

Appendix C

Photographs (29)

STS

Brown Bridge Dam

STS Project No. 200802039



Photo 1 – 6-19-08 - View of left embankment dam and powerhouse/spillway structure from right abutment.



Photo 2 – 6-19-08 – View looking up left embankment from downstream edge of spillway. Seepage water is evident on the groundwater surface in this area.

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Brown Bridge Dam

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Photo 3 – 6-19-08 – Toe of natural soil to left embankment contact near end of spillway. Note soil erosion at toe of slope. Seepage flow was evident in this area and above.



Photo 4 – 6-19-08 – Close-up of seepage breakout near left downstream wingwall of the spillway.

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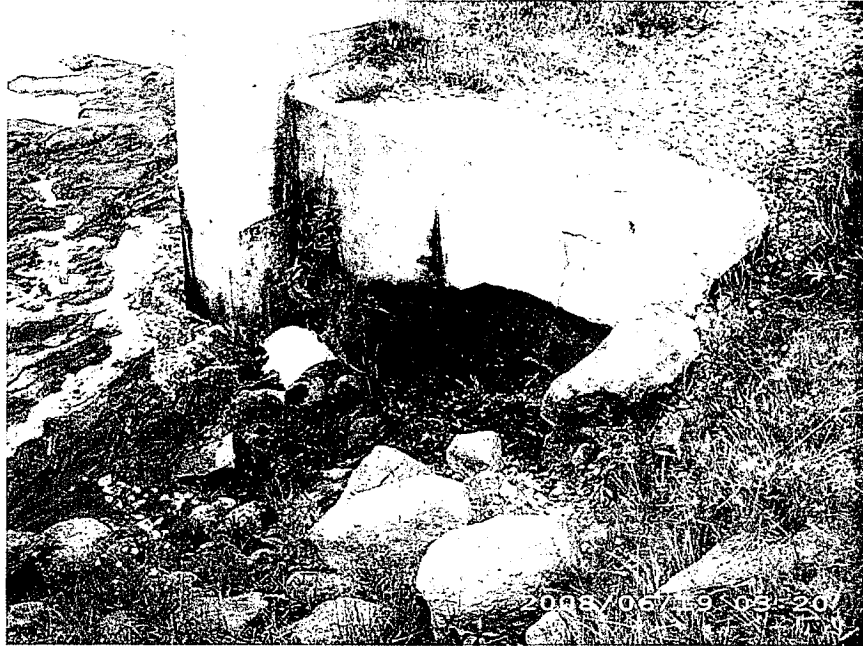


Photo 5 – 6-19-08 – Erosion at contact of left spillway training wall and left embankment toe.
Note seepage from below wall.



Photo 6 – 6-19-08 – View of right embankment from powerhouse.



Photo 7 – 6-19-08 – View looking right from spillway. Note that dark green grass identifies elevation where the phreatic surface is close or at the ground surface.



Photo 8 – 6-19-08 – View looking left from toe of right embankment. Note that dark green grass identifies elevation where the phreatic surface is close or at the ground surface.



Photo 9 – 6-19-08 – View of rebar probe and area where sand bags were used to confine a former seep. The seep was not flowing but wet.



Photo 10 – 6-19-08 – View of typical drain pipe along toe of right embankment. Note sand deposits within grass.

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Brown Bridge Dam

STS Project No. 200802039



Photo 11 – 6-19-08 – Looking right along toe of right embankment at the small seepage collection ditch.



Photo 12 – 6-19-08 – Typical condition of core wall.

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Brown Bridge Dam

STS Project No. 200802039



Photo 13 – 6-19-08 – View of downstream side of powerhouse/spillway structure and left and right embankments. Note upper spillway gates and log chute.

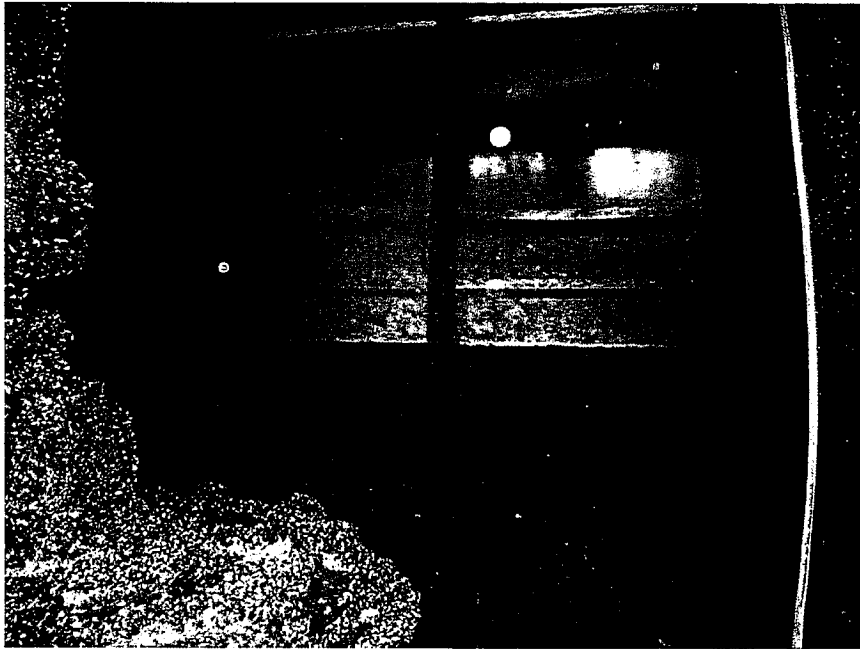


Photo 14 – 6-19-08 – View of head gate within left intake and top of turbine.

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Brown Bridge Dam

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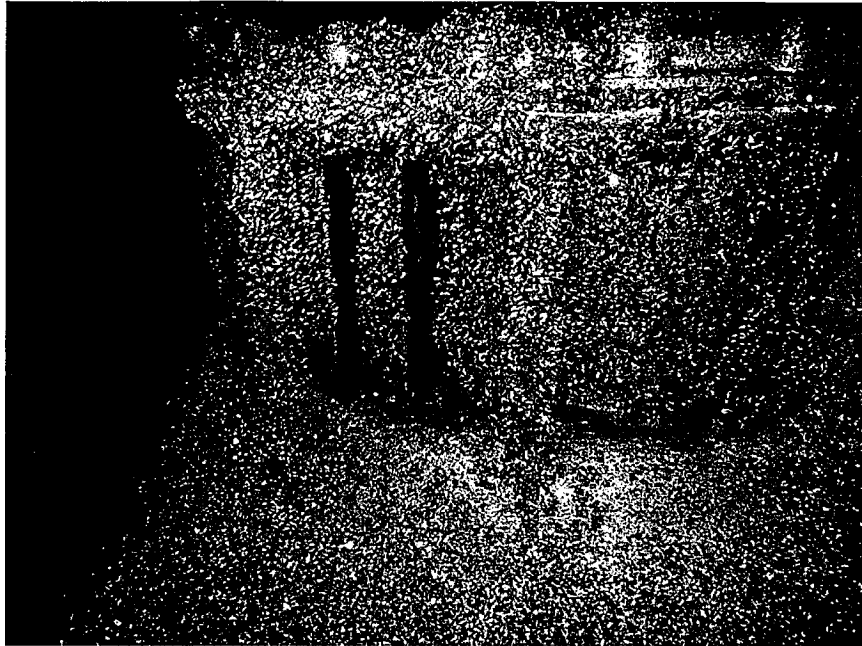


Photo 15 – 6-19-08 – View of wicket gates on right turbine. Note coating of zebra mussels.

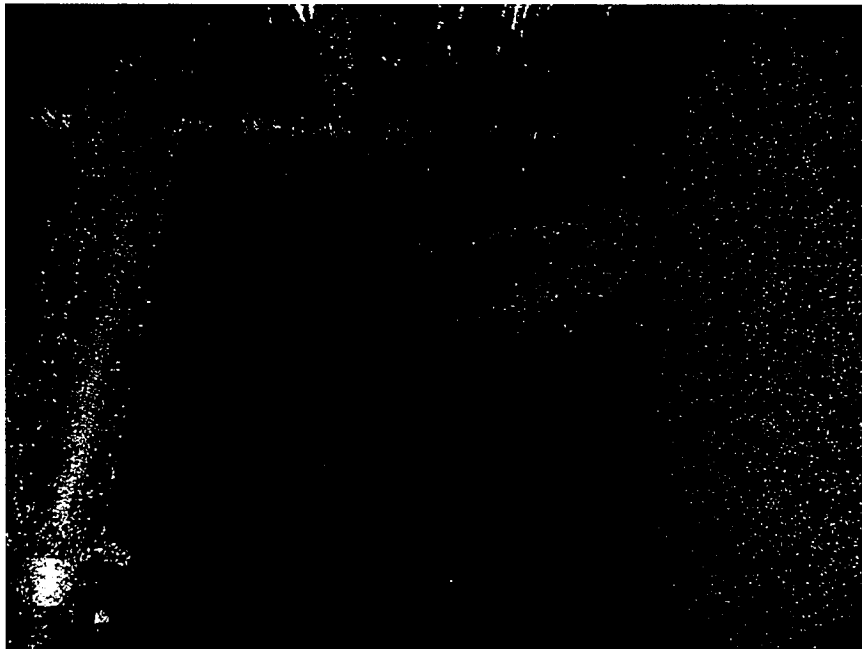


Photo 16 – 6-19-08 – View of lower tainter gate in right intake.
Note turbine shaft and coating of zebra mussels.

