VERMONT

Vermont Department of Environmental Conservation *Agency of Natural Resources*
Water Investment Division
1 National Life Drive, Davis 3
Montpelier, VT 05620
Phone: 802-622-4093

MEMORANDUM

TO:	Department of Fish and Wildlife – Dam Owner Commissioner Christophere Herrick
CC:	Marie Caduto – Springfield District Stewardship Team – Project Manager
FROM:	Andrew Sampsell, PE - Dam Safety Program - Engineer
DATE:	February 8, 2024
SUBJECT:	Risk Reduction Measures Prison Pond Dam, Windsor, Vermont State ID No. 248.07 National ID No. VT00363

Introduction:

This memo was written in response to risk reduction measures recommended by the dam safety program (DSP) following the 2023 periodic inspection of Prison Pond Dam. The Department of Fish and Wildlife (DFW) reached out to the DSP through Marie Caduto of the Springfield District Stewardship Team to discuss potential methods for implementing the interim risk reduction measures until a larger project to permanently address the dam safety deficiencies at the dam can be implemented.

It is intended that this memo and its attachments be used by the dam owner or the dam owner's representative to build consensus among stakeholders (internal and external) to execute the interim risk reduction project. The DSP will remain available to assist with the technical engineering elements. Ultimately after consensus has been achieved, and necessary approvals obtained, a contractor will need to be hired to perform the work. The DSP will remain available to provide technical oversight of the contractor's work during construction.

The memo considers several potential risk reduction measures. The recommended solution involves lowering the water level of the impoundment by 2.4 feet by cutting a notch in the left side of the existing spillway approximately 6.3 feet wide. The recommended project also involves removal of trees and brush from the embankment so that the dam can be properly monitored during and post implementation of the risk reduction measure. If conditions are observed to worsen, additional risk reduction measures may become necessary.

Attached to this memorandum are the following supporting documents.

- ***Attachment A***: Risk Reduction Figures/Sketches
- ***Attachment B***: Simplified Dam Failure Flood Inundation Maps
- ***Attachment C***: Select References from Draft 2022 DuBois & King, Inc. / GEODesign, Inc. Engineering Report
- ***Attachment D***: 2023 Dam Safety Program Periodic Inspection Report

Background:
Prison Pond Dam is a composite concrete, stone masonry, and earth fill dam. File records indicate that the dam was originally constructed around 1925, and underwent reconstruction in 1950, and 1989. The dam includes a concrete crest wall, concrete ogee shaped spillway, and reportedly two outlet pipes (low-level-outlet/pond drain, and water supply) whose exact configurations are not known. The overall length and maximum height of the dam are 154 feet and 18 feet respectively. The dam is currently rated as SIGNIFICANT hazard potential based on dam failure analysis performed in 2008, which determined that failure of the dam would result in the loss of the water supply for a former prison's fire suppression system, as well as overtopping of a few local roads. The normal and maximum storage volumes are approximately 6.3 acre-ft and 8.7 acre-ft, respectively. The contributing drainage area to the impoundment is approximately 0.32 square miles (205 acres).

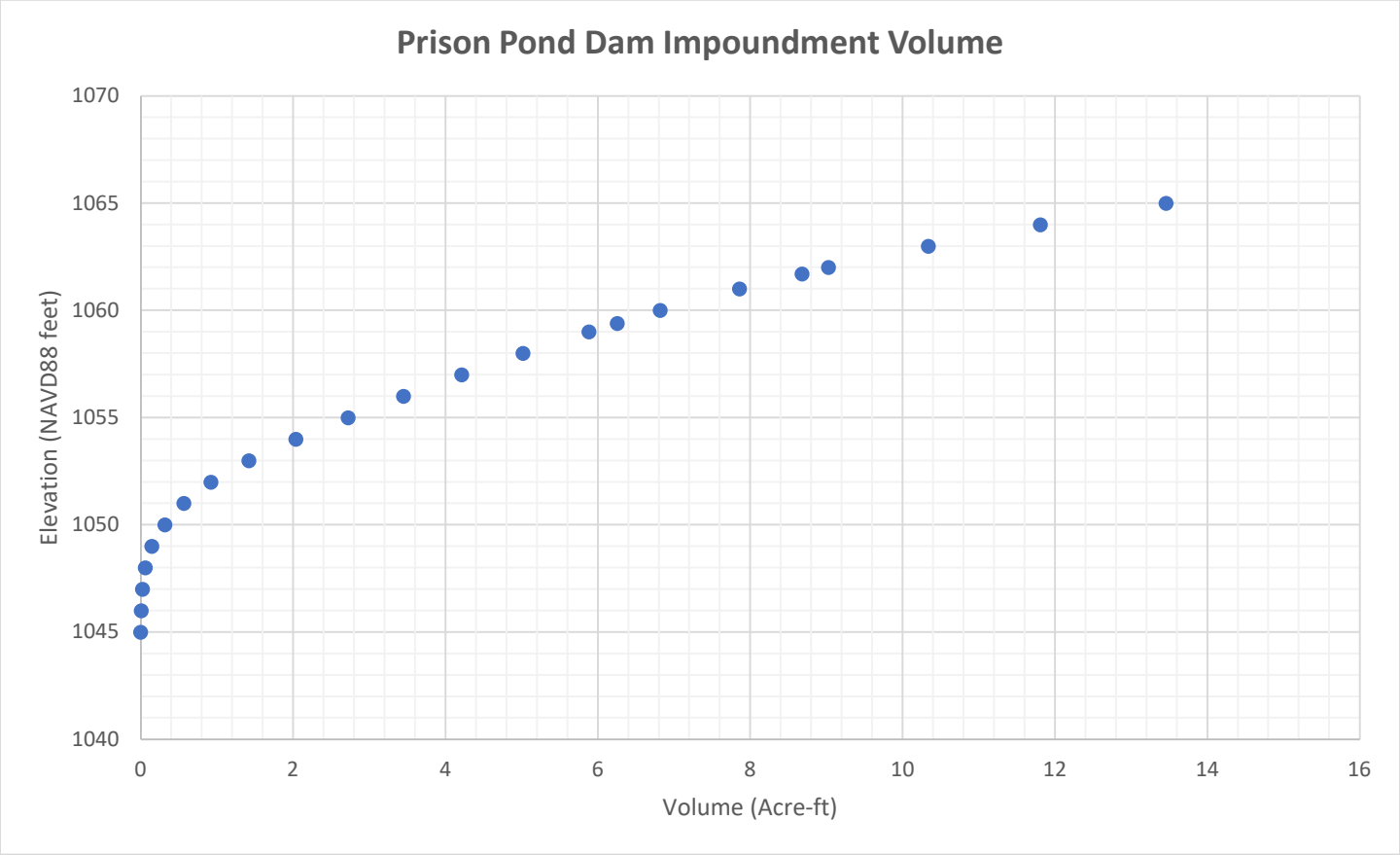
On August 3, 2023 the DSP performed a periodic inspection of Prison Pond Dam following the July 2023 flood event and found the dam to be in UNSATISFACTORY condition (previously rated POOR in 2006 and 2022). The change in condition rating was made largely based on the deteriorated condition of the concrete crest wall and concrete spillway. The deterioration of the concrete crest wall was found to have progressed to the point at which the leakage through the concrete crest wall under normal conditions had become excessive and was resulting in a slow progressive erosion of the downstream embankment slope. The DSP recommended to the DFW in the inspection report that the water level of the impoundment be lowered as an interim risk reduction measure until a project can be executed to either bring the dam into compliance with dam safety standards or be removed.

Risk Reduction Target:
The DSP utilized survey and engineering information from a 2022 draft engineering alternatives analysis performed by DuBois & King, Inc. and GeoDesign, Inc. to develop a recommended water level to provide temporary risk reduction. The analysis provided the following elevation-storage information.

Table 1

	Elevation (NAVD88 feet)	Storage Volume (acre-feet)
Dam Crest	1,061.7	8.7
Spillway Crest	1,059.4	6.3
Low Level Outlet Pipe	Unknown	Unknown
Water Supply Pipe	Unknown	Unknown
Bottom of Pond	1,045.0	0

Figure 1



The elevation storage information was then input into a simplified dam failure model (DSS-WISE Lite) which allows the user to simulate the potential consequences of a dam failure based on geometric inputs of the dam including elevation-storage information. This allowed the DSP to iteratively simulate dam failure at reduced normal water levels until arriving at a water level that resulted in notably less impacts to downstream infrastructure. By extension this will presumably mean less impacts to the environment as well. The analysis was performed based on assuming a conservative sudden/rapid failure of the dam under normal "Sunny Day" conditions which excluded any consideration for flood inflows to the dam or inflows from tributary streams below the dam. Bridges and culverts downstream of the dam were not directly modeled due to the limitations of DSS-WISE Lite, and instead were represented by inputting a stream channel through downstream roadway embankments which matched the width of the bridge/culvert opening. This method does not allow of bridge/culvert decks to be accounted for.

The following tables compare the effectiveness of various lowered water levels in reference to potential dam failure impacts. Inundation maps depicting the dam failure flooding extent at the tested water levels are included in **Attachment B**.

Table 2

	Pond Surface Area (acres)	Storage Volume (acre-ft)
Current Normal Pool (El. 1,059.4)	0.89	6.3
1.4 ft lower Pool (El. 1,058.0)	0.83	5.0
2.4 ft lower Pool (El. 1,057.0)	0.78	4.2
3.4 ft lower Pool (El. 1,056.0)	0.75	3.5

Surface area and storage volumes determined using 2022 D&K engineering study data.

