Nashwaak River Enhancement Project:

Stream Survey and Habitat Assessment

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Sponsored Under

The Cooperation Agreement on Recreational Fisheries

Development

Fredericton Fish and Game Association

and

Kingsclear First Nation

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ACKNOWLEDGEMENTS

The Nashwaak River Enhancement Project was made possible because of people's belief that the river can be sustained as a major recreational fishing area. These people's beliefs is that they should become more actively involved in the management of the resource, and not left solely in the hands of government.

Weighing this statement, a few people need to be recognized for their efforts. Cyril Sacobie who helped me with the actual hands on gathering of the data for the stream surveys on a daily basis. Next, DNRE staff who provided much technical assistance - Pam Seymour, Katherine Collett, Lisa Macabe and Chris Connell.

The project could not have gone forward without the organization and financing provided by organizations and voluntary groups. These include: the Government of Canada (DFO) (under the Cooperation Agreement on Recreational Fisheries Development), the Province of New Brunswick (through the Department of Natural Resources and Energy), Kingsclear First Nation, Fredericton Fish and Game Association and the Nashwaak River Watershed Committee.

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ABSTRACT

The objective of the Nashwaak River Enhancement Project was to obtain information on habitat condition in its' tributaries through a stream survey and habitat assessment procedure. From July 12, 1995 until October 23, 1995 detailed stream survey asessments were carried out on 13 tributaries of the Nashwaak river. With respect to suitable habitat for sea run brook trout, the tributaries had excellent substrate composition, very little erosion due to a healthy riparion habitat. The tributaries were found to be in good condition suggesting that any problems in the Nashwaak watershed are not due to problems with tributary habitat.

INTRODUCTION

Early in 1995 the Fredericton Fish and Game Association applied to the Department of Fisheries and Oceans (DFO). Recreational Fisheries Branch for funding for a habitat survey on the tributaries of the Nashwaak River. The main objective was to see if the available habitat would support a second run (during the fall) of Sea Run Brook trout.

DFO, under the direction of Sharon Ford encouraged the establishment of a watershed organization to receive the funding rather than a unique interest group. In April two meetings were arranged to discuss concepts and goals of a watershed organization. Invities were varied, ranging from residents, anglers, municipal leaders and corporate forestry users. At the end of the meetings a draft of a vision statement was produced, along with a list of concerns about the Nashwaak River and its' watershed.

The vision statement is as follows: "The river should be managed as a natural healthy ecosystem that balances a variety of economic, recreational, social and landowner interests. All stakeholders on the Nashwaak are commited 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 still maintaining a healthy resource for generations to come."

As there was a lack of interest from those attending to accept positions to form an executive for a watershed organization; Gary Spencer and William Gammon volunteered to accept responsibility for the dispersement of funding from DFO, Fredericton Fish and Game Association and Kingsclear First Nation.

Early July saw Brad Sturgeon and Cyril Sacobie hired to conduct the stream survey. Should the habitat survey determine that 1. there is room available for additional trout and 2. the habitat is suitable to support the additional trout - then the next step would be to determine how to develop a second run.

METHODS

During the first week of July, DNRE held a day long workshop on how to do stream surveys. The first part of the day was spent going over map work involved with the surveys. The second part of the day was spent at Burtt's Corner (Jone's Forks) doing some stream survey work, becoming familiar with the technique and the form to record the data (Appendix A). The form for the stream survey and habitat assessment used standards developed by DNRE & DFO - New Brunswick.

The equipment required for conducting the survey work was chestwaders - as we were wading the streams. A hip chain, to measure distances, as well as spare string for the hip chain (which is biodegradable), 30 metre cloth tape to measure widths, a metre stick to record/measure depths, a thermometer to determine air and water temperatures, a clipboard to carry the assessment forms, and an HB pencil.

When doing a stream survey the survey must be conducted in a downstream direction. This meant that on some days we had to walk upstream such a distance that it would give us a day's work going back. The survey/assessments were carried out on tributaries of the Nashwaak River, and on those sections of the tributaries which were reasonably accessible.

All data for the survey/assessment was recorded on the form developed by DNRE/DFO. The top section of the form recorded general information, such as river name, personnel, start point, end point, date and GIS Map No. With the help of a drainage map. The drainage code could be recorded: A two digit number for the drainage, a two digit number for the sub-drainage and a two digit number for the sub-sub-drainage. As well, stream/river no. And stream order no. could be recorded. All this information helped to pinpoint the location of the work being done.

The first column recorded was the reach number. A reach is a physically defined area of a stream i.e. from a road crossing to a convergence with another stream. Reaches can vary greatly in length, and were predetermined and denoted on GIS maps as well as 1:50,000 topographical maps. The numbering of reaches begins where the tributary meets the river and works up the tributary in a left to right direction.

The second column is the unit number. A unit is a specific section of stream which maintains either the same stream type or substrate before changing to another unit. Units can vary greatly in length depending on the stream.