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Brown Bridge Dam
STS Project No. 200802039



Photo 17 – 6-19-08 – View of chipped out concrete indicating previous binding of right gate. Note chipping does not extend to stops, which may limit spillway capacity.



Photo 18 – 6-19-08 – View of upper spillway gate showing concrete deterioration near seal on right gate.



Photo 19 – 6-19-08 – View of downstream side of left gate showing typical concrete deterioration near side seals.

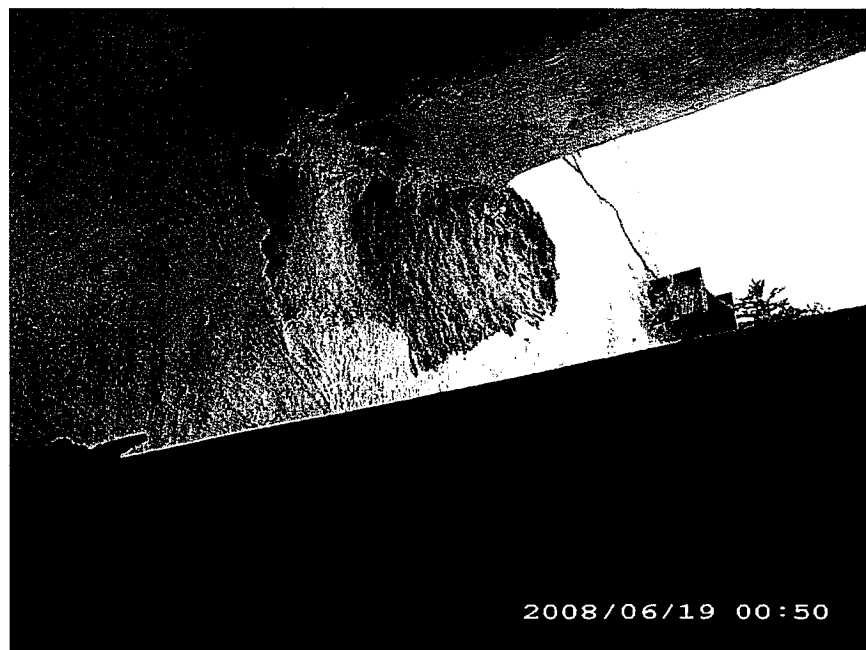


Photo 20 – 6-19-08 - View of chipped out concrete indicating previous binding of left gate. Note chipping does not extend to stops, which may limit spillway capacity.

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Brown Bridge Dam

STS Project No. 200802039

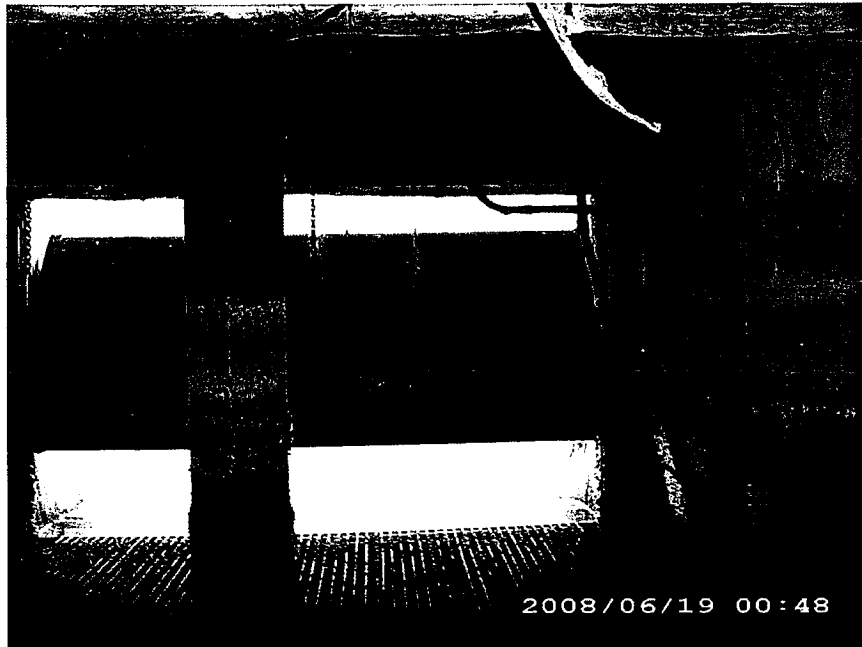


Photo 21 – 6-19-08 – View looking downstream at partially opened upper tainter gate.



Photo 22 – 6-19-08 – View of typical operating deck support beam. Note cracking indicating deep delaminations and presence of efflorescence.

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Photo 23 – 6-18-08 – Typical concrete deterioration on upstream side of head gate slot.



Photo 24 – 6-18-08 – Typical photo of deterioration observed at the water line downstream of trash racks.

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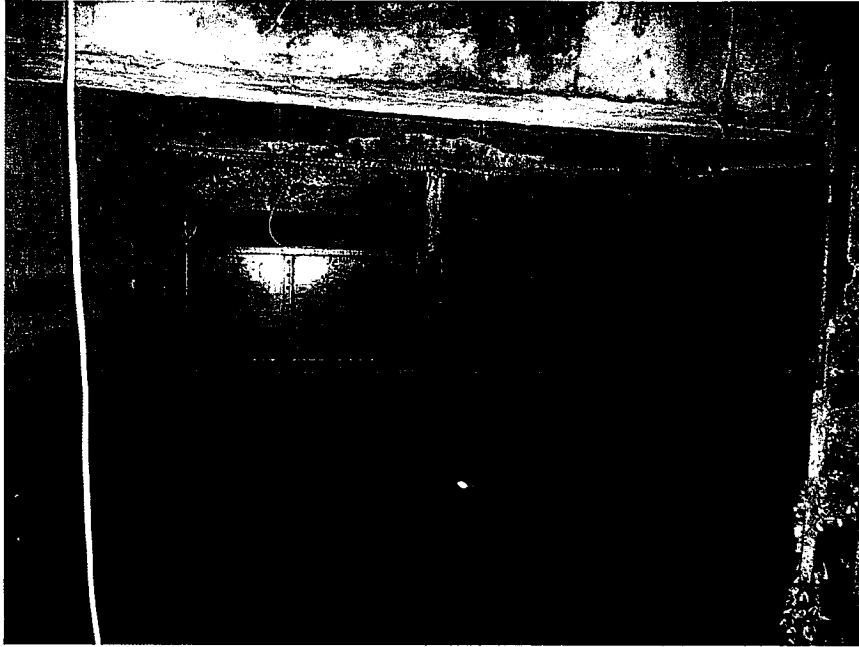


Photo 25 – 6-18-08 – View looking upstream at head gate in right bay.
Note cracking and efflorescence in beams.

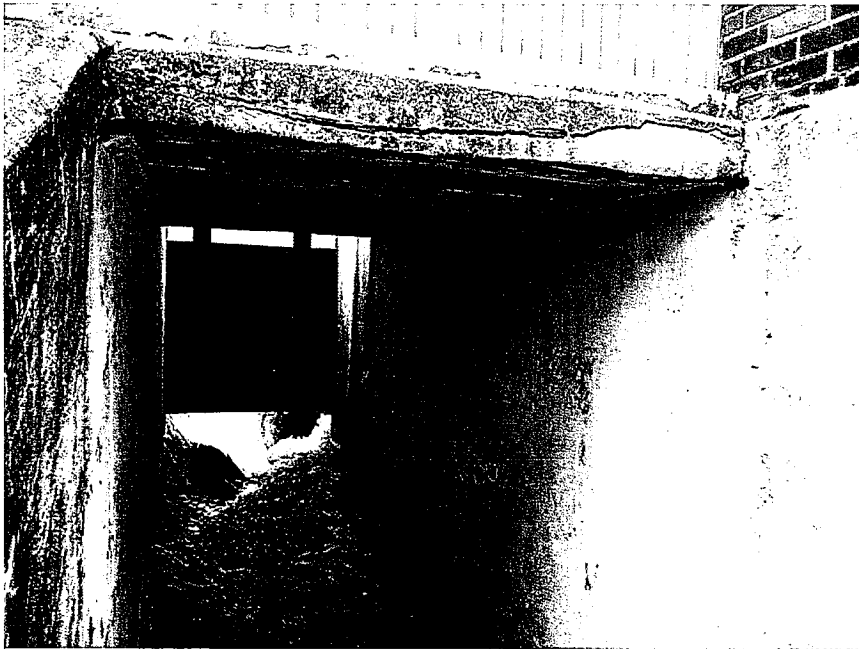


Photo 26 – 6-19-08 – View of log chute and sluice gate. Note deteriorated concrete slab.

