EMERGENCY ACTION PLAN

AMSTON LAKE DAM
DEEP #06704 / HAZARD CLASS "B"

AMES ROAD
TRIBUTARY TO RAYMOND BROOK
AMSTON / HEBRON, CONNECTICUT

PREPARED FOR:

AMSTON LAKE DISTRICT

AUGUST 2017
(REVISED APRIL 2021)

Prepared by:

KARL F. ACIMOVIC, P.E.
588 Stonehouse Road
Coventry, CT 06238

Professional Engineer Certification

The following certification must be signed by a Professional Engineer

"I hereby certify that the inundation map and the monitoring intervals were prepared and determined by me and are true and correct to the best of my knowledge, belief, and professional judgment."

Karl F. Acimovic — 11/14/2018

Signature of Professional Engineer — Date

Karl F. Acimovic, P.E. — 13032

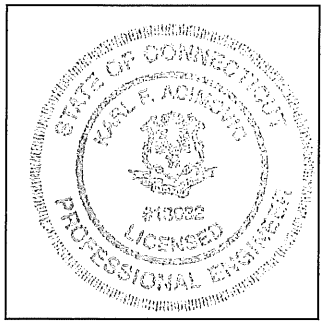
Printed Name of Professional Engineer — Title — CT P.E. Number

Karl F. Acimovic, P.E. & L.S., Consulting Engineer

Name of Firm

588 Stonehouse Road, Coventry, CT, 06238

Address of Firm



Affix P.E. Stamp Here

Revision Date: _____

Table of Contents

1. EXECUTIVE SUMMARY

1.1 Purpose

The purpose of this Emergency Action Plan (EAP) is to reduce the risk of human life loss and injury and minimize property damage during an unusual or emergency event at Amston Lake Dam. It is intended to provide guidance for proper monitoring of the dam during severe weather situations and for responding with appropriate emergency measures in the event of a potential failure of the spillway and / or the earth embankment section of the dam, or any other hazard that could endanger the general public downstream of this structure. Monitoring should be scheduled on a routine basis throughout the year and performed on a more intensive basis just prior to and during severe weather situations.

1.2 Facility Information & Dam History

A dam at Amston Lake was originally constructed in the 1700's and then raised in the mid-1800's, significantly increasing its storage. The dam is located along a tributary stream to Raymond Brook, unnamed on Town maps but named as Amston Lake Brook on current FEMA flood hazard maps. This brook runs westerly from the lake through a short wooded area to Ostrager Pond, passing through its spillway and then a downstream road culvert. From there it continues westerly through another wooded area to a small residential section near the intersection of Lake Road and Route 85. It crosses Lake Road in a northerly direction, just before the intersection and, through a culvert beneath the road prior to the culvert crossing, the stream makes a series of turns passing around a house at 12 Lake Road. After passing beneath Lake Road, it enters Ahlberg Pond, passes through its spillway and then continues in a northerly direction, beneath a driveway at 555 Church Street (Route 85) and eventually beneath Route 85 toward a large wetland area on the west side of the Airline Trail.

An important note is that the brook originally (in the 1800's) ran straight just prior to the intersection of Lake Road and Route 85, passed beneath Route 85 and continued in a westerly direction to downstream mills. Sometime in the late 1800's or early 1900's, the brook was diverted to what is now Ahlberg Pond, running in a northerly direction as previously noted. Remains of a channel still exist at the Route 85 crossing and it is apparent from topographic and field data that during periods of high flow, a significant portion of the discharge from Amston Lake will pass straight across Route 85 in its original path. As such,

this plan addresses that issue with the inclusion of the split in flow which will most likely occur in the event of a significant storm event and a potential breach at the dam.

Amston Lake Dam is accessible from both sides, on the right directly from Ames Road and on the left through a parking and beach area off Deepwood Drive. The top of the dam is normally closed off to vehicular access by gates on both sides, but can be accessed by construction equipment for routine maintenance or repair activities.

1.2.a Physical Description of the Dam

Amston Lake Dam consists of an earth embankment about 400 feet long, separated by a concrete spillway about 150 feet southwest of Ames Road. It's crest is relatively wide on the left side (about 50 feet) and approximately 15 feet wide near the spillway and the dam's right side. Just to the right of the spillway is a gated outlet structure which discharges near the right downstream end of the spillway. The upstream embankment slope is protected by riprap and a portion of the downstream area near the spillway has a toe drain. The intake structure was constructed in 2003 and with the installation of a new cutoff wall on the upstream side of the spillway in 2007 and again in 2011, the old outlet running through the spillway was filled in and abandoned. The dam is fully owned by the Amston Lake District, which is also responsible for its upkeep and routine maintenance.

Pertinent data for Amston Lake Dam includes the following:

Original Construction:	Mid 1700's; raised in the mid 1800's
Hazard Class:	"B"
Spillway Crest Elevation:	525.0'
Top of Dam Elevation:	527.4'
Spillway Length:	15'
Weir Type:	Broad Crested
Spillway Construction:	Concrete covering underlying stone masonry
Spillway Freeboard:	4.5'
Dam Type:	Earth Embankment

Length of Dam:	400 ft.
Dam Height (Max.):	10 ft.
Watershed:	1.04 Sq. Mi.
Breach Analysis Storm:	½ PMF
Water Level at ½ PMF: (Without Breach)	527.6' (0.2' Over top of Dam)
Outflow for ½ PMF:	383 cfs
Time to Breach:	3.0 Hrs.
Outflow (Max.) at Full Breach:	2,118 cfs

1.2.b Drainage Area & Watercourse

The drainage area of Amston Lake Dam is 1.04 sq. mi. in size, of which the lake occupies 187 acres (0.3 sq. mi.). The southern portion of the watershed is characterized by residential housing and some wooded areas, while the northerly portion is mostly wooded. Both sections have moderately sloped terrain and are, for the most part, underlain by relatively dense soils have a high runoff potential; the runoff curve number is 74.

Runoff is predominantly overland flow and intermittent streams. Because of the small size of the watershed and the large area occupied by the lake, there are few streams with consistent year-round flow and the major contribution to stream flow in the drier parts of the year appears to be from groundwater.

The main stream discharging from the dam leads directly into a lower pond, Ostrager Pond, about 200 feet downstream. This pond, about 1.3 acres in size, is also impounded by a dam located adjacent to the east side of Deepwood Drive. From this pond, the stream continues westerly, running parallel to Lake Road, toward Route 85 (Church Street). Although the stream does not appear to be officially named on Town maps, FEMA has called it out as Amston Lake Brook on its Flood Insurance Rate Maps. Just prior to reaching Route 85, the brook is diverted in a small channel around a house at 12 Lake Road with a series of turns (total about 270°) which then crosses Lake Road and runs northerly into Ahlberg Pond (see prior discussion of history for this area). Although this channel will carry normal flow, significant storm events will force the major portion of the flow toward the older channel area running westerly and crossing Route 85. While that channel appears

to have been abandoned, a culvert crossing does exist on Route 85, lined with concrete training walls on both sides. Its hydraulic capability is compromised, however, with thick vegetative growth on both its inlet and discharge sides. After passing the house on the west side of Route 85, flow will dissipate over a relatively wide area leading to a large wetland west of an old railroad track bed, now owned and used as a hiking trail by the State of Connecticut.

Because of the level intersection area where Lake Road joins Route 85, some flow will also spread across the full intersection and run northerly into Ahlberg Pond, potentially flooding portions of Route 85 as it heads northerly from the intersection. From Ahlberg Pond, the stream continues northerly eventually crossing Route 85 and then running westerly toward the same wetland area previously noted.

1.3 Dam Breach Flood

An analysis has been performed for Amston Lake Dam to estimate the downstream areas that could be inundated by flood waters in the event of a breach of this structure. The analysis was completed in 2017 by Karl Acimovic, P.E. The dam breach flood and downstream inundated areas were determined by use of the Corps of Engineers' HEC-1 computer model; this software was also used for the watershed's hydrologic assessment and hydraulic modeling for the dam's outflow and overflow.

The assumptions applied to the breach analysis and the potentially inundated areas are summarized below. Detailed information on the impacted areas, including inundation mapping and a listing of people at risk, is provided in Section 3.

Dam Breach Modeling Assumptions

The potential areas of inundation due to a breach of Amston Lake Dam as presented in this EAP are based on the following assumptions:

1. The pre-breach water level in the impoundment is approximately 0.2 feet over the top of the dam. The watershed and dam were analyzed for the occurrence of the ½ Probable Maximum Flood (1/2 PMF), which resulted in a water surface elevation of 527.6 feet, approximately 0.2 feet over the top of the dam.

2. The pre-breach water level in the downstream reach is based on the same HEC-1 analysis of the conditions prior to the breach but at the same conditions noted in No. 1, above.

3. The time from breach initiation to full formation used for the purpose of this EAP is 3.0 hours. Although other failure times were analyzed, this was chosen as the most likely due to the makeup of the dam (see discussion below).

4. The final breach bottom width is 20 feet, the depth from top of dam is 9 feet and the side slopes of the breach are 1H:1V.

5. Downstream culvert openings are assumed to be, at minimum, partially blocked.

Potential areas for failure at this dam site include the earthen embankment sections or the concrete spillway. Because the spillway was reconstructed in the recent past, with a new cutoff wall on the upstream side and a reconstruction of its downstream apron, both with reinforced concrete, it is not a likely failure option. Thus, we have chosen the most likely location as one of the deeper earth embankment areas along the right side of the spillway where the embankment is also at its narrowest point. During the construction and installation of a new low level outlet structure near this area, a lower dam was found within the embankment, another earthen embankment with stone masonry walls on both upstream and downstream sides. Because of this lower structure, it is assumed that any failure would be a progressive erosive process for which a rapid or sudden failure is not considered probable and, therefore, will not be considered for this analysis.

In the failure scenario, a small amount of overtopping would occur during the event of a half Probable Maximum Storm (1/2 PMF), as noted by the previous water surface elevations. The breach would most likely occur due to the steepness of slope and saturated embankment and toe areas. As well, there is a possibility, due to the unknown nature of the embankment fill, that failure could also occur due to piping through the embankment. In either of these cases, failure would be expected to occur over a period of time lasting about three (3) hours after the inception of a failure. The time factor for the failure mode is based on the presence of a lower and stable embankment within the body of the current dam. Although it would take some time to open up, failure would be expected to proceed rapidly thereafter.

Thus, for the purposes of a breach model, the following parameters were used:

Trapezoidal Opening / 20 ft. Wide at the Base / 9 ft. High / Side Slopes of 1H:1V
Time to Full Breach and Peak Outflow / 3.0 Hrs.
Location of Breach / The narrow portion of the right embankment area

This analysis provides a conservative estimate of the dam breach outflow and the potentially inundated downstream areas. However, the actual magnitude of the flood wave

and the resulting downstream flood levels will be dependent on numerous factors that cannot be predicted in advance. For example, the dam breach flood wave would be greater in magnitude if the water level in the impoundment is higher at the beginning of the failure. Furthermore, downstream flood levels could be increased due to conditions such as debris clogging culvert crossings or portions of the stream channel. If these conditions exist, additional nearby properties may be impacted and may need to be evacuated.

Potentially Impacted Downstream Areas

Results indicate that failure would result in one to two foot increases in elevation until flow crosses Route 85. This is a result basically of the significant amount of storage available within Amston Lake. While the flow increase would diminish somewhat at the intersection of Lake Road and Route 85, it would cover a substantial area because of the relative nature of the intersection and the road grades running north and south therefrom.

