WRIGHT-PIERCE
Engineering a Better Environment

DRAFT Memorandum

Date:	**12/1/2021**
Project No.:	**20720A**
To:	**Jonny Findon-Henry, PE, Dam Safety Engineer, NHDES**
From:	**Chris Berg, PE** **Nate Edwards, EI** **Alex Liptak, EI**
Subject:	**Edelweiss Dam (#D149004) Breach Analysis - Village District of Edelweiss, NH**

The purpose of this memorandum is to summarize the results of the Edelweiss Dam breach analysis. Wright-Pierce has conducted a breach analysis and developed an inundation map and is seeking review by the New Hampshire Department of Environmental Services (NHDES) Dam Bureau. Upon receipt of any comments, this memo and model will be finalized to support the development of the Emergency Action Plan (EAP).

Background

The Edelweiss Dam (NHDES Dam No. D149004) is an earthen embankment dam in fair condition, also known as the Pea Porridge Pond Dam, located along the southwestern shoreline of Little Pea Porridge Pond within the Village District of Edelweiss (VDOE). Wright-Pierce has met with the District and coordinated with NHDES Dam Bureau to collect information about the subject dam in order to perform this analysis.

On July 2, 2019, NHDES sent VDOE a letter regarding the reclassification of Pea Porridge Pond Middle & Little Dam. This letter provided the backup justification from the reclassification from “low hazard” to “significant hazard” and the requirements of VDOE under this updated classification. It is understood that this change is generally associated with the potential overtopping of State Route 113 (a Class I or II roadway). NHDES had collected survey information and developed a preliminary hydrologic and hydraulic (H&H) model of the dam, which have been reviewed by Wright-Pierce. See Attachment 1 for the letter, NHDES H&H report, and survey information.

NHDES, through their correspondence with the VDOE, have indicated simplified inundation mapping (ENV-Wr 503.02) could be applicable in the case of this project. The simplified inundation mapping approach was chosen by the VDOE, which avoids the need to complete a full dam breach analysis but is ultimately understood to be a conservative estimate of potential areas of inundation from a dam breach.

Model Description

The simplified dam breach analysis was performed utilizing the Federal Emergency Management Agency’s (FEMA) DSS-WISE program. DSS-WISE is a web-based, automated two-dimensional dam breach flood modeling and mapping software developed by the National Center for Computational Hydroscience and Engineering (NCCHE), the University of Mississippi.

Model input parameters were based primarily on the NHDES preliminary H&H report and supported by topographic data found in the latest version of the modeling program, DSS-WISE Lite 3.0, which derives its elevation data from publicly available Digital Elevation Models (DEMs). The DEMs used for this analysis was from the USGS 2018 National Elevation Dataset published by the National Oceanic and Atmospheric Administration (NOAA) with varying resolutions. All elevations are in the NAVD88 vertical datum. Simulation parameters, impounding structure characteristics, bridges, reservoir characteristics, and failure conditions were defined in the web-based modeling software before being submitted for calculation and processing online. Inundation results were returned within hours of submission of the model run for review and export. See Attachment 2 for the full FEMA DSS-WISE Flood Simulation Report, which includes all of the input parameters and results.

Simulation Parameters

Simulation distance requested (miles):	65
Simulation cell size requested (ft):	21.0
Simulation duration requested (days):	3

Impounding Structure Characteristics

The Edelweiss Dam was defined as "Structure 1" in the model and has the hydraulic height, crest elevation, and length shown below. The crest of the dam was defined at elevation 650.7' based on the NHDES inspection form dated June 12, 2019. This elevation was found to be supported by the approximate Edelweiss Drive roadway observed in the DEM.

The hydraulic height of the dam is the difference in height between the crest elevation and the culvert outlet invert, which according to the same NHDES inspection form is conservatively 636.7'. Therefore, the hydraulic height of the dam is 14', which is not to be confused with the maximum height of the dam of 17'.

The length of the dam was defined at 373' includes the auxiliary spillway and additional crest where overtopping flow would be expected to overtop Edelweiss Drive in a breach event. Since additional length was included, the overall structure length is longer than the NHDES reported 175' embankment over the primary outlet and 80' auxiliary spillway.

Number of Structures: 1

Structure Name:	Structure 1
Structure Type:	Embankment
Hydraulic Height (ft):	14.0
Crest Elevation (ft):	650.7
Length (ft):	373.0

Bridges

Three bridges downstream of the dam were defined in the model. The first was downstream bridge is the Grachen Drive Bridge, which was estimated to have a length of 10' based on aerial imagery and the DEM. The next bridge downstream is the Conway Road Bridge, which was estimated to have a length of 10' based on aerial imagery and the DEM. The third was downstream bridge is the NH Rt. 113 Bridge, which was estimated to have a length of 15' based on aerial imagery and the DEM.

As shown in the Job Flow Summary of the attached FEMA DSS-WISE Flood Simulation Report, user identified bridges are removed from the DEM for the analysis. This is to assume the maximum amount of conveyance and most conservatively estimate flooding downstream.

Number of Bridges: 3

Bridge Name:	Grachen Drive Bridge
Length(ft):	10.0
Coordinates (Latitude/Longitude):	43.9327362046/-71.1411724985
Bridge Name:	Conway Road
Length(ft):	10.0
Coordinates (Latitude/Longitude):	43.9339511722/-71.1463679373
Bridge Name:	NH 113 Bridge
Length(ft):	15.0
Coordinates (Latitude/Longitude):	43.9641927725/-71.1449316144

Reservoir Characteristics

The maximum pool elevation of the reservoir was set equal to the Edelweiss Drive roadway crest since that is the highest point in which the impoundment could fill until overtopping. The normal pool elevation was input as 647.2' based on the water surface elevation upstream of the dam, as reported in the NHDES inspection form. The maximum and normal storage volumes of 406 acre-feet and 210 acre-feet, respectively, were defined based on the NHDES inspection form's estimate of the maximum storage.

Selected Reservoir Point (Latitude/Longitude):	43.9363139623/-71.1372208631
Pool Elevation @ Max Storage (ft):	650.69
Maximum Storage Volume (ac-ft):	406.0
Pool Elevation @ Normal Storage (ft):	647.4
Normal Storage Volume (ac-ft):	210.0

Failure Conditions

Failure conditions of the dam were defined within the NHDES accepted ranges of dam breach parameters for an earthen embankment per Env-Wr 502.06 (b) and shown in Figure 1 and Table 1. Side slopes of the breach were modeled as 3:1 (H:V), which is on the steeper end of the NHDES accepted range to be more conservative and assume a larger breach in the dam. The breach depth was assumed to be the hydraulic height of the dam (14') and the bottom width of the breach zero feet, making the top width of the breach 42' wide and equating to an average breach width of 21' or 1.5-times the dam height, falling in the NHDES recommended range. Time to breach failure was modeled at 0.5 hours (30 minutes), which is also within the NHDES accepted range of 0.1 to 1.0 hours for earthen embankments.

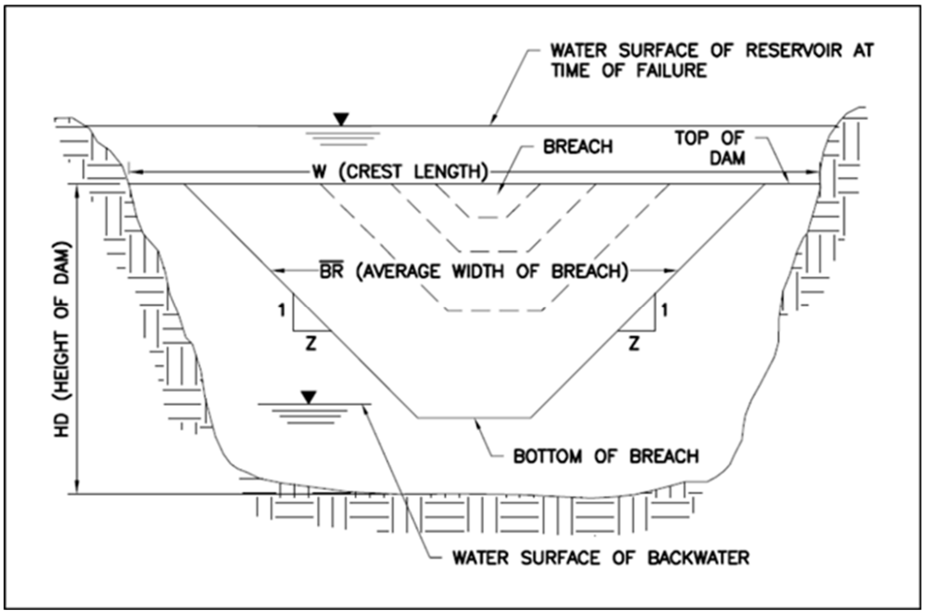

Figure 1: Dam Breach Parameter Sketch

Table 1: Dam Breach Parameters

Parameter	Type of Dam	Value
Average Width of Breach (BR)	Earth, Rockfill, Timber Crib	HD ≤ BR ≤ 5HD
Horizontal Component of Side Slope of Breach (Z)	Earth, Rockfill, Timber Crib	0.25 ≤ Z ≤ 1
Time to Failure (TFH) in Hours	Earthen (Engineered, Compacted), Timber Crib	0.1 ≤ TFH ≤ 1.0
	Earthen (Non-Engineered, Poor Construction)	0.1 ≤ TFH ≤ 0.5

Results and Inundation Mapping

The flood wave produced by a breach of the subject dam is estimated to reach the Pequawket Pond after approximately 30 hours. Incremental rise of the breach wave is below 1-foot by the time it reaches the Pequawket Pond, nearly 5 miles downstream.

As discussed, the full results can be found in Section 4 of the FEMA DSS-WISE Flood Simulation Report in Attachment 2. See Figure 7 in Section 4.4 for maximum flood depths and Figure 8 in Section 4.5 for how long it takes for the flood wave to reach the given areas within the inundation area.

Two residential houses on River Lane, as shown on the attached inundation map, were estimated to be impacted by a breach. The flood wave is expected to arrive at these structures within approximately 6 hours of a breach of the dam. The flood depths in this area are anticipated to range from approximately 1-3 feet.

The simplified inundation map is included in Attachment 3, in lieu of a traditional inundation map. This map displays aerial imagery, flow path, impoundment structure, modeled bridges, impacted structures and extents of inundation.

