Draft Environmental Assessment and Finding of No Significant Impact (FONSI)

Waterbury Dam Safety Modification Report
Washington County, Vermont
E6-P-1729004142

US Army Corps of Engineers ®
New England District

January 2025

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List of Acronyms and Abbreviations

ALARP	As Low as Reasonably Practicable
ASR	Alkali-Silica Reaction
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CEJST	Climate and Economic Justice Screening Tool
CFR	Code of Federal Regulations
CO_2	Carbon Dioxide
CWA	Clean Water Act
dB	Decibel
DO	Dissolved Oxygen
DSMS	Dam Safety Modification Study
EA	Environmental Assessment
EIS	Environmental Impact Statement
El	Elevation
EJ	Environmental Justice
EO	Executive Order
EPA	U.S. Environmental Protection Agency
FONSI	Finding of No Significant Impact
ft	Foot/Feet
FWS	U.S. Fish and Wildlife Service
GHG	Greenhouse Gas
GMP	Green Mountain Power
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
IPaC	Information for Planning and Consultation
MOA	Memorandum of Agreement
$MTCO_2e$	Metric Tons of CO_2 Equivalent
NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NGVD29	National Geodetic Vertical Datum of 1929
NHPA	National Historic Preservation Act
NLAA	Not Likely to Adversely Affect
NLEB	Northern Long-eared Bat
N_2O	Nitrous Oxide
NR/NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
PED	Pre-construction Engineering and Design
PFM	Potential Failure Mode
QRA	Quantitative Risk Assessment
RCRA	Resource Conservation and Recovery Act
RMP	Risk Management Plan
sq mi	Square Mile

SQRA	Semi-quantitative Risk Assessment
TRG	Tolerable Risk Guideline
USACE	U.S. Army Corps of Engineers
VAI	Vermont Archaeology Inventory
VANR	Vermont Agency of Natural Resources
VDFPR	Vermont Department of Forests, Parks, and Recreation
VDFW	Vermont Division of Fish & Wildlife
VNHI	Vermont Natural Heritage Inventory
VSQG	Very Small Quantity Generator
VT DEC	Vermont Department of Environmental Conservation
VT SHPO	Vermont State Historic Preservation Officer
WQC	Water Quality Certificate
WQS	Water Quality Standards
WRDA	Water Resources Development Act

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FINDING OF NO SIGNIFICANT IMPACT
Waterbury Dam Safety Modification Study
Washington County, Vermont
E6-P-1729004142

The U.S. Army Corps of Engineers (USACE), New England District proposes modifications to address to the possibility of poor performance of the gated spillway section during frequent and extreme flood events at Waterbury Dam in Washington County, Vermont as identified by the Waterbury Dam Safety Modification Study. Waterbury Dam is an earth fill embankment dam that provides flood risk mitigation to the Winooski River and Lake Champlain watersheds.

The Waterbury Dam Safety Modification Study is authorized by Section 1177 of the Water Resources Development Act of 2016 (WRDA 2016), as amended. Section 1177 provides the U.S. Army Corps of Engineers authority to rehabilitate a dam that:

(1) has been constructed, in whole or in part, by the Corps of Engineers for flood control purposes;
(2) for which construction was completed before 1940;
(3) that is classified as high hazard potential by the State dam safety agency of the State in which the dam is located; and
(4) that is operated by a non-Federal entity.

Waterbury Dam meets these criteria. The state of Vermont is the non-federal sponsor for the study.

USACE has completed an Environmental Assessment (EA) for this project in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended.

The purpose of the project is to rehabilitate the spillway project Tainter gates to reduce the risk of failure and resulting loss of the gates for flood risk mitigation, address bedrock erosion of the unlined rock channel at the toe of the gated spillway to improve project resilience.

The project includes: complete replacement of the two 20-foot(ft)-wide Tainter gates and rehabilitation of the newer 35-ft-wide Tainter gate; construction of a new service bridge providing access to the gates and hoisting equipment; installation of new hoisting equipment and appropriate electrical upgrades; construction of a 100-ft wide concrete scour apron downstream of the gated spillway section; repair of degraded concrete on the spillway weirs, piers, and the training wall on the right abutment; the development of temporary construction access roads; and implementation of a precautionary drawdown during construction.

I find that based on the evaluation of environmental effects discussed in the EA, this project is not a major federal action significantly affecting the quality of the environment. The EA includes an evaluation of the affected environment and the

geographical context and intensity of the direct, indirect, and cumulative long-term and short-term effects of the action. The effects of the proposed plan relative to significance criteria are summarized below. None are implicated to warrant a finding of NEPA significance.

(i) The degree to which the action may adversely affect public health and safety. The project is expected to have a positive effect on public health and safety. Rehabilitation of the Tainter gates will allow for continued provision of downstream flood risk management.

(ii) The degree to which the action may adversely affect unique characteristics of the geographic area such as historic or cultural resources, parks, Tribal sacred sites, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas. The project will have no significant impacts to unique characteristics of the geographic area such as Tribal sacred sites, prime farmlands, wild and scenic rivers, or ecologically critical areas. The project will have an adverse effect on historical and cultural resources from the modifications to the Waterbury Dam, which is eligible for listing on the National Register of Historic Places (NRHP). USACE, Vermont State Historic Preservation Officer, Vermont Agency of Natural Resources - Department of Environmental Conservation, Waterbury Historical Society, the Narragansett Indian Tribe, Wampanoag Tribe of Gay Head (Aquinnah), and the Nulhegan Abenaki Tribe will execute a Memorandum of Agreement (MOA) to minimize and mitigate adverse historical impacts and ensure that the action does not cause significant effects to historical properties. The temporary drawdown will cause short-term adverse impacts to wetlands and recreation sites and to water quality, through increases in turbidity; however, these resources will recover after the project is complete. The proposed project will also have temporary adverse impacts to water quality from increased turbidity from sediment mobilization during the precautionary drawdown. To minimize turbidity and sediment mobilizations, the reservoir pool drawdown will occur slowly, and vulnerable areas of the exposed reservoir bed will be temporarily revegetated. An invasives species plan will be developed to minimize impacts to wetlands following the drawdown. Temporary ramps and improvements to boat access are currently being considered to reduce recreational impacts.

(iii) Whether the action may violate relevant Federal, State, Tribal, or local laws or other requirements or be inconsistent with Federal, State, Tribal, or local policies designed for the protection of the environment**.** The action will not violate federal, state, tribal or local laws or policies for the protection of the environment.

(iv) The degree to which the potential effects on the human environment are highly uncertain. The project effects are not uncertain. USACE has

conducted numerous dam safety modification studies, including prior modifications at Waterbury Dam.

(v) The degree to which the action may adversely affect resources listed or eligible for listing in the National Register of Historic Places**.** The project will have adverse effects on Waterbury Dam, which is eligible for listing in the NRHP. A MOA will be implemented to minimize and mitigate adverse historical effects associated with repairs to Waterbury Dam.

(vi) The degree to which the action may adversely affect an endangered or threatened species or its habitat, including habitat that has been determined to be critical under the Endangered Species Act of 1973. The project will not likely adversely affect any federal or state threatened or endangered species or designated critical habitat for such species.

(vii) The degree to which the action may adversely affect communities with environmental justice concerns. The project will not adversely affect communities with environmental justice concerns. The project is not located within disadvantaged communities and will have positive community impacts associated with reduced risk of loss of life from dam failure.

The degree to which the action may adversely affect rights of Tribal Nations that have been reserved through treaties, statutes, or Executive Orders. The project will not adversely affect rights of Tribal Nations that have been reserved through treaties, statutes, or Executive Orders.

Based on my review and evaluation of the environmental effects as presented in the EA, I have determined that the proposed modification of Waterbury Dam is not a major federal action significantly affecting the quality of the environment and is therefore exempt from requirements to prepare an Environmental Impact Statement.

_____ _____

Date

Justin R. Pabis, P.E.
Colonel, Corps of Engineers
District Engineer

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1.0 INTRODUCTION

The U.S. Army Corps of Engineers (USACE), New England District has prepared this Environmental Assessment (EA) to evaluate the potential environmental, cultural, and socioeconomic impacts of alternatives based on the Waterbury Dam Safety Modification Study (DSMS). The DSMS identified and recommend a Risk Management Plan (RMP) that reduces the risk associated with the failure of the Tainter gates, and erosion of the unlined spillway channel. This EA has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 and the Council of Environmental Quality's Regulations (CEQ) (40 Code of Federal Regulations (CFR) 1500-1508) and USACE Implementing Regulations (33 CFR Part 230). This EA provides sufficient information about the potential adverse and beneficial environmental effects to allow the USACE, New England District Commander to make an informed decision on the appropriateness of completing an Environmental Impact Statement (EIS) or signing a Finding of No Significant Impact (FONSI).

1.1. Project Location and Description

Waterbury Dam is located along the Little River, 2.5 miles upstream of the confluence with Winooski River (Figure 1) in the Lake Champlain watershed. The project provides flood risk mitigation to both the Little River and Winooski River basins. Outlet flow is utilized by Green Mountain Power (GMP) for hydroelectric energy generation. The project is located in the town of Waterbury in Washington County, Vermont. Waterbury Dam and Reservoir are located within Mount Mansfield State Forest. There are numerous recreational facilities along the Reservoir, including both Waterbury and Little River State Parks.

Waterbury Dam consists of an earthfill embankment dam, gate house and gated outlet works, an unlined rock channel spillway with an uncontrolled ogee weir and three Tainter gates, and other features as shown on Figure 2. The main embankment is approximately 1,850 feet (ft) long, and the dam crest is 187 ft high at its maximum section above the original river channel. The dam base is approximately 1,000 ft wide (USACE, 2021b). The foundation is comprised of overburden and bedrock. Waterbury Dam was constructed over a natural gorge and is built over bedrock and glacial soils (USACE, 2021b).

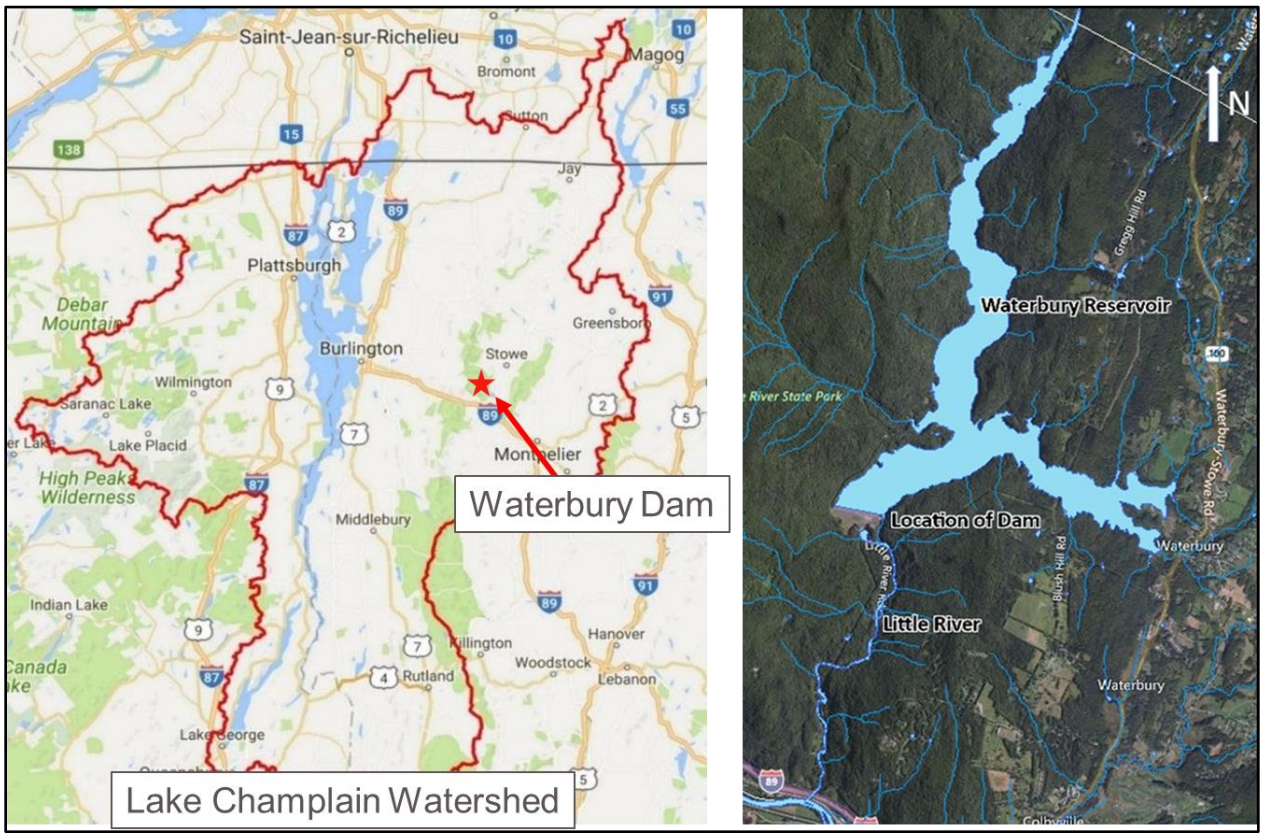

Figure 1. Location of Waterbury Dam and Reservoir, Vermont.

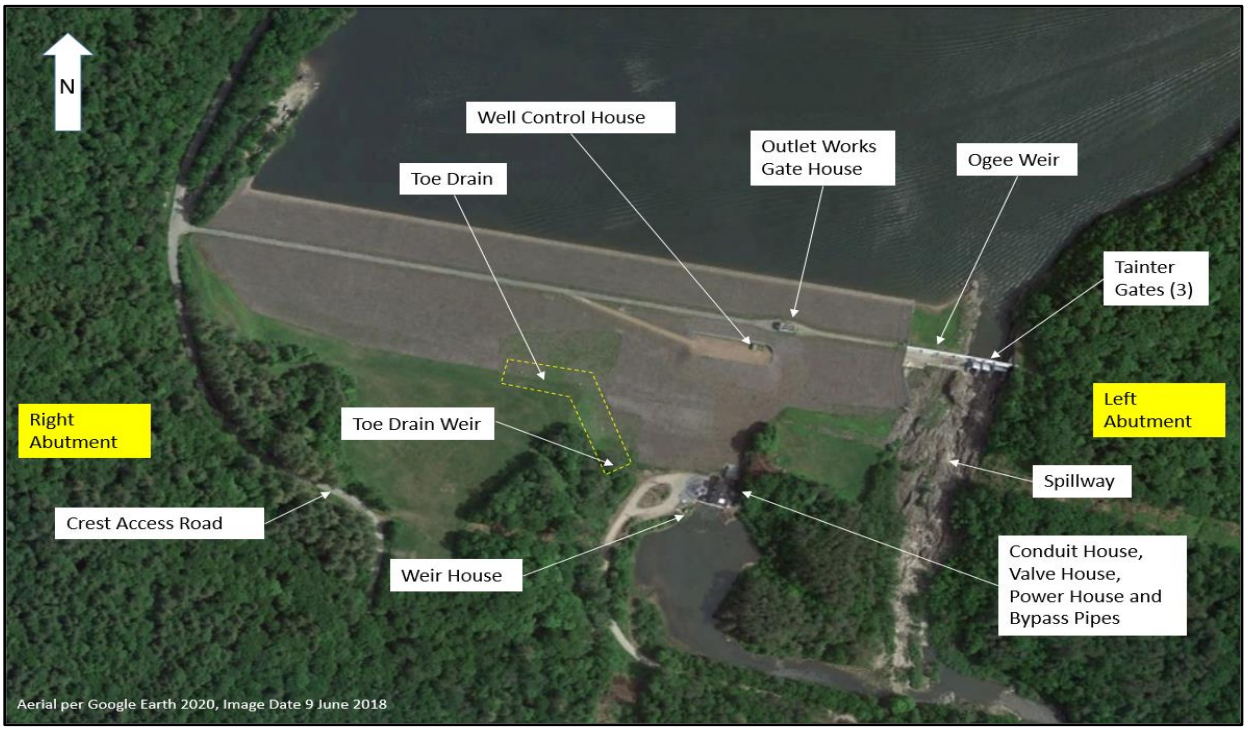

Figure 2. Aerial View of Waterbury Dam and Project Features.

1.1.1. Existing Dam Spillway Features

The spillway and associated features were the focus of the DSMS. The spillway consists of gated and ungated portions (Figure 3 and Figure 4). The gated portion on the left[1] side of the spillway is 100 ft wide overall (75 ft effective width) and contains three Tainter gates. A Tainter gate is a type of radial arm floodgate used in dams and canal locks to control water flow. Two of the gates are 20 ft wide and were part of the original dam construction (1938). The third gate is 35 ft wide and was added in 1958. The sill at all three gates is at elevation (El.) 591.75 feet North American Vertical Datum of 1988 (NAVD88). The right side of the spillway consists of a 161-ft wide ungated mass concrete gravity "ogee" weir section with a crest El. 617.25 feet NAVD88 (151'-6"- wide effective width). The spillway discharges to an unlined rock channel.

