Cathance River Watershed
Stream Corridor Survey
Summary Report




Survey Date: September 8, 2007
Report Date: March 17, 2008

Prepared by
Jeff Varricchione, Margaret Chabot, and Megan Wooster
Maine Stream Team Program
Maine Department of Environmental Protection

TABLE OF CONTENTS

Background …… 3
Results and Discussion …… 4
- Land Use, Geology, and Terrain …… 4
- Streamside (Riparian) Vegetation and Temperature Conditions …… 5
- Stream Bottom, Streambank, and Channel Conditions …… 5
- Water Quality and Potential Pollution Sources and Problems …… 7
- Visual Biological Survey …… 7
- Rapid Geomorphic Assessment …… 8

Conclusions and Suggested Next Steps …… 9
Tables …… 10
References …… 23
Appendices …… 24

A. Background Information about the Basics of Stream Corridor Surveys (Level 1) …… 24
B. Maps …… 28
C. Site Sketches …… 47
D. Photographs …… 51
E. Field Observations – Raw Data …… 88
F. Additional Notes and Memos from the Field Data Sheets …… 101
G. Advantages and Disadvantages of Using Riprap to Stabilize Streambanks …… 103

ACKNOWLEDGEMENTS

We would like to thank a number of people and organizations for assistance with completing this stream corridor survey including:

A number of local volunteers
Town of Topsham
Cathance River Education Alliance
Androscoggin Valley Soil & Water Conservation District
Bowdoin College's Geology Department

BACKGROUND

The mainstem of the Cathance River flows from Bradley Pond in the Town of Topsham and eventually through the Town of Bowdoinham as it empties into Merrymeeting Bay (Appendices B-1, B-2). The two main, upper tributaries to the mainstem of the Cathance River are West Cathance Stream and East Cathance Stream, both of which are mostly contained within the Town of Bowdoin. A waterbody, apparently named West Branch according to USGS topographic maps, enters the Cathance River in Bowdoinham approximately two miles before the Cathance empties into Merrymeeting Bay (not shown on maps in this report). The Cathance River is located entirely within Sagadahoc County, Maine. The main focus area of the survey described in this report consisted of river/stream reaches within the Town of Topsham section, though some reaches in Bowdoin also were surveyed (Appendices B-3, B-4).

Currently, limited water quality information regarding the Cathance River exists within Maine DEP. Bowdoin College[1] also collects water quality information at a limited number of sites on the Cathance River. Therefore, this initial survey of the watershed serves as an important information-gathering effort led by citizens. It should be able to help identify key areas within the watershed to target for conservation or recreation enhancement, future water quality monitoring efforts, and best management practice implementation in order to reduce the existence of stormwater pollution and habitat degradation problems within the watershed. More intensive follow-up surveys may be necessary.

On September 8, 2007, a number of local residents, along with representatives from the Town of Topsham, Cathance River Education Alliance, Androscoggin Valley Soil & Water Conservation District, Bowdoin College's Geology Department, and Maine DEP's Maine Stream Team Program, conducted a Stream Corridor Survey (Level 1), which comprised of stream habitat survey and rapid geomorphic assessment techniques. The following presents the findings of that survey. Background information about the purpose, history, and methods of Stream Corridor Surveys (Level 1) is presented in Appendix A. <u>Please note that these techniques are conducted fairly rapidly, and in a mostly qualitative (as opposed to quantitative) manner, so the results contained in this report should be viewed as a first-cut, screening-level of information. More intensive, quantitative study of the stream's condition may be necessary.</u>

[1] Bowdoin College - Maine Watershed Web
< http://learn.bowdoin.edu/apps/hydrology/watersheds/data >

RESULTS AND DISCUSSION

Land Use, Geology, and Terrain

Despite the fact that two major roadways, Interstate 95 and Highway 201, cross over the Cathance River, much of the watershed lands have only limited amounts of urban development (Appendix B-2). Residential development, I-95, and farmland constitute significant land uses in the lower sections of surveyed Cathance River (reaches A4 to A1). A great deal of forestland, however, remains in these sections, including what appears to be a 1000 ft buffer width of forestland alongside much of the Cathance River through these sections. Agriculture and a powerline crossing are dominant land uses in reach A5. In reaches A6 and A7, heading up to Bradley Pond, most of the lands within 1000 - 200 ft of the river remain undeveloped. Tributary streams "G" (Weymouth Brook) and "E" each have a roughly 50/50 mix of agriculture and forest lands, with a limited amount of residential development. The section surveyed on West Cathance Stream (M4) was mostly forested, but included a gravel pit within a few hundred feet. The sections surveyed in East Cathance Stream (P2 and P3) have some agriculture and residential land use). Aside from the portion of reach A4 just west of I-95, residential development is generally light near the river corridor. (Land use information was gathered primarily from field survey notes and observations of recent aerial photographs.)

Most of the river/stream reaches surveyed in this study had fairly gentle slopes (low gradients), though sections A1, A2, and portions of A3 were estimated as having either moderate (hill-like; approx. 3-4%) or steep (ridge-like; > 5%) slopes. This variety of terrains in the watershed should allow for a variety of different recreation experiences including canoeing/kayaking, fishing, hiking, cross-country skiing, etc.

