

March 8, 2010
W-P Project No. 12018A

DRAFT

Mr. Ed Wojnowski, Town Administrator
Town of Newmarket
186 Main Street
Newmarket, New Hampshire 03857

Subject: Macallen Dam - Preliminary Report
Structural Analysis and Recommendations

Dear Mr. Wojnowski:

The purpose of this letter report is to summarize the results of the visual inspection conducted on the Macallen Dam in November of 2009 and to offer recommendations with respect to repairs/rehabilitation to maintain the dam for the near term future. The inspection is part of Wright-Pierce's overall assessment of the dam, which includes hydraulic and breach analyses, drafting of an Emergency Action Plan and preparation of a permit application to increase the discharge capacity of the dam. The facility, which is identified as #177.01 by the State, is classified as a "significant" hazard.

Those attending the inspection effort on November 5, 2009, included the following: David Skidgel and Jennifer Mates (Wright-Pierce), Rick Malasky (Town of Newmarket Public Works Director), Julie Glover (Newmarket Project Coordinator), Steve Doyon and Chuck Corliss (State of New Hampshire DES Dam Bureau), several individuals from the New Hampshire Fish & Game Department and yourself. Prior to the inspection, the Town had lowered the water level on the upstream side of the dam by about 6 feet from the dam spillway crest in order to expose the top portion of the dam. It is our understanding that previous inspections of the dam had been performed by the DES, the latest on November 7, 2007. This inspection resulted in a Letter of Deficiency to the Town dated May 5, 2008.

SUMMARY OF THE FACILITIES

The dam is a concrete and stone gravity type dam with a 68 foot long spillway (Figure 1). Previous inspection reports indicate that the height of the dam is approximately 27 feet although we were unable to confirm this dimension due to high water at the toe of the dam. (Photo 1) Engravings on the dam and gate structure indicate that the dam was constructed in 1887 (Photo 2) and the gate structure in 1925 (Photo 3). It is our understanding that the fish ladder was constructed sometime in the 1970's. The downstream face of the dam consists of stacked stone blocks and the top four feet (vertically) of the sloped upstream portion of the dam appears to have been faced with stone. The spillway consists of a 3 feet wide by 1 foot deep concrete cap. A corroded 15 inch wide steel channel section is bolted across the full width of the spillway crest (Photo 4). Plan views of the dam and affiliated structures are included in Appendix A. Photographs taken in July 2008 and November of 2009 are included in Appendix B. The Letter of Deficiency is included in Appendix C.



The east side of the spillway is bounded by a concrete gate structure which is used to control the discharge water through the dam. This structure consists of three concrete channels, each equipped with wood gates operated with hydraulic rack and pinion risers (Photos 5 & 6). The west side of the spillway is bounded by a concrete fish passageway, which is owned and operated by the New Hampshire Fish & Game Department (Photos 7 & 8).

PHYSICAL CONDITIONS OF THE DAM

Following is a summary of each of the dam components. Please note that portions of the dam surfaces were not observable due to the presence of debris and the fact that portions of the upstream dam surfaces were located below the water level.

Dam Structure

Downstream face

Based on limited views from the fish passageway structure, the stone blocks appear to be in good condition with no visible signs of distress. The wall consists of large and medium sized blocks with smaller blocks filling in the gaps (Photo 9). Water streaks were visible on block surfaces in four locations, but there was no visual indication of water leaking through the voids between the stone blocks. The leaks appeared about six feet below the top of the wall. It did not appear that there was mortar in the joints. There was vegetation in several of the joints near the top of the wall. There was a small pipe near the bottom of the exposed portion of the wall on the west side. This may have served as a drain in the past.

Upstream Face

The spillway and exposed upstream (sloped) face were covered with thick layers of vegetation and mud so it was difficult to assess the condition of the dam structure. (Photo 11) It appeared the top four vertical feet of the face were faced with stone. We observed what appeared to be very deteriorated concrete with exposed aggregate just below the point where the stone terminated. The spillway consists of a 3 feet wide by 1 foot deep concrete cap. A severely corroded 15 inch steel channel section is bolted across the full width of the spillway crest. It is not apparent if this channel was used for attachment of flash boards or if it simply increases the storage capacity by several inches. It is our understanding that during normal hydraulic operation this channel section serves as the main spillway crest.

Gate Structure

The gate structure consists of three reinforced concrete channels with a concrete operation platform above them (Photo 12). The inverts of the channels are about 8 feet below the crest of the dam. We were not able to observe the surface of the channel slab from a close proximity due to flows (Photo 13). It is likely that there would be deterioration of the concrete due to the age of the structure and erosion. The east side of the structure is built into the east side retaining wall (Photo 14) and the west side is built into a stacked stone wall abutting the spillway (Photo 15). The west side stone wall is ungrouted with vegetation growing through some of the joints. The structure appeared to be in fair condition with the following deficiencies noted:



1. The upstream surfaces of the concrete channels at and below the normal water level (especially the rounded edges of the channel walls) are in poor condition exhibiting severe exposure of the aggregate. (Photo 16 & 17)
2. The surfaces of the slab supporting the west side stone wall are in poor condition exhibiting severe exposure of the aggregate. It appears that this slab was cast monolithically with the upstream face of the dam. (Photo 15)
3. There is a hole in the southeast concrete channel wall where it frames into the stone retaining wall. It was not possible to observe this hole from a close view, but it is our understanding that the hole extends fairly deep into the retaining wall.
4. There are cracks and spalls in the southwest concrete channel wall that abuts the spillway. (Photo 15)
5. There are several spalls in the edge of the concrete platform slab. (Photo 13)
6. The west platform steel fence is very loose. (Photo 12)
7. There are gaps in the west side stone wall where smaller stones were washed out during the May 2006 flood.
8. Thin layers of concrete are peeling off the south face of the structure where the construction date is etched. (Photo 3)
9. Water was observed leaking through the edge seals of the stop log gates when the gates were closed.

Retaining Walls

Upstream (East Wall)

The upstream retaining wall on the east side of the river (Photo 18) is comprised of stacked stone blocks, which also serve as a foundation for the adjacent abandoned Mill Building (Photo 19). It is our understanding that the current Owner of the building has secured permits to convert the building into condominiums. The wall consists of large and medium sizes blocks with smaller blocks filling in the gaps. The wall appears to be partially grouted and in fair condition. There is vegetation growing through some of the joints. There is an impoundment area below the building first floor bounded by the stone wall foundation and brick arch. At one time the impoundment fed the old penstock that ran below the building and current parking lot and discharged to the south of the dam. The penstock has been discontinued and most of it removed. There is still some remaining rubble from the demolition within the impoundment area below the Building.

It is our understanding that sink holes have formed in the parking lot on the other side of the wall which may be an indication that water is getting behind the retaining wall either through the stone wall or through the old penstock cavity. (Photo 20)

There is a brick pier structure at the northeast corner of the gate structure with a large portion of the bricks either damaged or missing. It is our understanding that this damage was caused by the flood in May 2006. It is not apparent what function the brick pier serves. (Photo 14)

Upstream (West Wall)



The upstream retaining wall on the west side and immediately north of the dam is comprised of stacked stone blocks with a concrete overlay wall (Photo 11). The retaining wall frames into the concrete fish passage inlet structure which bounds the west end of the spillway. There is a small impoundment area to the north of the retaining wall that is bound by a stacked stone and concrete retaining wall (running east-west) and the Route 108 stacked stone and concrete retaining wall (running north-south). (Photo 21)

The concrete overlay wall appears to be about 12 inches thick and only partially covers the stone wall. The wall forms from a wall cap at the top and terminates unevenly between 3 and 5 feet above the drawn down water line (Photo 22). The stone wall is visible behind the concrete wall where it terminates. The bottom of the wall is submerged at the normal water level (Photo 23). All of the walls appear to be in fair condition. Spalls are present in the concrete at the north end of the wall where the concrete was placed around several stone blocks. There is some remaining wood cribbing in front of the wall (Photo 24). In addition, there was an exposed pile of riprap and debris in front of this wall that is submerged at the normal water level (Photo 25). There is a corroded pipe near the bottom of the exposed wall running in the east-west direction. It is not apparent what function the pipe serves.

