WISCONSIN
DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

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November 22, 2004

Sue Black, Parks Director
Milwaukee County Park System
9480 Watertown Plank Road
Wauwatosa, WI 53226

Subject: Estabrook Dam, FF#40.08, Inspection Report

Dear Ms. Black:

Enclosed is a copy of the dam inspection report based on the Department of Natural Resources' inspection of the Estabrook Dam on October 27, 2004. The inspection report forms the basis for this Department dam safety report which identifies work that needs to be done on the dam and a schedule for when that work is to be completed. In our 1995 dam safety report to Milwaukee County, the Department estimated the Estabrook Dam to be a low hazard dam. We have no new information to date that would change this determination.

The following items need to be addressed:

1) The signing around the Estabrook Dam is inadequate per the requirements in Wisconsin Administrative Code NR 330. This deficiency was also noted in the 1995 dam safety report. At a minimum, the County needs to provide signs warning of the presence of the dam and directing people to a suitable portage route around the dam. We would also suggest that No Trespassing signs be strategically placed on the dam. I have enclosed a copy of NR 330 with this report. Proper signs must be installed by March 1, 2005.

2) All trees and shrubs must be removed from the area around the left and right abutments for the both the fixed crest spillway and gated sections of the dam. Removal is to include the complete removal of the stumps and the roots, filling the holes created with firmly compacted tight soils and adding topsoil and grass seed to stabilize the area. This problem and an explanation of its importance were discussed in the 1995 dam safety report. Department staff can assist the County in determining the extent of vegetation removal. Removal of the trees and shrubs must be completed by June 1, 2005.

3) There is extensive debris that must be removed from both the fixed crest spillway and the ice breakers upstream of the gated section of the dam (See photos #5, #6, #8 and #12 in the report). The debris appears to consist of large amounts of woody material (logs and large branches) but also a significant amount of man-made material (plastic bottles, tires, park table, etc.). The material will have to be mechanically removed and not burned off as was attempted a few years ago. Mechanical removal will most likely involve some dredging of the accumulated sediment in these areas. Since the Estabrook impoundment is contaminated with PCBs, sediment testing will be required to properly characterize the dredged material for disposal. The debris removal must be completed by December 31, 2005.

4) The ice breakers upstream of the gated section of the dam are very deteriorated (See photo #8 in the report). These structures must be removed or reconstructed by December 31, 2006. If removal is proposed, a structural analysis of the dam including ice and debris loading on the gated portion of the structure must be submitted to and approved by the Department prior to removal.

5) The gates on the dam require a variety of work. All the gates and their tracks are rusty and need to be sandblasted and cleaned. The gate seals should be cleaned or replaced as well. Gates #6 and #7 are currently inoperable and need to be repaired (See photos #3 and #4 in the report). There currently is no way to manually operate the gates. All of the gates must have a manual override. All of this work on the dam's gates must be completed by December 31, 2006.

6) Most of the piers on the upstream side of the gate section had gunite applied to them some years ago. This material is now spalling and appears saturated which means it no longer is bonding to the concrete piers (See photos #1 and #2 in the report). All of the piers need to have this material removed and be repaired with concrete. The concrete needs to be at least 6 inches thick and mechanically bonded to the piers. The capacity of the gate section may not be reduced as a result of this repair. This work needs to be completed by December 31, 2006.

7) The left and right abutments of the gate section of the dam have erosion on the upstream and downstream side that must be repaired. The repair must consist of excavating the area down to cohesive soils, placing firmly compacted tight soils to the desired elevation and stabilizing with riprap. The works needs to be done by June 1, 2005.

8) There are cracks in the structure of the gate section of the dam need further evaluation (See photo #11). The location of these cracks was noted on page of the attached inspection report. The structural integrity of the dam must be evaluated by a structural engineer. A structural analysis needs to be done by December 31, 2005 (see #4 for more information).

9) The stoplogs and their supports on the fixed crest spillway section of the dam need to be replaced. This work must be completed by December 31, 2005.

10) The concrete access stairs on the left and right ends of the gate section of the dam have deteriorated to the point where they are unsafe (See photo #10). These stairs must be rebuilt by December 31, 2005.

11) Given the age of the Estabrook Dam and the high flows on the Milwaukee River earlier this year, the County needs to provide the Department with a scour/undermining analysis of the dam. This analysis must be completed by December 31, 2005.

12) The Estabrook Dam needs to have a written plan for regular operation, inspection and maintenance (OIM Plan). Maintenance should include all of those areas identified on the "Dam Inspection Checklists" included with this report. An OIM plan must be developed for the dam by December 31, 2005.

