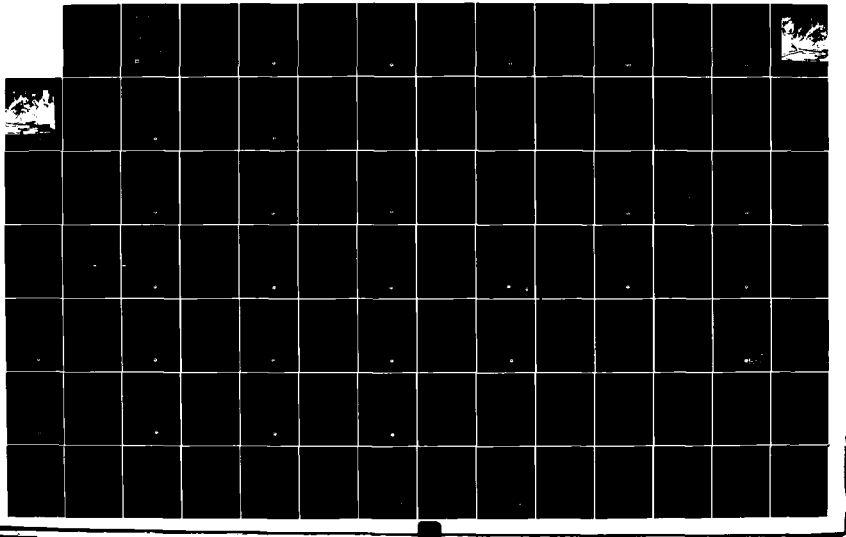
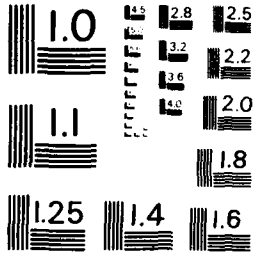
AD-A134 915 CONSTRUCTION FOUNDATION REPORT MISSOURI RIVER FORT PECK 1/2
LAKE MONTANA VOLUME 3 DRAWINGS(U) CORPS OF ENGINEERS
OMAHA NE JAN 83

UNCLASSIFIED F/G 13/13 NL





CONSTRUCTION FOUNDATION REPORT

(3)

A134915

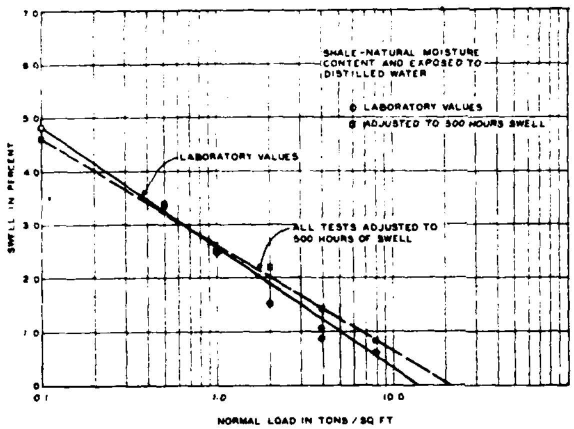
MISSOURI RIVER
FORT PECK LAKE, MONTANA

VOLUME III
DRAWINGS

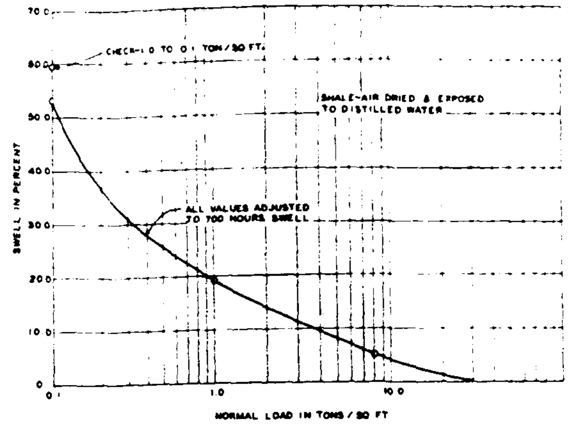
JANUARY 1983

US Army Corps
of Engineers
Omaha District

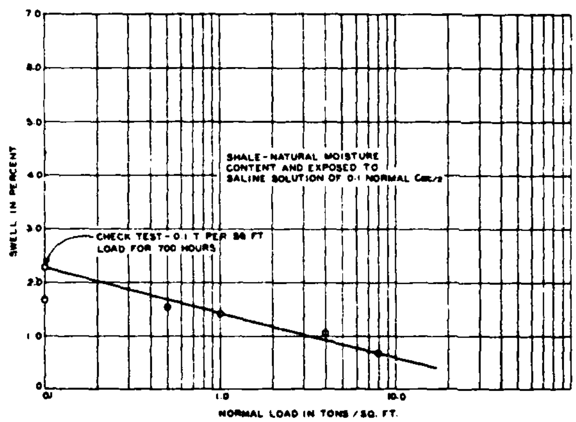
CORPS OF ENGINEERS



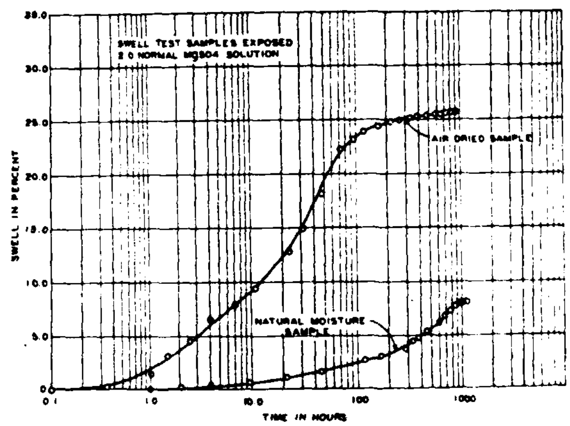
PERCENT SWELL Vs NORMAL LOAD
REPORT SERIES #12 SAMPLES U-13 & U-15



PERCENT SWELL Vs NORMAL LOAD
REPORT SERIES #29 SAMPLE U-23

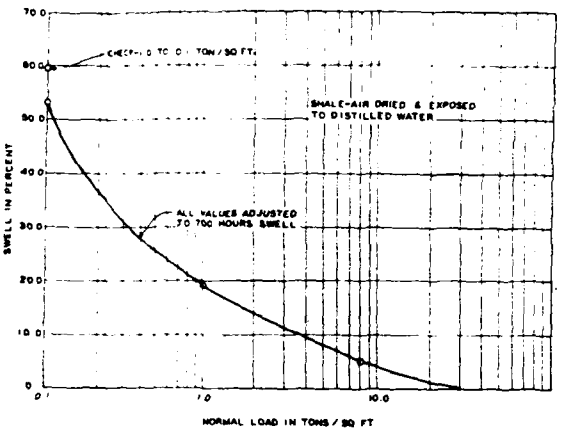


PERCENT SWELL Vs NORMAL LOAD
REPORT SERIES #13 SAMPLE U-13

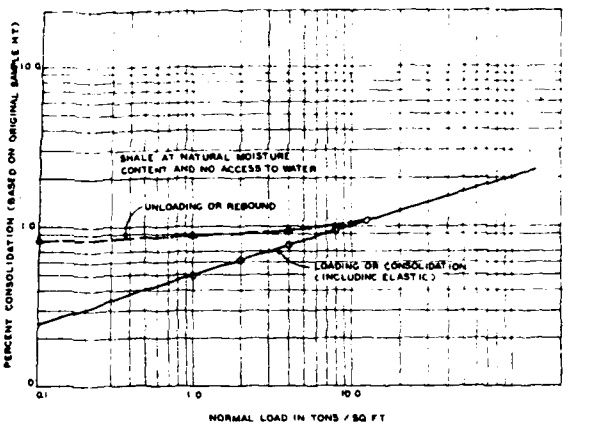


SWELL Vs TIME
0.1 TON PER SQ FT NORMAL LOAD

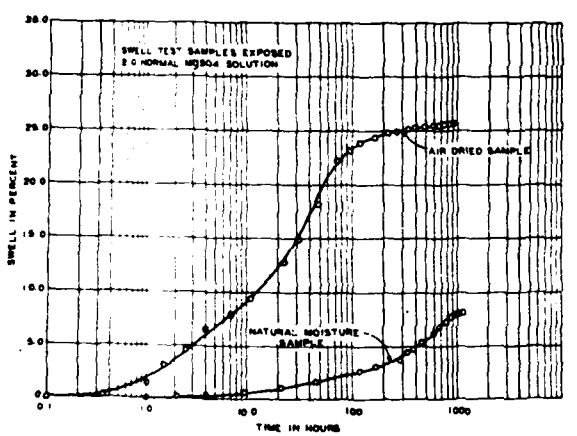
U. S. ARMY



PERCENT SWELL Vs NORMAL LOAD
REPORT SERIES #29 SAMPLE U-23



CONSOLIDATION Vs NORMAL LOAD
REPORT SERIES #1 SAMPLE U-23



SWELL Vs TIME
0.1 TON PER SQ FT. NORMAL LOAD

A1

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

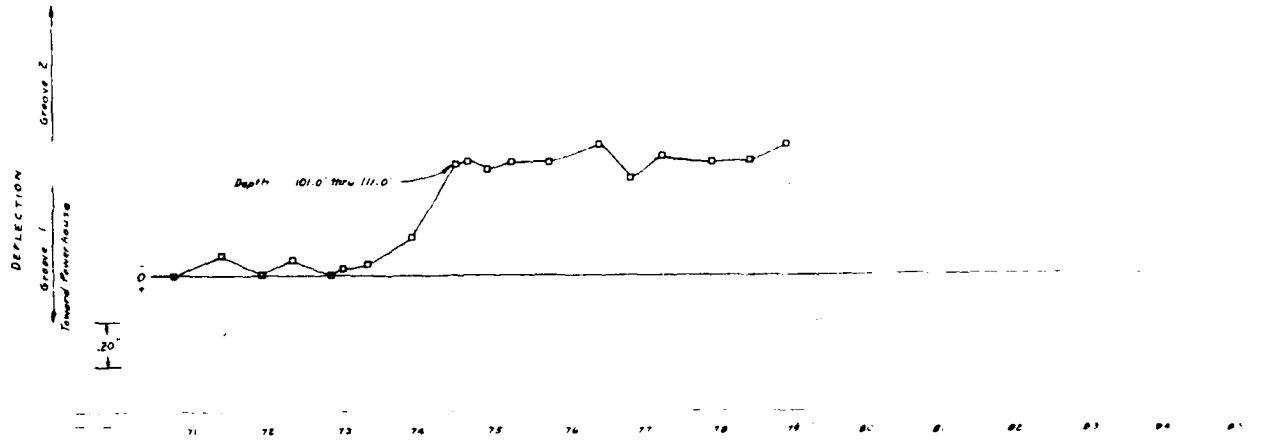
MISSOURI RIVER
FORT PECK DAM AND RESERVOIR
SPILLWAY REHABILITATION
SUMMARY OF RESULTS
SWELL AND CONSOLIDATION TESTS

SEPT 1966

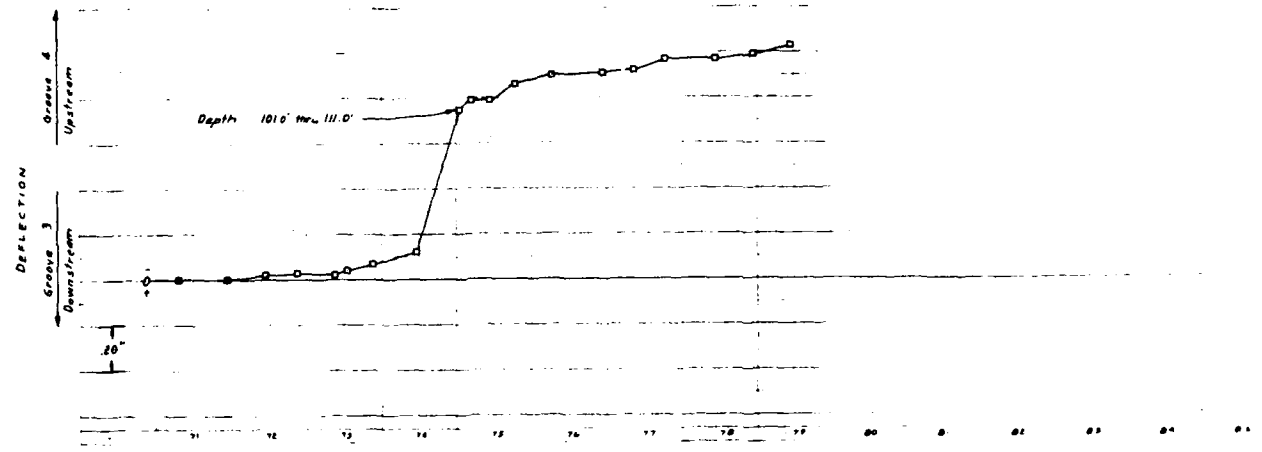
SAFETY DAYS

CONSTRUCTION FOUNDATION REPORT PLATE 151

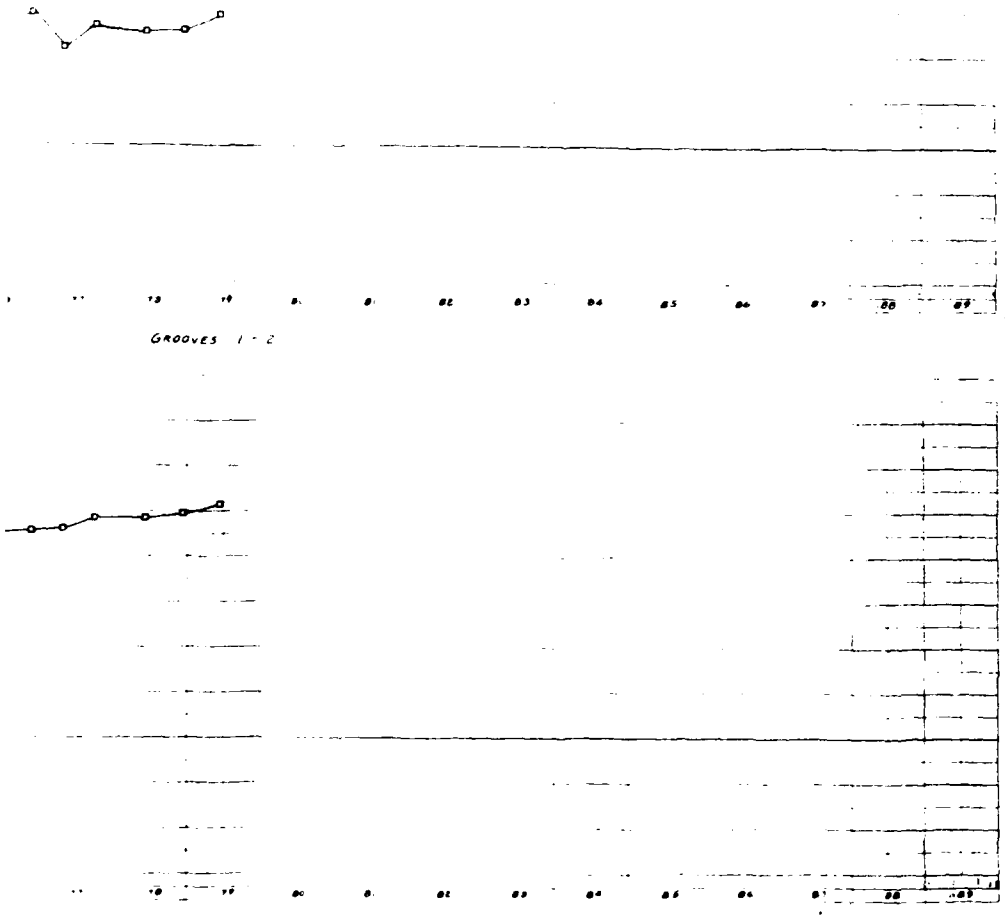
2

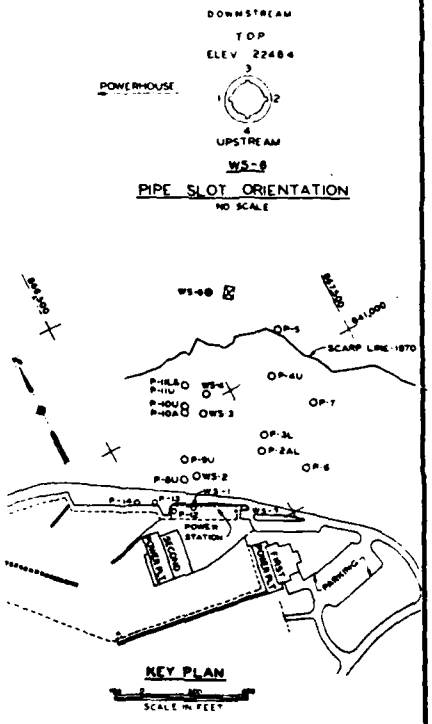


GROOVES 1 - 2



GROOVES 3 - 4



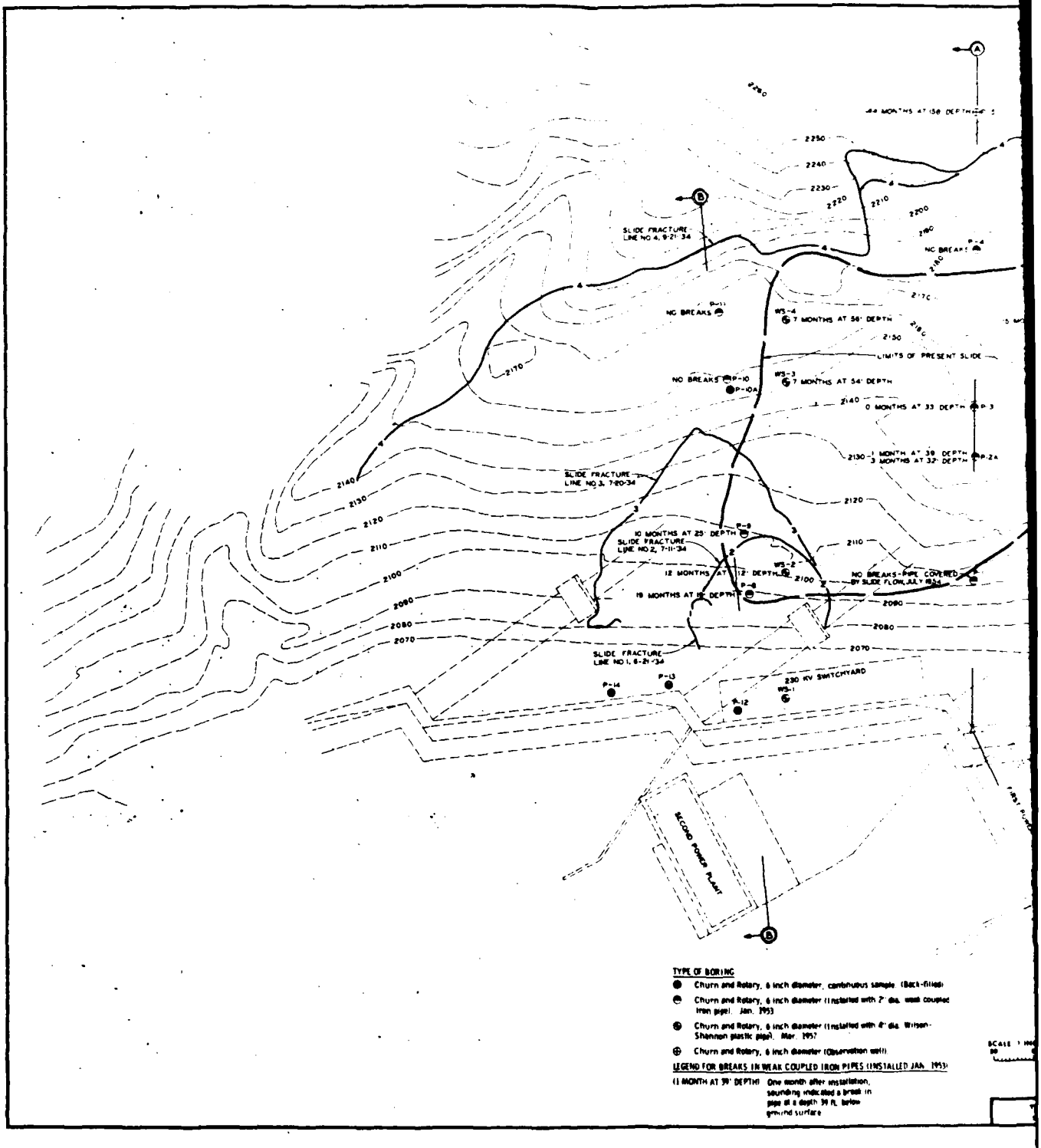


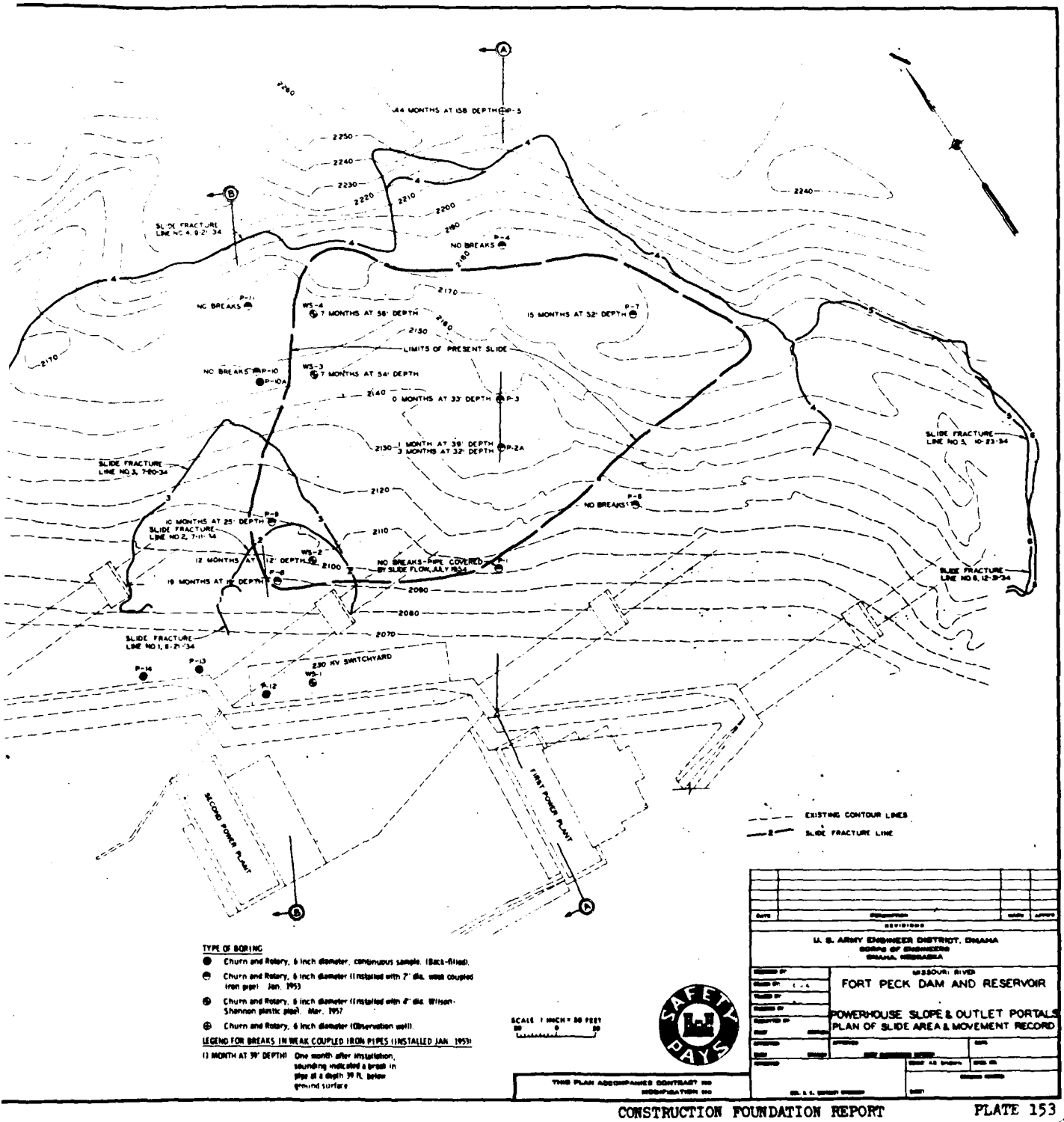
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER
FORT PECK DAM
POWERHOUSE SLOPE EXCAVATION
TILTMETER OBSERVATIONS
WS-6

DEFLECTION VS TIME

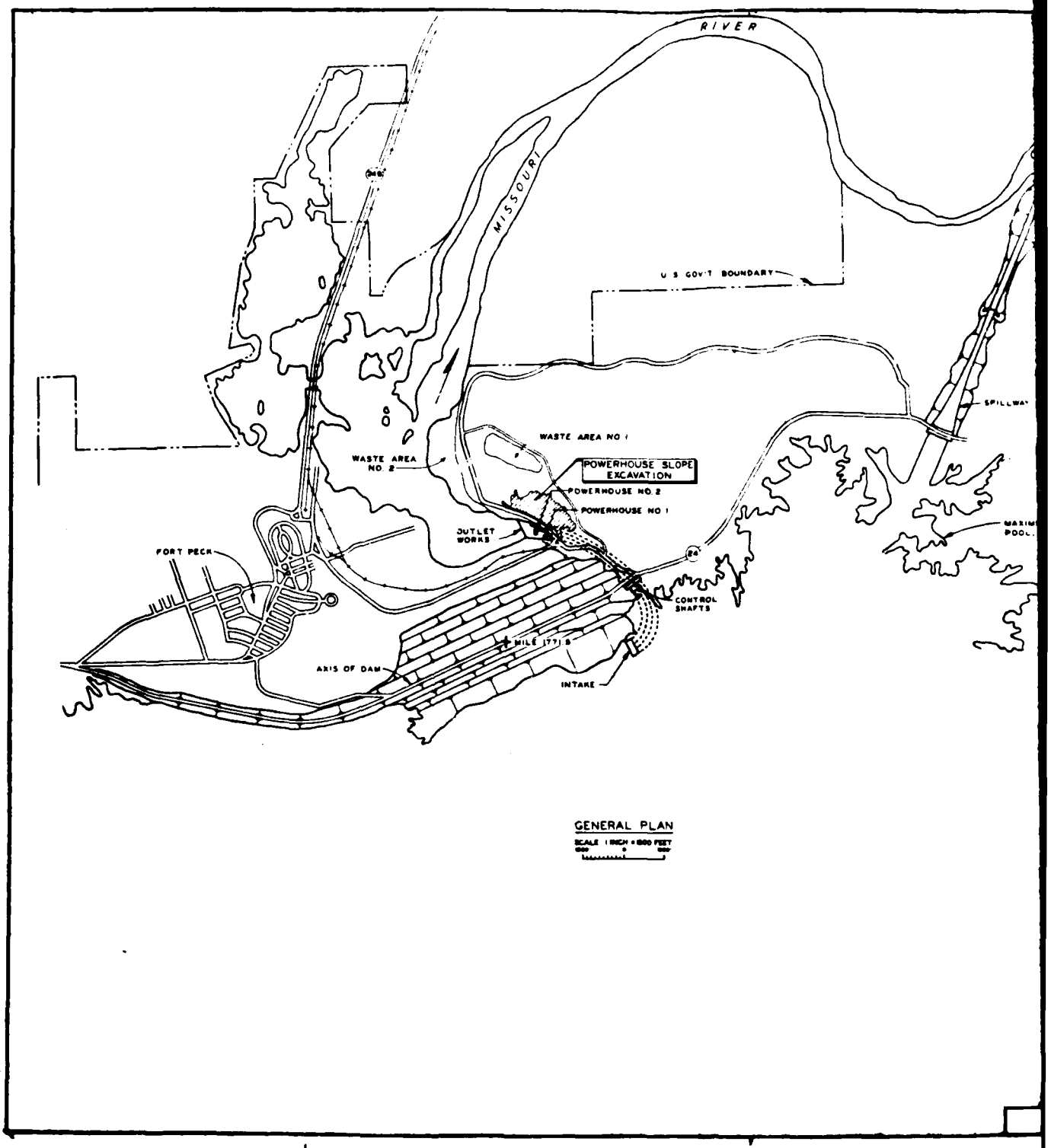
SAFETY DAYS


A
B
SLIDE FRACTURE LINE NO 4, 9-21-34
NO BREAKS P-4
NO BREAKS P-11
WS-4 7 MONTHS AT 56' DEPTH
LIMITS OF PRESENT SLIDE
NO BREAKS P-10 P-10A
WS-3 7 MONTHS AT 54' DEPTH
0 MONTHS AT 33' DEPTH P-3
1 MONTH AT 39' DEPTH 3 MONTHS AT 32' DEPTH P-2A
SLIDE FRACTURE LINE NO 3, 7-20-34
10 MONTHS AT 25' DEPTH P-9
SLIDE FRACTURE LINE NO 2, 7-11-34
12 MONTHS AT 12' DEPTH WS-2
NO BREAKS-PIPE COVERED BY SLIDE FLOW, JULY 1934
19 MONTHS AT 18' DEPTH P-8
SLIDE FRACTURE LINE NO 1, 8-21-34
P-14
P-13
230 KV SWITCHYARD
WS-1
P-12
SECOND POWER PLANT
TYPE OF BORING
Churn and Rotary, 6 inch diameter, continuous sample (Back-filled)
Churn and Rotary, 6 inch diameter (Installed with 2" dia. weak coupled iron pipe) Jan. 1953
Churn and Rotary, 6 inch diameter (Installed with 4" dia. Wilson-Shannon plastic pipe) Mar. 1957
Churn and Rotary, 6 inch diameter (Observation well)
LEGEND FOR BREAKS IN WEAK COUPLED IRON PIPES (INSTALLED JAN. 1953)
(1 MONTH AT 39' DEPTH) One month after installation, sounding indicated a break in pipe at a depth 39 ft. below ground surface



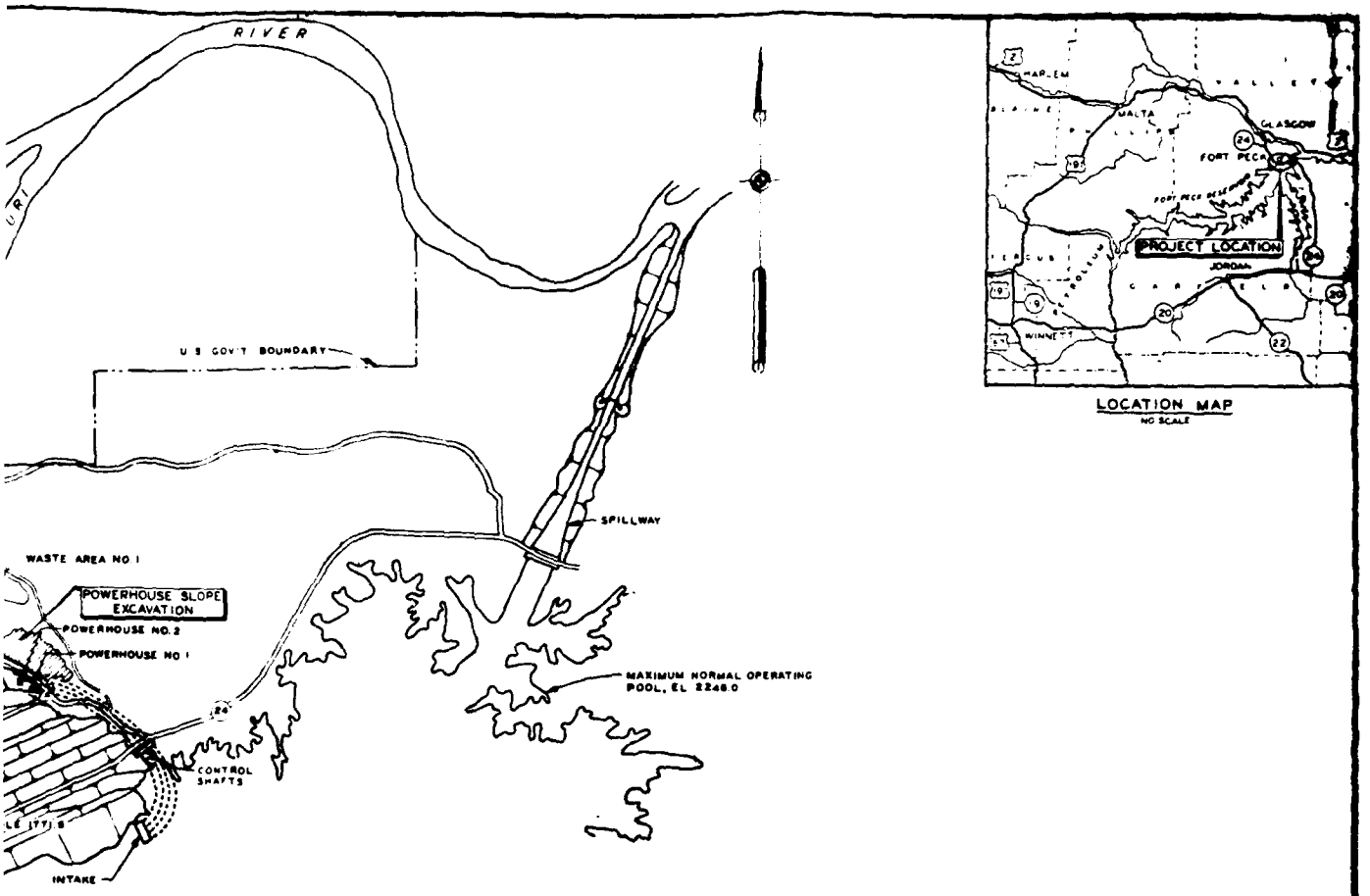
CONSTRUCTION FOUNDATION REPORT PLATE 153

2



GENERAL PLAN

SCALE 1 INCH = 1000 FEET



LOCATION MAP
NO SCALE

GENERAL PLAN
SCALE 1 INCH = 800 FEET

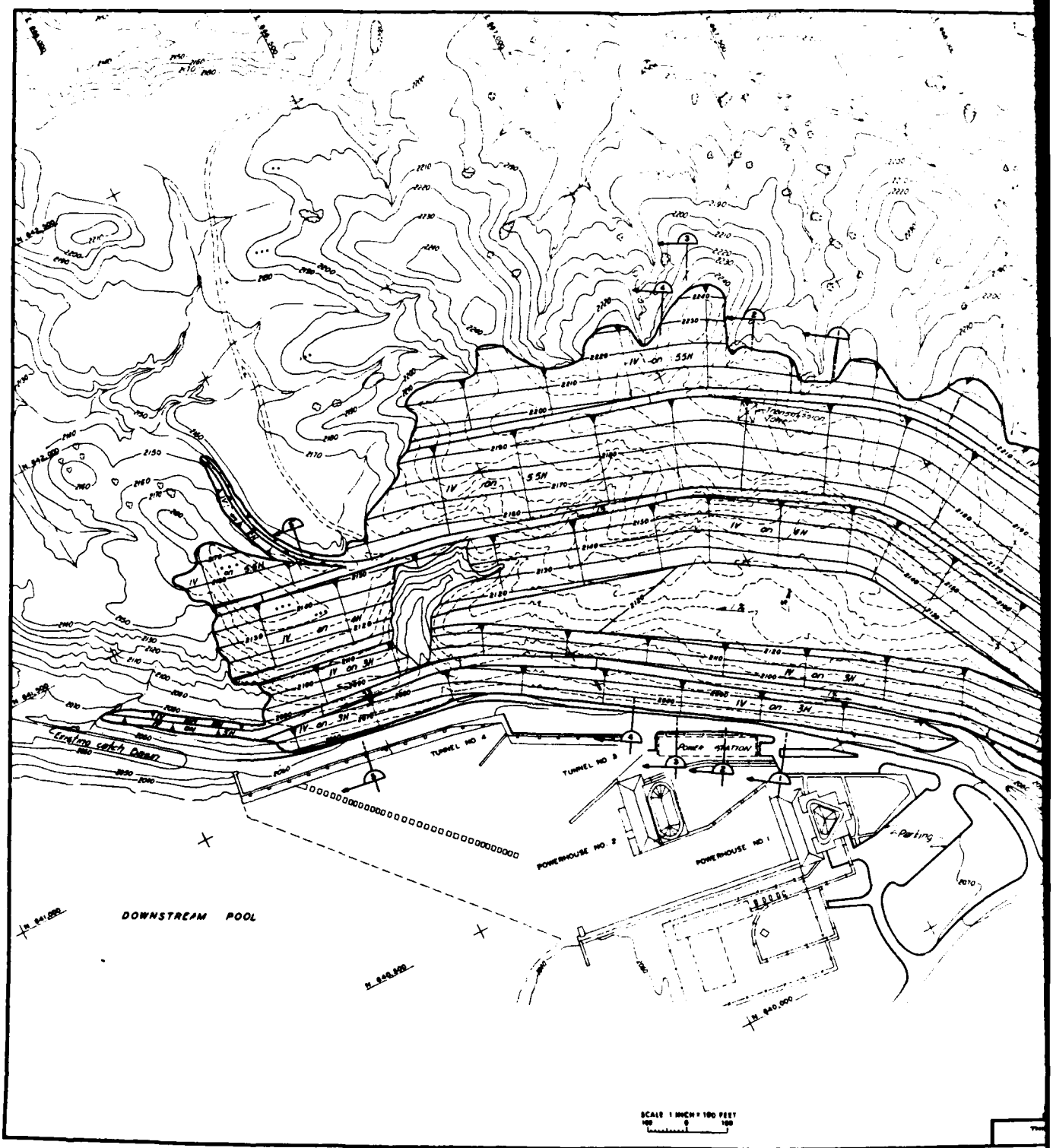
THIS DRAWING HAS BEEN REDUCED TO THREE EIGHTHS THE ORIGINAL SCALE

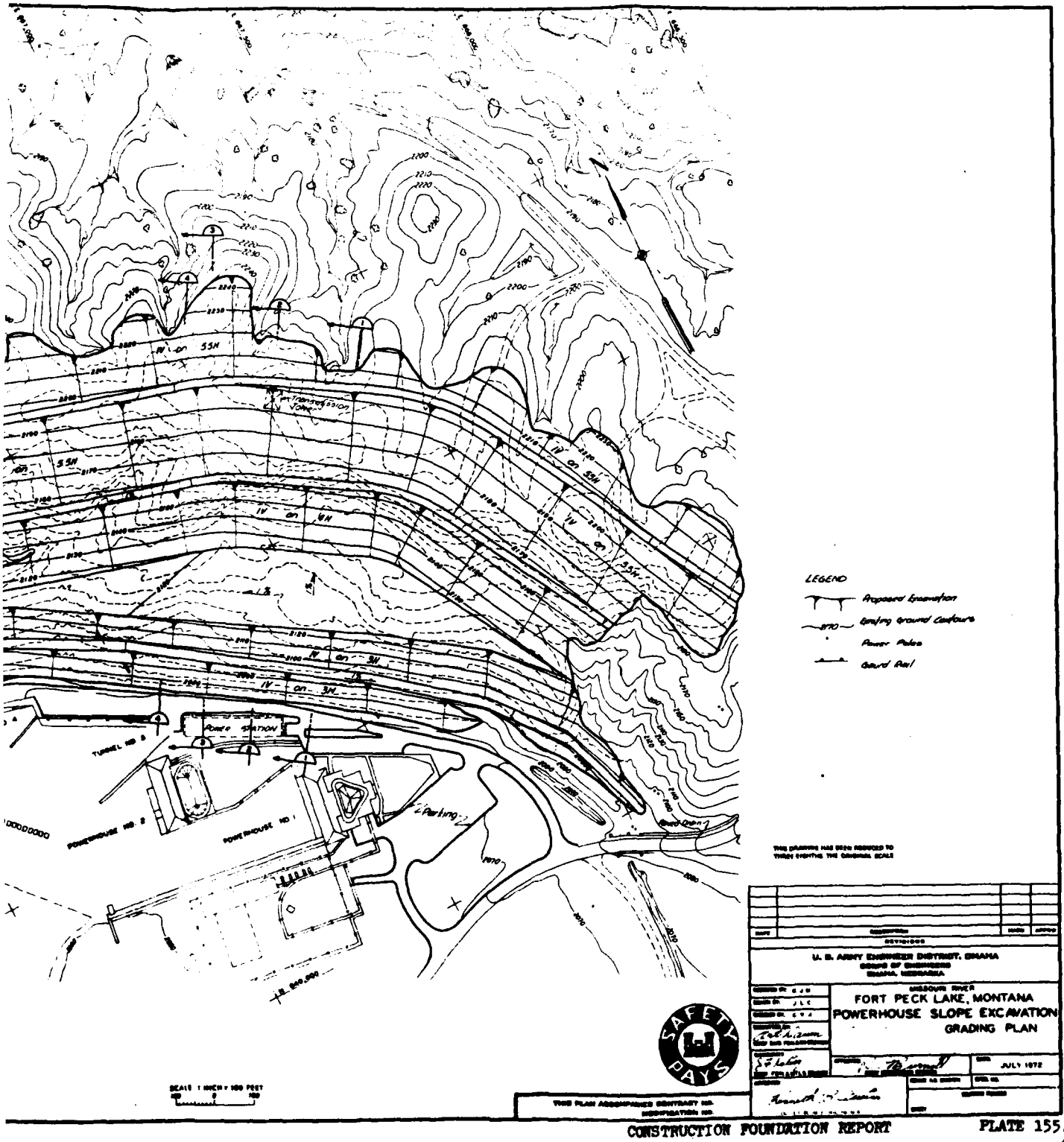
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
GENERAL PLAN AND LOCATION MAP

JULY 1976

SAFETY PAYS


DOWNSTREAM POOL
POWERHOUSE NO. 2
POWERHOUSE NO. 1
POWER STATION
TUNNEL NO. 4
TUNNEL NO. 3
Existing catch basin
Parking
SCALE 1 INCH = 100 FEET



THIS DRAWING HAS BEEN REDUCED TO THREE EIGHTHS THE ORIGINAL SCALE

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
GRADING PLAN

JULY 1972

THIS PLAN ACCOMPANIES CONTRACT NO. _____
MODIFICATION NO. _____

CONSTRUCTION FOUNDATION REPORT PLATE 155-2


0.5
1.5
1.0
FORT PECK POWERHOUSE SLOPE

THIS DRAWING HAS BEEN REDUCED TO THREE EIGHTHS THE ORIGINAL SCALE

SAFETY PAYS

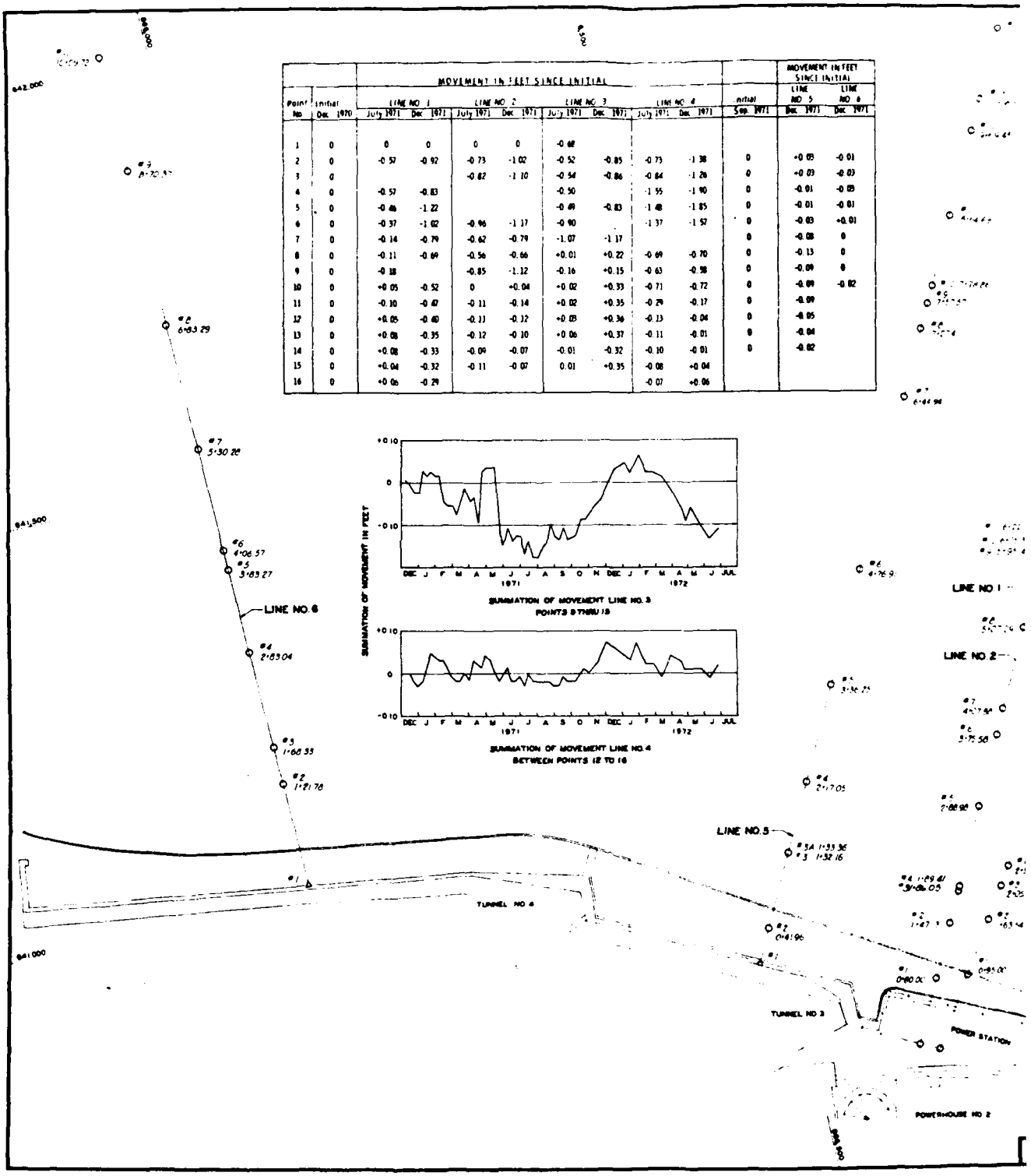
THIS PLAN ACCOMPANIES CONTRACT NO MODIFICATION NO

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
MOVEMENT CONTOURS MAP

JULY 1972

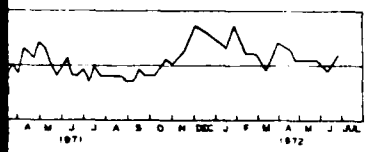
CONSTRUCTION FOUNDATION REPORT PLATE 156-2



Point No	Initial Dec 1970	MOVEMENT IN FEET SINCE INITIAL: LINE NO 1 July 1971	LINE NO 1 Dec 1971	LINE NO 2 July 1971	LINE NO 2 Dec 1971	LINE NO 3 July 1971	LINE NO 3 Dec 1971	LINE NO 4 July 1971	LINE NO 4 Dec 1971	Initial Sep 1971	MOVEMENT IN FEET SINCE INITIAL: LINE NO 5 Dec 1971	LINE NO 6 Dec 1971
1	0	0	0	0	0	-0 68						
2	0	-0 57	-0 92	-0 73	-1 02	-0 52	-0 85	-0 73	-1 38	0	+0 05	-0 01
3	0			-0 82	-1 10	-0 54	-0 86	-0 84	-1 26	0	+0 03	-0 03
4	0	-0 57	-0 83			-0 50		-1 55	-1 90	0	-0 01	-0 05
5	0	-0 46	-1 22			-0 49	-0 83	-1 48	-1 85	0	-0 01	-0 01
6	0	-0 37	-1 02	-0 96	-1 17	-0 90		-1 37	-1 52	0	-0 03	+0 01
7	0	-0 14	-0 79	-0 62	-0 79	-1 07	-1 17			0	-0 08	0
8	0	-0 11	-0 69	-0 56	-0 66	+0 01	+0 22	-0 69	-0 70	0	-0 13	0
9	0	-0 18		-0 85	-1 12	-0 16	+0 15	-0 63	-0 58	0	-0 09	0
10	0	+0 05	-0 52	0	+0 04	+0 02	+0 33	-0 71	-0 72	0	-0 09	-0 02
11	0	-0 10	-0 47	-0 11	-0 14	+0 02	+0 35	-0 29	-0 17	0	-0 09	
12	0	+0 05	-0 40	-0 11	-0 12	+0 03	+0 36	-0 13	-0 04	0	-0 05	
13	0	+0 08	-0 35	-0 12	-0 10	+0 06	+0 37	-0 11	-0 01	0	-0 04	
14	0	+0 08	-0 33	-0 09	-0 07	-0 01	-0 32	-0 10	-0 01	0	-0 02	
15	0	+0 04	-0 32	-0 11	-0 07	0 01	+0 35	-0 08	+0 04			
16	0	+0 06	-0 29					-0 07	+0 06			

MOVEMENT IN FEET SINCE INITIAL								
LINE NO. 2		LINE NO. 3		LINE NO. 4		Initial	LINE NO. 5	LINE NO. 6
July 1971	Dec. 1971	July 1971	Dec. 1971	July 1971	Dec. 1971	Sep. 1971	Dec. 1971	Dec. 1971
0	0	-0.68						
-0.73	-1.02	-0.52	-0.85	-0.73	-1.38	0	+0.03	-0.01
-0.82	-1.10	-0.54	-0.86	-0.84	-1.26	0	+0.03	-0.03
		-0.50		-1.55	-1.90	0	-0.01	-0.05
		-0.49	-0.83	-1.48	-1.85	0	-0.01	-0.01
-0.96	-1.17	-0.90		-1.37	-1.57	0	-0.03	+0.01
-0.62	-0.79	-1.07	-1.17			0	-0.08	0
-0.56	-0.66	+0.01	+0.22	-0.69	-0.70	0	-0.13	0
-0.85	-1.12	-0.16	+0.15	-0.63	-0.58	0	-0.09	0
0	+0.04	+0.02	+0.33	-0.71	-0.72	0	-0.09	-0.02
-0.11	-0.14	+0.02	+0.35	-0.29	-0.17	0	-0.09	
-0.11	-0.12	+0.02	+0.36	-0.13	-0.04	0	-0.05	
-0.12	-0.10	+0.06	+0.37	-0.11	-0.01	0	-0.04	
-0.09	-0.07	-0.01	-0.32	-0.10	-0.01	0	0.02	
-0.11	-0.07	0.01	+0.35	-0.08	+0.04			
				-0.07	+0.06			

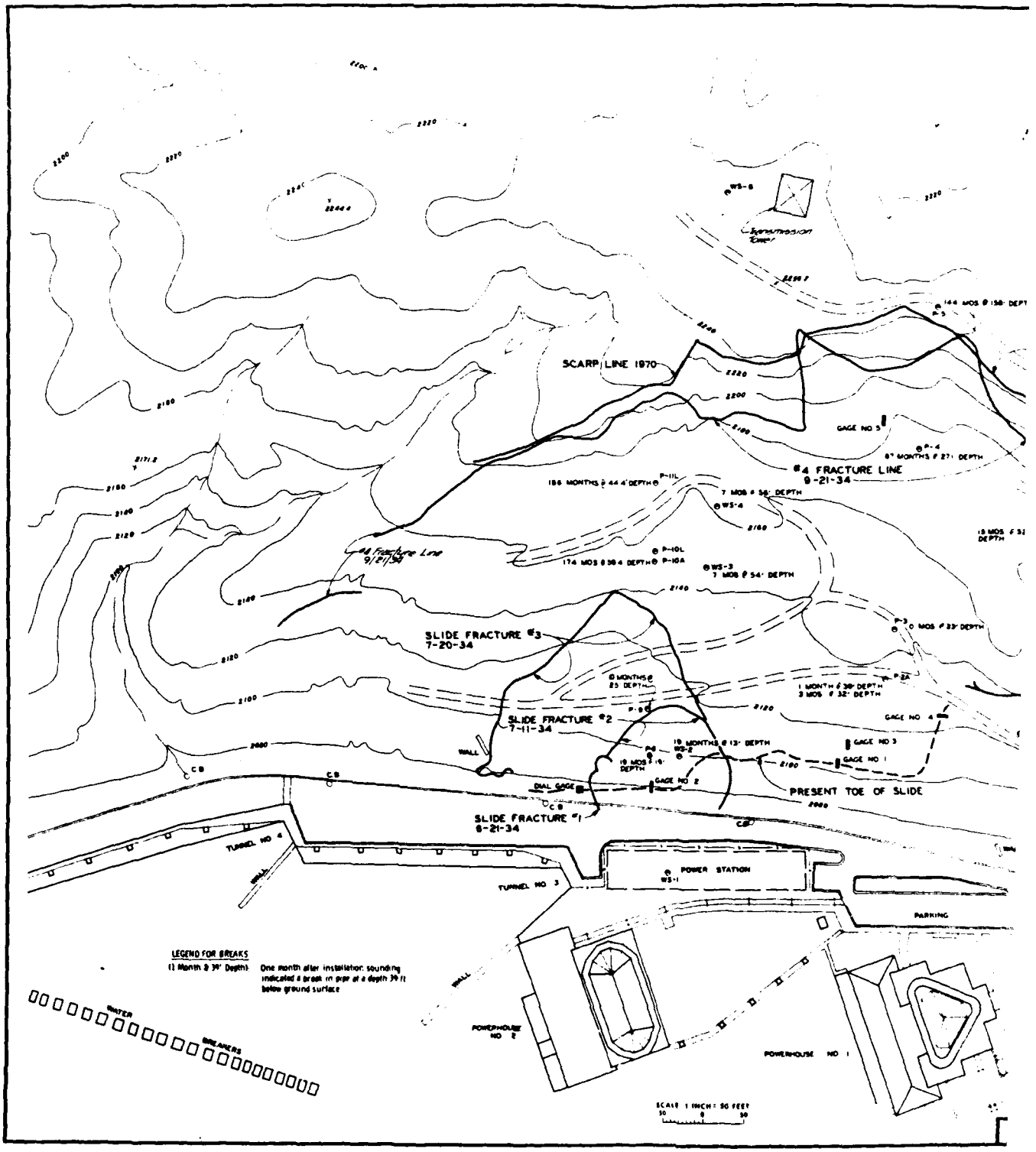
SUMMATION OF MOVEMENT LINE NO. 3
POINTS 8 THRU 15

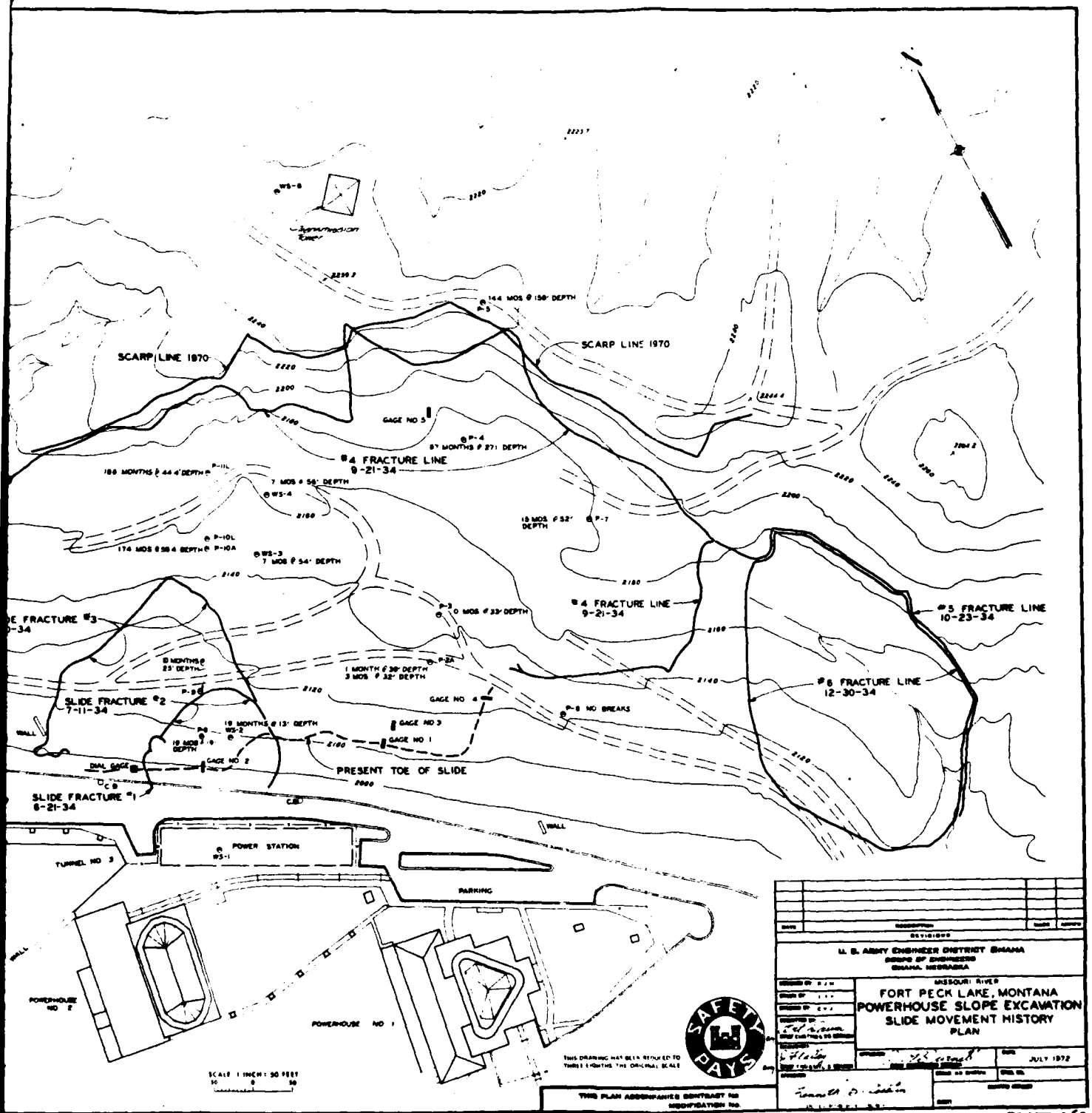


SUMMATION OF MOVEMENT LINE NO. 4
BETWEEN POINTS 12 TO 16

CONSTRUCTION FOUNDATION REPORT PLATE 157

2

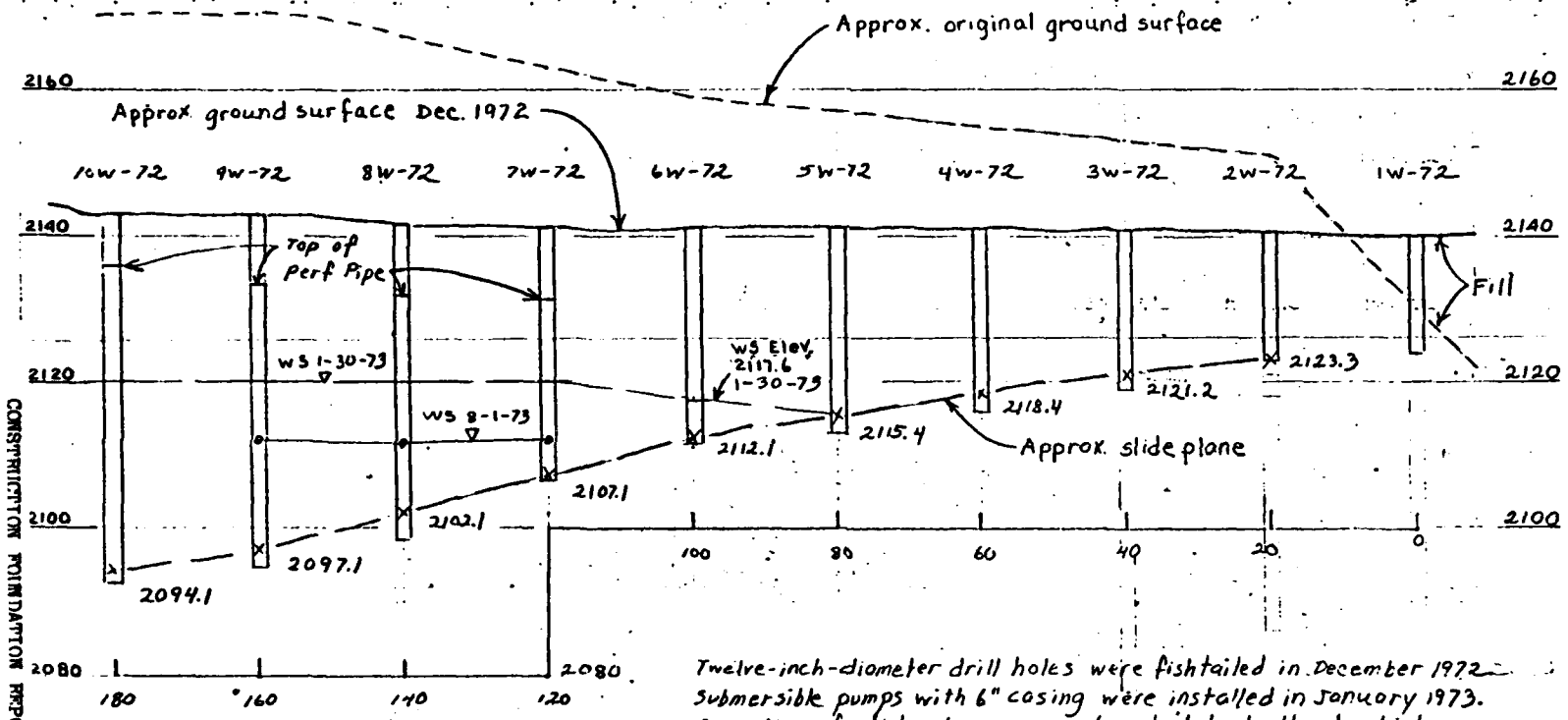

SCARP LINE 1970
#4 FRACTURE LINE 9-21-34
#4 Fracture Line 9/21/34
SLIDE FRACTURE #3 7-20-34
SLIDE FRACTURE #2 7-11-34
SLIDE FRACTURE #1 8-21-34
PRESENT TOE OF SLIDE
GAGE NO 5
GAGE NO 4
GAGE NO 3
GAGE NO 2
GAGE NO 1
DIAL GAGE
WS-6
WS-4
WS-3
WS-2
WS-1
P-11L
P-10L
P-10A
P-9
P-8
P-5
P-4
P-3
P-2A
TUNNEL NO 4
TUNNEL NO 3
POWER STATION
PARKING
POWERHOUSE NO 2
POWERHOUSE NO 1
WALL
CB
LEGEND FOR BREAKS
(1 Month @ 39' Depth)
One month after installation sounding indicated a break in pipe at a depth 39 ft below ground surface
WATER
BREAKERS
SCALE 1 INCH = 50 FEET



CONSTRUCTION FOUNDATION REPORT PLATE 160

2

MAP OF SLUMP CRACKS
2 AUG TO 22 AUG 1973
AND APPROXIMATE LOCATION OF HAUL ROAD
SCALE: 1"=100'
TUNNEL NO. 4
HAUL ROAD
Limits of Excavation
Limits of Excavation
8/10/73
8/22/73
8/2/73
21+00
22+00
22+00
23+00
24+00
25+00
25+00
26+00
27+00
27+00
28+00
28+00
29+00
29+88.64
2180
2100
2150
2150
N



CONSTRUCTION FOUNDATION REPORT

WELL	Bot. Screen Elev.
7	2107.5
8	2102.1
9	2097.1
10	2094.1

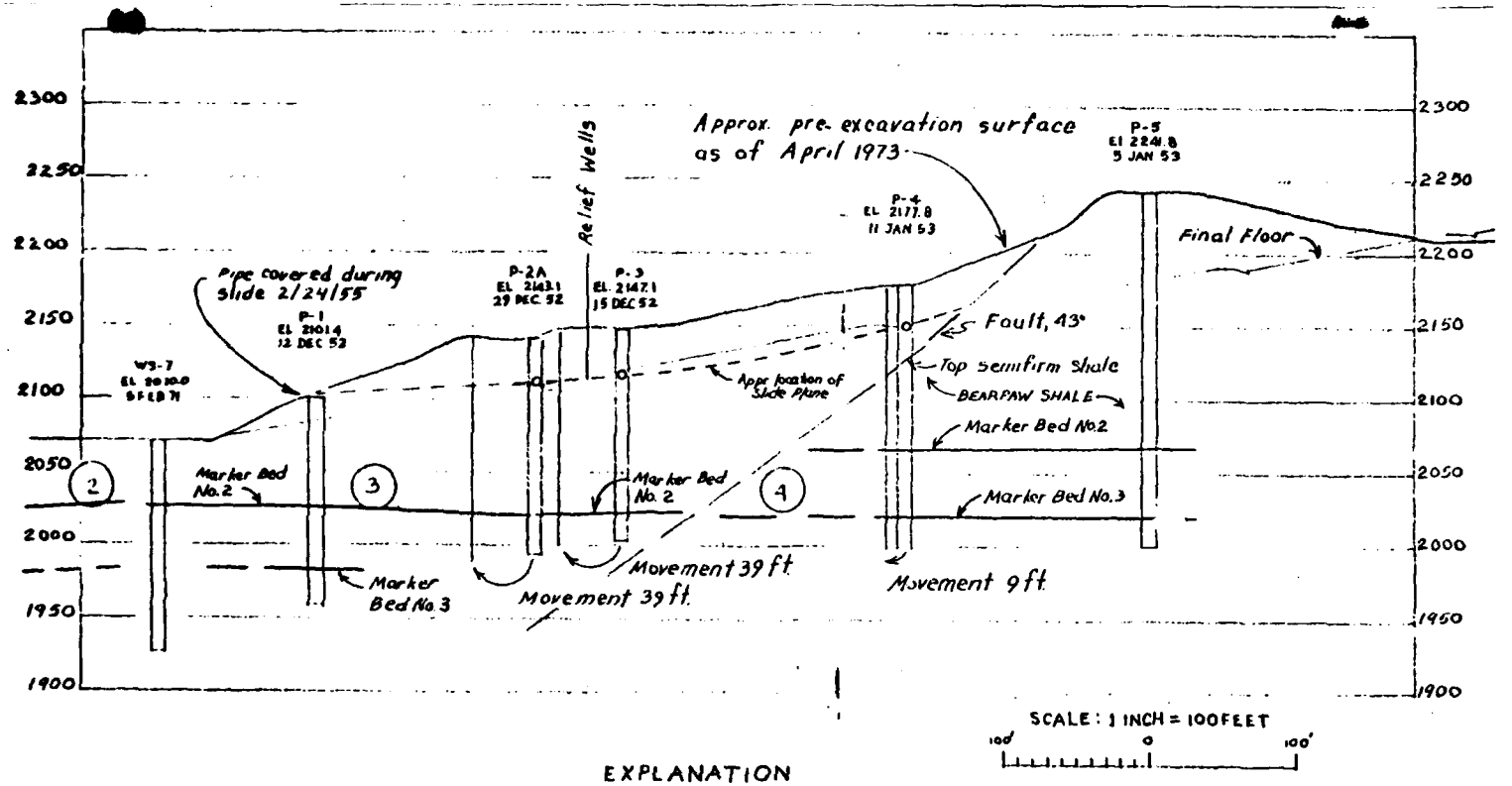
Twelve-inch-diameter drill holes were fishtailed in December 1972. Submersible pumps with 6" casing were installed in January 1973. Elevation of slide plane was estimated by depth at which unweathered shale was encountered. Total amount of water pumped was 34,859 gallons from 31 Jan to 1 Aug. 1973. Water was not encountered in wells 1 thru 5 and pumps & casing were not installed in wells 1 thru 6. Pumps in wells 8, 9 & 10 took most of the load.