The third column records the stream type, which can be subdivided into fastwater or pools. Fastwater types are:

1. Fall - Fast, turbulent flow of water over a steep incline/drop off.

2. Cascade
   - fast, turbulent flow of water over an incline
   - large bolder and rock bottom

3. Riffle (GR/RB) - shallow flow of water, evenly peaking

4. Riffle (R/B)
   - with little turbulence
   - GR/RB: gravel/rubble substrate
   - R/B/ rock/boulder substrate

5. Riffle (Sand)

6. Sheet (ledge) - a smooth run of water over a bedrock substrate

7. Chute - narrow channeled river where water depth is equal to or greater than the channel width.

8. Run - Shallow (1 to 5 foot depth) water flowing with no surface turbulence

9. Rapid
   - fast, shallow, turbulent flow of water with white peaks present
   - peaks are normally ≥or = 5 inches high
   - rocks and boulders are often seen breaking the water surface.

Pool Types are:

10. Midchannel - a pool that may encompass the entire width of the river.

11. Convergence - a pool resulting due to the convergence of a river/stream into the main branch of the river system

12. Lateral - a pool found on the side of the river/stream system.

13. Beaver

14. Trench

15. Plunge - A pool found at the base of a fall/cascade/dam.

16. Bogan - a backwater area formed by a small stream input or river meander.

17. Eddy - a pool created by the swirl of water behind a rock or boulder.

18. Gabion

19. Log structure

20. Road crossing

21. Wood debris

22. Man-made dam

23. Natural deadwater

The next column recorded is the length of the unit in metres, followed by the wet width (metres) and the bank channel (high water mark) in metres.

Substrate was recorded as a percentage in each unit as:

1.	Bedrock	
2.	Boulder	≥ 461 mm
3.	Rock	180 - 460 mm
4.	Rubble	54 - 179 mm
5.	Gravel	2.5 - 53 mm
6.	Sand	0.06 - 2.5 mm
7.	Fines	0.0005 - 0.05 mm

Substrate total percentage was always 100% for each unit.

Using the metre stick an average depth - wet width was determined and recorded in centimetres. An estimate was made for the left and right bank on the percentage of the bank was undercut up to 50% for each side. A similar estimate, up to 50% was made for each bank on the amount of overhanging bank vegetation.

In each unit an estimate of large woody debris (≥ 5 cm. Diameter) in stream was made, and a cumulative length in metres was recorded. About every 6 or 7 units the air and water temperature were noted.

Embeddedness, or the degree to which larger substrate (rubble and/or rock) is embedded in sands or fines was recorded as: 1. ≤ 20%, 2. 20 - 35%, 3. 35 - 50%, 4. ≥ 50%.

Channel type was recorded as:

1. Main (if measurement refers to main area of river)
2. Side channel (water diverted by islands)
3. Split (if stream is split into various types)
4. Bogan.

A comment could be recorded numerically from a checklist of 45 land use attributes.

In each unit the % of shade up to 100 was estimated for high noon on the wet part of the stream.

Stream bank condition was recorded through vegetation (%) and erosion (%). The vegetation considered was bare ground, grasses, shrubs and trees; a percentage of each was estimated for a total of 100 percent. Erosion considered the left bank and the right bank separately, each totaling 50%. On each bank it was estimated how much was stable, bare stable or eroding.

Lastly, on a daily basis a water flow measurement was done. The unit number and stream type were recorded, a wet width (m) was taken. The depth was recorded at 1/4 way, 1/2 way and 3/4 way in centimetres, averaged and converted to metres. Depending on the stream type a coefficient A was used, 0.9 - smooth or 0.8 - rough. For a distance of 3 metres a wooden objects float time was recorded for 1/4 way, 1/2 way and 3/4 way then averaged.

$$\text{Flow Rate (Cms)} = \frac{\text{W (width) (m)} \times \text{D (depth)(m)} \times \text{L (length) (m)} \times \text{A (Coefficient)}}{\text{T (Time) (Seconds)}}$$

RESULTS

The results of the Nashwaak River Enhancement Project are summarized on an individual stream basis. Tables 1 to 13 show the physical characteristics of the surveyed streams. Stream types, substrate types by area are presented as well as a riporian zone status. The riparian zone status shows the amount of each type of vegetation present and the amount of erosion. The stream area shaded, water temperature (at base flow) and flow rate are also displayed. What is not shown and should be mentioned is a possible problem area below the outlet of the fish farm at Tay Falls; for a distance of 200 meters the substrate is covered with algae.

Table 1. A Summary of the Physical Data Collected on Surveyed Portions of Napadogan Brook

Physical Characteristics

Portion of Mainstream Surveyed: 6.5243 km.