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Brown Bridge Dam

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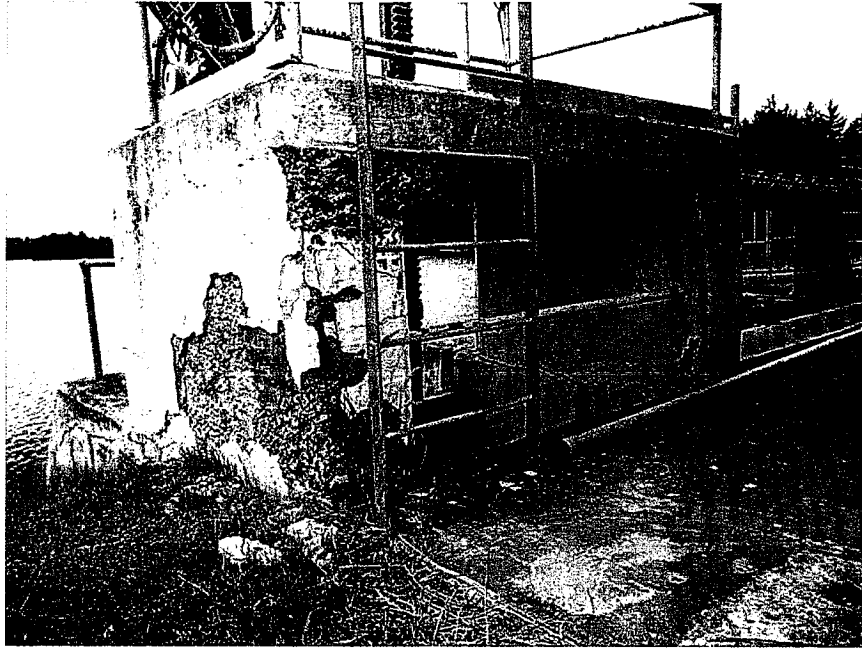


Photo 27 – 6-19-08 – Deteriorated concrete support for log chute gate hoist.

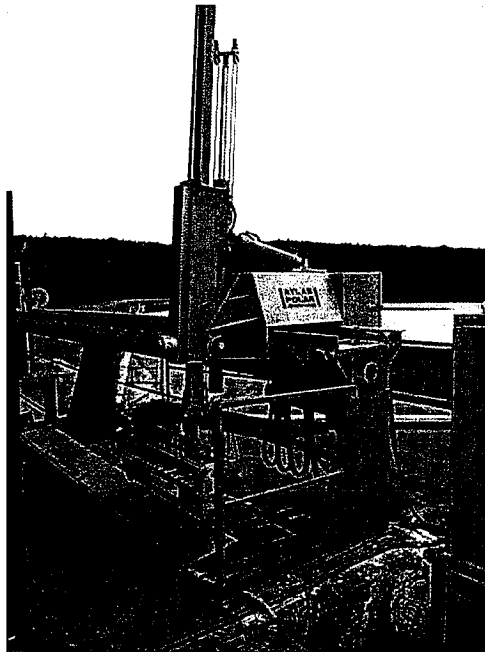


Photo 28 – 6-19-08 – Permanent trash rack rake equipment.

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Brown Bridge Dam

STS Project No. 200802039

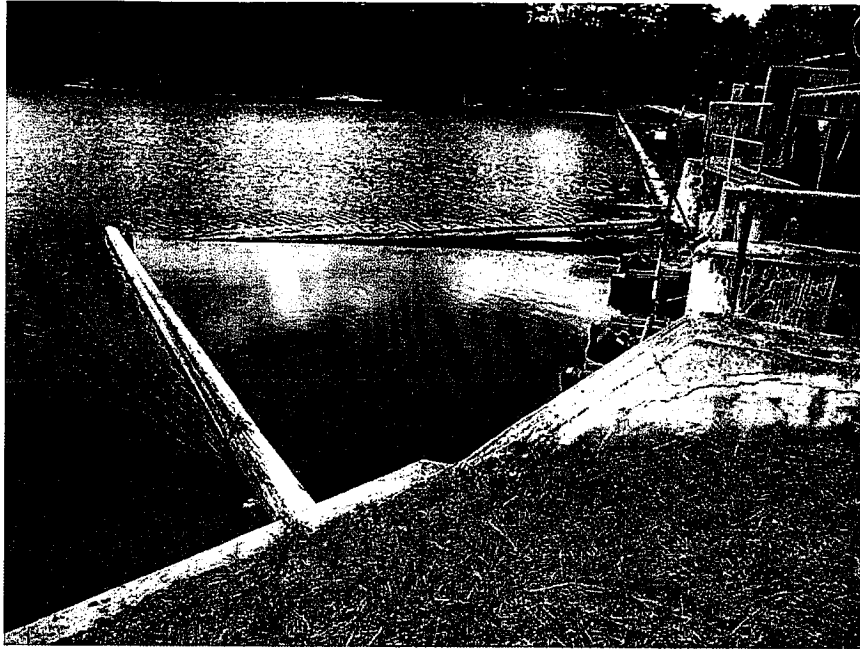


Photo 29 – 6-19-08 – Log booms form front of intake.

Appendix D

Hydrological Data

MDEQ Flood Discharge Request Record

Land and Water Management Division

Flood Discharge Request Record 20080188-4

6/17/2008

[Home](#) | [Water Management](#) | [Lowflows](#) | [Discharge Requests](#) | [Watersheds Map](#) |

Discharge Information

Watercourse: BOARDMAN RIVER

Location: Brown Bridge Dam

Basin Name: 09 - Boardman

County: Grand Traverse

Township: East Bay

Quad Name: Mayfield

Quad ID: L20NE

Requested By: Prein & Newhof

Request Type: Dam

File Number: 20080188-4

Drainage Area: 150.4 mi²Contributing Area: 121.23 mi²

Tn/Rng/Sec: 26N10W/15

Latitude: 44.64347262

Longitude: -85.50944665

Received Date: 5/27/2008

Issued Date: 6/5/2008

Reference Number: 544

Discharge Frequencies:

10%: 750 cfs

2%: 950 cfs

1%: 1000 cfs

0.5%: 1100 cfs

0.2%: 1300 cfs

Volume Frequencies:

1%:

0.5%:

Access to the Flood Flow Database is provided as a service to allow you to check the status of your flood flow requests or to view discharges from previous requests for preliminary design purposes. The discharges values are only valid for the original requestor and for one year after the original request date. To obtain discharge information from the Land and Water Management Division's Hydrologic Studies Unit (HSU), a flood flow [discharge request form](#) may be submitted electronically to the HSU. A written or email response to your request will be returned to you and must accompany your permit application.

Appendix E

Dam Inspection Checklist

VISUAL INSPECTION CHECKLIST

- 1. Name of Dam: *Brown Bridge Dam*
- 2. Inventory No.:
- 3. Hazard Category: *High*
- 4. Size Classification:
- 5. Owner: *TC*

- 6. Date Inspected: *6/18/08*
- 7. Pool Elevation: *-24" below NMP*
- 8. Tailwater Elevation:
- 9. Purpose of Dam: *Recreation - Former*
- 10. Weather: *hydro*
↳ P. Cloudy 65°

Directions: Mark an "X" in the "YES" or "NO" / column.
If item does not apply, write "N/A" in "REMARKS" columns.
Use "OTHER COMMENTS" space to amplify "REMARKS"

ITEM	YES	NO	REMARKS
RESERVOIR			
1. Any Upstream Development?		<input checked="" type="checkbox"/>	Inventory No.
2. Any Upstream Impoundments?		<input checked="" type="checkbox"/>	
3. Shoreline Slide Potential?		<input checked="" type="checkbox"/>	
4. Significant Sedimentation?		<input checked="" type="checkbox"/>	<i>None noted by divers.</i>
5. Any Trash Boom?	<input checked="" type="checkbox"/>		<i>Two logs in front of dam.</i>
6. Any Ice Boom?		<input checked="" type="checkbox"/>	<i>3' Trash racks don't go above HED</i>
7. Operating Procedure Changes?		<input checked="" type="checkbox"/>	<i>+ install a propeller device</i>
DOWNSTREAM CHANNEL			
1. CHANNEL			
a. Eroding or Backcutting?		<input checked="" type="checkbox"/>	
b. Sloughing?		<input checked="" type="checkbox"/>	
c. Obstructions?		<input checked="" type="checkbox"/>	
d. Bridging?		<input checked="" type="checkbox"/>	
2. DOWNSTREAM FLOODPLAIN			
a. Occupied Housing?	<input checked="" type="checkbox"/>		
b. Farming?		<input checked="" type="checkbox"/>	
c. Recreation Areas?	<input checked="" type="checkbox"/>		
d. Changed Hazard Potential?		<input checked="" type="checkbox"/>	
e. New Development?		<input checked="" type="checkbox"/>	<i>?? Unknown</i>
INSTRUMENTATION			
1. Are there			
a. Piezometers?	<input checked="" type="checkbox"/>		<i>Several</i>
b. Weirs?	<input checked="" type="checkbox"/>		<i>2</i>
c. Settlement Pins?	<input checked="" type="checkbox"/>		
d. Observation Wells?	<input checked="" type="checkbox"/>		
e. Other?	<input checked="" type="checkbox"/>		
2. Are readings			
a. Available?	<input checked="" type="checkbox"/>		
b. Plotted?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
c. Taken Periodically?	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<i>-Will get data from Robin</i>

