TOWN OF BRATTLEBORO

Town Manager's Office · 230 Main Street · Brattleboro, VT 05301
(802) 251-8151 Fax (802) 257-2322

January 9, 2020

To: Brattleboro Selectboard
Via: Peter B. Elwell, Town Manager
From: Patrick Moreland, Assistant Town Manager
Re: Handicapped Parking on West Side of Main Street

The ADA Committee, the Traffic Safety Committee, and Town staff all recommend the designation of a handicapped parking space on the west side of Main Street.

In 2019, these same groups recommended and the Selectboard approved the designation of a handicapped parking space on the east side of Main Street. That space is used almost continuously by residents and visitors who possess handicapped parking permits. Making the change that is currently recommended would provide a similar accommodation for the other side of the street.

As background, any owner of a handicapped permit has the right to park in any public parking space without the need to pay and without the usual time restrictions. The issue here is not cost, but availability. By mid-morning, parking on Main Street can be difficult to find for anyone. These spaces are in high demand as they are some of the most desirable (closest to local shops) spaces within the parking system. But for a person with limited mobility, if no space is found on the west side of Main Street, they must traverse either from the east side of Main Street or from the Harmony Parking Lot (the closest handicapped spaces), which may be difficult.

The west side of Main Street has parallel parking and given the existing road and sidewalk width, a truly ADA compliant space is not possible. However, this doesn't prevent a space from being designated as a handicapped space. According to the New England ADA Center, a regional resource and a member of the national network of ADA centers, "There's nothing in the ADA that prohibits the use of the International Symbol of Accessibility in circumstances where the ADA Standards have not been met."

After reviewing the conditions on Main Street and conferring with both the ADA Committee and the Traffic Safety Committee, staff recommends the first space south of High Street (in front of Duo restaurant) be designated as a handicapped parking space. The space would be appropriately striped and signed. This location is currently designated as a loading zone through the first half of the day, but Town staff and Duo restaurant employees report that this space is not regularly used for that purpose.

MEMORANDUM

To: Selectboard

From: Peter B. Elwell, Town Manager

Re: Proposed Contract with Melanson Heath For Interim Finance Director Services

Date: January 9, 2020

Finance Director John O'Connor will soon retire from Town service. We are commencing our second search for his replacement and expect that a successful outcome will result in the new Finance Director joining our team in April. To provide the necessary oversight of the Town's financial operations during this transitional period, we have arranged for the accounting and auditing firm of Melanson Heath to provide Interim Finance Director services by contract. The initial (and hopefully total) contract period will be January 15, 2020, through April 15, 2020.

Laurie Garland, a Certified Public Accountant and experienced auditor with Melanson Heath will work part-time in the Interim Finance Director position. She will be backed-up, as needed, by other Melanson Heath accountants and the Town's contract will be with the firm, not with Ms. Garland individually. The engagement will begin with a short overlap period during which Mr. O'Connor will "pass the baton" to Ms. Garland.

Melanson Heath is based in Nashua, New Hampshire, and also maintains several satellite offices, including one in Greenfield, Massachusetts. The firm is familiar with the Town's financial software and with the particular requirements of Vermont municipal finance law as it provides auditing services to the cities of Burlington and St. Albans. Ms. Garland is the partner in charge of those two audits.

The financial terms of the agreement are that the Town will pay a minimum of $5,000 and a maximum of $25,000 for the three-month engagement. Melanson Heath estimates that the hours necessary to fulfill its obligations to the Town will likely result in a total cost of approximately $20,000 during this three-month period.

Town Attorney Bob Fisher has reviewed and approved the draft agreement.

At the January 14 Selectboard meeting I will request that the Selectboard authorize me to execute the agreement and proceed with this engagement.

PBE:

MEMORANDUM

TO: Selectboard
VIA: Peter Elwell, Town Manager
FROM: Sue Fillion, Planning Director
DATE: January 3, 2020
RE: VT Outdoor Recreation Collaborative Community Grant 2019-20

The Planning Services Department is proposing to apply to the 2019-20 Vermont Outdoor Recreation Collaborative Community Grant in the amount of $50,000. We would like to use these funds to work with partners who steward publicly-accessible trails and forests to collectively increase the accessibility and visibility of recreational trail opportunities in Brattleboro and ensure that information for users is available at convenient facilities that have adequate parking, clear access points, user-friendly displays, and wayfinding signs and maps. Grant activities will include hiring a consultant to help establish a consistent trail brand, developing and distributing promotional materials includes maps and brochures, and installing signage or kiosks as grant funding allows.

Brattleboro is fortunate to have several public trails on privately conserved land easily accessible from the downtown. People come to work, dine, and shop in downtown but then leave to take advantage of recreation opportunities outside of town. As noted in our 2018 Town Plan, "The trail system is a major quality-of-life amenity. However, the existing trails are not well publicized or, in some cases, marked. Kiosks, trail maps, directions, and clearly marked trails are some of the improvements that would help residents and visitors access this natural amenity." The Town Plan supports growing our outdoor recreation amenities through the following goals, policies, and actions:

<u>Economic Development</u>

Goal A	To pursue local economic development strategies that increase prosperity and opportunity to ensure a health community that respects the physical environment.

<u>Natural Resources</u>

Policy 11.5:	Coordinate a community trail system that accommodates a variety of trail users and creates trail linkages.
Action 11.5.2	Coordinate trail alignment to provide linkages to parks, schools, the downtown, regional trail systems, and other amenities.
Action 11.5.3	Work with nonprofit and volunteer organizations and private landowners to improve recreation opportunities and enhance existing open space areas

This grant opportunity comes at a time when there is a lot of momentum to improve the trail connections to downtown. The new bridge to NH has people excited about the opportunities to create a trails hub on Depot Street, near where the existing bridges that are slated for bicycle and pedestrian conversion. We have been working with several stakeholders (The Retreat Farm, Friends of West River Trail, Windham Regional Commission, Downtown Brattleboro Alliance, and the Connecticut River Conservancy) to find opportunities to enhance and build our assets. The Retreat Farm recently received a technical assistance grant from the National Park Service to look at how to establish connections between the trail resources, where to expand the trails, and how to coordinate maintenance across the trail systems. In early December, the VOREC Steering Committee held their meeting in Brattleboro and

we had the opportunity to give them a tour of our recreational resources and discuss our needs. This was well received by the Steering Committee.

We are requesting $50,000. No match is required. If successfully funded, we will hire a consultant for the Scoping study. The grant is due January 20 with awards in February. Work is expected to be completed by May 31, 2021.

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TOWN OF BRATTLEBORO
Finance Department
230 Main Street, Suite 208
Brattleboro, VT 05301
Phone (802)251-8104 • FAX (802)257-2322

MEMORANDUM

DATE: January 3, 2020

TO: Brattleboro Selectboard

VIA: Peter B. Elwell, Town Manager

FROM: Kim Ellison, Grants Manager

SUBJECT: VT Outdoor Recreation Collaborative Community Grant

For the 1/14/2020 Selectboard meeting, please add the following to the agenda:

The Planning Department requests authority to apply for a $50,000.00 VT Outdoor Recreation Collaborative Community Grant from the VT Department of Forests, Parks and Recreation in partnership with the VT Agency of Commerce and Community Development to hire a consultant to help establish a consistent trail brand, develop and distribute promotional materials and design & install signage.

Please see the attached GISTD and other supporting documents for additional details.

Request a Motion:

To approve the Planning Department's application for a $50,000.00 VT Outdoor Recreation Collaborative Community Grant from the VT Department of Forests, Parks and Recreation in partnership with the VT Agency of Commerce and Community Development to hire a consultant to help establish a consistent trail brand, develop and distribute promotional materials and design & install signage.

TOWN OF BRATTLEBORO

GRANT INFORMATION STATUS TRACKING DOCUMENT (GISTD)

APPLICATION PHASE

Please put all answers in BOLD

Date: **01/03/2014**

Grantor/funder: **VT Department of Forests, Parks, and Recreation in partnership with the VT Agency of Commerce and Community Development**

Funder's name of grant: **VT Outdoor Recreation Collaborative Community Grant**

Internal name of grant: **VOREC**

Funder's grant description/purpose: **To make grants from $10,000 up to $100,000 available to help Vermont communities fully leverage their local outdoor recreation assets to achieve a status of being an "outdoor-recreation-friendly" community as envisioned by the VT Outdoor Recreation Economic Collaborative Steering Committee. VOREC's goals are to 1) grow the outdoor recreation related business opportunities; 2) increase participation in outdoor recreation activities; 3) strengthen the quality and extent of outdoor recreation resources; 4) increase stewardship of outdoor recreation resources; 5) promote public health and wellness through outdoor recreation.**

Applicant's purpose/use of grant: **Bring together community partners who steward publicly-accessible trails and forests to collectively increase the accessibility and visibility of recreational trail opportunities in Brattleboro and ensure that information for users is available at convenient facilities that have adequate parking, clear access points, user-friendly displays, and wayfinding signs and maps**

What will the money be spent on specifically? **1) Hire a consultant to help establish a consistent trail brand (could include logo, standardized colors, graphics and other design features) that can be used on signage, maps, or other promotional material; 2) Develop and distribute promotional materials, including printed and digital trail maps and brochures. 3) design and install signage**

Amount being requested: **$50,000** Required match amount: **$0**

Sources of Match Funds, i.e. donations, general funds? **No match required**

Application deadline: **01/20/2020** Award notification date: **03/01/2020**

Grant term start date: **05/01/2020** Grant term end date: **05/31/2021**

Grant payout: ☐ Up-front (deferred), or ☒ Reimbursed basis (accrued)

How much administrative allowance does the grant permit if any: $_____**0**_____ or _____%

Department or community group requesting grant: **Planning Services Department**

Department sponsoring the grant: **Planning Services Department**

Contact name (person submitting): **Sue Fillion**

TOWN OF BRATTLEBORO

GRANT INFORMATION STATUS TRACKING DOCUMENT (GISTD)

Contact phone: **802-251-8112** Contact email: **sfillion@brattleboro.org**

Second contact:

2nd contact phone: 2nd contact email:

Is this a new program or new service(s)? ☒ yes ☐ no

Is this a ☒ new grant, or ☐ renewal of an existing/active grant?

How will this grant improve functions in your department or for the town and/or how will it save money or increase services? **This grant would help implement the Town Plan policy to "Coordinate a community trail system that accommodates a variety of trail users and creates trail linkages".**

How will the program or service be sustained after end of grant? **Volunteer efforts**

How will the project impact the resources of the rest of the department? **Town is responsible to lead a project team with a broad range of stakeholder participation.**

How will the project affect the resources of other departments? **This will not affect the resources of other departments.**

Will this grant trigger review by the Capital Grants Review Committee? ☐ yes ☒ no

Is this a program/service/item that would need to be paid for out of the general fund if the grant is not awarded, accepted and appropriated? ☒ yes ☐ no

What are the other sources of funding for this project? **None**

What other town commitments will be required during the life of the grant? **Performance reports must be submitted with reimbursement requests.**

What are the on-going commitments or costs to town after the end of the grant? **Grantees are required for ongoing tracking and measuring of outcomes to demonstrate the long-term success of the project. Products and deliverables developed as part of the grant program must be made available for adaptation and/or replication by other VT communities.**

Department Head Name & Title:

Department Head Signature: Susan Fillion Date: 1/3/2020

Finance Director Recommendations/Comments: _____

_____

Application Approved ☐ yes, or ☐ no

Printed Name: _____

Finance Director Signature: _____ Date: _____

TOWN OF BRATTLEBORO

GRANT INFORMATION STATUS TRACKING DOCUMENT (GISTD)

Town Manager Recommendations/Comments: _____

_____

Application Approved ☒ yes, or ☐ no

Printed Name: PETER B. ELWELL

Town Manager Signature: _____ Date: 1/8/20

Capital Grants Review Committee Recommendations/Comments: _____

_____

Application Approved ☐ yes, or ☐ no, or ☒ not applicable

Printed Name: _____

Committee Member Signature: _____ Date: _____

Selectboard Recommendations/Comments: _____

_____

Application Approved ☐ yes, or ☐ no, or ☐ not applicable

Printed Name: _____

Selectboard Member Signature: _____ Date: _____

Clean water. Healthy habitat. Thriving communities.

Connecticut River Conservancy

January 2020

Hello river neighbors,

Towns along the Connecticut River have been losing land since the 40s!

In 2017, many of the Connecticut River towns that are affected by the operation of the Wilder, Bellows Falls, and Vernon dams passed town meeting resolutions that were subsequently submitted to the Federal Energy Regulatory Commission (FERC) as comments regarding concerns about erosion issues along the river bank.

In the first quarter of 2020 we expect Great River Hydro to submit a final revised application for a new license. This year will be our last opportunity to comment on the application before FERC deems it complete.

CRC encourages all adjacent river towns to pass a resolution on Town Meeting Day and submit that resolution as comments to the Federal Energy Regulatory Commission (FERC) to clearly communicate the towns' ongoing concerns and interest in making sure that project operations are changed to minimize erosion of the riverbanks, and that towns and property owners are compensated for loss of land, or needed streambank stabilization work to protect their land and municipal infrastructure.

CRC suggests the following language:

> "Whereas, the peaking operations of Wilder, Bellows Falls and Vernon dams have been causing daily surface water elevation fluctuations of, on average 2-3 feet every day in the impoundments behind the dams for at least 70 years, resulting in loss of land for landowners in VT and NH and degradation of water quality and habitat of the river for decades;
>
> "Whereas, in the late 1970s, during the last relicensing process, the Army Corps of Engineers (ACOE) conducted an erosion study on the project area; and FERC issued the last licenses in early 1979 just months before the ACOE completed their study in November of that year; and the ACOE study clearly states that pool level fluctuations are the *second most important causative factor* for erosion in the project areas.
>
> "Whereas, the erosion study completed for the current relicensing by Great River Hydro, the current owner of these three projects did not look at the effect of pool level changes on erosion, instead, focusing only on potential erosion due to velocity along the bank edge that would be typical for a natural river system; and the Connecticut River in the project area does not function as a natural river, instead functioning as a series of lakes, with water flow controlled by the dams.
>
> "Whereas, many towns and landowners up and down the river have used millions of dollars in public and private money to attempt to stabilize and restore their streambanks to protect property and infrastructure over the past 70 years;
>
> "Therefore, be it resolved that the Town of Brattleboro, formally requests that the Federal Energy Regulatory Commission require, via license article, the current and any subsequent owners of the Wilder, Bellows Falls and Vernon Dams to modify current dam operations to minimize peaking; provide for ongoing streambank monitoring; develop a shoreline adaptive management plan; and create a mitigation and enhancement fund to support riverbank restoration and/or property owner compensation to reimburse towns and landowners for any and all damages resulting from the deterioration of the riverbank."

We will only be able to protect our local property owner rights and the health of the river by commenting and making sure that FERC has heard the public's concerns. There is nothing binding in this resolution other than communication to FERC. If we do not affect change to protect the riverbanks in this relicensing process, we will not have another opportunity until 2060!

I have attached two documents with detailed background information to provide as evidence.
Please submit the resolution as comments to FERC after Town Meeting, which can be done here: https://www.ferc.gov/docs-filing/eregistration.asp. Alternately, I am glad to help you do that.

Please try to move this resolution in your town this coming March!

Kathy Urffer
River Steward
Connecticut River Conservancy, formerly *Connecticut River Watershed Council*
PO Box 6219 | Brattleboro, VT 05302 | www.ctriver.org
802-258-0413 | kurffer@ctriver.org

Connecticut River Conservancy

Clean water. Healthy habitat. Thriving communities.

15 Bank Row, Greenfield, MA 01301
413.772.2020 · www.ctriver.org

April 23, 2018

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

Re: Wilder Dam Project No. 1892
Bellows Falls Project No. 1855
Vernon Dam Project No. 1904
Connecticut River Conservancy Comments on Great River Hydro, LLC Study Reports filed by February 9, 2018; Request for Study Modification to Require Compliance with the RSP.

Dear Secretary Bose,

The Connecticut River Watershed Council, Inc. (CRWC), now doing business as the Connecticut River Conservancy (CRC), is a nonprofit citizen group established in 1952 to advocate for the protection, restoration, and sustainable use of the Connecticut River and its four-state watershed. We have been participating in the relicensing of the five hydropower facilities on the Connecticut River since the beginning of the process in late 2012. We have reviewed the set of Study Reports that were posted by Great River Hydro between November, 2017 and February 9, 2018. CRC attended the study report meeting held on March 8, 2018. Where necessary in our comments below, we will also refer to the Revised Final Study Report for Study 2 and 3, dated February 4, 2017.

ILP Study 2 and Study 3 Riverbank Transect and Riverbank Erosion Study Supplement to Final Study Report dated 11/15/2017

Comments based on peer review

CRC again hired consulting engineering firm Princeton Hydro (http://www.princetonhydro.com/) to conduct a peer review of the ILP Study 2 and Study 3 Riverbank Transect and Riverbank Erosion Study Supplement to Final Study Report ("Supplement") which was submitted to the Commission by Great River Hydro on November 15, 2017. Princeton Hydro's review is attached to this comment letter. We include some of their major conclusions below as part of our formal comments.

- The Final Study Report indicated that, "Flow velocities were measured at three impoundment erosion monitoring sites and three riverine erosion monitoring sites with an acoustic Doppler current profiler (ADCP) that measures flow velocities using the Doppler effect of sound waves scattered back from particles within the water column." The FERC's Determination on Requests for Study Modifications and New Studies dated July 21, 2017 ("FERC Determination") states, "...Commission staff recommends that Great River Hydro include, in the November 15, 2017

addendum, near-bank velocities associated with multiple water surface elevations... as measured at the six sites with ADCPs." This information was not included in the supplemental report.

- Princeton Hydro (and CRC) request plotted cross-sections for each site with the following information shown on the same figure for each of the 21 monitoring sites: (i) annotations of erosional features (as depicted in the 2/4/17 Final Report Appendix A), (ii) water surface elevation fluctuations as measured by water level loggers, and (iii) the locations of the three sediment samples analyzed at each site in the Supplement.

- Regarding the HEC-RAS modeling, the use of a single Manning's N, or roughness, with no differentiation between in-channel and floodplain, could produce erroneous results. The model was run in "unsteady flow" at a single flow. This is equivalent to running the model in "steady flow" and is an unusual use of the model. Our key concern is the effect of daily river fluctuations on the riverbanks, so running the model at a steady flow precludes analysis of the main source of project effects.

- Critical shear stress is not as conservative a measure as claimed in the Supplement because it does not account for cohesion, compaction, and other forces resisting entrainment.

- The presence of beaches at 18 of the 21 sites indicate that water fluctuations influence the bank similarly to the action of water in lakes and tidal areas – through repeated surface water elevation changes. Great River Hydro implies that beaches are natural. They are not natural in a riverine system. Water surface elevation fluctuations also inhibit vegetative growth on the beaches, which otherwise would contribute to the stability of banks.

- The Supplemental Study and the Revised Study do not address the role played by operational water surface fluctuations in perpetuating the bank erosion cycle. Water surface fluctuations directly contribute to bank failure resulting in sediment deposits at the toe of the bank. Without addressing the effect of water surface elevation changes at the transect sites, the Supplement does not prove that project operations are not contributing to bank erosion.

- Though the report and the final sentence of Great River Hydro's meeting summary conclude that, "Study 2/3 results continue to show that operational flows contribute little to bank erosion," Princeton Hydro's peer review points out that 8 out of 21 sites showed some potential for sediment entrainment, which is a significant portion (30%) of the sites. See below for CRC's additional comments on study conclusions.

Additional CRC comments

1. The FERC Determination states that "The goals of studies 2 (Riverbank Transect Study) and 3 (Riverbank Erosion Study) were to: (1) monitor the riverbank erosion at selected sites in the project impoundments and riverine sections of the Connecticut River that are affected by the projects, (2) determine the location of erosion in areas affected by the projects and compare

these locations with previously compiled erosion maps, (3) characterize the process of erosion, (4) ascertain the likely causes of erosion, [emphasis added] and (5) identify the effects of shoreline erosion on other project resources." By avoiding any direct analysis of water surface elevation changes at the transects, Great River Hydro has not sufficiently characterized the process of erosion or ascertained the likely causes of erosion.

2. The Study Plan Determination dated September 13, 2013 states, "the requested correlation [comparing water level fluctuations caused by project operations with elevations along the riverbank where there is a lack of vegetation, undercutting, or other visual signs of erosion] would provide information and would be useful to identify the causes of erosion (§5.9(b)(5) and (6)). Besides water level fluctuations, other causes of erosion include land use practices, ground water seeps, gullies, and high flows. A stated objective of the study is to ascertain the likely causes of erosion [emphasis added] at various locations. Project operations would be a likely cause of erosion where visible signs of erosion closely track project-caused water level fluctuations..." [emphasis added]. Additionally, the Study Plan Determination states, "As a result, we recommend modifying study 3 to correlate visible indicators of erosion with project-caused water level fluctuations [emphasis added] at the 20 transect locations..." Project caused water fluctuations include daily surface water elevation changes at the dam. The Revised Final Study Report and Supplement have failed to adhere to the Study Plan Determination.

