



Ohio Department of Natural Resources

BOB TAFT, GOVERNOR

SAMUEL W. SPECK, DIRECTOR

James R. Morris • Chief

Division of Water

September 4, 2001

Dan West, Chief
Division of Parks & Recreation
1952 Belcher Dr., Bldg. C
Columbus, OH 43224

RE: Buckeye Lake Dam
Licking County
File Number: 9723-004

Dear Mr. West:

Enclosed you will find the report of the dam safety inspection that was completed on July 26, 2001, for the North Bank of Buckeye Lake Dam.

Please contact Peter George at 614/265-6725 with any questions.

Sincerely,

A handwritten signature in cursive script that reads "James R. Morris".

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., Project Manager, Division of Water

Enclosure



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

LOCATION: Fairfield County, Walnut Township &
Licking County, Union Township

DATE: Monday, February 5, 2001 (visual inspection)
Wednesday, February 21, 2001 (visual inspection)
Thursday, July 26, 2001 (density inspection)

TIME: 8:00 a.m.

INSPECTORS: Peter M. George, P.E., Project Manager
Thomas G. Lagucki, Construction Specialist

OTHERS PRESENT: Ed Frank, Park Manager, Buckeye Lake State Park

SITE CONDITIONS: It was cloudy and about 45 degrees Fahrenheit (2/5/01 site visit). The ground surface was dry.

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

INSPECTION PURPOSE AND AUTHORITY:

The Division of Engineering requested an inspection of the North Bank. On February 5 & 21, 2001, a visual inspection of the North Bank was performed. Then on July 26, 2001, the upstream slope was probed to determine the approximate density of the fill material. 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 North Bank began at an approximate station of 68+00 and ended at an approximate station of 213+00. This is the area north of the repair made near Mud Island to the parking lot west of Crane Lake. 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 sheet-pile retaining wall located on the upstream slope. The visual inspection included observation of structures such as: elevation of the fill material behind the sheet-pile retaining wall, sidewalks, and trees to observe the affects on the upstream embankment. The density of the upstream embankment material was tested with a 3-foot-steel tile probe.

The 3-foot-steel tile probe (T) was marked at 1-foot intervals and is referenced in the observations with a (<) less than symbol or with a (=) symbol. The resistance of the embankment material to the probe may identify areas that lack proper compaction or contain possible voids. A detailed inspection of the sheet-pile retaining wall was not performed.

Several trees varying in diameter from 0.5 foot to 3.0 feet were noted all along the North Bank. Also, some trees had been removed and depressions remained on the embankment in these locations. Some relatively new trees had been planted along the upstream slope.

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

OBSERVATIONS:

Station 68+00 to 69+00:

Two large diameter trees and two new trees were noted along this section of the upstream slope. The fill material was nearly even with the sheet-pile retaining wall located along the upstream slope. A tile probe reading of $T < 1$ was noted along this section. A house is located in the downstream slope. A steel cap had been welded to the top of the sheet-pile retaining wall.

Station 69+00 to 70+00:

Two large diameter trees were noted along this section of the upstream slope. The fill material was nearly even with the sheet-pile retaining wall located along the upstream slope. A tile probe reading of $T = 1$ was noted along this section. Houses were noted in the downstream slope. See a digital photo of this section on page 1.

Station 70+00 to 71+00:

Two large diameter trees were noted along the upstream slope. The fill material was nearly even with the sheet-pile retaining wall located along the upstream slope. A tile probe reading of $T = 1$ was noted along this section. Houses were noted in the downstream slope.

Station 71+00 to 72+00:

Fill material along the upstream slope was even with the top of the sheet-pile retaining wall. One large tree was noted on the upstream slope and two small trees were noted on the downstream slope. A tile probe reading of $T = 1$ was noted along this section.

Station 72+00 to 73+00:

Two trees were noted along the upstream slope. The fill material was level with the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was noted along this section. Houses were noted in the downstream slope.

Station 73+00 to 74+00:

Two large trees and one small tree were noted along the upstream slope. A tile probe reading of $T < 1$ was noted along this section. Houses were noted in the downstream slope.

Station 74+00 to 75+00:

A large tree was noted along the upstream slope. The fill material was level with the top of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was noted along this section. Houses were noted in the downstream slope.

Station 75+00 to 76+00:

Two large trees were noted on the upstream slope and two large trees were noted on the downstream slope. The fill material was even with the top of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was noted along this section. See a digital photo of this section on page 1 of the section.

