



Photograph No. 1:

Upstream slope. Note the dense trees and brush.



Photograph No. 2:

Crest. Photo taken from the right end of the dam looking toward the dam. Note that the right end of the dam is lower than the dam itself.



Photograph No. 3:

Downstream slope. Note the dense trees and brush.



Photograph No. 4:

Right sidewall of the principal spillway inlet.



Photograph No. 5:

Left sidewall of the principal spillway inlet.



Photograph No. 6:

Concrete stop-logs in the principal spillway.



Photograph No. 7:

Left sidewall of the principal spillway outlet.



Photograph No. 8:

Center dividing wall and left sidewall of the principal spillway outlet.



Photograph No. 9:

Right sidewall of the principal spillway outlet.



Photograph No. 10:

Principal spillway outlet.

Note that previous inspections noted that the spillway was undermined in these areas. The water was too deep and turbulent during this inspection to view these areas.



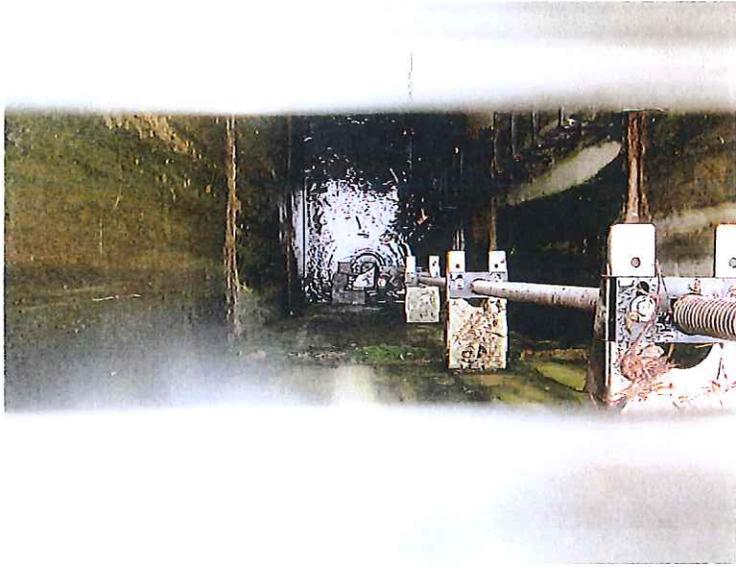
Photograph No. 11:

The lake drain is operated from the crest.



Photograph No. 12:

Lake drain.



Photograph No. 13:

Interior of the lake drain vault. View of the gate stem.



Photograph No. 14:

Interior of the lake drain vault. View of the lake drain discharge pipe.



Photograph No. 15:

Lake drain outlet.

Dam Classification Checklist

Name of Dam: Lower Shaker Lake Dam File Number: 1314-001
 County: Cuyahoga Date: September 30, 2014 Engineer: DCB

The classification of a dam is based on three factors: the dam's height, storage capacity, and potential downstream hazard. The height of the dam is the vertical distance from the crest to the downstream toe. The storage capacity is the volume of water that the dam can impound at the top of dam (crest) elevation. The downstream hazard consists of roads, buildings, homes, and other structures that would be damaged in the event of a dam failure. Potential for loss of life is also evaluated. Various dam failure scenarios must be considered, and they include failures when the dam is at normal pool level and failures during significant flood events. Each of the three factors is evaluated, and the final classification of the dam is based on the highest individual factor. Class I is the highest and Class IV is the lowest. The classification of a dam can change based on future development along the downstream channel.

This checklist is intended to establish or verify the appropriate classification in accordance with the Ohio Administrative Code – it does not necessarily show all potential hazards or the full extent of inundation. In addition, elevations are estimated.

HEIGHT CLASSIFICATION	STORAGE CLASSIFICATION	EXEMPT~NON-REGULATED
Dam Height = 17.30 feet	Stor. Capacity (top of dam)= 178.00 acre-feet	
<u> </u> > 60' - Class I	<u> </u> > 5000 acre-feet - Class I	<u> </u> Height ≤ 6 feet
<u> </u> > 40' - Class II	<u> </u> > 500 acre-feet - Class II	<u> </u> Storage ≤ 15 acre-feet
<u> </u> > 25' - Class III	<u> </u> X > 50 acre-feet - Class III	<u> </u> 6 ft. < Height < 10 ft. &
<u> </u> X ≤ 25' - Class IV	<u> </u> ≤ 50 acre-feet - Class IV	<u> </u> Stor. ≤ 50 ac-ft
 Height Class:	<u> </u> IV	
Storage Class:	<u> </u> III	
Hazard Class (see next page):	<u> </u> I	Estimated Population at Risk: (16+)
Final Class:	<u> </u> I	

