



The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES



Thomas S. Burack, Commissioner

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

May 29, 2009
Letter of Deficiency
DSP#09-055

RE: Lower Reservoir Dam #108.05, 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 cracked and displaced left concrete spillway training wall, and all other portions of the spillway, and provide recommendations for its repair or replacement. See photographs C, D, E, F, and G.
 - d) Investigate the benching and erosion of the upstream slope and provide recommendations for returning the slope to its original design configuration. See photograph A.
2. During the inspection it was documented that the embankment crest was 8 inches lower than the spillway training walls. Survey the entire crest of the dam and return it to its original elevation and re-establish a hearty grass cover after re-grading. See photograph B;
3. Repair the missing concrete located on the left upstream training wall approximately 7 ½ feet from the left end of the wall. See photograph E;
4. Investigate and report on the operability of the 16 inch pond drain; and

5. Update the EAP to reflect findings of item 1 (b).

Please note as a result of the above referenced inspection and subsequent file review, it is DES's opinion that the Lower 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/10805/LOD/20090529 10805

	<p>displacement observed.</p> <ul style="list-style-type: none"> • The upstream right training wall at the contact of the new concrete to the old concrete has an opening of 0.7 inches. The movement of this wall has been documented in several past inspection reports. The downstream portion of this wall has been patched, the patch failed with rebar exposed. A complete failure of this wall would likely not lead to a catastrophic failure of the dam at this location. • The spillway crest was in fair condition. No cracks observed. Flashboards were not installed at the time of inspection. • Downstream apron was in fair condition. The surface was slightly weathered with a few minor spalls and minor erosion at the contact with the left and right training walls. • There was missing concrete on the upstream left training wall located 7 ½ feet from the left end of the wall. The missing concrete is approximately 2 inches wide by 8 inches tall and located between two vertical cracks that extend through the thickness of the wall. No displacement of this wall was noted. • There is a crack and wall displacement of the left training wall, at the change in wall alignment which is located approximately 10 feet downstream from the spillway crest or 12 feet upstream from the center line of the dam. The displacement is approximately ¼ inch as measured just below the chamfer at the top of the wall. Minor cracking of the wall has been noted in previous inspection reports, however wall displacement has not. • There are multiple hairline cracks with efflorescence showing along the entire length of the left training wall. 	<p>M</p> <p>N/A</p> <p>N/A</p> <p>M</p> <p>M</p> <p>N/A</p>
Gate house	<ul style="list-style-type: none"> • The interior of the gate house was not viewed during this inspection. • The gate house was secure and locked. • The exterior of the gatehouse appeared to be in fair condition with minor erosion of the concrete below the normal water line. • The condition of the 16 inch pond drain is not known. Its outfall location is not known. 	<p>N/A</p> <p>N/A</p> <p>N/A</p> <p>M</p>

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

Downstream Hazard Review:

Feature	Observation
Reservoir Road	Reservoir Road parallels the discharge channel for approximately 0.6 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 0.85 miles downstream. Culvert size and description to be verified at next inspection.
Storrs Pond Recreation Area	Located approximately 0.9 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 1.5 miles downstream. Significant hazard structure.
Route 10	Located approximately 1.7 miles downstream. Verify structures at next

	inspection.
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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.

A breach analysis, using the ACOE Rule of Thumb method, was performed by the ACOE in 1979. According to their analysis, with the breach of the Upper Reservoir, the expected surge wave would overtop the Lower Reservoir dam by 0.1 feet with a flow of 780 cfs. A breach analysis was performed on the Lower Reservoir dam with the resulting surge wave channel routed to Storrs Pond by the ACOE. Results of this analysis estimated that the Storrs Pond dam would be overtopped.

Based on the results of the ACOE 1979 report, a failure of the dam would likely sever the same unpaved town road at 4 different locations before the breach flow enters Storrs Pond. The dam at the outlet of Storrs Pond, which is also a class B structure, may also be overtopped. Downstream of Storrs Pond, the flow crosses under NH route 10 before entering 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	Y if yes, explain below

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

The h/h was not reviewed as part of this inspection. According to a previous analysis the dam can

pass the 100 year event with a minimum of 1 foot of freeboard. Below is a description of the analysis from a previous report.

