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September 14, 2016

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

ORIGINAL

Re: TransCanada Project Nos. 1892-026, 1855-045 and 1904-073

Dear Secretary Bose,

Enclosed please find my comments and recommendations concerning the Combined Study Report for Studies 2 and 3 performed in connection with the relicensing of the above operations.

Thank you,

Sincerely yours,

O Ross McIntyre

O. Ross McIntyre

Comments and Recommendations TransCanada Studies 2/3
O.Ross McIntyre
9/14/16

To: Federal Energy Regulatory Commission
Office of Energy Projects
888 First Street N.E.
Washington D.C. 20426

From: O. Ross McIntyre
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Lyme, NH 03768
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Re: **Wilder Project (FERC No. 1892-026)**
Bellows Falls Project (FERC No. 1855-045)
Vernon Hydroelectric (FERC No. 1904-073)

TransCanada Hydro Northeast Inc. Consoldated Report
Study 2/3 Riverbank Transect and Riverbank Erosion Study

Date September 14, 2016

Contents: Landowner's Comments and Recommendations Consolidated Studies 2/3

Note, Coloring in Figures 3 and 7 in this report is hard to interpret. Original prints are included in the appendix of this report for improved color rendition. A better reproduction of Figure 9 is included as well.

Comments and Recommendations TransCanada Studies 2/3
O.Ross McIntyre
9/14/16

Part I of my comments and recommendations:

Two of the Objectives of studies 2 and 3 are:

"Monitor riverbank erosion at selected sites in the impoundments and project-affected riverine reaches below Wilder, Bellows Falls, and Vernon dams (Study 2);"

"Determine the location of erosion in project-affected areas and compare these locations with previously compiled erosion maps (e.g., Simons et al., 1979)";

The serious issues I raised in my comments concerning Study 1 objectives remain and are compounded by the information presented in the results presented for Studies 2 and 3. The maps of erosion sites, now brought up to 2014, are wrong or misleading for two sites in Lyme. One would have done better to read the local paper than to examine these two maps for knowledge about erosion in Lyme. (See below)

Here is a description of what happened to River Road North:

In 2011 a large section of the bank adjacent to the western side of River Road in Lyme, just south of the North Thetford road, collapsed into the Wilder impoundment. Because of this, 1200 feeet of River Road had to be reconstructed. This road passes through Lyme and other New Hampshire river towns and was the route to Canada in colonial times. Very little rerouting has occurred, and for the most part, the road follows the same path as it did more than 250 years ago. The section of road that had to be reconstructed passes between the river and houses built around the time of the signing of the Declaration of Independence. Until 2011, the road was able to defy the record floods and ice jams to which it was subjected.

