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October 14, 2015

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

Re: TransCanada Hydro Northeast Inc.'s Updated Study Results Meeting Summary
Project Nos. 1892-026, 1855-045, and 1904-073

Dear Secretary Bose:

TransCanada Hydro Northeast Inc. ("TransCanada") is the owner and licensee of the Wilder Hydroelectric Project (FERC No. 1892), the Bellows Falls Hydroelectric Project (FERC No. 1855), and the Vernon Hydroelectric Project (FERC No. 1904). The current licenses for these projects each expire on April 30, 2019. On October 31, 2012, TransCanada initiated the Integrated Licensing Process by filing with the Federal Energy Regulatory Commission ("FERC" or "Commission") its Notice of Intent to seek new licenses for each project, along with a separate Pre-Application Document for each project.

With this filing, TransCanada submits its Updated Study Results Meeting Summary for the three projects, as required by 18 C.F.R. §5.15(c)(3). The Updated Study Results Meeting was held on October 1, 2015 at the Fairfield Inn and Suites in White River Junction, Vermont and on October 2, 2015 at TransCanada's Operations Control Center in Wilder Vermont, with WebEx and call-in capability for participants who could not attend in person. Based upon scheduling consultation with FERC relicensing staff and previous selected dates for similar USR meetings for FirstLight Project No. 1889 and No. 2485, TransCanada's meeting was held slightly beyond fifteen days of filing the USR Study Report (ISR) as required by 18 C.F.R. §5.15(c)(2). The USR was filed on September 14, 2015 in accordance with the two-year anniversary of the Study Plan Determination ("SPD") for non-aquatics studies.

The attached meeting summary includes meeting notes, points of discussion, the list of meeting attendees, a copy of the presentation slides used during the meeting, and a copy of written comments submitted at the meeting.

If there are any questions regarding the information provided in this filing or the process, please contact John Ragonese at 603-498-2851 or by emailing john_ragonese@transcanada.com.

Sincerely,

John L. Ragonese
FERC License Manager

Attachment: Updated Study Results Meeting Summary

cc: Interested Parties List (distribution through email notification of availability and download from TransCanada's relicensing web site www.transcanada-relicensing.com).

UNITED STATES OF AMERICA

BEFORE THE

FEDERAL ENERGY REGULATORY COMMISSION

TRANSCANADA HYDRO NORTHEAST INC.

Wilder Hydroelectric Project (FERC Project No. 1892-026)
Bellows Falls Hydroelectric Project (FERC Project No. 1855-045)
Vernon Hydroelectric Project (FERC Project No. 1904-073)

Updated Study Results Meeting Summary

October 14, 2015

TRANSCANADA HYDRO NORTHEAST INC.
UPDATED STUDY RESULTS MEETING
OCTOBER 1 – 2, 2015

October 1, 2015 at Vermont Conference Room of the Fairfield Inn and Suites, 102 Ballardvale Drive, White River Junction, VT

- 9 am – Introductions (attendees – see attached list)
- 9:15 - Summary of progress on the following ILP Studies:

Study No.	Study Title
4	Hydraulic Modeling Study
5	Operations Modeling Study
6	Water Quality Study
13	Tributary and Backwater Fish Access and Habitats Study (Study report filed 09/14/2015)
14	Resident Fish Spawning in Impoundments Study
15	Resident Fish Spawning in Riverine Sections Study
Break ~ 11:00 – 11:15	
16	Sea Lamprey Spawning Assessment
21	American Shad Telemetry Study
7	Aquatic Habitat Mapping Study (Study report filed 03/02/2015)
8	Channel Morphology and Benthic Habitat Study (Study report filed 03/02/2015)
9	Instream Flow Study
Lunch ~ 12:15 – 12:45 pm brought in	
30	Recreation Facility Inventory and Use & Needs Assessment
31	Whitewater Boating Flow Assessment - Bellows Falls and Sumner Falls
32	Bellows Falls Aesthetic Flow Study
24	Dwarf Wedgemussel and Co-occurring Mussel Study (Phase I Study report filed 09/15/2014, Phase II report filed 03/02/2015)
25	Dragonfly and Damselfly Inventory and Assessment
Break ~ 2:15 – 2:30	
26	Cobblestone and Puritan Tiger Beetle Survey
27	Floodplain, Wetland, Riparian, and Littoral Vegetation Habitats Study (study report filed 09/14/2015)

Study No.	Study Title
28	Fowler's Toad Survey
29	Northeastern Bulrush Survey
1	Historical Riverbank Position and Erosion Study
2	Riverbank Transect Study
3	Riverbank Erosion Study
Location and Agenda for 10/02 Meeting	

This meeting summary supplements the slide presentation provided during the meeting and attached herewith. The summary represents the discussion that occurred during and following each presentation.

Lissa Robinson, GEI: Study 4 – Hydraulic Model

Model set up: calibrated, validated to ensure that the model reflects what is happening in the river (WSE, flow) rating curves compared to USGS gages and time of flow.

Q: The 2 calibrations shown are really tight – were all calibrations that close?
A: yes, within 10ths of ft or 0.5 ft. We had to close some gaps in riverine sections (via Study 7, Study 9, and additional ADCP work in 2015 – BF bypass and mainstem below BF station, and Sumner Falls up to Ottaquechee River). Now we have very good calibrated cross sections and the model was also validated with velocity data.

Q: transects for Instream Flow study – were some used for this study as well?
A: We used that data to create the model. And, study sites and cross sections from that study are identified in the model.

Q: How many transects used in the calibration/validation?
A: About 22. We looked at periods of time with spill, typical operations and valid logger data to get convergence. Seven sites were used for velocity validation.

Model output: WSE, flow, velocity at locations for use in other studies, for agency use, and for input to Operations Model. We did velocity comparisons at 7 sites. Lag time that goes to Ops Model, "pulse" of water flow as it moves downstream to calculate lag time. Rating curves relationship at a cross section (in miles) WSE compared to total flow (showed examples - see slide presentation). To be used for pre-screening of project effects from resource study observations at study sites (example shows area on graph within and outside of project operations) to correlate resources with the model to show if resources are within the range of project operations or not. Further analysis use time series analysis (frequency, duration, time of year of project effects, etc.).

Q: Weren't all study areas within the project-affected area and by default influenced?
A: No, they were identified by geographic area originally, but now the models will define what the project effects are for each resource which may be more or less sensitive to different conditions. While

a resource may be in the geographic area influenced by the projects, it may not be negatively impacted by project operations.

Q: If you are above the influence of one project's impoundment, but still influenced by the project upstream and its flow.
A: yes, exactly.

Subhourly model runs: currently running in 1-minute time steps and will work more on subhourly flows. This is a 2016 exercise – in those resource areas/locations that are still included after pre-screening. This process is more iterative with input from stakeholders on which scenarios to run for subhourly.

Q: Remaining activities – already incorporated instream flow, there was a reference to obtaining data from FirstLight for the area below Vernon dam.
A: We have that data as of this week and will run that data too. We have high confidence that FL's model is well calibrated in that reach.

Q: You are using TC's data from McIndoes to model into Wilder?
A: We have inflow from McIndoes and other inflow, but the hydraulic model examines flow in a snapshot manner, that is at a specific flow at a specific cross-section (e.g., at 20,000 cfs flowing through all of the cross sections while Wilder Dam elevation is at xx ft,). The Operations Model uses upstream inflows over the 5 sample hydrologies and simulates TC operations over the same time period to demonstrate and examine project effects.

Stu Bridgeman, Hatch: Study 5 - Operations Model

The Operations Model models the behavior of TC's control of the river and how that affects flows and levels between the projects. Simulations based on actual chronological sequences from historical data and historical hourly operations in response to hydrology. Looked at existing operations to get a baseline and can look at various alternative operations to see effects of resources on an hourly basis and the overall effects of those alternatives. Model is driven by hydrology, hourly prices, generating unit and spillway gate physics, and license/operations conditions and limitations. Model could be run for all 45 years or so, but model run times would take a long time. We picked 5 representative years (wet, dry, normal range years) to develop time series at any point of interest (econodes) of water levels and flows at those locations.

Model validation: Difference usually within 1/100th of a percent. Data is from 1976 to 2011. We ranked from wettest to driest years and picked 5 representative years that span the range of dry/normal/wet adjusted a little bit for seasonal variation and patterns. Operating parameters for FMF and First and Second Lake storage, and this model constrained that operation a little to be narrower than what the FMF license and settlement agreement allow.

Rating curves and routing characteristics: Embedding into the model, so time series from Study 5 will agree with rating curves from Study 4. Model input will include defined habitat suitability indices at a location to identify potential alternative operations (e.g., different ramping rate at a particular site for a particular resource) to compared to baseline operations, and assess the marginal changes.

Timing: We would like to do pre-screening between now and March 2016 (and will provide to stakeholders), then put resource issues into Operations Model to start looking at alternatives. We will have a series of working group meetings to review and stakeholders should think about what types of alternative scenarios you'd like to see.

Q: Model calibration effectively mimics years you selected?
A: Yes, 2 levels of calibration. First force the model to match to the actual year of operation. Second calibration we looked at a coarser representation of price signals since a historical year may have had specific things that changed price (e.g., regional outage that spiked prices). 99% of the time the model has to follow the operating rules.

Q: So in 1996 (one of the 5 years) are you importing the prices and signals pre-deregulation decision making?
A: No, it is mimicking current post-deregulation pricing drivers and only mimicking the hydrology of the particular year. We will not use this model to come up with costs other than energy prices (other ancillary pricing).

Q: Operational constraints – Vernon increased its generation capacity between the 5 selected years, how was that dealt with?
A: We used current operations, checked with TC Operations to verify how TC would operate now. The 5 years selected were based on hydrology as the primary driver (not generation – only to do minor adjustments based on other characteristics – different type of spring than other years had, for instance).

Q: Econodes already selected or based on resource studies?
A: In the hydraulic model, econodes are physical locations at cross sections. In the operations model, econodes is an hourly point not a physical location. We get the relationship between flow level and downstream elevation from the hydraulic model. The operations model then looks at hourly flows at that point.

Matt Burak, LBG: Study 6 – Water Quality

Summary (see slides) of study sites, timing. Field work ongoing through mid-November.

10-day low flow study: We used the threshold flow (3x 7Q10) at each project, and temperature triggers provided by NHDES. Wilder never made it up to temperature trigger (23 degrees C), but we were running out of time toward fall. Each location had 20 days of data.

Study variances: With concurrence of the working group, we made minor locational changes at upstream of impoundment sites; adjusted number of temperature loggers for the 10-day flow study due to shallow water depths.

Initial results: Observed fairly uniformly mixed water column until late July. Some minor stratification in late summer but temperature differences were very small. Never saw DO fall below VT or NH state water quality standards. Tributaries were colder further north, warmer further south.

Q: In the USR, graphs show the 10-day low flow period. There seems to be fairly large precipitation event in the beginning. Would it be a good idea to shift the 10-day period?
A: Yes, we will pick the period that has the lowest flow (likely between 09/02 and 09/12). We have 20 days of low flow data to pick from.

Q: What additional data are you waiting for?
A: continuous sonde data, checking and downloading weekly, more lab results coming in for nutrients and temperature data through mid-November.

Q: Would like to get more information on correlating WQ data with TC operations data. Would like to see generation over the WQ monitoring period.
A: Okay. We will take that into consideration as well. During the continuous WQ monitoring we can overlay on an hourly timestep. It was a pretty low generation year. Have been running minimum flows only for almost 2 ½ months until this latest precipitation. Post-meeting note: a comparison of these results with project operations and data from nearby weather stations is a component of the study plan and will be provided in the study report.

Drew Trested, Normandeau: Study 13 – Tributary and Backwater Access

Summary: Used 0.5 ft of depth to define adequate access, 25% of the time or more. Most sites (27 of 37) met those criteria over the period of record. 8 sites failed that criteria and required additional analysis. Two sites, in particular, may have access restrictions potentially related to project operations. There were 2 additional sites had a significant amount of missing water level logger data that will require Study 4 cross-section based water surface elevation data to evaluate potential project effects. Examples from study report Appendix A were presented.

Q: Liked how took all sites and reduced to potentially affected sites . From that group it was less clear how it was determined that there were or were not access issues (e.g., McArthur Brook). We need some justification of those 10 sites and the ones determined to have no project effect.
A: That stream (McArthur Brook) was dry in some cases, if the stream was wet that stranding area might be wet. The screening that we did was based on field conditions and available logger information. That site is still one of the 10 that are potentially affected and we will look at it through the modeling data. Admittedly the study report is qualitative in terms of project effect including distance of project effect. For instance, if that stream had 1 ft of water in it, there could be a project effect on that depth but with no water in it, we can't really say. There is a difference between a barrier and a dry stream. In this case, we couldn't put a logger in the dry stream. We were essentially monitoring a backwater not the dry tributary.

Q: That should be a perennial stream, so why dry? It should have water in it sometimes. It could be seasonally used (spring/fall).
A: That was just what we saw in the field, we only saw water during 1 site visit. The study data presents worst case (July – November when it is drier). There is no barrier in the thalweg. If there is flow in the stream fish can get to it but we didn't find water most of the time.

Q: Process wise – how will the objectives that haven't been addressed in the study reports be presented to stakeholders?

A: Three study reports have been filed (8, 13, 27) that you can comment on. Some studies will be updated with project affect analysis results. We can file study report addendums when those analyses are completed.
FERC – we will be revising the process plan and schedule for those issues.

Q: The 25% time criteria – was that discussed with the working group? Anything less than 0% is a problem. Is there a way through the models to look at data for the spring for all sites?
A: We came up with the 25% of the time as a way to classify the sites to look at further or not. We looked at the thalweg to determine if there is a barrier or not, and for instance, under low flow if there is not a barrier, why would there be a barrier under high flow? However, the model elevations can be compared at the confluence cross sections and will analyze that (either at the 10 sites or at all 37 sites).

Q: The 10 sites are based on 0.5 ft and 25% of the time (not agreed to by stakeholders). It would be interesting to know how many more tributaries would be included if 25% was 0%.
A: there is a table in the report that details that for all study sites. You can disagree with our logic, but we looked at the dry season and if there was no barrier during that time period, then why would there be a barrier during spring/spawning seasons?

Mark Allen: Study 14 and 15 – Resident Fish Spawning Studies

Summary: Study 14 components – egg block sampling, backwater sampling, nest spawning. Substantial effort occurred from late April to end of May. Egg blocks, only sucker eggs at 2 sites in Wilder impoundment (seemed to be random eggs that have drifted downstream), no walleye eggs in impoundment sites. Backwater sampling was conducted for early and late spawners. No pike or pickerel spawning despite seeing individuals, no aggregations that looked like spawning (splashing, swirling). Some bass and fallfish were observed in impoundment tributaries. Added angling, caught pickerel and pike, larval trawls caught over 1000 larva including 1 chain pickerel larva [not an egg as the slide says – slide corrected after the meeting]. We're not sure why we didn't see more spawning of those species. We collected a lot of data on yellow perch, with elevation data on 123 locations with egg masses. Data is biased toward nests/eggs in shallower water due to high flows causing turbidity and limited depth visibility conditions this spring.

Q: Timing of sampling in the 3 impoundments – was the effort, timewise (temporally), consistent among the areas?
A: We had 4 crews out, so everything was synchronous for the most part. Egg block installations in riverine sections (study 15) started earlier, then we started putting them in impoundments, then in backwaters.

Summary: Study 15 – same methodologies in mainstem riverine sections [refer to slides]. A lot of effort but little spawning activity was observed, like study 14. A subset of nests (6 – 10) had a marker installed so that we could photograph and re-photograph over time.

Q: When did the backwater sampling start?
A: April 28, as soon as we had gotten egg blocks out to make sure we captured the early spawners.

Q: Do you think you missed the pike and pickerel spawn?

A: We don't know, even with all the trawls we did we still didn't get spawning although we saw a lot of individuals. It's possible but maybe there are just very limited spawning areas they go to.

Q: I just wonder where we go from here, realizing how difficult these surveys are. Does some of this need to be repeated so that we have data?
A: Our impression is that spawning occurred at fairly defined times and we have larvae we can look at. We were there at the right time for suckers, but they may have been going further up into tributaries. We don't know how far walleye or sucker eggs will drift, but it seems that they may have spawned further upstream. We hit the correct temperatures for walleye and sucker (and were out sampling, with 40,000 cfs at Vernon). As soon as the temperatures hit we were in the water. There was about a week temperature lag from Vernon to Wilder. We don't think we missed the spawning timing at all. There are not a lot of pike out there, but pickerel would be a good surrogate. Given the amount of time and effort spent, if there had been a lot of spawning we would have seen it.

Q: So you may have missed locations?
A: Yes, but in the backwaters particularly as the trawls show, we did a lot of searching. We focused on the shallower water areas that could become dewatered. The fishermen target deeper areas – the fish could have been in deeper water. That is a good point, we did see literature on spawning at a range of depths – a lot of the eggs were captured in deeper water. It could be that spawning occurring in those areas but in deeper water.

Q: Did you record the specific location of the nests?
A: Yes, we recorded habitat data, substrates, % fines, dominant form of cover within 10 ft (video of bass protecting nest showed a big log in the background), field notes, RTK position on the nests.

Q: Any other reports of rosy faced shiners in the river? Or is it an introduction?
A: NHFG has no knowledge of their presence in the river (Katie - last report of them in the river was 1971 and no known impacts even though they are on USGS non-indigenous species list).

Steve Leach – Study 16 – Sea Lamprey

Summary: 37 of 40 tagged fish were detected, 3 were not (could have gone out of project, dropped back or dead tags perhaps) and 18 of FirstLight's tagged fish were detected. Of the spawning sites located, many had multiple nests on them. At least 14 sites with nests were distributed among the project area. We did some out of scope work (study variance) to go back out during lower water to look for nests where lamprey were detected but might have been too deep to see in spring when water was higher and turbid. Study variance (with concurrence of working group) to terminate red capping due to low success and caps altering nest substrate; ammocetes were found in study 21 (video clip of an adult building nest was shown).

Q: Of the documented sites, how many were by radio vs habitat-based?
A: About 50-50, we used radio telemetry to identify clusters of hits and cross referenced that with the known habitat. Some of the radio telemetry confirmed that the site selection was appropriate. But if you looked hard enough in the habitat-based selected sites where nests were not positively identified, you'd probably find activity.

Doug Royer – Study 21 – Shad Telemetry Study

Summary: We conducted radio tagging/tracking and spawning trawls. Data analysis is in progress. There was spawning evidence in the Bellows Falls riverine reach (slide 95 clarified that "Walpole to Westminster" meant the riverine reach of Bellows Falls).

Q: Did you collect water temperature profiles and relate that to spawning?
A: Yes, all the habitat and water data was taken at each sample and will be included in the report.

Q: Tracking fish to determine spawning areas, if there wasn't any splashing-you are characterizing it as spawning area or could they have been resting only? How did you decide they were spawning?
A: Shad are not nest spawners, we looked for congregations then pulled trawls to determine spawning by collecting eggs in general spawning areas.

Q: They do have some favorite spots which can change from year to year except some spots where substrate (e.g., boulders) doesn't move. You can identify spawning vs resting because spawning fish are up at the surface and resting fish will be deeper in the water column.
A: Yes, we were out in the dark and going by radio telemetry signal and couldn't distinguish where in the water column the fish was.

Q: Did you document when you did see splashing and/or spawning behavior?
A: Yes, in field notes.

Maryalice Fischer – Study 7 – Aquatic Habitat Mapping

Summary: Study was conducted in 2013, and reported on last year. The report was filed March 1 along with overwintered 2013/2014 water level logger data. Subsequently we found some data conversion errors affected 3 sites so that data was corrected and refiled with the USR along with overwintered 2014/2015 data. So overall the study results served as the habitat basis for the other studies.

Mike Chelminski, Stantec – Study 8 – Channel Morphology and Benthic Habitat

Summary: We collected data on pebble counts, embeddedness, and habitat quality. It was a qualitative assessment. There was a general shift downward in embeddedness from first to second round in 9 transects of 25, 1 site had upward shift. Coarse grain sediment dominates, and very coarse grain down near Vernon. Saxtons River just below Bellows is a large bar, the Cold River has a bar and that river has had pre-Irene events, as has Saxtons. Sites downstream also reflect that mid-size tributaries are very important. Temporal variability was limited and consistent with literature.
Q: In the USR site 08-M15 was considered as being poorly suited for inclusion in the study. Can you discuss evaluation of alternate sites and deciding to include that site anyway?
A: This was a reference site just below Bellows Falls like the one just below Wilder dam. We did not find suitable surrogate site nearby this site – so kept it as representative of conditions out there and didn't want to abandon a site just below the project (Bellows Falls). Documents some characteristics of sediment transport. We also moved one site slightly (Mascoma River) for coarse grained material.

Steve Eggers – Study 9 – Instream Flow

Summary: All field work has been completed, with high flow measurements done in May 2015. Our HSC proposal was modified slightly by agencies with some additions. Bellows Falls bypassed reach and Sumner Falls demonstration flows and profiles were taken. Habitat vs. discharge modeling, habitat modeling results are being developed in the operations model scenarios.

Q: For the HSCs, it was decided to wait to include long nose dace in case there were not any found. And you noted that those found were young of year, so you added it, but wouldn't you also want to add the other two life stages and update the table to include those?
A: Yes, so the table needs to be updated [slide 112 was updated to include all three life stages].

Q: Below Vernon, what hydraulic model will you use to model IFIM there?
A: Looking at the HEC-RAS rating curves for WSEs and then use study 9 velocities. Some issues there when we were doing transects, due to Turners Falls operations.

Jot Splenda – Recreation and Aesthetics Studies

Study 30 – Recreation Facility Inventory and Use & Needs Assessment

Summary: identified where public access points are for projects and riverine reaches including facility assessment, activities there, levels of use, public comments, for baseline understanding of recreation use. We completed one complete year of field work March 2014 – Feb 2015. Of the 49 or so study sites, TransCanada's are a fraction of those.

Q: Reasons for non-use "not interested" or "could non-use" be based on site condition (e.g., portage at BF)?
A: surveys and onsite intercepts (i.e., onsite questionnaires) had both scores and the ability to comment. All comments will be provided in the report.

Q: What is the expected date for the study report?
A: Before the end of the year.

Q: You noted some congestion on the CT River Paddlers' Trail, what would people do if they can't find a camping spot?
A: We had very few intercepts with paddlers at campsites. However, the one occasion where this issue came up was between the projects in the riverine reach from Wilder to Bellows Falls and not at TC campsites.

Q: Did you get enough data from the paddlers to draw conclusions?
A: We did see paddlers and got a lot of interviews when they were coming in and out, portaging etc., just not when they were at campsites.

Study 31 – Whitewater Boating Flow Assessment

Summary . Sumner Falls can support a wide range of flows and boating abilities. Local people knew when flows were higher (through WaterLine) and showed up during the demonstration. Bellows Falls challenge was to document whitewater opportunities without knowing how it would behave. First we did some direct flows for viewing only to assess whether it was even boatable. The flow range was identified. Access is the other issue (shown on slide with mouse). Described boating features – dome rock, waves, etc. (on slides). The fish barrier dam was a safety concern that was mitigated with safety personnel stationed above it and boaters required to exit well before approaching it; no safety issues occurred. Within each flow there was mostly positive responses from the boaters.

Q: One comment – I credit Louis Berger and TC for all the support and hard work. At Sumners Falls there was a lot of non-study activity below the study area, people floating down to Windsor as part of a rafting outfit.
A: Yes, Sumners is a put-in point for commercial outfitters and during the demonstration there were multiple trips by others (not participating in the study), also lots of families with small inflatable kayaks, etc. The Study 30 report mentions that.

Q: To clarify, for the top wave – the characteristics changed dramatically from low to higher flows.
A: Yes there was a range of responses on Class of flows.

Q: At what level did features wash out?
A: At the low levels, there was less power, less force, less standing waves and less interest from boaters. Interest increased as flow increased. A smaller number of boaters boated 10,000 cfs which was quick, short and the ability to catch the wave was limited. Takeout eddies at lower flows disappeared at higher flows.

Q: There were certain things unknown at Bellows Falls (e.g., impact of fish barrier on upstream rapids, the features below the fish barrier), there was a washing out of features at higher flows (7,800 cfs etc.). The type of craft used affected the evaluations, in addition to the skill of the boater.
A: Bellows was advanced, and limited to expert boaters only which included 1 open canoe expert.

Study 32 – Bellows Falls Aesthetic Flow Study

Summary: This study was built to piggyback on study 31 and flows being videotaped/photographed. Visual access into the reach is limited. Videos used whitewater flows, everyone reported them to be aesthetically pleasing. We characterized results as better at higher flows (with caveats based on responses).

Q: Can you explain how the participants gave opinions? Video/photos and not in-person viewing?
A: There was no in-person viewing, however all participants know the area, know that it changes with the seasons, and are familiar with the reach. We viewed 10-second videos for each flow at each KOP which were rated by participants, then close out survey and discussion.

Q: How were participants selected?
A: Through TC staff knowledge, Rockingham Conservation Commission, local businesses, etc. People were nominated with a requirement that they couldn't be TC employees or relatives of employees.

Q: Did you talk about the petroglyphs that are on the historic trail and when Vilas Bridge opens again – that will increase public traffic there.
A: That was not a focus, but participants acknowledged the existence of the petroglyphs and the closed bridge.

Q: Will the videos be available to agencies?
A: Yes, they will be part of the study report. We wanted to use the photos over the videos due to differences in lighting and focus of the different videos. FERC suggested using the videos anyway. The photos (shown on presentation slides) really show better. But there are basically no public access points.

Q: This is an access question. Certain conclusions can be drawn now, but that could be alleviated if there was more access. If there was access would the results be different?
A: We tried to address this in the report but the point is, the study is just about flows in the reach.

Q: [Observation] The best view of the entire area is from Table Rock on Fall Mountain on the NH shore.

Ethan Nedeau – Study 24 – Dwarf Wedgemussel and Co-occurring Mussel Survey

Summary (USR and study reports already filed). Using that study data to develop Habitat Suitability Criteria (HSC) and existing published and unpublished data, and expert input. HSCs have never been successfully done for mussels yet so this is new territory. The process will be the Delphi process, with structured process panel of experts.

Q: Remind us where the quadrats were done. Where is the upstream extent of the impoundment/riverine section?
A: Chase Island is sort of considered the boundary between Wilder riverine and Bellows Falls impoundment.

Q: Where you have historic densities and current densities, how do they compare?
A: Lower now, but the study/field methods were not the same in the 1990s and some parameters weren't measured then but were measured in current studies.

Q: Did you do any surveying up the tributaries known to have DWM?
A: We found them in the lower Black River, lower Ottaquechee. We did go into the project-influenced tributary areas.

Q: In your schedule are you planning to put the HSCs out to agency consultation before running them through the model?
A: Yes, and we need to get going on it. Other studies play in too (tessellated darter, instream flow, etc.) in addition to the modeling.

Q: The DWM HSC curves will be fed into the instream flow model, is it possible then for the benthic habitat study 8 data to be fed into instream flow model too? Some DWM have been found in sand and gravel. The concern is about stability of the substrate.
A: The hydraulic model will do this, and we can make observations on how velocity may be influencing benthic habitat, stability, etc. and we are hoping to incorporate that somehow. That would depend on DWM needs for on coarse-grained substrate but DWM habitats are more on fine grained substrate which is not a part of Study 8. At study 8 sites we didn't see lots of mussels. We can get shear stress and velocities coming out the model, but that is not in any specific study scope (except perhaps the erosion studies).

Sarah Allen – Terrestrial Studies

Study 25 – Dragonfly and Damselfly Survey

Summary: There was a study variance with working group concurrence to limit surveys to June/July based on the literature of timing to emergence/eclosure. We were able to time eclosure and now have a good understanding of that. We conducted detailed habitat assessments (vegetation, benthic, etc.) across each 300-meter transect area. We also collected WSE data and elevations. Species abundance was highest in upper impoundments and lowest in riverine sections, except highest overall in Vernon riverine section. Wilder section was unique in its diversity. We were able to watch 18 individuals emerge, it took generally 30 minutes for them to do so. They emerged during all sorts of water levels, and we found exuvia way up the bank in vegetation. About more than 10% of the animals observed did not survive eclosure (preliminary results and excluding predation).

Q: Was there observation of emergence getting flooded from rising water levels?
A: We went out every other week, and discarded any exuvia once found, since they can stay around for a while. We know that boat wakes affected them as observed, but 30 minutes from emergence to eclosure is short and typically they emerged to about 8 to 16 inches above the water line and they have time to get out of the water. Once the larvae emerge, they can get knocked back into the water and try again. They seem to be able to respond quickly.

Study 26 – Cobblestone Tiger Beetle Survey

Summary: (Information presented from ISR presentation and meeting summary, and USR presentation)

Q: Were there any noted differences between where they were found or not found?
A: Nothing pronounced observationally, but there may be some subtle things, for instance elevation, and we still need to look at that to confirm.

Study 27 – Floodplain, Wetland, Riparian and Littoral Vegetative Habitats Study

Summary: (from the ISR and USR, report filed with USR). Aquatic beds could not be picked up via LiDAR from 2013 since it was flown before leaf out at higher flows, so we relied on orthophotos flown in August in 2010.

Q: How much confidence do you have in the submerged aquatic vegetation mapping?

A: We did a lot of field verification to do just that, looking at underwater vegetation so we are confident.

Study 28 – Fowler's Toad Survey

Summary: (from the ISR and USR), Study sites were locations where acoustic monitors were placed, or location from which we did call surveys, not locations of toads themselves – we can't locate the exact locations of the breeding pools.

Q: What happened to the Hart Island site?
A: That was a mis-filed record that belonged to the Stebbins site so it was a duplicate record to the Stebbins Fowler's data and no Fowler's toad were actually recorded at Hart Island.

Study 29 – Northeastern Bulrush Survey

Summary: (from ISR and USR). No bulrush were found, but we did find changed conditions from the previously described record in 2006 at the one recorded site. In 2014 a large beaver dam was there, but beavers come and go so bulrush could possibly be dormant at that site, waiting for better conditions. Other sites should also have an eye kept on them as they contain suitable habitat.

Q: Where is the recorded site?
A: Rockingham VT.

John Field – Erosion Studies

Study 1 – Historical Riverbank Study

Summary: Mostly Study 1 was a data collection exercise. This included digitized historical maps from 1958 and 1978; geo-rectified aerial photos 1950/1955, 1970's, and 2010 digital orthophotos; and re-taking of ground photos in 2014/2015 of sites that had been photographed earlier – most showing stabilization and re-vegetated since historical photos, but some show continuing erosion. Comparison with 2014/2015 data and additional analysis will be part of Study 3.

Study 2 – Riverbank Transect Study

Summary : 21 monitoring sites, 8 rounds of monitoring from 11/2013 to 09/2015. May still need to do a post-flood monitoring per the study plan flow thresholds. Transects and ground photos. Top of bank recession has occurred at 2 sites through winter and spring flows more than in summer, and still movement on lower banks.

Study 3 – Riverbank Erosion Study

Summary: Areas that we are calling erosion, are not necessarily what others called erosion at different times in the past (e.g., with vegetation that may have covered erosion). We need to be careful with making those comparisons across time. Different categories of erosion were created for this study. All of the study information gets tied into analysis of erosion, and potential impacts on erosion from various river aspects [see slide 209]. There is a lot of rip rap armoring from the railroad. Valley constrictions act

like dams during flood flows with upstream meanders and/or meander cutoffs and islands with erosion associated with them. These are types of potential causes and we are designing a way of analyzing how much erosion is associated with them.

Q: On the Weathersfield/Claremont slide [slide 215] land to the north is an agricultural field and there is no buffer there. You haven't mentioned land use relative to erosion.
A: Another GIS shapefile we have created includes where riparian buffers are located.

Q: One of the forces of erosion is human activity on the river, e.g. boat use and boat wakes set off wave action on soft soils that are unprotected, and this is a concern for many in the valley.
A: Yes, this is important, but it is very difficult to analyze. But the operative force that may be moving material at the bank base may not be able to be analyzed.

No general questions from the day. Friday 10/02 meeting location and agenda presented.
Meeting adjourned ~ 5 pm.

Attendee list (in person and those identified on the phone) October 1, 2015.

Name	Affiliation	Name	Affiliation
Bob Nasdor	American Whitewater	Patrick Crile	
Ethan Nedeau	Biodrawversity	Amy Chang	
David Deen	CRWC	Garret Graskamp	
Chris Yurek	CRWC	Steve Leach	Normandeau
John Field	Field Geology	Doug Royer	Normandeau
Steve Kartalia	FERC	Charles Soucy	Normandeau
John Baummer	FERC	Drew Trested	Normandeau
Bill Connolly	FERC	Rick Simmons	Normandeau
Adam Becco	FERC	Maryalice Fischer	Normandeau
Nick Ettema	FERC	Jen Bryant	Normandeau
John Howard	FirstLight	Sarah Allen	Normandeau
John Warner	FWS	Tim Brush	Normandeau
Melissa Grader	FWS	Mark Allen	Normandeau
Julianne Rosset	FWS	Robin MacEwan	Stantec
Lissa Robinson	GEI	Mike Chelminski	Stantec
Mark Wamser	Gomez & Sullivan	John Ragonese	TC
Stu Bridgeman	Hatch	Jen Griffin	TC
John Bruno	Landowner	Rocco Ruggeri	TC
John Mudge	Landowner	Matthew Cole	TC
Mark Goodwin	City of Lebanon	Edwin Nason	TC
Bernward Hay	LBG	Don Devanney	TC
Jot Splenda	LBG	Pat Mock	TC
Matthew Burak	LBG	Katie Kennedy	TNC
Doug Hjorth	LBG	Jeff Crocker	VANR
Owen David	NHDES	Rod Wentworth	VANR/F&W
Gabe Gries	NHFG	Eric Davis	VTDEC
Kevin Mendick	NPS	Marie Caduto	VTDEC

October 2, 2015 at TransCanada's River Operations Center (ROC) at Wilder Dam in Wilder, Vermont.

- 9 am – Introductions
- 9:15 - Summary of progress on the following ILP Studies:

Study No.	Study Title
33	Cultural and Historic Resources Study
10	Fish Assemblage Study
11	American Eel Survey
12	Tessellated Darter Survey
17	Upstream Passage of Riverine Fish Species Assessment
Break ~ 10:30 – 10:45	
18	American Eel Upstream Passage Assessment
19	American Eel Downstream Passage Assessment
22	Downstream Migration of Juvenile American Shad – Vernon
20	American Eel Downstream Migration Timing Assessment
23	Fish Impingement, Entrainment and Survival Study
Lunch brought in	
Questions, Meeting summary to be filed, comments on USR due	

Suzanne Cherau – Study 33 – Cultural and Historic Resources

Summary: There were 11 identified erosion areas with archaeological significance. We received NHSHPO concurrence but didn't hear back from VTSHPO so assumed concurrence. Most of these areas are on private land, a few on TC property. 60% have given permission to access the sites. We are now preparing Phase II proposals and hoping to start work this fall. Most sites are on the VT side of the river. Architectural surveys have been completed and reports have been submitted.

Q: You mentioned that VTSHPO had not replied within the time period, did they reply at all?
A: VTSHPO has not replied to either archaeological or architectural reports [slides 4 and 6 corrected to clarify that VTSHPO did not comment on the reports]. Typically we don't hear from them unless there is an issue but they were involved in the study plan design and had approved the Phase 1B methodology. And we expanded scope as a result of input from the VT archaeologist.

Q: Investigations of Phase 1B have been completed at Wilder and Bellows Falls, what about Vernon?

A: We did Phase 1B at Vernon. The areas we surveyed were completed in the last couple of weeks, where we had landowner permission.

Q: What about the TCP (traditional cultural properties) section of the survey?
A: We are preparing a draft report. We have made at least 3 or 4 attempts to engage the Narragansett Tribe and The Nolumbeka Project. We had also originally contacted the Abenaki tribe bands early in the relicensing process, at the PAD/NOI stage. Our consultant has not received any responses but has continued to conduct archival research and develop a technical report.

Q: Who was on that contact list? The Abenaki? They would appreciate being re-contacted. And VT and NH commissions on Native American Affairs should be added as central clearing houses.
A: We'd be happy to add them and contact them.

Q: With regard to tribal and commission contacts, has PAL contacted them and/or received replies?
A: That's generally not how that part is done. PAL follows National Park Service practices. Have they gone out to ask where they should dig or not, no. PAL has not had contact with Abenaki, but if the TCP consultant had, he would have passed that along to PAL to make sure that they could participate. That isn't unusual in NH and VT and PAL has had no involvement, unless those groups are concerned. We are always open to information from them.

Q: About communications, Dick Boisvert state archaeologist in NH approved the digging on the Mudge property.
A: Yes, he is familiar with TC's work, but how the state interacts with the Abenaki we don't know. If we had people we knew wanted to talk to us, we are completely open to that. [PAL] if the states had any information they would probably pass it along to us as well. So, the communications are usually pretty good.

Drew Trested – Fish Community Studies

Study 10 – Fish Assemblage Study

Summary: Field work was completed last week (Sept) for the summer portion of the study. Results from the spring effort are presented and include spottail shiner as the most dominant species and the largest overall number of individuals collected in the Wilder riverine reach.

Q: American eel is not on the list.
A: We didn't catch any in the spring (on slide table), but we did catch some later in summer and fall sampling rounds.

Q: When you are reporting the species, please order it taxonomically (not alphabetically) and please provide a spreadsheet of the final data.
A: Will do.

Q: The one bridal shiner? It may be a mis-identification for the CT River.
A: We will follow up to verify species, and are pretty sure we retained it. If needed, that will be clarified/corrected in the study report.

Study 11 – American Eel Survey

Summary: Field work completed last week (Sept). After 252 samples, we collected 3 eels total, all in Bellows Falls impoundment. We had also caught some in Study 10 summer/fall sampling including 1 in the Bellows Falls bypassed reach.

Q: Where specifically in Bellows impoundment?
A: The one shown on slide 15 was near Charlestown.

Q: That eel in the picture was caught how?
A: By boat electrofish sampling in the evening (2 hrs prior to sunset as defined in the study plan/SSR).

Study 12 – Tessellated Darter Survey

Summary: Field work completed last week (Sept). We conducted darter counts and detailed habitat surveys within each count circle and also looked for mussels presence/absence including dwarf wedgemussel. We counted several hundred darters. Small study plan variance – shifted one habitat unit upstream since one was right at the Bellows Falls boater boom.

Q: In the study plan you said you would use beach seine or backpack electrofish in shallow areas.
A: We can check that it may be a study variance, and will note that in the report, but our intent was to have options open, not specify use of all methods [as the RSP indicates on page 140]. We decided to use diving/snorkeling for consistency. After talking to Ethan Nedeau (study 24-DWM) we decided the visual surveys would be best in all sites.

Q: RE: studies 10 and 11 – what is the number of eels captured?
A: A small number, less than 10 probably less than 5 individuals.

Q: Did you find mussels?
A: Yes, and we found 1 dwarf wedgemussel.

Q: Was the plan to take habitat measurements in each count area?
A: Yes, we collected data on water depth, substrate, veg and woody debris % coverage, GPS, etc.

Q: Did you note any slimy sculpin in these studies? Did you note all other species?
A: We will check, and include that in the study report, but divers were keyed in to darters.

Rick Simmons – Study 17 – Upstream Passage of Riverine Species

Summary: We have reviewed video up to September 17th and will continue until ice-in. Counts table from [slide 23]. Mostly walleye and white sucker in spring, sunfish and bass during the summer. Negative numbers indicate net downstream movement of fish. There were high flows in June. Slides 26 – 28 show total "traffic" for each species over the year, whether passing up or downstream. American

eel upstream passage was higher at Vernon, we don't know enough about the fish to know whether they move into tributaries, or what.

Q: In the report will you report the true numbers both up and down separately?
A: Yes, we will have all of that data too. And we will reorder species counts by taxonomy [as requested].

Q: Do you have data on downtime of the video?
A: We haven't had a lot of downtime, less than 1 ½ days at all projects. There might be a few hours lost and then the equipment gets reset on each visit. There have been no equipment malfunctions. We did shut down the ladder at Wilder for ½ day in mid- Sept or so for maintenance. Normally we don't run the ladders year round, but Brett Towler (FWS) looked at Wilder and thought there may have been clogging and perhaps attraction water issues, so we shut it down and cleaned the window at the same time. We did find some debris and also a small American eel [slide25]. We will look at the original design plans for the Wilder ladder. Shutting the ladder down requires confined space permitting and special gear and it takes about 4 people, all day.

Q: Did you do any calibration?
A: Every week we filmed at least 1 hr of quality control video which has not been review yet but will be compared to the same hour on the regular video.

Q: Was the May 5th start date at Vernon due to ice at that time?
A: We needed to get Brett out there to inspect the ladder first, and had to make sure everything was operable, included the lift needed for shad and had to correct mechanical issue. May 5th was as soon as possible this year after ice out.

Q: Did you see walleye right away in the spring?
A: Yes. We knew walleye and suckers would pass early.

Q: Would it be feasible to open Vernon ladder earlier in the season?
A: Perhaps, but we can't prescribe that. We can only do that pending initial ladder inspection, etc.

Q: What are the reasons for higher numbers at Vernon for bass, sucker? Based on the fishery, there wouldn't be a difference in numbers of smallmouth bass below the different dams.
A: That was just what we observed. Vernon ladder is designed differently from other ladders, and is very good at passing shad. But, we don't know the answer to that and this study was not designed to figure that out, just to quantify numbers passing.

Q: Do you intend to evaluate the Wilder attraction water issue and include that in the report?
A: In the report, we will comment on whether the ladders operated as they should but will not be able to quantify that.

Q: When do ladders normally open now?
A: The schedule is driven by shad or salmon migration. At Wilder, not open at all now; at Vernon April 15 is the target, but it is coordinated with projects downstream and provided to us by FWS. Typically May 1 to md-July.

Rick Simmons - Study 18 – American Eel Upstream Passage

Summary: Field work started in May [slide 31 corrected to state May rather than April] with both baited eel pots and surveys. Since we were running the fish ladders for study 17, we have seen eels in ladders, but not so much at other locations and no eels at Wilder. We are also seeing some yellow eels at Vernon, but not what we expected to see based on fish ladder counts.

Q: Based on dates of finding eels, were the conditions favorable?
A: We were not allowed up in those locations during spill. At Vernon, we found eels most frequently at site 8 and at deep gates, every week. The deep gates are submerged completely – all of the gates have small leakages but you won't see a flow of any significance so we doubt they are sensing attraction of water or water flowing over a surface. They seem to be hanging out in front of the gates, they may be hiding there during the day in dark locations. We don't know if they are yellow resident eels or migrating. We've only seen a couple actively attempting to climb up. Will report in study report the project operations and available environmental data on the dates when eels were found via night surveys.

Q: How do you characterize the size of eels in fishways and found during night surveys?
A: Most were 12 inches or above in the ladders. In the deep gates they were about the same size. At Vernon sites 3 and 4, one eel was 8-10 inches. We're not seeing the real small ones.

Q: Alex Haro notes that he monitors catches downstream. Eels are significantly larger at Turners and the largest ones are too large to climb so they might go up fishways instead. If the smallest eel has been < 250 mm fishway counts may be underestimated because eels can move behind the gratings or below the counting windows.
A: We did try to block off some of those areas in the ladders. And in study 17 the QC video should pick up some of those that might not have been picked up by the video motion detecting (detecting thresholds are set very sensitively too). We switched from red light to infrared light (minor study variance) since the red light was lighting up the window too much. Also agree that we see that phenomenon at other projects.

Q: For reporting, in table (e.g., slide 32) cells with no data please add zeros # of fish and/or couldn't get to site, etc.
A: We will do this in the study report, along with adding project operations and environmental data that we have available.

Q: Did you miss any times since the spills in June?
A: No, we were able to get into these sites every week since then.

Q: Ladders won't run next year after shad season since study 17 will be done this year, and there is no guarantee that a license condition would require the fish ladder to run. We don't know what eels would do if ladders weren't running and whether (or if) to prescribe eel fishways through ladders or an alternative location. There is no data on where eels might want to go without the ladder running. We are likely to ask TC to assess an alternate condition than ladder operations.

A: What we have learned here is there are 1500+ eels interested in moving above Vernon, whether or not we solve how we do it, rather than whether we should do it. We understand the need and want to find a way to piece through a solution.

Q: Observation by Alex - at Turners they put some traps in the ladders to obtain data on numbers, size classes, etc. Doing temporary, interim solutions now can provide data that leads to longer term solutions. These fish are larger and are trying to get upstream but there are still questions about size distribution, absolute numbers, etc. This pattern is similar to other projects. There could be many more eels getting by through the ladder, so to install a trap in the ladder might help answer those questions.
A: It is also important to determine which generating units are running, etc. It seems that if we are not seeing eels elsewhere, it may be better to concentrate efforts on where we are seeing them.

Doug Royer – Study 19 – American Eel Downstream Passage

Summary: Pathology testing of eels for import from Newfoundland is in progress now. We expect eels to come in Oct 21 and 23rd or the 22nd and 24th (a Saturday) via a FWS inspector at Logan airport. Telemetry will start as soon as eels are on site and stabilized for 24 – 48 hrs, and survival studies will begin about the same time and will be completed by early November. The study has to be completed by Nov 15th at Bellows Falls due to the planned Bellows Falls station generating unit overhaul which will change the conditions at that station. We will still be recording radio tagged eels, etc.

Q: If eels come in on Oct 24th, how is the release schedule affected?
A: We will use a release protocol that will get them into the river without having to worry about radio signal collisions. We still want to do multiple releases and will do that to the best of our ability, without going past Nov 15th.

Q: Observation by Alex - USGS has started to sample eels at Holyoke, as of yesterday sampled and were able to get 60 eels in 3 hours, so eels are moving now and water temperature is still high (19 degrees) and recent rains. Even though the start of the study is delayed he doesn't foresee any really significant environmental change that would affect the results.

Doug Royer – Study 22 – Downstream Passage of Juvenile Shad

Summary: Fish are being raised by FWS to be delivered October 5th at size (120 mm) for turbine tagging. Turbine tests will start that week too. Radio tagging, to date we have done 2 releases, 40 fish total. Hydroacoustics – we have lost some data, earlier on. We have worked with the vendor, have switched out much of the equipment, etc. The equipment has been running pretty well now, but we lost about a day in September also. We typically don't see these problems with this equipment, it is very reliable overall.

Q: The study plan called for radio tagged fish, 320 fish, 40 fish/week. Are you going to compress that? How about 3 releases/week of 20 fish each?
A: Yes, we'd like to increase the numbers, frequency and are agreeable to that. We've had recent higher water (Wilder 25,000 cfs, Bellows was spilling, and Vernon is still spilling) but flows are coming down now. It doesn't look like the hurricane will be coming either.

Q: We want to have some fish later on too, but want to have a range of conditions including spill.
A: Today we are spilling about 10,000 at Vernon plus units running at 14,000. The fish will probably go right through the gates. Do we really want to test whether fish are going through the gates? Are you concerned about gate passage at Vernon?

Q: It could validate the desktop entrainment, and the ratio of spill to generation is not too large.
A: We have been holding off releases during spill and expectation of another storm. We can put them in this week with flows receding.

Agencies will caucus and get back to us [later they did and all agreed to release shad over the weekend of October 3 and then check in again afterward].

Q: You selected units 4 and 8, the 3rd unit type (units 9 and 10) were already tested?
A: Yes, the study plan only calls for the 2 unit types not previously tested. Turbine survival tests will start next week (Oct 5th) with fish delivery then stabilization and testing over 4 days. We could still do turbine testing up to about 20,000 cfs safely. We were concerned we would not be able to retrieve test fish in the tailrace in too high water though.

Q: So the cast net data are from the same time as when the fish were picked up from the echogram?
A: Yes, within the hour. We captured 3 shad and 1 walleye and the crew made visual observations from the surface that also confirmed the presence of juvenile shad.

Q: Are you seeing time of day differences?
A: We haven't looked at enough data yet, but we have seen them mostly between noon and sunset from the echograms. We are still compiling the data and will continue to do so during the course of the study.

Doug Royer – Study 20 – American Eel Downstream Migration Timing

Summary provided

Q: If the FirstLight study is a 2-year study, do you intend to use just the first year's study results?
A: We're not going to wait to release our study report, but we could revisit and add any additional information that comes out of FirstLight in the second year. Our study is not contingent on their study but we won't ignore that data either.

Q: If you happen to see eels using the fish ladder moving downstream, would you incorporate that information too if you can verify that they are silver eels, to better inform the timing?
A: We could look at that but there is no real way to measure them and determine if they are silvered from within the fish ladder.

Q: Is there any intention to look at hydroacoustic information for eel size?
A: If we see an eel and can make a determination that it is an eel we would include that but the hydroacoustic design in study 22 did not include eel, only juvenile shad.

Q: If you see pulses of fish in the ladders that could be correlated with downstream movement of eels then that information could be included in the analysis and report.
A: Yes that makes sense and we will attempt to do that.

Drew Trested – Study 23 – Fish Impingement, Entrainment, and Survival

Summary provided
Q: None.

Meeting adjourned ~ 12 pm. Attendee list (in person and those identified on the phone).

Name	Affiliation	Name	Affiliation
David Deen	CRWC	Doug Royer	Normandeau
Chris Yurek	CRWC	Charles Soucy	Normandeau
Ken Sprankle	FWS	Drew Trested	Normandeau
John Warner	FWS	Rick Simmons	Normandeau
Melissa Grader	FWS	Maryalice Fischer	Normandeau
Mark Wamser	Gomez & Sullivan	Jen Bryant	Normandeau
John Mudge	Landowner	Doug Royer	Normandeau
Doug Hjorth	LBG	Tim Brush	Normandeau
Gabe Gries	NHFG	Chris Gurshin	Normandeau
Katie Kennedy	TNC	Tyler Parent	Normandeau
Sarah Verville	TRC	Steve Olausen	PAL
Jeff Crocker	VANR	Suzanne Cherau	PAL
Rod Wentworth	VANR/F&W	John Ragonese	TC
Eric Davis	VTDEC	Jen Griffin	TC
Marie Caduto	VTDEC	Craig Martin	TC
Alex Haro	USGS	Shawn Kensiton	TC
Rich Holschuk	Vermont citizen	Wayne Gelinas	TC
		Pat Mock	TC

After the meeting, John Ragonese presented a brief summary of methods and approaches we intend to use to evaluate project effects using the hydraulic and operations models.

The Hydraulic model will produce rating curves for variables such as water surface elevation, flow, velocity, shear stress, etc. at each individual resource location. With these curves, resource study leads can do an initial screening to determine whether or not each of their individual resources/locations are affected by project operations relative to any of the multiple variables . This would cull out individual resources/locations that are clearly not affected by the projects, allowing for a smaller, more manageable subset of resources/locations that are potentially affected by the projects to be closely evaluated using the Operations Model to look at timing, frequency, periodicity, seasonality, probability, extremes, etc. All of the pre-screening data would be provided to working group participants for their review and concurrence before a resource/location was removed from further analysis.

Wilder, Bellows Falls, and Vernon Project Relicensing

Updated Study Results Meeting – October 1, 2015

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Agenda - October 1, 2015

Study No.	Study Title	Presenter
4	Hydraulic Modeling Study	Lissa Robinson
5	Operations Modeling Study	Stu Bridgeman
6	Water Quality Study	Matt Burak
13	Tributary and Backwater Fish Access and Habitats Study (Study report filed 09/14/2015)	Drew Trested
14	Resident Fish Spawning in Impoundments Study	Mark Allen
15	Resident Fish Spawning in Riverine Sections Study	Mark Allen
Break ~ 11:00 – 11:15		
16	Sea Lamprey Spawning Assessment	Steve Leach
21	American Shad Telemetry Study	Doug Royer
7	Aquatic Habitat Mapping Study (Study report filed 03/02/2015)	Maryalice Fischer
8	Channel Morphology and Benthic Habitat Study (Study report filed 03/02/2015)	Mike Chelminski
9	Instream Flow Study	Steve Eggers
Lunch ~ 12:15 – 12:45 pm brought in		
30	Recreation Facility Inventory and Use & Needs Assessment	Jot Splenda
31	Whitewater Boating Flow Assessment - Bellows Falls and Sumner Falls	Jot Splenda
32	Bellows Falls Aesthetic Flow Study	Jot Splenda
24	Dwarf Wedgemussel and Co-occurring Mussel Study (reports filed 09/15/2014; 03/02/2015)	Ethan Nedeau
25	Dragonfly and Damselfly Inventory and Assessment	Sarah Allen
Break ~ 2:15 – 2:30		
26	Cobblestone and Puritan Tiger Beetle Survey	Sarah Allen
27	Floodplain, Wetland, Riparian, and Littoral Vegetation Habitats Study (Study report filed 09/14/2015)	Sarah Allen
28	Fowler's Toad Survey	Sarah Allen
29	Northeastern Bulrush Survey	Sarah Allen
1	Historical Riverbank Position and Erosion Study	John Field
2	Riverbank Transect Study	John Field
3	Riverbank Erosion Study	John Field
Questions; Location and Agenda for 10/02 Meeting		

Agenda – October 2, 2015

Study No.	Study Title	Presenter
33	Cultural and Historic Resources Study	Steve Olausen
10	Fish Assemblage Study	Drew Trested
11	American Eel Survey	Drew Trested
12	Tessellated Darter Survey	Drew Trested
17	Upstream Passage of Riverine Fish Species Assessment	Rick Simmons
Break ~ 10:45 – 11:00		
18	American Eel Upstream Passage Assessment	Rick Simmons
19	American Eel Downstream Passage Assessment	Doug Royer
22	Downstream Migration of Juvenile American Shad – Vernon	Doug Royer, Steve Leach, Chris Gurshin
20	American Eel Downstream Migration Timing Assessment	Doug Royer
23	Fish Impingement, Entrainment and Survival Study	Drew Trested
Lunch ~ 12:15 – 12:45 pm brought in		
Questions; Meeting summary and comments schedule		

Study 4
Hydraulic Modeling

Objective:

Develop a hydraulic model of the Lower Connecticut River to assist in the evaluation of the effects of project operations on aquatic, terrestrial, and geologic resources.