3. The FERC Determination requires that, "Great River Hydro file an addendum... that includes an analysis of estimated critical shear stress, near-bank velocity, and the potential correlation of these factors with project operation at the 21 monitoring sites. This discussion should include a table for each monitoring site that lists critical shear stresses and near-bank velocities with respect to water surface elevations corresponding to project operation..." [emphasis added]. Project operations include daily fluctuations in surface water elevation at the dam, not just changes in flows with the dam held at a single elevation. Great River Hydro chose to take sediment samples based on modeled surface water elevations at transects while maintaining no surface water fluctuation at the dam. CRC contends that this was not what was asked of them in the FERC Determination and this limited interpretation of the FERC Determination does not support the goals of the study.

   Not only did the analysis for the supplemental report not involve river fluctuations, but the dam elevations used to run the velocity and sheer stress analysis do not correspond with dam operation elevations typically used for those flows. Figures in the Pre-Application Documents (PADs) dated October 2012, for example Figure 2.5-1 in the Wilder PAD, provide "normal generation ranges" for each impoundment, and it also shows the reservoir profile operation for elevation at each dam. The table below summarizes the dam elevations used in the supplemental report for the "minimum," "average operational," and "capacity" flows vs. the flows those elevations correspond to under normal operations according to the PAD. The dam elevation used for most of the Vernon Dam analysis is particularly odd, since it lies outside of the normal operational range. According to the PAD, each dam is held at higher elevations for flows within the facility's operational control, and for higher flows, each dam's elevation is lowered. That is the opposite of what was done for the analysis in this Supplement. Therefore, the dam elevations used for the analysis do not appear to reflect typical operation elevations for those flows, potentially calling the entire analysis into question.

Project	Flows used in supplemental report (cfs)			Dam elevation used in Supplement, Appendix A (NAVD88 ft msl)	Elevation converted to NGVD29 ft msl	Flow (cfs) corresponding to the NGVD29 elevation in PAD Figure 2.5-1
	min	ave	capacity			
Wilder	700	5,000	12,000	382.6 384.6 (W09 and W12 max only)	383.04 385.04	14,000 cfs <10,000 cfs
Bellows Falls	2,000	5,000	12,000	290.2 291.2 (B09 max only)	290.7 291.7	~20,000 cfs <11,000 cfs
Vernon	2,000	6,000	15,000	217.6 219.6 (V06 max only)	218.06 220.06	Unknown, outside of normal operation range <15,000 cfs

4. Princeton Hydro's peer review of the Revised Final Study Report dated 5/15/2017 noted, "The data presented in Table 5.8-1 [of the Revised Final Study Report] actually show that velocities increase between 36% and 400% during these periodic operational drawdowns, resulting in velocities significantly in excess of the threshold velocity for sediment entrainment later discussed in Section 6.1. The data presented in Table 5.8-1 therefore suggests that periodic operation drawdowns, in preparation for high flows, could regularly mobilize sediment at the toe of the streambank at 9 of the 13 monitored impoundment cross sections." We had hoped that because of FERC's request for additional analysis, the Supplement would shed some more light on this observation, but Great River Hydro instead set up their model runs for the supplemental analysis to completely avoid this issue altogether. They held the impoundment at the same elevation, and for the sites closest to the dam, the model used a higher impoundment level to run the "max" elevations, which is directly contrary to their practice, according to the PAD, of lowering the impoundment elevations for higher flows.

5. The FERC determination stated that, "Great River Hydro include... an analysis of the stratigraphy at the 21 monitoring sites, including, at a minimum, a discussion of any potential correlation between erosive features (e.g., notches, undercutting) and soils present within normal operation ranges" [emphasis added]. Normal project operational ranges would include daily fluctuations in surface water elevation (SWE) at the dam and the resulting fluctuations at transect sites at various points along the river. The license allows surface water elevations at the dam to fluctuate by several feet. By maintaining the SWE at the dam at the same elevation they are not actually modeling the operations of the dam. Both variables, SWE fluctuations and velocity of water, need to be considered.

6. CRC is concerned that many of the transect sediment samples were taken at elevations that do not correspond to where the surface water elevations would actually fall on the bank. Slide 28 presented during the Updated Study Report meeting clearly gives the impression that the sediment station at the upper part of the bank corresponds to the "maximum flow," the mid part of the bank corresponds to the "medium" flow, and the lower part of the bank corresponds to the "minimum" flow. This does not seem to be how it was actually done, though. For instance, the Supplement states, "Similarly, at some sites, especially impoundment sites just upstream of a dam (e.g., W12), the WSE for the 3 operational conditions were essentially at the

same elevation since the nearby dam WSE remained unchanged for all operational flows considered." Additionally, the sediment sample elevations for many of the sites either fall completely outside of the median WSE fluctuation or only one sampling site falls within that area of the bank. As far as we can tell, the soil samples have no particular connection with the river flows and dam elevations used in the model, and moreover, some don't include samples within typical operational ranges. See attached graphs for B03, V03, V06, W03, and W10 depicting where we think the soil samples were collected, given the information provided in the Supplement [note: we could only use the sample elevation to determine sample station location because the "sample station (ft)" corresponded to a horizontal distance from the hydraulic model which differ from the horizontal distances shown in figures Appendix A of the Final Revised Study]. We have also plotted the logger data for W10 as an example of where the sediment samples fall in relation to daily fluctuations – we note for this figure that the Supplement Appendix A lists the "max" elevation of 383.4 as "dry" for the 700 and 5,000 cfs model runs, therefore giving no velocity readings, but according to the logger graph included here, listing the max elevation as dry at 5,000 cfs does not appear to be accurate.

7. Also of concern is the fact that we have no way to know actual or average surface water elevation fluctuations for December to May of most years since actual SWE for those months was not provided due to the difficulty of logger placement in winter. As mentioned above, the validation of the model using surface water elevations at the 6 ADCP sites was not included in the supplement. We request that this information be provided, and it include maximum historic operational surface water elevation changes at the dam and resulting surface water elevation changes at the transect sites for various flows.

8. The analysis of entrainment of average sediment particle size is problematic. It may very well be that the average sediment particle size is high because clays and fines have been removed from the bank due to surface water fluctuations. This would skew the velocity needed to move sediments to be a higher threshold velocity. Additionally, focusing on the velocity needed to move the average size particle ignores the erosion of up to 50% of the sediment material, including the loss of clays and fines and resulting reduced bank cohesion. Ignoring the impact on clays and fines also ignores the possibility that the structure of the bank is being destroyed.

   Shear stress (and entrainment) is based on the description of moving materials away from the base - it is not what causes the material to be at the base. CRC contends that shear stress at various operational flows is not the issue. At issue is the change in cohesion due to repeated wetting and drying of the banks as a result of water surface elevation changes. The velocity of water draining out of the bank as water surface elevations go down and sediments are removed was not considered. By not considering cohesion or the process of upper bank erosion, the Supplemental Study primarily examines the mechanism of moving sediments that have already eroded from the bank.

9. The FERC determination states that, "Great River Hydro include near bank velocities associated with multiple water surface elevations... as measured at the six sites with ADCPs. For the remaining 15 sites... the average velocity associated with multiple water surface elevations as calculated by the HEC-RAS model. If, possible, Great River Hydro should include a discussion or estimate of the near-bank velocity or these 15 sites based on available data."

   During the study plan meeting on March 8, 2018, Lissa Robinson (GEI Consultants) stated that, "Sub-critical flow - in the riverine flow you would have downstream flow. Sub-critical flow is in

the pools where flow might go upstream; for each 10 feet by 10 feet cell in the HEC-RAS model you would have velocity that could flow in multiple directions. It could pick up and model an eddy if it did exist." While GRH provided tables for each transect site, it is not clear if the velocity listed is "near-bank" or average velocity. Additionally, based on Lissa Robinson's comment it is not clear the direction of the flow of velocity. Is it downstream, based on an eddy, or upstream?

10. The Supplemental Report states, "Colluvial material derived from erosion higher on the bank still covered the stratigraphy at the base of the banks at many of the monitoring sites as was the case during the two years of monitoring from 2013 to 2015." The question is not why the colluvial material hasn't moved (and erroneously, thus erosion is not taking place). It is instead, "why is there colluvial material at the toe of the bank?" If the study had answered that question it might have "ascertained the likely causes of erosion" as required as a goal of the study.

11. The Revised Final Study Report also states, "The degree of change at the [ADCP] monitoring sites does not appear to be related to flow velocities as some of the sites with the highest flow velocities experienced no or little change during the two-year monitoring period... Similarly, some of the sites with the lowest flow velocities experienced the greatest amount of change during the two years of monitoring as at the Bellavance Site. The comparison between flow velocity and documented change at the monitoring sites shows no strong relationship and indicates that other factors [emphasis added]... may also exert some control on the location of bank changes." Those other factors may well be the loss of fines and clays from repeated water surface elevation fluctuations. The Supplement and Revised Final Study Report did not address this.

12. The licenses for Wilder, Bellows Falls and Vernon were issued in 1979, prior to the completion of the *USACE Connecticut River Streambank Erosion Study: Massachusetts, New Hampshire and Vermont (1979)*. The 1979 license states, "The New Hampshire Fish and Game Department recommended that NEPCO [New England Power Corporation, the previous owners of these dams] be required to stabilize bank conditions within the impoundment area. The Department contends that fluctuation of the reservoir level has caused serious bank erosion and resultant siltation in the Connecticut River. Intervenors including For Land's Sake, have also raised this issue. Over 100 protests to the issuance of a long-term license to NEPCO, prior to the completion of the US Army Corps of Engineers Study have been received on the subject of erosion... In our order we denied For Land Sake's motion that we not issue a license for the Wilder Project until the erosion study was complete."

    The *USACE Connecticut River Streambank Erosion Study: Massachusetts, New Hampshire and Vermont, 1979* study ("1979 Army Corps Study") states, "Evaluation of forces causing bank erosion verifies the relative importance of causative factors. In descending order of importance they are: shear stress (velocity), pool fluctuations, boat waves, gravitational forces, seepage forces, natural stage variations, wind waves, ice, flood variations, and freeze-thaw. Analysis of the causes of bank erosion shows that these causes can be subdivided into those that cause general bank erosion and those that cause upper bank erosion. Tractive forces exerted by flowing water cause general bank erosion, with their maximum attack occurring at about two-thirds of the depth below the water surface. Hence, even if the upper bank is stable or stabilized, the flow can erode the lower bank causing failure of the lower and upper banks. Forces such as wind waves, boat waves, pool fluctuations, ice, etc., are the most common causes of upper bank erosion... In time, a berm or beach is formed... Furthermore, limited

control of upper bank erosion can be achieved by limiting pool fluctuations associated with hydropower development..." [emphases added]. CRC contends that the focus on instream velocity and entrainment only addresses part of what is going on. The Final and Supplemental reports for Studies 2 and 3 have still not addressed pool level fluctuations and the resulting effects of upper bank erosion. Focusing on the entrainment and movement of already eroded and non-cohesive sediment is not proof that project operations do not contribute to the overall erosion cycle.

13. The 1979 Army Corps study states, "The magnitude of the energy gradient has been altered by the low head hydropower dams... the analysis of the stability of the system must consider the changes imposed on the slope of energy gradient by the systems of dams. The system no longer operates as a free-flowing alluvial channel. Its energy gradient and the velocity have been reduced except for those reaches above the influence of the pools." Additionally, the Revised Final Study states, "NRCS' (2007) publication on thresholds for small channel design recommends a maximum permissible velocity of 1.5 feet per second (ft/s) for fine sand in clear water without any detritus but 2.5 ft/s in water carrying colloidal silts as higher velocities are needed to transport silt and clay, because of their cohesiveness, than fine sand." Hence, basing the velocity threshold on the NRCS thresholds for small channel design may not be appropriate.

14. The 1979 Army Corps study says on page 67, "Comprehensive literature surveys reveal that numerous experienced engineers and geologists have concluded that 90-99% of all significant bank erosion occurs during major flood events. These observations are not based upon concept or theory, but on field observation." [emphasis added]. We went into this relicensing process knowing that major flood events cause changes in river morphology, and we did not need several years of study to confirm this. As we said in our comments from July 15, 2013 on the Preliminary Study Plan for Study 2, "The problem of erosion is not just a matter of high flows and ice out scour. There is legitimate concern that daily reservoir level fluctuation causes piping of water in and out of a saturated bank, piping that would be an important contributor to the erosion problems landowners are experiencing in the impoundment areas." Great River Hydro, and FirstLight as well, have both focused on the erosion processes related to high flow events, ignoring the impact that daily river fluctuations from project operations contribute to bank erosion (including instability that can then lead to bank failure during high flow events).

15. The Kleinschmidt *Lower Connecticut River Shoreline Survey Report (2011)* states that, "Sand and silt particles that make up the bank and bed material along the river erode most readily. Also, decreases in shear strength of the soil bank material may lead to failure. This is especially true where swelling of fine soil materials from absorption of water increases groundwater pressure within the bank, and soil creep (downhill slope movement) weakens the bank.... Bank slumping, sometimes described as mass failure or collapse can occur from various mechanisms, but is most commonly a result of rapid draw down of stream flow following a prolonged period of bank-full flow (high water or flood flows with a relatively rapid reduction in flow) resulting in saturation of bank material." Even though Great River Hydro paid for the Kleinschmidt study, with the conclusions of their Supplemental Study they still are ignoring the impact that daily river fluctuations from project operations have on bank erosion.

16. We have included our notes from the March 8, 2018 study report meeting to be added to the record to supplement the summary provide by Great River Hydro in order to provide additional detail in regard to specific questions asked and the flow of discussion.

CRC recommendations and conclusions

Based on the peer review and our own analysis, CRC continues to believe that Studies 2-3: (1) were conducted in violation of the Revised Study Report (RSP) dated August 14, 2013 and approved with modifications from FERC on September 13, 2013; (2) did not follow several recommendations from FERC's Determination on Requests for Study Modifications and New Studies dated July 21, 2017; and/or (3) otherwise reached conclusions that the science, data or evidence do not support.

In accordance with 18 CFR §5.15(a), CRC recommends GRH do the following:

- As mentioned above, the validation of the model using surface water elevations at the 6 ADCP sites was not included in the supplement. We request that this information be provided, and that it include maximum historic operational surface water elevation changes at the dam and resulting surface water elevation changes at the transect sites for various flows.

- Prepare figures showing cross-sections for each site with (i) annotations of erosional features (as depicted in the 2/4/17 Final Report), (ii) water surface elevation fluctuations as measured by water level loggers, (iii) the water surface elevations corresponding to the three discharges analyzed in the Supplement, and (iv) soil sample locations used in the supplement.

- Provide graphs that show velocity across the span of the river at transect sites as shown in Slide 27 in the Study Report meeting presentation.

- Great River Hydro indicated that they have a gradation of sediment size for all samples taken. Please provide a table showing the percentages of particle sizes in the corresponding sediment samples and what particle size could be moved by various near bank velocities.

- Otherwise address all concerns described in these comments and the Princeton Hydro peer reviews.

The issue of erosion continues to be widespread in the project area and worsens year by year. These issues were brought to the attention of FERC by a significant number of river citizens almost 40 years ago during the last relicensing process and were not addressed at that time or since. We request that the FERC recognize its public trust responsibility and ensure that erosion control and streambank stabilization figure prominently in the relicensing of these facilities.

Great River Hydro's conclusion that project operations do not cause erosion has not been proven and is not supported by the evidence provided in numerous studies. **The Supplemental study was not designed in a way that reflects normal operational conditions and** ultimately **only examined the velocity needed to entrain an average sediment particle.** CRC contends that the studies conducted by GRH have not adequately considered or identified the possible causes of erosion. At this point in the process, we believe the licensees of the Connecticut River projects are not going to adequately look at operational effects on bank erosion. Consequently, CRC requests that FERC conduct a robust review of the Great River Hydro and FirstLight erosion studies, including the raw data from all underlying models

used (HEC-RAS, River2D, BSTEM). Impoundment fluctuations are widely understood to contribute to erosion. Both companies will have to provide ways to avoid, minimize, and mitigate the impact. CRC recommends a publicly warned site visit by qualified FERC personnel to examine the eroding riverbanks first-hand. The FERC site visits that took place during the fall of 2012 as part of the relicensing scoping process are now more than five years in the past, the tours did not look at erosion sites close up from the land nor cover much of the impoundment, and many FERC staff currently involved in the relicensing were not present at the tours. CRC is glad to help coordinate this site visit if needed.

ILP Study 18: American Eel Upstream Passage Assessment

A primary goal of the study was to determine how well temporary eel ramps might work when the fish ladder is not functional. During the study period, the ladder was open three weeks longer than usual, until August 7, and this may have confounded the study results.

We appreciate the ongoing support and enhancements that Great River Hydro is making to provide eel passage. As upgrades are made to the ladder, pit tag studies should be conducted to evaluate the efficacy of changes made. Additionally, the ladder should be open to allow for the full seasonal upstream and downstream migration.

ILP Study 21: American Shad Telemetry Study – Vernon

A goal of Study 21 was to evaluate downstream passage routes and survival. It would be helpful to have analysis that shows routes specific to project operation states, and associated survival. For example, what are common routes and survival rates when there is spill vs. when there is not spill? Similarly, what are routes and survival rates when there are certain turbines operating vs. not operating? Without this information there is not enough data to inform operational scenarios that support the success of downstream migration.

In addition to the comments provided above for both Study 18 and Study 21, please note that CRC also supports the comments submitted by the natural resource agencies, including but not limited to, the New Hampshire Fish and Game Department (NHFGD), the Vermont Fish and Wildlife Department (VTFWD), and the U.S. Fish and Wildlife Service (USFWS).

We appreciate the opportunity to provide comments on the studies submitted by February 9, 2018. I can be reached at kurffer@ctriver.org or (802) 258-0413.

Sincerely,

Kathy Urffer
River Steward

ATTACHMENTS:

1) Princeton Hydro peer review dated May 15, 2017
2) River Stage profiles for B03, V03, V06, W03, W10

3) Logger Data for W10
4) K. Urffer notes from March 8, 2018 Study Report Meeting

CC:
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Scientists, Engineers & Environmental Planners Designing Innovative Solutions for Water, Wetland and Soil Resource Management

March 6, 2018

MEMORANDUM

To: Andrea Donlon, River Steward, CRC
Kathy Urffer, River Steward, CRC

From: Paul Woodworth, Fluvial Geomorphologist, Princeton Hydro, LLC
Laura Wildman, PE, Princeton Hydro, LLC

Re: FERC Re-Licensing Process for Great River Hydro, LLC
Peer-Review of ILP Study 2 and Study 3
Riverbank Transect and Riverbank Erosion Studies
Supplement to Final Study Report, dated 11/15/2017

FERC Numbers:
Project No. 1892-026 – New Hampshire/Vermont, Wilder Hydroelectric Project
Project No. 1892-045 – New Hampshire/Vermont, Bellows Falls Hydroelectric Project
Project No. 1904-073 – New Hampshire/Vermont, Vernon Hydroelectric Project
Great River Hydro, LLC

The Connecticut River Conservancy (CRC) (formerly Connecticut River Watershed Council) is a stakeholder and participant in the re-licensing process of the Federal Energy Regulatory Commission (FERC) for the three hydropower facilities owned by Great River Hydro, LLC (GRH, formerly TransCanada Hydro Northeast Inc.) on the Connecticut River: Wilder Dam, Bellows Falls Dam, and Vernon Dam. Princeton Hydro (PH) was retained by CRC to complete a peer review of the Supplement to Final Study Report, Integrated Licensing Process (ILP) Study 2 and Study 3: Riverbank Transect and Riverbank Erosion Studies, dated 11/15/2017. The Supplement to Final Study Report was in response to FERC's request to provide (i) an analysis of estimated critical shear stress, near-bank velocity, and the potential correlation of these factors with project operation at the 21 monitoring sites, and (ii) near-bank velocities associated with multiple water surface elevations (e.g., minimum flow, average project operating range, maximum project hydraulic capacity), as measured at the six sites with ADCPs. See the full wording of FERC's request below. Where necessary, this memorandum also refers to the Revised Final Study Report, dated 2/4/2017. This memorandum is a critical review of that report and aims to address the following questions as defined in 18 CFR § 5.15 Conduct of Studies (d) Criteria for modification of approved study, the RSP, and FERC's 11/29/2016 Determination on Requests for Study Modifications and New Studies – Wilder, Bellows Falls, and Vernon Hydroelectric Projects:

- Is the supplemental report now in compliance with the Revised Study Plan (RSP) dated 8/14/2013 and FERC's determination letter dated 7/21/2017?
- Were the new analyses conducted in a way that is generally accepted scientific practice?
- Are the results and conclusions valid?

Compliance with Revised Study Plan and FERC's determination letter

1. FERC's specific recommendation related to *River Transect Assessments* is as follows:

   "Because critical shear stress and near-bank velocities can play a significant role in the erosion process, staff recommends that Great River Hydro file an addendum to the revised study report by November 15, 2017, that includes an analysis of estimated critical shear stress, near-bank velocity, and the potential correlation of these factors with project operation at the 21 monitoring sites. This discussion should include a table for each monitoring site that lists critical shear stresses and near-bank velocities with respect to water surface elevations corresponding to project operation (e.g., minimum flow, average project operating ranges, maximum hydraulic capacity). For each monitoring site, Great River Hydro should describe the river channel features corresponding to each water surface elevation, including stratigraphy, the presence or absence of vegetation, the presence of any visual erosion indicators (e.g., slumps, falls, notching, undercutting), and other notable bank features (e.g., groundwater seeps)."

