Relicensing Study 3.1.2

NORTHFIELD MOUNTAIN/TURNERS FALLS OPERATIONS IMPACT ON EXISTING EROSION AND POTENTIAL BANK INSTABILITY

Updated Study Report Summary

Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)

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FirstLight
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SEPTEMBER 2015

1.1 Study Summary

Study No. 3.1.2 *Northfield Mountain/Turners Falls Operations Impacts on Existing Erosion and Potential Bank Instability* examines the causes of erosion present throughout the Turners Falls Impoundment (TFI), the forces associated with them, and their relative importance at a particular location. Activities conducted since the 2014 Initial Study Report (ISR) include: continued data gathering and literature review, continued field data collection, data analyses, and model development. Activities which have occurred during 2015 are discussed in greater detail in the sections below.

Appendix A provides an overview of the correspondence FirstLight has distributed or received since the ISR.

1.2 Study Progress Summary

Task 1: Data Gathering and Literature Review

This task is complete. A full list of the existing data and literature sources gathered as part of this task was provided to the Stakeholders and filed with FERC on December 15, 2014 as part of FirstLight's *Response to Stakeholder Comments on the Initial Study Report and Meeting Summary*. Boat wave and groundwater data as well as TFI water level and flow data were provided to the Stakeholders on May 26, 2015. Additional resources identified by FirstLight since the December 2014 filing were included in Study 3.1.2 *Progress Report No. 1* which was filed with FERC on August 18, 2015 (Appendix A).

Additional data or literature sources identified since the December 2014 filing include:

Hydraulic data (near shore depths and velocities 1997-2011 collected periodically)

Suspended sediment samples (collected periodically from 1997-2011)

Bed and bank material samples (collected periodically from 1997-2008)

Analysis of Ice Formation on the Platte River (Simons & Associates, 1990)

Physical Process Computer Model of Channel Width and Woodland Changes on the North Platte, South Platte, and Platte Rivers (Simons & Associates, 1990)

Calibration of SEDVEG Model Based on Specific Events from Demography Data (Simons & Associates, 2002)

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<u>Task 2: Geomorphic Understanding of the Connecticut River</u>

This task is substantially complete. The geomorphic assessment has focused on the following areas:

- Recent Geomorphic History of the Connecticut River
- Modern Geomorphology
- Natural Riverine Geomorphology

- Hydrology, Channel Geometry, Hydraulics, and Bank Material of the TFI
- Historic Comparison of the TFI Riverbank and Channel
- Erosion Comparison of the TFI and Connecticut River

As required by FERC in its Study Plan Determination Letter (SPDL) dated September 13, 2013, FirstLight reviewed the "1970 vintage ground survey" (original Exhibit K drawings) to determine if comparisons could be made with recent aerial imagery and available survey data to "analyze trends in bank position within the TFI." The findings of this comparison were filed with FERC as part of the Study No. 3.1.2 Quarter 1 Data Deliverable submitted by FirstLight on May 26, 2015 (Appendix A).

As stated in the May 2015 filing, the original Exhibit K drawings were developed in the late 1960s and early 1970s through a combination of aerial imagery, photogrammetry, and ground surveys. The original drawings contained information pertaining to the Project Boundary, minimum and maximum flow lines, ownership rights, topography, and miscellaneous facility details.

Upon preliminary review of the drawings, it appeared that the Minimum Flow Line depicted the edge of water, however, as the drawings were reviewed more closely that did not appear to be the case. Furthermore, it is unclear how the location of the Minimum Flow Line was identified and what mapping methods were used to develop the original maps. FirstLight also explored the possibility of developing correlations between the Minimum Flow Line depicted on the original Exhibit K drawings and existing surveyed cross-sections of the river to determine the location of the edge of water at the time the original drawings were developed, however, that effort proved unsuccessful.

The location of the Maximum Flow Line was also reviewed to determine if that line could be used to conduct the analysis FERC recommended. Upon review of the drawings it became clear early on that the Maximum Flow Line would not be an accurate representation of the edge of water given that its location extends into the flood plain a far distance from the actual river channel in a number of locations.

FirstLight is currently examining the availability of other historic datasets that could be used for context when discussing the historic geomorphology of the Connecticut River. The findings of this will be included in the final study report (last outstanding sub-task).

Task 3: Causes of Erosion

This task is in progress. FirstLight informed the Stakeholders at the 2014 Initial Study Report Meeting that the potential causes of erosion and potential primary causes of erosion identified in the Revised Study Plan (RSP) were reviewed and have not changed. The potential causes of erosion to be examined as part of this study include:

- Hydraulic shear stress due to flowing water;
- Water level fluctuations due to hydropower operations;
- Boat waves;
- Land management practices and anthropogenic influences to the riparian zone;
- Animals;
- Seepage and piping;
- Freeze-thaw; and,
- Ice or Debris.

The potential primary causes of erosion that are being examined in greater detail include:

- Hydraulic shear stress due to flowing water;
- Water level fluctuations due to hydropower operations;
- Boat waves;
- Land management practices and anthropogenic influences to the riparian zone; and,
- Ice

While identification of the potential causes of erosion has been completed, the process of assessing the relative importance of each of those potential primary causes of erosion will not be concluded until completion of Tasks 4, 5, and 6. In regard to the identification of the potential and potential primary causes of erosion, relevant report sections are starting to be drafted.

<u>Task 4: Field Studies and Data Collection</u>

This task is on-going. The majority of the field work was conducted in 2014 with supplemental field work occurring in 2015 and continuing into March 2016 (ice monitoring as specified in the August 2014 RSP Addendum pertaining to the closure of Vermont Yankee).

Prior to the 2014 field efforts, FirstLight consulted with Stakeholders in selecting the location of the detailed study sites found throughout the TFI. The final set of detailed study sites were presented in FirstLight's *Selection of Detailed Study Sites* report which was filed with FERC as Appendix B of the Study No. 3.1.2 *Initial Study Report Summary*.

During the 2014 field season data collection at the detailed study sites consisted of:

- Soils analyses including classification, structure, parent materials, texture, hydric regime, position on landscape, and engineering dynamics such as susceptibility to slope failure

- Collection of sediment samples which were analyzed for particle size distribution as related to critical shear analysis using Shield's criteria. To the extent that different soil layers were visible, samples were collected and analyzed for each layer.

- Direct, in-situ bore hole shear tests using a hand auger from which the effective cohesion, angle of internal friction, pore-water pressure, and bulk unit weight were determined

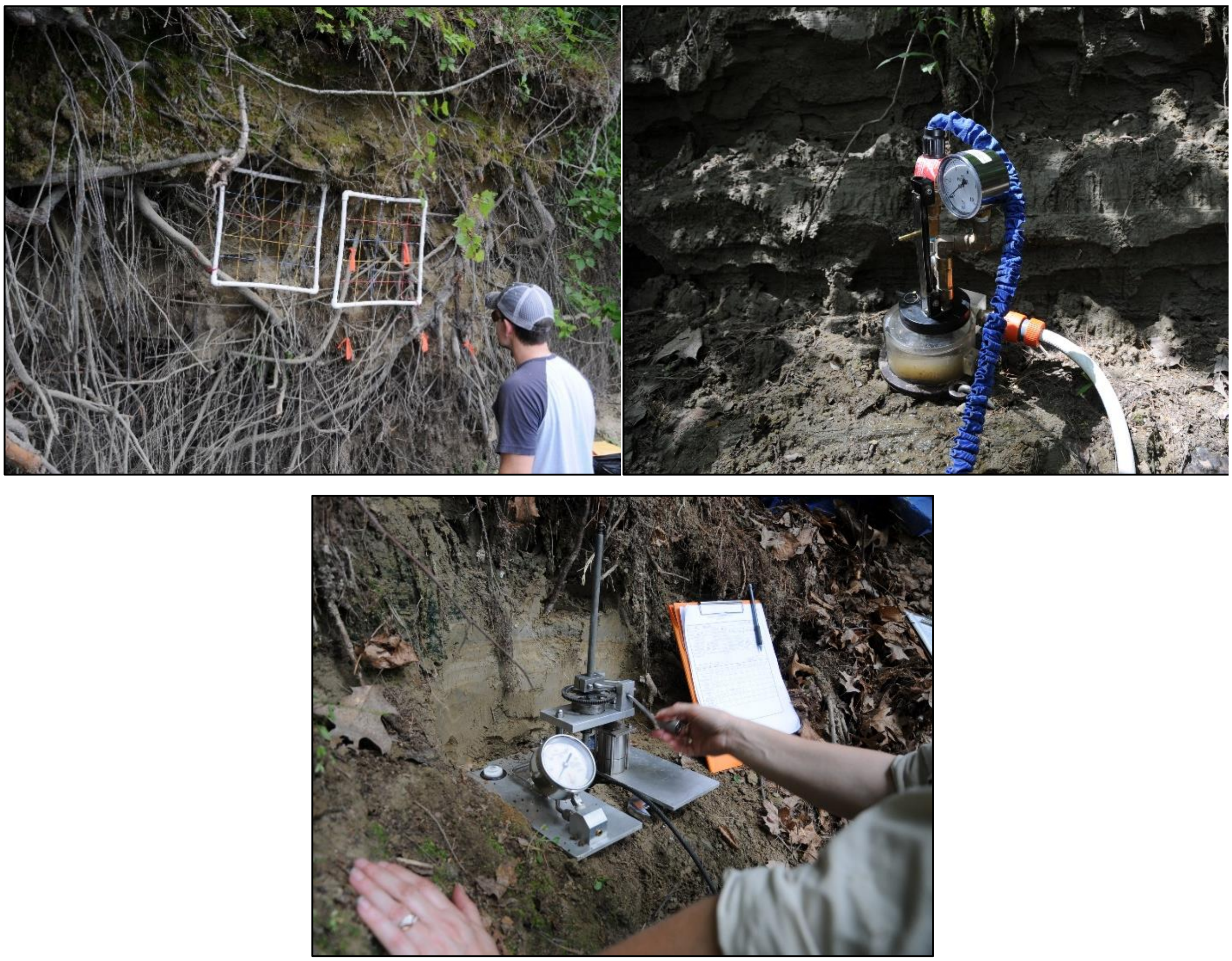
- Determination of the erodibility coefficient using a submerged jet test

- Information on vegetation, root structure, and density

At the conclusion of the 2014 field season data collection efforts which were required for the input parameters to BSTEM were substantially complete. Over the course of the winter 2014-2015 all field collected data were reviewed, as well as the existing historic datasets to be used as part of this study, to determine if supplemental data collection efforts would be required during the 2015 field season. Based on this review, it was determined that the existing boat wave dataset was insufficient for input into BSTEM. In order to fill this data gap, FirstLight collected supplemental boat wave data at three locations throughout the TFI from May through September 2015. Additional details related to this task can be found in Section 1.3.

Additionally, annual cross-section surveys were conducted in 2014 and 2015 at the 22 long term TFI cross-sections as well as at each detailed study site. The annual surveys were full cross-section surveys. That is, each survey started at the top of one bank, continued down the bank, across the channel, up the opposite bank, and back to the top. The results of these surveys will be used for various analyses including in support of BSTEM.

2015 also saw the completion of two significant modeling efforts, the TFI HEC-RAS model and the TFI River2D model. Output from these models will be used as input parameters for BSTEM as well as for various hydraulic analyses as they relate to erosion. Project operations data (including flow, water level, pumping and generating cycles, etc.) continue to be collected by FirstLight. At the conclusion of the 2015 field season all necessary data collection efforts should be completed with the exception of ice monitoring which will occur during the winter 2015-2016 until approximately March 31, 2016.



Clockwise from top left: (1) Vegetation and root density data is collected for input into BSTEM's RIPROOT module; (2) an erosion jet test is conducted on the bank of a detailed study site; and (3) a bore hole shear test is conducted at a detailed study site

<u>Task 5: Data Analysis</u>

This task is on-going. Data collected during the 2014 field season have been reviewed, post processed (if required), and undergone QA/QC. Following the completion of the QA/QC process, the data were analyzed for incorporation into BSTEM. Data that have been reviewed and analyzed since the ISR include: annual cross-section surveys, HEC-RAS output data, sediment sample results, soils information, vegetation information, and the results of the bore hole shear tests and submerged jet tests. Data analysis and BSTEM setup and calibration are still ongoing as of the date of this report. Supplemental data that has been, or is, being collected during the 2015 field season will undergo the same review, post processing, and QA/QC process as the data collected in 2014 did. Some preliminary analysis of the 2015 data is currently underway.

Additionally, FirstLight provided stakeholders with supplementary information regarding the modeling process in the *Response to Stakeholder Comments on the Initial Study Report and Meeting Summary* filed with FERC on December 15, 2014.

Task 6: Evaluation of the Causes of Erosion

The 2014 ISR stated that preliminary evaluation of the causes of erosion based on the data collected in 2014 will occur in 2015. At this time some preliminary and high level analyses have occurred, however, given that data review is ongoing and data collection is continuing through 2015 and into 2016, any in-depth analysis would be premature at this time and as such has not been conducted. Relevant output data from the River2D and HEC-RAS models continue to be reviewed while setup and calibration of BSTEM is still ongoing. The bulk of this task will not be started until the completion of Task 5 and the successful completion of model runs.

Task 7: Report and Deliverables

Some sections of the report are in the process of being drafted. A final report will be completed in the second quarter of 2016.

1.3 Variances from Study Plan and Schedule

The 2014 ISR indicated a variance in the RSP pertaining to the presence of ice in the TFI. In order to determine the effects, if any, that the Vermont Yankee closure may have on potential increases in ice and shoreline erosion processes, in August 2014, FirstLight included an addendum to the RSP that addresses ice issues. That work will continue as identified in the RSP Addendum.

A variance to the study plan has been the collection and analysis of supplemental boat wave data as part of Tasks 4 and 5. In early 2015, during a review of the existing datasets collected and compiled to support this study, it was determined that the historic boat wave data was insufficient for inclusion in BSTEM. In order to fill this data gap, FirstLight collected supplemental boat wave data during the 2015 field season (May-September). Data collected as part of this effort included boat statistics (boat length, boat speed, and distance of its sailing line from the shoreline) and wave properties (wave period, wave height, and direction of wave propagation).

In order to capture the required information, digital cameras equipped with data acquisition and transmission systems and self-logging wave staffs were installed at three monitoring locations throughout the TFI. Equipment was installed in May 2015 and will be operational through September 2015. Monitoring locations where the equipment were installed include: (1) just upstream of the French King Bridge, (2) just downstream of the Route 10 Bridge, and (3) just upstream of the Schell Bridge/Pauchaug Boat Launch. At each of these locations a camera was mounted to the bridge and a corresponding wave logger installed in the water a short distance from shore. When a boat passes the monitoring location, the camera captures the pertinent boat information while the wave logger captures the relevant wave properties. Data is downloaded on a bi-weekly basis at which time a preliminary quality assurance check is conducted.

The collected data is then analyzed using a custom developed image processing tool to measure the speed, location, and passage time of the boat as well as to estimate the type, shape, and size of boats as they pass.

The corresponding wave data for each wave passage is then extracted from the wave staff measurements. The results of the imaging analysis together with the wave measurements will provide data for the calibration and use of the empirical wave height model in BSTEM.

Clockwise from top: (1) digital image of a passing boat captured by the camera mounted to the Route 10 Bridge; (2) wave logger located just downstream of the Route 10 Bridge; and (3) Dual wave loggers located just upstream of the French King Bridge

1.4 Remaining Activities

- Completion of Tasks 2-7.

Appendix A – 2015 Correspondence Log

Study No. 3.1.2 - Summary of Correspondence since the 2014 Initial Study Report

Author	Distributed to	Date	Description	Included in Appendix
FirstLight	FERC (e-filing)	9/15/2014	Initial Study Report	No
FirstLight	Meeting	9/30-10/1/2014	Initial Study Report Meeting	No
FirstLight	FERC (e-filing)	10/15/2014	Initial Study Report Meeting Summary and Attachments	No
FirstLight	Stakeholders, FERC, MADEP	11/4/2014	FirstLight response to CRSEC August 28, 2014 Memo	Yes
CRWC, FRCOG	FERC, FirstLight	11/14/2014	Comments on the Initial Study Report and Initial Study Report Meeting	Yes
Northfield Board of Selectmen	FERC	11/4/2014	Comments on the Initial Study Reports for Study 3.1.1 and 3.1.2	Yes
FRCOG	FERC	1/9/2015	Request for erosion transect information	Yes
FERC	FirstLight	1/22/2015	Determination on Requests for Study Modifications and New Studies	No
FirstLight	Stakeholders, FERC, MADEP	3/31/2015	2015 Qtr. 1 Data Deliverable	Yes *(Cover letter only)*
FirstLight	FERC (e-filing)	5/26/2015	2015 Qtr. 1 Data Deliverable	Yes *(Cover letter only)*
FirstLight	FERC (e-filing)	7/21/2015	Notification of Updated Study Report Meetings	No
FirstLight	FERC (e-filing)	8/18/2015	Study No. 3.1.2 Progress Report No. 1	Yes

November 4, 2014

VIA EMAIL

Brandon Cherry, FERC
*Joe Hassel, FERC
*Brian Harrington, MADEP
*David Foulis, MADEP
*Bob Kubit, MADEP
*Bill McDavitt, NMFS
Russ Cohen, MA Riverways
Kimberly Noake MacPhee, FRCOG
* Peggy Sloan, FRCOG
*Andrea Donlon, CRWC
*Tom Miner, CRSEC
John Bennett, FCD
Mike Bathory, LCCLC
**designates attendees at the August 4, 2014 meeting*

Re: CRSEC August 28, 2014 Memo in regard to FirstLight Relicensing Study No. 3.1.2- *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability*

Dear All,

On Monday August 4, 2014 FirstLight Hydro Generating Company (FirstLight) held a meeting with stakeholders at the Northfield Mountain Visitor Center to finalize the selection of detailed study sites associated with Relicensing Study No. 3.1.2 *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability.* Part of that meeting included a discussion of comments submitted on Friday August 1, 2014 by the Franklin Regional Council of Governments (FRCOG) on behalf of the Connecticut River Streambank Erosion Committee (CRSEC). At the conclusion of the meeting, Tom Sullivan (Gomez and Sullivan Engineers, consultant for FirstLight) reviewed action items resulting from the meeting. By letter dated August 28, 2014 the CRSEC submitted a follow-up memo stating commitments it believes were made by Tom Sullivan at the August 4th meeting. Below please find FirstLight's response to the items identified in the CRSEC memo.

CRSEC Commitment #1: Detailed cross-section drawings for each of the detailed study sites (like those provided by Kit Choi for the land based survey sites).

FirstLight Response: Kit Choi will conduct detailed site assessments, including site sketches, at each study site identified in the *Selection of Detailed Study Sites Report* filed with FERC on September 15,

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2014 (as an appendix to the ISR for Study No. 3.1.2). These site assessments and sketches will be included as an appendix to the final study report issued in 2016.

CRSEC Commitment #2: Full cross-section drawings for sites located at permanent transects – include both banks and presented at a scale that can be easily read.

FirstLight Response: FirstLight will provide the CAD files and/or prints of each cross-section at a scale that can be easily read as an appendix to the final study report issued in 2016.

CRSEC Commitment #3: Locate the Mean Annual Low Water mark on the cross-section and provide the water level elevation (MSL).

