October 3, 2007

Coopers Mills Dam Committee
Final Report

Section I: Introduction and Summary

The Coopers Mills Dam Committee (A list of members at the end of the report) was established by the Selectmen of the town of Whitefield to review options with respect to the dam, including the possibility of establishing a hydro power station at the site. The committee consisted of several residents of Whitefield and was assisted in its work by representatives of the Sheepscot River Watershed Council and other interested organizations who formed a coalition seeking to replace the dam with a rock ramp facility (the coalition). The committee met with hydro developers, state and federal government officials, engineers, biologists and others. Thanks to a generous donation by the US Fish and Wildlife Service, the committee was able to draw on a "pre-feasibility" study of the hydro potential at the site, prepared by the firm Gomez and Sullivan (the G&S study). The committee also made use of studies of the dam prepared for the Coalition by the firm Kleinschmidt Associates (the KA study).

Built over a century ago, the Coopers Mills dam (CMD) is a 150 foot long concrete and stone structure, owned by the town of Whitefield. On the east end of the dam is a concrete Denil-type fish ladder with wooden baffles, which is owned by the Maine Department of Inland Fisheries and Wildlife. The dam was used to power a sawmill until the 1940s; its major use now is to impound water for the fish ladder and for a fire hydrant. Located in the center of the village of Coopers Mills, the dam has long been a cultural and aesthetic center for the community.

The dam leaks in two places. On the west side, two culvert gates are permanently frozen open and on the east upstream side there is a hole which allows water to seep under the dam. During periods of low river flow, these leaks can cause the impoundment to drop below the level at which the fire hydrant and the fish ladder are operable. The committee heard a variety of opinions about the cost and complexity of repairing the dam's leaks. Based on these views and its own judgment, the committee believes that the leaks could be repaired using local resources at considerably less expense than the $218,000 in the KA report. Repairing the leaks would raise impoundment levels to the top of the spillway and fix low flow problems with the fish ladder and the hydrant.

The Sheepscot is home to several fish species, including the federally endangered Atlantic salmon, whose normal migratory patterns take them past the dam. The fish ladder, which is owned and regularly maintained by the State of Maine, allows fish to bypass the dam going upstream and downstream, as long as the flow of water is sufficient to keep the level of the impoundment at the top of the dam. Under current conditions, it appears that passage around the dam is generally available to most species at times of typical use, except sometimes for the late summer and fall downstream passage of young alewives, which may have to wait for the return of high water in the fall. Upstream passage for salmon may also be blocked at times. A Maine state official who has worked with the fish ladder for many years told the committee that fixing the leaks would also fix most problems associated with the fish ladder.

The G&S study shows that the physical potential for a small hydropower facility exists at the CMD site but there are questions regarding its economic feasibility under current conditions. Under one scenario, raising the level of the dam two feet by adding flashboards, which formerly existed at the dam, would create the power capacity of 190 KW and, based on average annual flows, would produce an estimated average of 572.24 MWH annually. Using the range of daily average spot power prices over the past year, this would produce annual revenue between $40,710 to $27,140. Price subsidies for alternative power about to take effect in Maine and available now elsewhere in New England could substantially increase the annual revenue, according to officials at the Maine PUC. A developer would have to consider whether potential income would be sufficient to justify the cost of installing and operating a hydro facility. Any developer would also be required to obtain federal and state permits to begin operation. The state official responsible for the hydro permitting process told the committee that a "working assumption" would be that a hydro facility at the CMD would be eligible for the so-called "exemption" permitting process, which could typically take 2-3 years for completion. During the study two hydro developers visited the site and expressed possible interest in it; one has submitted an outline proposal which is attached to this report.