In addition to working with Milwaukee County to address these issues with the Estabrook Dam, the Department will be working with the County to develop an operational order for the dam. Various individuals and municipalities have requested Milwaukee County to operate the Estabrook Dam in different ways over the years. Frequently these requests have been contrary to each other and have caused environmental harm to the Milwaukee River. Based on this history, the Department will be working with Milwaukee County to establish an official operational order for the dam.

Linked to the issues with the Estabrook Dam and the establishment of an operational order is the contaminated sediment in the Estabrook Dam impoundment. Any long term decisions regarding the dam and any conditions in an operational order must reflect how the contaminated sediment in the impoundment is to be remediated. Past studies of the impoundment by USGS and Baird & Associates have demonstrated that contaminated sediment moves downstream of the dam every time the gates are opened. The Department is currently finalizing a pre-remediation report of the Estabrook impoundment which characterized the sediments and estimated volumes for removal and remediation. We will provide Milwaukee County with a copy of this report once it is finalized.

The Department looks forward to working with Milwaukee County in addressing the issues with the Estabrook Dam and developing a plan to address the contaminated sediment in the impoundment. Hopefully we can create a project that will improve the environmental health of the Milwaukee River and increase the recreational opportunities along its corridor. If you have any questions, please call me at (414) 263-8652. Thank you.

Sincerely,

Michael J Bruch, Jr.
Water Management Engineer

c: Jack Takerian – Milwaukee County Parks, Chief of Operations
Greg High – Milwaukee County Parks, Director AE&ES Section
Bill Sturtevant – WDNR/GEF2
Jim Schmidt – WDNR/SER HQ

Name of Dam: ESTABROOK DAM			**Date:** 10-27-2004
Inspectors: MJR & WDS			**F.F #:** 40.08
Owner's Name: MILWAUKEE COUNTY			**Key Seq #:** 857
Street:			
City, State, Zip Code:			
County: MILWAUKEE		**Phone:**	
Weather and Site conditions: PARTLY CLOUDY, 50's		**Email:**	

GENERAL

	Item	N	Notes/ Observations	Action M	Action I	Action R
1	**Monuments/Benchmarks** Location: Elevation:		File indicates multiple benchmarks. These were not verified during this inspection.			
2	**Pool Level** Normal/Operating: Maximum: Minimum:	X	Impoundment was drawn down. Currently there is no operational order for this dam.			
3	**Access Road**	X	There is adequate access on the north river bank but the County has no access on the south river bank.			
4	**Signage/ Security**	X	-No signage noted except for gate operation.			1
	Portage:		- Dam warning and portage signs need to be installed.			
	Dam Warning:					
	Downstream Hazard:					
	Fencing/Railings/Catwalks:	X	- Dam is reasonably secure.			
5	**Hazard Section**	X				
	A. D/S Development Density: Distance: Type (Residential, Commercial, Industrial):		Milwaukee River coordor D/S of Estabrook is almost entirely park land until downtown Milwaukee. Lake Michigan controls water levels once in the downtown area.			
	B. Channel Crossing Type: Dimensions: D/S distance: Traffic Level (Local, CTH, Rail Road, STH, Interstate, etc):	X	Bridge, Ford, Culvert, Trestle, Other (Explain) (Circle One) Only large bridges well above the floodplain are D/S of Estabrook Dam.			
	C. Distance to nearest D/S community/impoundment: Name:	X	No impoundments D/S since North Ave. Dam was removed.			
	D. Estimated Hazard (based on landuse):	X	Dam was assigned a low hazard rating in our 1995 inspection due to dam submergence during a 100-year flood.			

N = Noted; M= Monitor
I= Investigate; R= Repair
F.F.= Field File; RT = Right; LT = Left
U/S = Upstream; D/S = Downstream

Action Suggestion 1. Requires immediate action
2. Plan to do soon
3. Do when convenient

Additional Comments:

Concrete access stairs on the left and right ends of the gate section have deteriorated to the point of being unsafe and need to be rebuilt.