The concrete fish passage structure appears to be in fair condition. The base slab of the structure was exposed during the drawdown and revealed that the structure overhangs a larger base slab by several feet. It is not clear when the base slab was constructed and what specific purpose it serves (it has a curved edge and doesn't line up evenly with any other structure). (Photo 26)

Downstream (East Wall)

The downstream retaining wall on the east side of the dam is comprised of stacked stone blocks. It appears that a portion of the wall just north of the gate structure to the pedestrian bridge was built on a ledge outcrop (Photo 27). The wall appears to be partially grouted and in fair condition. There is vegetation growing through some of the joints. There is a drain pipe discharging about 5 feet from the top of the wall approximately 10 feet downstream from the gate structure. This may have served as a drain in the past.

Downstream (West Wall)

The downstream retaining wall on the west side of the dam is comprised of the concrete fish passage structure and the stacked stone foundation wall for the adjacent building (Photo 7). The fish passage structure appears to be in fair condition. There appears to be some cracks in the wall that have been repaired in the past and still show signs of efflorescence stains, which usually indicates past leakage through the crack. The stacked stone wall appears to be partially grouted and in fair condition. There is vegetation growing through some of the joints.

RECOMMENDED REPAIRS / REHABILITATION MEASURES

Following is a summary of recommended repairs of the dam components. Please note that all repairs are considered long term repairs and should be undertaken within the next two years. It should be noted that a structural or stability analysis was not performed for the dam.

Dam Structure



I. Downstream face

- A. Due to the river and tidal conditions at the dam, a full inspection is only possible with the assistance of professional divers. No repairs to the downstream face of the dam are required at this time.
- B. While it was not possible for us to conduct an assessment of the area below the water level (i.e. more than 6-8 feet below the dam crest) the nature of the structure (stone masonry) suggests that the limited seepage that is evident at the downstream face of the dam does not constitute a problem of any significance from a safety perspective.

II. Upstream Face

Following are recommended repairs to the upstream face of the dam:

- A. The water should be drawn down as much as possible to expose as much of the dam face as possible. The dam should be cleaned with high pressure water. The need for additional repairs is often identified once the dam faces are completely exposed and inspected. We typically handle these construction costs by having the contractor provide unit prices for each type of repair anticipated for this type of dam. This eliminates the need to negotiate costs during construction.
- B. Replace the steel channel across the top of the spillway (it may be desirable to use a hot dipped galvanized steel channel for greater longevity).

III. Gate Structure

Following are recommended repairs to the gate structure:

- A. Resurface the upstream surfaces of the concrete channels at and below the normal water level with a cementitious overlay. The upstream noses of the channel should be lined with stainless steel wear plates. (Photo 16)
- B. Fill the hole in the southeast concrete channel wall where it frames into the stone retaining wall with reinforced concrete. Reinforcing steel dowels should be drilled into the existing concrete and adhered with epoxy resin. (Photo 12)
- C. The cracks in the southwest concrete channel wall that abuts the spillway should be filled with an epoxy resin. The spalls in the wall should be repaired with a structural concrete patching material. Larger areas of spalling can be addressed by removing portions and replacing them with new reinforced concrete. (Photo 15)
- D. The spalls in the edge of the concrete platform slab should be repaired with a structural concrete patching material. (Photo 13)
- E. The west platform steel guard posts should be stabilized by installing epoxy grout in the embedded post sleeves in the concrete. (Photo 12)
- F. The gaps in the west side stone wall should be filled with stone or grout.
- G. The thin layers of concrete that are peeling off the south face of the structure where the construction date is etched do not present a serious structural problem at this time. Thus, no repairs are required at this time. (Photo 15)



- H. At such time as the water leaking through the gates presents a problem to the Town, the wooden gates should be replaced.
- I. Any vegetation should be fully removed.

Retaining Walls

IV. Upstream (East Wall)

Following are recommended repairs to the upstream east retaining walls:

- A. Repair the damaged brick pier by filling the gap with grout or mortared bricks. (Photo 14)
- B. Settlement of the parking lot should be monitored in the future. If sink holes continue to form, it is most likely a sign that water is getting in the subgrade either through the retaining wall or through the old penstock cavity below the Mill Building. (Photo 20)
- C. The Town should maintain dialogue with the Building Owner and coordinate how repairs to the Dam and/or Building will affect the other.

V. Upstream (West Wall)

Following are recommended repairs to the upstream west retaining wall:

- A. The spalling concrete at the north end of the wall where the concrete was placed around several stone blocks should be removed and repaired with a structural concrete patching material. (Photos 22 & 24)
- B. The existing construction drawings for the concrete fish passage structure should be reviewed by a Structural Engineer to confirm that the structure is adequate to cantilever over the slab. (Photo 28)
- C. The concrete overlay wall does not appear to be distressed. However, this wall should be monitored for future movement or cracking.

VI. Downstream (East Wall)

No repairs to the downstream east retaining wall are required at this time.

VII. Downstream (West Wall)

No repairs to the downstream west retaining wall are required at this time.

We appreciate this opportunity to assist the Town of Newmarket within this capacity. We look forward to meeting with you at your convenience to review this draft report and discuss our recommendations with you. After you have reviewed this preliminary report, we will prepare a cost estimate to address the structural deficiencies discussed above. As you are aware, we are also working on the Emergency Action Plan as required by NHDES and anticipate sending you a draft of that document by the end of this week. In the interim, please feel free to contact us at 430-3728 with any questions or comments you may have.

Very truly yours,

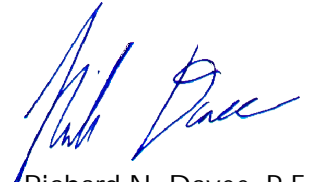
To: Mr. Wojnowski
Date: March 8, 2010
Page 7 of 7



WRIGHT-PIERCE



Jennifer S. Mates, P.E.
Project Manager



Richard N. Davee, P.E.
Vice President

JSM/RND/als

Attachments

cc: Julie Glover, Newmarket Project Coordinator (w/attachments)
Rick Malasky, Newmarket Director of Public Work (w/attachments)

Appendix A

Source:
All base mapping data obtained from the Maine Office of GIS.
Map developed by Wright-Pierce GIS Dept.

