123 FERC ¶ 62,200
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

TransCanada Hydro Northeast, Inc. Project No. 1904-051

ORDER APPROVING PLAN TO MONITOR EFFECTIVENESS OF UPSTREAM FISH PASSAGE PURSUANT TO REVISED ARTICLE 402

(Issued June 6, 2008)

On January 18, 2008, TransCanada Hydro Northeast, Inc. (TransCanada), licensee for the Vernon Hydroelectric Project, filed its plan for monitoring upstream fish passage at the project during operation of newly approved generating units pursuant to ordering paragraph M of the Order Amending License, issued on July 28, 2006,[1] which revised Article 402. The project is located on the Connecticut River, in Cheshire County, New Hampshire and Windham County, Vermont.

BACKGROUND

On March 1, 2006, TransCanada filed an application for amendment of its license to replace certain generating units. The amendment approved the replacement of four existing 2.0-MW turbine/generator units with four new 4.0-MW units. Article 402 of the amended license requires the licensee to file, for Commission approval, a monitoring plan to ensure the safe and efficient upstream passage of Atlantic salmon, American shad, and other anadromous fishes during operation of the new units. The upstream passage monitoring plan is required to include, but not be limited to: (1) the results of the licensee's hydraulic modeling study showing the effects of the new units' discharges on the hydraulic conditions in the project tailrace; (2) recommendations, based on the results of the modeling study or on-site observations, for any changes to the project's structures or operation needed to ensure safe and efficient upstream passage of anadromous fishes; (3) a proposed plan and schedule for monitoring the effectiveness of the fish ladder during operations of the new units; and (4) a schedule for filing with the Commission the results of the monitoring and, for approval, any additionally recommended changes to the project's structures or operations, based on the monitoring results, to ensure safe and efficient upstream passage of anadromous fishes.

The licensee is required to prepare the monitoring plan following consultation with

1 116 FERC ¶62,078

the Connecticut River Atlantic Salmon Commission, the U.S. Fish and Wildlife Service (FWS), the Vermont Department of Fish and Wildlife, and the New Hampshire Fish and Game Department. If the licensee does not adopt an agency recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission has reserved the right to require changes to the plan or schedule. Upon Commission approval, the licensee is required to implement the plan according to the approved schedule, including any changes to the plan or schedule required by the Commission.

The results of the studies are to be filed with the Commission according to the approved schedule. If the results indicate that modifications are needed to improve upstream fish passage, the licensee must also file recommendations for these changes with the Commission for approval, along with consultation with the resource agencies on the monitoring results and on the proposed modifications. The Commission has reserved the right to require any changes to project structures or operations to improve the effectiveness of upstream passage of anadromous fish at the project.

PROPOSED PLAN AND DISCUSSION

The licensee notes that the purpose of its plan is to provide a monitoring approach and schedule to ensure safe and efficient upstream passage of anadromous fish through the existing ladder subsequent to the installation and operation of the new units at the project. To this end, upstream passage is provided via a 984 foot-long concrete combination fish ladder (Ice Harbor and vertical slot designs) with 51 pools and a total rise of 35 feet. The ladder was constructed in 1981 and designed to pass 40,000 adult Atlantic salmon and 750,000 adult American shad annually. During ladder operation, the licensee operates units 9 and 10 in a first on - first off fashion to produce a linear flow across the fish ladder entrance and eliminate the potential for an eddy caused by the operation of the formerly proposed units 11 and 12. Although these units were not installed, the concern for potential effects on the ladder entrance from the new units still exists.

To address the issues regarding new units 5-8, the licensee commissioned a computational fluid dynamics (CFD) study using various scenarios of unit operation. The study concluded that operation of only units 5 through 8 resulted in a strong eddy forming at the fish ladder entrance. Elimination of this eddy can be achieved by operating unit 10 first, in conjunction with units 7 and 8 during fish ladder operation. However, until field verification of tailwater flow patterns during fish ladder operation are completed and an agreed upon permanent operating protocol is established between the licensee and the resource agencies, an interim protocol will remain in effect. The protocol will be as

follows: Unit 10 first on, last off generating unit; operate Unit 8 and/or Unit 7; operate Unit 9; operate Unit 5 and/or 6; lastly operate units 1 through 4. All units will be operated up to best efficiency before another unit is placed online or shut down.

The intent of the field evaluation study will be to provide a qualitative assessment of flow prediction from the CFD model. A summary report of the findings from the study as well as any recommendations for additional study to operational changes will be provided for agency review and approval at the conclusion of the study. If results of the field study indicate a disruptive eddy current formation near the fish ladder entrance, the licensee will immediately modify the interim operating protocol for the duration of the upstream passage season. The licensee proposed a schedule for conducting the field study prior to May 15, 2008, in order to determine if and what interim operating protocols will be needed for the remainder of the season before reaching an approved and permanent protocol, implementing interim operating protocol during the upstream fish passage season with any changes if initial field verification indicates a disruptive eddy formation in the vicinity of the fish ladder, consulting with the resource agencies on the study results by October 30, 2008 and filing the summary report to the Commission by December 31, 2008.

CONSULTATION

The FWS provided comments on the licensee's plan by letter dated December 5, 2007. The licensee addressed the comments by the FWS and incorporated them into the plan. The licensee notes that it is premature to speculate if additional study or modifications are needed unless clear evidence shows that the operation of the new units is detrimental to upstream fish passage.

A consultation meeting was held with the agencies on April 8, 2008, to further discuss the formation of eddies near the fish ladder. The licensee noted it would prefer to operate the new units as they are the most efficient, but only if there is not a problem associated with an eddy forming in front of the fish ladder entrance. The FWS determined that the fish ladder could not be operated without unit 10 running but it was agreed that a combination of different units running would be tested to determine impacts on operation of the ladder. This would consist of operating:

- unit 10 alone
- unit 8 alone and add unit 10
- unit 7 alone and add unit 10
- units 10, 7 and 8
- units 10 and 5 through 7
- units 9 and 10 and 5 through 8

- unit 8 alone and then add unit 9
- unit 9 alone
- units 9, 7 and 8
- units 8 and 7
- units 8 through 5 possibly

The FWS agreed to the test operations and requested an operations protocol be developed for diffusing the eddy in the event unit 10 is out of service. The other agencies did not provide further comments.

CONCLUSION

The licensee's plan for monitoring upstream fish passage during operation of units 5 through 8 complies with revised license article 402. The plan provides an adequate method for assessing impacts on upstream fish passage efficiency and should be approved.

The Director orders:

(A) TransCanada Hydro Northeast, Inc's (TransCanada) plan for monitoring upstream passage of Atlantic salmon, American shad, and other anadromous fish at the Vernon Hydroelectric Project during operation of the new generating units, filed on January 18, 2008, is approved.

(B) TransCanada shall consult with the Connecticut River Atlantic Salmon Commission, the U.S. Fish and Wildlife Service, the Vermont Department of Fish and Wildlife, and the New Hampshire Fish and Game Department on the field evaluation study and file a final report with the Commission by December 31, 2008. If the results indicate that modifications are needed to improve upstream fish passage, the licensee shall also file, for Commission approval, recommendations for these changes.

(C) This order constitutes final agency action. Requests for a rehearing by the Commission may be filed within 30 days of the date of issuance of this order, pursuant to 18 C.F.R. § 385.713.

George H. Taylor
Chief, Biological Resources Branch
Division of Hydropower Administration
and Compliance

Upstream Fish Passage Monitoring Plan

Vernon Hydroelectric Project
FERC Project No. 1904

December 2007

TransCanada Hydro Northeast Inc.
4 Park Street
Concord, NH 03301

TABLE OF CONTENTS

1.0 INTRODUCTION

This Upstream Fish Passage Monitoring Plan (the Plan) is being submitted by TransCanada Hydro Northeast Inc. (TransCanada) to the Federal Energy Regulatory Commission (FERC) for review and approval, in accordance with Article 402 of the Federal Energy Regulatory Commission (FERC) Order amending the FERC License for the Vernon Hydroelectric Project, FERC No. 1904 (the Project) issued on July 28, 2006.