Total Stream Area Surveyed: 61, 900.0 m^2

Area of Stream Habitat As:

Pool	3834.5 m^2	6.19%
Riffle	24563.3 m^2	39.86%
Run	27937.1 m^2	45.1%
Rapids	5478.1 m^2	8.85%

Area of Substrate as

Bedrock:	958.62 m^2	1.55%	Rubble:	30671.45	49.55%
Boulder:	2410.26 m^2	3.89%	Gravel:	10851.07	17.53%
Rock:	7731.31 m^2	12.49%	Sand:	7984.00 m^2	12.89%
			Fines:	1300.99m^2	2.10%

Area with overhang veg. 11.31% 7002.79 m^2

Percent Undercut Banks 1.14% 74.38 meters

Percent of Area Shaded 6.1% 3777.96 m^2

Riparian Zone Status

Trees	810.32 meters	6.21%
Shrubs	8173.53 meters	62.64%
Grass	3192.12 meters	24.46%
Bare	872.95 meters	6.69%

Total Bank Length Surveyed 13048.6 meters

Total Length X 2

Portion Eroding 446.48 meters 3.42%
Temp. At Base Flow: 15.8 Celcius
Flow (Cubic meters/sec): 0.41 m^3 /sec.

Table 2. A Summary of the Physical Data Collected on Surveyed Portions of Rocky Brook

Physical Characteristics

Portion of Mainstream Surveyed: 0.8256 km

Total Stream Area Surveyed: 4796.74m^2

Area of Stream Habitat As:

Pool	436.02	9.09%
Riffle	2180.34	45.45%
Run	2180.60	45.46%
Rapids	----	----

Area of Substrate as

Bedrock:	0.0 m^2	0.0%	Rubble:	1477.18m^2	30.79%
Boulder:	179.88m^2	3.75%	Gravel:	1531.69	31.93%
Rock:	730.41m^2	15.23%	Sand:	725.27	15.12%
			Fines:	152.62m^2	18%

Percent Area with overhang veg. 28.18% 1351.72 m^2

Percent Undercut Banks 0.17% 2.81 meters

Percent of Area Shaded 7.73% 370.66m^2

Riparian Zone Status

Trees	58.12 meters	3.52%
Shrubs	1300.32 meters	78.75%
Grass	292.71 meters	17.73%
Bare	0.0 meters	0.0%

Total Bank Length Surveyed

Total Length X 2 1651.2 meters

Portion Eroding	35.65 meters	2.16%
Temp. At Base Flow:	19.50 Celcius	
Flow (Cubic meters/sec):	0.07 m^3 /sec.	

Table 3. A Summary of the Physical Data Collected on Surveyed Portions of McBean Brook

Physical Characteristics

Portion of Mainstream Surveyed:	3.6037 km
Total Stream Area Surveyed:	20617.13m^2

Area of Stream Habitat As:

Pool	1891.48m^2	9.17%
Riffle	7187.62m^2	34.86%
Run	8133.36m^2	39.45%
Rapids	3405.95m^2	16.52%

Area of Substrate as

Bedrock:	567.44m^2	2.75%	Rubble:	14926.8m^2	72.4%
Boulder:	85.12m^2	0.41%	Gravel:	2033.34	9.86%
Rock:	1692.87m^2	8.21%	Sand:	378.29	1.83%
			Fines:	936.28m^2	24.54%

Percent Area with overhang veg.	37.77%	7787.30 m^2
Percent Undercut Banks	1.73%	124.54 meters
Percent of Area Shaded	33.64%	6934.78m^2

Riparian Zone Status

Trees	1322.46 meters	18.35%
Shrubs	5072.57 meters	70.38%
Grass	740.58 meters	10.27%
Bare	72.73 meters	1.00%

Total Bank Length Surveyed

Total Length X 2	7207.4 meters	
Portion Eroding	252.98 meters	3.51%
Temp. At Base Flow:	17.53 Celcius	
Flow (Cubic meters/sec):	0.145m^3 /sec.	

Table 4 A Summary of the Physical Data Collected on Surveyed Portions of Ryan Brook

Physical Characteristics

Portion of Mainstream Surveyed: 3.6883 km

Total Stream Area Surveyed: 15255.84m^2

Area of Stream Habitat As:

Pool	2625.42m^2	17.21%
Riffle	4683.19m^2	30.70%
Run	4896.06m^2	32.09%
Rapids	3051.17m^2	20.00%

Area of Substrate as

Bedrock:	1781.03m^2	11.67%	Rubble:	6638.06m^2	43.51%
Boulder:	447.03m^2	2.93%	Gravel:	3381.12	22.16%
Rock:	2625.53m^2	17.21%	Sand:	262.54m^2	1.72%
			Fines:	117.08m^2	0.77%

Percent Area with overhang veg. 16.63% 2537.05m^2

Percent Undercut Banks 1.63% 120.24 meters

Percent of Area Shaded 19.05% 2906.45m^2

Riparian Zone Status

Trees	1535.81 meters	20.82%
Shrubs	2367.30 meters	32.09%
Grass	2447.55 meters	33.18%
Bare	1025.94 meters	13.91%

Total Bank Length Surveyed

Total Length X 2 7376.6 meters

Portion Eroding	366.76 meters	4.9%
Temp. At Base Flow:	18.57 Celcius	
Flow (Cubic meters/sec):	0.038m^3 /sec.	

