Document Number
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RESULTS OF THE SITE INVESTIGATION, PHASE II

9207141 56

at the

Paducah Gaseous Diffusion Plant

Paducah, Kentucky

owned and operated by

U.S. Department of Energy

and managed by

Martin Marietta Energy Systems, Inc.

April 1992

Volume 5A of 6

CH2M HILL SOUTHEAST, INC.
Oak Ridge, Tennessee

TMA/ Eberline
Albuquerque, New Mexico

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Denver, Colorado

SAIC
Oak Ridge, Tennessee

Martin Marietta Energy Systems, Inc.
Paducah, Kentucky

contributed to the preparation of this document and should not be considered eligible contractors for its review.

APPENDIX 2B-1

Water Level Measurements, October 1990 through September 1991

TECHNICAL MEMORANDUM NO. 1A
PGDP PHASE II SITE INVESTIGATION

PREPARED BY: Russell Lahoud/ORO
Greg Schaefer/ORO

SUBJECT: Water Level Measurements, October 1990

PROJECT: ORO30888.FL

INTRODUCTION

PURPOSE AND SCOPE

Monthly water level measurements are planned for wells in and around the PGDP for a period of 1 year. This memorandum presents data collected October 22-23, 1990, from 61 wells.

FIELD PERSONNEL

The field personnel were:

Sample Team Leader (STL)	Dawn Geshwender
Sample Team Member (STM)	Greg Schaefer
IH/HP Technician	Duncan Morrison
Escort	Wallace Cunningham
Site Safety Coordinator (SSC)	Craig Morrison/TMA/Eberline

METHODOLOGY

Measurements were taken with an electronic water level meter, measuring from the top of the datum index, in compliance with "Task Instructions for Water Level Measurements, PGDP Phase II," as amended by the October monthly addendum.

TECHNICAL DATA

MEASUREMENTS

Sixty-one of the scheduled 76 wells were measured. Access agreements for the 12 TVA wells could not be obtained in time for this month's measurements. MW-69 and -153 were dry. MW-27 could not be located and was not measured.

Measurement data are shown on Table 1A-1. Measurements were recorded on the data sheet and in field logbook 6.

Table 1A-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 1 of 8)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements October 1990		
				October DTW (ft)	Elevation (ft)	Remarks
PGDP Wells						
7	SGS	TOC	373.08	---	---	Not scheduled for measurement until 2/91.
19	RGA	TOC	364.46	---	---	Not scheduled for measurement until 2/91.
23	DGS	TOC	373.64	16.77	356.87	
24	DGS	TOC	375.71	11.25	364.46	
25	SGS	TOC	380.02	---	---	WL above riser.
26	DGS	TOC	383.23	33.53	349.70	
27	DGS	TOC	381.59	---	---	Not located.
43	SGS	TOC	373.39	---	---	Not scheduled for measurement until 2/91.
52	RGA	TOC	372.29	45.62	326.67	
53	RGA	TOC	375.12	48.47	326.65	
54	RGA	TOC	373.91	47.34	326.57	
63	RGA	WWP	372.60	46.34	326.26	
64	SGS	WWP	372.60	10.36	362.24	
65	RGA	WWP	372.58	46.35	326.23	
68	RGA	WWP	379.72	56.26	323.46	
69	SGS	WWP	379.72	---	---	Dry.
70	RGA	TOC	379.25	51.68	327.57	
71	RGA	WWP	379.72	52.24	327.48	
73	RGA	TOC	374.97	48.06	326.91	

Table 1A-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 2 of 8)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements October 1990		
				October DTW (ft)	Elevation (ft)	Remarks
74	SGS	TOC	375.06	22.06	353.00	
75	SGS	TOC	376.10	11.75	364.35	
77	RGA	TOC	377.16	49.87	327.29	
82	SGS	TOC	376.54	15.53	361.01	
83	SGS	TOC	376.59	14.44	362.15	
85	SGS	WWP	375.86	17.88	357.98	
88	SGS	WWP	375.74	17.05	358.69	
90	RGA	WWP	374.51	47.49	327.02	
91	SGS	WWP	374.48	13.14	361.34	
92	RGA	WWP	374.51	47.47	327.04	
93	RGA	WWP	377.61	50.53	327.08	
94	SGS	WWP	377.62	19.76	357.86	
95	RGA	WWP	377.62	50.44	327.18	
96	SGS	TOC*	377.32	34.75	342.57	
120	DGS	TOC	386.57	59.70	326.87	
121	DGS	TOC	374.70	53.70	321.00	
122	DGS	TOC	364.66	39.23	325.43	
123	RGA-SH	TOC	374.69	50.77	323.92	
124	RGA-DP	TOC	364.71	38.24	326.47	
125	RGA-DP	TOC	374.89	50.95	323.94	

Table 1A-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 3 of 8)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements October 1990		
				October DTW (ft)	Elevation (ft)	Remarks
126	RGA-SH	TOC	364.02	37.54	326.48	
127	SGS	TOC	374.81	26.38	348.43	
128	SGS	TOC	364.38	35.34	329.04	
129	SGS	TOC	386.14	14.75	371.39	
130	SGS	TOC	386.03	14.54	371.49	
131	SGS	TOC	385.77	14.29	371.48	
132	RGA-DP	TOC	362.83	38.95	323.88	
133	RGA-DP	TOC	336.93	15.46	321.47	
134	RGA-DP	TOC	368.20	43.14	325.06	
135	RGA-DP	TOC	335.94	14.87	321.07	
137	RGA-SH	TOC	335.69	14.62	321.07	
138	SGS	TOC	335.57	11.02	324.55	
139	RGA-SH	TOC	363.17	39.30	323.87	
140	DGS	TOC	344.12	22.30	321.82	
141	RGA-DP	TOC	344.86	19.99	324.87	
142	RGA-SH	TOC	345.04	20.14	324.90	
143	SGS	TOC	345.37	12.73	332.64	
144	RGA-DP	TOC	379.89	52.91	326.98	
145	RGA-SH	TOC	380.08	53.08	327.00	
146	RGA-DP	TOC	352.91	33.51	319.40	

Table 1A-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 4 of 8)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements October 1990		
				October DTW (ft)	Elevation (ft)	Remarks
147	RGA-SH	TOC	353.08	33.69	319.39	
148	RGA-DP	TOC	373.35	49.29	324.06	
149	SGS	TOC	373.87	49.81	324.06	
150	RGA-DP	TOC	376.60	51.19	325.41	
151	SGS	TOC	382.56	20.72	361.84	
152	RGA-DP	TOC	353.36	37.82	315.54	
153	SGS	TOC	353.10	---	---	Dry.
154	SGS	TOC	374.49	10.78	363.71	
155	RGA-DP	TOC	381.25	---	---	Well not completed.
156	RGA-SH	TOC	382.06	---	---	Well not completed.
157	SGS	TOC	381.56	---	---	Well not completed.
158	RGA-DP	TOC	373.72	---	---	Well not completed.
159	RGA-SH	TOC	373.82	---	---	Well not completed.
160	SGS	TOC	373.56	---	---	Well not completed.
161	RGA-SH	TOC	373.55	---	---	Well not completed.
162	SGS	TOC	374.17	---	---	Well not completed.
163	RGA-SH	TOC	386.14	---	---	Well not completed.
164	SGS	TOC	386.29	---	---	Well not completed.
165	RGA-SH	TOC	379.74	---	---	Well not completed.
166	SGS	TOC	380.07	---	---	Well not completed.

Table 1A-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 5 of 8)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements October 1990		
				October DTW (ft)	Elevation (ft)	Remarks
167	SGS	TOC	376.36	---	---	Well not completed.
168	RGA-SH	TOC	377.42	---	---	Well not completed.
169	RGA-SH	TOC	373.41	---	---	Well not completed.
170	SGS	TOC	373.98	---	---	Well not completed.
171	SGS	TOC	374.63	---	---	Well not completed.
172	SGS	TOC	373.79	---	---	Well not completed.
173	RGA-SH	TOC	373.30	---	---	Well not completed.
174	SGS	TOC	373.29	---	---	Well not completed.
175	RGA-SH	TOC	381.18	---	---	Well not completed.
176	SGS	TOC	381.23	---	---	Well not completed.
177	SGS	TOC	379.74	---	---	Well not completed.
178	RGA-SH	TOC	378.80	---	---	Well not completed.
179	RGA-SH	TOC	358.60	---	---	Well not completed.
180	SGS	TOC	358.11	---	---	Well not completed.
181	RGA-SH	TOC	370.84	---	---	Well not completed.
182	SGS	TOC	371.15	---	---	Well not completed.
184	SGS	TOC	373.19	---	---	Well not completed.
185	RGA-SH	TOC	373.64	---	---	Well not completed.
186	SGS	TOC	373.62	---	---	Well not completed.
187	SGS	TOC	373.24	---	---	Well not completed.

Table 1A-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 6 of 8)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements October 1990		
				October DTW (ft)	Elevation (ft)	Remarks
188	RGA-SH	TOC	374.24	---	---	Well not completed.
189	SGS	TOC	375.50	---	---	Well not completed.
190	SGS	TOC	373.21	---	---	Well not completed.
191	RGA-SH	TOC	360.00	---	---	Well not completed.
192	SGS	TOC	359.04	---	---	Well not completed.
193	RGA-SH	TOC	367.85	---	---	Well not completed.
194	RGA-SH	TOC	356.21	---	---	Well not completed.
195	SGS	TOC	356.21	---	---	Well not completed.
196	SGS	TOC	368.12	---	---	Well not completed.
197	RGA-SH	TOC	368.24	---	---	Well not completed.
198	SGS	TOC	368.24	---	---	Well not completed.
199	RGA-SH	TOC	0.00	---	---	Well not completed.
200	RGA-SH	TOC	378.27	---	---	Well not completed.
201	RGA-SH	TOC	0.00	---	---	Well not completed.
202	RGA-SH	TOC	372.60	---	---	Well not completed.
203	RGA-SH	TOC	376.23	---	---	Well not completed.
204	SGS	TOC	377.73	---	---	Well not completed.
205	RGA-SH	TOC	0.00	---	---	Well not completed.
206	RGA-SH	TOC	0.00	---	---	Well not completed.

Table 1A-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 7 of 8)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements October 1990		
				October DTW (ft)	Elevation (ft)	Remarks
TVA Wells						
TVA-3	RGA	TOC	361.78	---	---	No Access.
TVA-4	RGA	TOC	336.55	---	---	No Access.
TVA-5	RGA	TOC	332.35	---	---	No Access.
TVA-6	RGA	TOC	328.58	Under water	---	No Access.
TVA-9	RGA	TOC	348.13	---	---	No Access.
TVA-11	RGA	TOC	321.36	Under water	---	No Access.
TVA-13	RGA	TOC	332.64	---	---	Not scheduled for measurement until 2/91.
TVA-14	RGA	TOC	354.66	---	---	No Access.
TVA-17	RGA	TOC	365.42	---	---	No access.
TVA-19	RGA	TOC	363.19	---	---	No Access.
TVA-24	RGA	TOC	358.73	---	---	No Access.
TVA-25	RGA	TOC	353.38	---	---	No Access.

Table 1A-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 8 of 8)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements October 1990		
				October DTW (ft)	Elevation (ft)	Remarks
TVA-27	RGA	TOC	353.61	---	---	No Access.
TVA-28	RGA	TOC	363.81	---	---	Not scheduled for measurement until 2/91.

Elev = Elevation from USC&GS first order monuments.
DTW = Depth to water from datum.
TOC = Top of innermost casing or riser, excluding pump discharge risers. The surveyed reference datum is a mark or notch on the north edge of the inner casing.
WWP = Well Wizard head plate on older funnel-shaped, exterior Well Wizard cap.
TOC* = Square stainless steel outer casing; 50 yd due south of MW-68 through MW-71 in open field.

Lithology:

SGS = Shallow Groundwater System
RGA = Regional Gravel Aquifer
RGA-SH = Regional Gravel Aquifer (shallow)
RGA-DP = Regional Gravel Aquifer (deep)
DGS = Deep Groundwater System

QUALITY ASSURANCE/QUALITY CONTROL

The reported data sheet has been confirmed with the STL logbook.

FIELD MONITORING

Health and safety monitoring was done by Duncan Morrison/Eberline at designated "C level" wells and by the STL at the other wells. Dawn Geshwender and Greg Schaefer received instruction on field monitoring from Craig Morrison/Eberline.

All Type B wells were monitored with minimal PPE, in accordance with instructions from the SSC. Also, MW-138 has been downgraded to a Type B well.

DECONTAMINATION OF EQUIPMENT

Decontamination of equipment was performed in accordance with ESP 900 (Section V, a.1) and ESP 901.

WASTE MANAGEMENT

Only a small amount of waste was generated by this task. This waste was turned over to the SSC for containment and will eventually be given to Energy Systems.

DISCUSSION

Figures 1A-1 through 1A-3 show the groundwater elevations in the DGS, RGA, and SGS.

The following general statements characterize the hydrologic setting at the site.

- Vertical flow is typically downward. Wager level measurements indicate decreasing piezometric head with depth.

- The hydrologic systems from shallow to deep are:

  - Shallow Groundwater System

    This unit is contained in permeable sections of the Upper Continental Deposits down to the lowest clay layer above the gravel of the Lower Continental Deposits. The unit overlies the entire area and is characterized by relatively high piezometric slopes, generally sloping north toward the Ohio River.

- Regional Gravel Aquifer

  This unit consists of the gravel within the Lower Continental Deposits along with hydraulically well-connected units (sands and silts) immediately above and below. The unit is roughly 20 to 60 feet thick north of the plant and thins sharply to the south (and possibly to the east) in the vicinity of the plant. The RGA (shallow) wells were set at the top of the gravel, the RGA (deep) wells were set at the bottom of the gravel, and the RGA (undifferentiated) wells were set somewhere within the RGA. The unit is characterized by very low piezometric slopes toward the northeast.

  Well clusters have been installed at several locations onsite and offsite, with wells completed in the top and bottom of the Lower Continental Deposits at each cluster. Measurements typically show water levels with less than a 0.03-foot difference between paired wells. For this reason, water level elevations from RGA wells will be used to compile a single RGA water level map each month, regardless of whether the wells were completed in the upper section of the RGA (RGA-SH), the lower section of the RGA (RGA-DP), or the RGA, undifferentiated. The table of water level elevation data will still reflect the different placements of the wells in case differences are found in a later round of measurements.

- Deep Groundwater System

  This unit consists of thin sand layers within the clay matrix of the Coastal Plain Deposits and underlies the entire area. Its upper member is below the fat clay below the gravel of the Lower Continental Deposits. The unit consists of clayey sand and silt of the McNairy Formation and the Porters Creek Clay. The deep groundwater system south of the plant, where the Lower Continental Deposits are thin or possibly nonexistent, may be in direct contact with the shallow groundwater system.

These plots are intended as a general representation of the subsurface hydrology only. They are characterized by a relatively small number of data points. The recharging and discharging reaches of Big Bayou Creek, Little Bayou Creek, and any of the onsite ditches have not been accounted for. These factors could strongly affect the shallow groundwater system near these features.

Deep Groundwater System

Figure 1A-1 shows that flow in this system is north-northeast toward the Ohio River. MW-120, -121, -122, and -140 control the major contours on the plot. MW-23, -24, and -25 are on the terrace south of the plant.

A high hydraulic gradient exists at the terrace feature in the southwest portion of the site (0.005) and decreases to a gradient value of approximately 0.0008 north of Ogden Landing Road.

MW-133 is in the sands directly underlying the Regional Gravel Aquifer. The sands are on top of the McNairy Formation. The measurements taken in October show that this well is closely connected hydraulically with its paired lower RGA well and that it is also anomalous with regard to the other Coastal Plain Deposit wells. For these reasons, the data from MW-133 are used for the RGA plot (Figure 1A-2).

Regional Gravel Aquifer

Figure 1A-2 shows flow toward the north-northeast with the gradient increasing slightly toward the Ohio River. A relatively small hydraulic gradient within the RGA exists beneath the plant (0.0003) and increases to an approximate value of 0.001 northward past Ogden Landing Road.

MW-184 was thought to be in the RGA, but the October measurements are very high compared to those of any other RGA wells. MW-184 is now thought to be screened in a thinning section of the Lower Continental Deposits in the same terrace-type system postulated for MW-23, -24, and -25 (Phase I report). In all four of these wells, there is a relatively large impediment to flow between the gravel in the terrace system and the RGA to the north of the plant, resulting in a 30- to 50-foot piezometric head difference.

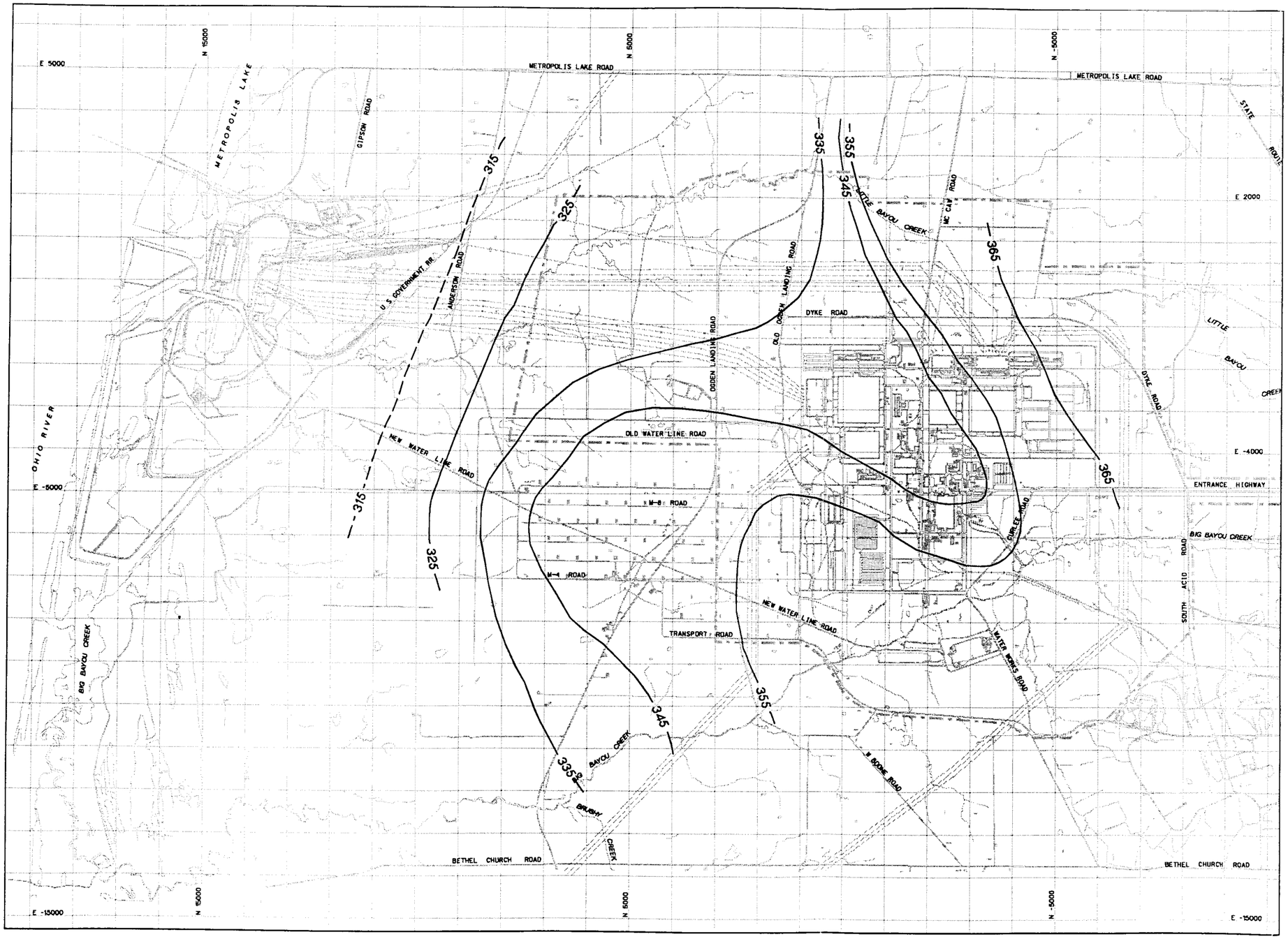
Shallow Groundwater System

Figure 1A-4 shows an irregular flow system generally discharging toward the northeast with an elevated mound in the area of MW-64, a northeast-trending trough near MW-96, and a terrace in the southeast corner of the plot.

MW-64 may be influenced by local features such as the C-717 lagoons or the ditch immediately north of the well. MW-128 and -145 may be influenced by recharge into surface drainage from the groundwater system. MW-151 was added to this plot as part of the shallow groundwater system.

The hydraulic gradients vary within the SGS beneath the site: a relatively high value (0.006) from the southeast corner of the plant toward the center of the plant; 0.001 north of the C-616-F lagoon; and 0.004 north of Ogden Landing Road.

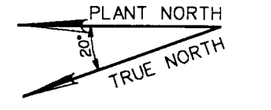
0888tm03.dgn 4-Sep-1991

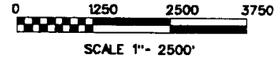


LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- —325— CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL =10 ft

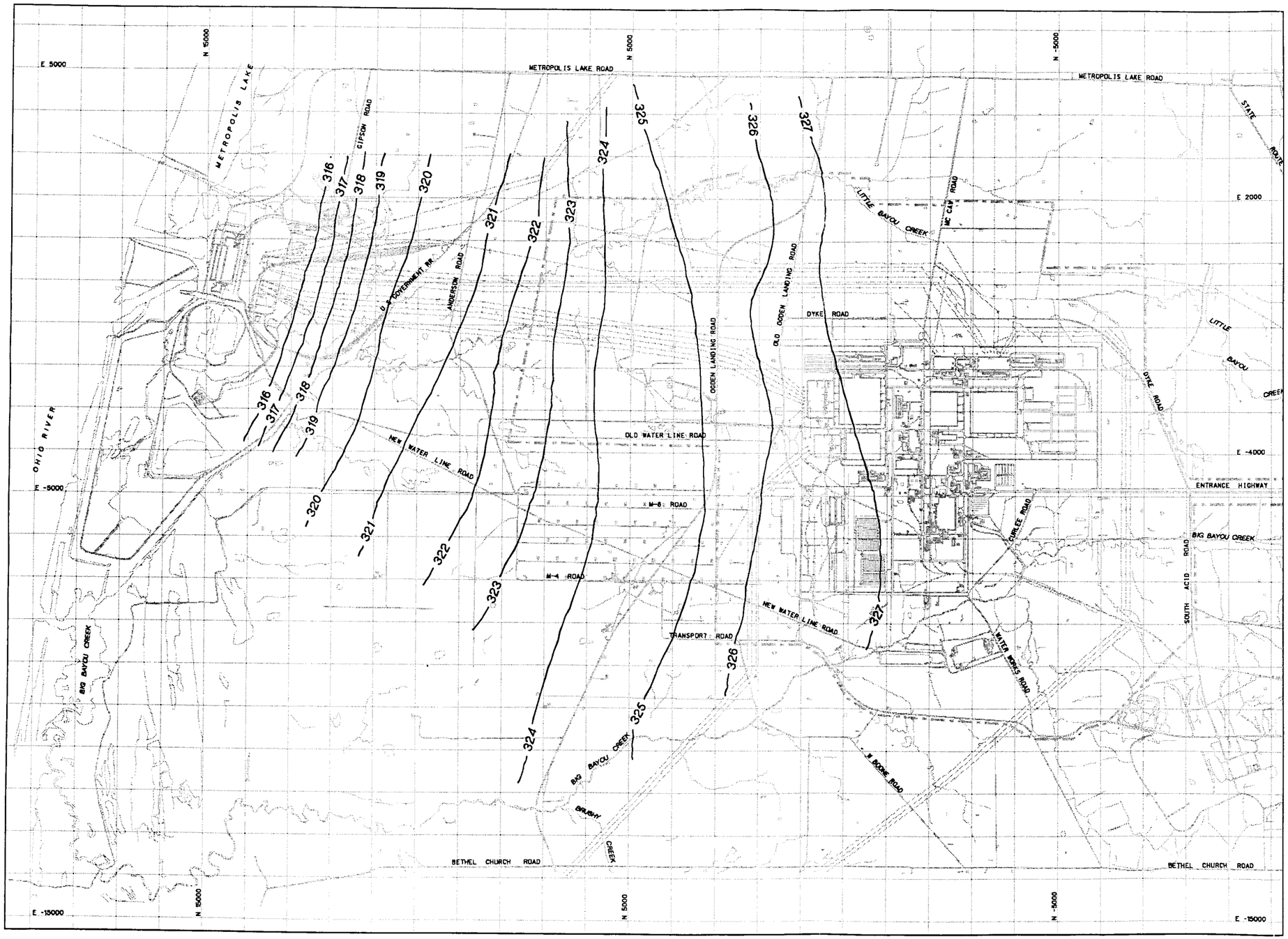




SCALE 1"= 2500'

Figure 1A-1
WATER LEVEL ELEVATIONS
FOR THE SHALLOW
GROUNDWATER SYSTEM-OCTOBER,1990
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0888tm34.dgn 28-Aug-1991



LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

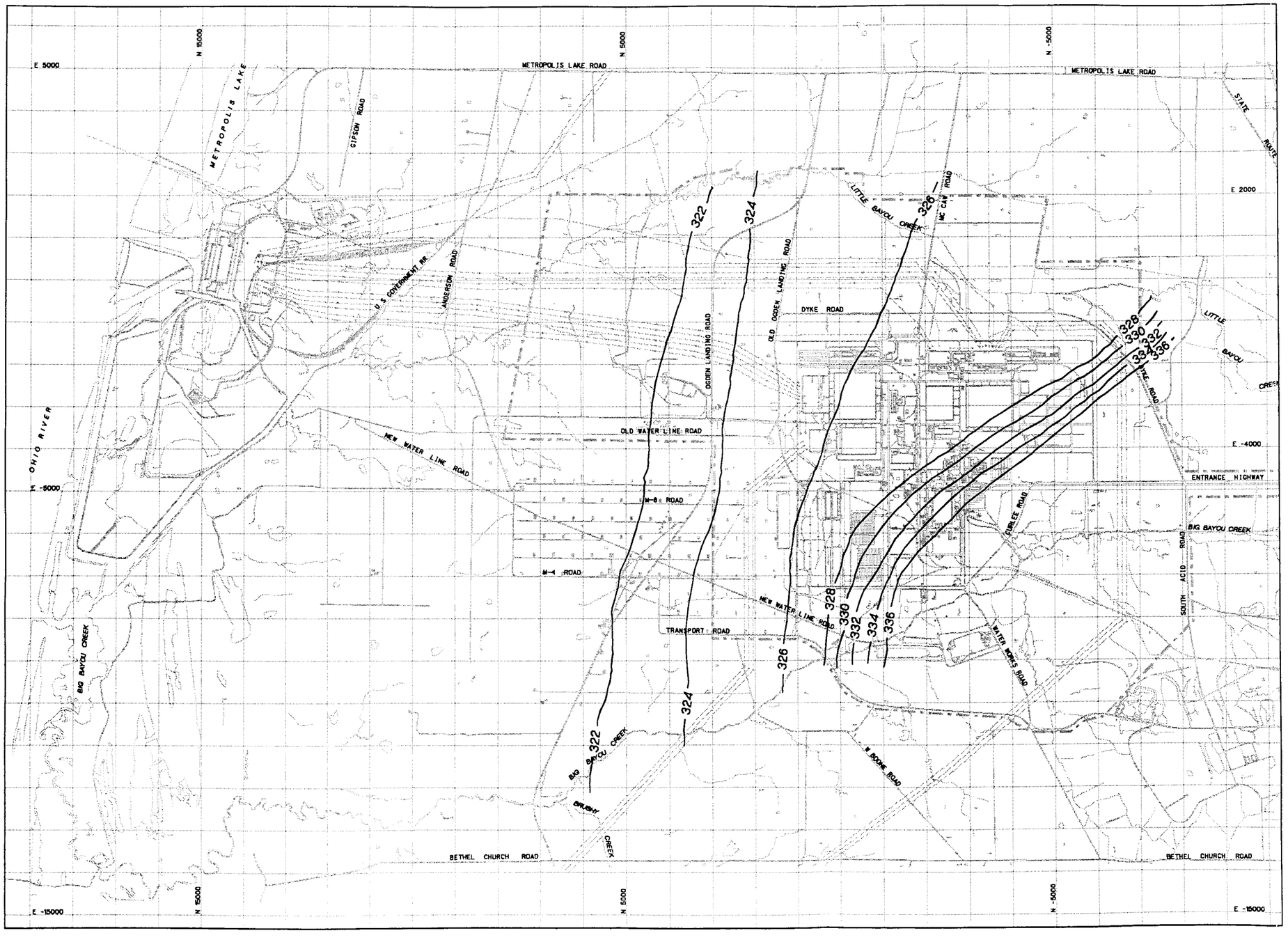
CONTOUR INTERVAL = 1 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1" = 2500'

Figure 1A-2
WATER LEVEL ELEVATIONS FOR THE REGIONAL GRAVEL AQUIFER-OCTOBER, 1990
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0888tm35.dgn 28-Aug-1991



REVIEWED FOR CLASSIFICATION
WS 9/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 2 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1" = 2500'

Figure 1A-3
WATER LEVEL ELEVATIONS FOR THE DEEP GROUNDWATER SYSTEM-OCTOBER, 1990
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

TECHNICAL MEMORANDUM NO. 1B
PGDP PHASE II SITE INVESTIGATION

PREPARED BY: Greg Schaefer/ORO
Russell Lahoud/ORO

SUBJECT: Water Level Measurements, November 1990

PROJECT: ORO30888.FL

INTRODUCTION

PURPOSE AND SCOPE

Monthly water level measurements are planned for wells in and around the PGDP for a period of 1 year. This memorandum presents data collected November 12-13, 1990, from 63 wells.

FIELD PERSONNEL

The field personnel were:

Sample Team Leader (STL)	Dawn Geshwender
Sample Team Member (STM)	Greg Schaefer
IH/HP Technician	Craig Morrison
Escort	Wallace Cunningham
Energy Systems Escort	Jeff Douthitt
Site Safety Coordinator (SSC)	Craig Morrison/TMA/Eberline

METHODOLOGY

Measurements were taken with an electronic water level meter, measuring from the datum index, in compliance with "Task Instructions for Water Level Measurements, PGDP Phase II," as amended by the November monthly addendum.

TECHNICAL DATA

MEASUREMENTS

Sixty-three of the scheduled 76 wells were measured. Access agreements for the 12 TVA wells could not be obtained in time for this month's measurements. MW-27 could not be located and therefore was not measured. MW-155 through -206 were not completed by the November sampling date. MW-69 and -153 were dry.

Measurement data are shown on Table 1B-1. Measurements were recorded on the data sheet and in field logbook 6.

MW-25 and -26 are not properly identified in the field. Well numbers are painted on the riser or pad of both wells. The current depth of the well marked as "25" is less than 20 feet, while the construction diagram shows a well near 40 feet in depth. The well marked as "26" has a depth to water measurement of 33.98, while the construction diagram shows a well depth of less than 20 feet. In discussions with Jeff Douthitt and other Energy Systems' personnel, it was decided to continue to refer to the two wells as currently marked. Energy Systems will mark the original construction diagrams to indicate that the deep well, constructed as "MW-25," will be called MW-26, and that the shallow well, constructed as "MW-26," will be called MW-25. It is speculated that the wells were mismarked prior to CH2M HILL's Phase I work; thus all data collected by CH2M HILL have been recorded using the wells as currently marked.

QUALITY ASSURANCE/QUALITY CONTROL

The reported data sheet has been confirmed with the STL logbook.

FIELD MONITORING

The wells to be measured were coded for health and safety monitoring, and the following specifications were used to determine personal protective equipment worn by the sample team at each location. In addition, an IH/HP was present at all Type C wells. The guidelines for these codes were:

Present	Specifications	Protection
Type A	Non-elevated offsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type B	Non-elevated onsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type C	Wells in radiological exclusion zones or wells that have not been evaluated previously	Tyvek coveralls, booties, surgical gloves, hard hat, eye protection, and safety shoes

Health and safety monitoring was performed by the SSC at designated Type C wells and by the STL at the other wells.

Table 1B-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 1 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements November 1990		
				November DTW (ft)	Elevation (ft)	Remarks
PGDP Wells						
7	SGS	TOC	373.08	---	---	Not scheduled for measurement until 2/91.
19	RGA	TOC	364.46	---	---	Not scheduled for measurement until 2/91.
23	DGS	TOC	373.64	16.81	356.83	
24	DGS	TOC	375.71	11.38	364.33	
25	SGS	TOC	380.02	0.08	379.94	
26	DGS	TOC	383.23	33.98	349.25	
27	DGS	TOC	381.59	---	---	Not located.
43	SGS	TOC	373.39	---	---	Not scheduled for measurement until 2/91.
52	RGA	TOC	372.29	46.55	325.74	
53	RGA	TOC	375.12	49.39	325.73	
54	RGA	TOC	373.91	52.29	321.62	
63	RGA	WWP	372.60	47.21	325.39	
64	SGS	WWP	372.60	10.43	362.17	
65	RGA	WWP	372.58	47.20	325.38	

Table 1B-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 2 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements November 1990		
				November DTW (ft)	Elevation (ft)	Remarks
68	RGA	WWP	379.72	53.15	326.57	
69	SGS	WWP	379.72	---	---	Dry.
70	RGA	TOC	379.25	52.54	326.71	
71	RGA	WWP	379.72	53.14	326.58	
73	RGA	TOC	374.97	48.92	326.05	
74	SGS	TOC	375.06	22.35	352.71	
75	SGS	TOC	376.10	12.15	363.95	
77	RGA	TOC	377.16	50.74	326.42	
82	SGS	TOC	376.54	14.75	361.79	
83	SGS	TOC	376.59	15.95	360.64	
85	SGS	WWP	375.86	18.25	357.61	
88	SGS	WWP	375.74	17.38	358.36	
90	RGA	WWP	374.51	48.36	326.15	
91	SGS	WWP	374.48	13.43	361.05	
92	RGA	WWP	374.51	48.35	326.16	

Table 1B-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 3 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements November 1990		
				November DTW (ft)	Elevation (ft)	Remarks
93	RGA	WWP	377.61	51.30	326.31	
94	SGS	WWP	377.62	20.16	357.46	
95	RGA	WWP	377.62	51.33	326.29	
96	SGS	TOC*	377.32	34.96	342.36	
120	DGS	TOC	386.57	60.24	326.33	
121	DGS	TOC	374.70	54.22	320.48	
122	DGS	TOC	364.66	39.85	324.81	
123	RGA-SH	TOC	374.69	51.55	323.14	
124	RGA-DP	TOC	364.71	39.18	325.53	
125	RGA-DP	TOC	374.89	51.77	323.12	
126	RGA-SH	TOC	364.02	38.49	325.53	
127	SGS	TOC	374.81	26.77	348.04	
128	SGS	TOC	364.38	35.73	328.65	
129	SGS	TOC	386.14	15.23	370.91	
130	SGS	TOC	386.03	15.03	371.00	

Table 1B-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 4 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements November 1990		
				November DTW (ft)	Elevation (ft)	Remarks
131	SGS	TOC	385.77	14.78	370.99	
132	RGA-DP	TOC	362.83	39.87	322.96	
133	RGA-DP	TOC	336.93	16.00	320.93	
134	RGA-DP	TOC	368.20	44.04	324.16	
135	RGA-DP	TOC	335.94	15.61	320.33	
137	RGA-SH	TOC	335.69	15.38	320.31	
138	SGS	TOC	335.57	10.58	324.99	
139	RGA-SH	TOC	363.17	40.17	323.00	
140	DGS	TOC	344.12	22.68	321.44	
141	RGA-DP	TOC	344.86	20.81	324.05	
142	RGA-SH	TOC	345.04	21.00	324.04	
143	SGS	TOC	345.37	12.84	332.53	
144	RGA-DP	TOC	379.89	53.78	326.11	
145	RGA-SH	TOC	380.08	53.97	326.11	
146	RGA-DP	TOC	352.91	34.12	318.79	

Table 1B-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 5 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements November 1990		
				November DTW (ft)	Elevation (ft)	Remarks
147	RGA-SH	TOC	353.08	34.28	318.80	
148	RGA-DP	TOC	373.35	50.20	323.15	
149	SGS	TOC	373.87	50.71	323.16	
150	RGA-DP	TOC	376.60	52.11	324.49	
151	SGS	TOC	382.56	21.26	361.30	
152	RGA-DP	TOC	353.36	38.61	314.75	
153	SGS	TOC	353.10	---	---	Dry.
154	SGS	TOC	374.49	11.28	363.21	
155	RGA-DP	TOC	381.25	---	---	Well not completed.
156	RGA-SH	TOC	382.06	---	---	Well not completed.
157	SGS	TOC	381.56	---	---	Well not completed.
158	RGA-DP	TOC	373.72	---	---	Well not completed.
159	RGA-SH	TOC	373.82	---	---	Well not completed.
160	SGS	TOC	373.56	---	---	Well not completed.
161	RGA-SH	TOC	373.55	---	---	Well not completed.

Table 1B-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 6 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements November 1990		
				November DTW (ft)	Elevation (ft)	Remarks
162	SGS	TOC	374.17	---	---	Well not completed.
163	RGA-SH	TOC	386.14	---	---	Well not completed.
164	SGS	TOC	386.29	---	---	Well not completed.
165	RGA-SH	TOC	379.74	---	---	Well not completed.
166	SGS	TOC	380.07	---	---	Well not completed.
167	SGS	TOC	376.36	---	---	Well not completed.
168	RGA-SH	TOC	377.42	---	---	Well not completed.
169	RGA-SH	TOC	373.41	---	---	Well not completed.
170	SGS	TOC	373.98	---	---	Well not completed.
171	SGS	TOC	374.63	---	---	Well not completed.
172	SGS	TOC	373.79	---	---	Well not completed.
173	RGA-SH	TOC	373.30	---	---	Well not completed.
174	SGS	TOC	373.29	---	---	Well not completed.
175	RGA-SH	TOC	381.18	---	---	Well not completed.
176	SGS	TOC	381.23	---	---	Well not completed.

Table 1B-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 7 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements November 1990		
				November DTW (ft)	Elevation (ft)	Remarks
177	SGS	TOC	379.74	---	---	Well not completed.
178	RGA-SH	TOC	378.80	---	---	Well not completed.
179	RGA-SH	TOC	358.60	---	---	Well not completed.
180	SGS	TOC	358.11	---	---	Well not completed.
181	RGA-SH	TOC	370.84	---	---	Well not completed.
182	SGS	TOC	371.15	---	---	Well not completed.
184	SGS	TOC	373.19	---	---	Well not completed.
185	RGA-SH	TOC	373.64	---	---	Well not completed.
186	SGS	TOC	373.62	---	---	Well not completed.
187	SGS	TOC	373.24	---	---	Well not completed.
188	RGA-SH	TOC	374.24	---	---	Well not completed.
189	SGS	TOC	375.50	---	---	Well not completed.
190	SGS	TOC	373.21	---	---	Well not completed.
191	RGA-SH	TOC	360.00	---	---	Well not completed.
192	SGS	TOC	359.04	---	---	Well not completed.

Table 1B-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 8 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements November 1990		
				November DTW (ft)	Elevation (ft)	Remarks
193	RGA-SH	TOC	367.85	---	---	Well not completed.
194	RGA-SH	TOC	356.21	---	---	Well not completed.
195	SGS	TOC	356.21	---	---	Well not completed.
196	SGS	TOC	368.12	---	---	Well not completed.
197	RGA-SH	TOC	368.24	---	---	Well not completed.
198	SGS	TOC	368.24	---	---	Well not completed.
199	RGA-SH	TOC	353.00	---	---	Well not completed.
200	RGA-SH	TOC	378.27	---	---	Well not completed.
201	RGA-SH	TOC	0.00	---	---	Well not completed.
202	RGA-SH	TOC	372.60	---	---	Well not completed.
203	RGA-SH	TOC	376.23	---	---	Well not completed.
204	SGS	TOC	377.73	---	---	Well not completed.
205	RGA-SH	TOC	379.75	---	---	Well not completed.
206	RGA-SH	TOC	385.14	---	---	Well not completed.

Table 1B-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 9 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements November 1990		
				November DTW (ft)	Elevation (ft)	Remarks
TVA Wells						
TVA-3	RGA	TOC	361.78	---	---	No Access.
TVA-4	RGA	TOC	336.55	---	---	No Access.
TVA-5	RGA	TOC	332.35	---	---	No Access.
TVA-6	RGA	TOC	328.58	---	---	No Access.
TVA-9	RGA	TOC	348.13	---	---	No Access.
TVA-11	RGA	TOC	321.36	---	---	No Access.
TVA-13	RGA	TOC	332.64	---	---	Not scheduled for measurement until 2/91.
TVA-14	RGA	TOC	354.66	---	---	No Access.
TVA-17	RGA	TOC	365.42	---	---	No access.
TVA-19	RGA	TOC	363.19	---	---	No Access.
TVA-24	RGA	TOC	358.73	---	---	No Access.

Table 1B-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 10 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements November 1990		
				November DTW (ft)	Elevation (ft)	Remarks
TVA-25	RGA	TOC	353.38	---	---	No Access.
TVA-27	RGA	TOC	353.61	---	---	No Access.
TVA-28	RGA	TOC	363.81	---	---	Not scheduled for measurement until 2/91.

Elev = Elevation from USC&GS first order monuments.
DTW = Depth to water from datum.
TOC = Top of innermost casing or riser, excluding pump discharge risers. The surveyed reference datum is a mark or notch on the north edge of the inner casing.
WWP = Well Wizard head plate on older funnel-shaped, exterior Well Wizard cap.
TOC* = Square stainless steel outer casing; 50 yd due south of MW-68 through -71 in open field.

Lithology:

SGS = Shallow Groundwater System
RGA = Regional Gravel Aquifer
RGA-SH = Regional Gravel Aquifer (shallow)
RGA-DP = Regional Gravel Aquifer (deep)
DGS = Deep Groundwater System

All type B wells were measured with minimal PPE, in accordance with instructions from the SSC.

DECONTAMINATION OF EQUIPMENT

Decontamination of the well sounder was done in accordance with ESP 900 (Section V, a.1) and ESP 901.

WASTE MANAGEMENT

Only a small amount of waste in the form of surgical gloves, booties, and decontamination fluids was generated by this task. This waste was turned over to the SSC for containment and was given to Energy Systems after the completion of the task.

DISCUSSION

Figures 1B-1 through 1B-3 show an interpretation of the groundwater elevation in the DGS, the RGA, and the SGS.

These plots are intended as a general representation of the subsurface hydrology only. They are characterized by a relatively small number of data points. The recharging and discharging reaches of Big Bayou Creek, Little Bayou Creek, and any of the onsite ditches have not been accounted for. These factors could strongly affect the shallow groundwater system near these features.

The hydrologic setting around the PGDP is discussed in TM No. 1A.

Deep Groundwater System

Figure 1B-3 shows that the flow in this system is northeast across most of the plant, with north flow nearer the Ohio River, as in October. MW- 120, -121, -122, and -140 control the major contours on the plot.

Hydraulic gradients within the DGS for November vary from approximately 0.0008 near Ogden Landing Road to 0.003 beneath the plant.

MW-23, -24, and -26 are on the terrace-type feature postulated in the Phase I report. They are also near a closed landfill that may affect the data. The hydrogeology in the area of the terrace is not well understood, but the piezometric surface appears to rise sharply at the terrace.

Regional Gravel Aquifer

Figure 1B-2 shows that the general flow pattern observed in October is present, although the general elevation is 1 foot lower over the site. Hydraulic gradients increase from the plant boundary (0.0004) toward the TVA plant (0.0008).

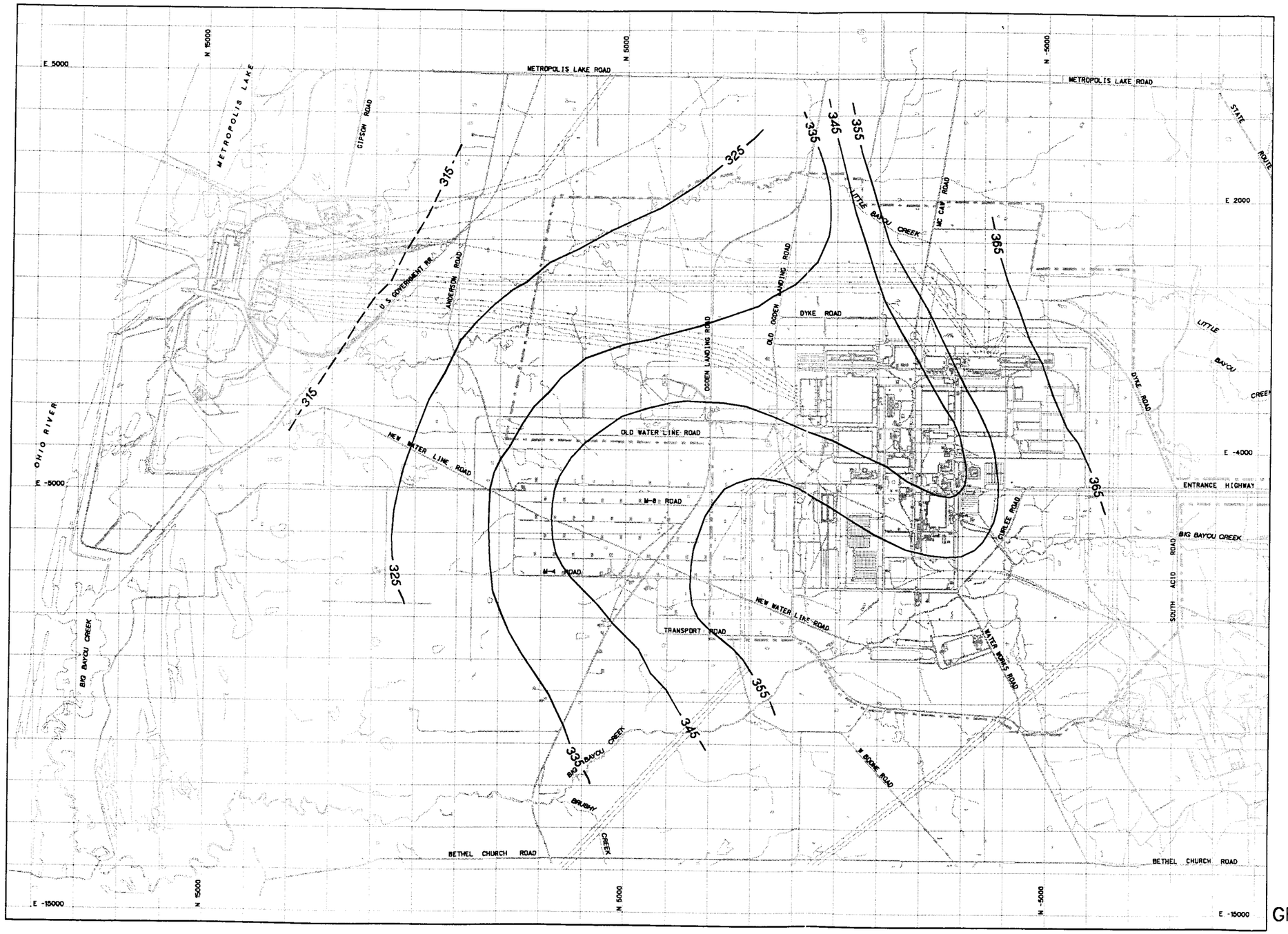
The lack of contours in the southwest portion of the map is a reflection of well locations rather than hydrology. The terrace may extend to the west-northwest from the southwest corner of the security fence.

Shallow Groundwater System

Figure 1B-1 shows that the trends observed in October are present, including the northeast-trending trough beneath the northeast section of the plant.

Hydraulic gradients within the SGS decrease from the plant toward the river. Gradients of approximately 0.009 are located beneath the southeast corner of the plant and decrease to values of 0.002 along the axis of the northeast-trending trough. Gradients of approximately 0.004 exist north of Ogden Landing Road.

0888tm36.dgn 29-Aug-1991



REVIEWED FOR CLASSIFICATION
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- —325— CONTOUR OF WATER LEVEL ELEVATIONS

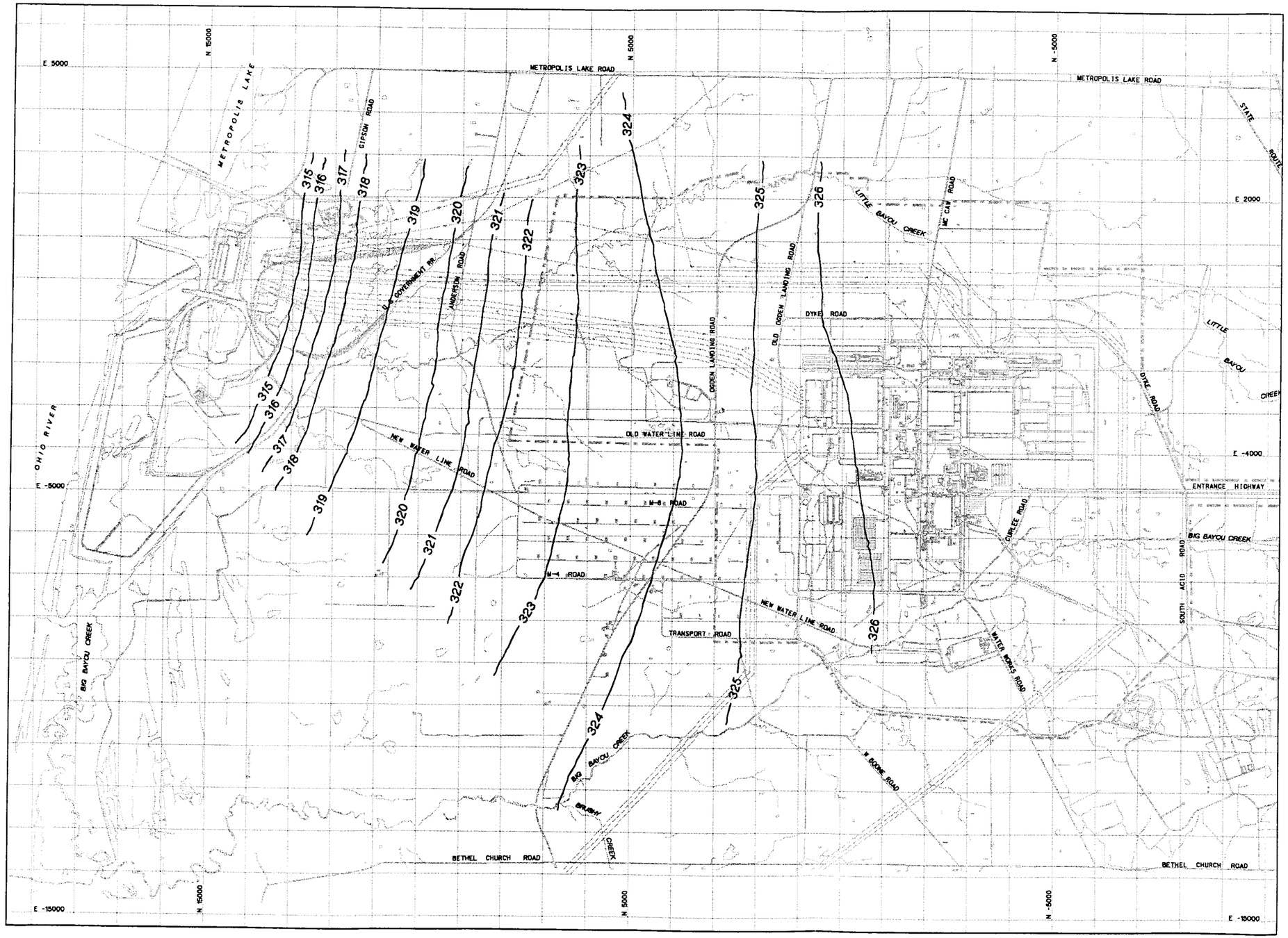
CONTOUR INTERVAL =10 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1B-1
WATER LEVEL ELEVATIONS FOR THE SHALLOW GROUNDWATER SYSTEM-NOVEMBER, 1990
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0888tm37.dgn 28-Aug-1991



REVIEWED FOR CLASSIFICATION
WS 7-9-03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

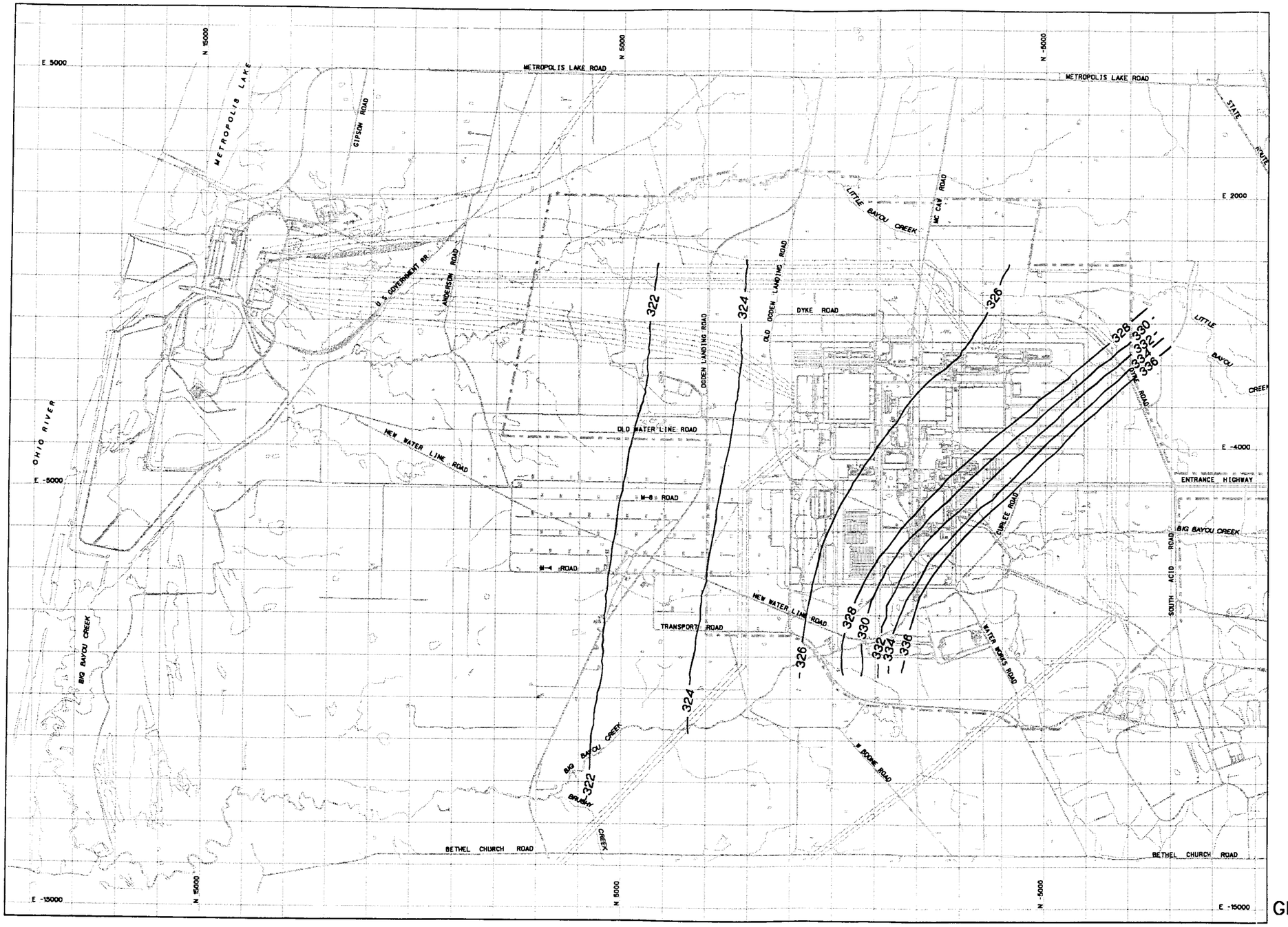
CONTOUR INTERVAL = 1 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1B-2
WATER LEVEL ELEVATIONS FOR THE REGIONAL GRAVEL AQUIFER-NOVEMBER, 1990
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0888tm38.dgn 28-Aug-1991



REVIEWED FOR CLASSIFICATION
WDS 7-9-03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 2 ft

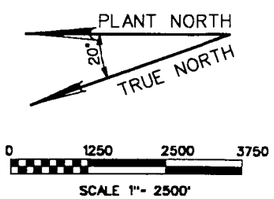


Figure 1B-3
WATER LEVEL ELEVATIONS FOR THE DEEP GROUNDWATER SYSTEM-NOVEMBER, 1990
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

TECHNICAL MEMORANDUM NO. 1C
PGDP PHASE II SITE INVESTIGATION

PREPARED BY: Greg Schaefer/ORO
Russell Lahoud/ORO

SUBJECT: Water Level Measurements, December 1990

PROJECT: ORO30888.FL

INTRODUCTION

PURPOSE AND SCOPE

Monthly water level measurements are planned for wells in and around the PGDP for a period of 1 year. This memorandum presents data collected December 10-11, 1990, from 76 wells.

FIELD PERSONNEL

The field personnel were:

Sample Team Leader (STL)	Russ Lahoud
Sample Team Member (STM)	Elena Pomar
IH/HP Technician	Pat Scofield
Escort	Wallace Cunningham
Energy Systems Escort	Jeff Douthitt
Site Safety Coordinator (SSC)	Craig Morrison/TMA/Eberline

METHODOLOGY

Measurements were taken with an electronic water level meter, measuring from the datum index, in compliance with "Task Instructions for Water Level Measurements, PGDP Phase II," as amended by the December monthly addendum.

TECHNICAL DATA

MEASUREMENTS

All of the scheduled 76 wells were measured. MW-7, -19, -22, -155 through -206, and TVA-13 and -28, were not scheduled for measurement during the December sampling event. Twelve TVA wells were added to the sampling suite for December. MW-69 and -153 were dry.

Measurement data are shown on Table 1C-1. Measurements were recorded on the data sheet and in field logbook 6.

QUALITY ASSURANCE/QUALITY CONTROL

The reported data sheet has been confirmed with the STL logbook.

FIELD MONITORING

The wells to be measured were coded for health and safety monitoring, and the following specifications were used to determine personal protective equipment worn by the sample team at each location. In addition, an IH/HP was present at all Type C wells. The guidelines for these codes were:

Present	Specifications	Protection
Type A	Non-elevated offsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type B	Non-elevated onsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type C	Wells in radiological exclusion zones or wells that have not been evaluated previously	Tyvek coveralls, booties, surgical gloves, hard hat, eye protection, and safety shoes

Health and safety monitoring was performed by the IH/HP technician at designated Type C wells and by the STL at the other wells.

All Type B wells were measured with minimal PPE in accordance with instructions from the SSC; also, MW-138 has been downgraded to a Type B well.

DECONTAMINATION OF EQUIPMENT

Decontamination of the well sounder was performed in accordance with ESP 900 (Section V, a.1) and ESP 901.

WASTE MANAGEMENT

Only a small amount of waste in the form of surgical gloves, booties, and decontamination fluids was generated by this task. This waste was turned over to the SSC for containment and was given to Energy Systems after the completion of the task.

Table 1C-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 1 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements December 1990		
				December DTW (ft)	Elevation (ft)	Remarks
PGDP Wells						
7	SGS	TOC	373.08	---	---	Not scheduled for measurement until 2/91.
19	RGA	TOC	364.46	---	---	Not scheduled for measurement until 2/91.
23	DGS	TOC	373.64	16.82	356.82	
24	DGS	TOC	375.71	11.40	364.31	
25	SGS	TOC	380.02	0.15	379.87	
26	DGS	TOC	383.23	34.54	348.69	
27	DGS	TOC	381.59	19.17	362.42	
43	SGS	TOC	373.39	---	---	Not scheduled for measurement until 2/91.
52	RGA	TOC	372.29	46.78	325.51	No lock.
53	RGA	TOC	375.12	49.62	325.51	
54	RGA	TOC	373.91	48.46	325.45	
63	RGA	WWP	372.60	47.42	325.18	
64	SGS	WWP	372.60	10.75	361.85	
65	RGA	WWP	372.58	47.42	325.16	

Table 1C-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 2 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements December 1990		
				December DTW (ft)	Elevation (ft)	Remarks
68	RGA	WWP	379.72	53.40	326.32	
69	SGS	WWP	379.72	---	---	Dry.
70	RGA	TOC	379.25	52.98	326.27	No Cap.
71	RGA	WWP	379.72	53.39	326.33	
73	RGA	TOC	374.97	49.18	325.79	
74	SGS	TOC	375.06	22.23	352.83	
75	SGS	TOC	376.10	12.05	364.05	
77	RGA	TOC	377.16	51.01	326.15	
82	SGS	TOC	376.54	14.70	361.84	
83	SGS	TOC	376.59	15.96	360.63	
85	SGS	WWP	375.86	18.34	357.52	
88	SGS	WWP	375.74	17.34	358.40	
90	RGA	WWP	374.51	48.78	325.73	
91	SGS	WWP	374.48	13.61	360.87	
92	RGA	WWP	374.51	48.77	325.74	

Table 1C-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 3 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements December 1990		
				December DTW (ft)	Elevation (ft)	Remarks
93	RGA	WWP	377.61	51.72	325.89	Caution.
94	SGS	WWP	377.62	20.13	357.49	
95	RGA	WWP	377.62	51.77	325.85	
96	SGS	TOC*	377.32	34.99	342.33	
120	DGS	TOC	386.57	60.64	325.93	
121	DGS	TOC	374.70	53.69	321.01	
122	DGS	TOC	364.66	40.36	324.30	
123	RGA-SH	TOC	374.69	51.93	322.76	
124	RGA-DP	TOC	364.71	40.58	324.13	
125	RGA-DP	TOC	374.89	52.15	322.74	
126	RGA-SH	TOC	364.02	38.90	325.12	
127	SGS	TOC	374.81	27.06	347.75	
128	SGS	TOC	364.38	35.60	328.78	
129	SGS	TOC	386.14	14.48	371.66	
130	SGS	TOC	386.03	14.29	371.74	

Table 1C-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 4 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements December 1990		
				December DTW (ft)	Elevation (ft)	Remarks
131	SGS	TOC	385.77	14.02	371.75	
132	RGA-DP	TOC	362.83	40.16	322.67	
133	RGA-DP	TOC	336.93	16.34	320.59	
134	RGA-DP	TOC	368.20	44.43	323.77	
135	RGA-DP	TOC	335.94	15.75	320.19	
137	RGA-SH	TOC	335.69	15.51	320.18	
138	SGS	TOC	335.57	8.75	326.82	
139	RGA-SH	TOC	363.17	40.52	322.65	
140	DGS	TOC	344.12	22.77	321.35	
141	RGA-DP	TOC	344.86	21.24	323.62	
142	RGA-SH	TOC	345.04	21.42	323.62	
143	SGS	TOC	345.37	12.72	332.65	
144	RGA-DP	TOC	379.89	54.25	325.64	
145	RGA-SH	TOC	380.08	54.39	325.69	
146	RGA-DP	TOC	352.91	34.32	318.59	

Table 1C-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 5 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements December 1990		
				December DTW (ft)	Elevation (ft)	Remarks
147	RGA-SH	TOC	353.08	34.49	318.59	
148	RGA-DP	TOC	373.35	50.50	322.85	
149	SGS	TOC	373.87	51.01	322.86	
150	RGA-DP	TOC	376.60	52.50	324.10	
151	SGS	TOC	382.56	20.68	361.88	
152	RGA-DP	TOC	353.36	37.73	315.63	
153	SGS	TOC	353.10	---	---	Dry.
154	SGS	TOC	374.49	10.85	363.64	Caution.
155	RGA-DP	TOC	381.25	---	---	Not scheduled for measurement until 3/91.
156	RGA-SH	TOC	382.06	---	---	Not scheduled for measurement until 3/91.
157	SGS	TOC	381.56	---	---	Not scheduled for measurement until 3/91.
158	RGA-DP	TOC	373.72	---	---	Not scheduled for measurement until 3/91.
159	RGA-SH	TOC	373.82	---	---	Not scheduled for measurement until 3/91.
160	SGS	TOC	373.56	---	---	Not scheduled for measurement until 3/91.
161	RGA-SH	TOC	373.55	---	---	Not scheduled for measurement until 3/91.

Table 1C-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 6 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements December 1990		
				December DTW (ft)	Elevation (ft)	Remarks
162	SGS	TOC	374.17	---	---	Not scheduled for measurement until 3/91.
163	RGA-SH	TOC	386.14	---	---	Not scheduled for measurement until 2/91.
164	SGS	TOC	386.29	---	---	Not scheduled for measurement until 3/91.
165	RGA-SH	TOC	379.74	---	---	Not scheduled for measurement until 2/91.
166	SGS	TOC	380.07	---	---	Not scheduled for measurement until 3/91.
167	SGS	TOC	376.36	---	---	Not scheduled for measurement until 3/91.
168	RGA-SH	TOC	377.42	---	---	Not scheduled for measurement until 2/91.
169	RGA-SH	TOC	373.41	---	---	Not scheduled for measurement until 2/91.
170	SGS	TOC	373.98	---	---	Not scheduled for measurement until 3/91.
171	SGS	TOC	374.63	---	---	Not scheduled for measurement until 3/91.
172	SGS	TOC	373.79	---	---	Not scheduled for measurement until 3/91.
173	RGA-SH	TOC	373.30	---	---	Not scheduled for measurement until 3/91.
174	SGS	TOC	373.29	---	---	Not scheduled for measurement until 3/91.
175	RGA-SH	TOC	381.18	---	---	Not scheduled for measurement until 3/91.
176	SGS	TOC	381.23	---	---	Not scheduled for measurement until 3/91.

Table 1C-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 7 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements December 1990		
				December DTW (ft)	Elevation (ft)	Remarks
177	SGS	TOC	379.74	---	---	Not scheduled for measurement until 3/91.
178	RGA-SH	TOC	378.80	---	---	Not scheduled for measurement until 3/91.
179	RGA-SH	TOC	358.60	---	---	Not scheduled for measurement until 3/91.
180	SGS	TOC	358.11	---	---	Not scheduled for measurement until 3/91.
181	RGA-SH	TOC	370.84	---	---	Not scheduled for measurement until 3/91.
182	SGS	TOC	371.15	---	---	Not scheduled for measurement until 3/91.
184	SGS	TOC	373.19	---	---	Not scheduled for measurement until 3/91.
185	RGA-SH	TOC	373.64	---	---	Not scheduled for measurement until 3/91.
186	SGS	TOC	373.62	---	---	Not scheduled for measurement until 3/91.
187	SGS	TOC	373.24	---	---	Not scheduled for measurement until 3/91.
188	RGA-SH	TOC	374.24	---	---	Not scheduled for measurement until 3/91.
189	SGS	TOC	375.50	---	---	Not scheduled for measurement until 3/91.
190	SGS	TOC	373.21	---	---	Not scheduled for measurement until 3/91.
191	RGA-SH	TOC	360.00	---	---	Not scheduled for measurement until 4/91.
192	SGS	TOC	359.04	---	---	Not scheduled for measurement until 4/91.

Table 1C-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 8 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements December 1990		
				December DTW (ft)	Elevation (ft)	Remarks
193	RGA-SH	TOC	367.85	---	---	Not scheduled for measurement until 4/91.
194	RGA-SH	TOC	356.21	---	---	Not scheduled for measurement until 4/91.
195	SGS	TOC	356.21	---	---	Not scheduled for measurement until 4/91.
196	SGS	TOC	368.12	---	---	Not scheduled for measurement until 4/91.
197	RGA-SH	TOC	368.24	---	---	Not scheduled for measurement until 4/91.
198	SGS	TOC	368.24	---	---	Not scheduled for measurement until 4/91.
199	RGA-SH	TOC	353.00	---	---	Not scheduled for measurement until 4/91.
200	RGA-SH	TOC	378.27	---	---	Not scheduled for measurement until 4/91.
201	RGA-SH	TOC	0.00	---	---	Not scheduled for measurement until 4/91.
202	RGA-SH	TOC	372.60	---	---	Not scheduled for measurement until 4/91.
203	RGA-SH	TOC	376.23	---	---	Not scheduled for measurement until 4/91.
204	SGS	TOC	377.73	---	---	Not scheduled for measurement until 4/91.
205	RGA-SH	TOC	379.75	---	---	Not scheduled for measurement until 6/91.
206	RGA-SH	TOC	385.14	---	---	Not scheduled for measurement until 6/91.

Table 1C-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 9 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements December 1990		
				December DTW (ft)	Elevation (ft)	Remarks
TVA Wells						
TVA-3	RGA	TOC	361.78	42.39	319.39	
TVA-4	RGA	TOC	336.55	18.20	318.35	
TVA-5	RGA	TOC	332.35	15.15	317.20	
TVA-6	RGA	TOC	328.58	12.51	316.07	
TVA-9	RGA	TOC	348.13	28.66	319.47	4" PVC/6" steel casing
TVA-11	RGA	TOC	321.36	16.80	304.56	
TVA-13	RGA	TOC	332.64	---	---	Not scheduled for measurement until 2/91.
TVA-14	RGA	TOC	354.66	36.29	318.37	
TVA-17	RGA	TOC	365.42	48.93	316.49	
TVA-19	RGA	TOC	363.19	44.74	318.45	
TVA-24	RGA	TOC	358.73	43.33	315.40	

Table 1C-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 10 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements December 1990		
				December DTW (ft)	Elevation (ft)	Remarks
TVA-25	RGA	TOC	353.38	37.52	315.86	
TVA-27	RGA	TOC	353.61	37.65	315.96	
TVA-28	RGA	TOC	363.81	---	---	Not scheduled for measurement until 2/91.

Elev = Elevation from USC&GS first order monuments.
DTW = Depth to water from datum.
TOC = Top of innermost casing or riser, excluding pump discharge risers. The surveyed reference datum is a mark or notch on the north edge of the inner casing.
WWP = Well Wizard head plate on older funnel-shaped, exterior Well Wizard cap.
TOC* = Square stainless steel outer casing; 50 yd due south of MW-68 through -71 in open field.

Lithology:

SGS = Shallow Groundwater System
RGA = Regional Gravel Aquifer
RGA-SH = Regional Gravel Aquifer (shallow)
RGA-DP = Regional Gravel Aquifer (deep)
DGS = Deep Groundwater System

DISCUSSION

Figures 1C-1 through 1C-3 show an interpretation of the groundwater elevation in the DGS, the RGA, and the SGS.

These plots are intended as a general representation of the subsurface hydrology only. They are characterized by a relatively small number of data points. The recharging and discharging reaches of Big Bayou Creek, Little Bayou Creek, and any of the onsite ditches have not been accounted for. These factors could strongly affect the shallow groundwater system near these features.

The hydrologic setting around the PGDP is discussed in TM No. 1A.

Deep Groundwater System

Figure 1C-3 shows that the flow in this system is northeast across most of the plant, with north and northwest flow nearer the Ohio River, as observed in previous months.

Hydraulic gradients within the DGS for December vary only slightly across the site. Values range from 0.0004 beneath the plant to 0.0005 north of Ogden Landing Road.

MW-23, -24, and -26 are on the terrace-type feature postulated in the Phase I report. They are also near a closed landfill that may affect the data. The hydrogeology in the area of the terrace is not well understood, but the piezometric surface appears to rise sharply at the terrace.

Regional Gravel Aquifer

Figure 1C-2 shows that the general north-northeast flow pattern observed in previous months is present, with water level elevations the same as in October. Hydraulic gradients increase from the plant (0.0004) toward the Ohio River (0.001).

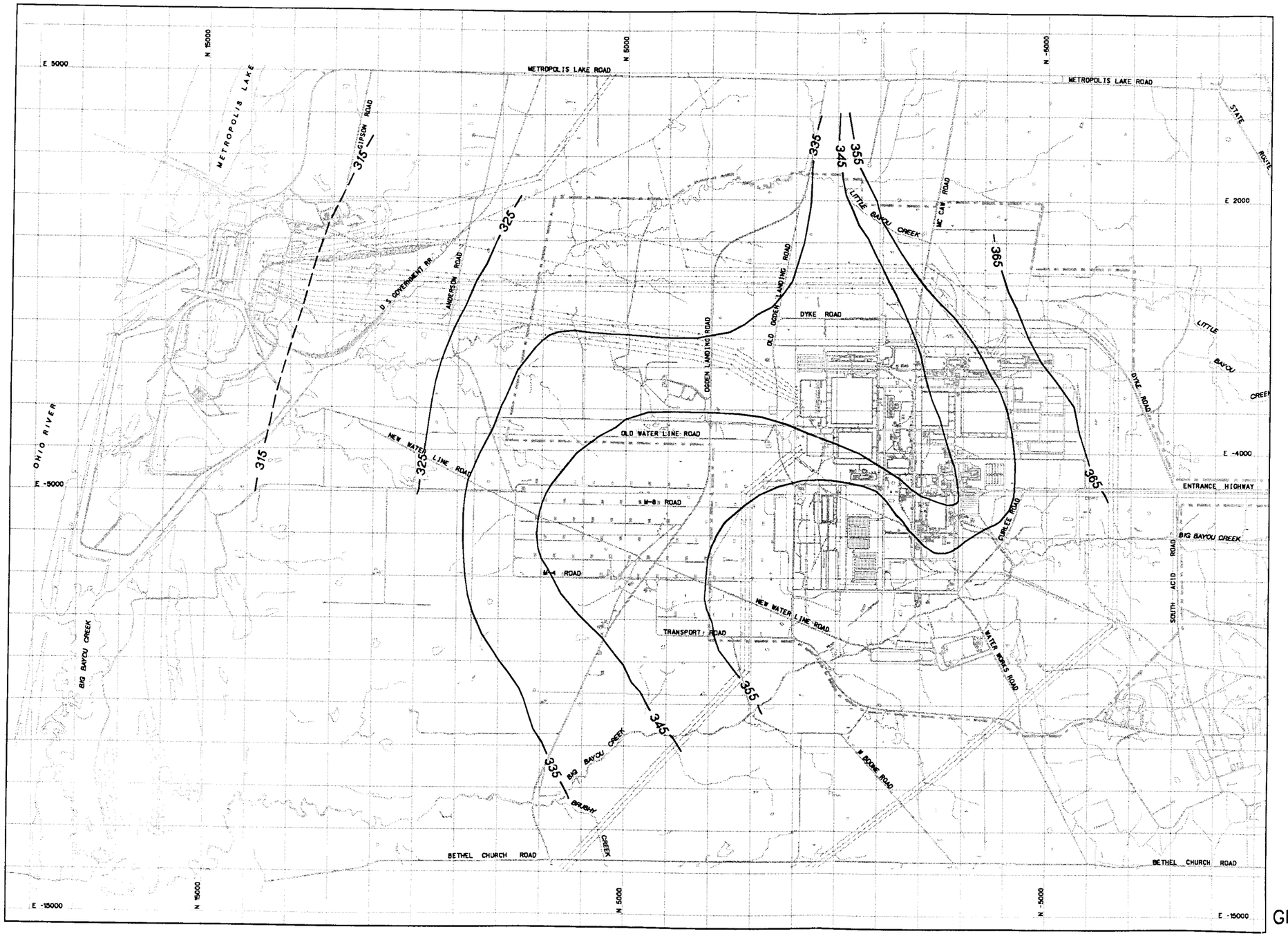
The addition of 12 TVA wells to the sampling suite allowed the RGA water levels near the Ohio River and west of the TVA plant to be defined more accurately.

Shallow Groundwater System

Figure 1C-1 shows that the same general northeast flow trends observed in previous months are present, along with the same water level elevations. The northeast-trending trough extending from Curlee Road in the southwest is still defined.

Hydraulic gradients within the SGS are virtually the same as in November, with a decrease from the plant toward the river. Gradients range from 0.009 beneath the southeast corner of the plant toward the center of the plant to 0.001 along the northeast-trending axis of the trough beneath the plant. Gradients of approximately

0.004 are present in the SGS north of Ogden Landing Road and decrease toward the TVA plant.

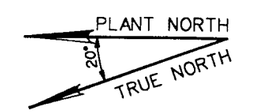


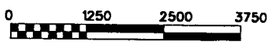
REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- —325— CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL =10 ft

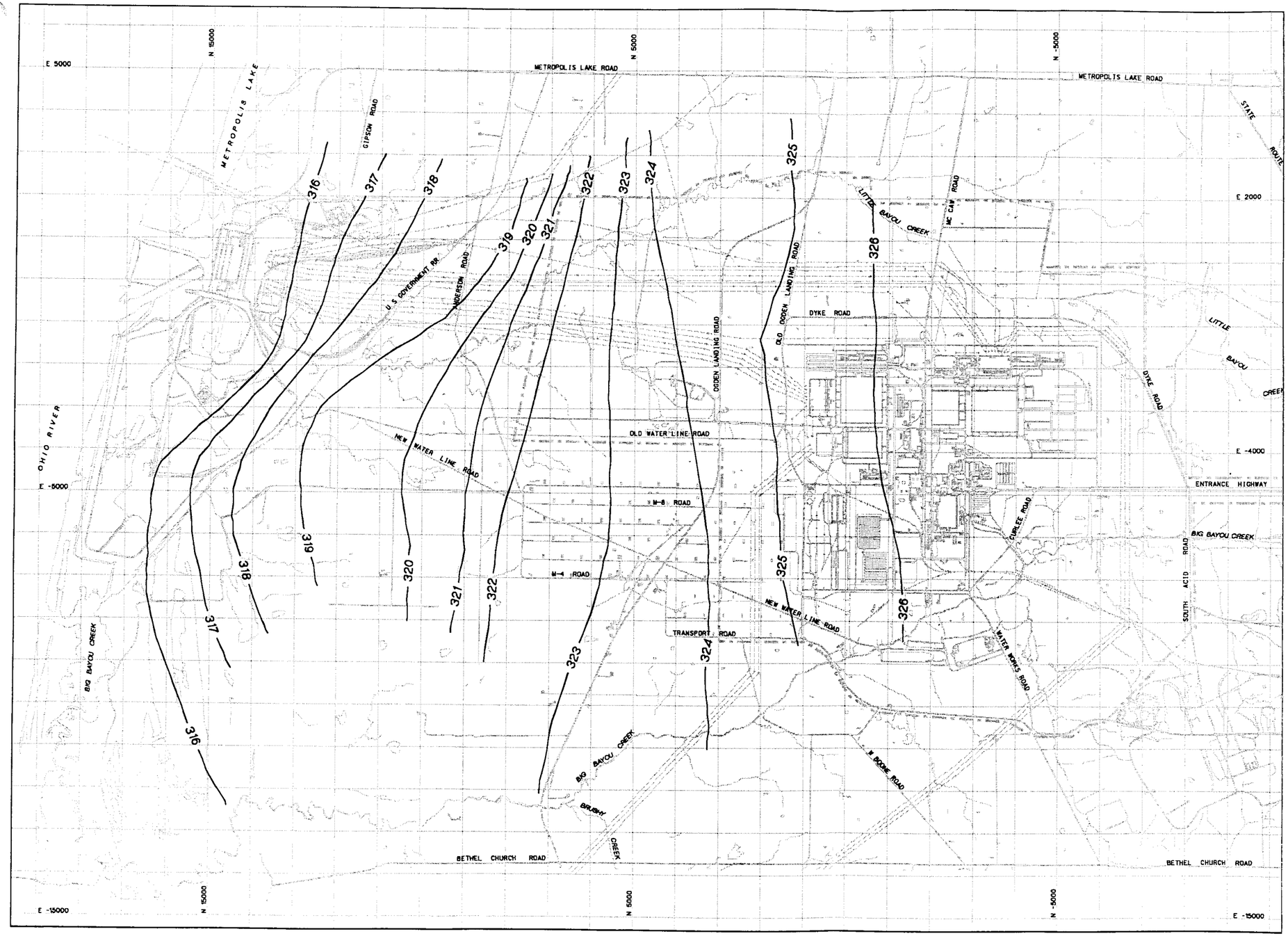




SCALE 1"= 2500'

Figure 1C-1
WATER LEVEL ELEVATIONS
FOR THE SHALLOW
GROUNDWATER SYSTEM-DECEMBER,1990
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0888tm10.dgn 28-Aug-1991



REVIEWED FOR CLASSIFICATION
WJ 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

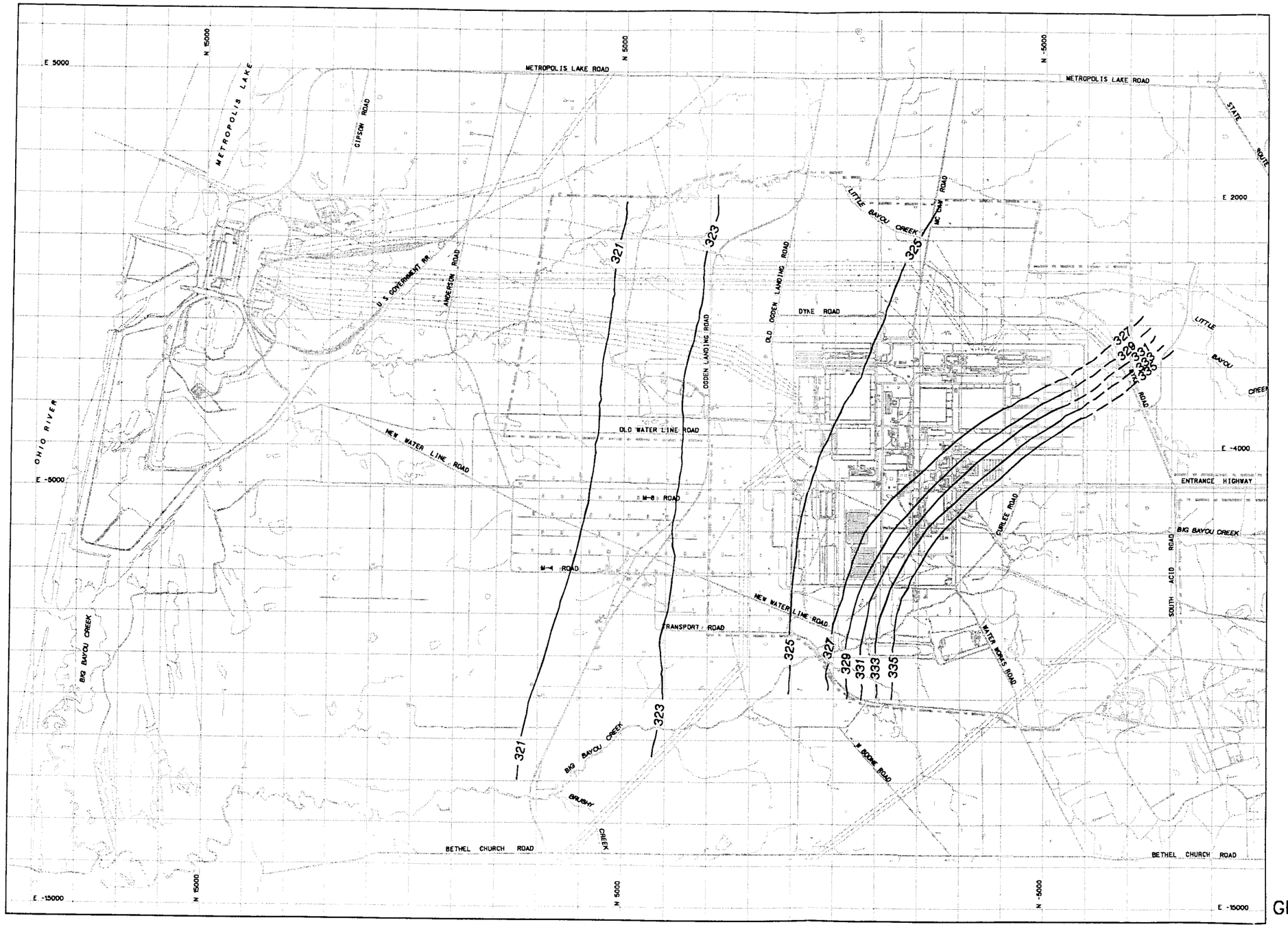
CONTOUR INTERVAL = 1 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1C-2
WATER LEVEL ELEVATIONS FOR THE REGIONAL GRAVEL AQUIFER-DECEMBER, 1990
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

08E8tm41.dgn 26-Aug-1991



REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- —325— CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 2 ft

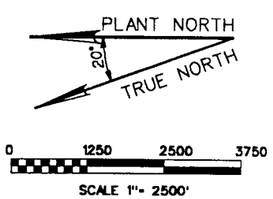


Figure 1C-3
WATER LEVEL ELEVATIONS
FOR THE DEEP
GROUNDWATER SYSTEM-DECEMBER,1990
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

TECHNICAL MEMORANDUM NO. 1D
PGDP PHASE II SITE INVESTIGATION

PREPARED BY: Greg Schaefer/ORO
Russell Lahoud/ORO

SUBJECT: Water Level Measurements, January 1991

PROJECT: ORO30888.FL

INTRODUCTION

PURPOSE AND SCOPE

Monthly water level measurements are planned for wells in and around the PGDP for a period of 1 year. This memorandum presents data collected January 14-15, 1991, from 73 wells.

