

Emergency Action Plan

For

Cedar Meadow Lake Dam

Leicester, MA

NID ID #MA00984

Prepared by Cedar Meadow Lake Watershed District

May 2014

Updates:

**Emergency Action Plan
For
Cedar Meadow Lake Dam**

Table of Contents

Section

1.0	Notification Flowchart	iii
2.0	General	1
2.1	Description of Dam and Appurtenances	1
2.2	Size Classification	2
2.3	Hazard Classification	2
3.0	Downstream Flood Path and Flow Capacities	2
3.1	Downstream Flood Path	2
3.2	Downstream Flood Potential	2
3.3	Spillway Capacity	2
3.4	Culverts Under Pine Street	2
3.5	Culvert Under Green Street	2
4.0	Possible Emergency Conditions/Responses	3
4.1	Excessive Precipitation or Flood Flows	3
4.2	Failure of Upstream Impoundment	3
4.3	Excessive Seepage	3
4.4	Spillway or Low Level Outlet Blockage	3
4.5	Earthquake	3
4.6	Vandalism, Sabotage or Terrorism	3
4.7	Flooding That Threatens Downstream Dams	4
5.0	Issuing Early and Final Warnings	4
6.0	Storm Event Monitoring Procedures	5
6.1	Inspection Frequency	5
6.2	Inspection Procedures	5
6.3	Safety Precautions	6
6.4	Emergency Lighting	6
6.5	Responsible District Officials	6
7.0	All Clear Notice	7
8.0	Potentially Affected Downstream Properties	7
8.1	Roadways	7
8.2	Homes	7
8.3	Inundation Area Below Greenville Pond	7
8.4	Precautionary Notifications	8

9.0	Emergency Repair Measures	8
9.1	Overtopping	8
9.2	Erosional Seepage	8
9.3	Spillway or Low Level Outlet Blockage or Damage	8
10.0	Flash Board Installation and Removal and Low Level Outlet Operation	9
10.1	Flash Board Removal	9
10.2	Flash Board Installation	9
10.3	Low Level Outlet Operation	9
11.0	Emergency Response Equipment, Materials and Manpower	10