Access to the gates is along the access/service bridge constructed above the spillway. Hoist equipment is located on this bridge over the gates. The gated spillway sections experience flow several times a year (Figure 5). The ungated sections have never experienced flow; it would take a pool exceeding Top of Active Storage, El. 617.25 ft NAVD88, annual exceedance probability 1/1,900, to result in activating the ungated spillway sections.

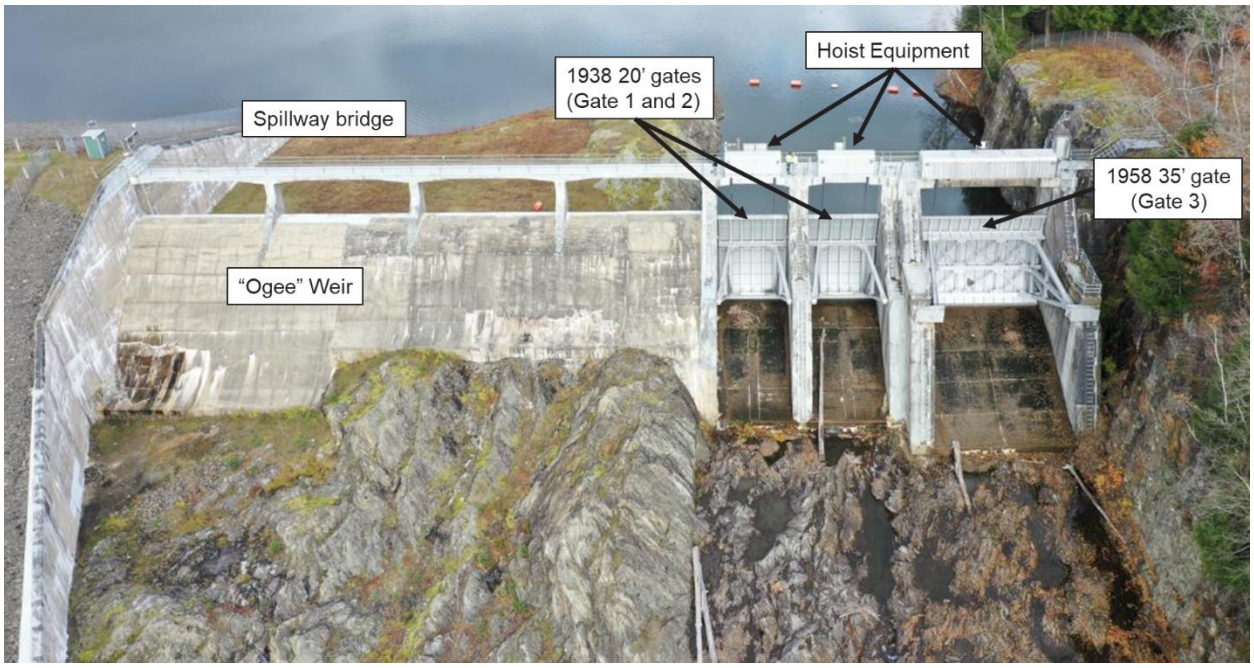

Figure 3. Aerial View of Spillway Structures (with features labeled).

[1] "Left" and "right" as used in this document refer to directions while looking downstream.

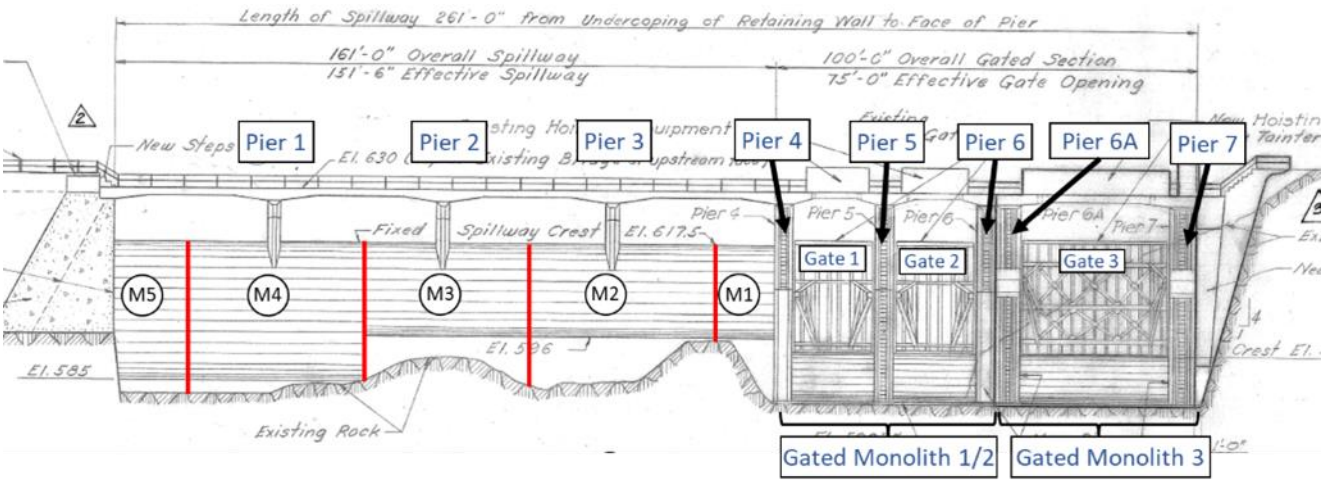

Figure 4. Elevation View of Spillway Structures.

Figure 5. Waterbury Dam Spillway Releases in July 2023. Gate 3 open approx. 2 ft, estimated 1,200 cubic feet per second discharge. Reservoir El. 604 ft NAVD88.

1.2. Authority

Waterbury Dam was constructed in 1933 for flood risk mitigation purposes following the 1927 flooding of Winooski River. The USACE constructed Waterbury Dam with Civilian Conservation Corps (CCC) labor. Construction was completed in 1938, and ownership

of the dam was transferred to the state of Vermont. Section 1177 of the Water Resources Development Act of 2016 (WRDA 2016) authorizes USACE to rehabilitate Waterbury Dam.

1.3. Purpose and Need

The purpose and need for the project is to address risks identified during studies on the spillway in 2005. The USACE Baltimore District conducted an evaluation the structural integrity of the existing steel Tainter gates and determined that the gates were at risk of buckling if fully loaded during flood operations (USACE, 2005). An interim risk reduction measure of reduced gate loading was put in place until the gates could be fixed. This interim measure reduces the flood storage available at the project. The project also has a history of alkali-silica reaction (ASR) concrete degradation that impacts the integrity of the project. During the DSMS study, continuing erosion of the unlined spillway channel was identified as an additional concern. USACE, in partnership with the Vermont Department of Environmental Conservation (VT DEC), conducted a DSMS to evaluate risks, formulate plans, and compare plans to recommend a RMP to rehabilitate Waterbury Dam.

Waterbury Dam provides flood risk management to downstream communities. Failure of the Tainter gates would impact the flood risk management afforded by the project to the communities of Waterbury, Richmond, Essex Junction, Winooski, and South Burlington and areas in between would be impacted by flooding (Table 1). Most of the economic damages and life safety risk occur in the town of Waterbury, which is approximately 3 miles from the dam. Waterbury's proximity to the dam means there would be little warning time in the case of a tainter gate failure.

Table 1. Communities Downstream of the Waterbury Dam, Vermont.

Community	Population	Distance Downstream of Dam (miles)	Arrival of Flood Waters in Event of a Breach
Waterbury	1,897	4	<1 hour
Richmond	853	15	2-3 hours
Essex Junction	10,590	25	5-6 hours
South Burlington	20,292	30	5-6 hours
Winooski	7,997	32	5-6 hours

Source: U.S. Census Bureau, 2020

A previous Dam Safety Assurance Program Report by the USACE New York District estimated the expected average annual benefits provided by Waterbury Dam at $2,297,000 (2000 U.S. Dollar) (USACE, 2000). This value was indexed to $4,984,000 in 2024 U.S Dollar. Annual Lost benefits of recreation and hydropower are estimated at $859,000, and $3,656,200, respectively.

2.0 PLAN FORMULATION AND ALTERNATIVES

Prior to the DSMS, a semi-quantitative risk assessment (SQRA) was conducted by USACE to evaluate potential failure modes at Waterbury Dam (USACE, 2021a). This study assessed the risk associated with each potential failure mode (PFM) relative to

the USACE's Tolerable Risk Guidelines (TRG)s. TRGs are USACE guidelines that establish the acceptable types and severity of risks for a given project or facility. The SQRA identified spillway monolith instability and Tainter gate failure as risk drivers. At the start of the DSMS, a Quantitative Risk Assessment (QRA) was performed on the following potential failure modes:

- PFM 4A1: Instability of Gated Spillway Sections Leads to Breach (no scour)
- PFM 4A2: Instability of Gated Spillway Sections Due to Rock Scour Leads to Breach
- PFM 4B: Instability of Ungated Spillway Sections Due to Rock Scour Leads to Breach; and
- PFM 5: Tainter Gate Strut Arms Buckle When Gates Operated Under Load.

Measures to address the four PFMs were identified and the initial array of risk management measures were screened against the following criteria:

- Cost: The range of construction cost for each measure. For standalone measures, cost includes mobilization/ de-mobilization, construction access, etc. For measures that are not standalone, the costs would be the additional incurred if the measure was "added on" to one of the standalone measures.
- Effectiveness: Effectiveness is measured in the orders of magnitude that the measure would reduce risk.
- Robustness: The reliability of the measure for a range of events. This criterion was rated a low, moderate, or high.
- Resiliency: Qualitative discussion of the ability to avoid, minimize, withstand, and recover from the effects of adversity, whether natural or manmade, under all circumstances of use. This criterion was rated as low, moderate, high.
- Completeness: The extent to which the measure provides and accounts for all necessary investments/ actions to realize the planned effect.
- Constructability: The ease and efficiency with which a measure can be built. Constructability was estimated as high, moderate, or low. Low constructability indicates there are access issues, difficult materials to obtain, and/or uncommon construction methods necessary to complete the project.
- Environmental Impacts: Qualitative identification of potential short and long-term environmental impacts due to implementation of the measure.

2.1. Analysis of Alternative Plans

The QRA identified PFM 5 (failure of the Tainter gates) as the primary risk driver. Retained measures were combined to form two RMPs which would address PFM 5. The final array is shown below on Table 2. RMP 1 includes full replacement of Gates 1 and 2, and rehabilitation and structural reinforcement of Gate 3. RMP 2 includes rehabilitation and structural reinforcement of all three Tainter gates. The No Action Alternative was also carried forward. Given the deteriorating nature of the concrete on the bridge deck, RMP 1 and 2 both include complete replacement of the spillway hoist

bridge. In addition, RMP 1 and 2 include replacement of the gate hoist equipment and electrical systems, which are also aging.

Furthermore, three “as low as reasonably practicable” (ALARP) measures were carried forward to supplement the two RMPs (Table 3). These supplemental measures, when implemented alongside an RMP, would improve robustness and resiliency of the monolith structures in the future. The final RMPs and ALARP features are described below.

Table 2. Final Array of RMPs.

RMP	Alternative
0	No Action
1	Replace/Rehabilitate Tainter Gates
2	Rehabilitate Tainter Gates

Table 3. Final Array of ALARP Features.

Supplemental Feature	Feature
3a	Concrete apron downstream of gated sections
3b	Concrete apron downstream of ungated spillway
4b	Upstream stability block at gated and ungated monolith heel

2.1.1. Replace/Rehabilitate Tainter Gates (RMP 1)

This RMP includes replacement of the two 20-ft Tainter gates and the rehabilitation/ structural reinforcement of the strut arms of the 35-ft Tainter gate. The construction also includes:

- Rehabilitation of bridge piers
- Repair of surficial concrete
- Construction of new access bridge
- New hoisting equipment and electrical upgrades
- Construction of access roads on crest and upstream face of dam; and
- Precautionary reservoir drawdown to mitigate loss of flood operations when existing Tainter gates are non-functional.

2.1.2. Rehabilitate all Tainter Gates (RMP 2)

This RMP includes rehabilitation/structural reinforcement of the strut arms of all three Tainter gates. Construction includes:

- Rehabilitation of bridge pier
- Construction of new access bridge
- New hoisting equipment and electrical upgrades
- Construction of access roads on crest and upstream face of dam; and

- Precautionary reservoir drawdown to mitigate loss of flood operations when existing tainter gates are non-functional.

2.1.3. Supplemental (ALARP) Measures

Concrete Apron Downstream of Gated Sections (Measure 3a)

This feature includes the construction of a 100-ft long spillway apron downstream of the gated monolith sections. The apron reduces the potential for scour of the spillway rock channel by dissipating energy. Additionally, the apron would provide additional monolith stability by acting as a stabilizing block.

Concrete Apron Downstream of Ungated Spillway (Measure 3b)

This feature includes construction of a 160-ft long spillway apron approximately 50-ft downstream of the ungated monoliths. The apron reduces the potential for scour of the spillway rock channel by dissipating energy. The apron would also feature a toe block to provide additional stability to the monolith.

Upstream Stability Block at Gated and Ungated Monolith Heel (Measure 4b)

This feature includes the addition of concrete mass stability blocks upstream of the spillway monoliths. The stability blocks would be anchored into the existing monoliths as well as the bedrock. The stability blocks would provide stability against sliding for pool loading events and serve as foundation support for the new access bridge.

2.2. Alternatives Carried Forward

Risk reduction of the two RMPs was evaluated; it was concluded that RMP 1 and 2 have the same level of risk reduction. The RMPs were similar in estimated construction costs, with RMP 1 being about 3% higher than RMP 2, but within the uncertainty range of the Class 4 cost estimates. Environmental impacts were also identical for the two plans. The difference in the two plans is in the treatment of Tainter Gates 1 and 2. RMP 1 proposed replacement of these older gates, and RMP 2 proposed rehabilitation of these gates. Consultation with subject matter experts on the likelihood of successful rehabilitation of Gates 1 and 2 (constructed circa 1930s), identified significant engineering uncertainty associated with the success of the proposed rehabilitation of these older gates. RMP 1, which includes replacement of these two older Tainter gates, was considered to have the lower implementation risk of the two and was selected over RMP 2.

Considering the ongoing erosion of the spillway bedrock downstream of the gated portion of the spillway, as well as observed undermining of the gated monoliths, ALARP measure 3a is also proposed to be implemented. Implementing Measure 3a would mitigate the existing erosion by removing loose rock in the channel, and creating an apron with energy dissipation features that would protect the channel from future erosion that could further undermine the existing spillway structure.

2.2.1. No Action Alternative

The No Action Alternative, also known as the Future Without Action Condition, assumes no modification would occur. Under the No Action Alternative, spillway rehabilitation would not occur, and the structural deficiencies of the Tainter gates would not be addressed. The risk of gate failure and rock erosion in the spillway would continue comprising the flood risk mitigation capability of the project.

Currently, Vermont draws the reservoir down from January to mid-March each year up to 40 ft to provide precautionary storage for winter snow melt due to concerns about the Tainter gates. This results in a loss of about 8,000 acre-feet of flood storage at the project. The current Water Quality Certification for the project allows for this winter drawdown until the Tainter gates are rehabilitated (VANR, 2014). If no action is taken, it is assumed that this winter drawdown will continue.

Maintenance costs will increase in the coming years as the existing structures continue to deteriorate. Erosion of spillway rock at normal discharges will continue. While the magnitude of erosion during normal discharges is not expected to lead directly to failure of the gated monoliths, it could result in additional localized undermining of gated structures. This could potentially lead to an increased likelihood of significant erosion at higher discharge events where the gates have to be opened.

2.2.2. Proposed Risk Management Plan

The proposed RMP includes a complete replacement of the two 20-ft gates (Gates 1 and 2) and rehabilitation of the newer 35-ft gate (Gate 3) (RMP 1). The existing service bridge would be rebuilt, new hoisting equipment installed, and appropriate electrical upgrades made. The proposed plan also includes repairs of ASR degraded concrete on the spillway weirs, piers, and the training wall on the right abutment. Diagrams of the repairs are shown on Figure 6 and Figure 7. In addition to the gates, a 100-ft concrete scour apron would be installed downstream of the gated spillway sections (ALARP Measure 3a) as shown on Figure 8 and Figure 9.