The elevation of many sections of the Cathance River, especially the mainstem and the "M4" section of West Cathance Stream, appeared to be heavily influenced (controlled) by the presence of exposed bedrock on the channel bottom. Many reaches of the Cathance River and its tributaries had channel bottoms were comprised of primarily of sands and silts (with occasional deposits of gravels, cobbles, and boulders). Despite this presence of the sediment and rock deposits in many locations throughout the watershed, the widespread presence of exposed bedrock on river and stream bottom will be a major control on the types, shapes, and elevations of channel found throughout the watershed.

Streamside (Riparian) Vegetation and Temperature Conditions

Shading of river and stream waters is important to the health of coldwater fish species (e.g., brook trout and Atlantic salmon) and other aquatic organisms (e.g., aquatic insects and other macroinvertebrates) for a variety of reasons including the fact that cold water has the ability to retain more dissolved oxygen and create less physiological stress on aquatic organisms than warm water (Allan and Castillo, 2007).

The Cathance River is a fairly wide, small river. Therefore, it is not surprising that most of the reaches surveyed, especially on the mainstem sections (A1 – A7), had "canopy-shading-of-river channel" values estimated at 50 % or less. Other sections with ≤ 50 % shading included tributaries to the mainstem such as reaches E1, G2-B (Weymouth Brook), and P2 and P3 (East Cathance Stream). The remaining, less-wide, river/stream reaches had shading values ranging from 75 – 100 % (Table 1, Appendix B-5).

In many cases, these relatively open canopy situations appeared to be a mostly natural situation due to a fairly intact community of trees, shrubs, and other vegetation. (These wooded areas may have been sporadically logged historically, so that the trees might have been even larger and more abundant in the absence of humans in the landscape.) Reaches that appeared to have riparian vegetation zones damaged by human land use activities (e.g., agriculture, powerline clearings, and roads) included: A4, A5*, E1*, G2-B, P2, and P3 (Table 1, Appendix B-5) (* = most severe).

Stream Bottom, Streambank, and Channel Conditions

Typically, communities of coldwater fish (e.g., salmonids such as brook trout and Atlantic salmon) and other aquatic organisms (e.g., aquatic insects and other macroinvertebrates) in streams and small rivers are more diverse and robust in streams and rivers having a diverse array of habitats – especially those containing riffles, with gravel and/or cobble substrates, and pools, formed by scouring action behind boulders and downed pieces of large wood (e.g., tree trunks, logs) (Allan and Castillo, 2007). Gravels and cobbles provide fairly stable anchoring/attachment sites for a diversity of macroinvertebrates, algae, and aquatic plants. Because of the spaces typically found between gravels and cobbles that are not embedded (not clogged with sediments), these types of substrates also provide well-oxygenated spawning (egg-laying) sites for salmonids and excellent habitat for macroinvertebrates to crawl through and cling to. Large pieces of wood in streams and small rivers help form pools and provide cover (important habitat needs of salmonids; Flebbe and Dolloff, 1995) as well as trap leaves and twigs, which are an important food source for macroinvertebrates – a common food source for fish. In low-gradient streams and small rivers dominated by fine sediment particles (e.g., sand, silt, or clay) on the stream bottom, large wood can be critical towards the maintenance of diverse communities since it is essentially the only stable substrate available to aquatic organisms (Smock et al., 1989; Allan and Castillo, 2007).

The somewhat low diversity of stream bottom substrates and habitat, along with low abundance of habitats such as gravel and/or cobble riffles, within many of the reaches surveyed in the Cathance River watershed may be a natural condition due to local stream and valley slope (gradient) and geological conditions. Predominant channel bottom materials were either sand/silt/clay, bedrock and boulders, or some combination of these dominant sediment/rock materials. Activities such as agriculture, winter sanding of nearby roads, and excessive streambank erosion due to human influences in certain reaches of the watershed might be responsible for some introduction of excess sediments to the Cathance River and its tributaries. Generally, however, there currently is not enough evidence to suggest that human-caused sedimentation is responsible for the dominance of sands, silts, and clays in the stream bottom materials in many sections.

U. S. Geological Survey surficial geology maps indicate that much of the lands near or under the Cathance River and its tributaries were submerged under the ocean following the retreat of glaciers and they consist mostly of glaciomarine sediment deposits. More recent stream alluvium and freshwater wetland deposits, comprised of peat, muck, mud, silt, sand, and some gravel, are also commonly found underneath the Cathance River and its tributaries. The relatively wide, flat Cathance River valley appears to be conducive to allowing much of these fines to deposit on the Cathance River bed. These stream and river stream bottom habitat conditions are common in some of the flatter coastal areas of Maine which also, long ago, had been covered under ocean waters and associated deposited glaciomarine sediments.

Wood was noted as being “many” or “plentiful” in about 2/3 of the reaches surveyed in the Cathance River watershed, while its abundance was noted as being “few” or “none” in about 1/3 of the reaches. Still, the observations made by volunteers were qualitative and, also, not in comparison to pristine, unlogged watersheds. Some local scientists theorize that the amounts of large wood in rivers and streams in coastal (and perhaps other) regions of Maine may be significantly less that that prior to European settlement of North America (Magilligan et al., in press). (Scientists in other regions around the U. S. have proposed similar hypotheses for their own locales.) Also, ongoing, unpublished research conducted streams in the White Mountain National Forest region of NH and ME has suggested that additions of large wood to high gradient, rocky-bottomed streams in that area has a strong positive effect on brook trout and macroinvertebrate communities. The continued research of the potential benefits of large wood in streams and rivers is expected to have an increasing influence on restoration designs in Maine.