ITEM	YES	NO	REMARKS
SPILLWAYS			TYPE: 2 upper gates + 2 lower gates + 1 flash shoot.
1. CREST			TYPE:
a. Any Settlements?		<input checked="" type="checkbox"/>	
b. Any Misalignments?		<input checked="" type="checkbox"/>	
c. Any Cracking?		<input checked="" type="checkbox"/>	
d. Any Deterioration?		<input checked="" type="checkbox"/>	
e. Exposed Reinforcement?		<input checked="" type="checkbox"/>	
f. Erosion?		<input checked="" type="checkbox"/>	
g. Silt Deposit Upstream?		<input checked="" type="checkbox"/>	
2. CONTROL STRUCTURES			TYPE:
a. Mechanical Equipment Operable?	<input checked="" type="checkbox"/>		
b. Are Gates Maintained?	<input checked="" type="checkbox"/>		Lower gates are not operated.
c. Will Flashboards Trip Automatically? <i>NA</i>			
d. Are Stanchions Trippable? <i>NA</i>			
e. Are Gates Remotely Controlled?	<input checked="" type="checkbox"/>		1st gate is remotely operated
3. STILLING BASIN			TYPE: Apron below tailwater
a. Any Cracking?		<input checked="" type="checkbox"/>	
b. Any Deterioration		<input checked="" type="checkbox"/>	
c. Erosion?		<input checked="" type="checkbox"/>	
d. Exposed Reinforcement?		<input checked="" type="checkbox"/>	
e. Seepage at Lift Lines or Joints?		<input checked="" type="checkbox"/>	
4. ENERGY DISSIPATORS <i>NA</i>			TYPE: None
a. Any Deterioration		<input checked="" type="checkbox"/>	
b. Erosion?		<input checked="" type="checkbox"/>	
c. Exposed Reinforcement?		<input checked="" type="checkbox"/>	
5. METAL APPURTENANCES			
a. Corrosion?		<input checked="" type="checkbox"/>	
b. Breakage?		<input checked="" type="checkbox"/>	
c. Secure Anchorages?	<input checked="" type="checkbox"/>		
6. EMERGENCY SPILLWAY			TYPE:
a. Adequate Grass Cover?	<input checked="" type="checkbox"/>		
b. Clear Approach Channel?	<input checked="" type="checkbox"/>		
c. Erodible Downstream Channel?		<input checked="" type="checkbox"/>	
d. Erodible Fuse Plug?	<input checked="" type="checkbox"/>		
e. Stable Side Slope?	<input checked="" type="checkbox"/>		
7. AIR BUBBLES <i>NA Use propellers</i>			

Other Comments:

ITEM	YES	NO	REMARKS
FILL DAMS			TYPE:
1. CREST			Inventory No.
a. Any Settlement?		X	Surveyors did checks every 50'
b. Any Misalignment?		X	
c. Any Cracking?		X	
d. Adequate Freeboard?	X		Fetch: < 1 mile
2. UPSTREAM SLOPE			
a. Adequate Slope Protection?	X		Type: Concrete wall
b. Any Erosion or Beaching?		X	
c. Trees Growing on Slope?		X	
d. Deteriorating Slope Protection?		X	
e. Visual Settlements?		X	
f. Any Sinkholes?		X	
3. DOWNSTREAM SLOPE			
a. Adequate Slope Protection?	X		Type: Grass
b. Any Erosion?		X	
c. Trees Growing on Slope?		X	Some no spots
d. Animal Burrows?		X	
e. Sinkholes?		X	Signs of ground loss - probably
f. Visual Settlement?		X	return - no subsidence found
g. Surface Seepage?		X	Along entire toe of Rt Dam
h. Toe Drains Dry?	X	X	→ Dry along toe of Lt Dam
i. Relief Wells Flowing?		X	
j. Slides or Slumps		X	
4. ABUTMENT CONTACTS			
a. Any Erosion?		X	
b. Seepage Present?	X	X	At Rt abutment
c. Boils or Springs Downstream?	X	X	Lots of flow to small cracks
5. FOUNDATION			Type: Clayey sandstone
a. If Dam Founded on Permafrost		X	
(1) Is Fill Frozen?	X		
(2) Are Internal Temperatures Monitored?			
b. If Dam Founded on Bedrock		X	Type:
(1) Is Bedrock adversely bedded?		X	
(2) Does Bedrock contain Gypsum?		X	
(3) Weak Strength Beds?		X	
c. If Dam Foundation Overburden			Type: Clayey sandstone
(1) Pipable?		X	
(2) Compressive?		X	
(3) Low Shear Strength?		X	

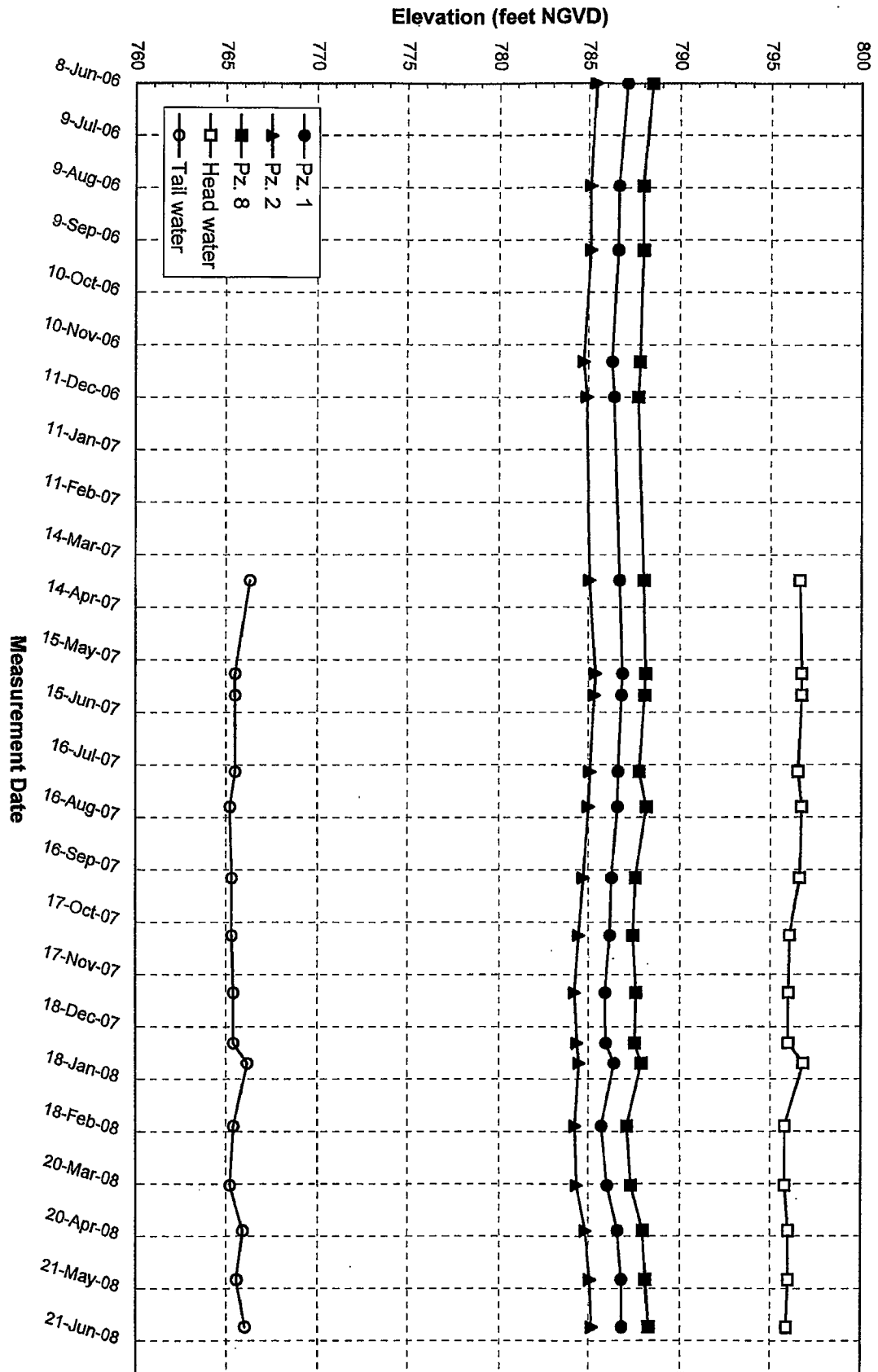
Other Comments:

ITEM	YES	NO	REMARKS
INTAKES / POWERHOUSE			
1. EQUIPMENT			
a. Trash Racks?	X		<i>Good condition per divers Manual</i>
b. Trash Rake?			
c. Mechanical Equipment Operable?	X		<i>Used both</i>
d. Intake Gates?	X		
e. Are Racks and Gates Maintained?	X		
f. Are Gate Operators Operable?	X		
2. CONCRETE SURFACES			
a. Any Cracking?		X	
b. Any Deterioration		X	
c. Erosion?		X	
d. Exposed Reinforcement?		X	
e. Are Joints Displaced?		X	
f. Are Joints Leaking?		X	
3. CONCRETE CONDUITS			
a. Any Cracking?		X	
b. Any Deterioration		X	
c. Erosion?		X	
d. Exposed Reinforcement?		X	
e. Are Joints Displaced?		X	
f. Are Joints Leaking?		X	
4. METAL CONDUITS			
a. Is Metal Corroded?		X	
b. Is Conduit Cracked?		X	
c. Are Joints Displaced?		X	
d. Are Joints Leaking?		X	
5. METAL APPURTENANCES			
a. Corrosion?		X	
b. Breakage?		X	
c. Secure Anchorages?	X		
6. PENSTOCKS			
a. Material Deteriorated?		X	TYPE MATERIAL:
b. Joints Leaking?		X	
c. Supports Adequate?	X		
d. Anchor Block Stable?	X		
7. POWERHOUSE WALLS			
			<i>Good condition</i>

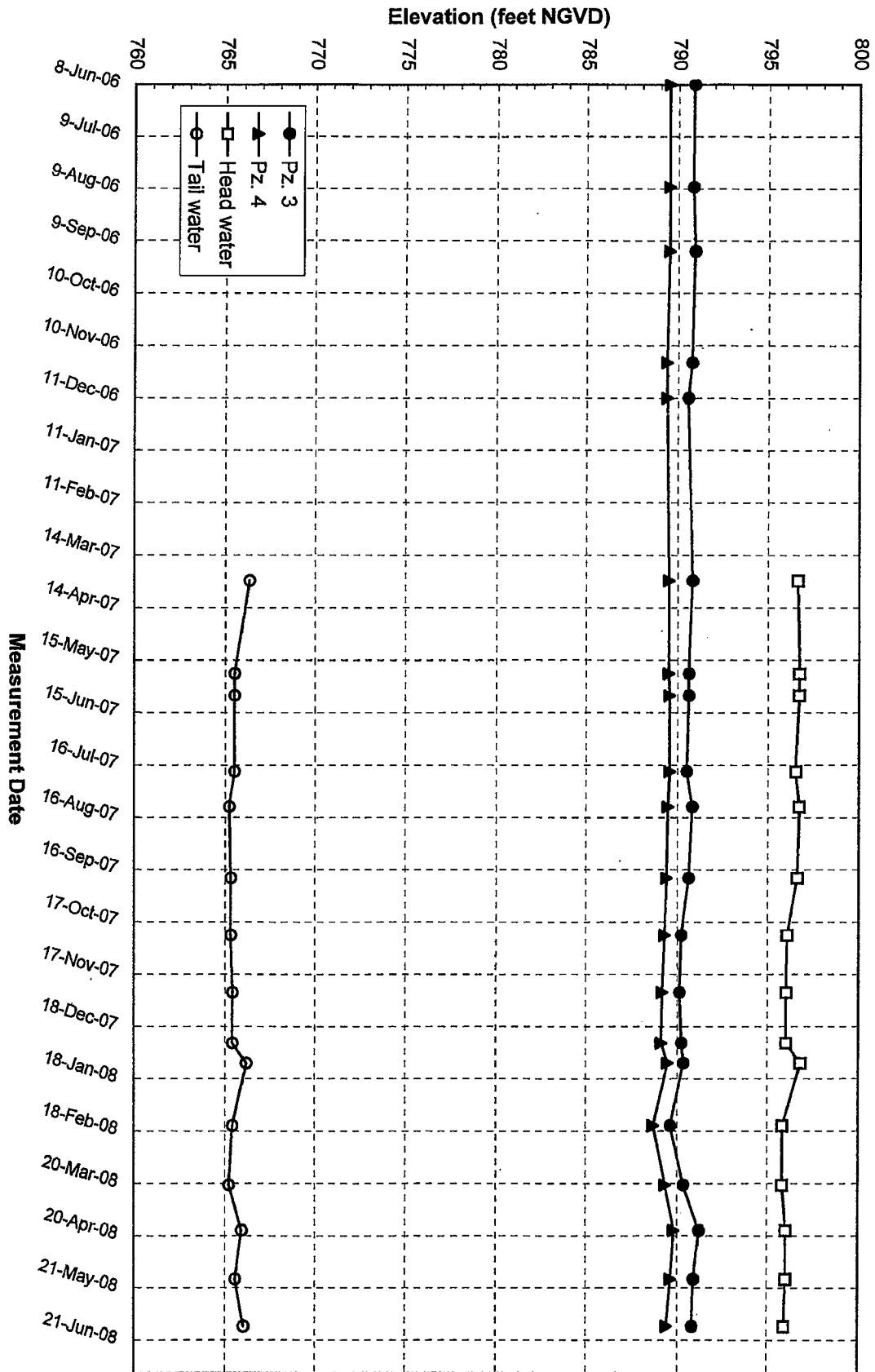
Other Comments:

Appendix F

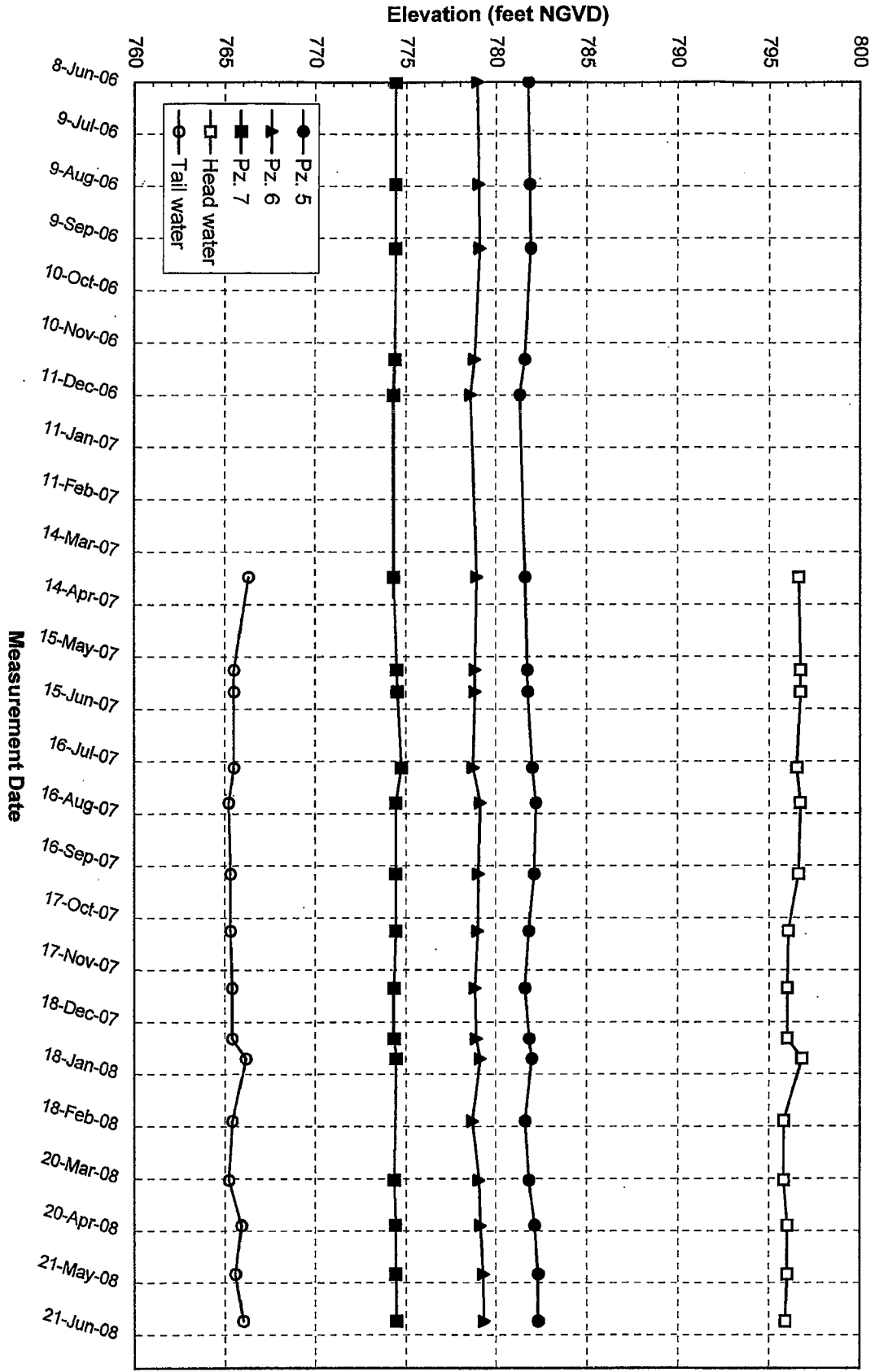
Control Point Survey, Bathymetric Soundings, Piezometer, and Weir Data