Table 5. A Summary of the Physical Data Collected on Surveyed Portions of Manzea Brook

Physical Characteristics

Portion of Mainstream Surveyed: 2.5982 km

Total Stream Area Surveyed: 9551.72m^2

Area of Stream Habitat As:

Pool	3061.45m^2	32.05%
Riffle	3919.07	41.03%
Run	2265.47m^2	23.72%
Rapids	306.14m^2	3.20%

Area of Substrate as

Bedrock:	104.09m^2	1.09%	Rubble:	5449.38m^2	57.05%
Boulder:	21.43m^2	0.22%	Gravel:	2113.80m^2	22.13%
Rock:	872.51m^2	9.13%	Sand:	704.13m^2	7.37%
			Fines:	287.78m^2	3.01%

Percent Area with overhang veg. 26.25% 2507.33m^2

Percent Undercut Banks 2.45% 127.52 meters

Percent of Area Shaded 46.60% 4451.1m^2

Riparian Zone Status

Trees	414.15 meters	7.97%
Shrubs	3581.58meters	68.92%
Grass	522.98 meters	10.06%
Bare	678.20 meters	13.05%

Total Bank Length Surveyed

Total Length X 2 5196.4 meters

Portion Eroding	361.00 meters	6.95%
Temp. At Base Flow:	15.95 Celcius	
Flow (Cubic meters/sec):	0.084m^3 /sec.	

Table 6. A Summary of the Physical Data Collected on Surveyed Portions of McKenzie Brook

Physical Characteristics

Portion of Mainstream Surveyed: 5.5694 km

Total Stream Area Surveyed: 52519.44m^2

Area of Stream Habitat As:

Pool	6717.60m^2	12.79%
Riffle	19542.12m^2	37.21%
Run	20151.71m^2	38.37%
Rapids	6108.01m^2	11.63%

Area of Substrate as

Bedrock:	6013.48m^2	11.45%	Rubble:	31028.48m^2	59.08%
Boulder:	1449.54m^2	2.76%	Gravel:	4621.71m^2	8.78%
Rock:	7342.22m^2	13.98%	Sand:	1785.66m^2	3.40%
			Fines:	288.86m^2	0.55%

Percent Area with overhang veg. 17.11% 8986.08m^2

Percent Undercut Banks 3.08% 345.3 meters

Percent of Area Shaded 9.86% 5178.42m^2

Riparian Zone Status

Trees	1089.37 meters	9.78%
Shrubs	6404.81 meters	57.50%
Grass	1903.62 meters	17.09%
Bare	1740.99 meters	15.63%

Total Bank Length Surveyed

Total Length X 2 11138.8 meters

Portion Eroding	522.41 meters	4.69%
Temp. At Base Flow:	18.5 Celcius	
Flow (Cubic meters/sec):	0.13m^3 /sec.	

Table 7. A Summary of the Physical Data Collected on Surveyed Portions of Cross Creek

Physical Characteristics

Portion of Mainstream Surveyed: 5.5202 km

Total Stream Area Surveyed: 34998.07m^2

Area of Stream Habitat As:

Pool	6390.65m^2	18.26%
Riffle	15063.17m^2	43.04%
Run	12781.29m^2	36.52%
Rapids	762.96m^2	2.18%

Area of Substrate as

Bedrock:	685.96m^2	1.96%	Rubble:	19514.92m^2	55.76%
Boulder:	356.98m^2	1.02%	Gravel:	7174.60m^2	20.50%
Rock:	4458.75m^2	12.74%	Sand:	2435.87m^2	6.96%
			Fines:	370.98m^2	1.06%

Percent Area with overhang veg. 15.16% 85305.71m^2

Percent Undercut Banks 3.49% 385.31 meters

Percent of Area Shaded 22.97% 8039.06m^2

Riparian Zone Status

Trees	2107.61 meters	19.09%
Shrubs	4485.71 meters	40.63%
Grass	1468.37 meters	13.30%
Bare	2978.70 meters	26.98%

Total Bank Length Surveyed

Total Length X 2 11040.4 meters

Portion Eroding 1058.77 meters 9.59%
Temp. At Base Flow: 16.4 Celcius
Flow (Cubic meters/sec): 0.30m^3 /sec.