Station 76+00 to 77+00:

Two large trees were noted on the upstream slope near the crest. No trees were noted along the downstream slope. The fill material was even with the top of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was noted along this section. Houses were noted in the downstream slope.

Station 77+00 to 78+00:

A large tree was noted along the crest. The sheet-pile retaining wall cap was eliminated near station 77+50. The fill material was 3 to 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was noted along this section.

Station 78+00 to 79+00:

Three large trees were noted along the upstream slope. Fill material was 2 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was noted along this section. No trees were noted along the downstream slope.

Station 79+00 to 80+00:

Five large trees were noted along the upstream slope. Fill material was 2 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was noted along this section. Houses were noted in the downstream slope.

Station 80+00 to 81+00:

Two large trees were noted along the upstream slope. Fill material was even with the top of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was noted along this section. Houses were noted in the downstream slope.

Station 81+00 to 82+00:

One large tree was noted along the upstream slope and one large tree was noted on the downstream slope. A 1-foot diameter depression was noted near station 81+75. Fill material was approximately 4 to 6 inches below the top of the sheet-pile retaining wall. A tile probe readings of $T = 1$ was noted along this section.

Station 82+00 to 83+00:

Two large trees were noted along the downstream slope and a large tree was noted near the sheet-pile retaining wall located on the upstream slope. No sidewalk was noted in this area. Fill material along the sheet-pile retaining wall was nearly even with the top. A tile probe reading of $T < 1$ was noted along this section.

Station 83+00 to 84+00:

Two large trees were noted along the upstream slope. Fill material along the upstream slope sheet-pile retaining wall was approximately 4 inches below the top. A tile probe reading of $T < 1$ was noted along this section. See a digital photo of this section on page 1.

Station 84+00 to 85+00:

A large tree was noted along the upstream slope. Fill material was even with the top of the sheet-pile retaining wall located along the upstream slope. Houses were noted in the downstream slope. A tile probe reading of $T < 3$ was noted along this section.

Station 85+00 to 86+00:

Fill material was nearly level with the sheet-pile retaining wall located along the upstream slope. Two large trees were noted along the crest. The tile probe resistance was recorded at $T < 1$ along this section. A steel cap was noted on the top of the sheet-pile retaining near station 86+00.

Station 86+00 to 87+00:

Two depressions that were approximately 2.5 feet in diameter were noted near the crest (trees were noted in these locations on the plan sheet). A new tree was noted on the upstream slope. The fill was approximately 4 to 5 inches below the top of the retaining wall. A tile probe reading of $T = 1$ was noted along this section.

Station 87+00 to 88+00:

Two large trees were noted along the upstream slope. A depression that was 5 feet in diameter and approximately 4 inches deep was observed. The area was soft and was located on the upstream side of the sidewalk. The fill material was approximately 6 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was noted along this section.

Station 88+00 to 89+00:

An 18-inch diameter depression was located near station 88+25 and upstream of the sidewalk. Two large trees and one small tree were noted along the upstream slope. A tile probe reading of $T < 1$ was noted along this section. The fill material was 4 to 6 inches below the top of the sheet-pile retaining wall.

Station 89+00 to 90+00:

At an approximate station 89+10 is where the embankment has been upgraded during the installation of the emergency spillway system. A tile probe reading of $T = 1$ was noted along this section. The sidewalk located on the crest was 8 inches lower than the upstream slope.

Station 90+00 to 91+00:

This section was repaired during the installation of the emergency spillway. A tile probe reading of T=1 was noted along this section.

Station 91+00 to 92+00:

This section was repaired during the installation of the emergency spillway.

Station 92+00 to 93+00:

This section was repaired during the installation of the emergency spillway.

Station 93+00 to 94+00:

Two large trees and two new trees were noted along the upstream slope. One tree was noted on the downstream. The fill material was 6 inches below the top of the sheet-pile retaining wall. A tile probe reading of T<1 was noted along this section. The sidewalk was 4 to 5 inches lower than the upstream slope.

Station 94+00 to 95+00:

Two large trees were noted on the upstream slope and one tree was noted on the downstream slope. The fill material was 6 inches below the top of the sheet-pile retaining wall. A tile probe reading of T<1 was noted along this section.

