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CONSTRUCTION REPORT  
PETROTOMICS TAILINGS EMBANKMENT  
SHIRLEY BASIN, WYOMING

Prepared For:

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## INTRODUCTION

The Petrotomics Shirley Basin uranium project consists of several open pit mines, a maintenance shop, a mill, and a tailings disposal area. The original tailings disposal impoundment consisted of an earthen dam constructed around 1963. The embankment was approximately 6,000 feet long with a maximum height of 35 feet. To increase tailings storage capacity, a tailings dam embankment addition was constructed utilizing the existing embankment as the upstream toe of the addition. The embankment addition has a crest length of approximately 6,400 feet, a top width of 50 feet, and a maximum height of 75 feet. Appurtenant structures to the tailings dam consist of a downstream seepage collection trench, associated seepage ponds, a pumping system to return seepage to the main impoundment, and a sand spigoting system to construct a sand beach wave protection of the upstream dam face.

## DESIGN

Geotechnical aspects of construction of the embankment addition were prepared by Chen and Associates, Inc. of Casper, Wyoming. The original geotechnical report was submitted to Petrotomics Company for submittal to the NRC on August 22, 1976. An additional investigation was conducted and the results submitted to Petrotomics Company for submittal to the NRC on September 23, 1976. A stability analysis was conducted and the results submitted to Petrotomics Company for submittal to the NRC on September 30, 1976. An additional foundation investigation was conducted and reported to Petrotomics Company on May 3, 1977. The final geotechnical report, plans, and specifications for construction were submitted to Petrotomics Company for submittal to the NRC on July 22, 1977. Specifications for the project were revised in January of

1978, May of 1978, and March of 1979 by Chen and Associates, Inc. for Petrotomics Company. Construction specifications for the project were prepared by Chen and Associates, Inc. Plans and construction drawings for the project were prepared by Banner Associates, Inc. of Laramie, Wyoming. Original plans and specifications were submitted to Petrotomics Company for submittal to the NRC on July 22, 1977 and revised by Chen and Associates and Banner Associates for submittal to the NRC January 31, 1978; May 4, 1978; March 2, 1979; and August 2, 1979.

#### CONSTRUCTION

All construction was done by personnel from Petrotomics Company. Clearing and grubbing of topsoil in the embankment addition area began on May 15, 1978. Construction of the embankment addition began on May 22, 1978 and was completed on September 15, 1979. As-built construction drawings for the embankment are presented in Appendix "A".

Throughout most of the construction, a double shift operation was in progress. Our field inspectors were on site during placement and compaction of fill. Daily reports have been submitted previously which indicate construction procedures, source of fill materials, compaction, and fill properties. Also weekly summaries were provided as the work progressed.

The embankment construction was inspected by Mr. Duane Lillard of the Corps of Engineers on July 12, 1978 and by Mr. Joe Kane and Mr. Ted Johnson of the NRC on April 19, 1979.

#### FOUNDATION PREPARATION

Subgrade Preparation: Topsoil was stripped from the dam foundation prior to commencement of excavation for the north and south cutoff walls and placement of the embankment soils. Subgrade preparation for the

north and south cutoff walls began on June 1, 1978. Subgrade preparation for the remainder of the embankment addition progressed as new work areas developed. Subgrade preparation consisted of scarifying, adjusting the moisture content, and recompacting the natural foundation soils according to the moisture and density specifications for the project. Removal of soft, wet areas around the existing seepage ponds and other localized soft pockets was completed and this material was replaced with compacted impervious fill. All subgrade preparation was completed by August 5, 1978. Considerable compactive effort was required in all locations to achieve the moisture and density specifications during subgrade preparation. Soft, wet areas required much time and effort for both excavation and recompaction. At the completion of subgrade preparation on August 5, 1978, all subgrade soils had been scarified and compacted to meet project specification requirements.

Compacted Earth Cutoff Trenches: Excavation of the north and south cutoff trenches was made according to construction plans and specifications. Excavation of the south cutoff trench began on May 22, 1978. At this time, alignment of the dam axis between Stations 0+00 and 12+00 was changed to provide roadway access to the mill building. Excavation of the south cutoff trench was completed, inspected, and impervious fill placement in this area began on June 30, 1978. Excavation of the north cutoff trench began on June 21, 1978. The excavation was completed and inspected on July 12, 1978 by Mr. Harold Hollingsworth of Chen and Associates, Inc. Placement of compacted fill began on July 13, 1978.

Slurry Wall Cutoff: A slurry wall cutoff was constructed by Engineered Constructors, Inc. of Pittsburg along the centerline of the embankment addition connecting the north and south compacted earth

cutoff trenches. The slurry wall cutoff consisted of a vertical walled trench 2.5 feet wide excavated by backhoe into bedrock through a slurry consisting of a colloidal bentonite-water suspension. The bentonite-water slurry was replaced with a viscous soil-bentonite mixture as required by specifications. Prior to mobilization of the specialty contractor, a 3-foot high working surface pad was constructed of impervious fill placed and compacted to project specifications along the slurry cutoff wall alignment. The slurry wall specialty contractor mobilized on the site July 11, 1978 and began excavation of the cutoff wall this date at Station 20+00. Backfilling with the soil-bentonite mixture began on July 14, 1978. Excavation and backfill of the slurry cutoff wall was completed to Station 60+00 on July 20, 1978. No difficulty was encountered by the specialty contractor during the construction of the slurry cutoff wall. Operations were ahead of schedule and the contractor demobilized from the site prior to the specified time. The slurry cutoff wall trench bottom was extended below the specified 1 foot penetration into bedrock. A summary of as-built slurry wall data is presented in Appendix "B".

#### MAIN EMBANKMENT

Placement of impervious fill in the dam prism began with the north and south cutoff trench backfill and construction of the slurry cutoff wall working surface pad previously described and continued with placement in the main body of the dam.