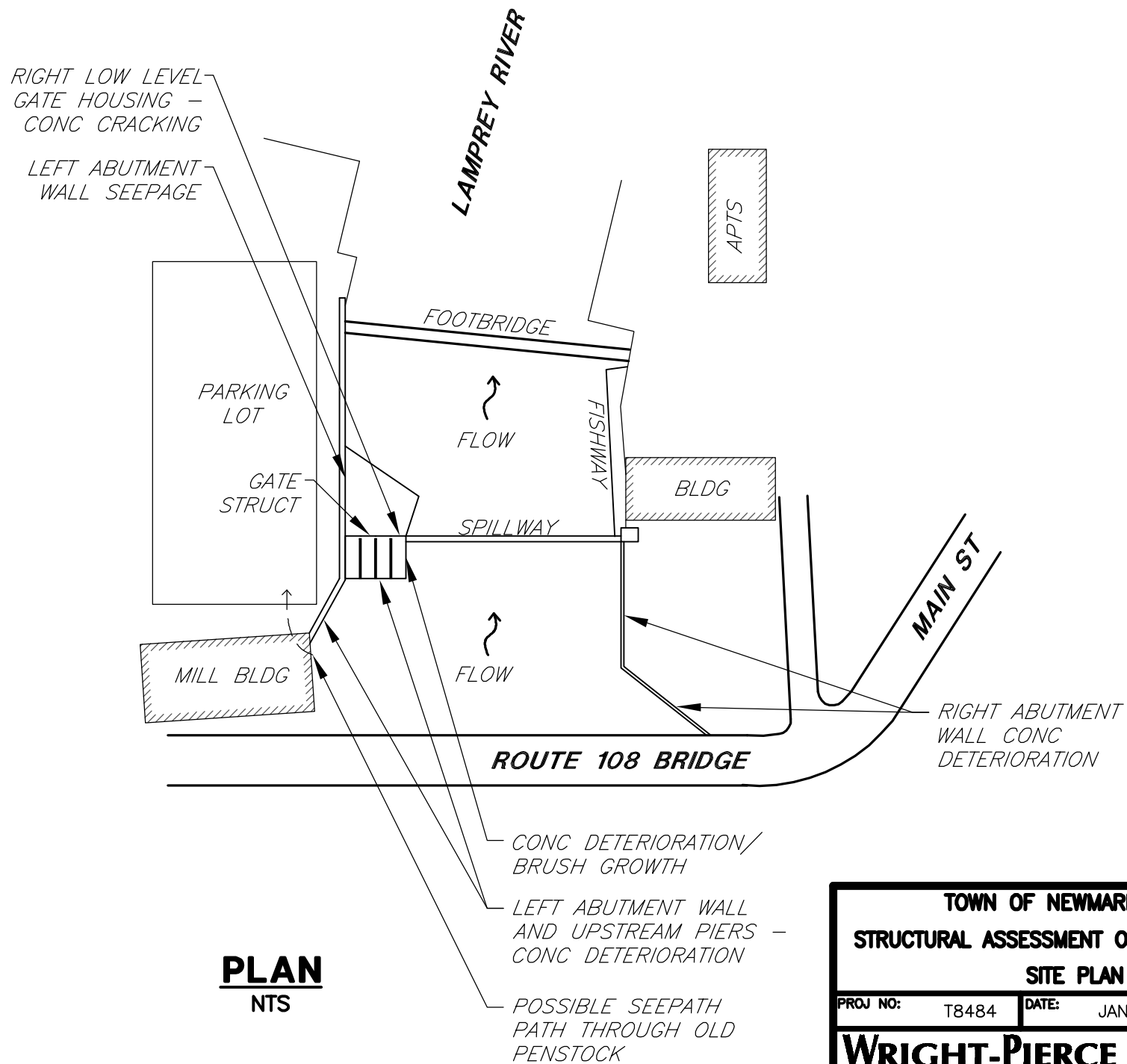


Newmarket, New Hampshire
Structural Assessment of
MaCallen Dam
Project Location

PROJ NO: 12018A | DATE: Mar 2010 | **FIGURE:**



W:\GIS_Development\Projects\12018_NH_Newmarket\PhaseA\Figures\Aerial_LocationMap_11x17.mxd



PLAN
NTS

TOWN OF NEWMARKET, NH		
STRUCTURAL ASSESSMENT OF MACALLEN DAM		
SITE PLAN		
PROJ NO:	T8484	DATE: JAN 2010
WRIGHT-PIERCE 		FIGURE: 1
Engineering a Better Environment		

Appendix B

Newmarket, NH
Macallen Dam Inspection
Project #12018A



Photo 1



Photo 2

**Newmarket, NH
Macallen Dam Inspection
Project #12018A**

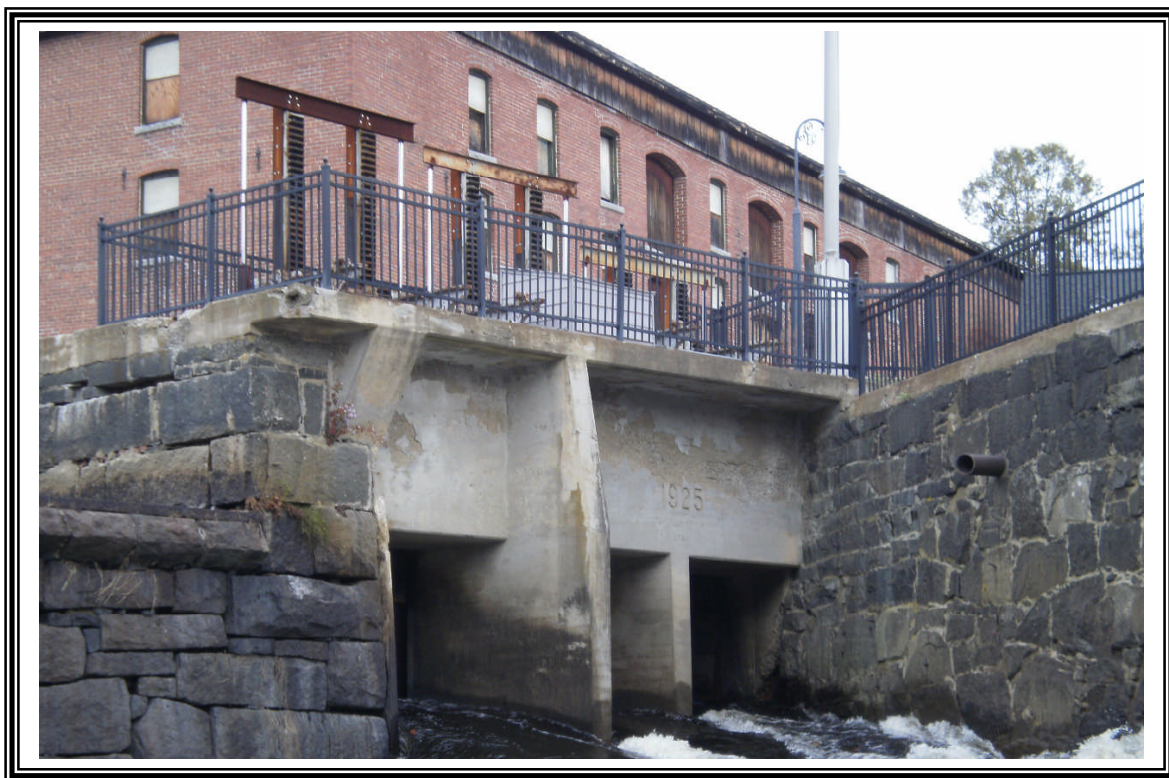


Photo 3



Photo 4

**Newmarket, NH
Macallen Dam Inspection
Project #12018A**



Photo 5



Photo 6

**Newmarket, NH
Macallen Dam Inspection
Project #12018A**



Photo 7



Photo 8

**Newmarket, NH
Macallen Dam Inspection
Project #12018A**



Photo 10

**Newmarket, NH
Macallen Dam Inspection
Project #12018A**



Photo 11



Photo 12

**Newmarket, NH
Macallen Dam Inspection
Project #12018A**



Photo 13



Photo 14

**Newmarket, NH
Macallen Dam Inspection
Project #12018A**



Photo 15



Photo 16

**Newmarket, NH
Macallen Dam Inspection
Project #12018A**



Photo 17



Photo 18

**Newmarket, NH
Macallen Dam Inspection
Project #12018A**



Photo 19



Photo 20

**Newmarket, NH
Macallen Dam Inspection
Project #12018A**



Photo 21



Photo 22

**Newmarket, NH
Macallen Dam Inspection
Project #12018A**



Photo 23



Photo 24

**Newmarket, NH
Macallen Dam Inspection
Project #12018A**



Photo 25



Photo 26

**Newmarket, NH
Macallen Dam Inspection
Project #12018A**



Photo 27



Photo 28

Appendix C



The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES



Thomas S. Burack, Commissioner

Department of Environmental Services
State Dam Safety Program
Water Division, Dam Bureau
29 Hazen Drive, P.O. Box 95
Concord, NH 03302-0095