20' 0 20'

SCALE: 1 INCH = 20 FEET.

FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
SHALE DRAINAGE SECTION

PT. ATR. 160B



EXPLANATION

Movement readings for instruments were last taken in April 1973

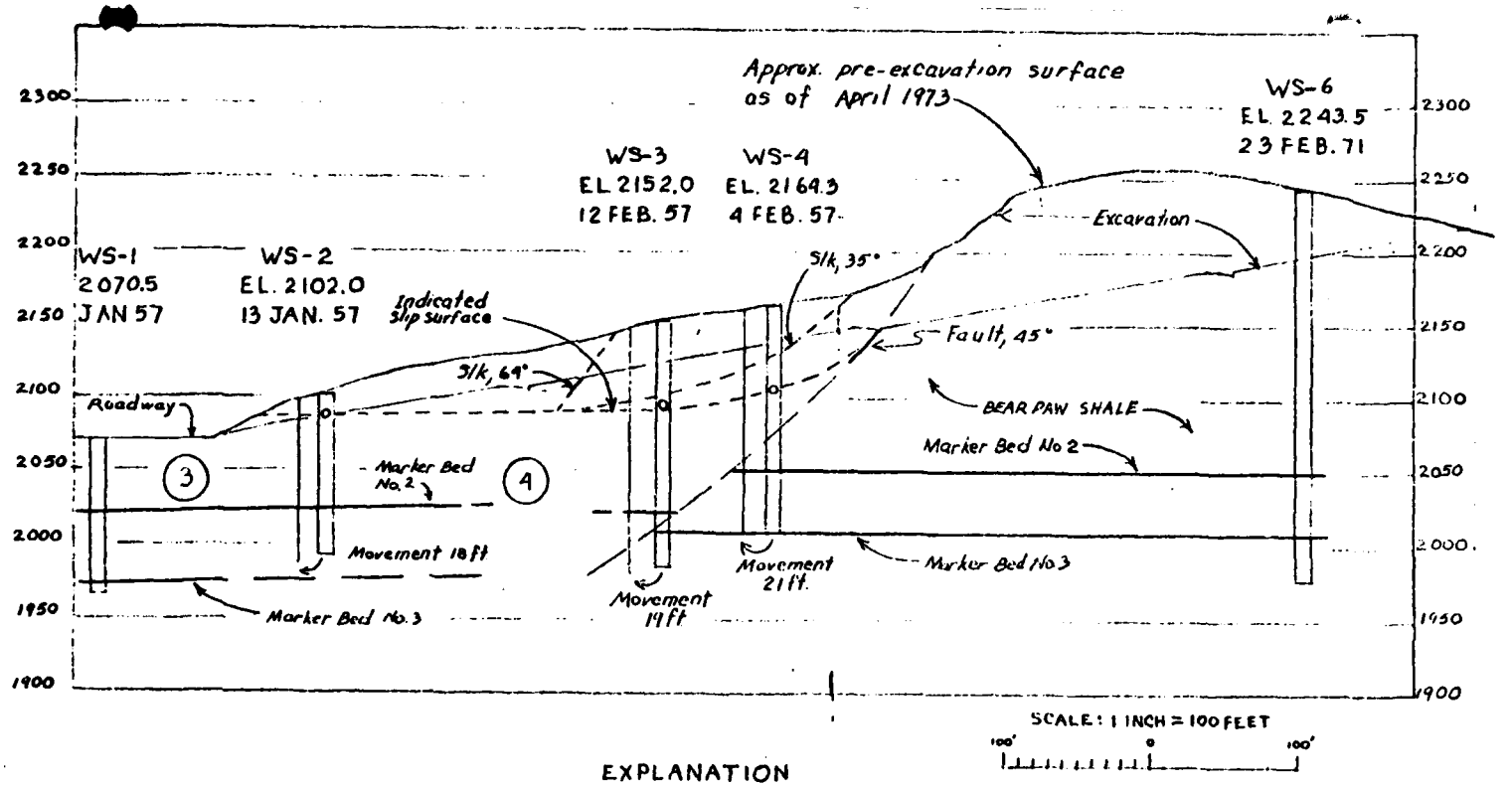
Position of pipe break

Outlet tunnel

FORT PECK LAKE MONTANA
POWERHOUSE SLOPE EXCAVATION
GEOLOGIC PROFILE
WS-7 THRU P-5

CONSTRUCTION FOUNDATION REPORT

PLATE 160C



SCALE: 1 INCH = 100 FEET

100' 0 100'

EXPLANATION

Movement readings for instruments were last taken in April 1973

• Position of pipe break

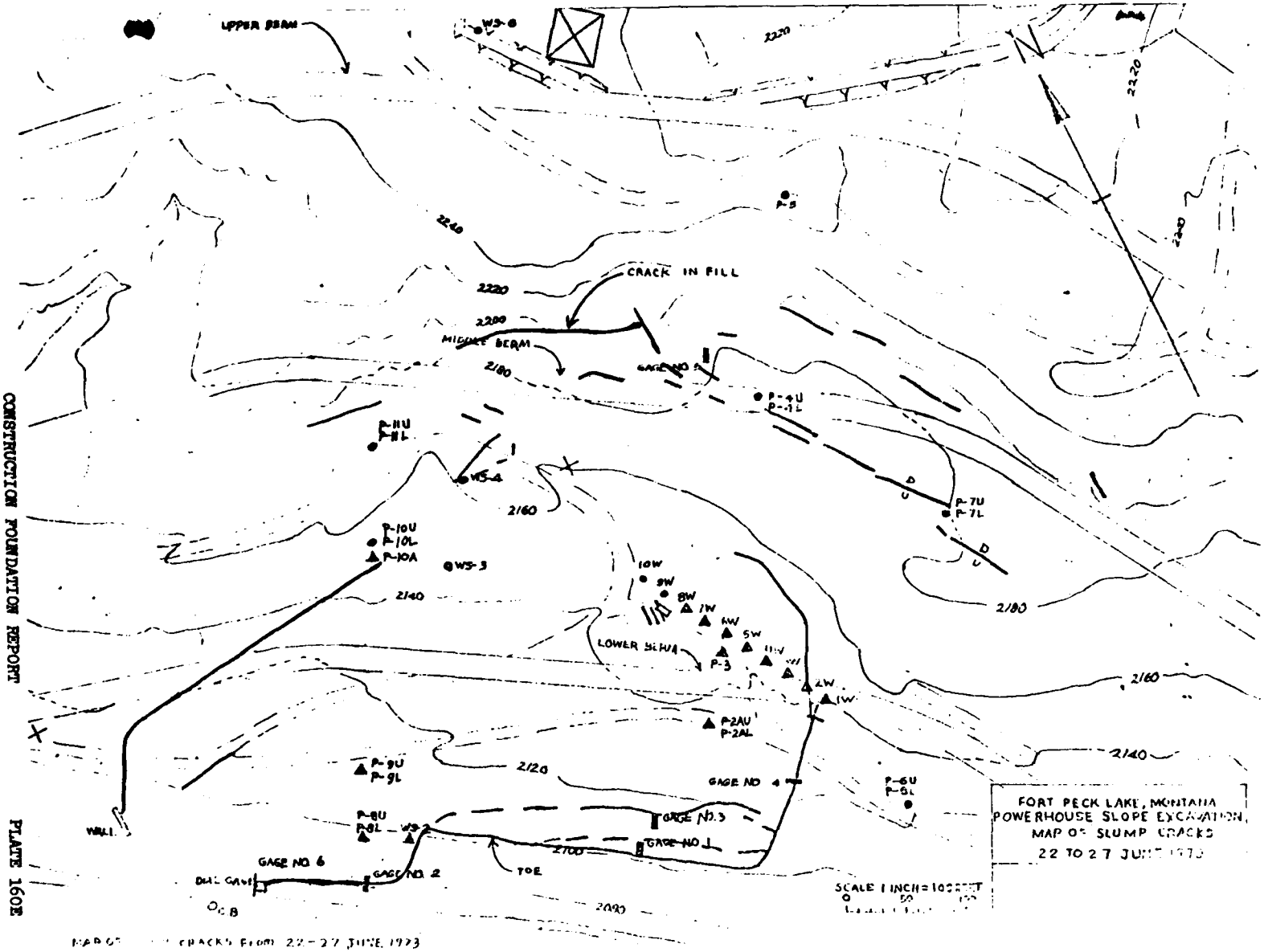
Outlet tunnel

FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
GEOLOGIC PROFILE
WS-1 THRU WS-6

For location of instruments see plate No. 11.

CONSTRUCTION FOUNDATION REPORT

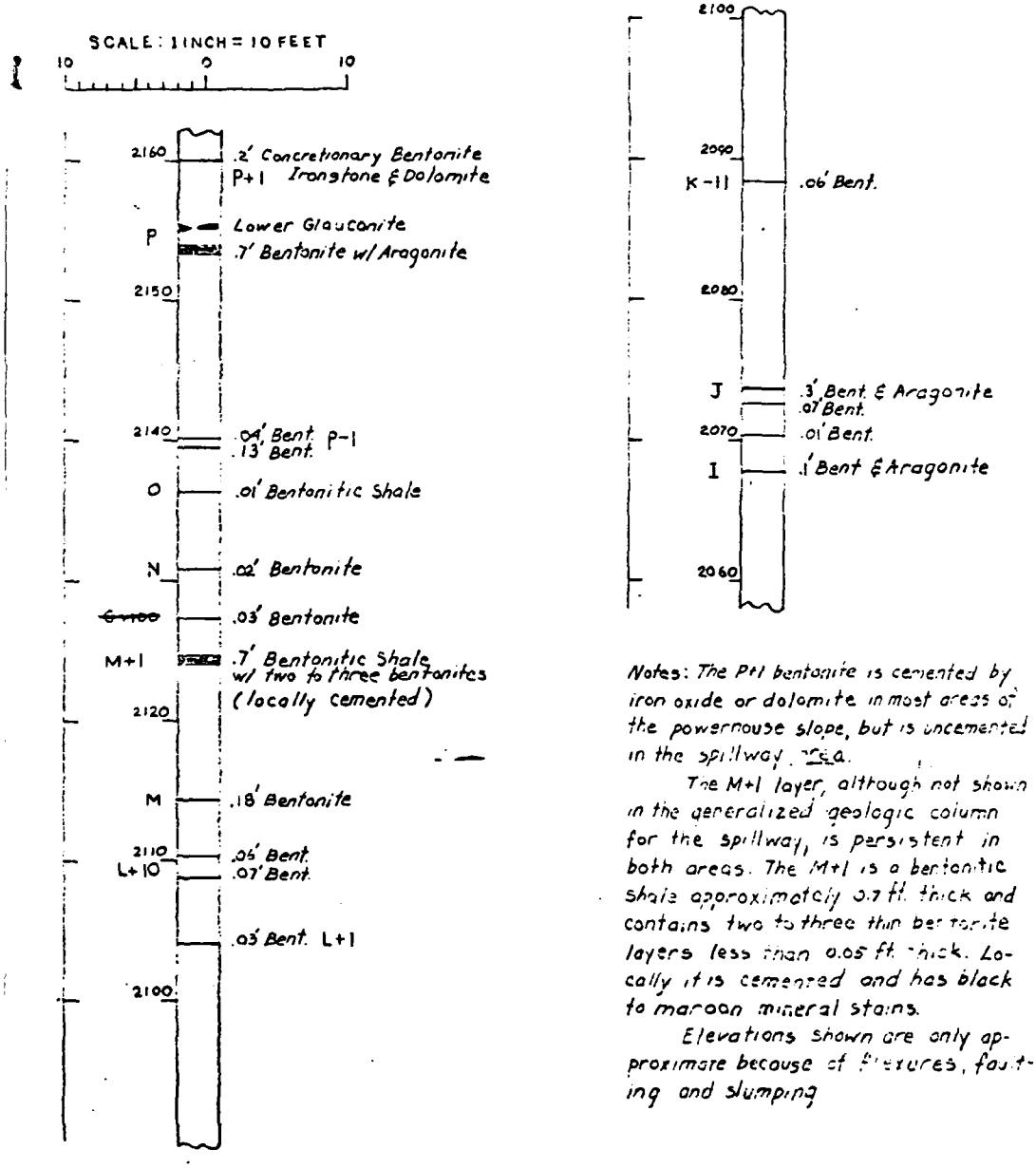
PLATE 160D



MAP OF SLUMP CRACKS FROM 22 - 27 JUNE 1973

PLATE 160E

GENERALIZED GEOLOGIC COLUMN OF BENTONITES
OBSERVED DURING SURFACE MAPPING

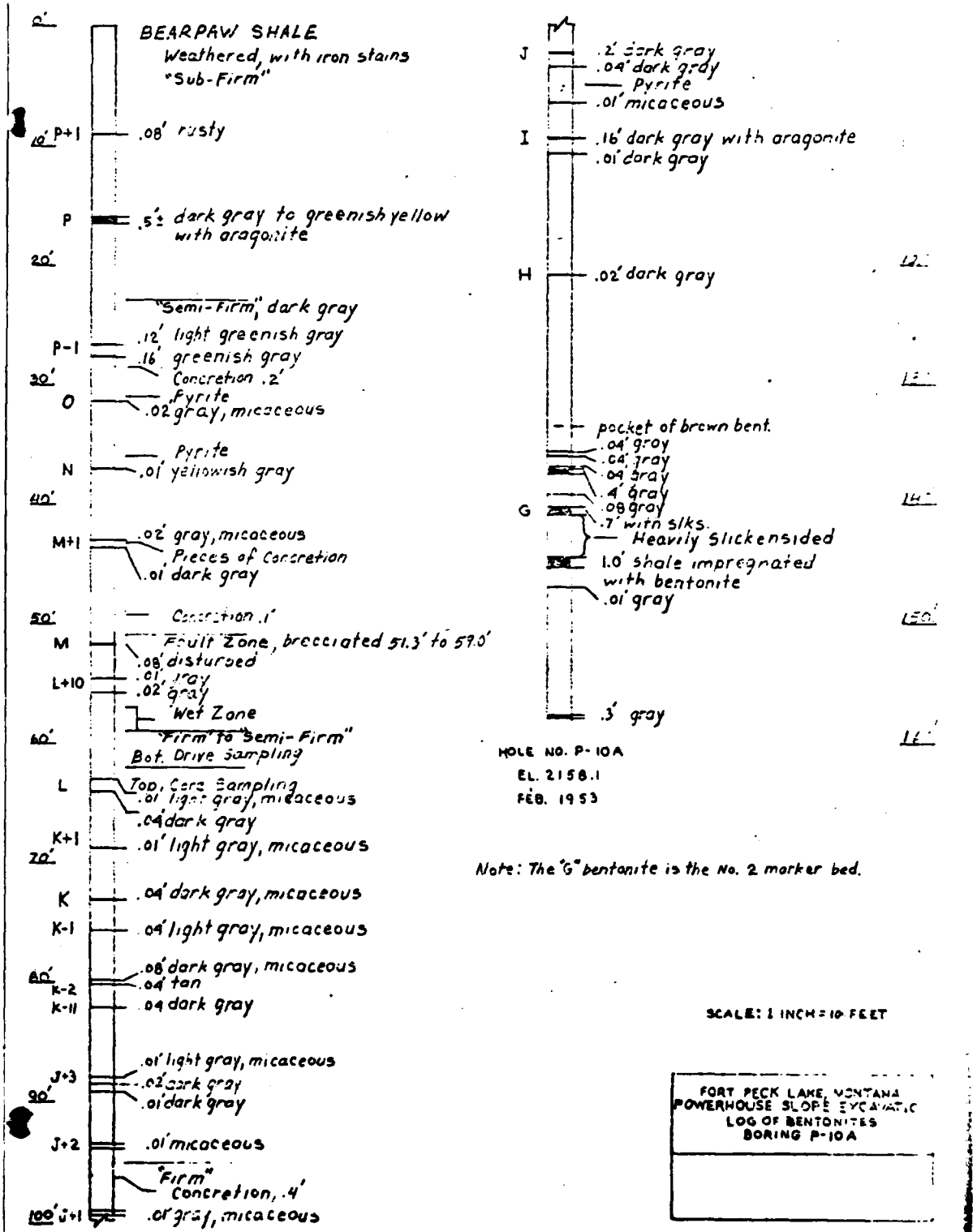


Notes: The P+1 bentonite is cemented by iron oxide or dolomite in most areas of the powerhouse slope, but is uncemented in the spillway area.

The M+1 layer, although not shown in the generalized geologic column for the spillway, is persistent in both areas. The M+1 is a bentonitic shale approximately 0.7 ft. thick and contains two to three thin bentonite layers less than 0.05 ft. thick. Locally it is cemented and has black to maroon mineral stains.

Elevations shown are only approximate because of flexures, faulting and slumping

FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
GEOLOGIC COLUMN

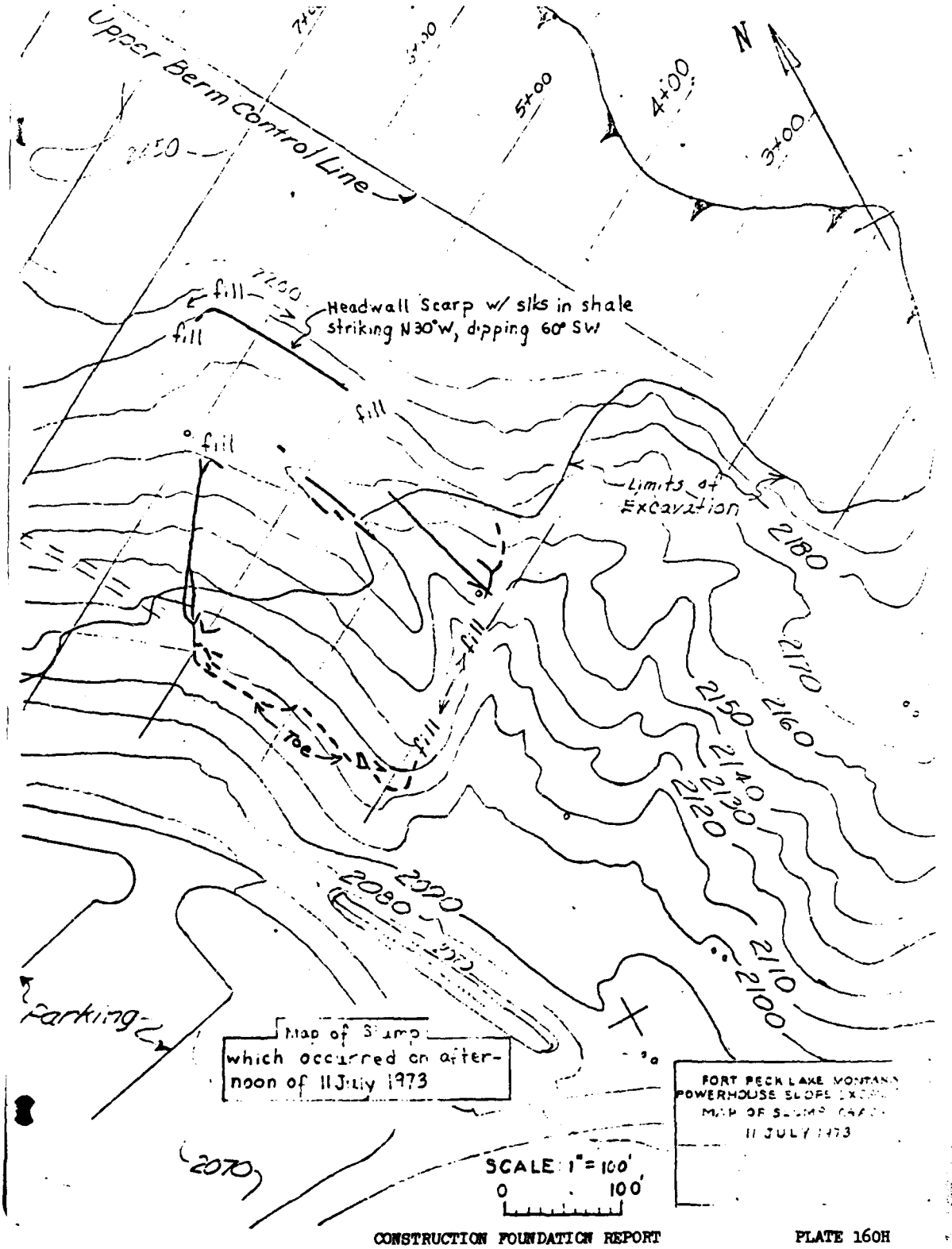


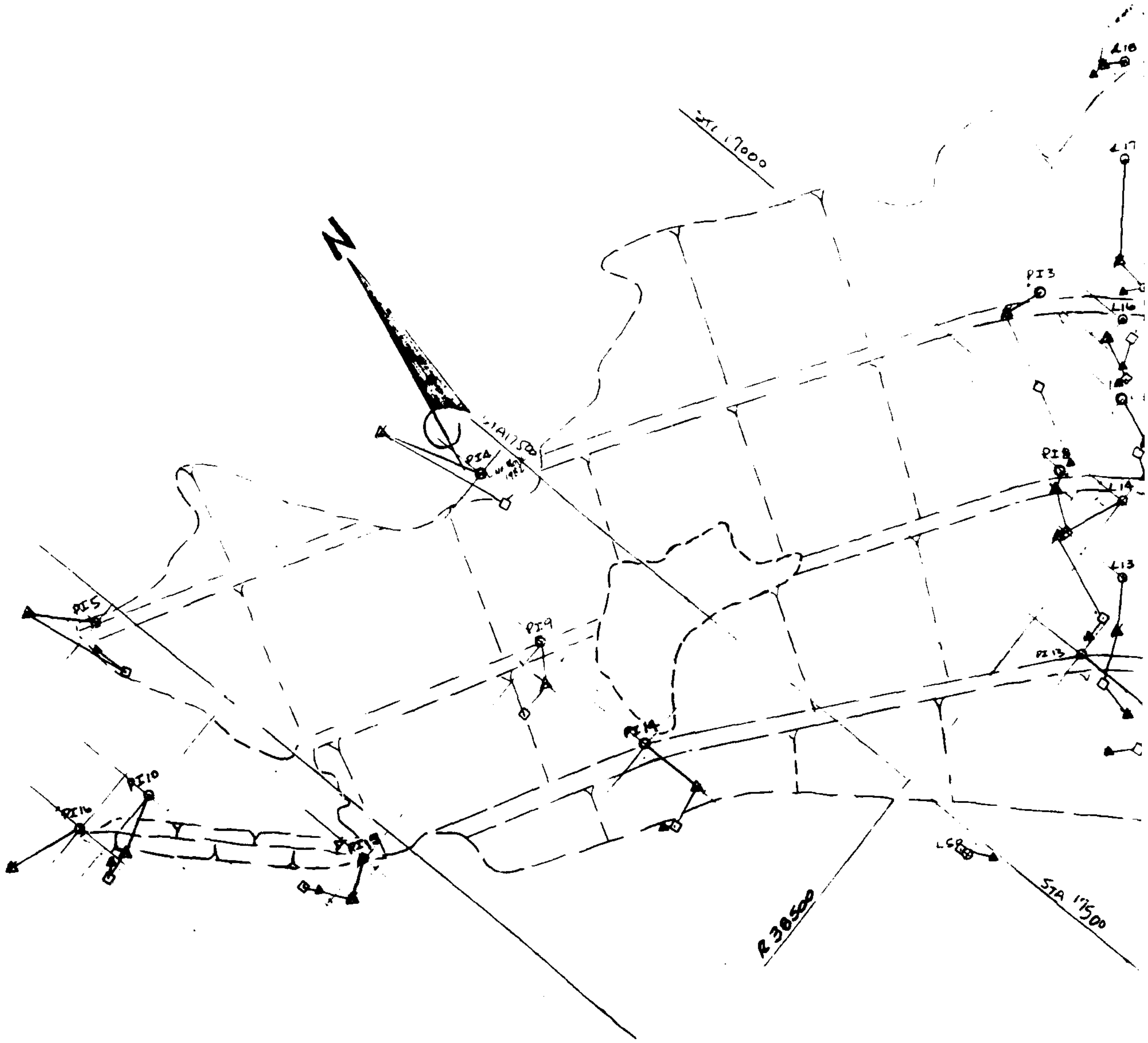
HOLE NO. P-10A
EL. 2158.1
FEB. 1953

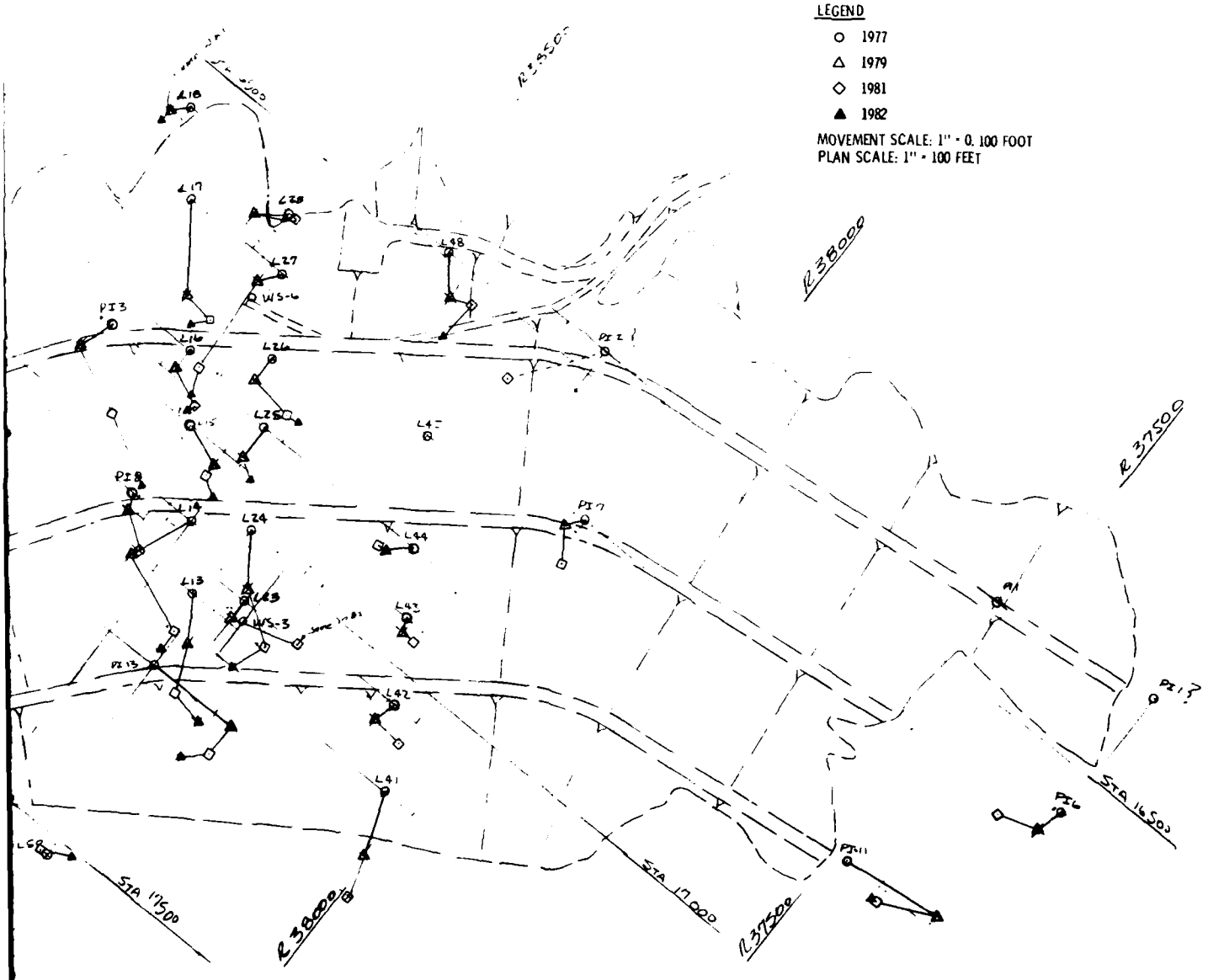
Note: The "G" bentonite is the No. 2 marker bed.

SCALE: 1 INCH = 10 FEET

FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATIC
LOG OF BENTONITES
BORING P-10A

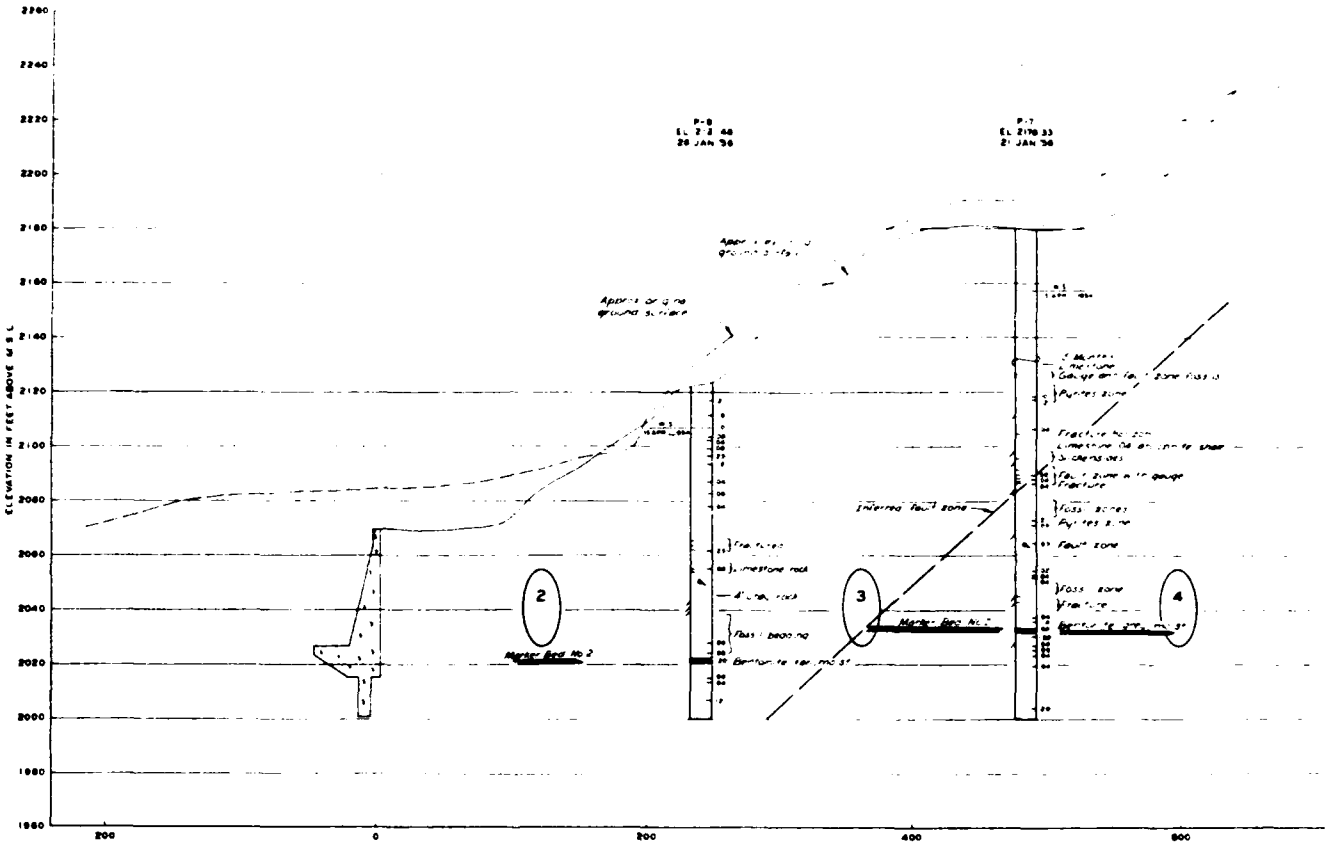

Upper Berm Control Line
7+00
6+00
5+00
4+00
3+00
N
2150
fill
2200
Headwall Scarp w/ slks in shale striking N30°W, dipping 60° SW
fill
fill
fill
Limits of Excavation
2180
2170
2160
2150
2140
2130
2120
2110
2100
2090
2080
2070
Toe
fill
fill
Parking
Map of Slump which occurred on afternoon of 11 July 1973
FORT PECK LAKE MONTANA
POWERHOUSE SLOPE EXCAVATION
MAP OF SLUMP AREA
11 JULY 1973
SCALE 1" = 100'
0 100'


N
PI 3
PI 5
PI 9
PI 10
PI 14
L 13
L 14
L 16
L 17
L 18
R 38500
STA 17500

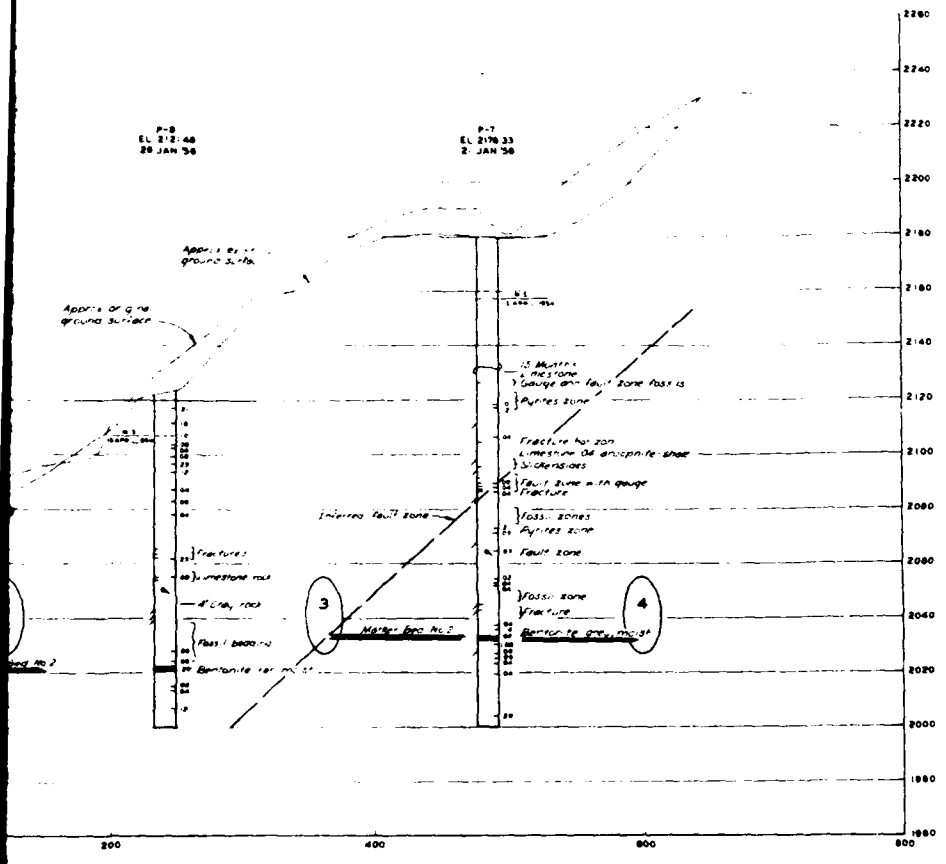


MISSOURI RIVER
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE MOVEMENT
1977 - 1982
U.S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS OMAHA, NEBRASKA

CONSTRUCTION FOUNDATION REPORT 2 PLATE 1601



SCALE VERT 1 INCH = 20 FEET
HORIZ 1 INCH = 40 FEET



LEGEND

- HOLE NUMBER
- ASPHALT AND GRAVEL OR WEATHERED SHALE
- *BENTONITE
- SLICKENSIDES
- JOINT
- LOST CORE
- CONCRETIONS
- 15 MONTHS - PIPE BREAK
- *NO INDICATES THICKNESS IN FEET

SCALE: VERT 1 INCH = 20 FEET
HORIZ 1 INCH = 40 FEET

THIS DRAWING HAS BEEN REDUCED TO THREE EIGHTHS THE ORIGINAL SCALE

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
GEOLOGIC PROFILE
P-8 & P-7

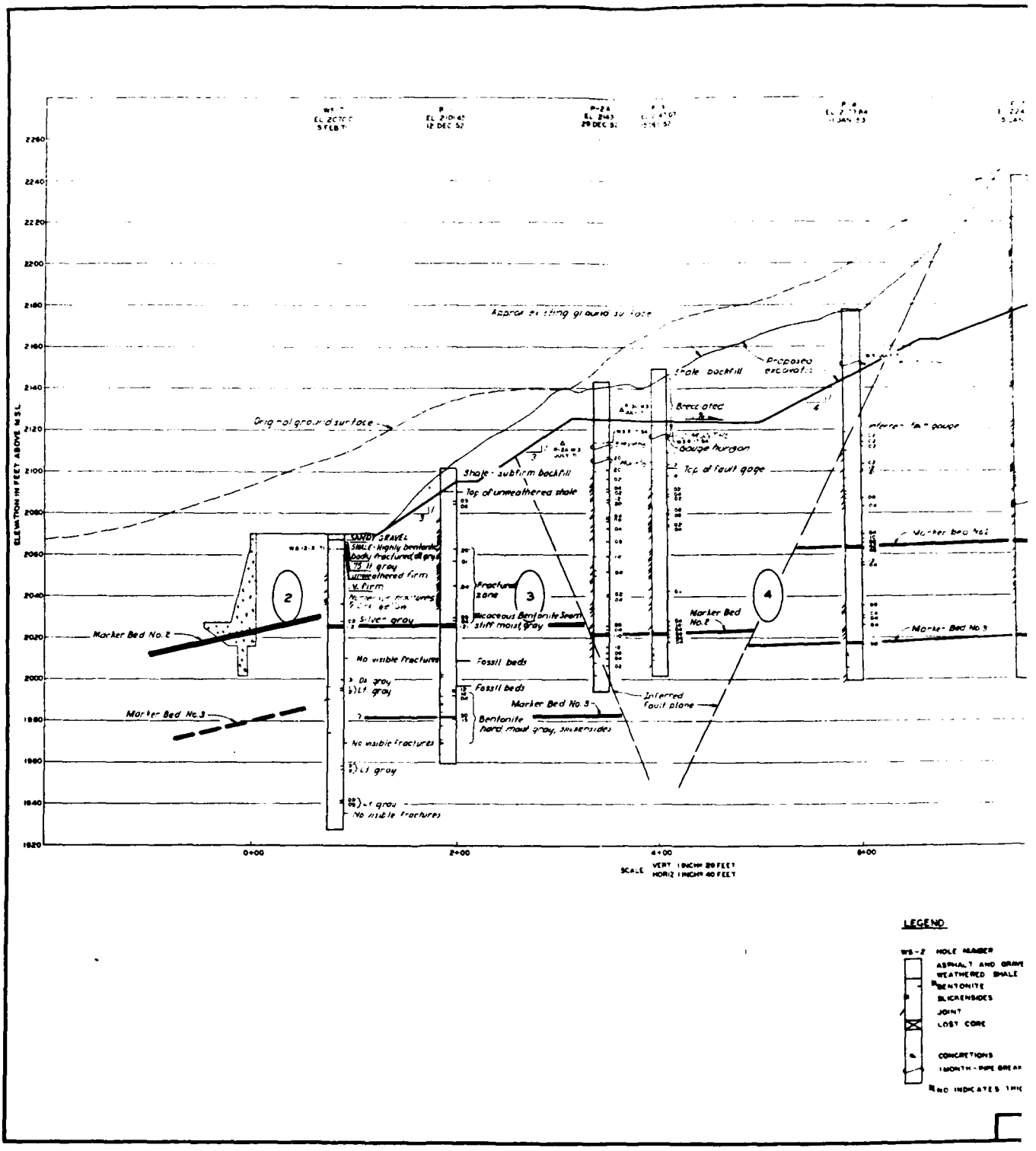
JULY 1972

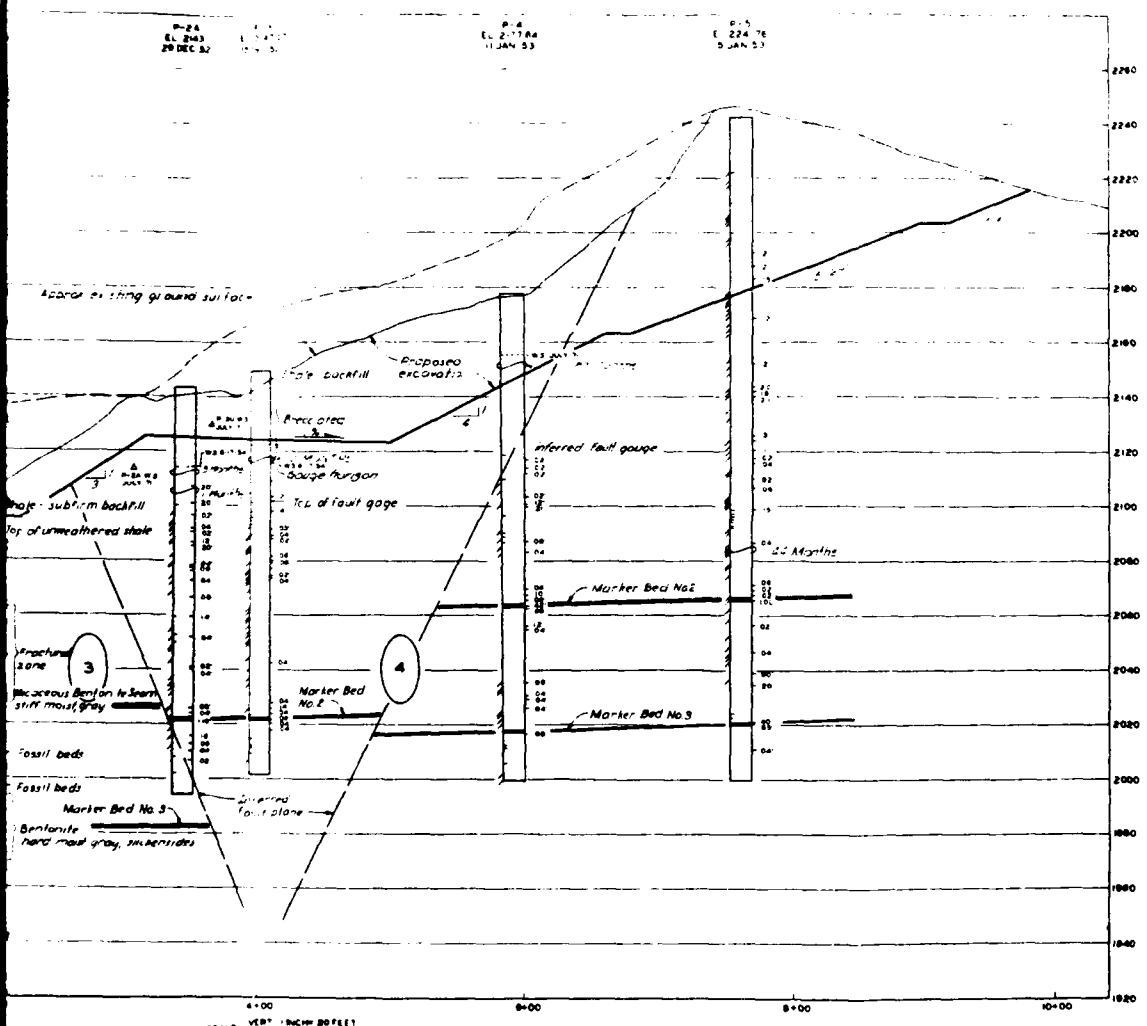
THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO

CONSTRUCTION FOUNDATION REPORT

PLATE 161

2


ELEVATION IN FEET ABOVE M.S.L.
2260
2240
2220
2200
2180
2160
2140
2120
2100
2080
2060
2040
2020
2000
1980
1960
1940
1920
0+00
2+00
4+00
6+00
Approximating ground surface
Original ground surface
Shale backfill
Proposed excavation
Brecciated
Shale - subfirm backfill
Top of unweathered shale
Top of fault gouge
Marker Bed No.2
Marker Bed No.3
Fracture zone
Micaceous Bentonite Seam
Fossil beds
Bentonite
Inferred fault plane
No visible fractures
SCALE VERT 1 INCH= 20 FEET
HORIZ 1 INCH= 40 FEET
LEGEND
HOLE NUMBER
ASPHALT AND GRAVEL
WEATHERED SHALE
BENTONITE
SLICKENSIDES
JOINT
LOST CORE
CONCRETE
1 MONTH - PIPE BREAK



THIS DRAWING HAS BEEN REDUCED TO THREE EIGHTHS THE ORIGINAL SCALE

LEGEND

WS-2 HOLE NUMBER

ASPHALT AND GRAVEL OR WEATHERED SHALE

BENTONITE

SLICKENSIDES

JOINT

LOST CORE

CONCRETIONS

1 MONTH - PIPE BREAK

NO INDICATES THICKNESS IN FEET

SAFETY PAYS

DATE	DESCRIPTION	DRAWN	APPROVED
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
GEOLOGIC PROFILE
P-1 THRU P-5

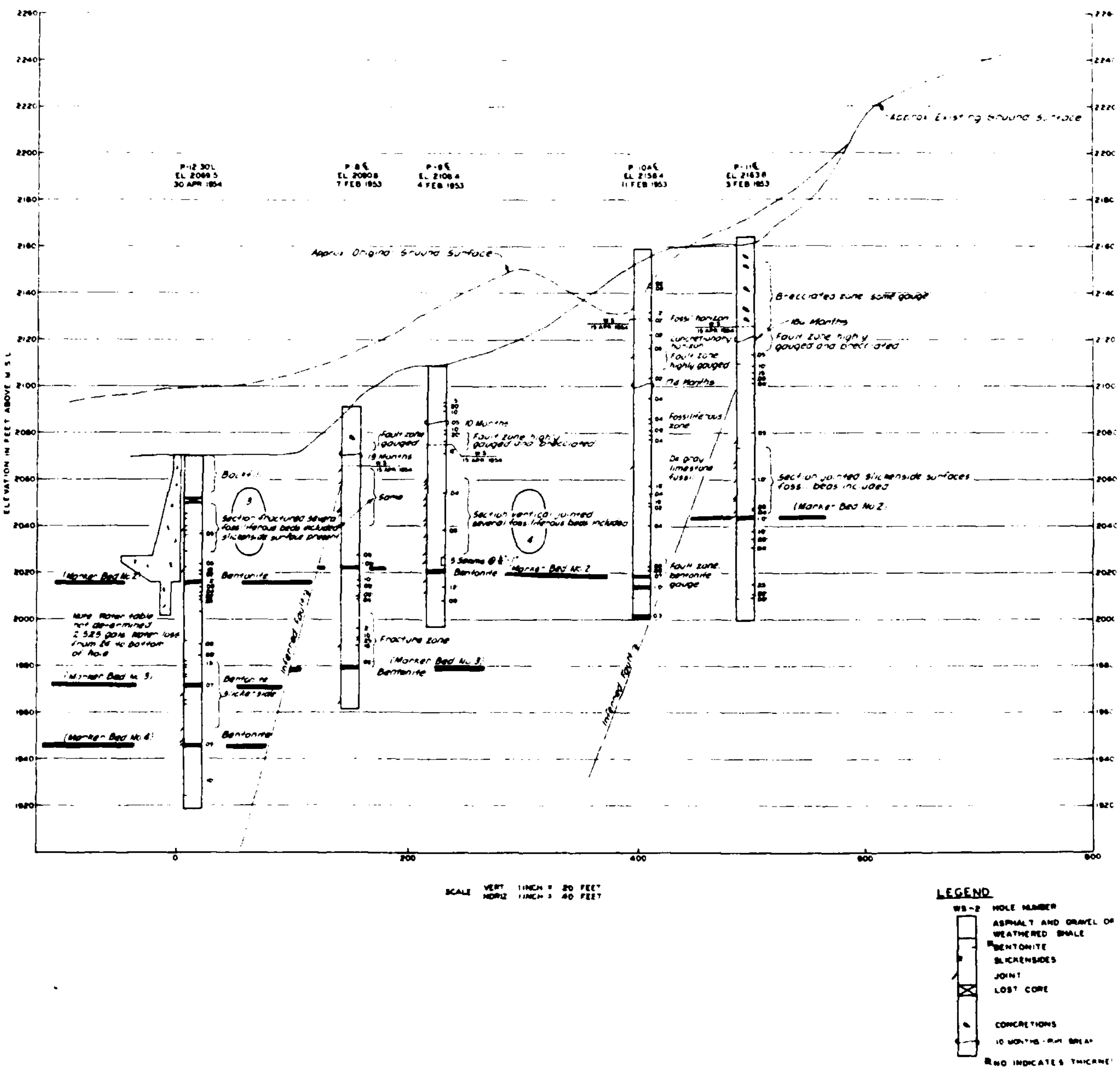
JULY 1972

THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

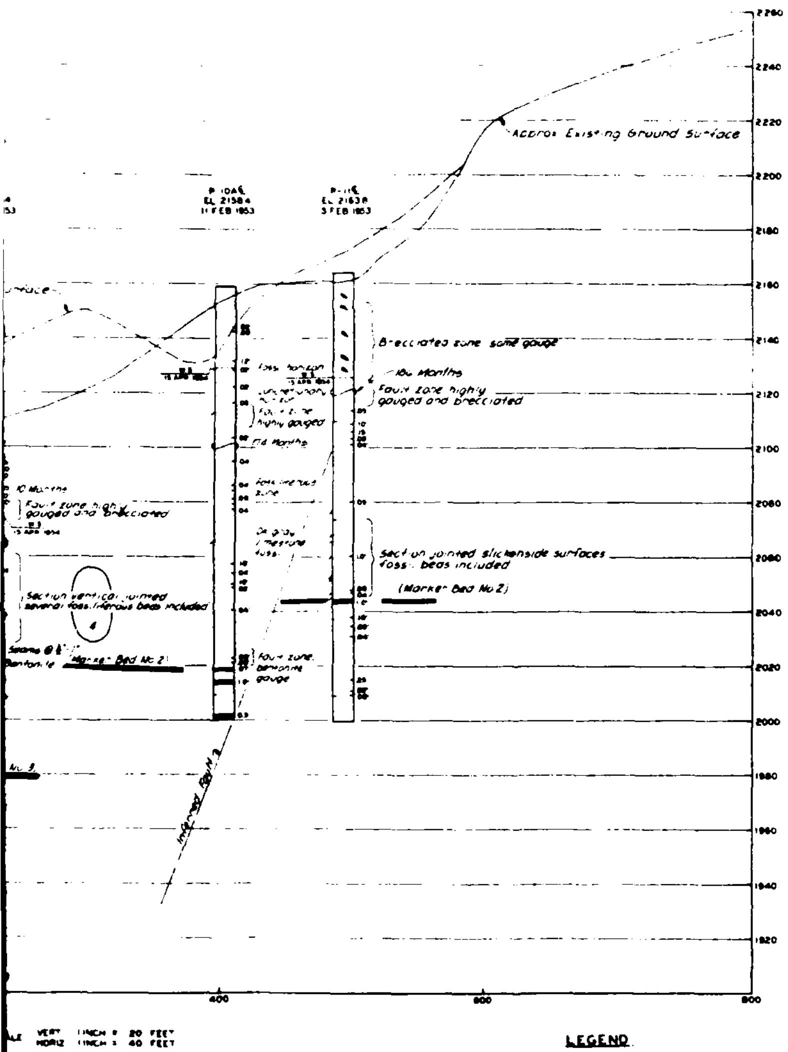
CONSTRUCTION FOUNDATION REPORT

PLATE 162

2



P-12 30L
EL 2069.5
30 APR 1954
P-8
EL 2090.8
7 FEB 1953
P-9
EL 2108.4
4 FEB 1953
P-10A
EL 2158.4
11 FEB 1953
P-11
EL 2163.8
5 FEB 1953
Approx. Existing Ground Surface
Approx. Original Ground Surface
Brecciated zone some gouge
Fault zone highly gouged and brecciated
Fault zone gouged
Fault zone highly gouged and brecciated
Backfill
Section fractured several fossiliferous beds included slickenside surface present
Section vertical jointed several fossiliferous beds included
Section jointed slickenside surfaces fossil beds included
(Marker Bed No. 2)
(Marker Bed No. 3)
(Marker Bed No. 4)
Bentonite
Fracture zone
Fossiliferous zone
Dk gray limestone fossil
Fault zone bentonite gouge
Inferred fault 1
Inferred fault 2
ELEVATION IN FEET ABOVE M.S.L.
SCALE VERT 1 INCH = 20 FEET
HORIZ 1 INCH = 40 FEET
LEGEND
HOLE NUMBER
ASPHALT AND GRAVEL OR WEATHERED SHALE
BENTONITE
SLICKENSIDES
JOINT
LOST CORE
CONCRETIONS



SCALE VERT 1 INCH = 20 FEET
HORIZ 1 INCH = 40 FEET

LEGEND

- WS-2 HOLE NUMBER
- ASPHALT AND GRAVEL OR WEATHERED SHALE
- BENTONITE
- SLICKENSIDES
- JOINT
- LOST CORE
- CONCRETIONS
- 10 MONTHS - PIPE BREAK
- NO INDICATES THICKNESS IN FEET

THIS DRAWING HAS BEEN REDUCED TO THREE EIGHTHS THE ORIGINAL SCALE

REVISIONS

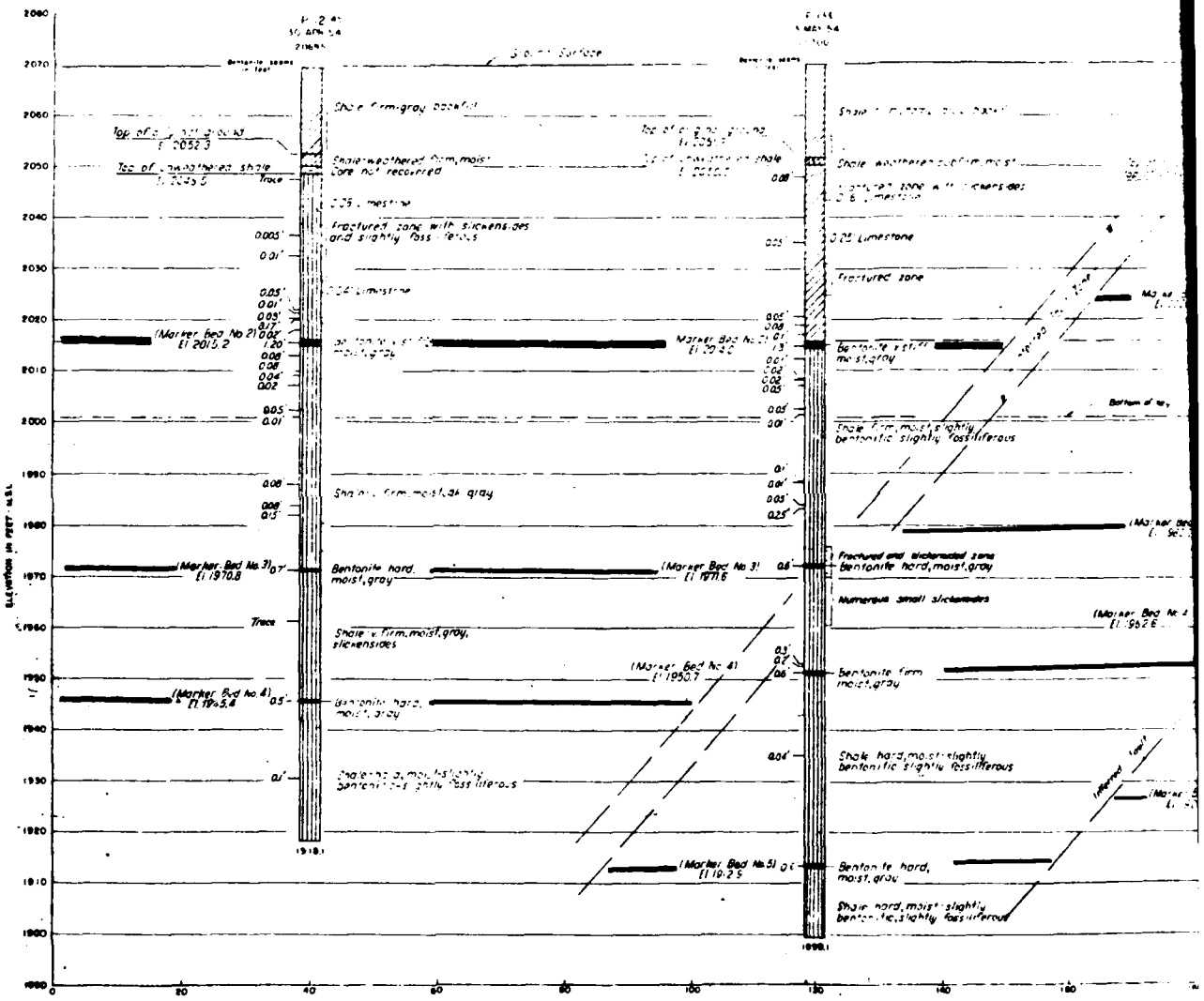
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
GEOLOGIC PROFILE
P-8 THRU P-11

JULY 1972

THIS PLAN ACCOMPANIES CONTRACT NO.
MODIFICATION NO.

