

WRRDA 7001 Submissions Package
U.S. Army Corps of Engineers

Proposal Name: Waterbury Dam risk assessment

Submission Date: 09/14/2016

Proposal ID Number: 4345ad03-a221-4681-9eb6-46fbe1bdbf1b

Purpose of Proposal: Perform a Dam Safety Assurance Evaluation on Waterbury Dam to assess risk from eliminating the winter drawdown. Unacceptable risk would be identified and the reservoir regulation manual would be revised to address the risk.

Waterbury Dam is a flood control dam authorized in 1933 and built from 1935 to 1938. Since it was completed, the reservoir levels have been manipulated for power generation. Since the 1950s, a winter drawdown has occurred with the reservoir being lowered approximately 40 feet to create storage for the spring runoff. this drawdown has also created additional flood storage for the spring runoff, although not required in the regulation manual.

The 401 Certificate issued on December 11, 2014 requires eliminating the winter drawdown once the spillway is replaced and the State determines after consultation with the Corps that elimination of the drawdown can be safely implemented.

Questions pertaining to increased risk by eliminating the winter drawdown have been raised, including questions pertaining to the performance of the embankment section and existing mineral filters.

1. Administrative Details

Proposal Name: Waterbury Dam risk assessment

by Agency: Vermont Agency of Natural Resources

Locations: VT

Date Submitted: 09/14/2016

Confirmation Number: 4345ad03-a221-4681-9eb6-46fbe1bdbf1b

Supporting Documents

File Name	Date Uploaded
planview.pdf	09/14/2016
20141028WaterburyDamIncreasedRiskComments.pdf	09/14/2016
2015-02-23 USACE Dam Safety Assurance Request.pdf	09/14/2016

2. Provide the name of the primary sponsor and all non-Federal interests that have contributed or are expected to contribute toward the non-Federal share of the proposed feasibility study or modification.

Sponsor	Letter of Support
State of Vermont, Agency of Natural Resources(Primary)	Attached

3. State if this proposal is for a feasibility study, a modification to an authorized USACE feasibility study or a modification to an authorized USACE project. If it is a proposal for a modification, provide the authorized water resources development feasibility study or project name.

Feasibility Study

4. Clearly articulate the specific project purpose(s) of the proposed study or modification. Demonstrate that the proposal is related to USACE mission and authorities and specifically address why additional or new authorization is needed.

Perform a Dam Safety Assurance Evaluation on Waterbury Dam to assess risk from eliminating the winter drawdown. Unacceptable risk would be identified and the reservoir regulation manual would be revised to address the risk.

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5. To the extent practicable, provide an estimate of the total cost, and the Federal and non-Federal share of those costs, of the proposed study and, separately, an estimate of the cost of construction or modification.

	Federal	Non-Federal	Total
Study	\$650,000	\$350,000	\$1,000,000
Construction	\$0	\$0	\$0

Explanation (if necessary)

6. To the extent practicable, describe the anticipated monetary and nonmonetary benefits of the proposal including benefits to the protection of human life and property; improvement to transportation; the national economy; the environment; or the national security interests of the United States.

Eliminating the winter drawdown restore aquatic habitat. It does increase risk since more water will be stored. Questions have been raised pertaining to increased risk from the increased storage. The increased risk relates directly to flood and storm damage reduction.

7. Does local support exist? If 'Yes', describe the local support for the proposal.

Yes

Local Support Description

A local professional engineer (former State Dam Safety Engineer) supports the risk assessment proposal.