Table 3

Stream Crossing Structure		No Water Level Lowering		1.4 feet lower		2.4 feet lower		3.4 feet lower	
		Depth* (feet)	Velocity (ft/s)	Depth (feet)	Velocity (ft/s)	Depth (feet)	Velocity (ft/s)	Depth (feet)	Velocity (ft/s)
Pond Road	24-inch diameter CMP culvert	2.9	16.3	1.9	13.6	1.5	12	1.1	10.4
Marton Road	68-inch diameter CMP culvert	0.2	2	0	0	0	0	0	0
2505 County Road Private Driveway**	assumed 72-inch diameter CMP culvert	0.6	4.3	0	0	0	0	0	0

*Depths and velocities correspond to road/driveway overtopping.
**Culvert for private driveway was not listed on VT culverts database, and assumption was made based on upstream and downstream culvert sizes.

Table 4

	No Water Level Lowering	1.4 feet lower	2.4 feet lower	3.4 feet lower
Nighttime Population at Risk (PAR)	10	10	9	8
Daytime Population at Risk (PAR)	6	6	6	6

PAR is defined as the estimated number of people occupying the area inundated due to dam failure prior to the issuance of any warning or evacuation. DSS-WISE Lite automatically calculates this number based on the overlap of the inundation area on census block data. Numbers are based on the full extent of the downstream flood routing which includes from the dam down to confluence of Hubbard Brook with the Connecticut River.

In addition to considering potential downstream impacts the DSP also investigated the discharge capacity required to reasonably limit the frequency the water level could rise to the current normal pool elevation. The current normal pool elevation results in leakage through the concrete crest wall and subsequent embankment erosion. According to the draft 2022 engineering analysis work the peak inflow to the pond is the following.

Table 5

Recurrence Interval, Annual Exceedance Probability	Peak Inflow (cfs)
2-year, 50%	31.3
10-year, 10%	78.0
50-year, 2%	137.8
100-year, 1%	166.7
500-year, 0.2%	250.5
1000-year, 0.1%	292.6

If the whole length of the existing spillway weir was lowered (length = 16.7 ft, assuming discharge coefficient C = 2.7).

Table 6

	Discharge Capacity at Current Normal Pool (El. 1,059.4)
1.4-foot Water Level Reduction	75 cfs
2.4-foot Water Level Reduction	168 cfs
3.4-foot Water Level Reduction	282 cfs

The above table suggests that lowering the entire length of the weir is not necessary, and that a small section can be lowered.

If just the 6-ft 3-inches wide left side of the existing spillway crest is lowered (assuming discharge coefficient C = 2.7).

Table 7

	Discharge Capacity at Current Normal Pool (El. 1,059.4)
1.4-foot Water Level Reduction	28 cfs
2.4-foot Water Level Reduction	63 cfs
3.4-foot Water Level Reduction	106 cfs

Recommendation:
Based on the above results, the DSP recommends lowering the 6-ft-3-inch-wide left side of the existing spillway crest by 2.4 feet through saw cutting and careful removal of concrete. **Attachment A** includes figures which can be used to discuss, permit, and implement these risk reduction measures.

According to the analysis, this recommended risk reduction measure results in both Marton Road and the downstream private driveway no longer being overtopped in the event of a sudden dam failure and decreases the frequency of the water level rising to existing pool levels to between a 2 to 10-yr recurrence interval flood event. It will also lessen the normal loading conditions on the dam, as well as reduce the rate of deterioration from leakage and freeze-thaw damage. Due to the proximity of Pond Road to the dam, it appears that anything short of a near full drawdown will not prevent Pond Road from being overtopped. The operability of the existing outlet pipes at the dam is unknown (assumed not operable, and unsafe to operate without further investigation). A pump/siphon system will need to be

brought in to temporarily lower the water level 1 to 2 feet below the invert of the proposed lower spillway crest while the work is being performed. Fall protection equipment will be required in order to safely perform the concrete removal work along the spillway crest. The work should be performed under supervision of an engineer. The engineer will be able to advise the contractor on any changes required based on the encountered conditions. In order to adequately monitor the condition and performance of the dam during/following the implementation of the risk reduction measures, all brush and trees should be cut within 15 feet of the dam footprint in accordance with recommendations from the most recent 2023 inspection report.

Other Considerations:

The following additional water level lowering options were considered but ultimately not recommended due to the number of unknowns, complexity, and potential regulatory challenges. Although, it should be noted that a full drawdown and uncovering/investigating the waterline and low-level-outlet would be valuable in terms of informing work required in a future dam removal or rehabilitation project.

Locate, inspect, and utilize former low-level outlet.

- The outlet is described in past reports as being a 15-to-18-inch diameter pond drain with a slide gate although there is some conflicting information between reports.
- The location of the outlet is unknown/buried. The location/configuration of this outlet would need to be determined before operating. This will likely require a full drawdown of the impoundment to uncover the upstream gate and inspect. Once uncovered, the gate could be opened, and a remote camera/video inspection performed to determine the condition of the pipe and where it goes. The downstream end of the outlet could then located/uncovered.
- The inlet of the outlet may be silted in and require dredging.
- The operability of the low-level-outlet gate is unknown, the fact that the valve stem has been welded in place and not operated for many years suggests that it is likely no longer operable.

Locate, inspect, and utilize former water supply/fire suppression pipe.

- Pipe is described in past inspection reports as being 8-inches in diameter.
- The location of the pipe is unknown/buried.
- The inlet of the pipe may be silted in and require a full drawdown to uncover inlet and de-silt.
- It is unknown if the valve stem located on the dam's spillway crest which has been welded in place, is connected to this waterline, and requires opening. If it is connected to the waterline then it would be assumed to be welded in the open position, otherwise the fire suppression system would not work.
- One of the downstream valves/hydrants could be tested to determine if the pipe is pressurized. The draft 2022 report by D&K and GeoDesign includes a sketch of the system overlaid on an orthographic photo (see **Attachment C**). The dam was formerly owned by BGS, so BGS may know more information about the condition of this system and how it can be operated.
- Alternatively, if the pipe can be located/exposed in the vicinity of the dam, a wet tap could be installed to test if the pipe is pressurized. If determined to be pressured, the impoundment could be released in a controlled manner using the tap. Once drained the pipe could be cut such that the pond would not store water except for when the inflow exceeded the discharge capacity of the pipe.

Irrespective of the selected approach, it is advisable to check with the current owner of the former correctional facility building to confirm that prison pond is no longer needed for the fire suppression system.

Permitting Considerations:
It is recommended the dam owner perform outreach to applicable Federal, State, and Local permitting entities prior to performing the recommended risk reduction measures. The following is a non-exhaustive list of regulatory entities that may need to be consulted in order to get permission to perform this work.

Federal

- US Army Corps of Engineers

State

- Dam Safety
- Wetlands
- Rivers
- Flow Protection
- Lakes & Ponds
- Fish & Wildlife
- Historic Preservation

Local

- Town of Windsor Planning/Zoning

Attachment A

Risk Reduction Figures/Sketches

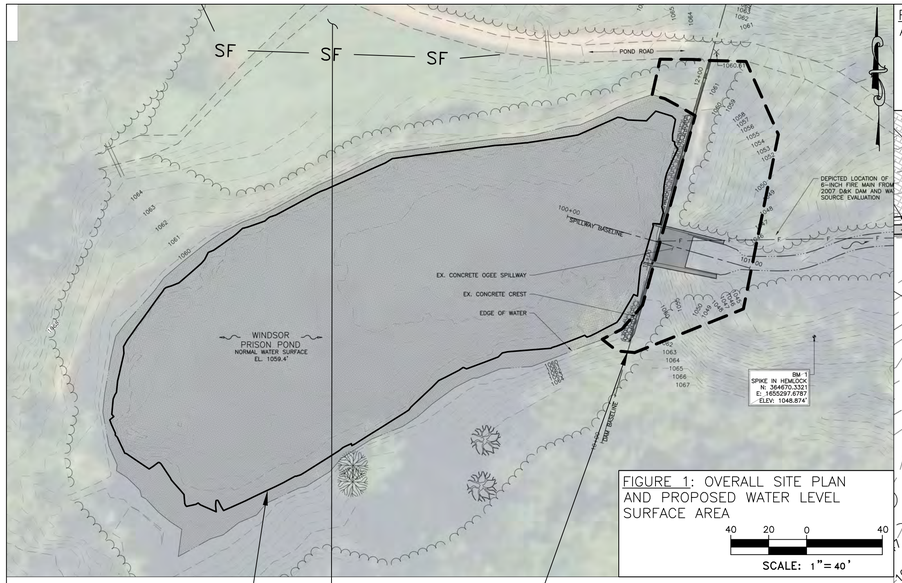


FIGURE 1: OVERALL SITE PLAN AND PROPOSED WATER LEVEL SURFACE AREA

40 20 0 40

SCALE: 1"=40'

