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LEHIGH RIVER BASIN
POHOPOCO CREEK, PENNSYLVANIA

BELTZVILLE LAKE

CONDITION REPORT

DAM, OUTLET WORKS & SPILLWAY

PERIODIC INSPECTION REPORT NO. 5

SEPTEMBER 1974

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

DECEMBER 1975

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No major areas of concern were noted by the inspection team as the overall condition of the project was considered excellent. Instrumentation data, as well as, the results of the visual inspection of the spillways, embankment, stilling basin, intake tower and drainage areas were given.

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INSPECTION & ACTION SUMMARY
PERIODIC INSPECTION REPORT NO.5

Summary of Comment(s)

1. Abutment & embankment junctions.

Erosion noted at downstream and upstream contacts of embankment with right abutment. Boulders placed on downstream junction during construction to reduce erosion have been only partially effective condition noted in Periodic Inspections 1,2,3,4,&5.

Dam operating personnel are filling and regrading the upstream contact area to provide drainage away from riprap toe. No action has been taken or is contemplated at present for the downstream area since condition of contact area is stable.

2. Sloughing or erosion of embankment slopes.

Resistance of material on downstream slopes to weathering & possible eventual clogging of horizontal drain with migrating fines was questioned during Periodic Inspection #1; minor erosion paths in downstream slope were noted during Periodic Inspection No. 2; no problems noted during Periodic Inspections 3 & 4. No problems noted in Periodic Inspection No. 5 except for slight erosion of the lower portion of upstream right abutment slope.

Slope has been closely observed for sloughing and erosion by operating personnel. Piezometers indicate no pressure increases attributable to ineffectiveness of horizontal drain. Gradation of drain should preclude infiltration. Project personnel to install gutter in lower portion of upstream right abutment slope to control erosion.

3. Spillway - Weepholes and drainage system.

Some weepholes in spillway slab clogged with dirt and needed cleaning (Periodic Inspection No. 1); installation of screens to prevent clogging & entry of burrowing animals recommended (Periodic Inspections 1,2, & 3). During Periodic Inspection No. 5 a few spillway slab protective screens were missing or displaced from outlets. The concrete lined ditch on top of the slope on the right side of the spillway has areas where the slab has cracked, areas beneath the slab have eroded and some slabs have been displaced.

Screens were installed following third periodic inspection. Protective screens will be replaced and realignment of slabs, backfilling of eroded areas beneath slab with lean concrete, and sealing of cracks with asphaltic or tar sealer is recommended (Periodic Inspection No.5).

4. Outlet Works
Conduit concrete
surfaces and
cracks.

Minor cracking in transition zone, conduit and tower sections noted in Periodic Inspections 1 & 2, crack survey and updating recommended. Minor spalling noted in Periodic Inspections 2,3,4&5.

Crack survey was made following Periodic Inspection No. 1 and updated after Periodic Inspection No. 2. No further action planned at this time.

5. Seepage Con-
dition (Embank-
ment and/or
foundation).

Small springs noted along left abutment downstream of dam (Periodic Inspection No. 2); seeps in rock cut to right of stilling basin had begun during preceding winter & continued throughout the summer, base flow of seepage along left abutment had increased during filling of the reservoir (Periodic Inspection No. 3). Installation and monitoring of weir system (Inspection 2 & 3) and seepage study (Periodic Inspection No. 3) recommended. The right abutment weir was not operational at Periodic Inspection No. 5.

Weirs installed, maintained and monitored. Evaluation of seepage condition submitted (Para 8, Periodic Inspection Report No. 3 and 4). Monitoring of weirs by operating personnel will continue on current schedule. Repair of the right abutment weir made by project personnel.

6. Outlet Works -
Joints and joint
material.

Leakage noted at construction joints 2+53.59 (Periodic Inspection No. 2) and 11+53.59 (Periodic Inspections 2,3, & 4). Minor spalling at construction joints noted during all inspections. Spalls appear to be result of patch failures. During Periodic Inspection No. 5 the leakage at STA 11+53.59 was slightly more than previously observed and spalls appeared to have increased in number due to loss of patching materials.

Joints will be monitored by Periodic Inspection Teams for further deterioration. No further action recommended at this time.

7. Outlet Works -
Water passages
including drains.

Replacement of missing pressure cell cover plate recommended (Periodic Inspection No. 2 & 3). A stream of cloudy water coming from the second weephole on the right side of the stilling basin was noted during Periodic Inspection No. 5.

Pressure cell cover replaced in spring 1973. Use of dye to attempt to trace source of cloudy water coming out of weephole was recommended.

8. Spillway - Joint displacement and joint material. Hairline cracking and poor surface appearance noted (Periodic Inspection No. 1); no changes in appearance or condition noted in Periodic Inspections Nos. 2, 3, & 4 except for some new spalling in center slabs upstream of bridge piers (Periodic Inspection No. 3). Cracks were noted on the sides of right abutment wingwalls (Periodic Inspection No. 5). Crack survey completed following Periodic Inspection No. 2. Cracks on sides of right abutment wingwalls do not require any repair (Periodic Inspection No. 5).
9. Spillway - Joint displacement and joint material. Extrusion of pre-molded joint material along the left side of the north spillway bridge pier due to closure of joint (Periodic Inspections No. 1, 2, 3 & 4). Joint space on right side of pier has opened to extent that joint material does not cover joint (Periodic Inspection No. 4 & 5). North bridge pier will be monumented to determine if joint action is the result of pier movement. Condition of joint material will be observed to determine need for replacement. Joint material on right side of pier should be removed and replaced.
10. Miscellaneous - Fencing. Fencing located at tower bridge abutment, designed to prevent entrance by unauthorized personnel, is inadequate (Periodic Inspection No. 2). Security fencing was modified to prohibit access by unauthorized personnel following Periodic Inspection No. 2.
11. Miscellaneous - Saw Mill Run erosion ditch. A ditch running from the downstream toe to Saw Mill Run had been badly eroded. Steep banks, 20 to 25 feet high with overhanging trees, presented a safety hazard to the Public (Periodic Inspection Report No. 2). Work on a drainage pipe commenced following Periodic Inspection No. 2 and was completed and performing satisfactorily prior to Periodic Inspection No. 4.

12. Miscellaneous -
Access Road entrance speed reduction.

Because of combination of vertical and horizontal curves on the relocated highway in the vicinity of the entrance to the public overlook area, sight distance were considered marginal. Recommendation to approach state highway officials to consider reduction of speed limit in this area of the public highway (Periodic Inspection No. 2).

No formal action taken. No complaints from public or accidents have been reported to the District.

13. Intake Tower
Equipment -
water quality control gates and hoists.

Gate does not close completely, having an opening of 0.4 inches in closed position (Periodic Inspection No. 3); Control gate leaks around stem seal at specific gate settings (Periodic Inspection No. 4). The control gate has slight leak in closed position, leakage less than noted in previous inspection (Periodic Inspection No. 5).

Control gate can be closed manually should the need arise for complete closure-no further action contemplated. Gate stem seal leak has been studied by District personnel and no action is required.

14. Intake Tower
Equipment -
Sluice gate and hoist.

Number 1 sluice gate had a bent stem and cracked casing and indicators were loose..(Periodic Inspection No. 3).Number 1 main gate needs new seal retainer flange (Periodic Inspection No. 5).

Stem and casing repaired; adjustments made to prevent reoccurrence.

15. Intake Tower
Equipment -
Elevator

Elevator was not operational at the time of Periodic Inspection No. 3. Primary causes of problem were shorts in the power cable and corrosion of relay contacts due to high humidity in the tower (Periodic Inspection No. 3). Wiring rearrangement needed (Periodic Inspection No. 5).

Permanent repairs completed after Periodic Inspection No. 3. Maintenance contractor keeping elevator in working order. Engineering Division will investigate and recommend changes to the wiring arrangement.

16. Intake Tower
Equipment -
Electrical
(general)
- Water present in electrical condits and boxes at lower elevations. Recommended surface mounting of boxes and repair of dead portable heater socket @ El.548. (Periodic Inspection No. 3). Most work completed with exception of a few receptacles still to be reset (Periodic Inspection No. 4) Dehumidifier system was not in operation due to backup of water into the equipment (Periodic Inspection No.5)
- District electrician has rewired lower tower elevations and provided for drainage of water in conduits. Repairs to the Dehumidifier system in October 1974.
-
17. Intake Tower
Environmental
Quality Control
Equipment
- Environmental Quality Control System was down for repair of damages caused by shorting from an electrical storm (Periodic Inspection No. 5).
- District is investigating methods of prevention of lightning damage which is a recurring problem.
-
18. Intake Tower
Equipment -
Heating
(general)
- Providing adequate heating in lower levels of the tower recognized as a problem, study of problem and initiation of corrective measures recommended. (Periodic Inspection No. 3).
- Study and corrective measures completed.
-
19. Spillway -
Bridge
guard rails.
- Many nuts holding guard rail to bridge parapet were not tight against railing base. (Periodic Inspection No.3).
- Nuts tightened after Periodic Inspection No. 3).
-
20. Spillway -
Side slopes
- Erosion noted along right side of spillway cut upstream of chute (Periodic Inspection No. 3); extent of weathering of slope questioned, comparison of present condition with job photos from construction files to determine extent recommended (Periodic Inspection No. 4).
- Operating personnel are correcting erosion problem by extending top of slope drainage ditch past eroding area. District will re-search construction files for photos and comparison with existing

Continuation of weathering and slow flattening of upstream side slopes were noted in Periodic Inspection No. 5.

conditions will be made. No corrective action is necessary for the weathering and flattening of upstream side slopes.

21. Recreation
Area - Boat
launching ramp.

State park managers and dam operating personnel reported a potentially dangerous situation. During first summer of operation, two cars rolled down the ramp into 10 to 15 feet of water when launching or landing boats. (Periodic Inspection No.3).

Boat launching ramps are being swept clean of loose gravel which had apparently contributed to former problems. No further problems reported.

22. Recreation
Area

Half of the toilet facilities have been blocked off by the state personnel. The state personnel have inquired as to the possibility of constructing a pool which would back up water under the covered bridge (Periodic Inspection No. 5).

State park personnel were informed that toilet facilities should be opened but this was not done due to reductions in their staff. State was requested to supply a plan for the intended construction of a pool for review by the Philadelphia District before approval is given.

23. Intake Tower
Equipment -
Emergency
engine generator

Hydraulic starter for emergency engine generator is difficult to reprime when engine fails to start, requires 20 minutes to reprime using hand crank.