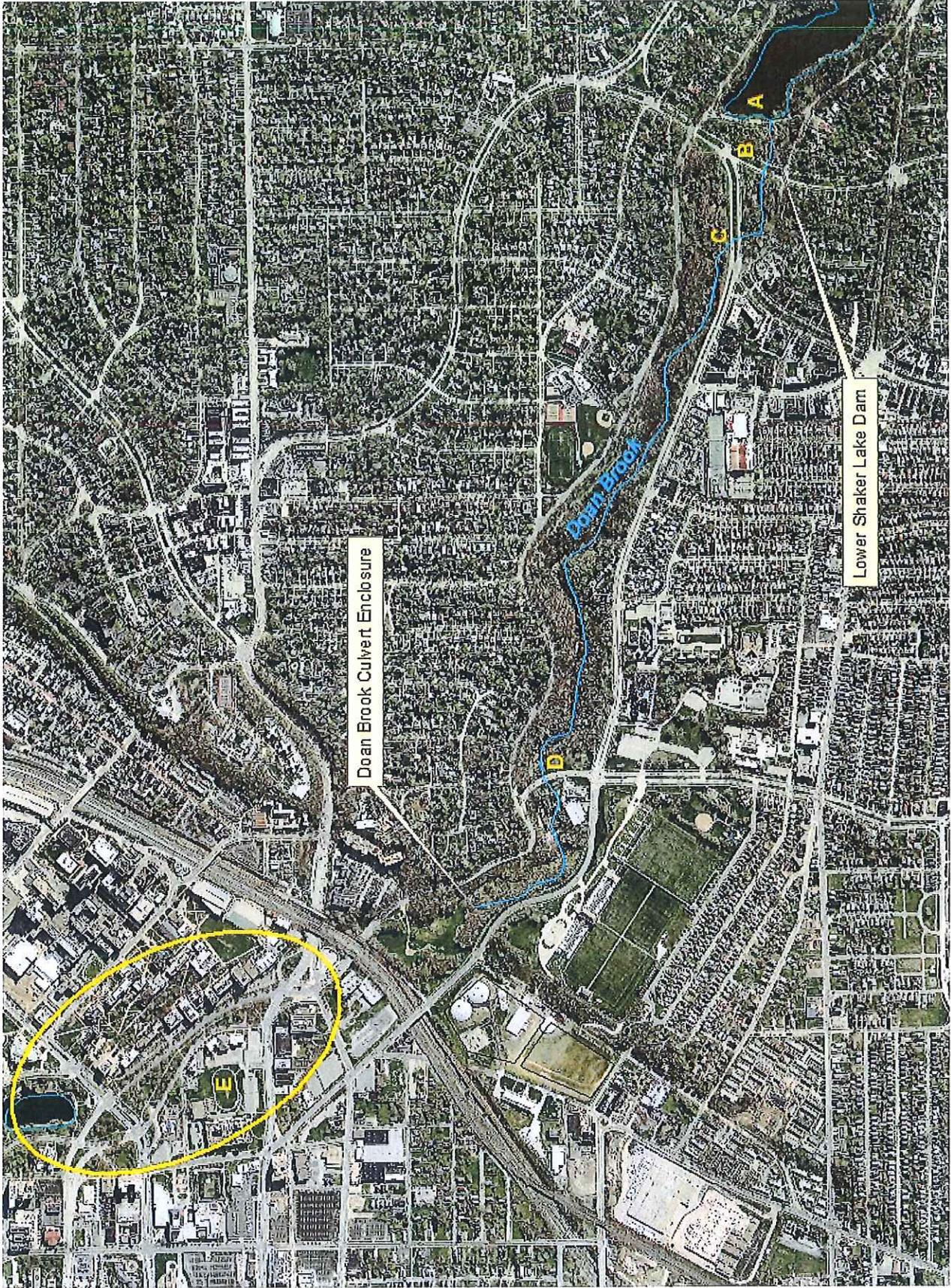
Class Changed (No)