CRSEC Commitment #4: Locate the Mean Annual High Water mark on the cross-section and provide elevation.

CRSEC Commitment #5: Locate the upper and lower project operational range of water level fluctuations (2000-2013) on the cross-sections and provide elevations.

CRSEC Commitment #6: Locate the upper and lower project operational range of water level fluctuations allowed by the current license on the cross-sections and provide elevations.

CRSEC Commitment #7: Locate the jurisdictional boundaries for the MA Wetlands Protection Act, MassDEP 401 WQC and US Army Corps of Engineers on each detailed cross-section.

FirstLight Response to CRSEC Commitments 3-7: FirstLight's internal notes of the meeting are not completely consistent with Commitments 3-7 as articulated by the CRSEC. FirstLight acknowledges having a broad discussion relative to how water surface elevation data may be illustrated in the final report but does not recall making the specific commitments that CRSEC has articulated. Relative to Commitment #7, FirstLight has had preliminary conversations with MADEP regarding the identification of the Ordinary High Water Mark (OHWM) at each study site; however, final resolution regarding how this will fit into the study methodology has not occurred at this time. FirstLight will continue to consult with MADEP, FERC, and CRSEC on the best way to present this data in the final report.

If you have any questions, please feel free to contact me at (413) 659-4489 or via email at john.howard@gdfsuezna.com.

Sincerely

John Howard

CONNECTICUT RIVER WATERSHED COUNCIL
The River Connects Us
15 Bank Row, Greenfield, MA 01301 crwc@ctriver.org www.ctriver.org

November 14, 2014

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

Re: Northfield Mountain Pumped Storage Project No. 2485-063
Turners Falls Project No. 1889-081
Comments on the Initial Study Report dated September 15, 2014
Comments on the 2014 Initial Study Meeting Summary dated October 15, 2014

Dear Secretary Bose,

The Connecticut River Watershed Council, Inc. (CRWC) 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. Below are our comments on the September 14, 2014 Initial Study Report (ISR) and October 15, 2014 Initial Study Meeting (ISM) Summary submitted by First Light.

3.1.1 2013 Full River Reconnaissance Study

CRWC is a member of the Connecticut River Streambank Erosion Committee (CRSEC). We were involved in drafting the letter commenting on study 3.1.1 submitted by CRSEC. We include the letter as **CRWC Attachment 1** in order to endorse the comments and include them as part of our own.

In addition to the CRSEC comments, we would like to make the following comments.

<u>Categorical data error</u>.

The Full River Reconnaissance (FRR) is described in the Revised Study Plan, the Quality Assurance Project Plan, and in the Initial Study Report as a "reconnaissance level survey," not a quantitative study. It is not quantitatively correct to simply treat categorical data as if it were numeric data (directly measured) to calculate the extent within the study area (or percent of total) of the various riverbank characteristics and erosion classifications. One may sum the segment lengths for each category in the study area, but that is not the same as the sum of each characteristic or classification, since the categories do not require a characteristic or classification to be solely present in the entire segment. The data presented in Table 6.1 of the FRR represents the proportion of riverbank classified in the categories, not the proportion of the riverbank exhibiting the various riverbank characteristics and erosion classifications. The FRR analysis frequently treats these data about categories in Table 6.1 as if they were referring directly to characteristics and classifications. This error is most prominent in the report's assertion that the 84.8% of riverbank in the category of None/little reported in the 2013 FRR represents an increase of 1.5% in riverbank stability and corresponding decrease in eroding banks from the 83.3% of riverbank categorized as None/little in the 2008 FRR (p. ii, v, 6-13, and 6-25). The difference between these studies is the difference in the category None/little, not the difference in length of eroding banks. The conclusion of a 1.5% increase in riverbank stability is not valid based on these data.

Riverbank lengths differ.

Despite being a reconnaissance level survey and not quantitative, the FRR on page 6-25 states, "From 2008 to 2013, the extent of riverbank experiencing None/Little erosion increased from 83.3% to 84.8% (205,153 to 211,158 feet), representing a 1.5% increase in stable length over this 5 year period." We would like to stress that the lengths given are very much quantitative. They also represent the lengths of all the segments that were classified as "little/none"extent of erosion. One could definitely not conclude that there is any change in the amount of erosion, since extent of erosion is assessed over segments that are not delineated on erosion features. Moreover, the extent of erosion is not the same as the stage of erosion, as implied when the FRR says there is a 1.5% increase in stable length. This statement is meaningless.

The 2008 FRR showed on page 2 of the Executive Summary that the total length of banks including islands is 246,282 ft. We took the GIS data provided to us from the 2013 FRR and found the total length of banks including islands is now 248,958 ft, a 1% difference. This alone shows you how different years measure things differently, despite having the same team do the work. Likewise, the 2007 Field report titled, "Fluvial Geomorphology Study of the Turners Falls Pool on the Connecticut River between Turners Falls MA and Vernon VT" describes on page 28 that two mapping efforts in 1990 provided an opportunity to determine how differences in mapping methods alter the results. Field 2007 also noted "A significant amount of the apparent changes between map years may merely be an artifice of differences in mapping techniques, personnel, and season of mapping."

CRWC request: In addition to comments and requests in the CRSEC letter, we request that First Light revise the FRR to remove the instances where categorical data are incorrectly analyzed. These statistical errors lead to false or misleading conclusions and assessments. Any estimates of length of riverbank (or percent of total) exhibiting riverbank characteristics and erosion classifications derived from the categorical data must also include confidence intervals or error bars.

3.1.2 Northfield Mountain/Turners Falls Operations Impact on Sediment Transport

As a member of CRSEC, CRWC was involved in drafting the letter commenting on study 3.1.2 submitted by CRSEC. We include the letter as **CRWC Attachment 2** in order to endorse the comments and include them as part of our own.

3.2.1 Water Quality Monitoring Study

CRWC expressed concern in our July 28, 2014 comment letter and again verbally at the ISR meeting held on September 30, 2014 about the varying depths and distance from the banks to which the temperature loggers will be placed upstream of the Turners Falls Dam, within the bypass reach, and downstream of the Deerfield River confluence. We continue to be concerned that the depths may be representative of different conditions.

To summarize, according to the revised Study 3.2.1:

- Data loggers in the Turners Falls impoundment "will be deployed in a representative location at a minimum of 4 ft from the surface, but not deeper than 25% depth. To confirm representativeness, periodic measurements of surface, logger depth and near bottom will occur."
- Loggers in the bypass reach, power canal, and below Cabot Station "will be placed in a representative location in mid-channel or thalweg at mid-depth, or just off the bottom depending on site-specific characteristics. Installation locations will be selected that are low risk for vandalism and will be as unobtrusive as possible to minimize conflicts with recreational use of the river. Areas of low water velocities (~< 1 fps) and significant turbulence will be avoided to the extent possible (MADEP, 2007). All loggers will be encased in perforated pipe, and attached to an immovable object or anchor using polypropylene rope or cable (MADEP, 2009)."
- The loggers between Cabot Station and the Holyoke Dam will "be encased in perforated protective housing, and secured off the bottom of the river with rocks or concrete blocks. The logger assembly will be tethered to an immovable object on shore with polypropylene rope or cable."

<u>CRWC request</u>: FirstLight should either modify the study plan to make all loggers consistently placed, or propose one location in each of the three study segments that to have duplicate loggers to demonstrate the varying logger locations lead to insignificantly different results.

3.3.7 Fish Entrainment and Turbine Passage Mortality

The ISR for study 3.3.7 indicates Task 1 is mostly complete. The August 14, 2013 Revised Study Plan (RSP) stated that in Task 1, FirstLight "will develop a summary of the life history traits and habitat requirements of key resident species as they relate to these factors affecting entrainment at the Northfield Mountain Project and Turners Falls Project from standard literature sources."

The key resident species nor any of their traits or requirements were provided in the ISR. However, despite FirstLight's objection to presenting results before a final report, Section 1.2 of the ISR, under Task 1, says,

> "Preliminary results indicate that most of the common resident fish are unlikely to be in the area of the intakes due to their habitat preferences, and therefore, unlikely to be entrained or impinged. Two species, walleye and fallfish, prefer habitat that is found in front of the Northfield Mountain Project intake/tailrace and may be more susceptible to entrainment or impingement depending on length. Most of the common resident fish are likely to sustain their populations even if individuals of the population are entrained because with the exception of largemouth bass, white suckers, walleye, white perch, and fallfish can double their numbers every 1.4 to 4.4 years (species summaries accessed at www.fishbase.org, 2012) and are not isolated populations due to the presence of upstream and downstream fish passage facilities."

Stakeholders are not able to evaluate such a statement when additional data are not provided. Stakeholders have to wait until March 2016 for this final report to be submitted. An ISR and/or the USR next year is an appropriate time to discuss species and methods so that stakeholders can get a sense of how the study is progressing.

3.3.9 Two-dimensional Modeling of the Northfield Mountain Pumped Storage Project Intake/Tailrace Channel and Connecticut River Upstream and Downstream of the Intake/Tailrace.

Three transects vs. four

FirstLight explained that it did not add a fourth transect as required in the September 13, 2013 Study Plan Determination 1 because the intake structure extends out under water to be close to Transect 1 shown in Figure 3.3.9-2 of the RSP. It is not clear to us how the stakeholders will understand velocity conditions experienced by fish in the large area that is typically underwater between transect 1 and the end of the wetted area at the eastern end of the tailrace.

Vector Maps

The ISM Summary leaves out a detail on page A-8. I asked if the consultant could make vector maps with vector arrows in the study reach of the Connecticut River (5km upstream and downstream of the Northfield Mountain tailrace). FirstLight's consultants said it wouldn't be 3D, but they could provide arrows showing which way the river was flowing at various flows and turbine production runs. I said that would be very helpful, and there was wide agreement in the room from stakeholders that these kinds of maps would be useful. The ISM Summary merely says, "Gary explained that only two-dimensional modeling was being done for the Northfield Mountain intake and Impoundment discharge area." This indicates no commitment to make the vector maps.

It is very important that we see arrows for the direction of the Connecticut River in the vicinity of the Northfield Mountain tailrace. That was one of the main purposes of CRWC's study request in the first place. It is important to understand river flows under pumping and generating conditions from a fisheries, erosion, as well as a recreation standpoint, from our perspective.

In the past, FERC has indicated an interest in the subject of flow reversals stemming from the operation of Northfield Mountain. Exhibit W to the 1972 Application for Relicensing for the Turners Falls Project submitted by Western Massachusetts Electric Company (WMECO) discussed flow reversals on pages 19 and 20, and Figure 5 to Exhibit W shows flow velocities in the vicinity of the Northfield Mountain tailrace under a river flow of 5,000 cfs and a pumping condition of 12,000 cfs. However, the analysis mainly considered Northfield pumping situations, not generation. A letter from the Federal Power Commission to WMECO dated January 22, 1974 requested more information on flow reversals. A response from WMECO to the Federal Power Commission dated March 12, 1974 indicated that WMECO was planning to conduct a study that summer to answer the questions in the January 22, 1974. WMECO indicated it would submit the study when complete. CRWC could not find any entries in the FERC e-library regarding the submittal of this study. Moreover, the weekday and weekend pattern of pumping and generation described in the 1972 Exhibit W is no longer applicable.

CRWC request: In the August 14, 2014 RSP, it states that the final report will contain, "Vector maps showing the magnitude and direction of water velocities." The final report for study 3.3.9 should specifically have vector maps showing the entire study stretch (5 km above and below the Northfield Mountain tailrace) of the Connecticut River under various river flow and pumping and generating conditions.

3.3.12 Control Gate Discharge Events

CRWC reviewed the report provided in the ISR as well as the updated tables presented as Attachment F in the ISR Meeting Summary.

It is useful to see the flows in Tables 4-1b and 4-2 and how often these occur during emergency and non-emergency events. What would be most useful to CRWC is to know from fisheries agencies what flows are of a concern, and then have a table showing all the data for those flows. For example, Table 4-2 presents periods when more than four spill gates were open. But are flows of interest experienced when there are 1-4 gates open, and if so, how often? Knowing the reason for each non-emergency spill gate release could also help stakeholders understand which releases could reasonably be delayed or modified to minimize impacts on shortnose sturgeon in the future.

Tabular information about flows at the sluice gate and reason for opening (trash or otherwise) would be helpful.

As for the question about whether or not field studies are necessary, CRWC recommends FirstLight provide all data needed for discussion, then schedule a meeting or conference call of stakeholders to discuss this matter in more detail.

3.6.1 Recreation Use/User Survey

As noted during the ISR meeting, the user contact surveys did not implement FERC-required changes until August of 2014. This missed a large part of the peak summer season, and most or all of the winter ski season. CRWC continues to be concerned about this omission, despite FirstLight assuring us that it will have no effect on study results.

The residential abutter survey was mailed out on July 30, 2014, rather than in the spring as stated in the RSP. After CRWC received some communications from abutters that they either did not receive the letter or were given only a few days to fill out the form, CRWC requested a copy of the cover letter to the survey. The letter and survey were apparently sent by certified mail, meaning recipients needed to go to the post office to pick it up. The letter requested a response by August 11 2014, less than two weeks after the letter was sent out. Given August being a vacation month, and the added detail of needing to pick up the certified letter, it is likely that abutters did only have a few days to return the form.

The final report for this study should show a diagram of where the pressure tube traffic counters were placed at each site. During a visit to the Poplar Street parking area in August 2014, I noticed that the pressure tube counter was located in a section of the parking lot that most people would never drive over; it was located very close to the river and the vast majority of parking would take place farther away from the river. If the pressure counter was never moved all season, it will need to be re-done in 2015.

<u>CRWC recommendations</u>: User contact surveys should be re-done from January to August 2015 with the full set of FERC-required questions. The pressure tube counter should be re-done at the Poplar Street launch in 2015.

3.6.2 Recreational Facilities Inventory and Assessment

This is a completed study. Though the RSP stated, "the bulk of this study was conducted in the summer of 2012," that was not the case. With the exception of three sites, all sites were inventoried in the off-season by the same 2-person team during October 15-17, 2011, well before the relicensing studies had been drafted or approved. On October 16, 2011, 12 sites were inventoried. Given the length of daylight in the middle of October and drive time between sites ranging from the Vernon Dam to Unity Park in Turners Falls, it appears the team spent less than an hour at each site. One site was entirely left out, the fishway viewing area. The work done was incomplete and it was done when the surveyors would not have seen peak use.

<u>Site 11: Boat Tour and Riverview Picnic Area</u>. The condition of the bathrooms was not given. They were probably locked at the time of the survey.

<u>Site 14: Cabot Camp Access Area</u>. A building at the site is mentioned as being not open to the public. What is this building currently used for, and what was it used for in the past?

<u>Site 15: Barton Cove Nature Area and Campground</u>. The survey was done when the facility was closed. No information is filled in the field sheet for this site under "site facilities" – no mention of showers or the condition they were in, no mention of grills, picnic tables, or parking areas, or the condition of tem.

<u>Site 16: Barton Cove Canoe and Kayak Rental Area</u>. The survey was done when the facility was closed The section of the report with the field forms attaches the Barton Cove Campground and Canoe/Kayak Rental Rates for 2011. This form is 3 years out of date. The company no longer provides the $30 upriver shuttle, so it should not be assumed that this service is still in place. What other details are out of date?

There is no mention that this site is the take-out location for portage around the dam. Is there signage indicating this? Is there a phone number provided, a phone provided, or information about how to get portage transport at this site?

<u>Site 17: (Barton Cove) State Boat Launch</u>. No information is provided about the season that the dock is installed at the site. There is no information about the sign/kiosk at the site. The form for this site was filled out on October 16, 2011, well past peak use time. Even though the text in Section 5 states that there is a portable toilet that is seasonal, the form said that sanitation facilities were, "maybe portable – pulled already." Predictably, there was no evidence of overcrowding, even though I have heard stories of vehicles being parked out on Route 2 and getting tickets. Barton Cove is used quite heavily for ice fishing in the winter. How do people get their fishing shacks out on the ice? Is the gate opened in the winter, or is the area accessed somewhere else?

<u>Site 20, Gatehouse Fishway Viewing Area</u>. "The condition of the public viewing facilities could not be rated since the inside of the facility was not open during the inventory site visits." FirstLight could have given the keys to the surveyors, or the consultant could have paid a visit to this facility during the month it is open.

<u>Site 23: Cabot Woods Fishing Access</u>. The site description states, "The access road along the canal is open to the public and is used for sightseeing." Note: this access road is used for fitness walking, dog walking, roller blading, bird watching, and bankside fishing in the canal. The field sheet indicates a flat gentle slope to the water. That may be true for the water in the canal, but not for the water in the bypass

channel. The trails down to the water in the bypass channel are eroded and not maintained. The bypass channel is frequently used for informal swimming, something that would not have been determined during the October 17, 2011 site visit to fill out the form.

Site 24: Turners Falls Canoe Portage. This site assessment would be better broken into site 16 for the take-out and site 24, which is the Poplar Street boat launch. The Poplar Street boat launch is also used as a put-in for paddling between Turners Falls and the Sunderland Bridge, the only section of river with speed limits for motor boats and a ban on personal watercraft. The field sheet says it has 4 spaces, but it has more than 4. Because parking spaces are not marked, it appears the person completing the survey may have mis-interpreted the location and configuration of parking. The site condition sections says, “The portage trail at the put-in site is currently functional, but as there have been no improvements to the put-in, no condition assessment was made of this area.” This statement is astounding. Why would no condition assessment be made if there have been no improvements? This put-in is steep, eroded, and in poor condition. The field form indicates severe compaction, moderate erosion. There would also likely be no evidence of overcrowding when the survey was completed on October 17, 2011.

CRWC request: CRWC requests that closed more up to date information be collected during times of peak usage, that a survey be completed of the fishway viewing area, and that more thoughtful “assessment” of the sites take place.

3.7.3 Traditional Cultural Properties Study

CRWC hopes that FERC and FirstLight can broker a conversation with the tribes to allow for adequate consultation. The study due date can be extended beyond the first quarter of 2015 to accommodate consultation.

Lastly, we are aware that the Massachusetts Department of Fish and Game has submitted a study request for Habitat Assessment and Surveys for State-listed Mussels in the Connecticut River, and we are supportive of that request.

We appreciate the opportunity to provide comments on the ISR. We also look forward to receiving FERC’s process plan to keep track of the varying due dates and comment deadlines for FirstLight’s 38 studies.

Sincerely,

Andrea F. Donlon

Andrea Donlon
River Steward

ATTACHMENTS

CRWC Attachment 1

CRSEC comment letter on Study 3.1.1

Franklin Regional
Council of Governments

CONNECTICUT RIVER STREAMBANK EROSION COMMITTEE

November 14, 2014

VIA ELECTRONIC FILING

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

Re: Northfield Mountain Pumped Storage Project No. 2485-063
Turners Falls Project No. 1889-081
Comments on Relicensing Study 3.1.1, 2013 Full River Reconnaissance (FRR)

Dear Secretary Bose:

The Connecticut River Streambank Erosion Committee (CRSEC) herein submits comments on Relicensing Study 3.1.1, 2013 Full River Reconnaissance, dated September 2014. CRSEC is a committee of the Franklin Regional Planning Board acting under the authority of the Franklin Regional Council of Governments (FRCOG). The CRSEC was created over two decades ago as a forum for stakeholders, including landowners, public agencies, nonprofits, and the licensee, to come together and work cooperatively to address the substantial erosion problems occurring in the Turners Falls Impoundment. Pursuant to Articles 19 and 20 of the Project's licenses, the CRSEC has worked for over 20 years in conjunction with FirstLight and its predecessor project owner, Northeast Generating Company, towards stabilizing thousands of feet of actively eroding shoreline along the Turners Falls Impoundment.