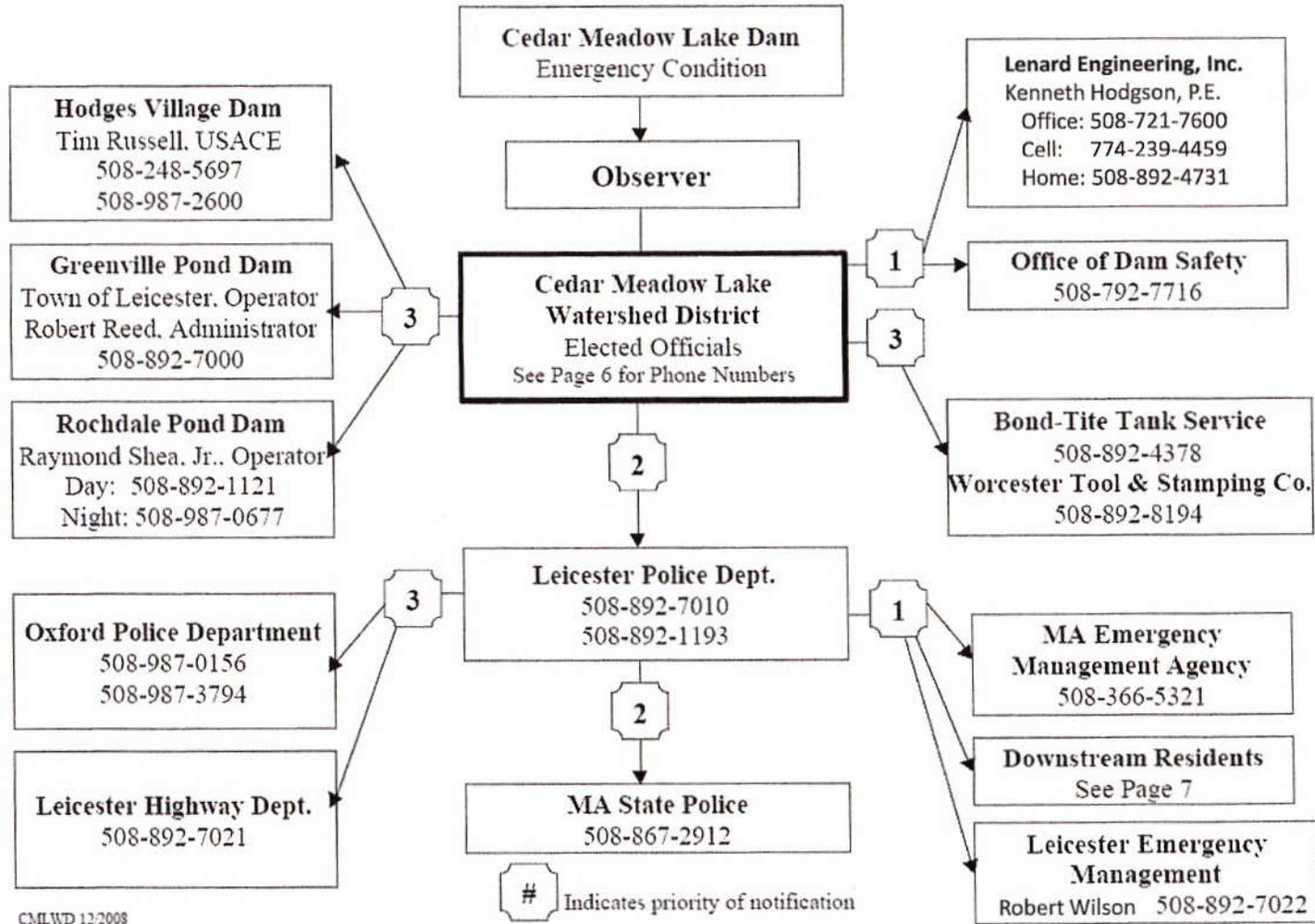
Appendix A

- | | | |
|---|----------------------------|-------------|
| • | Maps | A-1 and A-2 |
| • | R. H. White Company Letter | A-3 and A-4 |

Distribution:

- Gatehouse
- Elected District Officials
- Designated Dam Safety Engineering Firm
- Designated Dam Safety General Contractor
- Massachusetts Office of Dam Safety
- Leicester Emergency Management

Cedar Meadow Lake Dam Notification Flowchart



**Emergency Action Plan
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2.0 General

This Emergency Action Plan ("EAP") defines responsibilities and provides procedures designed to:

- Identify unusual and unlikely conditions which may endanger the dam.
- Initiate remedial actions to prevent or minimize the downstream impacts of a dam failure.
- Initiate emergency actions to warn public safety officials of impending or actual failure of the dam.

2.1 Description of Dam and Appurtenances

Official Name	Cedar Meadow Lake Dam
State Dam ID#	3-14-151-8
NID ID#	MA00984
Location	Off Charles Street, next to 142 Charles Street, Leicester, MA in Worcester County
Access	The east side of the dam is easily accessible through an easement next to 142 Charles Street. The west side of the dam is accessible through a paper street opposite 61 Fairview Drive. Traverse westerly through the paper street, then southerly through a clearing, then easterly through an electric utility easement, and then northerly to the dam.
Owner/Operator	Cedar Meadow Lake Watershed District

Cedar Meadow Lake Dam is a gravity masonry dam with earth fill. It is approximately 490 feet long with a maximum height of 15.3 feet. The width of the dam varies from 29 to 31 feet. The primary spillway is a concrete broad crested weir 42 feet long by 30.6 feet wide with 2.25 foot high training walls. A 4 foot wide by 2.8 foot deep low flow channel with flash board control is located at the east end of the primary spillway. The upstream face of the dam is a vertical stone masonry wall coated with concrete. Some areas of this wall and the face of the spillway are covered by poured concrete. The downstream face of the dam is a vertical stone masonry wall. The spillway discharges to a concrete apron and then to a natural channel.

The low level outlet is under a small concrete block structure near the center of the dam that once served as a gate house. This outlet is a 12 inch HDPE pipe with a gate operator in the upstream end which is accessible from a platform off the former gate house.

2.2 Size Classification

Cedar Meadow Lake Dam has a maximum height of 15.3 feet and a maximum storage capacity of 1090 acre feet and is considered a **Large** structure under Office of Dam Safety regulations.

2.3 Hazard Classification

Cedar Meadow Lake Dam is classified as a **Significant** hazard potential dam under Office of Dam Safety regulations.

