



Bob Taft • Governor

Samuel W. Speck • Director

Division of Water

James R. Morris • Chief

May 11, 2000

Dan West, Chief
Division of Parks and Recreation
1952 Belcher Drive, Building C-2
Columbus, Ohio 43224-1386

RE: Buckeye Lake Dam
Licking and Fairfield Counties
File Number: 9723-004

Dear Mr. West:

Enclosed you will find the report of the dam safety inspection performed on April 14, 2000, on the West Bank of Buckeye Lake Dam.

Please contact me or Mark Ogden at 6727 with any questions or comments about this report.

Sincerely,

James R. Morris, P.E.
Chief, Division of Water

JRM:pmg

cc: Scott Zody, Deputy Director
Steve Manilla, P.E., Chief, Division of Engineering
Ed Frank, Park Manager, Buckeye Lake State Park
Peter George, P.E., Senior Project Engineer, Division of Water

enclosures

Mission: To ensure a balance between wise use and protection of our natural resources for the benefit of all.



**DIVISION OF WATER
SITE VISIT MEMORANDUM
BUCKEYE LAKE DAM
FILE NUMBER: 9723-004**

LOCATION: Fairfield County, Walnut Township

DATE: Friday, April 14, 2000

TIME: 8:00 a.m.

INSPECTORS: Mark B. Ogden, P.E., Administrator
Peter M. George, P.E., Senior Project Engineer
Thomas G. Lagucki, Construction Specialist

OTHERS PRESENT: Ed Frank, Park Manager, Buckeye Lake State Park
Charlie Prince, Editor, Buckeye Lake Beacon

SITE CONDITIONS: It was sunny and about 65 degrees Fahrenheit. The ground surface was dry.

PHOTOGRAPHS: Digital photographs were taken and are on file at this office.

INSPECTION PURPOSE AND AUTHORITY:

On April 3, 2000, the Division of Water, Dam Safety Engineering Program inspected a sinkhole (13142 West Bank Road) on Buckeye Lake Dam, which was located south of Mud Island in Fairfield County. The severity of the sinkhole initiated an inspection of the entire upstream embankment of the West Bank.

This inspection was conducted under the provisions of Section 1521.062 of the Ohio Revised Code (ORC) to evaluate the condition of the dam and its appurtenances. The Dam Safety Engineering Program has the responsibility to ensure that human life, health, and property are protected from catastrophic dam failures.

DESCRIPTION:

The inspection of the West Bank began at an approximate station of 62+25 (residential address of 13284) and ended at an approximate station of 10+00 (residential address of 12472). This is the area from Mud Island to Leibs Island. The stationing is referenced from the plans titled "Buckeye Lake State Park Embankment Mapping" dated April 1990, by Dodson-Lindblom Associates, Inc. Both a visual inspection and an estimated embankment density inspection were performed from the centerline of the dam to the stone and masonry wall located on the upstream slope. The visual inspection included observation of structures such as the stone and masonry wall, sidewalks, trees, decks, and docks to observe the affects on the upstream embankment. The density of the upstream embankment material was tested with a 4-foot-steel tile probe.

The resistance of the embankment material to the probe may identify areas that lack proper compaction or contain possible voids. The observed portion of the stone and masonry wall located on the upstream slope was deteriorated. There were several areas with displaced stones and several areas where the wall was leaning toward the lake. A portion of the stone and masonry wall had been capped with concrete.

Several trees varying in diameter from 0.5 foot to 3.0 feet were noted all along the West Bank. Also, some trees had been removed and depressions remained on the embankment in these locations.

Some West Bank residents commented to the inspection party on the condition of the upstream embankment near the stone and masonry wall. Some residents reported that the material behind the wall sinks on a regular basis and they have been adding material regularly along the upstream embankment to maintain the top elevation of the dam. Some also reported seepage in their basements.

It was impossible to inspect many areas of the dam due to decks, patios and other landscaping and structures.

OBSERVATIONS:

Station 62+25 to 61+00:

The tile probes could be pushed half their lengths along most of this section. Near the stone and masonry wall, at an approximate station of 62+10, the tile probe was completely pushed its full length into the upstream embankment. See digital photograph labeled number 1 for additional information. The possible existence of a second wall was detected by repeated probing approximately 1.0 foot below the present grade and 5 to 6 feet behind the stone and masonry wall.

