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SCHUYLKILL RIVER BASIN.

TULPEHOCKEN CREEK, PENNSYLVANIA.

BLUE MARSH DAM  
AND  
RESERVOIR

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CONDITION REPORT.

DAM, OUTLET WORKS, SPILLWAY  
& BERNVILLE PROTECTIVE WORKS.  
PERIODIC INSPECTION REPORT

SEPTEMBER 1979.

APPROVED FOR PUBLIC RELEASE;  
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Rept. for  
1977-1979.



DEPARTMENT OF THE ARMY  
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS  
CUSTOMER HOUSE, 29 & CHESTNUT STREETS  
PHILADELPHIA, PENNSYLVANIA 19106

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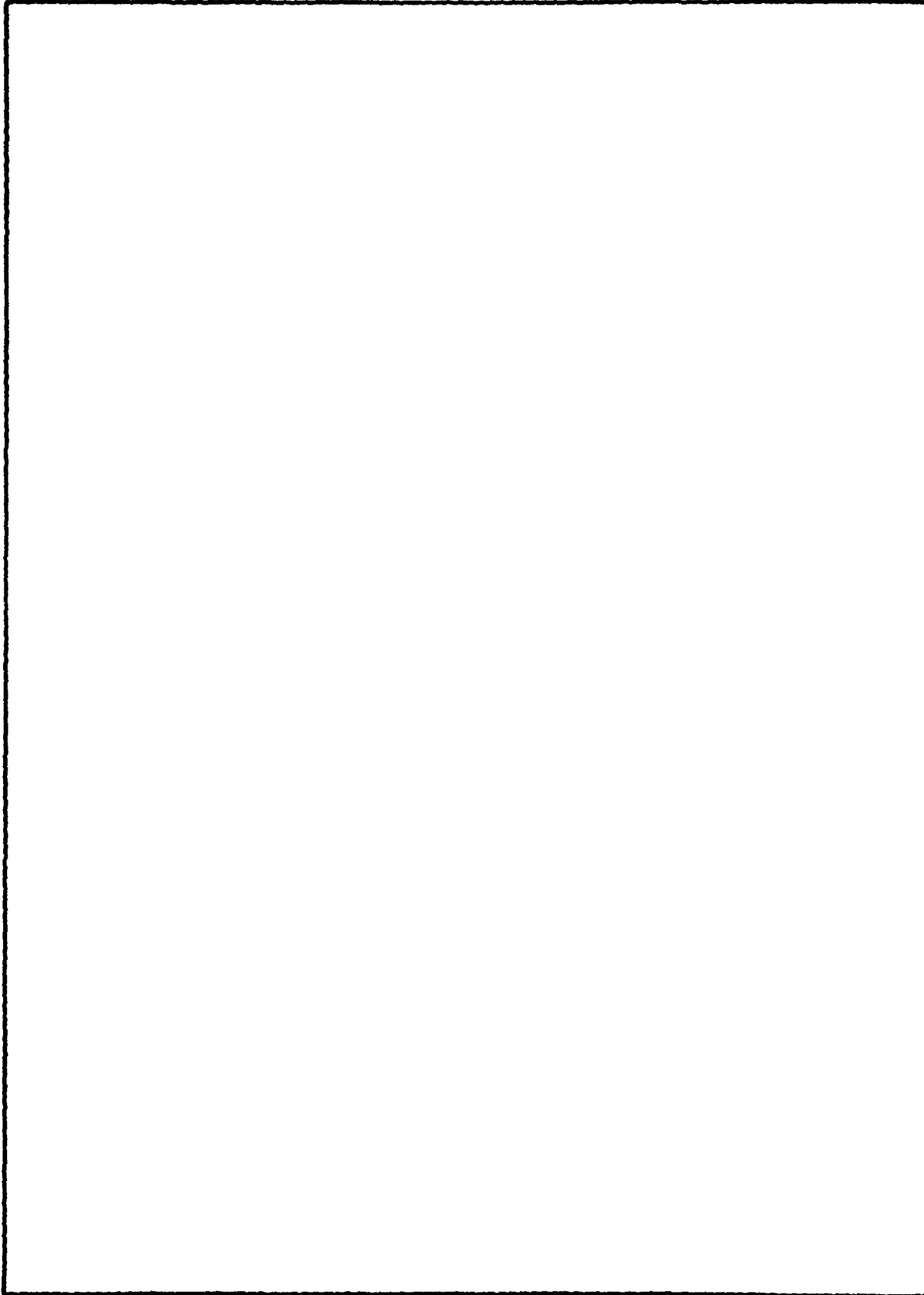
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This inspection report presented the results of the second periodic inspection, instrumentation readings and remedial measures adopted by the Philadelphia District Army Corps of Engineers on Blue Marsh Dam located on Tulpehocken Creek, Pa. Inspection data on the local protection works for the Borough of Bernville, Pa. was also included. The overall condition of the project was considered to be good. Sluice gates and pumps at the Bernville Pumping Station were repaired. Instrumentation was adequate and functioning properly. Piezometer and inclinometer data were provided in this project report.		

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)



SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

INSPECTION & ACTION SUMMARY  
Periodic Inspection Report No. 2

<u>Item</u>	<u>Summary of Comment(s)</u>	<u>Investigation &amp; Results/Actions</u>
1. Embankment & Abutments.	Erosion noted as follows:	
	a. Downstream left abutment/embankment junction vicinity Station 19+00 - shallow erosion Noted in Periodic Inspection 1 and 2.	a. No treatment required.
	b. Downstream right abutment/embankment junction - shallow to deep erosion. Noted in Periodic Inspection No. 1.	b. Rock gutter installed Station 13+00 outlet works.
	c. Drainage swale on downstream right abutment - moderate erosion. Noted in Periodic Inspection 1 and 2.	c. Stone erosion control placed from 150' downstream of toe to end of ditch after Periodic Inspection No. 1. Extension of rock lining of upstream end of ditch planned.
	d. Downstream slope of dam - shallow erosion. Noted in Periodic Inspection No. 1.	d. Grass planted after Periodic Inspection No. 1. Rate of erosion appeared insignificant at time of Periodic Inspection 2.
	Ground water seepage noted at embankment toe Station 8+00 on d.s. side and Station 9+00 to 10+00 on u.s. side.	No treatment required. (The seepage, perched ground water, was usually present during construction). All areas with pre-impoundment seepage and wet spots were recorded.
	Depressions noted at piezometer locations SBL-6 and SBL-7, apparently the result of consolidation of the hand compacted fill adjacent to the piezometers.	Continue backfilling these depressions as they occur.

INSPECTION & ACTION SUMMARY (Con't)  
Periodic Inspection Report No. 2

Item	Summary of Comment(s)	Investigation & Results/Actions
	Continued high readings of impermious core peizometers after initial response testing. Noted in Periodic Inspection 1.	Review of readings indicates functioning is satisfactory. Frequency of readings to be increased with rainfall and high pools.
2. Closure Dikes including Beekmantown Limestone Inlier at Dike A	Evaluate geologic setting and possible zone of solution activity; install observation wells; reevaluate remedial measures re possible leakage through inlier. Recommendations by Periodic Inspection No. 1 team.	Wells installed; Contract for grouting of full width of the Beekmantown inlier along upstream toe of Dike A complete prior to 2nd Periodic Inspection.
	Establish permanent monitoring system for Plum Creek. Recommenda- tion by Periodic Inspection No. 1 team.	Three engaging locations established in cooperation with USGS. Monitoring was initiated in 1977.
	Two small seeps were noted near Plum Creek during filling to normal pool. Also noted in Periodic Inspection No. 2.	Area is being inspected on regular basis to monitor flows.
	A marshy area and small stream were observed in the low area downstream of Dike C.	Area was noted initially in April 1979 before reservoir impoundment commenced and dam operator reports no change since filling
3. Spillway	a. Longitudinal cracking in weir concrete. Noted in Periodic Inspections 1 and 2.  b. Minor rock slide of left side slope and berm near upstream end during spillway excavation. Noted in Periodic Inspection No. 1.	None required  Slide occurred on local fault surface. Slide material removed no further treatment required.

INSPECTION & ACTION SUMMARY (Con't)  
Periodic Inspection Report No. 2

Item	Summary of Comment(s)	Investigation & Results/Actions
	c. Spalls or popouts noted in the concrete near the base of the left spillway wall. Noted in Periodic Inspection No. 2.	None required
4. Outlet Works Conduit.	Minor hairline cracks, generally vertical noted from Station 0+00 to service gates; hairline crack following centerline of floor and at crown. Noted during Periodic Inspection 1 & 2.	None required.
	Minor spalling of patch material at joints noted during Periodic Inspection No. 2.	None required.
5. Stilling Basin and Outlet Channel.	Slight leakage with some buildup of efflorescence was observed upstream of the dam axis. Noted in Periodic Inspection No. 2.	None required.
	Cracks in concrete at junction of wing walls and end walls. Noted in Periodic Inspections 1 and 2.	None required.
	Hand rail posts on both chute walls, forced up resulting in bent hand rails and spalling of concrete around base of posts. Noted in Periodic Inspection No. 2.	None required.
	Slight erosion of the left bank of the outlet channel beyond the riprap and on the lower portion of the service parking area slope. Noted in Periodic Inspection No. 2.	None required.

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INSPECTION & ACTION SUMMARY (Con't)  
Periodic Inspection Report No. 2

<u>Item</u>	<u>Summary of Comment(s)</u>	<u>Investigation &amp; Results/Actions</u>
6. Service Bridge	<p>Noticeable deadload deflection of girders due to insufficient camber. Noted in Periodic Inspection No. 1.</p> <p>A crazed pattern of hairline cracking on the right side of the pier and a diagonal crack through the upper corner of the transformer retaining wall at the bridge abutment. Noted in Periodic Inspection No. 2.</p> <p>Undersides of stay-in-place forms had a few scattered dark areas which appeared to be rust stains. Noted in Periodic Inspection No. 2.</p>	<p>As-built deflections will be obtained for record.</p> <p>None required</p> <p>None required</p>
7. Intake Tower.	<p>a. Consider purchase of mobile crane. Periodic Inspection No. 1.</p> <p>b. Place stop log units to check seals. Periodic Inspections No. 1 and 2.</p> <p>c. Emergency gate wheels did not turn.</p> <p>d. Check gate bypass systems when water level permits.</p>	<p>a. Purchase not economically justified at present.</p> <p>b. Will be checked in Summer 1980.</p> <p>Remedial work has been accomplished (Oct 1979).</p> <p>d. Currently checked on a monthly basis as part of service and emergency gate operational check. Begun checks on a regular basis in October 1979.</p>

INSPECTION & ACTION SUMMARY (Con't)  
Periodic Inspection Report No. 2

Item	Summary of Comment(s)	Investigation & Results/Actions
7. Intake Tower (Cont.)	<p>e. Closure procedures set by Fish &amp; Wildlife appear to be overly conservative. Noted in Periodic Inspection No. 1.</p> <p>f. Gate indicator system at lower level does not function well. Noted in Periodic Inspection No. 1</p> <p>Selsyn receivers in operators room did not track main gate accurately. Periodic Inspection No. 2.</p>	<p>e. Current gate operating procedures are included in the Reservoir Regulation Manual (Draft submitted for NAD Approval Feb 1980.)</p>
	<p>f. Gate indicator system at lower level does not function well. Noted in Periodic Inspection No. 1</p> <p>Selsyn receivers in operators room did not track main gate accurately. Periodic Inspection No. 2.</p>	<p>f. Gate indicator system modified to provide more stable operation. Selsyn receivers adjusted to best tolerance possible. Dam personnel normally operate gates from mezzanine level to allow reading scales on gate stems for accuracy on gate openings.</p>
	<p>g. Minor seepage and damp spots on Cylinder Floor (El.256<sup>0</sup>) and gutters and drains needed cleaning. Noted in Periodic Inspection No. 2.</p>	<p>g. No action required for seepage and damp spots. Gutters and drains are cleaned on a regular basis.</p>
	<p>h. Leakage around main gate shaft seals accumulates in a reservoir above seals and results in formation of residue on gate shaft.</p>	<p>h. Small holes were drilled in the bottom of the bonnet cover to prevent accumulation of water at this location.</p>
	<p>i. Hesitation between activation of the hydraulic system and beginning of service gate movement. Noted in Periodic Inspection No. 2.</p>	<p>Value replacement and investigation of a manual override of the valve to provide for a backup method of moving service gates in event of malfunction recommended.</p>

INSPECTION & ACTION SUMMARY (Con't)  
Periodic Inspection Report No. 2

<u>Item</u>	<u>Summary of Comment(s)</u>	<u>Investigation &amp; Results/Actions</u>
7. Intake Tower (Cont'd)	<p>j. Service gate seals appear to leak excessively for low heads. Noted in Periodic Inspection No. 1</p> <p>Low flow gate in No. 1 Service Gate had considerable leakage. Water quality gate did not seat tightly and leaked along its lower edge. Noted in Periodic Inspection No. 2.</p> <p>k. Hairline cracks were noted in the concrete deck near the access door on the work deck (E1.295) and in the floor slab at the down stairwell in the mechanical room. 1/8" wide crack noted in plaster facing on the east wall of the operators room. Periodic Inspection No. 2.</p>	<p>j. Service gates operate satisfactorily under higher heads, no further action required. Recommend exercising of low flow gate in No. 1 Service gate to improve sealing. No action required for water quality gate leakage.</p> <p>k. Patching of 1/8" wide crack in operators room recommended. No other action required.</p>
8. Upstream Reservoir Area and Bernville Protective Works.	<p>1. Consider installation of a log boom. Periodic Inspection No. 1.</p> <p>Numerous items including local erosion of reservoir side slopes in the limestone quarry backfill area, shallow area in cove near the old Glen Gary quarry, highway bridge crossings of the reservoir, condition and maintenance of Bernville Protection Works including levee, gravity drainage structures, pumping station detention dams #1 and #2 and pressure conduits. Periodic Inspection Reports.</p>	<p>Need for log boom evaluated. Debris has not been a problem since impoundment in 1979.</p> <p>See Text of Periodic Inspection Report No. 2 (pgs. 8 to 10) for detailed commentary.</p>

CONDITION REPORT  
BLUE MARSH LAKE  
TULPEHOCKEN CREEK, PENNSYLVANIA

PERIODIC INSPECTION REPORT NO. 2  
TABLE OF CONTENTS

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
<u>SECTION 1</u> <u>INTRODUCTION</u>		
1-01	Authority and Scope	1
1-02	Inspection and Evaluation	1
<u>SECTION 2</u> <u>DESCRIPTION OF PROJECT</u>		
2-01	General	2
2-02	Dike A Foundation and Grouting	2
2-03	Bernville Protective Works	2
<u>SECTION 3</u> <u>SECOND PERIODIC INSPECTION</u>		
3-01	General	5
3-02	Embankment	5
3-03	Intake Tower	6
3-04	Conduit and Stilling Basin	7
3-05	Spillway	8
3-06	Closure Dikes	8
3-07	Upstream Reservoir Area	8
3-08	Bernville Protective Works	9
<u>SECTION 4</u> <u>INVESTIGATION AND ACTIONS</u>		
4-01	First Periodic Inspection	11
4-02	Second Periodic Inspection	11
<u>SECTION 5</u> <u>INSTRUMENTATION</u>		
5-01	General	12
5-02	Piezometers	13
5-03	Weir	13
5-04	Inclinometers	13
5-05	Surface Monuments	13
5-06	Outlet Works and Service Bridge	13
5-07	Dike and Observation Wells	13

Rept. no. DAEN/MAP-01780/P1R02-80/04  
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SECTION 6

SUMMARY

PLATES

<u>No.</u>	<u>Title</u>
1	Instrumentation Plan
2	Piezometer Data 1976-1977
3	Piezometer Data 1978-1979
4	Dike A Observation Well Data 1978-1979
5	Inclinometer Data SIF 1
6	Inclinometer Data SIF 2

APPENDIX A

List of Attendees - Periodic Inspection No. 2

APPENDIX B

Photographs

APPENDIX C

NADEN-TF - Memorandum for Record dated 6  
November 1979.  
Subject: Periodic Inspection No. 2, Blue Marsh  
Dam, Pennsylvania

APPENDIX D

Selected Reference Drawings

BLUE MARSH LAKE  
TULPEHOCKEN CREEK, PENNSYLVANIA  
DAM, OUTLET WORKS, SPILLWAY &  
BERNVILLE PROTECTIVE WORKS  
PERIODIC INSPECTION REPORT NO. 2

SECTION 1  
INTRODUCTION

1.01. AUTHORITY AND SCOPE. The report has been prepared in accordance with Engineer Regulation 1110-2-100 entitled "Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures."

This report presents the results of the second periodic inspection, provides data and evaluation of data from the instrumentation, and describes the remedial measures adopted by the District. Also included are a description of the Bernville Protective Works and referenced drawings for important project features of this part of the Blue Marsh Lake Project.

1-02. INSPECTION AND EVALUATION. As required by ER1110-2-100 "Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures," a system of continuing evaluation including periodic inspection has been planned to assure the safety and stability of the Blue Marsh Lake Project. The periodic inspections are planned to detect problem areas and to provide a basis for recommendations of remedial treatment if and when required. Periodic Investigations have been performed or are tentatively scheduled as follows:

<u>Inspection</u>	<u>Time Interval</u>	<u>Scheduled Date</u>	<u>Actual Date</u>
1st Periodic	--	1977	Nov 1977
2nd Periodic	1 3/4 years	1979	Sep 1979
3rd Periodic	1 year	1980	
4th Periodic	1 year	1981	
5th Periodic	1 year	1982	
6th Periodic	1 year	1983	
7th Periodic	2 years	1985	
8th Periodic	2 years	1987	
9th Periodic	5 years	1992	

SECTION 2  
DESCRIPTION OF PROJECT

2-01 GENERAL. The project location and description of the Tulpehocken Creek Basin, the dam, spillway and three saddle dikes were given in Periodic Inspection Report No. 1 except for the results of the 1978-79 foundation grouting of Dike A which is described in part 2-02. Pertinent detail of the Bernville Protective Works are provided in part 2-03.

2-02. DIKE "A" FOUNDATION GROUTING. Grouting of the Beekmantown limestone beneath Dike A was begun in November 1978 and terminated in June 1979. The purpose of the grout curtain was to preclude major leakage of water through the weathered and cavernous limestone from the reservoir into the adjacent Plum Creek watershed. Two grout lines located along the upstream toe of the dike and spread 10 feet apart were planned. Large grout takes were experienced during the grouting which were attributable to filling solution channel, possible cavities and steeply dipping open joints (in excess of 60 cy of solids were injected at the point of water loss in a few holes). Due to the large takes and characteristics of the formation, the effectiveness of the grouting was questioned and upon higher authority recommendation, the grouting (lineal feet of hole drilled and grouted) was reduced from the planned amounts. Line No. 1 was fully grouted from Sta. 8+00 to Sta. 2+40 and partially grouted from Sta. 2+40 to Sta. 0+00. Line No. 2 was partially grouted with primary holes in pre-selected sections. The observation wells drilled on both sides of the dike are being monitored except OW-3 and OW-5 which were filled by grouting. Planned installation of larger diameter observation wells on both sides of Dike A was not accomplished because of shortage of funds.

2-03. BERNVILLE PROTECTIVE WORKS

a. General. The local protection works for the Borough of Bernville, Pennsylvania consists of a levee, flanking levee, detention dams and pumping station.

b. Geology. The Bernville Protective Works lies in the shale uplands portions of the Great Valley Section of the Appalachian Valley and Ridge Physiographic province. In the project area, the terrain resembles a dissected plateau and it is characterized by northeast-southwest trending hills which rise 150 to 200 feet above the main stream valleys. The area is underlain by the Upper Ordovician, Martinsburg formation which consists of highly folded shale with some interbedded limestone, siltstone and sandstone. Surface mapping and research of the literature indicate the Martinsburg formation is folded into a series of northeast-southwest trending anticlines and synclines. Bedding and cleavage strike northeast-southwest and dip variably 20 to 85 degrees southeast with the average dip being about 50 degrees. A closely spaced set of tension joints strike parallel to the cleavage and dip 20 to 60 degrees northwest. Scattered vertical joints strike in a north-south direction.

c. Bernville Levee.

(1) Site Geology. The levee is founded principally on the flood plain of Northkill Creek. The levee alignment is opposed to the northeast-southwest strike of geologic structure and stratigraphy and thus transverses diverse lithologies. Bedrock underlying the northern 1,600 feet of the levee is interbedded Martinsburg limestone, shale and sandstone. The remaining portion of the levee is underlain chiefly by red and green shale. Some yellow-brown and gray shale interbedded with green and red shale underlie the southern 400 feet of the alignment.

(2) Embankment. The levee section consists of central impervious core with outer shells of random fill. It is approximately 4,800 feet in length with a maximum height above bottom of cutoff excavation of approximately 30 feet. The levee has a crown width of 10 feet at elevation 320.5 except in the vicinity of the pumping station where it rises to elevation 325.5 and 60 feet crown width at elevation 322 for the highway portion of the levee. The impervious core provides a seepage cutoff in the embankment. Grouting of rock in the cutoff trench was not considered necessary due to the moderate pool levels of infrequent and short duration imposed on the levee. Any seepage which permeates the core and semi-pervious random fill zones should be intercepted by the interior drainage ditch which parallels the levee. Typical details and sections of the embankment are shown on referenced drawings 44735, 44736, and 44741.

d. Flanking Levee. The flanking levee extends in a northeast-southwest direction for approximately 400 feet and has a top elevation of 320.5. The maximum height is about 6 feet above the lowest original ground elevation, the internal zoning consists of random fill and the flanking levee's cross-section is similar to the main levee (Drawing No. 44744). Since (Lr 310 at elevation 310) downstream of the flanking levee, reservoir pools will only reach the flanking levee at frequencies greater than the 100-year spillway flood. Because of the infrequent and short duration of pools above elevation 310 and the low velocities from flows under Standard Project Flood conditions, stone protection on the flanking levee slope is not considered necessary.

e. Detention Dam Nos. 1 and 2. Dams built on Tributaries 1 and 2 were designed to protect Bernville from interior flooding at the same level of protection afforded by the levees from reservoir flooding. The dams will detain peak floods and pass flows directly through pressure conduits into Northkill Creek.

(1) Detention Dam No. 1. Detention Dam No. 1 consists of central impervious core with outer shells of rockfill on the upstream and random fill and rockfill on the downstream. It is approximately 300 feet in length with a maximum height above bottom cutoff excavation of approximately 28 feet. Detention Dam No. 1 has a crown

width of 25 feet at elevation 332. The impervious core provides a seepage cutoff in the embankment. Detention Dam No. 1 is founded on fractured green shale, highly to partly weathered. An excavated spillway is located east of the dam with a width of 50 feet at elevation 325 with a concrete control sill (Drawing No. 44745.)

(2) Detention Dam No. 2. Detention Dam No. 2 consists of a central impervious core with outer shells of random fill on the upstream and random fill and rockfill on the downstream. It is approximately 240 feet in length with a maximum height above bottom cutoff excavation of approximately 27 feet. Detention Dam No. 2 has a crown width of 25 feet at elevation 325. Conterminous to the embankment is a concrete spillway, 100 feet in length at elevation 320 (Drawing No. 44752). Both Detention Dam No. 2 and its spillway is founded on fractured green, gray, and red shale, highly to partly weathered.

f. Pumping Station. The pumping station is located inside the downstream end of the levee. The station's primary purpose is to provide evacuation of the interior drainage and runoff from the ponding area during high stages on Northkill Creek. It also provides the capability of discharging effluent from the Bernville sewage treatment plant during these periods. The structure is 68.5 feet long and 48.5 feet wide. It contains six chambers for the six 50 CFS storm drainage pumps and a smaller chamber for the sewage effluent pumps. Each of the main chambers is provided with a sluice gate. Storm water is discharged into Northkill Creek through six 30 inch diameter steel pipes and the treatment plant effluent is discharged through a 12 inch cast iron pipe.

g. Temporary Closure. Adjacent to the downstream end of the levee, in the Pennsylvania Route 183 cut through the high ground the surface is approximately 3 feet below the top of the levee. This roadway cut will be sandbagged when predicted stages are within 3 feet of the top of the levee (El. 321.0). One thousand empty sacks are to be provided for this purpose in storage at the pumping station.

SECTION 3  
SECOND PERIODIC INSPECTION

3-01 GENERAL. The second periodic inspection was held on 11 through 13 September 1979 and was attended by representatives of North Atlantic Division and Philadelphia District. The list of those attending is included in Appendix A. The pool level at the time of inspection was at Elevation 289.19. The permanent impoundment at Blue Marsh Lake began in May 1979.

The inspection parties were given copies of the pre-inspection brochure upon their arrival at the project site. The brochure included a discussion of the Bernville Protective Works and reference drawings for its important features. Pertinent data on the Blue Marsh Lake Dam and its apparent structures are included in Periodic Inspection Report No. 1, several copies of which were available for reference during the inspection.

Following the inspection, a critique was conducted in the project offices. Inspection comments are given in the following subsections.

3-02. EMBANKMENT.

a. Erosion was noted in the form of very shallow gullies on the left abutment/embankment junction. These gullies were located in the embankment surface just to the right of erosion control netting. No action required.

b. The seepage area noted during the first Periodic Inspection in the foundation at the downstream toe of the slope at Sta 8+00 (near piezometer SBL-14) was noted again during this periodic inspection. This wet area has shown little change in character, location or extent since the first periodic inspection which was performed prior to the filling of the reservoir. Several wet areas were also noted during these same two inspections along the upstream toe of slope on the right abutment between STA. 8+00 and 10+00. These upstream areas seem to be due to the ponding of surface water rather than seepage. The location and approximate extent of these wet areas are shown on Plate No. 1 (Instrumentation Plan). No action required.

c. Depressions were observed at piezometer locations SBL-6 and SBL-7. These are the result of consolidation of the fill around the piezometers which was less compact than the adjacent fill material. Back filling of these depressions as they occur will continue to be performed.

d. Piezometer SBL-17 seems to have tilted slightly in a direction downstream and towards the left abutment. Observation of this inclination by simple periodic measurements (once per year) will begin with 1980 surveys.

e. Ditch "E", located in the downstream area in the vicinity of Sta 8+00, has an eroded segment from the toe of the dam (ditch sta 0+00) to a point approximately 150 ft downstream. Starting at this point, the ditch has been rock lined for its remaining length. Continuation of maintenance effort to extend rock lining to upstream end of ditch recommended.

3-03. INTAKE TOWER.

a. Service Bridge.

(1) Concrete A crazed pattern of hairline cracking was noted on the right side of the pier, particularly in the lift just above grade. A diagonal crack through the upper corner of the transformer retaining wall at the bridge abutment was noted. Hairline cracking was observed in the bridge parapets. No action required.

(2) Structural Steel. The undersides of the stay-in-place forms have a few scattered dark areas which appear to be rust stains. No action required.

b. Tower Structure and Equipment.

(1) Cylinder Floor - El. 256.0

(a) Damp spots were visible in the upstream corners from El. 256.0 to approximately El. 260.

(b) Seepage was noted at the base of the left hand steel column supporting the mezzanine floor. Some calcite has accumulated on the anchor bolts, base plate and adjacent floor. No action required.

(c) Gutters and drains needed cleaning.

(d) Leakage around the gate shaft seals accumulates in a reservoir formed by the bonnet cover immediately above the seals. A residue has formed on the main gate shafts where they passed through this 1" (+) depth of water. Cleaning of the residue from the shaft and provision of a small (1/4 inch diameter) drain hole in the bottom of the bonnet cover was recommended to prevent the accumulation of water at this location. Action accomplished.

(e) A hesitation between activation of the hydraulic system and the beginning of service gate movement continues to be noticeable. Valve replacement was recommended. A manual override of the valve to provide for a backup method of moving the service gates in the event of valve malfunction should be investigated.

(f) Selsyn receivers in operators room do not track main gate operation accurately. They should be adjusted to provide

accurate readings.

(2) Work Deck - El. 295.0

(a) Several loose bolts were found on the rail post bases. All bolts should be checked and tightened as necessary.

(b) Top stop log lifting lug recesses contained water. A small drain hole should be drilled in each recess to relieve this condition.

(c) An operational test of the stop logs should be made as proposed in Periodic Inspection Report No. 1 since sufficient pool is now available for the test.

(d) Hairline cracks were noted in the concrete deck near the access door. No action required.

(3) Operator's Room. A 1/8" wide crack in the plaster facing was observed on the east wall of this room. This crack developed soon after construction and was noted in previous staff inspections. No change is apparent. Patching recommended.

(4) Mechanical Room. Hairline cracking was noted in the floor slab at the down stairwell. No action recommended.

(5) Service Gates. Low flow gate in No. 1 service gate has considerable leakage. Recommend exercising of this small gate to improve seating of its seals.

(6) Water Quality Gate. Gate did not seat tightly and leaked considerably along its lower edge. No action recommended.

(7) Liner Plates. Some minor flaking of the vinyl paint and rust stains were observed. No action recommended.

3-04. CONDUIT AND STILLING BASIN

a. Conduit.

(1) Minor spalling of patch material at the joints was noted. No action recommended.