3.0 **Downstream Flood Path and Flow Capacities**

3.1 Downstream Flood Path

The outflow of Cedar Meadow Lake enters Burncoat Brook and flows through Bouchard Pond and under Pine Street. Burncoat Brook east of Pine Street enters lowland swamps that extend to the north and south sides of Pine Street and to the east of Pine Street where Burncoat Brook intersects with Town Meadow Brook. The combined areas of these swamps exceeds the surface area of Cedar Meadow Lake. A sudden outflow from Cedar Meadow Lake would spread out over these swamps which would serve as initial collection areas to reduce the sudden impact downstream. Town Meadow Brook flows in a southerly direction through a lowland swamp and under Green Street and into Greenville Pond.

3.2 Downstream Flood Potential

Failure of the dam at maximum pool may cause road flooding on Pine Street at the outlet of Bouchard Pond just south of Cedar Meadow Lake where Bouchard Pond discharges into two seven foot diameter culverts. Pine Street bisects lowland swamp areas around Burncoat Brook that would be subject to flooding. House numbers 401 and 403 Pine Street and house number 80 Green Street, next to Town Meadow Brook, just north of Greenville Pond may also be subject to flooding. House numbers 380, 414 and 416 Pine Street may not be subject to flooding but may be temporarily isolated by flood waters.

3.3 Spillway Capacity

The spillway has a capacity of 173,500 GPM at a 24 inch depth. This exceeds the 127,070 GPM required to handle a 100 year storm. The spillway capacity is estimated to be 30% greater with the flash boards removed from the spillway channel, increasing the spillway capacity to approximately 225,000 GPM.

3.4 Culverts Under Pine Street

The combined capacity of the two 7 foot culverts under Pine Street is 125,700 GPM prior to back up. There is at least 3 feet of free board above the culverts to the road elevation. Water flowing over Pine Street would naturally flow downstream to Burncoat Brook.

3.5 Culvert Under Green Street

The arched culvert under Green Street is approximately 12 feet wide and 10 feet high and has a capacity that far exceeds the capacity of the culverts under Pine Street.

4.0 Possible Emergency Conditions/Responses

Listed below are some, not necessarily all, of the events which could lead directly to the failure of the dam or to emergency actions. Included after each one is a brief outline of steps to take to stabilize the situation.

- Excessive Precipitation or Flood Flows
- Failure of Upstream Impoundment
- Excessive Seepage
- Spillway or Low Level Outlet Blockage
- Earthquake
- Vandalism, Sabotage or Terrorism

4.1 Excessive Precipitation or Flood Flows

4.2 Failure of Upstream Impoundment

Excessive precipitation is the most likely condition to threaten the integrity of the dam. The outflow of Burncoat Pond directly enters Cedar Meadow Lake at its northwest corner. A sudden discharge from 122 acre Burncoat Pond would immediately impact 144 acre Cedar Meadow Lake and its dam. In either case, excessive volumes of water would flow into Cedar Meadow Lake.

If heavy rain and/or severe flooding conditions are forecast, or if a failure of the Burncoat Pond Dam is eminent or in progress, draw the lake level down through the use of the spillway channel and lower gate valve to avoid or delay overtopping. If overtopping or dam failure are threatened or imminent, immediately implement **Notification Flowchart** procedures. See Storm Event Monitoring Procedures in Section 6.0 below.

4.3 Excessive Seepage

Check the downstream wall of the dam for signs of seepage, and check the downstream toe of the dam for seepage and soft spots. Listen for the movements of excessive volumes of water through the dam structure if possible. If a marked increase of seepage is observed immediately implement **Notification Flowchart** procedures.

4.4 Spillway or Low Level Outlet Blockage

Any obstructions in the normal flow of water over the spillway or through the low level outlet must be immediately corrected. If such obstruction could cause an overtopping of the dam, immediately implement **Notification Flowchart** procedures and contact a contractor to remove the obstruction.

4.5 Earthquake

4.6 Vandalism, Sabotage or Terrorism

If an act of vandalism, sabotage or terrorism threatens the integrity of the dam, or an earthquake of Richter Magnitude 5.0 or greater has been reported in the vicinity, or the responsible individual(s) has (have) felt ground motions and experienced damage from a large earthquake, immediately conduct a general overall visual inspection of the dam.