Section II: Recommendation: The members of the CMD committee unanimously recommend the following to the Selectmen and the citizens of Whitefield:

The dam should be repaired to fix existing leaks, which would allow year-round, unimpeded functioning of the fire hydrant and the fish ladder. We believe this can be done at considerably less expense than the $218,000 mentioned in the KA report. As a practical matter, the Selectmen should immediately formulate and issue an RFP for repair of the dam, which will elicit more precise cost information. With a plan for repair in hand, the town can initiate pre-consultation with the Corps of Engineers and, if required, submit an application for a permit. Based on what the Committee has been told, it appears there are reasonable prospects that this process could be completed in time to allow repair to begin in the summer of 2008, at the time of the next expected period of low water. The committee identified several possible sources of funding and it recommends that the town seriously pursue outside funding sources. Nevertheless, it is likely that the town would have to commit its own resources to repair and maintenance of the dam. Members of the coalition told the committee that if the town decides to repair the dam they would help seek funds for repairing the fish ladder and enhancing the fire hydrant but thought it unlikely they could provide money for dam repair itself. As the process of repair goes forward, and based on the fact that removal of the dam could not be easily undone and on the public benefit of encouraging the use of clean, renewable, and domestic energy such as hydro power, the town should continue to study the option of finding a developer interested in installing and operating a hydropower facility at the dam.

Section III -- Hydro Power

Hydropower capacity is basically a function of the height of the fall of water at the site (head) and the amount of flow of water over the site. This basic calculation is affected by many other factors, including average flow levels over the course of a year

and the efficiency of generating equipment used. Available capacity is also affected by regulatory requirements that some flow be used for other purposes, such as fish passage.

The current head at the CMD is 10 feet. This could be easily raised to 12 feet by adding flashboards -- essentially temporary barriers -- to hold back water at the dam's spillway. Head could also be raised by piping water from the dam to a generator further downstream (penstock) but this adds cost, legal, fish passage and permitting complexity.

Flow of the Sheepscot varies considerably over the year. According to the KA study, the mean annual stream flow at the dam is 138 cubic feet per second (cfs) and the G&S study said that a flow of 100 CFS is equaled or exceeded at the CMD 41% of the time.

The G&S study looked at five possible head (site) options for a hydro facility at the CMD. It assumed a maximum usable flow of 220 cfs and a minimum useable flow of 55 cfs. It assumed an operating efficiency of 85% and a down-time of 8%. It also estimated that a good case could be made that any hydro site at CMD should only be required to divert for fish passage use the regulatory minimum of 18 cfs.

Based on the above assumptions, G&S calculated that a CMD hydro facility using two-foot flashboards (which seems to the committee the simplest option) would have a power capacity of 190 KW and an average annual power generation of 590 MWH To estimate revenue G&S looked at the maximum ($75/MWH) and minimum ($50/MWH) wholesale price of power over the past year in Maine. Annual revenue respectively would be $40,710 and $27,140. (A G&S table with these power generation and revenue options across the five head options and with a range of regulatory required by-pass flows is also attached.)

It should be noted that these G&S revenue calculations do not include any currently available or potential future subsidies to renewable energy power producers. Maine has adopted a renewable energy portfolio requirement, which will obligate power producers to include an increasing percentage of their generated power from renewable sources such as hydropower. Based on the experience of similar programs in other New England states (for which the CMD would also be eligible) officials at the Maine Public Utility Commission (PUC) thought this could add as much as $50/MWH to the estimated revenue from the dam's power, that is double the current lower end wholesale price. The CMD might also be eligible for other subsidies, such as carbon credits.

The G&S study also attempted an economic analysis of cost and payback time associated with a hydro site at the CMD. G&S estimated capital costs (including licensing) could range from $3,338,000 to $4,778,000. The author of the G&S study told the committee that he believes the Coopers Mills site is "marginal" for hydropower generation. However, he also acknowledged that he was unfamiliar with possible revenue subsidies which, as noted above, could substantially increase revenue, perhaps double it. With concerns growing about global warming and energy independence, the committee believes such subsidies are likely to increase. Moreover, the cost side of the G&S study was not site-specific; rather it looked at capital development costs of sites elsewhere in the North East, where costs could well be higher. It also took capital cost estimates from the KA study, which the committee and the developer who submitted a proposal to the committee believe could probably be reduced.

The committee consulted with several hydro developers who expressed potential interest in the site. One developer submitted an outline proposal showing how hydro might be developed at the site. (That proposal is attached to this report.)