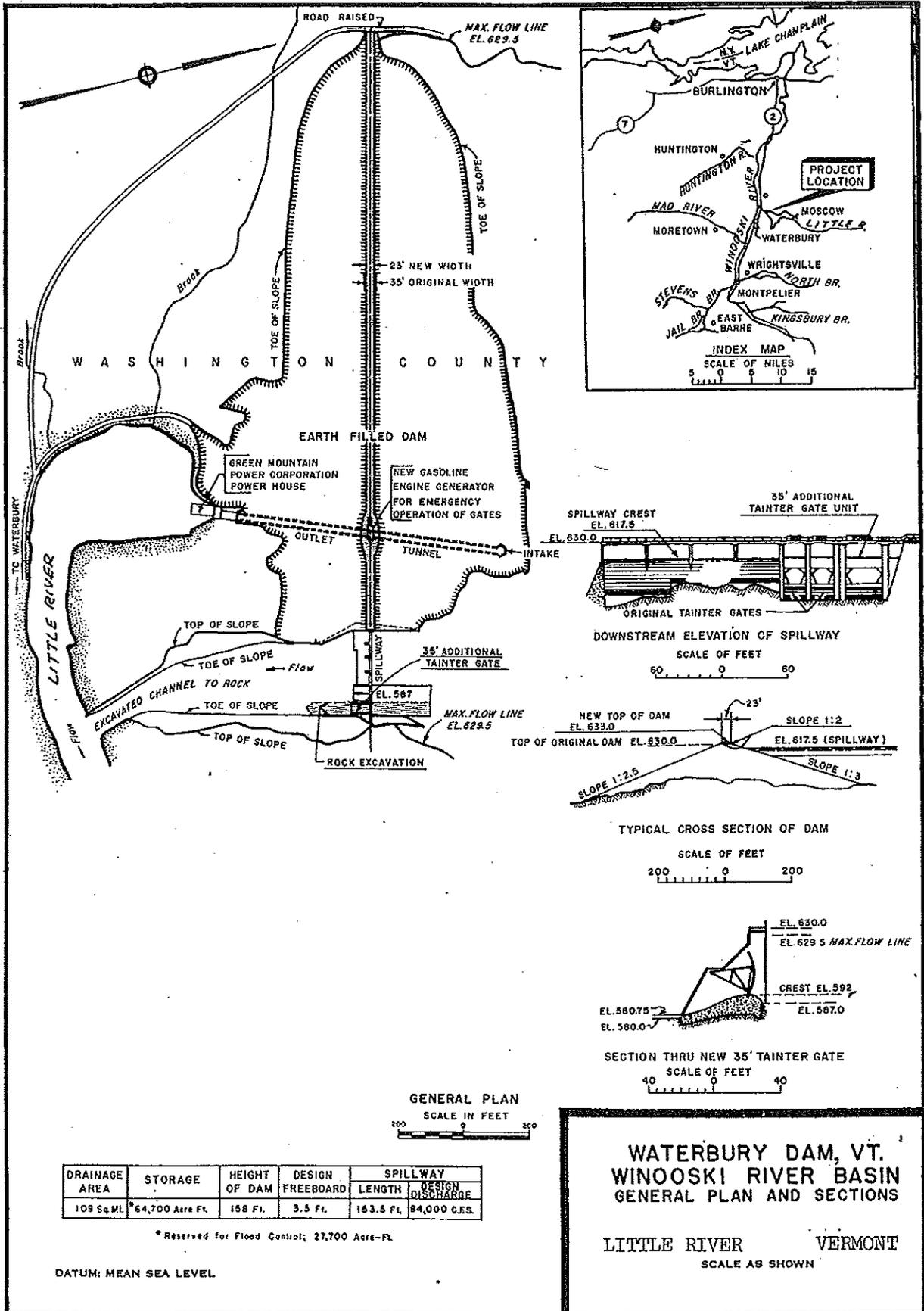
8. Does the primary sponsor named in (2.) above have the financial ability to provide for the required cost share?

Yes

Map Document

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planview.pdf



Reference: US Army Corps of Engineers, New York District Waterbury Dam and Reservoir Regulation Manual, June 1970

Figure A-2

Additional Proposal Information

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20141028WaterburyDamIncreasedRiskComments.pdf

Bushman, Steve

From: Crocker, Jeff
Sent: Tuesday, October 28, 2014 8:30 PM
To: Mears, David
Cc: Groveman, Jon; Bushman, Steve
Subject: FW: Comments on Waterbury Relicensing 401

David,

Below are comments that we received today from Bob Finucane.

