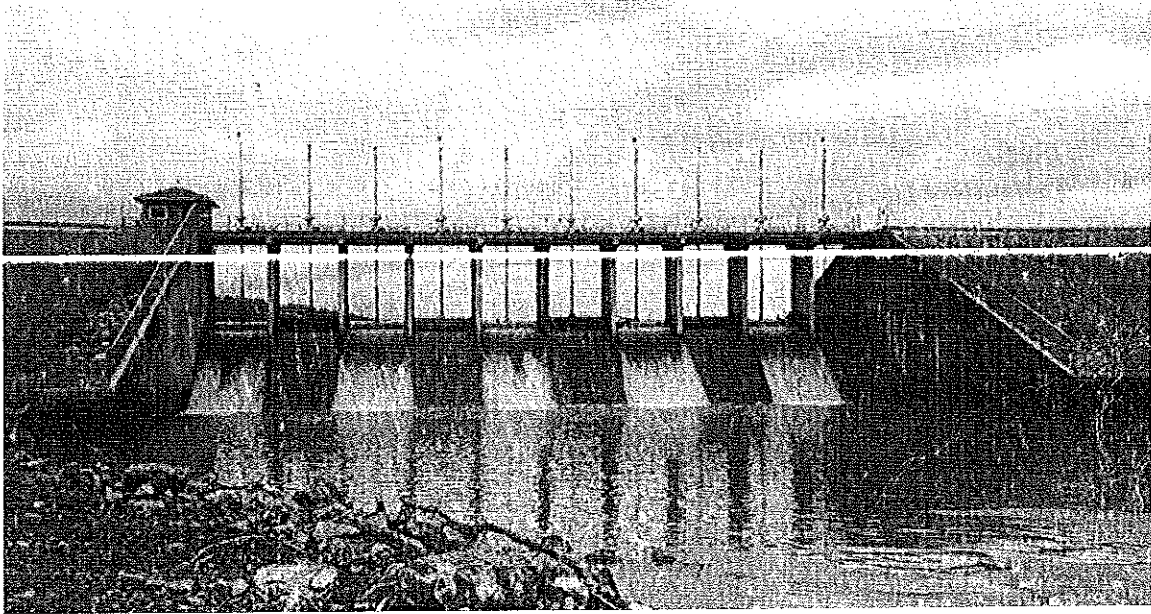


OPERATION PROCEDURES FOR GATED SPILLWAY AT GOSHEN DAM



Prepared for:
The Boy Scouts of America
National Capital Area Council
9190 Wisconsin Avenue
Bethesda, MD 20814-3897

DEQ-VALLEY

APR 17 1998

TO: EAU
FILE: _____

Prepared by:
Dewberry & Davis
8401 Arlington Boulevard
Fairfax, VA 22031-4666

April 9, 1998

GOSHEN DAM - SPILLWAY GATE OPERATION PROCEDURES

TABLE OF CONTENTS

I.	SCOPE	1
II.	KEY PERSONNEL AND STATE AGENCIES	1
III.	GATE OPERATION PROCEDURES	3
	A. Gate Inspection and Maintenance	3
	B. Data Collection and Monitoring Requirements	3
	C. Gate Operation Conditions	5
	D. Gate Operation in Safe Zone	6
	E. Gate Operation in Caution Zone	6
	F. Gate Operation in Warning Zone	8
	G. Communication and Notification Requirements	9
V.	CONCLUDING REMARKS	10

APPENDICES

- A. Goshen Dam Hydrologic Data and Gate Operation Log (Blank Form)
- B. Graph Showing Predicted Pool Elevations versus 24-Hour Rainfall for Various Antecedent Moisture Conditions
- C. Example Hydrologic Data and Gate Operation Log (Hypothetical Gate Operation for 1989 Rainfall and Temperature Records)

I. SCOPE

The following spillway gate operation procedures for Goshen Dam are intended to be supplemental to the existing operation and maintenance procedures which have been approved by the Virginia Department of Conservation and Recreation (DCR) as part of the existing Operation and Maintenance Certificate. The gate operation procedures presented here apply specifically to operation of the ten steel slide gates positioned along the crest of the concrete spillway structure. Operation of other gates and valves located within the control tower are not addressed here.

More definitive gate operation procedures are required in response to a Consent Special Order issued to the Boy Scouts of America, National Capital Area Council, by the State Water Control Board on April 6, 1998. The primary objective of these gate operation procedures is to provide for safe operation of the spillway system so that full spillway capacity can be made available when necessary for conveyance of large flood events. A secondary objective is to strive to maintain the lake level at or near the normal pool elevation of 1369 feet throughout the year.

II. KEY PERSONNEL AND STATE AGENCIES

The following organizations, personnel and state agencies have been identified in connection with the operation of the spillway gates at Goshen Dam.

- A. Boy Scouts of America, National Capital Area Council - this organization is the owner of Goshen Dam and is ultimately responsible for its maintenance and safe operation.
- B. Goshen Scout Reservation Camping Director - this individual has been designated by the BSA as the Dam Tender and primary spillway gate operator. This individual has the primary responsibility for implementation of the gate operation procedures and has complete authority to make decisions concerning the need to raise or lower the spillway gates.
- C. Goshen Scout Reservation Head Ranger - this individual is the alternative Dam Tender and gate operator in the absence of the Reservation Camping Director.
- D. Rockbridge County Special Enforcement Division - this agency is the local coordinator for emergency services and is responsible for directing emergency action procedures downstream of the dam in the event of a possible emergency at the dam or in advance of any major releases of flow.

- E. Virginia Department of Conservation and Recreation (DCR), Division of Dam Safety - this agency is responsible for monitoring dam owner compliance with the Virginia Dam Safety Regulations.
- F. Virginia Department of Emergency Services (DES) - this agency is responsible for directing emergency action programs statewide.
- G. Virginia Department of Environmental Quality (DEQ) - this agency is responsible for monitoring water quality downstream of Goshen Dam.

The table on the following page identifies key personnel concerned with the operation of Goshen Dam. Individuals filling these key positions as of October 1997 along with their addresses and phone numbers are provided.

Position	Individual (10/97)	Organization	Phone No.	Fax No.
Reservation Camping Director (Dam Tender)	David Henderson	Boy Scouts of America Goshen Scout Reservation 340 Millard Burke Mem. Hwy. Goshen, VA 24439-2421	(703)997-5773	(703)997-0535
Head Ranger (Alternate Dam Tender)	Jack Kyle	Boy Scouts of America Goshen Scout Reservation 340 Millard Burke Mem. Hwy. Goshen, VA 24439-2421	(703)997-5773	(703)997-0535
Deputy Scout Executive (Represents Dam Owner)	Alan Lambert	Boy Scouts of America National Capital Area Council 9190 Wisconsin Avenue Bethesda, MD 20814-3897	(301)214-9102	(301)564-3648
Territory Dam Safety Engineer	Duncan McGregor	VA Department of Conservation and Recreation, Division of Dam Safety 252 West Main Street, Suite 3 Abingdon, VA 24210	(540)676-5418	(540)676-5527
Deputy Emergency Services Coordinator	Bob Weikel	Rockbridge Co. Special Enforcement Div 150 South Main Street Lexington, VA 24450	(540)463-4361	(540)463-5981

Although several agencies and individuals are identified in connection with the operation of Goshen Dam, it is important to note that the Dam Tender is solely responsible for operation of the spillway gates and implementation of the procedures set forth in this document.

III. GATE OPERATION PROCEDURES

A. Gate Inspection and Maintenance

Procedures for gate inspection and maintenance are outlined in the existing Operation and Maintenance Manual and Operation Plan for Goshen Dam. These procedures outline a sequence of regularly scheduled inspection and maintenance tasks which must be performed for the gated spillway system to remain operable at all times. Because of the potential damage that can be caused by floating debris impacting the spillway gates, one very important maintenance item involves removal of debris from the debris boom and making sure the debris boom is in good repair and properly anchored to the lake bottom. Inspection of the debris boom should occur monthly and after all flood events, and any accumulated debris should be removed as soon as possible.

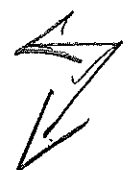
The Monthly Maintenance Plan should be revised to reflect the goal of maintaining the lake at the full pool elevation throughout the year. However, to accomplish certain inspection and maintenance tasks it will be necessary to lower the lake level periodically. In most cases it will not be necessary to lower the lake level below the concrete spillway crest; however, it will occasionally be necessary to completely drain the lake for more extensive gate maintenance procedures. These more extensive maintenance items may include complete gate removal and rehabilitation (e.g. complete sandblasting, repainting, seal replacement, etc.) and removal of sediment accumulations immediately upstream of the spillway gates. Therefore, the gate operation procedures set forth in this document are applicable only if the entire spillway system (e.g. gates, motors, debris boom, stand-by generator, etc.) have been properly maintained and are in good working condition.



B. Data Collection and Monitoring Requirements

The following meteorologic and hydrologic data shall be collected and recorded by the Dam Tender on a daily basis.