A horizontal sand drainage blanket was constructed beneath the downstream slope of the embankment addition to the dimensions shown on the construction drawings. The drainage material was obtained from a sandstone borrow area northwest of the construction site. Prior to

construction of the drainage blanket, grading of the subgrade soils to drain away from the dam and preparation of the subgrade soils as previously outlined was completed. Grading of the drain subgrade began on July 31, 1978 and was completed on August 5, 1978. Placement of drainage blanket fill began on August 5, 1978 and was completed on August 30, 1978. Placement of drainage fill progressed at a satisfactory rate. The major problem encountered during placement of drainage blanket fill consisted of clay contamination of the fill from adjacent areas. The fill in all contaminated areas was removed and replaced with suitable fill.

On August 5, 1978, preparation was made to stockpile impervious fill material taken from the 6980 bench of the operating mine pit. This material was stockpiled northwest of the construction site. Moisture was added to the fill material during stockpiling. By the end of the 1978 construction season, sufficient impervious fill material had been stockpiled to complete the project. Visual inspection of the borrow areas in the mine pit was conducted on a daily basis by field personnel from Chen and Associates, Inc. to insure quality of the imported material.

Additional fill processing equipment was purchased or leased by the owner during the fall of 1978. Placement of impervious fill progressed slowly until freezing of fill and bad weather made it necessary to shut down placement operations for the year. Fill placement terminated on November 14, 1978. At this time, approximately 390,000 cubic yards of impervious fill had been placed in the embankment addition.

Impervious fill placement resumed on April 25, 1979. At this time, permanent construction personnel had been assigned to the project. Adequate placement and processing equipment were available to perform



placement of impervious fill. During the 1979 construction season, fill was placed at a satisfactory rate and was placed to specification requirements. The embankment addition was completed on September 15, 1979. Final shaping of the slopes and excavation of the downstream seepage collection trench continued for an additional two weeks.

#### INSTRUMENTATION

Plans called for installation of 25 piezometers, 46 surface settlement and horizontal monuments, and six settlement sensors. Details of piezometers, monuments, and sensors are presented on the construction drawings presented in Appendix "A". Three permanent reference monuments were also installed. Their locations are presented in Appendix "C".

Of the 25 piezometers in the piezometer network, 10 were installed as foundation piezometers (Type B) and 15 were installed as embankment piezometers (Type A). The installed locations of the piezometers and a graphical presentation of piezometer readings for the piezometers which contained water since installation are presented in Appendix "E". Piezometers for which readings are not presented have either remained dry or no data are available. Since installation of the piezometers, there has been a slow decrease in the flow of water into the downstream seepage collection ponds. The installation of the slurry wall cutoff and overburden pressures exerted by the main embankment addition have decreased the underseepage through the embankment.

To monitor the horizontal and vertical movement of the embankment, monuments were installed at the locations presented in Appendix "D". Also presented are the original elevations.

The embankment settlement sensors were installed to monitor the settlements associated with the slurry cutoff wall. The installed



locations and original elevations are presented in Appendix "F". Graphical presentations of the readings since the installation of the sensors are also presented in Appendix "F".

#### OTHER CONSTRUCTION DETAILS

The downstream collector trench was designed to contain the PMF and to serve to collect any seepage through the embankment from the sand blanket and return it to the seepage collection ponds which are also designed to contain the PMF. The downstream collector trench was completed the week of September 20, 1979. The pump return system from the seepage ponds into the main tailings impoundment has been in service throughout construction of the project and remains in service at this time.

#### QUALITY ASSURANCE

During the construction of the embankment addition, Chen and Associates, Inc. had a qualified representative full time on each shift. A field soils laboratory was also established on the site to provide necessary laboratory testing backup for the quality assurance program. The quality assurance program began during the clearing and grubbing of topsoil in the embankment addition area. Quality assurance continued with monitoring the impervious fill sources in the pits, placement of impervious fill in the north and south cutoff trenches and for the slurry wall cutoff working surface pad, and continued throughout the entire construction period.

Daily inspections of the borrow areas in the mine pits were conducted to assure the suitability of the fill being stockpiled for use in the embankment addition. In-place moisture and density tests were

conducted throughout construction of the main embankment in both the drainage blanket and the impervious fill sections of the embankment to assure that all fill placed met specification requirements.

#### SUMMARY

Compaction specifications were easily met with the fill material and equipment being used. The end product of the construction project is a competent earth embankment which is performing as expected. The embankment has been built in accordance with construction drawings as revised and in compliance with project specification requirements.

CHEN AND ASSOCIATES, INC.



BY Harold Hollingsworth, Jr.  
Harold Hollingsworth, Jr., P.E.

REVIEWED BY Kenneth E. Temme  
Kenneth E. Temme, P.E.

HR:bec

POOR ORIGINAL

RE-ENTRY CONSTRUCTION PERMITS

## APPENDIX "B"

## AS BUILT PROFILE OF DIAPHRAGM CUTOFF WALL BOTTOM

<u>Station</u>	<u>Depth to Top of Bedrock (ft.)</u>	<u>Penetration into Bedrock (ft.)</u>	<u>Soil Type</u>	<u>Elevation of Trench Bottom</u>
20+00	9.0	10.0	Clavstone	7047.7
20+20	5.0	7.0	Claystone	7050.5
20+40	5.0	6.0	Claystone	7051.3
20+60	5.3	7.0	Claystone	7050.1
20+80	9.0	10.0	Claystone	7046.9
21+20	9.5	10.5	Claystone	7046.2
21+20	9.0	10.0	Claystone	7046.4
21+40	9.0	11.0	Claystone	7045.1
21+60	9.0	10.0	Claystone	7045.8
21+80	9.0	10.4	Claystone	7045.0
22+00	8.0	9.5	Claystone	7045.5
22+20	9.0	10.3	Claystone	7044.7
22+40	9.0	10.4	Claystone	7044.6
22+60	9.0	10.0	Claystone	7045.1
22+80	9.0	10.6	Claystone	7044.5
23+00	8.0	9.0	Claystone	7046.1
23+20	9.0	10.0	Claystone	7045.0
23+40	9.0	10.0	Claystone	7044.9
23+60	9.0	10.0	Claystone	7044.7
23+80	9.0	10.0	Claystone	7044.6
24+00	10.0	11.0	Claystone	7043.5
24+20	10.0	11.0	Claystone	7043.1
24+40	8.0	9.6	Claystone	7044.1
24+60	9.0	10.3	Claystone	7043.0
24+80	8.0	10.6	Claystone	7042.4
25+00	8.0	9.5	Claystone	7043.3
25+20	7.6	9.6	Claystone	7042.9
25+40	8.0	9.0	Claystone	7043.1
25+60	9.0	10.0	Claystone	7041.6
25+80	8.0	9.0	Claystone	7042.2
26+00	9.0	11.0	Claystone	7039.9
26+20	10.0	11.5	Claystone	7039.3
26+40	10.6	11.7	Claystone	7039.0
26+60	10.9	12.2	Claystone	7038.4
26+80	10.5	11.8	Claystone	7038.8
27+00	10.0	11.5	Claystone	7039.0
27+20	10.0	11.8	Claystone	7038.7
27+40	10.0	11.5	Claystone	7039.0
27+60	8.0	9.0	Claystone	7041.4
27+80	9.0	10.0	Claystone	7040.4
28+00	9.0	10.0	Claystone	7040.4
28+20	8.0	9.5	Claystone	7040.9
28+40	8.0	9.6	Claystone	7040.9
28+60	10.0	11.0	Claystone	7039.5
28+80	9.0	10.5	Claystone	7040.1