Table 8. A Summary of the Physical Data Collected on Surveyed Portions of Five Mile Brook

Physical Characteristics

Portion of Mainstream Surveyed: 1.4578 km

Total Stream Area Surveyed: 9361.99m^2

Area of Stream Habitat As:

Pool	2434.12m^2	26.0%
Riffle	3932.04m^2	42.0%
Run	2995.84m^2	32.0%
Rapids	0.00m^2	0.0%

Area of Substrate as

Bedrock:	299.58m^2	3.2%	Rubble:	5355.06m^2	57.2%
Boulder:	0.00m^2	0.0%	Gravel:	1600.90m^2	17.1%
Rock:	131.07m^2	1.4%	Sand:	1235.78m^2	13.2%
			Fines:	739.60m^2	7.09%

Percent Area with overhang veg. 33.45% 3131.59m^2

Percent Undercut Banks 2.3% 61.06 meters

Percent of Area Shaded 42.2% 3950.76m^2

Riparian Zone Status

Trees	99.13 meters	3.4%
Shrubs	2454.93 meters	84.2%
Grass	303.22 meters	10.4%
Bare	58.31 meters	2.0%

Total Bank Length Surveyed

Total Length X 2 2915.6 meters

Portion Eroding	199.72 meters	6.85%
Temp. At Base Flow:	14.0 Celcius	
Flow (Cubic meters/sec):	0.08m^3 /sec.	

Table 9. A Summary of the Physical Data Collected on Surveyed Portions of Grand John Brook

Physical Characteristics

Portion of Mainstream Surveyed: 1.2734 km

Total Stream Area Surveyed: 7309.32m^2

Area of Stream Habitat As:

Pool	1353.69m^2	18.52%
Riffle	2977.82m^2	40.74%
Run	2977.82m^2	40.74%
Rapids	0.00m^2	0.0%

Area of Substrate as

Bedrock:	0.00m^2	0.0%	Rubble:	4392.90m^2	60.10%
Boulder:	87.71m^2	1.20%	Gravel:	1015.26m^2	13.89%
Rock:	1312.75m^2	17.96%	Sand:	385.93m^2	5.28%
			Fines:	114.76m^2	1.57%

Percent Area with overhang veg. 14.54% 1062.77m^2

Percent Undercut Banks 3.05% 77.68 meters

Percent of Area Shaded 11.85% 866.15m^2

Riparian Zone Status

Trees	202.72 meters	7.96%
Shrubs	1474.09 meters	57.88%
Grass	804.02 meters	31.57%
Bare	65.96 meters	2.59%

Total Bank Length Surveyed

Total Length X 2 2546.8 meters

Portion Eroding	342.03 meters	13.43%
Temp. At Base Flow:	14.75 Celcius	
Flow (Cubic meters/sec):	0.29m^3 /sec.	

Table 10. A Summary of the Physical Data Collected on Surveyed Portions of the Tay River

Physical Characteristics

Portion of Mainstream Surveyed: 6.6011 km

Total Stream Area Surveyed: 67595.26m^2

Area of Stream Habitat As:

Pool	6144.41m^2	9.09%
Riffle	25503.69m^2	37.73%
Run	25503.69m^2	37.73%
Rapids	10443.47m^2	15.45%

Area of Substrate as

Bedrock:	10044.66m^2	14.86%	Rubble:	32411.93m^2	47.95%
Boulder:	4028.68m^2	5.96%	Gravel:	5022.33m^2	7.43%
Rock:	15966.00m^2	26.32%	Sand:	121.67m^2	0.18%
			Fines:	0.00m^2	0.0%

Percent Area with overhang veg. 1.88% 1270.79m^2

Percent Undercut Banks 0.83% 109.58 meters

Percent of Area Shaded 1.88% 1270.79m^2

Riparian Zone Status

Trees	1725.53 meters	13.07%
Shrubs	1786.26 meters	13.53%
Grass	5971.35 meters	45.23%
Bare	3719.06 meters	28.17%

Total Bank Length Surveyed

Total Length X 2 13202.2 meters

Portion Eroding 777.61 meters 5.89%
Temp. At Base Flow: 12.2 Celcius
Flow (Cubic meters/sec): 0.49m^3 /sec.

Table 11. A Summary of the Physical Data Collected on Surveyed Portions of McClean Brook

Physical Characteristics

Portion of Mainstream Surveyed: 0.6274 km

Total Stream Area Surveyed: 3293.85m^2

Area of Stream Habitat As:

Pool	91.57m^2	2.78%
Riffle	1372.55m^2	41.67%
Run	1463.79m^2	44.44%
Rapids	365.95m^2	11.115%

Area of Substrate as

Bedrock:	173.91m^2	5.28%	Rubble:	2214.45m^2	67.23%
Boulder:	18.12m^2	0.55%	Gravel:	370.56m^2	11.25%
Rock:	443.68m^2	13.47%	Sand:	73.12m^2	2.22%
			Fines:	0.00m^2	0.0%

Percent Area with overhang veg. 19.86% 654.16m^2

Percent Undercut Banks 0.28% 3.51 meters

Percent of Area Shaded 23.33% 768.45m^2

Riparian Zone Status

Trees	132.38 meters	10.55%
Shrubs	820.89 meters	65.42%
Grass	301.53 meters	24.03%
Bare	0.00 meters	0.0%

Total Bank Length Surveyed

Total Length X 2 1254.8 meters

Portion Eroding	24.34 meters	1.94%
Temp. At Base Flow:	10.7 Celcius	
Flow (Cubic meters/sec):	0.26m^3 /sec.	

