TRANSCANADA HYDRO NORTHEAST INC.

ILP Study 32
Bellows Falls Aesthetic Flow Study

Final Study Report

In support of Federal Energy Regulatory Commission Relicensing of:

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)

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EXECUTIVE SUMMARY

TransCanada Hydro Northeast Inc. (TransCanada) prepared this Bellows Falls Aesthetic Flow Final Study Report (ILP Study 32) to fulfill the requirements of the Revised Study Plan (RSP) as part of relicensing the Bellows Falls Hydroelectric Project (FERC Project No. 1855).

The purpose of the aesthetic flow study was to characterize the aesthetic attributes of the Bellows Falls bypassed reach. The report characterizes the aesthetic conditions in the bypassed reach at various flow levels and provides a range of aesthetic ratings for the different flows. Initial data collected in 2015 for the study included photographic and video of six flows from three Key Observation Points (KOPs). The data were reviewed, evaluated, and discussed by nine participants at a focus group meeting; the survey tools and viewable media were prepared for the focus group; and the focus group meeting was conducted.

Key findings made by the focus group participants include:

- In general, higher flow than typical dam leakage flows in the Bellows Falls bypassed reach improved aesthetics;
- seasonal variability in flow, with high flow in the spring and low flow in the summer and fall, are important aesthetic attributes that reflect typical seasonal differences;
- the need for aesthetic flow in the bypassed reach is of low importance to the public under today's conditions because access to viewing areas where the public could experience aesthetic flows is limited;
- even though public viewpoints are generally limited, the majority of participants agreed that some flow, even low leakage flow, is important to the aesthetics of the bypassed reach as compared to a dry reach (one participant preferred no flow); and
- without public access and viewing opportunities, there is little incremental gain by adding additional flows to the existing leakage flows. If public access and viewpoints could be created, the value of incremental additional aesthetic flow may increase.

In response to comments from the Vermont Agency of Natural Resources (VANR) on the original flow assessment, a supplemental aesthetics flow evaluation was conducted on June 29, 2016. In the original study, flows released for the whitewater boating flow assessment (Study 31 [Louis Berger Group and Normandeau, 2016]) were assessed. Flows associated with the instream flow study (Study 9 [Normandeau, 2016]) were not assessed, which represented a deviation from the approved study plan. To address the study plan deviation, a supplemental study of lower flows at the Bellows Falls dam (Appendix D). That evaluation showed only small discernible differences in aesthetics at different flows ranging from leakage to 1,600 cubic feet per second (cfs).

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cfs	cubic feet per second
FERC	Federal Energy Regulatory Commission
ILP	Integrated Licensing Process
KOP	Key Observation Point
RSP	Revised Study Plan
SPD	Study Plan Determination
TransCanada	TransCanada Hydro Northeast Inc.
VANR	Vermont Agency of Natural Resources

1.0 INTRODUCTION

This study report presents the findings of the Bellows Falls Aesthetic Flow Study (ILP Study 32) conducted in support of Federal Energy Regulatory Commission (FERC) relicensing efforts by TransCanada Hydro Northeast Inc. (TransCanada) for the Wilder Hydroelectric Project (FERC Project No. 1892), Bellows Falls Hydroelectric Project (FERC No. 1855), and the Vernon Hydroelectric Project (FERC No. 1904).

TransCanada developed the Bellows Falls Aesthetic Flow Revised Study Plan (RSP) and implemented the study to obtain information to characterize the aesthetic conditions in the Bellows Falls bypassed reach at various levels of flow. This aesthetic assessment report is based on flow data collected from May 30 and May 31, 2015, a focus group conducted on August 20, 2015, and supplemental flow data collected on June 29, 2016 (see Appendix D).

The RSP for this study was approved without modification in FERC's September 13, 2013, Study Plan Determination (SPD). However, the study was delayed to 2015, from the fall of 2014 due to low water at that time which precluded conducting flow demonstrations at higher than typical flows from the dam.

1.1 Project Description

The Bellows Falls Project's dam, canal, and powerhouse are located on the Connecticut River at river mile 173.7, near the village of Bellows Falls, Vermont, and town of North Walpole, New Hampshire. The Bellows Falls bypassed reach extends about 3/4 of a mile from the dam to the confluence with the tailrace of the powerhouse. Flow in the bypassed reach corresponds with spring freshet and large precipitation events when river flows exceed powerhouse capacity, and during outages at the powerhouse requiring water to be diverted to the dam and spilled into the bypassed reach. During the majority of the year, the only flows in the bypassed reach are the result of leakage through spillway gate seals and stanchion boards, which vary from year to year. From other studies, TransCanada estimates the leakage observed in this study as approximately 125 cubic feet per second (cfs).

1.2 Purpose and Study Area

The VANR requested that a study be conducted on the aesthetics of flows in the bypassed reach. This information will be used to characterize existing and potential aesthetic conditions before VANR can determine whether the project would meet Vermont water quality standards and could issue a Section 401 Water Quality Certificate under the Clean Water Act.

As defined in the RSP, the purpose of the aesthetic flow study was to characterize the aesthetic attributes of the Bellows Falls bypassed reach. The goals of this study were to:

- characterize the aesthetic conditions in the bypassed reach at various levels of flows; and

- provide a range of aesthetic ratings to assist in assessing conditions relative to Vermont's water quality standards.

Key objectives associated with the various components of this study are summarized as follows:

- 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; and

- estimate the costs to provide different levels of flow and assess the trade-offs of the various flows among different populations.

The study area included the Bellows Falls bypassed reach from the base of the dam to the confluence with the powerhouse tailrace. The bypassed reach was assessed from representative observation points under different flow conditions. Review of site conditions prior to field investigations during the study plan development suggested publicly accessible direct views into the bypassed reach were very limited.

Figure 1-1 shows the public Key Observation Points (KOPs), which include (from upstream to downstream): KOP-1: Arch Bridge, from the sidewalk looking over the dam into the bypassed reach[1]; KOP-2: along New Hampshire Route 12 (River Street or Main Street); and KOP-3: the now-closed Vilas Bridge (Bridge Street)[2]. The RSP identified a fourth possible KOP based on aerial photography (KOP-4: from the access road downstream of the fish barrier dam on the Vermont shore overlooking the downstream portion of the bypassed reach). Evaluation of this KOP-4 in the field presented poor viewing angles and inconclusive evidence of user created trails to view the bypassed reach from this area. Given the challenges of photographing flows from this location presented during field verification this location was not photographed for inclusion in the study. This represents a

[1] Views into the bypassed reach from KOP 1 are limited to pedestrians crossing the Arch Bridge because the concrete barrier of the bridge and the train trestle over the dam severely limit views into the reach from vehicles driving across the bridge.

[2] Concrete 'Jersey' barriers are in place to deter both vehicle and pedestrian access across the Vilas Bridge.

variance from the RSP. The RSP was developed in consultation with the study group which at that time, was presented with the potential that sites identified on aerial photography may not represent the attributes sought as a KOP during the photo documentation stage.