FIELD PERSONNEL

The field personnel were:

Sample Team Leader (STL)	Russ Lahoud
Sample Team Member (STM)	Greg Ford
IH/HP Technician	Craig Morrison/Bob Nash
Escort	Paul Graves
Energy Systems Escort	Jeff Douthitt
Site Safety Coordinator (SSC)	Craig Morrison/TMA/Eberline

METHODOLOGY

Measurements were taken with an electronic water level meter, measuring from the datum index, in compliance with "Task Instructions for Water Level Measurements, PGDP Phase II," as amended by the January monthly addendum.

TECHNICAL DATA

MEASUREMENTS

Seventy-three of the scheduled 76 wells were measured. MW-17, -19, -27, -155 through -206, and TVA-13 and -28, were not scheduled for measurement during the January sampling event. TVA-5, -6, and -11 could not be reached because of high flood waters from the Ohio River. MW-153 had a measurable water level for the first time during the task. MW-69 was dry.

Measurement data are shown on Table 1D-1. Measurements were recorded on the data sheet and in field logbook 6.

QUALITY ASSURANCE/QUALITY CONTROL

The reported data sheet has been confirmed with the STL logbook.

FIELD MONITORING

The wells to be measured were coded for health and safety monitoring, and the following specifications were used to determine personal protective equipment worn by the sample team at each location. In addition, an IH/HP was present at all Type C wells. The guidelines for these codes were:

Present	Specifications	Protection
Type A	Non-elevated offsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type B	Non-elevated onsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type C	Wells in radiological exclusion zones or wells that have not been evaluated previously	Tyvek coveralls, booties, surgical gloves, hard hat, eye protection, and safety shoes

Health and safety monitoring was conducted by the SSC and Bob Nash/CH2M HILL/ ORO at designated Type C wells and by the STL at the other wells.

All Type B wells were measured with minimal PPE in accordance with instructions from the SSC; also, MW-138 has been downgraded to a Type B well.

DECONTAMINATION OF EQUIPMENT

Decontamination of the well sounder was performed in accordance with ESP 900 (Section V, a.1) and ESP 901.

WASTE MANAGEMENT

Only a small amount of waste in the form of surgical gloves, booties, and decontamination fluids was generated by this task. This waste was turned over to the SSC for containment and was given to Energy Systems after the completion of the task.

Table 1D-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 1 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements January 1991		
				January DTW (ft)	Elevation (ft)	Remarks
PGDP Wells						
7	SGS	TOC	373.08	---	---	Not scheduled for measurement until 2/91.
19	RGA	TOC	364.46	---	---	Not scheduled for measurement until 2/91.
23	DGS	TOC	373.64	15.84	357.80	
24	DGS	TOC	375.71	10.91	364.80	
25	SGS	TOC	380.02	0.15	379.87	
26	DGS	TOC	383.23	7.89	375.34	
27	DGS	TOC	381.59	19.04	362.55	
43	SGS	TOC	373.39	---	---	Not scheduled for measurement until 2/91.
52	RGA	TOC	372.29	45.80	326.49	
53	RGA	TOC	375.12	48.56	326.56	
54	RGA	TOC	373.91	47.32	326.59	
63	RGA	WWP	372.60	45.92	326.68	
64	SGS	WWP	372.60	15.77	356.83	
65	RGA	WWP	372.58	45.91	326.67	

Table 1D-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 2 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements January 1991		
				January DTW (ft)	Elevation (ft)	Remarks
68	RGA	WWP	379.72	53.05	326.67	
69	SGS	WWP	379.72	---	---	Dry
70	RGA	TOC	379.25	52.58	326.67	
71	RGA	WWP	379.72	53.03	326.69	
73	RGA	TOC	374.97	48.44	326.53	
74	SGS	TOC	375.06	22.20	352.86	
75	SGS	TOC	376.10	11.24	364.86	
77	RGA	TOC	377.16	50.55	326.61	
82	SGS	TOC	376.54	14.13	362.41	
83	SGS	TOC	376.59	16.06	360.53	
85	SGS	WWP	375.86	18.46	357.40	
88	SGS	WWP	375.74	17.40	358.34	
90	RGA	WWP	374.51	47.95	326.56	
91	SGS	WWP	374.48	13.77	360.71	
92	RGA	WWP	374.51	47.93	326.58	

Table 1D-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 3 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements January 1991		
				January DTW (ft)	Elevation (ft)	Remarks
93	RGA	WWP	377.61	51.03	326.58	
94	SGS	WWP	377.62	20.01	357.61	
95	RGA	WWP	377.62	51.04	326.58	
96	SGS	TOC*	377.32	35.03	342.29	
120	DGS	TOC	386.57	60.59	325.98	
121	DGS	TOC	374.70	49.71	324.99	
122	DGS	TOC	364.66	40.06	324.60	
123	RGA-SH	TOC	374.69	47.38	327.31	
124	RGA-DP	TOC	364.71	38.11	326.60	
125	RGA-DP	TOC	374.89	47.59	327.30	
126	RGA-SH	TOC	364.02	37.44	326.58	
127	SGS	TOC	374.81	26.89	347.92	
128	SGS	TOC	364.38	32.91	331.47	
129	SGS	TOC	386.14	11.31	374.83	
130	SGS	TOC	386.03	11.12	374.91	

Table 1D-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 4 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements January 1991		
				January DTW (ft)	Elevation (ft)	Remarks
131	SGS	TOC	385.77	10.86	374.91	
132	RGA-DP	TOC	362.83	36.78	326.05	
133	RGA-DP	TOC	336.93	11.30	325.63	
134	RGA-DP	TOC	368.20	40.70	327.50	
135	RGA-DP	TOC	335.94	9.87	326.07	
137	RGA-SH	TOC	335.69	9.61	326.08	
138	SGS	TOC	335.57	3.97	331.60	
139	RGA-SH	TOC	363.17	37.11	326.06	
140	DGS	TOC	344.12	19.56	324.56	
141	RGA-DP	TOC	344.86	16.70	328.16	
142	RGA-SH	TOC	345.04	16.93	328.11	
143	SGS	TOC	345.37	11.87	333.50	
144	RGA-DP	TOC	379.89	53.23	326.66	
145	RGA-SH	TOC	380.08	53.37	326.71	
146	RGA-DP	TOC	352.91	24.65	328.26	

Table 1D-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 5 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements January 1991		
				January DTW (ft)	Elevation (ft)	Remarks
147	RGA-SH	TOC	353.08	24.86	328.22	
148	RGA-DP	TOC	373.35	47.75	325.60	
149	SGS	TOC	373.87	48.27	325.60	
150	RGA-DP	TOC	376.60	50.56	326.04	
151	SGS	TOC	382.56	16.13	366.43	
152	RGA-DP	TOC	353.36	27.24	326.12	
153	SGS	TOC	353.10	28.03	325.07	
154	SGS	TOC	374.49	8.39	366.10	
155	RGA-DP	TOC	381.25	---	---	Not scheduled for measurement until 3/91.
156	RGA-SH	TOC	382.06	---	---	Not scheduled for measurement until 3/91.
157	SGS	TOC	381.56	---	---	Not scheduled for measurement until 3/91.
158	RGA-DP	TOC	373.72	---	---	Not scheduled for measurement until 3/91.
159	RGA-SH	TOC	373.82	---	---	Not scheduled for measurement until 3/91.
160	SGS	TOC	373.56	---	---	Not scheduled for measurement until 3/91.
161	RGA-SH	TOC	373.55	---	---	Not scheduled for measurement until 3/91.

Table 1D-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 6 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements January 1991		
				January DTW (ft)	Elevation (ft)	Remarks
162	SGS	TOC	374.17	---	---	Not scheduled for measurement until 3/91.
163	RGA-SH	TOC	386.14	---	---	Not scheduled for measurement until 2/91.
164	SGS	TOC	386.29	---	---	Not scheduled for measurement until 3/91.
165	RGA-SH	TOC	379.74	---	---	Not scheduled for measurement until 2/91.
166	SGS	TOC	380.07	---	---	Not scheduled for measurement until 3/91.
167	SGS	TOC	376.36	---	---	Not scheduled for measurement until 3/91.
168	RGA-SH	TOC	377.42	---	---	Not scheduled for measurement until 2/91.
169	RGA-SH	TOC	373.41	---	---	Not scheduled for measurement until 2/91.
170	SGS	TOC	373.98	---	---	Not scheduled for measurement until 3/91.
171	SGS	TOC	374.63	---	---	Not scheduled for measurement until 3/91.
172	SGS	TOC	373.79	---	---	Not scheduled for measurement until 3/91.
173	RGA-SH	TOC	373.30	---	---	Not scheduled for measurement until 3/91.
174	SGS	TOC	373.29	---	---	Not scheduled for measurement until 3/91.
175	RGA-SH	TOC	381.18	---	---	Not scheduled for measurement until 3/91.
176	SGS	TOC	381.23	---	---	Not scheduled for measurement until 3/91.

Table 1D-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 7 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements January 1991		
				January DTW (ft)	Elevation (ft)	Remarks
177	SGS	TOC	379.74	---	---	Not scheduled for measurement until 3/91.
178	RGA-SH	TOC	378.80	---	---	Not scheduled for measurement until 3/91.
179	RGA-SH	TOC	358.60	---	---	Not scheduled for measurement until 3/91.
180	SGS	TOC	358.11	---	---	Not scheduled for measurement until 3/91.
181	RGA-SH	TOC	370.84	---	---	Not scheduled for measurement until 3/91.
182	SGS	TOC	371.15	---	---	Not scheduled for measurement until 3/91.
184	SGS	TOC	373.19	---	---	Not scheduled for measurement until 3/91.
185	RGA-SH	TOC	373.64	---	---	Not scheduled for measurement until 3/91.
186	SGS	TOC	373.62	---	---	Not scheduled for measurement until 3/91.
187	SGS	TOC	373.24	---	---	Not scheduled for measurement until 3/91.
188	RGA-SH	TOC	374.24	---	---	Not scheduled for measurement until 3/91.
189	SGS	TOC	375.50	---	---	Not scheduled for measurement until 3/91.
190	SGS	TOC	373.21	---	---	Not scheduled for measurement until 3/91.
191	RGA-SH	TOC	360.00	---	---	Not scheduled for measurement until 4/91.
192	SGS	TOC	359.04	---	---	Not scheduled for measurement until 4/91.

Table 1D-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 8 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements January 1991		
				January DTW (ft)	Elevation (ft)	Remarks
193	RGA-SH	TOC	367.85	---	---	Not scheduled for measurement until 4/91.
194	RGA-SH	TOC	356.21	---	---	Not scheduled for measurement until 4/91.
195	SGS	TOC	356.21	---	---	Not scheduled for measurement until 4/91.
196	SGS	TOC	368.12	---	---	Not scheduled for measurement until 4/91.
197	RGA-SH	TOC	368.24	---	---	Not scheduled for measurement until 4/91.
198	SGS	TOC	368.24	---	---	Not scheduled for measurement until 4/91.
199	RGA-SH	TOC	353.00	---	---	Not scheduled for measurement until 4/91.
200	RGA-SH	TOC	378.27	---	---	Not scheduled for measurement until 4/91.
201	RGA-SH	TOC	0.00	---	---	Not scheduled for measurement until 4/91.
202	RGA-SH	TOC	372.60	---	---	Not scheduled for measurement until 4/91.
203	RGA-SH	TOC	376.23	---	---	Not scheduled for measurement until 4/91.
204	SGS	TOC	377.73	---	---	Not scheduled for measurement until 4/91.
205	RGA-SH	TOC	379.75	---	---	Not scheduled for measurement until 6/91.
206	RGA-SH	TOC	385.14	---	---	Not scheduled for measurement until 6/91.

Table 1D-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 9 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements January 1991		
				January DTW (ft)	Elevation (ft)	Remarks
TVA Wells						
TVA-3	RGA	TOC	361.78	33.64	328.14	
TVA-4	RGA	TOC	336.55	7.62	328.93	
TVA-5	RGA	TOC	332.35	---	---	Under water.
TVA-6	RGA	TOC	328.58	---	---	Under water.
TVA-9	RGA	TOC	348.13	16.96	331.17	
TVA-11	RGA	TOC	321.36	---	---	Under water.
TVA-13	RGA	TOC	332.64	---	---	Not scheduled for measurement until 2/91.
TVA-14	RGA	TOC	354.66	27.12	327.54	
TVA-17	RGA	TOC	365.42	40.80	324.62	
TVA-19	RGA	TOC	363.19	37.94	325.25	
TVA-24	RGA	TOC	358.73	32.20	326.53	

Table 1D-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 10 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements January 1991		
				January DTW (ft)	Elevation (ft)	Remarks
TVA-25	RGA	TOC	353.38	26.22	327.16	
TVA-27	RGA	TOC	353.61	27.27	326.34	
TVA-28	RGA	TOC	363.81	---	---	Not scheduled for measurement until 2/91.

Elev = Elevation from USC&GS first order monuments.
DTW = Depth to water from datum.
TOC = Top of innermost casing or riser, excluding pump discharge risers. The surveyed reference datum is a mark or notch on the north edge of the inner casing.
WWP = Well Wizard head plate on older funnel-shaped, exterior Well Wizard cap.
TOC* = Square stainless steel outer casing; 50 yd due south of MW-68 through -71 in open field.

Lithology:

SGS = Shallow Groundwater System
RGA = Regional Gravel Aquifer
RGA-SH = Regional Gravel Aquifer (shallow)
RGA-DP = Regional Gravel Aquifer (deep)
DGS = Deep Groundwater System

DISCUSSION

Figures 1D-1 through 1D-3 show an interpretation of the groundwater elevation in the DGS, the RGA, and the SGS.

These plots are intended as a general representation of the subsurface hydrology only. They are characterized by a relatively small number of data points. The recharging and discharging reaches of Big Bayou Creek, Little Bayou Creek, and any of the onsite ditches have not been accounted for. These factors could strongly affect the shallow groundwater system near these features.

The hydrologic setting around the PGDP is discussed in TM No. 1A.

Deep Groundwater System

Figure 1D-3 shows that flow in this system has the same northeast and north flow trends as in previous months. A water level increase of approximately 2 feet north of the plant decreased the hydraulic gradient beneath and north of the plant. The gradient for the northern portion of the site is 0.0002 or less. This increase in water level in the DGS is a direct response to the heavy precipitation during January.

Regional Gravel Aquifer

The RGA showed a direct response to the high flood waters of the Ohio River. Figure 1D-2 shows a near reversal of gradient as compared to previous months. Flow in the RGA for January is from the Ohio River toward the plant, in a southeastern direction. This represents recharge of the RGA by the Ohio River.

Hydraulic gradients within the RGA near the Ohio River average 0.001 away from the river and decrease to an approximate value of 0.0002 near Ogden Landing Road. The gradient decreases below 0.0002 in the vicinity of the plant with a northeastern flow direction.

The lack of contours in the south and southwestern portion of the map is a reflection of well locations rather than hydrology. The terrace may extend to the west-northwest from the southwest corner of the security fence.

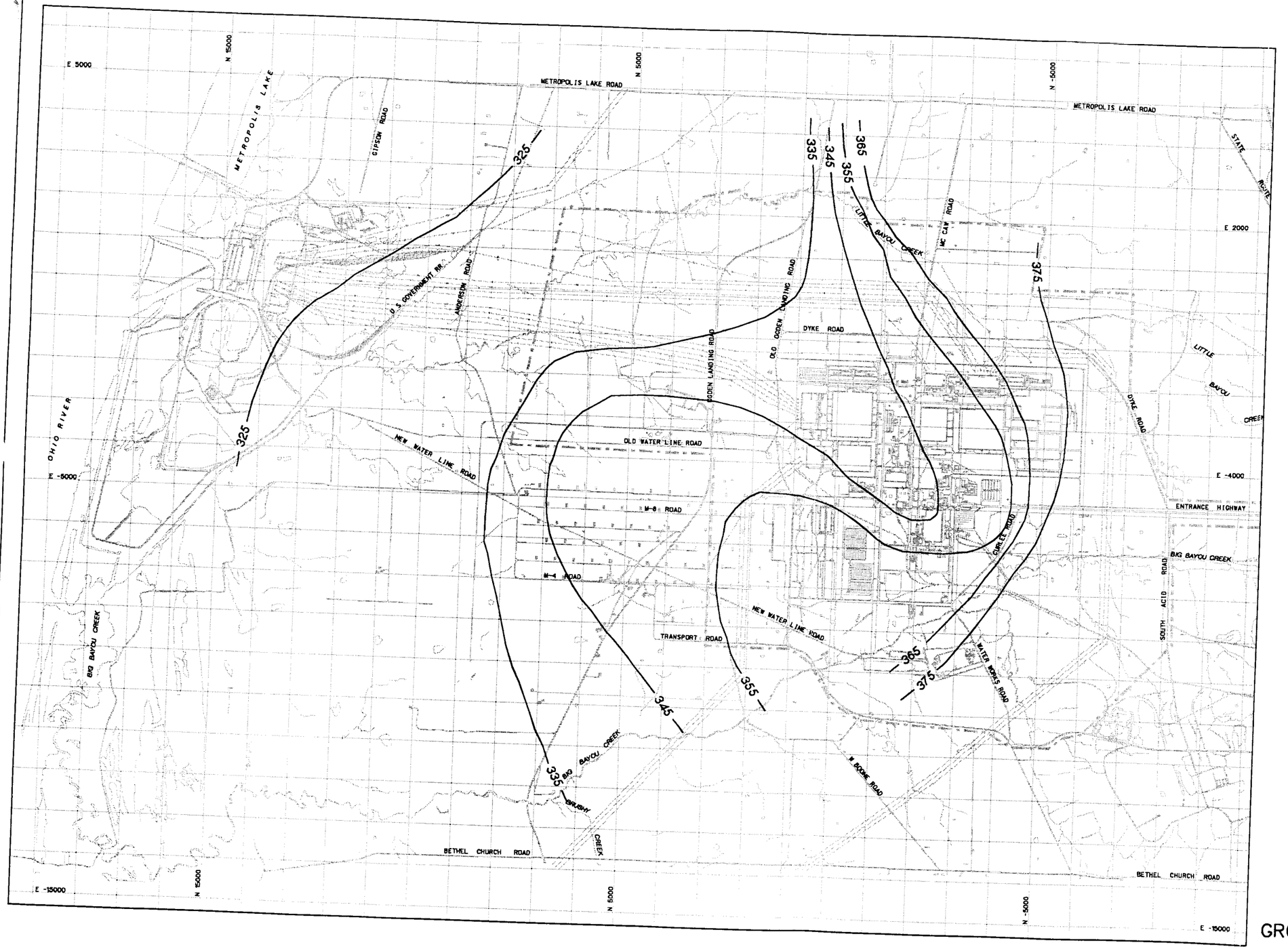
Shallow Groundwater System

Figure 1D-1 shows that features and trends present in January are the same as observed in previous months, including the northeast-trending trough and the general northeastern flow.

The hydraulic gradients for January in the SGS are approximately 0.007 from the southeast corner of the plant toward the center of the plant, and 0.005 toward the river

north of Ogden Landing Road. Approaching the TVA plant to the north, the gradients decrease to 0.002 or less.

0888tm42.dgn 29-Aug-199



REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- —325— CONTOUR OF WATER LEVEL ELEVATIONS

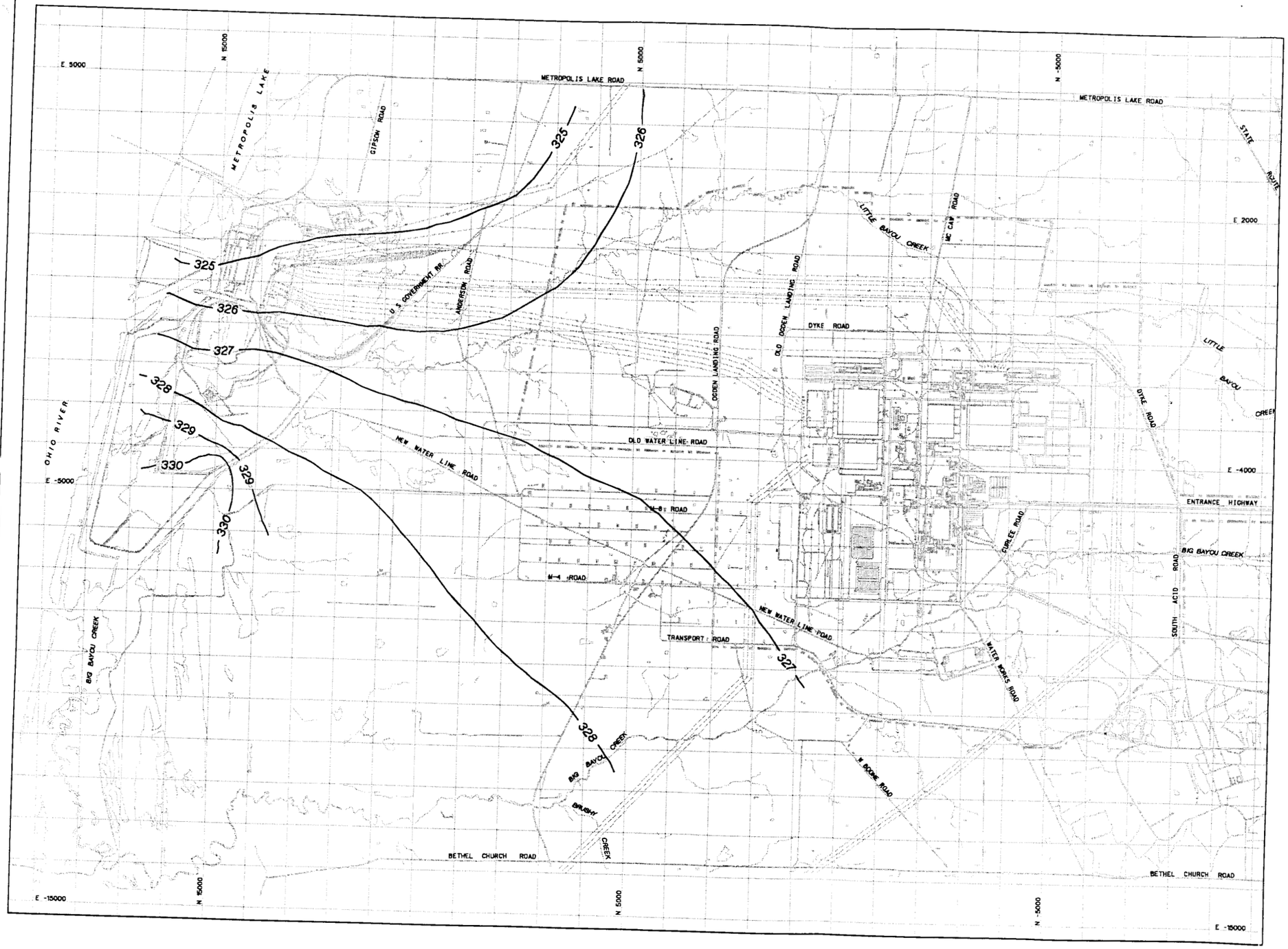
CONTOUR INTERVAL =10 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1D-1
WATER LEVEL ELEVATIONS FOR THE SHALLOW GROUNDWATER SYSTEM-JANUARY,1990
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0838tm43.dgn 28-Aug-1991



REVIEWED FOR CLASSIFICATION
WJS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

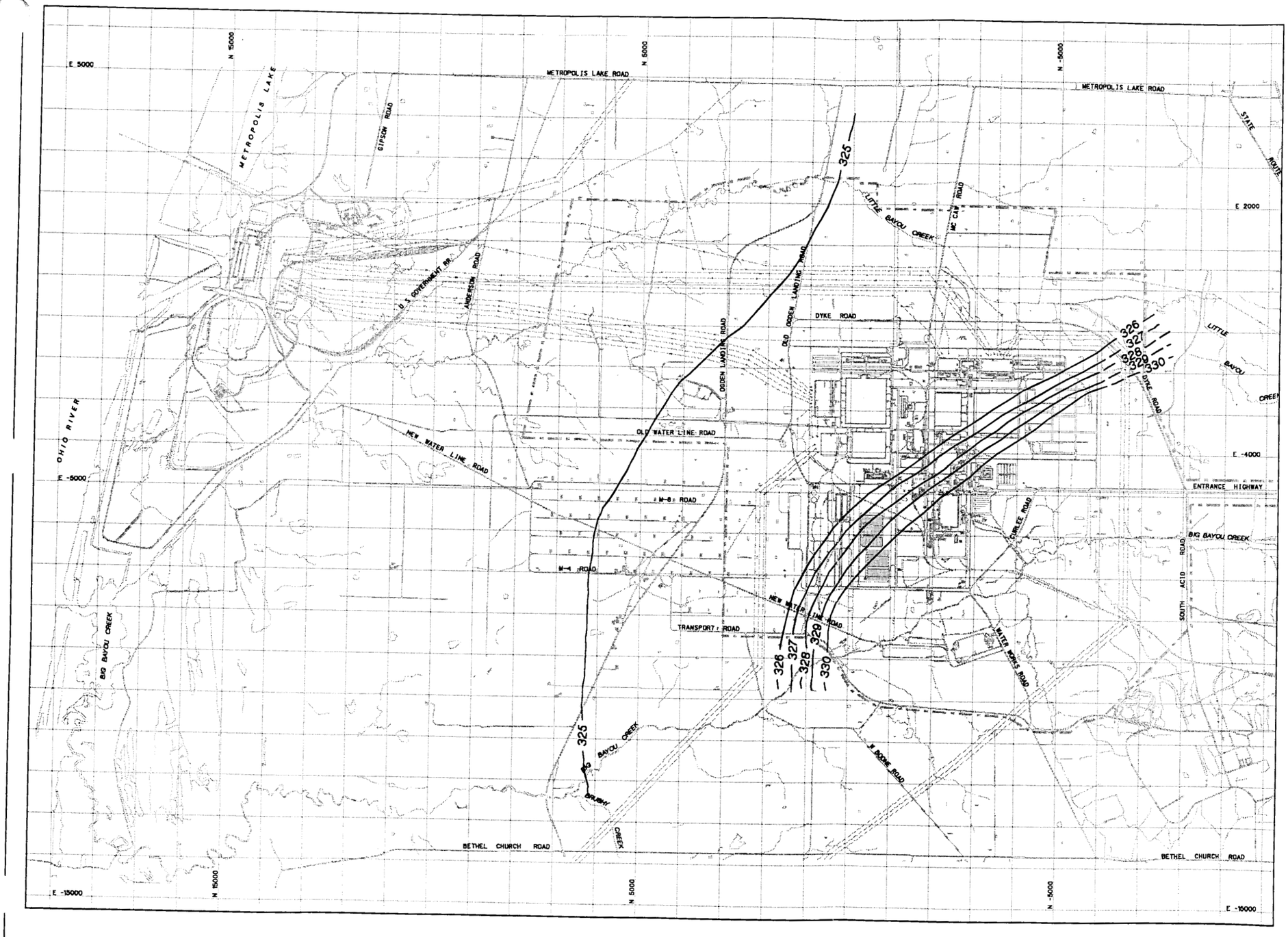
CONTOUR INTERVAL = 1 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1D-2
WATER LEVEL ELEVATIONS FOR THE REGIONAL GRAVEL AQUIFER-JANUARY, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0888tm44.dgn 28-Aug-1991



REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 1 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1" = 2500'

Figure 1D-3
WATER LEVEL ELEVATIONS FOR THE DEEP GROUNDWATER SYSTEM-JANUARY, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

TECHNICAL MEMORANDUM NO. 1E
PGDP PHASE II SITE INVESTIGATION

PREPARED BY: Greg Schaefer/ORO
Russell Lahoud/ORO

SUBJECT: Water Level Measurements, February 1991

PROJECT: ORO30888.FL

INTRODUCTION

PURPOSE AND SCOPE

Monthly water level measurements are planned for wells in and around the PGDP for a period of 1 year. This memorandum presents data collected February 11-12, 1991, from 82 wells.

FIELD PERSONNEL

Sample Team Leader (STL)	Russ Lahoud
Sample Team Member (STM)	Greg Ford
IH/HP Technician	Craig Morrison
Escort	Wallace Cunningham
Energy Systems Escort	Jeff Douthitt
Site Safety Coordinator (SSC)	Craig Morrison/TMA/Eberline

METHODOLOGY

Measurements were taken with an electronic water level meter, measuring from the datum index, in compliance with "Task Instructions for Water Level Measurements, PGDP Phase II," as amended by the February monthly addendum.

TECHNICAL DATA

MEASUREMENTS

Eighty-two of the scheduled 85 wells were measured. MW-155 through -162, -164, -166, and -167, and MW-170 through -206 were not scheduled for measurement during the February sampling event. TVA -6, -11, and -17 could not be reached because of flood waters from the Ohio River. MW-163, -165, -168, and -169, along with MW-7, -19, and -43, were added to the monthly sampling suite, as were TVA-13 and -28. MW-69 was dry.

Measurement data are shown on Table 1E-1. Measurements were recorded on the data sheet and in field logbook 6.

QUALITY ASSURANCE/QUALITY CONTROL

The reported data sheet has been confirmed with the STL logbook.

FIELD MONITORING

The wells to be mearusred were coded for health and safety monitoring, and the following specifications were used to determine personal protective equipment worn by the sample team at each location. In addition, an IH/HP was present at all Type C wells. The guidelines for these codes were:

Present	Specifications	Protection
Type A	Non-elevated offsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type B	Non-elevated onsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type C	Wells in radiological exclusion zones or wells that have not been evaluated previously	Tyvek coveralls, booties, surgical gloves, hard hat, eye protection, and safety shoes

Health and safety monitoring was performed by the SSC at designated Type C wells and by the STL at the other wells.

All Type B wells were measured with minimal PPE in accordance with instructions from the SSC; also, Well 138 has been downgraded to a Type B well.

DECONTAMINATION OF EQUIPMENT

Decontamination of the well sounder was performed in accordance with ESP 900 (Section V, a.1) and ESP 901.

WASTE MANAGEMENT

Only a small amount of waste in the form of surgical gloves, booties, and decontamination fluids was generated by this task. This waste was turned over to the SSC for containment and was given to Energy Systems after the completion of the task.

Table 1E-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 1 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements February 1991		
				February DTW (ft)	Elevation (ft)	Remarks
PGDP Wells						
7	SGS	TOC	373.08	6.21	366.87	
19	RGA	TOC	364.46	34.74	329.72	
23	DGS	TOC	373.64	16.07	357.57	
24	DGS	TOC	375.71	10.95	364.76	
25	SGS	TOC	380.02	0.12	379.90	
26	DGS	TOC	383.23	11.35	371.88	
27	DGS	TOC	381.59	18.58	363.01	
43	SGS	TOC	373.39	43.47	329.92	
52	RGA	TOC	372.29	43.77	328.52	
53	RGA	TOC	375.12	46.56	328.56	
54	RGA	TOC	373.91	45.39	328.52	
63	RGA	WWP	372.60	43.97	328.63	
64	SGS	WWP	372.60	10.88	361.72	
65	RGA	WWP	372.58	43.98	328.60	

Table 1E-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 2 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements February 1991		
				February DTW (ft)	Elevation (ft)	Remarks
68	RGA	WWP	379.72	51.09	328.63	
69	SGS	WWP	379.72	---	---	Dry.
70	RGA	TOC	379.25	50.65	328.60	
71	RGA	WWP	379.72	51.08	328.64	
73	RGA	TOC	374.97	46.29	328.68	
74	SGS	TOC	375.06	22.22	352.84	
75	SGS	TOC	376.10	10.85	365.25	
77	RGA	TOC	377.16	48.36	328.80	
82	SGS	TOC	376.54	13.90	362.64	
83	SGS	TOC	376.59	16.02	360.57	
85	SGS	WWP	375.86	18.22	357.64	
88	SGS	WWP	375.74	17.21	358.53	
90	RGA	WWP	374.51	45.75	328.76	
91	SGS	WWP	374.48	13.15	361.33	
92	RGA	WWP	374.51	45.75	328.76	

Table 1E-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 3 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements February 1991		
				February DTW (ft)	Elevation (ft)	Remarks
93	RGA	WWP	377.61	48.83	328.78	
94	SGS	WWP	377.62	19.60	358.02	
95	RGA	WWP	377.62	48.85	328.77	
96	SGS	TOC*	377.32	34.91	342.41	
120	DGS	TOC	386.57	59.63	326.94	
121	DGS	TOC	374.70	50.49	324.21	
122	DGS	TOC	364.66	38.59	326.07	
123	RGA-SH	TOC	374.69	46.65	328.04	
124	RGA-DP	TOC	364.71	36.28	328.43	
125	RGA-DP	TOC	374.89	46.87	328.02	
126	RGA-SH	TOC	364.02	35.59	328.43	
127	SGS	TOC	374.81	26.94	347.87	
128	SGS	TOC	364.38	31.00	333.38	
129	SGS	TOC	386.14	10.88	375.26	
130	SGS	TOC	386.03	10.67	375.36	

Table 1E-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 4 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements February 1991		
				February DTW (ft)	Elevation (ft)	Remarks
131	SGS	TOC	385.77	10.40	375.37	
132	RGA-DP	TOC	362.83	35.43	327.40	
133	RGA-DP	TOC	336.93	11.25	325.68	
134	RGA-DP	TOC	368.20	39.42	328.78	
135	RGA-DP	TOC	335.94	10.44	325.50	
137	RGA-SH	TOC	335.69	10.21	325.48	
138	SGS	TOC	335.57	5.14	330.43	
139	RGA-SH	TOC	363.17	35.76	327.41	
140	DGS	TOC	344.12	19.13	324.99	
141	RGA-DP	TOC	344.86	15.70	329.16	
142	RGA-SH	TOC	345.04	15.91	329.13	
143	SGS	TOC	345.37	12.20	333.17	
144	RGA-DP	TOC	379.89	51.41	328.48	
145	RGA-SH	TOC	380.08	51.56	328.52	
146	RGA-DP	TOC	352.91	28.20	324.71	

Table 1E-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 5 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements February 1991		
				February DTW (ft)	Elevation (ft)	Remarks
147	RGA-SH	TOC	353.08	28.41	324.67	
148	RGA-DP	TOC	373.35	46.06	327.29	
149	SGS	TOC	373.87	46.58	327.29	
150	RGA-DP	TOC	376.60	48.48	328.12	
151	SGS	TOC	382.56	15.16	367.40	
152	RGA-DP	TOC	353.36	31.86	321.50	
153	SGS	TOC	353.10	32.14	320.96	
154	SGS	TOC	374.49	8.15	366.34	
155	RGA-DP	TOC	381.25	---	---	Not scheduled for measurement until 3/91.
156	RGA-SH	TOC	382.06	---	---	Not scheduled for measurement until 3/91.
157	SGS	TOC	381.56	---	---	Not scheduled for measurement until 3/91.
158	RGA-DP	TOC	373.72	---	---	Not scheduled for measurement until 3/91.
159	RGA-SH	TOC	373.82	---	---	Not scheduled for measurement until 3/91.
160	SGS	TOC	373.56	---	---	Not scheduled for measurement until 3/91.
161	RGA-SH	TOC	373.55	---	---	Not scheduled for measurement until 3/91.

Table 1E-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 6 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements February 1991		
				February DTW (ft)	Elevation (ft)	Remarks
162	SGS	TOC	374.17	---	---	Not scheduled for measurement until 3/91.
163	RGA-SH	TOC	386.14	58.31	327.83	Added 2/91.
164	SGS	TOC	386.29	---	---	Not scheduled for measurement until 3/91.
165	RGA-SH	TOC	379.74	51.10	328.64	Added 2/91.
166	SGS	TOC	380.07	---	---	Not scheduled for measurement until 3/91.
167	SGS	TOC	376.36	---	---	Not scheduled for measurement until 3/91.
168	RGA-SH	TOC	377.42	48.61	328.81	Added 2/91.
169	RGA-SH	TOC	373.41	45.60	327.81	Added 2/91.
170	SGS	TOC	373.98	---	---	Not scheduled for measurement until 3/91.
171	SGS	TOC	374.63	---	---	Not scheduled for measurement until 3/91.
172	SGS	TOC	373.79	---	---	Not scheduled for measurement until 3/91.
173	RGA-SH	TOC	373.30	---	---	Not scheduled for measurement until 3/91.
174	SGS	TOC	373.29	---	---	Not scheduled for measurement until 3/91.
175	RGA-SH	TOC	381.18	---	---	Not scheduled for measurement until 3/91.
176	SGS	TOC	381.23	---	---	Not scheduled for measurement until 3/91.

Table 1E-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 7 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements February 1991		
				February DTW (ft)	Elevation (ft)	Remarks
177	SGS	TOC	379.74	---	---	Not scheduled for measurement until 3/91.
178	RGA-SH	TOC	378.80	---	---	Not scheduled for measurement until 3/91.
179	RGA-SH	TOC	358.60	---	---	Not scheduled for measurement until 3/91.
180	SGS	TOC	358.11	---	---	Not scheduled for measurement until 3/91.
181	RGA-SH	TOC	370.84	---	---	Not scheduled for measurement until 3/91.
182	SGS	TOC	371.15	---	---	Not scheduled for measurement until 3/91.
184	SGS	TOC	373.19	---	---	Not scheduled for measurement until 3/91.
185	RGA-SH	TOC	373.64	---	---	Not scheduled for measurement until 3/91.
186	SGS	TOC	373.62	---	---	Not scheduled for measurement until 3/91.
187	SGS	TOC	373.24	---	---	Not scheduled for measurement until 3/91.
188	RGA-SH	TOC	374.24	---	---	Not scheduled for measurement until 3/91.
189	SGS	TOC	375.50	---	---	Not scheduled for measurement until 3/91.
190	SGS	TOC	373.21	---	---	Not scheduled for measurement until 3/91.
191	RGA-SH	TOC	360.00	---	---	Not scheduled for measurement until 4/91.
192	SGS	TOC	359.04	---	---	Not scheduled for measurement until 4/91.

Table 1E-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 8 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements February 1991		
				February DTW (ft)	Elevation (ft)	Remarks
193	RGA-SH	TOC	367.85	---	---	Not scheduled for measurement until 4/91.
194	RGA-SH	TOC	356.21	---	---	Not scheduled for measurement until 4/91.
195	SGS	TOC	356.21	---	---	Not scheduled for measurement until 4/91.
196	SGS	TOC	368.12	---	---	Not scheduled for measurement until 4/91.
197	RGA-SH	TOC	368.24	---	---	Not scheduled for measurement until 4/91.
198	SGS	TOC	368.24	---	---	Not scheduled for measurement until 4/91.
199	RGA-SH	TOC	353.00	---	---	Not scheduled for measurement until 4/91.
200	RGA-SH	TOC	378.27	---	---	Not scheduled for measurement until 4/91.
201	RGA-SH	TOC	0.00	---	---	Not scheduled for measurement until 4/91.
202	RGA-SH	TOC	372.60	---	---	Not scheduled for measurement until 4/91.
203	RGA-SH	TOC	376.23	---	---	Not scheduled for measurement until 4/91.
204	SGS	TOC	377.73	---	---	Not scheduled for measurement until 4/91.
205	RGA-SH	TOC	379.75	--	---	Not scheduled for measurement until 6/91.
206	RGA-SH	TOC	385.14	---	---	Not scheduled for measurement until 6/91.

Table 1E-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 9 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements February 1991		
				February DTW (ft)	Elevation (ft)	Remarks
TVA Wells						
TVA-3	RGA	TOC	361.78	36.74	325.04	
TVA-4	RGA	TOC	336.55	12.55	324.00	
TVA-5	RGA	TOC	332.35	5.28	327.07	
TVA-6	RGA	TOC	328.58	---	---	Under water.
TVA-9	RGA	TOC	348.13	24.95	323.18	
TVA-11	RGA	TOC	321.36	---	---	Under water.
TVA-13	RGA	TOC	332.64	5.69	326.95	
TVA-14	RGA	TOC	354.66	31.70	322.96	
TVA-17	RGA	TOC	365.42	---	---	No access.
TVA-19	RGA	TOC	363.19	39.38	323.81	
TVA-24	RGA	TOC	358.73	37.53	321.20	

Table 1E-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 10 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements February 1991		
				February DTW (ft)	Elevation (ft)	Remarks
TVA-25	RGA	TOC	353.38	31.09	322.29	
TVA-27	RGA	TOC	353.61	32.00	321.61	
TVA-28	RGA	TOC	363.81	42.18	321.63	

Elev = Elevation from USC&GS first order monuments.
DTW = Depth to water from datum.
TOC = Top of innermost casing or riser, excluding pump discharge risers. The surveyed reference datum is a mark or notch on the north edge of the inner casing.
WWP = Well Wizard head plate on older funnel-shaped, exterior Well Wizard cap.
TOC* = Square stainless steel outer casing; 50 yd due south of MW-68 through -71 in open field.

Lithology:

SGS = Shallow Groundwater System
RGA = Regional Gravel Aquifer
RGA-SH = Regional Gravel Aquifer (shallow)
RGA-DP = Regional Gravel Aquifer (deep)
DGS = Deep Groundwater System

DISCUSSION

Figures 1E-1 through 1E-3 show an interpretation of the groundwater elevation in the DGS, the RGA, and the SGS.

These plots are intended as a general representation of the subsurface hydrology only. They are characterized by a relatively small number of data points. The recharging and discharging reaches of Big Bayou Creek, Little Bayou Creek, and any of the onsite ditches have not been accounted for. These factors could strongly affect the shallow system near these features.

The hydrologic setting around the PGDP is discussed in TM No. 1A.

Deep Groundwater System

Figure 1E-3 shows that flow in this system has the same north-northeast trends as observed in previous months, northeast across most of the plant, with north and northwest flow nearer the Ohio River. The DGS water level elevation has risen approximately 1 foot over the site.

The hydraulic gradients decrease from a value of 0.004 near the southwest portion of the site to 0.0004 just north of the plant.

Regional Gravel Aquifer

Figure 1E-2 shows a reversal of flow in the RGA compared to what was observed in January. The flow resumes the same general trend as observed in months prior to January, a north-northeasterly flow toward the Ohio River. Water level elevations in the RGA for February increased 2 to 3 feet over the site, compared to elevations in previous months.

With the addition of MW-19 and MW-163 to the sampling suite, two distinct features became apparent: (1) a small mound in the RGA water level at the north side of the North Sanitary Landfill and (2) a small depression in the water level southeast of the C-337 Building. With the addition of TVA-13 to the sampling suite, the gradient nearer the Ohio River is more clearly defined. Near the river, a reversal of the gradient is shown, indicating flow from the river toward the TVA plant (gradient of 0.002).

Hydraulic gradients over the site vary from 0.0002 beneath the plant to an increase of 0.0008 north of Ogden Landing Road.

Shallow Groundwater System

Figure 1E-1 shows that the same northeast flow trends and elevations observed in previous months are present. Two physical features within the plant are shown: (1) the northeast trending trough and (2) a small mound in the SGS beneath the C-745-B and -C cylinder yards.

Hydraulic gradients within the SGS range from 0.007 beneath the southeast section of the plant toward the center of the plant, to approximately 0.004 north of Ogden Landing Road.

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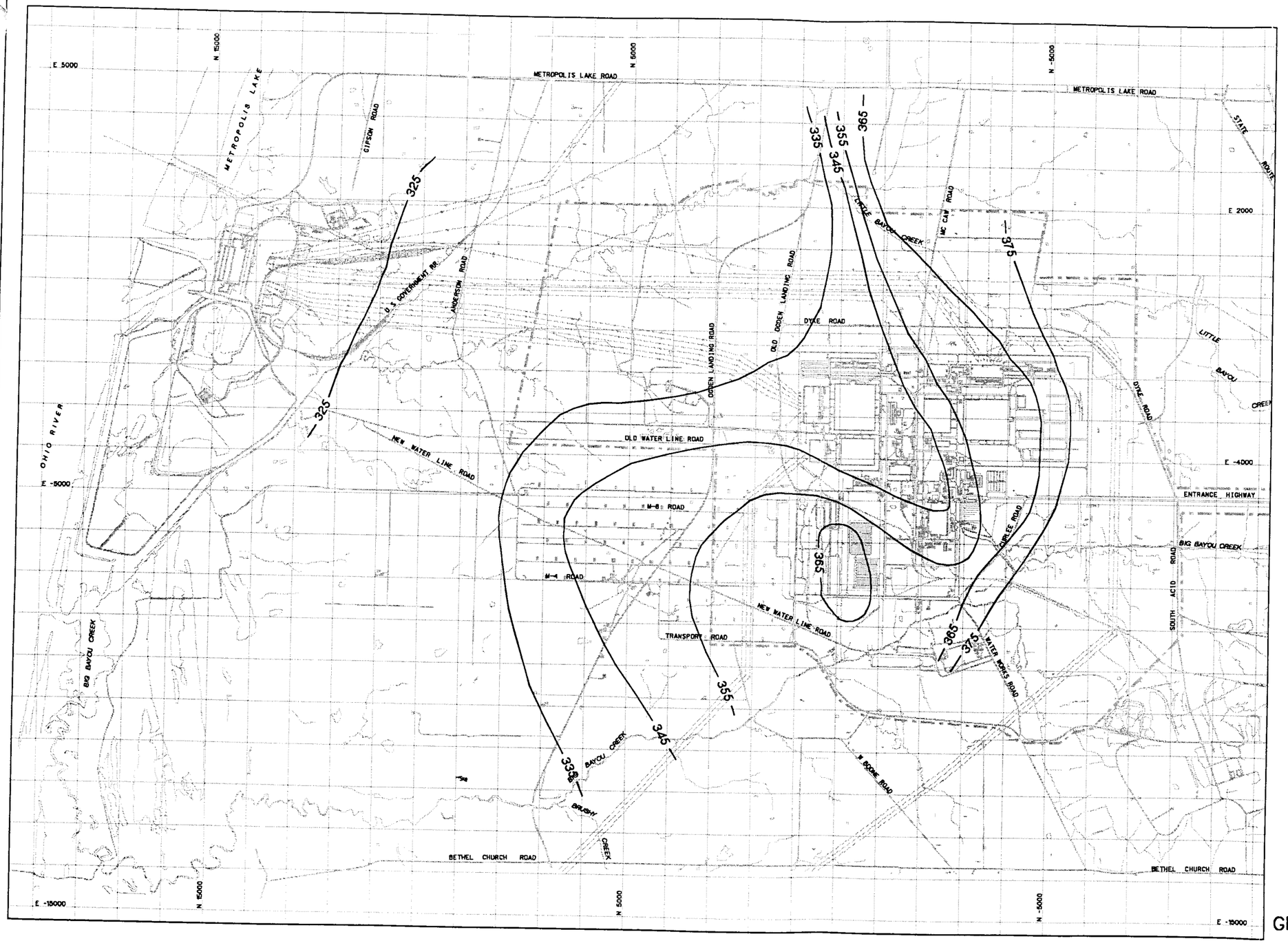

REVIEWED FOR CLASSIFICATION
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- —325— CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL =10 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1E-1
WATER LEVEL ELEVATIONS FOR THE SHALLOW GROUNDWATER SYSTEM-FEBRUARY, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

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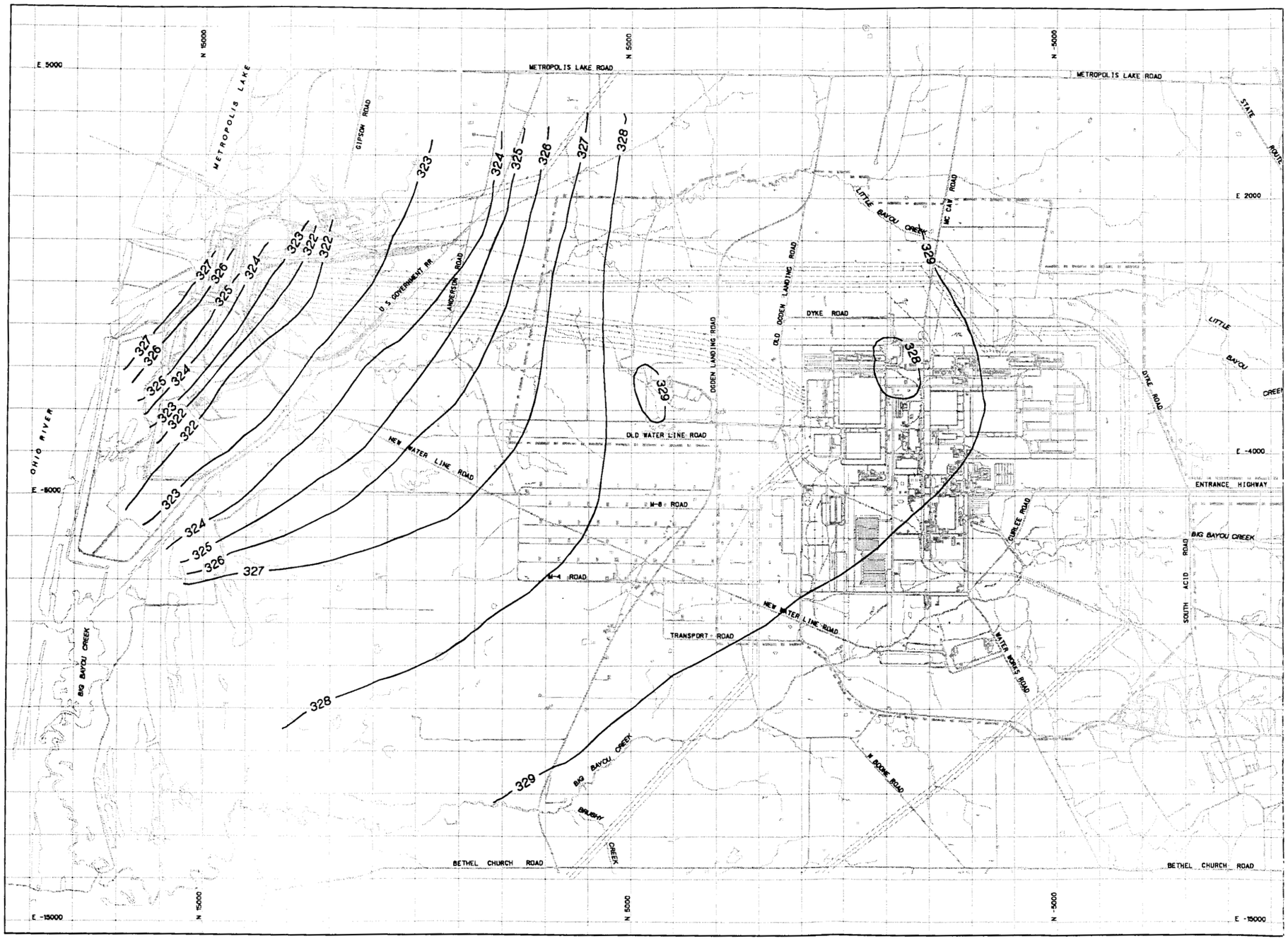


REVIEWED FOR CLASSIFICATION

Initials Date 7/9/03

UNCLASSIFIED

LEGEND

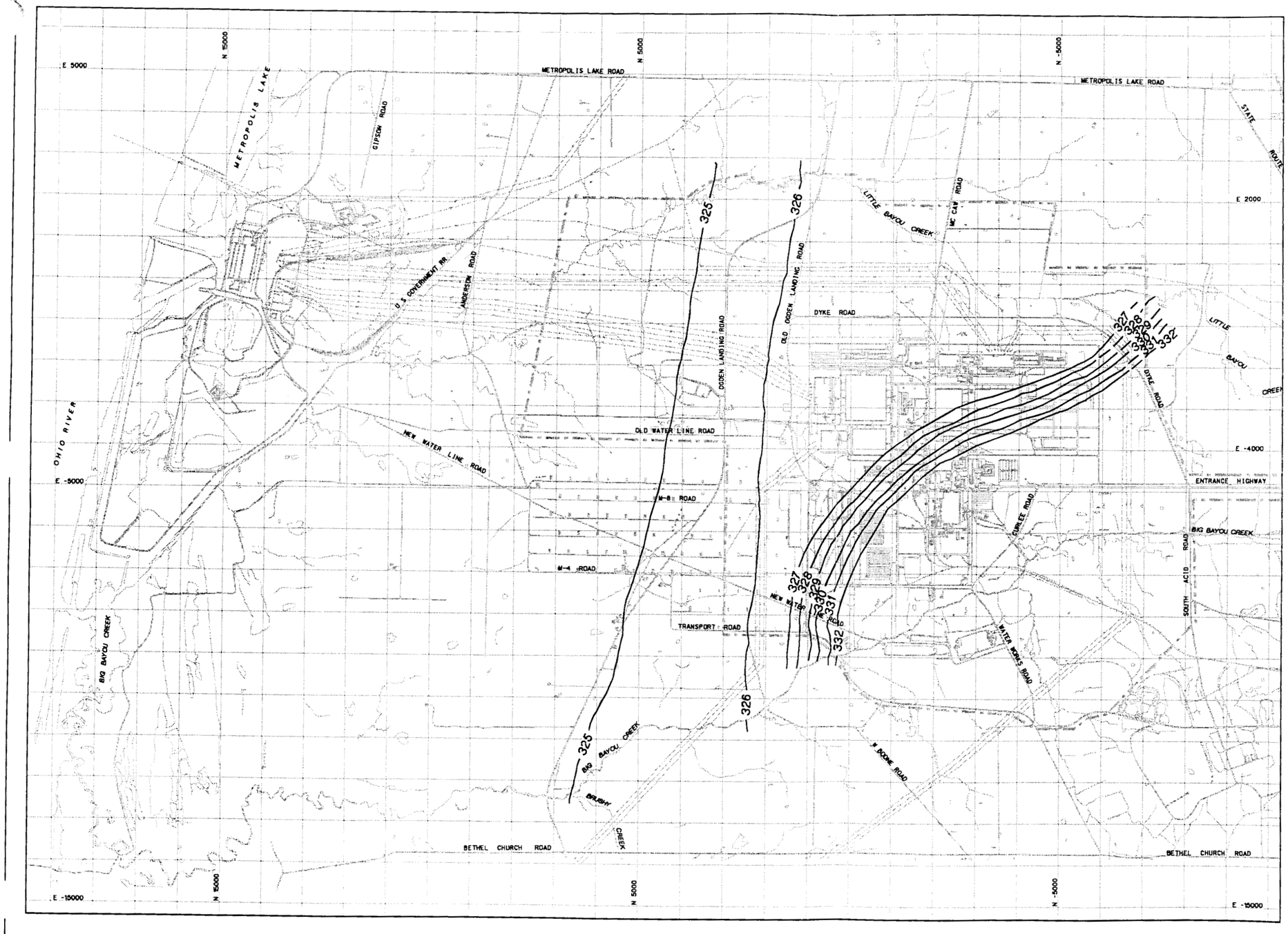
DOE BOUNDARY
POWER LINE
SURFACE WATER
FENCE
RR TRACKS
— 326 — CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 1 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"- 2500'

Figure 1E-2
WATER LEVEL ELEVATIONS FOR THE REGIONAL GRAVEL AQUIFER-FEBRUARY, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION



REVIEWED FOR CLASSIFICATION
LWZ 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 1 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1" = 2500'

Figure 1E-3
WATER LEVEL ELEVATIONS FOR THE DEEP GROUNDWATER SYSTEM-FEBRUARY, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

TECHNICAL MEMORANDUM NO. 1F
PGDP PHASE II SITE INVESTIGATION

PREPARED BY: Greg Schaefer/ORO
Russell Lahoud/ORO

SUBJECT: Water Level Measurements, March 1991

PROJECT: ORO30888.FL

INTRODUCTION

PURPOSE AND SCOPE

Monthly water level measurements are planned for wells in and around the PGDP for a period of 1 year. This memorandum presents data collected March 11-12, 1991, from 110 wells.

FIELD PERSONNEL

The field personnel were:

Sample Team Leader (STL)	Russ Lahoud
Sample Team Member (STM)	Greg Ford
IH/HP Technician	Craig Morrison
Escort	Russ Lahoud
Energy Systems Escort	Jeff Douthitt
Site Safety Coordinator (SSC)	Craig Morrison/TMA/Eberline

METHODOLOGY

Measurements were taken with an electronic water level meter, measuring from the datum index, in compliance with "Task Instructions for Water Level Measurements, PGDP Phase II," as amended by the March monthly addendum.

TECHNICAL DATA

MEASUREMENTS

One hundred ten of the scheduled 116 wells were measured. MW-191 through -206 were not scheduled for measurement during the March sampling event. TVA-6 and -11 could not be reached because of flood waters from the Ohio River. A metal plate on the Well Wizard of MW-53 could not be loosened, so access was not achieved;

MW-7 and -43 were not measured; MW-187 could not be located. MW-69 and -176 were dry.

Thirty-one Phase II wells were added to the March sampling suite: MW-155 through MW-162, MW-164, MW-167, and MW-170 through MW-190.

Measurement data are shown on Table 1F-1. Measurements were recorded on the data sheet and in field logbook 6.

QUALITY ASSURANCE/QUALITY CONTROL

The reported data sheet has been confirmed with the STL logbook.

FIELD MONITORING

The wells to be measured were coded for health and safety monitoring, and the following specifications were used to determine personal protective equipment worn by the sample team at each location. In addition, an IH/HP was present at all Type C wells. The guidelines for these codes were:

Present	Specifications	Protection
Type A	Non-elevated offsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type B	Non-elevated onsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type C	Wells in radiological exclusion zones or wells that have not been evaluated previously	Tyvek coveralls, booties, surgical gloves, hard hat, eye protection, and safety shoes

Health and safety monitoring was performed by the SSC at designated Type C wells and by the STL at the other wells.

All Type B wells were measured with minimal PPE in accordance with instructions from the SSC; also, Well 138 has been downgraded to a Type B well.

DECONTAMINATION OF EQUIPMENT

Decontamination of the well sounder was performed in accordance with ESP 900 (Section V, a.1) and ESP 901.

Table 1F-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 1 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements March 1991		
				March DTW (ft)	Elevation (ft)	Remarks
PGDP Wells						
7	SGS	TOC	373.08	---	---	Not measured.
19	RGA	TOC	364.46	33.24	331.22	
23	DGS	TOC	373.64	16.27	357.37	
24	DGS	TOC	375.71	10.95	364.76	
25	SGS	TOC	380.02	0.22	379.80	
26	DGS	TOC	383.23	15.48	367.75	
27	DGS	TOC	381.59	18.00	363.59	
43	SGS	TOC	373.39	---	---	Not measured.
52	RGA	TOC	372.29	41.44	330.85	
53	RGA	TOC	375.12	---	---	No access.
54	RGA	TOC	373.91	43.01	330.90	
63	RGA	WWP	372.60	41.67	330.93	
64	SGS	WWP	372.60	10.16	362.44	
65	RGA	WWP	372.58	41.71	330.87	

Table 1F-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 2 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements March 1991		
				March DTW (ft)	Elevation (ft)	Remarks
68	RGA	WWP	379.72	48.75	330.97	
69	SGS	WWP	379.72	---	---	Dry.
70	RGA	TOC	379.25	48.54	330.71	
71	RGA	WWP	379.72	48.72	331.00	
73	RGA	TOC	374.97	44.31	330.66	
74	SGS	TOC	375.06	21.66	353.40	
75	SGS	TOC	376.10	10.35	365.75	
77	RGA	TOC	377.16	46.41	330.75	
82	SGS	TOC	376.54	13.39	363.15	
83	SGS	TOC	376.59	15.53	361.06	
85	SGS	WWP	375.86	17.61	358.25	
88	SGS	WWP	375.74	16.63	359.11	
90	RGA	WWP	374.51	43.80	330.71	
91	SGS	WWP	374.48	12.67	361.81	
92	RGA	WWP	374.51	43.79	330.72	

Table 1F-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 3 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements March 1991		
				March DTW (ft)	Elevation (ft)	Remarks
93	RGA	WWP	377.61	46.89	330.72	
94	SGS	WWP	377.62	18.74	358.88	
95	RGA	WWP	377.62	46.91	330.71	
96	SGS	TOC*	377.32	34.50	342.82	
120	DGS	TOC	386.57	58.30	328.27	
121	DGS	TOC	374.70	49.39	325.31	
122	DGS	TOC	364.66	37.24	327.42	
123	RGA-SH	TOC	374.69	44.98	329.71	
124	RGA-DP	TOC	364.71	34.24	330.47	
125	RGA-DP	TOC	374.89	45.19	329.70	
126	RGA-SH	TOC	364.02	33.54	330.48	
127	SGS	TOC	374.81	26.40	348.41	
128	SGS	TOC	364.38	30.00	334.38	From groundwater sampling.
129	SGS	TOC	386.14	10.06	376.08	
130	SGS	TOC	386.03	9.83	376.20	

Table 1F-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 4 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements March 1991		
				March DTW (ft)	Elevation (ft)	Remarks
131	SGS	TOC	385.77	9.58	376.19	
132	RGA-DP	TOC	362.83	33.57	329.26	
133	RGA-DP	TOC	336.93	9.62	327.31	
134	RGA-DP	TOC	368.20	37.73	330.47	
135	RGA-DP	TOC	335.94	8.60	327.34	
137	RGA-SH	TOC	335.69	8.37	327.32	
138	SGS	TOC	335.57	5.57	330.00	
139	RGA-SH	TOC	363.17	33.92	329.25	
140	DGS	TOC	344.12	17.88	326.24	
141	RGA-DP	TOC	344.86	14.10	330.76	
142	RGA-SH	TOC	345.04	14.32	330.72	
143	SGS	TOC	345.37	12.46	332.91	
144	RGA-DP	TOC	379.89	49.60	330.29	
145	RGA-SH	TOC	380.08	49.75	330.33	
146	RGA-DP	TOC	352.91	26.91	326.00	

Table 1F-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 5 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements March 1991		
				March DTW (ft)	Elevation (ft)	Remarks
147	RGA-SH	TOC	353.08	27.11	325.97	
148	RGA-DP	TOC	373.35	43.90	329.45	
149	SGS	TOC	373.87	44.42	329.45	
150	RGA-DP	TOC	376.60	46.37	330.23	
151	SGS	TOC	382.56	14.54	368.02	
152	RGA-DP	TOC	353.36	29.70	323.66	
153	SGS	TOC	353.10	29.75	323.35	
154	SGS	TOC	374.49	7.61	366.88	
155	RGA-DP	TOC	381.25	50.40	330.85	
156	RGA-SH	TOC	382.06	51.24	330.82	
157	SGS	TOC	381.56	31.48	350.08	
158	RGA-DP	TOC	373.72	42.89	330.83	
159	RGA-SH	TOC	373.82	42.95	330.87	
160	SGS	TOC	373.56	9.02	364.54	
161	RGA-SH	TOC	373.55	42.65	330.90	

Table 1F-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 6 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements March 1991		
				March DTW (ft)	Elevation (ft)	Remarks
162	SGS	TOC	374.17	11.39	362.78	
163	RGA-SH	TOC	386.14	55.33	330.81	
164	SGS	TOC	386.29	42.43	343.86	
165	RGA-SH	TOC	379.74	49.14	330.60	
166	SGS	TOC	380.07	34.84	345.23	
167	SGS	TOC	376.36	7.67	368.69	
168	RGA-SH	TOC	377.42	46.62	330.80	
169	RGA-SH	TOC	373.41	42.58	330.83	
170	SGS	TOC	373.98	8.24	365.74	
171	SGS	TOC	374.63	5.90	368.73	
172	SGS	TOC	373.79	10.68	363.11	
173	RGA-SH	TOC	373.30	42.38	330.92	
174	SGS	TOC	373.29	6.73	366.56	
175	RGA-SH	TOC	381.18	50.34	330.84	
176	SGS	TOC	381.23	---	---	Dry.

Table 1F-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 7 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements March 1991		
				March DTW (ft)	Elevation (ft)	Remarks
177	SGS	TOC	379.74	42.73	337.01	
178	RGA-SH	TOC	378.80	47.92	330.88	
179	RGA-SH	TOC	358.60	28.16	330.44	
180	SGS	TOC	358.11	20.95	337.16	
181	RGA-SH	TOC	370.84	40.35	330.49	
182	SGS	TOC	371.15	10.99	360.16	
184	SGS	TOC	373.19	13.81	359.38	
185	RGA-SH	TOC	373.64	42.84	330.80	
186	SGS	TOC	373.62	7.73	365.89	
187	SGS	TOC	373.24	---	---	Not located.
188	RGA-SH	TOC	374.24	43.36	330.88	
189	SGS	TOC	375.50	19.06	356.44	
190	SGS	TOC	373.21	5.10	368.11	
191	RGA-SH	TOC	360.00	---	---	Not scheduled for measurement until 4/91.
192	SGS	TOC	359.04	---	---	Not scheduled for measurement until 4/91.

Table 1F-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 8 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements March 1991		
				March DTW (ft)	Elevation (ft)	Remarks
193	RGA-SH	TOC	367.85	---	---	Not scheduled for measurement until 4/91.
194	RGA-SH	TOC	356.21	---	---	Not scheduled for measurement until 4/91.
195	SGS	TOC	356.21	---	---	Not scheduled for measurement until 4/91.
196	SGS	TOC	368.12	---	---	Not scheduled for measurement until 4/91.
197	RGA-SH	TOC	368.24	---	---	Not scheduled for measurement until 4/91.
198	SGS	TOC	368.24	---	---	Not scheduled for measurement until 4/91.
199	RGA-SH	TOC	353.00	---	---	Not scheduled for measurement until 4/91.
200	RGA-SH	TOC	378.27	---	---	Not scheduled for measurement until 4/91.
201	RGA-SH	TOC	0.00	---	---	Not scheduled for measurement until 4/91.
202	RGA-SH	TOC	372.60	---	---	Not scheduled for measurement until 4/91.
203	RGA-SH	TOC	376.23	---	---	Not scheduled for measurement until 4/91.
204	SGS	TOC	377.73	---	---	Not scheduled for measurement until 4/91.
205	RGA-SH	TOC	379.75	---	---	Not scheduled for measurement until 6/91.
206	RGA-SH	TOC	385.14	---	---	Not scheduled for measurement until 6/91.

Table 1F-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 9 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements March 1991		
				March DTW (ft)	Elevation (ft)	Remarks
TVA Well						
TVA-3	RGA	TOC	361.78	35.41	326.37	
TVA-4	RGA	TOC	336.55	11.23	325.32	
TVA-5	RGA	TOC	332.35	4.36	327.99	
TVA-6	RGA	TOC	328.58	---	---	Under water.
TVA-9	RGA	TOC	348.13	24.55	323.58	
TVA-11	RGA	TOC	321.36	---	---	Under water.
TVA-13	RGA	TOC	332.64	4.82	327.82	
TVA-14	RGA	TOC	354.66	30.31	324.35	
TVA-17	RGA	TOC	365.42	40.68	324.74	
TVA-19	RGA	TOC	363.19	37.23	325.96	
TVA-24	RGA	TOC	358.73	35.22	323.51	

Table 1F-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 10 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements March 1991		
				March DTW (ft)	Elevation (ft)	Remarks
TVA-25	RGA	TOC	353.38	29.13	324.25	
TVA-27	RGA	TOC	353.61	29.81	323.80	
TVA-28	RGA	TOC	363.81	40.21	323.60	

Elev = Elevation from USC&GS first order monuments.
DTW = Depth to water from datum.
TOC = Top of innermost casing or riser, excluding pump discharge risers. The surveyed reference datum is a mark or notch on the north edge of the inner casing.
WWP = Well Wizard head plate on older funnel-shaped, exterior Well Wizard cap.
TOC* = Square stainless steel outer casing; 50 yd due south of MW-68 through -71 in open field.

Lithology:

SGS = Shallow Groundwater System
RGA = Regional Gravel Aquifer
RGA-SH = Regional Gravel Aquifer (shallow)
RGA-DP = Regional Gravel Aquifer (deep)
DGS = Deep Groundwater System

WASTE MANAGEMENT

Only a small amount of waste in the form of surgical gloves, booties, and decontamination fluids was generated by this task. This waste was turned over to the SSC for containment and was given to Energy Systems after the completion of the task.

DISCUSSION

Figures 1F-1 through 1F-3 show an interpretation of the groundwater elevation in the DGS, the RGA, and the SGS.

These plots are intended as a general representation of the subsurface hydrology only. They are characterized by a relatively small number of data points. The recharging and discharging reaches of Big Bayou Creek, Little Bayou Creek, and any of the onsite ditches have not been accounted for. These factors could strongly affect the shallow groundwater system near these features.

The hydrologic setting around the PGDP is discussed in TM No. 1A.

Deep Groundwater System

Figure 1F-3 shows that the general north-northeast flow pattern is the same as in previous months, with a rise in water level of approximately 1 foot over the site.

Hydraulic gradients decrease from the plant (0.0008) toward the river (0.0002 north of the plant).

Regional Gravel Aquifer

Figure 1F-2 illustrates the same north-northeast flow pattern with a reversal of gradient adjacent to the Ohio River. The RGA water level increased approximately 2 feet over the site. The small mound on the north side of the North Sanitary Landfill is still evident.

The hydraulic gradients are small beneath and just north of the plant (0.0001) and increase toward the Ohio River (0.001), with a gradient of 0.002 beneath the TVA plant.

Shallow Groundwater System

Figure 1F-1 shows the same general northeast flow trends and water level elevations as observed in previous months. With the increase of Phase II wells in the sampling suite for March, the SGS is more completely defined beneath the plant. The northeast-trending trough becomes more defined beneath the C-400 Building and the mound in

the water level in the northwest corner of the plant is more extensive to the north. An isolated mound is shown at the North Sanitary Landfill.

Hydraulic gradients are high (0.008) beneath the plant and decrease to 0.006 north of Ogden Landing Road.

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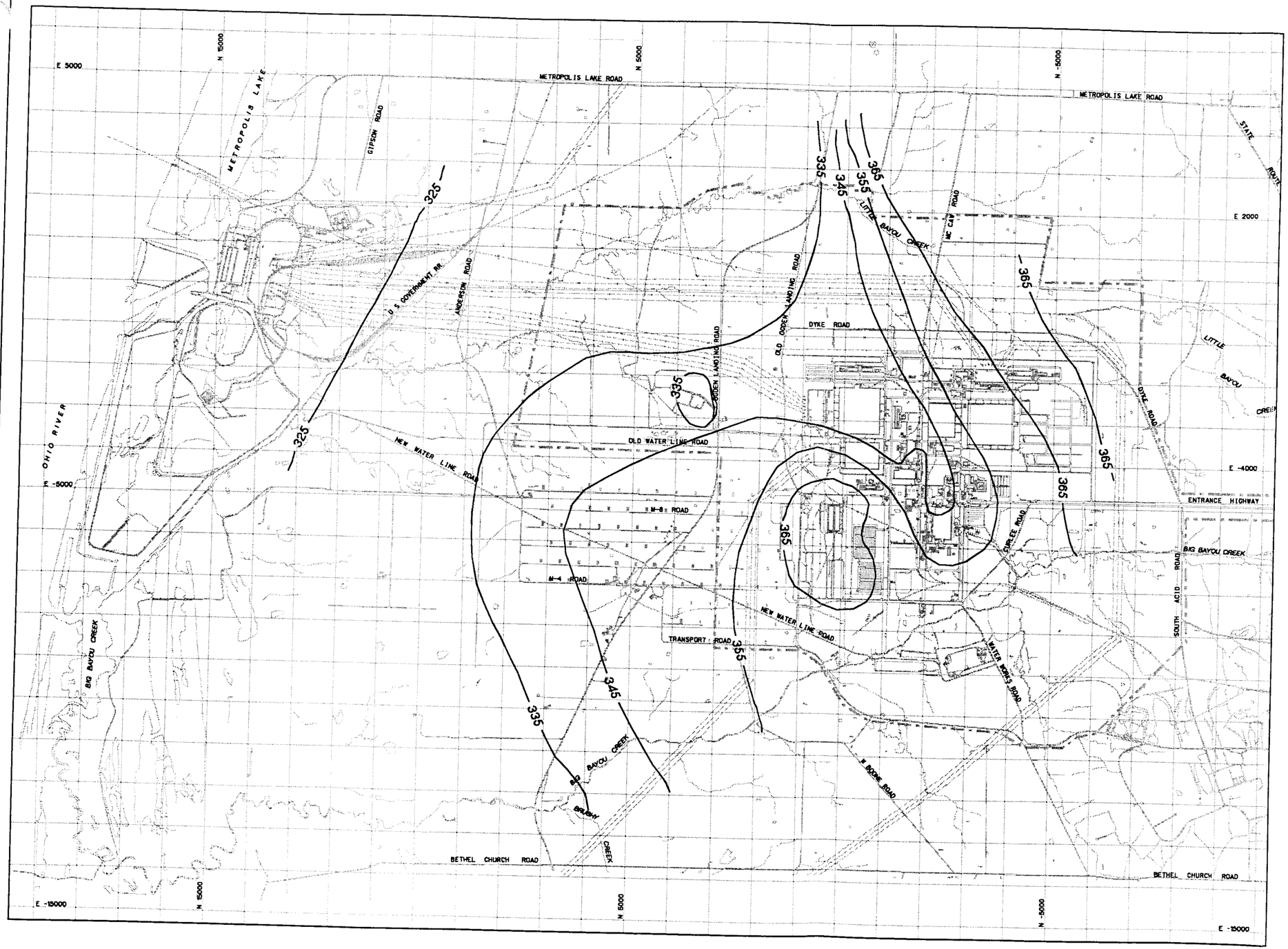

REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- —325— CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL =10 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1F-1
WATER LEVEL ELEVATIONS FOR THE SHALLOW GROUNDWATER SYSTEM-MARCH, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

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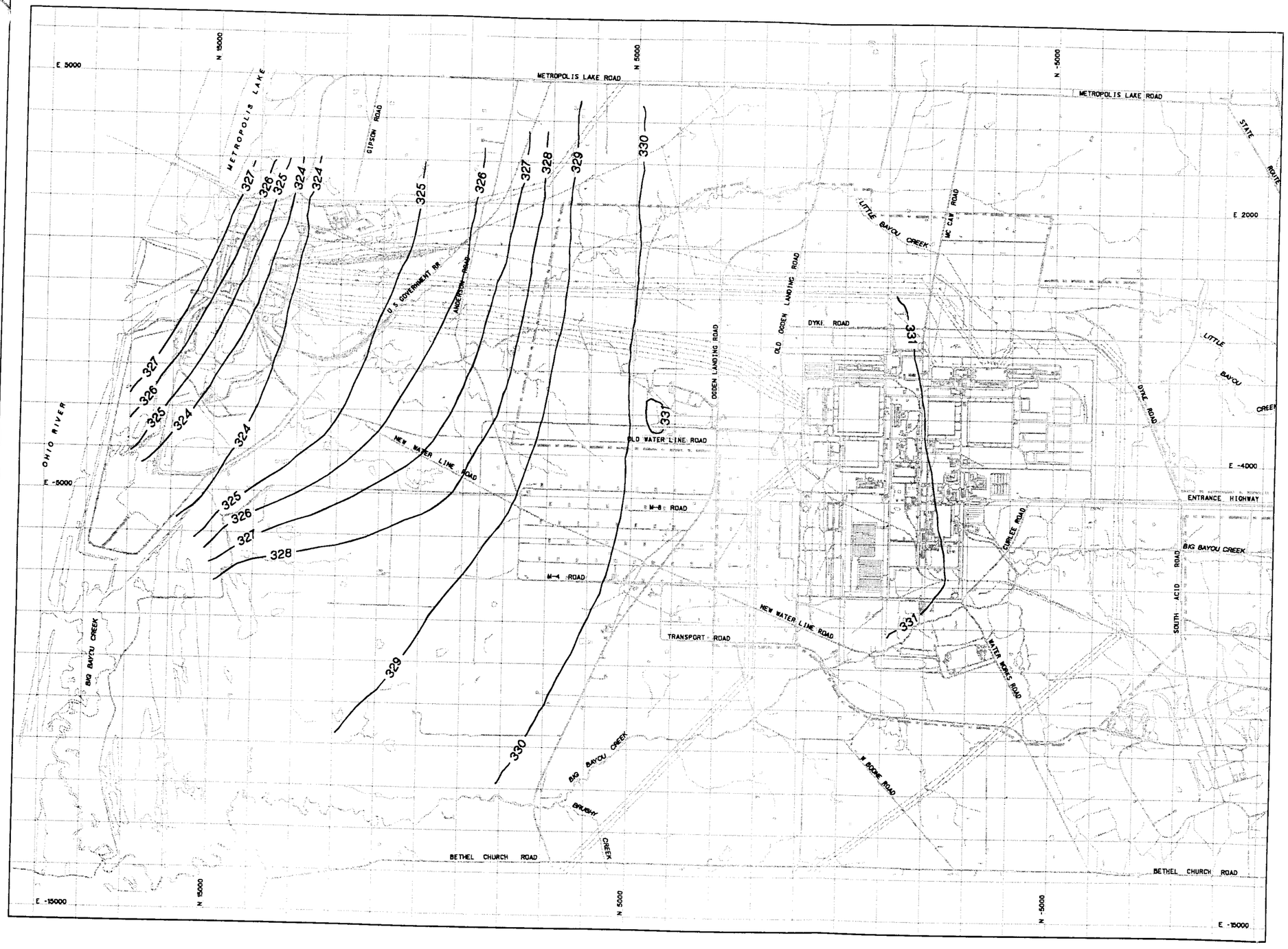

REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 1 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1F-2
WATER LEVEL ELEVATIONS FOR THE REGIONAL GRAVEL AQUIFER-MARCH, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

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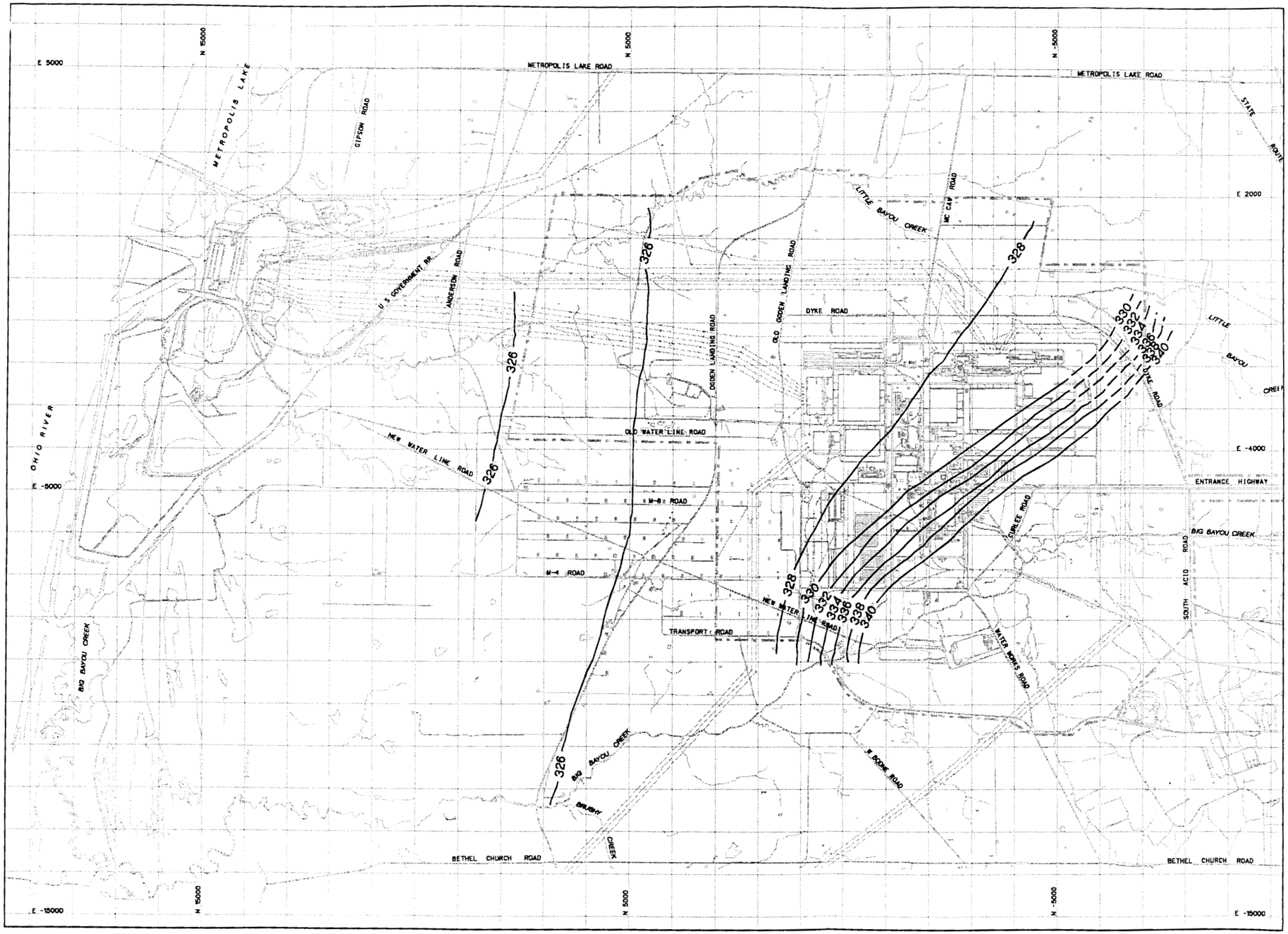


REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 2 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1F-3
WATER LEVEL ELEVATIONS
FOR THE DEEP
GROUNDWATER SYSTEM-MARCH,1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

TECHNICAL MEMORANDUM NO. 1G
PGDP PHASE II SITE INVESTIGATION

PREPARED BY: Greg Schaefer/ORO
Russell Lahoud/ORO

SUBJECT: Water Level Measurements, April 1991

PROJECT: ORO30888.FL

INTRODUCTION

PURPOSE AND SCOPE

Monthly water level measurements are planned for wells in and around the PGDP for a period of 1 year. This memorandum presents data collected April 8-9, 1991, from 125 wells.