Study 4 – Hydraulic Model Steps

Set up hydraulic model

- Model inputs
- Calibration and validation

Provide model output

- Velocity comparison
- Lag time (for operations model routing)
- Rating curves (WSEL, flow, velocity, shear stress)
- Sub-hourly model runs

Prepare study report

Study 4 – Hydraulic Model Steps

Set up hydraulic model

✓ Model inputs

✓ Calibration and validation

Provide model output

✓ Velocity comparison

80% Lag time (for operations model routing)

50% Rating curves (WSEL, flow, velocity, shear stress)

in progress Sub-hourly model runs

Prepare study report *in progress*

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Study 4 – Hydraulic Model Steps

Set up hydraulic model

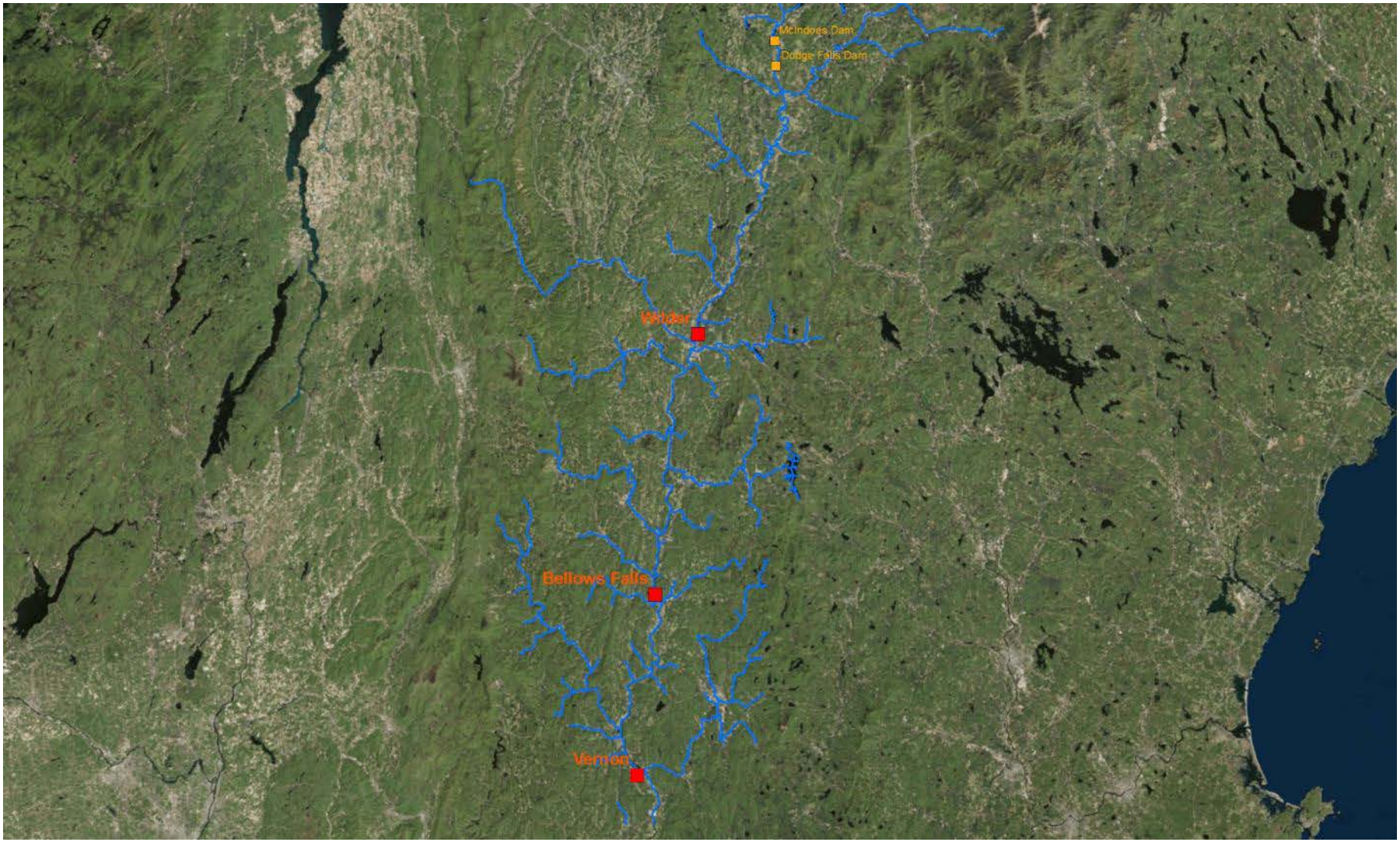
- Model inputs
- Calibration and validation

Provide model output

- Velocity comparison
- Lag time (for operations model routing)
- Rating curves (WSEL, flow, velocity, shear stress)
- Sub-hourly model runs

Prepare final report

Study 4 – Hydraulic Model Setup



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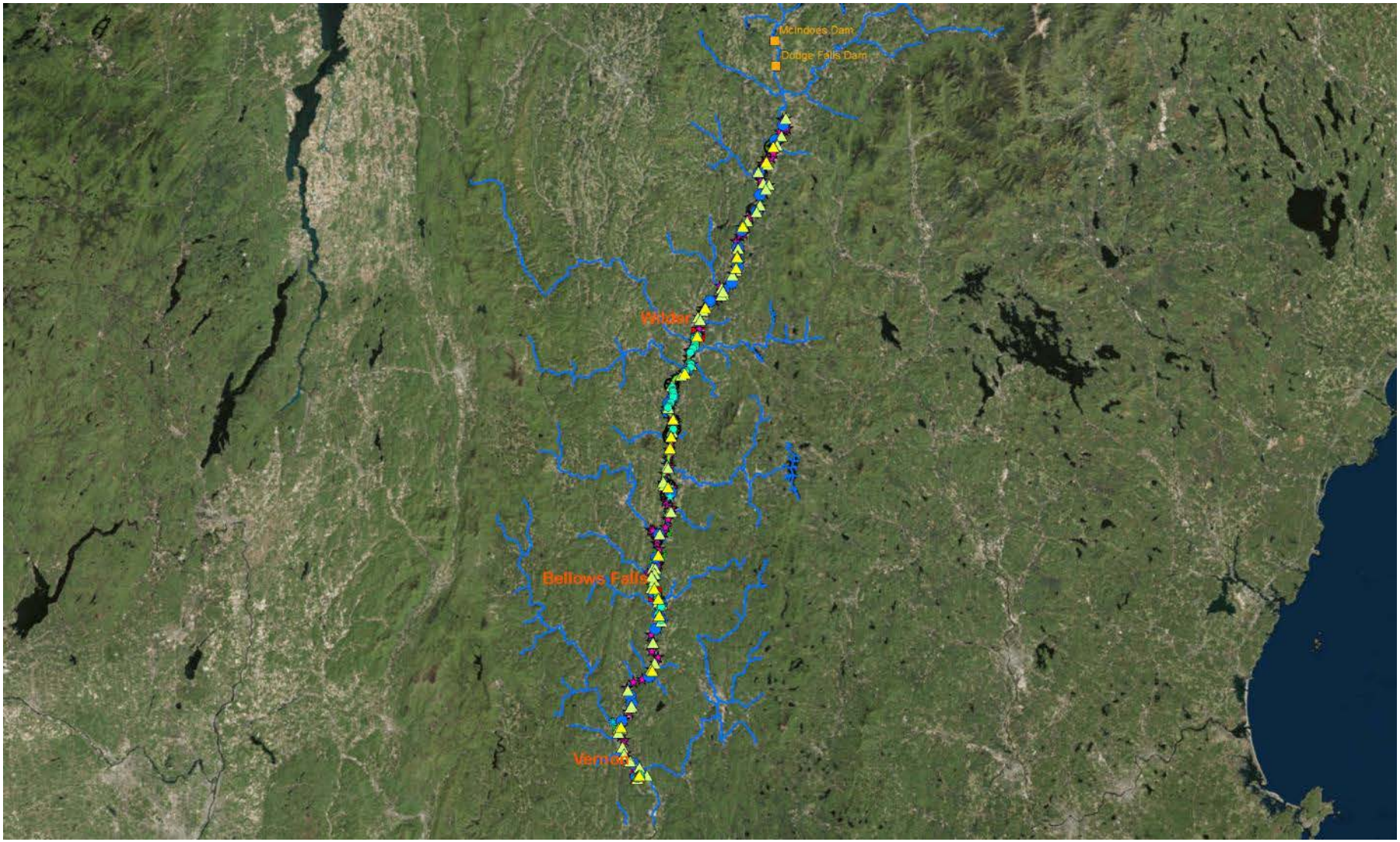
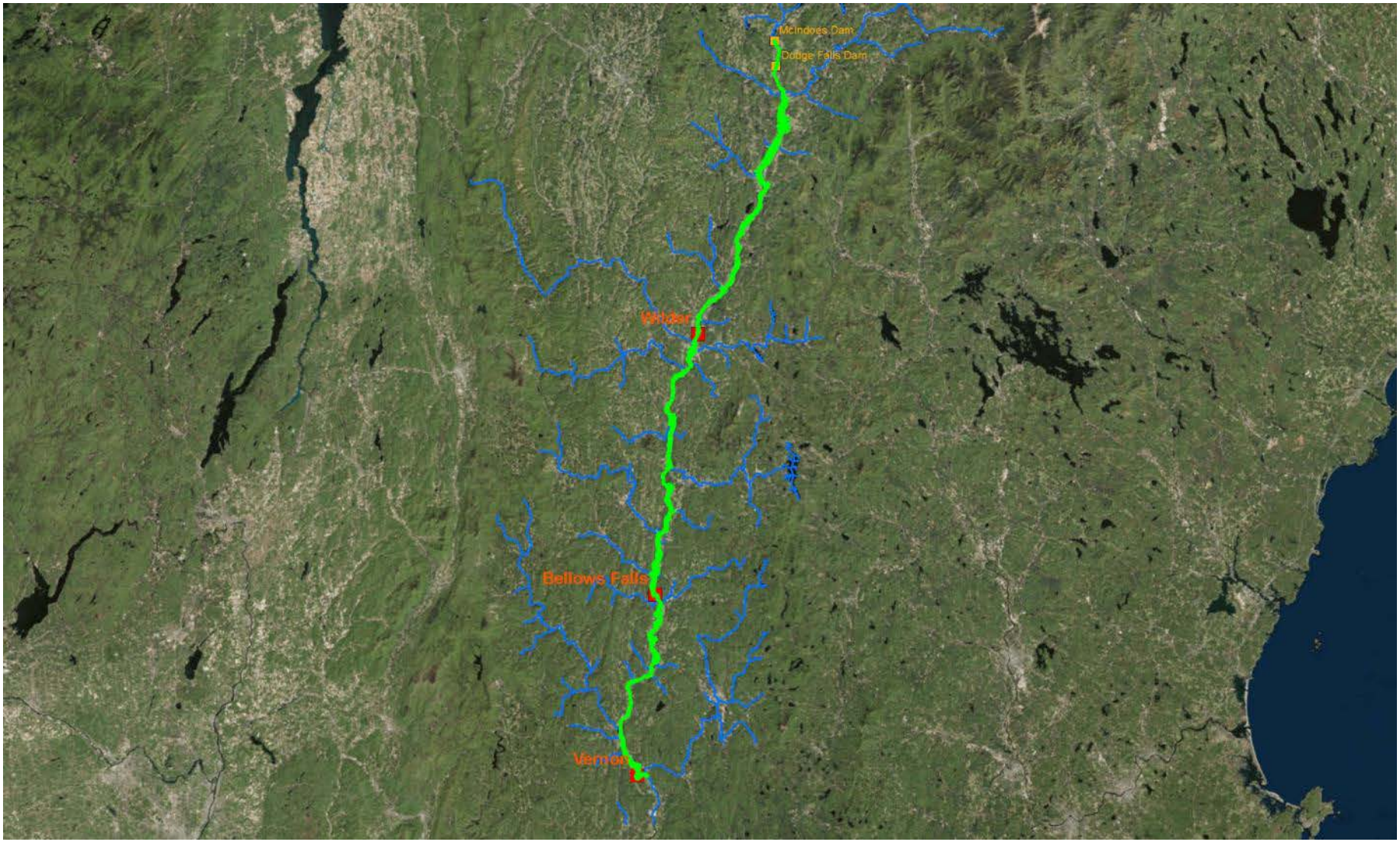
Study 4 – Hydraulic Model Setup



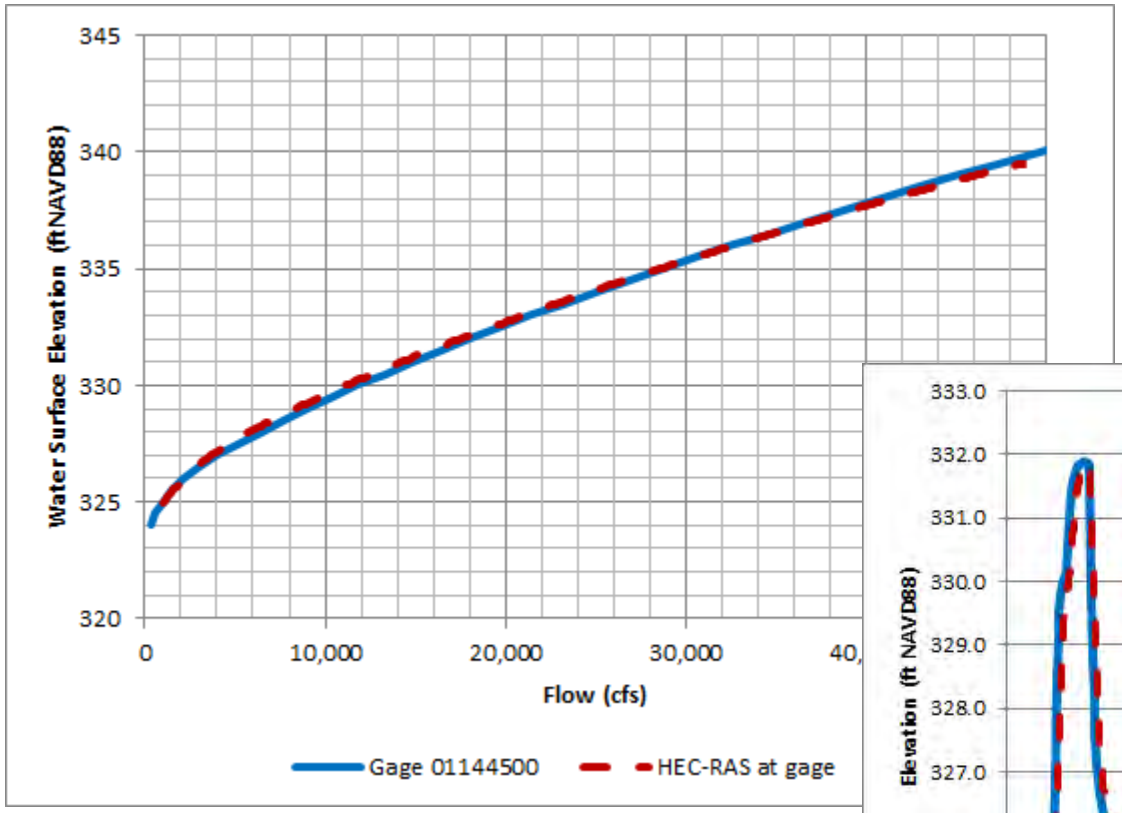
TransCanada

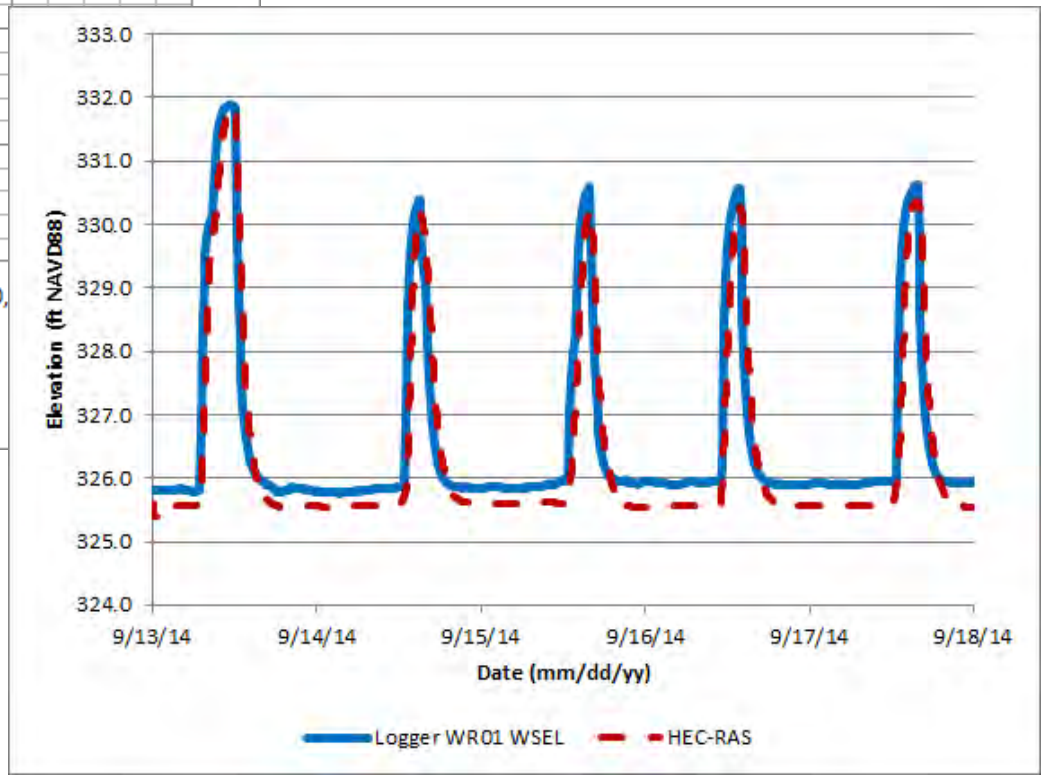
Study 4 – Hydraulic Model Setup



TransCanada

Study 4 – Hydraulic Model Calibration





TransCanada

Study 4 – Hydraulic Model Steps

Set up hydraulic model

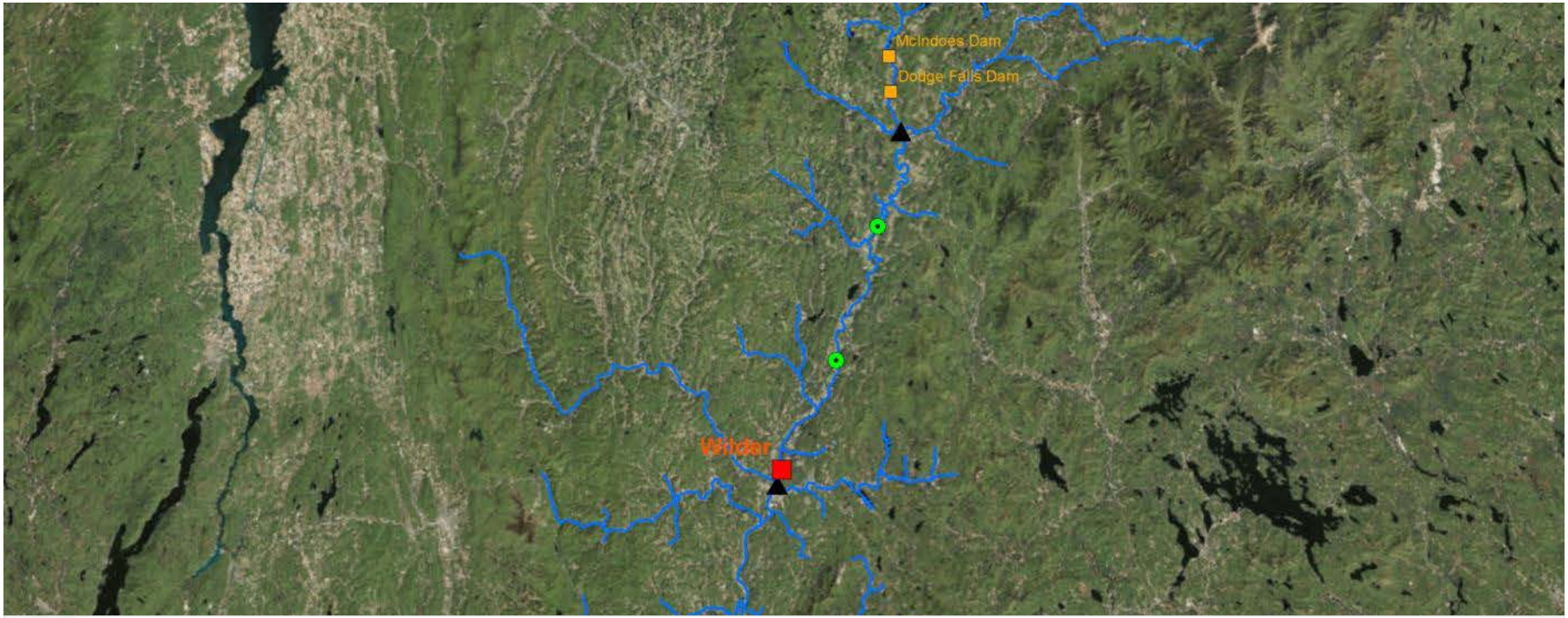
- Model inputs
- Calibration and validation

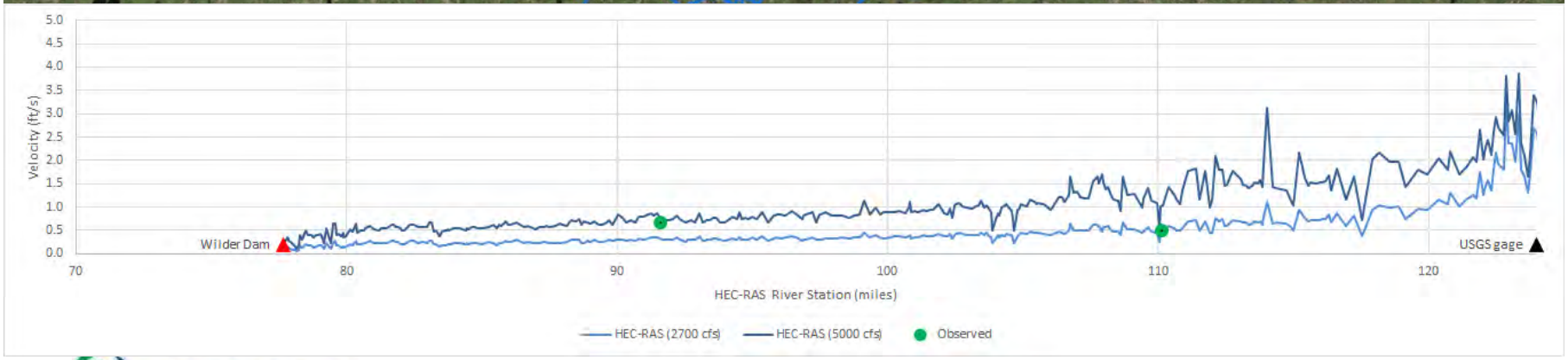
Provide model output

- Velocity comparison
- Lag time (for operations model routing)
- Rating curves (WSEL, flow, velocity, shear stress)
- Sub-hourly model runs

Prepare final report

Study 4 – Hydraulic Model Velocity Comparison





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Study 4 – Hydraulic Model Steps

Set up hydraulic model

- Model inputs
- Calibration and validation

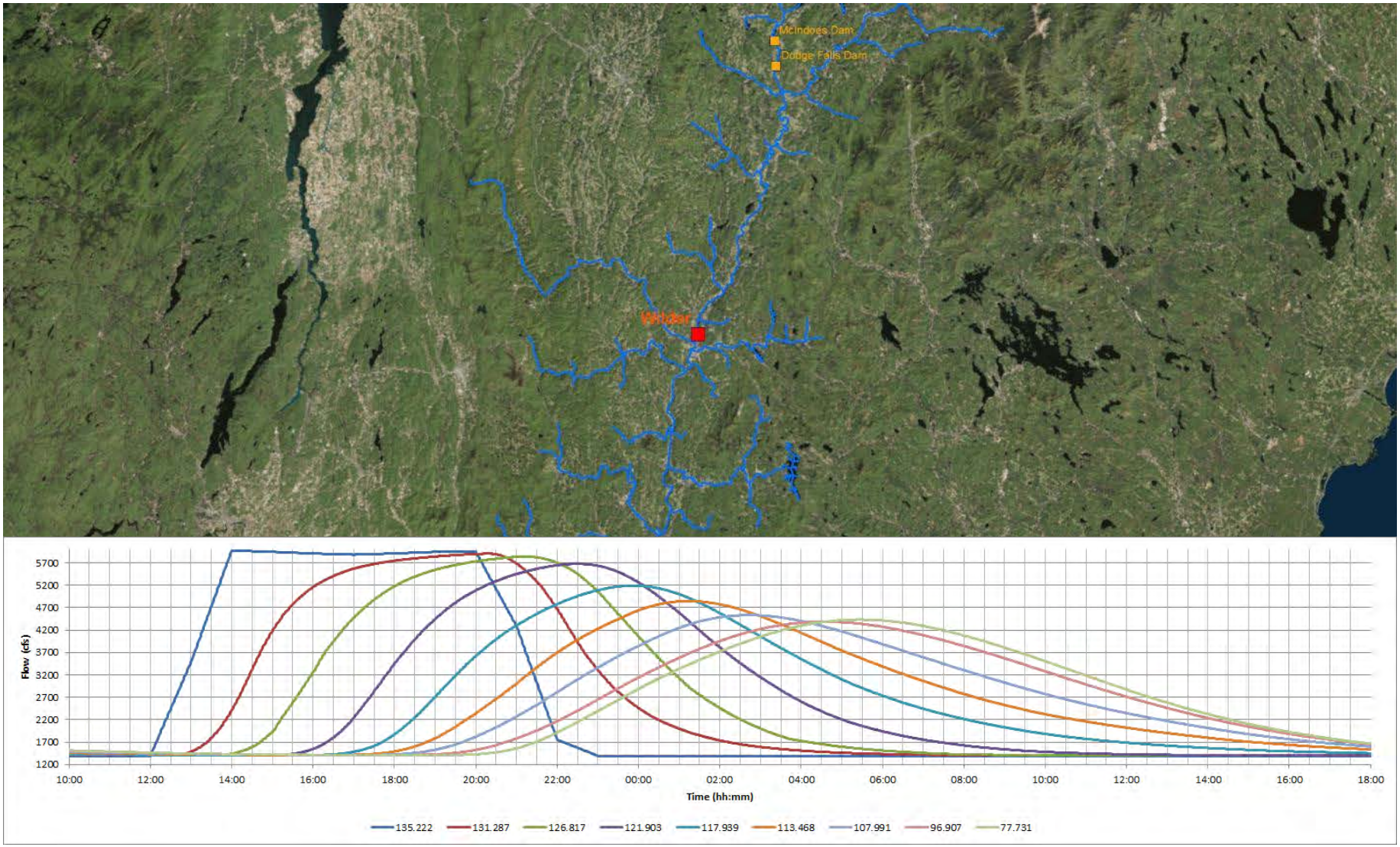
Provide model output

- Velocity comparison
- Lag time (for operations model routing)
- Rating curves (WSEL, flow, velocity, shear stress)
- Sub-hourly model runs

Prepare final report

TransCanada

Study 4 – Hydraulic Model Lag Time



TransCanada

Study 4 – Hydraulic Model Steps

Set up hydraulic model

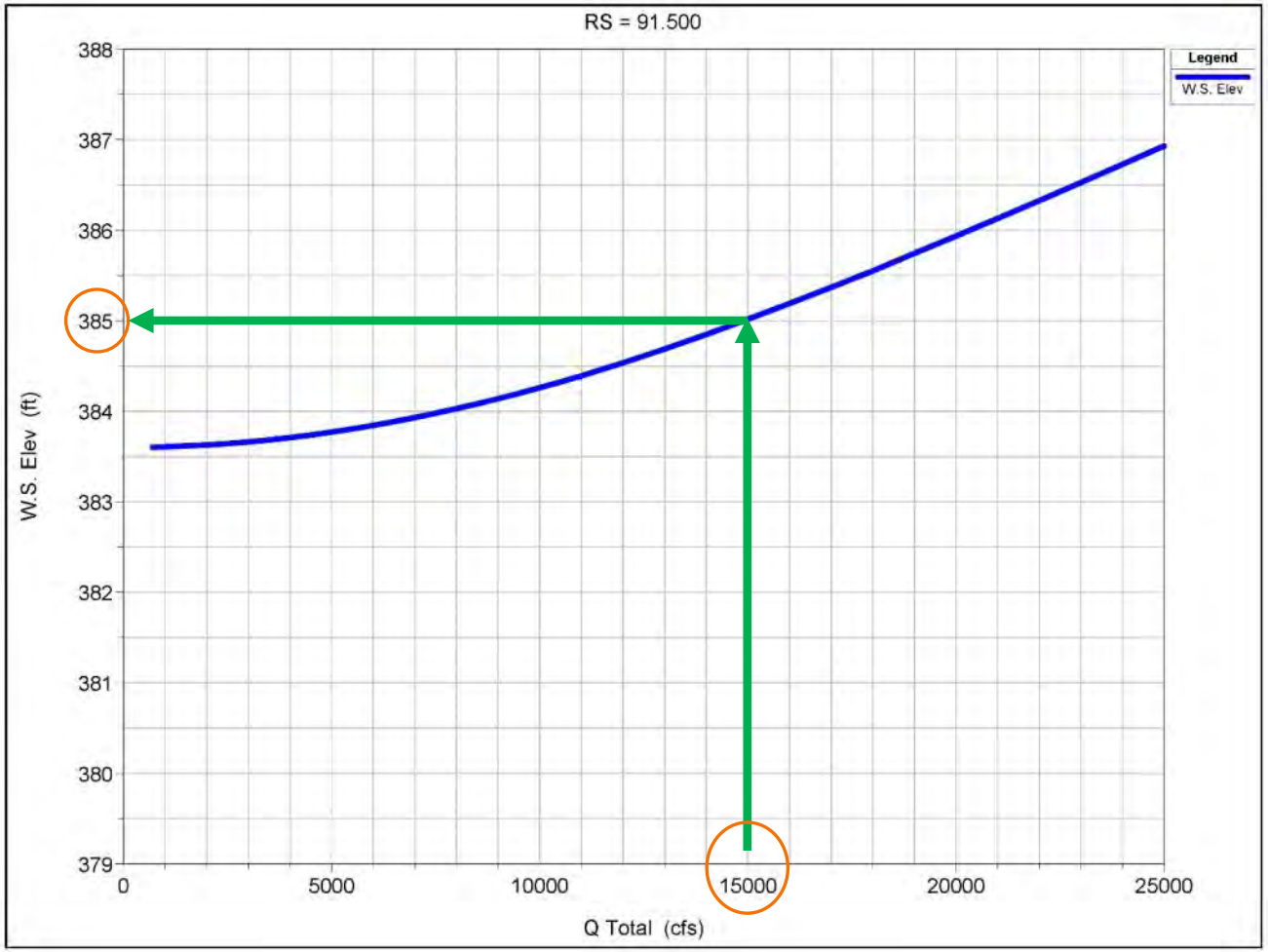
- Model inputs
- Calibration and validation

Provide model output

- Velocity comparison
- Lag time (for operations model routing)
- Rating curves (WSEL, flow, velocity, shear stress)
- Sub-hourly model runs

Prepare final report

Study 4 - Hydraulic Model – WSEL vs Flow



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Study 4 - Hydraulic Model – WSEL vs Flow

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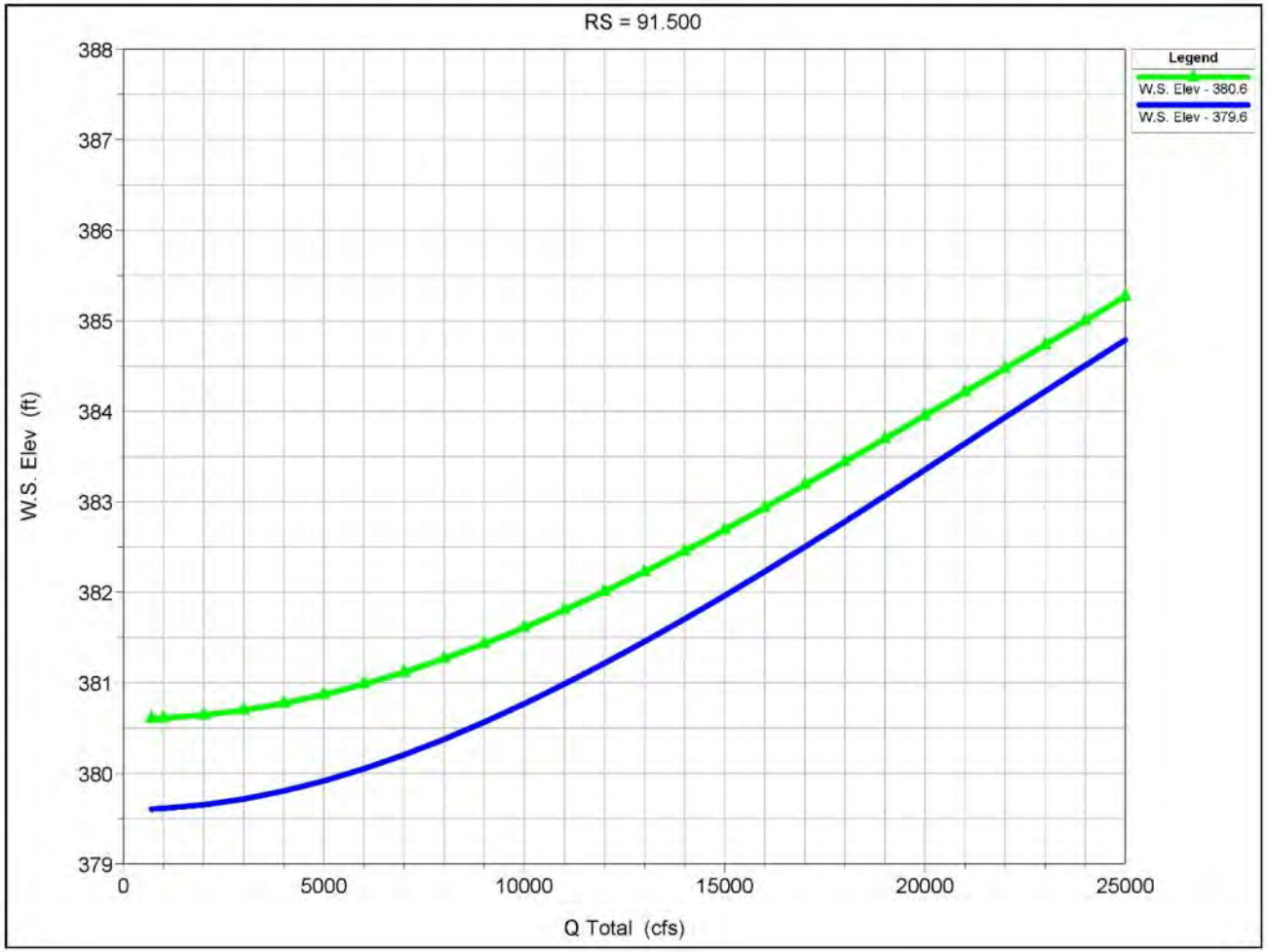
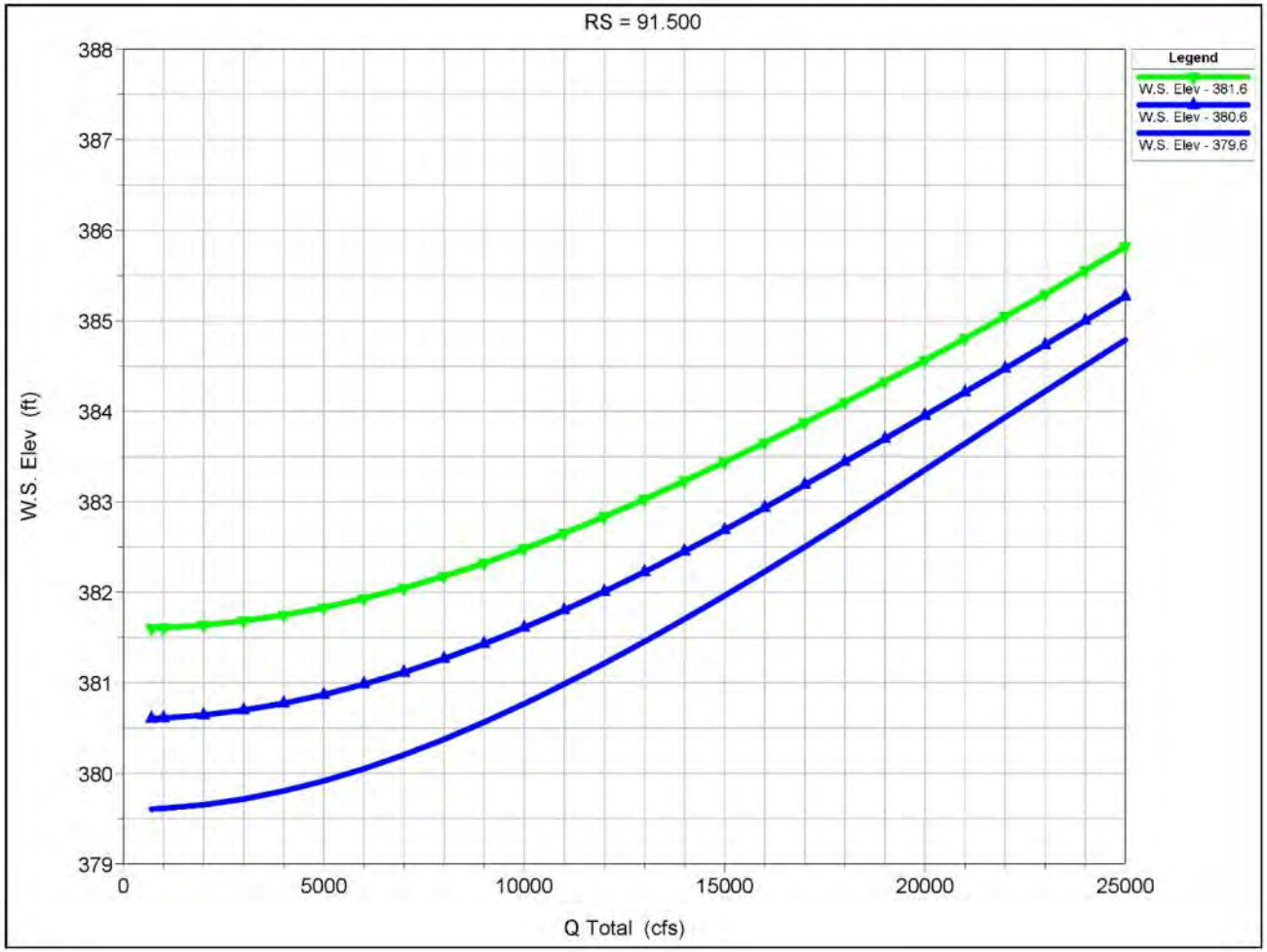
Study 4 - Hydraulic Model – WSEL vs Flow



TransCanada

Study 4 - Hydraulic Model – WSEL vs Flow



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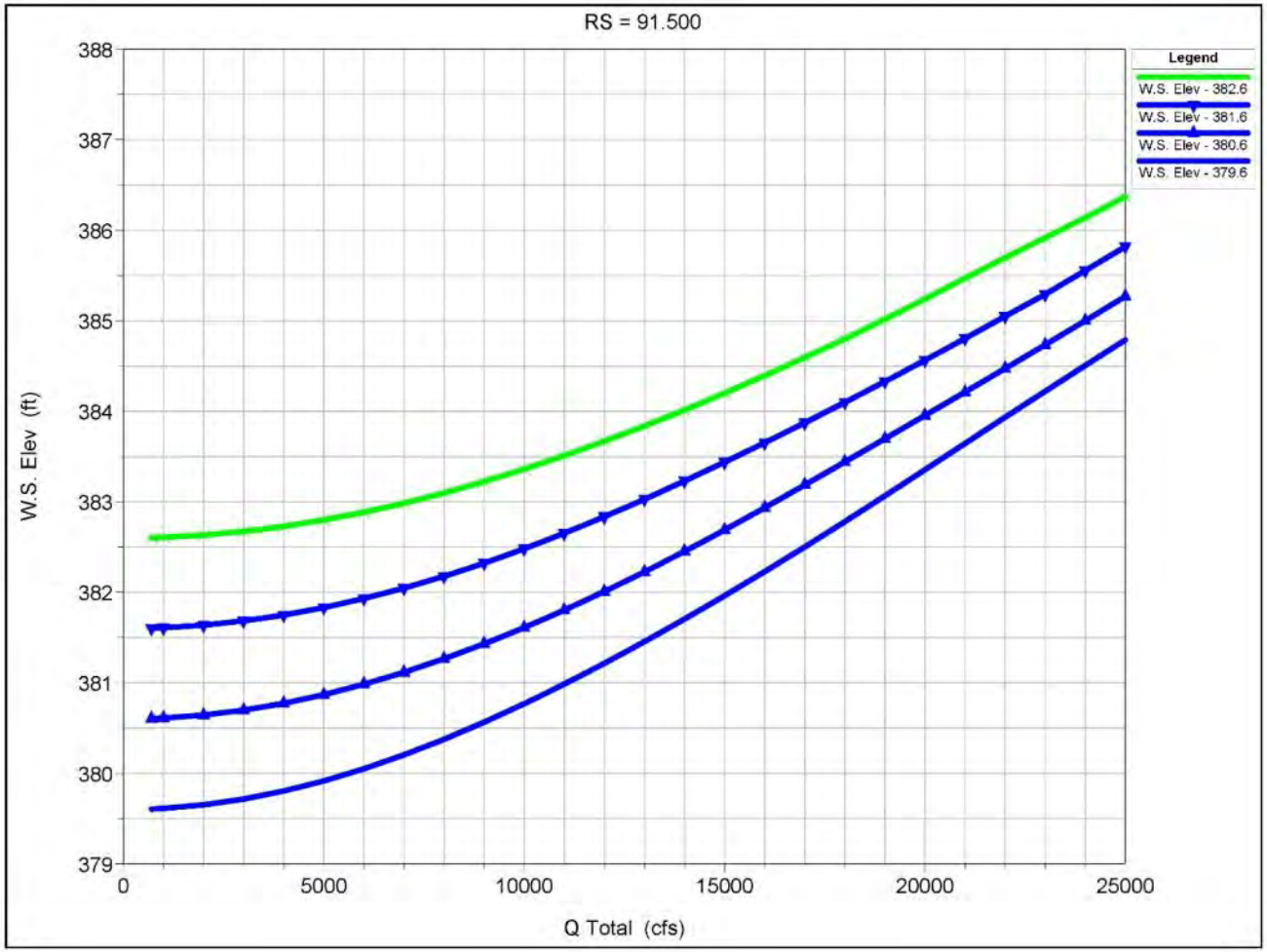
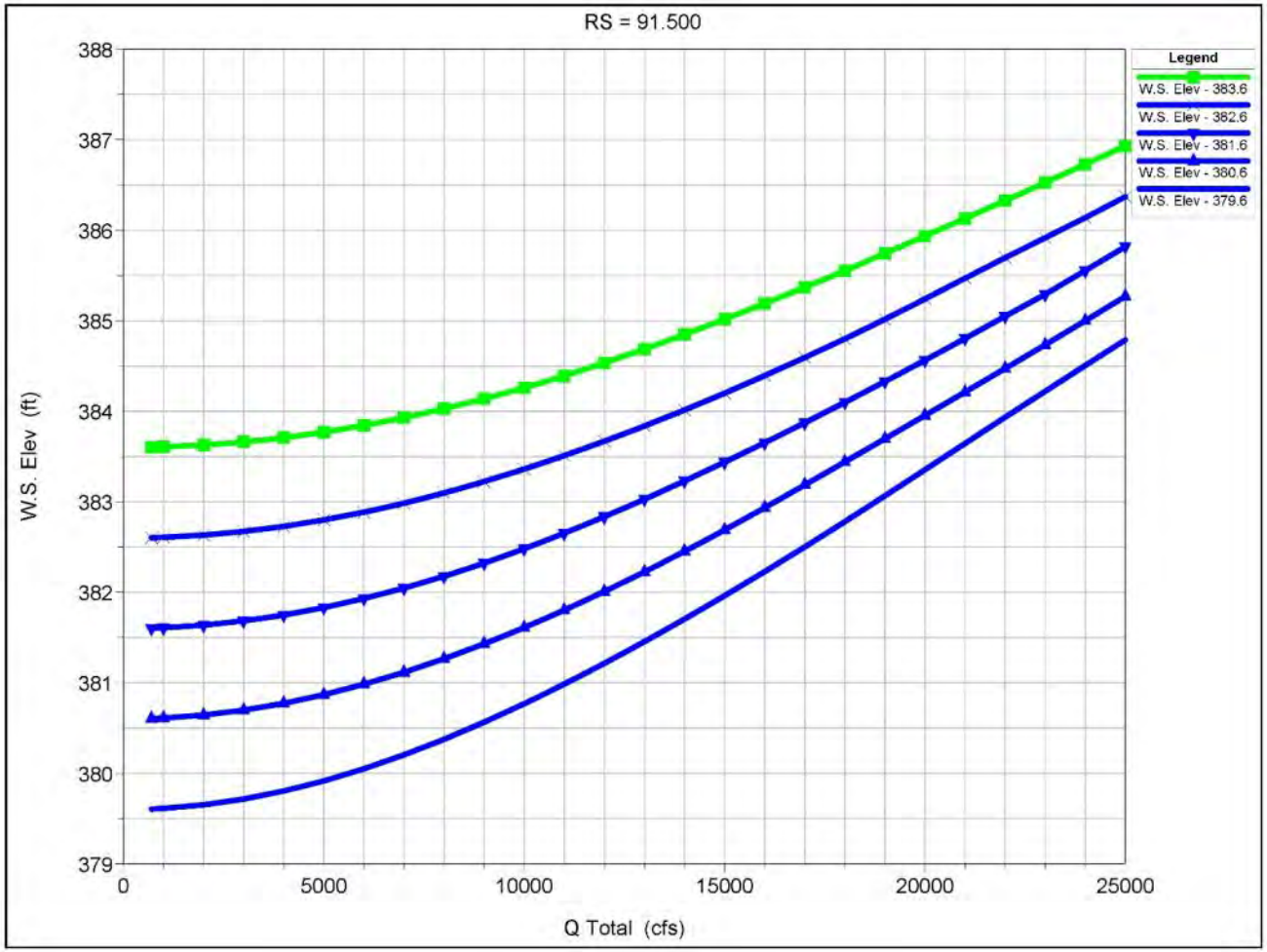
Study 4 - Hydraulic Model – WSEL vs Flow



TransCanada

Study 4 - Hydraulic Model – WSEL vs Flow



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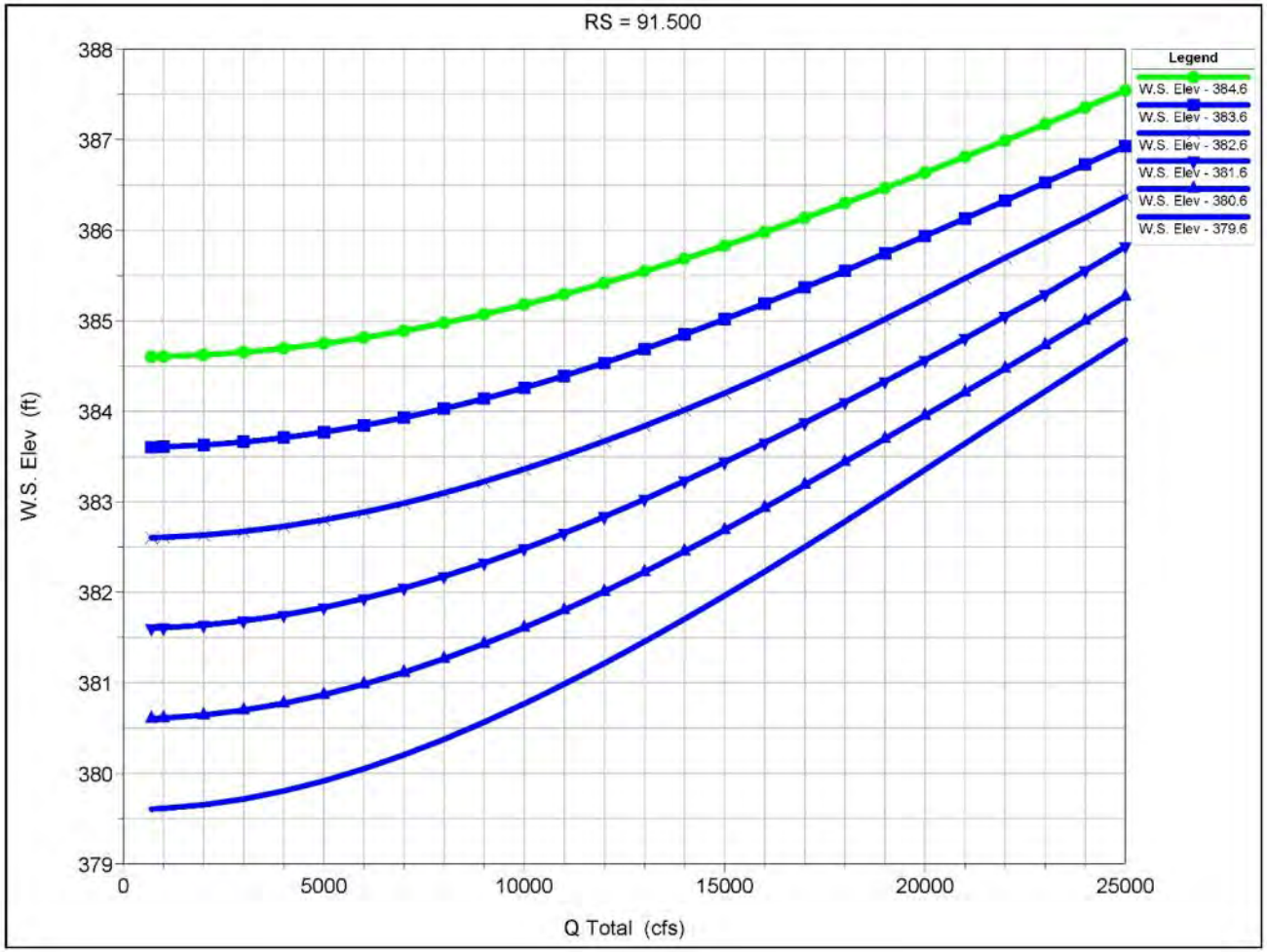
Study 4 - Hydraulic Model – WSEL vs Flow