The CRSEC has been an active participant in the Commission's relicensing proceedings for the Northfield Pumped Storage Project. We have also had a direct role in riverbank stabilization projects carried out over the past 15 years pursuant to the 1998 Erosion Control Plan, including oversight of four past Full River Reconnaissance studies. Our governmental sponsor, the FRCOG, secured numerous state and federal grants to support bank stabilization and repair projects. Our members include individuals with personal knowledge of the Connecticut River and lands bordering the Turners Falls Impoundment, and others with advanced degrees and decades of professional expertise in water resources management, geology, land use planning and ecology.

At the initiative of the Commission, the 2013 Full River Reconnaissance (FRR) was folded into the relicensing studies, giving it the dual role of a relicensing study and a compliance requirement. As a result, relicensing and compliance issues are inextricably intertwined and the comments presented here apply to both.

Despite its length and detail, we find the FRR has misleading, undocumented, and incorrect statements and conclusions, and does not follow its own Quality Assurance Project Plan (QAPP). These flaws call into question the conclusions of the entire study and any use of the FRR to inform Study 3.1.2, the so-called "Causation Study." The FRR does not provide enough sufficiently accurate information to allow a valid determination of compliance with the current licenses.

1. Statements from FirstLight indicate a bias that calls into question its ability to carry out studies in a scientific way.

FirstLight extensively cites an unvetted 2012 comparison of erosion on the Turners Falls Impoundment with other sections of the Connecticut River ("Riverbank Erosion Comparison Along the Connecticut River") conducted by Simons & Associates, the consultant that prepared the 2008 and 2013 FRRs. The 2012 Simons study is not a relicensing study and was commissioned by FirstLight outside of the FERC process and any CRSEC process. The final bullet cited by FirstLight from Simons 2012 states, "Based on the state of erosion in the northern un-impounded reach as well as the state of continued erosion in the Bellows Falls, Vernon and Holyoke impoundments, *it can be concluded that the riverbanks in the Turners Falls Impoundment are in the best condition (more stable and less eroding) than in any other part of the Connecticut River*" (emphasis added).

This is an incredible statement to put in the FRR, the purpose of which was to document riverbank conditions in the Turners Falls impoundment "at a reconnaissance level without reference to the cause of erosion (Revised Study Plan, p. 3-2)." It indicates bias that leads one to wonder how the studies could possibly be conducted and written in a manner that will simply document existing conditions. Additionally, in its October 10, 2014 "Answer of FirstLight Hydro Generating Company to Motion to Intervene and Comments" regarding an application for a temporary license amendment, FirstLight also stated on page 3, "FirstLight does not believe the current reservoir elevation limits are needed for engineering, environmental or any other reason…" This statement further demonstrates that FirstLight has already assumed a position that erosion is neither a significant issue nor caused by their project's operations.

The CRSEC finds a number of problems with the 2012 Simons study. One of the serious flaws in the report is that it completely ignores a body of scientific literature about erosion in impoundments and the impacts of water level fluctuations on bank stability.[1] Comparing free-flowing, alluvial reaches of the upper Connecticut River (or any other river) to the Turners Falls Impoundment is a red herring. While it is true that alluvial rivers are prone to natural erosion, the Turners Falls Impoundment exhibits only some of the characteristics of an alluvial river. The unanswered question remains: how do project operations impact bank stability in the unique geomorphic and hydrologic conditions of the Turners Falls pool? This is a question for Study 3.1.2, not 3.1.1.

The 2012 Simons study obscures a vital fact that <u>is</u> known – increased erosion is and has been occurring in the Turners Falls Impoundment since the Project began operating 40 years ago. Citing the study report in the FRR is not a scientifically valid approach and indicates a bias by both FirstLight and Simons & Associates, the consultant conducting the FRR, i.e., the types, severity and extent of erosion had been prejudged.

2. The FRR definition of "stable" was written one way, and then interpreted in another.

In Table 6.1 (page 6-6), the FRR reports the stages of erosion in the Impoundment, and calculates that 83.5% of the banks were stable, 9.1% eroded, 5.5% potential future erosion, 1.3% in the process of being stabilized, and 0.6% active erosion. "<u>Stable</u>" is defined in Table 5.2 (page 5-5) as "<u>riverbank segment does not exhibit types or indicators of erosion</u>."

Looking at the Table in Appendix I of the FRR, it is evident that many segments were characterized as having types or indicators of erosion, but were nevertheless classified as being "stable." In fact, using the FRR GIS database, we were able to calculate that, *using their own definition that stable is having no types or indicators of erosion, only <u>43.5% of riverbanks were "stable</u>."* The percentage of banks that had an erosion type and/or an

[1] See references cited in the expert opinion letter provided by the University of Illinois and included with our comments on Study 3.1.2.

indicator of erosion, seemingly not stable according to their definition but nevertheless labeled as stable by FirstLight, was 40.0% of the banks. The percentage of banks that had both a type of erosion and at least one indicator of erosion labeled as "stable" was 26.2% of the banks.

On page 6-5, the FRR explains the rationale behind the designations of stage and extent of erosion as follows:

> "Based on observations made during the FRR it was common to find some small degree of undercutting (even at the interface of bedrock and soil layers), exposed roots, and creep/leaning trees in many segments of the river even if those segments were classified as Stable with None/Little erosion. However, in many cases these features were not considered significant unless they reached beyond the previously defined classification thresholds or appeared in significant combinations to warrant elevating the classification of a segment from Stable or None/Little to another Stage or Extent of Current Erosion category."

It appears here that FirstLight has interpreted their definition of "stable" to be: riverbank segment does not exhibit *significant* types or indicators of erosion. FirstLight did not provide a threshold or definition of what "significant" means in the Revised Study Plan when it comes to Stages of Erosion. As discussed above, extent of erosion does have thresholds, and FirstLight has chosen to ignore and aggregate the data to fit its biased conclusions. The accepted definitions for Stages of Erosion do not include thresholds for moving from one category to the next. FirstLight has ignored the definition of stable as listed in the Revised Study Plan and Table 5.2 of ISR and inserted a high degree of subjectivity into the classification process. This is unacceptable and results in unsupported conclusions presented in the FRR.

3. Extent of Erosion is highly dependent on breakdown of river segments and how these segments were characterized in the FRR.

Page 5-2 of the FRR explains that the boat-based survey identified a total of 641 riverbank segments covering both banks and the islands. It also states, "Transition points where riverbank features and characteristics changed from one classification to another were identified…" Table 5.2 in the FRR defines the different riverbank characteristics, but does not define a "feature." There are 18 different riverbank characteristics. Transition points were apparently identified if one of 18 different riverbank characteristics changed from the segment that was previously being surveyed. A transition point was never determined based on an erosion classification because these are not riverbank characteristics defined in Table 5.2. Perhaps this implies that similar bank characteristics should behave similarly in terms of erosion.

As a result, many areas of erosion were missed, and some were incorrectly categorized. Some examples of areas that were missed are shown below.

Cropped version of FirstLight photo DSC_1164. Shot November 2013. Located along segment 513, classified as **none/little** extent of erosion.

Cropped version of FirstLight photo DSC_1192. Shot November 2013. Located along segment 515, classified as **none/little** extent of erosion.

Cropped version of FirstLight photo DSC_1203. Shot November 2013. Located along segment 515, classified as **none/little** extent of erosion.

The goal of the 2013 FRR was "to identify and define riverbank features and characteristics and the types, stages, indicators, and extent of erosion throughout the Turners Falls Impoundment" (Revised Study Plan page 3-2). Section 6.2 and Table 6.2 of the ISR states that the 2008 FRR found that 83.3% of impoundment riverbanks had none/little extent of erosion, while in 2013 84.8% had little/none erosion.

It is clear to us that splitting the riverbank into segments based on features other than erosion observations and then assessing the overall erosion in each segment is not a way to truly identify the extent of erosion along the banks. Therefore, the percentage numbers in 2013 and 2008 are meaningless, and in reality, using their methodology, no determination can be made about the extent of erosion and whether or not the riverbanks are getting more or less eroded over time.

4. Mischaracterization of extent erosion at a sampling of sites brings into question the FRR findings.

With two decades of experience reviewing bank erosion on the Impoundment, the CRSEC questioned the conclusion presented by the FRR that 84.8% of the riverbanks had none-to-little erosion (Table 6-2). Accordingly, we have reviewed photos of a selection of riverbank sites. The following are two examples.

A. Detailed examination of the 3,000 feet of bank downstream of the Kendall site (between river marker 790 and 760) demonstrate that the FRR maps in Figure 6.4 and Appendix J do not accurately characterize the extent of erosion. These riverbank segments (right side, looking downstream) are characterized as having "none-little erosion" in Figure 6.4 and Appendix J. We reviewed every photo along this stretch of riverbank and in every photo find two or more indicators of erosion, most extending along the entire length of the bank in each photo. See Attachment presenting these photos with an accompanying table comparing the bank characterizations in the FRR with CRSEC's observations.)

B. The Northern Connecticut River Fluvial Geomorphology Assessment done by Field Geology Services in 2004 says, "Reaches downstream of tributary confluences will generally have a morphology different than reaches immediately upstream of the confluence because of the introduction of sediment at the confluence….Delineating the reach breaks and understanding the morphological conditions present in each reach are critical for identifying the natural and human conditions leading to erosion and channel instability." (pages 10-11 in Field, 2004).

A look at the segments shown in Appendix G of the FRR indicate many segments straddle the upstream and downstream ends of tributary confluences. These include the Ashuelot River (segment 308), Newton Brook (517), Bottom Brook (509), Mallory Brook (499), Bennett Brook (465), Merriam Brook (126), Otter Run (441), and Ashuela Brook (438). Two segments shown on Appendix G maps seem to mostly be composed of a confluence: segment 88 at Pine Meadow Brook and segment 55 at the Millers River. How these could have bank characterizations is a mystery. For example, if one looks at DSC_0606 (below), one can see the Shearer house on the downstream end of segment 89. Segment 88, a segment 200 ft long, is to the right and shows submerged aquatic vegetation at the confluence of Pine Meadow Brook on the left, and then bank on the right. This segment was characterized as steep upper river bank slope, low upper river bank height, indicators of erosion (notch, exposed roots, creep/leaning trees), stable stage of erosion, and none/little extent of erosion. Though there is no erosion in the part of the segment that is a tributary meeting the Connecticut River, one would have a hard time concluding that the remaining bank has <10% of erosion, even though we could not know for sure where the segment break point was. Certainly including the tributary would "dilute" the extent of erosion in this segment.

FirstLight photo DSC_0606. Shot November 2013. Shearer property is on downstream end of segment 89. Tributary and downstream bank located along segment 88, classified as **none/little** extent of erosion.

5. Key observations and trends of Detailed Site Assessments are unsubstantiated and incomplete.

Page 6-3 of the FRR lists 11 key erosion observations and trends identified during the detailed site assessments conducted as part of the FRR land-based survey. Two of the 11 key observations (#5 and #9) refer to historical floods on the order of 50 years ago or older. We could find no reference to these observations in the Appendix H datasheets or the GIS files for the land-based or boat-based field work. When we asked for an example of these observations at the October 15, 2014 meeting on the FRR, FirstLight's representatives said they would have to get back to us with the information. To date, we have not received these examples. Observations #7 and 8 mentioned that there were several sites that were stable or had received deposition in 2011 from Tropical Storm Irene. Observations were glossed over for those sites such as 2, 12, 15, 18, and 31 that showed slumps, overhangs, tension cracks, undercuts, or exposed roods in the lower 0-8 feet above the water line.

6. The FRR is not in compliance with several elements of the QAPP.

Overall, the FRR contains no mention about following QAPP procedures or quality assurance tasks. Additional comments follow.

A. On page 14 of the QAPP and again on page 33, the QAPP states, "An appendix to the FRR report will include a comparison of the specific riverbank features and characteristics from the data logging files, or field data sheets, collected during the field surveys to a photograph of that same segment of riverbank captured from the digital geo-referenced video. A discussion will be presented in the FRR report based on this comparison. The process of comparing the data logging files to video/still images of a selected percentage of segments, or any segment of particular interest, provides a high level of quality assurance and control on the field data collection. This approach also provides a method for reference checking any subsequent interpretation of the field survey data after the survey has been completed." The FRR did not contain an appendix like this as promised.

B. Kit Choi is listed as the author of the FRR report on the cover. Section 4 of the QAPP did not list Mr. Choi as being involved in this project. It is very odd that the FRR was authored by someone not anticipated to be working on the FRR when the QAPP was written. What was his role and were other roles changed? Andrew Simon and Natasha Bankhead are listed on page 1-3 of the FRR, and these personnel were also not listed in the QAPP. Was the QAPP distributed to each new staff person such that they were familiar with the quality assurance requirements?

C. Page 20 of the QAPP says that for Task 2a, identify and define riverbank features and characteristics, "observations made as part of this task will occur from a boat approximately 50-100 ft from shore, or closer if possible." The FRR on page 5-2 says, "All field work associated with the boat-based survey was conducted from a slow moving boat located a relatively short distance from shore." The FRR does not provide the actual distance from shore that the boat personnel made observations, nor the speed at which the boat was traveling.

D. Field forms were not done or not provided in the FRR. There is thus no way to find out who did what on boat survey and how long it took.

7. Several deliverables listed in the RSP were either not provided or delayed.

Several items promised in the RSP were either not provided or were delayed, hindering any reviewer's ability to adequately review and comment on the report by the November 14th deadline.

The following items were listed as deliverables in the final report, according to the August 14, 2013 Revised Study Plan (RSP), but were not provided. What follows is commentary on each deliverable.

Task 1 – Land-Based Observations

- Data logging and field forms.

CRSEC comment: Appendix H includes datasheets for the 38 detailed geotechnical sites. A field form for the land-based surveys shown as Table 4 on page 18 in the Appendix D QAPP was not used. Six weeks after release of the FRR, on October 30th, in response to requests by CRSEC, Gomez and Sullivan sent CRSEC the GIS files and reported using a pentop computer to record field observations. We request copies of the digital data logging and field forms that were used instead of the forms described in the QAPP.

Task 2 – Classify Riverbank Features, Characteristics, and Erosion

- Data logging and field forms.

CRSEC comment: Boat-based field forms were specified in the QAPP. On October 30th, Gomez and Sullivan sent CRSEC the GIS files and reported using a pentop computer to record field observations. The GIS files included the same information as Appendix I, which had no locational information associated with it, making it difficult to utilize in assessment of the findings. We request copies of the digital data logging and field forms that were used instead of the forms described in the QAPP.

Task 3 – Spatially Define Riverbank Transition Points

- GPS data points denoting the start and end points of all riverbank segments.

CRSEC comment: Appendix G of the FRR showed all the riverbank segments on maps; however, no feature information, including GPS data points denoting the start and end points of all riverbank segments, was included with this, making it cumbersome to compare the Appendix I segment table with the Appendix G maps. In response to a request for the data, including a specific request for the GPS start and end points for the segments, Gomez and Sullivan sent CRSEC the GIS files on October 30th. No geo-referencing information was provided by FirstLight for the segments and FRCOG GIS staff had to create the GPS information data layer so that the other GIS data layers could actually be used.

- Data logging and field forms.

CRSEC comment. Again, no data logging and field forms, as specified in the RSP deliverables list and the QAPP, were provided to us as part of our data request. We again request copies of the digital data logging and field forms that were used instead of the forms described in the QAPP.

Task 4 – Video and Photographic Documentation

- Geo-referenced video of the entire Turners Falls Impoundment.

CRSEC comment: Appendix K simply states, "DVD available upon request." We requested it and received a thumb drive on September 25th that contained the videos and all photographs – but the video had no geographic references. In response to another request, it was not until October 13th that we received an email from Tim Sullivan of Gomez & Sullivan with a link to a website (http://bit.ly/1uBADod) that had information allowing us to know which video covered what river segment, and the time stamps associated with each video.

- Comparison of 2007 and 2014 photo logs, where applicable.

CRSEC comment: The FRR did not include this. One CRSEC member, the Connecticut River Watershed Council, notes that their August 19, 2013 comment letter on the RSP expressed confusion about the purpose of this task and also recommended against taking photos while the leaves were still on trees. [2] It appears that FirstLight also saw little value in this task, despite adding it between the updated study plan and the RSP. Did it serve as data control and reference checking?

The RSP stated only "FirstLight is seeking to file the final report for the FRR in September 2014, as opposed to April 2014, to match the timeline for filing other relicensing studies and to allow for the inclusion of the photo log which will be collected and analyzed in the summer of 2014." FERC did grant the requested extension to FirstLight. Ironically, the photo log and its analysis were never included in the FRR. For the reasons described above, CRSEC submits that there has not been sufficient time for technical review of the analysis and results of the 2013 FRR, and we would like to emphasize that sufficient time for technical review and analysis of results are required under 18 CFR 5.15(b) and 5.11(b)(3).

8. CRSEC has no evaluation of recommended Stabilization/Preventative Maintenance Sites in the FRR.

The 1998 Erosion Control Plan (ECP) established the approach the licensee would take to comply with License Articles 19 and 20. The ECP's objective was to minimize or prevent erosion in the Turners Falls Pool, and the ECP identified key steps to meet the objective. One step was prioritizing erosion sites to apply erosion control methodologies or treatments. Section 3.0 of the ECP identifies the two top criteria for priority erosion sites: potential and imminent threat to structures, and sites that contribute the greatest quantity of sediment to the river. The FRR was developed to document riverbank conditions and to provide information later used in ranking erosion conditions along the river. The 2013 FRR does not provide CRSEC with enough information to rank the sites that might contribute the greatest quantity of sediment to the river. In the previous 15 years, CRSEC has worked closely and in partnership with the licensee to assess erosion sites and develop a priority list for bank stabilization or preventive maintenance. The 2013 FRR is the first instance of unilateral decision making by FirstLight. We hope it will rejoin CRSEC in a collaborative effort to reduce erosion and protect the river and its prime agricultural riparian lands.

SUMMARY

The 2013 FRR has involved the collection of a great deal of useful data with regard to previous stabilization activities, land use along the banks, and information about detailed sites. However, CRSEC has long had problems with the FRR methodology as a means of documenting the amount of erosion and changes over the years (we refer the Commission to the Project docket since 1999 for the full suite of all our comments). What we want to emphasize here is that the 2013 FRR does not accomplish the goal of adequately analyzing the extent of active and potential erosion along the banks. We have the following recommendations for the Commission:

[2] From CRWC's 8/19/2013 letter, pages 2-3: The task of repeating the riverbank photo log completed by Field Geology Services in June of 2007 has been newly introduced in the RSP. The RSP states that this task will be done in June of 2014. In Field's 2007 report, recommendation #11 was that, "The photo log of the banks completed for this study (Appendix 6) should be repeated with each full river reconnaissance and comparisons made with previous years to identify changes visible along the banks. Digital image logs taken in 2001 and 2004 (NEE, 2005) should also be incorporated into this analysis where the bank position can be confirmed relative to the photo log." In the RSP, it is stated that this is to be done "as a means of data control and reference checking," which sounds different than Field's recommendation #11. We recommend that the purpose of this task be clarified. We recommend that digital image logs from 2001 and 2004 be included in this task. We also recommend that the photo log be taken at the same time as the FRR video, which is the fall of 2013, not June 2014. While leaf-off conditions in 2013 may not reflect observations in June 2007, it is not desirable to set up a pattern for future FRRs that involves different seasons of documentation like this.