1. Previous 24 hour rainfall amount estimated over the Little Calfpasture River watershed from either IFLOWS gage readings, Doppler radar, or other reliable source.
2. Previous 5 day total rainfall amounts estimated over the Little Calfpasture River watershed.
3. Predicted rainfall amount in the next 24 hours.
4. Water surface elevation or stage of reservoir pool.
5. Predicted high and low temperatures for the next four days.
6. Surface water temperature immediately upstream of the dam.
7. Percent of the normal pool surface that is covered with ice and proximity of ice to the spillway gates and debris boom.



The data shall be recorded in a log book or in a computer spreadsheet such as Microsoft EXCEL or QUATTRO PRO. A sample data form/spreadsheet is provided in Appendix A. How this data can be used to provide guidance with regards to gate operation is discussed in Sections IV(C-F).

In addition to the data outlined above, the dam tender shall also take note of the following:

1. Local weather forecast.
2. Any flood or flash flood warnings posted for the area within and immediately surrounding the Little Calfpasture watershed.
3. If heavy rainfall is predicted, current Doppler radar images should be observed to determine the size, intensity and predicted path of storm cells.

The information and data listed above may be collected from the following sources:

1. The Weather Channel or weather segments on local news programs will provide forecasts, radar images and warnings of severe weather.
2. Local newspapers typically publish monthly and previous 24 rainfall totals at select sites (e.g. airports etc.) and also provide abbreviated forecasts.
3. Information from IFLOWS stations can be obtained from the Department of Emergency Services or from an IFLOWS receiving station established at the Dam Tender's office. The National Weather Service also maintains an IFLOWS web site at (<http://www.nws.noaa.gov/afws/index.shtml>) where rainfall amounts recorded in the previous 24 hours can be obtained.
4. Most of the weather and hydrologic data outlined above can be found in one or more of the following Internet web sites:

NWS Forecast Office in Sterling, VA - Home Page (<http://www.nws.noaa.gov/er/lwx/>)
NWS Office in Blacksburg, VA - Home Page (<http://www.bev.net/weather/rnk.html>)
Weather Forecast for Roanoke Area (<http://www.intellicast.com/weather/roa/>)
Current Radar Image (updated hourly) (<http://www.intellicast.com/weather/roa/radar/>)
Previous 24-Hour Precipitation (Est.) (<http://www.intellicast.com/weather/roa/precip/>)
Virginia Flash Flood Warnings (<http://iwin.nws.noaa.gov/iwin/va/flashflood.html>)
IFLOWS Home Page (<http://www.nws.noaa.gov/afws/index.shtml>)
Lycos Global Weather Service (<http://weather.lycos.com/>)

C. Gate Operation Conditions

Based on the hydrologic data recorded daily by the Dam Tender, three gate operation conditions or “zones” have been identified depending on flood potential and ice buildup on the lake. These three operating zones are characterized as follows:

SAFE ZONE: For the gate operations to be considered in the safe zone all of the following must be true:

1. Predicted 24 hour rainfall is not sufficient to cause the lake level to rise more than one foot above normal pool.
2. There is no significant ice cover (less than 5 percent) on the lake and no ice is proximate to the spillway gates or the debris boom.
3. The average temperature predicted over the next four days is greater than 32°F and the surface water temperature in the lake is greater than 32°F.

CAUTION ZONE: Gate operations are considered to be in the caution zone if any of the following are true.

1. The predicted 24 hour rainfall may cause the lake level to rise between one and four feet above normal pool.
2. Ice cover on the lake is between 5 and 50 percent of the total lake surface
3. Ice is beginning to collect on the upstream side of the debris barrier or is beginning to form proximate to the spillway gates (proximate shall be defined as the area extending approximately 30 feet upstream of the gates between the concrete abutment walls).
4. The average temperature predicted over the next four days is less than or equal to 32°F or the surface water temperature in the lake is less than or equal to 32°F.

WARNING ZONE: Gate operations are considered to be in the warning zone if any of the following are true.

1. The predicted 24 hour rainfall may cause the lake level to rise more than four feet above normal pool.
2. Ice cover on the lake equals or exceeds 50 percent of the total lake surface.

3. Ice having thickness greater than 1 inch has formed proximate (as defined above) to the spillway gates.
4. Significant pack ice has collected upstream of the debris barrier (significant pack ice shall be defined as ice greater than 2 inches thick and extending more than 10 feet upstream of the debris barrier).

The hydrologic data recorded on the sample form in Appendix A shall be used to determine the applicable gate operation zone (e.g. safe, caution or warning). A chart/graph is also provided in Appendix B, which can be used to estimate the potential increase in reservoir elevation based on predicted 24 hour rainfall amounts. The data form in Appendix A has been programmed in a Quattro Pro spreadsheet to automatically determine the gate operation zone based on the hydrologic, temperature, and ice cover data input by the dam tender. An example data form representative of a year of hydrologic data and hypothetical gate operations is provided in Appendix C.

D. Gate Operation in Safe Zone

No specific actions or gate operation is required in the safe operation zone. However, the dam tender should always be prepared for potential storm events which may exceed predicted rainfall amounts and initiate appropriate gate operation to increase spillway capacity if required. In general, gate operation in the safe zone may be initiated at the Dam Tender's discretion. However, any gate operation which will result in a significant increase in downstream flow shall be reported to the Rockbridge County Emergency Services Coordinator in accordance with Section III(G).

E. Gate Operation in Caution Zone

Gate operation in the Caution Zone requires more vigilante monitoring by the Dam Tender than in the Safe Zone, because a greater potential exists for flooding or ice related damage to the spillway system. The primary goal of gate operation in the caution zone is for the dam tender to take appropriate actions to insure adequate spillway capacity is available and to reduce the potential for damage to the spillway gates. Different gate operation procedures exist in response to flood potential or ice build-up.

1. Gate Operation in Response to Flood Potential (Caution Zone)

If predicted rainfall is such that the lake elevation may increase anywhere from one to four feet above the normal pool elevation, the Dam Tender shall regularly monitor weather forecast and other data (e.g. real-time Doppler radar data) to assess the amount and likelihood of a potential rainfall or storm event. Based on

the Dam Tender's continual monitoring of available data and weather forecast, he shall determine the degree that the spillway gates should be lowered before or during a storm event to increase spillway capacity and reduce flood potential upstream of the dam. The chart/graph in Appendix B may be used to assist the Dam Tender make decisions concerning gate operation. For example, if the predicted rainfall amount could result in a 3 foot increase in lake elevation, the Dam Tender may decide to begin lowering the spillway gates roughly one half the predicted increase in reservoir rise (e.g. 1.5 feet) in advance of rainfall depending on the likelihood of the storm event. During the storm event, gate operations will be directed at trying to reduce the rate of reservoir rise and bring the reservoir back to the normal pool elevation. The dam tender shall continually monitor rainfall occurring in the watershed (e.g. IFLOWS, onsite rain gage, etc.) and, with the assistance of the graph in Appendix B, lower the spillway gates to a level which will offset the potential increase in reservoir elevation. During an actual storm event resulting in an increase in reservoir elevation greater 1370 feet (i.e. more than one foot above normal pool), the gates should be lowered an amount at least equal to or greater than the actual rise in reservoir elevation above normal pool. Any gate operation which will result in a significant increase in downstream flow shall be reported to the Rockbridge County Emergency Services Coordinator in accordance with Section III(G).

2. Gate Operation in Response to Ice Build-Up (Caution Zone)

If the amount of ice cover on the lake is between 5 and 50 percent of the total lake surface, or the predicted average temperature forecast over the next four days is less than 32°F, or the surface water temperature near the dam is less than or equal to 32°F, or ice is beginning to collect on the upstream side of the debris barrier, or ice is beginning to form proximate to the spillway gates; then the Dam Tender shall closely monitor ice build-up and the stability of any existing pack ice and take action to preclude damage to the spillway gate system and debris barrier resulting from impact by large pieces of floating pack ice. The spillway system will likely be most susceptible to ice damage during the spring thaw, after an extremely cold winter, particularly when coupled with heavy runoff. So long as conditions are indicative of the Caution Zone, it is not mandatory that the spillway gates be completely lowered. However, it is necessary that the dam tender position the gates such that some flow is maintained over the spillway to discourage ice formation near the gates. It may also be necessary for the Dam Tender to disconnect a portion of the debris barrier to allow sections of pack ice to be guided safely over a partially lowered spillway gate.

F. Gate Operation in Warning Zone

Gate operation in the Warning Zone is considered to be a serious situation requiring the Dam Tender's immediate attention and notification of the Rockbridge County Emergency Services Coordinator in accordance with Section III(G). The potential for flood or ice related damage to the spillway gates is much more severe in this situation and it will generally always be necessary for the Dam Tender to take some immediate action, such as lowering the spillway gates, in order to reduce the potential for flood or ice related damage while the gates are completely or partially raised. The Dam Tender must make every effort to avoid damage to the spillway gates, particularly while they are completely or partially raised, to insure that the maximum spillway capacity can always be made available. Gate operation procedures in response to flood potential or ice build-up in the Warning Zone are described below.

