Dam Safety Inspection Report

Dam Safety Program
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Name: **Nichols Pond**
State ID: **252.01** NID ID: **VT00184**
Hazard Class: **High Hazard Potential**

Town: **Woodbury**
Watershed: **Lamoille River**
Stream: **Nichols Brook**

Inspection Details

Inspection date: 06/28/2023 09:30

Inspection type: Periodic **Weather:** Cloudy, Recent Rainfall, 66F

Inspected by: Hannah Kuleba, Andrew Sampsell

Dam Safety Recommendations

The following recommendations and remedial measures describe the recommended approach to address current deficiencies at the dam. Maintenance level activities can be performed by the Owner, while Studies and Analyses and Remedial Repair Recommendations will require the services of a qualified professional engineer registered in the State of Vermont who is experienced in dam safety engineering design, permitting, and construction. Remedial repairs will likely require obtaining a Dam Order from the Dam Safety Program.

Overall dam condition:

☐ Satisfactory ☑ Fair ☐ Poor ☐ Unsatisfactory ☐ Not Rated

**See General Information section at the end of report for further details*

Maintenance level recommendations	
General	• Perform an update to the Emergency Action Plan at least every other year and provide the updates to all key contacts. • On a regular basis and following the application of unusual or extreme loading conditions, perform monitoring of the dam and its appurtenances. Report any unsafe condition to the Dam Safety Program.
General embankment	• Establish and maintain vegetation clearing limits a minimum of 15 feet from all portions of the dam. Annually cut and remove grass, weeds, brush, and woody vegetation (but leave stumps) from the dam crest, upstream and downstream slopes, abutments, and downstream areas to near ground surface
Crest area	• Fill ruts, depressions, and or puddles on the dam crest with compacted granular fill to match surrounding grades. Topsoil, seed, and mulch to establish grass cover.
Downstream slope area	• Regularly monitor seepage, leakage, and/or wet areas for changes in flow, turbidity, or size.
Upstream Wall	• Monitor and repair concrete cracking and deterioration.

Maintenance level recommendations	
Spillways	• Monitor and maintain the principal and/or auxiliary spillway free of debris to ensure free-flow conditions.
Low-level outlets	• Tests operate the low-level outlet annually to maintain operability and check leakage.

Studies and analysis	
Hydrology and hydraulics/hazard classification	• Perform updated hydrologic and hydraulic analyses of the dam to determine hydraulic adequacy. • Identify alternatives to make the dam hydraulically adequate or capable of safely being overtopped during the Inflow Design Flood.
Low-level outlets	• Evaluate the condition of the low-level outlet and make modifications needed to make it operable and reliable.
Operation and maintenance	• Develop an Operations and Maintenance Manual for the dam and provide a copy to the Dam Safety Program for record keeping purposes.

Remedial repair recommendations
• Based on the studies and analysis recommended above, repair, rehabilitate, or replace the dam to bring it into compliance with current dam safety rules and guidance. Alternatively, consider pursuing dam removal.

Dam Information

Type: Earth, Concrete, Masonry **Purpose:** Recreation, Other	**Status:** In Service **Height:** 18 ft **Length:** 200 ft	**Construction date:** 1900 **Foundation conditions:** Glacial till
Owner/Contact/Operator: Mike Sullivan at Hardwick Electric Department *email:* Msullivan@hardwickelectric.com *phone:* (802) 472-5201		
Normal storage: 2425 ac-ft	**Max storage:** 2,841 ac-ft	Dam has capability to impound **more than** 500k cubic feet (11.48 ac-ft)
Normal surface area: 167 ac	**Drainage area:** 4.56 sq mi	**Max surface area:** Not Calculated

Dam Information

Pool elevation during inspection: 7” above principal spillway	**Tailwater elevation during inspection:** Normal, no backwater on spillway discharge.	**Normal pool elevation:** El. 1,128.6 (NGVD29)
Dam **has not** been breached or overtopped.		
Dam **does not** have public road on crest.	Dam **does not** have public bridge.	Dam **does not** have associated dike.
Reservoir shape: Polygon	**Reservoir average depth (ft):** Unknown	**Reservoir observations:** None
Shoreline development: ☐ Undeveloped ☑ Semi-developed ☐ Developed ☐ Unknown		
Reservoir slopes: ☐ Mild ☑ Moderate ☐ Steep ☐ Unknown		
Inspection history: The dam was last inspected in 2021 and rated in FAIR condition. It was noted in that report that the physical condition of the dam is considered good but due to the hydraulic inadequacy, the overall condition of the dam is considered FAIR.		
Notes:		

