BARTON VILLAGE INC.

17 Village Square • P.O. Box 519 • Barton, VT 05822 • (802) 525-4747

August 8, 2005

Magalie R. Salas, Secretary
Federal Energy Regulatory Commission
Mail Code: DHAC, PJ-12
888 First Street, N.E.
Washington, DC 20426

Re: Barton Village Hydroelectric Project, FERC No. 7725, License Articles 403 and 404-Flow Management and Impoundment/Flow Monitoring Plan.

Dear Ms. Salas:

Barton Village, Inc. (Barton Village) is submitting to the Federal Energy Regulatory Commission (FERC) the enclosed Flow Management and Impoundment/Flow Monitoring Plan for the Barton Village Hydroelectric Project. The current FERC license for the project was issued on June 9, 2004, with an effective date of October 2, 2004. Articles 403 and 404 of the FERC License and Conditions D and E of the Vermont Water Quality Certification specify that Barton Village must prepare the above-referenced plans. While issued as separate requirements, flow management and monitoring of impoundment/flows are related; therefore, Barton Village has incorporated both requirements into a unified plan.

A draft of the plan was previously distributed to the Vermont Agency of Natural Resources (VANR), the United States Fish and Wildlife Service (USFWS), and the United States Geological Survey (USGS) for review and comment. Comments were provided by VANR and USFWS, and have been incorporated into this final plan.

If you have any questions, please feel free to contact me.

Sincerely,

Denis H. Poirier
Village Supervisor

BARTON VILLAGE HYDROELECTRIC PROJECT
FERC Project No. 7725

FLOW MANAGEMENT AND IMPOUNDMENT/FLOW MONITORING PLAN
LICENSE ARTICLES 403 and 404

BARTON VILLAGE, INC
17 Village Square
P.O. Box 519
Barton, VT 05822

August 2005

TABLE OF CONTENTS

LIST OF ACRONYMS AND ABBREVIATIONS

FERC	Federal Energy Regulatory Commission
MW	Megawatt
KWH	Kilowatt Hours
msl	Mean Sea Level
RM	River Mile
USFWS	United States Fish and Wildlife Service
VANR	Vermont Agency of Natural Resources
WQC	Water Quality Certification

1. INTRODUCTION

The Barton Village Hydroelectric Project (Project) is located at River Mile (RM) 11.3 on the Clyde River, between Pensioner Pond and Charleston Pond (also known as Lubber Lake), within the Town of Charleston, Vermont, approximately 16 miles northeast from Barton Village. The Clyde River flows northwesterly for approximately 20 miles to Lake Memphremagog in Newport, Vermont. The Clyde River basin at the project site has a watershed area of approximately 108 square miles.

The Project consists of the following existing facilities: (1) a 77-foot-long, 24-foot-high masonry and concrete gravity dam; (2) a 187-acre impoundment (Pensioner Pond) at a normal elevation of 1,140.94 feet msl; (3) a 665-foot-long, 7-foot-diameter steel penstock; (4) two 105-foot-long, 5.5 and 5.8-foot-diameter steel penstocks leading to: (5) a powerhouse containing two turbine/generating units with a total installed capacity of 1.4 MW; and (6) two tailraces. Approximately 800 feet of the Clyde River is bypassed by the Project.

The primary water conveyance structure at the dam is the flashboard topped spillway with a total length of approximately 53 feet (see Figure 1). In addition, the west gate structure consists of three conveyances that allow water to pass into the bypass reach as well. These conveyances include a 5-foot by 5-foot low-level slide gate with a manual hoist. The sill elevation of the gate is approximately 1131.94 feet, msl. Directly above the slide gate, there are two ungated arched openings. There is a 5 foot wide by 5 foot high opening and a smaller 1.9 foot wide by 5 foot high opening. Both of the ungated openings are without flashboards and have sill elevations of approximately 1139.94 feet, msl.

A new Federal Energy Regulatory Commission (FERC) license for the Project was issued on June 9, 2004, with an effective date of October 2, 2004 and a corresponding Vermont Water Quality Certification (WQC) was issued on May 19, 2003.

Under License Articles 403 and 404 of the FERC license and Conditions D and E of the WQC, Barton Village is required to develop both a flow management and impoundment/flow monitoring plan. While issued as separate requirements, flow management and monitoring of impoundment/flows are closely related; therefore, Barton Village has incorporated both requirements into a unified plan.

Specifically, License Article 403 states:

> *Within 210 days of the effective date of the license, the licensee shall file for Commission approval, a flow management plan that has been developed in a manner consistent with Condition D of the Appendix to this order.*
>
> *The licensee shall prepare the plan after consultation with the U.S. Fish and Wildlife Service and the Vermont Agency of Natural Resources. The licensee shall include with the plan documentation of consultation, 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 to make recommendations. 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. The plan shall not be implemented until the licensee is notified that the plan is approved. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.*

License Article 404 states:

> *Within 210 days of the effective date of the license, the licensee shall file for Commission approval, a monitoring plan for impoundment and flow management. The plan shall be developed in a manner consistent with Condition E of the Appendix to this order.*
>
> *The licensee shall prepare the plan after consultation with the U.S. Fish and Wildlife Service, the U.S. Geological Survey and the Vermont Agency of Natural Resources. The licensee shall include with the plan documentation of consultation, 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 to make recommendations. 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. The plan shall not be implemented until the licensee is notified that the plan is approved. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.*

Condition D of the WQC states:

> *The applicant shall develop a flow management plan detailing how the project will be operated to comply with the conservation flow and water level limitations described above. The plan shall include information on how the project will be managed to control lag times and avoid related non-compliance with the conservation flow requirements, how downstream fish passage will be provided, and procedures for reporting deviations from prescribed operating conditions. The plan shall be developed in consultation with the Department and the U.S. Fish and Wildlife Service, and a draft shall be submitted to the Department for review within 180 days of the issuance of a federal license. The final plan shall be subject to Department approval. The Department reserves the right of review and approval of any material changes made to the plan at any time.*

Condition E of the WQC states:

> *The applicant shall develop a plan for continuous monitoring and reporting of flow releases at the project (bypass flow release and turbine discharge), impoundment levels, and inflows. The plan shall include procedures for reporting deviations from prescribed operating conditions. The applicant shall maintain continuous records of flows and impoundment levels and provide such records on a regular basis as per specifications of the Department. The plan shall be developed in consultation with the Department and the U.S. Fish and Wildlife Service, and a draft shall be submitted to the Department for review within 180 days of the issuance of a federal license. The final plan shall be subject to Department approval. The Department reserves the right of review and approval of any material changes made to the plan at any time.*

This plan has been developed to comply with these requirements.

