Sheepscot River
Watershed Management Plan

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Project Partners: **Kennebec County Soil & Water Conservation District**
Sheepscot Valley Conservation Association (SVCA)
Knox-Lincoln Soil & Water Conservation District
Waldo Soil & Water Conservation District
Sheepscot River Watershed Council (SRWC)

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Contractual Partners: the project work was divided among a number of partner organizations active in the watershed.

- **Sheepscot Valley Conservation Association**. Lili Pugh carried out the research for and much of the writing of the Water Quality Assessment. The SVCA was also contracted to provide a number of GIS maps contained in this report.
- **Knox-Lincoln Soil & Water Conservation District** was contracted to carry out the NPS survey in Lincoln County and host public meetings. Shawn Biello carried out the tasks for the District.
- **Waldo Soil & Water Conservation District** was contracted to carry out the NPS survey in Waldo County and assist with public meetings and stakeholder interviews.
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- **Kennebec County Soil & Water Conservation District.** Jennifer McLean served as project manager and directed partner work. She co-authored the report with L. Sewall and L. Pugh.

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Executive Summary

The Project

The Sheepscot River Watershed Management Plan was funded by a Maine DEP 319[1] grant to the Time & Tide Resource Conservation and Development Council. The goal was to arrive at realistic goals for watershed protection by combining the knowledge and efforts of various governmental and non-governmental groups with values held by the watershed landowners and users. A non-point source (NPS) survey and a water quality assessment were significant portions of the project. Project publicity, a public survey, and interviews with landowners were also built into the project. The results were distributed for technical and stakeholder review in the fall of 2006 and the final draft published in January, 2007.

The Watershed

The Sheepscot River stretches 58 miles from Montville to Southport, and the watershed and waterbodies together encompass an area of approximately 364 square miles (including Sheepscot Bay). The watershed contains over 40 lakes and ponds and over 530 miles of streams. Portions of 22 towns in 4 counties fall within the geography of the watershed. The population of the watershed is estimated at 20,600. Between Head Tide in Alna and Wiscasset, the Sheepscot River forms a highly productive five mile-long estuary. The river then flows another approximately twelve miles and empties into Sheepscot Bay, and the larger Gulf of Maine.

Under Maine state law, the Sheepscot River is designated as an Outstanding River Segment[2]. The Sheepscot is also one of eight Maine rivers that provide essential spawning grounds for the endangered native Atlantic salmon. Numerous other fish,

[1] Section 319 of the U.S. Clean Water Act. The 319 program is managed at the federal level by the EPA. Funds are distributed to the states, which award grants for watershed projects.

[2] 12 MRSA § 403: "certain rivers, because of their unparalleled natural and recreational values, provide irreplaceable social and economic benefits to the people in their existing state". New dams and water diversions are prohibited without specific authorization of the Legislature.

including striped bass, the endangered short nose sturgeon, American shad and alewife also migrate between the Gulf of Maine and the Sheepscot River. Brook trout thrive in the river, as do sticklebacks, perch, and shiners.

The lower Sheepscot supports a lucrative lobster fishery and the river's tidal flats support a significant bait-worm industry. Rare oysters, marine invertebrates, and rare marine plants are also found in the estuary. Fish and invertebrates attract osprey, eagles, and other mammals that feed on the river's resources. The banks of the Sheepscot provide habitat for moose, white-tailed deer, fishers, otters, minks, and many smaller riparian mammals. The lower Sheepscot has been identified by the State as a Focus Area of Ecological Significance.

The watershed is largely forested with rural towns dispersed throughout. Estimates on forest cover range between 60% and 76%, with approximately 19% of the land area in agricultural use. Residential development is rapidly increasing in the watershed, especially along waterways. In the eight towns assessed by David Van Wie's report on land use, population growth over the decade between 1990 and 2000 averaged 3.5 times the growth rate for the state.

Water Quality

Although much of the Sheepscot River has the state's highest water quality classification[3] (Class AA and A waters), the watershed shows significant signs of degradation and faces a variety of threats. Telling signs at several locations include low levels of dissolved oxygen, high nutrient levels, high sediment loads, and elevated temperatures. Nine river segments or tributaries do not meet state standards mandated by Maine's Department of Environmental Protection. Changing development patterns within the watershed constitute the greatest threat, due to water quality problems associated with increasing numbers of roads, other impervious surfaces, and stream crossings. Among the eight salmon rivers, the Sheepscot River watershed has the highest density—over 800 miles—of year-round roads. Under this project, a survey of

[3] Water body classifications under the Clean Water Act section 305(b) refer to uses and goals (e.g., waters swimmable, support aquatic life); waters are then assessed as to whether or not they *attain* the standards of their class.

12 towns within the watershed revealed 335 non-point source (NPS) pollution sites (generally, sites where notable erosion occurs) on public roads alone. Of these, 102 were ranked as "high priority", indicating that the sites contribute significant sediment loads and road run-off to the river. Other on-going threats to the overall health of the watershed include issues related to agricultural run-off, ATV use, and fish passage. Poorly placed culverts prevent fish from reaching spawning and feeding habitat, increase sediment loads, increase water temperatures, and minimize the potential for naturally-occurring restoration. Similarly, nine dams are currently thought to influence water quality and habitat, and four dams are known to restrict fish passage.

Water quality in the Sheepscot River watershed varies significantly. As stated above, much of the river and its tributaries have good water quality. However, eight segments of the river and its tributaries, representing nearly 24 river miles, did not meet water quality standards in 2004. The 2006 listing includes nine impaired segments. In the Sheepscot, unmet standards primarily reflect low levels of dissolved oxygen and high levels of nutrient and sediment loading—suggesting non-point sources (NPS) of pollution and/or low flows. Other segments and tributaries attain some standards or have insufficient data to make final determinations. Seven lakes that are sufficiently monitored have either "average" or "below average" water quality. With respect to the river itself, the Maine Department of Environmental Protection's 2006 report states that the mainstem is "significantly enriched" in nutrients (nitrogen and phosphorous) when compared to other similar rivers, including 63 small watersheds with comparable levels of development.[4] Consistent with this finding, Sheepscot Bay, at the mouth of the river, is highly vulnerable to toxic algae blooms and is considered one of the most eutrophic coastal areas in the country.[5]

Three of four sites in the Sheepscot assessed for macroinvertebrates periodically fail to meet standards, suggesting pollutant impacts. The degree to which this reflects threats posed by pesticide use (including herbicides, fungicides, and insecticides) or other toxics is unknown. Low levels of dissolved oxygen and visible sedimentation are the clearest indicators that water quality is degraded in the system. High temperatures, and high nutrient loads are commonly observed but are less conclusive. MDEP's recent

[4] Whiting, Mark. Water Quality Summary for the Sheepscot River, 2006
[5] National Estuarine Eutrophication Assessment, NOAA. http://spo.nos.noaa.gov/projects/cads/nees/Eutro-Report.pdf

assessment states that the Sheepscot is "not grossly polluted, although it has some cumulative NPS issues." With respect to the West Branch, the DEP's draft TMDL report recommended a 16% reduction in the total nitrogen load and an 80% reduction of sediments.[6]

Public Perception and Values

Through a series of interviews with Sheepscot watershed landowners, it became apparent that the river is highly valued for recreational, economic, and aesthetic purposes. What was not apparent, however, was a common understanding of either water quality conditions or the impacts of specific land uses with respect to water quality. Interviewees raised questions frequently, however, indicating a desire to know more about the status of the river. Several also mentioned noticing river changes in recent years. In particular, it was noted that coves in the lower Sheepscot have become increasingly shallow due to sediments, and that lobsters have recently been dying while stored in "keepers" at the bottom of the river. One interviewee noted that there has been a significant, and beneficial, increase in public access to the river.

Given the variation in water quality throughout the watershed, it is understandable that few would be aware of overall water conditions, or the poor condition of specific river segments. The expressed value of the river, however, depends on long-term ecosystem health, and suggests the importance of an educational effort to alert watershed communities to the river's water quality status. Numerous interviewees suggested the need for such educational efforts, with an emphasis on early education programs. In addition, Van Wie's (2006) report [7], reviewed in Section III, recommends a *Shade the Sheepscot* campaign. Ideally, educational outreach would occur on numerous fronts. This plan recommends that outreach occurs primarily through positive and newsworthy restoration activities, a variety of school programs, and continued and expanded monitoring, involving local volunteers.

[6] Draft, West Branch TMDL, Maine Department of Environmental Protection, 2006

[7] *An Assessment of Land Use Regulations for Towns in the Sheepscot River Watershed*, MACTEC Engineering and Consulting, Inc., David Van Wie, Project Manager. May, 2006. Report commissioned by Sheepscot Valley Conservation Association.

Given the above, it is interesting to note that a public survey to assess watershed values revealed an overwhelming preference for land conservation along the river, irrespective of provisions for public access. This finding suggests significant public awareness regarding the impact of development, the importance of buffers, and the overall importance of open space. On the other hand, comparatively little importance was given to better enforcement of existing state and local laws, perhaps consistent with our finding that enforcement is not effective in many cases. This suggests educational needs regarding the importance of land use regulation, natural processes and restoration.

Another facet of community values is the level of volunteerism in the area. The relatively large number of long-term volunteers in the water quality monitoring programs bodes well for continued interest and implementation of the management plan.

Land Use Policy

Land use regulation in the Sheepscot River watershed varies considerably across towns. The Van Wie report documents the current status of regulations within the jurisdictions of eight river towns. The selected towns—Alna, China, Jefferson, Newcastle, Palermo, Somerville, Windsor, and Whitefield— together make up the bulk of the land area and river/stream frontage in the watershed. Given the rapid rate of development within the watershed and the nature of cumulative impacts, consistent and enforceable regulations are critical to the promotion of water quality.

The Van Wie report identifies major water quality concerns within the Sheepscot watershed and ranks towns according to overall concern with respect to land use practices that degrade water quality. Although Whitefield was ranked as having the highest level of concern, the report identifies weaknesses in municipal codes for each town, as well as town-specific opportunities for ordinance changes. For example, China has an ordinance regulating non-point sources of phosphorous with respect to China Lake and Three Mile Pond, but the ordinance does not apply to the portion of town that drains into the Sheepscot. Whitefield has no provision for CEO inspection of single family development; and Windsor's Resource Protection district lacks both a clear definition and the identification of designated areas. On the other side of the coin,

Section 7 of the report provides a list of seventeen “Best Practices” derived from ordinances of various towns in the Sheepscot.

The large number of recent studies in the Sheepscot offers the opportunity to act on the best analyses we have, rather than embarking on new research. The Van Wie report offers eleven thoughtful recommendations, providing a blueprint for future work within the watershed as a whole. In short, the recommendations are designed to prevent non-point sources (NPS) of pollution through a variety of means, including enforcing stormwater rules, restoring buffers, and making changes in land use regulations. With reference to strengthening ordinances, the Van Wie Report suggests a model ordinance produced by the town of Raymond, Maine. Similarly, a model ordinance specific to water quality has been implemented by the town of Windham. The purpose of Windham’s “Surface Water Protection Ordinance” is to set standards and mandate Best Management Practices “for development to reduce nutrient loading and sedimentation of water bodies within all watersheds of the town.”

Findings and Recommendations

The following findings and recommendations are conceived as watershed wide. Recommendations specific to the eight sub-watersheds are given in Section II of this report. Recommendations on land use planning specific to towns may be found in Van Wie’s report.

FINDING: Water quality is more compromised than generally assumed. Public values associated with the Sheepscot require healthy riparian and aquatic systems; however, most respondents were not knowledgeable about water quality problems. Many NPS sites exist throughout the watershed. Impervious surfaces, poorly constructed stream crossings, agricultural run-off, gravel mining operations, and ATV use all contribute to reduced water quality.

RECOMMENDATIONS: Focus on implementation, with an ecosystem perspective.

- Repair high priority NPS sites already identified.
- Establish and restore buffers, particularly near agricultural sites, by employing a wide range of approaches such as land trusts and NRCS programs.

- Support recent efforts to assess and repair culverts throughout the watershed in order to promote water quality, restore fish passage, and enhance the river's capacity to restore itself.
- Fund and empower a full time SRWC Coordinator, or other NGO staff, to implement NPS control measures, restore buffers, and promote passage.
- Encourage participatory educational events regarding water quality protection; e.g., combine construction projects with education and outreach to increase visibility of NPS remediation and best management practices.

FINDING: Patterns of development are changing; sprawl is occurring. The Sheepscot River watershed is already the most "road-ed" of the eight Atlantic salmon river watersheds. Impervious surfaces associated with development (and some traditional land use practices) significantly contribute to water quality degradation. Sediment loads are high. Local perception suggests that the effectiveness of town code enforcement varies.

RECOMMENDATIONS: Implement proven land use policies and strengthen enforcement and accountability.

- Utilize Van Wie's report[8] to implement changes in land use ordinances. Follow the eleven specific recommendations of the Van Wie Report.
- Encourage towns to adopt Maine Forest Service standards for timber harvesting in the shoreland zone.
- Provide support for training municipalities in Smart Growth principles, Low Impact Development standards, and progressive water protection ordinances.
- Encourage towns to consider novel and cost-effective approaches to code enforcement which depoliticize the job, such as making enforcement a county-wide function.

FINDING: Data analysis and management are not well coordinated. Several recent reports and plans document current conditions and needs. Together, they provide valuable information for management, restoration, and stewardship, and a blueprint for implementation. Strong leadership for coordinating information and implementation is needed.

[8] An Assessment of Land Use Regulations for Towns in the Sheepscot River Watershed, May 2006. Prepared for SVCA by MACTEC, Portland ME.

RECOMMENDATIONS: Avoid redundant research and analysis. Ensure leadership to communicate information, coordinate efforts, and implement previously articulated recommendations. Without better coordination among the volunteer, state and federal research and monitoring programs, non-profit activities, and town initiatives, there will continue to be repetitious work as well as missed opportunities for cooperation.

- The Sheepscot River Watershed Council (SRWC) should act on its Strategic Plan and assume a strengthened leadership role. Long-term funding for a full-time SRWC coordinator is critical.
- Use the Sheepscot River Water Quality Monitoring Strategic Plan for specific direction and responsibility for continued and enhanced monitoring. This group should be convened at least yearly.[9]

FINDING: The health of biological communities is not well known or well-communicated. Water chemistry indicators (DO, pH, nutrient concentrations) dominate water quality monitoring programs on the Sheepscot. Direct assessment of the biological community, e.g., through macro-invertebrate sampling, is under-represented in the Sheepscot. Biological monitoring using community volunteers has produced reliable data and built local stewardship elsewhere in the country. Such programs can serve as screens to direct professional monitoring.

RECOMMENDATIONS: Return water quality monitoring to its roots - Stressor Identification - in order to better organize the monitoring work and better communicate its value to the public.

- Professional (agency) monitoring priorities should follow from EPA's Stressor Identification (SI) process and allocate more effort to biological monitoring. The State (through DEP) should increase bio-monitoring in the Sheepscot.
- Regulators (DEP) and community groups could explore the possibilities of partnering to expand volunteer monitoring (water chemistry, biomonitoring, stream habitat)
- State funds should be allocated to the emerging Volunteer River Monitoring Network in Maine.

[9] Arter, B.S. 2004. Sheepscot River Water Quality Monitoring Strategic Plan. Project SHARE. Eastport, ME.

- Connect volunteer monitoring with other actions (BMPs, land use planning) to build a complete public education package.

Next Steps:

The culmination of several in-depth reports on the Sheepscot River watershed could catalyze significant restoration and protection. A convener or "umbrella group" is needed in the Sheepscot watershed to coordinate the numerous recommended tasks—or, at a minimum, keep the stakeholders connected and informed. We suggest that stakeholders' first order of business is to commit to sharing the responsibility of building capacity for communication and coordination of the recommended actions in this plan. This could take the form of an umbrella group or an individual convener. The next steps are: 1) confirmation of this need from all partners, 2) securing long-term funding for a full-time coordinator, and 3) recruitment of volunteer "local leaders" across the watershed.

SECTION I.
DESCRIPTION OF THE WATERSHED

1. Physical Geography

Scale

The mainstem of the Sheepscot River (excluding the West Branch) is 58 miles long. The West Branch is another 15 miles. The total watershed area of the Sheepscot watershed is approximately 364 square miles in area. (See **Map 1**). The Sheepscot can be categorized as medium sized compared with the much larger river systems of Maine, such as the Kennebec and Penobscot; however, the Sheepscot watershed is large enough to include over 40 lakes and ponds and parts of 22 towns in 4 counties. This presents a challenge in developing a workable watershed management plan. While many of the findings and recommendations apply to the whole area, others are more specific to certain towns or subwatersheds. For the purposes of water quality assessment, the watershed was divided into eight smaller drainages. The rationale is explained in Section II.

Geology & Topography

The following is excerpted from the SRWC Strategic Plan, 2005.

> The Sheepscot River watershed is underlain by northeast-southwest trending bedrock of Siluro-Devonian age. With areas of thin soils, bedrock outcrops are common throughout the watershed. These hard metamorphic rocks are more resistant to the weathering effects of wind, water, snow and ice and their linear topographic character is seen in the valleys and ridges of the area and in the finger-like coastline that is common in Maine.
>
> The dominant soils of the Sheepscot River watershed are brown podzolics of the Scantic-Merrimac-Hollis types. These soils are derived from glacial parent material and are easily observed along the stream banks. Boulders and rubble in the riffles of the river originate from glacial material as well and typical forest soils overlay glacial sand and gravel. Highly erodible soils are scattered throughout, but are more heavily concentrated in the northern parts of the watershed.

Based on USDA soils data (in GIS form) it was estimated that approximately 7% to 10% of the land area is of good agricultural soil (for crop, orchard or pasture production).

Maine's rivers tend to flow over bedrock, boulders, and coarse gravel, rather than fine materials. This makes most of Maine's rivers, including the Sheepscot, very different from rivers in other parts of the country. New hydrology models were needed to examine flooding in Maine and New England (Dudley 2004). The study found that bankfull or flood stage river flows occur more frequently in the Maine rivers than in other regions of the country. For example, bankfull occurs more than 30 days a year on average in central and coastal rivers of Maine compared to 15 days a year in Idaho rivers and every 1.5 years in North Carolina, Pennsylvania and Maryland.

Acknowledging that both land use and geology have shaped the river, Melissa Laser, a PhD candidate at Antioch University, emphasizes the importance of the granite bedrock and the river's natural course along faultlines. In essence, once a river has 'hit ledge' it cannot dig down into the river bed as flow increases but instead spreads out (causing bank erosion) and/or overtops the banks. This makes rivers like the Sheepscot even more vulnerable to the effects of increased stormwater runoff from the surrounding land. As impervious cover increases, bank failure and floods will increase. A second consequence of the Sheepscot's geology is that fine particles (like road sediment) in quantity are not a natural stream bottom for this system. Species like salmon and trout have evolved in a more rock-bottomed system. Therefore, sediment loading has a larger, negative effect on rivers like the Sheepscot.

The Sheepscot has recently attracted the attention of geomorphologists and historical ecologists. Dr. Noah Snyder, a geomorphologist at Boston College, is currently investigating the morphology and sediment transport processes of the Sheepscot and Naraguagus river systems. The research is being carried out through the use of remote sensing data and field measurements of stream morphology. The research will help watershed managers understand how present and future activities such as reforestation, anadromous fish reintroduction, and dam removal will affect the rivers and streams. Melissa Laser has completed a study of riparian function of the West Branch of the Sheepscot. Her research includes the history of settlement on the river (see Historical Use, below) and the large woody debris dynamics in the river. These and other studies will likely lead to management recommendations for restoring flow and functionality in the Sheepscot.

Waterbodies

In addition to the mainstem, the Sheepscot River system includes the West Branch, Dyer River, Meadow Brook, and Montsweag Brook. There are over 500 miles of streams that drain into these waterbodies. The estuaries in the lower watershed drain into Sheepscot Bay, which is included in the scope of this plan.

There are over 40 lakes and ponds within the Sheepscot watershed. Many of these are quite small and are of little influence to the river itself. Ten lakes (Beech Pond, Branch Pond, Clary Lake, Dyer Long Pond, Little Dyer Pond, Long Pond, Savade Pond, Sheepscot Pond, Three Corner Pond, and Turner Pond) are large enough to influence the river's water quality. These are listed in the following table and marked on **Map 1**.

Table I.1. Ponds and Lakes in the Sheepscot River watershed.