Attachments:

1) NHDES H&H Report and Survey Information
2) FEMA DSS-WISE Flood Simulation Report
3) Inundation Map

Attachment 1
NHDES H&H Report and Survey Information

The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES

Robert R. Scott, Commissioner

July 2, 2019

Village District of Eidelweiss, Chairman
1680 Conway Road
Madison, NH 03849

RE: Reclassification of Pea Porridge Pond Middle & Little Dam, #D149004, Madison

Dear Chairman:

The primary purpose of this letter is to notify you that, in accordance with Env-Wr 303.02, the New Hampshire Department of Environmental Services Dam Bureau (NHDES) has reviewed the impacts associated with a failure of the Pea Porridge Pond Middle & Little Dam and, consequently, reassigned its hazard classification. For the reasons outlined below, it is the determination of NHDES that the hazard classification should be changed from a "low hazard" potential to a "significant hazard" potential dam.

As a result of the reclassification, the dam will now be subject to meeting the current design and safety standards applicable to its new classification, as well as those changes listed below. A full listing of the requirements may be found in part Env-Wr 303 of the administrative rules relating to dams.

- Per RSA 482:8-a, the Annual Dam Registration Fee will change from $400 to $750.
- The scheduled safety inspections carried out by NHDES will now occur every four (4) years instead of every six (6) years.
- The Operations, Maintenance and Response (OMR) form should be revised to reflect the revised hazard classification.
- In accordance with Env-Wr 303.11 Discharge Capacity, a significant hazard dam must have sufficient capacity to pass the runoff produced by the 100-year flood generated by the drainage area upstream of the dam with one foot of freeboard and without manual operations. NHDES's regulations allow dam owners the option of passing the Inflow Design Flood (IDF). This is a storm that generates a lesser runoff rate and may be applied if it is shown that dam failure flows, when combined with this runoff rate, would not contribute to endangering additional public safety or property downstream of the dam. Based on the recently created hydrologic and hydraulic models, NHDES has determined that the dam is able to safely pass the 100-year storm runoff with more than one foot of freeboard and therefore meets our discharge capacity requirements.
- As required by RSA 482:11-a and in accordance with Env-Wr 500, the owner shall develop an Emergency Action Plan (EAP).
- In accordance with Env-Wr 507.01 Notification Test, the owner shall conduct a test of the emergency communication network within one month of approval of the EAP and every four (4) years thereafter.

Hazard Classification and Justification:

As part of a recent inspection of the dam, NHDES performed hydrologic and hydraulic (H&H) modeling of the contributing drainage area, analyzed the adequacy of the dam to pass flood flows and reviewed the potential impacts to downstream structures associated with dam failure. During the modeling process, impacts to a few residential structures, Grachen Drive and NH Route 113 were evaluated in detail. The results of the analysis indicate that during both a sunny-day and 100-year storm breach scenario, the failure flows would overtop NH Route 113 by a maximum of 0.25 feet and 1.37 feet, respectively. However, residential structures on Winnigon and Grachen Drives would remain untouched. Grachen Drive would also be overtopped during both breach scenarios.

The definition of a significant hazard dam, provided in Env-Wr 101.39 of New Hampshire's Dam Safety Rules, includes specific criteria that could qualify a dam as a significant hazard dam. In this case NHDES has determined that the dam meets the criteria listed below:

Env-Wr 101.39 "Significant Hazard Structure" means a dam that has a significant hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in any of the following:

- *(a) No probable loss of life;*
- *(c) Structural damage to a Class I or II road which could render the road impassable or otherwise interrupt public safety issues.*

Please be advised that if you do not agree with the NHDES's determination to reassign the hazard classification and wish to request reconsideration, the process that must be followed is described in section Env-Wr 303 of the NHDES's administrative rules. Included with this letter are the administrative rules that govern the NHDES's review of and the procedures for appealing hazard classifications.

If you have any questions, or would like to discuss this matter further, please contact Charlie Krautmann, P.E. at 271-4130 or me at 271-1961.

Sincerely,

James W. Gallagher, Jr., P.E.
Chief Engineer
Dam Bureau

Enclosure: Env-Wr 303, H&H Report
cc: Town of Madison
ec: jcooley@loon.org; Carol.Henderson@wildlife.nh.gov; warrenterri@yahoo.com; TLcancelarich@wellington.com; cancelarich@yahoo.com; skiman194@aol.com; robgalante@eastcoastflies.com; office@vdoe-nh.org
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The State of New Hampshire

DEPARTMENT OF ENVIRONMENTAL SERVICES

Robert R. Scott, Commissioner

John and Terri Cancelarich
115 Waverly Avenue
Melrose, MA 02176

July 30, 2019

RE: Big Pea Porridge Pond, Madison

Dear John and Terri:

The primary purpose of this letter is to respond to your inquiry regarding the process to construct a dam on Big Pea Porridge Pond in Madison. Based upon discussions you've had with members of the New Hampshire Department of Environmental Services, Dam Bureau (NHDES) staff, it is understood that you and others are interested in exploring alternatives to both raise and manage the level of the pond. Further, that your interest stems from levels that appear to be consistently lower in the last several years. In late 2018, NHDES was made aware of an unauthorized dam that had been constructed at the outlet of the pond in 2018. That structure was removed within a few weeks, but its appearance further expresses abutters' concerns regarding low water levels.

In an attempt to better understand conditions, and to perhaps support your efforts, NHDES has reviewed available electronic information and performed several site visits to investigate conditions at Big Pea Porridge Pond, Big Loop Road and Little & Middle Pea Porridge Pond Dam. In addition, we have created a detailed watershed model to evaluate the system's response to various rainfall events. It is important to note that we have had discussions with representatives of the Village District of Eidelweiss and the Loon Preservation Committee related to how the dam that controls the level of Little and Middle Pea Porridge ponds is currently managed to foster successful loon nesting. The current operation plan of that dam is to delay filling the ponds to their summer recreational level until such time as loon chicks no longer rely on stationary nests.

Below are NHDES' preliminary findings based on its investigation to date, as well as the results of the hydrologic and hydraulic model created for the watershed:

1. The Village District of Eidelweiss' (VDOE) current operation plan at Little & Middle Pea Porridge Pond Dam (D149004) draws down the impoundment for the winter by removal of two stoplogs (~1.48' of stoplogs or to an elevation of 646.52') and maintains that level through the critical loon nesting period. Typically, the stoplogs are replaced at the end of June. During NHDES' 6/5/19 site visit, the pond was observed to be at an elevation of 647.19';
2. The culvert at Big Loop Road was replaced in 2012 as part of a NHDES Wetlands program permit. Though our review reveals that the new culvert is larger, it appears that the bottom invert of the new pipe matches that of the old one, so this work should not have affected normal channel/pond levels upstream. Further, provided that the debris rack at its upstream end is cleaned regularly, it should not act as a dam or impede flow to Little and Middle Pea Porridge ponds;
3. Multiple abutters have suggested that a beaver dam was located between Big Loop Road and the outlet of Big Pea Porridge Pond, and this dam was reportedly removed 2 to 3 years ago. More than likely the presence of the beaver dam contributed to slowing flow in the channel and raising water levels in Big Pea Porridge Pond, as since its removal the impoundment level has dropped to an elevation more consistent with the hydraulic control of the natural and unencumbered channel;
4. A historic, low concrete structure appears to span the bed of the narrow channel at the outlet of Big Pea Porridge Pond. During NHDES' 6/5/19 site visit this structure was determined to have

an elevation of ~647.49'. On the same day, Big Pea Porridge Pond was recorded to be at 648.42' and Little and Middle Pea Porridge ponds were at elevation 647.19' (a difference of 1.23');
5. On 6/26/19 NHDES made another site visit after a heavy rain storm dropped ~0.8" the night before. One stoplog had been replaced at Little & Middle Pea Porridge Pond Dam and the level there was observed to be 647.59'. Big Pea Porridge Pond was at elevation 648.08' (a difference of 0.49');
6. Based on discussions with a handful of abutters at Big Pea Porridge Pond, the preferred impoundment elevation seems to be in the range of 649.5-649.9'; and
7. Though modifications to the current operation plan at Little & Middle Pea Porridge Pond Dam could be made to restore the normal summer recreation pool earlier in the spring it is unlikely, based upon the feedback received from you and other abutters, that this change would be sufficient to achieve and maintain the preferred pond elevation at Big Pea Porridge Pond. In addition, this would require consultation with the NH Fish & Game Department as well as the Loon Preservation Committee to ensure that the considerations related to loon nesting are addressed.

NHDES Dam Safety and a Surveyor from the Engineering & Construction Section surveyed (via differential leveling) the appurtenant structures along all three ponds on June 5th, 2019. The above elevations are based on that survey which have an accuracy of ±0.1'. All elevations are based on the top of concrete at the outlet to be 648.0'.

Brief History:

NHDES files indicate that a fish screen/rock structure was built at the outlet of Big Pea Porridge Pond by either a local or state operated fish & game group in 1948/1949. A few photos of the remnant fish screen were taken in 1964 when the NH Water Resources Board (predecessor of NHDES) investigated the outlet conditions of the pond. A follow-up description stated: *"The remains of a fish screen are in the outlet brook. This screen was 2.0' high and the bottom was rocked in. In its present condition, the lower portion, rocked in, forms a dam approximately 1.4' high."* In 1965, Great Northern Land Corporation, submitted an application to the Board to construct a dam at the outlet of Little Pea Porridge Pond and build control structures at both Middle and Big Pea Porridge Ponds. The design was performed by L.F. Brown, an engineer out of Concord, NH. With the construction of the dam at Little Pea Porridge Pond, the design intent was to have all three ponds at the same elevation. Prior to construction the reported elevation of Little Pea Porridge Pond was 640', Middle Pea Porridge Pond was 644.9' and Big Pea Porridge Pond was 648.0.'

In January of 1966 the Board issued a permit to construct the dam at Little Pea Porridge Pond and connect the three ponds. The dam was constructed in 1966; however, at the end of 1967, NH Water Supply and Pollution Control Commission issued a cease and desist on dredging activities between Big and Middle Pea Porridge ponds. The original design intended to create a navigable way for small boats between the two ponds, but upon further investigation it was determined that the outlet channel at Big Pea Porridge Pond would have to be lowered approximately 3.0' to achieve it. The contractor submitted an amended application to the Board to complete this work but the Board stated *"that lowering of a control point at the outlet of a great pond over ten acres area comes under RSA Chapter 484 as amended. NH Fish & Game has notified this Board that some excavation...has already been undertaken. No more excavation shall take place in this area until after a hearing. Present natural control of Big Pea Porridge Pond must not be disturbed."* Based on another complaint in 1969, NH Fish & Game inspected the outlet of Big Pea Porridge Pond and found that no additional dredging had occurred. Further, it stated that it was inalterably opposed to lowering the natural outlet of Big Pea Porridge Pond. As such, that portion of the plan was dropped and NHDES is aware of no alteration to the outlet since that time.

Based on NHDES' site reconnaissance and modeling, along with its estimate of the water levels desired by the few abutters interviewed, the construction of a dam at the outlet of Big Pea Porridge Pond would need to be implemented to achieve a slightly higher and consistent level than presently exists. Depending on the dam's location, the structure could be of limited size and relatively simple to design and build.