The 100-year storm event was calculated using the software HydroCAD and the TR-20 method. The 1.86 square mile drainage area was divided into 4 sub-basins with one pond upstream. 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 900 cfs during the 100-year design storm event. This flow routed to 95 cfs through the spillway with 1.1 feet of freeboard on the dam. The dam can pass 325 cfs to the top of the dam. With failure of the flashboards, the dam can pass 700 cfs. With one foot of freeboard remaining, the dam is capable of passing 115 cfs unoperated.

Past studies has listed the 100- year storm inflow to be approximately 624 cfs derived from the average of the Kinnison-Colby method, the USGS method and the 100 -year inflow at Mink Brook. The routed outflow was estimated as 284 cfs.

Operations, Maintenance, and Response Form:

Plan on file, updated, and meets current requirements	Yes if no, explain below
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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. The gate house is kept locked preventing unauthorized operation of the gate valves.

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 1.4 miles and fork left on to Grasse Road.
- Dam is approximately 0.7 miles ahead.

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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- d) Investigate the benching and erosion of the upstream slope and provide recommendations for returning the slope to its original design configuration. See photograph A

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3. Repair the missing concrete located on the left upstream training wall approximately 7 ½ feet from the left end of the wall. See photograph E.

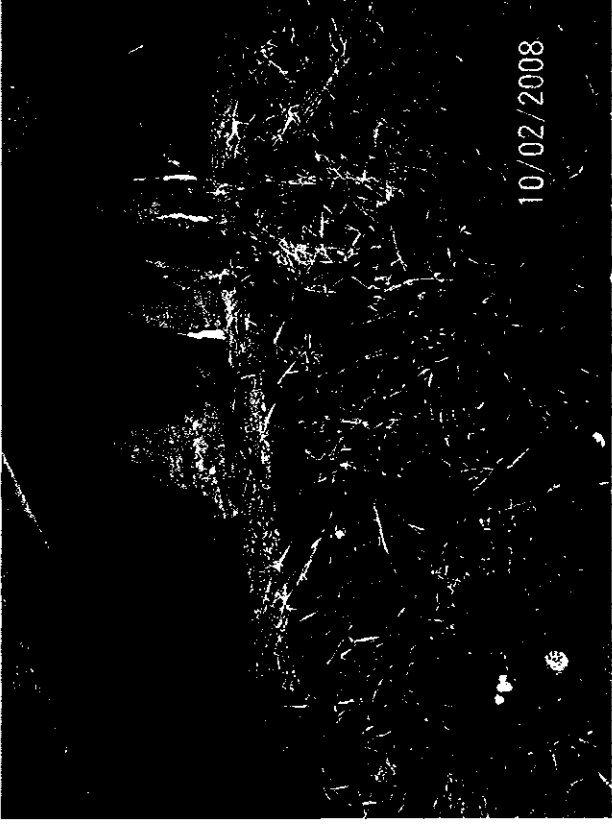
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5. Update the EAP to reflect findings of item 1 (b).

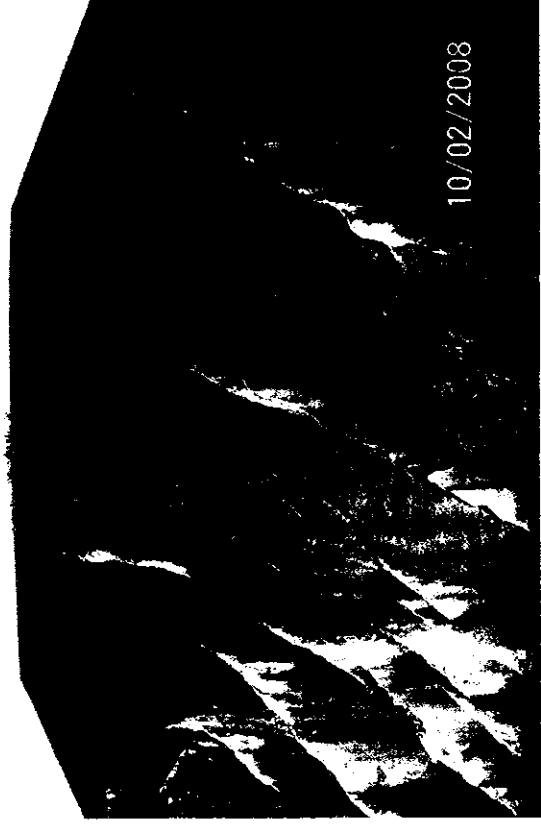
108.05, Lower Reservoir Dam, Hanover, October 2, 2008