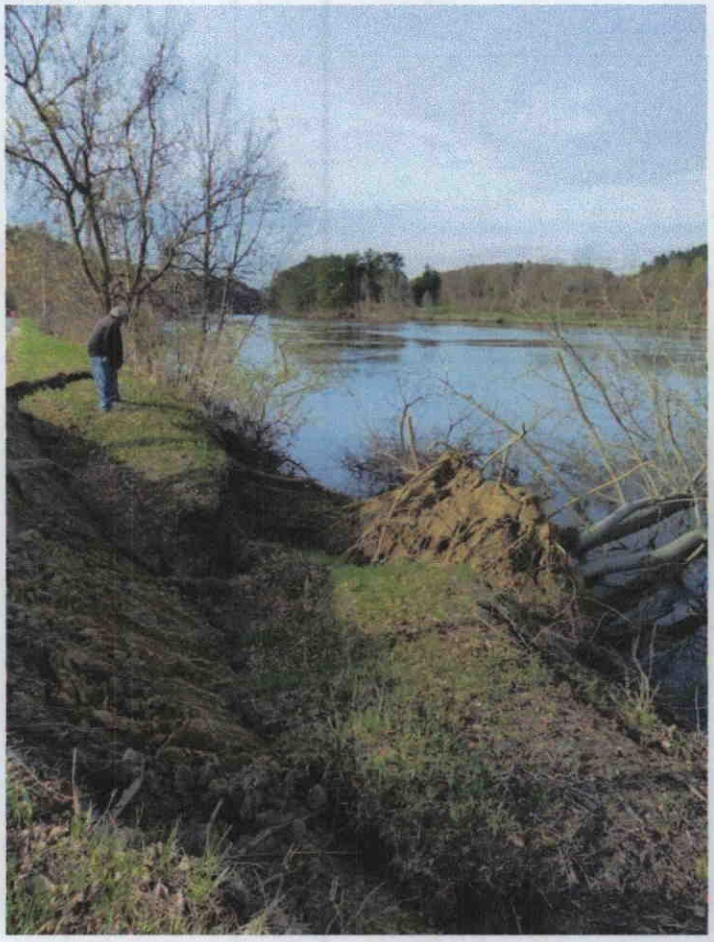

Figure 1. Collapse of a portion of Wilder impoundment bank in spring of 2011 necessitating reconstruction of 1200 feet of River Road near its intersection with the North Thetford Road in Lyme , New Hampshire.

Figure 2 River Road north adjacent to bank collapse. Note pattern of cracks in blacktop and compare with those in photo X, below, in area of slumping River Road South.

Lyme's consulting engineer on the repair of this damage, HTE Northeast, Inc. stated that the cause of the bank collapse was long-term erosion and undermining due to flow action, and existence of water in the riverbank soils. **"The frequent raising and lowering of the water level by downstream dam management (Wilder Dam), over time, is a contributing factor."**

In order to repair the road, it was moved east because of the excessive cost of reconstructing it *in situ*. The farmland to the east of the road was the subject of a conservation easement. Because of the protection of farmland conferred by the easement, it was necessary to take the land by eminent domain. The total cost of the project was about $850,000.