Pond/Lake	**Surface Area (acres)**	**Location**	**Lake Assocn.**
Branch Pond	310	head of West Branch, town of Palermo	Branch Pond Assocn.
Savade Pond	67	drains to West Branch, town of Windsor	(none known)
Sheepscot Pond	1,215	head of mainstem, town of Palermo	Sheepscot Lake Fish & Game Assocn.
Beech Pond	59	drains to Sheepscot Pond, town of Palermo	(none known)
Turner Pond	199	drains to Long Pond, towns of Somerville, Windsor	(none known)
Long Pond	504	on mainstem, towns of Somerville, Windsor	(none known)
Clary Lake	674	drains to mainstem, towns of Whitefield, Jefferson	Clary Lake Assocn.
Dyer Long Pond	425	on Dyer River, town of Jefferson	(none known)
Little Dyer Pond	112	drains to Dyer Long Pond, town of Jefferson	(none known)
Three Corner Pond	74	town of Jefferson	(none known)

2. Past and Present Use

Historical Use

The following is excerpted from the SRWC Strategic Plan, 2005.

> Settlement and farming began in the area in the mid-1600's. While the Sheepscot River watershed is now significantly forested, it was once farmed intensively and by the early 19th century much of the watershed, including riparian areas, was cleared for crops and pasture. This alteration led to stream erosion and changes in runoff rates. A trend toward farm abandonment began in the mid 1800's, and although fields have grown back to forests the altered stream channels remain.
>
> As on most New England rivers, beginning in the mid 1700's dams were constructed on the Sheepscot River to operate grain or saw mills and later to produce electricity. Other dams provided temporary storage water to augment flows for log driving. These dams blocked anadromous fish from much of their habitat and contributed to the decline in native fish populations.
>
> At one time the watershed had 44 dams (Laser 2004). [These were saw mills and grist mills.] Many of these still existed into the 1940's and didn't allow for fish passage until much later. The Head Tide Dam in Alna, for example, blocked fish from most of the Sheepscot River watershed for more than a century before it was notched for fish passage in 1960. While many of these dams have been breached, removed or altered, they can still affect spawning and rearing habitat by altering water quality and normal flow conditions. Some that remain still do not adequately pass fish.

As Melissa Laser points out in her doctoral work (Laser 2006), the past management of the Sheepscot for transportation and log driving means that many natural structural elements of the river (boulders, fallen trees) no longer exist, and that it is difficult to recreate the pre-settlement structure of the river.

Present Uses of the River, Tributaries, and Lakes

The Sheepscot is used primarily by people for recreation. Lakes are used for swimming, boating and recreational fishing. There are several local, but not official swimming holes along the Sheepscot as well. The section from North Whitefield to Sheepscot is often paddled by kayakers and canoeists, and several preserves provide trails to the river (Palermo Preserve, Whitefield Salmon Preserve, Bass Falls, Griggs Preserve, and Oven's Mouth).

There are nine public access points above Sheepscot Village (Delorme Atlas & Gazetteer). These are at Savade Pond, Turner Pond, Sheepscot Pond, just below Long Pond, Travel Pond, Clary Lake, Dyer Long Pond, Musquash Pond, and Kerr Pond. Five (Travel Pond, Clary Lake, Dyer Long Pond, Musquash Pond, and Kerr Pond) are hand carry access only. Most of the shoreline is accessible only by private landholders.

There are no towns that use the Sheepscot as a public water supply. Wiscasset is the only town in the watershed that uses the river for wastewater discharge.

There is no large chemical or manufacturing industry within the watershed, and therefore no concern of large-scale industrial pollution. Agriculture and logging are the primary commercial sources for pollution and runoff. Road erosion, residential development and landscaping are the other potential threats to water quality. Piecemeal residential development is occurring everywhere in the watershed and large-scale subdivision and marina developments are imminent on the coast (see Section III).

An IF&W fish hatchery in Palermo raises brown trout and splake (lake trout/salmon hybrid) (Project SHARE 2005). It is monitored by the DEP Pollutant Discharge Elimination Program, and is allowed lake water withdrawal from Sheepscot Lake and waste discharge into the Sheepscot River.

The river is home to many fish populations, including alewives and salmon. Alewives are fished commercially, with rights distributed by Alna and Jefferson. As an endangered species, Atlantic salmon is protected and takings are prohibited. Recreational sport fishermen utilize the Sheepscot for the various sport fishes found within the lakes and streams.

As mentioned above, there were at least 44 dams on the Sheepscot at one time. Many are no longer in use and are merely remnants, while 17 still exist. Nine of these dams have the potential to influence water quality and habitat (Arter 2005) (see also **Map 2** in this report). Four dams potentially restrict fish passage (KRIS).

Shellfish aquaculture is prevalent in Sheepscot Bay. There are two oyster aquaculture sites between the Wiscasset Rte. 1 bridge and the railroad bridge; one oyster aquaculture site between Leeman Island and Cunningham Island; one inactive trout farm at Mason Station; two oyster farms and one limited purpose site for oyster, clams, or mussels in Squam Creek salt pond, which goes as far as Westport on the Back River (Sirrois 2005). Harvesting of wild shellfish, given the frequent closings of shellfish areas for sanitary reasons (see discussion in Section II), is limited. The worm-bait industry is apparently thriving in the Wiscasset area.

3. Political Landscape & Demographics

Twenty-two towns in four counties have territory within the Sheepscot watershed. The majority of these have one-half or more of their territory within the watershed. (*see Table 1 below, and Map 1).*

Table I.2. Towns of the Sheepscot River watershed. (Source: Maine Office of GIS data). Towns having more than 15 square miles in the watershed are indicated in bold.

TOWN	TOTAL AREA OF TOWN (sq. mi.)	AREA OF TOWN WITHIN W.S. (sq. mi.)	Town Population (SPO estimates for 2006)	Pop. in watershed (based on % w.s. area)	West Branch, Upper, Middle, or Coastal?	COUNTY
China	**56.8**	**17.3**	**4542**	**1398**	**West Branch**	**Kennebec**
Windsor	**35.5**	**25.8**	**2432**	**1768**	**West Branch**	**Kennebec**
Palermo	**43.5**	**41.9**	**1382**	**1334**	**West Branch**	**Waldo**
Albion	39.4	0.18	2121	10	Upper Mainstem	Waldo
Freedom	22.2	4.0	706	128	Upper Mainstem	Waldo
Montville	43.1	7.5	1147	200	Upper Mainstem	Waldo
Liberty	28.4	7.3	1019	265	Upper Mainstem	Waldo
Somerville	**22.8**	**15.6**	**554**	**385**	**Upper Mainstem**	**Lincoln**
Washington	39.2	3.9	1481	148	Upper Mainstem	Knox
Whitefield	**47.5**	**32.4**	**2485**	**1692**	**W.B.- Middle**	**Lincoln**
Jefferson	**58.5**	**35.8**	**2634**	**1635**	**Middle**	**Lincoln**
Alna	**20.9**	**19.7**	**746**	**700**	**Middle**	**Lincoln**
Newcastle	**29.7**	**23.9**	**1871**	**1497**	**Middle**	**Lincoln**
Wiscasset	**24.7**	**22.2**	**3853**	**3391**	**Middle-Coastal**	**Lincoln**
Edgecombe	**18.2**	**15.3**	**1186**	**988**	**Middle-Coastal**	**Lincoln**
Woolwich	35.5	10.0	3080	880	Coastal	Sagahadoc
Arrowsic	7.8	1.8	548	126	Coastal	Sagahadoc
Boothbay	19	10	3151	1658	Coastal	Lincoln
Westport	8.9	8.9	871	871	Coastal	Lincoln
Boothbay H.	5.5	0.8	2252	327	Coastal	Lincoln
Georgetown	17.5	12.9	1107	822	Coastal	Sagahadoc
Southport	4.8	3.1	708	442	Coastal	Sagahadoc
TOTAL	**629.4**	**321.03**	**39,876**	**20,337**		

The focus of the Management Plan is on those towns with a significant watershed area (greater than 15 square miles) and/or significant Sheepscot River frontage. However, activities in individual coastal towns also have significance, albeit of a different focus

than the upper watershed. Socio-economic and land use differences among the towns are described in later sections.

Population for the 22 towns was adjusted according to portion of the town in the watershed (See Table 1 above). In this way the total population in the watershed is estimated at between 20,000 and 21,400 persons. According to SPO data, population in the watershed grew by an average of 12% from 1990 to 2000. However, during that same period housing units increased by 20% (Benjamin 2004). The fact that housing starts are increasing faster than population can largely be attributed to smaller households and the growth of second homes in the area. In 2004 and 2005 Knox and Lincoln counties had negative natural increases in population (i.e., deaths exceed births) but more than made up for this loss with newcomers. Kennebec and Waldo experienced both positive natural increase and a high number of newcomers (US Census 2005).

Data from towns provide a more accurate picture of socio-economics in the region than do county-wide data. For example, Knox, Waldo, and Lincoln counties all include coastal communities with very different economics than those from inland areas. Significant north-south differences can be illustrated by straightforward comparisons: the towns of Unity and Somerville in the upper watershed experience high poverty rates (22% of population below poverty line (year 2000 Census)) relative to the rest of Maine, whereas the towns of Boothbay and Boothbay Harbor on the coast are among the wealthiest in Maine (median house price over $275,000 in 2005 (MSHA)).

Land uses and the economy of the watershed can be characterized in the following general terms. The upper watershed is dominated by forestry and farming with a mix of home occupations, tradesmen, and commuters, with only a few larger commercial operations. In terms of revenue, tourism and services related to seasonal homes dominate the lower watershed In the upper watershed, Augusta to the west and Belfast to the east (both outside the watershed) are the chief destinations for work and services. Wiscasset serves as a service center for the lower watershed although residents might travel to Belfast, Bath, or Portland for work. The average daily commute (US Census 2000) varies between 37 and 53 miles in the four counties. Although it is difficult to say how much of this travel occurs within the watershed, it is an indication that roads will continue to have an impact in this area as the region grows. Land use patterns are discussed in more detail in Section III of this report. The response of towns to the challenge of balancing development with resource protection will also be addressed in Section III.

4. Special Resources

The Sheepscot River is recognized by the State Legislature as an Outstanding River Segment (12 M.R.S.A § 403). This designation places the Sheepscot among those rivers which, because of their “unparalleled natural and recreational values, provide irreplaceable social and economic benefits to the people in their existing state". New dams and water diversions are prohibited without specific authority of the Legislature. Outstanding River Segments are also given additional protections under the Natural Resources Protection Act (NRPA) and Shoreland Zoning.

The "unparalleled natural and recreational values" of the Sheepscot are many. In addition to its importance as breeding and rearing habitat for federally endangered Atlantic salmon and short-nosed sturgeon, the Sheepscot supports a number of other anadromous fishes, has important freshwater and tidal wetland plant communities, supports native brook trout in the upper reaches, and is well-known regionally for its beauty and recreational value.

Freshwater and tidal wetlands

The non-tidal sections of the Sheepscot have relatively little shoreline wetlands compared with rivers in Washington County and Canada (SRWC 2005). Consequently, species that depend on wetlands for part of their life cycle are especially vulnerable in the Sheepscot. The non-tidal wetlands upstream of the old dam in Alna support the globally uncommon brook floater (*Alasmidonta varicosa*).

The tidal wetlands downstream of Alna village and in neighboring Newcastle have been identified by the Maine Natural Areas Program as a Focus Area of Ecological Significance. The marshes support rare mussels and several species of rare plants, such as the salt marsh false foxglove (*Agalinis maritima*), which is found in large numbers in the Deer Meadow marsh.

Anadromous fishes

A great deal of research and restoration activity has been directed toward the Sheepscot because of its importance to federally endangered Atlantic Salmon (*Salmo salar*). The Sheepscot is one of 8 large river systems in Maine that have historically supported

populations of Atlantic salmon. The Sheepscot supported a robust salmon population prior to the 1940's and is still seen as containing valuable salmon breeding habitat. However the salmon population continues to decline. The estimated number of adult salmon returning to the Sheepscot has been less than 5/year for the last ten years (Lipsky 2004). The river is also stocked with hatchery-reared fry and parr (juvenile), the survival rate of which has been assessed as "moderate" (Lipsky 2004). It appears that the river is able to sustain a moderate population of salmon that are introduced to the river in their early life stages but returns of adult sea-run salmon are precariously low. [10]

The limiting factors on salmon population recovery are numerous and complex, partly because of the complex life history of the species, which depends on a variety of habitat at different stages of development. Scientists and fisheries managers continue to explore the reasons for low returns in various rivers and the question of whether or not the problem lies in the river habitat or poor survival at sea. Problematic impacts in freshwater salmon habitat include changes in flow, increased temperature, loss of habitat connectivity (access to tributaries for spawning), and changes in juvenile habitat (e.g., increased embeddedness of stream bottom, poorer water quality).

The Sheepscot River supports a number of other anadromous fish species at some point in their life cycle. These include Atlantic sturgeon, shortnose sturgeon, alewife, blueback herring, American shad, rainbow smelt, striped bass, sea-run brook trout and lamprey and American eel. Two of these are species of special concern—the shortnose sturgeon is Federally endangered and the status of the American eel is under review by the USFWS. Shad and alewife are important food source for other fish species and have been commercially fished in the past (Squires 2004).

Native trout

Cold water habitat suitable for trout tends to be localized, both in larger branches and in tributaries (Van Riper 2004). These areas are stocked with brown and brook trout. Attention is also turning to assessing the native brook trout population in the upper watershed, and to protecting these populations from overharvest or genetic influence of the hatchery-reared population. Trout Unlimited and the Maine Forest Service are

[10] 2006 saw very high counts of parr (juvenile salmon in freshwater). It remains to be seen whether these juveniles will survive the migration to sea and return in a few years to the Sheepscot to spawn.

conducting stream crossing inventories in the upper watershed to assess fish passage for coldwater species like trout.

Commercial Fisheries

Harvest of wild shellfish is done on a non-commercial scale in the watershed, where water quality permits. Shellfish aquaculture is described above. Lobstering in Sheepscot Bay is the only other commercial-scale fishery. The bait-worm industry is active in Wiscasset. Shad is regaining popularity with consumers in other New England rivers and could attain population levels large enough to support commercial fishing in some rivers of the Gulf of Maine. The status of shad in the Sheepscot is less well known than in the Kennebec and Androscoggin Rivers.

Recreational values

The scenic beauty of the river, with its mixture of forest and farmland, has prompted local support for land conservation groups such as the Sheepscot Valley Conservation Association (SVCA) and the Sheepscot Wellspring Lands Alliance (SWLA). A number of public preserves with hiking trails are managed by these land trusts. There are over 50 properties protected by easement or acquired by private land trusts or the State and accessible by the public (see **Map 3**). The State has given large parts of the Sheepscot River the highest water quality attainment classification of AA, indicating that swimmable and drinkable waters are a reasonable goal for these areas. Public use and access points for swimming, paddling and fishing are described above under present uses.

5. Organizations Active in the Watershed

Many governmental and non-governmental organizations have focused considerable time and effort on activities related to watershed protection in the Sheepscot. Some of these actions are spurred by the declining population of Atlantic Salmon and its listing as an endangered species under U.S. law. Other initiatives cover a wide range of conservation needs, of which recovery of anadromous fishes is a part. Many of these groups provided much information in writing this report and will be instrumental in carrying out the recommendations. The role of town government is treated separately,

with an in-depth look at town ordinances and comprehensive planning in Section III of this report.

Conservation Non-profits

Sheepscot River Watershed Council (SRWC): The SRWC was formed in 1997 as part of the Maine Atlantic salmon Conservation Plan. The organization was initially created to coordinate voluntary actions needed to support watershed and salmon restoration on the Sheepscot River. In addition to supporting salmon conservation, the mission of the SRWC has evolved to promote the protection and restoration of the Sheepscot River watershed, including the environmental, economic, and social well-being of the region and its citizens.

Sheepscot Valley Conservation Association (SVCA): A non-profit land trust and advocacy group established in 1969, currently with 550 member families. SVCA's mission is to conserve and restore the natural and historic heritage of the Sheepscot watershed. The organization currently protects more than 2,000 acres through purchases and conservation easements, including over 13 miles of Sheepscot River frontage. The SVCA network of volunteer water quality monitors collects water quality data used by the Maine DEP. Lili Pugh researched and wrote drafts of Section II of this report. The SVCA also contributed with GIS assistance and input on recommendations.

Sheepscot Wellspring Lands Alliance (SWLA): A relatively young land trust (formed in 1991) that is active in the upper reaches of the Sheepscot. To date there are 13 parcels preserved, totaling 775 acres. SWLA's mission is the permanent protection and restoration of the lands and waters, and their indigenous species, within the upper Sheepscot River watershed essential to the ecological health of the region. Other activities are public environmental advocacy and education; the support of sound scientific research; and management plans. SWLA volunteers coordinate with the SVCA in the collection of water quality data.

Trout Unlimited (TU): The Maine Council of Trout Unlimited's mission is to conserve, protect and restore Maine's trout and salmon fisheries and their watersheds. Local chapters have raised funds to help acquire a conservation easement on land that drains

into the west branch of the Penobscot River. TU Maine also carries out public education on cold water fish habitat through 'trout camp', fly-fishing lessons and volunteer stream walks to assess stream habitat. TU is partnering with the Maine Forest Service to conduct a culvert and crossing inventory in the Sheepscot.

Community Groups

Sportsmen's' Clubs. The traditional "rod and gun club" seems to be disappearing in the region. The Palermo Fish and Game Club is one of these old clubs which now operates mostly as a social club, although it was originally formed around issues of dam management and water quality in Sheepscot Pond. Outdoorsmen and many other members of the community are turning to motorized recreation. We gathered information on four different ATV clubs which have access to parts of the watershed. The erosion control issues attached to ATVs and the values and goals of these clubs are discussed in Section III.

Lake Associations. Lake associations are a common and well-established means of local organization in Maine. Members join for common goals such as dam management, road repairs, and water quality. The three larger (and more developed) lakes in the watershed have lake associations (see Table 1). At the time of publication of this report, we were not aware of any local groups formed around protection of a specific stream or reach of the river. The need for local organization around streams and river segments is critical, as detailed in our Recommendations.

Special Districts & Regional Groups

Time & Tide Resource Conservation and Development (RC&D) District: The Time & Tide Resource Conservation & Development Area was the project sponsor. Their mission is to help people develop, care for, and appreciate their natural resources in a way that will enrich the community and better their lives. Time & Tide serves six counties in Maine: Androscoggin, Kennebec, Knox, Lincoln, Sagadahoc, and Waldo.

Soil and Water Conservation Districts (SWCDs): Soil and Water Conservation Districts cannot be categorized as conventional non-profits or government agencies. They

operate at a county level but do not fall under county government. SWCDs were formed by legislative action but receive very modest funding from the State. They operate more like non-profits. Their connection to the Federal agency NRCS varies from county to county, depending on agricultural activity in the county and Board direction. The SWCDs whose territories include the Sheepscot watershed are:

Kennebec SWCD: The West Branch of the Sheepscot runs through eastern Kennebec County until crossing into Whitefield. The Kennebec SWCD has implemented a number of non-point source (NPS) reduction projects in the West Branch since the 1990s. In early 2005, Time & Tide RC&D contracted the Kennebec SWCD to organize and author the watershed plan.

Knox-Lincoln SWCD: The majority of the land draining into the Sheepscot mainstem lies in Lincoln County. Knox-Lincoln staff assisted with the NPS Survey and public meetings in the first year of the project.

Waldo SWCD: A large portion of the upper watershed, including a part of the West Branch is located in Waldo County. A Waldo SWCD contractor assisted with the NPS Survey and interviews.

Regional Planning Bodies & COGs: The role of these quasi-governmental groups will be discussed in Section III, Land Use Planning.

State Agencies

Any state agency connected to natural resource management has a role in the Sheepscot Watershed. Other state agencies are able to provide demographic and socio-economic information. These include the State Planning Office (SPO) and Maine Department of Agriculture.

Maine Department of Environmental Protection (DEP): The agency is responsible for recommending attainment classes for all waterbodies in the State and assessing water quality. This regulatory function is encapsulated in the 305(b) report submitted to US Environmental Protection Agency every two years. The bulk of the water quality monitoring in the Sheepscot is performed or managed by Maine DEP. This will be discussed in more detail in the next section.

Atlantic Salmon Commission (ASC): Established in 1998 by the Maine legislature and following several decades of work by the Atlantic Sea Run Salmon Commission. The ASC is recognized as the lead entity for recovery of the species in Maine, by continuing to monitor the status of salmon populations in the eight salmon rivers and working with partners to implement the Atlantic Salmon Recovery Plan.

Maine Department of Inland Fisheries & Wildlife (IF&W): Among the Department's many duties are stocking of rivers and lakes with game fish and regulation of fishing. The Department also assesses status of native (non-stocked) fish of special concern, such as native brook trout. Another role of IF&W is to communicate the State's laws on ATV use and enforce infractions of this law through the regular duties of IF&W wardens.