2. FERC's specific recommendation related to *Streamflow Velocity Analysis* is as follows:

   "...Commission staff recommends that Great River Hydro include, in the November 15, 2017 addendum, near-bank velocities associated with multiple water surface elevations (e.g., minimum flow, average project operating range, maximum project hydraulic capacity), as measured at the six sites with ADCPs. For the remaining 15 sites, staff recommends that Great River Hydro include the average velocity associated with multiple water surface elevations as calculated by the HEC-RAS model. If possible, Great River Hydro should include a discussion or estimate of the near-bank velocity for these 15 sites based on available data. Additionally, where available, this analysis should be supplemented with literature-based, soil-specific estimates of threshold velocities for each of the 21 monitoring sites, in order to determine the potential for project operation to effect riverbank erosion."

3. FERC's specific recommendation related to *Streamflow Velocity Analysis* is as follows:

   "Commission staff recommends that Great River Hydro make the requested HEC-RAS data available to stakeholders upon their request to allow for their supplemental analysis. Any data analyses filed by stakeholders in the proceeding will be independently reviewed by Commission staff."

While the Supplemental Study includes an analysis of estimated critical shear stress, near-bank velocity, and other factors regarding project operation at the 21 monitoring sites, certain elements of this study do not meet FERC's recommendation, as follows:

4. GRH did not initially make the native digital HEC-RAS model files available for review by stakeholders as recommended by FERC in (C) above. However, upon request they did provide the HEC-RAS files to CRC in a flash drive, which we were able to review briefly (see further comments later in this memo). In addition, the Hydraulic report (Appendix C) did not include model output such as graphics of the modeling domain with velocity and shear stress contours,

color-mapping, or output tables, all of which should be provided to evaluate the model's performance and accuracy. Resulting velocity and shear stress values are listed at the specific cross-section locations in the report body, but general output should also be provided, particularly in the absence of the native digital HEC-RAS model files. It is noted that standard HEC-RAS model output was also omitted from the Study 4 Hydraulic Modeling Report dated 3/1/2016; thus, no thorough evaluation of the HEC-RAS modelling effort has been performed to date.

5. Velocities measured with ADCP at six sites were not included as recommended by FERC in (B) above. Measured velocities provide a means of calibrating and/or validating the model results. PH requests the data associated with velocities measured with ADCP at the six sites as requested by FERC in (B) above.
6. While a table of values was provided for each river transect, cross-sections were not depicted showing the water surface elevations relative to bank conditions, including stratigraphy, the presence or absence of vegetation, the presence of any visual erosion indicators (e.g., slumps, falls, notching, undercutting), and other notable bank features (e.g., groundwater seeps). While Appendix A of the Revised Final Study Report (2/4/2017) included plots of transects, observed erosional features were plotted separately from water surface elevations that correspond to discharges, which differ from the discharges utilized in the Supplement to the Final Study Report (11/15/2017). Depicting all of these characteristics is essential to assess any interactions and potential correlation among the factors listed above. As this Supplement was specifically focused on the 21 transects, PH requests plotted cross-sections for each site with (i) annotations of erosional features (as depicted in the 2/4/2017 Final Report), (ii) water surface elevation fluctuation as measured by water level loggers, and (iii) the water surface elevations corresponding to the three discharges analyzed in the Supplement.

Accepted Scientific Practice

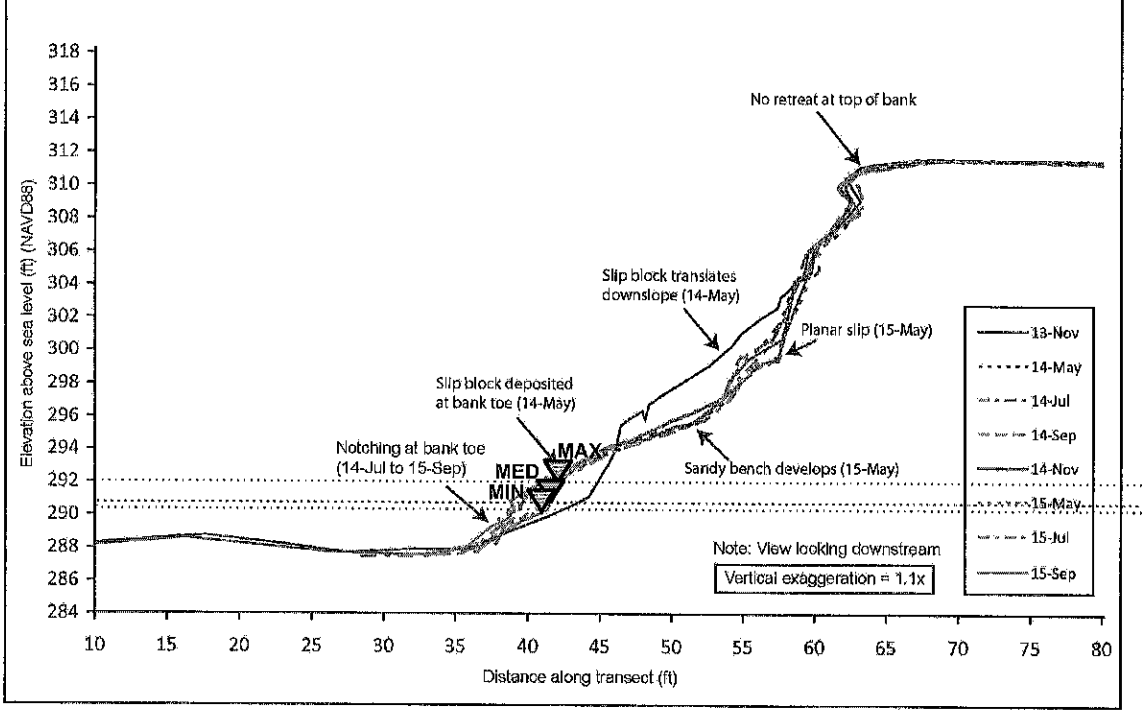
7. The methodology as described of the shear stress and velocity analysis conforms to generally accepted scientific practice. Literature references for published critical velocities and critical shear stresses are valid and applicable.
8. A preliminary review of the HEC-RAS model files yielded the following observations:
    a. Model domains appeared to cover substantial river length and over-bank areas.
    b. Of the 2-D geometries examined, it could not be confirmed if breaklines had been used to more accurately represent breaks in slope like at the top of bank or at the bottom of bank. River bathymetry appeared to be very uniform, potentially lacking detail. Topography on the floodplain appeared to be much more varied and detailed.
    c. Of the 2-D geometries examined, whole geometries were represented with a single Manning's N, or roughness, with no differentiation between in-channel roughness or floodplain roughness, which could produce erroneous results.
    d. While the model was run in "unsteady flow" (considered to be a more accurate mode), it was run at a single flow, which is functionally equivalent to running the model in "steady flow". This is atypical.

e. There were multiple model scenarios for each dam, and various dam heights and flows – a thorough outside review would require substantial time. Given the irregularities noted above and the complexity of the modeling effort, FERC should complete their own thorough examination of the modeling to confirm that standard hydraulic modeling practices were followed and that any deviations are adequately justified.

Validity of Results and Conclusions

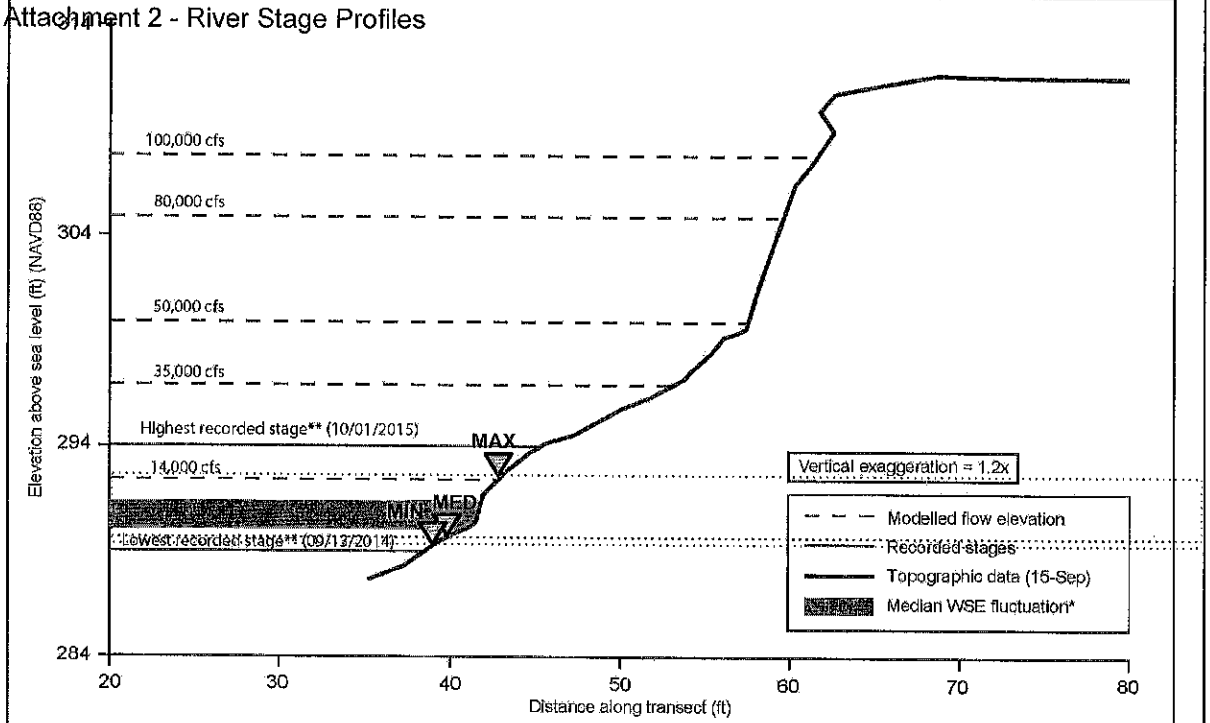
9. The Supplemental Study diminishes the value of the critical shear stress because it does not account for cohesion, compaction, and other forces resisting entrainment. However, as reported on page 124 of the Revised Study 2 and 3 (2/04/2017), "The character of sediments in the study area creates banks with limited resistance to erosion. The bank sediments at the monitoring sites, representative of the study area as a whole, are nearly ubiquitously comprised of fine-grained and unconsolidated floodplain or glaciogenic sediments that are particularly prone to erosion (see Appendix A stratigraphic columns)." For this reason, PH believes critical shear stress is not as conservative a metric as claimed in the Supplemental Study.
10. Section 3.0 states "only 8 out of 21 sites show any potential for sediment entrainment." PH notes that this is over 30% of the surveyed cross-sections – a significant portion – and may not include the banks that have already been actively stabilized. (If the single site that had been armored is added, 9 out of 21 sites equates to 43%.)
11. The Supplemental Study reports that at least 15 sites exhibit a "beach" that fronts the bank. A "beach" feature is atypical of free-flowing rivers, but it is very common in the lower reaches of the CT River that are tidally influenced. The daily water surface fluctuation inhibits the establishment of natural vegetation on this portion of the bank; without this daily water surface fluctuation, this beach would likely re-vegetate and promote greater stability to the bank.
12. Assuming the study correctly demonstrates that near-bank shear stress and velocities during operational flows are insufficient to entrain sediment at the banks, this Supplemental Study and the Revised Study do not discount the role played by operational water surface fluctuations in perpetuating the bank erosion cycle as described in the Revised Final Study. We assert that this Supplemental Study was mistakenly focused on near-bank shear stresses and velocities, when sub-daily water surface fluctuations can still inhibit vegetation and cause bank instability. Water surface fluctuation directly contributes to bank failures that result in sediment deposits at the toe of the bank, which is then entrained, allegedly only by flows above operations. The cycle of erosion turns only when all of its elements continue to occur. This Supplemental Study does not definitively prove that project operations are not a contributing factor to bank erosion.

Attachment 2 - River Stage Profiles



Erosion monitoring transect for 02-B03 (Jarvis Island Site).

Attachment 2 - River Stage Profiles

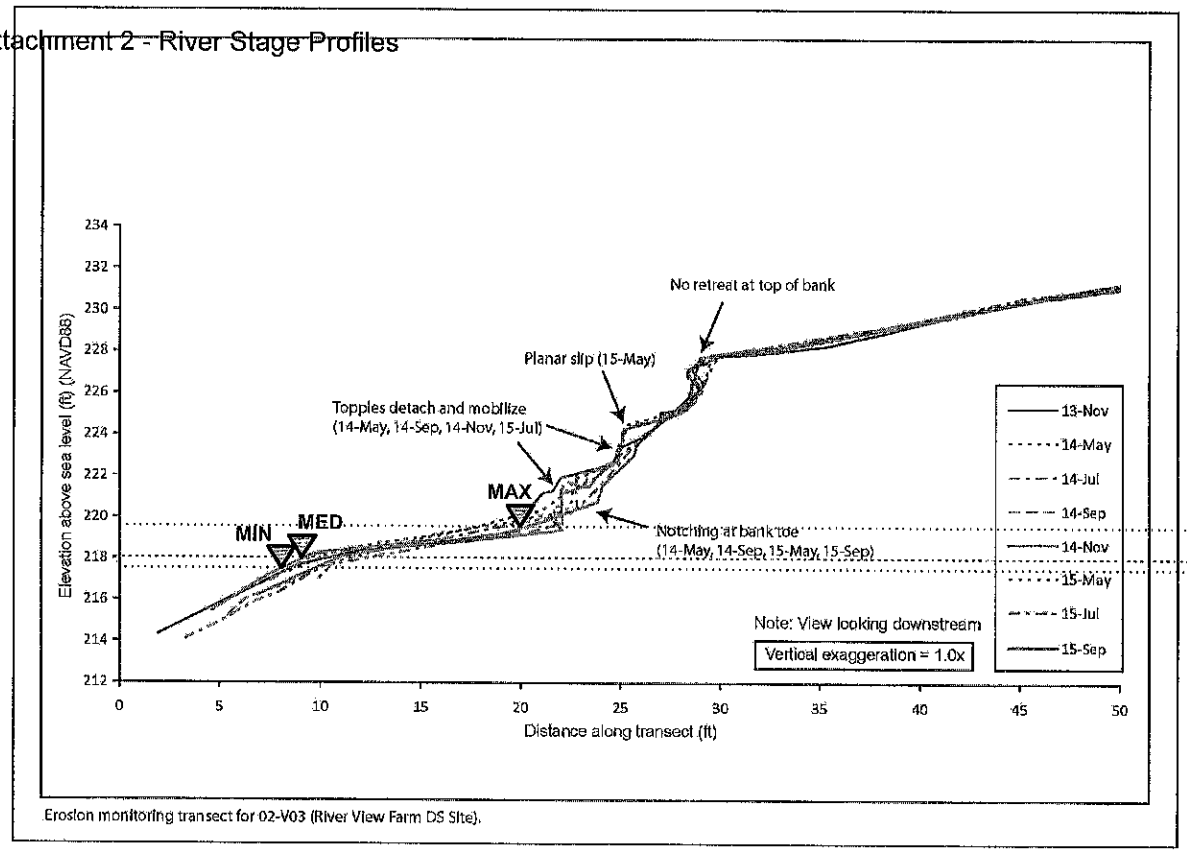


*Note: Median WSE fluctuation at site equals 4.5 feet under no-spill conditions

**Note: Flow stage recorded at site from 06/2014 - 11/2014 and 07/2015 - 11/2015

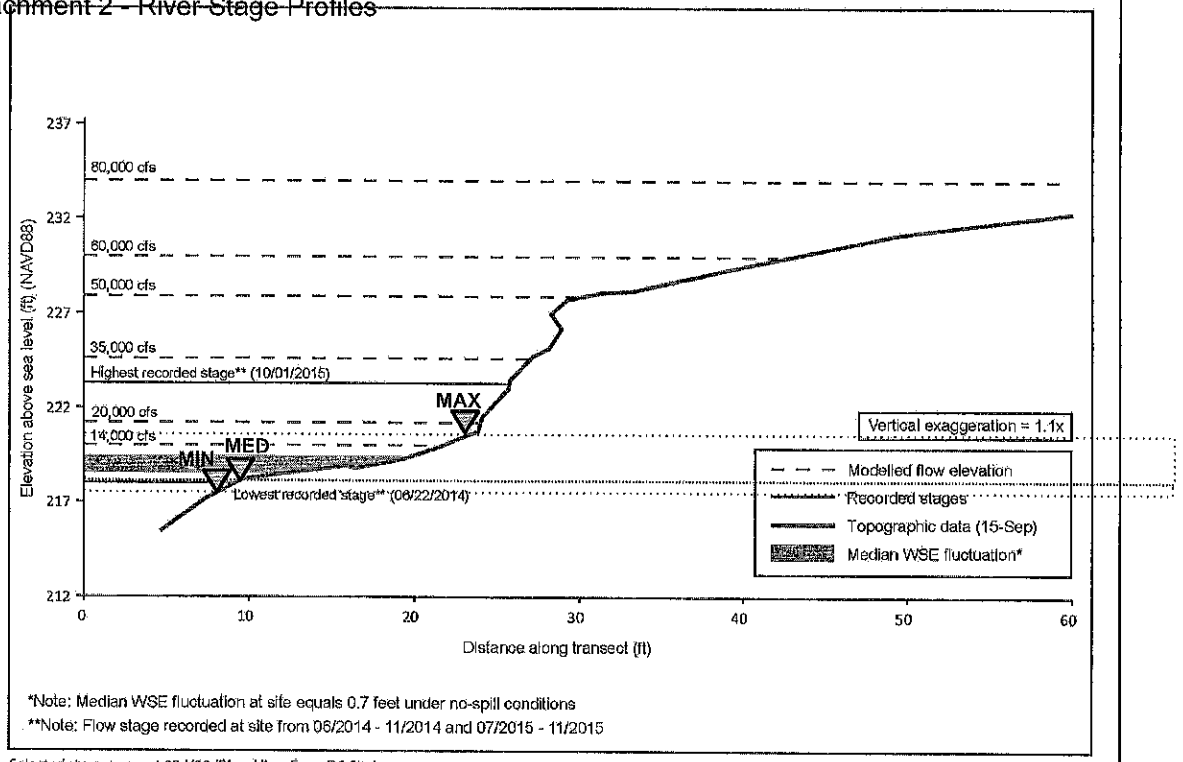
Selected river stages at 02-B03 (Jarvis Island Site).

Attachment 2 - River Stage Profiles



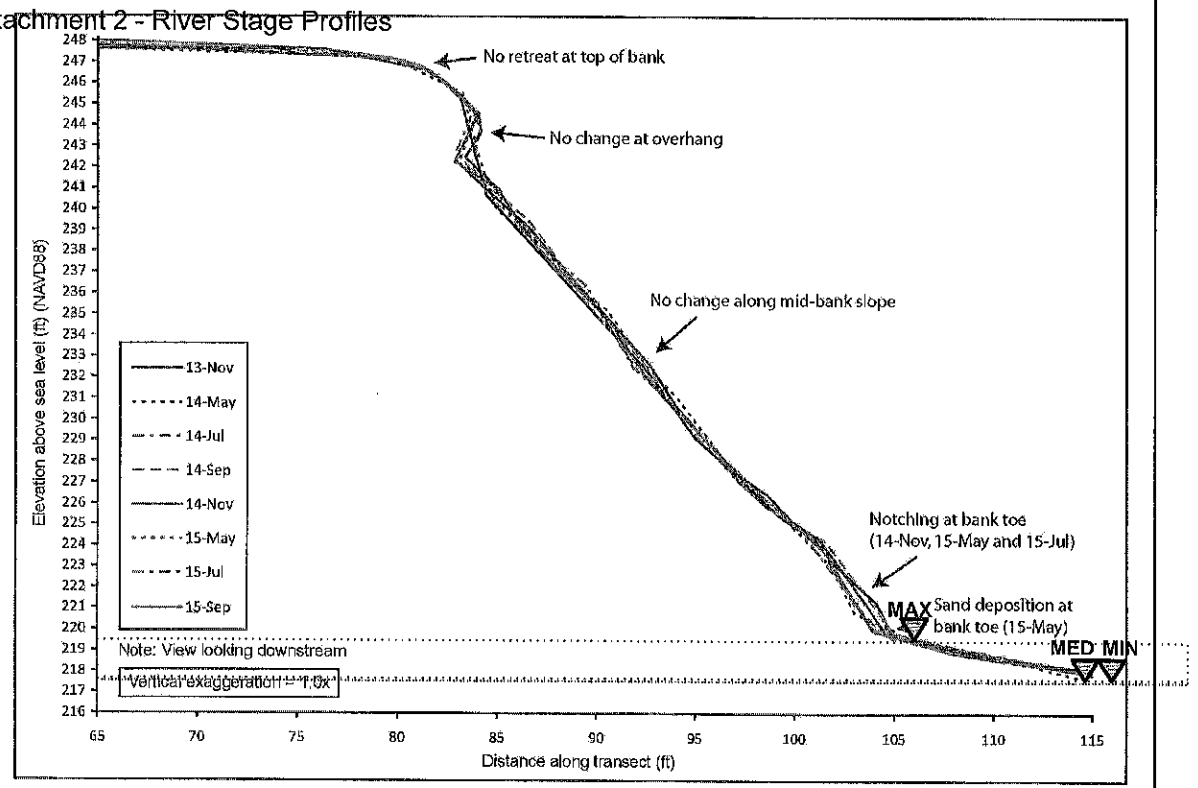
Erosion monitoring transect for 02-V03 (River View Farm DS Site).