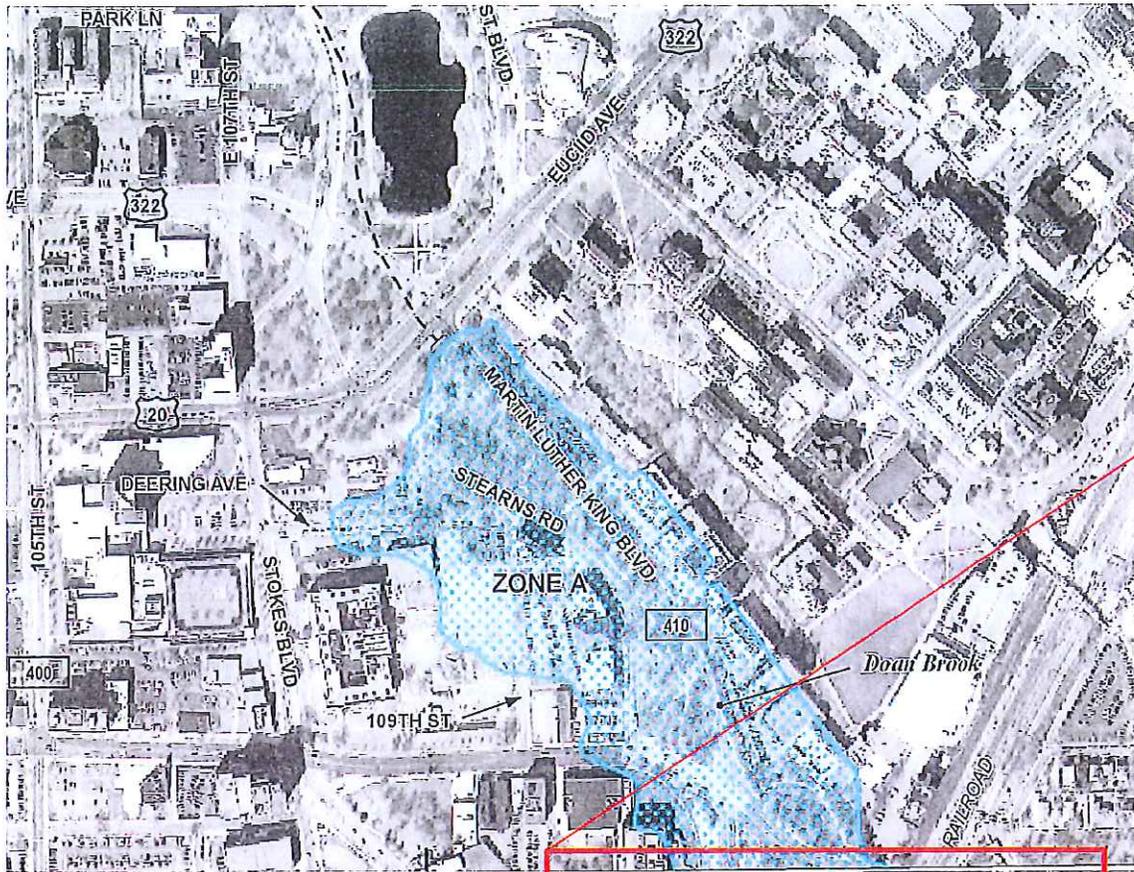
POTENTIAL DOWNSTREAM HAZARD

I		II				III		IV	-	-				
Probable loss of human life	Loss of public water supply or wastewater treatment facility, release of health hazardous waste	Flooding of structure or high-value property	Damage to high-value or Class I, II, III dam or levee	Damage to major road (US or state route), disruption of only access to residential or critical facility area	Damage to railroad or public utility	Damage to rural building, not otherwise high-valued property, or Class IV dam or levee	Damage to local road (county and township)	Loss restricted mainly to the dam or agricultural /rural land	No hazard to structure noted	No hazard assessment; further investigation needed	Distance downstream of dam to affected structure (feet)	Vertical distance from streambed to base of affected structure (feet)	Horizontal distance from stream to affected structure (feet)	
							A				0	0	0	Brook Rd/Lower Shaker Lake Dam
							B				300	11	0	Coventry Rd
							C				500	8	0	Fairhill Rd
									D		5000	13-30*	0	East Blvd.
E											7000	varies	varies	University buildings, roads, and other structures