The committee believes it makes sense to give serious study to installing a hydro power facility at the CMD. This study would go forward as the dam is being repaired, in order to fix problems with the dry hydrant and fish ladder, and because any hydro option would necessarily also require the dam's leaks to be fixed.

Section IV -- Fire Protection

The impoundment behind the dam supplies a dry hydrant for use by the Whitefield and neighboring fire departments. The hydrant has been used by fire departments in several recent fires.

The intake for the hydrant sits on the bottom of the river bed toward the eastern end of the dam. Fire department pump trucks pull in water through a permanently installed pipe accessed by driving down a short gravel road to the edge of the dam. According to the KA study, the hydrant intake is estimated to be in less than one foot of water on the average slightly more than one month out of every year, a figure which is roughly confirmed by the memories of local residents and firefighters.

(It should be noted that some considerations regarding low water at the dam may need to be revisited in light of the extensive network of beaver dams throughout the CMD drainage area, which have apparently had the effect in recent years of creating large boggy areas and holding back significant quantities of water. There is no question that leaks at the dam cause the impoundment level to decline and need to be repaired. On the other hand, it is possibly significant that the impoundment level rose quickly to the top of the dam shortly after removal of one of these beaver dams. This removal coincided with a short rainy period but the impoundment level remained at or near the top of the dam even into the following period of unusual dryness with low river flow. A definitive judgment on the effect of the beaver dams on impoundment levels at the dam site is beyond the scope of this report. But it would seem prudent to gain a better understanding of this issue before taking any costly and difficult to reverse action such as removing the dam.)

Repairing the leaks in the dam, which would raise the impoundment to the top of the dam, would provide fire departments with stable, year-round use of the hydrant. Adding flashboards to the dam, which could easily raise the level of the impoundment by an additional two feet, would add further assurance of uninterrupted use even in extraordinarily dry periods.

Repair of the dam will solve the fire hydrant issues at a fraction of the cost, in less time, and with considerably better assurance of access by fire trucks in all weather conditions than removal of the dam.

The coalition has created the "rock-ramp" option which would locate the hydrant intake behind a three foot rock barrier which its engineering studies have shown would provide a pool of water sufficient to allow year-round use of the hydrant. The coalition is seeking approximately $400,000 in funding to implement this option. Repair of the dam would accomplish the same objective more quickly and reliably at much less cost, leaving the money saved to be used for other important fish passage or general conservation tasks. Moreover, there may be some serious cost and access concerns with respect to the "rock ramp" option. The "rock ramp" option apparently calls for moving the hydrant intake point as much as 150 feet upstream from its current location. Fire vehicles would access the new intake point via a narrow unpaved road which runs

alongside the river. The coalition has apparently allocated funds to upgrade the existing road but ownership of the land is unclear and the topography of the land, which in some places slopes relatively steeply down to the river, would make any new road still relatively narrow. Fire trucks would either have to turn around at the new access point or back out down a narrow winding road. Accomplishing this under adverse weather conditions, such as heavy rain or ice and snow could well prove to be impractical, thereby rendering the hydrant inaccessible in such periods, which could well be longer than the current periods of inaccessibility caused by low water. Finally, obtaining the necessary permits for destruction of the dam and installation of a new "rock ramp" facility would almost certainly take longer to obtain and come with more conditions than the relatively simple and straightforward option of repairing the existing dam.

Section V -- Fish

The Sheepscot is home to several fish species whose passage at the dam site is really at the heart of the debate over what to do about the dam. The committee shares the concern of the coalition regarding effective fish passage and believes this can be best accomplished through repairs to the dam and the fish ladder, which can be done more quickly and cheaply than through removal of the dam and also preserves the many other benefits and values associated with the dam.