Attachment 2 - River Stage Profiles

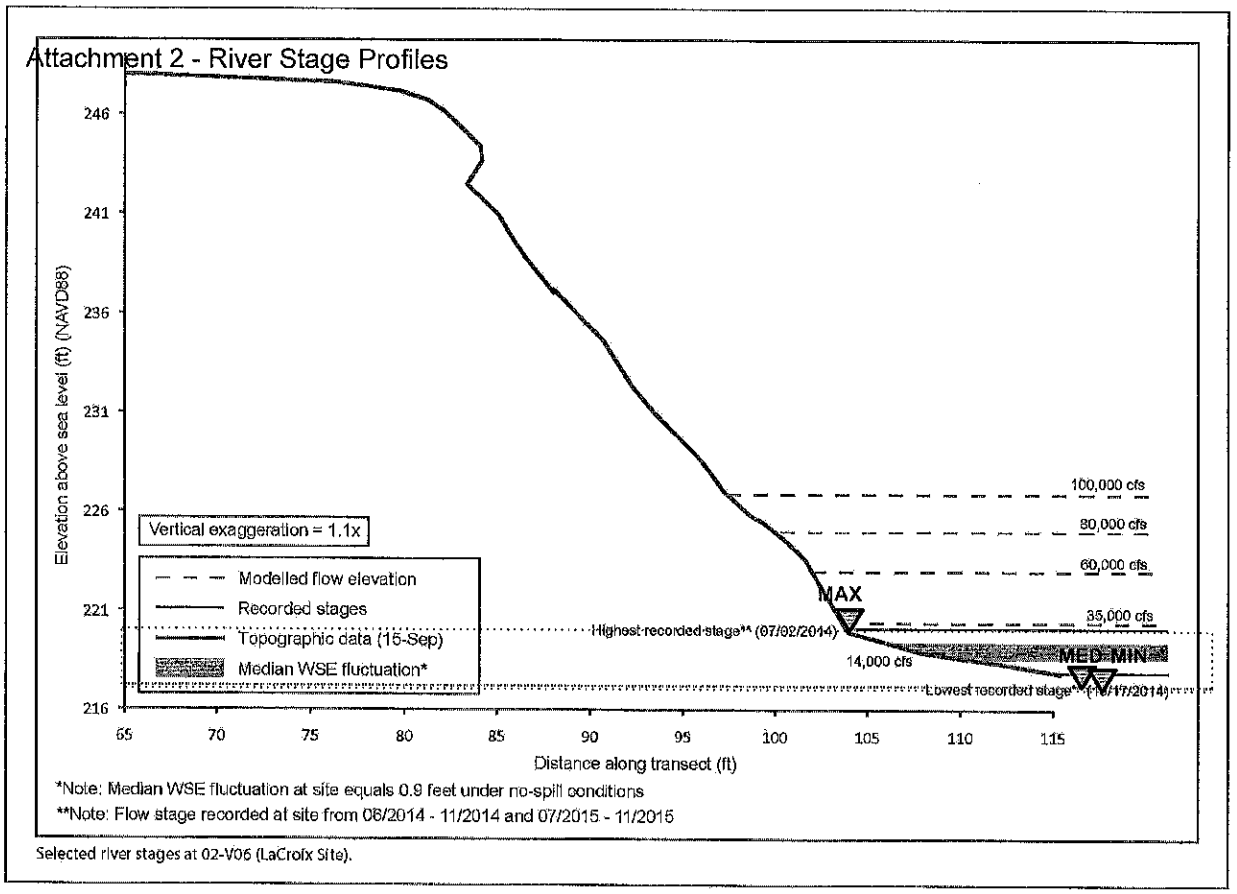


Selected river stages at 02-V03 (River View Farm DS Site).

Attachment 2 - River Stage Profiles

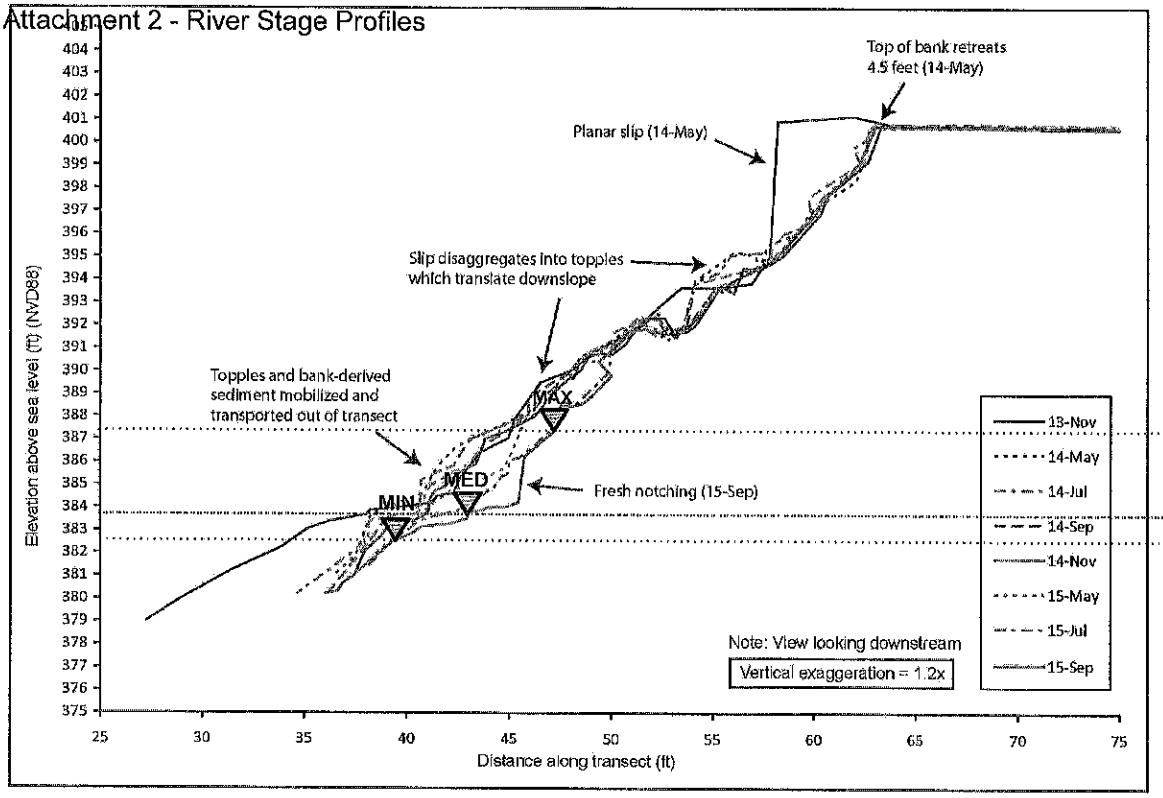


Erosion monitoring transect for 02-V06 (LaCroix Site).



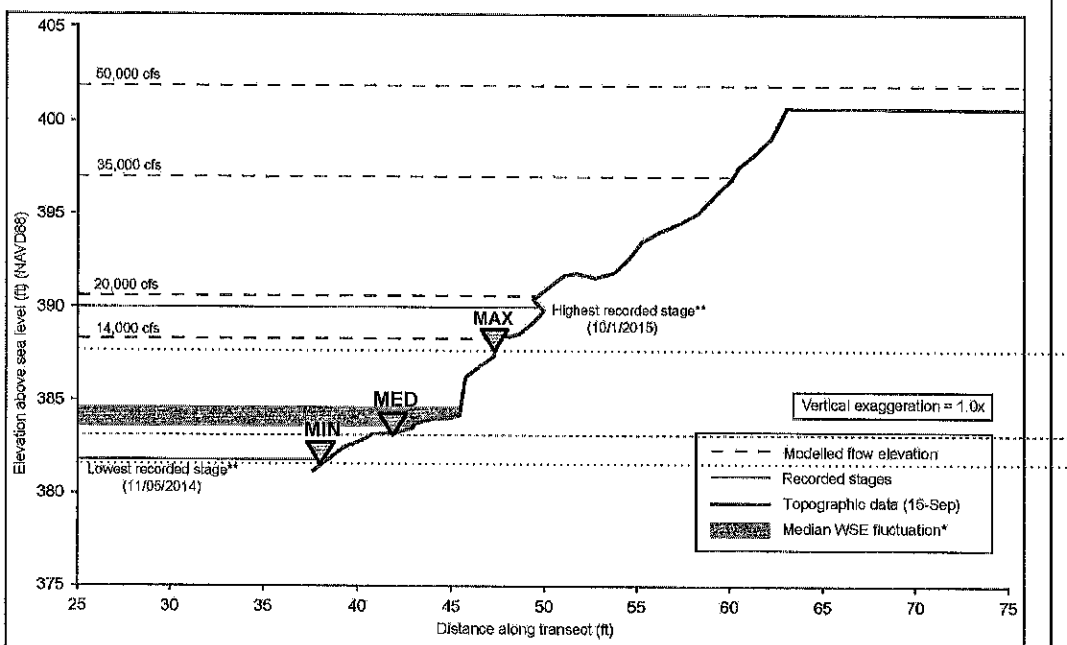
Selected river stages at 02-V06 (LaCroix Site).

Attachment 2 - River Stage Profiles



Erosion monitoring transect for 02-W03 (Bellavance Site).

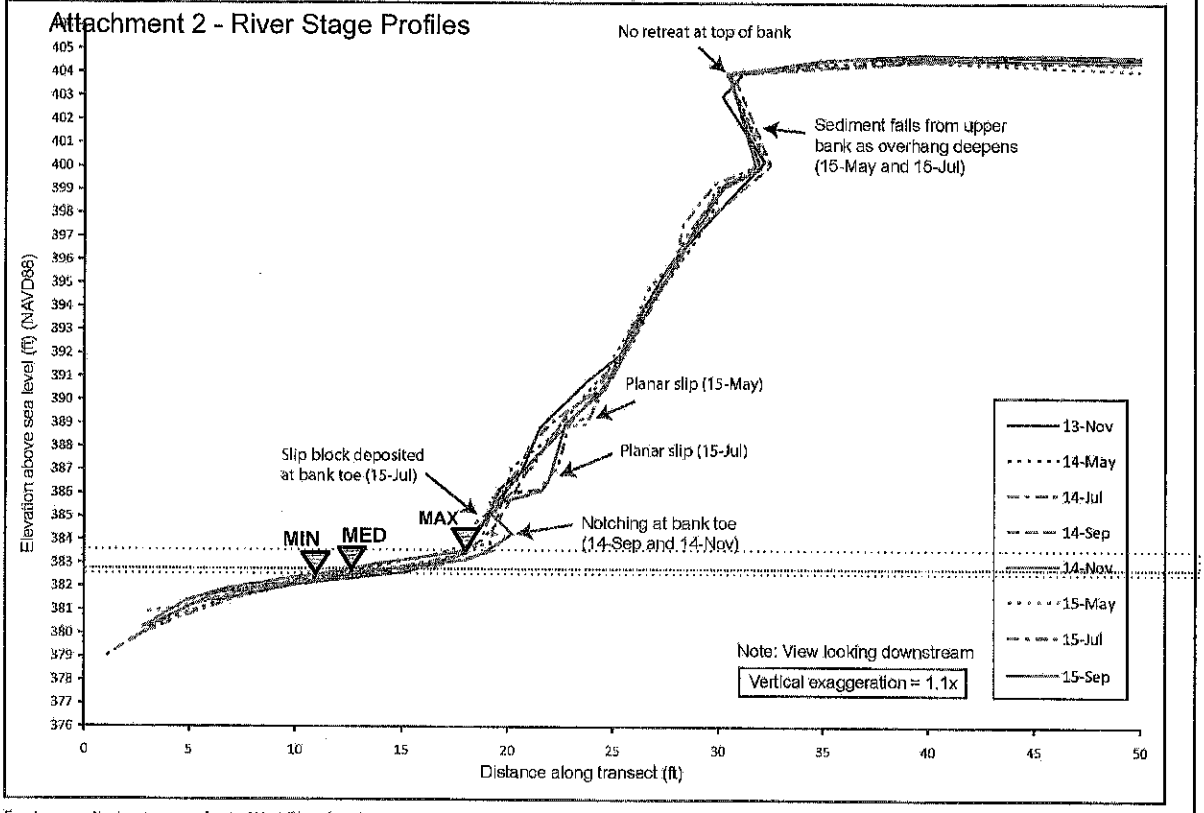
Attachment 2 - River Stage Profiles



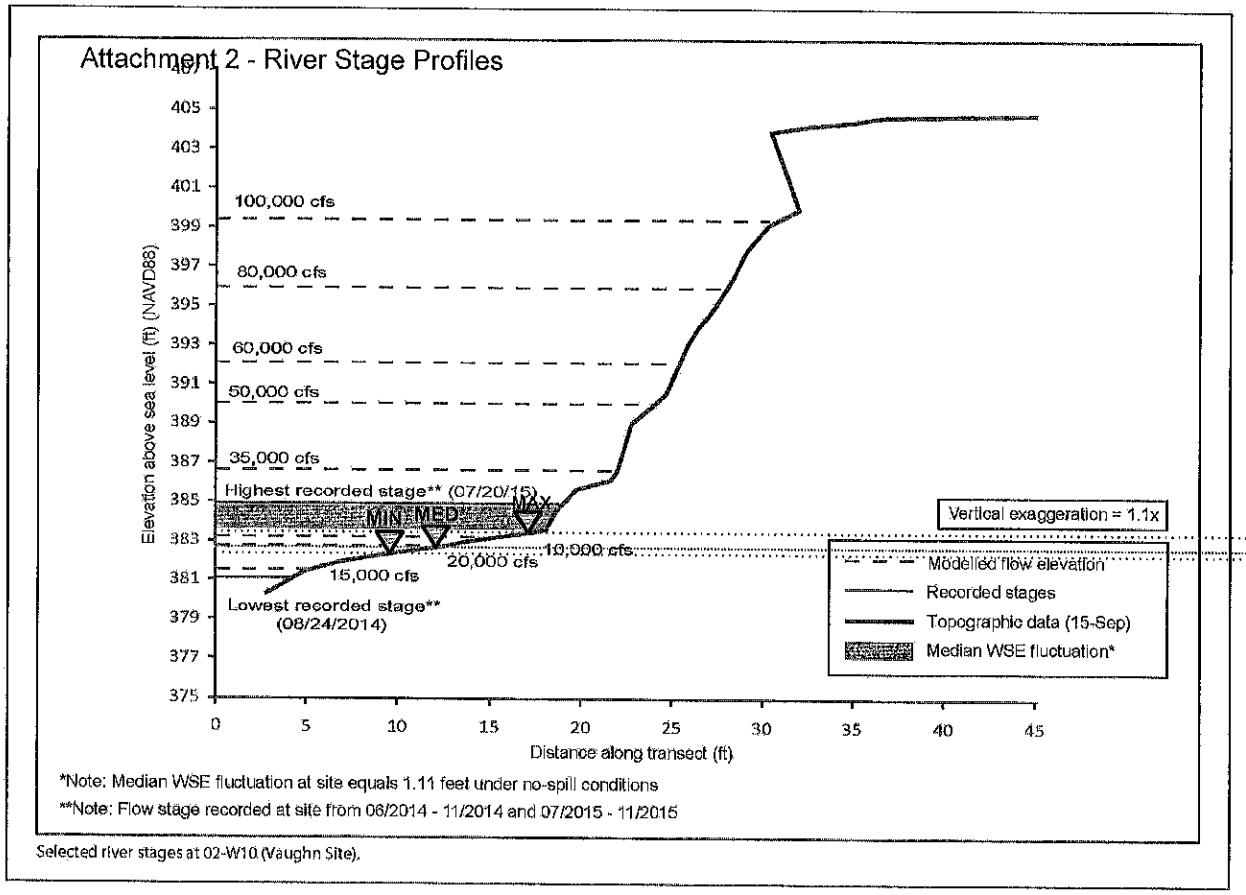
*Note: Median WSE fluctuation at site equals 1.05 feet under no-spill conditions

**Note: Flow stage recorded at site from 06/2014 - 11/2014 and 07/2015 - 11/2015

Selected river stages at 02-W03 (Bellavance Site).

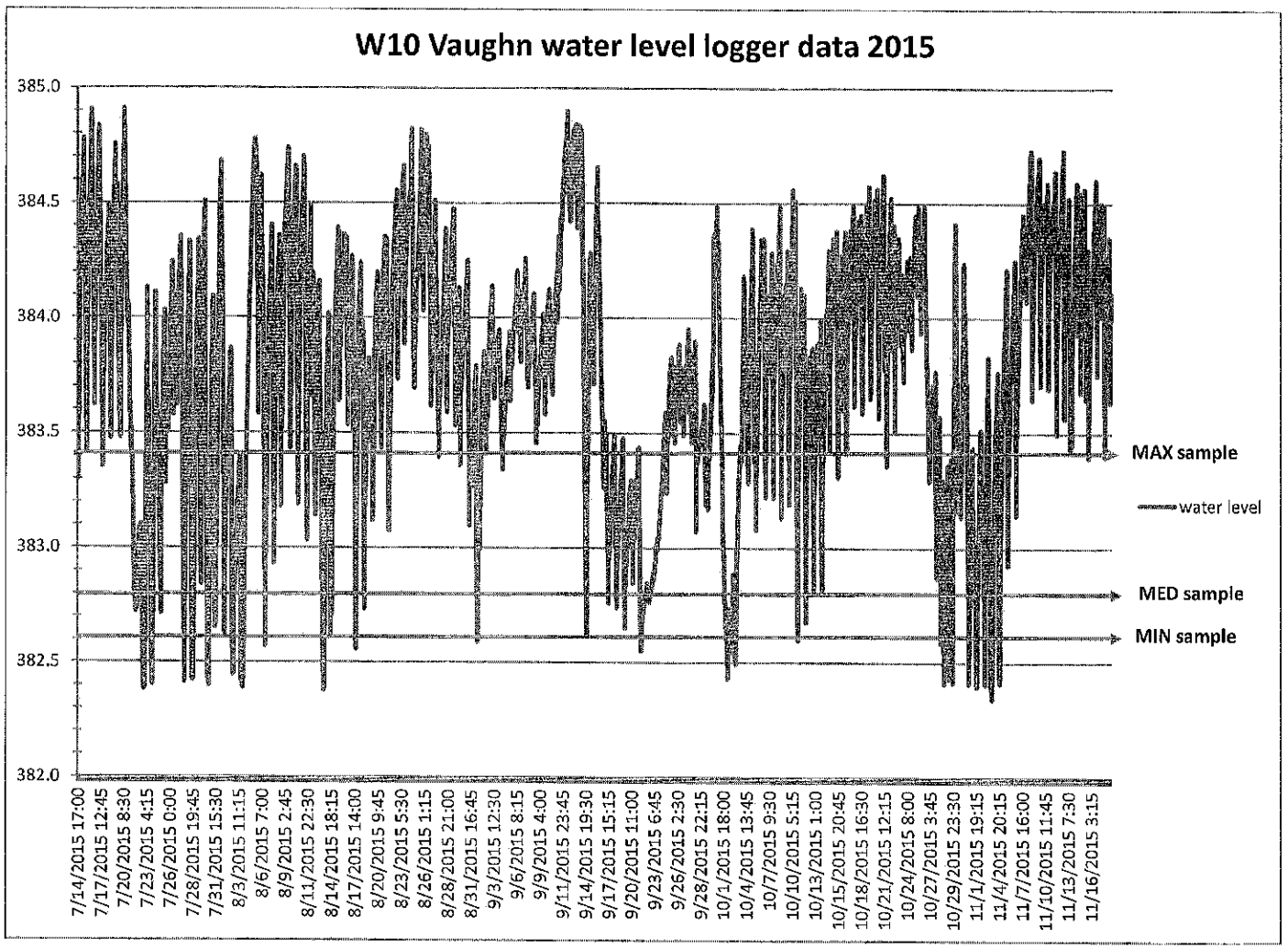


Erosion monitoring transect for 02-W10 (Vaughn Site).



Selected river stages at 02-W10 (Vaughn Site).

Attachment 3 - Logger Data for W10



Kathy Urffer (Connecticut River Conservancy – CRC) meeting notes from March 8, 2018 Study Report Meeting:

STUDY 18:
Christian Gagne from Normandeau will present on Study 18 America Eel:

Most eels moved after fishway was de-watered on August 7th. Perhaps because they were resident in fishway and moved out or because flow from fishway was reduced they chose to use the eel ladder.
Were eels using ramp trap smaller on average than those using fishway?

Lael Will (VT - Fish and Wildlife) asks:
1) Goals of the study was to determine what would happen after the fish ladder was closed (typically on July 15th)... it was open until August 8th. We really need to know what is going to happen after July 15th with normal fish ladder closure. Study was confounded because ladder was open. Ladder was operating normally.
John Ragonese (Great River Hydro – GRH) replies that they operated the ladder based on the observance of shad. John R. says, if necessary they will review the report.

2) From July 15 to August 8 - were attraction flows in the ladder?

Report should acknowledge that it is likely an inaccurate count.

Kathy Urffer (CRC) asks: Can you address how damage under sluice gate might have affected the study?