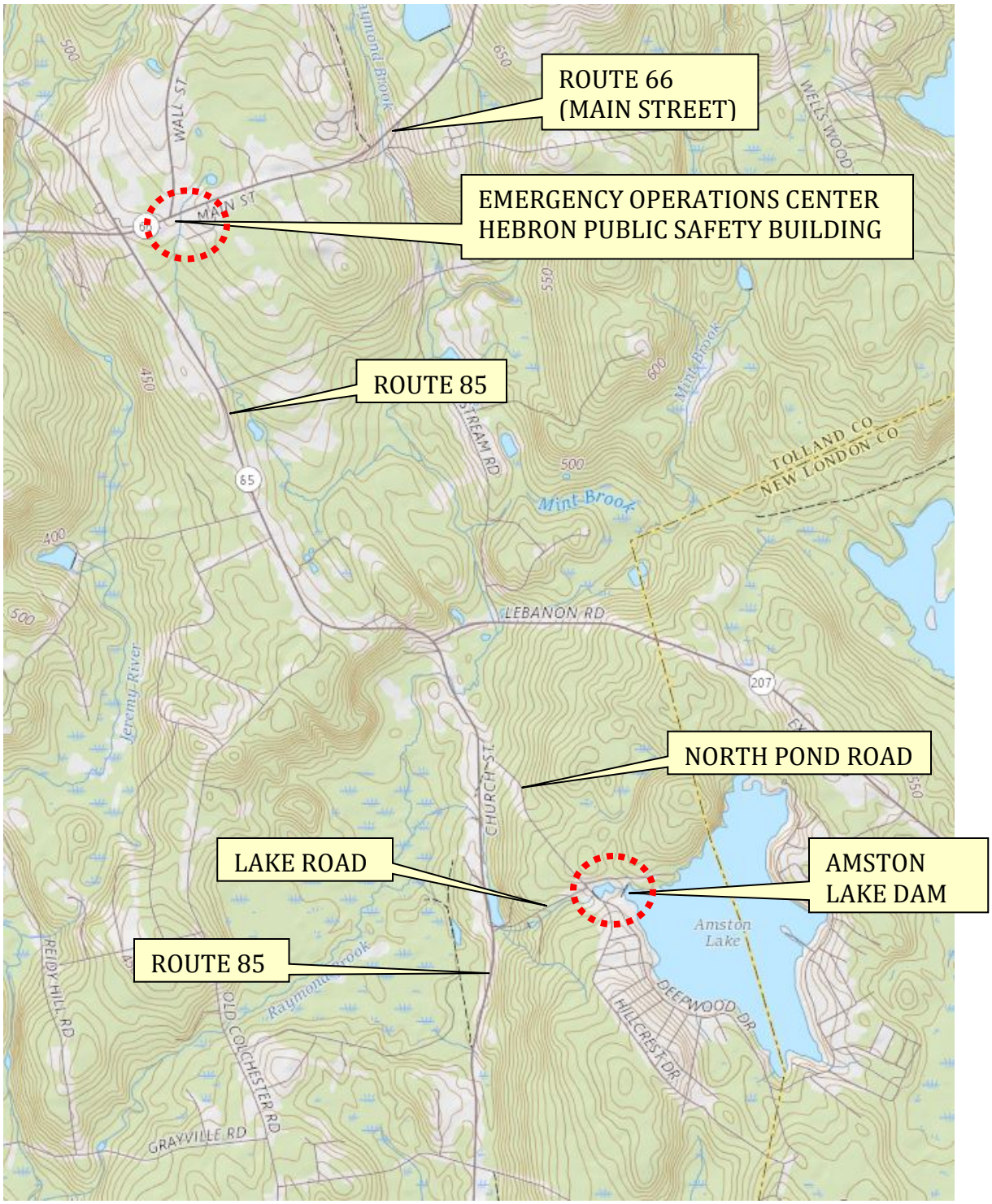
The area downstream of the dam that could potentially be impacted by a breach of the dam includes Ostrager Pond, which will most likely also be overtopped, and an inundation and potential erosion of Deepwood Drive, Lake Road and Route 85. While three of the residences noted below could be impacted by the breach flow, several more have been included on the list because they may be isolated by driveway or road crossings that could be either flooded and / or washed out due to heavy flows. A listing of potentially impacted parcels and roads is listed in following sections of this plan.

1.4 Location & Directions to the Dam

Amston Lake Dam is privately owned and operated by the Amston Lake District in the interests of recreation and conservation. It is located in the southeasterly corner of the Town of Hebron just south of Ames Road and about 700 feet easterly from its intersection with Deepwood Drive and Lake Road. The dam's right abutment is directly adjacent to Ames Road and the spillway is situated about 150 feet south, or left, of the abutment. The analyzed point of failure is approximately halfway between the road and spillway. Other than a short section of wood fence, there is no impediment for access to the dam, for either repairs or emergencies, from Ames Road, and it is also accessible through a gated entrance on its left side from a beach area adjacent to Deepwood Drive.

1.5 Location of Emergency Operations Center

Emergency Operations for the Town of Hebron are handled through its Emergency Management Director, Paul Bancroft, located at the Hebron Public Safety Building, 44 Main Street, Hebron, Connecticut 06248. (See following Location Map.)



LOCATION MAP / EMERGENCY OPERATIONS CENTER IN RELATION TO DAM

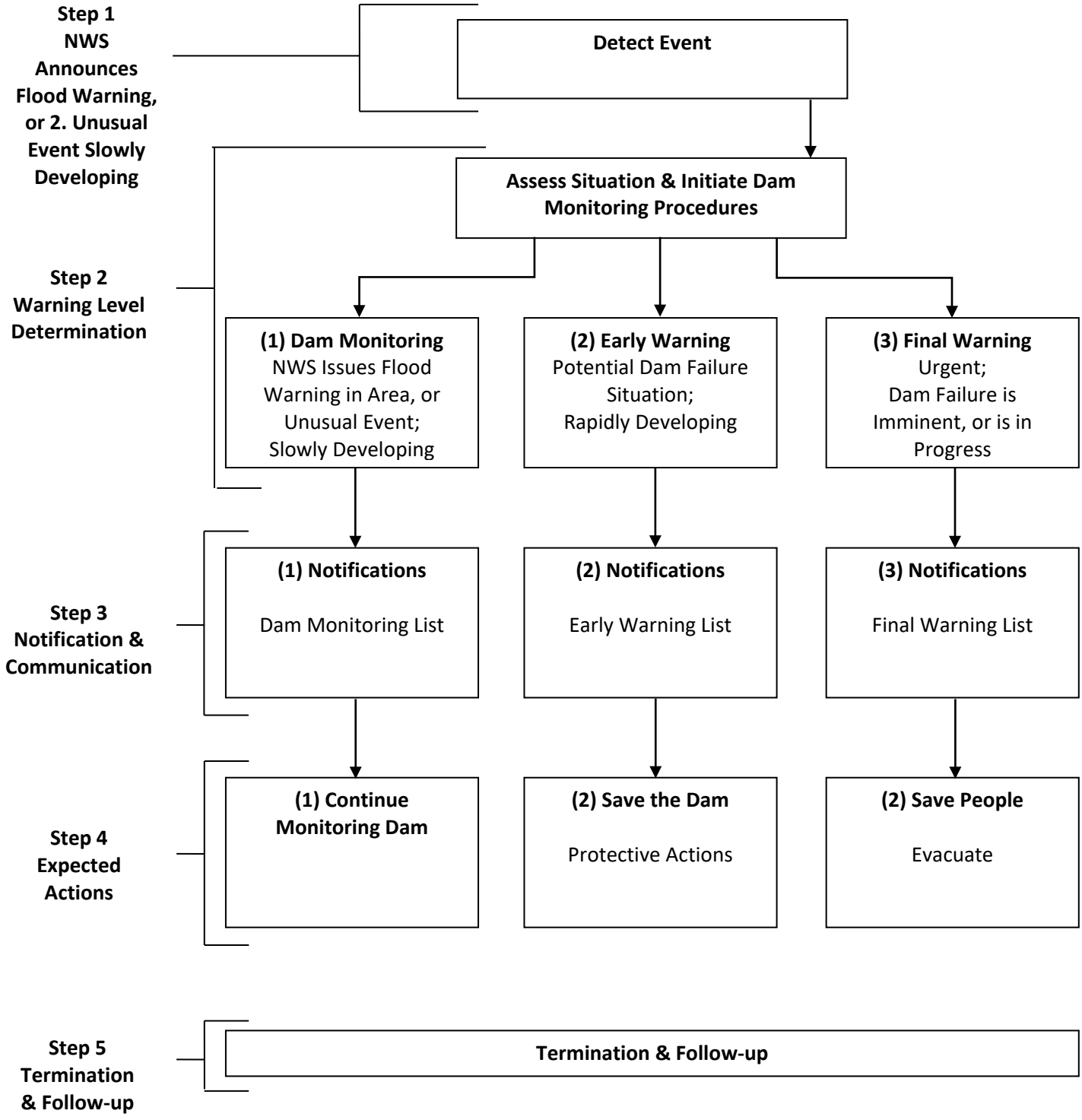
AMSTON LAKE DAM / LOCATION & VICINITY MAP

(*Source: Bing Maps*)

AMSTON LAKE DAM / SITE MAP

2. THE FIVE-STEP EAP PROCESS

2.1 EAP Overview



2.2 Warning Level Determination

After monitoring of the dam has been initiated, the Amston Lake District (ALD – the dam owner), the designated operator, or their representative is responsible for determining if conditions warrant one of the following warning levels:

Level 1 / Dam Monitoring – Non-emergency event, slowly developing:

Monitoring of the dam shall be initiated when the National Weather Service announces a *Flood Warning* for the area or when the ALD, the designated operator, their representative, or the engineer observes any of the following conditions:

- A marked increase in seepage through an embankment, particularly if evidence of a boil (release of seepage under pressure which tends to "float" away the material through which it flows) is observed.
- An increase in the rate of rise of the impoundment such that a non-overflow section (i.e., an earth embankment section) of the dam may be overtopped.
- An instability along any of the spillway weir or adjacent training or abutment wall areas, such that a failure of such walls could occur imminently.
- There is a noticeable shift or misalignment along a section of the embankment, particularly at the deepest sections, to the right of the outlet structure on the right side and approximately midway along the embankment on the left side.

Responsible Personnel

The following individuals are responsible for monitoring activities, decision making, and coordinating and implementing emergency repairs at the dam:

Personnel	Affiliation / Responsibilities	Phone Number(s)
Frank Hoisl ALD Member	ALD President	Cell: (860) 810-8757
Jim DeLisle	ALD Resident	Cell: (860) 707-6512

Monitoring Procedures

The personnel listed in the *Notification Chart* shall be notified that monitoring procedures have been initiated in accordance with this EAP.

Monitoring activities shall include viewing the dam and, if it is safe to do so, walking the dam crest at regular intervals to determine if any sloughing of the embankment, cracking, settlement, or movement of the dam has occurred. This shall also include the inspection of the toe of the dam and the abutment contacts to detect any signs of deterioration of the dam or its components, and inspection of the spillway and outlet structure for accumulations of debris.

All monitoring activities shall be documented on the *Unusual or Emergency Event Log* provided as *Appendix B-2*. At a minimum, the documentation shall include the following:

- The date and time of each inspection interval, rainfall data, and reservoir level.
- Observation of any changes in the dam including sloughing of the embankments, cracking, settlement, movement, erosion, seepage, deterioration of abutment contacts, debris obstructing the spillway or outlet structure, or any other sign the dam is deteriorating.
- When observing seepage, the written record shall comment on location, amount of flow and whether the flow is clear, cloudy or muddy.
- The written record shall comment on the extent, depth, and location of said conditions when observing movement, sloughing, or erosion of the dam.

Intervals at which monitoring should be conducted for severe storm events should be as follows:

- Prior to the beginning of a severe storm as predicted and determined by the NWS (National Weather Service) or other reliable weather information provider. This will provide a base line of conditions prior to inclement conditions.
- At the beginning of the storm and then every hour thereafter until water level in the spillway reaches 2 feet above the weir crest.
- When water level begins to surpass the 2-foot level, then monitoring should be conducted on a continuous basis until further action is required or until water levels begin to subside.

Note: See following table, *Guidance for Warning Level Determination*, for assistance in evaluating specific events to determine if they are unusual or potential emergency situations.

<u>Level 2 / Early Warning</u> - Potential dam failure situation, rapidly developing:

This situation may eventually lead to dam failure and flash flooding downstream, but there is not an immediate threat of dam failure. Remedial actions may be able to save the dam. If an engineer has been designated, time permitting, they should be contacted to evaluate the situation and recommend remedial actions to prevent failure of the dam. The ALD (the dam owner), the operator, or their representative should initiate remedial repairs (note local resources that may be available - see *Appendix A*) as recommended and as may be practical given time and circumstances.

This warning level is also applicable when the water level in the impoundment, as observed by levels in the spillway, is rising at a rate that **<u>may</u>** cause the outflow from the dam to increase significantly such that downstream areas and roads could be flooded, or people near the downstream channel could be endangered.

The ALD (the dam owner), the operator, their representative, or the engineer should closely monitor the condition of the dam and periodically report the status of the situation to the emergency management authority[1]. If the condition worsens and failure becomes imminent, the ALD, the operator, their representative, or the engineer must immediately notify the emergency management authority that conditions warrant issuing a *Final Warning*.

<u>Level 3 / Final Warning</u> - Urgent; dam failure appears imminent or is in progress:

This is an extremely urgent situation when a dam failure is about to occur or is occurring and cannot be prevented. Flash flooding will occur downstream of the dam.

Monitoring Equipment & Supplies

All inspections should be performed with proper safety equipment. Means of remote communication (e.g., mobile phone or two way radio) should be maintained to allow prompt contact with emergency officials if unsafe conditions are found at the dam. Additionally, the following steps will be taken to provide adequate lighting to view the dam

[1] Note that all references to an emergency management authority will apply to the Town's Emergency Management Director or his / her designee. Should such director or designated authority not be available, all contacts should be to 911.

at night. Because the ALD does not have emergency lighting equipment available, it will make every effort to obtain such from local rental establishments and, if unable to do so in a reasonable period of time preceding a severe storm situation, will contact emergency services to obtain assistance for emergency lighting from the local fire department or other emergency organization (e.g., police department, National Guard, or Civil Defense).

Note: See *Appendix A* for an inventory of available equipment, materials and manpower that can be utilized to respond to emergencies at the site. This list should be maintained by the ALD, the operator, or their representative and revised as necessary. It may be possible to enlist the service of a reliable construction contractor(s) who can be made available to supply needed manpower and equipment for emergency situations. This equipment should be used to buttress the dam structure (e.g., raise the crest of the dam or buttress eroded embankment areas, tipping walls, etc.) before water levels rise appreciably, or if possible, to perform emergency repairs during flooding.