1. Gate Operation in Response to Flood Potential (Warning Zone)

If predicted rainfall is such that the lake elevation may increase four feet or more above the normal pool elevation, the Dam Tender shall notify the Rockbridge County Emergency Services Coordinator in accordance with Section III(G) and begin lowering the spillway gates prior to the storm event to a level below normal pool at least equal to the predicted amount of reservoir rise using the graph in Appendix C. Because this will likely result in a significant increase in flow rate downstream of the dam, the Dam Tender shall, if possible, refrain from lowering the lake elevation until after the Emergency Services Coordinator has alerted downstream residents and other persons in or near the river and advised them to relocate away from the immediate floodplain area. However, if it is the Dam Tender's opinion that waiting for downstream notification would be unwise or could threaten the ability to safely convey flood flow past the dam, then he may proceed to lower the spillway gates at his discretion.

During the storm event, the Dam Tender shall monitor rainfall occurring in the watershed and continue to lower the spillway gates as necessary to offset the potential rise in reservoir elevation. Gates shall continue to be lowered as long as the reservoir elevation continues to rise. During an actual storm event resulting in an increase in reservoir elevation greater 1370 feet (i.e. more than one foot above normal pool), the gates should be lowered an amount at least equal to or greater than the actual rise in reservoir elevation above normal pool. Once the reservoir elevation falls to within a foot of normal pool, the Dam Tender may begin to raise the spillway gates back to the normal pool elevation at a rate which does not increase the reservoir elevation. The spillway gates may be raised only if they have not been damaged during the flood event and so long as no appreciable additional rainfall is predicted within the watershed.

day antecedent rainfall, particularly if significant melting has occurred in the previous five days.

Column 7 - The predicted rainfall amount over the next 24 hours. This information can be obtained from various forecasting sources. The following Web pages provide 24-hour rainfall forecast maps published by WSI:
(<http://weather.lycos.com/map.asp?theMap=namrpre1>) by Lycos
(<http://WWW.bloomberg.com/forecast/rain.html>) by Bloomberg
(http://www.boston.com/weather/new_england/rainfall.shtml) by Boston.com

Cols. 8 & 9 - Predicted high and low temperatures for current day and for next 3 days into the future. This information is used to predict the potential for ice formation on the lake surface and can be obtained from various forecasting sources. One source is the Web page (<http://www.intellicast.com/weather/roa/>) published by Intellicast.

Column 10 - The average temperature predicted over the next four days determined from the information in columns 8 and 9.

Column 11 - The percentage of the total lake surface covered with ice, estimated based on visual inspection by the Dam Tender.

Column 12 - Water temperature of the lake surface near the spillway.

Column 13 - Level of ice formation near the spillway gates, in the area extending approximately 30 feet upstream of the gates between the concrete abutment walls.

N - no ice formation

M - minor ice formation (less than or equal to 1" thick)

S - significant ice formation (greater than 1" thick)

Column 14 - Amount of pack ice accumulating upstream of the debris boom.

N - no ice upstream of boom

M - minor ice accumulation less than or equal to 2" thick and extending no more than 20' beyond boom

S - significant pack ice accumulation greater than 2" thick or extending more than 20' beyond boom

Column 15 - Gate operation condition (Safe, Caution, or Warning) based on rainfall data entered in columns 3 thru 7 and using the chart in Appendix B.

Safe - if predicted rainfall over the next 24 hours (col. 7) will not cause the lake to rise more than one foot above the normal pool elevation (1369 feet).

Caution - if the predicted 24-hr rainfall may cause the lake to rise between 1 and 4 feet above the normal pool elevation.

Warning - if the predicted 24-hr rainfall may cause the lake to rise more than 4 feet above the normal pool elevation.

Column 16 - Gate operation condition (Safe, Caution, or Warning) based on the temperature and ice formation data entered in columns 8 thru 14.

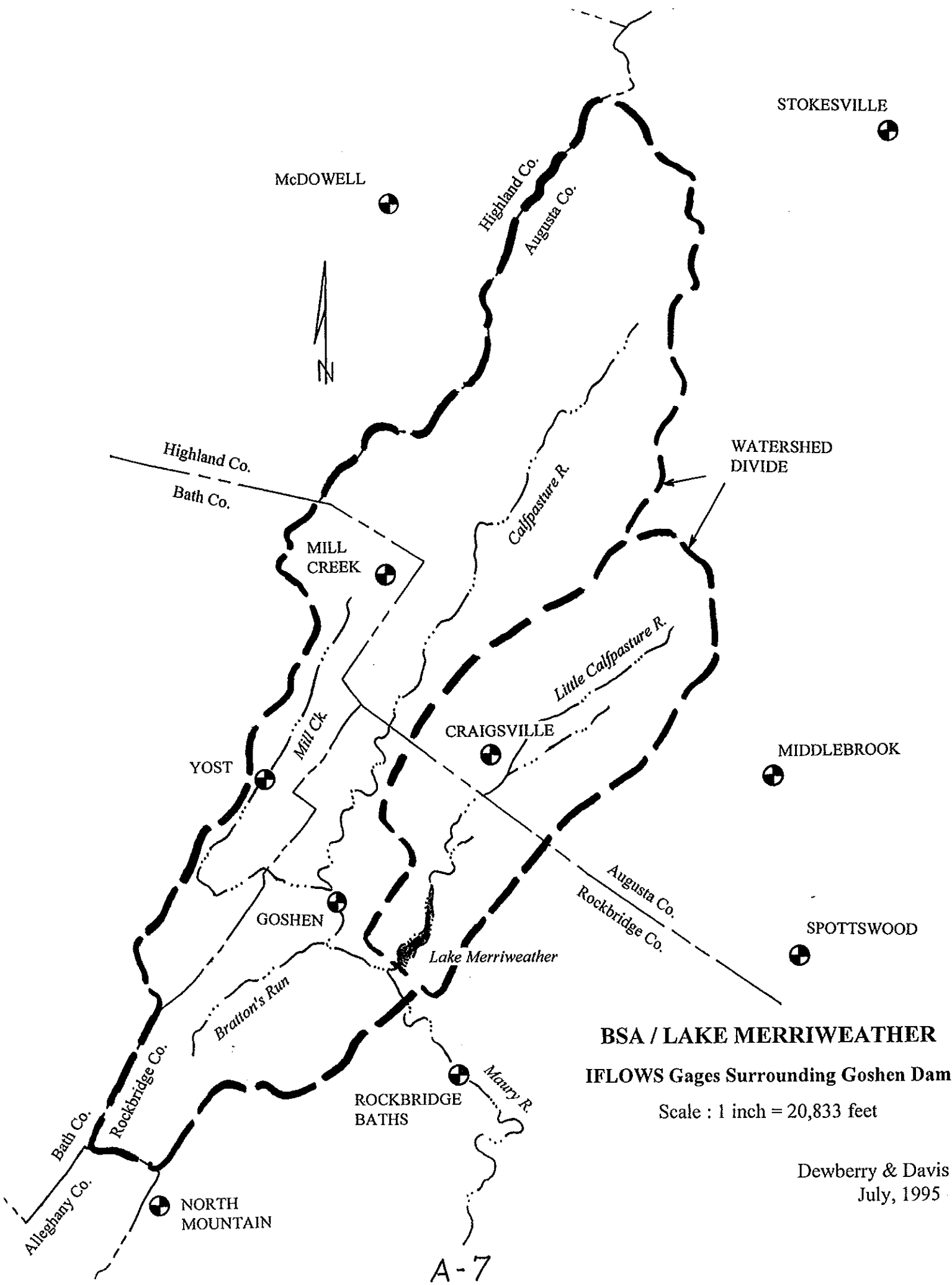
Safe - if ice cover is less than 5 percent of the lake surface, the average air temperature predicted over the next four days is greater than 32°F, the water temperature of the lake surface near the spillway is greater than 32°F, no ice has formed near the spillway gates, and no ice has accumulated on the upstream side of the debris boom.

Caution - if ice cover is between 5 and 50 percent of the lake surface, or the average air temperature predicted over the next four days is less than or equal to 32°F, or the water temperature of the lake surface is less than or equal to 32°F, or if minor pack ice is beginning to accumulate upstream of the debris boom or minor ice is beginning to form near the spillway gates.

Warning - if ice cover is greater than or equal to 50 percent of the lake surface, or significant ice has formed near the spillway gates or accumulated upstream of the debris boom.

Column 17 - Current water surface elevation in the reservoir measured in feet. The elevation of the top of the spillway gates in the completely raised position is 1369 feet (i.e. the normal pool elevation) and the elevation of the crest of the concrete weir is 1359.5 feet. To translate the staff gage reading on the spillway abutment wall to elevation add approximately 1343 feet. Therefore, a staff gage reading of 26 feet approximately equals the normal pool elevation of 1369 feet.

Column 18 - Comments and decisions concerning the gate operations performed; and general observations concerning spillway performance, damage, weather conditions, etc.