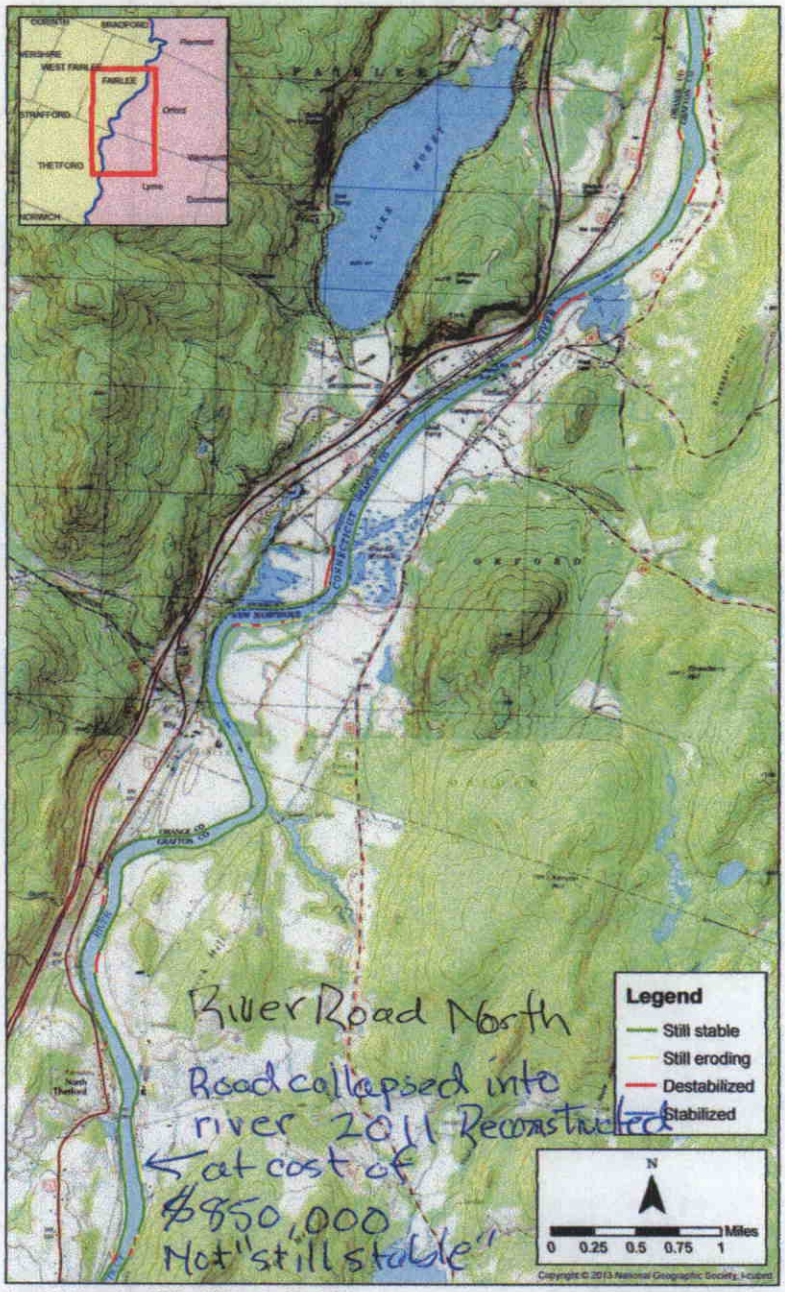

Fig. 3 I have annotated figure 20 in Appendix A of study 2 and 3 (Also described as Appendix D, Plate 3 of 14) to show this section of River Road. It is classified for erosion

as "still stable" in 2014. There is no mention that this section of road and the river bank has been completely reconstructed.

Fig4. This is the "dog leg" of the reconstructed road. It can be viewed from the river as well. Why was this change not noted on 2014 map of survey of erosion?

River Road South:

River Road a quarter mile south of the East Thetford Bridge ascends to a bench that runs along farm and woodland to the east. On the west a steep bank descends to the river below. In 2013 this section 120 feet of the western half of this road had settled, with a more pronounced dip along 30 feet the road as shown in Figure 5 below.

Figure 5. A photo taken in 2013 of River Road, Lyme, looking south about a quarter of a mile south of the East Thetford bridge. The string is on the road at each end of the slump which is 7 inches below the string in the center. Note the cracking of the blacktop on the west side of the road due to the slump and compare it with the linear cracking seen in the photo taken at the site of the collapse near the North Thetford road in Fgure 2

Figure 6. 2013 photo of River road south looking west. Wilder impoundment in background. Slump in road is 7 inches. In 2014 this slump had progressed alarmingly and catastrophic failure was felt likely by consulting engineers. The road has been closed for two years while plans for constructing a bypass are developed and financed. Cost estimates are in the $2 million range.