Article 402 of the FERC Order states:

> *"The licensee shall file…for Commission approval, a monitoring plan to ensure the safe and efficient upstream passage of Atlantic salmon, American shad, and other anadromous fishes during operation of the new units. The upstream passage monitoring plan shall include, but not be limited to: (1) the results of the licensee's hydraulic modeling study showing the effects of the new units' discharges on the hydraulic conditions in the project tailrace; (2) recommendations, based on the results of the modeling study or on-site observations, for any changes to the project's structures or operation needed to ensure safe and efficient upstream passage of anadromous fishes; (3) a proposed plan and schedule for monitoring the effectiveness of the fish ladder during operations of the new units; and (4) a schedule for filing with the Commission the results of the monitoring and, for approval, any additionally recommended changes to the project's structures or operations, based on the monitoring results, to ensure safe and efficient upstream passage of anadromous fishes.*
>
> *The licensee shall prepare the monitoring plan following consultation with the Connecticut River Atlantic Salmon Commission, the U.S. Fish and Wildlife Service, the Vermont Department of Fish and Wildlife, and the New Hampshire Fish and Game Department. The licensee shall include with the plan documentation of consultation and copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the agencies to comment and make recommendations prior to filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.*
>
> *The Commission reserves the right to require changes to the plan or schedule. Upon Commission approval, the licensee shall implement the plan according to the approved schedule, including any changes to the plan or schedule required by the Commission.*
>
> *The results of the studies shall be filed with the Commission according to the approved schedule. If the results indicate that modifications are needed to improve upstream fish passage, the licensee shall also file recommendations for these changes*

with the Commission for approval. The licensee shall consult with the agencies listed above on the monitoring results and on the proposed modifications. The Commission reserves the right to require any changes to project structures or operations to improve the effectiveness of upstream passage of anadromous fishes at the project."

2.0 SCOPE OF THE PLAN / BACKGROUND

In accordance with Article 402 of the Vernon Project License Amendment, the purpose of this Plan is to propose an upstream fish passage monitoring approach and schedule to ensure the safe and efficient upstream passage of migrating Atlantic Salmon, American Shad, and other anadromous fish through the existing fish ladder, subsequent to the installation and operation of four new 4.0 MW generating turbines at the facility.

Upstream passage at the Vernon Project is provided by a 984-foot-long concrete combination fish ladder (Ice Harbor and vertical slot designs) with 51 pools and a total rise of 35 feet from tailrace to headpond, two viewing windows for fish counting and public viewing, and a fish trap. The fish ladder also includes one main entrance weir and a collection gallery with multiple entrances in the tailrace. The collection gallery entrances, however, were found to be ineffective for attracting fish into the fish ladder, so the collection gallery is not in use at this time.

The fish ladder was constructed in 1981 and was designed to pass 40,000 adult Atlantic salmon and 750,000 adult American shad annually, although actual passage to date has been significantly less. TransCanada operates the fish ladder in the spring and fall of each year. The spring season for salmon, shad, and river herring runs from May 15 through July 15, 24 hours per day. The fall season for salmon runs from September 15 through November 15, 24 hours per day. The 1992 Vernon Project Fish Passage Action Plan was submitted to FERC to address a concern for a potential back eddy indicated through modeling (Alden 1992) of discharge flows from the two new 14-MW units that were approved in the 1992 Vernon Project License amendment. The Plan required the first-on last-off operation of either Unit 9 or 10 (on the Vermont end of the powerhouse, closest to the fish ladder entrance) during fish ladder operation in the spring to produce linear flow across the fish ladder entrance and eliminate the potential for an eddy caused by the operation of the proposed Units 11 or 12 in front of the entrance. Although TransCanada scrapped plans for the two 14-MW units and is now replacing Units 5-8 with four new slightly larger units, the concern over potential effects on the ladder entrance from flows originating from these new units remain.

3.0 FLOW MODELING STUDY

3.1 Overview

To address concerns regarding the new Units 5-8, Alden Research Laboratory, Inc. (Alden, 2005) performed a Computational Fluid Dynamics (CFD) study of Vernon Station. Under the revised re-powering proposal, Units 5-8 are being replaced with

four 4.0 MW turbines. The purpose of the 2005 study was to examine potential flow pattern changes in the tailrace associated with operation of the four new turbines; and to evaluate how those patterns might affect attraction flows from the fish ladder, which could affect anadromous species' ability to find the fish ladder entrance under different operating regimes. The intent was to complete the study in advance of agency comments on the proposed amendment to re-power Vernon with these new units, filed with the FERC in February 2006.

A ***FLOW3D***® CFD model was developed from topological maps and plant drawings. The CFD model was validated using results from physical modeling of the Vernon Station tailrace performed by Alden in 1992. Eight scenarios with varying flow condition were simulated using the CFD model to study the changes in flow patterns in the tailrace due to various operating conditions with the four new generating turbines.

A series of velocity vector diagrams were created for each scenario being modeled. Horizontal planes were created at three elevations: near bed, mid-depth, and near surface corresponding to 12 inches above the bed of the fish ladder entrance, midway between the fish ladder entrance bed and the fluid surface, and 12 inches below the fluid surface, respectively. There was little change among the three variations, so results summarized below focus on mid-depth model results only.

3.2 Flow Modeling Discussion and Results

Results from the CFD model predict that an eddy is not present when Unit 10 is operated first at 1,530 cubic feet per second (cfs) followed by Units 7 and 8 operating at up to 1,800 cfs each. With the addition of Units 5 and 6 at 1,800 cfs, the model indicates the presence of a very small eddy of such low velocity that attraction flows at the fish ladder entrance would not be impeded. Table 1 below, and Figures 1 - 8 in Appendix A present the results of the flow study. Each of the eight scenarios modeled are summarized below.

Scenario 1 - Units 7 and 8 discharge 1,800 cfs each, and Unit 10 discharges 1,800 cfs. No eddy is present in the vicinity of the fish ladder entrance and flow is in a downstream direction.

Scenario 2 - Unit 10 discharge is decreased to 1,530 cfs while the Unit 7 and 8 discharges remain at 1,800 cfs each. The flow pattern shows no eddy in front of the fish ladder entrance.

Scenario 3 - Units 7 and 8 are taken offline, Units 5 and 6 operate at 1,800 cfs, and Unit 10 operates at 1,530 cfs. This configuration allows the discharge from Unit 10 to flow away from the fish ladder entrance, which results in an eddy forming at the entrance and velocities flowing upstream toward the entrance. This eddy is very weak and could be a numerical artifact. Therefore, it is suggested that field observation be used to determine the actual presence of an eddy.

Scenario 4 - Units 5-8 are operating at 1,600 cfs, and Unit 10 is operating at 1,530 cfs. The increased flow from Units 5-8 limits the spread of flow from Unit 10 flow away from the fishway entrance, which results in the practical elimination of the weak eddy previously predicted in Scenario 3. There is a very small area immediately below the fish ladder entrance where the water is not flowing in a linear direction but the velocity appears to be so slow that it is difficult to classify this as an eddy current.

Scenario 5 - Flow from Units 5-8 is increased to 1,800 cfs. More of the Unit 10 flow is entrained by the higher discharge from Units 5-8 which results in a slightly stronger eddy in comparison to Scenario 4 but the strength is very weak. This eddy is relatively weak and produces upstream velocities of approximately 0.6 ft/s in front of the fish ladder entrance. The attraction flow emanating from the fish ladder entrance is approximately 100 cfs, which gives a depth-averaged downstream velocity of approximately 1.6 ft/s. The greater velocity from the fish ladder entrance would oppose the upstream flow and likely prevent formation of the eddy.

Scenario 6 - Unit 9 is brought online at 1,530 cfs, Units 5- 8 are operating at 1,800 cfs, and Unit 10 is operating at 1,530 cfs. The additional flow from Unit 9 in effect squeezes the Unit 10 discharge toward the fish ladder entrance, which eliminates the weak eddy seen in scenarios 4 and 5.