FIELD PERSONNEL

The field personnel were:

Sample Team Leader (STL)	Greg Schaefer
Sample Team Member (STM)	Greg Ford
IH/HP Technician	Steve Waide
Escort	Wallace Cunningham
Energy Systems Escort	Jeff Douthitt
Site Safety Coordinator (SSC)	Craig Morrison/TMA/Eberline

METHODOLOGY

Measurements were taken with an electronic water level meter, measuring from the datum index, in compliance with "Task Instructions for Water Level Measurements, PGDP Phase II," as amended by the April monthly addendum.

TECHNICAL DATA

MEASUREMENTS

One hundred twenty-five of the scheduled 128 wells were measured. MW-205 and -206 were not scheduled for measurement during the April sampling event. TVA-6 could not be reached because of flood waters from the Ohio River; the access road to TVA-11 was washed out. TVA-19 had an Energy Systems recorder inside and could not be measured. MW-193 and -199 were not completed at the time of sampling.

Fourteen Phase II wells (MW-191 through -204) were added to the April sampling suite. MW-69, -153, -176, and -204 were dry.

Measurement data are shown on Table 1G-1 Measurements were recorded on the data sheet and in field logbook 6.

QUALITY ASSURANCE/QUALITY CONTROL

The reported data sheet has been confirmed with the STL logbook.

FIELD MONITORING

The wells to be measured were coded for health and safety monitoring, and the following specifications were used to determine personal protective equipment worn by the sample team at each location. In addition, an IH/HP was present at all Type C wells. The guidelines for these codes were:

Present	Specifications	Protection
Type A	Non-elevated offsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type B	Non-elevated onsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type C	Wells in radiological exclusion zones or wells that have not been evaluated previously	Tyvek coveralls, booties, surgical gloves, hard hat, eye protection, and safety shoes

Health and safety monitoring was performed by the IH/HP technician at designated Type C wells and at the other wells. In accordance with instructions from the SSC, all Type B wells were measured with minimal PPE; also, Well 138 has been downgraded to Type B.

DECONTAMINATION OF EQUIPMENT

Decontamination of the well sounder was performed in accordance with ESP 900 (Section V, a.1) and ESP 901.

WASTE MANAGEMENT

Only a small amount of waste in the form of surgical gloves, booties, and decontamination fluids was generated by this task. This waste was turned over to the SSC for containment and was given to Energy Systems after the completion of the task.

Table 1G-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 1 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements April 1991		
				April DTW (ft)	Elevation (ft)	Remarks
PGDP Wells						
7	SGS	TOC	373.08	6.70	366.38	
19	RGA	TOC	364.46	32.17	332.29	
23	DGS	TOC	373.64	15.26	358.38	
24	DGS	TOC	375.71	11.00	364.71	
25	SGS	TOC	380.02	0.00	380.02	
26	DGS	TOC	383.23	18.99	364.24	
27	DGS	TOC	381.59	17.60	363.99	
43	SGS	TOC	373.39	40.91	332.48	
52	RGA	TOC	372.29	41.07	331.22	
53	RGA	TOC	375.12	43.82	331.30	
54	RGA	TOC	373.91	42.58	331.33	
63	RGA	WWP	372.60	41.28	331.32	
64	SGS	WWP	372.60	10.41	362.19	
65	RGA	WWP	372.58	41.29	331.29	

Table 1G-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 2 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements April 1991		
				April DTW (ft)	Elevation (ft)	Remarks
68	RGA	WWP	379.72	48.02	331.70	
69	SGS	WWP	379.72	---	---	Dry.
70	RGA	TOC	379.25	47.64	331.61	
71	RGA	WWP	379.72	48.04	331.68	
73	RGA	TOC	374.97	43.56	331.41	
74	SGS	TOC	375.06	21.62	353.44	
75	SGS	TOC	376.10	10.42	365.68	
77	RGA	TOC	377.16	45.58	331.58	
82	SGS	TOC	376.54	13.43	363.11	
83	SGS	TOC	376.59	15.42	361.17	
85	SGS	WWP	375.86	17.59	358.27	
88	SGS	WWP	375.74	16.71	359.03	
90	RGA	WWP	374.51	42.00	332.51	
91	SGS	WWP	374.48	12.86	361.62	
92	RGA	WWP	374.51	42.99	331.52	

Table 1G-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 3 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements April 1991		
				April DTW (ft)	Elevation (ft)	Remarks
93	RGA	WWP	377.61	46.07	331.54	
94	SGS	WWP	377.62	18.57	359.05	
95	RGA	WWP	377.62	46.08	331.54	
96	SGS	TOC*	377.32	34.40	342.92	
120	DGS	TOC	386.57	57.55	329.02	
121	DGS	TOC	374.70	48.88	325.82	
122	DGS	TOC	364.66	36.28	328.38	
123	RGA-SH	TOC	374.69	44.40	330.29	
124	RGA-DP	TOC	364.71	33.42	331.29	
125	RGA-DP	TOC	374.89	44.64	330.25	
126	RGA-SH	TOC	364.02	32.73	331.29	
127	SGS	TOC	374.81	31.98	342.83	
128	SGS	TOC	364.38	28.88	335.50	
129	SGS	TOC	386.14	9.99	376.15	
130	SGS	TOC	386.03	9.76	376.27	

Table 1G-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 4 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements April 1991		
				April DTW (ft)	Elevation (ft)	Remarks
131	SGS	TOC	385.77	9.52	376.25	
132	RGA-DP	TOC	362.83	32.81	330.02	
133	RGA-DP	TOC	336.93	8.87	328.06	
134	RGA-DP	TOC	368.20	37.13	331.07	
135	RGA-DP	TOC	335.94	8.81	327.13	
137	RGA-SH	TOC	335.69	7.60	328.09	
138	SGS	TOC	335.57	4.94	330.63	
139	RGA-SH	TOC	363.17	33.16	330.01	
140	DGS	TOC	344.12	17.46	326.66	
141	RGA-DP	TOC	344.86	13.66	331.20	
142	RGA-SH	TOC	345.04	13.89	331.15	
143	SGS	TOC	345.37	12.25	333.12	
144	RGA-DP	TOC	379.89	48.50	331.39	
145	RGA-SH	TOC	380.08	48.64	331.44	
146	RGA-DP	TOC	352.91	26.24	326.67	

Table 1G-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 5 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements April 1991		
				April DTW (ft)	Elevation (ft)	Remarks
147	RGA-SH	TOC	353.08	26.40	326.68	
148	RGA-DP	TOC	373.35	43.32	330.03	
149	SGS	TOC	373.87	43.83	330.04	
150	RGA-DP	TOC	376.60	45.72	330.88	
151	SGS	TOC	382.56	14.59	367.97	
152	RGA-DP	TOC	353.36	28.64	324.72	
153	SGS	TOC	353.10	---	---	Dry.
154	SGS	TOC	374.49	8.10	366.39	
155	RGA-DP	TOC	381.25	49.62	331.63	
156	RGA-SH	TOC	382.06	50.45	331.61	
157	SGS	TOC	381.56	32.14	349.42	
158	RGA-DP	TOC	373.72	42.23	331.49	
159	RGA-SH	TOC	373.82	42.31	331.51	
160	SGS	TOC	373.56	7.85	365.71	
161	RGA-SH	TOC	373.55	42.02	331.53	

Table 1G-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 6 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements April 1991		
				April DTW (ft)	Elevation (ft)	Remarks
162	SGS	TOC	374.17	11.77	362.40	
163	RGA-SH	TOC	386.14	54.52	331.62	
164	SGS	TOC	386.29	43.16	343.13	
165	RGA-SH	TOC	379.74	48.36	331.38	
166	SGS	TOC	380.07	35.40	344.67	
167	SGS	TOC	376.36	7.70	368.66	
168	RGA-SH	TOC	377.42	45.96	331.46	
169	RGA-SH	TOC	373.41	42.03	331.38	
170	SGS	TOC	373.98	8.24	365.74	
171	SGS	TOC	374.63	6.13	368.50	
172	SGS	TOC	373.79	8.12	365.67	
173	RGA-SH	TOC	373.30	41.82	331.48	
174	SGS	TOC	373.29	7.16	366.13	
175	RGA-SH	TOC	381.18	49.56	331.62	
176	SGS	TOC	381.23	---	---	Dry.

Table 1G-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 7 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements April 1991		
				April DTW (ft)	Elevation (ft)	Remarks
177	SGS	TOC	379.74	44.16	335.58	
178	RGA-SH	TOC	378.80	47.18	331.62	
179	RGA-SH	TOC	358.60	27.74	330.86	
180	SGS	TOC	358.11	18.08	340.03	
181	RGA-SH	TOC	370.84	39.84	331.00	
182	SGS	TOC	371.15	11.36	359.79	
184	SGS	TOC	373.19	13.64	359.55	
185	RGA-SH	TOC	373.64	42.32	331.32	
186	SGS	TOC	373.62	7.52	366.10	
187	SGS	TOC	373.24	8.04	365.20	
188	RGA-SH	TOC	374.24	42.71	331.53	
189	SGS	TOC	375.50	19.22	356.28	
190	SGS	TOC	373.21	5.01	368.20	
191	RGA-SH	TOC	360.00	28.75	331.25	
192	SGS	TOC	359.04	27.45	331.59	

Table 1G-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 8 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements April 1991		
				April DTW (ft)	Elevation (ft)	Remarks
193	RGA-SH	TOC	367.85	---	---	Not completed at time of sampling.
194	RGA-SH	TOC	356.21	24.84	331.31	
195	SGS	TOC	356.21	8.77	347.44	
196	SGS	TOC	368.12	8.80	381.09	
197	RGA-SH	TOC	368.24	36.97	331.15	
198	SGS	TOC	368.24	18.57	349.67	
199	RGA-SH	TOC	353.00	---	---	Not completed at time of sampling.
200	RGA-SH	TOC	378.27	47.45	330.82	
201	RGA-SH	TOC	0.00	37.65	---	
202	RGA-SH	TOC	372.60	42.71	329.89	
203	RGA-SH	TOC	376.23	46.86	329.37	
204	SGS	TOC	377.73	---	---	Dry.
205	RGA-SH	TOC	379.75	---	---	Not scheduled for measurement until 6/91.
206	RGA-SH	TOC	385.14	---	---	Not scheduled for measurement until 6/91.

Table 1G-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 9 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements April 1991		
				April DTW (ft)	Elevation (ft)	Remarks
TVA Wells						
TVA-3	RGA	TOC	361.78	34.72	327.06	
TVA-4	RGA	TOC	336.55	10.44	326.11	
TVA-5	RGA	TOC	332.35	3.82	328.53	
TVA-6	RGA	TOC	328.58	---	---	Under water.
TVA-9	RGA	TOC	348.13	25.06	323.07	
TVA-11	RGA	TOC	321.36	---	---	Road out.
TVA-13	RGA	TOC	332.64	4.72	327.92	
TVA-14	RGA	TOC	354.66	29.82	324.84	
TVA-17	RGA	TOC	365.42	39.75	325.67	
TVA-19	RGA	TOC	363.19	---	---	ES recorder in well.
TVA-24	RGA	TOC	358.73	34.20	324.53	

Table 1G-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 10 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements April 1991		
				April DTW (ft)	Elevation (ft)	Remarks
TVA-25	RGA	TOC	353.38	28.21	325.17	
TVA-27	RGA	TOC	353.61	28.73	324.88	
TVA-28	RGA	TOC	363.81	39.98	323.83	

Elev = Elevation from USC&GS first order monuments.
DTW = Depth to water from datum.
TOC = Top of innermost casing or riser, excluding pump discharge risers. The surveyed reference datum is a mark or notch on the north edge of the inner casing.
WWP = Well Wizard head plate on older funnel-shaped, exterior Well Wizard cap.
TOC* = Square stainless steel outer casing; 50 yd due south of MW-68 through -71 in open field.

Lithology:

SGS = Shallow Groundwater System
RGA = Regional Gravel Aquifer
RGA-SH = Regional Gravel Aquifer (shallow)
RGA-DP = Regional Gravel Aquifer (deep)
DGS = Deep Groundwater System

DISCUSSION

Figures 1G-1 through 1G-3 show an interpretation of the groundwater elevation in the DGS, the RGA, and the SGS.

These plots are intended as a general representation of the subsurface hydrology only. They are characterized by a relatively small number of data points. The recharging and discharging reaches of Big Bayou Creek, Little Bayou Creek, and any of the onsite ditches have not been accounted for. These factors could strongly affect the shallow groundwater system near these features.

The hydrologic setting around the PGDP is discussed in TM No. 1A.

Deep Groundwater System

Figure 1G-3 shows the same general north-northeast flow pattern observed in previous months and equivalent water level elevations in this system northeast across most of the plant, with north and northwest flow nearer the Ohio River, as in October. Wells 120, 121, 122, and 140 control the major contours on the plot.

The hydraulic gradient north of the plant for the DGS is approximately 0.0005 toward the river and sharply increases at the terrace (0.004) on the southwest corner of the plant.

Regional Gravel Aquifer

Figure 1G-2 shows the same north-northwest flow direction as observed in previous months, along with the gradient reversal adjacent to the Ohio River (hydraulic gradient at 0.001). The water levels in the RGA decreased slightly north of the plant in April.

A small depression is defined at the northeast corner of the C-720 Building, indicating a drop of approximately 2 feet in water level.

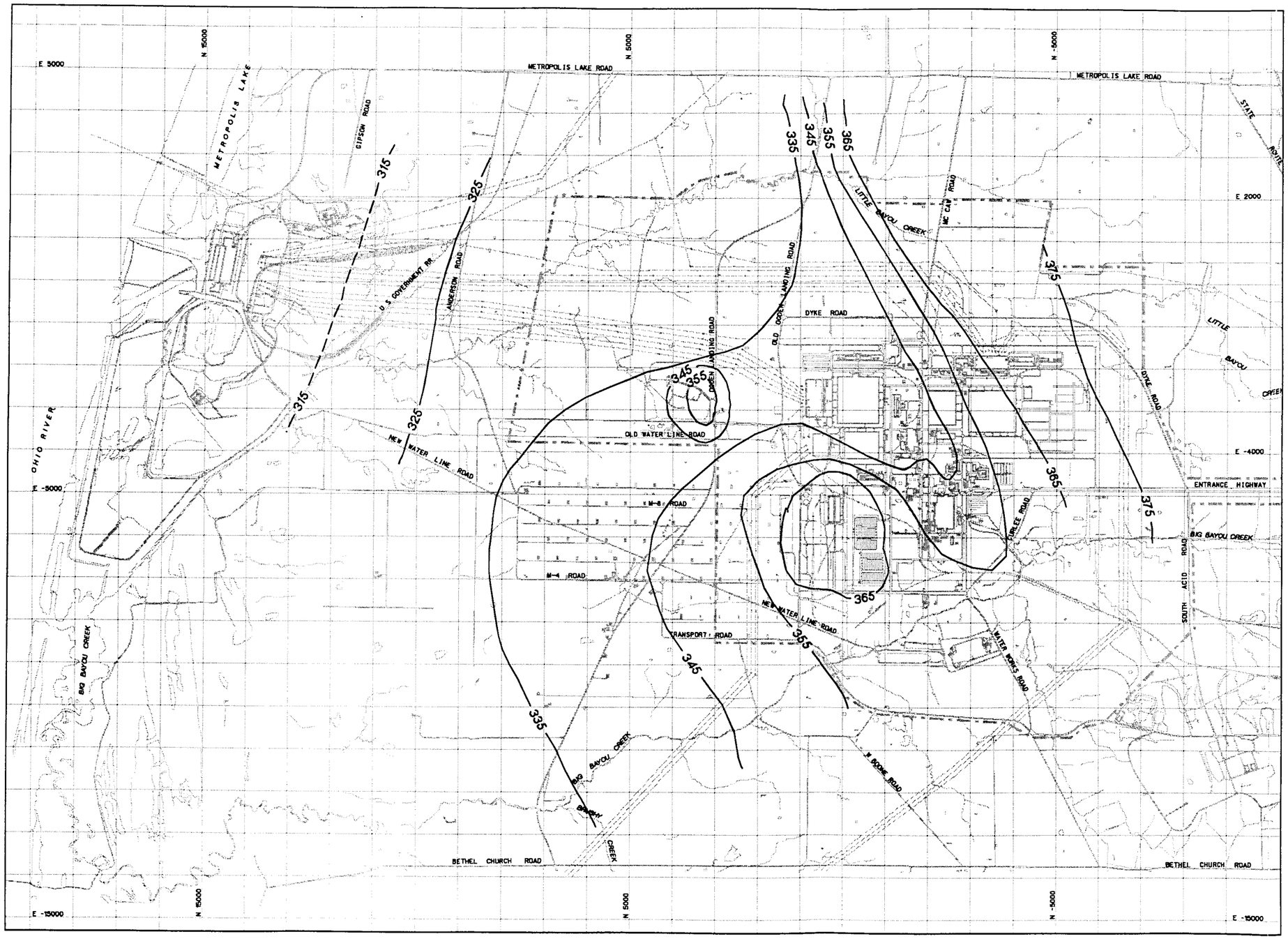
Excluding the depression near the C-720 Building, there is very little gradient from the center of the plant north to Ogden Landing Road (0.0001). North of Ogden Landing Road the hydraulic gradient increases to approximately 0.0002, and nearer the TVA plant the gradient increases to 0.0005.

Shallow Groundwater System

Figure 1G-1 shows the same northeast flow pattern and general water level elevations as observed in previous months. The northeast-trending trough near the center of the plant, along with the mounding of the SGS in the northwest corner of the plant, is still a defined feature. The mounding of the water level at the North Sanitary Landfill is more pronounced.

A high hydraulic gradient (0.007) from the southeast corner of the plant (Well Cluster No. 1) toward the center of the plant decreases to an approximate value of 0.004 north of Ogden Landing Road. The gradient from the south side of the North Sanitary Landfill to the north side of the landfill is a relatively high value of 0.01.

0888tm51.dgn 29-Aug-1991



REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- —325— CONTOUR OF WATER LEVEL ELEVATIONS

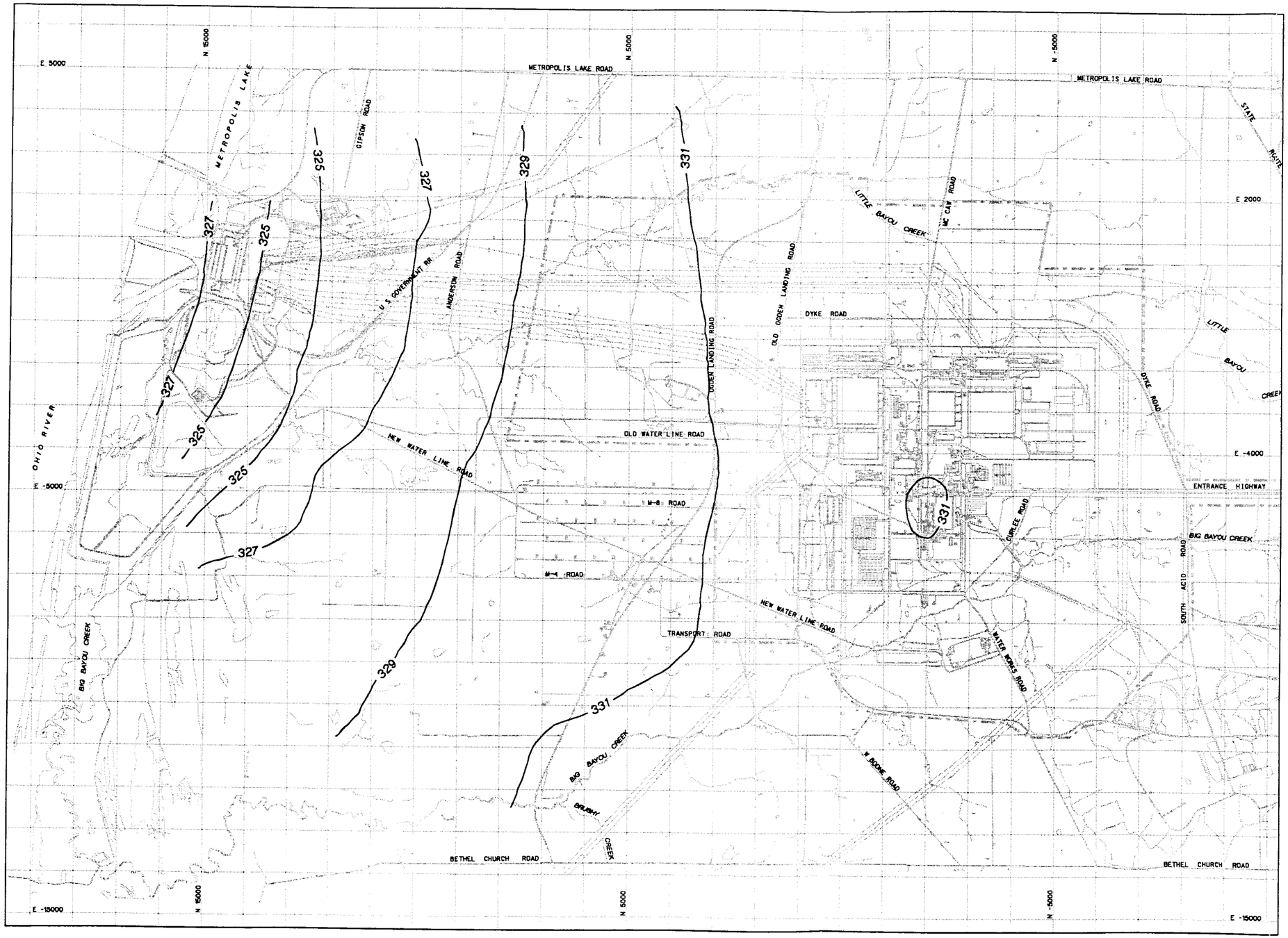
CONTOUR INTERVAL =10 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"- 2500'

Figure 1G-1
WATER LEVEL ELEVATIONS FOR THE SHALLOW GROUNDWATER SYSTEM-APRIL, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0888tm52.dgn 4-Sep-1991



REVIEWED FOR CLASSIFICATION
WJS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- 325 CONTOUR OF WATER LEVEL ELEVATIONS

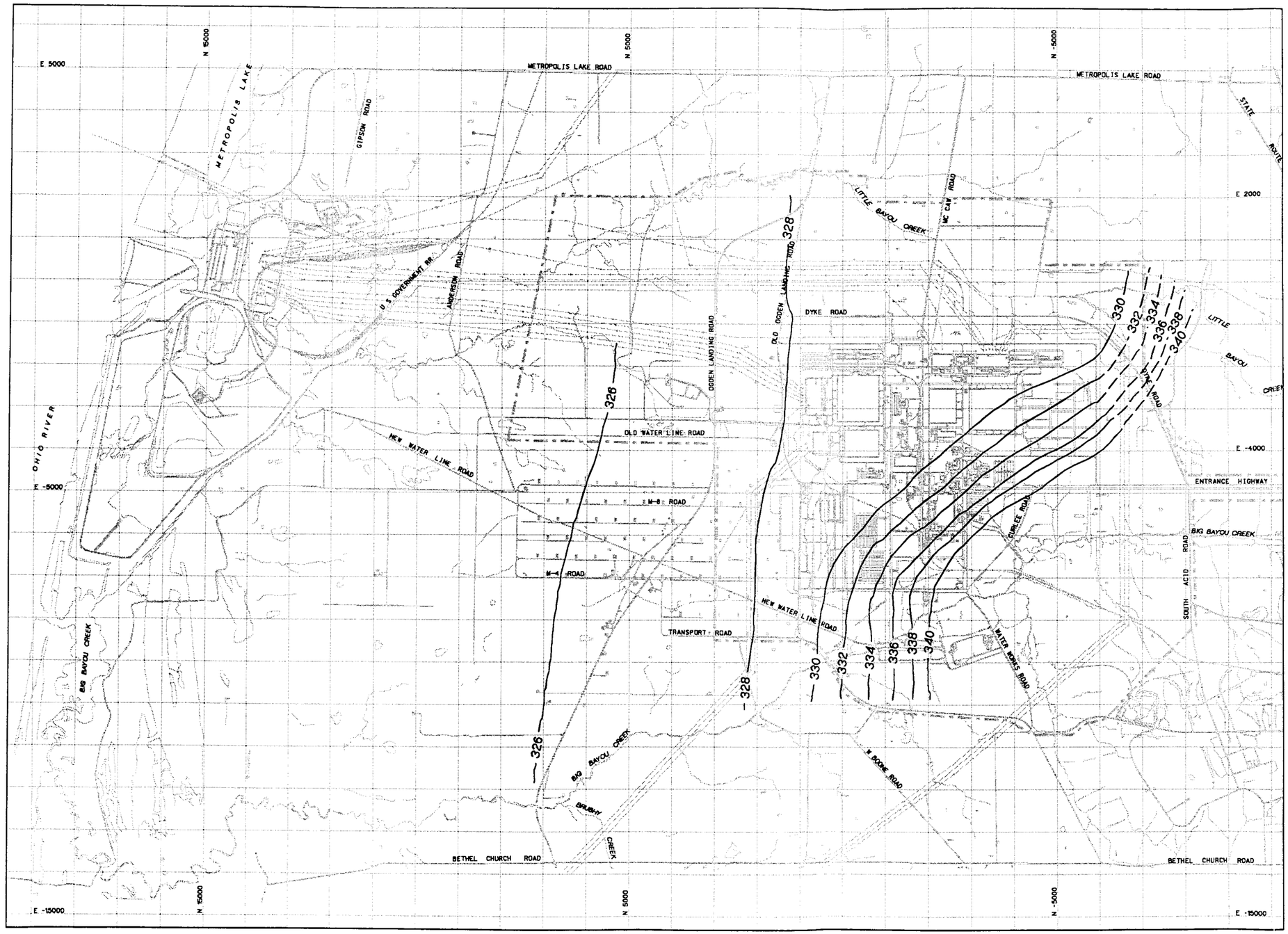
CONTOUR INTERVAL = 2 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"- 2500'

Figure 1G-2
WATER LEVEL ELEVATIONS FOR THE REGIONAL GRAVEL AQUIFER-APRIL, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0888tm53.dgn 28-Aug-1991



REVIEWED FOR CLASSIFICATION
WJS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 2 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1G-3
WATER LEVEL ELEVATIONS FOR THE DEEP GROUNDWATER SYSTEM-APRIL, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

TECHNICAL MEMORANDUM NO. 1H
PGDP PHASE II SITE INVESTIGATION

PREPARED BY: Greg Schaefer/ORO
Russell Lahoud/ORO

SUBJECT: Water Level Measurements, May 1991

PROJECT: ORO30888.FL

INTRODUCTION

PURPOSE AND SCOPE

Monthly water level measurements are planned for wells in and around the PGDP for a period of 1 year. This memorandum presents data collected May 14-15, 1991, from 124 wells.

FIELD PERSONNEL

The field personnel were:

Sample Team Leader (STL)	Greg Ford
IH/HP Technician	Craig Morrison
Escort	Wallace Cunningham
Energy Systems Escort	Jeff Douthitt
Site Safety Coordinator (SSC)	Craig Morrison/TMA/Eberline

METHODOLOGY

Measurements were taken with an electronic water level meter, measuring from the datum index, in compliance with "Task Instructions for Water Level Measurements, PGDP Phase II," as amended by the May monthly addendum.

TECHNICAL DATA

MEASUREMENTS

One hundred twenty-four of the scheduled 128 wells were measured. MW-205 and -206 were not scheduled for measurement during the May sampling event. TVA-6 could not be reached because of high water from the Ohio River. TVA-9 was not located. TVA-11 could not be reached because the access road was washed out. MW-154 was not measured. MW-193 and -199 were not completed by the time samples were taken. MW-69 and -176 were dry.

Measurement data are shown on Table 1H-1. Measurements were recorded on the data sheet and in field logbook 6.

QUALITY ASSURANCE/QUALITY CONTROL

The reported data sheet has been confirmed with the STL logbook.

FIELD MONITORING

The following wells to be measured were coded for health and safety monitoring, and the specifications were used to determine personal protective equipment worn by the sample team at each location. In addition, an IH/HP was present at all Type C wells. The guidelines for these codes were:

Present	Specifications	Protection
Type A	Non-elevated offsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type B	Non-elevated onsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type C	Wells in radiological exclusion zones or wells that have not been evaluated previously	Tyvek coveralls, booties, surgical gloves, hard hat, eye protection, and safety shoes

Health and safety monitoring was conducted by the SSC at designated Type C wells and by the STL at the other wells.

All Type B wells were measured with minimal PPE in accordance with instructions from the SSC.

DECONTAMINATION OF EQUIPMENT

Decontamination of the well sounder was performed in accordance with ESP 900 (Section V, a.1) and ESP 901.

WASTE MANAGEMENT

Only a small amount of waste in the form of surgical gloves, booties, and decontamination fluids was generated by this task. This waste was turned over to the SSC for containment and was given to Energy Systems after the completion of the task.

Table 1H-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 1 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements May 1991		
				May DTW (ft)	Elevation (ft)	Remarks
PGDP Wells						
7	SGS	TOC	373.08	7.44	365.64	
19	RGA	TOC	364.46	32.32	332.14	
23	DGS	TOC	373.64	15.54	358.10	
24	DGS	TOC	375.71	10.94	364.77	
25	SGS	TOC	380.02	0.20	379.82	
26	DGS	TOC	383.23	3.83	379.40	
27	DGS	TOC	381.59	16.98	364.61	
43	SGS	TOC	373.39	40.82	332.57	
52	RGA	TOC	372.29	40.45	331.84	
53	RGA	TOC	375.12	43.23	331.89	
54	RGA	TOC	373.91	42.12	331.79	
63	RGA	WWP	372.60	40.92	331.68	

Table 1H-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 2 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements May 1991		
				May DTW (ft)	Elevation (ft)	Remarks
64	SGS	WWP	372.60	7.90	364.70	
65	RGA	WWP	372.58	40.93	331.65	
68	RGA	WWP	379.72	47.33	332.39	
69	SGS	WWP	379.72	---	---	Dry.
70	RGA	TOC	379.25	46.85	332.40	
71	RGA	WWP	379.72	47.32	332.40	
73	RGA	TOC	374.97	42.93	332.04	
74	SGS	TOC	375.06	21.42	353.64	
75	SGS	TOC	376.10	10.50	365.60	
77	RGA	TOC	377.16	44.88	332.28	
82	SGS	TOC	376.54	13.45	363.09	
83	SGS	TOC	376.59	15.34	361.25	
85	SGS	WWP	375.86	17.53	358.33	
88	SGS	WWP	375.74	18.80	356.94	
90	RGA	WWP	374.51	42.39	332.12	

Table 1H-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 3 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements May 1991		
				May DTW (ft)	Elevation (ft)	Remarks
91	SGS	WWP	374.48	12.46	362.02	
92	RGA	WWP	374.51	42.39	332.12	
93	RGA	WWP	377.61	45.40	332.21	
94	SGS	WWP	377.62	18.40	359.22	
95	RGA	WWP	377.62	45.43	332.19	
96	SGS	TOC*	377.32	34.16	343.16	
120	DGS	TOC	386.57	56.74	329.83	
121	DGS	TOC	374.70	49.55	325.15	
122	DGS	TOC	364.66	35.50	329.16	
123	RGA-SH	TOC	374.69	44.99	329.70	
124	RGA-DP	TOC	364.71	33.04	331.67	
125	RGA-DP	TOC	374.89	45.20	329.69	
126	RGA-SH	TOC	364.02	32.35	331.67	
127	SGS	TOC	374.81	32.12	342.69	

Table 1H-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 4 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements May 1991		
				May DTW (ft)	Elevation (ft)	Remarks
128	SGS	TOC	364.38	28.00	336.38	
129	SGS	TOC	386.14	9.90	376.24	
130	SGS	TOC	386.03	9.68	376.35	
131	SGS	TOC	385.77	8.42	377.35	
132	RGA-DP	TOC	362.83	33.34	329.49	
133	RGA-DP	TOC	336.93	10.23	326.70	
134	RGA-DP	TOC	368.20	37.33	330.87	
135	RGA-DP	TOC	335.94	9.40	326.54	
137	RGA-SH	TOC	335.69	9.19	326.50	
138	SGS	TOC	335.57	4.84	330.73	
139	RGA-SH	TOC	363.17	33.86	329.31	
140	DGS	TOC	344.12	17.79	326.33	
141	RGA-DP	TOC	344.86	14.09	330.77	
142	RGA-SH	TOC	345.04	14.32	330.72	
143	SGS	TOC	345.37	11.49	333.88	

Table 1H-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 5 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements May 1991		
				May DTW (ft)	Elevation (ft)	Remarks
144	RGA-DP	TOC	379.89	47.93	331.96	
145	RGA-SH	TOC	380.08	48.09	331.99	
146	RGA-DP	TOC	352.91	28.33	324.58	
147	RGA-SH	TOC	353.08	27.51	325.57	
148	RGA-DP	TOC	373.35	43.69	329.66	
149	SGS	TOC	373.87	44.18	329.69	
150	RGA-DP	TOC	376.60	45.65	330.95	
151	SGS	TOC	382.56	14.66	367.90	
152	RGA-DP	TOC	353.36	32.38	320.98	
153	SGS	TOC	353.10	32.54	320.56	
154	SGS	TOC	374.49	---	---	Not done.
155	RGA-DP	TOC	381.25	49.00	332.25	
156	RGA-SH	TOC	382.06	49.80	332.26	
157	SGS	TOC	381.56	31.77	349.79	
158	RGA-DP	TOC	373.72	41.61	332.11	

Table 1H-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 6 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements May 1991		
				May DTW (ft)	Elevation (ft)	Remarks
159	RGA-SH	TOC	373.82	41.70	332.12	
160	SGS	TOC	373.56	8.83	364.73	
161	RGA-SH	TOC	373.55	41.40	332.15	
162	SGS	TOC	374.17	11.36	362.81	
163	RGA-SH	TOC	386.14	53.90	332.24	
164	SGS	TOC	386.29	44.11	342.18	
165	RGA-SH	TOC	379.74	47.69	332.05	
166	SGS	TOC	380.07	36.35	343.72	
167	SGS	TOC	376.36	7.43	368.93	
168	RGA-SH	TOC	377.42	45.42	332.00	
169	RGA-SH	TOC	373.41	41.44	331.97	
170	SGS	TOC	373.98	8.31	365.67	
171	SGS	TOC	374.63	5.44	369.19	
172	SGS	TOC	373.79	7.51	366.28	
173	RGA-SH	TOC	373.30	41.23	332.07	

Table 1H-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 7 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements May 1991		
				May DTW (ft)	Elevation (ft)	Remarks
174	SGS	TOC	373.29	7.01	366.28	
175	RGA-SH	TOC	381.18	48.92	332.26	
176	SGS	TOC	381.23	---	---	Dry.
177	SGS	TOC	379.74	45.05	334.69	
178	RGA-SH	TOC	378.80	45.56	333.24	
179	RGA-SH	TOC	358.60	27.64	330.96	
180	SGS	TOC	358.11	17.43	340.68	
181	RGA-SH	TOC	370.84	38.59	332.25	
182	SGS	TOC	371.15	7.91	363.24	
184	SGS	TOC	373.19	8.86	364.33	
185	RGA-SH	TOC	373.64	41.91	331.73	
186	SGS	TOC	373.62	8.86	364.76	
187	SGS	TOC	373.24	7.91	365.33	
188	RGA-SH	TOC	374.24	42.09	332.15	
189	SGS	TOC	375.50	18.39	357.11	

Table 1H-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 8 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements May 1991		
				May DTW (ft)	Elevation (ft)	Remarks
190	SGS	TOC	373.21	4.86	368.35	
191	RGA-SH	TOC	360.00	27.26	332.74	
192	SGS	TOC	359.04	28.32	330.72	
193	RGA-SH	TOC	367.85	---	---	
194	RGA-SH	TOC	356.21	24.73	331.42	
195	SGS	TOC	356.21	8.04	348.17	
196	SGS	TOC	368.12	8.32	381.57	
197	RGA-SH	TOC	368.24	36.98	331.14	
198	SGS	TOC	368.24	16.85	351.39	
199	RGA-SH	TOC	353.00	---	---	
200	RGA-SH	TOC	378.27	47.57	330.70	
201	RGA-SH	TOC	0.00	29.99	---	
202	RGA-SH	TOC	372.60	43.44	329.16	
203	RGA-SH	TOC	376.23	43.87	332.36	
204	SGS	TOC	377.73	40.41	337.32	

Table 1H-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 9 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements May 1991		
				May DTW (ft)	Elevation (ft)	Remarks
205	RGA-SH	TOC	379.75	---	---	Not scheduled for measurement until 6/91.
206	RGA-SH	TOC	385.14	---	---	Not scheduled for measurement until 6/91.
TVA Wells						
TVA-3	RGA	TOC	361.78	36.72	325.06	
TVA-4	RGA	TOC	336.55	12.81	323.74	
TVA-5	RGA	TOC	332.35	5.22	327.13	
TVA-6	RGA	TOC	328.58	---	---	Under water.
TVA-9	RGA	TOC	348.13	---	---	Not located.
TVA-11	RGA	TOC	321.36	---	---	Road out.
TVA-13	RGA	TOC	332.64	4.92	327.72	
TVA-14	RGA	TOC	354.66	32.00	322.66	
TVA-17	RGA	TOC	365.42	42.96	322.46	
TVA-19	RGA	TOC	363.19	39.12	324.07	
TVA-24	RGA	TOC	358.73	38.23	320.50	

Table 1H-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 10 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements May 1991		
				May DTW (ft)	Elevation (ft)	Remarks
TVA-25	RGA	TOC	353.38	31.62	321.76	
TVA-27	RGA	TOC	353.61	32.54	321.07	
TVA-28	RGA	TOC	363.81	44.82	318.99	

Elev = Elevation from USC&GS first order monuments.
DTW = Depth to water from datum.
TOC = Top of innermost casing or riser, excluding pump discharge risers. The surveyed reference datum is a mark or notch on the north edge of the inner casing.
WWP = Well Wizard head plate on older funnel-shaped, exterior Well Wizard cap.
TOC* = Square stainless steel outer casing; 50 yd due south of MW-68 through -71 in open field.

Lithology:

SGS = Shallow Groundwater System
RGA = Regional Gravel Aquifer
RGA-SH = Regional Gravel Aquifer (shallow)
RGA-DP = Regional Gravel Aquifer (deep)
DGS = Deep Groundwater System

DISCUSSION

Figures 1H-1 through 1H-3 show an interpretation of the groundwater elevation in the DGS, the RGA, and the SGS.

These plots are intended as a general representation of the subsurface hydrology only. They are characterized by a relatively small number of data points. The recharging and discharging reaches of Big Bayou Creek, Little Bayou Creek, and any of the onsite ditches have not been accounted for. This could strongly affect the shallow groundwater system near these features.

The hydrologic setting around the PGDP is discussed in TM No. 1A.

Deep Groundwater System

Figure 1H-3 shows the same principal north-northeast flow trends and water level elevations for the DGS as observed in previous months. The hydraulic gradients for May decrease from the terrace feature at the southwest corner of the plant (0.005) to 0.0007 north of the plant.

Regional Gravel Aquifer

Figure 1H-2 shows flow from the site toward the Ohio River in a north-northeasterly direction. A mound in the RGA is defined at the northeast corner of the C-400 Building, with a 1-foot water level rise. A slight depression (less than 1 foot) is defined beneath the northwest corner of the plant.

The hydraulic gradient still shows a reversal adjacent to the Ohio River with a gradient value of approximately 0.004 away from the river, locally. The hydraulic gradient north of the plant toward Little Bayou Creek is approximately 0.0004, with little or no gradient beneath the plant.

Shallow Groundwater System

Figure 1H-1 shows that the general northeast flow trends and water level elevations observed in previous months are present. The piezometric mound in the northwest corner of the plant and the northeast-trending trough extending from Curlee Road are still evident beneath the plant. The mounding of the SGS at the North Sanitary Landfill is also still defined.

The hydraulic conductivity of the SGS from the southeast corner of the plant (well cluster-1) toward the center of the plant for May is approximately 0.008; gradient values in the range of 0.005 exist north of Ogden Landing Road.

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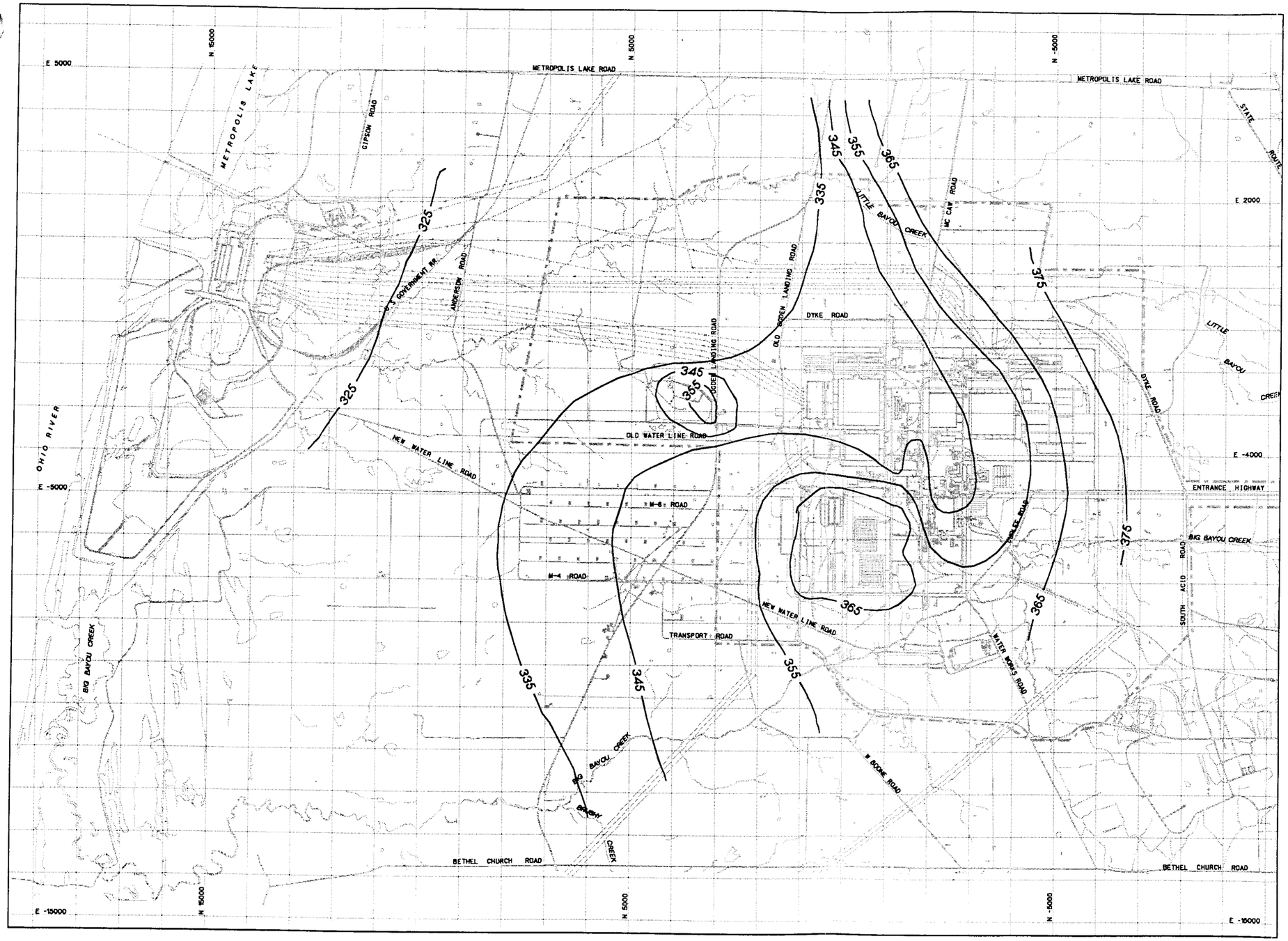


REVIEWED FOR CLASSIFICATION
WS 7/9/93
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- —325— CONTOUR OF WATER LEVEL ELEVATIONS

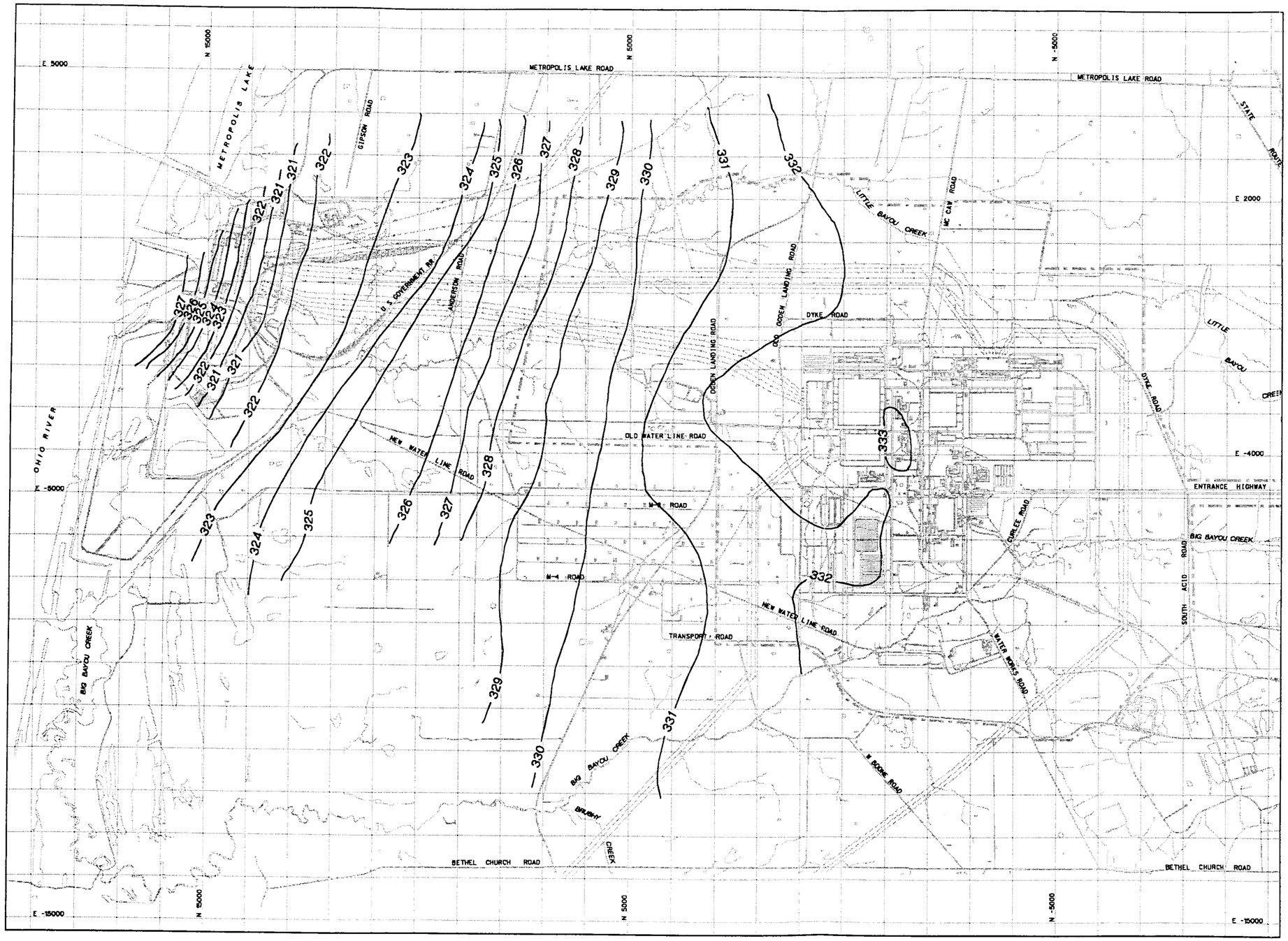
CONTOUR INTERVAL =10 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1H-1
WATER LEVEL ELEVATIONS FOR THE SHALLOW GROUNDWATER SYSTEM-MAY,1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0388tm55.dgn 26-Aug-1991



REVIEWED FOR CLASSIFICATION
Initials Date 7/9/07
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

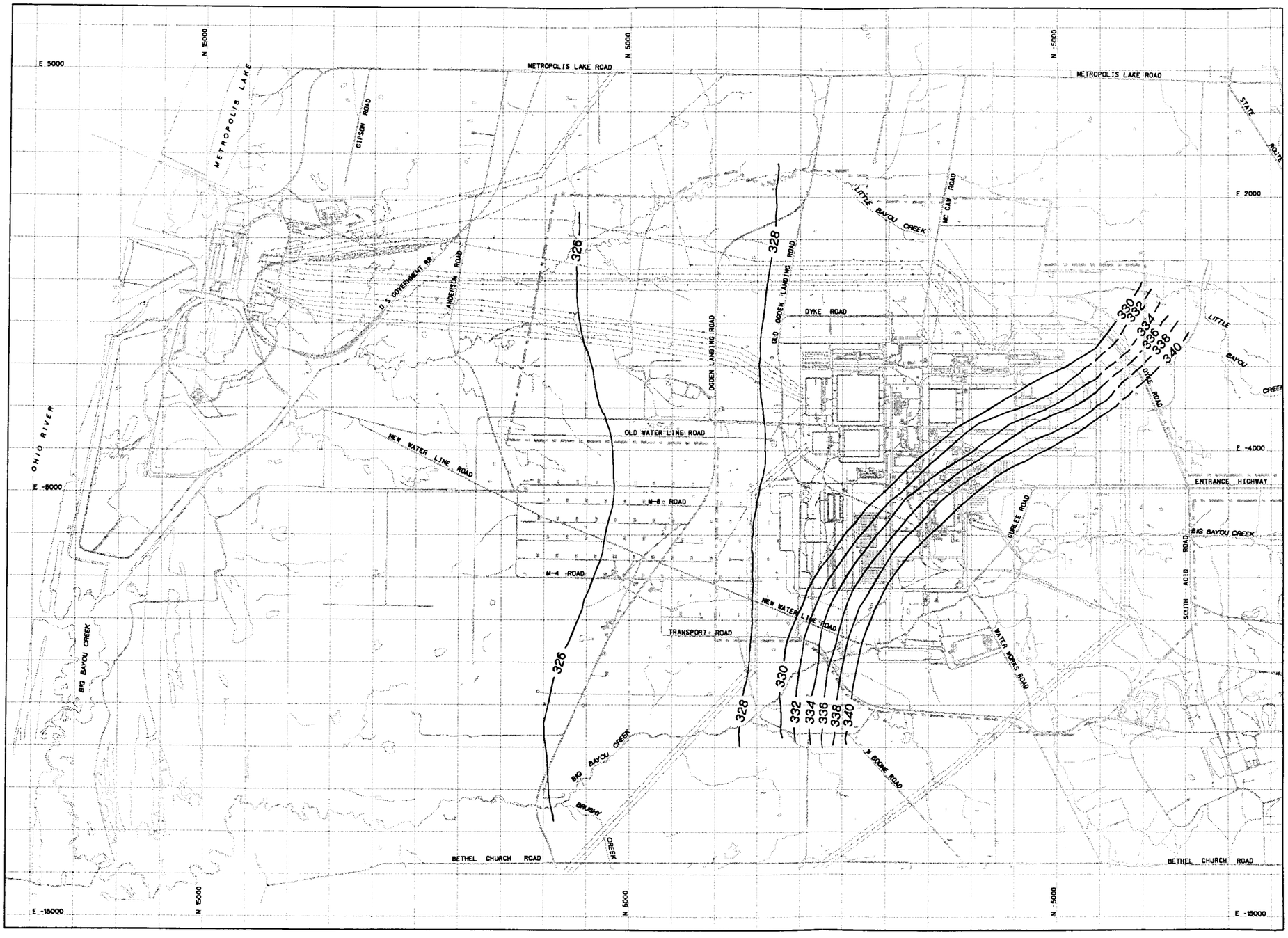
CONTOUR INTERVAL = 1 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1H-2
WATER LEVEL ELEVATIONS FOR THE REGIONAL GRAVEL AQUIFER-MAY, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0888tm56.dgn 28-Aug-1991



REVIEWED FOR CLASSIFICATION
WJS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 2 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1H-3
WATER LEVEL ELEVATIONS FOR THE DEEP GROUNDWATER SYSTEM-MAY, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

PREPARED BY: Greg Schaefer/ORO
Russell Lahoud/ORO

SUBJECT: Water Level Measurements, June 1991

PROJECT: ORO30888.FL

INTRODUCTION

PURPOSE AND SCOPE

Monthly water level measurements are planned for wells in and around the PGDP for a period of 1 year. This memorandum presents data collected June 13-14, 1991, from 126 wells.

FIELD PERSONNEL

The field personnel were:

Sample Team Leader (STL)	Greg Schaefer
Sample Team Member (STM)	Greg Ford
IH/HP Technician	Alan Grigsby
Escort	Joe Houston
Energy Systems Escort	Jeff Douthitt
Site Safety Coordinator (SSC)	Craig Morrison/TMA/Eberline

METHODOLOGY

Measurements were performed with an electronic water level meter, measuring from the datum index, in compliance with "Task Instructions for Water Level Measurements, PGDP Phase II," as amended by the June monthly addendum.

TECHNICAL DATA

MEASUREMENTS

One hundred twenty-six of the scheduled 132 wells were measured. The sampling team could not gain access into locking well caps at MW-157, -175, and -185; TVA-6 was not located; access to TVA-11 through -27 was not available. MW-205, -206, -193, and -199 were added to the monthly sampling suite. MW-69, -153, and -176 were dry.

Measurement data are shown on Table 1I-1. Measurements were recorded on the data sheet and in field logbook 6.

QUALITY ASSURANCE/QUALITY CONTROL

The reported data sheet has been confirmed with the STL logbook.

FIELD MONITORING

The following wells to be measured were coded for health and safety monitoring, and the specifications were used to determine personal protective equipment worn by the sample team at each location. In addition, an IH/HP was present at all Type C wells. The guidelines for these codes were:

Present	Specifications	Protection
Type A	Non-elevated offsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type B	Non-elevated onsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type C	Wells in radiological exclusion zones or wells that have not been evaluated previously	Tyvek coveralls, booties, surgical gloves, hard hat, eye protection, and safety shoes

Health and safety monitoring was conducted by the IH/HP technician at designated Type C wells and by the STL at the other wells.

DECONTAMINATION OF EQUIPMENT

Decontamination of the well sounder was performed in accordance with ESP 900 (Section V, a.1) and ESP 901.

WASTE MANAGEMENT

Only a small amount of waste in the form of surgical gloves, booties, and decontamination fluids was generated by this task. This waste was turned over to the SSC for containment, and was given to Energy Systems after the completion of the task.

Table 1I-1
PGDP Phase II Site Investigation
Water Level Measurements
(page 1 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements June 1991		
				June DTW (ft)	Elevation (ft)	Remarks
PGDP Wells						
7	SGS	TOC	373.08	7.56	365.52	
19	RGA	TOC	364.46	0.98	363.48	
23	DGS	TOC	373.64	16.24	357.40	
24	DGS	TOC	375.71	11.18	364.53	
25	SGS	TOC	380.02	0.00	380.02	@ surface
26	DGS	TOC	383.23	16.18	367.05	
27	DGS	TOC	381.59	16.64	364.95	
43	SGS	TOC	373.39	42.00	331.39	
52	RGA	TOC	372.29	40.66	331.63	
53	RGA	TOC	375.12	43.44	331.68	
54	RGA	TOC	373.91	42.26	331.65	
63	RGA	WWP	372.60	41.08	331.52	
64	SGS	WWP	372.60	8.39	364.21	
65	RGA	WWP	372.58	41.08	331.50	

Table 1I-1
PGDP Phase II Site Investigation
Water Level Measurements
(page 2 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements June 1991		
				June DTW (ft)	Elevation (ft)	Remarks
68	RGA	WWP	379.72	47.37	332.35	
69	SGS	WWP	379.72	---	---	Dry
70	RGA	TOC	379.25	47.19	332.06	
71	RGA	WWP	379.72	47.36	332.36	
73	RGA	TOC	374.97	43.01	331.96	
74	SGS	TOC	375.06	21.37	353.69	
75	SGS	TOC	376.10	10.54	365.56	
77	RGA	TOC	377.16	44.93	332.23	
82	SGS	TOC	376.54	13.40	363.14	
83	SGS	TOC	376.59	15.32	361.27	transducer in well.
85	SGS	WWP	375.86	17.63	358.23	
88	SGS	WWP	375.74	16.89	358.85	
90	RGA	WWP	374.51	42.51	332.00	
91	SGS	WWP	374.48	12.49	361.99	
92	RGA	WWP	374.51	42.50	332.01	

Table 1I-1
PGDP Phase II Site Investigation
Water Level Measurements
(page 3 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements June 1991		
				June DTW (ft)	Elevation (ft)	Remarks
93	RGA	WWP	377.61	45.45	332.16	
94	SGS	WWP	377.62	18.47	359.15	
95	RGA	WWP	377.62	45.48	332.14	
96	SGS	TOC*	377.32	34.12	343.20	
120	DGS	TOC	386.57	56.60	329.97	
121	DGS	TOC	374.70	50.78	323.92	
122	DGS	TOC	364.66	35.60	329.06	
123	RGA-SH	TOC	374.69	45.34	329.35	
124	RGA-DP	TOC	364.71	33.00	331.71	
125	RGA-DP	TOC	374.89	45.56	329.33	
126	RGA-SH	TOC	364.02	32.38	331.64	
127	SGS	TOC	374.81	24.50	350.31	
128	SGS	TOC	364.38	27.54	336.84	
129	SGS	TOC	386.14	10.12	376.02	
130	SGS	TOC	386.03	9.88	376.15	

Table 1I-1
PGDP Phase II Site Investigation
Water Level Measurements
(page 4 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements June 1991		
				June DTW (ft)	Elevation (ft)	Remarks
131	SGS	TOC	385.77	9.63	376.14	
132	RGA-DP	TOC	362.83	33.56	329.27	
133	RGA-DP	TOC	336.93	10.66	326.27	
134	RGA-DP	TOC	368.20	37.64	330.56	
135	RGA-DP	TOC	335.94	10.02	325.92	
137	RGA-SH	TOC	335.69	9.82	325.87	
138	SGS	TOC	335.57	4.54	331.03	
139	RGA-SH	TOC	363.17	33.88	329.29	
140	DGS	TOC	344.12	18.64	325.48	
141	RGA-DP	TOC	344.86	14.44	330.42	
142	RGA-SH	TOC	345.04	14.62	330.42	
143	SGS	TOC	345.37	12.58	332.79	
144	RGA-DP	TOC	379.89	47.92	331.97	
145	RGA-SH	TOC	380.08	48.04	332.04	
146	RGA-DP	TOC	352.91	28.10	324.81	

Table II-1
PGDP Phase II Site Investigation
Water Level Measurements
(page 5 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements June 1991		
				June DTW (ft)	Elevation (ft)	Remarks
147	RGA-SH	TOC	353.08	28.26	324.82	
148	RGA-DP	TOC	373.35	43.86	329.49	
149	SGS	TOC	373.87	44.38	329.49	
150	RGA-DP	TOC	376.60	45.70	330.90	
151	SGS	TOC	382.56	14.64	367.92	
152	RGA-DP	TOC	353.36	34.30	319.06	
153	SGS	TOC	353.10	---	---	Dry
154	SGS	TOC	374.49	9.22	365.27	
155	RGA-DP	TOC	381.25	48.91	332.34	
156	RGA-SH	TOC	382.06	49.71	332.35	
157	SGS	TOC	381.56	---	---	No access
158	RGA-DP	TOC	373.72	41.79	332.03	
159	RGA-SH	TOC	373.82	41.63	331.93	
160	SGS	TOC	373.56	8.30	365.25	
161	RGA-SH	TOC	373.55	41.36	332.81	

Table 1I-1
PGDP Phase II Site Investigation
Water Level Measurements
(page 6 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements June 1991		
				June DTW (ft)	Elevation (ft)	Remarks
162	SGS	TOC	374.17	11.28	374.86	
163	RGA-SH	TOC	386.14	53.77	332.52	
164	SGS	TOC	386.29	42.67	337.07	
165	RGA-SH	TOC	379.74	48.16	331.91	
166	SGS	TOC	380.07	34.62	341.74	
167	SGS	TOC	376.36	7.00	370.42	
168	RGA-SH	TOC	377.42	45.42	327.99	
169	RGA-SH	TOC	373.41	41.54	331.87	
170	SGS	TOC	373.98	8.36	365.62	
171	SGS	TOC	374.63	5.92	368.71	
172	SGS	TOC	373.79	7.70	366.09	
173	RGA-SH	TOC	373.30	41.34	331.96	
174	SGS	TOC	373.29	7.31	365.98	
175	RGA-SH	TOC	381.18	---	---	No access
176	SGS	TOC	381.23	---	---	Dry

Table II-1
PGDP Phase II Site Investigation
Water Level Measurements
(page 7 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements June 1991		
				June DTW (ft)	Elevation (ft)	Remarks
177	SGS	TOC	379.74	46.54	333.20	
178	RGA-SH	TOC	378.80	45.02	333.78	
179	RGA-SH	TOC	358.60	27.28	330.82	
180	SGS	TOC	358.11	17.50	340.61	
181	RGA-SH	TOC	370.84	39.62	331.22	
182	SGS	TOC	371.15	13.56	357.59	
184	SGS	TOC	373.19	13.74	359.45	
185	RGA-SH	TOC	373.64	---	---	No access
186	SGS	TOC	373.62	7.06	366.56	
187	SGS	TOC	373.24	7.68	365.56	
188	RGA-SH	TOC	374.24	42.05	332.19	
189	SGS	TOC	375.50	17.87	357.63	
190	SGS	TOC	373.21	4.25	368.96	
191	RGA-SH	TOC	360.00	28.38	331.62	
192	SGS	TOC	359.04	27.32	331.72	

Table II-1
PGDP Phase II Site Investigation
Water Level Measurements
(page 8 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements June 1991		
				June DTW (ft)	Elevation (ft)	Remarks
193	RGA-SH	TOC	367.85	36.40	331.45	
194	RGA-SH	TOC	356.21	25.00	331.21	
195	SGS	TOC	356.21	11.40	344.81	
196	SGS	TOC	368.12	9.30	358.82	
197	RGA-SH	TOC	368.24	37.24	331.00	
198	SGS	TOC	368.24	17.44	350.80	
199	RGA-SH	TOC	353.00	27.98	325.02	
200	RGA-SH	TOC	378.27	47.80	330.47	
201	RGA-SH	TOC	364.51	39.58	324.93	
202	RGA-SH	TOC	372.60	43.90	328.70	
203	RGA-SH	TOC	376.23	45.25	330.98	
204	SGS	TOC	377.73	40.10	337.63	
205	RGA-SH	TOC	379.75	47.66	332.09	
206	RGA-SH	TOC	385.14	52.70	332.44	

Table 1I-1
PGDP Phase II Site Investigation
Water Level Measurements
(page 9 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements June 1991		
				June DTW (ft)	Elevation (ft)	Remarks
TVA Wells						
TVA-3	RGA	TOC	361.78	37.40	324.38	
TVA-4	RGA	TOC	336.55	13.80	322.75	
TVA-5	RGA	TOC	332.35	6.08	326.27	
TVA-6	RGA	TOC	328.58	---	---	Not found
TVA-9	RGA	TOC	348.13	26.44	321.69	
TVA-11	RGA	TOC	321.36	---	---	Road out
TVA-13	RGA	TOC	332.64	5.60	327.04	
TVA-14	RGA	TOC	354.66	32.88	321.78	
TVA-17	RGA	TOC	365.42	44.40	321.02	
TVA-19	RGA	TOC	363.19	40.00	323.19	
TVA-24	RGA	TOC	358.73	40.60	318.13	

Table 1I-1
PGDP Phase II Site Investigation
Water Level Measurements
(page 10 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements June 1991		
				June DTW (ft)	Elevation (ft)	Remarks
TVA-25	RGA	TOC	353.38	33.34	320.04	
TVA-27	RGA	TOC	353.61	---	---	No access
TVA-28	RGA	TOC	363.81	47.88	315.93	

Elev = Elevation from USC&GS first order monuments.
DTW = Depth to water from datum.
TOC = Top of innermost casing or riser, excluding pump discharge risers. The surveyed reference datum is a mark or notch on the north edge of the inner casing.
WWP = Well Wizard head plate on older funnel-shaped, exterior Well Wizard cap.
TOC* = Square stainless steel outer casing; 50 yd due south of MW-68 through -71 in open field.

Lithology:

SGS = Shallow Groundwater System
RGA = Regional Gravel Aquifer
RGA-SH = Regional Gravel Aquifer (shallow)
RGA-DP = Regional Gravel Aquifer (deep)
DGS = Deep Groundwater System

DISCUSSION

Figures 1I-1 through 1I-3 show an interpretation of the groundwater elevation in the DGS, the RGA, and the SGS. These plots are intended as a general representation of the subsurface hydrology only. They are characterized by a relatively small number of data points. The recharging and discharging reaches of Big Bayou Creek, Little Bayou Creek, and any of the onsite ditches have not been accounted for. These factors could strongly affect the shallow groundwater system near these features.

The hydrologic setting around the PGDP is discussed in TM No. 1A.

Deep Groundwater System

Figure 1I-3 shows that little change in the north-northeast flow trends has occurred compared to what was observed in previous months. Water level elevations remained the same beneath the plant but dropped approximately 1 foot north of Ogden Landing Road.

A steep gradient is defined at the terrace deposits (0.005) near the southwest corner of the plant, and these decrease to a value of 0.001 north of Ogden Landing Road.

Regional Gravel Aquifer

A larger diameter mound in the RGA water level beneath the plant is shown in Figure 1I-2, with a peak water level elevation (333.7 feet) occurring at the northeast corner of the C-400 Building (MW-178). The north-northeast flow trends and water level elevations are generally the same as observed in previous months north of Ogden Landing Road. The reversal of the hydraulic gradient adjacent to the Ohio River is once again defined.

A hydraulic gradient of 0.007 exists from beneath the C-400 Building to the north side of the plant. The hydraulic gradients vary over the remaining portion of the site, from 0.0006 north of Ogden Landing Road to a gradient of 0.008 adjacent to the Ohio River, the latter flowing away from the river.

Shallow Groundwater System

Figure 1I-1 shows the same physical features as seen in previous months: the northeast-trending trough beneath the plant, a piezometric mound beneath the northwest corner of the plant, and a small piezometric mound beneath the north landfill. The same general water level elevations and northeast flow trends occur over the remainder of the site as were observed in previous months.

The hydraulic gradients over the site range from 0.004 north of Ogden Landing Road to 0.008 beneath the southeast corner of the plant. A relatively low gradient (0.0001) is present in the SGS north of the C-616-F lagoon.

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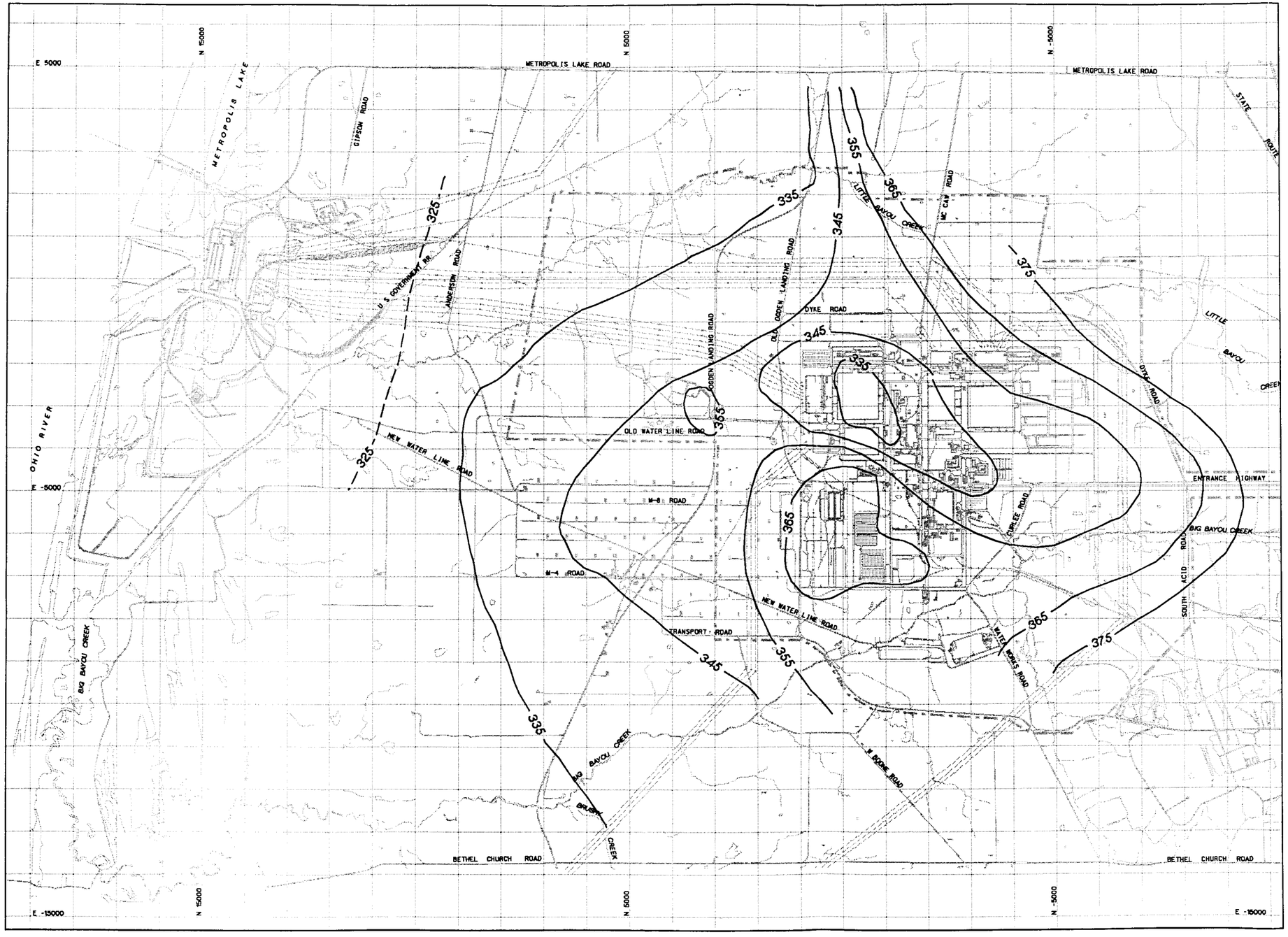

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WS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- —325— CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL =10 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 11-1
WATER LEVEL ELEVATIONS FOR THE SHALLOW GROUNDWATER SYSTEM-JUNE, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

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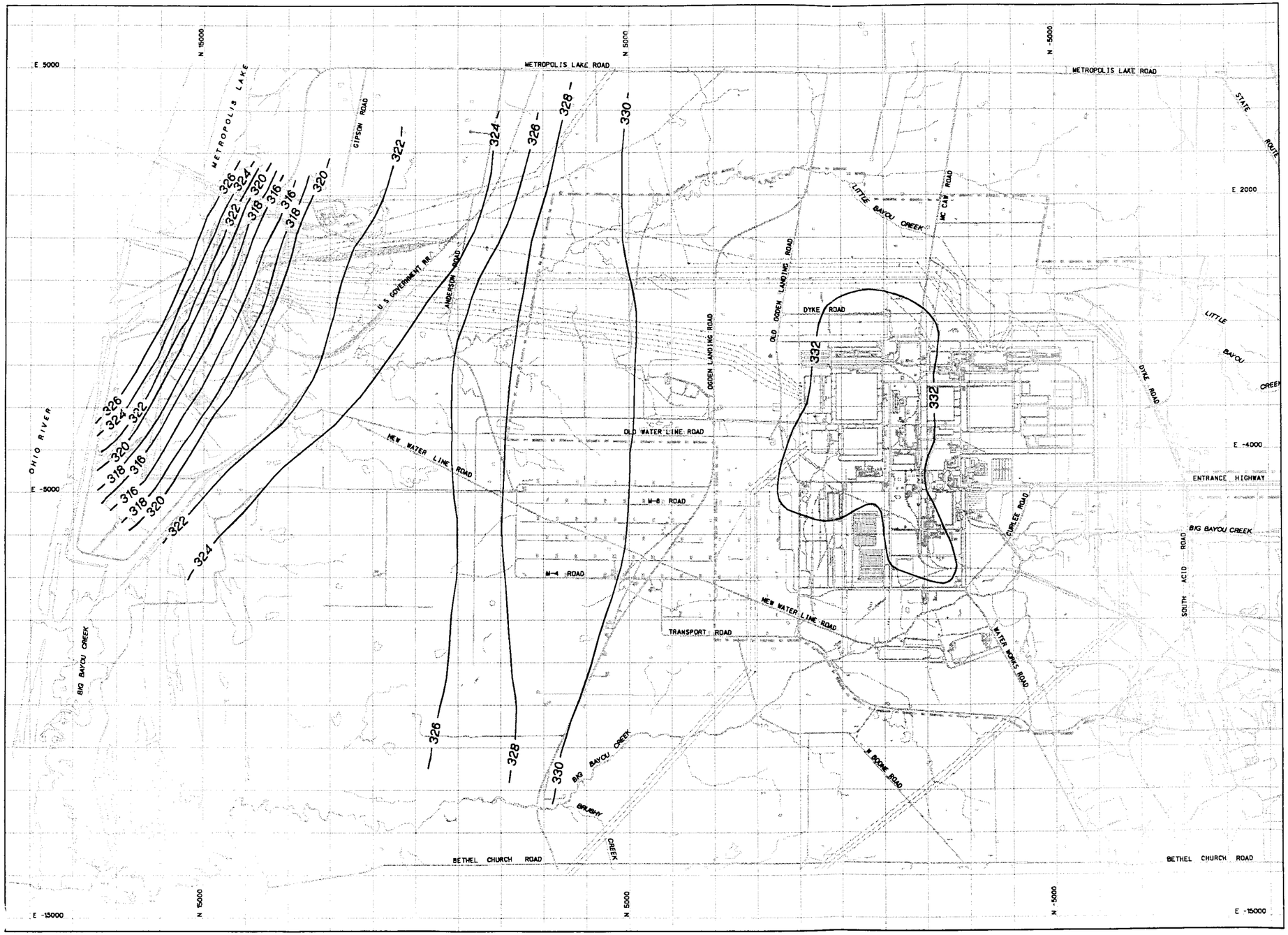

REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 2 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 11-2
WATER LEVEL ELEVATIONS FOR THE REGIONAL GRAVEL AQUIFER-JUNE, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

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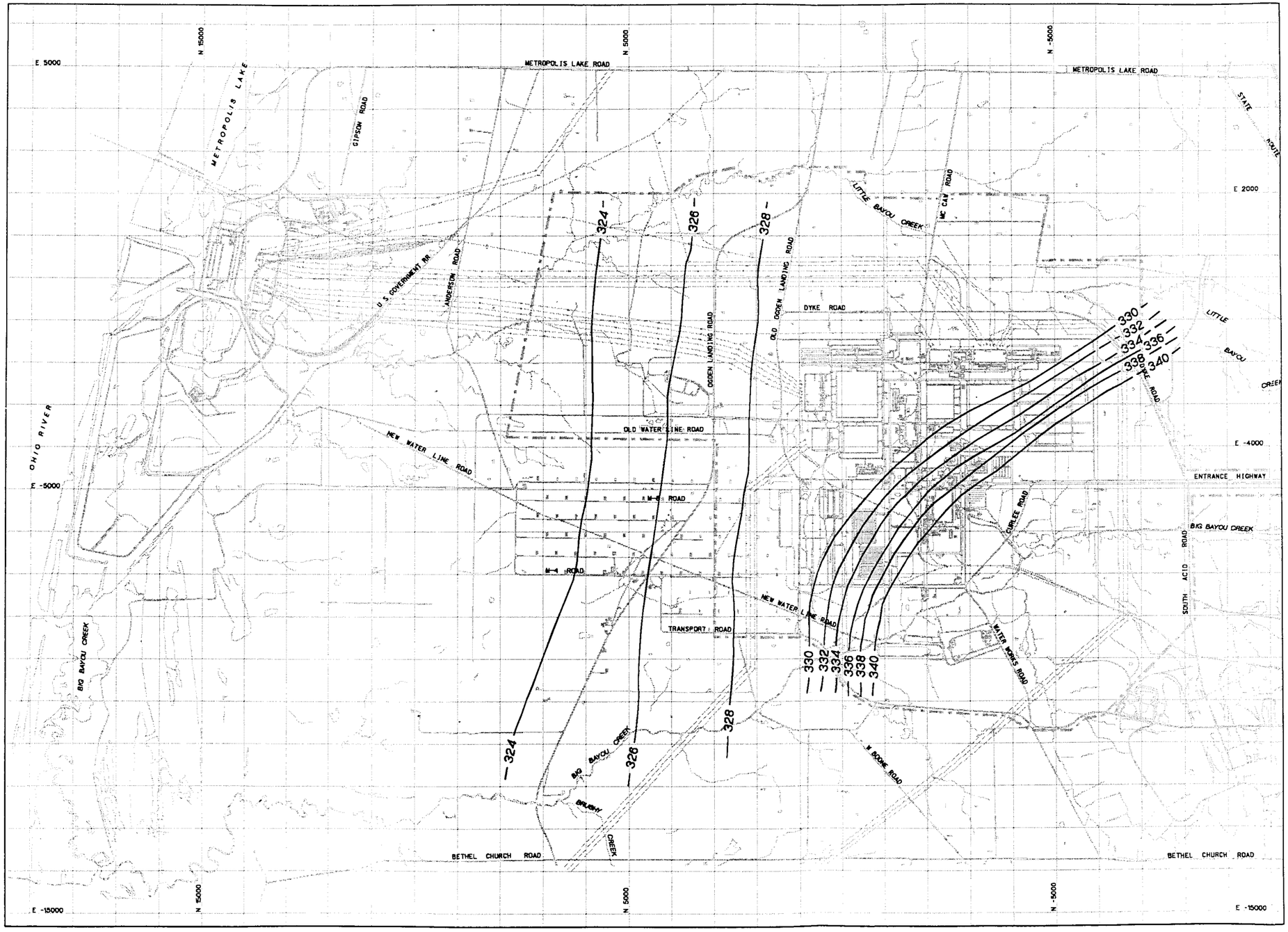

REVIEWED FOR CLASSIFICATION
WJS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 2 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 11-3
WATER LEVEL ELEVATIONS FOR THE DEEP GROUNDWATER SYSTEM-JUNE, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

TECHNICAL MEMORANDUM NO. 1J
PGDP PHASE II SITE INVESTIGATION

PREPARED BY: Greg Schaefer/ORO
Russell Lahoud/ORO

SUBJECT: Water Level Measurements, July 1991

PROJECT: ORO30888.FL

INTRODUCTION

PURPOSE AND SCOPE

Monthly water level measurements are planned for wells in and around the PGDP for a period of 1 year. This memorandum presents data collected July 15-16, 1991, from 130 wells.