Problem will be investigated by District personnel as funds become available for the study.

24. Stilling basin
- Outlet
channel side
slopes.

Outlet channel side slopes have suffered erosion on both banks due to extremely high releases during conduit gate rating and prototype testing in spring 1973. Most seriously eroded area is on right bank

Tentatively plan to riprap areas to prevent further erosion. Final plans and construction will be accomplished as funds

immediately downstream of stilling basin. (Periodic Inspection No. 4). Guard rail posts along the access road have been undermined at several locations due to this erosion (Periodic Inspection No. 5).

become available.

25. Embankment-
Movement of
structural
features. Ser-
vice bridge to
tower.

Small northward horizontal movement recorded by tower bridge alignment survey. Present quantity of movement presents no danger to structure. (Periodic Inspection No. 4 & 5).

District continuing observations on regular schedule. No further action scheduled.

26. Spillway -
Upstream wet
area.

Wet area observed in upstream end of spillway; recommended drainage by shallow trenching if site conditions permit (Periodic Inspection No. 4).

District to survey area to determine drainage feasibility.

27. Sewage
Treatment
Plant

The wire feeding the froth control pump is exposed (Periodic Inspection No. 5).

Recommend enclosing the wire in conduit (State of PA. responsibility).

Condition Report
Beltzville Lake
Pohopoco Creek, Pennsylvania

Periodic Creek, Pennsylvania
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Appendix A

List of Attendees - Periodic Inspection No. 5

Beltzville Lake
Pehopoco Creek, Pennsylvania
Dam, Outlet Works and Spillway
Periodic Inspection Report No. 5

SECTION 1
INTRODUCTION

1-01. AUTHORITY AND SCOPE. This report has been prepared in accordance with Engineer Regulation 1110-2-1100 entitled "Periodic Inspection and Continuing Evaluation of Civil Works Structures".

This report presents the results of the fifth periodic inspection, instrumentation readings obtained subsequent to the fourth periodic inspection, and presents remedial measures adopted by the District.

1-02. CONSTRUCTION HISTORY. The construction history of the dam site facilities and Phase I clearing contract to Elevation 586, were presented in Periodic Inspection Report No. 2. The Phase II clearing contract and recreation contract are described in Periodic Inspection Report No. 3 and 4.

1-03. INSPECTION AND EVALUATION. As required by ER 110-2-100 "Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures", a system of continuing evaluation including periodic inspection was planned to assure the safety and stability of the Beltzville Lake Project. These periodic inspections are planned to detect problem areas and to provide a basis for recommendations of remedial treatment if and when required. Periodic inspections for Beltzville Lake have been performed or are tentatively scheduled in the following sequence:

<u>Inspection</u>	<u>Time Interval</u>	<u>Scheduled Date</u>	<u>Actual Date</u>
Initial		July 1970	20 July 70
2nd Periodic	1 year	July 1971	22 July 71
3rd Periodic	1 year	July 1972	14-15 Sep 72
4th Periodic	1 year	July 1973	23-24 Aug 73
5th Periodic	1 year	July 1974	16-17 Sep 74
6th Periodic	2 years*	July 1976	
7th Periodic	2 years	July 1978	
8th Periodic	**	**	

* Originally scheduled for 1 year time interval. Changed to 2 year time as recommended by NAD inspection team following the 5th Periodic Inspection.

** Inspections following the two year interval will be increased to a five year frequency if justified by the results of previous inspections.

SECTION 2
FIFTH PERIODIC INSPECTION

2-01. GENERAL. The fifth periodic inspection was held on 16 and 17 September 1974 and was attended by representatives of North Atlantic Division and Philadelphia District. The list of those attending is included in Appendix A. Pool level at the time of the inspection was elevation 627.8 which is the normal pool elevation and is 125.8 feet above the normal pre-impoundment river elevation. The reservoir reached normal pool elevation on 18 December 1971, and with some fluctuation (-1 foot to +7 feet) had remained at that elevation until the time of the inspection.

Upon arrival at the project site, the inspection party was briefed on the results of the previous periodic inspections. Copies of the third and fourth periodic inspection were available for use by the inspection team members. A review of the instrumentation data collected since the last inspection was made prior to beginning the inspection and a detailed check list was supplied for use during the inspections. The party inspected the intake tower, conduit, stilling basin, downstream contact and sewage and upstream contact zone on the first day of the inspection and the spillway, spillway bridge, roadway bridges, and recreation areas during the morning of the second day.

Following the inspection, a critique was conducted in the project office based on the checklist which had been furnished. Comments made at the critique are summarized in the following subsections 2-02 through 2-12.

2-02. INSTRUMENTATION DATA. Review of settlement pipe and slope indicator readings resulted in recommending performance of these surveys on a six month rather than the then current three month schedule. It was recommended that piezometer and wier readings be continued on their present schedule and that piezometer P95-6 be replaced if erratic behavior continued. For details of instrumentation results refer to Section 4.

2-03. SERVICE BRIDGE.

- a. Concrete Surfaces - No deficiencies noted.
- b. Concrete Cracks - Cracking was noted in the parapet wall at light stantions - No repair required.
- c. Expansion Joints - Recommend cleaning and replacement of sealant.
- d. Drainage System - No deficiencies noted.
- e. Structural Steel - Some rust spots and paint blisters noted.
- f. Bearings - No deficiencies noted.
- g. Guard Rails and Fencing - No deficiencies noted.
- h. Bridge Movement - No abnormal movement noted.

2-04. INTAKE TOWER.

a. Structural.

- (1) Concrete Surfaces - No deficiencies noted.
- (2) Concrete Cracks - Cracks in tower roof, instrument room floor and walls show no change from previous year. Positive repair of tower roof crack recommended by NAD because of problems in the operations room caused by leakage through this crack.
- (3) Leakage - First landing up from operating floor was wet due to calcite buildup filling space between stairway and wall and preventing drainage through that space. Dam personnel will clean out space to allow drainage. Calcite buildup on walls continuing.

b. Equipment.

- (1) Service Gates and Hoists - #1 Main gate needs new seal retainer flange.
- (2) Emergency Gates and Hoists - No deficiencies noted.
- (3) Water Quality Control Gates and Hoists - Slight leakage in closed position - leakage was less than noted during previous inspection.
- (4) Sluice Gates and Hoists - No deficiencies noted.
- (5) Elevator - Wiring rearrangement needed. Engineering Division will investigate and recommend changes.
- (6) Sump Pumps and By Pass Drain - No deficiencies noted.
- (7) Electrical - No deficiencies noted.
- (8) Dehumidifier - System was not in operation due to backup of water into the equipment. Repairs in progress at the time of the inspection were completed in October 1974.
- (9) Engine Generator - No deficiencies noted.
- (10) Environmental Quality Control Equipment - System was down for repair of damages caused by shorting from an electrical storm. District is investigating methods of prevention of lightning damage which is a recurring problem.

2-05. CONDUIT.

- a. Concrete Surfaces - Good condition with minor changes from previous year's inspection.
- b. Concrete Cracks - No change noted since previous inspection.
- c. Leakage - Leak at Sta. 11 + 53.59 was again noted. Flow appeared slightly more than previously observed.
- d. Joints - Spalls at joints appear to have increased in size and number. This appears to be primarily due to loss of patching materials. No repairs considered necessary at this time.
- e. Drains - No deficiencies noted.

2-06. STILLING BASIN.

- a. Concrete Surfaces - No changes noted since previous inspection.
- b. Concrete Cracks - No changes noted since previous inspection.
- c. Leakage - None noted.
- d. Joints - No deficiencies noted.
- e. Drains (weepholes, etc.) - A stream of cloudy water was noted coming from the second weephole on the right side of the stilling basin. Use of dye to attempt to trace source of this water recommended by NAD Personnel.
- f. Other - Eroded outlet channel side slopes noted in fourth periodic inspection have not been repaired, a few guard rail posts along the access road are being undermined due to this erosion.

2-07. EMBANKMENT.

- a. Surface Cracks - None noted.
- b. Abutment and Embankment Junctions - No problems noted.
- c. Vertical and Horizontal Alignment - No problems noted.
- d. Unusual Movement or Cracking at or Beyond Toe - None noted.
- e. Unusual Through Embankment or Downstream Seepage - None noted.
- f. Sloughing or Erosion of Embankment or Abutment Slopes - No problems noted except for slight erosion of lower portion of upstream

right abutment slope. Project personnel plan to install gutter in this area to control this erosion.

g. Movement of Structural Features in Embankment (Conduit and Intake Tower) - None noted.

2-08. SPILLWAY.

a. Bridge.

- (1) Concrete Surfaces - No deficiencies noted.
- (2) Concrete Cracks - Cracks noted on sides of right abutment wing-walls. No repair required.
- (3) Expansion Joints - Expansion joint material has deteriorated and should be removed and replaced at joints located at piers and right abutment.
- (4) Drainage System - No deficiencies noted.
- (5) Structural Steel - Paint blisters and rust marks noted.
- (6) Bearings - No deficiencies noted.
- (7) Guard Rails - No deficiencies noted.
- (8) Bridgement Movement - No evidence of movement noted.

b. Chute and Gravity Walls.

- (1) Concrete Surfaces - No significant change since last inspection.
- (2) Concrete Cracks - No significant change noted since original crack survey performed subsequent to second periodic inspection.
- (3) Expansion Joints - No change noted in displacement of joint around north spillway bridge pier observed in the fourth periodic inspection. Joint sealer in expansion joint on right side of spillway should be removed and replaced.
- (4) Drainage System - Concrete lined ditch at top of slope on right side of spillway has areas where slab has cracked, areas beneath slab have eroded and some slabs have been displaced. Realignment of slabs, backfilling of eroded areas beneath slab with lean concrete, and sealing of cracks with asphaltic or tar sealer recommended. A few protective screens were missing or displaced from outlets of the spillway slab and wall will be replaced.

(5) Leakage - None noted.

c. Other.

1) Spillway Side Slopes - Continuation of weathering and slow flattening of side slopes upstream of the spillway crest noted. No corrective action necessary.

2-09. DOWNSTREAM AREA.

a. Erosion and Drainage - As mentioned in paragraph 2-00.f. outlet channel side slopes are eroded. Remedial measures (riprap protection) are recommended.

b. Surface Cracks - None noted.

c. Weirs - The right abutment weir was not operational at the time of the inspection. Repairs of this weir and continued readings of all weirs is recommended.