Process to Construct a Dam:

Big Pea Porridge Pond is a **Great Pond**, defined as a natural waterbody of 10 acres or more in size. In accordance with RSA 482:7, the construction of a dam on such water bodies requires legislation. Further, compliance with other portions of Chapter 482 of the state's statutes annotated and NHDES' administrative regulations will also be required. Our experience indicates that, as noted above, the structure will be small and low. Therefore, provided that it does not exceed 6 feet in height, it would be considered a Non-Menace dam. This keeps dam construction application fees at their minimum, imposes few construction requirements to achieve minimum dam safety standards and avoids the need for future routine dam safety inspections by NHDES. All rules related to the application process may be found in part Env-Wr Chapter 400. Additional environmental permits, such as one from NHDES' Wetlands Program, may also be required.

In order to initiate the legislative process, you or a core group of interested parties, will need to engage a member of either the Senate or the House of Representatives in your district to sponsor a bill. NHDES has included an attached template bill that has been used in prior cases. The draft proposal bill would be due in the fall for the following year's consideration. As the process moves forward, NHDES would be happy to facilitate and participate in meetings to both guide you and to assist in drafting the legislation, if needed. Based on previous cases, though this is not an exhaustive list of what might need to be addressed, NHDES recommends that you consider the following items:

1. Attempt to build consensus with abutters around Big Pea Porridge Pond. As may have been discussed, even a small increase in the normal elevation of the lake could have impacts and unintended consequences to shorefront property. Loss of beach area, impacts to docks, retaining walls, septic systems, increases in groundwater levels, etc. are a few examples;
2. Make contact with the NH Fish & Game Department and question if there could be any impacts to fisheries, aquatic species or wildlife;
3. Hire a consulting engineer to assist in the technical aspects of the project. Establishing and investigating the preferred elevation of the pond and designing the dam are examples;
4. Confirm that the landowners of the site chosen for dam construction are agreeable to participate. Land transfers, construction and access easements, etc. may be necessary;
5. Consider either forming a Village District or Lake Association. This will allow residents to become involved in matters concerning the pond/dam and to designate certain individuals to represent these concerns (see attached Fact Sheet); and
6. Consider the liability and responsibility of owning a dam (see attached Fact Sheets).

The following are a few of the applicable statutes and administrative regulations:

- RSA 271:20 – State Water Jurisdiction; Published List of Public Water; Rulemaking. –
  I. All natural water bodies of fresh water situated entirely in the state having an area of 10 acres or more are state-owned public waters, and are held in trust be the state for public use; and no corporation or individual shall have or exercise in any such body of water any rights or privileges not common to all citizens of this state; provided, however, the state retinas its existing jurisdiction over those bodies of water located on the borders of the state over which it has exercised such jurisdiction.

- Env-Wr 101.38 *"Non-menace structure" means a dam that is not a menace because it is in a location and of a size that failure or misoperation of the dam would not result in probable loss of life or loss to property, provided the dam is:*
  (a) Less than 6 feet in height if it has a storage capacity greater than 50 acre-feet; or
  (b) Less than 25 feet in height if it has a storage capacity of 15 to 50 acre-feet.

- RSA 482:2 – Definitions. –
I. "Classification of a dam" means the potential hazard classification placed on a dam by the department based on the potential threat to life and the potential extent of property damage in the event of accidental damage to, or failure of, the dam structure. The classifications shall be "non-menace," "low hazard potential," "significant hazard potential," or "high hazard potential."
II.(a) "Dam" means an artificial barrier, including appurtenant works, which impounds or divers water and which has a height of 6 feet or more, or is located at the outlet of a great pond. A roadway culvert shall not be considered a dam if its invert is at the natural bed of the water course, it has adequate discharge capacity, and it does not impound water under normal circumstances. Artificial barriers which create surface impoundments for liquid industrial or liquid commercial wastes, septage, or sewage, regardless of height or storage capacity, shall be considered dams.

- RSA 482:7 – New Dams on Great Ponds. –
No dam shall be constructed on the outlet of a great pond after September 3, 1977, without specific authorization from the legislature and without a permit to construct a dam from the department according to such terms and conditions as it deems necessary for the public safety.

- RSA 482:9 – Preliminary Filing of Information. –
I. No person shall begin the construction or reconstruction of any dam until:
(a) The person has filed with the department a statement of the height of the proposed dam and the location at which it is to be erected and the other information the department may require.
(b) A permit has been issued by the department.
II. The filing of the statement required by paragraph I or an application required by RSA 482:5 shall be accompanied by a fee for each statement or application filed. The fee shall be deposited in the dam maintenance fund established in RSA 482:55 to be used for the permitting of dams. The fee shall be as follows:
    (a) *Non-hazard potential dam $2,000*
    (b) *Low hazard potential dam $3,000*
    (c) *Significant hazard potential dam $4,000*
    (d) *High hazard potential dam $4,000*

If you have any questions, or would like to discuss this matter further, please contact Charlie Krautmann, P.E. at 271-4130 or me at 271-1966.

Sincerely,

Charlie Krautmann

for Steve N. Doyon, P.E.
Administrator
Dam Safety and Inspection Section

Enclosure: Engineers List, Template Bill, WD-DB-10, 12, 13 and 14
cc: Town of Madison and Village District of Eidelweiss
ec: jcooley@loon.org; Carol.Henderson@wildlife.nh.gov; warrenterri@yahoo.com; skiman194@aol.com; robgalante@eastcoastflies.com; office@vdoe-nh.org; Commissioner1@vdoe-nh.org; commissioner2@vdoe-nh.org; commissioner3@vdoe-nh.org
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AN ACT

Permitting ____to construct a dam on a Great Pond.

Be it enacted by the Senate of the House of Representatives in General Court convened:

: 1 Purpose. The general court declares it in the best interests of the littoral owners around Big Pea Porridge Pond in Madison and Conway and the people of New Hampshire, generally, to control the waters of said pond (a Great Pond) by allowing the construction of a dam at its natural outlet.

: 2 ________________Authorized. Pursuant to RSA 482:7, the __________________________is specifically authorized to construct a dam at the natural outlet of Big Pea Porridge Pond in the Town of Madison.

: 3 Effective Date. This act shall take effect upon its passage.

Dam Inspection/H&H Analysis Form

Dam number: D149004
Hazard Classification: **Low, recommend upgrading to Significant**
Condition Assessment: Fair
Dam name(s): **Pea Porridge Pond Middle & Little Dam**
Town: **Madison**
Date of inspection/s: May 29 & June 5, 2019
Inspector: Charlie Krautmann
Inspection Attendees: Adam Leiser (Commissioner), Kelly Robitaille (Highway Dept) and other abutters to the ponds
Water level: ~0.48' flowing over the stoplog bay and 0.81' below the top of the concrete drop inlet structure.
Report date: June 12, 2019

Pertinent Data:

Maximum Height: 17 ft
Storage: 210 ac-ft perm, 406 ac-ft max.*
Overall Length: ~175 ft**
Drainage Area: 2.7 mi^2 or 1,731 acres
Pond Area: 46 acres
Design event: 100-year storm
50 Year Storm: 536 cfs inflow routed to 136 cfs outflow w/ 3.25 ft of freeboard
100 Year Storm: 640 cfs inflow routed to 154 cfs outflow w/ 3.01 ft of freeboard
Discharge Capacity: 342 cfs w/1-ft fbd- no operations
1,012 cfs no fbd-no operations
Type of Construction: Earth embankment
Construction Date: 1966
Outlet Works: 1 – 60' long, concrete culvert that is 48" wide and 60" high that controls outflow from the stoplog bay and horizontal orifice
1 – 3' wide stoplog bay (Design Drawings suggest it is 11' high)
1 – Horizontal Orifice/Grate that is 6.0' wide and ~5.2' long
1 – Auxiliary Spillway on Left Abutment/Beach Area along Eidelweiss Drive that diverts flow through downstream playground. Design drawings suggest invert is 80' wide

* Storage Volumes based on previous analysis
** Excluding auxiliary spillway

Dam Inspection Observations:

Feature	**Observation**	**Type M/S/ NA***
Downstream embankment	• Entire embankment covered with saplings, brush and trees	M
Spillway	• Concrete has a significant amount of exposed aggregate • Crack/leakage observed in concrete drop structure along the left wall, a few feet below the top of the structure.	M/S S
Auxiliary Spillway	• Trees and boat racks would impede flow at the approach to the auxiliary spillway	M

	• Eidelweiss Drive acts as spillway	NA
Dam owner interview/comments	• See discussion below.	NA

*Type of Deficiency: M-Maintenance; S-Structural; NA-Not Applicable

Downstream Hazard Review:

Feature	Dist. d/s (miles/feet)	Observation
D149004/Eidelweiss Drive	0'	If dam completely failed, it would sever access across Eidelweiss Drive
Grachen Drive	~1,780'	60" diameter corrugated metal culvert below a gravel (Village District) road
NH Rte. 113	~3,780	Concrete box culvert that is 68" wide and 63" high
Upper Pequawket Pond	~14,500'	NA

Hazard Classification/Justification – Low to Significant hazard, Dam Breach Analysis:

Date of last breach analysis	1979 & 1991
Requires updated analysis	No

- Grachen Drive and NH Rte. 113 are the only apparent downstream structures that have the potential to be overtopped prior to the breach being attenuated by the Pequawket River.
- A cross-section was created for the residential structure on Winnigon Drive (owner Larry Leonard) that sits close to the river. Based on the model, the house remains untouched by both breach scenarios. All other residential structures are much higher than the river bed and would not be impacted by a breach. This remains true for residential structures on Grachen Drive, Bergdorf Place, Brookstone Lane and Pebblebrook Lane.