Maine Department of Marine Resources (DMR): responsible for fisheries management in tidal waters, including stock assessment and regulation of harvested species. Maine DMR coordinates with the ASC on recovery of Atlantic salmon. On the coast, monitoring of shellfish health and restriction of shellfish harvesting areas is an important public service and environmental indicator.

Federal Agencies

U.S. Fish & Wildlife Service (USFWS): a division of the U.S. Department of the Interior. The USFWS is responsible for reviewing the status of species with declining populations and making a determination of whether or not to list a species as endangered under the federal Endangered Species Act. The USFWS is one of several agencies partnering to implement the Atlantic Salmon Recovery Plan. The USFWS also plays a role in resource protection, whenever a permit application triggers federal review (see US Army Corps of Engineers).

Natural Resource Conservation Service (NRCS): A division of the U.S. Department of Agriculture, NRCS manages a large number of cooperative agreements with farmers and woodlot owners in the State. Programs are largely aimed at reducing impact of animal husbandry (especially manure management) and crop production on the local

resources. On-the-ground practices include manure pits, crop rotation, animal crossings, buffer strips, and other measures. An NRCS office exists in each of the counties.

National Oceanic and Atmospheric Administration (NOAA): a non-regulatory agency which contributes a large body of research and data on coastal waters and estuaries. There are also a few funding programs for wetland restoration and recovery of marine species. NOAA is a partner in the Atlantic Salmon Recovery Plan.

U.S. Army Corps of Engineers ('the Corps'): The Corps comes into play in the Sheepscot whenever a project involving dredging or filling of “navigable” waterways or wetlands is proposed. A permit from the Corps is needed in some cases.

U.S. Environmental Protection Agency (EPA): The federal agency responsible for implementing the U.S. Clean Water Act. This includes regulatory functions, through oversight of the State’s regulatory programs, and financial and technical assistance to carry out watershed protection programs. The '319' program managed by Maine DEP is funded through EPA.

SECTION II.
WATER QUALITY ASSESSMENT & WATER USES

1. Watershed Divisions

How can we make sense of such a large watershed?

The Sheepscot watershed (including the coast) is approximately 360 square miles in size[11]. There are over 40 lakes and ponds and over 30 tributaries within the watershed. To report on water quality of "the Sheepscot" as one uniform watershed would be impossible. Because of its size and the number of tributaries and lakes, the watershed must be divided into sections in order to make sense of the data. Ways to divide the watershed for analysis and management are numerous. Parts of the Sheepscot are in Sagadahoc, Lincoln, Kennebec, and Waldo Counties. There are 21 towns through which the Sheepscot and its lakes, ponds, and tributaries run and 10 of these towns each have over 15 square miles in the watershed. From a management point of view one might split the watershed by groups of towns or by county. From a water quality standpoint it is easier to split the watershed into reaches based on physical features and water chemistry.

The Maine Department of Environmental Protection (MDEP) uses two divisions for the watershed. HUC 10 divides Sheepscot Bay from the rest of the river. HUC 12 divides the Sheepscot into eight subwatersheds. This system allows for examination of three of the major tributaries of the Sheepscot independent of the mainstem. It also splits the mainstem into three sections and makes the West Branch another section. It is based on major drainage basins within the watershed and could aid in an understanding of inputs to the system. The problem with using these divisions is that subwatershed "Sheepscot River (3)" contains estuarine and freshwater portions of the river, which are hard to compare, since water quality standards are not comparable. The other concern is that water quality information is limited or non-existent for Dyer River, Meadow Brook and Montsweag Brook subwatersheds.

[11] USGS GIS data, HUC-10#'s 0105000305 and 0105000306

The Atlantic Salmon Commission (ASC) utilizes a scheme which splits the watershed into four priority Atlantic salmon habitat subwatersheds. This scheme does not separate any major tributaries. It is based mostly on grades of salmon habitat. Subwatersheds 1, 2 and 3 contain habitat that is useful for salmon. Subwatershed 4 provides limited if any habitat for anadromous fishes. These divisions, as with HUC 12, do not separate estuarine from freshwater; both are included in subwatershed 1.

After researching these different hydrologic and habitat divisions, Lili Pugh (SVCA volunteer water quality monitor) devised the following sub-divisions for discussion of water quality in this Management Plan (**Map 4**):

1. Lower Estuary- includes Sheepscot Bay to Sheepscot Falls
2. Montsweag Brook
3 Dyer River and Meadow Brook
4. Upper Estuary- Sheepscot Falls to Head Tide
5. Lower Mainstem- Head Tide to base of Long Pond
6. Middle Mainstem- Long Pond to head of Sheepscot Pond
7. Upper Mainstem- above Sheepscot Pond
8. West Branch

This combines some of the ideas presented by both the ASC and the MDEP schemes, taking into consideration availability and interpretation of data as well as fisheries and human use. These watershed divisions will come into play as we discuss recommendations, both for water quality monitoring and other activities.

2. Water Quality Monitoring Programs

Who is monitoring what in the Sheepscot?

At least nine agencies and organizations have been and/or are currently involved in monitoring the Sheepscot (see Table A.1 in Appendix A). This group includes the Sheepscot Valley Conservation Association (SVCA), Sheepscot Wellspring Land Alliance(SWLA), Volunteer Lakes Monitoring Program (VLMP), Maine Department of Environmental Protection (MDEP) Salmon Program, MDEP TMDL Program, MDEP Biomonitoring, MDEP Hatchery Licensing Program, MDEP Dam Regulation Program, Department of Marine Resources (DMR), Atlantic Salmon Commission (ASC), National

Oceanographic and Atmospheric Administration (NOAA), United States Fish and Wildlife Service (USFWS), and United States Geological Survey (USGS). Monitoring has been performed at over 40 sites along the Sheepscot, its tributaries and ten of the lakes and ponds within the watershed.

The largest amount of data collected concerns dissolved oxygen (DO), temperature, bacteria, and flow. Others parameters, such as BOD and TSS, make up a smaller proportion of the data set because they require more complicated lab analysis. The SVCA has the longest running volunteer sampling program along the river, collecting samples and testing for DO, temperature and bacteria for gauging attainment of water classification. The USGS has run a gauge station in North Whitefield for over 65 years, collecting continuous data on river flow rates.

What do the different measures tell us?

A host of water quality parameters are monitored in the watershed: dissolved oxygen (DO), pH, temperature, salinity, bacteria (*E. coli*), turbidity or total suspended solids (TSS), anions, cations, alkalinity, transparency, total phosphorus (TP), total nitrogen (TN), ammonia, macroivertebrates, biological oxygen demand (BOD), and chlorophyll-a. These are defined in Table A.2 in Appendix A.

No single water quality monitoring program has the resources to monitor all of the above parameters in every part of the watershed. Parameters are chosen based on what assessment is being performed (e.g., overall water quality or needs of a particular species) and what is already known about a particular water body. Continuity of the program and data quality, as well as cost, are also factors in choosing which parameters to monitor and how frequently.

Dissolved oxygen (DO) is the most widely used and most practical indicator of the health of a freshwater ecosystem. Once DO measures indicate that a river's health may be impaired, other measures (such as temperature, flow, biological oxygen demand (BOD) and sediment oxygen demand (SOD)) can yield more information for identifying the source of the problem. For example, direct nutrient measures are taken when it is suspected that algae growth may be the cause of lowered DO.

When managing a river for a sensitive species, such as Atlantic Salmon, DO alone is not an adequate indicator of environmental health and habitat value for the species. Other water quality parameters, such as salinity and pH, are important

indicators of stress on the different life stages of salmon. (Atlantic Salmon are particularly vulnerable to lowered pH)[12]. Turbidity of the water and embeddedness of the stream bottom are also significant stressors. Turbid waters tend to suffer from low DO and also stress predatory fishes who rely on vision. Too much sediment covering the streambed will impact macro-invertebrates, limit the breeding habitat of salmon and other fish species, and impact juvenile survival rates.

Excess nutrients lead to algae growth and oxygen depletion. Determining natural levels of nutrients (phosphorus and nitrogen) is difficult due to the lack of pristine reference sites. Nutrient levels in rivers are influenced by bedrock and soils, and by anthropogenic sources such as lawn fertilizer runoff, agriculture, and air pollution. Despite the difficulties in determining anthropogenic sources, direct measures of nutrient levels (phosphorus and nitrogen) can be used to determine whether manure runoff from farms, for example, is a contributor to nutrient-enriched waters.

While these water chemistry measures continue to have importance in monitoring the health of freshwater ecosystems, counting organisms that actually live in the water body has become increasingly prevalent. This approach, loosely called bio-monitoring, involves collecting aquatic macro-invertebrates (insects, mollusks, etc) from the streambed using a set protocol. The number and diversity of organisms (expressed in terms of taxonomic indices), and the presence or absence of certain sensitive organisms, are indicators of overall ecosystem health and function. Biomonitoring is often used in conjunction with water chemistry measures. For example, Maine DEP has biomonitoring results from 4 sampling stations in the Sheepscot watershed. The results at 2 of these stations indicated that the aquatic community was reduced.[13] This result, combined with low DO, further indicates that water quality is impaired in these areas.[14]

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[12] The pH range in the Sheepscot is 6.32 to 7.67, which is higher than the Downeast salmon rivers. The Sheepscot bedrock material is marine sedimentary rock (siltstone, mudstone) that are sources of carbonate. This provides a good buffering capacity for the river (better than the Downeast rivers) and therefore some protection from acid rain. (Whiting 2006)

[13] Two sites on the Sheepscot mainstem were assessed for macroinvertebrate community structure, and class attainment was determined. These sites have been sampled for many years by the biomonitoring program. The two sites are in North Whitefield at the USGS gage station and on the West Branch in Weeks Mills off Dirigo Rd. The North Whitefield site attained classification while the West Branch site did not when sampled in 2004 (the most recent season reported), though historically both sites have had years of attainment as well as non-attainment.

[14] Under the Clean Water Act Section 305(b), waterbodies are placed into water quality **Classes** (based on water quality standards they should reach) and attainment **Categories** (based on how well they attain the standards in their class). Water bodies not attaining their class may be "impaired". Water quality Classes and Categories are described in the Appendix.

Biomonitoring is the most direct assessment of biological health of a river or stream, whereas water chemistry parameters are proxy measures. Biomonitoring is carried out by Maine DEP professionals in determining whether a river or stream attains its water quality classification, i.e., supports a healthy biological community. It follows from EPA recommendations under the Stressor Identification process (see description in the Appendices), which, ideally, guides all water quality monitoring efforts. The DEP's macroinvertebrate collection and analysis protocol is fairly rigorous and costly, especially as it involves identification of insects and other macro-invertebrates by trained professionals. In several other states, macroinvertebrate collection, along with description and 'scoring' of the riparian and stream habitat is being carried out by volunteers. In some cases the data collected is usable by the state regulators, as in Virginia. In most cases, it serves as a 'screen' or early warning that can direct state regulators to specific locations and sampling effort for their professional monitoring. A volunteer biomonitoring program is also a means of building stewardship and community awareness, as discussed in later sections of this report.

Another water quality parameter of importance in some places in the Sheepscot is bacteria counts. Direct measures of bacteria in the water column are carried out when it is suspected that human wastewater pollution and/or high nutrient loading from agriculture or other sources is a problem in the waterbody.

Flow, measured as cubic fee per second, is increasingly studied as an indicator of habitat value and the total functionality of the river system. Flow measurements are linked to seasonal changes, and cannot be taken out of a temporal context. The structure of a river system, for example, how pools, riffles, and runs fit together is another, more complicated aspect of flow and river morphology. Flow patterns and channel morphology have been altered in the Sheepscot as a result of historic use (log drives and mills), and continued agricultural activity or other clearing. These activities can easily reduce forest buffers and consequently erode banks and widen the stream, altering sediment loads and flow rates. Low flow can contribute to higher temperature and lowered DO. Currently, flow is measured at the USFS gauging station in Whitefield and at the effluent of the Palermo fish hatchery. Recommendations have been made to increase flow studies.

Salmon habitat has been mapped by the Atlantic Salmon Commission and the NOAA/Gulf of Maine project. Substrate character, degree of runs and riffles in a reach, and temperature data were combined to assess reaches in terms of spawning and

rearing habitat. As of 2006, all freshwater sections of the Sheepscot have been mapped (i.e., upstream of Head of Tide). This information is available as a GIS data layer showing spawning and breeding (juvenile habitat) areas as features mapped on the river and streams. (**Map 5** displays this data at a larger scale).

3. Evaluation of Overall Water Quality and Ecosystem Health

Which parts of the Sheepscot have poor water quality?

According to Maine DEP's 305(b) report to DEP, nine[15] segments in the Sheepscot River and tributaries, representing approximately 38 miles, are listed by DEP as impaired for aquatic life. (See Table II.1, below, and **Map 4**). Two of these segments (representing nine river miles) are also impaired for recreational uses. As can be seen from the map, impaired segments are not concentrated in any one region of the greater watershed. The many other river segments and tributaries are not necessarily attaining all designated uses and standards; rather, they are listed in Category 2 (attains some uses; insufficient data). For each of the nine impaired segments, low DO is listed as the primary constraint on water quality. The most likely cause of low DO is non-point source (NPS) pollution, and particularly nitrogen and phosphorous carried by run-off. Of the forty-plus lakes and ponds within the Sheepscot watershed, only seven have enough data to make conclusive water quality assessments. The water quality of these lakes is either “average" or “below average.” There are as yet no 303(d)-listed (impaired) lakes in the watershed.

Table II.1: *Category 5-A waters (impaired waters requiring a TMDL): source: 305(b) Report 2004 and DEP Biomonitoring Program 2006.*

Segment Name	DEP's Assessment Unit (AU)	WS Division	Impaired Use	Cause	Potential Source
Dyer River below Rt. 215 to confluence w/Sheepscot	AU 528R03	3. Dyer River, Meadow Brook	Aquatic life, recreation	Dissolved Oxygen, Bacteria	Agricultural NPS
Trout Brook	AU 528R04	4. Upper	Aquatic life	Dissolved	NPS

[15] 8 segments were reported in Maine DEP's 2004 305(b) Report to EPA. An additional segment (AU 528R01) was assessed as non-attaining in 2006 and is likely to be added to the list for the 2006 305(b) Report.

(Alna)		Estuary		Oxygen	(unspecified)
Chamberlain Brook (Whitefield)	AU 528R09	5. Lower Mainstem	Aquatic life	Dissolved Oxygen	NPS (unspecified)
Sheepscot River between Sheepscot Pond and Long Pond	AU 528R08	6. Middle Mainstem	Aquatic life	Dissolved Oxygen	Aquaculture PS (hatchery)
Sheepscot River (from 0.24 miles above Head Tide downstream to undetermined point)	AU 528R01	1. Lower Estuary	Aquatic life	(not reported)	(not reported)
West Branch Sheepscot River below Halls Corner (Rte. 17)	AU 528R02	8. West Branch	Aquatic life	Dissolved Oxygen	Agricultural NPS
Meadow Brook (China)	AU 528R05	8. West Branch	Aquatic life	Dissolved Oxygen	NPS (unspecified)
Carlton Brook (Whitefield)	AU 528R06	8. West Branch	Aquatic life	Dissolved Oxygen	NPS (unspecified)
Choate Brook (Windsor)	AU 528R07	8. West Branch	Aquatic life	Dissolved Oxygen	NPS (unspecified)

What is causing the poor water quality (low DO) in the impaired reaches?

The water quality monitoring undertaken by DEP, SVCA and others provides us with data for the various parameters (e.g., DO, temperature, pH) but does not necessarily identify the cause of poor water quality. A full TMDL[16] report is one way of investigating sources of the problem and recommending solutions. This has been undertaken for the West Branch. TMDL reports for the other impaired reaches are scheduled for 2007 and 2008. In the case of the West Branch, the draft TMDL used a method of standards coefficients for nutrient exports from different land uses linked with acreages of those land uses. Because water quality data indicated that DO was slightly lower than the standard for this Class (Class AA in the case of the West Branch), the Maine DEP recommends a 16% reduction in total nitrogen load and an 80% reduction of sediments

[16] TMDL = Total Maximum Daily Load. A TMDL report, prepared by the Maine DEP for those water bodies that are impaired (i.e., fall under Section 303(d) of the Clean Water Act), identifies the total maximum discharge allowed for single pollutants.

through implementing best management practices (BMPs) on a combination of road, agricultural, and residential land.

The DEP Salmon Program used three comparisons (Table II.2) to determine whether total phosphorus (TP) and nitrate (NO3) levels in the Sheepscot are influenced by non-point source (NPS) pollution. Compared to the Ducktrap River, the Sheepscot is enriched in both NO3 and TP, with TP much higher than EPA criteria. Nitrate and phosphorus levels appear to vary seasonally. This is especially evident with nitrates, which show highest levels in the fall when cover on agricultural fields is minimal and runoff may be greatest (Whiting, pers. comm.). In addition to agricultural run-off (picking up nutrients in manure and fertilizers), other sources of excess nutrients include runoff from lawns where fertilizer is used, combined sewage overflows, road runoff, aquaculture operations, and other sources of sedimentation, such as ATV trails.

Table II.2. Sheepscot NO3 and TP levels compared to other reference levels (Source: Whiting 2006)

Watershed	Total N or NO3 (mg/L)	Total P (µg/L)
Sheepscot Watershed (NO3 only, a portion of total N)	**0.28 NO3**	**26.8**
Comparison 1: Ducktrap River (NO3 only)	0.09 NO3	16.4
Comparison 2: Ecoregion VIII (upper Midwest and Northern New England)	0.25 TN	15
Comparison 3: EPA recommended nutrient criteria	0.38 TN	10

Although data do not conclusively link sediment loading to lowered DO and other water quality problems in the watershed, sedimentation is seen by some water quality experts to be a major problem in the Sheepscot. The mainstem and its tributaries “run brown” after rainstorms, something that does not happen in most Class AA rivers. The fact that the Sheepscot is the most “roaded” of salmon rivers adds support to this assessment. When sediment load is high, in a river or stream, water clarity diminishes, nutrient levels rise, and gravel or cobble stream bottoms may be buried with sediment to such an extent that habitat for aquatic insects and fish diminishes significantly.

Total suspended solids (TSS) and turbidity are not measured as prevalently as DO and temperature. However, data from 17 sampling stations show that TSS ranges from 0 to 47 mg/L and averages 7.3 mg/L; turbidity ranges from 0-17 NTU and averages 3.11 NTU. For most of the year levels for both TSS and turbidity are low; the higher levels occur in spring flows (Whiting 2006). As with other water quality parameters, the

data must be put into a biological frame of reference. In the case of salmon, they can be stressed by turbidity levels as low as 1-3 mg/L. It is suspected that poorly maintained roads and stream crossings, and inadequate riparian buffers (e.g., around new construction or tilled fields), contribute to high sediment loads in the spring and after rainstorms throughout the year.

What are other water quality concerns?

Although sediment-loading from various sources (roads, ATV damage, farmland) is seen as a significant contributor to nutrient enrichment, and hence poor water quality, it may not be the only problem for the Sheepscot. Other water quality issues are:

Bacteria from wastewater: A symposium of salmon experts pointed to septics as major contributors of nutrients and bacteria (Arter, 2005) and the Gulf of Maine study (2001) indicates that point discharges from town waste treatment centers, and especially combined sewage overflows (CSOs), may be a major cause of low dissolved oxygen levels in the coastal area of the watershed. In the Sheepscot, overboard discharges (OBDs) are a more significant problem; the Maine Department of Marine Resources has recorded a large number of existing overboard discharges in coastal areas. (OBDs are an older type of household sewage disposal that does not use a drainfield). The prevalence and clustering of OBDs is linked to the risk of contaminated shellfish. Also with respect to bacteria, the condition of buffers along cow pastures abutting the Sheepscot (or its tributaries) has not been adequately documented.

Excess chloride from road salt: Chloride can be introduced into a river system through the use of road salt in winter. The EPA recommends a concentration below 250 mg/L to protect freshwater aquatic life. The Sheepscot concentration averages 5.8 mg/L with a range of 2.4 to 14.5 mg/L (Whiting 2006). The highest values occur at the Howe Road crossing in Whitefield on the West Branch. The salt deposit may be through the open grate deck of the Howe Road bridge or via the steep approach. Because the site is below Route 17 and several tributaries that cross major roads, there may be an accumulation of chloride from multiple road sites.