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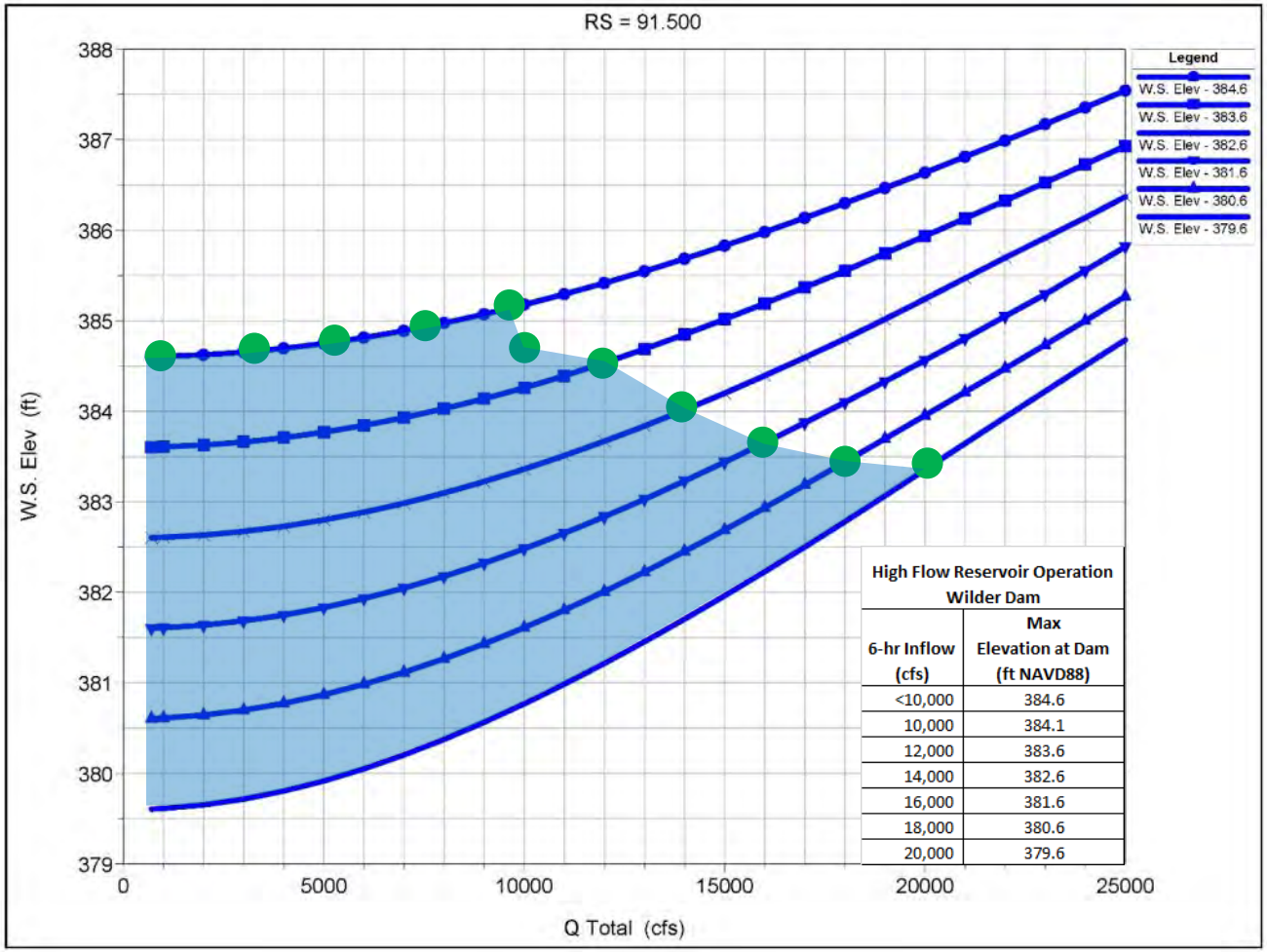
Study 4 - TransCanada Operations



High Flow Reservoir Operation
Wilder Dam

6-hr Inflow (cfs)	Max Elevation at Dam (ft NAVD88)
<10,000	384.6
10,000	384.1
12,000	383.6
14,000	382.6
16,000	381.6
18,000	380.6
20,000	379.6

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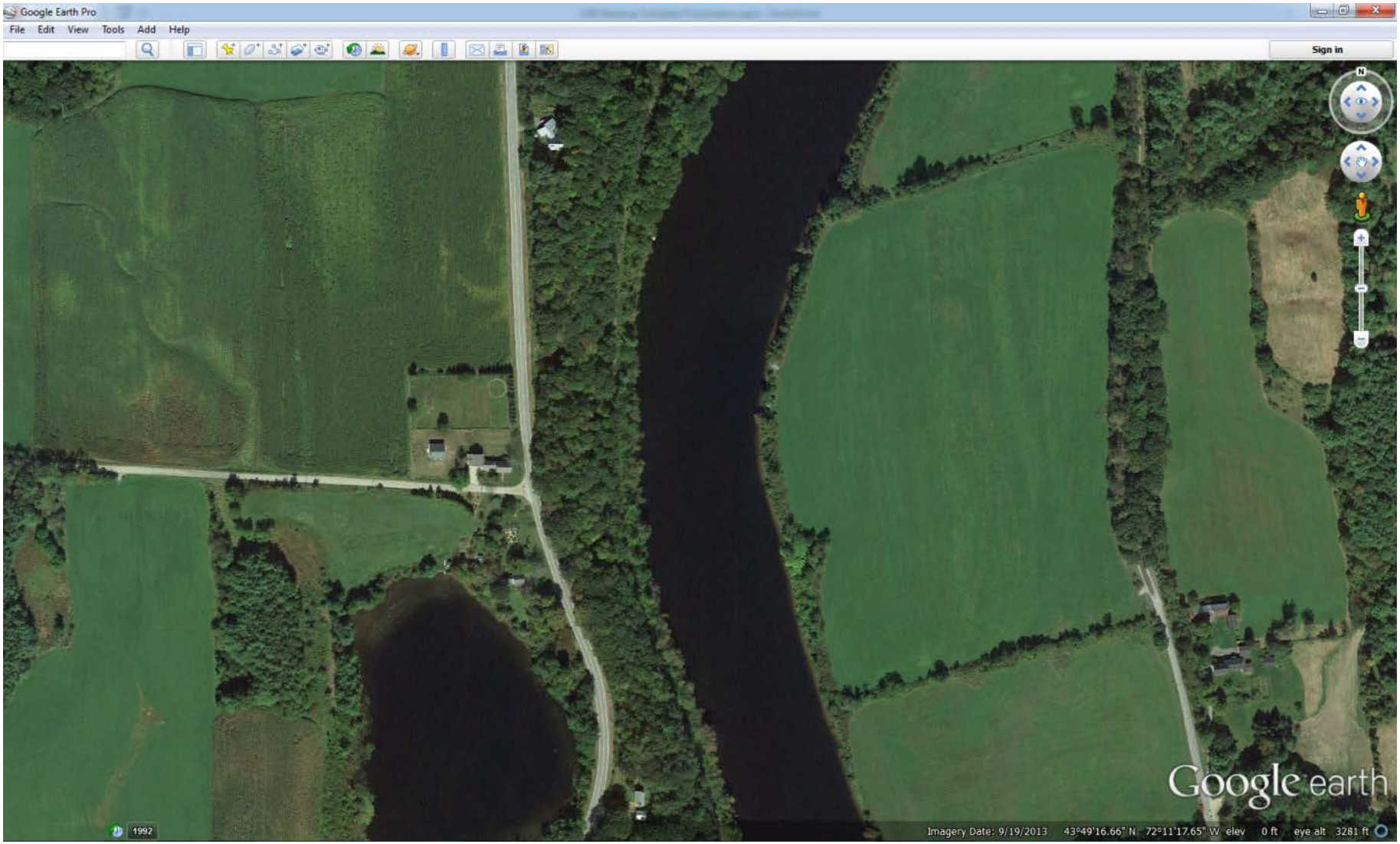
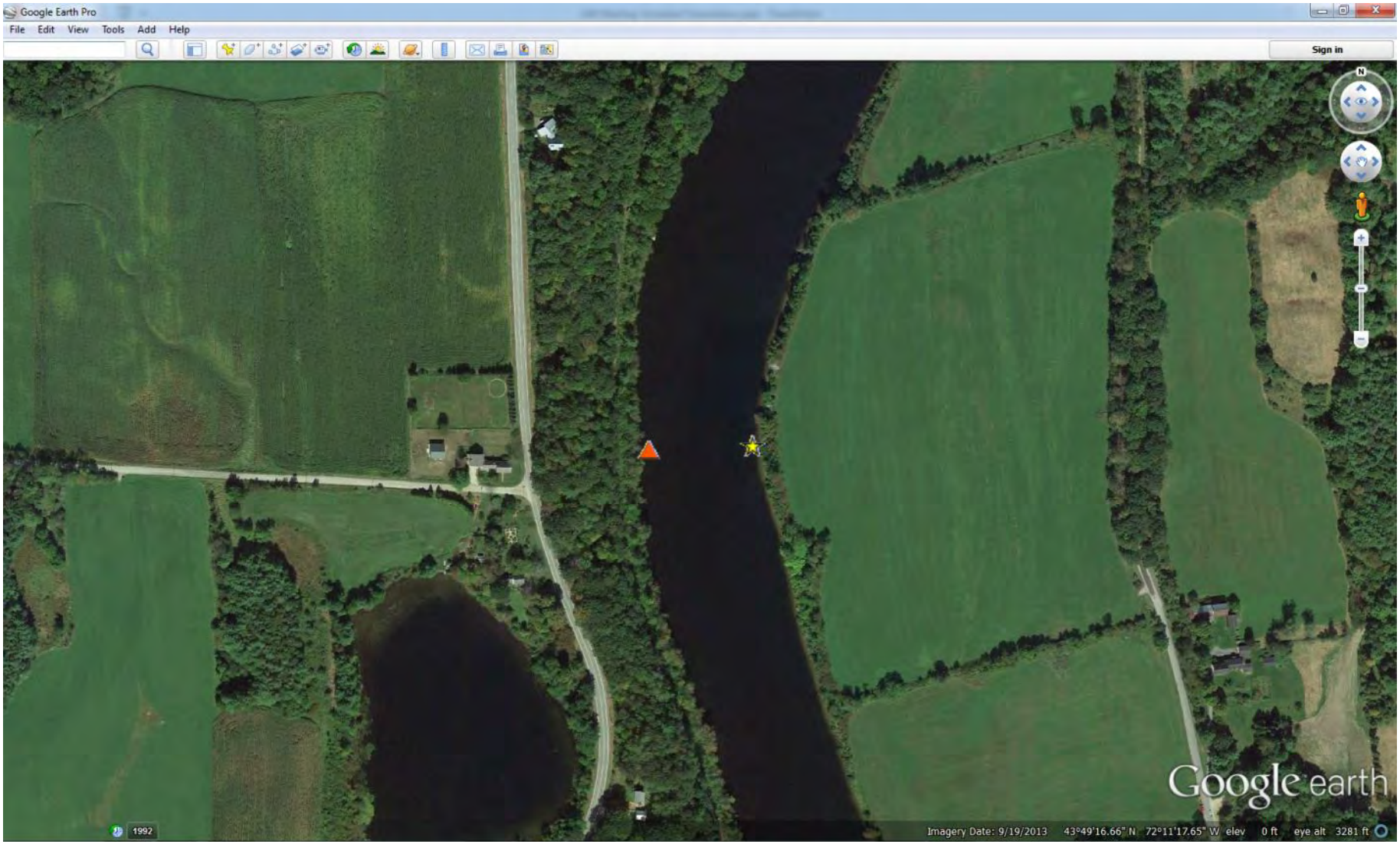
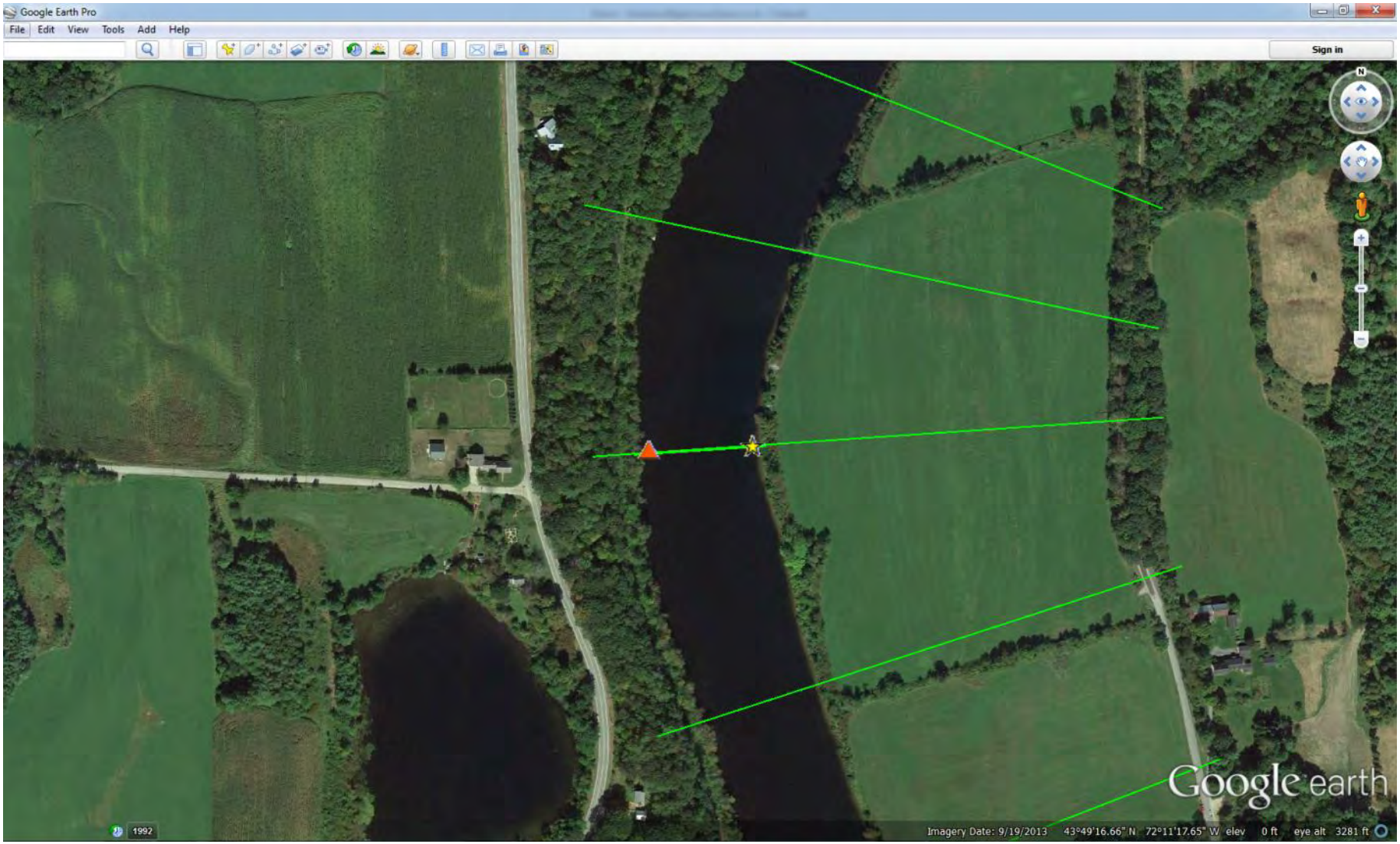
Study 4 - Hydraulic Model – results in GIS and Google Earth



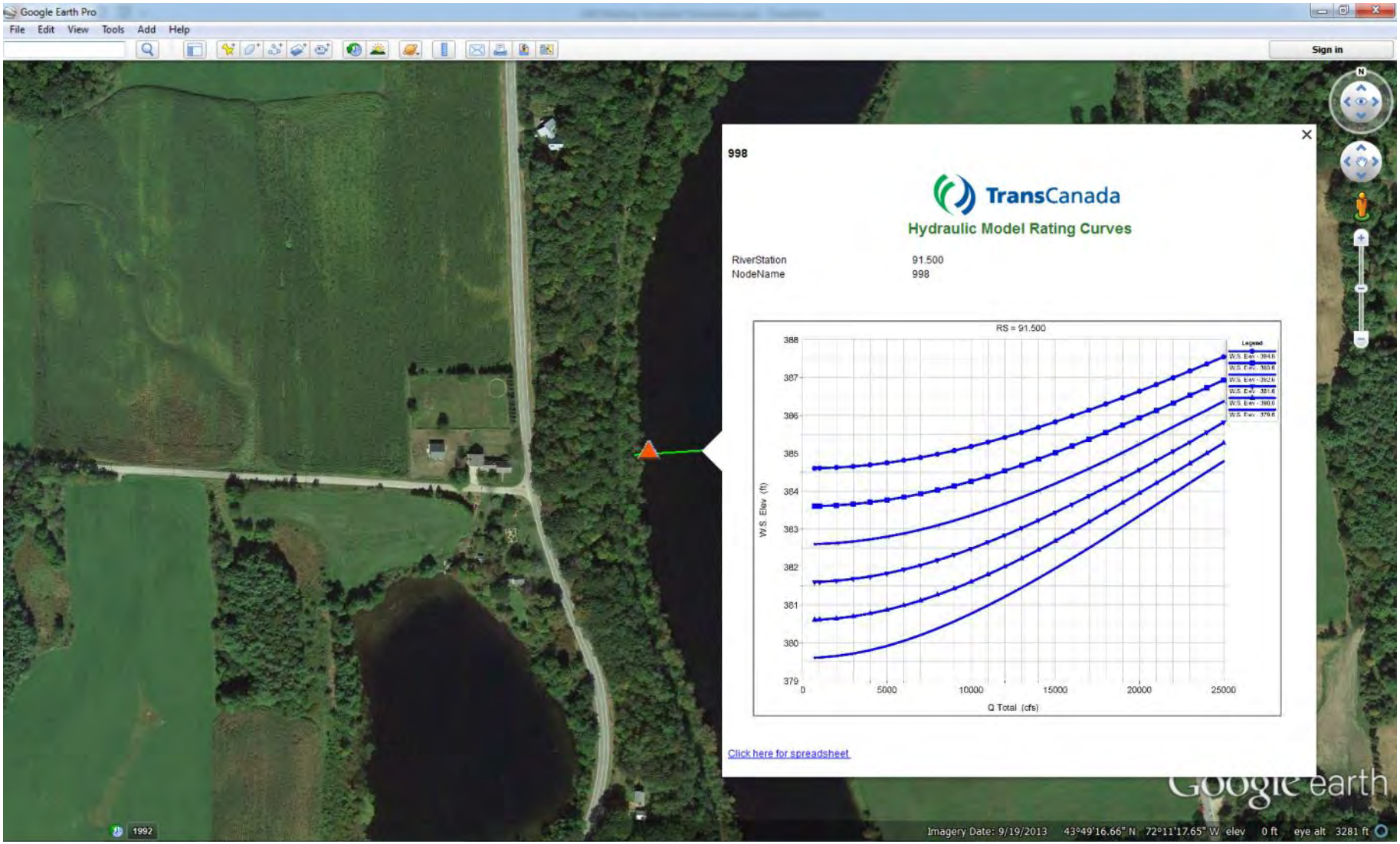
Study 4 - Hydraulic Model – results in GIS and Google Earth



Study 4 - Hydraulic Model – results in GIS and Google Earth



Study 4 - Hydraulic Model – results in GIS and Google Earth



Study 4 – Hydraulic Model Steps

Set up hydraulic model

✓ Model inputs

✓ Calibration and validation

Provide model output

✓ Velocity comparison

80% Lag time (for operations model routing)

50% Rating curves (WSEL, flow, velocity, shear stress)

in progress Sub-hourly model runs

Prepare final report *in progress*

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Study 5
Operations Modeling

Study 5 – Operations Model

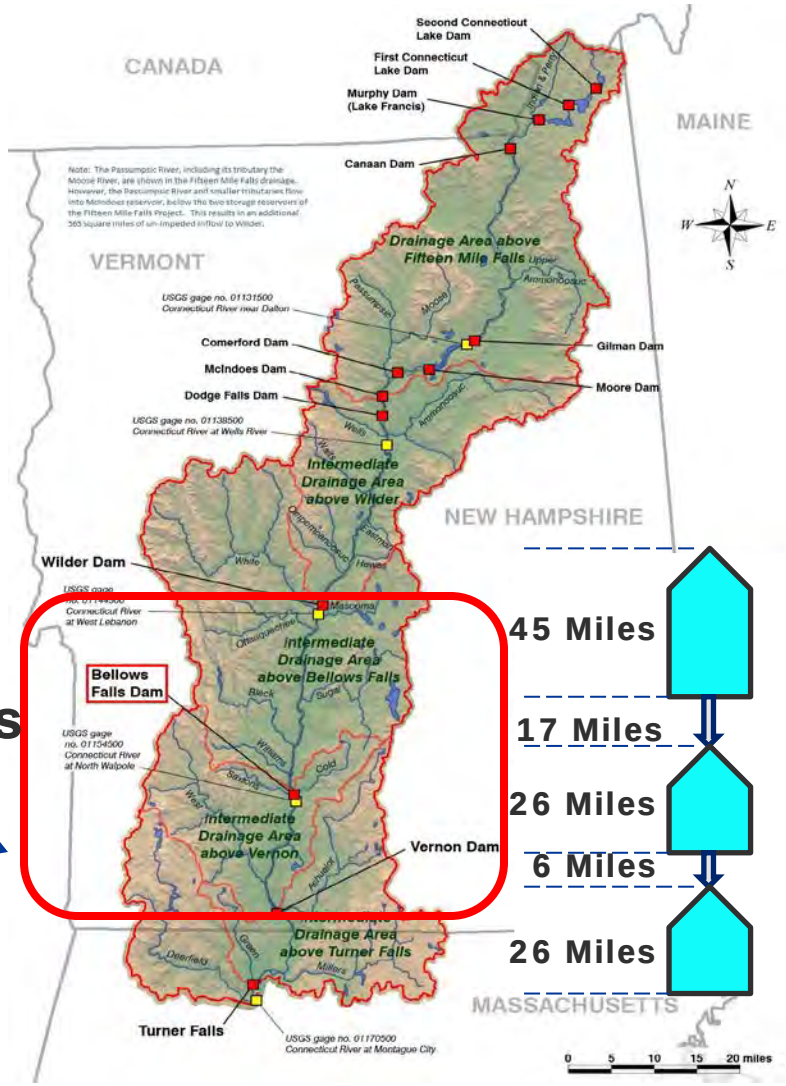
Overview:

- Operations model (Vista DSS™) simulates detailed hourly operation of all TransCanada water control facilities on the Connecticut River
- Simulation is based on input hydrologic sequence and defined operational situation

Objective:

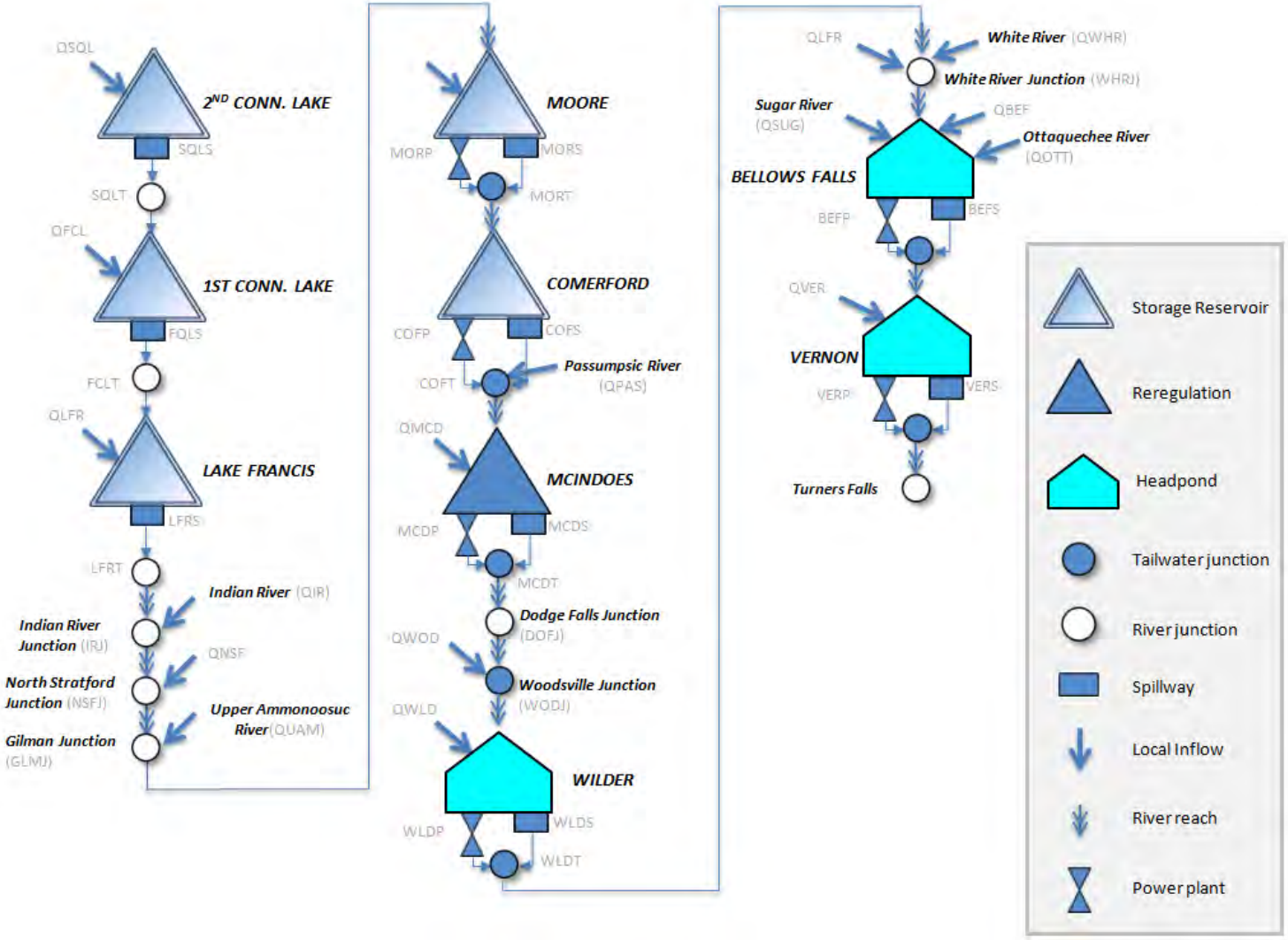
- To develop a time-series database of hourly water levels and flows for various selected operational scenarios
- The values will be available at many locations on the river system, including the three projects and identified areas of interest (econodes)
- These data will enable other studies to assess the effects of project operations on aquatic, terrestrial, and geologic resources at locations of interest

Study 5 - Project Location



Study Focus

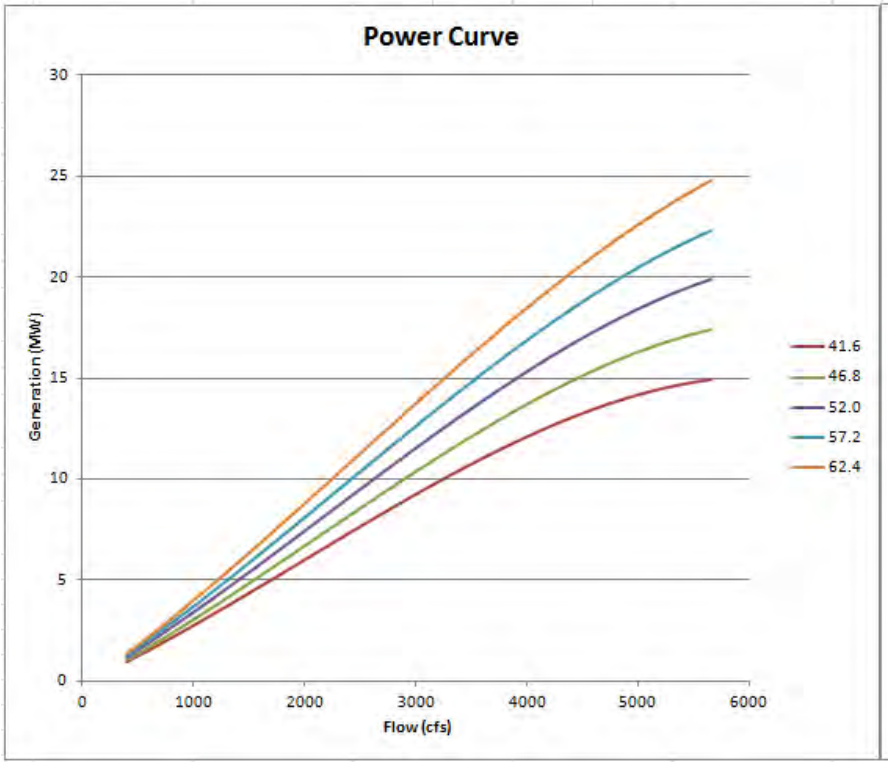
Study 5 - Vista DSS Schematic

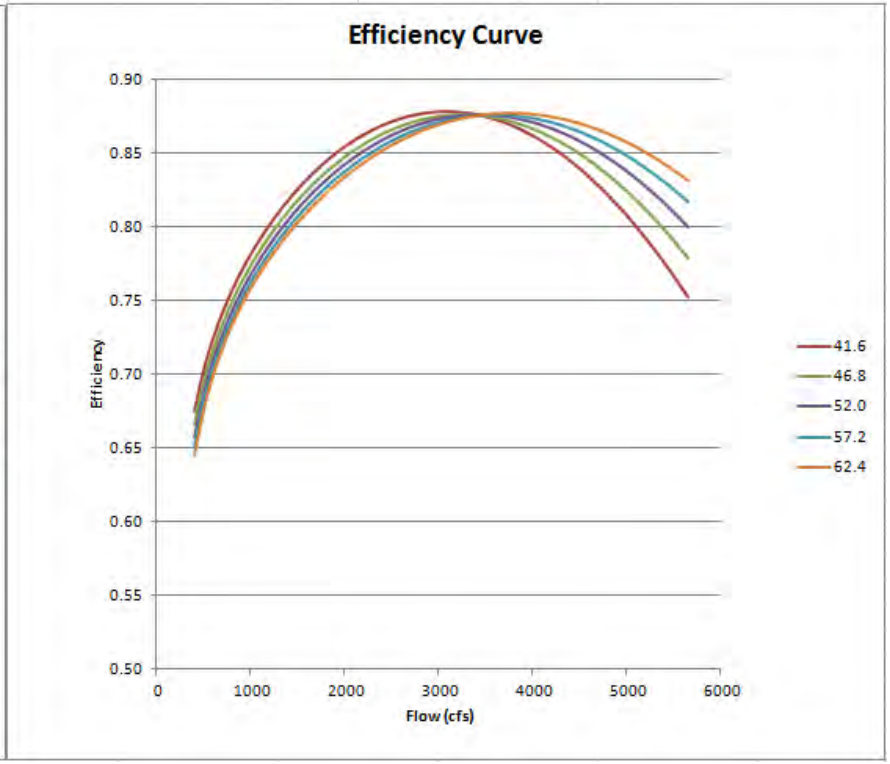


Study 5 - Approach

- Define all system data
  - generating unit performance characteristics
  - operational constraints (current license condition)
  - Update model hydrology through 2011
- Validate hourly simulation model
- Select five representative annual flow sequences to be used for detailed operation studies
- Simulate base case operations conditions for the five-year reference hydrology
- Simulate potential changed operations conditions

Study 5 - Sample Unit Data





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Study 5 - Model Validation for 2010

Station	Historic Energy (MWh)	Simulated Energy (MWh)	Difference (%)
Moore	299201	299327	0.04
Comerford	371389	371367	-0.01
McIndoes	51797	51796	0.00
Wilder	170767	170695	-0.04
Bellows Falls	258586	258612	0.01
Vernon	157540	157426	-0.07
System	1309280	1309223	0.0

Study 5 - Selected Annual Flow Sequences

Year	Annual Total Hydrology (cfsh)	Rank	Spring Total Hydrology (cfsh)	Rank	LT Vista Annual Generation (MWh)	Rank
1976	1.276E+08	26	8.296E+07	27	1572751	24
1977	1.042E+08	18	5.978E+07	10	1395058	20
1978	9.023E+07	10	7.584E+07	23	1198481	9
1979	9.775E+07	15	7.612E+07	25	1208162	10
1980	6.729E+07	1	4.368E+07	1	1032163	2
1981	1.023E+08	16	6.083E+07	11	1409333	21
1982	9.038E+07	11	6.891E+07	19	1222118	11
1983	1.110E+08	22	7.592E+07	24	1369404	19
1984	1.047E+08	19	8.547E+07	28	1246798	12
1985	7.775E+07	4	4.946E+07	2	1143329	7
1986	1.030E+08	17	6.746E+07	18	1285102	16
1987	9.522E+07	13	5.381E+07	5	1119958	6
1988	7.748E+07	3	5.034E+07	3	1117498	5
1989	9.658E+07	14	6.119E+07	12	1261104	15
1990	1.244E+08	25	7.171E+07	22	1676359	28
1991	9.420E+07	12	6.456E+07	15	1295117	17
1992	7.929E+07	5	5.496E+07	6	1081807	3
1993	8.069E+07	6	5.715E+07	8	1085556	4
1994	9.020E+07	9	6.643E+07	16	1171538	8
2001	7.007E+07	2	5.819E+07	9	954259	1
2002	8.760E+07	8	6.733E+07	17	1257622	14
2003	1.155E+08	24	5.535E+07	7	1331069	18
2004	8.758E+07	7	5.288E+07	4	1256885	13
2005	1.293E+08	27	6.970E+07	20	1643213	27
2006	1.425E+08	28	8.260E+07	26	1749818	30
2007	1.049E+08	20	7.158E+07	21	1466246	22
2008	1.442E+08	29	8.791E+07	29	1733930	29
2009	1.153E+08	23	6.368E+07	14	1585385	25
2010	1.099E+08	21	6.335E+07	13	1492769	23
2011	1.459E+08	30	8.857E+07	30	1615150	26

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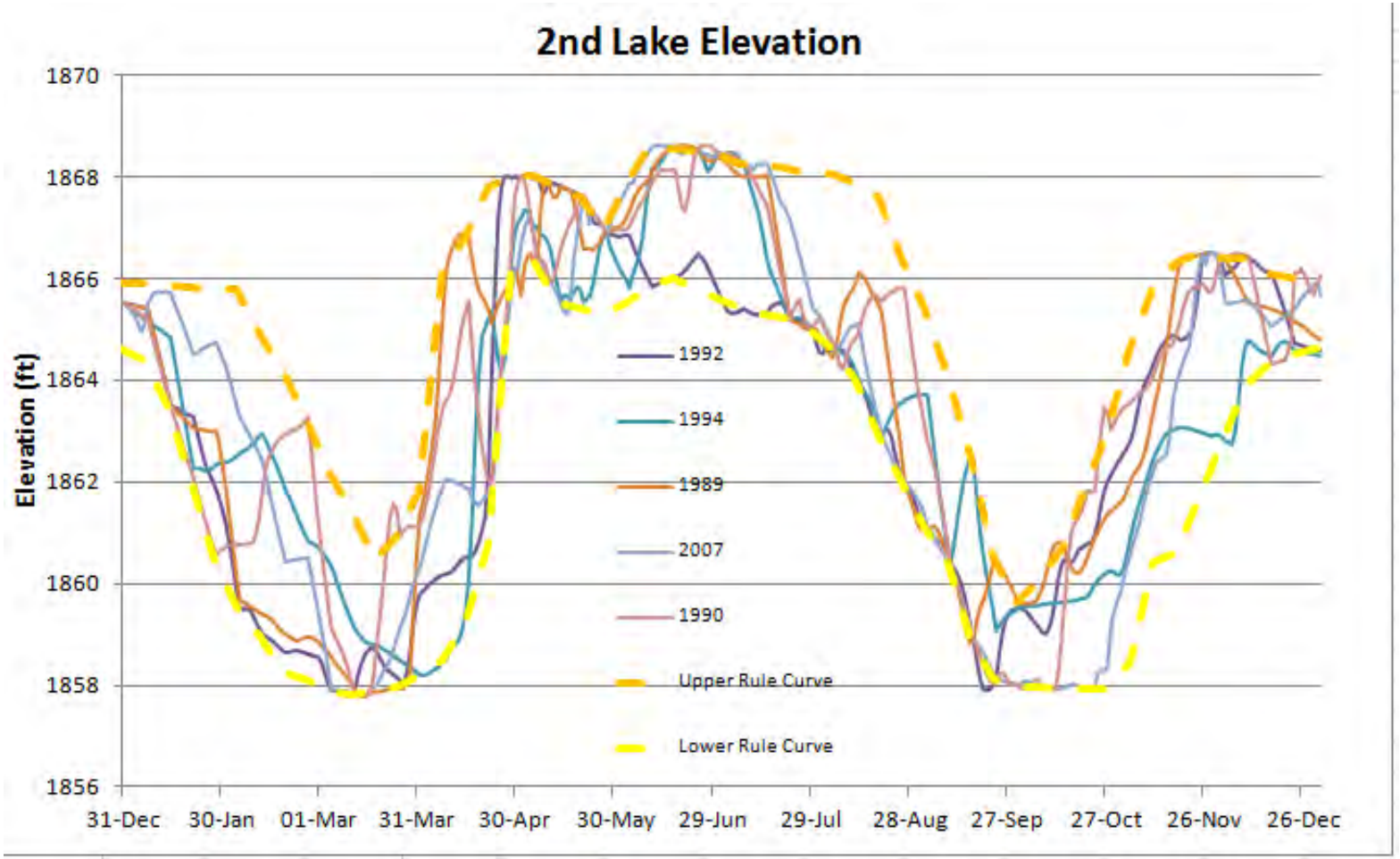
Study 5 - Base Case Simulation

Run AUTO Vista for the five selected hydrologic sequences subject to:

- Reservoir / headpond physical limits and operational constraints
- Unit maintenance outage
- Unit physical limits and operational constraints
- Spill flow operational constraints
- River channel flow constraints
- Market prices

Study 5 - Base Case Run – Sample Water Level Compliance with Rule Curves: Most Upstream Reservoir



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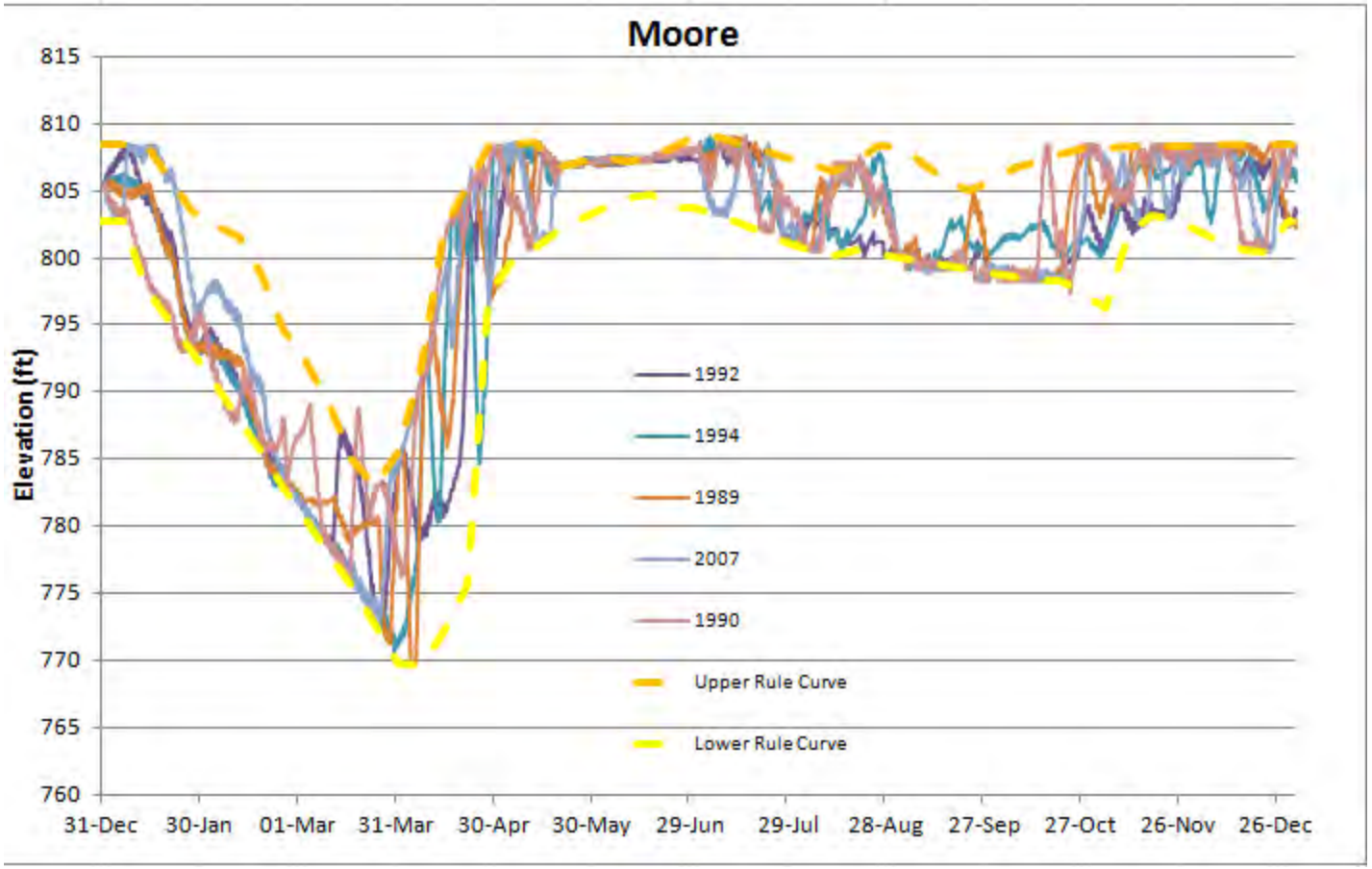
Study 5 - Base Case Run – Sample Water Level Compliance with Rule Curves: Largest Reservoir



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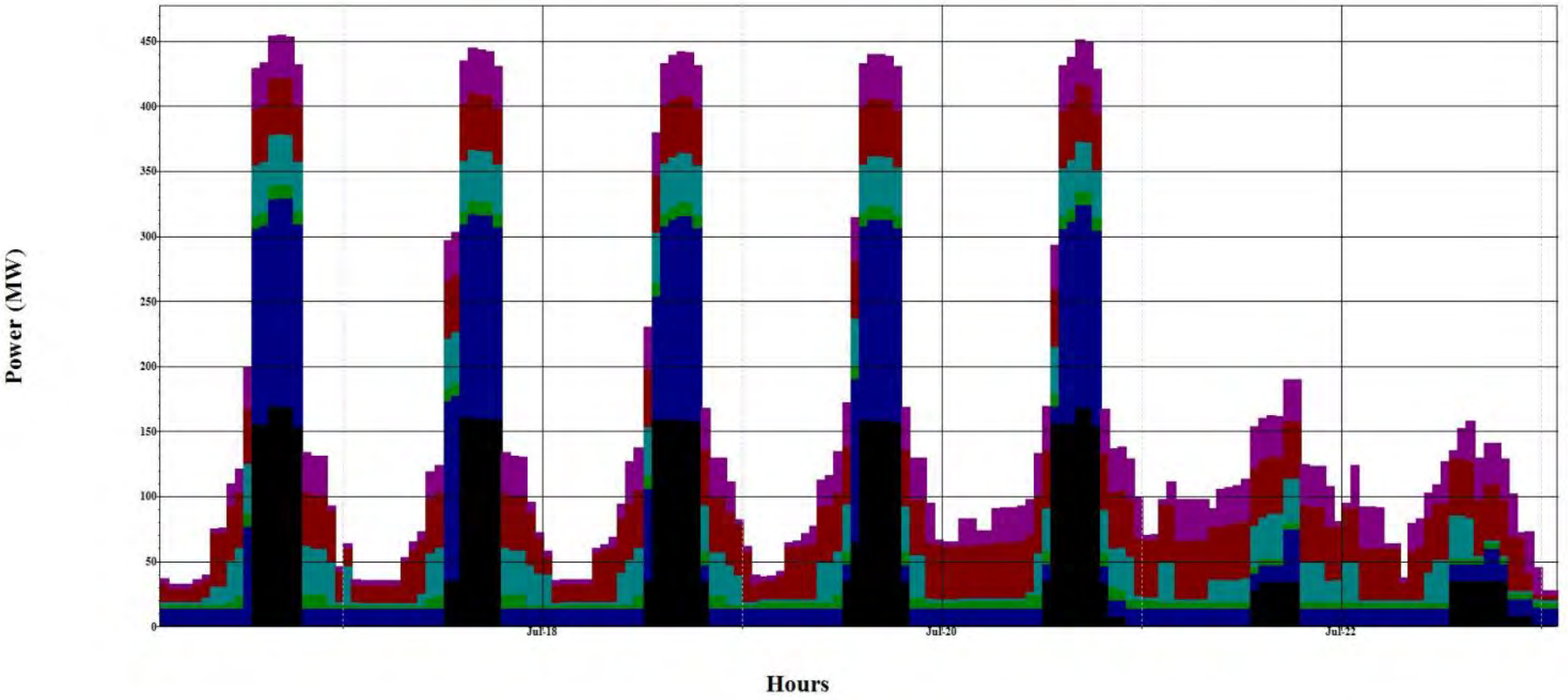
Study 5 - Base Case Run – Sample Power Output



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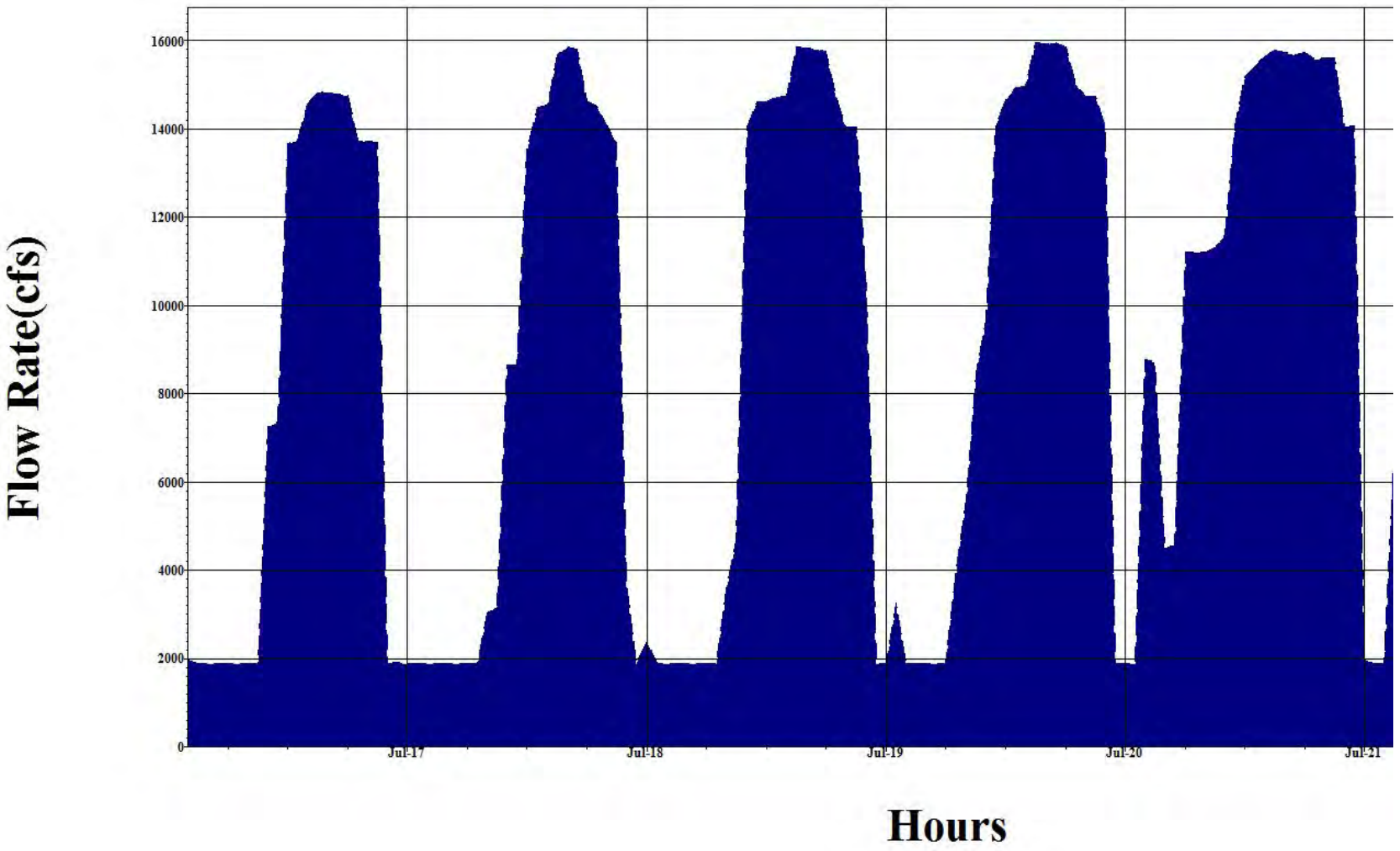
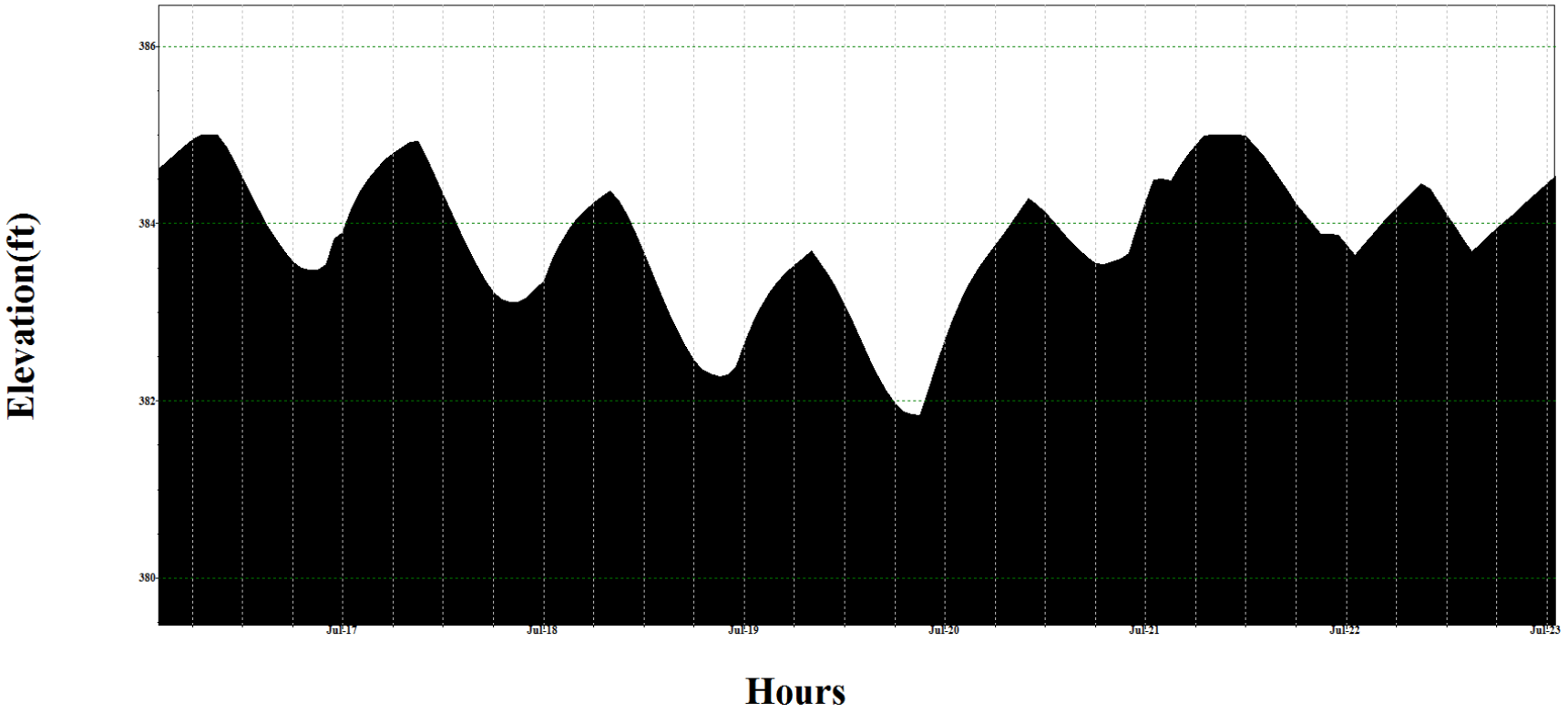
Study 5 - Base Case Run – Sample River Flowrate (Vernon)



Study 5 - Base Case Run – Sample Water Level (Wilder)



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Study 5 – Current Activity

Review of hydraulic model results at econodes

- “rating curves” (water level versus flow)
- “water routing” characteristics

Definition within operations model of econode

- Rating curves
- Water routing characteristics
- Habitat suitability indices (pending)

Interacting with resource studies to identify potential alternative operation constraints

Model will be used to re-run new scenarios and compare to base case

Study 6
Water Quality Study

Study Objectives

Characterize:

- Temperature in the river, impoundments, Bellows Falls bypass reach, forebays, tailraces, and the main tributaries
- Dissolved oxygen, conductivity, turbidity, and pH at river stations, including during a 10-day low-flow period
- Nutrient and chlorophyll concentrations at forebay stations

Assess:

- Potential effects of Wilder, Bellows Falls and Vernon Projects on water quality and temperature in the Connecticut River
- Compliance with VT and NH surface water quality standards