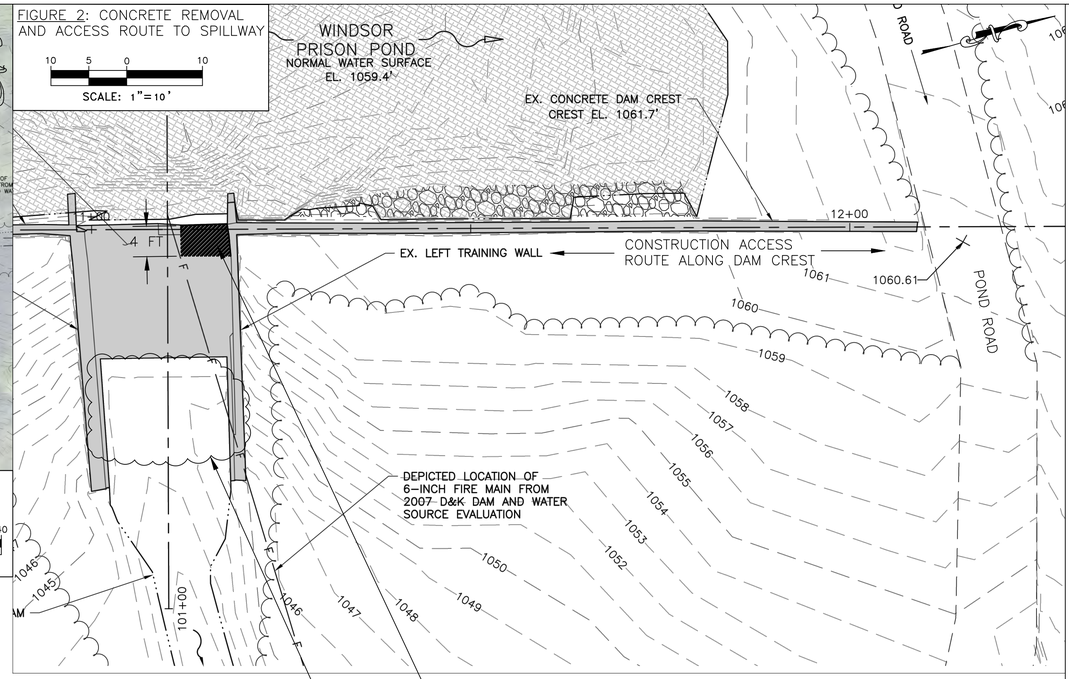


FIGURE 2: CONCRETE REMOVAL AND ACCESS ROUTE TO SPILLWAY

10 5 0 10

SCALE: 1"=10'

PROPOSED NORMAL WATER LEVEL SURFACE AREA WITH LOWERED SPILLWAY CREST (ELEVATION = 1,057.0)

PARKING / STAGING AREA

TREE AND BRUSH REMOVAL AREA.

CUT TREES TO STUMPS, LEAVE STUMPS IN PLACE.

CONCRETE REMOVAL AREA

REMOVE PILED UP DEBRIS FROM OUTLET CHANNEL.

FIGURE 3: CONCRETE REMOVAL PHOTO NOT TO SCALE

CONCRETE REMOVAL AREA

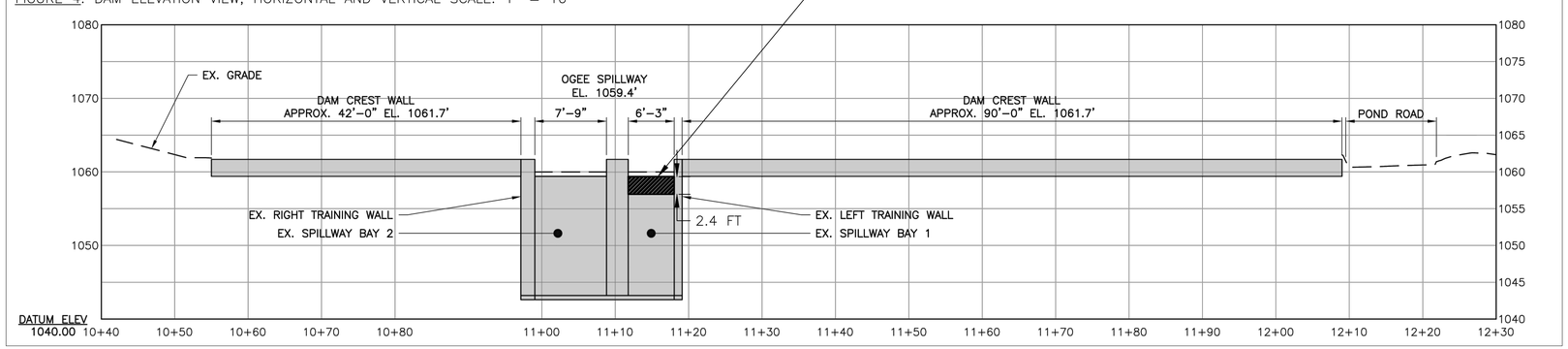
CONCRETE REMOVAL SHALL BE PERFORMED WITH CARE THROUGH INCREMENTAL SAW CUTTING AND MECHANICAL REMOVAL TECHNIQUES.

CONTRACTOR SHALL BE RESPONSIBLE FOR THE COST OF ANY REQUIRED REPAIRS TO SECTIONS OF CONCRETE NOT INTENDED TO BE REMOVED OR ANY DAMAGES AS A RESULT OF THE CONTRACTORS FAILURE TO EXERCISE CAUTION.

EXAMPLE CONSTRUCTION SEQUENCE:

1. CUT BRUSH AND TREES OFF OF DAM AND WITH 15 FEET OF DAM FOOTPRINT.
2. PUMP/SIPHON DOWN WATER LEVEL TO ELEVATION 1,056 (3.4 FEET BELOW THE EXISTING SPILLWAY CREST) AND PUT IN PLACE MEASURES TO MAINTAIN WATER AT THIS LEVEL UNTIL PROJECT IS COMPLETED.
3. INSTALL FALL PROTECTION EQUIPMENT AS REQUIRED TO TO PERFORM THE CONCRETE REMOVAL WORK.
4. PERFORM CONCRETE REMOVAL WORK.
5. REMOVAL FALL PROTECTION, PERFORM SITE CLEAN UP AND SURFACE RESTORATION AS REQUIRED.

FIGURE 4: DAM ELEVATION VIEW, HORIZONTAL AND VERTICAL SCALE: 1" = 10'



GENERAL NOTES:

1. PRISON POND DAM IS OWNED BY THE DEPARTMENT OF FISH AND WILDLIFE, AND IS LOCATED IN THE WINDSOR GRASSLANDS WILDLIFE MANAGEMENT AREA.
2. THE PROJECT IS BEING PERFORMED AS AN INTERIM RISK REDUCTION MEASURE BEFORE A LARGER SCALE PROJECT INVOLVING DAM REPAIR OR REMOVAL CAN BE EXECUTED TO PROPERLY ADDRESS THE UNSATISFACTORY CONDITION OF THE DAM.
3. THESE FIGURES/SKETCHES ARE APPROXIMATE IN NATURE AND ARE BASED ON DRAFT SURVEY AND ENGINEERING INFORMATION SUBMITTED BY DUBOIS & KING, INC. IN 2022 AS PART OF AN ENGINEERING ALTERNATIVES ASSESSMENT OF PRISON POND DAM. PDFs WERE BROUGHT INTO AUTOCAD CIVIL 3D, SCALED, AND SKETCHED OVER.
4. ALL WORK SHALL BE COORDINATED WITH OWNERS REPRESENTATIVE/ENGINEER.
5. THE CONTRACTOR IS RESPONSBILE FOR VERIFYING DIMENSIONS IN THE FIELD, AND ADVISING THE ENGINEER OF ANY CONFLICTS WITH THE PROPOSED PROJECT PRIOR TO STARTING THE WORK.
6. THE CONTRACTOR IS RESPONSIBLE FOR WORKER SAFETY. THE SITE DOES NOT INCLUDE ADEQUATE FALL PROTECTION. THE CONTRACTOR IS RESPONSIBLE FOR SUPPLYING ADEQUATE FALL PROTECTION IN ORDER TO PERFORM THE WORK AND SHALL BID ON THE PROJECT ASSUMING THAT THEY ARE RESPONSIBLE FOR SUPPLYING ALL WORKER SAFETY MEASURES.
7. IT IS HIGHLY RECOMMENDED THE CONTRACTOR VISIT AND BECOME FAMILIAR WITH THE SITE PRIOR TO SUBMITTING A BID.
8. THE CONTRACTOR IS RESPONSIBLE FOR SUPPLYING SIPHON/PUMP SYSTEM IN ORDER TO PERFORM THE WORK. NO WORK SHALL BE PERFORMED DURING HIGH WATER/FLOOD EVENTS. IF THE CONTRACTORS SIPHON/PUMP SYSTEM IS UNABLE TO KEEP THE WATER LEVEL 1 FOOT BELOW THE PROPOSED SPILLWAY CREST ELEVATION (EL. 1,056.0), WORK SHALL CEASE UNTIL THE HIGH WATER/FLOOD EVENT PASSES.
9. NO TURBID WATERS SHALL BE DISCHARGED AS PART OF THE PROJECT. NON-TURBID WATER SHALL BE PUMPED OVER DAM AND INTO EXISTING ROCK ARMORED CHANNEL DOWNSTREAM OF DAM. NO WATER SHALL BE DISCHARGED ON THE DAM EMBANKMENT.
10. THE DRAINAGE AREA OF THE POND IS 0.32 SQUARE MILES. BASE INFLOWS ARE ANTICIPATED TO RANGE BETWEEN 2 TO 6 CFS.
11. REMOVED CONCRETE SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND BE RESPONSIBLY DISPOSED OF OFFSITE.
12. CUT TREES AND BRUSH SHALL BE DRAGGED OFF OF THE DAM AND LEFT ON SITE TO EITHER SIDE OF THE OUTLET STREAM CHANNEL (OUTSIDE OF A 15 FOOT BUFFER). NO HAULING ROADS SHALL BE CONSTRUCTED.