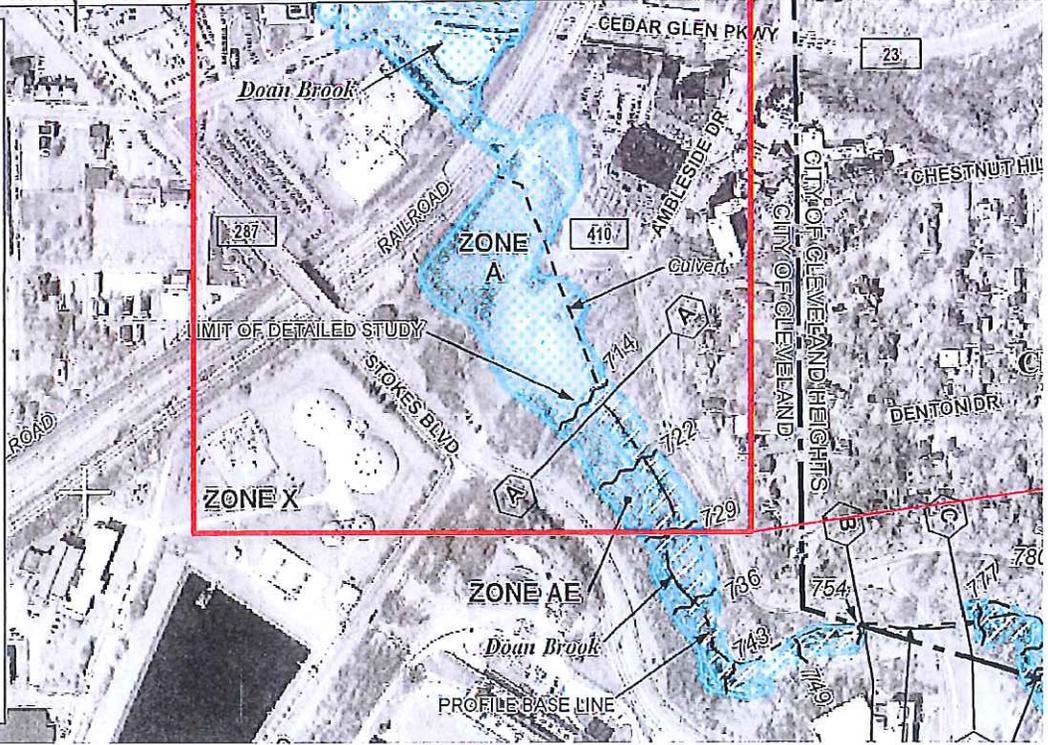
1. This checklist is intended to establish or verify the appropriate classification in accordance with the OAC – it does not necessarily show all potential hazards or the full extent of inundation.
2. The letters in the above chart correspond to matching letters on the following maps.
3. In the event of dam failure, downstream property owners or other affected parties in addition to those identified in the table above should be made aware of the situation.
4. This downstream hazard investigation is based on field observations and from 2012 aerial imagery obtained from Ohio Statewide Imagery Program (OGRIP).
* There is a 13 ft tall culvert at East Boulevard. The total embankment height is about 30 feet.