Jeff Crocker, River Ecologist
1 National Life Drive, Main 2
Montpelier, VT 05620-3522
802-490-6151 / Jeff.Crocker@state.vt.us
www.watershedmanagement.vt.gov



VERMONT DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
**WATERSHED
MANAGEMENT DIVISION**
RIVERS PROGRAM

From: robert finucane [<mailto:bobfinucane@hotmail.com>]
Sent: Tuesday, October 28, 2014 10:11 AM
To: ANR - WSMD Rivers; wshepeluktow@gmavt.net; wtbskip@comcast.net; publicworksdirector@waterburyvt.com
Subject: Comments on Waterbury Relicensing 401

To; Commissioner David Mears

Vermont Department of Environmental Conservation
1 National Life Drive, Main 2,
Montpelier, VT 05620-3522.

October 28, 2014

Thank you for the opportunity to comment on the proposed reservoir level operation component of the FERC relicensing of Waterbury Dam.

Year-round, full-pool operation of Waterbury Reservoir results in substantial increased risk to life and property downstream.

In the public meeting on October 7, 2014, you stated that you had reviewed the risk and found it to be "acceptable."

In what way was the increased risk quantified?

By what criteria or standard is the increased risk judged to be acceptable?

In modern dam safety engineering practice, risk is defined as the product of the probability of failure times the impact of the failure on life and property. Impact is known to be a function of how much water is impounded, and how much warning time can be expected compared to how long it would take to effectively evacuate the affected areas.

The increased risk of flooding from a full winter pool arises from a number of sources.

- While the dam has been in successful service for more than 70 years, it has a number of adverse risk factors. Spillway capacity is limited. The core is known to be fragile. The upstream and downstream filters which are supposed to protect the core from internal erosion may not be stable under all conditions. The core does not extend to the top of the dam. At high lake levels, seepage levels increase above what would be expected. The underlying geology of the site is not well understood. While the dam has displayed 70 plus years of good performance, all of those years have had a low winter reservoir level.
- There is an increased probability of catastrophic dam failure due to internal erosion or piping. The increased risk arises from a higher normal water level for part of the year, and higher reservoir levels than have been experienced in the past during the spring floods. For a greater portion of the year, the dam will be saturated and internal water pressure will reduce the stability of the dam. Piping risk is reduced but not eliminated by monitoring waterlevels within the dam as piping begins on a scale that is small in comparison to the distance between monitoring wells, and may rapidly progress from a flaw to a complete failure. Monitoring may detect a failure in progress but can only prevent one if the reservoir can be emptied in good time.
- There is an increased probability of catastrophic dam failure due to overtopping especially during a spring rainfall and snowmelt event such as the March 1936 storm which is the storm of record for much of New England. While reconstruction of the spillway may reduce this risk, it does not eliminate it.
- The potential consequences of failure during the winter are much greater with a full pool. Winter conditions impair early detection of a failure due to snow cover, reduced daylight, and fewer visitors to the dam, and thus reduce warning time. Conditions of cold and frozen precipitation and reduced visibility may delay evacuation.
- Outflows from the reservoir under spring flooding conditions will be greater and begin sooner than would be the case for the reservoir with a winter drawdown. The probability of reservoir rising above the top of the flood control pool with consequent flood damage downstream will increase. The probability of damage would increase from flooding downstream in Bolton, Richmond, and beyond due to ice jams when gate operations have not been commanded.

The concept of "acceptable risk" is not now in widespread use in dam engineering. You will find that it is very hard to define particularly when there is some risk of loss of life. It seems to mean that the people who are at risk have agreed that the benefits outweigh the risk, and they accept them.

I recommend that the winter drawdown operation be maintained until the spillway is reconstructed AND the increased risk arising from year-round full-pool operation is quantified and reviewed by an independent, expert organization such as FERC or the Corps of Engineers. Risk should not be increased by the reservoir raise to exceed the as low as reasonably possible standard.

This additional review of risk may have benefits in addition to preventing the inadvertent acceptance of excessive risk. For example, coupling the year-round full pool directly to spillway reconstruction may cause delay. A quantitative risk review will be conducted by the Corps before the spillway reconstruction begins. If the reservoir raise is a direct consequence of spillway reconstruction, the risk analysis may find that full pool operations result in an increase in risk that is large in comparison to the risk reduction of the enlarged spillway.