SAFETY PAYS



LEGEND

P-100 20R---Hole Number and Offset
3 MAY 54------Date Hole completed
2010.0 -----Elevation Top of Hole

Weathered Shale
Core Not Recovered
Minor Fractures
Sub Firm Shale
Marker Bed (Bentonite)
Firm Shale
Minor bentonite seams in feet
1892.0 - Elevation of bottom of hole

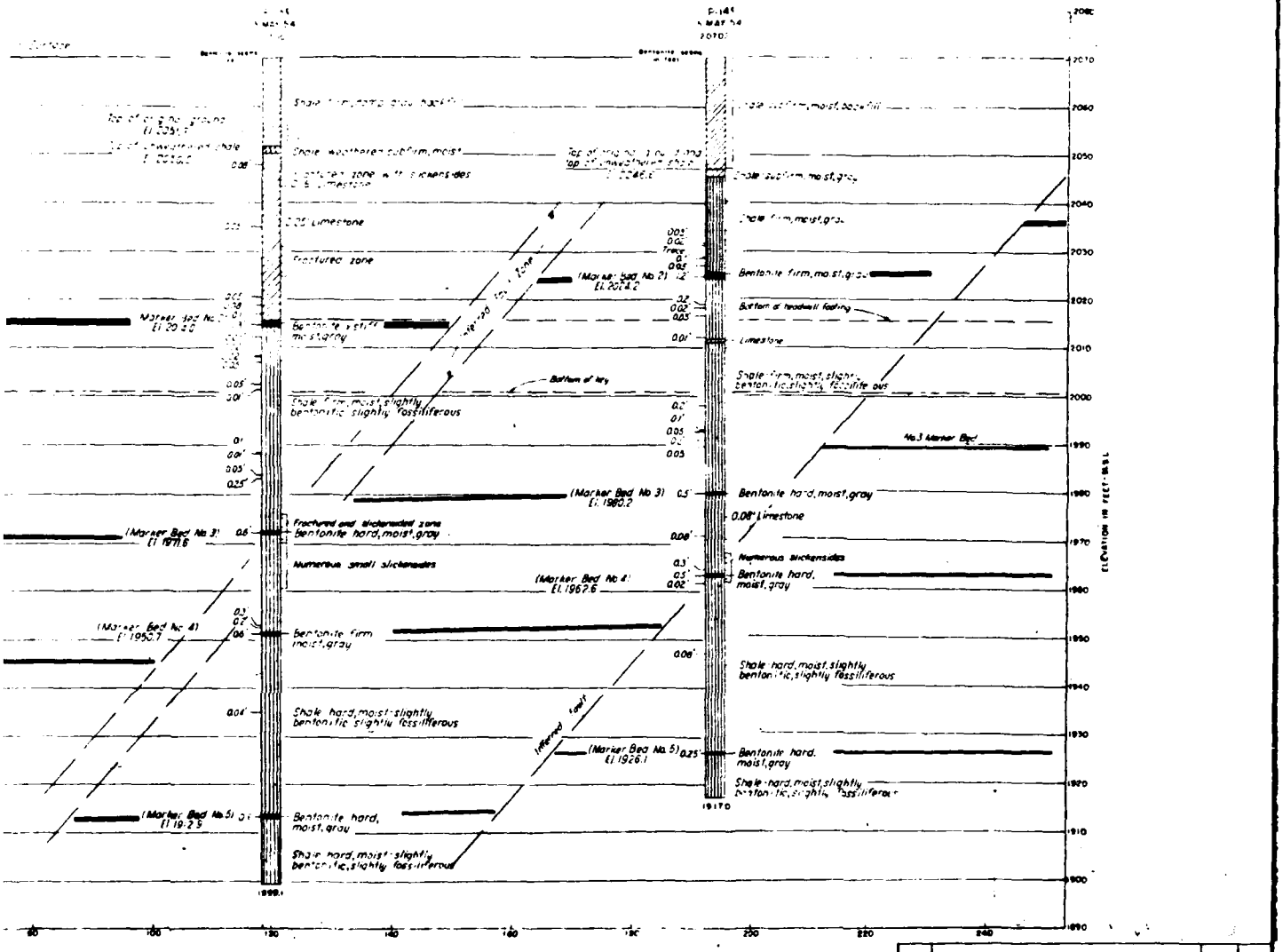
DESCRIPTIVE NOTES

The Bearpen formation is a dense uniform brush gray shale containing numerous thin light colored bentonite beds. The shale can be classified into three groups weathered, sub firm, and firm. The weathered shale has a fissile structure and is composed of small thin soft fragments of shale. The material in the sub-firm group has a shaly to flaggy structure, breaks with an irregular fracture and can be easily scratched with the fingernail. The firm shale has a massive structure, breaks with a conchoidal fracture and can be scratched with a fingernail only with difficulty.

The bentonite beds contain 75% or more clay-like minerals formed by the chemical alteration of volcanic ash beds. The bentonite is fine grained, light in color and has a waxy luster.

Numerous faults of an irregular pattern are present in the Bearpen in the tunnel outlet area.

SCALE HOR. 1" = 8'
VERT. 1" = 10'



SCALE HOR 1" = 8'
VERT 1" = 10'

NOTES

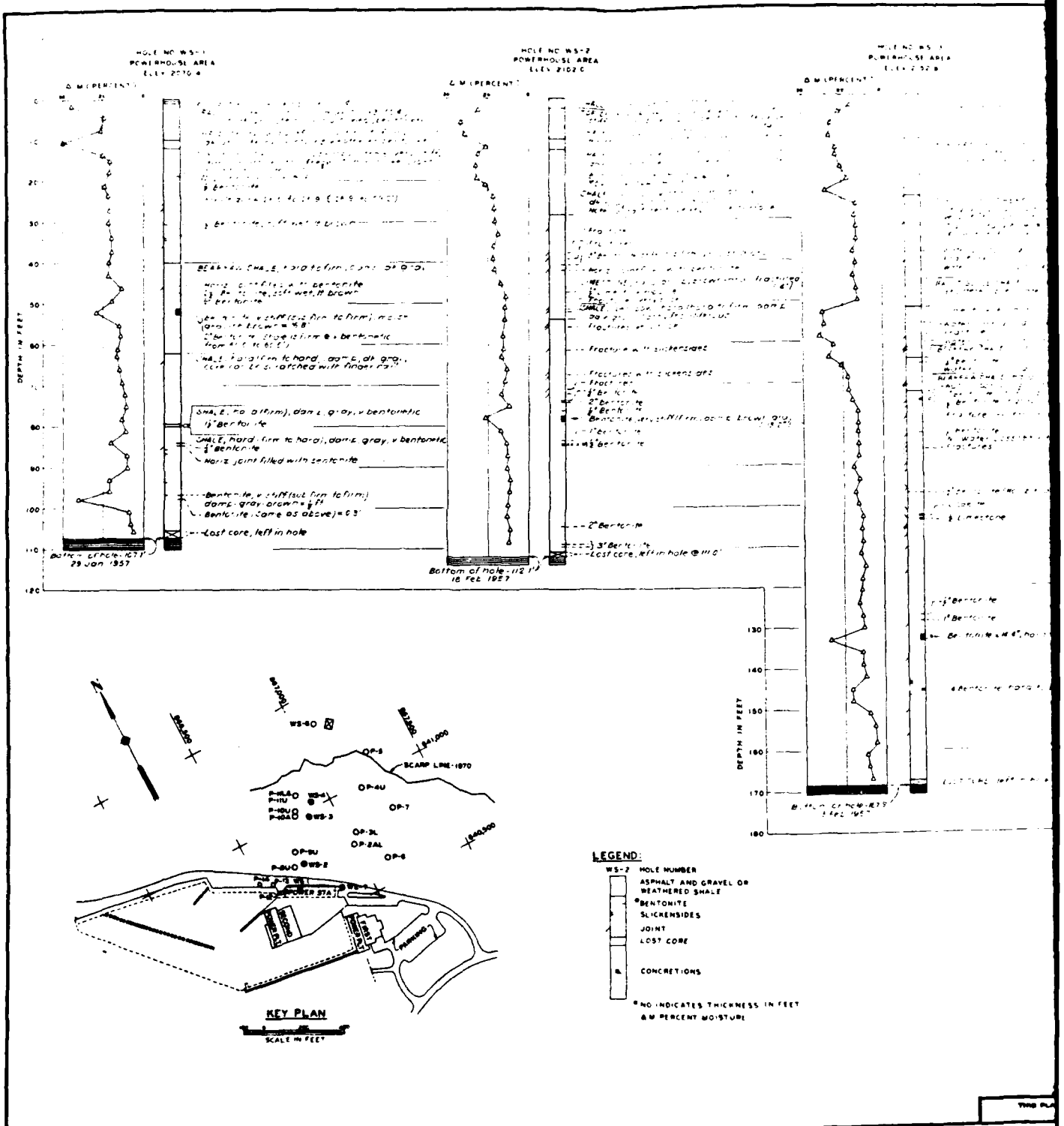
THIS DRAWING HAS BEEN REDUCED TO THREE FOURTHS THE ORIGINAL SCALE

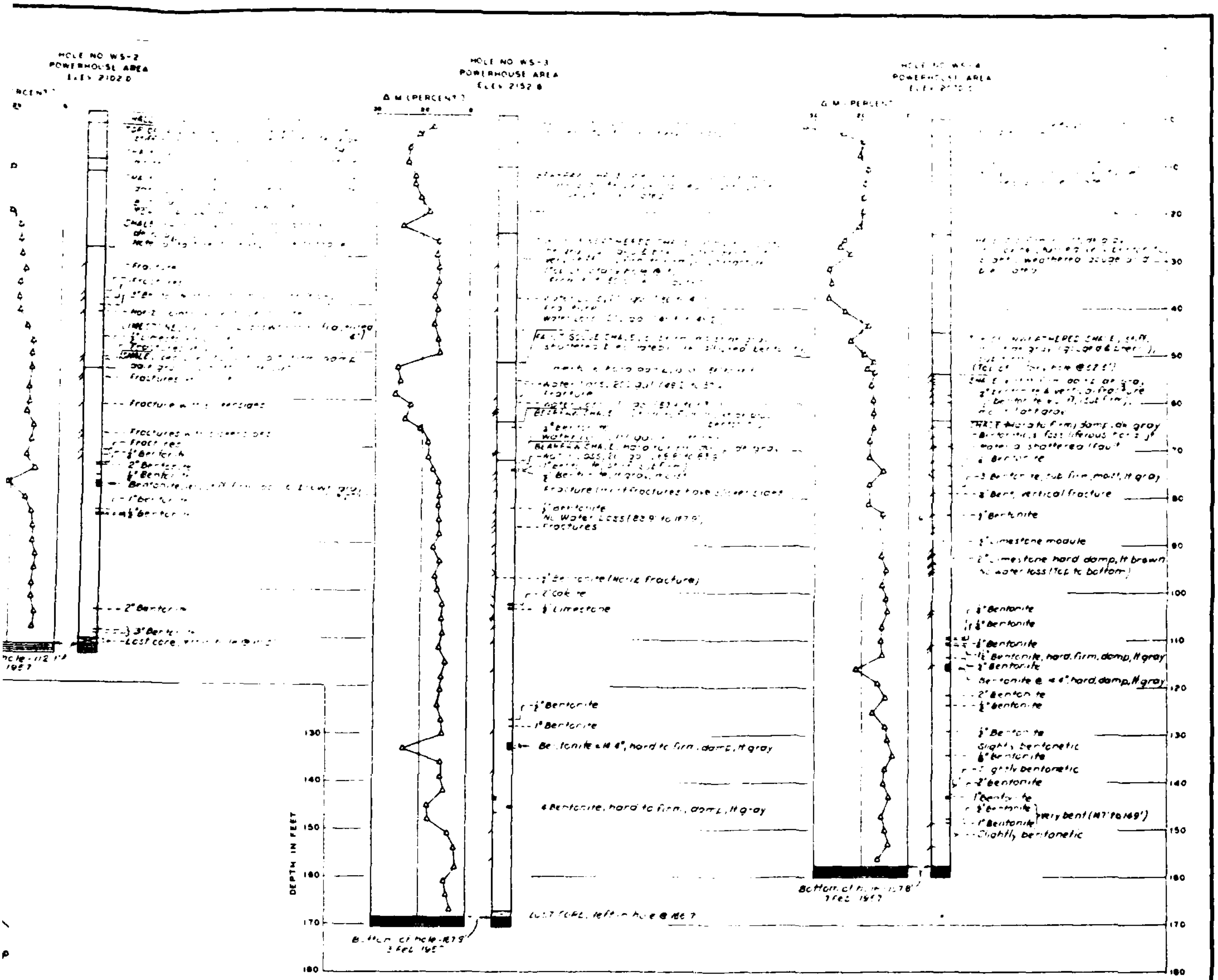
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
GEOLOGIC PROFILE
P-12, P-13 AND P-14

DESIGNED BY
DRAWN BY
TRACED BY
CHECKED BY
SUBMITTED
APPROVED
DATE JULY 1972

CONSTRUCTION FOUNDATION REPORT 2 PLATE 165


HOLE NO WS-1
POWERHOUSE AREA
ELEV. 2210.4
HOLE NO WS-2
POWERHOUSE AREA
ELEV. 2102.0
Δ M (PERCENT)
DEPTH IN FEET
Bottom of hole - 107.1'
29 Jan 1957
Bottom of hole - 112.1'
18 Feb 1957
Lost core, left in hole
Lost core, left in hole @ 111.0'
WS-60
WS-1
WS-2
WS-3
OP-5
OP-4U
OP-7
OP-3L
OP-2AL
OP-6
OP-3U
SCARP LINE-1870
POWER STA.
PARKING
KEY PLAN
SCALE IN FEET
LEGEND:
WS-2 HOLE NUMBER
ASPHALT AND GRAVEL OR WEATHERED SHALE
BENTONITE
SLICKENSIDES
JOINT
LOST CORE
CONCRETIONS
NO. INDICATES THICKNESS IN FEET
Δ M PERCENT MOISTURE



LEGEND:

- WS-2 HOLE NUMBER
- ASPHALT AND GRAVEL OR WEATHERED SHALE
- *BENTONITE
- SLICKENSIDES
- JOINT
- LOST CORE
- CONCRETIONS

*NO. INDICATES THICKNESS IN FEET

A.M. PERCENT MOISTURE

THIS DRAWING HAS BEEN REDUCED TO THREE EIGHTHS THE ORIGINAL SCALE

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER

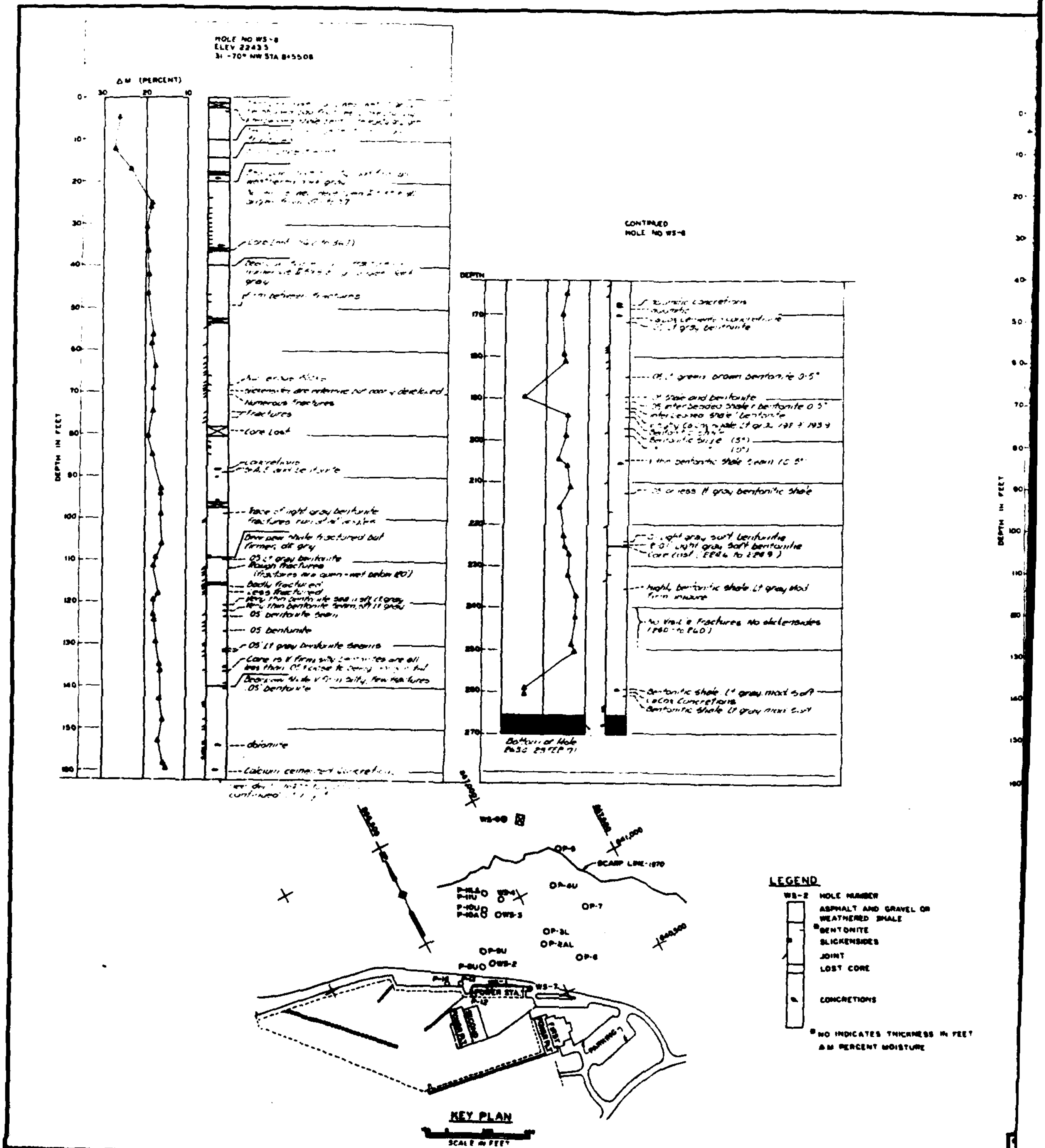
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
LOG OF BORINGS WS-1, WS-2
WS-3 AND WS-4

JULY 1972

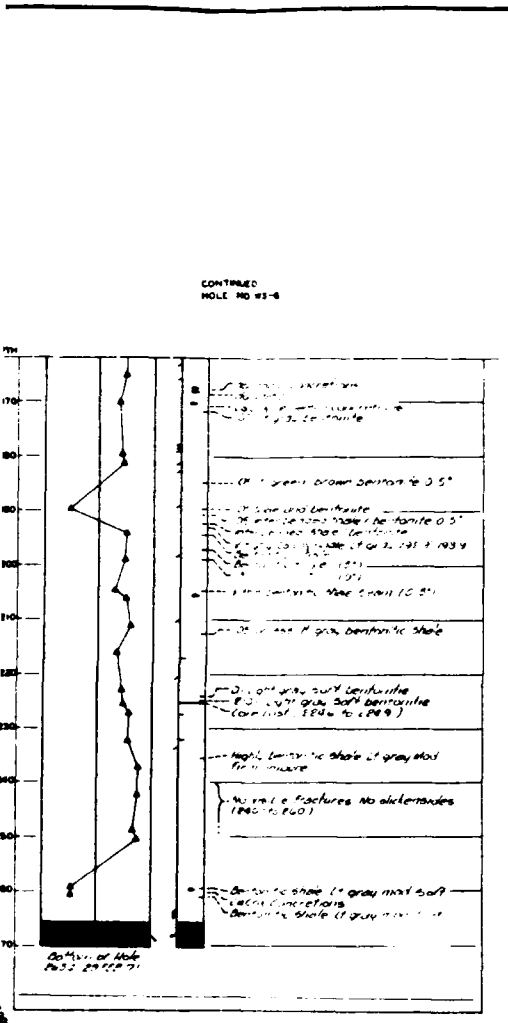
THIS PLAN ACCOMPANIED CONTRACT No.

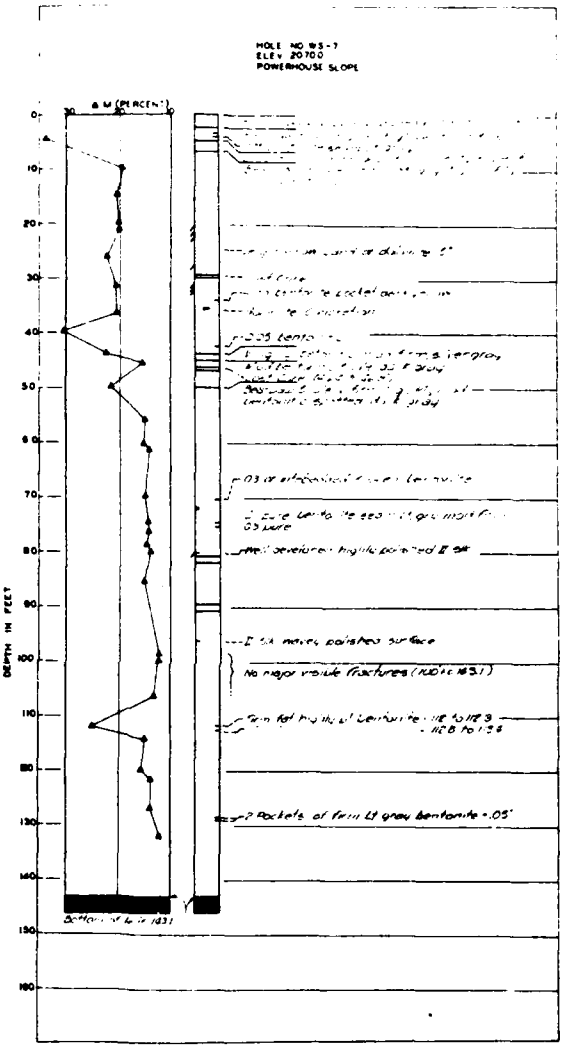
SAFETY PAYS

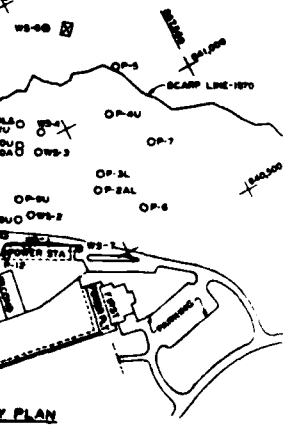
CONSTRUCTION FOUNDATION REPORT 2 PLATE 166



HOLE NO WS-8
ΔM (PERCENT)
DEPTH IN FEET
Core Lost
Trace of light gray bentonite
Calcium cemented concretion
dolomite
CONTINUED
HOLE NO WS-8
DEPTH
Bottom of Hole
KEY PLAN
SCALE IN FEET
SCARP LINE-1970
OWS-2
OWS-3
LEGEND
WS-2 HOLE NUMBER
ASPHALT AND GRAVEL OR WEATHERED SHALE
BENTONITE
SLICKENSIDES
JOINT
LOST CORE
CONCRETIONS
NO INDICATES THICKNESS IN FEET
ΔM PERCENT MOISTURE







LEGEND

WS-2 HOLE NUMBER

ASPHALT AND GRAVEL OR WEATHERED SHALE

BENTONITE

SLICKENSIDES

JOINT

LOST CORE

CONCRETIONS

NO INDICATES THICKNESS IN FEET

A M PERCENT MOISTURE

THIS DRAWING HAS BEEN REDUCED TO THREE EIGHTHS THE ORIGINAL SCALE

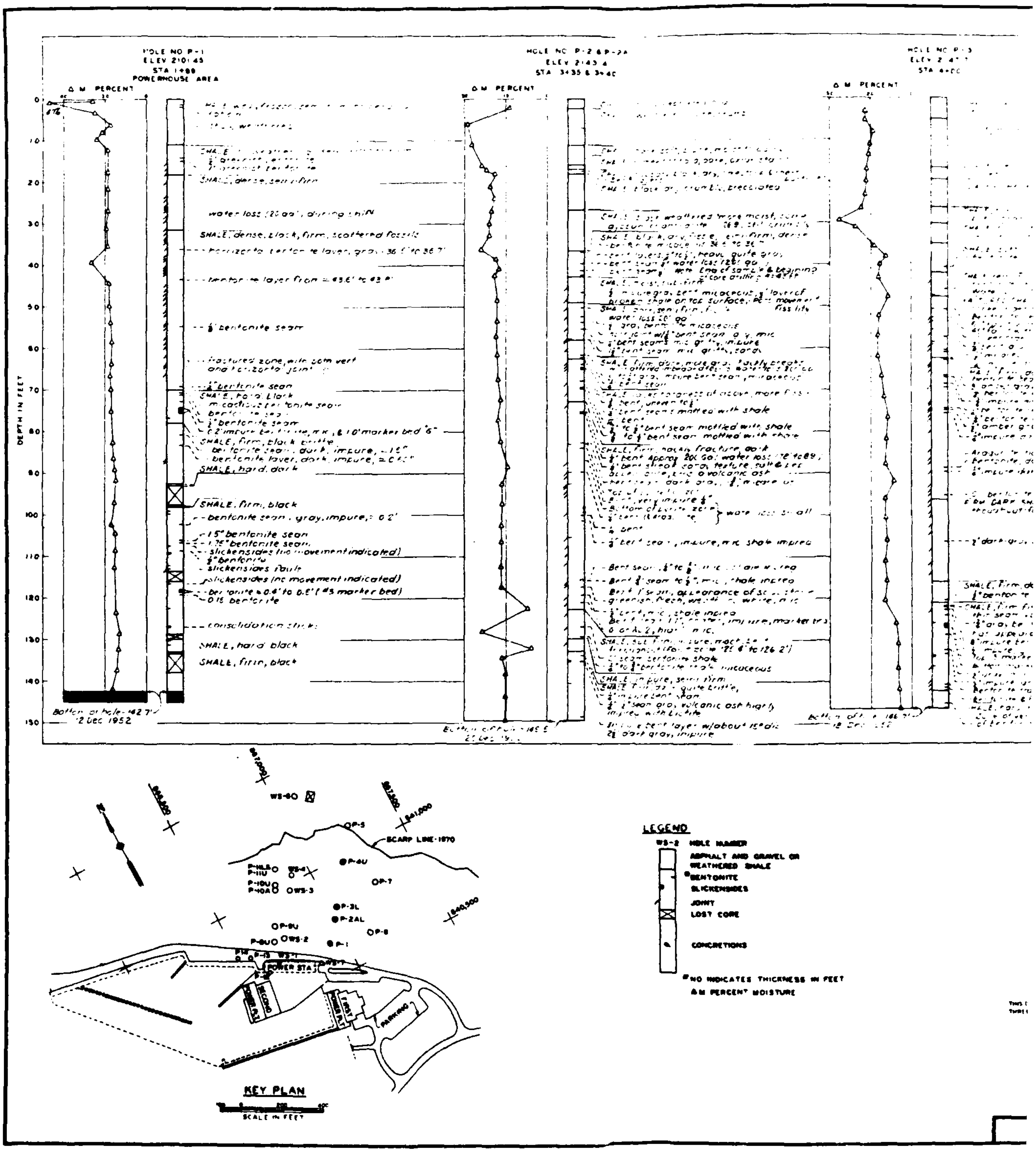
SAFETY PAYS

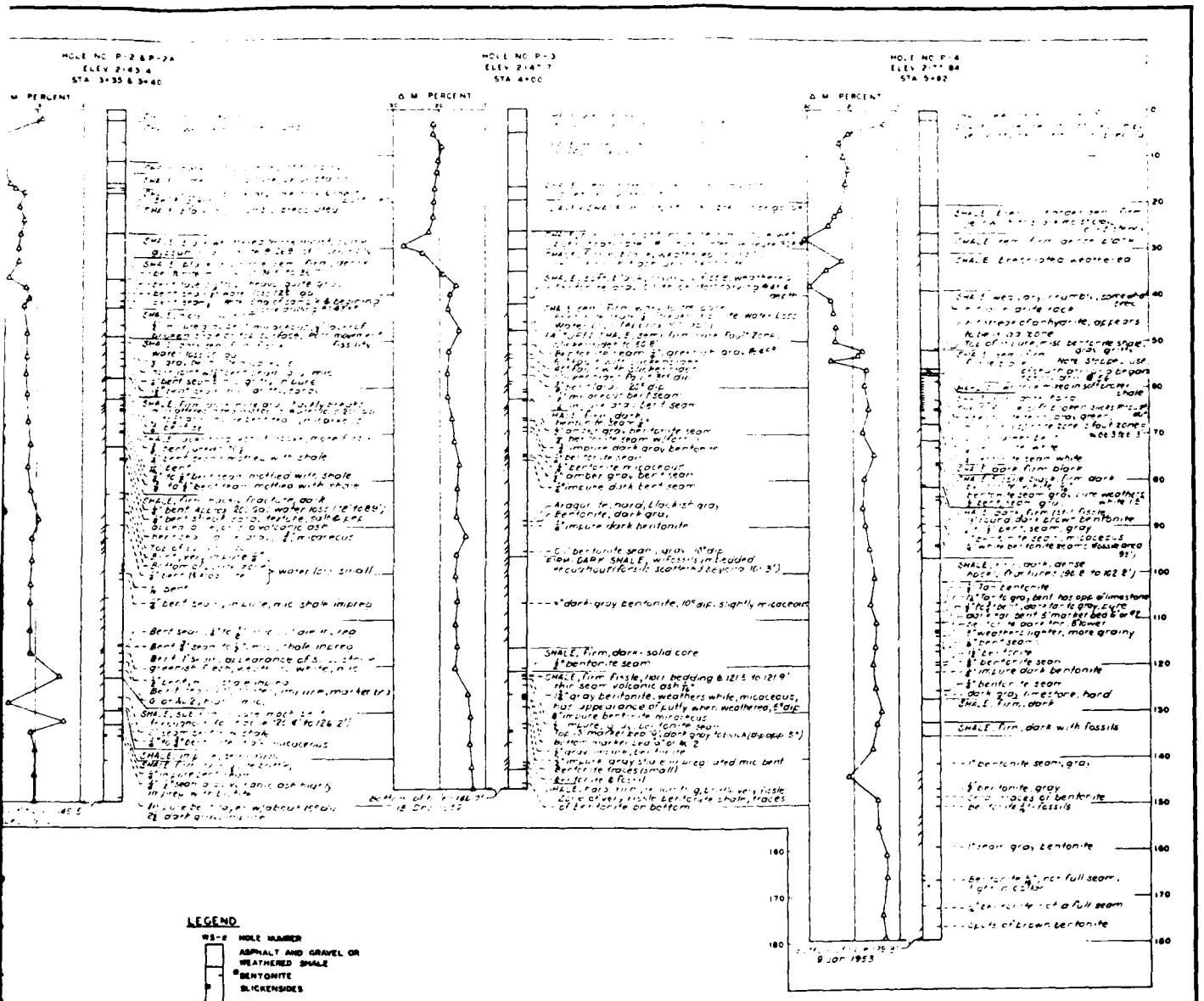
THIS PLAN ASSIGNED CONTRACT NO. DESIGNATION NO.

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
LOG OF BORINGS WS-6 & WS-7

DATE JULY 1972


HOLE NO P-1
ELEV 210.45
STA 1+88
POWERHOUSE AREA
DEPTH IN FEET
SHALE, dense, black, firm, scattered fossils
SHALE, hard, dark
SHALE, firm, black
SHALE, hard black
SHALE, firm, black
Bottom of hole - 142.7'
12 Dec 1952
HOLE NO P-3
SCARP LINE-1970
POWER STA
PARKING
KEY PLAN
SCALE IN FEET
LEGEND
HOLE NUMBER
ASPHALT AND GRAVEL OR WEATHERED SHALE
BENTONITE
SLICKENSIDES
JOINT
LOST CORE
CONCRETIONS
NO INDICATES THICKNESS IN FEET
AM PERCENT MOISTURE



LEGEND

WS-8 HOLE NUMBER

ASPHALT AND GRAVEL OR WEATHERED SHALE

*BENTONITE

SLICKENSIDES

JOINT

LOST CORE

CONCRETIONS

*NO INDICATES THICKNESS IN FEET

Δ M PERCENT MOISTURE

THIS DRAWING HAS BEEN REDUCED TO THREE EIGHTHS THE ORIGINAL SCALE

SAFETY PAYS

THIS PLAN ACCOMPANIES CONTRACT NO
MODIFICATION NO

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

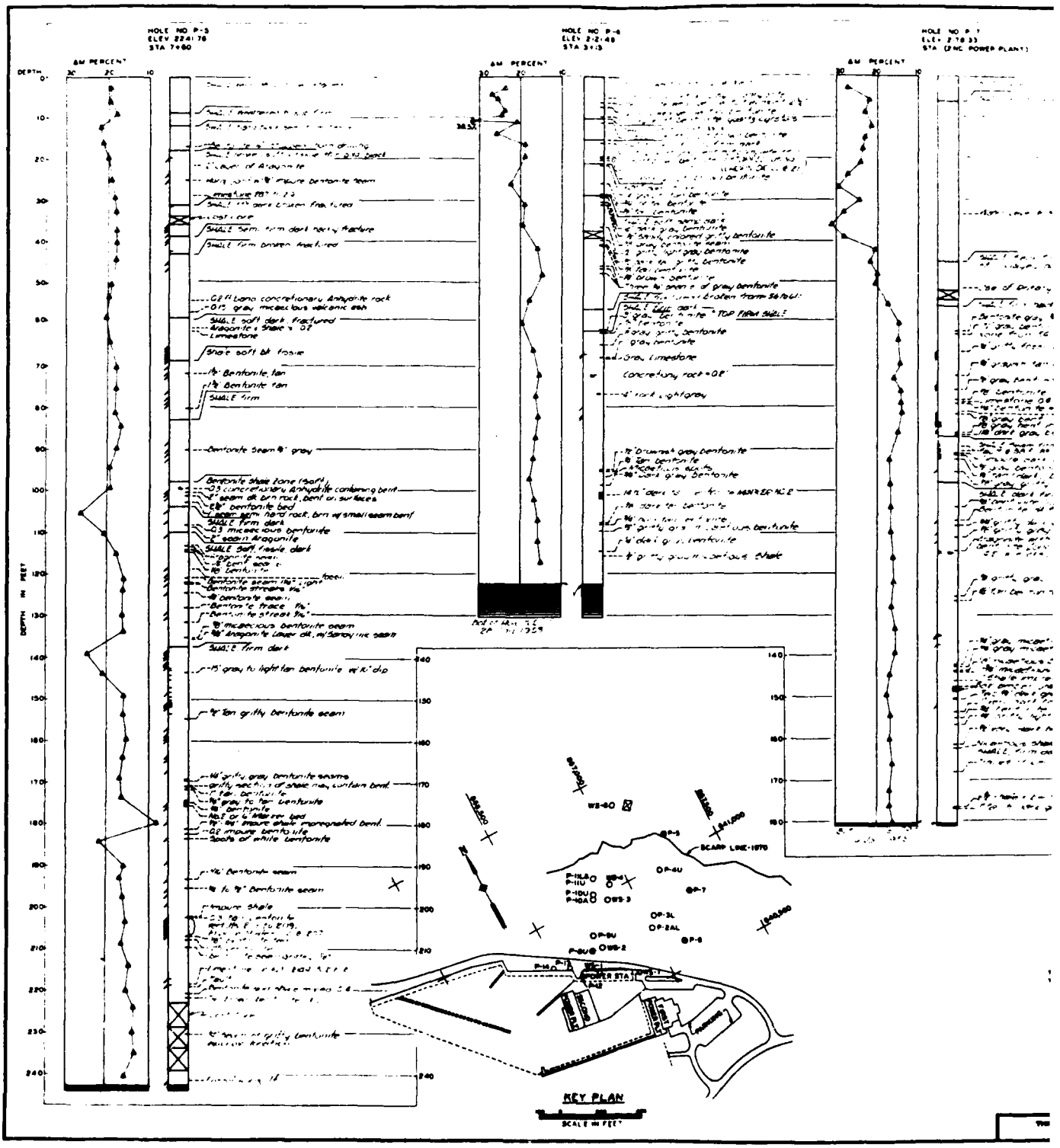
MISSOURI RIVER

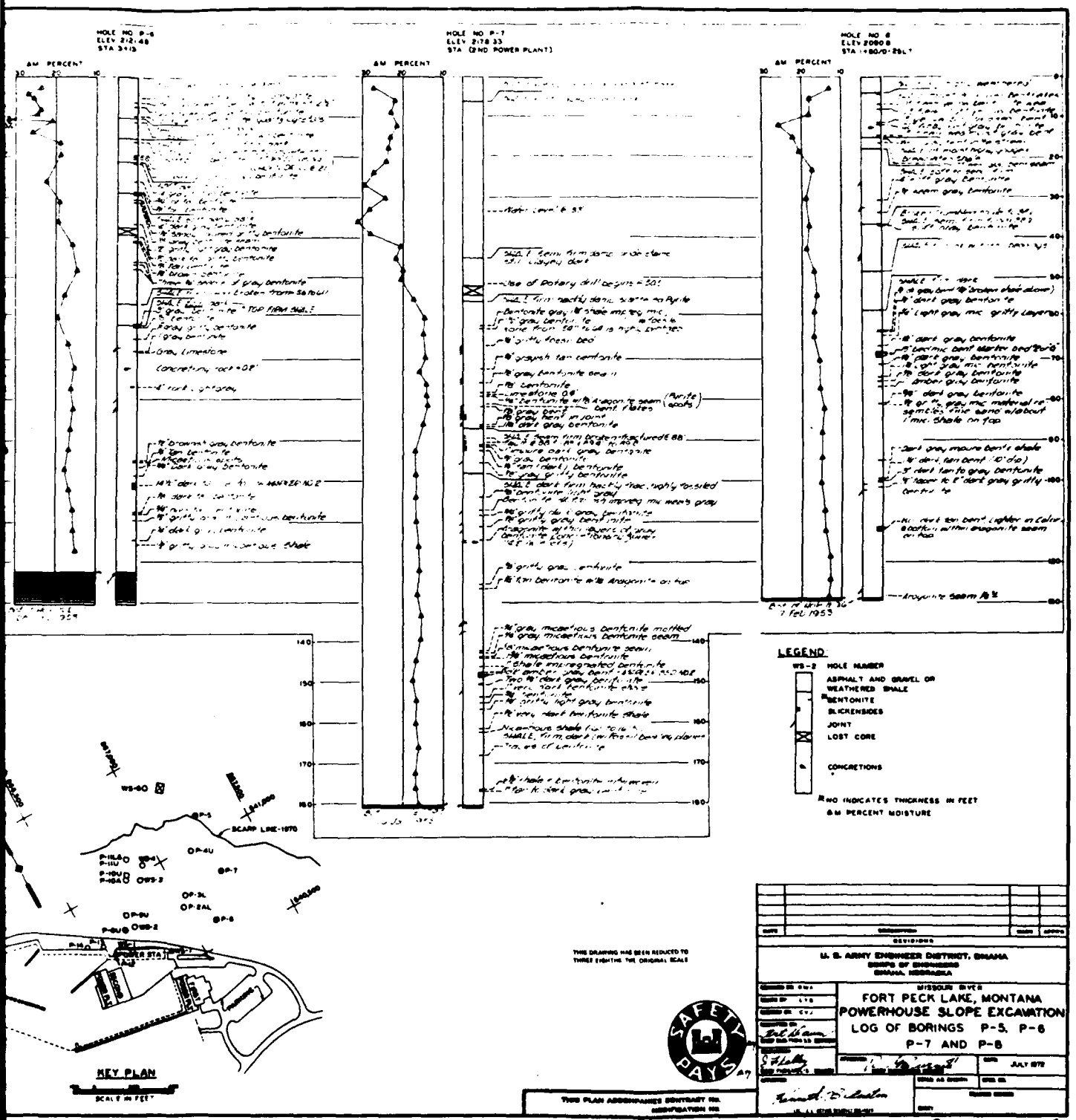
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
LOG OF BORINGS P-1, P-2 & 2A, P-3 & P-4

DESIGNED BY
DRAWN BY
CHECKED BY
QUANTITIES BY
APPROVED

DATE JULY 1972

CONSTRUCTION FOUNDATION REPORT 2 PLATE 168


HOLE NO P-5
ELEV 2241.76
STA 7+60
HOLE NO P-6
ELEV 2121.48
STA 3+13
HOLE NO P-7
ELEV 2150.33
STA (PMC POWER PLANT)
AM PERCENT
DEPTH IN FEET
KEY PLAN
SCALE IN FEET



THIS DRAWING HAS BEEN REDUCED TO THREE EIGHTHS THE ORIGINAL SCALE

SAFETY PAYS

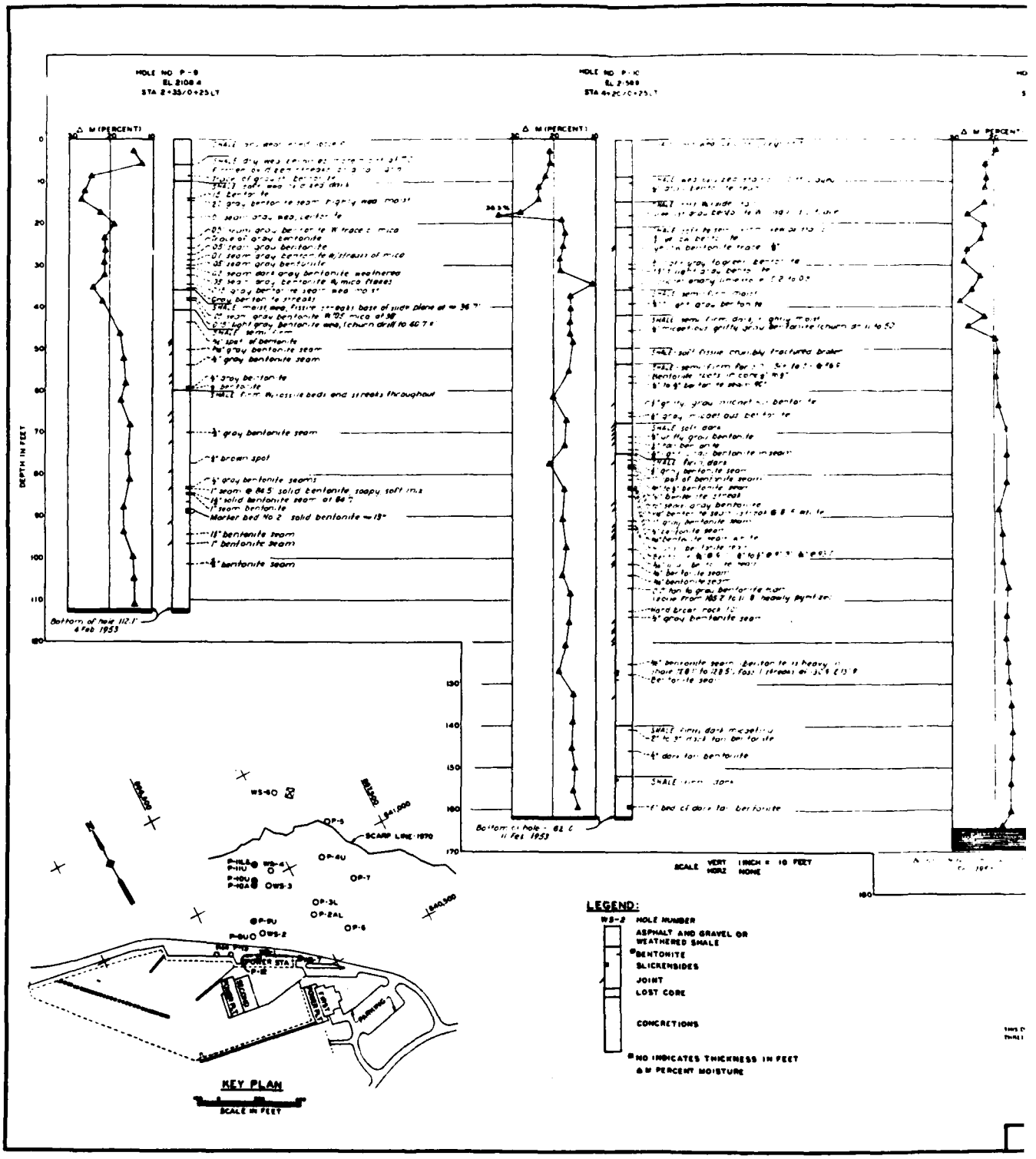
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

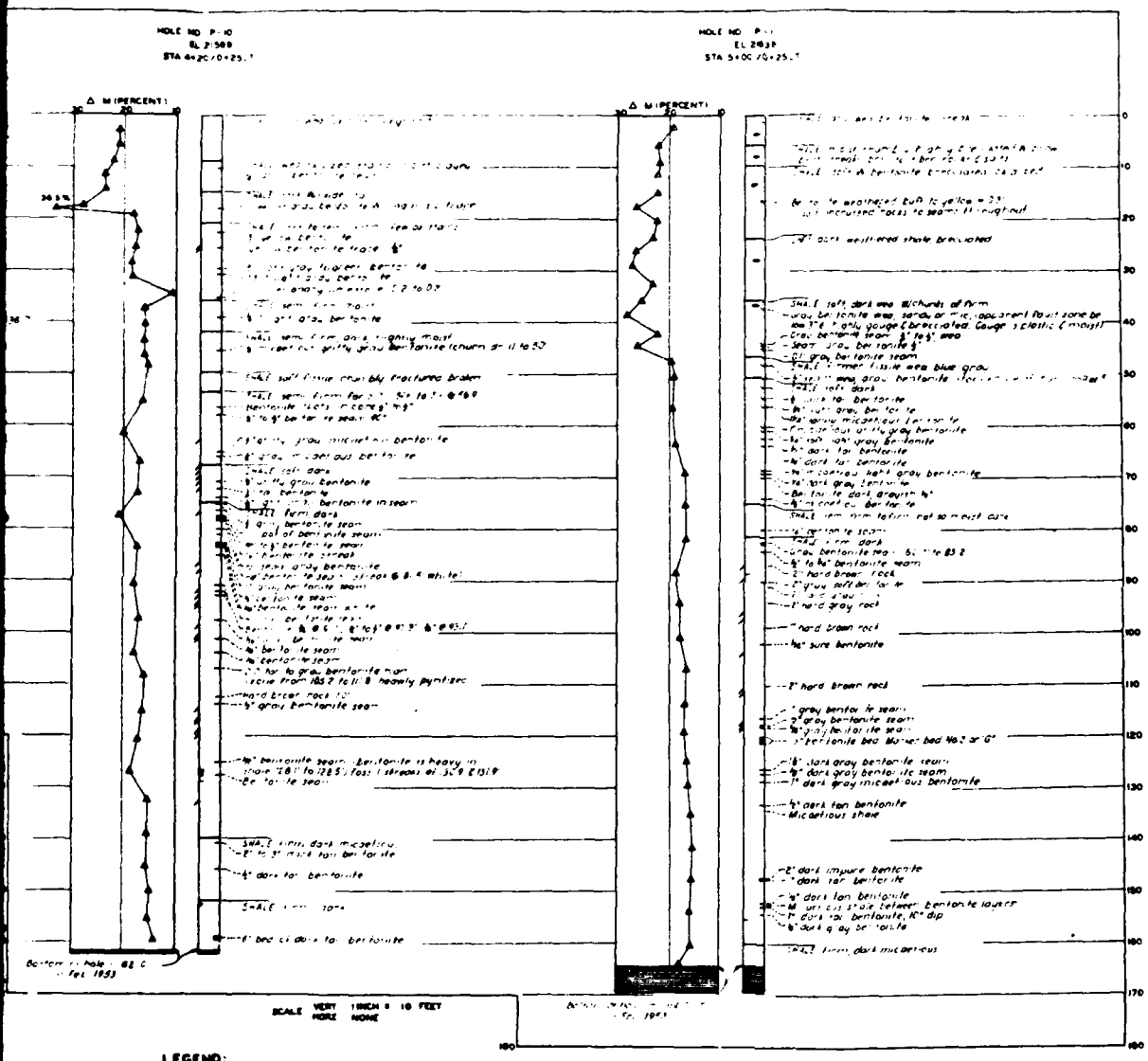
MISSOURI RIVER
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
LOG OF BORINGS P-5, P-6
P-7 AND P-8

JULY 1972

THIS PLAN ACCOMPANIES DEFINITORY NO. MODIFICATION NO.

CONSTRUCTION FOUNDATION REPORT 2 PLATE 169


HOLE NO P-9
EL 2108.4
STA 2+35/0+25 LT
HOLE NO P-10
EL 2109
STA 4+20/0+25 LT
Δ M (PERCENT)
DEPTH IN FEET
Bottom of hole 112.1' 6 Feb 1953
Bottom of hole = 82.0 11 Feb 1953
SCALE VERT 1 INCH = 10 FEET
HORZ NONE
SCARP LINE 1970
KEY PLAN
SCALE IN FEET
LEGEND:
WS-2 HOLE NUMBER
ASPHALT AND GRAVEL OR WEATHERED SHALE
BENTONITE
SLICKENSIDES
JOINT
LOST CORE
CONCRETIONS
NO INDICATES THICKNESS IN FEET
Δ M PERCENT MOISTURE



LEGEND:

WS-2 HOLE NUMBER

ASPHALT AND GRAVEL OR WEATHERED SHALE

*BENTONITE

SLICKENSIDES

JOINT

LOST CORE

CONCRETIONS

*NO INDICATES THICKNESS IN FEET

ΔM PERCENT MOISTURE

THIS DRAWING HAS BEEN REDUCED TO THREE EIGHTHS THE ORIGINAL SCALE

SAFETY PAYS

THIS PLAN ASSOCIATED CONTRACT NO.
IDENTIFICATION NO.

DATE	DESCRIPTION	INITIALS	APPVD

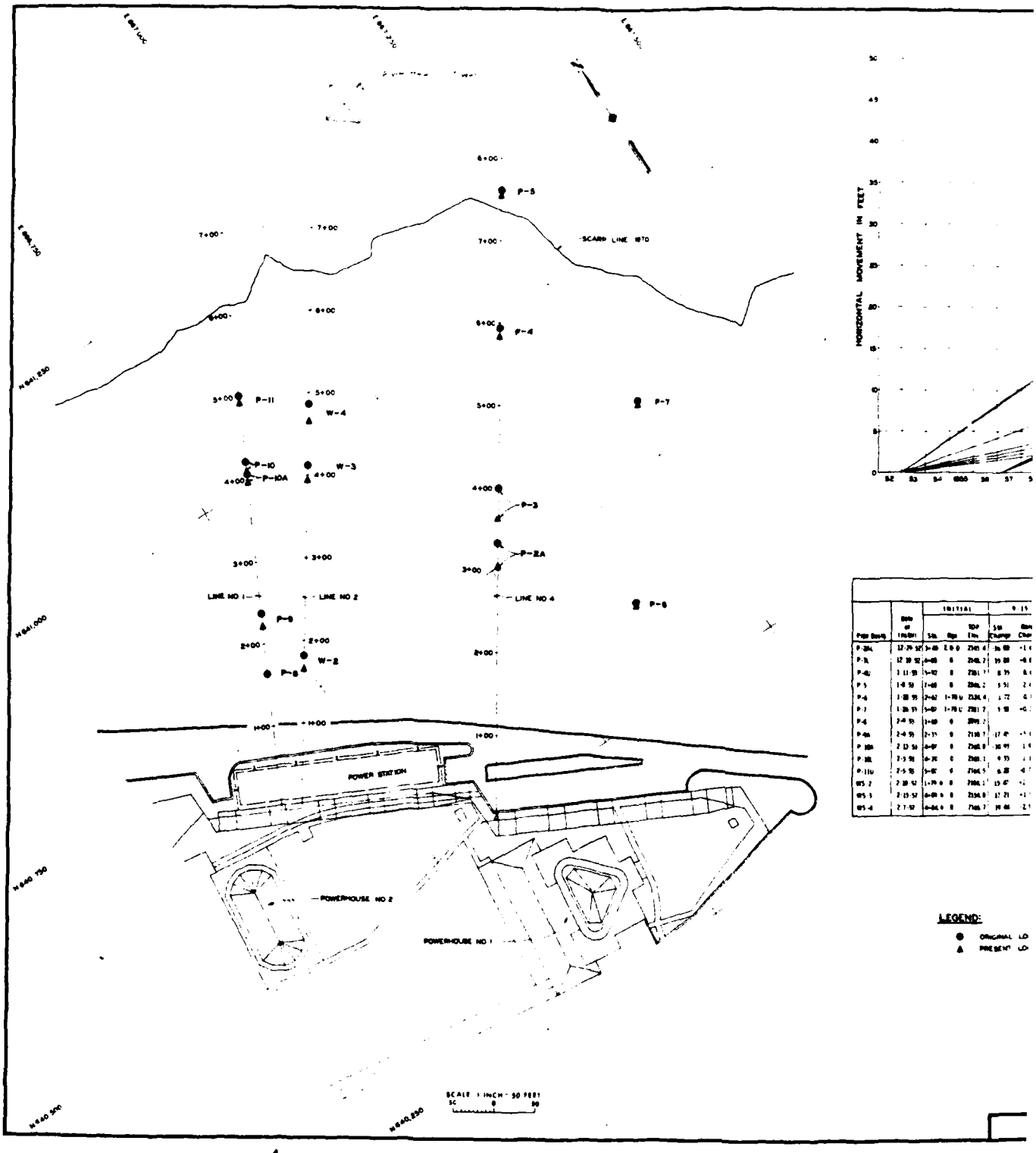
REVISIONS

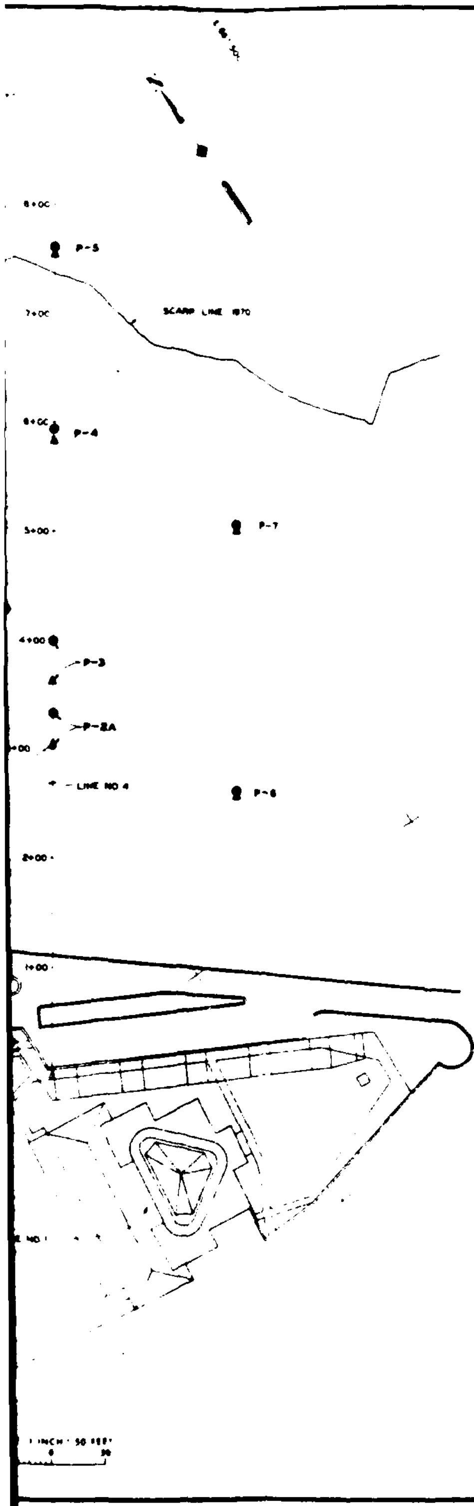
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

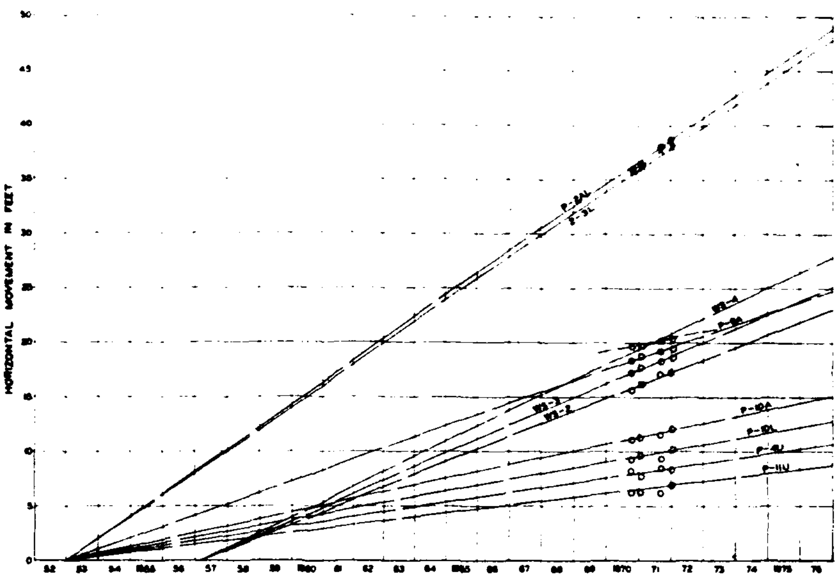
MISSOURI RIVER
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
LOG OF BORING
P-9, P-10 AND P-11

DESIGNED BY
DRAWN BY
TRACED BY
CHIEF, ENGINEERING DIVISION
CHIEF, CONSTRUCTION DIVISION
APPROVED
DATE JULY 1972

CONSTRUCTION FOUNDATION REPORT 2 PLATE 170


E 847,100
E 847,250
E 847,300
E 846,750
N 641,250
N 641,000
N 640,750
N 640,500
N 640,250
6+00
7+00
8+00
5+00
4+00
3+00
2+00
1+00
P-5
P-4
P-11
P-7
P-10
P-10A
P-3
P-2A
P-6
P-8
P-9
W-4
W-3
W-2
SCARP LINE 1970
LINE NO 1
LINE NO 2
LINE NO 4
POWER STATION
POWERHOUSE NO 2
POWERHOUSE NO 1
SCALE 1 INCH = 50 FEET
HORIZONTAL MOVEMENT IN FEET
LEGEND:
ORIGINAL LO
PRESENT LO