2. FERC LICENSE AND 401 WATER QUALITY CERTIFICATION CONDITIONS

The following sections describe the flow management conditions required by the FERC license and Vermont WQC.

2.1. Run-of-River Operation

License Article 401 of the new FERC license and Condition B of the WQC require run-of-river operation of the project, where instantaneous inflow to the dam equals instantaneous outflow from the project turbines and bypass reach.

Pensioner Pond shall be maintained at or above elevation 1,140.94 feet msl (the top of the flashboards) at all times, except when restoring the elevation of Pensioner Pond after replacement of failed flashboards, during an approved drawdown related to dam maintenance/safety, or an operational emergency.

Condition B of the WQC requires a flow of 45 cfs, or inflow if less, be released into the bypass reach at all times.

If a deviation from run-of-river operation or the minimum flow release occurs, Barton Village shall notify FERC as soon as possible, but no later than 10 days after each incident.

2.2. Flashboard Maintenance and Repair

Condition G of the WQC requires that flashboards be replaced at four-year intervals. In addition, Barton Village will inspect the flashboards for deterioration on an annual basis, and damaged boards will be replaced if necessary. Temporary drawdown of Pensioner Pond to facilitate routine flashboard replacement will be avoided.

2.3. Impoundment Refilling

License Article 402 and Condition C of the WQC requires at least 90 percent of the instantaneous inflow to the dam be released to the bypass reach and project turbines, when restoring the elevation of Pensioner Pond after replacement of failed flashboards, an approved drawdown related to dam maintenance/safety, or an operational emergency. During the refilling procedure, minimum flows to the bypass reach shall be met at all times.

3. FLOW MANAGEMENT AND IMPOUNDMENT/MONITORING PLAN

The following sections describe the operating procedures that Barton Village will implement to ensure compliance with the flow management conditions described in Section 2.

3.1. Run-of-River Operation and Minimum Bypass Flows

Barton Village proposes to upgrade the existing plant automation system to control and record future operations at the Project. The system will generally consist of water level sensors, a Programmable Logic Controller (PLC), and associated computer hardware/software.

Water level sensors will be located within Pensioner Pond, in front of and behind the existing trashracks. These sensors will operate continuously to measure water level at each location. Both sensors will be monitored for significant deviations between their readings. A staff gage, reading in feet and tenths of feet, will also be installed at the intake structure to calibrate and visually verify water levels measured by the Pensioner Pond sensors, when necessary.

Remote operation of the project will be conducted from the Barton Village offices. The automation system will issue an alarm to indicate any significant deviations from standard operating protocols, and the project operator will be dispatched to the site to take necessary corrective actions.

Flashboards will also be placed on the sill of the spillway sections located on the west gate structure. This will result in a comparable crest elevation (1140.94 ft, msl) for these water conveyance structures, relative to the flashboard-topped spillway section.

Minimum Bypass Flow

During project operation, Barton Village will release the required minimum bypass flow via an opening in the flashboards and through the low-level slide gate. The opening will be part of the downstream fish bypass-see Section 3.7[1]. The flashboard opening will be sized to pass 25 cfs, while the remaining portion of the minimum flow (approximately 20 cfs) will be passed through the low-level slide gate.

The water level corresponding to the required minimum bypass flow will be marked on a boulder just below the dam. This mark will be used to visually confirm that the minimum flow is being provided.

When the project is not operating, the additional river flow will be allowed to spill over the flashboard crest to the bypass reach. The low-level slide gate will not be adjusted in this situation.

When inflow falls below 45 cfs, the flow through the flashboard opening would decrease accordingly. During periods of extreme low flow (flows less than approximately 20 cfs)[2], operation of the low-level slide gate will be instituted to avoid making releases at the dam that are greater than inflow, which would otherwise result in the Pensioner Pond elevation falling below 1,140.94 feet msl (the top of the flashboards).

[1] Operation of the downstream fish bypass will not commence until April 1, 2008. As an interim measure, the required minimum bypass flow of 45 cfs or inflow will be passed through the low-level slide gate.

[2] Prior to the downstream fish bypass becoming operational, the low-level slide gate will be operated when inflow falls below 45 cfs to prevent a decrease in Pensioner Pond water level.

Based on the annual flow duration curve developed for the project, flows where less than 45 cfs and 20 cfs approximately 9% and 3% of the time, respectively, since 1909. The flow duration curve was developed using prorated flow from the Clyde River USGS gage.

Water Levels

For inflows less than or equal to the capacity of the project turbines plus the required minimum flow for the bypass reach (i.e., total inflow of approximately 310 cfs or less), the automation system will maintain the required Pensioner Pond water levels (i.e., elevation 1,140.94 feet, msl) by making turbine gate adjustments when necessary to compensate for varying inflows conditions.

When inflows fall below the minimum turbine capacity plus the required minimum flow (total flow of approximately 85 cfs), the automation system will cease project operation and all inflow will be passed to the bypass reach. In this situation, the low-level slide gate will remain in its normal position (opened 0.50 feet). Inflow previously passing through the project turbines will be passed over the flashboards.

During higher flow conditions, the automation system will allow the project turbines to operate at full capacity and excess flow will be passed over the flashboards to the bypass reach.

Rating Curves

Separate rating curves for water conveyance over the flashboard crest (includes spillway, west gate section lengths, and flashboard opening) and through the low-level gate were calculated (Appendix B). The rating curve for water conveyance over the flashboard crest relates Pensioner Pond water level elevation to discharge. This relationship was computed using the weir flow equation:

$$Q=CLH^{1.5}$$

Where: Q=discharge (cfs)
L=spillway crest length (ft)
H=head on spillway crest (ft)
C=coefficient of discharge (3.27+[0.44*H/1.5] for sharp-crest weir)

For the low-level slide gate, a relationship between Pensioner Pond water level elevation/gate opening and discharge was developed using the following equation (Appendix B):

$$Q=Ca\ (2gh)^{0.5}$$

Where: Q=Discharge (cfs)
C = coefficient of discharge (0.60)
A =area of gate opening (sq. ft.)
H = head above centerline of opening (feet)
g =acceleration due to gravity (32.2 feet/sec)

Upon approval of this plan, the accuracy of the coefficients of discharge in both of the above equations (and resulting flow computations) will be verified based on 3-4 wading streamflow measurements to be conducted in the bypass reach using standard U.S. Geological Survey protocols. A measurement will also be conducted to confirm that the minimum bypass flow of 45 cfs is being released when Pensioner Pond is at the target elevation of 1140.94 feet msl.