Table 12. A Summary of the Physical Data Collected on Surveyed Portions of Fisher Brook

Physical Characteristics

Portion of Mainstream Surveyed: 0.6847 km

Total Stream Area Surveyed: 1780.22m^2

Area of Stream Habitat As:

Pool	0.0m^2	0.0%
Riffle	733.09m^2	41.18%
Run	837.77m^2	47.06%
Rapids	209.35m^2	11.76%

Area of Substrate as

Bedrock:	0.00m^2	0.0%	Rubble:	269.70m^2	15.15%
Boulder:	0.00m^2	0.0%	Gravel:	337.71m^2	18.97%
Rock:	151.85m^2	8.53%	Sand:	827.27m^2	46.47%
			Fines:	193.69m^2	10.88%

Percent Area with overhang veg. 20.37% 6362.63m^2

Percent Undercut Banks 8.75% 119.82 meters

Percent of Area Shaded 32.94% 568.40m^2

Riparian Zone Status

Trees	497.37 meters	36.32%
Shrubs	525.58 meters	38.38%
Grass	338.38 meters	24.71%
Bare	8.08 meters	0.59%

Total Bank Length Surveyed

Total Length X 2 1369.4 meters

Portion Eroding	339.34 meters	24.78%
Temp. At Base Flow:	9.3 Celcius	
Flow (Cubic meters/sec):	0.05m^3 /sec.	

Table 13. A Summary of the Physical Data Collected on Surveyed Portions of McGivney Brook

Physical Characteristics

Portion of Mainstream Surveyed: 1.0279 km

Total Stream Area Surveyed: 4533.04m^2

Area of Stream Habitat As:

Pool	189.03m^2	4.17%
Riffle	1636.99m^2	36.11%
Run	1825.91m^2	40.28%
Rapids	881.22^2	19.44%

Area of Substrate as

Bedrock:	3.17m^2	0.07%	Rubble:	1662.27m^2	36.67%
Boulder:	69.35m^2	1.53%	Gravel:	2241.13m^2	49.44%
Rock:	273.80m^2	6.04%	Sand:	283.31m^2	6.25%
			Fines:	0.0m^2	0.0%

Percent Area with overhang veg. 18.61% 843.60m^2

Percent Undercut Banks 7.36% 151.31 meters

Percent of Area Shaded 21.81% 988.66m^2

Riparian Zone Status

Trees	836.50 meters	40.69%
Shrubs	879.47 meters	42.78%
Grass	239.91 meters	11.67%
Bare	99.91meters	4.86%

Total Bank Length Surveyed

Total Length X 2 2055.8 meters

Portion Eroding 233.33 meters 11.35%
Temp. At Base Flow: 8.46 Celcius
Flow (Cubic meters/sec): 0.20m^3 /sec.

Table 14. The Number of Wild and Hatchery Salmon Recorded at the Nashwaak River Counting Fence.

Wild Salmon:	294
Hatchery Salmon:	14
Wild Grilse:	544
Hatchery Grilse:	25
Total:	877

Note: Trout Numbers would have been recorded but none were caught in the trap.

DISCUSSION

The tributaries of the Nashwaak River equal approximately 397 km. In length; 40,002 km were surveyed, or 10.08% of the tributary watershed.

Streams with gravel - rocky bottoms and patches of silt in slow-moving sections with overhanging stream bank vegetation are typical trout waters (Scott and Scott, 1988). This predominate substrate in the Nashwaak tributaries was gravel - rock bottoms with small areas of fines and varying degrees of overhanging vegetation; some areas being ideal trout habitat.

For the early part of a salmon's life extensive gravelly bottom headwaters are essential (Scott and Scott, 1988). Again, a major portion of the substrate in the tributaries was gravel providing some possible sites for salmon spawning.

On several occasions or on a daily basis we observed trout in the tributaries as we were conducting the stream survey. The counting fence established by DFO on the mainstream of the Nashwaak captured 877 salmon. This number is below that for required spawners for the river: 1800 MSW (multi-sea winters) and 1700 ISW (one sea winter) fish (Marshall et al., 1992). (No trout were caught during the time the fence was in operation).

The numbers of trout in this river system varies from stream to stream. Trout density in the Dunbar stream in 1991 was approximaely 17.0 per 100 m

of stream area (Semple, 1991). Density of brook trout at one site on Hayden brook varied from 11.9 to 26.5 fish per 100 m^2 of stream area (Martin, 1980).