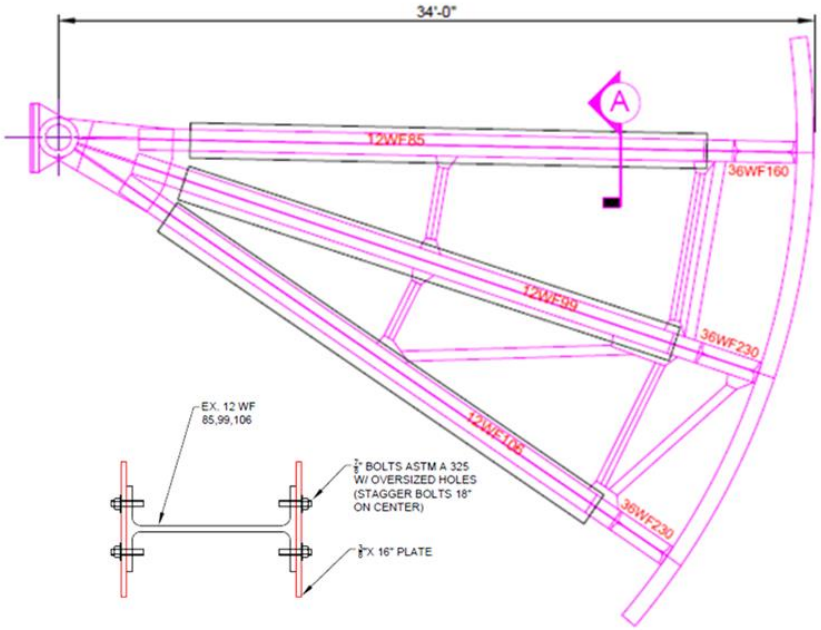

Figure 6. Reinforcement Concept for Tainter Gate 3.

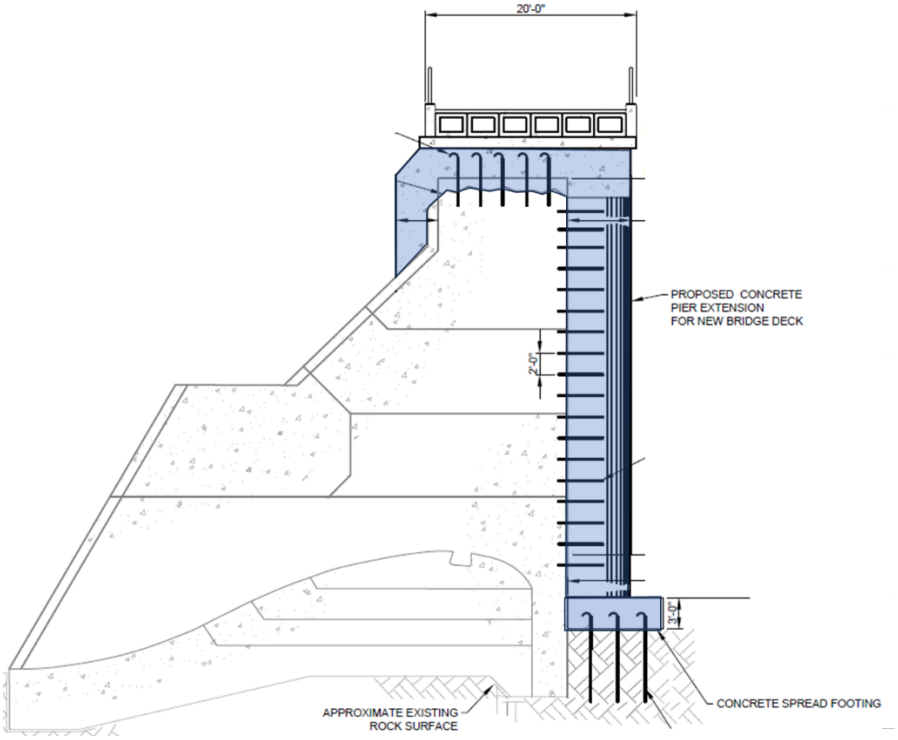

Figure 7. Bridge Configuration over Gated Monolith Sections.

Figure 8: Plan View of Apron Configuration.

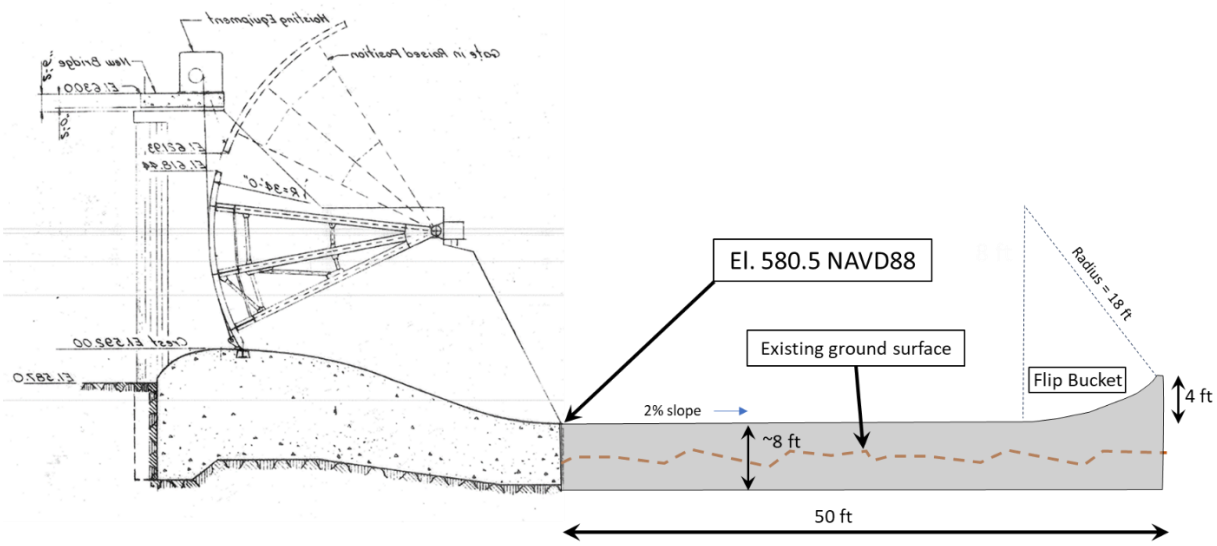

Figure 9. Concept Apron Design Downstream of Gate 3 (Gate 1 and 2 similar).

During construction, the existing gates will be removed and as well as the existing bridge and hoist equipment. This will significantly reduce available flood storage. Therefore, a temporary precautionary drawdown during construction will be implemented to provide flood control lost while the Tainter gates are inoperable. This will reduce the risk that during storm run-off the pool would rise and overtop the gated spillway sections (El. 591.75) and cause downstream flooding in Waterbury and other

communities on the Winooski River. During the 2000s, a precautionary drawdown was conducted by the Vermont Agency of Natural Resources (VANR) and USACE during seepage repairs of the dam. The reservoir was drawn down for approximately five years, with a 40-60 ft drawdown. The proposed risk management plan considers a 30-ft to 60-ft drawdown range for a duration of 18 months. The exact extent, duration, and timing of the drawdown will be determined during the Pre-construction Engineering and Design (PED) phase of the project. The estimated area of the reservoir bed exposed for the proposed drawdowns is tabulated in Table 4 and shown on Figure 10, below.

Development of construction access roads within the footprint of the dam will be needed to access all areas of the spillway during construction. This construction measure will require some tree removal/limbing along the spillway left abutment. Removal of partially detached and loose bedrock in the spillway channel will also be required. See Figure 11 for an aerial view of the recommend plan project features, access road, and work area.

Table 4. Reservoir Areas for Proposed Drawdown Levels.

Depth	Reservoir Pool Area (Acres)	Exposed Reservoir Bed Area (Acres)
0-ft	840	--
30-ft	468.97	371.03
40-ft	383.98	456.02
60-ft	181.3	658.7

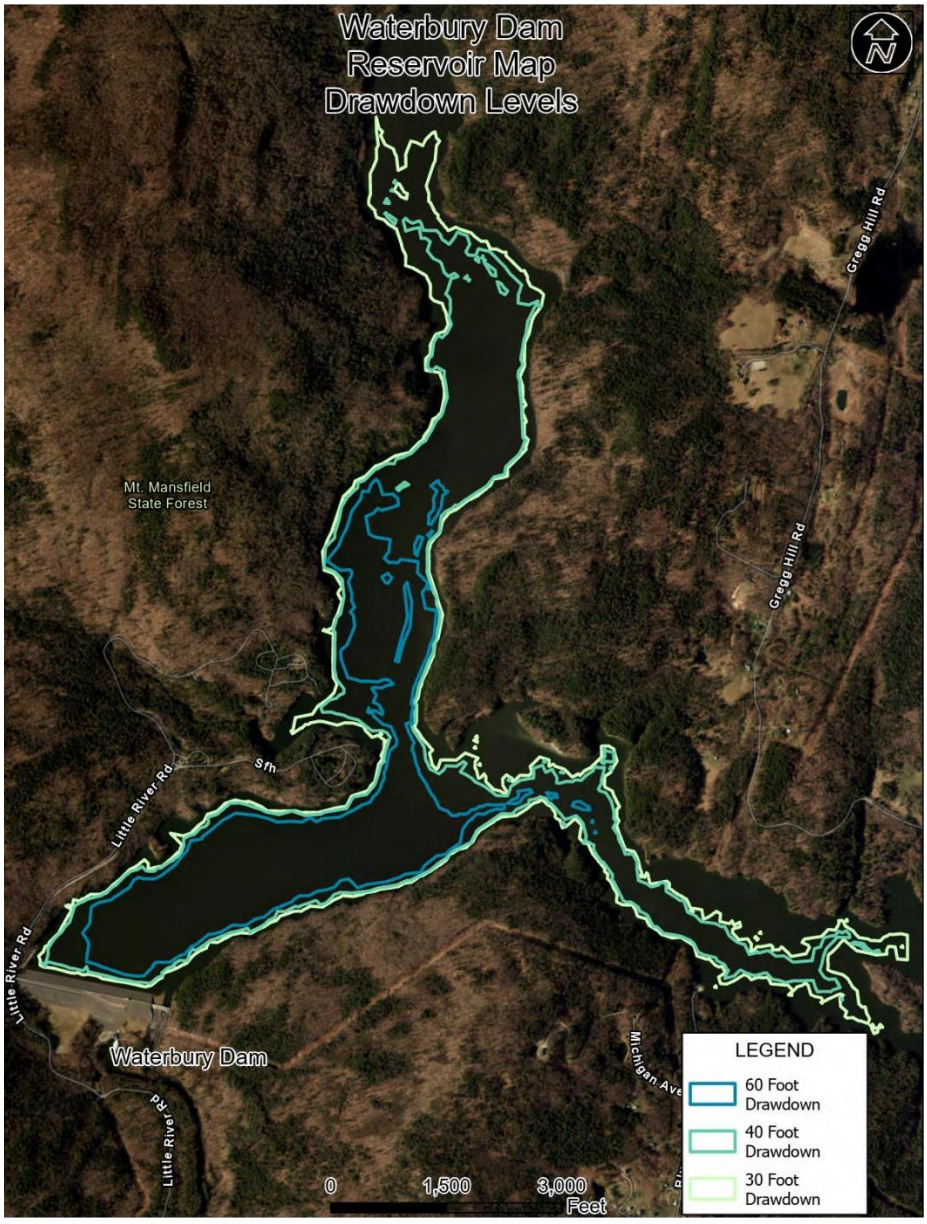

Figure 10. Waterbury Reservoir Proposed Drawdown Levels.

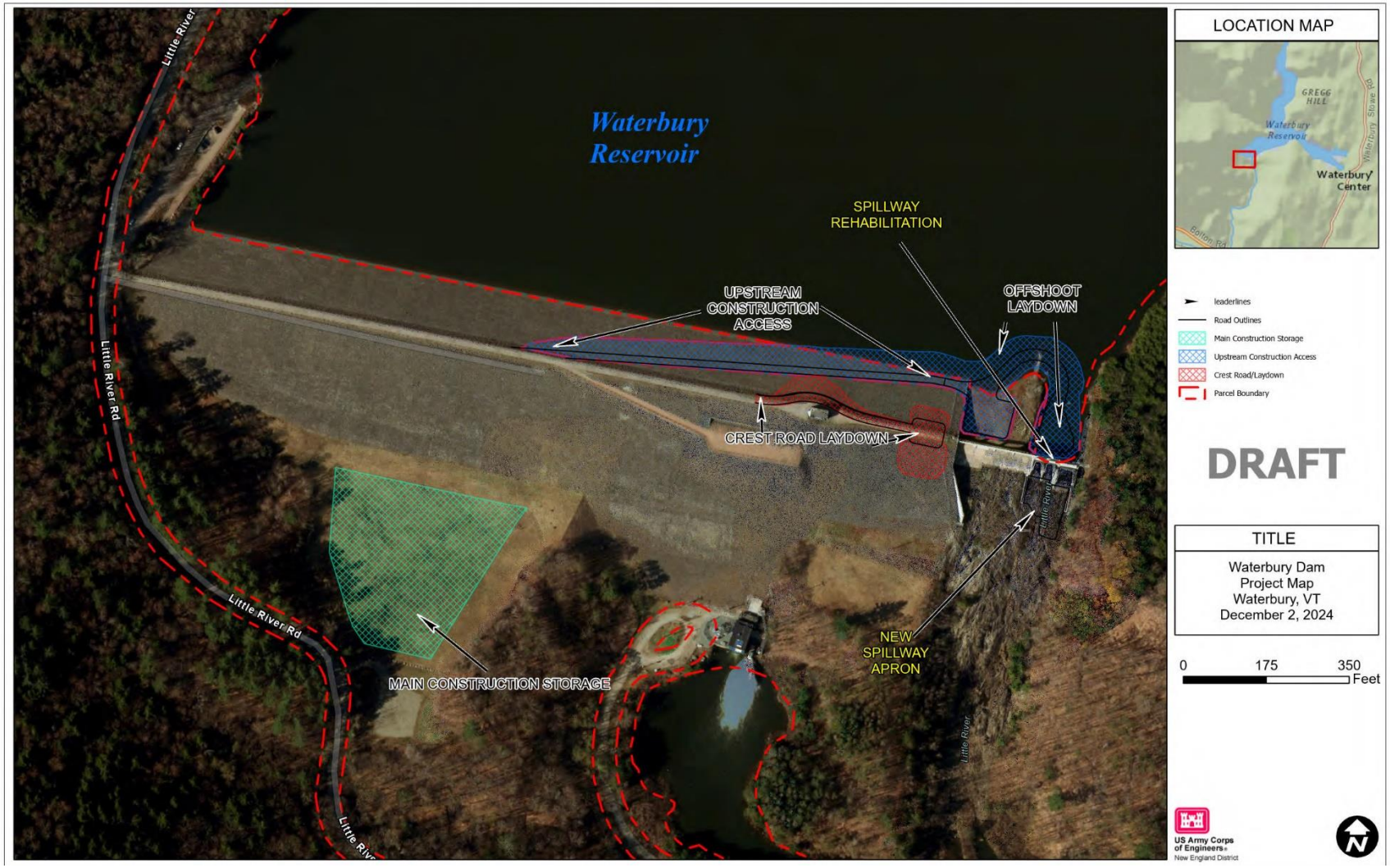

Figure 11. Aerial View of the Proposed Risk Management Plan and Temporary Construction Access Road.

3.0 AFFECTED ENVIRONMENT

The affected environment for the proposed project includes the Waterbury Dam, Waterbury Reservoir, and Little River and their surroundings. This section describes current environmental conditions for the affected environment.

3.1. General Setting

Waterbury Dam is located within the Little River watershed, which is a part of the Winooski River basin. The basin is primarily located within Washington and Chittenden counties, with a drainage area of 1,080 square miles (sq mi) (VT DEC, 2024a). Waterbury Dam is located along Little River, which is one of eight major tributaries to the Winooski River.

Land use within the watershed is primarily forested, with other uses including agricultural, non-residential urban land, and residential (Greenhorne & O'Mara, Inc., 2000). The reservoir has a drainage area of 109 sq mi with a normal surface area of 869 acres with an elevation of 592.0 ft (Greenhorne & O'Mara, Inc., 2000; VT DEC, 2024a). There are five tributaries to the reservoir: Little River, Cotton Brook, Stevenson Brook, Alder Brook, and Bryant Brook. Hydrologic inputs are primarily from precipitation, with some groundwater springs (Greenhorne & O'Mara, Inc., 2000).

3.2. Geology and Soils

The present-day topography and soils are the result of glacial and post-glacial activity (Stewart, 1971). Many of the local soils are formed from glacial parent materials such as till, outwash, and lacustrine deposits. Waterbury Reservoir and its surrounding area are characterized by high topographic relief, with steep slopes ranging from 20 to 60% (GMP, 2005).

Significant and ongoing soil erosion has occurred along the shoreline of the reservoir, as well as downstream near the dam in Little River. Historic erosional processes at the reservoir include bank instability and subsequent failure of the slope and wave erosion induced by boats and wind (USACE, 2001). In 2001, the USACE conducted a Dam Rehabilitation Project under the authority of Section 1203 of WRDA of 1986. The project included shoreline stabilization near Little River State Park, in order to reduce sediment yield through stabilizing eroded shorelines around the perimeter of Waterbury Reservoir. In 2018, the Waterbury Reservoir State Park Day Use Area completed slope regrading and live staking to address shoreline erosion (VANR, 2022).