- a. If dam is failing, or is damaged to the extent that there is increased flow passing downstream, immediately implement **Notification Flowchart** procedures.

- b. Check the dam crest for settlement. If dam crest has dropped more than 0.5 feet, lower the reservoir pool level the same amount as the settlement. If the outlet works are damaged, it may be necessary to utilize pumps to lower the pool level. The pool should remain drawn down until the dam can be examined by the Office of Dam Safety or other qualified professional engineers.
- c. Otherwise, if damage has occurred, but is not judged serious enough to cause failure of the dam, quickly observe the nature, location, and extent of the damage, and evaluate the potential for the failure. Then contact the Office of Dam Safety to provide a description of the new or increases seepage, and sudden settling, including the location, extent, rate of settling, effect of adjoining structures, springs and seeps, reservoir elevation, prevailing weather conditions, and other pertinent facts would be helpful.
- d. If there appears to be no imminent danger of dam failure, District officials should thoroughly inspect the following:
 - Both faces of the dam for possible cracks, settlement, or seepage
 - Abutments of possible displacement
 - Spillway structure to confirm continued safe operation
 - Outlet channel
 - Reservoir and downstream areas for landslides

Report all findings to the Office of Dam Safety and all other agencies that had been contacted earlier during the emergency. Also make sure to keep close watch on the dam for the next two to four weeks as some damage may not show up immediately after an earthquake or malicious acts by others.

4.7 Flooding That Threatens Downstream Dams

The integrity of the dam at Rochdale Pond has been threatened in the past as a result of rising water levels caused by heavy rain over an extended period of time.

If this occurs during the Fall/Winter period when the lake is drawn down or is being drawn down, or at any other time that the low level outlet or spillway channel are open, close the low level outlet and spillway channel to store water that would otherwise flow to exacerbate problems at the Rochdale Pond Dam.

5.0 **Issuing Early and Final Warnings**

An Early Warning is intended to orally inform local public safety officials and downstream dam owners that conditions exist at the dam that may, within several hours, result in the failure of the dam and the release of large volumes of water downstream. The Early Warning notice and/or actual evacuation of downstream residences and businesses should be performed according to pre-arranged plan prepared by local public safety officials.

A Final Warning should be initiated when, in the judgement of the individual(s) monitoring and inspecting the dam, failure of the dam is imminent. Local public safety officials, and only these officials, have the authority to order an evacuation.

When issuing either a Early Warning or Final Warning, District officials should also immediately implement Notification Flowchart procedures.

6.0 Storm Event Monitoring Procedures

6.1 Inspection Frequency

Flood Watch: When a Flood Watch alert is issued by the National Weather Service for Worcester County, or when heavy runoff conditions exist, elected officials of the Cedar Meadow Lake Watershed District or their designees should commence monitoring and inspection of the dam at three hour intervals.

Flood Warning: If a Flood Watch is upgraded to a Flood Warning, the dam should be monitored and inspected hourly.

Post Event: Follow-up inspections should be conducted as soon as it is safe to do so to identify any damage to the integrity of the dam.

Written records should be kept by those monitoring and inspecting the dam during and after a storm event.

6.2 Inspection Procedures

When possible to do so safely, the following procedures should be followed during a storm event or failure of the Burncoat Pond dam:

- a. Rate of water level rise: Check the water level relative to the spillway training walls and visually observe the rate of water rise. Install a staff gauge to make it easier to judge the rate of water rise and the amount of freeboard available before water begins to flow over the dam crest. If the increase in water elevation cannot be safely observed from the dam crest, install a staff gauge in the lake near Charles Street.
 - a. If the rate of rise in the water level is observed such that the crest of the dam will be overtopped within three hours, issue an Early Warning.
 - b. If the rate of rise in the water level is such that the crest of the dam will be overtopped in one hour, issue a Final Warning.
- b. Seepage, soft spots and settling: Check the toe and crest of the dam for signs of seepage, settling or soft spots.
 - a. If there is a marked increase in the seepage through or under the downstream vertical wall of the dam, or if new areas of settling are observed on the dam crest, issue an Early Warning.
 - b. If a dramatic increase in seepage is observed through or under the downstream vertical wall of the dam, or if substantial settling is observed on the dam crest, issue a Final Warning.
- c. Other conditions: If any other conditions are observed at the dam that may result in failure of the dam, issue a Final Warning.
- d. Inspect the culverts under Pine and Green Streets for obstructions and advise the Leicester Highway Department of the need to remove obstructions immediately.