See Next Pages for Location of Developments Downstream of Dam

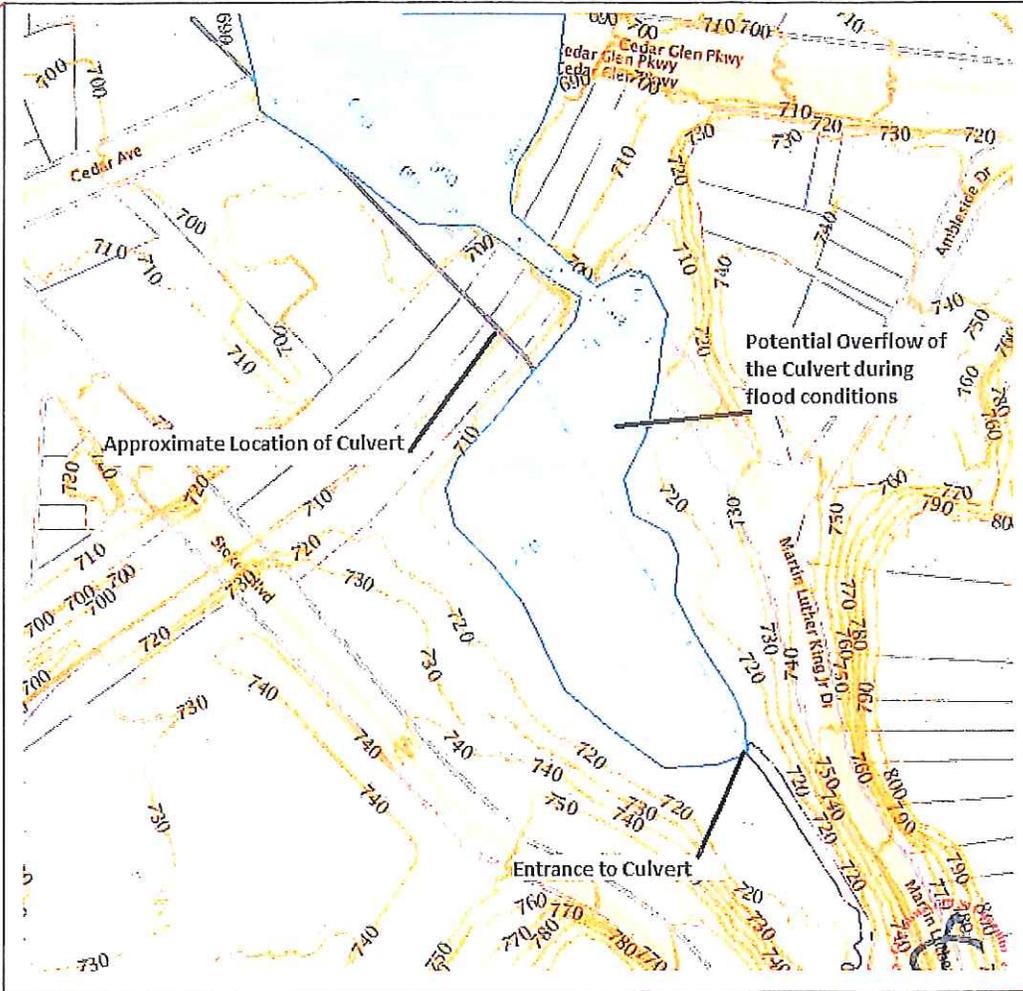




The blue-shaded area on the aerial photograph shows the 100-year floodplain from the 2010 Cuyahoga County Flood Insurance Study. Upstream of the railroad, Doan Brook enters an enclosed culvert that passes under the developed area downstream of the railroad. This map shows that there could be some overflow that does not enter the culvert but flows under the railroad along Martin Luther King Jr. Blvd. and floods several roads and buildings. In the event of a dam break, more flooding in these areas would occur.



The map below includes 2-ft contours obtained from the Cuyahoga County Auditor Website. The map shows that overflow from the culvert will flow along Martin Luther King Jr Blvd, under the railroad to developed areas downstream.



The culvert begins about 1.4 miles downstream of Lower Shaker Lake Dam and about 2.6 miles downstream of Upper Shaker Lake Dam.

Flood Routing Summary

A dam must be able to safely pass severe flood events. A dam uses a combination of reservoir storage capacity and spillway discharge to prevent floodwater from overtopping the embankment crest. As part of this inspection, the Division of Soil and Water Resources did not thoroughly investigate the ability of this dam to safely pass the required design flood. In 2009 a consultant performed hydrologic and hydraulic calculations to estimate the size of the design flood and the total spillway discharge capacity of the dam. These calculations combined with the reservoir storage capacity were used in the flood routings to determine the maximum water surface elevation in the reservoir for various flood events (see Table I).

Lower Shaker Lake Dam is a Class I dam; therefore, in accordance with OAC Rule 1501:21-13-02, the required design flood is 100% of the Probable Maximum Flood (PMF) or the critical flood. This dam and its spillway system must safely pass the design flood without overtopping the embankment crest. Flood routing calculations indicate that the dam can pass 2% of the PMF; Lower Shaker Lake Dam does not appear to be able to safely pass the design flood.

Table I - Flood Routing Summary

Flood Event	Maximum Inflow (cubic feet per second)	Maximum WSEL ¹ (feet)	Overtopping	
			Depth ² (feet)	Duration (hours)
PMF	23632	909.2	3.9	9.5
75% PMF	17724	908.4	3.1	9.4
50% PMF	11816	907.9	2.6	8.75
25% PMF	5908	906.5	1.2	8
12% PMF ³	2835	905.5	0.5	5

1. WSEL – water surface elevation, in feet above the mean sea level

2. A negative number indicates that the dam does not overtop and represents the elevation difference between the Maximum WSEL and the Top of Dam Elevation (freeboard)

3. 12% PMF is similar to the 100-year flood. The 100-year flood event has a 1% chance of occurring in any given year. This is only an approximation.