1) The FRR introduction should be re-written to explain the purpose of the FRR and how it resulted from serious concerns about erosion in the Turners Falls pool by stakeholders and the Commission. All mention of the 2012 Simons report should be deleted.
2) The methodology for assessing the extent of erosion should be revised to eliminate the current segment-based analysis. The video and photos from 2008 and 2013 should be assessed to analyze extent of erosion, and a new set of statistics determined. CRSEC feels that ideally a third party chosen by FERC should do this analysis.
3) The stages of erosion should be re-calculated according to FirstLight's own definition of the stages, or re-defined to follow the recommendations of the Field Geology Services 2007 Fluvial Geomorphology study of the Turners Falls Pool.

Sincerely,

Tom Miner
Chair
Connecticut River Streambank Erosion Committee

Linda L. Dunlavy
Executive Director
Franklin Regional Council of Governments

Attachment – Table comparing riverbank characterizations

Cc: Congressman James McGovern
Franklin County Legislative Delegation
FirstLight Hydro Generating Company
NOAA – National Marine Fisheries
U.S. Fish and Wildlife Service
Connecticut River Atlantic Salmon Commission
U.S. Army Corps of Engineers
Massachusetts Department of Environmental Protection
Massachusetts Division of Fisheries and Wildlife
Connecticut River Watershed Council
Franklin Conservation District
Windham Regional Commission
Landowners and Concerned Citizens for License Compliance
Town of Gill, MA Conservation Commission
Town of Northfield, MA Selectboard and Conservation Commission

Town of Montague, MA Planning and Conservation Department
Connecticut River Greenway State Park
The Nature Conservancy – CT River Program

Attachment – Table comparing riverbank characterizations

ATTACHMENT to CRSEC and FRCOG Comment Letter on 2013 Full River Reconnaissance Report, Study 3.1.1.

<table>
<tr><td colspan="3">FirstLight Characterization of Segment 517 Photos DSC_1216-1218
Length 190 m
Bank Height - High >3.7 m
Extent of Current Erosion: None/Little (Less than 70 square meters of erosion along the 700 sq. m segment)
Stage of Erosion: Stable (Riverbank does not exhibit types or indicators of erosion)
All Indicators of Potential Erosion: Creep/Leaning Trees</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Photo DSC _1216</td><td>Photo DSC _1217</td><td>Photo DSC _1218</td></tr>
<tr><td colspan="3">CRSEC Notes: Other Indicators of Erosion Observed: Notching (undercut); Exposed Roots.
Other Types of Erosion Observed: Slides, Falls</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3">FirstLight Characterization of Segments 518-521. Photos DSC_1219-1224
Total Length 760 m
Bank Height - High >3.7 m
Extent of Current Erosion: None/Little (Less than 562 square meters of erosion along the 5,620 sq. m segment)</td></tr>
</table>

Stage of Erosion: **Stable** (Riverbank does not exhibit types or indicators of erosion)
All Indicators of Potential Erosion: Creep/Leaning Trees, Exposed Roots.
Type of Erosion: Undercut

Photo DSC _1219

Photo DSC _1220

Photo DSC _1221

Photo DSC _1222

Photo DSC _1223

Photo DSC _1224

FirstLight Characterization of Segments 522-525. Photos DSC_1225-1233.

Total Length: 403 m. (1,322 feet)

Bank Height - High >3.7 m

Extent of Erosion: **None/Little** (298 meters); Some:105 meters.

Stage of Erosion: **Stable** (Riverbank does not exhibit types or indicators of erosion - 298 meters); Eroded (105 meters).

All Indicators of Potential Erosion: Overhanging Bank, Creep/Leaning Trees, Exposed Roots.

Type of Erosion: Undercut, Topples

		
Photo DSC _1225	Photo DSC _1226	Photo DSC _1227
		

<table>
<tr><td>Photo DSC _1228</td><td>Photo DSC _1229</td><td>Photo DSC _1230</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Photo DSC _1231</td><td>Photo DSC _1232</td><td>Photo DSC _1233</td></tr>
<tr><td></td><td colspan="2">Photos DSC_1232 and 1233 taken downstream of Kendall Restoration Site</td></tr>
<tr><td colspan="3">Land-Based Observation Point #21 done just downstream of Kendall Restoration Site.
Representative Segment 3,000 feet (Station Number 765 to 795).
Includes all of Segments 517-525 described above and shown in photos DSC_1216-1233.

CRSEC Notes: Description of Land-Based #21 and profile of bank conditions are a more accurate representation of conditions. This information does not align with the 2013 FRR classification of these segments as None/Little and Stable.</td></tr>
</table>

Connecticut River – Turners Falls Impoundment Riverbank Classification for Land Based Survey

Observation Point Number: *21* **Personnel:** *YKC, AS, MM, CM, TS*

Date: *November 15, 2013* **Time:** *1:50 pm*

Station Number: *792+50* **Photo Reference Numbers:** *664 - 668*

Left or Right Bank (Looking Downstream): *Right*

Length of Representative Segment, From Station Number *765+00* **To Station Number** *795+00*

Previously Stabilized? *No (Just downstream of Kendle Restoration Site)*

Geologic / Geotechnical Observations:

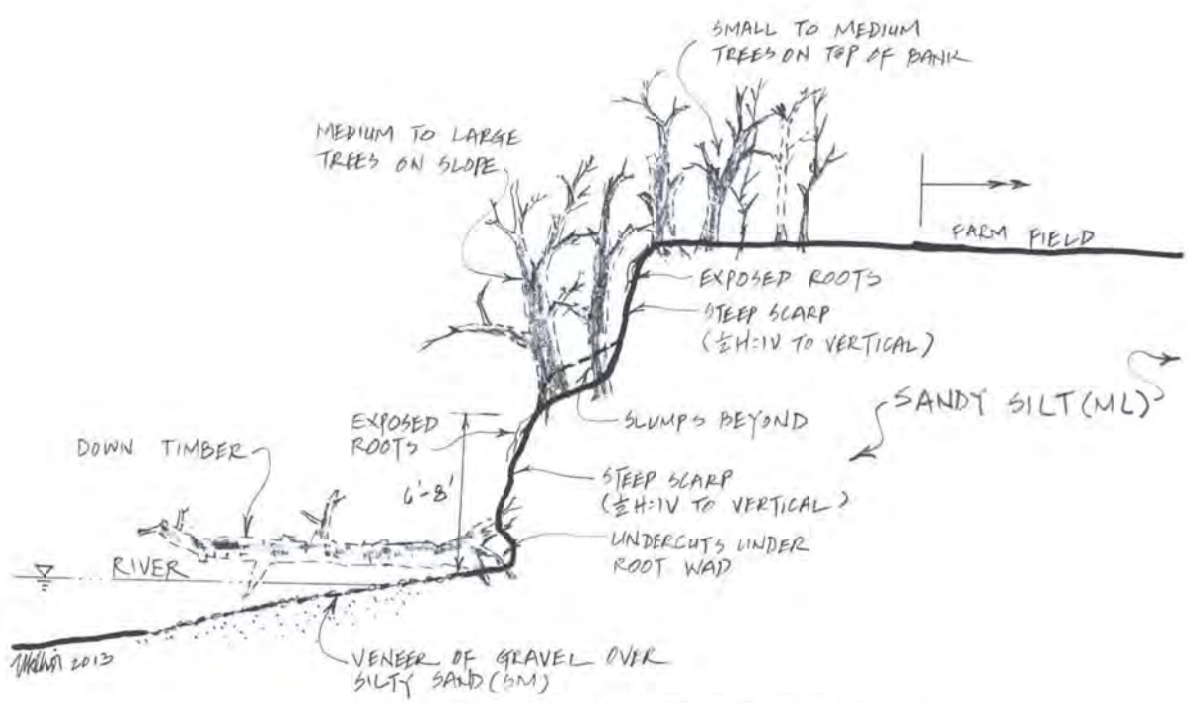
Stratigraphy:
(Refer to Site Sketch below for locations of soil/rock layers
Notations in parentheses are based on Unified Soil Classification System)

SANDY SILT (ML) – Nonplastic, 10% - 20% fine sand, gray.
Beach: GRAVEL (GP) to SILTY SAND (SM). Likely thin veneer.

Observed Erosion Features:

- *Significant erosion, with steep scarps and slumpings.*
- *Very steep banks, entire slope, with overhangs and undercuts near river level.*
- *Some slumpings.*
- *Exposed roots along scarps.*

Site Sketch:



SECTION – OBSERVATION PT. NO. 21
NOT TO SCALE

Connecticut River – Turners Falls Impoundment Riverbank Classification for Land Based Survey

Observation Point Number: *21* **Date:** *November 15, 2013*

Station Number: *792+50*

Maximum Root Depth:

-

Erosion Classification:

Types of Erosion: mass wasting

Indicators of Potential Erosion: Exposed roots
Overhanging bank
Undercuts

Notes: overhangs to near vertical scarps at the top of the bank, with sparse vegegation
Mass wasting & slumping at mid-slope
Sandy/silty soils on bank face, gravelly beach

Bank Vegetation:

Top: Heavy (>50%), Broad-leaved deciduous sapling/shrub
Staghorn sumac, winged euonymus, barberry, bittersweet, ag fields*

Face: None to Very sparse (0-10%), broad-leaved deciduous shrub
Winged euonymus, barberry, bittersweet, rye, solidago

Toe: None to Very sparse (0-10%), herbaceous
Gravel beach

NOTE: The dominant plant is noted with an *

Adjacent Land Use:
Agricultural

Sensitive Receptor:
No

Notes: *Eroding banks*

Agricultural gullies

Significant invasive plant colonization (euonymus, barberry, bittersweet, autumn olive, honeysuckle)

2013 Connecticut River Full River Reconnaissance
Land-Based Observations Photographs Reference No. 664 - 668
Observation Point No. 21 - November 15, 2013

Photo No. 664

2013 Connecticut River Full River Reconnaissance
Land-Based Observations Photographs Reference No. 664 - 668
Observation Point No. 21 - November 15, 2013

Photo No. 665

2013 Connecticut River Full River Reconnaissance
Land-Based Observations Photographs Reference No. 664 - 668
Observation Point No. 21 - November 15, 2013

Photo No. 666

Photo No. 667

2013 Connecticut River Full River Reconnaissance
Land-Based Observations Photographs Reference No. 664 - 668
Observation Point No. 21 - November 15, 2013

Photo No. 668

CRWC Attachment 2

CRSEC comment letter on Study 3.1.2

Franklin Regional Council of Governments

CONNECTICUT RIVER STREAMBANK EROSION COMMITTEE

November 14, 2014

VIA ELECTRONIC FILING

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

Re: Northfield Mountain Pumped Storage Project No. 2485-063
Turners Falls Project No. 1889-081
Comments on the Initial Study Report, Study 3.1.2

Dear Secretary Bose:

Study 3.1.2, Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability, the so-called "Causation Study," is a critical relicensing document of great importance to the Connecticut River Streambank Erosion Committee (CRSEC) and the Franklin Regional Council of Governments (FRCOG) (See 11/14/2014 comments on Study 3.1.1 for background on the CRSEC). The Project Study Plan calls for evaluating the causes of erosion in the Turners Falls Impoundment, determining if they are related to project operations, and identifying measures to stabilize the sites. To accomplish this, FirstLight is collecting data on the susceptibility of riverbanks in the Turners Falls Impoundment to erosion and will seek to allocate responsibility, i.e., causes, for the erosion.

Our experience with Study 3.1.1, the 2013 Full Reconnaissance Study, was that complex findings and conclusions were withheld from stakeholder review until the final report was issued and underlying data promised in the final report were not given until stakeholders requested it. CRSEC and the FRCOG are therefore greatly concerned by the request by FirstLight to withhold details and data from the Causation Study until March, 2016. The Initial Study Report issued on September 15, 2014 provided little or no information on the study, not even for tasks reported as complete. There is an inherent public interest in the timely issuance of substantive progress reports so that stakeholders and the Commission can review and comment on data that will be the underpinning of findings and recommendations affecting the new project license. With this introduction, CRSEC offers the following comments on Study 3.1.2.

Comments on Study 3.1.2

We note for the record that FirstLight did not include a schedule for issuing Progress Reports for the studies in the FERC approved Revised Study Plan (RSP), dated August 14, 2013, as stipulated in §5.15(b) and §5.11(b)(3). As stated in §5.11(b): "The potential applicant's proposed study plan **must** (emphasis added) include with respect to each proposed study: §5.11(b)(3), "[P]rovisions for periodic progress reports, including the manner and extent to which information will be shared; and **sufficient**

time for technical review of the analysis and results; (emphasis added)…". At the Initial Study Report meeting on October 1, 2014, we requested a progress report for Study 3.1.2 and were told that "FirstLight would rather not issue the study results in pieces, but rather as a complete assessment at the conclusion of the study." (Attachment A-19 of the Meeting Summary). This is not acceptable, and we urge FERC to address FirstLight's disregard of the ILP requirements. We note that the TransCanada ISR on studies 1-3 contain an appropriate level of detail for the upper section of the river and see no reason why FirstLight cannot provide a similar level of detail in their ISR for the Turners Falls Impoundment.

FirstLight has effectively stymied, if not precluded, stakeholders' ability to provide comments on Study Plan 3.1.2 within the timeframe dictated by the ILP by: 1) not issuing Progress Reports and 2) providing an Initial Study Report (ISR) that is remarkable in its lack of information. As stated on page B-7 of the September 13, 2013 Study Plan Determination Letter (SPDL) issued by FERC, "[it] is incumbent on FirstLight to provide an Initial Study Report that satisfies §5.15(c)(1) of the Commission's regulations. Section 5.15 of the Commission's regulations provides **an opportunity for all stakeholders to review and comment on the Initial Study Report and to seek improvements where appropriate**" (emphasis added). Stakeholders and FERC staff are not able to provide substantive comments or seek improvements where appropriate for many of the tasks for Study Plan 3.1.2 because FirstLight provided so little information in the Initial Study Report (ISR) and at the ISR meeting held on October 1st.

A Progress Report for Study Plan 3.1.2 at this point in the ILP is critical. We request that FERC direct FirstLight to issue a Progress Report for Study 3.1.2, including the missing items described below, on or before January 31, 2015 to provide FERC staff and stakeholders with the opportunity and "sufficient time for technical review of the analysis and results" of Tasks 1, 2 and 3. FirstLight has said these tasks are complete. The PowerPoint presentation for the ISR meetings listed Tasks 1-3 for Study 3.1.2 as complete with no work remaining to be done for these tasks.

FirstLight provided no information in the ISR about how the work completed under Tasks 1-3 informed the 2014 Field Studies or will inform the 2015 Field Studies. FirstLight did not propose any modifications to ongoing studies or propose new studies pursuant to §5.15 (c)(1). We find this position troubling and completely unsupported by the information provided in the ISR. FirstLight should be able to support their position that no data gaps were identified, no modifications to ongoing studies are needed, and there is no need to propose new studies. We request copies of all the data sets reviewed by FirstLight as well as a discussion of the analysis and conclusions associated with completed Tasks 1-3 on or before January 31, 2015, pursuant to §5.15(b). We also request an opportunity to comment on the Progress Report.

In support of our requests, we note the following:

- <u>Task 1: Data Gathering and Literature Review</u>: We request a complete list of all the existing data and literature sources for the topics listed on pages 2 and 3 of the Initial Study Report Summary-Relicensing Study 3.1.2. Stakeholders request the missing text for the 2004 FRR be provided immediately. This is a request we've made repeatedly for almost a decade yet the report has not been provided to us. We request all the available boat wave data, including the data for the Flagg site, downstream of the Route 10 bridge, and in the vicinity of the Northfield Mountain tailrace and from 1997 and 2008, and the groundwater elevation data from 1997-1998.

  Related to Task 1 is an omission from the Meeting Summary filed by FirstLight for the Initial Study Reports. On page 20 of Attachment A, the summary notes that Kimberly Noake MacPhee (FRCOG) asked about the data gaps identified under Task 1. Missing from the Meeting Summary is FirstLight's answer to Ms. MacPhee that "no data gaps were identified". Stakeholders question this assertion and, therefore, we are requesting the list of all the data and literature sources reviewed by FirstLight under Task 1 so that we can identify any data gaps and offer suggestions to improve the field studies for 3.1.2 prior to the Second Field Season.

- Task 2: Geomorphic Understanding of the Connecticut River. This is a critical issue for stakeholders and for the ILP.[1] Two sentences in the ISR and one slide in a PowerPoint presentation for a completed task are not acceptable and do not meet the requirements of §5.15(c)(1)(2). We request that FERC direct FirstLight to provide a list of the existing data that was reviewed, as stated in the RSP, "to gain a better understanding of the geomorphology of the Impoundment and Connecticut River within the study area" and a complete discussion of this task, as outlined in the RSP and the FERC Study Plan Determination Letter (SPDL), in a Progress Report issued on or before January 31, 2015.

  According to the September 13, 2013 SPDL issued by FERC (page B-5), FirstLight provided little detail in their Study Plan regarding the proposed historical trend analysis of bank conditions. To provide more detailed methodology (§5.9(b)(6)), FERC recommended that FirstLight perform its historic geomorphic assessment using available mapping such as the 1970 vintage ground survey of the impoundment as a base map, comparing it against more recent aerial imagery and available survey data to analyze trends in bank position over time, at an estimated price of $20,000.

  There was no mention of this SPDL work in the ISR. The Meeting Summary (Attachment A-19) indicates that FirstLight will provide this analysis in the final report and "that FirstLight surveyors are comparing aerial images with project boundary maps to try to get a sense of the movement of the riverbank over time." As this task is listed as complete by FirstLight in the ISR with no additional activities proposed for this task in 1.4 Remaining Activities (p. 4 of the ISR for Study Plan 3.1.2), we request that FERC direct FirstLight to provide stakeholders and FERC staff with 1) the digital data set for this task and 2) a complete description of the methodology for this task as outlined in the FERC Study Plan Determination Letter (SPDL). This information should be provided in a Progress Report issued on or before January 31, 2015.

  We also note that on page B-3 of the September 13, 2013 SPDL, FERC recommended that FirstLight include an analysis of operational changes through the period 1999 to 2013 to identify any correlation between operational changes and observed changes in erosion rates, and that this analysis should be conducted as part of study 3.1.2 at an estimated price tag of $10,000. The ISR contained no indication that this analysis would be done, what the methods might be, or what the final product would look like. Stakeholders are once again being denied the ability to review this task or seek improvements to it.