## APPENDIX "B"

## AS BUILT PROFILE OF DIAPHRAGM CUTOFF WALL BOTTOM

<u>Station</u>	<u>Depth to Top of Bedrock</u> (ft.)	<u>Penetration into Bedrock</u> (ft.)	<u>Soil Type</u>	<u>Elevation of Trench Bottom</u>
29+00	9.0	10.0	Claystone	7040.6
29+20	10.0	11.9	Claystone	7038.6
29+40	11.0	12.0	Claystone	7038.4
29+60	9.0	10.0	Sandstone	7040.3
29+80	10.0	11.0	Sandstone	7039.2
30+00	10.0	11.8	Sandstone	7038.3
30+20	12.0	13.0	Sandstone	7037.1
30+40	12.0	13.0	Sandstone	7037.2
30+60	12.0	13.0	Sandstone	7037.2
30+80	12.0	13.0	Sandstone	7037.2
31+00	12.0	13.0	Sandstone	7037.2
31+20	11.0	12.0	Sandstone	7038.3
31+40	12.0	13.8	Sandstone	7036.5
31+60	12.0	14.0	Sandstone	7036.2
31+80	13.0	14.9	Sandstone	7035.3
32+00	12.0	13.0	Sandstone	7037.2
32+20	11.5	13.0	Sandstone	7037.0
32+40	12.0	13.7	Sandstone	7036.1
32+60	12.0	14.8	Sandstone	7034.8
32+80	12.0	13.2	Sandstone	7036.2
33+00	13.0	14.5	Sandstone	7034.7
33+20	12.0	13.0	Sandstone	7036.0
33+40	12.0	13.0	Sandstone	7035.8
33+60	12.0	14.0	Sandstone	7034.7
33+80	12.0	13.0	Sandstone	7035.6
34+00	12.0	13.0	Sandstone	7035.4
34+20	12.0	13.0	Sandstone	7035.4
34+40	12.0	13.0	Sandstone	7035.4
34+60	12.0	13.0	Sandstone	7035.4
34+80	12.0	13.0	Sandstone	7035.4
35+00	12.0	13.0	Sandstone	7035.4
35+20	12.0	13.0	Sandstone	7035.3
35+40	12.0	13.0	Sandstone	7035.2
35+60	12.0	13.0	Sandstone	7035.0
35+80	12.0	13.0	Sandstone	7034.9
36+00	12.0	13.0	Sandstone	7034.8
36+20	12.0	13.0	Sandstone	7034.6
36+40	12.0	13.0	Sandstone	7034.4
36+60	12.0	13.0	Sandstone	7034.2
36+80	12.0	13.0	Sandstone	7034.0
37+00	12.0	13.0	Sandstone	7033.7
37+20	12.0	13.0	Sandstone	7033.6
37+40	12.0	13.0	Sandstone	7033.5
37+60	12.0	13.0	Sandstone	7033.3
37+80	10.0	11.0	Claystone	7035.1



## APPENDIX "B"

## AS BUILT PROFILE OF DIAPHRAGM CUTOFF WALL BOTTOM

<u>Station</u>	<u>Depth to Top of Bedrock</u> (ft.)	<u>Penetration into Bedrock</u> (ft.)	<u>Soil Type</u>	<u>Elevation of Trench Bottom</u>
38+00	14.0	15.0	Claystone.	7031.9
38+20	12.0	13.0	Claystone	7032.6
38+40	13.0	14.0	Claystone	7031.3
38+60	13.0	14.0	Claystone	7031.0
38+80	13.0	14.6	Claystone	7030.1
39+00	13.0	14.6	Claystone	7030.0
39+20	14.0	15.0	Claystone	7029.0
39+40	14.0	15.8	Claystone	7027.6
39+60	9.0	10.0	Sandstone	7032.8
39+80	9.0	10.0	Sandstone	7032.2
40+00	8.0	9.0	Sandstone	7032.7
40+20	9.0	10.0	Sandstone	7030.9
40+40	9.0	10.0	Sandstone	7030.1
40+60	9.0	10.0	Sandstone	7029.3
40+80	9.0	11.0	Sandstone	7027.6
41+00	10.0	13.0	Sandstone	7024.9
41+20	10.0	13.0	Sandstone	7024.2
41+40	10.0	13.0	Sandstone	7023.5
41+60	11.0	13.0	Sandstone	7022.8
41+80	10.0	12.0	Sandstone	7023.0
42+00	10.0	12.0	Sandstone	7022.2
42+20	10.0	12.0	Sandstone	7022.0
42+40	10.0	13.0	Sandstone	7020.7
42+60	11.0	13.0	Sandstone	7020.5
42+80	11.0	13.0	Sandstone	7020.2
43+00	11.0	14.0	Sandstone	7019.0
43+20	12.0	13.0	Sandstone	7020.6
43+40	12.0	13.6	Sandstone	7020.6
43+60	10.0	11.0	Sandstone	7023.8
43+80	10.0	12.0	Sandstone	7023.4
44+00	11.0	12.0	Sandstone	7024.0
44+20	12.0	13.0	Sandstone	7024.4
44+40	10.0	11.8	Sandstone	7027.0
44+60	9.0	10.6	Sandstone	7029.6
44+80	10.0	11.0	Sandstone	7030.6
45+00	10.0	11.0	Sandstone	7032.0
45+20	10.0	11.0	Sandstone	7032.1
45+40	10.0	11.0	Sandstone	7032.2
45+60	10.0	11.0	Sandstone	7032.2
45+80	11.0	12.0	Sandstone	7031.3
46+00	11.0	12.0	Sandstone	7031.4
46+20	10.0	11.6	Sandstone	7032.1
46+40	10.0	11.5	Sandstone	7032.6
46+60	10.0	11.0	Sandstone	7033.4
46+80	10.0	11.0	Sandstone	7033.8