Cathance River reaches that scored worst (4s and 5s) for stream bottom conditions (i.e., dominated by sand, silt, and/or clay) and lack of wood (either “few” pieces or “none” observed) were channel reaches A1, A6, A7, and G2-(A&B) (Table 2). Reaches that scored worst for streambank and channel conditions (4s and 5s) were A2, A3-(6), A4, A5, A6, A7, and E1 (Table 2; Appendices B-6, B-7).

(*Note*: The use of riprap [large stones] to armor and stabilize streambanks has both advantages and disadvantages. Since advantages are usually confined to the property to which it has been installed, while disadvantages tend to occur both at the site and at varying distances downstream of the site, riprap is typically considered to have a negative impact on river reaches in these types of surveys. In this survey, reaches that had significant amounts of riprap along streambanks included: A3-(6) and E-1 (Table 2, Appendix B-7). For more information about the advantages and disadvantages of riprap, see Appendix G.)

The frequent occurrence of exposed bedrock and associated weathered bedrock materials, such as boulders and glaciers, probably is a result of historical, massive, glacial scouring activity that occurred throughout much of Maine. (A professional geologist is needed to verify this condition for the Cathance watershed.) As mentioned earlier, the widespread presence of exposed bedrock on river and stream bottom is expected to be a major control on the types, shapes, and elevations of channel found throughout the watershed.

Water Quality and Potential Pollution Sources and Problems

Based upon visual and smell observations, there were no major, obvious water quality problems noted. There was some concern about turbidity in reaches A3-(2), A3-(4&5), and E1. Also, there was some concern about the potential impact of a chicken agriculture facility near reaches P2 and P3. A "rotten egg" smell was described in reach P3, though it also could have been the natural decomposition of organic material or naturally-anaerobic sediments in a wetland near the stream (Table 3, Appendix B-8).

Reaches that scored worst (4s and 5s) in this survey for potential water pollution problems and sources included: A4, A5, A6, A7, E1, and P2 (Table 3, Appendix B-9). These regions appear as though they would greatly benefit from voluntary installation or implementation of Best Management Practices (BMPs) on lands adjacent the river in order to reduce and minimize polluted runoff (e.g., eroded soil, pesticides, fertilizers, manure, etc.).

While some limited information water quality information on the Cathance River watershed exists within Maine DEP and Bowdoin College, additional water quality monitoring and analysis would provide important additional insight about the condition of waters in the Cathance River watershed.

Visual Biological Survey

Reaches in which a variety of wildlife was noted were: A3, A6, A7, and M4. Wildlife observed included: great blue heron, cormorant, frog, turtle, beaver, and other unspecified types of amphibians, reptiles, mammals, and fish (Table 2). While most reaches were not sampled for macroinvertebrates, some reaches were reported as having aquatic insects, clams, and snails (Appendix E). In all likelihood, more reaches would have reported these organisms, had sampling actually taken place.

Brown algae, filamentous green algae, and occasional mats of green algae were noted in many of the survey reaches. Observations of moderate to heavy growth of these algae were noted primarily in the Cathance River mainstem (reaches A1 – A7) and lower portions of East Cathance Stream (reaches P2 and P3) (Table 2). The river channel in these reaches was fairly wide and permitted adequate sunlight for the growth of algae, so algae growth may actually be at levels expected for this type of river channel. Given the qualitative nature of the observations and data, plus the absence of any detailed notes regarding algae abundance, only a recommendation for more detailed follow-up observations of the situation can be made here.

Rapid Geomorphic Assessment

The only reach that got a score of either a 4 or 5 was A2, which had a score of 5 (Table 4, Appendix B-10). The primary geomorphic process identified was degradation and the secondary process was widening. ("Degradation" indicates that the river channel is incising or downcutting to a lower elevation.) Further, more detailed, professional investigation would be needed to determine the true existence and extent of channel stability issues in this reach.

CONCLUSIONS AND SUGGESTED NEXT STEPS

As mentioned earlier, the Cathance River has the potential to be a very valuable natural resource to the Towns of Topsham, Bowdoin, and Bowdoinham. It has a variety of terrains in the watershed that allow for a variety of different recreation experiences including canoeing/kayaking, fishing, hiking, cross-country skiing, etc.

The Cathance River, and its tributaries, appears to be a reasonably healthy natural and recreation resource based upon this screening-level survey (although more quantitative monitoring data is desirable). Despite the fact that two major roadways, Interstate 95 and Highway 201, cross over the Cathance River, much of the watershed lands have only limited amounts of urban development. A great deal of forestland, remains in the watershed, including what appears to be a 1000 ft buffer width of forestland alongside much of the Cathance River through these sections. This forestland, if it remains relatively intact, will greatly help protect the water quality, habitats, and recreational experiences within the river corridor. Efforts to protect these forestlands and buffers are highly encouraged.

Some sobering conditions in the watershed do exist, primarily a number of moderate-level impacts that should be investigated more and hopefully remedied. Those impacts appear to be resulting from a variety of human land uses including agricultural activities and the associated probable pollutants (e.g., eroded soil, manure, fertilizer, and pesticides) in certain areas; disturbance of the riparian (shoreland) vegetation areas in agricultural, powerline, residential, and road areas; livestock near/in the channel; and a dirt boat launch and associated soil erosion.

