Photo # ER-35a



Photo # ER-35c



Photo # ER-35b



Photo ER-35d



Erosion Site #36

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	ER-36		
General Location:	Coulters Pool		
GPS Coordinates:	Northerly	46	15.837
	Westerly	66	38.650
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees, maybe engineered		
Eroding Bank Height (approx meters):	2		
Eroding Bank Length (approx meters):	60		
Channel Location:	Main		
Bank Location:	Right Hand Bank		
Special Location Instructions:	GPS Marked at site		

Photo # ER-36



Erosion Site #37

NWA I Eroding Bank Survey, ETF Project 2004/2005		
Eroding Bank Number:	ER-37	
General Location:	Approx 500 m upstream from Nashwaak Bridge	
GPS Coordinates:	Northerly	46 14.783
	Westerly	66 37.365
Erosion Severity:	Minor	
Recommended Remedial Action:	Trees, maybe engineered	
Eroding Bank Height (approx meters):	0.5 – 1	
Eroding Bank Length (approx meters):	45	
Channel Location:	Main	
Bank Location:	Both intermittently	
Special Location Instructions:	GPS Marked at site	

Photo # ER-37



Erosion Site #38

NWAI Eroding Bank Survey, ETF Project 2004/2005

Eroding Bank Number: 38

General Location: Campground

GPS Coordinates: Northerly 46 11.317

Westerly 66 66.497

Erosion Severity: Minor to Moderate in places

Recommended Remedial Action: Shrubs

Eroding Bank Height (approx meters): 1.2

Eroding Bank Length (approx meters): 92

Channel Location: Main Tay River

Bank Location: Left Hand Bank

Special Location Instructions:

Photo # ER-38



Erosion Site #39

NWAI Eroding Bank Survey, ETF Project 2004/2005

Eroding Bank Number:	39
General Location:	Farm land
GPS Coordinates:	Northerly 46 10.952
	Westerly 66 38.013
Erosion Severity:	Moderate with Major area at end of RHB-RHC
Recommended Remedial Action:	Shrubs
Eroding Bank Height (approx meters):	0.6-2.1
Eroding Bank Length (approx meters):	LHB, LHC = 30 and RHC, RHB = 60
Channel Location:	Left Hand Channel and Right Hand Channel
Bank Location:	(LHC) Left Hand Bank and (RHC) Right Hand Bank
Special Location Instructions:	

Photo # ER-39a



Photo # ER-39b



Erosion Site #40

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	40		
General Location:	Farm Land		
GPS Coordinates:	Northerly	46	10.889
	Westerly	66	37.627
Erosion Severity:	Moderate		
Recommended Remedial Action:	Shrubs		
Eroding Bank Height (approx meters):	1.5		
Eroding Bank Length (approx meters):	15.2		
Channel Location:	Main Tay River		
Bank Location:	Left Hand Bank		
Special Location Instructions:			

Photo # ER-40



Erosion Site #41

NWAJ Eroding Bank Survey, ETF Project 2004/2005	
Eroding Bank Number:	41
General Location:	Oxbow turn at Englist Settlement Road
GPS Coordinates:	Northerly 46 10.999 Westerly 66 37.462
Erosion Severity:	RHB = Minor, LHC-LHB = Major
Recommended Remedial Action:	Shrubs and Engineered
Eroding Bank Height (approx meters):	0.91 (RHB), 10.7 (LHB)
Eroding Bank Length (approx meters):	RHB = 51.8, LHB=12.2
Channel Location:	Mainstem Tay
Bank Location:	Right Hand Bank and Left Hand Bank
Special Location Instructions:	

Photo # Er-41a



Photo # Er-41c



Photo # Er-41b



Photo # ER-41d



Erosion Site #42

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	42		
General Location:	Church		
GPS Coordinates:	Northerly	46	10.961
	Westerly	66	37.355
Erosion Severity:	Moderate, Major on bank next to church		
Recommended Remedial Action:	Shrubs/engineered		
Eroding Bank Height (approx meters):	3.1		
Eroding Bank Length (approx meters):	LHB =150, RHB = 180		
Channel Location:	Main Tay River		
Bank Location:	LHB and RHB and LHB again		
Special Location Instructions:			