FIELD PERSONNEL

The field personnel were:

Sample Team Leader (STL)	Greg Schaefer
Sample Team Members (STM)	Greg Ford, Dawn Geshwender, Russ Lahoud, Bruce Haas
Escort	Charles Leneave
Energy Systems Escort	Bruce Phillips
Site Safety Coordinator (SSC)	Greg Schaefer

METHODOLOGY

Measurements were taken with an electronic water level meter, measuring from the datum index, in compliance with "Task Instructions for Water Level Measurements, PGDP Phase II," as amended by the July monthly addendum.

TECHNICAL DATA

MEASUREMENTS

One hundred thirty of the scheduled 132 wells were measured. A key for MW-19 was not available, and TVA-11 could not be reached because the road was washed out. MW-69 and -176 were dry.

Measurement data are shown on Table 1J-1. Measurements were recorded on the data sheet and in field logbook 6.

QUALITY ASSURANCE/QUALITY CONTROL

The reported data sheet has been confirmed with the STL logbook.

FIELD MONITORING

The wells to be measured were coded for health and safety monitoring, and the following specifications were used to determine personal protective equipment worn by the sample team at each location. In addition, an SSC was present at all Type C wells. The guidelines for these codes were:

Present	Specifications	Protection
Type A	Non-elevated offsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type B	Non-elevated onsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type C	Wells in radiological exclusion zones or wells that have not been evaluated previously	Tyvek coveralls, booties, surgical gloves, hard hat, eye protection, and safety shoes

Health and safety monitoring was conducted by the SSC at designated Type C wells and by the STL and STM at the other wells.

DECONTAMINATION OF EQUIPMENT

Decontamination of the well sounder was performed in accordance with ESP 900 (Section V, a.1) and ESP 901.

WASTE MANAGEMENT

Only a small amount of waste in the form of surgical gloves, booties, and decontamination fluids was generated by this task. This waste was turned over to the SSC for containment and was given to Energy Systems after the completion of the task.

DISCUSSION

Figures 1J-1 through 1J-3 show an interpretation of the groundwater elevation in the DGS, the RGA, and the SGS.

Table 1J-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 1 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements July 1991		
				July DTW (ft)	Elevation (ft)	Remarks
PGDP Wells						
7	SGS	TOC	373.08	9.06	364.02	
19	RGA	TOC	364.46	---	---	No key for lock
23	DGS	TOC	373.64	16.43	357.21	
24	DGS	TOC	375.71	11.30	364.41	
25	SGS	TOC	380.02	0.14	379.88	
26	DGS	TOC	383.23	19.16	364.07	
27	DGS	TOC	381.59	16.63	364.96	
43	SGS	TOC	373.39	42.50	330.89	
52	RGA	TOC	372.29	41.76	330.53	
53	RGA	TOC	375.12	44.55	330.57	
54	RGA	TOC	373.91	43.42	330.49	
63	RGA	WWP	372.60	42.42	330.18	
64	SGS	WWP	372.60	9.76	362.84	
65	RGA	WWP	372.58	42.42	330.16	

Table 1J-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 2 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements July 1991		
				July DTW (ft)	Elevation (ft)	Remarks
68	RGA	WWP	379.72	48.40	331.32	
69	SGS	WWP	379.72	---	---	Dry
70	RGA	TOC	379.25	48.50	330.75	
71	RGA	WWP	379.72	48.39	331.33	
73	RGA	TOC	374.97	44.15	330.82	
74	SGS	TOC	375.06	21.28	353.78	
75	SGS	TOC	376.10	10.78	365.32	
77	RGA	TOC	377.16	45.98	331.18	
82	SGS	TOC	376.54	13.54	363.00	
83	SGS	TOC	376.59	15.20	361.39	
85	SGS	WWP	375.86	17.66	358.20	
88	SGS	WWP	375.74	16.85	358.89	
90	RGA	WWP	374.51	43.60	330.91	
91	SGS	WWP	374.48	12.63	361.85	
92	RGA	WWP	374.51	43.60	330.91	

Table 1J-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 3 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements July 1991		
				July DTW (ft)	Elevation (ft)	Remarks
93	RGA	WWP	377.61	46.52	331.09	
94	SGS	WWP	377.62	18.59	359.03	
95	RGA	WWP	377.62	46.54	331.08	
96	SGS	TOC*	377.32	34.11	343.21	
120	DGS	TOC	386.57	56.99	329.58	
121	DGS	TOC	374.70	52.01	322.69	
122	DGS	TOC	364.66	36.14	328.52	
123	RGA-SH	TOC	374.69	47.22	327.47	
124	RGA-DP	TOC	364.71	34.34	330.37	
125	RGA-DP	TOC	374.89	47.44	327.45	
126	RGA-SH	TOC	364.02	33.64	330.38	
127	SGS	TOC	374.81	23.95	350.86	
128	SGS	TOC	364.38	29.55	334.83	
129	SGS	TOC	386.14	12.16	373.98	
130	SGS	TOC	386.03	11.90	374.13	

Table 1J-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 4 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements July 1991		
				July DTW (ft)	Elevation (ft)	Remarks
131	SGS	TOC	385.77	11.65	374.12	
132	RGA-DP	TOC	362.83	35.36	327.47	
133	RGA-DP	TOC	336.93	12.47	324.46	
134	RGA-DP	TOC	368.20	39.41	328.79	
135	RGA-DP	TOC	335.94	12.00	323.94	
137	RGA-SH	TOC	335.69	11.78	323.91	
138	SGS	TOC	335.57	10.22	325.35	
139	RGA-SH	TOC	363.17	35.70	327.47	
140	DGS	TOC	344.12	20.02	324.10	
141	RGA-DP	TOC	344.86	16.32	328.54	
142	RGA-SH	TOC	345.04	16.54	328.50	
143	SGS	TOC	345.37	12.80	332.57	
144	RGA-DP	TOC	379.89	49.02	330.87	
145	RGA-SH	TOC	380.08	49.16	330.92	
146	RGA-DP	TOC	352.91	31.04	321.87	

Table 1J-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 5 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements July 1991		
				July DTW (ft)	Elevation (ft)	Remarks
147	RGA-SH	TOC	353.08	31.20	321.88	
148	RGA-DP	TOC	373.35	45.54	327.81	
149	SGS	TOC	373.87	45.05	328.82	
150	RGA-DP	TOC	376.60	47.22	329.38	
151	SGS	TOC	382.56	17.20	365.36	
152	RGA-DP	TOC	353.36	36.34	317.02	
153	SGS	TOC	353.10	36.88	316.22	
154	SGS	TOC	374.49	9.64	364.85	
155	RGA-DP	TOC	381.25	49.95	331.30	
156	RGA-SH	TOC	382.06	50.73	331.33	
157	SGS	TOC	381.56	32.94	340.78	
158	RGA-DP	TOC	373.72	42.64	331.18	
159	RGA-SH	TOC	373.82	42.74	330.82	
160	SGS	TOC	373.56	8.85	364.70	
161	RGA-SH	TOC	373.55	42.40	331.77	

Table 1J-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 6 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements July 1991		
				July DTW (ft)	Elevation (ft)	Remarks
162	SGS	TOC	374.17	12.62	373.52	
163	RGA-SH	TOC	386.14	54.90	331.39	
164	SGS	TOC	386.29	45.78	333.96	
165	RGA-SH	TOC	379.74	48.77	331.30	
166	SGS	TOC	380.07	37.16	339.20	
167	SGS	TOC	376.36	7.31	370.11	
168	RGA-SH	TOC	377.42	46.54	330.88	
169	RGA-SH	TOC	373.41	42.73	330.68	
170	SGS	TOC	373.98	9.40	364.58	
171	SGS	TOC	374.63	7.32	367.31	
172	SGS	TOC	373.79	8.82	364.97	
173	RGA-SH	TOC	373.30	42.50	330.80	
174	SGS	TOC	373.29	8.17	365.12	
175	RGA-SH	TOC	381.18	49.88	331.30	
176	SGS	TOC	381.23	---	---	Dry

Table 1J-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 7 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements July 1991		
				July DTW (ft)	Elevation (ft)	Remarks
177	SGS	TOC	379.74	47.53	332.21	
178	RGA-SH	TOC	378.80	46.46	332.34	
179	RGA-SH	TOC	358.60	29.42	329.18	
180	SGS	TOC	358.11	17.43	340.68	
181	RGA-SH	TOC	370.84	41.14	329.70	
182	SGS	TOC	371.15	15.32	355.83	
184	SGS	TOC	373.19	13.93	359.26	
185	RGA-SH	TOC	373.64	43.30	330.34	
186	SGS	TOC	373.62	7.64	365.98	
187	SGS	TOC	373.24	8.17	365.07	
188	RGA-SH	TOC	374.24	43.10	331.14	
189	SGS	TOC	375.50	18.79	356.71	
190	SGS	TOC	373.21	4.96	368.25	
191	RGA-SH	TOC	360.00	29.74	330.26	
192	SGS	TOC	359.04	28.60	330.44	

Table 1J-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 8 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements July 1991		
				July DTW (ft)	Elevation (ft)	Remarks
193	RGA-SH	TOC	367.85	37.76	330.09	
194	RGA-SH	TOC	356.21	26.55	329.66	
195	SGS	TOC	356.21	13.06	343.15	
196	SGS	TOC	368.12	11.79	356.33	
197	RGA-SH	TOC	368.24	38.82	329.42	
198	SGS	TOC	368.24	19.79	348.45	
199	RGA-SH	TOC	353.00	30.02	322.98	
200	RGA-SH	TOC	378.27	49.56	328.71	
201	RGA-SH	TOC	364.51	41.59	322.92	
202	RGA-SH	TOC	372.60	45.86	326.74	
203	RGA-SH	TOC	376.23	46.22	330.01	
204	SGS	TOC	377.73	40.38	337.35	
205	RGA-SH	TOC	379.75	48.86	330.89	
206	RGA-SH	TOC	385.14	53.83	331.31	

Table 1J-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 9 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements July 1991		
				July DTW (ft)	Elevation (ft)	Remarks
TVA Wells						
TVA-3	RGA	TOC	361.78	39.30	322.48	
TVA-4	RGA	TOC	336.55	15.45	321.10	
TVA-5	RGA	TOC	332.35	11.25	321.10	
TVA-6	RGA	TOC	328.58	9.20	319.38	
TVA-9	RGA	TOC	348.13	27.43	320.70	
TVA-11	RGA	TOC	321.36	---	---	Road out
TVA-13	RGA	TOC	332.64	5.90	326.74	
TVA-14	RGA	TOC	354.66	34.48	320.18	
TVA-17	RGA	TOC	365.42	46.59	318.83	
TVA-19	RGA	TOC	363.19	42.00	321.19	
TVA-24	RGA	TOC	358.73	42.66	316.07	

Table 1J-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 10 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements July 1991		
				July DTW (ft)	Elevation (ft)	Remarks
TVA-25	RGA	TOC	353.38	35.28	318.10	
TVA-27	RGA	TOC	353.61	36.56	317.05	
TVA-28	RGA	TOC	363.81	48.50	315.31	

Elev = Elevation from USC&GS first order monuments.
DTW = Depth to water from datum.
TOC = Top of innermost casing or riser, excluding pump discharge risers. The surveyed reference datum is a mark or notch on the north edge of the inner casing.
WWP = Well Wizard head plate on older funnel-shaped, exterior Well Wizard cap.
TOC* = Square stainless steel outer casing; 50 yd due south of MW-68 through -71 in open field.

Lithology:

SGS = Shallow Groundwater System
RGA = Regional Gravel Aquifer
RGA-SH = Regional Gravel Aquifer (shallow)
RGA-DP = Regional Gravel Aquifer (deep)
DGS = Deep Groundwater System

These plots are intended as a general representation of the subsurface hydrology only. They are characterized by a relatively small number of data points. The recharging and discharging reaches of Big Bayou Creek, Little Bayou Creek, and any of the onsite ditches have not been accounted for. These factors could strongly affect the shallow groundwater system near these features.

The hydrologic setting around the PGDP is discussed in TM No. 1A.

Deep Groundwater System

Figure 1J-3 shows the same general north-northeast flow trends and water level elevations for the DGS as observed in previous months.

The hydraulic gradients for July in the DGS range from 0.008 at the terrace feature at the southwestern portion of the site to a value of 0.0009 north of Ogden Landing Road.

Regional Gravel Aquifer

Figure 1J-2 shows the same north-northeast flow pattern observed in earlier months. The overall water level elevation in the RGA dropped approximately 1 foot beneath the site. The main physical feature from previous maps that recurs is the isolated piezometric mound near the C-400 Building (although this mound is smaller in diameter than it was in June). The mound has a water level elevation that is approximately 1.5 feet higher than that of surrounding water levels.

Hydraulic gradients increase from beneath the plant (0.0004) to approximately 0.0008 north of Ogden Landing Road.

Shallow Groundwater System

In the SGS for July, two main physical features are defined (Figure 1J-1): (1) the large northeast-trending trough beneath the eastern portion of the site, and (2) two distinct piezometric mounds in the northwest corner of the plant. A small piezometric mound is also defined beneath the North Sanitary Landfill. The water level elevations and north-northeast flow trends are principally the same as were observed in previous months.

Relatively high hydraulic gradients (0.008) exist beneath the plant and decrease to approximate values of 0.004 (north of Ogden Landing Road) and 0.002 (near the TVA plant). The gradient declines to a value of 0.0007 north of the C-616-F lagoon.

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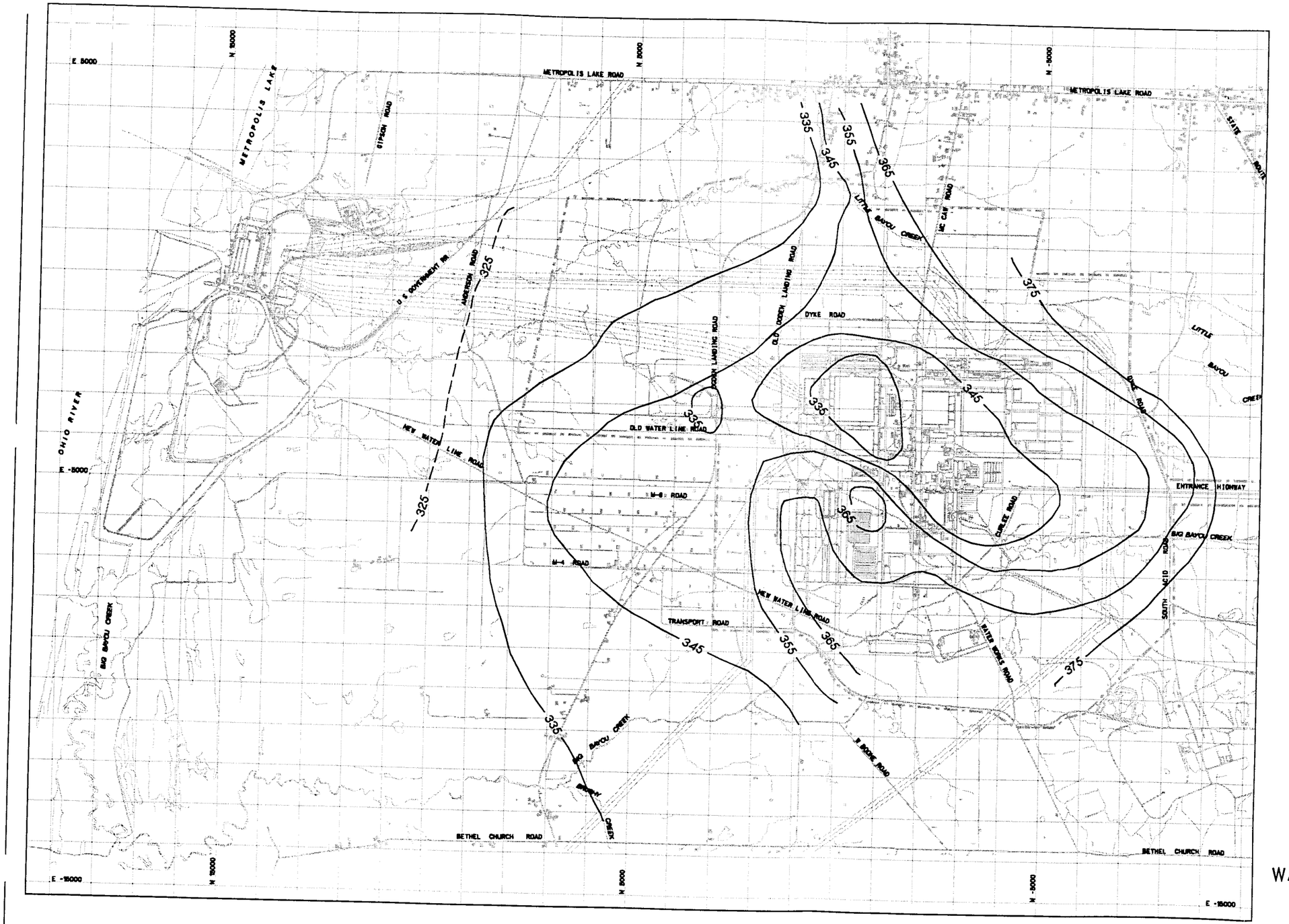

REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- —325— CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL =10 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1J-1
WATER LEVEL ELEVATIONS FOR THE SHALLOW GROUNDWATER SYSTEM, JULY 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

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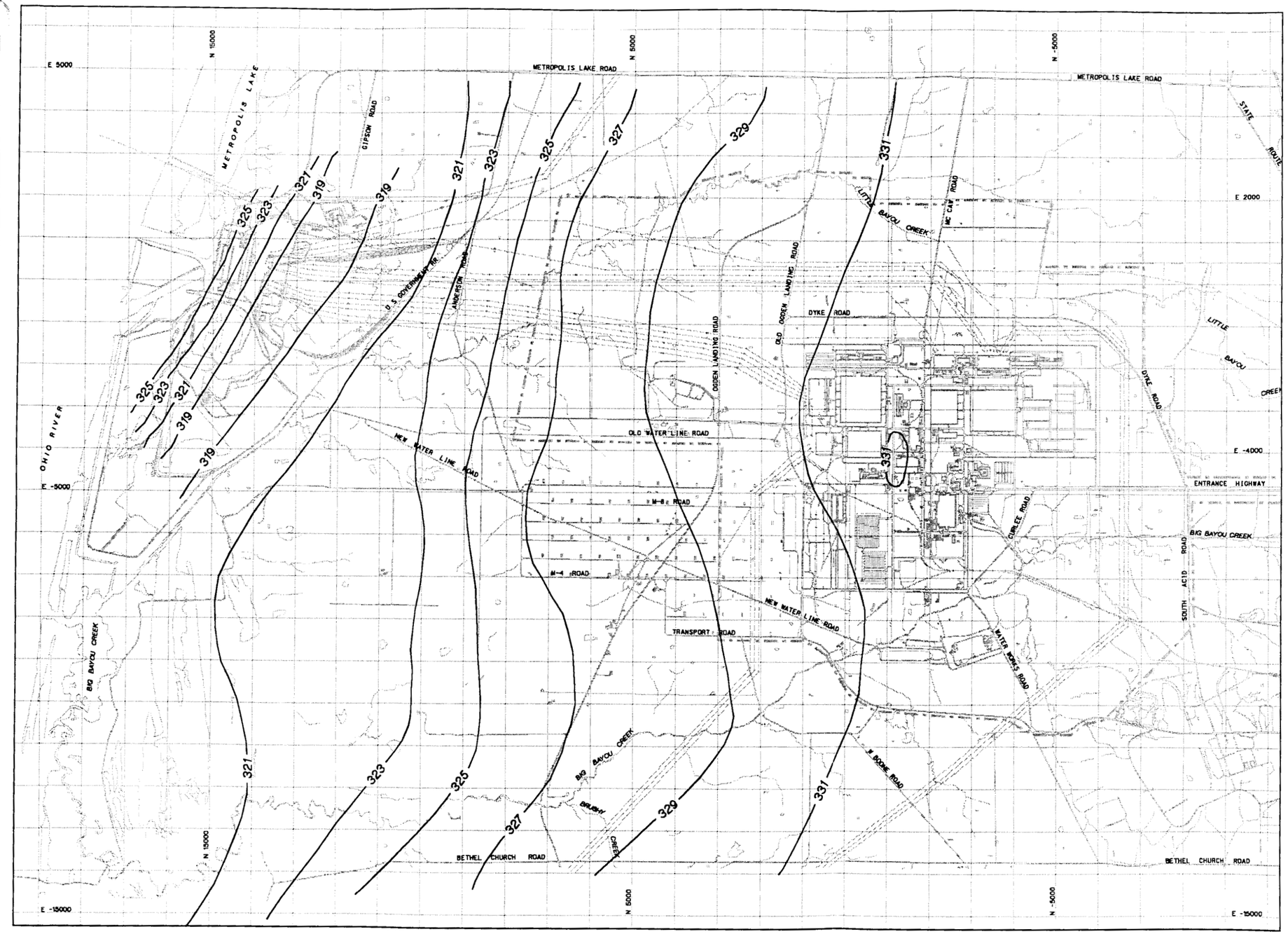

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WDS 2/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- —325— CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 2 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1J-2
WATER LEVEL ELEVATIONS FOR THE REGIONAL GRAVEL AQUIFER-JULY,1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

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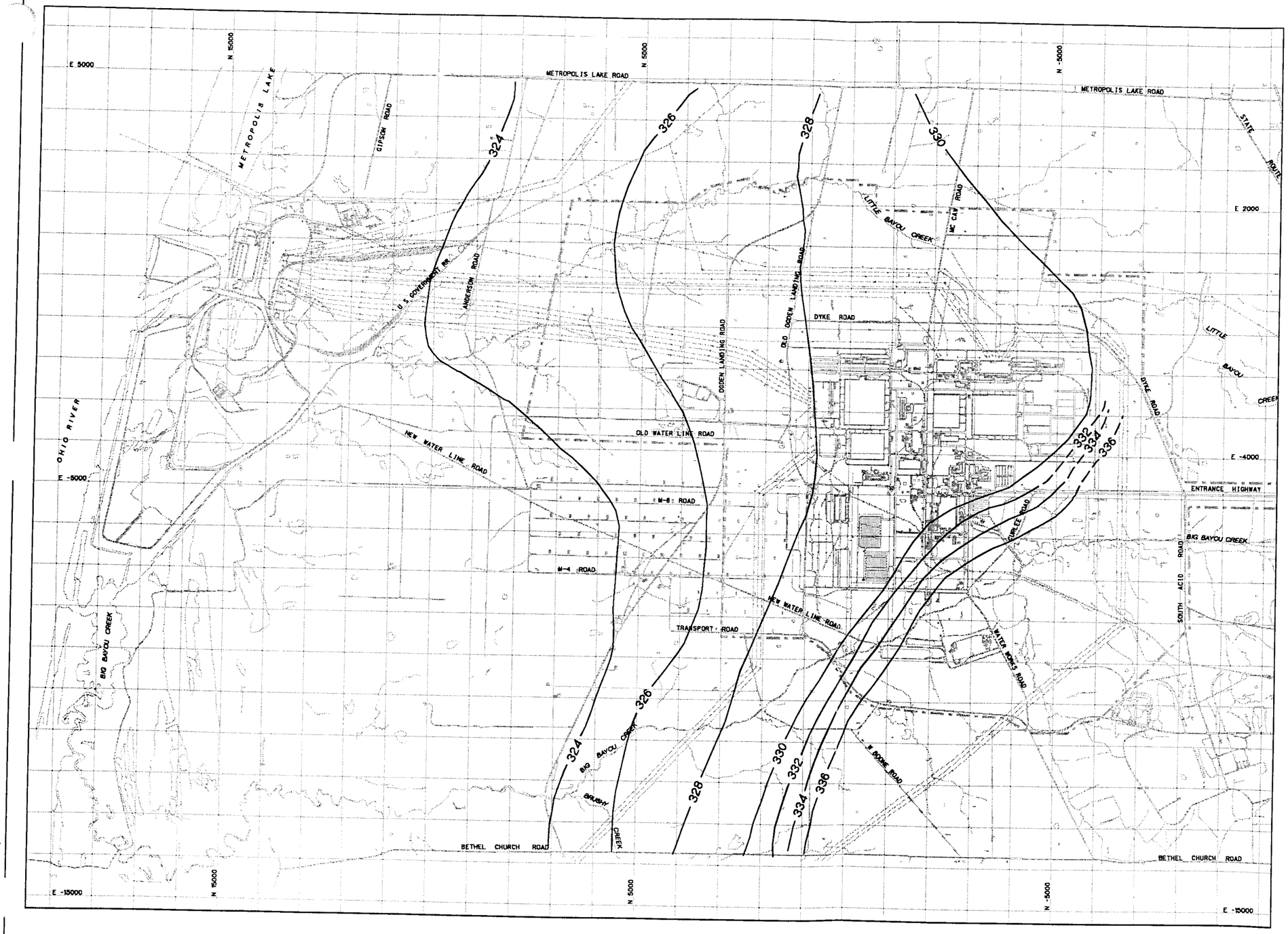

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Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 2 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1J-3
WATER LEVEL ELEVATIONS FOR THE DEEP GROUNDWATER SYSTEM-JULY, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

TECHNICAL MEMORANDUM NO. 1K
PGDP PHASE II SITE INVESTIGATION

PREPARED BY: Greg Schaefer/ORO
Russell Lahoud/ORO

SUBJECT: Water Level Measurements, August 1991

PROJECT: ORO30888.FL

INTRODUCTION

PURPOSE AND SCOPE

Monthly water level measurements are planned for wells in and around the PGDP for a period of 1 year. This memorandum presents data collected August 12-13, 1991, from 130 wells.

FIELD PERSONNEL

The field personnel were:

Sample Team Leader (STL)	Greg Schaefer
Sample Team Members (STM)	Greg Ford, Byron Souza
Escort	Charles Leneave
Energy Systems Escort	Ken Davis
Site Safety Coordinator (SSC)	Greg Schaefer

METHODOLOGY

Measurements were taken with an electronic water level meter, measuring from the datum index, in compliance with "Task Instructions for Water Level Measurements, PGDP Phase II," as amended by the August monthly addendum.

TECHNICAL DATA

MEASUREMENTS

One hundred thirty of the scheduled 132 wells were measured. A key for MW-19 was not available, and TVA-11 could not be reached because the road was washed out. MW-69, -153, -176, and -177 were dry.

Measurement data are shown on Table 1K-1. Measurements were recorded on the data sheet and in field logbooks 6 and 89.

Table 1K-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 1 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements August 1991		
				August DTW (ft)	Elevation (ft)	Remarks
PGDP Wells						
7	SGS	TOC	373.08	10.09	362.99	
19	RGA	TOC	364.46	---	---	No key for lock
23	DGS	TOC	373.64	16.50	357.14	
24	DGS	TOC	375.71	13.32	362.39	
25	SGS	TOC	380.02	0.14	379.88	
26	DGS	TOC	383.23	23.70	359.53	
27	DGS	TOC	381.59	16.92	364.67	
43	SGS	TOC	373.39	44.00	329.39	
52	RGA	TOC	372.29	43.21	329.08	
53	RGA	TOC	375.12	46.02	329.10	
54	RGA	TOC	373.91	44.87	329.04	
63	RGA	WWP	372.60	43.84	328.76	
64	SGS	WWP	372.60	8.42	364.18	
65	RGA	WWP	372.58	43.83	328.75	

Table 1K-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 2 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements August 1991		
				August DTW (ft)	Elevation (ft)	Remarks
68	RGA	WWP	379.72	49.64	330.08	
69	SGS	WWP	379.72	---	---	Dry
70	RGA	TOC	379.25	49.10	330.15	
71	RGA	WWP	379.72	49.64	330.08	
73	RGA	TOC	374.97	45.46	329.51	
74	SGS	TOC	375.06	21.12	353.94	
75	SGS	TOC	376.10	10.94	365.16	
77	RGA	TOC	377.16	47.23	329.93	
82	SGS	TOC	376.54	13.60	362.94	
83	SGS	TOC	376.59	15.14	361.45	
85	SGS	WWP	375.86	17.46	358.40	
88	SGS	WWP	375.74	16.73	359.01	
90	RGA	WWP	374.51	44.92	329.59	
91	SGS	WWP	374.48	12.47	362.01	
92	RGA	WWP	374.51	44.90	329.61	

Table 1K-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 3 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements August 1991		
				August DTW (ft)	Elevation (ft)	Remarks
93	RGA	WWP	377.61	47.80	329.81	
94	SGS	WWP	377.62	18.55	359.07	
95	RGA	WWP	377.62	47.85	329.77	
96	SGS	TOC*	377.32	34.11	343.21	
120	DGS	TOC	386.57	57.76	328.81	
121	DGS	TOC	374.70	53.28	321.42	
122	DGS	TOC	364.66	37.14	327.52	
123	RGA-SH	TOC	374.69	48.74	325.95	
124	RGA-DP	TOC	364.71	35.70	329.01	
125	RGA-DP	TOC	374.89	48.95	325.94	
126	RGA-SH	TOC	364.02	35.20	328.82	
127	SGS	TOC	374.81	24.28	350.53	
128	SGS	TOC	364.38	30.94	333.44	
129	SGS	TOC	386.14	13.60	372.54	
130	SGS	TOC	386.03	13.34	372.69	

Table 1K-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 4 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements August 1991		
				August DTW (ft)	Elevation (ft)	Remarks
131	SGS	TOC	385.77	13.11	372.66	
132	RGA-DP	TOC	362.83	36.86	325.97	
133	RGA-DP	TOC	336.93	13.88	323.05	
134	RGA-DP	TOC	368.20	40.94	327.26	
135	RGA-DP	TOC	335.94	13.44	322.50	
137	RGA-SH	TOC	335.69	13.22	322.47	
138	SGS	TOC	335.57	11.49	324.08	
139	RGA-SH	TOC	363.17	37.20	325.97	
140	DGS	TOC	344.12	21.38	322.74	
141	RGA-DP	TOC	344.86	17.90	326.96	
142	RGA-SH	TOC	345.04	18.10	326.94	
143	SGS	TOC	345.37	12.85	332.52	
144	RGA-DP	TOC	379.89	60.35	319.54	
145	RGA-SH	TOC	380.08	60.50	319.58	
146	RGA-DP	TOC	352.91	32.32	320.59	

Table 1K-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 5 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements August 1991		
				August DTW (ft)	Elevation (ft)	Remarks
147	RGA-SH	TOC	353.08	32.46	320.62	
148	RGA-DP	TOC	373.35	47.00	326.35	
149	SGS	TOC	373.87	47.52	326.35	
150	RGA-DP	TOC	376.60	47.68	328.92	
151	SGS	TOC	382.56	19.06	363.50	
152	RGA-DP	TOC	353.36	37.78	315.58	
153	SGS	TOC	353.10	---	---	Dry
154	SGS	TOC	374.49	10.80	363.69	
155	RGA-DP	TOC	381.25	51.19	330.06	
156	RGA-SH	TOC	382.06	52.00	330.06	
157	SGS	TOC	381.56	34.19	339.53	
158	RGA-DP	TOC	373.72	43.99	329.83	
159	RGA-SH	TOC	373.82	44.05	329.51	
160	SGS	TOC	373.56	9.45	364.10	
161	RGA-SH	TOC	373.55	43.71	330.46	

Table 1K-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 6 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements August 1991		
				August DTW (ft)	Elevation (ft)	Remarks
162	SGS	TOC	374.17	13.32	372.82	
163	RGA-SH	TOC	386.14	56.18	330.11	
164	SGS	TOC	386.29	47.14	332.60	
165	RGA-SH	TOC	379.74	50.08	329.99	
166	SGS	TOC	380.07	38.72	337.64	
167	SGS	TOC	376.36	7.56	369.86	
168	RGA-SH	TOC	377.42	47.85	329.57	
169	RGA-SH	TOC	373.41	44.07	329.34	
170	SGS	TOC	373.98	10.02	363.96	
171	SGS	TOC	374.63	8.39	366.24	
172	SGS	TOC	373.79	9.37	364.42	
173	RGA-SH	TOC	373.30	43.88	329.42	
174	SGS	TOC	373.29	8.44	364.85	
175	RGA-SH	TOC	381.18	51.20	329.98	
176	SGS	TOC	381.23	---	---	Dry

Table 1K-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 7 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements August 1991		
				August DTW (ft)	Elevation (ft)	Remarks
177	SGS	TOC	379.74	---	---	Dry
178	RGA-SH	TOC	378.80	48.86	329.94	
179	RGA-SH	TOC	358.60	30.88	327.72	
180	SGS	TOC	358.11	16.58	341.53	
181	RGA-SH	TOC	370.84	42.56	328.28	
182	SGS	TOC	371.15	16.96	354.19	
184	SGS	TOC	373.19	14.00	359.19	
185	RGA-SH	TOC	373.64	44.70	328.94	
186	SGS	TOC	373.62	8.07	365.55	
187	SGS	TOC	373.24	8.78	364.46	
188	RGA-SH	TOC	374.24	44.42	329.82	
189	SGS	TOC	375.50	19.66	355.84	
190	SGS	TOC	373.21	5.76	367.45	
191	RGA-SH	TOC	360.00	31.14	328.86	
192	SGS	TOC	359.04	29.96	329.08	

Table 1K-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 8 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements August 1991		
				August DTW (ft)	Elevation (ft)	Remarks
193	RGA-SH	TOC	367.85	39.20	328.65	
194	RGA-SH	TOC	356.21	28.02	328.19	
195	SGS	TOC	356.21	13.36	342.85	
196	SGS	TOC	368.12	13.34	354.78	
197	RGA-SH	TOC	368.24	40.32	327.92	
198	SGS	TOC	368.24	23.38	344.86	
199	RGA-SH	TOC	353.00	31.58	321.42	
200	RGA-SH	TOC	378.27	51.00	327.27	
201	RGA-SH	TOC	364.51	42.97	321.54	
202	RGA-SH	TOC	372.60	47.40	325.20	
203	RGA-SH	TOC	376.23	47.55	328.68	
204	SGS	TOC	377.73	41.05	336.68	
205	SGS	TOC	397.75	50.17	329.58	
206	RGA-SH	TOC	385.14	55.12	330.02	

Table 1K-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 9 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements August 1991		
				August DTW (ft)	Elevation (ft)	Remarks
TVA Wells						
TVA-3	RGA	TOC	361.78	40.54	321.24	
TVA-4	RGA	TOC	336.55	16.58	319.97	
TVA-5	RGA	TOC	332.35	12.90	319.45	
TVA-6	RGA	TOC	328.58	10.32	318.26	
TVA-9	RGA	TOC	348.13	28.40	319.73	
TVA-11	RGA	TOC	321.36	---	---	Road out
TVA-13	RGA	TOC	332.64	5.86	326.78	
TVA-14	RGA	TOC	354.66	35.50	319.16	
TVA-17	RGA	TOC	365.42	48.14	317.28	
TVA-19	RGA	TOC	363.19	42.90	320.29	
TVA-24	RGA	TOC	358.73	44.22	314.51	

Table 1K-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 10 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements August 1991		
				August DTW (ft)	Elevation (ft)	Remarks
TVA-25	RGA	TOC	353.38	36.62	316.76	
TVA-27	RGA	TOC	353.61	38.20	315.41	
TVA-28	RGA	TOC	363.81	49.80	314.01	

Elev = Elevation from USC&GS first order monuments.
DTW = Depth to water from datum.
TOC = Top of innermost casing or riser, excluding pump discharge risers. The surveyed reference datum is a mark or notch on the north edge of the inner casing.
WWP = Well Wizard head plate on older funnel-shaped, exterior Well Wizard cap.
TOC* = Square stainless steel outer casing; 50 yd due south of MW-68 through -71 in open field.

Lithology:

SGS = Shallow Groundwater System
RGA = Regional Gravel Aquifer
RGA-SH = Regional Gravel Aquifer (shallow)
RGA-DP = Regional Gravel Aquifer (deep)
DGS = Deep Groundwater System

QUALITY ASSURANCE/QUALITY CONTROL

The reported data sheet has been confirmed with the STL logbooks.

FIELD MONITORING

The wells to be measured were coded for health and safety monitoring, and the following specifications were used to determine personal protective equipment worn by the sample team at each location. In addition, an SSC was present at all Type C wells. The guidelines for these codes were:

Present	Specifications	Protection
Type A	Non-elevated offsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type B	Non-elevated onsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type C	Wells in radiological exclusion zones or wells that have not been evaluated previously	Tyvek coveralls, booties, surgical gloves, hard hat, eye protection, and safety shoes

Health and safety monitoring was conducted by the SSC at designated Type C wells and by the STM at the other wells.

DECONTAMINATION OF EQUIPMENT

Decontamination of the well sounder was performed in accordance with ESP 900 (Section V, a.1) and ESP 901.

WASTE MANAGEMENT

Only a small amount of waste in the form of surgical gloves, booties, and decontamination fluids was generated by this task. This waste was turned over to the SSC for containment and was given to Energy Systems after the completion of the task.

DISCUSSION

Figures 1K-1 through 1K-3 show an interpretation of the groundwater elevation in the DGS, the RGA, and the SGS.

The hydrologic setting around the PGDP is discussed in TM No. 1A.

Deep Groundwater System

Figure 1K-3 shows that the north-northeast flow pattern and water level elevations for the DGS are similar to what was observed in previous months. MW-120, -121, -122, and -140 control the major contours on the plot.

The DGS hydraulic gradients for August range from relatively high values near the southwestern terrace deposits (0.01) to a lesser gradient of 0.001 north of Ogden Landing Road, and 0.0001 east of the plant.

Regional Gravel Aquifer

Figure 1K-2 shows that the flow pattern toward the river is similar to what was observed in previous months. The reversal of the hydraulic gradient adjacent to the Ohio River is again defined, along with the piezometric mound beneath the center of the plant. The overall water level elevation beneath the site dropped approximately 1 foot in August.

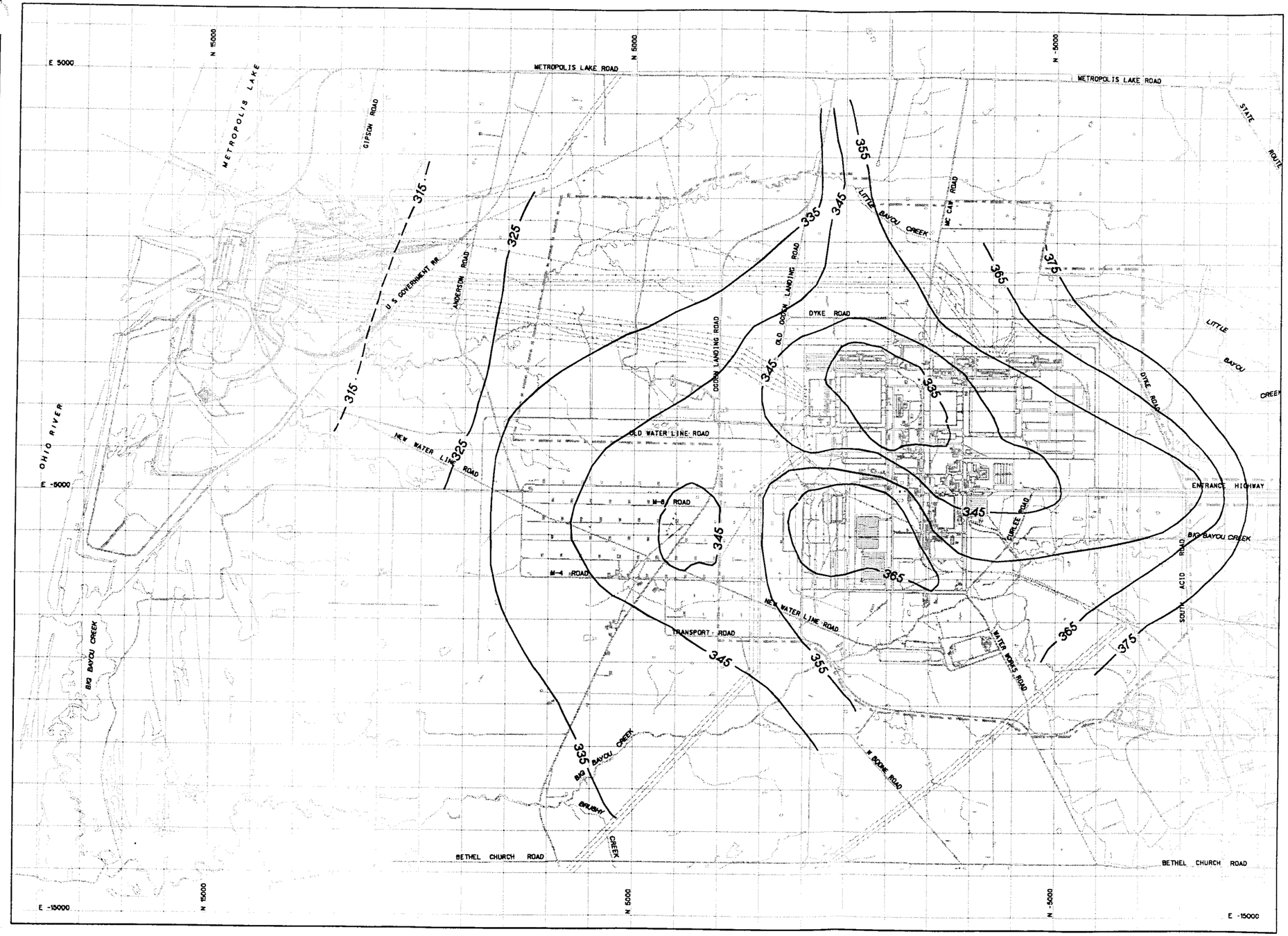
Hydraulic gradients in the RGA for August range from 0.0003 beneath the plant to an increase of 0.0008 north of Ogden Landing Road. The gradient is relatively high (0.006) adjacent to the Ohio River.

Shallow Groundwater System

Figure 1K-1 shows three distinct physical features in the SGS that were observed in August: (1) a northeast-trending trough beneath the plant, (2) a piezometric mound beneath the northwest corner of the plant, and (3) a depression (approximately 10 ft) in the water level elevations north of the C-616-F lagoon. The general water level elevations and northeast flow trends are similar to what was observed in previous months.

Hydraulic gradient values range from 0.007 beneath the plant, to 0.005 north of Ogden Landing Road, to 0.001 north of the C-616-F lagoon, all flowing easterly.

0888tm63.dgn 29-Aug-1991



REVIEWED FOR CLASSIFICATION
WJS 7-9-03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- —325— CONTOUR OF WATER LEVEL ELEVATIONS

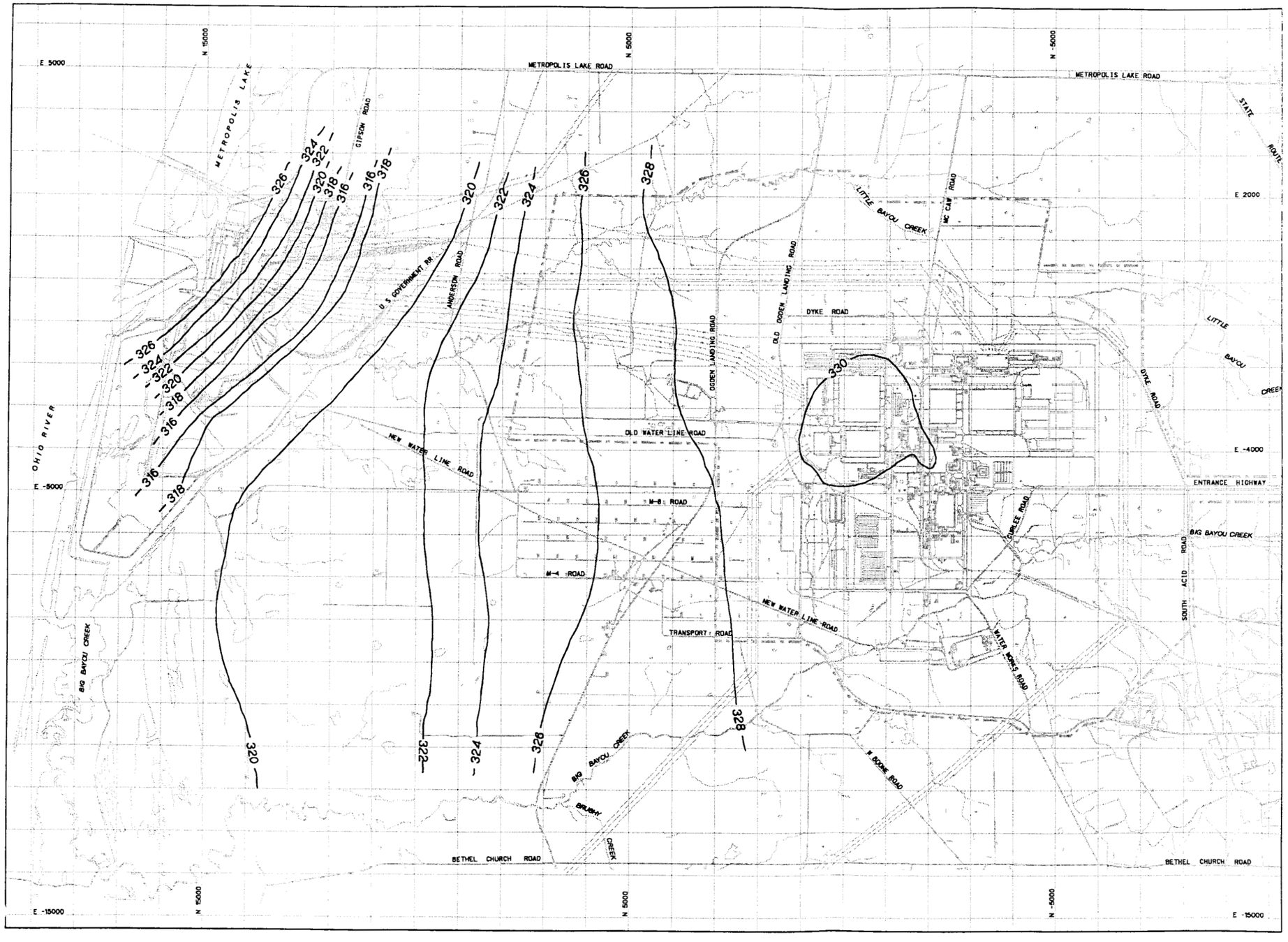
CONTOUR INTERVAL =10 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1K-1
WATER LEVEL ELEVATIONS FOR THE SHALLOW GROUNDWATER SYSTEM-AUGUST,1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0888tm64.dgn 28-Aug-1991



REVIEWED FOR CLASSIFICATION
WDS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

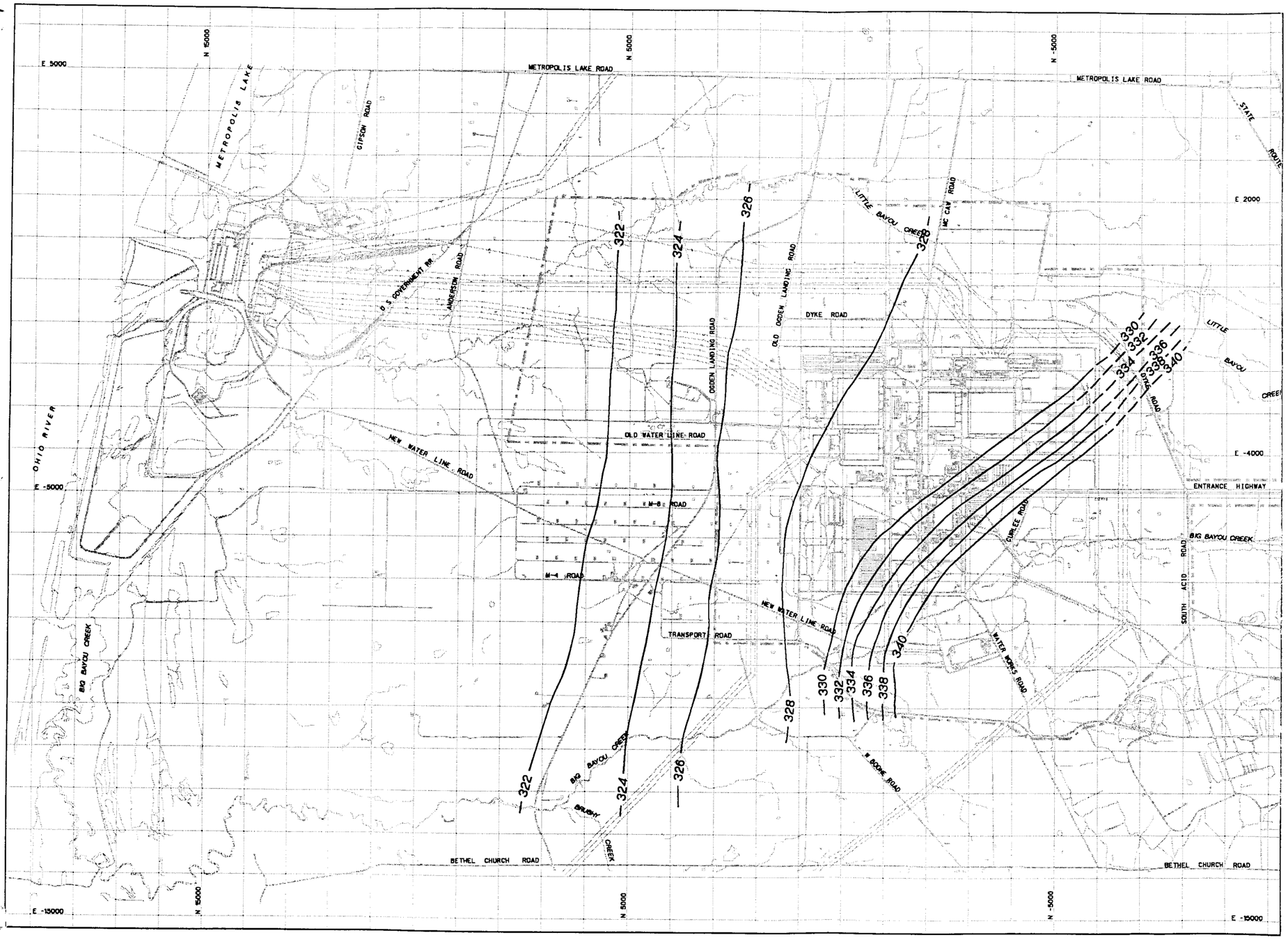
CONTOUR INTERVAL = 2 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1" = 2500'

Figure 1K-2
WATER LEVEL ELEVATIONS FOR THE REGIONAL GRAVEL AQUIFER-AUGUST, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0888tm65.dgn 28-Aug-1991



REVIEWED FOR CLASSIFICATION
LWD 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS
- — 326 — CONTOUR OF WATER LEVEL ELEVATIONS

CONTOUR INTERVAL = 2 ft

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1K-3
WATER LEVEL ELEVATIONS FOR THE DEEP GROUNDWATER SYSTEM-AUGUST, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

TECHNICAL MEMORANDUM NO. 1L
PGDP PHASE II SITE INVESTIGATION

PREPARED BY: Greg Schaefer/ORO
Russ Lahoud/ORO

SUBJECT: Water Level Measurements, September 1991

PROJECT: ORO30888.FL

INTRODUCTION

PURPOSE AND SCOPE

Monthly water level measurements were planned for wells in and around the PGDP for a period of 1 year. This memorandum presents data collected on September 16, 1991, from 129 wells.

FIELD PERSONNEL

The field personnel were:

Sample Team Leader (STL)	Greg Schaefer
Sample Team Members (STM)	Greg Ford
	Dawn Geshwender
	Byron Souza
	Bruce York
Energy Systems Escort	Ken Davis
Security Escort	Charles Leneave
Site Safety Coordinator (SSC)	Greg Schaefer

METHODOLOGY

Measurements were taken with an electronic water level meter, measuring from the top of the datum index, in compliance with "Task Instructions for Water Level Measurements, PGDP Phase II," as amended by the September monthly addendum.

TECHNICAL DATA

MEASUREMENTS

One hundred twenty-nine of the scheduled 132 wells were measured. The sample team was unable to gain entry into MW-19 and MW-43 due to lock changes. TVA-d11 was unaccessible due to a washed out road. MW-69, -153, -176, and -177 were dry.

Measurement data are shown on Table 1L-1. Measurements were recorded on the data sheet and in field logbooks 6, 89, and 91.

QUALITY ASSURANCE/QUALITY CONTROL

The reported data sheet has been confirmed with the STL logbook.

FIELD MONITORING

The wells to be measured were coded for health and safety monitoring, and the following specifications were used to determine personal protective equipment worn by the sample team at each location. In addition, the SSC was present during the work at all Type C wells. The guidelines for these codes were:

Present	Specifications	Protection
Type A	Non-elevated offsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type B	Non-elevated onsite wells	Surgical gloves, hard hat, eye protection, and safety shoes
Type C	Wells in radiological exclusion zones or wells that have not been evaluated previously	Tyvek coveralls, booties, surgical gloves, hard hat, eye protection, and safety shoes

Health and safety monitoring was conducted by the SSC at designated Type C wells and by the STL and STM at the other wells.

DECONTAMINATION OF EQUIPMENT

Decontamination of equipment was performed in accordance with ESP 900 (Section V, a.1) and ESP 901.

WASTE MANAGEMENT

Only a small amount of waste was generated by this task. This waste was turned over to the SSC for containment and was then given to Energy Systems after the completion of the task.

Table 1L-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 1 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements September 1991		
				September DTW (ft)	Elevation (ft)	Remarks
PGDP Wells						
7	SGS	TOC	373.08	11.12	361.96	
19	RGA	TOC	364.46	---	---	Changed lock
23	DGS	TOC	373.64	16.60	357.04	
24	DGS	TOC	375.71	11.38	364.33	
25	SGS	TOC	380.02	0.00	380.02	
26	DGS	TOC	383.23	32.14	351.09	
27	DGS	TOC	381.59	17.50	364.09	
43	SGS	TOC	373.39	---	---	Changed lock
52	RGA	TOC	372.29	44.78	327.51	
53	RGA	TOC	375.12	47.56	327.56	
54	RGA	TOC	373.91	46.43	327.48	
63	RGA	WWP	372.60	45.45	327.15	
64	SGS	WWP	372.60	8.95	363.65	
65	RGA	WWP	372.58	45.46	327.12	

Table 1L-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 2 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements September 1991		
				September DTW (ft)	Elevation (ft)	Remarks
68	RGA	WWP	379.72	51.21	328.51	
69	SGS	WWP	379.72	---	---	Dry
70	RGA	TOC	379.25	50.62	328.63	
71	RGA	WWP	379.72	51.21	328.51	
73	RGA	TOC	374.97	47.03	327.94	
74	SGS	TOC	375.06	20.89	354.17	
75	SGS	TOC	376.10	9.99	366.11	
77	RGA	TOC	377.16	48.78	328.38	
82	SGS	TOC	376.54	13.57	362.97	
83	SGS	TOC	376.59	15.04	361.55	
85	SGS	WWP	375.86	17.24	358.62	
88	SGS	WWP	375.74	16.50	359.24	
90	RGA	WWP	374.51	46.46	328.05	
91	SGS	WWP	374.48	12.28	362.20	
92	RGA	WWP	374.51	46.45	328.06	

Table 1L-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 3 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements September 1991		
				September DTW (ft)	Elevation (ft)	Remarks
93	RGA	WWP	377.61	49.35	328.26	
94	SGS	WWP	377.62	18.51	359.11	
95	RGA	WWP	377.62	49.40	328.22	
96	SGS	TOC*	377.32	34.27	343.05	
120	DGS	TOC	386.57	58.81	327.76	
121	DGS	TOC	374.70	53.92	320.78	
122	DGS	TOC	364.66	38.40	326.26	
123	RGA-SH	TOC	374.69	50.26	324.43	
124	RGA-DP	TOC	364.71	37.30	327.41	
125	RGA-DP	TOC	374.89	50.50	324.39	
126	RGA-SH	TOC	364.02	36.86	327.16	
127	SGS	TOC	374.81	25.00	349.81	
128	SGS	TOC	364.38	32.46	331.92	
129	SGS	TOC	386.14	14.53	371.61	
130	SGS	TOC	386.03	14.30	371.73	

Table 1L-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 4 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements September 1991		
				September DTW (ft)	Elevation (ft)	Remarks
131	SGS	TOC	385.77	14.04	371.73	
132	RGA-DP	TOC	362.83	38.42	324.41	
133	DGS-EO	TOC	336.93	15.18	321.75	QC check 15.24 DTW
134	RGA-DP	TOC	368.20	42.54	325.66	
135	RGA-DP	TOC	335.94	14.78	321.16	QC check 14.80 DTW
137	RGA-SH	TOC	335.69	14.54	321.15	QC check 14.58 DTW
138	SGS	TOC	335.57	12.28	323.29	QC check 12.28 DTW
139	RGA-SH	TOC	363.17	38.76	324.41	
140	DGS	TOC	344.12	22.35	321.77	
141	RGA-DP	TOC	344.86	19.50	325.36	
142	RGA-SH	TOC	345.04	19.70	325.34	
143	SGS	TOC	345.37	12.94	332.43	
144	RGA-DP	TOC	379.89	51.94	327.95	
145	RGA-SH	TOC	380.08	52.08	328.00	
146	RGA-DP	TOC	352.91	33.46	319.45	QC check 33.50 DTW

Table 1L-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 5 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements September 1991		
				September DTW (ft)	Elevation (ft)	Remarks
147	RGA-SH	TOC	353.08	33.62	319.46	QC check 33.66 DTW
148	RGA-DP	TOC	373.35	48.60	324.75	
149	SGS	TOC	373.87	49.10	324.77	
150	RGA-DP	TOC	376.60	50.34	326.26	
151	SGS	TOC	382.56	20.38	362.18	
152	RGA-DP	TOC	353.36	38.80	314.56	
153	SGS	TOC	353.10	---	---	Dry
154	SGS	TOC	374.49	10.48	364.01	
155	RGA-DP	TOC	381.25	52.76	328.49	
156	RGA-SH	TOC	382.06	53.56	328.50	
157	SGS	TOC	381.56	33.08	348.48	
158	RGA-DP	TOC	373.72	45.50	328.22	
159	RGA-SH	TOC	373.82	45.60	328.22	
160	SGS	TOC	373.56	9.77	363.79	
161	RGA-SH	TOC	373.55	45.28	328.27	

Table 1L-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 6 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements September 1991		
				September DTW (ft)	Elevation (ft)	Remarks
162	SGS	TOC	374.17	13.81	360.36	
163	RGA-SH	TOC	386.14	57.74	328.40	
164	SGS	TOC	386.29	48.02	338.27	
165	RGA-SH	TOC	379.74	51.62	328.12	
166	SGS	TOC	380.07	38.35	341.72	
167	SGS	TOC	376.36	7.82	368.54	
168	RGA-SH	TOC	377.42	49.43	327.99	
169	RGA-SH	TOC	373.41	45.59	327.82	
170	SGS	TOC	373.98	10.20	363.78	
171	SGS	TOC	374.63	8.66	365.97	
172	SGS	TOC	373.79	9.76	364.03	
173	RGA-SH	TOC	373.30	45.44	327.86	
174	SGS	TOC	373.29	8.48	364.81	
175	RGA-SH	TOC	381.18	52.77	328.41	
176	SGS	TOC	381.23	---	---	Dry

Table 1L-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 7 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements September 1991		
				September DTW (ft)	Elevation (ft)	Remarks
177	SGS	TOC	379.74	---	---	Dry
178	RGA-SH	TOC	378.80	50.42	328.38	
179	RGA-SH	TOC	358.60	32.44	326.16	
180	SGS	TOC	358.11	16.78	341.33	
181	RGA-SH	TOC	370.84	44.10	326.74	
182	SGS	TOC	371.15	17.98	353.17	
184	SGS	TOC	373.19	14.08	359.11	
185	RGA-SH	TOC	373.64	46.32	327.32	
186	SGS	TOC	373.62	8.82	364.80	
187	SGS	TOC	373.24	8.83	364.41	
188	RGA-SH	TOC	374.24	45.97	328.27	
189	SGS	TOC	375.50	20.51	354.99	
190	SGS	TOC	373.21	6.55	366.66	
191	RGA-SH	TOC	360.00	32.78	327.22	
192	SGS	TOC	359.04	31.56	327.48	

Table 1L-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 8 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements September 1991		
				September DTW (ft)	Elevation (ft)	Remarks
193	RGA-SH	TOC	367.85	40.80	327.05	
194	RGA-SH	TOC	356.21	29.65	326.56	
195	SGS	TOC	356.21	13.08	343.13	
196	SGS	TOC	368.12	14.49	353.63	
197	RGA-SH	TOC	368.24	41.94	326.30	
198	SGS	TOC	368.24	24.98	343.26	
199	RGA-SH	TOC	353.00	33.11	319.89	
200	RGA-SH	TOC	378.27	52.66	325.61	
201	RGA-SH	TOC	364.51	44.38	320.13	
202	RGA-SH	TOC	372.60	48.90	323.70	
203	RGA-SH	TOC	376.23	49.06	327.17	
204	SGS	TOC	377.73	42.02	335.71	
205	RGA-SH	TOC	379.75	51.77	327.98	
206	RGA-SH	TOC	358.14	56.67	328.47	

Table 1L-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 9 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements September 1991		
				September DTW (ft)	Elevation (ft)	Remarks
TVA Wells						
TVA-3	RGA	TOC	361.78	41.68	320.10	
TVA-4	RGA	TOC	336.55	17.56	318.99	
TVA-5	RGA	TOC	332.35	14.18	318.17	
TVA-6	RGA	TOC	328.58	11.50	317.08	
TVA-9	RGA	TOC	348.13	28.54	319.59	
TVA-11	RGA	TOC	321.36	---	---	Road out
TVA-13	RGA	TOC	332.64	5.76	326.88	
TVA-14	RGA	TOC	354.66	36.40	318.26	
TVA-17	RGA	TOC	365.42	49.38	316.04	
TVA-19	RGA	TOC	363.19	44.60	318.59	
TVA-24	RGA	TOC	358.73	45.18	313.55	
TVA-25	RGA	TOC	353.38	37.55	315.83	

Table 1L-1
Water Level Measurements
PGDP Phase II Site Investigation
(page 10 of 10)

Wells	System or Aquifer	Datum Index	Datum Elevation (ft)	Water Level Measurements September 1991		
				September DTW (ft)	Elevation (ft)	Remarks
TVA-27	RGA	TOC	353.61	39.05	314.56	
TVA-28	RGA	TOC	363.81	50.14	313.67	

Elev = Elevation from USC&GS first order monuments.
DTW = Depth to water from datum.
TOC = Top of innermost casing or riser, excluding pump discharge risers. The surveyed reference datum is a mark or notch on the north edge of the inner casing.
WWP = Well Wizard head plate on older funnel-shaped, exterior Well Wizard cap.
TOC* = Square stainless steel outer casing; 50 yd due south of MW-68 through -71 in an open field.

Lithology:

SGS = Shallow Groundwater System
RGA = Regional Gravel Aquifer
RGA-SH = Regional Gravel Aquifer (shallow)
RGA-DP = Regional Gravel Aquifer (deep)
DGS = Deep Groundwater System

DISCUSSION

Figures 1L-1 through 1L-3 show the groundwater elevations in the DGS, RGA, and the SGS.

The hydrogeologic setting around the PGDP is discussed in TM No. 1A.

Deep Groundwater System

Figure 1L-3 shows that flow in this system is north-northeast toward the Ohio River, as in previous months. Water levels within the DGS during September show an overall drop of approximately 1 foot in elevation beneath the site compared to those in August.

A high hydraulic gradient exists at the terrace feature in the southwest portion of the site (0.008) and decreases to a gradient value of approximately 0.0009 north of Ogden Landing Road, with a flow direction toward the Ohio River.

Regional Gravel Aquifer

Figure 1L-2 illustrates flow toward the north-northeast within the aquifer, as seen in previous months. Water level elevations within the Regional Gravel Aquifer for September dropped approximately 1 to 2 feet beneath the site compared to those in August.

Three distinct physical features within the RGA are defined in Figure 1L-2: (1) a piezometric mound (approximately 1-foot elevation difference) located beneath the plant; (2) a small piezometric depression beneath the TVA plant; and (3) a reversal of the hydraulic gradient (south-southwest) adjacent to the Ohio River.

Hydraulic gradients range from a relatively low 0.0002 value beneath the site to 0.0009 north of Ogden Landing Road, all in a north-northeast direction. Adjacent to the Ohio River, the hydraulic gradient increases to a value of 0.004 away from the river (south-southwest).

Shallow Groundwater System

Figure 1L-1 shows the same general northeast flow pattern as seen in previous months. Water level elevations are principally the same beneath the plant as those observed in August, except for an approximate 1-foot drop in elevation beneath the southeast corner of the plant. The remainder of the site shows a slight decrease (less than 1 foot) in water level elevations compared to those observed in August.

Physical features illustrated within the SGS for September are: a northeast-trending trough beneath the plant; a small piezometric mound beneath the northwest corner of

the plant; and a slight depression in the water level elevation north of the C-616-F lagoon.

The hydraulic gradients vary within the SGS beneath the site from a relatively high value of 0.005 from the southeast corner of the plant toward the center of the plant to 0.002 north of the plant toward the Ohio River.

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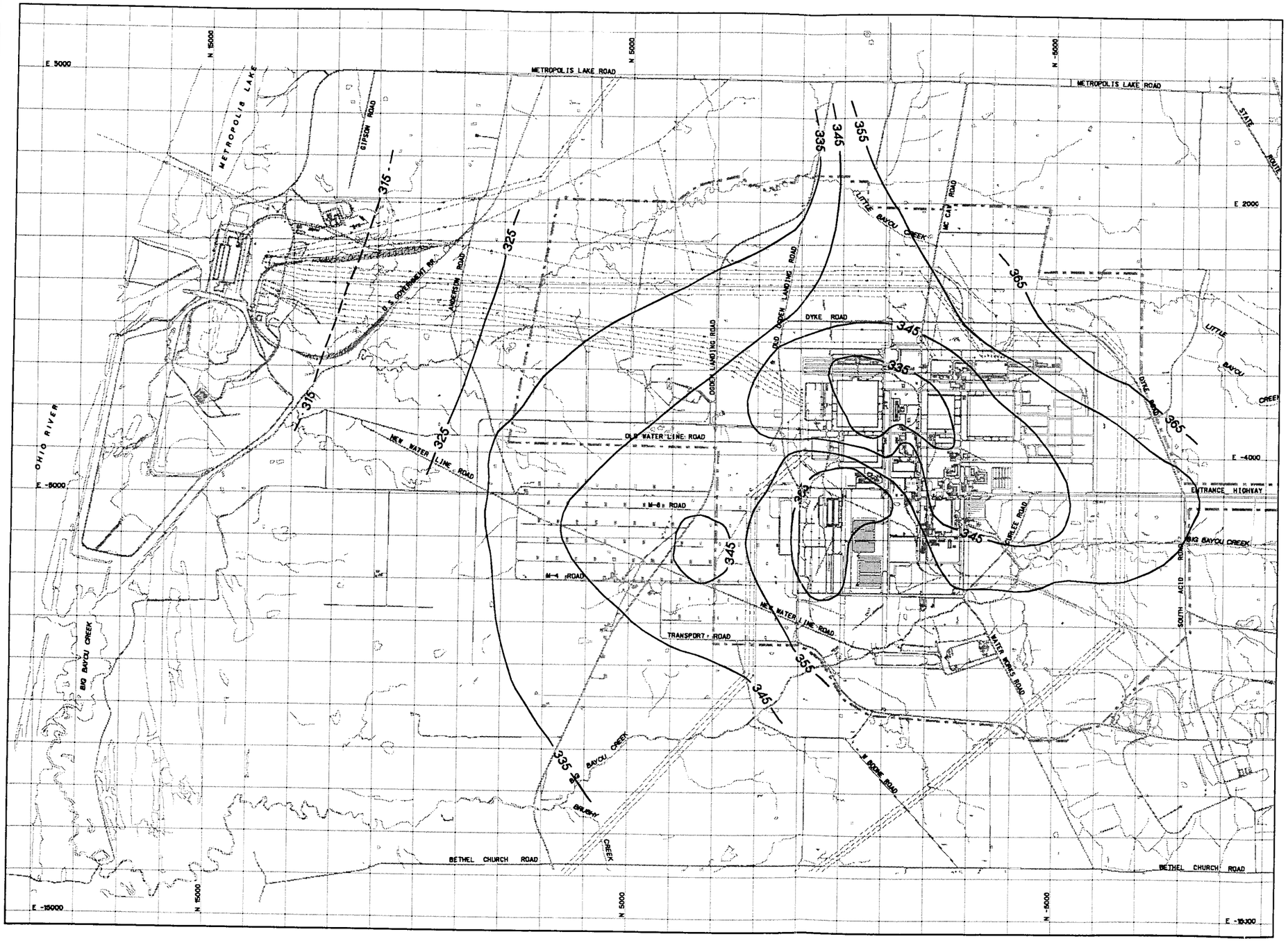


REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

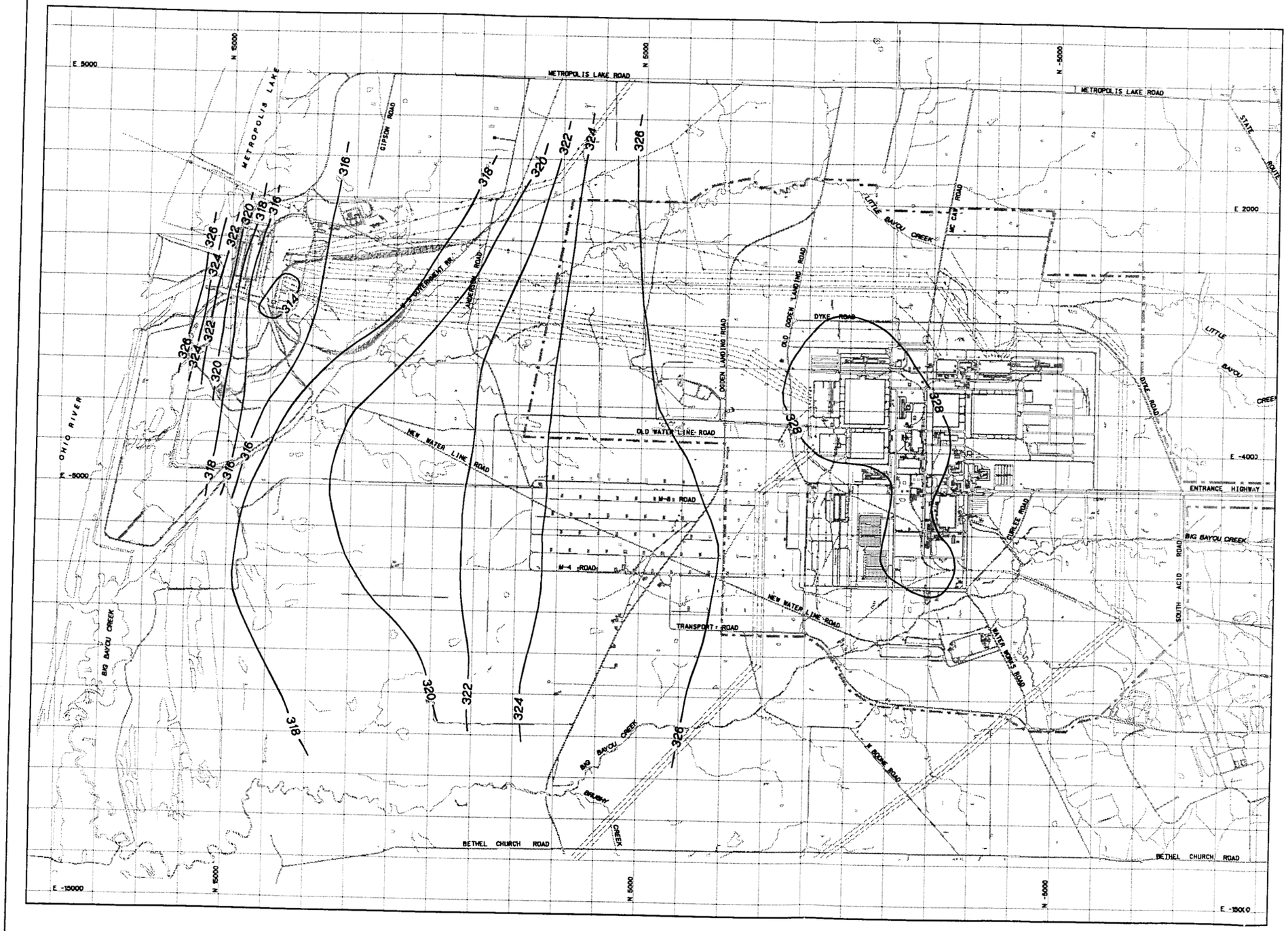
- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1L-1
WATER LEVEL ELEVATIONS FOR THE SHALLOW GROUNDWATER SYSTEM - SEPTEMBER, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

C888tm67.dgn 24-Sep-1991



REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

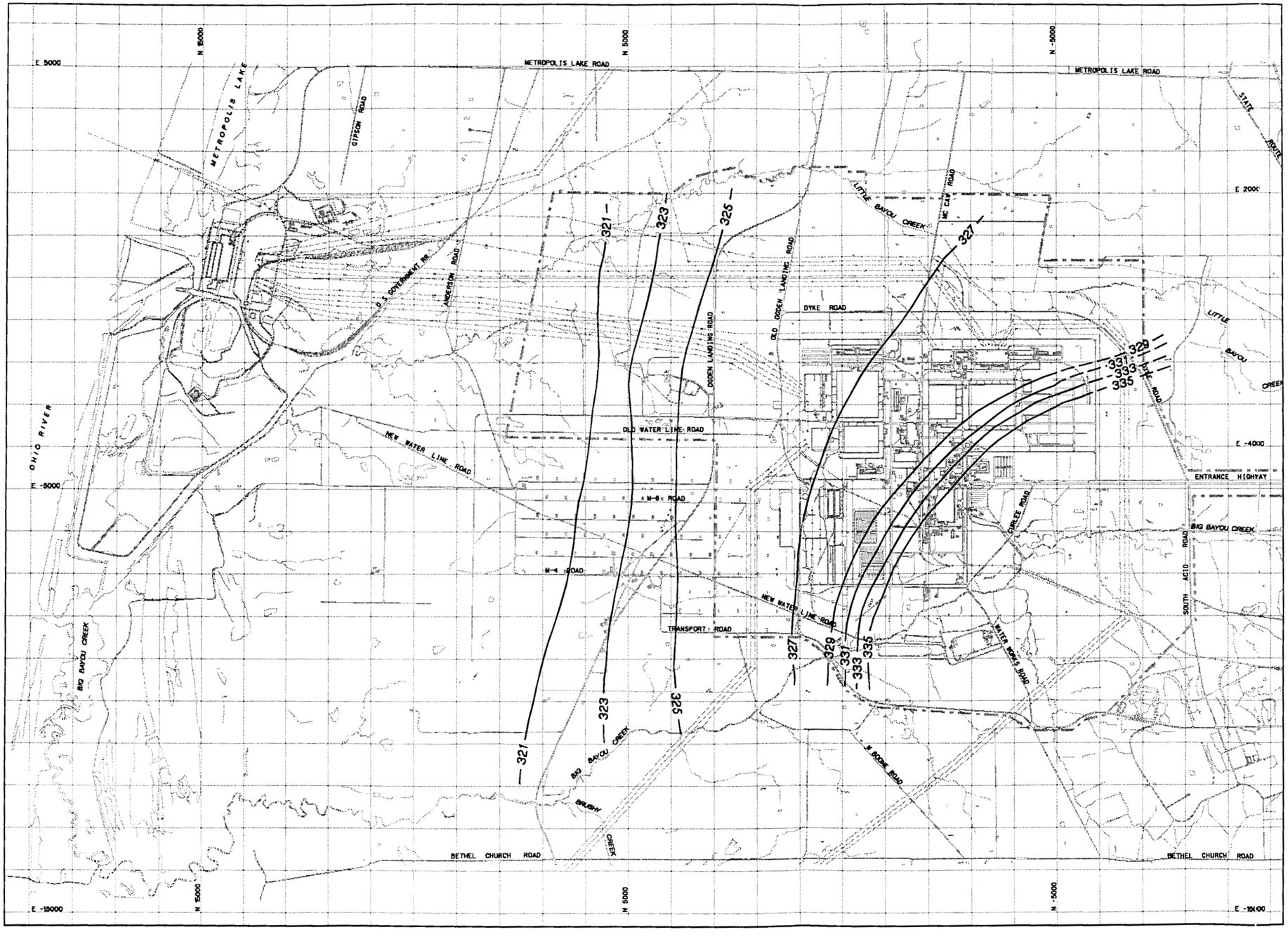
- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS

PLANT NORTH
20°
TRUE NORTH

0 1250 2500 3750
SCALE 1"= 2500'

Figure 1L-2
WATER LEVEL ELEVATIONS FOR THE REGIONAL GRAVEL AQUIFER - SEPTEMBER, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

0888tm68.dgn 24-Sep-1991



REVIEWED FOR CLASSIFICATION
LDS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

- DOE BOUNDARY
- POWER LINE
- SURFACE WATER
- FENCE
- RR TRACKS

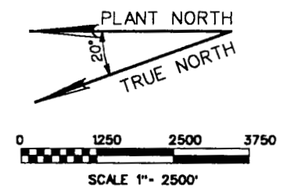


Figure 1L-3
WATER LEVEL ELEVATIONS FOR THE DEEP GROUNDWATER SYSTEM - SEPTEMBER, 1991
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY.
PHASE II SITE INVESTIGATION

APPENDIX 2B-2

Surface Reconnaissance Geophysical Investigations

TECHNICAL MEMORANDUM NO. 2
PGDP PHASE II SITE INVESTIGATION

PREPARED BY: Don Johnson/GLO

SUBJECT: Surface Reconnaissance Geophysical Investigations

PROJECT: ORO30888.FR

INTRODUCTION

PURPOSE AND SCOPE

This TM describes the geophysical investigations performed at PGDP as part of the Phase II Site Investigation. Geophysical investigations were performed to characterize the distribution of buried waste and scrap at selected areas at PGDP. Electromagnetic (EM) ground conductivity and magnetic methods were used. The surveys were performed at WMUs 1, 4, 7, 30 and 91.