BSA / LAKE MERRIWEATHER
IFLOWS Gages Surrounding Goshen Dam

Scale : 1 inch = 20,833 feet

Dewberry & Davis
 July, 1995

APPENDIX B - GRAPH SHOWING PREDICTED
POOL ELEVATIONS VERSUS 24-
HOUR RAINFALL FOR VARIOUS
ANTECEDENT MOISTURE
CONDITIONS (AMC)

PREDICTED RESERVOIR ELEVATIONS FOR VARIOUS 24-HR RAINFALL AMOUNTS AND ANTECEDENT MOISTURE CONDITIONS

The attached chart/graph was developed to aid the Dam Tender in evaluating the flood potential associated with various rainfall amounts under various soil moisture conditions. The graph was developed based on a hydrologic model of the Little Calfpasture River and Goshen Dam with the following major assumptions:

1. The spillway gates are completely raised and remain fixed in this position throughout the storm event.
2. The reservoir elevation prior to the rainfall event is 1369 feet (normal pool elevation).
3. The duration of the rainfall event is 24 hours with a center peaking distribution (SCS Type II distribution).
4. SCS methods are used to convert the hypothetical storm/rainfall event into a runoff or inflow hydrograph into Lake Merriweather.

Because most rainfall events will not match the hypothetical event used for hydrologic modeling purposes, the information provided in the attached graph should only be used as a guide with the understanding that the same rainfall amount may result in a wide range of possible reservoir elevations depending on the duration and distribution of the rainfall event. An example of how the attached graph may be used is provided below.

The following hydrologic data is collected by the Dam Tender:

1. rainfall in the previous five days totals 1.5 inches (growing season),
2. predicted rainfall over the next 24 hours is 3 inches,
3. the current reservoir elevation is at 1369 feet.

The Dam Tender must determine:

1. the current antecedent moisture condition,
2. the gate operation condition based on the potential rise in reservoir elevation,
3. the required gate operation, if any.

Solution:

1. Based on the table provided in Appendix B, the antecedent moisture condition will be AMC 2 since it is the growing season and between 1.4 and 2.1 inches of rain has occurred in the previous five days.
2. From the graph it is estimated that the reservoir could rise from elevation 1369 to 1372 feet given a projected 24 hour rainfall of 3 inches and AMC 2. This places gate operation in the Caution Zone.

3. As a result of gate operation in the Caution Zone, the Dam Tender will continually monitor weather forecasts and current Doppler radar to better understand the potential for rainfall to occur. Based on the results of this monitoring, the Dam Tender may decide to take one of the following actions:

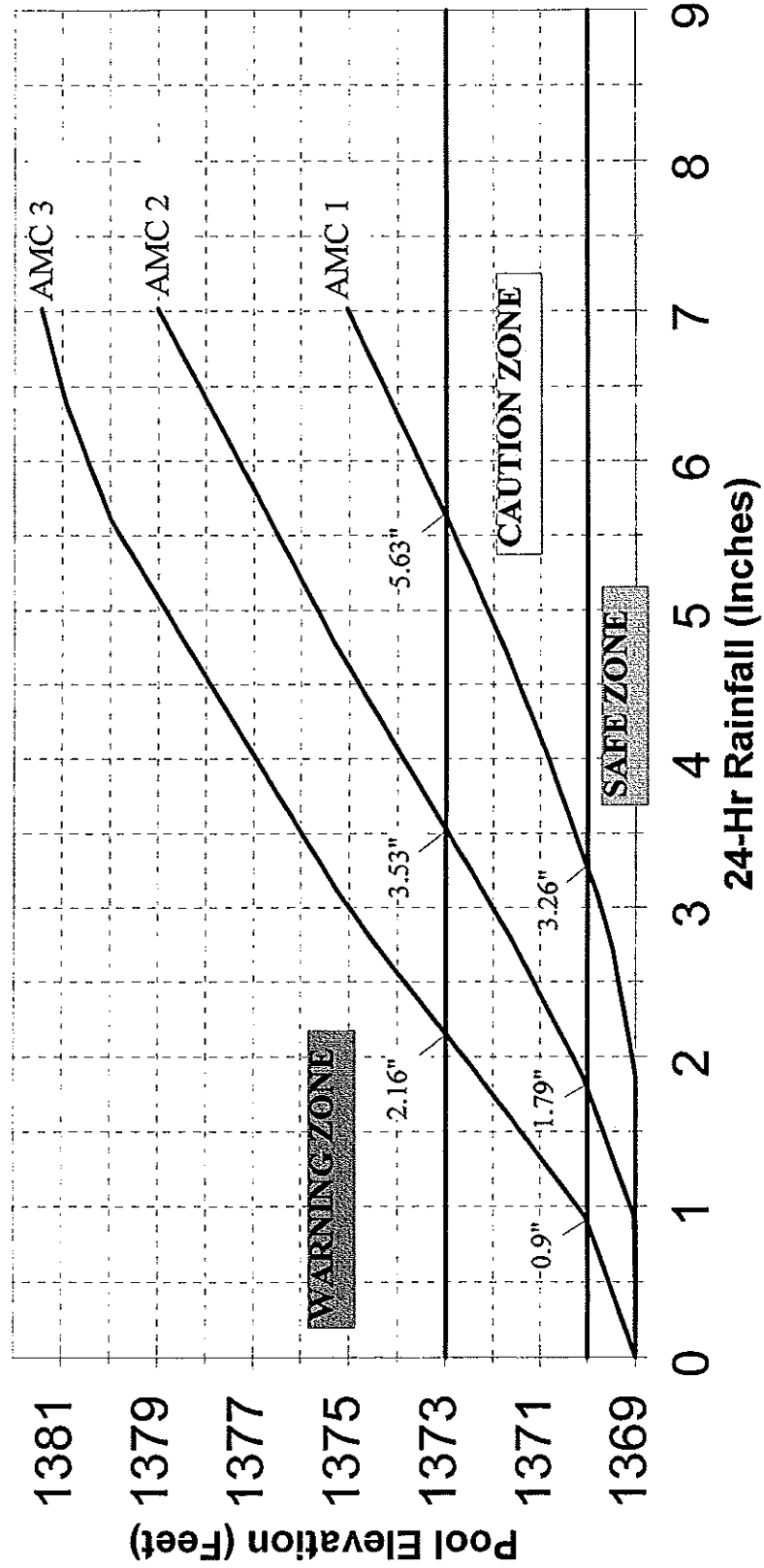
- lower the spillway gates an amount equal to the predicted rise in reservoir elevation, if the predicted rainfall is very likely;
- lower the spillway gates an amount equal to $\frac{1}{2}$ the predicted rise in reservoir elevation, if the predicted rainfall is only somewhat likely;
- if the predicted rainfall is unlikely, keep the gates in the up position and only begin lowering the gates if there is an actual rainfall event which results in an increase in reservoir elevation.

During an actual storm event resulting in an increase in reservoir elevation greater 1370 feet (more than one foot above normal pool), the gates should be lowered an amount at least equal to or greater than the actual rise in reservoir elevation above normal pool. For example, if the reservoir has risen to elevation 1372 feet (3 feet above normal), then the spillway gates should be at elevation 1366 feet (3 feet below normal pool) or lower.

Predicted Reservoir Elevations (feet) for Various 24-Hr Rainfall Amounts and Antecedent Moisture Conditions Assuming All Gates Completely Raised

Antecedent Moisture Condition	0	24-Hour Rainfall Amount (inches)											
		0.94	1.87	2.72	3.09	4.03	4.78	5.62	6.37	7.02			
1	1369	1369	1369.46	1370.86	1371.82	1372.99	1374.09	1375.05					
2	1369	1369.03	1370.09	1371.49	1372.17	1373.94	1375.3	1376.67	1377.92	1379.02			
3	1369	1370.05	1372.3	1374.36	1375.2	1377	1378.44	1380.01	1380.91	1381.44			

Pool Elev Vs Rainfall for Various Antecedent Moisture Conditions



**APPENDIX C - EXAMPLE HYDROLOGIC DATA
AND GATE OPERATION LOG**
(HYPOTHETICAL GATE OPERATION FOR 1989 RAINFALL
AND TEMPERATURE DATA)

GOSHEN DAM HYDROLOGIC DATA AND GATE OPERATION LOG - (Hypothetical Example Data)

(NOTE: Rainfall and Temperature Data Taken From Actual 1989 Records at Roanoke Airport)