RISK REDUCTION FIGURES

SCALE: AS NOTED

STATE OF VERMONT
AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WATER INVESTMENT DIVISION
MONTPELIER, VERMONT 05620-3510

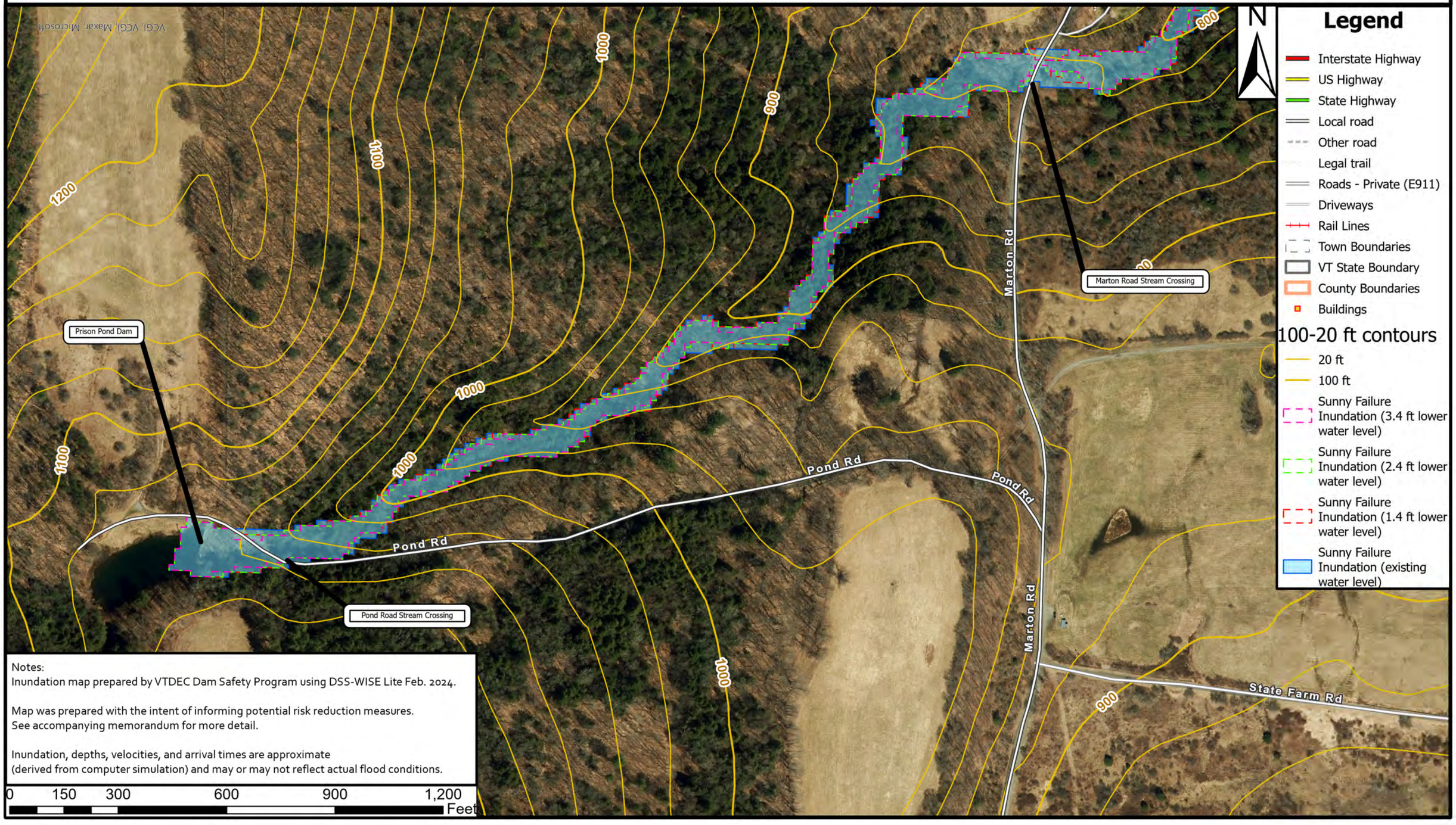
REVISIONS		DEPARTMENT	DESIGNED
		DAM SAFETY PROGRAM	AJS
		PROJECT	DRAWN
		PRISON POND DAM INTERIM RISK REDUCTION MEASURES	AJS
			CHECKED
			AJS
			SHEET 1 OF 1
			DATE 2-8-2024
		LOCATION POND ROAD, WINDSOR, VT 05089	SHEET SIZE 22" X 34"

Attachment B

Simplified Dam Failure Inundation Maps

Prison Pond Dam (248.07) - Windsor, VT - Dam Failure Inundation Map

Vermont Agency of Natural Resources - Department of Environmental Conservation - Dam Safety Program



Notes:
Inundation map prepared by VTDEC Dam Safety Program using DSS-WISE Lite Feb. 2024.

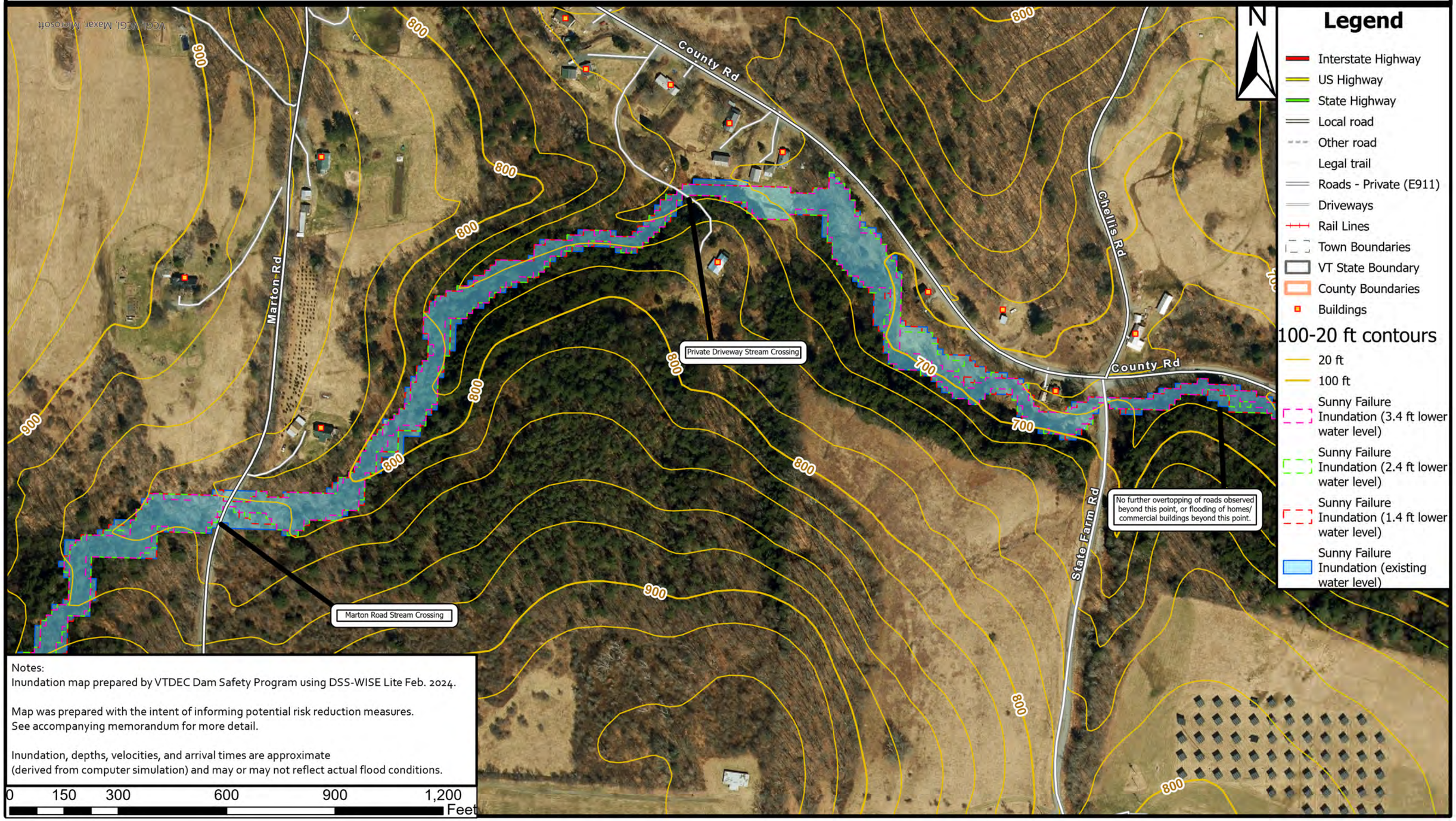
Map was prepared with the intent of informing potential risk reduction measures.
See accompanying memorandum for more detail.

Inundation, depths, velocities, and arrival times are approximate
(derived from computer simulation) and may or may not reflect actual flood conditions.