CONCLUSION

Stream survey and habitat assessments were carried out on portions of 13 tributaries feeding into the Nashwaak river. Some streams were not surveyed because of their remote locations. The general condition of the streams surveyed was very good. The major area of the stream habitat was either riffle or run and the predominate substrate was rock, rubble and gravel. The amount of shade and overhanging vegetation varied from stream to stream. For the most part the percentage of undercut banks remained low. All streams exhibited a healthy riparian zone with very little erosion (caused by substrate composition and stream flow). It should be noted the temperature and flow rates were taken at low base flows. All habitat indicators are excellent for nursery and spawning capabilities of a trout species.

RECOMMENDATIONS

Using this stream survey as a start point it would be useful to:

1. Do more stream survey, habitat assessment on streams not done, and on sections of the main river.
2. Do some detailed chemical analysis from samples taken from predetermined locations, i.e. below fish farm at Tay Falls.
3. Do fish population analysis of tributaries to get a handle on the status of the sea run brook trout. Then action can be taken to see whether a second fall run of sea run brook trout is possible.
4. Involve public to ensure that the Nashwaak River continues as a healthy resource for generations to come.

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Appendix A:

Stream Survey and Habitat Assessment Form

05-94

DNR&E / DFO - NEW BRUNSWICK
STREAM SURVEY and HABITAT ASSESSMENT

___ of ___

River: _____ Start Point: _____ End Point: _____ Drainage Code ☐☐ ☐☐ ☐☐ Stream/River No. ___

Personnel _____ Date: _____ GIS Map No. _____ Stream Order No. ___

REACH NO.	UNIT NO.	STREAM TYPE	LENGTH (m)	WIDTH (m)		SUBSTRATE (%)							AVE DEPTH - WET WIDTH (cm)	0-50% UNDERCUT BANK		0-50% OVER-HANGING BANK VEGETATION		LARGE WOODY DEBRIS IN STREAM (no.)	FLOWS				EMBEDDEDNESS (CRITERIA) 1 : ≤ 20% 2 : 20% - 35% 3 : 35% - 50% 4 : ≥ 50%	CHANNEL TYPE	COMMENTS	CHECKLIST OF LAND USE ATTRIBUTES (COMMENTS)
				WET	BANK CHANNEL	BED-ROCK	BOULDER	ROCK	RUBBLE	GRAVEL	SAND	FINES		L	R	L	R		TYPE	FLOW (cms)	TIME	TEMP °C W	TEMP °C A			

1. ACTIVE BEAVER DAM
2. INACTIVE BEAVER DAM
3. WOODY DEBRIS OBSTRUCTION
4. MAN-MADE DAM OBSTRUCTION
5. ROCK DAM (SWIMMING POOL)
6. BRAIDED STREAM CHANNELS
7. OBSTRUCTION IN STREAM
8. ROAD FORD

POLLUTION CAUSED BY:

9. FOOD PROCESSING INDUSTRY
10. FOREST INDUSTRY
11. CAMPSITES OR RESIDENTIAL
12. MINING
13. LITTER
14. OIL
15. AGRICULTURE WASTE
16. HEALTH HAZARD
17. CLEAR CUT TO STREAM EDGE
18. SELECTIVE CUT
19. BUFFER STRIP PRESENT
20. CATTLE CROSSING
21. EROSION FROM AGRICULTURE
22. SUSPENDED SILT NOTED
23. UNUSUAL STREAM SCOURING
24. LARGE BEDLOAD DEPOSIT
25. BANK EROSION - MODERATE
26. BANK EROSION - EXCESSIVE
27. STREAM DREDGING/BULLDOZING
28. GRAVEL REMOVAL
29. CHANNELIZATION (RIPRAP, ETC.)
30. STREAM DIVERSION
31. WATER WITHDRAWAL
32. REGULATED STREAM FLOW
33. CAMP/COTTAGE PRESENT
34. RESIDENTIAL AREA
35. ACCESS - ATV'S
36. ACCESS - TRAILS
37. ACCESS - TRUCK/CAR
38. ACCESS -BOAT
39. ROAD CROSSING (BRIDGE)
40. ROAD CROSSING (CULVERT)
41. BOAT LANDING
42. ORGANIC LITTER
43. AQUATIC PLANTS ABUNDANT
44. GOOD SPAWNING
45. GOOD NURSERY

STREAM TYPE

FASTWATER

1. Fall
2. Cascade
3. Riffle (GR/RB)
4. Riffle (R/B)
5. Riffle (Sand)
6. Sheet (ledge)
7. Chute
8. Run
9. Rapid

POOLS

10. Midchannel
11. Convergence
12. Lateral
13. Beaver
14. Trench
15. Plunge
16.
17. Bogan
18. Eddy
19. Gabion
20. Log Structure
21. Road Crossing
21. Road Crossing
22. Wood Debris
23. Man-Made Dam
24. Natural Deadwater