DATE	TIME	Previous 24-Hr. Rain. Amount (in.)	Source	Current 24-Hr Rainfall (in.)	AMC	Predicted Temp.		Predicted 4-Day Avg Temp. (deg. F)	% Ice Cover	Lake Temp. (deg. F)	Ice Near Gates (N.M.S)	Ice US of Boom (N.M.S)	Gate Oper. Condition		Current Pool Elev. (ft.)	Gate Operations Performed, General Comments Concerning Gate Operation Decisions, or Observations Concerning Spillway Performance or Damage
						Low (deg. F)	High (deg. F)						Based on Rainfall	Based on Ice Cover		
1/1/89	08:00 AM	0.31	Craigsville	1	1	0	37	42	38.75	20	30	M	SAFE	CAUTION	1369	
1/2/89	08:00 AM	0	Craigsville	1	1	0.5	38	56	37.625	20	30	M	SAFE	CAUTION	1369	
1/3/89	08:00 AM	0.14	Craigsville	1	1	0	33	45	36	20	30	M	SAFE	CAUTION	1369	
1/4/89	08:00 AM	0	Craigsville	1	1	0	24	35	36	20	30	M	SAFE	CAUTION	1369	
1/5/89	08:00 AM	0.01	Craigsville	1	1	0.5	21	49	40.75	20	31	M	SAFE	CAUTION	1369	
1/6/89	08:00 AM	0.24	Craigsville	1	1	0	33	48	41.875	15	31	M	SAFE	CAUTION	1369	
1/7/89	08:00 AM	0	Craigsville	1	1	0	38	42	40.375	15	31	M	SAFE	CAUTION	1369	
1/8/89	08:00 AM	0.04	Craigsville	1	1	0	36	61	40	15	31	M	SAFE	CAUTION	1369	
1/9/89	08:00 AM	0	Craigsville	1	1	0	34	45	38.5	10	31	M	SAFE	CAUTION	1369	
1/10/89	08:00 AM	0	Craigsville	1	1	0.5	29	40	38.375	10	31	M	SAFE	CAUTION	1369	
1/11/89	08:00 AM	0.08	Craigsville	1	1	0.5	26	49	36	10	31	M	SAFE	CAUTION	1369	
1/12/89	08:00 AM	0.24	Craigsville	1	1	0	38	47	37.875	10	31	M	SAFE	CAUTION	1369	
1/13/89	08:00 AM	0	Craigsville	1	1	0.5	23	55	36.125	10	31	M	SAFE	CAUTION	1369	
1/14/89	08:00 AM	0.14	Craigsville	1	1	0	18	32	35.625	10	32	M	SAFE	CAUTION	1369	
1/15/89	08:00 AM	0.07	Craigsville	2	2	0	29	61	39.625	5	32	N	SAFE	CAUTION	1369	
1/16/89	08:00 AM	0	Craigsville	1	1	0	25	46	41	5	32	N	SAFE	CAUTION	1369	
1/17/89	08:00 AM	0.21	Craigsville	1	1	0	21	53	42.625	5	32	N	SAFE	CAUTION	1369	
1/18/89	08:00 AM	0	Craigsville	1	1	0	24	58	41.25	5	32	N	SAFE	CAUTION	1369	
1/19/89	08:00 AM	0	Craigsville	1	1	0	42	59	39.125	5	32	N	SAFE	CAUTION	1369	
1/20/89	08:00 AM	0	Craigsville	1	1	0	33	51	37	5	32	N	SAFE	CAUTION	1369	
1/21/89	08:00 AM	0	Craigsville	1	1	0	23	40	37.875	5	32	N	SAFE	CAUTION	1369	
1/22/89	08:00 AM	0	Craigsville	1	1	0	17	48	42	5	32	N	SAFE	CAUTION	1369	
1/23/89	08:00 AM	0	Craigsville	1	1	0	23	61	45.75	5	32	N	SAFE	CAUTION	1369	
1/24/89	08:00 AM	0	Craigsville	1	1	0	27	64	47.25	5	32	N	SAFE	CAUTION	1369	
1/25/89	08:00 AM	0	Craigsville	1	1	0	34	62	46.375	5	33	N	SAFE	CAUTION	1369	
1/26/89	08:00 AM	0.01	Craigsville	1	1	0	39	56	47.625	5	33	N	SAFE	CAUTION	1369	
1/27/89	08:00 AM	0	Craigsville	1	1	0	40	56	49	5	33	N	SAFE	CAUTION	1369	
1/28/89	08:00 AM	0	Craigsville	1	1	0	26	58	49.875	5	33	N	SAFE	CAUTION	1369	
1/29/89	08:00 AM	0	Craigsville	1	1	0	36	70	53.875	0	33	N	SAFE	CAUTION	1369	
1/30/89	08:00 AM	0.03	Craigsville	1	1	0	44	62	56.25	0	33	N	SAFE	CAUTION	1369	
1/31/89	08:00 AM	0	Craigsville	1	1	0	38	65	57.125	0	33	N	SAFE	CAUTION	1369	
2/1/89	08:00 AM	0	Craigsville	1	1	0	42	74	52.625	0	33	N	SAFE	CAUTION	1369	
2/2/89	08:00 AM	0.03	Craigsville	1	1	0.2	48	76	45.25	0	32	N	SAFE	CAUTION	1369	
2/3/89	08:00 AM	0.03	Craigsville	1	1	0.2	40	73	39.375	0	32	N	SAFE	CAUTION	1369	
2/4/89	08:00 AM	0.03	Craigsville	1	1	0.2	27	40	34.125	0	32	N	SAFE	CAUTION	1369	
2/5/89	08:00 AM	0.17	Craigsville	1	1	0	28	31	33.75	5	31	N	SAFE	CAUTION	1369	
2/6/89	08:00 AM	0.06	Craigsville	1	1	0	28	48	32.125	5	31	N	SAFE	CAUTION	1369	
2/7/89	08:00 AM	0.02	Craigsville	1	1	0	27	44	28.75	5	31	N	SAFE	CAUTION	1369	
2/8/89	08:00 AM	0	Craigsville	1	1	0	25	39	29.25	5	31	N	SAFE	CAUTION	1369	
2/9/89	08:00 AM	0	Craigsville	1	1	0	15	29	30.625	10	31	M	SAFE	CAUTION	1369	
2/10/89	08:00 AM	0	Craigsville	1	1	0	14	37	31.875	10	31	M	SAFE	CAUTION	1369	
2/11/89	08:00 AM	0	Craigsville	1	1	0	22	53	36.125	10	30	M	SAFE	CAUTION	1369	
2/12/89	08:00 AM	0	Craigsville	1	1	0.5	25	50	42.375	10	30	M	SAFE	CAUTION	1369	
2/13/89	08:00 AM	0.22	Craigsville	1	1	0	23	31	44.875	10	30	M	SAFE	CAUTION	1369	
2/14/89	08:00 AM	0	Craigsville	1	1	0	28	57	46.125	10	31	M	SAFE	CAUTION	1369	
2/15/89	08:00 AM	0	Craigsville	1	1	0.2	46	79	42.75	5	31	M	SAFE	CAUTION	1369	

GOSHEN DAM HYDROLOGIC DATA AND GATE OPERATION LOG - (Hypothetical Example Data)

(NOTE: Rainfall and Temperature Data Taken From Actual 1989 Records at Resnoke Airport)