Study 6 – Water Quality Study

Field Activities

	Station ID	Wilder	Bellows F.	Vernon	Location	Mar-May	Jun-Sep					Oct-Nov
						Temp. sonde	Temp. Sonde	Temp. Transect	Multi-Sonde	Vertical profile	Water Sample Core	Temp. sonde
Connecticut River	06-W-04	●			upstream	●	●	7Q10	7Q10	●		●
	06-W-03	●			upper	●	●			●		●
	06-W-02	●			mid	●	●			●		●
	06-W-01	●			lower	●			●	●	●	●
	06-W-TR	●			tailrace	●			●	●		●
	06-BF-04		●		upstream	●	●	7Q10	7Q10	●		●
	06-BF-03		●		upper	●	●			●		●
	06-BF-02		●		mid	●	●			●		●
	06-BF-01		●		lower	●			●	●	●	●
	06-BF-BR		●		bypass reach	●			●	●		●
	06-BF-TR		●		tailrace	●			●	●		●
	06-V-04			●	upstream	●	●	7Q10	7Q10	●		●
	06-V-03			●	upper	●	●			●		●
	06-V-02			●	mid	●	●			●		●
	06-V-01			●	lower	●			●	●	●	●
	06-V-TR			●	tailrace	●			●	●		●
Tributaries	06-W-T02	●			Waits	●	●					●
	06-W-T01	●			Ompomp.	●	●					●
	06-BF-T05		●		White	●	●					●
	06-BF-T04		●		Mascoma	●	●					●
	06-BF-T03		●		Sugar	●	●					●
	06-BF-T02		●		Black	●	●					●
	06-BF-T01		●		Williams	●	●					●
	06-V-T03			●	Saxton	●	●					●
	06-V-T02			●	Cold	●	●					●
	06-V-T01			●	West	●	●					●

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Study 6 – Water Quality Study

Status

(completed activities in turquoise)

	Station ID	Wilder	Bellows F.	Vernon	Location	Mar-May	Jun-Sep					Oct-Nov
						Temp. sonde	Temp. Sonde	Temp. Transect	Multi-Sonde	Vertical profile	Water Sample Core	Temp. sonde
Connecticut River	06-W-04	●			upstream	●	●	7Q10	7Q10	●		●
	06-W-03	●			upper	●	●			●		●
	06-W-02	●			mid	●	●			●		●
	06-W-01	●			lower	●			●	●	●	●
	06-W-TR	●			tailrace	●			●	●		●
	06-BF-04		●		upstream	●	●	7Q10	7Q10	●		●
	06-BF-03		●		upper	●	●			●		●
	06-BF-02		●		mid	●	●			●		●
	06-BF-01		●		lower	●			●	●	●	●
	06-BF-BR		●		bypass reach	●			●	●		●
	06-BF-TR		●		tailrace	●			●	●		●
	06-V-04			●	upstream	●	●	7Q10	7Q10	●		●
	06-V-03			●	upper	●	●			●		●
	06-V-02			●	mid	●	●			●		●
	06-V-01			●	lower	●			●	●	●	●
	06-V-TR			●	tailrace	●			●	●		●
Tributaries	06-W-T02	●			Waits	●	●					●
	06-W-T01	●			Ompomp.	●	●					●
	06-BF-T05		●		White	●	●					●
	06-BF-T04		●		Mascoma	●	●					●
	06-BF-T03		●		Sugar	●	●					●
	06-BF-T02		●		Black	●	●					●
	06-BF-T01		●		Williams	●	●					●
	06-V-T03			●	Saxton	●	●					●
	06-V-T02			●	Cold	●	●					●
	06-V-T01			●	West	●	●					●

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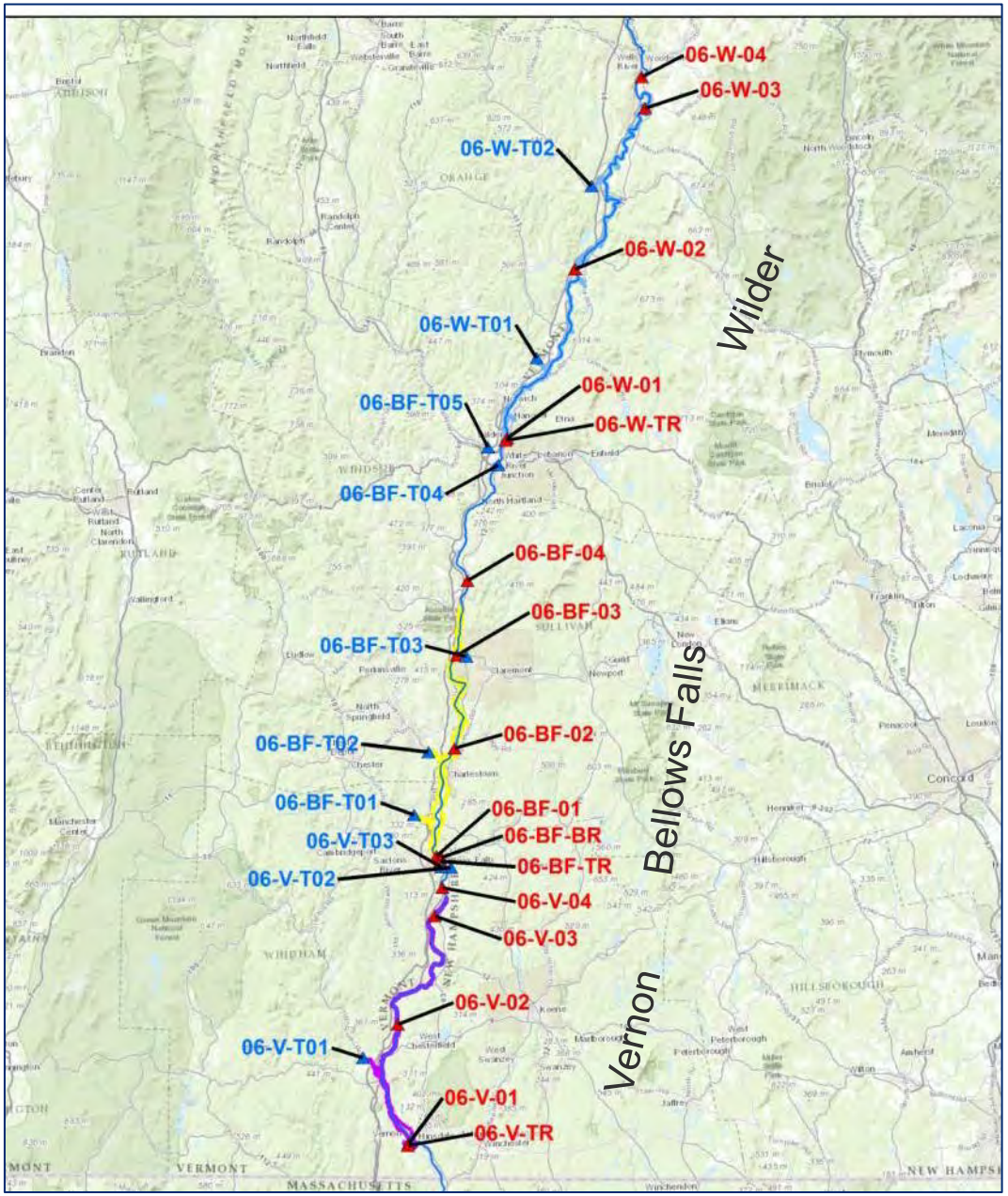
Study 6 – Water Quality Study

Stations

- Connecticut River
- Tributaries



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Study 6 – Water Quality Study

Stations – Example

Vicinity of Bellows Falls Dam

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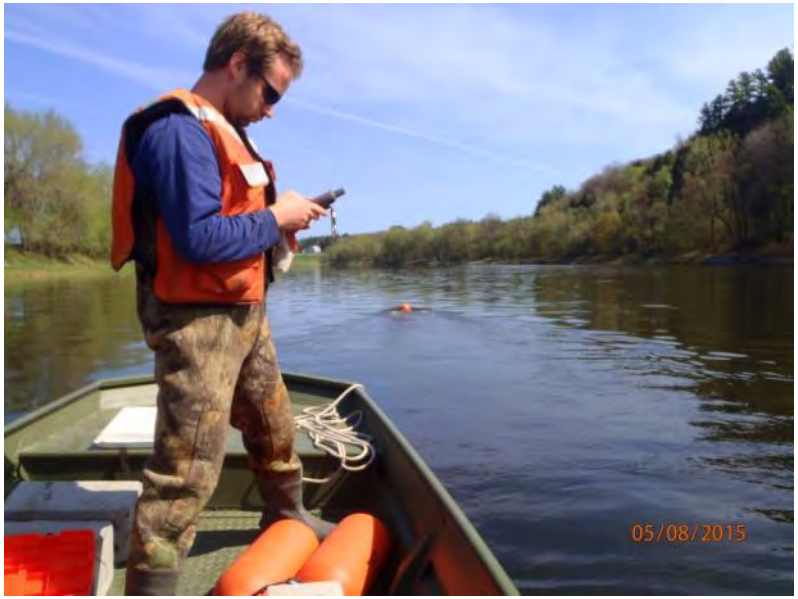
Study 6 – Water Quality Study

Study Progress

- *Nov. 2014:* Tributary station selection in field
- *March 2015:* Approval of Sampling and Analysis Plan (S&A) by Agencies
- *March 24:* Installation of first loggers in six tributaries. Other tributary and CT River stations occurred in April and May due to late ice-out and high flows
- Study proceeding according to plan



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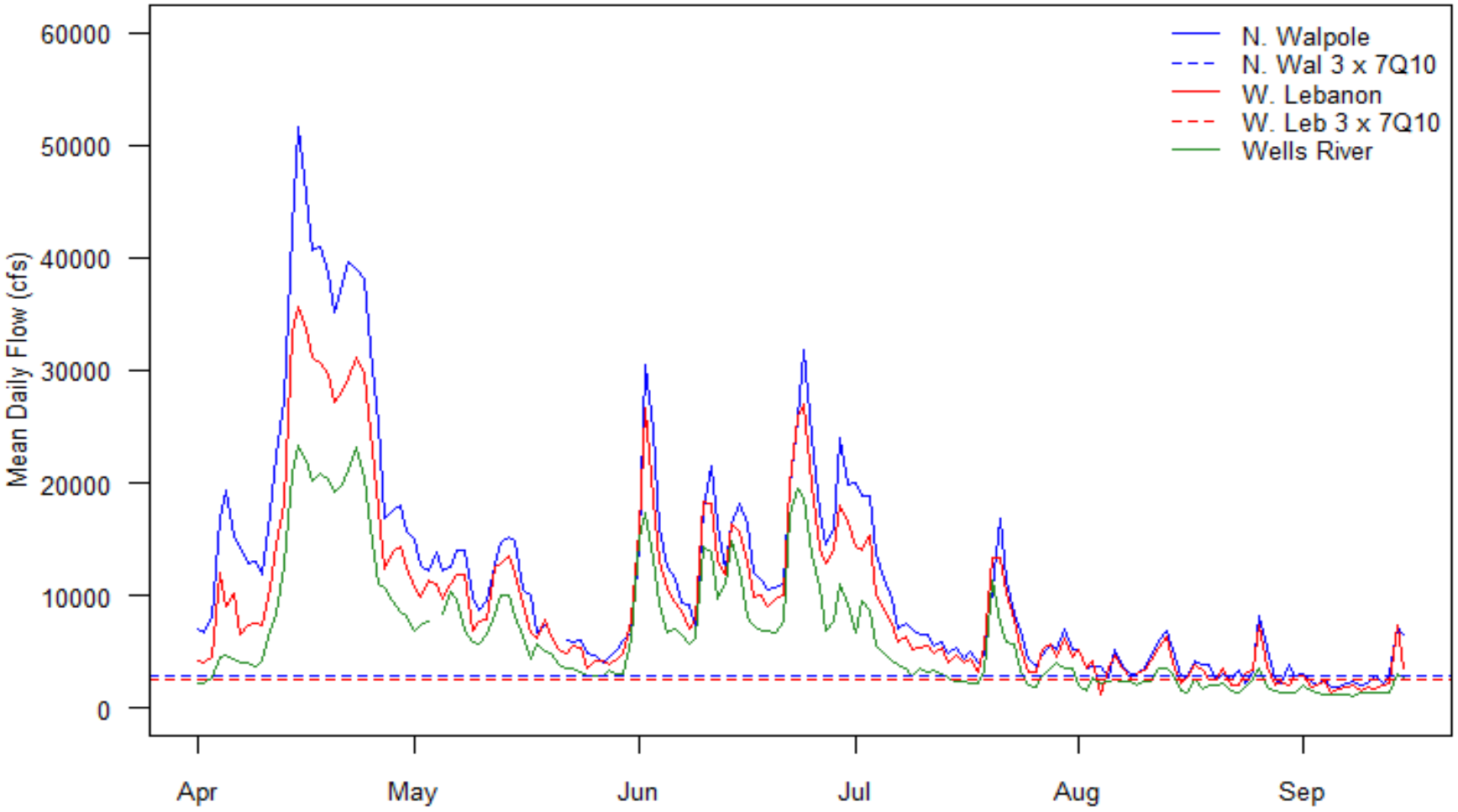
Mean Daily Flows in Connecticut River



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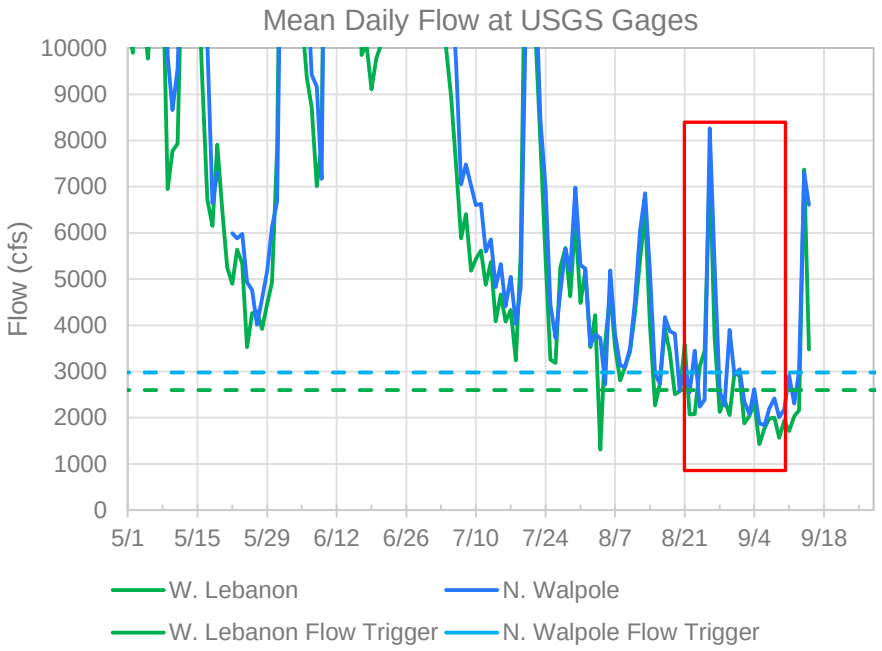
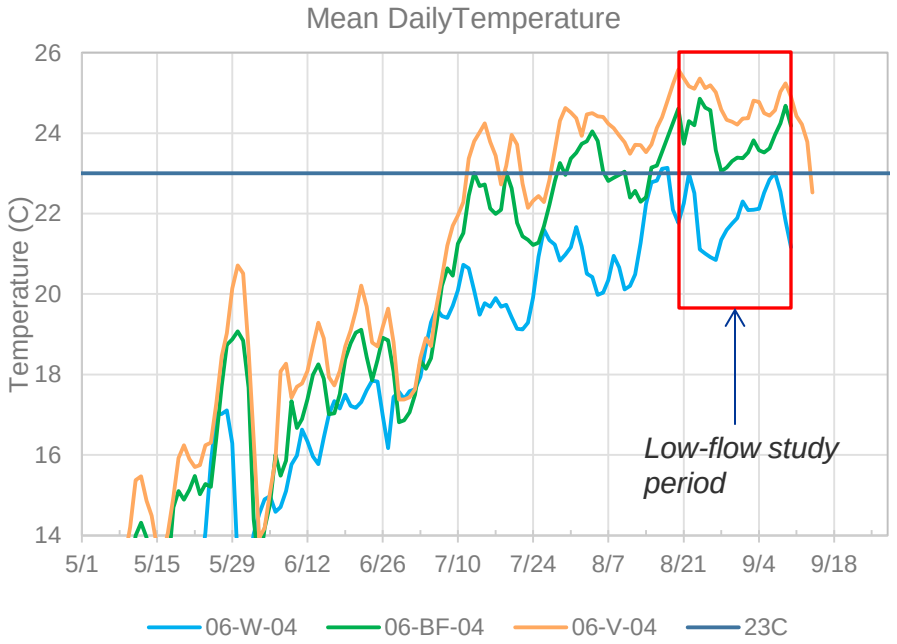
Study 6 – Water Quality Study

10-day Low-flow Study: Threshold : <3 x 7Q10, and 23ºC





Deployment length: Approximately 20 days in each impoundment

11 days of continuous low flows below 3 x 7Q10 between Sept. 2 and 12

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Study 6 – Water Quality Study

S&A Plan Variances

(coordinated with Agencies)

- *April 29:* Minor adjustment of upper impoundment stations downstream *(prior to start of any field work)*
- *June 30:* Adjustment of number of temperature probes for 10-day low-flow study at river stations due to shallow water depths *(prior to start of study)*

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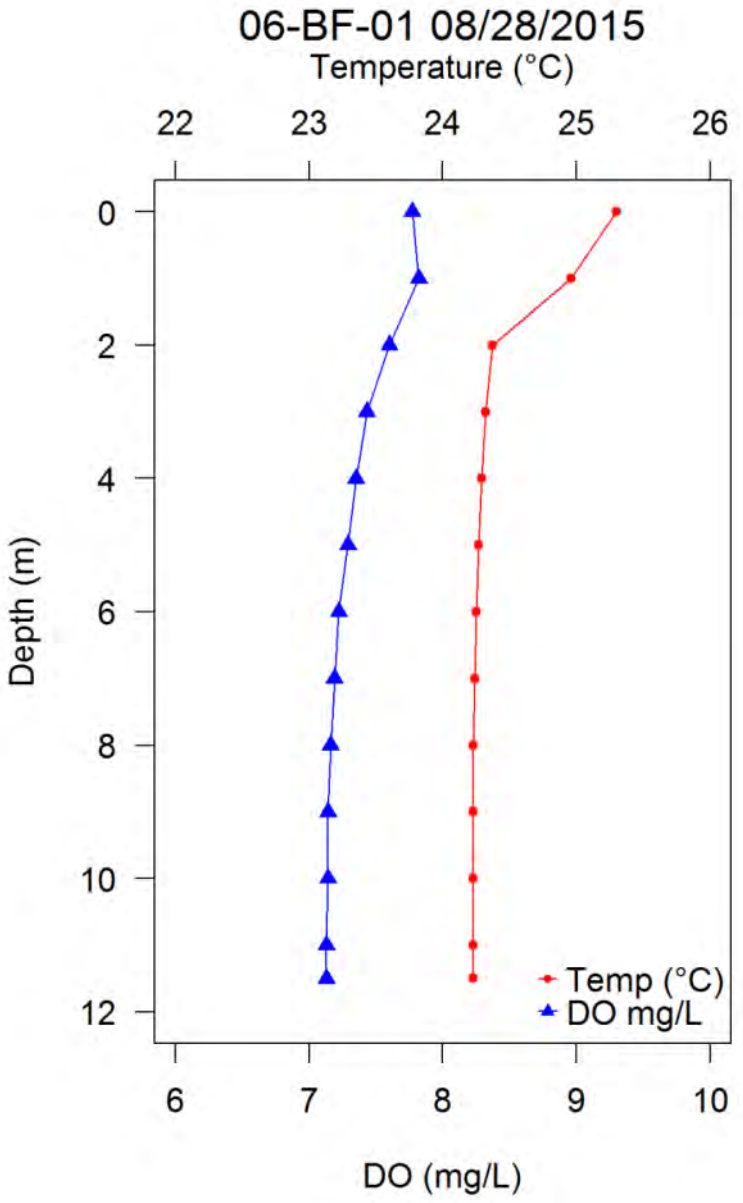
Remaining Activities

- *Field work:* Period 3 (Oct – Nov 15) for water temperature
- *Data analysis:*
  - comparison of the data with the 2012 study results
  - effects analysis
  - evaluation of compliance with VT and NH surface water quality standards
- *Issue study report*

Initial Results: Water Column in Connecticut River

- *Temperature:* Water column uniformly mixed till late July. Decrease in temperature with depth in late summer of around 1ºC.
- *Dissolved Oxygen:* DO in water column profiles were above VT and NH water quality standards at all stations at all times.



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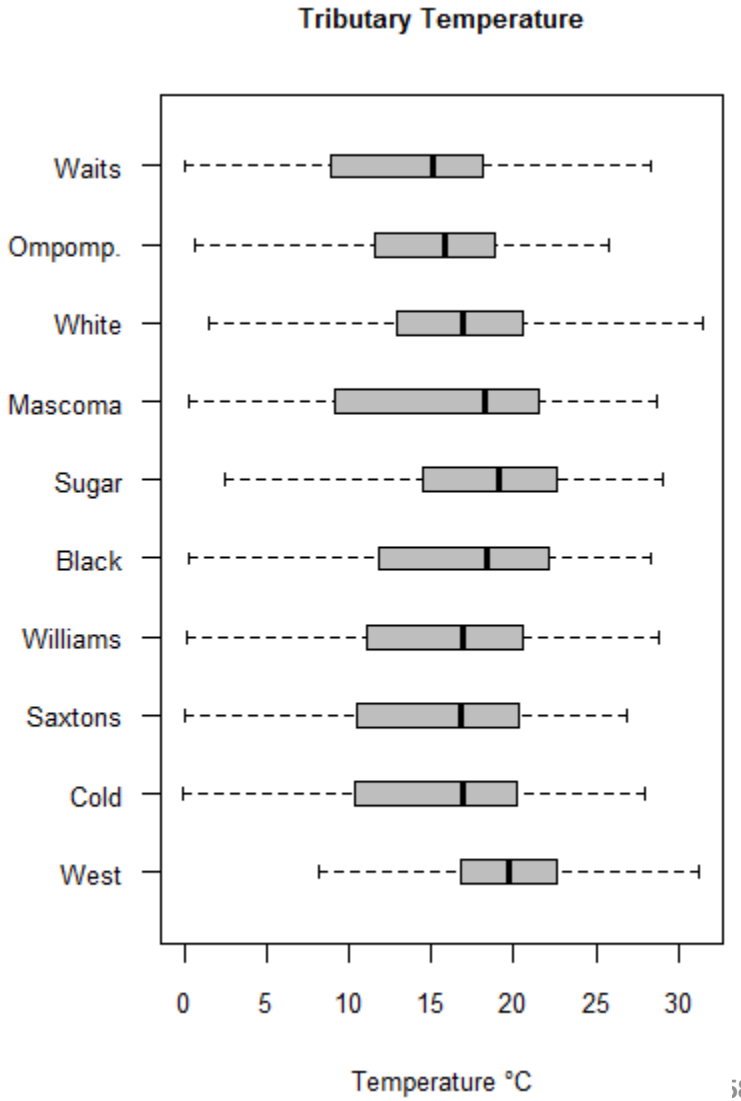
Initial Results: Temperature in Tributaries

- Cooler tributaries generally in the north
- Black, Williams, Saxtons, and Cold Rivers have similar temperature distributions (they are geographically close)
- West River generally the warmest



Initial Results: Water Chemistry (June 4 to August 22)

	Wilder (06-W-01)					Bellows Falls (06-BF-01)					Vernon (06-V-01)				
	Nitrate/Nitrite (as N)	Total Kjeldahl Nitrogen	Total Nitrogen	Total Phosphorus (as P)	Chlorophyll *a*	Nitrate/Nitrite (as N)	Total Kjeldahl Nitrogen	Total Nitrogen	Total Phosphorus (as P)	Chlorophyll *a*	Nitrate/Nitrite (as N)	Total Kjeldahl Nitrogen	Total Nitrogen	Total Phosphorus (as P)	Chlorophyll *a*
	mg/l				mg/m^3	mg/l				mg/m^3	mg/l				mg/m^3
Mean	**0.16**			**0.014**	**1.7**	**0.16**			**0.014**	**2.8**	**0.13**			**0.014**	**2.1**
Minimum	0.09	<0.5	<0.5	0.008	0.6	0.10	<0.5	<0.5	0.006	0.7	0.09	<0.5	<0.5	0.009	0.7
Maximum	0.30	0.60	0.77	0.026	3.1	0.30	1.30	1.47	0.036	4.6	0.18	0.90	1.04	0.023	4.6

Note: Data subject to final QA review

Water Quality Standards	
NH	No phosphorus or nitrogen in such concentrations that would impair any existing or designated uses, unless naturally occurring.
VT	Total phophorus loading limited so as to not accelerate eutrophication or the stimulation of the growth of aquatic biota in a manner that prevents full support of uses; Nitrates not to exceed 5.0 mg/l as NO_3-N at flows exceeding low median monthly flows.

Study 13
Tributary and Backwater
Fish Access and Habitats Study

Study Results (report filed as Vol III.A of USR)

- 37 study sites visited 3 or 4 times between July and mid-November 2014
- Bed elevations taken in tributary/backwater project-affected areas
- Water quality data showed:
  - 39% of tributaries/backwaters with low pH, < 2% were higher than state standards
  - 3.5% of samples (6 instances) had DO lower than state standards (4 at 1 site, 3 on same day)
- Analysis criteria of at least 0.5 ft depth at least 25% of the time indicates adequate access
  - Water level data at 8 sites (plus 2 with missing logger data) indicating potential access issues were correlated to non-spill project operations.
  - Of those, 2 sites (Cobb Brook, site BR-4.04 and unnamed Bellows impoundment stream order 1 site B-3.10) appeared to have project-related access limitations of any significance.
  - All other sites appeared to have no project effect or very minor effects under low mainstem and/or low tributary conditions.

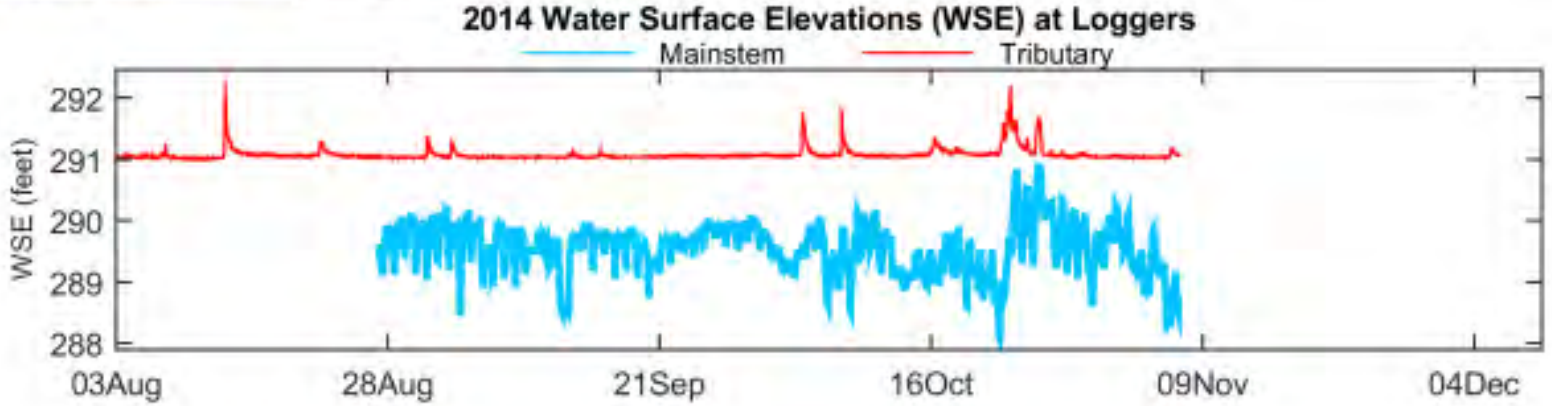
Study 13 – Tributary and Backwater Fish Access and Habitats

Example Study Site (B-3.10 from Report Appendix A)

Bellows Falls Impoundment, Connecticut River

Site ID: CT-B-3.10

Unnamed minor tributary, Stream Order 1



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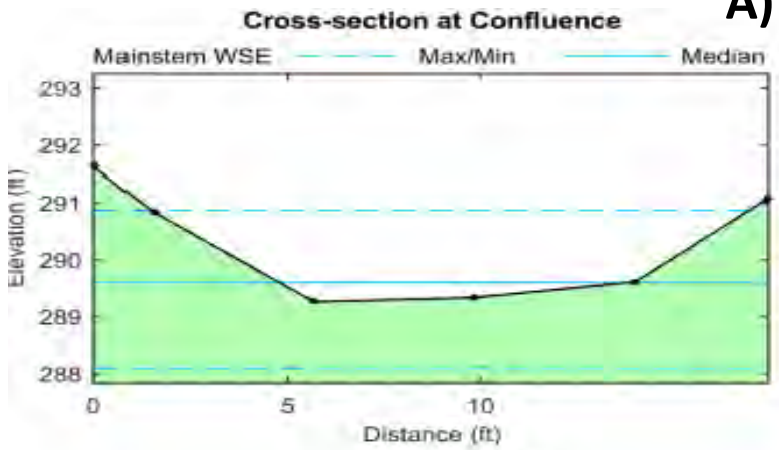
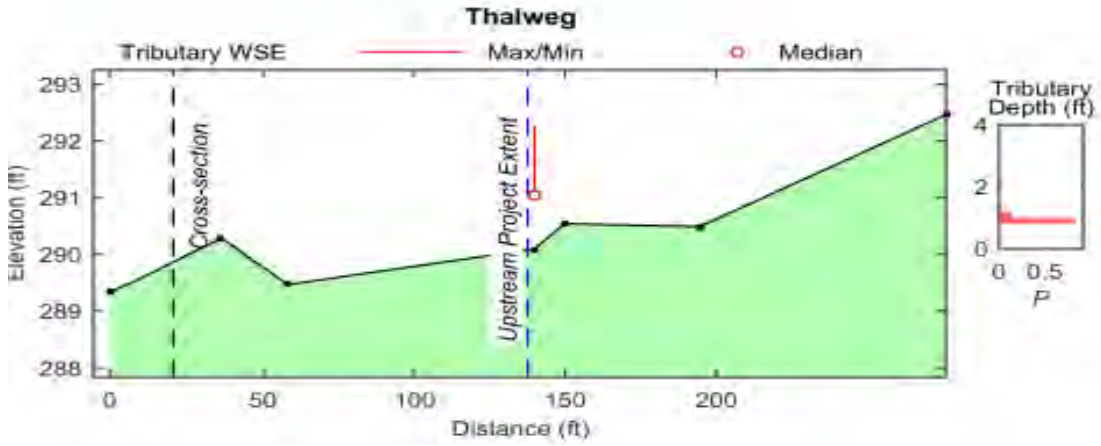
Study 13 – Tributary and Backwater Fish Access and Habitats

Example Study Site (B-3.10 from Report Appendix A)



Mainstem Logger 10338536		Maximum Measured Water
Feet: WSE	Date	Depth (ft)
Max: 290.9	28Jul2014	1.1
75%: 289.8	27Aug2014	1.7
Mean: 289.5	22Sep2014	1.3
50%: 289.6	07Nov2014	0.7
25%: 289.3		
Min: 288.1		



Tributary Logger 10338547		
		Water
Feet:	WSE	Depth
Max:	292.3	2.2
75%:	291.1	1.0
Mean:	291.1	1.0
50%:	291.1	1.0
25%:	291.0	0.9
Min:	291.0	0.9

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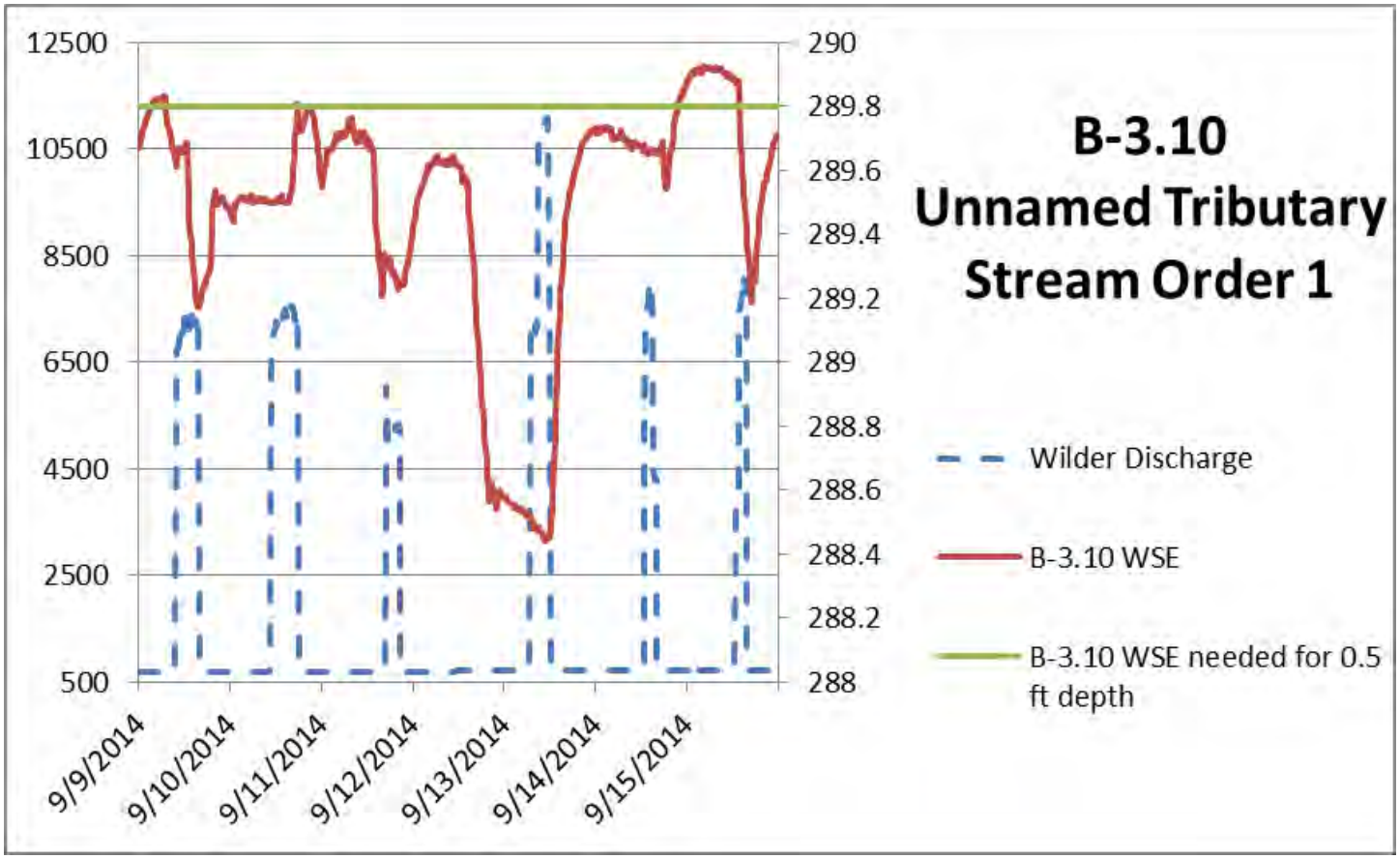
Study 13 – Tributary and Backwater Fish Access and Habitats

Potential Project-affected site B-3.10, 16 miles upstream of Bellows Falls dam Access limited 68.3% of the time



Similar graph using Bellows Falls discharge

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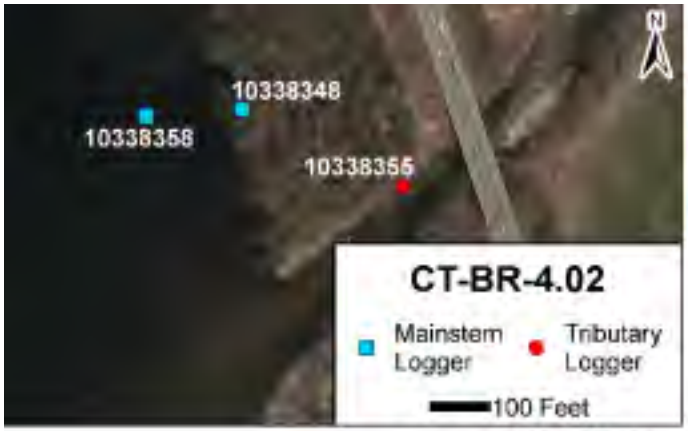
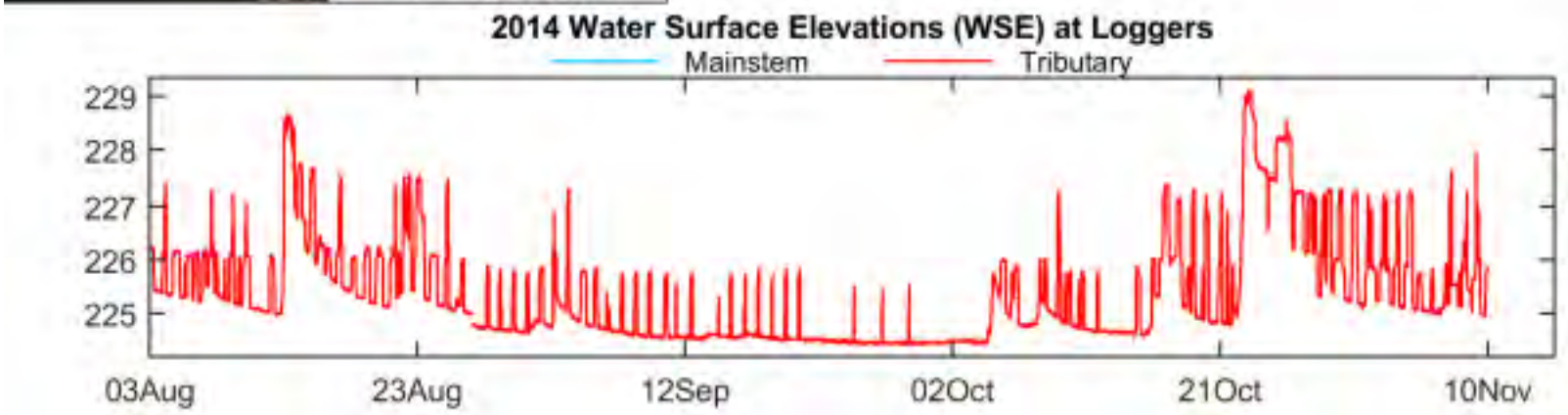
Study 13 – Tributary and Backwater Fish Access and Habitats

Example Study Site (BR-4.02 Cold River from Report Appendix A)



Bellows Riverine, Connecticut River
Site ID: CT-BR-4.02
Cold River, Major tributary, Stream Order 5



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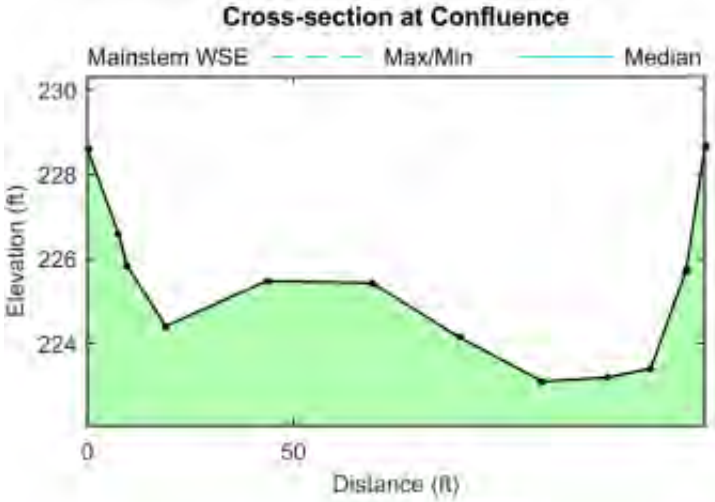
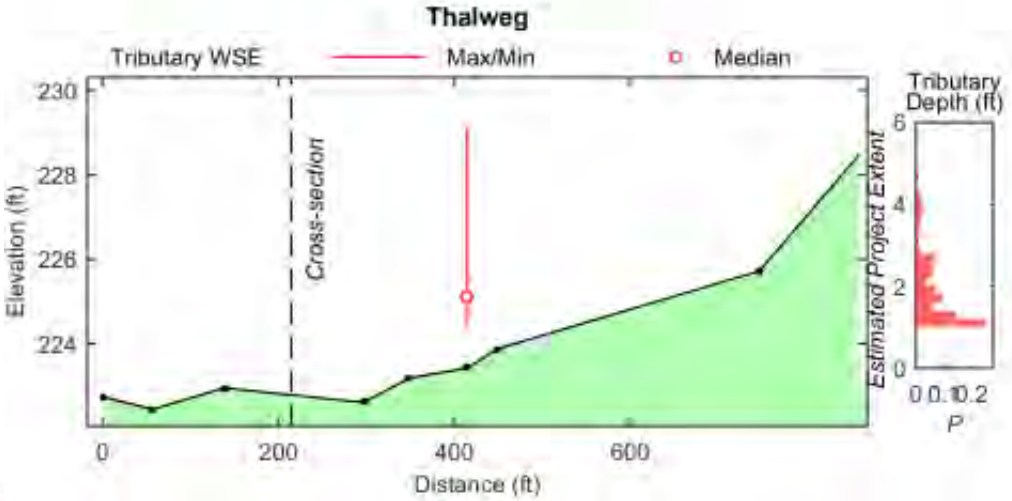
Example Study Site (BR-4.02 Cold River from Report Appendix A)



Date	Maximum Measured Water Depth (ft)
21Jul2014	1.9
27Aug2014	0.8
22Sep2014	1.2
10Nov2014	2.9



Tributary Logger 10338355		
Feet:	WSE	Water Depth
Max:	229.1	5.7
75%:	225.9	2.5
Mean:	225.4	2.0
50%:	225.1	1.7
25%:	224.6	1.2
Min:	224.4	1.0

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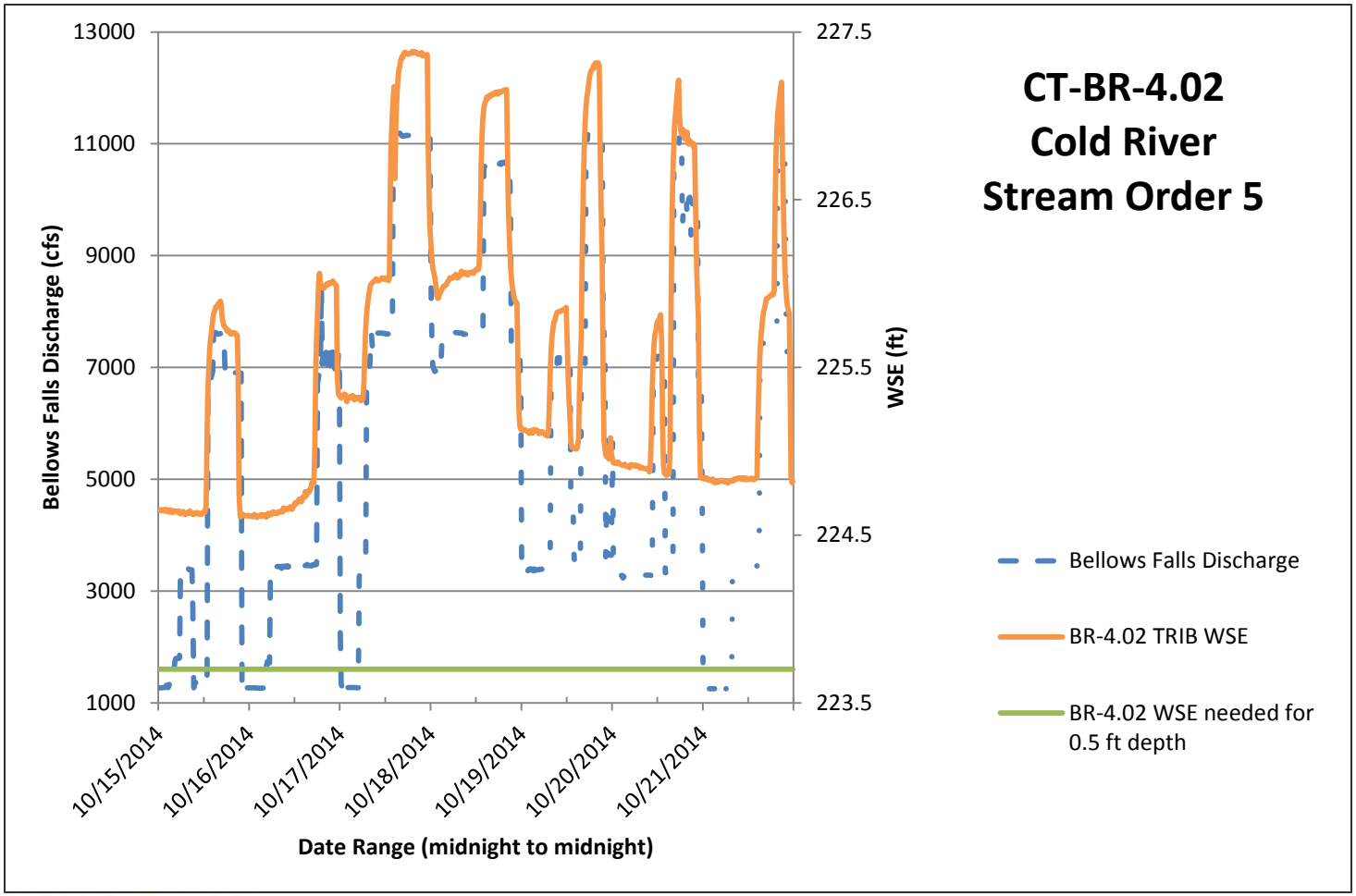
Study 13 – Tributary and Backwater Fish Access and Habitats

Site BR-4.02 Cold River - Unlikely to Have Project Effects



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Study 14
Resident Fish Spawning in Impoundments Study

Study Results

Field work completed from late April – early July, 2015

- Tributary Egg-Block Sampling (walleye & sucker): April 21 to May 27, 2015
  - 162 egg blocks deployed at 16 tributary sites, resulting in 3 collections of white sucker eggs in early May:
    - Lower Olivarian Brook and lower Hewes Brook
    - Most blocks had <5 eggs thus spawning likely occurred some distance upstream.

Study 14 – Resident Fish Spawning in Impoundments

Example of Egg Blocks at Tributary Mouth

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Study Results - continued

- Backwater Sampling: April 28 to July 2, 2015 at 12 sites
  - yellow perch, largemouth bass, bluegill, and pumpkinseed observed spawning or with eggs or nest activity.
  - No spawning activity observed for northern pike, chain pickerel, black crappie, ripe golden shiner, spottail shiner and eastern silvery minnow (some of these species were collected in Study 10 including 3 eastern silvery minnow in Wilder impoundment, but no observation of spawning aggregations)
  - Water clarity limited observations to shallow areas mostly <3-4 ft (less during high flow events)
  - Larval fish trawls yielded 1,161 larvae of target species (1 chain pickerel larva)

Study 14 – Resident Fish Spawning in Impoundments

Yellow perch egg masses

left image shows masses partly out of water, right image is all under water

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Study 14 – Resident Fish Spawning in Impoundments

Example of Backwater Surveys

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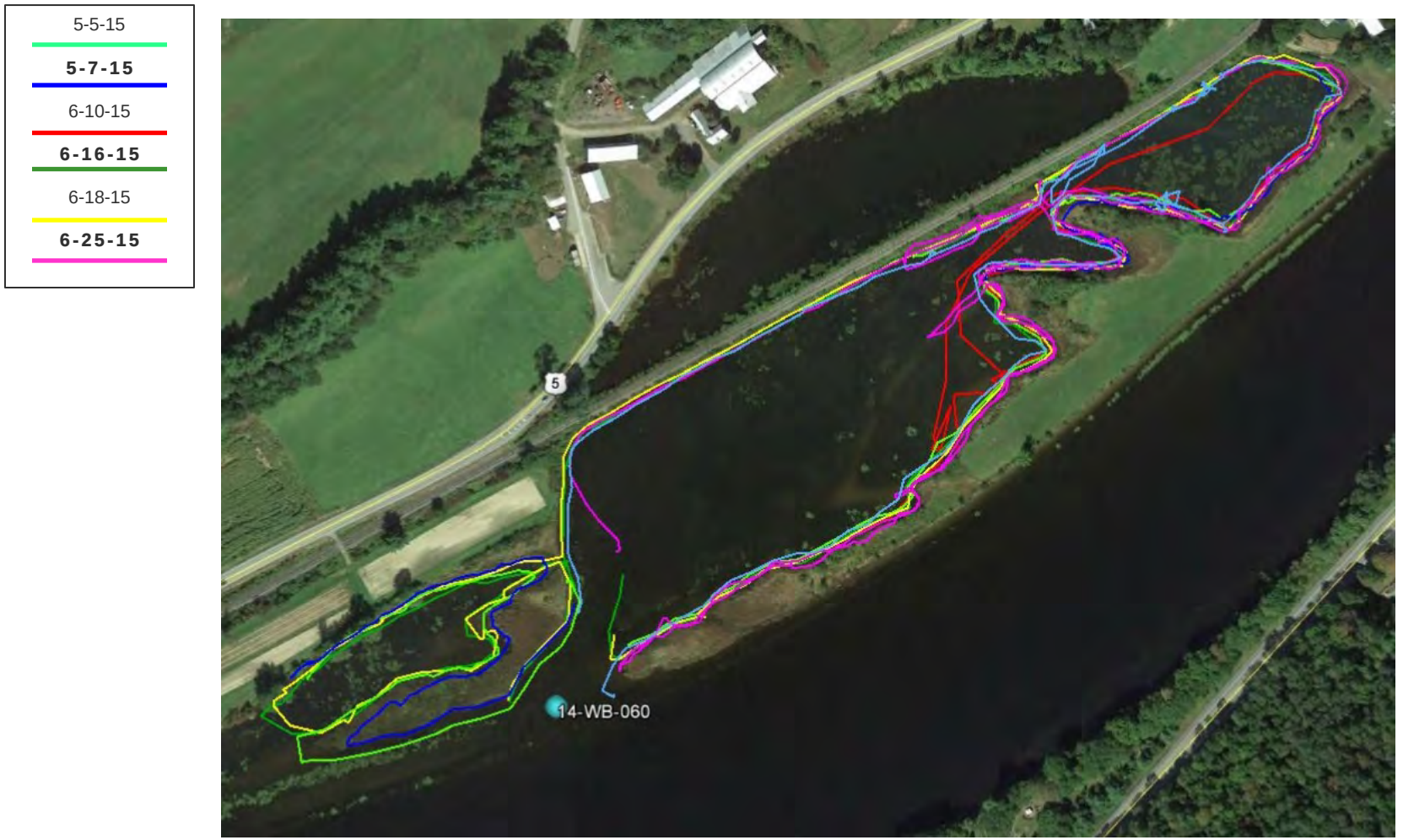
Study 14 – Resident Fish Spawning in Impoundments

Example of Backwater Showing Survey Tracks



Study Results - continued

- Tributary Nest Sampling (smallmouth bass & fallfish): May 22 to July 2, 2015 at 17 sites
- fallfish and smallmouth bass spawning activity observed

Remaining Activities

- QA/QC of the backwater and tributary nest data files
- Analysis of the relationship between egg and nest elevations and localized changes in water surface elevations (WSEs)
- Evaluation of project effects using modeling
- Issue study report

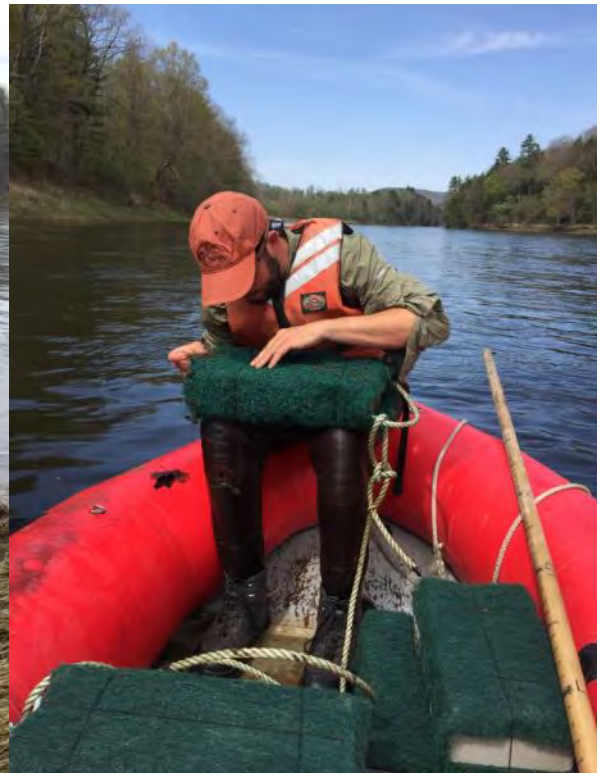
Study 15
Resident Fish Spawning in Riverine Sections Study

Study Results

- Riffle Egg-Block Sampling (walleyes & suckers): April 16 to June 5, 2015
    - 100 egg-blocks were deployed in 12 riffle habitats and were fished for a total of 2,080 block-days
    - No white sucker eggs were captured, and only 1 walleye egg was collected (lower reach of the Cold River) suggesting that walleye spawning occurred well upstream of the block sites.