SUMMARY TABULATION

FORT PECK POWERHOUSE SLOPE
MOVEMENT OBSERVATIONS -- PIEZOMETER & TILTMETERS

Pipe Desig.	Date of Install.	INITIAL Sta.	INITIAL Rge.	INITIAL TOP Elev.	9-15-70 OBS. Sta. Change	9-15-70 OBS. Range Change	9-15-70 OBS. TOP Change	9-15-70 OBS. Result Horiz. Movement	12-18-70 OBS. Sta. Change	12-18-70 OBS. Range Change	12-18-70 OBS. TOP Change	12-18-70 OBS. Result Horiz. Movement
P-2AL	12-29-52	3+40	2.0 D	2145.4	-36.00	+1.67 D	-2.9	-36.04	-36.59	+1.90 D	-3.0	36.64
P-3L	12-18-52	4+60	0	2148.7	-35.00	+0.85 D	-4.7	-35.01	-36.12	+1.02 D	-4.5	36.13
P-4U	1-11-53	5+92	0	2181.7	-8.35	-0.60 U	-1.5	-8.36	-7.85	+0.73 D	-1.6	-7.86
P-5	1-8-53	7+40	0	2246.2	-3.51	-2.45 U	-	-4.27	-3.24	-2.20 U	-	-3.92
P-6	1-28-53	2+62	1+70 U	2124.4	-1.72	-0.10 U	0	-1.72	-0.96	-0.00 U	+0.30	0.96
P-7	1-26-53	5+82	1+70 U	2181.2	-3.90	+0.21 D	0	-3.90	-3.93	+0.27	+0.01	-3.94
P-8	2-4-53	1+60	0	2095.2								
P-9A	2-6-53	2+35	0	2110.7	-17.45	+5.00 D	-5.7	-18.35	-17.81	+5.90 D	-5.9	-18.77
P-10A	2-13-53	4+07	0	2160.8	-10.95	1.90 U	-3.4	-11.09	-11.36	-1.30 U	-3.4	-11.50
P-10L	2-5-53	6+20	0	2165.1	-9.33	-1.13 U	-6.6	-9.40	-9.40	-1.01 U	-6.7	-9.54
P-11U	2-5-53	5+00	0	2164.5	-6.20	-0.75 U	-1.9	-6.32	-6.34	-0.50 U	-2.1	-6.35
WS-2	2-10-57	1+70 D	0	2184.1	-15.47	+2.71 D	-3.4	-15.71	-16.06	+2.00 D	-3.8	-16.33
WS-3	2-13-57	4+00 D	0	2154.8	-17.21	+1.50 D	-3.3	-17.30	-17.75	+1.70 D	-3.6	-17.84
WS-4	2-7-57	6+84 D	0	2166.7	-19.40	-2.50 U	-1.7	-19.61	-19.58	-2.46 U	-1.9	-19.73

Pipe Desig.	7-26-71 OBS. Sta. Change	7-26-71 OBS. Range Change	7-26-71 OBS. TOP Change	7-26-71 OBS. Result Horiz. Movement	7-26-71 OBS. Result Movement Rate Per Yr.	12-7-71 OBS. Sta. Change	12-7-71 OBS. Range Change	12-7-71 OBS. TOP Change	12-7-71 OBS. Result Horiz. Movement	12-7-71 OBS. Result Movement Rate Per Yr.
P-2AL	-38.04	+2.02 D	-3.0	-38.09	2.07'	-38.39	+2.11 D	-3.25	-38.50	2.04'
P-3L	-37.40	+0.90 D	-4.6	-37.41	2.07'	-37.97	+1.05 D	-4.67	-37.99	2.01'
P-4U	-8.94		-1.0		0.47'	-8.48		-1.50		0.47'
P-5	-3.44	-2.48 U		-4.21	0.25'	-3.32	-2.20 U	-4.72	-4.05	0.21'
P-6	-1.74	-0.16 U	+0.1	-1.75	0.09	-1.62	-0.40 D	+0.05	-1.62	0.07'
P-7	-3.54	+0.19 D	0	-3.55	0.19'	-3.51	+0.25 D	+0.06	-3.52	0.19'
P-8										
P-9A	-18.25	+6.10 D	-6.1	-19.24	1.06'	-18.40	+6.20 D	-6.30	-19.40	1.06'
P-10A	-11.35	-1.92 U	-3.4	-11.51	0.67'	-11.97	-1.90 U	-3.46	-12.13	0.64'
P-10L	-9.33	-1.11 U	-7	-9.40	0.51'	-10.20	-1.00 U	-6.90	-10.26	0.54'
P-11U	-6.14	-0.00 U	-2.1	-6.18	0.35'	6.95	-0.70 U	-2.15	-6.97	0.37'
WS-2	-16.79	+3.05 D	-4.1	-17.06	0.92'	-17.00	+3.20 D	-4.00	-17.30	0.92'
WS-3	-18.30	+1.74 D	3.6	-18.38	0.99'	-18.46	+1.85 D	-4.10	-18.55	0.98'
WS-4	-20.24	-2.40 U	-2.0	-20.29	1.09	-20.30	-2.50 U	-4.02	-20.40	1.08'

THIS DRAWING HAS BEEN REDUCED TO THREE EIGHTHS THE ORIGINAL SCALE

LEGEND:

- ● ORIGINAL LOCATION
- ▲ PRESENT LOCATION

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

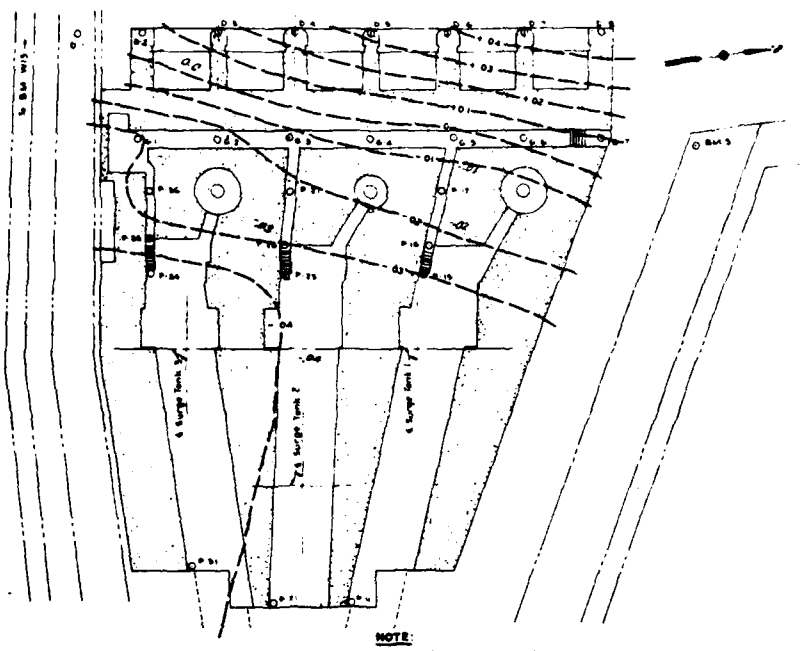
MISSOURI RIVER
FORT PECK LAKE, MONTANA
POWERHOUSE SLOPE EXCAVATION
SLIDE MOVEMENT OBSERVATIONS
PIEZOMETERS AND TILTMETERS

JULY 1972

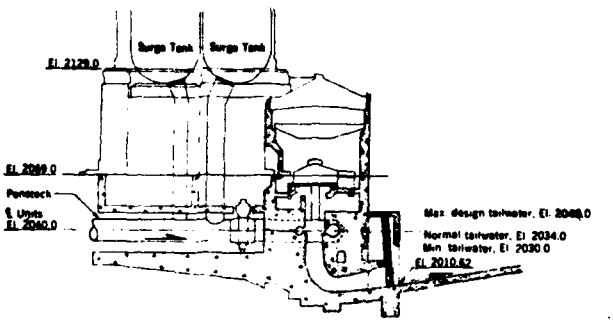
THIS PLAN ACCOMPANIES CONTRACT NO
MODIFICATION NO

SAFETY PAYS

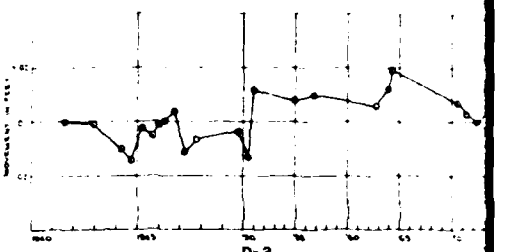
CONSTRUCTION FOUNDATION REPORT 2 PLATE 171

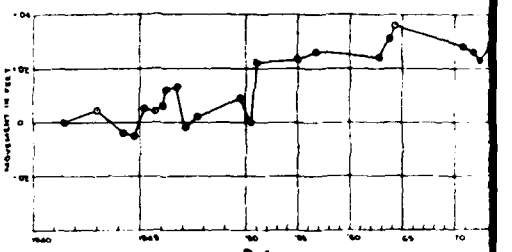


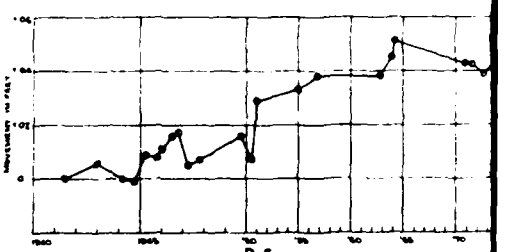
PLAN

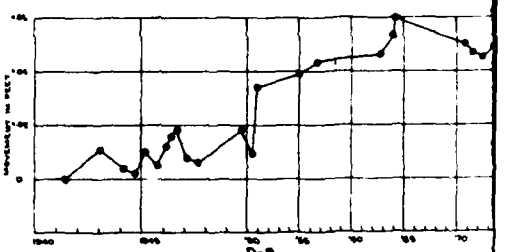


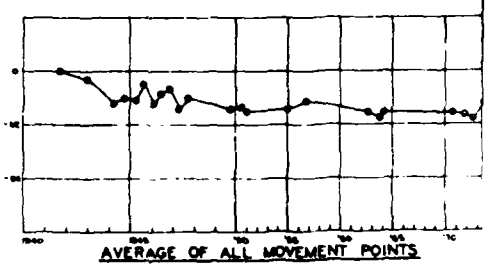
POWERHOUSE SECTION
FIRST POWER PLANT

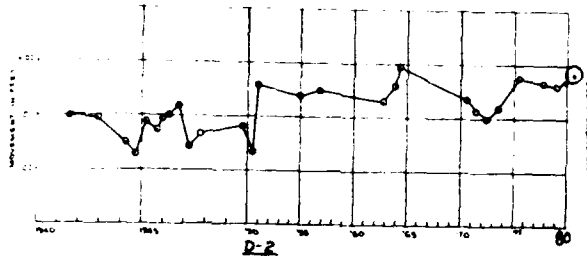

D-2

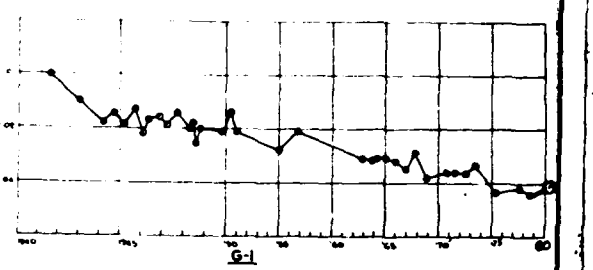

D-4

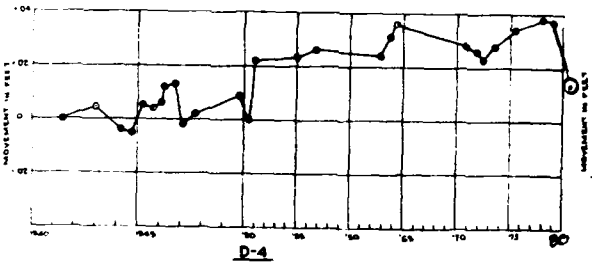

D-6

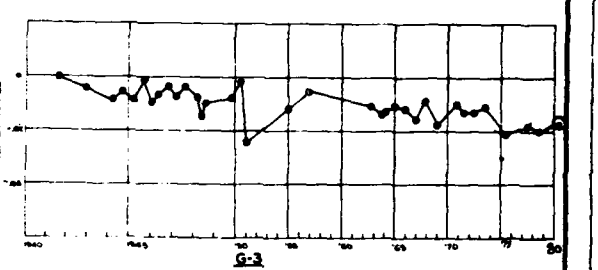

D-8

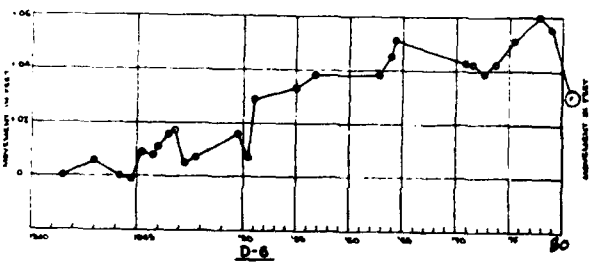

AVERAGE OF ALL MOVEMENT POINTS

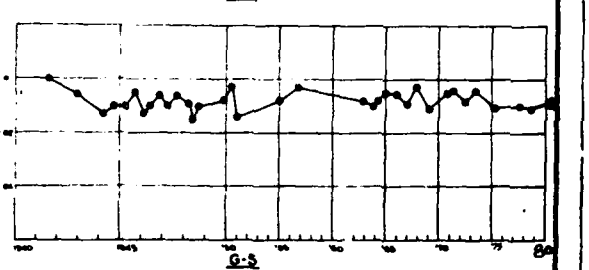


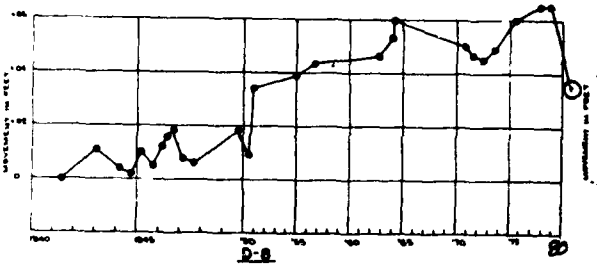


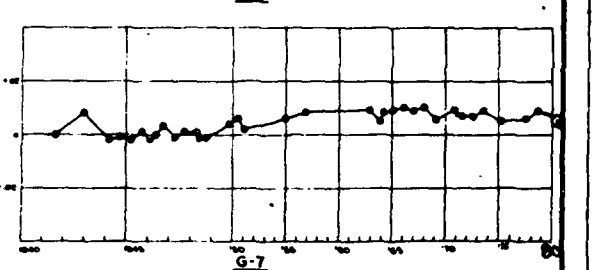


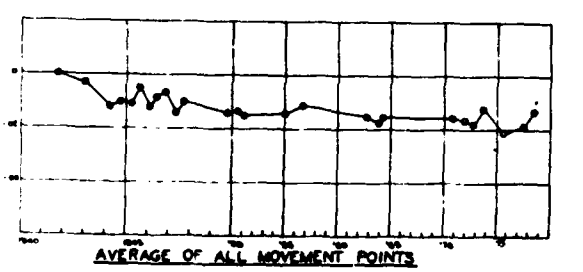












THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

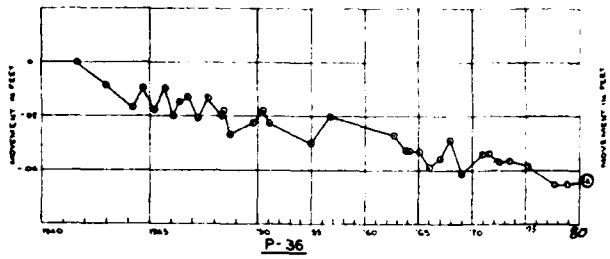
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

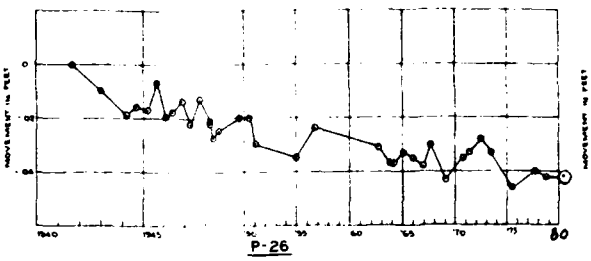
MISSOURI RIVER
FORT PECK LAKE, MONTANA
FIRST POWER PLANT
MOVEMENT OBSERVATIONS
TIME MOVEMENT RECORDS
SHEET 1 OF 2

SAFETY DAYS

CONSTRUCTION FOUNDATION REPORT PLATE 172

2


P-36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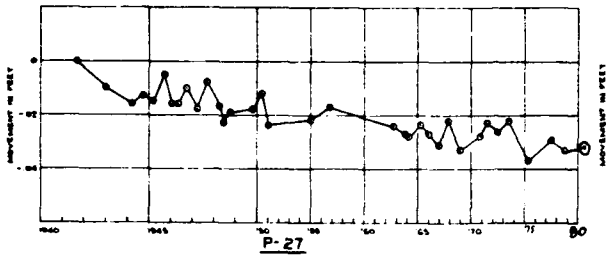
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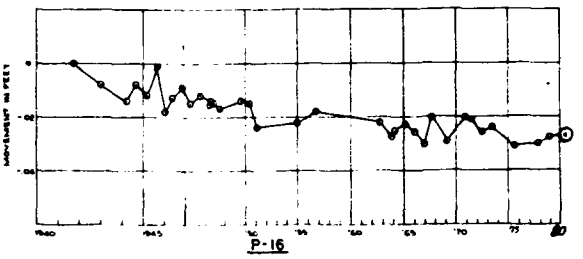
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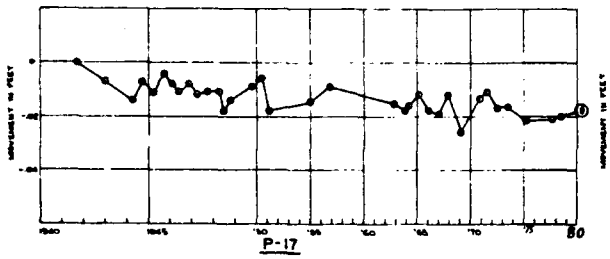
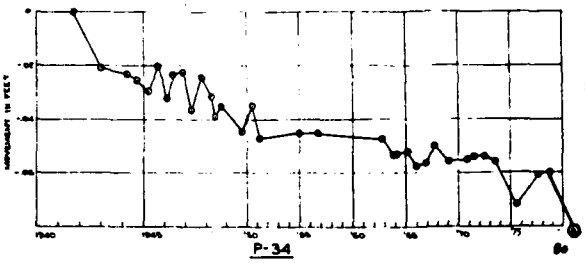
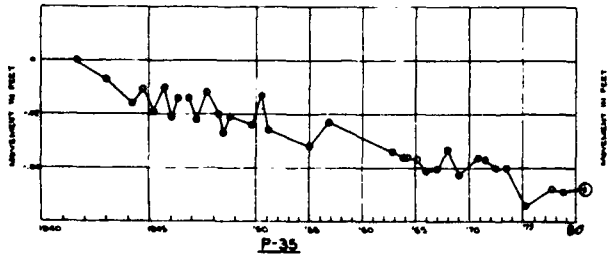
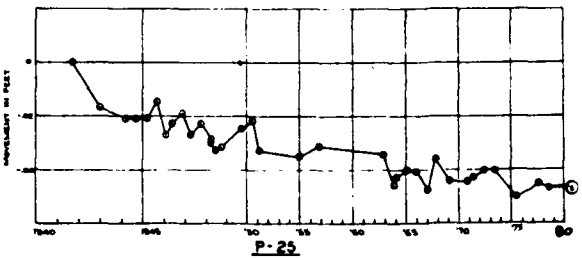
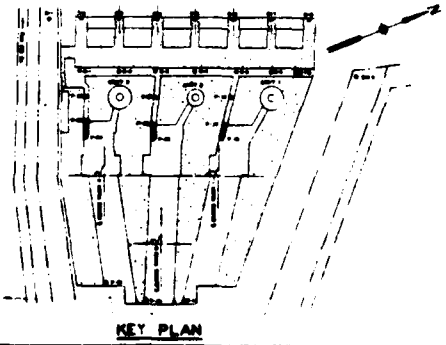
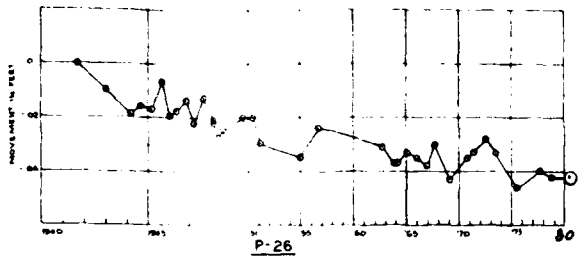

P-17

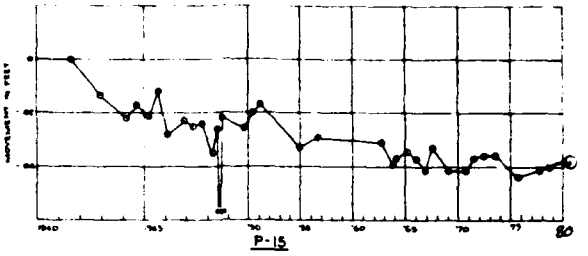

P-34

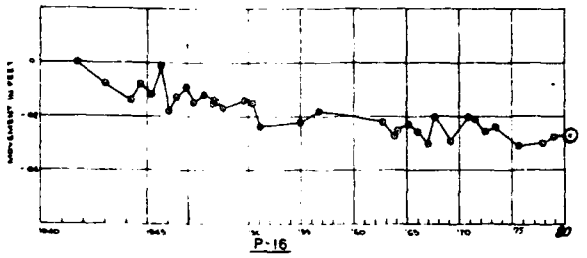

P-35

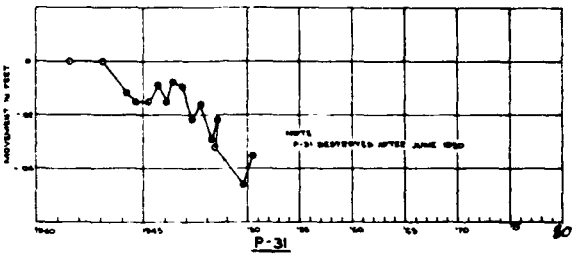

P-25

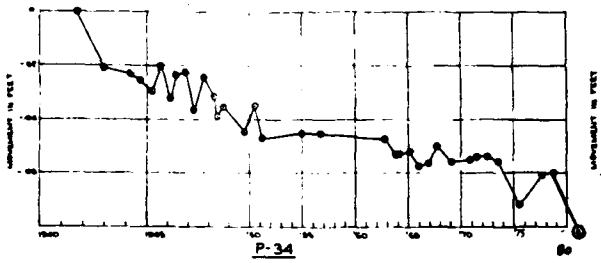

KEY PLAN

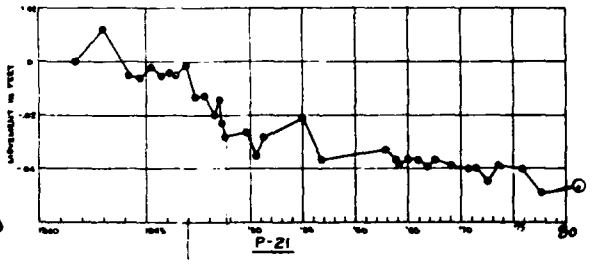


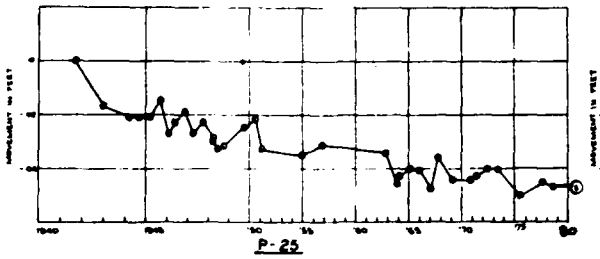


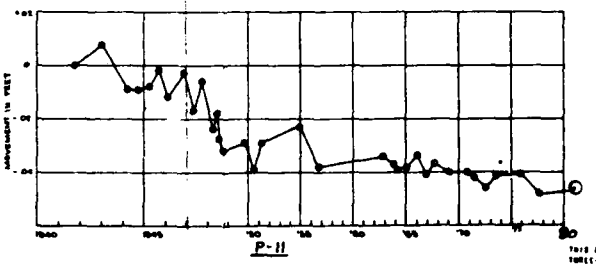










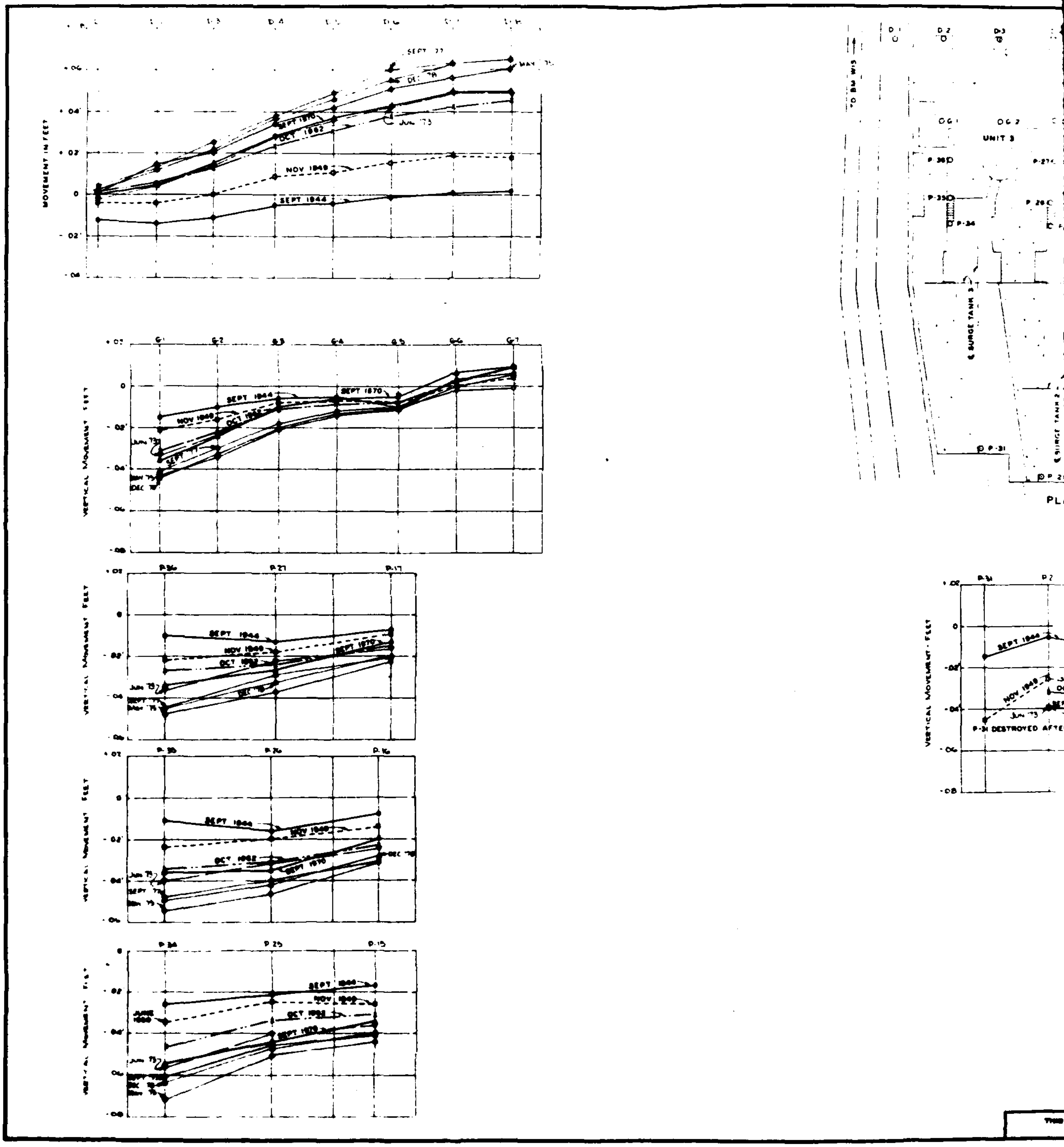


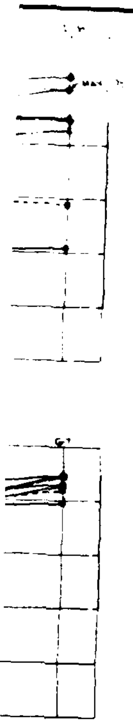
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

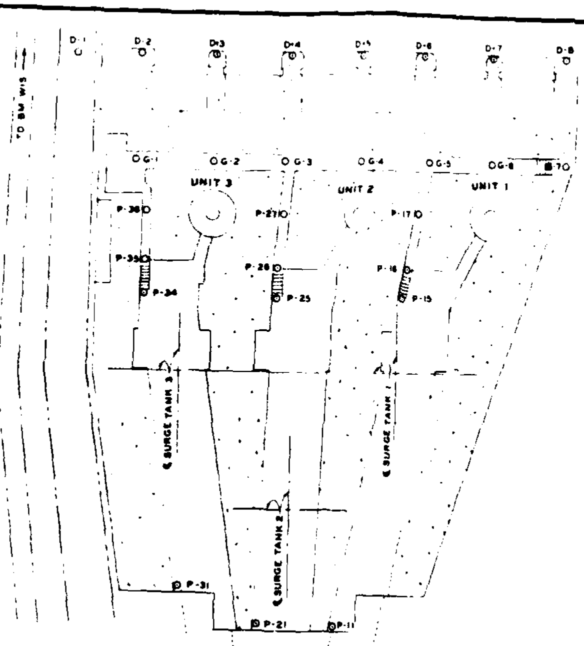
MISSOURI RIVER
FORT PECK LAKE, MONTANA
FORT PECK POWER PLANT
MOVEMENT OBSERVATIONS
TIME MOVEMENT RECORDS
SHEET 2 OF 2

SAFETY PAYS

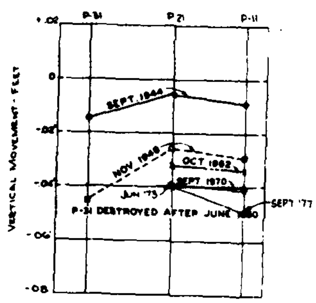
CONSTRUCTION FOUNDATION REPORT 2 PLATE 173


MOVEMENT IN FEET
SEPT 1944
NOV 1949
OCT 1962
SEPT 1970
VERTICAL MOVEMENT FEET
G-1
G-2
G-3
G-4
G-5
G-6
G-7
P-21
P-17
P-16
P-25
P-15
UNIT 3
P-31
P-31 DESTROYED AFTER





PLAN



THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

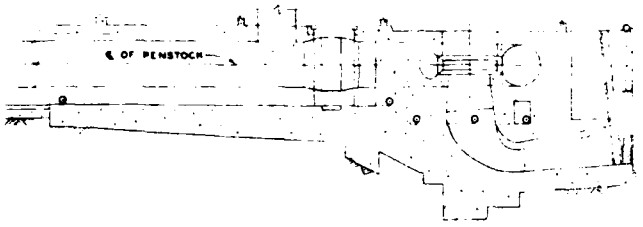
REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

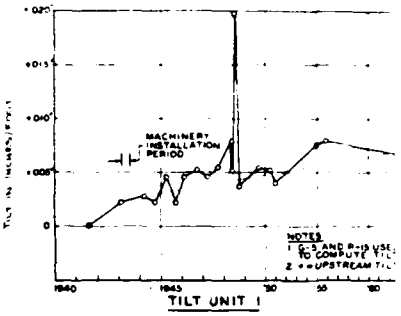
MISSOURI RIVER
FORT PECK LAKE, MONTANA
FIRST POWER PLANT
MOVEMENT OBSERVATIONS
SUMMARY OF TILT, UNITS 1, 2 & 3
SHEET 1

SAFETY PAYS

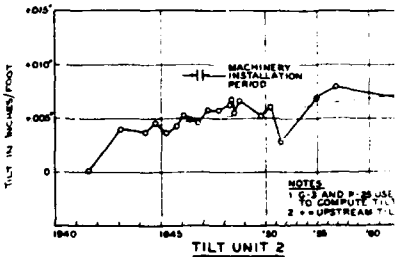
THIS PLAN ACCOMPANIES CONTRACT NO.
SPECIFICATION NO.



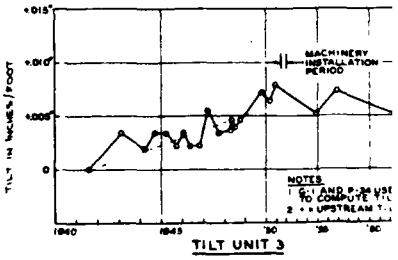
TYPICAL SECTION



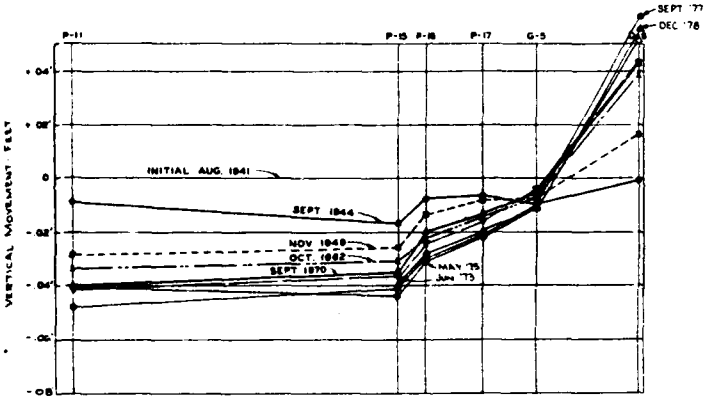
TILT UNIT 1



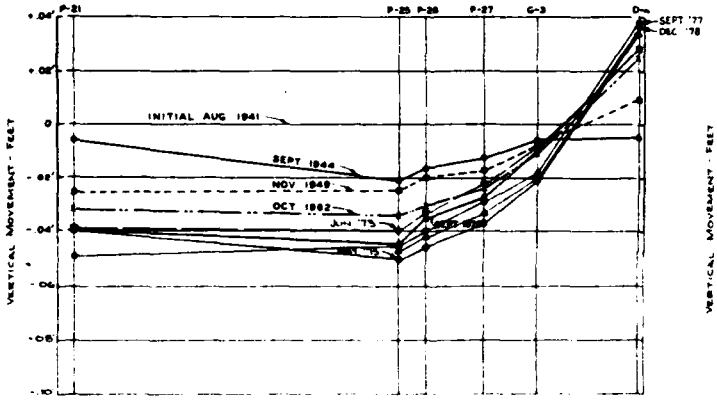
TILT UNIT 2



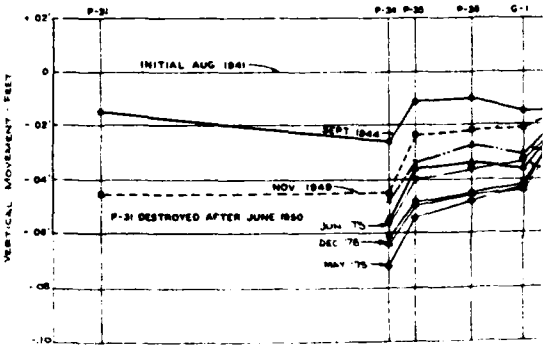
TILT UNIT 3



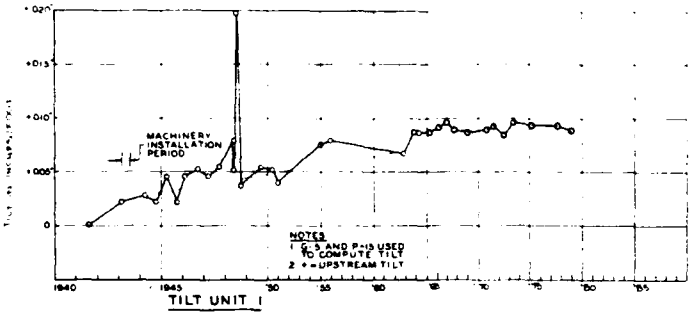
UNIT 1



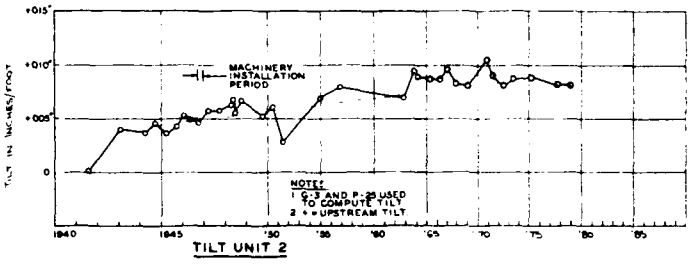
UNIT 2



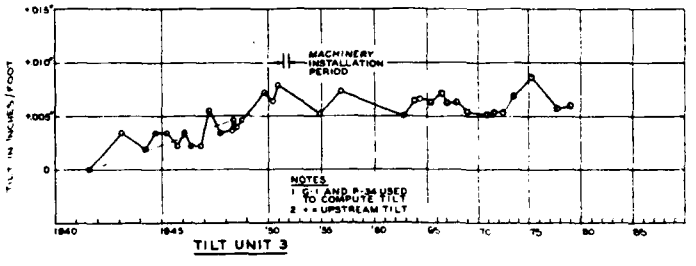
UNIT 3



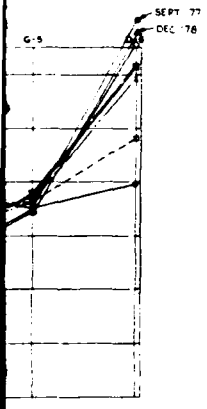
TILT UNIT 1

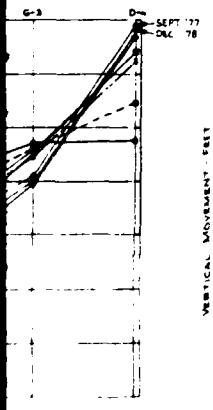


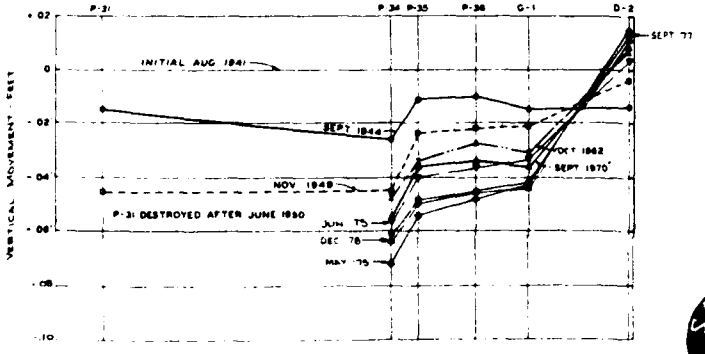
TILT UNIT 2



TILT UNIT 3







UNIT 3

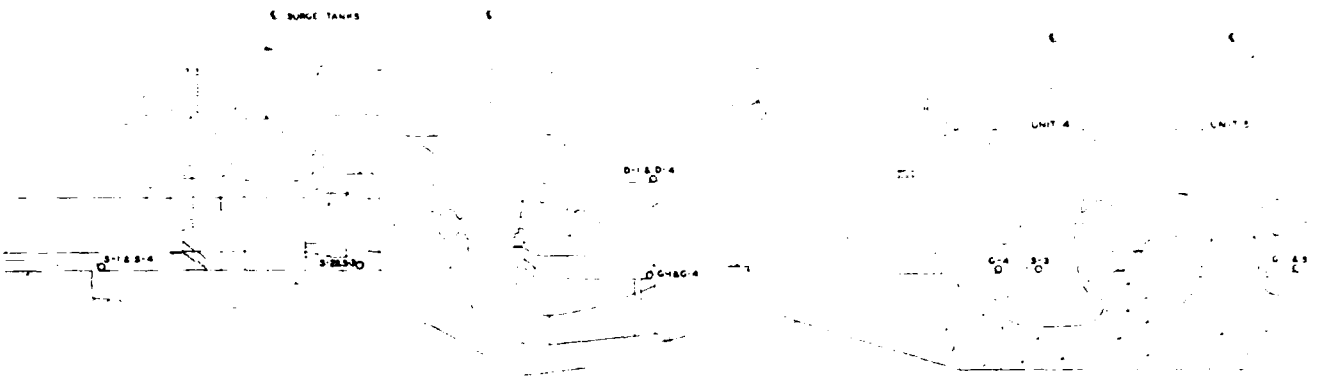
THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER
FORT PECK LAKE, MONTANA
FIRST POWER PLANT
MOVEMENT OBSERVATIONS
SUMMARY OF TILT, UNITS 1, 2 & 3
SHEET 2

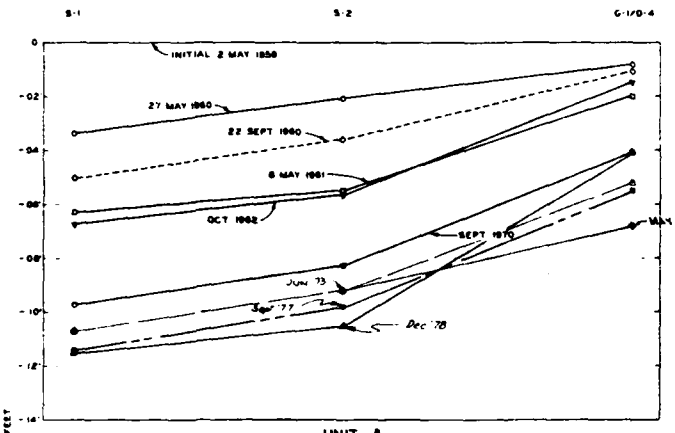
THIS PLAN ASSIGNED CONTRACT NO.
MODIFICATION NO.

CONSTRUCTION FOUNDATION REPORT 2 PLATE 175

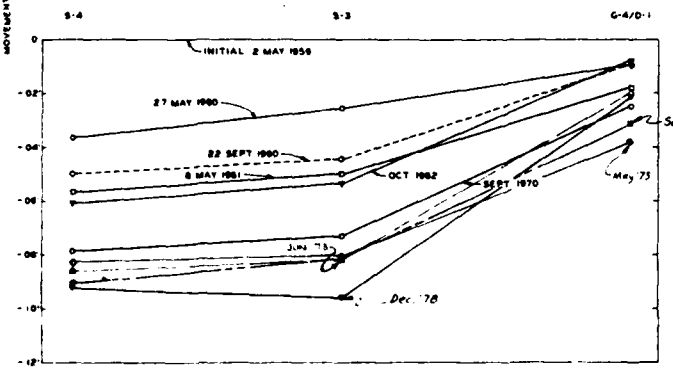


TYPICAL SECTION
UPSTREAM - DOWNSTREAM

TRANSVERSE SECTION
LOOKING UPSTREAM

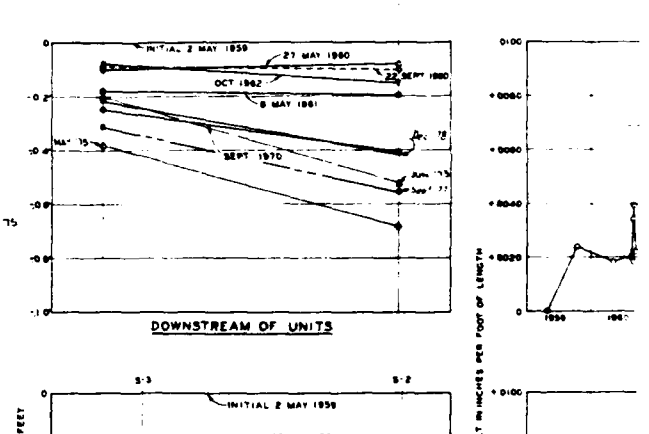


UNIT 5

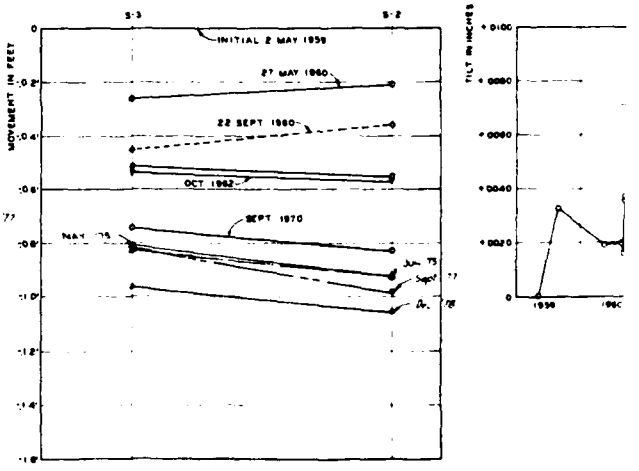


UNIT 4

UPSTREAM-DOWNSTREAM TILT OF POWERHOUSE UNITS



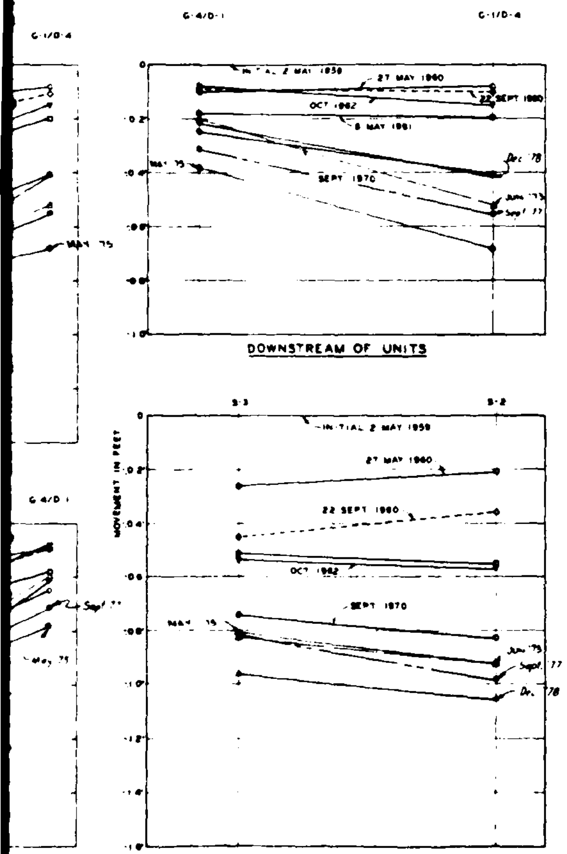
DOWNSTREAM OF UNITS



UPSTREAM OF UNITS

NORTH-SOUTH TILT OF POWERHOUSE UNITS

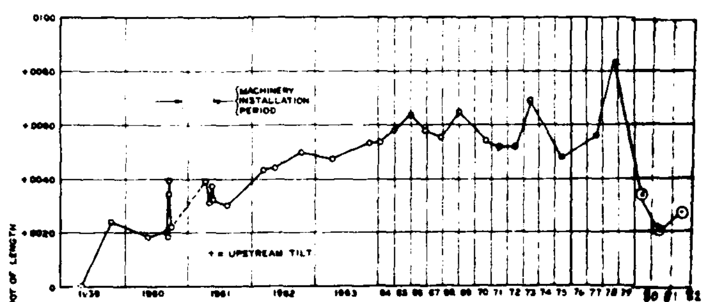
TRANSVERSE SECTION
LOOKING UPSTREAM



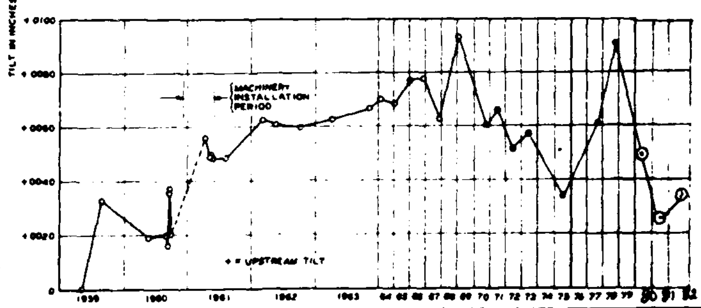
DOWNSTREAM OF UNITS

UPSTREAM OF UNITS

NORTH-SOUTH TILT OF POWERHOUSE UNITS



TILT G-4/D-1 TO S-3
UNIT 4



TILT G 1/D-4 TO S-2
UNIT 5

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE

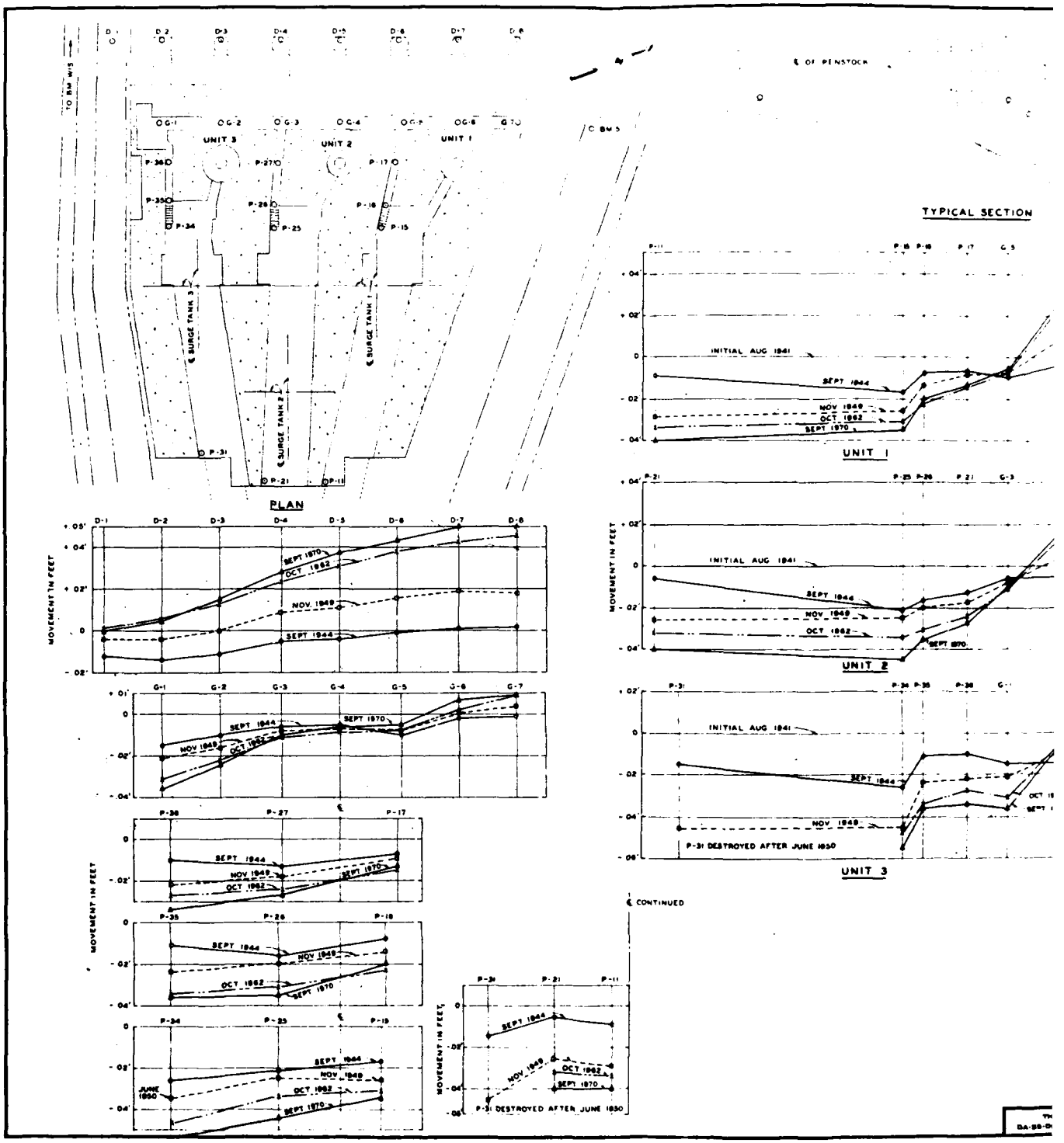
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

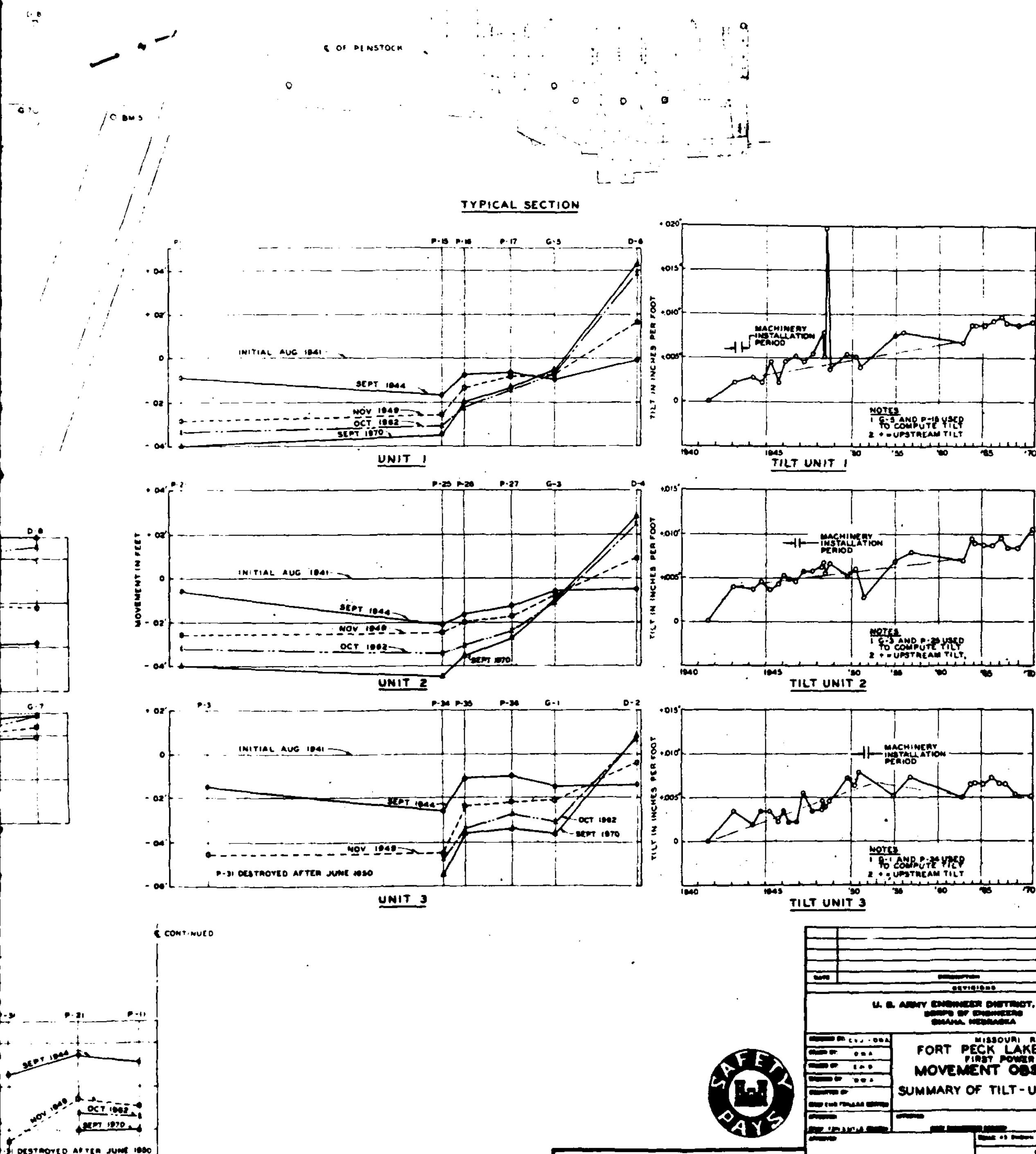
MISSOURI RIVER
FORT PECK LAKE, MONTANA
SECOND POWER PLANT
MOVEMENT OBSERVATIONS
SUMMARY OF TILT - UNITS 4 AND 5

SAFETY PAYS

CONSTRUCTION FOUNDATION REPORT

PLATE 176


PLAN
TYPICAL SECTION
UNIT 1
UNIT 2
UNIT 3
UNIT 3
P-31 DESTROYED AFTER JUNE 1950
P-31 DESTROYED AFTER JUNE 1950
CONTINUED
INITIAL AUG 1941
SEPT 1944
NOV 1949
OCT 1962
SEPT 1970
JUNE 1950
MOVEMENT IN FEET
SURGE TANK 3
SURGE TANK 2
SURGE TANK 1
TO BM W-5
BM 5
OF PENSTOCK

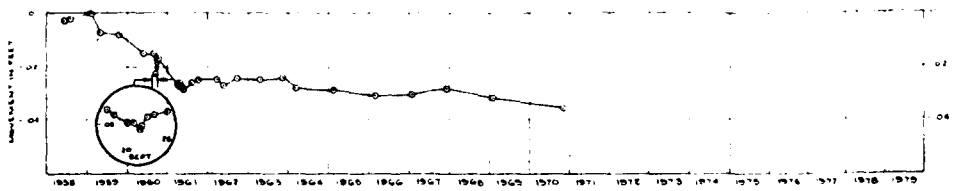


U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

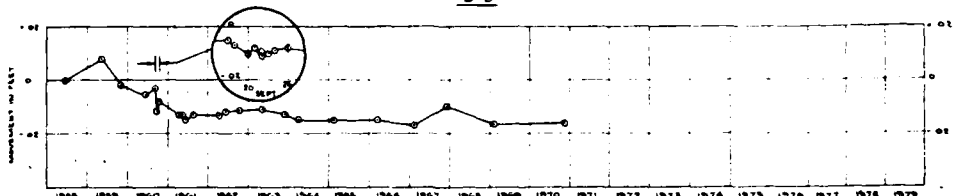
MISSOURI RIVER
FORT PECK LAKE, MONTANA
FIRST POWER PLANT
MOVEMENT OBSERVATIONS
SUMMARY OF TILT - UNITS 1, 2 AND 3

SAFETY PAYS

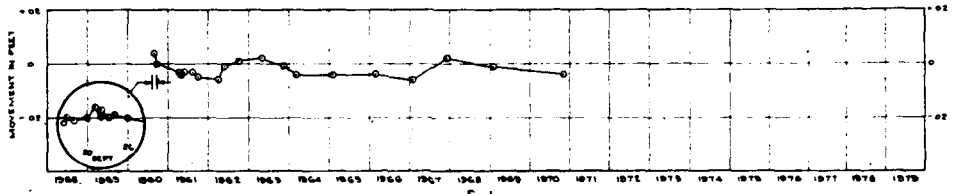
THIS PLAN ACCOMPANIES CONTRACT NO.