(2) Hairline cracks, primarily at the crown and floor of the conduit were observed. Little change from cracking noted during the first periodic inspection was apparent. No action recommended.

(3) Slight leakage with some buildup of efflorescence was noted upstream of the dam axis. No action recommended.

b. Stilling Basin and Outlet Channel.

(1) Cracking in wingwalls and endwalls was essentially the same as observed during the first periodic inspection. No action recommended.

(2) Handrail posts on both chute walls have been forced up, resulting in bent handrails and spalling of concrete around the base of the posts. Upward displacement is approximately 2 inches at post with maximum movement. Freezing of trapped water below the grouted fence posts is the most likely cause of this phenomena. If movement continues, epoxy injection grouting at the posts or other measures may be necessary.

(3) Slight erosion was noted on the left bank from the end at the riprap to the confluence of the outlet channel and Tulpehocken Creek and on the lower portion of the service parking area slope. No action recommended.

#### 3-05. SPILLWAY.

(1) Spalling or popouts noted in the concrete near the base of the left spillway wall. Longitudinal cracking was noted near the center of all slab and wall sections. No action recommended.

(2) No new rock slides were noted in the spillway cut.

#### 3-06. CLOSURE DIKES.

a. Dike A. Two small seeps were present downhill from Dike A adjacent to Plum Creek a few feet above normal creek level. Most of the ground adjacent to Plum Creek in this area is marshy. Continued observation of area on a regular basis recommended.

b. Dike C. A marshy area and small stream were observed in the low area downstream of Dike C. This area was noted initially by the dam operator in April 1979 before filling of the reservoir commenced. He reported no change in the character of this area since filling.

#### 3-07. UPSTREAM RESERVOIR AREA.

a. Erosion of reservoir side slopes was noted in the backfill area in the vicinity of the limestone quarry and Ohnmacht's Cave. Some earth slope slippage has also been noted in this area. Recommend this area to be kept under close scrutiny, particularly during drawdown periods. Protective fencing should be placed to deny public access to the area.

b. A shallow area is present in the cove area formed at the old Glen Gary Quarry. This shallow area should be marked to warn boaters.

c. Highway Bridges.

(1) Vertical hairline cracks were noted in all sections of the concrete parapet walls on all five of the relocated bridges. No action recommended.

(2) LRO6047 Relocation bridge has two sheared conduits at the abutment nearest Route 183. PADOT should be notified of this problem.

(3) LRO6020 Relocation bridge has a fairly wide vertical crack in the end face of the cheek wall. PADOT should be advised so that proper action can be taken to prevent deterioration.

3-08. BERNVILLE PROTECTION WORKS.

a. Levee. The area upstream of Sta. 27+50, currently being maintained by PADOT, is poorly maintained in comparison to the C.E. maintained areas. Three 1" diameter saplings and vegetation 2 to 3 feet high were observed in the PADOT maintained area. The use of defoliant to control growth along the guard rail has resulted in denuding the top of slope and subsequent erosion in this same area. Recommend that C.E. assume responsibility for maintaining this portion in addition to the remainder of the levee.

b. Gravity Drainage Structures.

(1) Gatewell at Sta. 55+81 has considerable sediment buildup which may prevent tight closure of sluice gates. Sediment should be cleaned out.

(2) Route 183 culvert located near the intersection of Route 183 and 4th Street is nearly blocked with sediment and should be cleaned.

c. Pumping Station.

(1) Hairline cracks were observed in the exterior deck and walls. These had been noted in previous NAP staff inspection and no change in their appearance is evident.

(2) Pump No. 6 and Sluice Gates Nos. 1, 4, 5 and 6 were not operational at the time of the inspection. Immediate action to make these items operational was recommended.

(3) Two of the three pumps required for sewage and dewatering are removed for repairs. Completion of repairs and reinstallation as soon as possible was recommended.

(4) Water stains on interior face of wall at southeast corner of building and behind transformer indicative of past or

present leakage. Check, and seal as necessary, the coping at S.E. side and expansion joint behind the transformer.

(5) The bubbler system for determining the water level in the ponding area and stream is inoperable because of leakage. Recommend repair of system.

d. Detention Dam #1.

(1) Intake. Some spalling was noted on the nose of the dividing wall of the conduits. There was very little debris around the intake at the time of the inspection, but the dam operators reported that debris accumulation, cleanup and disposal are recurrent problems.

(2) Spillway. Minor cracking and spalling was noted in the spillway sill and extension. No action recommended.

(3) Pressure Conduit. Slight accumulation of sediment (6 inches or less) was noted in both passages. Numerous seepage spots and several water jets ( $\pm$  1/8 inch diameter) were noted in both passages, approximately 6 jets were noted in the right and 4 in the left passage. Generally, the seeps and jets occur at form ties. No action recommended.

e. Detention Dam #2.

(1) Intake. Some cracks through roof of intake structure. Although there was very little debris around the intake at the time of the inspection, dam operators reported debris accumulation, cleanup and disposal are recurrent problems. Debris at this site includes considerable amounts of man-made items in addition to the woody and other natural materials which collect at both detention dams.

(2) Spillway. Wet spots and ponded water were noted downstream of the concrete spillway structure. Some minor cracks and spalling were noted on the spillway structure. No action recommended.

(3) Pressure Conduit. A crack extending completely around the pressure conduit walls and roof was noted in the fourth monolith from the intake. Although present in this conduit, seepage spots and water jets were not as numerous as in pressure conduit #1. Most seepage occurs at form ties. Considerable silt buildup (up to 15 inches in depth) was present in both passages of the conduit. Patching mortar has pulled loose at several locations where it was applied at offset joints. No action recommended.

SECTION 4  
INVESTIGATIONS AND ACTIONS

4-01 FIRST PERIODIC INSPECTION. Corrective measures taken since the submission of first periodic inspection report to alleviate problem areas noted during that inspection are listed in the following subparagraphs. Page numbers refer to the report of that inspection.

a. Page 12. Erosion on downstream slope and abutment/embankment junctions of dam.

Downstream slope was graded and seeded and rock gutter was extended along the right abutment/embankment junction.

b. Page 12. Impervious core piezometers showed continued high readings.

Piezometer records were reviewed and one piezometer was bailed. All piezometers function satisfactorily.

c. Page 13. Emergency gate tower wheels were freed

d. Page 14. Grouting along the upstream toe of Dike A was accomplished.

4-02. SECOND PERIODIC INSPECTION. Actions taken to alleviate problem areas noted during the second periodic inspection are as follows:

a. A small weir was installed in the marshy area near Dike A to assist in the observation of the seeps in this area.

b. Pumping Station-Bernville Protection Works.

(1) Pump No. 6 and Sluice Gates Nos. 1, 5 and 6 were repaired one week after the inspection, Sluice Gate No. 4 is being repaired.

(2) The sewage and dewater pumps have been repaired and reinstalled.

(3) The bubbler system for determining water levels has been repaired and placed in operation.

SECTION 5  
INSTRUMENTATION

5-01. GENERAL. Instrumentation of the Blue Marsh Lake Dam includes piezometers, cased bore holes, a weir, inclinometers, surface settlement pipes, slope observation points and survey points on the tower, service bridge and stilling basin. In addition, observation wells allow monitoring of ground water levels in the vicinity of Dike A. The locations of the instrumentation in place at the time of the second periodic inspection is shown on Plate 1.

5-02. Piezometers. During the period between the first and second periodic inspections short term high pools occurred in January and March of 1978 and January and February 1979 as the result of a short term flood water storage. Long term filling of the reservoir for water supply and recreation began in May 1979 and was essentially completed at the time of the second periodic inspection.

Piezometers SBL-14, 15 and 16, located in the foundation near the right abutment end of the dam, have reacted rapidly to fluctuation in pool level since their installation. During periods of low pools (below El.260), these piezometers indicated ground water elevations above the pool level, while during higher pool levels of short duration they reached elevations somewhat below the maximum pool levels. Following the filling of the reservoir in the spring of 1979, the ground water levels in SBL-14, SBL-15 and 16 have maintained elevations slightly below pool level.

Foundation piezometers SBL 11, 12 and 13, located in the right abutment downstream of the centerline between Stations 12+00 and 14+00, have reacted normally to fluctuations in pool level. SBL-17, located in the same area, showed no reaction to pool level changes until the filling of the reservoir in the spring of 1979. Beginning in July 1979, ground water levels in this piezometer have increased and appear to be reacting to pool level fluctuation in the same manner as other piezometric in this area.

Upstream piezometer SBL-5, located near the bottom of the random section of the embankment, responds almost immediately to pool fluctuations and exhibits a water level close to the pool elevation. Impervious core piezometers SBL-1 and SBL-6 have been responsive to pool changes since 1978. Lag times have been consistent with their locations near the base of the impervious core. SBL-7 which is located higher in the core, did not respond to pool fluctuations until the drawdown to winter pool elevation in November 1979. Prior to that time it had shown a water level which receded slowly from El.295 (Feb 1978) to El.282 (Oct 1979). This piezometer was bailed out in September 1979 and its water level returned to the elevation (El.282) it had prior to bailing. This test indicates that the piezometer is operating satisfactorily and is providing dependable readings. The readings apparently reflect excess pore pressure in the

core due to incomplete consolidation of the core material as indicated by the surface subsidence around this piezometer.

Downstream random zone piezometers SBL-2 and SBL-8 have generally responded to long and short term pool fluctuations in a manner consistent with their locations.

Drainage zone piezometers SBL-3, SBL-4 and SBL-9 have exhibited very slight reactions to changes in pool level and indicate satisfactory performance of the dam's drainage zone.

SBL-10, SBL-18 and SBL-19, piezometers located in the downstream foundation of the deep valley section of the dam show only slight reaction to pool fluctuations and have remained at elevations which are indicative of satisfactory performance of the cutoff, grout curtain and internal drainage of the embankment.

5-03. WEIR. To date the flow measurements at the weir, which include periods of no flow appear to be the result of surface runoff and subsurface seepage resulting from infiltration of rainfall on the downstream side of the dam. No correlation between pool level and weir flow has been established.

5-04. INCLINOMETERS. Inclinerometers SIF-1 and SIF-2 were installed in the late summer and early fall of 1978. Readings in spring, and early and later summer 1979 indicate no zones of active movement in the embankment of these locations.

5-05. SURFACE MONUMENTS. Instrumentation to measure surface movement in the crest and upstream slope of the dam embankment was installed during construction. Readings taken in 1977 and 1979 indicate no unusual movements in the crest or upstream slope of the embankment.

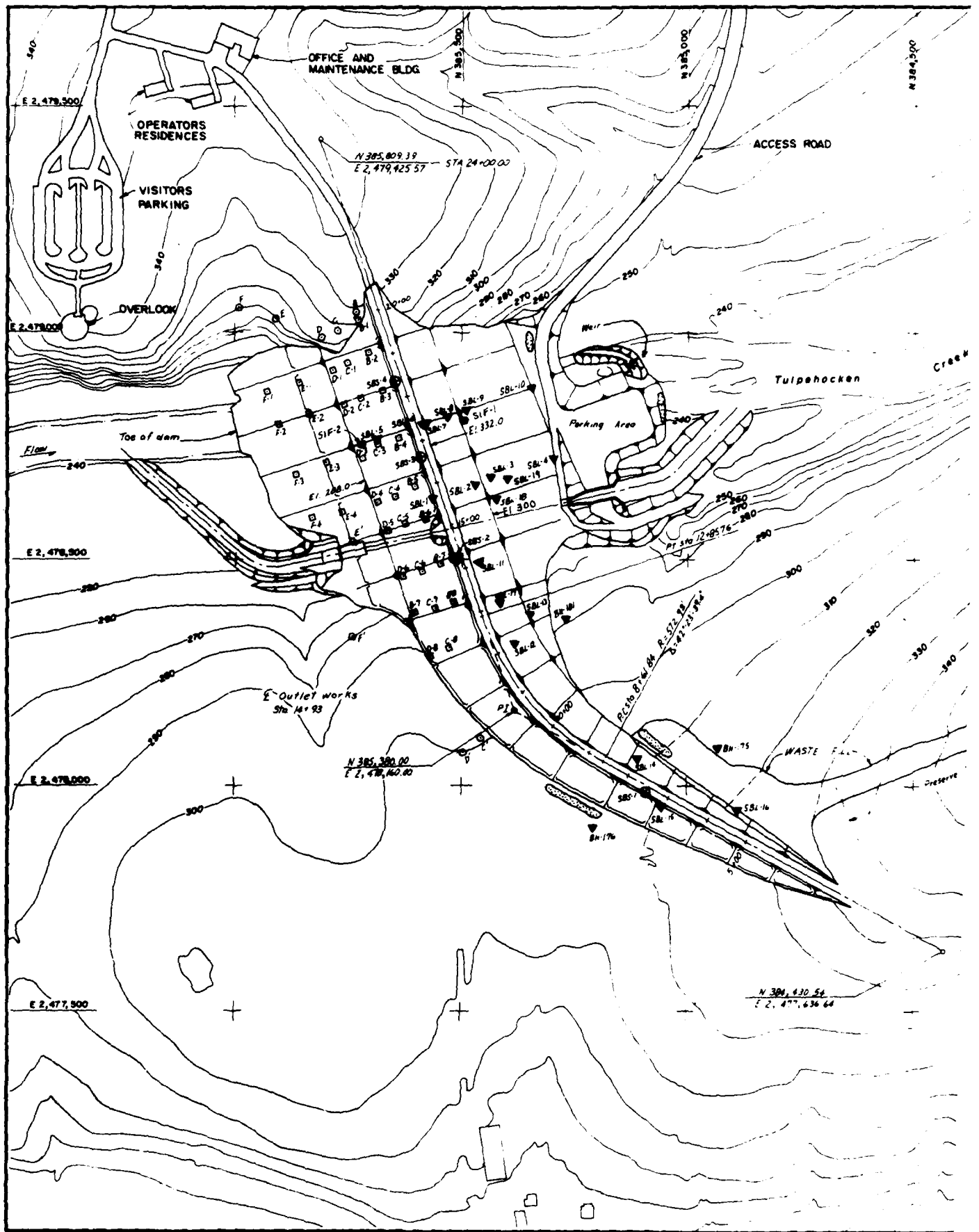
5-06. OUTLET WORKS AND SERVICE BRIDGE. Points on the stilling basin, intake tower and service bridge were established in 1979. Periodic surveys will be conducted to measure movement of these points.

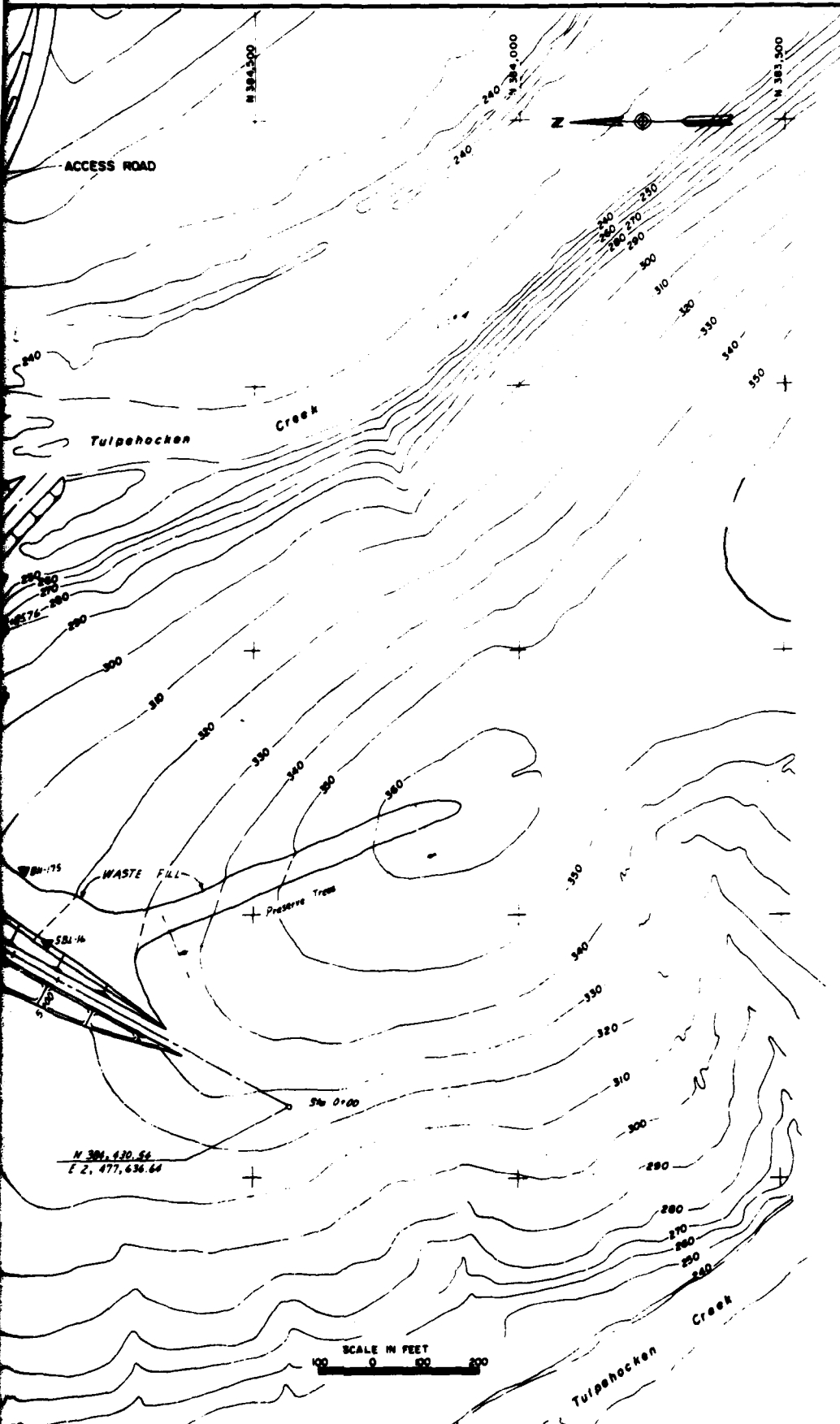
5-07. DIKE A OBSERVATION WELLS. Wells located in the right abutment have generally read well above pool level since their installation while those in the bottom of the saddle section (OW-4 and OW-8) showed levels ranging from well above to slightly below pool elevation prior to the start of long term filling in May 1979. Since that time, OW-4 has shown a ground water level at approximately the same level as the pool. During the first month of the reservoir filling period, OW-8 read from 5 to 10 feet below the pool. After that, its piezometric level rose to approximately the same elevation as the pool. The pool level pressure on the Plum Creek side of the grout curtain (OW-8) is not necessarily indicative of lack of accomplishment of the purpose of the grouting since the primary objective was the filling of large cavities and open joints to thus reduce or prevent possible

development of large volume leakages into the Plum Creek area. It is unlikely that the month lag in the rise to pool water level on the Plum Creek side would have been experienced if the grouting had not been performed. The lag will result in smaller increases in downstream pressures during the short periods of flood storage above normal pool.


#### SECTION 6 SUMMARY

The overall condition of the project is considered good. The items of most concern to the inspection party were the condition of sluice gates and pumps in the Bernville Pumping Station. With the exception of one sluice gate these items had been repaired within two weeks after the inspection. The minor remedial work recommended on other items will be accomplished. The resident staff is considered worthy of commendation for their work to date.



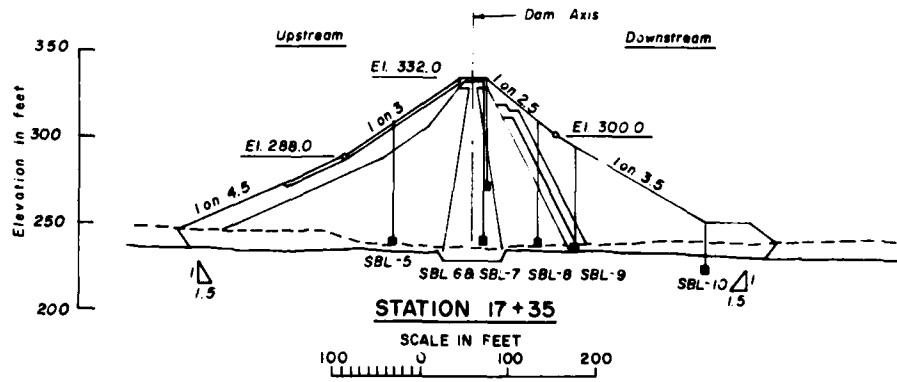
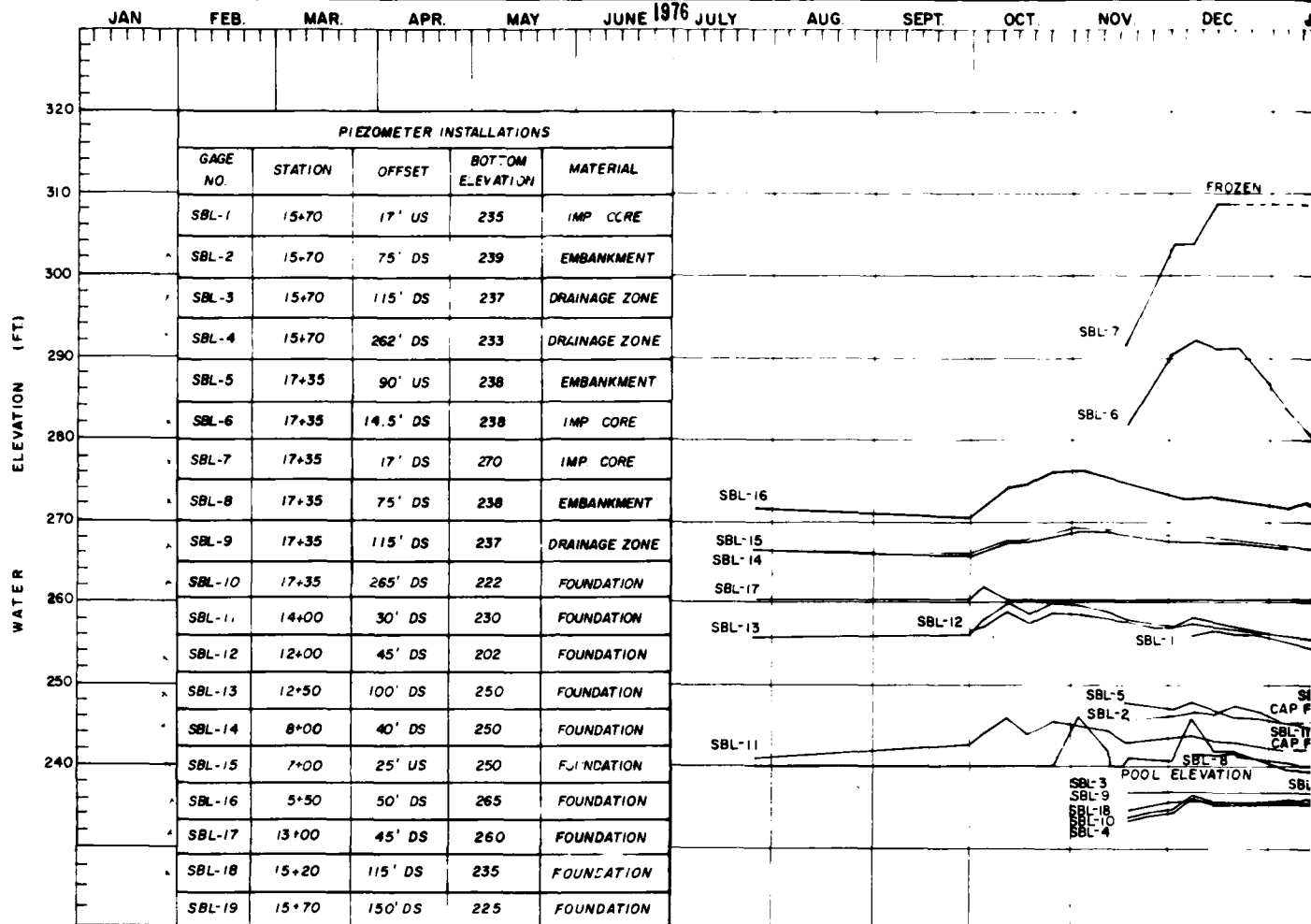


**LEGEND**

- Surface Motion Point (Monuments)
- Surface Motion Points
- ▼ Piezometers
- ⊕ Settlement Monument Location
- Inclinometer Location
-  Wet Areas

**BLUE MARSH LAKE  
INSTRUMENTATION PLAN**

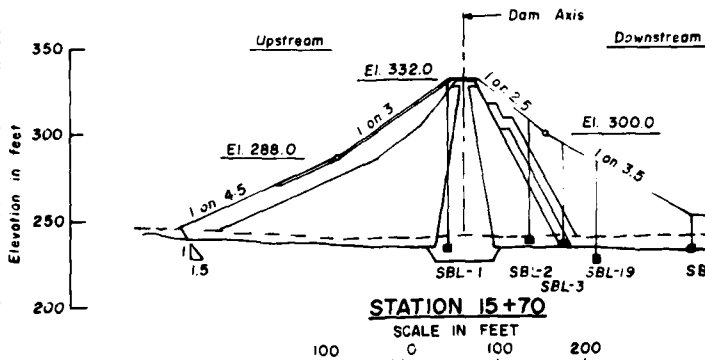
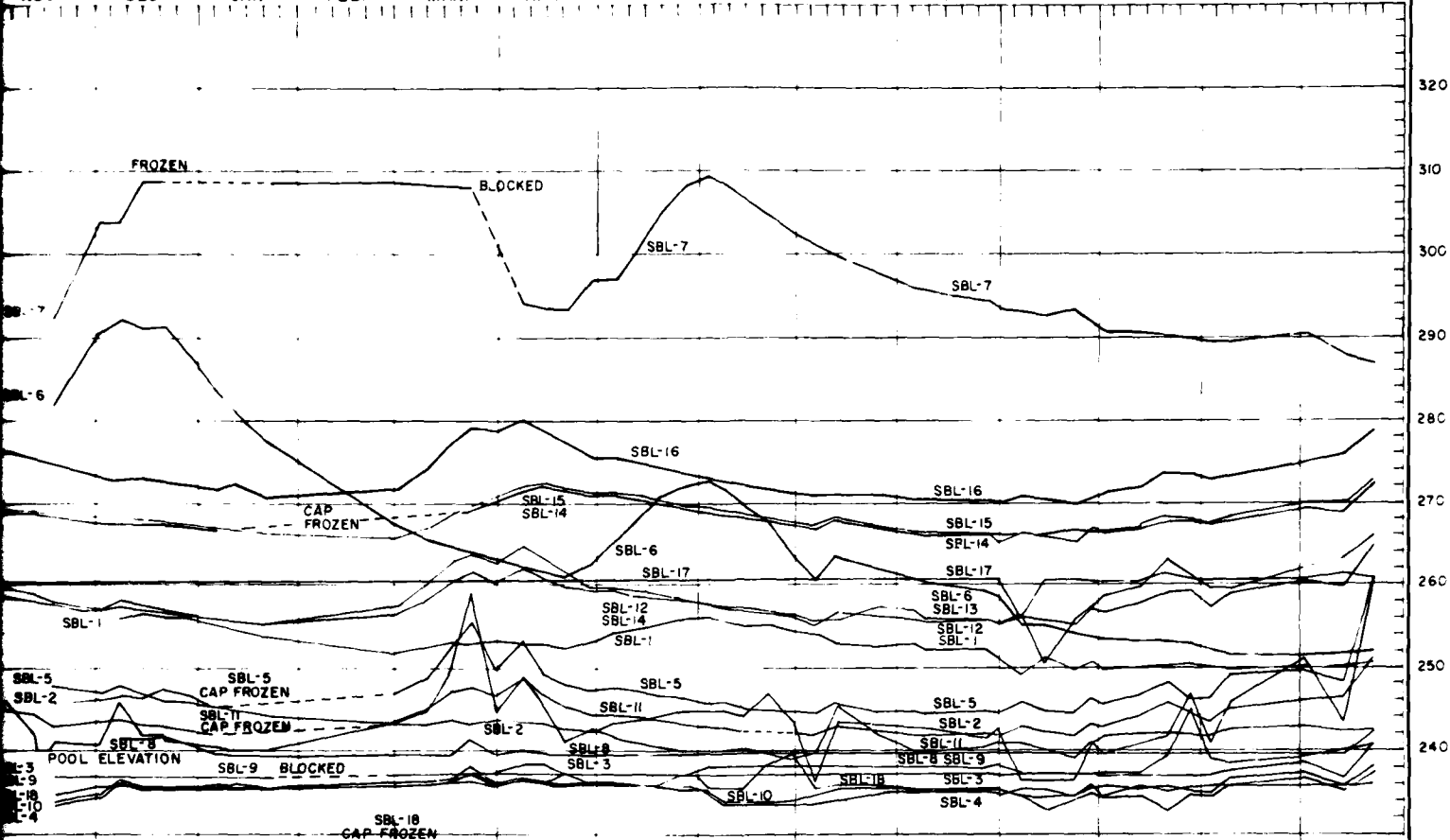
CORPS OF ENGINEERS



JAN. FEB. MAR. APR. MAY JUNE 1976 JULY AUG. SEPT. OCT. NOV. DEC.