Answer: Beneath location #12 there were two original structures designed to pass water. The upper of the two was a 4 x 4 opening that failed in 2016. Because of that GRH put in monitors of downstream passage of shad. There was no ability to observe whether eels were going up through that. Velocities were 30 feet per second. It was deep below the crest of the sluice gate. The structure has been abated and spot is fixed. They have now seen that there is more flow going through the 6 x 6 hole below that. They can't observe those bulkheads from the downstream side because of safety.

Steve Leach (Normadeau) agrees, juvenile eels would not be able to swim up through that velocity. They were focused on looking for climbing surfaces. They have seen some eels in that area but nothing that would indicate an attraction flow.

Broader discussion about what will happen this year later on.

John Warner (US Fish and Wildlife): When ladder was shut down, was attraction flow completely shut off? Eels are attracted to even small flows.
Jennifer Griffin (GRH) responds: Entrance weir wasn't closed so tail water may have changed elevation of water in the ladder. GRH confirms that headgate flow was completely closed off.

Steve Leach: Observations at entrance continued and no evidence that eels were attracted because there was no flow.
Response to Lael: If ladder is shut down we assume eel ramp would be used.

Melissa Grader (US Fish and Wildlife): Asks why at spot 5 and 6 no eels were detected?
Steve Leach replies: rock outcrop goes all the way up to the dam and there was little to no leakage at #5 and #6. There is a ridge in the middle of the rock and leakage from 3 and 4 tend toward east.

John R. explains
#11 through #8 are tainter gates.
#7 through #3 leak more
#2 and #1 are tainter gates

Andrea Donlon (CRC) points out that 2017 there were higher numbers of eels. Can you tie together the three years? Are there common themes?
John R. says that eels are attracted to the ladder consistently. Is there a similar size classification?
Steve L.: Ramp trap was not installed until September 2016 and then in June 2017. We do see a proportionally larger eel component in the fish ladder as opposed to other sites.

Andrea asks if it is a problem to run ladder for time that eels are migrating? John R. says that we will discuss this.

Kathy U.: Was there a size differential in relation to passage routes?
Christian Gagne: Majority of eels observed outside of fishway were 6-12 inch (smaller). In fishway 12-16 inch class. They were larger in ladder.
Jennifer Griffin clarifies that during de-watering GRH walks through to make sure fish go down with the water. They shot a video of some of the eels that were going out. From video Normandeau was able to use an app to measure eel size for those leaving the ladder.
Eels that go into the ramp are measured.

Lael Will: said not to discount the smaller eels in the ladder. Is the eel ramp designed to accommodate the larger eels?
Steve L.: The substrate at other facilities can accommodate yellow eels that are over a foot long. Eel ramp design shouldn't discourage larger eel passage.

Rich Holschuh (VT Commission on Native American Affairs): Asks if there was some expectation as to when eel migration was peaking?
Steve L.: part of the purpose of these studies was to identify when peaks might be expected. Based on other sites thermal window and discharge are the drivers. Many sites peak will occur between June and July and then secondary peak in the fall. If it is not a particularly hot summer it may go straight through. Shoulder is skewed toward earlier side.
Steve: In July period was sort of peaking time. Timing of eel ramp is confounding factor because fish ladder was still open. Most eels were collected over a 2-3 day period.
John R.: We can't count on the numbers through the ladder based on how the ladder is currently configured. They will continue to work on this.

STUDY 21:
Goal was to look at downstream shad passage because 2015 study had too few fish to base conclusions on.
2017 - 99 shad tagged. 48 available for route passage assessment
6 returned upstream: Steve thinks that this is notable because they may not have been looking for a passageway downstream?
Of 48 most (N=23) passage occurred during high flows (all 10 units were in operation) and (N=21) occurred when at least on spill gate was open

Adjusted and Unadjusted residency:
Unadjusted is first documentation at passage
Adjusted represents when fish moved away and came back. Fish may have been searching for appropriate spawning habitat as opposed to looking for a downstream passage.

How many were tracked in 2015?
Is there a conclusion about passage if you combine numbers from 2015 and 2017?

Bill Connelly (FERC) asks: Appendix A had discharge from each of the gates. It would be nice if there was a way to tell the east from west spill gates. Please describe. Excel file has discharge for each of the units and each of the gates. Report talks about spill over

the east and west gates. Is tainter gate 1 in excel spreadsheet east or west. (Steve says that numbers proceed east to west - east is #1)

Residency graphs: If you look at residency graph for fish pipe and lay that over the one for units. It seems like many fish moved through fishpipes June 11 through the 20th and later they moved through units.

Steve: The subjective response is that debris load was high because of high flows. There were probably some debris loading on the trash boom that may have deterred fish later in the season.
John R. says: there used to be a large barrier that used to keep debris away from the fish pipe. Majority of fish in residence precede major flow events. The fish pipe was not closed and was not blocked.

Pete McHugh (VT Fish and Wildlife) asks: Looking at Appendix A and operations. It looks like there may be some sort of predictability with high flow events. Do flow values represent average or instantaneous?
Steve says: Instantaneous at time of passage. For those passing upstream, he would need to overlay those to figure out.

Pete M. says: He is trying to understand how operations relate to passage and survival. He looked at Appendix A data to look at flow by route. He wants to add 2015 data to broaden data set. Is there some scope to combine those data sets? Pete will follow up with John and Steve about that question.
John R.: wonders if the arrays may have an effect on the data because it was handled differently in the two years. Not sure if you want to combine them into some sort of statistical analysis.
Downstream passage device has never been 100% effective. What they have is the best they discovered. Unit 10 is preferential unit during fish ladder operations. 5 through 8 are the preferential units for fish passage.

John Warner: Ken Sprankle (US Fish and Wildlife) reviewed report and can't participate today. They will get his comments to you with detailed clarifications. Is there a standard operating protocol for opening sluice gates? What might be the best configuration of spill conditions to encourage fish to use specific routes during spill conditions?
John R. will try to provide that.
Protocol is flood gates vs surface gates vs stantion gates. Tainter gates have operational challenges.... may break, etc. This is something that may be worth looking at in migration season in regard to surface or deep.

STUDY 2/3:
John Field (Field Geology Services) presenting on supplemental study:

2D hydraulic modeling - velocities decrease as you approach the bank; higher in the middle. Lissa Robinson at GEI did modeling and then sent these to John Field.
"W10" = Wilder 10 transect site. "W_10_382.6_12000_date (= site number; elevation at dam; cfs flow at dam; date)

What defines "0" at left bank? That is the water's edge at left bank looking downstream. At edge of the water shear stress is "0". Grid size is 10 feet. They decided to take samples 20 feet from water's edge to have some velocity.

Minimum operational condition - what does that mean (controlling flows coming down?)
At least one (maybe a couple) at maximum operational capacity the water surface did not intersect the bank.

Charts for each of the transects: These are site characteristics at the various operating conditions. Sample elevation refers to the elevation where they took the sediment sample.

Not looking at SWE changes at transects?

Andrea: Questions about tables. Pulling up W07 Tullando site, the PAD has an operations summary that indicates the dam elevation at different flows. At 12,000 cfs the dam elevation is about 384, at lower flows it is actually higher. Didn't see this reflected in the tables. Why aren't higher flows at a lower elevation?

John Field answers: They chose a middle dam elevation for all scenarios. John Ragonese explains that they were asked to look at three different conditions. The PAD has 1929 datums instead of NAVD88 ft.

Andrea: If the river flow is 5,000 cfs, what elevation is that on the bank? How can we tell that in the table?
John Field answers: They defined the dam elevation and chose a medium elevation. Dam elevation was set. The actual WSE at a particular site is going to be different based on different flows. They used 1D study results to determine actual elevation at monitoring sites.

Andrea: Because you didn't show the profiles of each of the sites in this report Andrea went back to Appendix A profiles from August 2016 report to look at the median water surface elevation fluctuation band. The sediment sample elevation is not necessarily in the standard SWE range.
John Field answers: The discrepancy for this is that this study was, whereas in the actual erosion modeling study the transects are based on top of the bank.

Andrea: Velocity across span of river. These tables were not in the report. Graphs were not included in the report. They are happy to include them. John Ragonese will share them with us.

Ross McIntyre (Town of Lyme, NH): We have the earlier profiles show a shaded area that shows the modeled range of normal operations on the profile. Question is does that shaded area include where samples were taken?

They used a 12,000 flow which is higher than project operations. Would never see 700 cfs at these sites because is it at the dam.

Ross asks: whether the 2D model is based on laminar flow or other. Lissa: sub-critical flow - in the riverine flow you would have downstream flow. Sub-critical flow is in the pools where flow might go upstream; for each 10 feet by 10 feet cell in the HEC-RAS model you would have velocity that could flow in multiple directions. It could pick up and model an eddy if it did exist.

Ross: We had loggers at some transect sites which provided WSE at transects, but they did not provide velocity.
Ross: Why did you choose a medium grain size for detecting whether entrainment would occur, rather than the continuum of all sizes? The way this is calculated, one could have ignored entrainment of smaller particles.
John Field: They used the average particle grain size from each sample. While he agrees that finer particles could be moved, you winnow out the fines and then the sample becomes courser. By using average particle size they are characterizing the whole sample. John R. points out that this is standard practice.

Ross: Using the average grain size ignores the possibility that we are destroying the structure by removing the fines. The entire analysis assumes loose non-cohesive materials. By in large, they are assuming a loose sediment pack. This wasn't able to be quantified by should be considered. Assuming non-cohesion gives us more conservative results.

Mike McCrory (Claremont City Planner): Analysis is looking at whether the flow of the river carries sediment. It is strictly the velocity of the fluid flow carrying the particles.

Jim Kennedy (Upper Valley Subcommittee, CRJC): Aren't we just examining samples that have been eroded from bank.
John R. says: Looked at whether there were operation ranges that could affect the bank.

Gregg Comstock (NH DES): Trying to get at D50 sample size
John Field: Analysis on these tables is showing whether critical shear stress can move this particle size. Gregg is asking for table to show what particle size could be moved and the percentage of those grains in sample.
John R: not sure if there are gradation samples? John Field: Did a further gradation if clay/ silt represented more than 10% of sample. For some samples they may have a further gradation.

John R: We have gradation of all samples. To the extent that fines represented 10% or more they did an additional gradation. From that they will try to pull out data for tables.

Gregg: Regarding velocities - showing some sort of calibration to the model. When you took velocity data a few years ago do you have that at cross section to calibrate.
John R: ADCP was only done in requested sites. It is a vertical average. Gregg asks to see if the two compare and include that in supplement or report. John R: says that if sites match up they can try to calibrate. Lissa is not sure that detail is there. Steve Eggers may have additional information.

Kevin Sahr (from Lyme): He works on road committee. Study appears to be very thorough and logical. He is wondering... his observed data from working on road committee doesn't necessarily match your operational SWE. His concern is that he has observed much greater than the 1.8 feet SWE swings in shorter period of time. Much larger elevation changes in dry terms (in respect to rainfall). When you take the model results compared to observed data there is significant undercutting and washing away of bank.
John R. replies: They used loggers to calibrate the model. They have a limited range that they operate in. They expand that range in anticipation of high water. There are alot of water fluctuations that are out of GRH control.
Kevin: Do you have data showing SWE changes.
John R.: Yes, hobo transducers that recorded over time that picked up flow conditions at specific sites. They used them to calibrate operations model.
Kevin: asks for that calibrated with rainfall.

Ross: When beach along river gets mobilized by high water event we recognize that is not necessarily caused by the dam. We have not talked about water coming out of soil from runoff of the raising of the pool. What we don't know is when the water comes out of the bank at some unknown velocity. This changes the character of the river banks. Nor do we know how much if any particles are mobilized and fall down to the beach due to SWE fluctuations.

John Bennett (Windham Regional Commission):
1) Minimum, medium and maximum flows - what are they?
John Field.: In a reach in the impoundment those flows are modeled flows at that location. They correspond or characterize the lowest flow that might occur there. What it references is the minimum flow at Wilder Dam. High flow assumes highest operation plus added rainwater.

2) Velocity figure in table? For example on W07, Velocity at minimum flow is 0.067 (67 thousandths of a foot per second). This represents near bank velocity at that flow.
John Field: They could produce a similar looking graph from shear stress. Took shear stress 20 feet into channel from sample location.

3) Discussion of vegetation on banks? Did any of this analysis discuss loss of vegetation on entrainment.
John Field: entire analysis reflected in tables assumes no vegetation.

4) "Flood discharged exceeding operational flows are needed to remove sediment at base of bank." How is this defined?
John R. : At dam there is powerhouse and spillway. It is the ability of GRH to not spill and operate the power house at will. There is a maximum capacity that they can use at each station. At Wilder under 10,000, BF about the same, at Vernon 15,000 cfs. At bottom is minimum range. Above that range they have to spill.

Kathy: Could you include the definitions of the various parameters for tables to make them easier to understand? Did you consult with FERC to clarify what FERC was requesting? My reading of the requirement indicates surface water elevation fluctuations, which would include daily fluctuations at dam. Maintaining SWE at dam means that the study has still not address the effect of SWE at transect sites.

Jim McClammer (Connecticut River Joint Commission) Are you saying that the notching is not caused by operations?

John R: refers only to the report - sediments in soils are not mobilized by project operation flows. Report concludes that velocities are not sufficient to mobilize average size particle sediments.

Andrea:
In the conclusion on the last page "critical" in relation to shear stress is confusing.

VERNON FISH LADDER MODIFICATIONS:

John R:
Regarding America Eel - if the ladder is the most useful passage, how to enhance it through modest modifications? They would prefer to not construct something else. They may also be able to increase shad migration effectiveness through lower section of ladder.

Work on the ladder is why the ladder stayed open longer in 2017 season. They now have new transducers in place and expect there to be an improvement in entrance weir this year.

Lael: Keep in mind that if you still have fall back occurring you could still have negative numbers. This will make counts more accurate, but won't necessarily solve all problems. Plans to do a PIT count study?
John R.: Nope... there are a lot of paths and they are hoping to hit most of the additional places where eels can pass.

Wondering if GRH will install eel ramp this year?
John R. replies there is some indication that the majority of the eels are moving through in the middle of the summer, not in October. It may be that the ladder is used in summer and then ramp can be used to augment later in season. Lael suggests that GRH and fisheries talk more often this summer. GRH hasn't decided if they will install eel ramp for this season, or if they should run the ladder longer.

John Warner: Final design decisions - GRH should touch base with fisheries agents. John R. replies that Brett, Alex and GRH engineer have been in close communication about design.

Melissa asks if there is a concrete plan to evaluate the changes to fish ladder.
John R. replies that they are trying to improve accuracy of fish counts. They are willing to develop a plan to evaluate if requested or needed.

STUDY 9 INSTREAM FLOW AND CO-OCCURRING MUSSELS ONGOING CONSULTATION:

Final report filed last year. There was a consultation meeting right before final comment deadline. As a result of that meeting there were several requests for data, graphs, etc. All parties agreed to continue to meet.

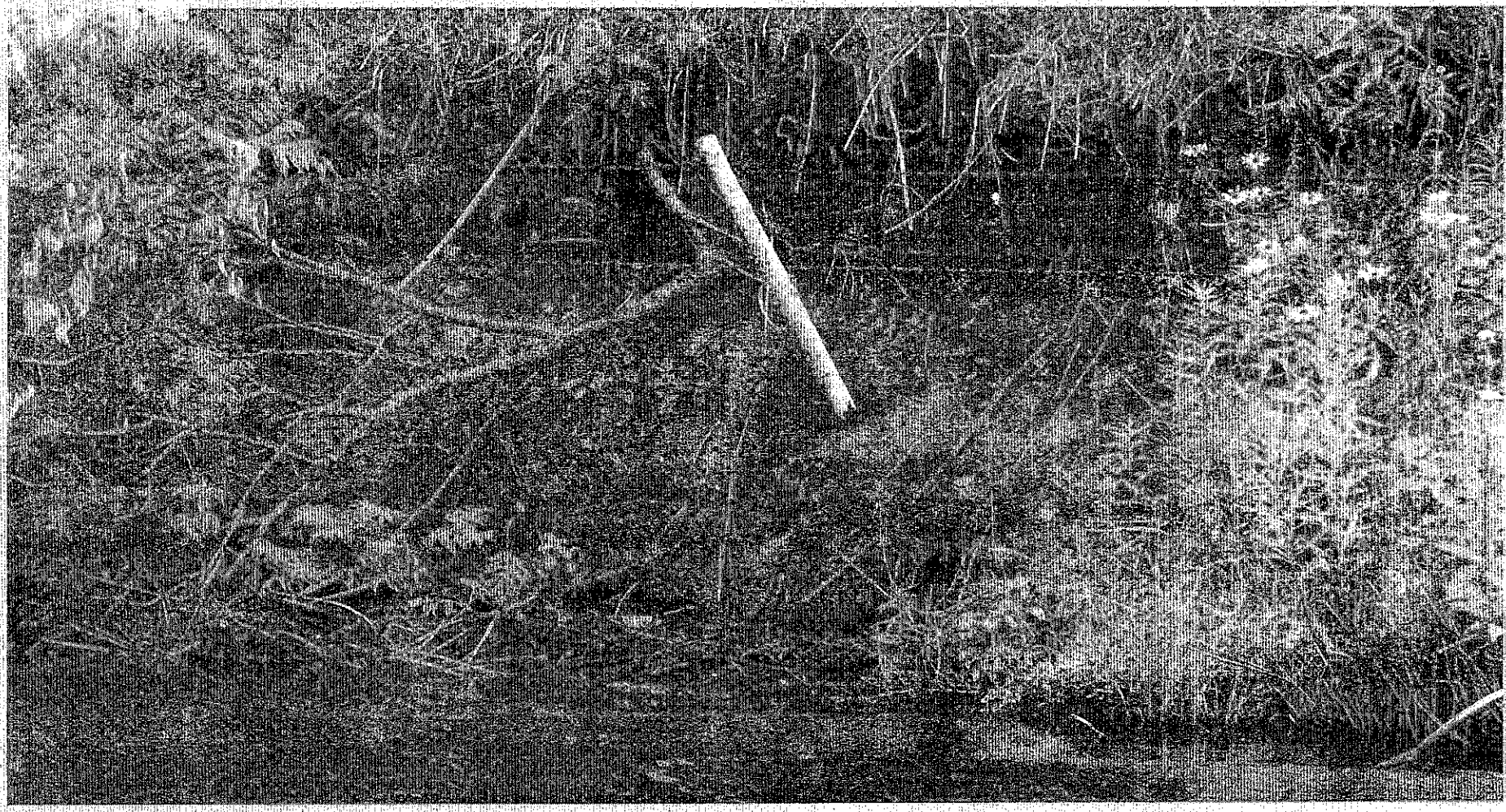
STUDY 25 ODONATES UPDATE:

Synopsis of supplemental report is a response to comments.

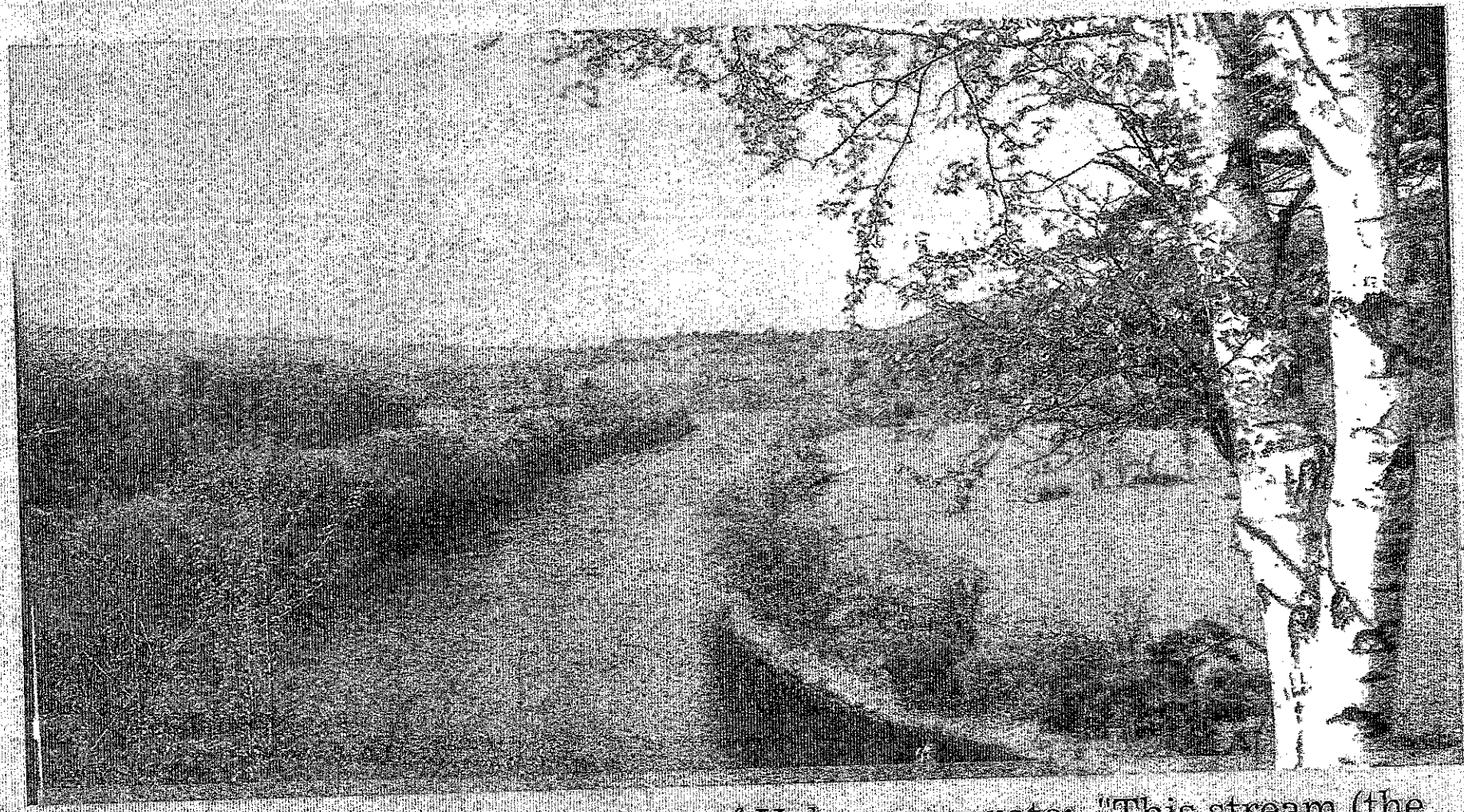
STUDY 33:

GRH is working on developing a programmatic agreement. GRH would prefer to develop a process to continue to work on issues. That would be embodied in a programmatic agreement and HPMP - recognition that GRH will consult with tribal interests on "pretty much everything" that they deal with. PA has been drafted. HPMP has not been started yet. There may not be additional changes to Study 33. PA and HPMP would be part of the life of the license. Traditional Cultural Properties process includes consultation. FERC would like to have PA (signed agreement: signed by SHPO, licensee, advisory council, and affected tribes) developed and SHPO would want HPMP developed before the license agreement.