Top of Dam Elevation: 905.30 feet above msl
 Normal Pool Elevation: 903.00 feet above msl

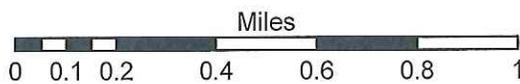
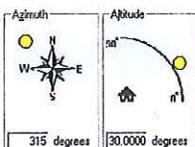
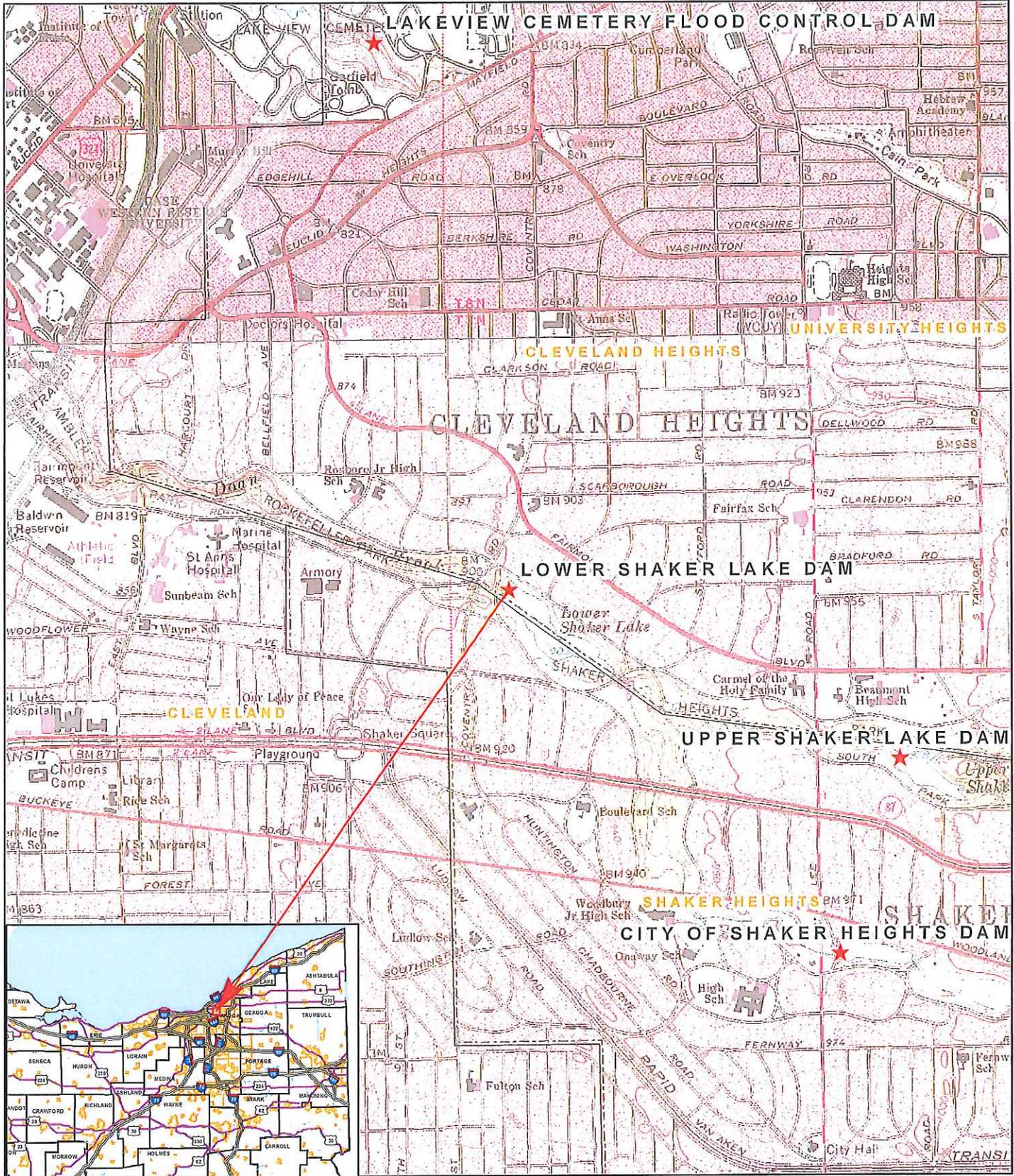
History of Lower Shaker Lake Dam

Date	Event
1830	Dam constructed.
1977	Dam safety inspection by the Division of Soil and Water Resources.
1979	Phase I inspection performed.
1985	Dam safety inspection by the Division of Soil and Water Resources.
1996	Dam safety inspection by the Division of Soil and Water Resources.
1998	Partial tree removal, installation of lake drain.
2004	Dam safety inspection by the Division of Soil and Water Resources.
2009	H&H study submitted and approved.
April 29, 2009	Dam safety inspection by the Division of Soil and Water Resources.
September 30, 2014	Dam safety inspection by the Division of Soil and Water Resources.