Photo # ER-42b



Photo # ER-42d



Photo # ER-42e



Photo # Er-42f



Photo # ER-42g



Photo # ER-42h



Erosion Site #43

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	43		
General Location:	Mouth of Tay River		
GPS Coordinates:	Northerly	46	10.715
	Westerly	66	37.165
Erosion Severity:	Moderate		
Recommended Remedial Action:	Shrubs		
Eroding Bank Height (approx meters):	1.5		
Eroding Bank Length (approx meters):	61		
Channel Location:	Main Nashwaak		
Bank Location:	Right Hand Bank		
Special Location Instructions:			

Photo ER-43



Erosion Site #44

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	44		
General Location:	Top of 1st island below Tay		
GPS Coordinates:	Northerly	46	10.309
	Westerly	66	36.881
Erosion Severity:	Major to Moderate		
Recommended Remedial Action:	Engineered		
Eroding Bank Height (approx meters):	4.5		
Eroding Bank Length (approx meters):	30		
Channel Location:	Right Hand Channel		
Bank Location:	Right Hand Bank		
Special Location Instructions:			

Photo # Er-44



Erosion Site #45

NWA I Eroding Bank Survey, ETF Project 2004/2005				
Eroding Bank Number:	45			
General Location:	Bottom of 1st island after mouth of Tay	Start	End	
GPS Coordinates:	Northerly	46	10.099	09.819
	Westerly	66	36.928	36.668
Erosion Severity:	Major/Moderate			
Recommended Remedial Action:	Trees/shrubs			
Eroding Bank Height (approx meters):	2.1			
Eroding Bank Length (approx meters):	482			
Channel Location:	Main			
Bank Location:	Right Hand Bank then Left Hand Bank around bend			
Special Location Instructions:	Some rip rap on LHB working well, railbed along major erosion			

Photo # Er-45b



Photo # ER-45c



Erosion Site #46

NWAI Eroding Bank Survey, ETF Project 2004/2005

Eroding Bank Number:	46		
General Location:	Above Sterling's Warf		
GPS Coordinates:	Northerly	46 09.665	09.473
	Westerly	66 36.562	36.793
Erosion Severity:	Minor for forest stretch then Moderate for field		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	2.4		
Eroding Bank Length (approx meters):	530		
Channel Location:	Main		
Bank Location:	Left Hand Bank		
Special Location Instructions:			

Photo # ER-46a



Photo # ER-46b



Erosion Site #47

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	47		
General Location:	Above Dunbar Brook		
GPS Coordinates:	Northerly	46	08.647
	Westerly	66	36.653
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	1.2-1.5		
Eroding Bank Length (approx meters):	137		
Channel Location:	Main		
Bank Location:	Left Hand Bank		
Special Location Instructions:			

Photo # ER-47a



Photo # ER-47b



Erosion Site #48

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	48		
General Location:	Upstream from Durham Bridge		
GPS Coordinates:	Northerly	46	07.859
	Westerly	66	36.722
Erosion Severity:	Major		
Recommended Remedial Action:	Engineered		
Eroding Bank Height (approx meters):	4.6-7.6		
Eroding Bank Length (approx meters):	12		
Channel Location:	Left Hand Channel		
Bank Location:	Left Hand Bank		
Special Location Instructions:			

Photo # ER-48



Erosion Site #49

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	49		
General Location:	Bridge @ Taymouth		
GPS Coordinates:	Northerly	46	10.952
	Westerly	66	37.046
Erosion Severity:	Moderate-minor		
Recommended Remedial Action:	Trees/shrubs		
Eroding Bank Height (approx meters):	2.3		
Eroding Bank Length (approx meters):	9		
Channel Location:	Main		
Bank Location:	Left Hand Bank		
Special Location Instructions:			