Breach Assumptions

- Bottom Elevation: 642.71' (Based on pond bottom during survey. Culvert invert is 636.698', ie. conservative estimate).
- Breach Height: 8.0' (Dam Height is 17.0', ie. conservative estimate).
- Bottom Width: 12.0' (Based on outlet configuration and steep valley slopes).
- Start Time: 12.2 hours (Based on peak inflow at 12.65 hours).
- Breach Time: 0.4 hours

Grachen Drive

- **50 Year Storm:** 136 cfs inflow routed to 136 cfs outflow w/ 3.11 ft of freeboard
- **100 Year Storm:** 154 cfs inflow routed to 154 cfs outflow w/ 2.61 ft of freeboard
- **Sunny-Day Breach:** 356 cfs inflow routed to 356 cfs outflow w/ 0.75 ft of overtopping
- **50 Yr Storm & Breach:** 477 cfs inflow routed to 477 cfs outflow w/ 1.10 ft of overtopping
- **100 Yr Storm & Breach:** 504 cfs inflow routed to 504 cfs outflow w/ 1.16 ft of overtopping

NH Route 113

- **50 Year Storm:** 555 cfs inflow routed to 555 cfs outflow w/ 0.70 ft of overtopping
- **100 Year Storm:** 692 cfs inflow routed to 692 cfs outflow w/ 0.91 ft of overtopping
- **Sunny-Day Breach:** 356 cfs inflow routed to 356 cfs outflow w/ 0.20 ft of overtopping

- **50 Yr Storm & Breach:** 976 cfs inflow routed to 976 cfs outflow w/ 1.24 ft of overtopping
- **100 Yr Storm & Breach:** 1,112 cfs inflow routed to 1,112 cfs outflow w/ a maximum of 1.37 ft of overtopping. Road overtops for 8+ hours

Hydrologic/Hydraulic Analysis:

Required Discharge Capacity Env-Wr 303.11 or 403.04	100-year
Date of last analysis	2019
Meets current discharge requirement with required freeboard	Yes
If "N", does dam overtop during design event?	No
Requires updated analysis	No

- H&H performed with HydroCAD 10.00 using Atlas 14 precipitation
- 50-year, 24 hr. rain = 6.43 inches
- 100- year, 24 hr. rain = 7.17 inches
- DA = 2.7 mi^2 or 1,731 acres
- NHDES Dam Safety and a Surveyor from the Engineering & Construction Section surveyed (via differential leveling) the appurtenant structures along all three ponds on June 5th, 2019. The following elevations are based on that survey which have an accuracy of ±0.1'.

- **Little Pea Porridge Pond/Dam**
  - Water Surface Elevation = 647.19'
  - Water Surface Elevation at Middle Pea = 647.34'
  - Top of Stoplogs = 646.52'
  - Top of Concrete/Drop Inlet = 648.0'
  - Invert of Culvert (In & Out) = 636.69'
  - Pond Bottom In Front of Drop Inlet = 643.29'
  - Crest of Road Above Culvert = 652.44'
  - Control Point of Auxiliary Spillway = 650.69'

- **Big Pea Porridge Pond/Dam**
  - Water Surface Elevation = 648.42'
  - Control Point of Outlet (man-made, concrete) = 647.49'
  - Pond Bottom 10' Upstream of Control Point = 645.89'
  - Stream Bottom 25' Downstream of Control Point = 647.19'
  - Water Surface Elevation 50' Downstream of Control Point = 647.69'

- **Big Loop Road**
  - Water Surface Elevation Upstream of Culvert= 647.37'
  - Water Surface Elevation Downstream of Culvert= 647.35'
  - Water Surface Elevation at Middle Pea (900' downstream) = 647.34'
  - Crest of Road Above Culvert = 652.38'
  - Crest of Road Right Abutment (low spot) = 651.57'
  - Culvert Invert Upstream = 645.40'
  - Culvert Invert Downstream = 645.74'

Operations, Maintenance, and Response Form:

Plan on file, updated, and meets current requirements	No

- An OMR was submitted in August of 2016 although reflects the dam as a low hazard structure. The OMR should be reviewed and updated and the hazard classification should be changed to Significant.

Emergency Action Plan:

EAP on file, up to date, meets current requirements	No

- An EAP is required based on the dam being upgraded (from a Low hazard dam) to a Significant hazard dam. A Simplified Inundation Map (Env-Wr 503.02) should be applicable in this case as only 2 structures (State and Town Road) in the near vicinity of the dam are impacted. Therefore, the owner would be exempt from a breach analysis (based on Env-Wr 502.02).

Access and Security:
- The dam is accessed by vehicle approximately 0.5' miles east of NH Route 113 at the main entrance to Eidelweiss Village District on Eidelweiss Drive. The beach area acts as the right abutment. There are a handful of houses that overlook the beach and dam area. The stoplog bay is padlocked although all areas of the dam are easily accessed by foot.

Directions:
- Take NH Rte. 16 (Chocorua Mountain Highway) to the intersection of NH Rte. 113 south in Albany/Conway. Head south on NH Rte. 113 for ~2.25 miles and then take a left (east) onto Eidelweiss Drive. The dam is approximately 0.5' miles east of NH Route 113 at the main entrance to Eidelweiss Village District on Eidelweiss Drive

Design:
- 1965, October 22 – Drawings received by L.F. Brown, Engineer (Concord, NH) for design of Dam & Roadway at Eidelweiss for Great Northern Land Corporation (Title Sheet and 3 Drawings). Sheet C1 was revised and resubmitted on December 8, 1965.
  - Sheet C1 – Control Structure Design at Outlet of Both Big Pea and Middle Pea to maintain elevation 648.0'
  - Sheet C2 – Auxiliary Spillway 80' wide with invert of 649.5'
  - Sheet C2 – Crest of Dam = 652.0'
  - Sheet C2 – Outlet Invert U/S = 637.0'
  - Sheet C2 – Outlet Invert D/S= 636.89' (Slope of 0.2%)
  - Sheet C2 – Design Elevation of Pond and Top of Stoplogs = 648.0'

Ongoing Discussions with:
John Cooley – Senior Biologist with the Loon Preservation Committee: jcooley@loon.org
Carol Henderson – NHF&G Environmental Review Coordinator: Carol.Henderson@wildlife.nh.gov
Terri Warren: warrenterri@yahoo.com
Terri Cancelarich – VDOE Resident & Big Pea abutter: TLcancelarich@wellington.com
John Cancelarich – VDOE Resident & Big Pea abutter: cancelarich@yahoo.com
Larry Leonard – VDOE Resident: skiman194@aol.com
Rob Galante – Big Pea abutter: robgalante@eastcoastflies.com
Nancy Cole – VDOE Administrator: office@vdoe-nh.org & Commissioners:
commissioner1@vdoe-nh.org, commissioner2@vdoe-nh.org, commissioner3@vdoe-nh.org

Attachment 2
FEMA DSS-WISE Flood Simulation Report

National Center for Computational Hydroscience and Engineering (NCCHE)

The University of Mississippi

DSS-WISE™ Lite Flood Simulation Report

Dam Breach Analysis

Eidelweiss Dam 11192021

NH00768

November 19, 2021

Contact Information:

DSS-WISE™ Lite modeling questions: admin@dsswiseweb.ncche.olemiss.edu

Table of Contents

1.0 Overview

The Decision Support System for Water Infrastructure Security (DSS-WISE™) is an integrated software package combining 2D numerical flood modeling capabilities with a series of GIS-based decision support tools. It was developed by the National Center for Computational Hydroscience and Engineering (NCCHE) at the University of Mississippi and was initiated by the US Department of Homeland Security (DHS) Science and Technology Directorate through the Southeast Region Research Initiative (SERRI) Program.

A simplified, and fully automated, version of the DSS-WISE™ software suite (DSS-WISE™ Lite Ver 1.0) was developed on behalf of the US Army Corps of Engineers (USACE) Critical Infrastructure Protection and Resilience (CIPR) Program and the DHS Office of Infrastructure Protection. This simplified dam break flood modeling capability was available to interested parties through the Dams Sector Analysis Tool (DSAT) secure web portal until November 2014. An updated version with more features was developed on behalf of Federal Emergency Management (FEMA) and is available at dsswiseweb.ncche.olemiss.edu.

The DSS-WISE™ Lite software suite, running on NCCHE servers, automatically processes input files for dam-break modeling scenarios submitted by an user. DSS-WISE™ Lite further simplifies simulations by making several general overarching assumptions in an effort to streamline data preparation and computations.

The results produced by this simplified dam-break flood simulation tool represent a rough approximation. They are not intended to replace more detailed flood inundation modeling and mapping products or capabilities developed by hydraulic and hydrologic engineers and GIS professionals.

The user is, therefore, warned that professional engineering judgment should be used in the interpolation of the results generated by this simplified and automated dam-break flood analysis.

To learn more about DSS-WISE™ and DSS-WISE™ Lite visit us at:
`https://dsswiseweb.ncche.olemiss.edu`

Disclaimer

The National Center for Computational Hydroscience and Engineering (NCCHE), The University of Mississippi, makes no representations pertaining to the suitability of the results provided herein for any purpose whatsoever. All content contained herein is provided "as is" and is not presented with any warranty of any form. NCCHE hereby disclaims all conditions and warranties in regard to the content, including but not limited to any and all conditions of merchantability and implied warranties, suitability for a particular purpose or purposes, non-infringement and title. In no event shall NCCHE be liable for any indirect, special, consequential or exemplary damages or any damages whatsoever, including but not limited to the loss of data, use or profits, without regard to the form of any action, including but not limited to negligence or other tortious actions that arise out of or in connection with the copying, display or use of the content provided herein.

Elevation Datum

All reported elevations use the North American Vertical Datum of 1988 (NAVD 88).

2.0 Modeling Parameters and Conditions

2.1 Project Information

Project Name:	Eidelweiss Dam 11192021
Scenario Name:	Dam Breach Analysis
NIDID:	NH00768
Scenario Description:	Dam Breach
User e-mail:	alexander.liptak@wright-pierce.com

2.2 Simulation Parameters

Simulation distance requested (miles):	10
Simulation cell size requested (ft):	21.0
Simulation duration requested (days):	3

2.3 Impounding Structure(s) Characteristics

Number of Structures: 1

Structure Name:	Structure 1
Structure Type:	Embankment
Hydraulic Height (ft):	14.0
Crest Elevation (ft):	650.7
Length (ft):	373.054073118

2.4 Bridge(s) to be Removed

Number of Bridges: 3

Bridge Name:	Grachen Drive Bridge
Length(ft):	10.0
Coordinates (Latitude/Longitude):	43.9327362046/-71.1411724985

Bridge Name:	Conway Road
Length(ft):	10.0
Coordinates (Latitude/Longitude):	43.9339511722/-71.1463679373
Bridge Name:	NH 113 Bridge
Length(ft):	15.0
Coordinates (Latitude/Longitude):	43.9641927725/-71.1449316144

2.5 Reservoir Characteristics

Number of Reservoirs: 1

Reservoir Name:	Little/Middle Pea Porridge Pond
Selected Reservoir Point (Latitude/Longitude):	43.9363139623/-71.1372208631
Pool Elevation @ Max Storage (ft):	650.69
Maximum Storage Volume (ac-ft):	406.0
Pool Elevation @ Normal Storage (ft):	647.19
Normal Storage Volume (ac-ft):	210.0

2.6 Failure Conditions

Structure Name:	Structure 1
Structure Type:	Embankment
Failure Mode:	Partial Dam Breach
Breach Type:	Embankment
Pool Elevation @ Failure (ft):	650.69
Storage Volume @ Failure (ac-ft):	406.0
Breach Width (ft):	42.0
Time to Failure(hrs):	0.5
Breach Invert Elevation (ft):	636.7
Breach Location (Latitude/Longitude):	43.9357224925/-71.1378946774

3.0 Automated Data Preparation and Job Flow Summary

3.1 Job Flow Summary

1. Prepare Digital Elevation Model (DEM) and Land Use/Land Cover (LULC) tiles for the Area of Interest (AOI) based on requested cellsize and maximum downstream distance.