\* DRY

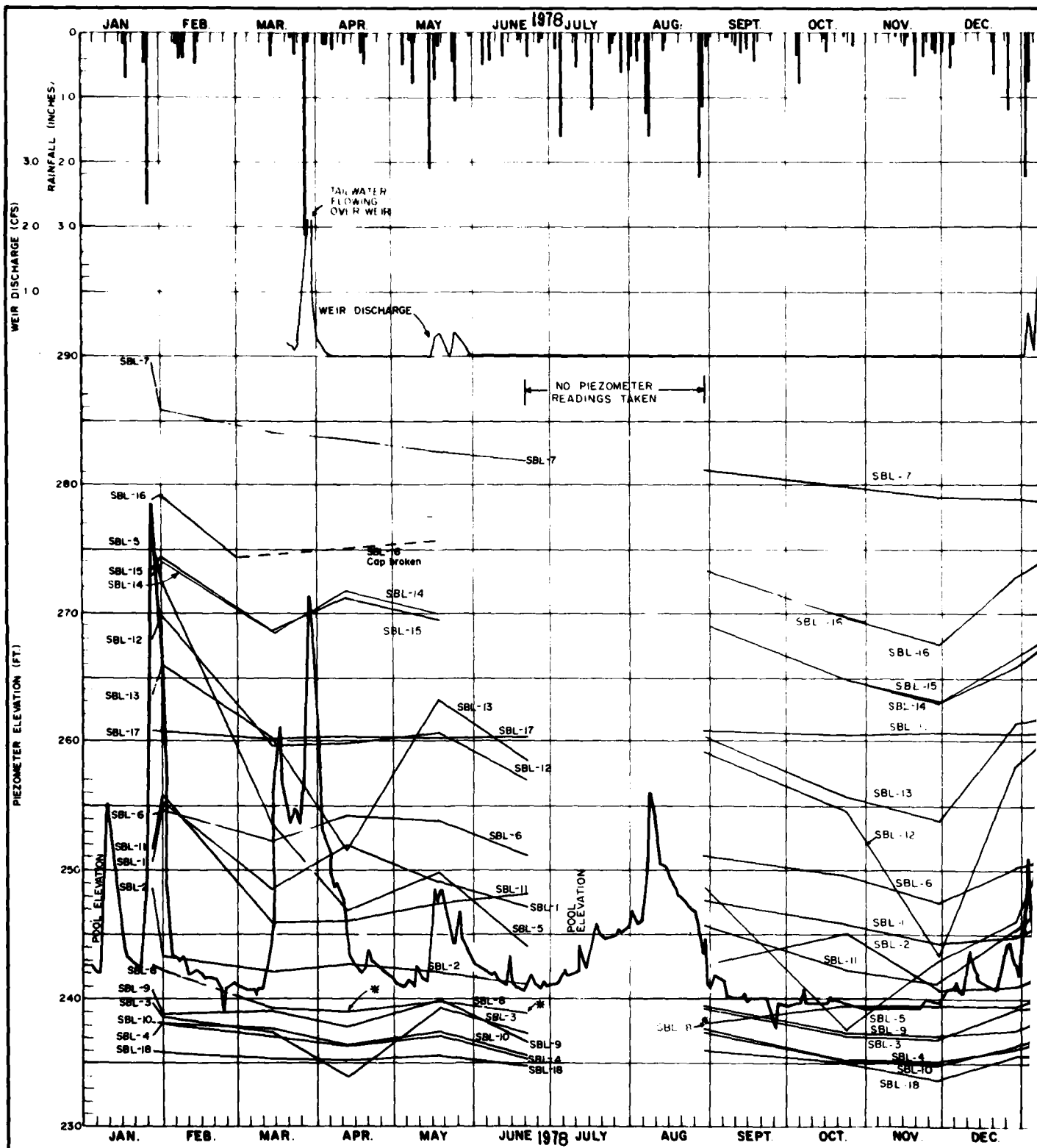
NOV DEC JAN FEB MAR APR MAY JUNE 1977 JULY AUG SEPT OCT NOV DEC



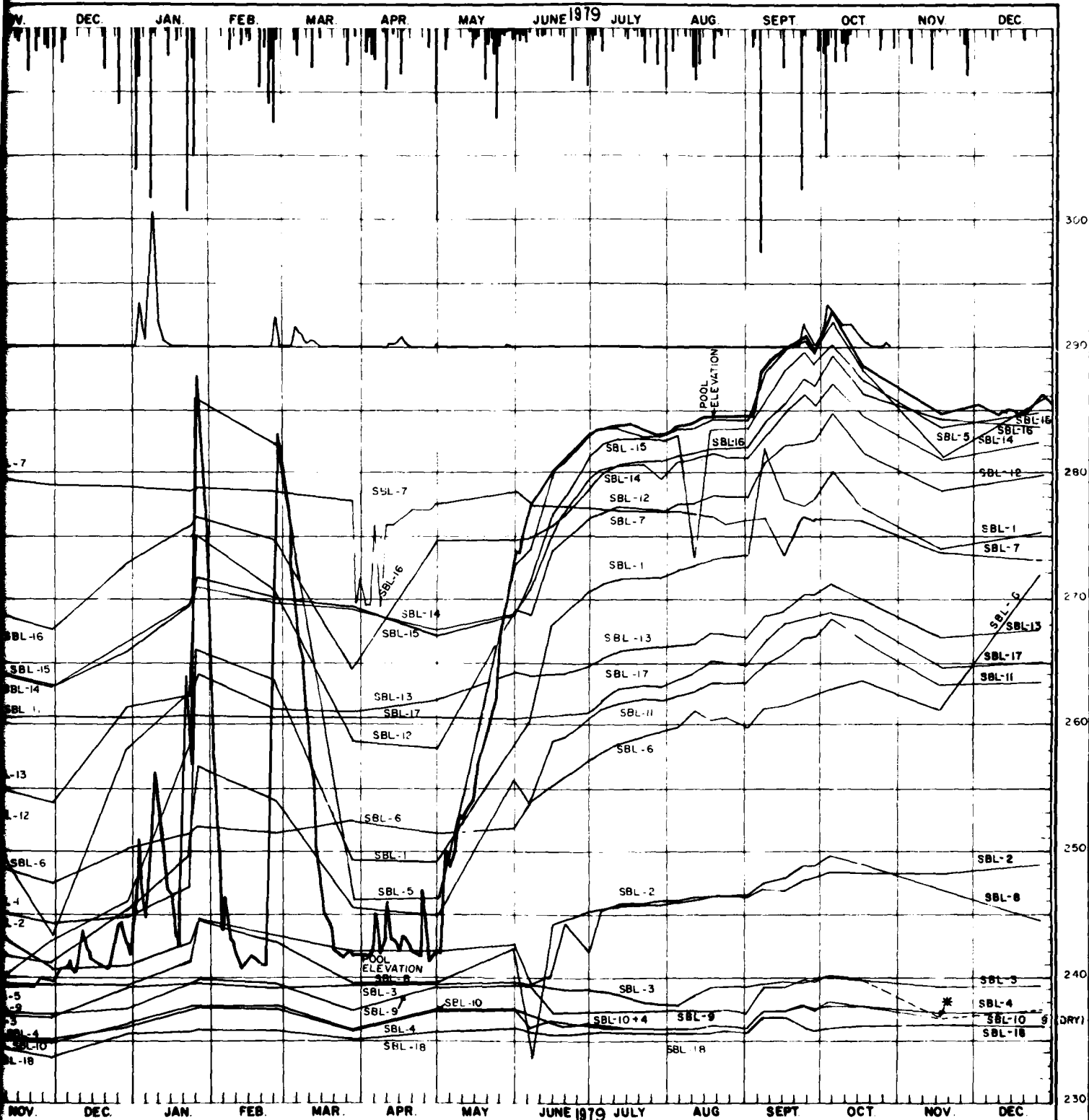
NOV DEC JAN FEB MAR APR MAY JUNE 1977 JULY AUG SEPT OCT NOV DEC

SCHUYLKILL RIVER BASIN  
 TULPEHOCKEN CREEK, PENNSYLVANIA  
**BLUE MARSH LAKE**  
 PIEZOMETER DATA  
 1976 - 1977

1 2



\* DRY

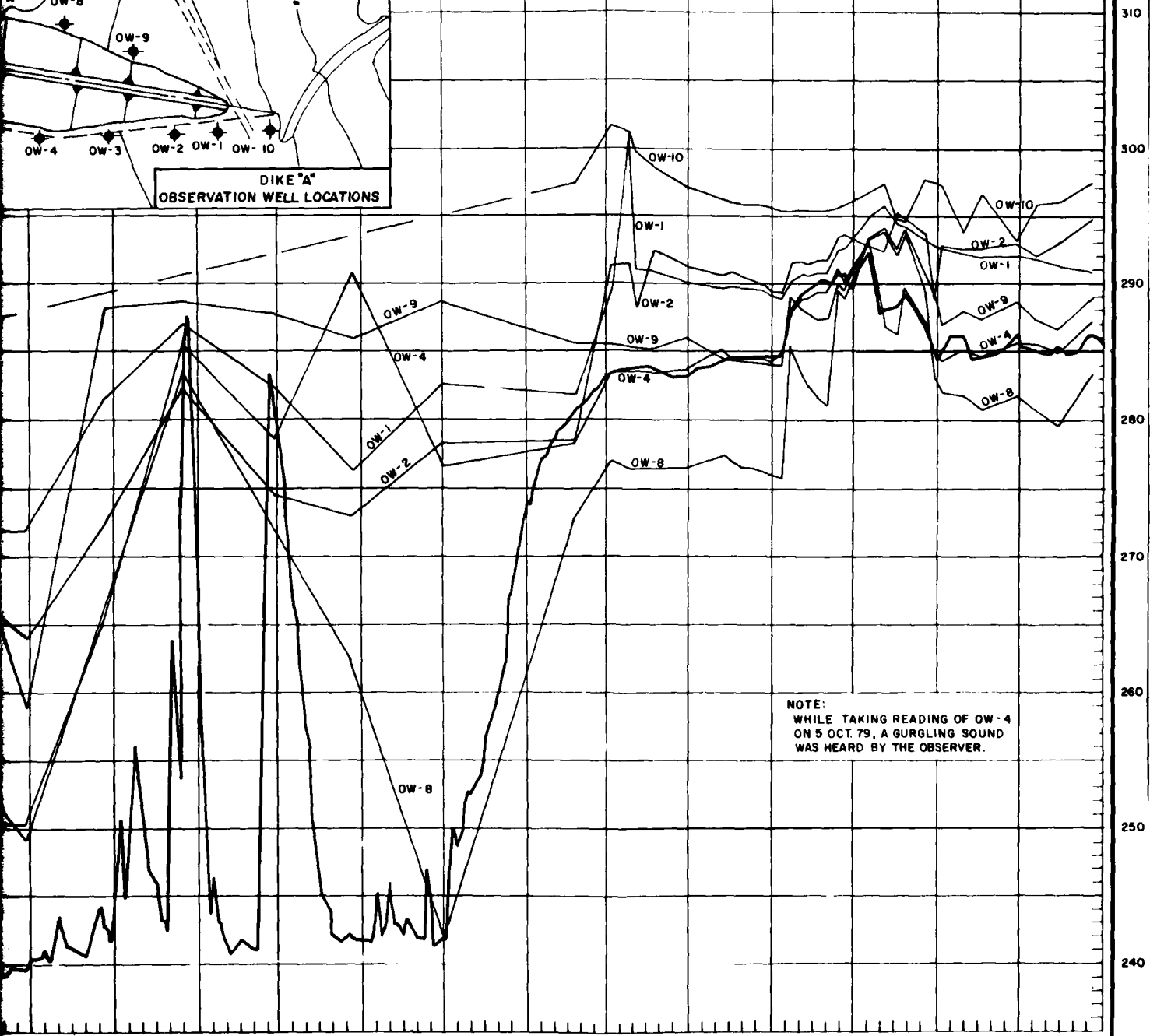
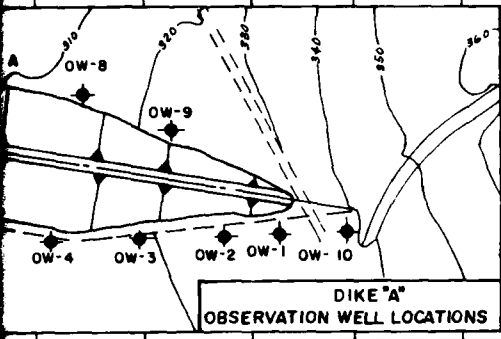


SCHUYLKILL RIVER BASIN  
 TULPEHOCKEN CREEK, PENNSYLVANIA  
**BLUE MARSH LAKE**  
 PIEZOMETER & WEIR DATA  
 1978 - 1979

12



DEC. JAN. FEB. MAR. APR. MAY JUNE 1979 JULY AUG. SEPT. OCT. NOV. DEC.

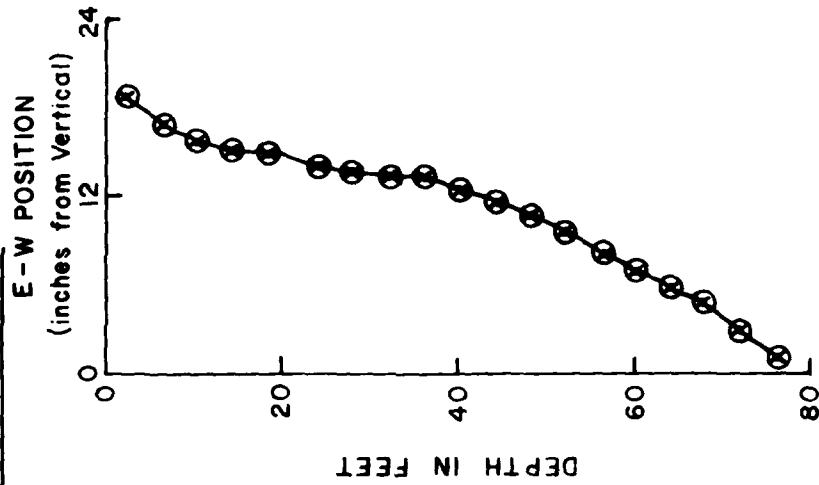
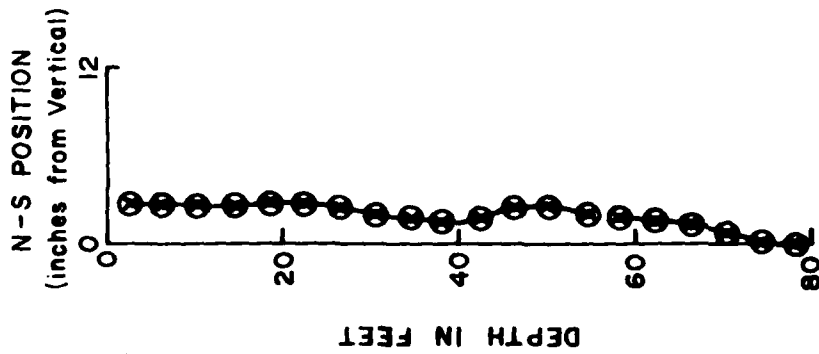


DEC. JAN. FEB. MAR. APR. MAY JUNE 1979 JULY AUG. SEPT. OCT. NOV. DEC.

SCHUYLKILL RIVER BASIN  
TULPEHOCKEN CREEK, PENNSYLVANIA  
**BLUE MARSH LAKE**  
DIKE "A"  
OBSERVATION WELL DATA  
1978-1979

1 2

SIF - I DOWNSTREAM



SIF - I

STATION - 17+35 D.S.  
OFFSET - 111.0'  
ELEVATION - +302.62

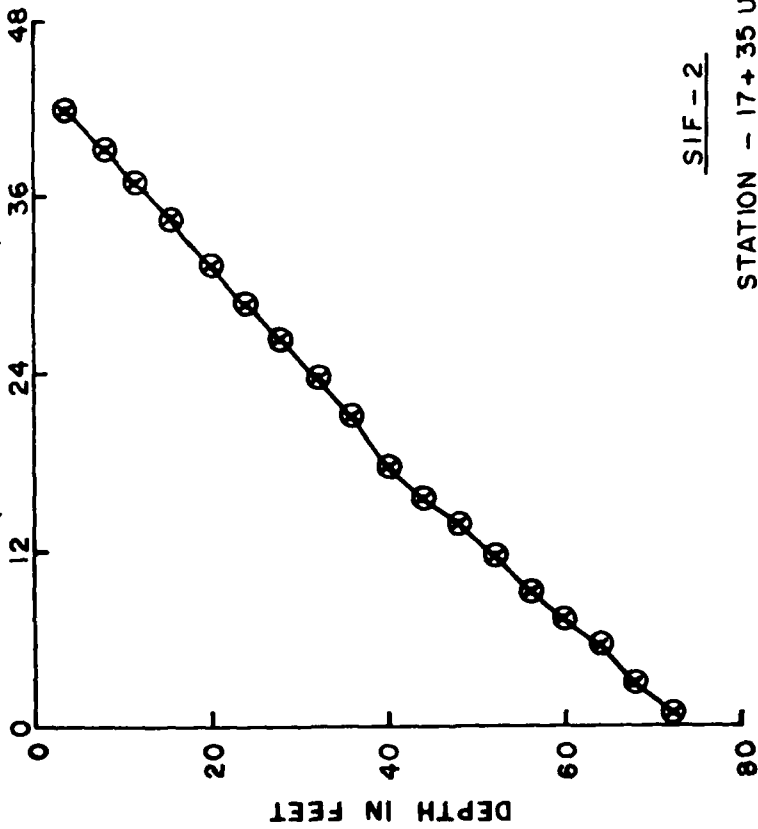
LEGEND

○—○ 30 NOV. '79  
\*—\* 19 APR. '79

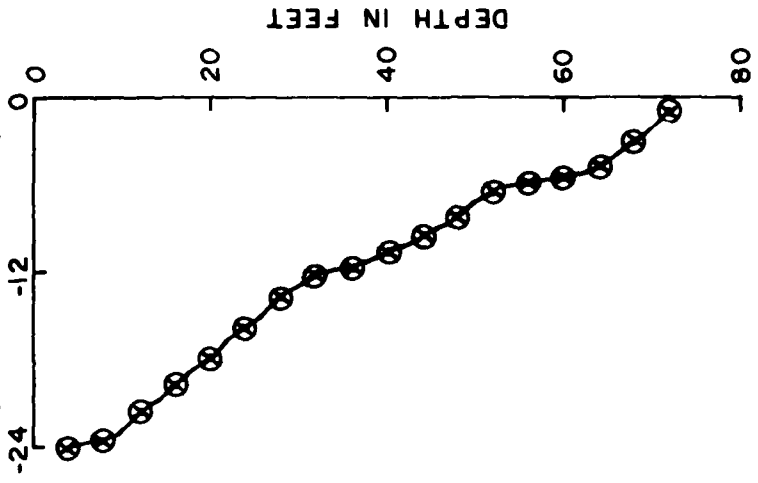
BLUE MARSH LAKE  
TULPEHOCKEN CREEK, PA.  
INCLINOMETER DATA  
SIF - I

SIF - 2 UPSTREAM

N-S POSITION  
(inches from Vertical)



E-W POSITION  
(inches from Vertical)



SIF - 2

STATION - 17+35 U.S.  
 OFFSET - 125.7'  
 ELEVATION - +297.99

LEGEND

- 30 NOV. '79
- \*— 19 APR. '79

BLUE MARSH LAKE  
 TULPEHOCKEN CREEK, PA.  
 INCLINOMETER DATA  
 SIF - 2

APPENDIX A

Condition Report  
Blue Marsh Lake  
Tulpehocken Creek, Pennsylvania

Periodic Inspection Report No. 2

List of Attendees

BLUE MARSH LAKE  
LIST OF ATTENDEES  
PERIODIC INSPECTION NO. 2

M. Sylvester	- NAD, Construction
G. Rosette	- NAD, Engineering
T. Maisano	- NAD, Engineering
L. Jack	- NAD, Engineering
J. Torres	- NAD, Engineering
Major W. Elliot	- Northern Area Engineer, NAP
R. Smith	- Northern Area Office, NAP
C. Warner	- Head Dam Operator, Blue Marsh Lake
M. Husovich	- Dam Operator, Blue Marsh Lake
E. Peterson	- NAPEN-D
H. Rubright	- NAPEN-D
J. McKenzie	- NAPEN-D
R. Lazor	- NAPEN-D (12 Sept 79 only)
B. Uibel	- NAPEN-D (11 and 13 Sept 79 only)

APPENDIX B

Condition Report  
Blue Marsh Lake  
Tulpehocken Creek, Pennsylvania

Periodic Inspection Report No. 2

Photographs



Photo No. 1. Cracks in wingwall-right side of stilling basin



Photo No. 2. Crack at wingwall/stilling basin wall intersection -  
right side

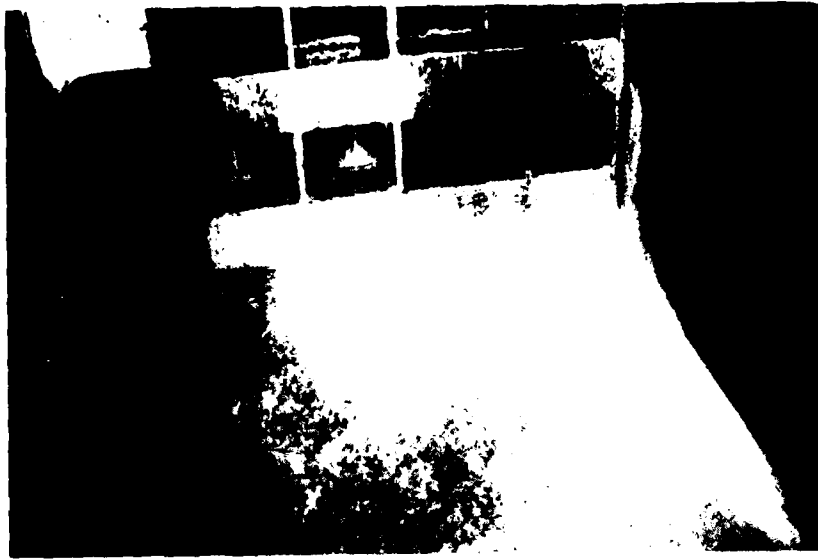


Photo No. 3. Leakage past service gate

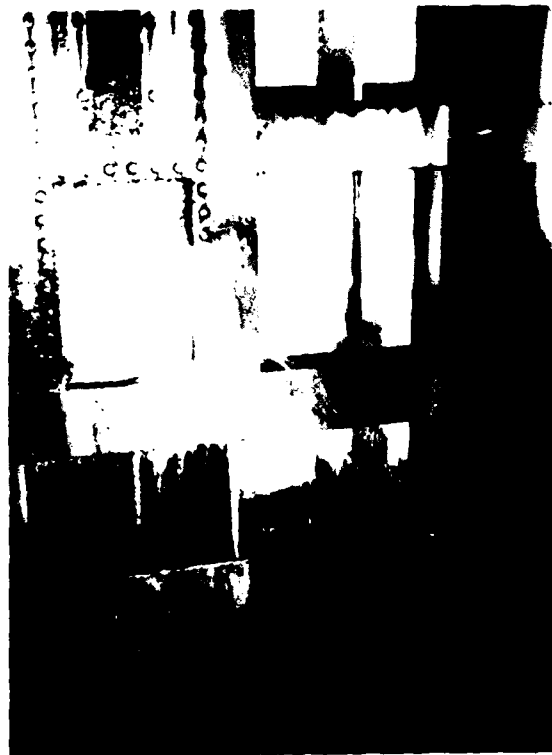


Photo No. 4. Leakage past flow gate in service gate



Photo No. 5. Displacement of stilling basin posts and handrails  
- left side.



Photo No. 6. Close up at base of displaced post-right side



Photo No. 7. Eroded area vicinity of Dry Brooks Boat Launching Area



Photo No. 8. Patching material pulled loose from wall at offset joint.  
Bernville Protection Works- Pressure Conduit of  
Detention Dam No. 2



Photo No. 9. Seepage and efflorescence at wall of pressure conduit -  
Bernville Protection Works Detention Dam No. 2

**APPENDIX C**

**Condition Report  
Blue Marsh Lake  
Tulpehocken Creek, Pennsylvania**

**Periodic Inspection Report No. 2**

**NADEN-TF Memorandum for Record dated 6 November 1979.  
Subject: Periodic Inspection No. 2, Blue Marsh Dam, Pennsylvania**

NADEN-TF

6 November 1979

MEMORANDUM FOR RECORD

SUBJECT: Periodic Inspection No. 2, Blue Marsh Lake Dam, Pennsylvania

1. Blue Marsh Lake Dam is on Tupelhocken Creek about six miles northwest of the confluence of the creek with the Schuylkill River at Reading, Pennsylvania. It consists of an earthfill dam; an outlet works consisting of an intake tower, an outlet conduit and a stilling basin, an emergency spillway and three saddle dikes. The project also includes local protection works for the borough of Bernville, PA consisting of the levee, flanking levee, retention dams and pumping station.

2. Date: 11 September 1979.

3. Attendees:

M. Sylvester	NADCO-OP
L. Jack	NADEN-T
G. Rossetti	NADEN-TS
T. Maisano	NADEN-TH
J. Torres	NADEN-TF
Maj. Elliott	NAO
B. Uibel	NAPEN-F
E. Peterson	NAPEN-D
H. Rubright	NADEN-D
J. McKenzie	NAPEN-F
C. Warner	NAPBM
H. Husovich	NAPBM

4. The following items were noted by the above NAD personnel and should be included in the report. Recommendations where appropriate are included.

a. Intake Tower:

(1) Hairline cracks were noted at elevation 295.0 of the stoplog and trashrack deck between the deck and the main tower on both sides of the door and extending to the top of the rail beam.

(2) Calcite deposits were noted around the perimeter of the left support post base plate in the gate room at elevation 256.0.

NADEN-TF

6 November 1979

SUBJECT: Periodic Inspection No. 2, Blue Marsh Lake Dam, Pennsylvania

(3) It is recommended that the results after testing the emergency and services gates should be included in the Reservoir Filling Plan.

b. Conduit and Stilling Basin

(1) Fence posts around the stilling basin walls have been pushed up.

(2) Efflorescence is present between the grout around the posts and the concrete of the wall.

(3) Hairline cracks were noted through the left side wall along the axis of the posts.

(4) Significant amounts of efflorescence was noted at station 1+40 downstream on the conduit.

c. Embankment:

(1) Erosion at about station 10+50 to 13+50, downstream right abutment and embankment junction, is deeper than in the previous inspection. It is recommended to continue monitoring these area, in order to evaluate the efficiency of the erosion control measures.

(2) Ground water seepage in the right abutment groins upstream and downstream was the same noted in the previous inspection. It should be monitored.

(3) Instrumentation data was reasonable. Additional data such as last readings of Plum Creek's seepage and foundation piezometer #19 should be included in the report.

d. Spillway:

Minor spalling and surface cracks were found at the control sill and the left concrete gravity.

e. Downstream Area:

Erosion was noted at right side of the stilling basin.

f. Dike A - The observation wells are reflecting ground water levels, but they are rising gradually as the pool rises. These wells should be carefully observed and data evaluated to determine the effectiveness of the grouting.

g. Dike C - A small pre-existing wet area and a little spring exists downstream of the dike. It should be monitoring.

NADEN-TF

6 November 1979

SUBJECT: Periodic Inspection No. 2, Blue Marsh Lake Dam, Pennsylvania

h. Bernville Pumping Station:

(1) Gates #1, 4, 5 which presently do not operate automatically must be left in an open position at all times until repairs can be made. With present operation (i.e. pump #6 not operating) only two of the six pumps would function automatically under the design flows. Repairs to pump #6 should be made as soon as possible.

(2) Three sewage lift pumps are required in accordance with the specifications to lift sewage over the levee when required. Only one of the three pumps were operational. The two additional sewage lift pumps should be repaired and installed as soon as possible. If during operation of the pump station the sewage pump breaks down, there is no way to pump sewage over the levee.

(3) An expansion crack was noted in the roof immediately above and to the right of the entrance door.

i. Recreation Area Sewage Plant:

(1) Reduce the on time that showers are running in the bathhouse to about ten to twenty seconds in lieu of the two to three minutes observed.

(2) When feasible (i.e. higher flows), the treatment plant should be run every day in lieu of one day on and one day off.

(3) Consider providing a drainage collection trench around the spray irrigation fields which would intercept storm water runoff prior to reaching the irrigation fields. When first flush of stormwater occurs, a possibility now exists (i.e. when sanitary wastewater load is increased) that nutrients will be flushed directly into the waterway which may be of concern to downstream users and regulatory agencies.

j. Detention Dams:

(1) An erosion resistant working surface (crushed stone or pavement) is needed around the intakes to support maintenance equipment for removal of silt and debris, and to improve drainage control of insect breeding.

(2) Detention Dam No. 2:

(a) Spillway:

(1) Minor spalling and surface cracks were noted on the first and second spillway panels from the downstream and on the 1, 2 and 3 panel from the right side.