The investigations were performed by Don Johnson/CH2M HILL with the assistance of Greg Schaefer, Dawn Geshwender, and Jim Anderson/CH2M HILL. Field activities took place from October 30 to November 8, 1990.

This TM is organized into four sections and four attachments. The remainder of this introduction section will present an overview of this task and its objectives. A brief background of each of the WMUs investigated is also included in this section. The section titled Technical Data will briefly describe the theory of operation of the geophysical equipment used, field procedures employed in the collection of data, and methods used to interpret the data. WMU-specific data collection procedures are also provided in this section. Results and Interpretation will present the results of the investigation, as well as an interpretation of the results. Contour maps of the geophysical data and maps showing the location of interpreted features, such as buried metal, are included. The Discussion and Recommendations section includes recommendations for use of the data and limitations of its use.

The attachments contain profile plots of the data collected during the investigation.

BACKGROUND

Phase I Site Investigation at PGDP and historical records have indicated the potential for buried scrap and wastes as possible sources for groundwater contamination at the site. The following briefly describes each of the WMUs investigated by geophysics along with the goal of the geophysical investigations:

WMU 1: C-747-C Oil Landfarm

The oil landfarm area consists of two farmed plots, each covering about 1,125 square ft, where waste oils were mixed into the soil to evaluate the potential for biodegradation of the oil. The locations of the plots are not precisely known. Borings made near WMU-1 during Phase I encountered TCE contamination at 26 to 32 ft, but not at shallower depths. It is possible that the TCE migrated laterally to the location of the boring from the farm plots.

Because the specific location of the farmed plots was not known, an EM ground conductivity survey was performed to try to locate the farm plots. A limited magnetometer investigation was performed over areas of anomalous EM. The surveys covered about 2 acres (Figure 2-1).

WMU 4: C-747 Contaminated Burial Yard

The contaminated burial yard reportedly consists of two pits excavated to a depth of about 15 ft. One of the pits covered an area of 50 ft by 15 ft and the other 50 ft by 150 ft. The larger pit was used until 1958 to dispose of both contaminated and uncontaminated trash and equipment, some of which was burned. The smaller pit received scrap (primarily contaminated) that could not be sold. The waste areas were covered by 2 to 3 ft of soil and 6 in. of clay.

The burial yard could be a source of Tc-99 or uranium contamination from contaminated materials disposed of there. Samples from monitoring wells in the vicinity are contaminated with both TCE and Tc-99.

An EM conductivity survey was performed to delineate the buried waste pits. A limited magnetometer survey helped define selected EM anomalies. The geophysical information may be used to estimate waste volumes and/or to plan soil boring locations. About 6 acres were covered by the geophysical investigations (Figure 2-2).

WMU 7: C-747-A Burial Ground
WMU 30: C-747-A Burn Area

The burial ground was operated from 1957 to 1979 and consists of seven discrete areas that were used for disposal of both contaminated and uncontaminated trash including equipment, scrap metal, concrete, and possibly drums. The disposal areas ranged in size from 15 ft by 100 ft to 70 ft by 275 ft. In general, the burial areas were excavated, filled with waste, and covered with 3 ft of earth.

The burn area was used from 1951 to 1970 for burning combustible trash. Ash and burned material from the tepee incinerator were buried here when the incinerator was closed.

Phase I investigations encountered TCE and Tc-99 in the vicinity of WMU 7 and 30, which may have originated in either of the WMUs. The burial ground may have received uranium-contaminated material from the C-410 feed plant and is a suspected source of Tc-99 contamination. Although there are no records of TCE disposal, the burial ground received various wastes generated around the plant that may have included TCE.

The objective of the geophysical investigations at these WMUs was to delineate the buried waste pits. Both magnetometer and EM conductivity surveys were performed. The information may be used to plan a test pit program to characterize the buried wastes, to estimate waste volumes, and to identify areas to be avoided during boring activities. Since WMU 7 and 30 are adjacent to each other, they were investigated as a single area. About 5.5 acres were covered by the investigation (Figure 2-3).

WMU 91: UF_6 Cylinder Drop Area

The cylinder drop test area was used in 1979. It consisted of a steel plate resting on a cement pad and an adjacent pit large enough to hold a 10-ton UF_6 cylinder. The pit was lined with plastic and filled with TCE and dry ice. A UF_6 cylinder was frozen in the pit, picked up by a crane, and dropped onto the steel plate. TCE might have been left in the pit for days before it was removed. TCE has been detected to a depth of 36 ft in soil samples in the area.

The pit has been backfilled and its exact location is not known, although it is thought to be near the drop pad, which is still in place. An EM conductivity survey was performed to locate the pit. About 0.6 acre was covered by the investigation (Figure 2-4). A limited magnetometer survey was performed to better define selected EM anomalies.

TECHNICAL DATA

THEORY OF OPERATION

EM Conductivity

A Geonics Model EM31 ground conductivity meter was used to collect the EM conductivity data at PGDP. The EM31 consists of two coplanar coils, 12 ft apart. The coils are oriented with vertical axes. One coil is the transmitter coil, the other a receiver. An alternating current is passed through the transmitter coil, causing an EM field to be transmitted that causes eddy currents to flow in the ground. The receiver coil measures the sum of the fields due to the transmitting coil (the primary field) and due to the eddy currents in the ground (secondary field). The primary field strength at the receiver coil is known and is subtracted from the total field measured at the receiver; the remainder is the secondary field. The secondary field is divided into a

component in-phase with the transmitted field and into an out-of-phase component. The strength of the out-of-phase component is linearly proportional to the ground conductivity over a range of typical soil conductivities. At higher conductivities, the response is no longer linear and may result in negative measurements. The in-phase response provides an indication of buried metal, as it generally requires higher conductivities than the out-of-phase component to cause an instrument response.

The effective depth of investigation of the EM31 is about 15 to 20 ft.

Magnetics

A GEM magnetometer/gradiometer was used for the magnetic investigation. The GEM is a proton precession magnetometer with the capability to take vertical magnetic gradient measurements. It can store the location coordinates and magnetic field data in its internal memory.

The magnetometer sensor consists of a small container filled with an organic, hydrogen-rich fluid, such as kerosene. A current is passed through a coil wrapped around the container, causing the molecules of the liquid to orient themselves with the inducing magnetic field produced by the coil. When the current to the coil is stopped, the molecules realign (precess) themselves with the earth's magnetic field. A small electric field, produced by the molecules as they realign themselves, is measured by the coil around the container and amplified. The strength of this field is proportional to the strength of the earth's magnetic field. The electronic circuitry of the magnetometer converts the measured field to a digital display of the magnetic field strength.

The magnetic field measured by the magnetometer is the sum of the earth's field, fields due to geologic formations, and nearby man-made features such as buildings, cars, and other ferrous metal. The earth's field may vary during the day due to solar activity; these variations are called diurnal drift.

The earth's field is uniform over a given area and can be removed from the data by subtracting a constant. Diurnal drift is measured by periodic readings at a base station and removed from the data if necessary. Diurnal drift is usually negligible compared to anomalies from buried metal. Anomalies due to geologic formations are often negligible depending on the nature of the formations and their depth. Geologic anomalies are usually related to igneous or metamorphic rock formations that are not present near the surface at PGDP.

The vertical magnetic gradient is the difference between two simultaneous total field measurements made at different heights above the ground. The gradiometer sensor supplied with the GEM magnetometer consists of two sensors about 2 ft apart. The vertical gradient measurement is more responsive to nearby objects than the total field measurement, and may therefore provide higher resolution of anomalies. The vertical gradient is not subject to diurnal drift.

FIELD PROCEDURES

EM Conductivity

The procedures used for data collection were essentially the same at each WMU. Specific procedures for each WMU will be described later. The procedures common to each area are as follows:

- A function test was performed on the Geonics EM31 at the beginning of each day. The functional check establishes that the instrument is operating correctly. It is not a calibration check, in that the response over ground of uniform and known conductivity is not made. The instrument is calibrated at the factory or the rental agency; no field adjustment is made. The equipment passed each functional check made each day.

- Data were collected at 10-ft intervals along lines 20 ft apart. A digital data logger was used to collect and store data for later transfer to a computer. Both conductivity and in-phase response were collected.

- Additional data were collected along lines midway between the lines 20 ft apart in areas where an initial interpretation indicated additional information would be useful.

- Measurements were also recorded in the field logbook at the time of collection, along with observations of features that might affect data, such as fences, or features that would aid in mapping, such as roads and ditches.

- Data from the digital logger were transferred to a computer on a daily basis and the data reviewed to determine if they were properly recorded and matched the data manually recorded in the logbook.

Magnetics

- A GEM magnetometer was used for the investigation. It has an internal digital memory that simultaneously records the total magnetic field intensity and the vertical magnetic gradient. It also records the station coordinates and time with each measurement.

- No functional checks are prescribed in the operator's manual for this equipment. Initial readings were compared against total field intensity predicted for the area, as shown on a map of the United States that was provided with the equipment. Equipment was determined to be responsive by taking measurements at different locations and noting that the measurements did not remain constant. To reduce external noise

sources, the operator eliminated metal from his person (to the extent practical).

- A base station was established for each WMU investigated. The site for the base station was located by finding a location where the total field readings changed by less than about 10 gammas when the instrument was moved a few ft in any direction. Base station readings were taken at about 2- to 3-hour intervals during the course of the magnetometer work at each WMU.

- Measurements of the total field and vertical gradient were collected at 10-ft intervals along lines 20 ft apart, except as noted in the survey specifications for each WMU. Data were stored in the instruments internal memory and also recorded manually in the field logbook along with pertinent observations. Data were transferred to a computer file and reviewed daily.

SURVEY SPECIFICATIONS

WMU 1: Oil Landfarm

EM31 data were collected on November 2, 1990. Data were collected at 10-ft intervals along north-south grid lines spaced 20 ft apart (Figure 2-1). The instrument was oriented east-west for all data collection. The north end of lines east of 1280 east terminated at the edge of a gravel access road. West of 1280 east, lines terminated at the south side of a ditch that had numerous areas of surface radioactivity identified. The south ends of the lines ended near a ditch.

EM data were initially collected along lines 20 ft apart. Subsequent to an initial review of the data, additional data were collected along intermediate lines in selected areas. The denser coverage resulted in a 10-ft line spacing in the area between easting 1050 and 1300.

Magnetometer data were collected on November 8, at 10-ft intervals along selected lines to determine if buried metal were associated with the EM conductivity anomalies identified at the site. Figure 2-1 shows the location of the magnetometer lines.

WMU 4: Contaminated Burial Yard

EM31 data were collected on October 30, 31, and November 1. Data were collected at 10-ft intervals along north-south grid lines, as shown in Figure 2-2. The north end of the survey area was bounded by Virginia Avenue. The east and west sides of the survey were bounded by 6th Street and 4th Street, respectively. Lines extended south to grid line 900 north. The site history indicated this coverage would investigate the entire burial yard.

Data were initially collected along lines 20 ft apart. An initial review of the data indicated additional data were needed in certain areas. These areas are shown on Figure 2-2 as the areas with the 10-ft line spacing. The initial review also indicated anomalous readings at the south end of the lines, west of grid line 1110 east. Those lines were extended to the south to fully define the anomalous area. Lines west of 950 east were added to define an anomaly detected at the west edge of the survey area.

Magnetometer data were collected on November 8 at 10-ft intervals along lines shown in Figure 2-2. The magnetometer data were collected to better define an area with anomalous EM conductivity.

WMU 7: C-747-A Burial Ground
WMU 30: C-747-A Burn Area

Both EM and magnetometer data were collected on November 6, 7, and 8. Ground conductivity data were collected at 10-ft intervals along lines 20 ft apart (Figure 2-3). Magnetometer data were collected over the same area as the EM survey. The north end of the lines stopped at the ditch on the south side of Patrol Road 2. The western limit of the survey was Patrol Road 1. A fence bounded the eastern side of the investigation, and railroad track bounded the south. The southeastern portion of the burial ground, where large piles of scrap metal are present, could not be investigated.

WMU 91: UF_6 Cylinder Drop Test Area

Ground conductivity data were collected on November 5 at 10-ft intervals along east-west lines 10 ft apart (Figure 2-4). The area covered by the investigation extended south from the south edge of a cylinder storage area to an open field.

Magnetometer data were collected on selected north-south grid lines in the vicinity of a gravel drill pad installed during Phase I investigations. Magnetometer data were collected at 10-ft intervals on November 8.

DATA PROCESSING AND INTERPRETATION PROCEDURES

EM Conductivity Data

The EM data in raw form, as transferred from the data logger to the computer, consists of data files in XYZ format. X and Y are the grid coordinates of the data point, and Z is the EM conductivity value. A similar data file is also created that contains the EM in-phase response instead of the conductivity. The following steps were performed in interpretating the data:

- Data were imported into a spreadsheet and rearranged into a spreadsheet format. Each spreadsheet row and column represents an east-west and north-south grid line, respectively. Data was moved to the appropriate spreadsheet location based on grid location.

- Profile plots were created by the spreadsheet program. Each plot consisted of the conductivity and in-phase value plotted against distance along the survey line. The profile plots were used to interpret the location of the source of each anomaly. The interpreted locations of the sources of the anomalies were transferred to the base map.

- A contour map was generated from either the spreadsheet files or the XYZ files. If the same line spacing was used throughout the investigation, the spreadsheet data was used. If fill-in lines were used, then XYZ files were used. The contour map was used to help establish spatial relationships of anomalies. Source locations of the anomalies were not interpreted from the contour map.

- Anomalies were identified using the profile plots. An anomaly was defined as any observable deviation from background and may have been either a positive or negative deviation. Buried wastes were expected to result in positive anomalies (conductivity highs); however, buried metal may produce negative anomalies. The edges of the source of the anomalies were generally interpreted as the location where the conductivity (or in-phase response) changed the most between adjacent stations. Professional judgment based on experience is used when conductivity changes are gradual. Narrow, strong conductors (e.g., buried water pipelines) produce a characteristic response that was interpreted as a narrow source, even though anomalous readings covered a width of 60 to 80 ft. The characteristic pipe response consists of a narrow, low response (often negative) between two highs.

Magnetometer Data

Preparation and plotting of the magnetometer data was the same as for the EM data. The data were received in XYZ format, imported into a spreadsheet, and rearranged into a spreadsheet format with columns representing survey lines and rows representing position along the line. Profile plots of magnetic intensity and vertical magnetic gradient were prepared, and contour maps of the magnetic values were generated.

The interpretation of the magnetometer data is different from that of the EM data. A magnetic anomaly normally consists of both a magnetic high and a magnetic low. The pair of high and low values is due to the field induced into the buried metal by the earth's field. The field induced into the buried object has both a north and south magnetic pole resulting in a net increase and decrease, respectively, in the measured total field. In the northern hemisphere the magnetic high is on the south side of the source and the low is on the north side. The source of the anomaly is interpreted as extending from the peak of the magnetic high to the lowest value just north of the high. The high/low pairs are not always well-defined because of nearby interferences, and professional judgment is required in delineating magnetic sources.

DEVIATIONS FROM THE WORK PLAN AND PROJECT INSTRUCTIONS

Data were to be collected at 10-ft intervals along lines 10 ft apart, regardless of whether it was EM or magnetic data. The decision was made to use a 20-ft line spacing instead of the 10-ft line spacing because the larger line spacing would not have missed any of the desired targets (e.g., buried trenches). Although some of the trenches were as narrow as 15 ft and could have fit between 20-ft survey lines if fortuitously oriented, both the EM31 and the magnetometer can "see" far enough to the side to have detected them. In areas where the 20-ft line spacing did not provide sufficient detail, additional lines were added to provide coverage at a 10-ft line spacing.

Although a magnetometer survey alone was planned for WMUs 7 and 30, EM conductivity data were also collected. Large piles of scrap metal caused strong magnetic gradients that were too strong for the magnetometer to respond. Collection of usable magnetic data in those areas was not possible. The EM31 was able to collect data closer to the piles. Also, because EM conductivity apparently worked so well in defining likely areas of buried waste at the other WMUs, it was felt that it would provide valuable data here as well.

Only an EM investigation was planned for WMU 1 (the Oil Landfarm area); however, anomalous low EM conductivity readings suggested buried metal may have been present. No buried metal was anticipated, based on the site history. A limited magnetometer investigation was conducted to determine if buried metal was present.

Only an EM survey was planned for WMU 4 (the contaminated burial ground). The EM investigation identified several areas of high conductivity, indicating buried wastes were present. One of the areas (Area A in Figure 2-9) did not have well-defined boundaries, so a magnetometer investigation was performed over this portion of the site to possibly better locate the edges of the anomalous area.

No magnetometer survey was planned for WMU 91 (the cylinder drop test area), but EM data suggested buried metal may have been present in one area. A limited magnetometer investigation was performed to evaluate whether or not buried metal might be present.

RESULTS AND INTERPRETATION

WMU 1: C-747-C OIL LANDFARM

Three areas have been identified in the oil landfarm area that may be related to buried wastes or landfarming activities. These are identified as Areas A and B in Figure 2-5. Area C is interpreted as a narrow conductor, such as a pipe, and may not be related to the farm plots that were the target of this investigation. Areas A and B also appeared

to have some buried metal that is possibly not consistent with the farming activities. Metal may be have been buried in the farm plots after the biodegradation studies had been completed, or may be completely unrelated.

Interpretations based on each geophysical method used at the site are summarized in the following sections.

EM Conductivity

The ground conductivity is shown contoured in Figure 2-6. Profile plots are in Attachment A. Anomalies along the northern edge of the survey area are related to the ditch and culverts draining into the ditch.

Three anomalous areas have been identified that cannot be explained by observable or known features. These are identified as Areas A, B, and C in Figure 2-6. Areas A and B have been delineated based on weak conductivity lows. They are approximately 10 to 15 ft wide and 20 and 40 ft long, respectively. The most predominant feature is a linear anomaly crossing the site from northeast to southwest. This is due to a water supply pipeline, and its interpreted location is shown in Figure 2-5. Area C appears as a conductivity low, but because of the weak highs on either side, is interpreted as a narrow conductor like a pipe. Area C is likely the water supply pipeline; its interpreted location is shown in Figure 2-5 and does not appear to extend west of line 1280.

EM In-Phase

The in-phase response, shown contoured in Figure 2-7, indicates the same features as the EM conductivity data plot. The in-phase response at Areas A and B are negative, suggesting buried metal. The in-phase response at Area C is weakly positive and is not evident in the contour map, although it shows on the profile plots. This type of response at Area C is consistent with a narrow conductor although it is a poorer conductor compared to the water pipeline. Profile plots of the in-phase data are in Attachment A.

Total Magnetic Field Intensity

Five lines of magnetic data were collected to determine if metal was present in Areas A, B, and C as suggested by the EM data. The profile plots are presented in Attachment A. No contour map was generated because of the limited amount of data. The locations of these lines are shown in Figure 2-1. The magnetometer data indicate that metal is present at all three areas. The anomalies at Areas A and B are weak and indicated only a small amount of metal. The data at Area C indicate a greater amount of metal or metal at a shallower depth.

Vertical Magnetic Gradient

The vertical gradient data are shown in Attachment A. The data are consistent with the total magnetic field data and provide the same interpretation.

WMU 4: C-747 CONTAMINATED BURIAL YARD

Seven areas interpreted as buried wastes have been delineated in WMU 4 (Figure 2-8). Three of them (A1, A2, and A3) may be areas of more concentrated wastes within a larger, single area of buried wastes (Area A). All three have both EM and magnetic anomalies, although the EM conductivity high is more extensive. Area A3 may be a thin conductor (such as a utility line). Area B is the largest area of buried waste identified at WMU 4 and covers an area of about 100 ft by 350 ft. Areas C and D appear as extensions of Area B. Data collected along the side of 4th Street indicates Area E does not extend beneath the road. A thin conductor, possibly a utility line, is interpreted as extending from 1270 east, 1310 north to 1430 east, 1310 north. The buried water supply pipeline crosses beneath the site from 1510 east, 1000 north to 1310 east, 900 north.

EM Conductivity

EM conductivity data are shown contoured in Figure 2-9. Profile plots are in Attachment B. Several areas of anomalously high EM conductivity were identified by this investigation. These have been identified as Areas A through E in Figure 2-9. Two other anomalous areas are apparent on the contour map. One of these is due to the water pipeline and crosses the grid from 1310 east, 900 north to 1510 east, 1000 north. Another feature, which has the characteristics of a buried utility, extends from 1270 east, 1310 north to 1430 east, 1310 north. The source of this anomaly is not known.

The features identified as Areas A through E are interpreted as being due to buried wastes. Area A covers an area about 100 ft by 250 ft and includes several highs that suggest more than one discrete burial area is present. The shape of this area suggests random disposal rather than trenches. A thin conductor is possibly present from 1100 east, 1320 north to 1190 east, 1310 north. The interpretation of this feature as a thin conductor is uncertain because of the interference of other nearby anomalies. It is represented in Figure 2-8 as having width and not as a thin conductor. Area B is about 100 ft wide by about 350 ft long. The conductivity data indicates this is a single continuous area, and the shape suggests a trench. The other areas are smaller than either A or B. Area C may be connected to the west end of B. Surface radiological contamination was encountered at Area D.

EM In-Phase

Contoured in-phase data are presented in Figure 2-10 and the profiles are in Attachment B. The in-phase data has identified essentially the same features as the conductivity data. Area A appears as three discrete features (A1, A2, and A3 in

Figure 2-10). A3 has the characteristics of a thin conductor, such as a buried utility. Negative in-phase values along the south side of feature B also suggest a thin conductor from about 1030 east, 960 north to 1210 east, 950 north. There are no reported utilities at either of these locations.

Total Magnetic Field Intensity

Magnetic data were collected only over Area A to better delineate it. Contoured magnetic data are shown in Figure 2-11. Profiles are presented in Attachment B. The data indicate buried metal is probably present at Areas A1, A2, and A3. Buried metal is also likely present at two other areas (1150 east, 1120 north and 1170 east, 1270 north). These areas are small and have no corresponding EM anomalies.

Vertical Magnetic Gradient

Vertical gradient data are shown contoured in Figure 2-12. Profile plots are in Attachment B. The gradient data, which were also only collected over Area A, indicate the same anomalous areas as the total field data.

WMU 7: C-747-A BURIAL GROUND
WMU 30: C-747-A BURN AREA

Seven areas of buried wastes (including metal) have been delineated in these WMUs (Figure 2-13). Areas A, B, and C are each about 75-ft wide and from 200 to 250 ft long, and cover a combined area of slightly more than 1 acre. Areas D, E, F, and G are smaller. Additional areas of buried wastes may exist east of Area G, but are hidden by scrap metal on the surface.

EM Conductivity

Contoured EM conductivity data are shown in Figure 2-14. Profile plots are in Attachment C. All the areas show up as areas of anomalously high conductivity. Areas A, B, and C are roughly rectangular in shape, about 75-ft wide, and from about 200 to 250 ft long. The separation between Areas B and C is not distinct, and the two areas may be connected. Area D covers an area of about 40 ft by 80 ft. Area E covers only about 10 by 20 ft. Areas F and G may be part of a larger area that extends eastward beneath the buried scrap. There was no observed surface metal scrap at Areas F and G, but tanks on the surface caused the anomalies east of Area G. Data could not be collected in the southeast portion of WMU 7 because of large piles of scrap metal. A thin conductor, extending from 2010 east, 1130 north to 2130 east, 1130 north was identified from the profile plots.

EM In-Phase

Contoured in-phase data and profile plots are shown in Figure 2-15 and Attachment C, respectively. Information provided by the in-phase data are the same as the

conductivity data. The separation between Areas B and C is more distinct in this data than in the conductivity data.

Total Magnetic Field Intensity

Figure 2-16 shows the contoured total magnetic field data. Attachment C contains the profile plots. Magnetic anomalies generally corresponded to EM anomalies, and all the areas of anomalous EM conductivity identified earlier also produced magnetic anomalies. Anomalies in Areas A, B, and C were generally greater than 5,000 gammas and nearly as high as 20,000 gammas. These intense anomalies (the highest related to buried wastes that this investigator has seen) indicate large amounts of metal, probably not more than a few ft deep. Several areas within Areas C, D, E, F, and G contain data gaps because the instrument could not respond due to high magnetic gradients. Areas E, F, and G, in particular, could not be adequately defined with the magnetometer data. The thin conductor identified by the EM survey in the eastern portion of the site was also identified by profile plots of the magnetic data.

Vertical Magnetic Gradient

Figure 2-17 shows the vertical gradient data. Profile plots are in Attachment C. The information provided by this data is essentially the same as the total field data. Areas E and F are poorly defined because of missing data where gradients were too strong for the instrument to respond. Area G is not identifiable at all for the same reason.

WMU 91: UF_6 CYLINDER DROP TEST AREA

One anomalous area that could not be attributed to culverts or the steel drop pad has been identified at WMU 91 and identified as Area A in Figure 2-18. Both EM and magnetic data indicate buried material, including metal, may be present beneath the east side of the drill pad constructed during the Phase I Investigation. Although the pit may not have contained metal during its use, metal may have been included in the material used to fill the pit. It is also possible that the buried metal indicated by the investigation is unrelated to the pit.

EM Conductivity

Several anomalies are evident in the data shown contoured in Figure 2-19. Profile plots are in Attachment D. Culverts draining the cylinder storage area north of WMU 91 and the drop pad account for all anomalies, except for the one centered between 880 and 890 east, 1040 north, and labeled Area A in Figure 2-19. Although there is a culvert at 900 east, additional buried material is suspected. None of the other culverts resulted in an anomaly of this shape or width. No anomalies were encountered south of the ditch at 1010 north.

EM conductivity values at Area A were recorded as negative values, indicating metal. The metal indicated by the data may or may not be related to the pit that was the target of the investigation at this WMU. If metal was put into the pit as part of the fill, the anomaly may be showing the location of the pit. Otherwise, the buried metal may be unrelated to the pit. The anomaly is located at the east side of the gravel pad installed as a drill pad during the Phase I Investigation.

EM In-Phase

The in-phase values are presented contoured in Figure 2-20 and as profiles in Attachment D. The in-phase data show the same features as the conductivity data.

Total Magnetic Field Intensity

Profile plots of the magnetic data are in Attachment D. No contour map of magnetic data was prepared because of the limited amount of data.

Magnetic data indicate buried metal beneath the north ends of lines 890 east and 900 east. Part of the magnetic anomaly is related to the culvert beneath line 900 east; however, the strongest anomaly is at line 890 east. This suggests, as does the EM data, that metal in addition to the culvert is present at this location.

Vertical Magnetic Gradient

The plots of the vertical gradient data are presented with the total field data in Attachment D. The gradient data shows the same features as the total field data.

CONCLUSIONS AND RECOMMENDATIONS

Geophysical methods have successfully identified areas of buried material in all of the WMUs investigated. Where both EM and magnetic methods were used, generally the same areas of buried wastes were identified. A few exceptions to this were seen where small magnetic anomalies were encountered (on a single line with only one or two anomalous points), but no EM anomalies were encountered. These small magnetic anomalies are attributed to small amounts of metal and are relatively insignificant compared to the larger delineated areas of buried wastes.

The accuracy of the limits of buried wastes shown in the figures depends on a number of conditions, including the survey specifications, equipment, and the physical nature of the buried material. Up to a point, the shorter the line and station spacing, the more accurately the waste boundaries can be determined. Because of instrument response characteristics and distance/depth to the waste material, shorter data spacings do not improve the accuracy of the interpretation of the data. The nature of the waste pit boundaries also affects the accuracy of the interpretation. A waste pit with vertical

sides will result in more distinct anomalies than one with sloping sides. Most of the waste limits presented in this TM are probably accurate to about 10 ft; better in some areas, not as good in others.

Conclusions specific to each WMU investigated follow:

WMU 1: C-747-C Oil Landfarm

- The two areas identified by the investigation (Areas A and B in Figure 2-5) may be the farm plots although the reason buried metal is present is not known.

- The areas can be investigated by borings or excavations centered at grid locations 1140 east, 925 north and 1250 east, 945 north.

- The water pipeline has been identified and marked on Figure 2-5. A proposed boring is located directly above the pipeline and should be moved.

- The location of buried utility related to the manhole at 1155 east, 840 north, could not be determined by the geophysical investigation. Its location should be considered when drilling or excavating in the area.

WMU 4: C-747 Contaminated Burial Yard

- Although the site history described only two areas of buried waste, at least five areas have been identified (Figure 2-8). Area A may consist of several smaller areas, although elevated EM conductivity surrounding these areas suggests they are one area.

- Magnetometer data over Area A indicates buried metal is present within this area. Magnetometer investigations over the rest of WMU 4 is not recommended because the EM has clearly identified other areas of buried waste. It is not known if buried metal is present at the other areas.

- The water pipeline was identified and is marked on Figure 2-8.

WMU 7: C-747-A Burial Ground
WMU 30: C-747-A Burn Area

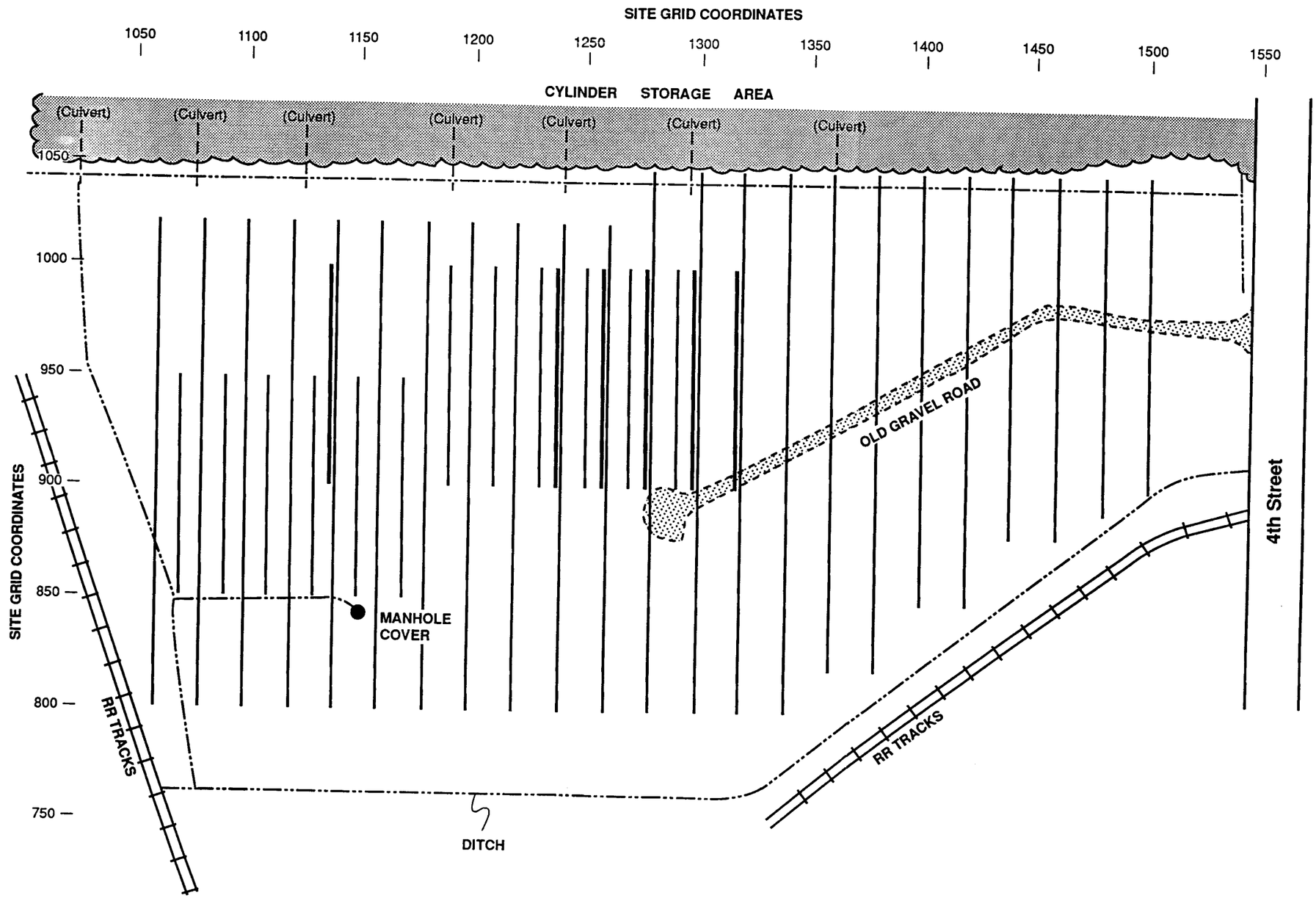
- The letter designations given to the anomalous areas identified by the geophysical investigations (Figure 2-13) are not meant to correspond to the letter designations given to the WMU 7 waste units described in the workplan. No attempt was made to correlate the anomalous areas to specific waste units except as described below.

- Based on their dimensions, the three largest waste units described in the workplan may correspond to Areas A, B, and C in Figure 2-13. Area A, however, is located in WMU 30 and may not be one of the WMU 7 waste units. Area A contains a large amount of metal, which is not necessarily consistent with the WMU 30 site history.

- Additional buried wastes may be present in the southeast portion of the burial ground, but could not be identified because of scrap metal at the surface.

WMU 91: UF_6 Cylinder Drop Test Area

- Buried metal has been located beneath the east side of the Phase I drill pad (Figure 2-18). Although buried metal was not anticipated as part of the filled-in pit, metal may have been included with the fill. The buried metal may be identifying the pit.



LEGEND

EM SURVEY LINE

MAGNETOMETER SURVEY LINE

NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

Grid North

0 50'
SCALE IN FEET

Figure 2-1
WMU-1: OIL LANDFARM AREA
EXTENT OF GEOPHYSICAL INVESTIGATION
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR

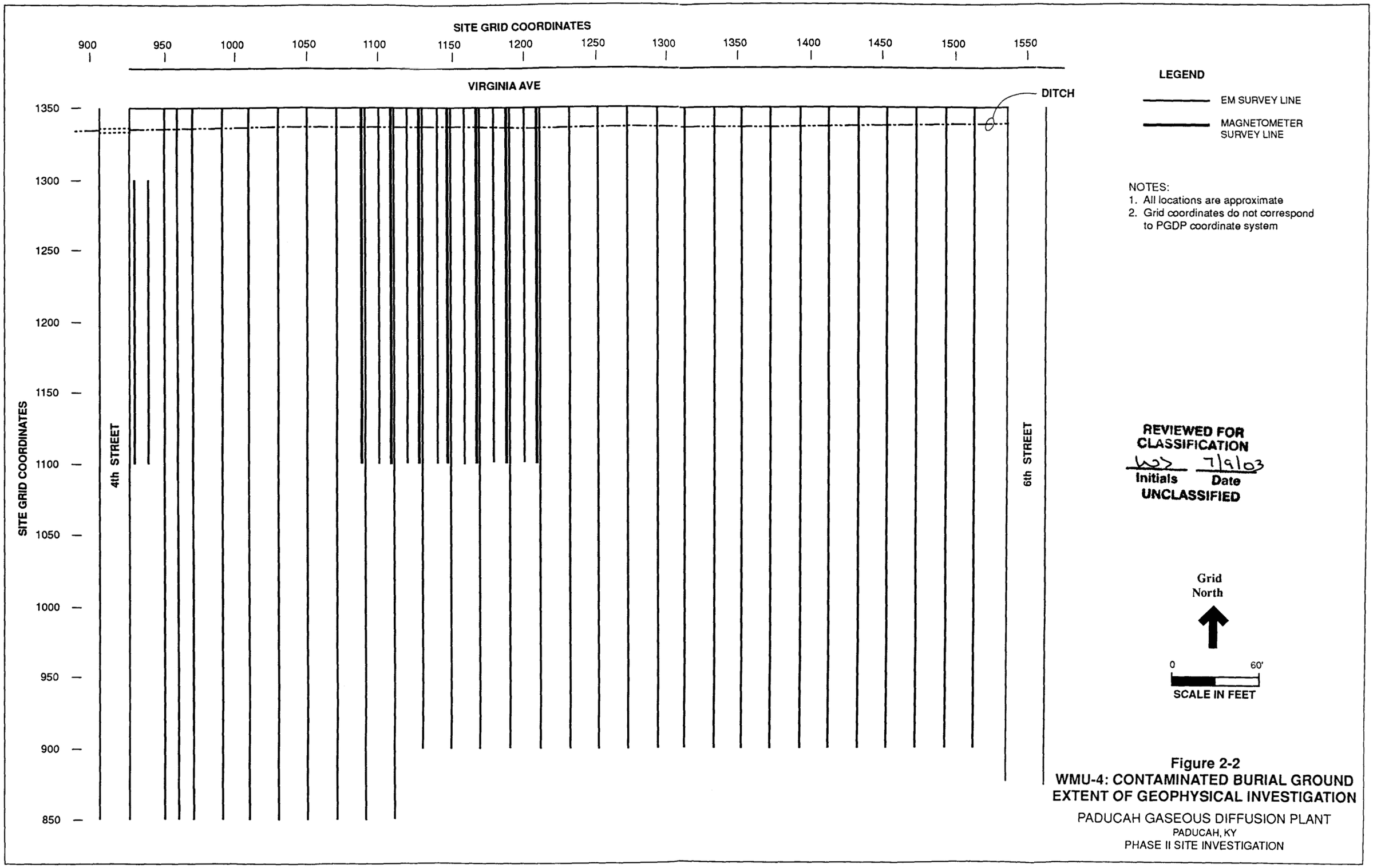
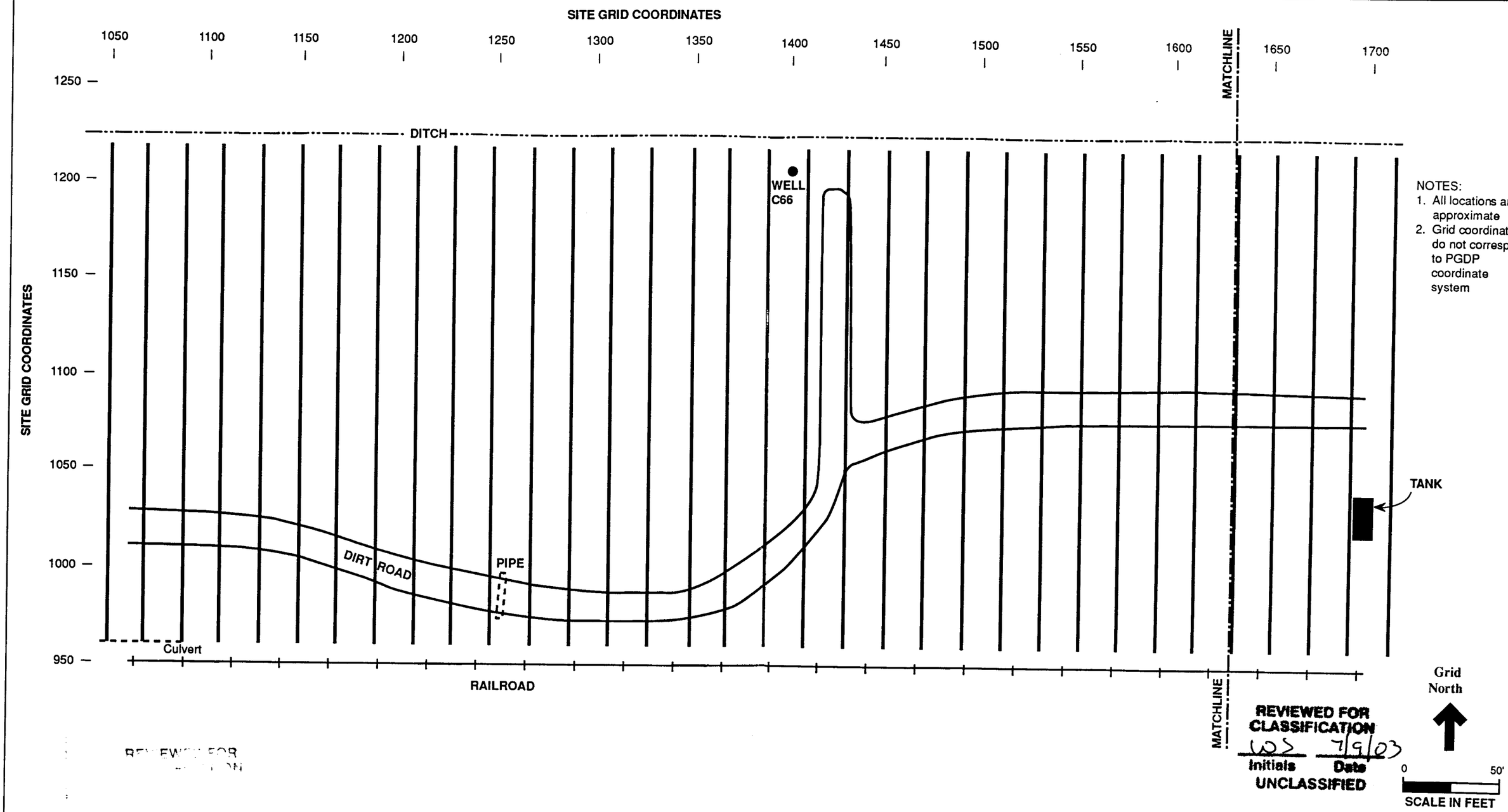


Figure 2-2
WMU-4: CONTAMINATED BURIAL GROUND EXTENT OF GEOPHYSICAL INVESTIGATION

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION



NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

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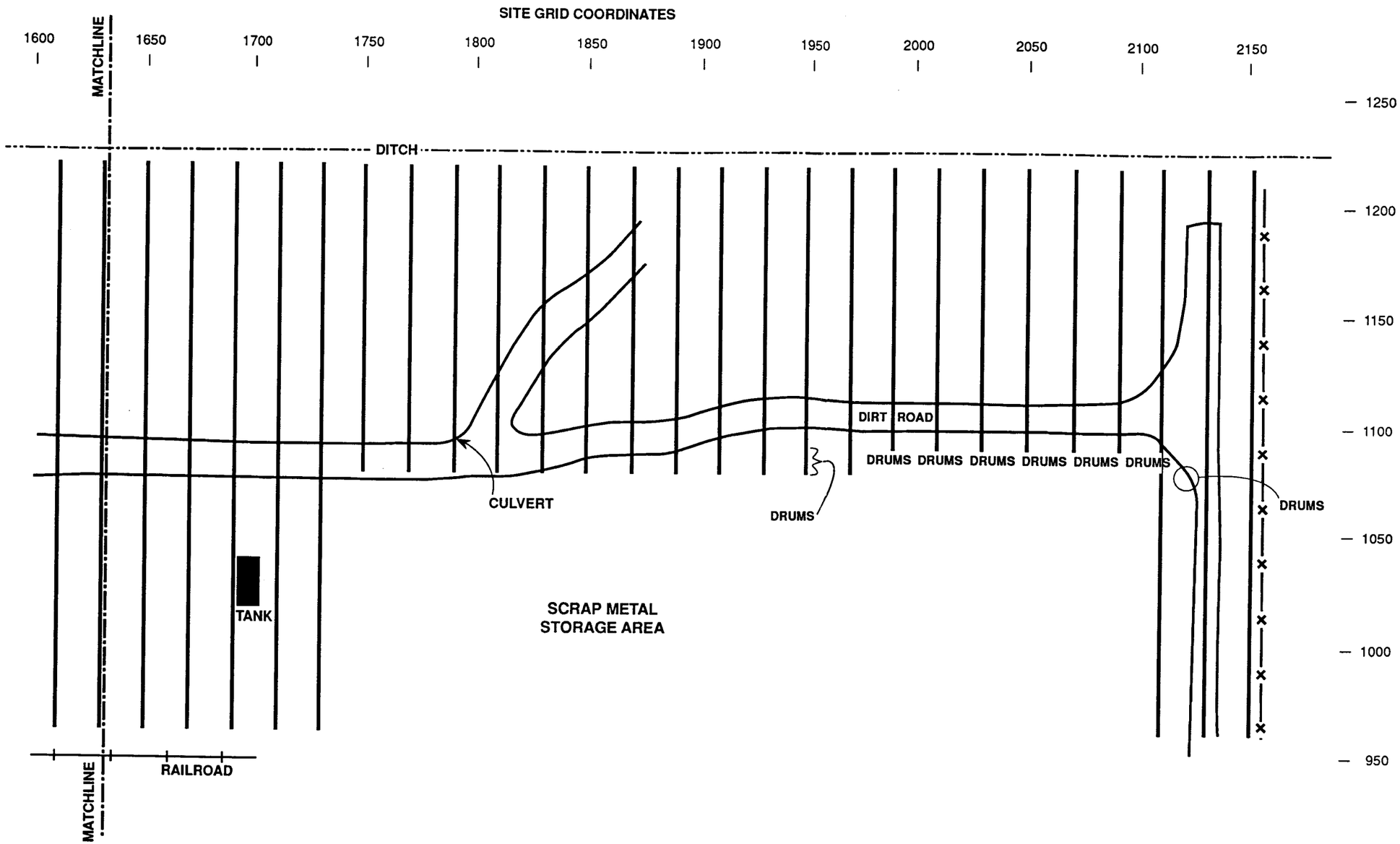
WDS 7/9/03
Initials Date
UNCLASSIFIED

Figure 2-3 (Sheet 1 of 2)
WMU-7: BURIAL GROUND
WMU-30: BURN AREA
EXTENT OF GEOPHYSICAL INVESTIGATION

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR



NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

REVIEWED FOR CLASSIFICATION
WDS 7/9/03
Initials Date
UNCLASSIFIED

Grid North

0 50'
SCALE IN FEET

Figure 2-3 (Sheet 2 of 2)
WMU-7: BURIAL GROUND
WMU-30: BURN AREA
EXTENT OF GEOPHYSICAL INVESTIGATION

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR

ORO30888.RR

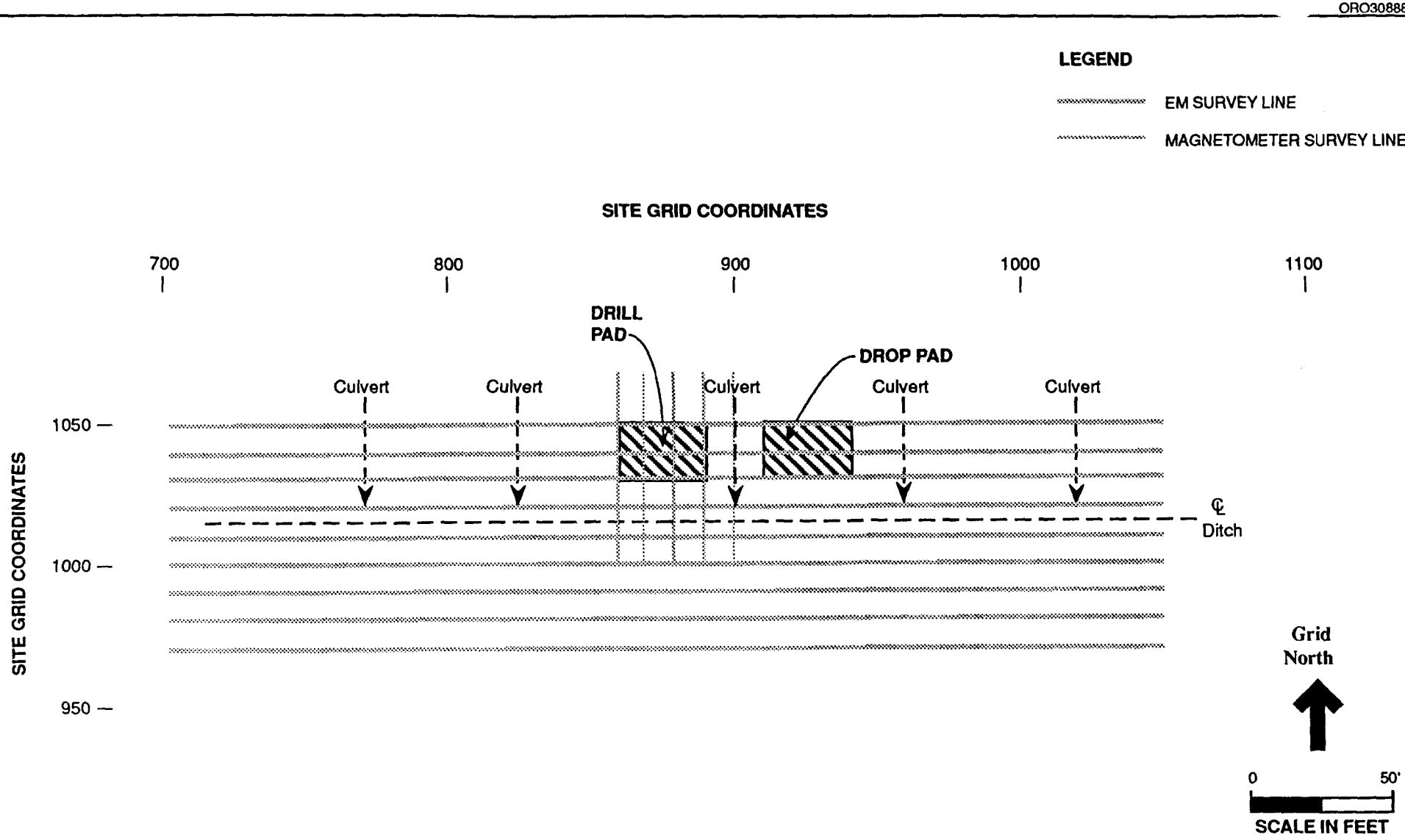
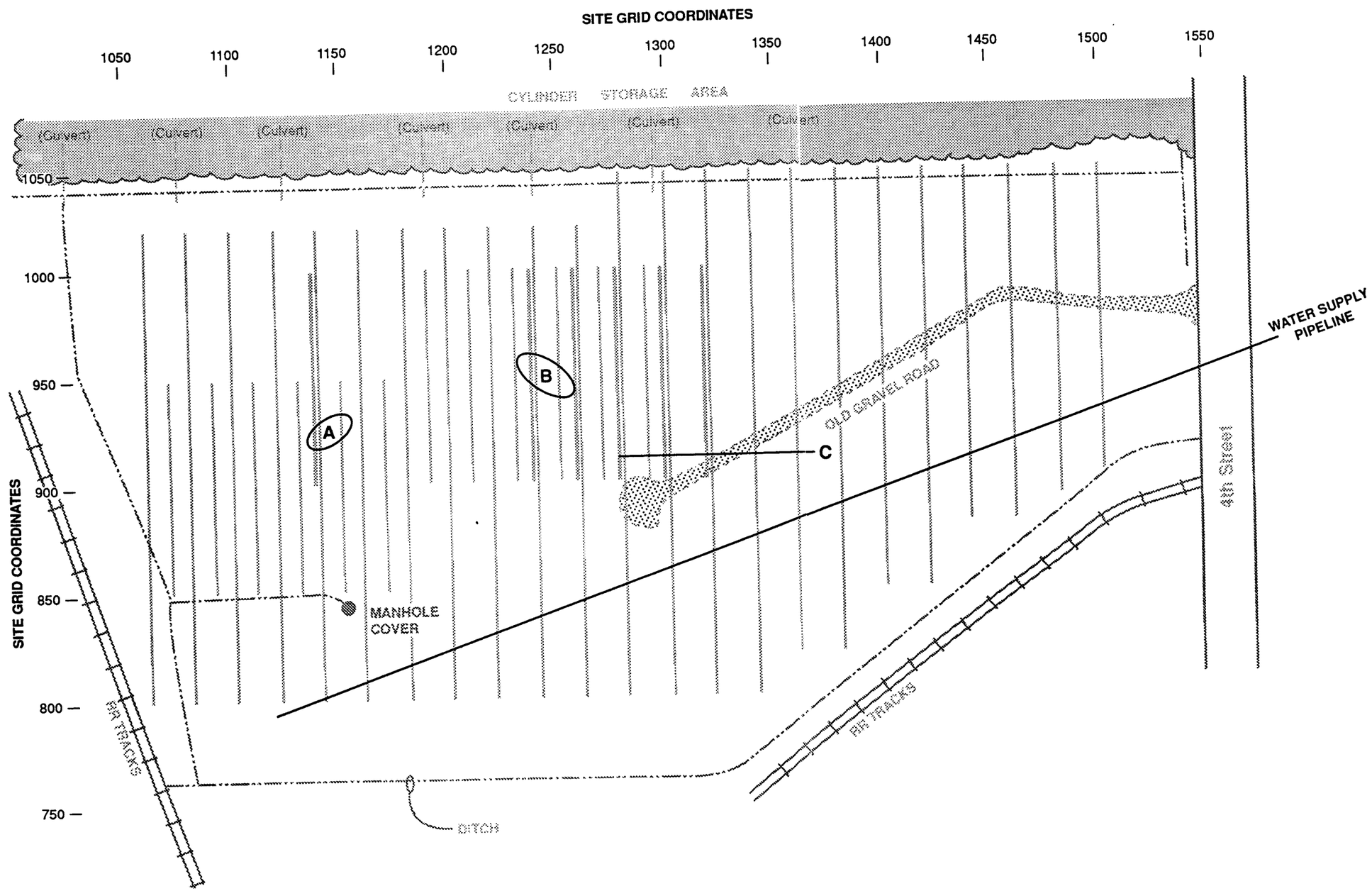


Figure 2-4
WMU-91: DROP TEST AREA EXTENT OF GEOPHYSICAL INVESTIGATION

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION



LEGEND

- EM SURVEY LINE
- MAGNETOMETER SURVEY LINE
- INTERPRETED AREA OF BURIED WASTE
- INTERPRETED THIN CONDUCTOR (SUCH AS BURIED PIPE)

NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

REVIEWED FOR CLASSIFICATION
LOS 7/9/03
Initials Date
UNCLASSIFIED

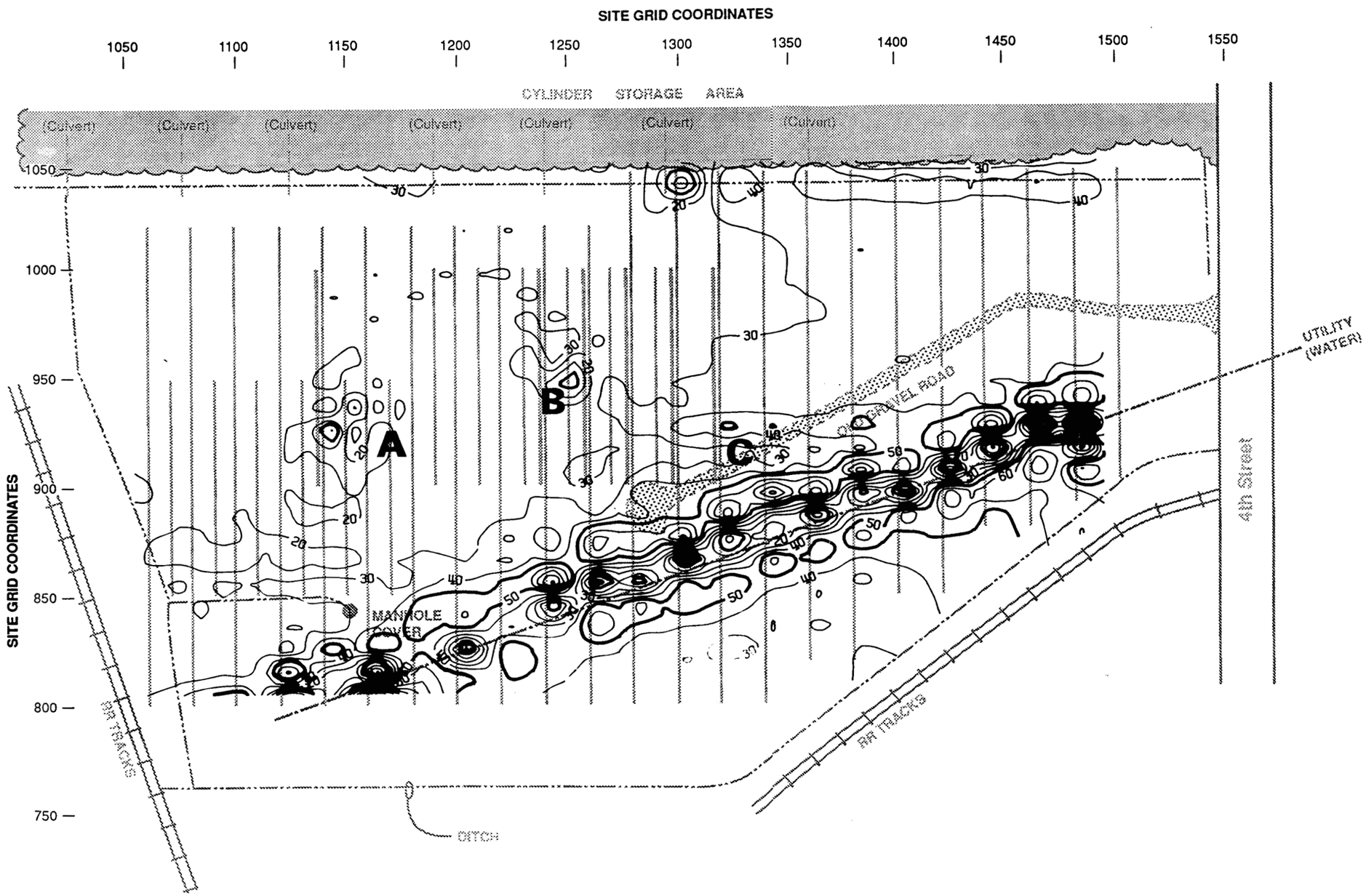
Grid North

0 50'
SCALE IN FEET

Figure 2-5
WMU-1: OIL LANDFARM AREA
RESULTS OF GEOPHYSICAL INVESTIGATION

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR



LEGEND

EM SURVEY LINE

MAGNETOMETER SURVEY LINE

NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

CONTOUR INTERVAL = 10 millimhos / meter

REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

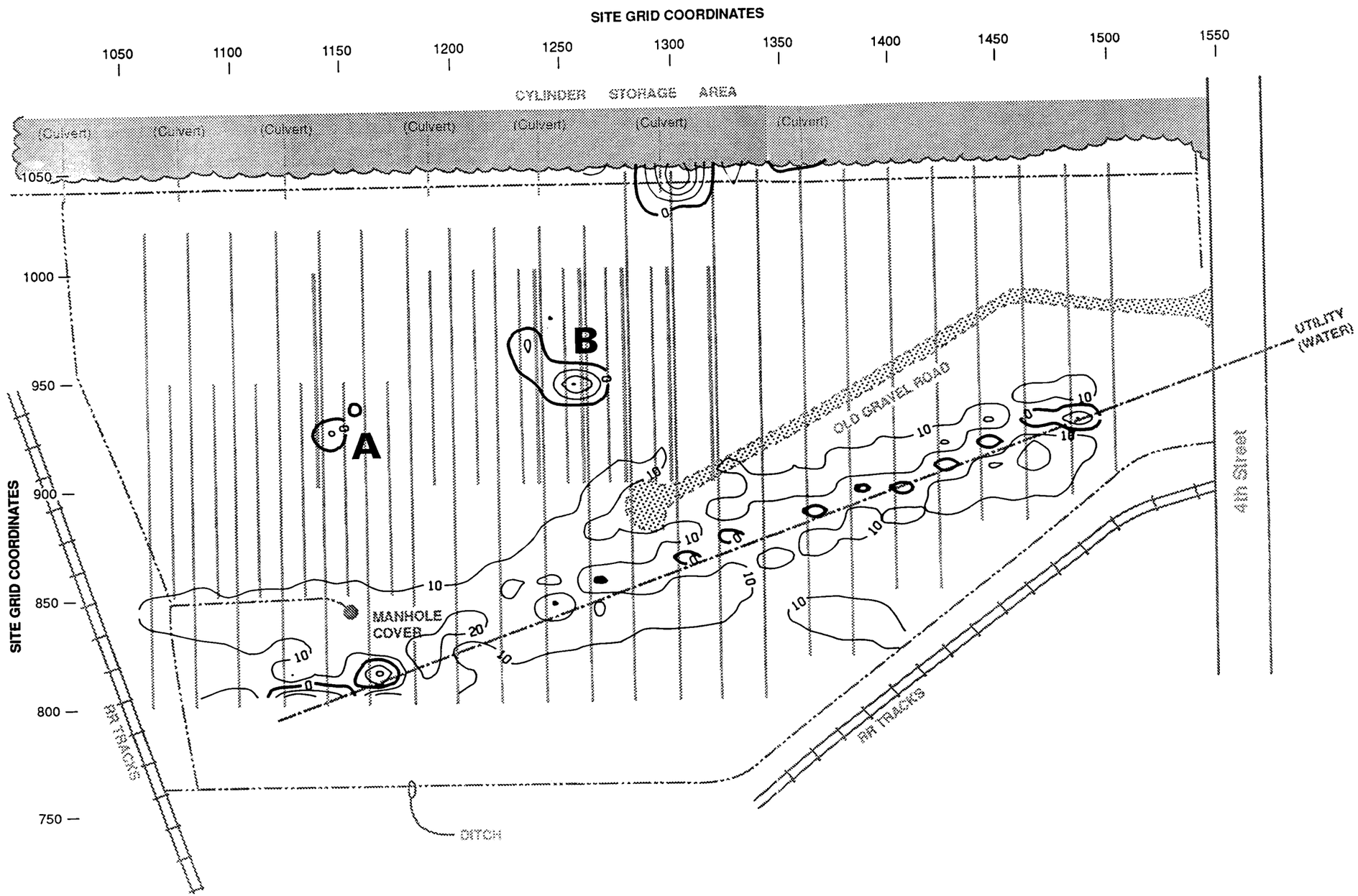
Grid North

0 50'
SCALE IN FEET

Figure 2-6
WMU-1: OIL LANDFARM AREA
EM CONDUCTIVITY DATA

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR



LEGEND

EM SURVEY LINE

MAGNETOMETER SURVEY LINE

NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

CONTOUR INTERVAL = 10 parts per thousand

REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

Grid North

0 50'
SCALE IN FEET

Figure 2-7
WMU-1: OIL LANDFARM AREA
EM IN-PHASE DATA

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR

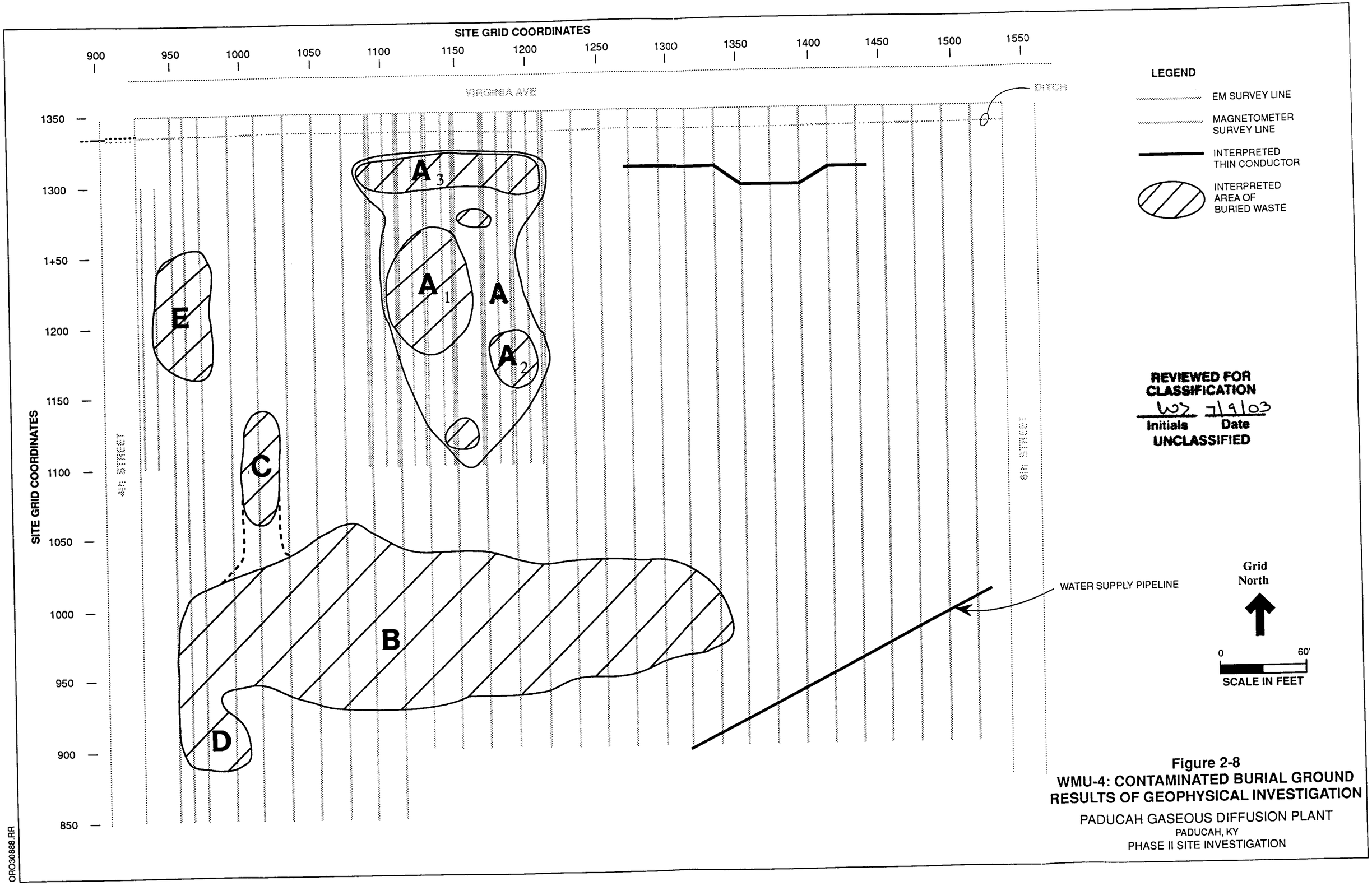
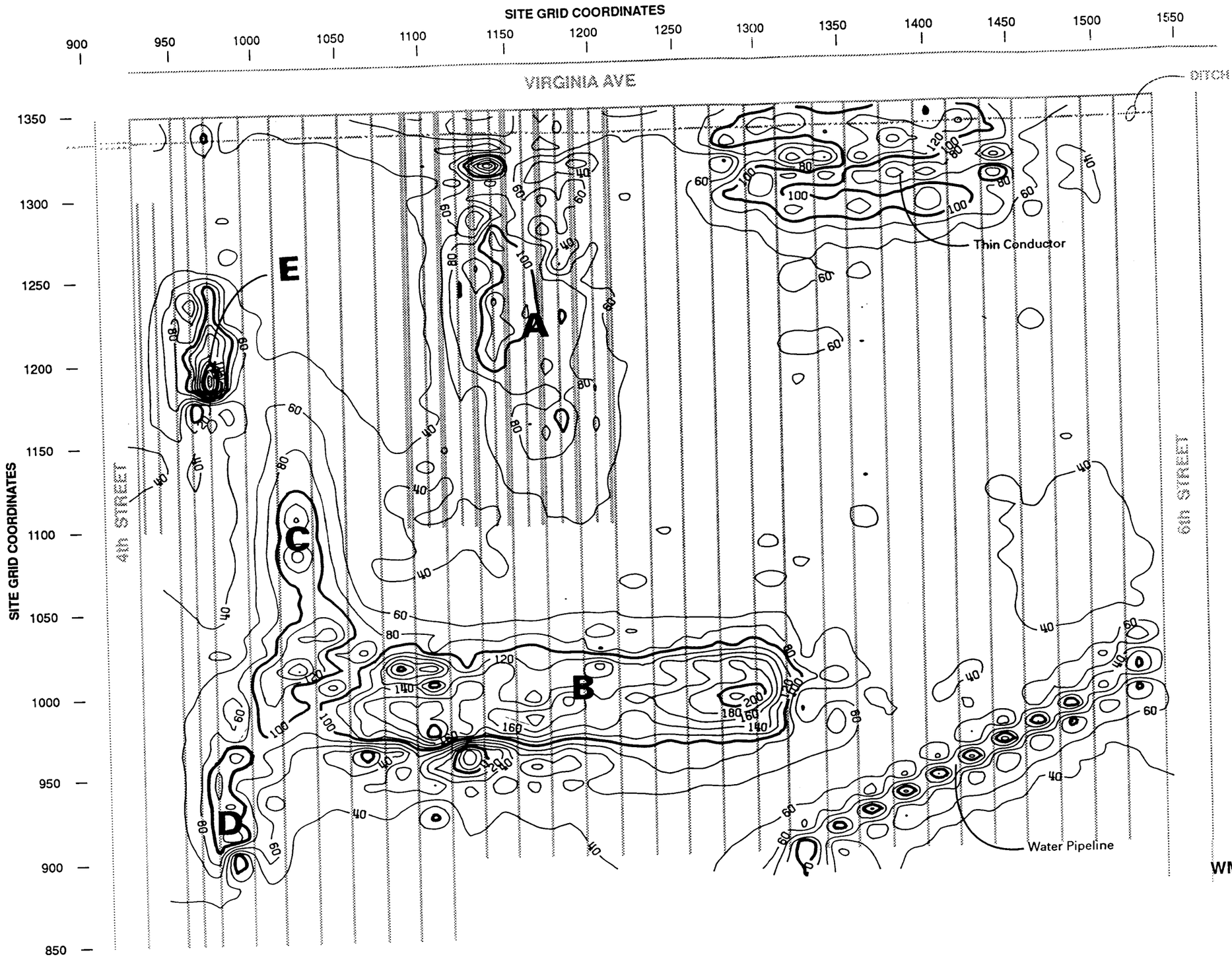


Figure 2-8
WMU-4: CONTAMINATED BURIAL GROUND
RESULTS OF GEOPHYSICAL INVESTIGATION

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR



LEGEND

EM SURVEY LINE

MAGNETOMETER SURVEY LINE

CONTOUR INTERVAL= 20 millimhos/meter

NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

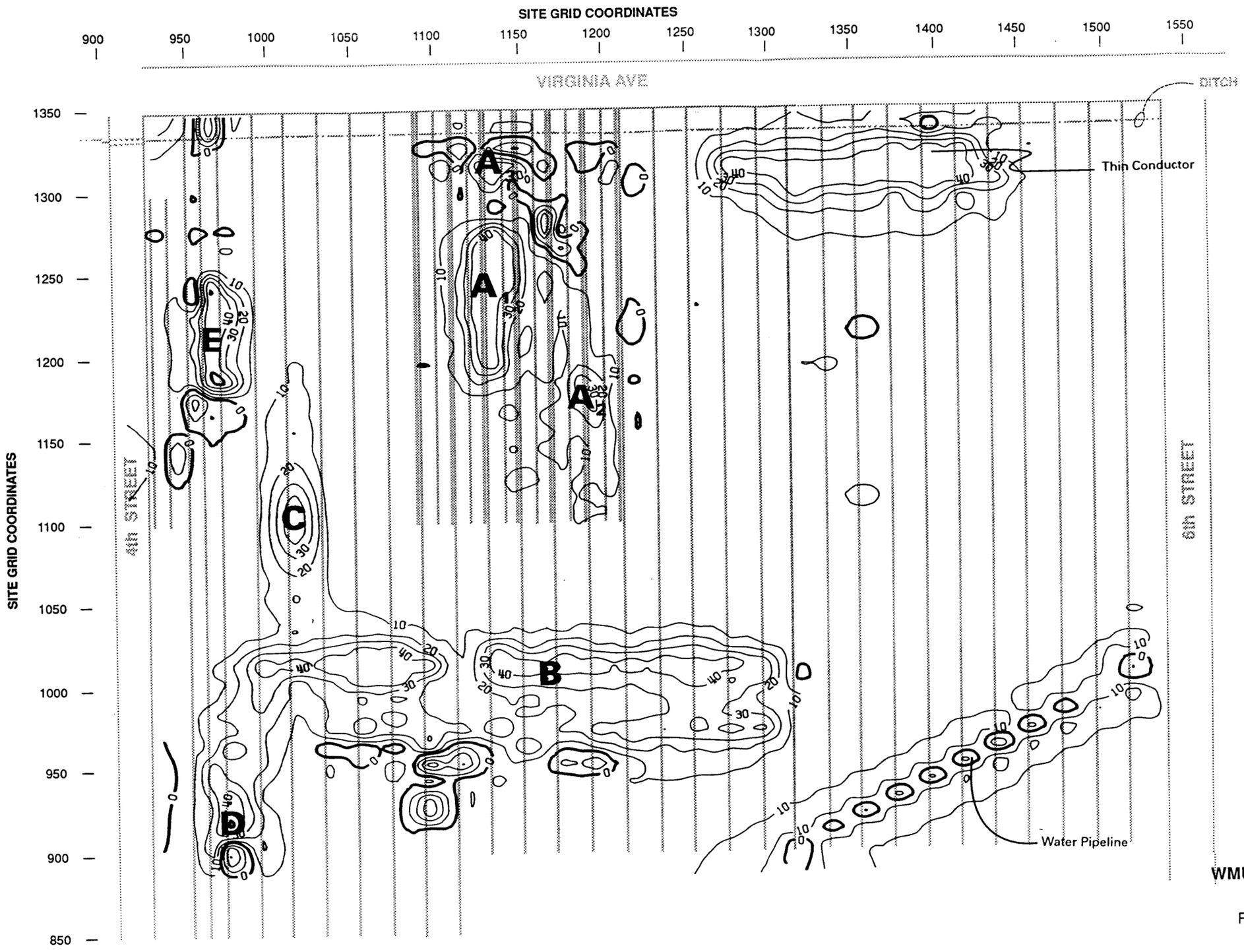
Grid North

0 60'
SCALE IN FEET

Figure 2-9
WMU-4: CONTAMINATED BURIAL GROUND EM CONDUCTIVITY DATA

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR



LEGEND

EM SURVEY LINE

MAGNETOMETER SURVEY LINE

CONTOUR INTERVAL = 10 parts per thousand

NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

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LDS 7/9/03
Initials Date
UNCLASSIFIED