2-10. SEWAGE TREATMENT PLANT. Wiring feeding froth control pump is exposed. Recommend enclosing wiring in conduit (State of Pennsylvania responsibility).

2-11. UPSTREAM RESERVOIR AREA.

a. Erosion of Reservoir Sideslopes - No problems noted or reported.

b. Condition of Highway Embankment - Some growth noted in riprap protection at Pine Run Bridge. No corrective action required.

c. Concrete Drainage Ditches - No problems noted.

d. Highway Bridges - No deficiencies noted.

2-12. RECREATION AREA.

a. Facilities - Half of the toilet facilities had been blocked off by the state park personnel. These should be opened up and this recommendation has been made to the state personnel for appropriate action.

b. Covered Bridge - The state personnel have inquired as to the possibility of construction for a small impoundment to back up water under the covered bridge. The state will be required to submit a plan of the intended construction for review by Philadelphia District before approval of this work is given.

SECTION 3
CORRECTIVE MEASURES

3-01. GENERAL. Several corrective measures were undertaken by District personnel to alleviate problem areas noted during the fourth periodic inspection. The inspection comments and corrective actions taken are listed in subsection 3-02.

3-02. COMMENTS AND ACTIONS.

a. Page 8. Bearings (on service bridge to Intake Tower) - "Generally satisfactory. Movable bearing at center pier is apparently frozen. No physical reason is apparent, however dam tender will loosen nut on anchor bar which extends through slot in bearing pad."

Nut was loosened and subsequent measurements indicate freeing of bearing to some extent.

b. Page 8. Concrete Cracks - "No additional cracks noted since previous inspection. Top deck slab continues to leak. Recommend trial use of fiberglass cloth-epoxy combination for repair".

Cracks were repaired by chipping out top of crack and filling with non-shrink grout. Repair held up for approximately 6 months. Repairs made following 5th Periodic Inspection consisted of filling cracks with proper materials, "Radgrout" and "Water Stop". This seal has been in place for more than 6 months and has not failed to this time.

c. Page 10. Sloughing or Erosion of Embankment and Abutment Slopes - "Minor erosion along the right abutment embankment contact zone on the upstream side of the embankment was noted as previously reported in the 2nd Periodic Inspection. Recommend project forces reshape ditch or provide check dams to prevent undermining riprap in this area."

Eroded area was backfilled with quarry run material and ditch reshaped. Repair considered satisfactory by 5th Periodic Inspection team.

SECTION 4
INSTRUMENTATION RESULTS

4-01. GENERAL. The results of readings on the existing instrumentation during the construction period and during impoundment to elevation 628 and post impoundment period through the fourth periodic inspection were presented in previous inspection reports. A brief discussion of the instrumentation data for the period following the fourth periodic inspection through October 1974 follows:

4-02. PIEZOMETERS. Piezometer and pressure cell readings have remained relatively constant, varying with major fluctuations in pool level in a manner and at time lags considered normal for the structure and the locations of the instruments within the structure. Most upstream Piezometers (PZE 77-1, PZE 95-1, and PZE 98-1) continued to hold at or near the reservoir operating level. Two upstream piezometers (PZE 86-1 and PZE 92-1) have continued to indicate lower than typical Piezometric levels under the normal operating pool elevations. Impervious core piezometers (PZC 77-2 and PZC 95-3) do not indicate any change in operating characteristics since the previous periodic inspection. Impervious core piezometer (PZC 98-2) had dropped from 12 to 38 feet below normal pool elevation between July 16, 1972 to July 26, 1973 and from 38 to 40 feet between July 26, 1973 to September 25, 1974.

Two downstream pressure cells (PPF 95-5 and 98-6) have become inoperative since the previous inspection. The two downstream pressure cells (PPF 86-5 and 98-7), which had not indicated any pressure head up to September 1973 and February 1973 respectively, indicated between 2 and 3 foot of head after those dates.

Pressure cell (PPE 95-6) dropped 3 feet from May 28, 1974 to June 28, 1974 and increased 9 feet from June 29, 1974 to August 21, 1974 .

The remaining Piezometers (PZE 86-2 and PZC 86-3) and Pressure cells (PPF 77-3, PPF 98-3, and PPF 98-4) continue to react to changes with the pool level in previously established patterns.

4-03. VERTICAL INCLINATION INSTRUMENTS.

a. General. These instruments permit measurement parallel and perpendicular to the dam centerline and horizontal settlements within any portion of the embankment height. The summarized readings, current as of 15 October 1974 are as shown in Table 1.

b. Settlement. The maximum settlements for VIF 92-2, 95-2, and 98-5 have the same zones as for the fourth inspection. These instruments have indicated maximum settlement changes since the fourth periodic inspection reports of 0.05, 0.02 and 0.08 feet respectively.

c. Horizontal Movement. All three inclinometers indicated an initial upstream (easterly) movement prior to impoundment and a downstream (westerly) trend during and following reservoir filling. The maximum movement in the east-west direction was recorded in instrument 92-2 during April of 1971 and the maximum movement in the north-south direction was recorded in 92-2 during February of 1970. During the period between 20 March 1973 and 15 October 1974, very little movement has occurred in the inclinometers. These movements amount to 0.06 inches in the east-west direction (VIF 98-5) and 0.27 inches in the north-south direction (VIF 92-2) during the 19 month period.

Since the Fourth Periodic inspection the deflection in the east-west direction for VIF 95-2 changed from maximum in the east direction at elevation 569.9 to a maximum in the west direction at elevation 660.4. The deflection at elevation 569.9 decreased from 2.23 inches east (March 1973) to 2.10 inches east (October 1974) and the deflection at elevation 660.4 increased from 1.98 inches west (March 1973) to 2.28 inches west (October 1974). The increase in the westerly direction deflection at elevation 660.4 has been gradually increasing since August 1970.

4-04. SURFACE SETTLEMENT PIPES. Surface settlement readings, which are shown in Table 2, were presented in the second, third and fourth periodic inspection reports. During the recording period from 3 July 1973 to 15 October 1974, the settlement indicated negligible movement in the horizontal (less than 0.10 feet) and vertical (less than 0.05 feet).

A greater settlement has been experienced in the vicinity of the temporary end-fill zone of the embankment: Station 8+000 to Station 9+400. Settlement readings on pipes SP-4, SP-5 and SP-6 (for the second periodic inspection) and SP-5 (for the third & fourth periodic inspection) indicated the largest settlement readings of the seventeen settlement pipes. As with the third & fourth periodic inspection the trend remains only affecting SP-5.

4-05. SERVICE BRIDGE. A study of the tower bridge movement in both the horizontal and vertical direction has been undertaken since August of 1971 (shown on Tables 3 and 4). The readings are obtained on a three-month schedule by Survey Branch personnel as the settlement pipe and inclinometer elevations are obtained. The survey points are punch marks in the fixed plate and movable bar at each plate expansion dam of the bridge roadway. The points are numbered from one to ten beginning at the bridge-embankment abutment and proceeding eastward.

The results of the tower bridge movement are presented hereafter in Table 5. Results of the fourth periodic inspection report indicated very little movement had taken place at the expansion joint located above the middle pier of the three-span bridge (survey points 5 and 6). The fourth periodic inspection team inspected the expansion bearings at this location but could not find any reason for lack of movement. The dam operator was instructed to loosen the anchor bolt nut at the slotted expansion bearing to determine if the nut was preventing movement. Since the anchor bolt nut has been loosened slight movement has been noted.

Elevations taken at the bridge punch marks indicate little or no movement except at the bridge-embankment abutment which has settled 0.07 feet in the three-year observation period. No problems have been indicated by the movement records. The District will continue to monitor this feature of the project and evaluate the movements.

SECTION 5
ENVIRONMENTAL QUALITY CONTROL EQUIPMENT

The description and history of the environmental quality control system were included in Periodic Inspection Report No. 3 and No. 4.

Since publication of the above reports the problems with data logging have been corrected. However, the system has been seriously damaged by lightning surges and the unit is being repaired and preventive measures are being designed.

SECTION 6
SUMMARY

No major areas of concern were noted by the inspection team in the fifth periodic inspection. The instrumentation installed to date appears to be adequate with the exception of four pressure cells which are presently inoperative. Replacement of these cells with open type piezometers is planned. The overall condition of the project is considered excellent. Minor remedial work will be accomplished by routine maintenance and as funds become available on more significant items.

TABLE 1

VERTICAL INCLINATION DATA SUMMARY

Installation	Ht. of Fill Above Bottom of casting (Ft)	Maximum Settlement and Zone 10-15-74	North		South		East		West	
			Direction	Maximum Deflection	Direction	Maximum Deflection	Direction	Maximum Deflection	Direction	Maximum Deflection
VIF 92-2 (Rt Abut)	151	1.71' 605.96-610.96	North	3.11" 2/70	East	5.92" 4/71				
			North	1.98" 10/74	East	5.43" 10/74				
VIF 95-2 Closure	169	1.96' 604.72-609.72	South	-3.04" 9/70	East	3.80" 8/70				
			South	-2.93" 10/74	West	-2.28" 10/74				
VIF 98-5 (Left Abut)	115	1.32' 608.71-613.71	North	1.73" 11/71	East	3.58" 8/71				
			North	1.54" 10/74	East	3.11" 10/74				

TABLE 2

Surface Settlement Data
Settlement Pipe & Offset & Elevations

1 Instrument Number	2 Station	3 Height of Fill	4 Initial Survey Date	5 Initial Offset	6 Offset 15 Oct 74	*7 Offset Diff	8 Initial Elev.	9 Elevation 15 Oct 74	10 Diff. Elev.
SP-1	6+201.03	27	9 July 70	14.49	14.47	0.02	672.04	672.02	0.02
SP-2	7+401.03	44	9 July 70	14.50	14.47	0.03	672.04	672.01	0.03
SP-3	7+201.42	72	9 July 70	14.50	14.58	-0.08	672.06	671.96	0.10
SP-4	8+401.43	74	9 July 70	14.41	14.43	-0.02	672.03	671.85	0.18
SP-5	8+201.15	91	9 July 70	14.40	14.56	-0.16	672.04	671.53	0.51
SP-6	8+401.43	166	9 July 70	14.52	14.58	0.06	672.02	671.83	0.19
SP-7	8+201.15	172	18 Dec 70	14.44	14.42	-0.04	671.68	671.49	0.19
SP-8	8+600.0	172	18 Dec 70	14.55	14.50	0.05	672.00	671.86	0.14
SP-9	8+600.0	172	18 Dec 70	14.58	14.53	0.05	672.04	671.89	0.15
SP-10	8+201.15	172	18 Dec 70	14.53	14.41	0.12	672.05	671.91	0.14
SP-11	8+600.0	140	18 Dec 70	14.79	14.73	0.06	672.04	671.89	0.15
SP-12	8+600.0	112	18 Dec 70	14.74	14.70	0.04	671.97	671.79	0.18
SP-13	8+201.15	116	18 Dec 70	14.55	14.53	0.02	671.86	671.73	0.13
SP-14	8+201.15	116	9 July 71	14.51	14.51	-0.01	672.03	671.88	0.15
SP-15	8+201.15	65	18 Dec 70	14.38	14.36	0.02	672.12	672.03	0.09
SP-16	8+201.15	16	18 Dec 70	14.53	14.51	0.01	672.32	672.26	0.06
SP-17	8+201.15	0	14 x 27 May 71	13.67	13.66	0.01	688.10	688.10	0.00