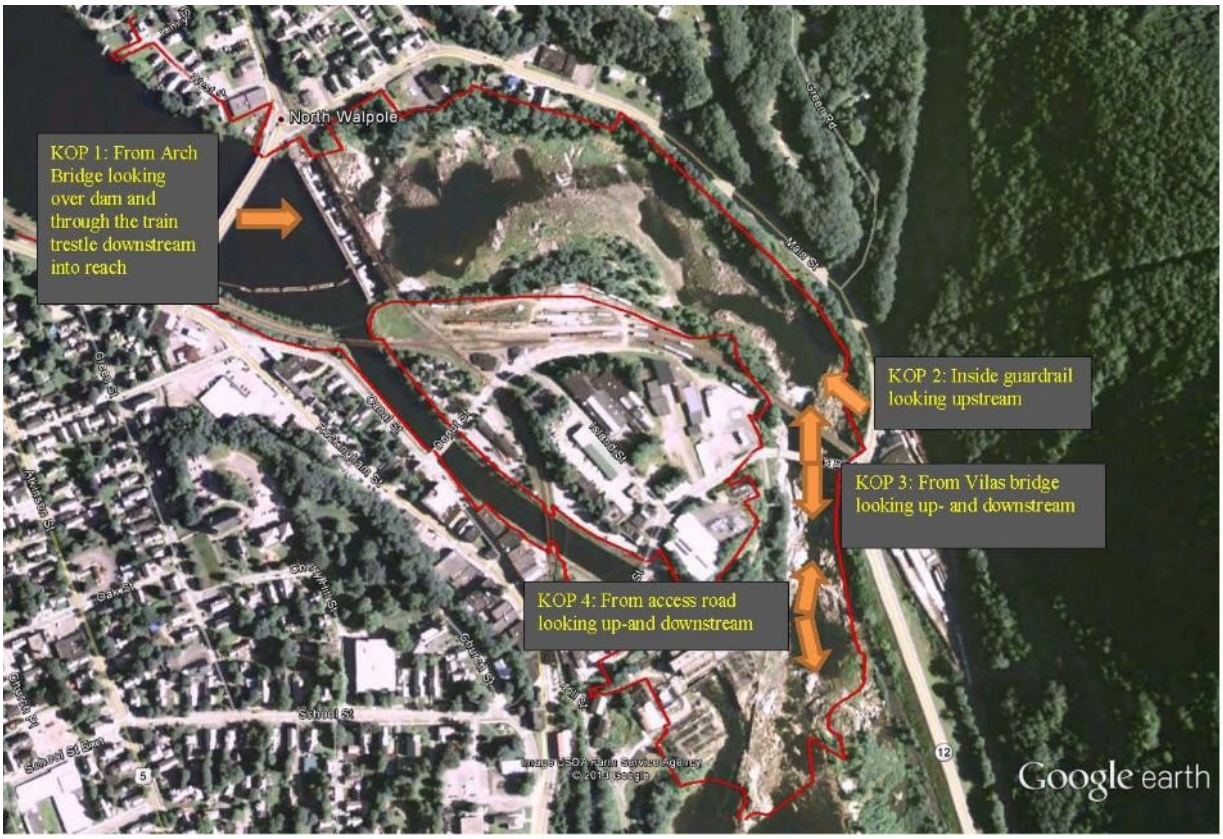

Figure 1-1. Locations of key observation points for Bellows Falls aesthetic flow study.

2.0 METHODS

Data collection methods included capturing photographic and video media for use in the study, assembling a representative focus group, preparing the survey tools and viewable media for the focus group, conducting the focus group meeting, assembling the data, analyzing the results and preparing the report. This section describes each data collection method and when it was used.

Preparation of materials for this study followed on the Whitewater Boating Flow Assessment (Study 31). As such, aesthetic flow levels relied on whitewater flow releases to obtain a wide range of example flows. Bypassed reach flow conditions were recorded with digital videography and photographs. A Cannon EOS 60D digital camera capable of both still photography and video recordings was used to capture all whitewater flows with a 105-200mm zoom lens[3]. Photos and videos of demonstration flows or controlled releases scheduled as part of the whitewater flow assessment conducted on May 30 – 31, 2015 were recorded from the KOPs and edited for use in this study.

The Bellows Falls Project is a central feature to the villages of Bellows Falls, Vermont and North Walpole, New Hampshire. To evaluate the scenic components of various flows at the local landscape level, study leads organized residents, business owners, and employees in the local area to respond to survey questions and open discussion in a focus group setting. TransCanada Community Relations and Rockingham, Vermont Conservation Commission staff were contacted to provide initial contacts for potential study participants. These contacts then nominated additional or alternative participants who were contacted and invited to participate. Recommendations for participant group size from Kruger (2008) were applied to the study.

In the study plan development discussions, FERC staff considered including up to 16 participants in the focus group to ensure an appropriate cross section of the broader population. Over 20 residents, business owners, or local workers were contacted and invited to participate in the focus group. Thirteen volunteers responded that they would participate; however, after follow up reminder emails and phone calls, only nine actually came to the focus group meeting. However, given the relatively small populations in the two towns and the lack of clear sight lines into the bypassed reach, this number of participants was within Kruger's recommendation (8 to 10 participants) but not FERC suggestion. All participants had preexisting knowledge of where the Bellows Falls bypassed reach was; were not employed or related to any employee of TransCanada; nor had any preconceived notion regarding appropriate flow levels in the bypassed reach.

Nine study participants convened at TransCanada's North Walpole office to view a series of videos of different levels of flow including existing (leakage) conditions in the bypassed reach taken from the KOPs. Each participant was asked to rate the conditions in the videos under the specified flow releases using a predefined rating form (included as Appendix A). A seven-point Likert acceptability scale ranging from -3 ("totally unacceptable') to +3 ("totally acceptable") with a 0 midpoint ("neutral") was used to score the results. Researchers have advocated the use of

[3] Although there is a wealth of literature in the photographic world documenting the 50mm lens as the "natural image angle", the zoom lens was used to compensate for the long viewing distances to the bypassed reach through obstructions (e.g., train trestle, vegetation) to provide the focus group with more detail to consider to help differentiate between flows.

this type of metric for assessing recreation and aesthetic flows (Shelby et al., 1992; Whittaker et al., 1993, 2005).

Digital media from each flow from lowest to highest was viewed from each KOP. After all of the single flow assessments, participants were asked to compare aesthetics of different flows overall. The actual flow (in cubic feet per second, cfs) was not disclosed and respondents were asked to evaluate flows by demonstration flow number only. At the conclusion of the single flow and comparative flow assessments, participants were led through an open discussion of factors that influenced their responses and their overall perceptions of the aesthetics of the bypassed reach. Table 2-1 summarizes the flow number and the flow amount recorded during the whitewater boating study for use in this study.

Table 2-1. Flow number and corresponding flow rate.

Flow Number	Flow Rate (cfs)
1	~ 125
2	1,580
3	2,370
4	3,300
5	4,370
6	5,560

Survey responses were summarized, and results were tallied to identify whether each assessed flow created acceptable, neutral, or unacceptable conditions based on the perceptions of the group.

In addition to the flows that the focus group assessed, lower flows (existing leakage [125 cfs], 500 cfs, 1,000 cfs, and 1,600 cfs) were also photographed and videotaped by the same methods described above, in 2016. These lower flows were evaluated to provide a broader range of aesthetic ratings in order to assess aesthetic conditions relative to Vermont's water quality standards. Because these lower flows were captured after the original report was prepared and after the focus group meeting, the aesthetics of the flows were qualitatively analyzed. Full discussion of these flows is provided in Appendix D.

3.0 RESULTS

All except one of the participants were from the Bellows Falls and North Walpole areas. The one participant that was an exception is an outside area resident that regularly views the bypassed reach at Bellows Falls Dam. In general, all of the participants commented that they view the dam and reach for a typical time period of 1 to 20 minutes. Only one participant indicated that aesthetics of the bypassed reach were extremely important to them; the average score was 1.8 ('moderately important'). Nobody reported the importance of the bypassed reach as 0 ('neutral') or lower. In general, most participants reacted more favorably to all flows higher than leakage flow; however, participants' preferred flow levels ranged for each level with no clear preferred level.

