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A Plan for the Future of the Presumpscot River: Cumulative Impacts to Environmental Conditions on the River and its Shorelands

Presumpscot River Management Plan Steering Committee

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How Has Use of the River, and Concern About Impacts to the River, Changed Over Time?

Original accounts and archaeological findings on the Presumpscot report it to have been a rushing river with many falls and rapids; abundant fish life, including sea-run species such as Atlantic salmon; and a Native American population (the Rockomeecook tribe of the Abenakis) living largely off the river's bounty, supplemented by corn fertilized with fish caught at the river's falls.

The Presumpscot has a rich history. The river was settled early in Maine's history (the first dam was constructed at Smelt Hill in the early 1730's). The power and water supplied by the Presumpscot were fundamentally important to the early development of the area. Without the river there would have been no mills and little development in the area. The Presumpscot was the site of Maine's first pulp mill, first hydroelectric project, only significant canal, and largest gunpowder mill.

The impact of this development on the river has been significant. No other river in Maine has virtually all its hydraulic head captured behind dams.

While use of the river for power and waste disposal were viewed as a normal part of economic development at the time, the impacts of the dams to the river's fisheries have been a concern since the 1700's. It was the site of one of the first serious disputes over water rights in Maine (fish versus

Cumulative Impacts to Environmental Conditions on the River and its Shorelands

dams). Orders from the Massachusetts Legislature in 1735 and 1741 required that any dams constructed on the river provide passage for fish. In the 1840's concerns were raised over pollution of the river with bark and sawdust; in the 1850's the paper industry was established on the river, and a number of other industries including woolen and textile mills, iron works, and a gunpowder mill added to the pollutant loading of the river. For the next 100 years, industrial uses of the river were pre-eminent over other uses.

By the 1950's the condition of the lower river was similar to most rivers in the developed northeast -- it was heavily polluted and its primary value was as a conduit for waste. The culture of environmental consciousness that grew in the 1960's, led to passage of the Clean Water Act and marked reductions in water pollutant discharges by the 1970's. While industrial and municipal treatment plant discharges to the river have been dramatically reduced since the 1960's, nonpoint sources of contamination from development and other land uses in the watershed have increased.

Interest in reclaiming the river was given a boost in 1992 when the Maine Department of Inland Fisheries & Wildlife undertook one of its most successful efforts to reestablish a trout and salmon fishery in the upper reach of the river, below Sebago Lake. More recently, the removal of the Smelt Hill Dam at head-of-tide, and cessation of the Westbrook Mill's pulp operation have combined to improve the condition of the lower river and air quality in the area. As in the past, this has given rise to a new set of competing interests, which are being addressed by this planning effort.

How Have Water Resources Been Impacted Over Time?

Altered Flow Regimes

One of the most significant changes to the natural river, dramatically altered hydrology, resulted from controlling flows from Sebago Lake, and the development of dams and impoundments on the river. This changed both the flows and character of the river, and altered water levels on Sebago Lake. This analysis addresses cumulative impacts to the river, but does not address changes to Sebago Lake.

Naturally occurring flows were undoubtedly more variable than flows that have occurred with regulation by the dam at Sebago. The figure above compares a typical hydrograph of flows in the Presumpscot River at Westbrook with a hydrograph for the Ossipee River, a comparably sized river with significant headwater lakes. This comparison indicates that the principal effect of the flow regulation at Sebago Lake has been to augment low flow periods. In addition, the hydrographs suggest that flow regulation also moderates high spring flows, and tempers the effects of summer storms (the Presumpscot River is less flashy in the summer).

In addition, current velocities have been decreased by the dams in places along the river; these dams have largely converted the river from free-flowing to a series of impoundments.

Changes in Water Quality

Because the basin was originally almost entirely forested, the original water quality naturally occurring in the Presumpscot River was in all likelihood very similar to that in Sebago Lake, its source.

The cumulative impacts of waste discharges, watershed development, and damming of the river are quantifiable. Changes in water quality include:

- Increased Total Suspended Solids
- Increased Dissolved Solids
- Lowered Dissolved Oxygen
- Increased Bacterial Levels
- Shift to Pollution-Tolerant Aquatic Organisms
- Elevated Temperature

Changes in Aquatic Habitat

In the Presumpscot, the community of aquatic life has been adversely affected by cumulative impacts in the river: sedimentation, warming, and creating impoundments. After the historic removal of the Smelt Hill Dam, over half of the river remains impounded.

How Have Estuarine Resources Been Impacted?