**NADEN-TF**

6 November 1979

**SUBJECT: Periodic Inspection No. 2, Blue Marsh Lake Dam, Pennsylvania**

(2) Drainage should be provided at the downstream area.

**k. Upstream Reservoir Area:**

**Reservoir Sideslopes:** Erosion was noted on three fill areas and one old road cut. The erosion near the quarry should be observed during the drawdown to the winter pool.

*Juana Torres*  
**JUANA TORRES**  
Civil Engineer

**APPENDIX D**

**Selected Reference Drawings**

**SELECTED REFERENCE DRAWINGS**

**Bernville Protective Works**

44725      **General Plan**

44735      **Road, Levee & Channel, STA 15 + 30 to STA 24 + 60 - Sections**

44736      **Road, Levee & Channel, STA 24 + 60 to STA 28 + 50 - Sections**

44741      **Levee & Channel, STA 51 + 10 to STA 56 7 00 - Sections**

44744      **Flanking Levee, Plan, Profile & Section**

44745      **Detention Dam & Conduit, Tributary No. 1**

44752      **Detention Dam 7 Conduit, Tributary No. 2**

44761      **Drainage Structure at STA 20 + 70**

44762      **Drainage Structure at STA 20 + 70, Gatewell Details**

44768      **Drainage Structure at STA 45 + 60**

44769      **Drainage Structure at STA 45 + 60, Gatewell Details**

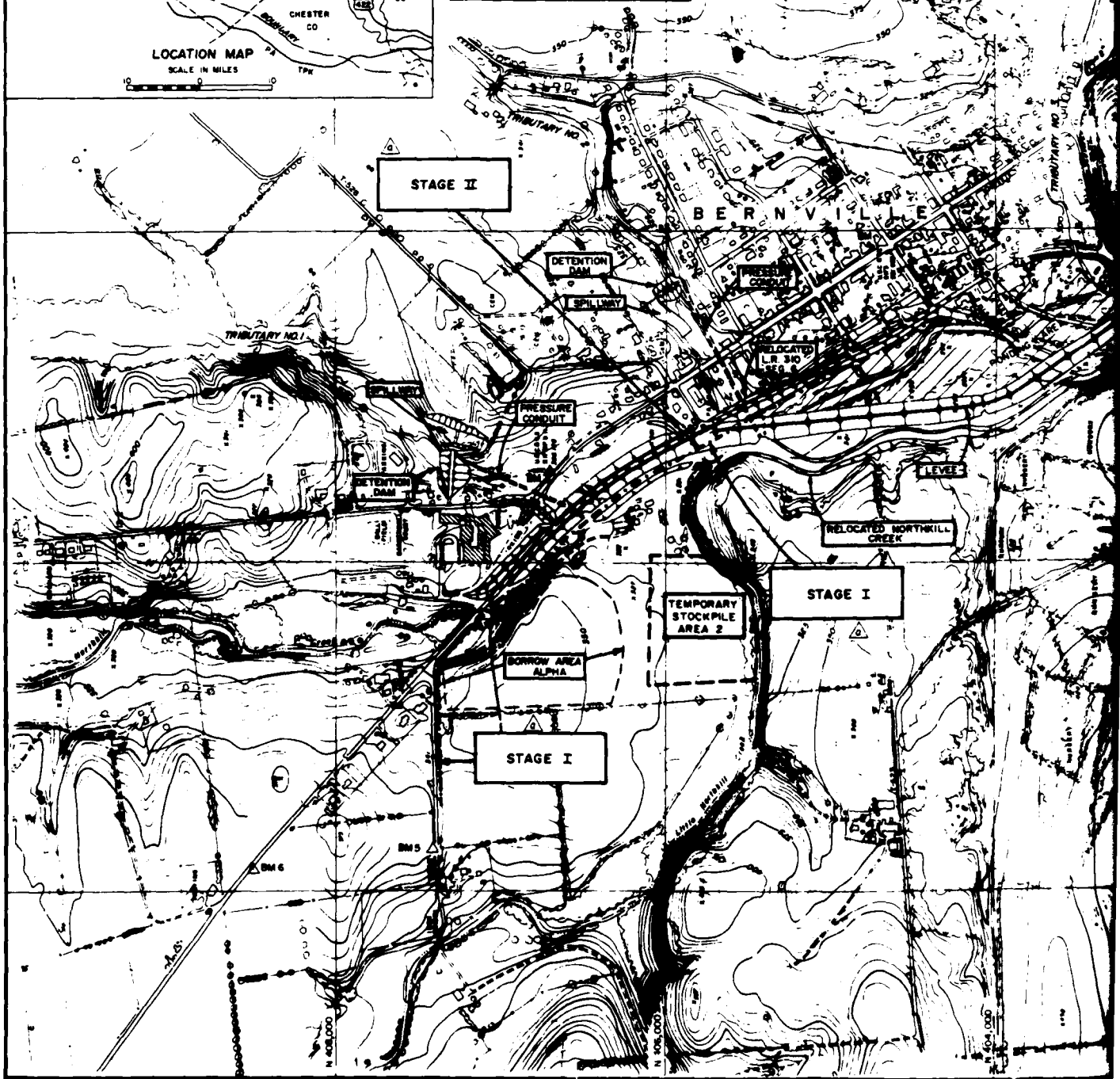
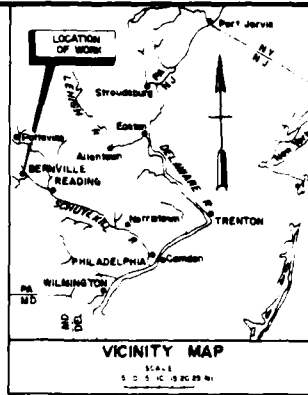
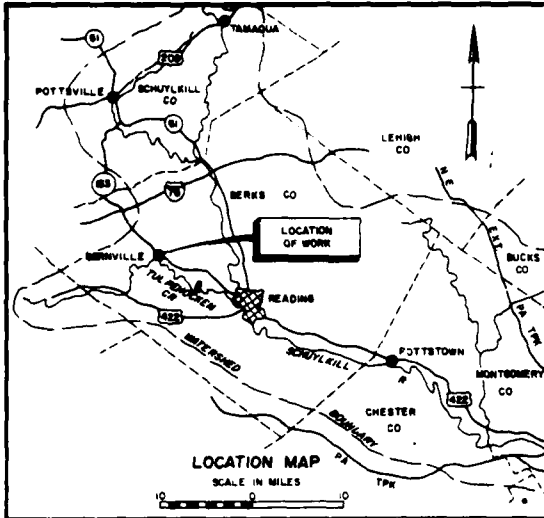
44797      **Pumping Station 30" Discharge Lines**

44817      **Pumping Station - Operating Floor Mechanical**

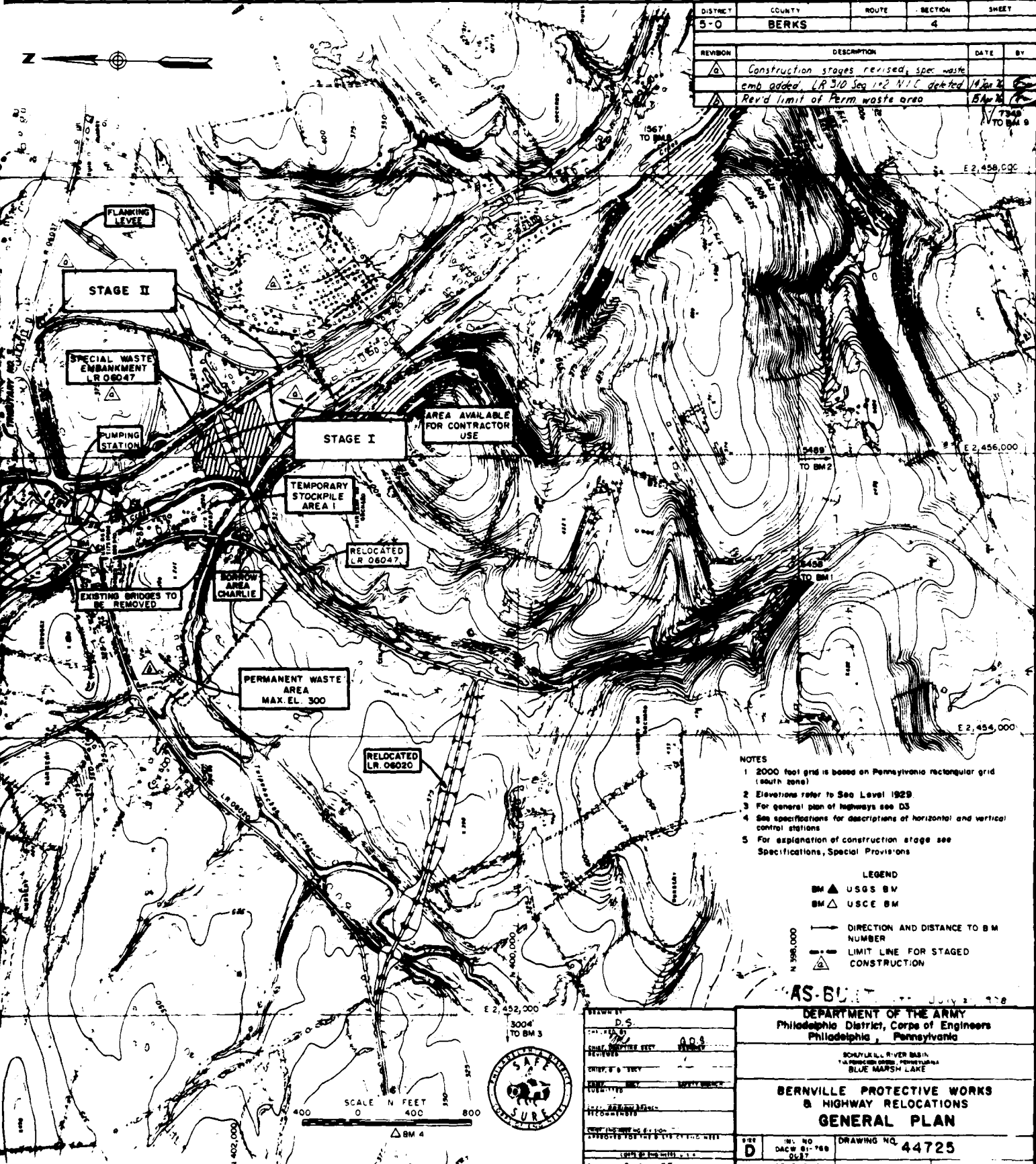
44819      **Pumping Station - Mechanical**

**Recreational Facilities**

46203      **General Site Plan**



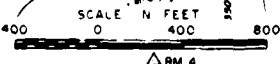
DISTRICT	COUNTY	ROUTE	SECTION	SHEET
5-0	BERKS		4	
REVISION	DESCRIPTION	DATE	BY	
△	Construction stages revised, spec waste emb added, LR 310 Seg 1+2 N.E. deleted	11/27/75		
△	Revised limit of Perm waste area	5/14/76		



- NOTES
- 2000 foot grid is based on Pennsylvania rectangular grid (south zone)
  - Elevations refer to Sea Level 1929
  - For general plan of highways see D3
  - See specifications for descriptions of horizontal and vertical control stations
  - For explanation of construction stage see Specifications, Special Provisions

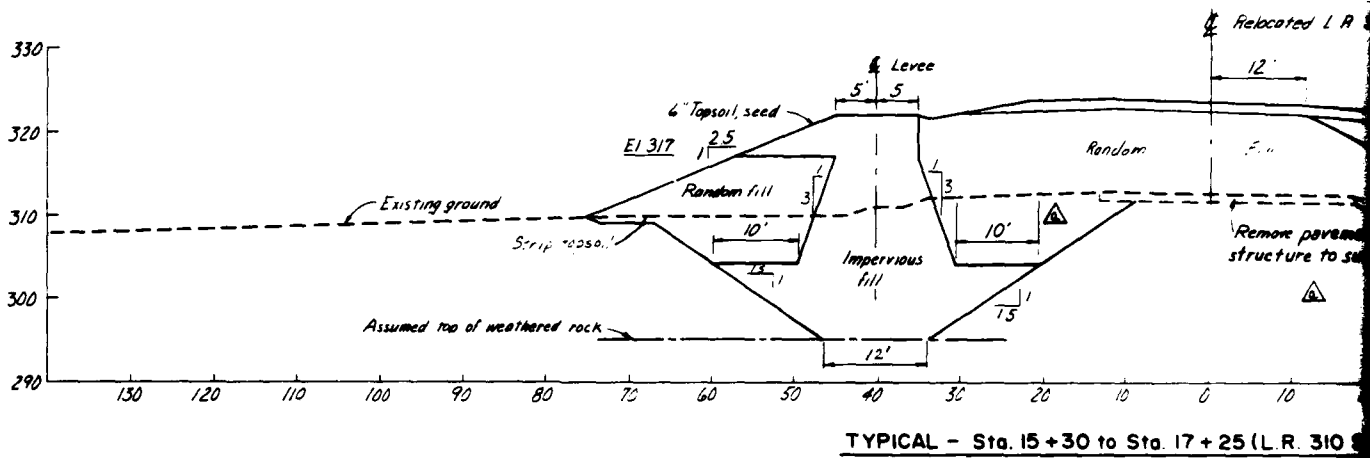
- LEGEND
- BM ▲ USGS BM
  - BM △ USCE BM
  - DIRECTION AND DISTANCE TO BM NUMBER
  - LIMIT LINE FOR STAGED CONSTRUCTION

AS-BUILT JULY 3, 1978

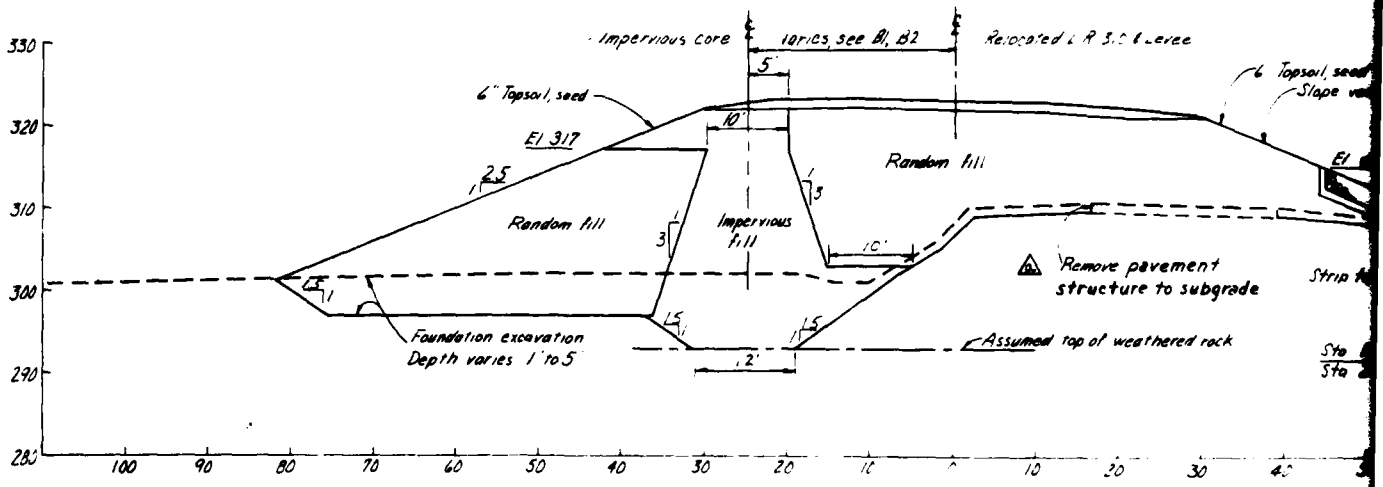


DESIGNED BY	D.S.
CHECKED BY	ADS
DATE	2/16/75

DEPARTMENT OF THE ARMY Philadelphia District, Corps of Engineers Philadelphia, Pennsylvania	
SCHUYLKILL RIVER BASIN BLUE MARSH LAKE	
<b>BERVILLE PROTECTIVE WORKS          &amp; HIGHWAY RELOCATIONS          GENERAL PLAN</b>	
D DATE 01-76 0687	DRAWING NO. 44725
SCALE AS SHOWN	SHEET

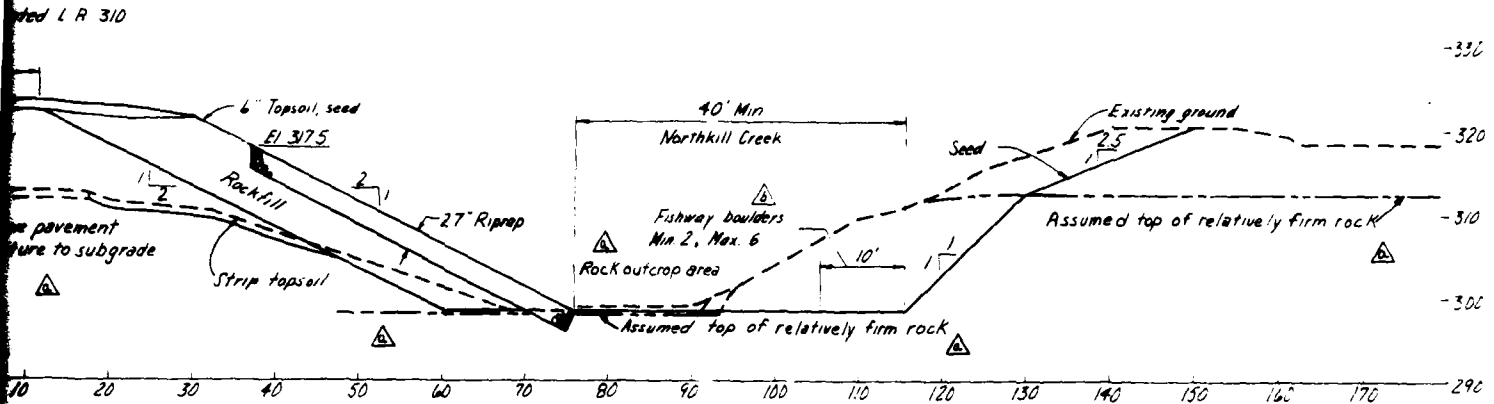


TYPICAL - Sta. 15+30 to Sta. 17+25 (L.R. 310)

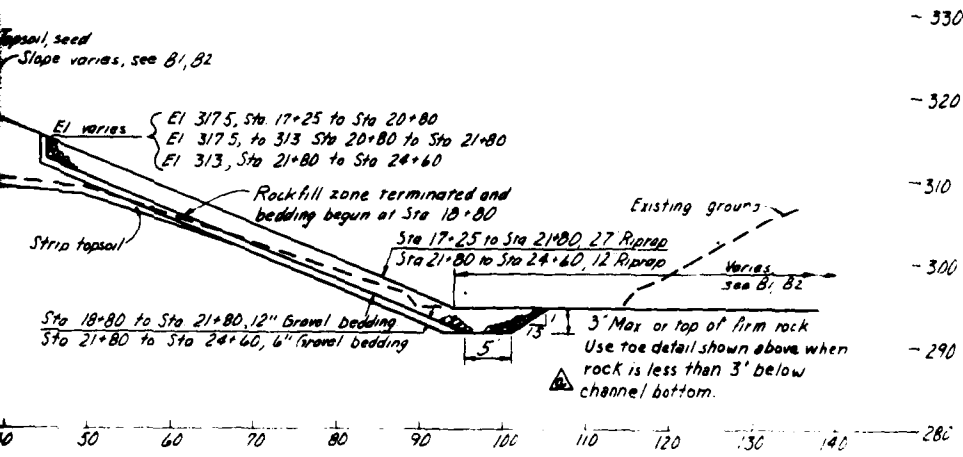


TYPICAL - Sta. 17+25 to 24+60 (L.R. 310)

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
REVISION	DESCRIPTION	DATE	BY	
15	Miscellaneous Revisions	8/24/54	...	
16	Boulder Quantity shown	8/24/54	...	



R. 310 Sta. 746+50±)



R. 310 Sta. 739+17±)

Note  
 1 Depth and extent of foundation excavation shall be as directed by the Contracting Officer in the field

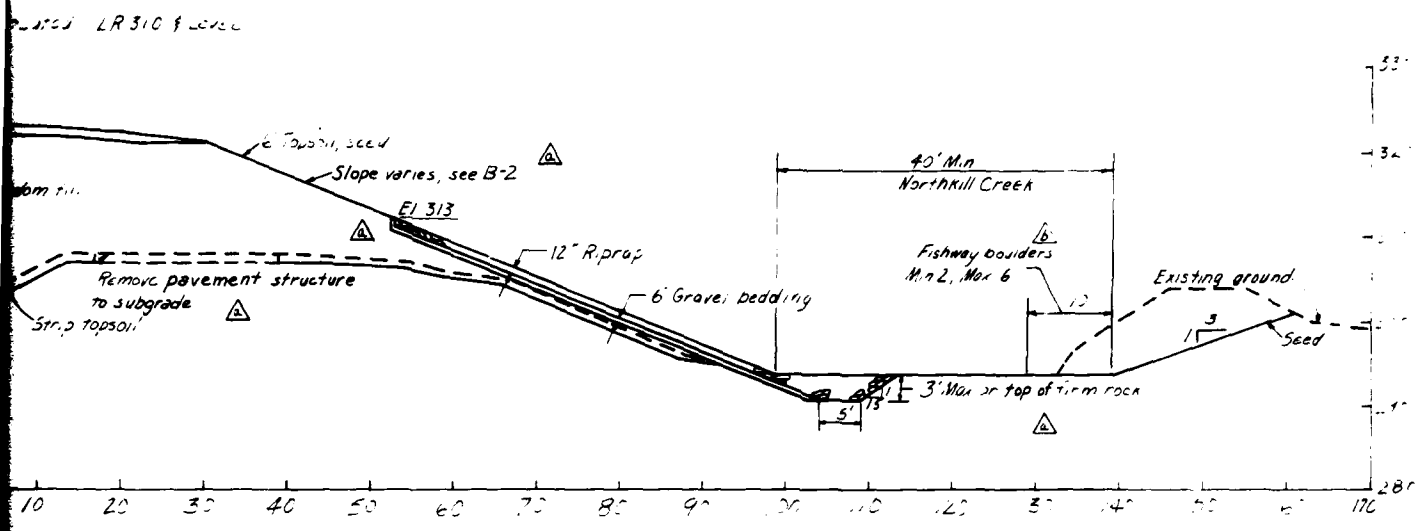
DEPARTMENT OF THE ARMY  
 Philadelphia District, Corps of Engineers  
 Philadelphia, Pennsylvania

BERNVILLE PROTECTIVE WORKS  
 SECTIONS  
 ROAD, LEVEE & CHANNEL  
 STA 15+30 TO STA 24+60

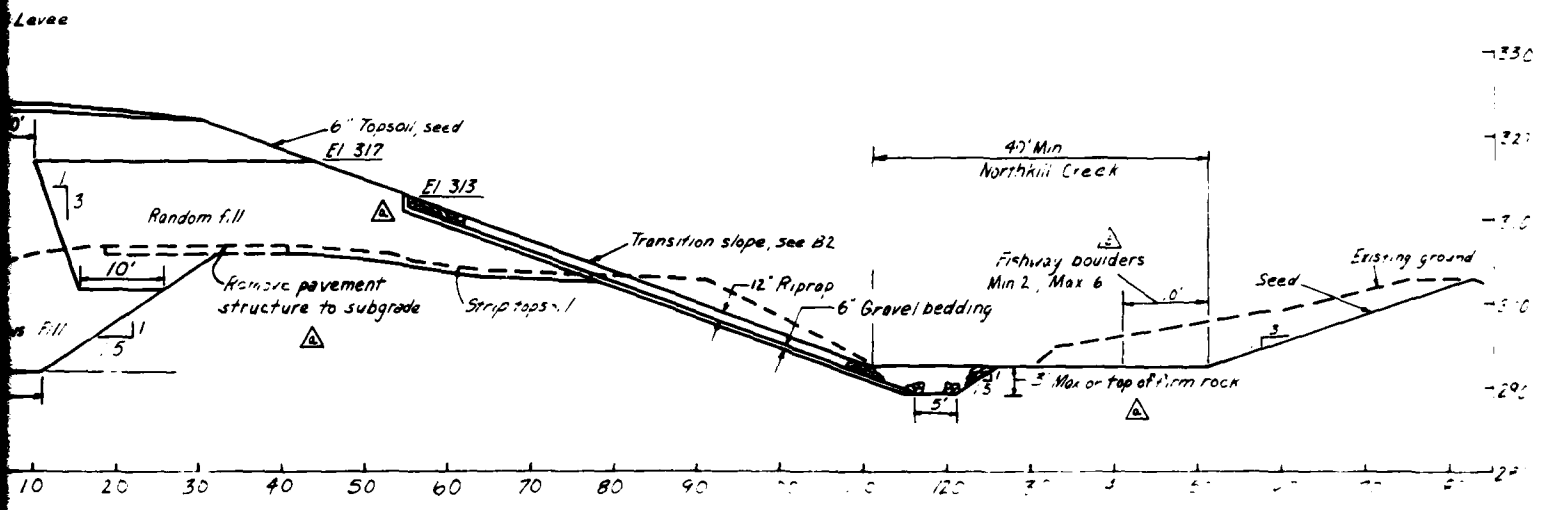
44735



DISTRICT	COUNTY	ROUTE	SECTION	SHEET	
REVISION	DESCRIPTION			DATE	BY
1	Miscellaneous Revisions			6/24/78	Law
2	Boulder Quantity Shown			6/27/78	Law



10 (LR 310, Sta. 737 + 20)



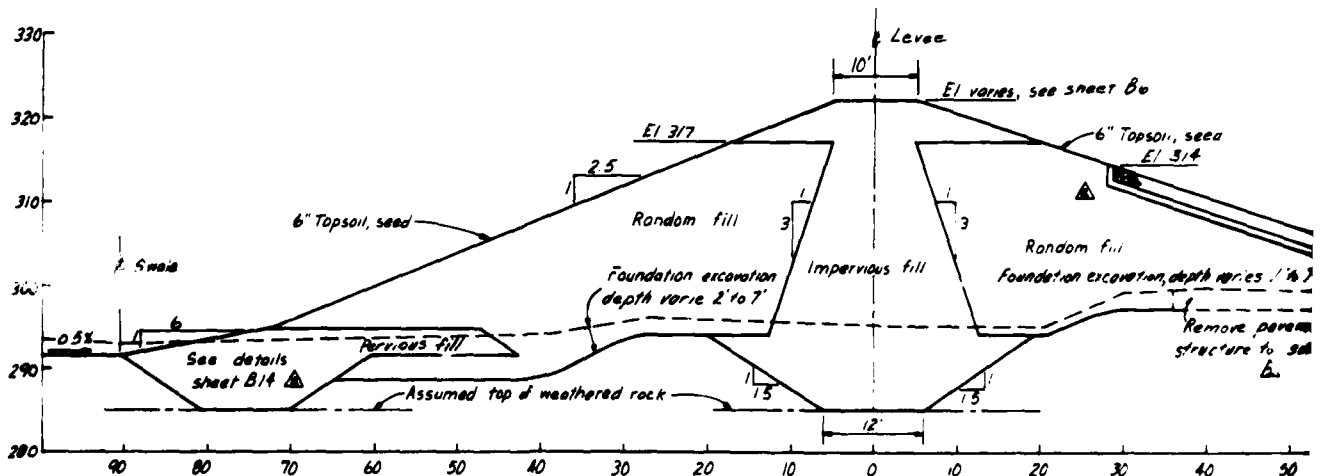
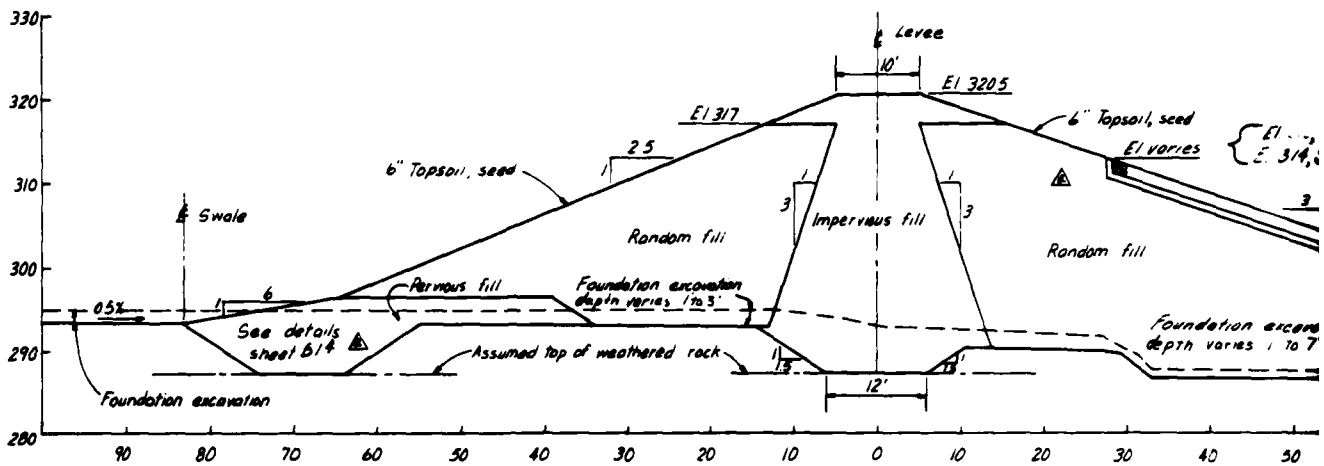
16 + 60 to Sta. 28 + 50