- Task 3: Causes of Erosion. Two sentences are provided in the ISR for this completed task. FirstLight states that the potential causes of erosion and potential primary cause of erosion identified

[1]We once again note that a section of the 2007 Field Fluvial Geomorphology Study of the Turners Falls Pool conducted for FirstLight was devoted to this topic, and we don't know what gaps in understanding FirstLight identified and needed to fill in this task.

in the RSP were reviewed and no changes are proposed at this time. For Task 3, the RSP states that "Task 2 will identify and summarize the principal potential causes of erosion." The list in the RSP and any additional identified under Task 2 will "form the basis for all field studies under Task 4 and data analysis Task 5." We request a detailed discussion of this completed task be provided to stakeholders and FERC staff on or before January 31, 2015 pursuant to §5.15(b) so that we have the opportunity to propose modifications to the study plan "in light of the progress of the study plan and data collected." (§5.15(c)(2)).

- <u>Task 4: Field Studies and Data Collection</u>. FirstLight listed this task as ongoing. We are shocked that the ISR provided six very brief, one to two line bullet point updates for this complex task that spans 7 pages in the Revised Study Plan. Remaining Activities were described in one line as "[c]omplete field data collection efforts." This is not acceptable. Once again, the paucity of information in the ISR reaffirms our position that FERC staff and stakeholders have been denied sufficient time for technical review of the analysis and results and a meaningful opportunity to seek improvements in Study Plan 3.1.2, and especially for this critical and complex Task 4.

  Task 4c: Identification and Examination of Fixed Riverbank Transects: This task is listed as complete in the ISR. In their SPDL, the FERC recommended that FirstLight consult with stakeholders prior to final transect selection. In our opinion, this task is not complete for three important reasons. First, the list of fixed riverbank transects and data collected from these sites during the 2014 Field Season should be evaluated against the concerns and limitations of the BSTEM model, discussed in the next section. Second, the findings and conclusions of the 2013 Full River Reconnaissance (FRR) have been called into question. In their RSP, FirstLight states that the selection of the fixed transects will be based on field observations made during the 2013 FRR and analysis of the 2013 FRR data, all of which we assert is seriously flawed (see CRSEC comment letter on Study 3.1.1). Finally, the CRSEC has recently corresponded with FirstLight about information to be included for each of the detailed study sites and there are issues that remain unresolved. CRSEC will be preparing a response to John Howard's November 4, 2014 letter.

The FRCOG has very limited funding for expert technical review, and we were unable to secure funding in 2013 for expert review services during the Study Plan development process. When the ISR was filed, it was obvious that we required expert assistance to review Study 3.1.2 properly. Given the importance of Study 3.1.2 to the CRSEC, FRCOG found funding and contracted with the UMass Center for Economic Development to help us retain experts to evaluate the information we expected to receive in the Initial Study Report (ISR). Experts from the University of Illinois at Urbana-Champaign, Department of Civil and Environmental Engineering Hydrosystems Laboratory were hired to assist the FRCOG and CRSEC.

We asked the Univ. of Illinois experts to comment on the suitability and limitations of the BSTEM, HEC-RAS and River2D models and data collection methods with respect to the unique conditions of the Turners Falls Impoundment. The experts identified several significant data gaps and limitations in the FirstLight methodology. A Progress Report for Study Plan 3.1.2 at this point in the ILP is critical so FERC staff and stakeholders have an opportunity and "sufficient time for technical review of the analysis and results" and make appropriate recommendations for the Second Field Season. The letter from Drs. Garcia and Waterman is attached.

Conclusion

Study 3.1.2 is of the utmost importance to the CRSEC and other local stakeholders. It focuses on project impacts that directly affect landowners and natural resources of singular value to our region. We have watched as prime agricultural riverside soils have been consumed by bank erosion since the Project began operation 40 years ago. Based on the questionable methodology and biased conclusions of the 2013 Full River Reconnaissance, we are concerned about the integrity of Study 3.1.2, the so-called Causation Study. We believe that full transparency provided by regular progress reports during the study are essential to providing confidence in the study results.

At several points in these comments we have asked the Commission to require FirstLight to provide progress reports with sufficient detail to allow for an independent, expert review. We conclude our comments with a repeated, and we believe reasonable request for a Progress Report by January 15, 2015 and follow up report as each study task is completed.

Sincerely,

Tom Miner, Chair
Connecticut River Streambank Erosion Committee

Linda L. Dunlavy, Executive Director
Franklin Regional Council of Governments

Attachment: Letter from University of Illinois

Cc: Congressman James McGovern
Franklin County Legislative Delegation
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Windham Regional Commission
Landowners and Concerned Citizens for License Compliance

Town of Gill, MA Conservation Commission
Town of Northfield, MA Selectboard and Conservation Commission
Town of Montague, MA Planning and Conservation Department
Connecticut River Greenway State Park

Attachment: Letter from University of Illinois

UNIVERSITY OF ILLINOIS
AT URBANA-CHAMPAIGN

Department of Civil and Environmental Engineering
Hydrosystems Laboratory 2535B, MC-250
205 North Mathews Avenue
Urbana, IL 61801-2352
(217) 244 4484; mhgarcia@illinois.edu

November 13, 2014

Kimberly Noake MacPhee
Land Use & Natural Resources Planning Program Manager
Franklin Regional Council of Governments
12 Olive Street, Suite 2
Greenfield, MA 01301

Dear Ms. Noake MacPhee:

At your request, we have performed a review of various materials prepared as part of the FERC relicensing of the Northfield Mountain / Turners Falls operations on the Connecticut River. In particular, our review has focused on the analyses pertaining to river hydraulics and bank retreat included in the following documents:

- Revised Study Plan (FirstLight Power Resources, 2013a), Sections 3.1.2 and Sections 3.2.2.
- Initial Study Report Summary for Section 3.1.2 (Choi, 2014a)
- Initial Study Report Summary for Section 3.2.2 (Gomez and Sullivan Engineers, 2014)

For additional background information regarding the river characteristics, we also reviewed the following project documents that were provided:

- Fluvial Geomorphology Study of the Turners Falls Pool on the Connecticut River Between Turners Falls, MA and Vernon, VT (Field Geological Services, 2007)
- Hydraulic Modeling Assessment Of The Turner Falls Impoundment (FirstLight Power Resources, 2013b)
- 2013 Full River Reconnaissance report (Choi, 2014b)

Our review has primarily focused on the models (BSTEM, HEC-RAS, RIVER2D) and the data collection methods used by the project consultants. We need to preface our analysis by clearly stating that we have not performed any onsite analysis of the Connecticut River; we also have not performed a thorough review of the abundant analyses that have been completed dating back to the 1970s associated with bank retreat for this reach of the river. Our site-specific knowledge pertaining to the river is derived from a review of the above-referenced documents.

We deem the following physical river characteristics particularly important to our assessment of the bank retreat issue in the Turner Falls impoundment:

- The river banks in the reaches that have experienced the most pronounced bank retreat are alluvial deposits of predominantly sand and silt; stratigraphic analysis reveals inter-bedded layers of sand and silt (Field Geological Services, 2007; p.18, p.25, p.66)
- Narrow "beach" landforms are common - these are described as mild transverse slopes extending riverward from the toe of the steep portion of the river bank and extending out a short distance from the bank before dropping off more steeply into the deeper part of the channel (Field Geological Services, 2007; p.17, p. 43)

- Bank retreat is occurring in locations that are apparently independent of high boundary shear stresses (Field Geological Services, 2007; p.20, p. 25)

The majority of our analysis will discuss the proposed modeling of bank retreat per Section 3.1.2 of the Revised Study Plan (RSP). The suitability of any model is dependent on the objectives of the modeling effort; the most sophisticated model is not necessarily the most appropriate for all purposes. In this case, the objective has been defined as evaluating and identifying the causes of erosion in the impoundment and determining to what extent they are related to project operations; the modeling is one part of an effort to satisfy that objective. We recognize that this is an extremely challenging task, due to the inter-related nature of the various causes of bank retreat. The BSTEM model has been proposed to quantify the effect of two of the identified causative factors in bank retreat: fluctuating water levels and fluvial boundary shear stresses. BSTEM was designed to couple the processes of fluvial erosion and mass failure that are both integral to bank erosion analyses; to our knowledge, that model (along with its predecessor, the ARS Bank Stability Model) was the first model available for engineering practice outside an academic research setting to couple those processes using physics-based formulations. The model was developed at the USDA National Sedimentation Laboratory; for the last several decades that group has been at the forefront of developing techniques to quantify bank erosion and develop models for practical usage. We will discuss the model's suitability and limitations with respect to the unique conditions in the Turners Falls impoundment.

The issue of fluctuating water levels, in its most basic form, is a rapid drawdown problem that has conventionally been treated by geotechnical engineers considering earthen embankments (Morgenstern, 1963; Desai, 1977; Lane and Griffiths, 2000). When the water level is drawn down, pore water remains in the embankment which maintains the weight of the soil (the gravitational force is the primary driving force behind potential failures) while the confining pressure acting on the surface of the soil mass is removed, thus reducing the factor of safety. An integral part of the problem is the knowledge of the water level in the water body and the phreatic surface (or more accurately, the pore pressure distribution) of the groundwater. The BSTEM model includes the effect of the water level difference that is of primary importance to the problem, but the water levels are specified as parameters. Therefore how the water level difference is specified in the proposed analysis is very important. Accurate treatment involves not only the magnitude of the drawdown but also the rate of drawdown, as the water table does not adjust at the same rate as the stage of the water body. An appropriate treatment would involve an unsteady state 2D groundwater model (e.g., SEEP/W) applied to a cross-section using the maximum drawdown rate over the maximum magnitude of drawdown (the boundary conditions of the groundwater model) to determine the appropriate values of the input parameters pertaining to the water levels used in BSTEM. In review of the Revised Study Plan (RSP), there is no mention of proposed groundwater modeling; mention is made that a single transect of three piezometers was established and monitored at a site and that the groundwater responded to the river water stage quickly. We would recommend that such data be used with caution in the absence of a site-specific model on which such data would serve as calibration, which could then allow the full range of potential boundary conditions to be evaluated. We would also caution that such data should not be extrapolated to all sites in the system as the stratification and hydraulic conductivities along the ~20-mile long impoundment are certainly not uniform. For example, the 2013 Full River Reconnaissance (FRR) includes geotechnical site data sheets that include sites where the bank profile is dominated by sand (USCS classification SM) and profiles dominated by silt (USCS classification ML); the hydraulic conductivities of such soils are likely to differ by an order of magnitude or more. In the absence of a groundwater model to establish the appropriate water level difference used in BSTEM, then conservative assumptions would be required regarding how fast the groundwater table responds to the river water level. For example, in the analysis of Morgenstern (1963), the pore water pressure distribution (a linear function of the groundwater level in a free-draining incompressible material) was assumed to be maintained at its pre-drawdown level throughout much of the embankment for the stability analyses. In more sophisticated analyses such as Lane and Griffiths (2000), the pore pressure distribution is solved numerically before the stability calculation proceeds. Some justification will need to be provided for conservative estimates of groundwater table levels in the absence of calibrated groundwater models. Note that in all of the cited conventional geotechnical analyses, the seepage forces are neglected; the significance of seepage forces are discussed later in this letter.

In terms of the magnitude and rates of variation in the river stage (the river stage input as a parameter in the BSTEM model), we understand that an unsteady state HEC-RAS model will be developed and calibrated. We feel that HEC-RAS is an appropriate model for this purpose. Even though impounded, the river is generally curvilinear and the flows can be reasonably approximated as 1D for the purpose of determining stage. The primary data used in HEC-RAS is the bathymetry and bank/floodplain topography. Cross-sections are spaced more closely in steep rivers and where the geometry changes significantly over short distances. The modeling proposed includes cross-sections at 500 feet longitudinal spacing sampled from longitudinal bathymetric transects. For a river with mild slopes such as the Connecticut River where the bankfull width is typically 600 to 700 feet, having cross-sections spaced at 500 feet is quite resolute for a 1D model and will characterize spatial geometry variations at an appropriate scale. Utilizing stage recorders to obtain calibration data as proposed is also appropriate. Calibration of roughness coefficients using the steady flow calculation procedure as indicated in the RSP should be performed when flow through the system is confirmed to be steady (flow input equal to flow output from the system).

Regarding other aspects of the geotechnical slope stability calculations used in BSTEM, beyond the issue of rapid drawdown, we feel it would be appropriate if the project geotechnical engineer confirmed that the factor of safety values calculated by BSTEM for planar failure are indeed less than that calculated from the analysis of rotational failure. BSTEM was designed for use on short steep slopes typical of most river banks where planar failures and cantilever failures resulting from undercutting are the dominant modes of failure. In some areas in the Turners Falls impoundment there are fairly high slopes (some reported >50 feet in height) and some of these areas have soils classified as being silt-dominated (ML classification). If the cohesiveness of these silty soils turns out to be substantial, a more deep-seated rotational failure might be the actual mode of failure as opposed to shallow planar failures. In fact, on Table 7-2 of the Initial Study Plan Summary for 3.1.2, a number of the representative and calibration sites have indicated rotational failures.

Proceeding to the issue of fluvial erosion of the bank toe used by BSTEM, we feel that the proposed use of RIVER2D for the determination of boundary shear stresses is appropriate. While a 1D model such as HEC-RAS will provide cross-sectional average values, RIVER2D will provide variation across the cross-section, including in the near-bank region, which is the preferable approach. The domain of RIVER2D modeling would preferably include the entire impoundment; however, if local domains are used for each of the calibration sites, the domain should be confirmed to be sufficiently long both upstream and downstream of the calibration sites such that the velocity field calculated at the calibration site is relatively insensitive to the specific velocity fields specified for the upstream and downstream boundaries.

Quantifying the parameters used in the fluvial entrainment routine of BSTEM has been proposed using both a submerged jet test in the field and by determining grain-size distributions which can then be used to specify the critical shear stress parameter when the soil is non-cohesive. The submerged jet test is generally considered to be the standard to quantify the parameters used in the entrainment rate formulation for bank erosion. The field methods proposed and the specific formulations used by BSTEM are the best that are currently available to quantify the fluvial entrainment of bank materials. However, the entrainment rates thus determined must be understood to still involve substantial uncertainty. Thus the issue of calibration as proposed in the study becomes important.

The issue of calibration must be treated with some caution in a study where causality is intended to be quantified (as specified in the objectives). For example, it has been observed that areas of significant bank retreat exist in areas of low boundary shear stress. One approach of calibration would be to modify the critical shear stress parameter to a very low value and modify the erodibility coefficient to a very high value in the entrainment rate formulation to achieve the magnitude of fluvial entrainment and subsequent mass failure observed in the low fluvial shear areas – thus achieving a calibrated model. However, a calibrated model does not guarantee that the physics of the model is correct; in other words, if the original values used in the model did not yield the observed bank deformation, it is also possible that other causative factors are involved that are not accounted for in the models. With this in mind, one causative factor that we feel is of high importance pertaining to the issue of bank retreat and not incorporated into the modeling is erosion associated with seepage from water continually being transported into and out of the banks associated with frequent stage changes; (note that this is a separate issue from the rapid drawdown problem described previously, but it is a related issue). The processes where the seepage forces are dominant involve the gradual sapping of soil grains from a soil stratum, potential development of soil pipes, and the associated structural weakening of the soil; the processes are discussed in limited detail in the following paragraphs. This physical factor is not accounted for in the BSTEM model - although this is not a fault of the model or the choice of model, but rather a limitation in the current state of the science. This makes the issue of assigning causality to various factors very difficult.

In geotechnical engineering practice, seepage forces are typically accounted for by ensuring that a critical hydraulic gradient is not exceeded along a flow path through the soil, which is particularly important when considering groundwater flow beneath dams or excavations below the water table (e.g., Terzaghi et al., 1996). In sophisticated models analyzing slope stability, the seepage forces may be accounted for with respect to their reduction of the effective stress and thus the frictional shear resistance along potential failure planes. However, quantifying processes associated with gradual sapping of soil grains which may eventually lead to the development of piping is still a developing field. The following statement in Terzaghi et al. (1996, p.475) is particularly pertinent to the current discussion: "*In nonhomogeneous material the locations of lines of least resistance against subsurface erosion and the hydraulic gradient required to produce a continuous channel along these lines depend on geologic details that cannot be ascertained by any practicable means.*" Advances are currently being made in this field of research as it relates to stream bank erosion, including substantial contributions by the USDA National Sedimentation Laboratory (the agency that developed the BSTEM model); but to our knowledge, quantitative models are still in the research stage and have not advanced to the level of practical engineering usage.

The current state of the science associated with bank retreat due to seepage forces is well described in a review paper by Fox and Wilson (2010). The essential aspects are that the hydraulic gradient of the groundwater is associated with a pressure force that reduces grain-to-grain friction, which can lead to entrainment of particles into the groundwater flow path. In its most extreme form, the seepage forces can exceed the weight of soil grains and cause a non-cohesive soil mass to fully liquefy. However, in cases of bank erosion, where hydraulic head gradients are generally more limited, the gradual process of grain by grain entrainment is the expected mode. Fox and Wilson (2010) use the term seepage erosion to describe this entrainment process. In its most developed condition, it can lead to development of soil pipes and cavities and collapse of overlying soil strata as described in Hagerty (1991a; 1991b); in those papers, the terms piping and sapping are used to describe the removal of soils by seepage exfiltration from a bank face. Hagerty (1991a) indicates the issue to be most prevalent in alluvial soil deposits where the natural layering favors concentration of groundwater flow in the more pervious strata; he also indicates the necessary conditions for the process to occur, which include the presence of a free exfiltration face, a source of water, and stratification of layers of different hydraulic conductivity that promotes flow concentration. Hagerty (1991a) states: "*The variations in texture and porosity among alluvial strata in a bank may not be noticeable and may appear to be slight, but even seemingly minor changes in soil texture can change hydraulic conductivity by orders of magnitude……a silty sand may be 100 times more pervious than a sandy silt, even though both soils look and feel very similar*." Fox et al. (2007) provide evidence that lateral flow can be generated in more pervious strata when the vertical component of the hydraulic conductivity between layers is less than an order of magnitude different. The hydraulic gradient, and thus the seepage force, will generally be steepest at the free exfiltration face as a groundwater level adjusts to a new surface water level; thus the tendency for particle entrainment will be greatest at the exposed face and may not necessarily be maintained deeper into the bank. The sapping of grains from a strata, particularly when the grains being removed are fine-grained and provide some cohesion to the strata, is also expected to reduce the resistance of the surface to fluvial erosion. Therefore fluvial erosion may still be eroding the toe of the bank, but the effect of stage changes on sapping grains from strata and its effect on fluvial erosion cannot currently be decoupled.