Guidance for Warning Level Determination

Guidance for determining the appropriate warning level for Amston Lake Dam is provided in the table below.

Event	Situation	Warning Level
NWS Flood Warning	A flood warning has been issued by the National Weather Service for the area in the general vicinity of the dam.	1
Sustained Spillway Flow	Spillway flow that would result in flooding of people downstream if the lake level continues to rise.	3
Embankment Cracking	New cracks in the embankment greater than ¼"- inch wide without seepage	1*
	Cracks in the embankment with seepage	2
	Cracks in the embankment with significant outflow	3
Embankment Movement	Visual movement/slippage of the embankment slope	2*
	Sudden or rapidly proceeding slides of the embankment slopes	3
Embankment Overtopping	Lake level is within 1.2 feet of the top of the embankment	1
	Lake level is 1.0 foot or less below the dam crest, or overtopping the dam	2
	Lake level is 0.5 foot or less below the dam crest, or overtopping the dam	3
Seepage	New seepage areas in or near the dam	1
	New seepage areas with cloudy discharge or increasing flow rate	2*
	Rapidly increasing seepage with discharge carrying soil particles	3
Sinkholes	Observation of new sinkhole in lake area or on embankment	2
	Rapidly enlarging sinkhole	3
Earthquake	Measurable earthquake felt or reported within 50 miles of the dam	1
	Earthquake resulting in visible damage to the dam or appurtenances	2*
	Earthquake resulting in uncontrolled release of water from the dam	3
Security Threat Sabotage Vandalism	Damage to dam or appurtenances with no impacts to the dam functions; damage does not present a downstream threat.	1*
	Vandals have made changes to the structure or controlled outflow mechanisms that could affect dam functions, but show no direct signs of imminent downstream threat	1
	Verified bomb threat that, if carried out, could result in damage to the dam	2
	Detonated bomb that has resulted in damage to the dam	2*
	Damage to dam or appurtenances from vandalism and / or a bomb that has resulted in uncontrolled water release from any portion of the structure	3

Note: Numbers for warning levels refer to the discussion on previous pages. An * denotes specific warning levels which could be moved to the next level if so deemed by supervisory personnel.

Examples of Emergency Situations

The following are examples of conditions that could constitute an emergency situation that may occur at a dam. Adverse or unusual conditions that can cause the failure of a dam are typically related to aging or design and construction oversights. Extreme weather events that exceed the original design conditions can cause significant flow through the spillway or overtopping of the embankment. However, accidental or intentional damage to the dam may also result in emergency conditions. The conditions have been grouped to identify the most likely emergency-level condition, in the same order as detailed in the previous table. The groupings are provided as guidance only. Not all emergency conditions may be listed, and the ALD, the operator, or its representative is urged to use conservative judgment in determining whether a specific condition should be defined as an emergency situation at the dam. In the event that a judgment or decision may be difficult to assess, it is recommended that an upgrade to the next stage be implemented.

Pre-existing conditions at this dam:

For pre-existing conditions that could have an impact on this dam during an emergency situation, one should look to the latest inspection report which lists current conditions and, in particular, recommendations for improvements thereto. If recommendations for upgrades, maintenance and / or repairs have been carried out, then a greater degree of safety will have been attained. Those repairs or upgrades should be the first items inspected to check as to their sufficiency under severe conditions.

Sustained Spillway Flow:

A National Weather Service Report has been issued for the general area of the dam, with impending severe weather conditions imminent. From the beginning of such storm events, observations must be made of the sustained severity of precipitation and wind and, in particular, rising water levels within the lake and in the spillway. Continued increases in spillway elevation and outflow will be the main and most straightforward conditions to monitor. Note should be taken of the elevations at which monitoring and emergency warnings are to be issued, as noted in the previous table.

Embankment and / or Spillway Structural Conditions:

Cracks appearing on the dam, whether along the crest, the slopes or the toe, are a sign of issues within the embankment itself. In the case of Amston Lake Dam, it would indicate, depending upon the severity, size and extent of such fissures, a potential problem with the soil materials making up the embankment fill. Should such cracks or gaps be observed, monitoring should be continuous. If the crack or cracks continue to widen, enlarge (deepen) or increase in length, then emergency actions and warnings will be necessary.

Likewise, should cracks appear in the structural portions of the concrete spillway or its training and abutment walls, a full or partial collapse could lead to the dislodgment of individual or entire walls sections. Should that occur, then it would most likely lead to an earth embankment failure as well.

Embankment Movement:

Cracking, moving or slippage of surface areas, such as unequal lateral movement along cracks or sloughing of slope areas, would indicate potential water and / or soil pressures forcing large segments of the earth embankment to move out of place. While small movements may be monitored, large or significant displacement (depending upon location) must be given to early warnings and, if they continue, would lead to final warnings for downstream evacuations.

Embankment Overtopping:

Embankment overtopping is a direct indication of one of the most severe situations encountered at an earth embankment dam such as Amston Lake Dam. For this dam and impoundment, in particular, the precipitation leading to such an event would be the ½ Probable Maximum Storm (1/2 PMF), approximately 16 inches of rainfall over a 24-hour period. While the beginning of overtopping should lead to an immediate downstream evacuation, this will have been preceded by a rise in elevation of flow passing through the spillway, which as previously indicated in the table, will have led to a final warning prior to water level reaching the top of the dam. In the case of Amston Lake Dam, with its well-maintained and strong growth grass slopes, a small amount of overtopping would most likely not lead to immediate failure. However, given that an immense amount of rain will have fallen and then soaked into the soils of the embankment, a saturated slope condition will most likely lead to a sloughing failure depending upon the duration of the overtopping.

Seepage:

The most common indicator of a situation showing problems with an earth embankment, particularly when associated with a storm event, is an increase in seepage as water levels rise. Increases in flow from a known discharge point could lead to sloughing of the embankment and internal erosion of soil materials, typically associated with piping of flow through the entire embankment of the dam. Such findings early in a storm should lead to continuous monitoring, and an increase in quantity or quality of flow (i.e., cloudy or silt laden water) should then precipitate appropriate warnings if and when an increase is noted in either amount.

Sinkholes:

Sinkholes, if they appear during an early or intermediate stage of a storm event, are a definite sign of internal problems in the case of a large soil embankment, as is the case with Amston Lake Dam. This would be an indicator that a void has been created within the embankment, with an associated loss of soil materials. This often occurs in the vicinity of an outlet structure; in the case of this dam, the sluice gate structure and low level outlet pipe at the right side of the spillway. The most likely factor causing sinkholes would be the result of water moving through or along the outside of outlet pipes. In any case, no matter the location, these internal problems will only and most likely worsen. Any increase in size must be treated as a worsening situation, monitored accordingly and precipitate warnings as required.

Earthquake(s):

Earthquakes typically result in the movement of the earth's crust and, in the case of dams, in the movement of surficial and underlying soils of a dam, particularly with earth embankments. Such movements, if severe enough to impact a dam, would produce cracks, sinkholes and lateral shifts or displacements of embankment soils and open up potential seepage paths through the embankment. While these issues are addressed above, an earthquake is often unpredictable and any response thereto must be immediate. Should one noticeable enough to cause concern in the general community occur, an immediate inspection must be performed to ascertain any potential issues, similar to the ones described above. If detected, monitoring and emergency warnings must be instituted as required by the circumstances.

Security Threats, Sabotage and Vandalism:

As with earthquakes, these scenarios are typically unpredictable unless preceded by threats issued through various public or private sources. Should such occur, police and emergency personnel should be notified immediately. Because it is difficult to impact a dam as large as this site, sabotage or vandalism will typically be directed at outlets or outlet structures. Only in the case of a large explosive device would the main embankment be in danger. To prevent such situations, in the case of this site, fencing and access gates should be kept as secure as possible, even under normal conditions.

"Sunny Day" Failure:

Although rarely discussed and encountered in our region of the country, dams have been known to fail, due to any of the foregoing reasons, on a clear, sunny day or a clear night without impending storms that include heavy precipitation or high winds. These most likely occur due to a lack of maintenance or attention to problems which may have been

predetermined, but not necessarily maintained. For this reason, normal inspections and regular maintenance must be sustained on a regular, routine and proactive basis.

2.3 Notification & Communication

After the warning level has been determined, the Town of Hebron Emergency Management Authority shall be notified immediately.

Communication with Authorities

Emergency Level 1 / Initiation of Dam Monitoring – Amston Lake District (ALD - the dam owner), the operator, their representative, or the Engineer should contact the Emergency Management Authority. Describe the situation, and request engineering assistance on the next steps that should be taken.

Emergency Level 2 / Early Warning - Emergency event, potential dam failure situation; rapidly developing:

The following message may be used to help the dam owner, operator, representative or engineer to describe the emergency situation to emergency management authority:

"This is ____ Give your name and title, and provide name of owner & operator, if different.

I am, OR [name of person is] presently on site monitoring the dam.

There is an emergency condition at Amston Lake Dam, located in the southeasterly section of the Town of Hebron and along Ames Road, east of Route 85.

*I have activated the Emergency Action Plan for this dam. The following conditions have been observed **[identify the conditions]** and indicate that the dam may be compromised and that the current conditions could lead to a potential failure.*

*These conditions warrant an **Early Warning** notification, i.e. residents within the limits of the inundation area as depicted in the EAP should be warned that an evacuation of this area **may** be necessary and first responders should be prepared to evacuate the inundation area.*

Reference the Inundation Map, People At-Risk Table and evacuation routes identified in your copy of the Emergency Action Plan.

I will advise you when the situation is resolved or if the situation gets worse.

I can be contacted at the following number _____. If you cannot reach me, please call the following alternative number _____."

<u>Emergency Level 3 / Final Warning</u> - Urgent event; dam failure appears imminent or is in progress:

The following message may be used to help the Amston Lake District (ALD - the dam owner), the operator, its representative or the Engineer to describe the emergency situation to the Emergency Management Authority:

"This is ____<u>Give your name and title, and provide name of owner & operator, if different</u>.

I am, OR [name of person is] presently on site monitoring the dam.

There is an emergency condition at Amston Lake Dam, located in the southeasterly section of the Town of Hebron and along Ames Road, east of Route 85.

I have activated the Emergency Action Plan for this dam. The following conditions have been observed ***[identify the conditions]*** *and indicate the dam* ***<u>is in imminent danger of failing, or is failing.</u>***

These conditions warrant a ***Final Warning*** *notification, i.e. residents within the limits of the inundation area as depicted in the EAP should be warned to evacuate the area immediately.*

Reference the Inundation Map, People At-Risk Table and evacuation routes identified in your copy of the Emergency Action Plan.

I will continue to contact you and keep you up to date on the condition of the dam.

I can be contacted at the following number _____. If you cannot reach me, please call the following alternative number _____."

SAMPLE MESSAGE FOR EMERGENCY MANAGEMENT AUTHORITY

The following prescribed messages **may** be used as a guide for the Emergency Management Authority to communicate the status of the emergency with the public:

EMERGENCY LEVEL 2 / EARLY WARNING
(Potential failure / Possible evacuation)

This is [Name and title of the Emergency Management Authority]

There is an emergency condition at Amston Lake Dam, located in the southeasterly section of the Town of Hebron and along Ames Road, east of Route 85.

The Emergency Action Plan has been activated for this dam due to current conditions that may cause the dam to fail.

Please be prepared for a possible evacuation if conditions at the dam worsen. You will be notified when the situation is resolved or the situation gets worse.

EMERGENCY LEVEL 3 / FINAL WARNING
(Imminent Failure / Evacuate those at risk downstream)

This is [Name and title of the Emergency Management Authority]

This is an emergency. Amston Lake Dam, located in the southeasterly section of the Town of Hebron and along Ames Road, east of Route 85 is failing / or has failed.

Residents located in the downstream area must evacuate immediately.

Repeat. Amston Lake Dam, located in the southeasterly section of the Town of Hebron and along Ames Road, east of Route 85 is failing / or has failed.

Evacuate immediately using the following evacuation route(s), or proceed immediately to high ground if you feel you can't get to the evacuation route in time.

<u>Evacuations Routes are as follows</u>[2]*:*

> ***For areas on the right or north upstream side of the dam and lake, along Ames Road*** *– Because this road ends in a dead end and because the only means of access is from its west end, it must be evacuated before a dam failure so that residents are not isolated by either high water or washout conditions. For these structures, evacuation is recommended at Emergency level 2. Evacuation should be west along Ames Road to*

[2] Subsequent to evacuation, emergency shelters are expected to be open for use as stipulated in Section 3.3 of this plan.

either Lake Road or North Pond Road to Route 85, then northerly to either Hebron Elementary School (on Route 85) or the RHAM Middle or RHAM High School on Wall Street.