2. Burn U.S. Army Corps of Engineers (USACE) levee lines into DEM for the AOI.

3. Assign Manning's coefficients based on LULC classifications.

4. Validate user provided simulation input parameters.

5. Remove user identified bridges from the DEM.

6. Estimate reservoir bathymetry.

7. Extend impounding structures if the specified reservoir level cannot be contained.

8. Fill reservoir to specified failure elevation.

9. Prepare boundary condition and all input data for simulation.

3.2 Reservoir Bathymetry and Filling

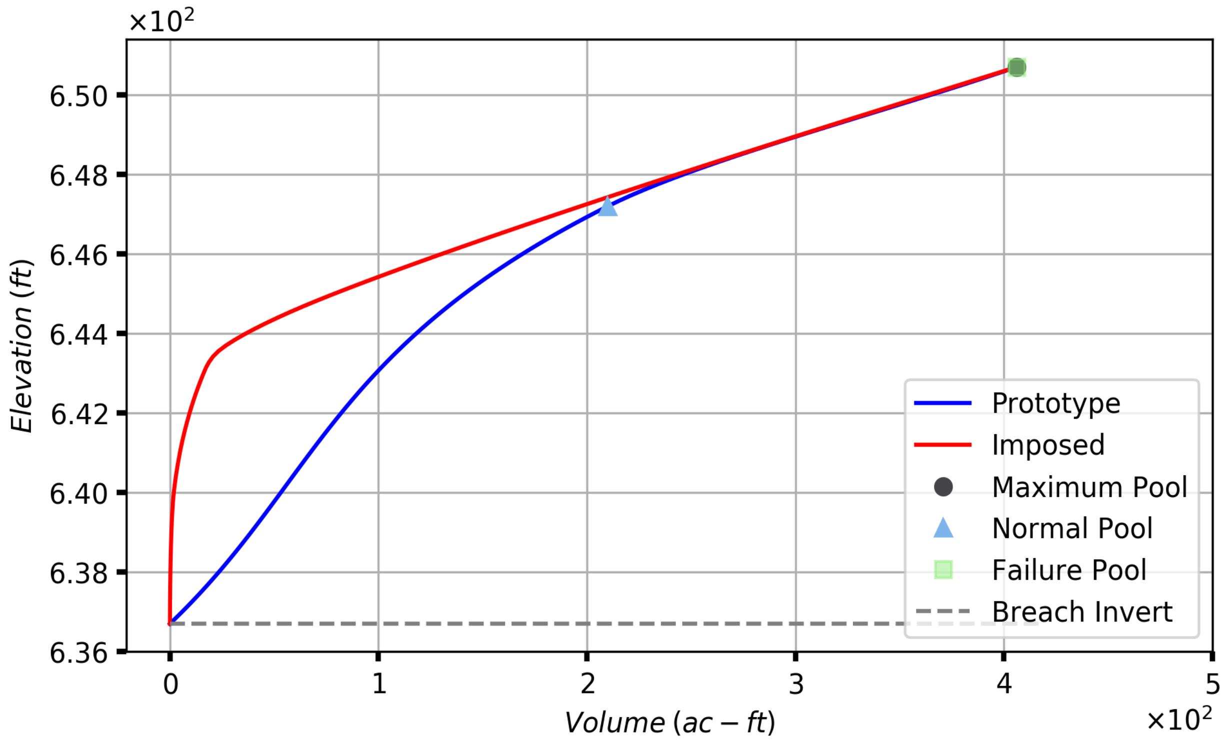

Figure 1. Stage-Volume Curve for Reservoir: Little/Middle Pea Porridge Pond.

Prototype: Theoretical cubic Hermite spline curve generated from user-provided reservoir elevation and volume information.
Imposed: Measured from reservoir bathymetry after filling to the failure elevation.

The reservoir water surface was detected to be in the DEM, so bathymetry estimation was performed using the prototype stage-volume curve shown above.
User-given Storage Volume at Failure (ac-ft): 406.0
Imposed Storage Volume at Failure (ac-ft): 406.0
After filling to the failure elevation, the imposed reservoir volume matched 100.0% of the prototype volume.

3.3 Data Sources

1. Digital Elevation Models

   Sources: USGS 2018 National Elevation Dataset, NOAA, DEM provided by group.

   Resolutions: 2, 1, 1/3, 1/9, 0.15 arc-seconds, 1 meter, and 10 feet based on availability

   Vertical Datum: NAVD88

   Horizontal Datum: NAD83

2. National Land Use/Land Cover Data

   Source: USGS 2016 National Land Cover Database

   Resolution: 30 m

3. National Levee Database

   Source: USACE

3.4 Digital Elevation Model

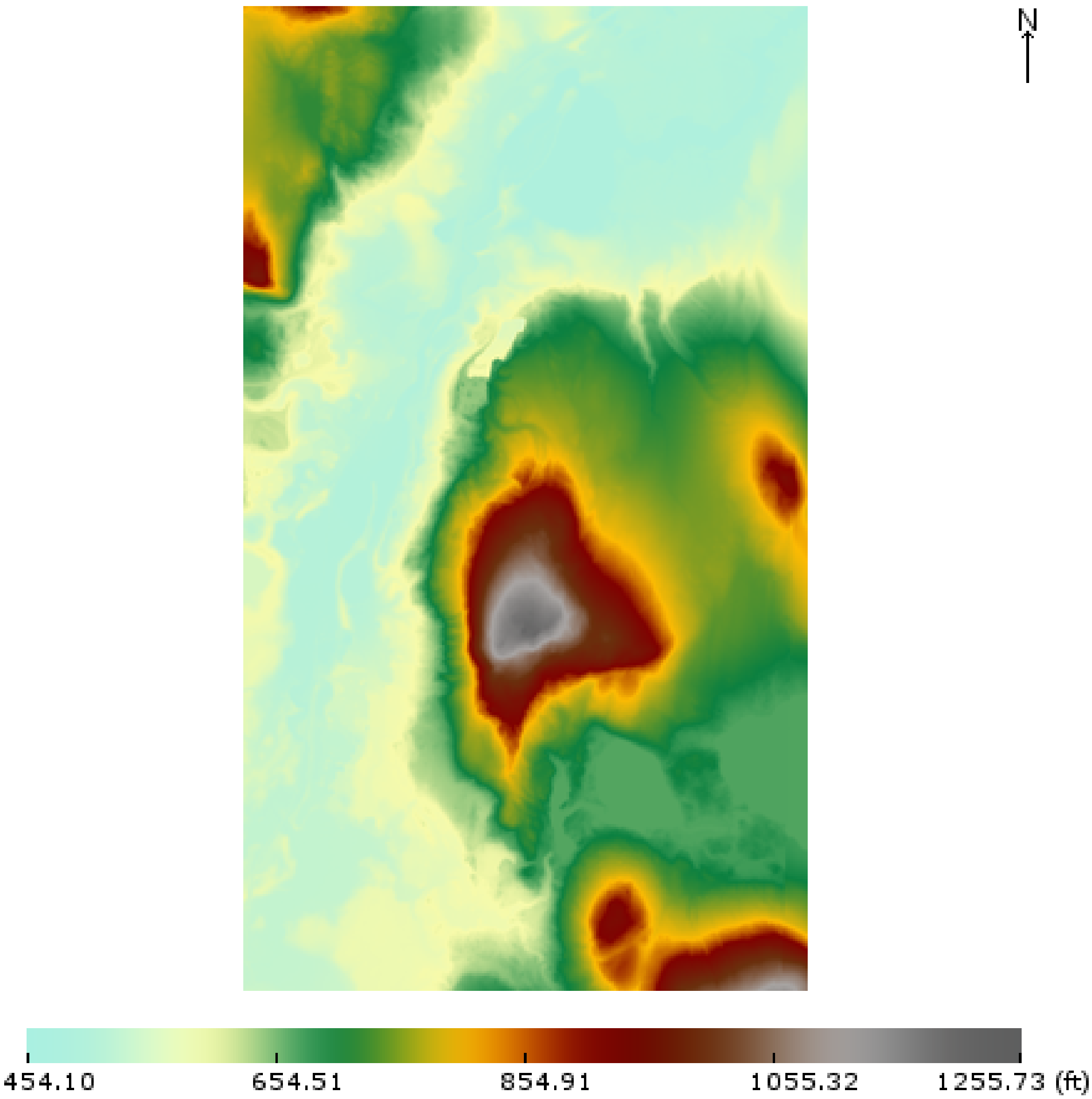

Image Dimensions: N-S: 3.353 miles E-W: 1.925 miles

Figure 2. Map of Digital Elevation Model with Levees for AOI.