DATE	TIME	Previous 24-Hr. Rain. Amount (in.)	Source	Previous 5 Day Rainfall (in.)	Current 24-Hr Rainfall	Predicted 24-Hr Rainfall	Predicted Low Temp. (deg. F)	Predicted High Temp. (deg. F)	Predicted 4-Day Avg Temp. (deg. F)	% Ice Cover	Lake Temp. (deg. F)	Ice Near Gates (N.M.S)	Ice of Boom (N.M.S)	Gate Oper. Based on Rainfall	Condition Based on Ice Cover	Current Pool Elev. (ft.)	Gate Operations Performed, General Comments Concerning Gate Operation Decisions, or Observations Concerning Spillway Performance or Damage
2/19/89	08:00 AM	0.18	Craigsville	0.4	1	0.1	37	58	35.5	5	31	N	M	SAFE	CAUTION	1369	
2/17/89	08:00 AM	0.02	Craigsville	0.42	1	0.5	27	37	32	5	31	N	M	SAFE	CAUTION	1369	
2/18/89	08:00 AM	0.43	Craigsville	0.63	2	0	25	33	36.25	5	32	N	M	SAFE	CAUTION	1369	
2/19/89	08:00 AM	0	Craigsville	0.63	2	0	20	47	39.5	5	32	N	M	SAFE	CAUTION	1369	
2/20/89	08:00 AM	0	Craigsville	0.63	2	0.5	25	42	38.5	5	32	N	M	SAFE	CAUTION	1369	
2/21/89	08:00 AM	0.39	Craigsville	0.84	2	0.1	38	62	36.625	0	32	N	M	SAFE	CAUTION	1369	
2/22/89	08:00 AM	0.1	Craigsville	0.92	2	0.1	35	49	32.125	0	32	N	M	SAFE	CAUTION	1369	
2/23/89	08:00 AM	0.09	Craigsville	0.58	2	0	24	35	32.25	0	31	N	M	SAFE	CAUTION	1369	
2/24/89	08:00 AM	0	Craigsville	0.58	2	0	19	33	34.125	5	31	N	M	SAFE	CAUTION	1369	
2/25/89	08:00 AM	0	Craigsville	0.58	2	0	17	45	36.875	5	31	N	M	SAFE	CAUTION	1369	
2/26/89	08:00 AM	0	Craigsville	0.19	1	0.1	34	51	38.625	5	31	N	M	SAFE	CAUTION	1369	
2/27/89	08:00 AM	0.1	Craigsville	0.19	1	0.2	33	41	37.25	5	31	N	M	SAFE	CAUTION	1369	
2/28/89	08:00 AM	0.17	Craigsville	0.27	1	0	29	45	37.5	5	31	N	M	SAFE	CAUTION	1369	
3/1/89	08:00 AM	0	Craigsville	0.27	1	0	24	52	38.75	5	32	N	N	SAFE	CAUTION	1369	
3/2/89	08:00 AM	0	Craigsville	0.27	1	0.2	24	50	40.875	0	32	N	N	SAFE	CAUTION	1369	
3/3/89	08:00 AM	0.12	Craigsville	0.39	1	0.1	34	42	42	0	32	N	N	SAFE	CAUTION	1369	
3/4/89	08:00 AM	0.06	Craigsville	0.35	1	0.1	37	47	39.625	0	32	N	N	SAFE	CAUTION	1369	
3/5/89	08:00 AM	0.04	Craigsville	0.22	1	1	41	52	36.125	0	32	N	N	SAFE	CAUTION	1369	
3/6/89	08:00 AM	0.76	Craigsville	0.98	2	0	32	51	34.375	0	31	N	N	SAFE	CAUTION	1369	
3/7/89	08:00 AM	0	Craigsville	0.98	2	0	24	33	34.375	5	31	N	N	SAFE	CAUTION	1369	
3/8/89	08:00 AM	0	Craigsville	0.86	2	0	23	33	38.875	5	31	N	N	SAFE	CAUTION	1369	
3/9/89	08:00 AM	0	Craigsville	0.8	2	0	26	53	44.625	5	32	N	N	SAFE	CAUTION	1369	
3/10/89	08:00 AM	0	Craigsville	0.76	2	0	25	58	44.625	5	32	N	N	SAFE	CAUTION	1369	
3/11/89	08:00 AM	0	Craigsville	0	1	0	34	59	43.875	0	32	N	N	SAFE	CAUTION	1369	
3/12/89	08:00 AM	0	Craigsville	0	1	0.5	36	66	46.375	0	33	N	N	SAFE	SAFE	1369	
3/13/89	08:00 AM	0.3	Craigsville	0.3	1	0	34	45	46.375	0	33	N	N	SAFE	SAFE	1369	
3/14/89	08:00 AM	0	Craigsville	0.3	1	0.5	34	43	49.375	0	33	N	N	SAFE	SAFE	1369	
3/15/89	08:00 AM	0.28	Craigsville	0.58	2	0	40	73	55.125	0	35	N	N	SAFE	SAFE	1369	
3/16/89	08:00 AM	0	Craigsville	0.58	2	0	38	64	51.25	0	35	N	N	SAFE	SAFE	1369	
3/17/89	08:00 AM	0	Craigsville	0.58	2	0.1	31	72	46.875	0	35	N	N	SAFE	SAFE	1369	
3/18/89	08:00 AM	0.12	Craigsville	0.4	1	0	45	78	45.25	0	36	N	N	SAFE	SAFE	1369	
3/19/89	08:00 AM	0	Craigsville	0.4	1	0.5	32	50	40.25	0	36	N	N	SAFE	SAFE	1369	
3/20/89	08:00 AM	0.44	Craigsville	0.56	2	0.1	29	38	39.125	0	36	N	N	SAFE	SAFE	1369	
3/21/89	08:00 AM	0.12	Craigsville	0.68	2	0	38	52	41.5	0	36	N	N	SAFE	SAFE	1369	
3/22/89	08:00 AM	0	Craigsville	0.68	2	1	32	51	44.875	0	38	N	N	SAFE	SAFE	1369	
3/23/89	08:00 AM	0.6	Craigsville	1.16	3	0.2	33	40	49.25	0	38	N	N	SAFE	SAFE	1369	
3/24/89	08:00 AM	0.12	Craigsville	1.28	3	0	34	52	56.375	0	38	N	N	SAFE	SAFE	1369	
3/25/89	08:00 AM	0	Craigsville	0.84	2	0	41	76	63.375	0	38	N	N	SAFE	SAFE	1369	
3/26/89	08:00 AM	0	Craigsville	0.72	2	0	42	78	66.75	0	40	N	N	SAFE	SAFE	1369	
3/27/89	08:00 AM	0	Craigsville	0.72	2	0	50	80	69.25	0	40	N	N	SAFE	SAFE	1369	
3/28/89	08:00 AM	0	Craigsville	0.12	1	0	59	83	67.125	0	42	N	N	SAFE	SAFE	1369	
3/29/89	08:00 AM	0	Craigsville	0	1	0	62	82	59	0	42	N	N	SAFE	SAFE	1369	
3/30/89	08:00 AM	0	Craigsville	0	1	0	63	75	52.25	0	44	N	N	SAFE	SAFE	1369	
3/31/89	08:00 AM	0	Craigsville	0	1	0	42	71	50.125	0	44	N	N	SAFE	SAFE	1369	
4/1/89	08:00 AM	0	Craigsville	0	1	0	30	47	52.625	0	48	N	N	SAFE	SAFE	1369	
4/2/89	08:00 AM	0	Craigsville	0	1	0	30	60	56.75	0	48	N	N	SAFE	SAFE	1369	

GOSHEN DAM HYDROLOGIC DATA AND GATE OPERATION LOG - (Hypothetical Example Data)

(NOTE: Rainfall and Temperature Data Taken From Actual 1989 Records at Roanoke Airport)

DATE	TIME	Previous 24-Hr. Rain. Amount / Source (in.)	Current 5 Day Rainfall (in.)	Current 24-Hr Rainfall (in.)	Predicted Low (deg. F)	Predicted High (deg. F)	4-Day Avg Temp. (deg. F)	% Ice Cover	Lake Temp. (deg. F)	Ice Near Gates (N.M.S.)	Ice US of Boom (N.M.S.)	Gate Oper. Condition Based on Rainfall	Current Pool Elev. (ft.)	Gate Operations Performed, General Comments Concerning Gate Operation Decisions, or Observations Concerning Spillway Performance or Damage	
7/4/89	08:00 AM	1.54 / Craigsville	1.54	2	69	77	75.375	0	76	N	N	CAUTION	SAFE	1369	
7/5/89	08:00 AM	1.56 / Craigsville	3.1	3	67	75	76.375	0	76	N	N	WARNING	SAFE	1369.5	Lowered all gates 3 feet to elevation 1366 feet
7/6/89	08:00 AM	2.36 / Craigsville	5.46	3	0	70	85	77.125	0	76	N	SAFE	SAFE	1371	Lowered all gates one additional foot to elevation 1365 feet
7/7/89	08:00 AM	0 / Craigsville	5.46	3	0	70	90	77.75	0	76	N	SAFE	SAFE	1369.5	Gate stems for gates 5 and 6 damaged, leave all gates at elevation 1365 feet.
7/8/89	08:00 AM	0 / Craigsville	5.46	3	0.1	65	89	78.5	0	76	N	SAFE	SAFE	1369	
7/9/89	08:00 AM	0.04 / Craigsville	3.96	3	0	60	88	79	0	76	N	SAFE	SAFE	1366	
7/10/89	08:00 AM	0 / Craigsville	2.4	3	0	68	92	79.625	0	76	N	SAFE	SAFE	1365	
7/11/89	08:00 AM	0 / Craigsville	0.04	1	1	72	94	78	0	76	N	SAFE	SAFE	1365	
7/12/89	08:00 AM	1.27 / Radar	1.31	1	0.5	70	88	74.75	0	76	N	SAFE	SAFE	1365	
7/13/89	08:00 AM	0.12 / Radar	1.43	2	0	70	83	72.875	0	76	N	SAFE	SAFE	1365	
7/14/89	08:00 AM	0 / Radar	1.39	1	0.5	63	84	71.25	0	76	N	SAFE	SAFE	1365	
7/15/89	08:00 AM	0.41 / Radar	1.8	2	0.5	61	79	71.125	0	76	N	SAFE	SAFE	1365	
7/16/89	08:00 AM	0.46 / Radar	2.26	3	0.1	67	76	72	0	76	N	SAFE	SAFE	1365	
7/17/89	08:00 AM	0.02 / Radar	1.01	1	0	66	74	73.25	0	76	N	SAFE	SAFE	1365	
7/18/89	08:00 AM	0 / Radar	0.89	1	0	66	80	75.375	0	76	N	SAFE	SAFE	1365	
7/19/89	08:00 AM	0 / Radar	0.89	1	0	65	82	76.625	0	76	N	SAFE	SAFE	1365	
7/20/89	08:00 AM	0 / Radar	0.48	1	0	67	88	78.375	0	76	N	SAFE	SAFE	1365	
7/21/89	08:00 AM	0 / Radar	0.02	1	0	69	88	79.25	0	76	N	SAFE	SAFE	1365	
7/22/89	08:00 AM	0 / Radar	0	1	0	66	90	80.25	0	76	N	SAFE	SAFE	1365	
7/23/89	08:00 AM	0 / Radar	0	1	0	69	92	81	0	76	N	SAFE	SAFE	1365	
7/24/89	08:00 AM	0 / Radar	0	1	1	67	93	80.375	0	76	N	SAFE	SAFE	1365	Gate repairs complete, raise all gates back to normal pool elevation of 1369 feet
7/25/89	08:00 AM	0.78 / Radar	0.78	1	0.5	72	93	79.875	0	78	N	SAFE	SAFE	1366	
7/26/89	08:00 AM	0.31 / Radar	1.09	1	0.1	70	92	77.5	0	78	N	SAFE	SAFE	1367	
7/27/89	08:00 AM	0.03 / Radar	1.12	1	0	69	87	75.875	0	78	N	SAFE	SAFE	1367.5	
7/28/89	08:00 AM	0 / Radar	1.12	1	0	69	87	75.75	0	78	N	SAFE	SAFE	1367.5	
7/29/89	08:00 AM	0 / Radar	1.12	1	1	61	85	74.875	0	78	N	SAFE	SAFE	1367.5	
7/30/89	08:00 AM	0.9 / Radar	1.24	1	0.5	65	84	75.25	0	78	N	SAFE	SAFE	1368.5	
7/31/89	08:00 AM	0.29 / Radar	1.22	1	0	67	88	75.75	0	78	N	SAFE	SAFE	1369	
8/1/89	08:00 AM	0 / Radar	1.19	1	0	68	81	76.625	0	76	N	SAFE	SAFE	1369	
8/2/89	08:00 AM	0 / Radar	1.18	1	0	65	84	78.625	0	76	N	SAFE	SAFE	1369	
8/3/89	08:00 AM	0 / Radar	1.19	1	0	62	91	79.875	0	76	N	SAFE	SAFE	1369	
8/4/89	08:00 AM	0 / Radar	0.29	1	0	71	91	78.625	0	76	N	SAFE	SAFE	1369	
8/5/89	08:00 AM	0 / Radar	0	1	0	74	91	74.625	0	76	N	SAFE	SAFE	1369	
8/6/89	08:00 AM	0 / Radar	0	1	0	69	90	69.75	0	76	N	SAFE	SAFE	1369	
8/7/89	08:00 AM	0 / Radar	0	1	0	59	84	65.875	0	76	N	SAFE	SAFE	1369	
8/8/89	08:00 AM	0 / Radar	0	1	0	54	76	64.375	0	74	N	SAFE	SAFE	1369	
8/9/89	08:00 AM	0 / Radar	0	1	0	50	76	65.25	0	74	N	SAFE	SAFE	1369	
8/10/89	08:00 AM	0 / Goshen	0	1	0.1	50	78	67	0	74	N	SAFE	SAFE	1369	
8/11/89	08:00 AM	0.03 / Goshen	0.03	1	0	60	71	66.5	0	74	N	SAFE	SAFE	1369	
8/12/89	08:00 AM	0 / Goshen	0.03	1	0	59	78	71.125	0	74	N	SAFE	SAFE	1369	
8/13/89	08:00 AM	0 / Goshen	0.03	1	0.1	56	84	72.875	0	74	N	SAFE	SAFE	1369	
8/14/89	08:00 AM	0.08 / Goshen	0.11	1	0	65	83	74.5	0	74	N	SAFE	SAFE	1369	
8/15/89	08:00 AM	0.01 / Goshen	0.12	1	0	65	79	72.625	0	74	N	SAFE	SAFE	1369	
8/16/89	08:00 AM	0 / Goshen	0.09	1	0.5	64	87	72.75	0	76	N	SAFE	SAFE	1369	
8/17/89	08:00 AM	0.34 / Goshen	0.43	1	0.5	65	88	72.375	0	76	N	SAFE	SAFE	1369	
8/18/89	08:00 AM	0.56 / Goshen	0.99	1	0.1	64	69	72.875	0	76	N	SAFE	SAFE	1369	