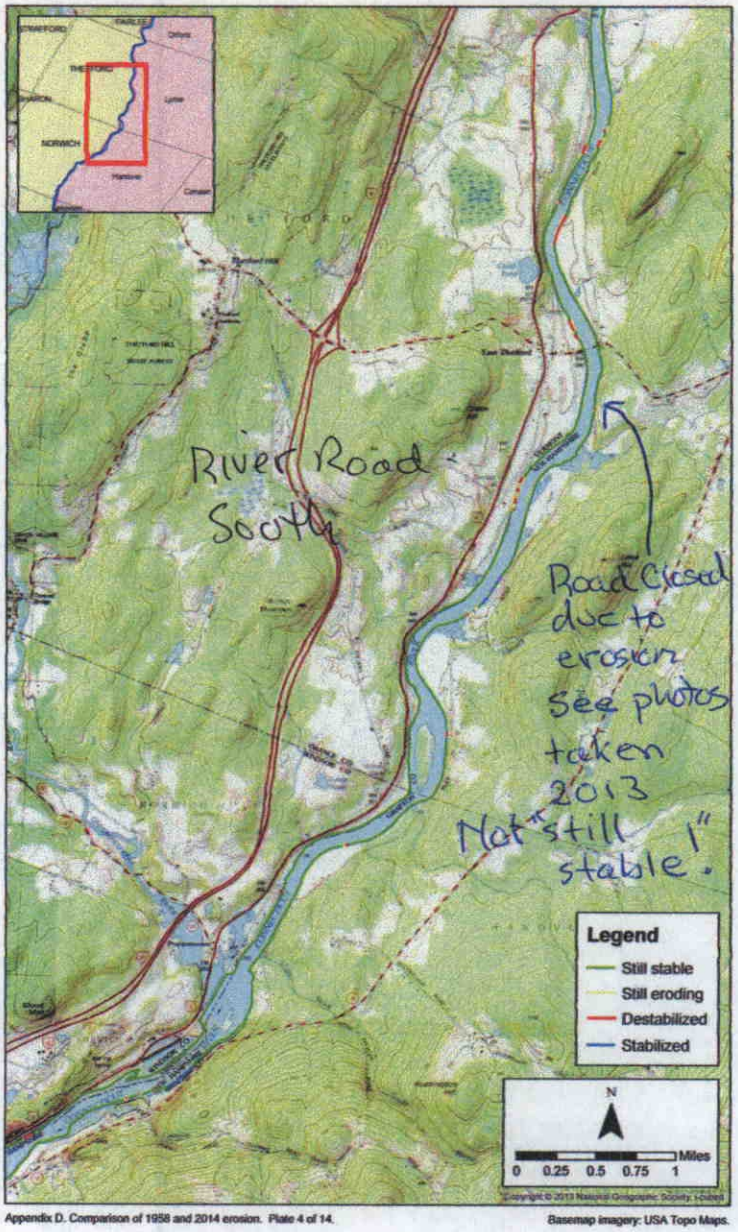

Fig. 7 Annotated Figure 21 from Appendix A (Also described as Appendix D plate 4 of 14) showing River Road south of the bridge to East Thetford, VT. Note that this section is classified as "still stable" despite a large hole in the bank adjacent to road and subsiding pavement road pavement above The hole is easily visible from river, but the sagging road surface is not easily seen from river.

Additional observations on River Road: Immediately north of the section shown in Figure 5 and 6 another several hundred feet of River road is threatened by erosion and is subject to collapse. **A survey of the rest of the road by the Town of Lyme reveals additional segments constituting about a mile in total that are in danger.**

Commentss on georeferencing and erosion mapping. Study objectives 1 and 2.

From the methodology described in the study report, I understand that update of the GIS georeference files employed aerial photographs from 2010. The figures above are labeled "Comparison of 1958 and 2014 erosion. I do not find aerial photos from 2014 mentioned. Where was the data for the period, 2010 to 2014 obtained? From the field mapping of bank conditions described in section 5.6 of the report? From LIDAR? I was with Mr. Field when he visited both sections of river road described above, and climbed down and around the hole under the section recently closed to traffic. How did this section of the bank get classified incorrectly?

Here is how the report describes the accuracy of the maps employing georeferencing:

"Given the original low resolution of the historical aerial photographs and potential errors in the georeferencing process, bank position changes of up to **50 ft** [emphasis mine] may have occurred in some areas that are not captured in this analysis. Additionally, to reiterate, the measurements of change were taken at 0.5-mile intervals so some shorter areas of significant change may not be captured in this analysis."

Recommendation: The above history of River Road erosion is coupled with a description of report methodology that allows opportunities for study personal to overlook, or eliminate from study objective 1 and 2 reports. sites of erosion known to the study personnel. That this has apparently occurred in a situation that that has damaged infrastructure and may come to litigation is of serious concern. FERC has a responsibility to correct this methodology and the conclusions based upon it.

Note: At the August 25 meeting at which the results of the combined Study 2 and 3 were presented by TransCanada and at which I objected to the results presented in the two figures cited above, John Ragonese of TransCanada stated that he would have a look at the figures I described in the report Appendix and that they "would be changed." FERC should make certain that they are changed.