3.5 Reservoir Boundary and Breaching Structure

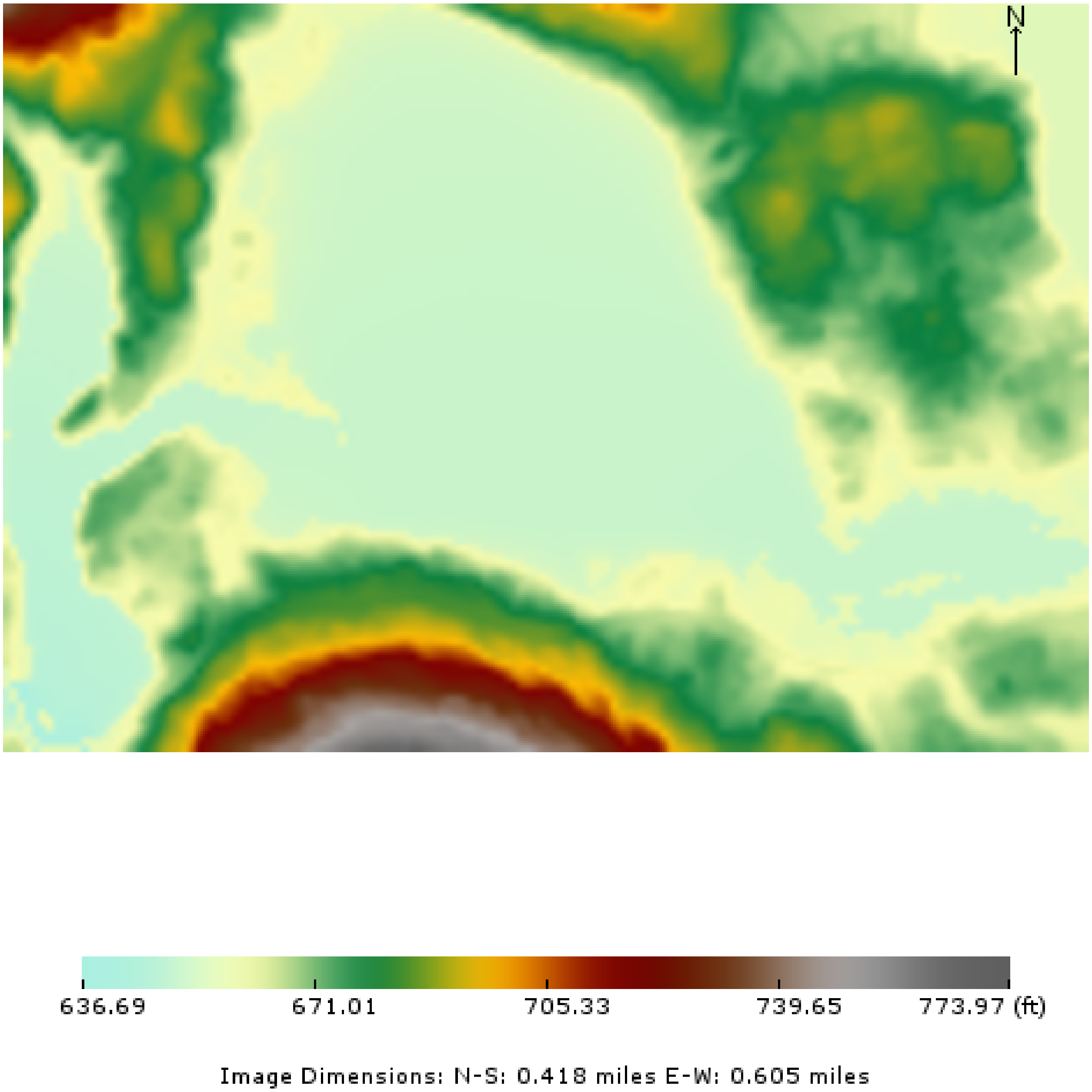

Figure 3. Map of Reservoir Boundary and Breached Structure.

3.6 Reservoir Initial Depth Profile

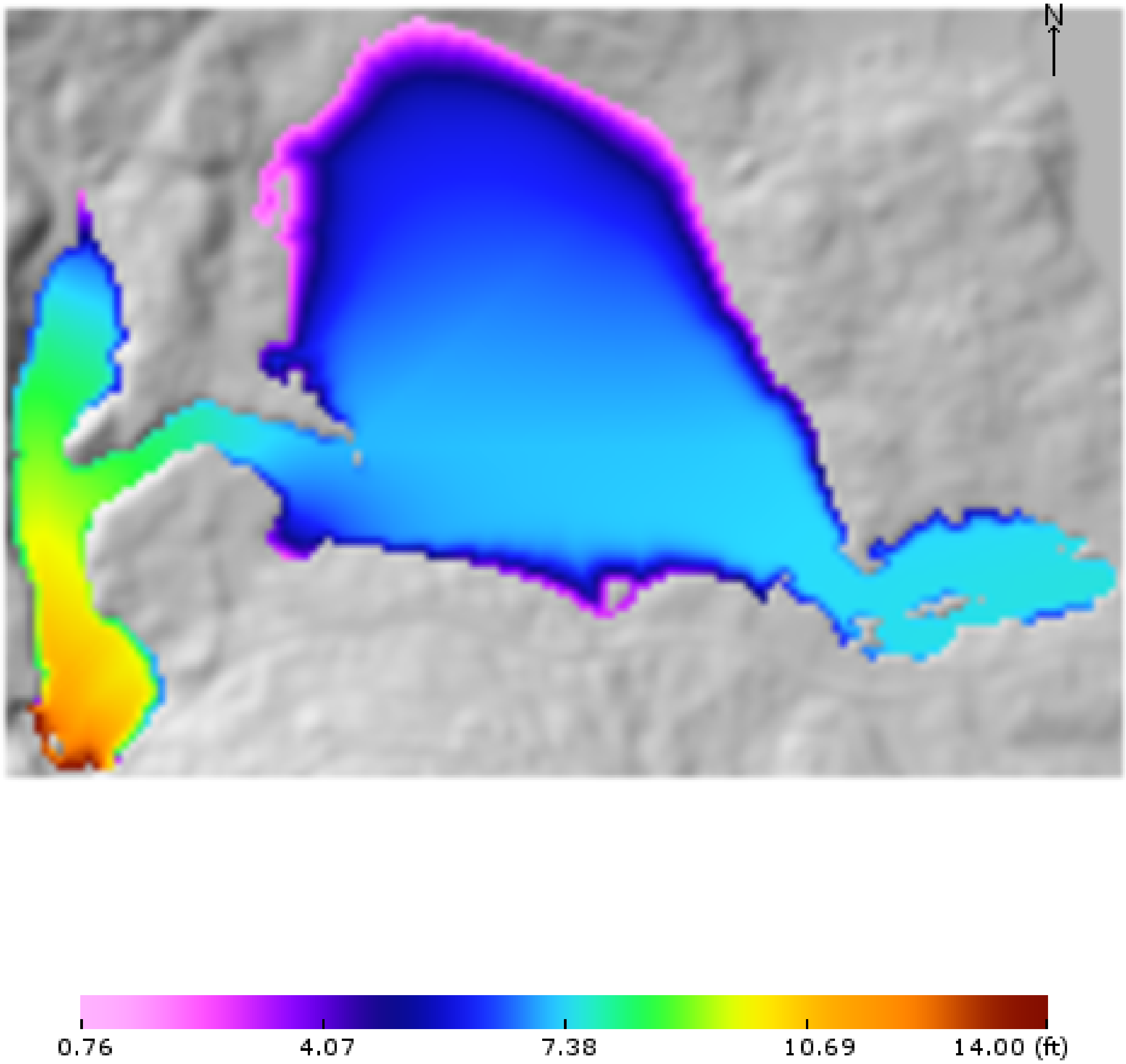

Image Dimensions: N-S: 0.430 miles E-W: 0.620 miles

Figure 4. Map of Initial Depths in Reservoir at Failure Conditions.

3.7 Land Use/Land Cover

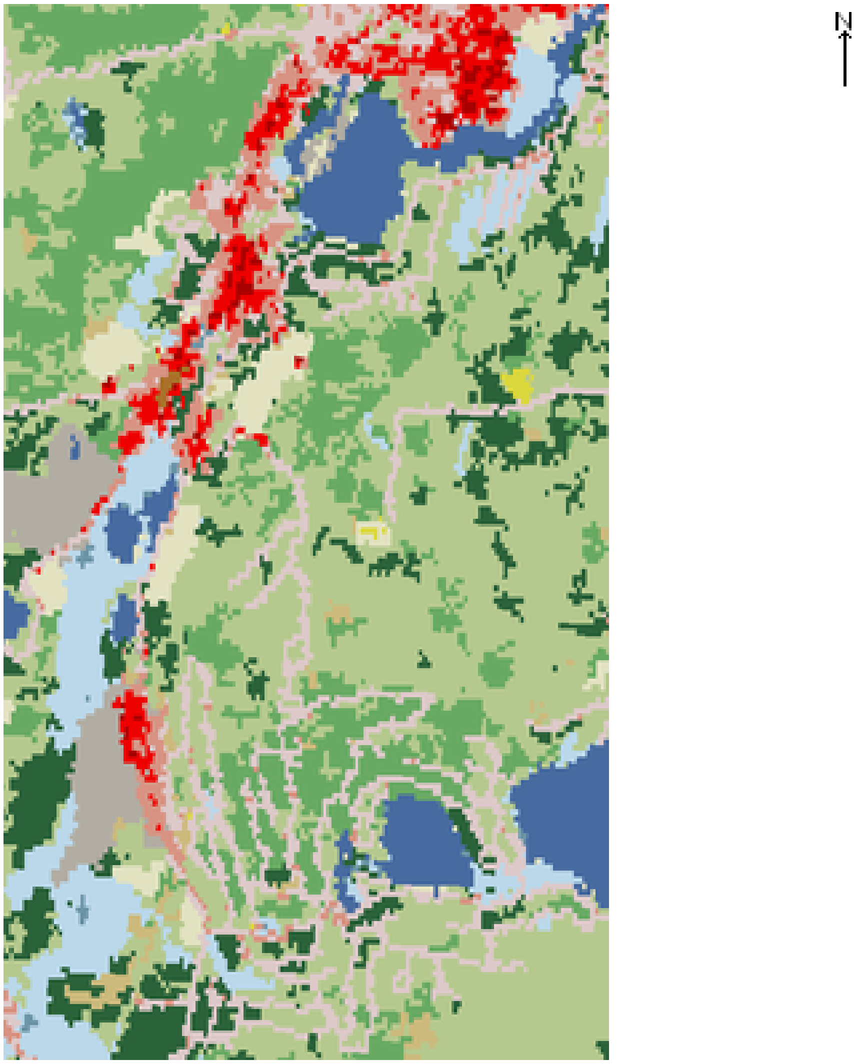

Image Dimensions: N-S: 3.353 miles E-W: 1.925 miles

Figure 5. Map of Land Use for AOI.

4.0 Simulation Results

4.1 Simulation Summary

Simulation Request Received:	09:41 AM CST (11/19/2021)
Simulation Start Time:	09:42 AM CST (11/19/2021)
Simulation End Time:	09:45 AM CST (11/19/2021)
DEM resolution used for simulation (ft):	21.0
DEM resolution requested (ft):	21.0
Final distance reached downstream (miles):	3.0
Maximum downstream distance requested (miles):	10
Elapsed simulation time after breach initiation (hrs):	55.0
Remaining reservoir volume at termination (%):	2.353
Termination condition:	Water stopped spreading.

4.2 Land Use and Manning's Roughness Coefficient for Inundated Area

Land Use Description	% of Inundated Area	n-Value($m^{-1/3}s$)	Code	Color
Woody Wetlands	47.69	0.1500	90	
Open Water	36.02	0.0330	11	
Mixed Forest *	4.65	0.1200	43	
Developed, Open Space	2.74	0.0404	21	
Evergreen Forest *	2.74	0.1000	42	
Emergent Herbaceous Wetlands	1.96	0.1825	95	
Developed, Low Density	1.68	0.0678	22	
Developed, Medium Density	0.78	0.0678	23	
Grassland/Herbaceous	0.64	0.0400	71	
Barren Land	0.60	0.0113	31	
Developed, High Density	0.28	0.0404	24	
Deciduous Forest *	0.10	0.1000	41	
Shrub/Scrub	0.06	0.0400	52	
Unclassified	0.00	0.0350	0	
Perennial Snow/Ice	0.00	0.0100	12	
Dwarf Scrub *	0.00	0.0350	51	
Sedge/Herbaceous *	0.00	0.0350	72	
Lichens *	0.00	0.0350	73	
Moss *	0.00	0.0350	74	
Hay/Pasture	0.00	0.0350	81	
Cultivated Crops	0.00	0.0700	82	

Note: * indicates an n-value estimated by NCCHE. ** indicates an n-value given by the user. Other values are taken from literature.