Photo # ER-49



Erosion Site #50

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	50		
General Location:	Near closed gas station approx 1 km above Marysville Bridge		
GPS Coordinates:	Northerly	45	59.502
	Westerly	66	34.654
Erosion Severity:	Moderate		
Recommended Remedial Action:	Rocks for channel running down eroding bank		
Eroding Bank Height (approx meters):	0.8		
Eroding Bank Length (approx meters):	2		
Channel Location:	Main		
Bank Location:	Right Hand Bank		
Special Location Instructions:			

Photo # ER-50a



Photo # ER-50b

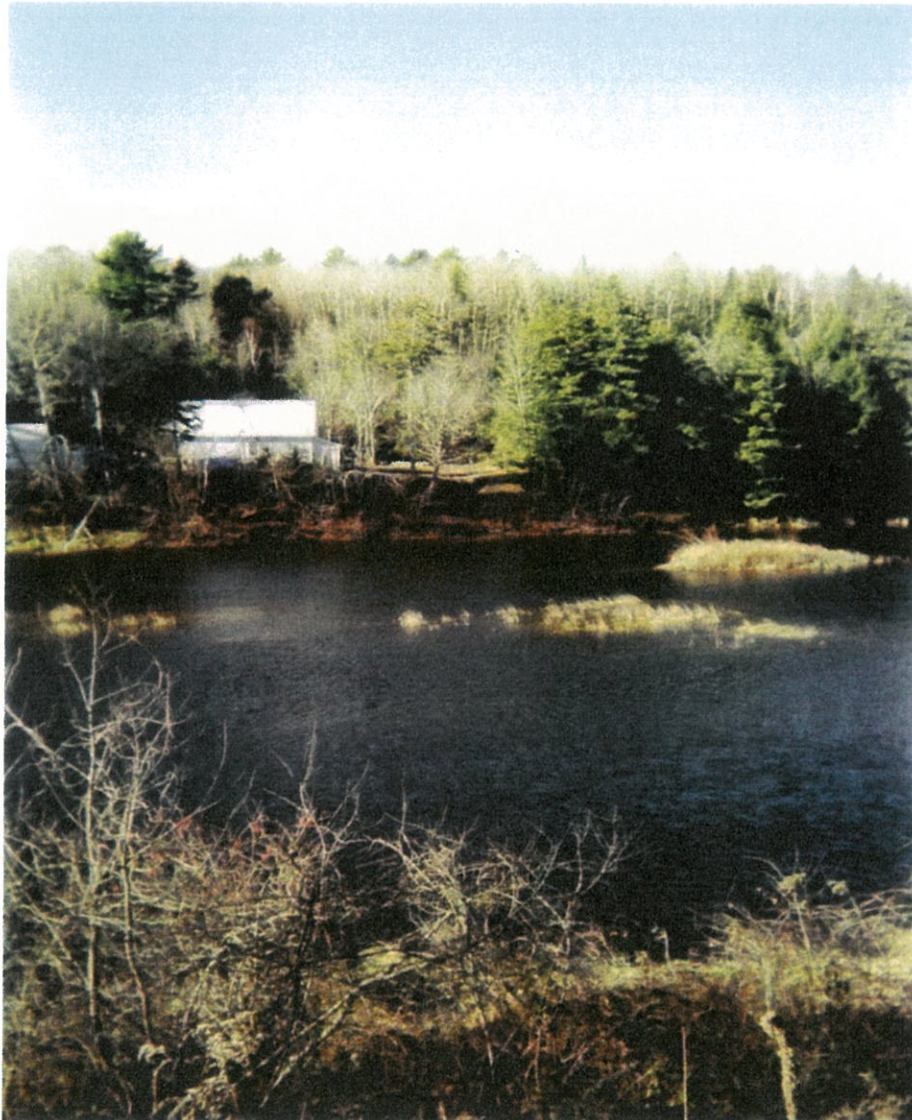


Erosion Site #51

NWAI Eroding Bank Survey, ETF Project 2004/2005

Eroding Bank Number:	51
General Location:	400 m downstream from Penniac Bridge
GPS Coordinates:	Northerly 46 00.080
	Westerly 66 34.593
Erosion Severity:	Major
Recommended Remedial Action:	Trees and shrubs
Eroding Bank Height (approx meters):	4
Eroding Bank Length (approx meters):	10
Channel Location:	Main
Bank Location:	Right Hand Bank
Special Location Instructions:	