* Settlement Pipe & Offset & Elevations
 201 = 11.5 - 0.11
 202 = 11.5 - 0.11

TABLE 3

Tower Bridge Movement Study
Beltzville Lake

MARK NUMBERS	PUNCHMARK ELEVATIONS											
	8/13/71	7/12/72	9/13/72	12/8/72	3/20/73	7/3/73	9/21/73	1/7/74	4/10/74	7/15/74	10/17/74	
10	672.087	672.09	672.09	672.09	672.09	672.09	672.07	672.07	672.10	672.10	672.09	
9	672.078	672.07	672.07	672.06	672.07	672.07	672.05	672.06	672.08	672.08	672.07	
8	672.097	672.10	672.10	672.11	672.12	672.11	672.09	672.11	672.14	672.13	672.14	
7	672.081	672.08	672.09	672.09	672.10	672.09	672.08	672.10	672.11	672.12	672.12	
6	672.091	672.08	672.08	672.11	672.10	672.08	672.08	672.09	672.09	672.10	672.09	
5	672.073	672.07	672.07	672.09	672.08	672.07	672.05	672.08	672.08	672.08	672.08	
4	672.049	672.06	672.06	672.08	672.08	672.06	672.04	672.06	672.08	672.08	672.07	
3	672.045	672.06	672.05	672.08	672.07	672.06	672.03	672.05	672.08	672.07	672.07	
2	671.750	671.71	671.71	671.73	671.72	671.69	671.66	671.68	671.71	671.67	671.68	
1	671.724	671.69	671.69	671.71	671.70	671.67	671.64	671.85	671.69	671.65	671.65	

Tower Bridge Movement Study
Beltzville Lake

Table 4

Tower Bridge Centerline Offset- N (+)											Mark
8/12/71	7/12/72	9/13/72	12/8/72	3/21/73	7/3/73	9/21/73	1/7/74	4/10/74	7/15/74	10/17/74	Number
0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	-	0.000	-	10
0.000	0.018	0.025	0.045	0.040	0.043	0.063	0.093	0.096	0.065	0.089	9
0.000	0.015	0.025	0.040	0.045	0.042	0.067	0.088	0.088	-0.068	0.088	8
0.000	0.000	0.005	0.010	0.005	0.007	0.015	0.032	0.033	0.000	0.000	7
0.000	0.000	0.010	0.010	0.005	0.007	0.014	0.024	0.027	0.000	-0.011	6
0.000	0.000	0.010	0.010	0.008	0.010	0.014	0.015	0.015	0.000	-0.049	5
0.000	0.000	0.010	0.010	0.007	0.008	0.010	0.033	0.040	0.000	-0.030	4
0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.015	3
-	-	-	-	-	-	-	-	-	-	-	2
-	-	-	-	-	-	-	-	-	-	-	1