Alterations to flow and river morphology: The USGS data from the gauging station in Whitefield do not show an overall decrease in water volume over the years, but changes in seasonality are apparent. Ice-out is happening sooner in the year and higher flows are happening earlier in the spring. Flow is invariably affected as a watershed is developed. Along with impacts from the removal of forest buffers, there are changes in the recharge rate from the ground. As rural and suburban residential development increases, the number of private water wells increases. The impact of groundwater withdrawals from wells on the stream flow has not been evaluated.

Toxics (metals, organohalides, and other chemicals): Maine DEP utilizes data collected through its Bio-monitoring Program to determine if benthic macroinvertebrate communities are impacted by toxic contamination[17]. The program also coordinates with the Dioxin Monitoring Program to test for dioxin and coplanar PCBs. Several rivers have been monitored for PCBs and mercury levels in fish but the Sheepscot is not one of them. The lower likelihood of toxic pollution in this river is one reason. Another is the fact that only one specialist is assigned the task of monitoring over 3,000 water bodies in the state. To date, fewer than 100 of these have been monitored for mercury and PCBs (B. Mower, pers comm). Mercury levels in shellfish (blue mussels) were recorded in the tidal section of the Sheepscot in 2001 and were found to have decreased since the late 1980s. (SWAT 2001).

In 2006, the US Fish & Wildlife Service completed a three-year study of contaminants in the Maine salmon rivers. Native white suckers and brook trout were used as proxies for salmon and studied for endocrine disruption caused by organochlorine compounds and metals. White sucker sampling sites were below Branch Pond, Smokey's Camp downstream of Rt. 3, upstream of Maxcy's Mills Road and at Weeks Mills below Tyler Road - all on the West Branch. Brook trout 2006 only) were sampled from two Sheepscot tribs - Finn Brook and Weaver Brook. The results are being compiled in a report (2007). Preliminary data indicate the following (S.Mierzykowski, pers. comm.): for white sucker organics (n=22 organochlorine compounds, including Total PCBs), all samples from the West Branch of the Sheepscot were below detection. For brook trout organics (n=22 compounds), there was a low hit of p,p'-DDE (15 ppb, wet weight) in one trout from Finn Brook. All 18 other brook trout

[17] Maine DEP 2004 Surface Water Ambient Toxics Monitoring Project Report

samples from the Sheepscot tribs were below detection for all organochlorine compounds in the scan. For sucker inorganics (n=19 elements), most samples had detectable concentrations. Be, Cd, Cu, and Ni were below detection or sporadically detected. Mercury levels in the four composite white sucker samples from the West Branch of the Sheepscot ranged from 0.316 to 0.386 ppm, wet weight (mean 0.355 ppm, ww). We should note that 0.43 ppm is the level of concern for human consumption established by Maine Department of Human Services.

The Maine DEP has issued the following advisory concerning bio-accumulated mercury: "Mercury levels in Maine fish, loons, and eagles are among the highest in North America. This has led the Maine Bureau of Health to issue a statewide advisory recommending that pregnant women, women of childbearing age, and young children limit their fish consumption based on the type of fish they consume. The advisories have been in place since 1994 and remain in effect today because mercury levels in fish have not decreased."

4. Recommendations for Future Monitoring and Data Management

Although the Sheepscot is considered to be well-monitored for most water quality parameters, toxics such as mercury and organophosphates, are not monitored at all. Data on bacteria levels reveal significant levels of bacteria, but are inconclusive with respect to sources. For example, remaining overboard discharges, wastewater from Wiscasset's sewage treatment facility, and the likelihood of Combined Sewage Overflows (CSOs during storm events) are not commonly known by water quality experts working in the watershed. We do not know enough about bacteria levels or toxics (organophosphates, mercury or aluminum) to say with any certainty that these are or are not a problem in the watershed.

Certain water quality and habitat data needs can be ascribed to the entire watershed. Other monitoring needs are specific to certain segments of the river system. The 2005 *Sheepscot River Water Quality Monitoring Strategic Plan* (Arter 2005) is a compendium of all the water quality monitoring programs in the Sheepscot and provides valuable

insights and recommendations on both counts. In terms of needs appropriate to the watershed as a whole, the Strategic Plan recommends:

- The installation of flow meters to correlate DO, temp., and bacteria to flow (given that water quality trends are directly related to flow and discharge)
- Lengthening the sampling season from mid-April to mid-Oct to capture spring and fall rainfall data
- Initiating TSS and turbidity monitoring [This was begun in 2006]
- Conducting a survey of dams to regulate dam operation.
- Deploying loggers in known or suspected areas of groundwater input
- Conducting shoreline surveys to find source of bacteria
- Linking water quality monitoring to restoration, e.g., TSS may indicate upstream areas of bank destabilization; if bacteria is linked to livestock, target those areas for agricultural BMPs. [Similarly, salmon habitat data in the ASC atlas could be used when writing for NPS implementation grants, by selecting sites for BMPs that would offer the greatest protection to salmon habitat areas. Secondly, the atlas could be used to prioritize the selection of TSS sampling stations, and woody debris or buffer surveys]
- Data collection on toxics such as mercury and organophosphates.
- A number of additional analyses particular to salmon survival and stocking programs (see the Strategic Plan for details)

Also included in the recommendations is a general recommendation regarding the use of Stressor Identification protocols:

"The Stressor Identification Process should be the mechanism of choice when making determination regarding factors limiting salmon survival since it provides an organized, logical method for weighing evidence and eliminating and diagnosing potential stressors."

Although this recommendation was made in the context of a single species (Atlantic salmon) it could be applied to all water quality goals. As water quality professionals focus on their data sets, there is the danger of pursuing water chemistry data "for data's sake" without an ecological context. A continual reference back to the Stressor Identification (SI) Process is important for two reasons: 1) to prioritize and organize the

water quality work in the watershed, and 2) to explain the methodology and utility of water quality monitoring to the general public - who ultimately fund these programs.

Despite the general recommendation on SI, there were no recommendations from the group concerning refinement or expansion of biological monitoring—either professionally or through volunteers—and only one brief mention of the volunteer "Stream Team" protocol to characterize stream structure and habitat. Because biologically based monitoring provides the rationale for monitoring other water quality parameters, it should be given more attention in the Sheepscot. Cost is not an insurmountable obstacle. DEP budgeted its 2006 season professional macroinvertebrate sampling at $44,000 for 40 sampling stations in the Penobscot and North Coastal Basins.

In addition, the Strategic Plan suggests several over-arching initiatives including:

- *Greater inter-agency coordination of monitoring efforts*: This requires each agency or organization to follow through with commitments to perform specific monitoring tasks and a further commitment to consult the Strategic Plan annually to measure progress and plan new work. Greater coordination among participating groups also requires a follow-up meeting to reinforce and clarify earlier commitments. The first step for better co-ordination is an annual meeting of the participants of the Project Share symposium.
- *Timely dissemination and review of annual water quality data*, by sharing annual reports among the agencies and compiling DEP and other data on the PEARL database.
- *Reduce number of agencies/organizations collecting data at each site*. Project SHARE discussions revealed some redundancy in data collection. Sharing of labor should be encouraged.

In addition to these recommendations regarding data storage and inter-agency communication, there is a need for a public-friendly 'one-stop shop' for continuously updated information on all aspects of water quality monitoring in the Sheepscot. For example, we had trouble determining the total number of sampling stations (all agencies/groups). The KRIS website was intended to provide easily accessible data, but it is not necessarily user-friendly for the layperson. Recommendations on data sharing and public information are given in Section V.

Recommendations Specific to Sub-Watersheds

To avoid 'averaging' recommendations for the 360-square mile watershed, more specific recommendations on water quality monitoring can be tailored to each of the 8 divisions discussed in this report. These recommendations primarily come from the above-mentioned Water Quality Monitoring Strategic Plan (Arter 2005) and research by Lili Pugh (2005-2006). Refer to **Map 4**.

Division 1. Lower Estuary & Sheepscot Bay

Contains impaired waters? None listed

Of note: Two oyster aquaculture sites between Wiscasset Rte. 1 bridge and railroad bridge, one oyster aquaculture site between Leeman Island and Cunningham Island, one inactive trout farm at Mason Station; two oyster farms and one limited purpose site for oyster, clams, or mussels in Squam Creek salt pond which extends as far as Westport on the Back River (A Sirrois, Maine DMR, pers. commun. 2005). This section is monitored primarily by the DMR Shellfish Sanitation Program. Their goal is "to protect public health by ensuring that shellfish are harvested from pollution-free areas and are processed and transported under sanitary conditions" (Arter 2005). Of the approximately 45 sites, sampled from Head Tide in Alna to Newagen on Southport Island (east) and Outer Head on Georgetown Island (west) in Sheepscot Bay, 88% of the sampling stations meet approved standards for fecal coliform (Arter 2005). However, most of these water quality sampling stations are located upriver from the Bay or in smaller tributaries. Most of the coastal zone of Westport and Georgetown is in fact classified as "prohibited" due to the risk of contamination caused by pollution from point sources, or overboard discharges. The entire island of Southport is also prohibited. As well, a 1999 report by NOAA classifies Sheepscot Bay as one of the "most vulnerable to eutrophic conditions" amongst all coastal waters in the country.

Recommendations: Given the vulnerability of the shellfish industry to high nutrient and bacteria levels, the identification and elimination of OBDs should be a primary focus for monitoring. This could take the form of a shore survey for sewage discharge, and include the coordination of OBD removal with bacteria monitoring above

and below OBD sites. Known sites should be reported to town CEOs (Westport Island had been surveyed by DMR in 2006).

Division 2. Montsweag Brook

Contains impaired waters? None listed

Of note*:* This section is not currently monitored. Considering that Route 1 crosses the brook and that it is close to the Wiscasset airport and Chewonki campgrounds, its water quality may be important to monitor.

Recommendations: WQ Strategic Plan members to initiate monitoring in this division. Parameters to monitor are: DO, TSS, pH, turbidity and temperature. The Chewonki Foundation is exploring baseline monitoring before removal of the dam in 2008/2009.

Division 3. Dyer River

Contains impaired waters? Yes

(1 lengthy impaired segment, Dyer River below Rt 215)

Of note: The Dyer River and Deer Meadow Brook are major tributaries to the estuarine section of the Sheepscot. There are three sites on the Dyer River that have been sampled. One is currently being sampled. There are no sampling sites on Deer Meadow Brook, past or present. Deer Meadow Pond is not large enough to have been monitored by the VLMP. The Dyer River below Rte. 215 is on the 303(d) list. The 303(d) designation is due to low DO and high bacteria. (See Table in Appendices, Dyer River data summary**:** Source: L. Pugh SVCA data collection.) This section of the Dyer River has potential salmon habitat. The river just below Dyer Long Pond also has potential salmon habitat. The lake's water quality is below average, and needs to be protected from nutrient input. The Dyer has quite a bit of agricultural activity along it, suggesting that agricultural activity is contributing to the elevated nutrient levels.

Recommendations: 1) Initiate monitoring of the Dyer River, both below and above Dyer Long Pond, with a focus on bacteria; conduct shoreline surveys for evidence

of manure or sewage inputs. 2) Target the Dyer watershed for implementation projects, especially by marketing the NRCS programs in this sub-watershed.

Division 4. Upper Estuary

Contains impaired waters? Yes

(*2 impaired segments, Trout Brook and Sheepscot mainstem from Head Tide downstream to undetermined point*)

Of note: The upper estuary is less influenced by the tide; fresh water is more influential. The salinity at any time during the tide cycle is close to zero at Puddle Dock north. Flow of freshwater is controlled by the Head Tide dam. There are three tributaries that empty into this section, Culvert Pond Brook, Ben Brook and Trout Brook. Ben Brook is not currently sampled, although it has potential salmon habitat. The southern half of this section has adequate water quality, and meets state standards most of the time. From Puddle Dock (where Dock Rd. crosses the Sheepscot) to Head Tide in Alna bacteria levels are high (Pugh 2002). This section is category 5-B-1 according to the 305(b) report. This means it is low priority, because of its use and because DO is not impaired. The section therefore does not require a TMDL, although residents have expressed concern. The tributary Trout Brook has potential salmon habitat. DO levels are low here, with average of 6.4mg/l for years 1999-2004 (Pugh 2004). It is scheduled for a TMDL study.

Recommendations: 1) DEP to investigate cause of low DO in Trout Brook; is it natural or anthropogenic? 2) initiate monitoring in Ben Brook to protect high water quality.

Division 5. Lower Mainstem

Contains impaired waters? Yes

(*3 impaired segments, Carlton and Chamberlain Brooks, and a portion of Sheepscot mainstem above Head Tide*)

Of note: This section of the mainstem, as well as the sections upstream, is entirely fresh water. The tributaries that influence it are Chamberlain Brook, Carleton

Brook, Finn Brook, and Travel Brook which is fed by Travel Pond. Clary Lake and Long Pond are also influential. DO and bacterial levels are below comparison standards almost all the time for all sites in this section (Pugh 2004). There are stretches along this section with high temps. These are above and below Kings Mills. Also, the section between Coopers Mills and Long Pond has high temperatures and anecdotal low flow (Arter 2005). Chamberlain Brook has high bacteria and low flow. This is a tributary that becomes quite small quickly, which may contribute to the low flows. The source of the bacteria should be determined. The river below Clary Lake has potential salmon habitat. As with Dyer Long Pond, the lake has below average water quality with high TP and Chlorophyll a (Arter 2005). It is also sensitive to change, although with a low potential for algal blooms.

Recommendations: Reinstate summer temperature loggers in the main stem; initiate flow monitoring; on the AA classified segment of the mainstem (Rt. 17 to King's Mills and King's Mills to Head Tide), monitor for TP and turbidity and correlate water quality with precipitation; conduct shoreline surveys to ID bacteria source in lower reach (high bacteria, TP, nutrients; focus on this part of the mainstem because of AA class, salmon habitat). For the impaired stream (Carlton Brook), recommend DEP identify cause of low DO. In Clary Lake, intensify present monitoring.

Division 6. Middle Mainstem

Contains impaired waters? Yes

(*1 impaired segment, mainstem between Sheepscot and Long Ponds)*

Of note: In this section the main influences come from the two ponds, Long Pond and Sheepscot Pond. There is a third pond, Turner Pond, which indirectly influences the Sheepscot. The IF & W fish hatchery is also within this section. Turner Pond is not currently monitored by the VLMP. It is unknown whether it and Lovejoy Stream, which flows from the pond, attain water quality standards (Arter 2005). The pond and stream have not been surveyed for Atlantic salmon habitat. Both Sheepscot Pond and Long Pond drain into potential salmon habitat. Sheepscot Pond is of average water quality with average potential for blooms. There is currently no VLMP sampling effort on Long Pond. Its water quality is below average though with a low potential for blooms. There is

a regulated point source, the Palermo fish hatchery, in this section. Water quality conditions of Lovejoy Stream and Turner Branch are unknown

Recommendations: add monitoring site above hatchery to serve as control and additional site downstream to measure travel of effluent; initiate water quality monitoring in Lovejoy Stream; set up VLMP in Turner and Long Ponds.

Division 7. Upper Mainstem

Contains impaired waters? None listed

Of note: The river in this section is narrow. There are several small ponds that drain into this section of the river. The Sheepscot terminates in West Montville. This is a relatively pristine section with little development and that attains class A water quality standards much of the time. The water is cold. There is only one sampling site on this section monitored by SVCA in Liberty. Although not currently assessed as impaired, there is some reason to be concerned about water quality trends here. Measures of DO and bacteria show quite a bit of variation, with 2002-2004 having no days above bacterial instantaneous standards, although the seasonal geomean has been higher than the standard for the past three years though dropping. DO was lower than 7mg/l 20% of the season. SWLA volunteers have observed that siltification and increasing turbidity are occurring at this site (Arter 2005).

Recommendations: Initiate turbidity testing; determine source of bacteria.

Division 8. West Branch

Contains impaired waters? Yes

(3 impaired segments, Meadow Brook, Choate Brook, and West Branch above Rte. 17)

Of note: The major tributaries of this section are Choate Brook, which is fed by Savade Pond, Dearborn Brook, Hewitt Brook, and Meadow Brook. There are many sites along this section that have been monitored. The MDEP has completed a draft TMDL report for the entire West Branch. Most of the West Branch is in non-attainment for class AA standard**s** (Maine DEP 2004 303(d) Report) . The West Branch is in attainment for aquatic life but does not attain DO standards. The draft TMDL report

focuses mostly on DO. It is thought that low DO levels may be a natural occurrence. Sedimentation, however, is high, and nitrogen loading from sedimentation is currently being measured (2006/2007). Low DO may be a result of biological oxygen demand (BOD). An excess of BOD may correlate to nutrient loading. Several sites along the West Branch were sampled for BOD and Chlorophyll a. It was determined from these samples that BOD and Chlorophyll a production were normal, and therefore DO levels are probably not due to severe enrichment (Maine DEP draft TMDL for West Branch).

Recommendations: Create a monitoring plan for Meadow and Choate Brooks and intensify monitoring of West Branch below 17; conduct a shoreline survey to determine NPS sites. With respect to the West Branch, the DEP's draft TMDL report recommended a 16% reduction in the total nitrogen load and an 80% reduction of sediments.

Lakes (*currently no TMDL lakes in the Sheepscot watershed*)

Lakes are included in the watershed divisions described above but are grouped here for easier reference. There are over forty lakes and ponds within the Sheepscot Watershed. Many of these are quite small and are of little influence to the river itself. Ten lakes (Beech Pond, Branch Pond, Clary Lake, Dyer Long Pond, Little Dyer Pond, Long Pond, Savade Pond, Sheepscot Pond, Three Corner Pond, and Turner Pond) are large enough to influence the river's water quality. Of these ten, seven have been monitored. Five of these have enough water quality data to be classified by the MDEP/VLMP using five indicators. The water quality classifications of Clary Lake, Dyer Long Pond and Long Pond indicate that these lakes should continue to be monitored (Arter 2005).

III. LAND USE & NPS ANALYSIS

1. Land Use Overview

The Sheepscot River watershed is an extraordinarily beautiful landscape of forests, open farmland, wetlands, and rural villages. Although estimates vary, forest cover clearly dominates the watershed; 60-76% of the watershed is forested. The forest is largely composed of white pine and mixed northern hardwood with spruce-fir stands. Brushy areas consist of alder, willow, poplar, maple and oak. Open areas make up close to 19% of the land area and are agricultural fields, grasslands, and other clearings. Wetlands, accounting for about 7% of the watershed, include small bogs, hardwood floodplain forests, scrub-shrub wetlands, and tidal wetlands. Residential development is currently estimated at 1.6% to 2% of the land base (SRWC 2005).

Most of the watershed's development is concentrated in the southern reaches and along the Route 1 corridor. North of Wiscasset, the watershed remains rural with scattered small towns, few large subdivisions, and little commercial development. Much of the current development in the watershed comes from single lot residential building and the conversion or expansion of seasonal homes to year-round use. (Benjamin 2004, Van Wie 2006). However, development pressure is clearly increasing in the watershed, as it is throughout the mid-coast Maine region. Rates of population growth of watershed towns indicate an overall average growth rate of nearly 12% between 1990 and 2000. During that same time period, housing unit growth averaged nearly 20%, implying that much of the new development consists of second homes or smaller households (e.g., singles buying houses).

The rural communities in the watershed are growing faster than the densely settled towns, an indication of suburban sprawl. For example, the population of Boothbay Harbor decreased between 1990 and 2000, while the rural towns of Alna, Whitefield, Windsor, Palermo, and Liberty experienced rapid rates of growth—over 15%. Many of these now-rural towns expect population and housing numbers to double in the next 20 to 25 years. It is also expected that the pressure for subdivisions and commercial development in rural areas will accelerate. In 2006 the Town of Windsor, responding to an increase in subdivision proposals, passed a moratorium on new subdivision for six months in order to assess the current town ordinances for adequacy.

If not planned and well managed, development readily degrades a watershed's ecological function and integrity. Impervious surfaces—such as roads, driveways and roof tops—increase the volume and velocity of run-off, altering the system's overall hydrology and causing erosion. Run-off, or stormwater, collects a host of contaminants, including nutrients, sediment, toxics, oil residues, and road salt. Nutrient and bacterial pollution from septic systems, and pesticides and fertilizers from residential areas, are highly degrading when cumulative. Sprawl also results in forest, landscape, and habitat fragmentation. With respect to the river, sprawl fragments the river with stream crossings, often distorting the river's flow, altering water temperatures, and increasing the likelihood of erosion, sedimentation, and restricted fish passage.

The impacts of development on water quality are numerous and sometimes nearly invisible. For example, a largely overlooked consequence of increased development in the Sheepscot watershed is the accelerated pace of gravel extraction. The consequences include increased numbers of gravel trucks, increased deposition of pollutants from truck exhaust, increased road maintenance, and—unless gravel operations faithfully follow erosion control strategies—increased sediment loading into the river.