Part II

In this second section of my report, I will comment on Study Objectives number 3 and 4 listed below:

. *"Characterize the processes of erosion (e.g., piping [e.g., seepage], slumping, and slips);"*

. *"Ascertain the likely causes of erosion (e.g., high flows, groundwater seeps, eddies, and water-level fluctuations related to project operations);"*

While the combined report for Studies 2 and 3 abounds with descriptive and visual information concerning erosion in its myriad forms and locations, the studies that were carried out avoided any likelihood of showing that operation of the dams (water level fluctuations) causes erosion or, if so, how much. I believe that these study questions is why FERC required the studies of erosion. It is becoming more important than ever during this license renewal because after 60 years of project operations major infrastructure damage caused by erosion is a problem for the communities involved. I believe that the process of determining what fraction of erosion derives from operation of the dams has been biased from the outset. The Preapplication Dcoument (PAD) prepared by TransCanad at the start of the relicensing process, even before studies 2 and 3 were begun takes the position that erosion from dam operation is not a significant problem. From this beginning the Applicant has presented its beliefs on erosion rather than objective data on the topic. Let me quote from I letter I sent to Mr. Ragonese before these studies commenced.

"On page 3-14 [of the PAD] the statement is made that "*The project is operated in a daily cycle "run of the river" mode where daily inflow matches daily outflow. This may result in modest daily pond fluctuations due to upstream Project-related generation, mainly at the downstream end of the Wilder Reservoir due to the "pitch" of the river, but relatively constant water levels are maintained.*" I paddled my canoe on the Connecticut River in 1949, prior to the closure of the Wilder dam, and I find this statement outrageous. Current Wilder Lake levels are not a run of the river situation, and it is fortunate for the applicant to be able to blame the upstream dams if it isn't. A rise or fall of one or two feet during a single day prior to the presence of dams on the river would have signified a major meteorological event. The words "relatively constant" used to denote changes of a foot or more in water level in 24 hours could only be used by a person wishing to obfuscate the effects of water level changes and the statement should be removed from the Document. No unbiased person walking the river bank on even an occasional basis could agree that the river levels are "relatively constant"

Now, to the Study Report on Studies 2 and 3.

The report of studies 2 and 3 offers a tutorial on the sequence of steps that result in erosion as illustrated in Figure 8.