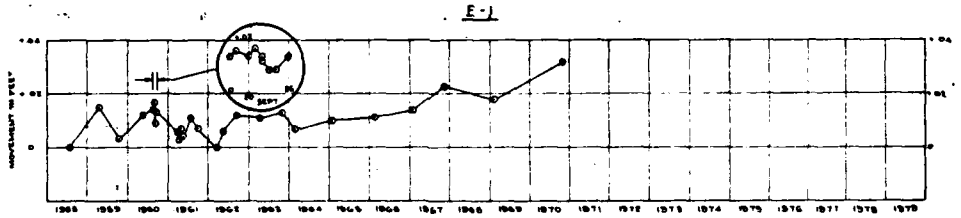
S-5



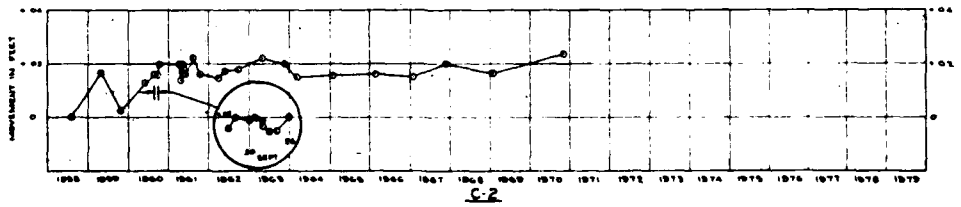
S-6



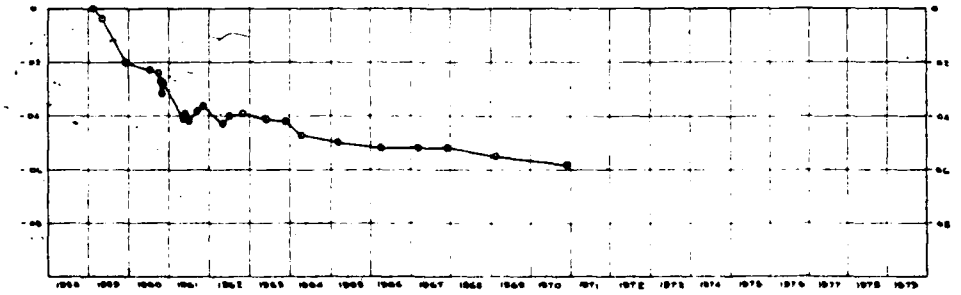
E-1



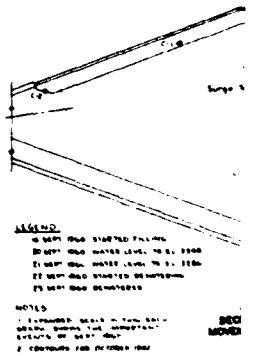
C-1

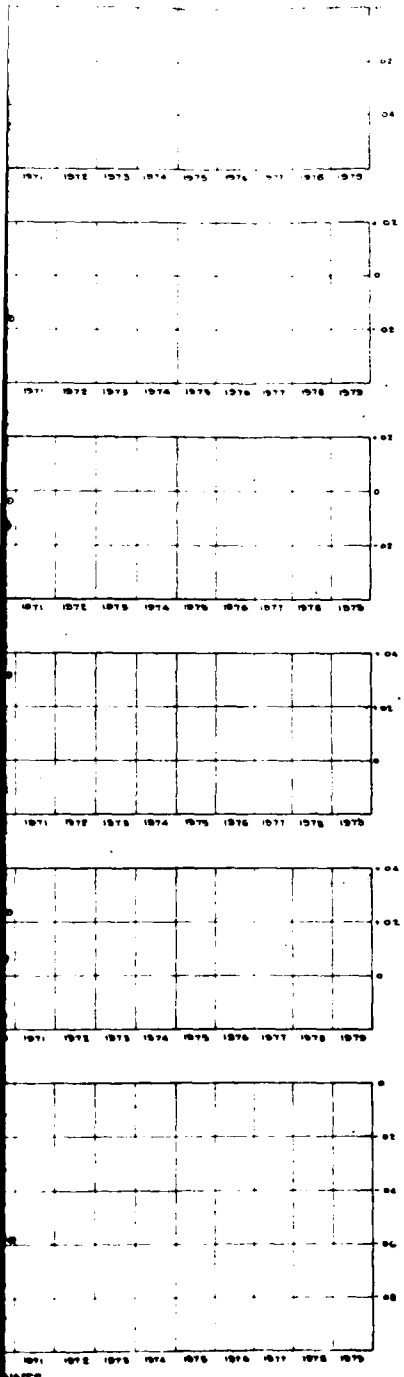


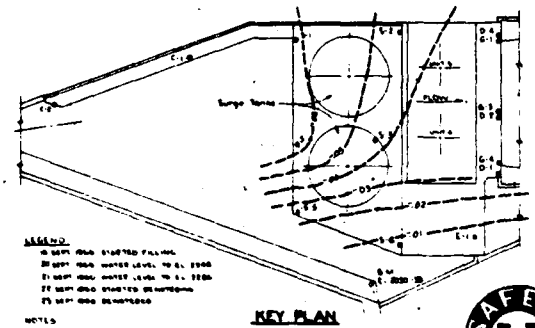
C-2



AVERAGE OF ALL MOVEMENT POINTS







KEY PLAN
SECOND POWER PLANT
MOVEMENT CONTROL POINTS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

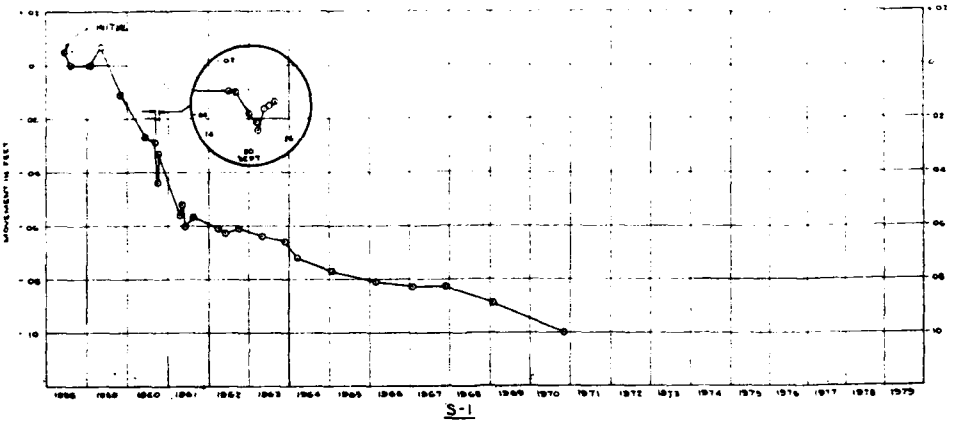
MISSOURI RIVER
FORT PECK LAKE, MONTANA
SECOND POWER PLANT

MOVEMENT OBSERVATIONS
TIME MOVEMENT RECORDS
SHEET 2 OF 2

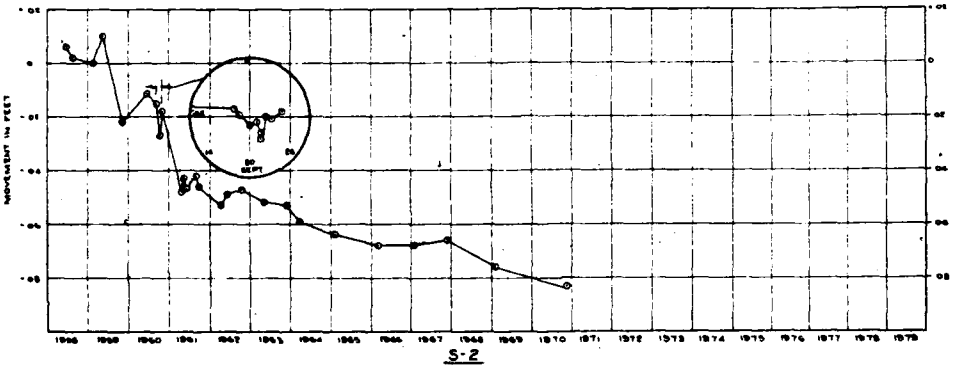
SAFETY PAYS

CONSTRUCTION FOUNDATION REPORT PLATE 178

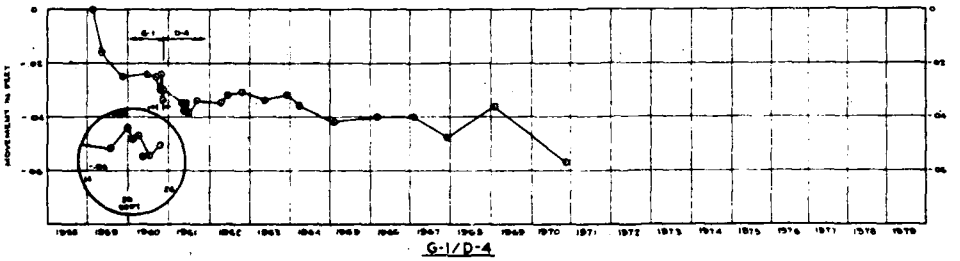
2



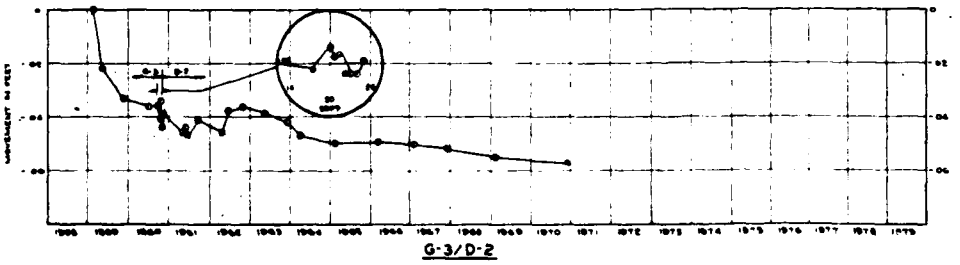
S-1



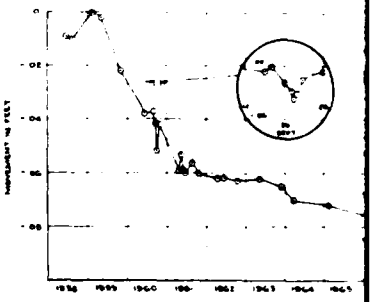
S-2

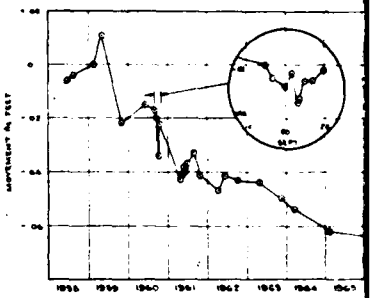


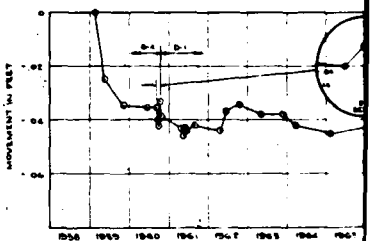
G-1/D-4

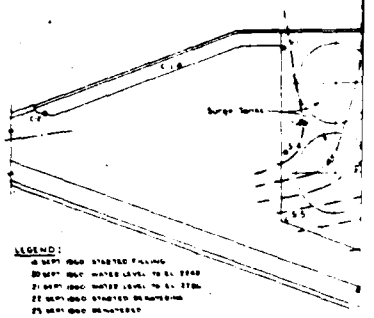


G-3/D-2





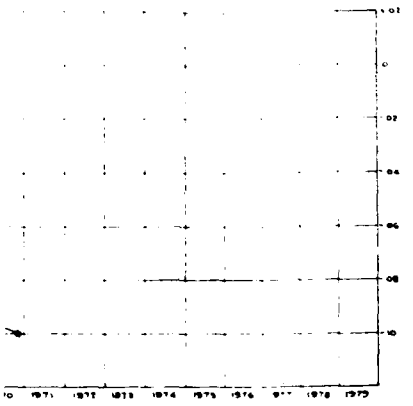


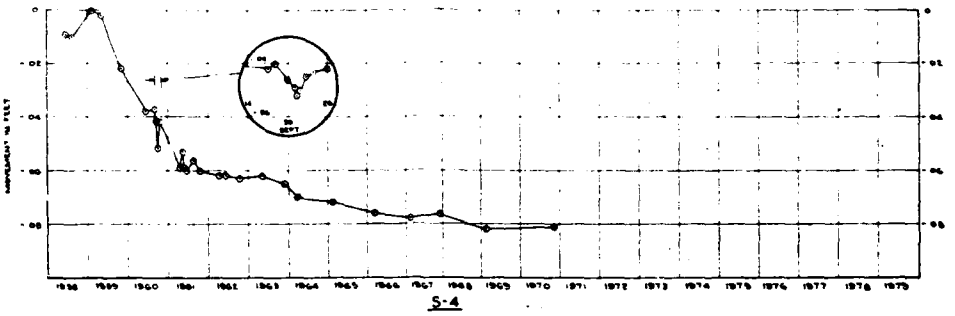


KEY PL

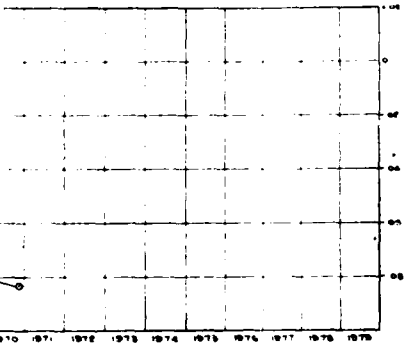
SECOND POWER

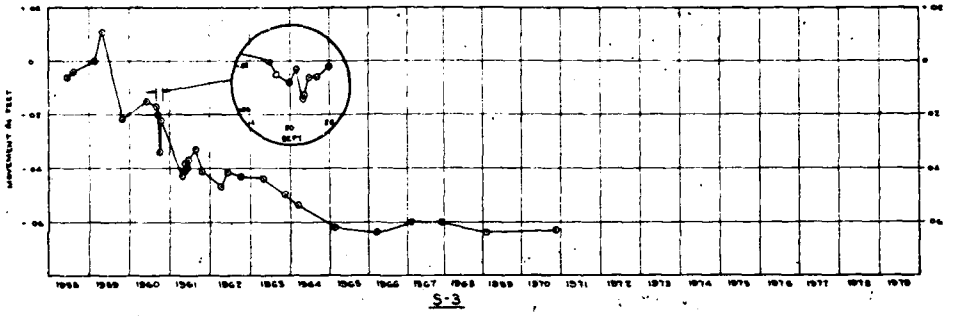
MOVEMENT CONTR



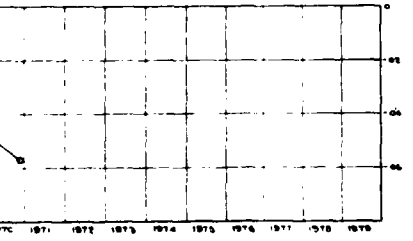


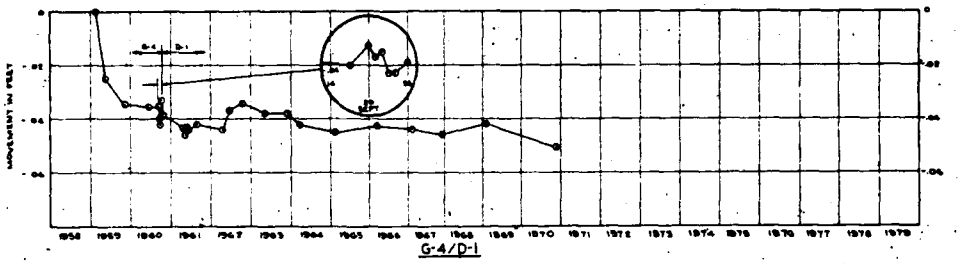
S-4



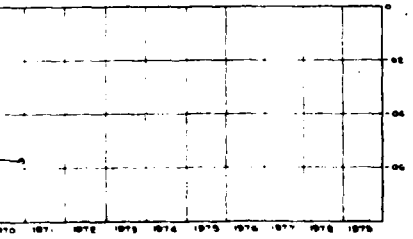


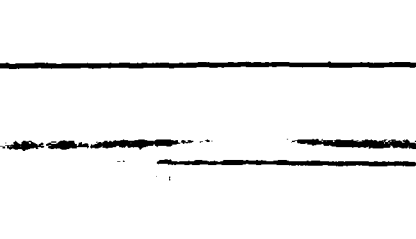
S-3

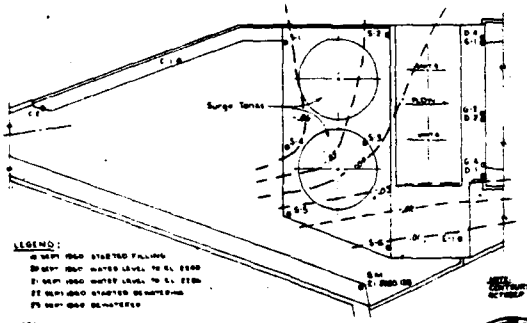




G-4/D-1







KEY PLAN
SECOND POWER PLANT
MOVEMENT CONTROL POINTS

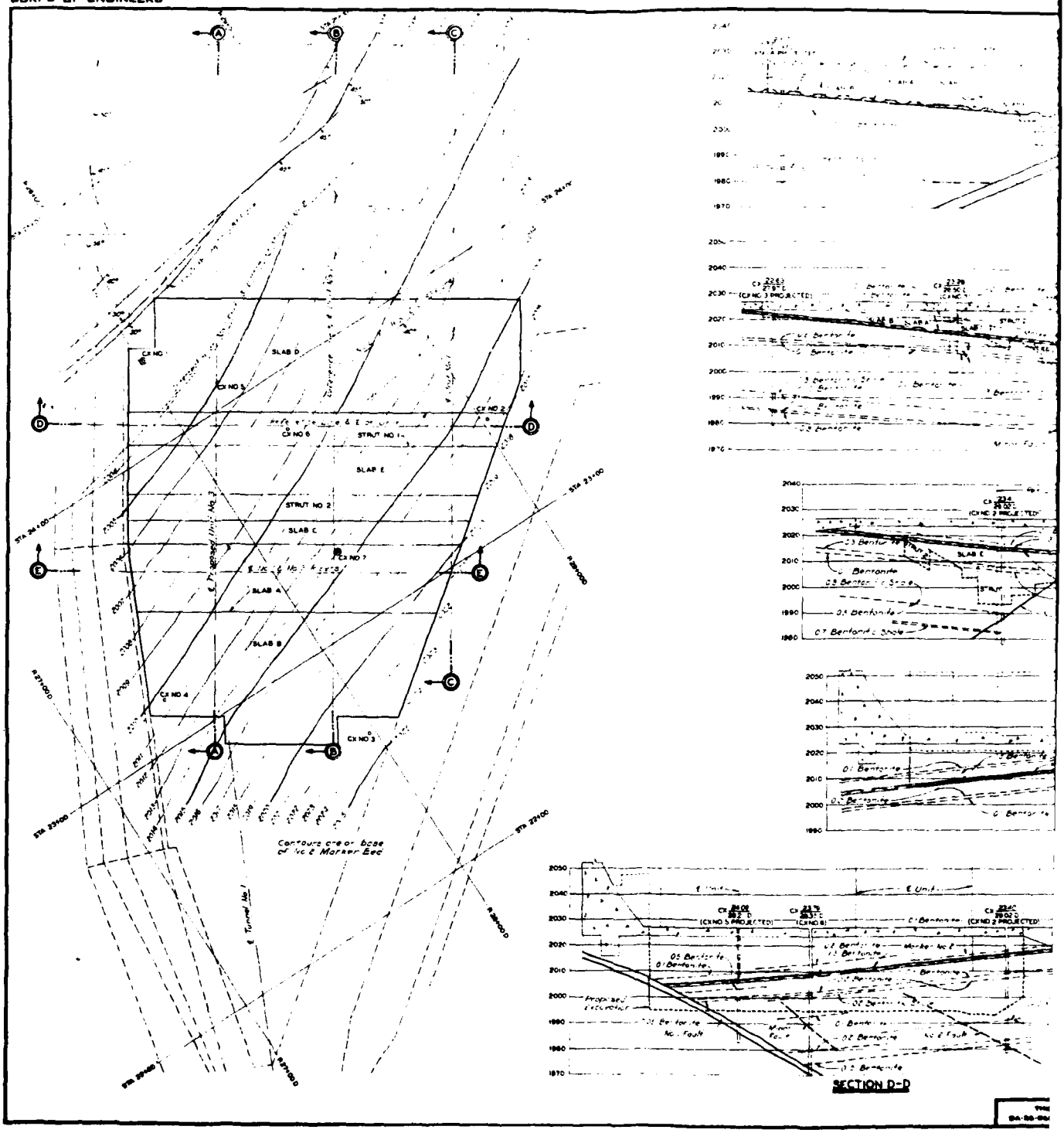
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

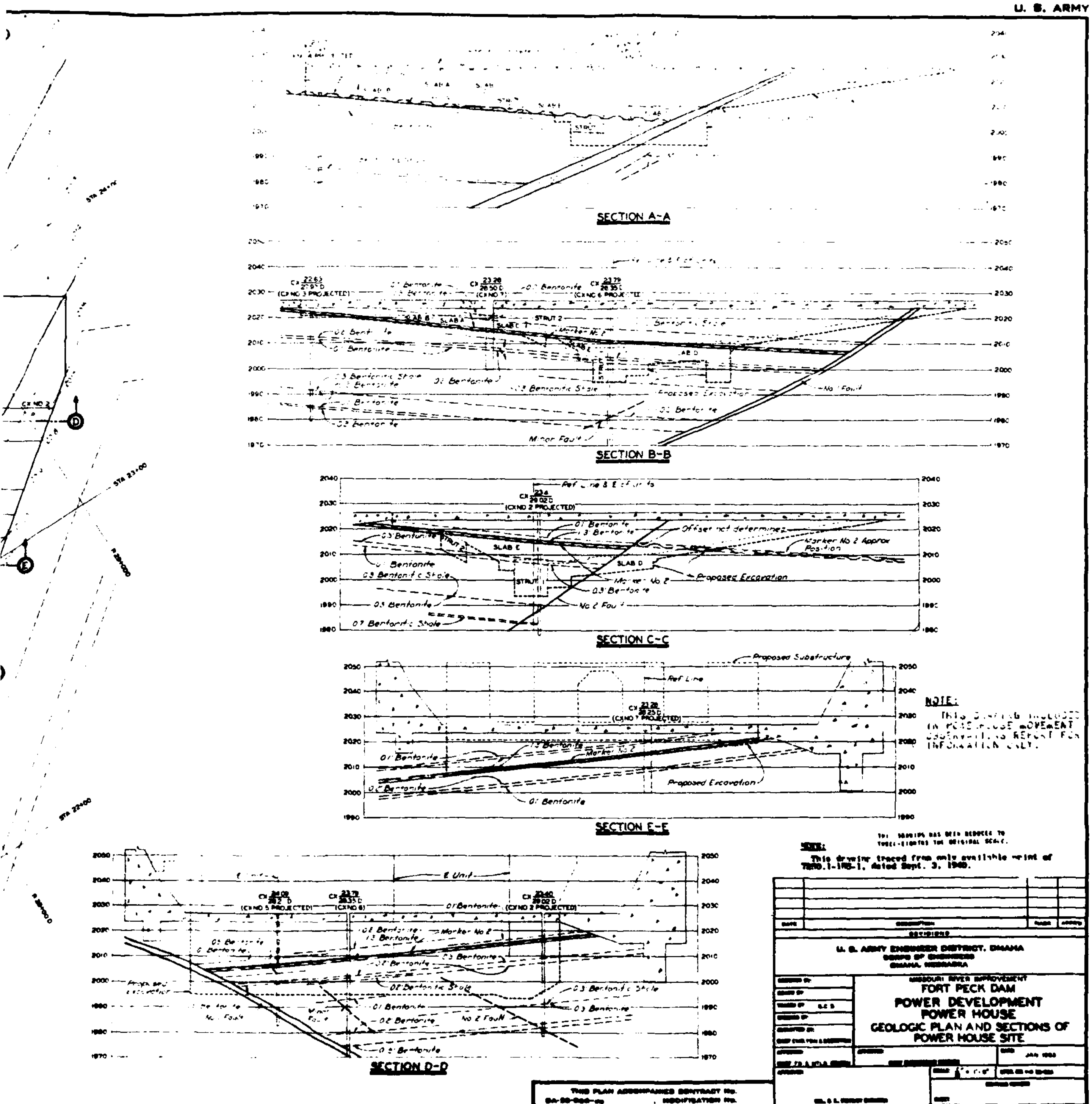
MISSOURI RIVER
FORT PECK LAKE, MONTANA
SECOND POWER PLANT
MOVEMENT OBSERVATIONS
TIME MOVEMENT RECORDS
SHEET 1 OF 2

SAFETY PAYS

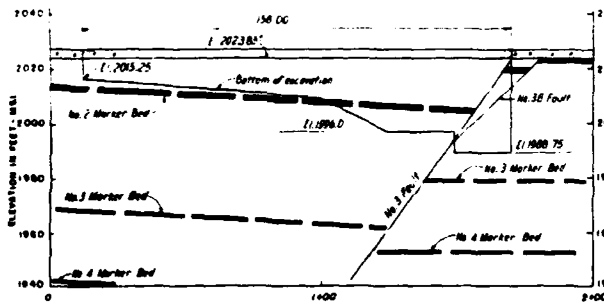
CONSTRUCTION FOUNDATION REPORT 2 PLATE 179

CORPS OF ENGINEERS

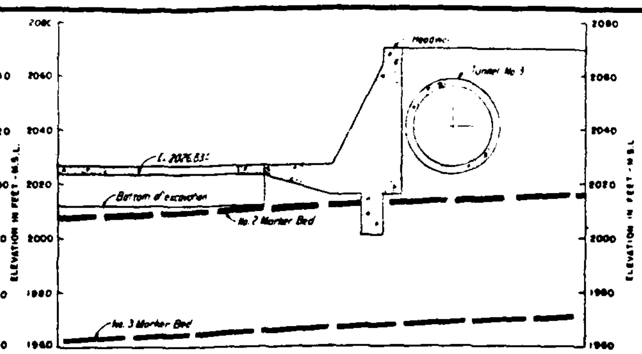



U. S. ARMY
SECTION A-A
SECTION B-B
SECTION C-C
SECTION E-E
SECTION D-D
STRUT
Proposed Excavation
Proposed Substructure
Ref Line
Marker No 2
No 2 Fault
Minor Fault
0.1 Bentonite
0.3 Bentonite
0.3 Bentonitic Shale
Offset not determined
SLAB C
SLAB D
E Unit
CX NO 2 PROJECTED
STA 23+00
STA 22+00
NOTE:
This drawing traced from only available print of
Sept. 3, 1940.
U. S. ARMY ENGINEER DISTRICT, OMAHA
MISSOURI RIVER IMPROVEMENT
FORT PECK DAM
POWER DEVELOPMENT
POWER HOUSE
GEOLOGIC PLAN AND SECTIONS OF
POWER HOUSE SITE

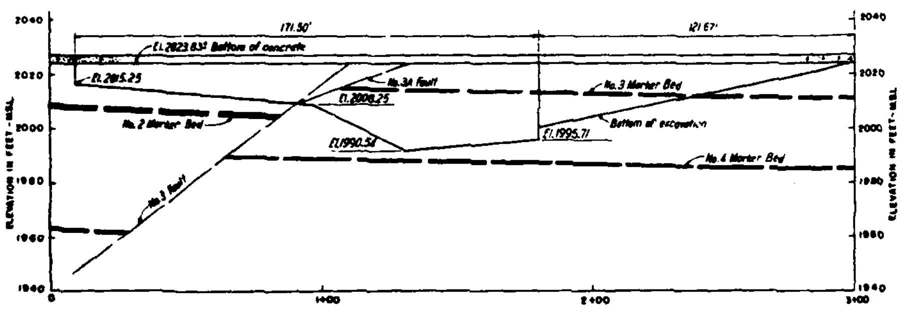
2



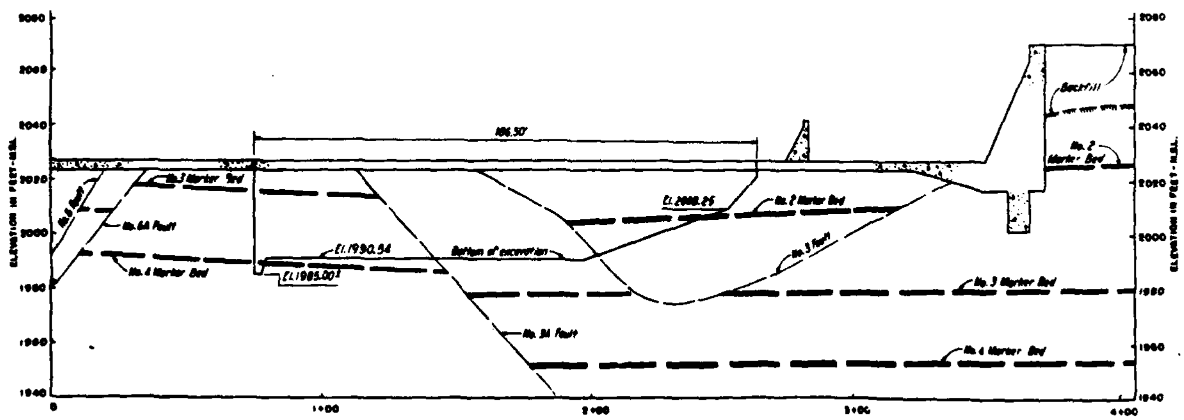
PROFILE A-A
SCALE 1" = 20'



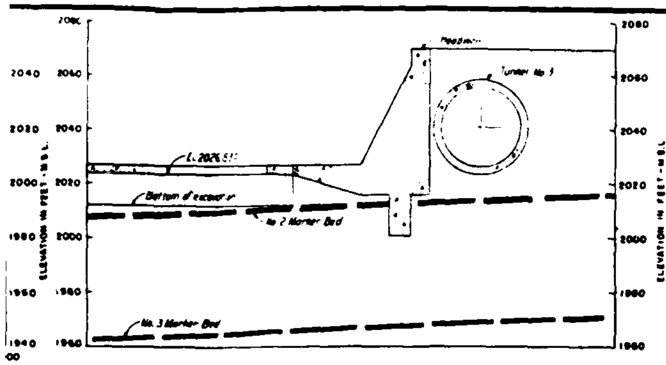
PROFILE D-D



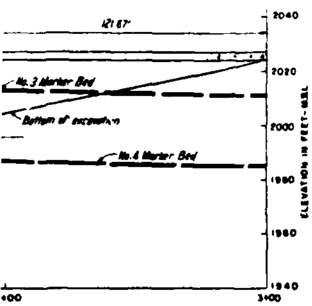
PROFILE B-B
SCALE 1" = 20'

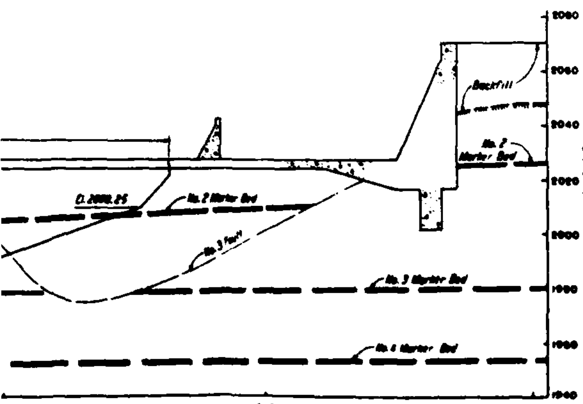


PROFILE C-C

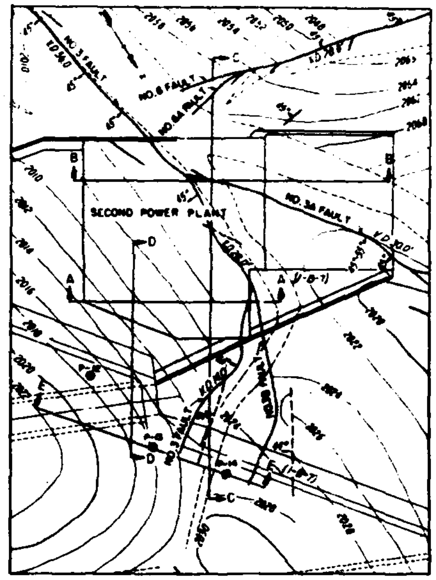


PROFILE D-D
SCALE 1"=20'





LE C-C



LOCATION PLAN
SCALE 1"=50'

NOTES:

Contours are on No. 2 Bentonite marker bed
Symbols: 45° = Dip of fault plane
V.D. 20.0' = Vertical displacement of fault

REFERENCE DWGS.
EXCAVATION (1-B-9)

NOTES:

Mark this drawing with 1-B-7
- Geologic interpretations shown on profiles based on adjacent borings and geologic mapping completed during initial excavations in the area.

NOTE:
THIS DRAWING INCLUDED IN THE POWER-HOUSE MOVEMENT OBSERVATIONS REPORT FOR INFORMATION ONLY.

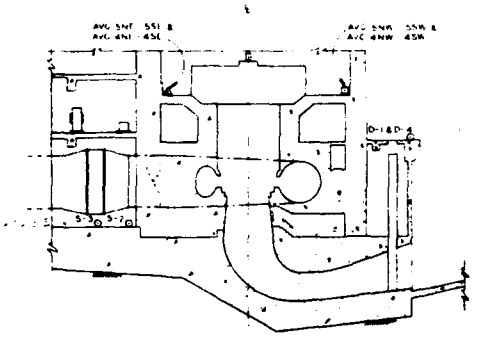
THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

GENERAL
FOUNDATION EXPLORATIONS

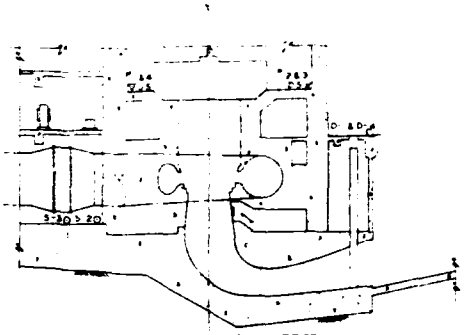
MAY 1956

2

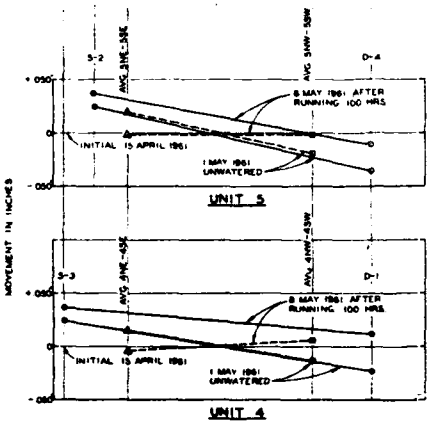
CORPS OF ENGINEERS



SURGE TANK UNWATERING TEST
TYPICAL SECTION

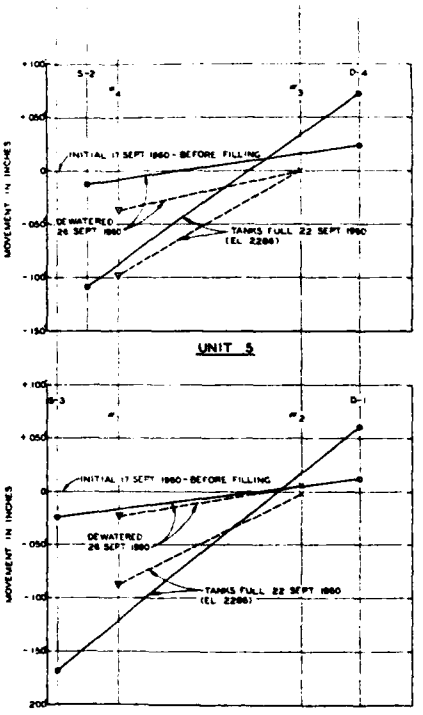


SURGE TANK LOADING TEST
TYPICAL SECTION



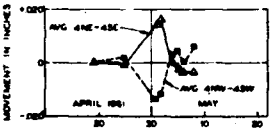
UNIT 5

UNIT 4

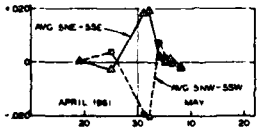


UNIT 5

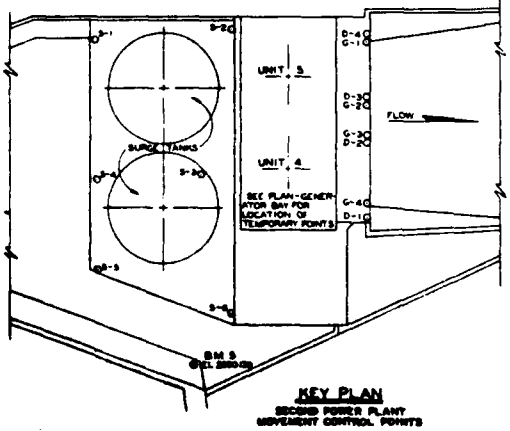
UNIT 4



TIME MOVEMENT - UNIT 4



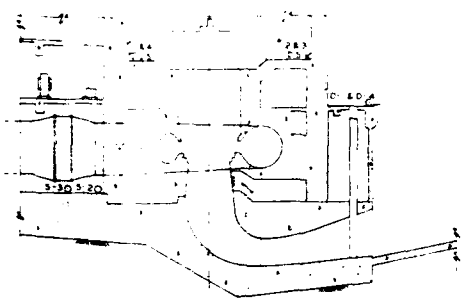
TIME MOVEMENT - UNIT 5



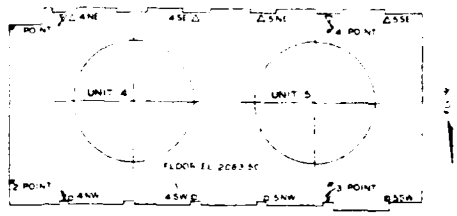
KEY PLAN
SECOND POWER PLANT
MOVEMENT CONTROL POINTS

LEGEND:

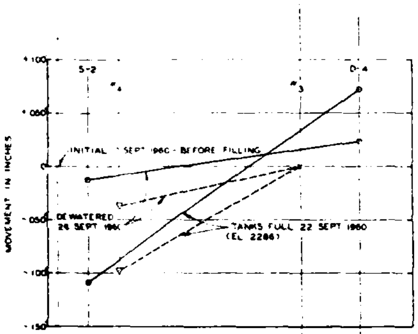
17 Sept.	1960	Before Initia
18 Sept.	1960	Penste
20 Sept.	1960	Water
21 Sept.	1960	Water
22 Sept.	1960	Tanks
23 Sept.	1960	Water
24 Sept.	1960	Crample
25 Sept.	1960	Dewate
26 Sept.	1960	Dewate
25 Apr.	1961	Before
1 May	1961	Penste
2 May	1961	2d hou
4 May	1961	Penste
8 May	1961	After



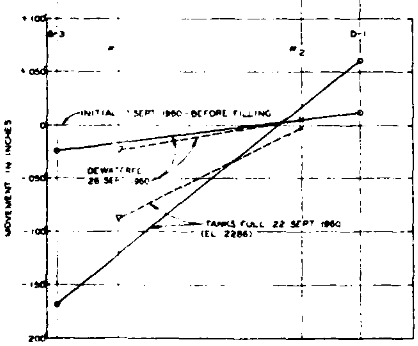
SURGE TANK LOADING TEST
TYPICAL SECTION



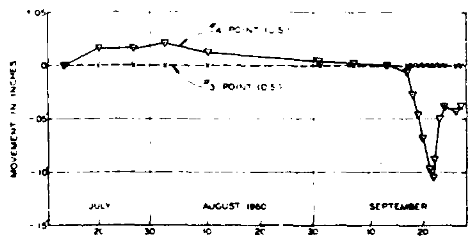
PLAN - GENERATOR BAY



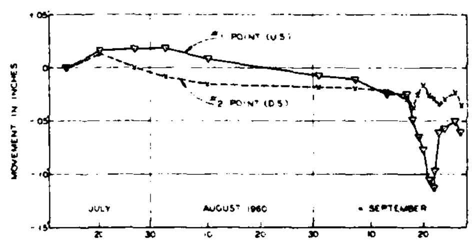
UNIT 5



UNIT 4



TIME MOVEMENT - UNIT 5



TIME MOVEMENT - UNIT 4

LEGEND:

17 Sept. 1960	Before filling Penstocks & Surge Tanks - Initial Elev. 2032.028
18 Sept. 1960	Penstocks filled to Elev. 2058
20 Sept. 1960	Water level - Elev. 2249
21 Sept. 1960	Water level - Elev. 2286
22 Sept. 1960	Tanks filled for 24 hours - 0800
22 Sept. 1960	Water level Elev. 2228 - Dewatering - 1500
23 Sept. 1960	Completely Dewatered
24 Sept. 1960	Dewatered for 36 hours
26 Sept. 1960	Dewatered for 3 days
25 Apr. 1961	Before Unwatering
1 May 1961	Penstocks & Surge Tanks Unwatered
2 May 1961	24 hours after Unwatering
4 May 1961	Penstocks & Surge Tanks Watered-up
8 May 1961	After running - Mechanical Test - 100 hours

THIS DRAWING HAS BEEN REDUCED TO THREE-EIGHTHS THE ORIGINAL SCALE.

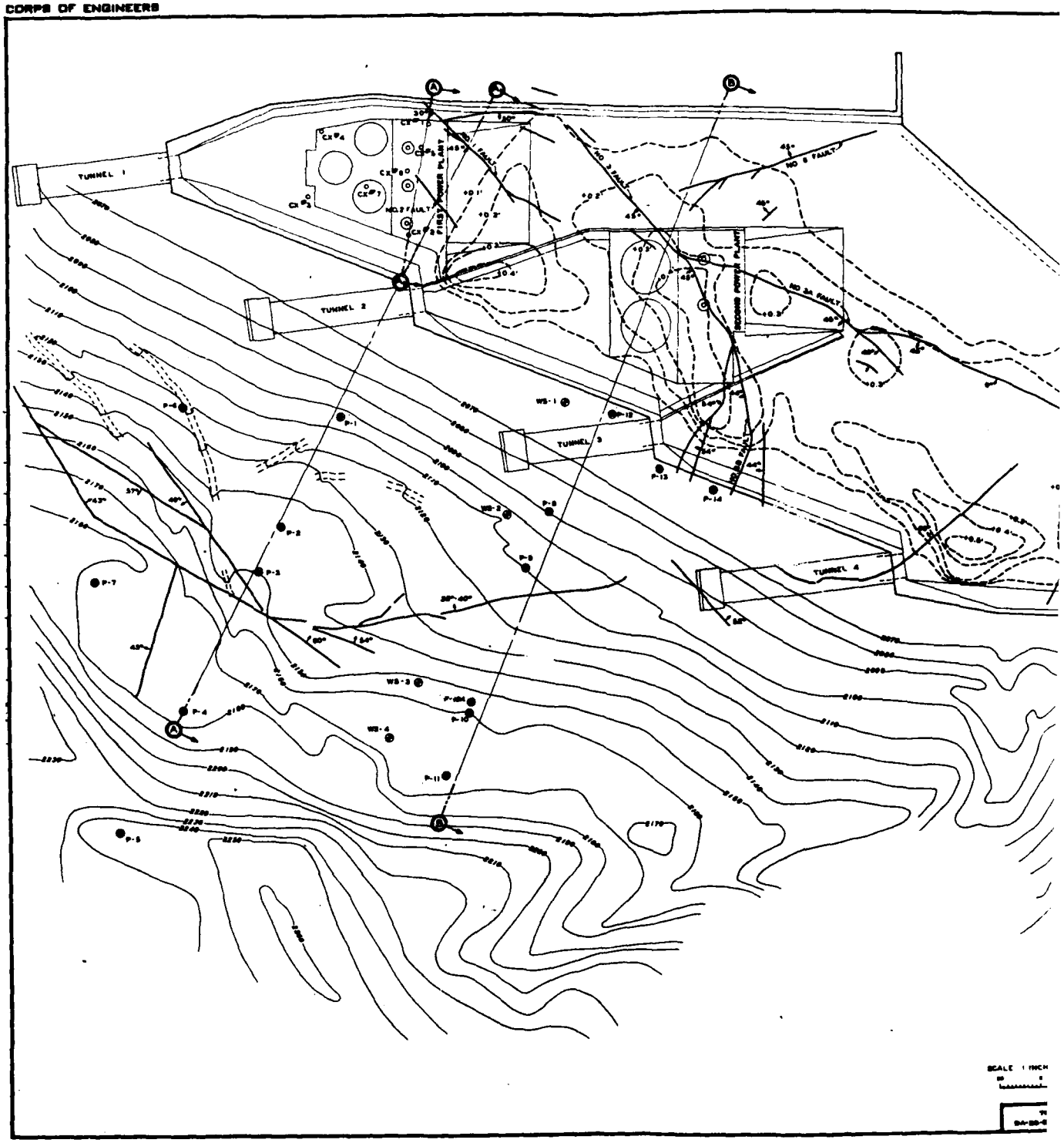
SAFETY PAYS

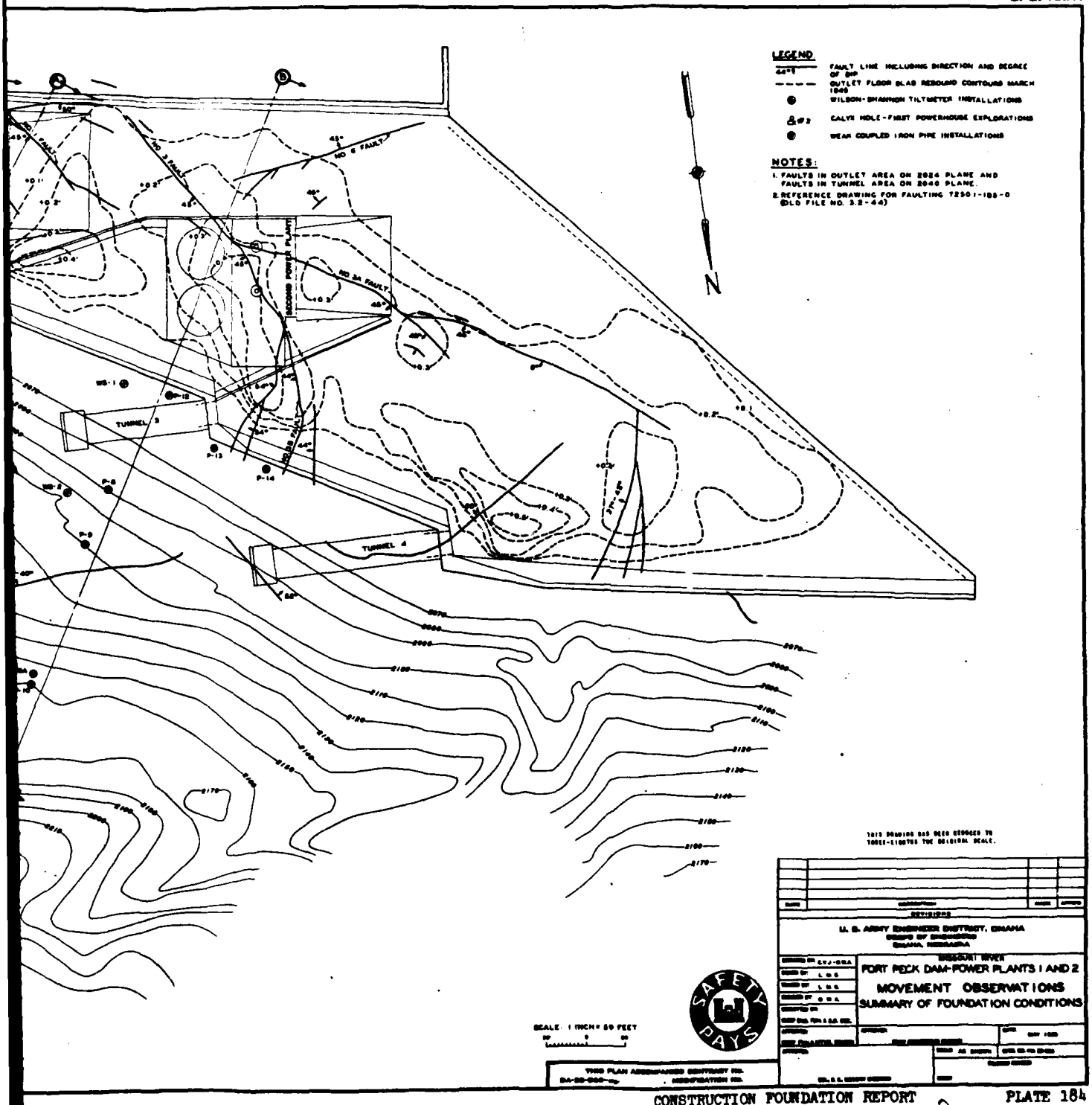
REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

MISSOURI RIVER
FT PECK DAM - SECOND POWER PLANT
MOVEMENT OBSERVATIONS
LOADING AND UNLOADING TESTS

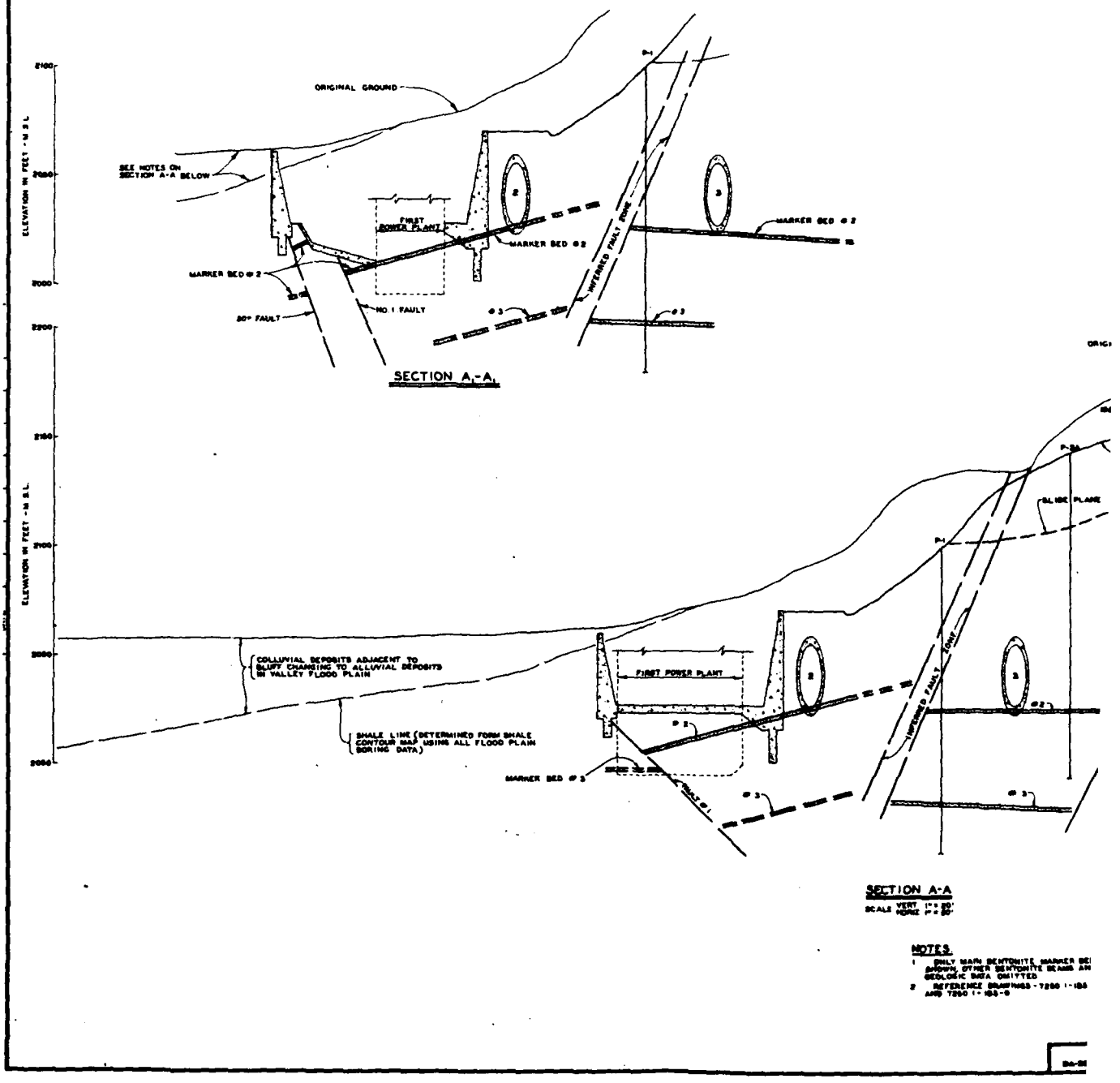
CORPS OF ENGINEERS





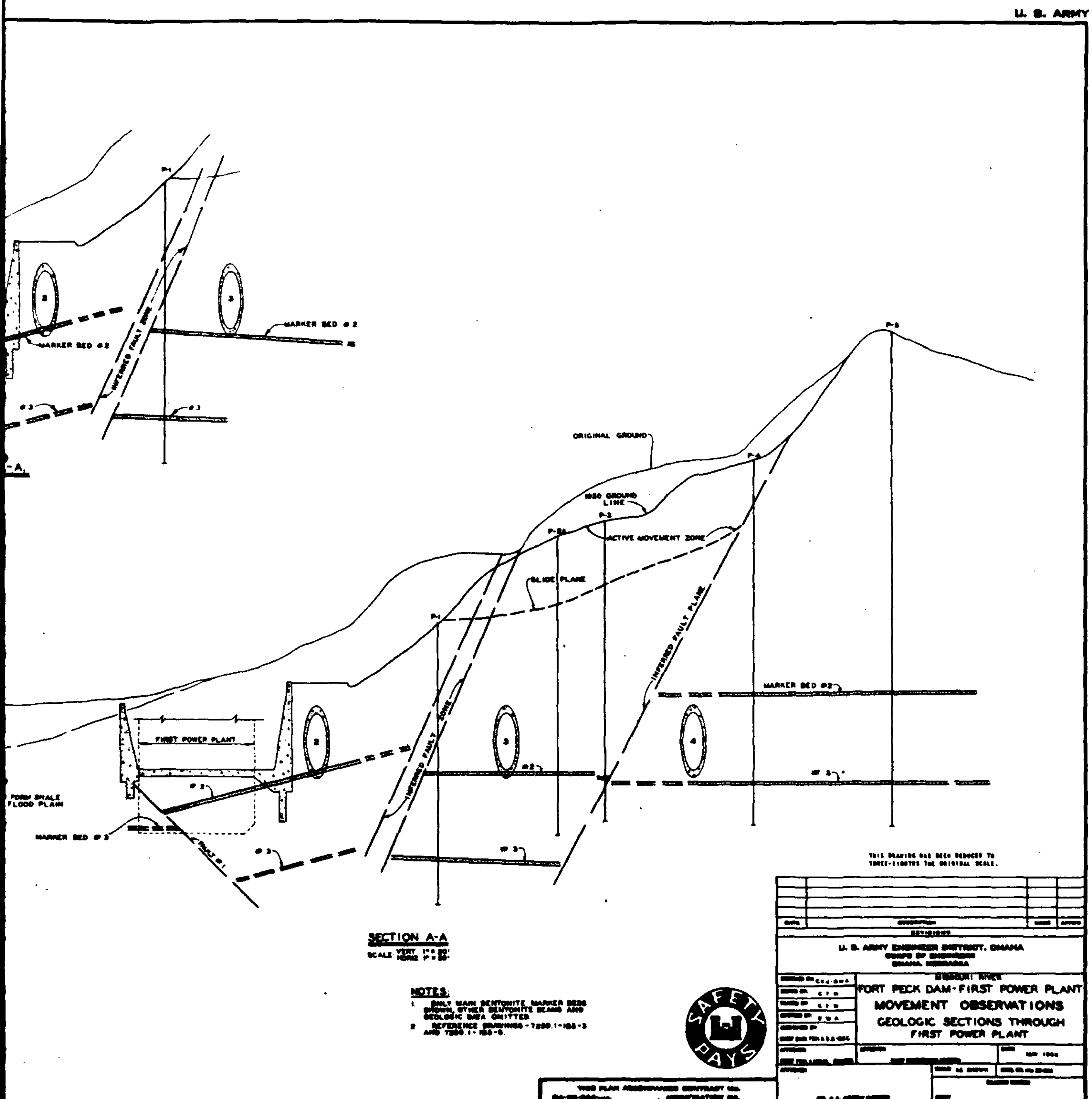
CONSTRUCTION FOUNDATION REPORT 2 PLATE 184

CORPS OF ENGINEERS

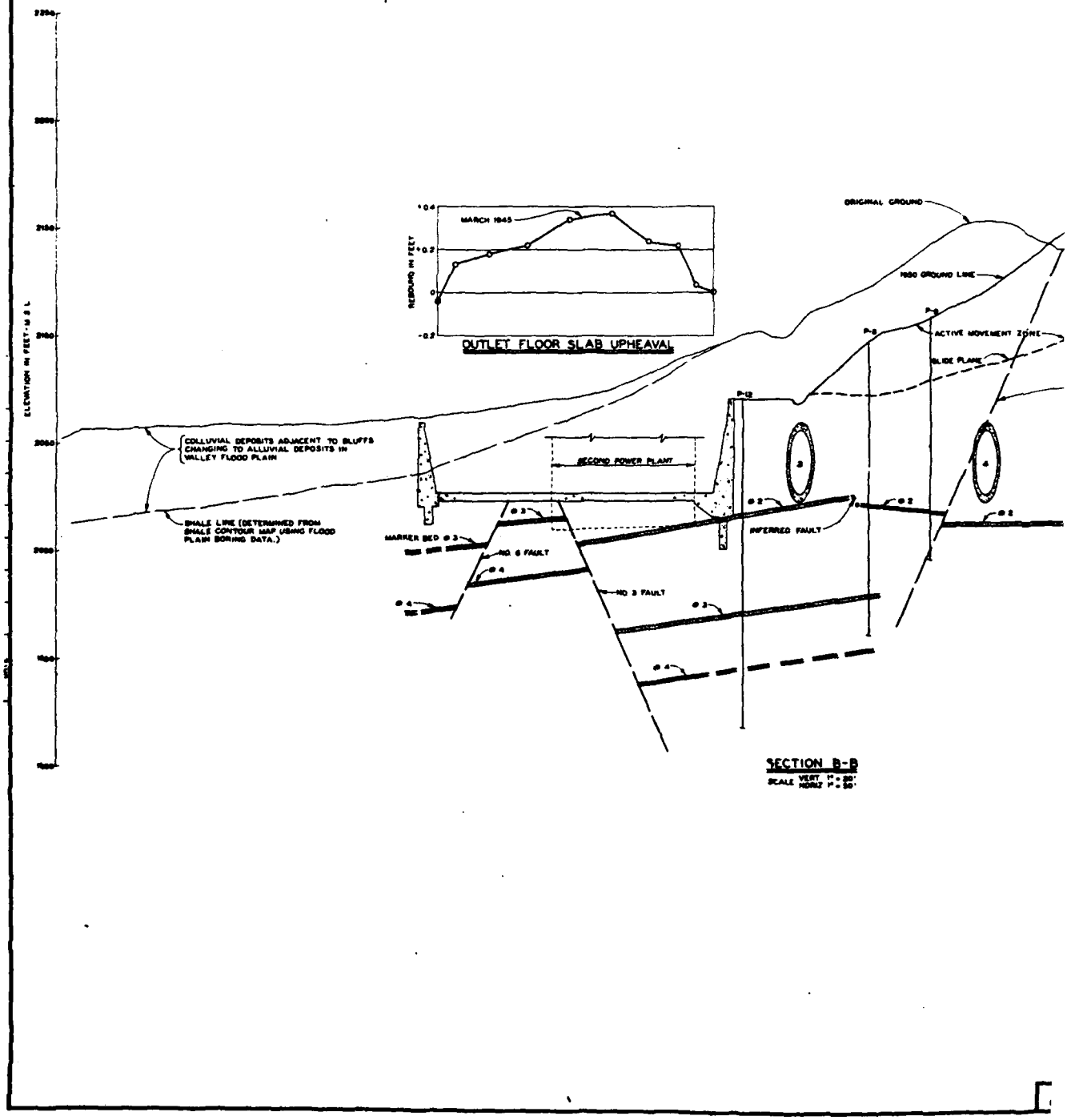


NOTES.