The construction site consists of Udorthent soils. The soils are primarily formed from human-transport materials as opposed to glacial origin or other natural soil formation processes. Waterbury Dam was constructed over a natural gorge. Its spillway channel consists of graphitic mica schist bedrock (USACE, 2021a). In 2021, the USACE conducted a geological assessment to evaluate the bedrock at Waterbury Dam (USACE, 2021a). The geological assessment identified significant erosion of bedrock within the spillway channel (USACE, 2021a)

3.3. Water Quality

Waterbury Reservoir Area

Waterbury Reservoir is managed by the VANR as a mixed-water fishery. The reservoir is mesotrophic and is characterized by moderate nutrient enrichment and plant growth (VT DEC, 2009; Greenhorne & O'Mara, Inc., 2000). Waterbury Reservoir exhibits thermal stratification in which three thermal zones exist: the hypolimnion, epilimnion, and metalimnion. The epilimnion region, at the surface region, is characterized by warm temperatures in the summer. The metalimnion is the transitional zone between the regions of the water column. There is limited circulation through the metalimnion. As a result, the deeper hypolimnion region has relatively colder waters with decreased dissolved oxygen (DO) (Greenhorne & O'Mara, Inc., 2000).

The Vermont Lakes and Ponds Program assessed Waterbury Reservoir using the Lake Scorecard assessment which rates lake health through nutrient trends, shoreline and lake habitat, and invasive species presence (VT DEC, 2024a). Waterbury Reservoir received a good rating for nutrient trend and shoreland condition but received a poor score for aquatic invasives due to the presence of European naiad (*Najas minor)*. The presence of any aquatic invasive species indicates a poor score, regardless of abundance or perceived nuisance.

The state of Vermont maintains the Vermont Priority Waters List to identify and monitor impaired and altered waters. Waterbury Reservoir is impaired for sedimentation turbidity (VT DEC, 2022a). Historical sources of sediment include reservoir bank instability and boat and wind-driven waves (USACE, 2001). Pollutant sources include both point and non-point inflow sources from a variety of agricultural, residential (septic), and community wastewater facilities and sources (Greenhorne & O'Mara, Inc., 2000).

Little River

Vermont Water Quality Standards (WQS) classify surface waters in order to manage and protect water quality (VT DEC, 2022b). Class A waters represent higher quality waters, with significant ecological value or those that serve as a public water source; Class B waters represent good or very good quality waters (VT DEC, 2022b). In addition to these classifications, streams are designated as either cold- or warm-water fish habitat. Little River is designated as Class B(2) water with a cold-water fish habitat designation. VANR manages Little River downstream of the dam as a cold-water fishery. Little River confluences with Winooski River 2.5 miles downstream of the dam. Winooski River is also designated as a Class B(2) water with cold-water fish habitat.

Little River is a part of the Vermont Priority Waters List for altered hydrology and impairment. Little River downstream is not in compliance with WQS for flow alteration due to reservoir drawdowns and artificial flows from GMP (VT DEC, 2022a). GMP discharges water from the reservoir to Little River and conducts a winter drawdown for hydroelectric purposes which alters all uses of the reservoir. GMP is required to implement new reservoir water level management following repair of the Tainter gates

which will allow compliance with the state's 401 Water Quality Certificate (WQC) for the hydroelectric operations (VANR, 2014).

GMP discharges water from the hypolimnion region of Waterbury Reservoir to downstream Little River (Greenhorne & O'Mara, Inc., 2000). This results in discharges of cold, oxygen-deficient water (VANR, 2014). GMP conducted monitoring in 1997 that indicated discharges to Little River did not meet the WQS for DO (VANR, 2014). WQS for cold-water fish habitat require no less than 7 milligrams per Liter and 75% saturation at all times, as well as no less than 95% saturation during egg maturation and larval development of salmonids (VT DEC, 2022b). In order to meet DO WQS, GMP equipped the turbines with a reaeration mechanism, and cone valves were installed on the bypass pipe.

The winter drawdown is associated with sediment mobilization and turbidity downstream. GMP monitored turbidity in 1998, 1999, and 2000 for their Federal Energy Regulatory Commission hydroelectric license. GMP observed elevated turbidity, exceeding WQS, during refilling following winter drawdowns (VANR, 2014).

Little River, upstream of the reservoir, is impaired due to urban runoff and sediment (VT DEC, 2024a). Identified pollutant sources include channel instability, channel manipulation, and urban/suburban development (VT DEC, 2024a).

3.4. Wetlands

There are approximately 87 acres of wetlands associated with the Waterbury Reservoir, from the establishment of the reservoir, or are maintained by surface water flows (Figure 12).

The National Wetlands Inventory (NWI) was utilized to determine the extent of wetlands in association with the reservoir (Table 5). Most of the wetlands around the reservoir are classified as shrub-scrub/emergent or forested/shrub-scrub emergent wetlands.

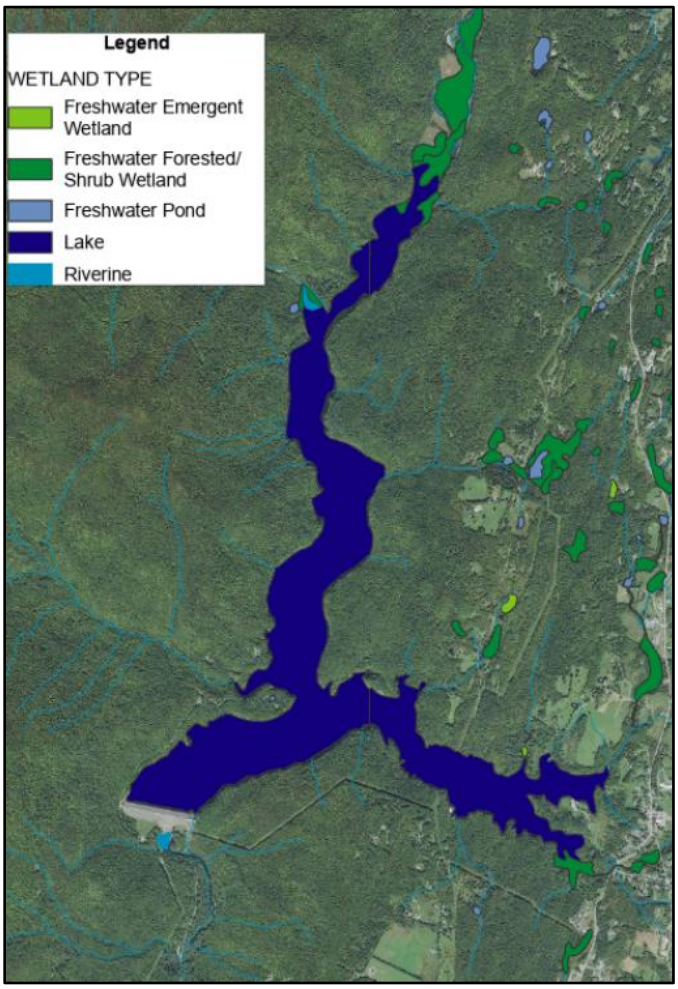

Figure 12. NWI Wetland Classifications at Waterbury Reservoir.

Table 5. NWI Wetland Classifications by Area at Waterbury Reservoir.

Wetland Classification	Area (acres)
Palustrine Emergent	0.8
Palustrine Shrub-Scrub/Emergent	32.12
Palustrine Forested/Shrub-Scrub Emergent	39.2
Palustrine Forested	15.21
TOTAL	**87.33**
Open Water	818.42

Source: FWS, 2024a.

Several wetlands in the northern and eastern portion of the reservoir are classified as Class II wetlands under the Vermont Wetland Rules, indicating they are statewide-significant (VANR, 2024a). Class II wetlands include the following categories:

- The wetland is of the same type and threshold size as those mapped on the Vermont Significant Wetlands Inventory maps (i.e. open water (pond)

emergent marsh; shrub swamp; forested swamp; wet meadow; beaver pond or beaver meadow; bog or fen; and is greater than 0.5 acres in size).

- The wetland contains dense, persistent non-woody vegetation or a prevalence of woody vegetation; is adjacent to a stream, river, or open body of water, and is over 2,500 square ft in size.
- The wetland is a vernal pool that provides amphibian breeding habitat.
- The wetland is a headwater wetland; and
- The wetland contains a species that appears in the Vermont Natural Heritage Inventory (VNHI) database as rare, threatened, endangered or uncommon; or is an exemplary natural community as mapped by VNHI.

In 1999, GMP conducted vegetation surveys to document dominant plant species at wetlands associated with the reservoir (Table 6).

3.5. Vegetation

Waterbury Reservoir is surrounded by northern hardwood forests, which are upland forests that are common throughout Mount Mansfield State Forest. Characteristic species of northern hardwood forests include sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), and American beech (*Fagus grandifolia*) (VDFW, 2015). Hemlock-Northern hardwood forests are also common to Waterbury Reservoir, with eastern hemlock (*Tsuga canadensis*) co-occurring with northern hardwood species (VDFW, 2015).

Various invasive species are present at Waterbury Reservoir, degrading the quality of the wetlands by reducing species diversity. Japanese knotweed (*Fallopia japonica*) and common reed (*Phragmites australis*) are known to occur in the northern wetlands of the reservoir (Table 6). European naiad is an aquatic invasive species present within Waterbury Reservoir (VT DEC, 2024a).

Table 6. Observed Plant Species at Waterbury Reservoir.

Scientific Name	Common Name
Trees	
Acer rubrum	Red maple
Betula alleghaniensis	Yellow birch
Populus tremuloides	Quaking aspen
Salix nigra	Black willow
Ulmus americana	American elm
Shrubs	
Alnus incana	Speckled alder
Impatiens capensis	Spotted-touch-me-not; jewelweed
Salix spp.	Willows
Spiraea alba	White meadowsweet
Herbaceous, Aquatic	
Calamagrostis canadensis	Blue-joint reed grass
Eleocharis acicularis	Needle spikesedge
Elodea spp.	Waterweed
Eutrochium maculatum	Spotted joe-pye weed
Equisetum fluviatile	Water horsetail
Fallopia japonica	Japanese knotweed
Iris spp.	Iris
Matteuccia struthiopteris	Ostrich fern
Najas flexilis	Slender naiad
Najas minor	Brittle water nymph
Phalaris arundinacea	Reed canary grass
Phragmites australis	Common reed
Pontederia cordata	Pickerel weed
Potamogeton spp.	Pondweed
Sagittaria latifolia	Broad leaf arrowhead
Scripus cyperinus	Woolgrass
Thalictrum dioicum	Early meadow-rue
Typha latifolia	Broadleaf cattail
Utricularia spp.	Bladderwort
Vallisneria americana	American eelgrass

Source: Greenhorne & O'Mara, Inc., 2000; VT DEC, 2024b.

3.6. Fish & Wildlife

Waterbury Reservoir

VANR manages Waterbury Reservoir as a mixed-water fishery as it contains both warmwater and coldwater fish species. Common species include brown trout (*Salmo trutta)*, smallmouth bass (*Micropterus dolomieu)*, yellow perch (*Perca flavescens*), rainbow trout (*Oncorhynchus mykiss*), black crappie (*Poxomis nigromaculatus*), rainbow

smelt (*Osmerus mordax*), white sucker (*Catostomus commersonii*), common shiner (*Luxilus cornutus)*, and brown bullhead (*Ameiurus nebulosus)* (Ladago, 2024).

Wetlands at the reservoir provide habitat for spawning, nursing, feeding, and cover to yellow perch, smallmouth bass, brown bullhead, and other forage species (Ladago, 2024). Tributaries of the reservoir also provide spawning habitat for rainbow smelt, brown trout, and rainbow trout (Ladago, 2024).

Waterbury Reservoir and surrounding areas, including Little River State Park and Mount Mansfield State Forest, provide wildlife habitat to various species of mammals, birds, reptiles, and amphibians (Table 7). The wetlands at the reservoir provide habitat for various birds, reptiles, and amphibians, including waterfowl and migratory birds.

Table 7. Common Wildlife Species at Waterbury Reservoir.

Common Name	Scientific Name
Mammals	
White-tailed deer	*Odocoileus virginianus*
American beaver	*Castor canadensis*
American mink	*Mustela vison*
River otter	*Lontra canadensis*
Red fox	*Vulpes vulpes*
Moose	*Alces alces*
Birds	
Common loon	*Gavia immer*
American black duck	*Anas rubripes*
Canada goose	*Branta canadensis*
Wood duck	*Aix sponsa*
Common merganser	*Mergus merganser*
Double-crested cormorant	*Phalacrocorax auritus*
Great blue heron	*Ardea herodias*
Belted kingfisher	*Megaceryle alcyon*
Osprey	*Pandion haliaetus*
Red-tailed hawk	*Buteo jamaicensis*
Northern harrier	*Circus cyaneus*
Bank swallow	*Riparia riparia*
Amphibians	
Red-spotted Newt	*Notophthalmus viridescens*
Spring peeper	*Pseudacris crucifer*
Gray treefrog	*Hyla versicolor*
American bullfrog	*Lithobates catesbeianus*
American toad	*Anaxyrus americanus*

Source: Greenhorne & O'Mara, Inc., 2000.

Little River

The downstream portion of Little River is managed as a cold-water fishery by the state of Vermont. Common species downstream of the dam include rainbow trout, smallmouth bass, longnose dace (*Rhinichthys cataracteae)*, common shiner, pumpkinseed (Lepomis gibbosus), blacknose dace (*Rhinichthys atratulus*), white sucker, and creek chub (*Semotilus atromaculatus*) (Ladago, 2024).

Common species of Little River upstream of the reservoir include rainbow trout, brown trout, brook trout (*Salvelinus fontinalis)*, white sucker, blacknose dace, slimy sculpin (*Cottus cognatus)*, longnose dace, rock bass (*Ambloplites rupestris)*, pumpkinseed, and brown bullhead. Rainbow smelt and brown trout utilize upstream Little River as spawning habitat (Ladago, 2024).

3.7. Threatened and Endangered Species

In accordance with Section 7 of the Endangered Species Act of 1973, as amended, the U.S. Fish and Wildlife Service's (FWS) Information for Planning and Consultation (IPaC) system was consulted to determine which federally listed threatened or endangered species potentially occur within the project area. IPaC identified two federally-listed species, the northern long-eared bat (NLEB) (*Myotis septentrionalis*) and the tricolored bat (*Perimyotis subflavus)*.

Northern long-eared bat

The NLEB was listed as a federally endangered species in 2022. NLEB is found in 37 states. White-nose syndrome is a fungal disease known to affect bats. White-nose syndrome is the predominant threat to NLEB and is associated with their population declines (FWS, 2024b). Winter hibernation occurs in caves and mines. In the spring, summer, and fall, NLEB roost in live trees, snags, and dead trees (FWS, 2024b). Breeding begins in late summer or early fall. Birth may occur from late May or early June to late July, depending on where the colony is located within the species' range.

Tricolored bat

The tricolored bat was listed as a proposed endangered species in 2022 (FWS, 2024c). Winter hibernation occurs in caves and abandon mines (FWS, 2024c). The tricolored bat is found in forested habitat during the spring, summer, and fall (FWS, 2024c). Roosting occurs in trees, primarily in live or recently dead deciduous hardwood trees (FWS, 2024c). White-nose syndrome is the predominant threat to the species.

3.8. State-Listed Species

The Vermont Division of Fish and Wildlife (VDFW) maintains the VNHI as a database for Vermont's natural communities and rare species. USACE conducted a preliminary assessment to determine potentially impacted rare, threatened, and endangered species.

Eastern pearlshell

The Eastern Pearlshell (*Margaritifera margaritifera)* is a freshwater mussel that occurs in Winooski River near its confluence with Little River. The species is considered threatened and is found in streams within the Lake Champlain basin and Connecticut

River basin (VAL, 2017). The species is found in cold streams that support trout populations with firm sandy bottoms, gravel, cobble, or small boulders (VAL, 2017). Clean gravel and sand habitat is necessary for the species (VAL, 2017).

Vasey's Pondweed

Vasey's Pondweed (*Potamogeton vaseyi)* is a submersed aquatic herb that occurs in freshwater lakes, ponds, and slow-moving rivers (MA DFW, 2015). The species is a rare species that is currently considered non-listed and is found within Waterbury Reservoir.

Common Loon

The Common Loon (*Gavia immer)* is a migratory bird species which utilizes lakes and deep ponds for breeding habitat. The species is considered uncommon and was previously listed as endangered in Vermont until 2005. No loons were nesting at Waterbury Reservoir in 2024, although nesting occurred in 2023 prior to flooding (A. Wood, Habitat Protection Specialist, VDFW, personal communication, July 31, 2024).

3.9. Recreation

Waterbury Reservoir is located within Mount Mansfield State Forest, which provides varied recreational opportunities to the public (Figure 13). Camping, boating (motorized and non-motorized), fishing, swimming, hiking, biking, water-skiing, paddle boarding, snowmobiling, and cross-country skiing are among the recreational opportunities available.