The committee met with several officials and fish biologists to discuss this issue. (Reports on fish species in the Sheepscot obtained from these sources are attached to this report.) Based on those discussions, and reflecting the fact that (according to the KA study) during the critical "low flow" months of July through October leaks in the dam make downstream passage through the fish ladder inadequate an estimated average of 56 days and based on historical experience of when periods of low flow tend to occur, it appears that species whose life cycle requires them to pass the dam can generally do so at times when they would typically make such passage, except for alewives returning downstream, which in cases of low water might have to wait for a higher flow to be able to descend the fish ladder or to swim over the dam spillway. Repairing the dam to fix the current leaks, as the committee advocates, would allow the fish ladder to work essentially throughout the year, according to a Maine state official who has been responsible for maintaining the fish ladder for many years. It is also clear that installing a hydro facility would add complexity to the fish passage issue since regulators would likely require a number of measures to assure fish passage such as minimal flow requirements, mechanisms to prevent fish from being sucked into turbines, and the like. On the other hand, these features are well understood for most species and common at hydro sites. They would add expense to any potential site and need to be factored into any developer's cost calculations but they need not pose an insurmountable obstacle to a hydro facility. One caveat to this judgment, which indeed runs throughout the entire debate on the dam, is the presence of federally endangered Atlantic Salmon in the Sheepscot, which means that regulatory conditions attached to a dam are likely to be high and which might lead some advocacy groups to try to block a hydro facility at any cost.

Certain species of fish pass up and down the Sheepscot River past the Coopers Mills dam to access spawning and rearing habitat to complete their lifecycle. These migrations are annual and follow seasonal cycles that vary somewhat among species.

The following is a summary of these fish migratory patterns relevant for this discussion, based on information from the Committee's contacts:

Alewives: Adults migrate upstream in late spring (*i.e*. May-June) to spawn. They pass up the fish ladder and are harvested at the top, with a requirement to leave at least 20,000 annually. Most post-spawned adults will return downstream in June. Juveniles and some of the post-spawning adults return downstream in late summer or early fall (August-October). In periods of low water, they may find passage down the fish ladder blocked if the water behind the dam is below the level of the fish ladder entrance.

Salmon: Adults move upstream to spawn in the late spring through early fall (May-November). There are known spawning sites upstream from the Coopers Mills dam. The adults reside in the river during the summer and early fall to await spawning season (typically November). Post spawning survivors may either return downstream immediately after spawning or wait until the following spring. Juveniles move downstream in mid-spring, typically in mid-May through early June. This pattern should allow passage either using the fish ladder or by swimming over the spillway. However during lower flows that may occur, attraction flow may be required to direct fish into a fishway.

Eels: Eels spawn in the ocean and return to the river to grow. Young eels typically travel upriver in May-June and adults typically go downstream at the end of September and October, that is at times typically characterized by high water behind the dam. Going upstream, eels may crawl up the fish ladder or the dam face; going downstream they would swim over the spillway or down the fish ladder. In some cases, regulators require mechanisms to assist eel passage. This could typically be done relatively easily by installing an abrasive substance, such as Astro-Turf on the dam face and fish ladder and providing attraction flow. Downstream passage for eels is poorly understood and in the case of a hydro facility, regulatory requirements would likely be greater, possibly including such things as mechanisms to prevent eels from being sucked into turbines or requiring down time for the turbines.

Section VI -- Community Issues

For over a century the dam has been one of the centers of village life in Coopers Mills. The dam and the waters around it have been and remain a place of enjoyment for the people of the community -- for walks, water recreation, and simply gazing. The dam site is also an attractive place for wildlife; committee members saw eagles, osprey, great blue herons and other species on their visits to the site. It is difficult to say how this would be altered by the dam's removal and the disappearance of the impoundment pool; some consequences could be negative for some species, others might be enhanced.

The aesthetic and historical values embodied in a traditional artifact such as the dam cannot be quantified but they are enduring and strongly felt. Committee members heard informally from many Whitefield citizens about the importance they attach to retaining the dam. Their concern is not misplaced. One lesson which communities concerned about their past have learned in recent years is that they should not lightly destroy their historical heritage, which is something held in trust for succeeding generations -- and that when such destruction happens, both the current and successor generations usually end up regretting it. Respect for historical legacy also has a more practical side. One thing

which makes Maine attractive to new people and new institutions is its traditional New England heritage; to the extent this heritage is bulldozed away, the communities responsible risk becoming less attractive as destinations of residence and innovation. Some options for retention of the dam, including funding options, could envision turning the dam into a center of continuing education and of use for the people of Whitefield and for their children. An approach which has been used successfully in some places is to integrate small hydro stations and the scientific, technical, and environmental lessons they provide -- into the on-going education programs of local schools. Financial support is potentially available for such programs through the Maine Voluntary Renewables Fund. Similar educational programs could be built around the fish and the history of the dam even if hydro is not an option.