Intent to Complete Repairs
DAM#177.01/DSP#08-023
DAM Macallen Dam

RE: Letter of Deficiency: Issued on May 5, 2008

Dear Dam Safety Program:

In response to the above referenced Letter of Deficiency (LOD), I concur with the Department of Environmental Service's recommendations, and specifically agree to complete the following items by the indicated schedule.

DATE: June 1, 2008

1. Submit an OMR form to DES for review;

DATE: November 1, 2008

2. Update, reformat, develop an inundation map and test the EAP;
3. Repair the deteriorated concrete noted in the following locations. Some of these areas were noted in the 2004 LOD. Refer to sketch and photos;
 - a. Upstream face of the concrete piers of the gate structure, at waters edge.
 - b. Right low level gate- housing wall and left spillway training wall
 - c. Upstream right abutment wall
 - d. Left upstream spillway training wall
 - e. Left upstream abutment wall
 - f. Right abutment wall
 - g. Gate structure and left spillway training wall
4. Remove the brush growing from the stonework in the left abutment;
5. Investigate and repair, if necessary, leakage from left abutment wall, d/s of gate, Photo 8 – 9; and
6. Submit a permit application with appropriate plans and specifications to increase the discharge capacity of the dam to safely pass the design flow (2.5 Q100 or IDF) with one foot of freeboard and no operations.

Please notify this office during a period of low river flow so that a follow-up inspection can be conducted to thoroughly inspect the spillway, fish ladder, and downstream face of the dam. Possibly a drawdown could be scheduled to facilitate this inspection.

Operation, Maintenance and Response Information

For information or questions, please contact the dam owner using the information below or the
NH Dept. of Environmental Services at (603) 271-3406.

1. Dam and Owner/Operator Information

Dam Name: MACALLEN DAMCity/Town: NEWMARKETNH Dam Inv # & Hazard Classification: 177.01, SDownstream Watercourse: LAMPREY RIVER

Dam Owner

Name: TOWN OF NEWMARKET

Address _____

City/Town/Zip _____

Telephone _____ Cell _____

E-mail _____

Emergency Contact (Dam incidents or flooding)

Name _____

Address _____

City/Town/Zip _____

Telephone _____ Cell _____

E-mail _____

2. Dam Information

Height(ft): 27 Length(ft): 150Pond Size(ac): 120Normal Storage Capacity(ac-ft): 480Drainage Area(sq mi): 211

Outlet Works – Describe the dam's discharge features, and then include specific information on each below (sizes, dimensions, inverts, etc...). _____

Spillway(s) _____ Other _____

Gate(s) _____ Other _____

Stoplog Bay(s) _____ Other _____

Description of the Area Downstream of the Dam (Include information on such things as roadways, dams, bridges or property that may be in danger of flooding due to high water events, dam failure or dam operations and, if known, the flow rates at which areas begin to be impacted. Also include information on any minimum flow needs downstream.) _____

3. Operations and Maintenance Information

Normal Reservoir Management Procedures (How is the impoundment level managed throughout the course of a calendar year? How do you achieve this?)

Summer _____

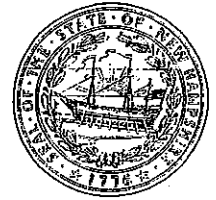
Fall _____

Winter _____

Spring _____



The State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES



Thomas S. Burack, Commissioner

May 5, 2008
Letter of Closure
For
Letter of Deficiency

Mr. Alphonse Dixon
Town Administrator
Town of Newmarket
186 Main Street
Newmarket, NH 03857

RE: Macallen Dam #177.01 in Newmarket
Letter of Deficiency (LOD) DAM #177.01
Issued on January 30, 2004

Dear Mr. Dixon:

Based on a file review and a scheduled inspection conducted on November 7, 2007 of the above referenced dam, the Department of Environmental Services has determined that the referenced LOD will be closed out. The reason(s) for this determination is that all of the deficiencies were not addressed. Please refer to the new LOD (#08-023) enclosed that incorporates any outstanding deficiencies as they relate to the January 2004 as well as any new deficiencies that were the result of this file review and site assessment.

If you have any questions or comments, please contact me at 603-271-3406 or write to the Water Division at the address listed below.

Sincerely,

Grace E. Levergood, P.E.
Dam Safety Engineer

Enclosure: Copy of January 30, 2004 LOD
cc: Gretchen R. Hamel, Legal Unit Administrator
GEL/was/h:/damfiles/17701/LOD/20080505 17701 04LODCLOSURE

Pertinent Data Sheet

Dam Number #177.01
Dam Name Macallen Dam
Town Newmarket
Date Inspected 11/07/2007
Report Date 3/26/2008

Pertinent Data

Water Body Lamprey River
Hazard Classification Significant
Height 27'
Length 150'
Type of Construction concrete/masonry
Pond Area 120 acres
Drainage Area 211 square miles
Storage Capacity
Permanent Pool 480 ac-ft Maximum Pool 1740 ac-ft
Design Event (50, 100, 2.5x100, 0.5 pmf, full pmf, other 100)
Inflow 8300 cfs Outflow 8300 cfs H&H 2008
Method Gauging Station Year 2006
Discharge Capacity (normal config.)
w/1' fbd 2740 cfs top of dam 3600 cfs
w/ operations w/1' fbd 5710 cfs top of dam 6720 cfs

Outlet Works

Spillway(s) 1- 68' long spillway with 6' freeboard
Gates 3 - 7' x 7" electrically powered double stem waste gates w/ stoplog bay on upstream face of all gates.
Other Fish ladder on right abutment

OMR Form

Last Update
EAP (if applicable)
Year Completed 1990 Last Update 2004 Last Test 1997
Additional work needed to assess hazard classification Yes X No
Additional work need to hydrologic/hydraulic analyses Yes X No

— LOD —
closed PREV-Y+95
DSP#08-023

Dam Inspection Form

Dam number #177.01

Town Newmarket

Water level 8.5' below top of dam, just over spwy

Dam name Macallen Dam

Inspector Grace Levergood

Date of inspection 11/07/2007

Feature	Type of deficiency M=maintenance S=structural	Observation
Upstream right abutment wall	M	Concrete deterioration - Photo 1
Right low level gate-housing wall and left spillway training wall	S	Cracking in concrete- Photo 2
Left spillway training wall -Upstream	M	Concrete deterioration -Photo 3
Gate housing pier-upstream	M	Concrete deterioration on upstream face of gate pier below permanent pool level - Photo 4
Left abutment wall - upstream	M	Concrete deterioration -Photo 5
Right abutment wall	M	Cracking in right concrete abutment wall- Photo 6
Gate structure and left spillway training wall	M	Concrete deterioration and brush growth on gate structure - Photo 7
Left abutment wall-downstream of gate	S	Leakage from left abutment wall, d/s of gate- Photo 8 & 9
Left abutment wall-upstream	S	Possible seepage path at entrance to mill building on left upstream where flood waters enter basement. - Photo 10
Left abutment	S	Parking lot to the left and upstream of the dam - water enters brick building basement during floods - Photo 11
Low level gates (3-7' x 7')		Operators work, some leakage from gate seals.
Operation and maintenance plan		No plan on file.
Emergency Action Plan		Needs update and testing- last test was 1997, last update 2007