Note  
 1 Depth and extent of foundation excavation shall be as directed by the Contracting Officer in the field

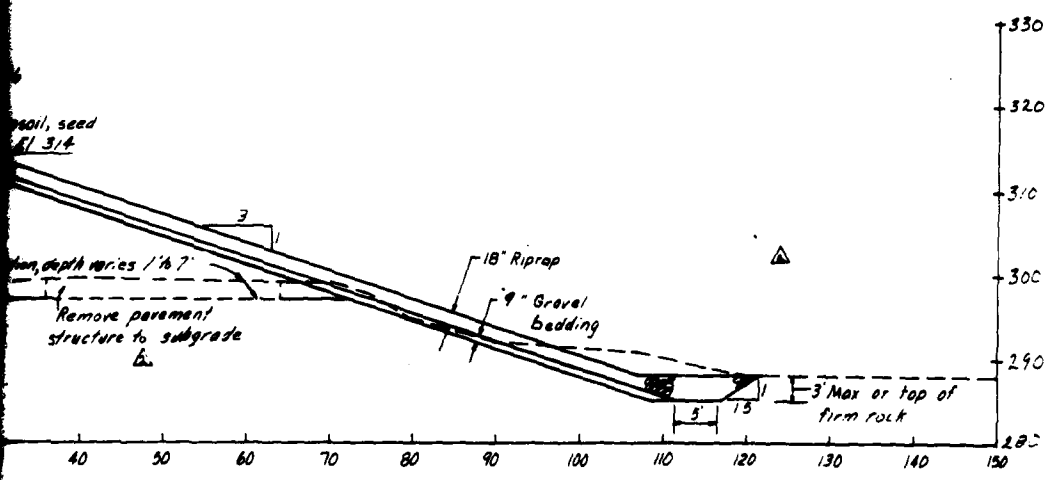
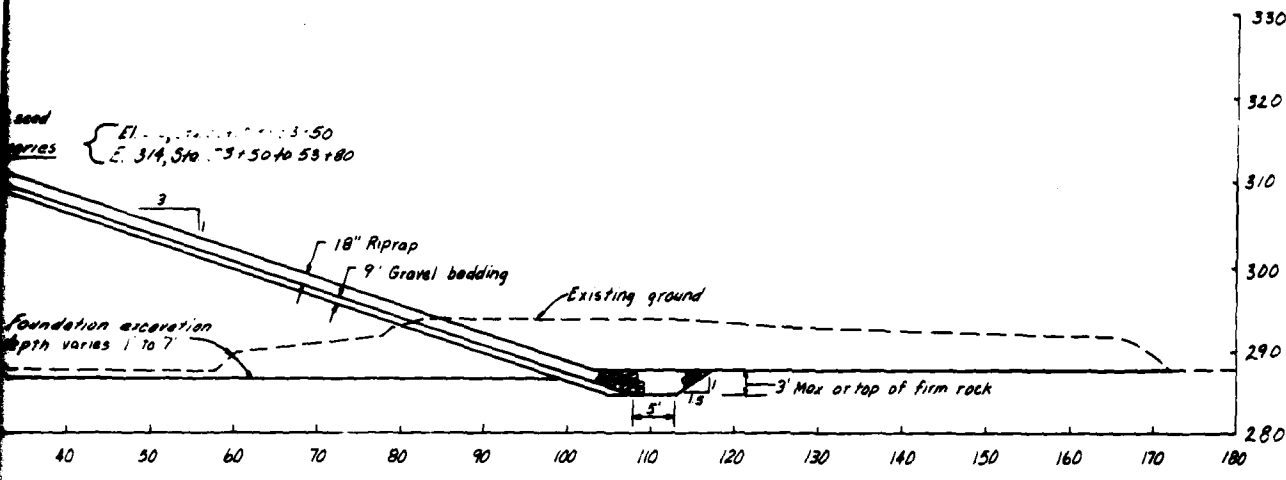
July 21, 1978

<b>DEPARTMENT OF THE ARMY</b> Philadelphia District, Corps of Engineers Philadelphia, Pennsylvania <small>SCHUYLER RIVER BASIN          ALPHECKEN CREEK REBASING          BLUE MARSH LAKE</small>	
<b>BERNVILLE PROTECTIVE WORKS</b> SECTIONS ROAD, LEVEE B CHANNEL STA 24+60 TO STA 28+50	
SHEET <b>D</b>	DRAWING NO. <b>44736</b>
SCALE AS SHOWN	SHEET

12



DISTRICT	COUNTY	ROUTE	SECTION	SHEET
REVISION	DESCRIPTION	DATE	BY	
▲	Miscellaneous Revisions	5/20/76	Tom	

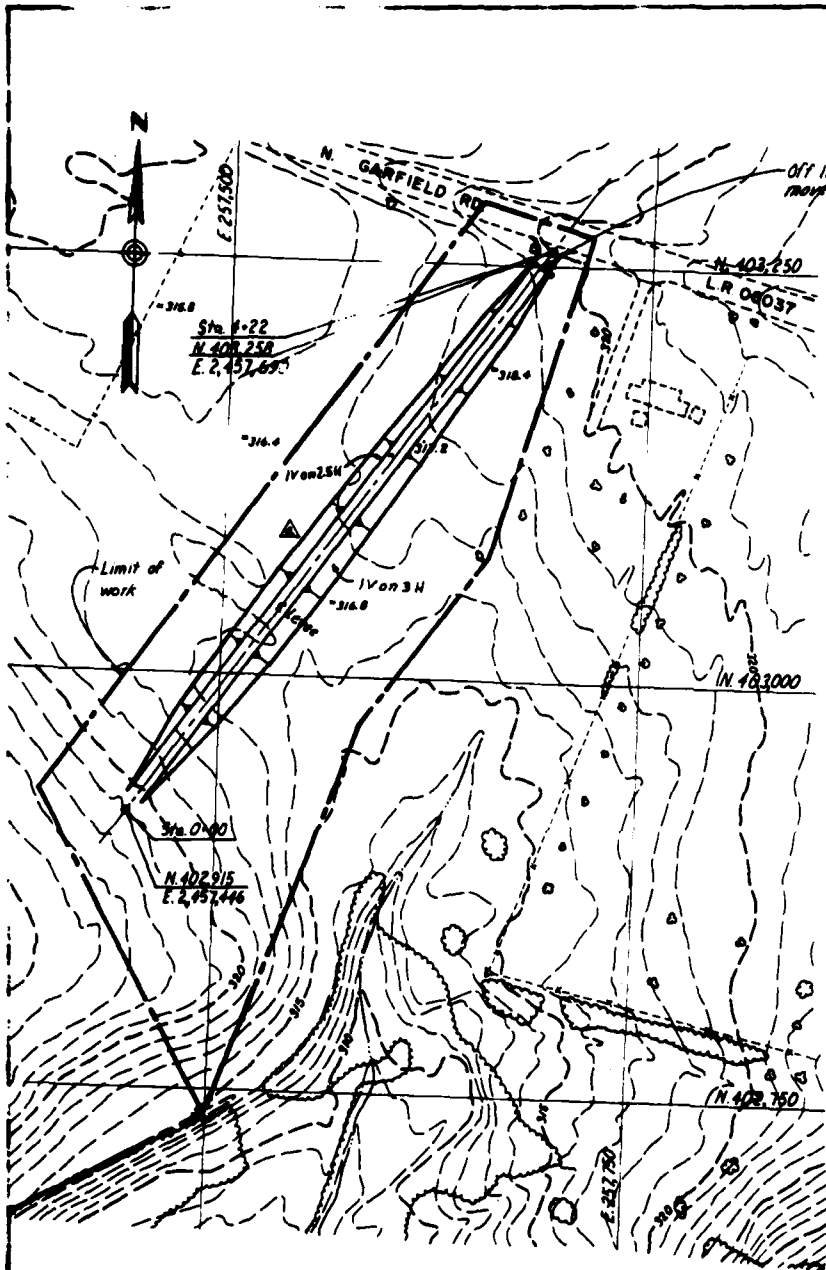


Note:  
 Depth and extent of foundation excavation shall be as directed by the Contracting Officer in the field.

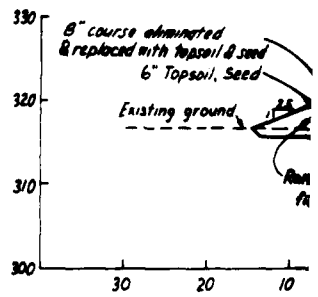
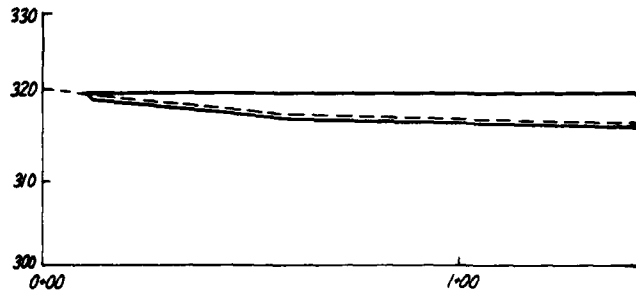
July 21, 1978

DEPARTMENT OF THE ARMY Philadelphia District, Corps of Engineers Philadelphia, Pennsylvania	
SCHUPFILL RIVER BASIN TULPOHOCH CREEK, PENNSYLVANIA BLUE MARSH LAKE	
BERNVILLE PROTECTIVE WORKS SECTIONS LEVEE B CHANNEL STA. 51+10 TO STA. 56+00	
SIZE D	DATE 8-7-78
SCALE AS SHOWN	DRAWING NO. 44741

12

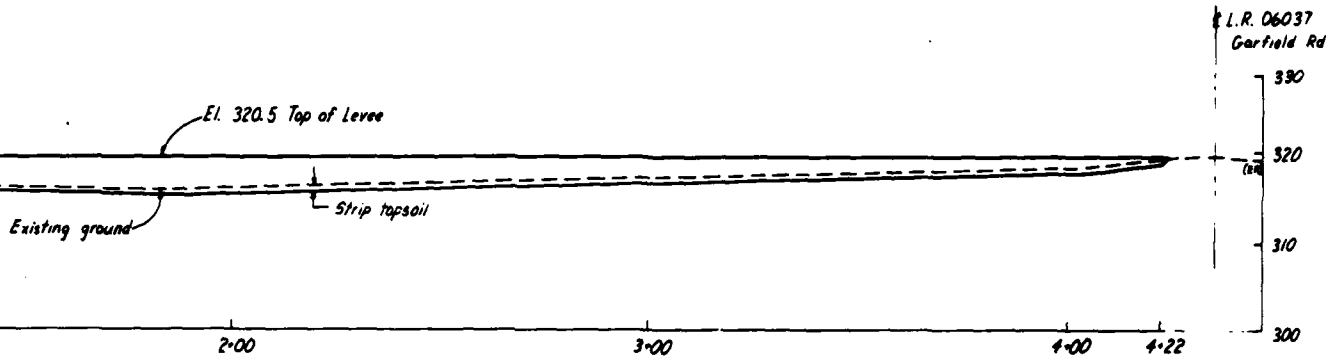


**PLAN**  
SCALE IN FEET  
0 50 100

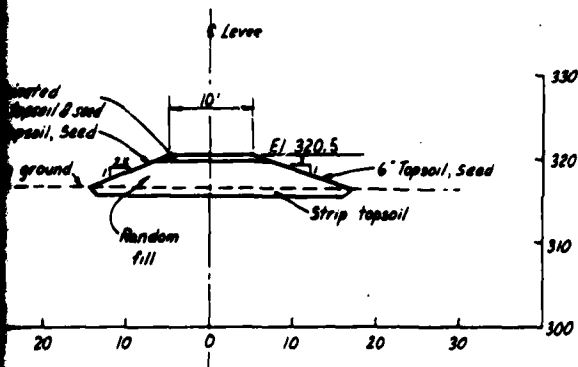


**TYPICAL S**

DISTRICT	COUNTY	ROUTE	SECTION	DATE	BY
DESCRIPTION		DATE	BY		
Slope design / soils deleted		4/24/78	Paul		
Base course changed to gravel and sand					



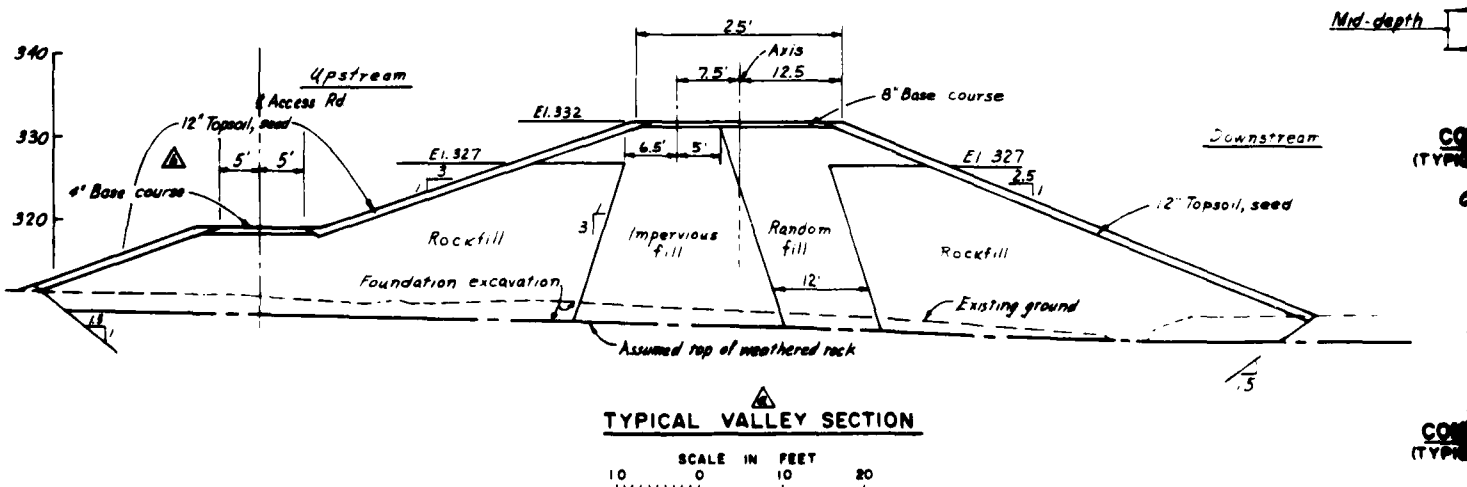
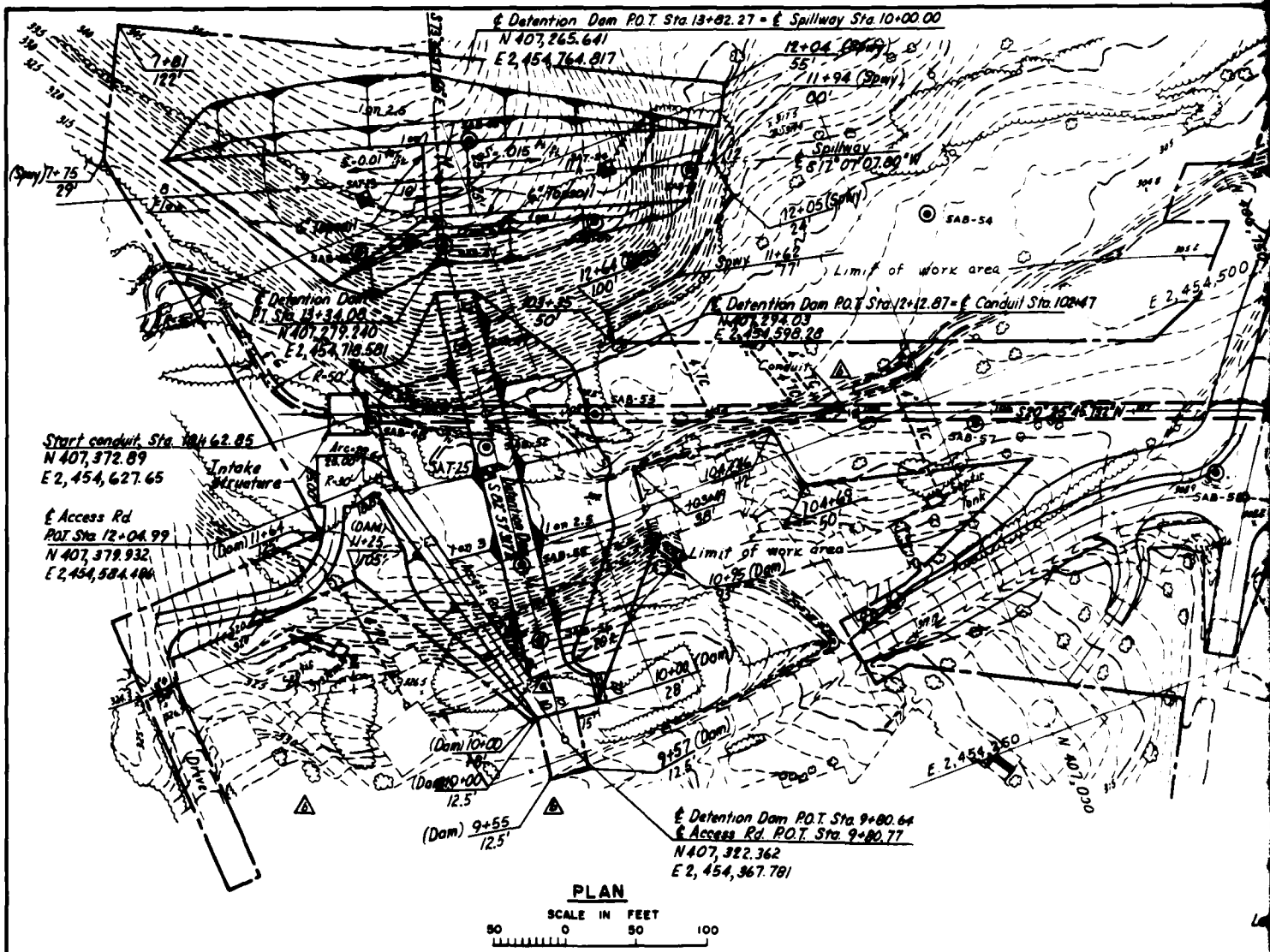
**CENTERLINE PROFILE - FLANKING LEVEE**



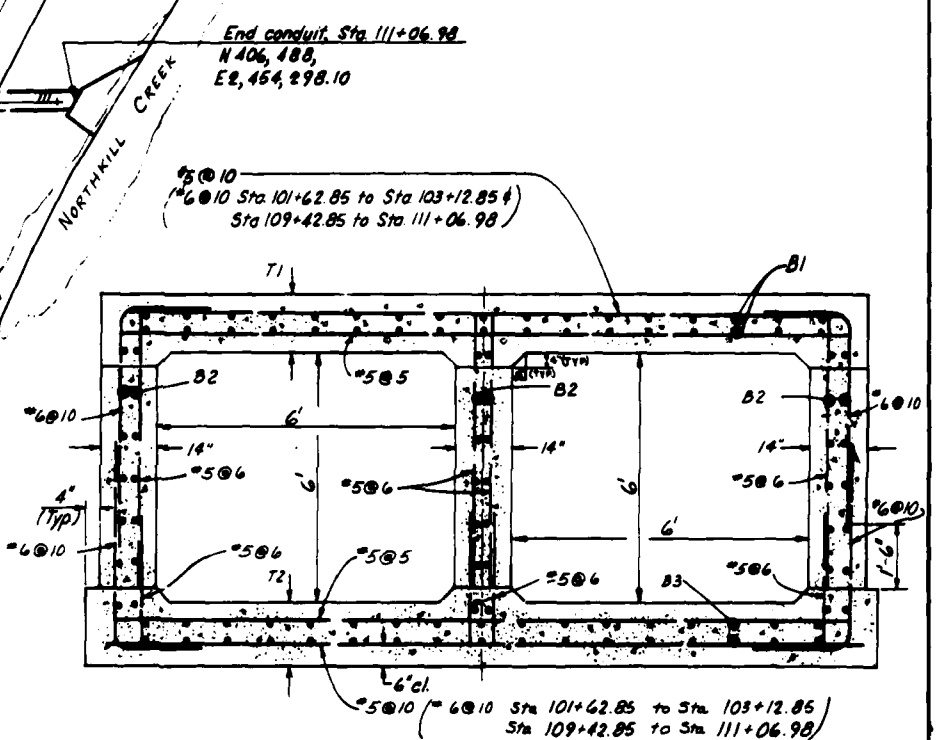
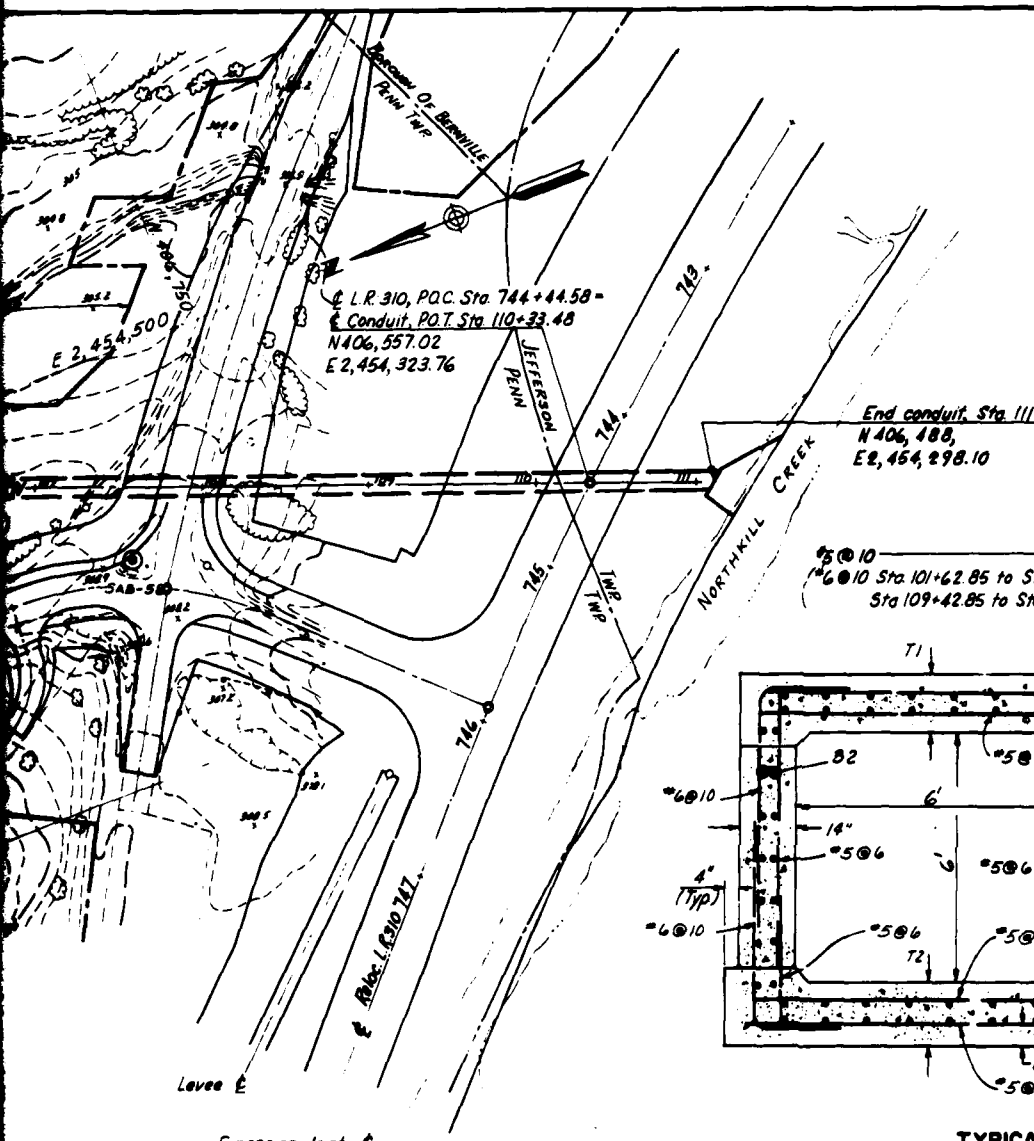
**TYPICAL SECTION - FLANKING LEVEE**

July 21, 1978

DEPARTMENT OF THE ARMY Philadelphia District, Corps of Engineers Philadelphia, Pennsylvania SCHUYLKILL RIVER BASIN TULPINGTON CREEK, PENNSYLVANIA BLUE MARSH LAKE		
<b>BERNVILLE PROTECTIVE WORKS          FLANKING LEVEE          PLAN, PROFILE &amp; SECTION</b>		
DATE 7/21/78	BY DACE, R. J.	DRAWING NO. <b>44744</b>
SCALE AS SHOWN		SHEET 819



DISTRICT	COUNTY	ROUTE	SECTION	SHEET
REVISION	DESCRIPTION	DATE	BY	
△	Miscellaneous Revisions	8/24/76	JAM	
△	Access road added; Limit of work area rev.	15Apr76	(S.A.M.)	

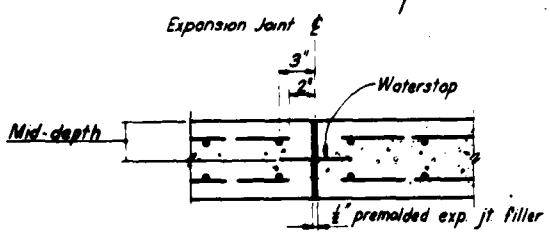


**TYPICAL CONDUIT SECTION**  
NOT TO SCALE

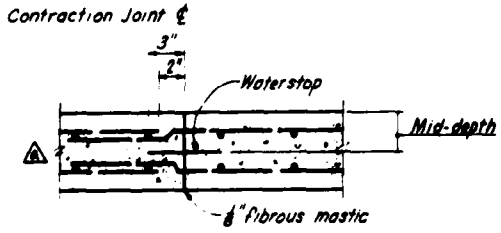
Location	T1	T2	B1	B2	B3
Sta. 101+62.85 to Sta. 103+12.85	18"	20"	"4@11"	"4@14"	"4@10"
Sta. 103+12.85 to Sta. 109+42.85	14"	16"	"4@14"	"4@14"	"4@12"
Sta. 109+42.85 to Sta. 111+06.98	16"	18"	"4@12"	"4@14"	"4@11"

**Notes:**

- All splices to be thirty bar diameters.
- Concrete cover on all reinforcement is to be four inches except where shown.
- Polyvinyl chloride waterstops detailed on PENNDOT BC-335 and in conformance with material requirements of PENNDOT Form 400 shall be used at all conduit contraction and expansion joints.
- For location of expansion and contraction joints see sheet B-22.
- Max Design Foundation Pressure for Conduit = 3000 PSF.
- For Logs of subsurface explorations see B5B.