A number of organizations exist in the watershed, or nearby, and should be tapped for help to learn about and protect the river. The Cathance River Education Alliance has a very nice facility in the woods near reach A3. It hopefully will help promote learning about and conservation of the river. The Town of Topsham is conducting inventories and preparing natural resource plans for the area and they will be a vital resource for tracking and protecting the river. Bowdoin College will likely continue to be an excellent education and research partner. Organizations such as the Androscoggin Valley Soil & Water Conservation Association and Maine DEP can provide advice and possibly other assistance towards implementing Best Management Practices in the watershed in order to minimize or eliminate pollution problems or enhance streamside riparian buffers or habitats. And certainly there are other organizations not mentioned here that can play an important role in conserving the Cathance River and its tributaries, including other conservation entities, landowners, and local volunteers.

TABLES

Legend and Notes About Scores in Tables

1 = problems not apparent / conditions appear to be in very good
2 = minor problem / conditions appear to generally be good
3 = moderate problem / conditions appear to generally be fair
4 = major problem / conditions appear to generally be poor
5 = severe problem / conditions appear to generally be very poor

These preliminary scores are based upon best professional judgment after reviewing the available information such as volunteer field notes, photographs, and other observational data (including maps and aerial photographs).

Table 1. Streamside (riparian) vegetation and temperature conditions for the different survey reaches within the Cathance River watershed. This vegetation zone is important shading of the stream and for bank stability. *Notes:* * (Shade conditions generally appear to be natural for a wide river, especially because the riparian zone appears pretty well vegetated [including tall trees].) ** (For the sub-reaches of reach "A3" the volunteer field notes recorded a riparian shading value of 25%, however reach photos suggested that the shading value might have actually been closer to 50% or more. The correct values of 50% are presented in this table.)

Reach ID	**Stream Reach Name**	**Streamside (Riparian) Vegetation and In-Stream Temperature Conditions**	**Preliminary Score**
A1	Cathance River	--- 50% shaded *	3
A2	Cathance River	--- 50% shaded *	3
A3	Cathance River	--- 50% shaded *, **	3
A3-(2)	Cathance River	--- 50% shaded *, **	3
A3-(3)	Cathance River	--- 50% shaded *, **	3
A3-(4&5)	Cathance River	--- 50% shaded *, **	3
A3-(6)	Cathance River	--- 50% shaded *, **	3
A3-(7)	Cathance River	--- n/a	n/a
A4	Cathance River	--- 25% shaded --- The shade conditions generally appear to be natural for a wide river, however there are some locations where agricultural land needs wider / better riparian buffers.	4
A5	Cathance River	--- 0% shaded --- This lack of shading may be partly natural due to the fact that the river is pretty wide here. Still, many areas (e.g., powerline, agricultural region) look like they need better / taller / wider riparian vegetation buffers.	5
A6 & A7	Cathance River	--- 25% shaded --- The shade conditions generally appear to be natural for a wide river, especially because the riparian zone appears fairly well vegetated.	3
E1	Cathance River Tributary	--- 0% shaded --- Poor vegetation cover and lack of shading is a man-made problem (agriculture-related).	5
E2	Cathance River Tributary	--- 100% shaded	1

Table 1 cont'd.

Reach ID	Stream Reach Name	Streamside (Riparian) Vegetation and In-Stream Temperature Conditions	Preliminary Score
G1	Weymouth Brook	--- n/a	n/a
G2-(A)	Weymouth Brook	--- 75% shaded	2
G2-(B)	Weymouth Brook	--- 25% shaded --- Appeared to be mostly cleared due to proximity of agricultural land and paved road.	4
G3	Weymouth Brook	--- 75% shaded	2
M4	West Cathance Stream	--- 75% shaded	2
P2	East Cathance Stream	--- 25% shaded --- Some residential streambank regions could probably use some more trees.	4
P3	East Cathance Stream	--- 25% shaded --- Some residential streambank regions could probably use some more trees.	4

Table 2. Stream bottom, streambank, and channel conditions for the different survey reaches within the Cathance River watershed. Stream bottom condition scores are based upon ecological requirements of cold water fish and aquatic macroinvertebrates. *Notes:* [a] (See text in the Summary of Findings section for comments on possible geologic and topographic factors influencing stream bottom conditions. Note that many of these stream bottom conditions appear to a result of natural factors.)

				Preliminary Scores	
Reach ID	**Stream Reach Name**	**Stream Bottom Conditions [a]**	**Streambank and Channel Conditions** (other than stream bottom substrate)	**Stream Bottom [a]**	**Streambank & Channel**
A1	Cathance River	Primarily silt/clay and sand. Large wood: few.	At least a couple of residential dwellings are situated close to the edge of the streambanks. Also, it might be worth looking into floodplain release culverts for the bridge in the photo, as it appears narrow relative to the river width. *Positive note*: Overall, this reach appeared fairly intact to volunteers.	5	3
A2	Cathance River	Primarily silt/clay and sand. Large wood: many.	An old, unpaved road cuts through stream. Old bridge footings remain in the stream. It's not clear how significant a soil erosion problem there might be.	3	4
A3	Cathance River	Primarily rubble, with some bedrock. Large wood: ?	*Positive note*: Some wildlife noted (amphibians, reptiles, mammals, fish - species not mentioned). *Positive note*: Overall, this reach appeared fairly intact to volunteers.	2	3
A3-(2)	Cathance River	Primarily silt/clay. Large wood: many.		3	3
A3-(3)	Cathance River	Primarily bedrock, boulder, and sand. Large wood: many.		3	3
A3-(4&5)	Cathance River	Primarily silt/clay. Large wood: many.		3	3
A3-(6)	Cathance River	Primarily bedrock, boulder, and silt/clay. Large wood: plentiful. Channel substrate noted as being “mostly (75%) embedded”.	About 25-50% of streambank length estimated to be covered with riprap.	3	4
A3-(7)	Cathance River	Primarily silt/clay and bedrock. Large wood: plentiful.		3	3

Table 2 cont'd.