Due to the fact that the science has not yet advanced sufficiently to quantitatively model the process of seepage erosion and its effect on bank retreat, correlation to other sites where this process has been observed to be a dominant process is appropriate. The shape of the Connecticut River near-bank region described by Field Geology Services (2007) and bulleted above on p.1-2 of this letter warrants special consideration and provides an indication of the dominant processes occurring in the near-bank region. Hagerty et al. (1995) considered a gently sloping bench just below the ordinary low water level to be characteristic of rivers having controlled stage; the particular case considered was navigation pools on the Ohio River, although examples were also provided from observations elsewhere in the country. They clearly state that the process of bench formation is not fully demonstrated, but that the evidence suggests a process whereby the permanently submerged portion of the bank becomes more stable, and the above-water portion of the bank migrates at a faster rate than the below-water portion of the bank – even though both may be migrating more slowly than the pre-controlled condition. In each of the cases described by Hagerty et al. (1995), a primary cause of bank migration in the portion of the bank above the maintained low water stage was associated with the piping / sapping mechanism. A stable bench at a migrating bank is not a typical landform in an unregulated river. When a bank is eroding due to fluvial entrainment, migration of the deeper portions of the bank will generally drive the migration of the upper portion of the bank because the shear stresses generally increase with depth. Therefore, for a bench to form on or above the lower bank, at some point in time the lower portion of the bank must not be driving migration of the upper portion of the bank. This is not meant to imply that fluvial action cannot still erode the toe of the bank above the bench; rather it is simply meant to point out that the process is not typical of a migrating bank and that other processes may be involved. The presence of the undercut "notches" located near the normal water stage with the maximum extent of the cut not extending deeper below the water surface also suggests other mechanisms are likely acting in concert with fluvial erosion; note that Table 6.1 of the FRR indicates that approximately 43% of the river banks show evidence of this feature. A notch whose maximum extent is located near the normal water surface suggests the effect of both wave action and sapping associated with the steepest part of the groundwater table following a period of drawdown, and its influence in making the bank material more susceptible to fluvial erosion.

Finally, we would like to reiterate that the objectives for which the modeling is intended to satisfy (decoupling and quantifying the various causative factors) is daunting, if not impossible in a strict sense, given the current state of the science regarding the physical processes and our ability to contend with physics occurring at a variety of spatial scales and with high spatial heterogeneity. This does not imply that a modeling approach, which will always require simplifications, is without value. In general, we feel the proposed approach of using BSTEM is a sound practical approach that will provide insights into which processes are important in a relative sense. However, such findings should be strongly qualified; a finding that suggests that the fluctuating stages associated with the pumped storage operations has no impact on the bank retreat or, conversely, that it is entirely responsible for the bank retreat would not be defensible given the uncertainties involved.

Sincerely,

Marcelo H Garcia PhD Dist.M.ASCE F.EWRI
M.T. Geoffrey Yeh Chair in Civil Engineering
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Appendix A: References

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Education

National Litoral University, Argentina,	Water Resources	Dipl. Ing.	1982
University of Minnesota	Civil Engineering	M.S.	1985
University of Minnesota	Civil Engineering	Ph.D.	1989

Academic Experience

2012-present	Faculty Fellow, National Great Rivers Res. and Ed. Center, Alton, Illinois
2006-present	Professor of Geology (adjunct), Department of Geology, University of Illinois
2001-2014	Chester and Helen Siess Endowed Professor of Civil Eng., University of Illinois
2000 – present	Professor, Dept. of Civil and Environmental Eng., University of Illinois
1999 (1 month)	Visiting Assoc. Prof., Ecole Polytech. Federale de Lausanne, Switzerland
1997 (4 months)	Visiting Associate Professor, California Institute of Technology
1997 – present	Director, Ven Te Chow Hydrosystems Laboratory, University of Illinois
1996 - 2000	Associate Professor, Dept. of Civil and Env. Eng., University of Illinois
1990 - 1996	Assistant Professor, Department of Civil Eng., University of Illinois
1993 - present	Visiting Professor, School of Water Resources Eng., UNL, Santa Fe, Argentina
1993 (4 months)	Contract Professor, Istituto di Idraulica, University of Genoa, Italy
1988 - 1989	Research Fellow, St. Anthony Falls Hydraulic Lab., Univ. of Minnesota
1983 – 1987	Research Assistant, St. Anthony Falls Hydraulic Lab., Univ. of Minnesota

Honors: : ASCE Hilgard Prize (1996, 1999), Huber Research Prize (1998), H.A. Einstein (2006), Housner Award (2012), Rouse Award Lecture (2012); Borland Lecture (2009), IAHR Ippen Award ('01); National Academy of Engineering, Argentina (2005), Enrico Marchi Lecture (2012), Distinguished Member, American Society of Civil Engineers (2013), Yeh Chair (2014).

Five Relevant Publications (total of 130 archive journal publications)

1. Motta, D., Abad, J.D., Langendoen, E., and M.H. Garcia (2012). A simplified 2D model for meander migration with physically-based bank evolution, Geomorphology 163–164, 10–25. doi:10.1016.
2. Motta, D., Abad, J.D., Langendoen, E., and M.H. Garcia (2012). The effects of floodplain soil heterogeneity on meander planform shape, Water Resources Research, AGU, DOI:10.1029.
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5. Fernandez, R.L.; Cauchon-Voyer, G.; Locat, J.; Dai, H.; Garcia, M. H.; Parker, G. (2011) "Co-evolving delta faces under the condition of a moving sediment source."Journal of Hydraulic Research, 49(1), 42-54.

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2. Abad J. D. and García, M. H. *RVR Meander: A toolbox for re-meandering of channelized streams.* Computers & Geosciences, 32: 92-101, 2006.
3. Abad, J. D., Buscaglia, G. and Garcia, M. H. (2008) "*2D Stream Hydrodynamic, sediment transport and bed morphology model for engineering applications*". Hydrological Processes, 22: 1443-1459.
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5. García, M. H., "Modelling Sediment Entrainment into Suspension, Transport, and Deposition in Rivers," Chapter 15 in *Model Validation: Perspectives in Hydrological Science*, M.G. Anderson and P.D. Bates (Editors), 389-412, John Wiley & Sons, England, 2001.

Synergistic Activities

Member, Steering Committee, Community Surface Dynamics Modeling System (CSDMS), 2013-2018.
Editor-in-Chief, ASCE/EWRI "Sedimentation Engineering," Manual of Practice 110, May 2008.
Member, National Research Council Panel on "River Science at the US Geological Survey." 2005-2006.
Expert Panel Member, Mississippi River Hydrodynamic and Sediment Transport Modeling, Battelle & US Army Corps of Engineers, 2013-2016.
International Scientific Committee on Flooding, Firenze 2016, Florence, Italy, 2014-2016.

Ph.D. Advisees(total: 27): Yarko Niño (Prof., University of Chile); Fabian López, (Minister for Public Works, Cordoba, Argentina); Sung-Uk Choi (Prof., Yonsei University, South Korea); Jeffrey Parsons (Consultant, WA); David Admiraal (Assoc. Prof., University of Nebraska-Lincoln), Xin Huang (Software Engineer, Motorola, Inc.), Fabian Bombardelli (Assoc. Prof., University of California-Davis), Jose Rodriguez (Senior Lecturer University of Newcastle, Australia), Michelle Guala (PhD, Univ. of Genoa; Asst. Prof. Minnesota), Robert Holmes,Jr. (National Flood Hazard Coordinator, USGS), Arthur Schmidt (Res. Asst. Prof., University of Illinois), Juan Fedele (ExxonMobil), Yovanni Catano (Sr.Eng., Alden Research Lab, MA), Michael Yang (Consulting, Shaw Group), Octavio Sequeiros (Researcher, Shell Co, The Netherlands, w/ Gary Parker), Carlos M. Garcia (Prof. Universidad Nacional de Cordoba), Mariano Cantero (Asst. Prof., Instituto Balseiro, Argentina), Jorge Abad (Asst. Prof., Univ. of Pittsburgh), Albert Dai (Asst. Prof., Tamkang University, Taiwan); Xiaofeng Liu (Asst. Prof., Penn State), Arturo Leon (Asst. Prof ., Oregon State University), Francisco Pedocchi (Asst. Prof., Universidad de la Republica, Uruguay), J. Ezequiel Martin (Res. Assoc., Univ. of Iowa), Blake Landry (Post-Doc, UIUC), Sumit Sinha (Res. Assoc., Helmholtz Inst., Germany), Davide Motta (Cons. PA), Tatiana Garcia (PostDoc USGS).

Currently: 12 graduate students. MS Thesis Students Advised to date: 40

Graduate Studies Advisor: Gary Parker, University of Minnesota (currently at UIUC)

List of Collaborators: Bruce Rhoads, Jim Best, Gary Parker, University of Illinois, Eddy Langendoen (USDA), S. Balachandar, University of Florida, Colin Stark, Columbia University, Mohamed Ghidaoui, Hong Kong University of Science and Technology, Mario Amsler and Ricardo Szupiany, Universidad Nacional del Litoral, Argentina, Daniel Brea, Instituto Nacional del Agua, Argentina, Kevin Oberg and Ryan Jackson (Hydroacoustics, USGS), Faith Fitzpatrick (USGS).

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EDUCATION

Bachelor of Science, Engineering (BSE), 1996
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HONORS

Ben Chie Yen Fellowship Award, 2012

ACADEMIC EXPERIENCE

Graduate Research Assistant, *University of Illinois at Urbana Champaign* *2009-present*

- Bubbly Creek sediment oxygen demand study [Masters project]

  Waterman, D. M., Waratuke, A. R., Motta, D., Cataño-Lopera, Y. A., Zhang, H., & García, M. H. (2011). In situ characterization of resuspended-sediment oxygen demand in Bubbly Creek, Chicago, Illinois. *Journal of Environmental Engineering*, 137(8), 717-730.
- Physical modeling of stepped canoe chute / fish passage facility; Arkansas River, KS
- Field and laboratory experiments on oil-sediment aggregation processes associated with submerged oil; Kalamazoo River, MI
- Physically-based bank erosion formulation implementation into the model RVR Meander model; Mackinaw River, IL
- Morphodynamics of bank accretion; Green River, UT

PROFESSIONAL EXPERIENCE

Environmental Scientist / Project Engineer / Project Manager, *Environmental Technology Consultants (A Division of Sisul Enterprises, Inc.), Vancouver, WA* *1996-2008*

- Performed civil engineering design and plan preparation for residential and commercial development projects.
- Performed modeling of open channel systems using HEC-RAS as part of conveyance design and floodway / floodplain analysis.
- Performed wetland delineations in a variety of ecoregions throughout the Pacific Northwest
- Performed all aspects of Section 404 wetland/stream permitting.

CONTINUED…

Civil Engineering Technician, *US Army Corps of Engineers, Operations Division, Navigation Section; Louisville, KY* *1994-1995 (Summer)*

- Produced hydrographic survey maps from raw field data for channel maintenance dredging.

Geotechnical Engineering Technician, *Greenbaum Associates, Inc., Louisville, KY* *1993 (Summer)*

- Assisted drill operator in soil core sampling and installation of monitoring wells. Prepared well logs.
- Inspected structural foundations at construction sites.

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FEDERAL ENERGY REGULATORY COMMISSION

November 4, 2014

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

P-1889

Re: Relicensing of the Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Project No. 1889
Comments on the Initial Study Reports 3.1.1 and 3.1.2

Dear Secretary Bose:

The Connecticut River flows through the middle of our town. Northfield residents farm the fertile land along the river and our businesses serve residents and tourists who use recreational facilities along the river, such as campgrounds, picnic areas and boat launches, for fishing and enjoying this marvelous public resource. We are concerned that the operation of the Northfield Mountain Pumped Storage Project and the Turners Falls Dam undermine the stability of the river banks and contribute to the serious bank erosion and loss of massive amounts of prime farmland soils in our town.

We take public stewardship of the river very seriously. Our rural town is run primarily by a dedicated group of volunteers and we have limited resources and staff that can spend time reviewing documents and filing comments as part of FERC's Integrated Licensing Process. Therefore, we support the ongoing work of stakeholders, including the Massachusetts Department of Environmental Protection and the Franklin Regional Council of Governments, in the relicensing process. We are counting on these stakeholders and FERC to ensure a robust and scientifically valid evaluation of the environmental impacts of project operations and the development of adequate mitigation recommendations.

The 2013 Full River Reconnaissance report (Study 3.1.1) is a disappointment, as it follows the same flawed methodology of previous studies and asserts that 1) this reach of the river is in the best shape as compared to the river north of the Vernon Dam and south of the Turners Falls Dam and 2) the pace of bank stabilization/restoration work is keeping up with the rate of erosion. Neither of these assertions is supported by the conditions we see on the river every day. Further, the lack of scientifically credible data and analysis further undermines FirstLight's findings. The lack of data and information in the Initial Study Report for Study Plan 3.1.2 Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability is so glaring as to render it useless to stakeholders who have to prepare comments by November 14, 2014.

FirstLight has adequate financial resources to conduct state of the art, scientifically valid studies that can be peer reviewed and accepted with confidence by stakeholders, Massachusetts Department of Environmental Protection, and FERC. We urge FERC to require FirstLight to conduct an appropriate level of scientific inquiry and analysis and engage in meaningful stakeholder involvement. Our river, a magnificent public resource, deserves no less.

Sincerely,

John G. Spanbauer, Chair

Jed Proujansky

Tracy Rogers

Northfield Board of Selectmen

cc: Congressman Jim McGovern
Franklin County Legislative Delegation
Brian Harrington, MassDEP
Dave Foulis, MassDEP
Linda Dunlavy, FRCOG

Franklin Regional Council of Governments

January 9, 2015

VIA ELECTRONIC FILING

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

Re: Northfield Mountain Pumped Storage Project No. 2485-063
Turners Falls Project No. 1889-081
Request for erosion transect information

Dear Secretary Bose:

On November 14, 2014, the Connecticut River Streambank Erosion Committee (CRSEC) submitted comments on Relicensing Studies 3.1.1 and 3.1.2, also known as the 2013 Full River Reconnaissance and the Erosion Causation Study. Our comment letter on November 14, 2014 primarily focused on issues related to compliance with the Integrated License Process (ILP) because of tight deadlines. In the course of our review of these two studies, however, we have reviewed other documents submitted by FirstLight, and in this letter we are submitting a compliance-related request.

On January 22, 2013, FirstLight submitted to FERC a series of cross-section plots of long-term transects within the Turners Falls impoundment. Though FirstLight's cover letter to the transect report explained that FERC requested FirstLight to provide information on long-term monitoring of cross-sections, we could find no documentation of this request from FERC. The report was submitted outside of any particular filing process and there was no comment period or FERC response to this submission. As such, CRSEC members were largely unaware of the filing and reviewed it only briefly. The information provided in the January 22, 2013 report covers the years 1999-2012 (not the full history of the transects), and the figures are difficult to review and interpret. The diagrams cover the full river width including the river bottom, making the scale tiny for viewing, and the colors are repetitive such that it is difficult to interpret which line corresponds to which year.

By comparison, in 2004, Northeast Generation Services (NGS), FirstLight's predecessor, submitted a Full River Reconnaissance Report (FRR) with an Appendix B showing the details of cross-section monitoring along the bank. The cross sections in the 2004 FRR Appendix B were easily readable and gave a good indication of the shape of the bank. Table 3 of the 2004 FRR even included total estimated sediment loss at each transect. The report on page 14 states, "The bank locations will be re-evaluated during subsequent years, beginning in 2005, and these data will be used to quantify actual rates of erosion and sediment loss." See page 14 attached.

In 2007, a report prepared for the Northfield Mountain Pumped Storage Project by Field Geology Services titled, "Fluvial Geomorphology Study of the TF Pool on the CT River between TF, MA and Vernon VT" included an analysis of transect data for the years 1990-2005. Table 5 showed rates of change for each transect on east and west banks, identifying greatest change between surveys and which years the greatest change occurred. Data problems were identified and described. Appendix 8 to the 2007 Field Report contained transect data, but the data were not summarized and there were no diagrams. To our knowledge, no other document provided the information promised in the 2004 FRR on page 14.

We would like to request that FERC require a different transect report be submitted to focus on the river banks, not the river bottom. For each transect on each bank, a figure be provided showing the bank shape over the years for the full monitoring period (1990-2012 or later), with the years being easily readable. If any years have data problems, as indicated in the 2007 Field Report but possibly resolved since then, the data should be flagged in this report. Using that information, the actual rates of erosion and sediment loss or sediment accumulation should be calculated for intervals of time, as promised in the 2004 FRR. We have looked through the 2013 FRR and the revised study plan for study 3.1.2, and do not think this information will be provided in the relicensing studies. We view our requested report as useful for compliance purposes for license articles 19 and 20 for P-1885 and P-2485. Our request is consistent with the intent of the 1999 Erosion Control Plan (ECP) for the Turners Falls Pool of the Connecticut River, which in its Executive Summary, states that riverbank segments were [and are] prioritized for repair and preventative maintenance based on "those segments that are contributing the most sediment to the river." We also note that the ECP on page 12 said that the licensees will include an ad hoc erosion committee to serve as an advisory group in planning the work to be done under this Plan. CRSEC did not play a role in developing the list of recommended sites for future work that was included in the 2013 FRR submitted to FERC.

Sincerely,

Linda Dunlavy, Executive Director
Franklin Regional Council of Governments

Tom Miner, Chair
Connecticut River Streambank Erosion Committee of the Franklin Regional Planning Board

ATTACHMENT: Page 14 and one page from Appendix B from 2004 FRR

Cc: Christopher Chaney, FERC
Brandon Cherry, FERC
Patrick Crile, FERC
David Cameron, MassDEP
David Foulis, MassDEP

Table 3. Estimated Sediment Loss

Mile Marker (approx.)	Site Name	Cross Section #	BEHI Rating	Bank Height	Reach Length	Total Sediment Loss cubic yards/foot/year
15.6 right	Split River Farm	1	48.2 extreme	13'	405'	0.202
14.8 right	Split River Farm	2	46.3 extreme	14'	900'	0.217
14.1-14.5 right	Upper Split River Farm (former Kaufold)	3,4,5	46.3 extreme	17.5	1740	0.272
13.2-14.2 left	L'Etoile	1,2,3,4,5	45.5 very high	17.0'	5,600'	0.113
9.1-9.3 left	Rt. 10 Bridge	1,2	48.3 extreme	17.0'	775'	0.264
5.0-5.2 right	Kendall	1,2,	47.6 extreme	20.0'	750'	0.311

Actual Sediment Loss. The results in Table 2 provide an estimated sediment contribution from the sites evaluated based on data from Colorado stream banks, which is the closest model available to the Connecticut River. The actual sediment loss can be determined only by direct measurement. NGS has incorporated 20 survey cross sections to measure existing conditions (See Figure 2) which have been used to determine actual rates of erosion. In addition, at each of the sites which were evaluated for the BEHI, three foot long bank pins were installed (thin metal rods) horizontally into the banks, along with permanent vertical reference points to measure rates of erosion. The attached figures in Appendix B show the profile at each of the surveyed bank locations. The bank locations will be re-evaluated during subsequent years, beginning in 2005, and these data will be used to quantify actual rates of erosion and sediment loss.