GOSHEN DAM HYDROLOGIC DATA AND GATE OPERATION LOG - (Hypothetical Example Data)

(NOTE: Rainfall and Temperature Data Taken From Actual 1989 Records at Roanoke Airport)

DATE	TIME	Previous 24-Hr Rain. Amount (in.)	Source	Previous 5 Day Rainfall (in.)	Current AMC	Predicted 24-Hr Rainfall	Predicted Low (deg. F)	Predicted High (deg. F)	Predicted 4-Day Avg Temp. (deg. F)	% Ice Cover	Lake Temp. (deg. F)	Ice Near Gates (N.M.S)	Ice Near of Boom (N.M.S)	Gate Oper. Condition Based on Rainfall	Current Pool Elev. (ft.)	Gate Operations Performed, General Comments Concerning Gate Operation Decisions, or Observations Concerning Spillway Performance or Damage
8/19/89	08:00 AM	0.01	Goshen	0.92	1	0	64	81	75.875	0	78	N	N	SAFE	1369	
8/20/89	08:00 AM	0	Goshen	0.91	1	0.5	61	87	78.125	0	78	N	N	SAFE	1369	
8/21/89	08:00 AM	0.48	Goshen	1.39	1	0.1	69	88	79.5	0	78	N	N	SAFE	1369	
8/22/89	08:00 AM	0.08	Goshen	1.13	1	0.1	67	90	77.25	0	78	N	N	SAFE	1369	
8/23/89	08:00 AM	0.02	Goshen	0.59	1	0	70	93	76	0	78	N	N	SAFE	1369	
8/24/89	08:00 AM	0	Goshen	0.58	1	0.1	70	89	74.875	0	78	N	N	SAFE	1369	
8/25/89	08:00 AM	0.04	Goshen	0.62	1	0	67	72	74.5	0	78	N	N	SAFE	1369	
8/26/89	08:00 AM	0	Goshen	0.14	1	0	68	81	76.875	0	76	N	N	SAFE	1369	
8/27/89	08:00 AM	0	Goshen	0.06	1	0	70	84	78.125	0	76	N	N	SAFE	1369	
8/28/89	08:00 AM	0	Goshen	0.04	1	0	68	88	77.625	0	78	N	N	SAFE	1369	
8/29/89	08:00 AM	0	Goshen	0.04	1	0	67	91	76	0	76	N	N	SAFE	1369	
8/30/89	08:00 AM	0	Goshen	0	1	0	68	89	76	0	76	N	N	SAFE	1369	
8/31/89	08:00 AM	0	Goshen	0	1	0	62	88	73	0	76	N	N	SAFE	1369	
9/1/89	08:00 AM	0	Goshen	0	1	0	57	86	70.25	0	76	N	N	SAFE	1369	
9/2/89	08:00 AM	0	Goshen	0	1	0	70	88	68.875	0	76	N	N	SAFE	1369	
9/3/89	08:00 AM	0	Goshen	0	1	0	56	77	68.75	0	74	N	N	SAFE	1369	
9/4/89	08:00 AM	0	Goshen	0	1	0	53	75	67.25	0	74	N	N	SAFE	1369	
9/5/89	08:00 AM	0	Goshen	0	1	0.1	61	71	70.5	0	74	N	N	SAFE	1369	
9/6/89	08:00 AM	0.04	Goshen	0.04	1	0.2	63	78	73.5	0	74	N	N	SAFE	1369	
9/7/89	08:00 AM	0.2	Goshen	0.24	1	0	66	71	75.875	0	74	N	N	SAFE	1369	
9/8/89	08:00 AM	0	Goshen	0.24	1	0	67	87	78.375	0	74	N	N	SAFE	1369	
9/9/89	08:00 AM	0	Goshen	0.24	1	0	64	92	77.875	0	74	N	N	SAFE	1369	
9/10/89	08:00 AM	0	Goshen	0.24	1	0.1	66	94	77	0	74	N	N	SAFE	1369	
9/11/89	08:00 AM	0.07	Goshen	0.27	1	2	68	89	76.625	0	74	N	N	SAFE	1369	
9/12/89	08:00 AM	1.68	Goshen	1.75	2	0	68	81	76	0	74	N	N	SAFE	1369.2	
9/13/89	08:00 AM	0	Goshen	1.75	2	0.05	69	80	74.375	0	74	N	N	SAFE	1369	
9/14/89	08:00 AM	0.02	Goshen	1.77	2	2	70	87	72.5	0	74	N	N	CAUTION	1369	
9/15/89	08:00 AM	2.5	Goshen	4.27	3	2	67	85	69.25	0	72	N	N	CAUTION	1371	Lowered gates 3, 4, 5, 6, and 7 two feet to elevation 1367 feet
9/16/89	08:00 AM	1.38	Goshen	5.98	3	0	62	75	66.75	0	72	N	N	SAFE	1371	
9/17/89	08:00 AM	0	Goshen	3.9	3	0	58	76	66.25	0	72	N	N	SAFE	1369.5	Raised gates 3, 4, 5, 6, and 7 one foot to elevation 1368 feet
9/18/89	08:00 AM	0	Goshen	3.9	3	0	54	77	68.75	0	70	N	N	SAFE	1369	Raised gates 3, 4, 5, 6, and 7 back to normal pool elevation of 1369 feet
9/19/89	08:00 AM	0	Goshen	3.88	3	0.1	60	72	70.5	0	70	N	N	SAFE	1369	
9/20/89	08:00 AM	0.09	Goshen	1.47	2	0.1	63	70	69.25	0	70	N	N	SAFE	1369	
9/21/89	08:00 AM	0.08	Goshen	0.17	1	1	68	86	65.25	0	70	N	N	SAFE	1369	
9/22/89	08:00 AM	1.24	Goshen	1.41	2	0	70	75	58.625	0	70	N	N	SAFE	1369.5	
9/23/89	08:00 AM	0	Goshen	1.41	2	0	44	78	56.375	0	70	N	N	SAFE	1369	
9/24/89	08:00 AM	0	Goshen	1.41	2	1	37	64	54.75	0	68	N	N	SAFE	1369	
9/25/89	08:00 AM	0.9	Goshen	2.22	3	0.5	44	57	55.125	0	68	N	N	SAFE	1369.2	
9/26/89	08:00 AM	0.22	Goshen	2.36	3	0	53	74	57.875	0	68	N	N	SAFE	1369.5	
9/27/89	08:00 AM	0	Goshen	1.12	1	0	41	68	57.375	0	66	N	N	SAFE	1369.2	
9/28/89	08:00 AM	0	Goshen	1.12	1	0	36	68	58.75	0	66	N	N	SAFE	1369	
9/29/89	08:00 AM	0	Goshen	1.12	1	0.5	52	71	63.375	0	66	N	N	SAFE	1369	
9/30/89	08:00 AM	0.52	Goshen	0.74	1	2	59	64	64.625	0	64	N	N	SAFE	1369	
10/1/89	08:00 AM	1.54	Goshen	2.06	3	0.5	59	61	63.625	0	64	N	N	SAFE	1369.3	
10/2/89	08:00 AM	0.32	Goshen	2.38	3	0	60	81	62.75	0	64	N	N	SAFE	1369.5	
10/3/89	08:00 AM	0	Gate at Dam	2.38	3	0	56	77	62.5	0	64	N	N	SAFE	1369.2	