Study 14 – Resident Fish Spawning in Impoundments

Example of Egg Blocks in Mainstem Riffles



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Study 15 – Resident Fish Spawning in Riverine Sections

Riffle egg-block site at Cold River, showing egg-block locations (red squares). Walleye egg was found on block A.

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Study Results - continued

- Island/Bar Nest Sampling (smallmouth bass & fallfish): May 20 to June 26, 2015. Sampling continued into July but water conditions prevented collection of additional spawning data
    - 12 island/bar habitats surveyed
    - Active smallmouth bass nests were observed at 8 sites
    - Fallfish nests were observed at 7 sites
    - Gravid spottail shiners were captured in the Wilder riverine reach, but no spawning activity or sites were found
    - Rosyface shiners were observed to exhibit spawning-related behaviors over an existing fallfish nest

Study 15 – Resident Fish Spawning in Riverine Sections

Recent and active smallmouth bass and fallfish nests were observed and monitored at many sites.

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Study 15 – Resident Fish Spawning in Riverine Sections

Rosy faced shiner spawning aggregation over a fallfish nest in the Wilder riverine reach (site WI-004 just below Sumner Falls). .

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Study 15 – Resident Fish Spawning in Riverine Sections

Male Rosy faced shiner

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Study 15 – Resident Fish Spawning in Riverine Sections

Remaining Activities

- QA/QC of all spawning data files
- Analysis of the relationship between egg and nest elevations and localized changes in water surface elevations (WSEs)
- Evaluation of project effects using modeling
- Issue study report

Study 16
Sea Lamprey Spawning Assessment

Study 16 – Sea Lamprey Spawning Assessment

Study Progress

- 40 migrating sea lamprey collected from Vernon Fish Ladder, radio tagged and released ~ one mile upstream of the Vernon and Bellows Falls Projects (20 each). 18 females, 8 males, and 14 unknown (likely males)
- Tracking with boat and aircraft from Stebbins Island to Wilder Dam, and major tributaries, generally to the first obstruction
- Redd capping attempted on four nests at 3 sites where nest building was actively observed
- High flows persisted through much of the season with elevated velocities, water surface elevations, and turbidity, limiting deeper water observation at some sites
- Those sites were revisited in low flow conditions (August) and remnant nests were searched for, and nest elevations recorded

Study 16 – Sea Lamprey Spawning Assessment

Connecticut River Fish Passage Counts

- Wilder: 2
- Bellows Falls: 971
- Vernon: 2,519
- Turners Falls: 8,423
- Holyoke; 22,245

Sea Lamprey in Vernon Fish Ladder

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Study 16 – Sea Lamprey Spawning Assessment

Study Results

- 37 of 40 tagged lamprey were relocated in manual tracking, additionally at least one position fix made for 18 tagged lamprey released downstream for FirstLight relicensing studies

Sea Lamprey nest building

Tagging Sea Lamprey, Vernon Dam

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Study 16 – Sea Lamprey Spawning Assessment

Study Results

- 23+ sites were assessed for spawning activity based on habitat suitability and radio telemetry;
  - Active spawning behavior was observed or nests were identified at 14 sites
  - At another 2 (tributary) sites tagged lamprey were tracked upstream of the project affected area, but no spawning behavior was identified in the project affected area
  - At another site possible remnant nest was identified.

Characterizing Sea Lamprey redds

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Study 16 – Sea Lamprey Spawning Assessment

Study Results

- No ammocoetes were collected from redd caps.
- Nest micro-habitat was being altered within the redd caps
- Redd capping terminated followed an agency consultation conference call on August 27, 2015
- Post-emergent ammocoetes were collected in 6 samples in Study 21 - American Shad Telemetry Study
- Preliminary data - one or more ammocoeates were collected in Study 10 – Fish Assemblage Study

Redd caps in varying habitat, Partridge Brook and Black River

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Remaining Activities

- QA/QC of all spawning data files
- Analysis of the relationship between egg and nest elevations and localized changes in water surface elevations (WSEs)
- Evaluation of project effects using modeling
- Issue study report

Study 21
American Shad Telemetry Study

Study Results – Tagging/Tracking

- Field-work began in May 2015 and continued into early July
- 100 adult American shad were collected from the Holyoke fishlift, tagged and released at Northfield, MA on May 10, 14, and 28, 2015.
    - 52 were tagged with both a radio tag and PIT tag
    - 48 were only PIT tagged.
    - 50 each, male and female
    - Water temperatures at the time of release ranged from 13.4-16.1^{o}C
- 54 additional shad were collected at the Vernon fish ladder, radio-tagged, and released into the Vernon impoundment May 17, 24, and 30 2015.
    - 37 male, 17 female
    - Water temperatures at the time of release ranged from 13.4-16.1^{o}C
- Shad were manually tracked from lower end of Stebbins Island upstream to the Bellows Falls tailrace

Study 21 – American Shad Telemetry Study

Tagging and tracking of adult shad

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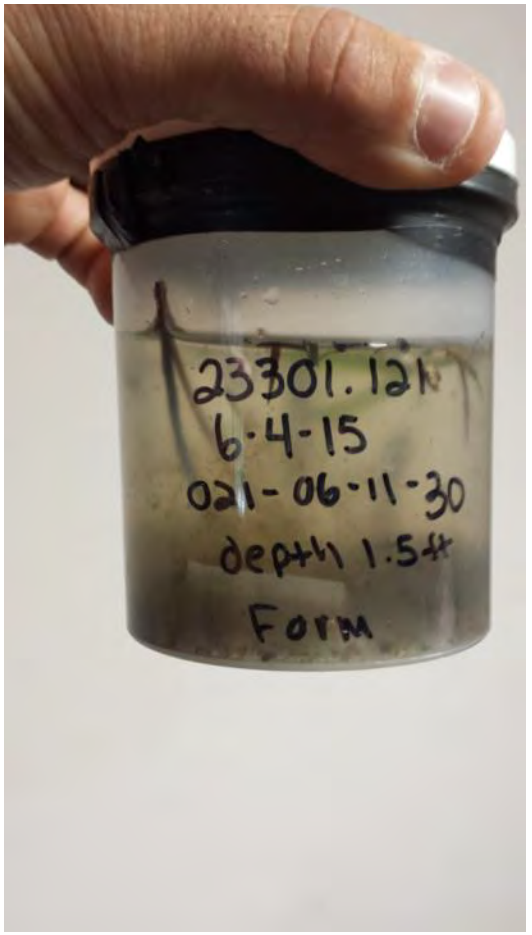
Study Results - Spawning

- Trawls performed for 2 nights above Vernon, 1 night below Vernon and repeated
- A few areas of concentration noted were the Vernon tailrace, and downstream of Bellows Falls
- Tailraces held significant numbers of shad, especially BF to Dunshee Island
- Higher gradient (tributary gravel/cobble bars) held more shad during spawning and staging
- Very little splashing occurred on spawning events
- 120 individual ichthyoplankton net samples (at 60 trawl locations) were collected on 30 nights between 26 May and 2 July, 2015.
- Shad eggs were successfully collected in all study areas
- 792 American shad eggs and larvae were collected in 46 samples from below and above Vernon Dam.
    - 774 (98%) were eggs
    - 9 (1%) were yolk sack larvae (YSL)
    - 9 (1%) were post yolk sack larvae (PYSL)

Study 21 – American Shad Telemetry Study

Night trawling

Egg sample collection



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Remaining Activities

- Data analysis in progress
- Evaluation of project effects using modeling
- Issue study report

Study 7
Aquatic Habitat Mapping

Study 7 – Aquatic Habitat Mapping

Study Summary

- Study completed in 2013 and report filed March 2, 2015
- Data on impoundment bathymetry, riverine mesohabitat, and water level logger locations is in geo-database on website, and summarized in the study report
- Data used for habitat selection in 2014 and 2015 studies and for modeling

Additional Related Effort

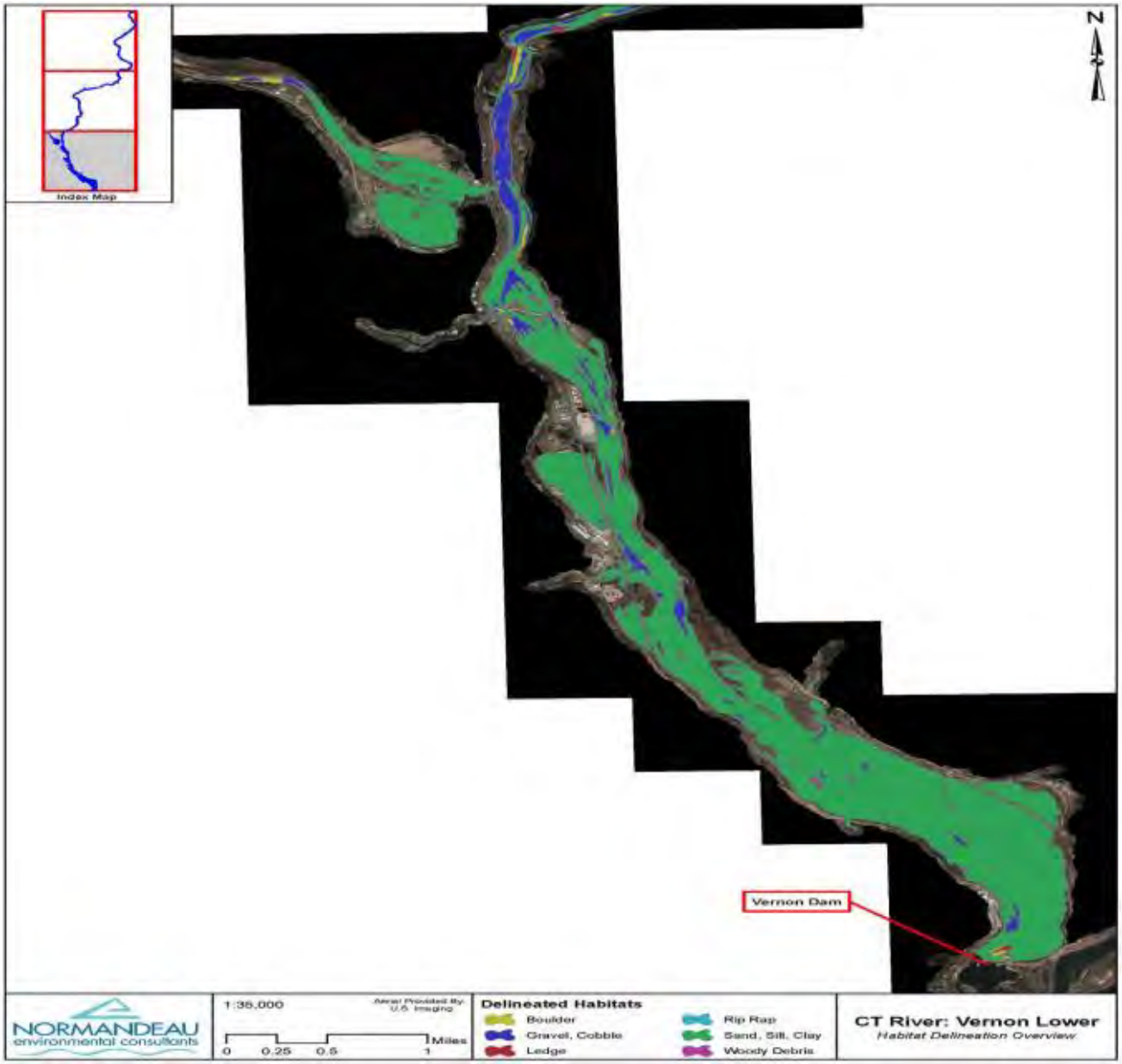
- 5 of 9 water level loggers overwintered 2013/2014 were downloaded in 2014 (3 were lost and replaced, 1 not downloaded).
- Data was filed March 2, 2015 and re-filed (revised) with USR
- 9 loggers were successfully overwintered 2014/2015 and data was filed with USR

Study 7 – Aquatic Habitat Mapping

Example maps (from ISR Meeting)

Overview of lower Vernon impoundment aquatic habitat

(image stretched)



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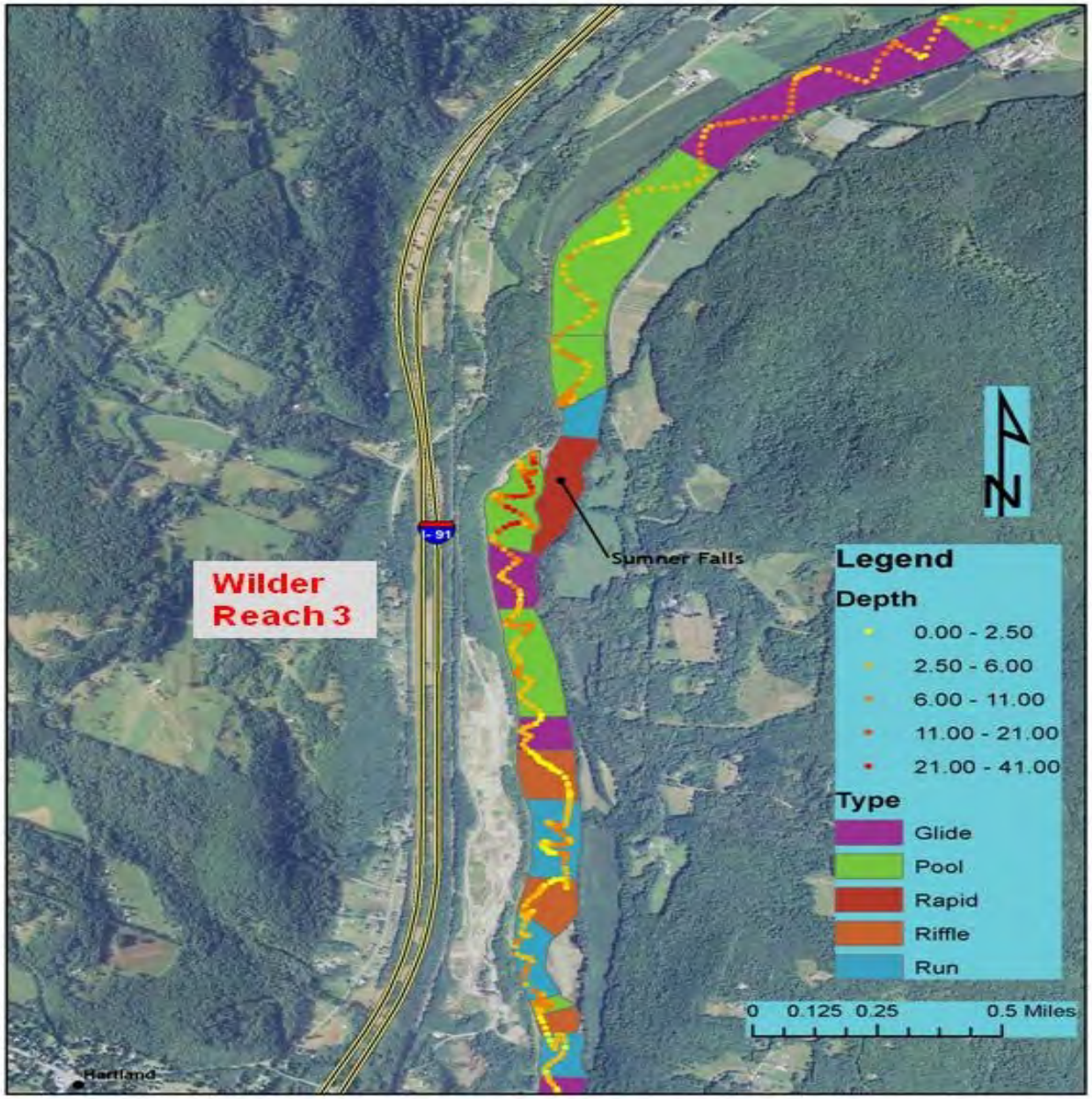
Study 7 – Aquatic Habitat Mapping

Overview of upper Wilder riverine aquatic habitats

(image stretched)



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Study 8

Channel Morphology and Benthic Habitat Study

Study 8 – Channel Morphology and Benthic Habitat Study

Study Summary

Field Data Collection Completed:

- Round 1: July & August 2014
- Round 2: October 2014

Field Data Collected:

- Pebble counts and embeddedness
- Point locations (GPS)
- Photographs

Data Analysis:

- Material size gradation curves
- Average embeddedness

Assessment:

- Characteristics & distribution of coarse-grained sediment

Study Report Submitted:

- March 2, 2015

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Study Site 08-M07. Mid-channel bar upstream from Sumner Falls (riverine reach below Wilder).

Transect 1 at Study Site 08-M07. Representative substrate.

Field Data Analysis

Pebble Count Data

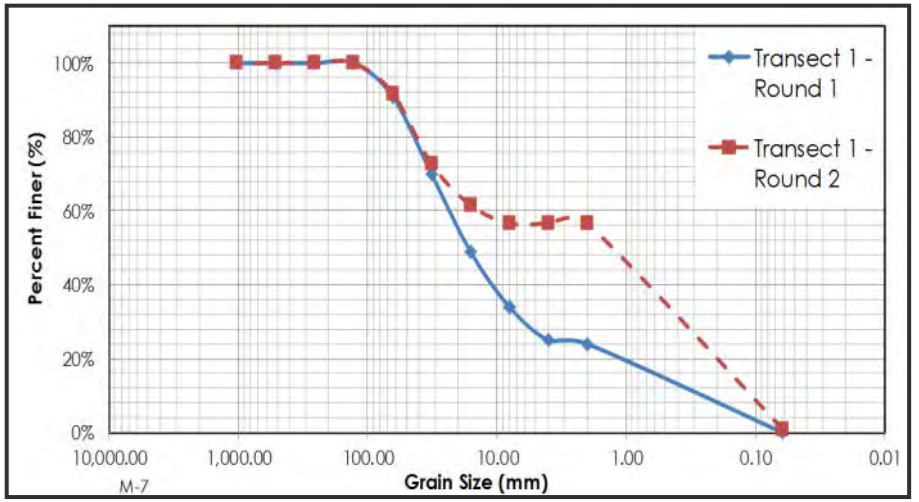
- Material size gradation curves developed
  - Particles categorized using Wentworth Scale
  - Gradations based on average size for each class

- **Spatial Variation**
  - Comparison between transects
  - Comparison between sites

- **Temporal Variation**
  - Comparison of Round 1 and Round 2 data

PERCENT FINER (By Transect)

Wentworth Size Class		Size range (mm)	TRANSECT 1		TRANSECT 2		TRANSECT 3	
			Round 1	Round 2	Round 1	Round 2	Round 1	Round 2
Silt/Clay	Silt/Clay	<0.062	0%	0%	0%	0%		
Sand	Sand	0.062 - 2.0	0%	1%	0%	0%		
Gravel	Very Fine	2-4	24%	57%	23%	42%		
	Fine	4-8	25%	57%	25%	43%		
	Medium	8-16	34%	57%	28%	45%		
	Coarse	16-32	49%	62%	50%	49%		
	Very Coarse	32-64	70%	73%	74%	67%		
Cobble	Small	64-128	91%	92%	94%	90%		
	Large	128-256	100%	100%	100%	100%		
Boulder	Small	256-512	100%	100%	100%	100%		
	Medium	512-1024	100%	100%	100%	100%		
	Large - Very Large	1024-4096	100%	100%	100%	100%		
Bedrock	Bedrock	-	100%	100%	100%	100%		



Particle Size Distribution. Study Site 08-M07.

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Field Data Analysis

Condition Category	Poor	Marginal	Suboptimal	Optimal
Embeddedness Score	1–5	6–10	11–15	16–20
% Embeddedness	>75%	75–50%	50–25%	25–0%

Embeddedness Scores and Condition Categories. Rapid Bioassessment Protocols for Use In Wadeable Streams and Rivers (Barbour et al., 1999).

Embeddedness Data

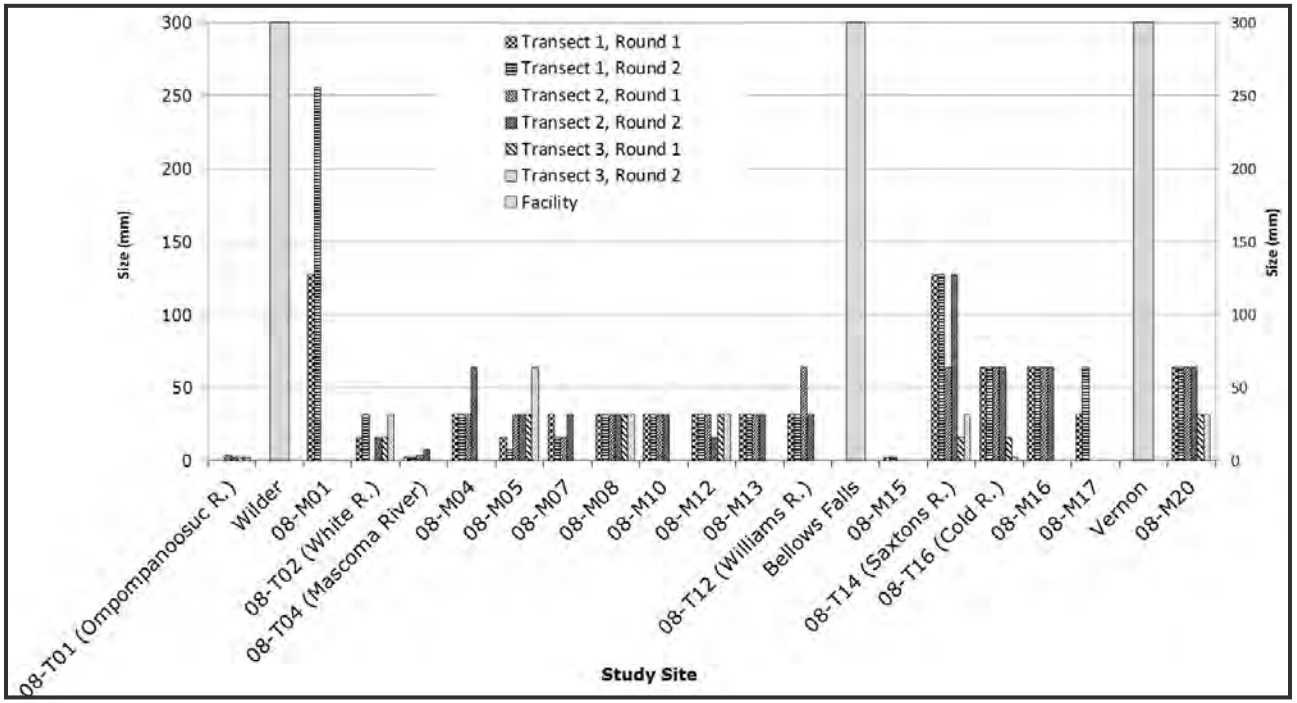
- Average embeddedness scores and condition categories based on % embeddedness
- Embeddedness categories presented in tabular format for analysis

Study Site	Transect 1		Transect 2		Transect 3	
	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2
08-T01	N/A	N/A	Poor	Poor	Poor	Poor
08-T02	Optimal	Suboptimal	Marginal	Marginal	Suboptimal	Suboptimal
08-T04	Poor	Poor	Poor	Marginal	-	-
08-T12	Marginal	Suboptimal	Optimal	Suboptimal	-	-
08-T14	Optimal	Optimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal
08-T16	Optimal	Optimal	Optimal	Suboptimal	Suboptimal	Marginal

Average Embeddedness Condition Categories at tributary study sites.

Summary of Findings from Field Data Analysis

- Coarse gravel dominant at study sites between Wilder and Bellows Falls Dams
- Very coarse gravel dominant at study sites downstream from Bellows Falls Dam
- Characteristics and influences of tributary sediment supply varies by tributary
- Temporal variability of particle size limited within study period
- Temporal variability of embeddedness trended towards increased embeddedness in Round 2



Median-Diameter Particle Size at Mainstem and Tributary Study Sites

Study 8 – Channel Morphology and Benthic Habitat Study

Remaining Activities

Review of Information Provided in Other Studies

- Studies 1, 2, and 3 (Erosion Studies)
- Study 4 (Hydraulic Modeling Study)
- Study 5 (Operations Study)

Additional Analysis Based on Pending Studies

- Sources and influences of sediment recruitment
- Temporal and spatial patterns of coarse-grained benthic habitat availability
- Availability and stability of coarse-grained benthic habitat over range of flows
- Assessment of project effects

Study Site 08-M08. Mid-channel bar downstream from Sumner Falls (riverine reach below Wilder).

Transect 3 at Study Site 08-M08. Representative substrate.

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Study 9
Instream Flow Study

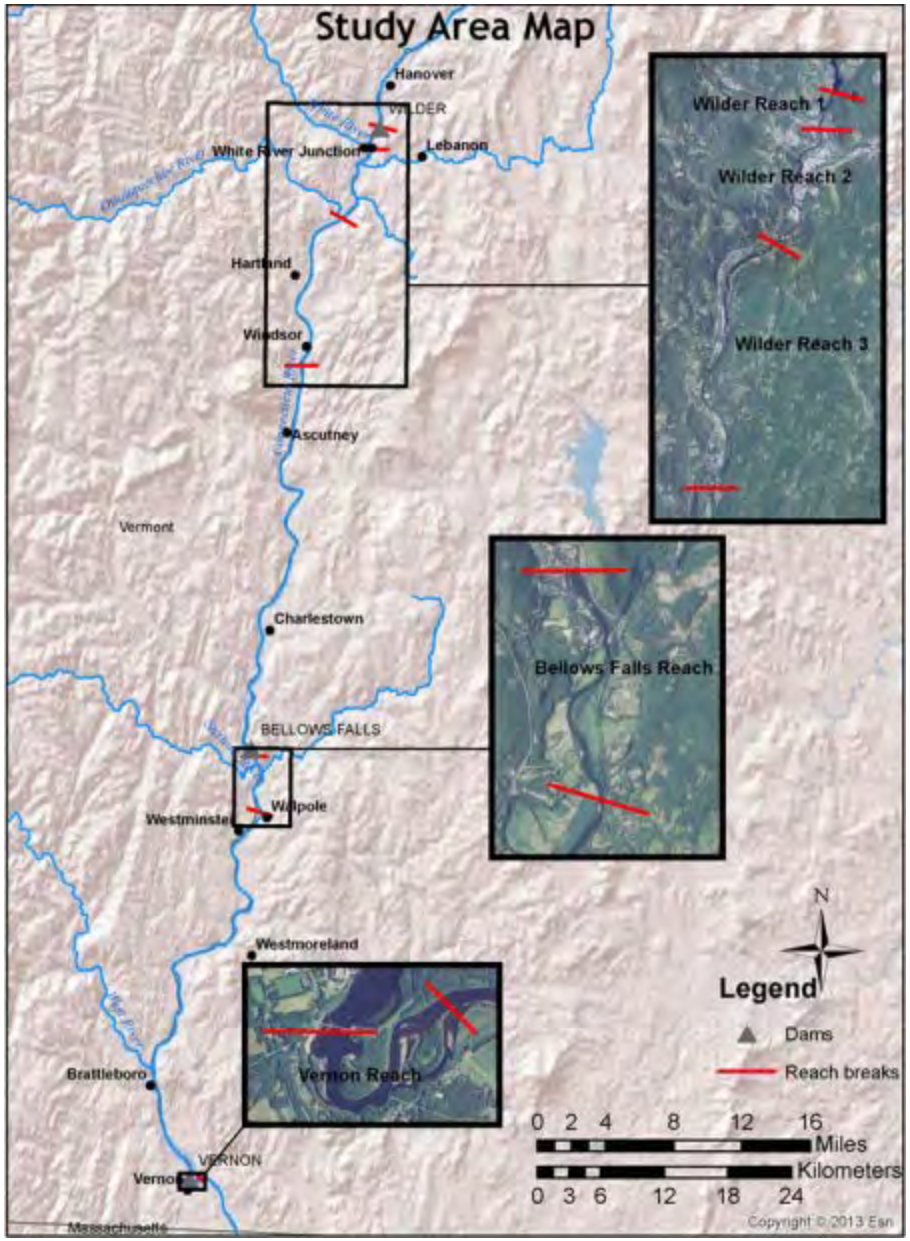
Study Progress Since 2014

- High flow measurements on 1D transects
  - Wilder, Bellows and Vernon reaches (May 2015)
- HSC proposed
  - Comments and recommendations received
- Bellows Falls bypassed reach transects selected
  - 7 transects selected; measured 2 flows (October 2014, and May 2015)
- Sumner Falls demonstration flow
  - 5 transects established to provide information on changes in average depth and wetted width; flows observed in August 2015
- Calibration of 1D transects and 2D sites ongoing
- Preliminary habitat modeling results

Study 9 – Instream Flow Study

Study Area

- Wilder Reach 1 – 9 transects
- Wilder Reach 2 – 15 transects plus a 2D site
- Wilder Reach 3 – 13 transects plus a 2D site
- Bellows Falls Reach – 19 transects
- Vernon Reach – 10 transects
- Bellows Falls bypassed reach – 7 transects



TransCanada

Study Progress

	Target Flows		
	Low (cfs)	Middle (cfs)	High (cfs)
Wilder Reach 1	700-2,000	5,000	10,000-12,000
Wilder Reach 2	700-2,000	5,000	10,000-12,000
Wilder Reach 3	700-2,000	5,000	10,000-12,000
Bellows Falls	1,300-2,000	4,500-7,500	9,000-11,000
Vernon	1,600-2,500	5,000-7,500	10,000-12,000

	Measured Flows		
	Low (cfs)	Middle (cfs)	High (cfs)
Wilder Reach 1	793	5,650	12,057
Wilder Reach 2	1,392	6,598 - 7,340	12,899 - 13,788
Wilder Reach 3	1,661 - 1,737	6,550 - 6,969	15,419 - 16,926
Bellows Falls	1,824 – 1,880	5,400 – 5,575	11,439 – 12,298
Vernon	2,035	4,100 and 8,600	12,550

Ranges indicate measurements over multiple days or conducted under varying flow levels

Study 9 – Instream Flow Study

HSC

	Species	Life stage	Periodicity	Study Reaches	Addition	Comment
1	Shad	J	June 7 - Nov 30	V, B		
2	Shad	A	May 1 - June 30	V, B		
3	Shad	S	May 1 - July 15	V, B		
4	Walleye	FR	May 1 - July 1	V, B, W		
5	Walleye	J	Year round	V, B, W		
6	Walleye	A	Year round	V, B, W		
7	Walleye	S	April 1 - May 31	V, B, W		
8	Fallfish	FR	June 1 - July 1	V, B, W		
9	Fallfish	J	Year round	V, B, W		
10	Fallfish	A	Year round	V, B, W		
11	Fallfish	S	May 1 - June 30	V, B, W		
12	W sucker	FR	June 1 - Sep 30	V, B, W		
13	W sucker	J	Year round	V, B, W		
14	W sucker	S	April 1 - June 30	V, B, W		
15	LN dace	J	Year round	TBD	Yes	If found in reach
16	LN dace	A	Year round	TBD	Yes	If found in reach
17	LN dace	Y	July 1 - Sep 30	TBD	Yes	If found in reach
18	Tess. Darter	A	Year round	V, B, W		Revised
19	Sea lamprey	S	May 1 - July 15	V, B, W		
20	SM bass	Y	July 1 - Sep 30	V, B, W		
21	SM bass	J	Year round	V, B, W		
22	SM bass	A	Year round	V, B, W		
23	SM bass	S	May 1 - June 30	V, B, W		
24	Macroinvertebrates		Year round	V, B, W		
25	Rainbow trout	A	Year round	V, B, W	Yes	Cover TBD
26	GHC shallow-fast	SF		V, B, W	Yes	
27	GHC shallow-slow	SS		V, B, W	Yes	
28	GHC deep-fast	DF		V, B, W	Yes	
29	GHC deep-slow	DS		V, B, W	Yes	

Abbreviations

A	adult
J	juvenile
S	spawning and incubation
Y	young-of-year
FI	fingerling
FR	fry
GHC	Generalized habitat criteria
B	Bellows Falls
V	Vernon
W	Wilder

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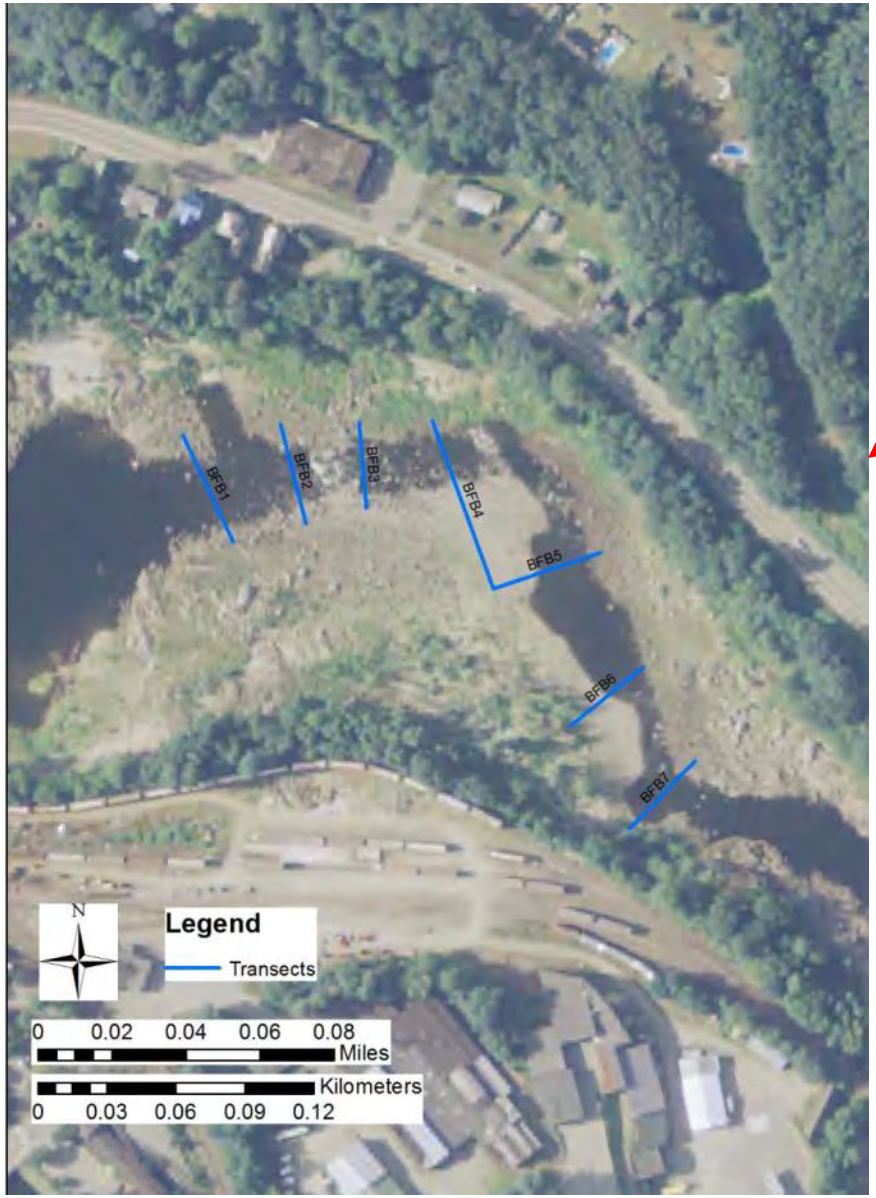
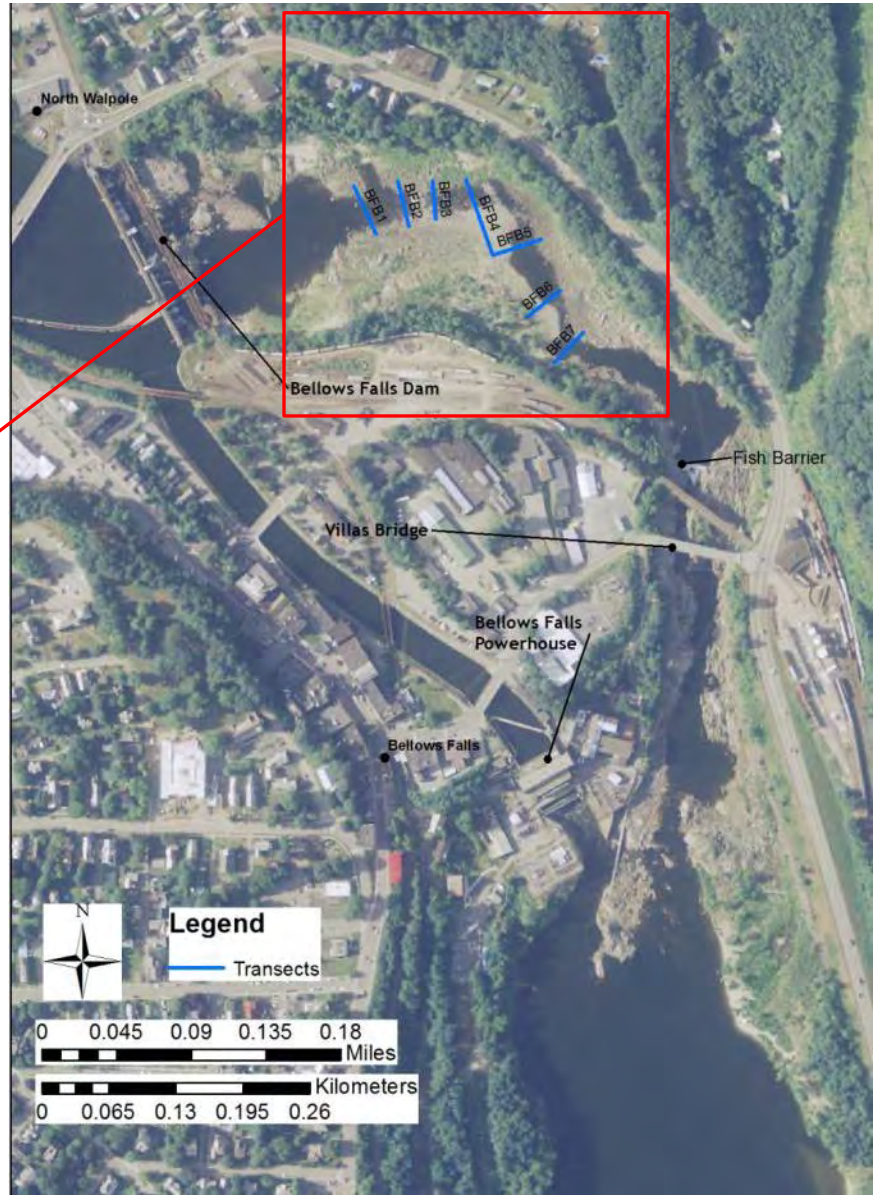
Study 9 – Instream Flow Study

Bellows Falls bypassed reach





Study 9 – Instream Flow Study

Bellows Falls bypassed reach – Transect 1

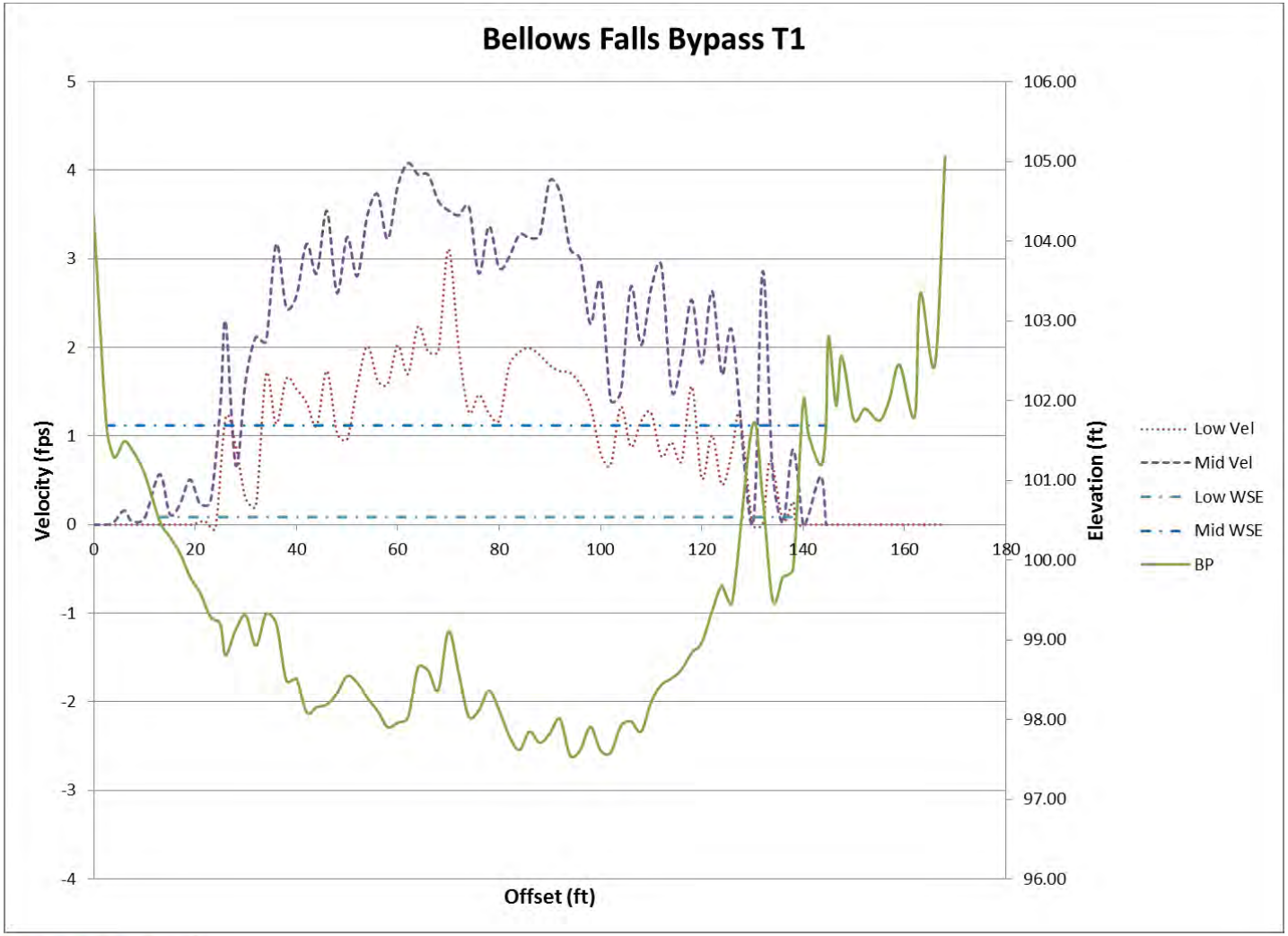
285 cfs

920 cfs

TransCanada

Study 9 – Instream Flow Study

Bellows Falls bypassed reach



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Study 9 – Instream Flow Study

Bellows Falls bypassed reach – Transect 3

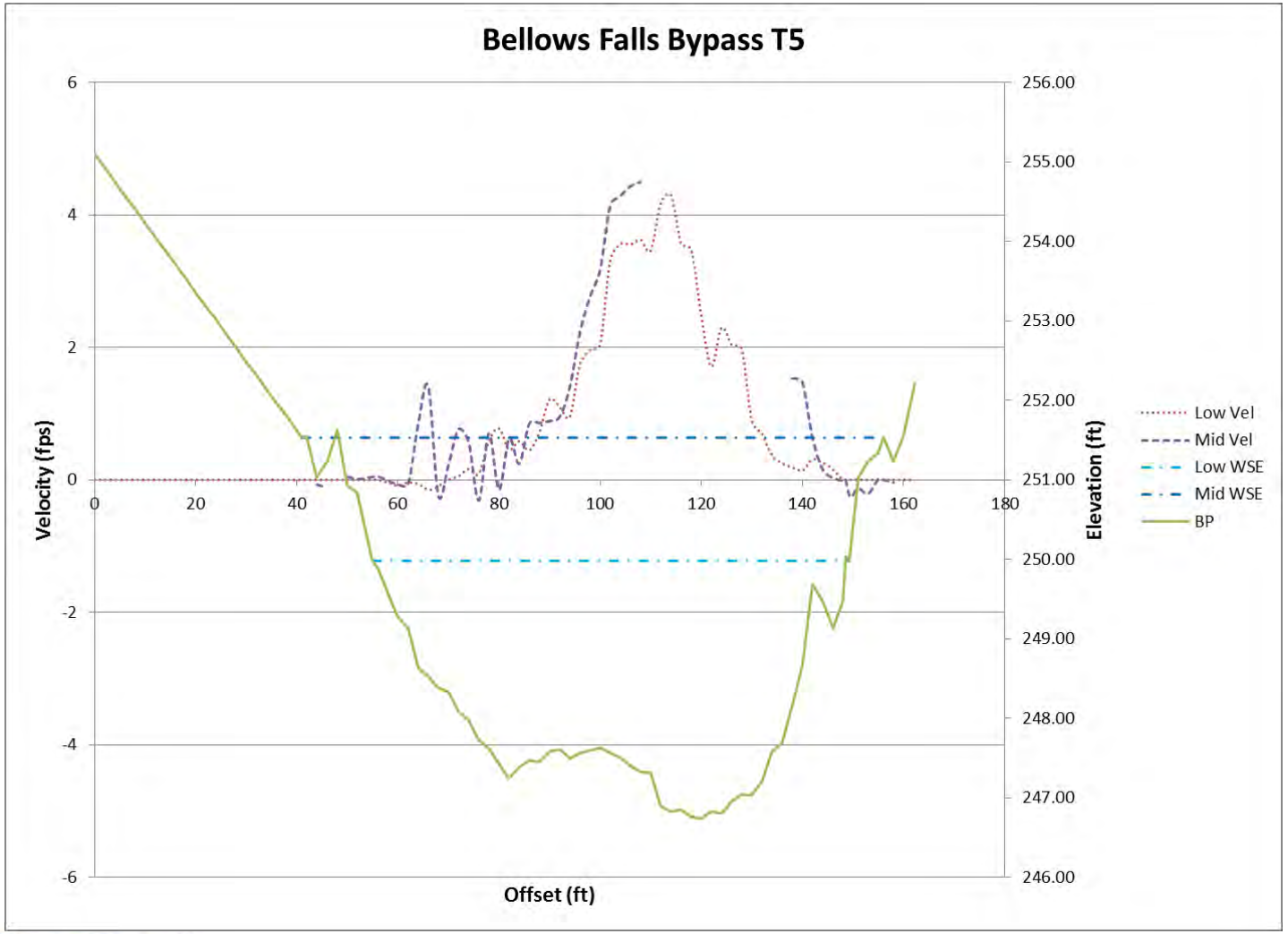
285 cfs

920 cfs

TransCanada

Study 9 – Instream Flow Study

Bellows Falls bypassed reach



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Sumner Falls Demonstration Flow

- 5 transects established in upper portion of Sumner Falls
- Bottom profiles surveyed
- Gages (4 foot rebar painted with 1/10 foot increments) placed on both banks and strategically placed across transects
- 4 flow levels observed
- Discharge measured at the site using ADCP
- Aerial photos taken at each flow level
- Changes in water surface elevation noted at each flow level by reading gages

Sumner Falls Demonstration Flow

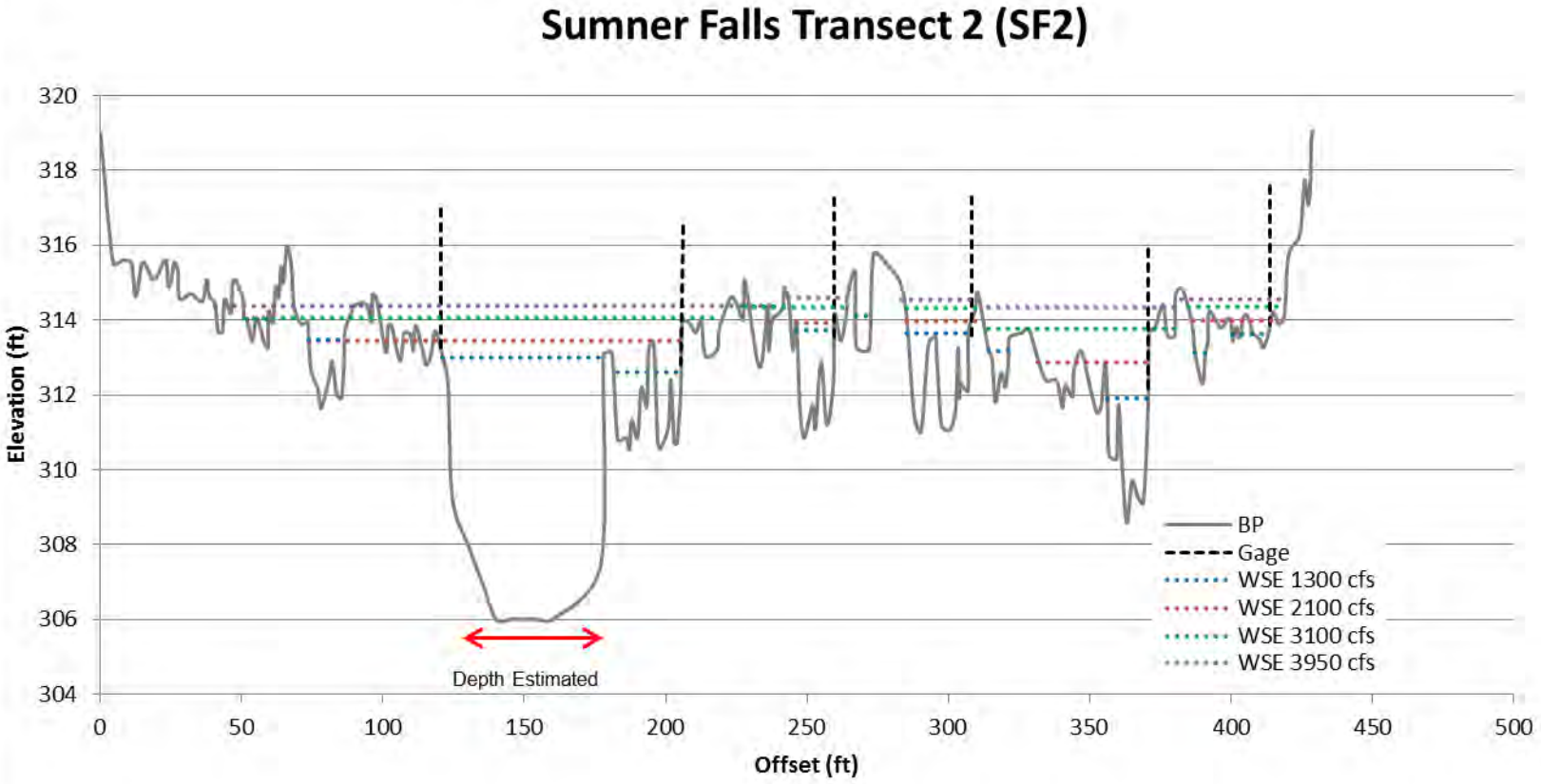
Sumner Falls Demonstration Flow

Sumner Falls
Discharge 8/5/2015
ADCP

Start Time	Flow (ft^3/s)
13:06	2088
13:09	2068
14:40	2803
14:44	2725
15:19	2904
15:24	3021
15:58	3063
16:02	3178
17:40	3732
17:58	3942

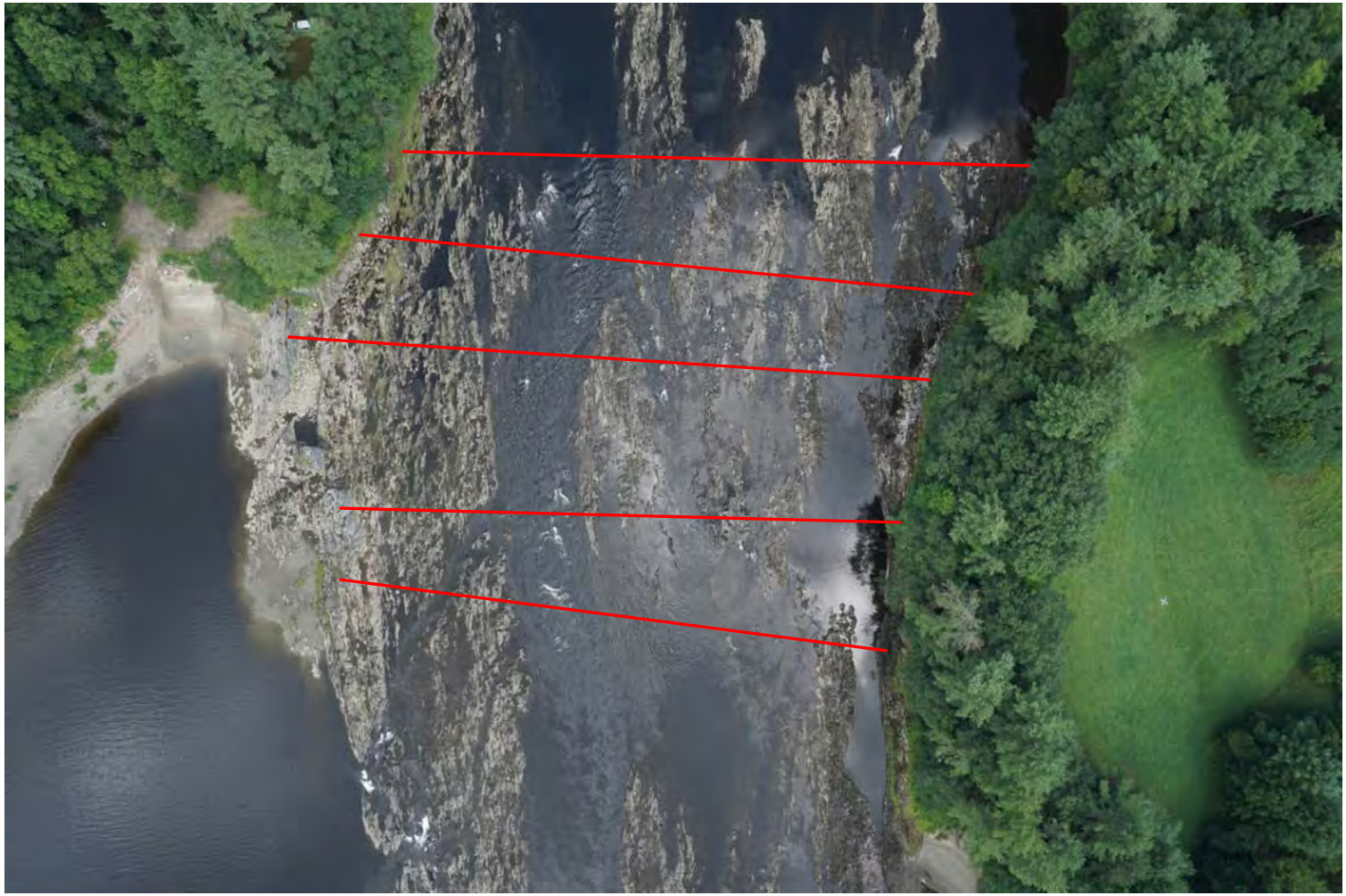
Time	Flow at Wilder	Flow at Sumner	Change (+)
start	700	1350	
13:00	1500	2078	728
16:00	2500	3121	1043
18:00	3500	3942	822

Sumner Falls Demonstration Flow



Study 9 – Instream Flow Study

Sumner Falls Demonstration Flow – 1,350 cfs



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Study 9 – Instream Flow Study

Sumner Falls Demonstration Flow – 2,100 cfs

TransCanada

Study 9 – Instream Flow Study

Sumner Falls Demonstration Flow – 3,100 cfs

Study 9 – Instream Flow Study

Sumner Falls Demonstration Flow – 3,950 cfs

TransCanada

Study 9 – Instream Flow Study

Remaining Activities:

- Final calibration of 1D transects in Vernon and Bellows Falls bypassed reach, and 2D models
- Select flows to model – primarily for 2D modeling
- Determine species/life stages to model in Bellows Falls bypassed reach
- Produce habitat versus discharge modeling results
  - Will assist in determining flow pairs and combinations to model for dual-flow analysis (flow fluctuations).
  - Select species/life stages for dual flow analysis.
  - Habitat modeling results to be used in time series analysis for various operational scenarios.