Section 3

LOCATION MAP

LOWER SHAKER LAKE DAM - 1314-001



Legend	
	Dams
	Cities
	County Boundary
	Quad Boundary



Dam Inventory Sheet

Name: LOWER SHAKER LAKE DAM **File No:** 1314-001
National #: OH00352
Permit No.: N/A
Class (Ht-Vol): I (IV - III)

Reservoir: _____ **Owner Information** _____
Owner: City of Cleveland (leased to Shaker Heights) **Owner Type:** Public, Local
Address: City of Shaker Heights **Multi-Dams:** Yes: 3, Class I:2
Dept. of Public Works 15600 Chagrin Boulevard **Parcel No.:**
City: Shaker Heights **State:** OH **Zip:** 44120
Contact: Bill Boag, Pub. Works Dir. **Phone No.:** 216/491-1495

_____ **Location Information** _____
County: Cuyahoga **Latitude Deg.:** 41 **Min.:** 29 **Sec.:** 24
Township: City Of Shaker Heights **Longitude Deg.:** 81 **Min.:** 34 **Sec.:** 54
Stream: Doan Brook
USGS Quad.: Shaker Heights **USGS Basin No.:** 04110003

_____ **Design/Construction Information** _____
Designed By: North Union Shaker Colony
Constructed By: North Union Shaker Colony
Completed: 1830 **Plan Available:** NO **At:**
Failure/Incident/Breach:

_____ **Structure Information** _____
Purpose: Recreation, Private
Type of Impound.: Dam And Spillway
Type of Structure: Earthfill
Drainage Area (sq. miles): 4.82 **or (acres):** 3085
Embankment Data
Length (ft): 600 **Upstream Slope:** 3H:1V
Height (ft): 17.3 **Downstream Slope:** 1H:1V
Top Width (ft): 45 **Volume of Fill (cub. yds.):** 25700

Spillway Outlet Works Data
Lake Drain: 24-IN DUCTILE IRON PIPE
Principal: 39.5-FT LONG STONE MASONRY WEIR
Emergency: NONE
Maximum Spillway Discharge (cfs): 425 **Design Flood:** 1.0 **Flood Capacity:** 0.02
Dam Reservoir Data

	Elevation (ft-MSL)*	Area (acres)	Storage (acre-feet)
Top of Dam:	905.3	18.7	178
Emergency Spillway:			
Principal Spillway:	903	16	132
Streambed:	888		

*Elevations are not necessarily related to a USGS benchmark

_____ **Inspection Information** _____
Inspection 9/30/2014 DCB **Phase I:** 10/25/1979
History: 4/29/2009 TMG **Other Visits:** 3/13/97, 5/7/1997, 6/8/1999
6/21/2004 DMR
5/21/1996 TML
9/17/1985
11/29/1977 **Inspection Year:** B

_____ **Operation Information/Remarks** _____ CLEV
PHASE I: UNSAFE - NON-EMERGENCY; SHAKER HEIGHTS & CLEVELAND HEIGHTS OPERATE AND MAINTAIN THE DAM.

Emergency Action Plan: Not Approved **Format:** No Plan **OMI:** No
Last Entry: 10/1/2014

Dam Safety Inspection Checklist

Cuyahoga County

Name of Dam: Lower Shaker Lake Dam
 Date of Inspection: 9-30-14
 File Number: 1314-001
 Class: I
 Haz.: I, Height: IV, Volume: III

Required Action
 None Mon. Maint. Eng.

Design Flood: 1.0 Flood Capacity: 0.02

Interview with Owner (at the site):

Owner/Representative present: (Yes) Name(s): Andre Spencer, Cleveland Heights; William Boag, Shaker Heights
 Owner's Name(s): City of Cleveland (leased to Shaker Heights) Joseph Ciuni, CPD Group
 Address: City of Shaker Heights, Dept. of Public Works, 15600 Chagrin Boulevard
 City: Shaker Heights State: OH Zip (+4): 44120
 Contact Person: Bill Boag, Pub. Works Dir. Telephone: 216/491-1495
 Email Address:
 Purpose of dam: Recreation, Private

Owner Dam Safety Program

Emergency Action Plan NO EPP None Mon. Maint. Eng.
 EAP (document): Need a full EAP Up-to-date? (yes, no)
 Downstream development: Mostly roads, Cleveland Heights, University Heights

Operation, Maintenance, and Inspection No None Mon. Maint. Eng.
 OMI (document): Up-to-date? (yes, no)
 All drains operable? (yes, no)

Normal rate of drawdown: Unknown Accessibility for operation: Unknown
Maintenance
 Frequency of mowing: Only the shoulders along the road on the crest mowed.
 Other maintenance: None

Inspection
 Frequency and thoroughness of day-to-day & routine inspections: None
 Problems found during inspections: None reported.