				Preliminary Scores	
Reach ID	**Stream Reach Name**	**Stream Bottom Conditions [a]**	**Streambank and Channel Conditions** (other than stream bottom substrate)	**Stream Bottom [a]**	**Streambank & Channel**
A4	Cathance River	Primarily silt/clay and sand. Some bedrock and boulders present. Large wood: many. Channel substrate noted as being "mostly (75%) embedded".	Brown algae (probably diatoms) is noted as being thick in some places [not as alarming as if it had been large masses of filamentous green algae]. The brown algae is probably years of accumulation that has not been flushed out of this low-gradient system. /// Boat access (dirt ramp) is a source of eroded soil pollution. Collapsing banks are noted as a severe problem. Grazing lands, croplands, and animal feedlots / holding areas are noted as impacting the stream.	3	4
A5	Cathance River	Primarily silt/clay and sand. Some gravel, rubble, and boulders present. Large wood: few. Channel substrate noted as being "mostly (75%) embedded".	Mud / silt / sand observed entering the stream via roads, bridges, cropland, grazing land, and animal feed lots / holding areas. Livestock with unrestricted access to the stream.	3	4
A6 & A7	Cathance River	Primarily silt/clay. Large wood: none.	Roads / bridges, cropland, grazing land, and animal feedlots / holding areas are noted as impacting the stream in this region. *Positive notes*: Lots of wildlife & plant life noted including great blue heron, cormorant, frog, turtle, beaver.	5	4
E1	Cathance River Tributary	Primarily silt/clay. Some sand, gravel, and cobble present. Large wood: few.	Road/culvert may be a fish barrier. Rip-rap along 50-75% of both sides of stream bank (may transfer erosional energy problems downstream or provide poor habitat on streambank). (Rip-rap is probably helping stabilize streambank in the immediate locale.)	3	4

Table 2 cont'd.

				Preliminary Scores	
Reach ID	**Stream Reach Name**	**Stream Bottom Conditions [a]**	**Streambank and Channel Conditions** (other than stream bottom substrate)	**Stream Bottom [a]**	**Streambank & Channel**
E2	Cathance River Tributary	Primarily silt/clay. Large wood: many.	Road/culvert may be a fish barrier.	3	2
G1	Weymouth Brook	--	(*Note*: This reach was not actually surveyed -- just photos were taken at this reach due to time constraints.)	--	--
G2-(A)	Weymouth Brook	Primarily silt/clay and sand. Large wood: few.		4	2
G2-(B)	Weymouth Brook	Primarily silt/clay and sand. Large wood: few.		4	3
G3	Weymouth Brook	Primarily silt/clay and sand. Large wood: many.		3	2
M4	West Cathance Stream	Primarily cobble; the remainder of materials was an even mix of bedrock, boulder, rubble, gravel, sand, and silt. Large wood: plentiful.	*Positive note*: Some wildlife noted (amphibians, waterfowl, mammals, fish - species not mentioned).	1	2
P2	East Cathance Stream	Primarily silt/clay. Some sand, cobble, rubble, boulder present. Large wood: plentiful.	Beaver dam in culvert noted (probably could use a "beaver deceiver"). *Positive note*: Good riparian zone noted.	3	3
P3	East Cathance Stream	Primarily silt/clay. Some sand, cobble, rubble, boulder, and bedrock present. Large wood: plentiful.	An old road and debris dams are noted as possible barriers to fish movement.	3	2

Table 3. Water quality issues and potentially significant pollution problems/sources for the different survey reaches within the Cathance River watershed. *Notes*:
[a] (Water quality notes and scores are based upon qualitative volunteer observations only. No actual quantitative measurements were made. Sites were given a preliminary score of "NAI" [no apparent impact] if no negative water observations were noted for a particular river reach. A score of "?" indicates that follow-up water quality monitoring or observations may be needed to verify issues that are noted here. Overall, in all reaches water quality monitoring would be beneficial to understanding the condition of the watershed.)

				Preliminary Scores	
Reach ID	**Stream Reach Name**	**Water Quality Issues [a]**	**Potentially Significant Sources of Pollution**	**Water Quality [a]**	**Potential Pollution Problem**
A1	Cathance River	Some oily sheen on water noted (probably natural due to decomposition of natural organic matter).	Some minor erosion problems noted.	?	2
A2	Cathance River	Some oily sheen on water noted (probably natural due to decomposition of natural organic matter).	An old, unpaved road cuts through stream. Old bridge footings remain in the stream. It's not clear how significant a soil erosion problem there might be.	?	3
A3	Cathance River		Hiking paths with soil erosion areas. Bare soil noted as being common and present on the streambanks and floodplain regions.	NAI	3
A3-(2)	Cathance River	Water noted as opaque in color.	Hiking paths with soil erosion areas. Bare soil noted as being common and present on the streambanks and floodplain regions.	3	3
A3-(3)	Cathance River		Hiking paths with soil erosion areas. Bare soil noted as being common and present on the streambanks and floodplain regions.	NAI	3
A3-(4&5)	Cathance River	Water noted as turbid.	Hiking paths with soil erosion areas. Bare soil noted as being common and present on the streambanks and floodplain regions.	3	3
A3-(6)	Cathance River		Hiking paths with soil erosion areas. Bare soil noted as being common and present on the streambanks and floodplain regions.	NAI	3

Table 3 cont'd.