SUBSTRATE

1. Bedrock
2. Boulder = > 461 mm
3. Rock = 180 - 460 mm
4. Rubble = 54 - 179 mm
5. Gravel = 2.6 - 53 mm
6. Sand = 0.06 - 2.5 mm
7. Fines = 0.0005 - 0.05 mm

FLOW TYPE

1. Survey Stream
2. Spring
3. Brook/River Trib

POOL RATING (reverse side)

CRITERIA (NO.)	AREA OF SITE (LETTER)
1 - Depth ≥ 1.5 m Cover ≥ 30%	a - ≥ 30% b - ≥ 10% to 30% c - < 10%
2 - Depth .5 to 1.5m Cover 5 to 30%	a - ≥ 50% b - < 50%

CHANNEL TYPE

1. Main (if measurement refers to main area of river)
2. Side Channel (water diverted by islands)
3. Split (if river is split into various different stream types)
4. Bogan

Note: Stream surveys should be undertaken only during summer base (low) flow conditions. Also, minimum size of stream type is 4m² for larger streams.

REACH NO.	SITE (50m - interval)	% SITE		SHADE (%)	STREAM BANKS										O_2 (mg/l)	pH	DEPTH						POOL RATING (CRITERIA ON OTHER SIDE)		POOL TAIL			% TURBULENCE
					VEGETATION (%)				EROSION (%)								1/4 (m)		1/2 (m)		3/4 (m)				EMBEDDEDNESS (CRITERIA) 1: ≤ 20% 2: 20% - 35% 3: 35% - 50% 4: ≥ 50%	MEAN SUBSTRATE	% FINE	
		RIFFLE/ RUN	POOLS		BARE GROUND	GRASSES	SHRUBS	TREES	LEFT BANK (0-50%)			RIGHT BANK (0-50%)					WET	CHANNEL	WET	CHANNEL	WET	CHANNEL	NO.	LETTER				
									STABLE	BARE STABLE	ERODING	STABLE	BARE STABLE	ERODING														

NOTE: * For selected site study, these columns (reverse side) should be done for a habitat assessment

WATER FLOW MEASUREMENT

REACH NO.	CORRESPONDING LOCATION		STREAM TYPE	WIDTH (m)		DEPTH (cm)			AVERAGE DEPTH SUM / 4		COEFFICIENT (0.9 - smooth) (0.8 - rough)	LENGTH (m)	FLOAT TIME (sec)			COMMENTS (LOCATION)
	UNIT NO.	SITE (50 - interval)		WET	CHANNEL	1/4 way	1/2 way	3/4 way	CENTIMETERS (cm)	METERS (m)			1/4 way	1/2 way	3/4 way	

Formula (CMS) = W (m) x D (m) x A / T (sec) x L (m)

Where: W = width, D = depth, L = length, A is a coefficient for the stream bottom

Appendix B:

Stream Survey and Assessment for Dunbar Stream

Fish habitat characteristics of surveyed sections of Dunbar Stream, Hashwaak River, New Brunswick.

Location	Surveyed		Mean		Area of habitat (m^2)[a]					Bottom type (%)						Shade[b]
	Distance (km)	Area (m^2)	Width (m)	Depth (cm)	Riffle	Run	Flat	Still	Pool	Silt	Sand	Gravel	Cobble	Boulder	Bedrock	
Dunbar Stream (Main stem)	2.3	28,977	12.6	17	19,764 (68.2)	8,332 (28.8)	286 (1.0)	175 (0.6)	420 (1.4)		1.5	7.0	28.9	55.9	6.7	O-H
South Branch Dunbar Stream (main stem)	7.3	43,180	5.9	12	24,461 (56.6)	10,966 (25.4)	4,457 (10.3)	1,040 (2.4)	2,256 (5.2)	3.0	4.7	9.9	58.9	21.7	1.8	H-D-O
North Branch Dunbar Stream (main stem)	2.9	20,237	7.2	14	17,317 (85.6)	914 (4.5)		95 (0.5)	1,911 (9.4)	0.3	1.0	8.8	82.2	4.7	2.9	H-O
Tinkettle Brook	1.6	8,270	5.2	13	6,121 (74.0)	323 (3.9)			1,826 (22.1)	8.1	5.6	4.1	78.4	3.4	0.3	O-H
Seymour Brook	1.1	5,730	5.2	10	4,038 (70.5)	288 (5.0)	312 (5.4)	124 (2.2)	968 (16.9)	4.1	1.8	11.8	72.7	7.3	2.3	
Total	15.2	106,395			71,701 (67.4)	20,823 (19.6)	5,055 (4.8)	1,434 (1.4)	7,381 (6.9)							

[a] Figures in parentheses are percentages of the total area.

[b] The degree of shading is ranked from highest to lowest occurrence, O = open (< 25%), H = moderate (25%-75%), D = dense (> 75%).