Camping occurs throughout Waterbury Reservoir with primitive camping, remote campsites, and at a traditional campground. Primitive camping is dispersed in sanctioned areas at the northern end of the reservoir. Waterbury Reservoir Remote Campsites are 30 semi-primitive campsites which are only accessible by boat. Waterbury Reservoir Remote Campsites and Little River State Park are staffed and operated from mid-May through mid-October. Little River State Park includes a traditional campground with approximately 100 campsites, two beaches, and a boat launch. Table 8, below, provides recent visitation numbers for Little River State Park, Waterbury Center State Park, and the Waterbury Reservoir Remote Campsites. Visitation numbers represent registered users during the operating season for the parks and does not include visitation off-season or for boat launches (C. Ummel, personal communication, NE Parks Regional Operations Manager, VDFPR, October 24, 2024)

Table 8. Recent Public Visitation within State Parks on/Surrounding the Waterbury Reservoir.

Year	Combined Attendance
2021	98,743 visitors
2022	94,455 visitors
2023	72,620 visitors
2024	73,035 visitors

Five of seven recreational sites surrounding the reservoir provide boating, canoeing, and kayaking access to the reservoir: Waterbury Dam Fishing Area, Little River State Park, Waterbury Center State Park (Day Use Area), Blush Hill Boating Access, and Cotton Brook Canoe Access. Three of the recreational sites provide direct fishing access to the reservoir: Waterbury Dam Fishing Access, Little River State Park, and Waterbury Center State Park (Day Use Area).

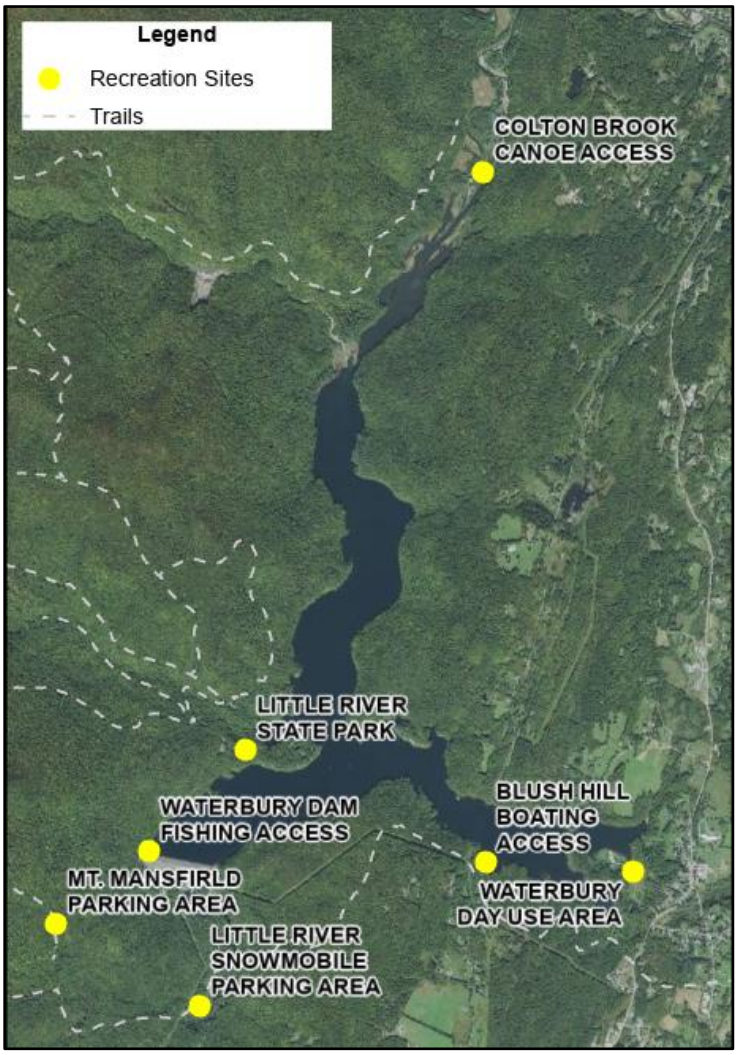

Figure 13. Recreation Sites and Trails near Waterbury Reservoir.

3.10. Noise

Adverse noise is associated with health risks, with potential risks including hearing loss, high blood pressure, stress related illness, and sleep disruption (EPA, 2024a). A decibel (dB) measures the intensity of sound. The Environmental Protection Agency (EPA) uses the average 24-hour noise level to identify noise exposure levels .70 dB is the maximum level to protected hearing loss, while 55 dB is the maximum for protected outdoor activity interference and annoyance. The threshold for pain is at a level of 135 dB. The A-weighted scale (dBA) is used to reflect the sensitivity pattern of the ear's response to noise and speech (EPA, 1981). The noise level for common construction equipment (in dBA at 50 feet) is described below in Table 9 (EPA, 1971).

Sources of noise for Waterbury Reservoir include vehicular traffic on trails and roadways, and boat traffic on waterways. Noise may vary seasonally due to recreational uses, such as snowmobile activity in the winter (Greenhorne & O'Mara, Inc., 2000).

Table 9. Construction Equipment Noise Level

			Noise Level (dBA) at 50 feet
Equipment Powered by Internal Combustion Engines	Earth Moving	Compactors (Rollers)	73 - 75
		Front Loaders	72 - 84
		Backhoes	72 - 94
		Tractors	76 - 96
		Scrapers, Graders	80 - 93
		Pavers	86 - 88
		Trucks	82 - 93
	Materials Handling	Concrete Mixers	75 - 88
		Concrete Pumps	81 - 83
		Cranes (Movable)	76 - 87
		Cranes (Derrick)	86 - 88
	Stationary	Pumps	69 - 71
		Generators	71 - 82
		Compressors	74 - 86
Impact Equipment		Pneumatic Wrenches	83 - 88
		Jack Hammers and Rock Drills	81 - 98
		Pile Drivers (Peak)	95 - 105
Other		Vibrator	69 - 81
		Saws	72 - 81

Source: (EPA, 1971)

3.11. Air Quality

The EPA, as authorized by the Clean Air Act, has set National Ambient Air Quality Standards (NAAQS) for six principal pollutants. These include ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead. Waterbury, Vermont is in attainment with the NAAQS for all criteria pollutants (EPA, 2024b). Attainment means that an area is meeting or is below a given safe standard set by the EPA for the criteria pollutant.

3.12. Climate Change and Greenhouse Gas Emissions

Federal agencies are required to consider greenhouse gas (GHG) emissions and climate change, consistent with the CEQ's interim guidance on analysis and considerations of GHG emissions and climate change and Executive Order (EO) 13990. GHGs are gases which trap heat in the atmosphere (EPA, 2024c). CEQ defines GHGs as carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, nitrogen trifluoride, and sulfur hexafluoride. GHG emissions includes the release of stored GHGs as a result of land management activities affecting terrestrial GHG pools (i.e. carbon stocks in forests and soils) and future changes in carbon stocks. The common unit of measurement for GHGs is metric tons of CO_2 equivalent ($MTCO_2e$).

The Vermont Global Warming Solutions Act, passed in 2020, established GHG emission reduction requirements. The Act requires the State to reduce GHG emissions to 26% below 2005 levels by 2025, 40% below 1990 levels by 2030, and 80% below 1990 levels by 2050 (VANR, 2024b). The Vermont Greenhouse Gas Emissions Inventory and Forecast estimates emissions in millions of metric tons of carbon dioxide equivalent (MMT CO_2e). The latest GHG inventory includes estimates for the years 1990-2021. In 2021, the transportation/mobile sector was the highest GHG contributor (39.2% of total emissions) with residential, commercial, and industrial fuel use as the second highest contributor (31.2%) (VANR, 2024c).

3.13. Hazardous, Toxic, and Radioactive Waste (HTRW)

The EPA's EnviroMapper tool identifies facilities including air pollution sites, Superfund sites, Toxic Release Inventory sites, Resource Conservation and Recovery Act (RCRA) sites, National Pollutant Discharge Elimination System sites, Brownfield sites, and Biennial Report (BR) sites. Two RCRA sites were identified at Waterbury Reservoir and are classified as very small quantity generators (VSQGs): Little River State Park and the GMP Little River Hydro Plant. VSGQs are hazardous waste generators that generate less than or equal to the following amounts in a calendar month:

(1) 100 kilograms (220 lbs) of non-acute hazardous waste;

(2) 1 kilogram (2.2 lbs) of acute hazardous waste;

(3) 100 kilograms (220 lbs) of any residue of contaminated soil, water, or other debris resulting from the cleanup of a spill, into or on any land or water, of any acute hazardous waste.

3.14. Socioeconomics Resources and Environmental Justice

In 2020, Washington County had a total population of about 59,807, with a total population of 5,331 in Waterbury (U.S. Census Bureau, 2024). In Washington County, the median household income was $77,278 with a poverty rate of 9.9% in 2022 (U.S. Census Bureau, 2024). Approximately 91% of the population were white and 2.7% were Hispanic or Latino. American Indian and Alaska native, black or African American, and Asian constituted 1% or less of the total population (U.S. Census Bureau, 2024).

EO 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” issued in 1994, ensures that federal actions do not have disproportionately high and adverse human health or environmental effects on minority and low-income populations. EO 14096, “Revitalizing Our Nation's Commitment to Environmental Justice for All” issued in 2023, builds off EO 12898 and focuses specifically on environmental justice (EJ). Objectives include promoting the latest science to understand EJ impacts, expanding interagency coordination, and requiring each agency to include EJ in their missions.

The CEQ provides information on disadvantaged census tracts through the Climate and Economic Justice Screening Tool (CEJST). Disadvantaged tracts identified in the CEJST meet burden and socioeconomic thresholds. Burden categories considered include climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development. The census tract that contains Waterbury Dam was not considered disadvantaged for any burden indicators (CEQ, 2024).

EO 13045, “Protection of Children from Environmental Health Risks and Safety Risks” addresses environmental health and safety risks that may disproportionately affect children and ensures that policies, programs, activities, and standards address these risks. There are no child-related areas in the vicinity of the project area.

3.15. Cultural Resources

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended and implementing regulations 36 CFR 800 require federal agencies to take into account impacts to historic properties from a federal undertaking. The first step upon confirmation of an undertaking is to identify known historic properties and areas of historic and archaeological sensitivity within the projects area of potential effect (APE), defined as “the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist” (36 CFR 800.16(d)). As part of the NHPA compliance, USACE will be coordinating with the Vermont State Historic Preservation Officer (VT SHPO), the Waterbury Historical Society, the Narragansett Indian Tribe, the Wampanoag Tribe of Gay Head (Aquinnah), the Nulhegan Abenaki Tribe, a VT State recognized Tribe whose area of interest encompasses the Waterbury area. Coordination will include a defined project APE along with a determination of effect upon historic properties for which USACE will request concurrence and any comments.

The Waterbury Dam is eligible for listing on the National Register of Historic Places (NRHP) under Criterion A: “associated with events that have made a significant

contribution to the broad patterns of our history." Constructed in response to the devastating flood of 1927, the USACE utilized the CCC labor that had also built the Wrightsville and East Barre dams, completed in 1935. The former CCC camp (VT-WA-26) is described below. The Waterbury Dam is an important component of the New England history of the CCC and of the USACE civil works program during the early to mid-twentieth century in Vermont. Modifications to the dam were conducted in 1959 and 1985, and the USACE has since conducted rehabilitation of the dam in 2000, which included filter shaft construction and dam foundation repairs in 2006. Although modified, Waterbury Dam retains integrity and NRHP significance (Greenhorne & O'Mara, Inc. 2000:37).

During the 2000 rehabilitation, the USACE determined that this project would have an "adverse effect" upon Waterbury Dam, a significant historic property eligible for the NRHP. In addition, the proposed staging area was located in the vicinity of the former CCC camp which housed the dam workers and could affect the archaeological district (VT-WA-0026). The drawdown of the reservoir from the normal winter pool elevation of approximately 550 ft National Geographic Vertical Datum of 1929 (NGVD29) to 520 ft NGVD29 for the estimated 18-month timeframe of the work, also had the potential to affect submerged archaeological resources due to slumping or erosion.

As a result, a Memorandum of Agreement (MOA) was developed between USACE, VT SHPO, and VT DEC which included the following stipulations:

- completion of Historic American Engineering Record (HAER) or state equivalent documentation of the Waterbury Dam and Reservoir, prior to start of rehabilitation work;
- completion of an archaeological investigation of that portion of the CCC camp archaeological district to be used as a staging area; and,
- limited archaeological investigations of the area between 520 ft and 550 ft NGVD29, with monitoring of this area during the drawdown for any erosion or other impacts from exposure.

Historic and photographic documentation of the Waterbury Dam was conducted by contract in July 2001 to state level documentation standards (Doherty and Emidy, 2001). All original elements of the dam including the gate house, conduit house, valve house, and spillway were inspected, and large format black-and-white archival photographs were taken to document conditions at the dam. Building interiors were also photographed and select historic drawings and photographs were obtained.

An intensive level archaeological survey was conducted by contract (Cherau and Heitert, 2002) to identify historic properties within the three proposed construction work areas adjacent to the southern embankment of the dam which were previously determined to have moderate archaeological sensitivity due to their proximity to the CCC camp archaeological district (VT-WA-26). Field investigations and survey determined a high degree of compaction and disturbance within these work areas due to continued use as a staging and stockpile area since the original construction of the dam and subsequent renovation and rehabilitation. The disturbance is such that these

work areas maintain no archaeological integrity and are not likely to yield additional information. Additionally, the southernmost staging area was well outside of and on the opposite bank from the CCC campsite. No further archaeological investigations were recommended.

Lastly, the USACE through its Contractor, The Public Archaeology Laboratory, Inc., conducted historic and archaeological mapping and testing for the temporary drawdown area between 520 and 550 feet NGVD29 and for GMP between 550 and 590 feet NGVD29 at Waterbury Dam and Reservoir (Heitert, Cherau, and Macpherson, 2004). Documentary research and field investigations including extensive site mapping were completed. These investigations identified eight home/farmstead sites and four bridge sites within the GMP portion of the project area. None of these sites were determined to be significant archaeological properties. Most of the surveyed areas had undergone severe disturbances related to the construction of the existing dam structures and no further work was recommended.

A review of the Vermont Archaeology Inventory (VAI) mapping tool identified primarily historic period archaeological sites in the vicinity of Waterbury Dam and within the reservoir. The closest site is the former CCC camp archaeological district (VT-WA-26) which is located approximately 3,350 feet southwest of the dam. Additional archaeological sites noted downstream of the dam and west of Waterbury Center are shown in Table 10.

Table 10. Archaeological Sites Noted Downstream of the Dam and West of Waterbury Center.

Site Number	Name	Description
0029	Woodward Hill Arch. District	Historic
0148	J. Whitney/C. Hulrburt Farmstead Site	Historic
0149	J.E. Montgomery/L. White Farmstead Site	Historic
0150	D. Lord / S.M. Eddy Farmstead Site	Historic
0151	Mrs. A. Marshall Site	Historic
0152	L. Hall/H. Stowell/A. Newhall Farmstead Site	Historic
0153	J. Whitney/C. Hulrburt Farmstead Site	Historic
0154	S.R. Huse Barn Site	Historic
0155	C. Fish/R. Pike Farmstead Site	Historic
0156	H. Newton/C. Thayer Farmstead Site	Historic
0157	Alder Brook Bridge 2 Site	Historic
0158	Alder Brook Bridge 3 Site	Historic
0159	Cotton Brook Bridge Site	Historic
0160	Little River Bridge Site	Historic

The former CCC campsite is listed in the VAI as an archaeological district (VT-WA-26). The camp was first formed in 1933 as Camp S-53, commonly known as Camp Smith (for then governor, Charles M. Smith). At peak use during the construction of Waterbury Dam from 1935-1938, the camp was home to approximately 2,000 men. The camp consisted of barracks, a hospital, a church, and a theater. Visible features at VT-WA-26

include three standing fireplace chimneys (from administration buildings 31, 33, and 38), foundation holes, mounds, steps, foundation slabs, subsurface water and storm drain systems, and ornamental landscape plants (Frink,1987; GMPC, 1999 in Greenhorne & O'Mara, Inc. 2000:37). Other subsurface remains are also likely present.

The nearest pre-Contact sites within the town of Waterbury are located southeast of the dam off Vermont State Route 100 and Route 2 near the town of Duxbury. However, this is probably a result of a lack of archaeological investigations rather than the absence of pre-Contact populations in this area. Small to moderate sized seasonal prehistoric sites would be expected along Little River and its major tributaries, Cotton Brook, Stevenson Brook, and Alder Brook. Submerged terraces along Little River may also contain pre-Contact sites. However, extensive site destruction may have occurred as a result of earth removal for dam construction during the period 1935 to 1938.

There were several historic communities in Waterbury that were located adjacent to Little River and in the uplands along Stevenson Brook and Cotton Brook. Residences and farmsteads were situated along River Road and a sawmill was located at the falls on Little River, now the site of Waterbury Dam. Most of these villages existed to take advantage of logging the uplands while using the water sources to power sawmills. The upland farmsteads eked out a marginal existence and many were abandoned by the turn of the twentieth century.

The Stevenson Brook district is designated as VT-WA-27 in the VAI. The district includes one standing structure, the Goodell House, which is a nineteenth century farmhouse. Former properties in the district included four farms and a sawmill. Two of these five possible archaeological sites are currently submerged.