Photo # ER-51



Erosion Site #52

NWAI Eroding Bank Survey, ETF Project 2004/2005

Eroding Bank Number:	52
General Location:	Just below Penniac Bridge
GPS Coordinates:	Northerly 46 00.399
	Westerly 66 34.792
Erosion Severity:	Moderate-Major
Recommended Remedial Action:	Trees/Shrubs/Engineered?
Eroding Bank Height (approx meters):	1 -- 2
Eroding Bank Length (approx meters):	12.5
Channel Location:	Left Hand Channel
Bank Location:	Left Hand Bank
Special Location Instructions:	Large culvert has extremely eroded gully.

Photo # ER-52a



Photo # ER-52b



Photo # ER-52c



Erosion Site #53

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	53		
General Location:	Left Hand Channel around Penniac Island		
Channel Location:	Left hand Channel		
GPS Coordinates	Northerly	46 01.775	01.817
	Westerly	66 34.962	34.440
Erosion Severity:	Major, Moderate and Minor		
Recommended Remedial Action:	Trees and Shrubs		
Eroding Bank Height (approx meters):	<1m to 4m		
Eroding Bank Length (approx meters):	?		
Bank Location:	Both banks intermittently, majority eroded		
Special Location Instructions:	Long and varied site, many areas of severe erosion		

Photo # ER-53a



Photo # ER-53d



Photo # ER-53b



Photo # ER-53e



Erosion Site #53 photographs continued

Photo # ER-53f



Photo # ER-53i



Photo # ER-53g



Photo # ER-53j



Photo # ER-53h



Photo # ER-53L



Erosion Site #53 Photographs Continued

Photo # ER-53m



Photo # ER-53s



Photo # ER-53n



Photo # ER-53t



Photo # ER-53r



Erosion Site #60

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	60		
General Location:	Below Harry Allen Bridge		
GPS Coordinates:	Northerly	46	02.707
	Westerly	66	32.451
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees		
Eroding Bank Height (approx meters):	2.5		
Eroding Bank Length (approx meters):	20		
Channel Location:	Penniac Stream		
Bank Location:	Left Hand Bank		
Special Location Instructions:			

Photo # 60



Erosion Site #61

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	61		
General Location:			
GPS Coordinates:	Northerly	46	02.675
	Westerly	66	32.629
Erosion Severity:	Minor-Moderate		
Recommended Remedial Action:	Trees/riprap		
Eroding Bank Height (approx meters):	LHB = 0.6, RHB = 2		
Eroding Bank Length (approx meters):	LHB = 50, RHB = 150		
Channel Location:	Main Penniac		
Bank Location:	Left Hand Bank and Right Hand Bank		
Special Location Instructions:			

Photograph # ER-61a



Photo # Er-61b



Erosion Site #62

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	62		
General Location:	Below ER-61 on RHC of island		
GPS Coordinates:	Northerly	46	02.555
	Westerly	66	32.807
Erosion Severity:	Major		
Recommended Remedial Action:	Riprap		
Eroding Bank Height (approx meters):	2.5		
Eroding Bank Length (approx meters):	10		
Channel Location:	Right Hand Channel		
Bank Location:	Right Hand Bank		
Special Location Instructions:			

Photo # ER-62



Erosion Site#63

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	63		
General Location:	Farmers Bridge Site		
GPS Coordinates:	Northerly	46	02.466
	Westerly	66	33.279
Erosion Severity:	Minor		
Recommended Remedial Action:	Trees/Shrubs		
Eroding Bank Height (approx meters):	0.6		
Eroding Bank Length (approx meters):	10		
Channel Location:	Main Penniac		
Bank Location:	Left Hand Bank		
Special Location Instructions:			