GOSHEN DAM HYDROLOGIC DATA AND GATE OPERATION LOG - (Hypothetical Example Data)

(NOTE: Rainfall and Temperature Data Taken From Actual 1989 Records at Roanoke Airport)

DATE	TIME	Previous 24-Hr Rain		Current 24-Hr Rainfall	Predicted 24-Hr Rainfall	Low (deg. F)	High (deg. F)	4-Day Avg Temp. (deg. F)	% Ice Cover	Lake Temp. (deg. F)	Ice Near Gates (N.M.S)	Ice US of Boom (N.M.S)	Gate Oper. Condition Based on Rainfall	Current Pool Elev. (ft.)	Gate Operations Performed, General Comments Concerning Gate Operation Decisions, or Observations Concerning Spillway Performance or Damage	
		Amount (in.)	Source													
11/19/89	08:00 AM	0	Craigsville	3.1	3	0	29	55	43.625	0	36	N	N	SAFE	1369	
11/20/89	08:00 AM	0	Craigsville	2.94	3	0	46	67	40.75	0	34	N	N	SAFE	1369	
11/21/89	08:00 AM	0	Craigsville	0.64	2	0.1	30	59	34.625	0	33	N	N	SAFE	1369	
11/22/89	08:00 AM	0.64	Craigsville	0.67	2	0	27	36	32.375	0	32	N	N	SAFE	1369	
11/23/89	08:00 AM	0.03	Craigsville	0.67	2	0	26	35	37.5	0	31	N	N	SAFE	1369	
11/24/89	08:00 AM	0	Craigsville	0.67	2	0	22	42	40.75	5	31	N	N	SAFE	1369	
11/25/89	08:00 AM	0	Craigsville	0.67	2	0	20	51	46.625	5	32	N	N	SAFE	1369	
11/26/89	08:00 AM	0	Craigsville	0.67	2	0	41	63	46.75	0	32	N	N	SAFE	1369	
11/27/89	08:00 AM	0	Craigsville	0.03	1	0	40	47	43.75	0	32	N	N	SAFE	1369	
11/28/89	08:00 AM	0	Craigsville	0	1	0	41	70	49.375	0	32	N	N	SAFE	1369	
11/29/89	08:00 AM	0	Craigsville	0	1	0	27	45	40	0	32	N	N	SAFE	1369	
11/30/89	08:00 AM	0	Craigsville	0	1	0	27	53	38.875	0	31	N	N	SAFE	1369	
12/1/89	08:00 AM	0	Craigsville	0	1	0	30	54	37.125	0	31	N	N	SAFE	1369	
12/2/89	08:00 AM	0	Craigsville	0	1	0	25	59	38.875	0	31	N	N	SAFE	1369	
12/3/89	08:00 AM	0	Craigsville	0	1	0	23	40	42.25	5	31	N	N	SAFE	1369	
12/4/89	08:00 AM	0	Craigsville	0	1	0	20	46	48.25	5	31	N	N	SAFE	1369	
12/5/89	08:00 AM	0	Craigsville	0	1	0	42	56	46	5	31	N	N	SAFE	1369	
12/6/89	08:00 AM	0	Craigsville	0	1	0	44	67	39.875	5	31	N	N	SAFE	1369	
12/7/89	08:00 AM	0	Craigsville	0	1	1	39	58	34.375	0	31	N	N	SAFE	1369	
12/8/89	08:00 AM	0.75	Craigsville	0.75	2	0	25	39	30.125	0	31	N	N	SAFE	1369	
12/9/89	08:00 AM	0	Craigsville	0.75	2	0	23	28	30.625	5	31	N	N	SAFE	1369	
12/10/89	08:00 AM	0	Craigsville	0.75	2	0	20	47	30.875	10	30	N	N	SAFE	1369	
12/11/89	08:00 AM	0	Craigsville	0.75	2	1	20	41	28.75	10	30	N	N	SAFE	1369	
12/12/89	08:00 AM	0.72	Craigsville	1.47	3	0.1	30	38	28.125	10	30	N	N	SAFE	1369.2	
12/13/89	08:00 AM	0.06	Craigsville	0.78	2	0	19	32	23.125	15	30	M	M	SAFE	1369.2	
12/14/89	08:00 AM	0	Craigsville	0.78	2	0	14	36	20.625	20	30	M	M	SAFE	1369	
12/15/89	08:00 AM	0.02	Craigsville	0.8	2	0	18	38	21	20	30	M	M	SAFE	1369	Begin lowering all gates due to projected cold temps. Lower all gates one foot to elevation 1367 feet
12/16/89	08:00 AM	0	Craigsville	0.8	2	0	8	20	20.375	25	30	M	M	SAFE	1366	Lowered all gates one foot to elevation 1367 feet
12/17/89	08:00 AM	0	Craigsville	0.08	1	0	7	24	23.125	30	30	M	M	SAFE	1367	Lowered all gates one foot to elevation 1366 feet
12/18/89	08:00 AM	0.02	Craigsville	0.02	1	0.1	19	34	24.125	35	30	S	S	SAFE	1366	Lowered all gates one foot to elevation 1365 feet
12/19/89	08:00 AM	0.06	Craigsville	0.08	1	0	18	33	18.875	50	30	S	S	SAFE	1365	Lowered all gates one foot to elevation 1364 feet
12/20/89	08:00 AM	0	Craigsville	0.06	1	0	17	33	14.75	55	30	S	S	SAFE	1364	Lowered all gates one foot to elevation 1363 feet
12/21/89	08:00 AM	0	Craigsville	0.06	1	0	8	31	12	60	30	S	S	SAFE	1363	Lowered gate #1 one foot to elevation 1362 feet, and guide pack ice over gate #1
12/22/89	08:00 AM	0	Craigsville	0.06	1	0	0	11	11.875	60	30	S	S	SAFE	1362.8	Lowered all gates 0.5 foot and continue to guide ice over spillway gate #1
12/23/89	08:00 AM	0	Craigsville	0.06	1	0	-2	20	17.625	100	30	S	S	SAFE	1362.5	Lowered all gates 0.5 foot and continue to guide ice over spillway gate #1
12/24/89	08:00 AM	0	Craigsville	0	1	0	0	28	20.75	100	30	S	S	SAFE	1362	Lowered all gates 1.0 foot and continue to guide ice over spillway gate #1
12/25/89	08:00 AM	0	Craigsville	0	1	0	11	27	26.125	100	30	S	S	SAFE	1361	Lowered gates #2 thru #10 one foot and gate #1 0.5 foot and continue to guide ice over gate #1
12/26/89	08:00 AM	0	Craigsville	0	1	0	20	37	30	100	30	S	S	SAFE	1360	Lowered gates #2 thru #10 0.5 foot to elevation 1359.5 foot
12/27/89	08:00 AM	0	Craigsville	0	1	0	14	29	34	100	30	S	S	SAFE	1359.5	
12/28/89	08:00 AM	0	Craigsville	0	1	0.1	27	44	39.625	100	30	S	S	SAFE	1359.5	
12/29/89	08:00 AM	0.02	Craigsville	0.02	1	0.1	21	48	40	100	30	S	S	SAFE	1359.5	Disconnected portion of debris barrier and guided pack ice over spillway
12/30/89	08:00 AM	0.06	Craigsville	0.06	1	1	34	55	40	90	30	S	S	SAFE	1359.5	Continue to guide pack ice over spillway
12/31/89	08:00 AM	0.91	Craigsville	0.99	2	0	37	51	40	80	30	S	S	SAFE	1359.5	Continue to guide pack ice over spillway