3.2. Flashboard Maintenance and Repair

In lieu of a temporary drawdown, during routine maintenance and repair activities, flashboards will be replaced in sections. To facilitate the replacement of each section, water will be directed away from each work area by a temporary blocking device, to be located just upstream from the flashboard pins.

3.3. Impoundment Refilling

When restoring the elevation of Pensioner Pond after an approved drawdown related to dam maintenance/safety, or an operational emergency, Barton Village will release 90 percent of instantaneous inflow below the project. Barton Village will estimate inflow at the dam before commencing refill of the impoundment using rating curves established for the project turbines and water conveyance structures (spillway and low-level slide gate). During the refilling procedure, minimum flows to the bypass reach will be met at all times. The turbines will be operated so that the total downstream flow (turbine discharge plus minimum bypass flow) is equal to 90 percent of the inflow.

3.4. Monitoring of Water Level Elevations and Flows

The automation system will directly measure water elevation at Pensioner Pond (near the dam), as well as station generation, instantaneously. These readings will be averaged and recorded at 30-minute intervals by a datalogger. These data, along with rating curves for the turbines and water conveyance structures, will be used to monitor the following station parameters:

- Water level elevations at Pensioner Pond (near the dam);
- Project generation (KW) and turbine flow (cfs); and
- Flow (cfs) in the bypass reach.

The automation system will not directly measure turbine or bypass reach flow. These parameters will be calculated using rating curves for the turbines and water conveyance structures. Specifically, project generation (KW) will be measured directly and used to determine turbine flow using a rating curve, and the water level elevations at Pensioner Pond (near the dam) will be used to determine bypass flows using rating curves for the spillway and low-level gate.

A proposed turbine rating curve plan was submitted to FERC on September 8, 2004, per the requirements of License Article 301. Development of the water conveyance structure rating curves is described in Section 3.1 above. The proposed rating curves are shown in Appendix B and are subject to verification.

These parameters will be used by Barton Village to demonstrate run-of-river operation, maintenance of the minimum bypass flow, and record overall project operations.

3.5. Maintenance of Water Level and Flow Records

Barton Village will maintain electronic records of water level elevation and project flow data at their office in Barton Village, and provide the data to VANR on an annual basis. In addition, this data will be provided to appropriate entities upon written or verbal request within 14 working days.

3.6. Procedure for Reporting Deviations from Operating Conditions

Notification of any deviations from the required Pensioner Pond water levels and bypass reach minimum flow will be made to appropriate entities. Specifically, initial notification via telephone or email will be

made to VANR within 24 hours of a deviation. A follow-up written notice will be made to FERC, VANR, and the USFWS within 10 days of the event. This written notice will include an explanation and duration of the event, the reason for occurrence, and any actions undertaken to rectify the problem.

Scheduled maintenance or repair work that requires a temporary suspension of standard operating conditions will require prior approval from VANR and USFWS.

3.7. Downstream Fish Passage

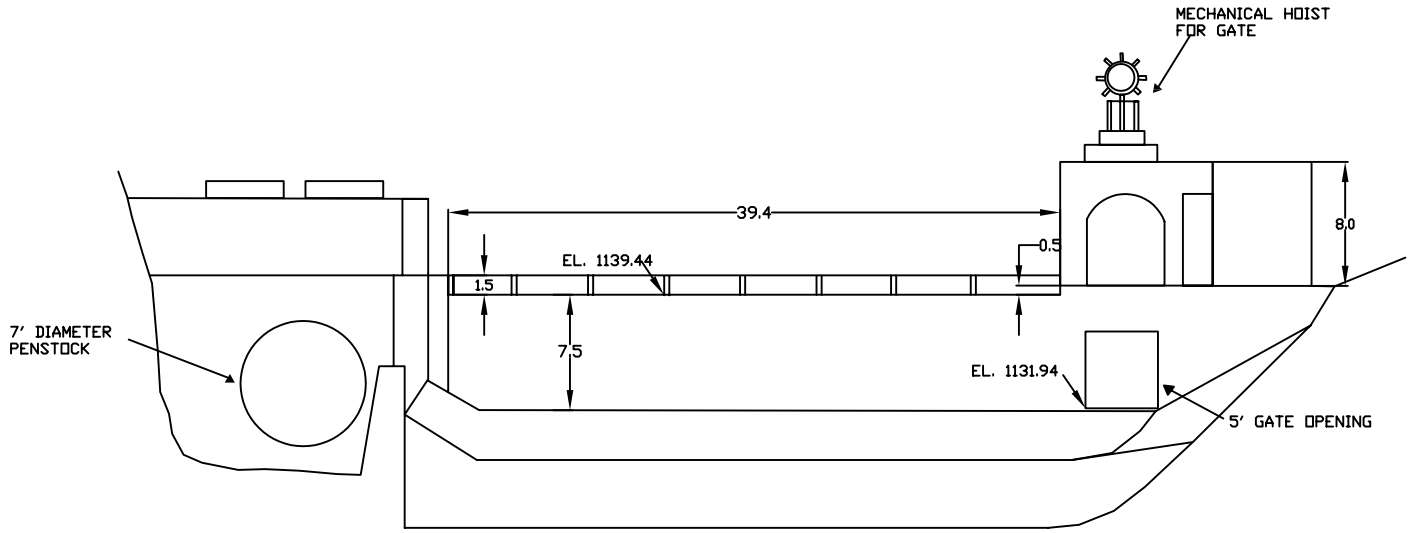
After consultation with VANR and USFWS, it was agreed that installation of downstream fish passage facilities at the project will be deferred. Specifically, it was agreed that final design plans for the facilities will be developed in consultation with VANR and USFWS, and submitted to FERC on or before September 1, 2006. Operation of the facilities will commence by April 1, 2008.