In summary, there already is a lot of risk at Waterbury Dam. Risk will increase as a result of ending the winter drawdown. The risk cannot be considered "acceptable" until it has been quantified and compared to a standard of acceptability. The process by which the risk is determined to be "acceptable" should be open and public.

If you have any questions about the information in this letter, please contact me at 802 230 6771.

Thank you again for the opportunity to comment on this.

Robert B. Finucane P.E., F. ASCE

Primary Sponsor Letter of Support

(As uploaded)

2015-02-23 USACE Dam Safety Assurance Request.pdf

Commissioner's Office

One National Life Drive, Main 2 [phone] 802-828-1556

Montpelier, VT 05620-3520 [fax] 802-828-1541

February 23, 2015

Colonel Paul Owen, District Commander
U.S. Army Corps of Engineers, New York District
26 Federal Plaza, 21st Floor
New York, New York 10278

Re: Waterbury Dam, Waterbury, VT

Dear Colonel Owen:

The State of Vermont Department of Environmental Conservation (VTDEC) requests that the U.S. Army Corps of Engineers, New York District, perform a Dam Safety Assurance Evaluation and risk assessment on Waterbury Dam, located in Waterbury Vermont. VTDEC is interested in partnering with the Corps to cost-share in order to complete the Dam Safety Assurance Evaluation and risk assessment during State Fiscal Year 2016.

Green Mountain Power operates the hydroelectric project at the Waterbury Dam site. Although neither the governing federal regulations nor the current 2005 "Revised Waterbury Dam and Reservoir Regulation Manual," require a winter drawdown as part of the flood control operations, *see* 33 C.F.R. § 208.11, Green Mountain Power has conducted winter drawdowns to varying levels for a majority of the years that the dam has been in operation.

VTDEC recently issued Green Mountain Power a Section 401 Water Quality Certification (certification) to continue operating the hydroelectric project at the site. The certification includes conditions that require Green Mountain Power to eliminate the current winter drawdown practice and operate the reservoir in a run-of-river mode at summer pool elevation once the Tainter gates and spillway are replaced. As a result, VTDEC is seeking a three-step cost-share partnership with the Corps to (1) evaluate and assess risks associated with eliminating winter drawdown at the site; (2) design the spillway and any other remediation work identified in the first stage; and (3) construct the spillway and any other remediation work identified in the first stage.

Accordingly, VTDEC requests that the Corps conduct a Dam Safety Assurance Evaluation and risk assessment to provide the following items:

- Answers to the following questions:
 - Are there deficiencies in the dam that prevent operation of the reservoir at the normal summer pool year round?
 - What level of risk does a year round pool at the normal summer elevation pose?
- Identification of risk management measures. In other words, are there ways to manage the risk of maintaining the year round pool at summer elevation so it does not present an unacceptable risk to the public?
- As necessary, revisions to the Code of Federal Regulations and Dam and Regulation Manual to address the identified risk management measures.

Waterbury Dam, Waterbury, VT
February 23, 2015
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Looking forward from this assessment, VTDEC is interested in pursuing completion of the spillway replacement project within the next five years by continuing to partner with the Corps. VTDEC's key target dates are as follows: (1) begin design of the spillway, including corrections of any deficiencies documented during this study no later than State Fiscal Year 2017; and (2) begin spillway replacement and additional remedial repairs during State Fiscal Year 2018.

We look forward to meeting with you and your staff after you have had time to review this request. Stephen Bushman, P.E., Dam Safety Engineer, is the lead staff person on this project. You or your staff should feel free to contact Mr. Bushman directly (phone: 802-490-6229) if there are any questions that arise.

Sincerely,



David K. Mears, Commissioner
Vermont Department of Environmental Conservation

Cc: Senator Patrick Leahy
Senator Bernie Sanders
Congressman Peter Welch
Deb Markowitz, Secretary, Vermont Agency of Natural Resources
Alyssa Schuren, Deputy Commissioner, VTDEC
Eric Blatt, P.E., Director, VTDEC Facilities Engineering Division
Stephen Bushman, P.E. VTDEC Dam Safety Engineer