Station 95+00 to 96+00:

A large tree was noted on the upstream slope. The fill material was 6 to 9 inches below the top of sheet-pile retaining wall. A tile probe reading of T<1 was noted along this section. Houses were noted along the downstream slope.

Station 96+00 to 97+00:

Two large trees were noted on the upstream slope near station 96+75. Two small trees were noted on the crest. Fill material was 4 to 6 inches below the top of the sheet-pile retaining wall. A soft area, located near station 96+35, measured 12 inches in diameter and 3 inches deep. Tile probe readings of T= 1 & T=3 were noted along this section. One large tree was noted on the downstream slope.

Station 97+00 to 98+00:

Along the section the downstream slope had been removed and the basement for a new house had been constructed. The excavation was 9 to 10 feet below the top of the crest elevation. Two large trees were noted on the upstream slope and one tree was noted on the downstream slope. A low area near station 97+60 was noted that was approximately 6 feet in diameter, 3 to 4 inches deep and 12 feet from the sheet-pile retaining wall. The fill material was approximately 6 to 8 inches below the top of the sheet-pile wall. A tile probe reading of T<1 was noted along this section. See digital photos of this section on page 1 & 2. There was no sidewalk in this location.

Station 98+00 to 99+00:

Four large trees were noted along the upstream slope. A tile probe reading of T=1 was noted along this section. Fill material was 6 to 8 inches below the top of the sheet-pile retaining wall. Dense brush was noted on the downstream slope. Houses were noted in the downstream slope.

Station 99+00 to 100+00:

A large tree and scrubs were noted on the upstream slope. The fill material was 2 to 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of T=2 was noted along this section.

Station 100+00 to 101+00:

Four large trees were noted along this area. The fill material was approximately 8 to 10 inches below the top of the sheet-pile retaining wall. A tile probe reading of T=1 was noted along this section. Houses were noted in the downstream slope.

Station 101+00 to 102+00:

Two trees were noted along this section. The upstream slope was hummocky and the fill material was approximately 12 inches below the top of the sheet-pile retaining wall. A tile probe reading was recorded at T<1 along this section. The downstream slope was removed up to the crest and replaced with a concrete block retaining wall. See a digital photo of this section on page 2.

Station 102+00 to 103+00:

Two large trees were noted along the upstream slope. The fill material was 6 inches below the top of sheet-pile retaining wall. A tile probe reading of T<1 was recorded along this section. Sidewalk is uneven and sloping towards the downstream slope. Near station 102+00, a 12-inch tall steel I-beam had been welded to the top of the sheet-pile retaining wall. See a digital photo of this section on page 2.

Station 103+00 to 104+00:

Two large trees were noted along the crest. The fill material varied between 4 to 6 inches below the top of the sheet-pile retaining wall. A 12-inch tall steel I-beam was noted on the top of the sheet-pile wall. A tile probe reading of T<1 was recorded along this section.

Station 104+00 to 105+00:

Two large trees were noted on the upstream slope. Three tile probe readings of T=1, T=2, & T=3 were recorded along this section. Fill material along the upstream slope was below the top of the 12-inch tall steel I - beam.

Station 105+00 to 106+00:

Three large trees were noted along the upstream slope. Fill material was at the same elevation as the top of the I-beam elevation and sloped down to the crest. A tile probe reading of T<2 was recorded along this section. The sidewalk was 8 to 10 inches below the upstream slope elevation.

Station 106+00 to 107+00:

Two large trees were noted on the upstream slope. Three small trees were noted on the downstream slope. Fill material was below the top of the sheet-pile retaining wall. The sidewalk is sloped toward the downstream slope. See a digital photo of this section on page 2. A tile probe reading of T<1 was recorded along this section.

Station 107+00 to 108+00:

Fill material was even with the top of the sheet-pile retaining wall. The downstream slope was bare and lacked vegetal cover. A tile probe reading of T<2 was recorded along this section. A large tree still exists near station 107+50.

Station 108+00 to 109+00:

Three large trees were noted on the upstream slope and one large tree was noted on the downstream slope. Fill material was 10 inches below the top of the steel I-beam that had been placed on top of the sheet-pile retaining wall. A tile probe reading of T<1 was recorded along this section.

Station 109+00 to 110+00:

Two trees were noted along the upstream slope. Fill material was 10 inches below the top of the steel I-beam that had been placed on top of the sheet-pile retaining wall. The downstream slope had been landscaped with rock. The downstream slope lacked grass cover. A tile probe reading of T<1 was recorded along this section.