Station 61+00 to 60+00:

The upstream embankment contained a low area (0.5 foot deep) near the stone and masonry wall at an approximate station of 60+15. The tile probes were pushed their full lengths in this area. See digital photograph labeled number 2 for additional information.

Station 60+00 to 59+00:

The upstream embankment contained low areas all along the stone and masonry wall. The tile probes were pushed their full length in this area. A section of the stone and masonry wall was broken and displaced near station 59+40. A sidewalk (station 59+10) that extended from the crest to the stone and masonry wall was broken and displaced. The area along the sidewalk could be probed half the distance of the tile probe. See digital photograph labeled number 3 for additional information.

Station 59+00 to 58+00:

The upstream embankment adjacent to a walkway that extended from the crest to the stone and masonry wall, at an approximate station (58+00), was probed. The tile probes could be pushed their full lengths along the walkway. The remainder of this embankment was probed a distance of three-fourths the length of the tile probe.

Station 58+00 to 57+00:

A 2-foot diameter by 1-foot deep depression was observed near station 57+85. The tile probe was pushed its full length in the area of the depression. Another low area approximately 1-foot in diameter was observed near station 57+75. The tile probe was pushed half its length in the low area and in the remainder of this section.

Station 57+00 to 56+00:

This section contained voids, less than 0.5 foot in diameter, along the stone and masonry wall. The tile probes were pushed half their lengths along this distance.

Station 56+00 to 55+00:

At an approximate station of 55+50, a depression of 0.5 foot deep was observed along the stone and masonry wall. The probe was pushed its full length in the area of the depression. See digital photograph labeled number 4 for additional information.

Station 55+00 to 54+00:

Near station 54+50, the stone and masonry wall was observed to be tilting towards the lake. Along this section of the upstream embankment, the tile probe was pushed its full length. See digital photograph labeled number 5 for additional information.

Station 54+00 to 53+00:

The sinkhole noted during the April 3, 2000 Division of Water inspection was located near station 53+80. A survey of the sinkhole revealed that the approximate bottom elevation was at 890.5 feet (5.4 feet below the crest) and the water level in the lake was at the same elevation as in the sinkhole. The tile probes were pushed their full lengths in this section.

Station 53+00 to 52+00:

The distance between stations 52+50 to 53+00 was easily probed to the full extent of the tile probe. Between station 52+50 to 52+00, half the length of the tile probe could be pushed into the embankment.

Station 52+00 to 51+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 51+00 to 50+00:

A depression 0.5 foot deep was observed, at station 50+25, along the stone and masonry wall. The tile probe was pushed its full distance in this area.

Station 50+00 to 49+00:

A deck covered a large portion of this area. A tile probe could not be used on this area of the upstream embankment. The tile probe was pushed half its length in the remainder of the section. See digital photograph labeled number 6 for additional information.

Station 49+00 to 48+00:

The tile probe was pushed three-fourths of its length in this section.

Station 48+00 to 47+00:

A sinkhole was observed, at station 47+25, along the stone and masonry wall. The probe was pushed its full length in the area of the sinkhole.

Station 47+00 to 46+00:

Sinkholes less than 0.5 foot in diameter, were observed at station 46+50, adjacent to the stone and masonry wall. The tile probe was pushed its full length in this area.

Station 46+00 to 45+00:

A depression was noted at station 45+75, along the stone and masonry wall. The tile probe was pushed three-fourths its length in this section.

Station 45+00 to 44+00:

A low area, 18 inches deep, was noted along the stone and masonry wall. The tile probe was pushed its full length along the stone and masonry wall. See digital photograph labeled number 7 for additional information.

Station 44+00 to 43+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 43+00 to 42+00:

Along this section of the upstream embankment, the tile probe was pushed half to three-fourths its length.

Station 42+00 to 41+00:

Near station 41+45, a tree had been removed. A tile probe was pushed its full length in the area where the tree had been removed. The tile probe was pushed its full length between stations 41+45 and 41+00.

Station 41+00 to 40+00:

This area was probed half the length of the tile probe. A resident located near station 40+00 (house number 12938) stated that the area near the stone and masonry wall (upstream embankment) drops in elevation every year. Also, the resident stated that material is added each year to retain the elevation of the stone and masonry wall.