				Preliminary Scores	
Reach ID	Stream Reach Name	Water Quality Issues [a]	Potentially Significant Sources of Pollution	Water Quality [a]	Potential Pollution Problem
A3-(7)	Cathance River		Hiking paths with soil erosion areas. Bare soil noted as being common and present on the streambanks and floodplain regions.	NAI	3
A4	Cathance River		Boat access (dirt ramp) is a source of eroded soil pollution. Collapsing banks are noted as a severe problem. Grazing lands, croplands, and animal feedlots / holding areas are noted as impacting the stream.	NAI	5
A5	Cathance River		Significant problems noted: (a) bare soil in the riparian region; (b) mud / silt / sand observed entering the stream via roads, bridges, cropland, grazing land, animal feed lots / holding areas, livestock with unrestricted access to the stream.	NAI	5
A6 & A7	Cathance River		Roads / bridges, cropland, grazing land, and animal feedlots / holding areas are noted as impacting the stream in this region.	NAI	5
E1	Cathance River Tributary	Some turbidity noted.	The adjacent land is dominated by agricultural uses. Some fencing exists close to the stream, but overall better, wider, shrub/tree buffer vegetation could be a big benefit here. (Very little buffer, just small strip of wild flowers on both sides.)	3	4
E2	Cathance River Tributary		Some lawn is noted as being in the riparian zone, but it doesn't sound severe.	NAI	2
G1	Weymouth Brook	--	An in-stream farm pond just downstream of the road crossing may be causing some temperature and/or fish passage problems.	--	--
G2-(A)	Weymouth Brook		No significant issues noted.	NAI	2
G2-(B)	Weymouth Brook		No significant issues noted except for some sparse remnants of an old junk pile.	NAI	3

Table 3 cont'd.

				Preliminary Scores	
Reach ID	**Stream Reach Name**	**Water Quality Issues [a]**	**Potentially Significant Sources of Pollution**	**Water Quality [a]**	**Potential Pollution Problem**
G3	Weymouth Brook		No significant issues noted.	NAI	2
M4	West Cathance Stream			NAI	2
P2	East Cathance Stream	Concerns about spreading of manure waste by a chicken agriculture facility	Concerns about spreading of manure waste by a chicken agriculture facility and 2 - 3 houses near stream. Also, fallow agricultural fields noted as impacting stream.	4	4
P3	East Cathance Stream	A "rotten egg" smell was noted. It is possible this is just the smell of sulfur dioxide resulting from natural decomposition in wetland area.		3	2

Table 4. Rapid geomorphic assessment (RGA) conditions for the different survey reaches within the Cathance River watershed. “Degradation” indicates that the river channel is incising or downcutting to a lower elevation, “Aggradation” indicates that the river channel is accumulating excess deposits of sediments, and “Planform” indicates that the river channel is becoming more straight or sinuous/curvy or it is cutting new side channels.

Reach ID	**Stream Reach Name**	**Primary Geomorphic Process**	**Secondary Geomorphic Process**	**Preliminary Score**
A1	Cathance River	Widening		3
A2	Cathance River	Degradation	Widening	5
A3	Cathance River	Widening	Degradation	3
A3-(2)	Cathance River	*Note*: Overall score didn't indicate a problem, but widening did seem to be occurring.	--	1
A3-(3)	Cathance River	--	--	1
A3-(4&5)	Cathance River	--	--	1
A3-(6)	Cathance River	--	--	--
A3-(7)	Cathance River	--	--	--
A4	Cathance River	Widening	Degradation	3
A5	Cathance River	Widening	Degradation	1
A6 & A7	Cathance River	Widening	Degradation	1
E1	Cathance River Tributary	Degradation	--	3
E2	Cathance River Tributary	Widening	Aggradation	3
G1	Weymouth Brook	--	--	--
G2-(A)	Weymouth Brook	Aggradation	Planform	1
G2-(B)	Weymouth Brook	Aggradation	--	1
G3	Weymouth Brook	Aggradation	Planform	1

Table 4 cont'd.

Reach ID	Stream Reach Name	Primary Geomorphic Process	Secondary Geomorphic Process	Preliminary Score
M4	West Cathance Stream	Widening	Aggradation	3
P2	East Cathance Stream	Aggradation	Degradation	1
P3	East Cathance Stream	Widening	Aggradation	3

Table 5. Summary of scores and (preliminary) overall condition for the different survey reaches within the Cathance River watershed. "RGA" = rapid geomorphic assessment. "NAI" = no apparent impact.