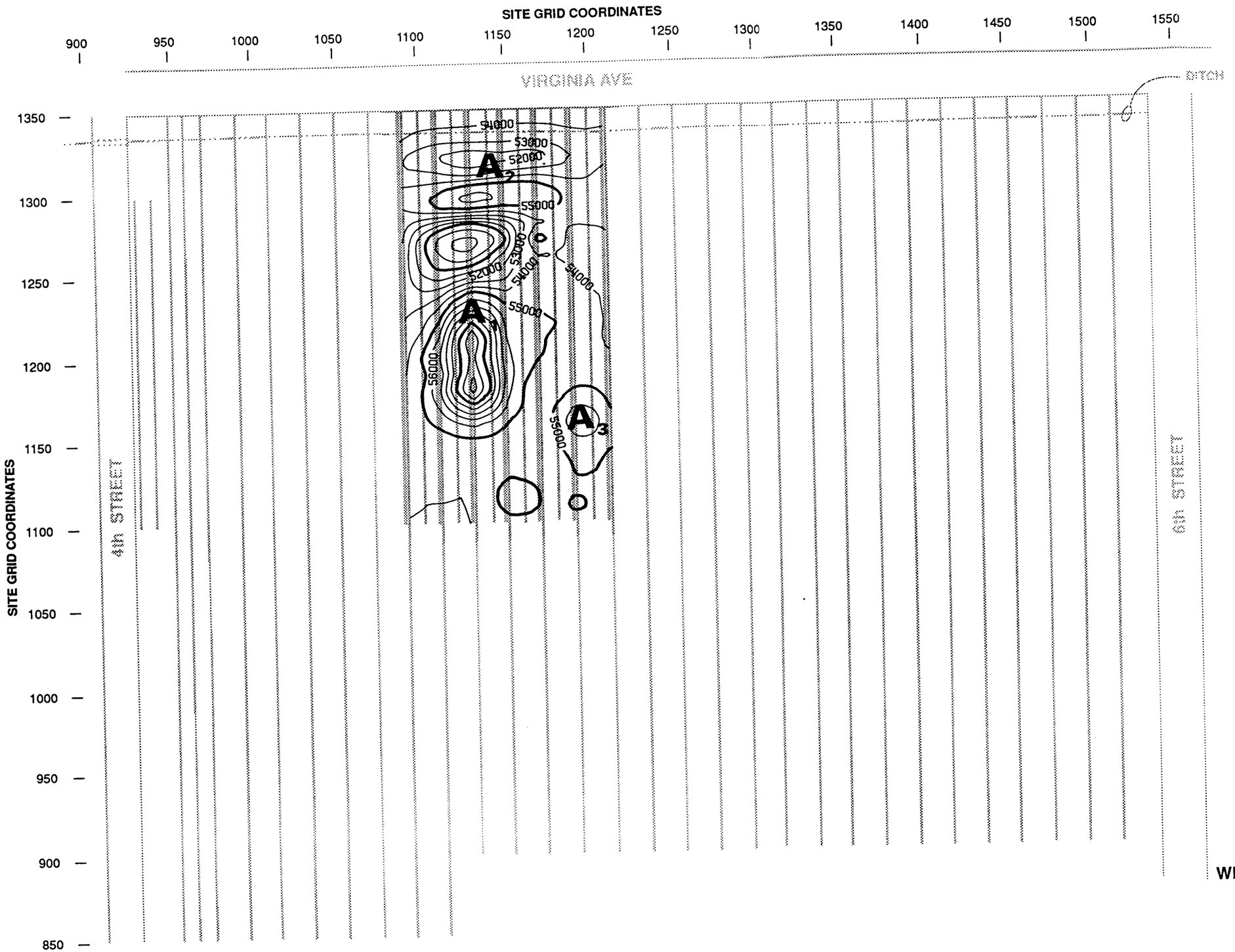
Grid North

0 60'
SCALE IN FEET

Figure 2-10
WMU-4: CONTAMINATED BURIAL GROUND EM IN-PHASE DATA

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR



LEGEND

EM SURVEY LINE

MAGNETOMETER SURVEY LINE

CONTOUR INTERVAL = 1000 gammas

NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

REVIEWED FOR CLASSIFICATION
Initials 7/9/03 Date
UNCLASSIFIED

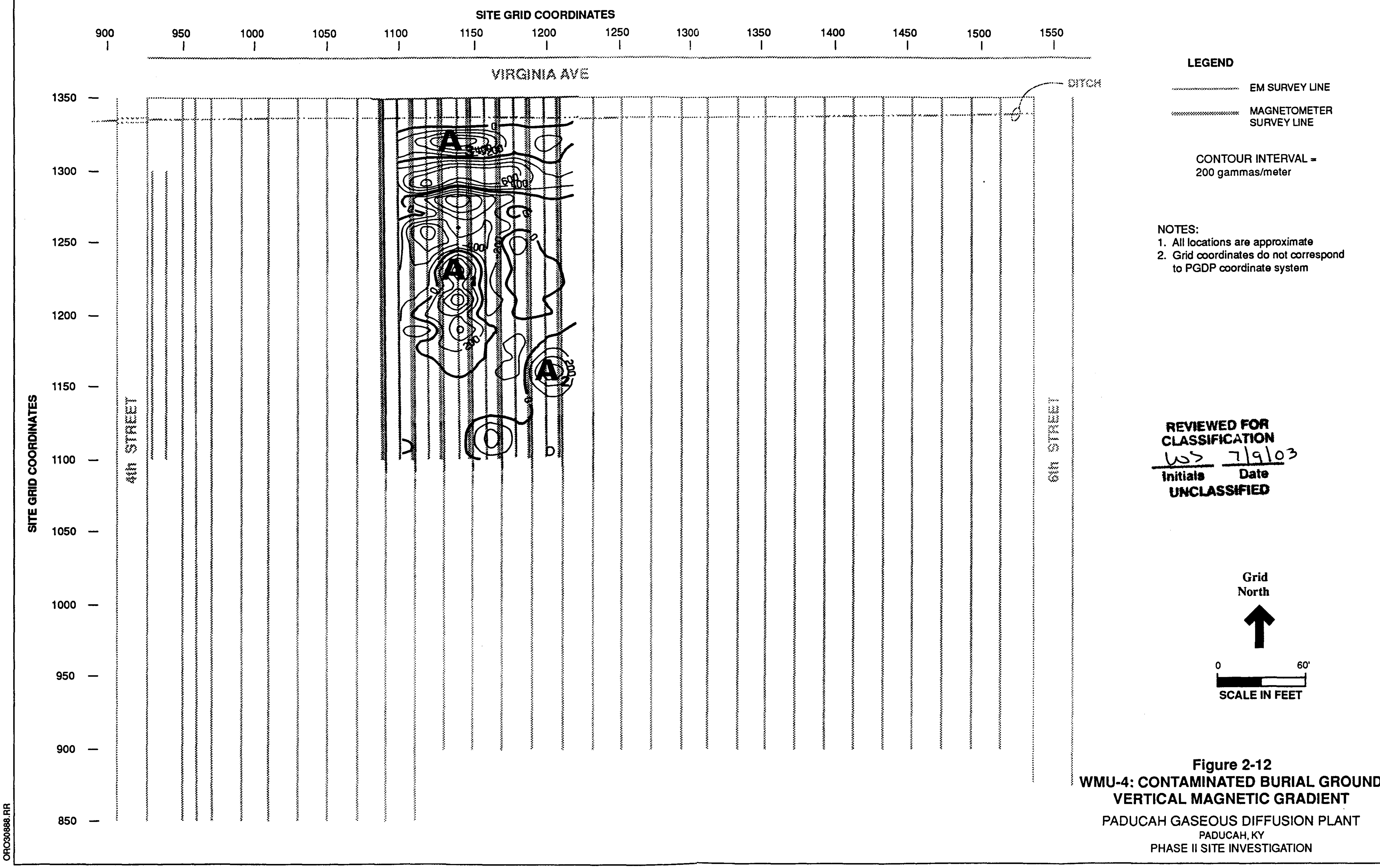
Grid North

0 60'
SCALE IN FEET

Figure 2-11
WMU-4: CONTAMINATED BURIAL GROUND TOTAL MAGNETIC FIELD INTENSITY

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR



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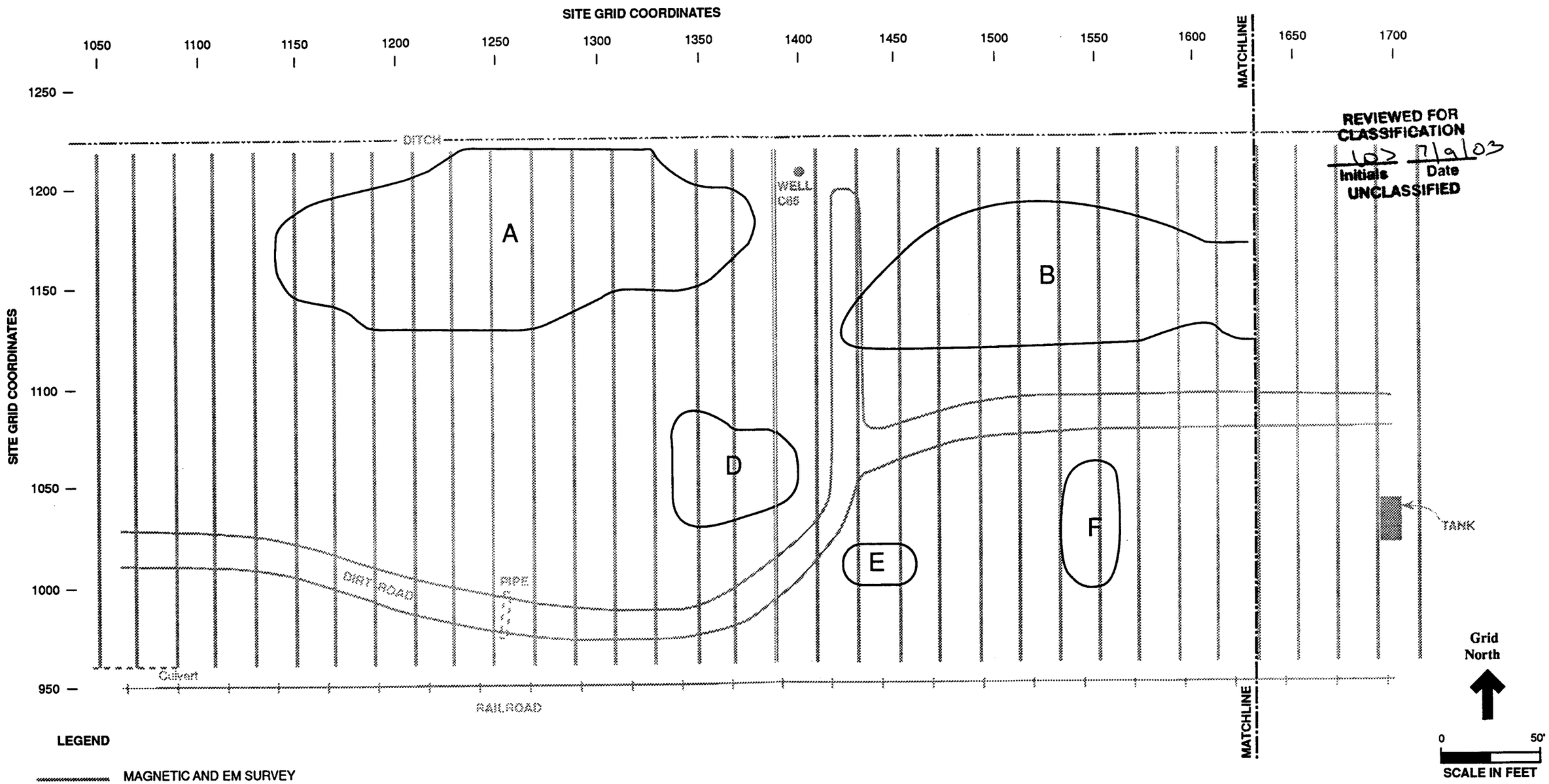
WS 7/9/03
Initials Date
UNCLASSIFIED

Figure 2-12
WMU-4: CONTAMINATED BURIAL GROUND VERTICAL MAGNETIC GRADIENT
PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION



REVIEWED FOR CLASSIFICATION
LDS 7/9/03
Initials Date
UNCLASSIFIED

LEGEND

MAGNETIC AND EM SURVEY LINE

INTERPRETED AREA OF BURIED WASTE

NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

Figure 2-13 (Sheet 1 of 2)
WMU-7: BURIAL GROUND
WMU-30: BURN AREA
RESULTS OF GEOPHYSICAL INVESTIGATION

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORC30888.RR

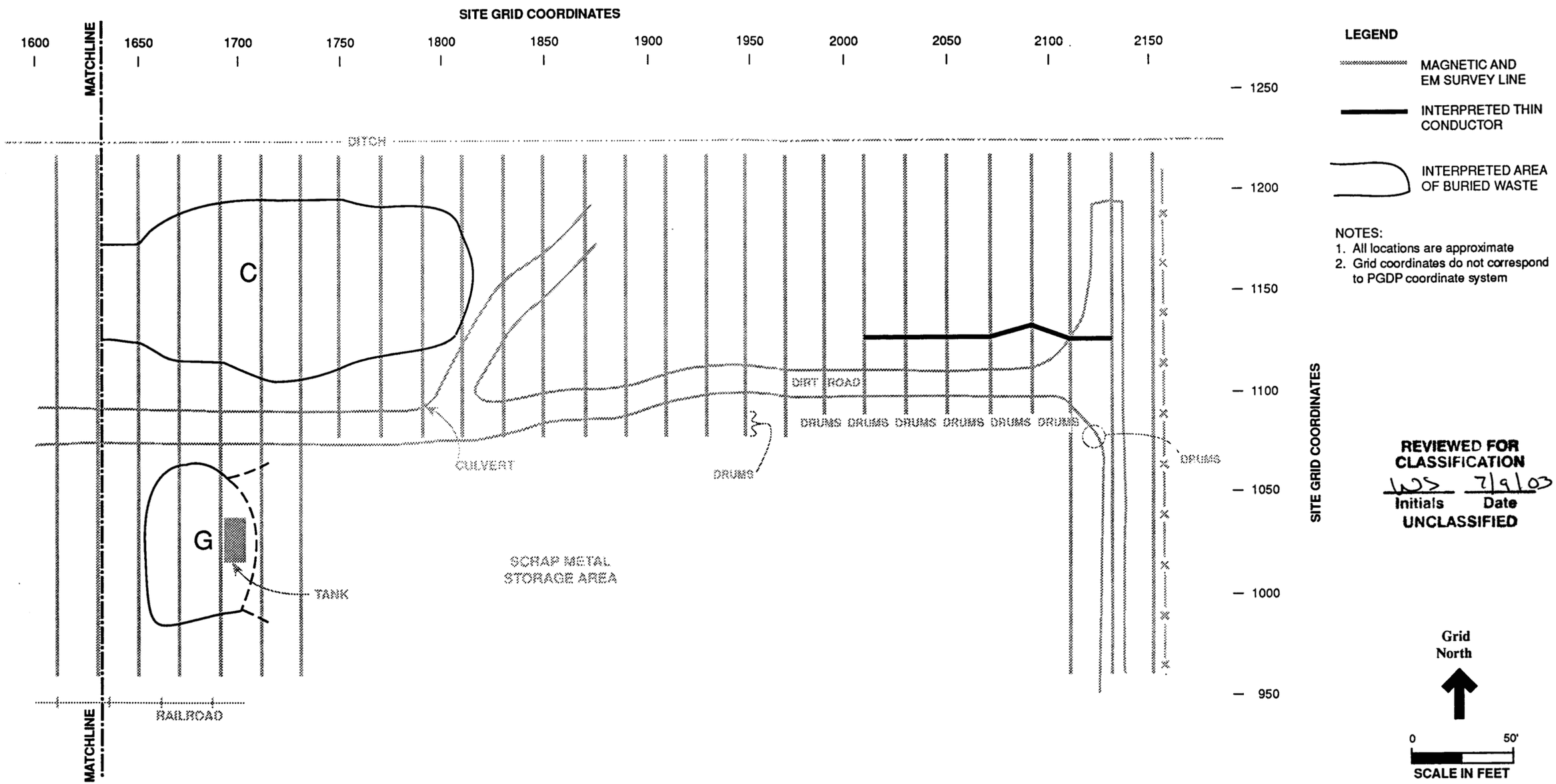
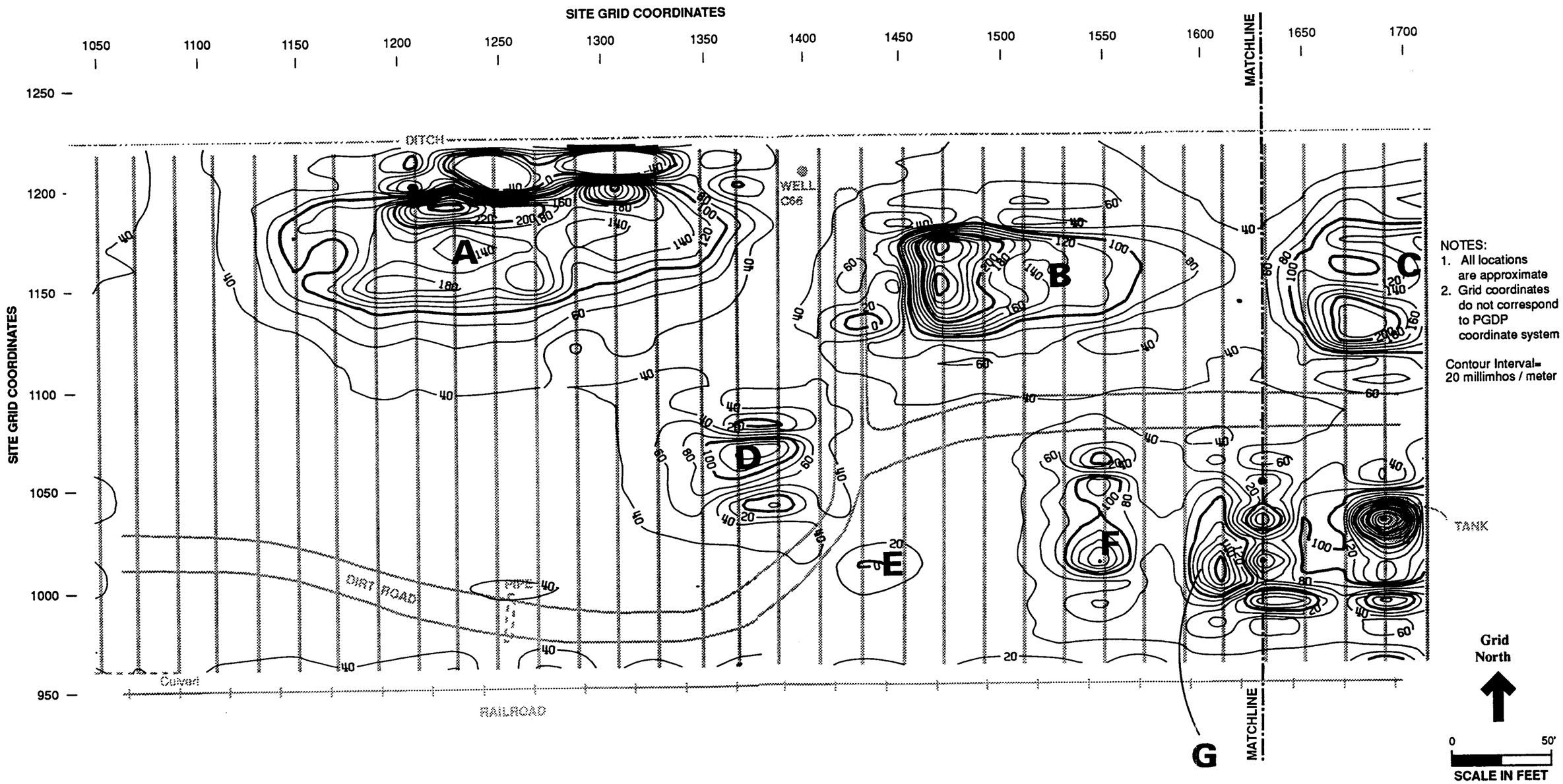


Figure 2-13 (Sheet 2 of 2)
WMU-7: BURIAL GROUND
WMU-30: BURN AREA
RESULTS OF GEOPHYSICAL INVESTIGATION

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR



NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

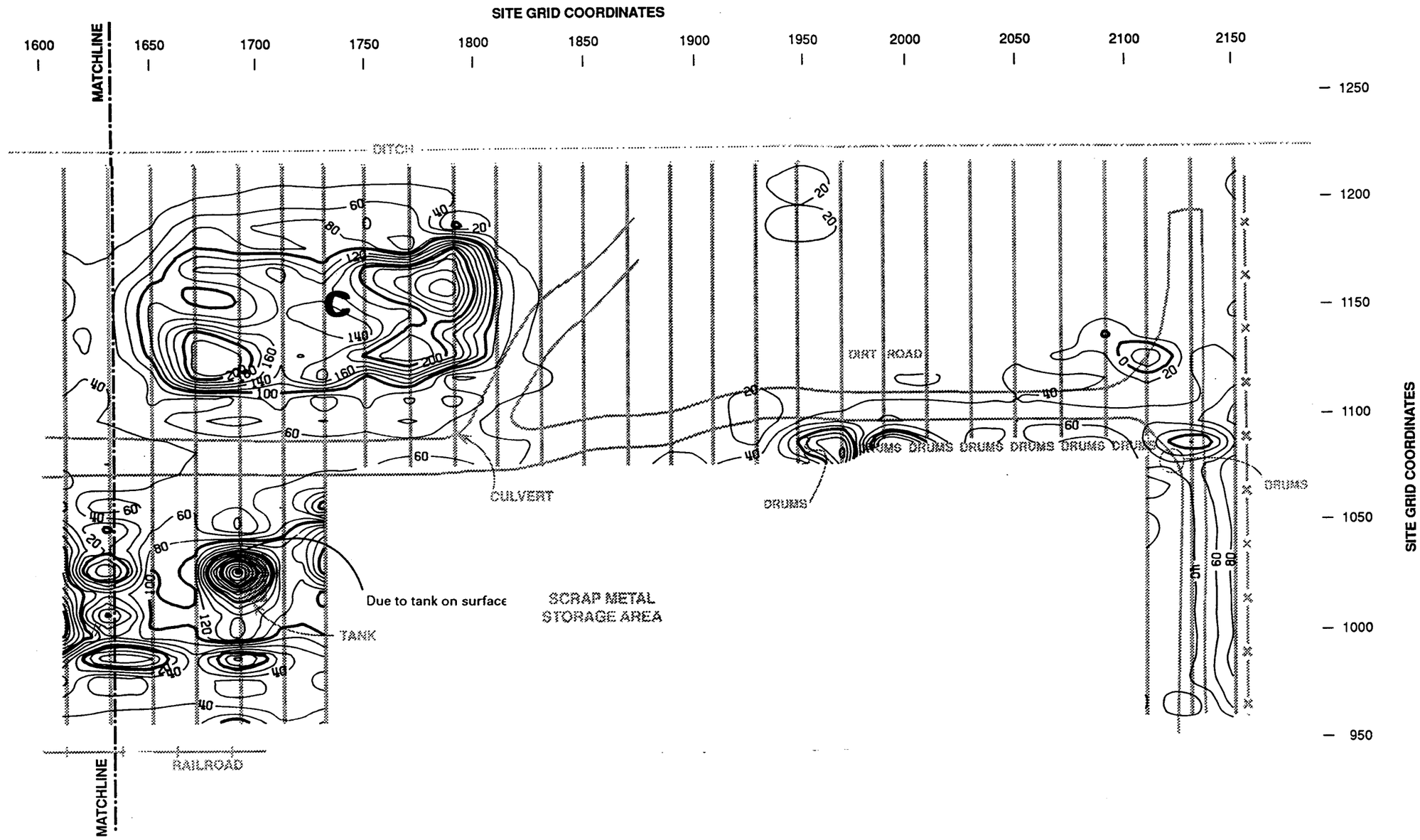
Contour Interval= 20 millimhos / meter

REVIEWED FOR CLASSIFICATION
WOS 7/9/07
Date
UNCLASSIFIED

Figure 2-14 (Sheet 1 of 2)
WMU-7: BURIAL GROUND
WMU-30: BURN AREA
EM CONDUCTIVITY DATA

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORC30888.RR



NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

CONTOUR INTERVAL = 20 millimhos / meter

REVIEWED FOR CLASSIFICATION
WD 7/9/03
Initials Date
UNCLASSIFIED

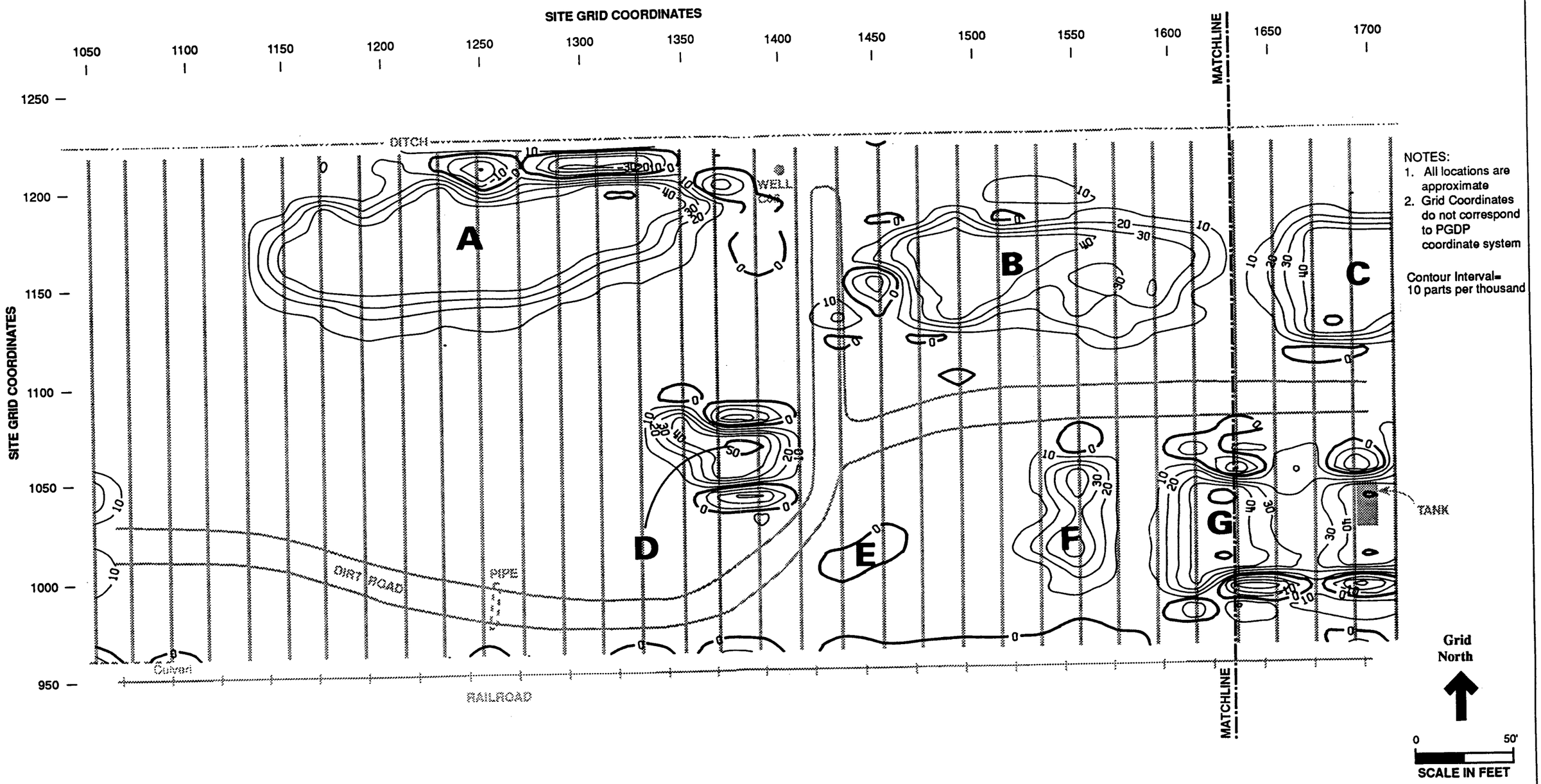
Grid North

0 50'
SCALE IN FEET

Figure 2-14 (Sheet 2 of 2)
WMU-7: BURIAL GROUND
WMU-30: BURN AREA
EM CONDUCTIVITY DATA

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR

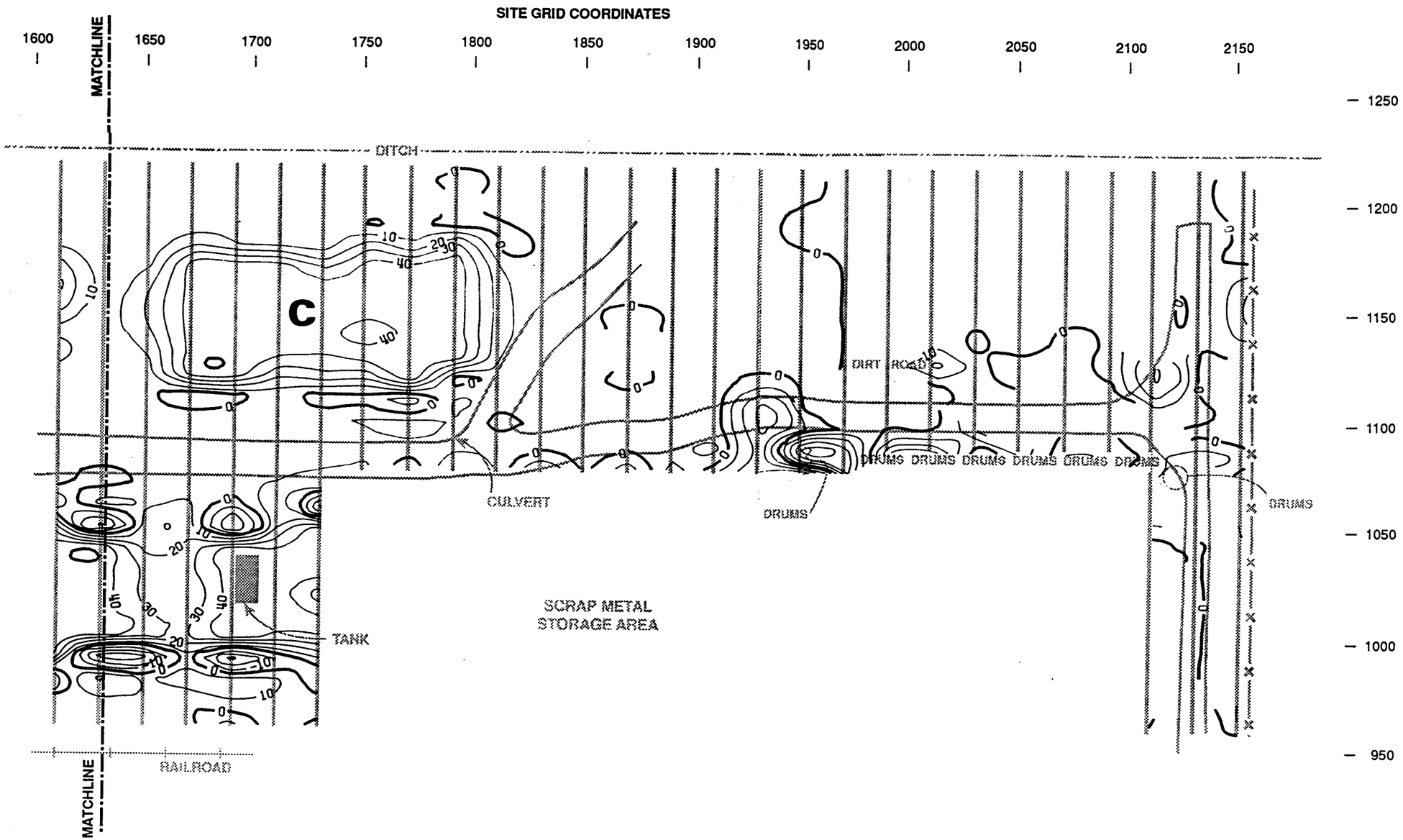


REVIEWED FOR CLASSIFICATION
WS 7/9/03
Date
UNCLASSIFIED

Figure 2-15 (Sheet 1 of 2)
WMU-7: BURIAL GROUND
WMU-30: BURN AREA
EM IN-PHASE DATA

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORC30888.RR



NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

CONTOUR INTERVAL = 10 parts per thousand

REVIEWED FOR CLASSIFICATION
WJS 7/9/03
Initials Date
UNCLASSIFIED

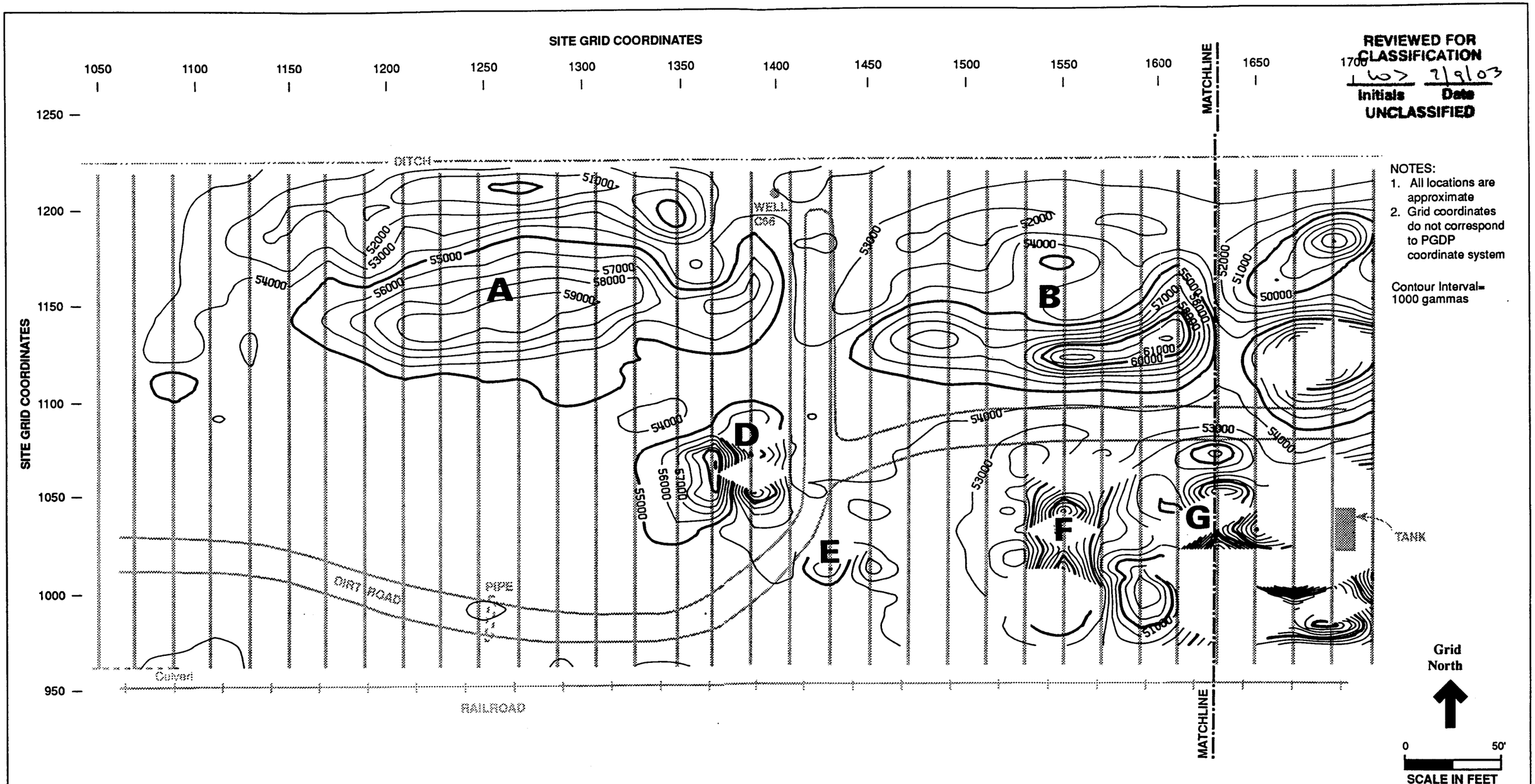
Grid North

0 50'
SCALE IN FEET

Figure 2-15 (Sheet 2 of 2)
WMU-7: BURIAL GROUND
WMU-30: BURN AREA
EM IN-PHASE DATA

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR Figure 2-15 (2 of 2) 8-12-91 MJL



REVIEWED FOR CLASSIFICATION
LWS 2/9/03
Initials Date
UNCLASSIFIED

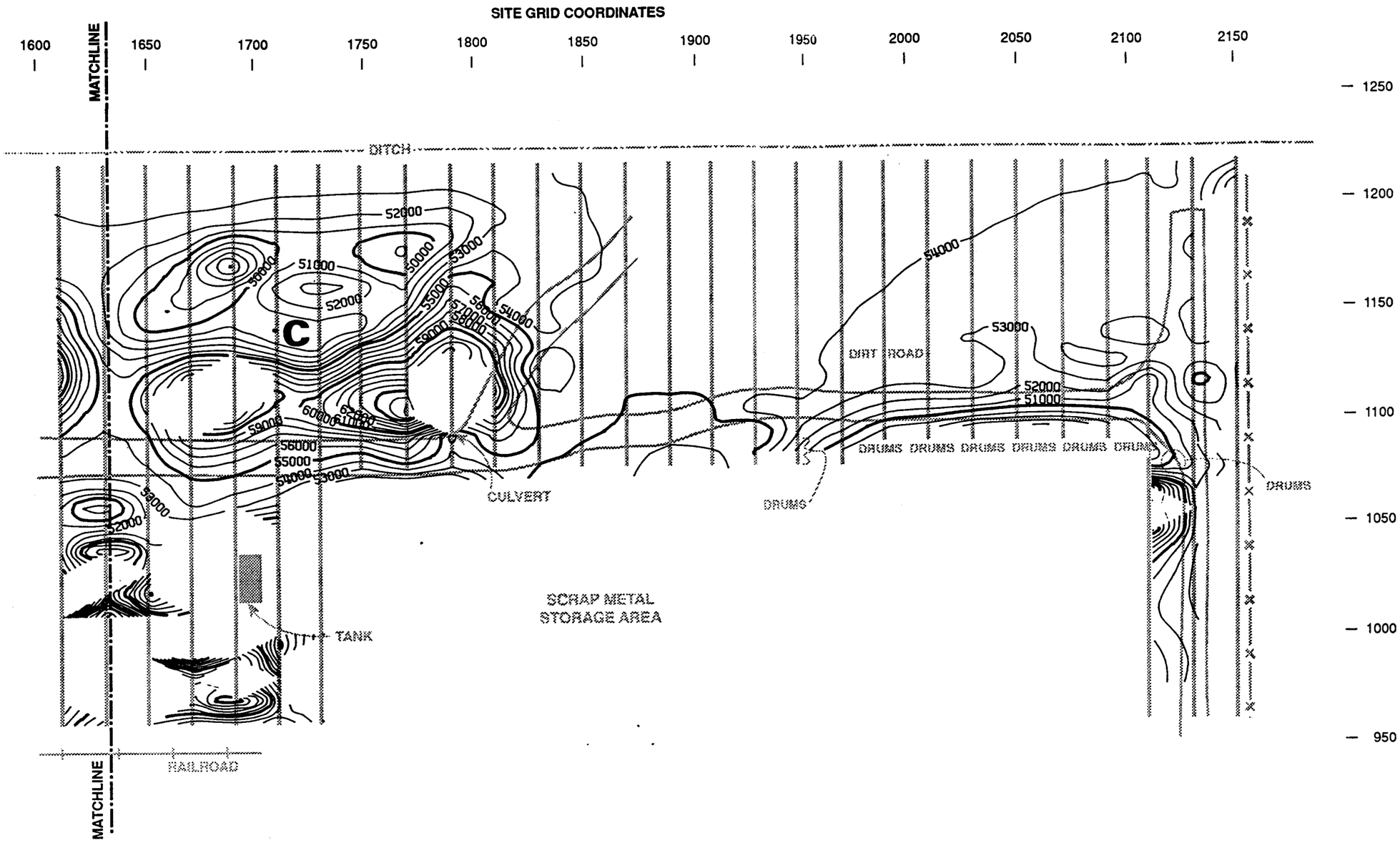
NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

Contour Interval= 1000 gammas

Figure 2-16 (Sheet 1 of 2)
WMU-7: BURIAL GROUND
WMU-30: BURN AREA
TOTAL MAGNETIC FIELD INTENSITY

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR



NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

CONTOUR INTERVAL = 1000 gammas

REVIEWED FOR CLASSIFICATION
WS 7/9/03
Initials Date
UNCLASSIFIED

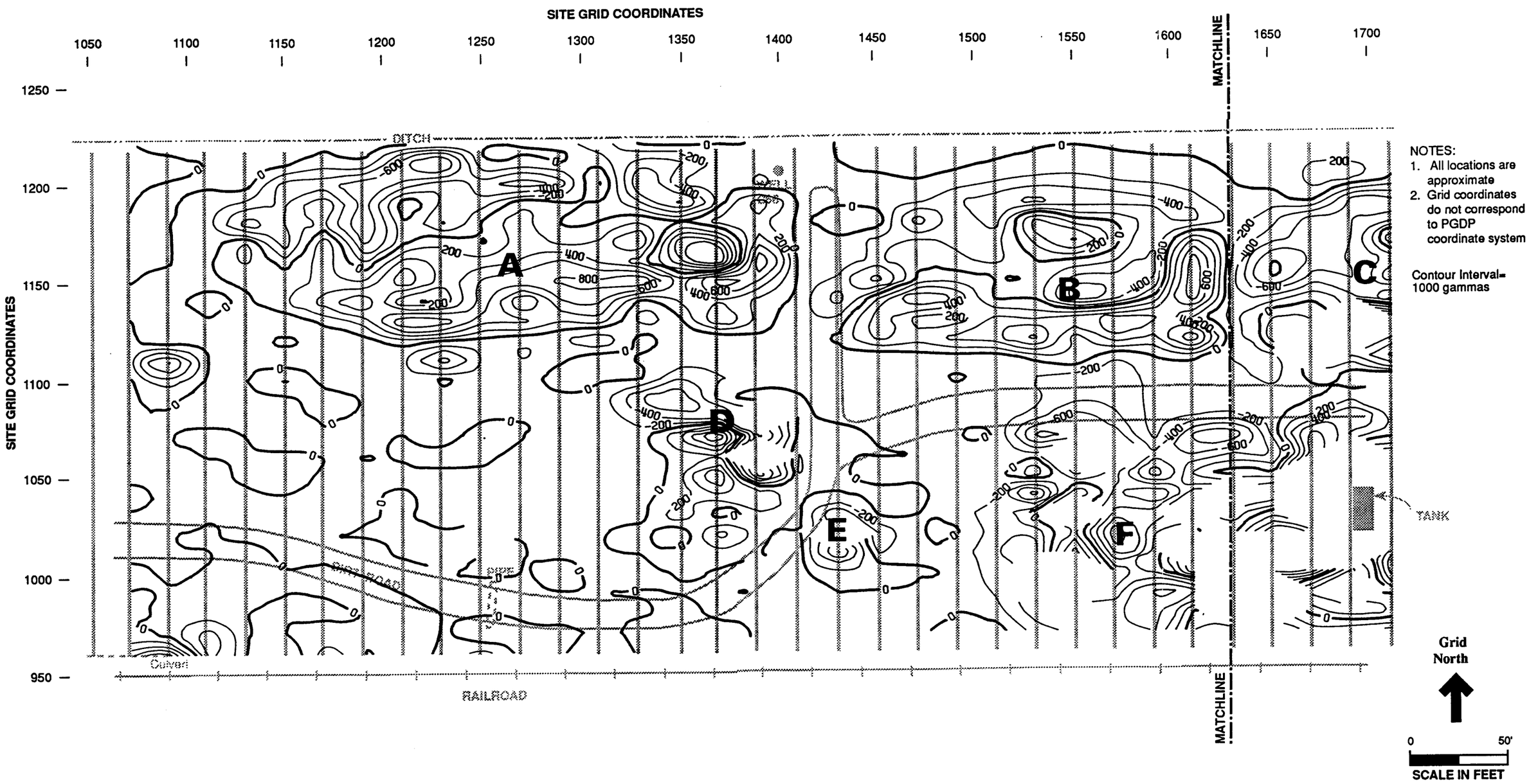
Grid North

0 50'
SCALE IN FEET

Figure 2-16 (Sheet 2 of 2)
WMU-7: BURIAL GROUND
WMU-30: BURN AREA
TOTAL MAGNETIC FIELD INTENSITY

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR



NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

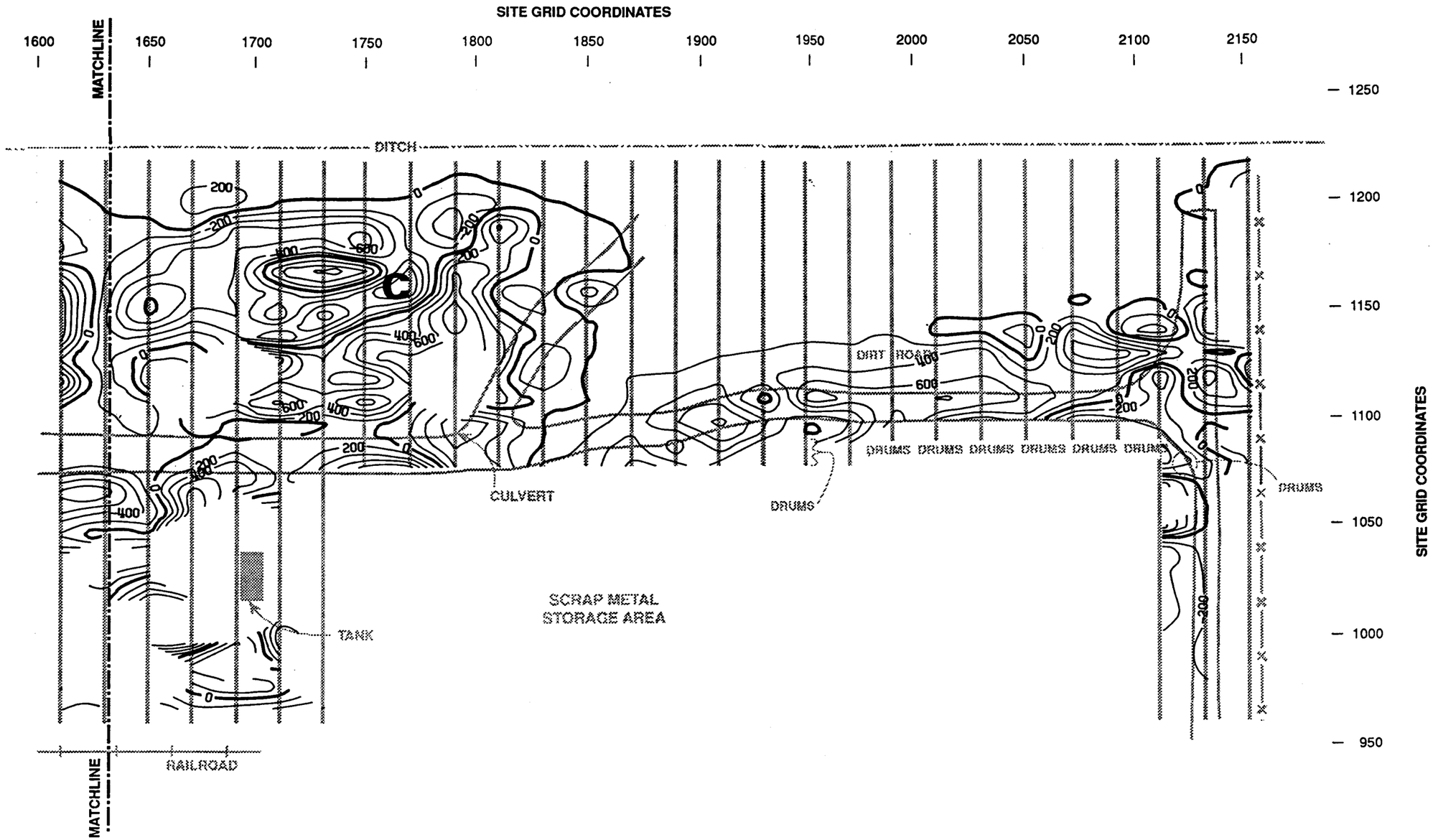
Contour Interval= 1000 gammas

REVIEWED FOR CLASSIFICATION
WS 7/9/03
Date

Figure 2-17 (Sheet 1 of 2)
WMU-7: BURIAL GROUND
WMU-30: BURN AREA
VERTICAL MAGNETIC GRADIENT

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30888.RR



NOTES:
1. All locations are approximate
2. Grid coordinates do not correspond to PGDP coordinate system

CONTOUR INTERVAL = 200 gammas / meters

REVIEWED FOR CLASSIFICATION
Initials Date
UNCLASSIFIED

Grid North

0 50'
SCALE IN FEET

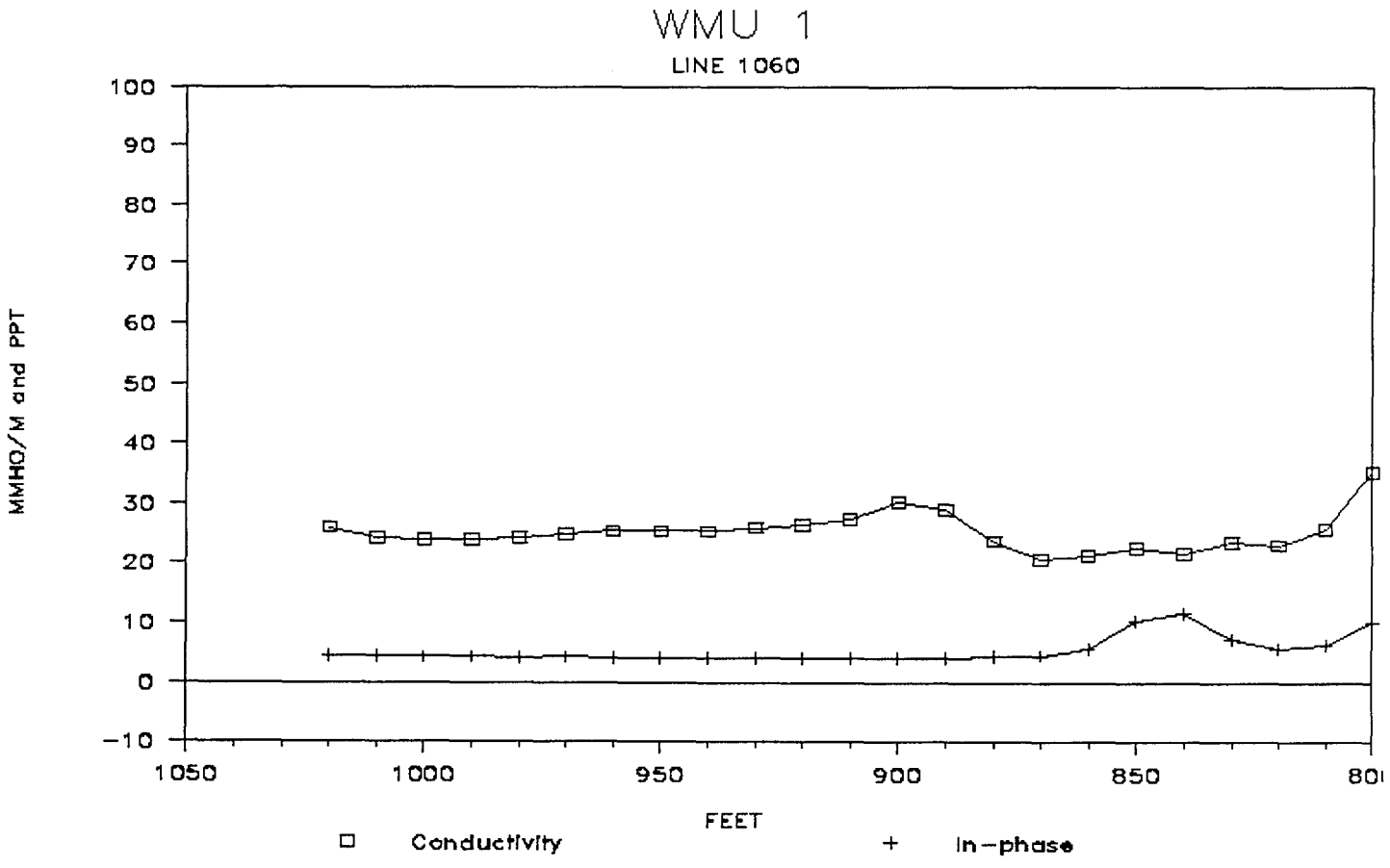
Figure 2-17 (Sheet 2 of 2)
WMU-7: BURIAL GROUND
WMU-30: BURN AREA
VERTICAL MAGNETIC GRADIENT

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

ORO30688.RR

Attachment A

WMU 1 - OIL LANDFARM AREA GEOPHYSICAL DATA


WMU 1
LINE 1060
MMHO/M and PPT
100
90
80
70
60
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40
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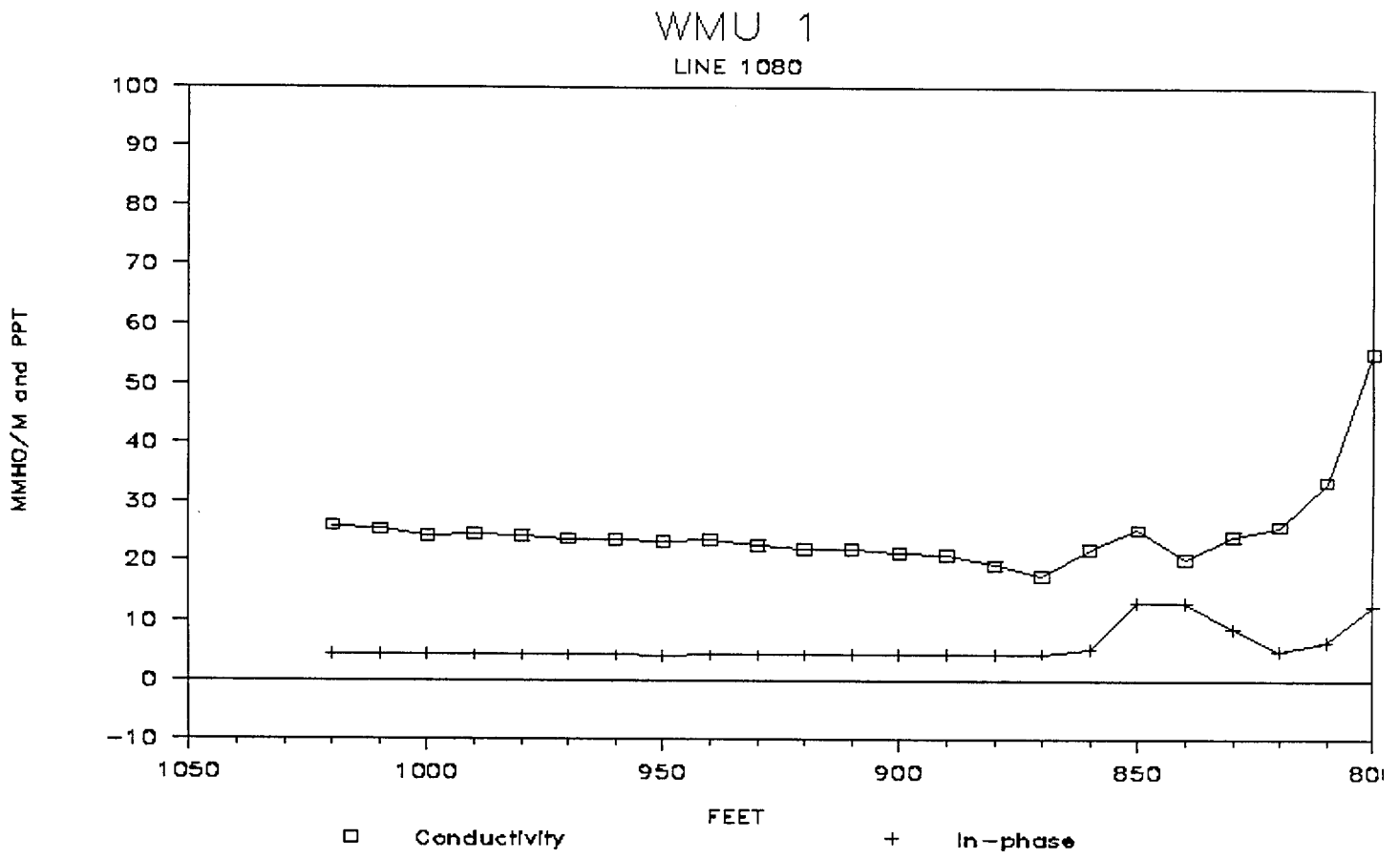
20
10
0
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase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LINE 1080
MMHO/M and PPT
100
90
80
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60
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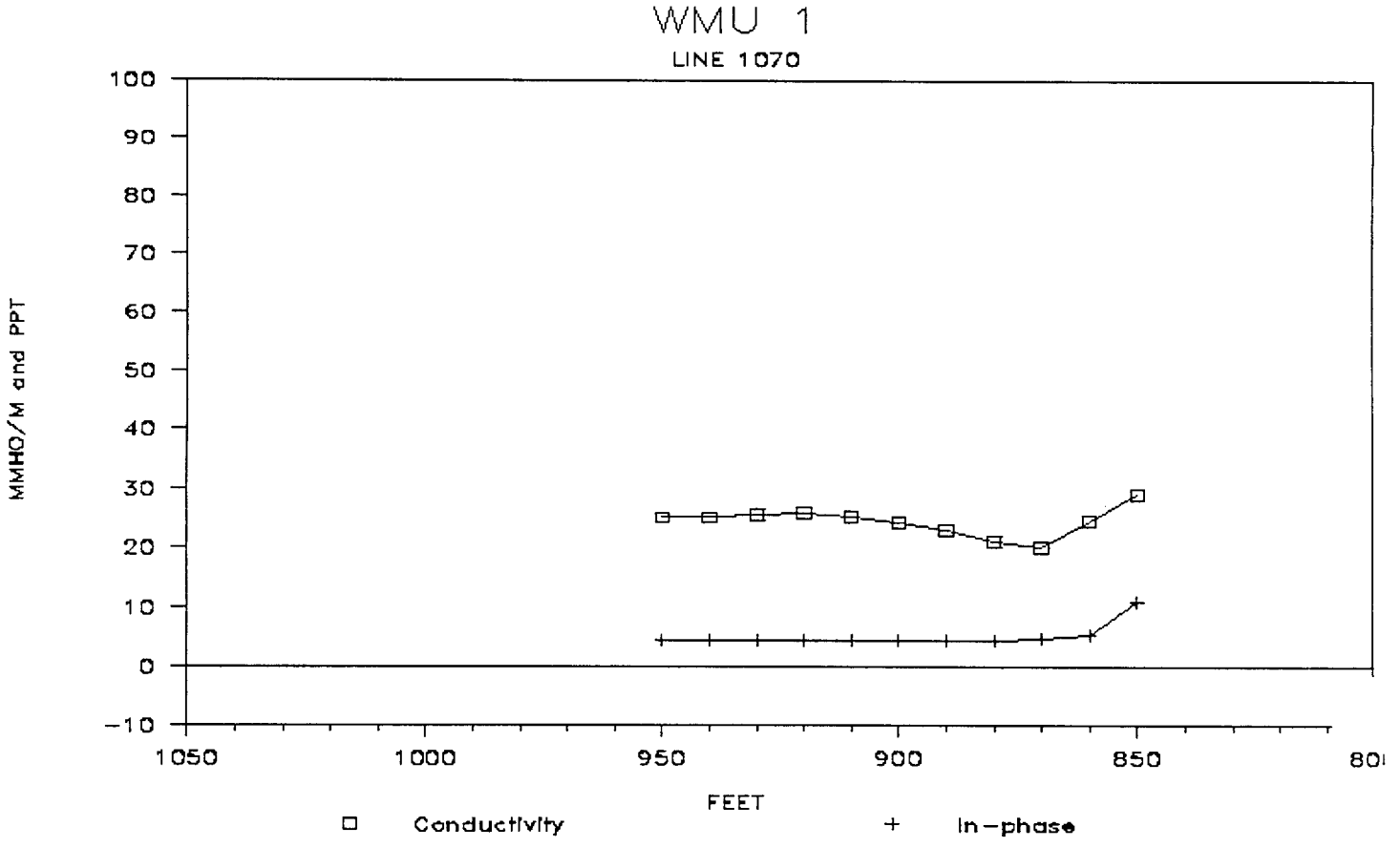
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase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LINE 1070
MMHO/M and PPT
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90
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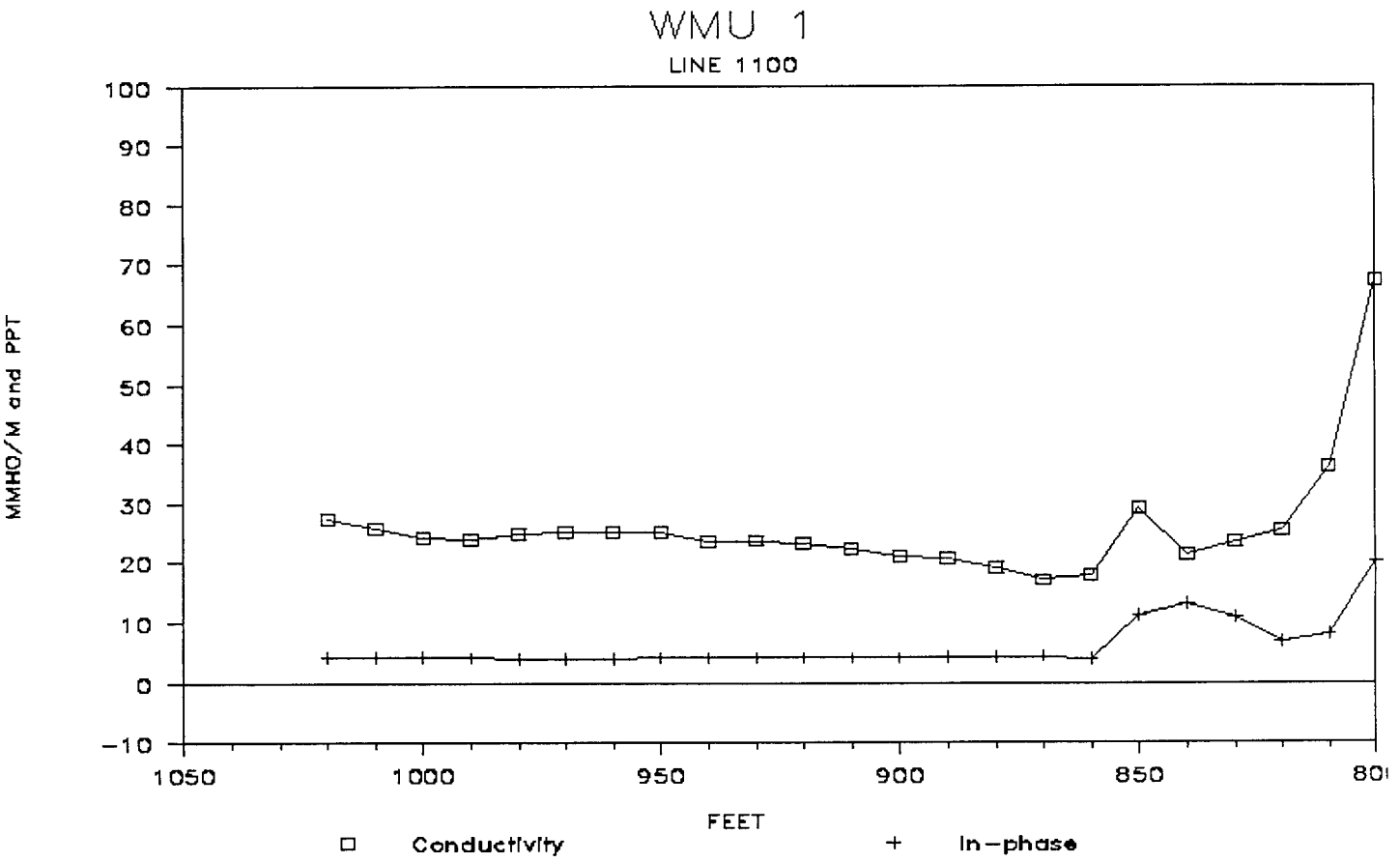
0
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase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MMHO/M and PPT
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90
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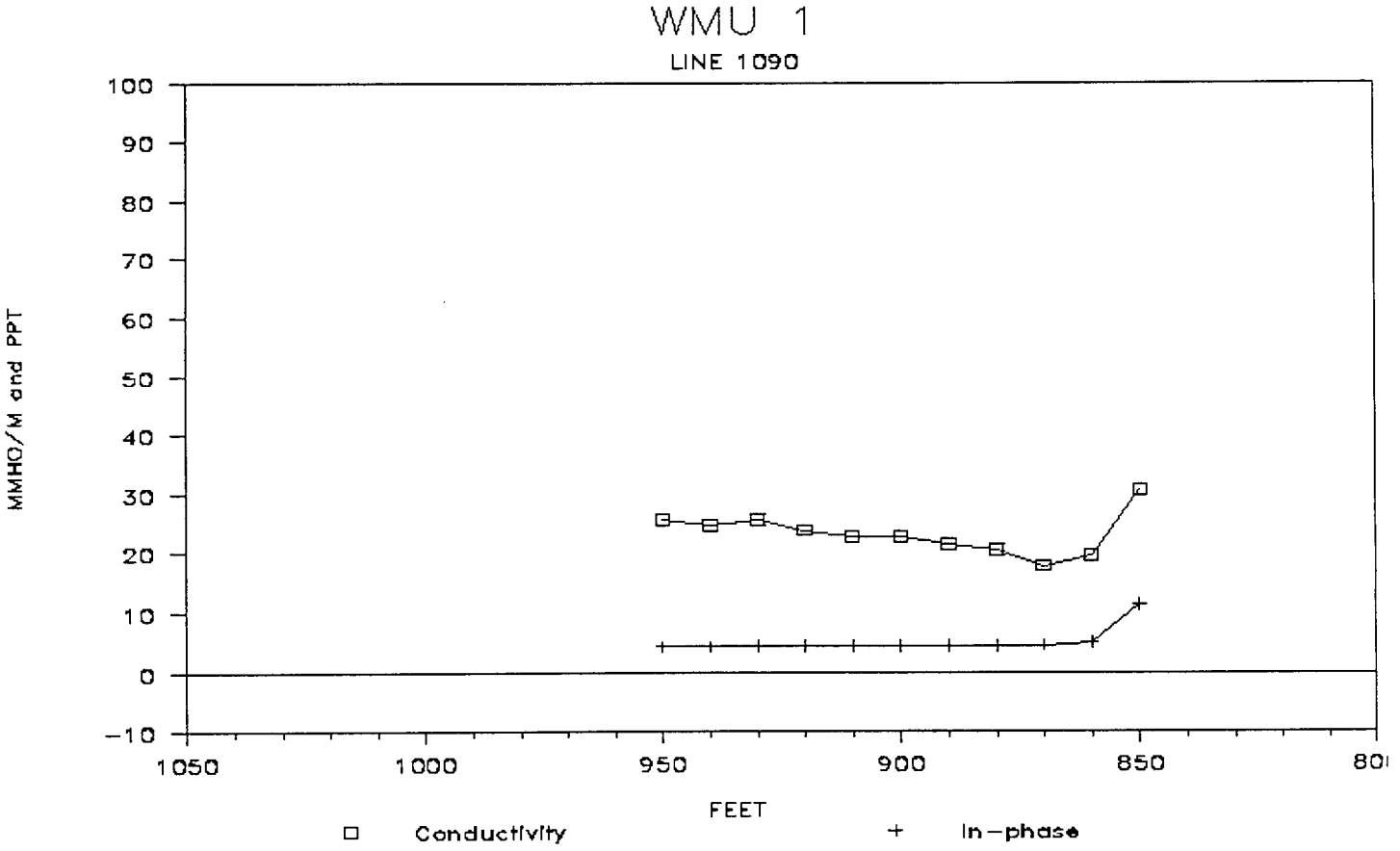
950
900
850
FEET
Conductivity
In-phase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LINE 1090
MMHO/M and PPT
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90
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0
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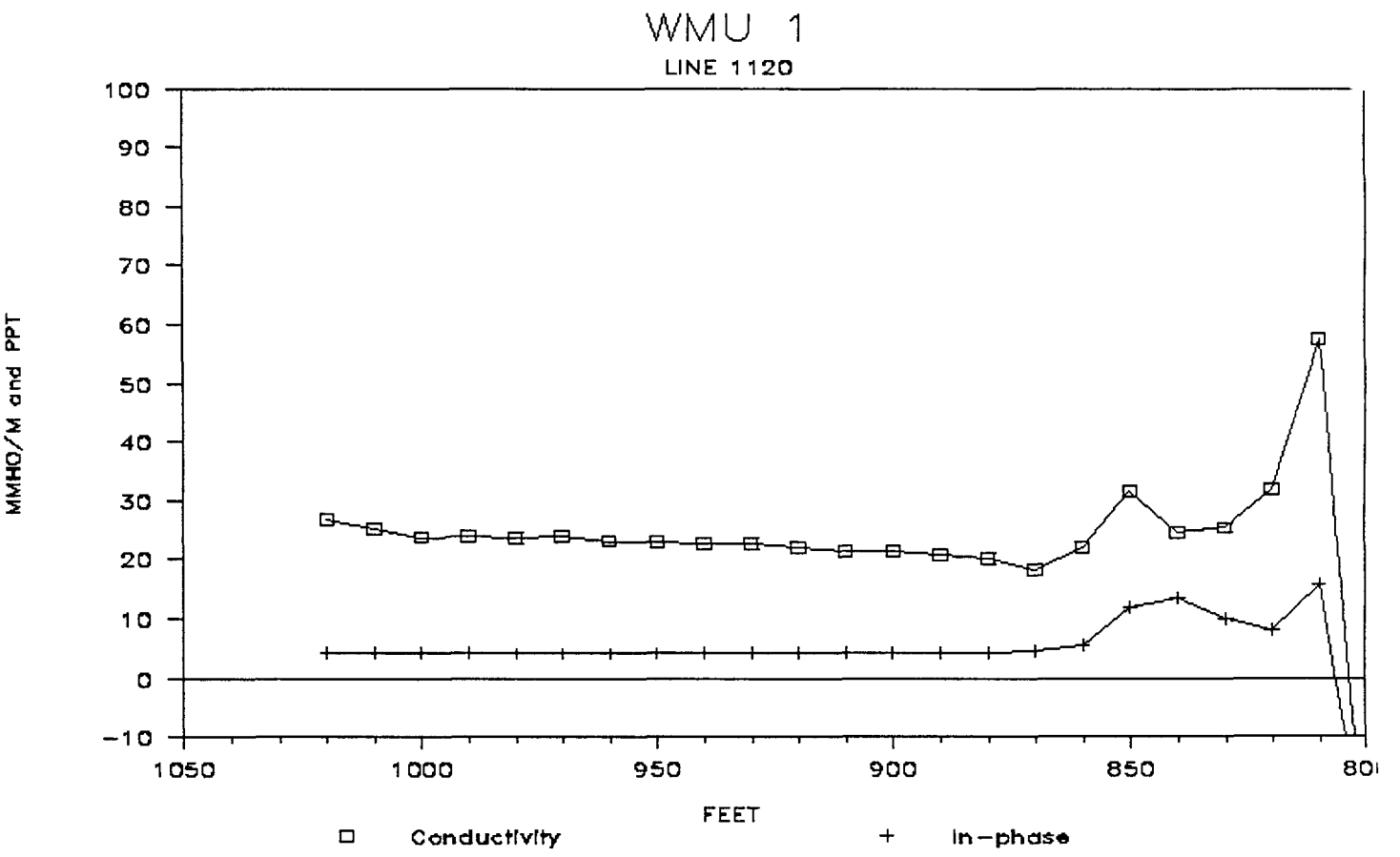
1050
1000
950
900
850
FEET
Conductivity
In-phase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LINE 1120
MMHO/M and PPT
100
90
80
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60
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40
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0
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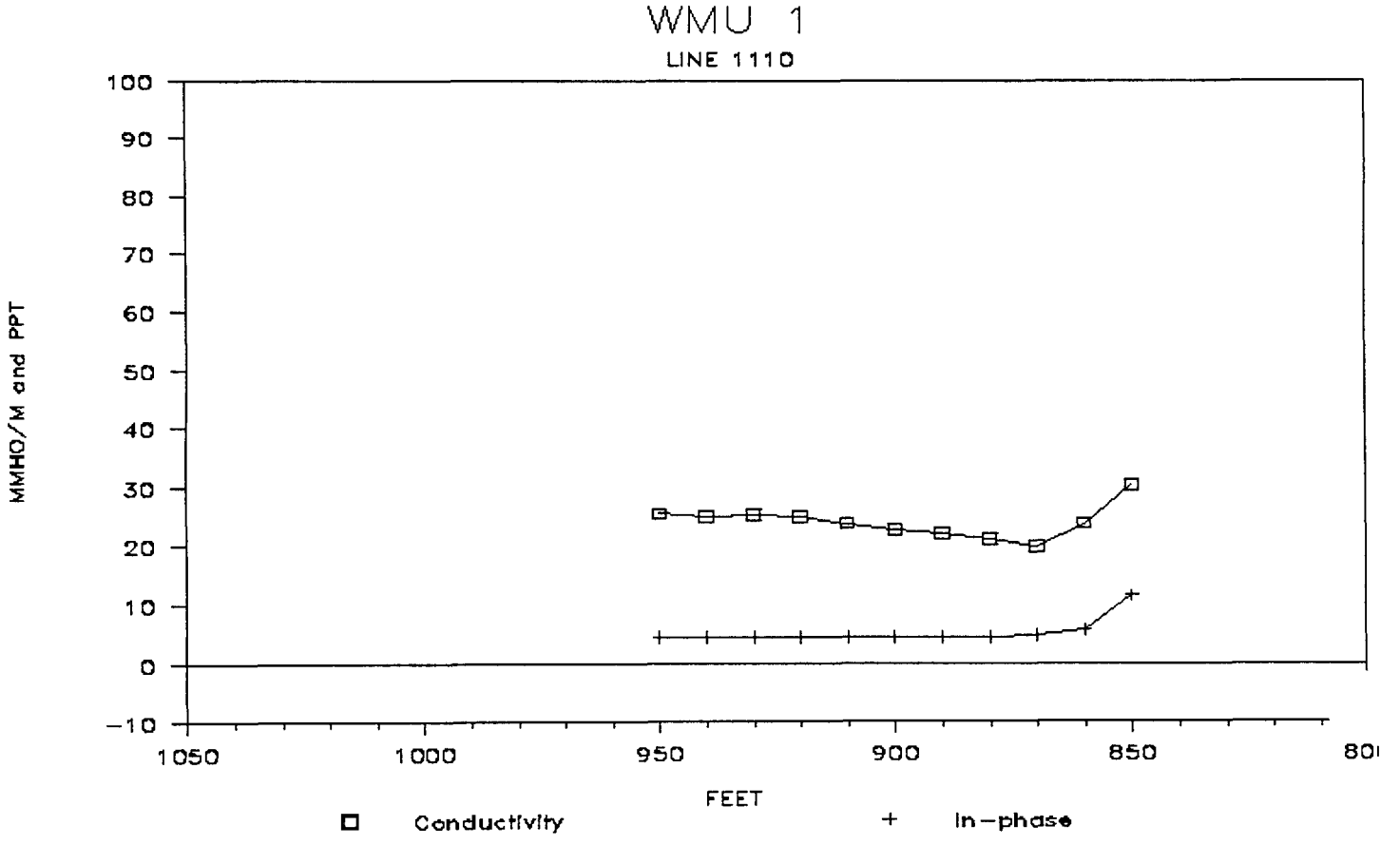
1050
1000
950
900
850
FEET
Conductivity
In-phase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90
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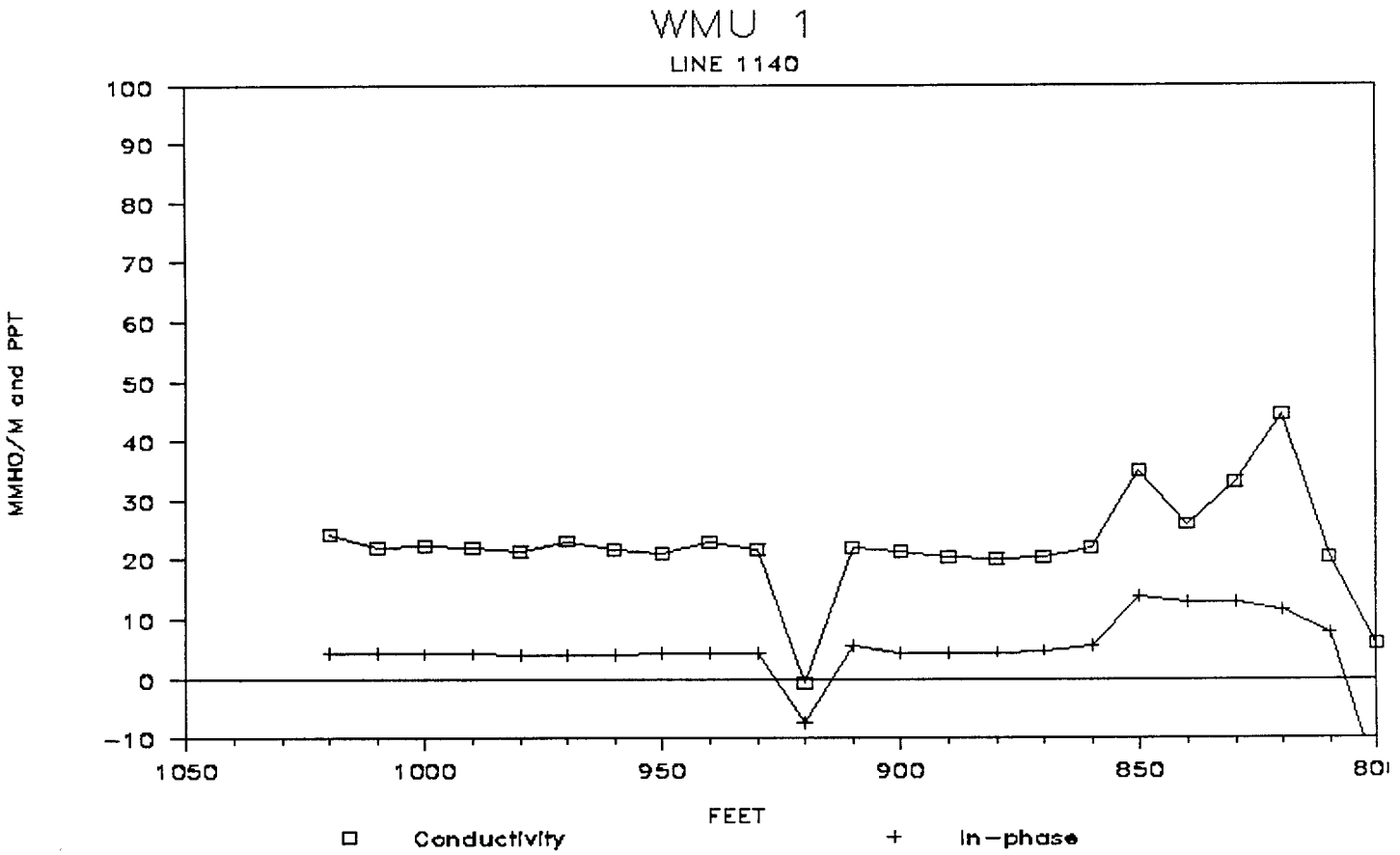
FEET
Conductivity
In-phase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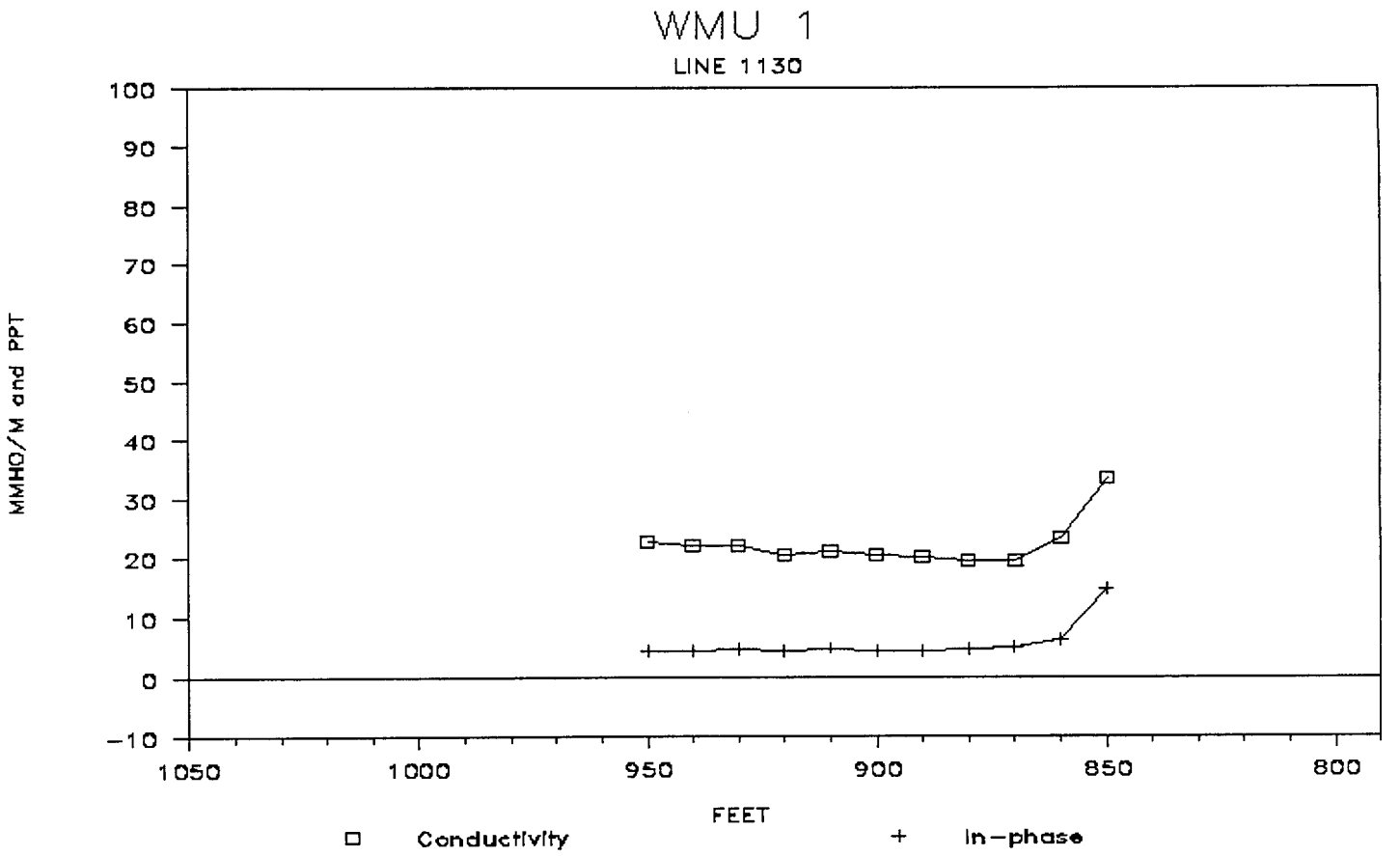
FEET
Conductivity
In-phase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90
80
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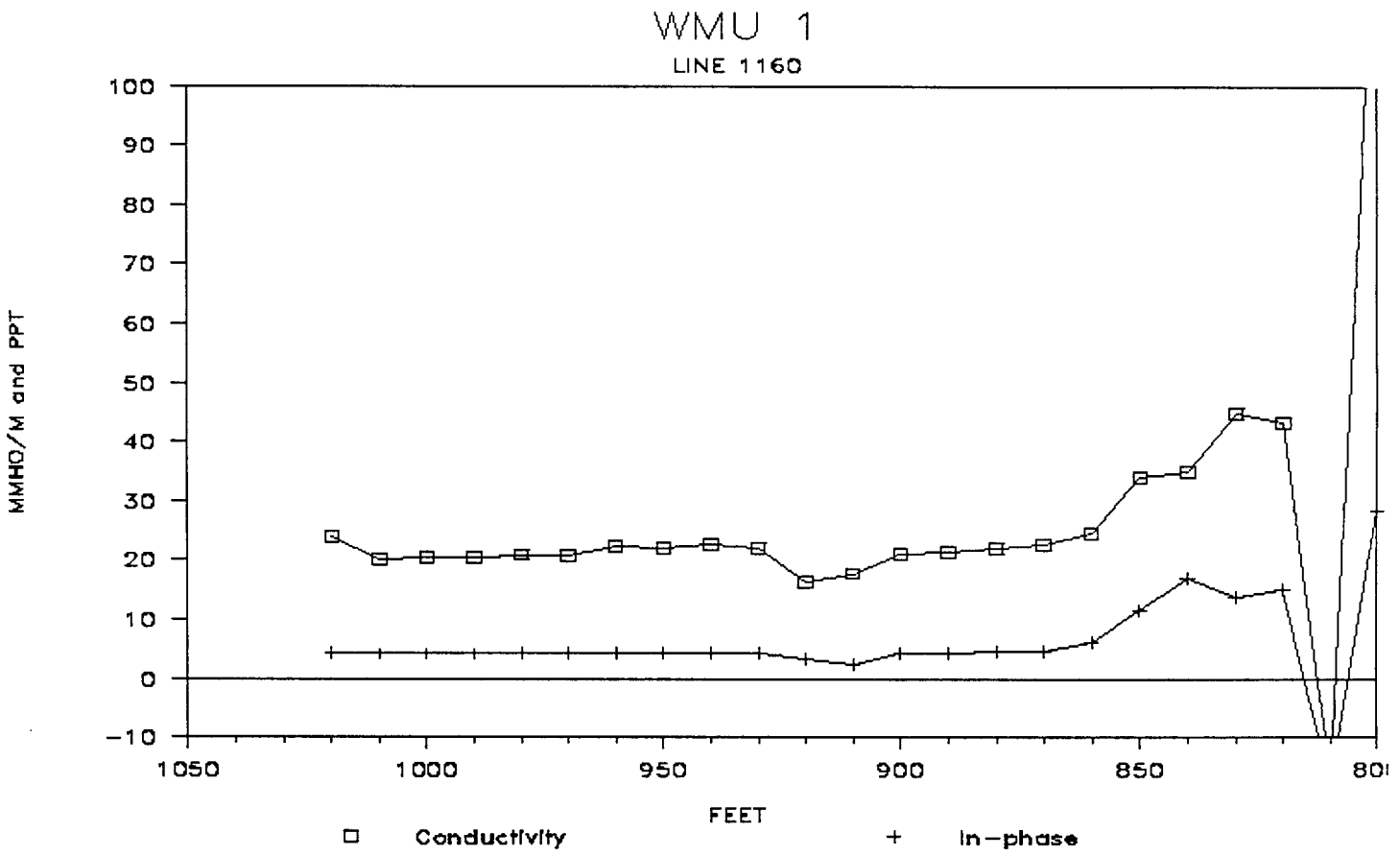
950
900
850
800
FEET
Conductivity
In-phase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LINE 1160
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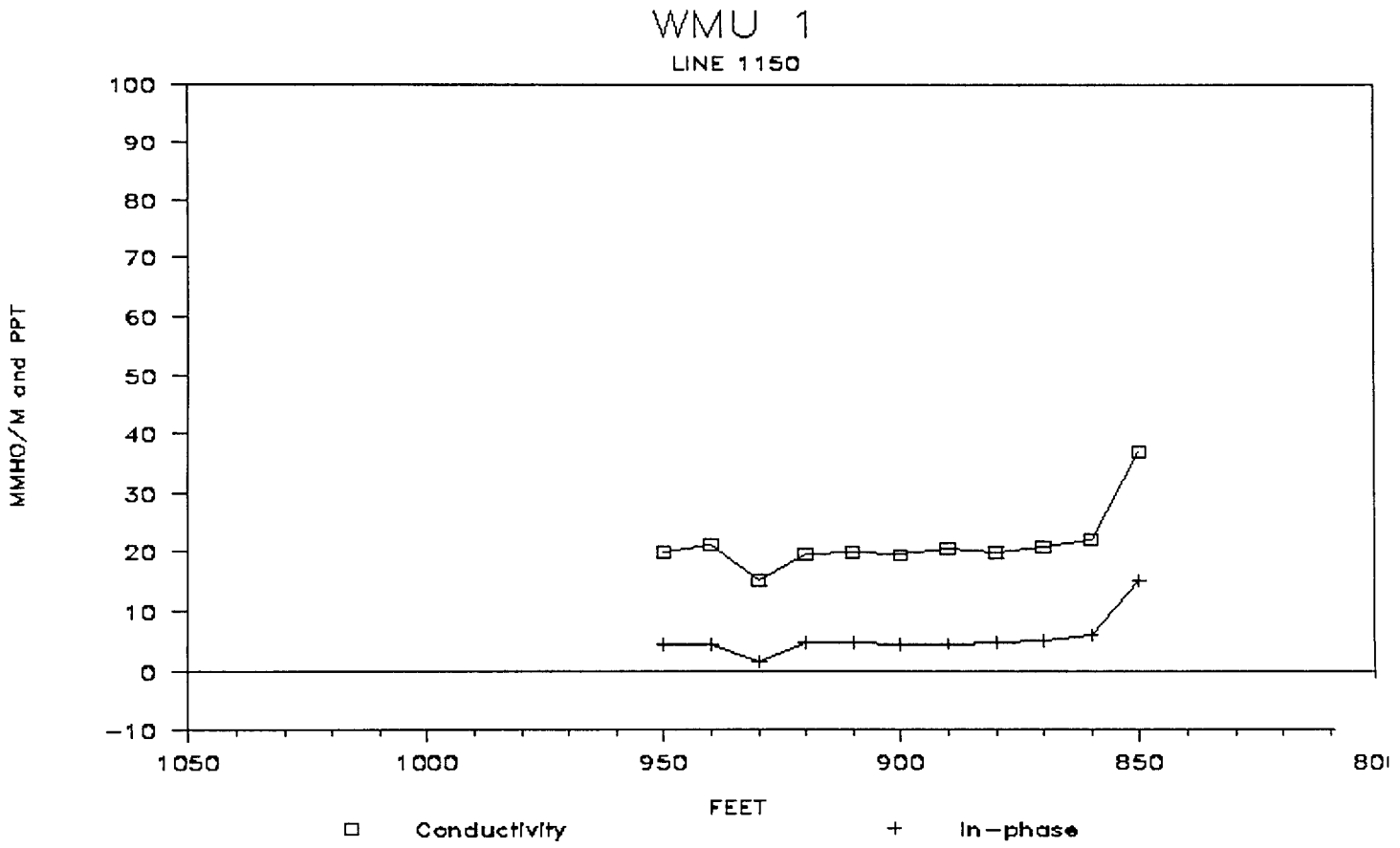
950
900
850
FEET
Conductivity
In-phase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LINE 1150
MMHO/M and PPT
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90
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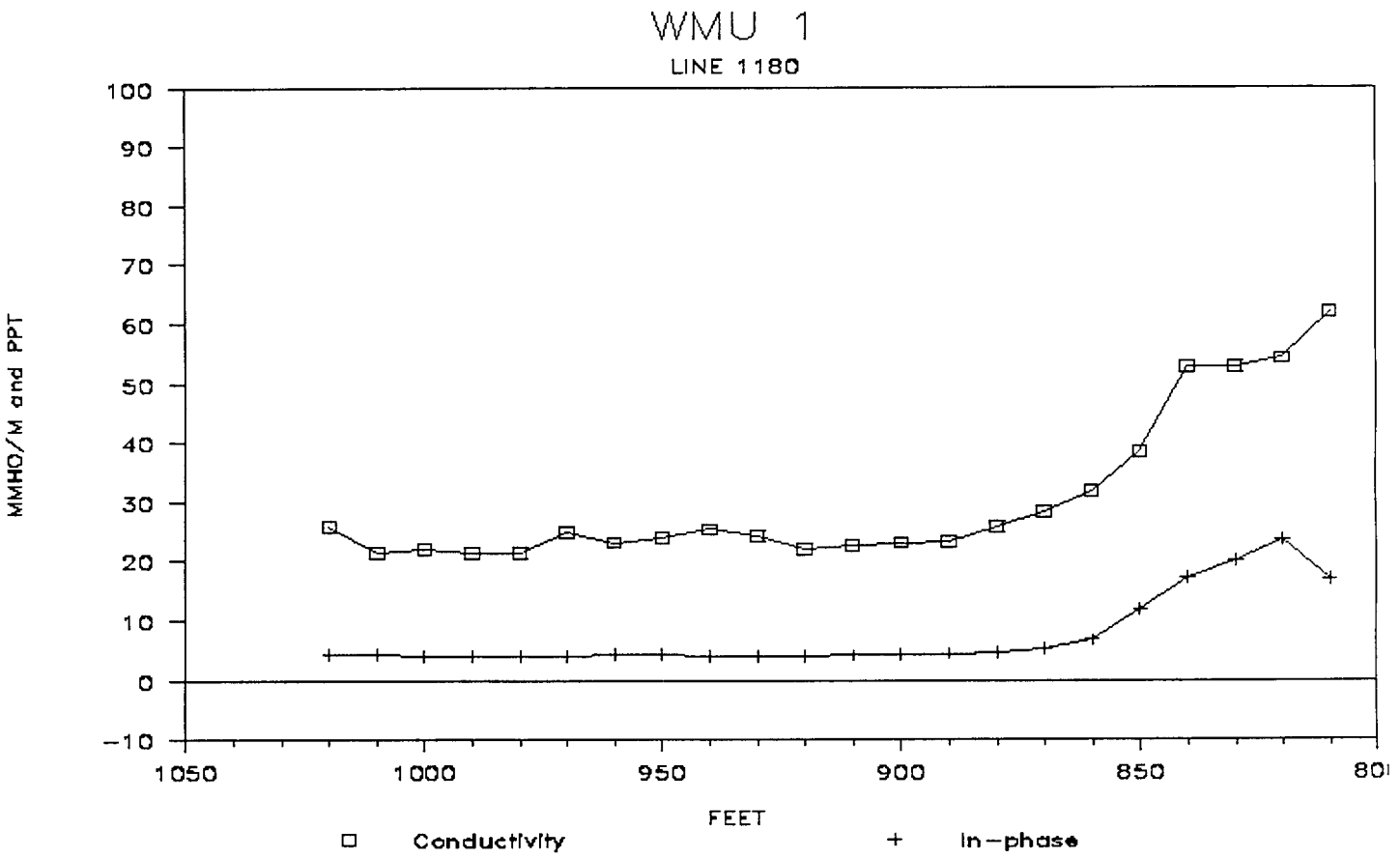
1050
1000
950
900
850
FEET
Conductivity
In-phase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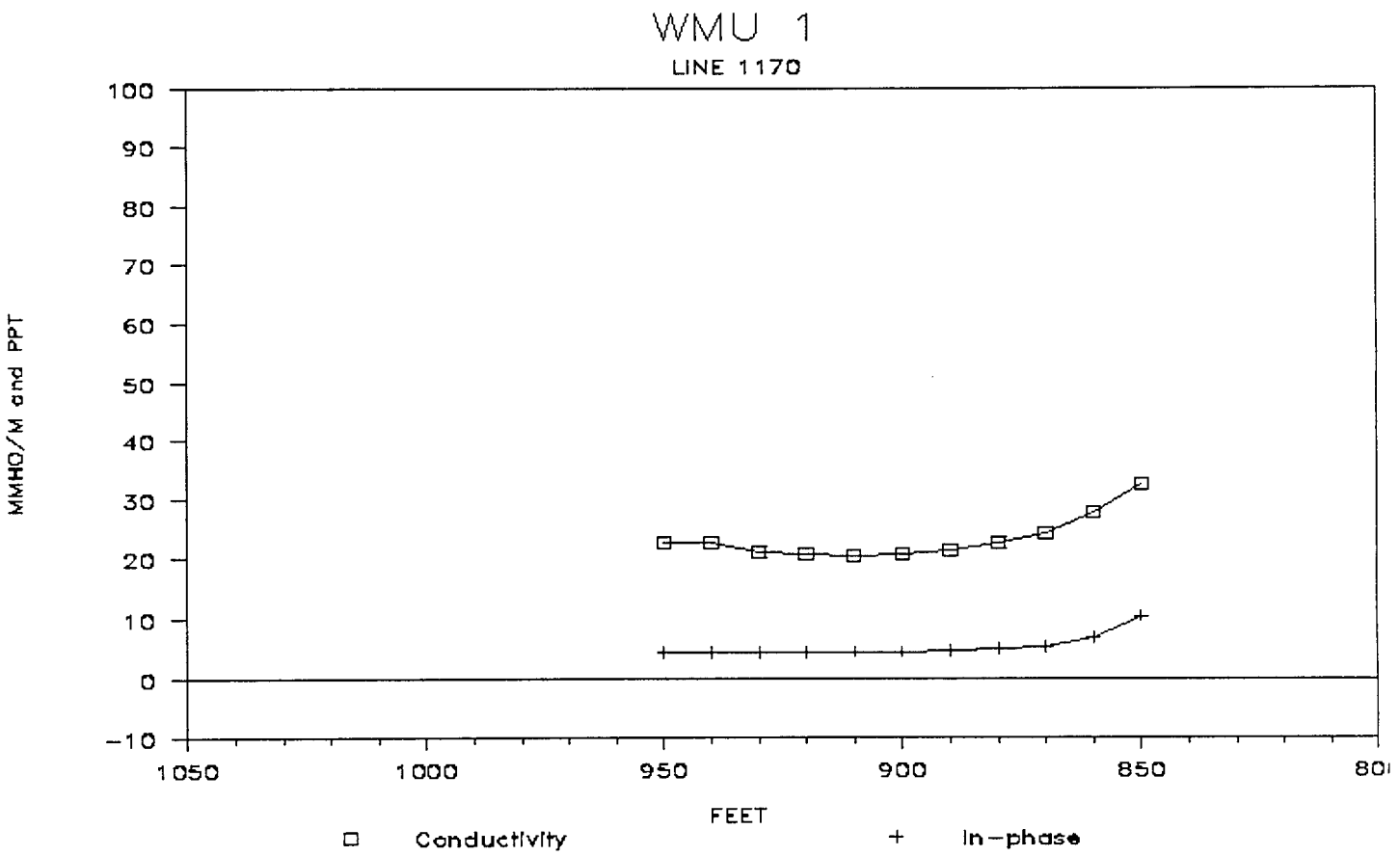
950
900
850
FEET
Conductivity
In-phase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LINE 1170
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90
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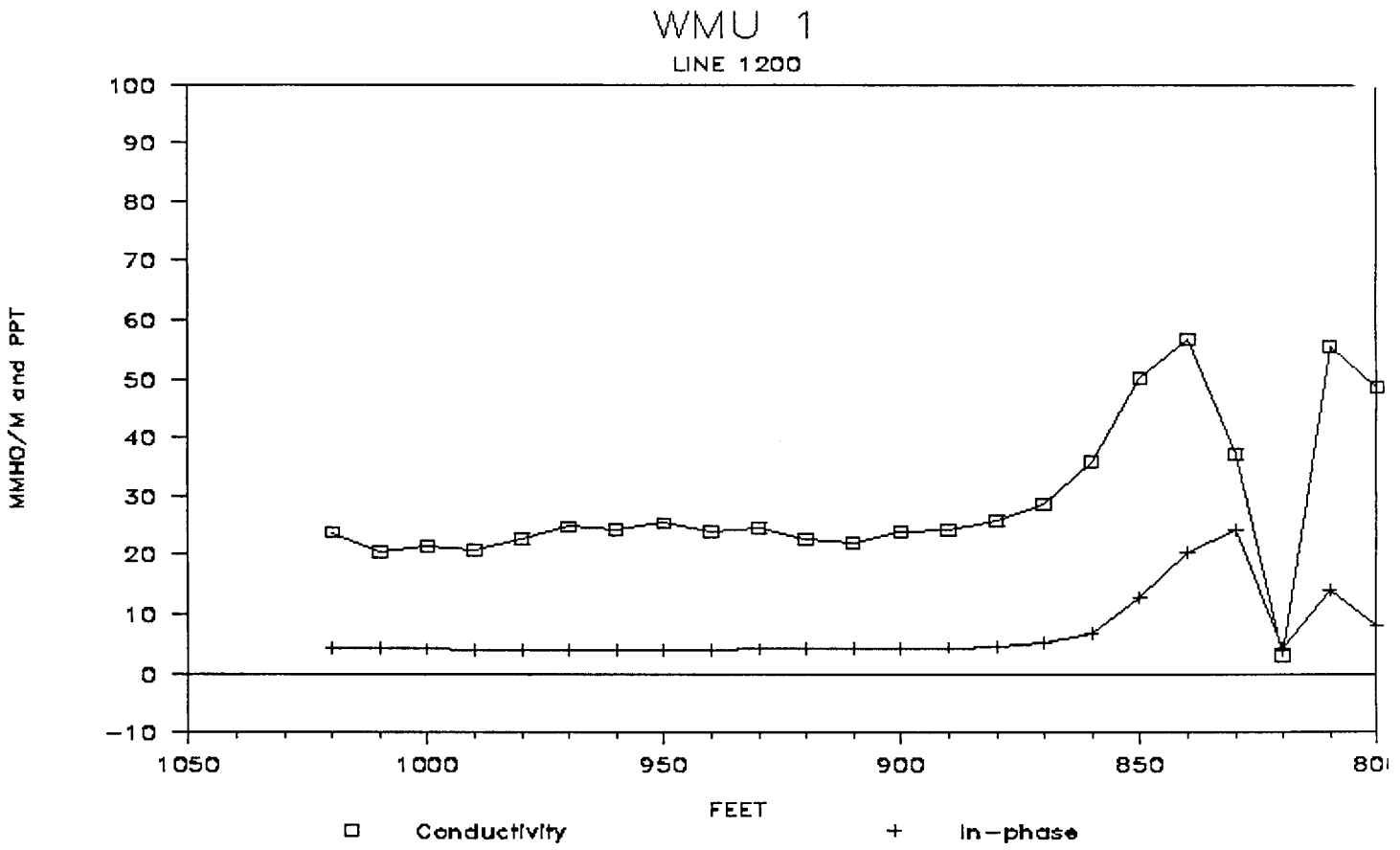
1000
950
900
850
FEET
Conductivity
In-phase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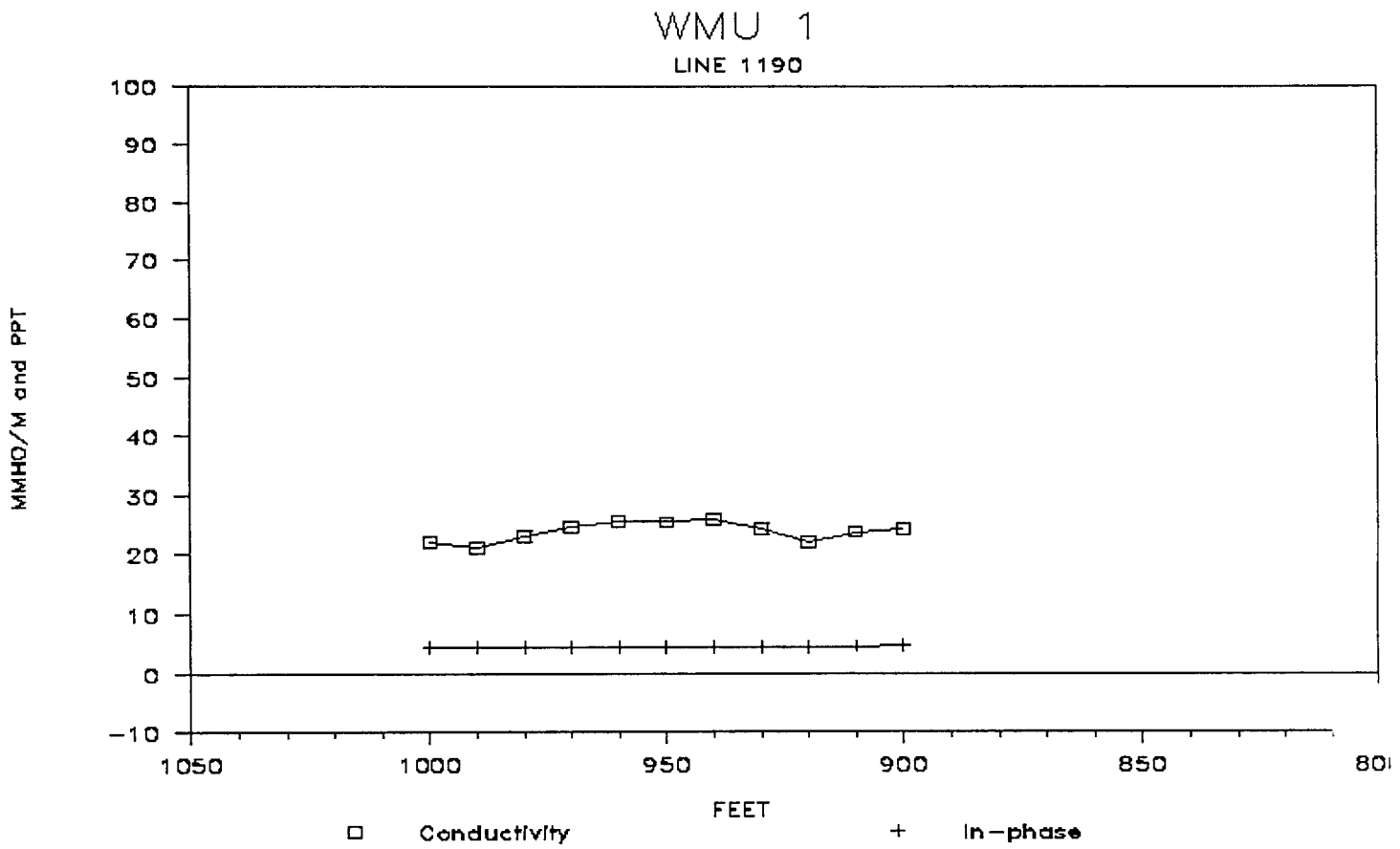
950
900
850
FEET
Conductivity
In-phase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MMHO/M and PPT
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90
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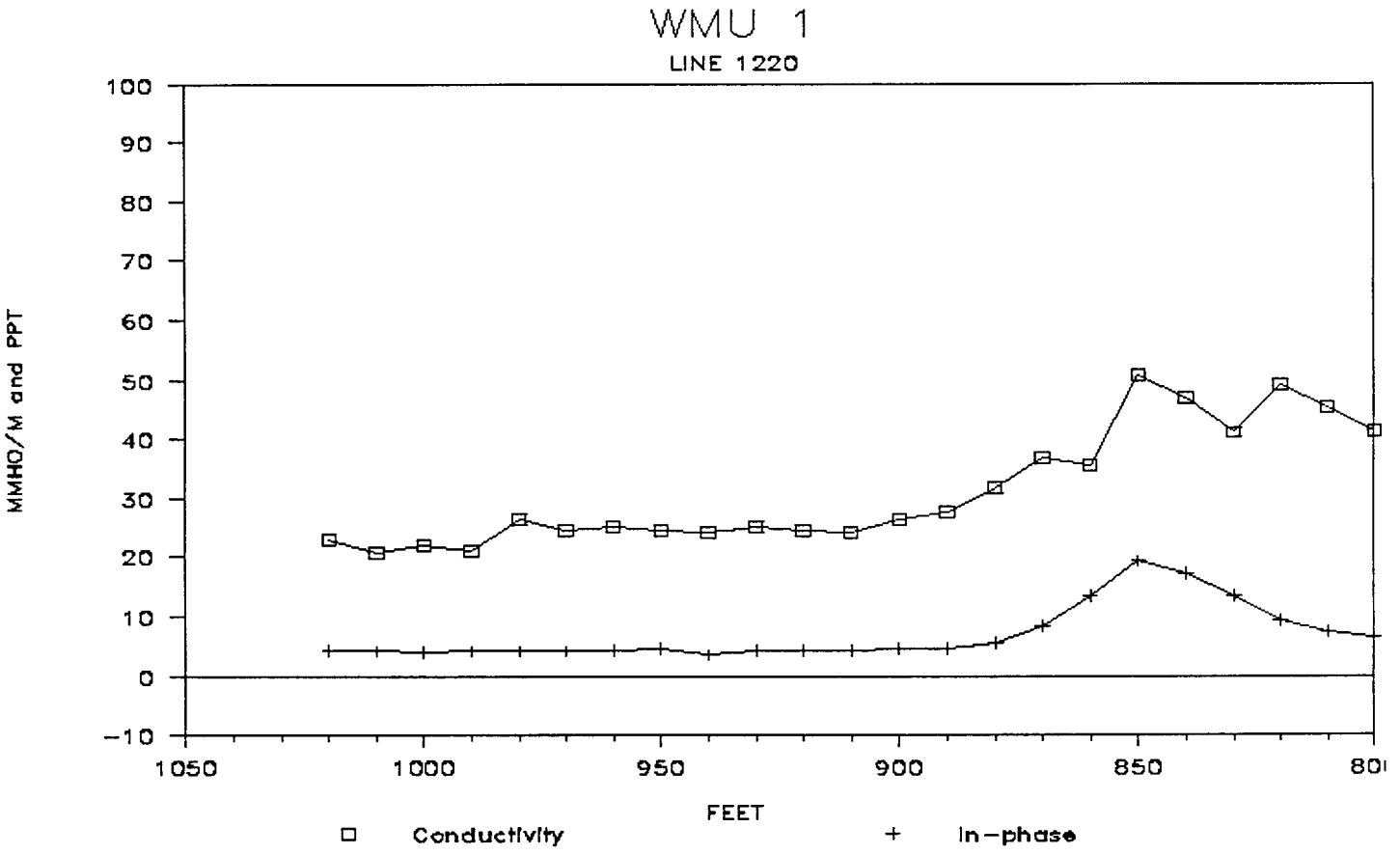
1000
950
900
850
FEET
Conductivity
In-phase