Station 110+00 to 111+00:

One large tree and two new trees, that had been recently planted, were noted along the upstream slope. A tile probe reading of T=1 was recorded along this section. Fill material was 4 inches below the top of the 12-inch tall steel I-beam that was attached on the top of sheet-pile retaining wall. The downstream slope lacked grass cover.

Station 111+00 to 112+00:

Two large trees were noted along this section of the upstream slope. According to Mr. Frank a new sheet-pile retaining wall starts at an approximate station 111+65. Fill material was 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of T=1 was recorded along this section.

Station 112+00 to 113+00:

A large tree was noted on the upstream slope and four trees were noted on the downstream slope. The fill material was approximately 8 inches below the sheet-pile retaining wall. A tile probe reading of T=1 was recorded along this section.

Station 113+00 to 114+00:

Three trees were noted along the upstream slope. Two large trees were noted on the downstream slope to the left of residence 3709. The fill material was 4 inches below the top of the sheet-pile wall. Tile probe readings of T=1 & T=2 were recorded along this section.

Station 114+00 to 115+00:

Two trees were noted along the upstream slope. The fill material was 8 inches below the top of the sheet-pile retaining wall. According to Mr. Frank, (Buckeye Lake Park Manager) the resident at 3733 had seepage problems along the downstream slope. A tile probe reading of T=1 was recorded along this section.

Station 115+00 to 116+00:

One tree was noted along the upstream slope and four trees were noted on the downstream slope. Fill material was 6 to 8 inches below the sheet-pile retaining wall. A tile probe reading of T<1 was recorded along this section.

Station 116+00 to 117+00:

A tree was noted near the crest and three trees were noted on the downstream slope. The fill material 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of T<1 was recorded along this section. The sidewalk was approximately 4 inches lower than the upstream slope.

Station 117+00 to 118+00:

No trees were noted along the upstream slope but a large tree was noted on the downstream slope. The fill material in this area is a couple of inches below the top of the sheet-pile retaining wall. A tile probe reading of T=1 was recorded along this section. The downstream slope lacked grass cover. See a digital photo of this section on page 2.

Station 118+00 to 119+00:

A low area/depression was noted approximately 8 feet from the sheet-pile retaining wall. The area was 14 feet long, 2 feet wide and 4 inches low. The sidewalk had sunken approximately 4 inches lower than the upstream slope. One tree was noted on the downstream slope. A tile probe reading of T=1 was recorded along this section.

Station 119+00 to 120+00:

An 8-foot by 8-foot area approximately 6 inches low was noted approximately 15 feet from the sheet-pile retaining wall. The fill material was approximately 3 to 4 inches below the sheet-pile retaining wall. A tile probe reading of T<1 was recorded along this section. See a digital photo of this section on page 2.

Station 120+00 to 121+00:

Two trees were noted on both the upstream and downstream slope. The fill material along the wall was 6 inches below the top of the sheet-pile retaining wall. A tile probe reading of T=2 was recorded along this section.

Station 121+00 to 122+00:

A large tree and a new tree were noted near the crest and a tree was noted on the downstream slope. Fill material was approximately 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of T<1 was recorded along this section.

Station 122+00 to 123+00:

Two large trees were noted on the upstream slope and on tree was noted on the crest. One tree was noted on the downstream slope. A tile probe reading of T<1 was recorded along this section. Fill material was 4 inches below the top of the sheet-pile retaining wall.

Station 123+00 to 124+00:

A large tree was noted on the upstream slope near the crest and a large tree had been removed near the sheet-pile wall. Fill material was level with the top of the sheet-pile retaining wall. A tile probe reading of T=2 was recorded along this section.

Station 124+00 to 125+00:

A large tree and a new tree were noted on the upstream slope. The fill material was even with the top of the sheet-pile retaining wall. A tile probe reading of T=3 was recorded along this section.

Station 125+00 to 126+00:

Three trees were noted along the upstream slope. The fill material was approximately 2 inches below the top of the sheet-piling wall. A tile probe reading of T<1 was recorded along this section.

Station 126+00 to 127+00:

Two large trees were noted along the upstream slope. Four large trees were noted on the downstream slope. A low area/depression that was approximately 65 feet long, 6 feet wide and 8 inches deep was noted along the upstream slope. The fill material was approximately 8 inches below the to of the sheet-pile wall. A tile probe reading of T<1 was recorded along this section.