0 150 300 600 900 1,200 Feet

Prison Pond Dam (248.07) - Windsor, VT - Dam Failure Inundation Map

Vermont Agency of Natural Resources - Department of Environmental Conservation - Dam Safety Program



Notes:
Inundation map prepared by VTDEC Dam Safety Program using DSS-WISE Lite Feb. 2024.

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See accompanying memorandum for more detail.

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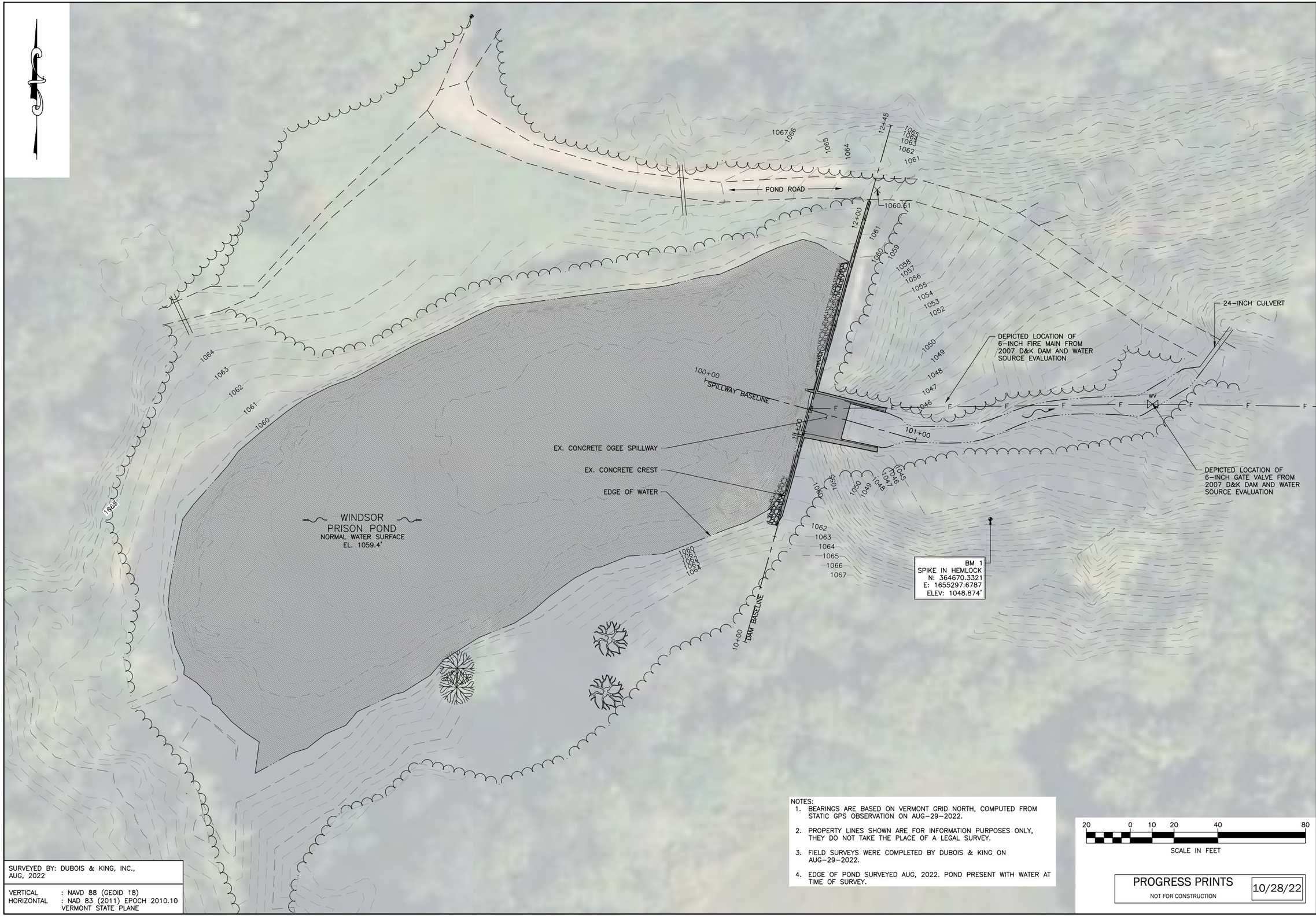
(derived from computer simulation) and may or may not reflect actual flood conditions.

0 150 300 600 900 1,200 Feet

Attachment C

Select References from Draft 2022 Dubois & King, Inc. / GEODesign, Inc. Engineering Report



NOTES:
1. BEARINGS ARE BASED ON VERMONT GRID NORTH, COMPUTED FROM STATIC GPS OBSERVATION ON AUG-29-2022.
2. PROPERTY LINES SHOWN ARE FOR INFORMATION PURPOSES ONLY, THEY DO NOT TAKE THE PLACE OF A LEGAL SURVEY.
3. FIELD SURVEYS WERE COMPLETED BY DUBOIS & KING ON AUG-29-2022.
4. EDGE OF POND SURVEYED AUG, 2022. POND PRESENT WITH WATER AT TIME OF SURVEY.

20 0 10 20 40 80
SCALE IN FEET

SURVEYED BY: DUBOIS & KING, INC., AUG, 2022

VERTICAL : NAVD 88 (GEOID 18)
HORIZONTAL : NAD 83 (2011) EPOCH 2010.10 VERMONT STATE PLANE

PROGRESS PRINTS
NOT FOR CONSTRUCTION
10/28/22

DuBois & King inc.

www.dubois-king.com

PROFESSIONAL SEAL

NOT FOR CONSTRUCTION PRELIMINARY PLANS

NO.	DATE	DESCRIPTION	BY	CK'D

PROJECT NAME:
WINDSOR PRISON POND DAM
POND RD, WINDSOR, VT 05089
VERMONT FISH & WILDLIFE

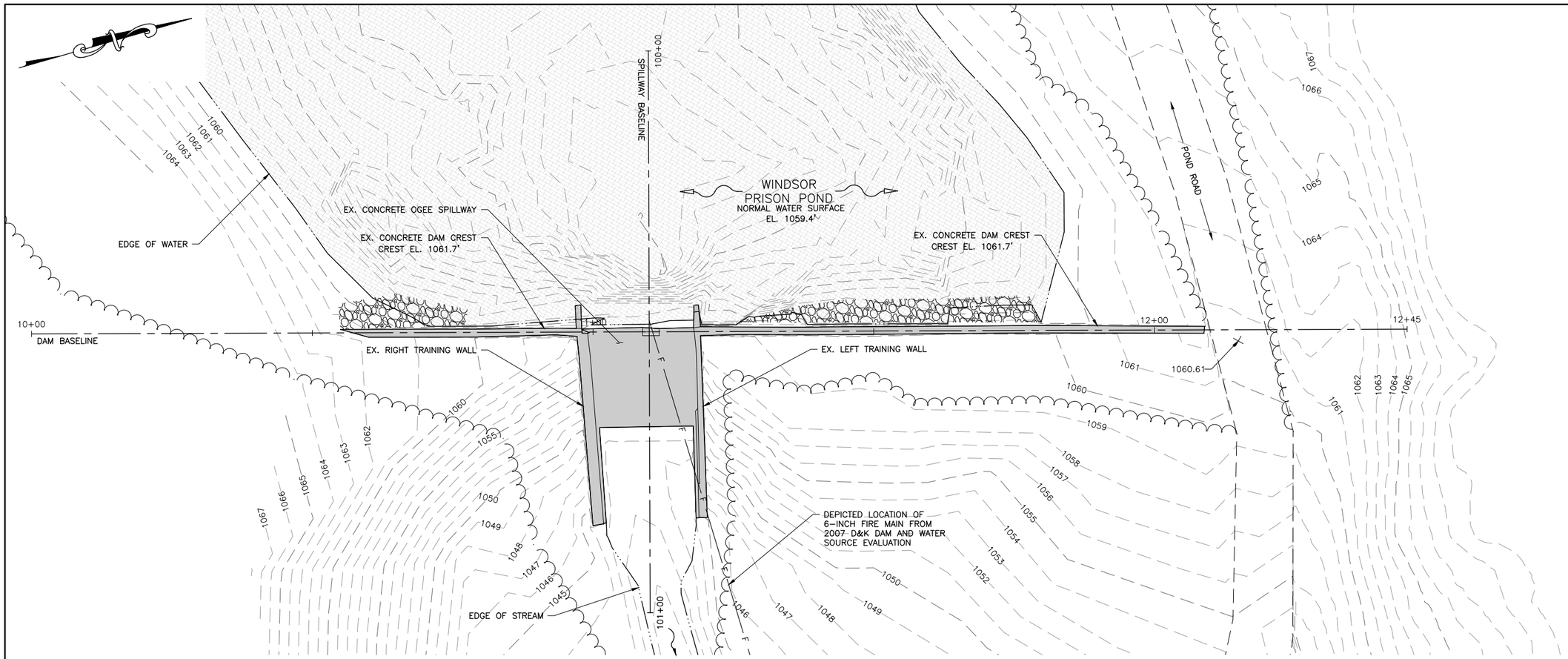
SHEET TITLE:
EX CONDITIONS SITE PLAN

DRAWN BY	DATE
HLP	10/28/22
CHECKED BY	D&K PROJECT #
	828216
PROJ. ENG.	SCALE
CWJ	1:10

SHEET NUMBER
C1

SHEET 1 OF 2

I:\8\828216 Windsor Prison Pond Dam\Drawings\AutoCAD\828216_WindsorPrisonPondDam_SP01.dwg 10/28/2022 3:15 PM