Scenario 7 - Units 9 and 10 are taken offline and Units 5-8 are operating at 1,800 cfs each. The discharge plume from Units 5-8 generates an eddy near the fish ladder entrance resulting in an upstream flow at the fish ladder entrance.

Scenario 8 - Units 9 and 10 are taken offline and Units 5-8 are operating at 1,800 cfs each. The eddy is slightly stronger due to the increased flow of the discharge plume. Generally, as the discharge rate of Units 5-8 increases, the strength of the eddy will increase.

Table 1
Results of Alden Flow Modeling Study, 2005

Scenario #	Total Discharge cfs	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10	Eddy Forms
1	5400	-	-	1800	1800	-	1800	No
2	5130	-	-	1800	1800	-	1530	No
3	5130	1800	1800	-	-	-	1530	Weak, if any
4	7930	1600	1600	1600	1600	-	1530	Weak, if any
5	8730	1800	1800	1800	1800	-	1530	Weak, if any
6	10260	1800	1800	1800	1800	1530	1530	No
7	7200	1800	1800	1800	1800	-	-	Yes
8	6400	1600	1600	1600	1600	-	-	Yes

Source, Alden 2005

3.3 Flow Study Conclusions

The final Alden report concluded that "[o]peration of only Units 5 through 8 results in a strong eddy forming at the fishway entrance. Elimination of the entrance eddy can be achieved by operating Unit 10, first on at 1,530 cfs followed by Units 7 and 8 at up to 1,800 cfs each. It is likely, given an attraction flow of 260 cfs emanating from the fishway entrance plus the 50 cfs from the downstream passage fish tube that Units 5 and 6 could then be brought online without creating an eddy in front of the fishway entrance." (Alden, 2005)

3.4 Agency Review

State and Federal fishery agencies reviewed the results of the 2005 Alden report and on behalf of these agencies, the US Fish and Wildlife Service (FWS) filed comments with FERC on July 7, 2006. In their comments they conceptually concurred with TransCanada's proposal for an interim plan to operate Units 9 or 10 at all times during the upstream passage seasons and that on-site observations would be scheduled after commissioning of the new units. The on-site observations of flow patterns at the fishway entrances would determine if alternative or additional measures are needed to dissipate the predicted eddy. TransCanada proposed that following these field observations, "an agreeable permanent operational protocol during fish ladder operation will be developed". The FWS went on to state that FERC should condition the order approving the license amendment to require a filing of the results of the on-site observations and agency comments and recommendations on measures needed to assure passage or studies needed to evaluate passage further.

4.0 RECOMMENDATIONS

4.1 Evaluation of Modeled Flow Patterns

The results of the Computational Fluid Dynamics model study indicate that eddy formation can be prevented by running Unit 10 in conjunction with Units 7 and 8 during periods of fish ladder operation. It suggests that the same would be true operating Unit 9 in conjunction with either Unit 7, 8 or 10. It indicates that operating Units 1-8 without Unit 10 can and in some cases will definitely form an eddy in front of the entrance to the fish ladder. Both TransCanada and the consulting fishery agencies agree that since the model is a mathematical evaluation, scenarios that describe the possibility of a weak eddy, as in Scenarios 3-5 and scenarios not modeled, require field verification to validate the existence of such.

Details of the field evaluation study will be developed in consultation with the fishery agencies prior to the field evaluation itself and prior to the 2008 spring upstream passage season. In general, the field verification assessment will include visual evaluation of tailrace flow patterns near the entrance of the fish ladder, as well as measurement of flows from each turbine, spill gates and the fish ladder. Direct field measurement of flow vectors and velocities will be difficult to conduct safely in the field. Use of drones or visual observation tools will also be considered as a means of improving the qualitative assessment of impact.

The intent of the study is to provide a qualitative assessment of flow predictions from the CFD model. Representatives from FWS, and NH and VT fishery agencies will be invited to participate in the field assessment. It is also anticipated that representatives from Alden Lab will be onsite for this evaluation.

A summary report of findings from the field verification study, including any recommendations for additional study and/or additional long-term measures or operational changes, will be provided for agency review and approval at the conclusion of the study.

4.2 Vernon Station Interim Operating Protocol during Fish Ladder Operation

An interim operating protocol will govern the priority and order units dispatched on and off during all times when the fish ladder is in operation. Until field verification of tailwater flow patterns during fish ladder operation is complete and an agreed upon permanent operating protocol is established between TransCanada and the fishery agencies, the interim operating protocol will remain in effect. Pending any immediate and agreed upon modifications to the protocol established during or immediately following the field verification, the protocol will be as follows:

1. Unit 10 first-on, last-off generating unit
2. Unit 8 and/or Unit 7
3. Unit 9

4. Unit 5 and/or 6
5. Units 1 - 4
6. All units will be operated up to best efficiency before another unit is placed into service or shut down.

4.3 Evaluation of Fish Passage Effectiveness

Field verification of the scenarios modeled with the CFD as well as scenarios not modeled, including operation of Unit 9 alone followed by Units 7 and 8, and any other scenarios including attraction flows should adequately demonstrate that anadromous species could safely and effectively locate and enter the fish ladder

If results of the field verification indicate a disruptive eddy current formation near the fish ladder entrance, TransCanada will immediately modify the interim operating protocols described in Section 4.2 above for the duration of the upstream passage season. TransCanada will also consult with the agencies to devise a plan for additional field verification and/or monitoring or other measures to eliminate disruptive eddy formation and/or to demonstrate upstream passage effectiveness. At this time, it is premature to speculate if additional study or modifications may be necessary. Such a plan would be developed in consultation with the agencies and implemented only if clear evidence can be shown that operating the new units has a detrimental effect on current upstream passage. This plan would be implemented only if deemed necessary by the results of the field verification study, and upon approval of agencies and FERC.

5.0 IMPLEMENTATION SCHEDULE

The schedule for implementation of this Plan is contingent upon the timing of the new generating turbines being commissioned and placed into operation. Based on the current schedule for unit start-up, the field verification study can be conducted prior to the 2008 spring upstream migration.