6.3 Safety Precautions

Individuals that monitor or inspect the dam during a storm event should only do so if their personal safety is assured. Monitoring and inspection on and around the dam should always be performed by at least two individuals at the same time if any unsafe conditions exist or are possible. They should not venture out onto the dam or its abutments or on either the upstream (by boat) or downstream side of the dam if there is any possibility the dam will fail. Under unsafe conditions, observations must be performed from a safe distance. Individuals performing monitoring or inspections should always be equipped with remote communications such as cell phones or two way radios.

6.4 Emergency Lighting

Mobile high intensity lighting should be made available to provide the ability to monitor and inspect the dam during nighttime hours. This equipment, if not available through public safety agencies, should be rented.

6.5 Responsible District Officials

The following individuals are responsible for emergency dam monitoring and inspection and for listening and responding to National Weather Service alerts and warnings. They are also responsible for coordinating and implementing emergency repairs and other measures to avoid or prevent dam overtopping. Please contact in the following order:

- | | | | |
|----|-----------------|--|---|
| a. | Tommy Lee | 61 Fairview Drive, Leicester
Management Committee | 508 892-3750 home
774 239-1799 cell
508 306-5365 work |
| b. | Paul Dufresne | 47 Fairview Drive, Leicester
Management Committee | 508 892-0173 home
508 868-7301 cell |
| c. | Thomas Forsberg | 66 Hill Street, Auburn | 508 832-3249 home
800 392-0039 work
508 633-4451 cell |
| e. | Terence O'Coin | 12 Caron Road, Sturbridge
Treasurer | 508 347-6863 home
860 836-2327 cell
860 665-1719 work |

R. H. White Construction of Auburn has been designated as the District's dam safety general contractor. Contact John Kelley @ 508 832-3295 office, or 508 241-3243 cell.

Lenard Engineering, with offices in Auburn, MA and Connecticut, has been designated as the District's dam safety engineering firm. Contact Kenneth Hodgson @ 508 721-7600 office, 774 239-4459 cell, or 508 892-4731 home

7.0 All Clear Notice

The following steps must be taken if a Final Warning was issued and evacuations or roadway closures occurred prior to the issuance of an All Clear Notice:

- a. Determine that the flood emergency has abated. The dam safety emergency can be considered abated when the dam has been completely breached, and the lake emptied, or the emergency situation is stabilized.
- b. Determine that the outflow of the lake no longer threatens downstream property.

8.0 Potentially Affected Downstream Properties

Since the Cedar Meadow Lake Dam is classified as a significant hazard potential dam under Office of Dam Safety regulations, a downstream inundation assessment is not required. As stated previously in this plan, a complete failure of the Cedar Meadow Lake dam could result in the following flooding between the outlet of the dam and Greenville Pond:

- 8.1 Roadways Pine Street between Charles Street and River Street where the culverts cross under Pine Street at the outlet of Bouchard Pond. It may be necessary to close Pine Street to vehicular traffic between Charles Street and River Street.

Pine Street between house number 401 and 405, a low spot where Pine Street bisects swampy areas around Burncoat Brook. It may be necessary to close this section of Pine Street to vehicular traffic.

Green Street next to house number 80 where Town Meadow Brook passes through a 20 foot culvert under Green Street. It may be necessary to close Green Street between Baldwin and Pleasant Street to vehicular traffic and to temporarily evacuate house #80.

- 8.2 Homes Possibly subject to flooding:
- | | | |
|-----------------|-----------------------------|--------------|
| 401 Pine Street | Kevin and Kristi Rookey | 508-892-7184 |
| 403 Pine Street | John and Jacqueline Guertin | 508-892-8509 |

Possibly subject to temporary isolation due to flood water:

380 Pine Street	Earl and Doris Mayo	508-892-4335
414 Pine Street	Joseph and Alice Niewiera	508-892-9309
416 Pine Street	Marlene and Ben Rodrick	774-239-6434

Please note that the odd and even house numbers on Pine Street do not line up with one another, e.g., house number 380 is opposite house number 403.