Access road to dam	
Type: Maintained gravel road	**Road name:** Nichols Pond Dam Rd
Seasonal access: ☐ Plowed winter ☐ Sanded winter ☐ Maintained in mud season ☐ Passable in all weather conditions ☐ Need high clearance vehicle ☑ Unknown, likely challenging access during winter and spring mud season conditions.	
Access of emergency/construction equipment: Fair	
Action required: ☐ None ☑ Monitor ☐ Maintenance ☐ Engineer	

Security	
Device type(s): None observed	Dam **has** sign of vandalism, trespass, or unauthorized operation. **Description:** Campfires on dam crest
Action required: ☐ None ☑ Monitor ☑ Maintenance ☐ Engineer	

Public/Inspection team safety at dam	
Confined space entry required: Inspection of LLO pipe and gate.	Fall protection required: No

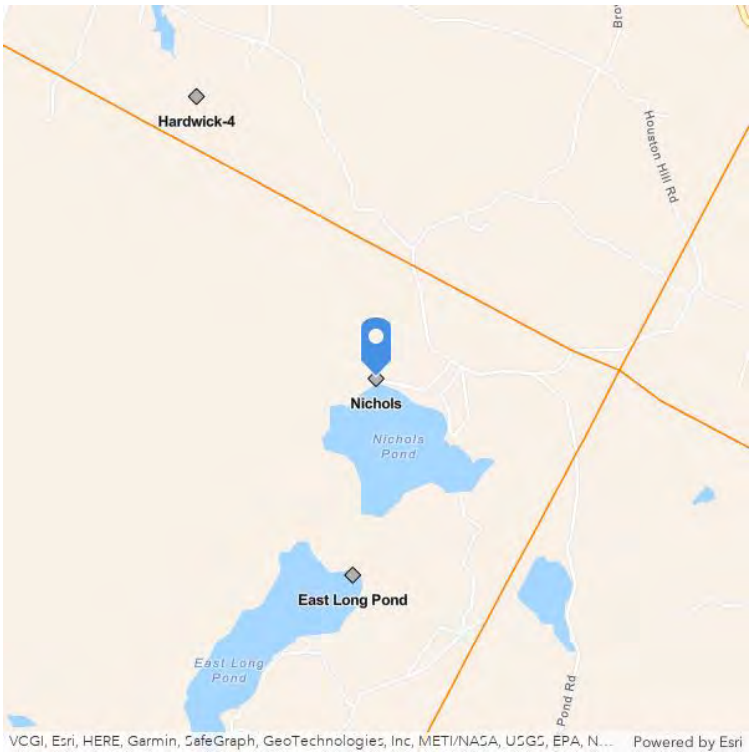
Public/Inspection team safety at dam	
Other safety required: No	Public safety consideration: Railings along spillway training walls may be advised.
Action required: ☑ None ☐ Monitor ☐ Maintenance ☐ Engineer	

Dam Description/Background

Nichols Pond Dam is a combination earth, masonry, and reinforced concrete dam with a concrete upstream face/cutoff wall, earthen embankment, principal spillway, and gated low-level outlet (LLO) works. The dam is currently classified as a HIGH hazard potential. According to file information, the dam is about 200 feet long and 18 feet high. The upstream face consists of a reinforced concrete cutoff wall backed by an earthen embankment with a rock lined downstream slope. The dam crest is approximately El. 1,131.7 (National Geodetic Vertical Datum of 1929 (NGVD29)).

The principal spillway is a broad crested weir that is 30 feet wide at the entrance and transitions to 15 feet wide at the outlet with a weir crest of El. 1,129.1. A 9-foot-wide by 0.5-foot low flow channel is located at the center of the weir at El. 1,128.6. The principal spillway channel drops approximately 16 feet to the discharge channel below. The LLO consists of a 42-inch steel pipe controlled by a timber slide gate with a timber trash track centered under the principal spillway channel. The “invert in” of the LLO is El. 1,114.2. The drainage area of the dam is 4.56 square miles, which includes the drainage area of East Long Pond located upstream. Nichols Pond at normal pool is approximately 167 acres and the normal and maximum storage capacity of the dam are approximately 2,425 acre-feet and 2,840 acre-feet, respectively. The dam was formerly used to store water for hydropower use but is now used solely for recreation. The dam was originally constructed circa 1900 with major repairs in 2004 to stabilize a failing downstream masonry wall and in 2009 to reconstruct the spillway and LLO. The dam is the middle in a series of three HIGH hazard potential dams that include East Long Pond Dam upstream and Mackville Dam downstream, all of which are located upstream of the Town of Hardwick.