1. ONLY MAIN BENTONITE MARKER BE... SHOWN, OTHER BENTONITE BEDS AR... GEOLOGIC DATA OMITTED
2. REFERENCE DRAWINGS - 7250 1-105 AND 7250 1-105-D

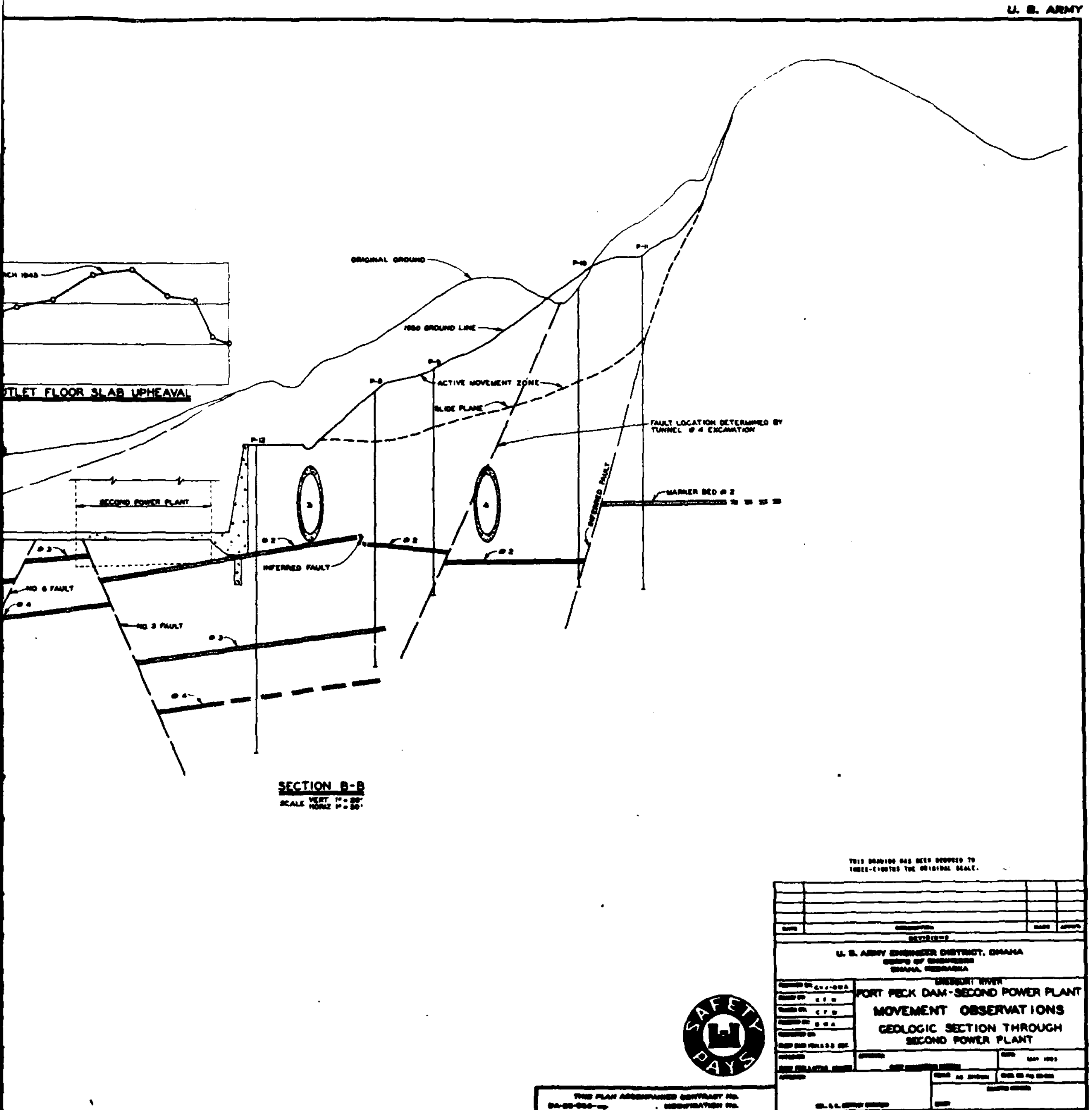

U. S. ARMY
P-1
MARKER BED # 2
INFERRED FAULT ZONE
ORIGINAL GROUND
1950 GROUND LINE
P-2A
P-3
P-4
P-5
ACTIVE MOVEMENT ZONE
SLIDE PLANE
INFERRED FAULT PLANE
FIRST POWER PLANT
MARKER BED # 3
FAULT # 1
SECTION A-A
NOTES:
1. ONLY MAIN BENTONITE MARKER BEDS SHOWN, OTHER BENTONITE SEAMS AND GEOLOGIC DATA OMITTED
2. REFERENCE DRAWINGS - 7250.1-185-3 AND 7250.1-185-6.
U. S. ARMY ENGINEER DISTRICT, OMAHA
FORT PECK DAM - FIRST POWER PLANT
MOVEMENT OBSERVATIONS
GEOLOGIC SECTIONS THROUGH FIRST POWER PLANT
SAFETY PAYS

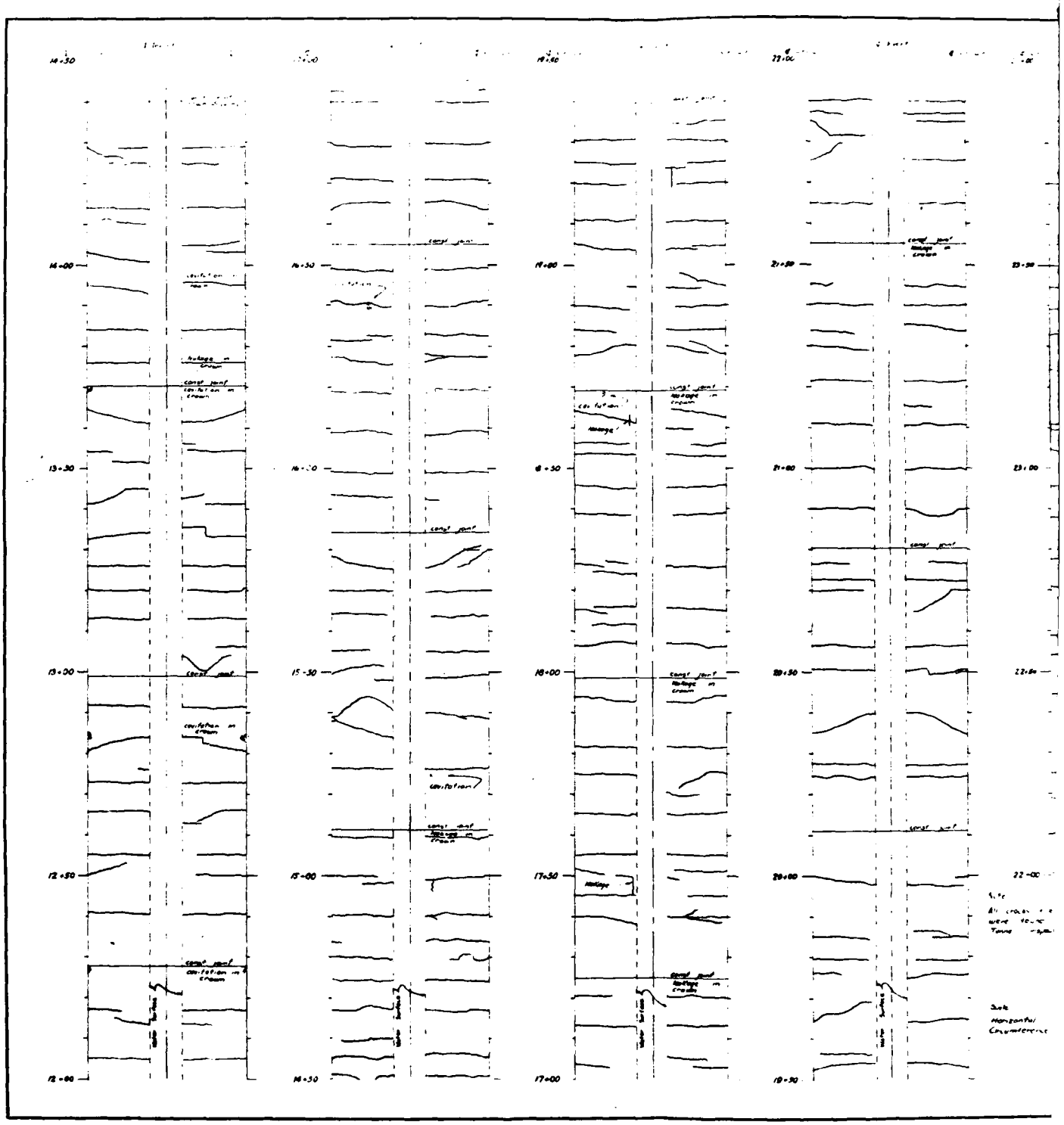
CORPS OF ENGINEERS

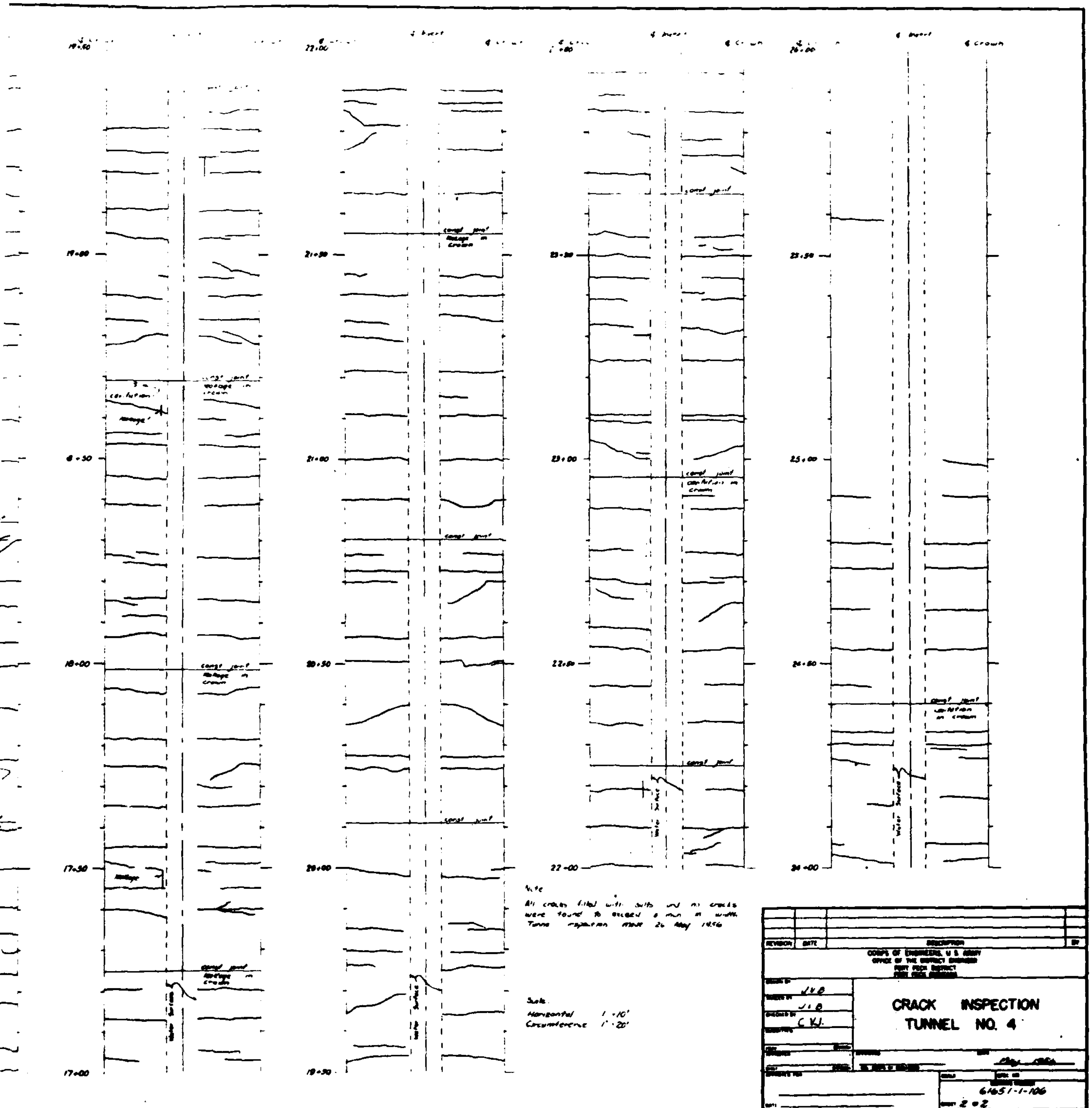


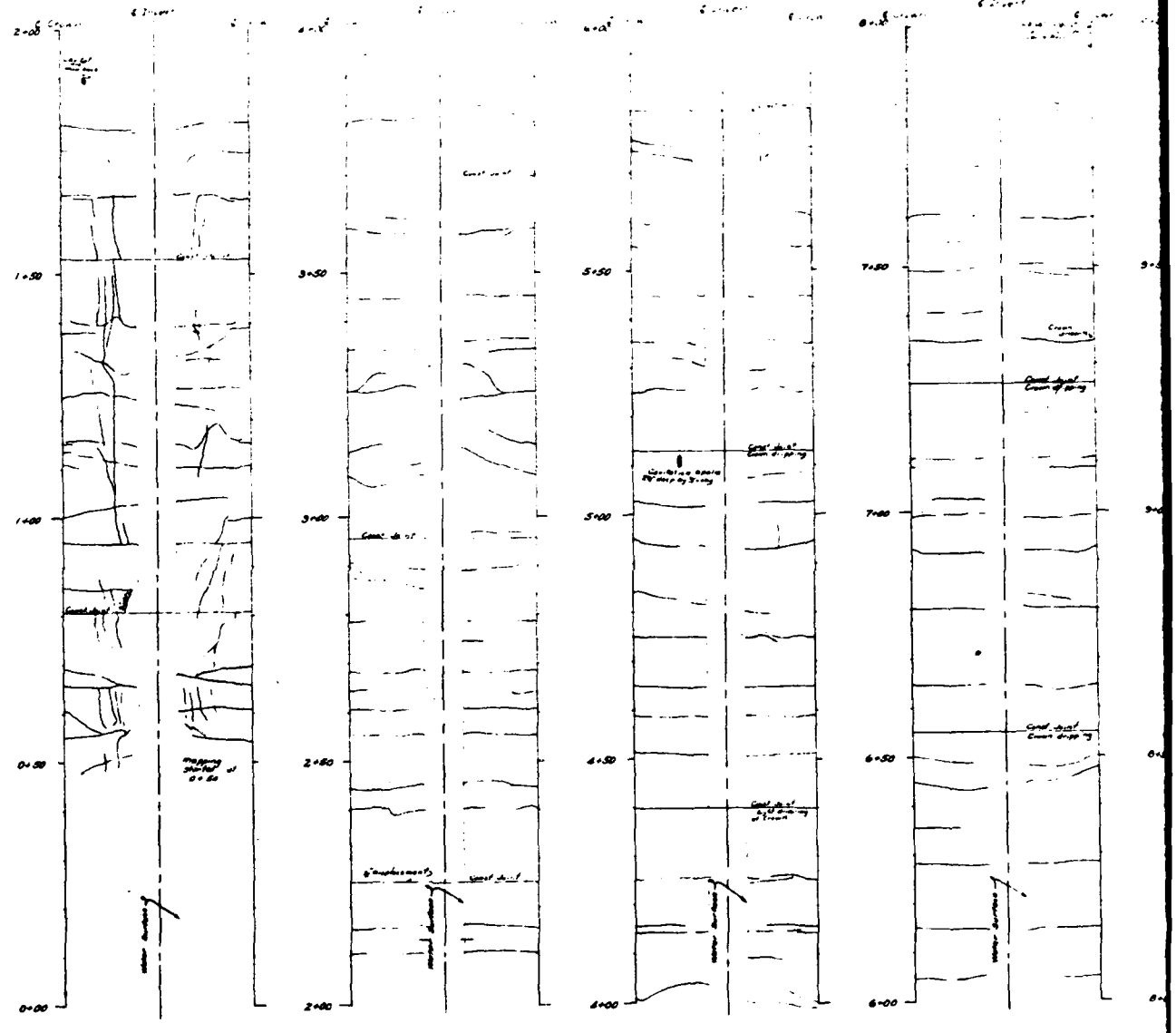
SECTION B-B

SCALE VERT. 1" = 20'
HORIZ 1" = 50'


U. S. ARMY
ORIGINAL GROUND
1950 GROUND LINE
ACTIVE MOVEMENT ZONE
SLIDE PLANE
FAULT LOCATION DETERMINED BY
TUNNEL # 4 EXCAVATION
MARKER BED # 2
INFERRED FAULT
SECOND POWER PLANT
NO 6 FAULT
NO 3 FAULT
TLET FLOOR SLAB UPHEAVAL
SECTION B-B
U. S. ARMY ENGINEER DISTRICT, OMAHA
FORT PECK DAM-SECOND POWER PLANT
MOVEMENT OBSERVATIONS
GEOLOGIC SECTION THROUGH
SECOND POWER PLANT

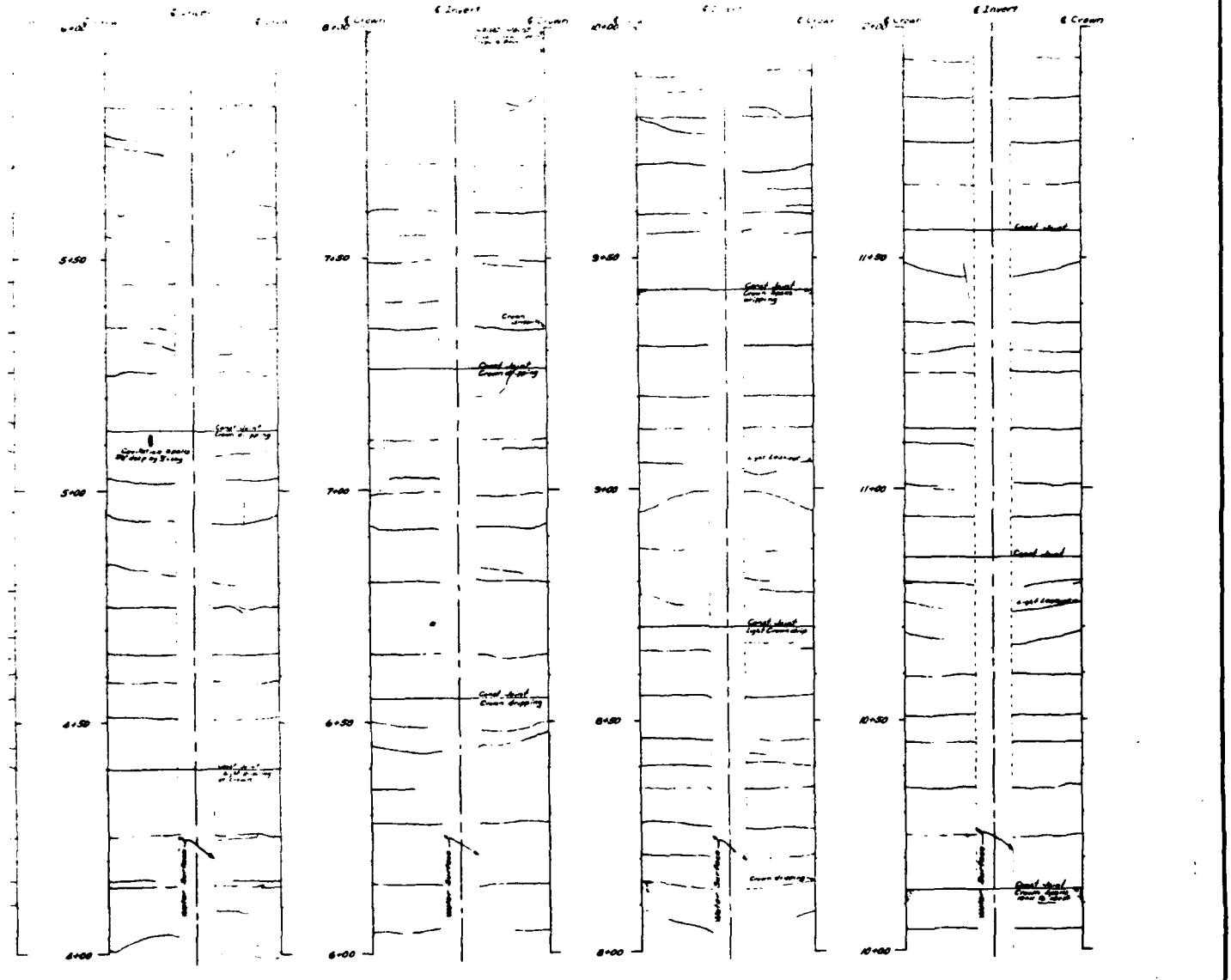

14+50
14+00
13+50
13+00
12+50
12+00
15+50
15+00
14+50
18+50
18+00
17+50
17+00
21+00
20+50
20+00
19+50
23+00
22+50
22+00


Note
All cracks filled with
were found to exceed
Tunnel May 1956
Scale
Horizontal 1" = 10'
Circumference 1" = 20'
REVISION
DATE
DESCRIPTION
BY
CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
FORT PECK DISTRICT
CRACK INSPECTION
TUNNEL NO. 4
61651-1-106
2 of 2



Note:
All cracks filled with salts and no cracks were found to exceed ⅛ inch in width.
Almost all cracks were leaking at crown between 0+50 and 2+60.
Tunnel inspection made 26 May, 1956

Scale
Horizontal 1"= 10'
Circumference 1"= 20'



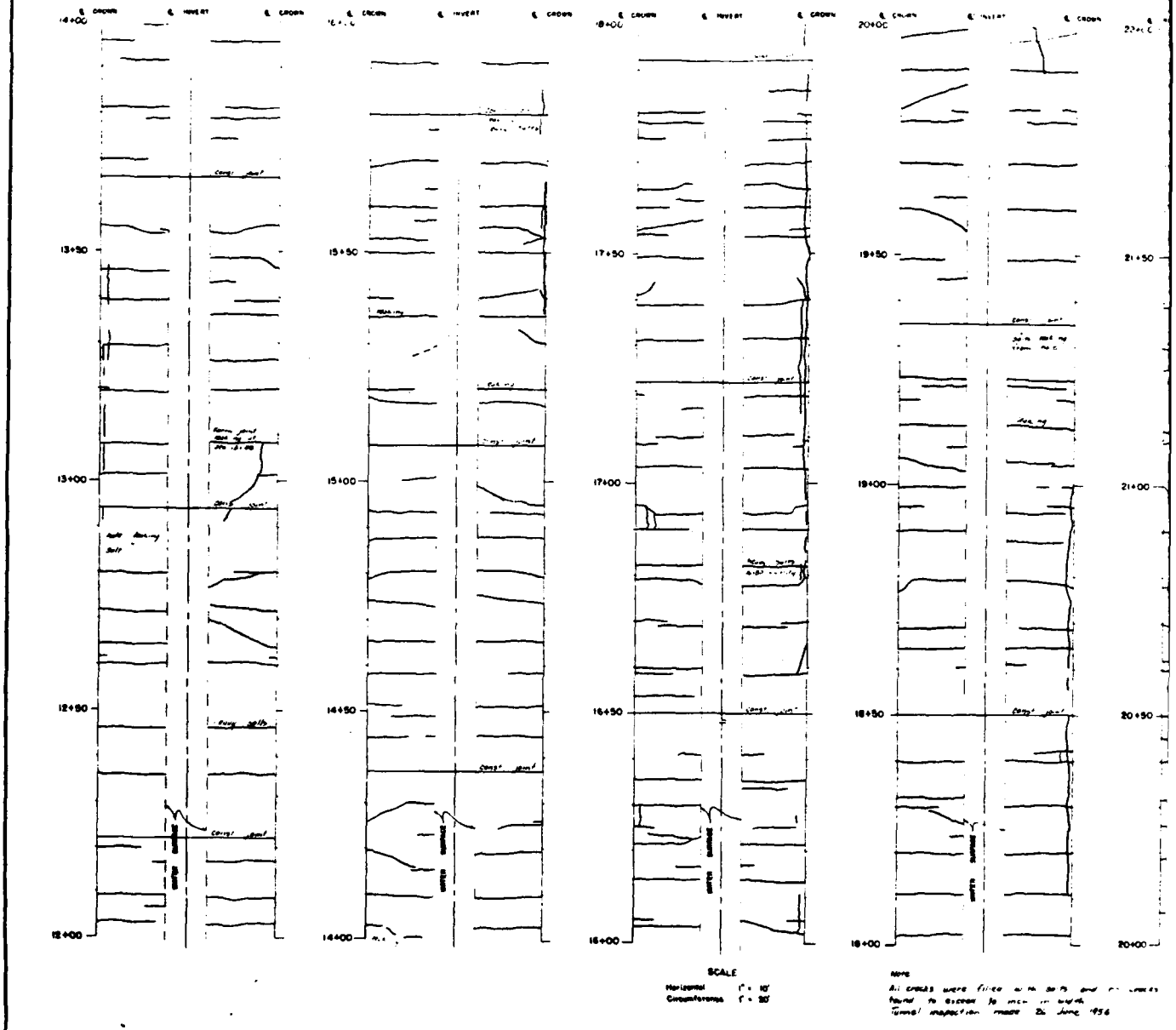
Scale

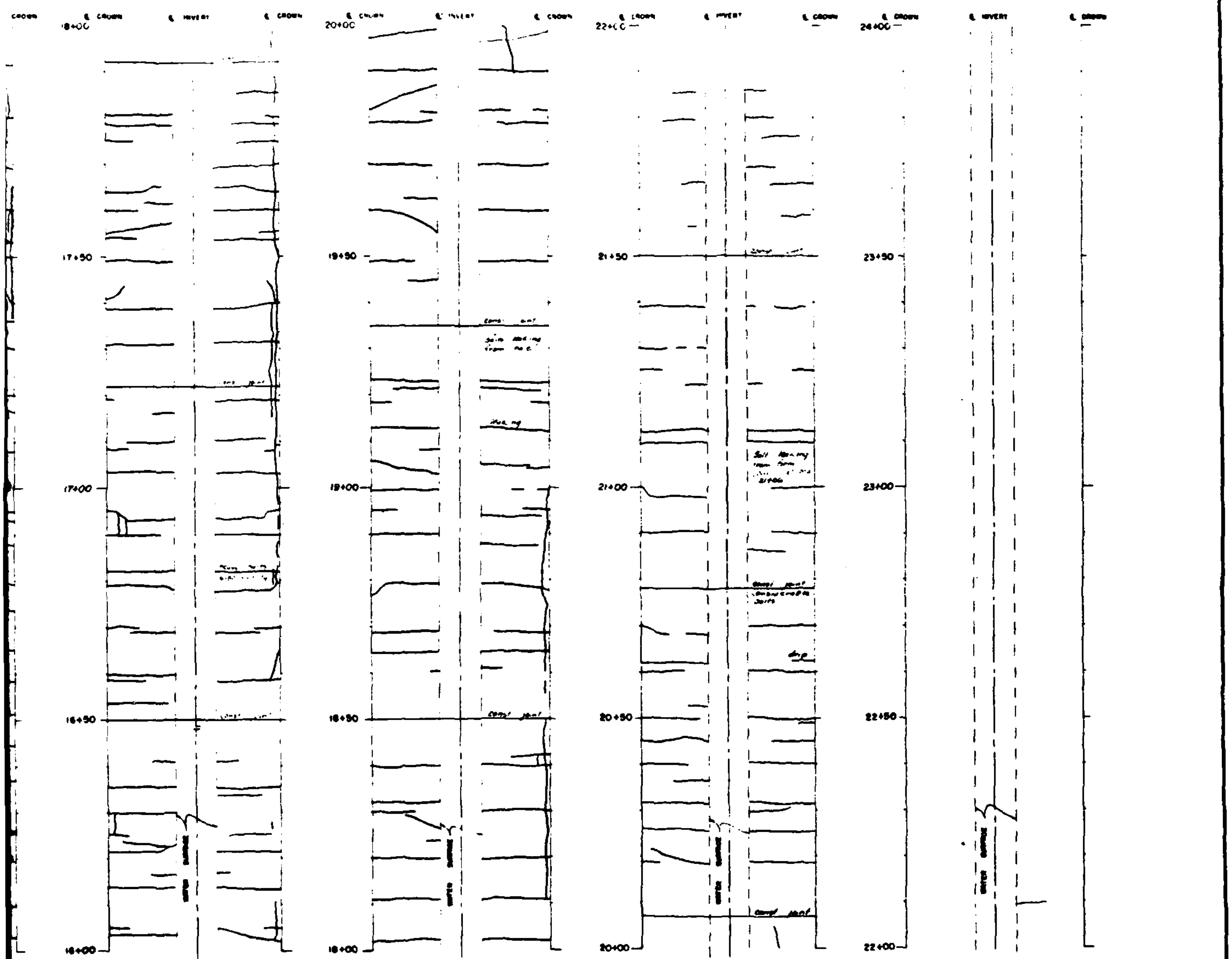
Horizontal 1" = 10'
Circumference 1" = 20'

CRACK INSPECTION
TUNNEL NO. 4

CONSTRUCTION FOUNDATION REPORT

PLATE 188


12+00
13+00
13+50
14+00
14+50
15+00
15+50
16+00
16+50
17+00
17+50
18+00
18+50
19+00
19+50
20+00
20+50
21+00
21+50
SCALE
Horizontal 1" = 10'
Circumference 1" = 20'



SCALE

Horizontal 1" = 10'
Circumference 1" = 20'

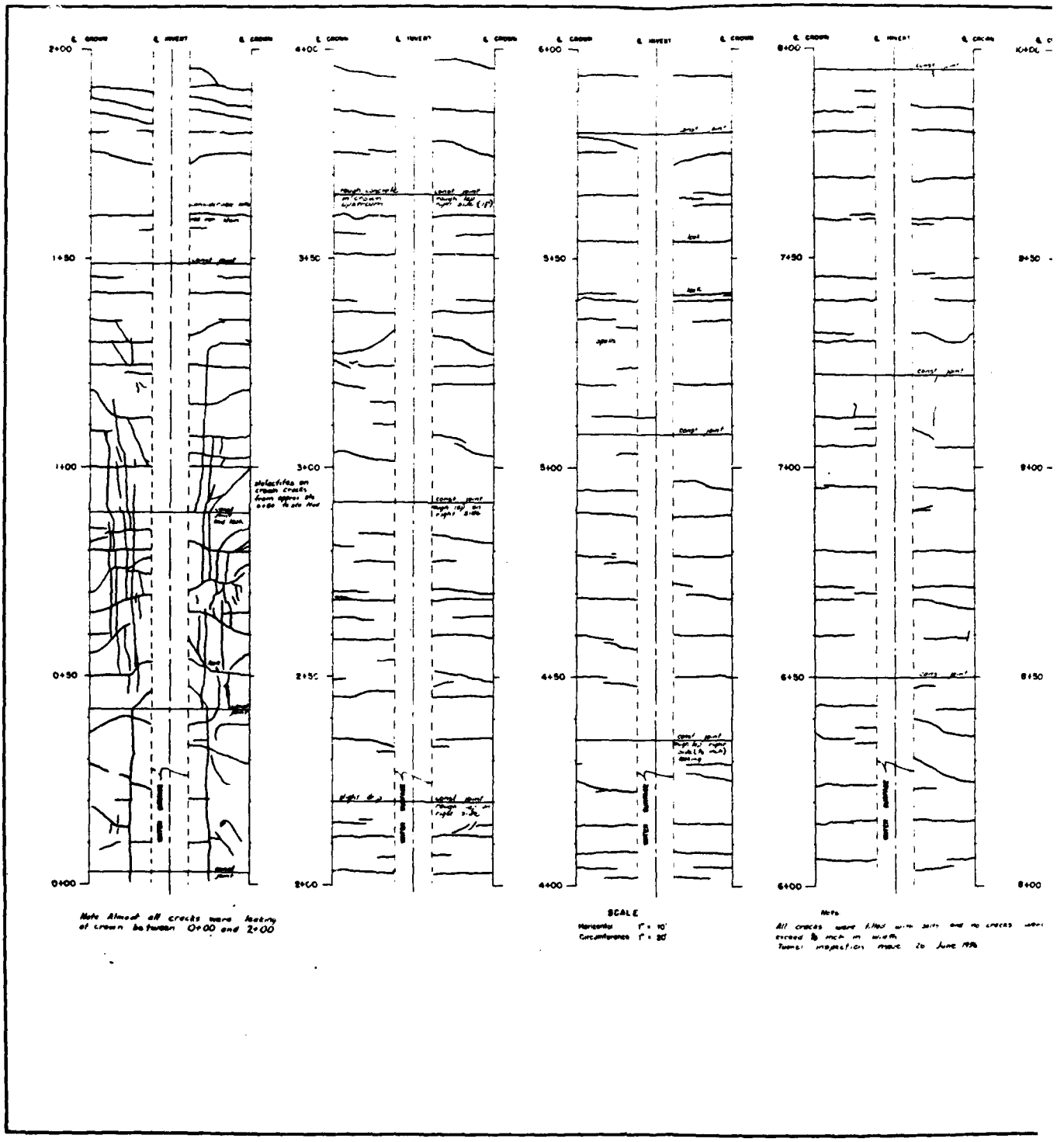
Note
All cracks were filled with salts and no cracks were found to exceed [illegible] inch in width.
Tunnel inspection made 26 June 1956

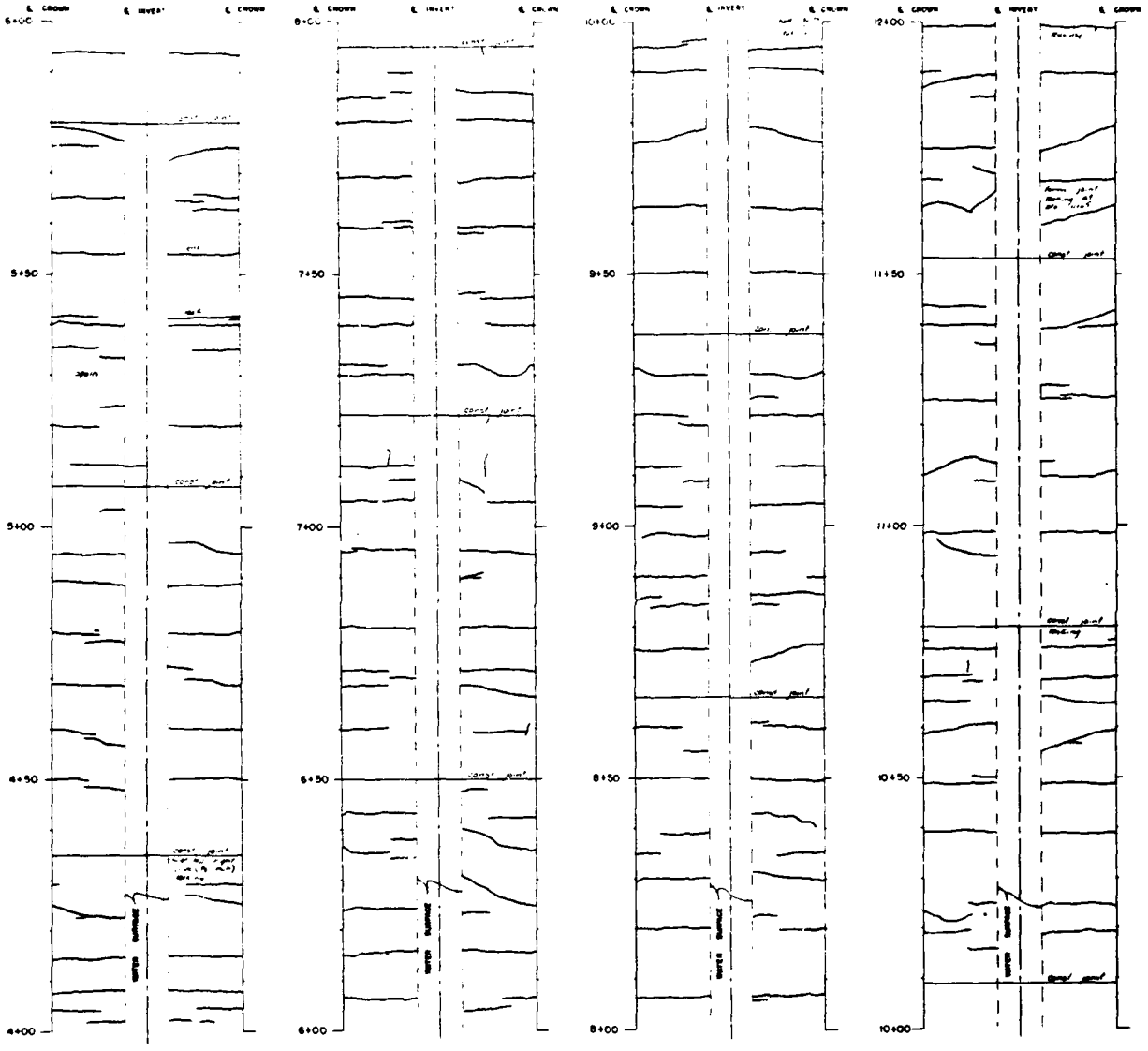
CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER
FORT PECK DISTRICT

CRACK INSPECTION
TUNNEL NO. 3

6165.1-1-110

SHEET 2 OF 2


2+00
1+50
1+00
0+50
0+00
3+50
3+00
2+50
2+00
5+50
5+00
4+50
4+00
7+50
7+00
6+50
6+00
8+00
Note Almost all cracks were looking at crown between 0+00 and 2+00
SCALE
Horizontal 1" = 10'
Circumference 1" = 20'



SCALE

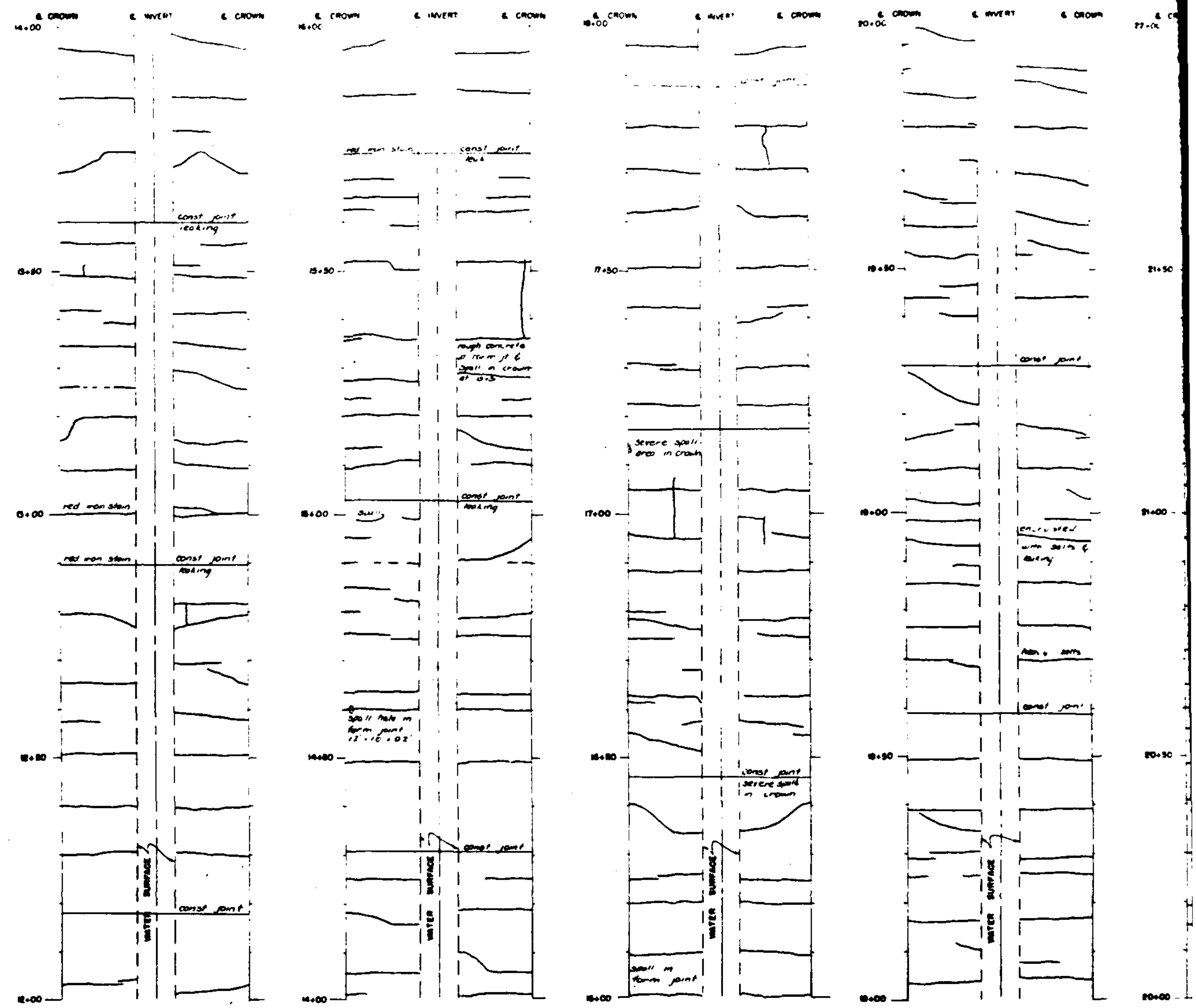
Horizontal 1" = 10'
Circumference 1" = 20'

Note

All cracks were filled with soil and no cracks were found to exceed ¼ inch in width.
Tunnel inspection made in June 1956

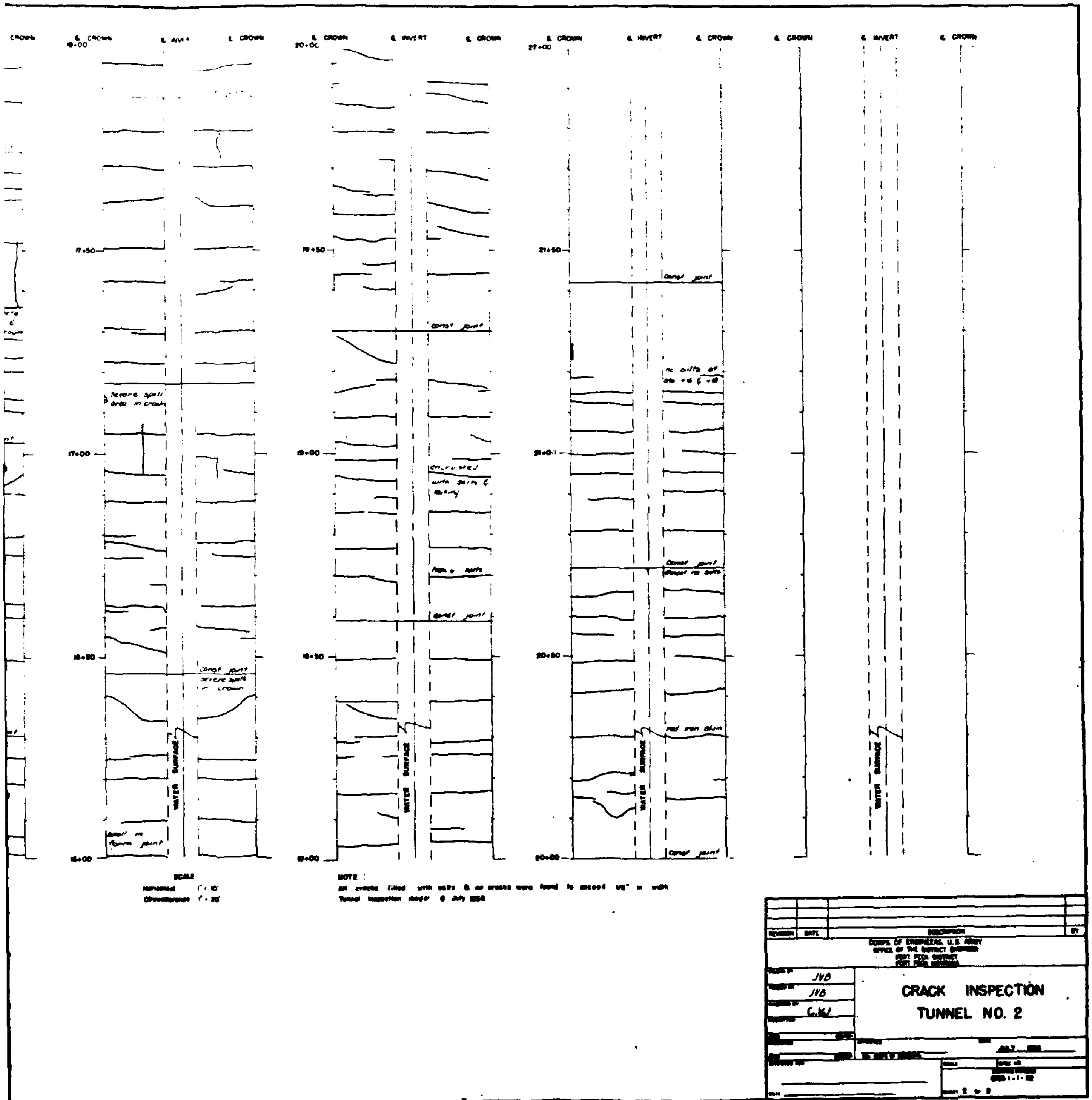
CRACK INSPECTION
TUNNEL NO. 3

CONSTRUCTION FOUNDATION REPORT 2 PLATE 190

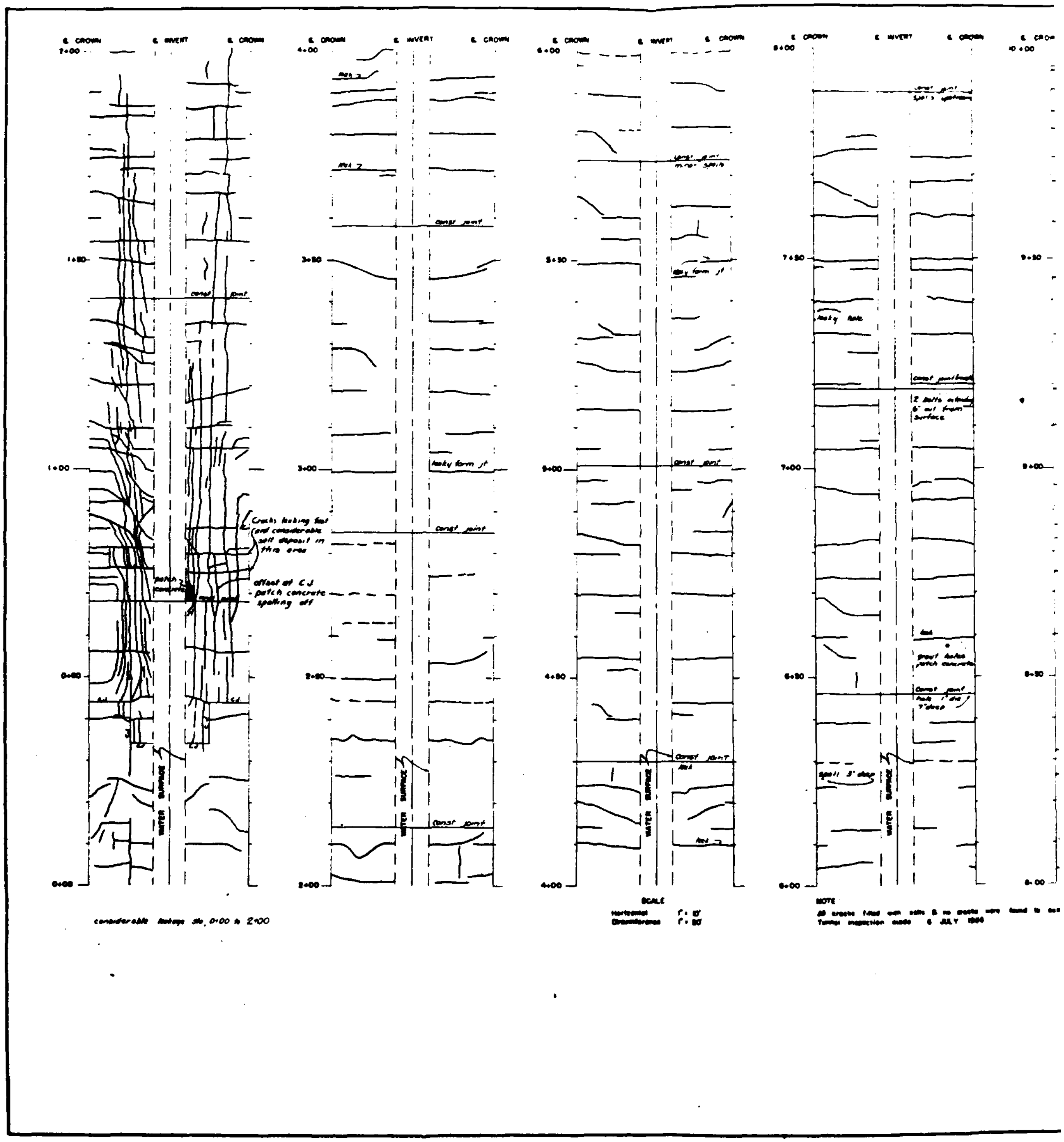


SCALE
Horizontal 1" = 10'
Circumference 1" = 20'

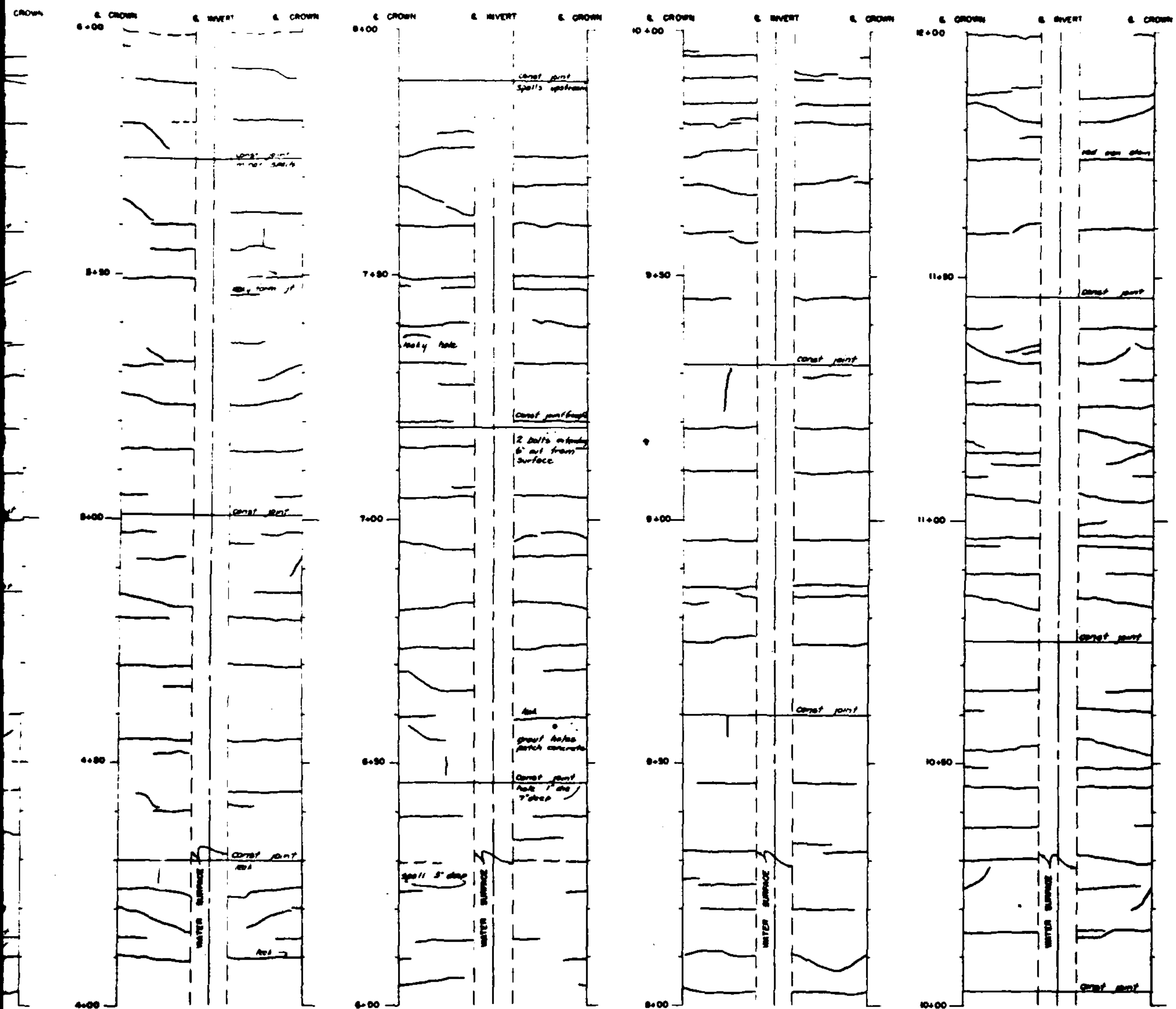
NOTE :
All cracks filled with salts & no cracks were found to [illegible]
Tunnel inspection made 6 July [illegible]



℄ CROWN
℄ INVERT
WATER SURFACE
16+00
16+50
17+00
17+50
18+00
18+50
19+00
19+50
20+00
20+50
21+00
21+50
22+00
const joint
severe spall area in crown
severe spall in crown
small in form joint
encrusted with salts & leaking
heavy salts
no salts at sta +6 ℄ +8
almost no salts
red iron stain
SCALE
NOTE :
CORPS OF ENGINEERS, U.S. ARMY
OFFICE OF THE DISTRICT ENGINEER
FORT PECK DISTRICT
JVB
JVB
C.W.
CRACK INSPECTION
TUNNEL NO. 2



CROWN
INVERT
0+00
0+50
1+00
1+50
2+00
2+50
3+00
3+50
4+00
4+50
5+00
5+50
6+00
6+50
7+00
7+50
8+00
9+00
9+50
10+00
const joint
leaky form jt
Cracks leaking fast and considerable salt deposit in this area
offset at C.J.
patch concrete
spalling off
WATER SURFACE
leaky hole
2 bolts sticking 6" out from surface
grout holes
patch concrete
spall 3" deep
considerable leakage Sta. 0+00 to 2+00
SCALE
NOTE



SCALE

[illegible] 1" = 10'
[illegible] 1" = 20'

NOTE

All cracks filled with [illegible] & no cracks were found to exceed 1/8" in width
Tunnel inspection made [illegible] JULY [illegible]

REVISION	DATE	DESCRIPTION	BY

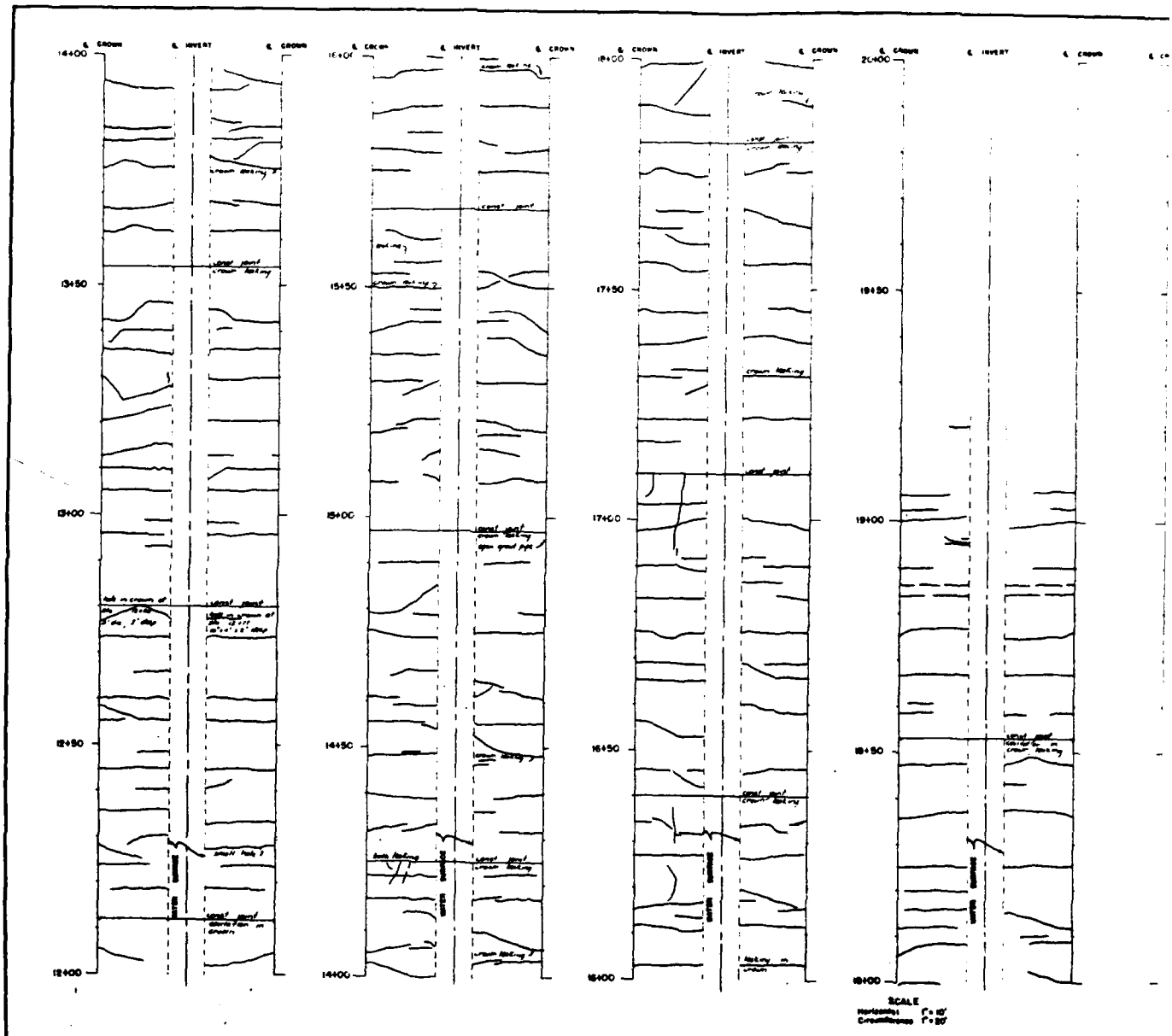
CORPS OF ENGINEERS, U. S. ARMY
OFFICE OF THE DISTRICT ENGINEER
[illegible]

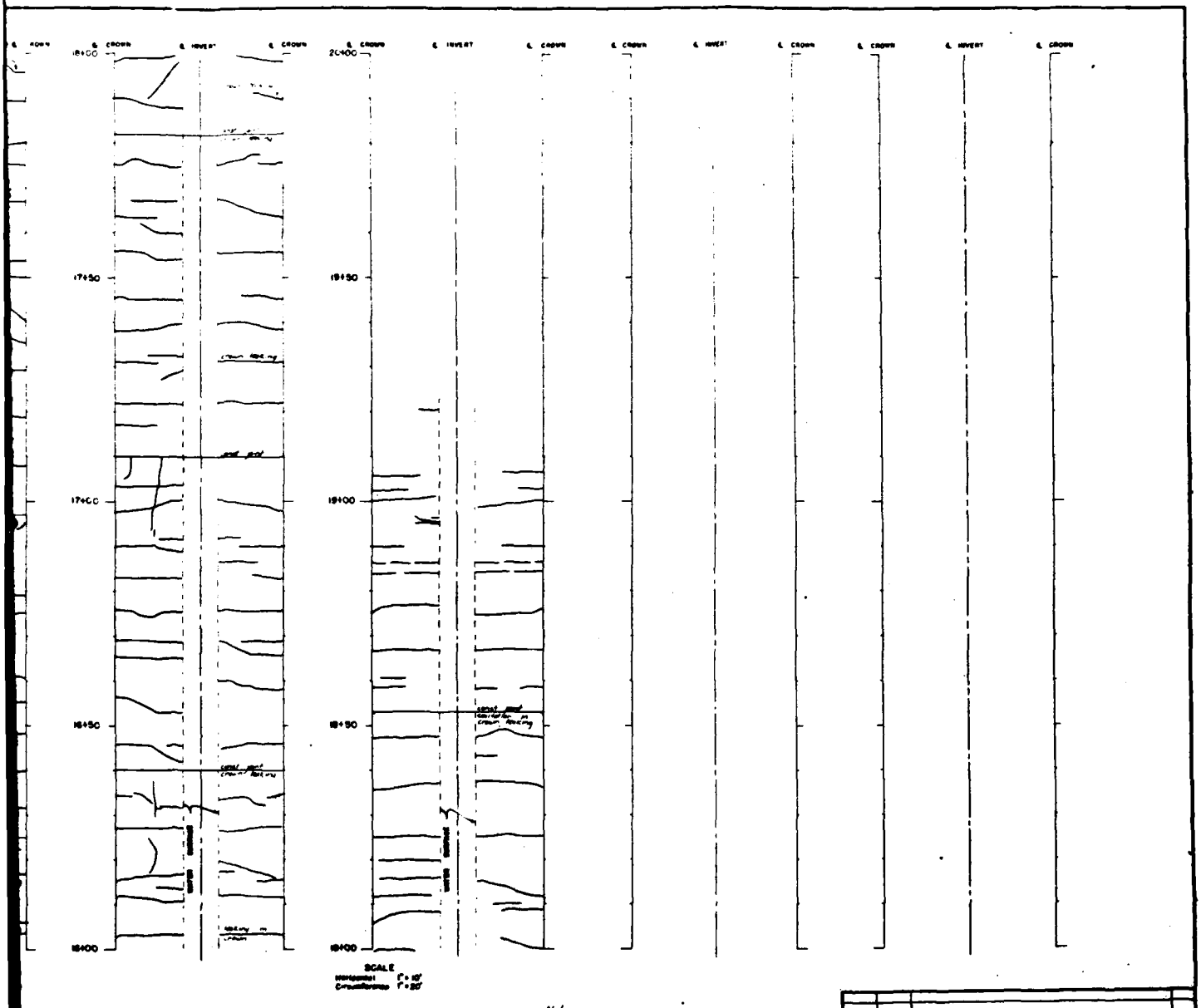
[illegible] JVB
[illegible] JVB
[illegible] C.W.J

CRACK INSPECTION
TUNNEL NO. 2

[illegible] JULY [illegible]

