



The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES



Thomas S. Burack, Commissioner

Mr. Don Ware
Hanover Water Works Co
194 Lebanon Street
Hanover, NH 03755

May 29, 2009
Letter of Deficiency
DSP#09-056

RE: Upper Reservoir Dam #108.06, Hanover

**NEW STATUTORY PENALTY PROVISIONS
PLEASE READ CAREFULLY**

Dear Mr. Ware:

The Department of Environmental Services, Dam Bureau (DES) is responsible for ensuring the safety of dams in New Hampshire through its dam safety program. One of the many tools that helps us to reach this goal is our dam inspection program. In accordance with RSA 482:12 and Env-Wr 302.02, an inspection of the subject dam was conducted on October 2, 2008. Based upon the results of that inspection, as well as upon additional investigation or analysis that may have been conducted, DES is issuing this Letter of Deficiency to advise you that the following items constitute deficiencies that DES believes can be remedied in accordance with the deadlines indicated:

By October 1, 2010:

1. Engage the services of a professional engineer who is licensed in the State of New Hampshire and has dam-related experience to investigate and/or analyze the below items and submit a report to DES. The report should include all investigation findings, recommendations, and a schedule for repair to make the dam compliant with the current standards for high hazard dams.
 - a) Conduct an analysis to determine if the dam has adequate discharge capacity in accordance with Env-Wr 303.11. If the analysis indicates the dam has insufficient discharge capacity, submit a plan in accordance with Env-Wr 303.12.
 - b) Conduct a detailed dam breach analysis and produce updated inundation maps in accordance with Env-Wr 503.
 - c) Investigate the benching and erosion of the upstream slope and provide recommendations for returning the slope to its original design configuration.
2. Replace the missing embankment material on both sides of the spillway. See photographs A and B;
3. Remove the minor brush from the rip rap on the upstream slope of the dam. See photograph C;
4. Remove the brush located at the far right end of the dam on the upstream slope and for a distance of 15 feet beyond the footprint of the dam. See photograph D; and
5. Update the EAP to reflect findings of item 1 (b).

Letter of Deficiency
Dam #108.06/DSP#09-056
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Please note as a result of the above referenced inspection and subsequent file review, it is DES's opinion that the Upper Reservoir Dam meets the definition of a high hazard potential structure as defined in Env-Wr 101.09 for the reasons outlined in the attached inspection report. Should you dispute this determination please refer to Env-Wr 303.03 which outlines the procedures for appealing the hazard classification. Because of the change in hazard classification, DES will inspect this dam every year. In addition the annual dam registration fee for a high hazard dam is \$1,500 as opposed to \$750 for a significant hazard dam.

Our intent in issuing this Letter of Deficiency is to make you aware of items that require your attention to ensure the continued safe operation of your dam. It is our hope that, through the return of the attached form and correction of the identified deficiencies, you will develop and maintain a commitment to keeping a safe and well-maintained dam.

Please note that effective January 1, 2009, significant changes to the penalty provisions of New Hampshire's dam safety statute (RSA 482) became effective. These changes require DES to commence proceedings to levy fines of up to \$2,000 per violation per day against a dam owner who does not respond within 45 days of receipt of a written order, directive, or any notice of needed maintenance, repair, or reconstruction issued by DES. To avoid proceedings under this provision, you **must respond** to this Letter of Deficiency. We believe the easiest way to respond is to sign and return the attached "Intent to Complete Repairs" form, either agreeing to correct the identified deficiencies by the dates indicated OR by proposing amendments to the listed work items or dates, which you may do by writing directly on the form. DES will evaluate and respond to any reasonable requests for proposed amendments in a timely manner. We have enclosed a self addressed stamped envelope for you to return this form. You may also scan and e-mail the completed form to damsafety@des.nh.gov or fax it to (603) 271-6120. **If you fail to return this form within 45 days or fail to otherwise respond in writing within 45 days indicating your intent to remedy the identified deficiencies, you will not have the benefit of the compliance deadlines indicated on the form and DES will commence a proceeding under RSA 482:89 to seek administrative fines for the identified deficiencies.** Please note that responding as required does not preclude DES from pursuing other appropriate action for the identified deficiencies, in accordance with the DES Compliance Assurance Response Policy, available on-line at <http://des.nh.gov/organization/commissioner/legal/carp/index.htm>.

If you have any questions or comments regarding this Letter of Deficiency or would like to be present at future inspections, please contact me at 271-3406 or write to me at the address for the Water Division listed on the bottom of the previous page.