Dam Location



Emergency Action Plan

EAP **on** file **EAP date:** May 31, 2016

As this is a HIGH Hazard dam, an up-to-date EAP with dam failure flood hazard inundation map is required.

Has the EAP been exercised? ☐ Yes ☑ No

What issues are present with the EAP?	**Action**
☐ None ☑ Revisions required ☐ Not approved ☐ No plan available ☐ Inundation study required ☐ Format out of date ☐ Under review	☐ None ☐ Monitor ☑ Maintenance ☐ Engineer

Operation & Maintenance Manual

O&M Manual **not on** file	
Accessibility to outlets or low-level outlet (LLO): Fair	**Frequency of outlet or LLO discharge:** Unknown
Frequency of mowing: Annual	**Seasonal drawdown?** ☐ Yes ☑ No
Frequency of dam owner surveillance: Unknown	**Owner surveillance during storm events:** ☐ Yes ☑ No
Operating problems since last inspection: Unknown	**History of repairs since last inspection:** Unknown

Downstream Hazard Classification

Current classification: High Hazard Potential
Current classification appears appropriate, and an inundation map was used to determine the classification. There appears to be **no** significant changes in land use or habitation since the last inspection.

Hydrologic/Hydraulic Data

Since Nichols Pond Dam is a HIGH hazard potential dam, the inflow design flood (IDF) is considered Probable Maximum Flood (PMF) event according to Federal Guidance currently used in the State of Vermont. Based on file review, the most recent hydrologic and hydraulic assessment of the dam was performed by Dubois & King, Inc. (D&K) in 2012. As part of this work, D&K confirmed the elevations of key hydraulic features at the dam (NGVD29, as noted above):

- o Principal Spillway Weir/Normal Pool (low flow): El. 1,128.6
- o Principal Spillway Weir El. 1,129.1
- o Dam Crest: El. 1,131.7

Storm Event	Inflow (cfs)	Outflow (cfs)	Peak WS El.	Freeboard (+) or Overtopping (-)
100-year	539	117	1,130.4	1.3
½ PMF	4,489	2,210	1,130.0	-2.3
PMF	15,764	8,936	1,139.3	-7.6

Based on the above results, the dam has approximately 3.1 feet of freeboard to the lowest portion of the dam crest under normal pool conditions, which is in compliance with the allowable freeboard threshold (3 feet) according to State requirements. However, the dam overtops during the IDF and does not appear to include armoring provisions to prevent erosion and scour of the embankment under these conditions. Since the dam cannot safely pass the IDF without overtopping, the dam is considered hydraulically inadequate.

Upstream Slope

Not applicable, see upstream wall below.

Crest

Length: 230 ft **Width:** 30 ft

Freeboard:

Principal spillway to crest: 3.33 ft	Principal spillway to auxiliary spillway: 0.5 ft	Auxiliary spillway to crest: 2.67 ft

Additional comments: Depressions where water can puddle.

Crest issues	Action
Other Erosion from foot traffic, evidence of past campfires.	☐ None ☐ Monitor ☑ Maintenance ☐ Engineer

Crest images

Downstream Slope

General slope inclination: 2H:1V (slopes **are not** within generally accepted stable inclinations). Downstream slope appears stable based on visual observation under current loading conditions.

There **are** isolated areas where the slope is over steepened (1.5H:1V).

Visual comments: Slope is covered with heavy riprap that appears stable.	Additional comments: Presence of vegetation prevented a thorough inspection.