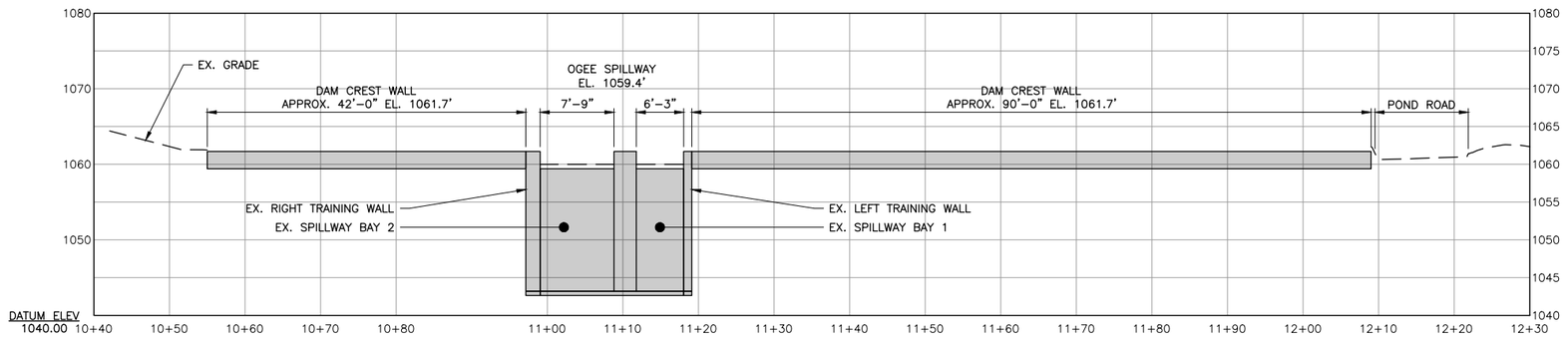


EXISTING CONDITIONS SITE PLAN

SCALE 1" = 10'

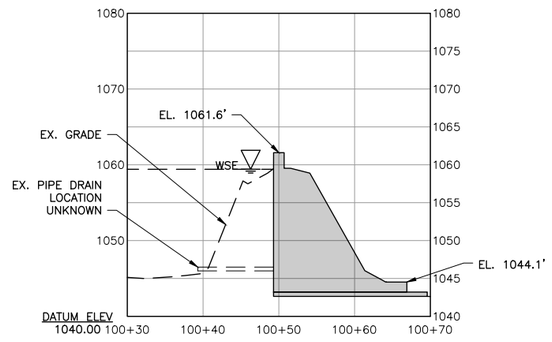
10 0 5 10 20 40

SCALE IN FEET



DAM ELEVATION PROFILE

SCALE 1" = 10'



SPILLWAY ELEVATION PROFILE

SCALE 1" = 10'

PROGRESS PRINTS
NOT FOR CONSTRUCTION
10/28/22

DuBois & King inc.

www.dubois-king.com

PROFESSIONAL SEAL

NOT FOR CONSTRUCTION PRELIMINARY PLANS

NO.	DATE	DESCRIPTION	BY	CK'D

PROJECT NAME:
WINDSOR PRISON POND DAM
POND RD, WINDSOR, VT 05089
VERMONT FISH & WILDLIFE

SHEET TITLE:
EX CONDITIONS PLAN AND SECTIONS

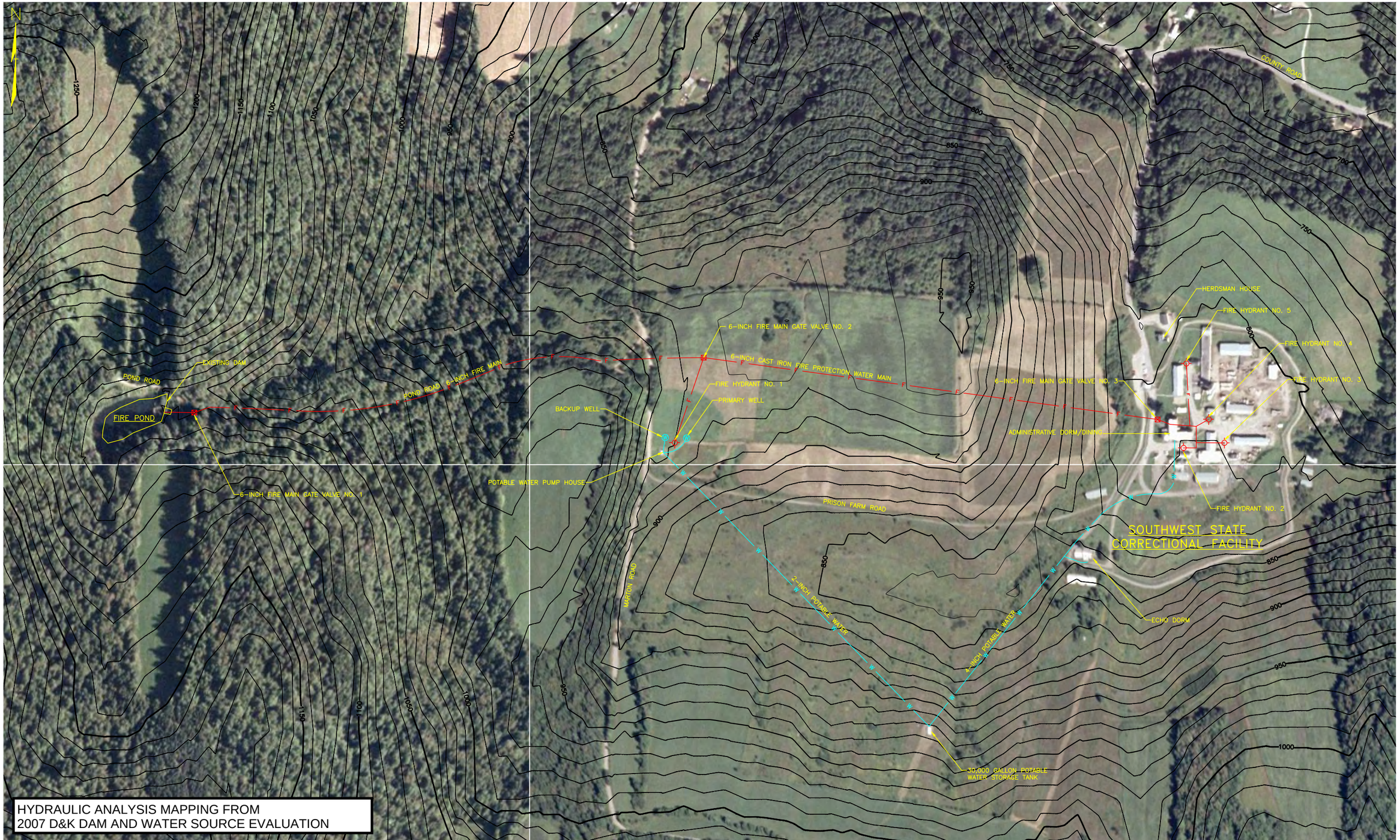
DRAWN BY	DATE
HLP	10/28/22
CHECKED BY	D&K PROJECT #
	828216
PROJ. ENG.	SCALE
CWJ	1:10

SHEET NUMBER

C2

SHEET 2 OF 2

I:\8\828216 Windsor Prison Pond Dam\Drawings\AutoCAD\828216_WindsorPrisonPondDam_SP01.dwg 10/28/2022 3:15 PM



HYDRAULIC ANALYSIS MAPPING FROM
2007 D&K DAM AND WATER SOURCE EVALUATION

NOTES:

1. FIRE MAIN ALIGNMENT BETWEEN GATE VALVE NO. 1 AND NO. 2 IS BASED ON BEST AVAILABLE INFORMATION AND ASSUMED TO FOLLOW POND ROAD
2. FOR CLARITY, SMALLER POTABLE WATER DISTRIBUTION PIPING BETWEEN BUILDINGS IS NOT SHOWN WITHIN CORRECTION FACILITY
3. MAP SOURCE: ORTHOPHOTO – VERMONT MAPPING PROGRAM NAIP 2003, 10' CONTOURS – INTERPRETED BY DUBOIS & KING USING VERMONT MAPPING PROGRAM DEM DATA

SITE PLAN
SCALE: 1" = 200'

200 100 0 200 600
SCALE IN FEET

NO.	DATE	REVISIONS	BY	CK'D

DuBois & King inc.
engineering planning management development

SOUTHWEST STATE CORRECTIONAL FACILITY
WINDSOR, VERMONT

DAM AND WATER SOURCE EVALUATION

EXISTING CONDITIONS – SITE PLAN

DRAWN BY	DATE
EBS	DEC. 2007
CHECKED BY	PROJ. NO.
EHH	220035
PROJ. ENG.	DRAW. NO.
CKG	

SHEET 1 OF 4

I:\220035 Windsor CF Water\dwg\MAP.dwg, EXISTING, 1/4/2008 11:16:12 AM

I:\220035 Windsor CF Water\dwg\MAP.dwg, Jan 04, 2008 – 11:16am

Attachment D

2023 Dam Safety Program Periodic Inspection Report

Dam Safety Inspection Report

Dam Safety Program
One National Life Drive
Montpelier, VT 05620-3510
(802) 622-4093
benjamin.green@vermont

Name: **Prison Pond**
State ID: **248.07** NID ID: VT00363
Hazard Class: **Significant Hazard Potential**

Town: **Windsor**
Watershed: Mill Brook
Stream: Hubbard Brook-TR

Inspection Details

Inspection date: 08/03/2023 14:18

Inspection type: Periodic	**Weather:** Sunny, Cloudy, 72F
Inspected by: Andrew Sampsell, State of Vermont Michael Hildenbrand, DuBois & King, Inc.	**Others present:**

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.