Tower Bridge Movement Study
Beltzville Lake

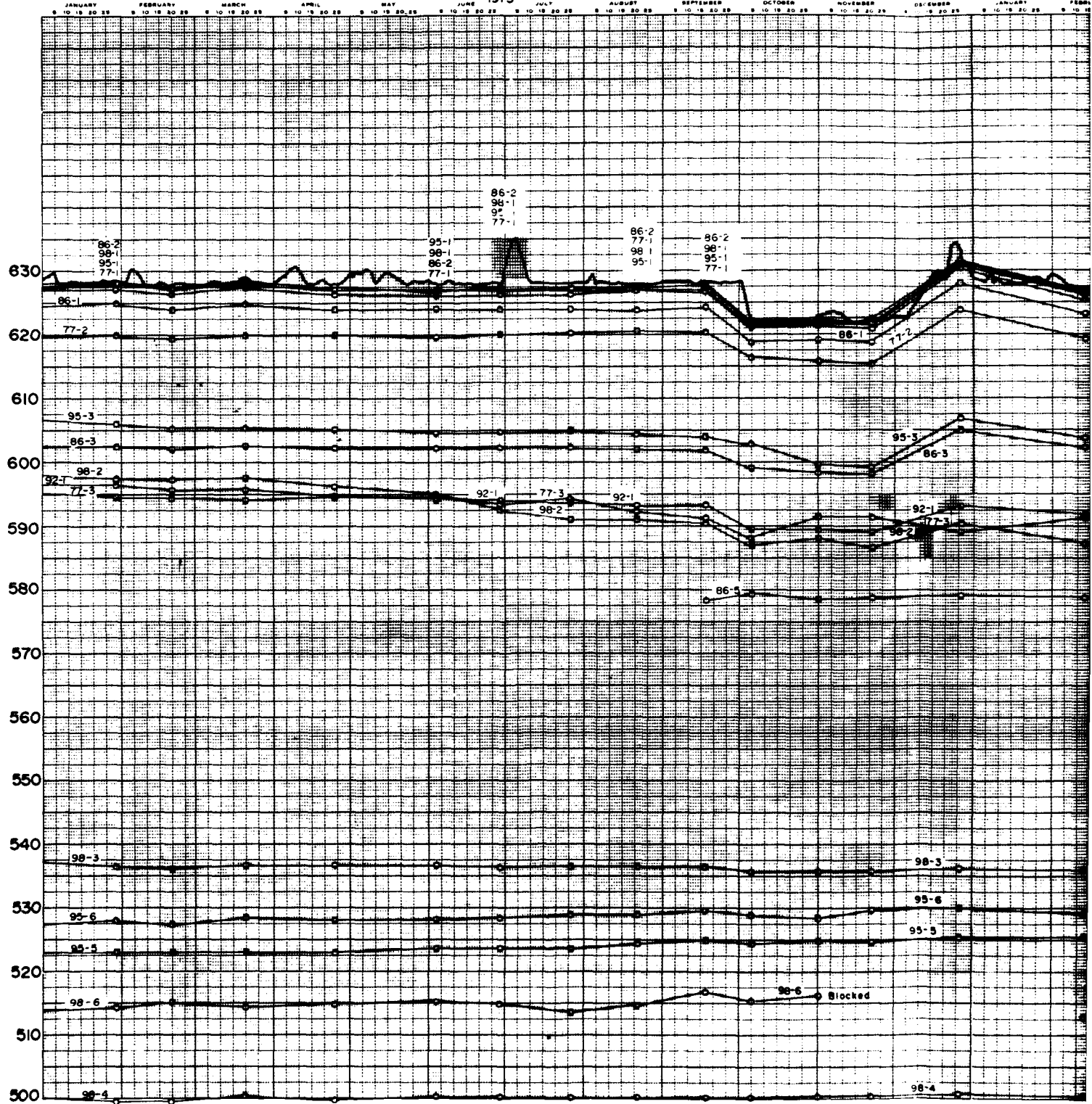
TABLE 5

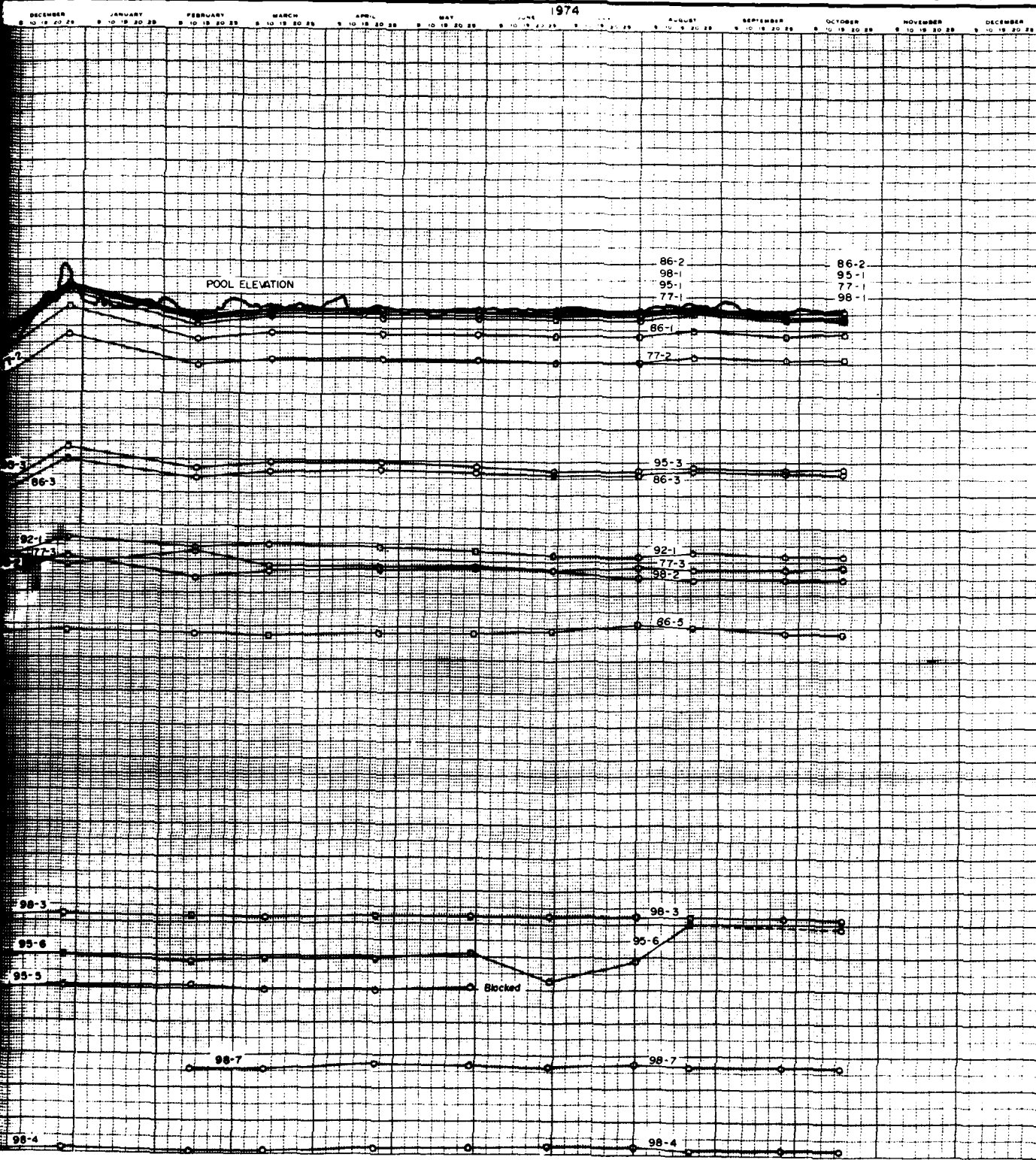
DISTANCE BETWEEN SPAN PUNCH MARKS

Mark Number	8/12/71	7/12/72	9/13/72	12/8/72	3/21/73	7/3/73	9/21/73	1/7/74	4/10/74	7/5/74	10/17/74
10	0.500	0.495	0.505	0.500	0.498	0.498	0.503	0.500	0.496	0.498	0.496
9											
8	0.496	0.490	0.515	0.565	0.548	0.502	0.545	0.515	0.587	0.505	0.547
7											
6	0.500	0.495	0.510	0.498	0.500	0.498	0.503	0.495	0.490	0.485	0.480
5											
4	0.500	0.490	0.520	0.568	0.550	0.505	0.550	0.563	0.542	0.520	0.570
3											
2	0.500	0.510	0.525	0.550	0.550	0.510	0.528	0.540	0.530	0.500	0.510
1											

CORPS OF ENGINEERS

1973

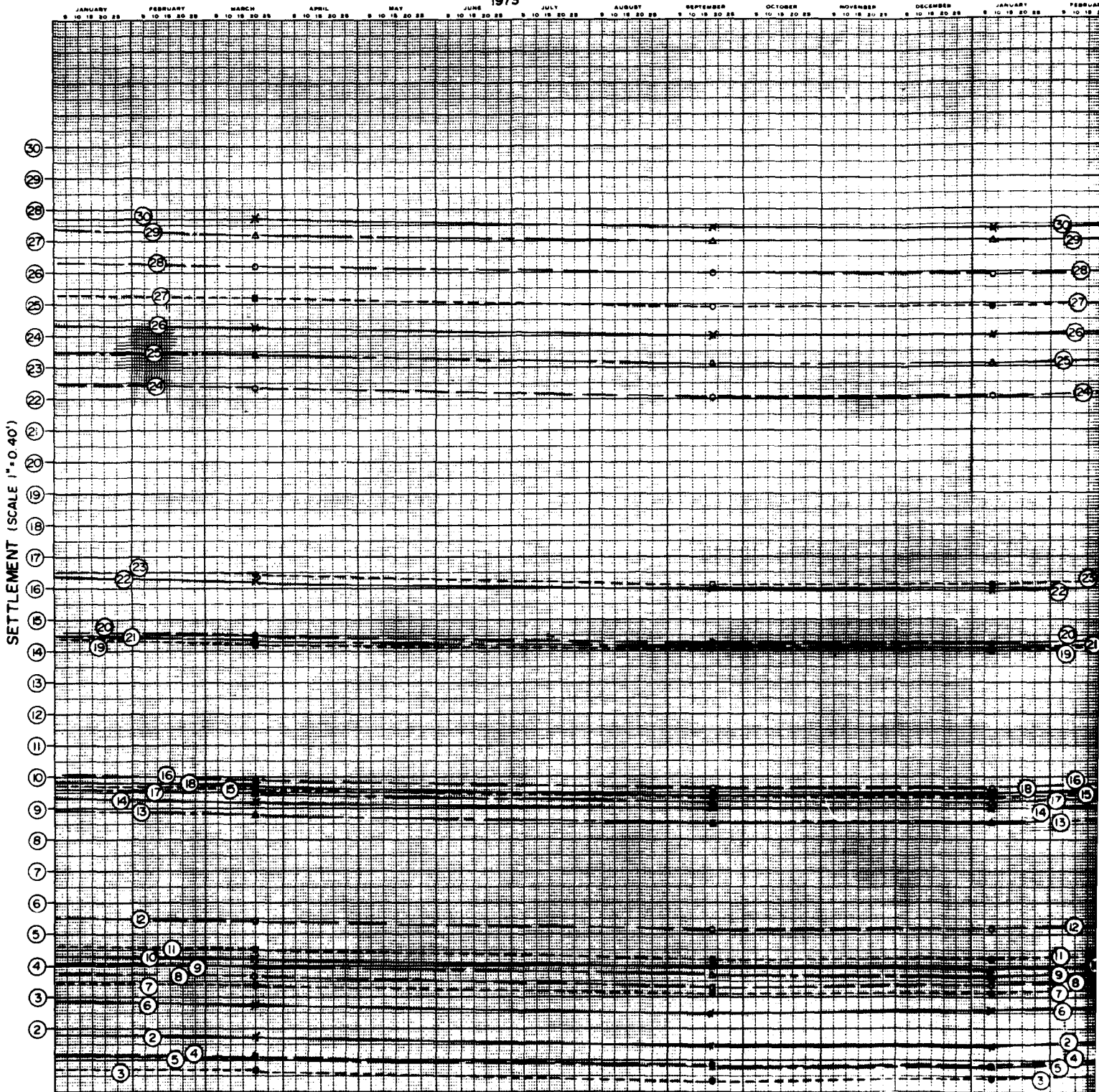




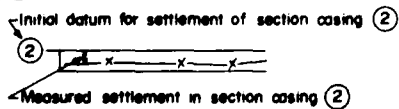
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
PIEZOMETER DATA
1973-1974

CORPS OF ENGINEERS

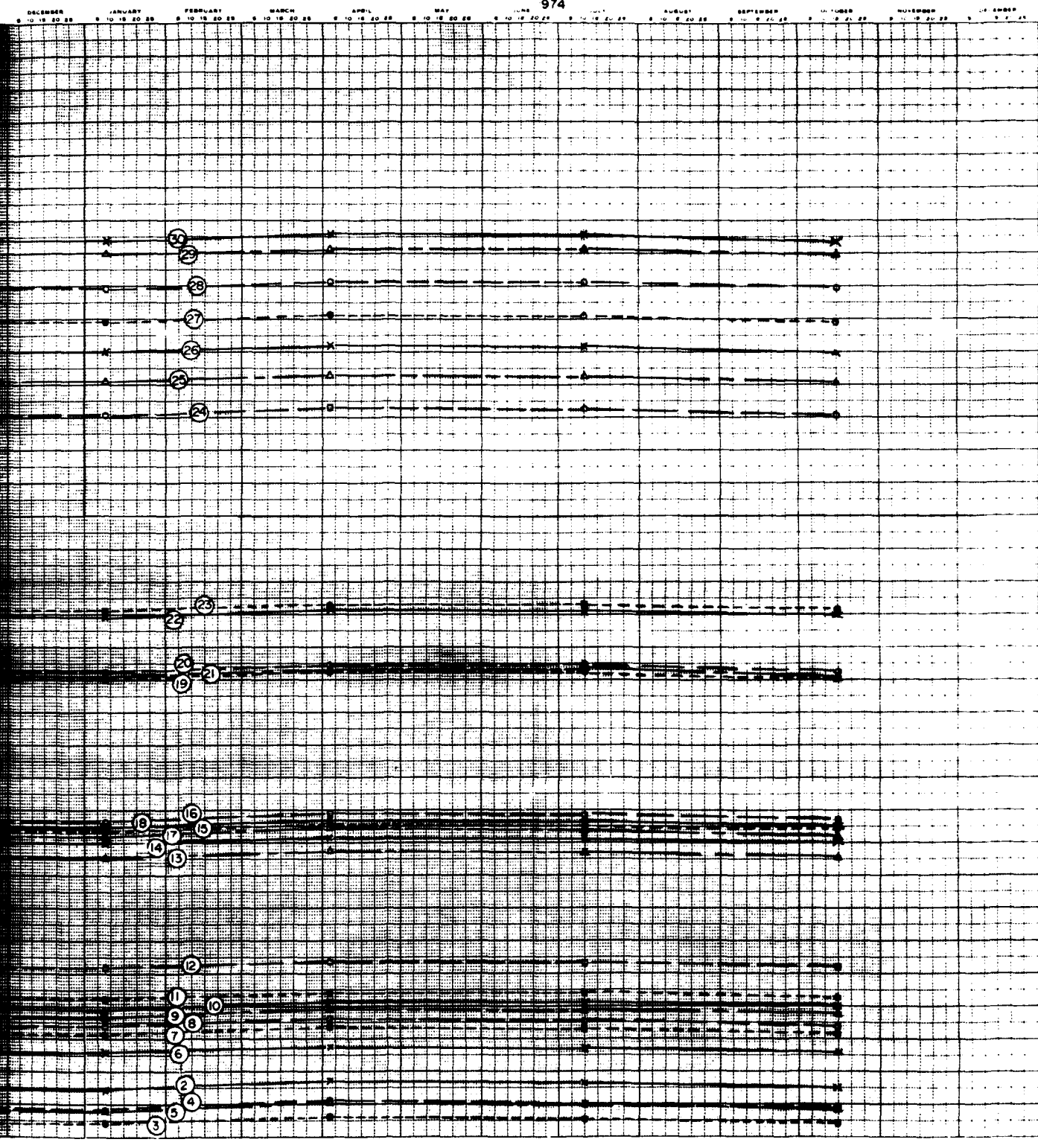
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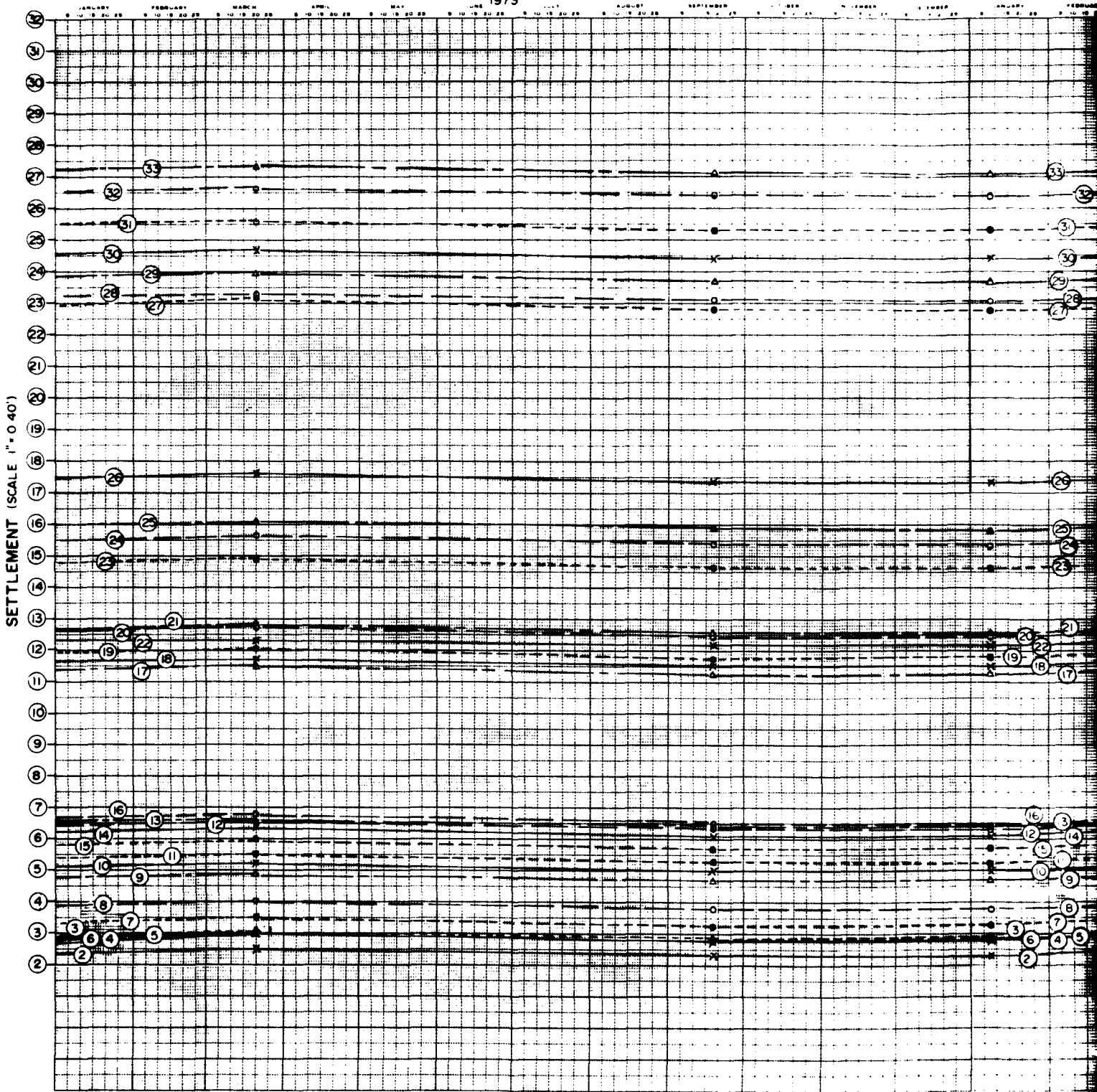
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LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF - 92 - 2 1973-1974