Sincerely,



Jeffrey M. Blaney, P.E.
Dam Safety Engineer

Attachments: Dam Report, DB13
cc: Gretchen Hamel, Legal Unit Administrator
Town of Hanover

Certified # 7007 2560 0001 3866 0223
JMB/was/h:/damfiles/10806/LOD/20090529 10806

	<ul style="list-style-type: none"> The crest appeared to be level, however, it is difficult to view due to its length. No embankment deformation observed above the embankment penetration for the pond drains. 	N/A N/A
Downstream slope (design 2:1)	<ul style="list-style-type: none"> Good condition, hearty grass cover, no settlement, sloughing, burrows, or damage observed. There is a stone drainage ditch with a perforated pipe located approximately 450 feet to the right of the spillway. This was installed in the 1980's to help drain the flat area located downstream from the embankment. The ditch was mowed, no flowing water observed. There is a stone ditch located approximately 20 feet to the left of the aerators. No flow was observed. 	N/A N/A N/A
Spillway (design 25' w/3.5' high, w/1.4' flashboards)	<ul style="list-style-type: none"> The concrete training walls appeared to be in fair condition with several hairline cracks, the most notable on the right wall approximately 10 feet downstream from the spillway crest. No wall displacement was observed. The spillway concrete appeared to be in fair condition, with a rough surface due to approximately 60 years of service life (1950-present). The spillway structure is cast on ledge. During the inspection there was water leaking under the stoplogs preventing detection of seepage under the spillway structure. 	N/A N/A N/A
Pond Drains (2-10" valves)	<ul style="list-style-type: none"> The drain valves were not inspected during this inspection. According to the design plans it appears that the valves are located on the downstream side of the embankment with no shut offs on the upstream side. 	N/A

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

Downstream Hazard Review:

Feature	Observation
Lower Reservoir	Upper Reservoir is located approximately 1300 feet upstream from the upstream end of the Lower Reservoir impoundment. Lower Reservoir Dam is located approximately 3400 feet downstream from Upper Reservoir Dam.
Reservoir Road	Reservoir Road parallels the discharge channel for approximately 1.24 miles until it intersects with Storrs Pond Road. Inspect intersection to estimate if flow will split into two reaches or all stay in same reach which flows to Storrs Pond. Culvert size and description to be verified at next inspection.
Storrs Pond Road	Located approximately 1.5 miles downstream. Culvert size and description to be verified at next inspection.
Storrs Pond Recreation Area	Located approximately 1.5 miles downstream. Verify structures at next inspection. According to aerial photo's area contains tennis courts, swimming, pool and buildings.
Storrs Pond Dam, #108.07	Located approximately 2.1 miles downstream. Significant hazard structure.
Route 10	Located approximately 2.3 miles downstream. Verify structures at next inspection.

Hazard Classification/Justification, Dam Breach Analysis: Significant-Recommend increase to

High

Date of last breach analysis	N/A-waived in 1992
Requires updated analysis	Yes, if yes, explain below

In a letter dated October 29, 1992, DES granted a request for exemption from the requirement to conduct a breach analysis and associated inundation mapping on the condition that the EAP's cover the entire area from the subject dam to the Connecticut River. At that time it was agreed that there were no habitable structures in the downstream reach. Since then, the administrative rules, specifically the definition of a high hazard dam, Env-Wr 101.09 has been re-written to include damage to structures which are occupied under normal conditions as well as any other circumstance which would more likely than not cause one or more deaths.

Previous reports have mentioned the presence of a recreational camping area located in the downstream reach just upstream of Storrs Pond. During this inspection the recreation area was not visited, however, after reviewing aerial photographs it is evident that the area is still an active recreation area and includes tennis courts, swimming pools, and assorted buildings which are likely occupied under normal conditions and their presence may result in the loss of one or more lives should the upstream dams fail.

Based on the above reasoning, it appears that the dam meets the definition of a high hazard potential structure. DES should notify the dam owner of the change in classification and inform them of Env-Wr 303.03 which outlines the procedures for appealing the classification should the owner disagree with DES's determination.

Should the dam remain as a significant hazard potential structure, a dam breach analysis should be conducted to estimate the depth and timing of flooding in this area as well as the depth and duration of overtopping of Route 10.

Below is a summary of the hazard classification from previous inspection reports.