For areas downstream of the dam, along both sides of Lake Road and areas at or near the intersection of Lake Road and Church Street (Route 85) *– As with Ames Road, a number of structures in these areas or their driveway access may be impacted well before any potential failure of the dam, due to substantial outflows from the dam. As such, it is recommended that evacuations start well before the Emergency Level 3 to avoid being cut off due to high flows or road washouts. Evacuations along Lake Road should be west to Route 85, then north along Route 85 as previously noted, while those being evacuated in the Route 85 (Church Street) area should proceed directly northerly to the emergency shelters noted.*

The following roads may be closed due to flooding or washouts:

Lake Road and Route 85*, in the vicinity of their intersection approximately one-half (1/2) mile downstream of the dam.*

Deepwood Drive*, in the vicinity of the culvert and stream crossing, from flow emanating from Amston Lake Dam and Ostrager Pond. While there is an alternate access for the numerous residential structures south of the dam along Deepwood Drive and Hillcrest Drive, this crossing may have to be closed early due to the heavy flows and road inundation anticipated during an extreme storm event.*

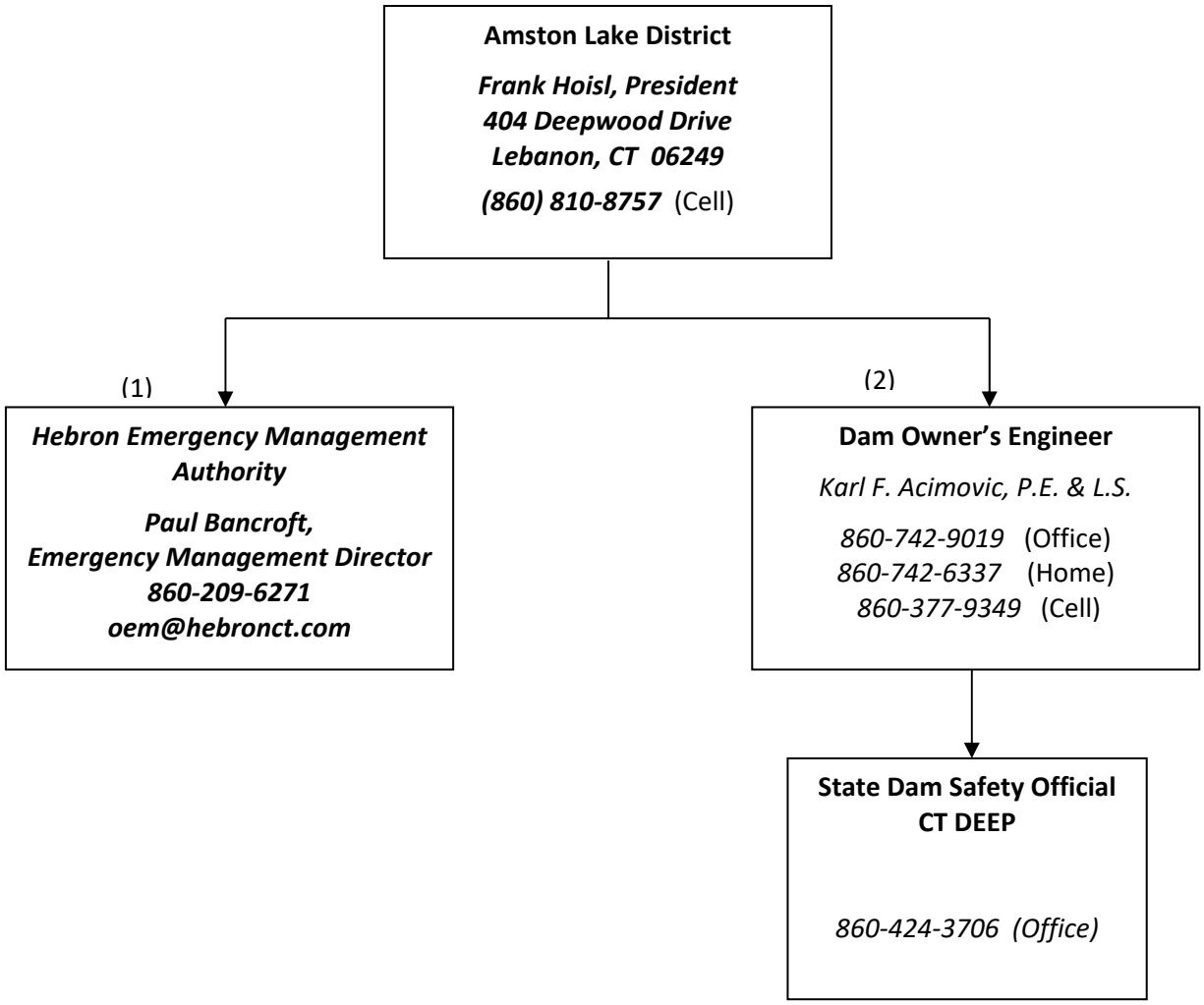
Dam Monitoring Notifications

Nonemergency

National Weather Service issues a Flood Warning for the Area,

OR

Unusual event; slowly developing

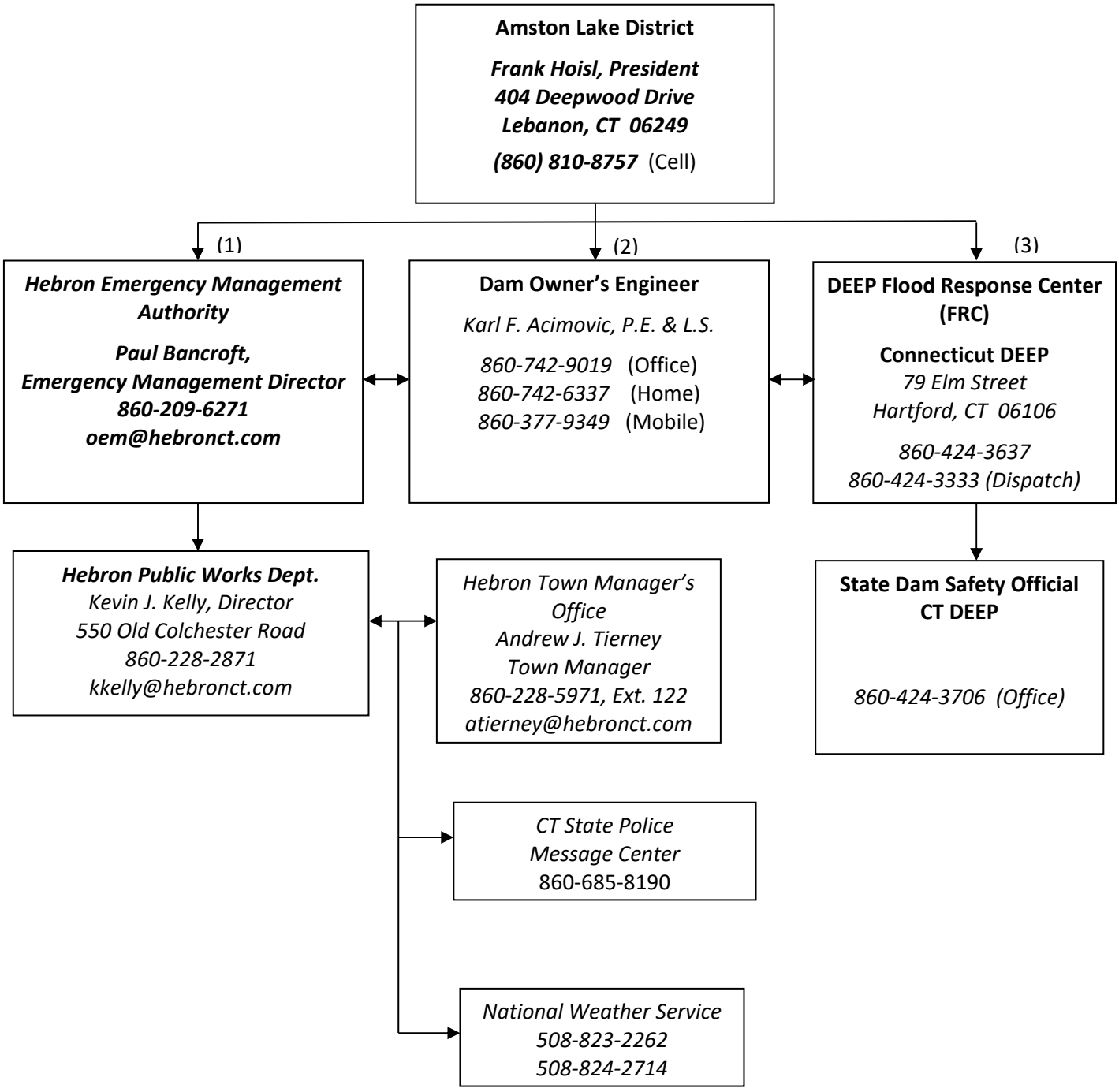


Early & Final Warning Notifications

(Call sequence is identical for both warning levels; nos. 1, 2, 3 denote call sequence)

Early Warning: Emergency event rapidly developing / Potential for dam failure

Final Warning: Imminent Failure / Evacuate those at risk downstream



2.4 Expected Actions

If the police or fire department receives a 911 call (or anyone else receives notice) regarding observations of an unusual or emergency event at the dam, they should immediately contact the ALD, its operator, representative, or engineer. After the ALD, its operator, representative, or engineer determines the warning level, the actions listed below should be taken. If time permits, the ALD, its operator, representative, or engineer should be contacted for consultation.

Dam Monitoring - Nonemergency, unusual event; slowly developing:

A. The ALD, its operator, representative, or engineer should inspect the dam. At a minimum, inspect the full length of the upstream slope, crest, downstream toe, downstream slope and spillway area. Also, check the impoundment area, abutments, and downstream channel for signs of changing conditions. If increased seepage, erosion, cracking, or settlement are observed, refer to the *Guidance for Warning Level Determination* (*Section 2.2*) for guidance in determining the appropriate warning level for the new condition and recommended actions.

B. All contacts should be made per the Dam Monitoring notification chart.

C. Record all contacts that were made on the *Contact Checklist* (*Appendix B–1*). Record all information, observations, and actions taken in the *Unusual or Emergency Event Log* (*Appendix B–2*). Note the time of changing conditions. Document the situation with photographs and video, if possible.

Early Warning - Potential dam failure situation; rapidly developing:

A. All contacts should be made per the *Early Warning* notification chart. If an Engineer has been designated, and time permits, request that he / she investigate the situation and recommend corrective actions.

B. The ALD, its operator, representative, or engineer should contact the Emergency Management Authority to inform him / her that conditions exist to warrant issuing an **EARLY WARNING** and if current conditions get worse, an emergency situation may require evacuation. The Emergency Management Authority should begin preparations for possible road closures and evacuations.

C. The ALD, its operator, representative, or engineer should provide updates to the Emergency Management Authority. These updates can assist the Emergency Management Authority in making timely decisions concerning the need for warnings, road closures, and evacuations.

D. The Emergency Management Authority should issue the **EARLY WARNING** to residents and businesses in the inundation / evacuation area using local notification procedures.

E. The Emergency Management Authority should also issue an **EARLY WARNING** through the National Weather Service.

F. The Emergency Management Authority should warn the Connecticut Department of Transportation and the Hebron Department of Public Works about possible impacts to bridges and roadways.

G. The Town of Hebron Department of Public Works is responsible for local road closures and detours. The Connecticut Department of Transportation is responsible for State road closures and detours.

H. The ALD, its operator, representative, or engineer should continue to inspect the dam. At a minimum, as previously noted, inspect the full length of the upstream slope, crest, downstream toe, downstream slope and spillway area. Also, check the impoundment area, abutments, and downstream channel for signs of changing conditions. If increased seepage, erosion, cracking, or settlement are observed, refer to the *Guidance for Warning Level Determination* table (*Section 2.2*) for guidance in determining the appropriate warning level for the new condition and recommended actions.

I. Record all contacts that were made on the *Contact Checklist* (*Appendix B–1*). Record all information, observations, and actions taken on the *Unusual or Emergency Event Log* (*Appendix B–2*). Note the time of changing conditions. Document the situation with photographs and video, if possible.

J. See the following discussion regarding possible remedial actions.

Possible Remedial Actions

If time and physical site conditions permit, the following emergency remedial actions should be considered for *Early Warning* conditions. Immediate implementation of these remedial actions may delay, moderate, or prevent the failure of the dam. Several of the listed adverse or unusual conditions may be apparent at the dam at the same time, requiring implementation of several modes of remedial actions. Following implementation, the dam must be closely monitored to confirm the success of the remedial actions. Time permitting, the actions should be developed in consultation with the ALD's Operator or Engineer. See *Appendix A* for sources of equipment and materials.

Embankment Overtopping

1. If the water level in the impoundment is no longer rising, place sandbags along the low areas of the top of the dam to control wave action, reduce the likelihood of flow concentration during minor overtopping, and to safely direct more water through the spillway.
2. Cover the weak areas of the top of the dam and downstream slope with riprap, sandbags, plastic sheeting, or other materials to provide erosion-resistant protection.

Seepage & Sinkholes

1. If the entrance to the seepage origination point is observed in the impoundment (possible whirlpool) and if it is accessible, attempt to reduce the flow by plugging the entrance with readily available materials such as hay bales, bentonite, soil or rockfill, or plastic sheeting.
2. Cover the seepage exit area(s) with several feet of sand/gravel to hold fine-grained embankment or foundation materials in place. Alternatively, construct sandbag or other types of ring dikes around seepage exit areas to retain a pool of water, providing backpressure and reducing the erosive nature of the seepage.
3. Prevent vehicles and equipment from driving between the seepage exit points and the embankment to avoid potential loss of embankment material from the collapse of an underground void.