8.3 Inundation Area Below Greenville Pond

The outflows of Cedar Meadow Lake and Stiles Reservoir both flow through Greenville Pond. See the inundation area map and list of Downstream Property Owners south of Greenville Pond contained in the Emergency Action Plan for Stiles Reservoir for guidance regarding possible or potential downstream damage resulting from a complete failure of the Cedar Meadow Lake Dam.

8.4 Precautionary Notifications

It would be prudent to notify downstream dam operators and businesses located in close proximity to the brook running between Greenville Pond and Rochdale Pond. See the **Notification Flowchart** for telephone numbers.

Dams: Greenville Pond Dam
Rochdale Pond Dam
Hodges Village Dam

Businesses: Bond-Tite Tank Service
Worcester Tool and Die
See Flowchart for telephone numbers

9.0 **Emergency Repair Measures**

Emergency repair measures are taken to help prevent or minimize the effects of dam failure. The following actions should be performed under the direction of the Office of Dam Safety or other qualified licensed professional engineers with experience in dam safety. Taking these actions does not eliminate the need to issue warnings to local authorities.

9.1 Overtopping due to flood waters or upstream dam failure:

- e. Lower the water level by opening the low level outlet and removing the flash boards from the spillway channel.
- f. Place sand bags along the crest to divert water flow to the spillway or natural ground next to the dam abutments.

9.2 Erosional Seepage (Piping) through the dam structure or abutments:

Note that it is not practical to stop all small volume leakage and that the dam has and will continue to operate safely with minor, non-erosive, seepage.

- a. Plug the flow entrance (suction point) with whatever material is available, such as plastic sheeting, if the entrance to the leak is in the upstream face of the dam.
- b. Lower the water level until the erosional seepage flow decreases or stops.
- c. Use professional divers to stop the leaks in the upstream face of the dam as soon as it is safe to do so by hand packing with concrete.

9.3 Spillway or Low Level Outlet Blockage or Damage

- a. Employ qualified contractor to remove spillway blockage.
- b. Employ qualified contractor to make temporary spillway repairs through the use of sand bags, rip-rap or other material.
- c. Lower the water level if possible to prevent increased damage to the spillway.
- d. Use pumps to help reduce the water level if necessary.
- e. Employ experienced professional divers to assess the situation and make necessary repairs to the low level outlet.

10.0 Flash Board Installation / Removal and Low Level Outlet Operation

The dam is equipped with a low level outlet and a spillway channel with flash boards (also referred to as stop logs). The primary purpose of the spillway channel, in combination with the low level outlet, is to provide a means to quickly reduce the water elevation in the lake. When the lake is full and the spillway channel and low level outlet are fully opened, the lake level can be reduced as much as 7 inches in 24 hours (2.7 million gallons). Follow procedures described below to remove the flash boards and to open the low level outlet.

10.1 Flash Board Removal

This operation is best performed by two people when the lake is full. The first step in removing the flash boards is to unlock the padlock and raise the locking mechanism. To remove the flash boards when the lake is full, partially raise one or more of the flash boards through the use of a hammer and pinch bar, or similar tool to create a small flow through the channel. The water pressure against the channel opening created by this small flow will allow the channel stop to easily be lowered into, and kept in, place across the upstream channel opening to stop water flow. The channel stop is constructed of two layers of 3/4 inch plywood and is sized so as to extend beyond the bottom and sides of the spillway channel opening. The flash boards are kept in place within the channel in vertical steel frames. Raise and remove each flash board separately until all flash boards have been removed. Remove the channel stop by levering it upward through the use of crowbars and wooden blocks. A series of holes have been drilled in one layer of plywood to facilitate this process. As the channel stop is raised, water will begin to flow under it. Water pressure against the channel stop diminishes as the channel stop is raised higher and higher until it can be removed. The channel stop, and flash boards when removed, along with the locking mechanism, are stored in the gatehouse. This gatehouse is double locked and is accessible only to the elected officials of the District and dam caretakers.

10.2 Flash Board Installation

Install the channel stop across the spillway channel opening. Water pressure usually necessitates the use of a heavy hammer to lower the channel stop below the bottom of the channel opening. The channel stop does not completely stop flow. Begin the install the flash boards one layer at a time. The first, or lowest, flash board is "V" shaped on the bottom to fit into a groove in the channel bottom. Remove small stones and debris from this groove before installing the first flash board. Each of the middle flash boards overlap the others. The top flash board has a square top that fits into the locking mechanism. When all of the flash boards are installed, remove the channel stop by raising it to release water pressure.