4. IMPLEMENTATION SCHEDULE

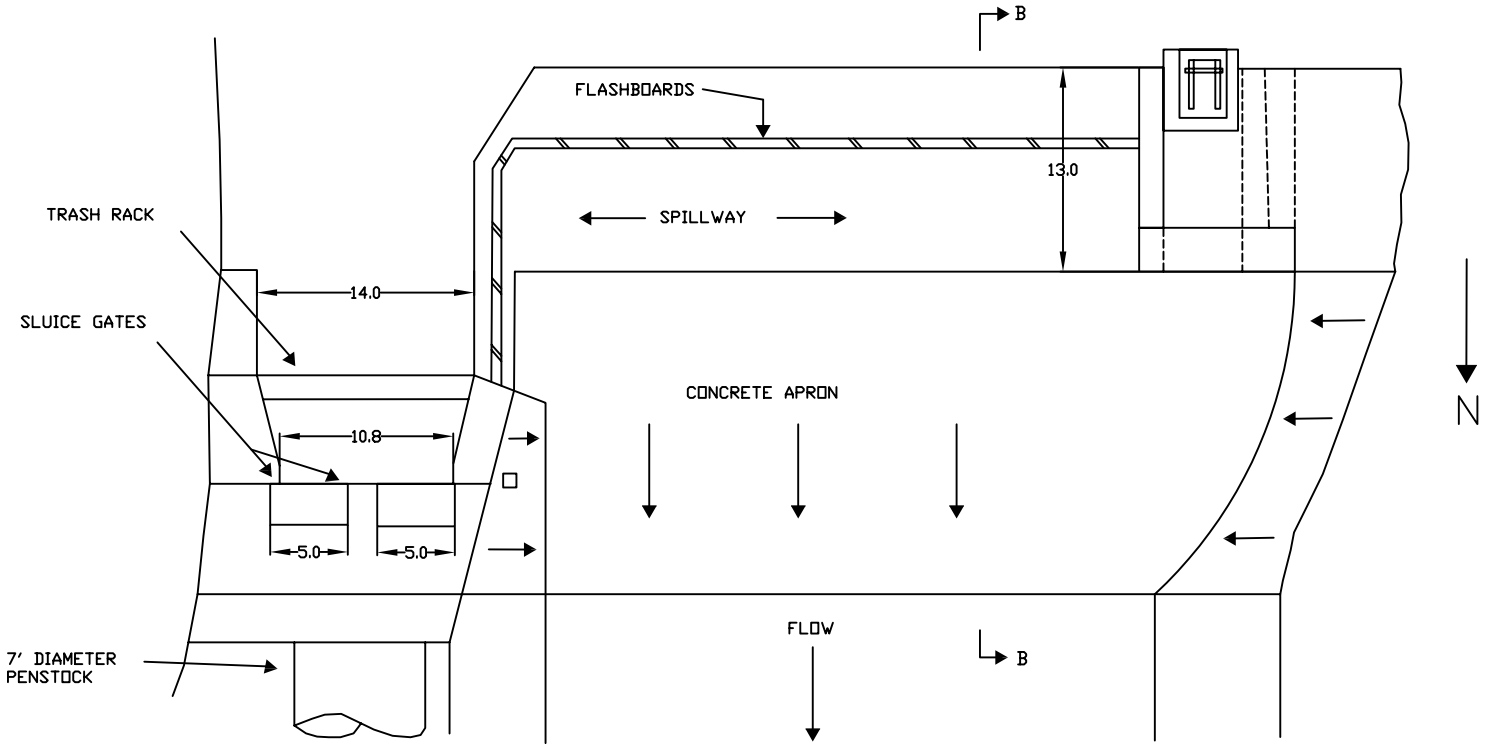
The required operating conditions have been implemented and monitored manually by the on-site project operator since the effective date of license. Except where noted otherwise, the measures proposed herein will be implemented no later than 6 months after FERC's approval of this plan.

5. AGENCY CONSULTATION

A draft of this plan was provided to the VANR, USFWS, and USGS. Comment letters were received from VANR and USFWS and are contained in Appendix A.



DAM ELEVATION



DAM PLAN

Barton Village Electric Department
Barton, Vermont
Barton Village Hydroelectric Project

Principal Project Works

FIGURE 1

APPENDIX A-AGENCY CONSULTATION

Kirk Smith

To: Wentworth, Rod; Melissa_Grader@fws.gov

Cc: 'Denis Poirier'; Fitzgerald, Brian; Gerardi, Len

Subject: RE: Barton Village Hydroelectric Project

Rod and Melissa,

The Village accepts the VANR and USFWS proposal to defer installation of the downstream fish passage facilities, so that operation would not commence until April 1, 2008. The Village will work with VANR and USFWS to develop final plans in 2006 for both a fish- and cost-effective design.

The Village will file the Flow Management and Impoundment/Flow Monitoring Plan with FERC this month. With regard to this issue, the plan will describe the general agreement proposed below by VANR and USFWS.

Later this year, the Village will collect site-specific data and photo documentation to better assist with the development of engineering design plans.

The Village appreciates the willingness you have shown to further consider this issue, and address its recent concerns.

Kirk Smith
Gomez and Sullivan Engineers, P.C.
55 North Stark Highway
Weare, NH 03281
ksmith@gomezandsullivan.com
t - 603-529-4400
f - 603-529-4411

From: Wentworth, Rod [mailto:rod.wentworth@state.vt.us]
Sent: Thursday, August 04, 2005 1:21 PM
To: 'Kirk Smith'; Melissa_Grader@fws.gov
Cc: 'Denis Poirier'; Fitzgerald, Brian; Gerardi, Len
Subject: RE: Barton Village Hydroelectric Project

Kirk, I am responding for VANR and USFWS. We have discussed your email and offer the following proposal. As we indicated in 2003 and again during the June 3, 2005 teleconference, resident fish do migrate within the Clyde River system. Therefore, measures should be put in place to facilitate their safe downstream passage past the dam – hence the reason for the requirement. The need for passage is not solely linked to salmon. You refer to “resident” and “migratory” species, but it should be recognized that resident species do in fact often move a great deal. The removal of West Charleston dam would add to the need for downstream fish passage, but the need exists now. However, the fish and wildlife agencies are willing to defer on the requirement for installation of the downstream fish passage facilities, so that operation would not commence until April 1, 2008. Final design plans should be developed in 2006.