Embankment Movement

1. Repair settlement of the crest by placing sandbags or earth and rockfill materials in the damaged area to restore freeboard.
2. Stabilize slides by placing a soil or rockfill buttress against the toe of the slide.

Earthquake

1. Immediately conduct a general overall visual inspection of the dam.
2. Perform a field survey to determine if there has been any settlement and movement of the dam embankment, spillway, and low-level outlet works.
3. Lower water level in the lake by use of the sluice gate in the low level outlet structure or by the use of siphons if the sluice gate is inoperable, to the extent that it will help to lessen the water pressure on any vulnerable areas.

Final Warning - Urgent; dam failure appears imminent or is in progress:

A. All contacts should be made per the *Final Warning* notification chart.

B. The Emergency Management Authority must alert the public and immediately issue a **FINAL WARNING** to evacuate at-risk people and close roads as necessary using local notification procedures.

C. The emergency management authority shall lead the efforts to carry out warnings, close roads, and evacuate people at risk downstream from the dam.

D. The ALD, its operator, representative, or engineer should provide updates to the Emergency Management Authority to help him / her make timely decisions concerning the need for warnings, road closures, and evacuations.

E. All parties should record all contacts that were made on the *Contact Checklist* (*Appendix B-1*).

F. The ALD, its operator, representative, or engineer should record all information, observations, and actions taken on the *Unusual or Emergency Event Log* (*Appendix B–2*). Note the time of changing conditions. Document the situation with photographs and video, if possible.

G. Advise people monitoring the dam to follow safe procedures. Everyone should stay away from any of the failing structures or slopes and out of the potential breach inundation areas.

H. The Emergency Management Authority should also issue an **FINAL WARNING** through the National Weather Service.

I. The Emergency Management Authority should warn the CT Department of Transportation (DOT), if state-owned roads could be impacted (i.e., Routes 85), and the Hebron Public Works Department about impacts to local culverts, bridges and roadways.

J. The CT DOT is responsible for state road closures and detours. The Hebron Public Works Department is responsible for local road closures and detours.

2.5 TERMINATION

Whenever the EAP has been activated, an emergency level has been declared, all EAP actions have been completed, and the emergency is over, the EAP operations must eventually be terminated and follow-up procedures completed.

Termination Responsibilities

The Emergency Management Authority is responsible for terminating EAP operations and relaying this decision to the Hebron Emergency Operations Center (EOC) and the State DEEP Flood Response Center (FRC). The following conditions and procedures are required prior to termination of a ***Final Warning*** event that has not caused the dam to fail:

- The event has passed (water level is receding).
- The dam has been inspected by the ALD's engineer and deemed safe.
- The State DEEP Dam Safety Official has been contacted and agrees with the safe determination.
- The Emergency Management Authority has been informed of the engineer's determination and DEEP's concurrence.
- The Emergency Management Authority gives the all-clear notice.

It is then the responsibility of each group/person in the notification charts to make sure that the contacts listed above and below them are notified that the event has been terminated. The Emergency Management Authority should contact the following to terminate the emergency:

- The National Weather Service
- CT Department of Transportation
- Hebron Public Works Department
- Any other private or public services that were assisting to issue warnings
- Downstream residents and business owners.

Note: The ALD, operator, or their representative shall have the engineer who inspected the dam complete the Dam Safety Emergency Situation Report (Appendix B–3) to document the emergency event and all actions that were taken. The dam owner, operator, their representative, or engineer must distribute copies of the completed report to the State DEEP Dam Safety Official and the emergency management authority who coordinated the event.

3. INUNDATION AREAS

3.1 Residents, Businesses & Infrastructure at Risk

A major flood caused by a breach of the dam is estimated to inundate four (4) homes and three (3) roadways. A substantial number of homes, however, may be isolated due to the loss of road connections and / or dead-end streets. These have been listed along with those recommended for evacuation, as shown in the following table. The properties are listed approximately starting from the nearest impacted downstream of the dam and then continuing further downstream; in this case, along two potential inundation routes, crossing Route 85 (Church Street) and running in a northerly direction parallel to it.

Street Numbers	**Street Name**	**Property Type**	**Number of Properties**
Impacted and Evacuation Areas			
18	Lake Road	Residential	1
12	Lake Road	Residential	1
17	Lake Road	Residential	1
605	Church Street	Residential	1
612	Church Street	Residential	1
598	Church Street	Residential	1
590	Church Street	Residential	1
584	Church Street	Residential	1
582	Church Street	Residential	1
578	Church Street	Residential	1
574 - 576	Church Street	Residential	1
572	Church Street	Residential	1
568	Church Street	Residential	1
11 – 58[3]	*Ames Road*	*Residential*	*15*

[3] Although these residential addresses are not anticipated to be inundated by a potential dam failure, their access may be cut off due to road flooding and / or washouts between Amston Lake Dam and Ostrager Pond Dam. It is for this reason that they have been included in this table.

3.2 Evacuation Routes & Road Closures

The following roads will serve as evacuation routes for areas west and north of Amston Lake and its discharge stream. It should be noted that, because the flow from Amston Lake either crosses or potentially inundates the following roads either partially or fully, evacuation should be considered well ahead of water levels reaching toward the top of the dam, before a potential breach and before flooding occurs at the brook crossing any of the roads. The reason for this warning is that, should debris collect within any of the road culvert crossings, roads may be impacted and become impassable well ahead of the dam's overtopping which could lead to a potential breach of the embankment.

Ames Road	Heading westerly and northerly from this road is the only evacuation route for areas immediately north and east of the dam, due to the fact it is a dead end road at its easterly end. As such, evacuation is recommended if observations indicate a potential inundation of the road, regardless of a potential breach of the dam.
Deepwood Drive	The stream emanating from Amston Lake crosses Deepwood Drive through a culvert just below Ostrager Pond. With flows significant enough to create a potential breach, this culvert will most likely be inundated and perhaps washed out. When such flow is impending, it must be blocked off, cutting off residents to the south of the lake and dam. Any evacuations necessary in those areas will then have to proceed easterly to avoid the flows.
Lake Road	As pointed out previously in this document, the intersection area near Route 85 (Church Street) will need to be closed and evacuated well before a potential breach of the dam, due to inundation from high storm flows. This is necessary because driveway access may be impeded.
Church Street	(Route 85) The area at and along Route 85 may require closure due to the flows noted on the inundation plan. There is a culvert crossing on Route 85 that will be inundated and flood over the crossing area. In addition, areas running north from the intersection, along the west side of Church Street, may have their driveway access cut off due to a portion of the flow which

will pass into and along Ahlberg Pond. This will be the responsibility of the State DOT; again, evacuations should start well before a potential breach.

For evacuation directions for these areas, see Section 2.3, “Evacuation Routes”.

3.3 Emergency Shelters (*Town of Hebron Emergency Shelters):*

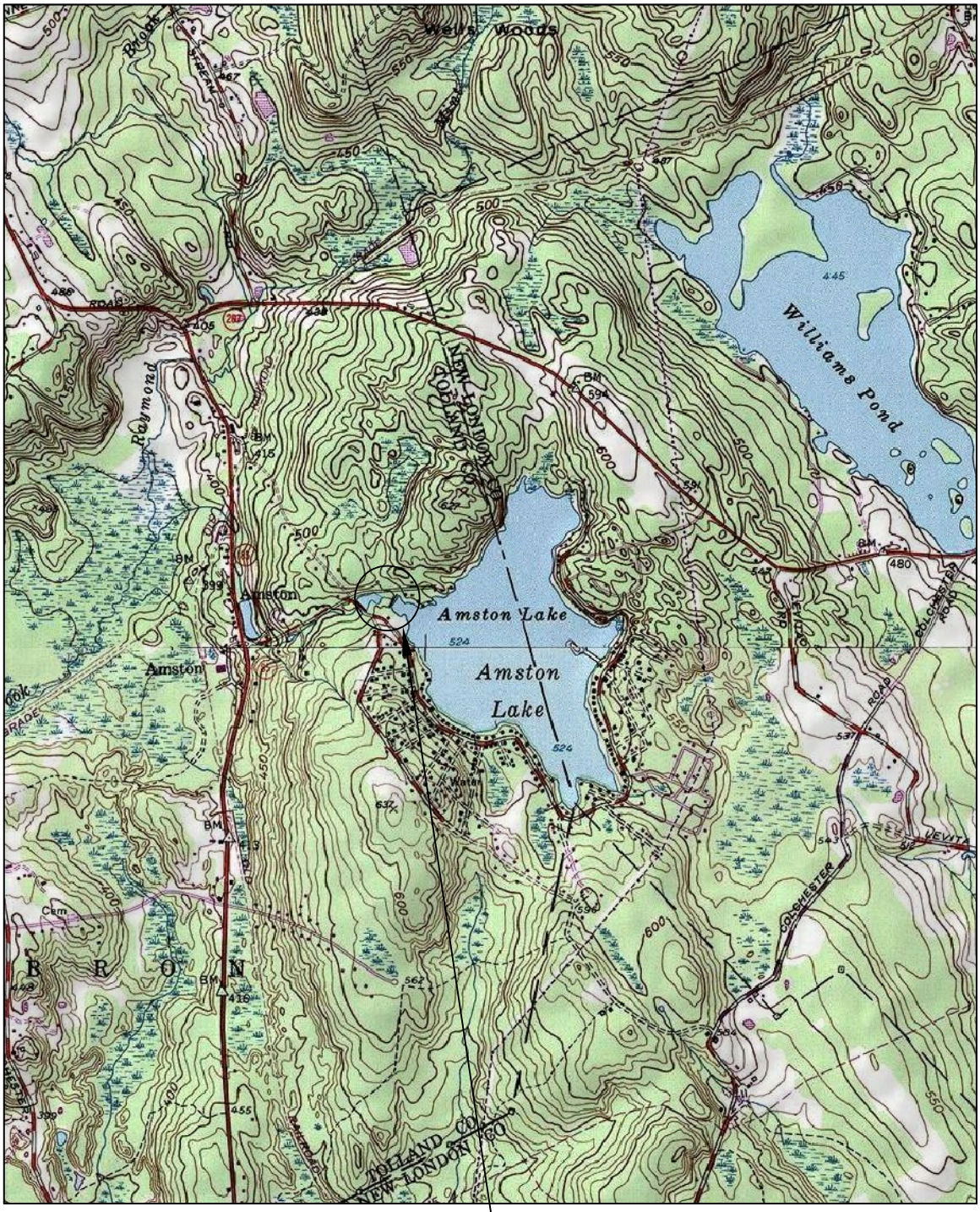
Emergency shelters are located as follows:

1) Hebron Elementary School, 92 Church Street, Hebron 06248

2) RHAM Regional Schools, 85 Wall Street, Hebron 06248

3.4 Dam Breach Inundation Map

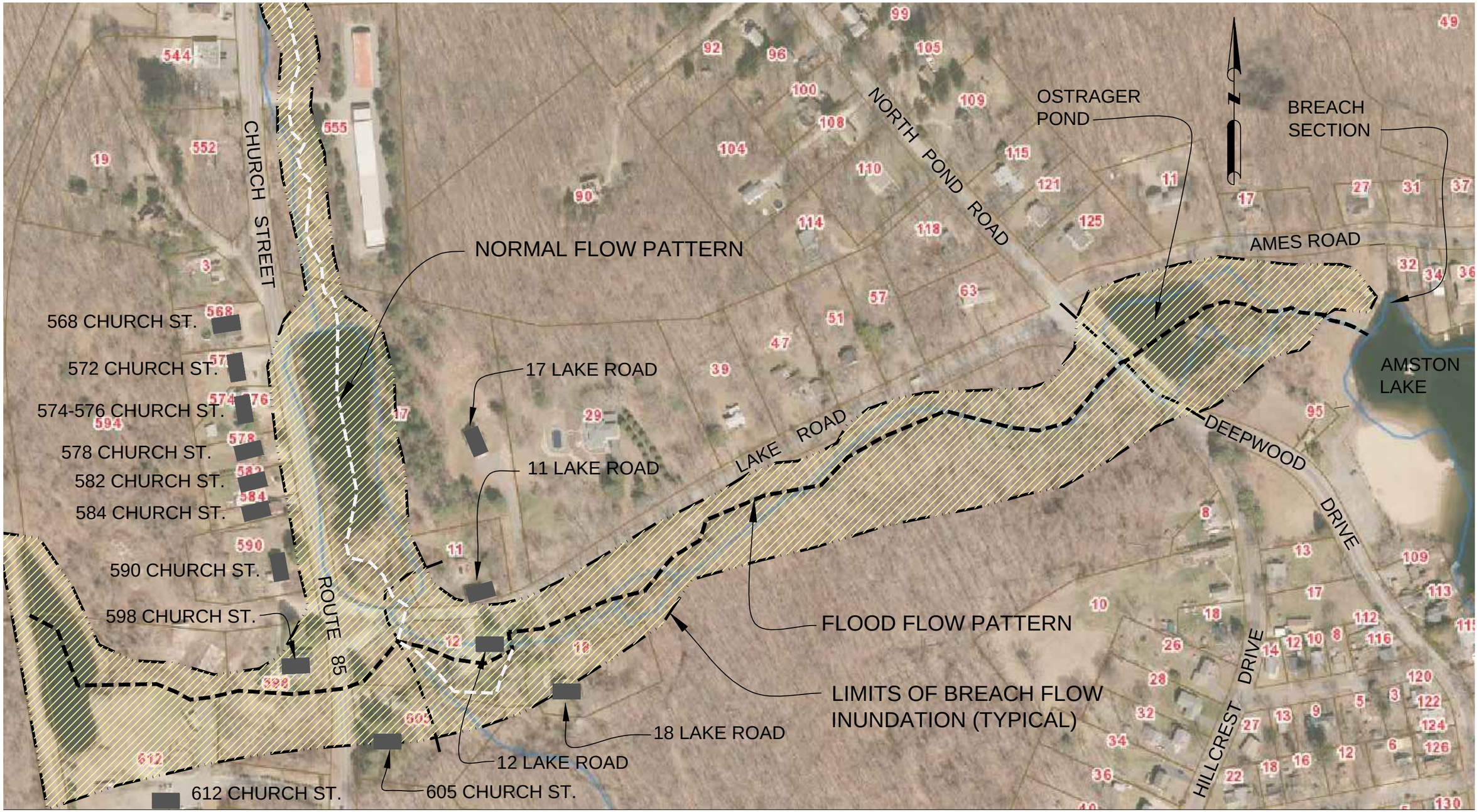
The following page includes a map of the inundation areas and a table, immediately following the plans, denoting critical impact areas and other relevant information related thereto.