All but one participant indicated their frequency of viewing the bypassed reach as 'drive/walk by – see it frequently' with a single participant indicating 'see it seasonally (time scale months between visits)'. Five participants noted that the most common condition they observed while viewing the bypassed reach were leakage flows which is not out of the ordinary given that the majority of people see the bypassed reach frequently and periods of spill are limited to a few days during the spring or the rare outage at the powerhouse. Three of the participants (1/3rd) noted that spilling was the most common condition they observed and one participant said neither. Three participants noted that there are no publicly available viewing areas and thus questioned the need for specific aesthetic flows.

3.1 KOP 1

KOP 1 is located at the Arch Bridge looking over the top of the dam through the train trestle, downstream into the reach. Pedestrian access is not limited at this KOP. Between Demo Flow 1 and Demo Flow 3 (125 and 2,370 cfs, respectively) there was an increase in the average overall aesthetic rating, with Demo Flow 3 having the highest average rating of 1.5 which is between 'acceptable' and 'slightly acceptable'. Average scores for the overall aesthetic rating condition dropped to a low of 0.5, between 'neutral' and 'slightly acceptable' for Demo Flow 5 (4,370 cfs) and rose to an average rating of 1.2, 'acceptable' for Demo Flow 6 (5,560 cfs).

Participants generally commented that Demo Flow 1 (125 cfs leakage flow) was an acceptable amount of water, a nice quiet pool, and a somewhat below average flow amount. Participants noted that there were not significant or material aesthetic differences between Demo Flow 1, Demo Flow 2, and Demo Flow 3. Only one participant noted that Demo Flow 3 looked slightly higher than the previous flow amount in Demo Flow 2. Demo flow 4 (3,300 cfs) was the first flow a participant labeled as being a slightly higher flow than the previous flow amount.

Participants generally commented that Demo Flow 5 and Demo Flow 6 looked about the same as Demo Flow 4, but the average ratings of these flows dropped relative to Demo Flows 1, 2 and 3. Overall, views into the bypassed reach from this area are severely obstructed by the train trestle providing only a slim viewing window between the top of the dam and the bottom of the trestle to view the bypassed

reach. Table 3-1 presents the average participant rating for all study attributes for all flows observed from KOP 1. Figure 3-1 shows representative photos from KOP 1 at low (125 cfs), medium (2,370 cfs), and high flows (5,560 cfs). A complete portfolio of photos from each KOP at each flow appears in Appendices A and C.

Table 3-1. Average participant ratings for demo flows observed at KOP 1.

Demo Flow Number	Sound Level	Sound Interest	Amount of pools/ still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/ streambed in channel	Contrast between pools and moving water	Amount of water through/ over dam	Overall Aesthetic Rating
1 (125 cfs)	0.5	0.9	0.8	0.8	0.9	0.4	1.3	1.3
2 (1,580 cfs)	1.6	0.8	0.7	0.7	0.7	0.7	0.9	1.2
3 (2,370 cfs)	1.2	1.1	1.2	1.2	1.5	1.4	0.9	1.5
4 (3,300 cfs)	1.4	1.3	1.3	1.3	1.2	0.8	1.0	1.3
5 (4,370 cfs)	1.4	1.1	0.3	0.3	0.4	0.5	0.9	0.5
6 (5,560 cfs)	1.4	1.2	0.1	0.1	0.8	0.4	0.8	1.2

Flow no. 1 – Low (125 cfs) Flow No. 3 – Medium (2,370 cfs) Flow No. 6 – High (5,560 cfs)

Figure 3-1. Representatives photographs of low, medium, and high flows from KOP 1. Note: The bypass reach is largely obscured by the pool and associated dam in the foreground of each picture.

3.2 KOP 2

KOP 2 is located along New Hampshire Route 12 looking upstream, and is the most common view from vehicles traveling north along Route 12. Route 12 is a well-traveled state road that goes from 50 miles per hour a mile south of the KOP to 30 miles per hour as the road enters the small community of North Walpole. The viewing opportunity window for passengers in vehicles is limited to this brief section of road estimated to be about 150 feet. There is a sidewalk on the opposite side of the road as the bypassed reach but not along the river side of the road. Both vehicular and pedestrian views are available year round; however the viewing window is limited to the short segment described above as the remainder of the road and sidewalk views are obstructed by residences and vegetation.

Demo Flow 1 (125 cfs) was the lowest rated flow at this KOP, with an average overall aesthetic rating of 0.7, below 'slightly acceptable'. Demo Flows 2 (1,580 cfs) through 6 (5,560 cfs) however, were all given an average overall aesthetic rating over 1.0, 'slightly acceptable' with Demo Flows 2, 3, and 4 (1,580 – 3,300 cfs) having the highest average rating of 1.7, between 'slightly acceptable' and 'acceptable'. Overall, participants commented that they could see the water better at KOP 2 compared to KOP 1, but were unable to agree on a preferred flow amount.

A majority of the participants commented that since higher flows are more common in the spring, they preferred to see the bypassed reach with less flow other times of the year, and some variation by season. One participant liked the aesthetic of the bypassed reach without any flow. Overall, the participants preferred a variability of flow from this KOP that followed the natural hydrograph where there would more water in the spring and less during the summer and fall. Generally, participants commented that there was some observable difference between Demo Flow 1 (125 cfs) and Demo Flow 2 (1,580 cfs), noting that at each higher flow there was less pooling and fewer rocks seen in the bypassed reach. Table 3-2 presents the average participant rating for all study attributes for all flows observed from KOP 2. Figure 3-2 shows representative photos from KOP 2 at low, medium, and high flows. A complete portfolio of photos from each KOP at each flow appears in Appendix B.

Table 3-2. Average participant ratings for demo flows observed at KOP 2.

Demo Flow Number	Sound Level	Sound Interest	Amount of pools / still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks / streambed in channel	Contrast between pools and moving water	Amount of water through / over dam	Overall Aesthetic Rating
1 (125 cfs)	0.4	0.1	0.8	0.6	0.9	0.4	1.3	1.3
2 (1,580 cfs)	1.7	1.4	0.7	1.0	0.7	0.7	0.9	1.2
3 (2,370 cfs)	1.3	1.2	1.2	1.0	1.5	1.4	0.9	1.5
4 (3,300 cfs)	1.2	1.0	1.3	1.4	1.2	0.8	1.0	1.3
5 (4,370 cfs)	1.2	1.0	0.3	0.5	0.4	0.5	0.9	0.5
6 (5,560 cfs)	1.4	1.2	0.1	0.7	0.8	0.4	0.8	1.2

Flow no. 1 – Low (125 cfs) Flow No. 3 – Medium (2,370 cfs) Flow No. 6 – High (5,560 cfs)

Figure 3-2. Representatives photographs of low, medium, and high flows from KOP 2.

3.3 KOP 3

KOP 3 is located on the now-closed Vilas Bridge looking downstream. Pedestrian access is limited at this KOP by the presence of large concrete 'jersey' barriers and signage prohibiting public use, but the bridge is used illegally by a small number of local residents. The average overall aesthetic rating for all demo flows at this location was over 1.0, 'slightly acceptable'. Interestingly, Demo Flow 1 (125 cfs) had the highest average overall aesthetic rating of 1.7, just under 'acceptable' followed by Demo Flows 2 (1,580 cfs) and 6 (5,560 cfs).

Overall, participants agreed that there was a noticeable increase in the volume of water in the bypassed reach, and an increase in the size of waves and ripples. All participants except one liked the view of the leakage (125 cfs) flow at this KOP. Additionally, the participants agreed that they were able to observe noticeable changes between incremental flows as compared to the other KOPs. Table 3-3 presents the average participant rating for all study attributes for all flows observed from KOP 3. Figure 3-3 shows representative photos from KOP 3 at low, medium, and high flows. A complete portfolio of photos from each KOP at each flow appears in Appendix B.

Table 3-3. Average participant ratings for demo flows observed at KOP 3.