As you know, the downstream passage release must not discharge fish onto the dam’s concrete apron. However, there is some latitude in the design configuration to achieve this objective, and hence opportunities to develop a design that is both fish- and cost-effective. For example, it may be possible to construct a plunge pool in the location where the spill will fall, absent a flume.

We believe that this is a fair compromise, and look forward to hearing from you.

Rod Wentworth
VT Dept. of Fish & Wildlife
103 South Main Street
Waterbury, VT 05671-0501
Phone: (802)241-3709
Fax: (802)241-3295
Note that the address below is new, please update your records.
Email: rod.wentworth@state.vt.us

From: Kirk Smith [mailto:ksmith@gomezandsullivan.com]
Sent: Monday, August 01, 2005 1:52 PM
To: Melissa_Grader@fws.gov
Cc: 'Denis Poirier'; Fitzgerald, Brian; Wentworth, Rod; Gerardi, Len
Subject: Barton Village Hydroelectric Project

Greetings,

I wanted to follow-up on my previous email (see below) to gauge your reaction to the Village's recent proposal. Let me know your thoughts.

Kirk Smith
Gomez and Sullivan Engineers, P.C.
55 North Stark Highway
Weare, NH 03281
ksmith@gomezandsullivan.com
t - 603-529-4400
f - 603-529-4411

From: Kirk Smith [mailto:ksmith@gomezandsullivan.com]
Sent: Monday, June 20, 2005 4:13 PM
To: 'Melissa_Grader@fws.gov'
Cc: 'rod.wentworth@state.vt.us'; 'Len.Gerardi@state.vt.us'; 'Denis Poirier'
Subject: Barton Village Hydroelectric Project

Thanks again for taking part in the June 3rd conference call to discuss the fish bypass at the Barton Village Hydroelectric Project. The Village appreciates the input that was offered by USFWS and VANR.

After some consideration, the Village continues to have reservations with regard to the need for a downstream fish bypass at the Barton Village Hydroelectric Project. Specifically, it is the Village's understanding that only resident species are found upstream of the dam, and at this time there are currently no plans to stock migratory fish above the dam. Also, due to the current configuration of the river, the only riverine habitat to be accessed by any fish passing the dam would be the short bypass reach. Any further downstream movement is obstructed by Charleston Dam.

However, with what appears to be the impending removal of Charleston Dam, some of these circumstances are likely to change. For this reason, the Village would like USFWS and VANR to consider postponing discussions on the downstream fish bypass at the Barton Village Hydroelectric Dam until the Charleston Dam is successfully removed, and management objectives on the Clyde River as well as its physical configuration are redefined. At that time, the Village would propose to resume discussions in effort to find a mutual agreeable solution.

Under this scenario, the Village would move forward with the filing of the flow management and impoundment/flow monitoring plan, which would include a provision describing the aforementioned proposal.

Let me know your thoughts.

Kirk Smith
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WATER QUALITY DIVISION
103 South Main Street
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TEL 802.241.3770
FAX 802.241.3287

April 11, 2005

Kirk Smith
Gomez and Sullivan Engineers, P.C.
55 North Stark Highway
Weare, NH 03281

RE: Barton Village Hydroelectric Project – FERC No. 7725
Articles 403/404 *Flow Management and Impoundment/Flow Monitoring Plan*

Dear Mr. Smith:

The Agency of Natural Resources has reviewed the draft *Flow Management and Impoundment/Flow Monitoring Plan* for the Barton Village Hydroelectric Project, submitted electronically on March 10, 2005. Our comments follow, referenced by plan section.

3.1: The plan calls for installation of headpond elevation sensors behind the trashracks. This location could lead to measurement errors should the racks become clogged with debris. Such an event would result in the turbine discharge being reduced, avoiding a drawdown of the headpond. Nonetheless, the sensor should be installed in a location that will avoid erroneous headpond measurements.

We strongly recommend that two sensors be installed and operated continuously. The PLC should be configured so that an alarm will be triggered if the two sensors deviate beyond a set point. Further, we recommend the use of ultrasonic sensors, which are more reliable than float-type water level sensors.

It is unclear how data from the sensor in the Unit No. 1 tailrace will be used in plant operation or compliance monitoring. It may be possible to eliminate this sensor and eliminate some expense.

The plan should explain what conditions would trigger a call to the plant operator, how that will be done (e.g., autodial pager) and the anticipated response time.

The minimum bypass flow should be passed through the low-level gate and the fishway. Given the lack of public access to the dam, spillage over the dam is not required to meet the aesthetics criterion. (During the relicensing process, aesthetics was a concern in the bypass, but not necessarily at the dam.) In order to maintain effective downstream passage, 25 cfs should be released through the fishway and 20 cfs through the low-level gate. If inflow to Pensioner Pond drops below 45 cfs, the flow through the fishway would be reduced. Gate adjustments would not be necessary until inflow dropped below 20 cfs.

The information on occurrence of low flows should be changed to indicate the frequency of flows below 45 cfs and 20 cfs.

The plan proposes that the low-level gate will be operated when spillage over the flashboards exceeds 2.5 feet. Please confirm that discharge through the gate will be high enough to have a significant effect on spillage. In other words, it may not be worth operating the gate if the reduction in spillage is such a small fraction of the total discharge that the flashboards are still likely to fail.

When data are gathered to refine the rating curves for the spillway, gate and fishway, the measurements should also be used to confirm that 45 cfs is being released into the bypass when the headpond is at the target elevation.

3.4: Again, it is unclear why water level elevation in the Unit No. 1 tailrace is being recorded. Data should be averaged and reported for 30 minute, rather than one hour, intervals.

The low level gate opening may be subject to clogging with debris. There should be some means (staff gage or other mark) provided so that the operator can visually confirm that the required flow is passing through the gate. The operator's observation should be recoded in the station log.

3.6: The Agency of Natural Resources should be notified within 24 hours of any deviations from license/certification conditions. This initial notification can be via telephone or e-mail, and need only indicate that a deviation has occurred and what is known at that point about the circumstances. The intent is for the Agency to be aware of the situation in the event that public calls or complaints result. The more detailed account and explanation can follow within 10 days.