Field Information

Pool Elevation (during inspection): ~ 1 inch above normal pool Time: 12:30 (a.m. (p.m.))
 Site Conditions (temp., weather, ground moisture): 70°F, Damp from earlier rain
 Inspection Party: Dena Barnhouse, Jim Huitger, John Watkins
 Confirm the Following: Dam Height (ft): 17.3 NP Area (ac): 16

Reference Information

City of Cleveland owns the dam; City of Shaker Heights and City of Cleveland Heights (216-291-3737, Carl Czaga) lease the property and take responsibility for managing the dam; copy City of Cleveland on correspondence: Dept of Water Pollution Control, 12302 Kirby Avenue, Cleveland, OH, 44108-1617, Darrell Brown, Commissioner
 High pools would potentially overtop right end and flow down street; added flashboards under bridge;

Impound. Type: Dam And Spillway
 Structure Type: Earthfill
 Township: City Of Shaker Heights
 Stream: Doan Brook
 Designed By: North Union Shaker Colony
 Constr. By: North Union Shaker Colony
 Year Compl.: 1830 Plans Avail.? No At:
 Fail./Incid.:

Phase I: Unsafe - Non-emergency; Shaker Heights & Cleveland Heights Operate And Maintain The Dam.				
	Elev.	Area (ac)	Stor. (ac-ft)	(in.)
TOD:	905.3	18.7	178	0.2
Em. S/w:				
Prin. S/w:	903	16	132	
Strmbd:	888			
Basin (ac):	3085			

Required Action
None Monitor Repair Engineer

Upstream Slope Gradient: 3H:1V

Typical Problems: shoreline erosion, trees & brush, surface erosion, ruts, rodent burrows, earth slides, cracks

Dense trees and brush entire slope. Vegetation was too dense to see the slope. Previous inspections noted erosion along the shoreline.

None	Monitor	Repair	Engineer
		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Crest Width (ft): 45 Length (ft): 600 Total Freeboard (ft): 2.30

Typical Problems: low areas, trees & brush, surface erosion, ruts, cracks

The crest is paved and clear of trees and brush.

The right end of the dam is 2 to 3 feet lower than the rest of the dam. North Park Road floods above the 50-yr ~~err~~ flood according to owner. It was reported to have happened in July of this year.

None	Mon.	Rep.	Eng.
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>

Downstream Slope Gradient: 1H:1V

Typical Problems: trees & brush, surface erosion, ruts, rodent burrows, earth slides, cracks, seepage

Very dense trees and brush. The slope was hummocky with trails.

There is a masonry foundation from an old mill near the right end of the downstream toe. Previous inspections noted ponded water in this area.

None	Mon.	Rep.	Eng.
<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Principal Spillway 39.5-ft Long Stone Masonry Weir

Typical Problems: Inlet obstructed, unsatisfactory trashrack/anti-vortex plate, material deterioration, misalignment, open joints, outlet erosion, outlet overgrown, undermining

The inlet was clear of obstructions. The masonry walls had some weathering/deterioration. Concrete stop-logs are located in each bay of the spillway. Condition unknown. Vegetation was growing in the masonry wall joints. Some of the blocks were deteriorating. Previous inspections noted undermining at the outlet but it was not possible to view during this inspection due to water depth and turbulence.

A failing storm sewer on the left side of outlet channel was noted at last inspection. Could not access area due to dense vegetation during this inspection.

None	Mon.	Rep.	Eng.
		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
			<input checked="" type="checkbox"/>

Sufficient measurements to perform hydraulics (dimensions, riser depth, outlet elevation)

Required Action

None
Emergency Spillway Freeboard (to normal pool, feet)

Typical Problems: Flowpath obstructed, material deterioration, erosion, misalignment, overgrown, undermining

Not specifically required.

None	Monitor	Repair	Engineer
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Sufficient measurements to perform hydraulics (dimensions, breadth, side slopes)

Lake Drain 24-in Ductile Iron Pipe

Typical Problems: Poor operating access, inoperable, deteriorated/missing components, outlet erosion

Lake drain was reported to be operable. The components appeared to be in good condition.

None	Mon.	Rep.	Eng.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other

None	Mon.	Rep.	Eng.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

All Field Data Gathered (inspector's initials): DUS JRH

Site Sketch

Investigate Downstream Hazard