Overall dam condition:

☐ Satisfactory ☐ Fair ☐ Poor ☑ Unsatisfactory ☐ Not Rated

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

Immediate Consideration

- The concrete crest wall to the left and right of the spillway is cracked resulting uncontrolled leakage. This is causing erosion of the downstream embankment and if left unchecked could potentially lead to dam failure. Additionally due to the deteriorated condition of this concrete wall, there is an elevated risk of the wall failing due to inadequate strength to resist loading conditions. A measure to maintain a lower water level which does not result in uncontrolled leakage under normal conditions should be implemented as soon as possible to mitigate the likelihood and potential risks of dam failure. The water level should be maintained at the lower level until remedial repairs are implemented and approved.

Maintenance level recommendations

General	• Consider posting warning signage restricting public access to the dam. • 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 conditions to the Dam Safety Program.

Maintenance level recommendations	
Emergency Action Planning	• Review/update Emergency Action Plan procedures and contacts at least every other year and provide the updates to all key contacts. The current EAP on file is from 2008 and the pdf does not include the inundation maps from the dam failure analysis.
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. • Once tree stumps are suitably rotten, remove stumps and backfill resulting voids with compacted granular fill. Seed and mulch the ground surface to promote grass cover. • Mow the grass surfaces of the embankment and auxiliary spillway once to twice annually.
Upstream Slope	• Monitor the condition of the stone fill on the reportedly over-steepened upstream slope.
Crest area	• Monitor the dam crest for signs of settlement. • Monitor the condition of the concrete joints. Remove debris from the joints and re-install sealant.
Concrete Walls	• Monitor the concrete surface conditions. Perform minor surficial repairs as needed. • Monitor the upstream/downstream concrete/stone masonry walls for unusual movement, and changes in leakage.
Downstream Slope	• Monitor the reportedly over-steepened downstream slope. • Monitor the area of erosion along the outside of the principal spillway training walls. Repair/temporarily stabilize erosion by placing stone. • Monitor wet area below right downstream slope for changes.
Spillways	• Maintain the spillway free of debris to ensure free-flow conditions. • Monitor and repair minor concrete cracking and deterioration. • Monitor the condition of the concrete chute and training walls.

Studies and analysis	
General	• Review findings of 2022 alternatives analysis report by DuBois & King, Inc. The report evaluates the dam's condition based on visual inspection and file review, includes a recent hydrologic and hydraulic analysis, and comments on deficiencies/uncertainties. The report also provides a series of conceptual alternatives for the owner's considerations along with corresponding cost/benefit information.

Studies and analysis	
Hydrology and hydraulics/hazard classification	• Consider re-evaluating the hazard potential classification of the dam since the impoundment no longer serves as the supply for a fire suppression system. If the dam is found to have LOW hazard potential, the technical standards which it will be required to me will be lessor than current standards based on SIGNIFICANT hazard potential. • Identify alternatives to make the dam hydraulically adequate or capable of safely being overtopped during the Inflow Design Flood.
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. • Investigate and document the location of all piping through the dam including the reported 15-18 inch low-level-outlet pipe and the 8-inch water supply / fire suppression system pipe. Determine if any pipes through the dam are perpetually pressurized. Evaluate the condition of the piping. Evaluate the condition/operability of the gate mechanism located on the principal spillway crest. Identify remedial measures to address any deficiency associated with the location/condition/configuration/operability of these outlets. • Currently it appears there is no readily available method to lower the impoundment in the situation where an unusual/unsafe condition is detected at the dam. Evaluate potential alternative measures to allow for the water level to be lowered.
Structural/ Geotechnical	• Evaluate concrete deterioration, cracking, and leakage. Develop repair solution(s) to address leakage through the concrete crest wall and subsequent erosion of the downstream slope. • Perform an engineered stability analysis of the dam and appurtenant structures such as the principal spillway training walls. • Evaluate the appropriateness of either temporarily partially breaching the dam or buttressing the dam and its appurtenant structures until it is possible to proceed with removal/rehabilitation/replacement.

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 pursing dam removal.

Dam Information

Type: Concrete **Purpose:** Fire Protection or Small Farm Pond	**Status:** In Service **Height:** 18 ft **Length:** 154 ft	**Construction date:** 1925 **Foundation conditions:** Concrete at left abutment extends to gravel access road about 1 ft higher than road, water would flow down road before overtopping dam crest.
Owner/Contact/Operator: State of Vermont - DFW		
Normal storage: 6 ac-ft	**Max storage:** 8 ac-ft	Dam has capability to impound **more than** 500k cubic feet (11.48 ac-ft)
Normal surface area: 1 ac	**Drainage area:** 0.32 sq mi	**Max surface area:** Not determined
Pool elevation during inspection: 2.5 inches above crest	**Tailwater elevation during inspection:** Normal no backwater	**Normal pool elevation:** Reportedly El. 1,059.4 (NAVD88 ft)
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: Round	**Reservoir average depth (ft):** Unknown	**Reservoir observations:** Not Estimated
Shoreline development: ☑ Undeveloped ☐ Semi-developed ☐ Developed ☐ Unknown		
Reservoir slopes: ☐ Mild ☑ Moderate ☐ Steep ☐ Unknown		
Inspection history: Last periodic inspection was in 2022 and the dam's condition was rated POOR.		
Notes: **none**		

Access road to dam		
Type: Seasonal road	**Road name:** Pond Rd	**Distance from access road to dam:** 50 feet
Seasonal access: ☐ Plowed winter ☐ Sanded winter ☐ Maintained in mud season ☐ Passable in all weather conditions ☑ Need high clearance vehicle		
Access of emergency/construction equipment: Fair, would be difficult for larger vehicles; work truck can access. Winter access is likely challenging. Outflow from dam has the potential to washout the access road at culvert crossing.		
Action required: ☐ None ☑ Monitor ☐ Maintenance ☐ Engineer		

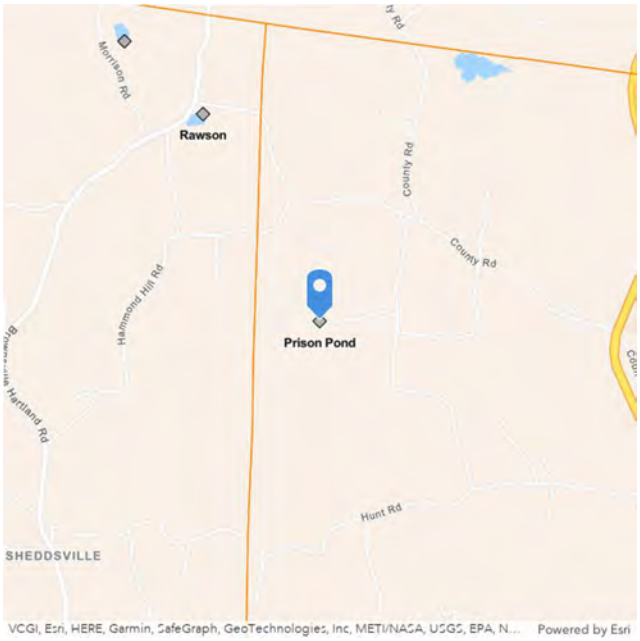
Security	
Device type(s): Welded metal plates and chain around outlet operating stem.	Dam has **no** sign of vandalism, trespass or unauthorized operation. File records indicate vandalism has been an issue in the past.
Action required: ☐ None ☑ Monitor ☐ Maintenance ☐ Engineer	

Public/Inspection team safety at dam	
Confined space entry required: No	Fall protection required: Recommended in the vicinity of the spillway.
Other safety required: None Observed	Public safety consideration: Post warning signage, restrict public access.
Action required: ☐ None ☑ Monitor ☐ Maintenance ☐ Engineer	

Dam Description/Background

Prison Pond Dam is a composite stone masonry, earth fill, and concrete dam with principal spillway and Low-Level Outlet (LLO). The dam is currently classified as a SIGNIFICANT hazard potential. The dam has a total length of approximately 154 feet and a height of 18 feet. The dam crest is a concrete wall which is 1.5 feet wide and runs the full length of the dam excluding the spillway sections. The upstream wall face has 5-7 feet of exposed surface, and the downstream wall face has 1-3 feet of exposed surface. The principal spillway is a 20-foot concrete ogee shaped weir with downstream training walls in the dam center; it includes a small concrete pier in the center to support the safety measures and operating stem of the LLO. The spillway discharges into a rock-lined channel. The LLO is reportedly a 15 to 18-inch diameter galvanized metal pipe operated by a slide gate which is accessible from the pier in the principal spillway. In addition, there is reportedly an 8-inch diameter pipe in the same vicinity that was/is used to provide water to fire hydrants at the former correctional facility. The Prison Pond reservoir has a surface area of approximately 1 acre, a normal storage of 6 acre-feet, a maximum storage of 8 acre-feet, and a drainage area of 0.32 acres. The dam was constructed in 1925 for fire protection at the State Prison and has undergone reconstruction in 1950 and 1989. The Vermont Department of Fish and Wildlife (F&W) acquired former "Windsor Prison Farm" property from the Vermont Department of Buildings and General Services (BGS) and converted the land in 2018 into the Windsor Grasslands wildlife management area (WMA).