EMBANKMENTS

Description: Earthen left embankment, earth & rock central island, natural riverbank on right

	Item	N	Location on Embankment and Deficiency	Action M	Action I	Action R
1	**Vegetation:**		No problem			
	A. Trees Quantity (<5,sparse,dense): Diameter: Location:	X	- Small trees and shrubs on left embankment but only on the riverbank, the rest is an access road. - Some trees on center island near concrete abutments will have to be removed.			X
	B. Brush Quantity (sparse,dense): Location:	X	- Some on left embankment and center island will have to be removed.			X
	C. Ground cover Type (grass, crown vetch,other): Quantity (bare, sparse,adequate, dense): Appearance (too tall, too short, good):	X	Very little groundcover			
2	**Erosion**		No problem / Not applicable / Could not inspect			
	A. Wave erosion (Beaching): Scarp: Length/ Width: Location:	X	No wave erosion noted. Riverbanks are bare due to impoundment being drawn down each year.	X		
	B. Runoff Erosion (Gullies) Quantity: Length/ Width/ Depth: Location:	X	- Erosion on left embankment where it meets the left concrete abutment both U/S and D/S. - Erosion on left side of center island where it meets the right abutment of the gate section.			X
3	**Instabilities**		No problem / Not applicable / Could not inspect			
	A. Slides Transverse: Longitudinal: Scarp: Length/ Width: Crack Length/ Width:		NONE OBSERVED			
	B. Cracks: Transverse: Longitudinal: Length/ Width/ Depth: Location: Other:		NONE OBSERVED			
	C. Bulges/ Depressions Size: Height/ Depth:		NONE OBSERVED			
	D. Slope (Too Steep) U/S, D/S	X	Slope of embankments adjacent to concrete abutments is steep and may need riprap to stabilize.			X

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Action Suggestion
1. Requires immediate action
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Additional Comments:

EMBANKMENTS (Cont.)

	Item	N	Notes/ Observations	Action M	Action I	Action R
4	**Slope Protection**		No problem ☐ Not applicable ☐ Could not inspect ☐			
	A. Type (none, riprap, wave berm, concrete slabs, loose formed concrete/asphalt):	X	Mainly riprap or natural vegetation.			
	B. Condition:	X	Adequate on center island, may need additional riprap on left embankment.		X	
5	**Other**		No problem ☐ Not applicable ☐ Could not inspect ☐			
	A. Rodent burrows (few, many) Location:		NONE OBSERVED			
	B. Ruts Length/ Width/ Depth: Location:	X	Minor ruts in road over left embankment.		X	
	C. Other					
6	**Alignment**	X	No problem ☐ Not applicable ☐ Could not inspect ☐			
	A. Vertical Low area: Elevation Difference: Location:		NO PROBLEMS OBSERVED			
	B. Horizontal					
	C. Width Too narrow: Location:					
7	**Toe**	X	No problem ☐ Not applicable ☐ Could not inspect ☐			
	Cracks/Slumps: Embankment drains: Type/Flow: Location: Seepage/ Wetness: Hummocky:		NO PROBLEMS OBSERVED			
8	**Seepage**	X	No problem ☐ Not applicable ☐ Could not inspect ☐			
	Wet area: Boil: Sinkhole: Aquatic vegetation: Rust colored deposits: Other: Sediment in Flow: Flowrate: Location:		NONE OBSERVED			

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Action Suggestion 1. Requires immediate action
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3. Do when convenient

Additional Comments:

SPILLWAY--PRINCIPAL - FIXED CREST				Action		
Item	N	Notes/ Observations		M	I	R
1 **Fixed Crest**		No problem	Not applicable / Could not inspect			
A. Dimensions Top Width:		Did not measure.				
B. Materials	X	Concrete with a flashboard section.				
C. Shape (sharp-crested, broad-crested, ogee, chute, gated, overflow, morning glory, dropbox, labyrinth)	X	Very sinuous overflow weir				
D. Debris Prevention (racks, booms, etc.):	X	Massive amount of debris trapped U/S of the spillway. Major clean out needed.				X
E. Concrete Condition *	X	D/S face and crest appear to be in fair condition. U/S face covered by debris so we could not inspect.			X	
F. Flashboards (none, number):	X					X
Type (Metal, wood):		WOOD				
Dimensions:						
Operability:		? Have not been operated since 1994 according to County staff. Appear to need replacement.				
G. Abutments	X	Spillway is tied into riverbank on the right and the center island on the left. No problems observed at these points.		X		
Condition: *						
Seepage/wetness:						
H. Drains		No problem	Not applicable / Could not inspect			
Type; Weep holes/ Relief drains/ Other:	X	NONE OBSERVED				
Flow Rate:						
I. Other						

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Action Suggestion 1. Requires immediate action
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3. Do when convenient

Controlled = Gated **Uncontrolled** = Overflow

Additional Comments:

The entire structure should be fully evaluated once the debris is removed to verify there is no seepage and that the spillway is still structurally sound.