4.3 Coverage and Sources of DEM Raster Datasets

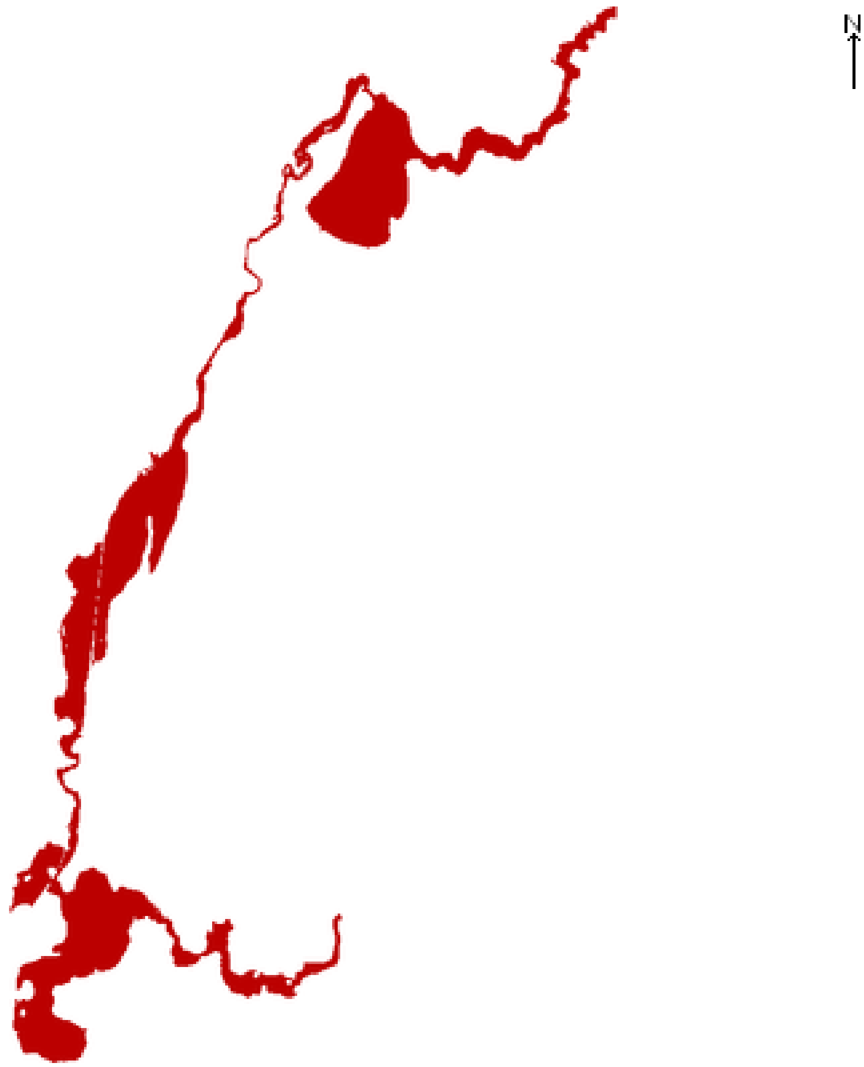

Figure 6. Coverage of DEM Raster Datasets in the Inundation Area.

DEM Source	Source Resolution	Source Dataset	Color
USGS	1 arc-second	usgs_1as	
USGS	1/3 arc-seconds	usgs_13as	
USGS	1 meter	usgs_utm_z19_1m	

Note: The DEM for this job was created from the source DEM raster datasets listed above. These DEM raster datasets were resampled and reprojected to the user defined cell size and UTM zone, respectively. Resampled and projected DEM raster datasets were then stacked in the order specific to the group under which this simulation was submitted.

4.4 Maximum Flood Depth

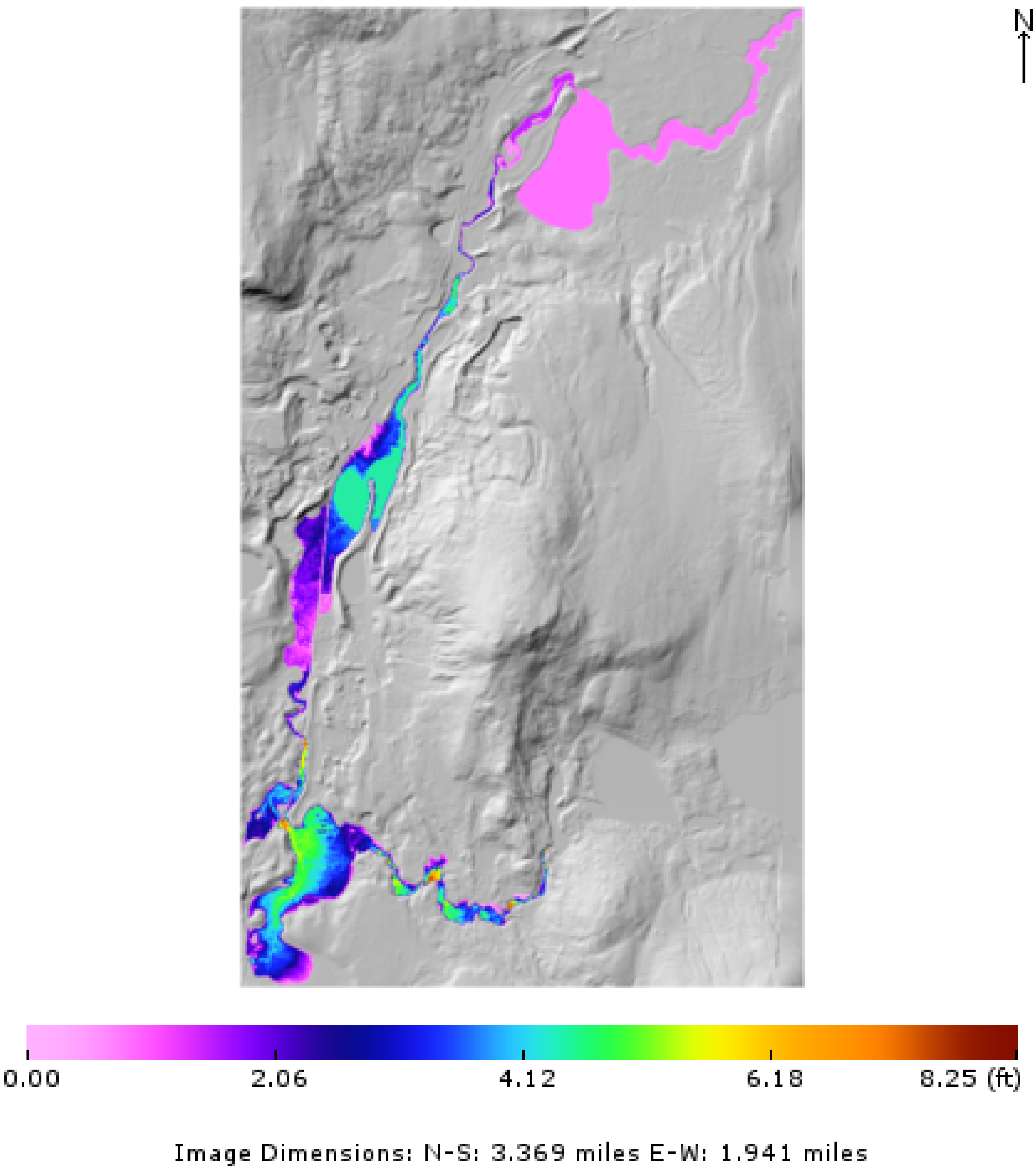

Figure 7. Maximum Flood Depth Map.

4.5 Flood Arrival Time

Flood arrival time is measured from the beginning of the simulation.

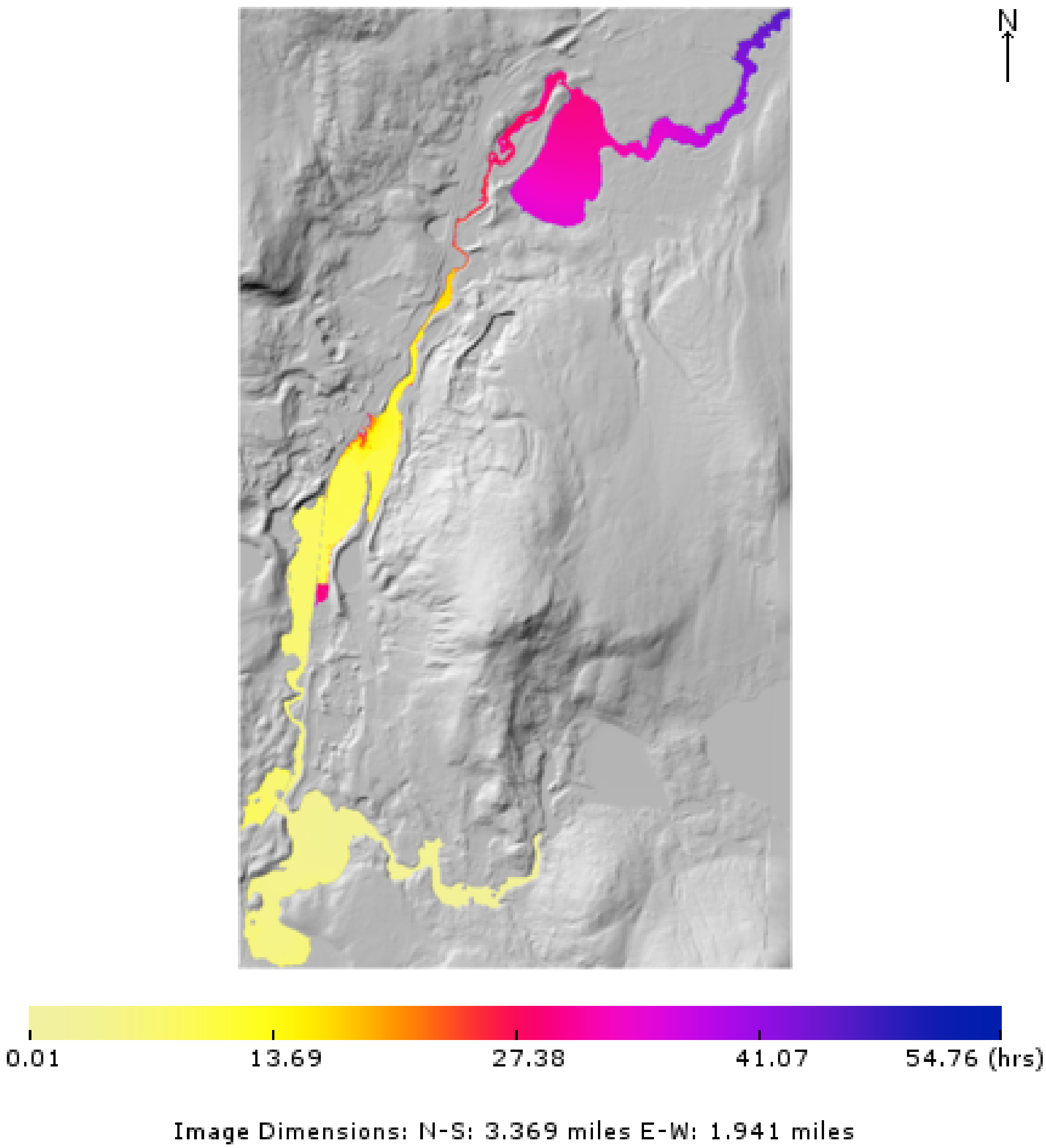

Figure 8. Flood Arrival Time Map.