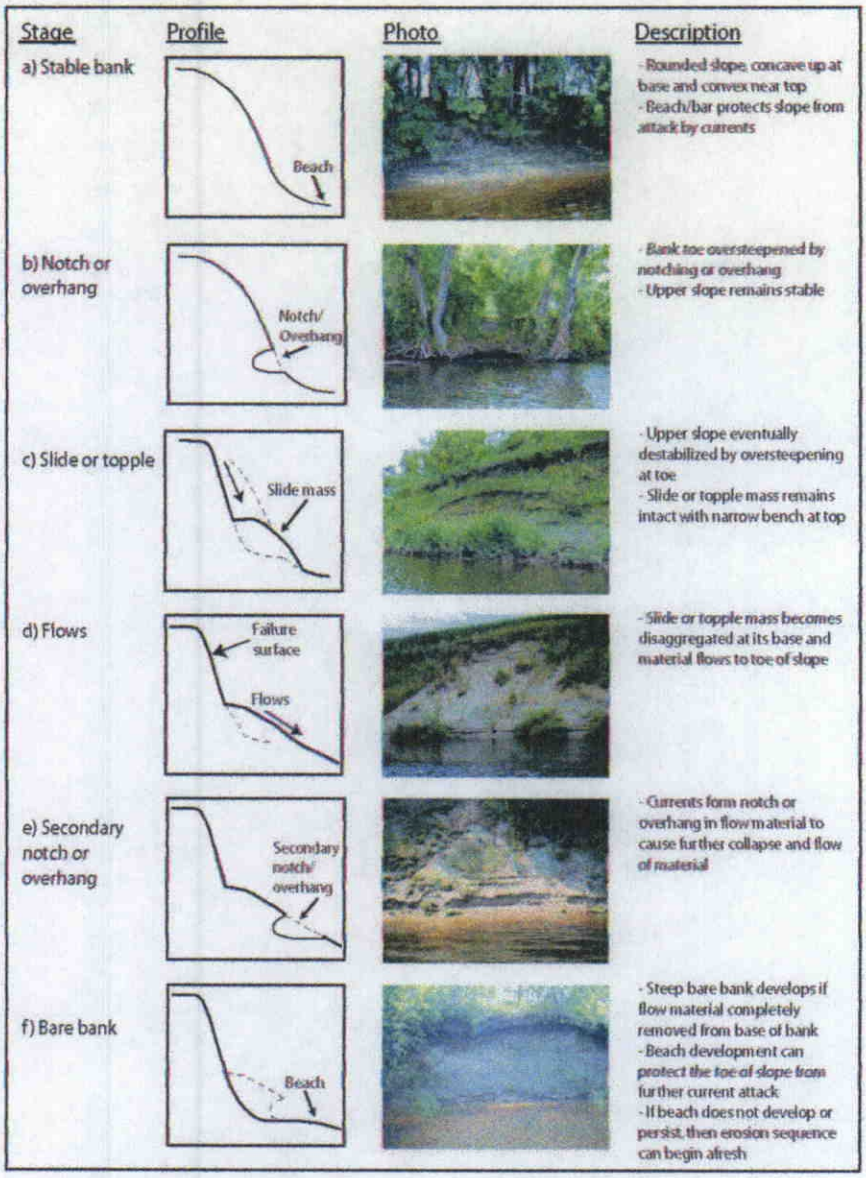

Figure 5.6.2-1. Model idealizing steps in the cycle of erosion. Different stages of erosion can be occurring adjacent to each other along a long, continuously eroding bank (adapted from Field, 2007a).

The above figure, Figure 8 of my comments, was used by John Field as he gave his primer on erosion during the presentation of the study 2 and 3 results. The sequence shown in the figure adequately describes what is seen when one examines a site of erosion. And one must agree that one of the steps in streambank erosion is the removal of bench material by high water events so that he cycle can repeat itself.

The lesson that was offered, however, ignored or failed to give adequate emphasis to an important cause of the type of erosion most likely to be active as a result of dam operations. This is piping., or as referred to by the applicant in the report "seepage" erosion.'

The failure of the report of studies 2 and 3 to include a diagram like the one shown in Figure of this report, as part of the tutorial on erosion is a deplorable omission.

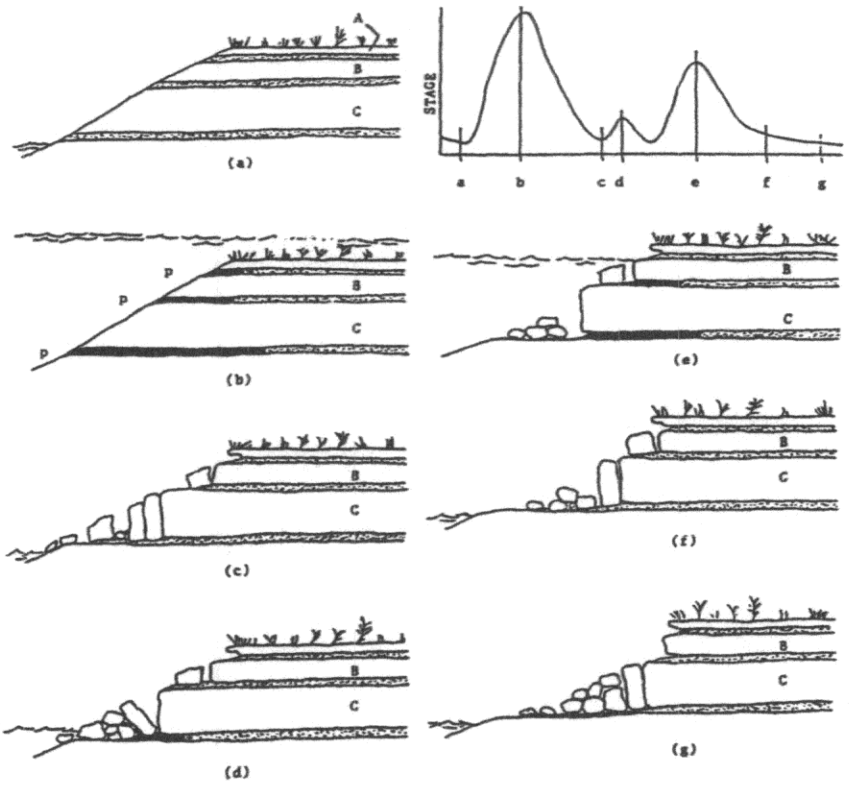

Figure 2. Sequence of stage fluctuation with attendant recharge into pervious zones (sections b, d, and e) and subsequent piping/sapping and failure (sections c, f, and g)