Demo Flow Number	Sound Level	Sound Interest	Amount of pools/ still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/ streambed in channel	Contrast between pools and moving water	Amount of water through/ over dam	Overall Aesthetic Rating
1 (125 cfs)	1.0	0.9	1.3	1.2	1.6	1.4	0.9	1.7
2 (1,580 cfs)	1.7	1.4	0.9	1.6	1.6	0.9	1.1	1.6
3 (2,370 cfs)	1.9	1.3	1.0	1.4	1.4	0.8	1.4	1.4
4 (3,300 cfs)	1.4	1.2	1.1	1.6	1.4	1.3	1.0	1.4
5 (4,370 cfs)	1.6	1.4	1.1	1.6	1.6	1.2	1.2	1.4
6 (5,560 cfs)	1.8	1.6	1.1	1.7	1.7	0.6	1.1	1.6

Flow no. 1 – Low (125 cfs) Flow No. 3 – Medium (2,370 cfs) Flow No. 6 – High (5,560 cfs)

Figure 3-3. Representatives photographs of low, medium, and high flows from KOP 3.

3.4 Overall Flow Comparison

Table 3-4 presents the participant responses to the comparative flow questions from the survey form. A majority of participants commented during the open discussion portion of the study that the aesthetics and scenic quality of the bypassed reach declined between Demo Flows 2 and 4 however Demo Flows 3 and 4 received the most number of responses to the question "What was your preferred flow condition". Participants agreed that this same flow range between Demo Flows 2 through 4 (1,580 – 3,300 cfs), was also the acceptable flow range for a minimum aesthetic flow. Most participants preferred flows higher than leakage flows. Individual participant responses are located in Appendix C in Tables C-3 through C-20.

Table 3-4. Comparative flow responses.

Participant Number	At what flow level do the aesthetics/scenic quality of the bypassed reach decline?	What flow level would you consider acceptable for a minimum aesthetic flow?	What was your preferred flow condition?
1	1	4	6
2	5	3	4
3	2	no response	1
4	3	2-4	4
5	2-4	3	3-4
6	3	4	6
7	3	2	3
8	no response	no response	no response
9	2-3	no response	2-3

The majority of study participants did not have final written comments, but the few comments received from the close-out survey include:

- Without public viewing areas, there is not much as far as aesthetics.
- There is no public access to see any flow; therefore, there is no need to have any flow; recommend no flow or Demo Flow 1 (125 cfs).
- I like the river in all the various phases but more so with more flow. How many people even see this? On the other hand, the river is generating clean energy which is so important; even though

aesthetics are important, improving the flow is not very visible in the spots where the flow varies the most. Can we create more spots for people to see the river?

4.0 DISCUSSION

Following the review and assessment of the video clips from each KOP, the study team facilitated an open discussion about aesthetics in the bypassed reach. Highlights from the discussion are listed below:

1. Views from KOP 1 showed very little difference between low and high flow. At higher flows, participants could see some mist (spray) beyond the dam. Very little of the bypassed reach could be seen from KOP 1 and the views of the impoundment in front of the dam did not change significantly from the lowest to the highest flows.

2. Of the three KOPs, the participants were able to notice the most difference between flows at KOP 3, where they noted more rocks and pools exposed at the lower flow and bigger waves and faster water at higher flows.

3. Participants noted that there are usually four to six weeks of high flow during the spring runoff and then essentially no flow in the bypassed reach for the rest of the year. One participant noted that climate change is causing unusually large storm events that create high flows throughout the year.

4. Some participants like the aesthetics of the reach at low flows because the reach is accessible [informally] and people can walk along the rocks next to the water or swim in the pools (although it is important to note that there is no formal public access into the bypassed reach).

5. Most participants like the experience of viewing very high flows associated with spring runoff and flood conditions. The speed, sound, and power of the water in the bypassed reach elicit a sense of awe for the natural forces of the water.

6. Participants noted that seasonal variability, with higher flows in the spring and low flows in the summer and fall were important aesthetic attributes that reflected the seasonal changes that are typical in Vermont. Participants liked the idea of changing conditions in the bypassed reach. One participant noted that something you don't see every day is more special, such as the occasional high flow and flood events, but low flow has its place too.

7. Participants generally agreed that some flow, even leakage flow, is important to the aesthetics of the bypassed reach because it makes it

seem like a river that is alive. Participants generally agreed that no flows in the bypassed reach would undermine the aesthetics, but some flow adds aesthetic value.

8. The overall aesthetic value of flow in the bypassed reach depends on whether or not people can see it. Participants noted that there is no reasonable public access to the bypassed reach. The viewpoints from a car are fleeting. On foot, the viewpoints are hard to get to, often requiring trespassing on private land or the train tracks. As a result of difficult access, aesthetic flow in the reach would be underutilized and underappreciated.

9. Without public access and viewing opportunities, there is little incremental gain by adding additional flows to current leakage flows and seasonal or precipitation driven spillage from the dam. However, the participants noted that there appears to be some interest in the community and by visitors to see the historic falls and rapids. If public access and viewpoints could be created, the value of incremental additional aesthetic flow may increase.

5.0 CONCLUSIONS

The study participants generally reported that flow higher than leakage flow in the Bellows Falls bypassed reach rated at higher aesthetic value scores. Higher flow made the reach look more like an unregulated river and feel more "alive." Most participants liked the experience of viewing very high flows associated with spring runoff and flood conditions, but noted that seasonal variability, with high flow in the spring and low flow in the summer and fall were important aesthetic attributes that reflected the seasonal changes that are typical in Vermont.

However, the participants considered aesthetic flow in the bypassed reach to be of low importance to the public under today's conditions because access to viewing areas where the public could experience aesthetic flow is limited. The land on both sides of the bypassed reach is privately owned with heavy industrial uses on the west (Bellows Falls, Vermont) side associated with active train tracks and a switchyard, and primarily residential properties on the east (N. Walpole, New Hampshire) side and a closed-to-public-access bridge across the bypass reach between NH and VT. As such, access to the bypassed reach requires visitors to trespass, which limits the ability of the public to take advantage of aesthetic flows.

Even though public viewpoints are generally limited, the majority of the participants agreed that some flow, even low leakage flow, is important to the aesthetics of the bypassed reach. With the exception of one participant, the focus group generally agreed that no flows in the bypassed reach would undermine the aesthetics, but some flow does add aesthetic value. A single participant preferred no flow in the bypassed reach over all other scenarios.

Without public access and viewing opportunities, there is little incremental gain by adding additional flows above the current leakage flow. However, participants noted that there appeared to be some interest in the community and by visitors to see the historic falls and rapids. If public access and viewpoints could be created, the value of incremental additional aesthetic flow may increase.

While the study showed that overall, participants found flow that was higher than leakage flow improves aesthetics in the bypassed reach, the study plan utilized whitewater boating flows in the bypassed reach ranging from a low of 1,580 cfs to a high of 5,560 cfs. As such, the original study did not establish the aesthetic value of small incremental changes in flow above the current leakage flow (approximately 125 cfs).

Subsequent to the original study, and after filing of the original study report on March 1, 2016, the VANR requested additional information on aesthetic flows at Bellows Falls dam, in particular lower flows than those assessed by the focus group in 2015 as a part of this study. The purpose of collecting supplemental information in 2016 was to identify potential lower flow levels at Bellows Falls dam and the bypassed reach than had been assessed in 2015 in order to qualitatively assess lower flows that could support aesthetics under the Vermont water quality standards.