Comments		<p>Dam overtopped during the 5/2006 and 4/2007 floods prompting emergency sandbagging of both abutments. Flows were gauged at 9100 cfs on 5/16/2006 and 8450 cfs on 4/18/07.</p> <p>Abutment walls should be raised to prevent future emergency response. Photo 12, taken on 5/16/2006, shows no ponding behind the Rte 108 upstream bridge as predicted in 1980 ACOE report</p>
Downstream Hazard Assessment		<p>Photos 1 – 7: Right abutment downstream reach.</p> <p>Photos 8 – 12: Left abutment downstream reach</p>

Report Form

Dam Number #177.01
Dam Name Macallen Dam
Town Newmarket
Date Inspected 11/07/2007
Inspector Grace Levergood
Report Date 4/7/2008

gm
4/14/08

Hazard Classification Significant to High

The 1980 ACOE Phase I Inspection report predicted 1 – 3' of flooding downstream of the dam in the event of a failure of the spillway. Loss of life is possible. The 5/16/2006 flood event generated flooding downstream of the dam up to the apartments but not into them as evidenced by a debris line. (Photo 6. Downstream Assessment). Flooding is expected to rise above the first floor level in these residences in the event of a dam breach. Severe damage is also expected to a marina that is located within 1000 feet downstream of the dam. According to Env-Wr 101.09 (b) flooding above the first flood level of a residence justifies a high hazard classification.

Hydrology and Hydraulics

The dam overtopped during the 5/2006 and 4/2007 floods prompting emergency sandbagging of both abutments. Flows were gauged at 9100 cfs on 5/16/2006 and 8450 cfs on 4/18/07. At peak flow water levels were measured at the left abutment as 6'3" over the spillway on 5/16/2006 and 5' 4" over the spillway on 4/18/2007. The freeboard above the spillway at the left abutment is 8' 6" and 5' 9" on the right abutment. According to the USGS publication, "Flood of May 2006 in New Hampshire", the peak flow exceeded the 100 year storm. It appears that the flows recorded during the 10/21/1996 flood event of 8302 cfs serves as a better estimate of the 100 year storm.

The storm of October 21, 1996 brought the equivalent of a 100-year storm event to the area. Using the recorded flows at the USGS gauging station #01073500, Lamprey River at Newmarket, the 100-year storm event of 8302 cfs was estimated using the area-ratio technique. This flow is significantly larger than cited in past studies. Past reports have listed the routed 1/2 PMF and the 100- year storm to be approximately 7,250 cfs and 6,350 cfs, respectively. The 1980 ACOE Phase I Inspection Report predicted that the upstream Rte 108 bridge crossing would constrict the inflow during the 100 year storm. **Photo 12, taken on 5/16/2006, shows no ponding behind the Rte 108 upstream bridge as predicted in 1980 ACOE report.**

According to the DES flood survey of the 10/23/96 flood event, the water level over the spillway was measured as 94-inches. This corresponds to 1.83 feet over the dam. With gates open this would correspond to approximately 9019 cfs. If the gates were closed, the flow would have been on the order of 5900 cfs.

The dam can pass a total of 6,720 cfs with all gates open and no freeboard and 5710 cfs with 1 foot of freeboard. Without operation of the gates the dam can pass 2740 cfs with on foot of freeboard and 3600 cfs to the top of the dam. These discharge capacities are based on the top of the right abutment, which is 2'9" lower than the left abutment.

EAP

The Emergency Action Plan was last updated on March 20 2004 and last tested on January 6, 1997. The document needs to be updated and reorganized into the acceptable DES format. An acceptable inundation map does not exist and should be developed for this dam. The EAP test is overdue.

OMR Form

There is no dam operation and maintenance plan on file.

Recommendations NOI LOD X AO

There is an existing LOD dated 1/30/2004 that has not been completely addressed. A flood letter was sent on 6/22/2006 reminding the dam owner of the outstanding deficiencies. The Town is working with a consulting engineer to develop repairs to the dam that will improve the discharge capacity of the structure.

Since the Town is actively working on addressing the dam safety concerns, I recommend the DES close out the outstanding LOD and issue new LOD. The LOD should request the completion of the following by the indicated dates:

By June 1, 2008

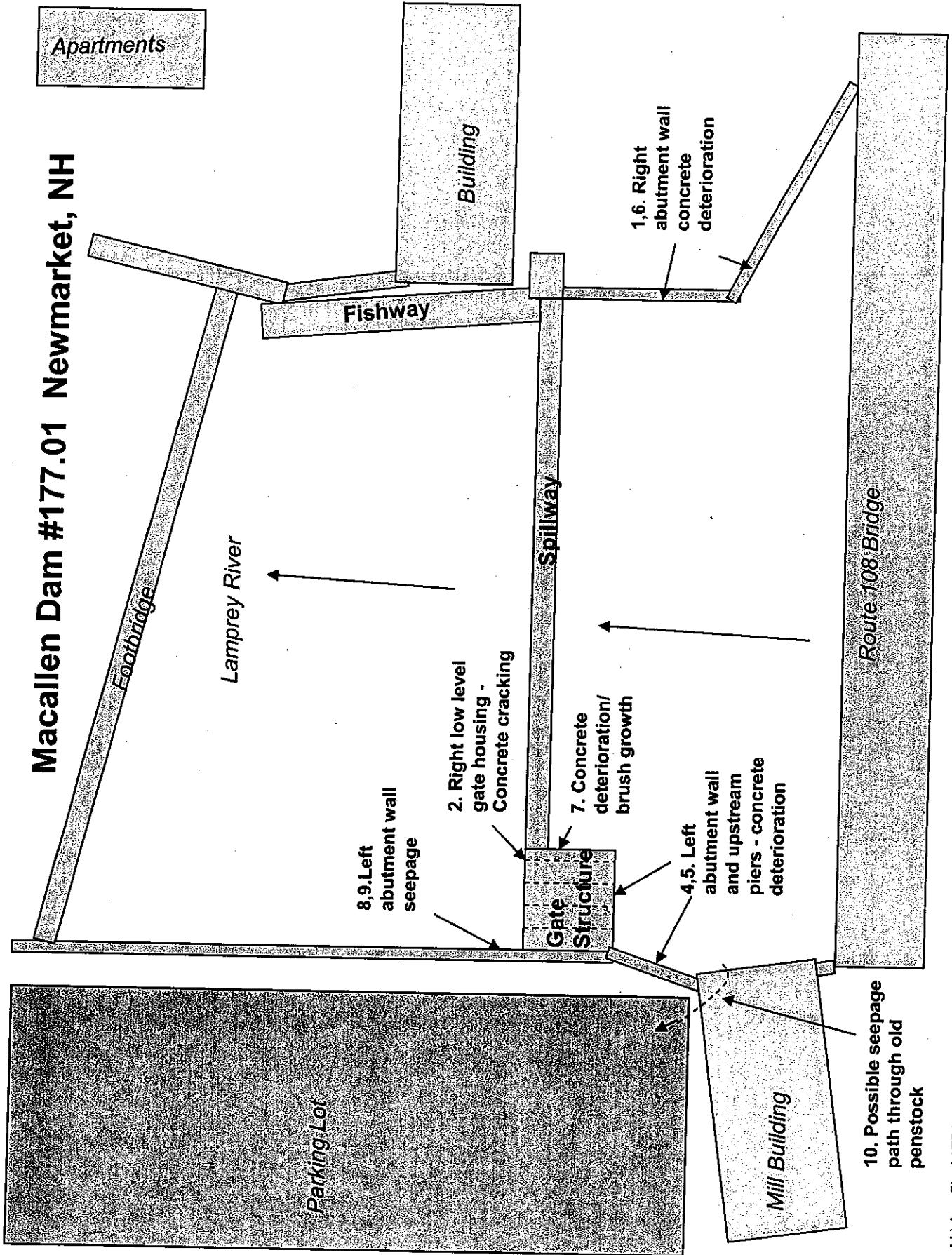
1. Submit an operation, maintenance, and response (OMR) plan to DES for review. Refer to enclosed template.