LUNCH BREAK – 30 Minutes

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Study 30

Recreation Facility Inventory, Use and Needs Assessment

TransCanada

Study 30 – Recreation Facility Inventory, Use & Needs

Study Objectives

- Characterize:
  - condition of existing recreation facilities and access sites
  - recreation use and opportunities, and
  - present and future use estimates;
- Conduct an assessment of the need to enhance recreation opportunities and access
- Present use and opportunities within the larger context of regional opportunities
- Photograph views from public recreation facilities to document existing aesthetic conditions
- Lay the foundation for preparation of a Recreation Management Plan

TransCanada

Study 30 – Recreation Facility Inventory, Use & Needs

Study Progress:

- 1 year of on-site data collection
- March 2014 – February 2015

Study Results:

- 577 interviews
- 2,702 spot counts
- 4,195 days of traffic count data
- 263 returned mail surveys

- The CT river is a significant feature in Vermont and New Hampshire
- The main reason regional residents don't recreate at or near the Projects
    - Not interested
    - Unable to participate (e.g., health)

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Study 30 – Recreation Facility Inventory, Use & Needs

Study Results – continued

- 617,000 recreation days at study sites
- Public boat launches were below capacity most of the year
- Public site users were satisfied with the type and number of facilities
- Recommendations called for more boat ramps, launches, river access for fishing, park amenities (e.g., tables, benches), and walking trails.
- Routine maintenance and upgrades were documented at many public ramps

Remaining Activities

- Finalize study report (In draft now)

Study 31

Whitewater Boating Flow Assessment Bellows Falls and Sumner Falls

TransCanada

Study 31 – Whitewater Boating Flow Assessment

Study Objectives

- Identify recreational paddling opportunities at Sumner Falls and determine the suitability of the Bellows Falls bypassed reach for whitewater boating
- Describe flow-quality relationships at each location and identify acceptable and optimal ranges for each study site
- Describe potential effects of project operations on paddling at each location and identify boaters' sensitivity to current operations regimes (e.g., project discharges ranging from minimum flow to full generation)
- Broadly characterize recreational paddling-relevant hydrology of the existing operating regime and qualitatively describe the relationship between paddling opportunities and project operations

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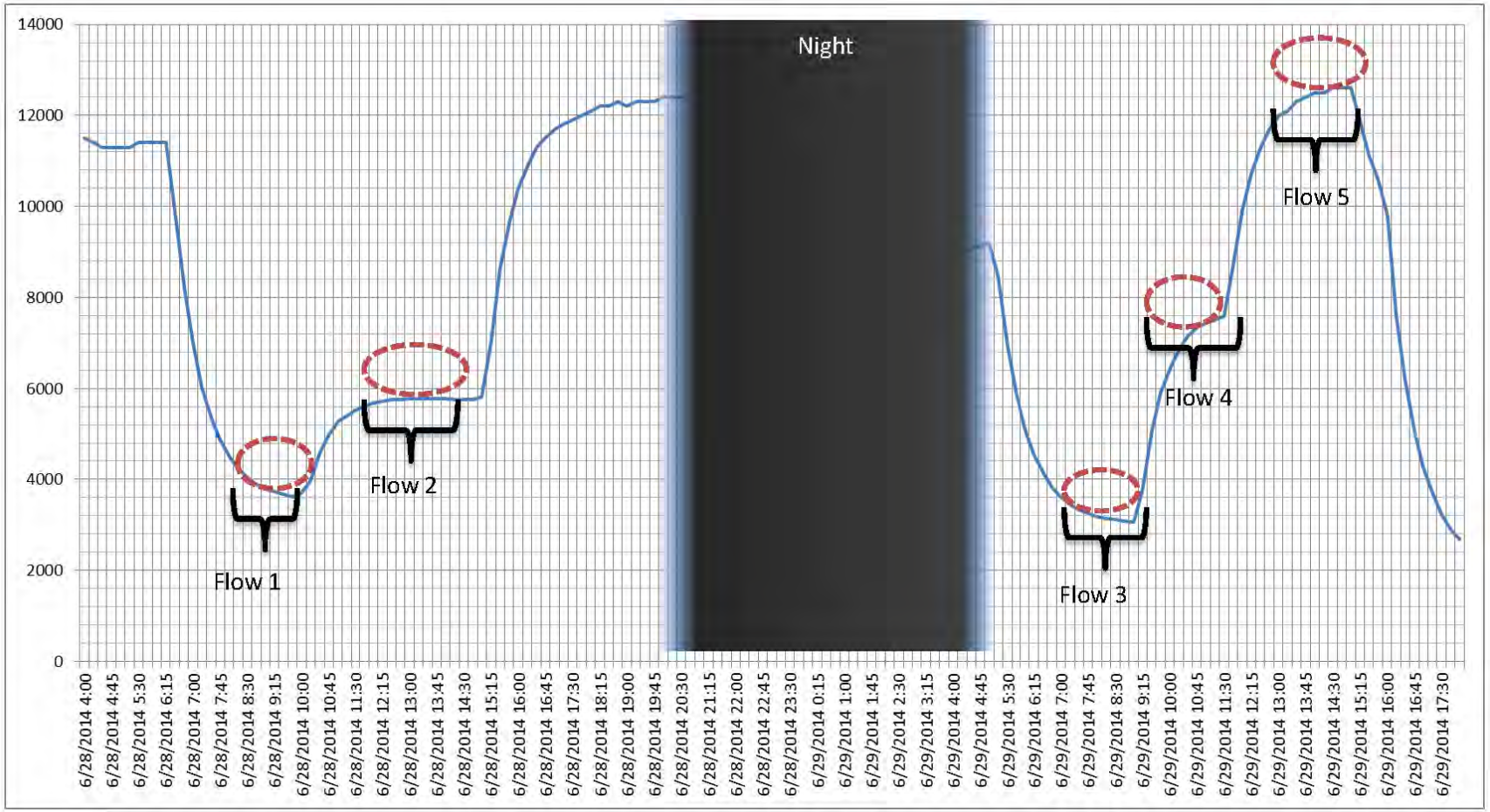
Study 31 – Whitewater Boating Flow Assessment

Sumner Falls

Sumner Falls

West Lebanon gage



Study 31 – Whitewater Boating Flow Assessment

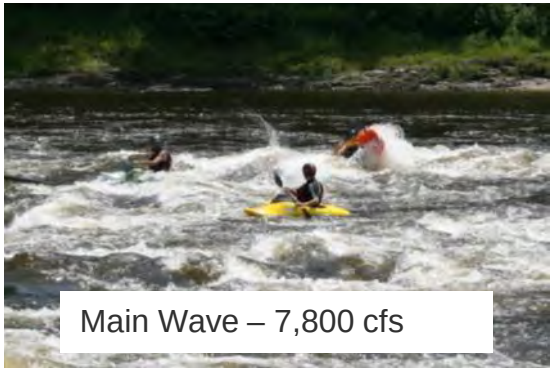
Study Results – Sumner Falls:

- Study conducted June 28 & 29, 2014
- 16 boaters and 5 flow levels
    - 3,750 cfs, 4,700 cfs, 6,700 cfs, 7,800 cfs and 13,000 cfs
- All boaters reported all flows as ‘Marginal’ or higher with multiple preferred flow levels
- Participant estimates that less than 2,000 cfs would be less than ‘Marginal’
- Comments confirm findings that Sumner Falls area is large and diverse enough to accommodate a wide range of flows allowing boaters of various skill levels and craft types to find boatable features that result in positive experiences.


Right center slot – 7,800 cfs


Main Wave – 3,750 cfs


d/s Main Wave – 13,000 cfs


Main Wave – 7,800 cfs

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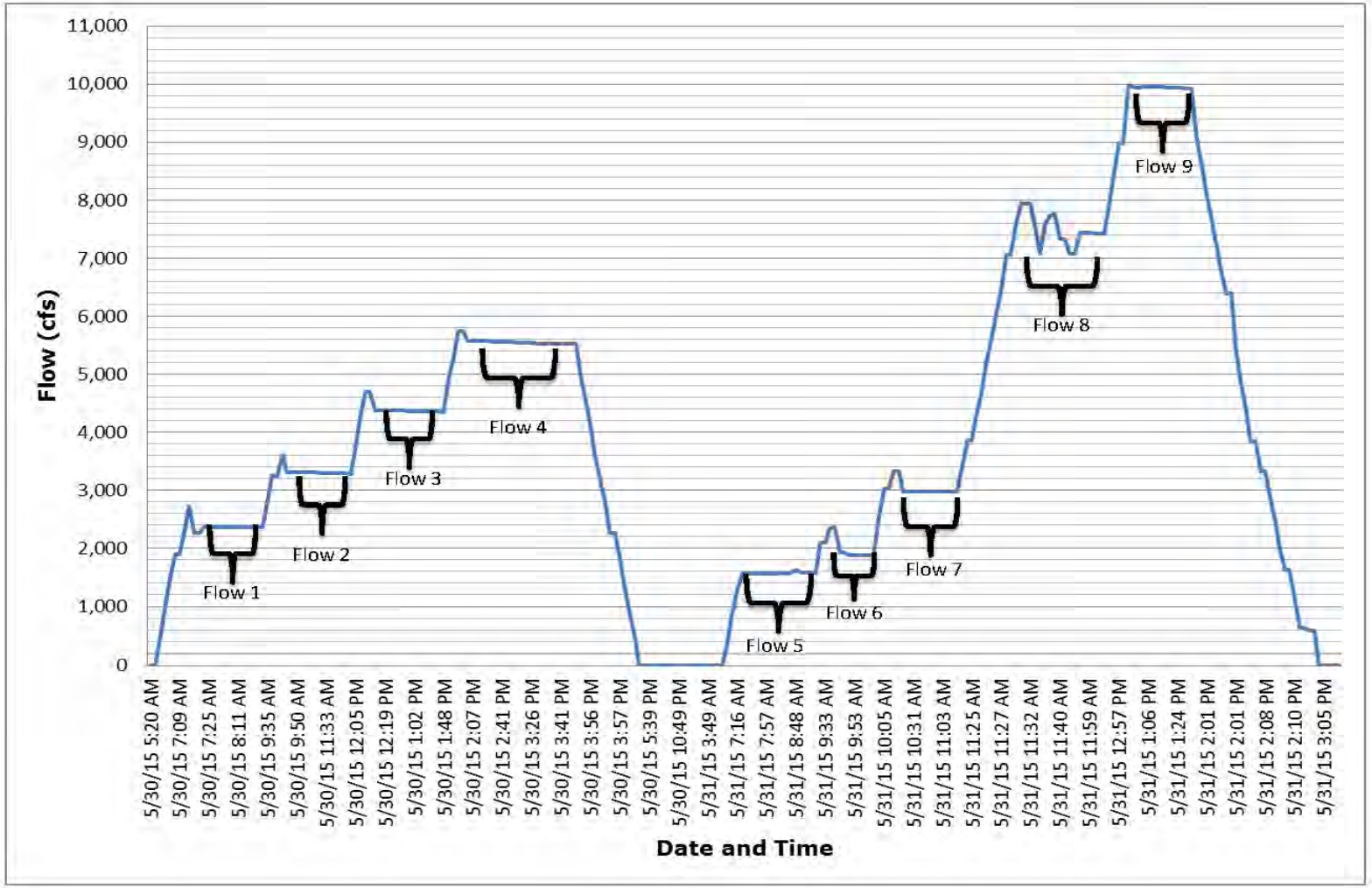
Study 31 – Whitewater Boating Flow Assessment

Bellows Falls

TransCanada

Bellows Falls



Study 31 – Whitewater Boating Flow Assessment

Study Results – Bellows Falls:

- Study conducted May 30 & 31, 2015
- 11 boaters and 9 flow levels
    - 1,500 cfs, 2,000 cfs, 2,500 cfs, 3,000 cfs, 3,500 cfs, 4,500 cfs, 5,500 cfs, 7,500 cfs and 10,000 cfs
- Ten of 11 boaters reported all flows as ‘Marginal’ or higher with multiple preferred flow levels
- Less than ‘Marginal’ rankings were from single boater of 1,500 cfs, 3,000, and 3,500 cfs
- Comments indicate the reach has 1-3 boatable features
- No public access
- Fish barrier dam significant safety hazard

Remaining Activities

- Finalize study report (In draft now)

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Study 32
Bellows Falls Aesthetic Flow Study

TransCanada

Study 32 – Bellows Falls Aesthetic Flow Study

Study Objectives:

- Collect videography and still photography to document the appearance of the bypassed reach under various existing and controlled flows conditions
- Identify populations potentially affected by the aesthetic conditions in the bypassed reach and determine how the interests of these populations relate to the aesthetic conditions
- Identify flow ratings and timing preferences across the full range of potential user groups
- Estimate the costs to provide different levels of flow and assess the trade-offs of the various flows among different populations

Flow Number	Flow Rate
1	~ 130
2	1,580
3	2,370
4	3,300
5	4,370
6	5,560

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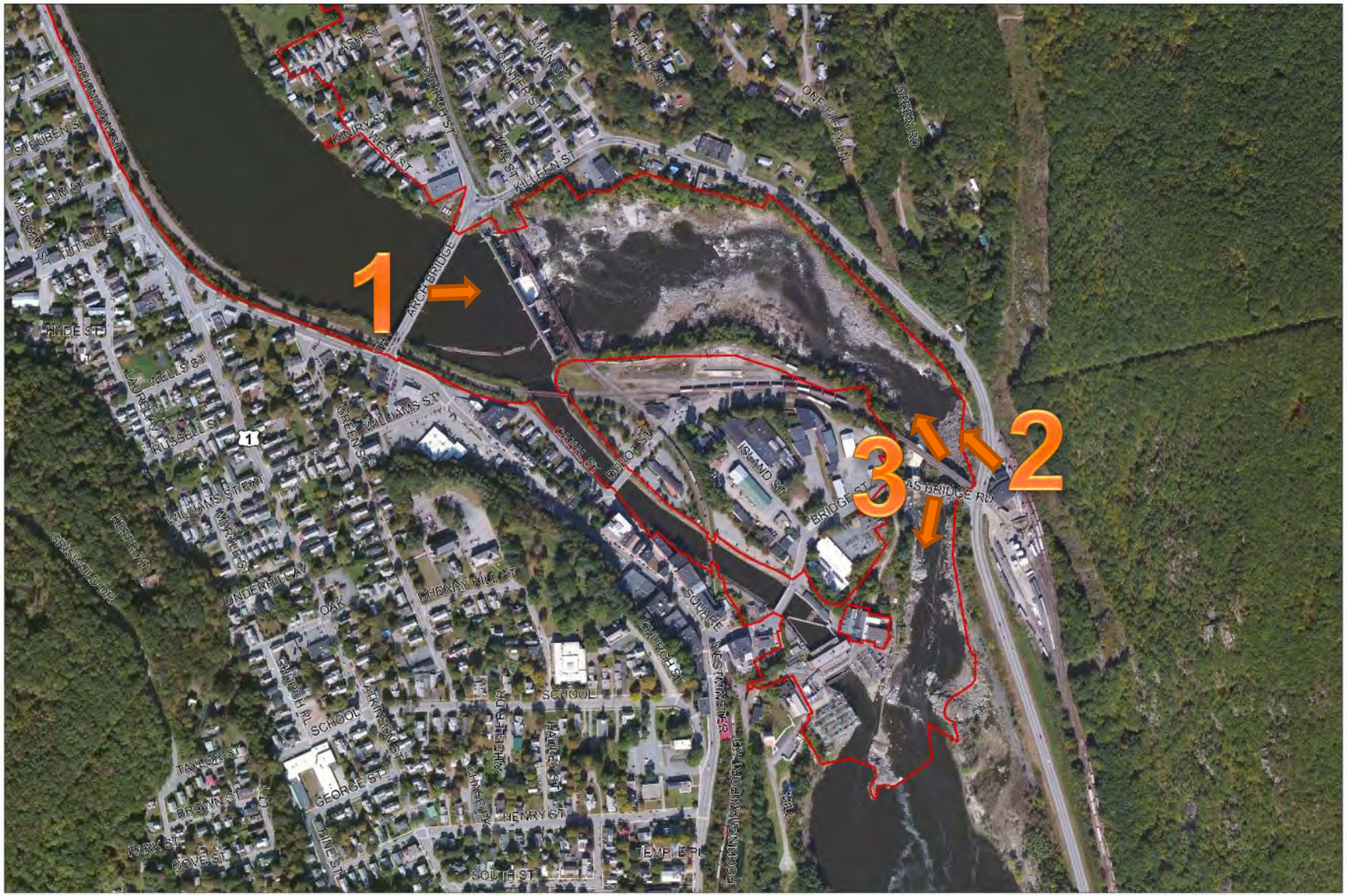
Study 32 – Bellows Falls Aesthetic Flow Study



Study 32 – Bellows Falls Aesthetic Flow Study

Study Results:

- Photography and video footage captured during whitewater boating study (Study 31) on May 27-28, 2015
- Focus group participants convened on August 20, 2015
- Single flow assessments and comparison surveys and group discussion
- Only 1 participant indicated the aesthetics were extremely important
- No participants reported it as ‘Neutral’ or lower
- In general, participants reacted more favorably to higher flows; however participants’ preferred flow level ranged within a few scores at each level and no clear preferred level was evident
- One-third od participants noted there are no publically available viewing areas and questioned the need for specific aesthetic flows give the lack of visibility

Remaining Activities

- Finalize study report (In draft now)

Study 32 – Bellows Falls Aesthetic Flow Study

Flow no. 1 – Low (130 cfs)

Flow No. 3 – Medium (2,370 cfs)

Flow No. 6 – High (5,560)

Flow no. 1 – Low (130 cfs)

Flow No. 3 – Medium (2,370 cfs)

Flow No. 6 – High (5,560)

Flow no. 1 – Low (130 cfs)

Flow No. 3 – Medium (2,370 cfs)

Flow No. 6 – High (5,560)

Study 24
Dwarf Wedgemussel and Co-occurring Mussel Study

Study Progress

- **2013** - Phase 1 field work completed, report filed in Vols IV, V of the ISR
- **2014**
  - Phase 2 study plan, consultation and plan revision (Vol VI of the ISR)
  - Field work in 2014 based on revised plan
  - Additional consultation (FWS counter proposal and TC response).
- **2015**
  - FERC determination issued January 22, 2015
  - Phase 2 study report filed March 2, 2015
  - Additional consultation March 5, 2015

Study Results to date (recap of reports)

Phase 1:

- In the Wilder riverine reach no live or dead DWM were found at the 39 survey sites, and co-occurring mussel species were also extremely rare
- Few DWM found in the upper Wilder and Bellows Falls impoundments, almost always at very low densities
- Co-occurring species were also rare in both impoundments, except for generalists (i.e., eastern elliptio and eastern lampmussel) which were usually common in the impoundments and in parts of the free-flowing reach
- Based on this and past studies, DWM populations were not considered large enough to permit certain types of quantitative sampling, monitoring, or analysis

Study Results to date (recap of reports)

Phase 2 Transects:

- Live DWMs were found in 5 transects and shells were found in 2 additional transects Two other species, triangle floater and creeper were found at similar or lower frequency and density as DWM. Eastern elliptio was the most numerous followed by eastern lampmussel
- Brief qualitative surveys near transects documented an additional 9 live DWM. Four transect had no live or dead DWM
- Location, habitat, and biological parameters were recorded for each transect

Phase 2 Quadrats:

- Low mussel densities throughout most of the 2,400-meter reach, with generally higher mussel densities near shorelines in depositional areas and hydraulic refugia
- Only 251 mussels found, including 222 eastern elliptio, 28 eastern lampmussel, and only one DWM and one triangle floater
- Live DWM not found in any of the historic monitoring sites that were within this sampling reach
- One live DWM found in a depositional area where densities of eastern elliptio and eastern lampmussel were also high
- Location, habitat, and biological parameters were recorded for each quadrat

2015 Agreement on Study "Phase 2A" Approach

- No additional field work in 2015
- Approach to develop Habitat Suitability Indices (HSIs) as proposed by TC
  - Review and synthesize data
  - Delphi panel of regional experts
- Methods
  - Draft HSI criteria framework for key parameters, with written rationale
  - Identify regional experts willing to be part of the Delphi panel and provide background information
  - Draft questionnaire to solicit opinion of the Delphi panel
  - Fine-tune, eliminate, or add HSI criteria based on responses from experts.
  - Revise HSI criteria based on comments and resolve any outstanding issues from first round. Finalize the HSI criteria following second round of comments from experts
  - Final HSI criteria will be used to model habitat in project-affected reaches using 1D and 2D modeling, as part of Study 9, and the results will be used for interpretation and inclusion in the final study report

Study 24 – Dwarf Wedgemussel and Co-occurring Mussels

Phase 2A Study Progress

- Potential Delphi panelists identified and contacted; five have agreed to participate.
- Early steps of gathering and synthesizing existing information are partially complete

Remaining Activities

- Delphi process September – December 2015
- Final HSI development using the process described above expected to be completed by December 2015
- Data analysis and issuance of study report early 2016
- Evaluation of project effects using modeling

Study 25
Dragonfly and Damselfly Inventory and Assessment

Study 25 – Dragonfly and Damselfly Inventory and Assessment

Preliminary Work – Spring 2015:

- Potentially suitable sampling sites were identified based on aerial imagery
    - Sand substrate, steep banks
    - Previously sampled by Hunt
    - Others from SSR
- Field reconnaissance was performed in late May 2015 to confirm the presence of suitable emergence habitat.
- Eleven sites were selected to cover geographic extent of the project area and a variety of hydrologic and habitat conditions
- Site Selection Report prepared
- Scientific Collection Permit from VFWD and a Scientific License from NHFGD were issued

Study 25 – Dragonfly and Damselfly Inventory and Assessment

Site ID	Site Name	Study Reach	Previously Surveyed
25-01	Bedell Bridge	Wilder Impoundment	Yes
25-02	Lyme	Wilder Impoundment	No
25-03	Wilder Dam	Wilder Impoundment	Yes
25-04	West Lebanon	Wilder-Riverine	Yes
25-05	Plainfield/Cornish	Wilder-Riverine	Yes
25-06	North Charlestown	Bellows Falls Impoundment	Yes
25-07	North Walpole	Bellows Falls Impoundment	Yes
25-08	North Westminster	Bellows Falls-Riverine	No
25-09	Brattleboro/ Chesterfield	Vernon Impoundment	Yes
25-10	Broad Brook	Vernon Impoundment	Yes
25-11	Stebbins Island	Vernon-Riverine	Yes

Field Work – Summer 2015:

- 6 visits during June and July to all eleven sites
- Searched five 3-meter wide transects at each site for dragonfly larvae, exuviae, and tenerals (pre-flight dragonflies)
- Measured horizontal and vertical distances from the water
- If larvae were observed in the process of emerging, the location was marked, and the larvae were regularly observed to document the length of time and location of emergence
- Near-shore benthic samples were taken to sample for mature odonate larvae and prey species
- Detailed habitat assessment was conducted at each site
- Continuous water surface elevations for the entire sample period and representative elevation data were collected for each site

Study 25 – Dragonfly and Damselfly Inventory and Assessment

Results:

- Over 750 observations of 19 species, with at least 1 observation at each study site
    - Two species accounted for >60% abundance, *Gomphus vastus* and *Stylurus spiniceps*
- Six of the eight target listed odonates were observed throughout the projects
    - The remaining two were unlikely occurrences
- Species diversity and abundance of listed species in upper impoundments
    - Lowest in riverine stretches below Wilder and Bellows Falls; highest below Vernon
- Critical period for emergence is approximately 30 minutes during eclosure
- Six of the eight target listed odonates were observed
    - The remaining two were unlikely occurrences
- Multiple larvae were observed from emergence to eclosure to flight

Study 25 – Dragonfly and Damselfly Inventory and Assessment

Rapids Clubtail teneral in Wilder Impoundment (Site 25-02), prior records from Vernon

Riverine Clubtail teneral in Wilder Impoundment (Site 25-02)

Spine-crowned Clubtail exuvia in Bellows Falls Impoundment (Site 25-08), prior records only from Vernon

Study 25 – Dragonfly and Damselfly Inventory and Assessment

Arrow Clubtail larva preparing to leave water to eclose

Arrow Clubtail during eclosure, hit by boat wake

Zebra Clubtail eclosing

Study 25 – Dragonfly and Damselfly Inventory and Assessment

Remaining Activities

- Data processing of elevation and water level logger data
- Evaluation of project effects using modeling
- Issue study report

15 minute break

Study 26
Cobblestone and Puritan
Tiger Beetle Survey

Study 26 – Cobblestone and Puritan Tiger Beetle Survey

Study Results

- 13 study sites selected and surveyed
- Cobblestone Tiger Beetle (CTB) observed and photographed at 7 sites
- CTB observed with lower certainty at 3 additional sites
- Study resulted in 2 new CTB state records (Ascutney Riverbank, West River)
- Reproductive behavior observed (adults clasping) at 4 sites
- Adult cobblestone tiger beetles appeared to have specific habitat requirements preferences related to the size and variability of cobble substrate (5-8 cm), but not to other site characteristics such as vegetative cover or habitat area
- Appropriate habitat and survey observations of cobblestone tiger beetle were most common between Hartland and Westminster, Vermont.
- No Puritan Tiger Beetles observed

Study 26 – Cobblestone and Puritan Tiger Beetle Survey

Survey Site	Site ID #	Cobblestone Tiger Beetle Present?	River Section	Previous State Record?
Mascoma River	26-01	No	Wilder Riverine	No
Johnston Island	26-02	Yes	Wilder Riverine	Yes
Burnaps Island	26-03	Yes	Wilder Riverine	Yes
Sumner Falls	26-04	Yes[1]	Wilder Riverine	No
Hart Island	26-05	Yes	Wilder Riverine	Yes
Chase Island	26-06	Yes	Bellows Falls Impoundment	Yes
Claremont Island	26-07	No	Bellows Falls Impoundment	No
Ascutney Riverbank	26-08	Yes	Bellows Falls Impoundment	No
Sugar River	26-09a and 26-09b	Yes[2]	Bellows Falls Impoundment	No
Jarvis Island	26-10	Yes[2]	Bellows Falls Impoundment	No
Saxtons River	26-11	No	Bellows Falls Riverine	No
Walpole Island	26-12	Yes	Bellows Falls Riverine	Yes
West River	26-13	Yes	Vernon Impoundment	No[3]

1 Observed outside survey period
2 Observed with low certainty
3 Previous record just upstream, outside influence of the Vernon Project

TransCanada

Study 26 – Cobblestone and Puritan Tiger Beetle Survey

Burnaps Island, upper Wilder riverine

Study 26 – Cobblestone and Puritan Tiger Beetle Survey

Remaining Activities

- Data processing of elevation data collected in 2015
- Evaluation of project effects using modeling
- Issue study report

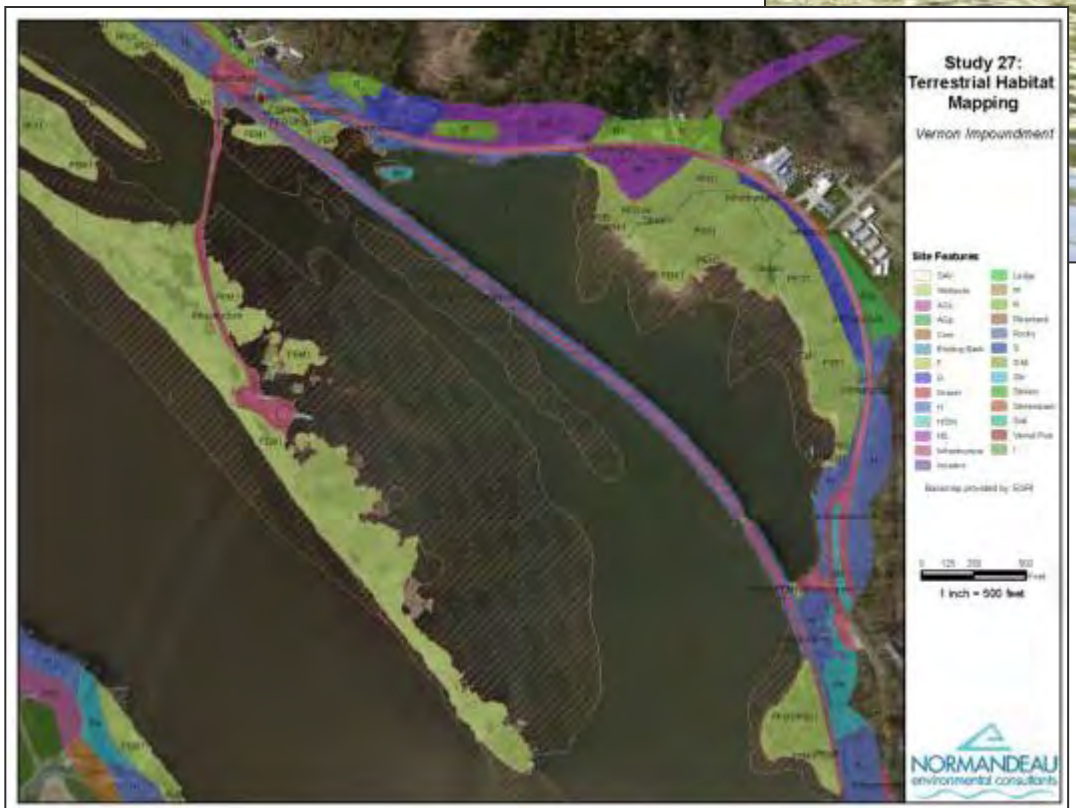
Study 27
Floodplain, Wetland, Riparian and Littoral Vegetative Habitats Study

Study Results

- Maps were completed of all terrestrial cover types, floodplains, aquatic vegetation beds, invasives (mostly Phragmites and Japanese Knotweed), and bald eagle winter roosts
- Field verification occurred in June, July, and August 2014 and included incidental wildlife observations of 87 species
- Associated data from the field were tabulated and compiled into a database for future analysis
- Natural features and land uses mapped covered a total of 9,153 acres, and were comprised of upland vegetation cover (62% cover), wetlands and tributary streams (23% cover), developed lands (12% cover), and riverine features (2% cover)

Study 27 – Floodplain, Wetland, Riparian, Littoral Vegetative Habitats

Example
Terrestrial Habitat Map
Hinsdale, NH



Study 27 – Floodplain, Wetland, Riparian, Littoral Vegetative Habitats

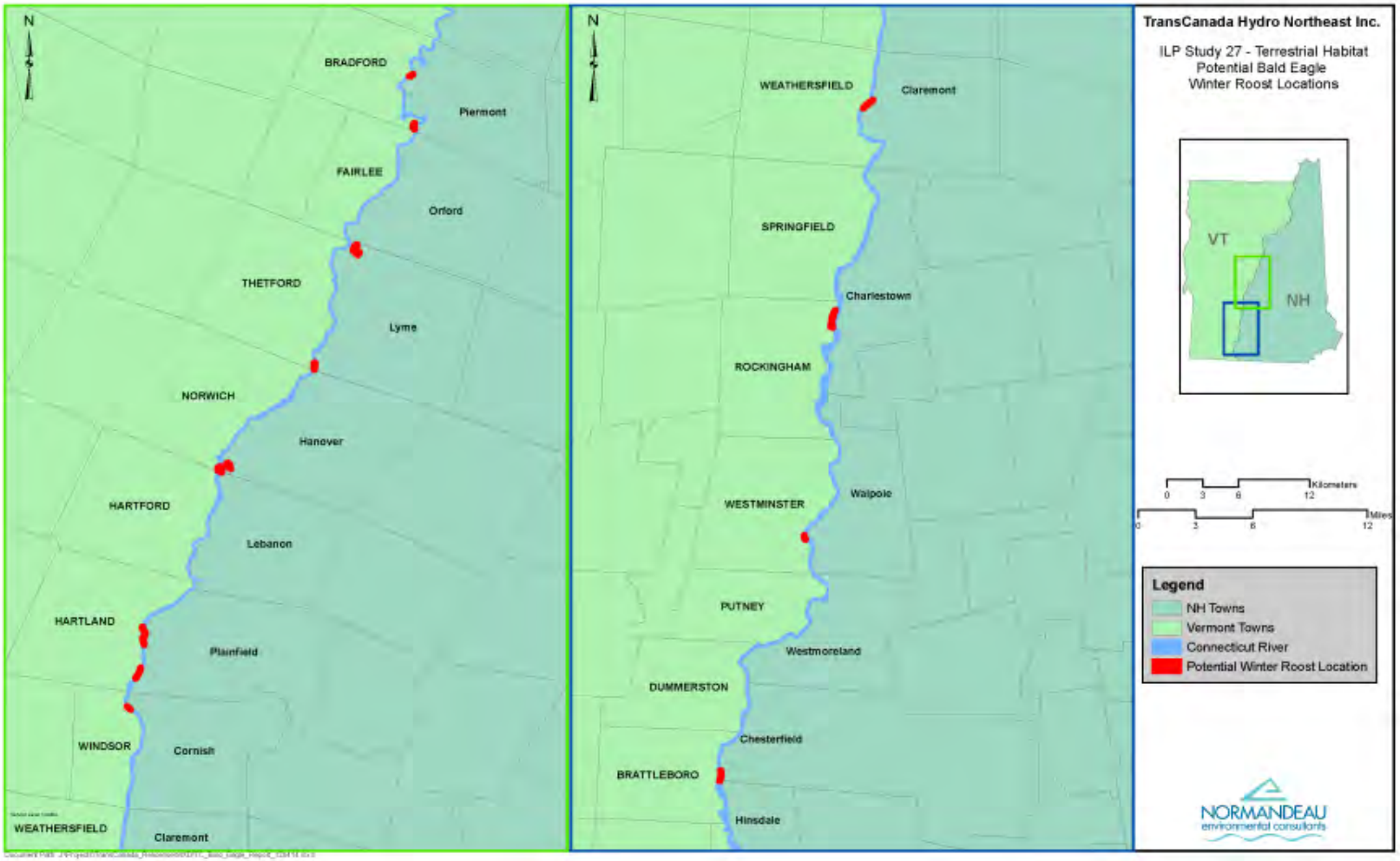
Upland riverbank community in Vernon, showing zonation of vegetation approximately associated with water level fluctuations. The effects of periodic flooding and scour are evident in the lower portion of the bank and absent in the upper.

Study 27 – Floodplain, Wetland, Riparian, Littoral Vegetative Habitats

Japanese knotweed-dominated upland riverbank community bordering agricultural fields in the Wilder Project

Study 27 – Floodplain, Wetland, Riparian, Littoral Vegetative Habitats

Potential Bald Eagle Winter Roost Sites



Study 27 – Floodplain, Wetland, Riparian, Littoral Vegetative Habitats

Bank Swallow Holes – Vernon Impoundment

Study 27 – Floodplain, Wetland, Riparian, Littoral Vegetative Habitats

Remaining Activities

- Evaluation of project effects using modeling and erosion study results.
- Study report was filed in Volume III.B of the USR

Study 28
Fowler's Toad Survey

Study 28 – Fowler's Toad Survey

Study Results

- 15 sites surveyed in 2014
  - 11 call survey sites with 3 rounds of site visits.
  - 4 acoustic monitoring sites over 2 – 4 weeks.
- Survey methods consisted of direct listening (call surveys) and acoustic recording
- Fowler's toad was detected in one location – Stebbins Island, (subject to water level fluctuations in Turners Falls impoundment)

NOTES:

- The 2014 report included potential detection at Hart Island breeding pool which was not a valid record when QA-ed.

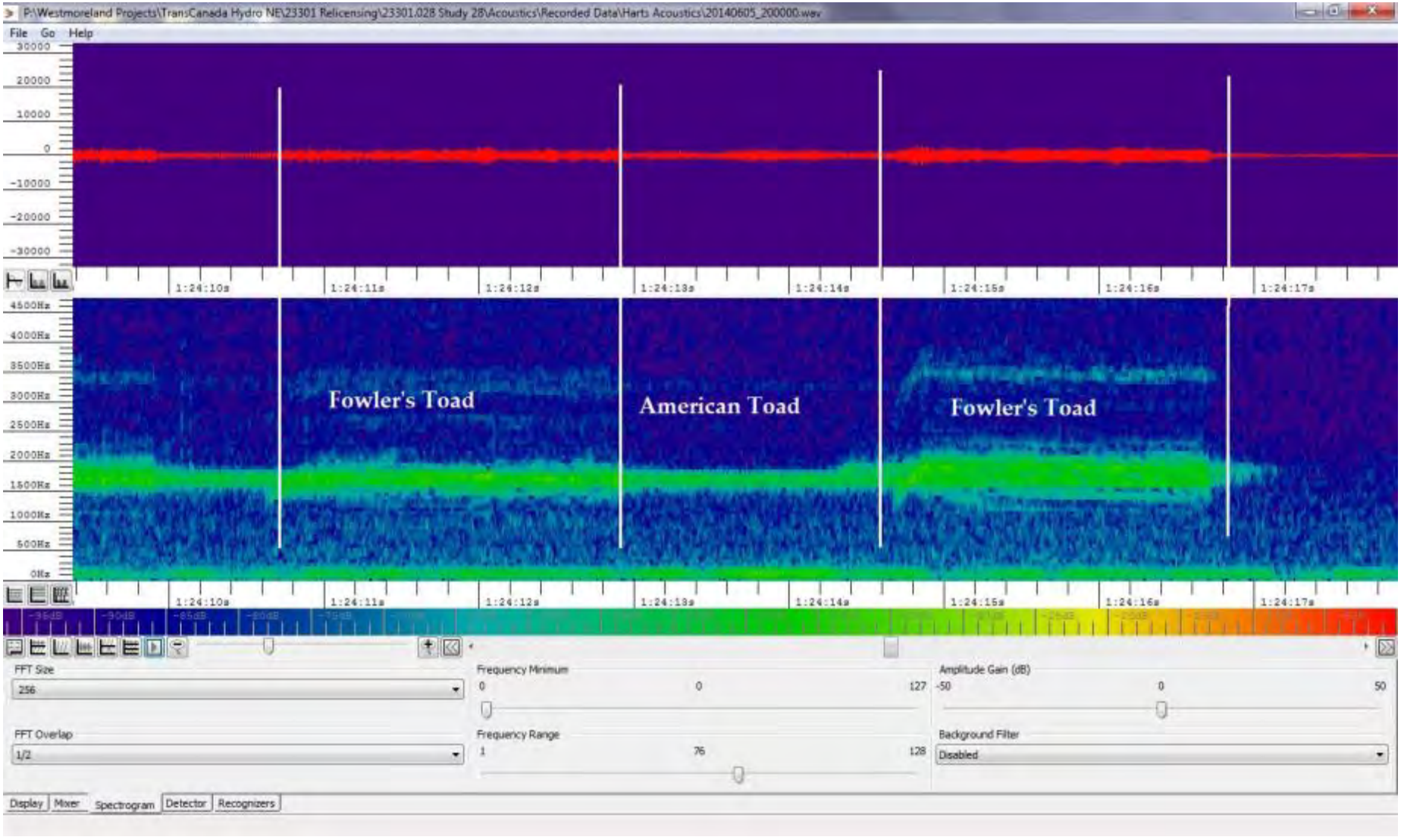
- Vermont listed Fowler's toad as a state-endangered species as a Priority 1 "Very Rare" species.

Study 28 – Fowler's Toad Survey

Breeding pool Stebbins Island, June 3 2014

Study 28 – Fowler's Toad Survey

Example Sonogram
June 5, 2014 from Stebbins Island



Study 28 – Fowler's Toad Survey

Remaining Activities

- Data processing of elevation data collected in 2015
- Evaluation of project effects using modeling
- Issue study report

Study 29
Northeastern Bulrush Survey

Study 29 – Northeastern Bulrush Survey

Study Results

- Developed a typical profile of suitable habitat
- Vegetation habitat maps were reviewed for potential sites
- Field verification was conducted in August and September 2014
  - 9 sites were initially identified
  - 4 sites were eliminated based on field review
  - The remaining 5 sites were more intensively surveyed
  - Including the one site where northeastern bulrush was last observed
- No plants were found

Study 29 – Northeastern Bulrush Survey

Previously recorded northeastern bulrush site

Study 29 – Northeastern Bulrush Survey

Remaining Activities

- Data processing of elevation data collected in 2015
- Evaluation of project effects using modeling
- Issue study report

Studies 1-3

Historical Riverbank Position and Erosion Study

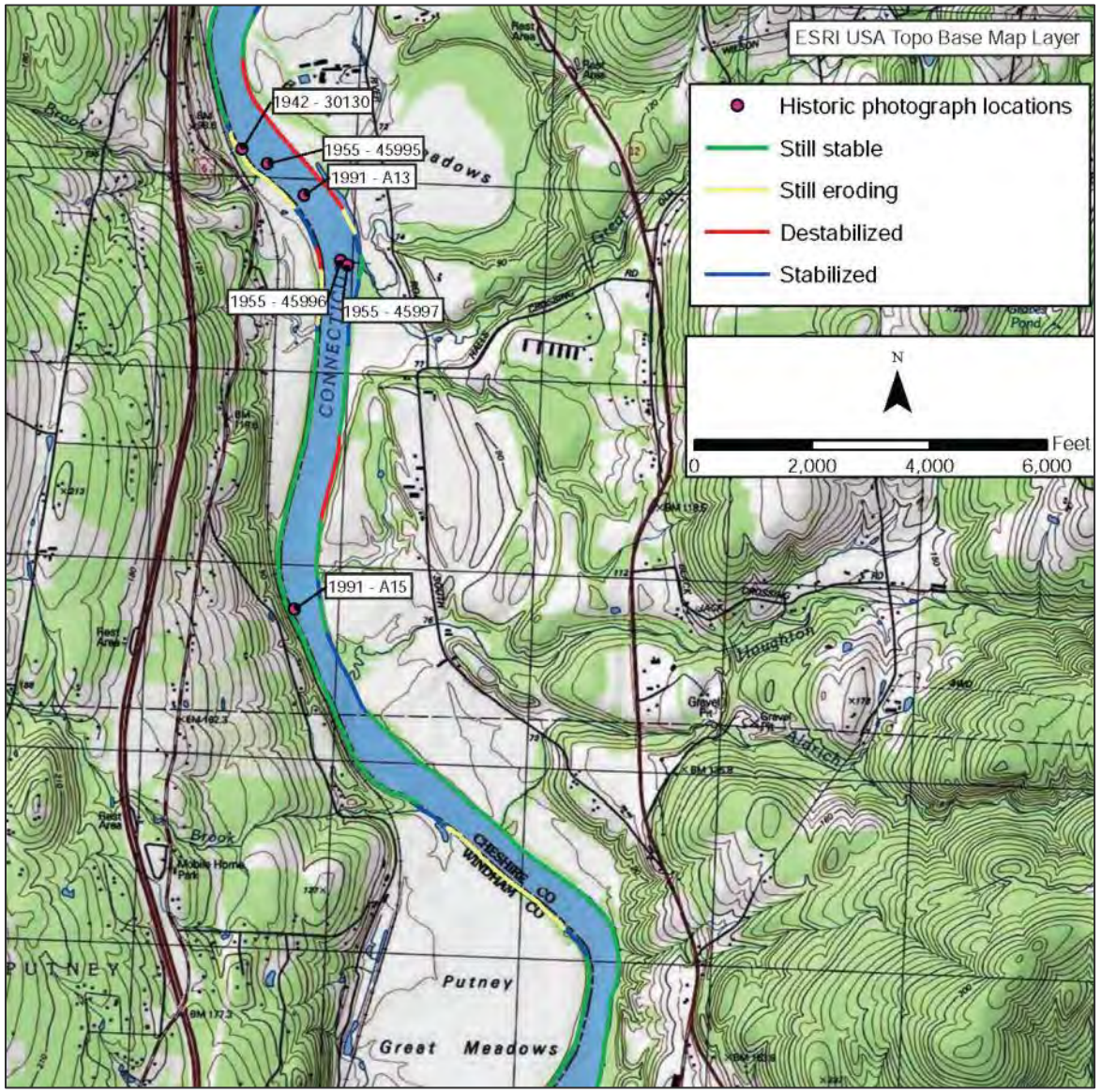
Riverbank Transect Study

Riverbank Erosion Study

Study 1 is complete, report in draft

- Comparisons of erosion between 1958 and 1978
  - Erosion along approximately 12 percent of the riverbanks in both years but significant changes in the locations of that erosion
  - Comparisons with 2014 to be part of Study 3 but also shows 12 percent erosion

Study 1 – Historical Riverbank Position and Erosion Study



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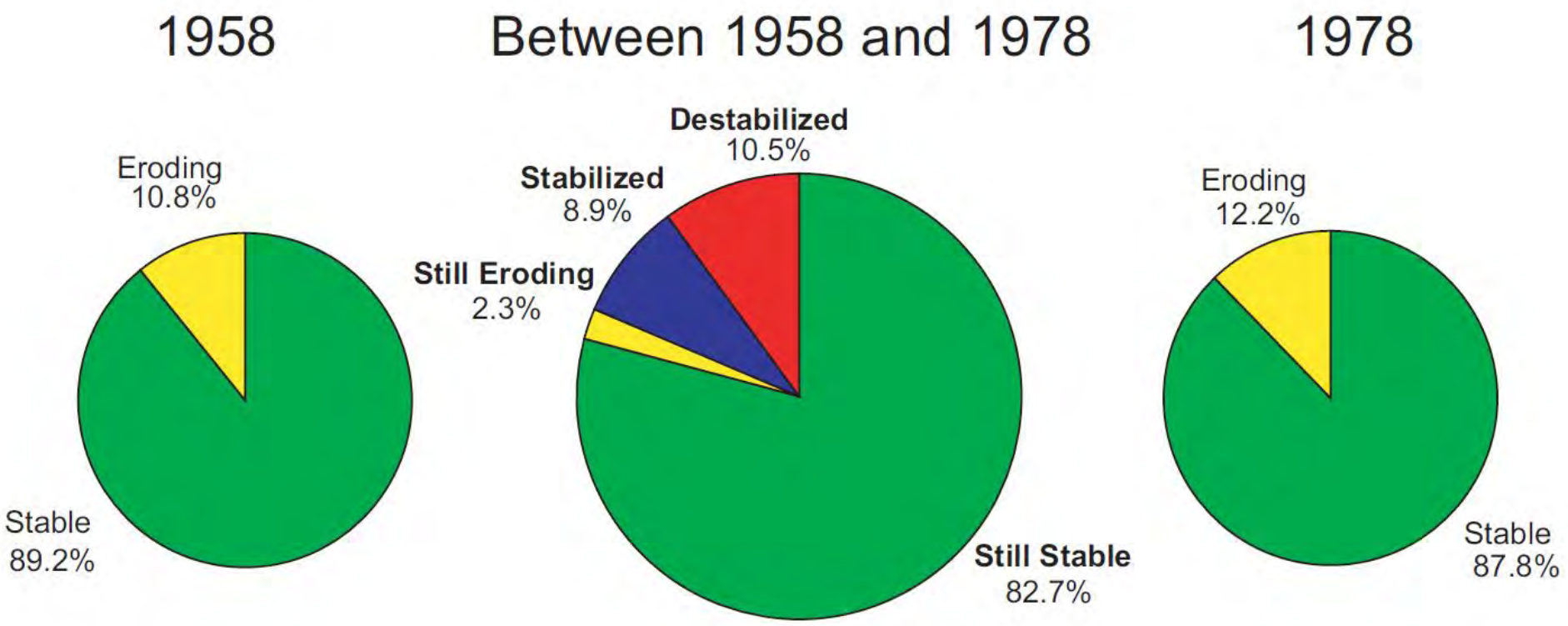
Study 1 – Historical Riverbank Position and Erosion Study