Table 2
Implementation Schedule

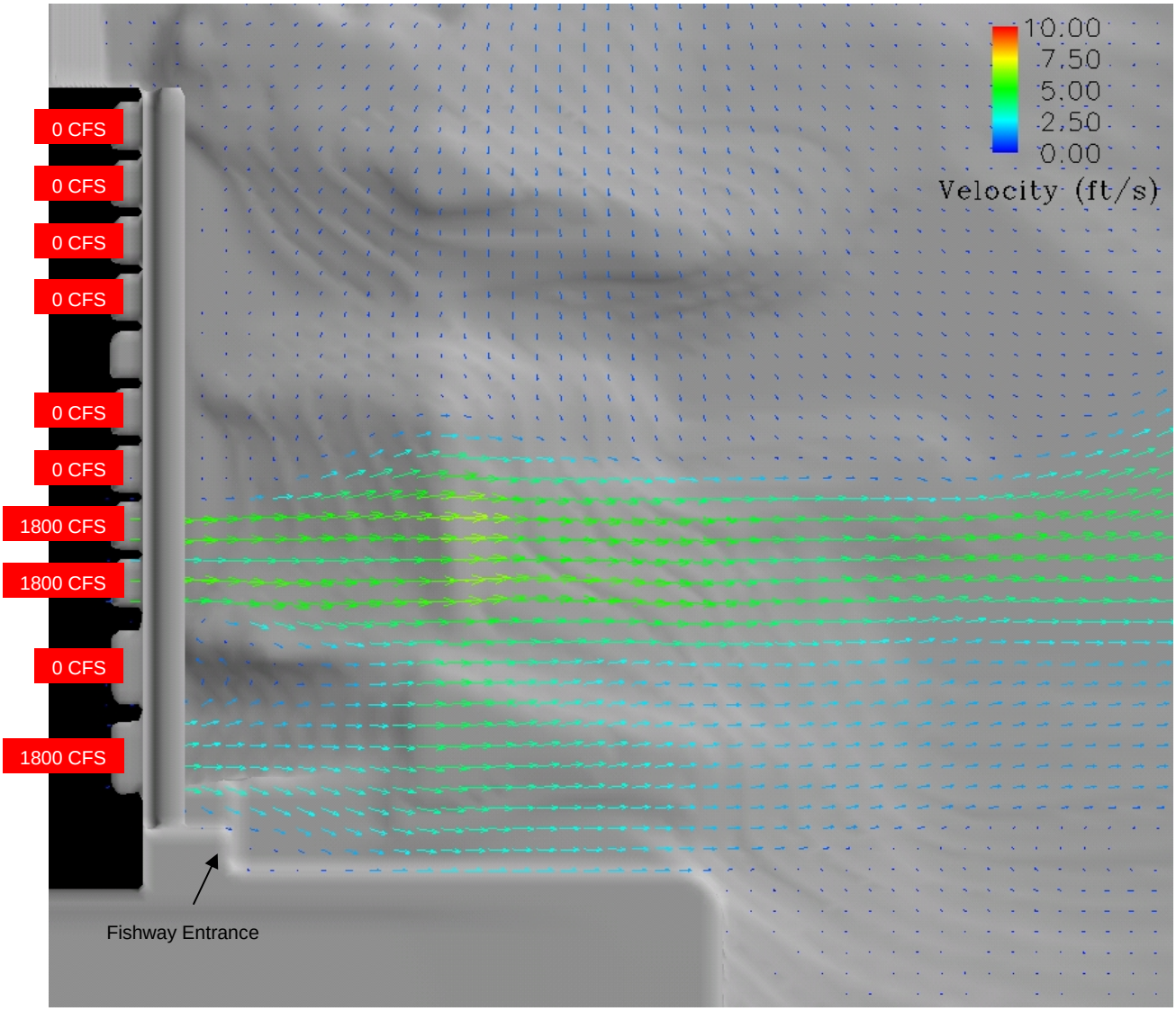
Implementation Task	Targeted Date
Meet with agencies to specify details of field verification study	Prior to March 31, 2008
Finalize scope and schedule for field verification study	Prior to April 30, 2008
Conduct field verification study of CFD model	Prior to May 15, 2008

Implement (and modify if necessary) interim operating protocols	Upstream passage seasons 2008 (May 15 – July 15; September 15 – November 15 if tagged salmon are present)
Submit summary report of the results of field verification for agency review	By September 30, 2008
Consult with Agencies on results of field verification in meeting if requested	By October 30, 2008
Obtain agency comments and submit summary report to FERC	By December 31, 2008