The peak flow from a breach of Upper Reservoir Dam was estimated using the ACOE Rule of Thumb method and a formula derived from Boss International, Dambrk software program. The peak breach was estimated to be 16,760 cfs and 18,480 cfs respectfully without the addition of the design storm flow, which in comparison is minor. The breach flow would enter a short reach to Lower Reservoir Dam, which would likely be overtopped by more than 3 feet and is assumed will subsequently fail. There are no habitable structures between Upper and Lower Reservoirs and the only property damage between the reservoirs would be the annihilation of the access road to Upper Reservoir. Further downstream of the Lower Reservoir is a seasonal camp ground in the upstream reaches of Storrs Pond, which would likely be flooded. Storrs Pond is supported by a 34-foot high dam, which would likely be overtopped by several feet and would likely fail before the peak breach height is reached. Finally the breach flow would cross New Hampshire route 10 causing significant damage before being attenuated within the Connecticut River.

Hydrologic/Hydraulic Analysis:

Required Discharge Capacity Env-Wr 303.11 or 403.04	100year, increase to 2.5x100 year
Date of last analysis	October 2000
Meets current discharge requirement with required freeboard	Yes for significant, unknown for high
Requires updated analysis	Yes

The analysis will need to be updated if the hazard classification is upgraded as recommended above.

The h/h was not reviewed as part of this inspection. According to previous analysis the dam can pass the 100 year event with a minimum of 1 foot of freeboard. Below is a narrative from previous inspection reports.

The 100-year storm event was calculated using the software HydroCAD and the TR-20 method. The 0.96

square mile drainage area was divided into 2 sub-basins. The Upper Reservoir Dam (#108.06) flows into the Lower Reservoir Dam (#108.05) to provide drinking water to the Town of Hanover.

The model predicted an inflow of 589 cfs during the 100-year design storm event. This flow routed to 120 cfs through the spillway with 1.0 foot of freeboard on the dam. The dam can pass 286 cfs to the top of the dam. With failure of the flashboards, the dam can pass 550 cfs. With one foot of freeboard remaining, the dam is capable of passing 120 cfs unoperated.

Operations, Maintenance, and Response Form:

Plan on file, updated, and meets current requirements	Yes
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Emergency Action Plan:

EAP on file, up to date, meets current requirements	No if no, explain below
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The EAP was updated in January of 2009 and is in compliance with the current EAP template outlined in the administrative rules. As noted above, a detailed breach analysis has not been conducted, as such the depth and timing of flooding is not included on the inundation maps. A detailed breach analysis should be conducted and inundation maps updated.

Access and Security:

This dam is part of a water supply system and is completely surrounded by chain link fence. The fence prevents unauthorized access to the dam and watershed property. At the time of inspection the fence and gates were in good condition.

Directions:

- From Concord take Route 89 north to exit 18 which is route 120.
- Take route 120 north approximately 4.7 miles and take a right onto East Wheelock street.
- Travel approximately 2.6 miles to a locked gate on left side of road.
- Dam is approximately 0.35 miles behind gate.

Miscellaneous:

n/a

Recommendations: LOD

I recommend issuing an LOD to the dam owner requesting the following items be addressed by the dates indicated. In addition the below paragraph should be added to the LOD template language.

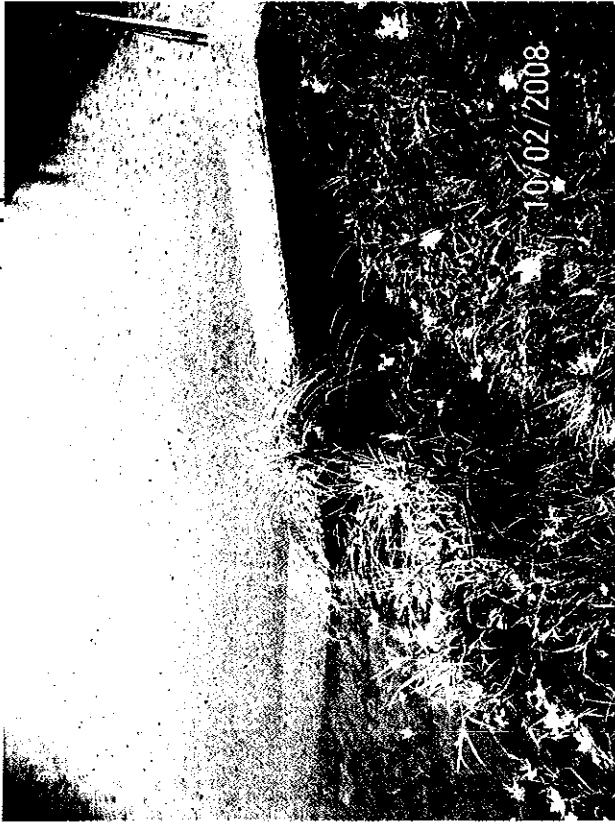
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By October 1, 2010