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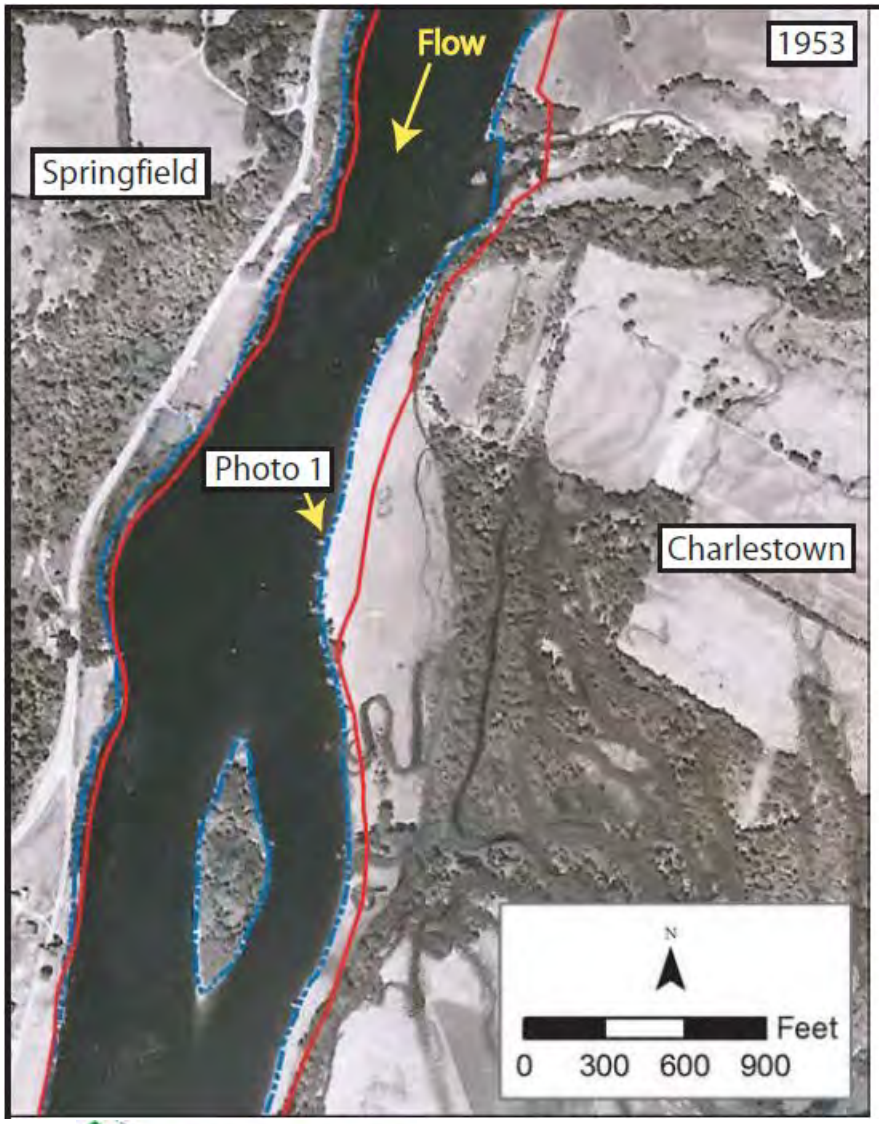
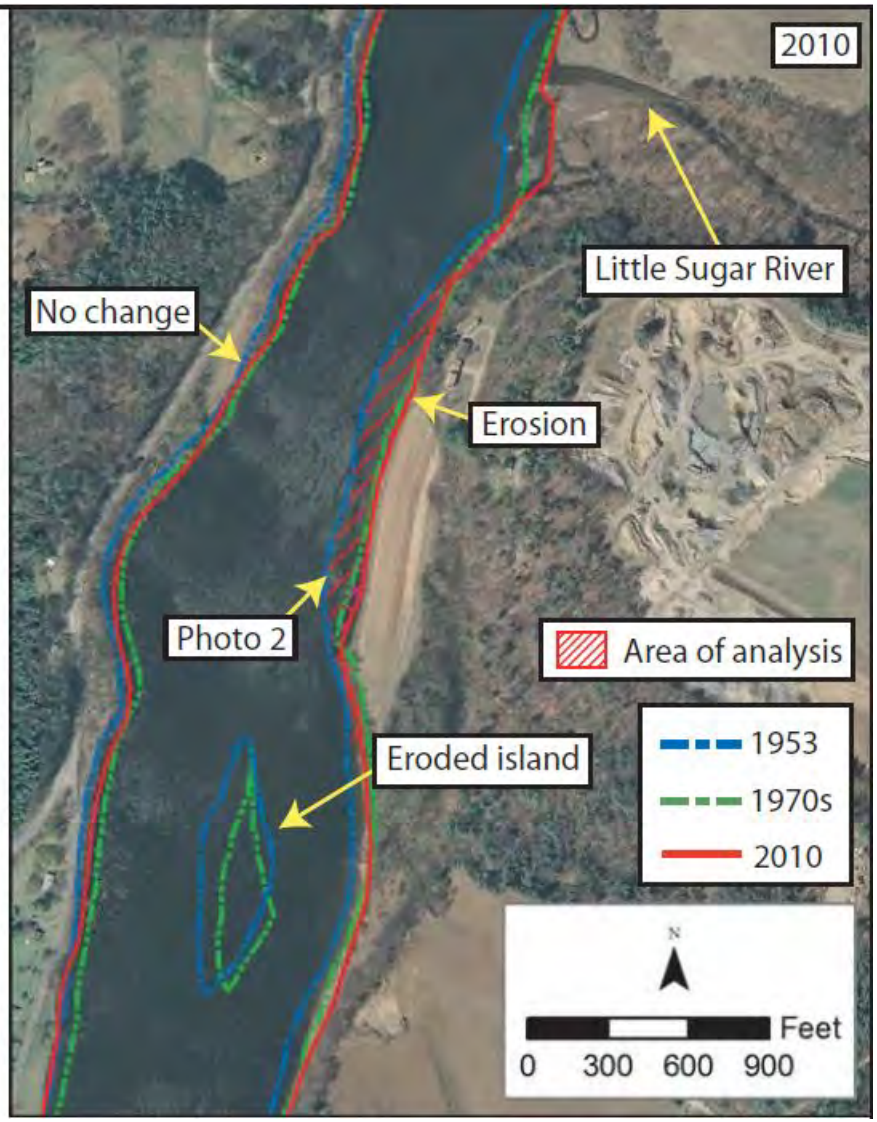
Study 1 – Historical Riverbank Position and Erosion Study

- Georectified historical aerial photographs from 1940's, 1950's, and 1970's, and compared with 2010
- Numerous types of changes characterized but thorough analysis to be part of Study 3

Study 1 – Historical Riverbank Position and Erosion Study





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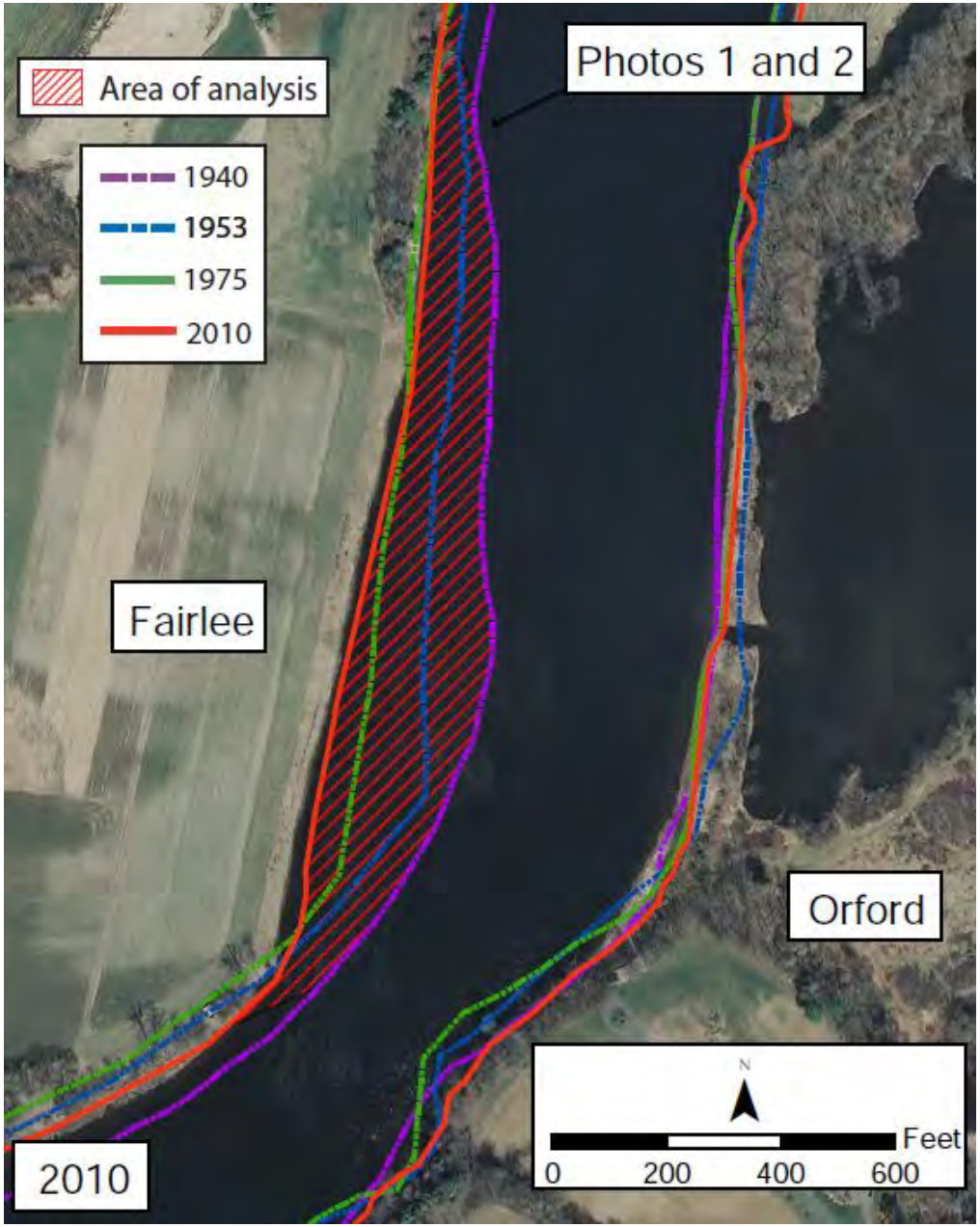
Study 1 – Historical Riverbank Position and Erosion Study

Bank Retreat

Time period	Average Length (feet)	Average Rate (ft/yr)	Maximum Length (feet)	Maximum Rate (ft/yr)	Area (acres)	Volume (yd^3)	Rate (yd^3/yr)
1953 to 1975	85.2	3.9	130	5.9	4.2	69,549	3,161
1975 to 2010	16.2	0.5	44	1.3	0.8	13,226	378
1953 to 2010	101.4	1.8	152	2.7	5.0	82,775	1,452

Study 1 – Historical Riverbank Position and Erosion Study



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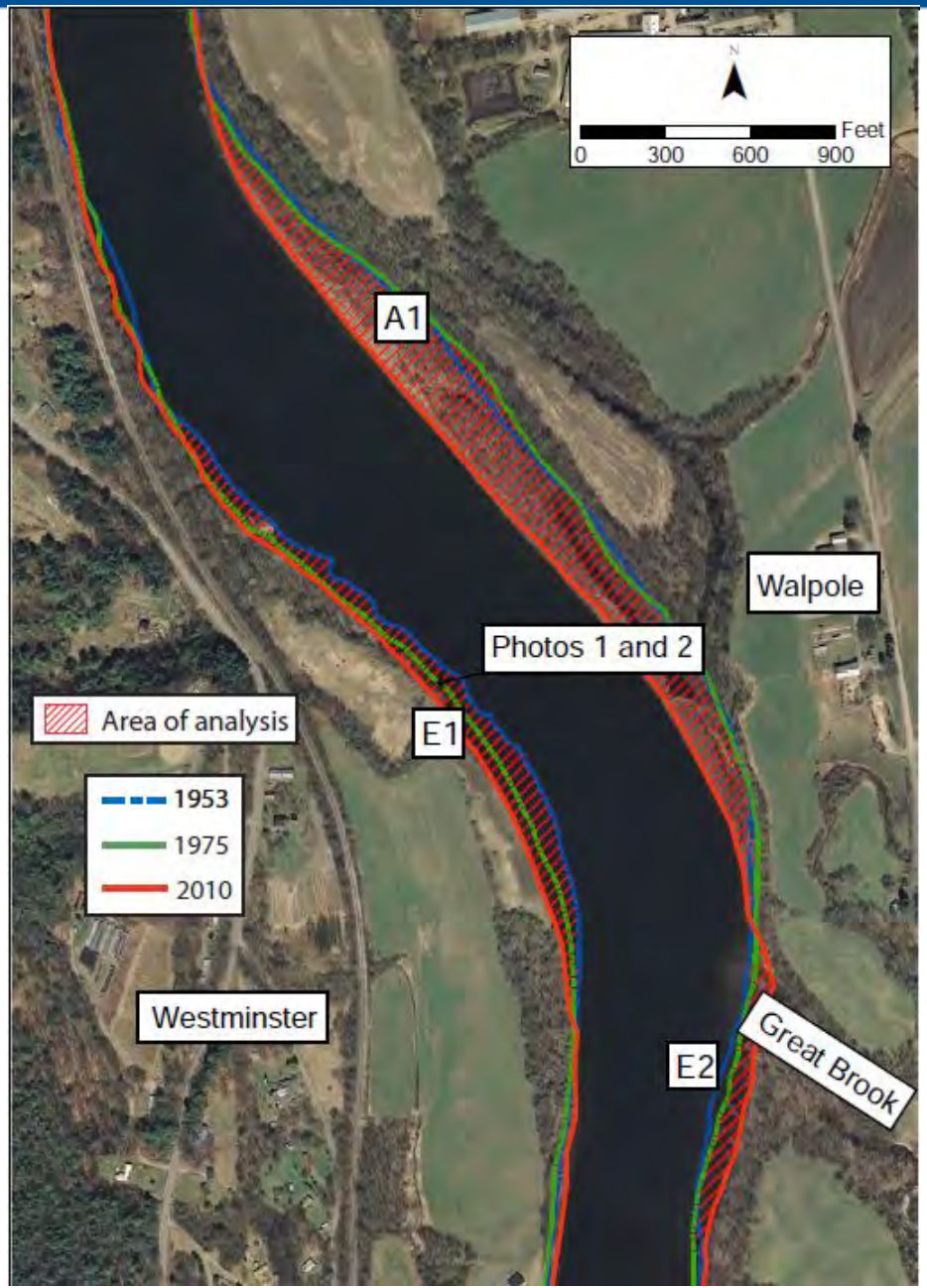
Study 1 – Historical Riverbank Position and Erosion Study

Bank Retreat

Time period	Average Length (feet)	Average Rate (ft/yr)	Maximum Length (feet)	Maximum Rate (ft/yr)	Area (acres)	Volume (yd^3)	Rate (yd^3/yr)
1940-1955	55.7	3.7	126.0	8.4	2.8	45,271	3,018
1955-1970	61.9	4.1	115.0	7.7	2.7	44,171	2,945
1970-2010	34.6	0.9	60.0	1.5	0.7	11,976	299
1940-2010	152.2	2.2	255.0	3.6	6.2	101,417	1449

Study 1 – Historical Riverbank Position and Erosion Study



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Study 1 – Historical Riverbank Position and Erosion Study

	Bank Retreat							
		Average		Maximum				
Site	Time period	Length (feet)	Rate (ft/yr)	Length (feet)	Rate (ft/yr)	Area (acres)	Volume (yd^3)	Rate (yd^3/yr)
E1	1953 to 1975	43.8	2.0	88	4.0	3.4	80,872	3,676
	1975 to 2010	33.0	0.9	57	1.6	1.8	44,011	1,257
	1953 to 2010	76.8	1.3	138	2.4	5.2	124,884	2,191
E2	1975 to 2010	62.2	1.8	181	5.2	8.8	183,875	5,254
A1	1975 to 2010	-150.0	-6.82	-159	-7.2	-3.3	-12,408	-355

Study 1 – Historical Riverbank Position and Erosion Study

- Ground photographs of erosion sites from 1950's to 1990's were rephotographed in 2015
- Numerous sites show increased vegetation and stabilization

Study 1 – Historical Riverbank Position and Erosion Study

Fairlee, VT

1951 - 44

2015 - 77

TransCanada

Study 1 – Historical Riverbank Position and Erosion Study

North Walpole, NH

(Study 2 02-B09 Monitoring Site)

TransCanada

Study 1 – Historical Riverbank Position and Erosion Study

Putney, VT

1991 - A23

1955 - 45897

2015 - 46

1964 - 56439

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Study 1 – Historical Riverbank Position and Erosion Study

- Initial analysis of historical data suggest rate of erosion has remained the same or decreased through time but more thorough analysis in Study 3 needed to confirm this trend

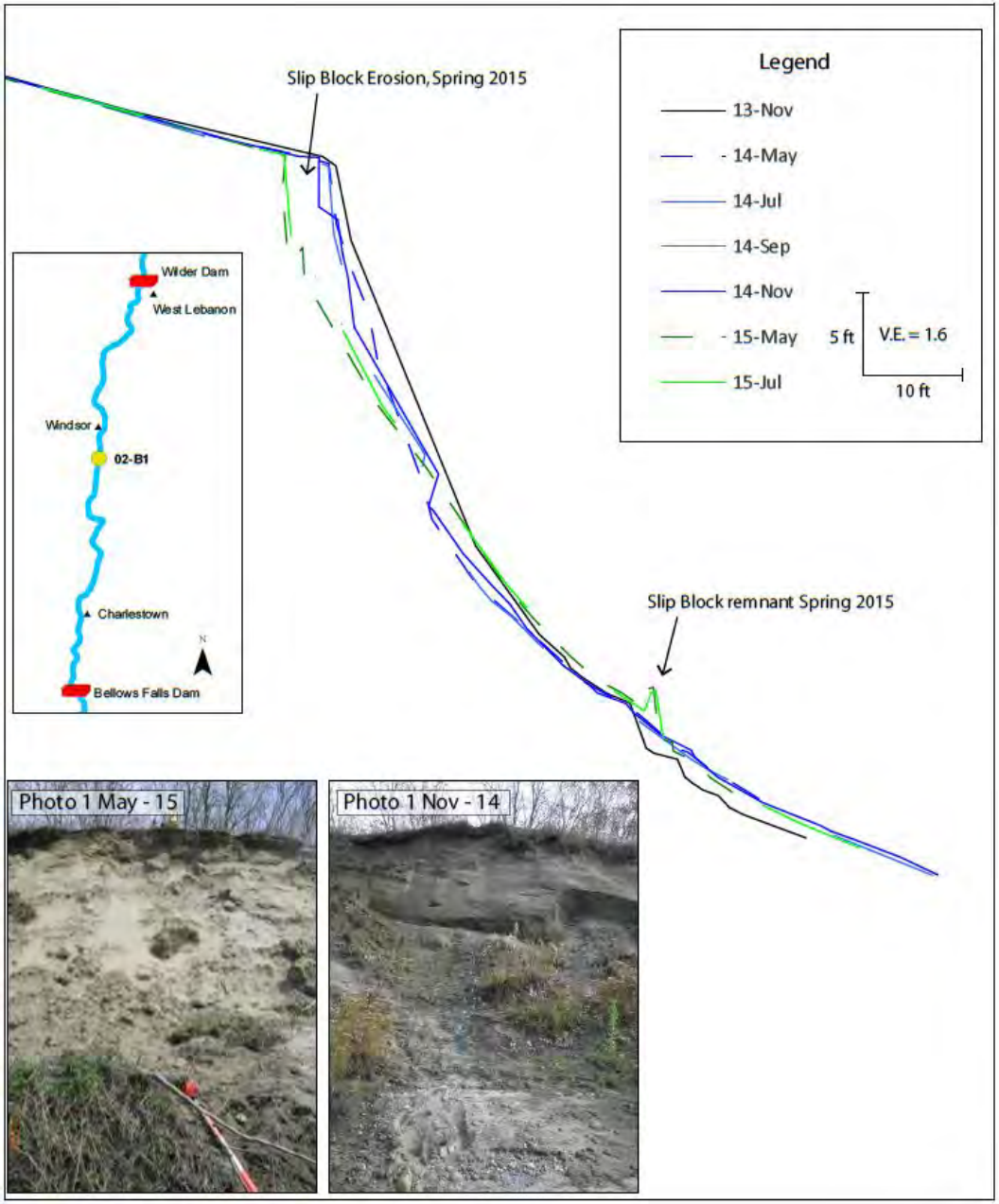
Study 2 fieldwork is nearly complete

- Eighth round of monitoring at 21 sites completed in September 2015
- Water level monitoring will continue until November 2015

Remaining Activities

- Retrieval of water level loggers.
- Data for all monitoring rounds will be compared to document any changes that occurred during the monitoring period.
- Data from water-level monitoring will be processed and elevations linked to stratigraphic columns to identify possible links to erosion.
- Preparation of the study report detailing the amount, timing, and possible causes for erosion (pending study 3 and modeling) at the 21 monitoring sites.

Study 2 –Riverbank Transect Study



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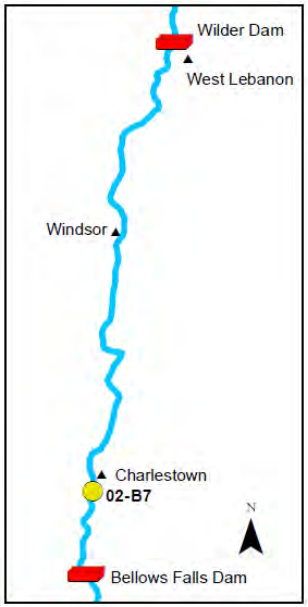
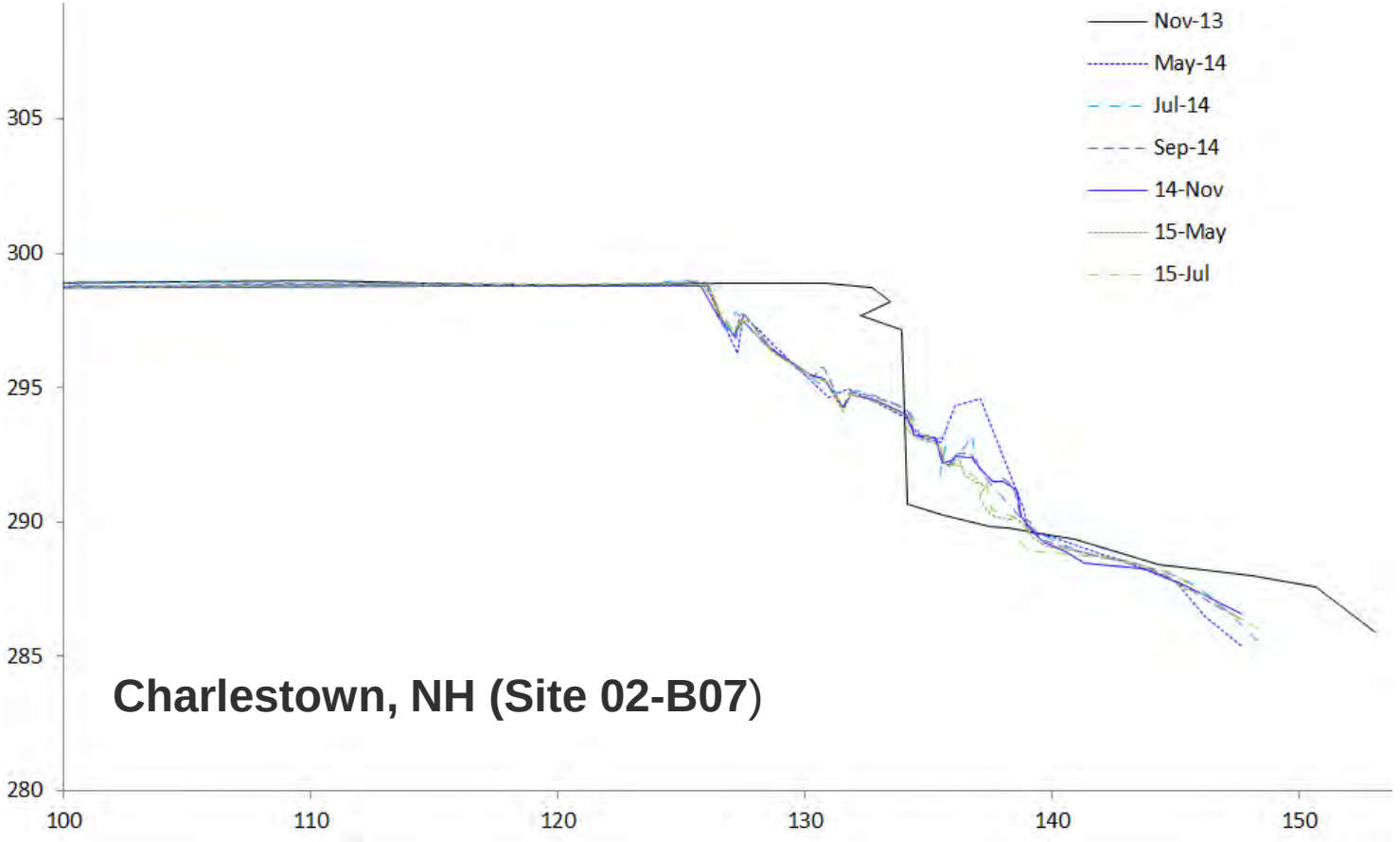
Study 2 –Riverbank Transect Study





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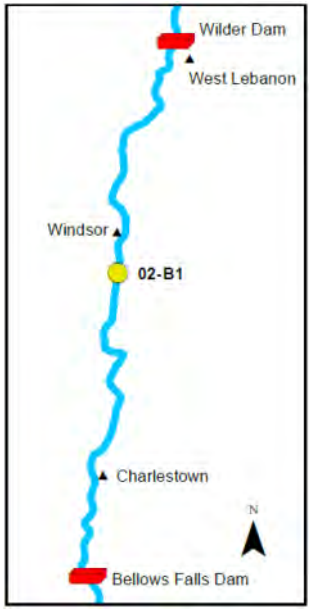
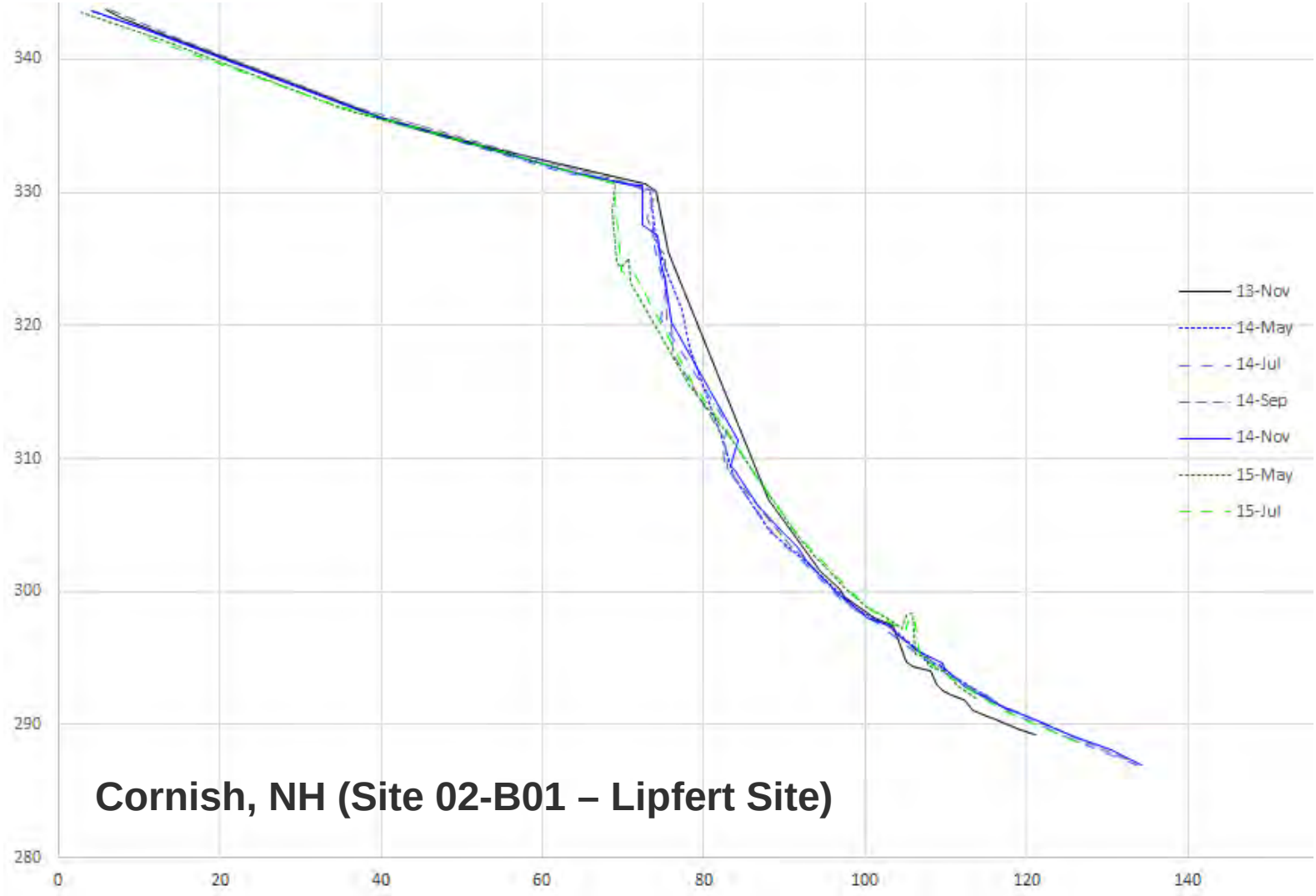
Study 2 –Riverbank Transect Study

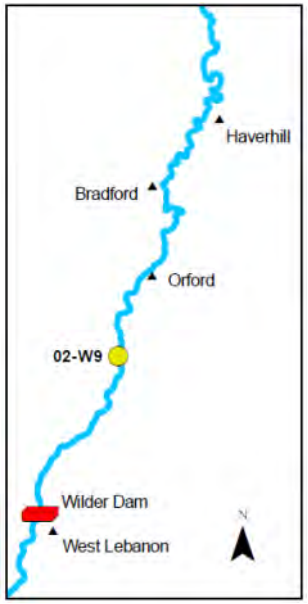


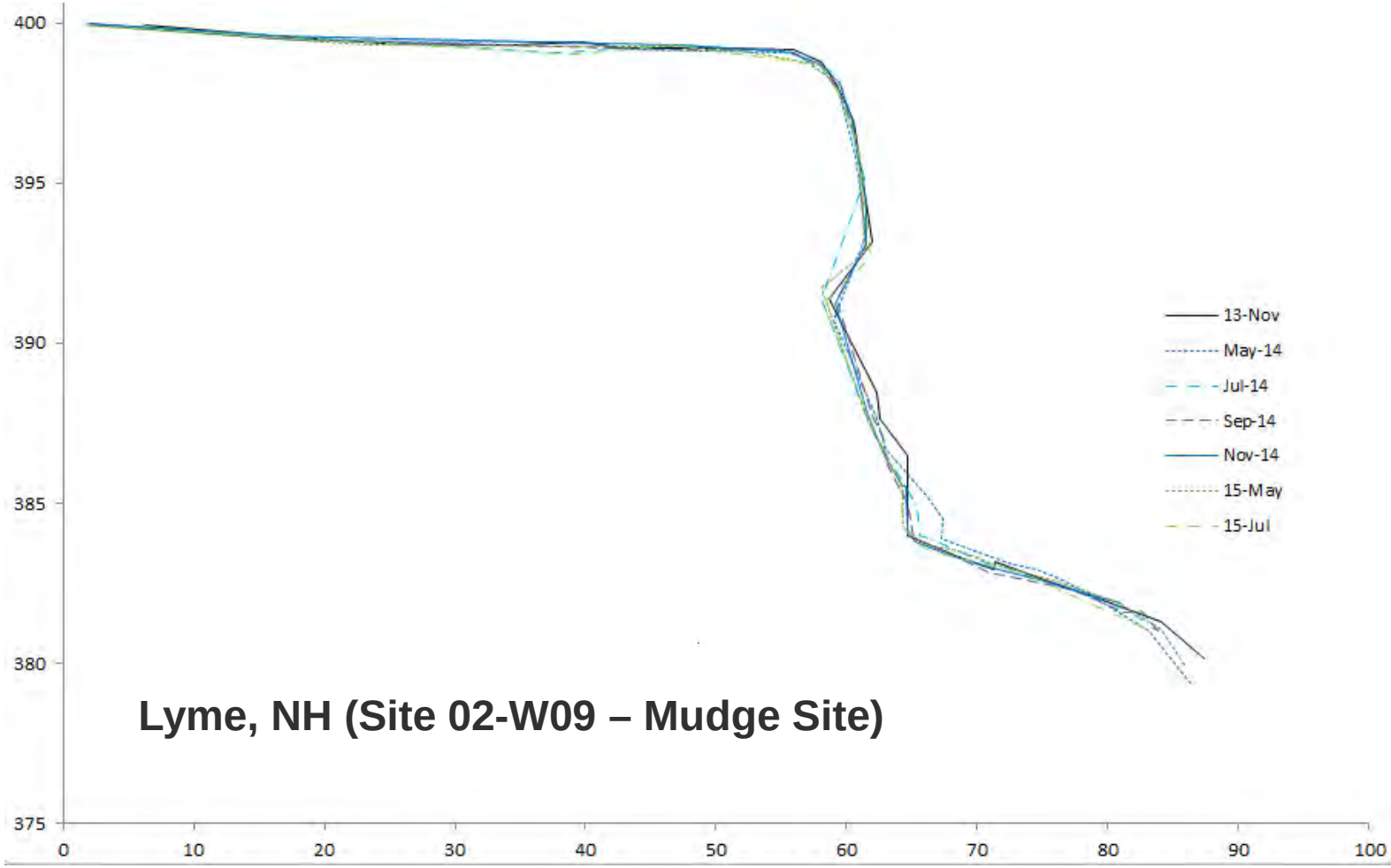


Cornish, NH (Site 02-B01 – Lipfert Site)

TransCanada

Study 2 –Riverbank Transect Study





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Study 2 –Riverbank Transect Study

Study 2 –Riverbank Transect Study

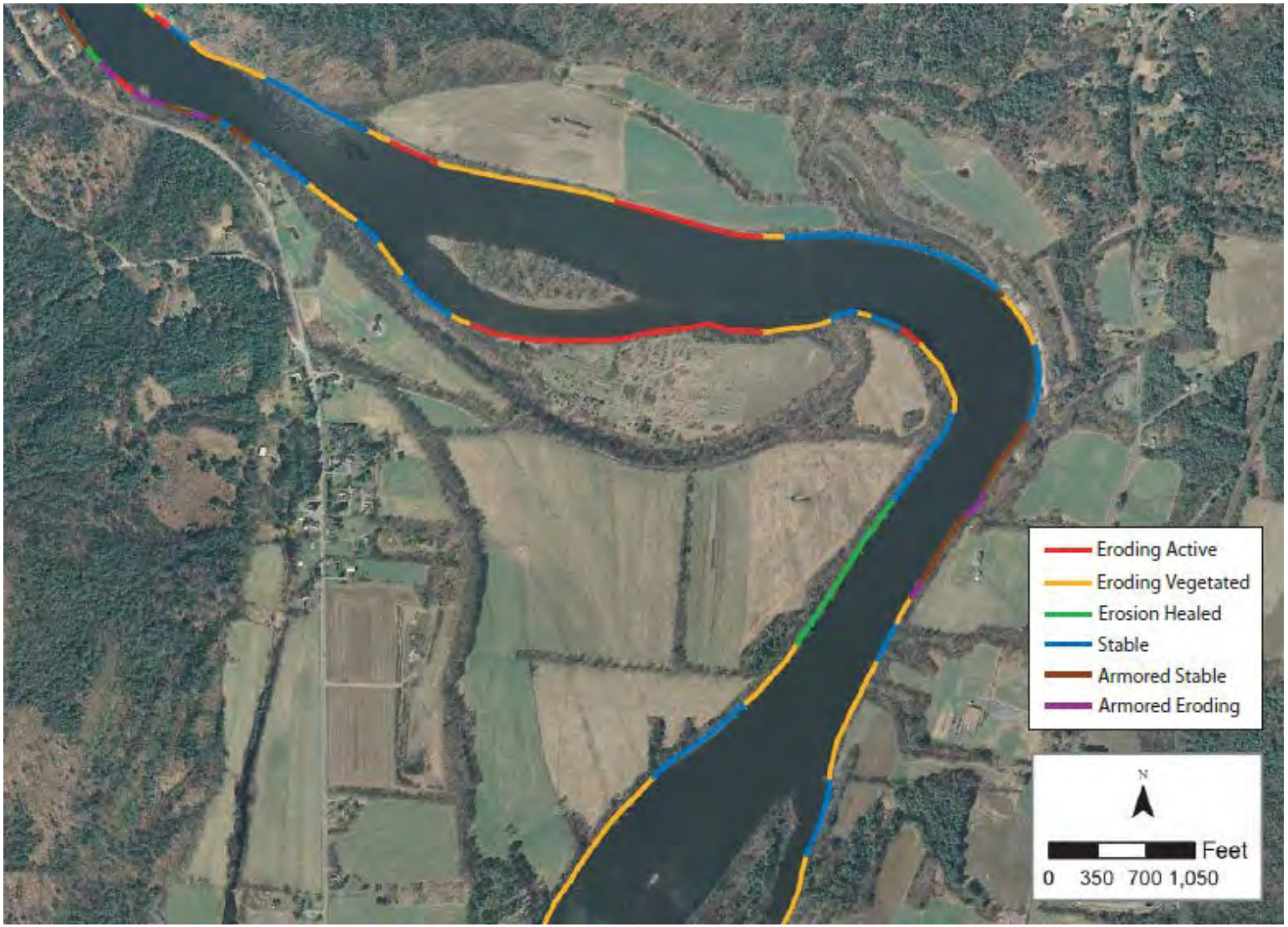
Study 3 fieldwork is nearing completion

Erosion mapping completed

Remaining Activities

- Resurvey previously surveyed sites to determine recent erosion rates
- Analyze erosion and determine influence of tributaries, valley constrictions, soil type, project operations, etc.
- Review of hydraulic and operations modeling (Studies 4 and 5) and bathymetry (from Study 7) to identify potential causes of erosion (e.g., areas of high shear stress values).
- Issue study report

Study 3 –Riverbank Erosion Study



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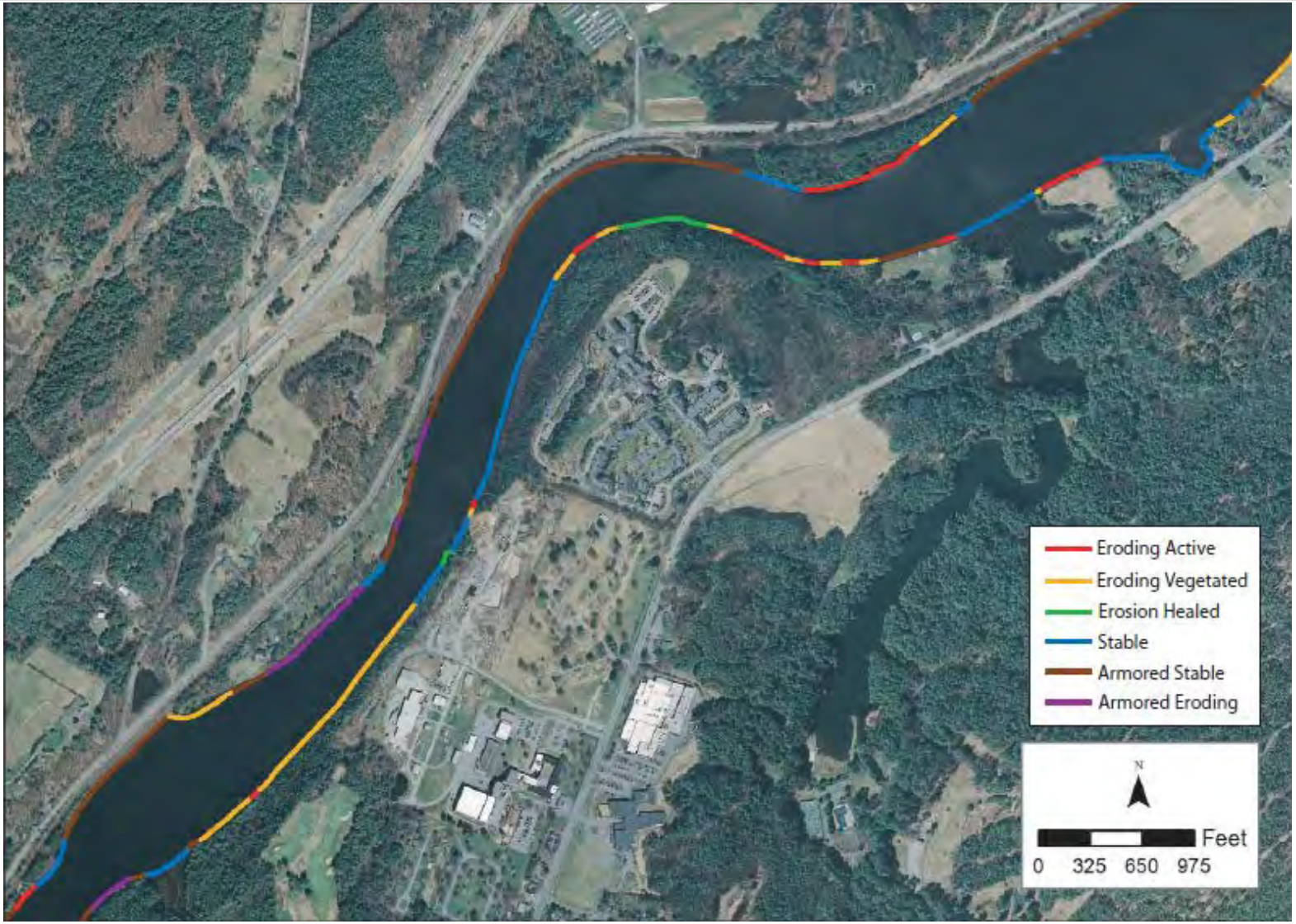
Bellows Falls Impoundment
(Weathersfield. VT/Claremont, NH)

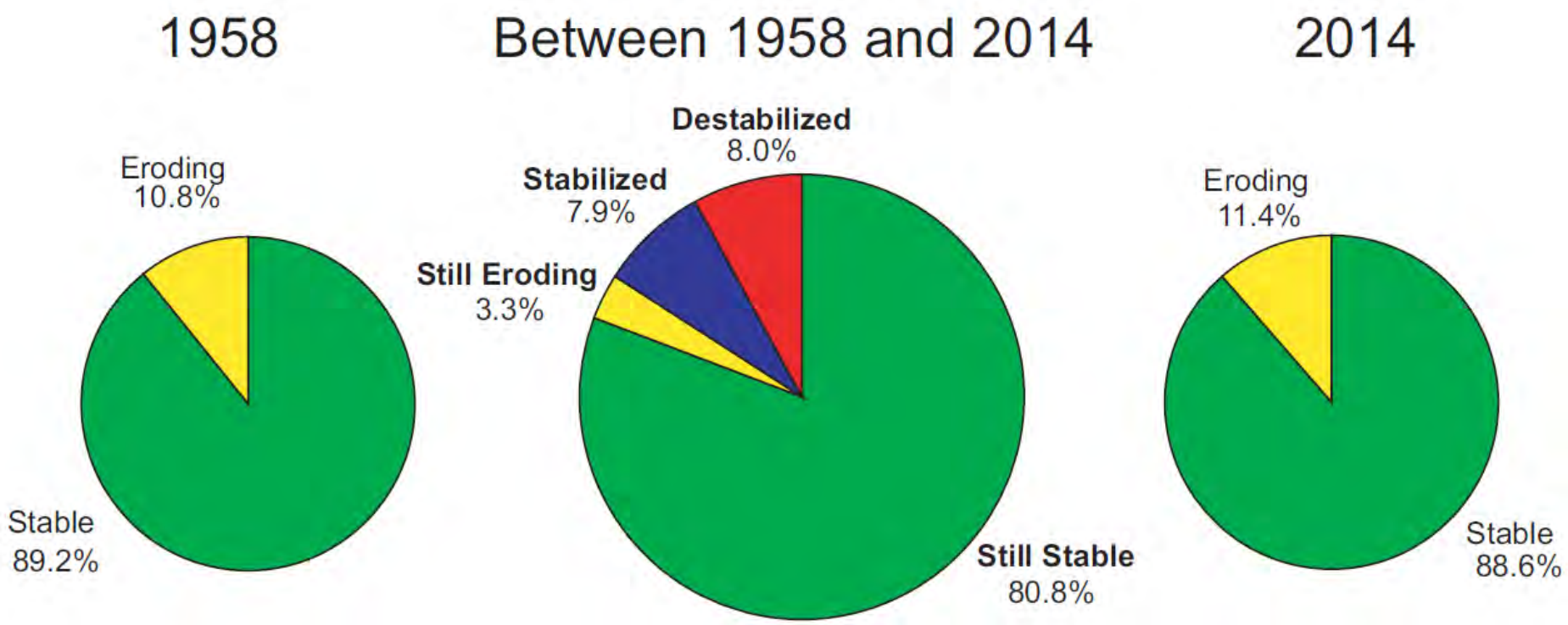
Study 3 –Riverbank Erosion Study



TransCanada

Wilder Impoundment
(Norwich. VT/Hanover, NH)

Study 3 –Riverbank Erosion Study



Analysis of erosion to be completed

Potential impact of:

- tributary inputs
- channel constrictions
- soil types
- channel position
- project operations (based on modeling)

Study 3 –Riverbank Erosion Study

TransCanada

Bloods Brook
(Lebanon, NH)

Study 3 –Riverbank Erosion Study

Bloods Brook
(Lebanon, NH)

Study 3 –Riverbank Erosion Study

Bloods Brook
(Lebanon, NH)

Study 3 –Riverbank Erosion Study

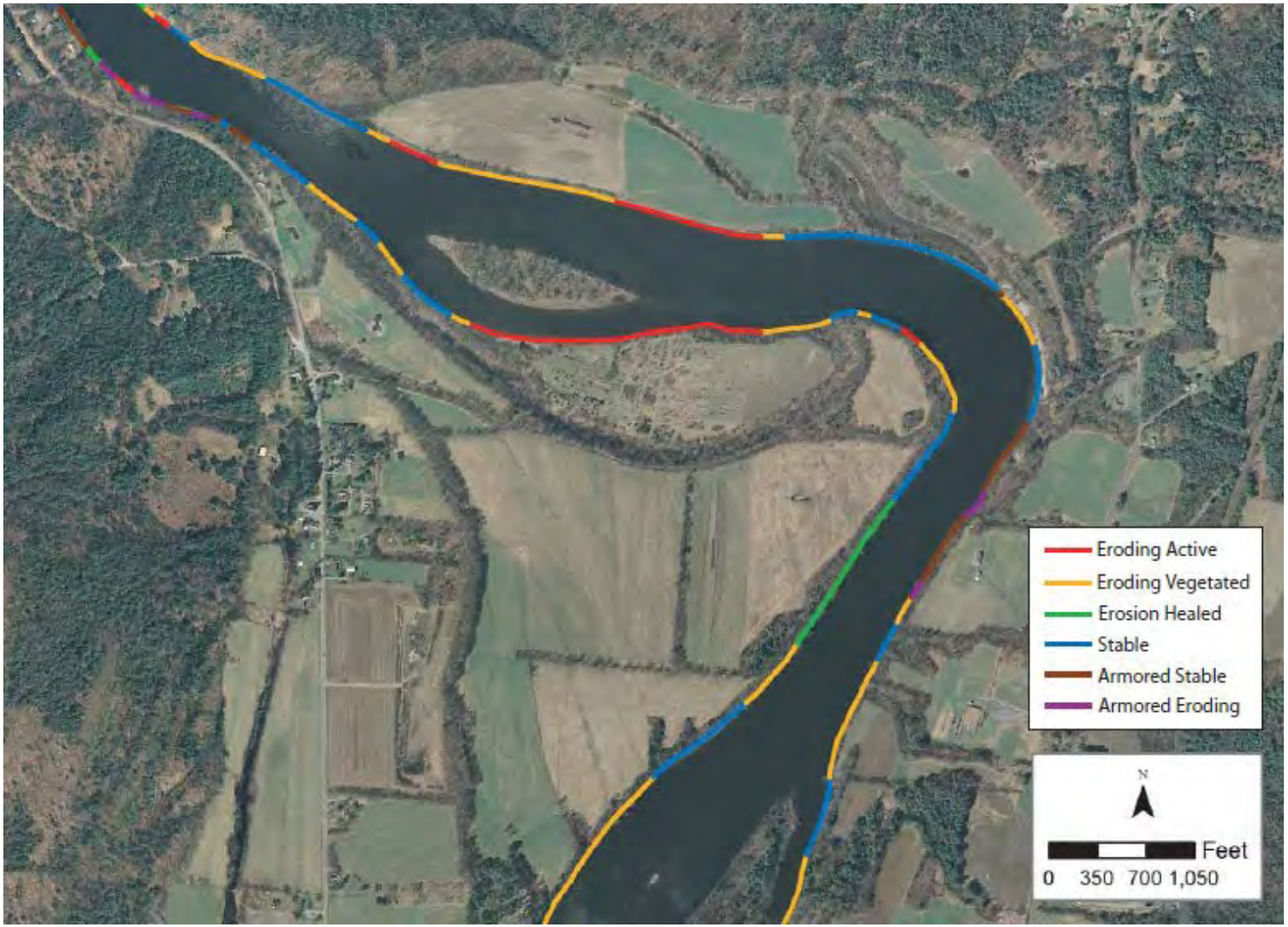
Bloods Brook
(Lebanon, NH)

Study 3 –Riverbank Erosion Study

TransCanada

Wilder Impoundment
(Bradford, VT/Piermont, NH)

Study 3 –Riverbank Erosion Study



TransCanada

Bellows Falls Impoundment
(Weathersfield, VT/Claremont, NH)

Questions and Discussion

Location and agenda for 10/02 Meeting

Agenda – Friday October 2, 2015

9 am at TransCanada ‘s River Operations Center
275 Wilder Dam Road Wilder, VT 05088

Park in the area to the right of the access road before you reach the fence and building.

Please wait for someone to open the gate as this is a NERC-secure facility.

Study No.	Study Title	Presenter
33	Cultural and Historic Resources Study	Steve Olausen
10	Fish Assemblage Study	Drew Trested
11	American Eel Survey	Drew Trested
12	Tessellated Darter Survey	Drew Trested
17	Upstream Passage of Riverine Fish Species Assessment	Rick Simmons
Break ~ 10:45 – 11:00		
18	American Eel Upstream Passage Assessment	Steve Leach
19	American Eel Downstream Passage Assessment	Doug Royer
22	Downstream Migration of Juvenile American Shad – Vernon	Doug Royer, Steve Leach, Chris Gurshin
20	American Eel Downstream Migration Timing Assessment	Doug Royer
23	Fish Impingement, Entrainment and Survival Study	Drew Trested
Lunch ~ 12:15 – 12:45 pm brought in		
Questions; Meeting summary and comments schedule		

Wilder, Bellows Falls, and Vernon Project Relicensing

Updated Study Results Meeting - October 2, 2015

TransCanada

Agenda – October 2, 2015

Study No.	Study Title	Presenter
33	Cultural and Historic Resources Study	Steve Olausen
10	Fish Assemblage Study	Drew Trested
11	American Eel Survey	Drew Trested
12	Tessellated Darter Survey	Drew Trested
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23	Fish Impingement, Entrainment and Survival Study	Drew Trested
Lunch ~ 12:15 – 12:45 pm brought in		
Questions; Meeting summary and comments schedule		

Study 33
Cultural and Historic Resources Study

Study 33 – Historic and Cultural Resources

Study Progress - Archaeological Investigations

Vernon Project 2013 Monitoring Program/Update of Phase 1A Archaeological Reconnaissance Survey Report:

- Study Complete: final report submitted to FERC, VTSHPO, NHSHPO, Nolumbeka Project, and Narragansett THPO on December 23, 2014.
- NHSHPO agreed with TransCanada's recommendations for Phase IB survey in New Hampshire on February 23, 2015.
- No response to the report was received from the VTSHPO within the allotted review time [or at all], so agreement with recommendations for proposed Phase 1B testing was assumed, as is common.

Phase IB Archaeological Identification Surveys – Wilder, Bellows Falls, and Vernon Projects:

- Study ongoing
- Fieldwork on TransCanada fee-owned land completed Spring 2015.
- All private property owners where Phase IB survey was proposed have been contacted by TransCanada and approximately 60 percent granted permission to conduct testing.
- Phase IB testing has been completed on lands where permissions have been granted.
- Phase IB Reports for each Project are currently in process.

Study Progress - Archaeological Investigations

Phase II Archaeological Evaluation Survey

- Study ongoing
- Fieldwork scheduled for fall 2015, report spring 2016

Study 33 – Historic and Cultural Resources

Study Progress - Continued

Historic Architectural Resources National Register Evaluation

- Study Complete: report was submitted to FERC, NHSHPO, and VTSHPO on May 25, 2015.
- NHSHPO requested the report be provided in its Project Area Form format on June 29, 2015 and TransCanada submitted Project Area Forms for the Wilder, Bellows Falls, and Vernon Projects to the NHDHR on July 30, 2015.
- By letter dated August 27, 2015 the NHSHPO evaluated the Wilder Dam eligible for the National Register and stated their opinion that the relicensing of the Projects will have no adverse effect on historic architectural resources.
- The VTSHPO did not comment on the report. TransCanada assumes concurrence with the report's conclusions that the resources associated with the development and operation of the Wilder, Bellows Falls, and Wilder Projects are eligible for listing in the National Register as part of a potential historic district at each Project.