**CONDUIT EXPANSION JOINT DETAIL**  
(TYPICAL FOR ALL WALLS & SLABS OF CONDUIT)  
NOT TO SCALE



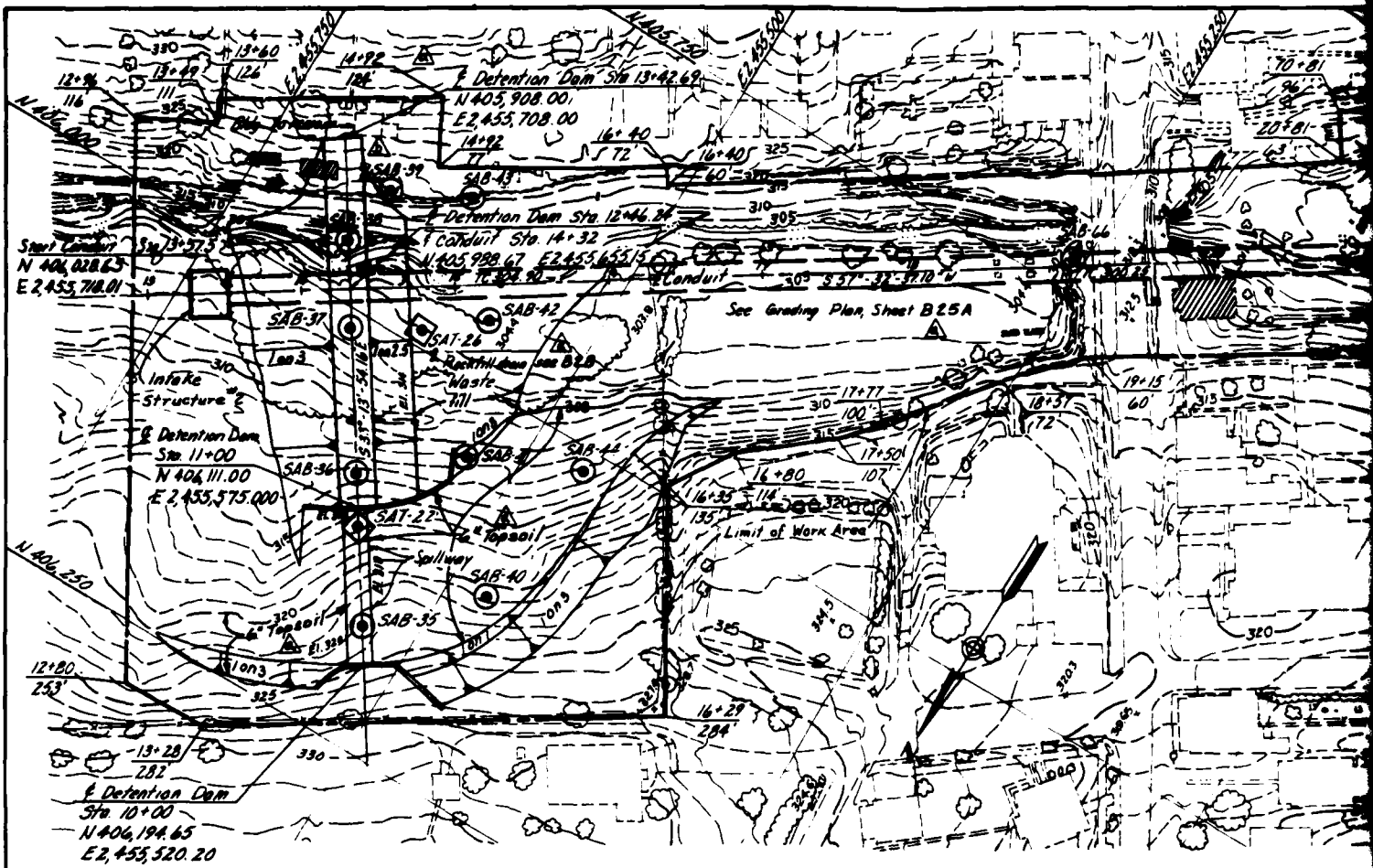
**CONDUIT CONTRACTION JOINT DETAIL**  
(TYPICAL FOR ALL WALLS & SLABS OF CONDUIT)  
NOT TO SCALE

DEPARTMENT OF THE ARMY  
Philadelphia District, Corps of Engineers  
Philadelphia, Pennsylvania

SCHUYLKILL RIVER BASIN  
TULPEHOCKEN CREEK, PENNSYLVANIA  
BLUE MARSH LAKE

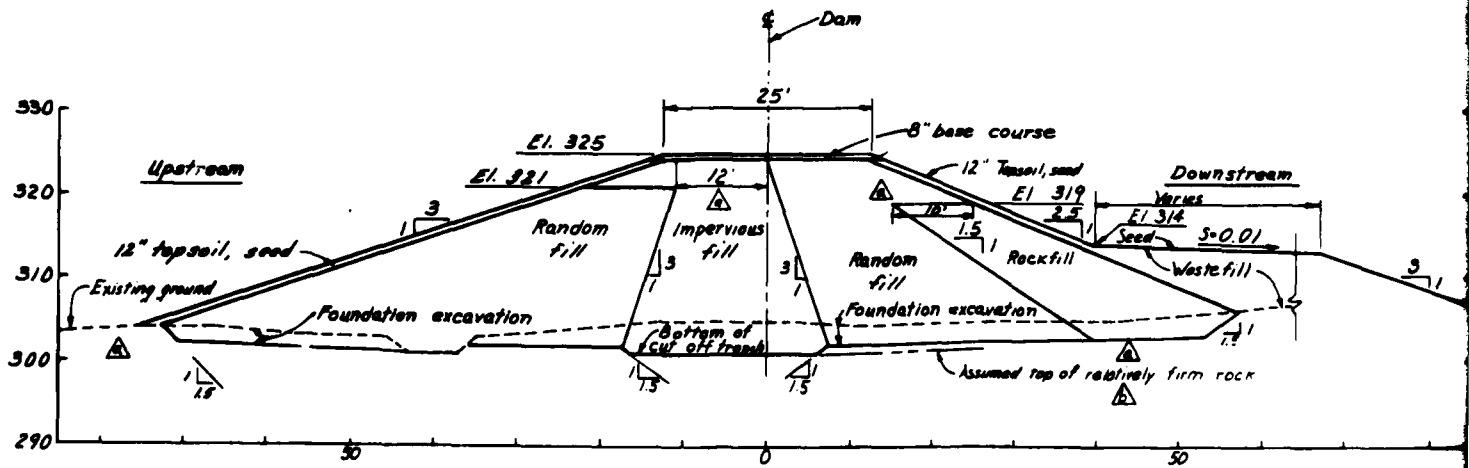
**BERNVILLE PROTECTIVE WORKS**  
DETENTION DAM & CONDUIT-TRIBUTARY NO. 1  
**PLAN & SECTIONS**

SIZE **D** REV. NO. **2** DATE **8-24-76** DRAWING NO. **44745**  
SCALE AS SHOWN SHEET



**PLAN**

SCALE IN FEET

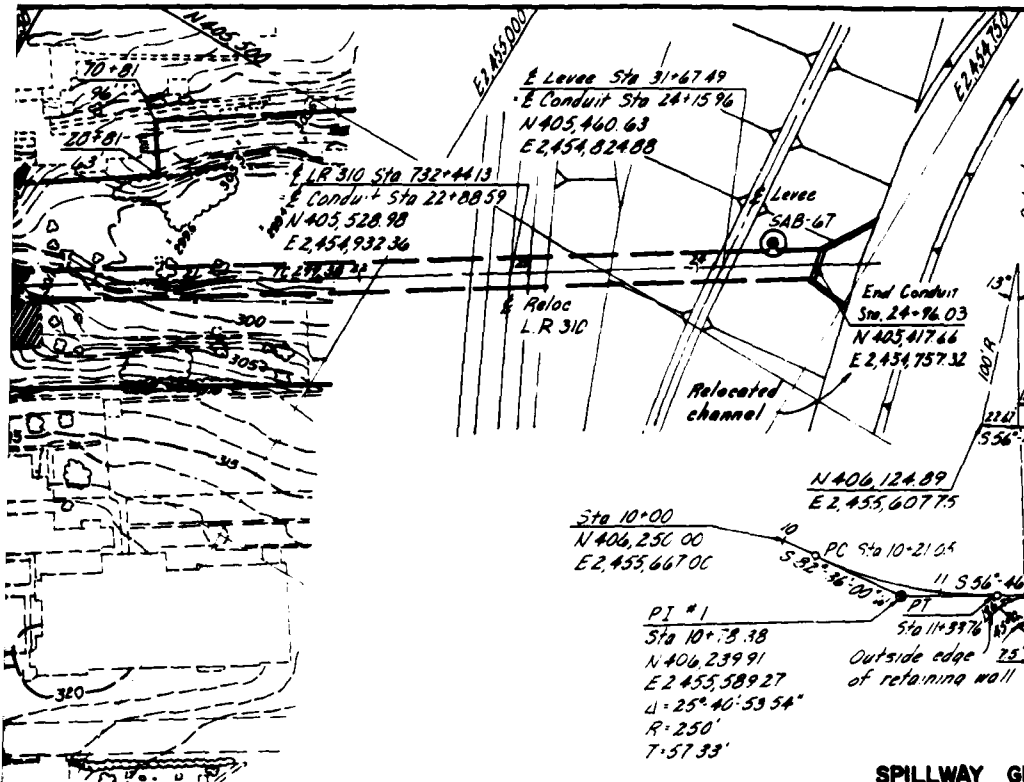


**TYPICAL VALLEY SECTION**

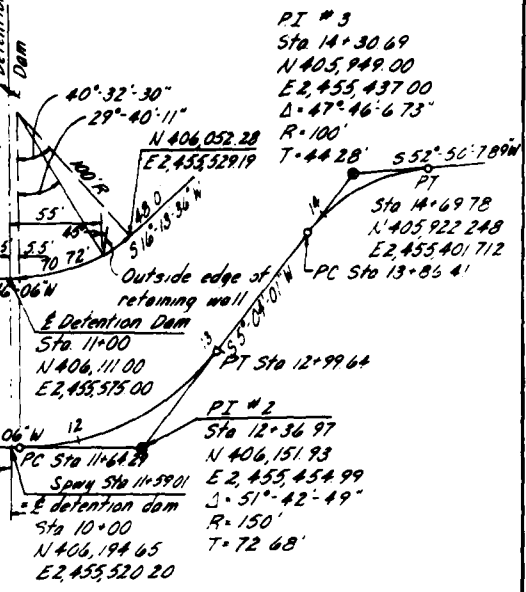
SCALE IN FEET



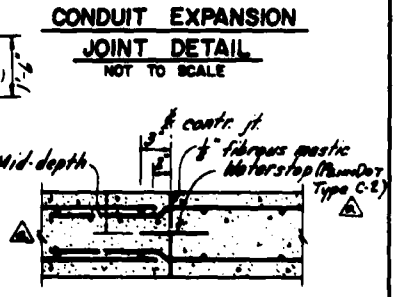
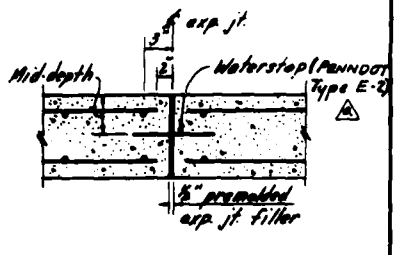
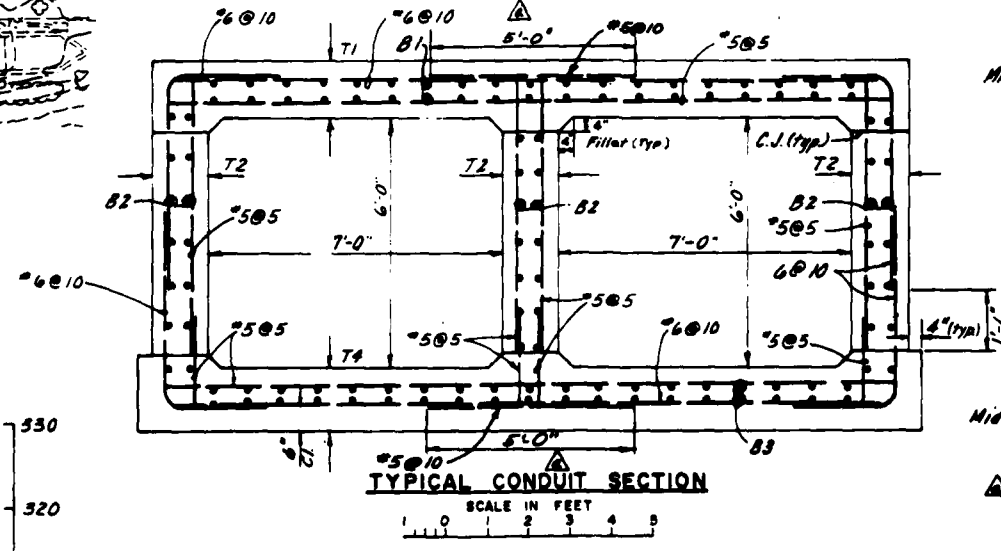
Note: Left abutment excavated to relatively firm rock, core trench right excavated between highly weathered & relatively firm rock.



DISTRICT	COUNTY	ROUTE	SECTION	SHEET
REVISION	DESCRIPTION	DATE	BY	
1	Miscellaneous revisions	5/20/61	RM	
2	Miscellaneous revisions			



**SPILLWAY GEOMETRY PLAN**



LOCATION	T1	T2	T4	B1	B2	B3
Sta. 13+57.5 to Sta. 15+07.5	18	14	20	#4@11	#4@14	#4@10
Sta. 15+07.5 to Sta. 23+47.5	16	14	18	#4@12	#4@14	#4@11
Sta. 23+47.5 to Sta. 24+96.03	18	14	20	#4@11	#4@14	#4@10

- Notes:**
- All splices to be 30 bar diameters.
  - Concrete cover on all reinforcement to be 4" except where shown.
  - Polyvinyl chloride waterstops detailed on PannDOT BC-385 and in conformance with material requirements of PannDOT Form AOB shall be used at all conduit contraction and expansion joints.
  - For location of expansion & contraction joints see B20.
  - Max Design Foundation Pressure for Conduit = 8000 PSF.
  - For Logs of Subsurface Explorations see B59.

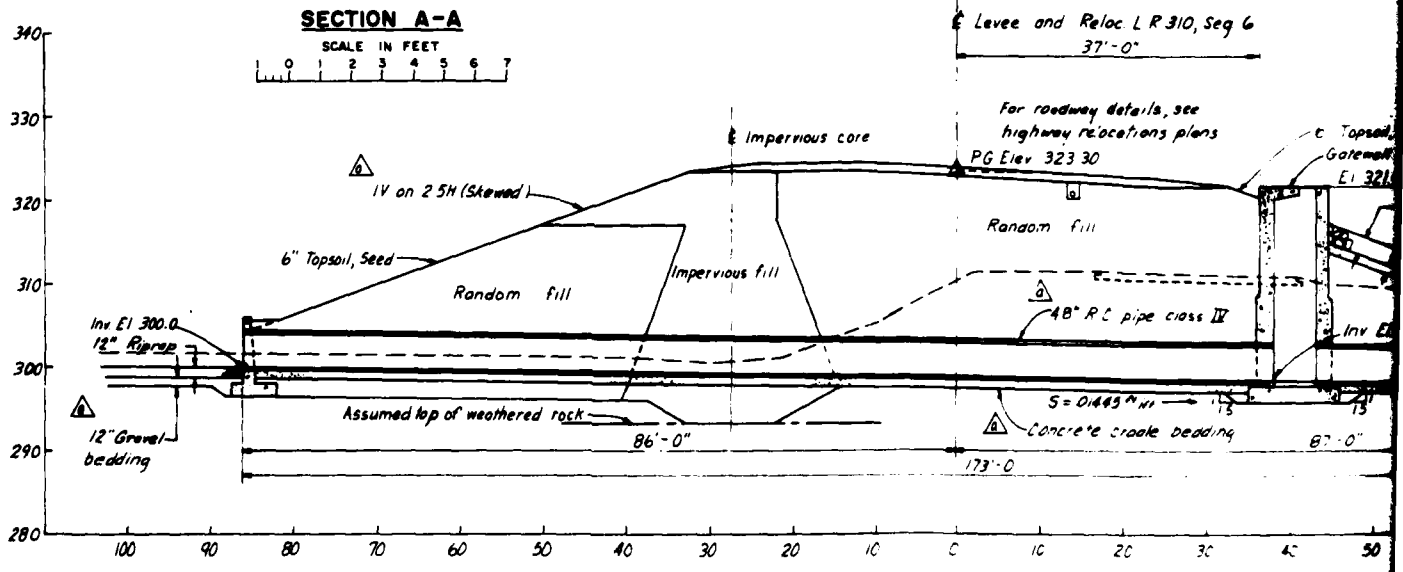
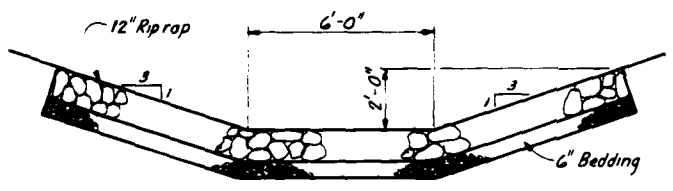
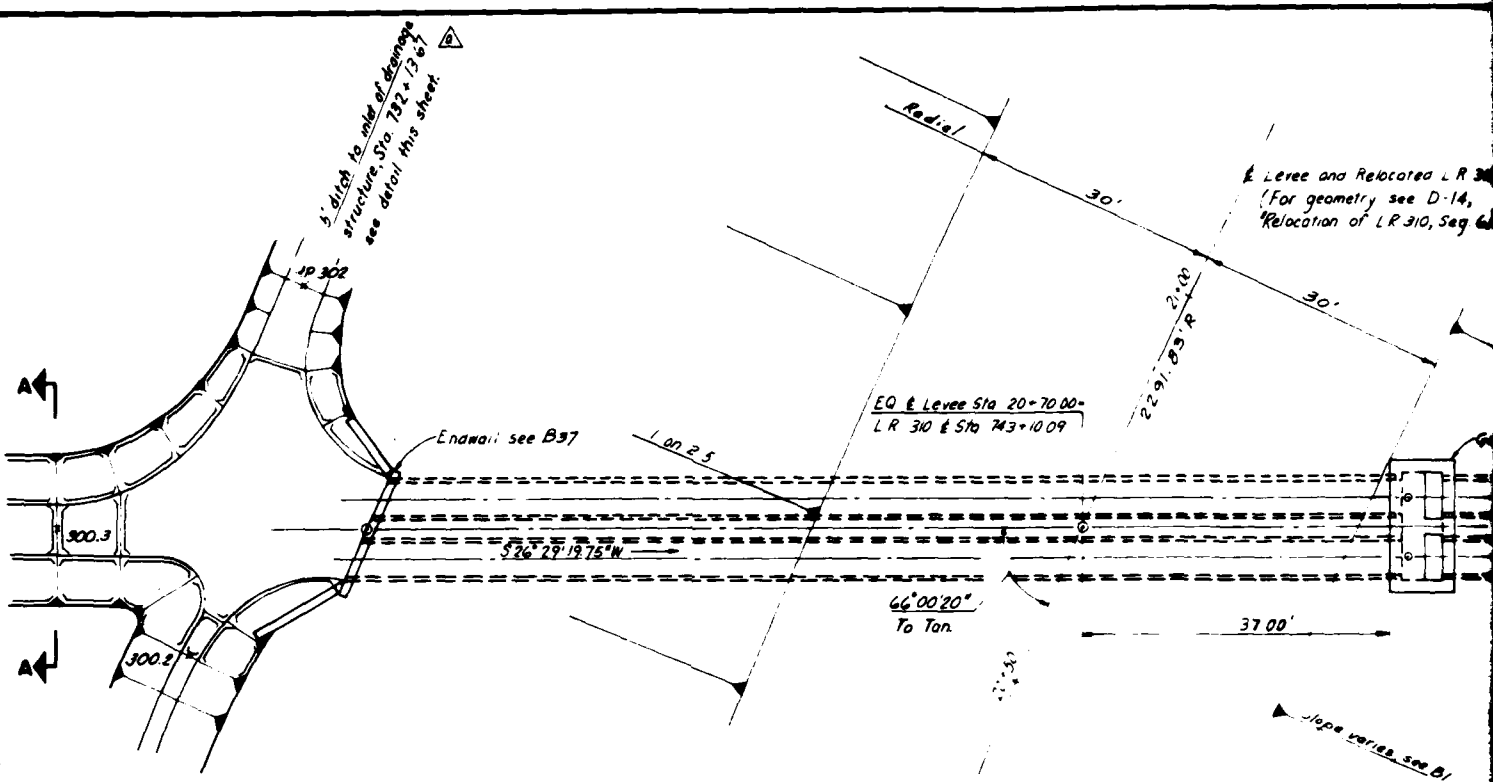
DEPARTMENT OF THE ARMY  
 Philadelphia District, Corps of Engineers  
 Philadelphia, Pennsylvania

SCHUPLILL RIVER BASIN  
 TULPEHOCHEN CREEK, PENNSYLVANIA  
 BLUE MARSH LAKE

**BERNVILLE PROTECTIVE WORKS  
 DETENTION DAM & CONDUIT-TRIBUTARY NO.2  
 PLAN & SECTIONS**

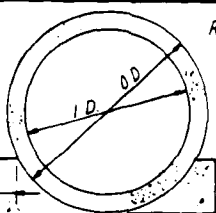
REV. NO. 01 - PNO  
 DATE 5/20/61  
 DRAWING NO. **44752**

AS SHOWN



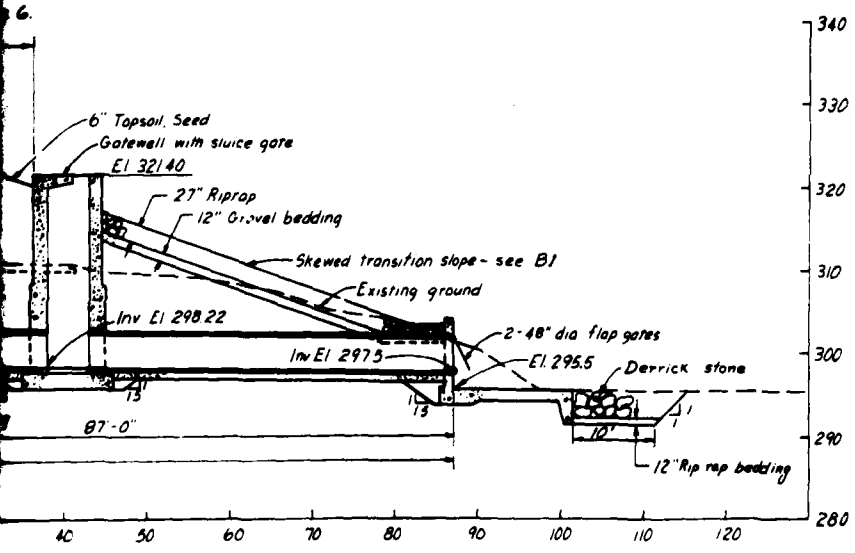
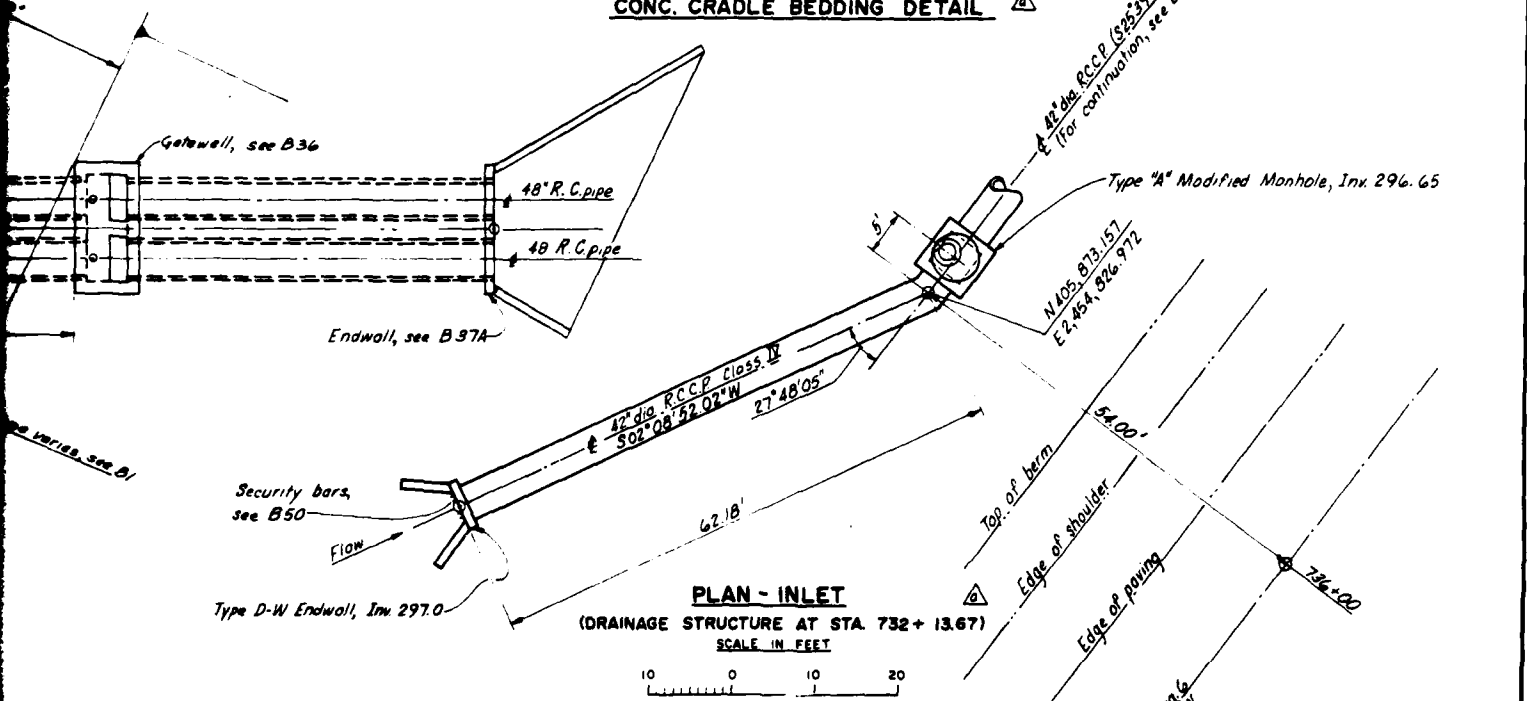
**PROFILE ALONG CENTERLINE DOUBLE 48" R.C. PIPES**

Rebarced L R 310, Seg 6  
 Detail see D-14,  
 of L R 310, Seg 6)



**CONC. CRADLE BEDDING DETAIL**

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
REVISION	DESCRIPTION	DATE	BY	
1	Slope, gravel bedding, stationing concrete cradle and R.C.P. Class added	8/26/76		



- Notes:**
1. For location of drainage structure, Sta 732+13.67 see B.2.
  2. Type D-W endwall and Type A modified manhole refer to PENNDOT Standard, series RC-31 and RC-39 respectively.