* **Type of Concrete Problems:** Spalling, cracks, exposed rebar, misalignment, joints, bug holes, efflorescence, popouts, honeycombing, scaling, craze/map cracks, isolated crack, disintegration, other

SPILLWAY-PRINCIPAL - GATES			Action		
Item	N	Notes/ Observations	M	I	R
1 Gates		No problem / Not applicable / Could not inspect thoroughly			
A. Types (lift/slide, tainter(radial), stoplogs, leaf, roller, flashboards, needles, other): Number and Size:	X	Lift gates 10 gates, 11.6' x 7.5'			
B. Stoplogs Dimensions: Condition:	X	NONE ON GATE SECTION			
C. Abutments Condition: * Seepage/wetness:	X	Some spalling of concrete and wetness, no seepage observed but impoundment was drawn down.		X	
D. Piers (number, shape) Condition: *	X	11 piers, gunite spalling off all piers and very damp gunite will have to be removed and replaced with concrete			X
E. Operability Type of Operator: Condition(chain, cables,hoists): Security(locked?): Backup Operator:	X	2 of 10 gates not operable (#6 & #7) Gates are power operated from a secure dugout to the left of the dam. No way to manually operate gates			X
F. Access	X	Dam is locked and gated as are the operational controls. Good access for maintenance.			
G. Condition Rust: Seals (leakage):	X	Gates are very rusty and need to be sandblasted and cleaned. Seals should also be replaced.			X
H. Ice protection Type (Heaters, Bubblers, Barriers, Other)	X	Ice breakers placed U/S of the dam's gated section. Ice breakers need major work.			X
I. Debris Prevention (Rack, boom, etc.)	X	Ice breakers also catch debris. Major debris removal required			X
J. Condition of Flowway	X	Appeared free of any major debris except at the ice breakers.			
K. Drains Type (Weep holes/ Relief drains/ Other): Flow rate: Location:	X	NONE OBSERVED			
L. Other					

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Action Suggestion 1. Requires immediate action
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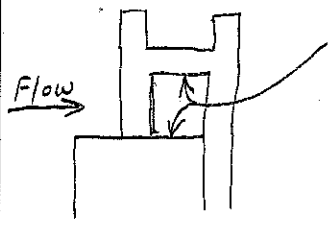
Additional Comments and/or Sketch:



There are cracks in the structure in these locations on multiple supports in the gate section. Need to be evaluated by a structural engineer.

* **Type of Concrete Problems:** Spalling, cracks, exposed rebar, misalignment, joints, bug holes, efflorescence, popouts, honeycombing, scaling, craze/map cracks, isolated crack, disintegration, other

SPILLWAY--PRINCIPAL - OUTLET EROSION CONTROL & UNDERMINING

Item	N	Notes/ Observations	Action M	I	R
1 Outlet Erosion Control		No problem ☐ Not applicable ☐ Could not inspect thoroughly ☐			
A. Type (none, endwall, plunge pool, energy dissipation structure rock lined channel, apron)		Only short concrete aprons were visible D/S of the gate section and fixed spillway section. Adequacy must be studied.			
B. Scour	X	Not safe for us to inspect, must be evaluated by owner		X	
C. Material	X			X	
a. Riprap: Avg Diameter: Condition (adequate, sparse, displaced, weathered): Bedding fabric- (Yes/ No): **b. Concrete** * Dimensions/Location:		Only short concrete apron observed, condition and adequacy must be studied.			
D. Sidewall/Headwall Misalignment: Location: Description:		N/A			
E. Separated Joint / Loss of Joint Material: Location: Description:		Unable to safely inspect		X	
F. Natural					
2 Undermining		No problem ☐ Not applicable ☐ Could not inspect thoroughly ☐			
Location: Description:	X	Could not evaluate, Must be studied		X	