## APPENDIX "B"

## AS BUILT PROFILE OF DIAPHRAGM CUTOFF WALL BOTTOM

<u>Station</u>	<u>Depth to Top of Bedrock</u> (ft.)	<u>Penetration into Bedrock</u> (ft.)	<u>Soil Type</u>	<u>Elevation of Trench Bottom</u>
47+00	10.0	11.0	Sandstone	7034.1
47+20	10.0	11.0	Sandstone	7034.2
47+40	10.0	11.0	Sandstone	7034.3
47+60	10.0	11.8	Sandstone	7033.6
47+80	10.0	11.0	Sandstone	7034.5
48+00	11.0	12.2	Sandstone	7033.4
48+20	10.0	11.0	Sandstone	7034.9
48+40	10.0	11.0	Sandstone	7035.1
48+60	10.0	11.4	Sandstone	7035.0
48+80	10.0	11.2	Sandstone	7035.4
49+00	10.0	11.0	Sandstone	7035.9
49+20	10.0	11.0	Sandstone	7036.0
49+40	10.0	12.6	Sandstone	7034.5
49+60	10.0	11.2	Sandstone	7036.1
49+80	10.0	11.2	Sandstone	7036.2
50+00	10.0	12.0	Sandstone	7035.5
50+20	10.0	12.2	Sandstone	7035.3
50+40	10.0	11.3	Sandstone	7036.3
50+60	10.0	11.5	Sandstone	7036.1
50+80	10.0	12.0	Sandstone	7035.7
51+00	10.0	11.0	Sandstone	7036.7
51+20	10.0	11.0	Claystone	7036.7
51+40	10.0	11.8	Claystone	7035.9
51+60	10.0	11.0	Claystone	7036.7
51+80	10.0	11.0	Claystone	7036.7
52+00	10.0	11.0	Claystone	7036.7
52+20	10.0	11.5	Claystone	7036.0
52+40	9.0	10.9	Claystone	7036.4
52+60	8.0	9.0	Claystone	7038.0
52+80	8.0	9.0	Claystone	7037.8
53+00	8.0	9.0	Claystone	7037.6
53+20	8.0	9.0	Claystone	7038.0
53+40	8.0	9.0	Claystone	7038.3
53+60	8.0	10.0	Claystone	7037.7
53+80	9.0	10.8	Claystone	7037.2
54+00	9.0	11.0	Claystone	7037.4
54+20	9.0	11.0	Claystone	7037.8
54+40	9.0	10.0	Claystone	7039.2
54+60	9.0	10.6	Claystone	7038.9
54+80	7.0	8.0	Claystone	7041.9
55+00	7.0	8.0	Claystone	7042.3
55+20	8.0	9.0	Claystone	7041.9
55+40	18.0	19.0	Claystone	7032.4
55+60	12.0	13.0	Claystone	7039.0
55+80	12.0	13.0	Claystone	7039.5



## APPENDIX "B"

## AS BUILT PROFILE OF DIAPHRAGM CUTOFF WALL BOTTOM

<u>Station</u>	<u>Depth to Top of Bedrock (ft.)</u>	<u>Penetration into Bedrock (ft.)</u>	<u>Soil Type</u>	<u>Elevation of Trench Bottom</u>
56+00	12.0	13.6	Claystone	7039.5
56+20	11.0	13.0	Claystone	7040.8
56+40	11.0	12.0	Claystone	7042.5
56+60	11.0	12.0	Claystone	7043.1
56+80	11.0	12.0	Claystone	7043.8
57+00	11.0	12.0	Claystone	7044.5
57+20	10.0	11.0	Claystone	7045.9
57+40	7.0	8.0	Claystone	7049.2
57+60	7.0	8.7	Claystone	7048.9
57+80	7.0	8.0	Claystone	7049.9
58+00	9.0	10.0	Claystone	7048.3
58+20	7.0	8.0	Claystone	7050.3
58+40	7.0	8.0	Claystone	7050.3
58+60	7.0	8.0	Claystone	7050.3
58+80	8.0	9.0	Claystone	7049.3
59+00	7.0	8.0	Claystone	7050.3
59+20	8.0	9.0	Claystone	7049.9
59+40	10.0	13.6	Claystone	7045.9
59+60	11.0	12.0	Claystone	7048.1
59+80	11.0	12.0	Claystone	7048.7
60+00	11.0	12.0	Claystone	7049.2

# APPENDIX "C"

## PERMANENT REFERENCE MONUMENTS INSTALLED LOCATION AND ORIGINAL ELEVATIONS

<u>Monument</u>	<u>Coordinates</u>		<u>Elevation</u>
19	608,578.53N	805,666.50E	7064.68
41	610,979.84N	805,859.09E	7038.31
G	607,956.57N	808,066.28E	7071.52
H	612,065.64N	807,666.80E	7089.93

Monument Type-3 ft. steel pins 1" O.D., driven 3 ft. in original ground.