Downstream slope protections				Action
Riprap Average diameter: ☐ Type A (18"-30") ☑ Type B (12"-24") ☐ Type C (6"-18") ☐ Type D (3"-12") Condition: ☑ Adequate ☐ Displaced ☐ Vegetation present ☐ Sparse ☐ Weathered ☐ Unraveled Comments:				☑ None ☐ Monitor ☐ Maintenance ☐ Engineer
Vegetation Condition: ☐ Adequate ☐ Bare ☑ Too tall ☐ Improper ☐ Sparse ☐ Too short Comments:				☐ None ☐ Monitor ☑ Maintenance ☐ Engineer

Downstream slope issues	Action
Trees Quantity: Few DBH: Varies Location: No trees located on downstream slope, but some are located within 15 feet of toe of dam.	☐ None ☐ Monitor ☑ Maintenance ☐ Engineer
Brush Coverage: Medium Dense Location: Entire Surface	☐ None ☐ Monitor ☑ Maintenance ☐ Engineer
Standing water/Saturated soil Location: Right End, Toe	☐ None ☑ Monitor ☐ Maintenance ☐ Engineer

Seepage Collection Systems	Number
Toe drains	2

Toe drains					
Tag: Left					
Flow rate:	Unknown	Measure method:	Not measured due to backwater condition.	Location:	Rock lined channel at the end of the concrete walls,

Toe drains					
Tag: Left					
					left downstream
Action required: ☐ None ☑ Monitor ☐ Maintenance ☐ Engineer					
Comments: 4-inch drain, iron staining visible in invert of pipe					
Tag: Right					
Flow rate:	Unknown	Measure method:	Not measured due to backwater condition.	Location:	Rock lined channel at the end of the concrete walls, right downstream
Action required: ☐ None ☑ Monitor ☐ Maintenance ☐ Engineer					
Comments: 4-inch drain, iron staining visible in invert of pipe					

Downstream slope images

Downstream slope images

Instrumentation

No instrumentation found

Principal Spillway

Spillway type: Weir	**Primary material:** Concrete	**Weir:** Broad-Crested
Spillway location: Center of dam		
Water level measured against principal spillway crest: 7” above	**Erosion control structures**: End Sill, Rock-Lined Channel	

Spillway components:

☐ Anti-vortex plate	☐ Filter Diaphragm	☐ Training Walls
☐ Flashboard	☐ Trashrack	☑ Other: Safety rack

Additional comments: Consider replacing the safety rack at the downstream end of the spillway with one with a larger grid opening size to reduce potential for debris getting caught on it.

Principal spillway issues	Action
No principal spillway issues were observed during inspection	None

Principal spillway drains	Number
No drains were observed during inspection	None

Principal spillway images

Auxiliary Spillway

Spillway type: Weir	**Primary material:** Concrete	**Weir:** Broad-Crested
Spillway location: Center of dam		
Water level measured against auxiliary crest: 1”		**Erosion control structures**: End Sill, Rock-Lined Channel
Spillway components:		
☐ Anti-vortex plate	☐ Filter Diaphragm	☑ Training Walls
☐ Flashboard	☐ Trashrack	☑ Other: Safety Rack
Additional comments: Auxiliary spillway consists of raised concrete (6 inches higher) to either side of principal spillway center channel/weir.		**Number of auxiliary spillways:** 1

Auxiliary spillway issues	Action
No auxiliary spillway issues were observed during inspection	None

Auxiliary Spillway Drains	Number
No drains were observed during inspection	None

Auxiliary spillway images

Outlets

Number of outlets: **1**

Face mounted slide gate	
Elevation: Near base/foundation of dam	**Location:** Center of dam
Drain size and configuration: Slide gate, discharges into pipe that is 42” diameter steel	**Access:** Operation requires access into principal/auxiliary spillway. The operability of the outlet is considered unknown.
Additional comments: Outlet **was not** operated during inspection.	

Outlet issues	**Action**
Leakage: Outlet was not inspected due to spillway activation. Previous 2021 inspection indicated leakage was observed.	☐ None ☑ Monitor ☐ Maintenance ☐ Engineer

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Outlet images

Outlet images

Note: 42” steel outlet conduit hidden by spillway discharge.

Upstream Wall

Wall type: Concrete
Length: 230 ft

Wall height (exposed):	**Horizontal wall alignment:**	**Vertical wall alignment:**
11 ft	Satisfactory	Satisfactory

Unusual wall movement: ☐ Yes ☑ No

Additional comments: At right abutment there is an eroded foot path.	**Surface condition:** Fair condition, minor hairline cracking and efflorescence, concrete sprawling, exposed aggregate
Joint condition: Satisfactory	**Abutment contact condition:** Satisfactory

Upstream wall issues	Action
Other: Concrete erosion on left wall where joint has section loss and rebar is exposed.	☐ None ☐ Monitor ☑Maintenance ☐ Engineer