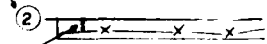
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1973



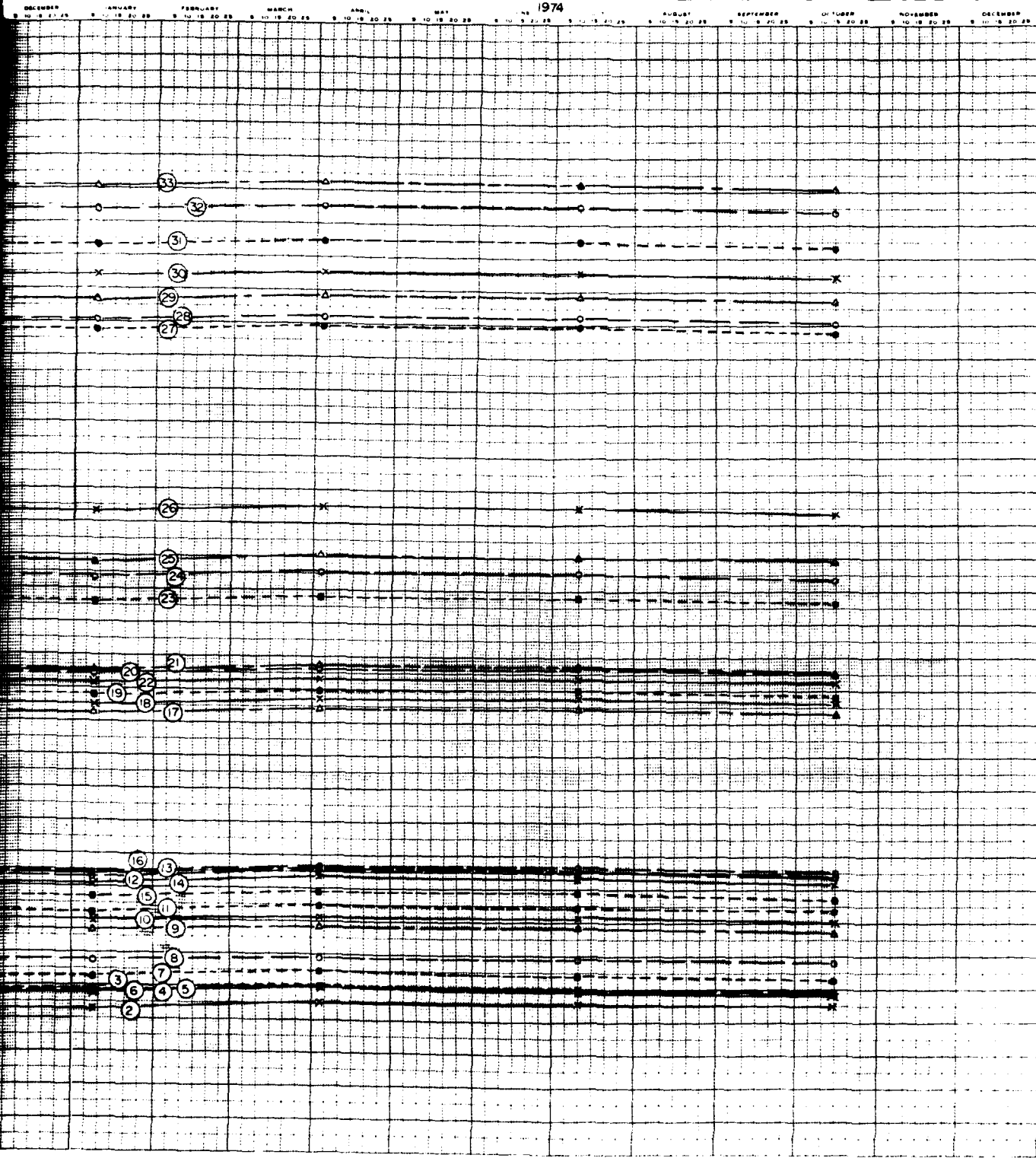
NOTE

Initial datum for settlement of section casing (2)



Measured settlement in section casing (2)

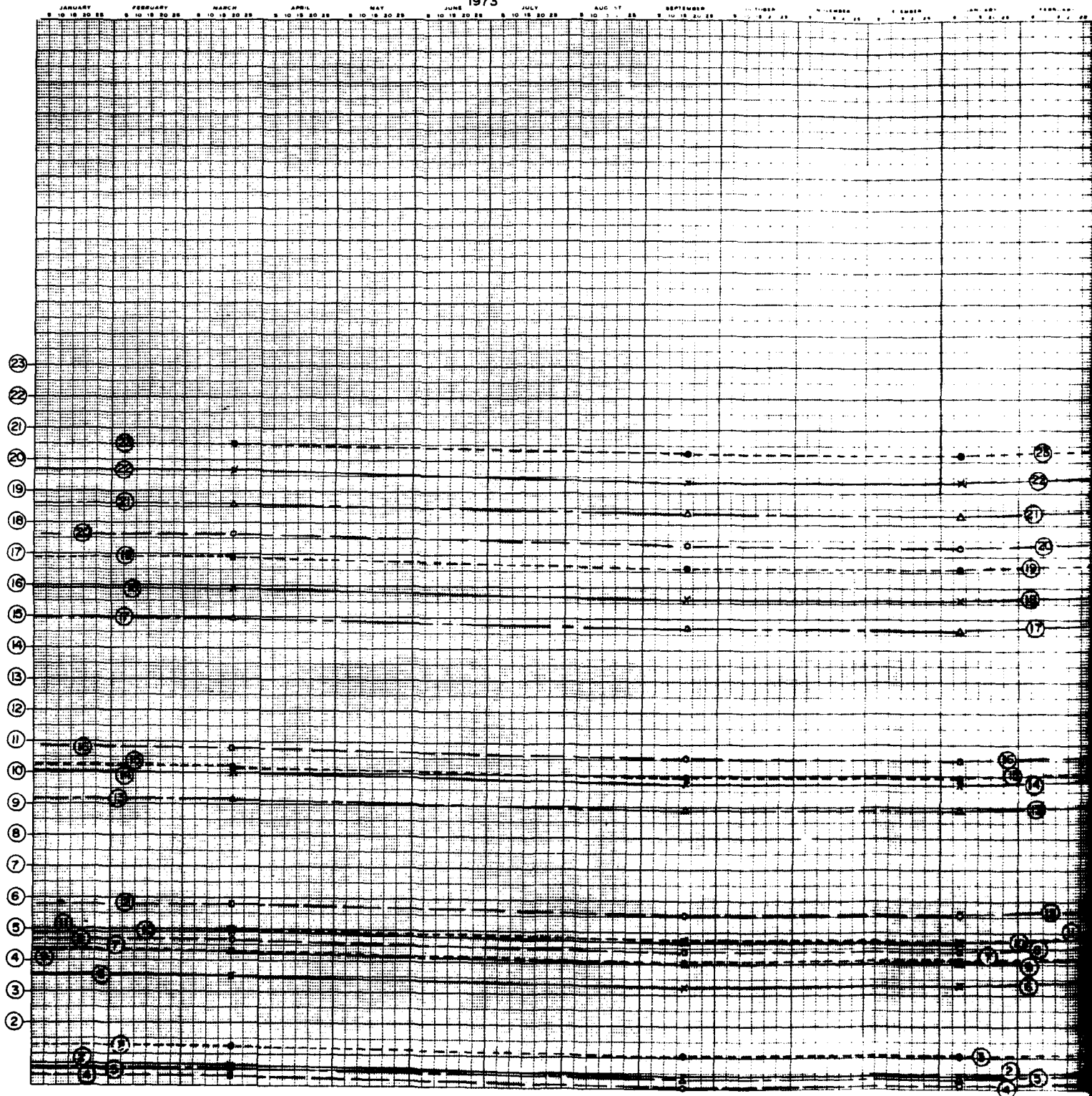
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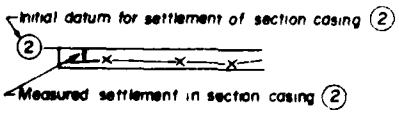
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF - 95 - 2 1973 - 1974