# APPENDIX "D"

## SURFACE HORIZONTAL AND VERTICAL MOVEMENT MONUMENTS INSTALLED LOCATION AND ORIGINAL ELEVATIONS

<u>Monument</u>	<u>Coordinates</u>		<u>Elev.</u>	<u>Offset Sta.</u>	<u>Bearings</u>	<u>Dist.</u>
1-A	608,593.19N	808,301.87E	7099.65	6+00	S 47° 27' 34"E	17.47'
1-B	608,585.59N	808,311.30E	7098.37	6+00	S 48° 57' 49"E	29.56'
2-A	608,511.81N	808,240.81E	7099.66	7+00	S 54° 57' 40"E	22.97'
2-B	608,496.30N	808,262.39E	7094.66	7+00	S 54° 36' 12"E	49.55'
3-A	608,278.94N	808,057.04E	7099.64	10+00	S 52° 38' 43"E	26.47'
3-B	608,253.40N	808,089.10E	7085.81	10+00	S 51° 55' 26"E	67.45'
4-A	608,161.46N	807,780.82E	7099.87	13+00	S 7° 41' 36"W	23.75'
4-B	608,110.81N	807,767.97E	7083.91	13+00	S 12° 11' 32"W	75.90'
5-A	608,271.76N	807,496.04E	7100.07	16+00	S 8° 19' 13"W	20.46'
5-B	608,224.12N	807,462.51E	7081.56	16+00	S 28° 15' 40"W	77.07'
6-A	608,453.67N	807,255.76E	7100.08	19+00	S 40° 48' 58"W	20.26'
6-B	608,405.19N	807,212.61E	7079.31	19+00	S 41° 28' 03"W	85.16'
7-A	608,644.39N	807,025.16E	7099.90	22+00	S 39° 48' 08"W	21.62'
7-B	608,563.39N	806,952.75E	7065.38	22+00	S 41° 27' 52"W	130.26'
8-A	608,834.60N	806,793.83E	7099.98	25+00	S 37° 36' 01"W	23.22'
8-B	608,756.30N	806,724.98E	7065.42	25+00	S 40° 38' 50"W	127.45'
9-A	609,026.67N	806,561.50E	7100.16	28+00	S 38° 20' 45"W	23.37'
9-B	608,951.55N	806,490.60E	7065.63	28+00	S 42° 25' 22"W	126.59'
10-A	609,219.79N	806,328.52E	7100.09	31+00	S 42° 18' 01"W	25.97'
10-B	609,150.18N	806,264.97E	7065.66	31+00	S 42° 22' 26"W	120.23'
11-A	609,436.41N	806,123.88E	7100.20	34+00	S 51° 09' 34"W	23.26'
11-B	609,375.23N	806,051.21E	7065.70	34+00	S 50° 09' 10"W	118.25'
12-A	609,696.85N	805,967.84E	7099.88	37+00	S 61° 15' 53"W	25.27'
12-B	609,651.24N	805,885.54E	7065.26	37+00	S 61° 03' 36"W	119.37'
13-A	609,986.81N	805,874.23E	7100.19	40+00	S 77° 09' 35"W	23.35'
13-B	609,967.77N	805,788.36E	7066.09	40+00	S 77° 25' 38"W	111.31'
14-A	610,296.40N	805,926.28E	7100.43	43+00	N 77° 40' 39"W	25.30'
14-B	610,340.90N	805,845.82E	7065.66	43+00	N 64° 37' 09"W	116.42'
15-A	610,532.14N	806,141.69E	7100.62	46+00	N 43° 54' 20"W	30.73'
15-B	610,593.05N	806,083.25E	7065.91	46+00	N 43° 50' 20"W	115.14'
16-A	610,732.63N	806,376.15E	7100.51	49+00	N 41° 34' 38"W	32.93'
16-B	610,793.29N	806,313.89E	7065.80	49+00	N 41° 22' 07"W	113.65'
17-A	610,926.91N	806,594.24E	7100.71	52+00	N 40° 34' 16"W	28.84'
17-B	610,992.33N	806,538.58E	7065.61	52+00	N 40° 26' 12"W	114.74'
18-A	611,117.08N	806,823.98E	7100.71	55+00	N 44° 52' 40"W	19.87'
18-B	611,186.78N	806,755.19E	7065.60	55+00	N 44° 39' 59"W	117.80'
19-A	611,321.76N	807,048.21E	7100.65	58+00	N 43° 37' 47"W	28.68'
19-B	611,391.07N	806,992.09E	7065.21	58+00	N 40° 07' 26"W	117.79'
20-A	611,505.35N	807,282.06E	7100.59	61+00	N 39° 33' 28"W	32.88'
20-B	611,540.96N	807,253.83E	7083.54	61+00	N 38° 53' 22"W	78.32'
21-A	611,684.57N	807,529.81E	7100.59	64+00	N 35° 42' 16"W	19.17'
21-B	611,716.05N	807,517.63E	7088.18	64+00	N 26° 24' 50"W	52.13'
22-A	611,743.91N	807,829.84E	7100.25	67+00	N 12° 26' 46"W	28.58'
22-B	611,767.90N	807,823.11E	7092.00	67+00	N 13° 56' 52"W	53.48'
23-A	611,798.96N	808,002.56E	7100.57	68+83	N 18° 53' 33"W	53.86'
23-B	611,811.08N	807,997.64E	7100.31	68+83	N 19° 31' 04"W	66.93'