USGS LOCATION MAP

AMSTON LAKE DAM
AMSTON, CONNECTICUT

SOURCE: USGS QUAD SHEETS
COLUMBIA & COLCHESTER



LIMITS OF POTENTIAL FLOODING DUE TO DAM BREACH
AMSTON LAKE DAM / HEBRON, CONNECTICUT
DEEP #06704 / HAZARD CLASS "B"

KA / 2017-07-31

SCALE: 1" = 200'

Location	**Distance from Dam (in feet)**	**Est. Peak Breach Travel Time (in min.)***	**Est. Travel Time of Peak After Beginning of Breach (in hrs. and min.)****	**Est. Max. Water Depth Increase (feet)**	**Description of Est. Max. Water Depth Relative to Infrastructure**[4]
Amston Lake Dam	0'	0	1:24	N / A	N / A
Deepwood Drive Crossing	560'	2	1:34	2.0'	4.0' Above Low point in Deepwood Drive. [Culvert Crossing]
Route 85 & Lake Street Crossing	2,500'	9	1:53	1.5'	2.0' Above Low Point in crossing the intersection of Lake Road and Route 85. [Culvert Crossing]

*Estimated time for the peak of the breach flood wave to travel from the dam to downstream locations.

** Estimated travel time for the peak breach flood outflow to occur after the start of the breach.

[4] In the two road crossings, the depths relative to infrastructure are the distance from the road surface elevation above the crossing to the high water level.

4. MAINTENANCE - EAP REVIEW & UPDATE

4.1 EAP Periodic Review

The ALD or their representative will review and, if needed, update the EAP at least once every two years, or more frequently as necessary to reflect significant changes. The EAP review will include the following:

- Calling all contacts on the three notification charts in the EAP to verify that the phone numbers and persons in the specified positions are current. The EAP will be updated if any of the contacts have changed.

- In addition, the ALD or their representative will ask if the person contacted knows where the EAP is kept and if responsibilities described in the EAP are understood.

- Calling the locally available resources included on the Emergency Services Contacts list to verify that the phone numbers, addresses, and services are current.

- A review of any significant change in downstream conditions, particularly new construction (e.g., housing or infrastructure) which may impact flooding delineations or areas to be evacuated.

4.2 EAP Exercise

Section 22a-411a-2 RCSA requires EAPs to include a description of an exercise, or test to be conducted at a minimum of once every two years. The exercise shall include participation of all appropriate personnel identified in the EAP that are responsible for providing emergency services in the event the EAP is initiated.

The ALD has three optional methods of conducting periodic EAP exercises and will utilize that method which appears most appropriate at the scheduled time. For Amston Lake Dam, a "B" hazard dam, as a general rule, a full tabletop or drill exercise will be conducted once every six (6) years starting two years from the currently dated plan. In intervening biennial years, the ALD will conduct call-out exercises to confirm / verify then current personnel in responsible positions, phone numbers and other contact information. Schedule for the next 14 years is as follows:

October 2017 Call-Out exercise
October 2019 Tabletop or Drill Exercise
October 2021 Call-Out exercise
October 2023 Call-Out exercise
October 2025 Tabletop or Drill Exercise
October 2027 Call-Out exercise
October 2029 Call-Out exercise
October 2031 Tabletop or Drill Exercise

Call-Out Exercise

The ALD will conduct the Call-Out Exercise. The ALD will verify that all persons and telephone numbers on the *Early Warning* and *Final Warning Notification Charts* are current. In addition to verifying personnel and contact information, the ALD will verify that each contact can locate their copy of the EAP and that they understand their roles and responsibilities in the event of an emergency, as described in the EAP.

The ALD will contact the locally available resources provided in the EAP to verify contact information and ensure that the services are current.

The ALD will review the most recent Dam Inspection Report, any significant development or construction activity downstream of the dam, and any modifications to the dam or spillway. The EAP must be updated to reflect any significant changes to the dam or downstream area and any changes in personnel or contact information.

Tabletop Exercise

The Tabletop Exercise will be facilitated by the ALD. The exercise will consist of a meeting and subsequent review of the EAP. The ALD, a representative from the Town, and any others with key responsibilities as identified in the EAP, should be present at the exercise.

The Tabletop Exercise will begin with the facilitator presenting a scenario of an unusual or emergency event at the dam. The scenario will be developed prior to the exercise. Once the scenario has been presented, the participants will discuss the responses and actions that they would take to address, mitigate and resolve the scenario. The facilitator will control the discussion, ensuring realistic responses and developing the scenario throughout the exercise.

The ALD will also verify that all persons and telephone numbers on the *Early Warning* and *Final Warning Notification Charts* are current. In addition to verifying personnel and

contact information, the ALD will verify that each contact can locate their copy of the EAP and that they understand their roles and responsibilities in the event of an emergency, as described in the EAP. The ALD will also contact the locally available resources provided in the EAP in order to verify contact information and ensure the services are current.

The ALD will review the most recent Dam Inspection Report, note any significant development or construction activity downstream of the dam, and any modifications to the dam or spillway. The EAP must be updated to reflect any significant changes to the dam or downstream area and any changes in personnel or contact information.

Drill Exercise

The Drill Exercise will be facilitated by the ALD and will consist of a visit to the dam site, a simulated exercise, and subsequent review of the EAP. The ALD, persons responsible for the Dam Monitoring Procedure, a representative from the Town, and any others with key responsibilities as identified in the EAP should be present at the Drill Exercise.

Participants of the Drill Exercise will visit the dam to familiarize themselves with the site prior to the initiation of the exercise. If a site visit is not possible to coordinate, exercise participants may familiarize themselves with the site through the use of aerial photographs or topographical maps, and a review of the most recent inspection report for the dam. Following the site visit, exercise participants will meet at the Town of Hebron Emergency Operations Center (EOC) as identified in this EAP, to hold the exercise. If the EOC is not available, a mutually agreeable alternate location may be used.

The facilitator will present a scenario of an unusual or emergency event at the dam. The scenario will be developed prior to the exercise. Once the scenario has been presented, participants will respond and activate the EAP as if the scenario were a real-life event. The facilitator will develop the scenario throughout the exercise. Once the scenario has been completed, the participants will discuss the responses and actions taken to address, mitigate, and resolve the scenario. The facilitator will prepare a written summary of the exercise and the EAP should be updated as necessary.

Note: *While the Drill Exercise should be treated as an actual event, participants should clearly verbalize that this is a drill and not a real life event while making phone calls. No actions should actually be taken (i.e. mobilizing emergency equipment, evacuations, etc.). The purpose of the Drill Exercise is to test the EAP and facilitate the response to an actual event.*

4.3 Updates

The ALD is responsible for updating the EAP document. The EAP document held by the ALD is the master document. When revisions occur, the ALD will provide updated pages with the date of the revision noted on each updated page and an update summary page to all the EAP document holders (see *Appendix E-1*). The document holders are responsible for updating their outdated copy of the respective document(s) whenever revisions are received. Outdated pages shall be immediately discarded to avoid any confusion with the updates. Updates and revisions made to the EAP should be recorded on the form provided as *Appendix F-2*. Part of each biennial exercise will be the verification that all responsible individuals holding registered copies of the EAP have the latest / updated version.

Section 22a-411a-2 RCSA requires EAPs to include a description of an exercise, or test to be conducted at a minimum of once every two years. The exercise shall include participation of all appropriate personnel identified in the EAP that are responsible for providing emergency services in the event the EAP is initiated.

5. Roles and Responsibilities

Amston Lake District, Its Operator or Representative

- Distribute this EAP to appropriate Control Copy Holders (see Appendix E-1).
- Review this EAP at least every two years and make revisions as needed (See Appendix E-2).
- Provide revised pages and a revision list to all EAP Control Copy Holders.
- Host and facilitate a periodic test of this EAP at least once every 2 years (See Section 4.2)
- Initiate monitoring of the dam at the onset of conditions identified in this EAP and notify the Emergency Management Authority that monitoring has begun (see notification charts).
- Provide a list identifying personnel and their alternate(s) that would be utilized by the ALD or operator(s) responsible for decision making and for implementing emergency repairs when the owner is absent.
- Determine if conditions warrant the notification of an *Early Warning* or *Final Warning*. If not, continue monitoring the dam.
- If an *Early Warning* or *Final Warning* is warranted, immediately notify the Emergency Management Authority (see notification charts).
- Provide updates of the situation to the Emergency Management Authority to help her / him make timely and accurate decisions regarding warnings and evacuations.
- Provide leadership to assure the EAP is reviewed and updated biennially and copies of the revised EAP are distributed to all who received copies of the original EAP.

State Dam Safety Agency (CT DEEP, Dam Safety Section)

- State-wide monitoring during flood emergencies; provide support and communication with the local Emergency Management Authority(s).
- Prior to a *Final Warning* being terminated by the Emergency Management Authority, review and provide concurrence with the assessment provided by the ALD's engineer that the dam is in a safe condition.
- Contact the National Weather Service (NWS) to coordinate the state-wide flood outlook.

Town of Hebron Emergency Management Authority
Paul Bancroft, Town of Hebron Emergency Management Director

- Serve as the primary contact person responsible for coordination of all emergency actions.
- Maintain communications with the media.
- When an ***Early Warning*** is issued:
    - Prepare emergency management personnel to evacuate people at risk downstream if conditions worsen and a *Final Warning* is issued.
    - Initiate the warnings that an evacuation ***may*** be necessary to people at risk downstream of the dam.
    - Alert the general public.
- When a ***Final Warning*** is issued:
    - Initiate the order to emergency management personnel to begin evacuation of people at risk downstream of the dam.
    - Alert the general public.
- Decide when to terminate the emergency (see guidance provided in Section 2.5).
- Participate in a biennial review and update of the EAP.

APPENDIX A

Resources Available (Equipment, Materials & Manpower)

Locally available resources include:

Heavy Equipment Service & Rental	**Sand & Gravel Supply**	**Ready-mix Concrete Supply**
Base Construction *403 Deepwood Drive* *Lebanon, CT 06249* *860-543-3585 (Office)*	*To be provided through standby contractor.* *Base Construction*	*To be provided through standby contractor.* *Base Construction*
Pumps	**Diving Contractor**	**Sand Bags**
To be provided through standby contractor. *Base Construction*	*Will rely on Emergency Services Dive Team* *(The ALD does not have a standby contractor for this service)*	*To be provided through standby contractor.* *Base Construction*

APPENDIX B-1

Contact Log

Dam name: ***Amston Lake Dam***

Location: ***Ames Road, Hebron, CT*** Date _____

The following contacts should be made immediately after the dam monitoring has been initiated and/or when the warning level has been determined. (See *Section 2.2).* The person making the contacts should initial and record the time of the call and who was notified for each contact made. See the *Notification Charts* for critical contact information and *Emergency Services Contacts* for contact information for other possible emergency services.