The Cotton Brook district (VT-WA-28) includes the former locations of several farmsteads and houses, a sawmill, a boarding house, and a schoolhouse (District No. 6). The majority of potential archaeological resources are located beneath the reservoir.

There are numerous historic properties in communities along the Winooski River that have been listed on the National Register (NR). The Waterbury Village Historic District is composed of over 200 structures dating from the late eighteenth to the early twentieth centuries. The Preston-Lafreniere Farm in Bolton is a homestead and barn complex owned from 1810 until 1991 by one family. There are two early twentieth century bridges in Richmond determined eligible for the NR, and another, the Checkered House Bridge is listed on the NR. The Round Church in Richmond is a rare, unaltered, sixteen-sided meetinghouse. Built from 1812 to 1814, the church is listed on the NR and is a designated National Historic Landmark. Fort Ethan Allen in Essex Junction is also listed on the NR.

Other properties in the communities along the lower Winooski River are listed on the State Register. Some of these historic resources could potentially be eligible for the NR as well. These resources include: the Mill Village District, the Town Highway (T.H.) 56 Bridge, and the T.H. 4 (Winooski Street) Bridge in Waterbury; the Stevens Mill Historic District in Bolton; and the Bridge Street Historic District in Richmond. Many other properties have also been individually listed on the State Register (Greenhorne & O'Mara, Inc., 2000).

4.0 ENVIRONMENTAL CONSEQUENCES

This section discusses the effects on the resources caused by the project's operation, including the effects of the No Action Alternative and the Proposed Risk Management Plan. Only the affected resources are described in detail.

4.1. Geology and Soils

No Action Alternative

Under the No Action Alternative, the project would not occur and there would be no change to existing geology and soils within the project area and surrounding the reservoir.

Proposed Risk Management Plan

Construction of the project would result in direct impacts to the geology of the construction area. Removal of loose or partially detached rock would occur along the base and walls of the spillway channel. Construction of the spillway apron would reduce the long-term erosion of bedrock in the spillway channel.

The precautionary drawdown would result in short-term, temporary impacts to soils. A study conducted by GMP identified reservoir fluctuations as a secondary cause for shoreline erosion at Waterbury Reservoir. In 2001, a study by BBC&M Engineering, Inc. identified increased erosion of lacustrine sediments during the winter drawdown. Freezing of lacustrine sediments during the precautionary drawdown will result in increased soil erosion (GMP, 2005).

The magnitude of soil erosion, and subsequent sediment mobilization, will be influenced by the exact extent, timing, and duration of the precautionary drawdown. A 30-ft to 60-ft range of drawdowns are being considered, which will result in several hundreds of acres dewatered. Table 4 and Figure 10, above, provide the reservoir pool elevations and amount of area dewatered for a 30-ft, 40-ft, and 60-ft drawdown.

During the initial drawdown, sediment mobilization will occur from shoreline erosion and inflows to the reservoir. To minimize erosive velocities, a slow, gradual reservoir drawdown will occur. Inflows to the reservoir will cut channels through deposited sediments during the initial drawdowns. As soon as practicable, following the drawdown, the dewatered reservoir bed will be temporarily vegetated to reduce potential soil erosion and sediment mobilization.

The proposed project would result in long-term beneficial impacts to soils. Once gate repairs are completed, the project will be operated in run-of-river mode and winter drawdowns below the normal operating level would not be allowed (VANR, 2014).

4.2. Water Quality

No Action Alternative

Under the No Action Alternative, no construction would occur at the project area. The precautionary drawdown (associated with construction) would not occur. Rehabilitation of the Tainter gates would not occur as necessary for GMP to meet conditions of their

WQC. As a result, GMP would continue winter drawdowns and would not convert to instantaneous run-of-river mode. Little River and Waterbury Reservoir would remain impaired for flow alteration. The winter drawdowns would continue to increase shoreline erosion along the reservoir.

Proposed Risk Management Plan

The proposed project will result in short-term impacts to water quality as a result of the precautionary drawdown. A 30-ft to 60-ft drawdown range is being considered. The timing, magnitude, and duration of the drawdown will be determined during PED and will determine the significance of downstream impacts. The drawdown will expose several hundreds of acres of bare soil which will be subject to erosive forces. Figure 10, above, shows the reservoir pools associated with each drawdown. Table 4, above, describes the number of acres exposed for the considered 30-ft to 60-ft drawdown range.

The USACE conducted a study to estimate potential sediment transport during dam seepage repairs in 2001. The VANR and the USACE conducted a precautionary drawdown during repairs, which was associated with sediment discharge and turbidity. Sediment discharge was associated with the initial drawdown and reservoir inflows during the drawdown period (USACE, 2001). The USACE conducted water quality monitoring, which indicated that 78% of 177 samples exceeded turbidity standards during the precautionary drawdown (VANR, 2014). The drawdown may result in increased temperatures of discharged water during summer months (USACE, 2001).

The reservoir pool will be slowly drained in order to minimize initial erosion. A stable pool will be maintained following the initial drawdown unless there is a storm event that results in increased inflows, which would increase the pool elevation. The pool elevation would be allowed to return to the stable pool elevation as soon as possible after the storm. Sediment transport will occur as inflows will cut channels in previously deposited sediment of the resevoir bottom which will result in turbid discharges. Significant rainfall events during the drawdown will cause additional sediment erosion and discharge events to occur.

As soon as practicable, vunerable areas of the exposed reservoir bed will be temporarily vegetated to reduce soil erosion and subsequent sediment mobilization. A Water Quality Monitoring Plan will be developed during PED. Water Quality Monitoring will occur within the downstream portion of Little River, and will monitor temperature, DO, and turbidity. Baseline monitoring will be conducted prior to construction. USACE will obtain a WQC from the state of Vermont during PED.

The proposed project will result in long-term beneficial impacts to water quality. The project will satisfy dam modifications required to convert GMP’s hydroelectric operations to instantaneous run-of-river. In doing so, Waterbury Reservoir and Little River will be able to be removed from Vermont’s list of impaired and priority waters (VANR, 2014).

4.3. Wetlands

No Action Alternative

Under the No Action Alternative, no construction precautionary drawdown would occur and there would be no changes to existing wetlands. There would be no changes to the existing winter drawdown. The current winter drawdown reduces the potential productivity of wetlands, this disturbance can favor the establishment of invasive species in the wetlands (GMP, 2005).

Proposed Risk Management Plan

The proposed project would result in short-term impacts to wetlands. The precautionary drawdown would result in the dewatering of wetlands during the 18-month construction period in the northern and eastern ends of the reservoir. These vegetated wetlands are dependent on the normal reservoir level The desiccation of wetlands may cause temporary loss of herbaceous vegetation and a diminished emergent vegetation seedbank during the drawdown period. Natural revegetation will occur following the initial drawdown through native seed banks as observed following the 2000s drawdown. No long-term impacts are expected to wetlands as shown by the reestablishment and recovery of wetlands during the complete drawdown in the 1980s and the partial drawdown in the 2000s.

The precautionary drawdown may promote the spread of invasive species from increased hydrologic stress. An invasive species management plan will be developed during PED to manage invasive species in wetlands associated with the reservoir.

Following the proposed project, drawdowns below the normal reservoir operating level of 589.25 ft will no longer occur (VANR, 2014). This may result in increased wetland habitat, with the potential for aquatic bed and emergent wetland habitat to expand (GMP, 2005).

4.4. Upland Vegetation

No Action Alternative

Under the No Action Alternative, no construction would occur and there would be no changes or impacts to existing vegetation.

Proposed Risk Management Plan

Construction will result in minor, direct impacts to vegetation associated with tree limbing or removal and the precautionary drawdown. Tree limbing/ removal will be required along the left abutment extending around 200 ft past the spillway channel. The precautionary drawdown will result in temporary, short-term impacts to vegetation along shoreline and riparian areas of the reservoir. It is expected that vegetation would recolonize once the reservoir is refilled to the normal summer pool elevation. Trees and shrubs will be planted post-construction to replace lost riparian vegetation.

4.5. Fish and Wildlife

No Action Alternative

Under the No Action Alternative, the project would not occur and there would be no changes to existing fish and wildlife. The WQC conditions for Tainter gate remediation would not be met, and GMP's hydroelectric project would not convert to complete run-of-river conditions. Fish habitat downstream of the dam would continue to be affected by peaking flow regimes. Aquatic and shoreline habitat within the reservoir would continue to be affected by the winter drawdowns. Short-term flow alterations in Little River would continue to affect stream bank erosion and morphology (GMP, 2005).

Proposed Risk Management Plan

Waterbury Reservoir

The precautionary drawdown would temporarily dewater several hundreds of acres of aquatic habitat. Refer to Table 4, above, for the estimated reservoir pool associated with the potential 30-ft to 60-ft drawdowns. The reduced quantity of habitat and restricted tributary access will reduce the carrying capacity of the system for fish and wildlife, reducing population sizes. There may be emigration of fish to tributaries with less stressful conditions (Greenhorne & O'Mara, Inc., 2000), but these habitats are assumed to be at their carrying capacity for fish, so the reduction in habtat will cause a short-term reduction in the overall fish population in the system. There will be short-term, temporary impacts to fish movement, including reduced spawning habitat. VDFW observed rainbow smelt spawning at Waterbury Reservoir. Cotton Brook was inaccessible for rainbow smelt spawning during the 2001 drawdown (B. Ladago, personal communication, Fisheries Biologist, VDFW, August 2, 2024). With an 18-month drawdown, the system will lose one or two spawning seasons, depending on the precise timing of the drawdown.

There will be short-term impacts to wildlife that are dependent on the summer pool elevation and the associated wetland habitat. Reservoir water level flunctuations will reduce the amount of shoreline habitat avaliable. A stable reservoir pool will be maintained to reduce stranding of nests that may result from the precautionary drawdown. Water level fluncutations may result in mortality of hibernating wildlife, such as herptiles (reptile and amphibian species). The timing of the drawdown will be coordinated to minimize unneccesary impacts to hibernating wildlife.

Wildlife may be displaced during the drawdown to adjacent upstream or downstream areas if adequate habitat exists. The drawdown would reduce foraging habitat for wading birds impacting waterfowl and wading birds that utilize the wetlands. The drawdown would also result in the temporary loss of wetland and aquatic habitat for herptiles at the reservoir (Greenhorne & O'Mara, Inc., 2000). The aquatic and wetland habitat would reestablish after the proposed project is completed in which fish and wildlife species may recover to pre-drawdown conditions.

There would be long-term, benefical impacts for fish and wildlife within the reservoir after completion of construction. Once gate repairs are completed, the project will be

operated in run-of-river mode and drawdowns below the normal operating level would not be allowed (VANR, 2014). The elimination of the winter drawdown would result in increased aquatic habitat for fish and wildlife. Additionally, aquatic habitat would increase for overwintering herptiles within the reservoir.

Little River

The proposed project will result in short-term, temporary impacts to downstream fish habitat. The precautionary drawdown will mobilize sediment from dewatered reservoir sediments. Increased turbidity from sediment mobilization may negatively impact adult trout spawning and survival rates of young trout (Ladago, 2024). Electrofishing surveys and macroinvertebrate sampling will be conducted to monitor water quality impacts to fish and aquatic habitat in Little River. Baseline sampling will occur during PED to determine existing fish and aquatic habitat quality, and sampling will occur during construction.

The project would have long-term benefits on downstream fish and aquatic habitat. Following the proposed project, GMP would convert to complete run-of-river operations. The instantaneous run-of-river mode would create a more stable temperature regime. A stable temperature regime would be beneficial to downstream conditions for fish and invertebrates by eliminating drastic variations in temperature. The seasonal drawdown would no longer be necessary which would result in decreased turbid discharges in Little River.

4.6. Threatened and Endangered Species

No Action Alternative

Under the No Action Alternative, construction would not occur and there would be no changes to existing threatened or endangered species.

Proposed Risk Management Plan

The proposed project was determined not likely to adversely affect (NLAA) the federally listed NLEB and tri-colored bat species. The USACE is currently in coordination with FWS on this determination and to ensure species protection.

4.7. State-Listed Species

No Action Alternative

Under the No Action Alternative, construction would not occur and there would be no changes to existing threatened or endangered species.

Proposed Risk Management Plan

The proposed project will have short-term impacts on state-listed species associated with the precautionary drawdown. Sediment mobilization may result in adverse effects to eastern pearlshell mussel habitat in Winooski River. As discussed earlier in this EA, there will be a slow initial drawdown of the reservoir to minimize sediment transportation to Little River and Winooski River. As discussed in Sections 4.1 Geology and Soils and Section 4.2 Water Quality, temporary vegetation will be planted following the initial

drawdown to minimize subsequent sediment released. The drawdown may cause stranding of Vasey's pondweed and may impact loon nesting at the reservoir if present during construction (A. Wood, Habitat Protection Specialist, VDFW, personal communication, July 31, 2024). To the extent the project allows for opportunities to avoid or minimize impacts to state-listed species, USACE will coordinate with VT DEC.

4.8. Recreation

No Action Alternative

Under the No Action Alternative extensive construction at Waterbury Dam would not occur and related road, trail, campsite, and/or boat ramp closures would not occur.

Proposed Risk Management Plan

The proposed drawdown will result in temporary, adverse short-term impacts to recreation. The precautionary drawdown will reduce the water surface area and will limit water-based recreation. The reservoir will not meet depth/size requirements necessary for wake sports, including water skiing. The precautionary drawdown may also impact sea planes. The reduced water area may not provide adequate surface for safe landings and takeoffs.

The drawdown will result in limited boat launch access, impacting various recreation uses. Boat fishing will be impacted as a result, including limited bass boat fishing. The Moscow Paddler's Access (Cotton Brook) boat launch will be inaccessible due to the drawdown. Paddle boating (canoe, kayak, standup paddleboard) will be limited to the Waterbury Dam and the Blush Hill boat launches. Motorboats will also be impacted by boat launch inaccessibility. The Blush Hill and Waterbury Center State Park boat launches will be inaccessible to motorboats during the drawdown. Waterbury Dam would be viable to motorboats, and sail crafts (C. Ummel, personal communication, NE Parks Regional Operations Manager, VDFPR, October 24, 2024). USACE will coordinate with the Vermont Department of Forests, Parks, and Recreation (VDFPR) to provide reasonable water-based recreational access to Waterbury Reservoir.

No impacts are anticipated to recreation on surrounding lands such as hiking, biking, cross country skiing, and snowshoeing. Shoreline and river fly fishing will have no significant impacts.

There will be short-term impacts to camping. No significant impacts are expected to Little River State Park, although there may be a short-term reduction in campers. Swimming at Little River State Park, as well as Waterbury Center State Park, will be impacted by the drawdown. The Waterbury Reservoir Remote Campsites will be significantly impacted by the drawdown. The remote campsites are only accessible by boat-access. Some remote campsites may remain accessible, although it is expected many of the campsites will not be accessible during the drawdown.

4.9. Noise

No Action Alternative

Under the No Action Alternative, the project would not be constructed and there would be no impacts to noise levels.

Proposed Risk Management Plan

The proposed risk management plan would result in no impacts to noise sensitive land uses, such as residential and recreational areas. There will be temporary, localized impacts to noise levels from construction. Construction equipment would be properly maintained and in good working order to minimize potential effects. Noise sources include heavy equipment and increased traffic to and from the construction site. The proposed risk management plan will include the use of compactors (rollers), front loaders, backhoes, tractors, graders, trucks, concrete pumps, cranes, pumps, generators, and pile hammers. Average noise levels associated with construction equipment (generally in the range of 72 to 96 dBA) are described in Section 3.10. Noise levels generated from construction equipment would reduce to conversation level (60 to 70 dBA) at a distance of approximately 200 to 3,200 ft. No sensitive noise receptors (e.g., recreation sites) are located within the area where noise levels would be above conversation level: therefore, no impacts to noise sensitive receptors would occur due to construction of the project.

4.10. Air Quality

No Action Alternative

Under the No Action Alternative, the project would not be constructed and there would be no impacts to air quality because of construction and heavy equipment.

Proposed Risk Management Plan

There would be temporary, localized impacts to air quality limited to the operation of construction equipment. Emissions from heavy equipment, airborne dust, and soil surface disturbance are potential air pollution sources. Heavy equipment emissions would be similar to other mobile sources, such as motor vehicles.

4.11. Climate Change and Greenhouse Gas Emissions

No Action Alternative

Under the No Action Alternative, the project would not be constructed, and there would be no impacts to existing conditions. No construction would occur and therefore, no GHG emissions would result from the operation of construction vehicles or equipment.

As part of the dam safety modification study, a climate change assessment was performed to describe existing and future challenges as a result of past and future climatic changes. The evaluation followed guidance in Engineering Construction Bulletin 2018-14 (USACE, 2018). The No Action Alteration (FWAC) was evaluated for climate change risks. The evaluation concluded that climate change is not considered to be a significant factor in future operation of Waterbury Dam.