## APPENDIX "E"

PIEZOMETERS  
INSTALLED LOCATION

<u>Piezometer</u>	<u>Coordinates</u>		<u>Ground Elev.</u>	<u>Offset Sta.</u>	<u>Bearings</u>	<u>Dist. (ft.)</u>
EP-1	608,836.19	806,779.77	7099.18	25+00	S 59° 13' 40"W	32.86
EP-2	609,751.52	805,938.43	7099.28	37+50	S 83° 34' 00"W	32.58
EP-3	610,257.36	805,901.14	7100.01	42+50	N 63° 59' 55"W	32.73
EP-4	610,630.46	806,245.05	7099.41	47+50	N 57° 29' 42"W	39.15
EP-5	611,117.95	806,815.77	7099.61	55+00	N 56° 04' 43"W	26.79
EP-6	608,799.47	806,746.23	7081.28	25+00	S 49° 05' 16"W	81.74
EP-7	609,725.70	805,885.03	7076.28	37+50	S 71° 02' 15"W	90.69
EP-8	610,287.04	805,858.46	7078.71	42+50	N 58° 35' 18"W	84.48
EP-9	610,677.71	806,226.01	7077.51	47+50	N 37° 19' 11"W	85.87
EP-10	611,160.37	806,789.44	7081.91	55+00	N 40° 14' 45"W	75.16
EP-11	608,777.01	806,725.56	7069.68	25+00	S 47° 19' 53"W	112.12
EP-12	609,714.55	805,860.73	7066.08	37+50	S 69° 44' 39"W	117.33
EP-13	610,302.00	805,836.97	7070.31	42+50	N 57° 46' 36"W	110.63
EP-14	610,704.03	806,215.92	7065.21	47+50	N 33° 18' 04"W	113.20
EP-15	611,180.37	806,766.29	7070.81	55+00	N 42° 49' 33"W	105.49
FP-1	608,789.25	806,759.27	7082.08	25+00	S 37° 23' 38"W	80.24
FP-2	609,719.04	805,893.06	7078.18	37+50	S 65° 04' 23"W	85.73
FP-3	610,280.94	805,858.45	7079.41	42+50	N 62° 15' 20"W	81.48
FP-4	610,669.80	806,222.51	7079.51	47+50	N 42° 37' 10"W	82.05
FP-5	611,156.85	806,779.93	7081.01	55+00	N 47° 09' 34"W	79.20
FP-6	608,717.69	806,673.93	7057.78	25+00	S 44° 44' 11"W	190.48
FP-7	609,672.75	805,774.15	7046.78	37+50	S 67° 15' 38"W	213.22
FP-8	610,356.02	805,757.10	7036.51	42+50	N 56° 54' 56"W	207.03
FP-9	610,808.37	806,175.97	7039.01	47+50	N 27° 10' 00"W	223.62
FP-10	611,255.54	806,706.05	7048.51	55+00	N 40° 51' 38"W	201.69

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PIEZOMETRIC DATA - PIEZOMETER FP-1