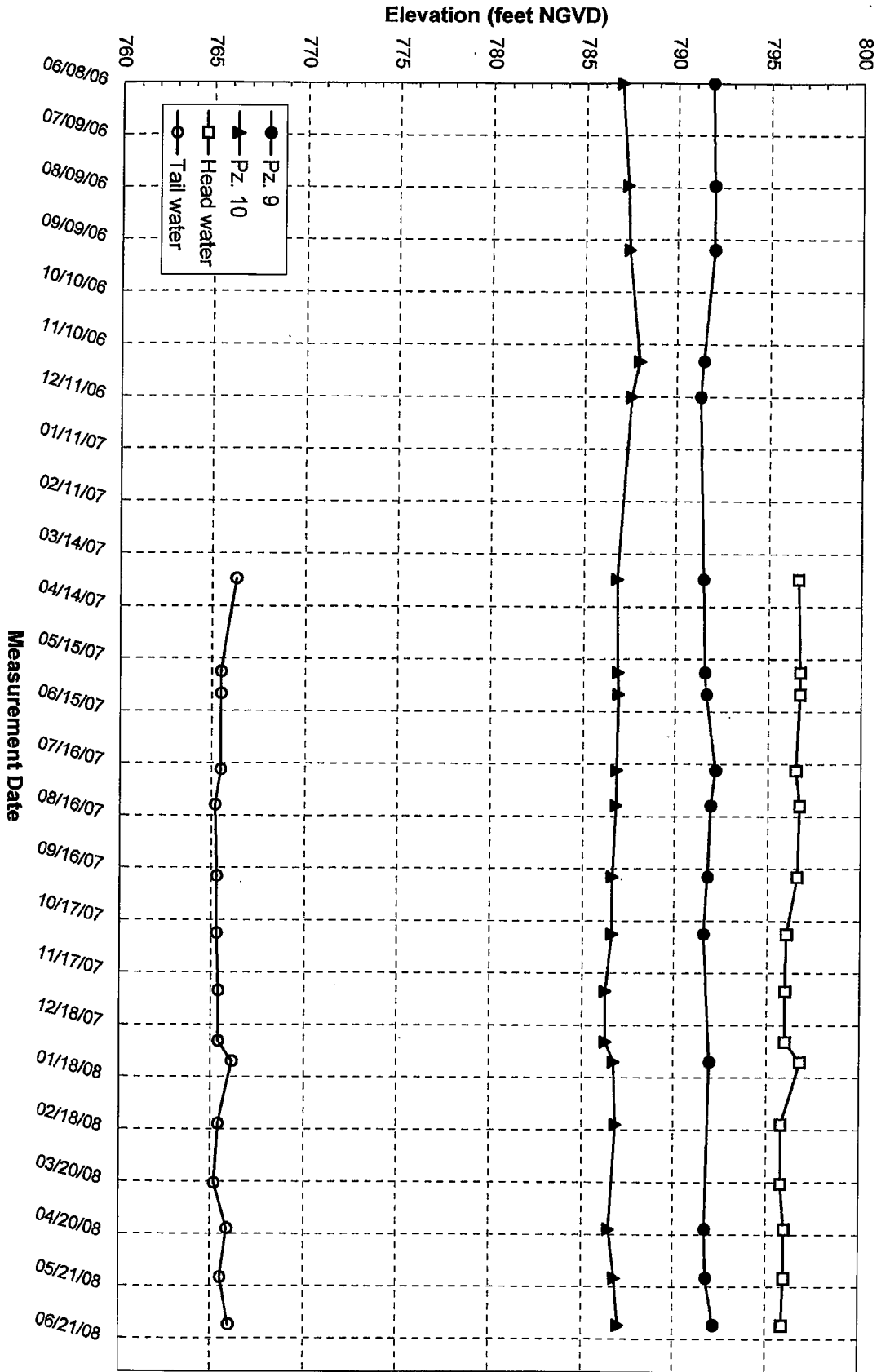
Time History Plot
(Piezometers 3, 4)