SHEET 1 OF 2

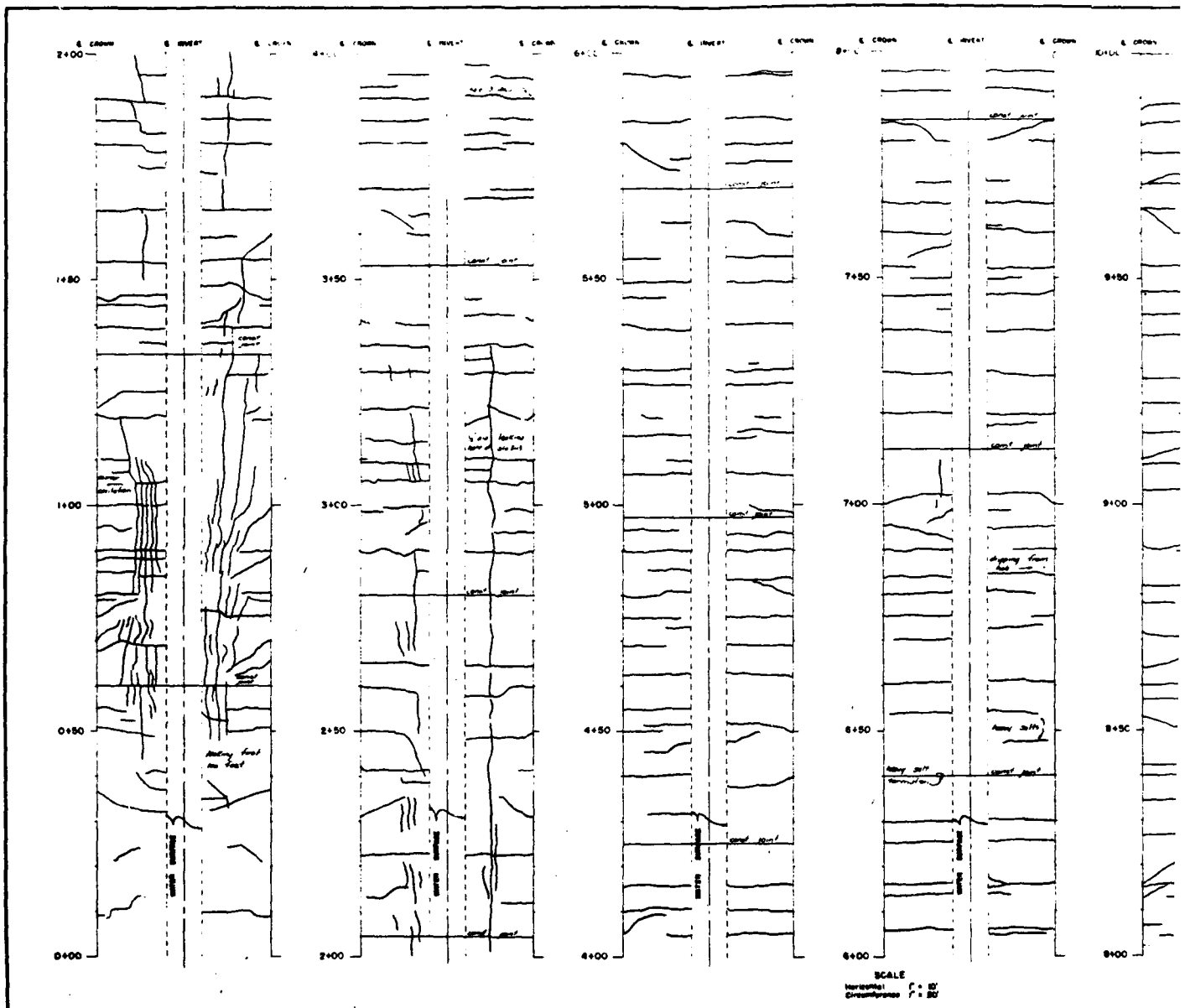

14+00
13+50
13+00
12+50
12+00
15+00
15+50
14+50
14+00
17+00
17+50
16+50
16+00
19+00
19+50
18+50
18+00
20+00
SCALE



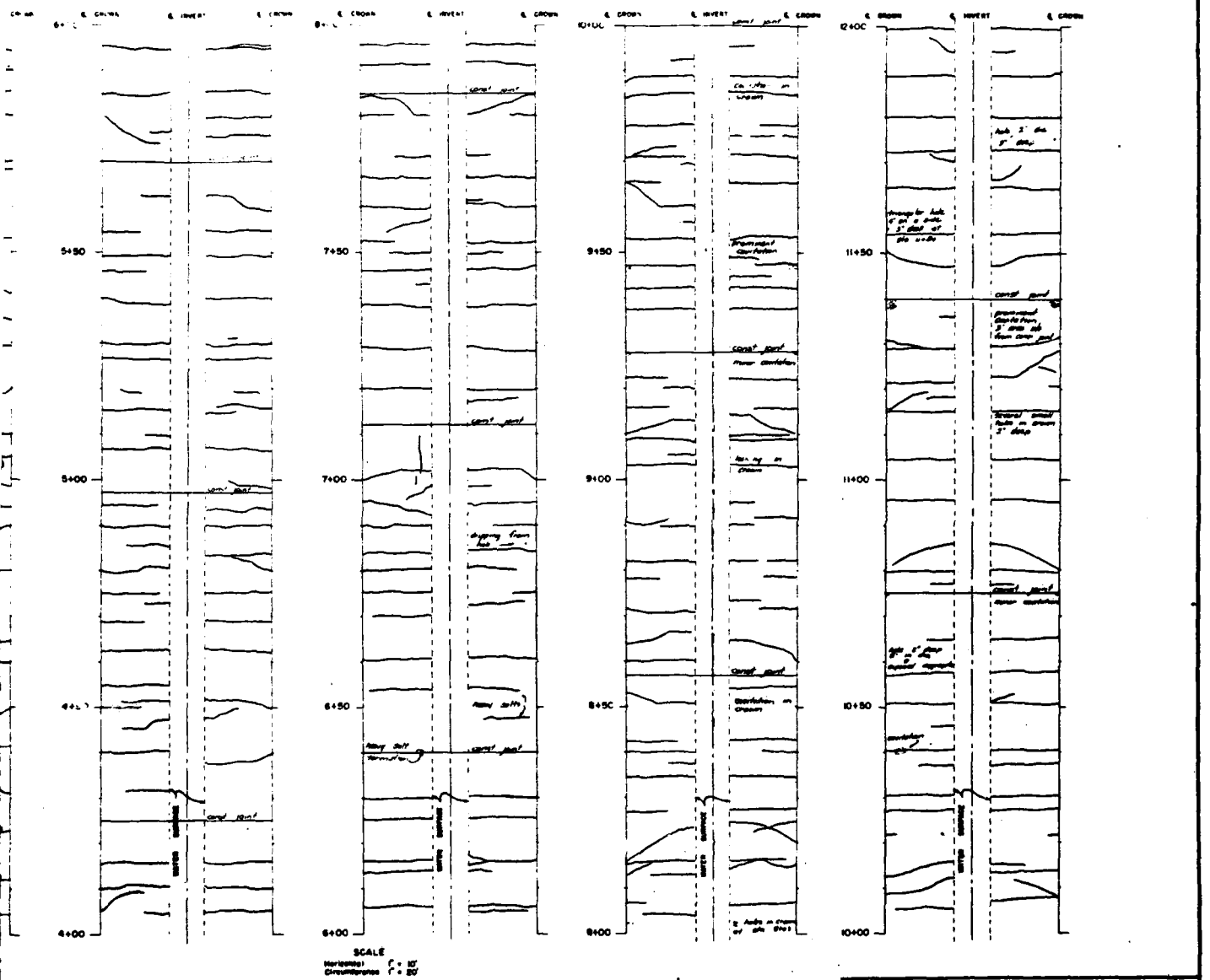
Note:
All cracks filled with putty and no cracks were found to exceed ⅛" in width.
Tunnel inspection made 10 June 1956

CRACK INSPECTION
TUNNEL NO. 1

2

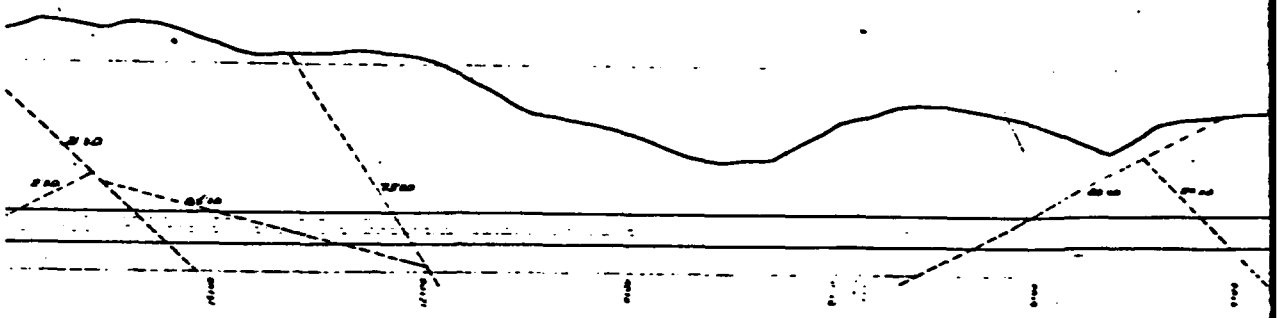


Note:
All cracks filled with
were found to exceed
Tunnel inspection

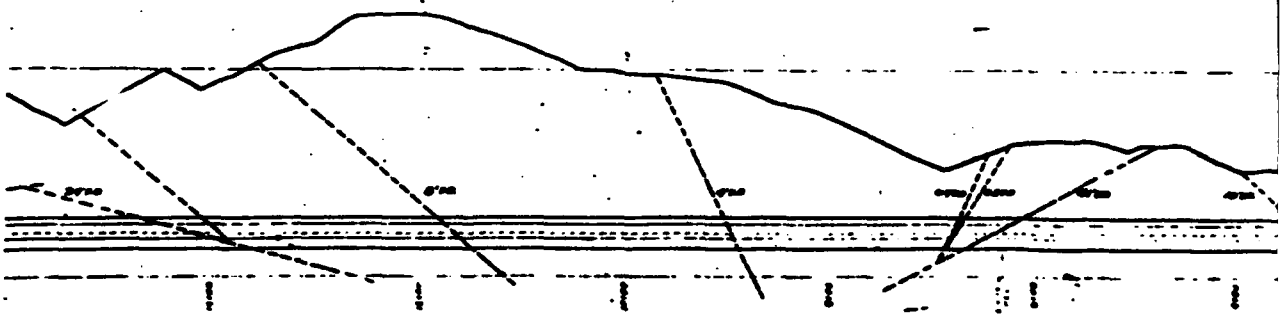


Note
All cracks filled with silts and no cracks were found to exceed ⅛" in width
Tunnel inspection made 10 June 1956

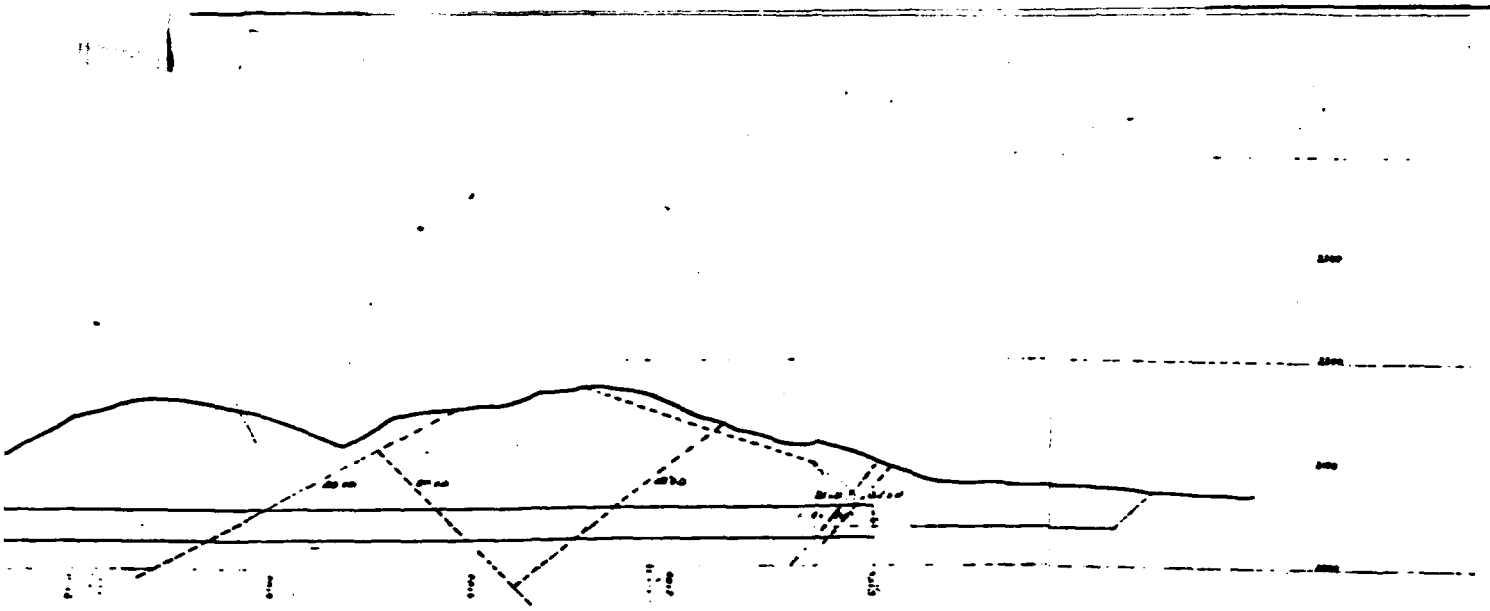
JVB	CRACK INSPECTION TUNNEL NO. 1	
JVB		
C.V.J		



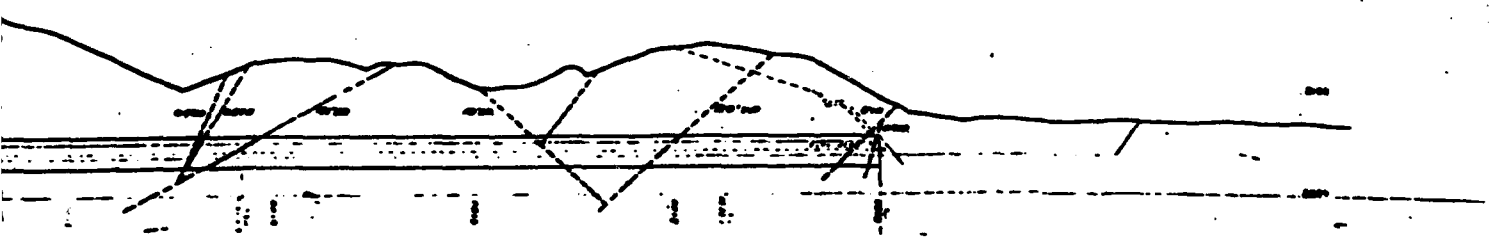
TUNNEL NO.
Sta. 0+00 to Sta.



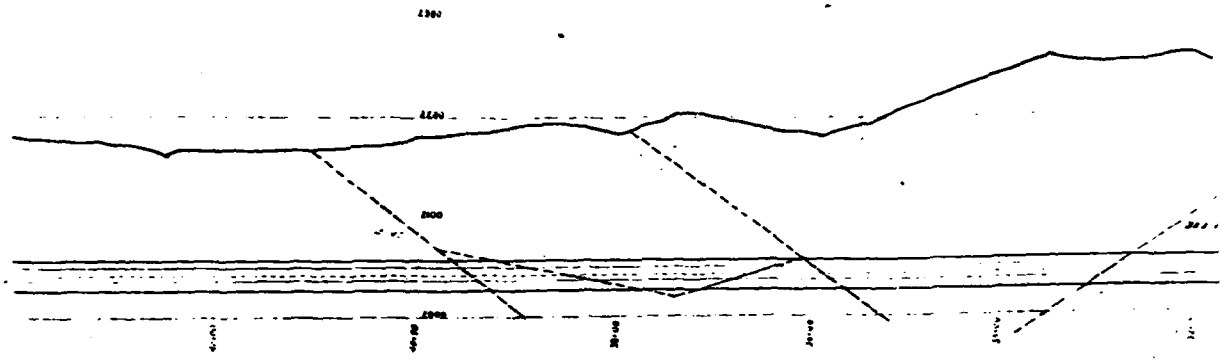
TUNNEL NO.1



TUNNEL NO. 2
Sta. 0+00 to Sta. 16+00



TUNNEL NO. 1

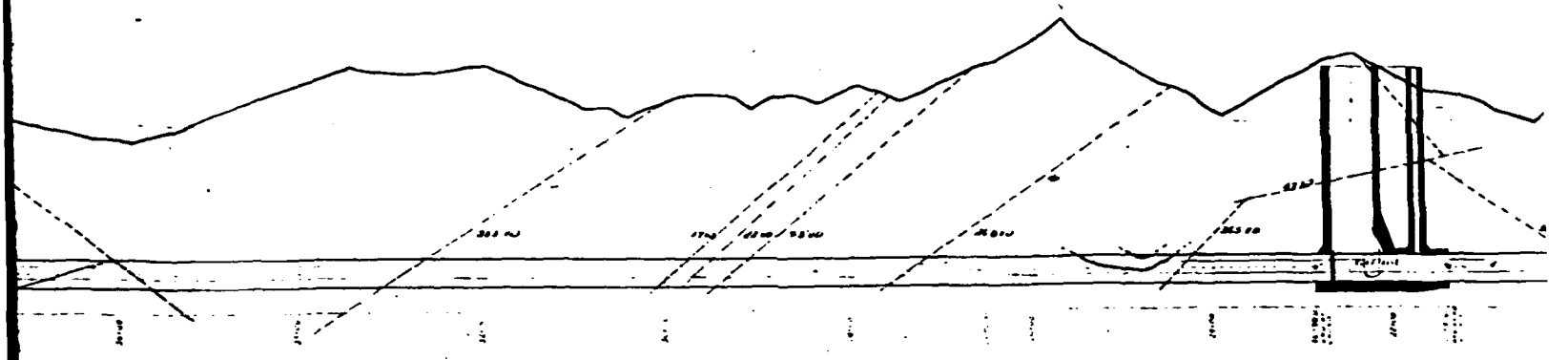


TUNNEL
Sta. 16+00

SCALE
FAULTS
VERTICAL
AS BENTO

TUNI

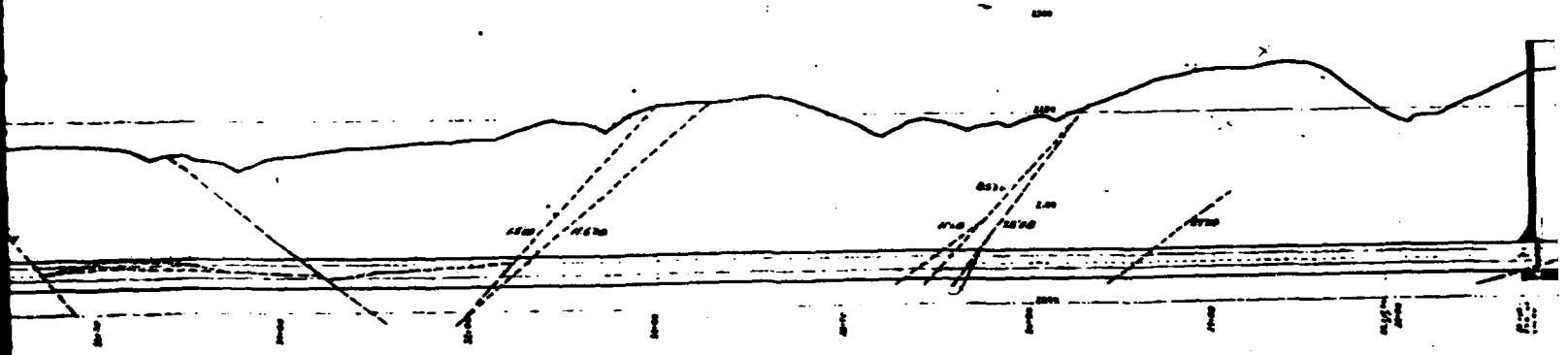
SCALE: 1"



TUNNEL NO. 2
Sta. 16+00 to Sta. 44+00 .

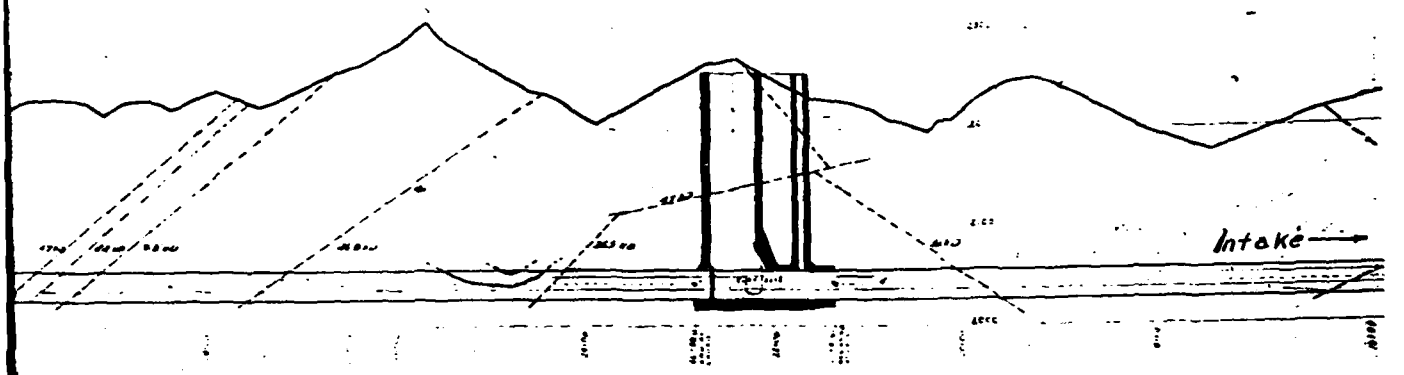
SCALE: 1"=80'

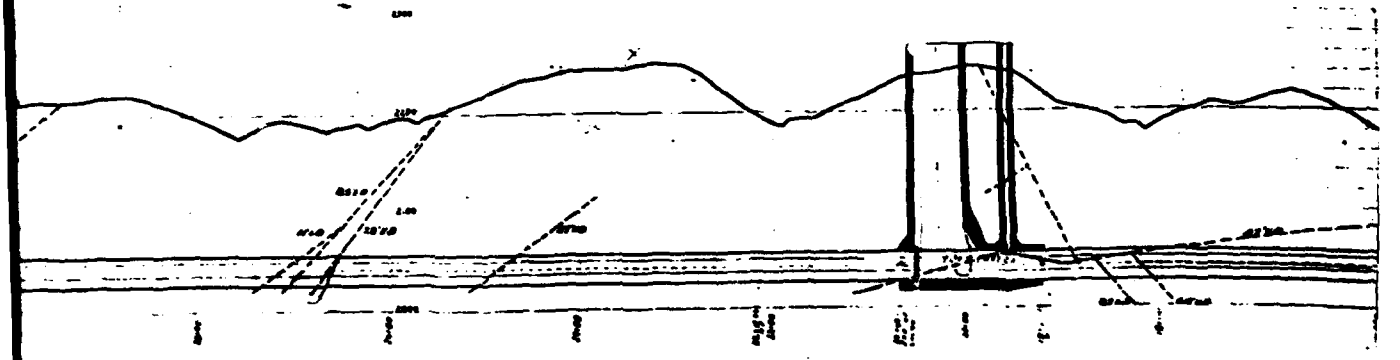
FAULTS SHOWN - - - -
VERTICAL DISPLACEMENT - V.D.
45° BEDDING PLANE BOD —



TUNNEL NO.1

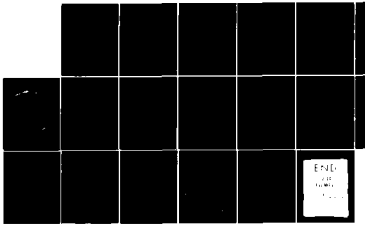
SCALE: 1"=80'

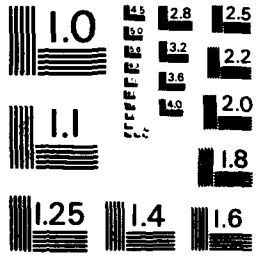

Intake



AD-A134 915 CONSTRUCTION FOUNDATION REPORT MISSOURI RIVER FORT PECK LAKE MONTANA VOLUME 3 DRAWINGS(U) CORPS OF ENGINEERS OMAHA NE JAN 83 2/2

UNCLASSIFIED F/G 13/13 NL

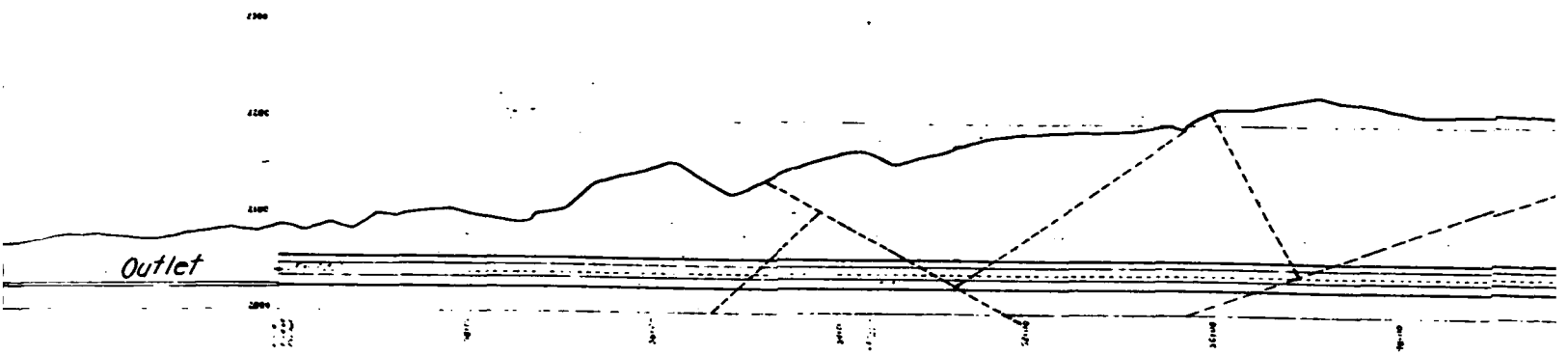




Outlet

LEG
Faults Sh
Vertical L
1.3' Bent

Plate M
Profiles Tunnels
1, 2, 3 & 4



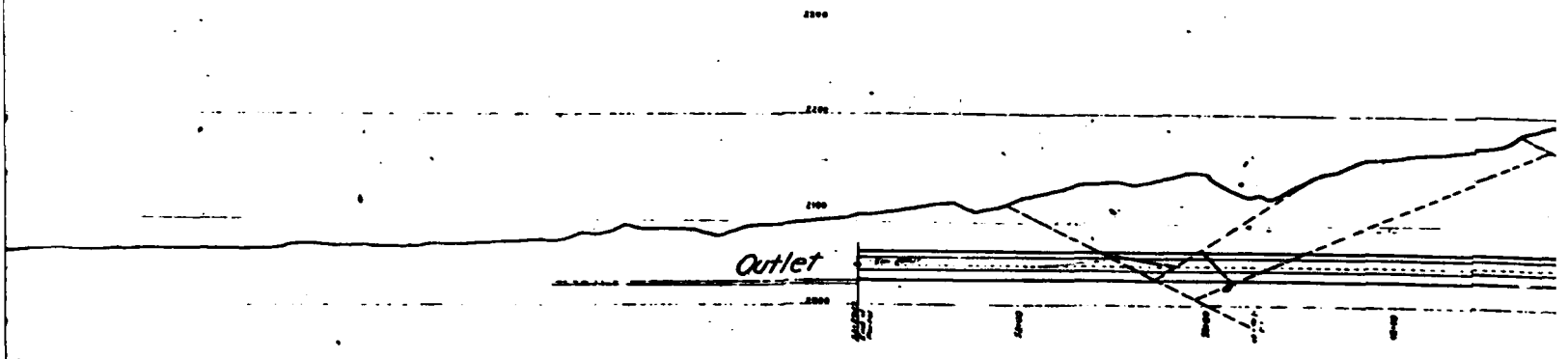
TUNNEL NO. 2
Sta. 44+00 To End
Scale 1" = 80'

LEGEND

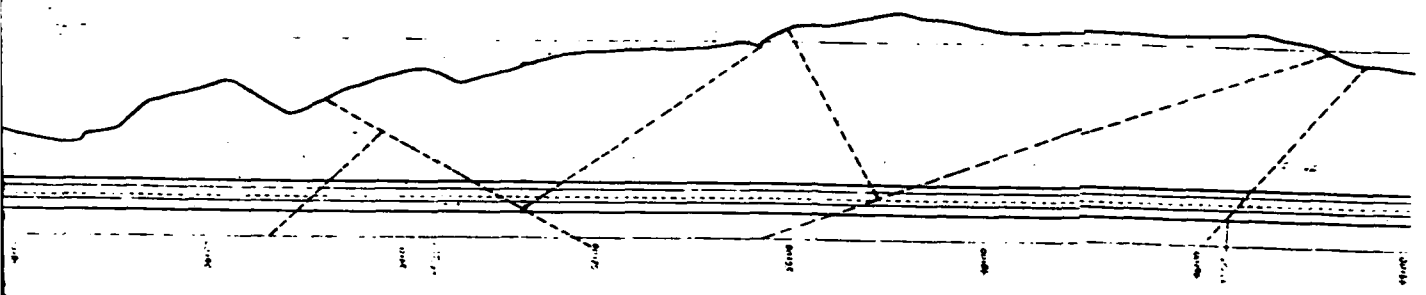
Faults Shown - - - -
Vertical Displacement V.D.
1.3' Bentonite Bed —

GRAPHIC SCALE

0 1 2 3 4 5



TUNNEL NO. 1
Sta. 44+00 To End
Scale 1" = 80'

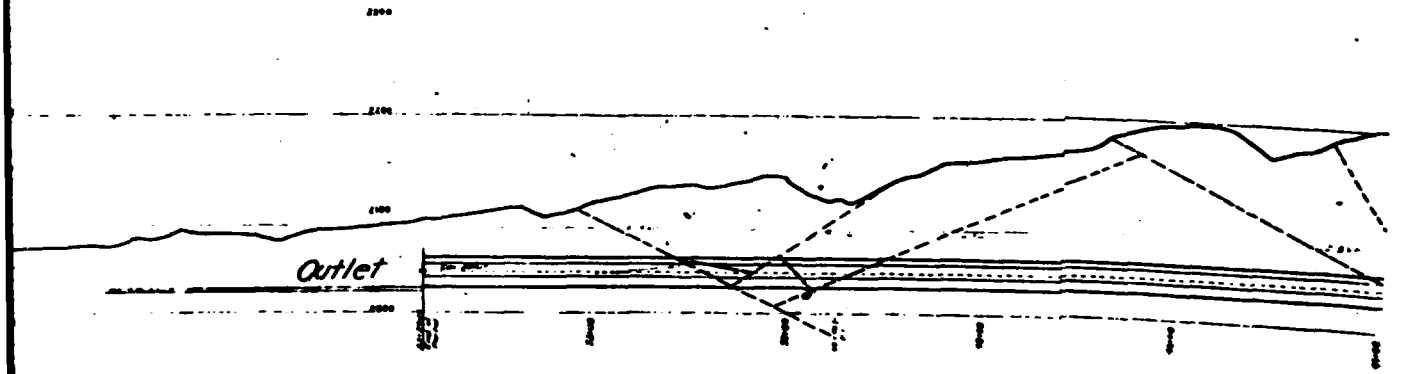


TUNNEL NO. 2
Sta. 44+00 To End
Scale 1" = 80'

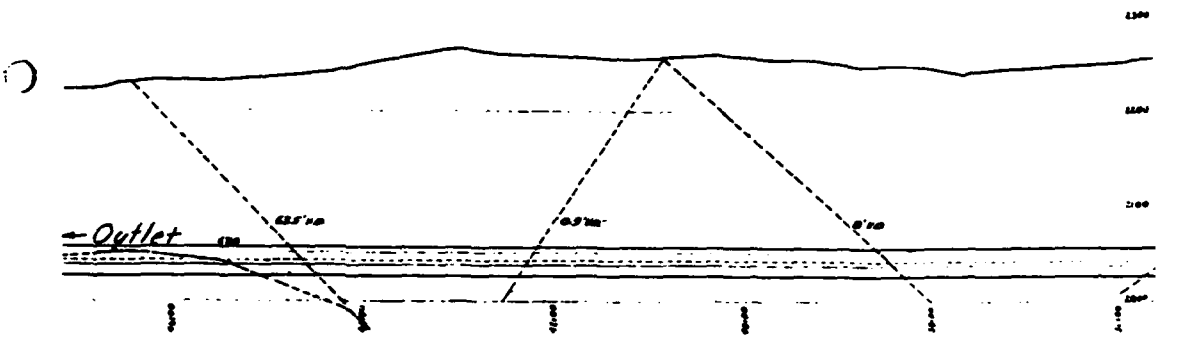
GRAPHIC SCALE

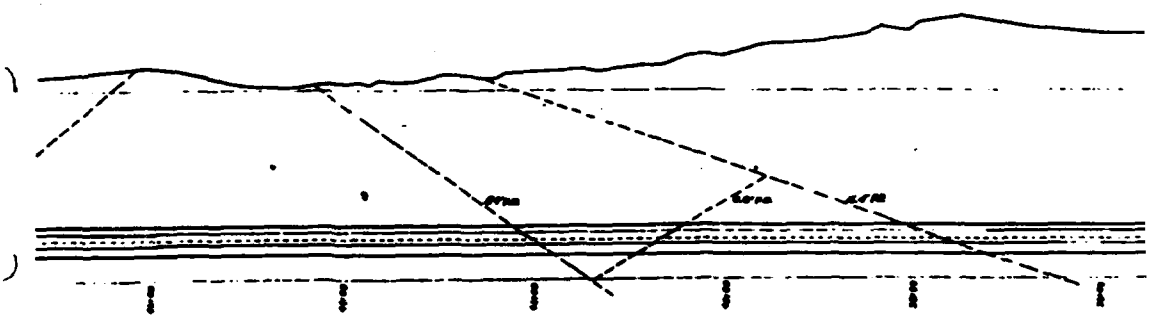
0 1 2 3 4 5

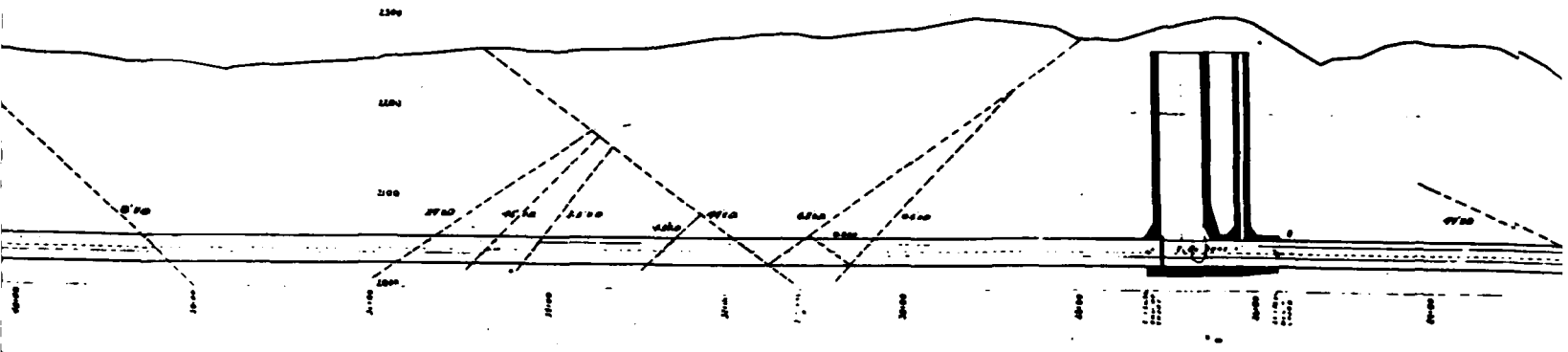
ot V.D.



TUNNEL NO. 1
Sta. 44+00 To End
Scale 1" = 80'


Outlet

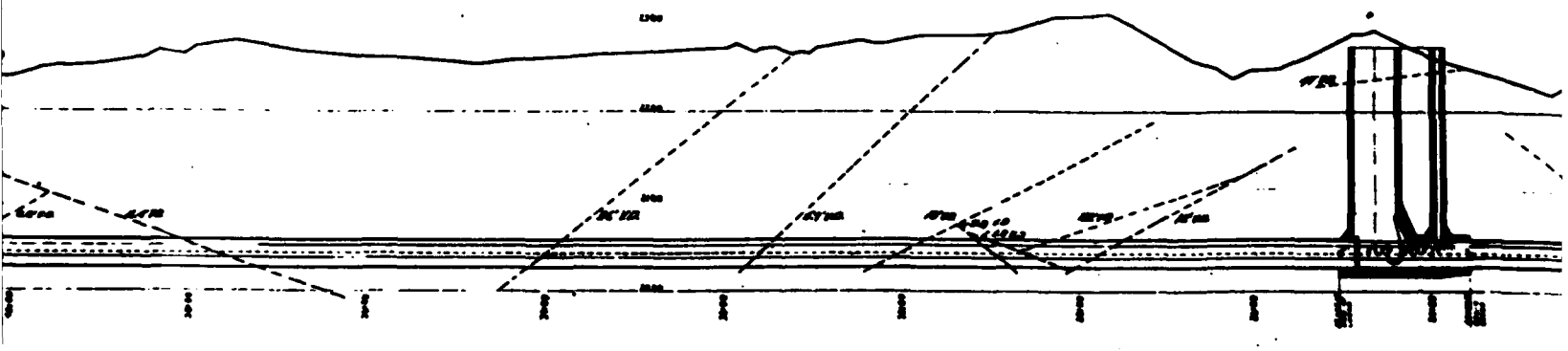




TUNNEL NO. 4
Sta. 18+00 TO Sta 46+00

SCALE 1"=80'

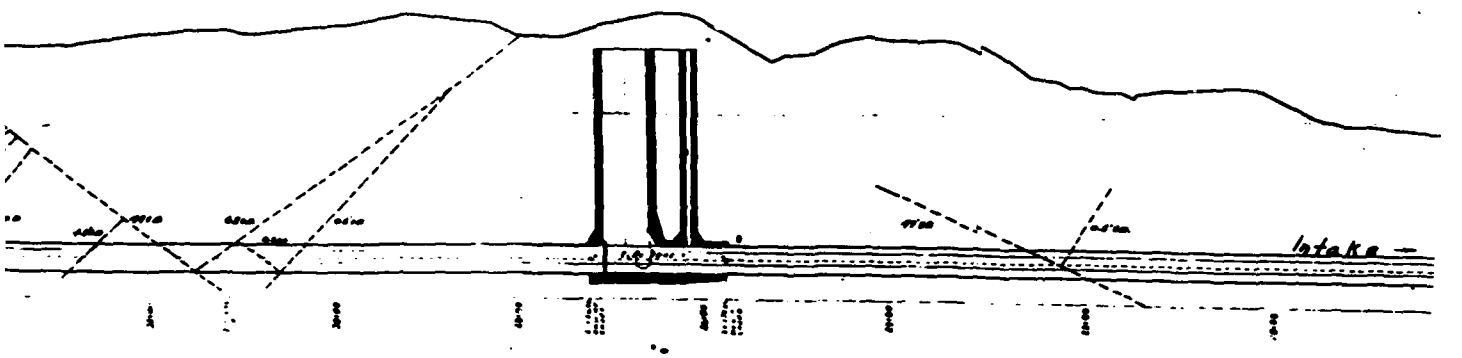
FAULTS SHOWN - - - - -
VERTICAL DISPLACEMENT - U.D.
13' BENTONITE BED ——



TUNNEL NO.3

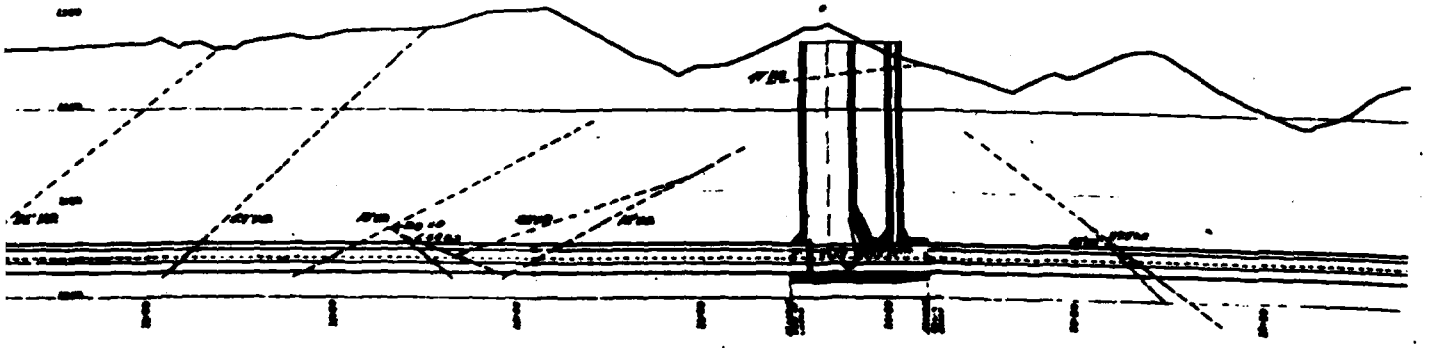
SCALE: 1"=80'

CONSTRUC



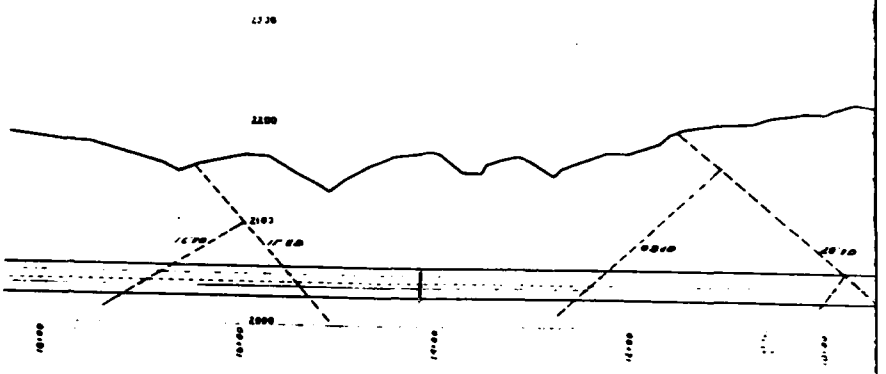
TUNNEL NO. 4
Sta. 18+00 TO Sta 46+00

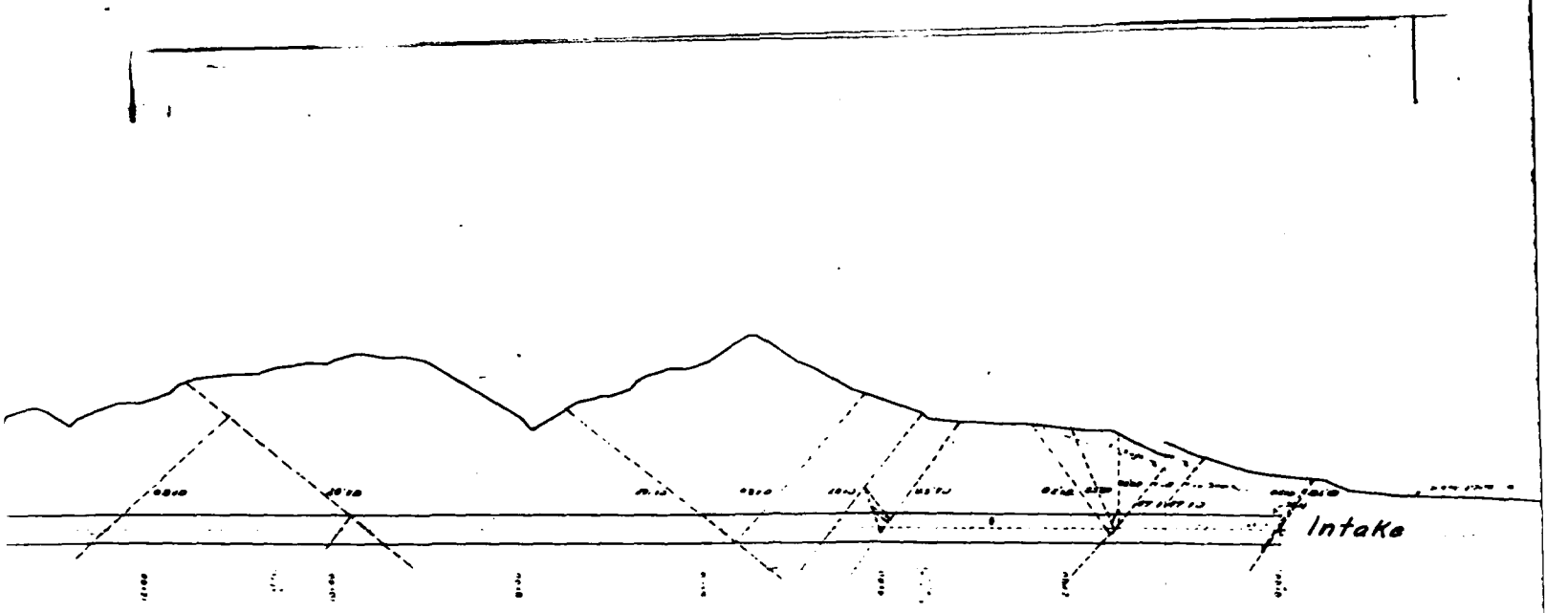
SCALE 1"=80'
FAULTS SHOWN - - - - -
VERTICAL DISPLACEMENT - 40
13' BENTONITE BED ——



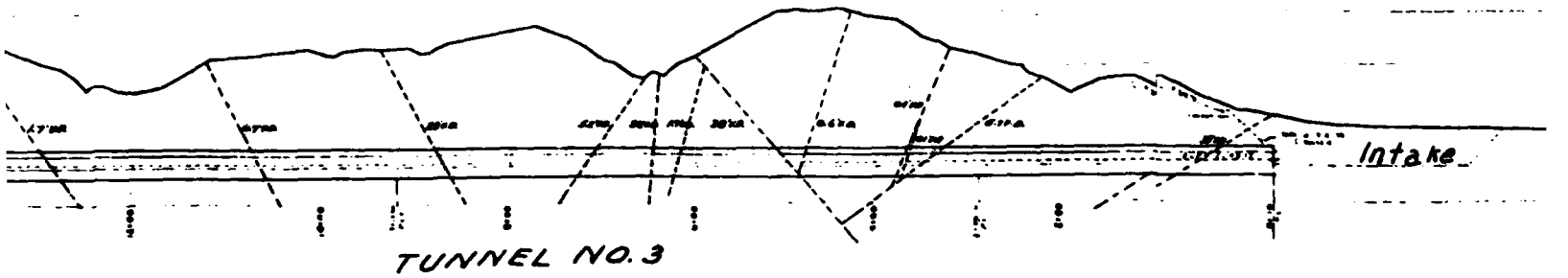
TUNNEL NO.3

SCALE: 1"=80'

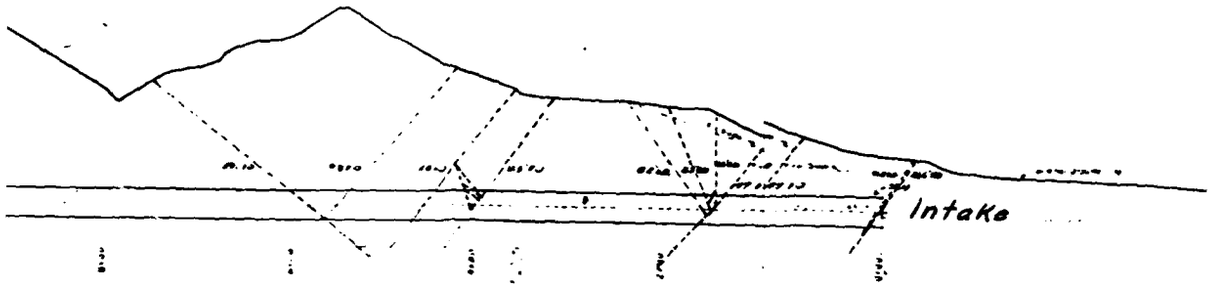




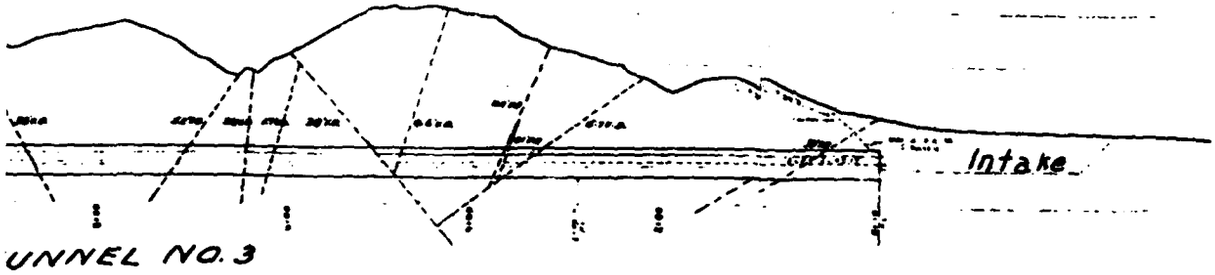
TUNNEL NO.4
Sta. 46+00 to End



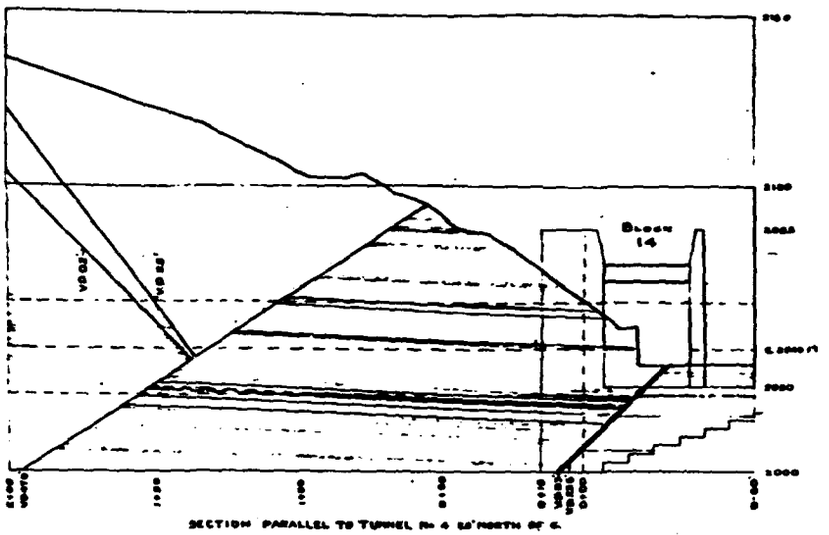
TUNNEL NO.3



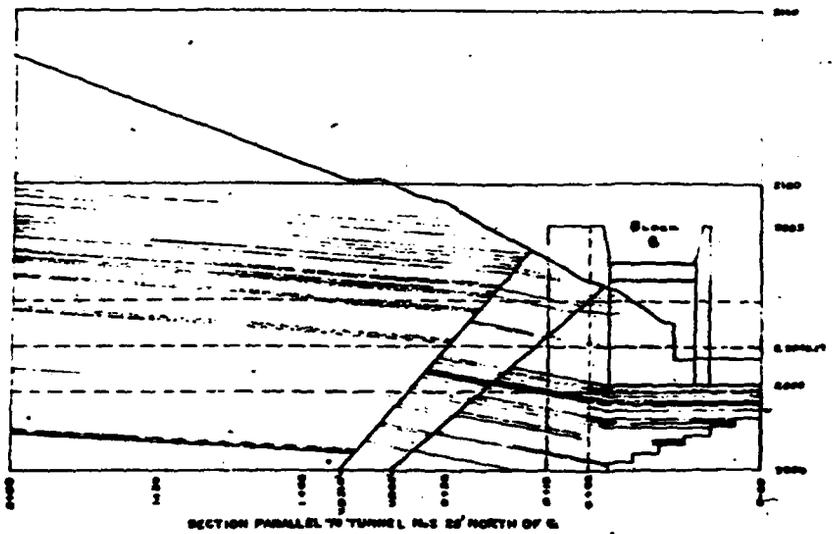
'NNEL NO.4
46+00 to End



UNNEL NO.3



SECTION PARALLEL TO TUNNEL No 4 50' NORTH OF ℄



SECTION PARALLEL TO TUNNEL No 5 50' NORTH OF ℄

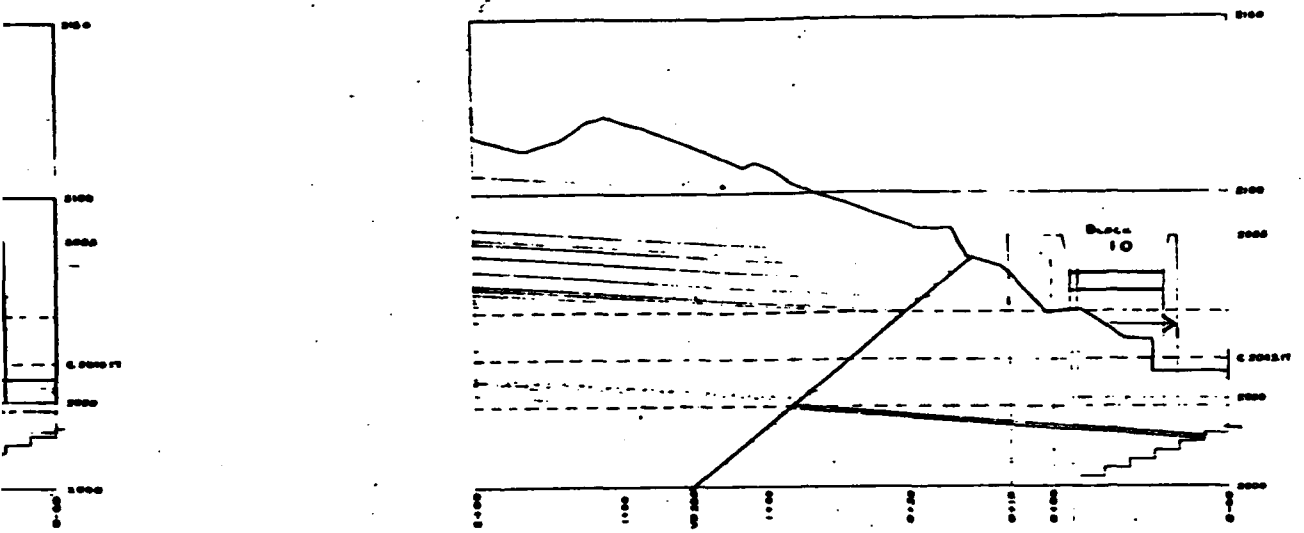
UPPER PORTALS

VERTICAL SECTIONS PARALLEL TO TUNNELS

SHOWING GEOLOGIC STRUCTURES

Scale in Feet

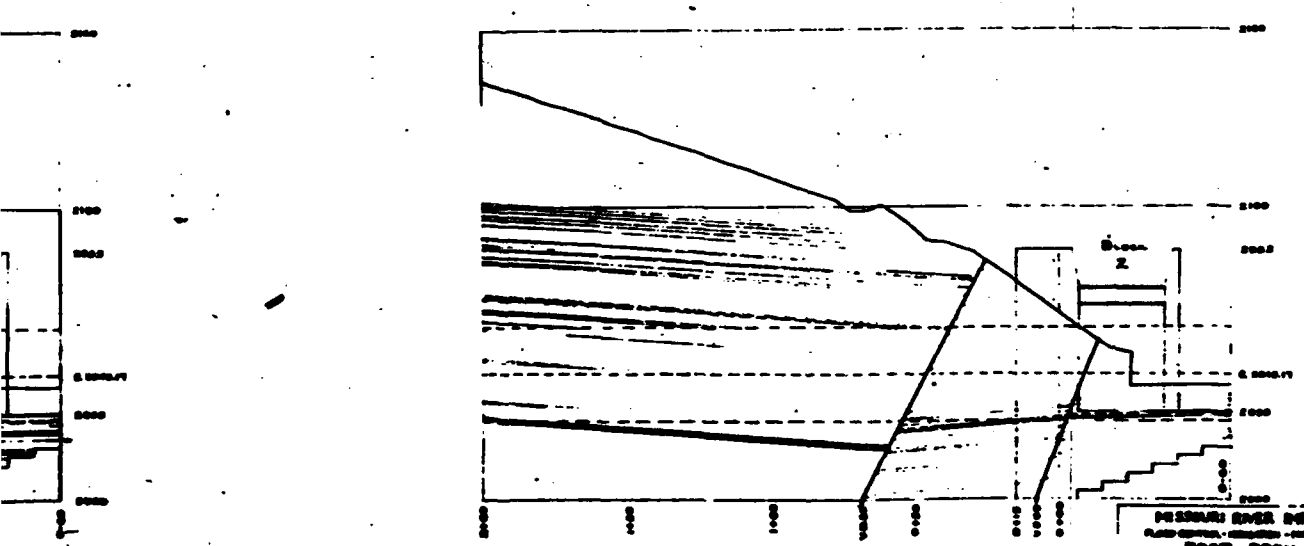
1			Ground Line Revised	
			Revised	



SECTION PARALLEL TO TUNNEL No 3 25' NORTH OF ℄

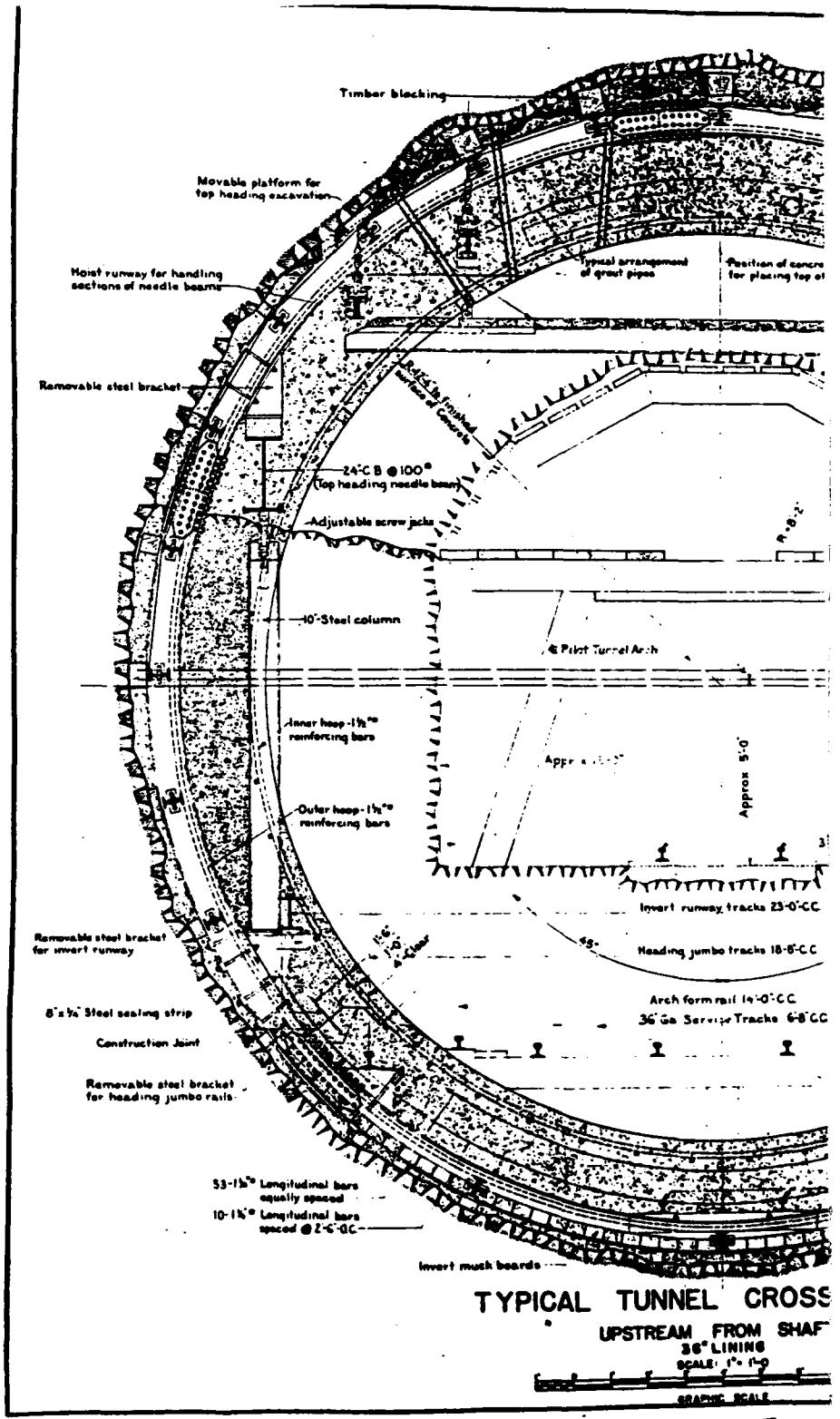
UPPER PORTALS

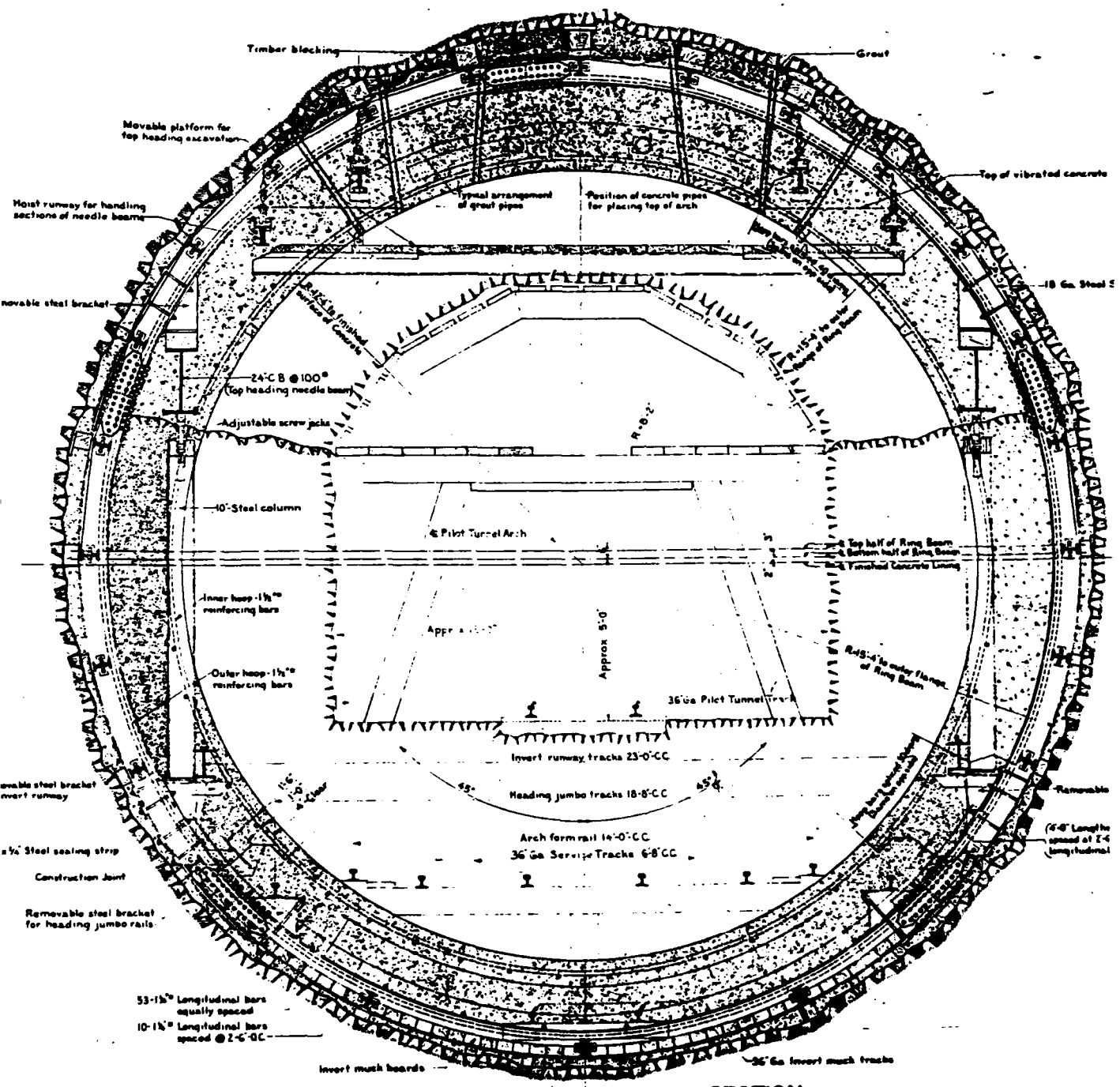
VERTICAL SECTIONS PARALLEL TO TUNNELS
SHOWING GEOLOGIC STRUCTURES



SECTION PARALLEL TO TUNNEL No 1 25' NORTH OF ℄

MISSOURI RIVER IMPROVEMENT
FORT PECK DAM
UPPER PORTAL
GEOLOGIC STRUCTURE


Timber blocking
Movable platform for top heading excavation
Hoist runway for handling sections of needle beams
Typical arrangement of grout pipes
Removable steel bracket
24"C B @100#
Top heading needle beam
Adjustable screw jacks
10"-Steel column
Pilot Tunnel Arch
Inner hoop-1½"# reinforcing bars
Outer hoop-1½"# reinforcing bars
Approx 5'-0"
Invert runway tracks 23'-0" CC
Heading jumbo tracks 18'-6" CC
Removable steel bracket for invert runway
Arch form rail 14'-0" CC
36" Ga Service Tracks 6'-8" CC
8" x ⅜" Steel sealing strip
Construction Joint
Removable steel bracket for heading jumbo rails
53-1½"# Longitudinal bars equally spaced
10-1¼"# Longitudinal bars spaced @ 2'-6" CC
Invert mush boards
TYPICAL TUNNEL CROSS
UPSTREAM FROM SHAF
36" LINING
SCALE: 1" = 1'-0"
GRAPHIC SCALE