Due date for requested study modification is April 23. They will issue study modification letter by June 21.

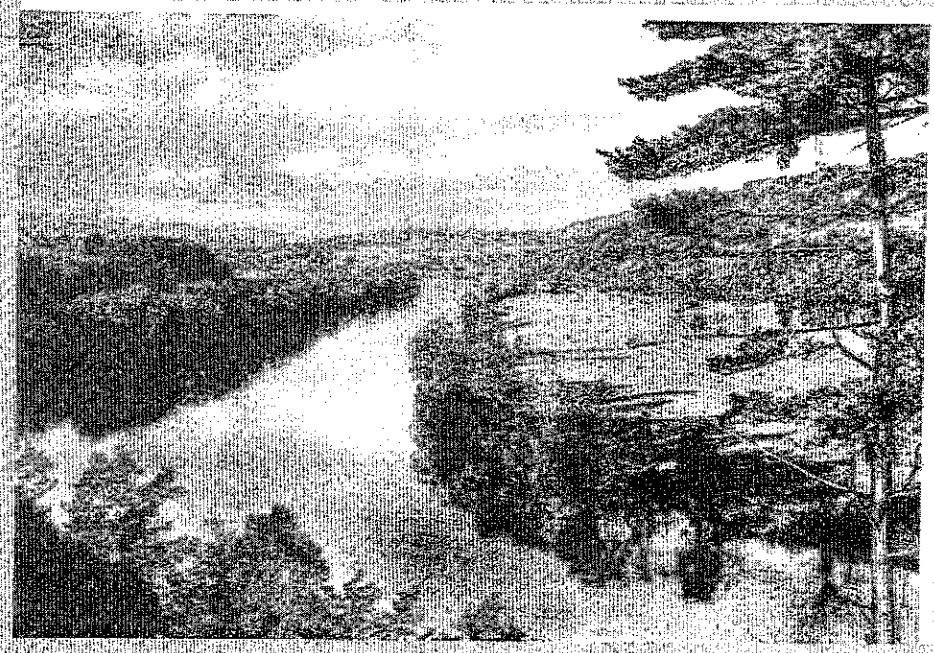


The Erosion Ratio
or
Erosion for Dummies



As Timothy Dwight, the President of Yale once wrote: "This stream (the Connecticut River) may perhaps with more propriety than any other in the world be named the beautiful river... the uncommon and universal beauty of its banks, here a smooth and winding beach, there covered with rich verdure, now fringed with bushes, now covered with lofty trees, and now formed by the intruding hill, the rude bluff and the shaggy mountain are objects which no traveler can thoroughly describe."

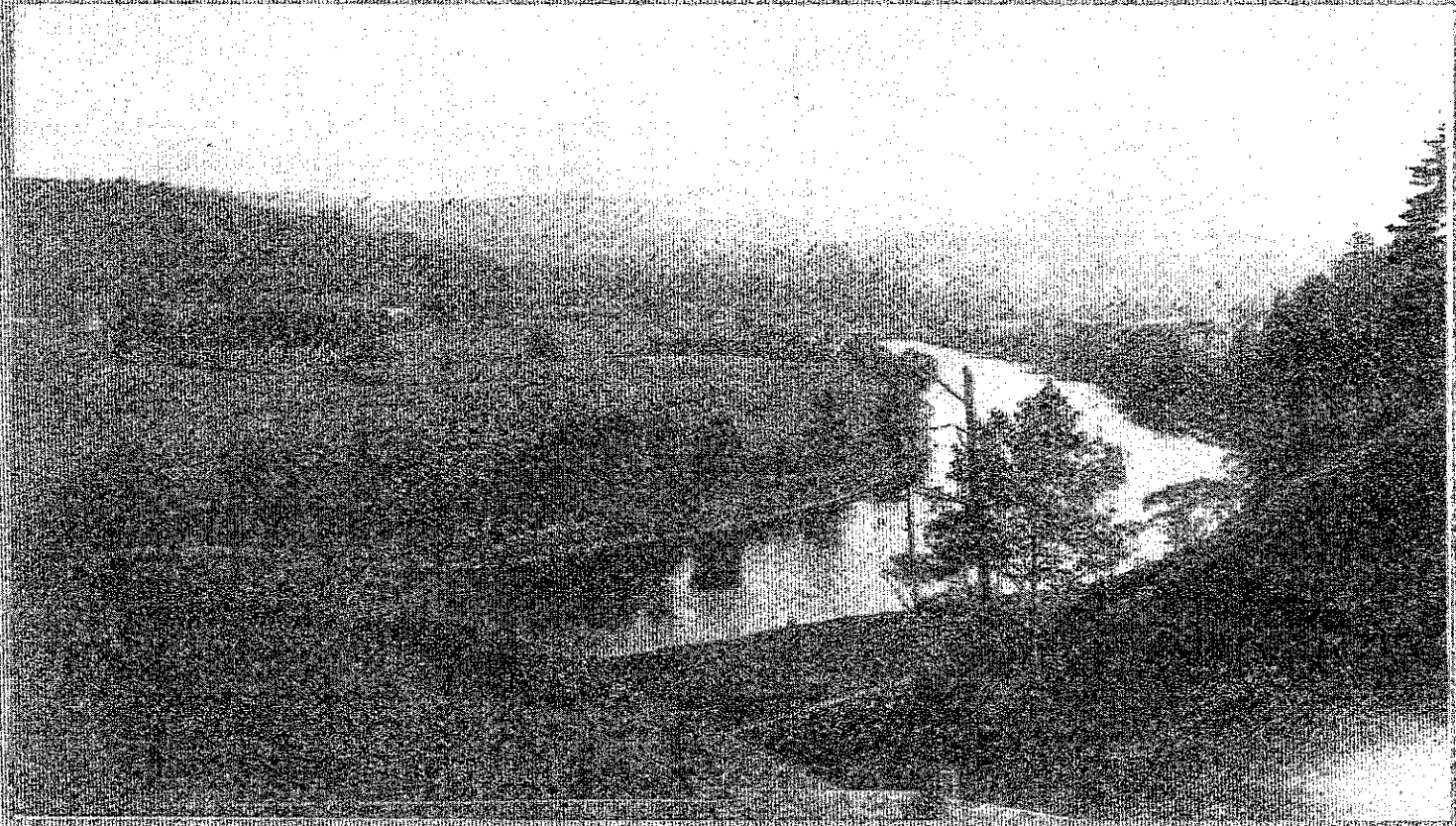
--Photo 1940s by Winston Pote.

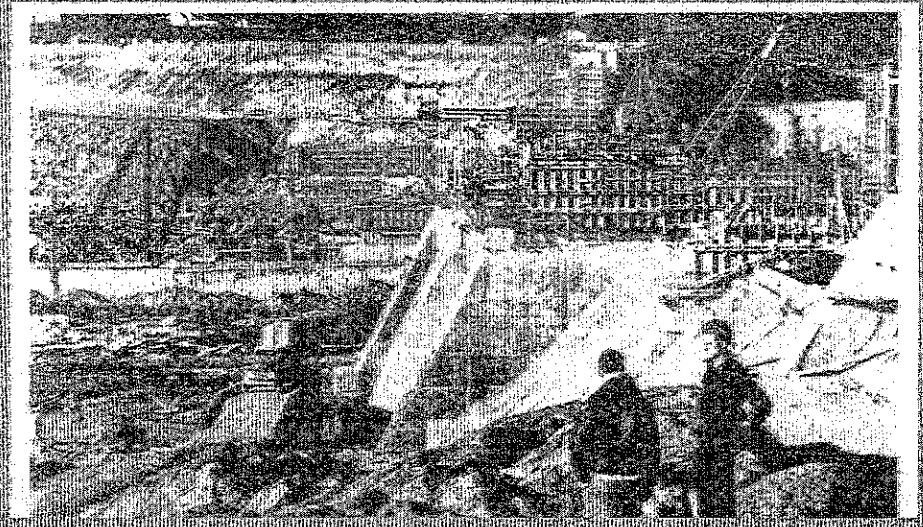


This is the farmland on the Connecticut River in Lyme that my parents purchased in 1962.

It is beautiful farmland, and it is threatened.

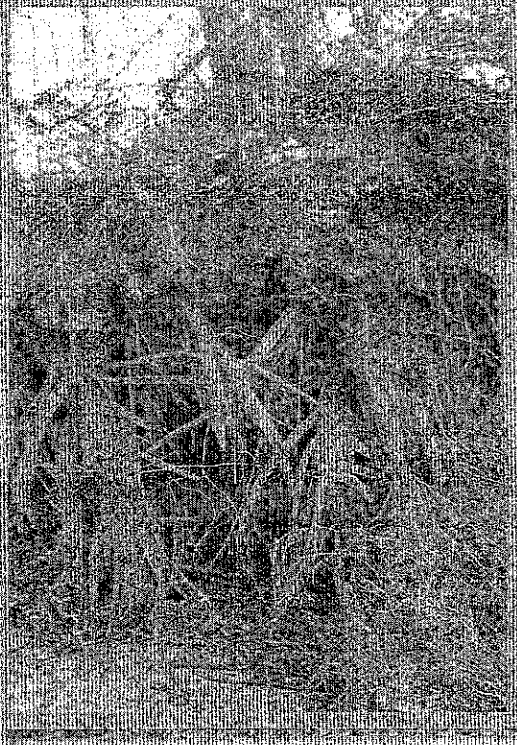
Left, April 1943, National Geographic. Above, from about 1939.

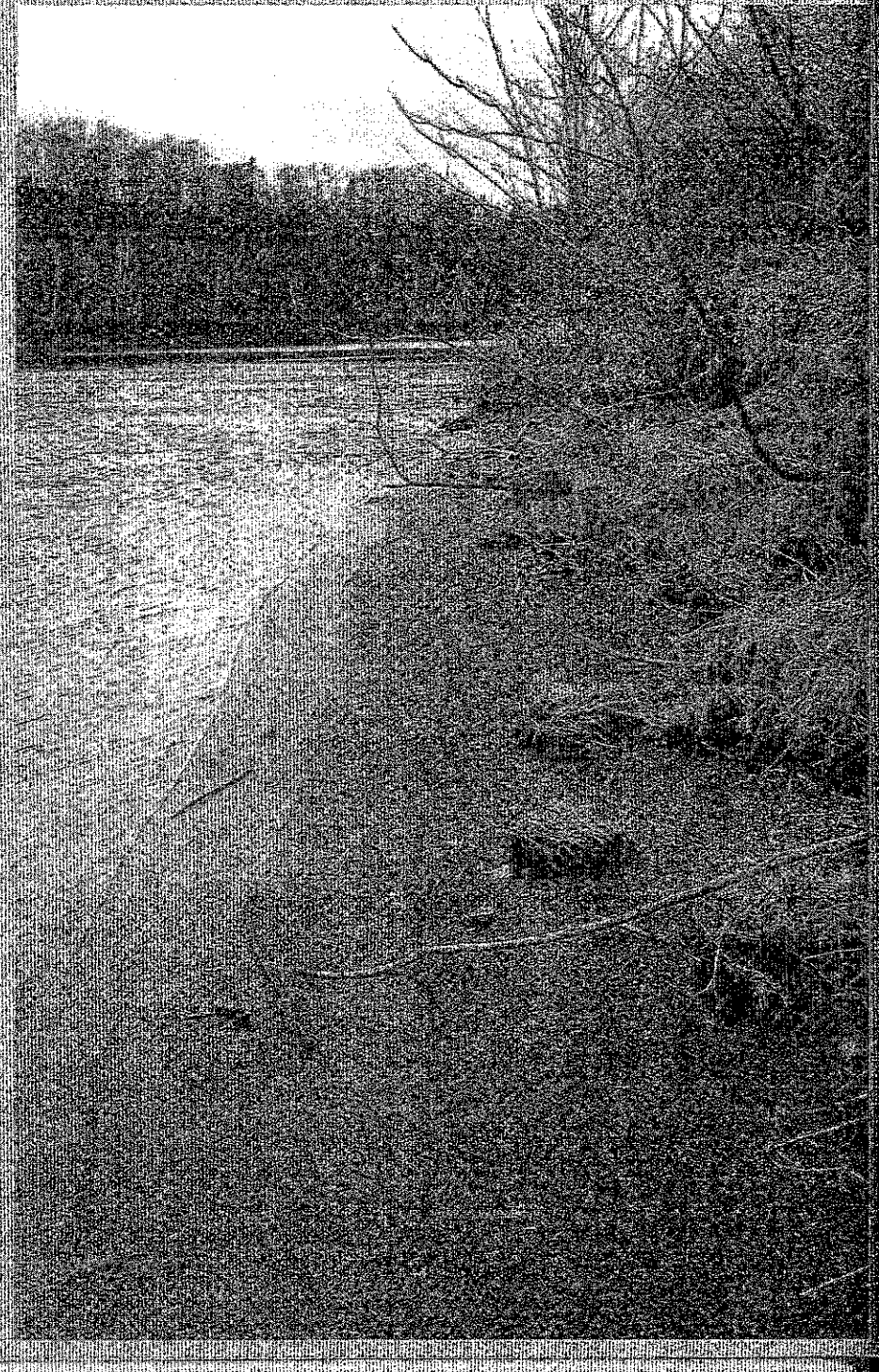


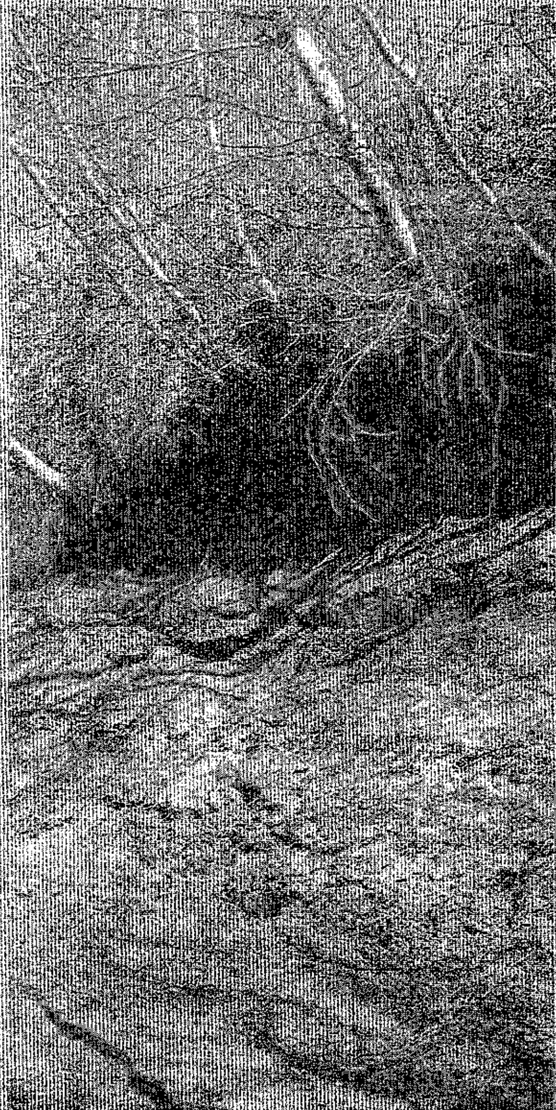


Above, the land, the "lower fields," before 1898 when the covered bridge was washed out. Then, in 1949, the Wilder Dam was built and the river and the land, the riverbank, were forever changed.

Look back at the old pictures of the riverbank. This is the riverbank today--- undercut, roots exposed and in one place, at least 40 feet of erosion as measured by land surveyors in 1961, 1989, and 2015.



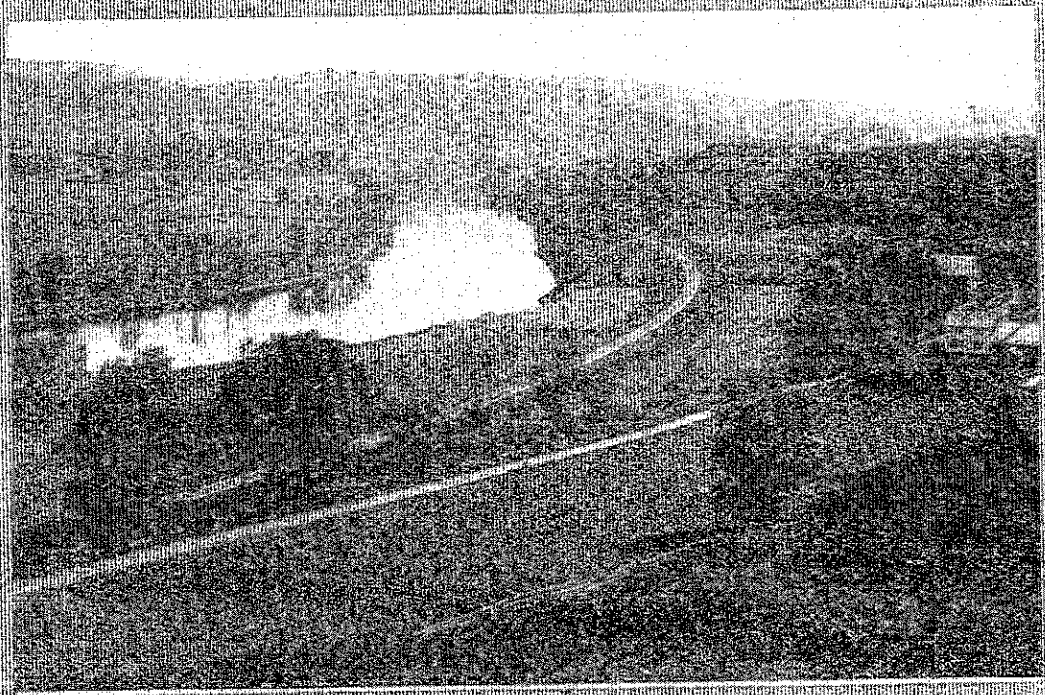




The trees on the riverbank were cut.

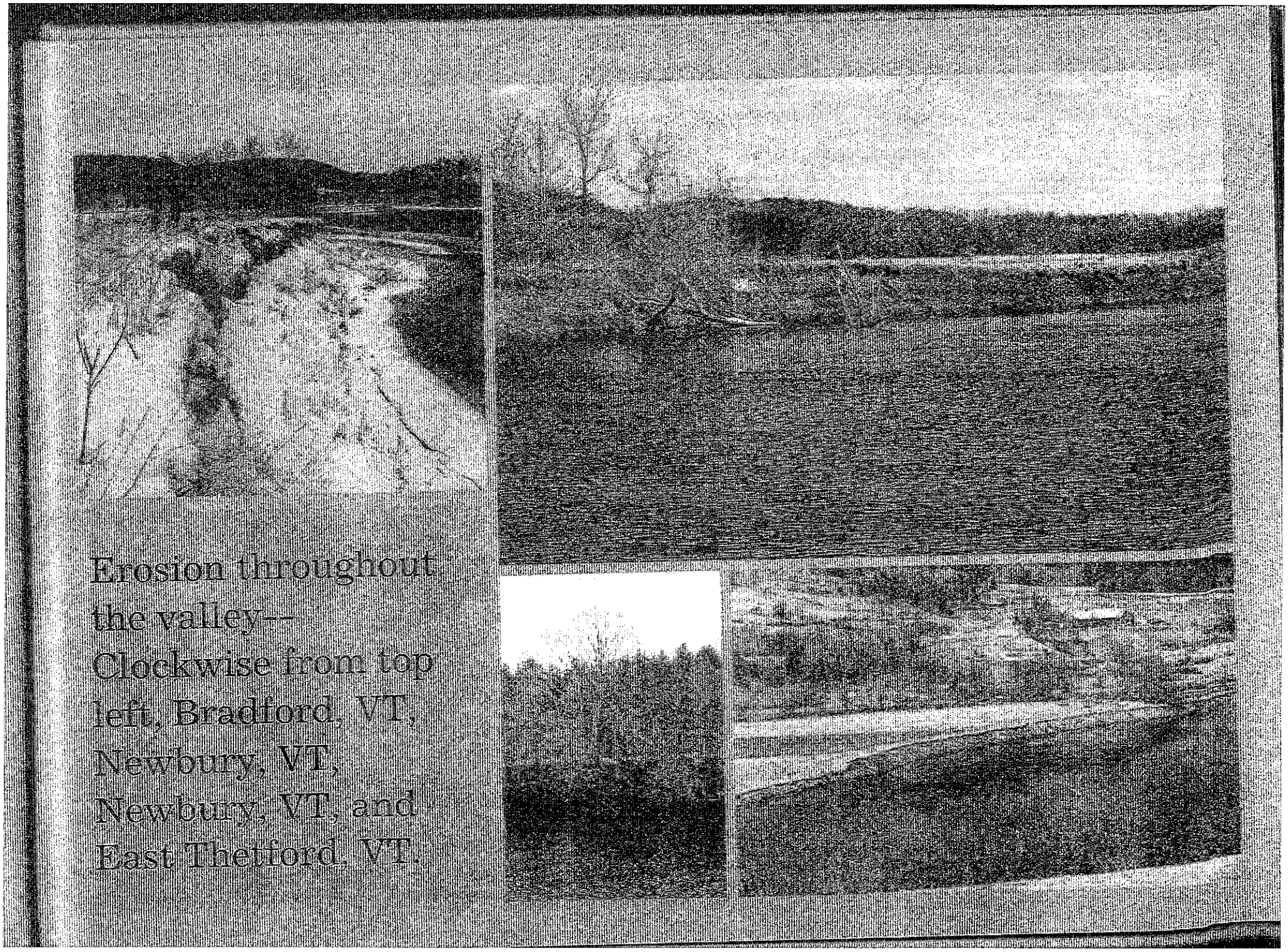
The riparian buffer was destroyed.