Station 127+00 to 128+00:

A tree was noted on the upstream slope and six large trees were noted on the downstream slope. A sinkhole was noted near station 127+75, approximately 11 feet from the sheet-pile wall and measured 8 inches in diameter. See a digital photo of this section on page 3. A tile probe reading of T=3 was recorded along this section.

Station 128+00 to 129+00:

Three trees were noted on the upstream slope. The fill material was 2 to 3 inches below the top of the sheet-pile wall. Dense brush was noted on the downstream slope. The house between 727+50 and 128+00 had been removed. A tile probe reading of T=3 was recorded along this section.

Station 129+00 to 130+00:

Three trees were noted upstream slope. The fill material was nearly level with the sheet-pile retaining wall. A tile probe reading of T=1 was recorded along this section. Two trees were noted on the downstream slope.

Station 130+00 to 131+00:

The sidewalk was 3 to 4 inches below the upstream slope elevation. No trees were noted on the upstream or downstream slope. A tile probe reading of $T < 1$ was recorded along this section.

Station 131+00 to 132+00:

Three trees were noted on the upstream slope and four trees were noted on the downstream slope. The fill material was 8 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was recorded along this section.

Station 132+00 to 133+00:

A large tree was noted on the crest and four large trees were noted on the downstream slope. The fill material was approximately 8 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was recorded along this section.

Station 133+00 to 134+00:

Three large trees were noted on the upstream slope and three large trees were noted on the downstream slope. A soft area that was approximately 3 feet by 2 feet was noted 14 feet from the sheet-pile retaining wall on the upstream slope. A portion of the old stone wall was exposed on the crest. Fill material was 8 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was recorded along this section. The sidewalk was 4 inches lower than the upstream slope.

Station 134+00 to 135+00:

A large tree was noted on the upstream slope and four trees were noted on the downstream slope. The fill material was approximately 3 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was recorded along this section. The sidewalk was lower than the upstream slope elevation and tilted toward the downstream slope.

Station 135+00 to 136+00:

Two large trees were noted on the upstream slope. The fill material was approximately 2 to 3 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was recorded along this section. The sidewalk was 6 to 8 inches lower than the upstream slope elevation and was tilted toward the downstream slope.

Station 136+00 to 137+00:

One tree was noted on the upstream slope. The fill material was approximately 2 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was recorded along this section. The sidewalk was 6 to 8 inches lower than the upstream slope and tilted toward the downstream upstream slope.

Station 137+00 to 138+00:

One large tree was noted along the upstream slope and three trees were noted on the downstream slope. The fill material was approximately 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was recorded along this section.

Station 138+00 to 139+00:

One large tree was noted along the downstream slope. The fill material was approximately 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was recorded along this section.

Station 139+00 to 140+00:

Two trees were noted on the upstream slope. The fill material was 2 to 3 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was recorded along this section. See a digital photo of this section on page 3.

Station 140+00 to 141+00:

Three large trees were noted on the upstream slope. The fill material was near the top of the sheet-pile retaining wall. The sidewalk had sunken 2 to 3 inches below the upstream slope elevation. A tile probe reading of $T = 3$ was recorded along this section.

Station 141+00 to 142+00:

One tree was noted on the upstream slope and one tree on the downstream slope. A tile probe reading of $T = 1$ was recorded along this section. Fill material was level with the top of the sheet-pile retaining wall. The sidewalk was 2 to 3 inches lower than the upstream slope elevation.

Station 142+00 to 143+00:

One large tree was noted on the upstream slope. The fill material was approximately 3 to 4 inches below the sheet-pile retaining wall. A tile probe reading of $T = 3$ was recorded along this section.

Station 143+00 to 144+00:

One tree was noted on the upstream slope and three trees were noted on the downstream slope. The fill material was 2 to 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 3$ was recorded along this section.

Station 144+00 to 145+00:

Two trees were noted near the crest and a tree was noted on the downstream slope. Fill material was approximately 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was recorded along this section.

Station 145+00 to 146+00:

One large tree was noted on the upstream slope and two trees were noted on the downstream slope. Fill material was approximately 2 to 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was recorded along this section.

Station 146+00 to 147+00:

Two trees were noted on the upstream slope and two trees were noted on the downstream slope. The fill material was approximately 2 to 3 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was recorded along this section.