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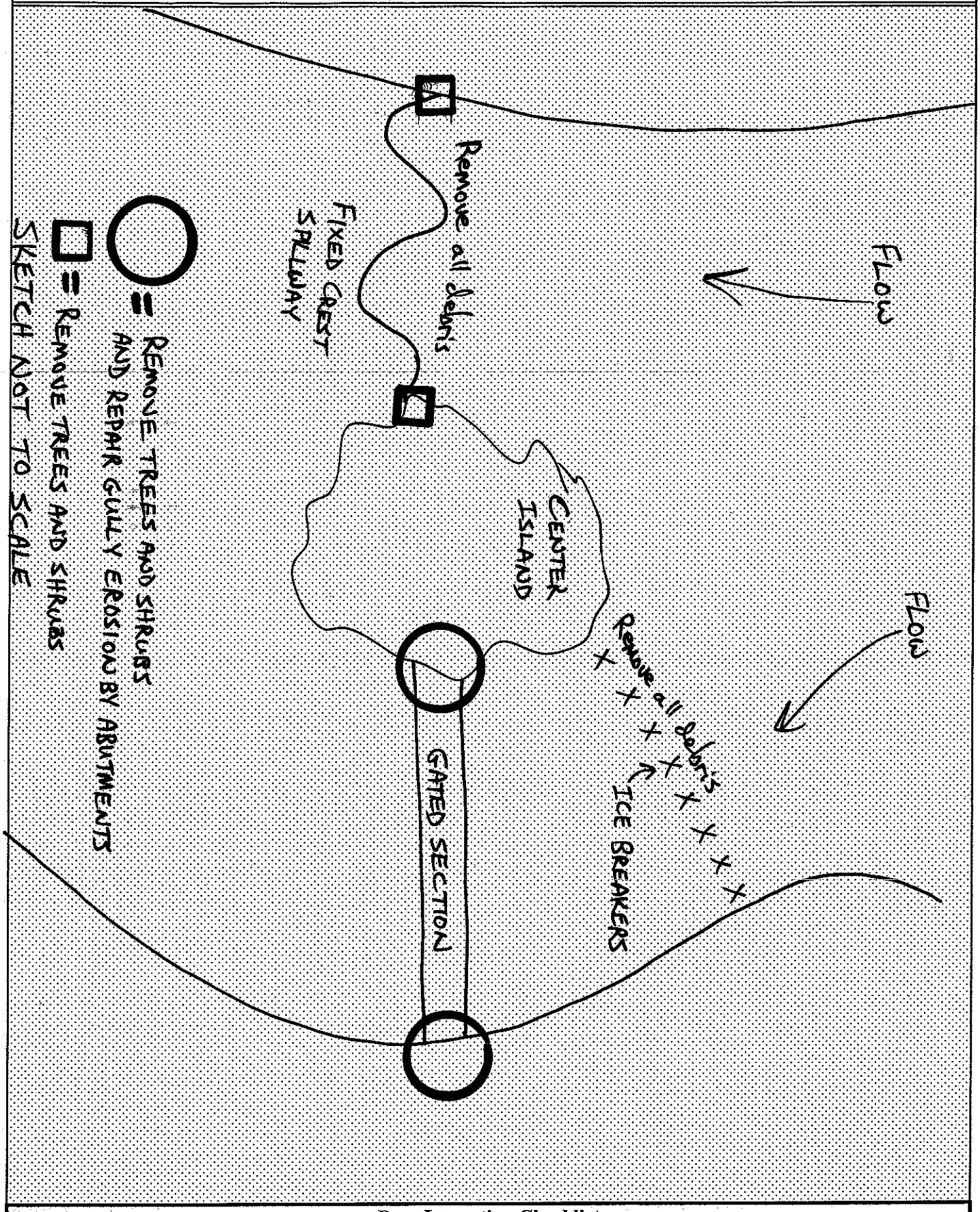
Additional Comments:

We do not have to proper safety equipment or training to evaluate the potential scour and undermining that may be occurring on the Estabrook Dam, Given the flows on the Milwaukee River in May and June of 2004 and citizen observations, Milwaukee County will have to hire a consultant to evaluate scour and undermining.

*** Type of Concrete Problems:** Spalling, cracks, exposed rebar, misalignment, joints, bug holes, efflorescence, popouts, honeycombing, scaling, craze/map cracks, isolated crack, disintegration, other

SKETCH


FLOW
Remove all debris
FIXED CREST SPILLWAY
CENTER ISLAND
FLOW
Remove all debris
ICE BREAKERS
GATED SECTION
= REMOVE TREES AND SHRUBS AND REPAIR GULLY EROSION BY ABUTMENTS
= REMOVE TREES AND SHRUBS
SKETCH NOT TO SCALE

ESTABROOK DAM
INSPECTION PHOTO LOG

PHOTO NO.	DESCRIPTION
1	U/S of gated section of the dam
2	Pier on U/S of gated section of the dam
3	D/S of gated section of the dam showing inoperable gates
4	Top of gated section of the dam showing no mechanicals for gates #6 and #7
5	Fixed crest spillway of the dam looking from center island to the right bank
6	Typical debris built up against the fixed crest spillway
7	Ice breakers as viewed from the top of the gated section of the dam
8	Close-up of ice breakers showing debris and deterioration
9	Stoplog section on the fixed crest spillway of the dam
10	Deteriorated access stairs on the left side of the gated section
11	Cracks in the concrete supports of the gated section of the dam
12	Typical debris U/S of the fixed crest spillway, note man-made garbage