L'Etoile Cross Section #3

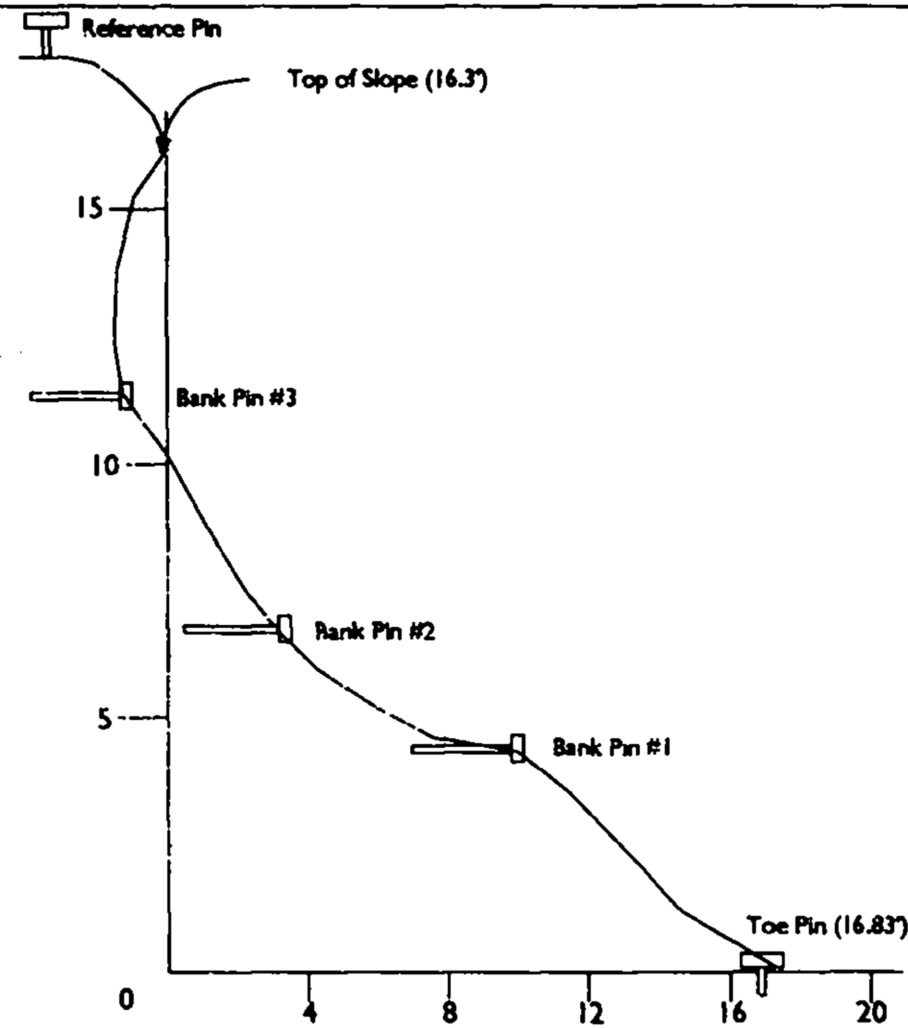
Toe Pin to Ref. Pin Horz. = 29.67'
Toe Pin to Ref. Pin Vert. = 19.2'
Toe Pin to Top of Slope Horz. = 16.83'
Toe Pin to Top of Slope Vert. = 16.3'

Bank Pin #3
To Toe Pin Horz. = 18'
To Toe Pin Vert. = 11.3'

Bank Pin #2
To Toe Pin Horz. = 13'
To Toe Pin Vert. = 6.8'

Bank Pin #1
To Toe Pin Horz. = 6'
To Toe Pin Vert. = 4.3'

Bank Pin #1 = 3.17'
Bank Pin #2 = 3'
Bank Pin #3 = 2.04'



New England Environmental, Inc.
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Amherst, MA 01002
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(413) 256-1092 Fax

NEE

CONNECTICUT RIVER
FULL RIVER RECONNAISSANCE
TURNERS FALLS POOL

NEE File #04-2430

L'Etoile
Cross Section #3

March 31, 2015

VIA EMAIL

Brandon Cherry, FERC
Patrick Crile, FERC
Brian Harrington, MADEP
David Cameron, MADEP
David Foulis, MADEP
Mike Bathory, LCCLC
Russ Cohen, MA Riverways
Bill McDavitt, NMFS
Kimberly Noake MacPhee, FRCOG
Andrea Donlon, CRWC
Tom Miner, CRSEC
John Bennett, FCD

Re: *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability* – 2015 Qtr. 1 Data Deliverable

Dear All,

On December 15, 2014, FirstLight Hydro Generating Company (FirstLight) filed with the Federal Energy Regulatory Commission (FERC) the *Response to Stakeholder Comments on the Initial Study Report and Meeting Summary* for the Turners Falls Hydroelectric Project (FERC No. 1889) and the Northfield Mountain Pumped Storage Project (FERC No. 2485). Included in that document were FirstLight's responses to Stakeholder comments pertaining to Study 3.1.2 – *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability*. In the response, FirstLight agreed to provide the following data in the 1st quarter of 2015: 1) boat wake data from 1997 and 2008; 2) groundwater data from 1997-1998; 3) Turners Falls Impoundment elevation and flow data for 2013; 4) project boundary digital data from the original survey (Exhibit K drawings); and 5) Turners Falls Impoundment elevation data from 2014.

In order to satisfy this requirement, enclosed please find the following:

- Qtr. 1 Data Overview and Pertinent Information.pdf
    - *Descriptions and metadata for each dataset included in this submittal as well as a map denoting the approximate location of each monitoring instrument.*
- Bennett Meadow Groundwater Data (1997-1998).xlsx
    - *Groundwater data collected at four wells adjacent to Bennett Meadow from July 1997 through February 1998*
- Bennett Meadow Groundwater Plots (1997-1998).pdf
    - *Weekly plots of the groundwater data collected adjacent to Bennett Meadow from July 1997 through February 1998*

John S. Howard
Director FERC Compliance, Hydro

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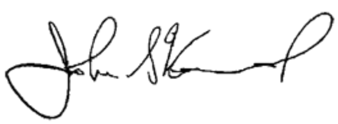
Tel. (413) 659-4489/ Fax (413) 422-5900/
E-mail: john.howard@gdfsuezna.com

- Boat Wave Data (1997).xlsx and Boat Wave Data (2008).xlsx
    - *Data summarizing boat activity and staff gage readings*
- FirstLight Water Level and Flow Data 2013-2014.xlsx
    - *Water level elevations recorded at various locations throughout the Turners Falls Impoundment in 2013 and 2014*
    - *Flow data recorded at: (1) Vernon, (2) Ashuelot River, (3) Northfield Mountain Pumped Storage Project, and (4) Millers River in 2013 and 2014*
- Exhibit_K_Project_Boundary.shp
    - *GIS shapefile containing the project boundary as digitized from the georeferenced Exhibit K drawings (the shapefile is comprised of 8 individual files)*

If you have any questions upon review of these datasets, please feel free to contact me at (413) 659-4489 or via email at john.howard@gdfsuezna.com.

Sincerely,



John Howard

Attachments

QTR. 1 2015 - DATA DELIVERABLE
Data Overview & Pertinent Information

In accordance with FirstLight's *Response to Stakeholder Comments on Initial Study Report and Meeting Summary,* FirstLight provided Stakeholders with the following data in the 1st Quarter of 2015:

- Boat Wave data from 1997 and 2008;
- Groundwater data from 1997-1998;
- Turners Falls Impoundment elevation and flow data for 2013 and 2014; and
- Project boundary digital data from the original survey (Exhibit K drawings)

Below is an overview of each dataset as well as pertinent information and metadata.

Boat Wave Data

Boat wave data were collected by Simons & Associates (S&A) in May and July 1997 and July 2008. In May 1997, data were collected at the Flagg site in the vicinity of Transect 6A; and in July 1997 data were collected just downstream of the Route 10 Bridge adjacent to Bennett Meadow. These data included video photography of boat waves with a staff gage and collection of suspended sediment samples. In July 2008, boat wave data were collected on the right bank in the vicinity of the Northfield Mountain tailrace. Data collection included video photography of boat waves.

The approximate locations where boat wake observations were made are depicted on the enclosed map.

Groundwater Data

Groundwater data were collected by S&A from mid-July 1997 through February 1998. The data were collected at Bennett Meadow on the right bank just downstream of the Route 10 Bridge. Four pressure transducers were installed with one being in the river and three in groundwater monitoring wells placed 52, 65 and 210 feet back from the bank in a line perpendicular to the direction of the river. The pressure transducers were set up to record water level on an hourly basis. The data were downloaded periodically and developed into graphs to show the relationship between water level in the river and the ground at various distances from the river. The datum used for this data was NGVD29, U.S. Feet.

The approximate locations where groundwater monitoring was conducted are depicted on the enclosed map.

Turners Falls Impoundment Elevation Data (2013 & 2014)

FirstLight maintains 3 permanent water level loggers at various locations throughout the Turners Falls Impoundment. Permanent water level recorder names and locations are provided below:

Name: Northfield_Tailrace	Location: Northfield Mountain Tailrace
Name: TF_Pond	Location: Turners Falls Dam
Name: Vernon	Location: Vernon Hydroelectric Project

Data was collected on a 15-minute timestep in 2013 and 2014. The datum used for this data was NGVD29, U.S. Feet. Data gaps found in the enclosed Excel spreadsheet represent data that was removed during the QA process (typically due to equipment malfunctions).

FirstLight also temporarily deployed 7 water level recorders at various locations throughout the Turners Falls Impoundment in 2013 and 2014. Temporary water level recorder names and locations are provided below:

Name: DOWNSTREAM STEBBINS	Location: Downstream of Stebbins Island, right bank
Name: DOWNSTREAM_FRENCHKING	Location: Downstream French King Gorge, left bank
Name: DOWNSTREAM_PAUCHAUG	Location: Downstream Pauchaug Boat Launch, left bank
Name: RT10 BRIDGE	Location: Upstream of the Rt. 10 Bridge, right bank
Name: STATELINE	Location: Upstream of the MA / VT Stateline, right bank
Name: UPSTREAM NORTHFIELD TAILRACE	Location: Upstream of the Northfield Mountain Tailrace, right bank
Name: UPSTREAM STEBBINS	Location: Upstream Stebbins Island, left bank

Data was collected on a 15-minute timestep in 2013 and 2014. The datum used for this data was NGVD29, U.S. Feet. The (1) UPSTREAM STEBBINS, (2) DOWNSTREAM STEBBINS, (3) STATELINE, (4) RT10 BRIDGE, and (5) UPSTREAM NORTHFIELD TAILRACE recorders were deployed from August - November 2013 and March/April - November 2014.

The DOWNSTREAM_PAUCHAUG and DOWNSTREAM_FRENCHKING recorders were deployed from Mar/Apr - November 2014. In addition, TransCanada had a water level recorder deployed downstream of Vernon (DOWNSTREAM_VERNON_TC) in the same vicinity as the UPSTREAM STEBBINS recorder. Data from the TransCanada recorder was provided to FirstLight for the period of late March - July 2014 to supplement the FirstLight recorder. Data gaps found in the enclosed Excel spreadsheet represent (1) periods of time when the temporary recorders were not deployed or (2) data that was removed during the QA process (typically due to equipment malfunction).

Additional water level loggers were also deployed in the vicinity of the Northfield Mountain Tailrace from April - November 2014 in support of Study No. 3.3.9 – *Two-Dimensional Modeling of the Northfield Mountain Pumped Storage Project Intake/Tailrace Channel and Connecticut River Upstream and Downstream of the Intake/Tailrace.* Data at these locations was collected on a 15-minute timestep. The datum used for this data was NGVD29, U.S. Feet. Data gaps found in the enclosed Excel spreadsheet represent data that was removed during the QA process (typically due to equipment malfunctions).

The approximate location of all water level recorders are depicted on the enclosed map.

Turners Falls Impoundment Flow Data (2013 & 2014)

FirstLight collects discharge (flow) data from the Vernon Hydroelectric Project (Vernon_CFS) and from the Northfield Mountain Pumped Storage Project (Northfield_CFS). Discharge data is recorded on a 15-minute timestep in units of cubic feet per second (cfs). Positive flow values recorded at Northfield Mountain represent generating conditions, negative values represent pumping conditions, and no values represent when Northfield Mountain is offline.

In addition, two major tributaries enter the Turners Falls Impoundment; the Ashuelot and Millers Rivers. Discharge data from these tributaries is obtained from USGS gages found on each river. Tributary discharge data should be considered provisional unless otherwise noted on the USGS website. All disclaimers found on the USGS website for each gage station are applicable to this data. The combined discharge from the Ashuelot River, Millers River, and Vernon represent the Turners Falls Natural Routed Flow.

Data gaps found in the enclosed Excel spreadsheet represent data that was removed during the QA process.

Exhibit K Shapefiles

The original Exhibit K drawings were developed in the late 1960s and early 1970s by Gordon Ainsworth Associates through a combination of aerial imagery, photogrammetry, and ground surveys. The original Exhibit K drawings contained information pertaining to the project boundary, minimum and maximum flow lines, ownership rights, topography, and miscellaneous facility details. National Map Accuracy Standards suggest that this mapping should have been compiled to an accuracy of 1/40th of an inch, which translates to $\pm$10 feet. The original drawings were hand drawn and existed in hard copy format only. FirstLight scanned the hard copy drawings, imported them into ArcGIS, and georeferenced them using common features found on both the original drawings and recent ortho-photos. One should expect some loss of accuracy in the scanning and translation to a digital format. The Project Boundary was developed using the existing coordinates, bearings and distances shown on the plans, limited field work with a GPS receiver and digitizing the contour line as depicted on the plans.

Furthermore, unlike today's mapping which does not tend to lose much fidelity when plotted, the original Exhibit K drawings were hand drawn and are therefore susceptible to errors accumulated there from. Review of the original drawings suggest that the project boundary was added by the surveyor after the mapping was delivered. Although the same control was likely used throughout, it's conceivable that there are additional inaccuracies by this multi-pronged approach.

For this study, 2009 ortho-photos from MassGIS were used for the reference/base mapping to which the Exhibit K drawings were projected and overlaid. By their definition, ortho-photos have been reduced to a flat surface and provide a uniform scale throughout their extent for a given accuracy – in this case 6-10 feet (2-3 meters referenced in the source). When the overlaid dataset also happens to be reduced to a flat surface, as in the Exhibit K mapping, one can typically find a suitable translation, rotation, and scale factor to overlay the mapping.

Building corners and road intersections were chosen as the most reliable control points between the datasets. Five to six well-spaced control points were selected for each Exhibit K sheet. In a few cases, due to a lack of adequate features, the project boundary was used as a control point. Given that the project boundary appears to have been added to the mapping after it was originally compiled by the photogrammetrist, concerns exist as to whether or not the project boundary can serve as an adequate source of control. While using the project boundary as a control point was avoided as much as possible, there were a few instances where this was unavoidable.

There are a number of different projections provided by the ArcGIS software to perform the transformation. Past experience has shown that the Affine Transformation (1st order polynomial) is appropriate when overlying map data of a fixed scale (i.e. reduced to a flat plane); as such, the Affine Transformation was used for this effort. This method allows for a translation, rotation, and different scale factors in the x and y axis. Prior research by others suggests that there is typically a bias in the material on which the mapping is drawn. This bias creates different scale factors in two orthogonally related directions related to shrinkage and expansion. The Affine Transformation attempts to account for the bias and create a better transformation versus using one uniform scale throughout the map.

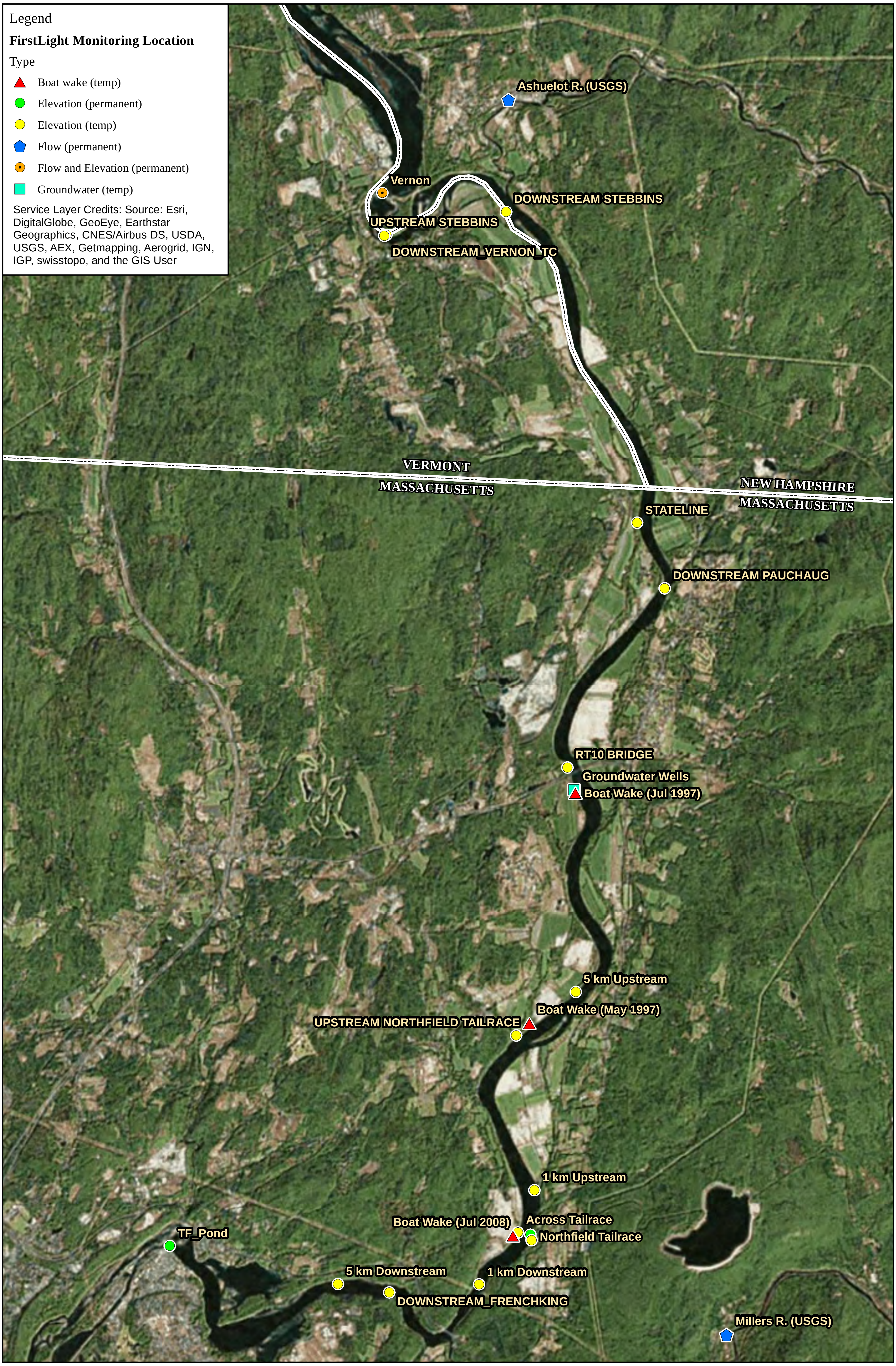
The results of using the 5-6 control points with the procedures noted above appear very good. Transformations for all Exhibit K sheets (10) were created with a root mean square of ~10 feet or less, and no control points had residuals greater than 15 feet.

As required by FERC in their Study Plan Determination Letter (SPDL) dated September 13, 2013, FirstLight reviewed the "1970 vintage ground survey" (original Exhibit K drawings) to determine if comparisons could be made with recent aerial imagery and available survey data to "analyze trends in bank position within the Turners Falls Impoundment." Upon close review of the Exhibit K drawings it was found that such a comparison is not possible due to the fact that the original drawings do not appear to capture the edge of river as it existed at the time the drawings were created.