CORPS OF ENGINEERS

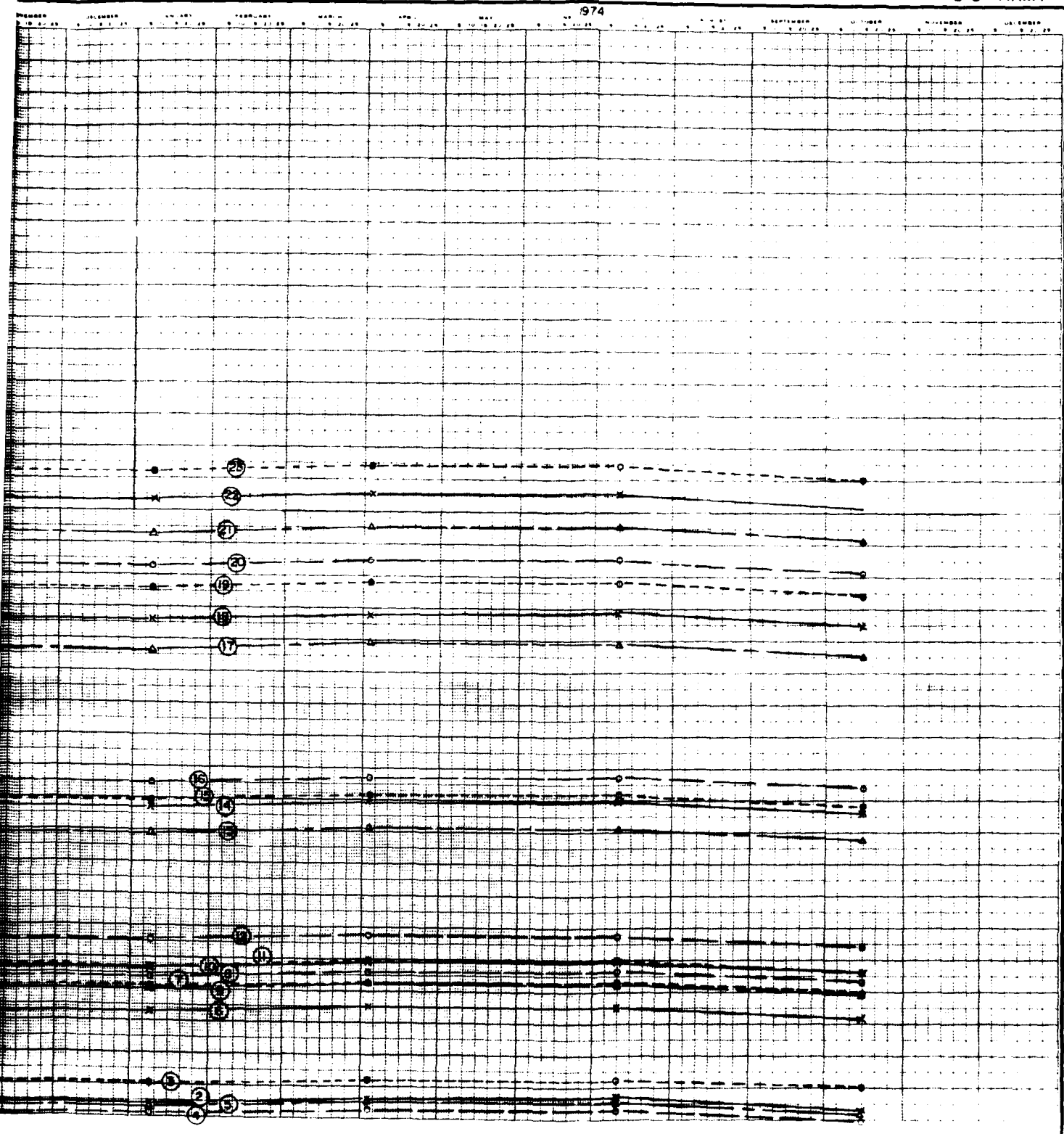
1973



NOTE:



1974

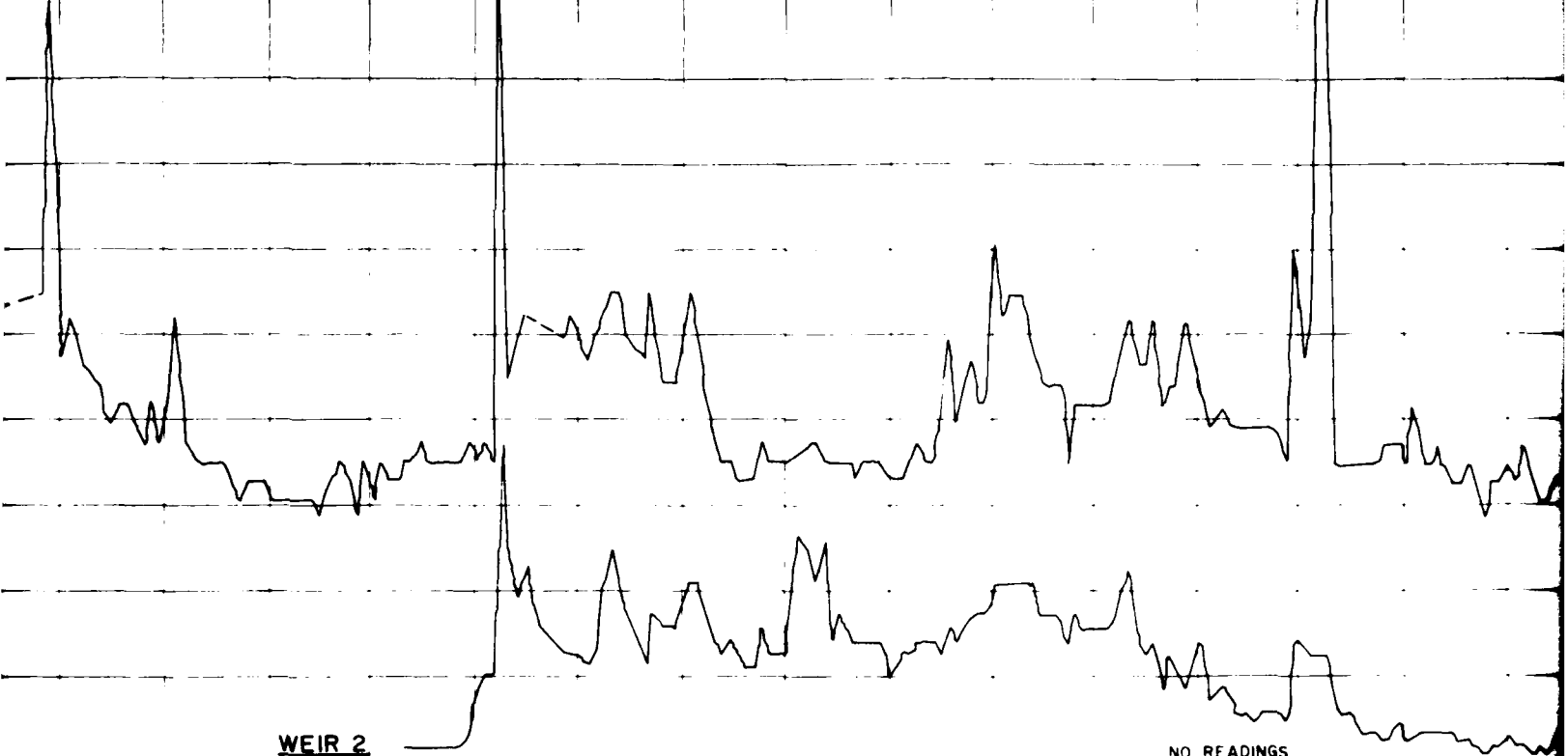


LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF-98-5 1973-1974

1972

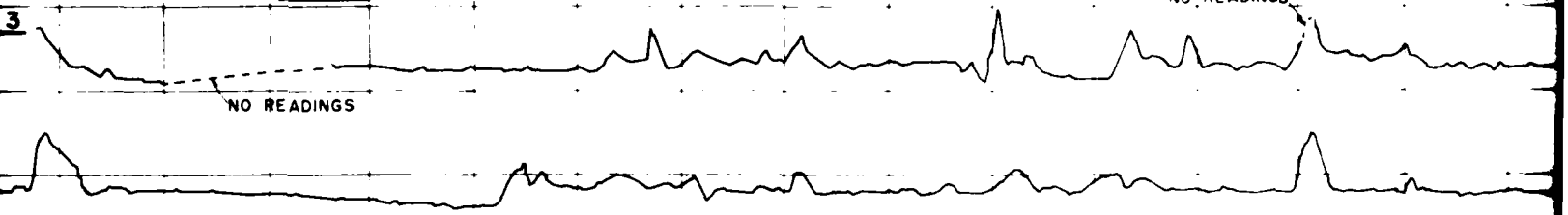
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NOV. DEC. JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT. OCT. JULY AUG. SEPT.