Focus group respondents had commented in the 2015 evaluation that there were little to no observable differences in aesthetics from KOP 1 at the flows assessed in the original study report. Given this, it is highly probable that there also would be few observable differences between the even more subtle changes between lower flow levels evaluated in 2016 from this viewing location (see Appendix D). Focus group respondents also identified KOP 3 as the location where the largest differences between flows could be observed because, at low flows (e.g., leakage flow), the pools and exposed rocks were highlighted. Seasonal variability and the occurrence of high spring flows were important to the focus group for the aesthetics of the bypassed reach and have little bearing on low flow conditions over the remainder of the year.

Extrapolating from the focus group discussion points that indicated any flow in the bypassed reach is better than no flow, continuing the current leakage in the channel would maintain the aesthetics in the bypassed reach. Although it is easiest to discuss the small overall differences between flows, characterizing which features are visible and which are submerged and no longer visible as the water rises, and their relative aesthetic value does not suggest that any specific flow is more aesthetic than another. In all cases (both the originally studied higher flows and the supplemental lower flows) flows were free of visible debris, foam, trash, and other constituents that would negatively impact overall aesthetics in the bypassed reach.

6.0 LITERATURE CITED

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APPENDIX A
Rating Form

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Date:_____ Your name: _____

Section A: General

1. Which statement best represents your perspective? Today I am viewing the flows in the bypassed reach as: *CHECK ONE*
   - Bellows Falls/North Walpole Resident *LIST TOWN*_____
   - Area Resident *LIST ZIP CODE*_____
   - Bellows Falls/N. Walpole Business Owner or Employee
     *LIST BUSINESS TYPE AND LOCATION*_____
     _____
   - Commuter
     TYPICAL TIME OF DAY PAST VIEWS OF THE BYPASSED REACH
     _____
   - Out-of-Area Visitor *LIST ZIP CODE*_____

2. How would you rate your familiarity with the Bellows Falls bypassed reach? *CHECK ONE*
   - Drive/walk by - see it frequently (time scale days between visits)
   - See it seasonally (time scale months between visits)
   - Few viewings (time scale years between viewings)
   - Rare viewings (time scale decades between viewings)
   - First time viewing

3. Considering your typical viewing of the bypassed reach, how long do you typically look at and consider the conditions within the bypassed reach during each viewing opportunity?_____minutes/hours

4. What is the most common condition you observe while viewing the bypassed reach?
   - Spilling
   - Leakage flows (non-spill)

5. How important to you are the overall aesthetics of the Bellows Falls bypassed reach? *CIRCLE ONE NUMBER*

-3	-2	-1	0	1	2	3
Not at all important	Slightly important		Neutral	Moderately important		Extremely important

Key Observation Point 1 - Demo Flow #:_____

6. Please evaluate the flow at this level for each of the following characteristics *(Check one number for each item).*

	Totally Unacceptable			Neutral			Totally Acceptable
Sound level	-3	-2	-1	0	1	2	3
Sound interest	-3	-2	-1	0	1	2	3
Amount of pools/still water in channel	-3	-2	-1	0	1	2	3
Amount of visibly moving water in channel	-3	-2	-1	0	1	2	3
Amount of exposed rocks/streambed in channel	-3	-2	-1	0	1	2	3
Contrast between pools and moving water	-3	-2	-1	0	1	2	3
Amount of water through/over dam	-3	-2	-1	0	1	2	3
Overall Aesthetic Rating	-3	-2	-1	0	1	2	3

7. In general, would you prefer a flow that was higher, lower, or about the same as this flow from this view? *(Check one).*
   - ⌋ Much lower flow
   - ⌋ Slightly lower flow
   - ⌋ About the same; this was close to an optimum flow
   - ⌋ Slightly higher flow
   - ⌋ Much higher flow
   - ⌋ Doesn't matter

8. List any positive attributes of this flow level (LIST SOME):

_____

_____

_____

9. List any negative attributes of this flow level (LIST SOME):

_____

_____

_____

Key Observation Point 2 - Demo Flow #:_____

10. Please evaluate the flow at this level for each of the following characteristics *(Circle one number for each item).*

	Totally Unacceptable			Neutral			Totally Acceptable
Sound level	-3	-2	-1	0	1	2	3
Sound interest	-3	-2	-1	0	1	2	3
Amount of pools/still water in channel	-3	-2	-1	0	1	2	3
Amount of visibly moving water in channel	-3	-2	-1	0	1	2	3
Amount of exposed rocks/streambed in channel	-3	-2	-1	0	1	2	3
Contrast between pools and moving water, hydraulic features or drops	-3	-2	-1	0	1	2	3
Flow over fish dam	-3	-2	-1	0	1	2	3
Overall Aesthetic Rating	-3	-2	-1	0	1	2	3

11. In general, would you prefer a flow that was higher, lower, or about the same as this flow from this view? *(Check one).*
    - ⌋ Much lower flow
    - ⌋ Slightly lower flow
    - ⌋ About the same; this was close to an optimum flow
    - ⌋ Slightly higher flow
    - ⌋ Much higher flow
    - ⌋ Doesn't matter

12. List any positive attributes of this flow level (LIST SOME):

    _____

    _____

    _____

13. List any negative attributes of this flow level (LIST SOME):

    _____

    _____

    _____

Key Observation Point 3 - Demo Flow #:_____

14. Please evaluate the flow at this level for each of the following characteristics *(Circle one number for each item).*

	Totally Jnacceptable			Neutral			Totally Acceptable
Sound level	-3	-2	-1	0	1	2	3
Sound interest	-3	-2	-1	0	1	2	3
Amount of pools/still water in channel	-3	-2	-1	0	1	2	3
Amount of visibly moving water in channel	-3	-2	-1	0	1	2	3
Amount of exposed rocks/streambed in channel	-3	-2	-1	0	1	2	3
Contrast between pools and moving water, hydraulic features or drops	-3	-2	-1	0	1	2	3
Flow over fish dam	-3	-2	-1	0	1	2	3
Overall Aesthetic Rating	-3	-2	-1	0	1	2	3

15. In general, would you prefer a flow that was higher, lower, or about the same as this flow from this view? *(Check one).*
    - ⌋ Much lower flow
    - ⌋ Slightly lower flow
    - ⌋ About the same; this was close to an optimum flow
    - ⌋ Slightly higher flow
    - ⌋ Much higher flow
    - ⌋ Doesn't matter

16. List any positive attributes of this flow level (LIST SOME):

_____

_____

_____

17. List any negative attributes of this flow level (LIST SOME):

_____

_____

_____

APPENDIX B
KOP Photos

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KOP 1 Demo Flows

KOP 1 – Demo Flow 1 (125 cfs)

KOP 1 – Demo Flow 2 (1,580 cfs)

KOP 1 – Demo Flow 3 (2,370 cfs)

KOP 1 – Demo Flow 4 (3,300 cfs)

KOP 1 – Demo Flow 5 (4,370 cfs)

KOP 1 – Demo Flow 6 (5,560 cfs)

KOP 2 Demo Flows

KOP 2 – Demo Flow 1 (125 cfs)

KOP 2 – Demo Flow 2 (1,580 cfs)

KOP 2 – Demo Flow 3 (2,370 cfs)

KOP 2 – Demo Flow 4 (3,300 cfs)

KOP 2 – Demo Flow 5 (4,370 cfs)

KOP 2 – Demo Flow 6 (5,560 cfs)

KOP 3 Demo Flows

KOP 3 – Demo Flow 1 Upstream (US) (125 cfs)

KOP 3 – Demo Flow 1 Downstream (DS) (120 cfs)

KOP 3 – Demo Flow 2 US (1,580 cfs)

KOP 3 – Demo Flow 2 DS (1,580 cfs)

KOP 3 – Demo Flow 3 US (2,370 cfs)

KOP 3 – Demo Flow 3 DS (2,370 cfs)

KOP 3 – Demo Flow 4 US (3,300 cfs)

KOP 3 – Demo Flow 4 DS (3,300 cfs)