Station 147+00 to 148+00:

Two large trees were noted along the upstream slope. The fill material was approximately 2 to 6 inches below the top of the sheet-pile retaining wall. Tile probe readings of T=1 & T=2 were recorded along this section. Houses were located in the downstream slope.

Station 148+00 to 149+00:

A large tree was noted on the downstream slope. A tile probe reading of T<1 was recorded along the upstream slope. One new tree was noted on the upstream slope. Fill material was 6 to 8 inches below the top of the sheet-pile retaining wall.

Station 149+00 to 150+00:

A tree was noted on the upstream slope and downstream slope. Fill material was nearly level with the top of the sheet-pile retaining wall. A tile probe reading of T<1 was recorded along this section.

Station 150+00 to 151+00:

Two large trees were noted on the upstream slope. The fill material was nearly level with the top of the sheet-pile retaining wall. A tile probe reading of T=1 was recorded along this section.

Station 151+00 to 152+00:

A tile probe reading of T<2 was recorded along this section. Two large trees were noted along the upstream slope. Fill material was level with the top of the sheet-pile retaining wall. Houses were located in the downstream slope.

Station 152+00 to 153+00:

A low-area was noted near station 152+25 along the upstream slope that measured 3 feet by 3 feet and 4 inches deep. One tree was noted on the upstream slope and one tree on the downstream slope. A tile probe reading of T=1 was recorded along this section. The steel I-beam located on top of the sheet-pile retaining wall was eliminated near station 153+00.

Station 153+00 to 154+00:

Two large trees were noted on the upstream slope and one large tree was noted on the downstream slope. Fill material was 2 to 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of T<1 was recorded along this section.

Station 154+00 to 155+00:

A low area was noted that measured 50 feet long, 10 feet wide and 5 inches deep. Two large trees were noted along the upstream slope and two large trees were noted on the downstream slope. A tile probe reading of T=1 was recorded along this section. See a digital photo of this section on page 3.

Station 155+00 to 156+00:

Two trees were noted near the crest and two trees had recently been planted near station 155+85. One tree was noted on the downstream slope. A tile probe reading of T<2 was recorded along this section. Fill material was 3 inches below the sheet-pile retaining wall.

Station 156+00 to 157+00:

A tile probe reading of $T < 3$ was recorded along this section. One small tree was noted on the downstream slope. Fill material was nearly level with the sheet-pile retaining wall.

Station 157+00 to 158+00:

Four trees were noted along the upstream slope and two trees were noted on the downstream slope. The fill material was approximately 10 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was recorded along this section.

Station 158+00 to 159+00:

The fill material was approximately 8 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was recorded along this section.

Station 159+00 to 160+00:

Three trees were noted on the upstream slope and four trees were noted on the downstream slope. A tile probe reading of $T < 1$ was recorded along this section. Fill material was 6 inches below the top of the sheet-pile retaining wall.

Station 160+00 to 161+00:

One tree was noted on the upstream slope. A low area was noted on the upstream slope in close proximity of the sheet-pile retaining wall. The area was approximately 75 feet long, 10 feet wide and 8 inches deep. A tile probe reading of $T = 1$ was recorded along this section. See a digital photo of this section on page 3.

Station 161+00 to 162+00:

The fill material was 2 to 3 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was recorded along this section.

Station 162+00 to 163+00:

A tile probe reading of $T < 1$ was recorded along this section.

Station 163+00 to 164+00:

A tile probe reading of $T = 1$ was recorded along this section. One tree was noted on the upstream slope. Fill material was 4 inches below the sheet-pile retaining wall.

Station 164+00 to 165+00:

A large tree was noted along the upstream slope. The fill material was 2 to 3 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T < 2$ was recorded along this section.

Station 165+00 to 166+00:

Two large trees were noted on the upstream slope. A tile probe reading of $T = 1$ was recorded along this section. Fill material was 2 to 4 inches below the top of the sheet-pile retaining wall.

Station 166+00 to 167+00:

One tree was noted along the upstream slope. A tile probe reading of $T=1$ was recorded along this section.

Station 167+00 to 168+00:

The fill material behind the wall varied between 2 to 4 inches below the top of the sheet-pile retaining wall. One tree was noted on the upstream slope. A tile probe reading of $T<1$ was recorded along this section.

Station 168+00 to 169+00:

The fill material behind the wall varied between 2 to 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T<2$ was recorded along this section.