Photo # 63



Erosion Site #64

NWAI Eroding Bank Survey, ETF Project 2004/2005

Eroding Bank Number:	64		
General Location:	Just above sharp stream turn beside road		
GPS Coordinates:	Northerly	46	2.500
	Westerly	66	33.36
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/Shrubs		
Eroding Bank Height (approx meters):	1.2		
Eroding Bank Length (approx meters):	15		
Channel Location:	Main Penniac		
Bank Location:	Left Hand Bank		
Special Location Instructions:			

Photo # ER-64



Erosion Site # 65

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	65		
General Location:			
GPS Coordinates:	Northerly	46	02.487
	Westerly	66	33.417
Erosion Severity:	Minor		
Recommended Remedial Action:	Shrubs		
Eroding Bank Height (approx meters):	0.3		
Eroding Bank Length (approx meters):	61		
Channel Location:	Main Penniac		
Bank Location:	Right Hand Bank		
Special Location Instructions:			

Photo # Er-65



Erosion Site #66

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	66		
General Location:			
GPS Coordinates:	Northerly	46	02.437
	Westerly	66	33.408
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees and Shrubs		
Eroding Bank Height (approx meters):	0.3-0.6		
Eroding Bank Length (approx meters):	9		
Channel Location:	Main Penniac		
Bank Location:	Left Hand Bank		
Special Location Instructions:			

Photo # ER-66a



Photo # ER-66c



Photo # ER-66b



Erosion Site #67

NWAI Eroding Bank Survey, ETF Project 2004/2005

Eroding Bank Number: 67

General Location:

GPS Coordinates: Northerly 46 02.437
Westerly 66 33.450

Erosion Severity: Moderate

Recommended Remedial Action: Trees/Shrubs

Eroding Bank Height (approx meters): 0.6-0.9

Eroding Bank Length (approx meters): 30

Channel Location: Main Penniac

Bank Location: Left Hand Bank and Right Hand Bank

Special Location Instructions:

Photo # 67



Erosion Site #68

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	68		
General Location:			
GPS Coordinates:	Northerly	46	02.381
	Westerly	66	33.537
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/Shrubs		
Eroding Bank Height (approx meters):	0.9		
Eroding Bank Length (approx meters):	5		
Channel Location:	Main Penniac		
Bank Location:	Right Hand Bank		
Special Location Instructions:			

Photo # ER68



Erosion Site #69

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	69		
General Location:			
GPS Coordinates:	Northerly	46	02.369
	Westerly	66	33.632
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/Shrubs		
Eroding Bank Height (approx meters):	0.4		
Eroding Bank Length (approx meters):	6		
Channel Location:	Main Penniac		
Bank Location:	Right Hand Bank		
Special Location Instructions:			

Photo # ER-69



Erosion Site #70

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	70		
General Location:			
GPS Coordinates:	Northerly	46	02.310
	Westerly	66	33.627
Erosion Severity:	Minor		
Recommended Remedial Action:	Shrubs, trees		
Eroding Bank Height (approx meters):	0.6		
Eroding Bank Length (approx meters):	45		
Channel Location:	Penniack Stream		
Bank Location:	Right Hand Bank		
Special Location Instructions:			

Photo # ER-70a



Photo # ER-70e



Erosion Site #71

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	71		
General Location:			
GPS Coordinates:	Northerly	46	02.184
	Westerly	66	34.126
Erosion Severity:	Minor		
Recommended Remedial Action:	Shrubs		
Eroding Bank Height (approx meters):	0.3		
Eroding Bank Length (approx meters):	6		
Channel Location:	Main Penniac		
Bank Location:	Right Hand Bank		
Special Location Instructions:			