DAM MONITORING	Person Contacted	Time Contacted	Contacted by
___ Emergency Management Authority	_____	_____	_____
___ Dam Owner's Engineer (if needed)	_____	_____	_____

EARLY WARNING	Person Contacted	Time Contacted	Contacted by
____ Emergency Management Authority	_____	_____	_____
____ Dam Owner's Engineer	_____	_____	_____
____ DEEP Flood Response Center	_____	_____	_____
____ State Dam Safety Official	_____	_____	_____

FINAL WARNING	Person Contacted	Time Contacted	Contacted by
____ Emergency Management Authority	_____	_____	_____
____ Dam Owner's Engineer	_____	_____	_____
____ DEEP Flood Response Center	_____	_____	_____
____ State Dam Safety Official	_____	_____	_____

APPENDIX B-2

Unusual or Emergency Event Log
(to be completed during the emergency)

Dam Name: ***Amston Lake Dam*** [CT DEEP ID #06704]

Emergency Management Authority: Paul Bancroft, Emergency Management Director

When and how was the event detected? If the event started with a weather flood warning, then that should be listed here:

_____

_____

Weather conditions: _____

General description of the emergency situation:

_____

_____

_____

Warning level determination: _____ Made by: _____

Actions & Event Progression

Date	Time	Rainfall Data	Lake Level	Action/Event Progression	Recorded By

Report prepared by: _____ Date: _____

APPENDIX B-3

Dam Emergency Situation Report

(Complete following the termination of the emergency)

Dam name: ***Amston Lake Dam*** [CT DEEP ID #06704]

Emergency Management Authority: ***Paul Bancroft, Emergency Management Director***

Dam location: ***Ames Road, Hebron, CT Tolland Amston Lake Brook***

(Street) (City) (County) (Stream/River)

Date: _____ Time: _____

Weather conditions: _____

General description of emergency situation: _____

_____

_____

_____

Area(s) of dam affected: _____

_____

_____

_____

Extent of dam damage: _____

_____

_____

_____

Possible cause(s): _____

_____

_____

Effect on dam's operation: _____

_____

_____

Initial reservoir elevation: _____ Time: _____

Maximum reservoir elevation: _____ Time: _____

Final reservoir elevation: _____ Time: _____

Description of area flooded downstream/damages/injuries/loss of life: _____

_____

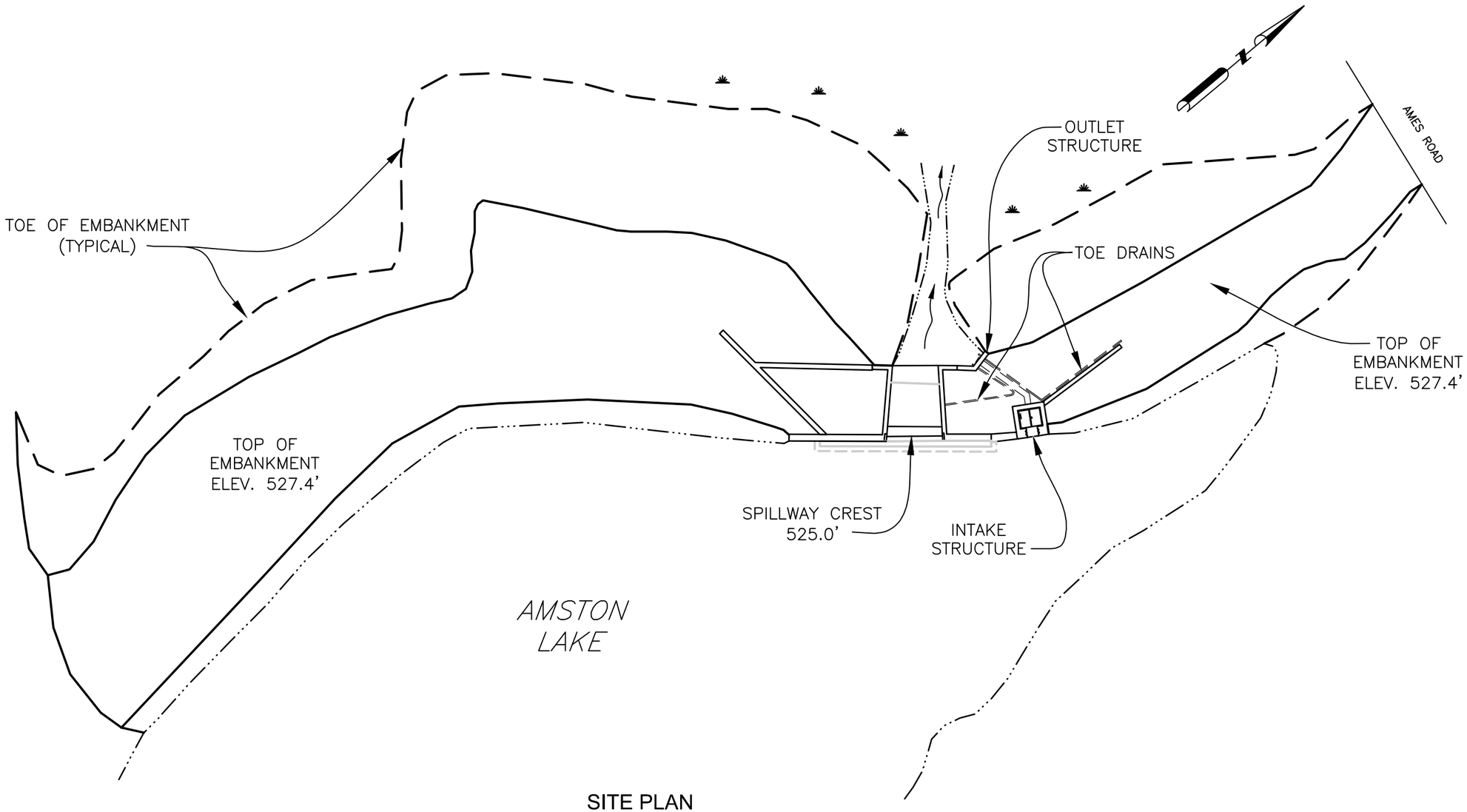
_____

Other data and comments: _____

Observer's name and telephone number:_____

Report prepared by: _____ Date: _____

APPENDIX C-1 / PLAN OF DAM & SUPPORTING INFORMATION



SITE PLAN

AMSTON LAKE DAM
AMSTON LAKE DISTRICT
HEBRON, CONNECTICUT

0' 30' 60' 90'

SCALE: 1" = 30'

APPENDIX C-2

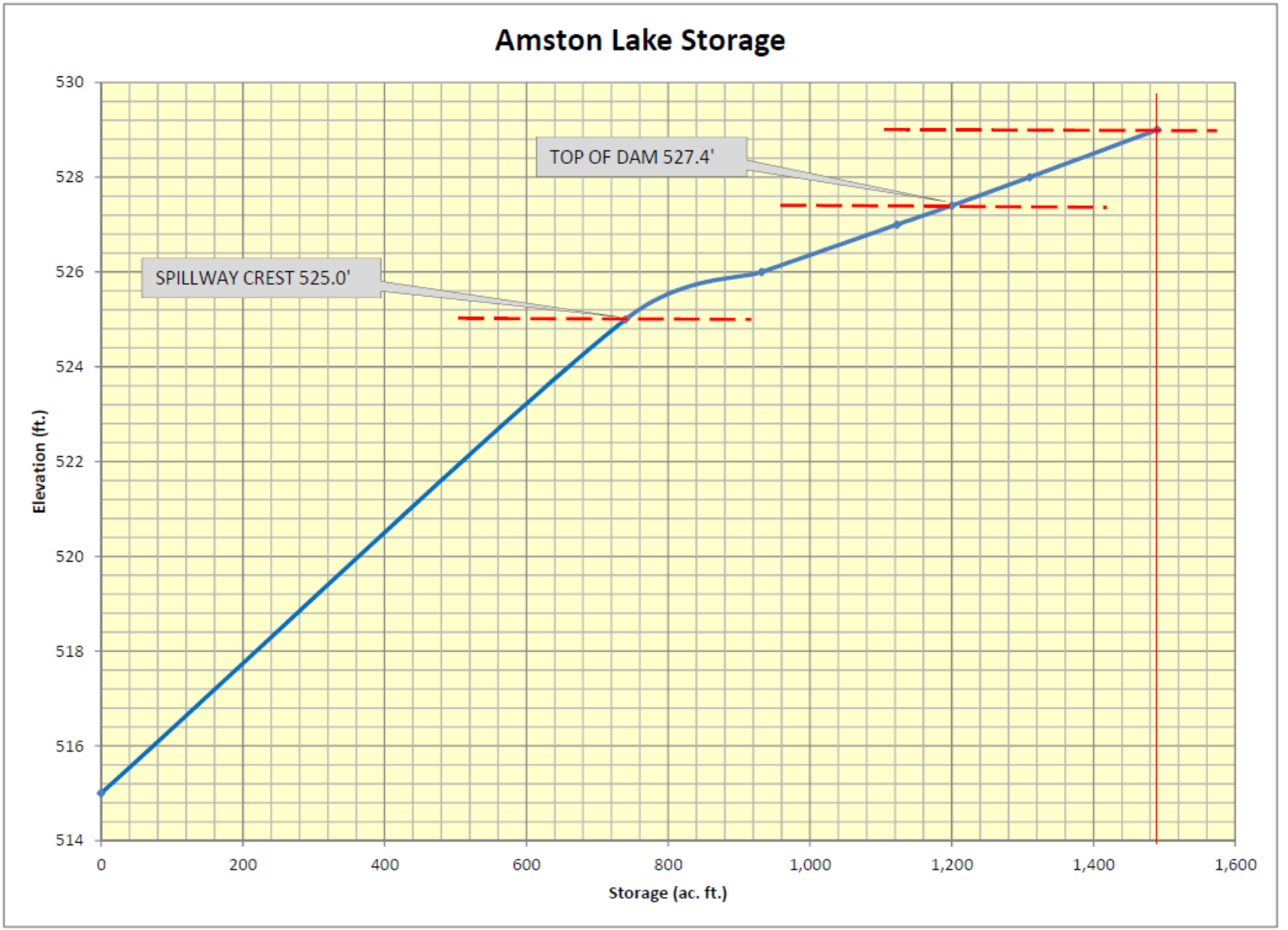
RESERVOIR ELEVATION-AREA-VOLUME & DISCHARGE CAPACITY DATA

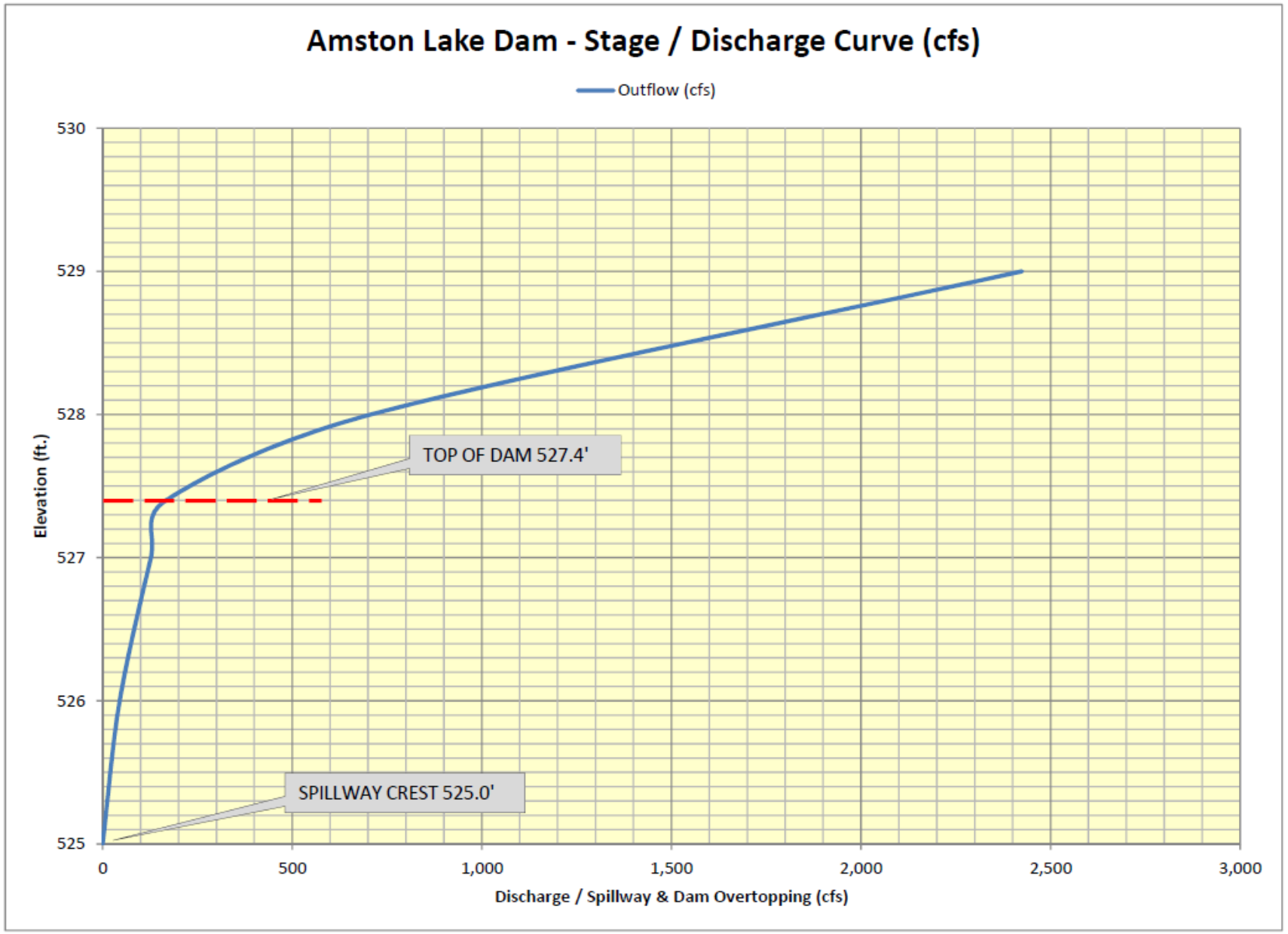
AMSTON LAKE DAM

[CT DEEP ID #06704]

SPILLWAY RATING TABLE - AMSTON LAKE DAM

Elevation (ft.)	Height (ft.)	Outflow Q (cfs)	Description
525	0.0	0	Weir Crest
526	1.0	45	
527	2.0	127	
527.4	2.4	167	Top of Dam
528	3.0	708	Overtopping
529	4.0	2,425	Overtopping


Amston Lake Storage
TOP OF DAM 527.4'
SPILLWAY CREST 525.0'
Elevation (ft.)
530
528
526
524
522
520
518
516
514
0
200
400
600
800
1,000
1,200
1,400
1,600
Storage (ac. ft.)