3.7: The opening in the flashboards should be 1.5 feet high (the full height of the flashboards) and 4.0 feet long. Final designs for the fishway should be subject to USFWS approval prior to construction.

4: The schedule should be changed so that implementation is complete within six months of plan approval.

Please contact me if you have any questions about these comments.

Thank you.

Very truly yours,

Brian T. Fitzgerald
Hydrologist

c: Rod Wentworth, VDFW
Len Gerardi, VDFW
Melissa Grader, USFWS

ORIGINAL

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New England Field Office
70 Commercial Street, Suite 300
Concord, New Hampshire 03301-5087

REF: FERC No. 7725
Barton Village, Inc.

April 12, 2005

Kirk Smith
Gomez and Sullivan Engineers, P.C.
55 North Stark Highway
Weare, NH 03281

Dear Mr. Smith:

This responds to your March 10, 2005 electronic message and attached Flow Management and Impoundment/Flow Monitoring Plan (Plan) for the Barton Village Project, located on the Clyde River in Vermont. The Plan is required per Articles 403 and 404 of the license issued on June 9, 2004.

The purpose of the Plan is to: (1) detail how the project will be operated to comply with the required conservation flow and water level limitations; and (2) develop a monitoring program that allows verification of compliance with mandated run-of-river and bypass flow requirements. We have reviewed the draft Plan and have the following comments.

Proposal

Project Operation

Barton Village will automate plant operations by installing water level sensors, a Programmable Logic Controller (PLC), and associated computer hardware/software. The PLC system will be programmed to maintain the headpond at or above elevation 1141.11 feet (approximately 2 inches above the top of the flashboards) during project operation. This will result in approximately 13 cfs spilling over the flashboards for an aesthetic veiling flow, and 32 cfs passing through the slide gate.

When inflow is less than the minimum hydraulic capacity of the units plus the bypass flow (total flow of 85 cfs), then project operation will cease and all flow will be directed to the bypass reach. If inflow falls below 45 cfs, Barton Village proposes to decrease the aesthetic flow and pass inflow through the slide gate. Under extreme low flow conditions, spill would cease and all inflow would pass through the slide gate (which would then operate to maintain the headpond at elevation 1140.94 feet).

Routine maintenance of flashboards will not require a drawdown of the impoundment. When restoring the headpond after an approved drawdown related to dam maintenance/safety or an operating emergency, 90% of inflow will be released downstream through a combination of turbine discharge and flow to the bypass reach.

Monitoring
The PLC system will directly measure station generation and water surface elevation in the headpond and in the Unit 1 tailrace. These data will be used to calculate turbine and bypass reach flow based on rating curves. Readings will be averaged and recorded at hourly intervals by a datalogger.

Electronic records of water level elevations, project generation, turbine flow and bypass flow will be maintained and provided to the Vermont Agency of Natural Resources (VANR) on an annual basis. These data also will be available to appropriate entities upon request.

Downstream Fish Bypass
Barton Village proposes to modify a section of flashboards to create a 1.5 ft. by 0.5 ft. opening for fish to pass through. Under normal operating conditions this opening would provide a flow of approximately 2 cfs.

Implementation
The measures proposed in the draft Plan will be implemented within nine months of the Commission's approval of the Plan.

Comments
3.1 Run-of-River Operation and Min. Bypass Flows
1. The final Plan should include drawings showing both plan and section views of the release structures (slide gate, spillway and fishway slot), along with pertinent elevations.

2. The Plan should explain why a sensor will be located in the tailrace of Unit 1 (versus Unit 2). Also, because of potential head losses downstream of the trashracks, we recommend installing the headpond sensor upstream of the trashracks in a stilling well.

Minimum Bypass Flow
1. In terms of distributing the flow, we recommend that the 45 cfs bypass flow be split in the following manner: approximately 25 cfs should be released through the fish bypass slot, and the remaining flow (20 cfs) should pass through the slide gate. Because the primary aesthetic concern is flow over the Great Falls, there is no need to spill water across the length of the dam.

When inflow is less than 45 cfs, the fish slot may be closed and inflow can pass through the slide gate. Under extreme low flow conditions (<20 cfs), the slide gate should be manipulated to maintain headpond level. The automation system should still be set to maintain Pensioner Pond at elevation 1140.94 feet.

2. The Plan should include a discussion of how the station operator will be alerted to conditions that require corrective action (e.g., flows that necessitate closing the fish slot and/or slide gate, sensor failure, etc.). Will there be an alarm, and if so, how will the station operator be notified that the alarm has been tripped?

Water Levels

The Plan states that when spill exceeds 2.5 feet over the flashboards, the slide gate will be opened to increase flow and prevent loss of boards. In our experience, most hydroprojects in New England have flashboards that begin to fail at only 1.5 ft. of spill. We are concerned that the proposed protocol may unnecessarily lead to more flashboard failures. However, it is our understanding that boards rarely fail at this site (presumably under a protocol similar to the one proposed). Therefore, we can accept your proposal, but suggest the Plan include language indicating that if board failure is occurring more frequently than expected, the target height for opening the gate will be lowered.

3.3 Impoundment Refilling

The attached Low Level Slide Gate spreadsheet only calculates discharges down to a headpond level of 1137 feet. If any anticipated maintenance activities require drawing down the pond below this level, the spreadsheet should be expanded to cover those elevations.

3.4 Monitoring of Water Level Elevations and Flows

1. We recommend averaging and recording readings at more frequent intervals (e.g., 30-minute).

2. One of the drawbacks of using an orifice opening like the slide gate to provide bypass flow is the difficulty in monitoring due to potential debris clogging. While low-level openings may be less prone to debris load relative to surface structures, it is harder to discern when clogging is occurring. Also, because the openings typically are narrow (i.e., 0.5 ft. at Barton Village), a relatively small obstruction could significantly reduce flow.

Given this potential problem, we recommend that the final Plan provide a method of visually confirming that the required flow is being released (e.g., via a staff gage, mark on a boulder, etc.). This "marker" can be determined once the accuracy of the discharge is verified by the methods described in Section 3.1 – Rating Curves.

3.7 Downstream Fish Bypass

The dimensions of the opening as proposed are inadequate to effectively attract and pass fish. Our standard fishway dimension criterion requires that the opening be a minimum of three feet wide by two feet deep.