Station 40+00 to 39+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 39+00 to 38+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 38+00 to 37+00:

Near station 37+85 and 37+10, the tile probe was pushed its full length along the upstream embankment. The remaining area between the above mentioned stations was probed half the length of the tile probe.

Station 37+00 to 36+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 36+00 to 35+00:

Sinkholes were observed near station 35+85, in the upstream embankment, adjacent to the stone and masonry wall. A full tile probe distance was obtained in the area around the sinkholes. At an approximate station 35+60, the elevation of the upstream embankment was a 0.5 feet below the top of the stone and masonry wall. The tile probe was pushed its full length and the tip of the tile probe was wet. See digital photograph labeled number 8 for additional information.

Station 35+00 to 34+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 34+00 to 33+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 33+00 to 32+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 32+00 to 31+00:

Near station 31+75, a hole less than 1-foot in diameter was observed next to the stone and masonry wall. The tile probe was pushed its full length in this area. Sinkholes less than 0.5-foot in diameter were observed near station 31+25. The tile probe was pushed three-fourths its length in this area.

Station 31+00 to 30+00:

Near station 30+50, a low area was noted approximately 3-feet in diameter. The low area varied in depth from a 0.5 foot to 1.0 foot. The tile probe was pushed half its length in this area.

Station 30+00 to 29+00:

Adjacent to the stone and masonry wall, the tile probe was pushed its full length.

Station 29+00 to 28+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 28+00 to 27+00:

Sink holes less than 1.0 foot in diameter were observed near station 27+50 and adjacent to the stone and masonry wall. The tile probe was pushed three-fourths its length in this area.

Station 27+00 to 26+00:

The tile probe was pushed its full length in close proximity of the stone and masonry wall at the following approximated stations: 26+25, 26+40, and 26+75. The tile probe was pushed three-fourths its length in the remainder of this section.

Station 26+00 to 25+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 25+00 to 24+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 24+00 to 23+00:

The tile probe was pushed its full distance, adjacent to the stone and masonry wall, at station 23+50. The tile probe was pushed half its length in remainder of this area.

Station 23+00 to 22+00:

Near station 22+60, the tile probe was pushed its entire length next to a sidewalk that transverses the upstream slope. The tile probe was pushed half its length in the remainder of this area.

Station 22+00 to 21+00:

Near station 21+40, the tile probe was pushed its full length. At station 21+15, the tile probe was pushed three-fourths its length. The tile probe was pushed half its length in the remainder of this section.

Station 21+00 to 20+00:

At station 20+50 (house number 126360), the resident stated that a lot of fill material had been placed in front of their house to raise the elevation of the upstream embankment. A tile probe was pushed its full length near station 20+25. The tile probe was pushed half its length in the remainder of the section. See digital photograph labeled number 9 for additional information.

Station 20+00 to 19+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 19+00 to 18+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 18+00 to 17+00:

A wet area approximately 4-foot in diameter was observed 12 to 15 feet beyond the downstream toe near station 18+00. The tile probe was pushed its full length along the stone and masonry wall between station 17+55 to 17+45. See digital photograph labeled number 10 for additional information.

Station 17+00 to 16+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

Station 16+00 to 15+00:

Near station 15+05 and adjacent to the stone and masonry wall, the tile probe was pushed the full length. The tile probe was pushed half its length in the remainder of this area. See digital photograph labeled number 11 for additional information.

Station 15+00 to 14+00:

Near station 14+75 and adjacent to the stone and masonry wall, the tile probe was pushed its full length. The upstream embankment behind the stone and masonry wall was 0.5 foot lower than the top of the wall between stations 14+65 and 14+25. The tile probe was pushed half its length in this area.

Station 14+00 to 13+00:

Near station 13+15 and adjacent to the stone and masonry wall on the upstream slope, the tile probe was pushed its entire length.

Station 13+00 to 12+00:

Near station 12+40 and adjacent to the stone and masonry wall, the tile probe was pushed its full length. The tile probe was pushed half its length in the remainder of this section.

Station 12+00 to 11+00:

Near station 11+60 and adjacent to the stone and masonry wall, the tile probe was pushed its full length and water was noted on the end of the probe. The tile probe was pushed half its length in the remainder of this section.