Clearly, our collective activities on land are directly related to water quality. The number of roads and parking lots we build, the methods we use to construct stream crossings, our treatment of waste and stormwater, home fertilizer use, and agricultural practices all have direct impacts on water quality. If a healthy watershed is a sincere goal for the residents of the Sheepscot watershed, much greater attention must be given to land use practices and regulations, and to incentives to "do the right thing."

2. Relative Land Use Impact

In the Sheepscot, no single land use stands out as dominant in the watershed, unlike several downeast watersheds where large-scale blueberry and forestry operations dominate, or alternatively, where urban and residential uses are dominant, as in southern, coastal regions of Maine. This does not mean, however, that the Sheepscot is without threats from specific land uses. For example, although the watershed may have a small percentage of agricultural land compared to other land use categories, much of it is located along the river and its tributaries. Even one farm with nutrient management problems may easily impact water quality downstream. One forestry operation can do

damage to the river, and one poorly planned development can dramatically alter a host of related functions.

Agriculture

According to the USDA Census of Agriculture, the land area devoted to farming in Kennebec County decreased by 11% between 1997 and 2002. In Waldo County, farmland decreased by 8% in the same time period. In contrast, Knox and Lincoln counties each experienced a slight increase in farmland.[18] Conservatively, it can be assumed that farming is decreasing in Kennebec County (and therefore along the West Branch) and holding steady in the other Sheepscot counties.[19] In Kennebec County, as in Waldo and Lincoln, the majority of farms are between 50 and 180 acres (USDA 2002 stats). This is probably representative of the watershed. In recent years the trend of decreasing farm acreage and number of farmers may have been reversed; however, matching up younger farmers with established or lapsed farms before they are sold for development is now the challenge.

Differing types of farm operations cannot be determined at the county level. However, large animal operations (>50 animal units; 1 animal unit = 1,000 lbs live animal body weight), operations importing more than 100 tons of manure, and those with a verified manure pollution complaint, are required to have Nutrient Management Plans. Within Lincoln County, there are at least five farms that either have a nutrient management plan or are required to obtain one. Within Newcastle and Whitefield, there are two farms with 312 and 102 animal units, respectively, that do not have nutrient management plans. According to the Department of Agriculture, only three of the six farms with more than 100 animal units have current Nutrient Management Plans. (Van Wie 2005). Two of the area's code enforcement officers (CEOs) have acknowledged livestock operations that are not in compliance with basic best management practices (BMPs).

Horse pasturing is apparently a growing activity in the watershed. Along with the increase in the number of horse farms, the NRCS is now providing funds for the construction of manure pits on horse farms. Another under-represented facet of

[18] The data are gathered largely from census returns that have been subjected to significant corrections in the past (e.g., 1997 data were revised by as much as 10,000 acres per county).
[19] This situation may have changed since 2002 as residential development is clearly increasing throughout the watershed. The 2007 census data should reveal such a change.

agricultural activity is the small family farm, with a few animals raised for domestic consumption. These farms are not noted by the Farm Bureau, but may still contribute to water quality concerns. Several farmers acknowledged that they are aware of such small operations occurring adjacent, and even in, tributaries and first order streams.

Water withdrawals from the Sheepscot are not believed to be significant, particularly when compared to the downeast rivers, where large blueberry operations require irrigation. Still, the amount of withdrawal from the Sheepscot appears to be unknown. Maine DEP has the authority to issue permits for water withdrawal, but does not currently do so. The Atlantic Salmon Recovery Plan (ASRT 2005) recommends the development of water use plans for salmon rivers not addressed by the state's Water Use Management Plan for the Narraguagus and Pleasant rivers. The Recovery Team further recommends that all agricultural water use, in all of the salmon river watersheds, be assessed and monitored, and that water withdrawal permitting be re-instated and conditioned on the needs of salmon.

As mentioned in Section II, the Sheepscot is not monitored for pesticides. However, the Maine Board of Pesticide Control performed surface water tests and a series of pesticide drift studies on the Narraguagus, Pleasant and Machias rivers. Only hexazinone, a pesticide used in blueberry production, was consistently found, and at numerous sites. According to the report, "The pervasive presence of hexazinone in surface water at low flow periods suggests that the material is entering the river through groundwater flow rather than storm-run-off." (ASRT 2005) Because the Sheepscot watershed has little blueberry production, hexazinone is not likely to be a concern. However, pesticides include fungicides, insecticides and herbicides, any of which may be used in other agricultural operations, and in residential landscaping. Notices of Intent to Harvest indicate some conversion of forest cover to blueberry barrens, which should be noted for future reference.

The most significant concerns regarding agriculture are loss of the riparian buffer and nutrient contamination from run-off. Although this is well recognized, Federal and State laws governing water quality do not also regulate agriculture; generally, they provide exceptions. For example, under Maine's Shoreland Zoning rules, tilling and grazing is allowed in the shoreland zone, without setbacks, for operations that existed prior to a town's adoption of shoreland zoning ordinances.[20] Similarly, Maine's new

[20] Maine BEP: Guidelines for Municipal Shoreland Zoning Ordinances (w/May 2006 revisions), Section 15, Land Use Standards, Par. N, Agriculture. Note: tilled areas in the Shoreland Zone

Erosion and Sediment Control Law, which would make chronic erosion sites a violation, completely exempts agriculture. On the federal level, the Clean Water Act provides a mechanism for incentives to implement BMPs but does not enforce such preventive measures.

In Maine, as in many other states, voluntary measures in agriculture are preferred over regulation and enforcement. Technical and funding assistance for implementing BMPs is offered through a variety of state and federal agencies, and U.S. Farm Bill provisions. In Maine, through the local NRCS field offices, Farm Bill and other federal funds are apparently readily available for fencing and re-vegetating buffers. Similarly, the Landowner Incentive Program, through US Fish and Wildlife, offers private landowners incentives for protecting and restoring habitat of federally endangered species. Such funds could be applied to reclaiming appropriate buffers. In the case of the Sheepscot watershed, the incentives, or political will, are thus far proving to be insufficient to remedy at least one particularly egregious source of agricultural run-off. Local regulatory initiatives[21] combined with consistent enforcement and aggressive pursuit of incentives, may be necessary to protect the Sheepscot from excessive nutrient loads and other impacts of agriculture.

On the other side of the coin, the loss of farmland is not a favored outcome. Prime farmland tends to make prime subdivision land for several reasons: farmland tends to be large, cleared areas with adequate road frontage and septic-suitable soils. Geologically, farms have typically been located on high ridges and these sites offer attractive vistas for residential development. Profitable farms supported by ag-friendly policies are more likely to stay in business under growing development pressure. The Maine Farmland Protection Program identified a number of successful farm-friendly local policies used in other states, with some pilot projects in Maine. These include institutionalizing Local Agricultural Commissions, Right-to-Farm By-laws, Overlay Zones (an agricultural version of Pine Tree economic zones), subdivision restrictions on agricultural land (identified by past use and soil type), short-term easements (such as NRCS Grassland Reserve Program), and current use assessments. Farm tax

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and greater than 40,000 sq. ft. (1 ac) require a Conservation Plan to be filed with the local Planning Board.

[21] The town of Windham provides an example of a water protection ordinance that mandates BMPs. In that case, protection of Sebago Lake as a drinking water source motivated stronger regulation.

incentives, like Maine's Tree Growth program, and health insurance benefits could increase household incomes for farmers.

The preservation of farmland is essential to the preservation of open space, community life, and character in the Sheepscot watershed. Landowner incentives, as much as regulation, will keep the farming community alive and well, and able to maintain good management practices with respect to the river's resources.
The various conservation assistance programs under the USDA are listed in **Appendix C.**

Forestry

The Sheepscot watershed is blessed with much forest land. Forests protect rivers from sediment loading, recharge groundwater, and avoid and mitigate the numerous impacts associated with residential and urban uses.

The Maine Forest Service estimates that 1-2% of forest cover within the eight salmon river watersheds is harvested annually (ASRT 2005)[22]. This is less than the statewide average, and both the USFWS and NOAA have concluded that, as a whole, timber harvesting does not represent a significant threat to water and habitat quality in the Sheepscot watershed. However, these Services also recognize that small operations close to streams can have significant impacts on water quality if BMPs are not used. The significant sediment loads observed in the Sheepscot following heavy rains suggests that unregulated clearing and timber harvesting may, in fact, be impacting the Sheepscot.

Prior to harvesting, landowners are required to file a Notice of Intent (NOI) to Harvest. The Maine Forest Service then provides landowners with information on salmon watershed protection, and on the kinds of technical assistance available for forestry operations. As of mid-October, 2006, 34 NOI's were filed for the year. Of these, five had management plans for harvesting; 28 were filed with question marks referencing timber management plans. Of the 1,876.5 acres that are intended for harvesting 1,151 acres are located within the Shoreland Zone, representing over 61% of all acres intended for harvest. Based on statewide data, the Van Wie report estimates that "roughly 20 to 30% of harvesting activities on non-industrial private sites in the

[22] This figure is comparable to our own GIS analysis of land cover data confined to the Sheepscot watershed; however it is a rough approximation at best.

watershed do not conform (or minimally conform) to BMPs and/or are ineffective in preventing soil from reaching waterbodies as a result of harvesting operations." This indicates that while total acreage harvested remains small, the proximity of clearing and harvest to the water, and the prevalence of poorly implemented BMPs, is worthy of concern.

New statewide Shoreland Zoning Rules, adopted in early 2006, include several options for regulating timber harvesting, two of which specify adopting new statewide standards for harvesting. According to Rich Baker, the Shoreland Zoning Coordinator at the Maine DEP, the impetus for the new timber harvesting rules in the shoreland zone came from large landowners wanting more consistency and expertise in the review and approval of forestry activities. Because local CEOs are not thought to be sufficiently knowledgeable regarding standards, landowners requested that standards be regulated by the Department of Conservation, and the Maine Forest Service.

Under the new Shoreland Zoning Rules, municipalities may choose to 1) repeal local ordinances with respect to timber harvesting, adopt the new statewide timber harvesting standards defined by the Maine Forest Service, and request the Service to police and enforce; 2) adopt the MFS standards but continue to enforce locally through the town planning board and CEO; or 3) keep local ordinances as they are and continue enforcement by the local CEO. The advantage of the new state standards is the clear intent to protect shoreline integrity, to prevent water pollution of all kinds, and to protect freshwater and coastal wetlands. Reviewers of the rule when proposed noted the added protection given to smaller streams. The MFS rule also provides both clarity and detail in relation to setbacks, the treatment of slash, shade and tree retention standards, skid trails, yards, the operation of equipment, road construction and maintenance, stream crossings. Regulation by the MFS would provide consistency and assistance in understanding the details of the regulations.

Timber harvesting has the potential to significantly impact water quality. Public sentiment suggests that local regulation is inconsistent for a variety of reasons, including the fact that many CEOs are part-time workers, may not fully understand the standards, and are often subject to local political and social constraints. The statewide rules for timber harvesting could avoid these regulatory pitfalls by placing regulatory responsibility with MFS. The rules, however, will not go into effect until 263 of 336 towns agree to adopt the new standards. With respect to water quality and forestry in the Sheepscot watershed, we strongly recommend that Sheepscot towns adopt the state rules.

Residential Development

The conversion of forest land to residential and urban uses has critical implications for any watershed. Within the Sheepscot, Saint Georges, and Medomak watersheds, notable increases in housing densities on 20 to 40% of the privately owned forests are expected within the next twenty years (USFS 2005). The larger drainage area, encompassing both the Sheepscot and St George Rivers, is one of twenty-six watersheds in the country identified as being "of special concern" by the US Forest Service due to the rate of conversion. The USFS study emphasizes the consequences of conversion from managed forest to suburban development, including "long-term modifications to and reductions in water quality and aquatic diversity when forests can no longer regulate the movement of storm water across the landscape, leading to changes in stream flows, increases in sediment, reshaped stream bottoms and banks, and impacts on water quality and aquatic species." The threshold of concern typically occurs at a population density of 150 people per square mile. (Wear 1999, cited in USFS 2005). Wiscasset currently has a population density of 147 per square mile. A more graphic account of demographic changes is captured by the fact that Wiscasset lost over 71% of its rural land in the period between 1980 and 2000. (Brookings 2006). Given the entire watershed's rate of development, the Forest Service study recommends that local and state governments institute programs for managed forest protection similar to farmland protection programs.

Although several subdivisions are in various stages of development in the middle and upper portions of the watershed, incremental, or lot-by-lot development, is more common in the upper reaches. Commercial development and larger subdivisions are much more apparent in the lower watershed. In watersheds like the Sheepscot, however, incremental development might be as much a concern as are larger subdivisions, depending on the specifics of local ordinances and the strength of enforcement. For example, subdivision ordinances providing incentives for clustering—thus minimizing roads and soil disturbance—are more protective of water quality than the development of single family residences with little or no oversight. Similarly, subdivisions, or any disturbance of more than one acre, will trigger state Stormwater regulations; smaller disturbances are not required to implement stormwater strategies, and may consequently contribute to significant cumulative impacts. Single-lot development virtually escapes notice outside the Shoreland Zone in those towns where

there is no town-wide zoning and building permits are not required. A small subdivision may not trigger stormwater regulation (disturbs less than 1 acre). Building permits are always required by towns for at least building codes (plumbing etc.) For single lot or smaller development, there may not be any environmental review or performance standards. Some towns have subdivision review and some type of review process for single lot development (this might be in the form of performance standards).

Residential development yields particular impacts on watershed health. Most fundamentally, replacing natural cover with impervious surfaces reduces the overall buffering capacity of undeveloped land. Road building and rooftops also increase the volume and velocity of runoff, stream temperatures, and sedimentation, and decreases groundwater recharge. Increases in velocity lead to 'flashy' streams having higher than normal wet weather flows and lower than normal dry season flows. Nutrients attached to soil particles make sediment-laden run-off especially problematic for downstream waters.[23] Toxics—entering the system through pesticide use, household chemicals, and motor oil—also cling to sediment particles. In contrast, forest cover provides buffering, infiltration, and groundwater recharge, protects stream flow, and prevents problematic increases in water temperature. Wetlands provide additional filtration and mediation for nutrients and toxics.

Population changes of the eight Sheepscot towns reveal a significant growth rate: an average of 14% between 1990 and 2000. Although this rate is down from the previous two census periods, it is nonetheless more than four times the growth rate of the state. Whitefield is the fastest growing town in Lincoln County, with a growth rate of 18% since 1990. Most of this growth appears as single lot development. Currently, in Whitefield, building permits are not required. This and other land use planning oversights are detailed in the Van Wie Report. The report provides a useful guide for identifying specific land use planning and regulatory needs to protect both water quality and the watershed's unique rural character. For example, three of the eight towns reviewed do not have comprehensive plans. Four of eight do not have floodplain regulations and seven of the eight do not have water quality or stormwater ordinances. According to the report, "Nearly all towns we reviewed need to update and upgrade their ordinances to adopt the latest practices for low impact development and stormwater

[23] A comparison between two Maine watersheds showed phosphorous transport to be ten times greater in a developed watershed than in a comparable, but forested, watershed. Stormwater Strategies: Community Responses to Runoff Pollution, NRDC, 1999, p. 42

management, including more use of infiltration best management practices (BMPs) and vegetated buffers."

Combined Sewer Overflows (CSOs) are another consideration associated with fast-paced residential development. CSOs occur when stormwater, channeled through ubiquitous drains and ditches to the local sewage treatment facility combines with sewage and then outpaces the capacity of the facility. For many mid-coast treatment plants built in the 1970's, storm events with over one inch of rainfall are likely to produce an overflow and the unfortunate discharge of untreated wastewaters directly into local rivers.

Wiscasset is the only town on the Sheepscot with a sewage treatment plant. Wiscasset's town planner claims that the treatment plant is currently operating at 40% of its capacity, and the Maine DEP states that the Wiscasset facility has no record of CSOs. For future reference, however, it is worth noting that the town of Wiscasset recently agreed to accept a portion of Edgecomb's wastewater via a new sewage pipe laid under the Sheepscot River and financed by the developer of Sheepscot Harbor Village and Resort, at Bentliff's Grill in Edgecomb. The capacity of the Wiscasset facility may also be challenged by the development of the new Point East Development Project on the site of the Mason Station Power Plant.

Overboard Discharges (OBDs)[24] represent a significant problem associated with previous land use practices. Since 1987, Maine law has prohibited new overboard septic systems and established a procedure for replacing old OBDs with appropriate septic systems or city sewer. Still, a significant number of OBDs are known to remain in the lower watershed, particularly in Edgecomb and the southern area of Southport Island. DEP has a licensing program that includes inspection. Those OBDs in place prior to 1987 may be licensed. If no alternative exists, a licensed OBD can exist. The goal is to eliminate them, but it may not be possible. Nutrient loading from OBDs in coastal waters leads to both bacterial and algal growth and low levels of dissolved oxygen—essentially, eutrophic conditions. The existence of OBDs requires some shellfish beds to remain permanently closed in Sheepscot Bay. The Department of Marine Resources is responsible for assessing the safety of shellfish for human consumption. A 2006 Report (Couture 2006) showed that most of Sheepscot Bay is closed for shellfish harvesting due to sanitary concerns. From this and other reports, a

[24] An antiquated septic system in which wastewater is discharged directly into a waterbody after passing through a sand filter.

number of active OBDs were mapped on the shores of Westport, Southport, Edgecomb and Georgetown. The DMR report includes a list of actual and potential waste discharge sites around Westport Island, surveyed in 2004 and verified in 2006. The sites include the following waste discharge types: OBD, malfunctioning septic, inground septic, sink drain, cellar drain, and outhouse. Tidal transport of the bacteria could mean that a greater area than Westport Island is affected.

The impacts of residential development on water quality can be significantly mitigated. Low impact development approaches have been pioneered throughout the country and assistance for land use planning is available. Well-designed stormwater systems prevent the problems associated with high volume and velocity run-off, and well vegetated buffers prevent water pollution. Contemporary septic systems are capable of preventing contamination from excessive nutrients. The real obstacle in water protection is a lack of local knowledge or political will to make thoughtful and progressive changes to ordinances, enforcement, and everyday practices. Well designed stormwater systems will mitigate the effects of development up to a point. Regardless, there will still be effects from development. Literature shows impacts to streams when watershed imperviousness reaches 10%.

Road Building and Maintenance

More development, of course, means more roads. Amongst the eight Maine salmon river watersheds, the Sheepscot already has the greatest density of roads. The water quality problems associated with impervious surfaces are amplified by poorly constructed or maintained roads—including shoulders, ditches, culverts, and bridges. These problems include increased sedimentation, nutrient loading, and water temperatures.

Our field survey of non-point sources revealed a large number of poorly constructed or maintained bridges and culverts, ditches and shoulders. Of the original 313 sites documented in the spring of 2005, 102 of these—or roughly one-third—were deemed to be high-priority sites because of the size of erosion and proximity to the water. Of these priority sites, roughly one-quarter were either at stream crossings or within 50 meters of a stream. High priority sites were distributed more or less evenly across the entire watershed; however, the priority sites that were also stream crossings tended to be

located in the upper half of the watershed - specifically in the towns of Montville, Palermo, and Windsor.

Improvements in road building can make a substantial difference in the volume of sediment and pollutants entering the river. It is also worth noting that the maintenance of poorly constructed roads is an on-going and significant expense to towns. Several of the Sheepscot towns have recognized the need for long-term planning for roads - rather than annual emergency fixes at the same chronic wash-outs. However, permanent fixes of these problem sites can cost as much as the town's entire road budget or more. Towns need to demonstrate planning and priority setting in order to pursue substantial funding and technical assistance from the State, federal agencies, or other sources. Even without external funding, a well laid-out road inventory and repair schedule will also help the town budget limited road funds and/or request more money from the townspeople.

Although it is clear that sediment loading is high in the Sheepscot, we do not have data to determine the degree to which sediments include sand run-off from either winter spreading or storage. It is also not known if Maine's DOT standards for salt and sand storage are enforced in Sheepscot towns. Nor is the river monitored for salinity, except at a few sampling stations (Arter 2005).