A



B



C



D

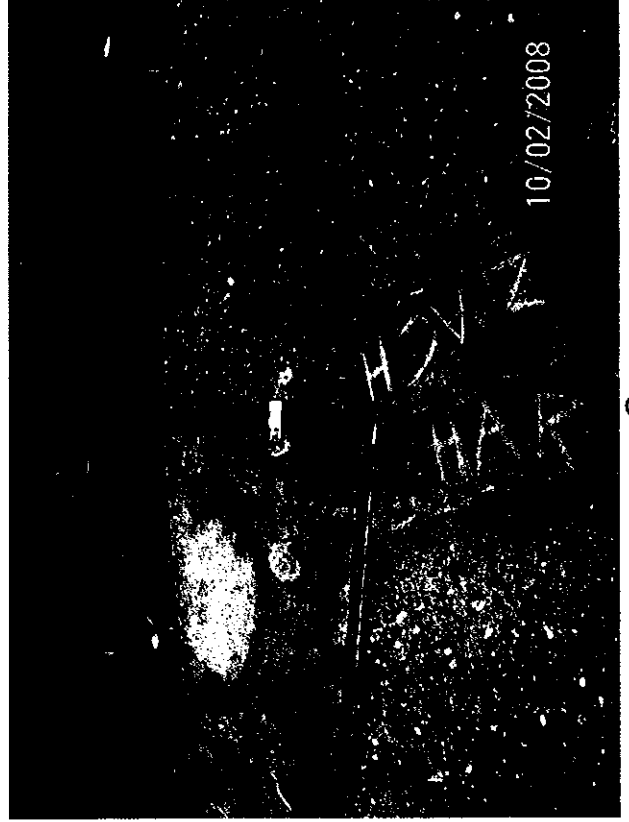
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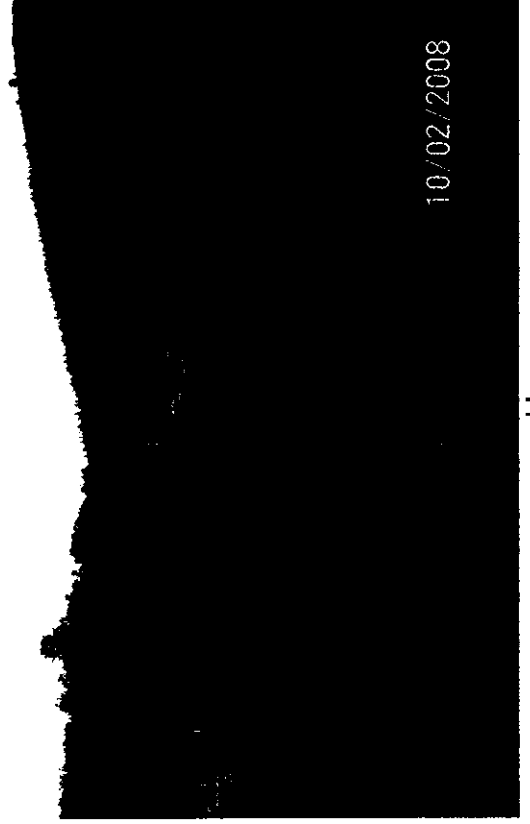
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F



G



H

108.05, Lower Reservoir Dam, Hanover