Photo # ER-71



Erosion Site #72

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	72		
General Location:			
GPS Coordinates:	Northerly	46	01.992
	Westerly	66	34.256
Erosion Severity:	Moderate		
Recommended Remedial Action:	Engineered		
Eroding Bank Height (approx meters):	1.5		
Eroding Bank Length (approx meters):	60		
Channel Location:	Penniack Stream		
Bank Location:	Right Hand Bank		
Special Location Instructions:			

Photo # ER-72



Erosion Site #73

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	73		
General Location:			
GPS Coordinates:	Northerly	46	01.931
	Westerly	66	34.232
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/Shrubs		
Eroding Bank Height (approx meters):	1.8		
Eroding Bank Length (approx meters):	30		
Channel Location:	Main Penniac		
Bank Location:	Right Hand Bank		
Special Location Instructions:			

Photo # ER-73a



Photo # ER-73c



Photo # ER-73b

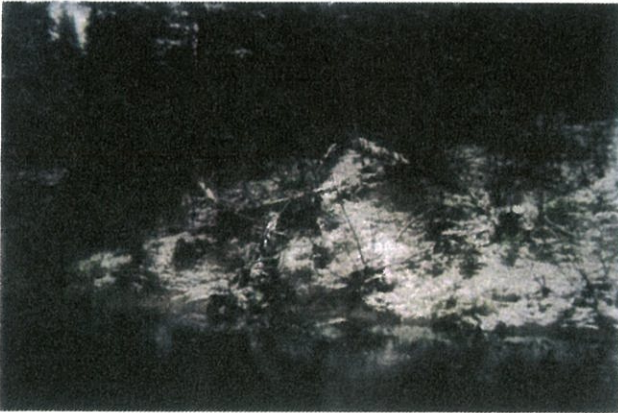


Photo # ER-73d



Erosion Site #74

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	74		
General Location:	Bridge - Penniac Stream		
GPS Coordinates:	Northerly	46	01.855
	Westerly	66	34.299
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/Shrubs		
Eroding Bank Height (approx meters):	0.6		
Eroding Bank Length (approx meters):	6		
Channel Location:	Main Penniac		
Bank Location:	Right Hand Bank		
Special Location Instructions:			

Photo # ER-74



Erosion Site #75

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	75		
General Location:	Immediately below Hwy 628		
GPS Coordinates:	Northerly	46	01.880
	Westerly	66	34.288
Erosion Severity:	Moderate		
Recommended Remedial Action:	Trees/Shrubs		
Eroding Bank Height (approx meters):	1.5		
Eroding Bank Length (approx meters):	45		
Channel Location:	Main Penniac		
Bank Location:	Right Hand Bank		
Special Location Instructions:			

Photo # ER-75a



Photo # Er-75b



Erosion Site #76

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number	76		
General Location	Mouth of Penniac		
GPS Coordinates	Northerly	46	01.869
	Westerly	66	34.426
Erosion Severity	Moderate		
Recommended Remedial Action	Trees/Shrubs		
Eroding Bank Height (approx meters)	1		
Eroding Bank Length (approx meters)	LHB = 30, RHB = 80		
Channel Location	Main Penniac		
Bank Location	Left Hand Bank and Right Hand Bank		
Special Location Instructions			

Photo # ER-76



Erosion Site #77

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	77		
General Location:	Above Hwy # Cross Creek Station Road		
GPS Coordinates:	Northerly	46	16.169
	Westerly	66	38.410
Erosion Severity:	Moderate to Major		
Recommended Remedial Action:	Engineered		
Eroding Bank Height (approx meters):	1-7		
Eroding Bank Length (approx meters):	LHC = 75, RHC = 20		
Channel Location:	Cross Creek Stream LHC and RHC		
Bank Location:	Left Hand Bank and Right Hand Bank		
Special Location Instructions:			