The farmland has been destroyed.

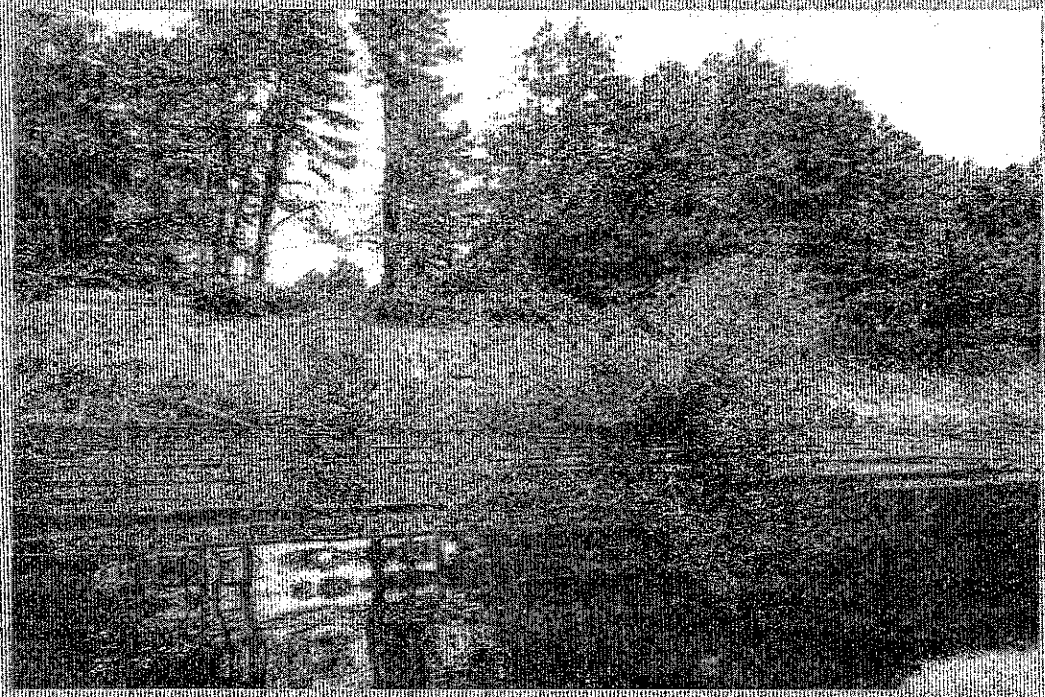


The erosion is not just on the Mudge land.

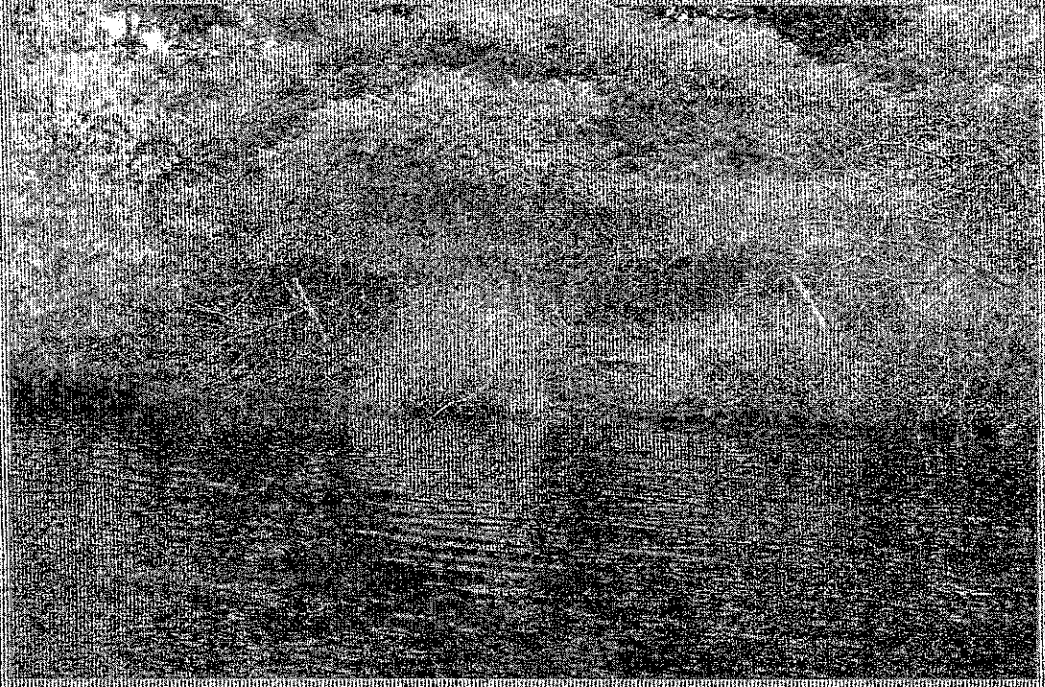
Upper photo of land in Lyme from north of North Thetford, VT. Lower photo, that same eroded riverbank today.



Erosion throughout the valley-- Clockwise from top left, Bradford, VT; Newbury, VT; Newbury, VT; and East Thetford, VT.



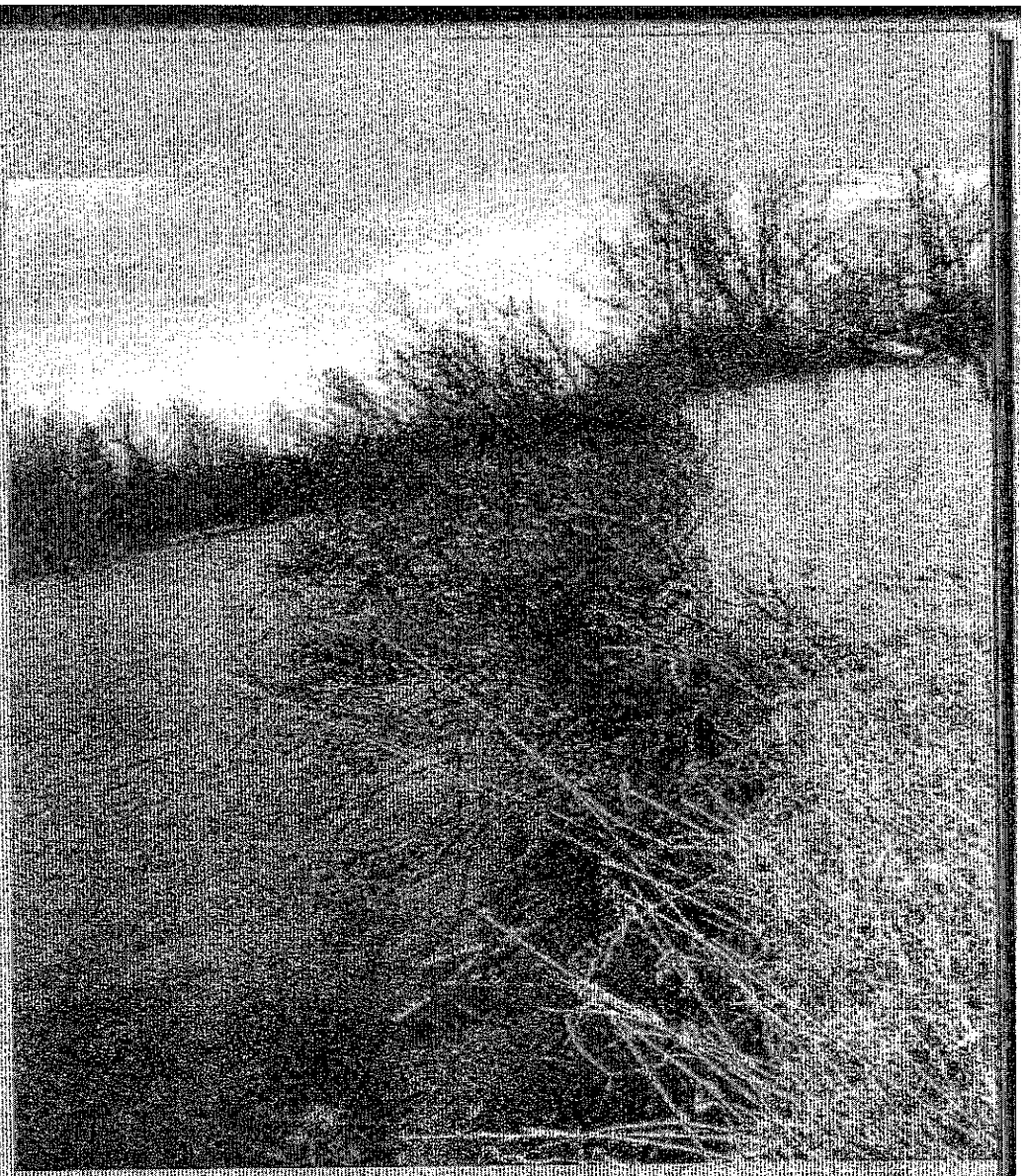
Orford, NH



Orford, NH.

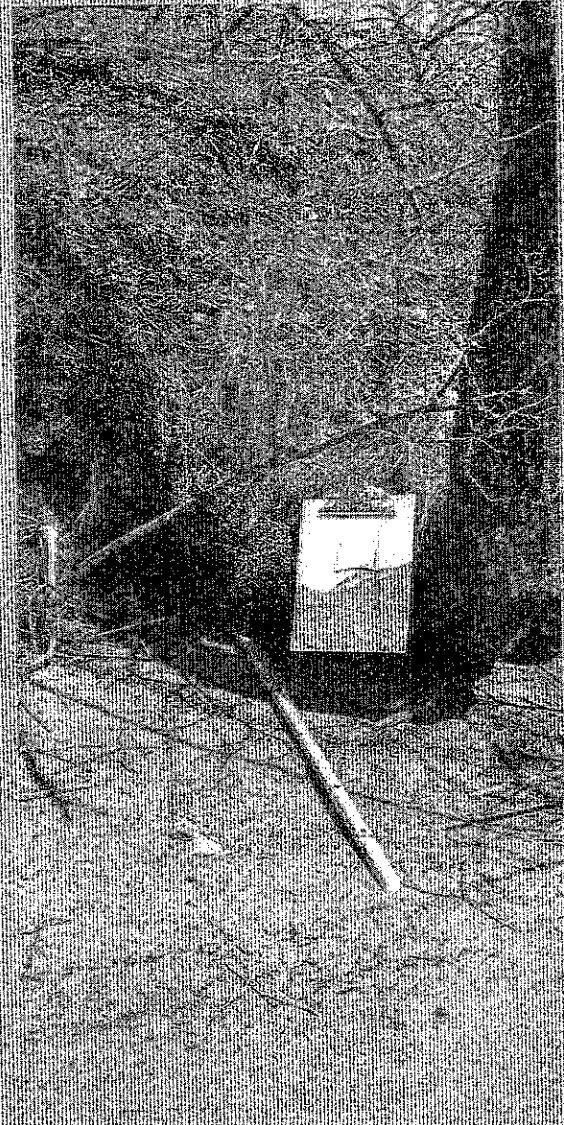
Note the "hanging fenceposts" where the riverbank has eroded the land.

Above: Newbury, Vermont.



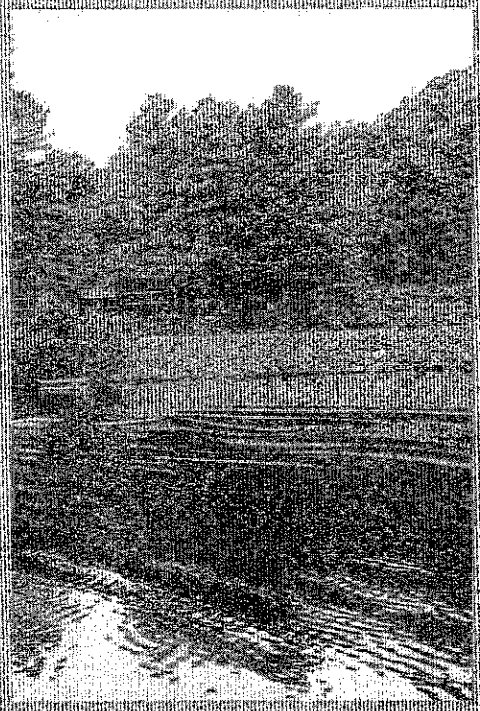
Above: Fairlee, Vermont.

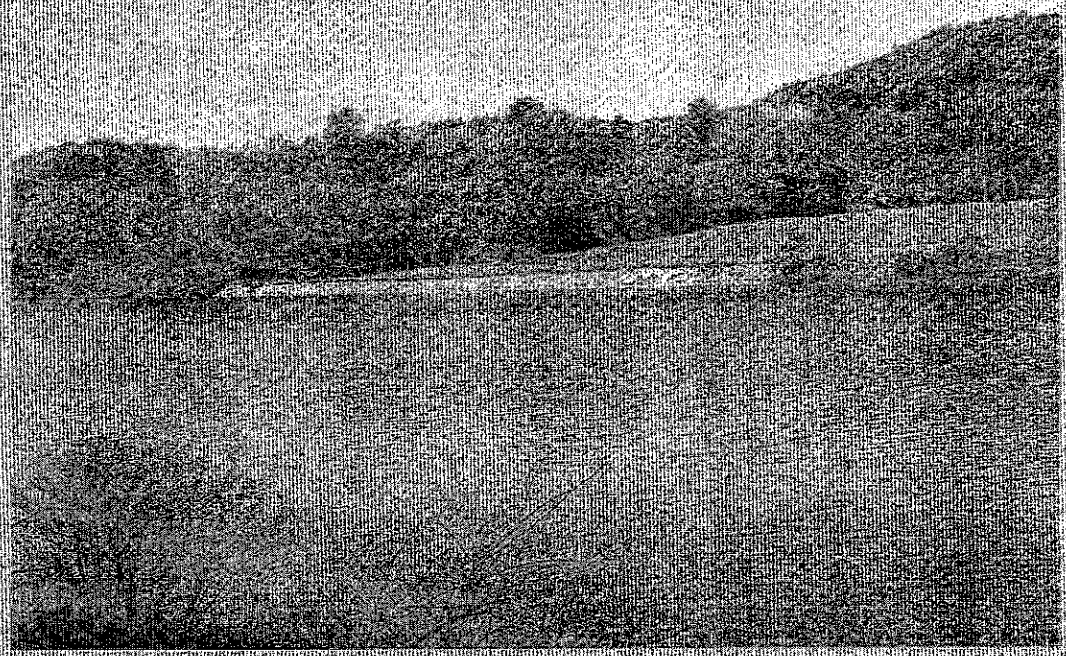
In the Fairlee picture, note the trees falling over the undercut riverbank, trees from a riverbank restoration project.

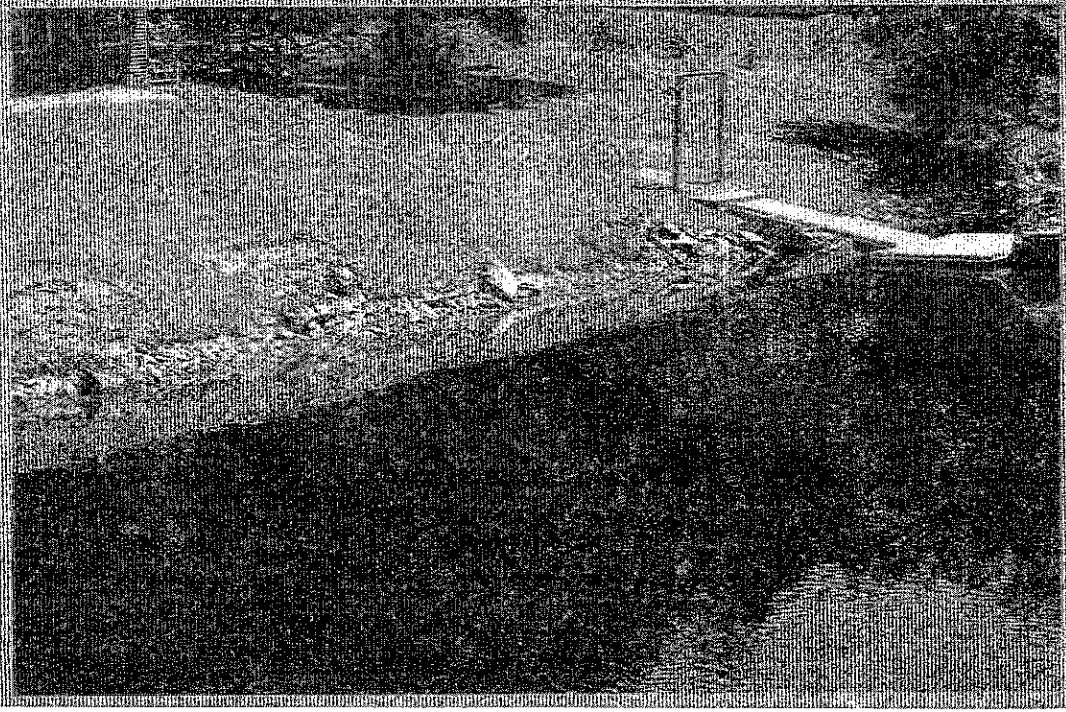


What happens? As the water level is raised, the silty and sandy soil is saturated. Then the water is lowered and seep holes are formed and soil is removed from the riverbank. Seeps can be 4-5 feet deep into the riverbank.

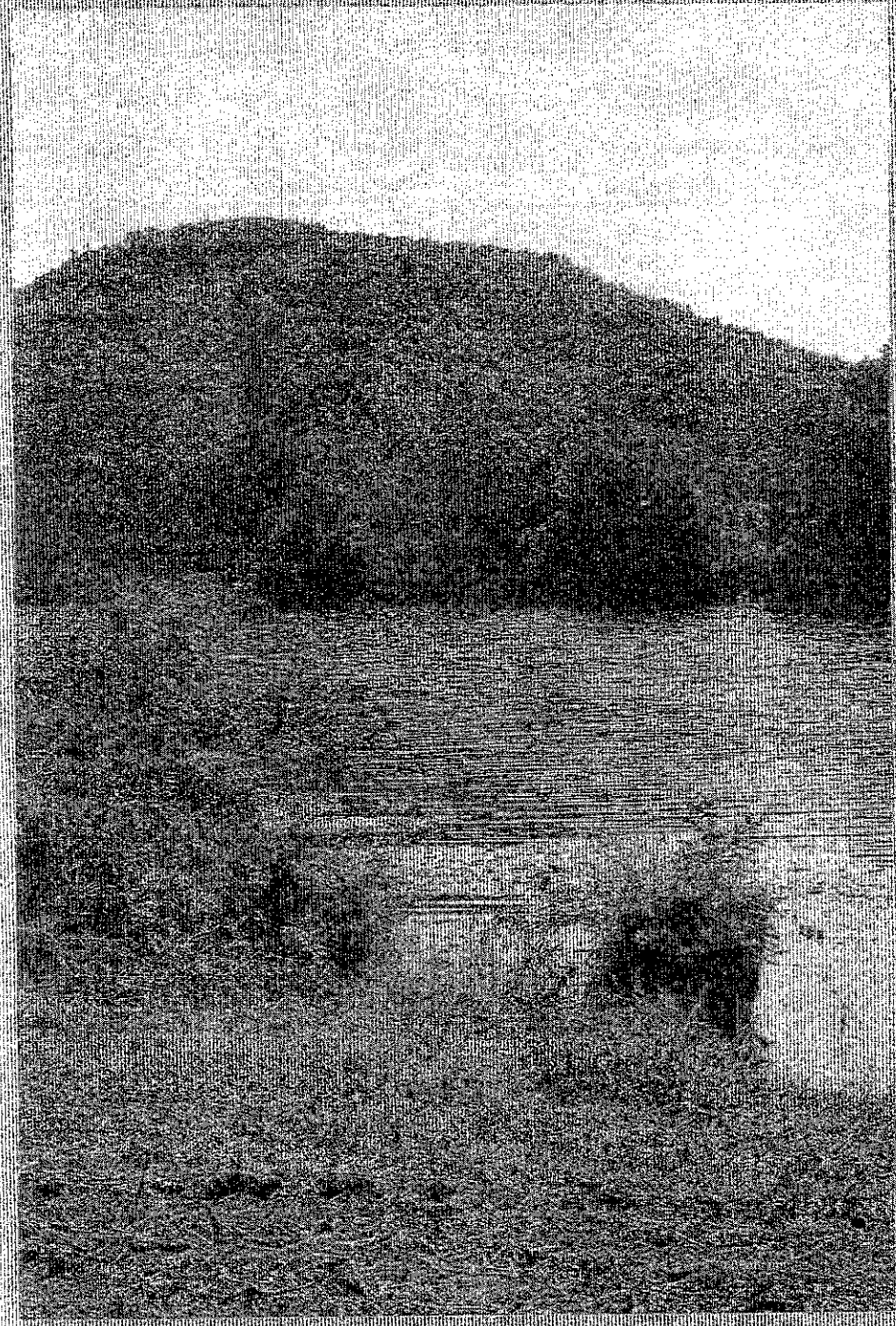
Next, the seep holes get larger and larger and in time they collapse and deep sink holes are formed and the erosion of the bank really begins. Above, sink holes 5-6 feet deep.