By November 1, 2008

2. Update, reformat, develop an inundation map and test the emergency action plan. Contact DES for further assistance.
3. Repair the deteriorated concrete noted in the following locations. Some of these areas were noted in the 2004 LOD. Refer to sketch and photos.
 - a. Upstream face of the concrete piers of the gate structure, at waters edge.
 - b. Right low level gate- housing wall and left spillway training wall
 - c. Upstream right abutment wall
 - d. Left upstream spillway training wall
 - e. Left upstream abutment wall
 - f. Right abutment wall
 - g. Gate structure and left spillway training wall
4. Remove the brush growing from the stonework in the left abutment.
5. Investigate and repair, if necessary, leakage from left abutment wall, d/s of gate, Photo 8 – 9.
6. Submit a permit application with appropriate plans and specifications to increase the discharge capacity of the dam to safely pass the design flow (2.5 Q100 or IDF) with one foot of freeboard and no operations.

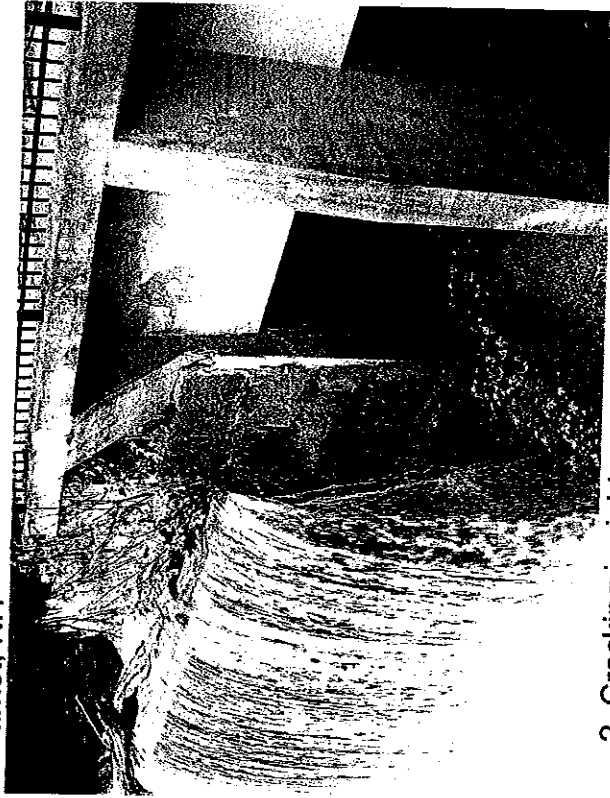
Please notify this office during a period of low river flow so that a follow-up inspection can be conducted to thoroughly inspect the spillway, fish ladder, and downstream face of the dam. Possibly a drawdown could be scheduled to facilitate this inspection.

Macallen Dam #177.01 Newmarket, NH





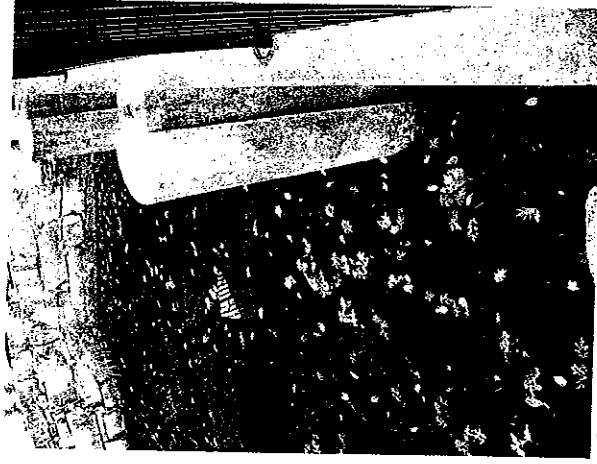
1. Concrete deterioration on upstream right abutment wall



2. Cracking in right concrete gate structure wall



3. Concrete deterioration on upstream left spillway training wall.



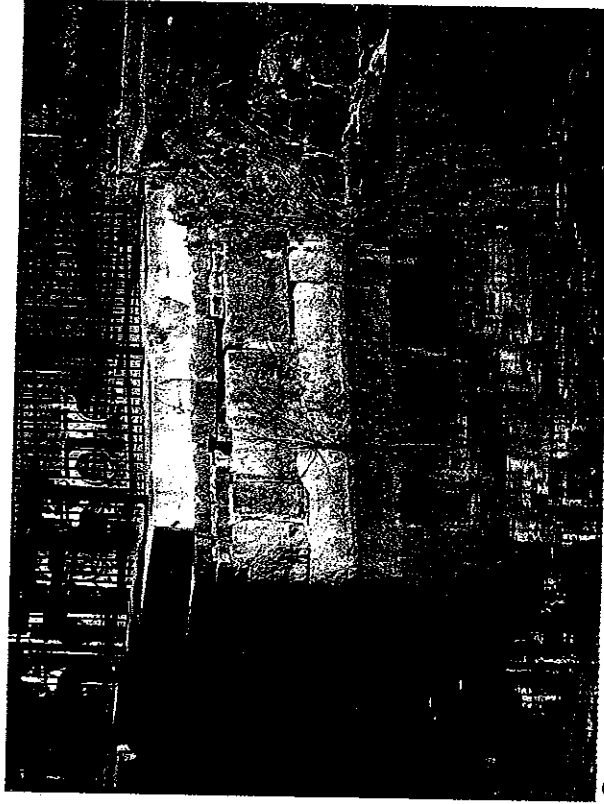
4. Concrete deterioration on upstream face of gate pier



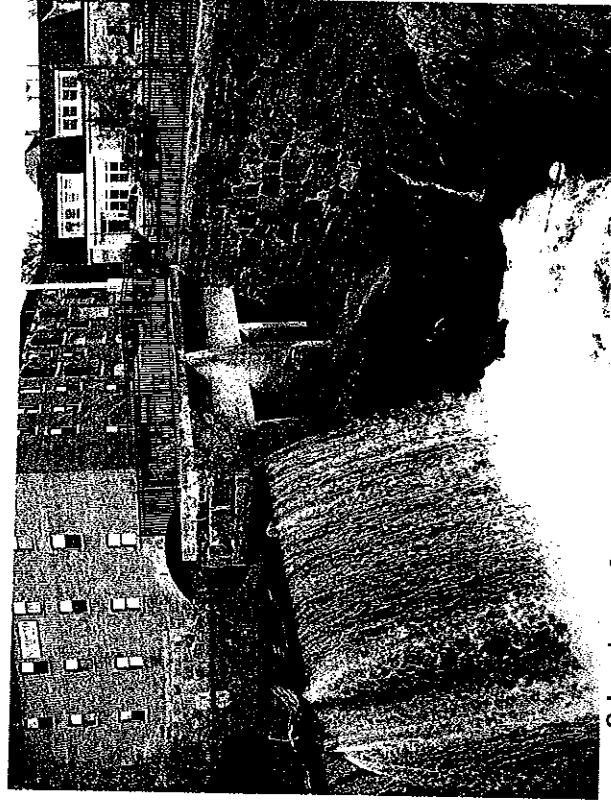
5. Concrete deterioration on left upstream abutment wall