The bottom line here is that repair of the dam would allow all of these multiple uses to continue, including fish passage which is the primary concern of the coalition. Removing the dam would permanently end all of these community uses and values, at considerably greater overall cost, and all for a slight increase in ease of fish passage.

Section VII -- Environmental issues

Repairing the dam provides a balanced approach toward the full range of environmental concerns associated with the site. Repairing the dam's leaks will enhance fish passage but it also preserves the option of installing a hydro facility, either now or in the future. Hydro energy is clean, renewable, non-carbon emitting, and domestically produced. It reduces air pollution, diminishes US reliance on imported energy, and helps fight global warming. It would make little sense to create free-flowing, dam-less rivers by means that fail to address the rise in global temperatures, which in years to come could well eliminate native fish from those rivers. A hydro site at the Coopers Mills dam might be small but it is important to start somewhere to create a more sensible and balanced US environmental and energy policy.

Section VIII Permitting

Permits will likely be required for work performed on the CMD, whatever option is chosen for its future. Permitting is a subject on which many claims and counter-claims have been made. This section is an effort to summarize the committee's findings on how permitting affects dam options, based on meetings and phone conversations the committee had with state and federal officials.

Permitting for repair of the dam alone would likely be less complicated and time-consuming than for installing a hydro facility and for that reason the two are discussed separately. The presence of federally endangered salmon in the Sheepscot would likely lead agencies to impose conditions on construction or operation under either the repair or the hydro option.

Repair: Permits for dam repair work would be required from the US Army Corps of Engineers, which has jurisdiction under the 1972 Clean Water Act, and from the Maine Department of Environmental Protection (DEP). The Corps official responsible for this process told the committee that carefully designed repair projects might fall under the threshold required for review, especially if any material deposited in the river, which is the Corps' primary concern, were strictly limited. In particular, repair of the gates used to close the two culverts at the west end of the dam, which are probably the source of at

least half of the current leakage, would be considered maintenance of an existing structure, and might not require a permit. In any case, there is a process of pre-consultation by which plans for dam repair could be shown to the Corps, in order to determine whether a permit would be needed. If a permit were required, the Corps would circulate the repair plans to interested federal agencies, which would have the opportunity to propose conditions for any work to be performed. One such condition which seems likely is a requirement that any work done on the dam be carried out in the summer when water levels are low. Other conditions might regulate the sediment which could be disturbed, the material such as sandbags or cofferdams which might be temporarily introduced into the river, or the type of materials or equipment which might be used in the repairs. None of the permitting concerns the committee heard would seem to be sufficient to prevent repair of the dam. It also seems reasonable to assume that regulators would take account of the fact that dam repair would permanently enhance fish passage. This principle seems to be provided for in the regulations by allowing a "supplemental environmental benefit trade-off." The degree of public interest and controversy around a proposal might also affect the permitting process; a project which might generate public controversy could lead the Corps to solicit public comments via a 30-day Public Notice period or the Corps could determine these from existing public record or hearings held by others.

The Maine official responsible for the permitting process told the committee that a permit is not required from DEP for the maintenance and repair of up to 50% at any one time of the CMD (including the existing fishway) (and more than 50% if approved by the U.S. Natural Resources Conservation Service) provided that: (1) erosion control measures are taken to prevent sedimentation into the water; (2) there is no additional intrusion into the waterway; and (3) the dimensions of the repaired dam do not exceed the dimensions of the dam as it existed 24 months prior to the repair. Any other repairs must receive a full permit from the DEP under the Natural Resources Protection Act. This permit process typically takes 6-9 months.