Poorly placed or undersized culverts cause a host of particular problems including temperature and sediment pollution, and restricted passage. Many culverts throughout the watershed are "terrible."[25] It is believed that numerous culverts are perched—impeding fish passage and changing the river's hydrology—although a complete inventory of bridges and culverts has not yet been done. On a statewide level, the Maine Forest Service assessed 102 crossings. Of the culverts, 60% were found to be undersized (which can lead to wash-outs in high flows). Within the Sheepscot watershed, it is estimated that 40% of town roads fragment the river's flow. It is also believed that most Sheepscot towns ignore the State and Federal requirements for permitting in the Sheepscot (because of ESA requirements and the State's own designation)[26] out of expediency or a genuine lack of knowledge of permitting. In the interest of "doing the right thing", NOAA provides funds to promote fish passage by replacing improperly placed culverts. The Maine Forest Service also has "a significant

[25] Informal consensus at Sheepscot River Watershed Council Meeting, October, 2006
[26] For example, under NRPA, the usual waiver of permitting for maintenance and replacement of culverts on town-maintained roads does not apply in Rivers of Special Significance, including the Sheepscot. Federal review (led by USACE) is also required.

amount of money" for promoting fish-friendly crossings on timberland roads. The DEP's 319 program has spent considerable money in the West Branch on road repairs. (A catalogue of assistance programs can be found in **Appendix C**.)

The environmental engineering firm, Kleinschmidt, prepared extensive guidelines for building better roads in Atlantic salmon watersheds. With an emphasis on improving habitat and fish passage, Kleinschmidt recommends that:

- New road crossings be located, whenever possible, away from Atlantic salmon habitat and in straight, stable channel areas, not in meanders.
- permanent bridge and permanent bottomless culverts be used for stream crossings; temporary culverts and fords are not recommended.
- Culverts be large enough for maximum flow and preferably at no slope and with no bottoms
- Culverts be placed parallel to the stream channel, and not skewed more than 30 degrees. In addition, numerous specific design and construction specs (e.g., embed pipes less than 48-inch diameter 6 inches into the streambed) are listed.
- When slip-lining a culvert is necessary (because replacement is too costly), the depth should be increased and velocity decreased with sluice channels, weirs and baffles.
- Bridges be designed with piers positioned above bankfull elevation to avoid debris buildup and bank erosion. Again, numerous specific design and construction specs (e.g., no gravel on bridge deck, do not excavate below NHW mark) are listed.
- Construction occur in the driest part of the year (July - September) if possible
- As many mature trees as possible be retained around the site

The Maine Department of Transportation (Maine DOT) has similar guidelines for its own road building projects at stream crossings (DOT 2005).

Once again, it should be emphasized that these road BMPs are ideal but not always affordable or practical in the case of many town-maintained roads and bridges. Many towns are constrained by their low population and low tax base in the context of many road miles to maintain. For example, in comparing the three West Branch towns of China, Windsor, and Whitefield (McLean 2005), the towns have comparable land area but differences in population and revenue base. Whitefield has significantly less to spend per mile of road than the other two towns and a much larger number of gravel roads in need of either paving or annual fixes. In contrast, China has the fewest miles of town-maintained road *per capita* of the three towns but the greatest tax revenue of the three (nearly three times either Windsor or Whitefield). The comparative wealth of China

is derived from a large number of shorefront homes around China Lake.[27] China's robust road budget, combined with a savvy and energetic approach, has resulted in the paving of all town roads as of 2006. The town can now focus on data collection and a long-range schedule of regular repairs, further maximizing efficiency. In the meantime, other towns struggle with annual wash-outs of low-lying gravel roads.

The differences in socio-economics does not by itself determine which towns will have more funds to spend and better maintained roads. The Town of Palermo is an example of a town with modest means that is nevertheless taking positive steps to grapple with their road problems. In 2006 the Road Commissioner took the Selectmen on a tour of the roads and made use of the DOT's Local Roads Center for technical assistance. The town is now drafting a road plan that will prioritize and schedule repairs, and find outside funding and assistance. Public pressure, along with the existence of some outside funds (a 319 grant), have been the carrot and stick to move the town toward road improvements. Palermo demonstrates how knowledge and openness about the problem at the town government level leads to better documentation and planning, which is necessary in order to either convince residents to raise taxes or aggressively seek out outside assistance. The recommendations of the West Branch roads assessment are given in **Appendix B**.

Large Commercial Developments: Two Short Stories

There may be numerous commercial and large residential developments in various stages of planning throughout the watershed. Time constraints did not allow for a thorough investigation. Rather, two current developments, Point East in Wiscasset and The Sheepscot Harbor Village and Resort in Edgecomb, are highlighted here. The development pressures in these coastal towns can be extrapolated inland as the upper reaches of the river become the new waterfront in the real estate market.

Point East is a large, mixed use development located on the south side of Wiscasset, on the previous site of the Mason Station Power Plant. It is an example of adaptive re-use, marketed as a “Land Trust Development”, and potentially a very instructive demonstration of transforming a brownfield into well planned public and

[27] While lake frontage raises a town's revenue it also presents significant NPS problems from privately maintained camp roads, as is the case around China Lake.

private space. The development is high density, with 80 single family residences and160 condominium units; a marina with 239 full service slips; a maritime village with "elegant boutiques", restaurants, and other services; a 200 car underground parking area; and an industrial park with five large lots and permitted buildings ranging from 15,000 to 60,000 square feet.

Community activists in the mid-coast region have been promoting size-cap ordinances in response to concerns about proposed big-box development. The case against big-boxes is multi-faceted. Studies demonstrate that big-box development results in sprawl, increased traffic, and pressure on a town's infrastructure—resulting in higher taxes for residents. They also render local businesses vulnerable to common cost-cutting strategies available to large corporations. Environmentally, it has been shown that big-box development not only creates large areas of impervious surface, but encourages still more development and impervious surface, resulting in degraded urban streams and erosion problems that become increasingly difficult to address. The now common rule of thumb regarding the relationship between impervious area and watershed health is simple: when the land area of a watershed becomes 10-20% impervious, water quality and overall watershed health declines significantly.[28]

In this context, Wiscasset's amended ordinances with respect to the Point East project are worth noting. An amendment, dated April 2005, provides for development within specially defined zoning districts—The Shoreland Business II and Marine Overlay Districts. The new districts include the Special Setback Area, the Impervious Surface Ninety Percent (90%) Area, and the Impervious Surface Fifty Percent 50% Area. Permitted uses, with Planning Board approval, include professional buildings and offices, convention halls, hotels, restaurants, low impact industrial uses, and more.

All of this begs the question: does a zoning ordinance that institutionalizes an "Impervious Surface Ninety Percent (90%) Area" and permits a long list of land uses, including laundry services, spas and industrial uses, set a precedent bound for watershed problems? In most of the Shoreland Business II district, the minimum setback is an unprecedented (in today's terms) 25 feet from the upland edge of coastal wetlands or normal high-water line. The state minimum setback for all shoreland districts (except the General Development I District or Fisheries/Maritime Activities District) from

[28] E.g., *Stormwater Strategies: Community Responses to Runoff Pollution*, Natural Resources Defense Council, 1999

coastal wetlands is 75 feet. How is Wiscasset's new district consistent with State Shoreland Zoning guidelines?

Although construction has just begun, Point East was recently believed to be responsible for a sediment plume streaming into the Sheepscot during a heavy rain. Dan Scheitzer, owner and operator of Island Oyster Farm, videotaped the event and commented: "Following the plumes to their sources, it was very obvious these plumes were caused by inadequate erosion controls at the Point East construction site."[29] The local code officer claims that all DEP requirements for erosion controls were met; Scheitzer's argument, however, was that the controls are not enough. The Project Manager claimed that the incident was not erosion, but stormwater run-off due to heavy rains. This demonstrates how language can confuse the issue. The local paper interpreted the remarks of the project manager to mean, "Erosion fears proven wrong". In reality, erosion happened. Erosion is simply the movement of soil due to the action of rainfall or flooding. Erosion is a physical fact. Stormwater runoff causes and exacerbates erosion. What was once 'clean' runoff can become sediment-laden as it passes through a construction site. The issue then becomes 1) whether the regulatory standards for erosion control were met on the construction site, and 2) whether these standards are in fact adequate for the severity of the storm events that occur and the proximity of the site to the resource.

Not only must completed projects be designed and operated to minimize the impact of stormwater runoff from their impervious surfaces, the construction of these projects must also be done in a way that minimizes soil exposure and prevents the movement of soil off-site. A number of State laws come into play during project construction, including the Site Location law, Construction General Permit, Erosion and Sediment Control Law, and State Stormwater rules. The new Stormwater Rules require that any disturbance of more than one acre meet basic standards for erosion prevention. Larger disturbances require greater measures and even mitigation. Under the Erosion and Sediment Control Law, landowners are required to prevent soil from being transported offsite. Whether or not a permit is needed, granted, or adhered to does not change the fact that polluted runoff from a construction site is a violation under State law.

[29] "Erosion fears proven wrong at Point East", *Lincoln County News*, October 26, 2006

On the other side of the river, the expansion of Bintliff's Grill has puzzled residents. Interviewees from Edgecomb and Wiscasset said that they do not understand how such development could occur. Suddenly, a long, narrow dock jutted into the river and a lot of clearing appeared to be woefully out of compliance with Shoreland Zoning. One employee at the Department of Marine Resources reported that, "Nobody knew it was happening." Another employee said, "I reviewed [the dock application] but there was nothing that I could hang my hat on to stop it." Edgecomb's code enforcement officer said that he had nothing to do with the project's approval, and that the Planning Board was responsible for permitting. A local resident claims that a member of the Planning Board is a partner in the project. The CEO also claims that the operation appears to have three different company names, one of which is The Sheepscot River Development Corporation. Apparently, the biggest controversy is over the density of the project, which increased significantly when Edgecomb adopted a sewer ordinance and the developer, Roger Bintliff, invested a million dollars or more to lay a pipe under the Sheepscot River for transporting sewage from Edgecomb to the treatment facility in Wiscasset. The town will repay the developer for his cash advance, although the Chair of the Edgecomb Planning Board admits that sewage service to Edgecomb will be limited to Davis Island and the area encompassed by the town hall, school, and maybe the fire station. Apparently the increased tax revenues from the development will finance the repayment. Although this solution appears to cover the costs of sewage infrastructure, (primarily benefiting the developer), it may not account for other infrastructure costs, and it certainly does not account for the potential impacts on the river, both scenic and otherwise. Water quality impacts will be largely determined by the maintenance of buffers, the landscaping practices of new homeowners, and the Maine DEP's oversight of stormwater at the site of development.

The Point East and Bentliff's Grill stories illustrate, at the very least, that there is a good deal of confusion about the specifics of permitting in the shoreland zone under local town ordinances and planning board review, and about what constitutes a violation of the State's water quality laws. It is not clear what the responsibility of the DEP was in each case, or how much flexibility town planning boards have in allowing projects to proceed in the first place. Enforcement responsibilities and performance standards should be absolutely clear with respect to water resources.

All Terrain Vehicles and their Impacts

The upper watershed appears to host significant All Terrain Vehicle (ATV) use. Five clubs currently exist, although, "Some are directly and some are on the fringe," according to Maine's Department of Conservation. Also according to the DOC, the problem for ATV users is lack of access to properties, particularly in the vicinity of the upper river corridor. In contrast, the Narraguagus study of non-point sources of pollution found that the problem with ATVs is the erosion and subsequent sediment-laden run-off they cause; the study found that 23% of identified NPS sites were associated with ATV trails. Problems and damage associated with trails include fording and riding in streams (which is illegal), extensive mud holes, a lack of drainage on trails and overall lack of maintenance. A joint ATV-snowmobile club in the West Branch area reported that they are losing some trails because landowners are posting properties that had been damaged by ATVers.

Utility corridors frequently serve as ATV highways—whether authorized or not. CMP's policy is to authorize ATV use only for those clubs that have been approved by the Bureau of Parks & Lands and have entered into a license agreement with CMP. However, this policy only applies to CMP-owned lands. Many utility lines are maintained on easements. As of 2006, a few clubs have agreements with CMP in Kennebec, Waldo, and Lincoln counties, although these are not the clubs most active in the Sheepscot area. With or without agreements, however, the problem of erosion remains, especially at stream crossings and small wetlands. Our CMP contact acknowledged that unauthorized use of utility corridors continues to be a problem that is very difficult for the company to manage.

Use of ATVs is increasing in Maine, as evidenced by increasing sales. The best approach to controlling the damage caused by ATV use in sensitive areas or at the wrong time of year is twofold: 1) increased instruction on the new ATV laws to both residents and local law enforcement, and 2) self-policing of ATV users and general good stewardship through organized clubs. If ATV clubs can demonstrate effective self-policing and stewardship they have a better chance of convincing property owners to keep land open for their use. The Friends and Neighbors Club, based in Liberty, is a good example of a club that takes great pains to build strong landowner relations and their own good reputation of responsible use.

Gravel Pits

According to the Van Wie report, there are 25 licensed gravel pits in the Sheepscot watershed. The majority of these pits are in the West Branch towns, and nine are in Windsor. Licensed Gravel pits are over 5 acres and are regulated by the Maine DEP. Specific performance standards include buffers, setbacks, internal drainage and reclamation, and enforcement is thought to be good. However, because the Sheepscot watershed contains significant sand and gravel deposits, Van Wie recommends that Sheepscot towns regulate smaller gravel operations as well. A gravel pit currently being developed on Choate Road in Windsor, although monitored by the DEP and currently in compliance with Shoreland Zoning, has neighbors concerned about sediment plumes into the West Branch.

Dredging

There is no active Federal Navigation Project (harbor work or channel dredging) in the Sheepscot and none planned for the foreseeable future (USACE 2006). Dredging by State or private operators would require permits from Maine DEP and the USACE. The USACE has not seen applications for this type of activity in the Sheepscot.

Summary of Land Use Issues across the Watershed

In the upper watershed and the West Branch, the primary land use issues are road maintenance, poorly constructed stream crossings, and heavy ATV use, with or without landowner authorization. Development and gravel extraction are also apparent. The impact from these activities would be greatly reduced if appropriate buffers, regulations and consistent enforcement were in place.

In the middle portion of the watershed, road maintenance is also of primary importance with respect to water quality. Gravel pits are potentially a secondary priority, again depending on enforcement. Small forestry operations may pose problems throughout the watershed, although most NOIs indicate significantly more activity in the middle and upper reaches.

In the coastal section, residential and commercial development present challenges to watershed health. Planning must reflect intentional water quality protection. The closure of shellfish beds due to the large number of OBDs is an obvious and relatively straightforward target that lacks only public pressure from local residents and knowledge of funding sources and solutions. Large-scale subdivision development is a two-edged sword that may irrevocably harm the natural environment or bring innovative solutions. Point East, we hope, will prove to model re-development done "right" with respect to water quality, advancing the credibility of careful planning, properly installed stormwater systems, and erosion control measures.

4. Land Use Policy: The Bigger Picture

"Towns in Maine, in this respect, enjoy some of the highest levels of local control in the nation, yet their autonomy gives them little mastery."

The Brookings Institute, Charting Maine's Future

The varying scope and sophistication of local land use policy in Sheepscot towns is similar to that found in much of Maine. The socio-economic stratification and development pressures found in the watershed also mirror state-wide issues. Similarly, trends across the state help to reveal issues within the Sheepscot watershed. The Brookings Institution's recent report, "Charting Maine's Future" provides a careful analysis of Maine's economic and governmental policies with respect to natural resources. The report boldly claims that Maine's "brand" is essential for economic health, and that our "brand", along with the state's natural resources, are significantly threatened by development pressures and poor planning. Many of the report's findings are consistent with activity in the Sheepscot watershed, including the pace and flavor of development. Maine's suburban sprawl during the 1990's, for instance, was "by far," the most accelerated among the fifty states. Since 1990, we have "suburbanized at an alarming rate"; 869,000 acres of rural land have been transformed into suburban-style residential lots (Conklin 2006).

The report's Action Plan provides specific recommendations. One such recommendation is to improve the capacity of local and regional planning—to "foster collaborative and regional planning" and "encourage planning at the multi-municipal level." A potentially very good example sited by the report is the Gateway I planning

process, involving 21 towns, the Department of Transportation, The Federal Highway Administration, and the State Planning Office. To date, the high level of collaboration bodes well for what is “the state’s largest-ever regional planning effort.” The effort may also bode well for other Sheepscot towns wishing to leverage resources, planning assistance, and enforcement capability.

With respect to land use planning, an interviewee commented that the fact of “home rule” in the state of Maine prevents our collective ability to perceive, embrace, or implement a regional perspective. “It’s a real mind set,” he said, adding that in his professional experience, land use planning in most of the country is much more progressive relative to mid-coast Maine; even in Wiscasset, until recently, the planning tools have been “archaic.”

It can also be argued that an older, town-centered form of government may only seem "archaic" to those who have witnessed elsewhere more active county governments that are geared for more suburbanized populations. In fact, the 'new urbanism' is now reaching back to the village scale of planning, which operates on a realistic size of community and sense of connection and responsibility. "Home rule" also makes for less cumbersome decision making when timing is critical. It was precisely this strong local control in several Sheepscot towns that enabled size-cap ordinances to be approved relatively quickly. Strong local control—if it is well-informed—can be a powerful tool for localizing the economy and protecting the environment. The recent adoption of size-cap ordinances in several towns demonstrates the power of town-centered planning.

If "regionalism" means regional or county-wide planning, it may carry the danger of thwarting time-sensitive citizen initiatives, that is, if public opinion must be averaged over several towns. Regional planning can also sacrifice quality of life in one area to preserve rural character in another; communities that are labeled "service centers" may end up paying for services that benefit non-residents (commuters) while also dealing with the quality of life impacts. Balance is needed to keep the best of home rule and combine it with multi-town cooperation where appropriate. It is not necessary to weaken home rule and the traditional town government in order to introduce beneficial aspects of regionalism. Rather, it may only be a question of starting with simple and flexible cooperative actions between towns (such as group purchasing) in order for the concept of regionalism to gain acceptance. Several towns have shared a CEO, with mixed

results. To be effective, sharing a CEO implies that town ordinances are consistent with one another. Shoreland Zoning ordinances tend to be similar across towns. We recommend that neighboring towns discuss the possibility of sharing the responsibility of Shoreland Zoning or turning this function over to either county or state regulation.

Until regionalism gains acceptance in Maine, we are left with individual town ordinances as the chief mechanism for land use planning and natural resource protection. The Van Wie Report provides an analysis of local ordinances in the context of water resources, and the protection of Atlantic salmon habitat. The basic finding is that land use regulations in the Sheepscot watershed are not fully prepared for the projected degree of development. The report documents the current status of regulations within eight river towns that "comprise the majority of the land area and river/stream frontage for the Sheepscot and tributaries." The selected towns—Alna, China, Jefferson, Newcastle, Palermo, Somerville, Windsor, and Whitefield—were ranked in terms of overall level of concern with respect to 1) the size of area of town within the watershed, 2) the scope, quality and clarity of ordinances, 3) the apparent development pressure, and 4) the quality of administration and enforcement; and offers practical recommendations.

The Town of Whitefield ranked highest in terms of overall concern, with Windsor and Somerville being close seconds. However, every town has clear opportunities for enhancing water quality protections. Somerville lacks clarity in its ordinances, a description of the location of shoreland zones, and specific requirements for buffers, stormwater management, and protection of first order streams. Jefferson is also cited for needing greater clarity in its ordinance language, and Palermo, too, needs more specific requirements for stormwater treatment, buffers and smaller streams.[30] Each of these towns could devise ordinance language to address shared concerns, or they could work together, identifying needs and solutions. The first of Van Wie's recommendations is to obtain professional help for drafting ordinances that are consistent with the new Shoreland Zoning rules (including the state standards for timber harvesting), new stormwater rules (Chapter 500), new NRPA regulations, and Nutrient Management guidelines. This is the type of effort that could potentially benefit from a regional, and collaborative, approach. At the very least, neighboring towns can share the cost of a planning professional. This is a more likely scenario than top-down planning from the state or even counties.

[30] The report suggests that all towns review and clarify their definition of streams.

Nine other recommendations provide a blueprint for future work within the watershed as a whole. In short, Van Wie's recommendations are to:

1) Raise awareness regarding problems associated with nutrient enrichment, promote phosphorous control BMPs, and address erosion, sedimentation, and other stormwater concerns.
2) Promote better implementation of road standards (especially in subdivisions and commercial projects), encourage low impact development, minimize impervious area, and require stormwater controls in the shoreland zone.
3) Educate town officials and citizens regarding the benefits of open space development, particularly as an alternative to standard subdivision in the shoreland zone.
4) Encourage provisions requiring CEOs to review single lot development, and establish streamlined performance standards for protecting water quality.
5) Encourage towns to regulate smaller (1 to 5 acres) gravel pits.
6) Educate town officials on current standards for Manure Utilization and the requirements of the Nutrient Management Act, and encourage undisturbed natural buffers.
7) Encourage towns to adopt the new state timber harvesting standards for all shoreland zones, including first order streams, and to enforce the new NRPA standards for clearing and development.
8) Develop a "Shade the Sheepscot" program to restore natural buffers
9) Seek landowner cooperation and Maine DEP funding to improve roads and reduce soil erosion.