10.3 Low Level Outlet Operation

The low level outlet is controlled by a 12 inch gate valve located under the access platform that runs from the gatehouse. To operate the valve, first, open the lake-side gatehouse door. Assemble the two pieces of the "T" shaped valve wrench through the use of the bolt and spring connector. This wrench is stored in the gatehouse. Lay the "T" portion of the wrench on the floor of the gatehouse and slide the two sections together while aligning the grooves etched into each piece. Raise the assembled wrench to a vertical position and

drop it through the hole in the platform and onto the valve stem. Turn the valve open or closed as necessary. The full range of the valve from fully closed to fully opened is 49 turns.

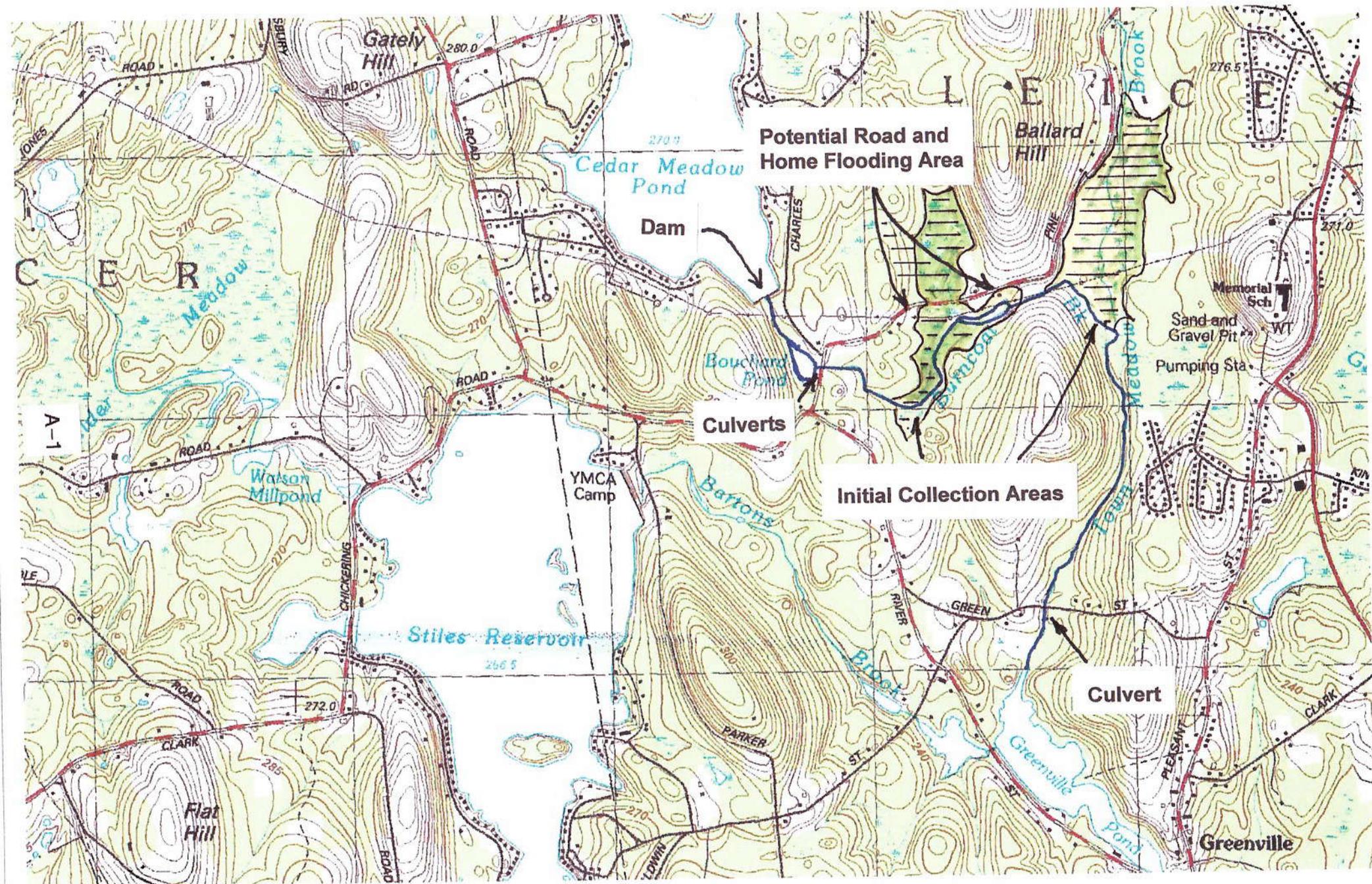
An aluminum trash rack with removable stainless steel grill is located on the inlet side of the valve. This rack has two purposes. The first is to prevent foreign objects from flowing into and blocking the low level outlet. The second purpose is to prevent a person or animal from being drawn against, and pinned, to the valve when open. It may be necessary to remove accumulated debris from the grill when the valve is closed.