Upstream Wall Photos	Action

GENERAL INFORMATION

Website: https://dec.vermont.gov/water-investment/dam-safety

The Dam Safety Program conducts periodic safety inspections of non-federal, non-power dams to determine their condition and the extent to which they pose a potential or actual threat to life, property, and the environment. The condition rating reported herein was based on available data and visual inspection. Detailed investigations/analyses were beyond the scope of this report. It should be realized that the reported condition was based on observations of field conditions at the time of inspection, along with data available to the inspection team. The condition of the dam depends on numerous and constantly changing internal and external conditions and is evolutionary in nature. It would be incorrect to assume that the reported condition of the dam will continue to represent the condition of the dam in the future. Only through continued care and inspection can there be any chance that unsafe conditions are detected.

Hazard Potential Classifications:

HIGH: Dams where failure or mis-operation will probably cause loss of human life.
SIGNIFICANT: Dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
LOW: Dams where failure or mis-operation results in no probable loss of human life and low economic and environmental losses.
MINIMAL: A dam that meets the LOW hazard definition, above, but is only capable of impounding less than 500,000 cubic feet.

Condition Ratings:

SATISFACTORY: No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions (static, hydrologic, seismic) in accordance with the applicable regulatory criteria or tolerable risk guidelines.
FAIR: No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range to take further action.
POOR: A dam safety deficiency is recognized for loading conditions which may realistically occur. Remedial action is necessary. POOR may also be used when uncertainties exist as to critical analysis parameters which identify a potential dam safety deficiency. Further investigations and studies are necessary.
UNSATISFACTORY: A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.
NOT RATED: The dam has not been inspected, is not under state jurisdiction, or has been inspected but, for whatever reason, has not been rated.

Definitions:

Upstream: The side of the dam that borders the impoundment located up gradient of the dam.
Downstream: The side of the dam opposite the upstream side, located down gradient of the dam.
Right: The area to the right when looking in the downstream direction (also known as “river right”).
Left: The area to the left when looking in the downstream direction (also known as “river left”).
Structural Height-of-Dam: The vertical distance from the lowest point in the stream bed or native ground surface at the downstream toe of the dam to the elevation of the lowest non-overflow section of the dam crest.
Embankment: An artificially constructed feature usually consisting of earth and rock with sloping sides and a flat crest, intended to provide a permanent barrier that impounds or is capable of impounding water.
Dam Crest: The top of the non-overflow portion of the dam.
Abutment: The part of a valley side against which a dam is constructed. An artificial abutment is sometimes constructed at the interface with a concrete gravity section.
Normal Pool: The water elevation, reservoir surface area, and reservoir storage capacity that is prevalent at the site or typical under normal, non-storm conditions. Typically, this level is controlled by the principal spillway.

Maximum Pool: The highest water elevation, reservoir surface area, and reservoir storage capacity that could be impounded by the dam, including accumulated sediments, with the water or liquid level at the top of the lowest non-overflow part of the structure or dam crest.
Principal spillway: A structure that maintains normal pool conditions and over which daily non-storm related and flood flows are discharged. Also called a primary or service spillway.
Auxiliary Spillway: The secondary spillway not in use under normal conditions but used when needed to pass flood flows that exceed the capacity of the principal spillway.
Low-level outlet or "LLO": An installed pipe and operable gate or valve typically located in or near the foundation of a dam that can be used to alter water levels, drain the reservoir, or otherwise meet operational or safety needs. Also called a pond drain.
Inflow Design Flood or "IDF": The storm event in which the hydraulic capacity of the spillway structure and dam is designed and required to safely pass. Dam safety rules under development are considering the following prescriptive iDF's, Low and Minimal = 100-year Storm, Significant = 1,000-year storm, High = PMF. The use of incremental consequence analysis or risk-informed decision making to evaluate the potential of selecting a smaller/site specific IDF is permitted.
Emergency Action Plan (EAP): A written plan that identifies the area that would likely be inundated by the failure of a dam and identifies the actions that should be taken by the Owner to protect life, property, lifelines, and the environment in the event of a dam failure or threatening condition at the dam. The plan is usually implemented in cooperation with the local, regional, and state emergency personnel.
Operation and Maintenance Plan or "O&M": A plan that provides guidelines for the necessary, regular operation and maintenance activities at a dam.

Complete list of definitions from the Vermont Dam Safety Rule:
https://anrweb.vt.gov/DEC/IronPIG/DownloadFile.aspx?DID=185352&DVID=0