Many of these efforts could benefit from working across town boundaries. In addition, three out of the eight towns reviewed by Van Wie do not have Comprehensive Plans. Four of the eight have no Floodplain regulations and seven of eight do not have water quality or storm water ordinances. Again, this is consistent with the Brookings Institute report, which boldly claims that poor land use planning profoundly threatens life in Maine as we know it. Within the watershed, Van Wie's report, again, stresses the need for professional assistance for towns facing development pressure, and for designing ordinances that promote low impact development.

Given the variety of factors at play—rapid growth, inadequate ordinances, regulatory omissions, inconsistent enforcement, and compromised water quality—it is

clearly a critical period for strengthening and institutionalizing practices that benefit the overall health of the watershed's natural community.

IV. Public Perception & Community Values

"The river is the soul of the life here…It's the center. It has a strong presence. Its value is in just being there."
Roland Barth, Farmer and long-time resident

"I can't catch a flounder at all. Twenty years ago, we caught them all the time."
Edgecomb resident

Public Input Methods

In order to conclusively determine management goals and objectives, community sentiment regarding the Sheepscot River and its tributaries was assessed through telephone interviews, public meetings, and presentations before towns. The interviews were designed to explore public values, observations, and concerns regarding the Sheepscot River watershed, and awareness with respect to water quality issues. The names of interviewees were selected by virtue of newsworthy participation in local affairs, as represented in the Lincoln County News. Interviewees were also selected from a list of municipal officials throughout the watershed, by asking interviewees to suggest others that might wish to contribute, and from a list of farmers and large land owners provided by the Knox-Lincoln Soil and Water Conservation District.

The interview approach was taken in 2006 after a series of public meetings in 2005 were poorly attended and yielded very little input. Presentations at Selectmen's meetings in several towns did illicit questions on specific issues but were not amenable to obtaining meaningful input from the residents. In contrast, one-on-one interviews provide the opportunity to gather important information and sincere opinion. Eighteen interviews were conducted. Interviews were initiated by explaining that the Sheepscot River Watershed Council is assisting the KCSWCD in gathering public values and concerns in order to inform the development of a Sheepscot River Watershed Management Plan.

Although the interviews and public discussions followed the thread of conversation, the basic questions posed to each interviewee are as follows:

1) How do people in your community use the river and streams? What is it you value about the Sheepscot River?

2) Have you seen changes in the river, streams, or lakes? What will the river and the town look like 20 years from now?

3) What activities on land are impacting the water quality? Which are the "hot topics" in land use in your community?

4) What are the best ways to protect water quality in the Sheepscot? What kinds of assistance (if any) do landowners want?

5) How is Shoreland Zoning working (or not working) for you and your community?

6) Is there anything else you would like to add? Is there anyone else I should call?

Findings from the Interviews

These findings are narrative and qualitative in nature. They are meant to reveal the local wisdom that becomes apparent in conversation. They are impressionistic, and convey both community-wide values and unique observations and concerns. Strong concerns came primarily from those with professional experience related to the rivers. They spoke specifically with reference to fisheries, land use, and road maintenance. Not surprisingly, strong observations came from those who have lived along the river for their entire lives.

Values: The river and bay are highly, and consistently, valued for recreational purposes. Canoeing, swimming and fishing were mentioned in nearly every interview. One interviewee commented that the river “is the single recreational resource in the area.” Economic and aesthetic values were frequently mentioned. A “big fleet” of lobstermen (more than 20 in the Wiscasset area alone) operate out of the estuary, and Wiscasset’s town planner commented on the significant numbers of worm and clam diggers in the area. He added that Wiscasset is “the worm capital” of the world. Other valued uses include irrigation and as a destination for hiking. A state resource manager acknowledged, too, that the river is valued as a nursery for anadromous fish species. Another said that the river is valued because it supports “a multitude of fisheries.” A forester said he valued the river as “an integrated system of forest, soils, and tributaries,” all of which supports the fishing he loves. One interviewee simply said, “What do I value about the river? Well, everything. Everything about it.”

Observations: Perhaps the most poignant observation came from an older gentleman who garnered my attention at a Planning Board meeting in Edgecomb. He said, "When I was a kid, they said that you could walk across the river on the backs of lamprey… Well, I've seen it!" Other observations commenting on the apparent loss of ecological abundance included an email note from a Town Selectman who wrote,

> I have lived on the Sheepscot all of my life and have personally seen a lively river deteriorate into a dead one. When I was a kid I could fish on the river and actually catch fish almost anytime I went out. Today you can fish all season and not get a nibble. I do not see the wildlife that the river once supported. There were Osprey nests and an occasional eagle sited, but today you are lucky to even see a duck.

The most common observation, throughout the watershed, was focused on increased development. Several people commented on a "brown foam" that has begun to appear regularly, after rain, in the lower portion of the river. Two people, including a lobsterman, described lobsters dying in keepers at the bottom of the river—something that has begun to happen only recently. The lobsterman has also observed an increase in shellfish closures when it rains. A lobsterman's wife noted that her husband has observed a sudden and dramatic decline in the crab population this year. Edgecomb's Harbormaster observed that more run-off "muddies the river up" and has made downstream coves shallower. He specifically mentioned that Eddie and Cod Coves are much shallower than he remembers. The cove in front of his place has "muddied out in just the last nine years." Another observer noted that "the river doesn't freeze like it used to", and named specific roads that he sees wash out regularly. He also commented on seeing substantial erosion into the river from ATV damage, and "dairy lands where buffers are gone." With respect to ATV damage, a farmer commented, "There is big trouble with ruts in every part of the woods—but what are you going to do about it?"

The observation of a forester is perhaps most significant in terms of the overall health of the river. He has noticed "green growth in marshes and salt flats. It looks like algae." He also noted, as if to provide a warning, that he had seen "blown out" river banks on other rivers, just downstream of new subdivisions. Although not a comment on the river itself, a road commissioner noted that, "Towns are not allotting enough money to make roads free of NPS (non-point-source) issues."

Despite the potential alarm that these observations might cause, perhaps half of those interviewed did not identify notable changes in the river. In response to the question, "Have you seen any changes in the river over the last decade or two?", many

either said something akin to “not really” or they made comments about changes on the land.

Concerns: Interviewees were not explicitly asked about their knowledge of the Sheepscot’s water quality. Still, it became apparent that very few know the status of the river’s water. This is not surprising given the varied condition of the Sheepscot. One farmer, born in 1937 and having spent his entire life in the watershed, reported his impressions of water quality:

> Back in the 1940’s when I was learning to swim, it was reasonably clean and clear and then it went through stages of warnings about coliform contamination and so forth, and now, in the last few years, it seems to be cleaner again.”

Despite his overall impression, this interviewee is quite concerned about development, gravel pits, and the number of gravel trucks and cars “spewing oil” and exhaust. He described a daily walk to the post office.

> “Five years ago, I could walk the two miles to the post office and back and not see a car go by. Now twenty cars will pass me in one trip, not to mention the gravel trucks. I see [the exhaust and oil residues] as a violation of the river… It all ends up in the river.”

There were numerous and clearly stated concerns about gravel pits—from the perspective of continued erosion, long term effects, and the numbers of trucks currently traveling watershed roads. One observer stated, “they [gravel pits] are all over the watershed."

The rate of development was another consistent concern, although very few made the correlations between development, increased impervious surface, and the degradation of water quality.

Agricultural run-off was also a notable concern. Although few mentioned nutrient enrichment and only one person referred to algae blooms, there is a widespread recognition that manure is a significant problem in the watershed. One farmer, who milks close to 200 cows, struggles to keep his manure ponds from overflowing and stressed that he would very much like to be a good environmental citizen, but that the heavy rains have been “out of his control” and prevent him from spreading the manure before the ponds become full. Another interviewee mentioned that a manure pond, built on his land and leased to a dairy farmer, is now “putrid and polluted and flows into the

river." Other farmers felt strongly that the real problems associated with nutrient loading stem from the small family "farm" with one or two animals penned next to, or even over, a tributary. When mentioned, another interviewee said, "I know the situation exactly," and proceeded to describe a family raising a few animals just above the Dyer River. Two other farmers were concerned about the increase of horse farms and the lack of education or regulation of such "hobby farms."

The lobsterman who spoke about dying lobsters is concerned about the sewage treatment plant in Wiscasset, although he does not know its capacity. The Harbormaster, an employee of the Department of Marine Resources in Boothbay, and the Chair of a Select Board are concerned about Overboard Discharges. The road commissioner is concerned about his belief that other watershed road commissioners do not know about NPS issues; he says that he knows about NPS problems only because he also harvests forests and has learned the regulations. He said that, "No one has brought road maintenance to their attention," and added that, "Selectmen need to get involved" to stabilize roads. An employee of the Atlantic Salmon Commission is most concerned about agriculture, stream crossings and road designs. The forester expressed concern that the Sheepscot River Watershed Council and others are valuing one species over "an entire watershed system," and believes that our collective focus should be on land uses and erosion.

One interviewee said he is concerned because potentially negative effects of development on water quality are "not just n the future, but forever." Another said, "Awareness and incentives are lacking." He recommended "stewardship building."

Recommendations: Most consistent in the responses regarding water quality protection were recommendations for education—both early education in the schools and education pertaining to land use and road maintenance. It was stressed that early education must engender a love of the river itself, and an understanding of place. Equally strong recommendations were for technical assistance to landowners and towns to install BMPs (and especially buffers) and "consistent and fair" enforcement of Shoreland Zoning regulations and building standards. One interview explicitly recommended that the county assume responsibility for code enforcement so that it may become "professional and fair." The Chair of a Planning Board said that, "More code enforcement services are needed."

Also recommended was “very intensive monitoring” and “some kind of coordinating agency around the watershed for all of the interest groups to work well together.” The need for assistance to farmers dealing with manure and run-off problems was also mentioned several times. One farmer commented, “It’s very expensive to comply with regulations.” He also said, “Hunters want to keep the river full of ducks,” as if implying that hunters might justifiably help fund the protection of the resource.

Requests: When asked what assistance landowners might need in order to help protect water quality, interviewees often seemed relieved to think that their requests might make a difference. Each person who clearly cares for the river, could also clearly state a need. For example, the farmer with the manure problem asked for help in finding alternatives to manure ponds. In particular, he asked for places to stack the manure away from the river. The harbormaster of Edgecomb requested another call once we found out what to do about Over Board Discharges in the estuary. The town Manager from China asked that they be recognized as committed with respect to road repair and maintenance; the town has an article that allows easy appropriation of matching funds for road work, and they are proactively looking for financial assistance.

Summary: For those that care about the river, there is concern—even a kind of sadness is distinct. Their concerns mirror those expressed in scientific and ecological terms, and numerous reports corroborate their comments. In essence, expressed concerns reflect an awareness of a potential collision between the pace of development and our collective lack of preparation with respect to land use patterns and regulations.

Many of the participants revealed themselves as experts in their own arena. The dairy farmer knows precisely what he needs for assistance and NRCS representatives know what kind of financial assistance is available from the federal government. The harbormaster knows that coves are silting up, and lobstermen know that lobsters are dying in keepers. In many respects, it might be said that local wisdom is alive and well, and untapped. Residents are eager to share stories and observations, and they, clearly, have the most to tell about the river.

Additional Information from the "Bean Ballot"

In order to further assess public conservation priorities, we took advantage of the very popular Common Ground Fair in September, 2006, by conducting a non-rigorous type of survey called a bean ballot. The "voters" were presented with a poster showing five conservation options with five voting boxes below. The instructions to the voters were:

You have 10 beans to vote with. Where would you put your beans if they were tax dollars to be spent in the Sheepscot River watershed?

1. Put more land into conservation?
This might include: expansion of open space and tree growth tax credits, public support of land trusts, acquisition of land by the State, programs to pay farmers for untilled land, etc.

2. Better law enforcement to protect water quality?
This might include boosting code enforcement by towns, increased response of DEP to public complaints, ear-marking money from violations to go directly into watershed protection, better explanation of the various land use laws.

3. Restore native fish habitat?
This might include funds to plant stream buffers, stabilize river banks, restore channel and pool structures, control invasive species.

4. Educate the public about water quality issues?
This might be education targeted to different audiences, e.g., schoolchildren, landowners, contractors, town officials. Issues are: non-point source pollution (erosion and runoff), nutrient loading, "smart growth" town planning.

5. More public access to the river?
This might mean building boat launches (trailered or hand-carry), trail building near the river and streams, promotion of eco-tourism, signage and other ways to delineate the watershed.

70 voters cast beans over the two-day fair. Voters are not necessarily residents of the Sheepscot or familiar with it but are a good cross-section of the Maine populace. Votes were as follows:

Option	**# votes**	**%**
1. Conserve Land	219	31
2. Enforce Law	107	15
3. Restore Habitat	162	23
4. Educate Public	131	19
5. Public Access	85	12
TOTAL	**704**	**100**

Participants grasped the voting question quickly, seemed to be familiar with the choices, and for the most part, considered choices carefully. Many of them read the poster and asked questions. Some spent several minutes on voting, the last bean being the hardest to spend! A good many also voted quickly, based on the box labels. Voters tended to spread their beans fairly evenly over all the boxes but in no particular order, indicating that option #1 was not overly favored because of its position. Some voters reserved their beans for only 2 or 3 of the 5 boxes. Where possible, these voters were 'polled' on their choices after they voted. Some of the comments:

- Law enforcement is not working or not fair
- We need to keep people away from the river.
- Education isn't working (but we need education)

There was some evidence that well-meaning landowners may be misinformed about water quality. For example, one landowner, who wants to start a fish hatchery on the Penobscot, was not aware that natural tannins can color water. He called the coffee-colored water coming out of the peat fen next to him as "pollution" - and if pollution is natural it should not be blamed on the landowners. Viewpoints like these might also explain why the enforcement option scored poorly, although the question might have been clearer if we emphasized better enforcement of existing rules. The need for better enforcement may be underestimated by the general public.

It was somewhat surprising that public access scored poorly relative to the other choices. This may have something to do with the voters' perception of the impact of boat launches and motorized recreation. (The State concept of "access" is the one we used; It would be interesting to have a separate vote on what “access” means). It is also worth noting that conservation of land was strongly supported without equally strong support for public access, and that habitat restoration is highly valued.

Note on Non-Resident Stakeholders

Water is an uncontained public good, or part of “the commons". Stakeholders may therefore include those that live beyond the strict confines of a watershed. For example, Gulf of Maine fishermen share an interest in the quality of habitat provided by the Sheepscot, and in the quality of the water pouring from the river. The construction of a 237 slip marina in Wiscasset suggests a high value placed on recreation originating up

and down the eastern seaboard, and from a national perspective, the health of our estuaries and marshes offers a source of “hazard abatement”.

Sustained local leadership and local action is needed in the Sheepscot—the kind exemplified by land trusts and volunteer monitors. However, given the special resources of the watershed and the fact that many "stakeholders" who stand to benefit from protection of the Sheepscot live outside its topographical boundaries, state funding for protection of the Sheepscot should be a given.

V. Recommended Actions

The following recommendations are the result of nearly two years of gathering and distilling information concerning water quality and land use in the Sheepscot watershed. In our research, we recognized unique qualities in each town, clear differences in wealth between coastal towns and those in the upper watershed, incongruities in land use and enforcement, the value of home rule and still, the importance of regionalizing land use planning. A watershed approach, in which the relationship between what happens upstream and downstream is recognized, may provide the awareness necessary to promote regional planning while preserving the value of home rule and town identities.

We suggest therefore a public education campaign designed to cultivate the awareness that, in many respects, “We all live downstream”, and that regional planning makes sense for both ecosystem health and for riparian communities. Such a campaign might begin with watershed maps and posters distributed widely, and a public picnic on the river. Given the many activities that could be organized to foster “watershed thinking,” the initiative requires coordination and facilitation.

Without an identifiable group of people who are willing to maintain the communication and coordination necessary to implement initiatives, the Sheepscot Watershed Management Plan is unlikely to advance. Individual activities, such as a culvert survey or a town comprehensive plan, will go forward in isolation—missing the opportunity to plan and act in a whole-watershed context and build more partnerships. An informed network of concerned citizens in every part of the watershed is needed to promote watershed-wide activities and awareness. Engaging committed volunteers should be one of the main functions of a nonprofit “umbrella group”.

The most active and well-established non-profit in the area is the Sheepscot Valley Conservation Association (SVCA). The SVCA and a smaller organization, the Sheepscot Wellspring Lands Alliance (SWLA) are land trusts focused on increasing the acreage of land protected, community outreach and maintenance of a volunteer force for water quality monitoring. Providing for a watershed coordinator or umbrella group is beyond the mission or capacity of these organizations.

The Sheepscot River Watershed Council (SRWC) has been active in the area for the past 10 years and at first glance appeared to be the most obvious choice for the needed convener or umbrella group that would "own" this plan. However, future funding for the organization is neither substantial nor secure over time, and the Council is not yet

organized into a 501(c)(3) non-profit, which provides the opportunity to accept donations. This, combined with the rate of turnover in the single, half-time staff position, raises questions about the longevity of the organization, and about whether or not it can evolve into an organization that can sustain the confidence of stakeholders throughout the watershed. Because of these questions, we have identified certain tasks that would or could fall to the SRWC, or an as yet un-named NGO. The individual members of the Council, however, are a group of dedicated and well-informed individuals who know the governmental and non-profit groups in the watershed. Our hope is that the SRWC will receive sustained and significant funding from state and private funding sources. The SRWC, along with two other mid-coast watershed councils, is currently exploring the possibility of receiving annual stipends from state agencies with whom the councils consistently work.

The need for coordinated planning across towns has been echoed in many reports, including the recent Brookings Institution's report, *Charting Maine's Future*. The eight sub-watersheds of the Sheepscot offer natural, hydrologically defined regions which cross town boundaries. A focus on the sub-watersheds could highlight the impaired stretches of the river (which also cross town boundaries) and facilitate town partnerships. Such partnerships could conceivably begin with efforts to address the land use oversights that cause problems for the stretch of river they share. Towns collaborating in the interest of watershed protection are more likely to receive funding and can readily share a variety of related costs, including those associated with land use planning and road repair. Again, this kind of initiative is more likely to succeed with the help of an organization that is familiar with the specific conditions of the river, the relevant land use issues, and the agencies that provide technical expertise and funding.

The Sheepscot River is a rare gem with a rich cultural history, the potential for restored ecological abundance, great stores of data, and a cadre of committed citizens, conservation practitioners, and scientists. The recreational and aesthetic values of the river are clear to all those interviewed, and both the *relatively* good water quality and threats to the river are clearly documented. At this point, with escalating development pressures, the responsible path forward clearly requires changing our collective behavior on the land. All that is lacking, it seems, is political will. This, we believe, must come from citizens—from ourselves. Do we care enough to draft more restrictive ordinances? Will we question our assumptions about the costs and benefits associated with

development? Will we consider living in clusters? Do we think about the commons, and the common good? Long-range planning and low-impact development will become doable only when communities become informed about the natural resource losses, and costs, associated with unplanned development.

In the Action Table, below, we have organized recommendations into four broad categories: 1) Watershed-wide communication and coordination, 2) Implementation of best management practices, 3) Land use policy, and 4) Water-quality and habitat information. Of course, the categories depend on one another for success and many of the recommendations cut across categories. For example:

- a large GIS initiative may at first be used to identify high-value habitat but could also have benefits for town NPS management;
- engaging volunteers for the purpose of collecting water quality data could also foster the participation of Local Leaders in town planning;
- ordinance provisions designed to channel mitigation money into the restoration of shellfish beds through OBD replacement depend on collection and communication of water quality data.

We have also organized the recommended actions into two time categories - Priority Actions (to do in 2007) and Actions Down the Road (in 2008 and later). The priority actions either have some time sensitivity—for example, the time to gain the most from a study or other initiative is while it's underway—or are necessary before further actions can be taken. In terms of sequencing, the recommendations for watershed-wide communication and coordination are most time-sensitive and will greatly enhance the likelihood of the other actions being implemented.