4.6 Computed Breach Hydrograph through the Breaching Structure

The positive discharges (Q^+) are measured in the positive direction with respect to each observation line.

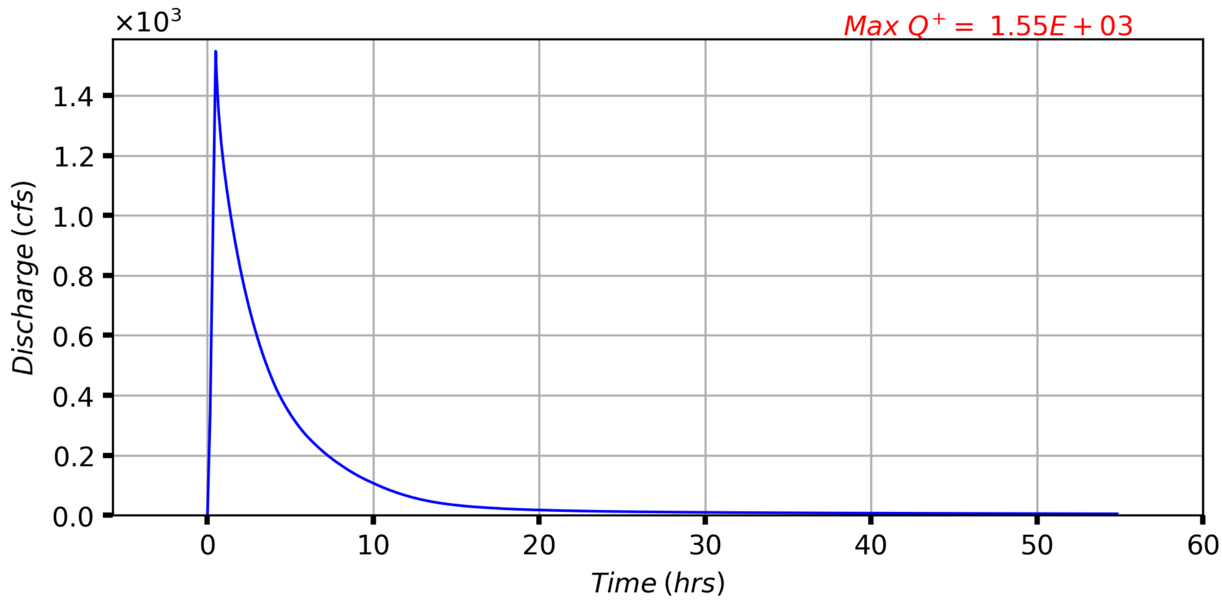

Figure 9. Breach Discharge Measured at: Structure 1.

4.7 Observation Line Hydrograph(s)

The positive discharges (Q^+) are measured in the positive direction with respect to each observation line.

No observation lines were defined.

4.8 Reservoir Time History

The reservoir water surface elevation as a function of time was computed by summing the water depth and bed elevation at a regular interval at the user-specified reservoir point.

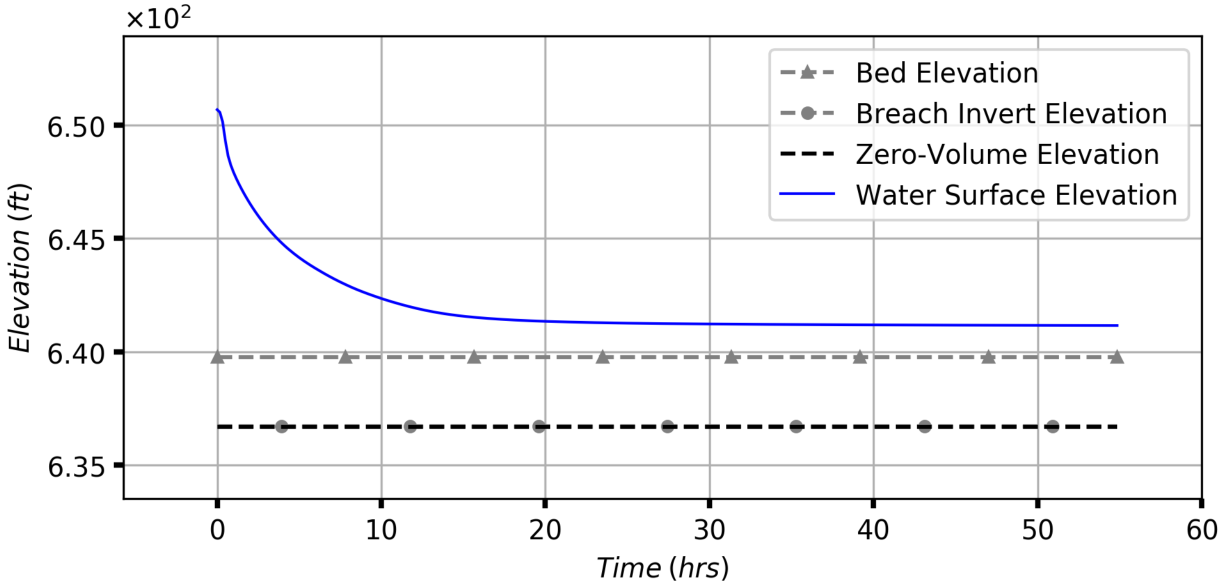

Figure 10. Reservoir Water Surface Elevation.

The reservoir volume as a function of time was computed by the following formula: $V_t = V_{init} - V_{net}$, where V_t is the reservoir volume at a given time, V_{init} is the reservoir's initial imposed volume, and V_{net} is the net volume that has crossed downstream across any part of the breaching structure's centerline up to that point. Since this only considers water which has completely exited the breach, it should be taken as an approximation.

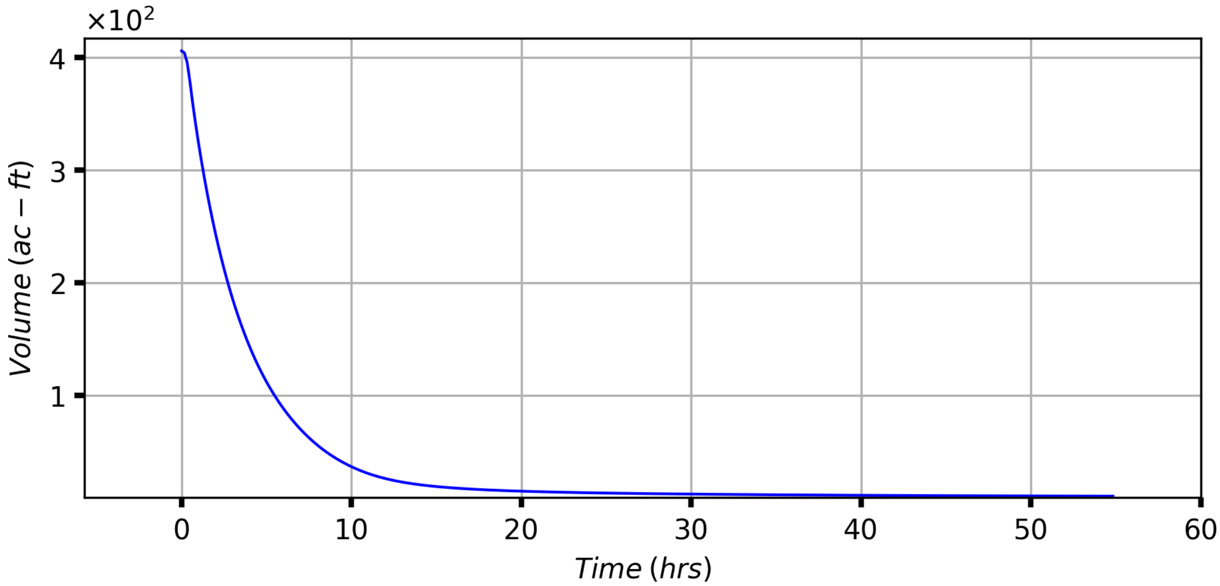

Figure 11. Reservoir Volume.

4.9 Downloading Simulation Results

The simulation results can be accessed at the following web address:

`https://dsswiseweb.ncche.olemiss.edu/download`

Job ID: 42315

Attachment 3
Inundation Map


Legend
Modeled Bridges
Flowpath
Impoundment Structure
Impacted Structures
DSS-WISE Indundation Extent
Main St
Main St
White Mountain Hwy
W Main St
End of 1' Flooding Incremental Rise
W Main St
W Main St Ext
NH Route 16
Brookside Ave
DREA
Pequawket Pond
Hobbs St
Pequawket Dr
Brookside Ave
Bridge St
Colbath St
Cranmore Shores Rd
Route 113 Bridge
NH Route 113
Ledge Pond Rd
Upper Pequawket Pond
Conway Rd
Pea Porridge Pond
Middle Pea Porridge Pond
Little Pea Porridge Pond
Eidelweiss Dam Breach Location
Eidelweiss Dr
Appenvel Way
Big Loop Road Culvert Crossing
Conway Rd
Bern Dr
Eidelweiss Dr
Grachen Dr
Winnigon Rd
Aspen Dr
Burgdorf Dr
Conway Road Bridge
Grachen Drive Bridge
Boulder Rd
Sylvester Rd
River Ln
Moss Ln
Boulder Rd
N
0 250 500 1,000 Feet
Eidelweiss Dam
Inundation Map
Madison, NH
PROJ NO: 20720
DATE: 11/18/2021
FIGURE: 1
WRIGHT-PIERCE
Engineering a Better Environment