6. Cracking in right concrete abutment wall

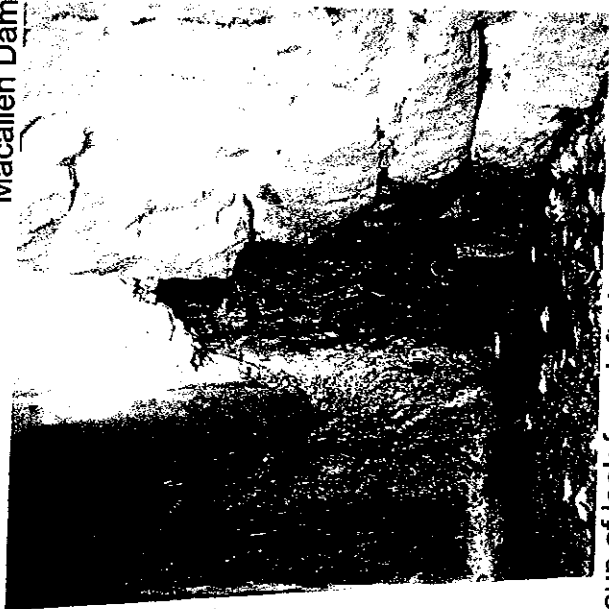


7. Concrete deterioration and brush growth on gate structure



8. Leakage from left abutment wall, d/s of gate

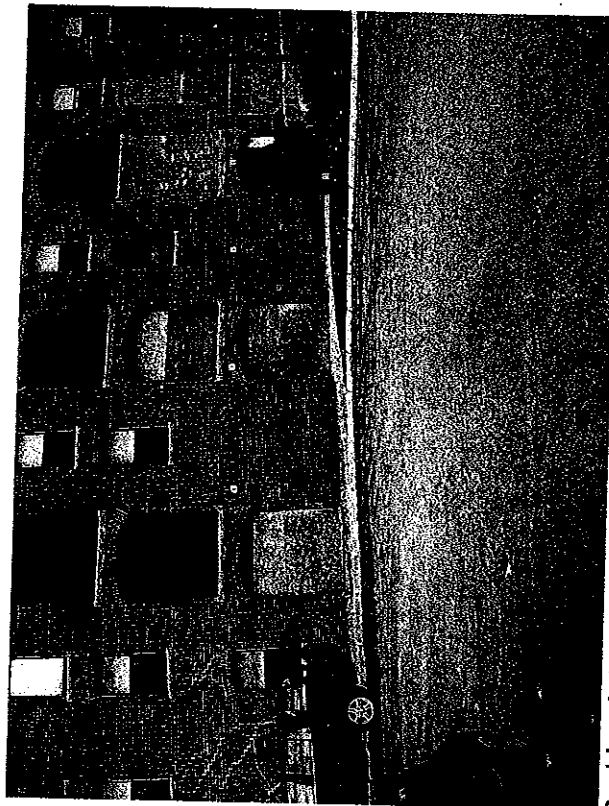
Macallen Dam #177.01 Newmarket, NH



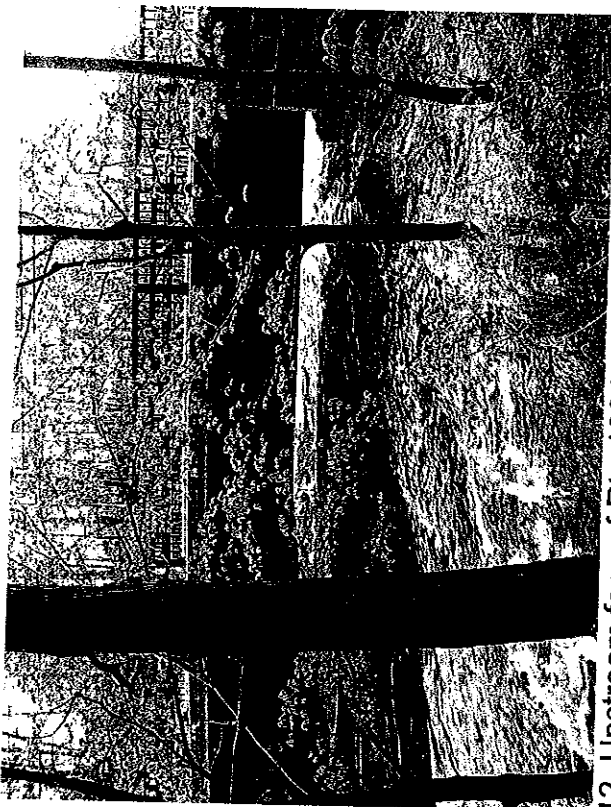
9. Closeup of leak from left abutment wall



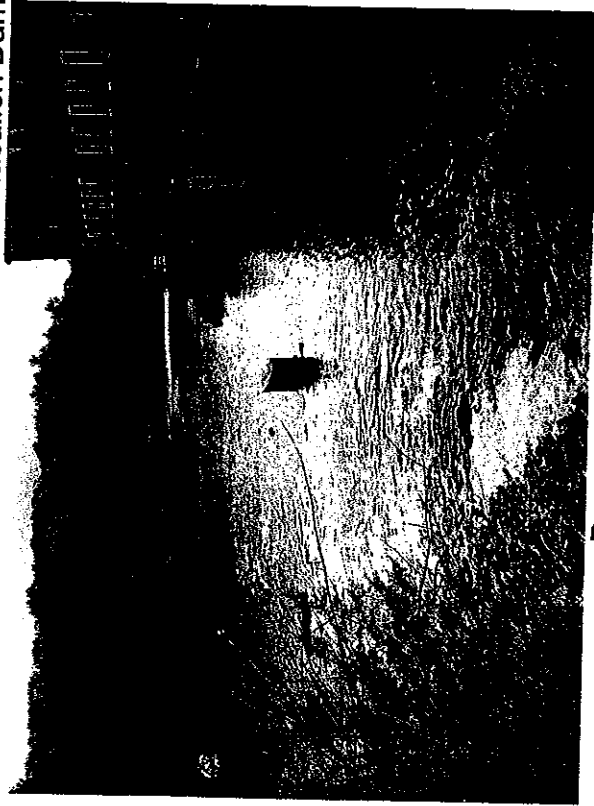
10. Entrance to mill building on left upstream where flood waters