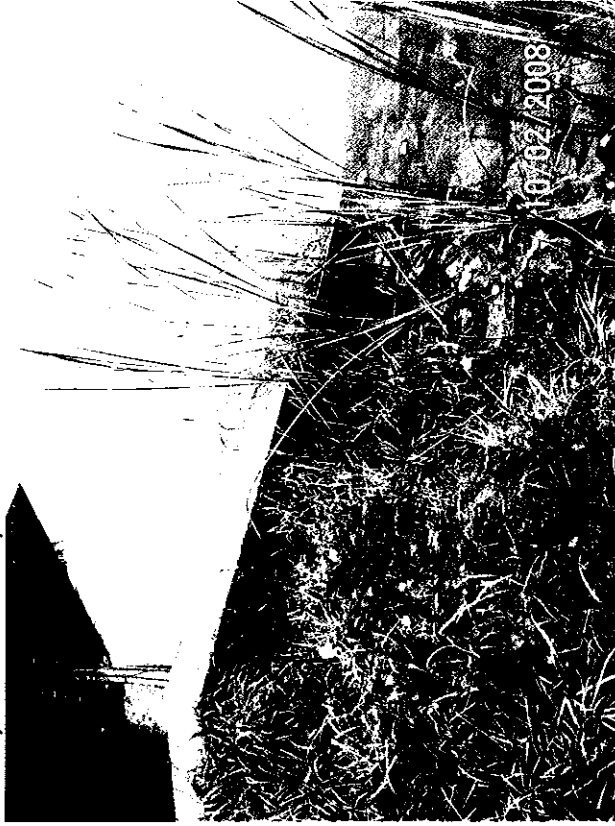
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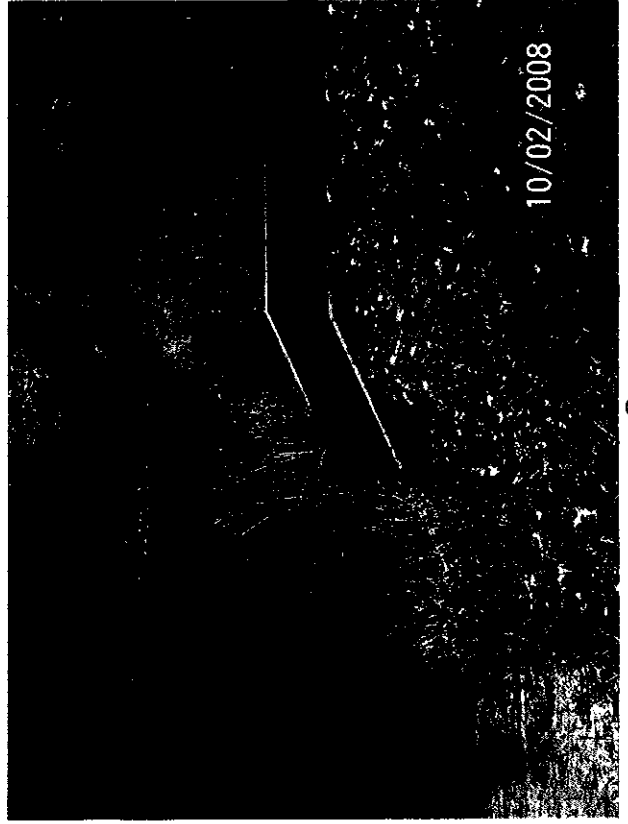
108.06, Upper Reservoir Dam, Hanover, October 2, 2008