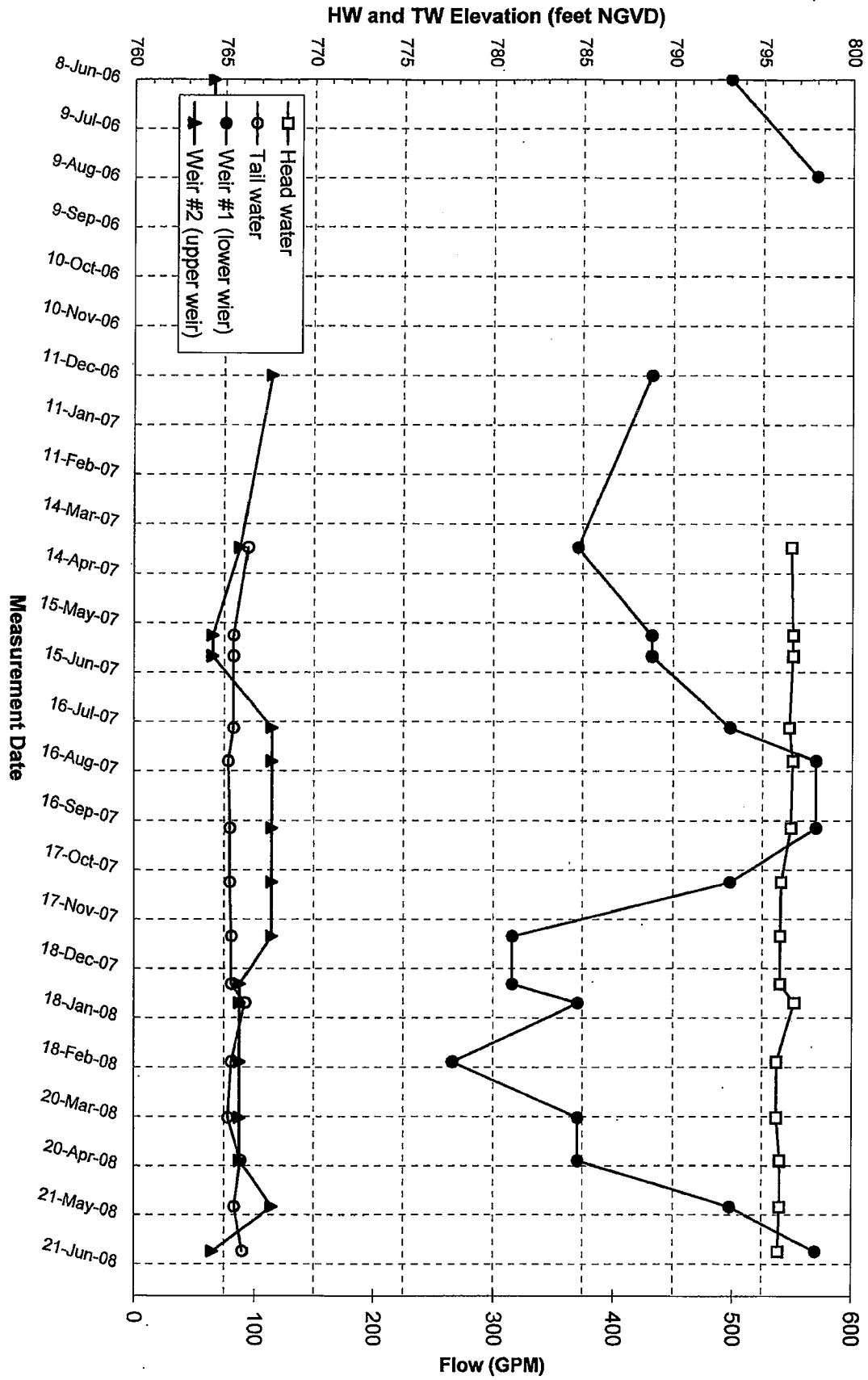


**Time History Plot
(Piezometers 5,6,7)**

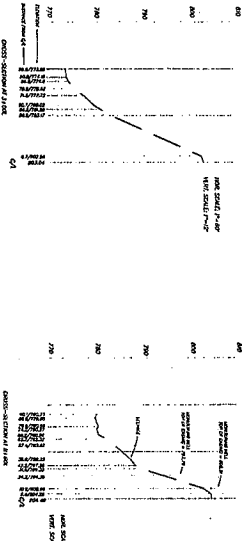
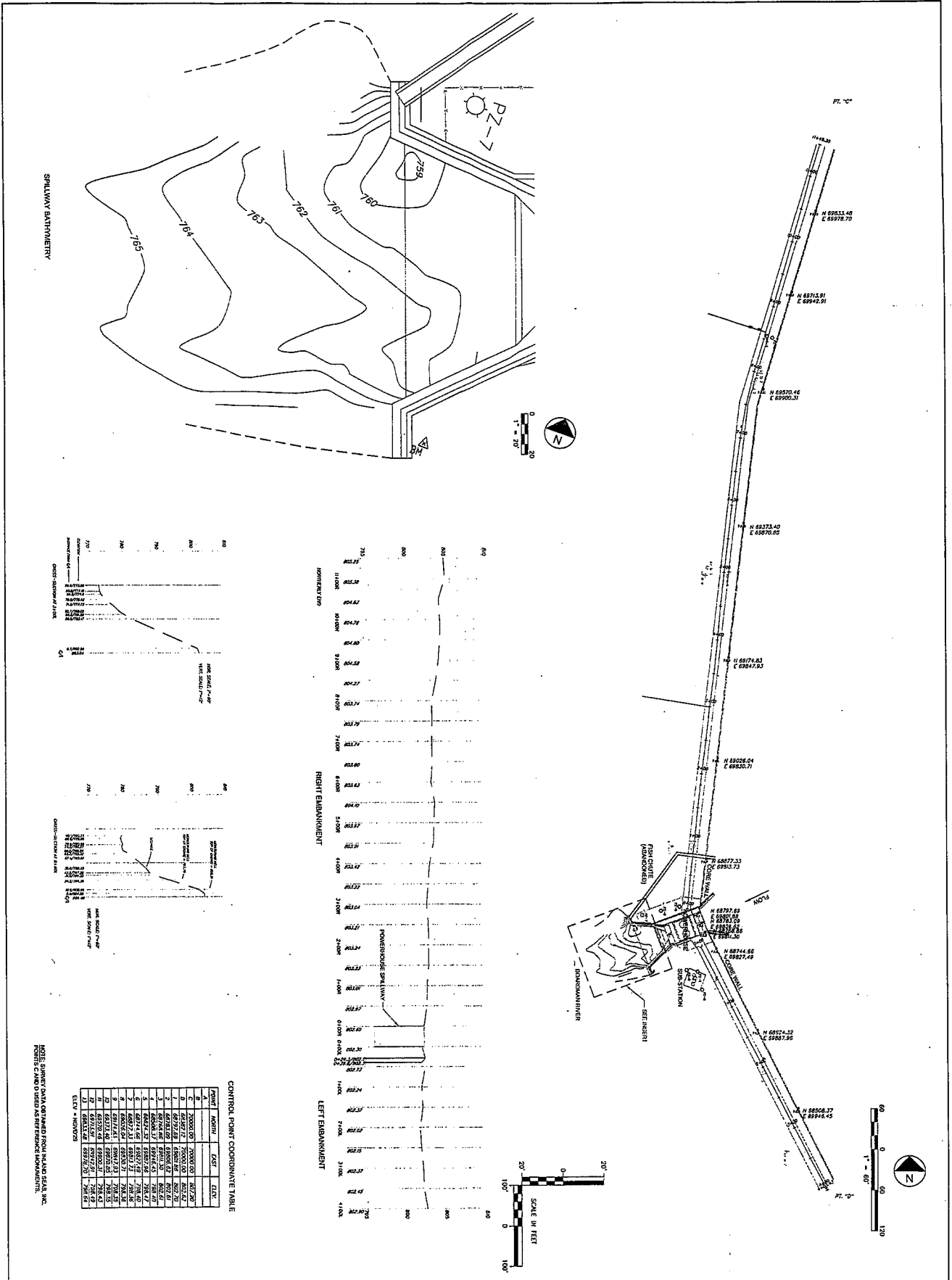


Time History Plot
(Piezometers 9, 10)





Time History Plot
(Upper and Lower Weirs)



CONTROL POINT COORDINATE TABLE

POINT	NORTH	EAST	ELEV.
A	6877.00	6892.00	700.00
B	6877.00	6892.00	700.00
C	6877.00	6892.00	700.00
D	6877.00	6892.00	700.00
E	6877.00	6892.00	700.00
F	6877.00	6892.00	700.00
G	6877.00	6892.00	700.00
H	6877.00	6892.00	700.00
I	6877.00	6892.00	700.00
J	6877.00	6892.00	700.00
K	6877.00	6892.00	700.00
L	6877.00	6892.00	700.00
M	6877.00	6892.00	700.00
N	6877.00	6892.00	700.00
O	6877.00	6892.00	700.00
P	6877.00	6892.00	700.00
Q	6877.00	6892.00	700.00
R	6877.00	6892.00	700.00
S	6877.00	6892.00	700.00
T	6877.00	6892.00	700.00
U	6877.00	6892.00	700.00
V	6877.00	6892.00	700.00
W	6877.00	6892.00	700.00
X	6877.00	6892.00	700.00
Y	6877.00	6892.00	700.00
Z	6877.00	6892.00	700.00

NOTES: POINT DATA OBTAINED FROM INLAND SURVEY INC.
POINTS C AND D USED AS BENCHMARK INDICATED.

PROJECT NUMBER
2008082039

DATE: 08/11/2008
DRAWN: JLS
CHECKED: JLS
APPROVED: JLS

STATION: 0+00

BROWN BRIDGE DAM
GRAND TRAVERSE COUNTY, MICHIGAN

CITY OF TRAVERSE CITY
PUBLIC SERVICES DEPARTMENT
625 WOODMERE AVE.
TRAVERSE CITY, MICHIGAN 49686

STS | AECOM

417.282.2500
WWW.STS-AECOM.COM

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G-01
SHEET NO. OF 11

Appendix G

Dive Inspection Report and DVD

Seaview

DIVING CONTRACTORS, INC.

Marine Construction

Diving Services

Potable Water

Wastewater Diving

Nuclear Diving

Underwater Cutting

Underwater Welding

Video Inspections

Pipe Penetrations

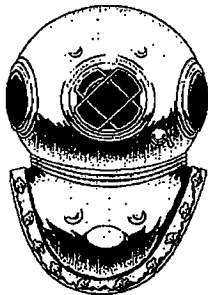
Concrete Restoration

Dam Repairs

Hydrographic Surveys

Zebra Mussel Control

Commercial Diving Report



www.seaviewdiving.com

N8867 County Road Y Seymour, WI 54165 920-833-7601 (Fax 920-833-7701)

Seaview Diving Contractors, Inc.

Pipelines * Construction * Burning & Welding * Salvage * Inspections * U/W Video * Concrete Repairs

N8867 County Road Y
Seymour, Wisconsin 54165
920-833-7601
Fax 920-833-7701
www.seaviewdiving.com

DATE: Tuesday June 24, 2008

SUBJECT: Commercial dive team to perform dam inspections for STS in Traverse City, Michigan on Tuesday, June 17 and Wednesday, June 18, 2008.

FOR: STS
Attn. Rick Anderson
2821 Dairy Drive Suite 5
Madison, WI 53718

BY: Seaview Diving Contractors, Inc.
N8867 County Road Y
Seymour, WI 54165
(920) 833-7601

JOB#: 2820

PO #: 200802039

PREPARED BY: Steve Haney
Commercial Diver

On Tuesday June 17th and Wednesday June 18th, 2008 Seaview Diving Contractors, Inc. reported for work with a three-man dive crew in Traverse City, Michigan. The scope of the job was to perform a video inspection on The Union Street Dam, and The Brown Bridge Dam.

Union Street Dam

On Tuesday morning Seaview met with our STS contact, Rick Anderson, and discussed how the inspection would be performed. After a dive station was mobilized, a commercial diver entered the water on the upstream side of the dam. The diver began the inspection by the fish ladder, and worked his way from left to right periodically testing the strength of the concrete with a chipping hammer. The diver reported the concrete to be in overall good condition with some zebra mussel coverage. Some minor cracks were found, (this can be seen in the video document provided.) Nothing seriously detrimental such as concrete spalling or rotting was discovered. The diver then surveyed the sheet piling and noted that it was in very good condition. After working his way over to the gate area the diver examined the trash racks, the gates, and the concrete bulkheads. The trash racks had some debris build up, but were in good working order. The diver reported that the gates appeared to be in sound condition with no major discrepancies, and the concrete bulkheads were in good condition as well. The diver also stated that no undermining was found through out the course of the upstream inspection. The upstream inspection was temporarily put on hold when the diver reached the live gates. After relocating over to the far left wall the diver examined the concrete by the spillway. The concrete was found to be in overall adequate condition, one small crack was found about 50 feet downstream on the far left wall. Moving in a clockwise direction the diver examined the spillway area reporting the stop logs were uncompromised and in good condition. The diver inspected the wall all the way around back to the fish ladder and relayed topside that the concrete was in good condition. After exiting the water the diver then moved to the downstream side. Starting by the fish ladder the diver discovered an area that was undermined approximately 5 feet wide by 2 feet deep. (This can also be seen via the video document provided.) The diver then proceeded to inspect the ten discharge pipes. We found these pipes to be corrugated and 48 inches in diameter. Most of the discrepancies found were minor such as coating delamination, and deteriorated expansion clamps. The discharge pipes were found to be sediment free, and the concrete in between the pipes was in good condition. ***The only major damage found was located in the 10th discharge pipe where a 2 foot breach about 10 feet from the end of the pipe was discovered. Sand was seen seeping in (please refer to the video document.)*** After inspecting the discharge pipes the diver moved downstream to check for undermining and reported that none was found. We then moved back upstream to conclude that part of the inspection. The diver stated that everything else on the upstream side was in good condition. The diver then exited the water and the Union Street Dam inspection was completed. ***On Thursday June 19th Seaview returned to install a neoprene seal over the compromised area in pipe #10. This seal was tightly secured by two expansion clamps***

that were carefully placed. After the installation was complete we video inspected the repair and found it to successfully seal the breached area.