8

Fig 9 of my comments is taken from Identification of Piping and Sapping Erosion of Streambanks, by D.J. Hagerty, Prepared for the Department of the Army, U.S. Army Corps of Engineers. Contract Report HL-92-1 Water infiltration into susceptible soils when they are exposed to elevated water levels results in loss o material when water

levels recede. Repeated high water levels shown in the graph in the upper right hand corner, lead to progressive bank collapse.

This definitive article on piping erosion was written by Hagerty and contained in the report of his studies supported by the Army Corps of Engineers. The Corps is particularly interested in piping erosion because it can lead to collapse of dams and levees.

The scientific reports of erosion research indicate a growing community of soil and erosion experts pursuing studies of piping erosion. They uniformly describe how erosion due to piping may be difficult to detect in situations where there are other causes of erosion at work. Characteristically, the volume of water involved in piping is underestimated by those not experienced in piping studies, as is the velocity at which water moves in piping erosion. Piping erosion is more common than generally recognized and can result in bank collapse and sink hole appearance long after high water has receded. Such erosion may be recognized later when it occurs under paved roads than in farm fields where observations are easier. Piping may be anticipated when porous soils are exposed to fluctuating water levels as encountered in dam impoundments.

The photo of the "sink-hole" shown on the Mudge property in the study report probably shows a result of piping erosion. Piping may also have been an important factor in damage to River Road in Lyme as stated by Lyme's consulting engineer who studied the River Road North collapse.

The report resulting from Studies 2 and 3 takes the position that water level fluctuations in the Wilder impoundment were unlikely to be an important cause of erosion. This conclusion was based upon correlating information on the magnitude of water level fluctuations and the frequency and location of erosive action seen on the banks of the impoundment rather than any direct measurements concerning the amount of erosion caused by such fluctuations. For the applicant's present analysis of erosion the fluctuations are assumed to be greatest at the upper portion of the impoundment. The Pre application document (PAD) states that they are greater at the dam. What is true? Where are the measurements of the fluctuating water levels in the report?

Because there are so many confounding factors at work at every site of erosion, it is imperative that direct measurements be made of erosion as caused by such fluctuations. Until we know how the weight of silt removed by each rise and fall of water level of a given height at a given site, of a given soil composition, at a given temperature, etc. etc, we don't know anything about the matter. FERC and the public should not conclude that erosion due to dam operation is unimportant on the basis of a single correlative study when the applicant can't even present consistent information on one of the factors used in the correlation.

Why was modeling of water level fluctuations at each of the 21 study sites used to define the range of likely water level changes? At each site water level monitors were used to measure the water level at 15 minute intervals. Why not use these instead of a derivative measure? **Because of other bias in the report it is easy for me to conclude that the**

reason the water level fluctuations are graphed in this manner is that one gets an innocuous gray area on the transcept profile of the bank. Showing the actual water level changes at 15 minute intervals could lead to a figure that offered a view of a dynamic process underway, something that the applicant does not wish to suggest is present.

<u>Recommendation:</u> It is unreasonable for FERC to require the applicant to perform or to support the studies of others in order to determine the amount of erosion caused by the operation of its dams. Such studies should employ investigators whose work and supervision does not expose them to conflicting interests.

Given the predicted amount of infrastructure damage by erosion in the next licensing period it is likely that the issue of damage related to dam operation will be determined by litigation rather than by studies performed by the dam operator. To avoid this, a fund to mitigate damages could be a requirement for the relicense.

Another way of looking at dam operation and erosion is more basic. If we supposed that the dams had not been built and the river was in a free and unencumbered state, how much erosion would be occurring? The only erosion that would then occur *at the present erosion sites* described in studies 1-3 would be on the occasion of 100 year floods. Using this rationale, we might then assign perhaps 90% of the erosive damage we see today to the presence of the dam and its operation.