Reach ID	Stream Reach Name	Riparian / Temperature	Stream Bottom	Streambank / Channel	Water Quality	Potential Pollution Problem	RGA	Overall Condition
A1	Cathance River	3	5	3	?	2	3	3
A2	Cathance River	3	3	3	?	3	5	3
A3	Cathance River	3	2	3	NAI	3	3	3
A3-(2)	Cathance River	3	3	3	3	3	1	3
A3-(3)	Cathance River	3	3	3	NAI	3	1	3
A3-(4&5)	Cathance River	3	3	3	3	3	1	3
A3-(6)	Cathance River	3	3	4	NAI	3	--	3
A3-(7)	Cathance River	n/a	3	3	NAI	3	--	3
A4	Cathance River	4	3	3	NAI	5	3	4
A5	Cathance River	5	3	3	NAI	5	1	5
A6 & A7	Cathance River	3	5	4	NAI	5	1	4
E1	Cathance River Tributary	5	3	4	3	4	3	4
E2	Cathance River Tributary	1	3	2	NAI	2	3	2
G1	Weymouth Brook	--	--	--	--	--	--	-- (photos indicate some issues may exist)
G2-(A)	Weymouth Brook	2	4	2	NAI	2	1	2
G2-(B)	Weymouth Brook	4	4	3	NAI	3	1	4

Table 5 cont'd.

Reach ID	Stream Reach Name	Riparian / Temperature	Stream Bottom	Streambank / Channel	Water Quality	Potential Pollution Problem	RGA	Overall Condition
G3	Weymouth Brook	2	3	2	NAI	2	1	2
M4	West Cathance Stream	2	1	2	NAI	2	3	2
P2	East Cathance Stream	4	3	3	4	4	1	4
P3	East Cathance Stream	4	3	2	3	2	3	3

REFERENCES

Allan, J. D. and M. M. Castillo. 2007. Stream ecology: structure and function of running waters. 2nd ed., Springer, Dordrecht, Netherlands. 436 pp.

Flebbe, P. A. and C. A. Dolloff. 1995. Trout use of woody debris and habitat in Appalachian wilderness streams of North Carolina. North American Journal of Fisheries Management 15: 579-590.

Magilligan, F.J., Nislow, K.H., Fisher, G.B., Wright, J., Mackey, G., Laser, M. (In press). The geomorphic function and characteristics of large woody debris in low gradient rivers, coastal Maine, USA. Geomorphology.

Smock, L. A.; Metzler, G. M.; Gladden, J. E. 1989. The role of organic debris jams in the structuring and functioning of low-gradient headwater streams. Ecology 70: 764-775.

APPENDIX A
Background Information about the Basics of Stream Corridor Surveys (Level 1).

The approach that the Maine Department of Environmental Protection (MDEP) and Maine Department of Environmental Protection (MDIF&W) are using for doing Stream Corridor Surveys (SCS) (Level 1) consists of a two part assessment - the Stream Habitat Survey and the Rapid Geomorphic Assessment. The Stream Habitat Survey is based on a simple protocol known as “Streamwalk” that was originally developed by U. S. Environmental Protection Agency’s regional office in Seattle. This procedure was modified slightly by MDIF&W’s Fisheries Research Section (Bangor, ME) and MDEP’s Stream Team Program between 2004 and 2006 so that it met the Maine agencies’ needs. This rapid survey approach was initially adopted by DEP and IF&W because it requires little equipment and training, and is a useful qualitative tool for assessing a stream’s overall biological and physical integrity and its potential as coldwater fisheries habitat.

The “screening level assessment” methods used in this survey focused at the scale of stream reaches. A “stream reach” is the stretch of stream for which observations were made, typically about 300-900 feet in length. Prior to the survey, the stream was broken down into reaches on a topographic map, with reach start and endpoints based upon dramatic changes in stream gradient, sinuousity, valley width, and other topography features. The intent was to identify fairly uniform sections of the stream to the greatest extent possible so that physical and biological conditions within the reach would be similar relative to other stream reaches within the watershed. Once in the field, the reach section could have been changed (broken into additional reaches) because the reach was less uniform than identified on the map. An overview of the methods employed in this study is provided below. Detailed methods can be found in the document “Stream Survey Manual: A Citizen’s Guide to Basic Watershed, Habitat, and Geomorphology Surveys in Stream & River Watersheds” (Maine Stream Team Program; draft in progress) or by contacting the Maine Stream Team Program.

The Stream Habitat Survey is most useful as 1) a screening tool to identify severe habitat or water quality problems and 2) a vehicle for learning about stream ecosystems and environmental stewardship. As volunteers walk the stream reach, they make observations about the physical and biological characteristics of the stream. Physical characteristics include parameters such as average stream width and depth, habitat types, bottom substrate, and sedimentation. Volunteers also make observations and notes about in-stream characteristics and the integrity of stream banks and riparian areas. Additionally, volunteers note problems such as garbage dumped near or in the stream, sedimentation sources, discharges, livestock that are near or have access to the stream, and riparian encroachment. Biological characteristics observed include type and abundance of fish, algae, and aquatic vegetation as well as barriers to fish passage. Lastly, volunteers have the option of doing a cursory macroinvertebrate survey. Macroinvertebrates are invertebrates that are visible without magnification such as aquatic insects (larvae and adults), clams, worms, snails, other crustaceans, and crayfish. Macroinvertebrates are used to assess water quality and habitat because they are abundant in streams year-round and do not migrate far, and because certain species are sensitive to water quality and habitat conditions more than others.