Warning: Do not work in the area of the valve opening when the valve is open. The suction action is very strong, particularly when water elevations are high.

11.0 Emergency Response Equipment, Materials and Manpower

The following lists the sources of equipment, material and manpower to utilize during a dam emergency. This list is updated as necessary.

<u>Material/Equipment/ Manpower</u>	<u>Leicester Highway Department</u>	<u>R. H. White Construction</u>
Contact:	Tom Wood	John Kelly
Phone Number:	508 892-7021	508 832-3295
Manpower	Limited	Extensive
Small Backhoe	Yes	Yes
Large Tracked Backhoe	No	Yes
Front End Loader	Yes	Yes
Dump Truck	Yes	Yes
Sand	Yes	Yes
Sandbags	Yes	Yes
Rip-rap	Yes	Yes
Steel Traffic Plates	Yes	Yes
Mobile Lighting:	United Rentals 361 Southwest Cutoff, Worcester 508 756-3306	
High Volume Diesel Fueled Pumps:	Rain For Rent 9 Pioneer Drive, North Oxford 508 987-0042	
Professional Divers	Specialty Diving Services 192 Smith Street, North Kingston, RI 401 295-5256	







R.H. WHITE CONSTRUCTION CO., INC.

A Subsidiary of R.H. White Companies, Inc.

41 Central Street – P.O. Box 404
Auburn, Massachusetts 01501
t: 508.832.3295
f: 508.832.7084

www.rhwhite.com

January 30, 2009

Mr. Richard D. Johnston
Cedar Meadow Lake Watershed District
1 Maple Glen Lane
Leicester, MA 01524

Re: Emergency Response Services

Dear Mr. Johnston,

This is to confirm that R.H. White Construction Company will provide labor, materials and equipment to respond to emergency conditions that may arise at the Cedar Meadow Lake Dam. These services may include but are not limited to: repairs to low level outlet gates and operators, spillway construction, and sandbagging and placement of sand in the event of overtopping the dams.

Per the attached letter dated January 16, 2009, Cedar Meadow Lake Watershed District guarantees payment for all documented costs associated with responding to the emergency conditions.

This agreement shall be in effect for a period of one year and can be renewed annually via both parties' written consent.

To the fullest extent allowable by the law, the Cedar Meadow Lake Watershed District, and any of its affiliates and subsidiaries, shall protect, defend, indemnify and hold harmless R.H. White Construction Co. Inc. including its successors, directors, employees and agents from and against any and all claims, actions, damages, losses costs and expenses arising out of their actual or alleged acts, omissions and errors related to responding to and providing services in response to emergency conditions at the dam located on Cedar Meadow Lake in Leicester, MA.

To the fullest extent allowable by the law, R.H. White Construction Co., Inc., and any of its affiliates and subsidiaries, shall protect, defend, indemnify and hold harmless Cedar Meadow Lake Watershed District including its successors, elected officials, employees and agents from and against any and all claims, actions, damages, losses costs and expenses arising out of their

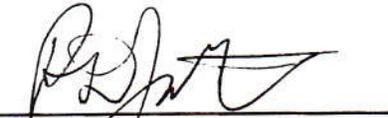
actual or alleged acts, omissions and errors related to responding to and providing services in response to emergency conditions at the dam located on Cedar Meadow Lake in Leicester, MA.

Sincerely,



Frank S. Salmon
Building Division Manager
R. H. White Construction Co., Inc.

I accept and agree to the terms and conditions described in the above Emergency Response Agreement between R. H. White Construction Co., Inc. and the Cedar Meadow Lake Watershed District.



Richard D. Johnston
District Clerk
Cedar Meadow Lake Watershed District