It is our understanding that notching the dam to meet the required 2 ft. depth may not be possible due to structural issues. This would limit the depth to the height of the flashboards (1.5 ft.). In order to pass the standard design flow (25 cfs or 2-3% of turbine capacity, whichever is more), the slot would have to be over 4 ft. wide. While these dimensions differ from our standard criterion, the longer, shallower opening is acceptable at this project for the following reasons:

- the fish slot would pass the recommended flow of 25 cfs, which is 9.4% of the maximum turbine capacity;
- the trashrack spacing is 1 inch clear, and, based on engineering drawings indicating trashrack dimensions of 10 ft. x 14 ft., the approach velocity is below 2 feet per second (however, this needs to be verified);
- the fish slot will be located nearly adjacent to the trashracks; and
- as proposed, the headpond would fluctuate minimally.

The proposed conveyance structure (half of a PVC circular pipe) will not work for the larger fish slot. Instead, we recommend using a flume with 18 inch side boards. The Plan should include drawings showing both plan and section views of the fish bypass. The final fish slot design should be developed in consultation with this office and the VANR.

4.0 Implementation Schedule

Nine months seems like an excessively long time to install the PLC system. We recommend completing implementation within six months.

Thank you for the opportunity to comment on the draft Plan. If you have any questions regarding these comments, please contact Melissa Grader of this office at 413/548-9138, extension 18.

Sincerely yours,

William J. Neidermyer

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APPENDIX B-WATER CONVEYANCE RATING CURVES

SPILLWAY (INCLUDES WEST GATE SECTION) WITH FLASHBOARDS
Use for when Downstream Fish Bypass is not Operational

Equation: Q=CLH^1.5

where: Q=Discharge (cfs)
C = coefficient of discharge (C=3.27+[0.4*H/h)
L = length of crest
H = head over crest

Flashboard Crest Elevation =	1140.94	feet
Spillway Length =	60.00	feet
h =	1.50	feet (flashboard height)

Headwater Elevation (feet)	Head Over Flashboard Crest (H, feet)	Ratio H/h	Coeff. of Discharge (C)	Total Discharge (cfs)
1140.94	0.00	0.00	3.27	0
1141.00	0.06	0.04	3.29	3
1141.10	0.16	0.11	3.31	13
1141.20	0.26	0.17	3.34	27
1141.30	0.36	0.24	3.37	44
1141.40	0.46	0.31	3.39	64
1141.50	0.56	0.37	3.42	86
1141.60	0.66	0.44	3.45	111
1141.70	0.76	0.51	3.47	138
1141.80	0.86	0.57	3.50	167
1141.90	0.96	0.64	3.53	199
1142.00	1.06	0.71	3.55	233
1142.10	1.16	0.77	3.58	268
1142.20	1.26	0.84	3.61	306
1142.30	1.36	0.91	3.63	346
1142.40	1.46	0.97	3.66	387
1142.50	1.56	1.04	3.69	431
1142.60	1.66	1.11	3.71	476
1142.70	1.76	1.17	3.74	524
1142.80	1.86	1.24	3.77	573
1142.90	1.96	1.31	3.79	624
1143.00	2.06	1.37	3.82	678
1143.10	2.16	1.44	3.85	733
1143.20	2.26	1.51	3.87	789
1143.30	2.36	1.57	3.90	848
1143.40	2.46	1.64	3.93	909
1143.50	2.56	1.71	3.95	971
1143.60	2.66	1.77	3.98	1036
1143.70	2.76	1.84	4.01	1102
1143.80	2.86	1.91	4.03	1170
1143.90	2.96	1.97	4.06	1240
1144.00	3.06	2.04	4.09	1312
1144.10	3.16	2.11	4.11	1386
1144.20	3.26	2.17	4.14	1462
1144.30	3.36	2.24	4.17	1539
1144.40	3.46	2.31	4.19	1619
1144.50	3.56	2.37	4.22	1700

SPILLWAY (INCLUDES WEST GATE SECTION) WITH FLASHBOARDS
Use for when Downstream Fish Bypass is Operational

Equation: Q=CLH^1.5

where: Q=Discharge (cfs)
C = coefficient of discharge (C=3.27+[0.4*H/h)
L = length of crest
H = head over crest

Flashboard Crest Elevation = 1140.94 feet
Spillway Length = 60.00 feet
h = 1.50 feet (flashboard height)

Headwater Elevation (feet)	Head Over Flashboard Crest (H, feet)	Ratio H/h	Coeff. of Discharge (C)	Flashboard Discharge (cfs)	Flashboard Opening Discharge (cfs)	Total Discharge (cfs)
1140.94	0.00	0.00	3.27	0	25	25
1141.00	0.06	0.04	3.29	3	27	29
1141.10	0.16	0.11	3.31	12	29	41
1141.20	0.26	0.17	3.34	25	32	57
1141.30	0.36	0.24	3.37	41	35	76
1141.40	0.46	0.31	3.39	59	38	98
1141.50	0.56	0.37	3.42	80	42	122
1141.60	0.66	0.44	3.45	103	45	148
1141.70	0.76	0.51	3.47	129	48	177
1141.80	0.86	0.57	3.50	156	52	208
1141.90	0.96	0.64	3.53	186	56	241
1142.00	1.06	0.71	3.55	217	60	277
1142.10	1.16	0.77	3.58	250	64	314
1142.20	1.26	0.84	3.61	286	68	353
1142.30	1.36	0.91	3.63	323	72	394
1142.40	1.46	0.97	3.66	362	76	438
1142.50	1.56	1.04	3.69	402	80	483
1142.60	1.66	1.11	3.71	445	85	530
1142.70	1.76	1.17	3.74	489	90	579
1142.80	1.86	1.24	3.77	535	94	629
1142.90	1.96	1.31	3.79	583	99	682
1143.00	2.06	1.37	3.82	632	104	737
1143.10	2.16	1.44	3.85	684	109	793
1143.20	2.26	1.51	3.87	737	115	852
1143.30	2.36	1.57	3.90	792	120	912
1143.40	2.46	1.64	3.93	848	126	974
1143.50	2.56	1.71	3.95	907	131	1038
1143.60	2.66	1.77	3.98	967	137	1104
1143.70	2.76	1.84	4.01	1029	143	1172
1143.80	2.86	1.91	4.03	1092	149	1241
1143.90	2.96	1.97	4.06	1158	155	1313
1144.00	3.06	2.04	4.09	1225	161	1386
1144.10	3.16	2.11	4.11	1294	168	1461
1144.20	3.26	2.17	4.14	1364	174	1539
1144.30	3.36	2.24	4.17	1437	181	1618
1144.40	3.46	2.31	4.19	1511	188	1699
1144.50	3.56	2.37	4.22	1587	194	1781