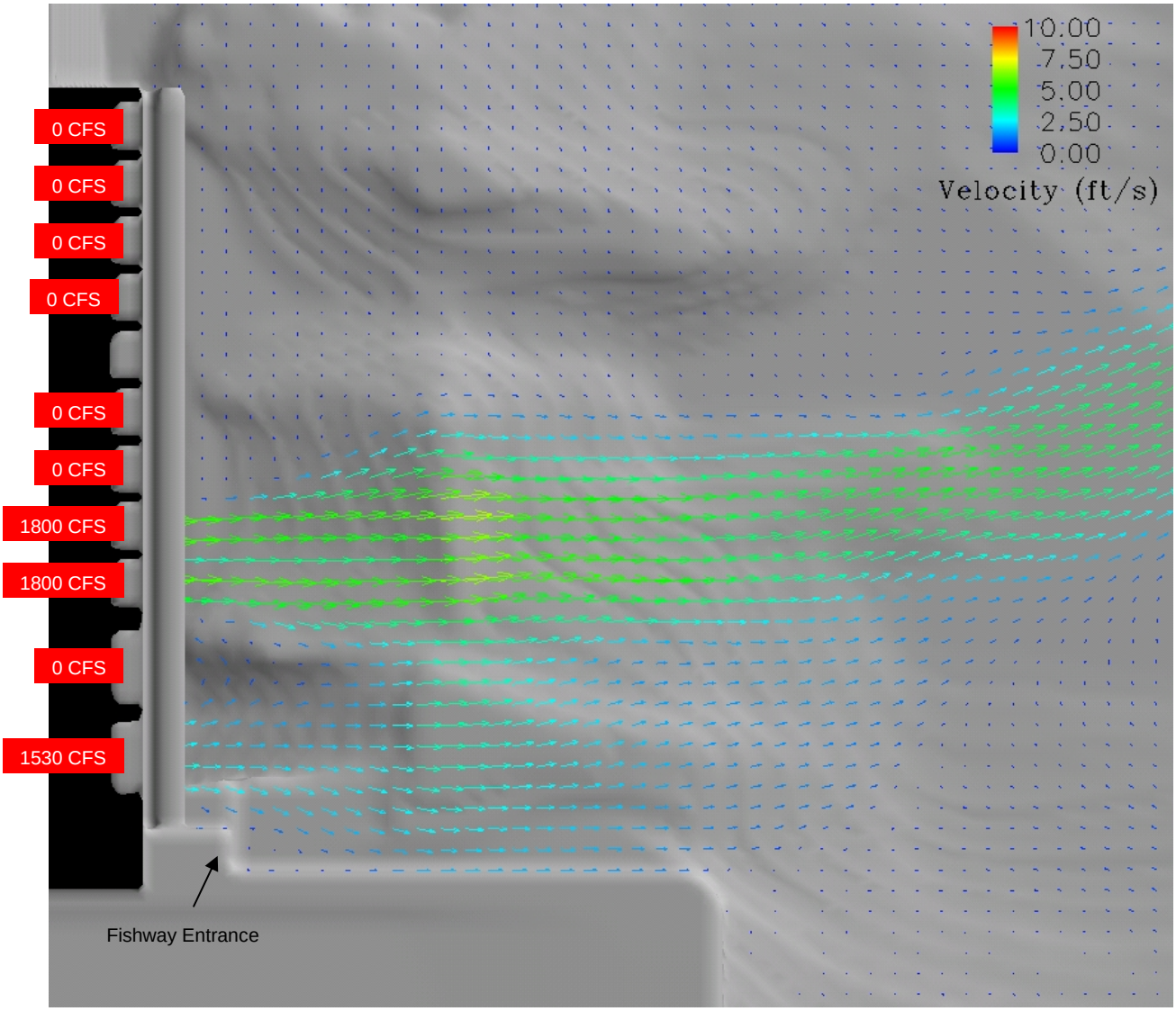
APPENDIX A

ILLUSTRATED FLOW SCENARIOS FROM CFD STUDY

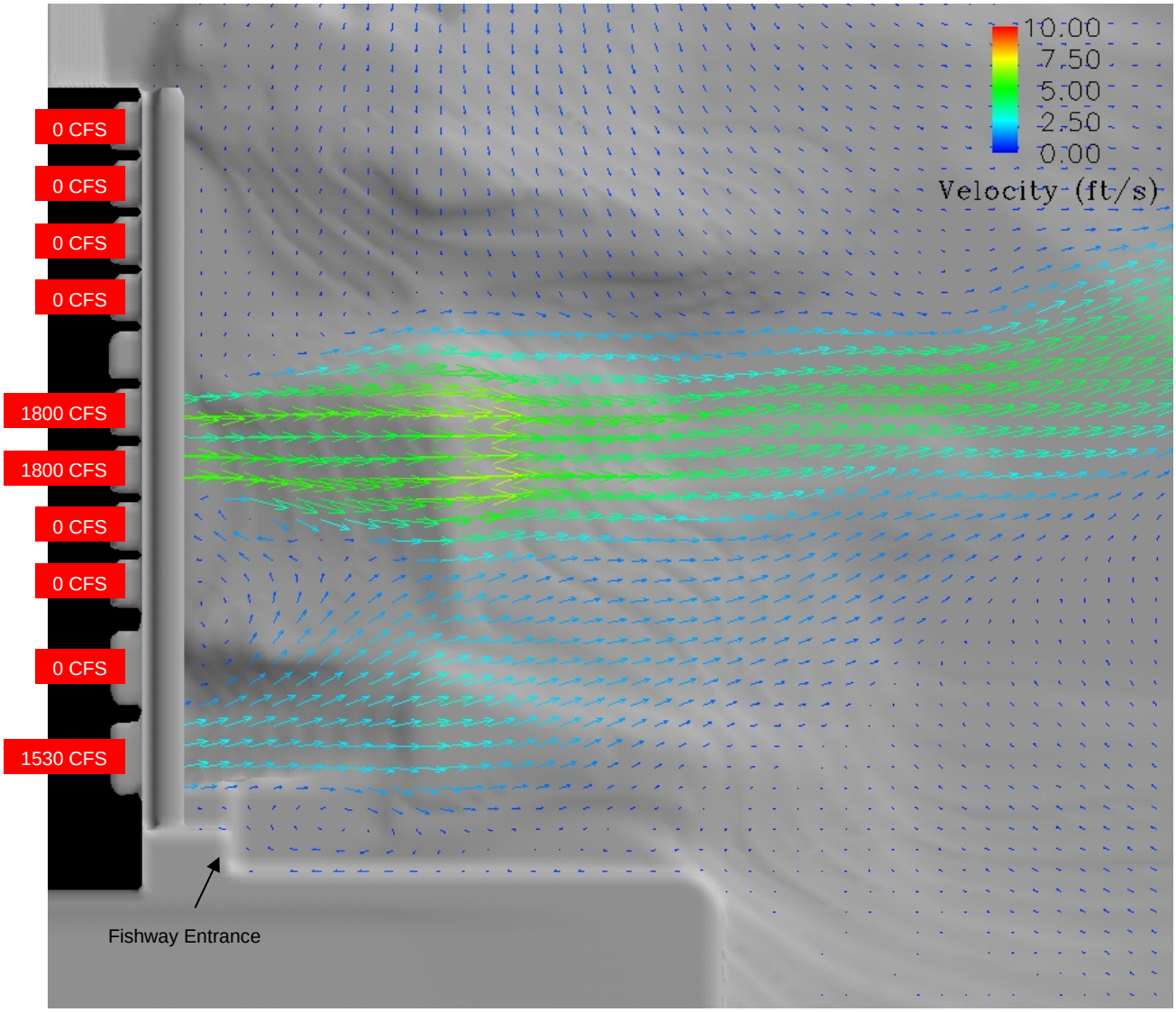
(Alden Research Lab, 2005)



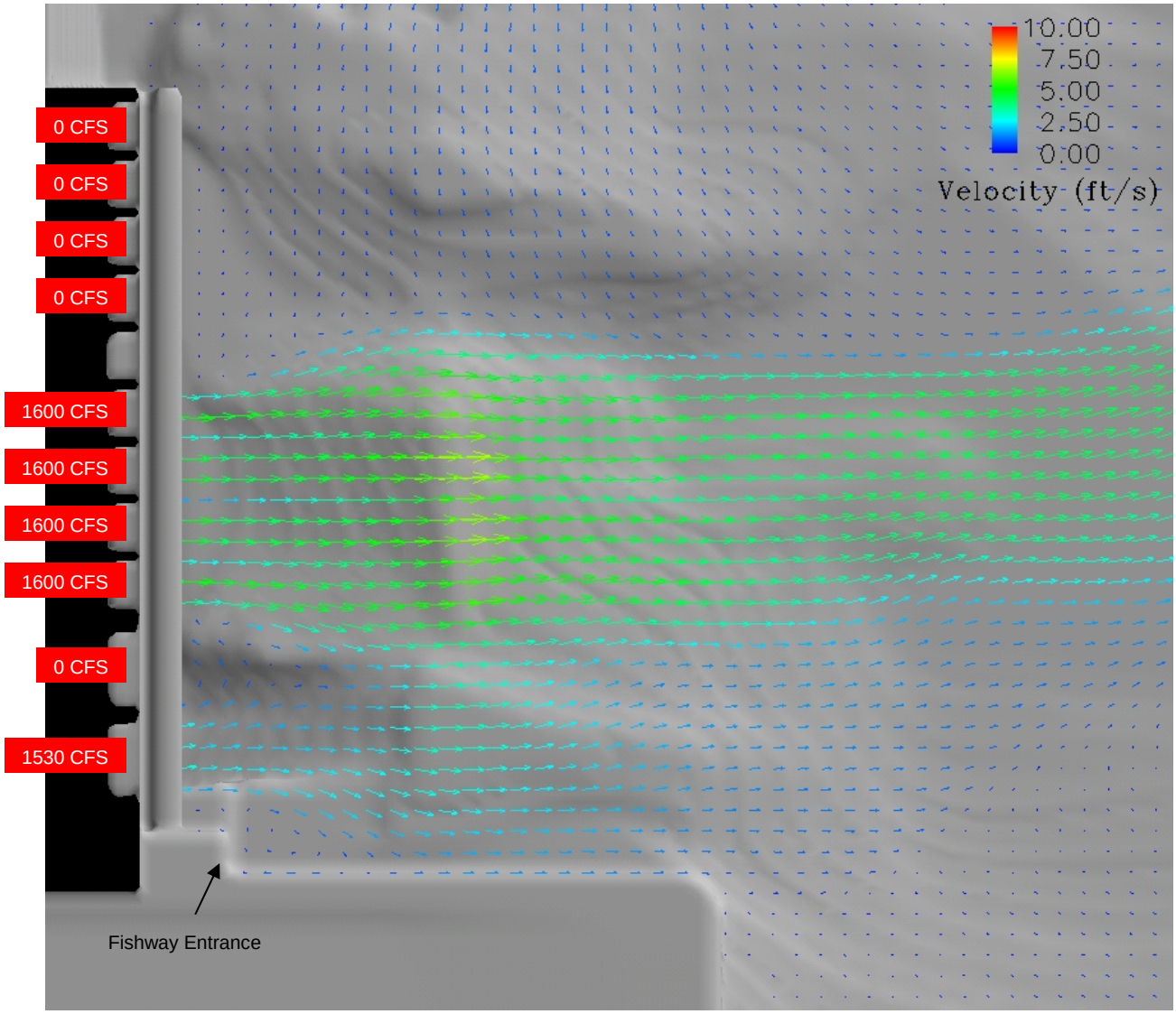
Scenario 1 Velocity Vector Diagram Mid-Depth Cut-Plane