Station 169+00 to 170+00:

The sidewalk was approximately 6 inches lower than the fill elevation along the upstream slope. A tile probe reading of $T<2$ was recorded along this section. One tree was noted along the upstream slope.

Station 170+00 to 171+00:

One tree was noted on the crest. A tile probe reading of $T=1$ was recorded along this section. Fill material was nearly level with the sheet-pile retaining wall.

Station 171+00 to 172+00:

Four large trees noted along the upstream slope. One tree was noted on the downstream slope. A tile probe reading of $T=1$ was recorded along this section. Fill material was 2 to 4 inches below the top of the sheet-pile retaining wall.

Station 172+00 to 173+00:

A tile probe reading of $T=1$ was recorded along this section. Two trees were noted on the upstream slope. Fill material was 4 inches below the top of the sheet-pile retaining wall.

Station 173+00 to 174+00:

Upstream slope fill elevation was approximately 6 inches lower than the sidewalk. A tile probe reading of $T<1$ was recorded along this section. One tree was noted on the downstream slope.

Station 174+00 to 175+00:

A tile probe reading of $T<1$ was recorded along this section. It appeared that the trees noted on the original plan sheets had been removed.

Station 175+00 to 176+00:

Two large trees were noted on the upstream slope, midway between the crest and sheet-pile retaining wall. A tile probe reading of $T<1$ was recorded along this section.

Station 176+00 to 177+00:

Two large diameter trees were noted on the upstream slope. The sidewalk was 3 to 4 inches lower than crest elevation. A tile probe reading of $T < 1$ was recorded along this section.

Station 177+00 to 178+00:

Two large trees were noted on the upstream slope. A large tree had been removed from the downstream slope. A tile probe reading of $T < 1$ was recorded along this section. Fill material was 2 to 4 inches below the top of the sheet-pile retaining wall.

Station 178+00 to 179+00:

Three large trees were noted on the crest. A 4-foot diameter low area/depression approximately 4 inches deep was noted near station 178+10. The fill material was 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was recorded along this section.

Station 179+00 to 180+00:

Three small trees were noted on the upstream slope. The fill material behind the wall was approximately 4 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T = 1$ was recorded along this section.

Station 180+00 to 181+00:

A tile probe reading of $T = 1$ was recorded along this section. Two trees were noted on the upstream slope.

Station 181+00 to 182+00:

This section is natural ground. Trees were noted near the sheet-pile retaining wall. No probing was performed.

Station 182+00 to 183+00:

This section is natural ground. Trees were noted near the sheet-pile retaining wall. No probing was performed.

Station 183+00 to 184+00:

This section is natural ground. No probing was performed.

Station 184+00 to 185+00:

This is the principal spillway section. No probing was performed.

Station 185+00 to 186+00:

The principal spillway repair extended to station 185+50. The existing sheet-pile retaining wall was approximately 12-inches lower than the repaired section of the principal spillway. No trees were noted along this section. A tile probe reading of $T < 1$ was recorded along this section.

Station 186+00 to 187+00:

Four large trees were noted along this section of the upstream slope. A tile probe reading of $T=1$ was recorded along this section. The sidewalk along the crest is 3 inches lower than the upstream slope elevation.

Station 187+00 to 188+00:

Three large trees were noted on the upstream slope, midway between the crest and sheet-pile retaining wall. The sidewalk is approximately 10 inches below the upstream slope elevation. A tile probe reading of $T<2$ was recorded along this section. Fill material was 2 to 4 inches below the sheet-pile retaining wall.

Station 188+00 to 189+00:

Two trees were noted along the upstream slope. Fill material was approximately 3 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T=1$ was recorded along this section.

Station 189+00 to 190+00:

Two trees were noted along the upstream slope of this section. A tile probe reading of $T<2$ was recorded along this section. Fill material was 3 inches below the top of sheet-pile retaining wall.

Station 190+00 to 191+00:

A low area/depression approximately 3 feet in diameter and 6 inches deep was noted near station 190+15. Two large trees were noted on the upstream slope. A tile probe reading of $T<2$ was recorded along this section.

Station 191+00 to 192+00:

A large tree was noted on the upstream slope and one large tree was noted on the downstream slope. A tile probe reading of $T<1$ was recorded along this section.

Station 192+00 to 193+00:

One tree was noted on the upstream slope of this section. A tile probe reading of $T<2$ was recorded along this section.