LOW LEVEL SLIDE GATE

Effective Width of Gate (ft)	5.00
Height of Gate (ft)	5.00
Elevation of Sill (ft)	1131.94
Full bay elevation of Top of Gates (ft)	1136.94
Spillway Crest Elevation (ft)	**1139.44**
Flashboard Crest Elevation (ft)	**1140.94**
Coefficient of Discharge for Gate	**0.6**

CALCULATION OF DISCHARGE (CFS)

Gate Opening (ft) =>	0.25	0.50	0.75	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00
Pond Elevation (ft)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)	Q (cfs)
1132.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1132.25	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1132.50	4	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1132.75	5	9	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1133.00	6	11	15	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1133.25	7	12	17	22	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1133.50	7	14	20	25	29	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1133.75	8	15	22	28	33	37	41	-	-	-	-	-	-	-	-	-	-	-	-	-
1134.00	8	16	23	30	36	41	46	50	-	-	-	-	-	-	-	-	-	-	-	-
1134.25	9	17	25	32	39	45	50	55	59	-	-	-	-	-	-	-	-	-	-	-
1134.50	9	18	27	35	42	49	55	60	65	69	-	-	-	-	-	-	-	-	-	-
1134.75	10	19	28	37	44	52	59	65	70	75	79	-	-	-	-	-	-	-	-	-
1135.00	10	20	30	39	47	55	62	69	75	81	86	90	-	-	-	-	-	-	-	-
1135.25	11	21	31	40	49	58	66	73	80	86	92	97	102	-	-	-	-	-	-	-
1135.50	11	22	32	42	52	61	69	77	85	91	98	104	109	113	-	-	-	-	-	-
1135.75	12	23	33	44	54	63	72	81	89	96	103	110	116	121	126	-	-	-	-	-
1136.00	12	23	35	45	56	66	75	84	93	101	108	116	122	128	133	138	-	-	-	-
1136.25	12	24	36	47	58	68	78	88	97	105	113	121	128	135	141	146	151	-	-	-
1136.50	13	25	37	49	60	70	81	91	100	110	118	126	134	141	148	154	160	165	-	-
1136.75	13	26	38	50	62	73	84	94	104	114	123	131	140	147	155	161	168	173	178	-
1137.00	13	26	39	51	63	75	86	97	107	117	127	136	145	153	161	168	175	182	187	193
1137.25	14	27	40	53	65	77	89	100	111	121	131	141	150	159	167	175	183	190	196	202
1137.50	14	28	41	54	67	79	91	103	114	125	135	146	155	164	173	182	190	197	204	211
1137.75	14	28	42	55	69	81	94	106	117	129	139	150	160	170	179	188	196	204	212	219
1138.00	15	29	43	57	70	83	96	108	120	132	143	154	165	175	185	194	203	211	220	227
1138.25	15	30	44	58	72	85	98	111	123	135	147	158	169	180	190	200	209	218	227	235
1138.50	15	30	45	59	73	87	100	114	126	139	151	162	174	185	195	206	215	225	234	243
1138.75	16	31	46	60	75	89	103	116	129	142	154	166	178	190	201	211	221	231	241	250
1139.00	16	31	47	62	76	91	105	119	132	145	158	170	182	194	206	217	227	238	248	257
1139.25	16	32	48	63	78	92	107	121	135	148	161	174	187	199	210	222	233	244	254	264
1139.50	16	33	48	64	79	94	109	123	137	151	165	178	191	203	215	227	239	250	260	271
1139.75	17	33	49	65	81	96	111	126	140	154	168	181	195	207	220	232	244	255	267	277
1140.00	17	34	50	66	82	98	113	128	143	157	171	185	198	212	225	237	249	261	273	284
1140.25	17	34	51	67	83	99	115	130	145	160	174	188	202	216	229	242	254	267	279	290
1140.50	17	35	52	68	85	101	117	132	148	163	177	192	206	220	233	247	260	272	284	296
1140.75	18	35	52	69	86	103	119	135	150	165	181	195	210	224	238	251	265	277	290	302
1141.00	18	36	53	70	87	104	121	137	153	168	184	199	213	228	242	256	269	283	296	308
1141.25	18	36	54	71	89	106	122	139	155	171	186	202	217	232	246	260	274	288	301	314
1141.50	18	37	55	72	90	107	124	141	157	174	189	205	220	235	250	265	279	293	307	320
1141.75	19	37	55	73	91	109	126	143	160	176	192	208	224	239	254	269	284	298	312	325
1142.00	19	38	56	74	92	110	128	145	162	179	195	211	227	243	258	273	288	303	317	331
1142.25	19	38	57	75	94	112	129	147	164	181	198	214	231	247	262	278	293	308	322	336
1142.50	19	39	58	76	95	113	131	149	166	184	201	217	234	250	266	282	297	312	327	342
1142.75	20	39	58	77	96	115	133	151	169	186	203	220	237	254	270	286	302	317	332	347
1143.00	20	40	59	78	97	116	134	153	171	189	206	223	240	257	274	290	306	322	337	352
1143.25	20	40	60	79	98	117	136	155	173	191	209	226	243	261	277	294	310	326	342	357
1143.50	20	40	60	80	100	119	138	156	175	193	211	229	247	264	281	298	314	331	347	362
1143.75	21	41	61	81	101	120	139	158	177	196	214	232	250	267	285	302	318	335	351	367
1144.00	21	41	62	82	102	121	141	160	179	198	216	235	253	271	288	305	323	339	356	372
1144.25	21	42	62	83	103	123	142	162	181	200	219	237	256	274	292	309	327	344	360	377
1144.50	21	42	63	84	104	124	144	164	183	202	221	240	259	277	295	313	331	348	365	382