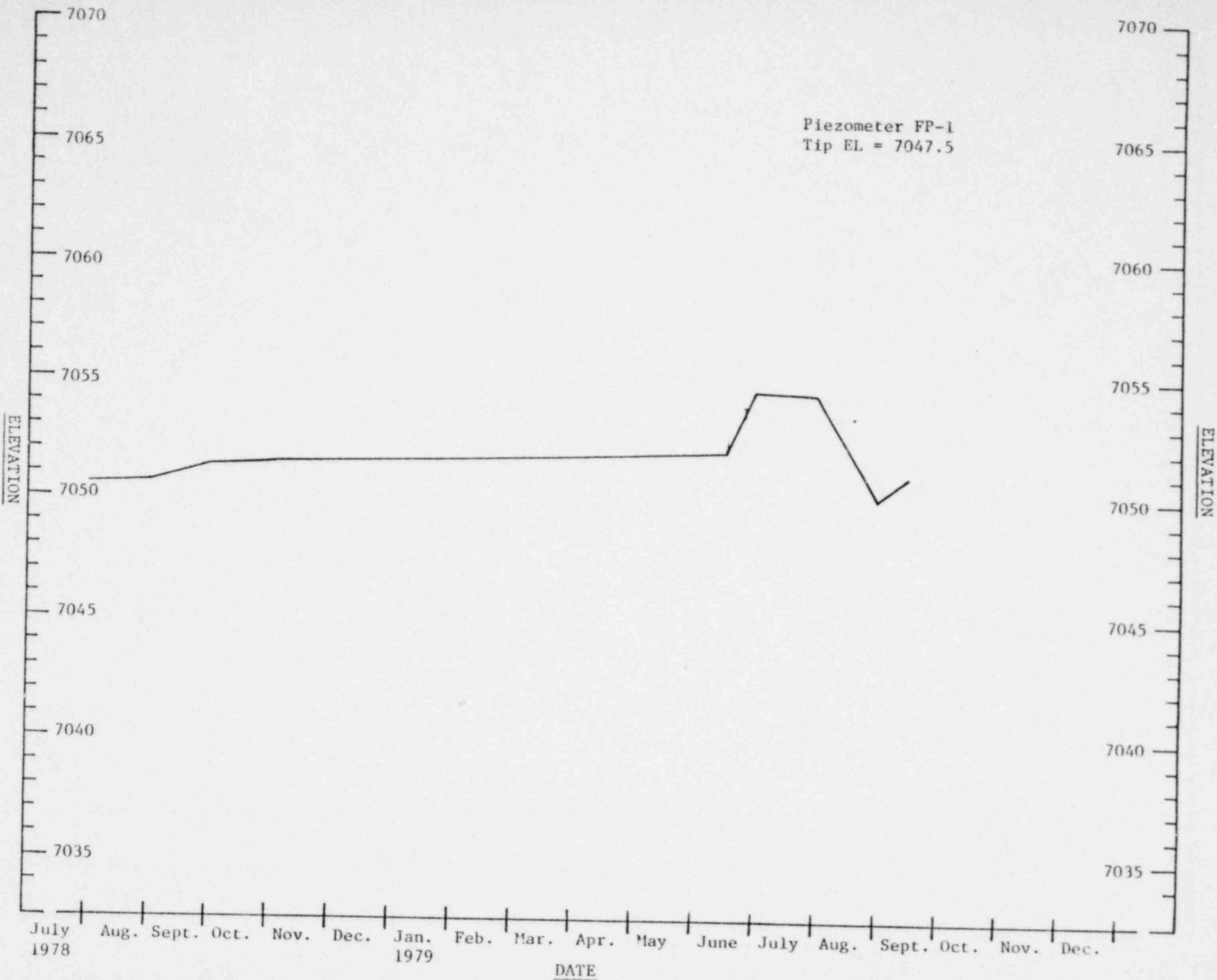


Fig. E-1

5625W

PIEZOMETRIC DATA - PIEZOMETER FP-2

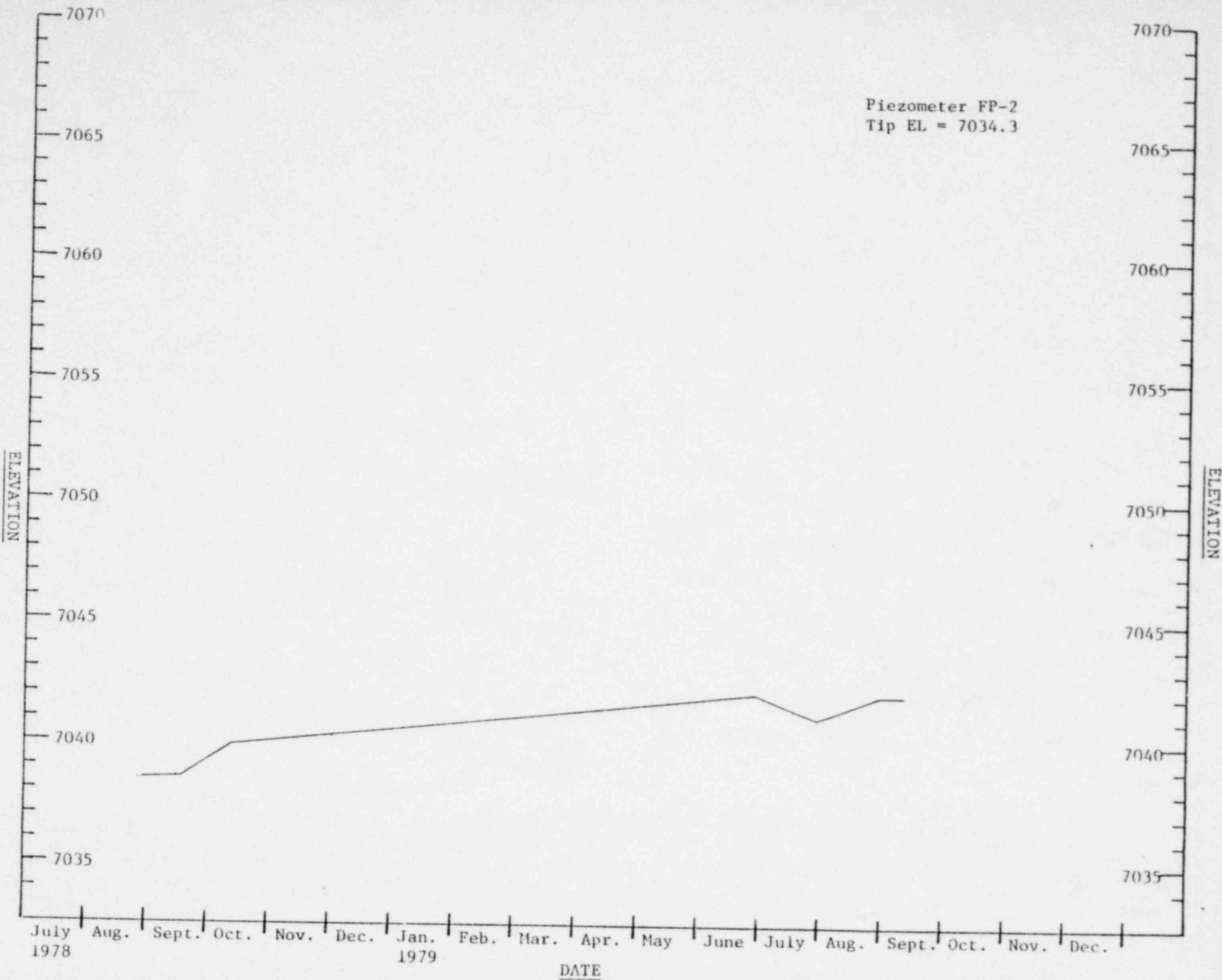
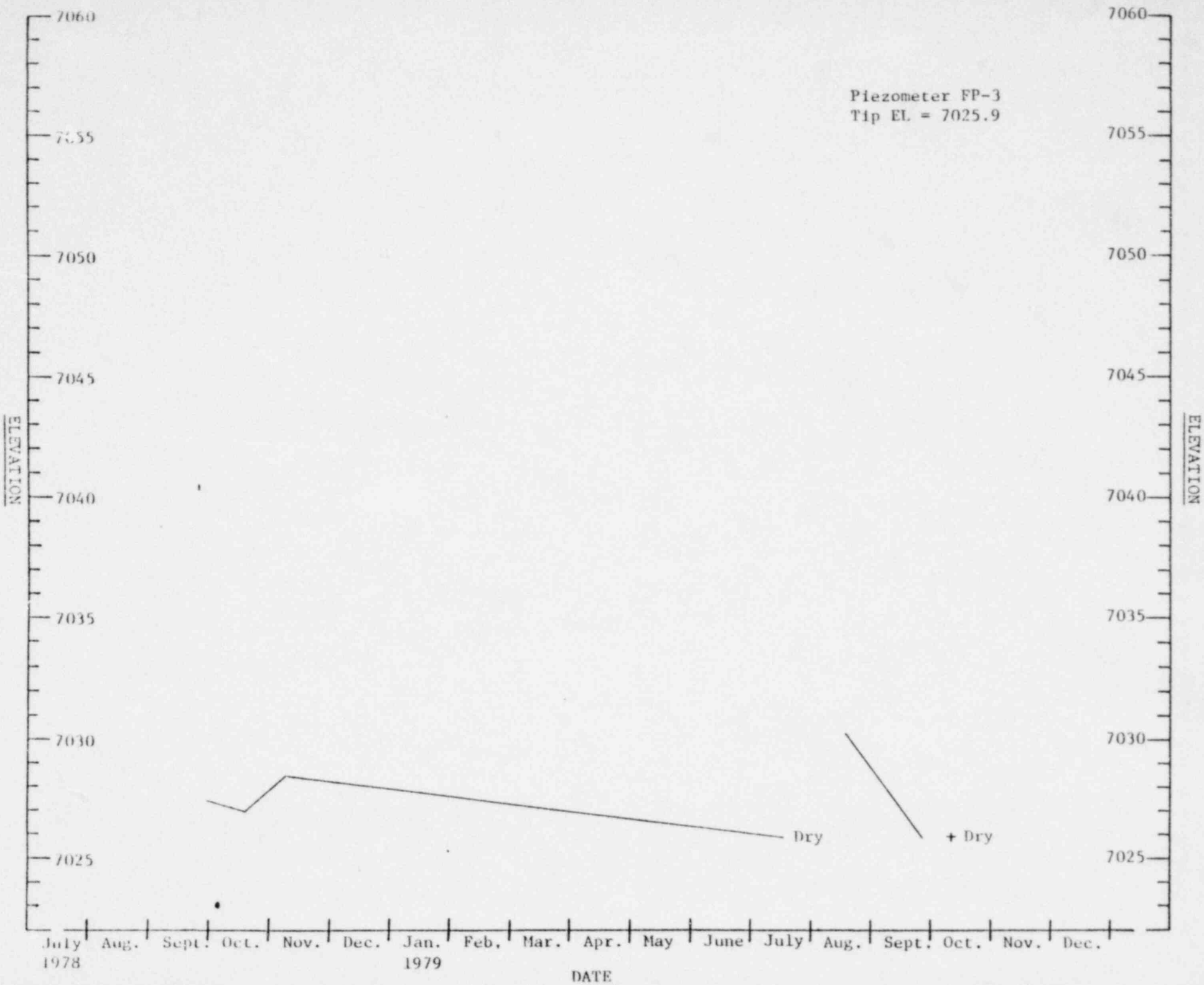