Upon preliminary review of the drawings, it appeared that the Minimum Flow Line depicted the edge of water, however, as the drawings were reviewed more closely that does not appear to be the case. Furthermore, it is unclear how the location of the Minimum Flow Line was identified and what mapping methods were used to develop the original maps. FirstLight also explored the possibility of developing correlations between the Minimum Flow Line depicted on the original Exhibit K drawings and existing surveyed cross-sections of the river to determine the location of the edge of water at the time the original drawings were developed, however, that effort proved unsuccessful.

The location of the Maximum Flow Line was also reviewed to determine if that line could be used to conduct the analysis FERC recommended. Upon review of the drawings it became clear early on that the Maximum Flow Line would not be an accurate representation of the edge of water given that its location extends into the flood plain a far distance from the actual river channel in a number of locations.

FirstLight is currently examining the availability of other historic datasets that could be used for context when discussing the historic geomorphology of the Connecticut River. The findings of this will be included in the final study report. For the purpose of this deliverable, a GIS shapefile has been included which depicts the location of the Project Boundary as shown on the original Exhibit K drawings.



FirstLight
GDF SUEZ

N

FIRSTLIGHT POWER RESOURCES

RELICENSING STUDY 3.1.2
NORTHFIELD MOUNTAIN/TURNERS FALLS
OPERATIONS IMPACTS ON EXISTING EROSION AND POTENTIAL BANK INSTABILITY

0 0.5 1 2
Miles

Figure 1
FirstLight Monitoring Locations

Path: W:\gis\studies\3_1_2\maps\Qtr 1 2015 Data Deliverable2.mxd

May 26, 2015

VIA ELECTRONIC FILING

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

Re: *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability* – 2015 Qtr. 1 Data Deliverable

Dear Secretary Bose,

As requested by the Federal Energy Regulatory Commission (FERC), FirstLight Hydro Generating Company (FirstLight) encloses for filing the 2015 Quarter 1 data deliverable for the Turners Falls Hydroelectric Project (FERC No. 1889) and Northfield Mountain Pumped Storage Project (FERC No. 2485) relicensing Study No. 3.1.2 – *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability.* The contents of this filing were previously distributed to Stakeholders on March 31, 2015.

On December 15, 2014, FirstLight filed with FERC the *Response to Stakeholder Comments on the Initial Study Report and Meeting Summary* for the Turners Falls and Northfield Mountain Projects. Included in that document were FirstLight's responses to Stakeholder comments pertaining to Study 3.1.2 – *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability*. In the response, FirstLight agreed to provide the following data in the 1st quarter of 2015: 1) boat wake data from 1997 and 2008; 2) groundwater data from 1997-1998; 3) Turners Falls Impoundment elevation and flow data for 2013; 4) project boundary digital data from the original survey (Exhibit K drawings); and 5) Turners Falls Impoundment elevation data from 2014.

In order to satisfy that requirement, FirstLight distributed the following datasets to Stakeholders on March 31, 2015:

- Qtr. 1 Data Overview and Pertinent Information.pdf
    - *Descriptions and metadata for each dataset included in the submittal as well as a map denoting the approximate location of each monitoring instrument.*
- Bennett Meadow Groundwater Data (1997-1998).xlsx
    - *Groundwater data collected at four wells adjacent to Bennett Meadow from July 1997 through February 1998*

John S. Howard
Director FERC Compliance, Hydro

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Northfield, MA 01360
Tel. (413) 659-4489/ Fax (413) 422-5900/
E-mail: john.howard@gdfsuezna.com

- Bennett Meadow Groundwater Plots (1997-1998).pdf
    - *Weekly plots of the groundwater data collected adjacent to Bennett Meadow from July 1997 through February 1998*
- Boat Wave Data (1997).xlsx and Boat Wave Data (2008).xlsx
    - *Staff gage readings*
- FirstLight Water Level and Flow Data 2013-2014.xlsx
    - *Water level elevations recorded at various locations throughout the Turners Falls Impoundment in 2013 and 2014*
    - *Flow data recorded at: (1) Vernon, (2) Ashuelot River, (3) Northfield Mountain Pumped Storage Project, and (4) Millers River in 2013 and 2014*
- Exhibit_K_Project_Boundary.shp
    - *GIS shapefile containing the project boundary as digitized from the georeferenced Exhibit K drawings (the shapefile is comprised of 8 individual files)*

The contents of the datasets enclosed with this filing are the same as those previously submitted to the Stakeholders. If you have any questions upon review of these datasets, please feel free to contact me at (413) 659-4489 or via email at john.howard@gdfsuezna.com.

Sincerely,

John Howard

Attachments

August 18, 2015

VIA ELECTRONIC FILING

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

Re: Turners Falls Hydroelectric Project (FERC No. 1889) and Northfield Mountain Pumped Storage Project (FERC No. 2485)
Study No. 3.1.2 *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability* Progress Report

Dear Secretary Bose,

On December 15, 2014, pursuant to the regulations of the Federal Energy Regulatory Commission (FERC), Title 18 Code of Federal Regulations (18 C.F.R), §5.15 (c)(5), FirstLight Hydro Generating Company (FirstLight), filed the response to comments on the Initial Study Report (ISR) and ISR meeting summary for the relicensing of the Turners Falls Hydroelectric Project (FERC No. 1889) and Northfield Mountain Pumped Storage Project (FERC No. 2485)(collectively, the Project). On January 22, 2015, FERC issued their *Determination on Requests for Study Modifications and New Studies – Turners Falls Hydroelectric Project and Northfield Mountain Pumped Storage Project*.

Included in FERC's determination was discussion pertaining to relicensing Study No. 3.1.2 *Northfield Mountain/Turners Falls Operations Impacts on Existing Erosion and Potential Bank Instability* (Study No. 3.1.2). As part of this discussion, FERC recommended that FirstLight file a progress report after completion of each of the seven tasks included in the approved study plan. The progress reports are to describe the activities that occurred during completion of the task, including any variances that were necessary to complete the task. FERC further noted that the progress reports would not need to include preliminary study conclusions or raw datasets but should include documentation of any ongoing consultation with stakeholders, including copies of comments and recommendations from consulted entities. As noted by FERC, the intent of the progress reports is to update the stakeholders on the status of the study and identify variances from the approved study plan. Enclosed please find FirstLight's first progress report for Study No. 3.1.2.

The approved study plan for Study No. 3.1.2 identities seven tasks to be completed prior to the filing of the final study report. These tasks include:

- Task 1: Data Gathering and Literature Review;

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Director FERC Compliance, Hydro

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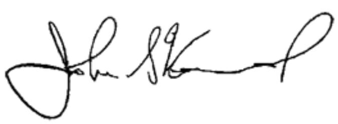
- Task 2: Geomorphic Understanding of the Connecticut River;
- Task 3: Causes of Erosion;
- Task 4: Field Studies and Data Collection;
- Task 5: Data Analyses;
- Task 6: Evaluation of the Causes of Erosion; and
- Task 7: Report and Deliverables

To date, FirstLight has completed Task 1 and substantially completed Tasks 2 and 3. For Task 1, a full list of existing data and literature sources previously gathered was provided to Stakeholders and filed with FERC on December 15, 2014 as part of FirstLight's *Response to Stakeholder Comments on the Initial Study Report and Meeting Summary.* Since that filing, additional resources have been identified by FirstLight which are included in the enclosed table. Task 2 is substantially complete, however, review and analysis of historic aerial imagery for context when discussing the historic geomorphology of the Connecticut River is on-going. In regard to Task 3, the identification of the potential and potential primary causes of erosion has been completed, however, the relative importance of each of those primary potential causes of erosion will not be assessed until completion of Tasks 4, 5, and 6. Tasks 4, 5, 6, and 7 are on-going. A high level status update regarding each task will be discussed in FirstLight's Updated Study Report (to be filed with FERC on September 14, 2015) and at the Updated Study Report Meeting (to be held September 29-30, 2015).

Upon review of the enclosed progress report, if you have any questions please feel free to contact me at (413) 659-4489 or via email at john.howard@gdfsuezna.com.

Sincerely,



John Howard

Attachment: Study No. 3.1.2 *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability* – Progress Report

Study No. 3.1.2 ***Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability –***
Progress Report No. 1

Task	Status	Variance	Consultation	Description of Activities Completed
Task 1: Data Gathering and Literature Review	Completed	No	Yes	• Task has been completed. • Consultation: A full list of the existing data and literature sources gathered as part of this task was provided to the Stakeholders and filed with FERC on December 15, 2014 as part of FirstLight's *Response to Stakeholder Comments on the Initial Study Report and Meeting Summary*. Boat wave and groundwater data as well as Turners Falls Impoundment water level and flow data were provided to the Stakeholders on May 26, 2015 • Additional data or literature sources identified since that filing include: Hydraulic data (near shore depths and velocities 1997-2011 collected periodically) Suspended sediment samples (collected periodically from 1997-2011) Bed and bank material samples (collected periodically from 1997-2008) *Analysis of Ice Formation on the Platte River* (Simons & Associates, 1990) *Physical Process Computer Model of Channel Width and Woodland Changes on the North Platte, South Platte, and Platte Rivers* (Simons & Associates, 1990) *Calibration of SEDVEG Model Based on Specific Events from Demography Data* (Simons & Associates, 2002) Flood Insurance Study, Town of Montague, Massachusetts, Franklin County by FEMA, 1982 U.S. Department of the Army, Corps of Engineers, New England Division, Technical Report, Flood Plain Information, Miller River, Orange-Athol, Massachusetts, June 1965 Johnstone, Don and W.P. Cross, Elements of Applied Hydrology, New York: Ronald Press Co., 1949 Water Resources, Wantastiquet Region River Subcommittee of the Connecticut River Joint Commissions, Adopted December 12, 2007. Updated August 2009 HEC-RAS model of the Turners Falls Impoundment, developed by Gomez and Sullivan Engineers, DPC, 2014 River2D model of the Turners Falls Impoundment, developed by Gomez and Sullivan Engineers, DPC, 2015 Abernethy, B., and Rutherfurd, I.D., 2001. The distribution and strength of riparian tree roots in relation to riverbank reinforcement. Hydrological Processes, 15(1), 63-79. Gray, D.H., and Sotir, R.B., 1996. Biotechnical and Soil Bioengineering Slope Stabilization: A Practical Guide for Erosion Control. John Wiley & Sons, Inc.: New York, NY. Fredlund, D.G., Morgenstern, N.R., and Widger, R.A., 1978. The shear strength of unsaturated soils. Canadian Geotechnical Journal. 15, 313-321. Micheli, E.R., and Kirchner, W., 2002. Effects of wet meadow riparian vegetation on streambank erosion. 2. Measurements of vegetated bank strength and consequences for failure mechanics. *Earth Surface Processes and Landforms*, 27: 687-697. Morgenstern, N. R. & Price, V. E. 1965. The analysis of the stability of general slip surfaces. Ge´otechnique 15, No. 1, 79–93. Pollen, N., 2007. Temporal and spatial variability in root reinforcement of streambanks: Accounting for soil shear strength and moisture. Catena, 69(3), 197-205. Pollen, N., Simon, A., and Collision, A.J.C. 2004. Advances in Assessing the Mechanical and Hydrologic Effects of Riparian Vegetation on Streambank Stability, In: S. Bennett and A. Simon, eds. Riparian Vegetation and Fluvial Geomorphology, Water Science and Applications 8, AGU: 125-139. Simon A., Curini A. 1998. Pore pressure and bank stability: The influence of matric suction. *In* Water Resources Engineering '98*, ed.* Abt S.R., 358-363. New York: American Society of Civil Engineers. Simon A, Curini A, Darby S.E, Langendoen E.J., 2000. Bank and near-bank processes in an incised channel, *Geomorphology* 35: 183-217.

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				Simon, A., and Collison, A.J.C. 2002. Quantifying the mechanical and hydrologic effects of riparian vegetation on stream-bank stability, *Earth Surface Processes and Landforms* **27**(5): 527-546. Simon, A., Thomas, R.E., and Klimetz, L., 2010. Comparison and experiences with field techniques to measure critical shear stress and erodibility of cohesive deposits. Federal Interagency Sedimentation Conference, Las Vegas, NV, 2010, 11 p. (on CD). Simon A, Curini A, Darby S.E, Langendoen E.J., 2000. Bank and near-bank processes in an incised channel, *Geomorphology* 35: 183-217. Thorne, C.R., 1990. Effects of vegetation on riverbank erosion and stability, In: J.B. Thornes, (ed.), Vegetation and Erosion. John Wiley & Sons Ltd.: Chichester, UK; pp.125-144. Thorne, C.R., and Tovey, N.K., 1981. Stability of composite river banks. Earth Surface Processes and Landforms, 6, 469-484. Waldron, L.J. and Dakessian, S. 1981. Soil Reinforcement by Roots: Calculation of increased soil shear resistance from root properties, Soil Science 132: 427-435. Wu, T.H., McKinnell III, W.P., and Swanston, D.N., 1979. Strength of tree roots and landslides on Prince of Wales Island, Alaska. Canadian Geotechnical Journal, 16(1), 19-33. ASTM, 1995. Annual Book of ASTM Standards: Section 4, Construction, v. 04-09. American Society for Testing and Materials: West Conshohocken, PA. Hanson, G.J., 1990, Surface erodibility of earthen channels at high stress, Part II - Developing an in situ testing device, Transactions of the American Society of Agricultural Engineers, 33(1), 132-137. Hanson, G.J., and Simon, A., 2001. Erodibility of cohesive streambeds in the loess area of the midwestern USA, Hydrological Processes, 15(1), 23-38. Little, W.C., Thorne, C.R., and Murphy, J.B., 1982. Mass bank failure analysis of selected Yazoo Basin streams. Transactions of the American Society of Agricultural Engineers, 25, 1321-1328. Lohnes, R. A. and Handy, R. L., 1968. Slope Angles in Friable Loess. Journal of Geology. Volume 76(3), 247-258 p. Lutenegger, J. A. and Hallberg, B. R., 1981. Borehole Shear Test in Geotechnical Investigations. ASTM Special Publications 740, 566-578 p. Thorne, C. R., Murphey, J. B. and Little, W. C., 1981. Stream Channel Stability, Appendix D, Bank Stability and Bank Material Properties in the Bluffline Streams of Northwest Mississippi. U.S. Department of Agriculture, Agricultural Research Service, National Sedimentation Laboratory. Oxford, MS. 227 p. Thorne, C.R., 1982. Processes and Mechanisms of River Bank Erosion. In, Hey, R.D., Bathurst, J.C. and Thorne, C.R., (Eds.). Gravel-Bed Rivers, John Wiley and Sons, Chichester, England. 227-271 p. Sorensen, R. M., and Weggel, J. R. (1984). Development of ship wave design information. Proceedings of the 19th Conference on Coastal Engineering, Houston, TX, 3-7 September 1984. Billy L. Edge, ed., American Society of Civil Engineers, New York, III, 3227-43. Kriebel, D. L., and Seelig, W. N. (2005). “An empirical model for ship- generated waves.” Proc., 5th Int. Symp. on Ocean Wave Measurement and Analysis (CD-ROM), Madrid, Spain Bhowmik, N. G., Soong, T. W., Reichelt, W. F., and Seddik, N. M. L. (1991). A Waves generated by recreational traffic on the Upper Mississippi River system, @ Research Report 117, Department of Energy and Natural Resources, Illinois State Water Survey, Champaign, IL. Blaauw, H. G., de Groot, M. T., Knaap, F. C. M., and Pilarczyk, K. W. (1984). A Design of bank protection of inland navigation fairways. @ Proceedings of the Conference on Flexible Armoured Revetments Incorporating Geotextiles, London, 29-30 March 1984. Thomas Telford, 239-66.

Task	Status	Variance	Consultation	Description of Activities Completed

Task 2: Geomorphic Understanding of the Connecticut River	Substantially Completed	No	No	• Task is substantially complete.
				• Geomorphic assessment focused on several areas including:
				  ○ Recent Geomorphic History of the Connecticut River
				  ○ Modern Geomorphology
				  ○ Natural Riverine Geomorphology
				  ○ Hydrology, Channel Geometry, Hydraulics, and Bank Material of the Turners Falls Impoundment
				  ○ Historic Comparison of the Turners Falls Impoundment Riverbank and Channel
				  ○ Erosion Comparison of the Turners Falls Impoundment and Connecticut River
				• Analysis of historic aerial imagery for context when discussing the historic geomorphology of the Connecticut River is on-going (last outstanding sub-task).
				• Relevant report sections are starting to be drafted.

Task 3: Causes of Erosion	Identification of Causes of Erosion (Completed)
	
	Report sections (Not Complete)
		No	Yes	• FirstLight has identified the potential and potential primary causes of erosion but have not yet assessed the relative importance of each of those potential primary causes pending completion of Tasks 4, 5, and 6.
				• Consultation: FirstLight informed the Stakeholders at the Initial Study Report Meeting on September 30 – October 1, 2014 that the potential causes of erosion and potential primary causes of erosion identified in the Revised Study Plan (RSP) were reviewed and have not changed. The potential causes of erosion examined as part of this study include:
				  ○ Hydraulic shear stress due to flowing water;
				  ○ Water level fluctuations due to hydropower operations;
				  ○ Boat waves
				  ○ Land management practices and anthropogenic influences to the riparian zone;
				  ○ Animals
				  ○ Seepage and piping
				  ○ Freeze-thaw; and
				  ○ Ice or Debris
				• Potential primary causes of erosion examined in greater detail include:
				  ○ Hydraulic shear stress due to flowing water;
				  ○ Water level fluctuations due to hydropower operations;
				  ○ Boat waves
				  ○ Land management practices and anthropogenic influences to the riparian zone;
				  ○ Ice
				• Relevant report sections are starting to be drafted.

Task	Status	Variance	Consultation	Description of Activities Completed
Task 4: Field Studies and Data Collection	On-going	Yes	Yes	• This task is on-going. • The majority of field work was completed in 2014. Supplemental field work has occurred throughout 2015 and will continue into 2016. • Consultation: FirstLight consulted with Stakeholders in selecting the location of the detailed study sites found throughout the Turners Falls Impoundment. The final set of detailed study sites were presented in FirstLight's *Selection of Detailed Study Sites* report which was filed with FERC as Appendix B of the Study No. 3.1.2 *Initial Study Report Summary*. A high level status update for this task will be provided in the Updated Study Report and at the Updated Study Report meeting. • Variance: Supplemental boat wake data collection.
Task 5: Data Analyses	On-going	Yes	Yes	• This task is on-going. • Consultation: FirstLight provided Stakeholders with additional information regarding the modeling process in the *Response to Stakeholder Comments on the Initial Study Report and Meeting Summary* filed with FERC on December 15, 2014. A high level status update for this task will be provided in the Updated Study Report and at the Updated Study Report meeting. • Variance: Analysis of supplemental boat wake data.
Task 6: Evaluation of the Causes of Erosion	On-going	No	No	• Some minor, preliminary analyses have been conducted, however, the bulk of this task will not be started until Task 5 has been completed.
Task 7: Report and Deliverables	On-going	No	No	• Report organization and drafting has begun and will continue into 2016. Report sections for tasks that have already been completed, or are substantially complete, are starting to be drafted. • The final report and deliverables will be filed in the second quarter of 2016.