Station 11+00 to 10+00:

Along this section of the upstream embankment, the tile probe was pushed half its length.

DISCUSSION:

Trees should not be permitted on embankment surfaces. Extensive root systems can provide seepage paths for water. Trees that blow down or fall over can leave large holes in the embankment surface that will weaken the embankment and can lead to increased erosion. Tree growth adjacent to concrete walls and structures may eventually cause damage to the concrete and should be removed. Stumps and root balls of cut trees should be removed so vegetation can be established and the surface mowed. All woody material (roots) must be removed and the cavity filled with well-compacted fill material and a grass vegetation established.

Probing of the embankment was performed to detect voids or areas that lacked proper compaction. Areas on the upstream embankment that lacked proper compaction or contained voids present an internal erosion or settlement problem within the embankment. The tile probe was used for a simple evaluation of the relative density of the upstream embankment material.

An approximate density of material can be estimated based on the prior experience as related to construction on new dams requiring 95 to 98 percent relative density of the embankment fill material. Properly constructed embankment fill material that has been constructed at a minimum of 95 percent relative density can usually be probed only a few inches with a tile probe.

This does not take into account topsoil on the embankment. Fill material that lacks proper compaction is easily eroded and lacks soil strength characteristics.

Depressions are sunken areas of the embankment surface. They may be created during construction, or may be caused by decay of buried organic material (tree roots), internal erosion of the embankment, or settlement (consolidation) of the embankment or its foundation.

The location of a number of the low areas and their proximity to the stone and masonry wall indicates that internal erosion has taken place in a number of areas. Internal erosion that is not corrected will weaken the embankment and could possibly lead to failure of the embankment.

RECOMMENDATIONS:

1. Repair the stone and masonry wall along the entire West Bank from Mud Island to Leibs Island. Also, repair the noted sinkholes and low areas with compacted clay material and establish a dense grass cover. Remedial measures must be taken immediately to stabilize the largest hole observed at station 53+80.
2. Monitor the depressions (low areas) along the upstream embankment for additional signs of settlement until repairs can be made.
3. Remove the trees and root systems along the upstream embankment. Replace the voids in the embankment with compacted fill material and establish a dense grass cover.
4. Remove all landscaping and structures from the state-owned portion of the dam. This will facilitate proper inspection and maintenance of the earthfill embankment.

 5/19/2000

Mark B. Ogden, P.E. Date
Administrator
Water Management Section
Division of Water

 5-11-2000

Peter M. George, P.E. Date
Senior Project Engineer
Dam Safety Engineering Program
Division of Water

**Buckeye Lake Dam
West Bank Inspection
April 14, 2000**



PHOTO # 1
Station 62+25 to 61+00
- the tile probe was pushed
half its distance along the
stone and masonry wall.



PHOTO #2
Station 61+00 to 60+00
- The tile probe was pushed
its full distance along the
stone and masonry wall.



PHOTO #3
Station 60+00 to 59+00
- The tile probe was pushed
its full distance along the
stone and masonry wall.
- Broken and displaced stone
and masonry wall.

**Buckeye Lake Dam
West Bank Inspection
April 14, 2000**



PHOTO #4
Station 56+00 to 55+00
- The tile probe was pushed its full distance along the stone and masonry wall.
- Depression behind the wall.



PHOTO #5
Station 55+00 to 54+00
- The tile probe was pushed its full distance along the wall.



PHOTO #6
Station 50+00 to 49+00
- Decks covered a large portion of this section. A visual inspection was not possible on the embankment.

**Buckeye Lake Dam
West Bank Inspection
April 14, 2000**



PHOTO #7
Station 45+00 to 44+00
- The tile probe was pushed its full length in this low area. The low area was 18 inches below the top of the wall.



PHOTO #8
Station 36+00 to 35+00
- The tile probe was pushed its full distance along the stone and masonry wall.



PHOTO #9
Station 21+00 to 20+00
- The tile probe was pushed its full distance along the stone and masonry wall.

**Buckeye Lake Dam
West Bank Inspection
April 14, 2000**



PHOTO #10
Station 18+00 to 17+00
- A wet area was observed
12 to 15 feet beyond the
downstream toe.



PHOTO #11
Station 16+00 to 15+00
- The tile probe was
pushed its full distance
along the stone and
masonry wall.