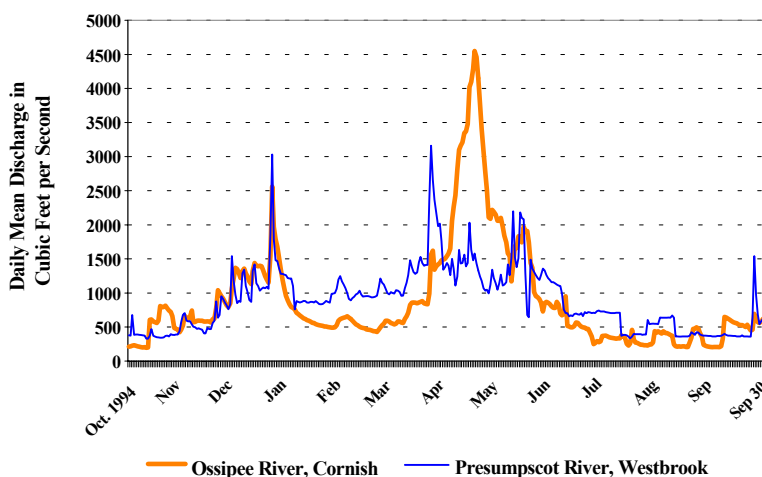
Salinity

It is unclear what estuarine species are benefited or disadvantaged by the existence of more stable fresh water flows to Presumpscot estuary, but it is clear that the system is different (more stable, less dynamic) than it would be under natural conditions.

Chemistry of Estuarine Sediments

The Presumpscot River estuary is a large depositional area where fine-grained sediments carried downstream by the river are accumulating. The fine-grained sediments of the river's estuary have moderately elevated levels of metals and high levels of PAHs (polycyclic aromatic hydrocarbons). Also the estuary has the highest levels of dioxins and furans found in Casco Bay.

A Comparison of Existing Flows on the Presumpscot River with the Ossipee River, an Uncontrolled River in the Adjacent Saco River Drainage



USGS Data, 1994

Volume of Sediments

The volume of coarse sediments reaching the estuary has been reduced by dams, while the volume of fine sediments has been increased by discharges and erosion in the watershed.

Estuarine Water Quality

The extent of eelgrass beds is often used as a positive indicator of estuarine water quality. A 1993-1995 eelgrass mapping project undertaken by the Maine Department of Marine Resources (MDMR) did not detect the presence of eelgrass in the estuary of the Presumpscot, a sign of a degraded condition.

Estuarine Animals

Pollution traveling downstream with the river has impacted estuarine organisms. In 1991, the Maine Department of Environmental Protection data indicated that dioxin, a carcinogen, was present in soft-shelled clams in the estuary in significant amounts, presenting a cancer risk of one in one million.

Eliminating the runs of sea-run fish and reducing the runs of American eels (a species that lives in fresh water and spawns in the ocean) has impacted the estuary as well as the river. Runs of approximately 34,500 to 136,000 adult American shad and 150,000 to 200,000 adult alewives, and 450,000 blueback river herring potentially could be restored to the river. If these potential runs develop, hundreds of millions of juvenile shad, alewives and bluebacks would be hatched in the river each year and tens of millions would migrate out of the river each year. The yearly migrations of these adult and juvenile fish would make the Presumpscot River estuary and Casco Bay more attractive for a wide variety of predators including, but not limited to, kingfishers, great blue herons, osprey, bald eagles, striped bass, and seals. Researchers on Delaware Bay concluded that restoring alewives and river herring to an area that is only half the habitat potentially available on the Presumpscot would produce between 539 pounds and 73,696 pounds of striped bass and weakfish in the Delaware Estuary.

How Have River Fisheries and Aquatic Life Been Impacted?

Historical documentation of the fishery noted that *"The Presumpscot is a ... rapid river ... frequented by salmon, shad and alewives, but seems to have been best adapted to salmon"* and that salmon ascended the river to Sebago Lake and beyond (United States Commission of Fish and Fisheries, 1887).

Major changes to the fish resources of the basin include:

- blocking (by dams) of fish passage for anadromous (salmon, shad, alewives, etc.) and catadromous (eels) species; DMR has estimated that if access were restored for 3 species (shad, alewives and blueback herring) that fish runs totaling approximately 634,000 to 786,000 fish could be supported by the river;
- fragmentation of habitats as a result of dams on the river;
- a shift from fast moving coldwater riverine habitats to a series of slower moving impounded areas (15 of 17.5 miles of the original river above the Cumberland Mills Dam remains impounded). This change favors fish species such as bass and panfish at the expense of native salmonids; and
- deterioration of water quality (including depressed dissolved oxygen conditions) resulting from industrial and municipal discharges.