Station 193+00 to 194+00:

Four trees were noted along this section of the upstream slope. A low area that measured 6 feet by 5 feet and 6 inches deep was observed near station 193+50. A tile probe reading of $T<1$ was recorded along this section.

Station 194+00 to 195+00:

Two large trees were noted along this section of the upstream slope. The fill material along the upstream slope was nearly level with the sheet-pile retaining wall. A tile probe reading of $T=1$ was recorded along this section.

Station 195+00 to 196+00:

Four large trees were noted along the upstream slope. The fill material along the upstream slope was nearly level with the sheet-pile retaining wall. A tile probe reading of $T < 2$ was recorded along this section.

Station 196+00 to 197+00:

Two large trees were noted along the upstream slope. The fill material along the upstream slope was nearly level with the sheet-pile retaining wall. A tile probe reading of $T < 1$ was recorded along this section.

Station 197+00 to 198+00:

A tile probe reading of $T < 2$ was recorded along this section.

Station 198+00 to 199+00:

An 18-inch diameter depression was noted on the upstream slope. It was approximately 8 inches deep. A tile probe reading of $T < 1$ was recorded along this section.

Station 199+00 to 200+00:

A tile probe reading of $T < 1$ was recorded along this section.

Station 200+00 to 201+00:

This section according to Mr. Frank (park manager) failed in the 1960's. See a digital photo of this section on page 3. A low area was noted near station 200+75 that measured 2 feet in diameter and 6 inches deep. A tile probe reading of $T < 1$ was recorded along this section.

Station 201+00 to 202+00:

The fill material was approximately 6 inches below the top of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was recorded along this section.

Station 202+00 to 203+00:

A tile probe reading of $T < 1$ was recorded along this section.

Station 203+00 to 204+00:

The Division of Engineering repaired this portion of the embankment in 1998. One tree was noted on the downstream slope. The fill material varied from 4 to 8 inches along the sheet-pile retaining wall near station 203+50. A tile probe reading of $T = 1$ was recorded along this section.

Station 204+00 to 205+00:

A 1-foot diameter low area was noted near station 204+25. No other problems were noted along this section of the upstream slope. A tile probe reading of $T < 1$ was recorded along this section.

Station 205+00 to 206+00:

The old stone wall was exposed upstream of the sheet-pile retaining wall. A tile probe reading of $T < 1$ was recorded along this section.

Station 206+00 to 207+00:

A crack in the sidewalk, located on the crest, began near station 206+25 and extended 75 feet. The crack varied from 0.4 inch to 2.0 inches in width and was approximately 8 inches deep in some locations. The upstream slope and crest are covered in concrete. See the digital photos of this section on page 4.

Station 207+00 to 208+00:

The upstream slope and crest are covered in concrete.

Station 208+00 to 209+00:

The upstream slope and crest are covered in concrete.

Station 209+00 to 210+00:

The upstream slope and crest are covered in concrete. See a digital photo of this section on page 4.

Station 211+00 to 212+00:

The upstream slope and crest are covered in concrete. See a digital photo of this section on page 4.

Station 212+00 to 213+00:

This section of the dam is where the north embankment ties into natural ground. The upstream slope and crest are covered in concrete.

DISCUSSION:

Trees are not 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.

Trees that are adjacent to a concrete wall or a sheet-pile retaining wall may eventually affect the structural integrity and should be removed. Stumps and root balls of cut trees should be removed and the cavity must be filled with well-compacted fill material and support a dense grass cover.

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 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 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.

REQUIREMENTS:

1. Investigate the integrity of the sheet-pile retaining wall above and below the normal pool level. Repair the sheet-pile retaining wall as necessary. Replenish the fill material behind the sheet-pile retaining wall to a consistent elevation along the north embankment.
2. Reestablish the crest elevation and repair the noted low-areas/depressions with compacted clay material and establish a dense grass cover.
3. Monitor the depressions (low areas) along the upstream embankment until repairs are made and following the repairs for additional signs of settlement.
4. Remove the trees and root systems along the upstream and downstream slope and the crest. Replace the voids in the embankment with compacted fill material and establish a dense grass cover.
5. Remove all landscaping and structures from the state-owned portion of the dam. This will facilitate proper inspection and maintenance of the earthfill embankment.

 8/31/01
Peter M. George, P.E. Date
Project Manager
Dam Safety Engineering Program
Division of Water

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