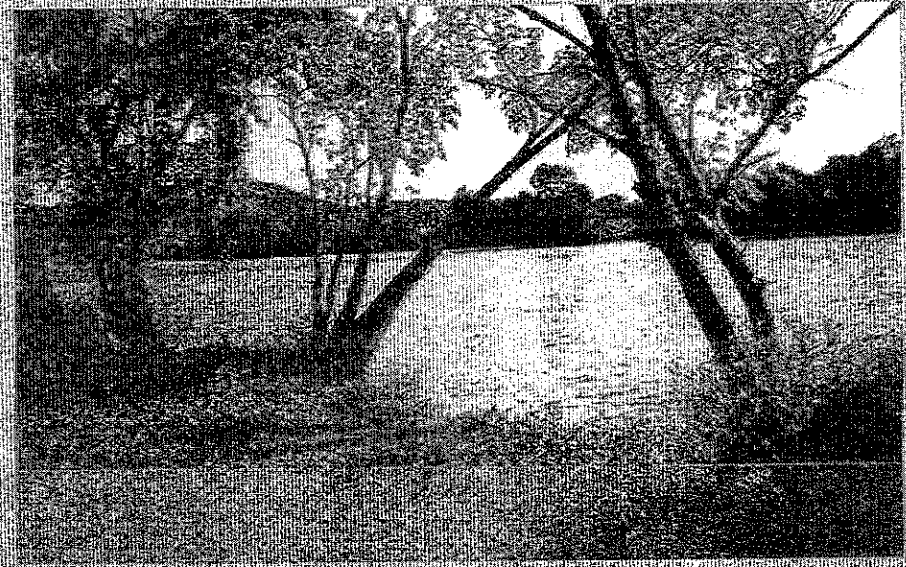




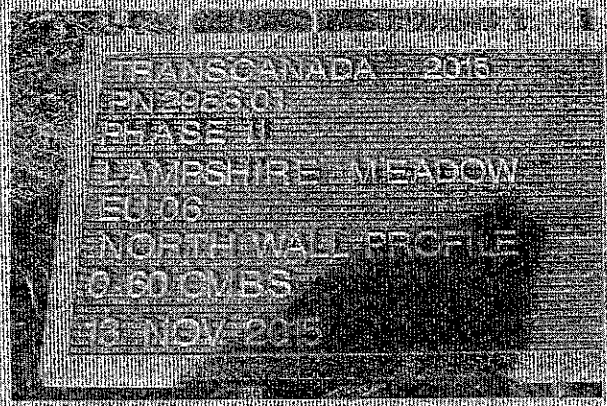


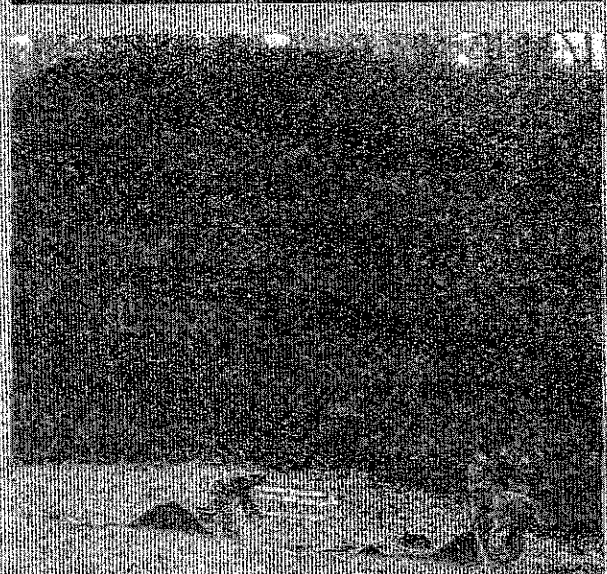
Some try rocks and gravel to protect their property, but it is expensive and does not often work.

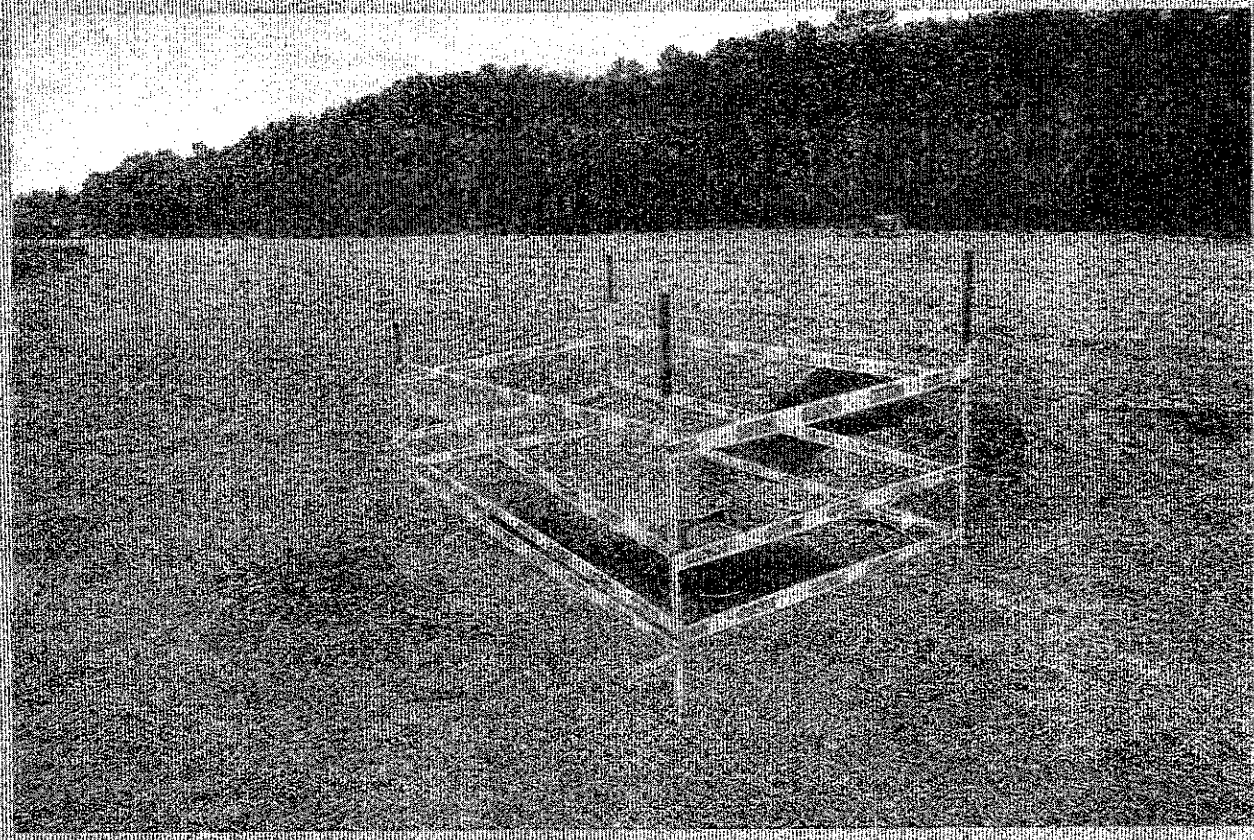




Erosion has destroyed the Butternut trees. We have only the stumps and a painting--
and we have 20-30 feet of erosion.

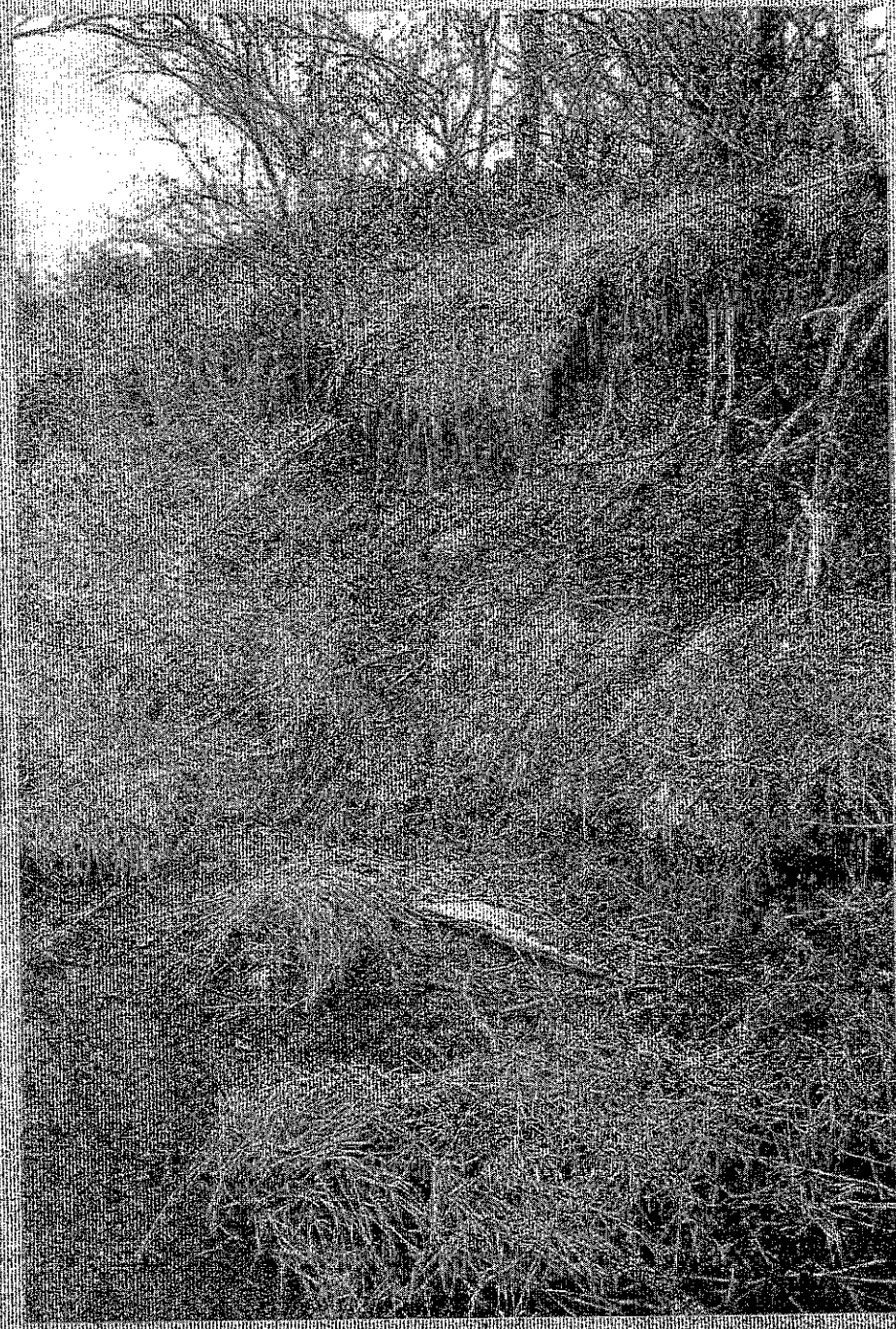






Things were not always this way. As a result of an archaeological dig in 2015, we know that people were in these fields 8,000-10,000 years ago.

And this is the riverbank right beside the site of the dig. What artifacts have been forever lost as a result of the erosion?!



Why is all of this important? The Wilder dam is being relicensed and studies are being done to determine whether the operations of the dam contribute to the erosion.

Guess what!! All of the studies done by the company that owns the dam conclude that dam operations do not contribute to the erosion.

Big surprise.

Let me walk this through.

There was no dam and there was no erosion.

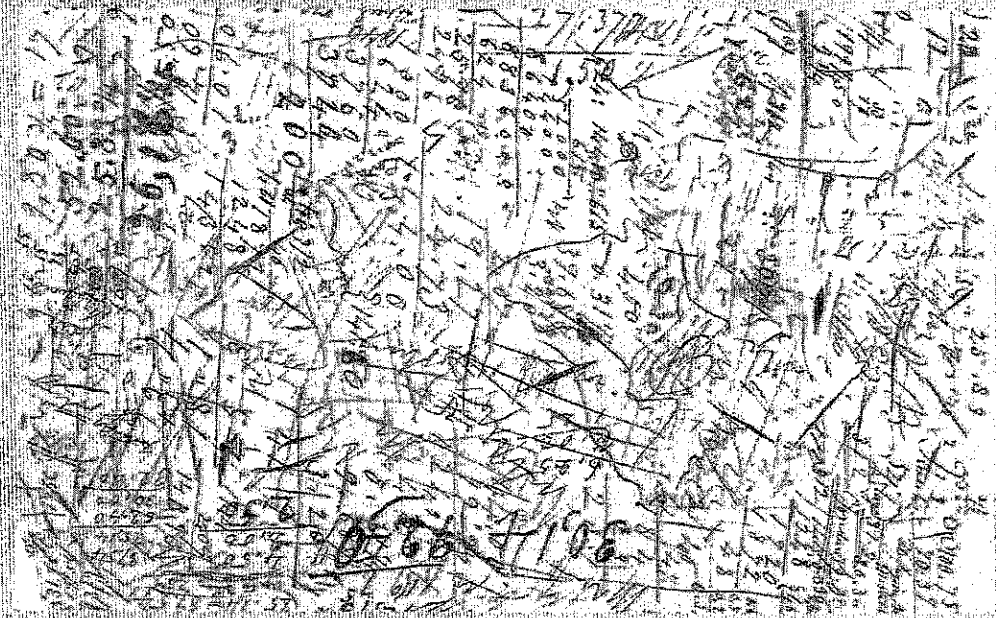
A dam was built, there were no other changes, and there was erosion, but the erosion is unrelated to the dam. Is that all correct?

That may seem too simple, but to further prove that there is no erosion, they use the "erosion ratio." What's that? They write : "The erosion ratio was initially developed by Field Geology Services LLC, to identify potential causes of erosion in the Turners Falls impoundment. The report was accepted by FERC with no substantive stakeholder comments regarding the erosion ratio, so the approach should be considered valid."

Hmmm.. That sounds like, "If I write it, you must be believe it", or "What me worry?"

Some of the greatest scientific minds in history have been consulted and they too have been puzzled by the "erosion ratio."

Maybe this is the proof:

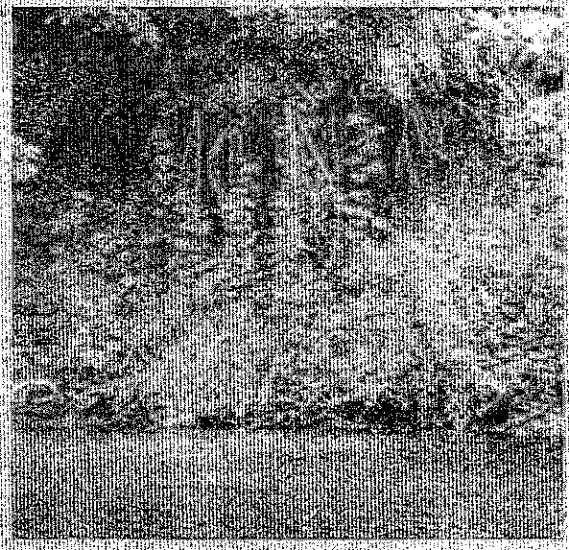


Wait! PrincetonHydro to the rescue and they wrote:

"...the revised study still utilizes and makes conclusions based on the erosion ratio. This approach is not an accepted scientific practice. No citation or reference is provided for this metric, and the metric is not used, to our knowledge, in the extant fluvial geomorphic scientific literature. The study does not demonstrate that the method conforms to generally accepted scientific practice, in fact the revised study states that the erosion ratio approach for identifying potential causes for erosion has not been widely used."

--In other words, don't believe the erosion ratio.

Erosion studies were done at several different transect sites, like this, near the tree in the background, left. Below is the root system for that tree. Look through the foliage in front of the root system. That has been described as "Erosion features, None."



More pictures of that tree and its root system.

Remember:

Erosion features, None.

Have questions, contact:

John Mudge, Lyme NH

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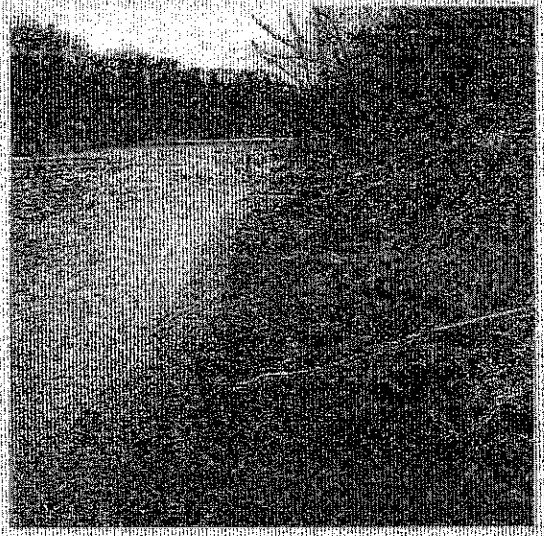
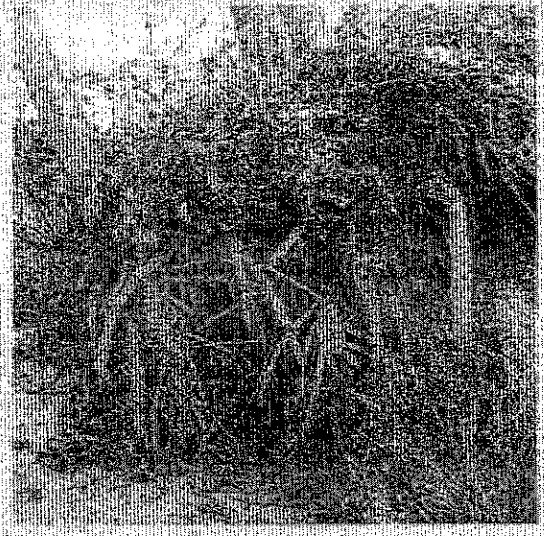
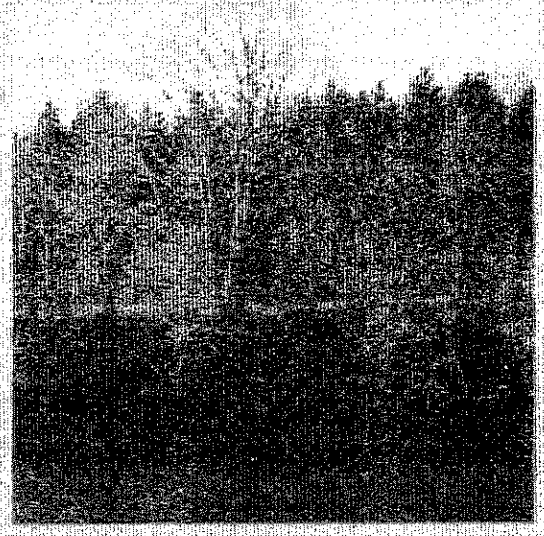
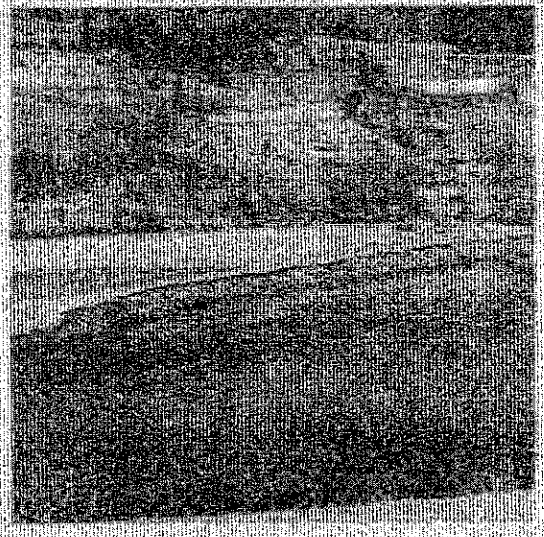
Come take a walk along the riverbank.









Erosion features, "None." Maybe we should take another look!