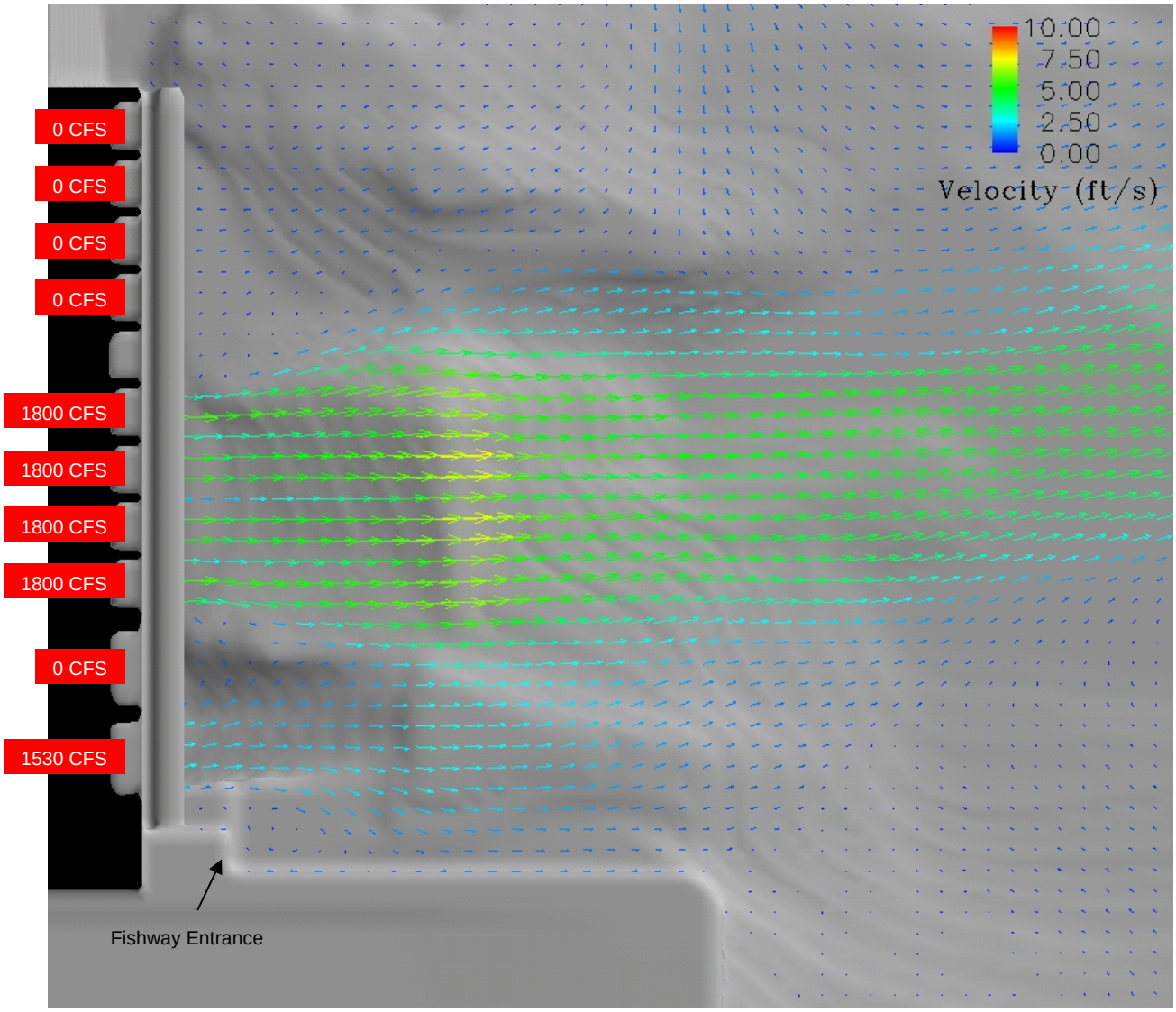
Scenario 2 Velocity Vector Diagram Mid-Depth Cut-Plane



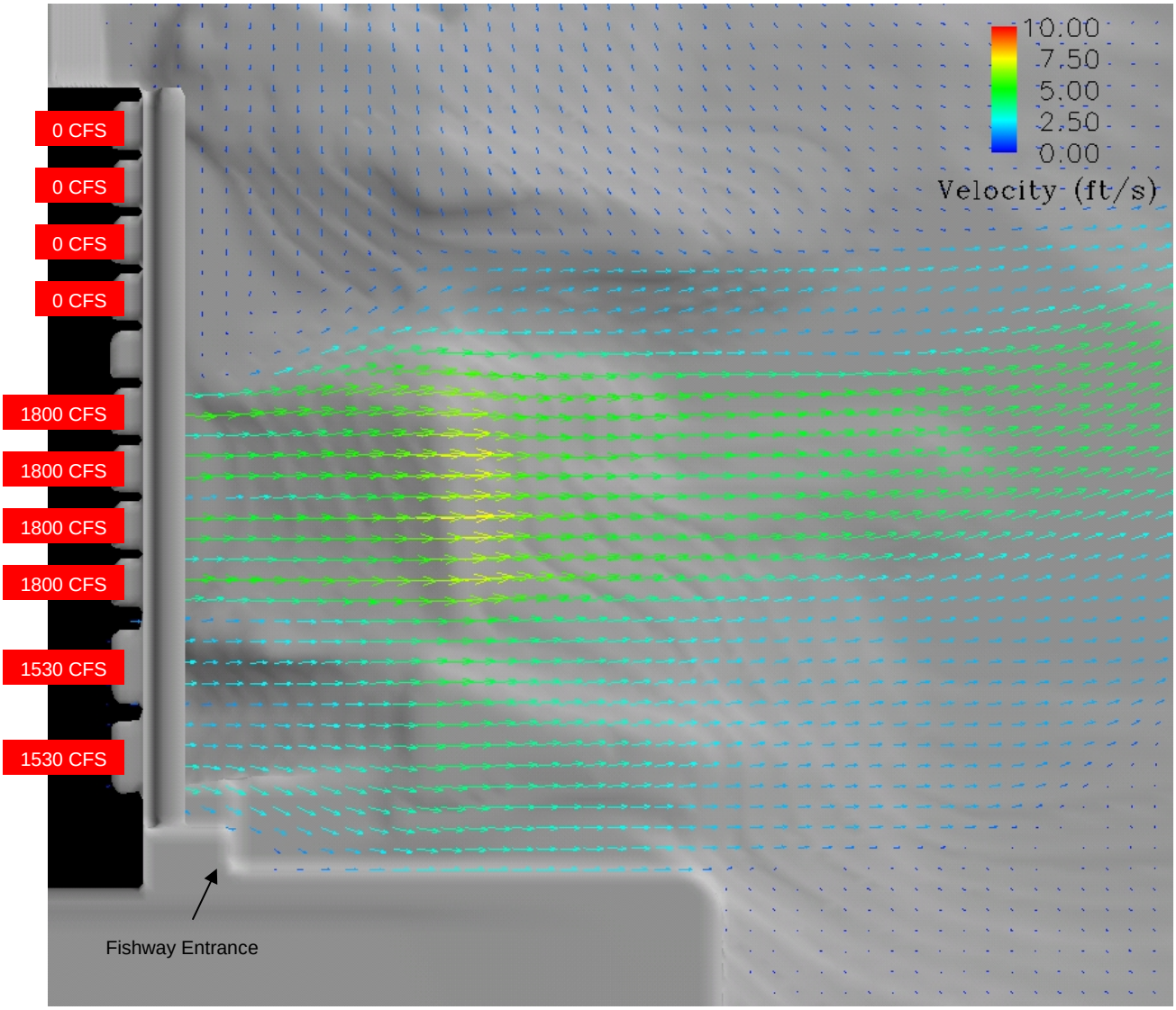
Scenario 3 Velocity Vector Diagram Mid-Depth Cut-Plane