Brown Bridge Dam

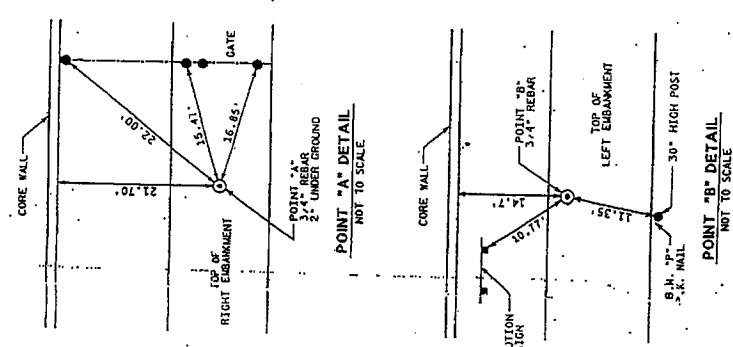
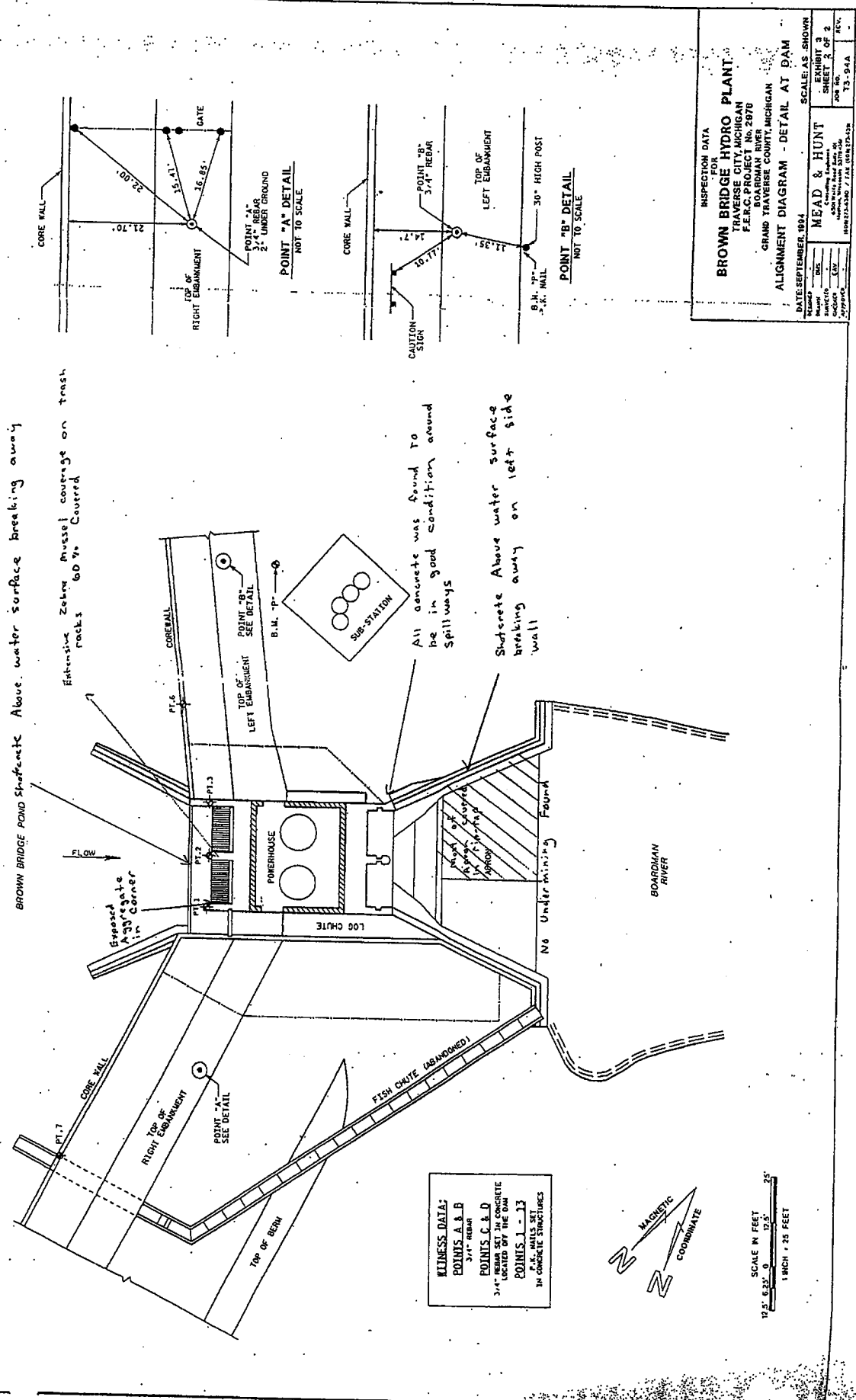
On Wednesday, June 18th Seaview again met with Rick Anderson to conduct a video inspection on the Brown Dam in Traverse City. After a dive station was set up, a commercial diver entered the water on the upstream side. Moving left to right the diver inspected the concrete and the trash racks. The diver found the concrete to be in good condition as he tested it with a chipping hammer. *Extensive zebra mussel coverage existed on the trash racks covering approximately 60% of the racks.* Some minor cosmetic discrepancies were found on the concrete above the surface of the water, where a spray on shotcrete had started to peel away. On the second trash rack in the far right corner a small void was found where some aggregate was exposed, but the concrete still appeared to be sound. The diver stated that no undermining was found, and the overall condition of the dam on the upstream side was very good. The diver then exited the water briefly, but re-entered after the logway gate was closed. He noted that all the concrete was in good condition with some zebra mussel coverage spread out sporadically. Some of the coating on the gate had peeled away but the gate was in good working order. The inspection on the upstream side was concluded and the diver relocated to the downstream side. The diver entered the water on the right side and worked his way left checking for undermining and concrete defects. Again the diver utilized a chipping hammer to periodically test the concrete strength. It was noted that the concrete around the two spillways was in excellent condition, and no undermining was found. After surveying the spillway area the diver moved downstream to inspect the left side wall, the concrete was found to be in good condition. Some of the shotcrete was breaking away above the water surface, but was not an area of concern. The diver then moved away from the wall to inspect the concrete apron. Although most of the apron was covered with rip-rap rock the diver found an exposed area on the right side and verified the concrete was in good condition, and no undermining existed. After examining the entire Brown Bridge Dam we determined the overall condition was very good. The inspection was concluded and the diver exited the water.

Recommendations

Although the overall condition of these dams was good Seaview Diving Contractors, Inc. recommends that annual inspections be performed. With heavy rainfall and the ice conditions in winter damage can occur quickly. Seaview would also recommend that the repair made in pipe #10 on the Union Street Dam be inspected in the near future to insure a proper seal is still obtained.

Seaview Diving Contractors, Inc. thanks you for the opportunity to service your underwater needs. Please call us at (920) 833-7601 with any questions or concerns you may have.

Figure 7.2



INSPECTION DATA

BROWN BRIDGE HYDRO PLANT

STATE OF MICHIGAN
TRAVERSE CITY, MICHIGAN
F.E.R.C. PROJECT No. 2878
BOARDMAN RIVER
GRAND TRAVERSE COUNTY, MICHIGAN

ALIGNMENT DIAGRAM - DETAIL AT DAM

DATE: SEPTEMBER, 1994

SCALE: AS SHOWN

MEAD & HUNT
Civil Engineering
1000 West Main Street
Traverse City, Michigan 49781-1500
Phone: (616) 933-2200
Fax: (616) 933-2200

DESIGNED BY	REV. 1	REV.
DRAWN BY	REV. 2	REV.
CHECKED BY	REV. 3	REV.
APPROVED BY	REV. 4	REV.
DATE	REV. 5	REV.
PROJECT NO.	REV. 6	REV.
SHEET NO.	REV. 7	REV.
TOTAL SHEETS	REV. 8	REV.

KINNESS DATA:
POINTS A & B
3/4" REBAR
POINTS C & D
3/4" REBAR
POINTS J & K
3/4" REBAR
IN CONCRETE STRUCTURES



SCALE IN FEET
1" = 25 FEET