Hydro: Permits for a hydro facility would be considerably more complex, lengthy, and expensive than for dam repair alone. Permits are required from the Maine DEP and from the Federal Energy Regulatory Commission (FERC). The DEP coordinates its permitting process with the FERC (under the Federal Power Act) and the US Army Corps of Engineers (under the Clean Water Act). The DEP official responsible for the hydro permitting process told the committee that it should take as a "working assumption" that the CMD would qualify for the so-called "exemption" procedure within the permitting process, since any hydro facility at the CMD would be well under 5 MW capacity and since the town owns the dam, This "exemption" procedure seems to be best described not as a genuine exemption from the need to obtain permits from both the FERC and the Maine DEP but rather as a way to obtain the needed permission somewhat more quickly and easily. The above-mentioned DEP official told the committee that the entire process of an "exemption" could take from two to three years from start to finish, while obtaining a "non-exempt" permit could take five years or more. In any case, from the town of Whitefield's perspective, it would be important to insist that any hydro developer assume contractual responsibility for obtaining all necessary permits.

The first stage of the permitting process, even under the "exemption" procedure, requires submitting hydro development plans to a range of interested state and federal

agencies, which would have the opportunity to establish conditions on the construction and operation of any hydro facility. These conditions would be included in the permit application submitted to the FERC, which then formally consults with federal and state agencies before issuing a permit. At the end of this process the applicant receives a permit which would include legally binding conditions to be met in the construction and operation of the dam. These can typically include such things as minimum flow requirements, impoundment level draw-down limits, recreational access, fish passage up and downstream, and limits on sedimentation and erosion during construction.

Section IX Funding

The committee lacked the time and the resources for a full-fledged research effort into all potential funding sources for Coopers Mills dam options. It located some potential sources of funding for some dam options (listed below) but more time and effort would be needed to identify and secure any such funding. Finding donor funding for dam repair alone would present the most difficult challenge. It is also clear that any likely donor would expect the town of Whitefield to fund at least a substantial part of the expense of dam repair and maintenance.

Even though repair of the dam would solve most fish passage problems, members of the Coalition told the committee that, as a practical matter, it would probably be impossible for them to find donor money to fund repair of the dam. On the other hand, members of the Coalition also said that in the context of a town decision to retain, repair, and maintain the dam, they would work to help secure funding for expenses directly associated with fish passage such as repair and upgrading of the fish ladder.

Funding for a hydro facility would most likely be on a commercial basis, through the developer. As noted in the hydro section, some non-market price subsidies are currently available which would have the effect of increasing revenue and thereby raising the investment attractiveness of a hydro facility. Such subsidies might be expected to grow as interest in renewable and non-polluting energy sources such as hydro rises.

The fish ladder is not owned by Whitefield and responsibility for repair and maintenance does not lie with the town. The state official responsible for the fish ladder for many years told the committee that funding for repair and maintenance has been regularly obtained over the years from a variety of sources, including the Department of Agriculture, the US FWS, and NOAA.

Committee members also believe that it might be possible to set up conditions to allow at least some of the current revenue obtained from the annual alewife harvest, which now goes to the town of Alna, to be used for maintenance of the dam and fish ladder.

The following is a list of possible funding sources identified by the committee. It is not exhaustive and a full-fledged, professional research effort might well identify more.

-- Voluntary Renewables Fund: An annual program by the FERC which provides up to $50,000 in funding to non-profits for such things as demonstration projects in renewable energy sources such as hydro. This could help fund hydro construction but it would have to be linked to an educational program.

-- Wildlife Habitat Incentive Program: (WHIP) A USDA program which provides up to $150,000 for approved programs. This has been used in other parts of Maine to fund dam

related projects and the Maine state official responsible for the CMD fish ladder said the program had been used to obtain funding for it. The local USDA official responsible for this program in our area was cautious, noting that WHIP would probably not provide money for dam repair and that using the program for repair of the fish ladder could be time-consuming and would require putting together a coalition to support the project.
-- Rural Development Program: A USDA program which provides below-market, long-term financing for infrastructure projects, including such things as dam repair.

Committee Members
Louis Sell, Chair
Chuck Vaughan, Vice Chair
Tony Marple
Jim McGrath
Steve Smith

Annexes

Hydro pre-feasibility study and table
Kleinschmidt study
Oswegatchie letter
Permitting material
Material on fish in the Sheepscot