A



B

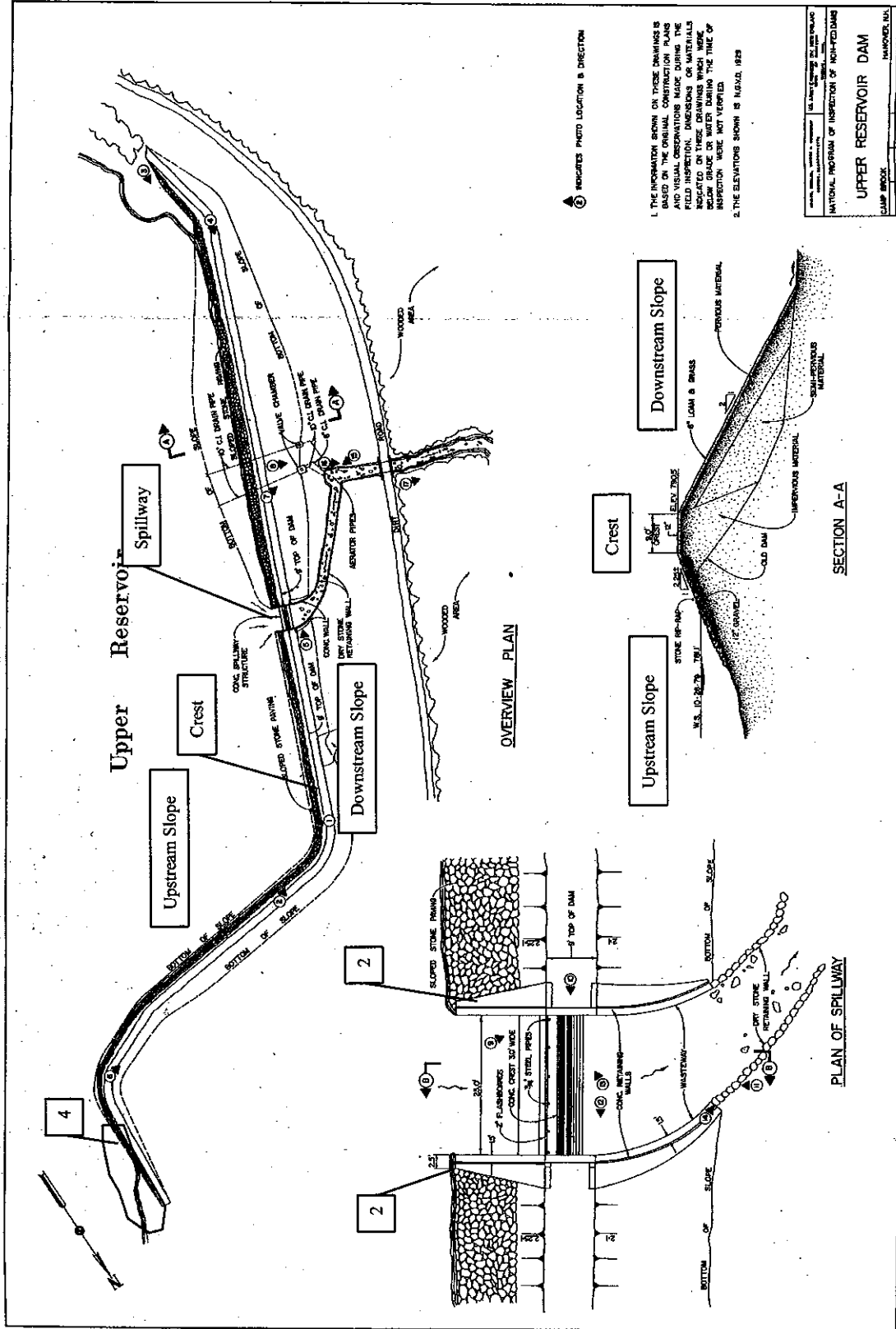


C



D

108.06 Upper Reservoir Dam, Hanover, October 2, 2008



④ INDICATES PHOTO LOCATION & DIRECTION

1. THE INFORMATION SHOWN ON THESE DRAWINGS IS BASED ON THE ORIGINAL CONSTRUCTION PLANS AND VISUAL OBSERVATIONS MADE DURING THE INSPECTION. VISUAL OBSERVATIONS WERE MADE FROM THE DAM AND FROM ELEVATORS WHICH WERE POSITIONED BELOW GRADE OR WATER DURING THE TIME OF INSPECTION. VISUAL OBSERVATIONS WERE NOT VERIFIED.
 2. THE ELEVATIONS SHOWN IS NAVD 83.

PROJECT NO.	108.06
DATE	10/2/08
BY	W. J. HANCOCK
CHECKED BY	W. J. HANCOCK
APPROVED BY	W. J. HANCOCK
NATIONAL PROGRAM OF INSPECTION OF NON-FEDERAL DAMS	
UPPER RESERVOIR DAM	
CLAMP BROOK	
HANOVER, NH	

Figure 1 of 2