Proposed Risk Management Plan

The proposed risk management plan will result in short-term, localized impacts to air quality and GHG emissions. Emissions include CO_2, N_2O, and CH_4 resulting from construction equipment and vehicles (i.e. aerial lifts, concrete mixers, cranes, crawler drills, crawler tractors, excavators, forklifts, generator sets, graders, off-highway trucks, plate compactors, pumps, rollers, tractors, and welders). A GHG emissions analysis was preformed to quantify emissions of construction vehicles and equipment using equipment emission factors (Attachment B). The total metric tons of CO_{2eq} were calculated for the total mass of greenhouse gas emissions (Table 10). The proposed project will result in an estimated 10,399.11 MT CO_{2eq}. In 2021, the transportation/mobile sources sector was the highest GHG contributor in Vermont with an estimated 3,240,000 MT CO_{2eq}. The proposed project represents 0.32% of the sector's estimated emissions.

Table 11. Summary of Total Greenhouse Gas Emissions for Construction

GHG Emissions in Pounds (lbs)				
CO_2	**N_2O**	**CH_4**	**CO_{2eq}**	**MT CO_{2eq}**
15,649,389	24,376	507	22,926,141	10,399.11

The climate change assessment report determined that climate change was not a significant factor in future operation of Waterbury Dam.

4.12. Hazardous, Toxic, and Radioactive Waste (HTRW)

No Action Alternative

Under the No Action Alternative, the project would not be constructed, and there would be no impacts to existing conditions. No construction would occur and therefore, no impacts would occur to any HTRW resources.

Proposed Risk Management Plan

The proposed risk management plan will result no impacts to or from existing HTRW facilities or resources as no HTRW sites are located in the area directly affected by the project.

4.13. Socioeconomics and Environmental Justice

No Action Alternative

The No Action Alternative will result in adverse impacts on socioeconomics due to the increased risk of property damage associated with potential Tainter gate failure. Short-term effects of the drawdown on recreation sites around the reservoir would not occur. The No Action Alternative will result in no impacts to environmental justice communities. No children or child-related areas will be impacted, as none are located in the project area.

Proposed Risk Management Plan

The proposed risk management plan will have short-term impacts to the local economy. The proposed risk management plan will limit recreational opportunities at Waterbury Reservoir, which may result in economic impacts to local recreational sites (Greenhorne & O'Mara, Inc., 2000).

There would likely be short-term and long-term benefits to the local economy. Short-term benefits associated with construction would occur due to spending on housing, fuel, and supplies by construction workers. Long-term benefits would be associated with increased flood control. The proposed project would result in reduced risks associated with Tainter gate failure. The project may have short-term, localized impacts to residents resulting from temporary construction noise and limited recreation.

The proposed risk management plan will result in no impacts to EJ communities, as there are no EJ communities in promixity to the affected area. No children or child-related areas will be impacted by the proposed risk management plan, as none are located in the project area.

4.14. Cultural Resources

No Action Alternative

Under the No Action Alternative, no ground disturbing activities would occur that may disturb or impact any cultural resources in the area. Historic properties downstream of the dam on the Little and Winooski River and in Waterbury such as the Waterbury Village Historic District may be impacted if the spillway and/or Tainter gates were to fail.

Proposed Risk Management Plan

The Proposed Action will have an adverse effect on the dam, which is eligible for listing on the NRHP. The proposed project will alter the original engineering aspects of this historic property and includes a complete replacement of the two 20-ft gates (Gates 1 and 2) and rehabilitation of the newer 35-ft gate (Gate 3). The existing service bridge would be rebuilt, new hoisting equipment installed, and appropriate electrical upgrades made. In addition to the gates, a scour apron with energy dissipation features would be installed downstream of the gated spillway sections. The project also includes repairs of ASR degraded concrete on the spillway weirs, piers, and the training wall on the right abutment.

The rehabilitation drawdown of the reservoir below 520.0 ft NGVD29 could affect currently submerged archaeological resources due to slumping or erosion. Archaeological investigations of the reservoir drawdown from 550 ft to 520 ft NGVD29 were conducted during the 2000 rehabilitation project. No archaeological sites were identified during this survey. The USACE does not expect the drawdown to be conducted below 520 ft NGVD29 at this time.

USACE will prepare a MOA to minimize and mitigate for the project's adverse effect on the dam. Minimization and mitigation measures will include: a Historic American Building Record/Historic American Engineering Record (HABS/HAER) Level II historic

and photographic documentation of the Waterbury Dam including all structures.; Limited archaeological investigations and monitoring during the drawdown for erosion or other impacts from exposure of the area below 520.0 ft NGVD29 would only be conducted if this is proposed prior to project construction.

A MOA will be prepared in consultation with the Vermont SHPO, VT DEC, Waterbury Historical Society, and the Narragansett Indian Tribe, the Wampanoag Tribe of Gay Head (Aquinnah), and the Nulhegan Abenaki Tribe, a Vermont State recognized Tribe, detailing the proposed mitigation measures. The Advisory Council on Historic Preservation will be notified of the pending MOA.

State-level historic documentation was completed in 2001. However, as more than 20 years has passed, new updated documentation will be required in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, and implementing regulations 36 CFR 800. This documentation will be completed during the PED phase of the study as part of the MOA.

4.15. Cumulative Impacts

Cumulative effects are effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (federal or non-federal) or other person undertakes such actions. Cumulative effects can result from actions with individually minor but collectively significant effects taking place over a period of time (40 CFR 1508.1(i)(3)). The impacts of past actions are discussed under the Affected Environmental sections of the EA, which describes existing or baseline conditions.

In the past, extreme drawdowns have occurred at Waterbury Reservoir. Historical drawdowns are associated with maintenance, construction, or rehabilitation of Waterbury Dam (Greenhorne & O'Mara, Inc., 2000). Major repairs have occurred in the 50s, 80s, and 2000s to address seepage. In the 2000s, a precautionary drawdown was conducted by the VANR and USACE. A 40-ft drawdown was maintained for six years, in addition to a 60-ft drawdown for six months. During the drawdown, adverse, short-term impacts occurred to water quality, recreation, and aquatic habitat. Water-based recreation at Waterbury Reservoir decreased as a result of limited or inacessible boat launches. Following the drawdown, the USACE completed a shoreline stabilization project in Little River State Park, as mitigation for the 2000s seepage repairs.

In 1953, GMP began hydroelectric operations at Waterbury Dam. GMP previously conducted winter drawdowns for hydroelectric supply. GMP's 2014 WQC requires a change to hydroelectric operations, in order to comply with the state's WQS. Under the WQC, GMP must convert the project to instantaneous run-of-river and drawdowns will no longer occur. In order to convert the project GMP was required to complete modifications, including replacement of the 24-inch bypass pipe valve with an automated valve and replacement of the turbine (VANR, 2014). This work has been completed. In addition, Vermont will work with the USACE to rehabilitate the spillway Tainter gates. Once the Tainter gate repairs are completed, GMP will convert to instantaneous run-of-river operations.

Major future actions are not anticipated in the foreseeable future at Waterbury Dam. Future actions at Waterbury Reservoir may include operation and maintenance for recreation facilities. GMP will convert to instantaneous run-of-river operations and continue operations in compliance with their WQC. No other projects will occur within the construction area during the project. No known related actions in the vicinity will contribute to the adverse effects of the project. The duration between drawdowns of the dam are sufficiently long that they can be considered separate actions and do not contribute to cumulative effects. No significant adverse cumulative impacts are expected for the project area.

5.0 ACTIONS TAKEN TO MINIMIZE IMPACTS

- The reservoir pool will be slowly drained in order to reduce sediment discharge during the initial drawdown.
- After drawdown, the reservoir pool will be maintained at a stable level (i.e. “run-of-river”) to reduce impacts to fish spawning and biological processes throughout the construction period except during high inflows from storm events.
- Run-of-river operations will be maintained downstream of the dam, except when inflows exceed outlet capacities such as during a storm run-off event.
- A Section 401 WQC will be obtained, and a water quality monitoring plan will be developed during PED to monitor impacts to temperature, dissolved oxygen, and turbidity in Little River.
- Electrofishing surveys and macroinvertebrate sampling will occur during PED (to collect baseline data) and construction to monitor impacts to fish and aquatic habitat.
- Following the drawdown, vulnerable areas on the exposed reservoir bed will be temporarily vegetated to reduce potential sediment mobilization, and its impacts to soil and water quality.
- An invasive species management plan will be developed during PED to manage invasive species that may become prevalent in wetlands after the drawdown.
- Trees and shrubs will be planted post-construction to replace any riparian vegetation lost during this project.
- The timing of the drawdown will be coordinated to minimize unnecessary impacts to hibernating amphibians and reptiles.
- An MOA will be prepared to minimize and mitigate the project’s adverse effect on the dam in consultation with VT SHPO, VT DEC, Waterbury Historical Society, and any interested Native American Tribes.
- State-level historic documentation will be completed during the PED phase of the study.
- Coordination will occur with VDFPR to determine reasonable access for recreational users; and

- Coordination will occur with VT DEC to minimize and avoid impacts to breeding loons if present during the construction period.

6.0 COORDINATION

The project was coordinated with the following federal, state, local, and tribal entities. An initial interagency coordination meeting was held on June 11, 2024, to introduce the project to federal and state agencies and obtain their initial comments. A 30-day public notice for the proposed project will be published to notify the public of the proposed project. Received comments will be incorporated into the final version of the EA.

Federal

EPA

FWS

State

VANR, VDFPR, VT DEC, VDFW

Agency of Commerce and Community Development, Vermont Division for Historic Preservation (VT SHPO)

Municipal Officials and Local Stakeholder Organizations

GMP

Waterbury Historical Society

Tribes

Narragansett Indian Tribe

Wampanoag Tribe of Gay Head (Aquinnah)

Nulhegan Abenaki Tribe

7.0 ENVIRONMENTAL COMPLIANCE

7.1. Federal Statutes

1. *Archaeological Resources Protection Act of 1979, as amended,16 U.S.C 470aa et seq.*

   Compliance: In compliance. Prior to any work being done as part of this project, the area will be surveyed for the presence of any archaeological resources.

2. *Preservation of Historic and Archeological Data Act of 1974, as amended, 54 U.S.C 312501 et seq.*

   Compliance: In compliance. Prior to any work being done as part of this project, the area will be surveyed for the presence of any archaeological resources.

3. *American Indian Religious Freedom Act of 1978, 42 U.S.C 1996.*

   Compliance: This project will not impede access by Native Americans to sacred sites, possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

4. *Clean Air Act, as amended, 42 U.S.C 7401 et seq.*

   Compliance: In compliance. Washington County, Vermont is in attainment for all six criteria pollutants. Air quality is not expected to be impacted to any measurable degree by the proposed action.

5. *Clean Water Act of 1977 (Federal Water Pollution Control Act Amendments of 1972), 33 U.S.C 1251 et seq.*

   Compliance: In compliance. A draft Section 404(b)(1) evaluation is included with this draft EA and a Section 401 WQC will be obtained from the state of Vermont.

6. *Coastal Zone Management Act of 1972, as amended, 16 U.S.C. 1451 et seq.*

   Compliance: Not applicable.

7. *Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 et seq.*

   Compliance: Pending. USACE made a NLAA determination for the NLEB and tri-colored bat. Coordination with the USFWS is on-going.

8. *Estuarine Areas Act, 16 U.S.C. 1221 et seq.*

   Compliance: Not applicable.

9. *Federal Water Project Recreation Act, as amended, 16 U.S.C. 460l-12 et seq.*

   Compliance: In compliance. Federal legislation requires that recreation and fish and wildlife enhancement be given full consideration in federal water

development projects. The project will not permanently negatively impact fish, wildlife or recreational use of the Waterbury Reservoir or Little River.

10. *Fish and Wildlife Coordination Act, as amended,16 U.S.C. 661 et seq.*

    Compliance: Pending. Coordination with the USFWS and the state wildlife agency is on-going.

11. *Land and Water Conservation Fund Act of 1965, as amended, 54 U.S.C. 200301 et seq.*

    Compliance: Public notice of availability of this report to the National Park Service and Office of Statewide Planning relative to the federal and state comprehensive outdoor recreation plans signifies compliance with this Act.

12. *Marine Protection, Research, and Sanctuaries Act of 1971, as amended, 33 U.S.C. 1401 et seq.*

    Compliance: Not applicable.

13. *National Historic Preservation Act of 1966, as amended, 54 U.S.C. 300101 et seq.*

    Compliance: Ongoing. Coordination with the VT SHPO, the Narragansett Indian Tribe, the Wampanoag Tribe of Gay Head (Aquinnah), the state-recognized Nulhegan Abenaki Tribe, and the Waterbury Historical Society along with implementation of an executed MOA with recommended stipulations to mitigate adverse impacts to historic properties signifies compliance.

14. *Native American Graves Protection & Repatriation Act (NAGPRA), 25 U.S.C 3001-3013, 18 U.S.C 1170.*

    Compliance: Regulations will be followed if discovery of human remains and/or funerary items occur during implementation of this project.

15. *National Environmental Policy Act of 1969, as amended, 42 U.S.C 4321 et seq.*

    Compliance: Preparation of an EA signifies partial compliance with NEPA. Full compliance shall be noted at the time the FONSI is issued.

16. *Rivers and Harbors Act of 1899, as amended, 33 U.S.C. 401 et seq.*

    Compliance: The project is operated pursuant to the Congressionally-approved authority and does not involve placement of fill in Section 10 waterways. Therefore, this act does not apply.

17. *Watershed Protection and Flood Prevention Act, as amended, 16 U.S.C 1001 et seq.*

    Compliance: This project is for flood risk management and thus is in compliance with this Act.

18. *Wild and Scenic Rivers Act, as amended, 16 U.S.C 1271 et seq.*

    Compliance: Not applicable.

19. *Magnuson-Stevens Act, as amended, 16 U.S.C. 1801 et seq.*

    Compliance: Not applicable.

20. *Marine Mammal Protection Act of 1972, as amended, 16 U.S.C. 1361-1407.*

    Compliance: Not applicable.

21. *Coastal Barrier Resources Act, as amended, 16 U.S.C. 3501 et seq.*

    Compliance: Not applicable.

22. *Bald and Golden Eagle Protection Act, 16 U.S.C. 688 et seq.*

    Compliance: The project does not involve take, sale, purchase, or transport of any Bald or Golden Eagles.

23. *National Invasive Species Act (NISA), as amended, 16 U.S.C. 4701 et seq.*

    Compliance: In compliance. The project will not promote or cause the introduction or spread of invasive species into waters of the United States.

24. *Comprehensive Environmental Response, Compensation and Liability Act (CERLA), as amended 42 U.S.C. 9601 et seq*.

    Compliance: Not applicable; the project does not involve the use or remediation of Superfund sites or hazardous waste.

25. *Farmland Protection Act, 16 U.S.C. 4601-12 et seq*.

    Compliance: Not applicable; the project does not involve or impact agricultural land.

7.1.1. Executive Orders

1. *EO 11593, Protection and Enhancement of the Cultural Environment, 13 May 1971.*

   Compliance: Coordination with the SHPO signifies compliance.

2. *EO 11988, Floodplain Management, 24 May 1977, amended by EO 12148, 20 July 1979.*

   Compliance: The proposed project will improve the existing flood risk reduction features of a federally authorized project. This action will not enhance the risk of flood loss or the impact of floods on human safety, health, and welfare, nor will the action degrade the natural and beneficial values served by floodplains.

3. *EO 11990, Protection of Wetlands, 24 May 1977.*

   Compliance: This project does not include construction in wetlands and preserves and enhances the value of these natural systems by managing invasive species.

4. *EO 12114, Environmental Effects Abroad of Major Federal Actions, 4 January 1979.*

   Compliance: Not applicable to projects located within the United States.

5. *EO 12898, Environmental Justice, 11 February 1994.*

   Compliance: The project is not expected to have a significant impact on minority or low-income population, or any other population in the United States.

6. *EO 13007, Accommodation of Sacred Sites, 24 May 1996.*

   Compliance: Access to and ceremonial use of Indian sacred sites by Indian religious practitioners will be allowed and accommodated. No adverse effects to the physical integrity of such sacred sites will occur.

7. *EO 13045, Protection of Children from Environmental Health Risks and Safety Risks. 21 April 1997.*

   Compliance: The project will not create a disproportionate environmental health or safety risk for children.

8. *EO 13061, and Amendments Federal Support of Community Efforts Along American Heritage Rivers, 11 September 1997, amended by EO 13093, 27 July 1998.*

   Compliance: The project is not located along an American Heritage River.

9. *EO 13112, Federal Agencies may not authorize, fund, or carry out actions likely to cause or promote the introduction or spread of invasive species, 3 February 1999 amended by EO 13751, 05 December 2016.*

   Compliance: The project will not promote or cause the introduction or spread of invasive species.

10. *EO 13175, Consultation and Coordination with Indian Tribal Governments, 6 November 2000.*

    Compliance: Consultation with Indian Tribal Governments, where applicable, and consistent with executive memoranda, Department of Defense Indian policy, and USACE Tribal Policy Principles signifies compliance.