Amston Lake Dam - Stage / Discharge Curve (cfs)
Outflow (cfs)
530
529
528
527
526
525
Elevation (ft.)
TOP OF DAM 527.4'
SPILLWAY CREST 525.0'
0
500
1,000
1,500
2,000
2,500
3,000
Discharge / Spillway & Dam Overtopping (cfs)

APPENDIX D

[*Note: The following discussion is a repeat of the analysis provided earlier in this report.*]

Dam Breach Inundation Analysis

The potential areas of inundation due to a breach of Amston Lake Dam as presented in this EAP are based on the following assumptions:

1. The pre-breach water level in the impoundment is approximately 0.2 feet over the top of the dam. The watershed and dam were analyzed for the occurrence of the ½ Probable Maximum Flood (1/2 PMF), which resulted in a water surface elevation of 527.6 feet, approximately 0.2 feet over the top of the dam.

2. The pre-breach water level in the downstream reach is based on the same HEC-1 analysis of the conditions prior to the breach but at the same conditions noted in No. 1, above.

3. The time from breach initiation to full formation used for the purpose of this EAP is 3.0 hours. Although other failure times were analyzed, this was chosen as the most likely due to the makeup of the dam (see discussion below).

4. The final breach bottom width is 20 feet, the depth from top of dam is 9 feet and the side slopes of the breach are 1H:1V.

5. Downstream culvert openings are assumed to be, at minimum, partially blocked.

Potential areas for failure at this dam site include the earthen embankment sections or the concrete spillway. Because the spillway was reconstructed in the recent past, with a new cutoff wall on the upstream side and a reconstruction of its downstream apron, both with reinforced concrete, it is not a likely failure option. Thus, we have chosen the most likely location as one of the deeper earth embankment areas along the right side of the spillway where the embankment is also at its narrowest point. During the construction and installation of a new low level outlet structure near this area, a lower dam was found within the embankment, another earthen embankment with stone masonry walls on both upstream and downstream sides. Because of this lower structure, it is assumed that any failure would be a progressive erosive process for which a rapid or sudden failure is not considered probable and, therefore, will not be considered for this analysis.

In the failure scenario, a small amount of overtopping would occur during the event of a half Probable Maximum Storm (1/2 PMF), as noted by the previous water surface

elevations. The breach would most likely occur due to the steepness of slope and saturated embankment and toe areas. As well, there is a possibility, due to the unknown nature of the embankment fill, that failure could also occur due to piping through the embankment. In either of these cases, failure would be expected to occur over a period of time lasting about three (3) hours after the inception of a failure. The time factor for the failure mode is based on the presence of a lower and stable embankment within the body of the current dam. Although it would take some time to open up, failure would be expected to proceed rapidly thereafter.

Thus, for the purposes of a breach model, the following parameters were used:

Trapezoidal Opening / 20 ft. Wide at the Base / 9 ft. High / Side Slopes of 1H:1V
Time to Full Breach and Peak Outflow / 3.0 Hrs.
Location of Breach / The narrow portion of the right embankment area

This analysis provides a conservative estimate of the dam breach outflow and the potentially inundated downstream areas. However, the actual magnitude of the flood wave and the resulting downstream flood levels will be dependent on numerous factors that cannot be predicted in advance. For example, the dam breach flood wave would be greater in magnitude if the water level in the impoundment is higher at the beginning of the failure. Furthermore, downstream flood levels could be increased due to conditions such as debris clogging culvert crossings or portions of the stream channel. If these conditions exist, additional nearby properties may be impacted and may need to be evacuated.

APPENDIX E-1

Record Holders of EAP Control Copies

Copy Number	Organization	Person Receiving Copy
1	Amston Lake District P.O. Box 95 Amston, CT 06231	ALD President Frank Hoisl
2	Amston Lake District P.O. Box 95 Amston, CT 06231	ALD Clerk Liz Bowen
3	Town of Hebron Emergency Management Authority Hebron Public Safety Building 44 Main Street Hebron, Connecticut 06248	Emergency Management Director Paul Bancroft
4	Karl F. Acimovic, P.E. & L.S. 588 Stonehouse Road Coventry, Connecticut 06238	Consulting Engineer Karl Acimovic
5	Connecticut DEEP 79 Elm Street Hartford, Connecticut 06106	Dam Safety Section
6		
7		
8		

APPENDIX E-2

Record of Reviews / Updates to EAP

Update Number	Date	Revisions Made	By Whom
1	04-07-2021	Revisions to personnel and contact information for the Owner, DEEP, and Town of Hebron on pages 7, 12, 25, 26, 43, 46, 47, 55, and 56.	Karl Acimovic, P.E.

APPENDIX E-3

Concurrences

By my signature, I acknowledge that I, or my representative, have reviewed this plan and concur with the tasks and responsibilities assigned herein for me and my organization.

1._____
Signature *Organization* *Date*

Printed name and title:

2. _____
Signature *Organization* *Date*

Printed name and title:

3._____
Signature *Organization* *Date*

Printed name and title:

4._____
Signature *Organization* *Date*

Printed name and title:

5._____
Signature *Organization* *Date*

Printed name and title:

6._____
Signature *Organization* *Date*

APPENDIX F / Glossary of Terms

Abutment	The natural ground that borders on either end of the dam structure.
Appurtenance	Any structure or mechanism other than the dam itself which is associated with its operation.
Arterial Roadway	A roadway that provides a high level of mobility and that is frequently the route of choice for buses and trucks, as provided in the U.S. Department of Transportation document entitled "Highway Functional Classification Concepts, Criteria and Procedures, 2013 edition".
Boil	A disruption of the soil surface due to water discharging from below the surface. Eroded soil may be deposited in the form of a ring (miniature volcano) around the disruption.
Breach	An alteration of a dam either deliberately or accidentally in such a way as to release its impounded waters resulting in partial or total failure of the dam.
Class B Dam	A significant hazard potential dam which, if it were to fail, would result in any of the following: (i) possible loss of life; (ii) minor damage to habitable structures, residences, including but not limited to, industrial or commercial buildings, hospitals, convalescent homes, or schools; (iii) damage to local utility facilities including water supply, sewage treatment plants, fuel storage facilities, power plants, cable or telephone infrastructure, causing localized interruption of these services; (iv) damage to collector roadways and railroads; or (v) significant economic loss.
Class C Dam	A Class C dam is a high hazard potential dam which, if it were to fail, would result in any of the following: (i) probable loss of life; (ii) major damage to habitable structures, residences, including, but not limited to, industrial or commercial buildings, hospitals, convalescent homes, or schools; (iii) damage to major facilities, including public water supply, sewage treatment plants, fuel storage facilities, power plants, or electrical substations causing widespread interruption of these services; (iv) damage to arterial roadways; or (v) great economic loss.
Collector Roadway	A roadway that collects traffic from local roadways and connects traffic to arterial roadways, as provided in the U.S. Department of Transportation document entitled "Highway Functional Classification Concepts, Criteria and Procedures, 2013 edition".
Conduit	A closed channel (round pipe or rectangular box) that conveys water through, around, or under the dam.
Control Section	A usually level segment in the profile of an open channel spillway above which water in the reservoir discharges through the spillway.

Cross Section	A slice through the dam showing elevation vertically and direction of natural water flow horizontally from left to right. Also, a slice through a spillway showing elevation vertically and left and right, looking downstream.
CT ID Number	A unique identifying number assigned to a dam registered and regulated by the State of Connecticut.
Dam	Any barrier of any kind whatsoever which is capable of impounding or controlling the flow of water, including but not limited to storm water retention or detention dams, flood control structures, dikes, and incompletely breached dams.
Dam Failure	A catastrophic breach characterized by the sudden, rapid, and uncontrolled release of impounded water, or a lesser breach that adversely affects the dam's primary function of impounding water.
Dam Height	The vertical distance from the crest of the dam or similar structure to the downstream toe of such dam or similar structure.
Dam Operator	The person(s) in control of, or having responsibility for, the daily operation of the dam as designated by the owner on the dam registration form required by Section 22a-409-1(b) of the Regulations of Connecticut State Agencies (RCSA).
Dam Owner	The person(s) having legal ownership of the dam.
Drains: toe, foundation, or blanket	A water collection system of sand and gravel that typically pipes along the downstream portion of the dam to collect seepage and convey it to a safe outlet.
Drainage Area (watershed)	The geographic area on which rainfall flows into the dam. The drainage area can be delineated using USGS StreamStats. StreamStats is an on-line GIS application that is available to the public free-of-charge. http://water.usgs.gov/osw/streamstats/connecticut.html
Drawdown	The lowering or releasing of the water level in a reservoir over time or the volume lowered or released over a particular period of time.
Early Warning Notification	An alert stage in which the local authorities are informed by the dam owner that a situation exists at a dam that could develop into a serious hazard to downstream inhabitants, making evacuation necessary.
Emergency	A condition of a serious nature which develops unexpectedly, endangers the structural integrity of a Class C or Class B dam, and requires immediate action.
Emergency Action Plan (EAP)	A formal document required to be submitted to the commissioner in accordance with section 22a-411a-2 of the Regulations of Connecticut State

	Agencies.
Emergency Management Authority	Any local, state, federal, or tribal agency responsible for emergency operations, planning, mitigation, preparedness, response, and recovery for all hazards.
Emergency Operations Center (EOC)	The location or facility where responsible officials gather during an emergency to direct and coordinate emergency operations, to communicate with other jurisdictions and with field emergency forces, and to formulate protective action decisions and recommendations during an emergency.
Evacuation Map	A map showing the geographic area downstream of a dam that should be evacuated if it is threatened to be flooded by a breach of the dam or other large discharge.
Final Warning Notification	A warning in which the local authorities are informed by the dam owner that a failure of the dam is a likely possibility and residents downstream should be evacuated immediately.
Flood	Any high flow, overflow, or inundation by water which causes or threatens damage to persons or property.
Flood Response Center (FRC)	The state DEEP coordination center for major flood events affecting the State of CT.
Freeboard	Vertical distance between a stated water level in the reservoir and the top of dam.
Gate, slide or sluice	An operable, watertight valve to manage the discharge of water from the dam.
Groin	The area along the intersection of the face of a dam and the abutment.
Hazard Potential	The probable damage that would occur if the structure failed, in terms of loss of human life and economic loss or environmental damage.
Instantaneous Sunny Day Breach	A condition where there is a dam breach with no concurrent flooding from other sources. This is considered a dangerous breach event because people are not expecting a flood without a storm or snowmelt. For modeling purposes, instantaneous means that the full breach of the dam occurs with zero formation time.
Instrumentation	An arrangement of devices installed into or near dams that provide measurements to evaluate the structural behavior and other performance parameters of the dam and appurtenant structures.
Inundation Map	A map sufficient in graphic detail and of a scale that clearly shows the downstream inhabited areas and the inundation zones with features and other related information required in section 22a-411a-2(b) of the Regulations of Connecticut State Agencies.

Outlet Works (principal spillway)	An appurtenant structure that provides for controlled passage of normal water flows through the dam.
Piping	The progressive development of internal erosion through a dam by water, appearing downstream as a hole or seam discharging water that contains soil particles.
Probable Maximum, Precipitation (PMP), or Flood (PMF)	The theoretically greatest precipitation or resulting flood that is meteorologically feasible for a given duration over specific drainage area at a particular geographical location.
Riprap	A layer of large angular rock generally placed on an embankment or along a watercourse as protection against wave action, erosion, or scour.
Risk	A measure of the likelihood and severity of an adverse consequence.
Seepage	The natural movement of water through the embankment, foundation, or abutments of the dam.
Slide	The movement of a mass of earth down a slope on the embankment or abutment of the dam.
Spillway (auxiliary or emergency)	The appurtenant structure that provides the controlled conveyance of excess water through, over, or around the dam.
Spillway Capacity	The maximum discharge the spillway can safely convey with the reservoir at the maximum design elevation.
Spillway Design Flood or "SDF"	The largest flood that a given structure is designed to pass safely.
Spillway Crest	The lowest level at which impoundment water can flow through/over the spillway.
State Emergency Operations Center (SEOC)	The State's coordination center for emergency services during any major emergency affecting the State of Connecticut.
Structure	The dam, its appurtenances, abutments and foundation.
Tailwater	The body of water immediately downstream of the embankment at a specific point in time.
Toe of Dam	The base portion of the impounding structure which intersects with natural ground at the upstream and downstream sides.
Top of Dam (crest of dam)	The elevation of the uppermost surface of a dam embankment which can impound water.