The second part of the stream assessment is the Rapid Geomorphic Assessment (RGA), a technique based upon the science of fluvial geomorphology. "Fluvial geomorphology" is the study of the interactions of climate, geology, hydrology, topography, vegetation and land use on the shape and form of rivers and streams. The function of a stream is to provide habitat and move water and sediment through the stream system. A stable stream is in balance with the water and sediment that is delivered to the stream. The stream is able to maintain its size, shape and pattern from year to year and the stream neither degrades (down cuts the channel) or aggrades (fills in the channel with large amounts of sediment). Streams are naturally dynamic in that they do change (e.g., limited amounts of stream bank erosion) and move across the landscape, but they do this over a long period of time and they are able to maintain their form and function. A stressed or unstable stream undergoes dramatic changes in response to changes in sediment size, load, water discharge and/or slope that is caused by land use changes or physical changes to the stream. Indicators that a stream is unstable include evidence of significant areas of collapsing banks, sediment deposition, channel scouring and new channel "cutting" (creation) by the stream. Over time the stream may develop a new equilibrium in response to the changes, but in the short-term it may undergo dramatic and rapid changes. The stream may also eventually evolve to a modified or different type of stream in response to permanent changes made to the stream or watershed (e.g., the new equilibrium state of the stream might have wider or deeper channel dimensions). More information on the fundamentals of fluvial geomorphology can be found at various websites including those of the Vermont Agency of Natural Resources and the North Carolina Stream Restoration Institute (see references Section below), and well as in various books (e.g., Rosgen, 1996).

Fluvial geomorphologists study streams at various levels of detail and for a variety of purposes. Geomorphic assessment generates information about the current condition of the stream and how it has responded to historic and current land uses in the watershed. This information is used to understand whether the stream is adjusting to changes, and if so, in what fashion and over what time period the stream is likely to adjust. The information aids natural resource professionals and local decision makers in making decisions about how to best manage, protect and restore the stream. At the watershed scale, the information is useful to prioritize reaches for protection, management, and restoration projects.

The Rapid Geomorphic Assessment that volunteers did for this particular study was a basic level of assessment and is referred to as a Level I assessment. It consists of noting whether particular indicators are present in the stream channel and bank conditions. These indicators are grouped into four categories: aggradation (9 indicators), degradation (7 indicators), widening (8 indicators) and planform adjustment (7 indicators). Aggradation means that the channel is being filled in because the sediment load to the stream has increased and the stream is unable to transport the increased load. Examples of features that indicate aggradation include sediment bars in the middle or on the side of a stream channel, sediments being deposited around large structures such as bridges or culverts, and siltation in pools. Degradation is downcutting of the channel caused by higher-than-normal (historically) streamflow volumes or energy. Indicators of degradation include absence of sediment bars or other depositional features, exposure of an erosion-resistant layer of large materials (former stream-bottom materials) higher up in the stream bank, and tree roots being scoured away. Widening occurs when stream banks along a reach erode, resulting in a channel that is wider and shallow. Examples of evidence of widening include active erosion or bank slumping along 50% or more of the reach, fallen or leaning trees, and occurrence of large trees or collections of organic debris in the channel or on bars. Planform adjustment is a change in stream course or pattern that occurs due to unstable stream banks that allow new channels or chutes to form. Evidence that planform adjustment is taking place includes the formation of islands in the channel, single main channel shifting to a multiple or braided pattern, and the presence of cut-off channels. The number of indicators present in each of the four categories is used to calculate a stability index and assign geomorphic condition. Stream reaches are determined to be “in regime”, “in transition or stressed”, or “in adjustment”. “In regime” means the reach is in good condition and is within the range of expected natural variability. Stream reaches determined to be “in transition or stressed” are considered to be in fair condition. These reaches have experienced changes in channel form and processes beyond the expected range of natural variability and may be moving toward further adjustment. Stream reaches “in adjustment” are considered to be in poor condition, are actively experiencing adjustments beyond the expected range of natural variability, have evolved into a new stream type, and are expected to continue to undergo adjustments.

REFERENCES
(for Appendix A)

Center for Watershed Protection. 2003. “Impacts of Impervious Cover on Aquatic Systems”. Watershed Protection Research Monograph No. 1. Center for Watershed Protection. Elliott City, MD. 142 pp.

Morse, Chandler. 2001. “The Response of First and Second Order Streams to Urban Land-Use in Maine”. MS Thesis, Ecology and Environmental Science Program, University of Maine. 98pp.

North Carolina Stream Restoration Institute. 1999. Natural Channel Processes. NC SRI Fact Sheets series. Obtained from website < http://www.bae.ncsu.edu/programs/extension/wqg/sri/fact_sheets.htm > on March 13, 2006.

Rosgen, D. L. 1996. Applied River Morphology. Wildland Hydrology; Printed Media Companies, Minneapolis, Minnesota.

Vermont Department of Environmental Conservation[1]. January 16, 2001. "Fluvial Geomorphology: A Foundation for Watershed Protection, Management and Restoration". 6 pp.

Vermont Department of Environmental Conservation[1]. "Stream Geomorphic Assessment Program Introduction".

Vermont Department of Environmental Conservation[1]. April, 2004. "Stream Geomorphic Assessment Protocols Handbook". 12 pp.

Vermont Department of Environmental Conservation[1]. "The Streamside Sentinel".

[1]The most current version of these Vermont Department of Environmental Conservation documents, along with other resources, can be found at
< http:// www.anr.state.vt.us/dec/waterq/rivers/htm/rv_geoassess.htm >.