Action Table

$➔ = funding opportunity. *Refer to the Catalogue of Funding Programs in the Appendices for details.*

GENERAL RECOMMENDATION	PRIORITY ACTIONS (2007)	ACTIONS DOWN THE ROAD (2008-)
WATERSHED-WIDE COMMUNICATION AND COORDINATION		
1. **Form/strengthen a watershed-wide ORGANIZATION (NGO)** • to provide a "home" for the plan • to coordinate and facilitate watershed activities • to serve as a communications hub and liaison with towns and agencies	• Use SRWC to continue to foster **communication and information sharing** through monthly meetings and guest speakers • Fund a **full-time professional co-ordinator**; provide office space (perhaps shared with another organization); clarify duties and authorities • SRWC should consider pursuing • **501(c)3 status for the SRWC or new NGO** • **recruit Local Leaders and build volunteer force** • **serve as progress monitor for WMP actions** **$➔** contact Maine Community Fndn and Good Ventures to get assistance building the 501(c)3; meet with watershed partners (e.g., SVCA, Chewonki, UMaine, Gulf of Maine) to strategize on funding the 501(c)3	• Annual review of Mission, Strategic Plan, and Funding options. • Annual review and revision of this Watershed Management Plan. • Annual mtg w/State agency contacts • NGO leadership to consider whether to launch a membership drive • Actively pursue grants for implementation • Pursue actions under LOCAL LEADERS and VOLUNTEERS (see below)
2. **Recruit volunteer "LOCAL LEADERS" throughout watershed** to help carry out recommended actions.	**SRWC/NGO**: • Set goal of recruitment by 2008 of at least one Local Leader from each of the four regions: upper watershed, west branch, middle watershed, coast. • Invite individuals who have already been identified	• Ideally, there is at least one Local Leader for each of the 12 principal towns in the watershed. • Build outreach and communication activities around the Local Leaders' interests.

GENERAL RECOMMENDATION	PRIORITY ACTIONS (2007)	ACTIONS DOWN THE ROAD (2008-)
• Leaders serve as local contacts, e.g., attend town meetings and share info. • Local Leaders assume other tasks according to their interests.	as active in this plan to serve as Local Leaders. • Give recognition to each new Local Leader at meetings, web site, and in the press.	• Tasks that Co-ordinator will need help with: maintaining volunteer database, updating website, writing and sending out newsletters • Local Leaders: meet at least quarterly; organize events to recruit more volunteers; organize yearly Sheepscot leaders' social.
3. **Build a shared database of VOLUNTEERS for partner groups** • Mutual gain from organizations' sharing their volunteers • Be systematic about volunteer recruitment and retention. • Broaden volunteerism to include numerous watershed initiatives (e.g.. water quality monitors should be aware of town issues, etc.) • Broaden volunteer base to include farmers, woodlot owners, ATV clubs.	**SRWC/NGO w/PARTNERS**: area land trusts (SVCA, SWLA, BRLT), Maine Stream Team, Maine IF&W, Chewonki Fndn., • explore sharing volunteers and building a joint volunteer database • prepare for time-sensitive and high-profile events, like **trout and salmon fry stocking**. Recruit volunteers early, establish 'phone trees' and other ways to quickly muster volunteers • **TU/Maine Forest Service**: use current data collection (culvert inventory in 2007) to recruit volunteers who live in the watershed. • **Chewonki w/Partners:** use Montsweag Brook reclamation as an opportunity for recruiting and training volunteers in the Sheepscot (see Water Quality Information, below)	**Local Leaders**: feature completed and planned volunteer events from all partners in a quarterly newsletter; make use of local press announcements **NGO/rotate w/PARTNERS:** host an annual social (bean supper? canoe trip?) to thank volunteers and give them recognition in the communities

GENERAL RECOMMENDATION	PRIORITY ACTIONS (2007)	ACTIONS DOWN THE ROAD (2008-)
IMPLEMENTATION OF BEST MANAGEMENT PRACTICES		
4. Focus on **ROAD REPAIRS & STREAM CROSSINGS** • use the **NPS Survey** included with this report • focus on **permanent road fixes** in sensitive areas (e.g., chronic washouts in wetlands and at stream crossings) • focus on making every stream crossing **fish-friendly;** emphasize habitat/funding connection to towns • Team up the town **Road Commissioners** and crew leaders to share knowledge and build skills for NPS remediation	**Soil & Water Conservation Districts (SWCDs) w/Towns**: Use existing information to apply for **NPS** implementation projects: **fix ditches, bridges, culverts** **$➔*Towns/Districts:*** *begin discussions now in order to apply for 319 funding in April 2007*. **Towns:** create or update inventory and schedule for road needs; identify ways to cooperate with neighboring towns. Involve Maine Municipal Assocn. and DOT Local Roads Ctr in order to speed planning and make results consistent with funders' needs. **$➔*Towns:*** *identify State road problems and submit to DOT SWQPP program, December 2007* **SWCDs/Local Roads Ctr**.: find and distribute to towns useful short vs. long-term cost information to help them decide on **paving vs. maintaining gravel roads.** **Districts/Local Roads Ctr/COGs:** Convene a Roads Roundtable in each of the 4 watershed regions. Attendance should also be open to any other towns in Kennebec, Waldo, and Lincoln counties. **$➔ SWCDs/Towns: Fund the first roundtable through Districts rather than a state agency (roundtable must be a locally-led effort, by and for Town road crews and supervisors)**	**Towns**: move towards group purchase of goods and services and more regional road planning. **SWCDs/Towns**: use GPS/GIS as a tool in maintaining an up-to-date road needs database; map the TU culvert inventory data as part of the long-range replacement program **Districts:** Publish and distribute outcomes of the 2007 Roads Roundtable, follow-up workshops based on attendees' interest. **$➔ SWCDs/Towns:** seek funding from SPO, DOT, and in partnership with Maine Municipal Association.

GENERAL RECOMMENDATION	PRIORITY ACTIONS (2007)	ACTIONS DOWN THE ROAD (2008-)
5. Plan for **ATV USE**; Reward **responsible users** • engage the organized ATV clubs; face-to-face meetings are needed • emphasize the positive • strategize with large landowners (e.g. CMP, towns) • map the most sensitive areas	**SRWC/NGO**: • Invite the Friends and Neighbors ATV Club to a info-sharing meeting • recruit ATV clubs as volunteers **SWCDs/Maine Dept. Conservation:** • educate landowners re. their rights, ATV users re. their responsibilities	**Districts/CMP:** engage CMP and other large landowners, start with mapping overlay of corridors on sensitive areas (streams, wetlands)
6. Focus on **BUFFERS** for streams and rivers • Compile and present to landowners/communities a **BUFFER BASKET** containing all possible approaches to buffers: rentals, Farm Bill practices, land trust or town acquisition or easement, tax incentives, Landowner Incentive Program • present **land conservation** (acquisition or	**NRCS/SWCDs**: • publicize USDA programs to establish and repair buffers; emphasize info for new customers, including horse farmers • re-examine environmental cost-benefit of tilling and herbicides to plant buffers under NRCS programs **SRWC/Districts/SVCA**: • devise a buffer promotion program, highlight flexibility and well-funded programs. Farm bill programs and land trust deals in same basket of options. **SWCDs/GIS users**: demonstrate need for buffers by producing a brief series of buffer aerials (see example in this report), using publicly available aerial photography;	**NRCS/SWCDs**: building on NRCS Rapid Watershed Assessment for the Sheepscot-St George watershed (underway in 2007-2008), continue to identify buffer needs and record accomplishments **NRCS/SWCDs**: consider recommending changes in the USDA specs regarding use of tilling and fertilizer and herbicide use, when planting buffers

GENERAL RECOMMENDATION	PRIORITY ACTIONS (2007)	ACTIONS DOWN THE ROAD (2008-)
easement) as a "BMP" in relevant planning documents or funding applications (e.g., NRCS Rapid Watershed Assessment)	ground check areas of interest **$➔*Landowners*** *w/SWCDs, NRCS: advocate for strong conservation program in next Farm Bill* See also **GIS MAPPING** below. **$➔** funding sources for riparian conservation are numerous. See *Catalogue of Funding*	
7. **Link FARM data to IMPLEMENTATION** • compile basic farm data within watershed boundaries • profitable, well-maintained farms are a "BMP"; look at whole conservation and social value of farm (as well as need for buffer) • advertise programs that increase profitability and sustainability of farms	**Landowners/SWCDs/Towns**: provide input to the NRCS **Rapid Watershed Assessment** for the Sheepscot/St. George watersheds (funded in 2007) and make use of the results. **SWCDs/Towns**: request watershed-related information from Maine Farm Bureaus (e.g. identification of required Nutrient Management Plans); insure compliance with agricultural BMPs; **SWCDs**: use all available means to promote **Maine Farmland Trust and Farmlink.** **- advertise programs to farmers** **- advertise programs to non-farming public to build support ($)**	**NGO/DEP/(DMR)**: attend Local Work Groups for each of the three NRCS Districts. Recommend prioritization of new contracts that specifically address water quality issues in the Sheepscot and tributaries. **NGO w/partners**: recognize farmers, woodlot owners as key stakeholders, add to list for future mailings; organize winter events that bring together farmers and large landowners **SWCDs**: continue to promote **Maine Farmland Trust and Farmlink.** **Work towards goal of 100,000 acres saved.**
LAND USE POLICY		
8.	**Towns w/local leaders and/or professional consultants**:	**SPO, MMA, GrowSmart** or other group: prepare rural towns for suburban development.

GENERAL RECOMMENDATION	PRIORITY ACTIONS (2007)	ACTIONS DOWN THE ROAD (2008-)
Review ordinances, Implement relevant **SMART GROWTH** and **Low Impact Development** principles. . Focus public awareness on the connection between land uses and water quality	• Obtain professional assistance for Smart Growth and Low Impact planning • Consider the **Center for Watershed Protection** recommendations regarding road specs and impervious surfaces • Foster cooperation among towns for planning and sharing costs • Consider moving appropriate infrastructure and analysis costs to developers (impact and exaction fees) • Reduce impervious surface • Implement the specific recommendations in the **VAN WIE REPORT** in reviewing and updating town ordinances, e.g., (see Van Wie 2005 for details): • extend phosphorus ordinance to rivers and streams. • Consider enacting moratorium on subdivision approval until Town has reviewed and revised subdivision ordinance and/or zoning • adopt single lot review ordinance • strengthen building code and site plan review requirements in anticipation of future project proposals; • recognize higher restrictions required in Sheepscot as "Outstanding River Segment".	Present 'hard facts' (cost-benefit analysis) of low-impact development to the town planning boards and public. How to use LID in rural Maine considering special conditions, e.g., non-paved surfaces, smaller budgets, proximity to streams. **Local Leaders** • review progress 2 and 5 years later, publish brief follow-up document; update Van Wie's list of ordinances obtained from towns as they become available. • Investigate continued planning needs of the different towns. Is there a role for professional planner for certain tasks? Could groups of towns **share planning services** in some cases (e.g., large subdivision review)
9. **REGIONALIZE the ENFORCEMENT of SHORELAND ZONING**	**Towns/counties**: consider **county-wide, full-time code enforcement** with respect to Shoreland Zoning. Towns retain control over enforcing other ordinances **SRWC/State Legislators:** poll towns on general concept of county-wide or shared code enforcement. ("Yes...if..."). • Start with one or two counties, rather than	**DEP/Towns/GIS Ctrs**: develop digitized Shoreland Zoning maps for each town. These maps can be used as overlays with other data (aerial photographs, species and habitat data)

GENERAL RECOMMENDATION	PRIORITY ACTIONS (2007)	ACTIONS DOWN THE ROAD (2008-)
• Respond to the need to depoliticize and strengthen local enforcement • Start with what towns have in common – Shoreland Zoning	statewide adoption • Shoreland Zoning penalties could go into a shared fund for the county to pay for a restoration project **Attorney General/SPO/DEP w/Maine Municip Assocn**: Research the legality and feasibility of this option under State law and town home rule **SPO/Towns/DEP**: compile status list of towns with/without official Shoreland Zoning maps, which need updating?	**Towns/counties** Implement regional Shoreland Zoning enforcement where feasible.
10. **COORDINATE STATE LAWS & REGULATIONS**; present in an understandable format for the benefit of landowners, residents, and town CEOs.	**DEP/SWCDs:** Get the individual experts on Site Law, Stormwater, NRPA, Shoreland Zoning, ESA, ESC, etc to develop a landowner and developer's aid that shows what **activities** trigger which **rules** under what **jurisdictions**. Product could be a poster-size flow-chart or "decision tree" that can be displayed in town offices and used by SWCDs and CEOs.	**DEP/SWCDs**: assign staff responsible for updates whenever a rule change is made; train new staff on the flow-chart.
11 Publicize and enforce the State Erosion and Sedimentation Control Law (**ESC**)	**DEP**: communicate to towns how the State intends to enforce the ESC and what – if any – the role of towns will be. Educate the public on their role: How do private citizens make complaints to DEP? What happens next? **DEP/SWCD**: work out role of SWCDs, if any.	**DEP/SWCDs**: • maintain a log of violations and actions in order to gauge effectiveness of the ESC Law.

GENERAL RECOMMENDATION	PRIORITY ACTIONS (2007)	ACTIONS DOWN THE ROAD (2008-)
12. Encourage towns to adopt the new **TIMBER HARVESTING STANDARDS** in the Shoreland Zone.	**NGO w/Maine Forest Service, District Forester**: make presentation of new standards to the Sheepscot towns in 2007.	**Towns**: draft and adopt ordinances that follow the MFS proposal.
13. Resolve **OBD POLLUTION** in estuaries and coastal waters, replace remaining OBDs with approved septic systems	**Coastal Towns**: • use DMR surveys to calculate overall and incremental cost of **converting existing OBDs** to cleaner systems. • w/DMR, establish baseline number and location of OBDs in order to track conversions over time • explore voluntary standards (e.g., LEED program of US Green Building Council) for environmentally responsible marinas and shorefront projects write ordinances specific to shellfish or water quality protection; tie proposed shorefront development to shellfish protection; e.g., through 1) better-than-standard waste treatment from shorefront projects (**zero discharge from marinas**), and 2) generous **mitigation fund for residential OBD conversions** in the area.	**USACE/DEP**: • broaden definition of wetland mitigation to include restoration of closed shellfish grounds **Coastal Towns:** • w/DMR, track and map OBD conversions over time • through incentives (zoning, tax) encourage waterfront developers to go beyond compliance and gain recognition for environmental leadership
14. **RULES FOR NEW ROADS:** Work toward minimizing NPS and impervious surfaces.	**Towns/Local Roads Ctr**: Write town ordinances that require new private roads to be built to the same drainage and maintenance standards as new town-maintained roads. **Towns**: research parking and road width ordinances, use	**Towns**: revise parking and road width ordinances, use Center for Watershed Protection calculations **Towns**: write exaction, impact and mitigation fees in subdivision ordinance and commercial

GENERAL RECOMMENDATION	PRIORITY ACTIONS (2007)	ACTIONS DOWN THE ROAD (2008-)
Provide towns with mechanism to levy exaction, impact and mitigation fees appropriately with respect to roads and associated BMPs	Center for Watershed Protection calculations to reduce area of impervious cover **Towns**: research exaction, impact and mitigation fees in subdivision ordinance and commercial development; can these fees be applied to roads and related infrastructure? (a town road inventory and management plan, detailing present and future costs to town would help this effort; see #4 above)	development;
WATER QUALITY & HABITAT INFORMATION		
15. **Promote active ENVIRONMENTAL EDUCATION** Foster awareness of "watershed thinking" and **broaden the species focus** beyond Atlantic salmon, several other species can be "charismatic", e.g., native brook trout, migrating alewives, shad Communicate **BIOLOGICAL MONITORING & STRESSOR IDENTIFICATION** to the public	**DEP/SVCA/SRWC/Chewonki:** • Highlight **Montsweag Brook** as restoration and education**;** gather baseline data in prep for dam removal in 2009. • Foster "watershed thinking" through a public education campaign, distribute maps and other media widely • Develop Stream Teams in the Sheepscot for summer 2007. Explore the feasibility of a volunteer macroinvertebrate monitoring program in the Sheepscot. Focus on **Montsweag Brook**, site of dam removal. • Fund current effort by DEP to develop **Volunteer River Monitoring Network** (currently proposed for water chemistry data collection only) • **SRWC/IF&W**: advertise brook trout study **DEP/SWCDs/SRWC**: Package DEP's (Susan Davies)	**Local Leaders**: work with partners to move **volunteer bio-monitoring** forward in the Sheepscot, based on discussions and trial monitoring in Montsweag. In seeking funds, make **youth education** the focus rather than data collection. • explore forming a **Youth Conservation Corps** in the Sheepscot, to assist homeowners with conservation landscaping **SWCDs**: increase emphasis on Sheepscot as part of annual Conservation Fair in Knox-Lincoln

GENERAL RECOMMENDATION	PRIORITY ACTIONS (2007)	ACTIONS DOWN THE ROAD (2008-)
	presentation on biological monitoring for public consumption. Demonstrate the utility of Stressor Identification to the public via a volunteer monitoring project (e.g., **Montsweag Brook**) publicize biological monitoring in the Sheepscot as a volunteer and educational opportunity **$➔** EPA funds? **$➔** Maine Yankee settlement funds applied to Montsweag Brook and Gulf of Maine Council • In seeking funds, make **youth education** the focus rather than data collection.	**DEP/SWCDs/Local Leaders**: train volunteers to present on biological monitoring at schools and public events; combine with field monitoring. **DEP**: keep SRWC abreast of latest developments in modeling, assessment, EPA rules, etc. **State/vol monitors**: increase the number of **biological monitoring sites** in the Sheepscot watershed and number of trained personnel.
16. **RECONVENE** the Sheepscot River Monitoring Strategic Plan group (multi agencies and others) and establish as an annual or semi-annual meeting	**DEP:** contact all groups and reconvene in 2007. Agenda should include 1) specific water quality monitoring recommendations 2) responsibility for KRIS database 3) self-nomination of agency contacts 4) focus on SI and Biological monitoring, use of volunteers 5) reports from recent geomorphology studies	**NGO/DEP:** translate academic info for public audience; focus on particular water quality recommendations for each of the 8 subwatersheds
17. Use existing **GIS mapping** resources and initiatives to	**Time&Tide/land trusts**: co-ordinate the two GIS-based watershed inventories now underway - **NRCS Rapid Watershed Assessmen**t and land trusts' **Sheepscot Watershed Focus Area Project** - to save time and money	**SVCA & Kennebec SWCD GIS Depts**: equip towns in the watershed with GIS capabilities (e.g. ArcReader). Make products of the Focus Area Project available but also concentrate on

GENERAL RECOMMENDATION	PRIORITY ACTIONS (2007)	ACTIONS DOWN THE ROAD (2008-)
publicize conservation in the watershed to foster a watershed consciousness	and produce results that lead to large grants for implementation. (See **BUFFER BASKET**) • SVCA: borrow GIS and field data already compiled by TNC? • Time&Tide: RWA manager to meet w/SVCA to discuss GIS data collection, mapping, pool data and use results?	town needs such as culvert inventories and road repair schedules.
18. Emphasize importance of the SHEEPSCOT in **Atlantic Salmon recovery.**	**ASC/SWCDs**: write news articles around recent redd survey and parr counts (highest in many years), build interest in adult returns of 2008, 2009. **Time&Tide/ASC/SWCDs:** use the Sheepscot/St George Rapid Watershed Assessment (2007) as another vehicle to publicize the conservation value of the Sheepscot to a broader audience.	**ASC/SWCDs/SRWC**: follow-up on news of adult returns in 2008, 2009 • translate national importance recognized by federal agencies (NOAA, NRCS) into public press. • involve State legislators
19. **DEP and EPA explore alternatives to TMDL reports for 303(d) listed waters**	**DEP**: tally cost of TMDLs for the last 3 years; estimate cost of future TMDLs in the Sheepscot watershed (the 303(d) waters) if these would be undertaken and translate to alternative actions (e.g., budgeted actions detailed in the NRCS Rapid Watershed Assessment under development in 2007, town road management plans, costs of NPS remediation)	**DEP/EPA**: discuss TMDL alternatives that are feasible under Clean Water Act.
20. Increase awareness of	**DMR**: report Sheepscot Bay data to the coastal Towns, devise monitoring protocol to measure baseline coliform	**NOAA/UMaine/others** • encourage research to compare historic

GENERAL RECOMMENDATION	PRIORITY ACTIONS (2007)	ACTIONS DOWN THE ROAD (2008-)
SHELLFISH BEDS as priority resources in the lower watershed and indicators of ecosystem health. With an emphasis on fisheries, foster awareness of the impact of development and NPS pollution on the health of the estuary and coastal waters.	pollution before marina development **DMR:** concentrate coliform and red tide monitoring at proposed shorefront development sites to establish baseline. **SRWC:** • recruit DMR staff as regular speakers at SRWC. • Re-engage the DMR Shellfish Sanitation program in the Water Quality Strategic Plan group.	shellfish production of Sheepscot River and Bay and potential production based on reference watersheds.

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