Location: Estabrook Dam

Date: 10-27-2004 Photos taken by: Michael Bruch

Photo No. 1

Photo No. 2

Location: Estabrook Dam

Date: 10-27-2004 Photos taken by: Michael Bruch

Photo No. 3

Photo No. 4

Location: Estabrook Dam

Date: 10-27-2004 Photos taken by: Michael Bruch

Photo No. 5

Photo No. 6

Location: Estabrook Dam

Date: 10-27-2004 Photos taken by: Michael Bruch

Photo No. 7

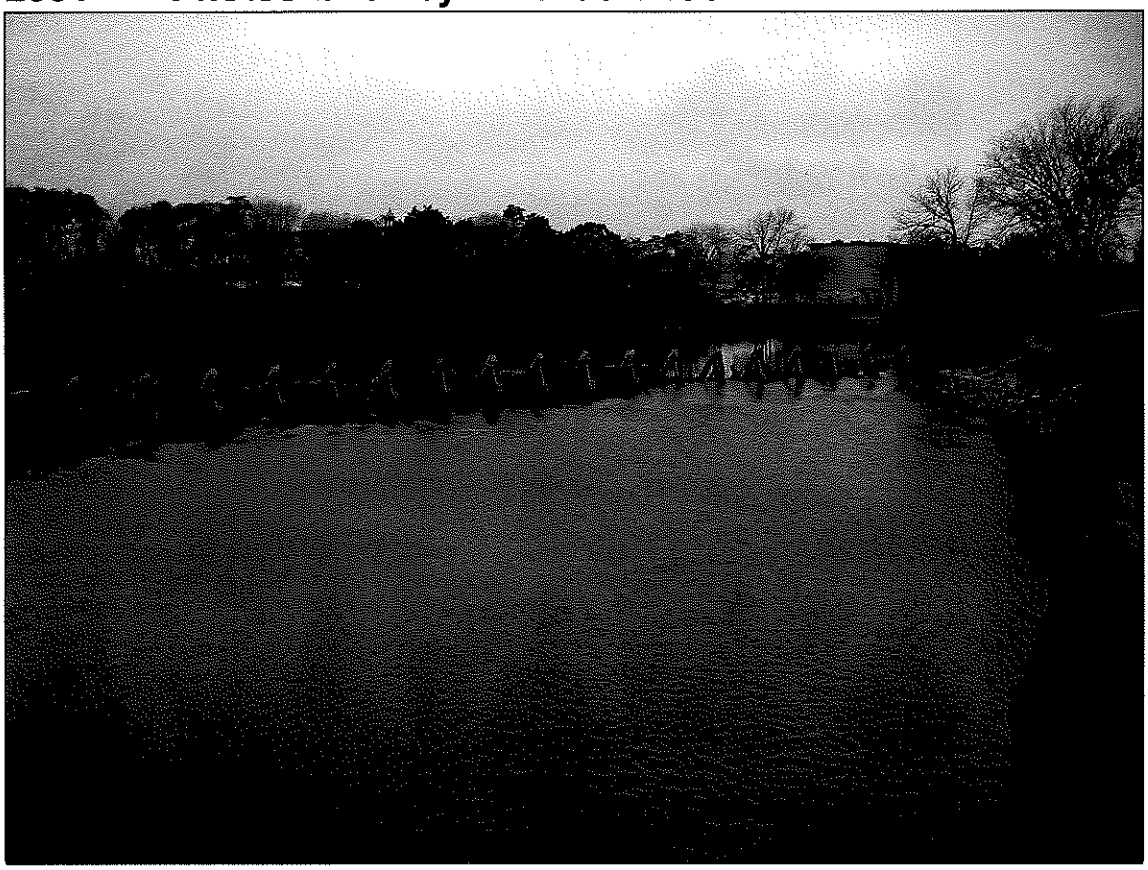


Photo No. 8

Location: Estabrook Dam

Date: 10-27-2004 Photos taken by: Michael Bruch

Photo No. 9

Photo No. 10

Location: Estabrook Dam

Date: 10-27-2004 Photos taken by: Michael Bruch

Photo No. 11

Photo No. 12