Study 33 – Historic and Cultural Resources

Study Progress - Continued

Traditional Cultural Properties (TCP) Identification Survey:

- Study ongoing
- Background archival ethnographic material has been gathered and continues based on new information provided as part of the archaeological and historic properties surveys.
- No meetings or interviews with NITHPO or the Nolumbeka Project have been conducted due to a lack of response to TransCanada's invitations and solicitations to participate in this study.
- A TCP report is being prepared that will include categories of historic properties that could be considered TCPs.

Study 10
Fish Assemblage Study

Study 10 – Fish Assemblage Study

TransCanada

Study Progress

- Site selection conducted in late 2014 with working group
- Revised SSR filed in Volume II of the USR
- 69 sites (“map units”) selected for each of spring, summer, and fall sampling events
- Sampling gear types preselected based on anticipated site conditions (boat electrofish, two-hour experimental gill net set, pram or backpack electrofish, beach seine)
- Spring (May-June), Summer (July-August) and Fall (September-October) sampling completed.
- Preliminary data available for Spring only at this time.

Preliminary Study Results to Date

Spring Sampling – collection by sampling method

River Reach	Number Sample Locations		# Collected Samples			
	Mainstem	Tributary/ Backwater	Boat Efish	Pram/ Backpack Efish	Gill Net	Seine
Wilder Impoundment	15	2	15	2	15	0
Wilder Riverine	12	2	0	14	0	9
Bellows Falls Impoundment	12	1	12	1	11	1
Bellows Falls Bypassed Reach	3	0	0	0	0	0
Bellows Falls Riverine	12	3	12	3	0	12
Vernon Impoundment	12	1	12	1	12	0
Vernon Riverine	3	3	3	3	2	1
Total	**69**	**12**	**54**	**24**	**40**	**23**

Preliminary Study Results to Date

Spring Sampling – 3,938 individuals, 35 species

Common Name	Total Spring Catch	% Composition	Common Name	Total Spring Catch	% Composition
Spottail shiner	1204	30.57%	Northern pike	21	0.53%
Rock bass	385	9.78%	Brook trout	17	0.43%
Yellow perch	371	9.42%	Golden shiner	10	0.25%
Tessellated darter	346	8.79%	Banded killifish	6	0.15%
Rosyface shiner	339	8.61%	Black crappie	4	0.10%
Fallfish	335	8.51%	Lake chub	4	0.10%
Smallmouth bass	238	6.04%	Mimic shiner	4	0.10%
Common shiner	133	3.38%	American shad	3	0.08%
White sucker	98	2.49%	Brown bullhead	3	0.08%
Slimy sculpin	81	2.06%	Eastern silvery minnow	3	0.08%
Walleye	59	1.50%	Brown trout	2	0.05%
Blacknose dace	44	1.12%	Chain pickerel	2	0.05%
Bluegill	44	1.12%	Bluntnose minnow	1	0.03%
Sea lamprey	38	0.96%	Bridle shiner	1	0.03%
Creek chub	34	0.86%	Channel catfish	1	0.03%
Longnose dace	28	0.71%	Esox sp.	1	0.03%
Longnose sucker	26	0.66%	Lepomis sp.	1	0.03%
Pumpkinseed	26	0.66%	Yellow bullhead	1	0.03%
Largemouth bass	24	0.61%			

Remaining Activities

- Field data currently being key-punched, verified, and subjected to data QC protocols.
- Issue study report

Study 11
American Eel Survey

Study 11 – American Eel Survey

Study Progress

- Site selection conducted in late 2014 with working group
- Revised SSR filed in Volume II of the USR
- 102 mainstem sites and 24 tributary sites (“map units”) selected
- Sampling consisted of a 500-m electrofish transect and a 24-hr baited eel trap set.
- All mainstem and tributary sampling (electrofish and eel trap) has been completed.

Study 11 – American Eel Survey

Study Results to Date

- 252 samples collected
- 3 eels captured by e-fishing in Bellows Falls impoundment

River Reach	Number Sample Locations		# Samples		
	Mainstem	Major Tributaries	Boat Efish	Pram/ Backpack Efish	Eel Trap
Wilder Impoundment	37	7	38	6	44
Wilder Riverine	15	4	0	19	19
Bellows Falls Impoundment	22	5	24	3	27
Bellows Falls Riverine	5	3	0	8	8
Vernon Impoundment	22	5	22	5	27
Vernon Riverine	1	0	1	0	1
Total	102	24	85	41	126

Study 11 – American Eel Survey

Remaining Activities

- Field data currently being key-punched, verified, and subjected to data QC protocols.
- Issue study report

Study 12
Tessellated Darter Survey

Study Progress

- Site selection conducted in late 2014 with working group
- Revised SSR filed in Volume II of the USR
- 45 sites with 3 cross-river transects each selected
- Each transect contained 5 fixed-radius count locations spaced evenly across the channel (3-m diameter)
- Diver or snorkeler (to be determined in field and dependent upon site conditions) descends down the line and records pertinent field data.
- Field work initiated week of September 1 and completed the week of September 21.

Study 12 – Tessellated Darter Survey

TransCanada

Study 12 – Tessellated Darter Survey

Study Results to Date

- No results at this time – sampling recently completed
- One site B-093 had to be relocated for safety reasons as it was too close to boater booms at Bellows Falls dam. Relocated site to similar substrate (sand-silt-clay) in the next map unit located 500-m upstream (B-092)

Remaining Activities

- Field data currently being key-punched, verified, and subjected to data QC protocols.
- Issue study report

Study 17
Upstream Passage of Riverine Fish Species Assessment

Study 17 – Upstream Passage of Riverine Fish Species

Study Progress

- Fishways began operation on April 15 at Wilder, April 9 at Bellows Falls, and May 5 at Vernon
- Video equipment began operating on April 16 at Wilder, April 15 at Bellows Falls, and May 5 at Vernon.
- Video data has been continually processed, reviewed and summarized on a weekly basis throughout the study season.
- Weekly fish count updates are sent via email to VDFW at their request.
- To date, motion capture video for all three dams has been reviewed through September 17, 2015.

Remaining Activities

- Continued video monitoring until ice-in, and data analysis
- Issuance of study report

Study 17 – Upstream Passage of Riverine Fish Species

Study Results as of September 17

Species	Wilder	Bellows Falls	Vernon
Migratory Species			
Atlantic Salmon	0	0	6
American Shad	0	44	39775
Sea Lamprey	2	971	2519
American Eel	40	55	1549
Resident Species			
Bass (Micropterus spp.)	46	-71	821
White Sucker	1	6	352
Walleye	20	-6	57
Trout	62	12	29
Sunfish (Lepomis spp.)	-5	5	1072
Bullhead	0	0	2
Crappie (Pomoxis spp.)	0	0	0
Pike (Esox spp.)	0	0	-1
Yellow Perch	0	0	0
Carp	0	0	27
Other (Channel catfish)	0	0	28

First Observation Date of Resident Species

Wilder		Bellows Falls		Vernon	
	Date First Observed		Date First Observed		Date First Observed
Walleye	5/12/2015	**Walleye**	5/10/2015	**Walleye**	5/5/2015
White sucker	5/12/2015	**White sucker**	5/3/2015	**White sucker**	5/5/2015
Micropterus spp. (Bass)	5/21/2015	**Micropterus spp. (Bass)**	5/12/2015	**Micropterus spp. (Bass)**	5/5/2015
Lepomis spp. (Sunfish)	5/21/2015	**Lepomis spp. (Sunfish)**	5/29/2015	**Lepomis spp. (Sunfish)**	5/7/2015
American eel	6/2/2015	**American eel**	6/21/2015	**American eel**	5/21/2015

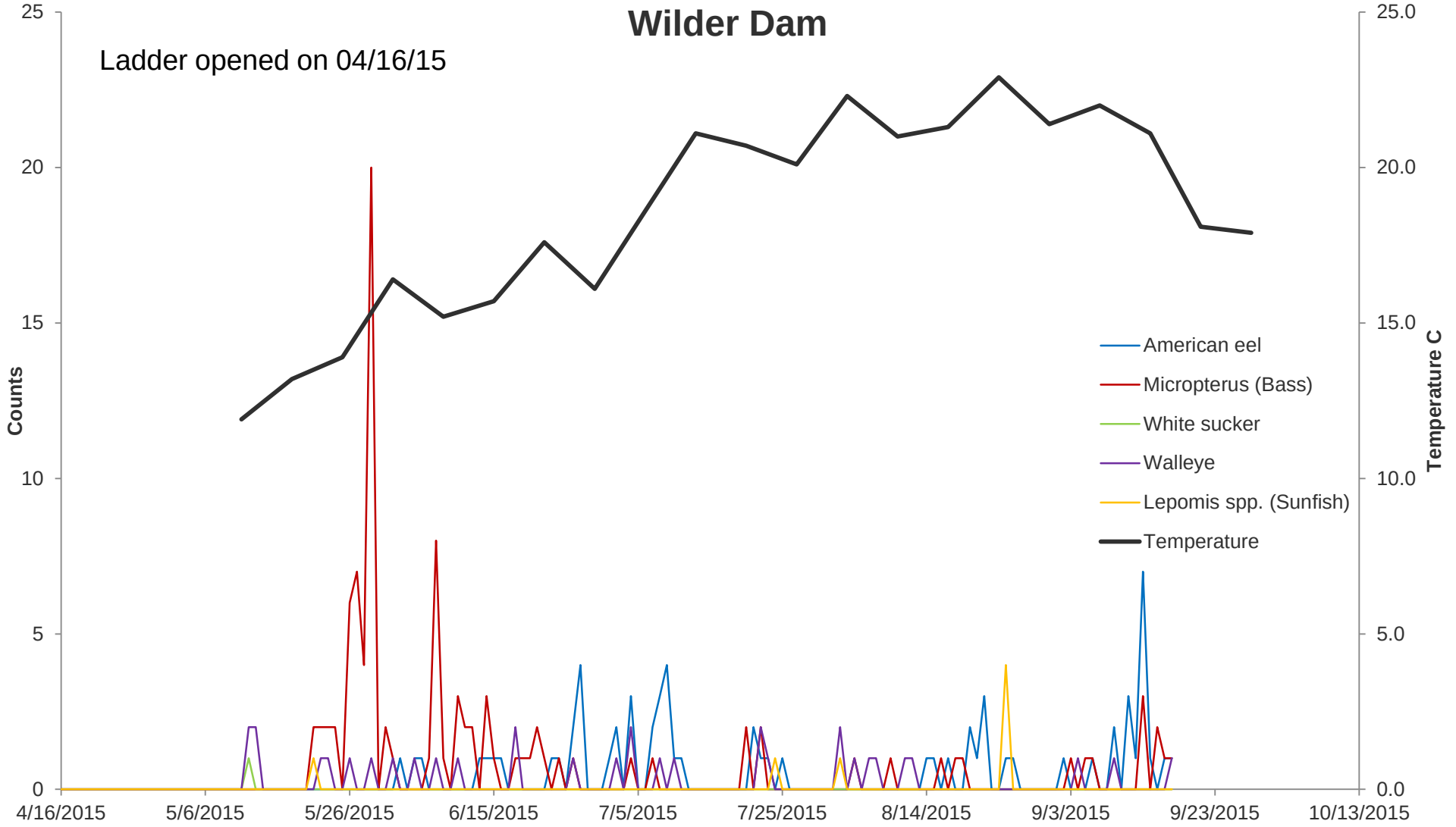
Study 17 – Upstream Passage of Riverine Fish Species

American Eel in Wilder Fish Ladder

September 23, 2015

TransCanada

Study 17 – Upstream Passage of Riverine Fish Species



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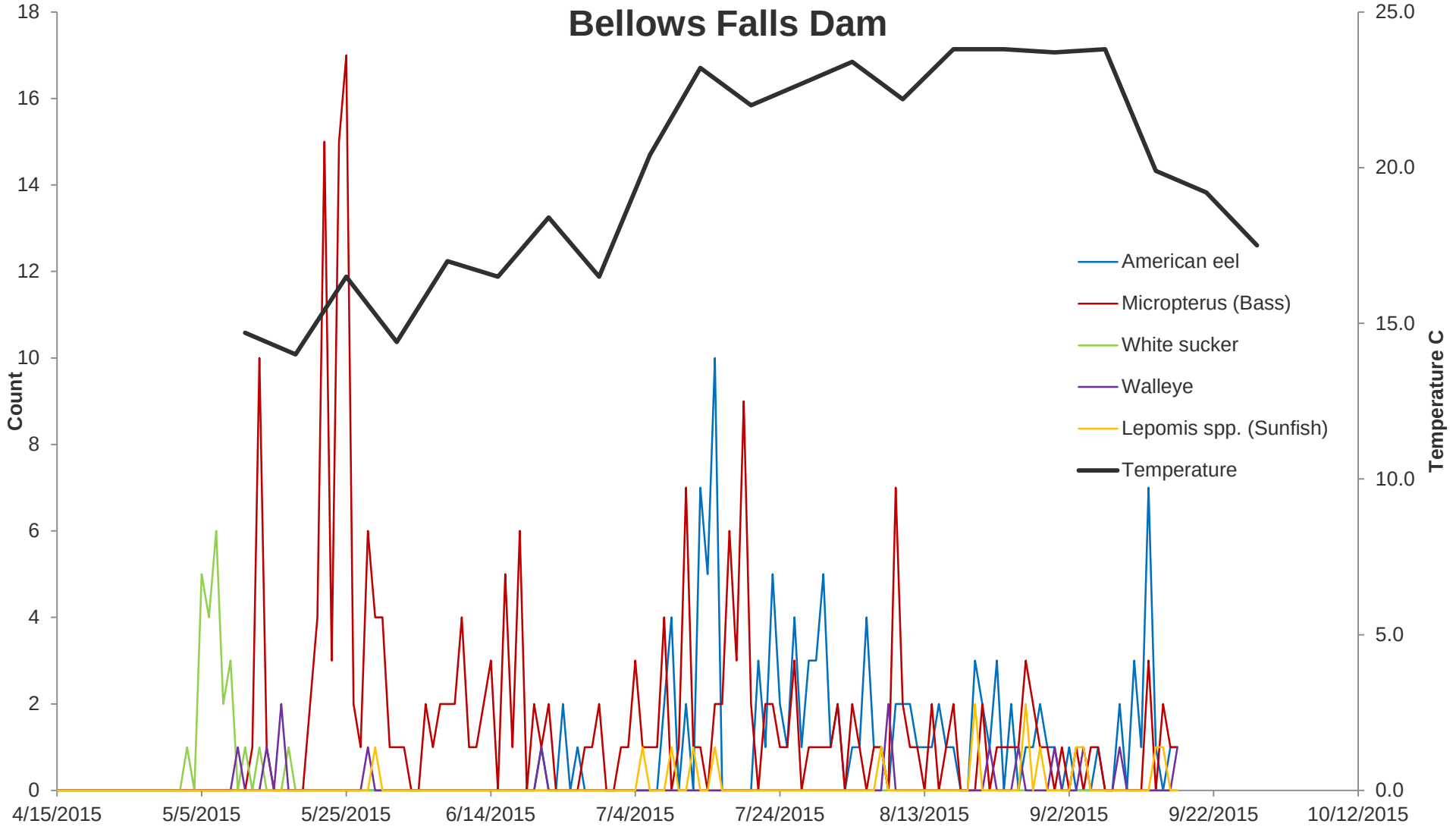
Study 17 – Upstream Passage of Riverine Fish Species



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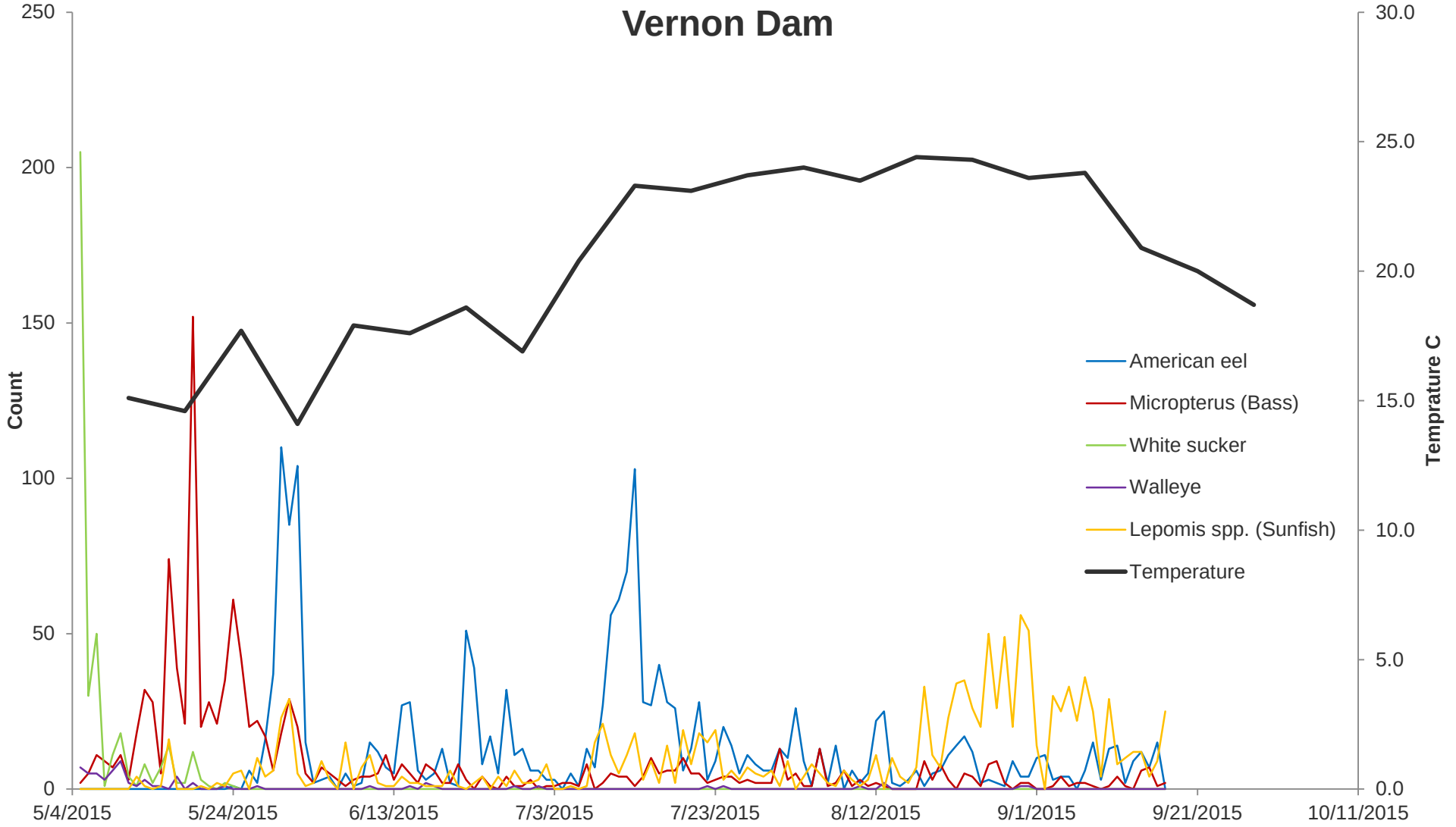
Study 17 – Upstream Passage of Riverine Fish Species



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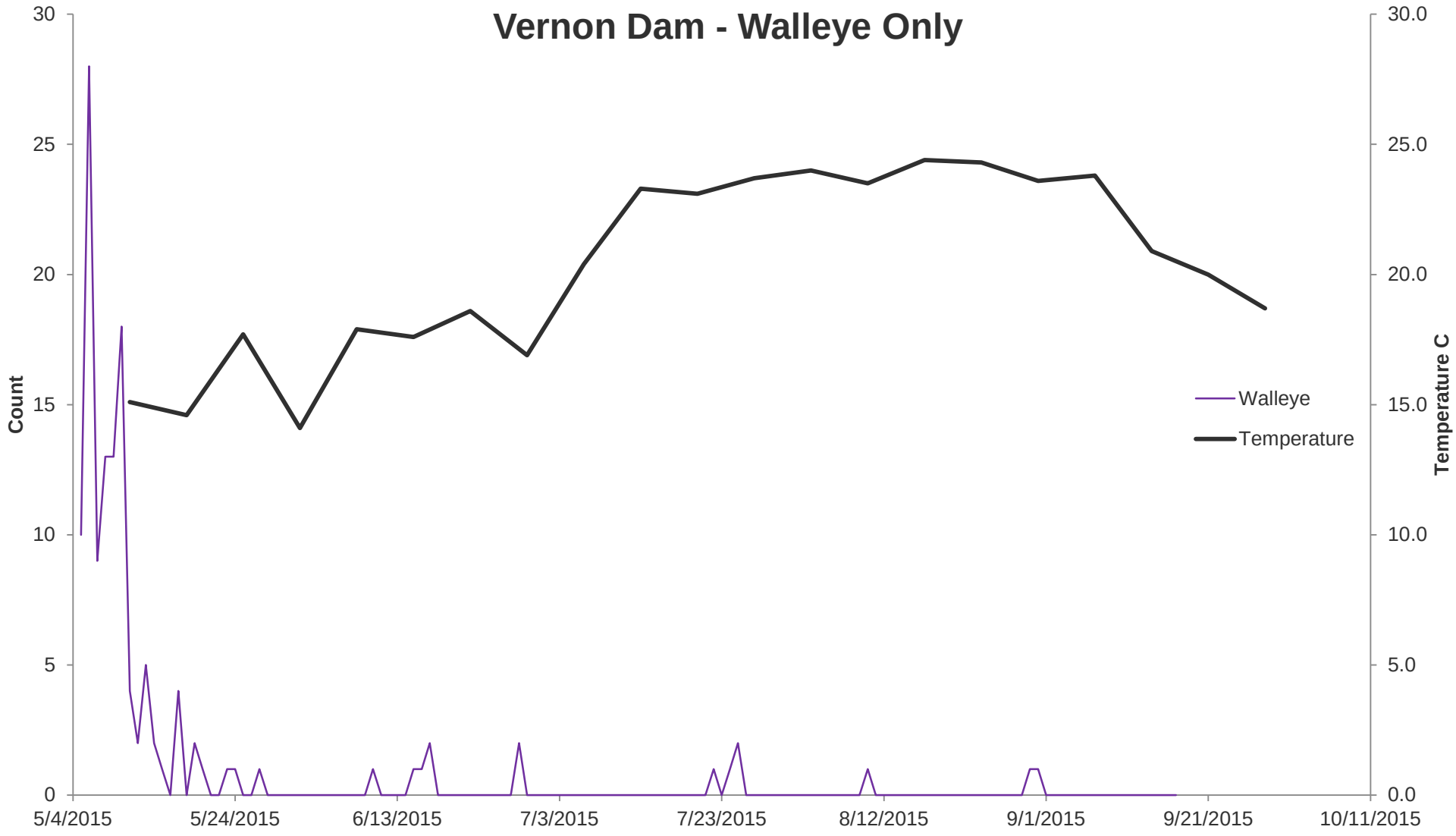
Study 17 – Upstream Passage of Riverine Fish Species



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Study 18
American Eel
Upstream Passage Assessment

Study 18 – American Eel Upstream Passage

Study Progress

- Systematic surveys of eel presence/abundance at tailrace and spillway locations at all three dams began in May 2015 and will continue through October 2015
- Collection of eels using baited eel pots began in May 2015, and ended on August 27, 2015 (with working group concurrence) due to limited success
- To date, no temporary ramp traps have been deployed since the only aggregation point thus far is the Vernon fishway (operated for Study 17)

Study Results to Date

- As of September 30, 2015**,** eels have been observed and/or trapped at Vernon and Bellows Falls dams. None have been observed or trapped at Wilder; however, eel activity has been detected at Wilder dam during Study 17

Study Results as of September 30

Number of eels collected

Date	Bellows Falls		Vernon						
	Site 1	Site 7	Site 3	Site 4	Site 7	Site 8	Site 9	Site 10	Site 15
7/8/15		1				2			
7/15/15					2	3	4	4	1
07/21/15	1								
7/22/15									2
7/29/15						2			1
8/5/15								1	
8/12/15									1
8/19/15					1	2	1		2
08/25/15	1								
8/26/15									2
9/2/15						4			6
9/9/15				2	1	4			3
9/16/15			1			1			3
09/23/15				1		1			2
09/30/15				1		2			
TOTAL	2	1	1	4	5	20	5	5	23

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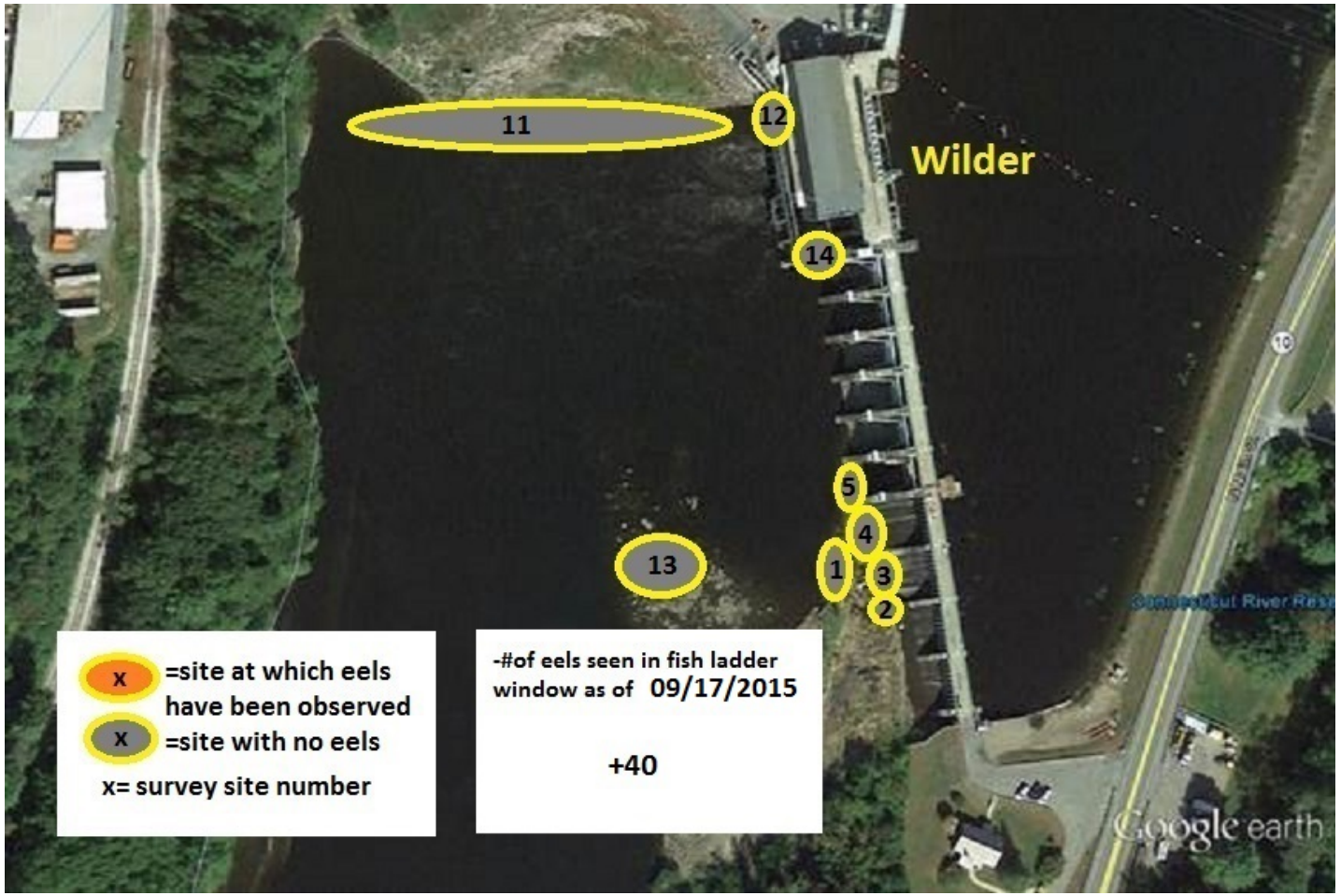
Study 18 – American Eel Upstream Passage



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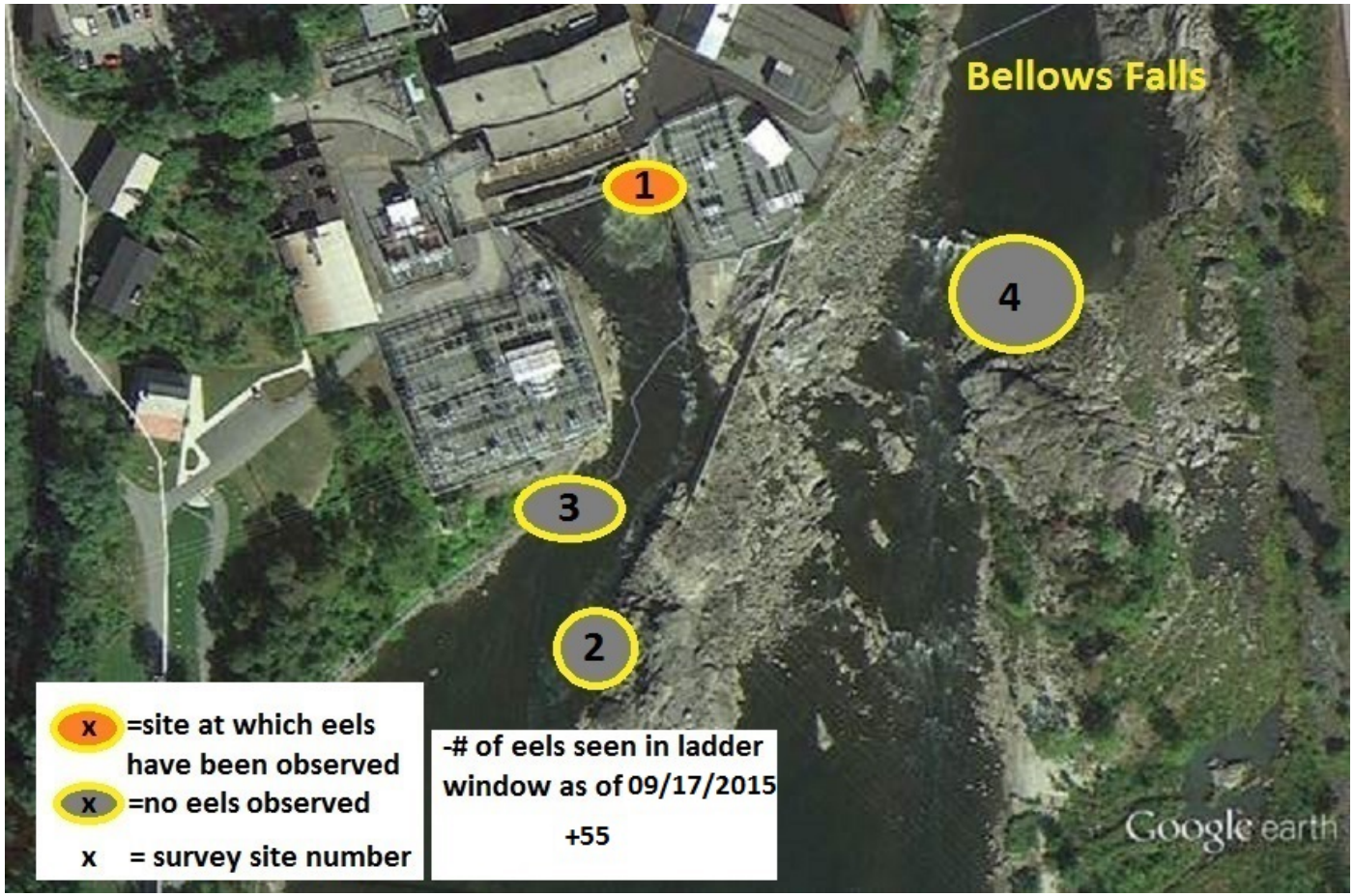
Study 18 – American Eel Upstream Passage



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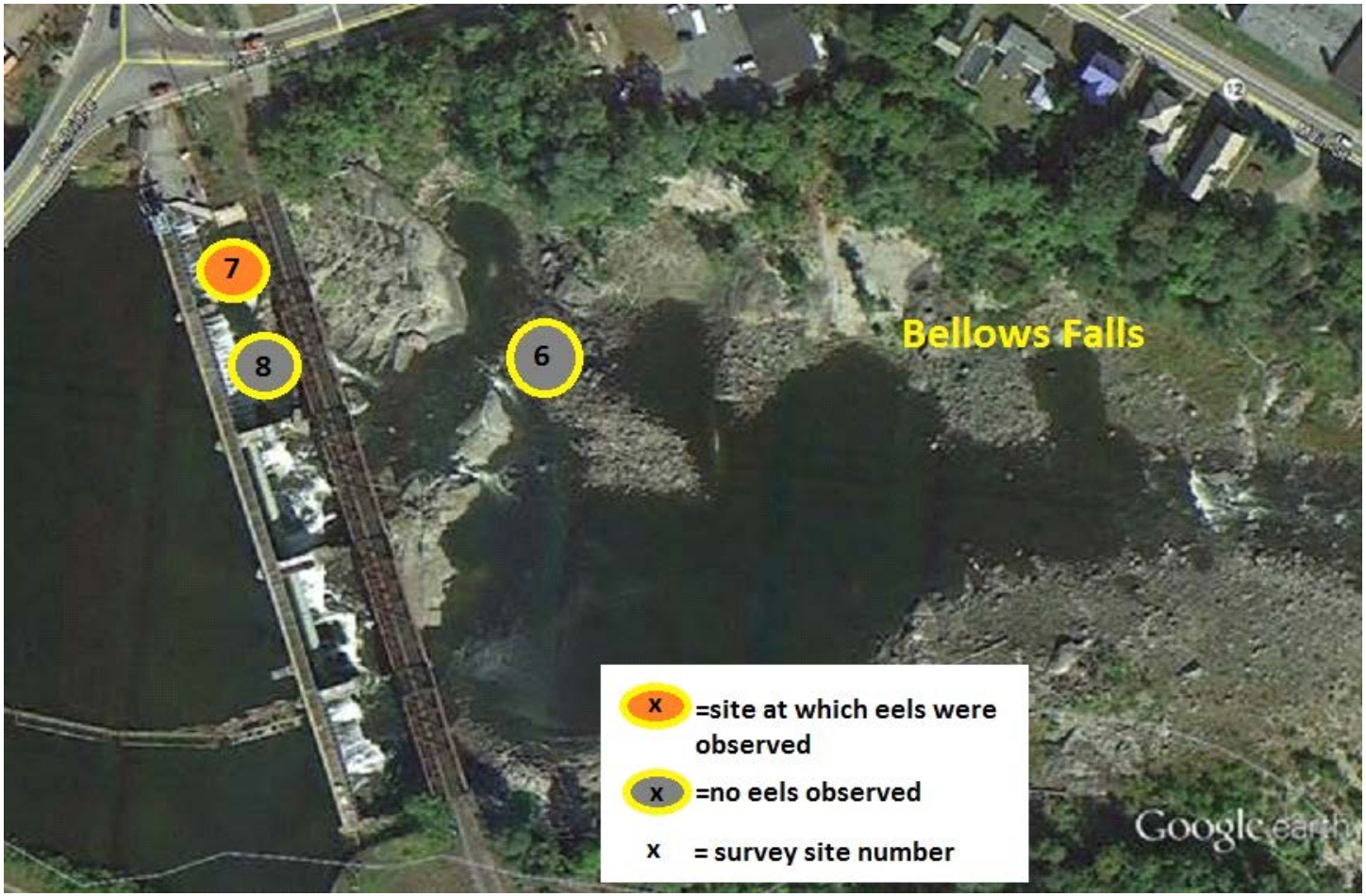
Study 18 – American Eel Upstream Passage



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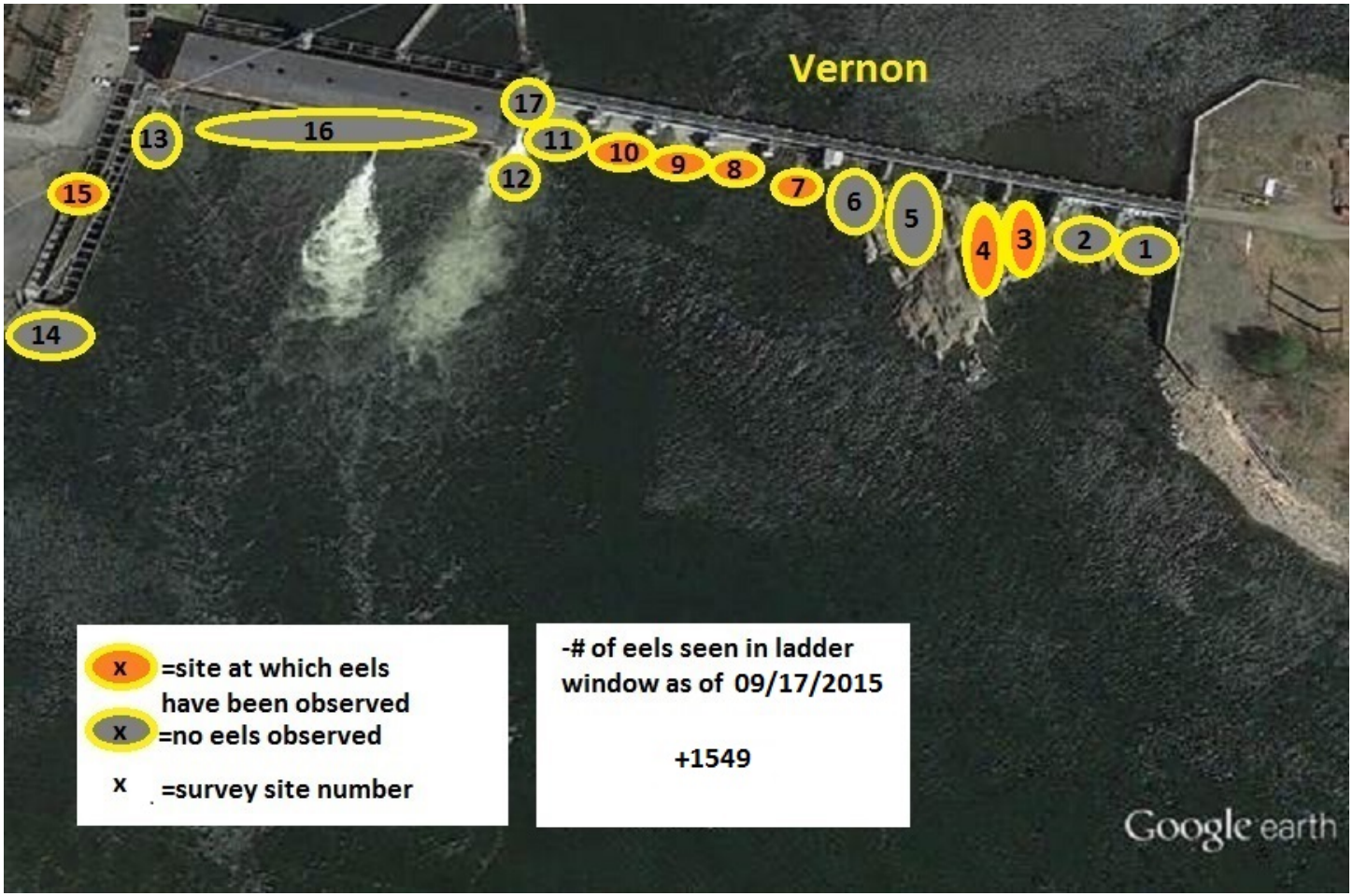
Study 18 – American Eel Upstream Passage



Study 19
American Eel
Downstream Passage Assessment

Study 19 – American Eel Downstream Passage

Study Progress

- Coordinated with FirstLight and agencies on eel importation from Newfoundland and required import pathology testing (in progress now)
- Radio telemetry and turbine equipment is set up, and turbine selection for survival study is in progress
- Expected delivery of eels is October 21 – 23 (delays start of route selection from study plan based on in-basin eel collection)

Remaining Activities

- Route selection will begin as soon as eels are onsite and stabilized
- Turbine survival will begin in late October.
- Field work expected be completed by mid-November, data analysis and issuance of report to follow

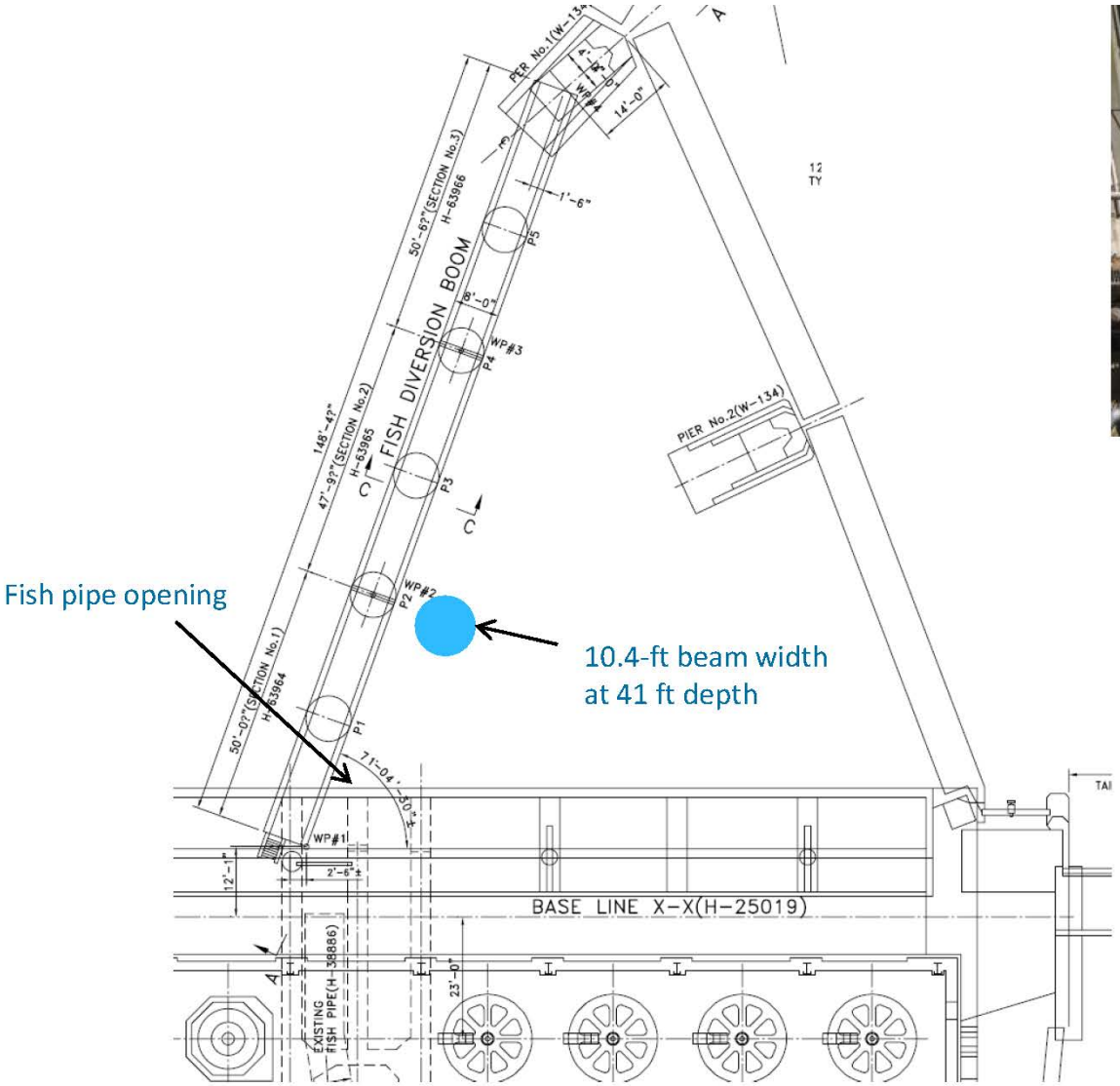
Study 22
Downstream Migration of
Juvenile American Shad - Vernon

Study 22 – Downstream Migration of Juvenile American Shad

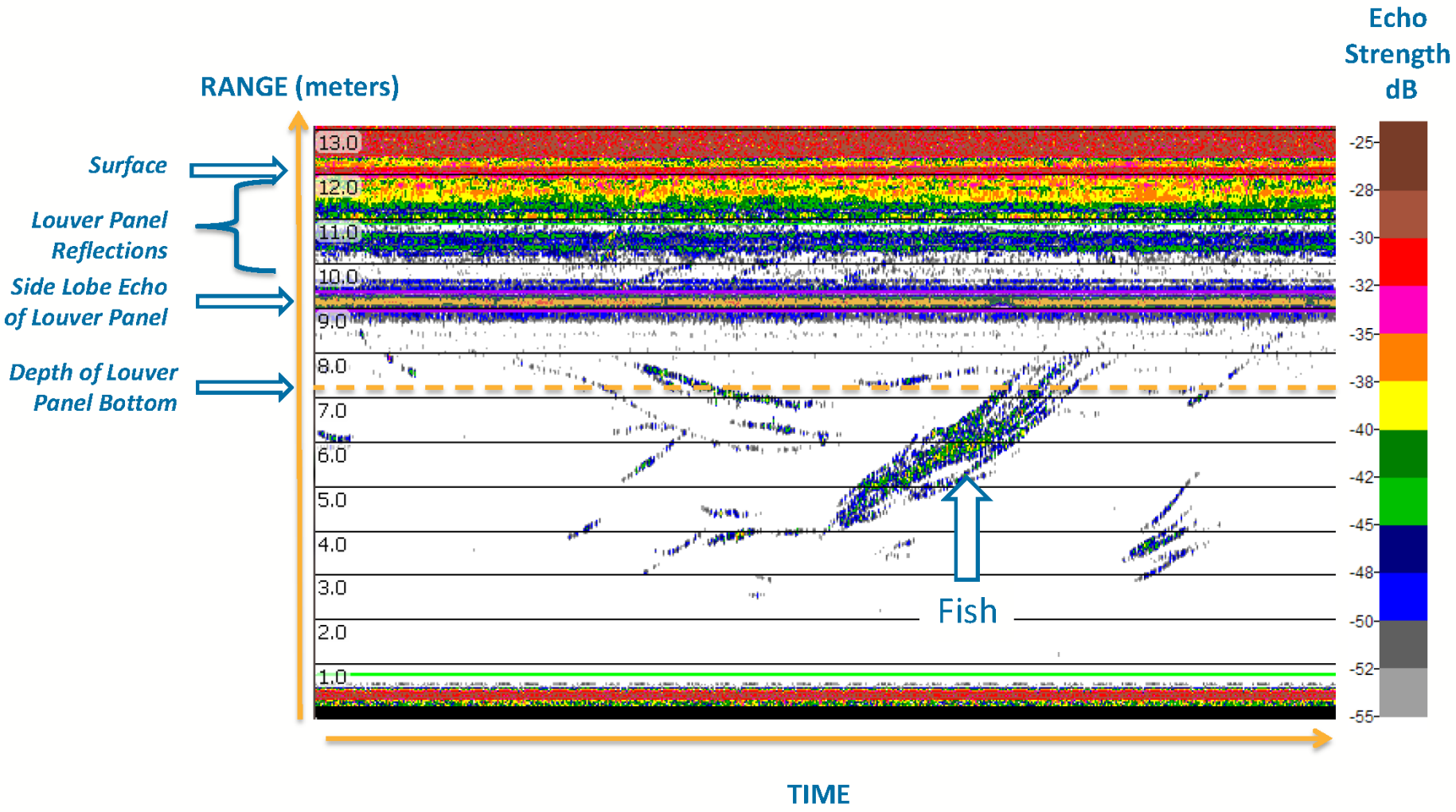
Study Progress

- Conducted transport survival evaluation and tagging experiment in October 2014, determining that wild shad were not large enough for turbine tag attachment method
- Coordinated with FWS to raise shad to 120 mm for turbine tagging (in progress and fish delivery expected October 5)
- Radio telemetry and turbine equipment is set up, and turbine selection for survival study is in progress
- Hydroacoustic (HA) equipment set up and operating (some data losses being investigated)
- Juvenile shad first seen on HA on September 14
- E-fishing collections of shad for radio tagging began September 25, with release of 20. About 40% of fish collected are tag-able (100 MM or larger)

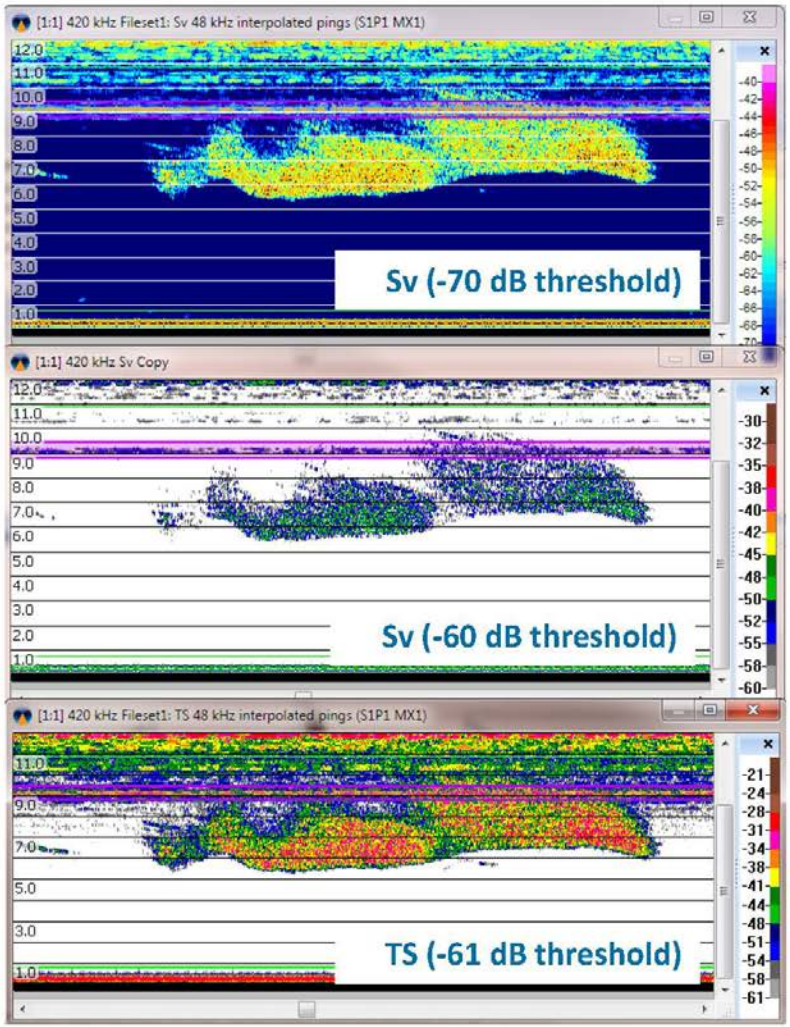
Study 22 – Downstream Migration of Juvenile American Shad



Study 22 – Echogram



Study 22 – Fish School Echos September 16



- Cast Net ±1 h sunset
- 5-10 throws each side of louver
- Mean TL = 104 mm, n=5 (97-117 mm)

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Study 22 – Downstream Migration of Juvenile American Shad

Remaining Activities

- Radio tagging, releases, and route selection will continue to mid-November
- Hydroacoustic data collection and net sampling will continue to mid-November
- Turbine survival expected to occur the week of October 5
- Field work to be completed by mid-November, data analysis and issuance of report to follow

Study 20
American Eel
Downstream Migration Timing Assessment

Study 20 – American Eel Downstream Migration Timing

Study Progress

- Literature reviews in progress, will be completed in the fall of 2015
- Completion of this study depends in part upon the results of the other American eel studies (Studies 11, 18 and 19) which are in progress; along with similar FirstLight studies also in progress

Remaining Activities

- Characterize expected outmigration of silver phase eels, based on environmental cues
- Once data is collected and consolidated from other studies, and analysis complete, the study report will be issued

Study 23
Fish Impingement, Entrainment, and Survival Study

Study 23 – Fish Impingement, Entrainment, and Survival

Study Progress

- Literature review in progress
- Intake and turbine specifications collected and under review
- Study implementation depends in part upon the results of Fish Assemblage Study (Study 10), the two American shad studies (Studies 21 and 22), and the two American eel downstream assessments (Studies 19 and 20)

Remaining Activities

- Characterize potential for impingement/entrainment based on site-specifics and assemblages of target species (Wilder and Bellows: American eel, Atlantic salmon, sea lamprey; Vernon: American shad, Atlantic salmon, river herring, sea lamprey)
- Once data is collected and consolidated from other studies, and analysis complete, the study report will be issued.

Lunch – 30 Minutes

Discussion and Questions

Upcoming Milestones:

- 10/14/15 - Meeting Summary Notes
- 11/13/15 - Disagreements, Requests to Amend Study Plan
- 12/13/15 - Responses to Disagreements, Requests
- 01/12/16 - FERC Determination on Disagreements, Requested Amendments
- 03/01/16 – Study Reports