Photo # ER-77b



Photo # Er-77f



Photo # ER-77d



Photo # ER-77g



Erosion Site #77 Photographs Continued

Photo # ER-77h



Photo # ER-77j



Photo # ER-77i



Photo # Er-77k



Erosion Site #78

NWA I Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	78		
General Location:	Starts just below swimming hole		
GPS Coordinates:	Northerly	46	16.165
	Westerly	66	38.268
Erosion Severity:	Moderate to Major		
Recommended Remedial Action:	Engineered		
Eroding Bank Height (approx meters):	1-7		
Eroding Bank Length (approx meters):	100		
Channel Location:	Cross Creek Stream LHC		
Bank Location:	Left Hand Bank		
Special Location Instructions:			

Photo # ER-78a



Photo # ER-78b



Erosion Site # 79

NWAJ Eroding Bank Survey, ETF Project 2004/2005			
Eroding Bank Number:	79		
General Location:	Above Train Bridge		
GPS Coordinates:	Northerly	46	16.327
	Westerly	66	38.059
Erosion Severity:	Major		
Recommended Remedial Action:	Engineered		
Eroding Bank Height (approx meters);	15		
Eroding Bank Length (approx meters);	20		
Channel Location:	Cross Creek Stream Left Hand Channel		
Bank Location:	Left Hand Bank		
Special Location Instructions:			

Photo # ER-79b



Photo # ER-79d



Photo # ER-79c



Photo # ER-79e



Appendix B

Point Sources of Pollution

Data and Photographs

Point Source # 1

NWA I Point Source Survey, ETF Project 2004/2005			
Point Source Number:	PS-1		
General Location:	Barkers Point		
GPS Coordinates:	Northerly	45	57.507
	Westerly	66	37.107
Point Source Type:	Fredericton WWTP		
Channel Location:	Main		
Bank Location:	RHB		
Special Location Instructions:			

Photo # PS-1



Point Source # 2

NWA Point Source Survey, ETF Project 2004/2005			
Point Source Number	PS-2		
General Location	Marysville		
GPS Coordinates	Bridge		
	Northerly	45	58.726
	Westerly	66	35.39
Point Source Type	600mm diameter storm		
Channel Location	outfall		
Bank Location	Main		
Special Location Instructions	LHB		

Photo # PS-2a



Photo # PS-2b



Point Source # 3

NWAJ Point Source Survey, ETF Project 2004/2005			
Point Source Number	PS-3		
General Location	Behind Marysville Heritage Center		
GPS Coordinates	Northerly	45	58.585
	Westerly	66	35.428
Point Source Type	600mm and 900mm diameter storm outfall		
Channel Location	Main		
Bank Location	LHB		
Special Location Instructions			

Appendix C

Potential Funding Sources for Riverbank Stabilization Projects

Funding Source	Public/Private/non-profit group	Amount Funded
NB Wildlife Trust Fund	Provincial	Up to 75% of the project's cost
EcoAction	Federal	Up to 50% or \$100 000, other 50% can't be federal gov. funds (in-kind support, or cash)
Habitat Stewardship Program	Federal	Attempt to leverage money from the recipients at a 2:1 ratio. In-kind support and volunteer time counts
MEC -- Environment Fund	Private	usually \$2000 to \$10 000
Shell Environmental fund	Private	up to \$5000 -- 50% at start, 50% at completion
TD Friends of the Environment	Private	N/A
The Agricultural Environmental Stewardship Initiative	Federal	
Canadian Tire Corporation Limited	Private	awards up to \$1000 -- a canadian tire employee must nominate.
Canadian Wildlife Federation	Non-profit	partial funding up to \$ 10 000
CGC charitable foundation	Private	varies
Home Depot	Private	varies
Commission for Environmental Cooperation (CEC)		up to \$40 000, must have other support
Pew Charitable Trusts	Private	up to \$300 000; smaller grants made to community based organizations
Schad Foundation	Private	varies
Seagull Foundation	Private	Between \$100 to \$5,000
Evergreen's Common Grounds Program, in partnership with Unilever Canada	Private	up to 50% of total projects costs.
Canadian Wildlife Fund Communities for Wildlife	Non-profit	up to \$10 000