July 21, 1978

DEPARTMENT OF THE ARMY  
 Philadelphia District, Corps of Engineers  
 Philadelphia, Pennsylvania

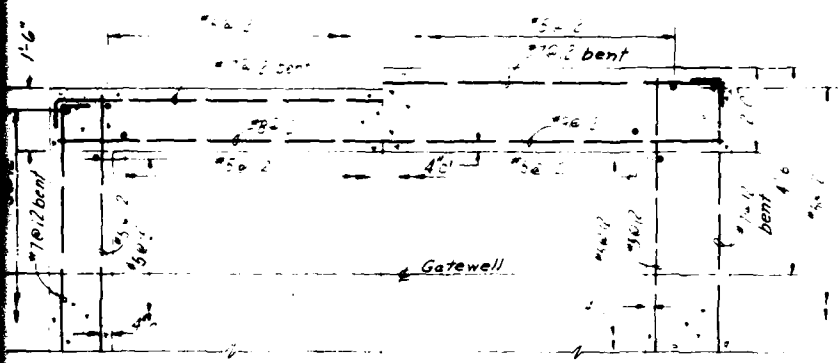
SCHUPLILL RIVER BASIN  
 TILGHOCKEN CREEK, PENNSYLVANIA  
 BLUE MARSH LAKE

BERNVILLE PROTECTIVE WORKS  
 DRAINAGE STRUCTURE AT STA. 20+70  
 PLAN & PROFILE

SIZE <b>D</b>	INV NO DACW 81-748 5032	DRAWING NO. <b>44761</b>
SCALE AS SHOWN		



REV'S	DESCRIPTION	DATE	BY



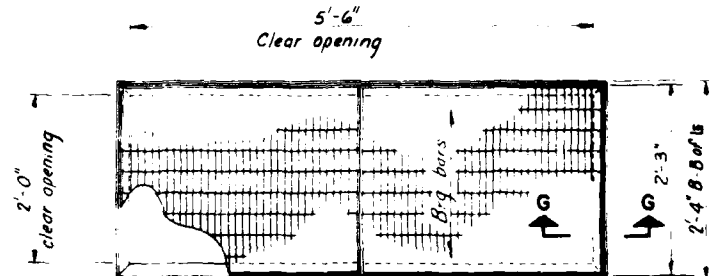
**SECTION C-C**  
SCALE IN FEET

Brq bars 1" x 3"  
Cross bars @ 1 1/2" c to c

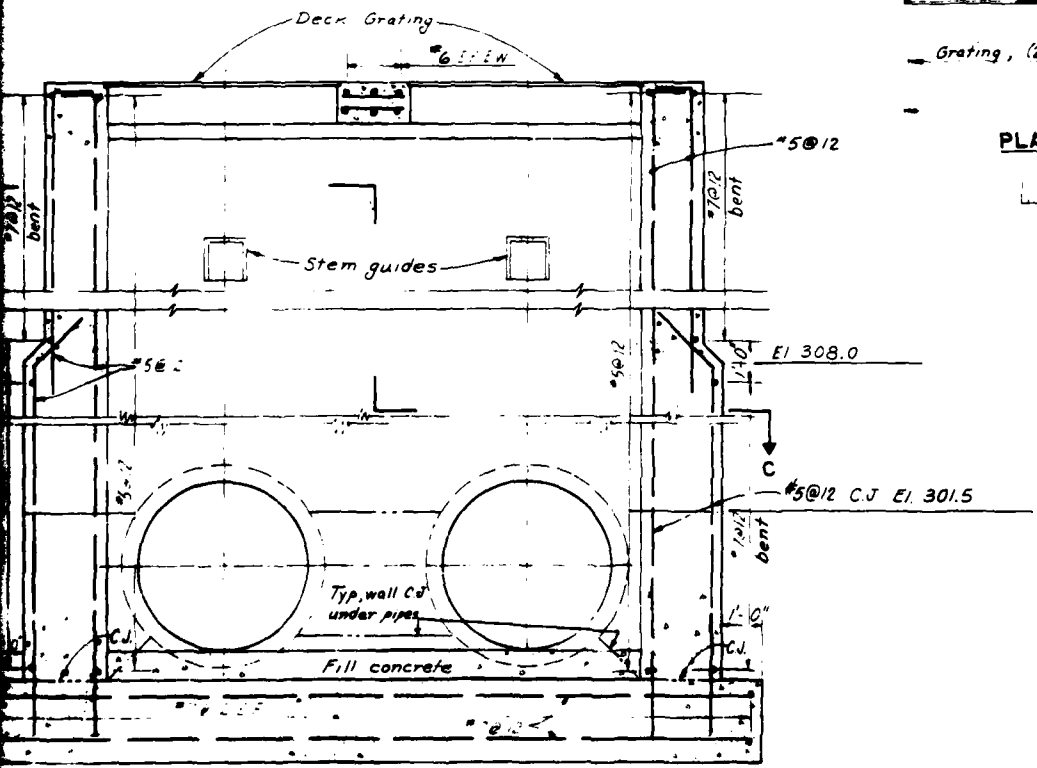
Fasten with Nelson type stud bolts and standard clips, approx 2'-0" c-c

3/8" dia x 0'-4" headed conc anchor stud @ 1'-6" c-c

**SECTION G-G**  
SCALE IN FEET



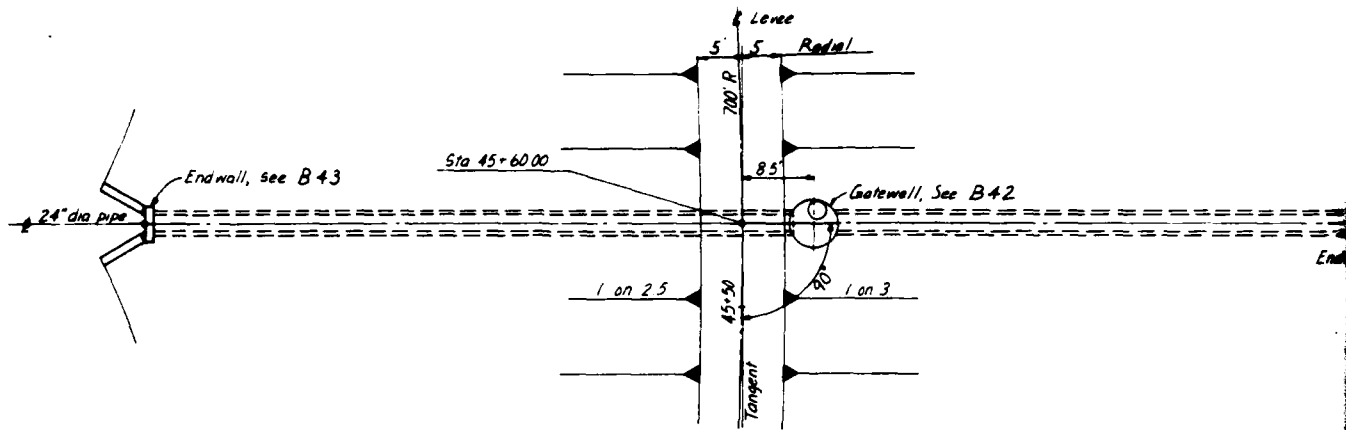
**PLAN OF DECK GRATING**  
SCALE IN FEET



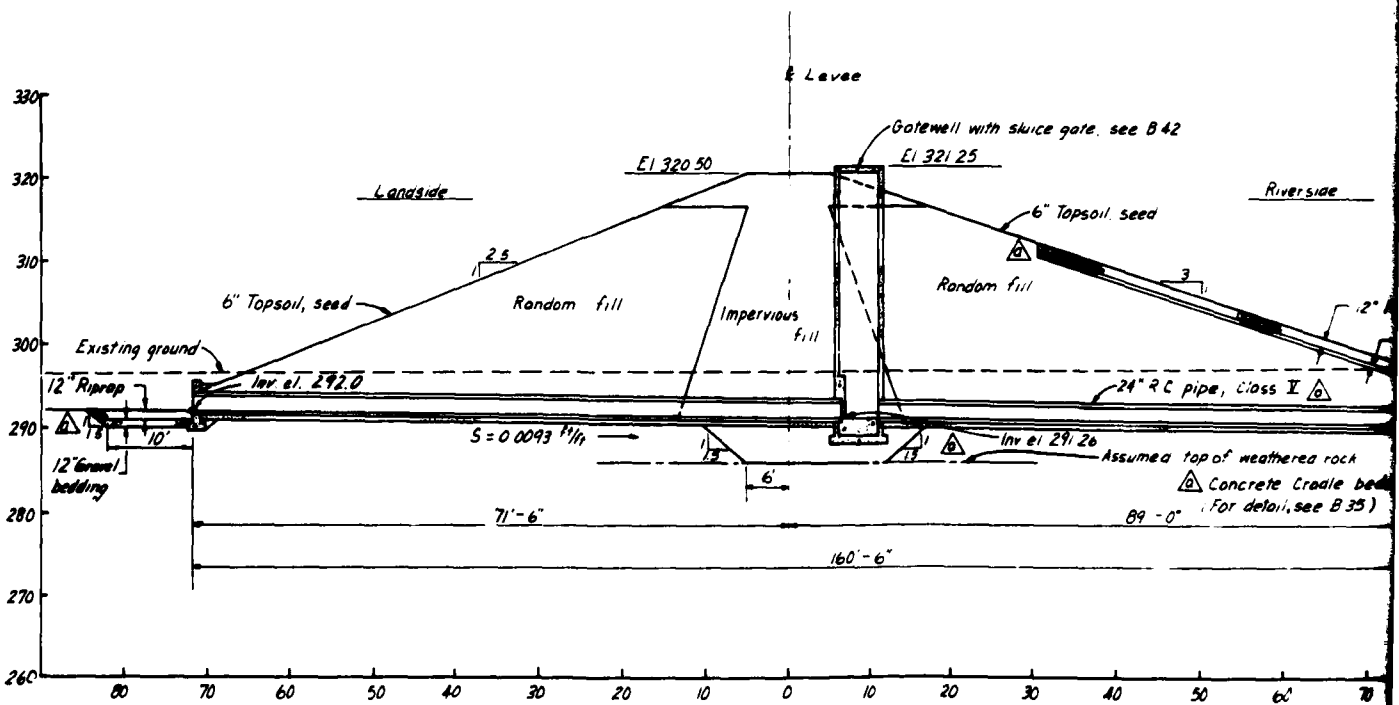
**SECTION B-B**  
SCALE IN FEET

JULY 21, 1978

DEPARTMENT OF THE ARMY Philadelphia District, Corps of Engineers Philadelphia, Pennsylvania		
SCHUYLKILL RIVER BASIN TULPINCROCK CREEK, PENNSYLVANIA BLUE MARSH, APE		
BERNVILLE PROTECTIVE WORKS DRAINAGE STRUCTURE AT STA 20+70 GATEWELL DETAILS		
DATE <b>D</b>	NO. IN CAL. & TOL <b>2017</b>	DRAWING NO. <b>44762</b>
SCALE AS SHOWN		SHEET



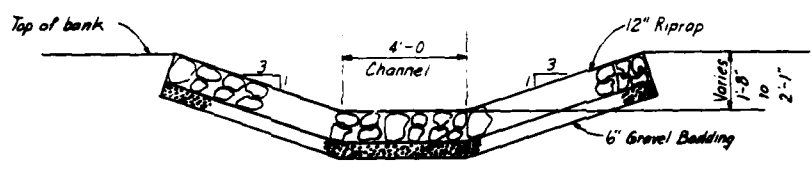
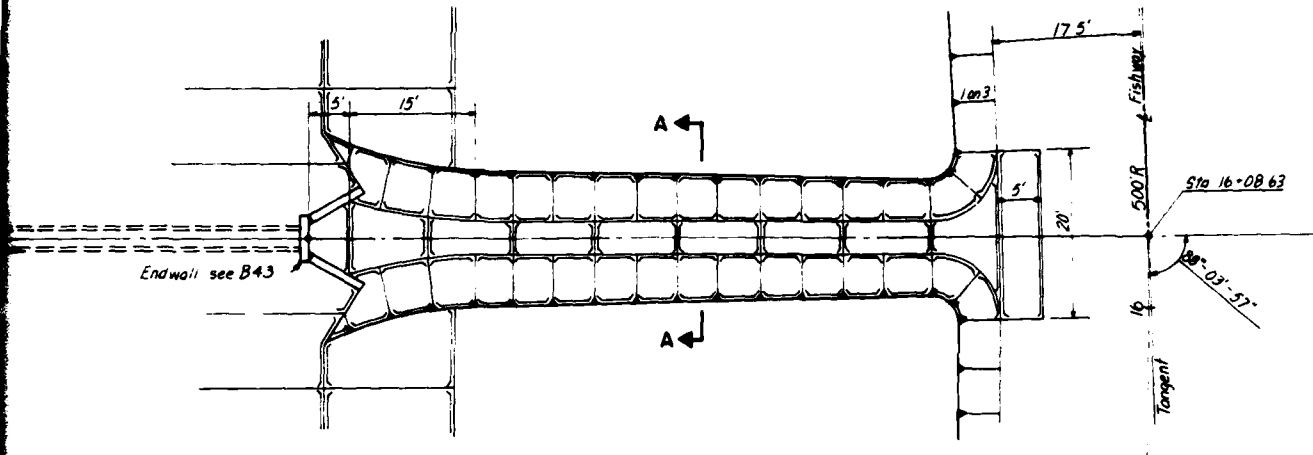
**PLAN**  
SCALE IN FEET  
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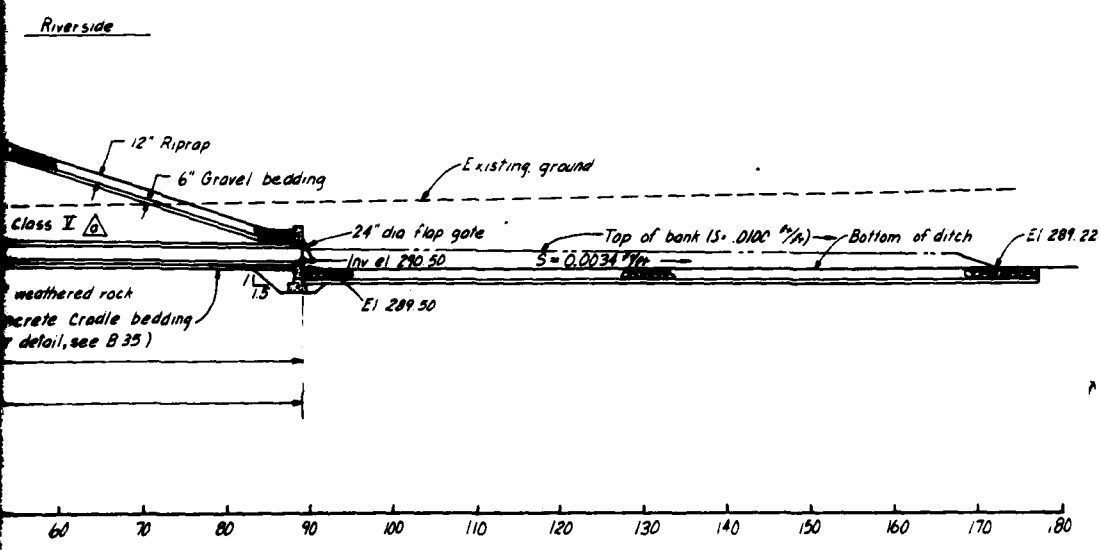
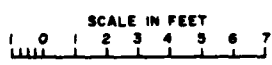
**PROFILE ALONG 24" R.C. PIPE**

SCALE IN FEET  
10 0 10 20  
HORIZ VERT

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
REVISION	DESCRIPTION	DATE	BY	
1	Riprap RC pipe Class II & Cradle bedding	2-25-96	Jaw	



**SECTION A-A**

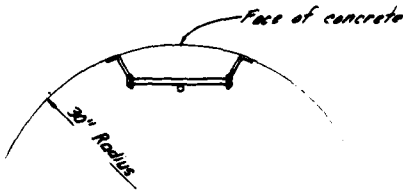


NOTE  
For location see B3

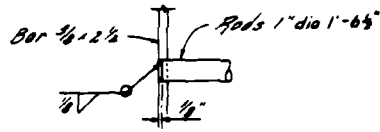
July 21, 1978

DEPARTMENT OF THE ARMY Philadelphia District, Corps of Engineers Philadelphia, Pennsylvania		
SCHUPLILL RIVER BASIN TULPOCKEN CREEK, PENNSYLVANIA BLUE MARSH LAKE		
<b>BERNVILLE PROTECTIVE WORKS</b> <b>DRAINAGE STRUCTURE AT STA 45+60</b> <b>PLAN &amp; PROFILE</b>		
DATE <b>D</b>	REV NO C.A.C. 81: 768 2007	DRAWING NO. <b>44768</b>
SCALE AS SHOWN		SHEET

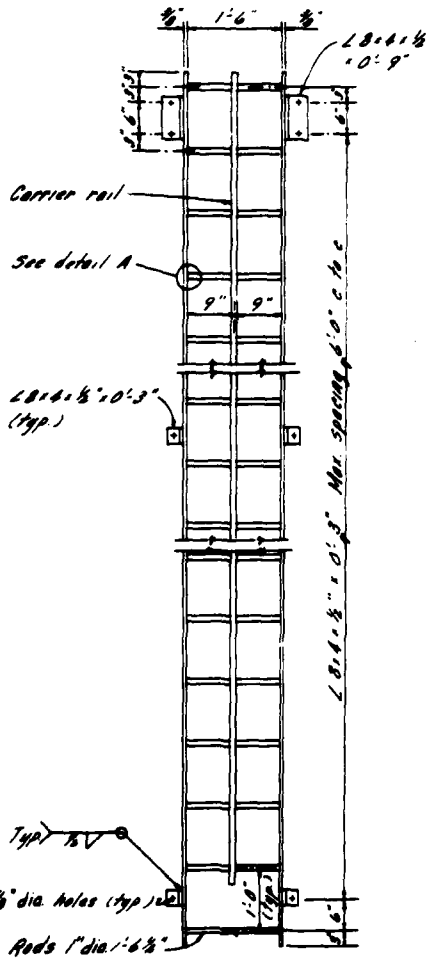
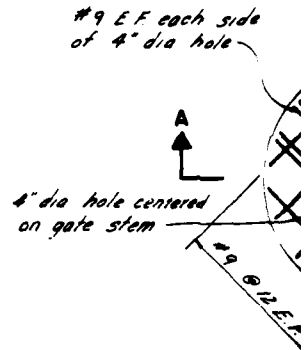
ADM 9EF 0000



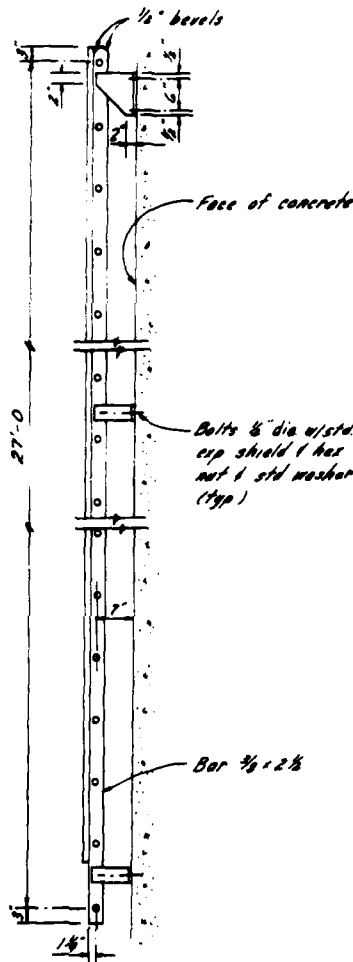
PLAN



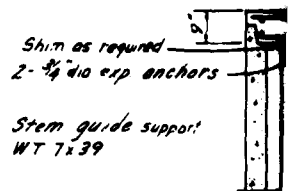
DETAIL A



FRONT ELEVATION



SIDE ELEVATION



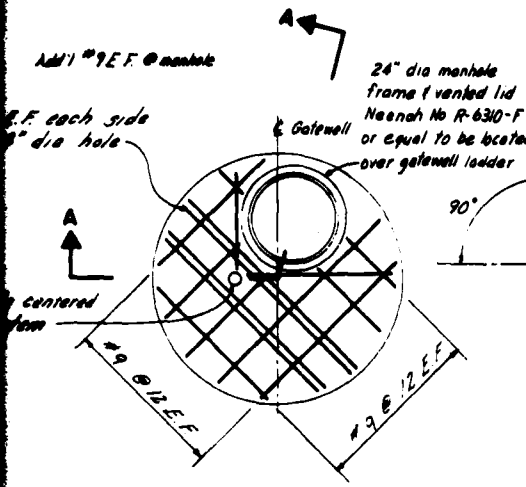
STEM C

LADDER DETAILS

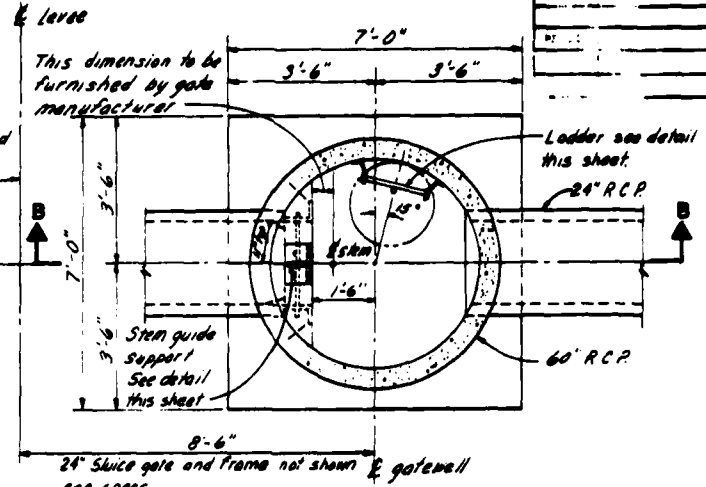
SCALE IN FEET



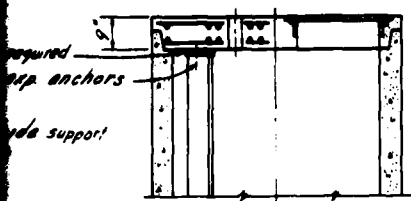
DATE	COUNTY	ROUTE	SECTION
BY	DESIGNED BY		



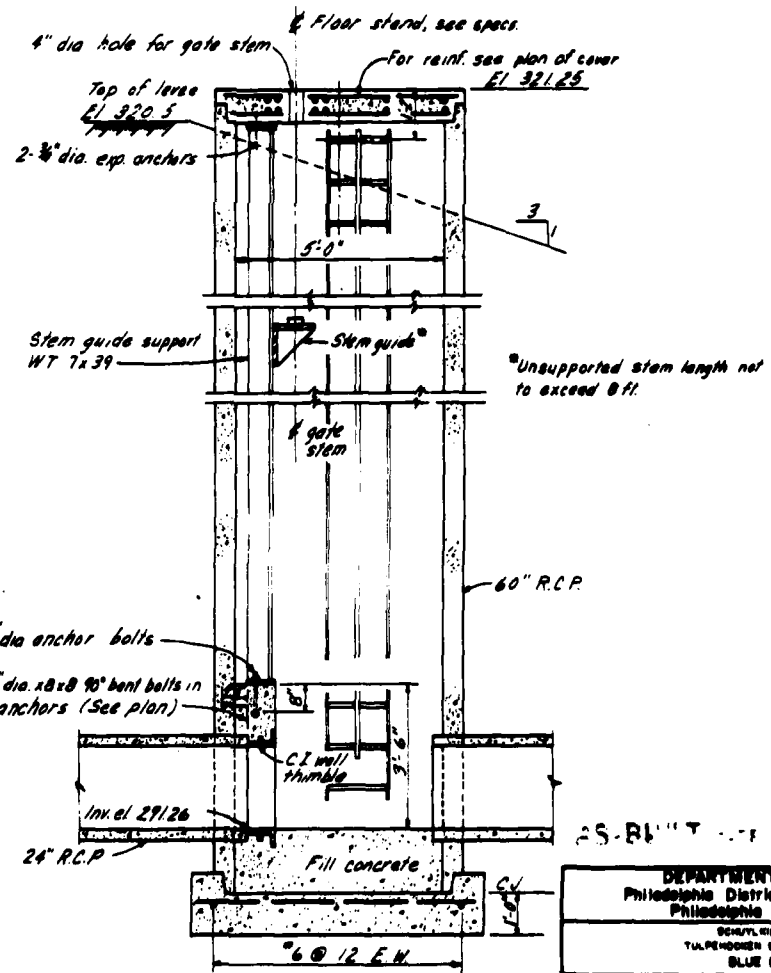
**PLAN OF COVER**  
SCALE IN FEET



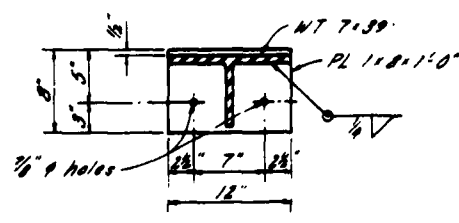
**PLAN AT EL. 295.0**  
SCALE IN FEET



**SECTION A-A**  
SCALE IN FEET



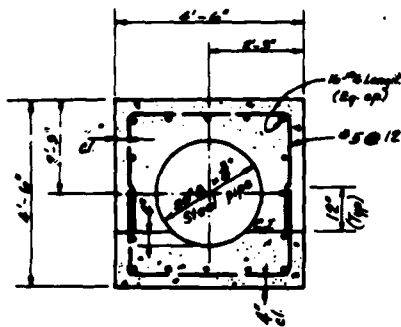
**SECTION B-B**  
SCALE IN FEET



**STEM GUIDE SUPPORT DETAIL**  
SCALE IN FEET

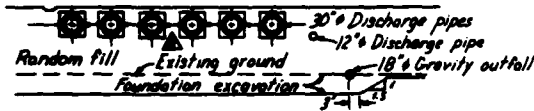
AS-BUILT DATE July 21, 1970

DEPARTMENT OF THE ARMY Philadelphia District, Corps of Engineers Philadelphia, Pennsylvania		
SCHUYLL KILL RIVER BASIN TULPONDEN CREEK, PENNSYLVANIA BLUE MARSH LAKE		
BERNVILLE PROTECTIVE WORKS DRAINAGE STRUCTURE AT STA 45+60 GATEWELL DETAILS		
REV D	REV NO DATE BY	DRAWING NO. 44769
SCALE AS SHOWN	SHEET	



**CONCRETE ENCASEMENT  
FOR 30" DISCHARGE PIPES**

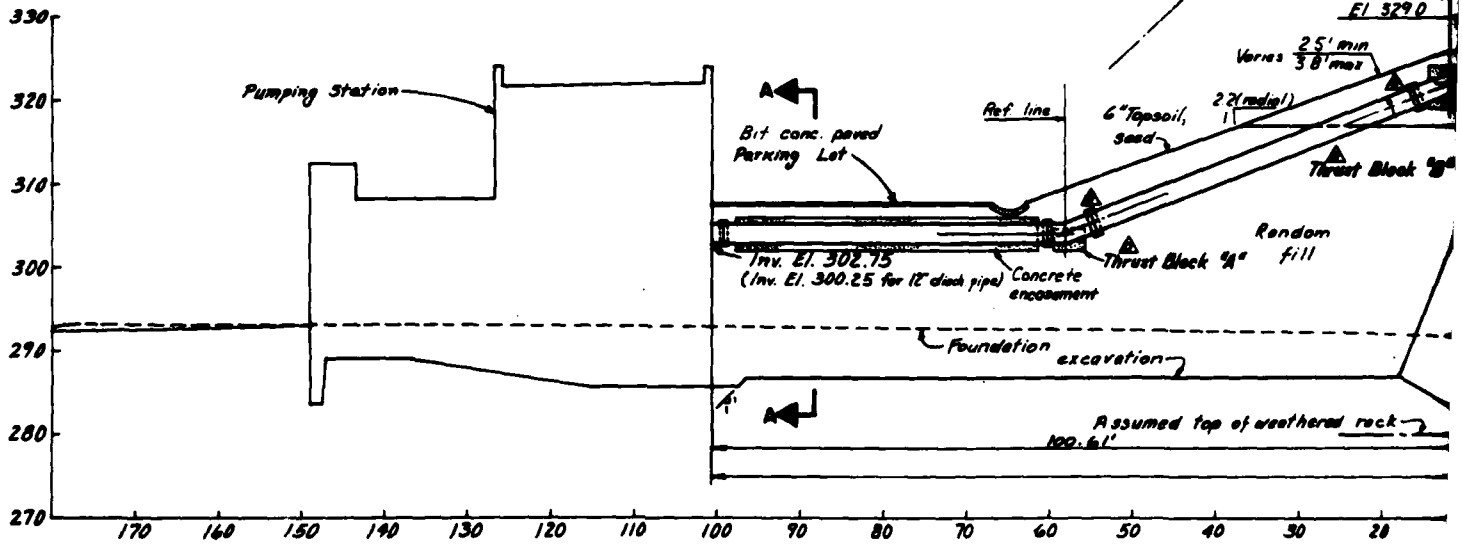
SCALE IN FEET  
0 2 4 5



**SECTION A-A**

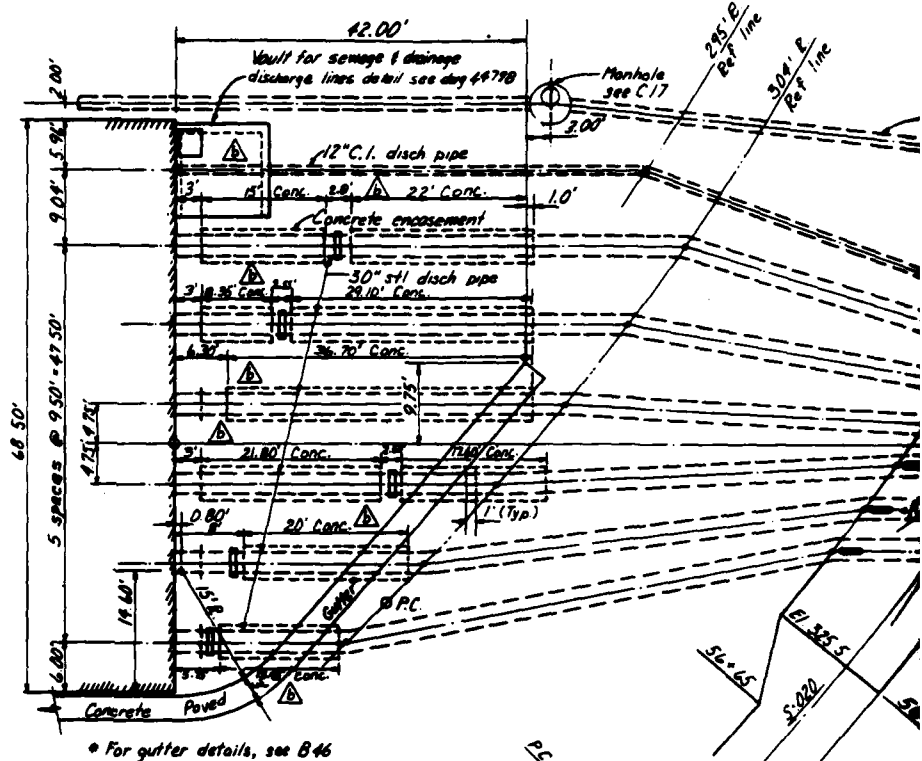
SCALE IN FEET

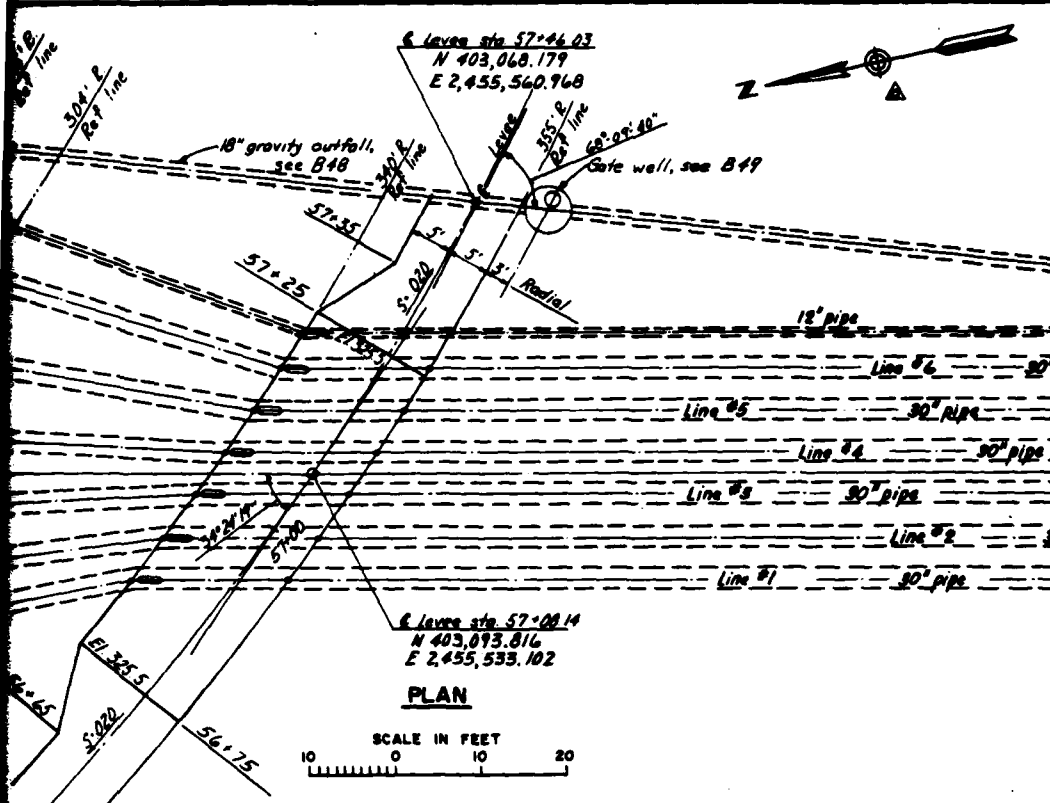
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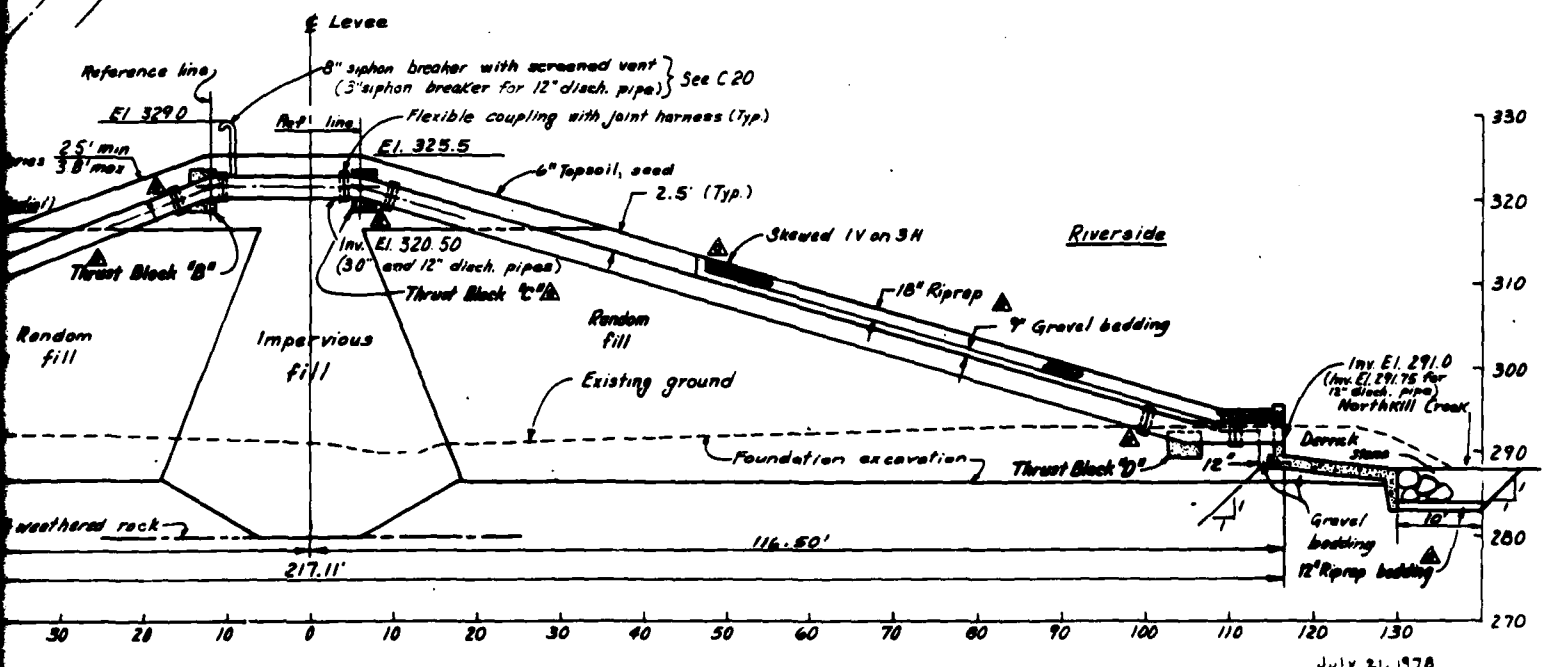
Note:  
For throat block details see C14415