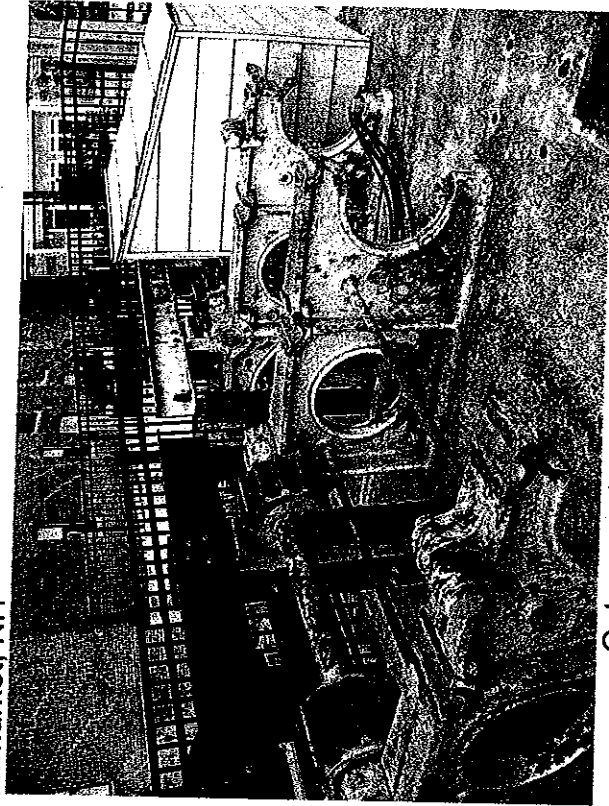
11. Parking lot to the left and upstream of the dam - water enters



12. Upstream face of Rte 108 bridge taken on 5/16/2006



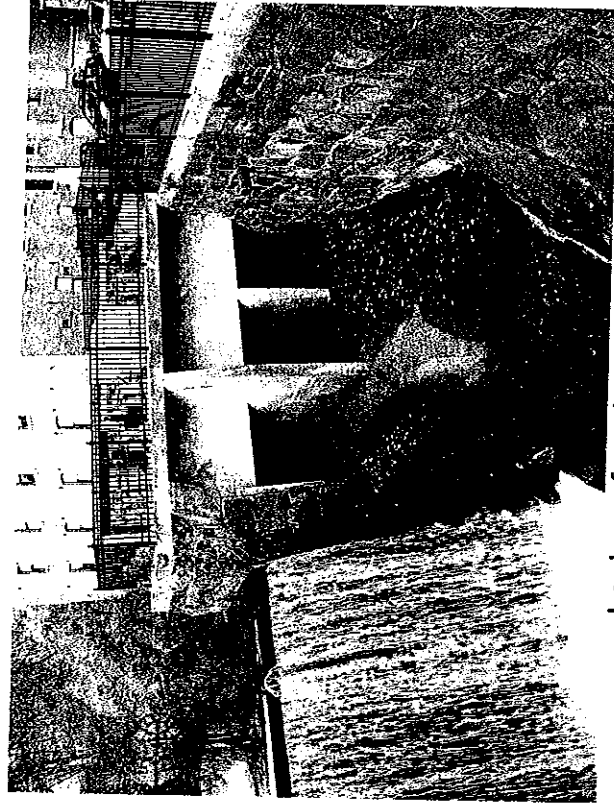
Downstream reach



Gate operators - downstream face



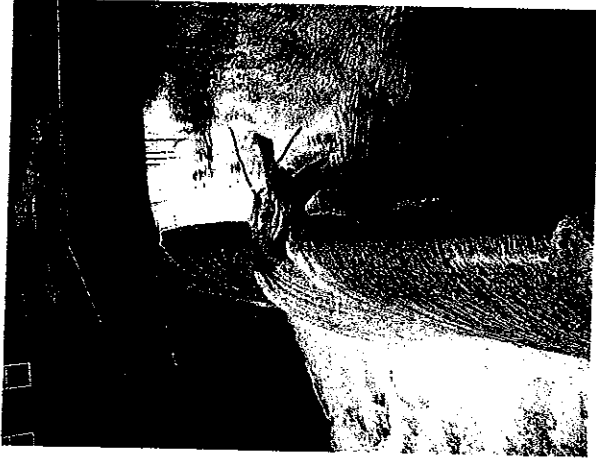
Leakage from low level gates



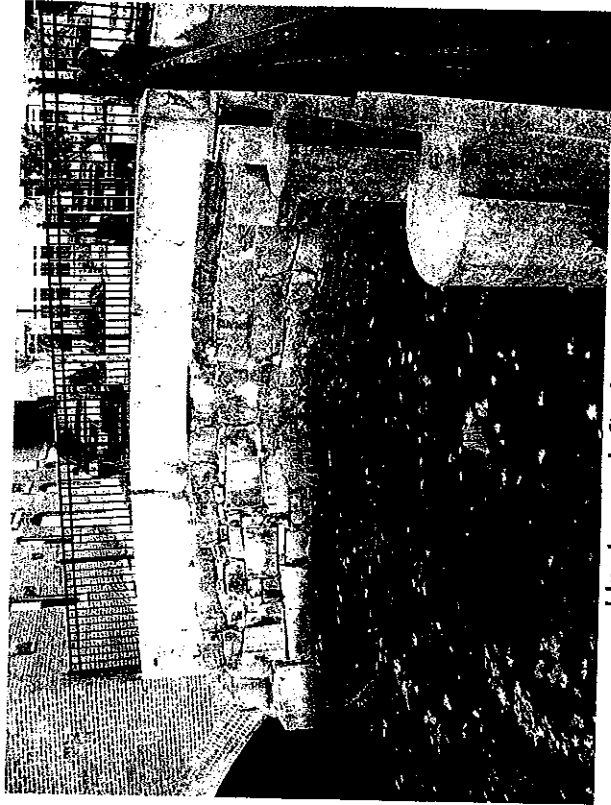
Leakage from low level gates



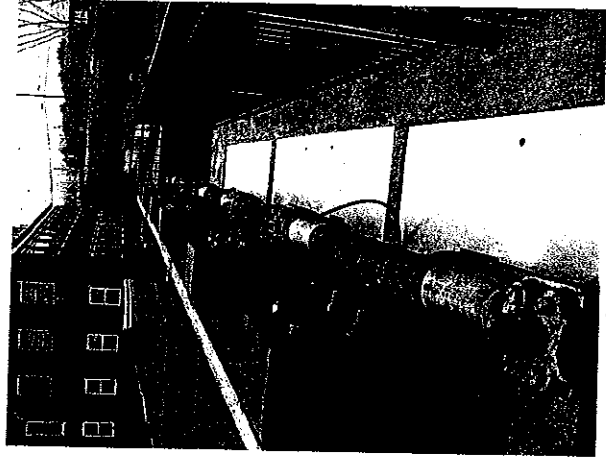
Overview



Spillway crest



Upstream left abutment wall

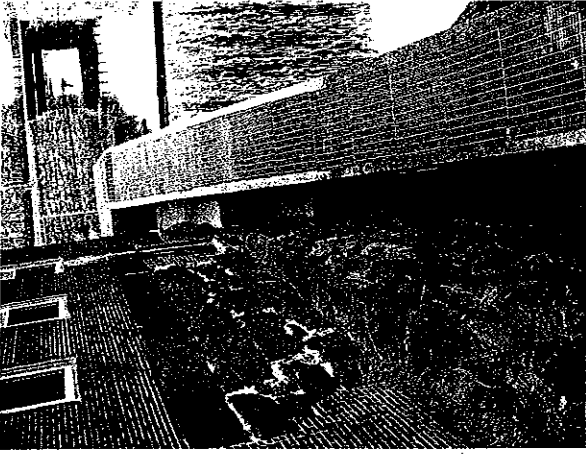


View across upstream face of gate operators

Macallen Dam #177.01 Newmarket, NH



View along crest of dam from left abutment



View upstream along fish way