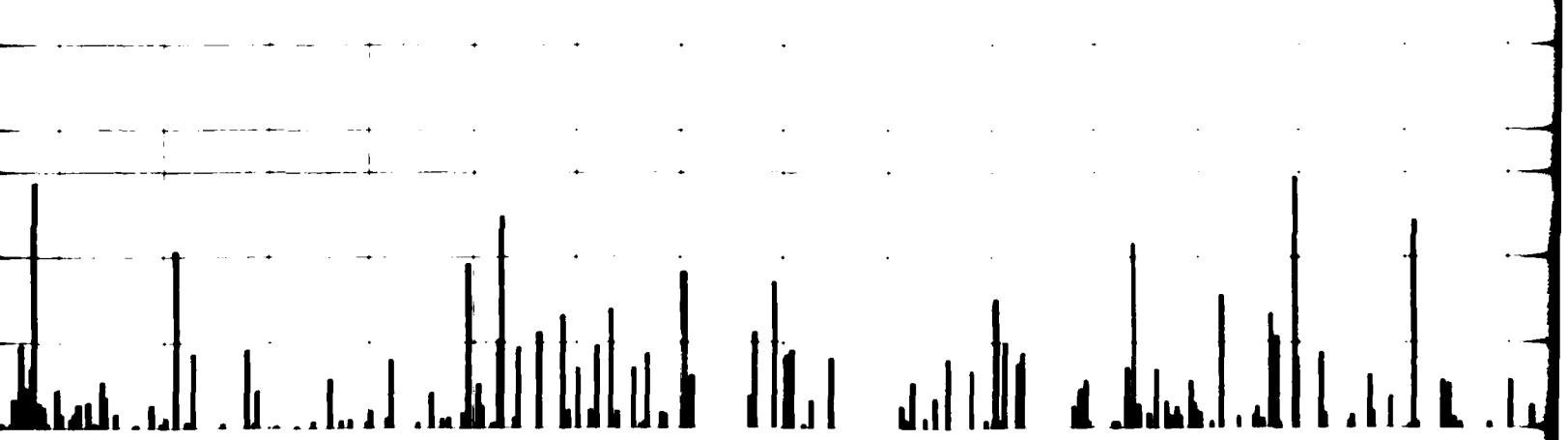


WEIR 2

NO READINGS



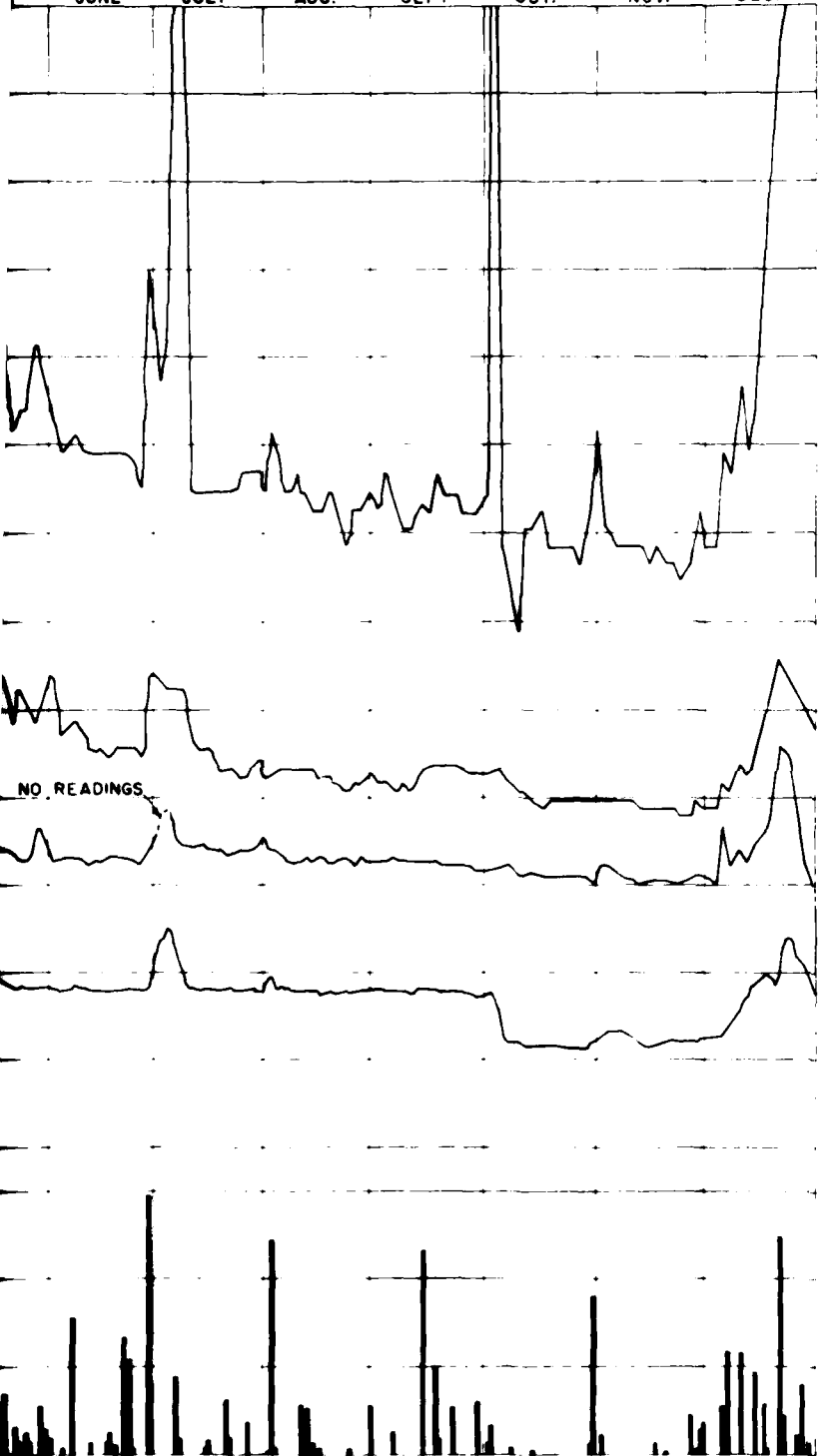
NO READINGS



BELTZ

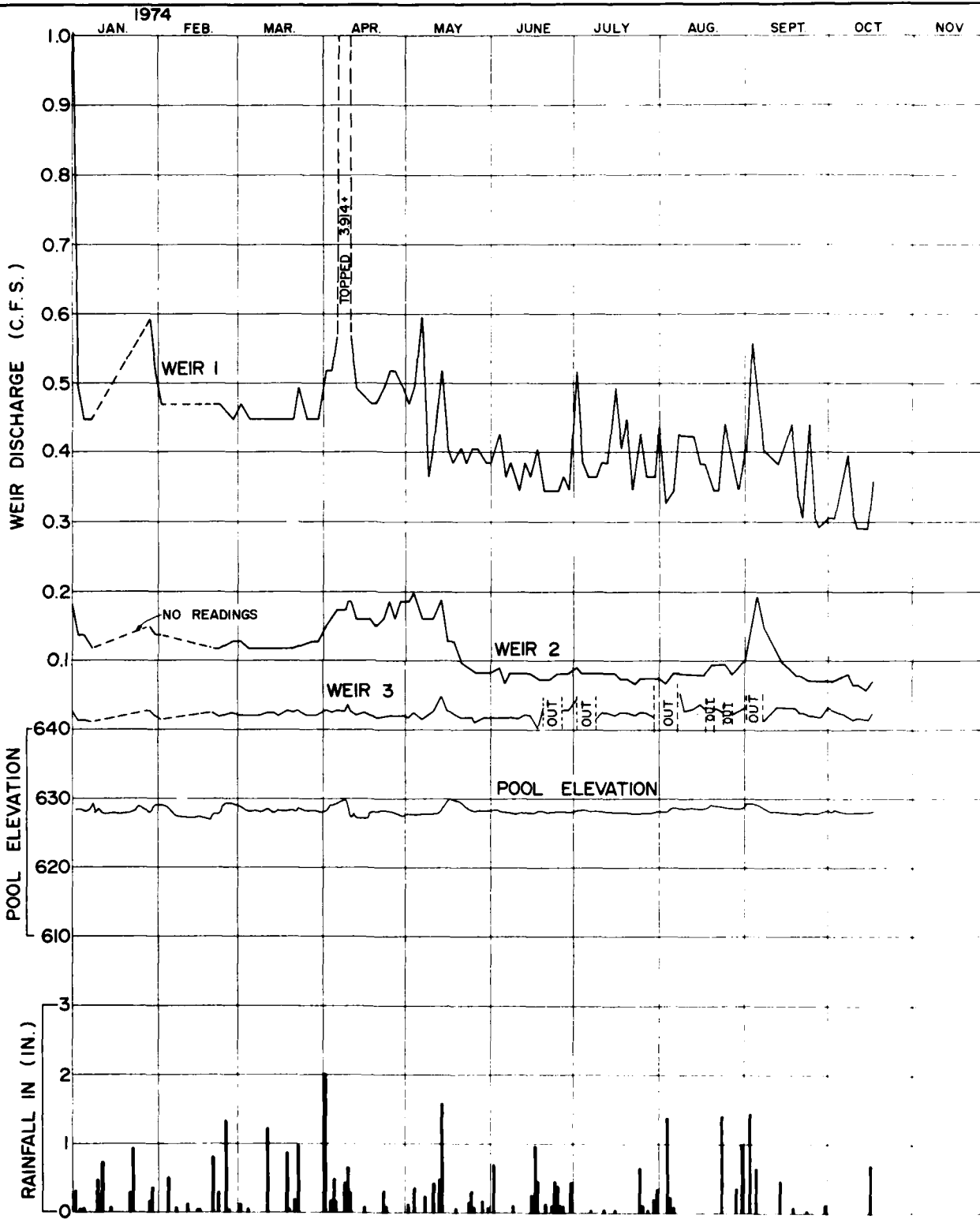
1973

JUNE JULY AUG. SEPT. OCT. NOV. DEC.



NO READINGS

LEHIGH RIVER BASIN
POMPOUCO CREEK, PENNSYLVANIA
BELTZVILLE DAM & RESERVOIR
WEIR DISCHARGE



Appendix A

Condition Report
Beltzville Lake
Pohopoco Creek, Pennsylvania

Periodic Inspection Report No. 5

List of Attendees

BELTZVILLE LAKE

List of Attendees - Periodic Inspection No. 5

F. J. Coppinger	- NAD, Engineering Division
W. Norwin	- NAD, Engineering Division
D. G. Parrillo	- NAD, Engineering Division
J. Smutz	- NAD, Engineering Division
F. Braun	- NAP, Engineering Division
M. Gross	- NAP, Engineering Division
J. Lenahan	- NAP, Engineering Division
H. Rubright	- NAP, Engineering Division
B. Uibel	- NAP, Engineering Division
B. Leatherman	- NAP, Construction-Operations Division
J. Borchick	- Chief Damtender
C. Warner	- Damtender

DA
FILM
5 -