11. *EO 13990, Protecting Public Health and the Environment and Restoring Science to tackle the Climate Crisis, 25 January 2021.*

    Compliance: The EA will include an accounting of project GHG emissions.

12. *EO 14096, Revitalizing our Nation's Commitment to Environmental Justice for All, 21 April 2023.*

    Compliance: The project will not have a disproportionate adverse effect on disadvantaged communities.

13. *EO 14008, Tackling the Climate Crisis at Home and Abroad, 27 January 2021.*

    Compliance: The EA will include an accounting of project GHG emissions; project construction will require Davis-Bacon prevailing wages; the project will not adversely affect biodiversity; and the project will not result in disproportionate impacts to disadvantaged communities.

7.1.2. Executive Memoranda

14. *Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA, 11 August 1980.*

    Not applicable. The project does not involve or include impacts to agricultural lands.

15. *White House Memorandum, Government-to-Government Relations with Indian Tribes, 29 April 1994.*

    Compliance: Consultation with Federally Recognized Indian Tribes signifies compliance.

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NEW ENGLAND DISTRICT

U.S. ARMY CORPS OF ENGINEERS, CONCORD, MA

EVALUATION OF CLEAN WATER ACT SECTION 404 (b)(1) GUIDELINES

Waterbury Dam Safety Modification Study (DSMS)

The U.S. Army Corps of Engineers (USACE), New England District proposes modifications to address the possibility of poor performance of the gated spillway section during frequent and extreme flood events at Waterbury Dam.

The project includes: a complete replacement of the two 20-ft wide Tainter gates (Gates 1 and 2) and rehabilitation of the newer 35-ft wide gate (Gate 3); a new service bridge; new hoisting equipment; appropriate electrical upgrades; repair of alkali-silica reaction degraded concrete on the spillway weirs, piers, and the training wall on the right abutment; a 100-ft concrete scour apron downstream of the gated spillway section; the development of construction access roads; and a precautionary drawdown during construction.

1. Review of Compliance (Section 230.10(a)-(d)).

	YES	NO
a. The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to or be located in the aquatic ecosystem to fulfill its basic purpose.	X	
b. The activity does not appear to: 1) violate applicable state water quality standards or effluent standards prohibited under Section 307 of the Clean Water Act (CWA); 2) jeopardize the existence of Federally listed threatened and endangered species or their habitat; and 3) violate requirements of any Federally designated marine sanctuary.	X	
c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, and economic values.	X	
d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem.	X	

1. Technical Evaluation Factors (Subparts C-F).

		N/A	Not Significant	Significant
a. Potential Impacts on Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)				
	1) Substrate		X	
	2) Suspended particulates/turbidity		X	
	3) Water column impacts		X	
	4) Current patterns and water circulation		X	
	5) Normal water fluctuations		X	
	6) Salinity gradients	X		
b. Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D)				
		N/A	**Not Significant**	**Significant**
	1) Threatened and endangered species		X	
	2) Fish, crustaceans, mollusks, and other organisms in the aquatic food web		X	
	3) Other wildlife (mammals, birds, reptiles, and amphibians)		X	
c. Potential Impacts on Special Aquatic Sites (Subpart E).				
	1) Sanctuaries and refuges	X		
	2) Wetlands		X	
	3) Mud flats	X		
	4) Vegetated shallows	X		
	5) Coral reefs	X		
	6) Riffle and pool complexes		X	
d. Potential Effects on Human Use Characteristics (Subpart F).				
	1) Municipal and private water supplies	X		
	2) Recreational and commercial fisheries		X	
	3) Water-related recreation		X	
	4) Aesthetics impacts		X	
	5) Parks, national and historic monuments, national seashores, wilderness areas, research sites and similar preserves		X	

3. Evaluation and Testing (Subpart G).

a.	The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)		
	1) Physical characteristics		X
	2) Hydrography in relation to known or anticipated sources of contaminants		
	3) Results from previous testing of the material or similar material in the vicinity of the project		
	4) Known, significant sources of persistent pesticides from land runoff or percolation		
	5) Spill records for petroleum products or designated hazardous substances (Section 311 of CWA)		
	6) Public records of significant introduction of contaminants from industries, municipalities, or other sources.		
	7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by human-induced discharge activities		
	8) Other sources (specify)		
	List appropriate references.		
		YES	**NO**
b.	An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredged material is not a carrier of contaminants or that levels of contaminants are substantively similar at extraction and disposal sites and not likely to require constraints. The material meets the testing exclusion criteria.	X	

4. Disposal Site Delineation (Section 230.11(f)).

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)		
	1) Depth of water at disposal site	
	2) Current velocity, direction, variability at disposal site	
	3) Degree of turbulence	
	4) Water column stratification	
	5) Discharge vessel speed and direction	
	6) Rate of discharge	
	7) Dredged material characteristics (constituents, amount, and type of material, settling velocities)	
	8) Number of discharges per unit of time	
	9) Other factors affecting rates and patterns of mixing (specify)	
	List appropriate references.	

	YES	NO
b. An evaluation of the appropriate information factors in 4a above indicated that the disposal sites and/or size of mixing zone are acceptable.	X	

5. Actions to Minimize Adverse Effects (Subpart H).

	YES	NO
All appropriate and practicable steps have been taken, through application of recommendation of Section 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.	X	

List actions taken

1) See Environmental Assessment Section 6.

6. Factual Determination (Section 230.11).

A review of appropriate information, as identified in Items 2 – 5 above, indicates there is minimal potential for short or long term environmental effects of the proposed discharge as related to:		
	YES	**NO**
a. Physical substrate at the disposal site (review Sections 2a, 3, 4, and 5 above)	X	
b. Water circulation fluctuation and salinity (review Sections 2a, 3, 4, and 5)	X	
c. Suspended particulates/turbidity (review Sections 2a, 3, 4 and 5)	X	
d. Contaminant availability (review Sections 2a, 3, and 4)	X	
e. Aquatic ecosystem structure, function and organisms (review Sections 2b and 2c, 3, and 5)	X	
f. Proposed disposal site (review Sections 2, 4, and 5)	X	
g. Cumulative effects on the aquatic ecosystem	X	
h. Secondary effects on the aquatic ecosystem	X	

7. Findings of Compliance or Non-compliance

	YES	**NO**
The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines.	X	

_____ _____

Date

Justin R. Pabis, P.E.
Colonel, Corps of Engineers
District Engineer

ATTACHMENT A
COORDINATION

Public and agency comments will be updated following the public notice and release of the draft environmental assessment. Attachment A will be updated to include any comments received from the agencies and the public.

ATTACHMENT B
GREENHOUSE GAS ASSESSMENT

Waterbury Dam Safety Modification Report
Greenhouse Gas Assessment

The Council on Environmental Quality (CEQ) released Interim NEPA Guidance on Consideration of Greenhouse Gas Emissions and Climate Change. This guidance recommends early consideration of greenhouse gas emissions in NEPA documents in the alternative formulation and evaluation for all current and future studies. This greenhouse gas assessment includes a quantitative analysis of greenhouse gas (GHG) emissions from the proposed Waterbury Dam risk management plan using emission factors from equipment that is likely to be used to construct the project.

Alternative 1: No Action Alterative

Under the No Action Alternative, the proposed risk management plan would not be implemented, and no modifications to Waterbury Dam would occur. There would be no operation of construction vehicles or equipment within the project site. No new emissions are expected under the implementation of the No Action Alternative.

Alternative 2: Proposed Risk Management Plan

The proposed risk management plan includes a complete replacement of the two 20-ft gates and rehabilitation of the newer 35-ft gate. The existing service bridge would be rebuilt, new hoisting equipment installed, and appropriate electrical upgrades made. The proposed plan also includes repairs of degraded concrete on the spillway weirs, piers, and the training wall on the right abutment. In addition to the gates, a 100-ft wide concrete scour apron would be installed downstream of the gated spillway sections.

Using Equation 1 below, emissions were quantified in pounds for CO_2, N_2O, and CH_4 by multiplying the proposed equipment's emissions factors by the estimated hours needed to complete the project. The South Coast Air Quality Management District (AQMD)'s Off-road Mobile Source Emission Factors were used to determine emission factors for the construction equipment and vehicles (South Coast AQMD, 2008). Results of the individual calculations are presented in Table 1 below and a summary of all emissions produced is presented in Table 2. The hours of operation per individual piece of construction equipment are based on the equipment reported in the project cost estimate.

Equation 1. Mass of Greenhouse Gas Emissions

$$CO_2 = EF_{CO_2} * hours$$
$$N_2O = EF_{N_2O} * hours$$
$$CH_4 = EF_{CH_4} * hours$$

Where:

CO_2 = the mass of Carbon Dioxide in pounds
N_2O = the mass of Nitrous Oxide in pounds
CH_4 = the mass of Methane in pounds
EF = Emission Factor in pounds per hour (South Coast AQMD, 2008)

The common unit of reported measurement of GHGs is metric tons of CO_2 equivalent ($MTCO_2e$). The CO_{2eq} was calculated for the total mass of greenhouse gas emissions in pounds using Equation 2. The total CO_{2eq} was converted from pounds to metric tons (MT) using Equation 3. In 2021, the transportation/mobile sources sector was the highest GHG contributor in Vermont with 3,240,000 MT CO_{2eq} (39.2% total emissions). The 2020 National Emissions Inventory estimated that nonroad gasoline and diesel emissions contributed 32% of total transportation emissions in Vermont (VANR, 2024). The calculated MT CO_{2eq} for the proposed project was 10,400 metric tons, which represents 0.32% of the estimated transportation/mobile sources emissions (Table 2).

Equation 2. Carbon Dioxide Equivalents

$$CO_{2eq} = X * CO_2 + Y * N_2O + LF\ x\ Z * CH_4$$

Where:

CO_{2eq} = the mass in grams, pounds, or metric tons of carbon dioxide equivalents

X = 100 Year Global Warming Potential for Carbon Dioxide = 1

Y = 100 Year Global Warming Potential for Nitrous Oxide = 298

Z = 100 Year Global Warming Potential for Methane = 25

Equation 3. Conversion of CO_{2eq} to $MTCO_{2eq}$

$$MTCO_{2eq} = lbs\ CO_{2eq} * 0.000453592$$

Table 1. Greenhouse Gas Equipment Emissions Factor Inventory

Construction Equipment List			Emissions Factors for Construction Equipment (lbs/hr)[1]			GHG Emissions from Construction Activities (lbs)			
Construction Equipment	**Power Rating (Hp)**	**Total Hours**	**CO_2**	**N_2O**	**CH_4**	**CO_2**	**N_2O**	**CH_4**	**CO_{2e}**
Telehandler	40	74	19.6128	0.1218	0.0015	1,451	9	0	4,141
Man-Lift, Straight Boom, 86’	150	3,591	212.8560	0.3660	0.0052	764,366	1,314	19	1,156,547
Man-Lift, Straight Boom, 46’	150	2,178	212.8560	0.3660	0.0052	463,600	797	11	701,464
Man-Lift, Line-Truck, 60’	450	2,175	212.8560	0.3660	0.0052	462,962	796	11	700,498
Drill, Hydraulic Track, Crawler, 73’	350	792	311.3086	0.1622	0.0064	246,556	128	5	284,955
Concrete Mixers, Stationary	5	36	6.3202	0.0461	0.0007	228	2	0	722
Cranes, Hydraulic, 102’ Boom	350	630	180.1013	0.3977	0.0077	113,464	251	5	188,254
Cranes, Hydraulic, 102’ Boom	350	121	180.1013	0.3977	0.0077	21,792	48	1	36,157
Cranes, Hydraulic, 128’ Boom	350	1,560	180.1013	0.3977	0.0077	280,958	620	12	466,153
Cranes, Mechanical, Lattice 250’ Boom	500	710	180.1013	0.3977	0.0077	127,872	282	5	212,159
Tractor, Crawler (Dozer)	250	958	166.1316	0.5348	0.0083	159,154	512	8	312,016
Tractor, Agricultural, Crawler-Rubber Track	320	50	259.2294	0.7527	0.0126	12,961	38	1	24,193
Tractor, Crawler (Dozer)	250	176	259.2294	0.7527	0.0126	45,624	132	2	85,158
Hydraulic Excavator, Crawler	100	181	73.6231	0.2638	0.0040	13,326	48	1	27,571

Construction Equipment List			Emissions Factors for Construction Equipment (lbs/hr)[1]			GHG Emissions from Construction Activities (lbs)			
Construction Equipment	**Power Rating (Hp)**	**Total Hours**	**CO_2**	**N_2O**	**CH_4**	**CO_2**	**N_2O**	**CH_4**	**CO_{2e}**
Hydraulic Excavator, Crawler	220	6,353	158.6827	0.2222	0.0085	1,008,111	1,412	37	1,429,729
Hydraulic Excavator, Crawler	300	26	233.7353	0.3091	0.0085	6,077	8	0	8,477
Hydraulic Excavator	350	150	233.7353	0.3091	0.0085	35,060	46	1	48,907
Fork Lift, Rough Terrain	25	1,155	14.6719	0.0904	0.0014	16,946	104	2	48,086
Concrete Vibrator, 2.5” w/ Generator	7.5	1,098	10.2077	0.0768	0.0010	11,208	84	1	36,366
Generator Set	150	751	141.9793	0.3291	0.0042	106,626	247	3	180,350
Grader, Motor, Articulated	300	1,536	229.4843	0.4468	0.0092	352,488	686	14	557,338
Water Truck, Tractor	175	111	125.0877	0.2376	0.0056	13,885	26	1	21,761
Concrete Pump, Boom, Truck	100	270	125.0877	0.2376	0.0056	33,774	64	2	52,932
Transit Mixer, Hydrostatic, Truck	450	597	272.3338	0.3878	0.0107	162,583	232	6	231,736
Dump Truck	485	457	272.3338	0.3878	0.0107	124,457	177	5	177,393
Dump Truck	650	324	441.7384	0.6384	0.0173	143,123	207	6	204,907
Concrete Batch Plant	168	171	106.5158	0.1729	0.0035	18,214	30	1	27,041
Pile Hammer	150	56	106.5158	0.1729	0.0035	5,965	10	0	8,856
Crew Truck	400	27,499	254.2385	0.3034	0.0071	6,991,305	8,342	196	9,482,260
Conventional Pickup Truck	250	1,854	254.2385	0.3034	0.0071	471,358	562	13	639,300
Truck	480	6,581	254.2385	0.3034	0.0071	1,673,144	1,996	47	2,269,274
Truck	420	2,120	254.2385	0.3034	0.0071	538,986	643	15	731,023
Truck	380	1,375	254.2385	0.3034	0.0071	349,578	417	10	474,130
Truck	350	132	254.2385	0.3034	0.0071	33,559	40	1	45,417
Compactor, Vibroplate	5	413	4.3138	0.0314	0.005	1,782	13	0	5,657

Construction Equipment List			Emissions Factors for Construction Equipment (lbs/hr)[1]			GHG Emissions from Construction Activities (lbs)			
Construction Equipment	**Power Rating (Hp)**	**Total Hours**	**CO_2**	**N_2O**	**CH_4**	**CO_2**	**N_2O**	**CH_4**	**CO_{2e}**
Pump, Grout, Mini, Air	25	73	19.4874	0.1512	0.0022	1,423	11	0	4,717
Pump, Water, Centrifugal	25	22,680	19.4874	0.1512	0.0022	441,973	3,430	50	1,465,407
Roller, Vibratory, Single Drum	25	179	13.3427	0.1017	0.0015	2,388	18	0	7,821
Roller, Vibratory, Padfoot Drum	60	391	58.9888	0.2647	0.0035	23,065	104	1	53,943
Roller, Vibratory, Double Drum	80	88	58.9888	0.2647	0.0035	5,191	23	0	12,141
Tractor, Agricultural, Wheel	55	50	51.7280	0.1761	0.0025	2,586	9	0	5,213
Loader/Backhoe, Wheel	220	168	171.7370	0.2157	0.0057	28,852	36	1	39,675
Loader, Front End, Wheel	220	1,486	171.7370	0.2157	0.0057	255,201	321	8	350,936
Loader, Front End, Wheel	400	218	344.8535	0.4127	0.0114	75,178	90	2	102,054
Welder, Engine Driven	5	159	6.2074	0.0468	0.0007	987	7	0	3,207
					TOTAL	15,649	24,376	507	22,930,000

Table 2. Summary of Total Greenhouse Gas Emissions for Construction

GHG Emissions in Pounds (lbs)				
CO_2	**N_2O**	**CH_4**	**CO_{2e}**	**$MTCO_{2e}$**
15,649,389	24,376	507	22,926,141	10,399.11

References

South Coast Air Quality Management District (South Coast AQMD). 2008. Off-road Mobile Source Emission Factors (Scenario Years 2007 – 2025). https://www.aqmd.gov/home/rules-compliance/ceqa/air-quality-analysis-handbook/off-road-mobile-source-emission-factors

Vermont Agency of Natural Resources (VANR). 2024. Vermont Greenhouse Gas Emissions Inventory and Forecast: 1990-2021.