Fig. E-2

456234

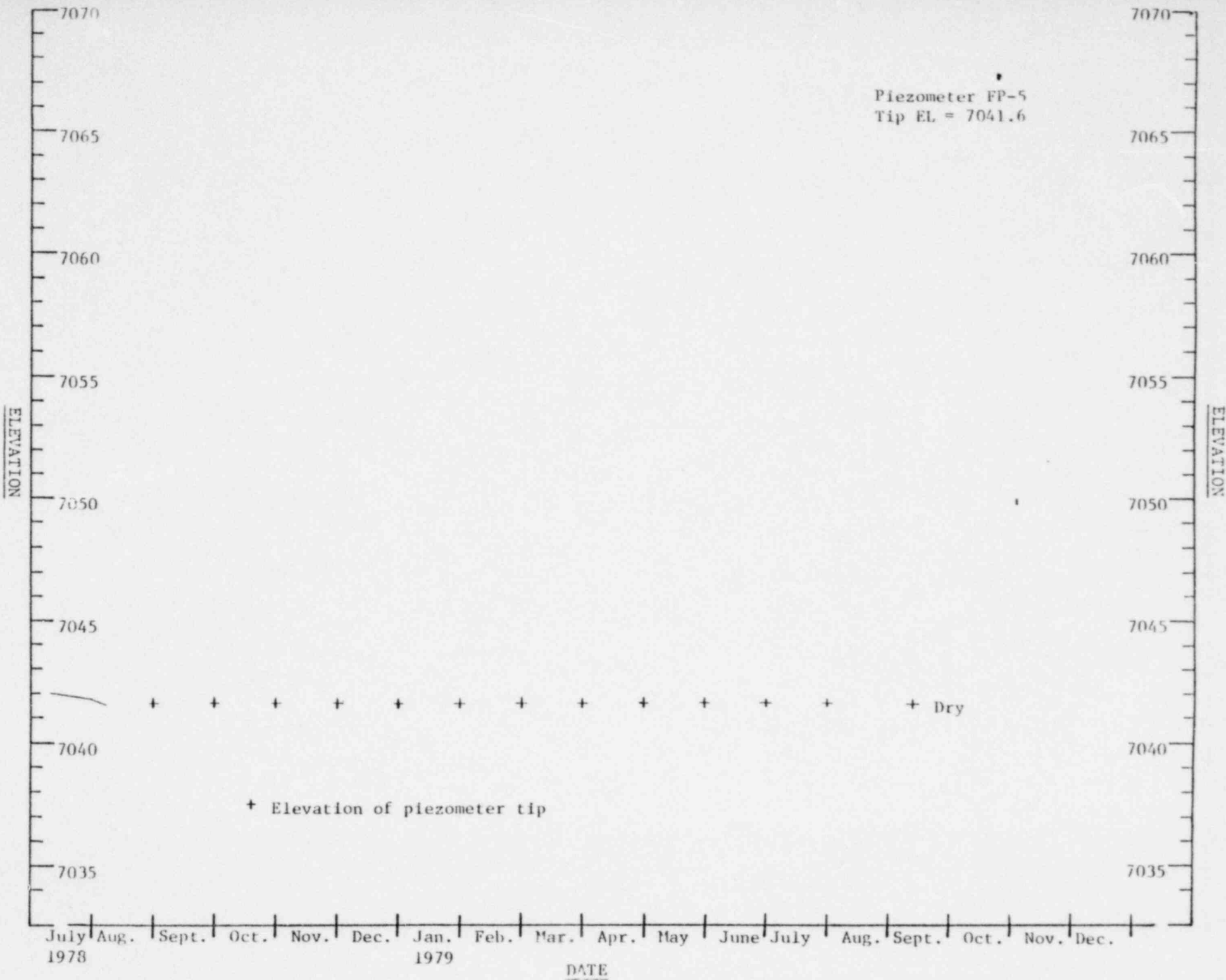
PIEZOMETRIC DATA - PIEZOMETER FP-3

111. 0.1





## PIEZOMETRIC DATA - PIEZOMETER FP-5



# APPENDIX "F"

## EMBANKMENT SETTLEMENT SENSORS INSTALLED LOCATION AND ORIGINAL ELEVATION

<u>Sensor</u>	<u>Coordinates</u>		<u>Elevation</u>	<u>Offset ¢ Sta.</u>	<u>Bearing</u>	<u>Distance</u>
Ess-s 1	608,853.00N	806,808.00E	7053.66	25+00	On Station	0.00'
Ess-e 1	608,845.05N	806,801.93E	7053.70	25+00	S 37° 36' 01"W	10.00'
Ess-s 2	610,515.00N	806,158.00E	7042.13	46+00	On Station	0.00'
Ess-e 2	610,522.24N	806,151.11E	7042.10	46+00	N 43° 54' 20"W	10.00'
Ess-s 3	611,101.00N	806,843.00E	7052.24	55+00	On Station	0.00'
Ess-e 3	611,108.13N	806,835.99E	7052.10	55+00	N 44° 52' 40"W	10.00'

Ess-s = Over Slurry Trench

Ess-e = Over Embankment



APPENDIX "T"

GRAPHICAL PRESENTATION OF SETTLEMENT SENSOR READINGS

15400