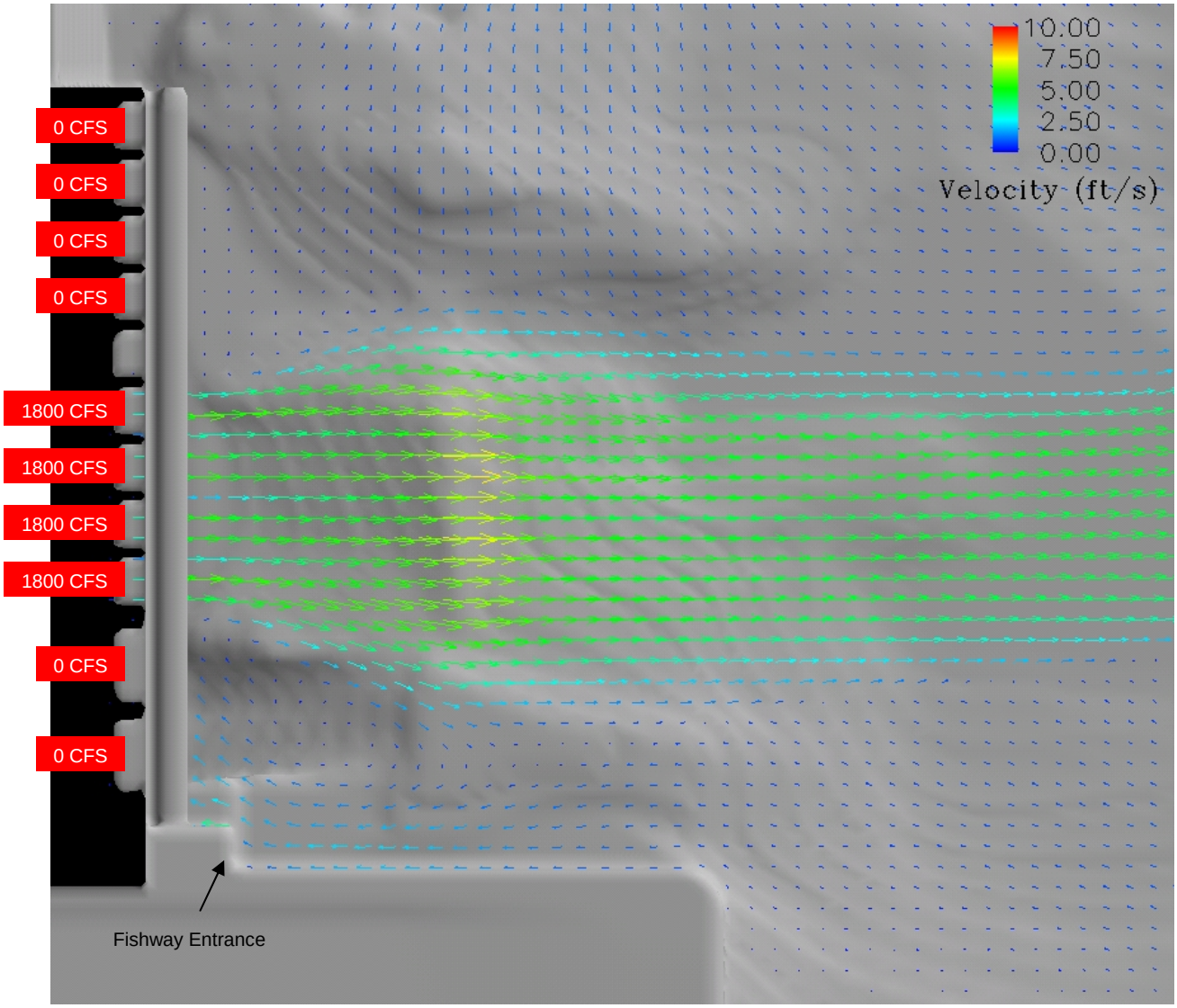
Scenario 4 Velocity Vector Diagram Mid-Depth Cut-Plane



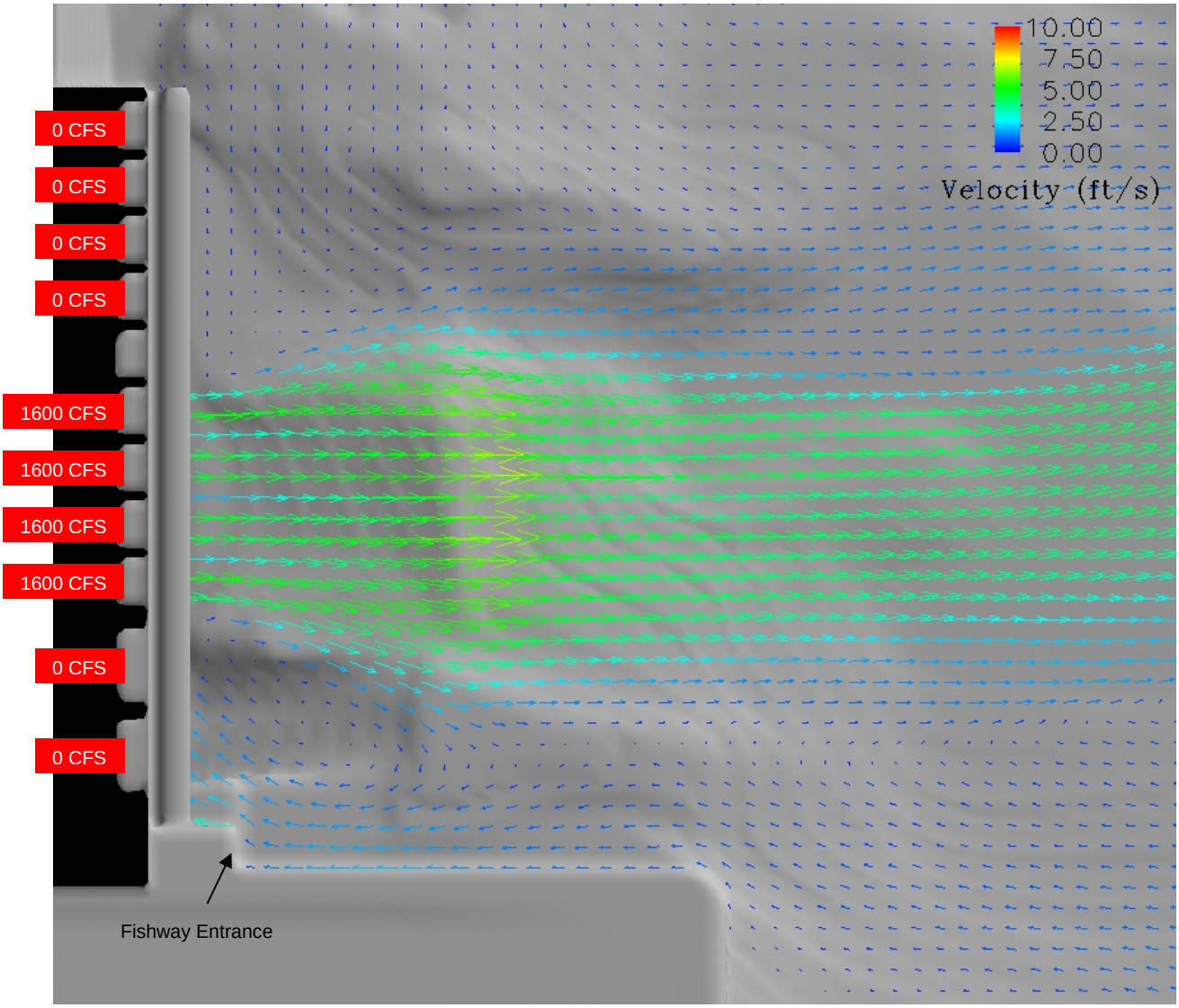
Scenario 5 Velocity Vector Diagram Mid-Depth Cut-Plane



Scenario 6 Velocity Vector Diagram Mid-Depth Cut-Plane



Scenario 7 Velocity Vector Diagram Mid-Depth Cut-Plane



Scenario 8 Velocity Vector Diagram Mid-Depth Cut-Plane

APPENDIX B

AGENCY COMMENTS

United States Department of the Interior

FISH AND WILDLIFE SERVICE

REF: FERC No. 1904

December 5, 2007

Mr. John Ragonese
TransCanada Hydro Northeast, Inc.
4 Park Street
Concord, NH 03301

Dear Mr. Ragonese:

We have completed our review of your proposed *Upstream Fish Passage Monitoring Plan – Draft for Agency Review, for the Vernon Hydroelectric Project*, located on the Connecticut River in New Hampshire and Vermont. The draft plan was transmitted via electronic mail on November 21, 2007.

The proposed plan is generally acceptable. However, we have the following comments:

3.4 Agency Review - We note that the letter referenced from the Service is actually dated July 7, 2006, not 2007. While it is correct that we conceptually concurred with operation of either unit 9 or 10 as first on, last off units, the Plan does not fully describe the interim operation scenario, which was outlined in the May 3, 2006 cover memo to the CFD modeling results report. That report identifies that sequentially, unit 9 or 10 would operate first on, then units 7 and/or 8, then both units 9 and 10. Only after the capacity of those units is exceeded would units 5 and 6 be brought on line.