KOP 3 – Demo Flow 5 US (4,370 cfs)

KOP 3 – Demo Flow 5 DS (4,370 cfs)

KOP 3 – Demo Flow 6 US (5,560 cfs)

KOP 3 – Demo Flow 6 DS (5,560 cfs)

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APPENDIX C
Participant Responses

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Table C-1. Participant background information

Question 1 (Which statement best represents your perspective?)	Town	Zip
Bellows Falls/North Walpole Resident	North Walpole	03609
Bellows Falls/North Walpole Resident	North Walpole	03609
Bellows Falls/North Walpole Resident	Bellows Falls, VT	05101
Bellows Falls/North Walpole Business Owner or Employee (Halladays Harvest Barn)	Bellows Falls, VT	05101
Area Resident	Westminster, VT	05158
Bellows Falls/North Walpole Business Owner or Employee (Halladays Harvest Barn)	North Walpole	03609
Bellows Falls/North Walpole Resident	Bellows Falls, VT	05101
Bellows Falls/North Walpole Resident	North Walpole	03609
Bellows Falls/North Walpole Business Owner or Employee (Village Commissioner)	North Walpole	03609

Table C-2. Additional participant background information

Question 2 (How would you rate your familiarity with the Bellows Falls bypassed reach?)	Question 3 (….how long do you typically look …?	Question 4 (…most common condition observed…?)	Question 5 (How important…overall aesthetics…?)
Drive/Walk by-see it frequently	1 minute	Leakage flows (non-spill)	1
Drive/Walk by-see it frequently	5-20 minutes	Leakage flows (non-spill)	2
Drive/Walk by-see it frequently	2-3 minutes	Leakage flows (non-spill)	1
Drive/Walk by-see it frequently	5 minutes	Neither	3
Drive/Walk by-see it frequently	5 minutes	Spilling	2
Drive/Walk by-see it frequently	30 minutes	Leakage flows (non-spill)	2
Drive/Walk by-see it frequently	None	Spilling	2
See it seasonally (time scale months between visits)	15-20 minutes	Leakage flows (non-spill)	1
Drive/Walk by-see it frequently	10 minutes	Spilling	2

Table C-3. KOP 1, Demo Flow # 1

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
1	1	0	3	0	3	3	3	3	3
	2	3	3	0	0	2	0	3	3
	3	1	0	1	0	0	1	0	1
	4								
	5	3	3	3	3	0	0	3	3
	6	-1	0	0	-1	-1	-1	-1	-1
	7	0	-2	2	-2	0	0	0	-1
	8	0	0	0	0	0	0	0	0
	9	-2	0	0	2	3	0	2	2

Table C-4. KOP 1, Demo Flow # 2

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
1	1	3	0	0	3	1	0	3	3
	2	3	3	3	2	3	2	0	3
	3	1	0	1	-1	1	1	1	1
	4	0	0	0	0	0	0	0	0
	5	3	3	0	3	0	3	3	3
	6	0	0	0	-1	-1	-1	-1	-1
	7	0	-2	2	2	0	-2	0	0

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
	8	3	3	0	0	0	2	1	0
	9	1	0	0	1	2	1	1	2

Table C-5. KOP 1, Demo Flow # 3

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
1	1	3	1	3	1	3	3	3	3
	2	3	3	3	3	3	3	0	3
	3	1		1	1	1	1	1	1
	4	0	0	0	0	0	0	0	0
	5	3	3	3	3	3	3	3	3
	6	0	0	1	0	0	-1	-1	0
	7	-2	-2	0	0	blank	blank	blank	blank
	8	3	3	0	1	1	1	0	1
	9	0	1	0	0	1	1	1	1

Table C-6. KOP 1, Demo Flow # 4

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
1	1	3	1	3	2	3	2	1	3
	2	3	3	3	3	2	3	3	3

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
	3	1	0	1	1	1	-1	-1	1
	4	0	0	0	0	0	0	0	0
	5	3	3	3	3	3	0	3	3
	6	1	1	1	2	2	2	2	1
	7	0	0	1	1	0	1	0	0
	8	1	1	0	0	0	0	0	0
	9	1	3	0	1	0	0	1	1

Table C-7. KOP 1, Demo Flow # 5

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
	1	2	1	3	2	3	3	2	1
	2	3	3	0	3	0	3	3	3
	3	1	0	-1	-1	-1	0	-1	-1
	4	0	0	0	0	0	0	0	0
1	5	3	3	0	3	3	0	3	3
	6	blank	blank	blank	blank	blank	blank	blank	blank
	7	0	0	0	-3	-3	-3	0	-2
	8	2	2	0	0	0	0	0	0
	9	0	0	0	0	1	1	0	0

Table C-8. KOP 1, Demo Flow # 6

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
1	1	3	2	2	1	1	2	1	3
	2	3	3	0	3	3	3	3	3
	3	1	0	-1	-2	-1	-2	-2	-2
	4	0	0	0	0	0	0	0	0
	5	3	3	0	3	3	0	3	3
	6	1	1	3	3	3	3	3	3
	7	0	0	-3	-3	-3	-3	-2	0
	8	2	2	0	0	0	0	0	0
	9	0	0	0	1	1	1	1	1

Table C-9. KOP 2, Demo Flow # 1

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
2	1	0	0	1	0	2	0	0	0
	2	3	3	3	1	3	0	0	2
	3	1	0	1	1	2	2	2	2
	4	0	0	blank	0	0	1	1	0
	5	3	3	3	2	3	1	0	3
	6	-1	-1	-2	-3	-3	-3	-3	-3
	7	0	-2	2	0	2	3	0	1
	8	0	0	0	0	1	1	0	1
	9	-2	-2	0	1	1	0	0	0

Table C-10. KOP 2, Demo Flow # 2

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
2	1	3	0	3	2	3	3	2	3
	2	3	3	3	3	3	3	3	3
	3	1	1	1	1	2	2	2	2
	4	1	1	1	1	1	1	1	1
	5	3	3	3	3	3	0	0	3
	6	-1	0	-2	-2	-3	-2	-2	-2
	7	2	2	1	2	1	2	1	2
	8	1	1	0	1	0	1	0	1

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
	9	2	2	1	2	2	2	1	2

Table C-11. KOP 2, Demo Flow # 3

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
2	1	3	1	2	1	2	1	1	3
	2	3	3	3	3	3	3	3	3
	3	1	1	-1	-1	-1	-2	-1	-1
	4	0	0	1	1	1	2	0	1
	5	3	3	3	3	0	0	3	3
	6	-1	0	-1	-1	-1	0	0	0
	7	0	0	1	2	2	2	2	2
	8	1	1	1	1	1	1	0	1
	9	2	2	3	3	3	3	3	3

Table C-12. KOP 2, Demo Flow # 4

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
2	1	1	0	1	2	2	1	1	2
	2	3	3	3	3	3	3	3	3
	3	-2	-1	-2	-2	-1	-2	-2	-2

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
	4	0	0	1	2	2	2	2	3
	5	3	3	3	3	0	0	3	3
	6	1	0	1	2	1	2	blank	1
	7	2	2	1	3	2	2	2	2
	8	1	1	1	1	0	0	0	0
	9	2	1	1	3	3	2	2	3

Table C-13. KOP 2, Demo Flow # 5

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
	1	3	2	1	3	0	1	1	3
	2	3	3	1	3	3	1	3	3
	3	-1	-1	-3	-1	-2	-3	-3	-2
	4	0	0	1	1	1	1	1	1
2	5	3	3	3	3	0	0	3	
	6	1	0	2	2	2	2	2	2
	7	0	0	0	0	0	0	0	0
	8	1	1	1	2	1	1	0	1
	9	1	1	1	3	3	1	2	3