How Have Threatened and Endangered Species Been Impacted?

Impacts to threatened and endangered plant species inhabiting the Presumpscot River corridor include loss of habitats, particularly floodplain forests as well as reduction in the productivity of these areas. Two plant species identified by the State as threatened or species of concern have been observed and two others reported historically. One of these species (small whorled pogonia) is extremely rare nationally. Agriculture, timber harvesting, inundation by impoundments, loss of anadromous fish, development and pesticide use have all contributed to cumulative impacts on certain threatened and endangered animal species (e.g., bald eagles).

How Have Recreational Resources Been Impacted?

Dams on Presumpscot have changed the character of the river from a fast moving river falling 267 feet over more than a dozen falls and rapids, to largely a series of impoundments. Until the recent removal of the Smelt Hill Dam, which restored 7 miles to riverine conditions, the Presumpscot had only 5 miles out of 27 that were not impounded, and approximately half of this was the tidal section of the river below the Smelt Hill Dam. Above Cumberland Mills Dam, only 2.5 miles of the river is free-flowing, and unimpounded sections are generally small segments, except for the Eel Weir Bypass Reach, which is 6,700 feet long (this section receives only a minor portion of the total outflow from Sebago Lake, most of which goes through a power canal). As a result, impacts to recreational resources include loss of opportunities for whitewater boating and extended river canoe trips as well as loss of coldwater fishing opportunities on the mainstem of the Presumpscot River. At the same time the dams have stabilized flows and created impoundments and opportunities for flat water recreation.

How Have the Local and Regional Economy Been Impacted?

The subsistence economy of the Native Americans who first inhabited the Presumpscot River area was based largely on the food resources provided by the river. This economy was in place for thousands of years before Europeans settled the area. In the 1700's, the European colonial economy was based on a mixture of agriculture and related industrial development.

It would be difficult to overstate the importance of the river to the region's early industrial economy. The power and water provided by the Presumpscot River, particularly the reliable flows which resulted from damming and managing the water level on Sebago Lake, were the reasons for the growth of industry and population centers on its banks.

The river and its management continue to impact the region's prosperity. Today, dams on the river produce low-cost electricity for the SAPPI mill in Westbrook, which provides jobs for over 500 people (energy savings are estimated at approximately \$2 million per year), and contributes approximately \$85 million per year to the local economy. However, the future of the SAPPI Westbrook mill depends on many factors beyond the energy production at these dams.

In addition, regulation of river flows through controls at Eel Weir Dam at the outlet of Sebago Lake (not proposed for removal by any option under consideration) has provided higher more constant summer flows, reducing wastewater treatment costs for downstream municipal and industrial dischargers.

The waterpower of the river has fueled the area's industrial economy, but there has also been an economic price to pay. This includes the external costs of industrial development borne by the public -- the cost of government programs to reduce pollution, public health costs, etc. -- resulting from industrial discharges. Another cost is reduced water quality, with reduced opportunities for trout and salmon fishing, loss of recreation opportunities, and aesthetic impacts. These costs are somewhat offset by enhanced opportunities for flat water recreation and bass fishing.

All of these costs have economic impacts, as well as impacts on the quality of life enjoyed by residents and visitors. For example, a statewide study found that inland fishing supports over 5,000 jobs and has a total economic output of \$292 million. Of course, only a small portion of this total results from fishing on the Presumpscot; however, it is likely that the loss of trout and salmon populations has resulted in a loss to the regional economy.

In comparison, in the year 2001 the pulp and paper industry employed 13,200 people in Maine and comprised about 4.5% (\$1.45 billion) of Maine's Gross State Product (information from the Maine Pulp and Paper Association), of which only a small portion is attributable to the economy of the Presumpscot Basin.

Thus, the development of the Presumpscot River and its corridor has resulted in important benefits as well as losses to the local and regional economy and environment. While society has benefited from the use of its waters for industry, for power, and for the dilution of wastes, the cumulative impacts of human use have eliminated most of the natural values of the *"river of many rough places."* The challenge faced by this planning effort is to find solutions to problems which reduce cumulative impacts, improve the quality of life for residents and visitors, increase economic activity based on improvements in environmental quality, and support both new and traditional industries.