We note, however, that while we conceptually agreed to the proposed scenario, no CFD modeling of only unit 9 operation was undertaken. Eddy formation is possible with only unit 9 operated in conjunction with unit 7 and/or 8. The uncertainty of modeling and the fact that this scenario was not actually modeled, means that the field evaluation is necessary to evaluate this scenario. Given the uncertainty as to the field evaluation date, which could be after the fish passage season has started, we would prefer to have both units 9 and 10 operated first on, last off. This protocol at least encompasses a modeled scenario. The CFD modeling summarized in Table 1 of the Plan shows that having both units 9 and 10 on line is the best option for assuring no eddy formation. At a minimum, the interim unit operation during the passage season should be to have unit 10 (not 9) as first on and then unit 9 brought on before units 5 and 6 are started.

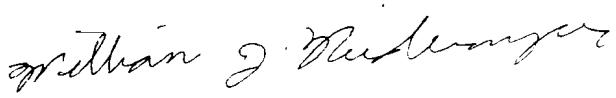
4.2 Evaluation of Fish Passage Effectiveness – This section proposes: "If results of field verification indicate a disruptive eddy formation in the vicinity of the fishway entrance, TransCanada will consult with agencies to devise a plan for additional field verification and/or monitoring". While additional verification and/or monitoring may be appropriate, depending on the evaluation results, immediate modifications to operating protocols may be needed to eliminate eddy formation and/or improve passage. This potential outcome should be specified in the Plan.

Appendix A - Illustrated Flow Scenarios from 2005 Alden CFD Study - The figures and flow vectors presented in the report are too small to be meaningful. Enlarged figures showing the fishway entrance should be included for each scenario. It is unclear from the figures if the CFD modeling runs included the normal 200 cfs discharge from fishway entrance, which should have been the case.

Lastly, as noted in the cover memo, specifics regarding the field evaluation in spring 2008 are still to be developed. This should be discussed in the Plan itself. We recommend that the Plan specifically state that the details of the field evaluation will be developed in consultation with the consulted agencies and that the Implementation Schedule, Table 2, include entries regarding when such discussions will occur and when the field evaluation details will be finalized.

We look forward to working cooperatively in the development of final field evaluation details and completion of the field monitoring. If you have any questions, please contact John Warner of this office at 603-223-2541, extension 15.

Sincerely,



William J. Neidermyer
Assistant Supervisor Federal Activities
New England Field Office

CC: VDFW/Waterbury – Rod Wentworth
VDFW/Springfield – Jay McMenemy
NHFGD/Keene – Gabe Gries
NHFGD/Concord - Matt Carpenter
RO/EN – Ben Rizzo
FERC- Div. Of Hydropower Administration and Compliance
Reading file

ES: JWarner:12-05-2007:603-223-2541

APPENDIX C

RESPONSE TO AGENCY COMMENTS

Vernon Hydroelectric Project
Upstream Fish Passage Monitoring Plan

Summary of Responses to Agency Comments

Agency Comment	Response
USFWS_1: (Section 3.4) We note that the letter referenced from the Service is actually dated July 7, 2006, not 2007.	Section 3.4 of the Final Plan has been corrected to state "July 7, 2006".
USFWS_2: (Section 3.4) While it is correct that we conceptually concurred with operation of either unit 9 or 10 as first on, last off units, the Plan does not fully describe the interim operation scenario, which was outlined in the May 3, 2006 cover memo to the CFD modeling results report. That report identifies that sequentially, unit 9 or 10 would operation first on, then units 7 and/or 8, then both units 9 and 10. Only after the capacity of those units is exceeded would units 5 and 6 be brought on line. We note, however, that while we conceptually agreed to the proposed scenario, no CFD modeling of only unit 9 operation was undertaken. Eddy formation is possible with only unit 9 operated in conjunction with unit 7 and/or 8. The uncertainty of modeling, and the fact that this scenario was not actually modeled, means that the field evaluation is necessary to evaluate this scenario. Given the uncertainty as to the field evaluation date which could be after the fish passage season has started, we would prefer to have both units 9 and 10 operated first on, last off. This protocol at least encompasses a modeled scenario. The CFD modeling summarized in Table 1 of the Plan shows that having both units 9 and 10 on line is the best option for assuring no eddy formation. At a minimum, the interim unit operation during the passage season should be to have unit 10 (not 9) as first on and then unit 9 brought on before units 5 and 6 are started.	The proposed interim operating protocol is described in more detail in Section 4.2 of the Final Plan. The use of the term interim operating protocol is further defined in Section 4.2. We added additional language stating that best efficiency point of a unit must be reached before bringing another unit online. TransCanada did not intend to convey that it would operate Unit 9 without Unit 10 as a practical matter but might opt to if Unit 10 tripped and could not start. We concur that since this scenario was not specifically modeled, that it should be included in the field verification in order to determine if eddy formation occurs with only Unit 9 operating in conjunction with Units 7 and/or 8. As stated in Section 4.3 all CFD scenarios will be field plus others not modeled can be examined during the field verification demonstration. The CFD modeling summarized in Table 1 of the Plan also shows (scenarios 1 and 2) that operating only Unit 10 followed by Units 7 and 8 does not cause an eddy to form. As described in the interim operating protocol in Section 4.2 of the Final Plan, TransCanada intends to operate units in the following order: Unit 10, Units 8 and/or 7, Unit 9, followed by Units 5 and/or 6 during upstream passage season pending field

	verification. Further modifications to this interim protocol can be agreed upon and put into place if during the field verification, anticipated scenarios that indicated no eddy in the CFD modeling do create such in the field, or ones thought to potentially cause a weak eddy in fact show no sign of a significant disruptive flow in front of the ladder entrance.
USFWS_3: (Section 4.2) This section proposes: "If results of field verification indicate a disruptive eddy formation in the vicinity of the fishway entrance, TransCanada will consult with agencies to devise a plan for additional field verification and/or monitoring". While additional verification and/or monitoring may be appropriate, depending up the evaluation results, immediate modifications to operating protocols may be needed to eliminate eddy formation and/or improve passage. This potential outcome should be specified in the Plan.	TransCanada concurs with the need to modify interim operating protocols immediately if the initial field verification indicates formation of a disruptive eddy formation in the vicinity of the fishway entrance. Modifications to this interim protocol can be agreed upon and put into place if, during the field verification a consensus among participant in the verification exercise determines anticipated scenarios, which had previous CFD modeling indicated no eddy formation do create such in the field. Similarly, scenarios thought to potentially cause a weak eddy, which show no sign of a significant disruptive flow in front of the ladder entrance could be added as an operating configuration during ladder operating periods if agreed to in the field. The interim operating protocols presently in effect are described above and in Section 4.2 of the Final Plan. TransCanada also proposes to conduct the field verification prior to the May 15, 2008 upstream passage season in order to determine if and what interim operating protocols will be needed for the remainder of the season before reaching an approved and permanent protocol. Those operating protocols would be maintained throughout the upstream passage season.
USFWS_4: (Appendix A) The figures and flow vectors presented in the report are too small to be meaningful. Enlarged figures showing the fishway entrance should be included for each scenario. It is unclear from the figures if the CFD modeling runs included the normal 200 cfs discharge from fishway entrances, which should have been the case.	Figures included in Appendix A of the Final Plan have been enlarged for better readability. The CFD modeling runs did not account for the discharges from the fish ladder entrance and from the downstream passage West Fishtube. However, the CFD final report concluded that those attraction flows would tend to further decrease the potential for eddy formation when Unit 10 is operated first-on, last-off followed by Units 7 and 8, and then by Units 5 and 6. Section 3.3 of the Final Plan has been modified to

	include this conclusion from the CFD modeling study. The effects of attraction flows, if any, should be noted in the field evaluation.
USFWS_5: (cover memo) Lastly, as noted in the cover memo, specifics regarding the field evaluation in spring 2008 are still to be developed. This should be discussed in the plan itself. We recommend that the Plan specifically state that the details of the field evaluation will be developed in consultation with the consulted agencies and that the Implementation Schedule, Table 2, include entries regarding when such discussions will occur and when the field evaluation details will be finalized.	Sections 4.1 – 4.3, 5.0 and Table 2 have been modified in the Final Plan to include additional detail about developing the specific field evaluation study to be conducted in spring 2008.