Table C-14. KOP 2, Demo Flow # 6

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
2	1	3	1	1	3	1	2	1	2
	2	3	3	2	3	3	2	3	3
	3	-2	-1	-3	-2	-1	-3	-3	-3
	4	0	0	1	1	1	1	1	1
	5	3	3	3	3	3	0	3	3
	6	2	0	2	2	2	2	2	2
	7	1	1	2	2	2	0	1	1
	8	1	1	1	1	1	1	1	1
	9	2	1	0	3	3	1	2	3

Table C-15. KOP 3, Demo Flow # 1

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
3	1	1	0	2	1	3	2	1	3
	2	3	3	3	3	3	3	2	3
	3	2	1	2	2	2	2	2	2
	4	0	0	0	0	0	0	0	0
	5	3	3	2	2	3	2	0	3
	6	-1	0	-2	-2	-3	-2	-2	-2
	7	0	0	2	2	2	2	2	2
	8	1	1	1	1	1	1	1	1
	9	0	0	2	2	3	3	2	3

Table C-16. KOP 3, Demo Flow # 2

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
3	1	3	1	3	2	1	1	2	2
	2	3	3	2	3	3	2	3	3
	3	2	1	2	2	3	2	2	2
	4	0	0	0	0	0	0	0	0
	5	3	3	2	3	3	2	0	3
	6	-1	0	-2	-2	-2	-2	-2	-2
	7	1	1	0	2	2	2	2	2
	8	1	1	1	1	1	1	1	1
	9	3	3	0	3	3	0	2	3

Table C-17. KOP 3, Demo Flow # 3

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
3	1	3	0	1	1	2	1	2	2
	2	3	3	3	3	3	3	3	3
	3	1	0	-1	-1	-1	-2	-1	-1
	4	3	3	3	3	3	3	3	3
	5	3	3	0	3	3	0	3	3
	6	1	0	-1	-1	-2	-1	-1	-1
	7	0	0	2	2	2	2	2	2
	8	1	1	1	1	1	0	0	0
	9	blank	blank	blank	blank	blank	blank	blank	blank

Table C-18. KOP 3, Demo Flow # 4

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
3	1	3	1	2	3	0	1	2	2
	2	3	3	2	3	3	2	2	3
	3	-1	0	-2	-2	-1	-2	-2	-2
	4	0	0	2	2	2	2	2	2
	5	3	3	1	2	2	2	0	2
	6	1	0	1	1	1	2	1	1
	7	0	0	2	2	2	2	2	2
	8	1	1	1	1	1	1	0	0
	9	3	3		2	3	2	2	3

Table C-19. KOP 3, Demo Flow # 5

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
3	1	0	1	1	2	0	1	2	2
	2	3	3	2	3	3	2	2	2
	3	-1	-1	-3	-2	-2	-3	-3	-2
	4	3	3	3	3	3	3	3	3
	5	3	3	0	-1	1	0	-1	0
	6	2	0	2	3	3	3	3	3
	7	0	0	2	2	2	2	2	2
	8	1	1	0	1	1	0	0	0
	9	3	3	3	3	3	3	3	3

Table C-20. KOP 3, Demo Flow # 6

KOP	Participant Number	Sound Level	Sound Interest	Amount of pools/still water in channel	Amount of visibly moving water in channel	Amount of exposed rocks/streambed in channel	Contrast between pools and moving water	Amount of water through/over dam	Overall Aesthetic Rating
3	1	2	1	0	3	1	0	2	3
	2	3	3	0	3	3	0	2	3
	3	-1	0	-2	-2	-2	-3	-2	-2
	4	3	3	3	3	3	3	3	3
	5	3	3	0	-1	1	0	-1	0
	6	2	0	3	3	3	3	3	3
	7	0	0	2	2	2	2	2	2
	8	1	1	1	1	1	0	0	0
	9	3	3	3	3	3	0	1	2

APPENDIX D
2016 Additional Aesthetic Flow Assessment

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Appendix D

2016 Additional Aesthetic Flow Assessment

D.1.0 Introduction

This final study report appendix provides additional information on aesthetic flows at the Bellows Falls dam. The purpose of collecting this additional information was to identify potential flow levels at the dam and in the bypassed reach to support the aesthetics criterion under Vermont water quality standards.

TransCanada conducted an aesthetic flow assessment and filed an original study report on March 1, 2016. The study report provided information on flows ranging from approximately 125 cubic feet per second (cfs) (leakage) to 5,560 cfs that corresponded to the flows released for the whitewater boating flow assessment (Study 31 [Louis Berger Group and Normandeau, 2016]). Flows associated with the instream flow study (Study 9 [Normandeau, 2016])) were not assessed, which represented a deviation from the approved study plan that states, "At a minimum, the controlled flow releases to be provided for the associated flow studies (Studies 9 and 31) would be videotaped and photographed for use in this study."

The Vermont Agency of Natural Resources (VANR, or Agency) commented on this deviation, asserting that the majority of the flows assessed in the study report exceeded what can likely be sustained as conservation flows in the bypassed reach. For example, three of the flows studied (50 percent) exceeded the highest flow considered in the instream flow study (3,000 cfs). VANR noted that, because the first flow assessed above leakage was 1,580 cfs, the data collected as part of the study did not allow the Agency to determine whether flows between leakage and 1,580 cfs could fully support aesthetics. The Agency stated that the second goal of the proposed study, "to provide a range of aesthetic ratings that can be used to assess conditions relative to Vermont's water quality standards," was not adequately met.

To correct the study plan deviation, the Agency requested that TransCanada videotape and analyze an additional set of lower flows at Bellows Falls dam. TransCanada photographed and videotaped additional lower flow spillages on June 29, 2016, and then qualitatively analyzed these additional flows. Photographs and video recordings were taken from the same Key Observation Points (KOPs) used in the original aesthetic flow assessment.

The study area included the Bellows Falls dam and bypassed reach and is identical to the previous study area described in Section 1.0 of the original study report.

D.2.0 Methods

Data collection methods included capturing photographic and video media, assembling the data, analyzing the results, and preparing the report. These methods follow methods used for the original aesthetic flow assessment and are

further described in Section 2.0, Methods, of the study report. Aesthetic flow levels relied on specified releases to obtain a range of example flows, which created a profile of lower flows in the bypassed reach from leakage (approximately 125 cfs) to 1,600 cfs and filled in the data gap identified by VANR (Table D.2-1). Bypassed reach flow conditions were recorded with digital videography and photographs. A Cannon EOS 60D digital camera capable of both still photography and video recordings was used to capture all flow levels with a 50-millimeter (mm) and a 105–200 mm zoom lens. Photographs and videos of controlled releases scheduled as part of the lower flow aesthetic flow assessment conducted on June 29, 2016, were recorded from the KOPs and edited for use in this study. Table D.2-1 summarizes the flow number and flow amount recorded for use in this study.

Table D.2-1. Flow number and corresponding flow rate.

Flow Number	Flow Rate (cfs)
1	aprox. 125 (Existing Leakage)
2	500
3	1,000
4	1,600

D.3.0 Results

D.3.1 KOP 1

Figure D.3-1 provides a photograph taken at each flow at KOP 1, which is located at the Arch Bridge looking over the top of dam through the train trestle, and downstream into the reach. Pedestrian access is available at this KOP. At all four flows, there was no discernible difference in the aesthetics of the upstream pool or the visible downstream portion of the bypassed reach viewed through the train trestle. Slight misting became apparent at the higher flow of 1,600 cfs. Overall, views into the bypassed reach from this KOP are severely obstructed by the train trestle, providing only a narrow viewing window between the top of the dam and the bottom of the trestle to view the bypassed reach.