Dam Location



Emergency Action Plan

EAP **on** file

EAP date:
January 31, 2008

Emergency Action Plan

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

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
The 2008 dam failure analysis should be reviewed to determine if the current hazard potential classification is still appropriate and determine if any updates to the analysis are warranted. The EAP should be reviewed, and procedures/contact information updated as appropriate. The inundation maps are missing from the EAP the dam safety program has on file.	

Operation & Maintenance Manual

O&M Manual **not on** file.

Accessibility to outlets or low-level outlet (LLO): Inadequate, center of spillway, access bridge no longer present.	**Frequency of outlet or LLO discharge:** Unknown, currently not operable.
Frequency of mowing: Unknown	**Seasonal drawdown?** ☐ Yes ☑ No
Frequency of dam owner surveillance: Unknown	**Owner surveillance during storm events:** ☐ Yes ☑ No
Operating problems since last inspection: None reported	**History of repairs since last inspection:** None reported

What issues are present with the O&M Manual?	Action
☑ No plan available	☑ Engineer

Downstream Hazard Classification

Current classification: Significant Hazard Potential
Reportedly the hazard potential classification was assigned Significant based on pond formerly serving as the fire suppression systems water supply for the prison. The prison reportedly closed in 2017. The results of the 2008 dam failure analysis performed by DuBois & King, Inc. indicate the following. Corresponding inundation maps were not available on DSP file.

- No homes flooded.
- No businesses flooded.
- 3 Roads Impacted: Marton Road, State Farm Road, County Road

Hydrologic/Hydraulic Data

Since the Prison Pond Dam is currently classified as a SIGNIFICANT hazard potential dam, the Inflow Design Flood (IDF) is considered the 1,000-year storm event in accordance with Federal Guidance currently used in the State of Vermont. Based on file review the most recent hydrologic and hydraulic (H&H) analysis for the dam was performed by DuBois & King, Inc. in 2022. This analysis involved an update of the 2008 H&H analysis that was performed as part of a hazard potential classification study and EAP development. All elevations listed are reportedly in reference to the NAVD88 feet vertical datum.

Flood Frequency	Precipitation (inches)	Peak Inflow (cfs)	Peak Outflow (cfs)	Maximum Pond Level (ft)	Freeboard (+) or Overtopping (-) Depth (ft)
2-yr (24-hr)	2.70	31.9	31.3	1,060.0	1.7
10-yr (24-hr)	3.90	78.0	77.3	1,060.5	1.2
50-yr (24-hr)	5.21	137.8	136.6	1,060.9	0.8
100-yr (24-hr)	5.80	166.7	165.2	1,061.2	0.5
500-yr (24-hr)	7.44	250.5	248.8	1,061.7	0
1000-yr (24-hr)	8.24	292.6	292.0	1,061.8	-0.1

Normal Water Level / Principal Spillway Crest EL.: 1,059.4 ft
Dam Crest El.: 1,061.7 ft

According to State requirements the dam needs to provide a prescriptive minimum of 1.5 feet of freeboard between the peak water surface elevation of the IDF and the dam crest. According to results of the analysis the dam is overtopped by 0.1 ft during the IDF, and this requirement is not met.

According to State requirements the dam needs to provide a minimum of 3.0 feet of freeboard between the normal water level and the dam crest. According to the analysis this requirement is not met.

Upstream Slope

General slope inclination: Not measured, submerged, file records indicate that the upstream slope is over-steepened at 1H:1V. The top of the upstream slope is benched.

Upstream Slope

Additional comments: The upstream slope consists of stone fill which appears to include an approximately 5-foot-wide bench at the top of the slope. File records indicate the dam used to a stone fill structure. It is considered plausible that the current dam configuration may have been built on top of remaining portions of the original dam.

Upstream slope protections	Action
Stone fill along the upstream concrete wall face.	☑ Monitor

Upstream slope issues	Action
No upstream slope issues were observed during the inspection.	☑ None

Upstream slope images

Crest

Length: 154 ft **Width:** 1.5 ft

Freeboard:
Principal spillway crest to dam crest: 2.3 ft

Additional comments: It is unknown how far down the crest wall extends into the embankment. At the left abutment a concrete wing-wall extends upstream towards the impoundment. Reportedly this wingwall was installed to prevent the adjacent access road from being washed-out during rare flood events. Several joints along the top of the crest wall are deteriorating and missing material. There is evidence of past repairs made to address concrete spalling along the crest of the wall.

Crest issues	Action
Brush Coverage: Dense Location: Right End, Middle	☐ None ☐ Monitor ☑ Maintenance ☐ Engineer
Missing Joint Material/Expansion of Joints Location: Entire Surface	☐ None ☑ Monitor ☑ Maintenance ☐ Engineer

Crest images

Crest images

Concrete Wall

Wall type: Concrete
Length: 154 ft

Wall height (exposed):	**Horizontal wall alignment:**	**Vertical wall alignment:**
5 to 7 ft above submerged rockfill (upstream) 1 to 3 ft above earth fill (downstream)	Good	Good

Unusual wall movement: ☐ Yes ☑ No

Additional comments: Wall has been noted to be deteriorating, resulting in leakage since at least 1993.	**Surface condition:** Poor condition, cracks, spalling.
Joint condition: Poor condition, missing material and expanding.	**Abutment contact condition:** Left abutment fair, higher than adjacent grade, right good, level with adjacent grade.

Concrete wall issues	**Action**
Concrete Deterioration While portions of the concrete seem solid based on sounding; there are areas of severe deterioration which result in leakage. These areas require an engineered repair solution.	☐ None ☑ Monitor ☐ Maintenance ☑ Engineer
Leakage Flow rate: 8 GPM+ Location: To either side of spillway along concrete wall. Through deteriorating concrete joints and cracks in wall. Leakage resulting erosion of downstream slope along outsides of principal spillway training walls.	☐ None ☑ Monitor ☐ Maintenance ☑ Engineer

Concrete wall images

Near intersection of left concrete wall with left spillway training wall.

Concrete wall images

Near intersection of right concrete wall with right spillway training wall.

Downstream Slope

General slope inclination: Not measured, appeared to be over-steepened. File records indicate the downstream slope is approximately 1V:1H.

Additional comments: Downstream slope consists of earth fill located below the concrete wall portions of the dam. The downstream slope was densely vegetated which prevented thorough inspection. While no engineered stability analysis available exist on file, the presence of the downstream material is likely critical to the overall stability of the dam, and similarly the condition of the concrete crest wall and it is ability to function as a hydraulic cutoff is likely critical to the stability of the downstream slope.

Downstream slope protections			Action
Vegetation Condition: ☐ Adequate ☐ Improper	☐ Bare ☐ Sparse	☑ Too tall ☐ Too short	☐ None ☐ Monitor ☑ Maintenance ☐ Engineer
Comments: Overgrown, lack of maintenance.			

Downstream slope issues	Action
Trees Location: Entire Surface	☐ None ☐ Monitor ☑ Maintenance ☐ Engineer
Wet Areas Location: Toe of right downstream slope.	☐ None ☑ Monitor ☐ Maintenance ☐ Engineer

Seepage Collection Systems	Number
No seepage collection systems were observed during the inspection.	0

Downstream slope images

Instrumentation

No instrumentation found.

Principal Spillway

Spillway type: Weir **Primary material:** Concrete **Weir:** Ogee

Spillway location: Center of dam **Gate:** Unknown

Water level measured against principal spillway crest: 1-inch above crest

Erosion control structures: Plunge Pool, Impact Basin, Rock-Lined Channel

Spillway components:

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

Additional comments: Water seeping through dam crest wall is running along the outside of the principal spillway training walls and eroding material. The base of the left concrete spillway training wall is being undermined. The left spillway training wall is more deteriorated than the right wall and has several cracks of considerable size. It appears the right wall was replaced or resurfaced more recently than the left wall. The surface of the spillway chute is slowly being eroded; deterioration is concentrating at vertical lift joints.

Principal spillway issues			Action
Deteriorating concrete Issues: ☐ Bug holes ☑ Hairline crack ☑ Efflorescence ☑ Spalling Location: Entire Surface	☑ Pop outs ☐ Honeycombing ☑ Scaling ☐ Crazed/Map cracks	☐ Isolated crack ☐ Exposed rebar ☐ Disintegration ☐ Other:	☐ None ☑ Monitor ☐ Maintenance ☑ Engineer
Vegetation & Debris			☐ None ☐ Monitor ☑ Maintenance ☐ Engineer

Principal spillway drains	Number
No drains were observed during inspection.	0

Principal spillway images

Principal spillway images

Outlets

The dam reportedly includes a low-level-outlet which can be accessed from the middle of the principal spillway crest. The walkway which formerly provided access to this outlet has been removed and metal plates have been welded to the operator stem to “discourage vandalism”. The size of the pond drain is reportedly 15 to 18 inches in diameter. The dam also reportedly includes an 8-inch pipe which supplies water to the former prison facility. It is unclear if this pipe is also controlled by the same operating mechanism. Neither pipe was observable during the inspection, pipes are assumed to have been buried.

Outlet images

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.

Spillway Design Flood or “IDF": The storm event which the 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