TYPICAL TUNNEL CROSS SECTION

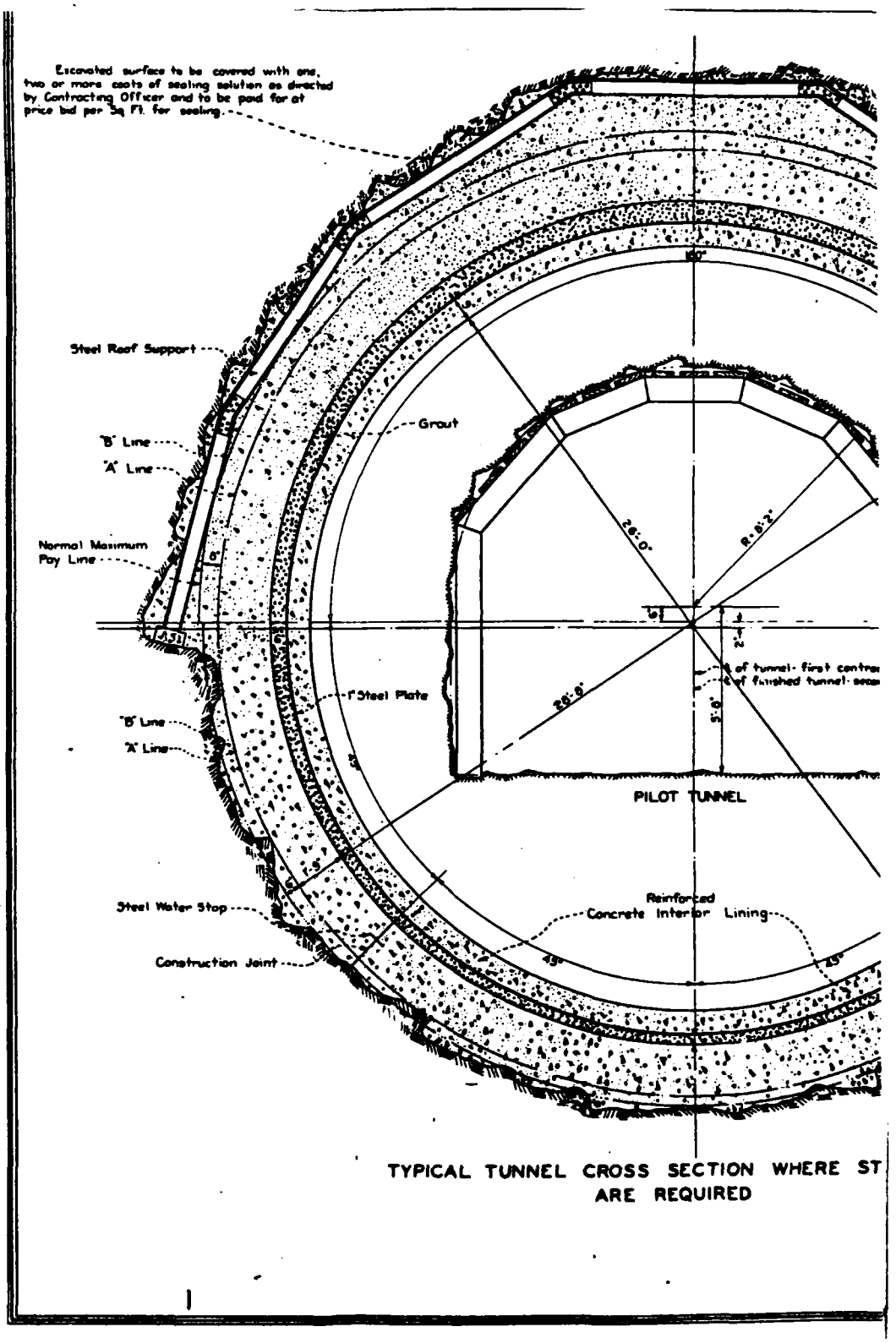
UPSTREAM FROM SHAFTS

36" LINING

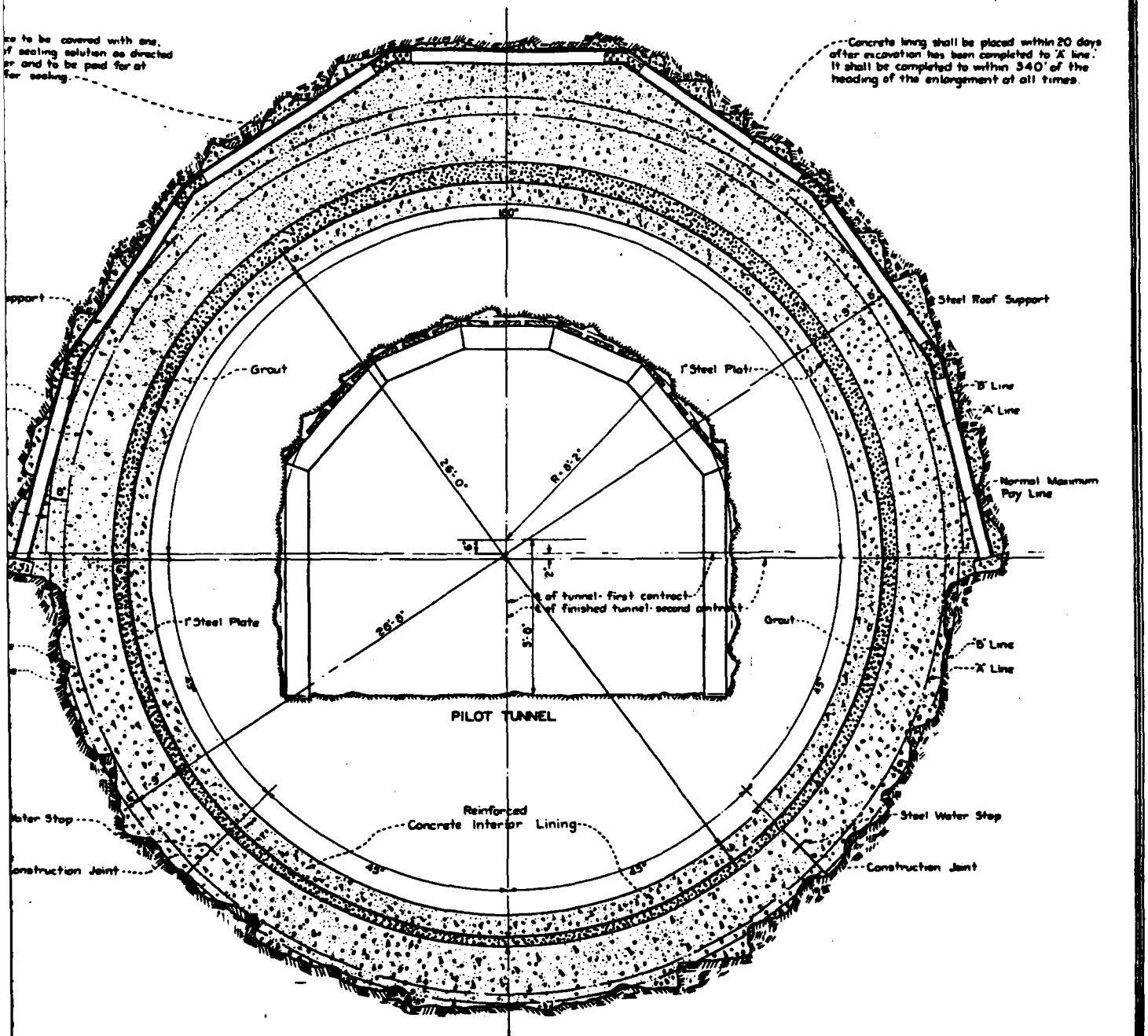
SCALE: 1" = 1'-0"

GRAPHIC SCALE

2



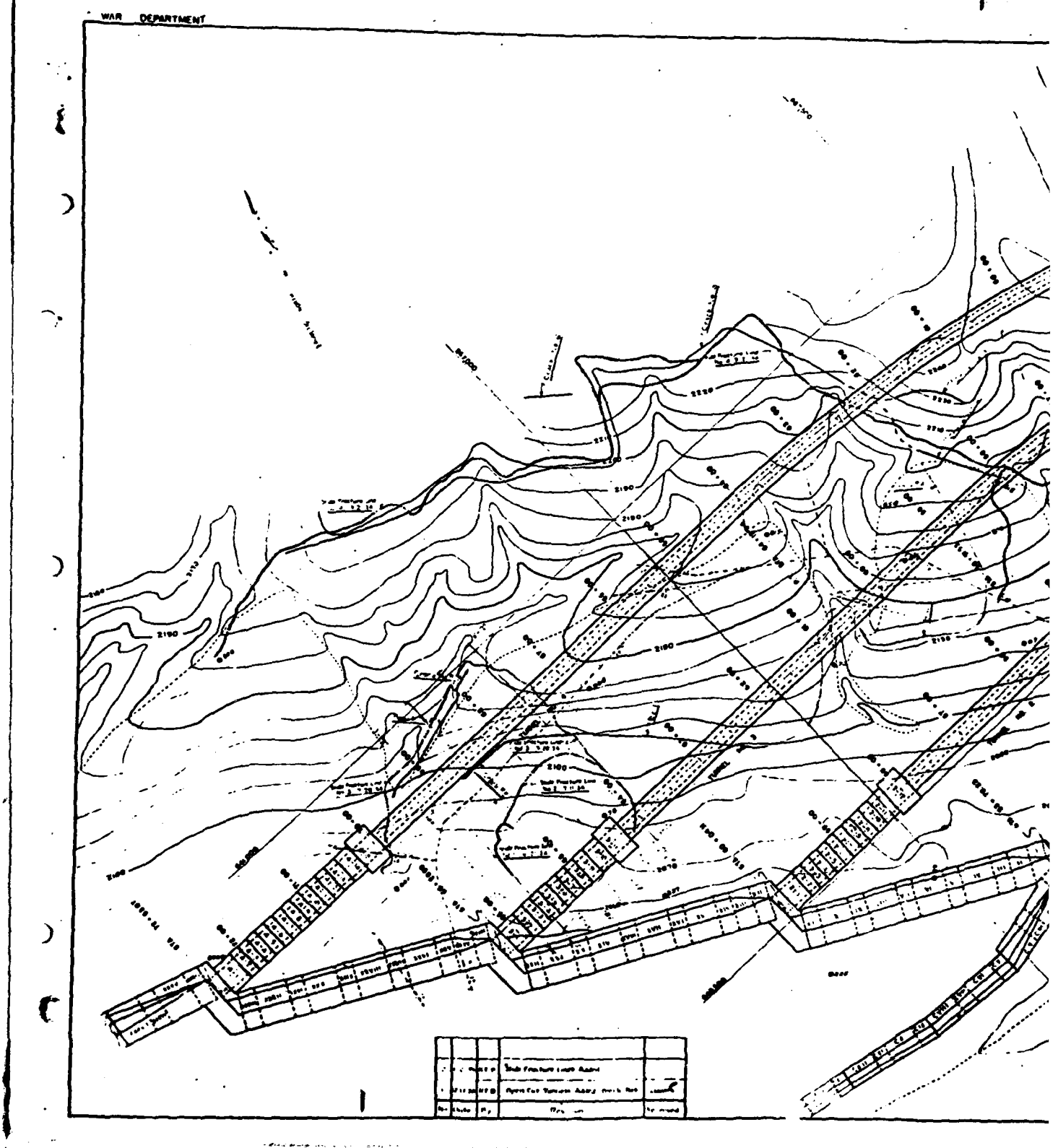
TYPICAL TUNNEL CROSS SECTION WHERE ST
ARE REQUIRED

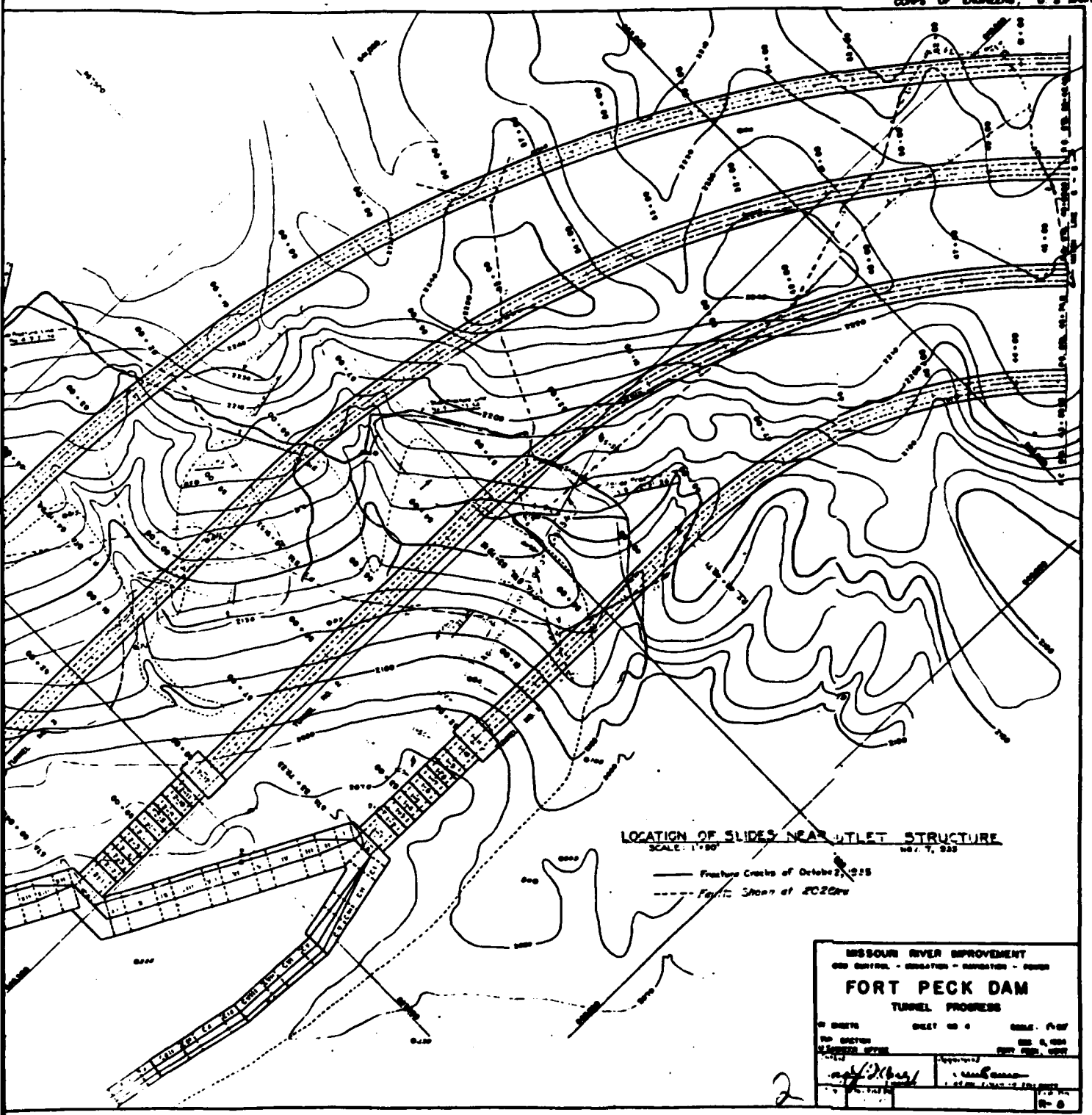


TYPICAL TUNNEL CROSS SECTION WHERE STEEL SUPPORTS ARE REQUIRED

2

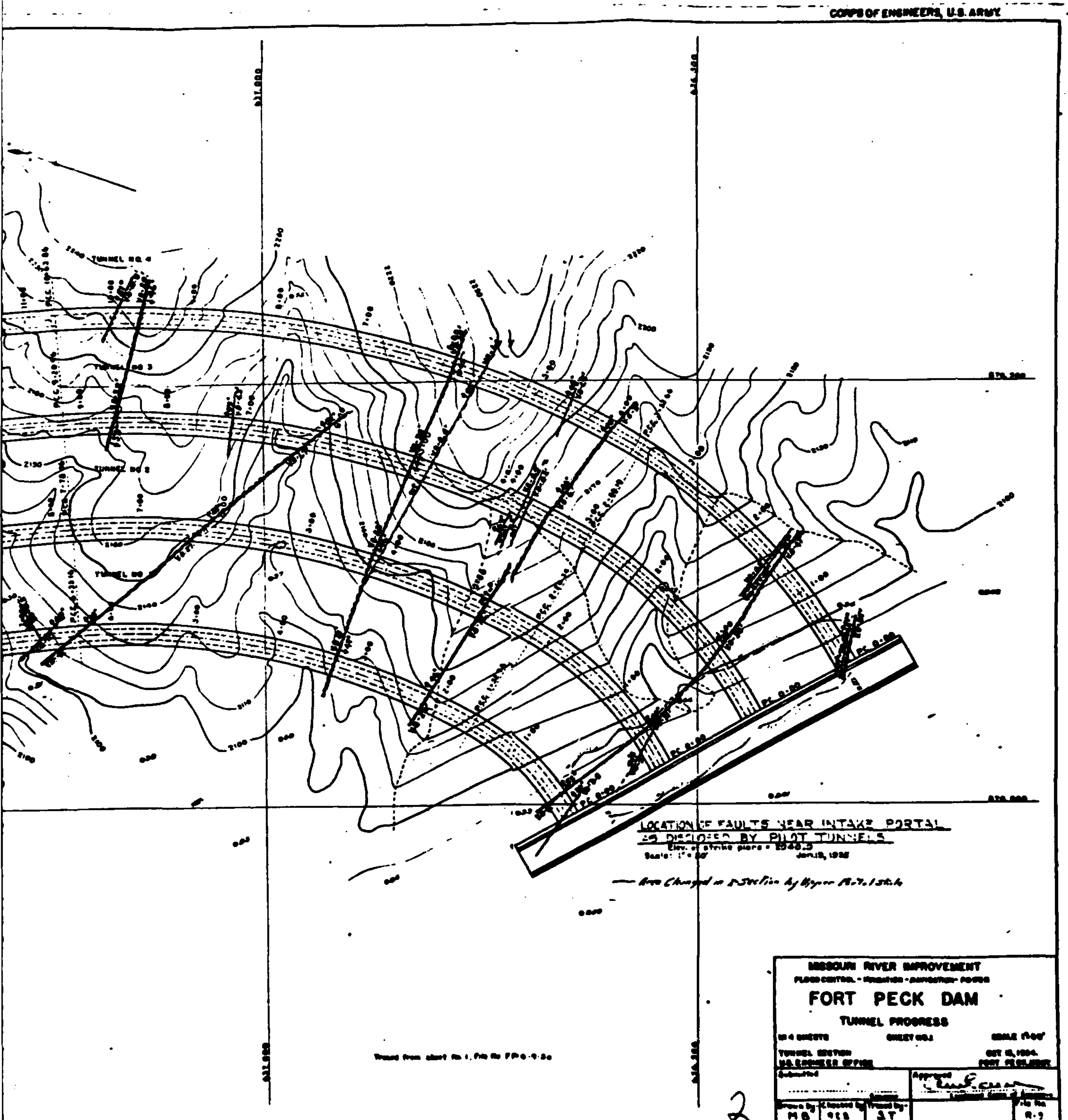
CONSTRUCTION FOUNDATION REPORT PLATE 2


WAR DEPARTMENT

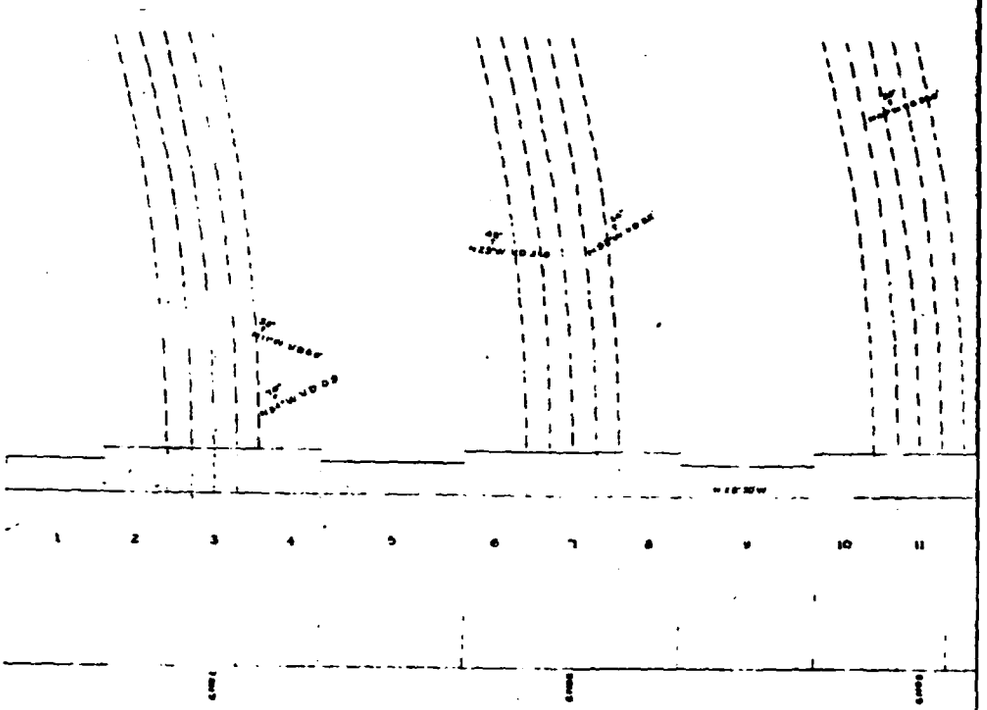


CONSTRUCTION FOUNDATION REPORT PLATE 204

WAR DEPARTMENT


CORPS OF ENGINEERS, U.S. ARMY
TUNNEL NO. 4
TUNNEL NO. 3
TUNNEL NO. 2
LOCATION OF FAULTS NEAR INTAKE PORTAL
AS DISCLOSED BY PILOT TUNNELS
MISSOURI RIVER IMPROVEMENT
FORT PECK DAM
TUNNEL PROGRESS
TUNNEL SECTION
U.S. ENGINEER OFFICE
Approved
Drawn by: MB
Traced by: ST

WAR DEPARTMENT

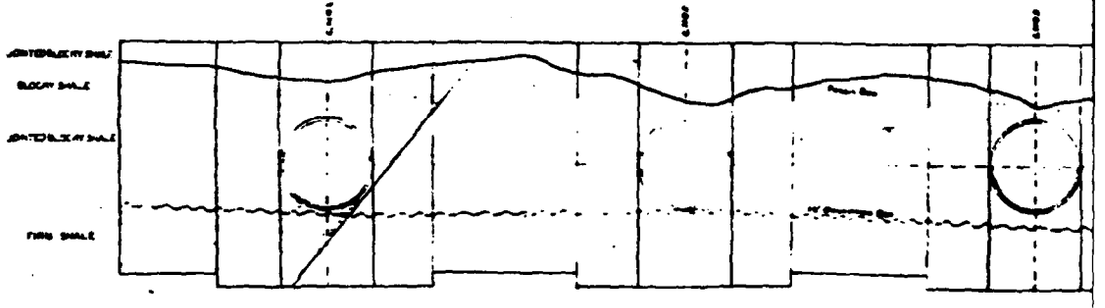


UPPER PORTALS

PLAN MAP AT ELEV 2080

SHOWING HEADWALL AND MONEY PIPES IN TUNNELS

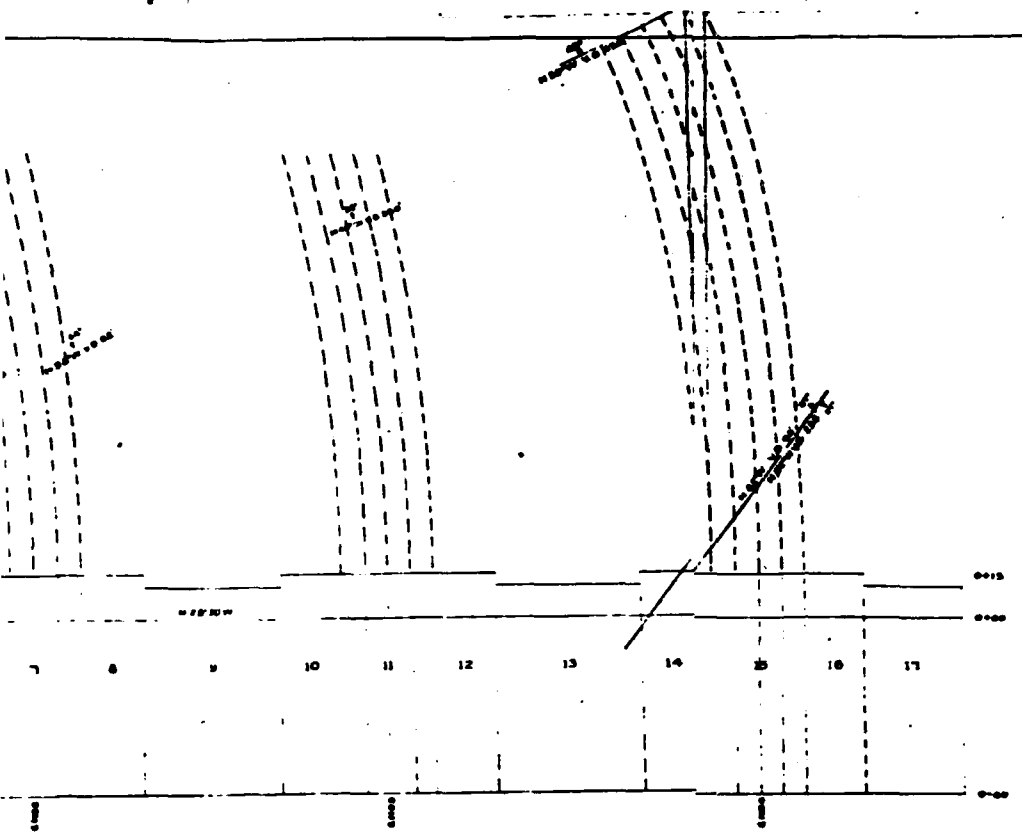
Scale in Feet



UPPER PORTALS

SECTION SHOWING GEOLOGIC STRUCTURE PARALLEL TO TUNNEL AT STA 60+10

Scale in Feet

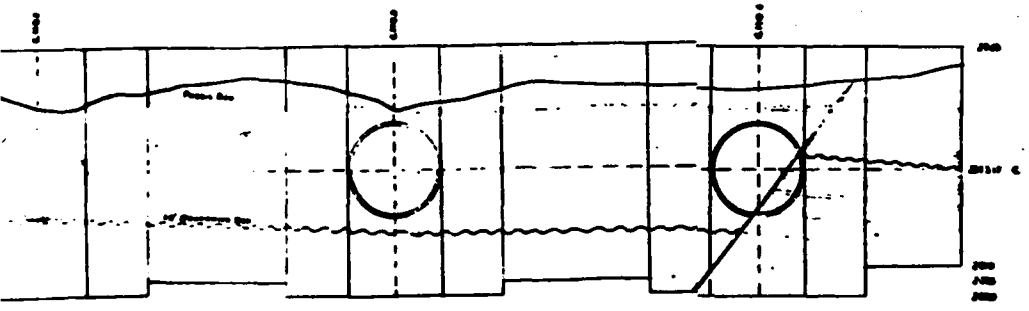


UPPER PORTALS

PLAN PARTIAT ELEV 2000

SHOWING HEADWALL AND HENRY FAULTS IN TUNNELS

Scale in Feet



UPPER PORTALS

SECTION SHOWING GEOLOGIC STRUCTURE PARALLEL TO VENTER AT STA 00+10

Scale in Feet

MISSOURI RIVER IMPROVEMENT

FLOOD CONTROL - IRRIGATION - NAVIGATION - POWER

FORT PECK DAM

UPPER PORTAL

GEOLOGIC STRUCTURE

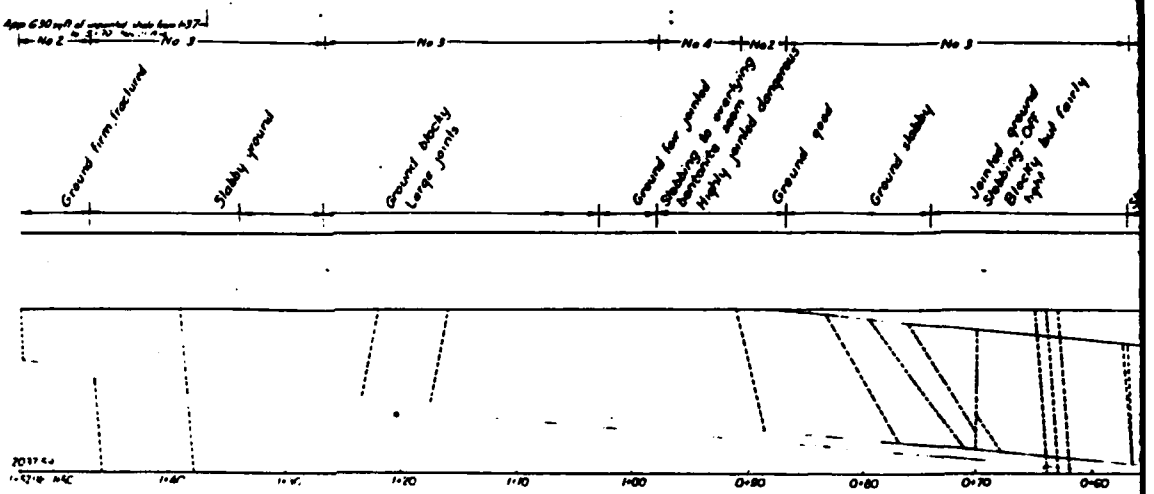
Scale 1" = 10'

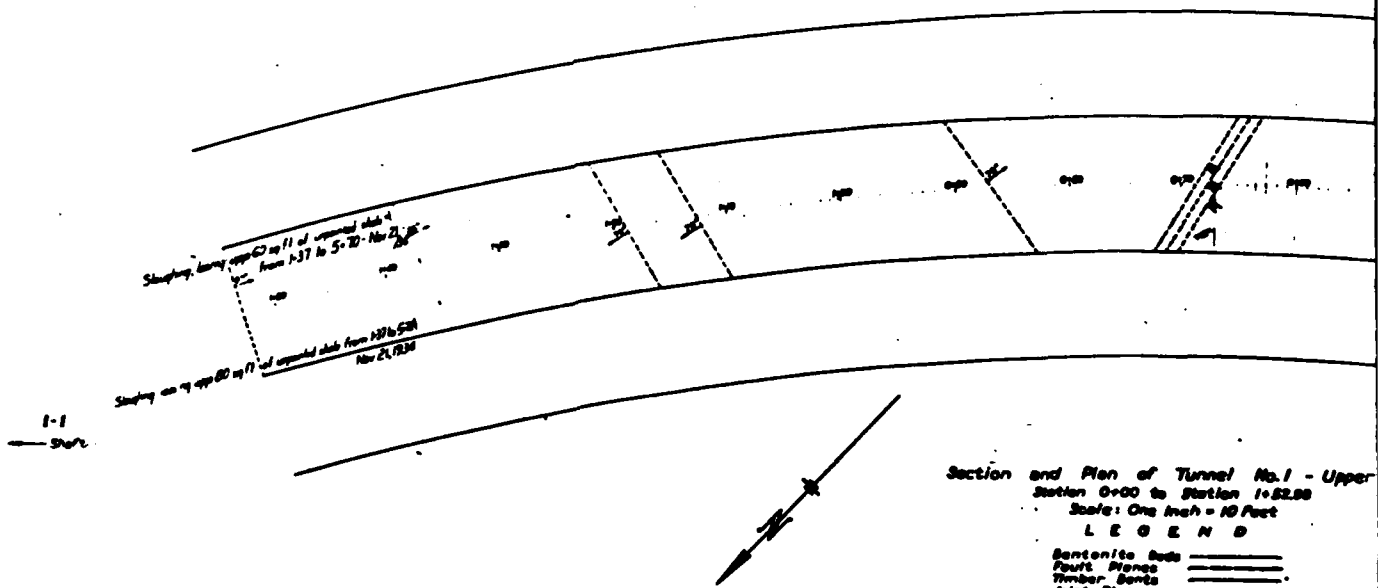
TUNNEL SECTION

APRIL 15, 1938

FORT PECK MONT.

2

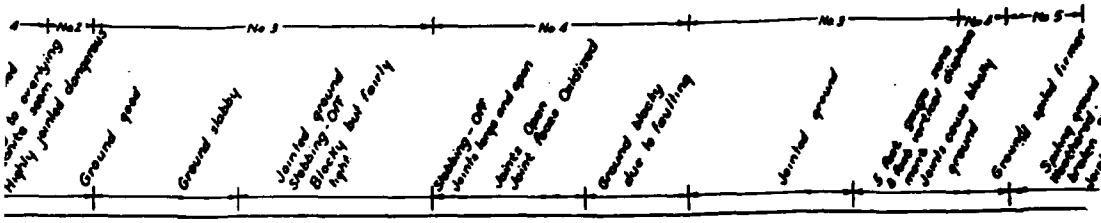


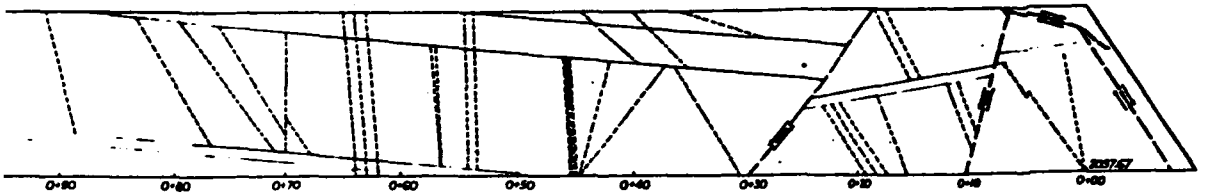


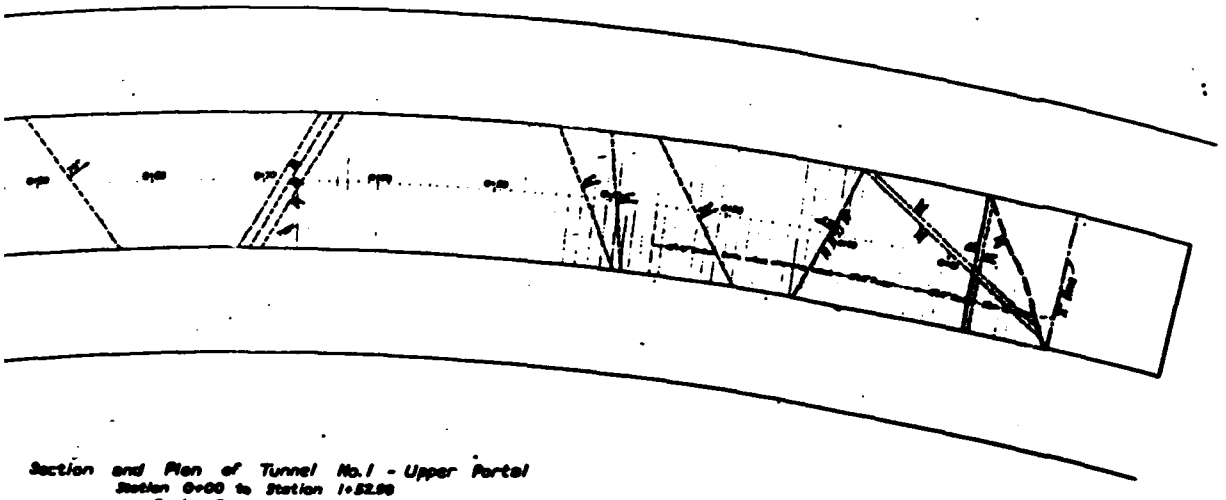
Section and Plan of Tunnel No.1 - Upper
Station 0+00 to Station 1+52.88
Scale: One Inch = 10 Feet

L E G E N D

Bentonite Beds
Fault Planes
Timber Bents
Joint Planes





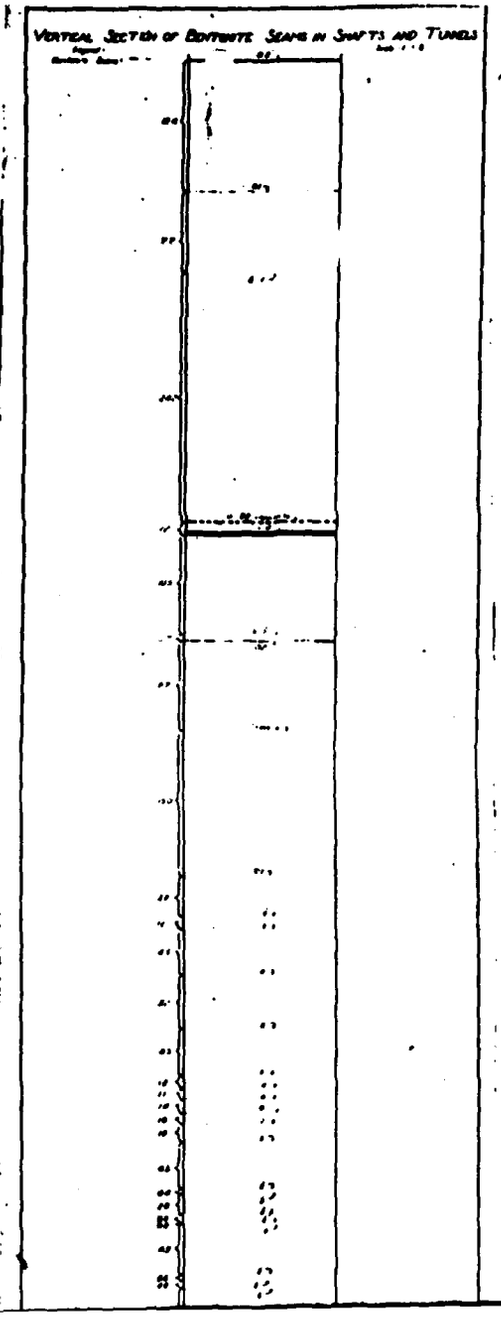


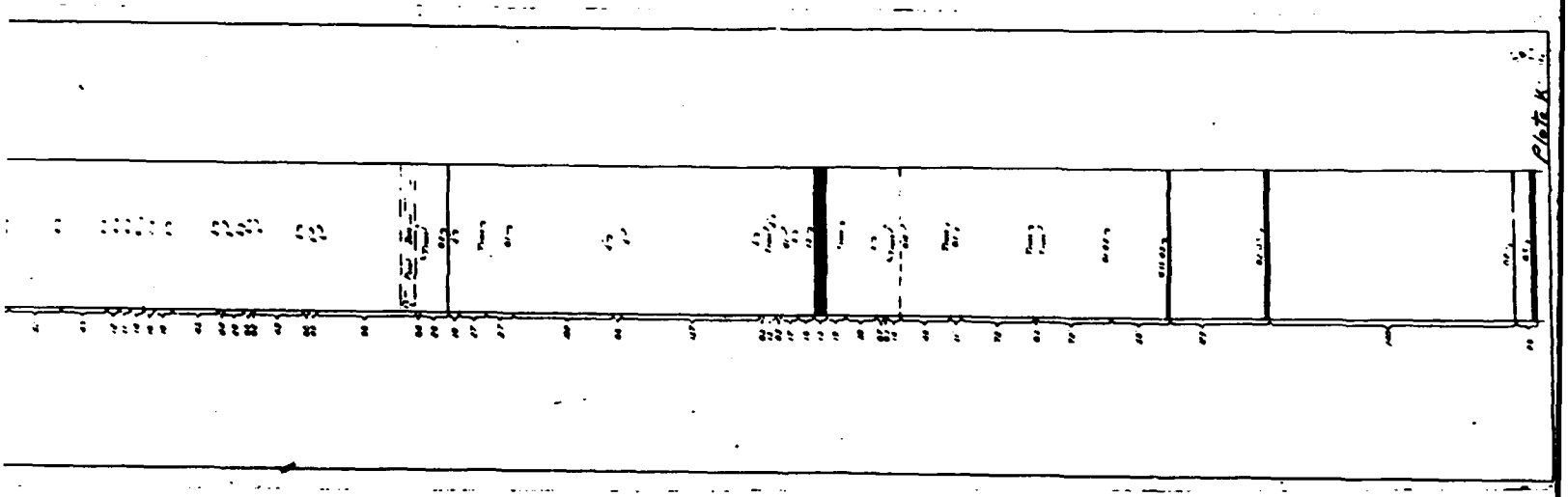
1-1
Upper Portal

Section and Plan of Tunnel No.1 - Upper Portal
Station 0+00 to Station 1+52.98
Scale: One Inch = 10 Feet

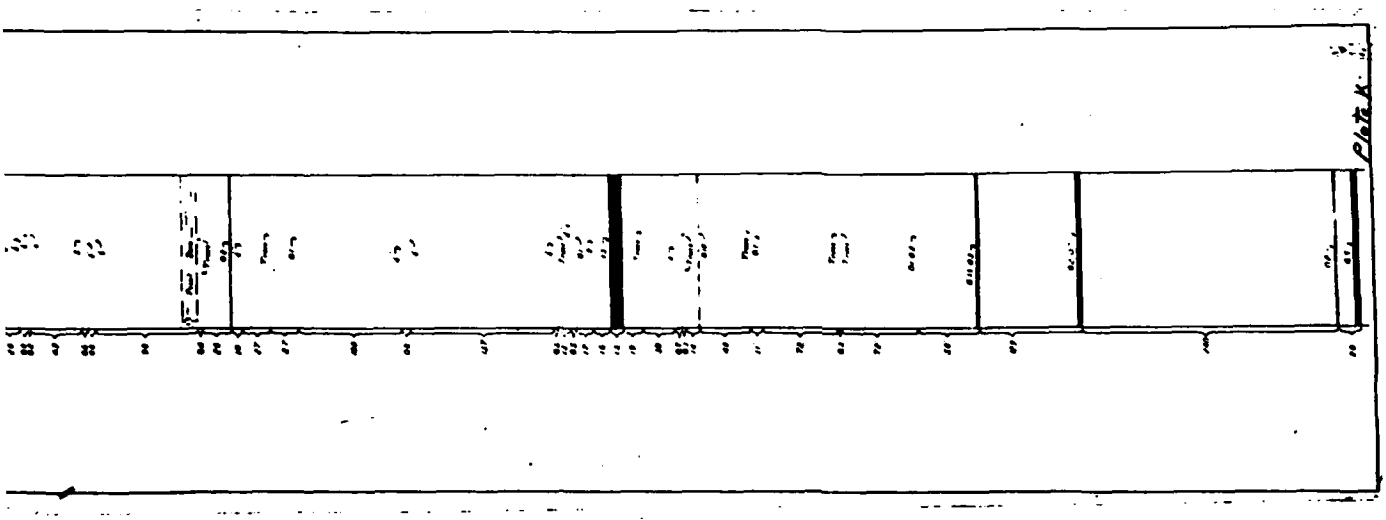
L E G E N D

Bentonite Beds
Fault Planes
Timber Bents
Joint Planes


Vertical Section of Bentonite Seams in Shafts and Tunnels

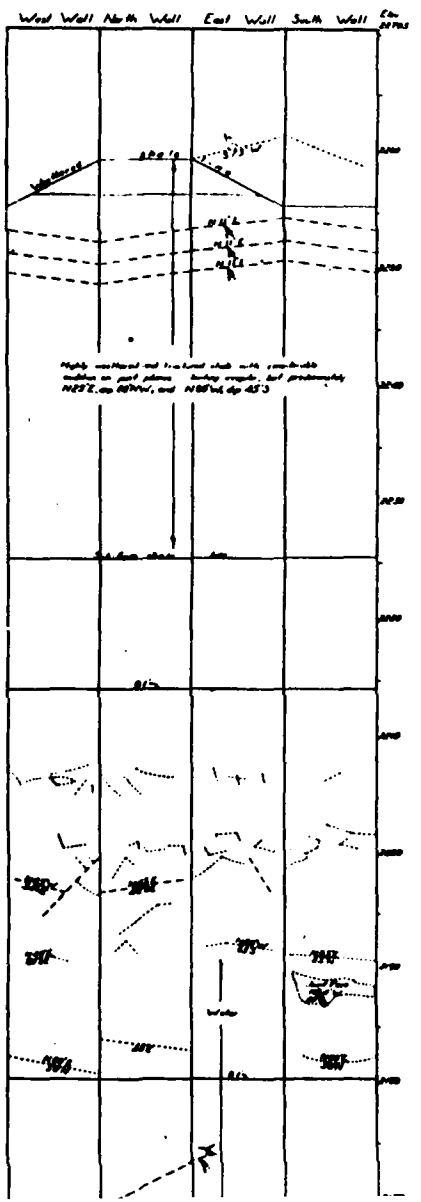


CONSTRUCTION FOUNDATION REPORT PLATE 20

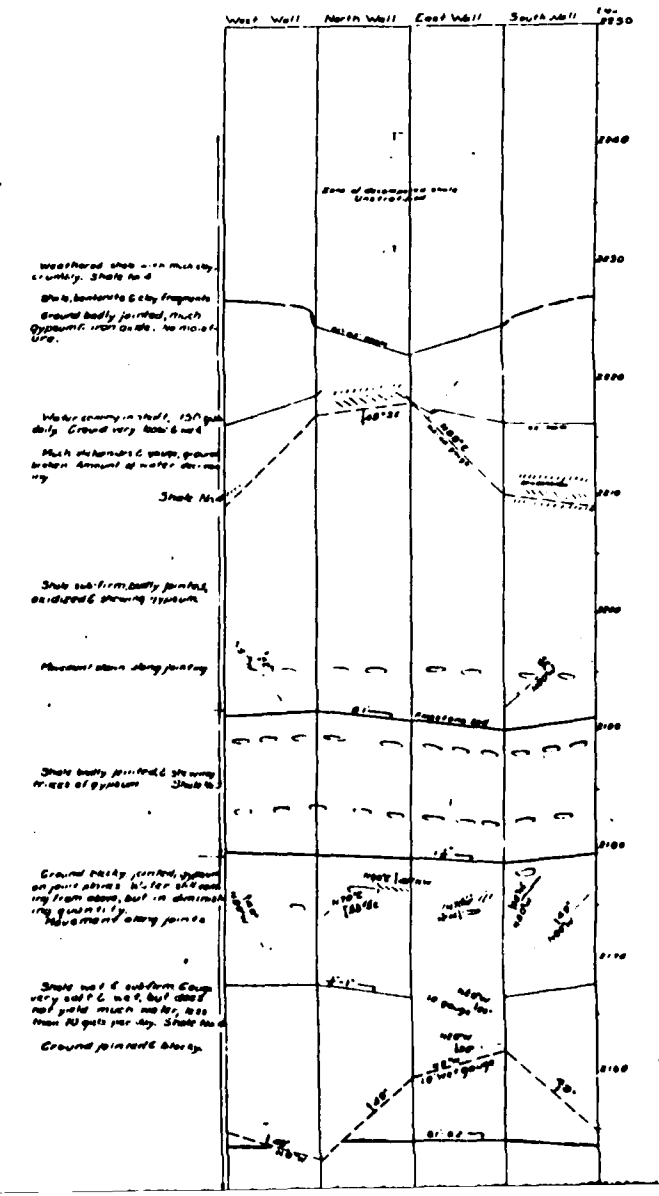


CONSTRUCTION FOUNDATION REPORT PLATE 208

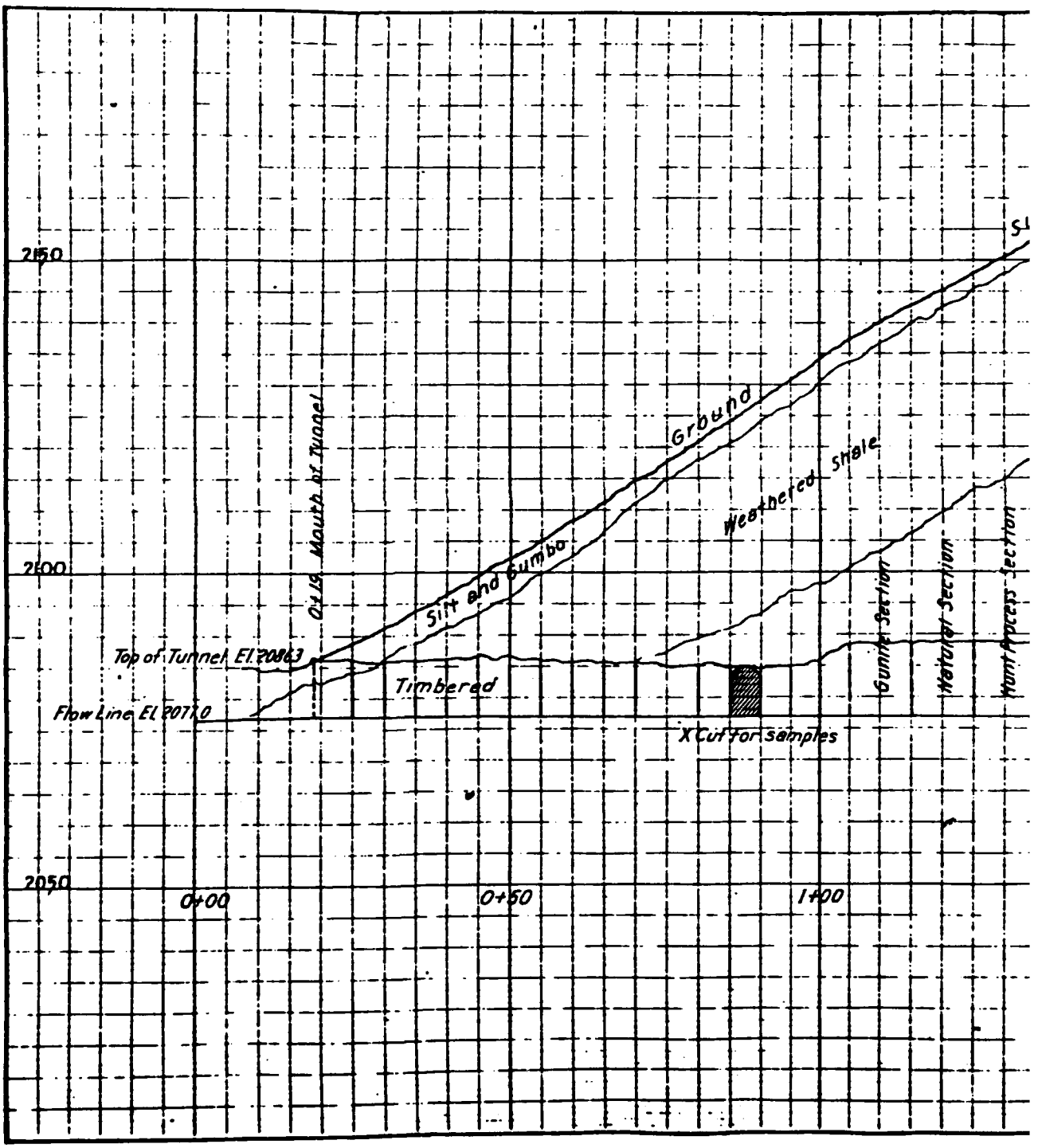
Pilot Shaft No.2

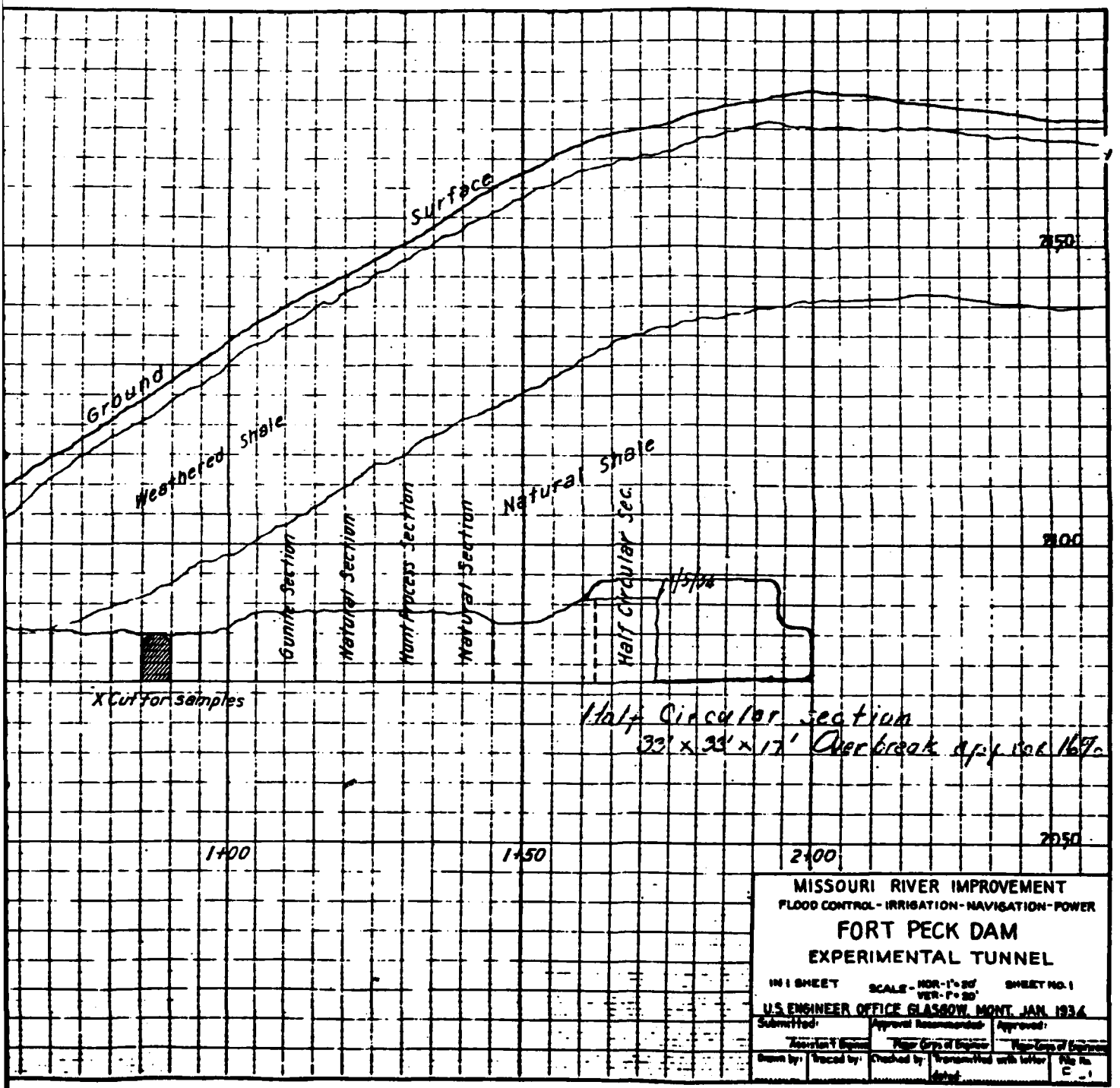


Emergency Control Shaft No.2



CONSTRUCTION FOUNDATION REPORT PLATE 209


2150
2100
2050
0+00
0+50
1+00
Ground
Weathered shale
Silt and Gumbo
Timbered
Top of Tunnel El 20863
Flow Line El 20710
0+19 Mouth of Tunnel
X Cut for samples
Gunnel Section
Natural Section
Mount Access Section



MISSOURI RIVER IMPROVEMENT
FLOOD CONTROL - IRRIGATION - NAVIGATION - POWER

FORT PECK DAM

EXPERIMENTAL TUNNEL

IN 1 SHEET SCALE - HOR - 1" = 20' VER - 1" = 20' SHEET NO. 1

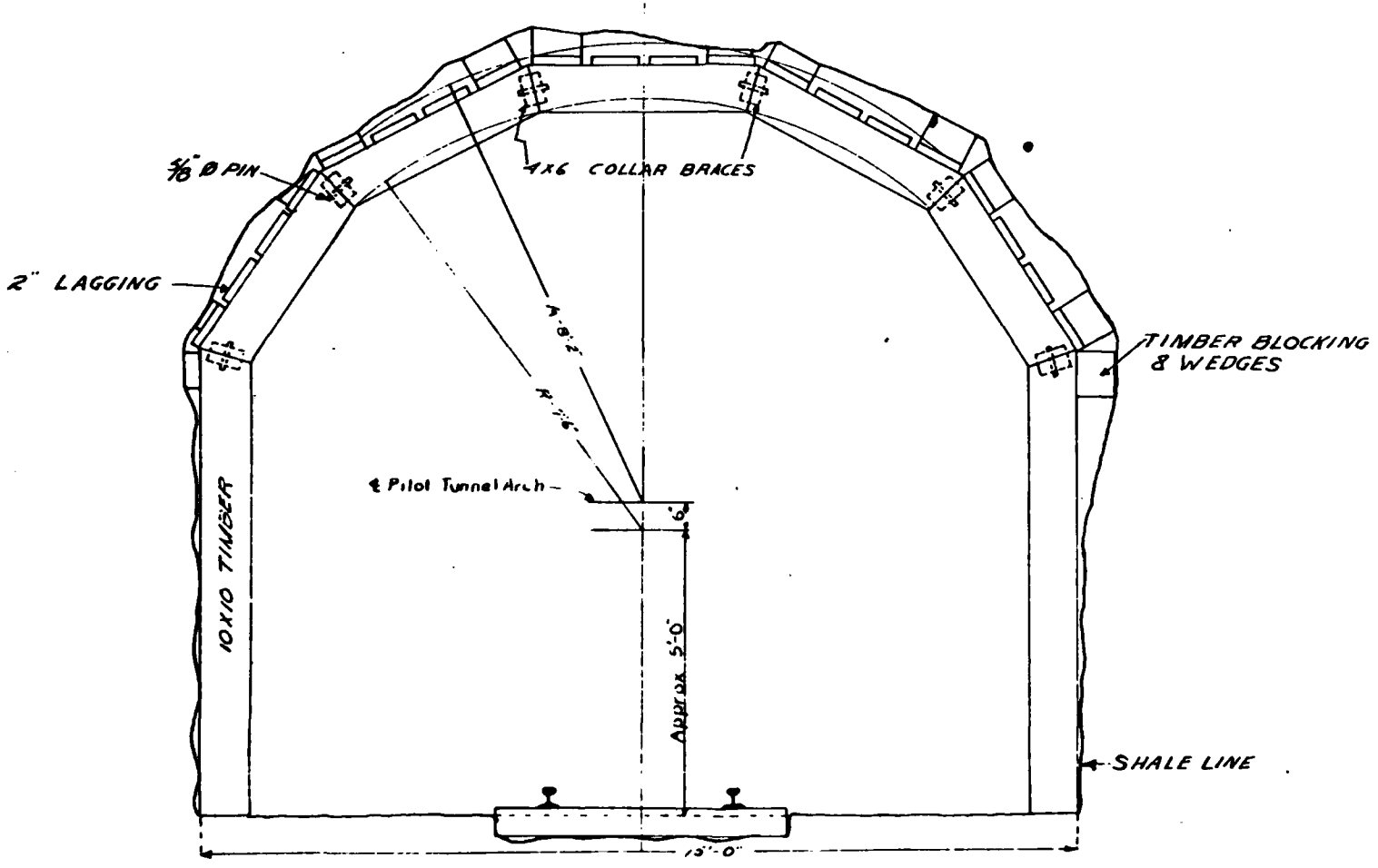
U.S. ENGINEER OFFICE GLASGOW, MONT. JAN. 1934

Submitted:	Approval Recommended:	Approved:
Assistant Engineer	Major Corps of Engineers	Major Corps of Engineers

Drawn by:	Traced by:	Checked by:	Transmitted with letter dated	File No. E-1

CONSTRUCTION FOUNDATION REPORT PLATE 210

2



TYPICAL PILOT TUNNEL SUPPORT

CONSTRUCTION FOUNDATION REPORT PLATE 211

END

DATE

FILMED

12 83

DT