Flow no. 1 – Existing Leakage

Flow no. 2 – 500 cfs

Flow no. 3 – 1,000 cfs

Flow no. 4 – 1,600 cfs

Figure D.3-1. Representative photographs of flow releases viewed from KOP 1. Note: the bypassed reach is largely obscured by the pool and associated dam in the foreground of each picture.

D.3.2. KOP 2

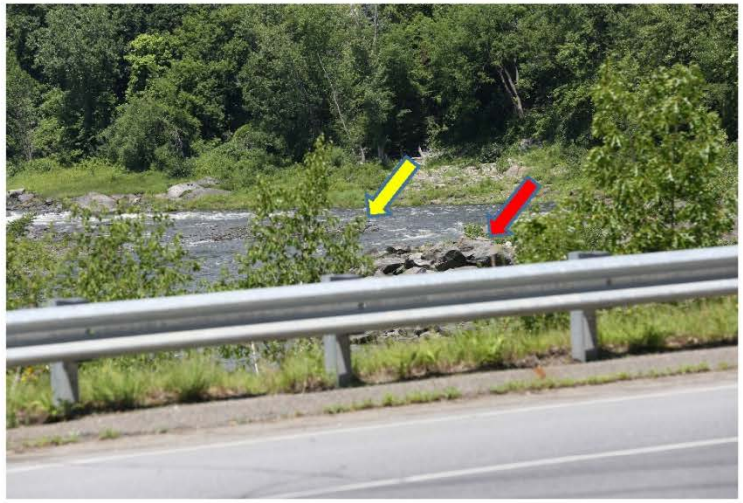
Figure D.3-2 provides a photograph taken at each flow at KOP 2, which is located along New Hampshire Route 12 looking upstream and is the most common view from vehicles traveling north along Route 12. However, traffic moves fast along this road (40–50 miles per hour in some stretches), and views from vehicles of the bypassed reach are limited to a few seconds before trees and/or buildings block the view.

Overall, there was little visible difference between the first two flows at this KOP (existing leakage and 500 cfs). Differences, while minor, appear the most evident between 500 cfs and 1,000 cfs as the rising water fills the channel and begins to cover the rocks in the foreground of the photo (red arrow in Figure D.3-2). As the water levels rise, the changes in the view are most noticeable from the loss or covering of the prominent stone channel bar jutting from the left (yellow arrow in the figure) into the center of the channel in the middle ground. Between 1,000 cfs and 1,600 cfs, there are few noticeable differences in the amount of water in the channel as the stone channel bar is covered up by both flows. .

Flow no. 1 – Existing Leakage

Flow no. 2 – 500 cfs

Flow no. 3 – 1,000 cfs



Flow no. 4 – 1,600 cfs

Figure D.3-2. Representative photographs of flow releases viewed from KOP 2.

D.3.3 KOP 3

Figure D.3-3 provides a photograph taken at each flow at KOP 3, which is located on the now-closed Vilas Bridge looking downstream. Pedestrian access is limited at this KOP by the presence of large, concrete 'jersey' barriers and signage prohibiting public use, but the bridge is used by a small number of local residents.

Overall, there was little visible difference between the first two flows at this KOP (existing leakage and 500 cfs. At 1,000 cfs and 1,600 cfs, increased water levels are somewhat more evident through the channel, as shown by the partial covering of the rock formations in the foreground of the photos (light blue arrows in Figure D.3-3).

There is a more noticeable visible difference between the lower flows and higher flows at this KOP. At the existing leakage and 500 cfs flow levels, prominent rock formations are visible in the foreground and in the background of the photo (the stone channel bar (yellow arrow in the figure) described for KOP 2 above). At the two higher flows, these features become submerged and are lost from view. The most noticeable change in flow-related aesthetics occurs between 500 cfs and 1,000 cfs. Any increases in the amount of whitewater between the 1,000 cfs and 1,600 cfs are only visible in the distant background and are too subtle to stand out as viewed from this KOP.

Flow no. 1 – Existing Leakage

Flow no. 2 – 500 cfs

Flow no. 3 – 1,000 cfs

Flow no. 4 – 1,600 cfs

Figure D.3-3. Representative photographs of flow releases viewed from KOP 3.

D.4.0 Overall Flow Comparison

In general, there was a negligible visible difference in aesthetics between the four flows at KOP 1 and only a small but visible difference in aesthetics between the lower two flows (leakage and 500 cfs) and the higher two flows (1,000 cfs and 1,600 cfs) at KOP 2 and KOP 3. Differences at each KOP are further discussed below.

As the photographic and video data show, aesthetics in the bypassed reach do not dramatically change at the flow levels studied at the three KOP sites. There were no noteworthy differences among any flows from KOP 1, which is not surprising given the small amount of visible change reported by the focus group in the 2015 evaluation conducted at the higher flows (see Section 4 of the study report) as viewed from this KOP.

Views from KOP 2 and KOP 3 are the angles from which the public has the greatest opportunity to observe the bypassed reach. Increasing flows influence these views by filling in, over, and around the stone channel bottom, the channel bar, and to a lesser extent, the edges of the bypassed reach; however, this change is minor between leakage flows and 500 cfs while these features are still visible, and between 1,000 cfs and 1,600 cfs after the bar is covered up. The most visible difference at both KOP 2 and KOP 3 is between 500 cfs and 1,000 cfs because it is between these flows that prominent features in the bypassed reach (stone channel bar, rock features, etc.) begin to become submerged. Additionally, a noticeable change in water level in the channel begins between these flows. The amount of water movement visible steadily increases and is most visible between the 500 cfs and 1,000 cfs flows in the foreground views from KOP 3.

There were slight differences in the sound of the water flowing in the bypassed reach at the four different flow levels at each KOP. At KOP 1, the water sounds at existing leakage and 500 cfs were easily obscured by surrounding noise primarily from passing cars. At the higher flows, 1,000 cfs and 1,600 cfs, there was a noticeable sound of flowing water. Because the visibility of the bypassed reach is limited at this viewpoint, however, it was difficult to identify the source of the sound.

At KOP 2 and the existing leakage flow level, the overall sound of the flowing water was lower than the other three flows and difficult to hear. It was difficult to discern a difference in sound level between 500 cfs, 1,000 cfs, and 1,600 cfs flows. Similar to KOP 1, surrounding noise from passing cars easily obscured the sound of the water flow at all flow levels.

At KOP 3, the sound level differences correlated directly with the visible changes between flow levels. At the existing leakage and 500 cfs flow levels, there was no discernible difference in the sound of water flowing in the channel. Between 500 cfs and 1,000 cfs, however, sound level increased in a manner similar to the differences discussed in the original study report. Video recorded as part of this lower flow assessment being filed separately on DVD.

Focus group respondents in the 2015 evaluation conducted at higher flows commented that there were little to no observable differences in aesthetics from KOP 1 at the flows assessed. Given this, it is highly probable that the focus group would repeatedly find no observable differences between the even more subtle lower flows evaluated in 2016 from this viewing location. Focus group respondents also identified KOP 3 as the location where the largest differences between flows could be observed because at low flows the pools and exposed rocks were highlighted. Focus group participants reported that seasonal variability and the occurrence of high spring flows were important for the aesthetics of the bypassed reach, and those flows have little bearing on the low flow conditions during the remainder of the year.

Extrapolating from the focus group discussion points that indicated any flow in the reach is better than no flow, continuing the current leakage in the channel would certainly maintain the aesthetics in the bypassed reach. Although it is easiest to discuss the small overall differences between flows, characterizing which features are visible and which are submerged and no longer visible as the water rises, and their relative aesthetic value does not suggest that any specific flow is more aesthetic than another. In all cases (both the originally studied higher flows and the supplemental lower flows) flows were free of visible debris, foam, trash, and other constituents that would negatively impact overall aesthetics in the bypassed reach.