**PROFILE ALONG C 30" DIA. PH**





DISTRICT	COUNTY	ROUTE	SECTION	SHEET
REVISION	DESCRIPTION	DATE	BY	
▲	Added flow readings & some annotations (See A-4) to the pipe identified Thrust Block & 30" pipes. Added the arrows.	20 Jun 76		
▲	Conc. encasement on pipe vault added			



18 & 30" DIA. PUMP DISCHARGE PIPE

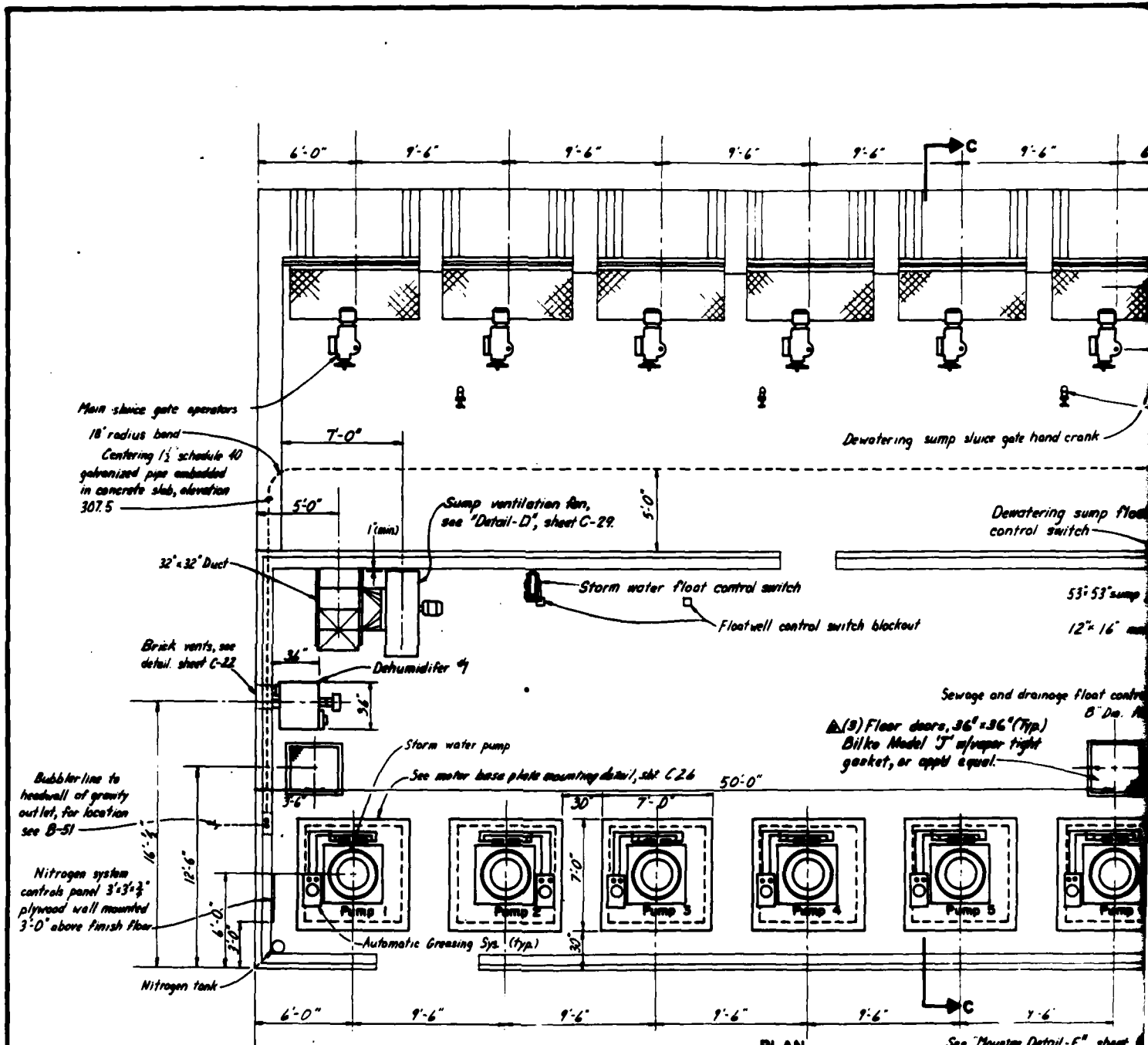
DEPARTMENT OF THE ARMY  
 Philadelphia District, Corps of Engineers  
 Philadelphia, Pennsylvania

GENERAL: GIVER BRON  
 TULPASHEN CREEK, PENNSYLVANIA  
 BLUE MARSH LAKE

**BERVILLE PROTECTIVE WORKS  
 PUMPING STATION 30" DISCHARGE LINES  
 PLAN & PROFILE**

SHEET	REV. NO.	DRAWING NO.
D	1	44797
SCALE: AS SHOWN		

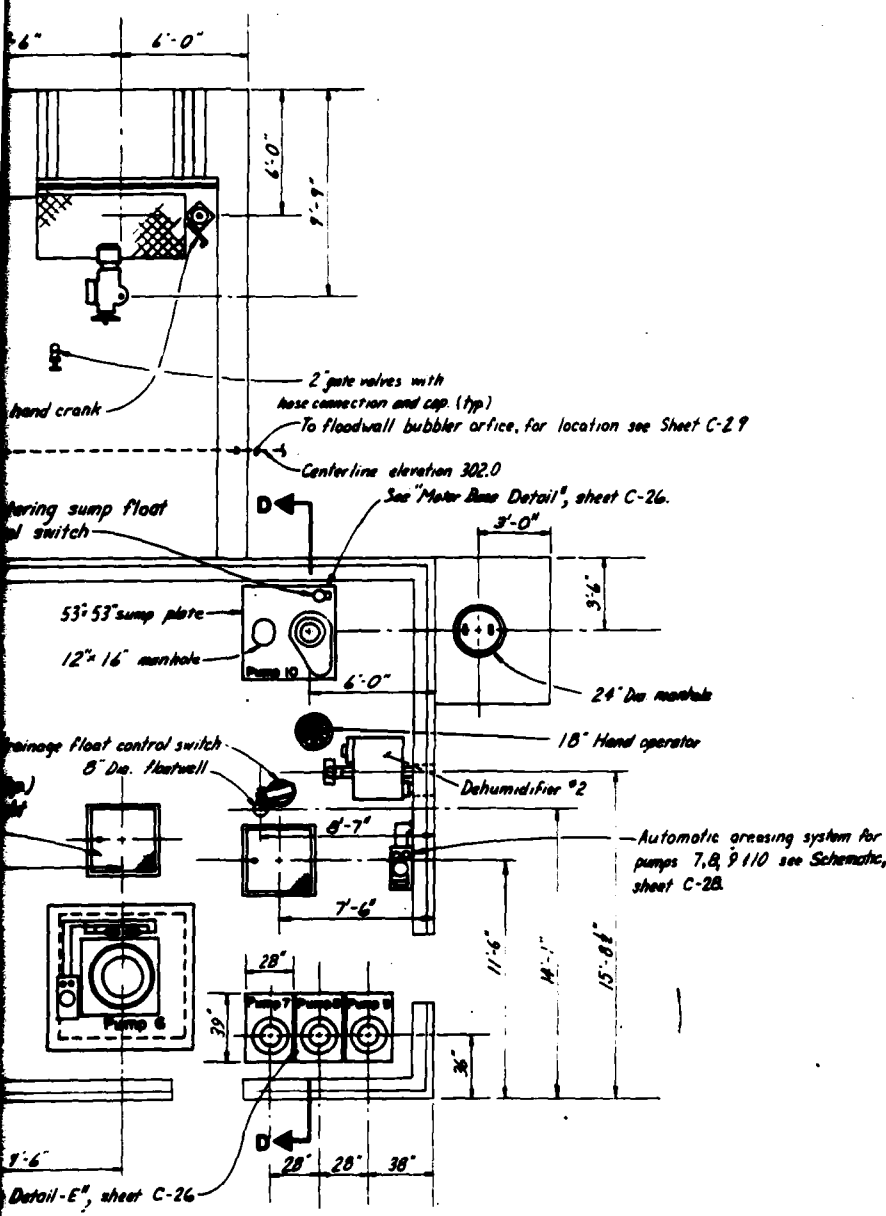
12



**PLAN**  
**OPERATING FLOOR AT EL. 308.0**

Alternator Sequence No.	PUMP START SEQUENCE				
	Pump Number 1	Pump Number 2	Pump Number 3	Pump Number 4	Pump Number 5
1	1	3	6	2	4
2	4	1	3	6	2
3	2	4	1	3	6
4	3	6	2	4	1
5	3	6	2	4	1
6	5	3	6	2	4

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
REVISION	DESCRIPTION	DATE	BY	
▲	Rev. floor door description	5/2/76	TLC	



- Notes.
- 1 For General Notes, see sheet C-7
  - 2 Work this drawing with drawings C-20, 22, 24, 25, 26, 27, 28, and 29.
  - 3 All pump and block-out dimensions shall be verified by the pump manufacturer for the pump proposed. See sheet C-7 for block-out dimensions.
  - 4 Coordinate controls for the storm water pumps with sheet C-36.
  - 5 See sheet C-28 for Details of Level Sensing equipment for bubbler system. All interconnecting tubing inside pump station shall be securely attached to walls to prevent sagging. Bonds shall be made with fittings.
  - 6 For wall penetration locations see sheet C-7.
  - 7 All ferrous metal below elevation 308.0 shall be galvanized.

FLOAT SWITCH SETTINGS

FLOAT SWITCH POSITION	ITEM	ELEVATION	
		ON	OFF
1	Highwater Elevation Alarm	298.0	294.0
2	Main Sump Slope Meter	298.0	(Manual Reset)
3	Pump No. 1	295.4	295.0
4	Pump No. 2	295.7	295.0
5	Pump No. 3	296.0	295.25
6	Pump No. 4	298.2	295.5
7	Pump No. 5	298.5	298.75
8	Pump No. 6	298.7	298.0

July 21, 1978

DEPARTMENT OF THE ARMY  
Philadelphia District, Corps of Engineers  
Philadelphia, Pennsylvania

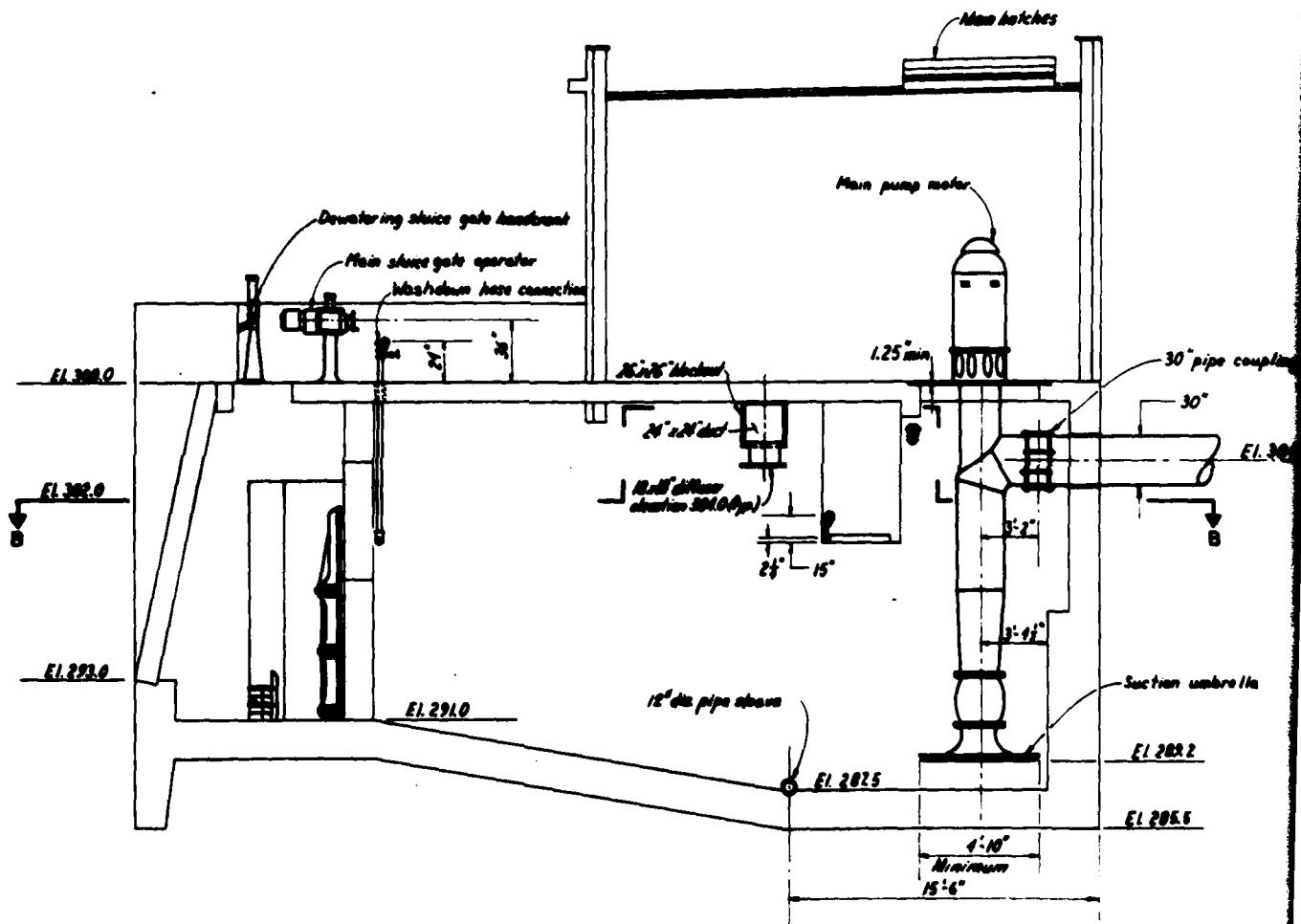
SCHUYLKILL RIVER BASIN  
TULPINDER CREEK, PENNSYLVANIA  
BLUE MARSH LAKE

**BERNVILLE PROTECTIVE WORKS  
PUMPING STATION  
OPERATING FLOOR-MECHANICAL**

SCALE: AS SHOWN

DRAWING NO. **44817**

SCALE IN FEET  
1" = 2'-0"



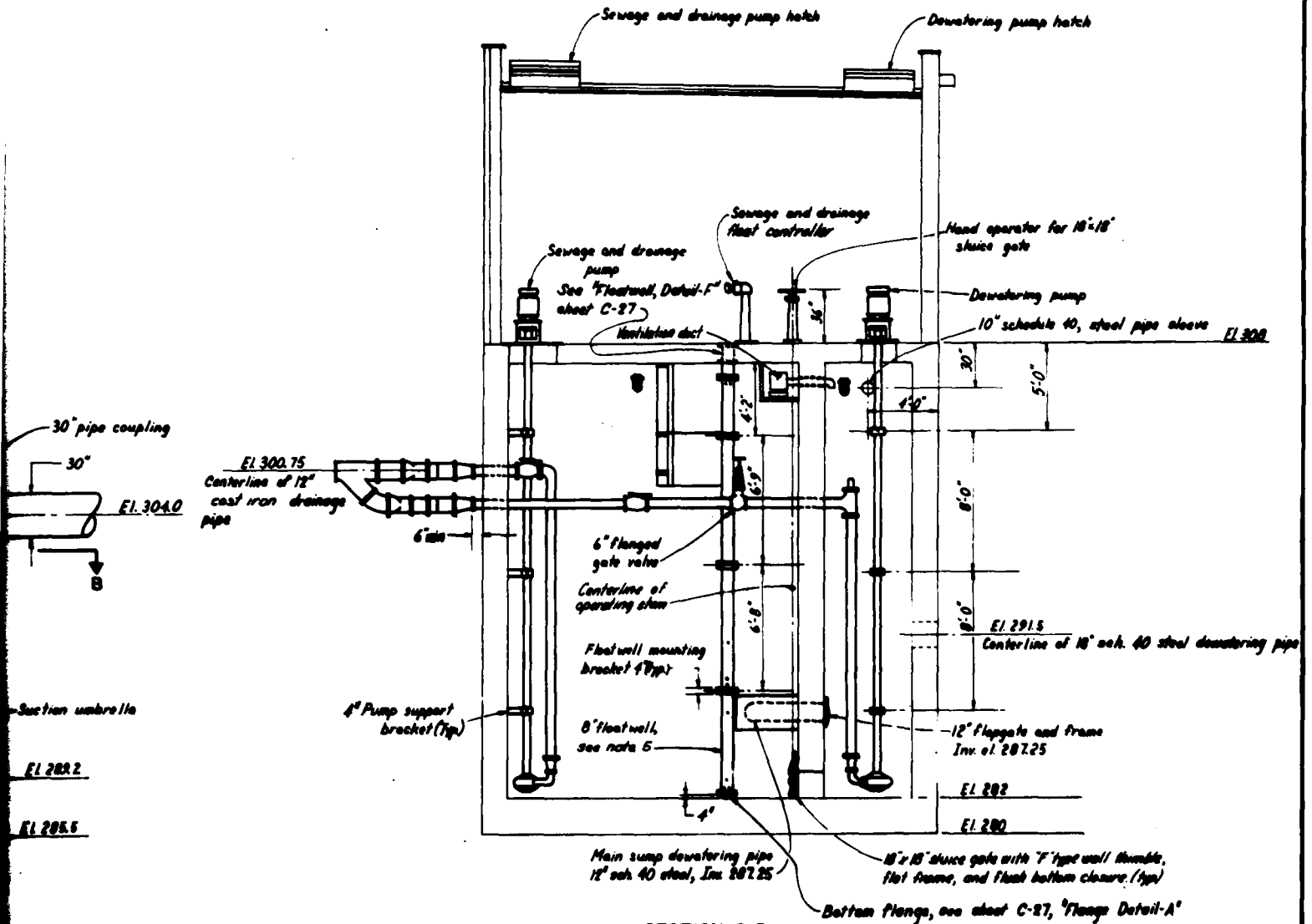
PUMP START SEQUENCE				
Alternator Sequence No.	Pump Number			
	X	Y	Z	
1	7	8	9	
2	8	9	7	
3	9	7	8	

**SECTION C-C**

DEWATERING FLOAT SWITCH	
Pump On	Pump Off
289.0	283.0

SEWAGE AND DRAG	
Floot Switch Position	
1	
2	
3	
4	WOB

DISTRICT	COUNTY	ROUTE	SECTION	SHEET	
REVISION	DESCRIPTION			DATE	BY



**SECTION D-D**

**Notes:**

1. For General Notes see sheet C-7.
2. For location of sections, see sheet C-25.
3. All openings between duct and masonry opening shall be filled at least two inches deep with calcium and topped with one inch of mastic.
4. Pump Nos. 7, 8, and 9 start sequence shall be rotated by a pump alternator.
5. The floatwell shall have six holes equally spaced on the circumference of the floatwell 3" from each of the end flanges. Holes shall be 1/2" in diameter.
6. A 3/8" dia. hole shall be centered on each float switch trip abutment.

AS-ENGINEER DATE: July 21, 1978

SCALE IN FEET

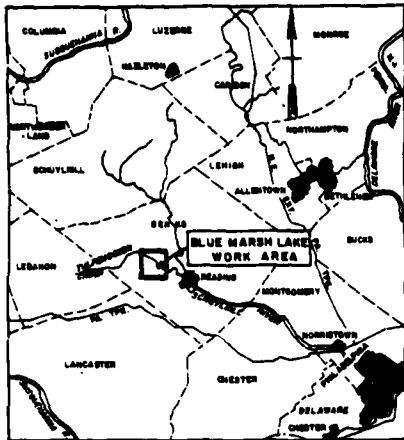


Float Switch Position	Nom	Elevation	
		On	Off
1	PUMP NO. X	287.0	283.0
2	PUMP NO. Y	288.5	283.0
3	PUMP NO. Z	289.0	283.0
4	HIGH WATER ALARM	291.0*	281.0*

DEPARTMENT OF THE ARMY  
Philadelphia District, Corps of Engineers  
Philadelphia, Pennsylvania  
BERNILLE STORM BARR  
TULPINDER GREEN, PENNSYLVANIA  
BLUE MARSH LAKE

**BERNILLE PROTECTIVE WORKS  
PUMPING STATION  
SECTIONS—MECHANICAL**

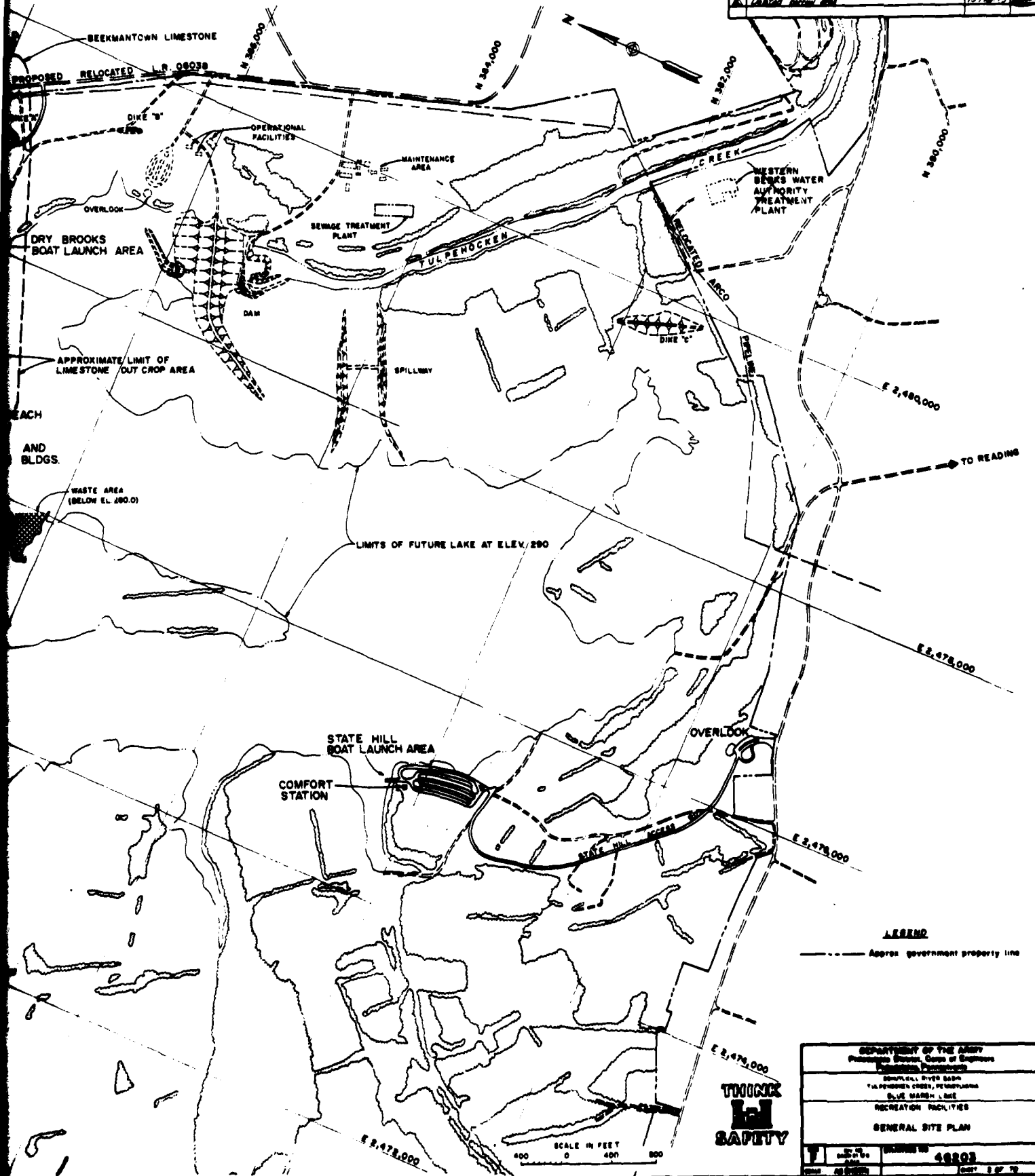
SIZE: **D** REV. NO. **0** DATE: **7-20** DRAWING NO. **44819**  
SCALE: **AS SHOWN** SHEET



**LOCATION MAP**  
SCALE IN MILES  
0 5



NO.	REVISED	DATE	BY
1	Original drawing	12/2/73	



**LEGEND**  
 - - - - - Approx government property line

DEPARTMENT OF THE ARMY Professional Services Corps of Engineers Fort Belvoir, Pennsylvania	
BEAVER CREEK DAM TULPEHOCKEN CREEK, PENNSYLVANIA DRY BROOKS LAUNCH	
RECREATION FACILITIES GENERAL SITE PLAN	
DRAWN BY 48202	CHECKED BY 48202
DATE 12/2/73	SCALE 1" = 400'



SCALE IN FEET  
 0 400 800

**DAT  
ILMI**