WMU 1
LINE 1220
MMHO/M and PPT
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90
80
70
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50
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30
20
10
0
-10
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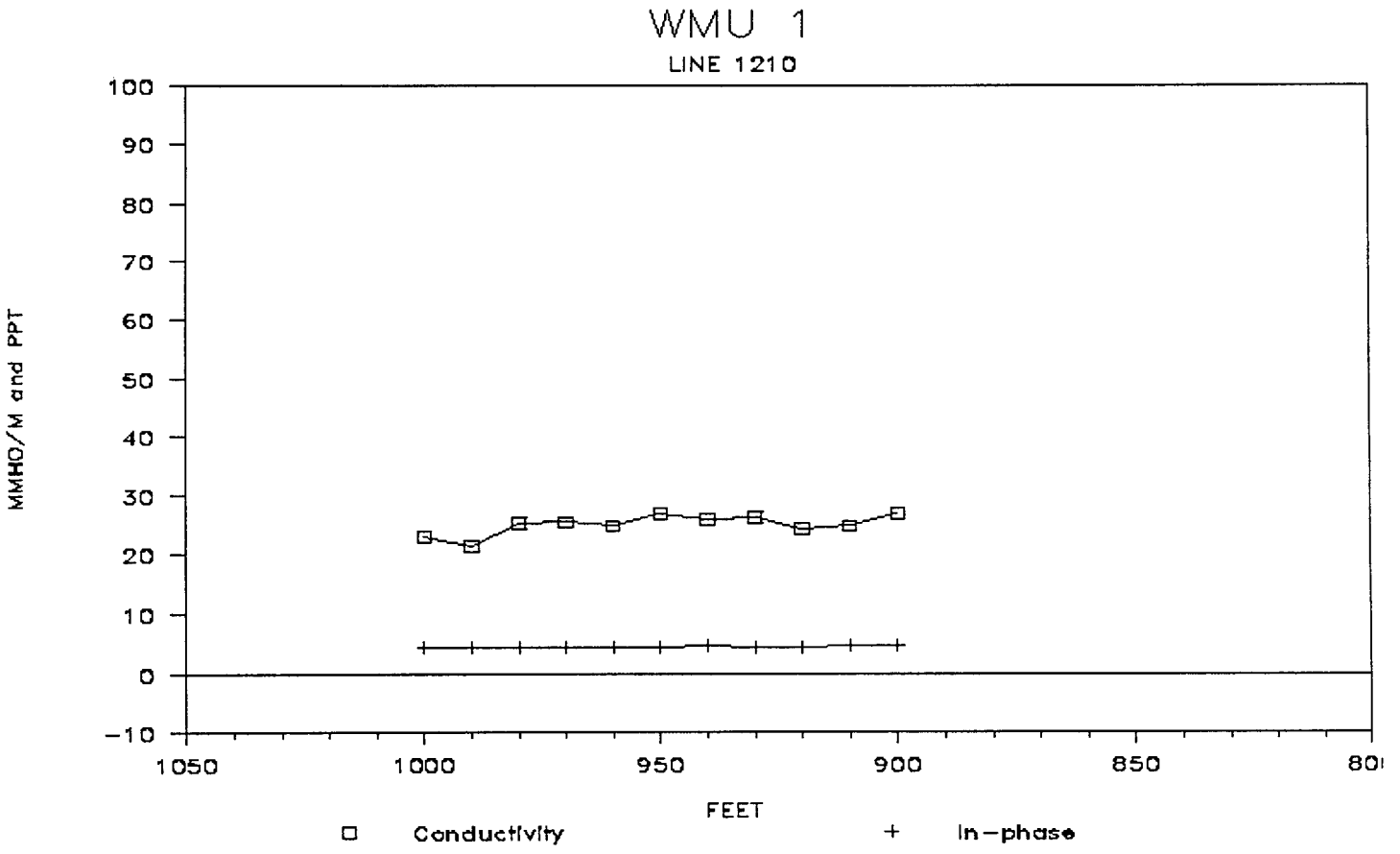
1000
950
900
850
FEET
Conductivity
In-phase


WMU 1
LINE 1210
MMHO/M and PPT
100
90
80
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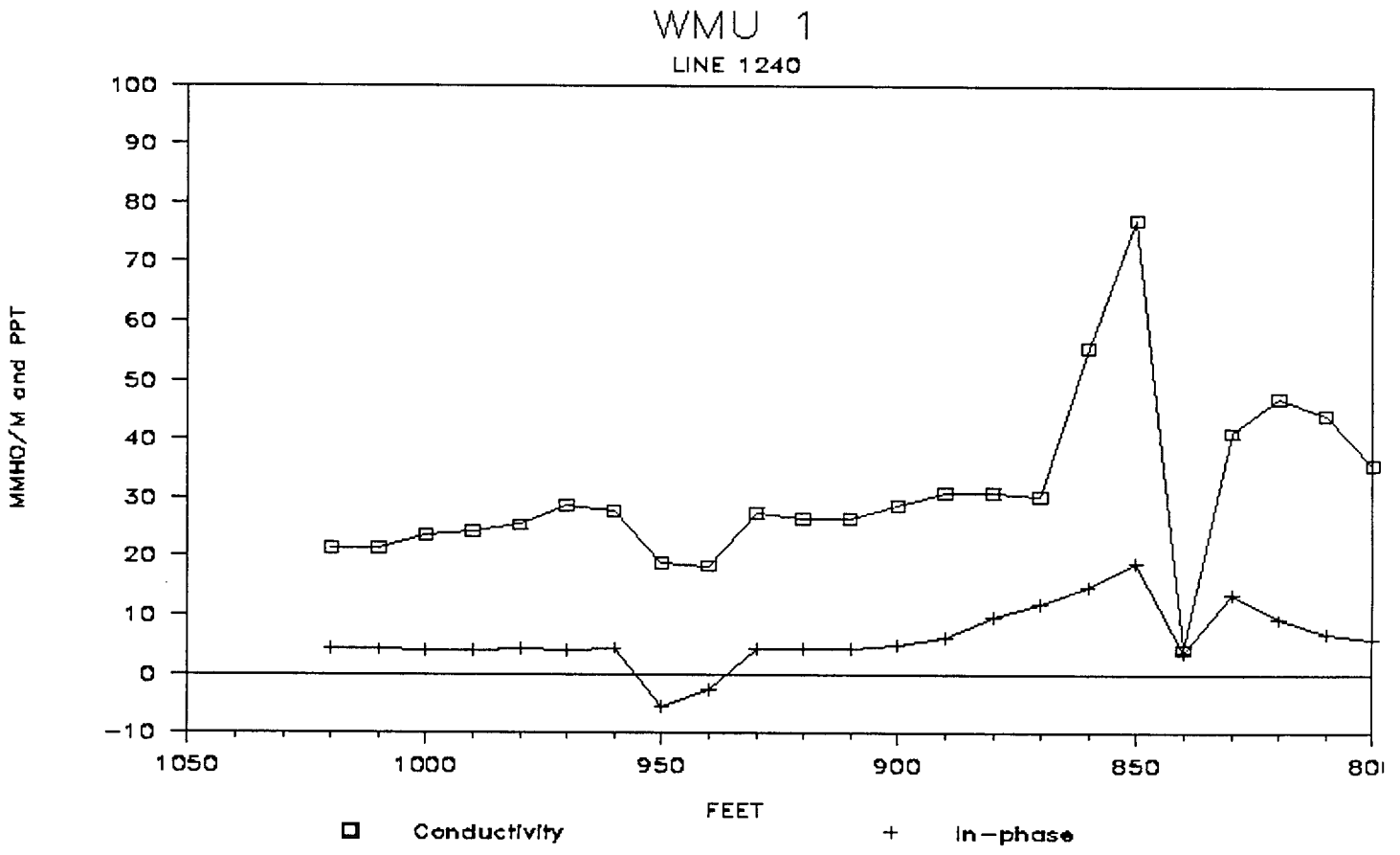
950
900
850
FEET
Conductivity
In-phase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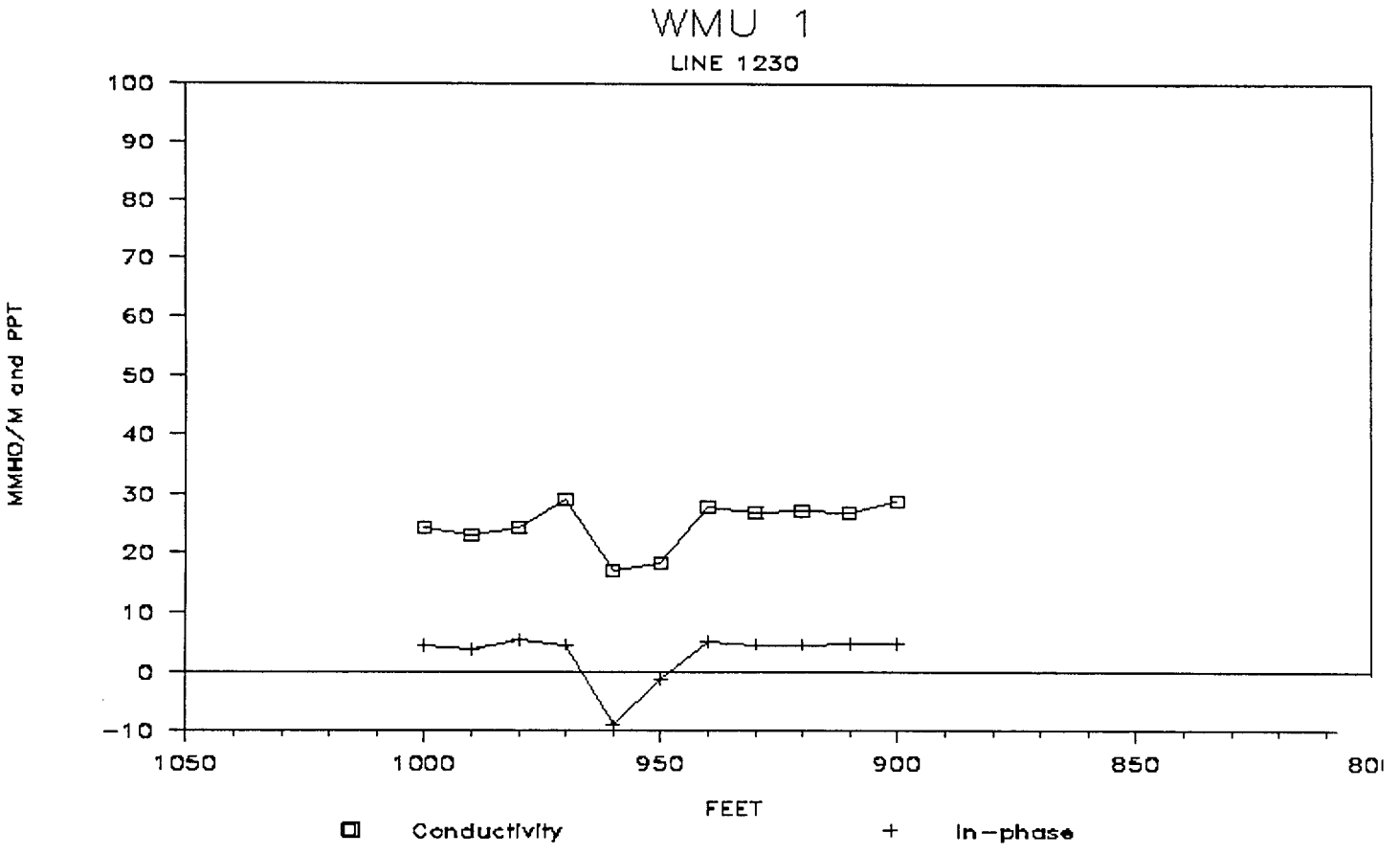
900
850
FEET
Conductivity
In-phase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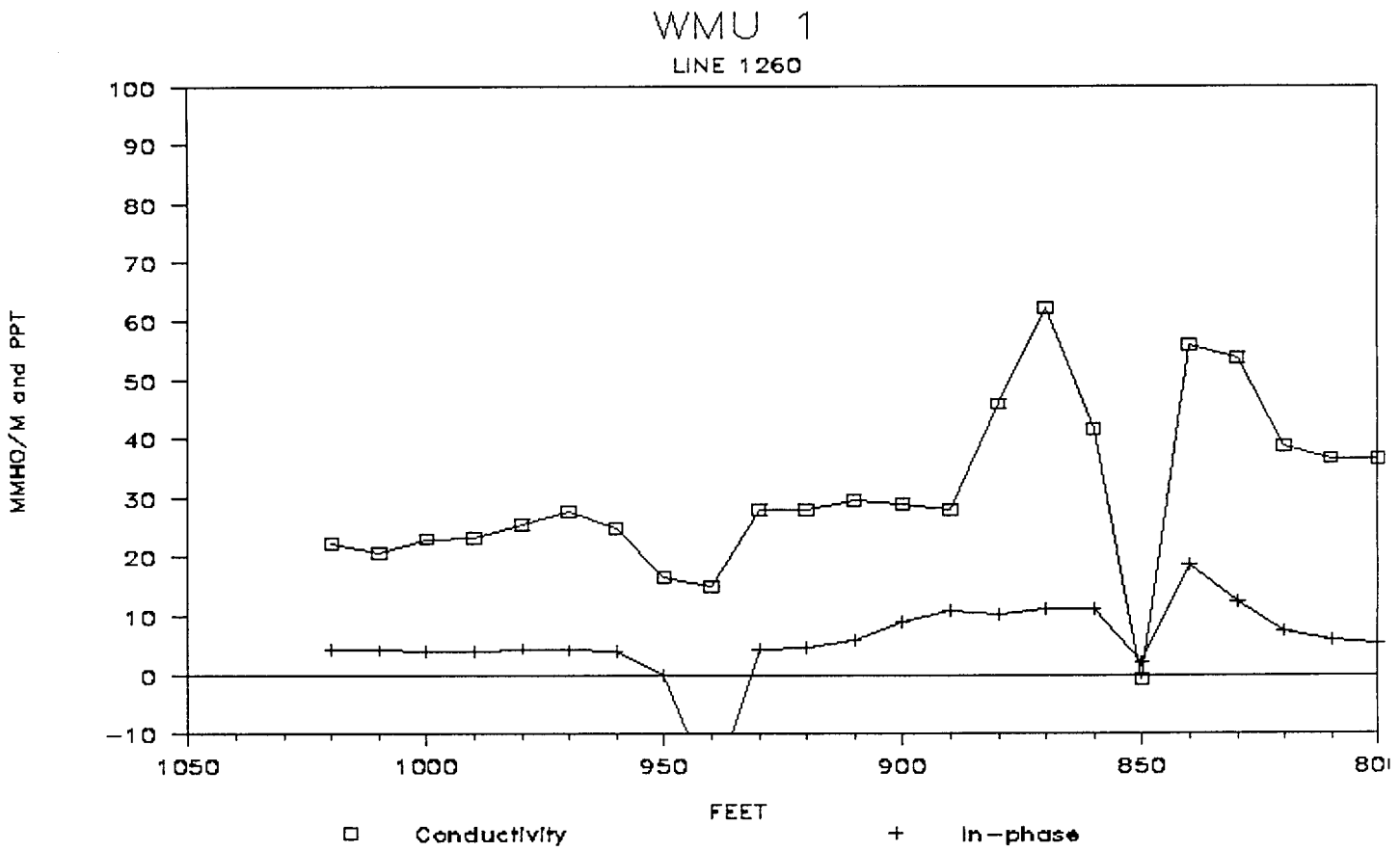
950
900
850
FEET
Conductivity
In-phase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LINE 1260
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100
90
80
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60
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30
20
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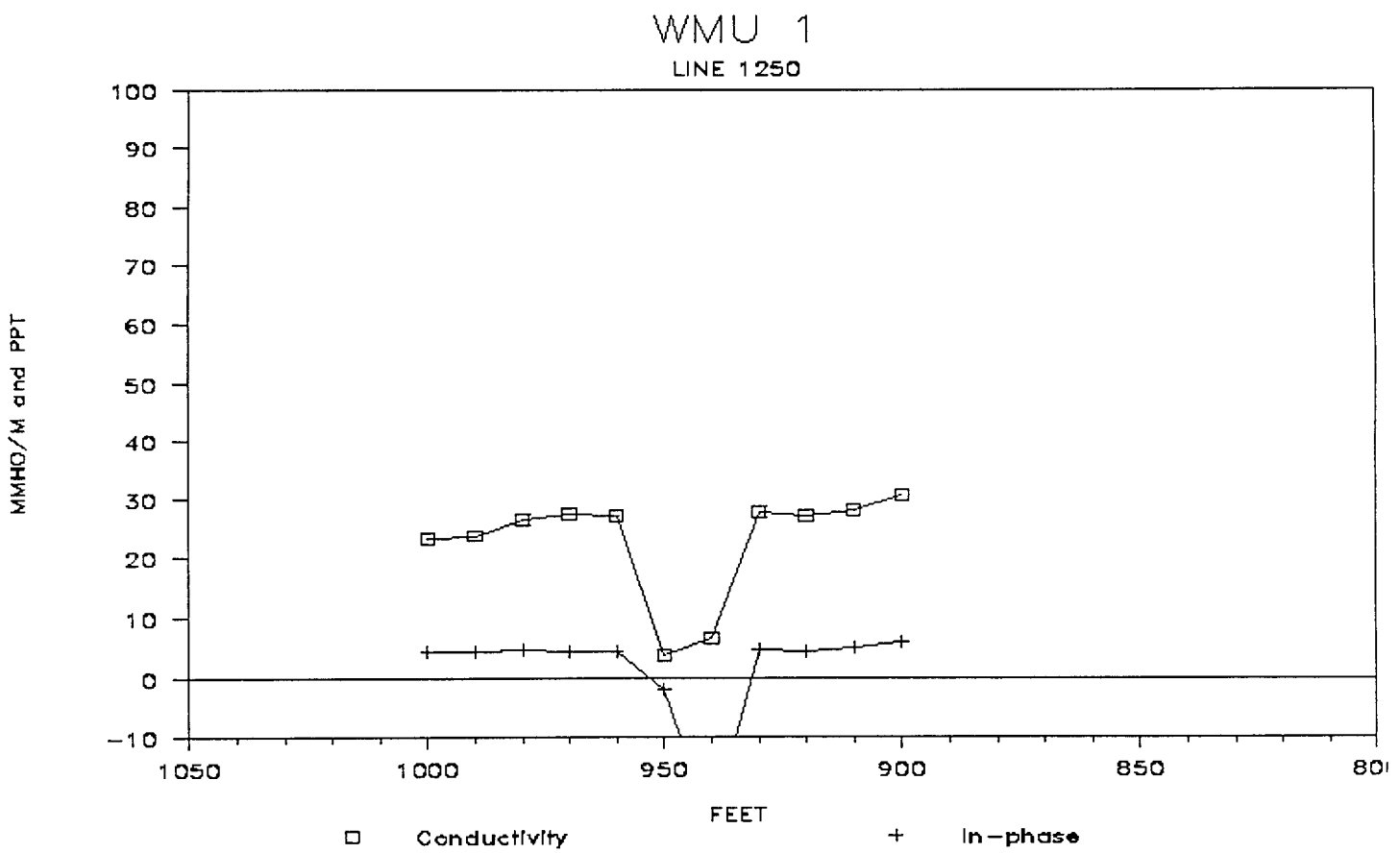
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase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MMHO/M and PPT
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90
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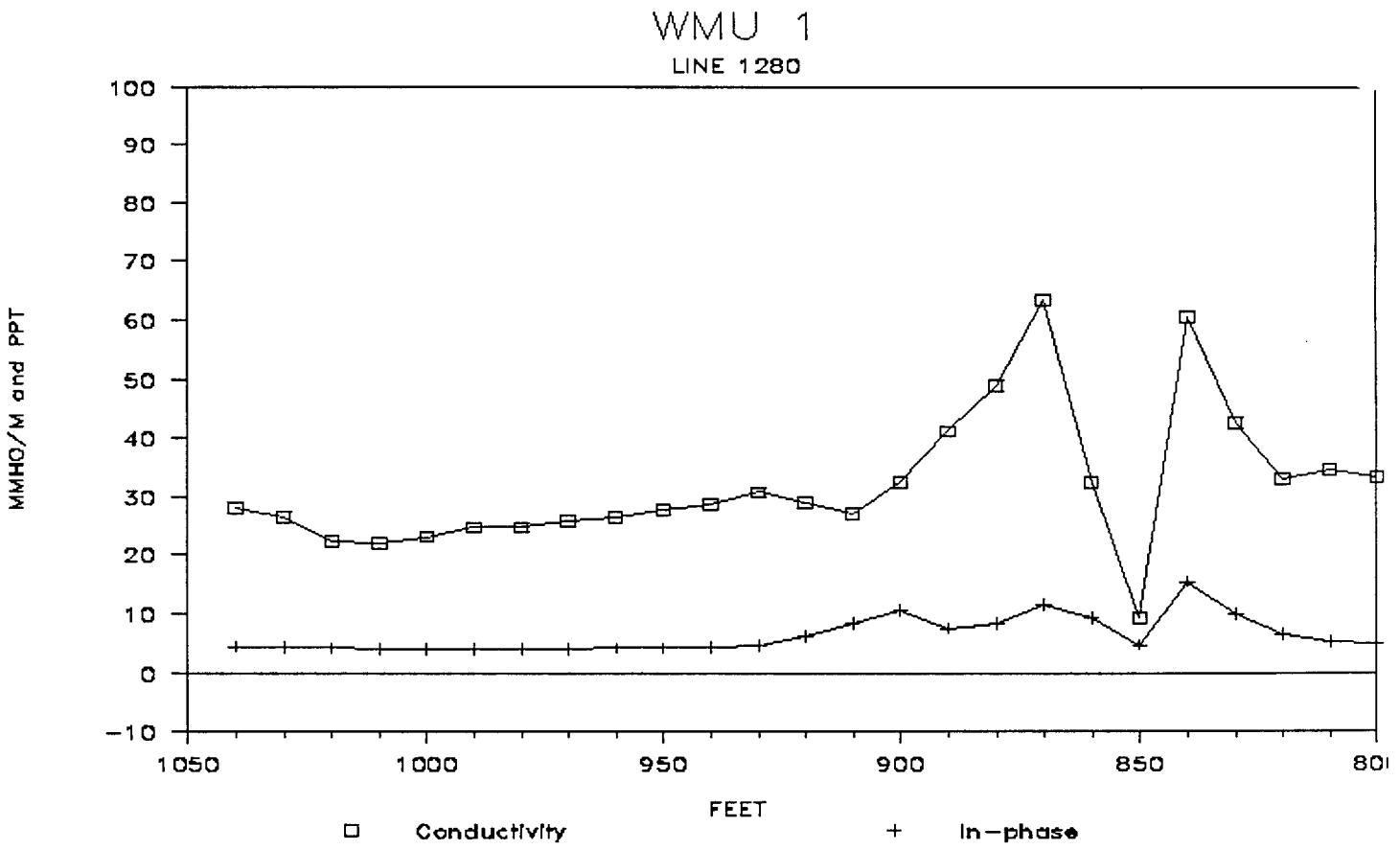
1000
950
900
850
FEET
Conductivity
In-phase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LINE 1280
MMHO/M and PPT
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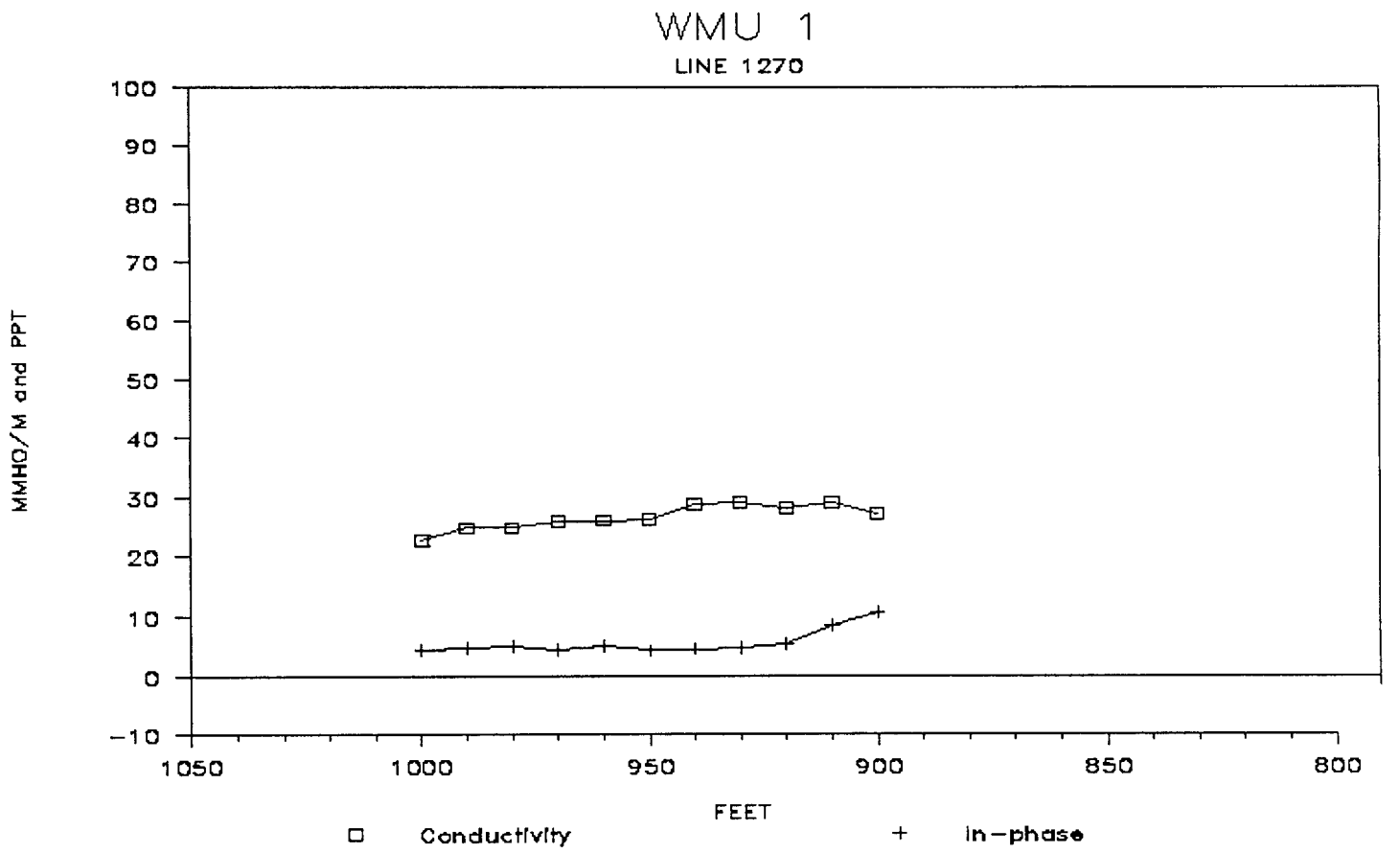
950
900
850
FEET
Conductivity
In-phase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LINE 1270
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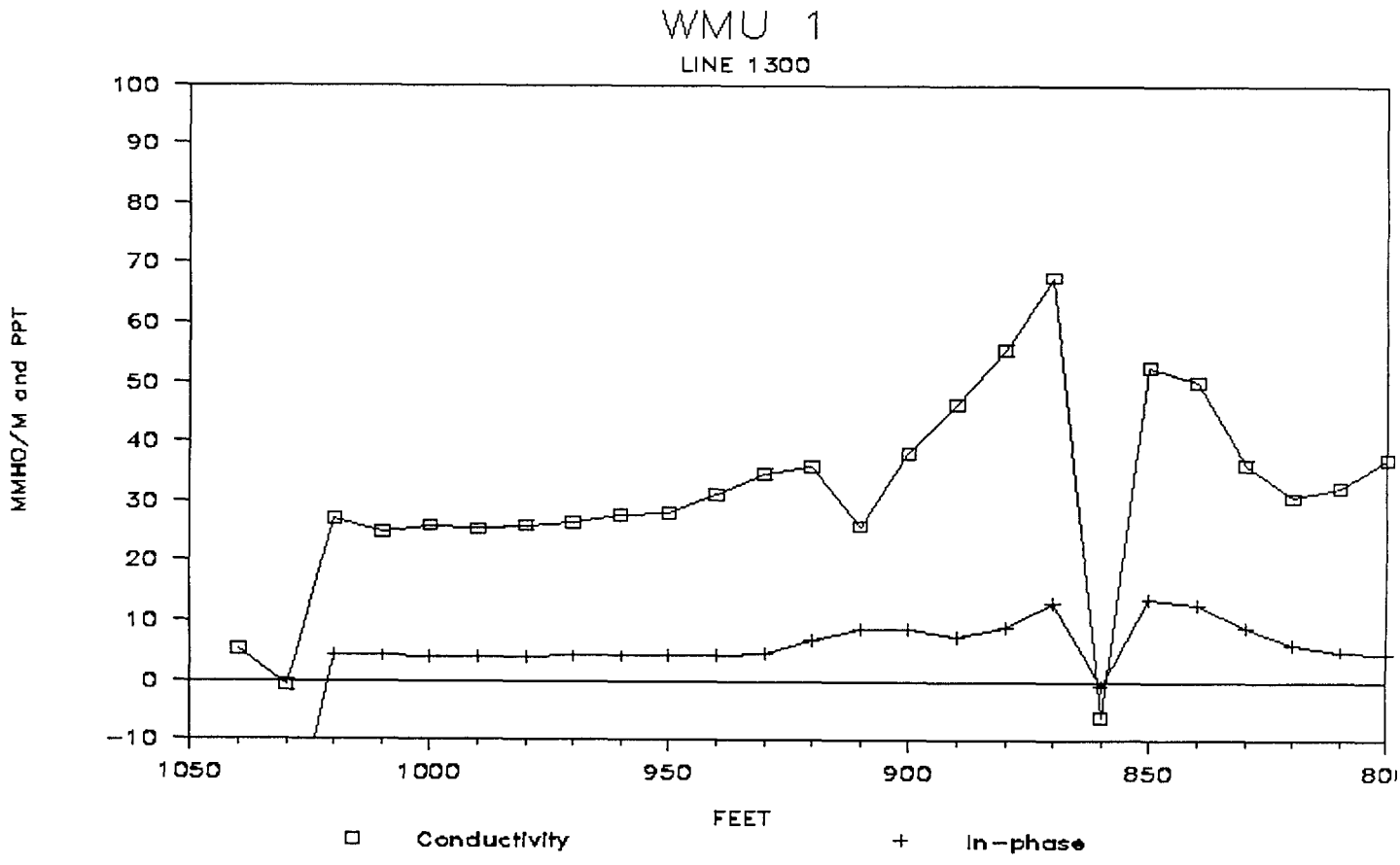
800
FEET
Conductivity
In-phase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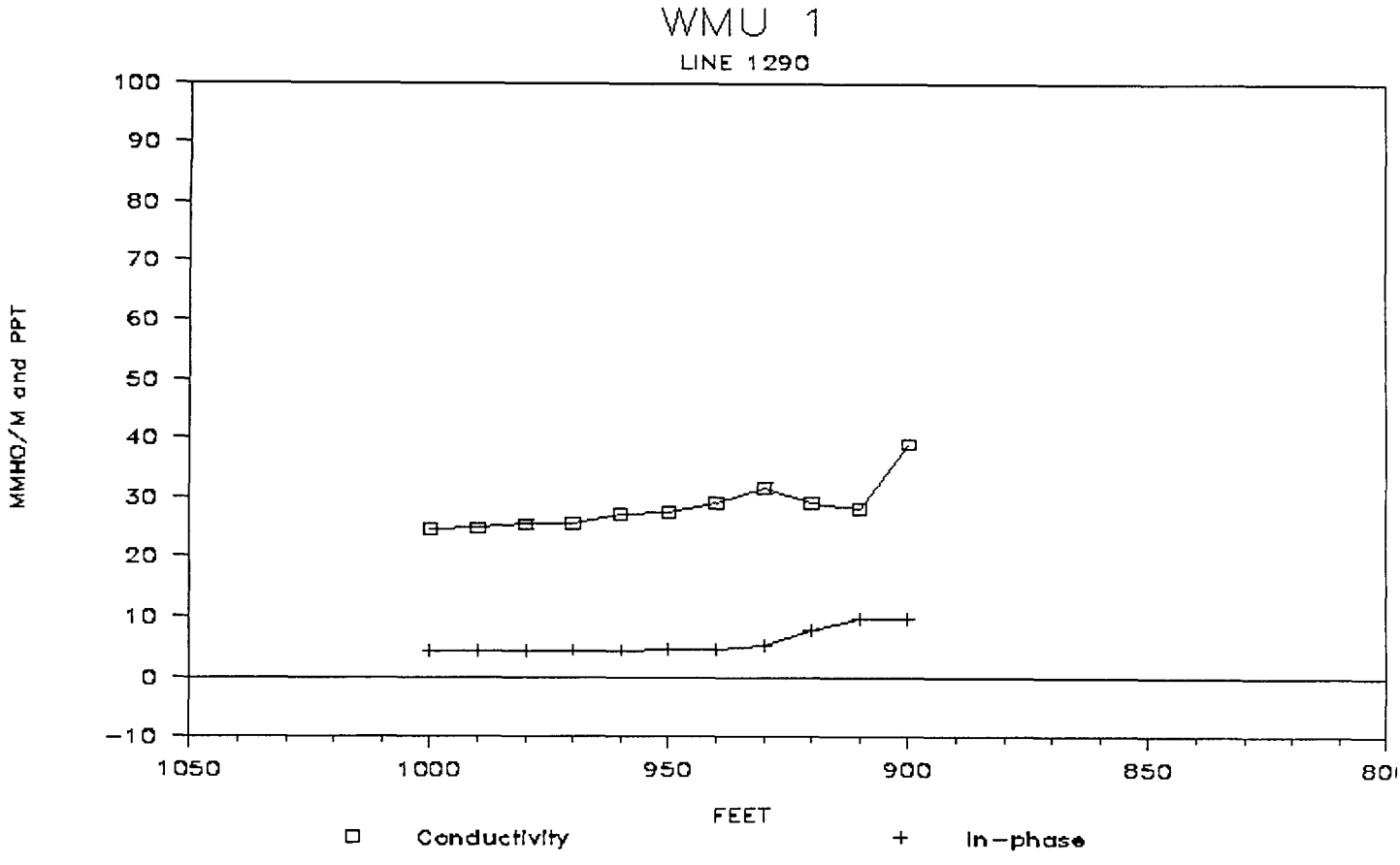
950
900
850
FEET
Conductivity
In-phase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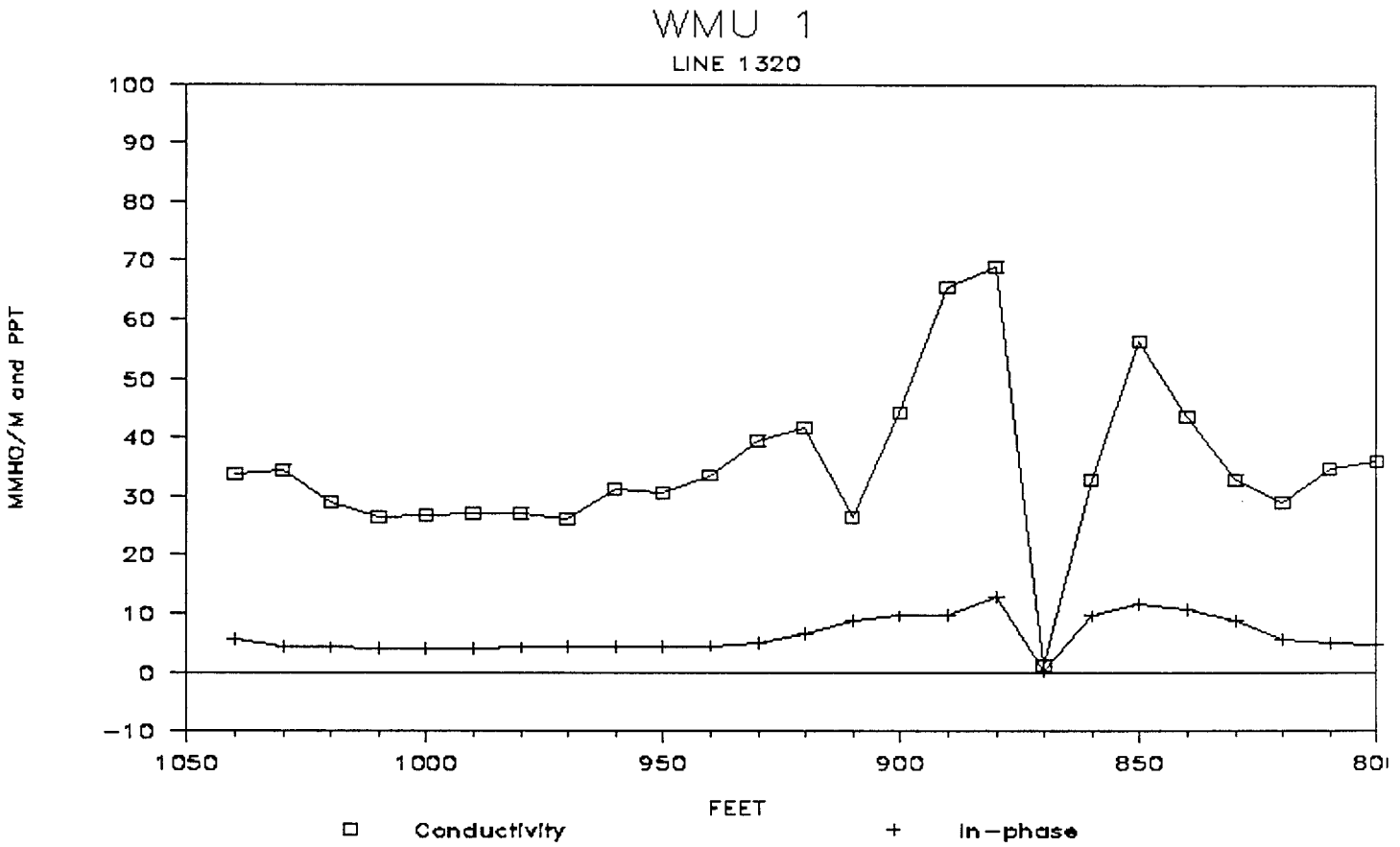
900
850
FEET
Conductivity
In-phase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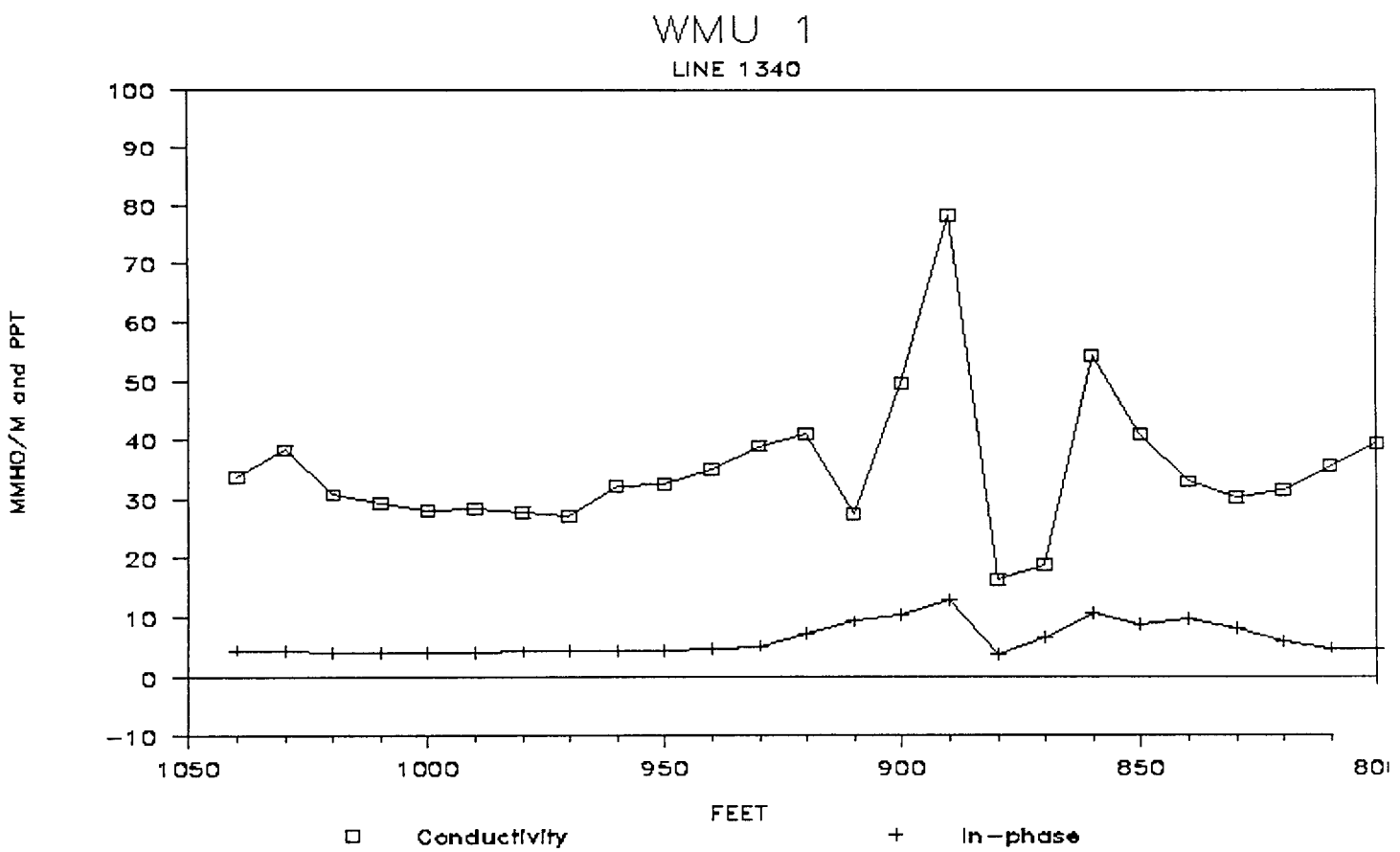
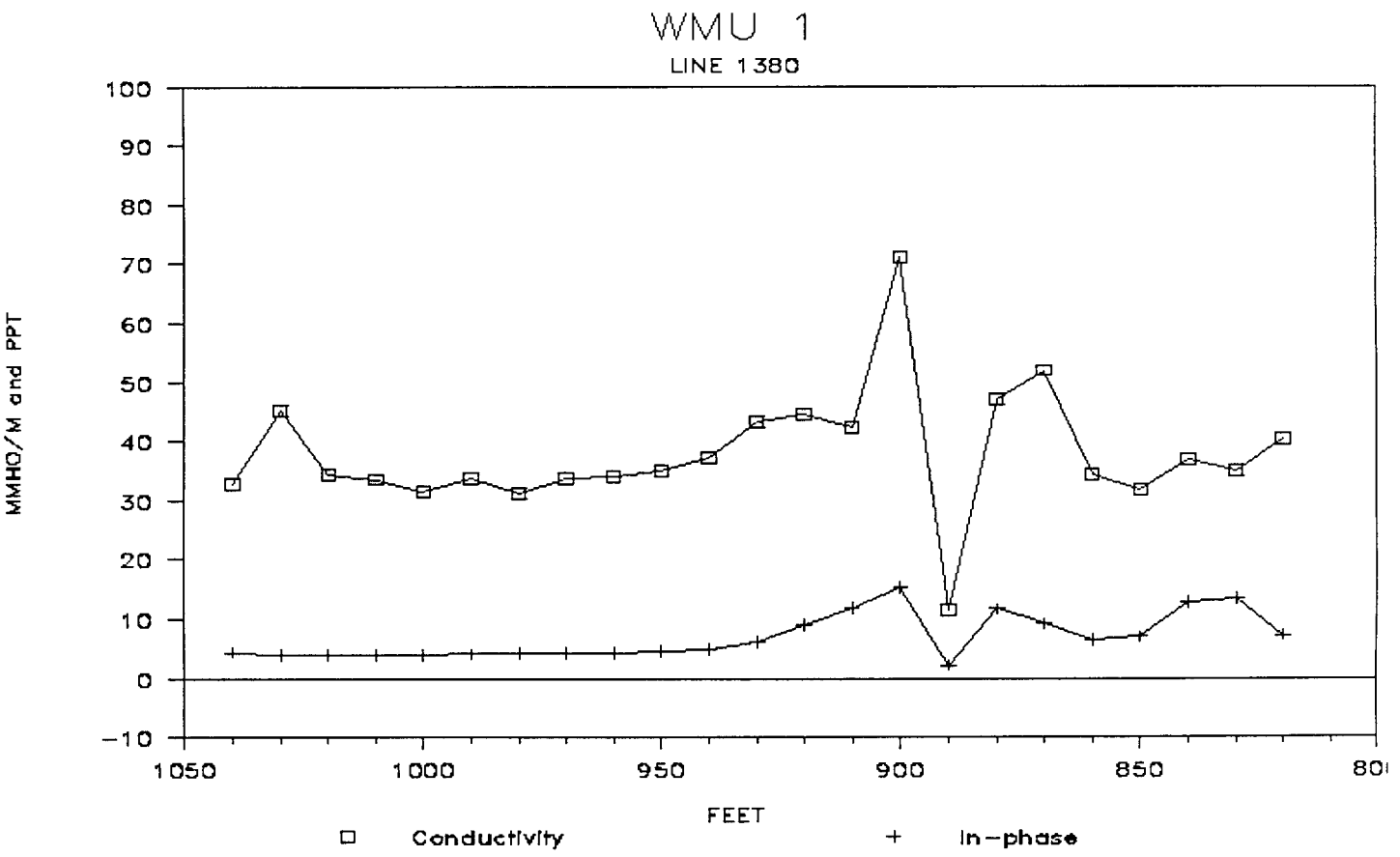
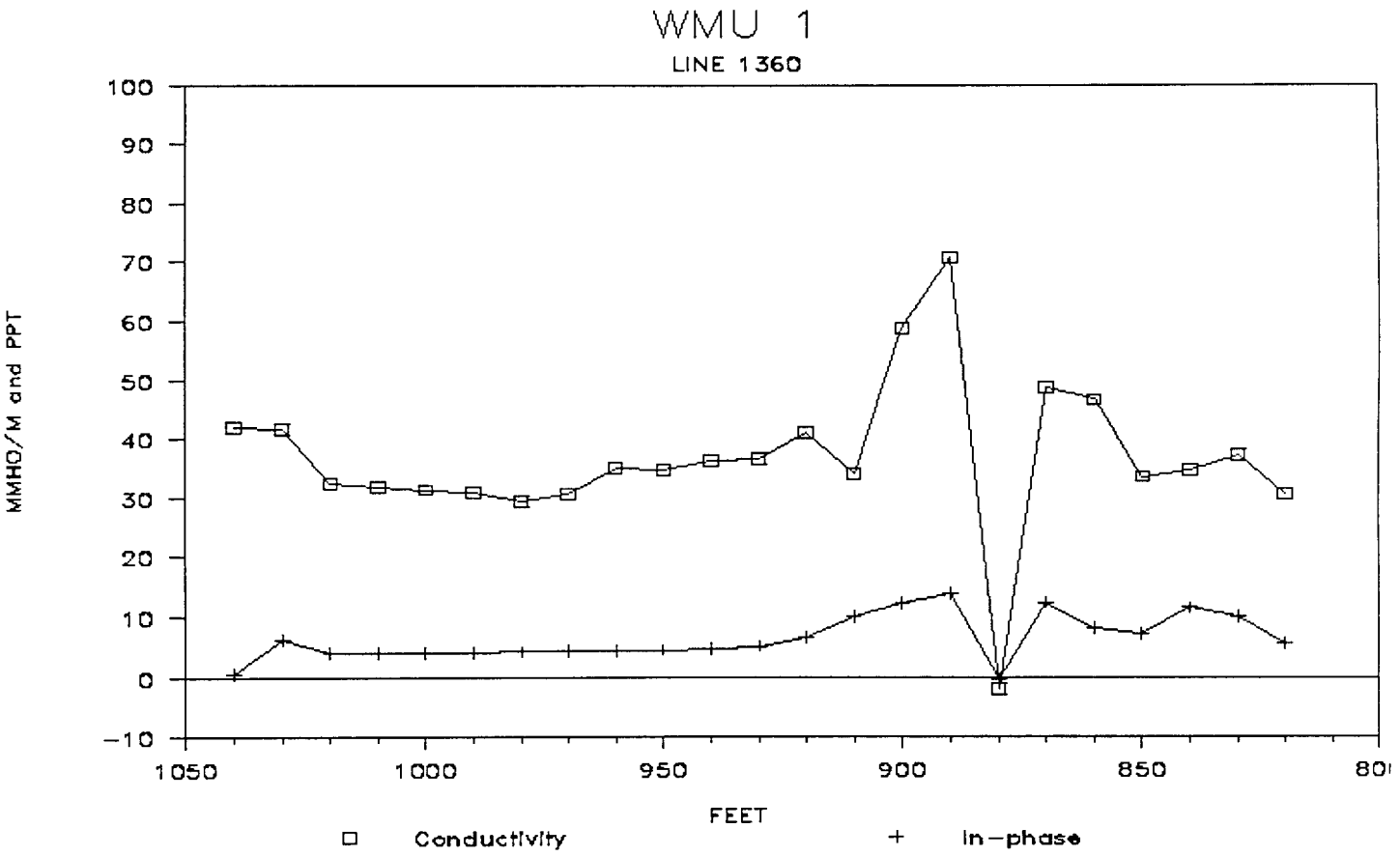
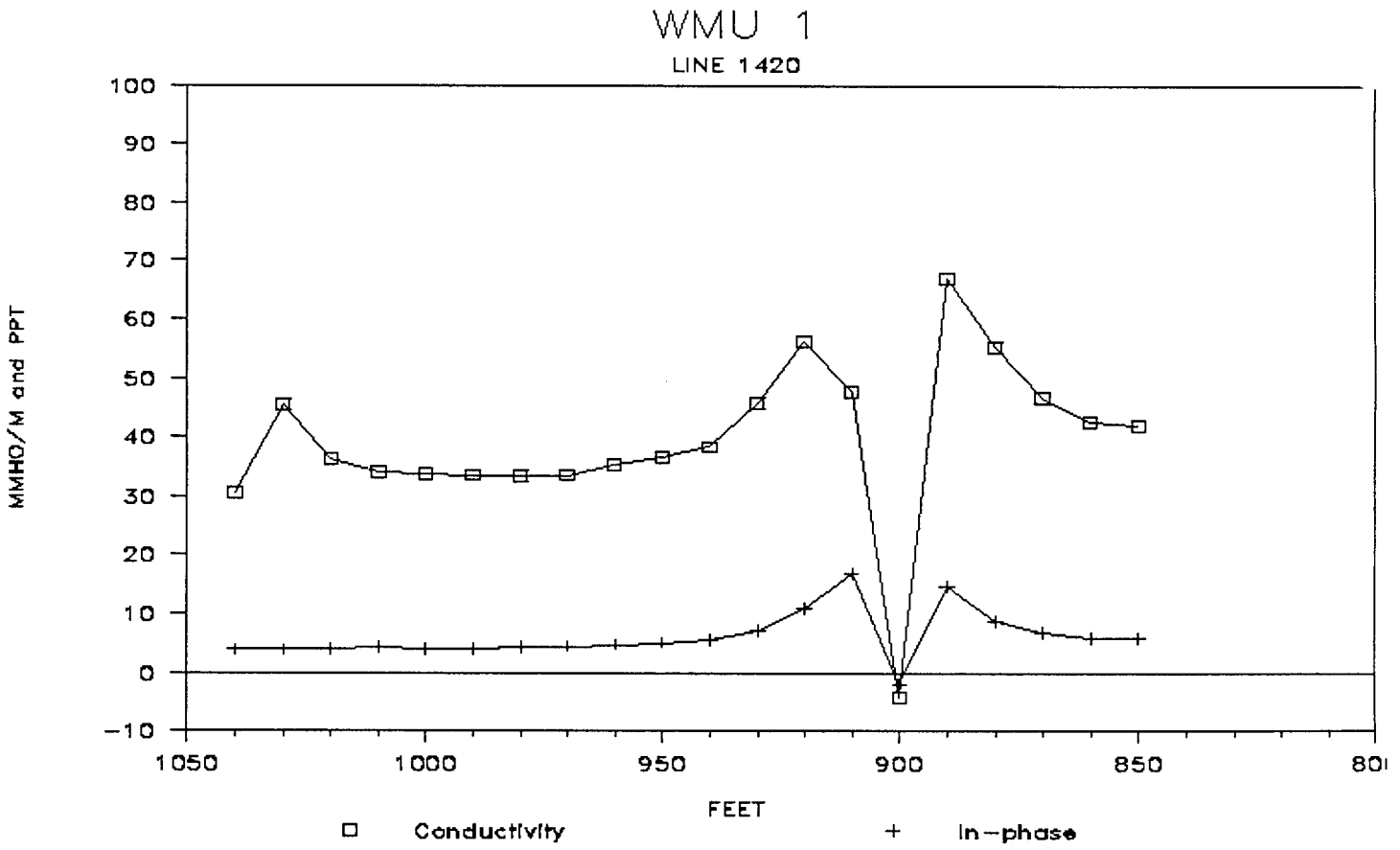
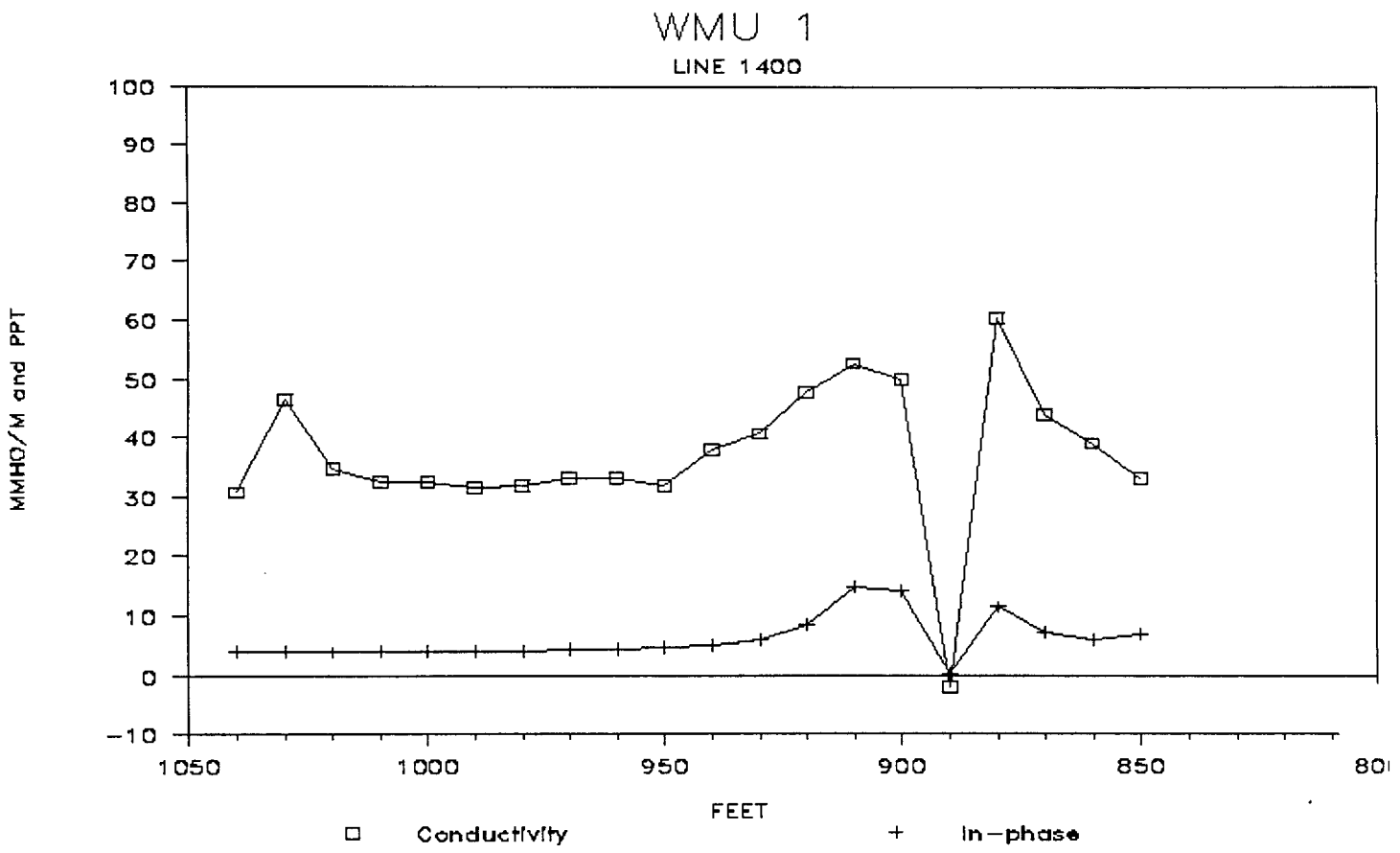
0
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase

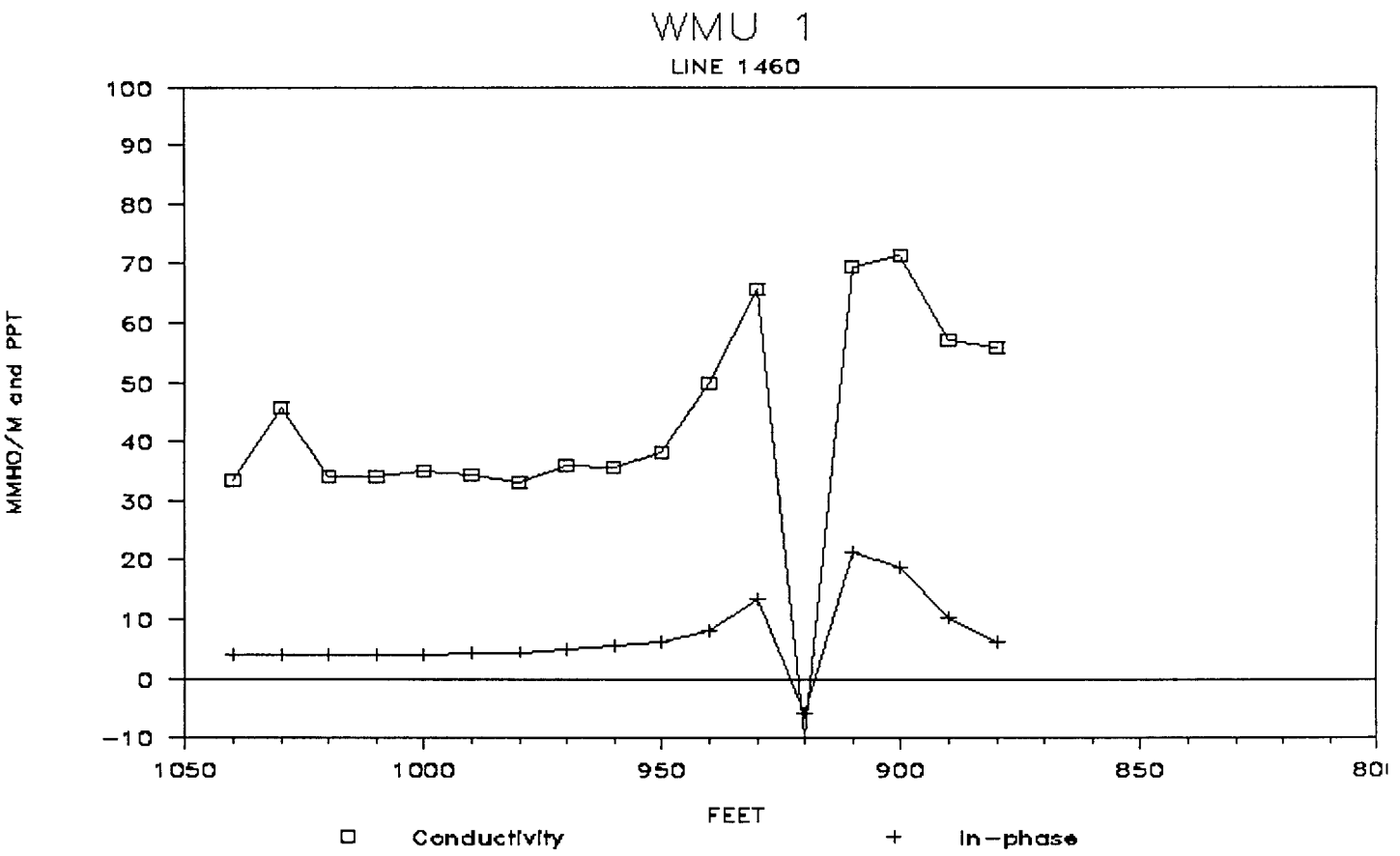

WMU 1
LINE 1340
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase

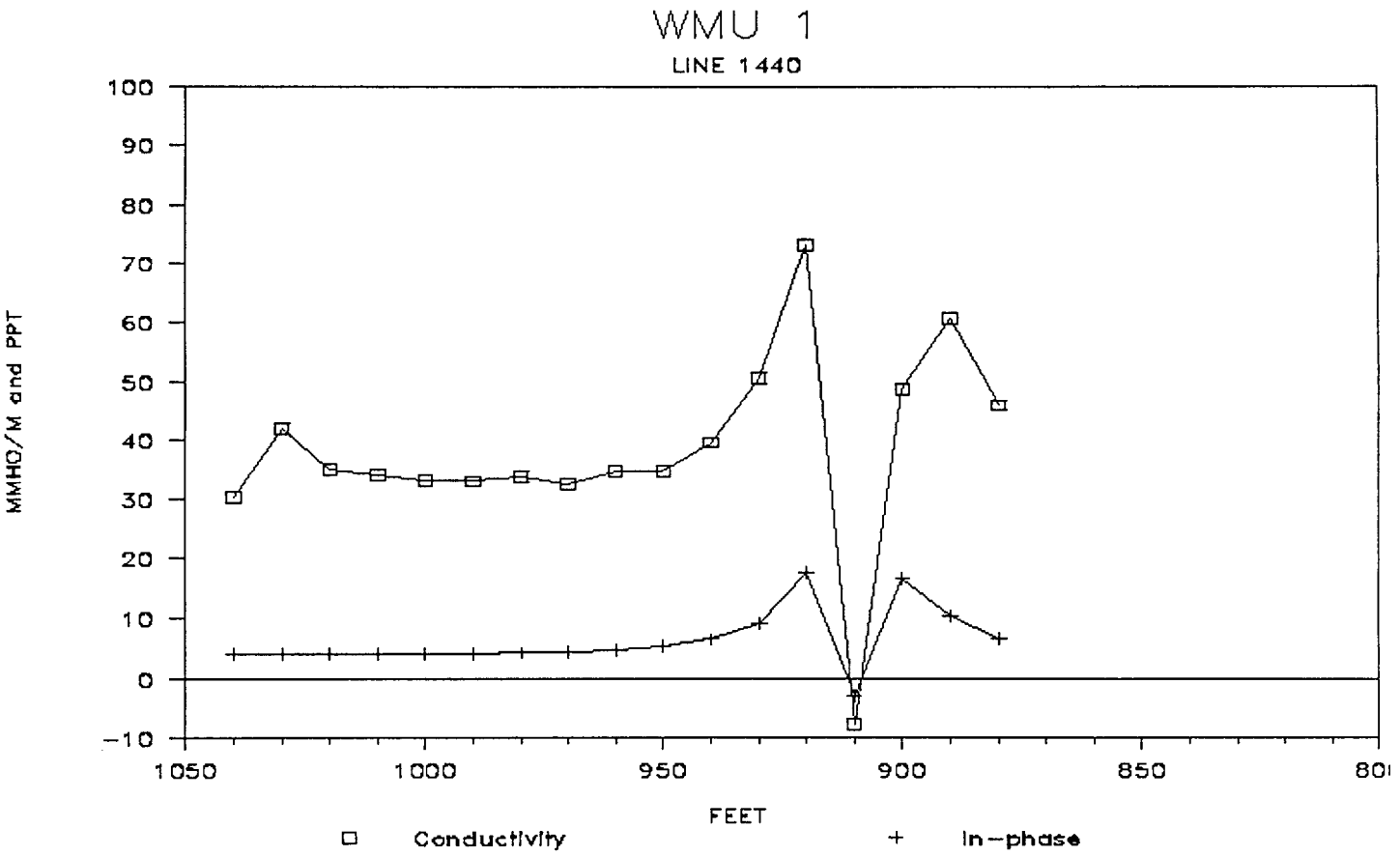

WMU 1
LINE 1380
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase

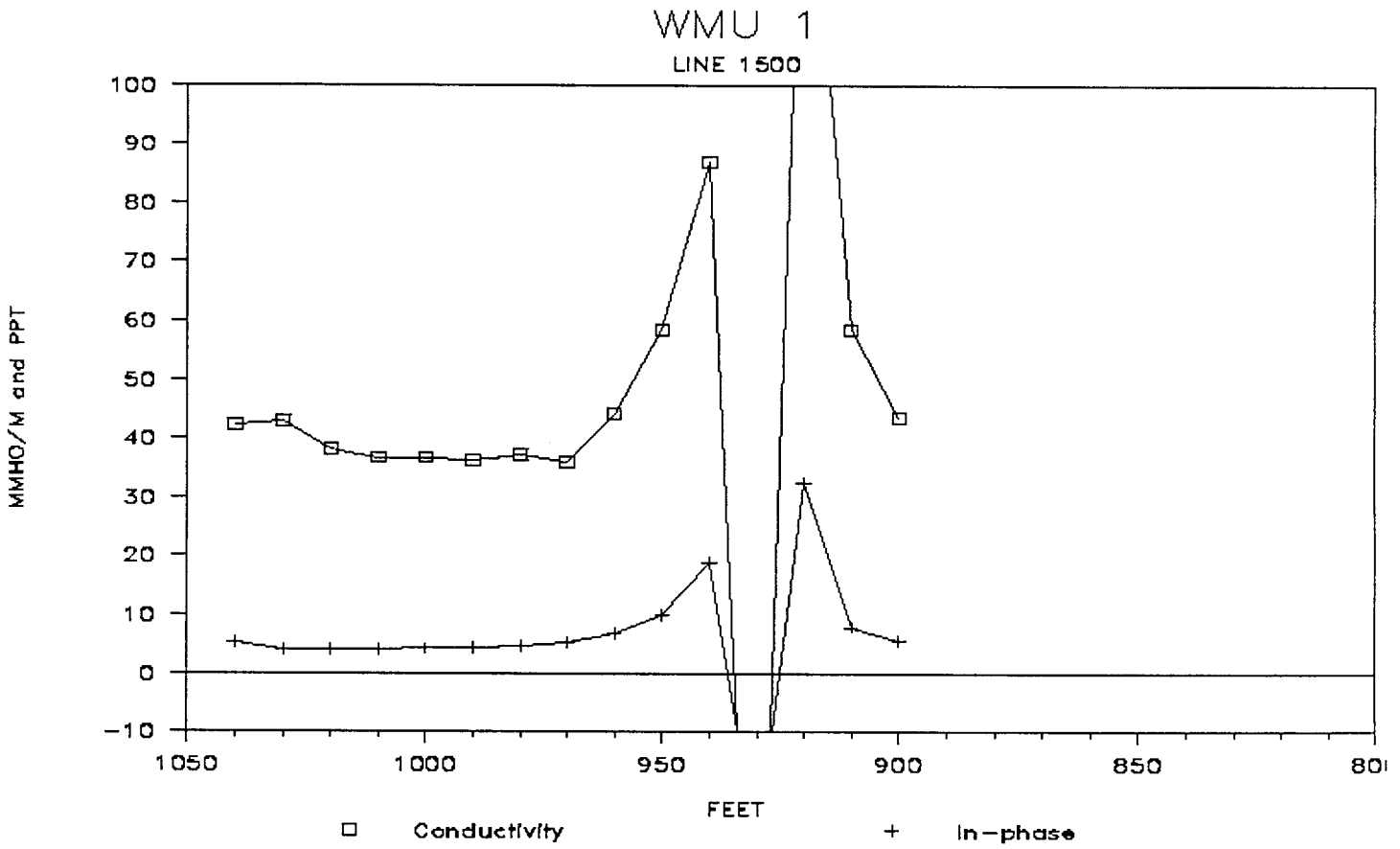

WMU 1
LINE 1360
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase

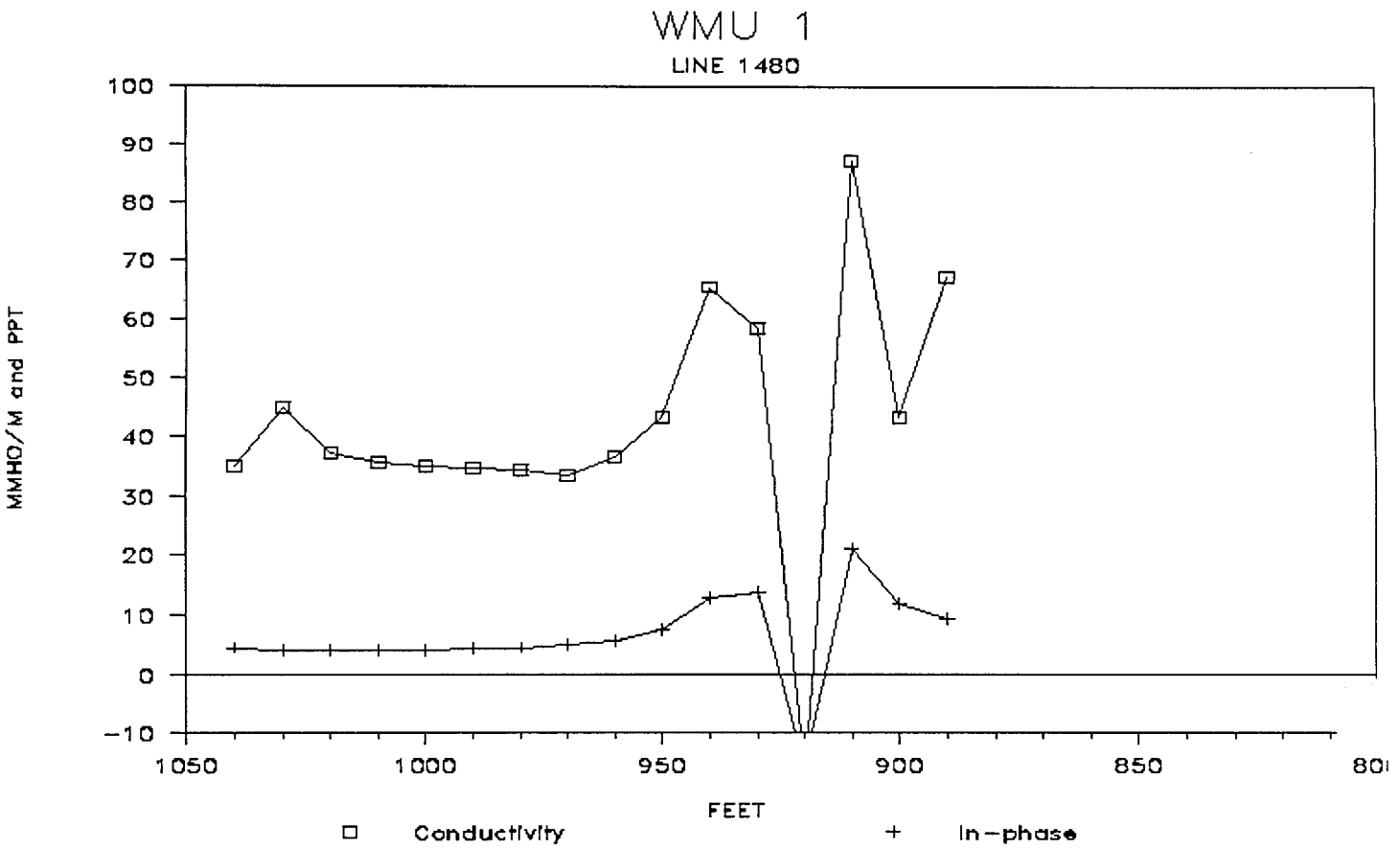

WMU 1
LINE 1420
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase

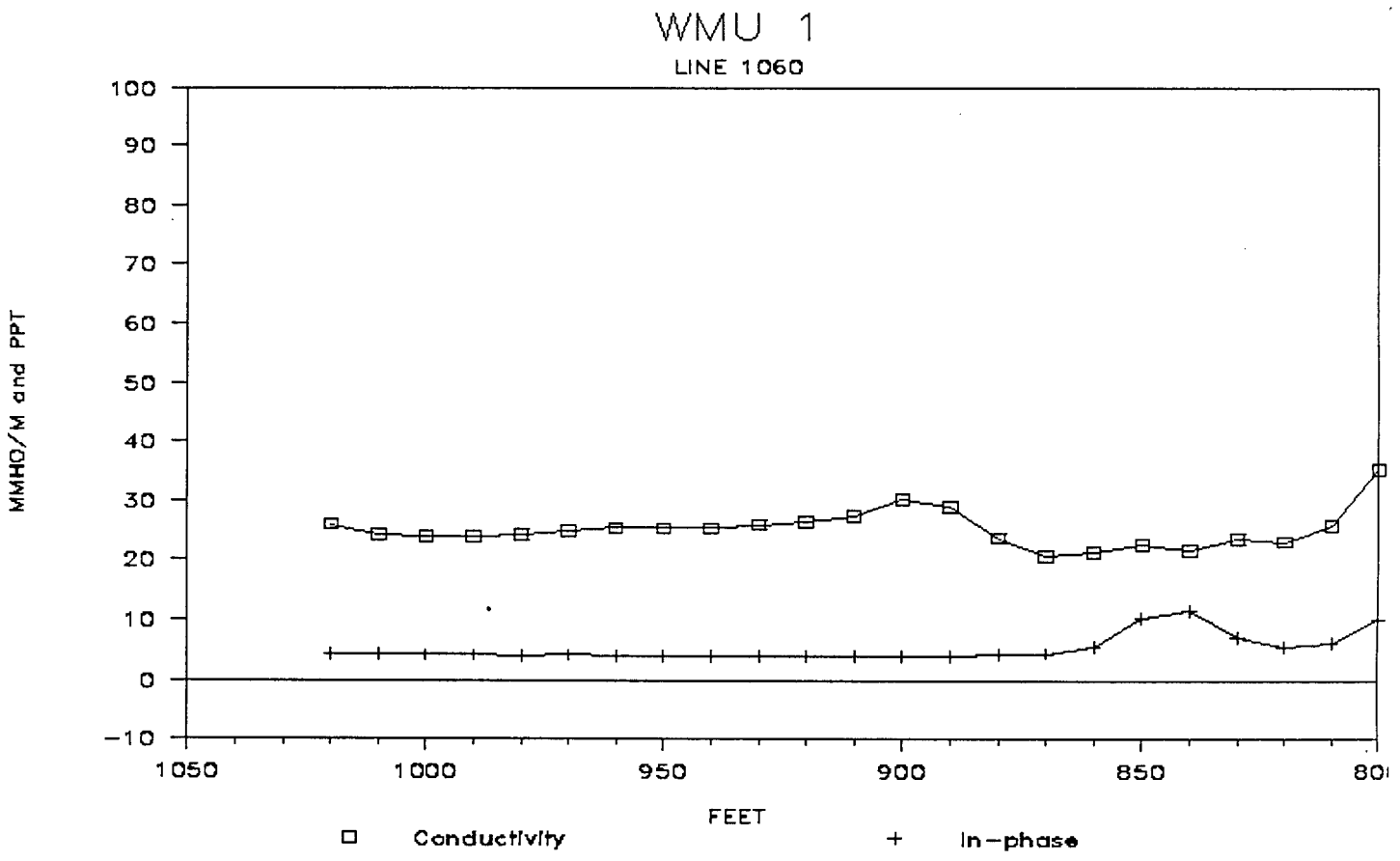

WMU 1
LINE 1400
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase

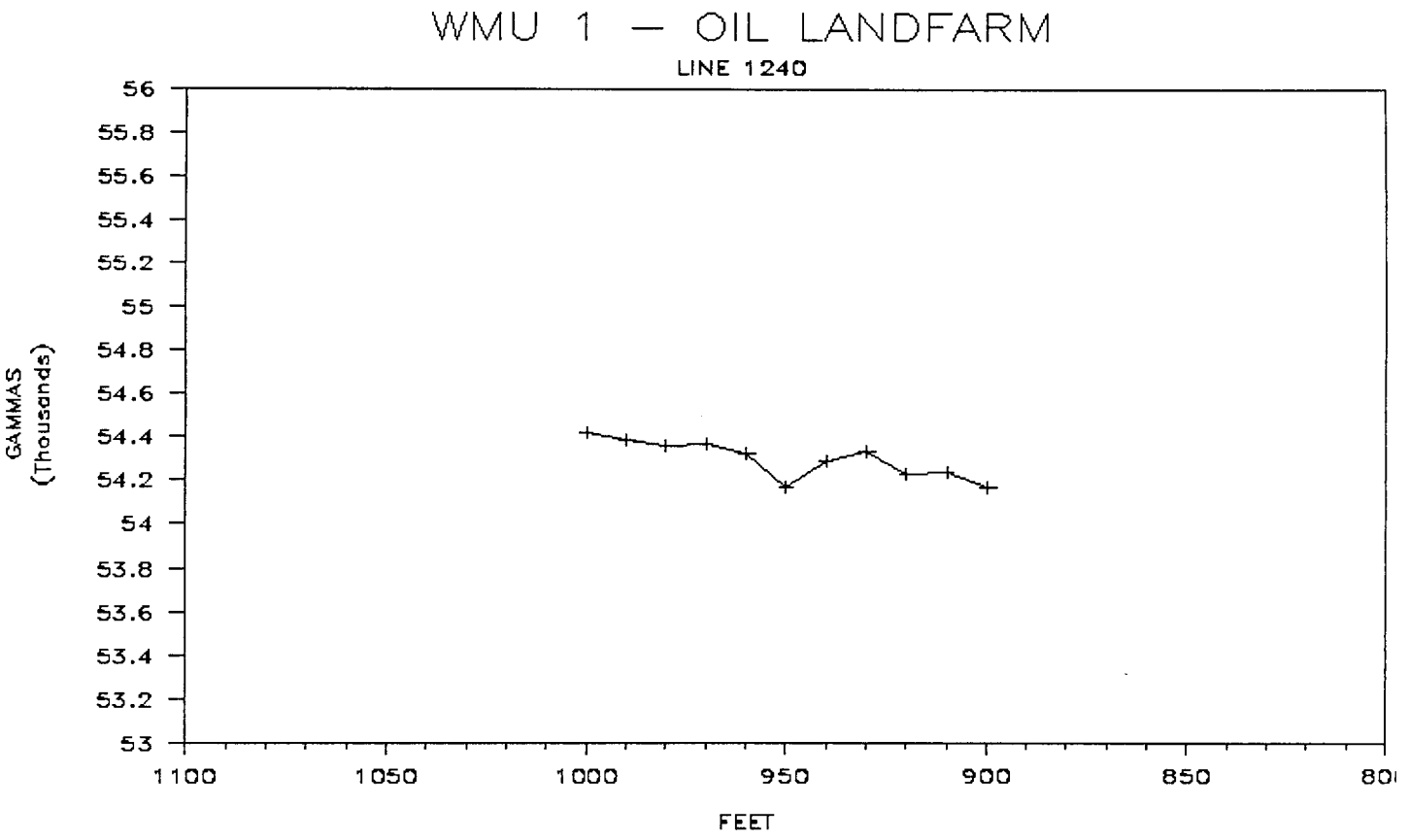

WMU 1
LINE 1460
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase

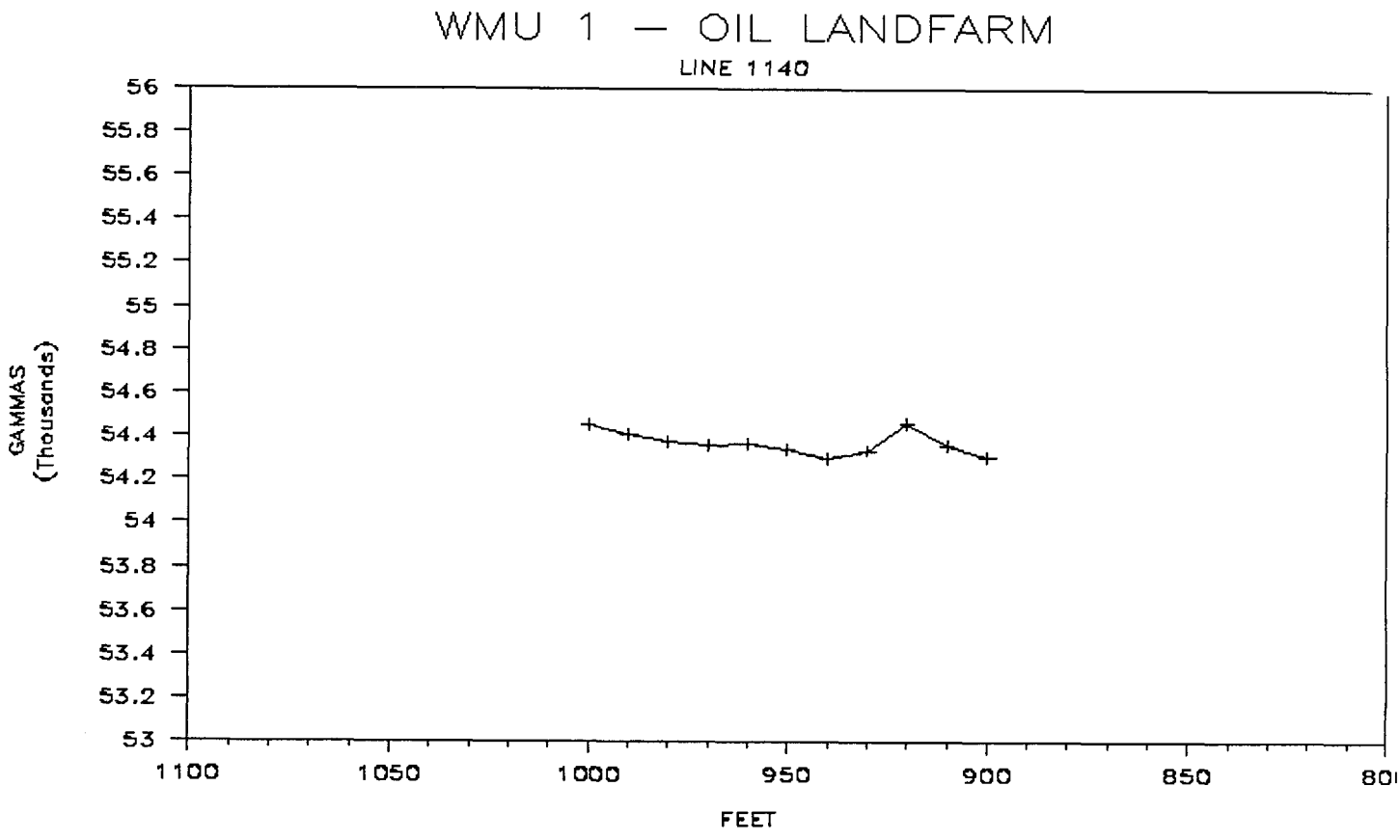

WMU 1
LINE 1440
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase

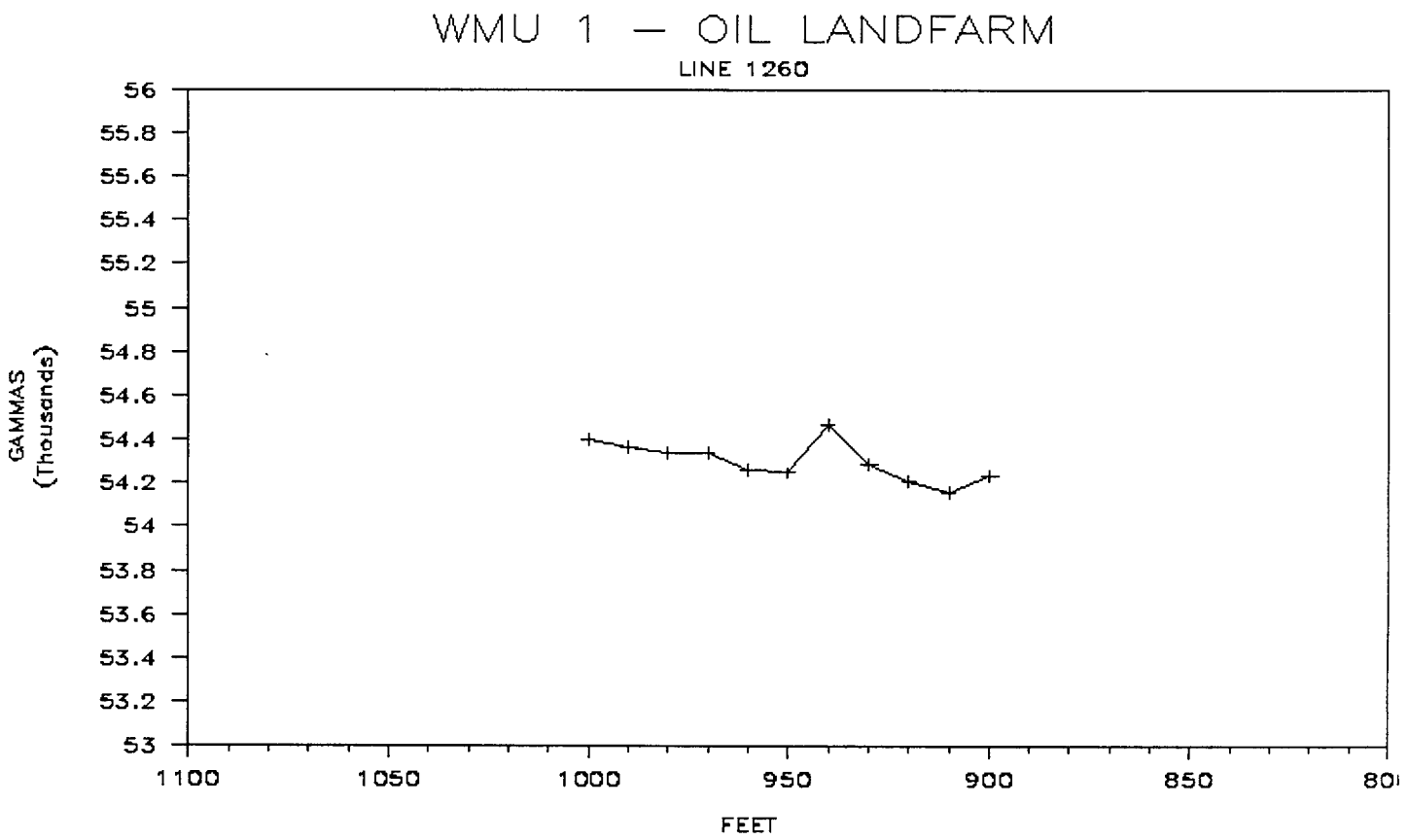

WMU 1
LINE 1500
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase

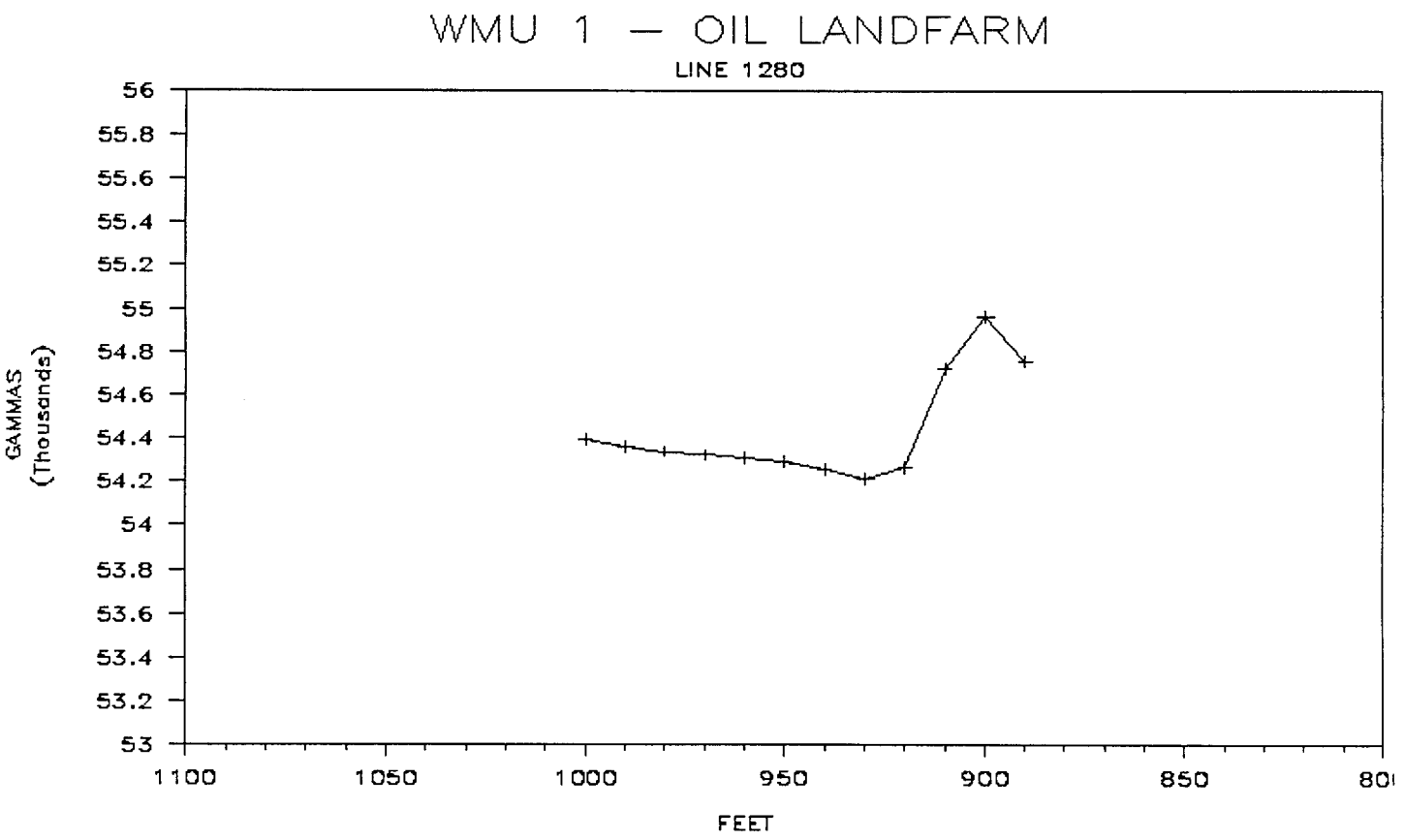

WMU 1
LINE 1480
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase

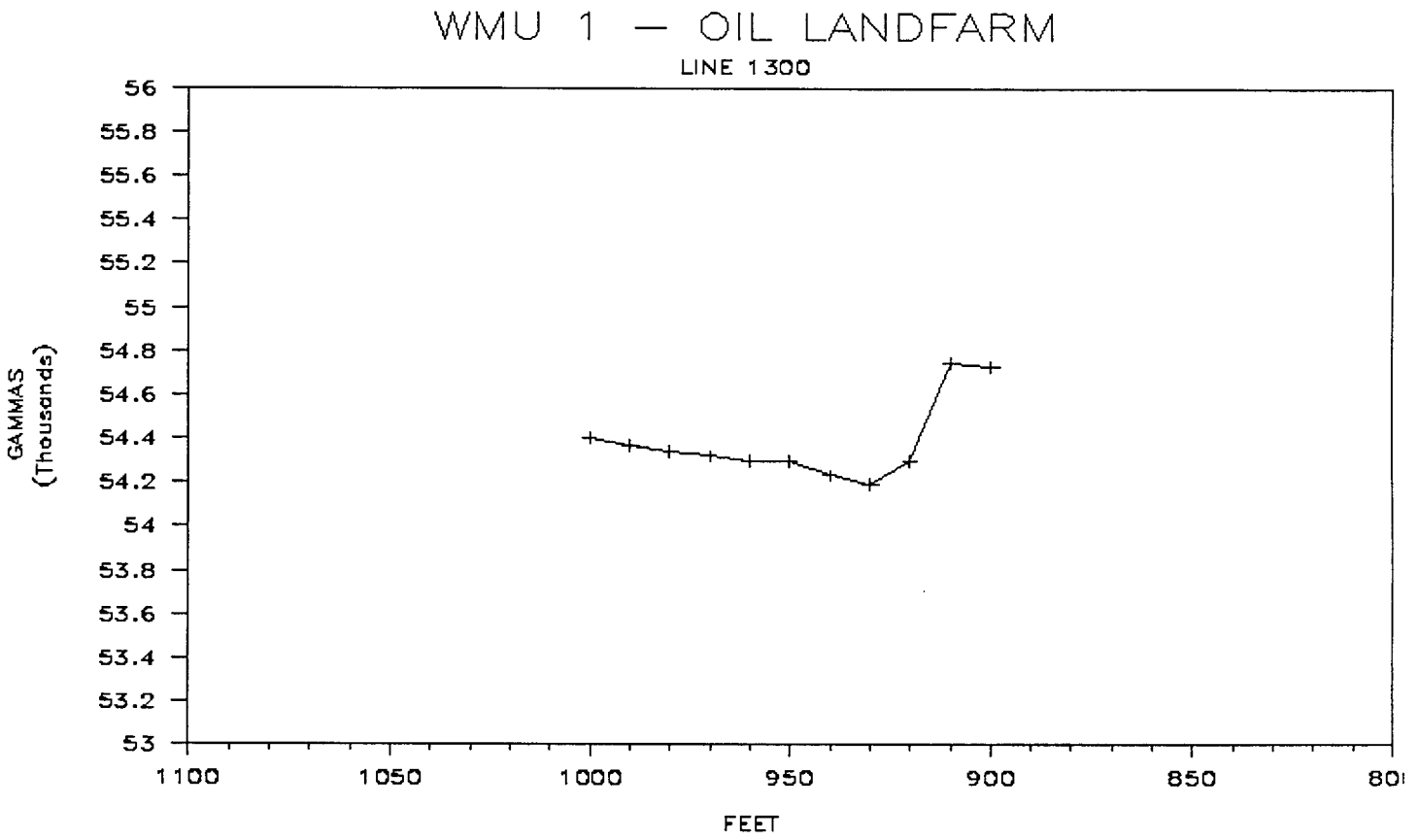

WMU 1
LINE 1060
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
1050
1000
950
900
850
FEET
Conductivity
In-phase

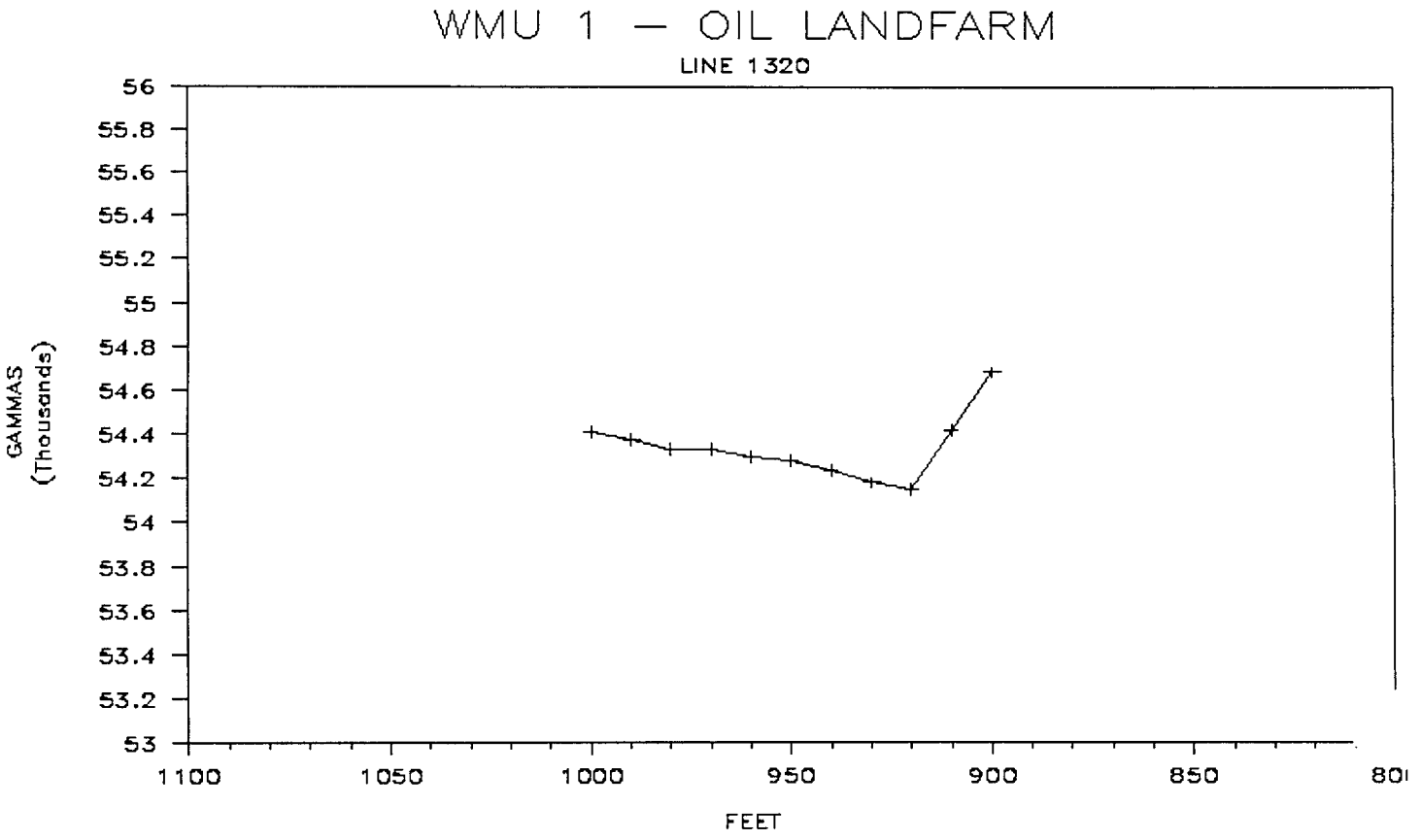

WMU 1 — OIL LANDFARM
LINE 1240
GAMMAS
(Thousands)
56
55.8
55.6
55.4
55.2
55
54.8
54.6
54.4
54.2
54
53.8
53.6
53.4
53.2
53
1100
1050
1000
950
900
850
FEET

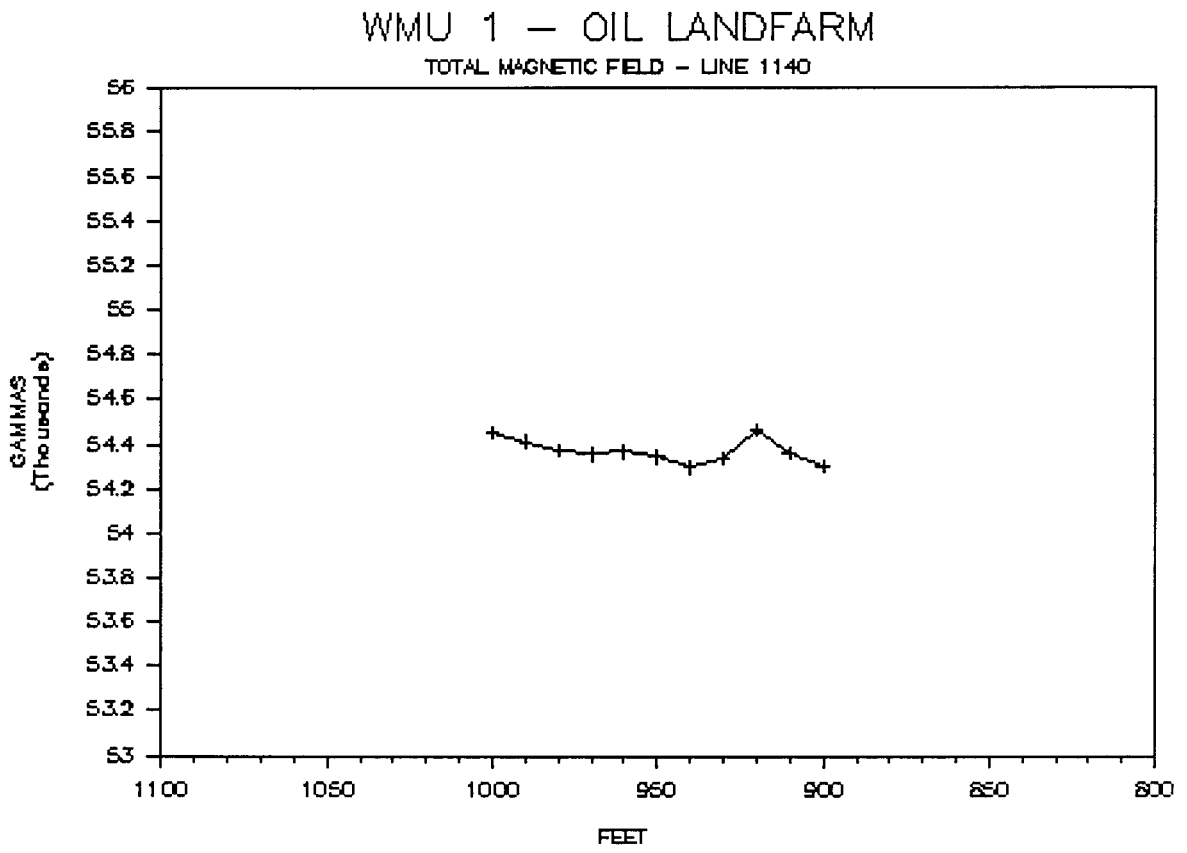

WMU 1 — OIL LANDFARM
LINE 1140
GAMMAS
(Thousands)
56
55.8
55.6
55.4
55.2
55
54.8
54.6
54.4
54.2
54
53.8
53.6
53.4
53.2
53
1100
1050
1000
950
900
850
FEET

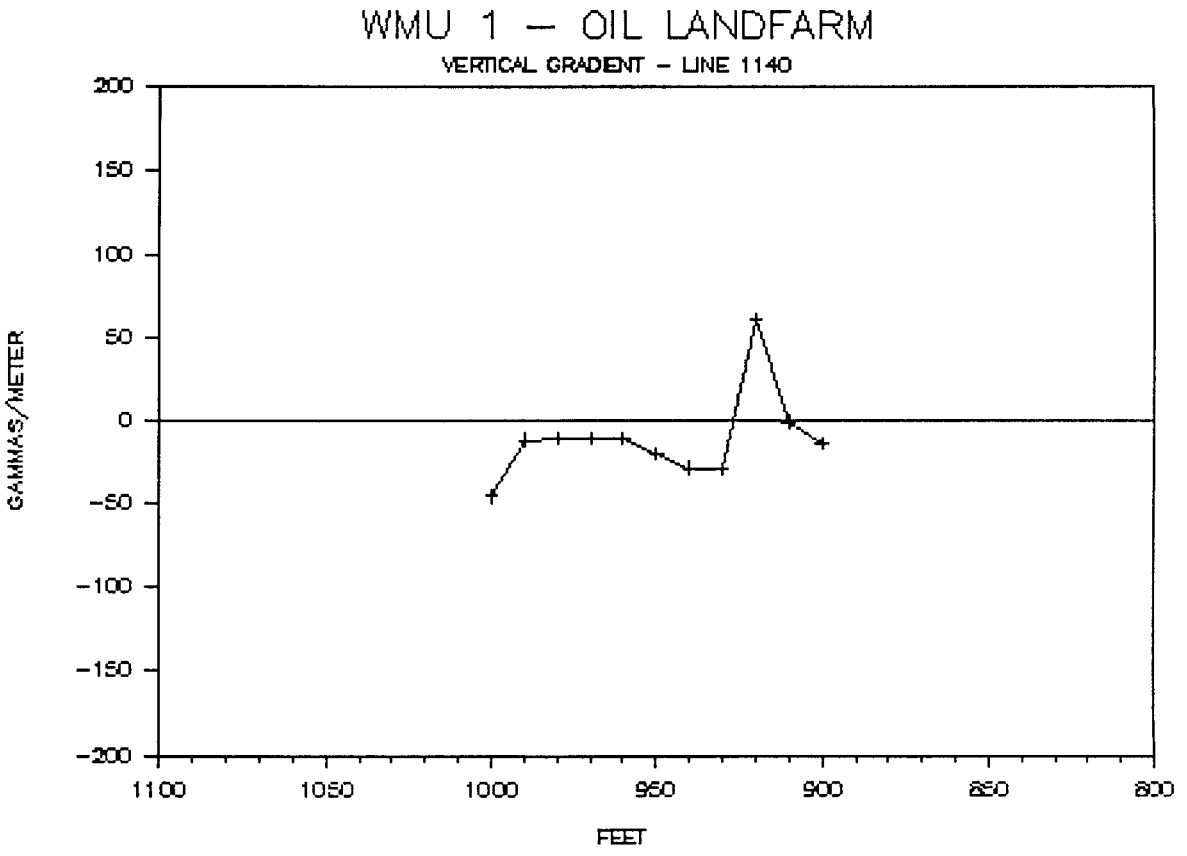

WMU 1 — OIL LANDFARM
LINE 1260
GAMMAS (Thousands)
56
55.8
55.6
55.4
55.2
55
54.8
54.6
54.4
54.2
54
53.8
53.6
53.4
53.2
53
1100
1050
1000
950
900
850
FEET

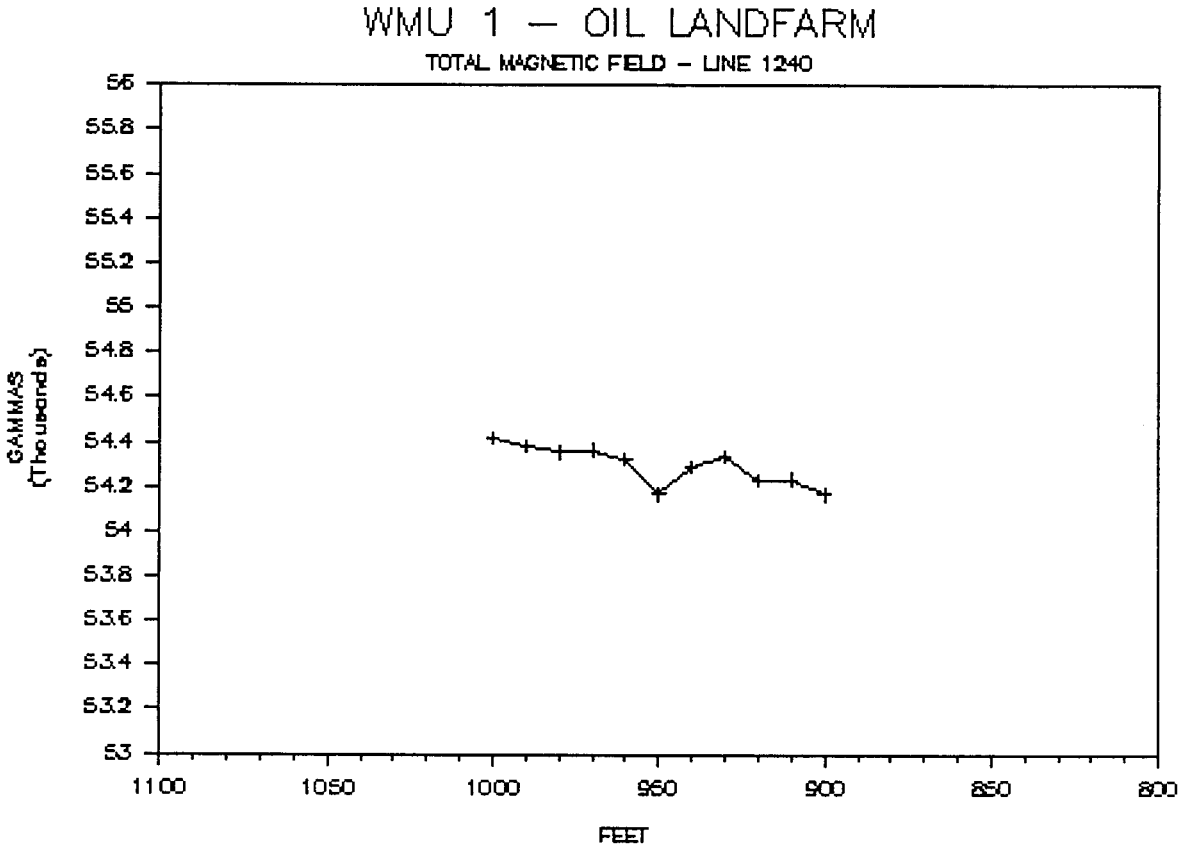

WMU 1 — OIL LANDFARM
LINE 1280
GAMMAS (Thousands)
56
55.8
55.6
55.4
55.2
55
54.8
54.6
54.4
54.2
54
53.8
53.6
53.4
53.2
53
1100
1050
1000
950
900
850
FEET

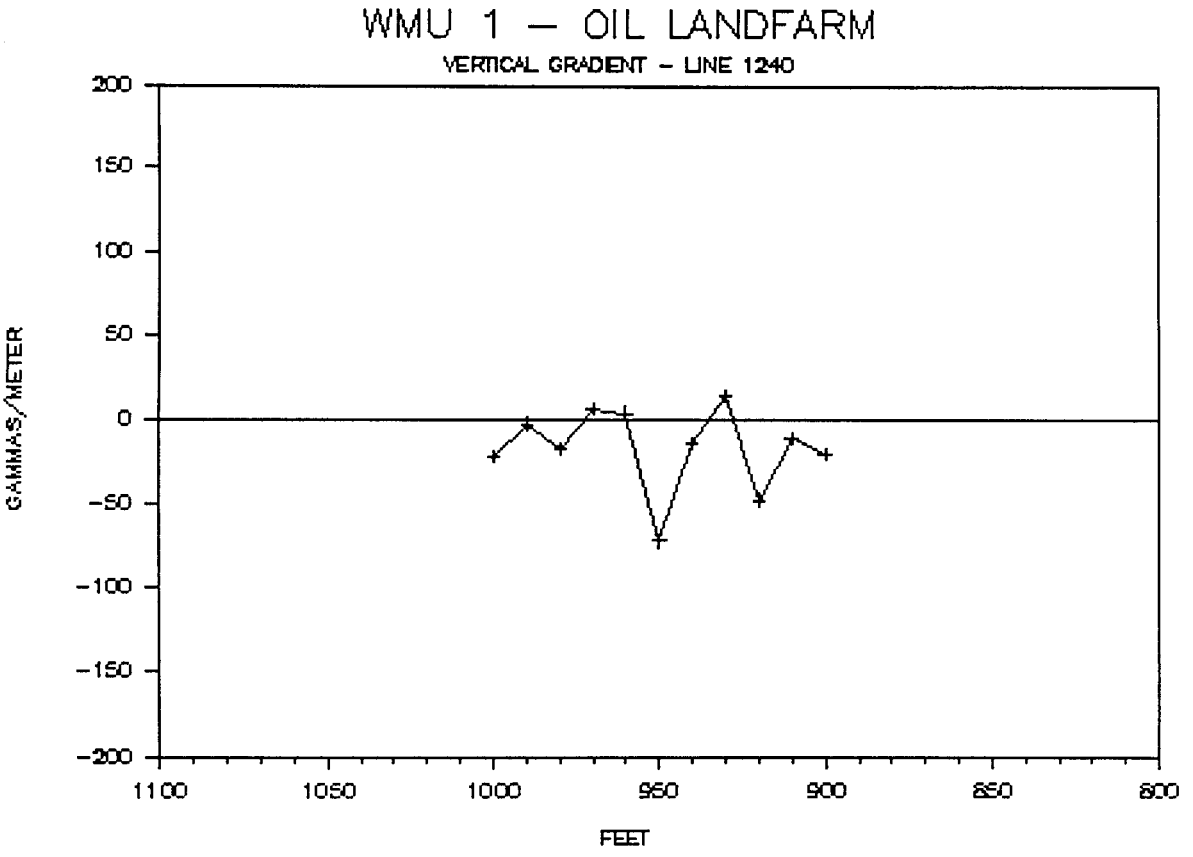

WMU 1 — OIL LANDFARM
LINE 1300
GAMMAS
(Thousands)
56
55.8
55.6
55.4
55.2
55
54.8
54.6
54.4
54.2
54
53.8
53.6
53.4
53.2
53
1100
1050
1000
950
900
850
FEET

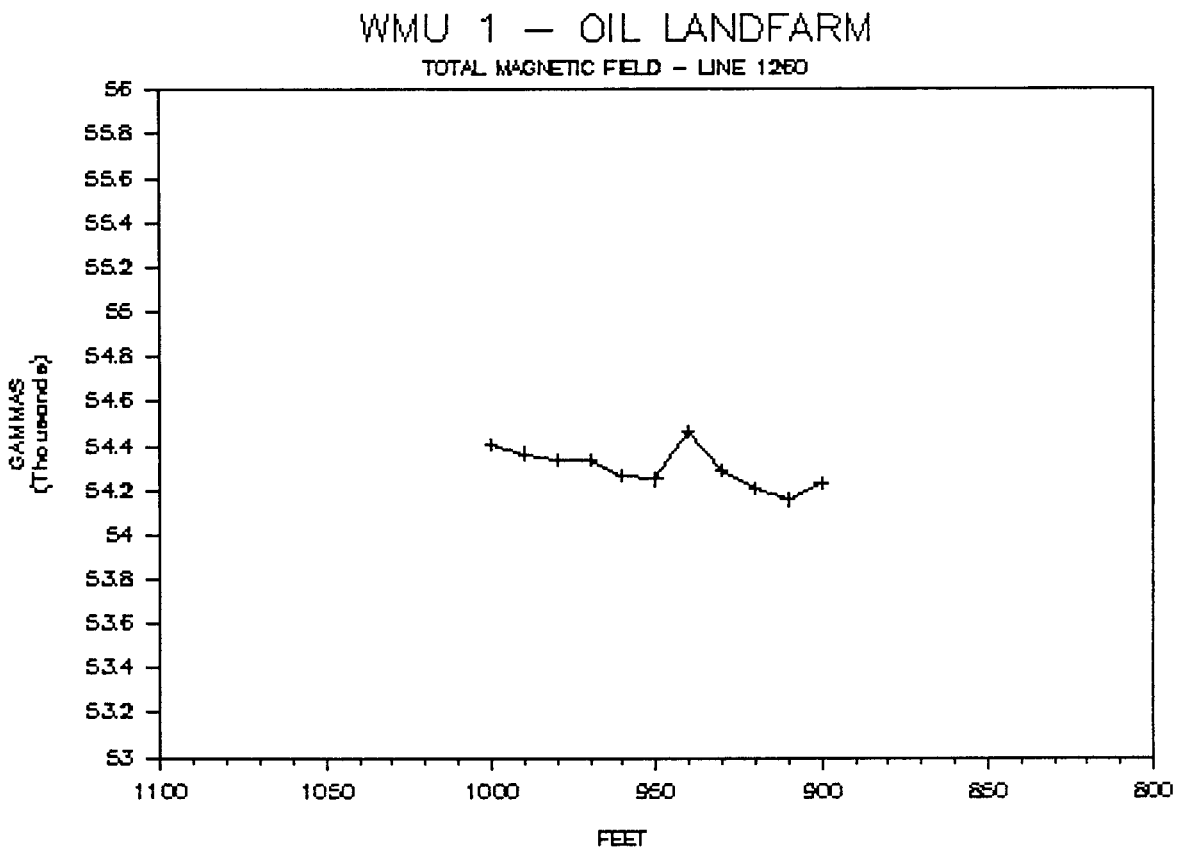

WMU 1 — OIL LANDFARM
LINE 1320
GAMMAS
(Thousands)
56
55.8
55.6
55.4
55.2
55
54.8
54.6
54.4
54.2
54
53.8
53.6
53.4
53.2
53
1100
1050
1000
950
900
850
FEET

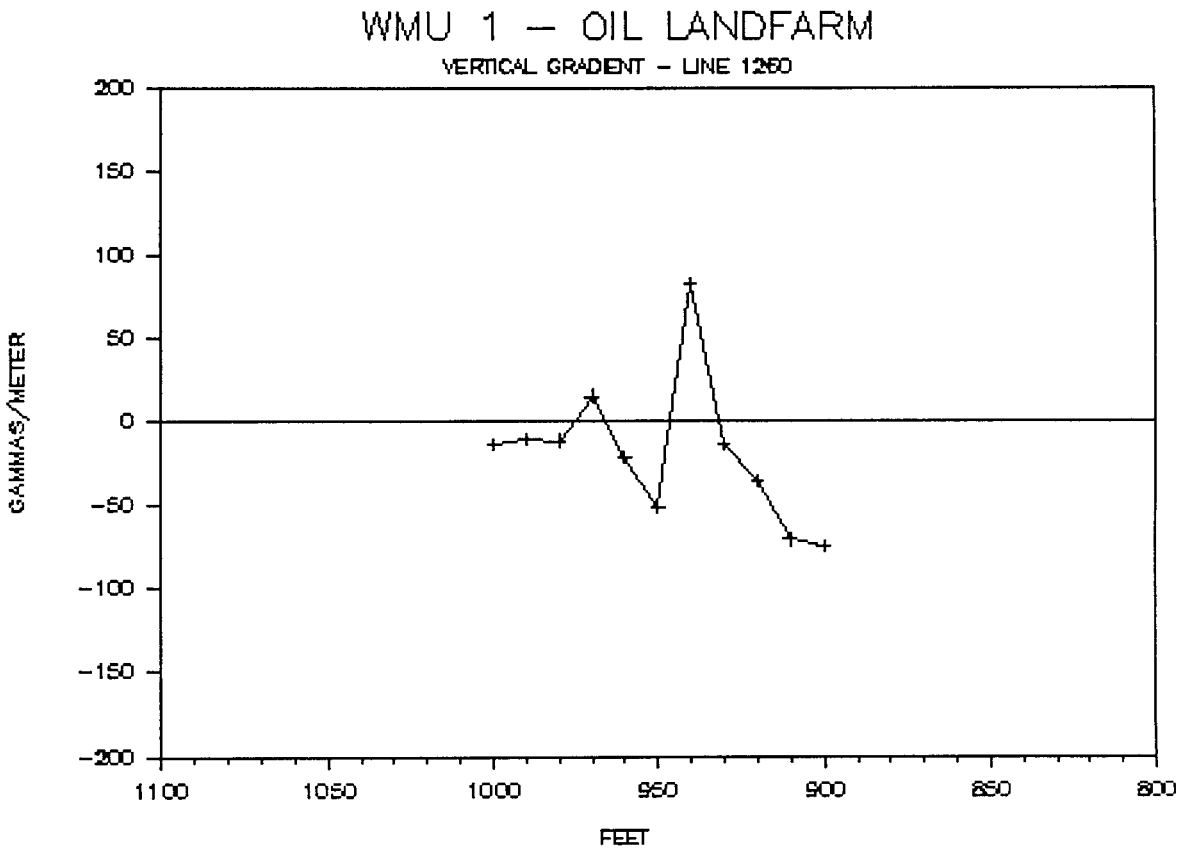

WMU 1 — OIL LANDFARM
TOTAL MAGNETIC FIELD – LINE 1140
GAMMAS (Thousands)
56
55.8
55.6
55.4
55.2
55
54.8
54.6
54.4
54.2
54
53.8
53.6
53.4
53.2
53
1100
1050
1000
950
900
850
800
FEET

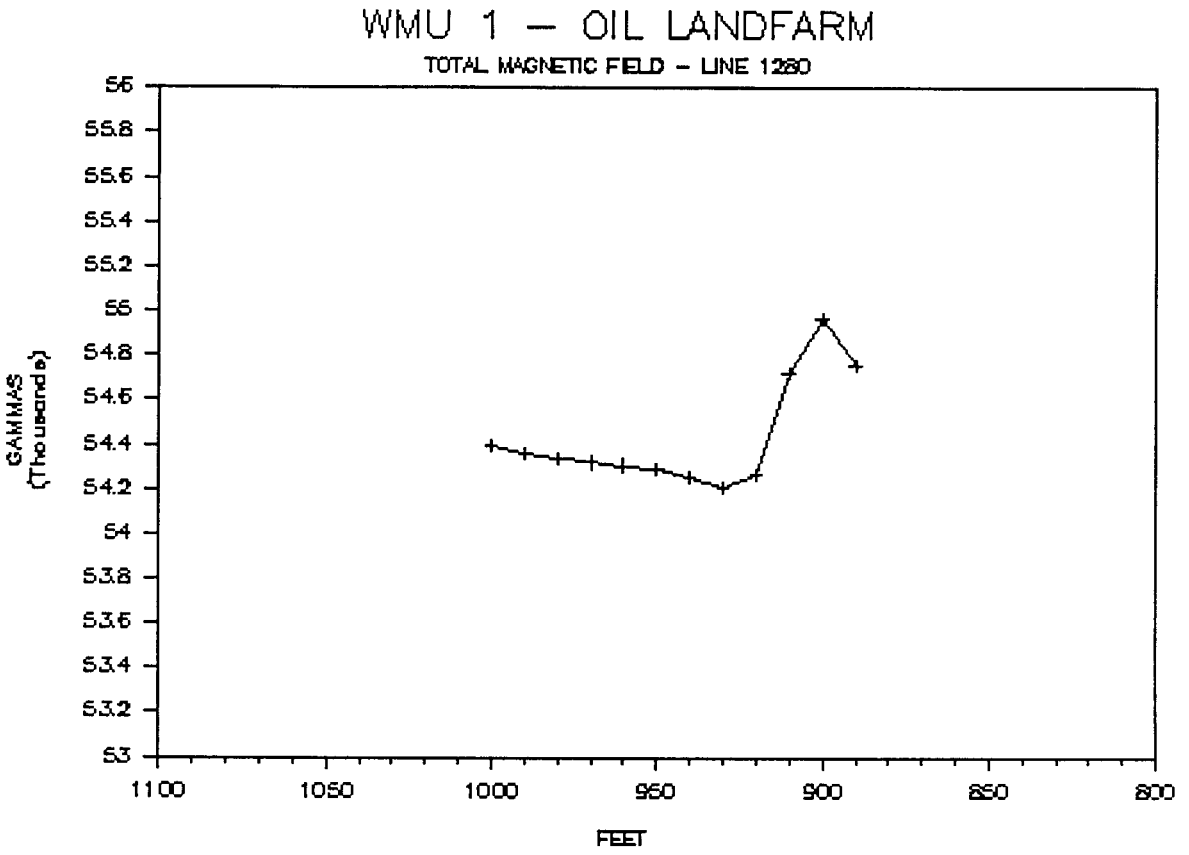

WMU 1 — OIL LANDFARM
VERTICAL GRADIENT – LINE 1140
GAMMAS/METER
200
150
100
50
0
-50
-100
-150
-200
1100
1050
1000
950
900
850
800
FEET

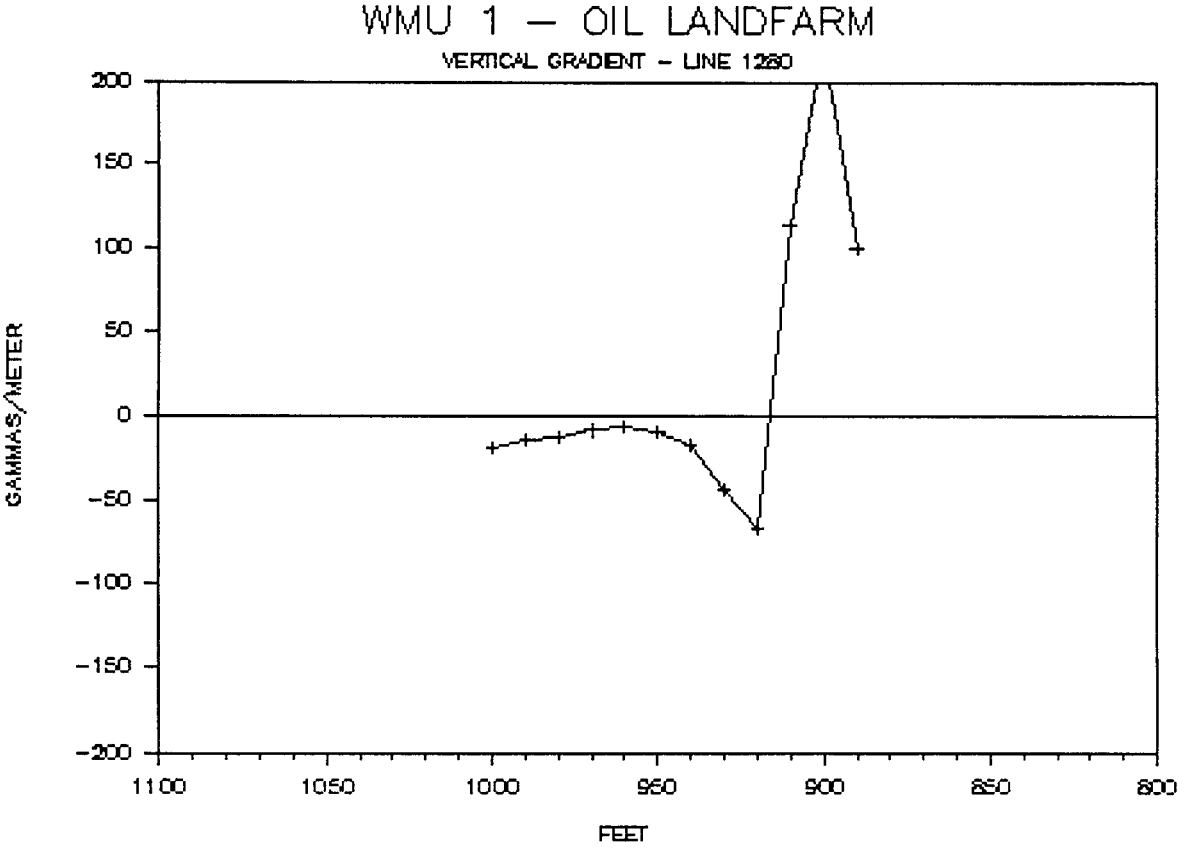

WMU 1 — OIL LANDFARM
TOTAL MAGNETIC FIELD – LINE 1240
GAMMAS (Thousands)
56
55.8
55.6
55.4
55.2
55
54.8
54.6
54.4
54.2
54
53.8
53.6
53.4
53.2
53
1100
1050
1000
950
900
850
800
FEET

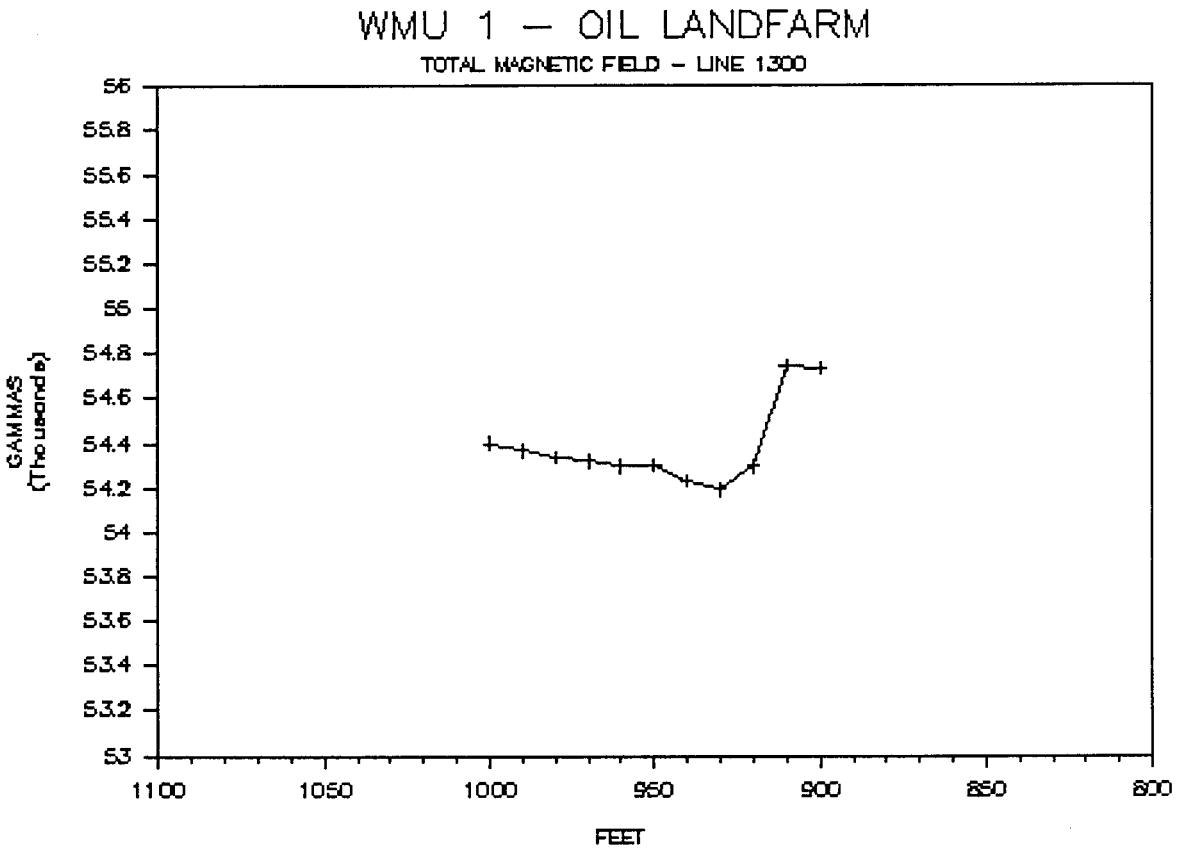

WMU 1 — OIL LANDFARM
VERTICAL GRADIENT – LINE 1240
GAMMAS/METER
200
150
100
50
0
-50
-100
-150
-200
1100
1050
1000
950
900
850
800
FEET

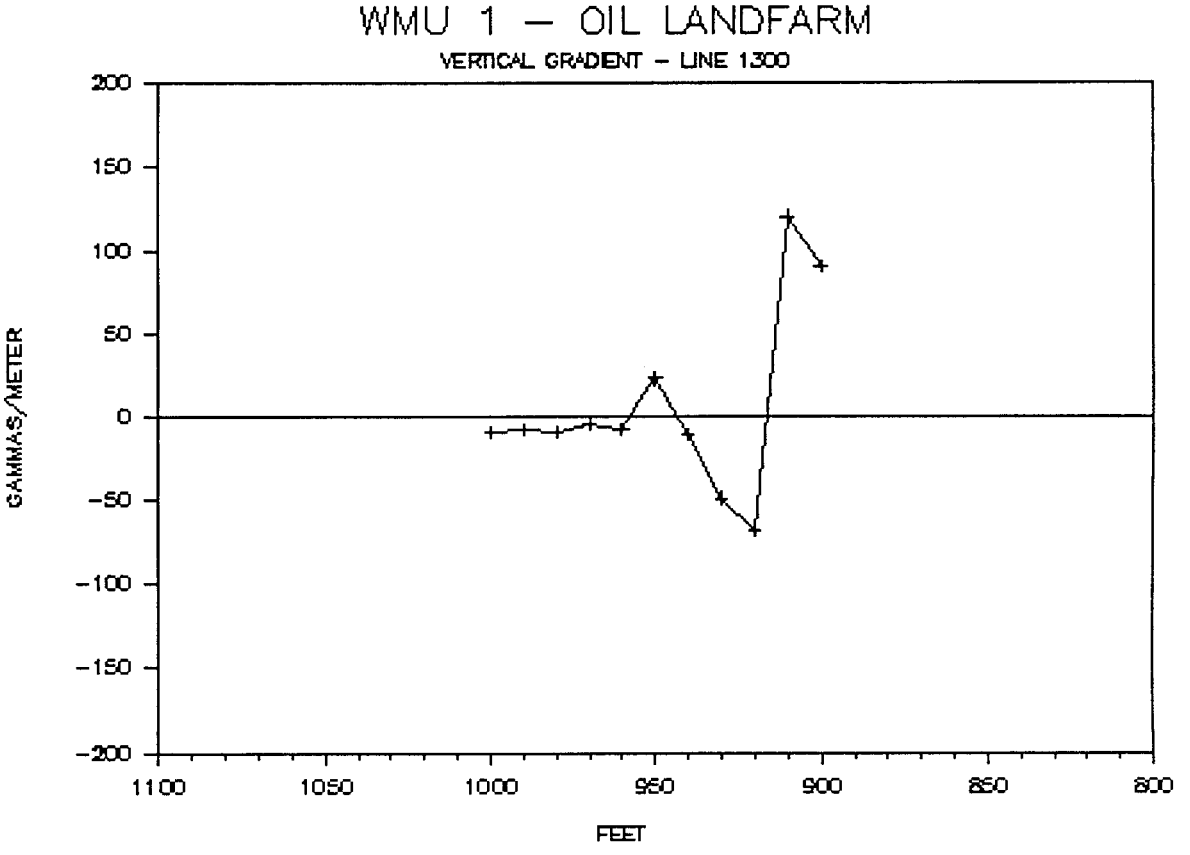

WMU 1 — OIL LANDFARM
TOTAL MAGNETIC FIELD – LINE 1260
GAMMAS (Thousands)
56
55.8
55.6
55.4
55.2
55
54.8
54.6
54.4
54.2
54
53.8
53.6
53.4
53.2
53
1100
1050
1000
950
900
850
800
FEET

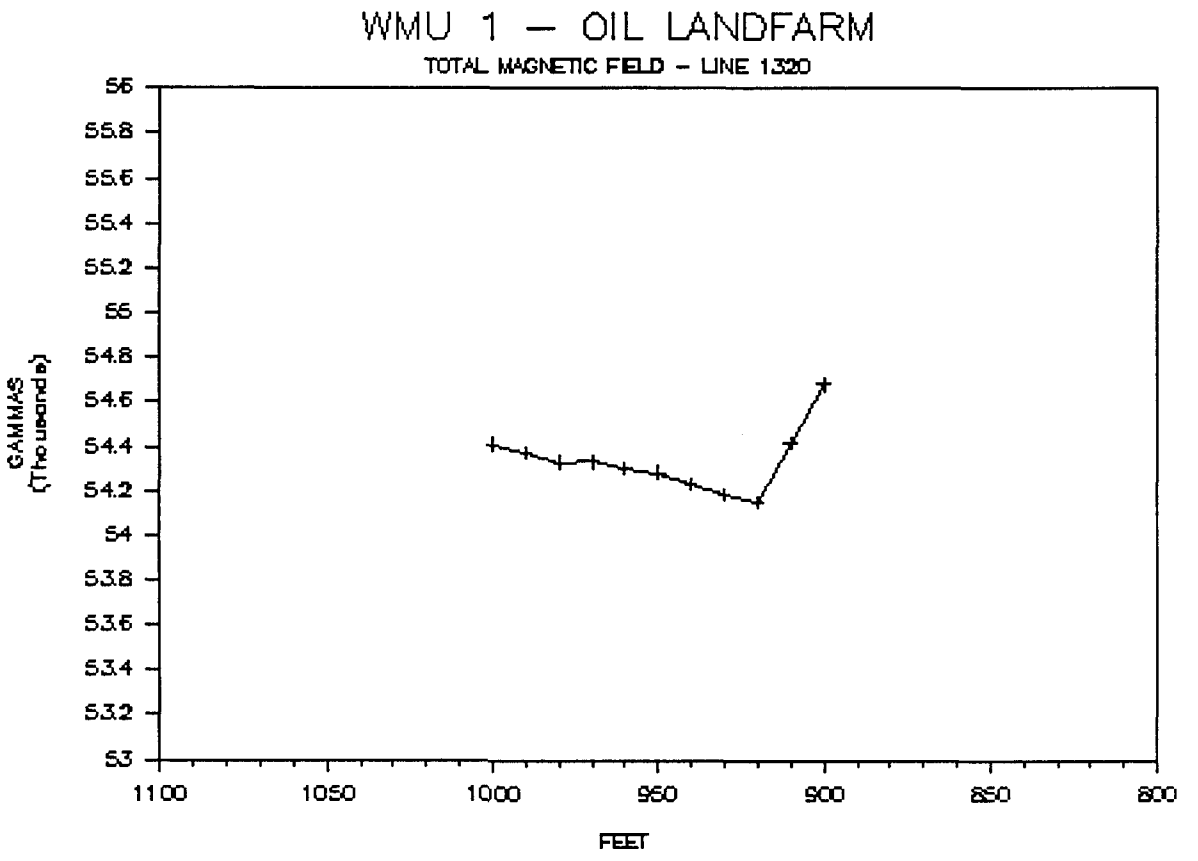

WMU 1 — OIL LANDFARM
VERTICAL GRADIENT – LINE 1260
GAMMAS/METER
200
150
100
50
0
-50
-100
-150
-200
1100
1050
1000
950
900
850
800
FEET

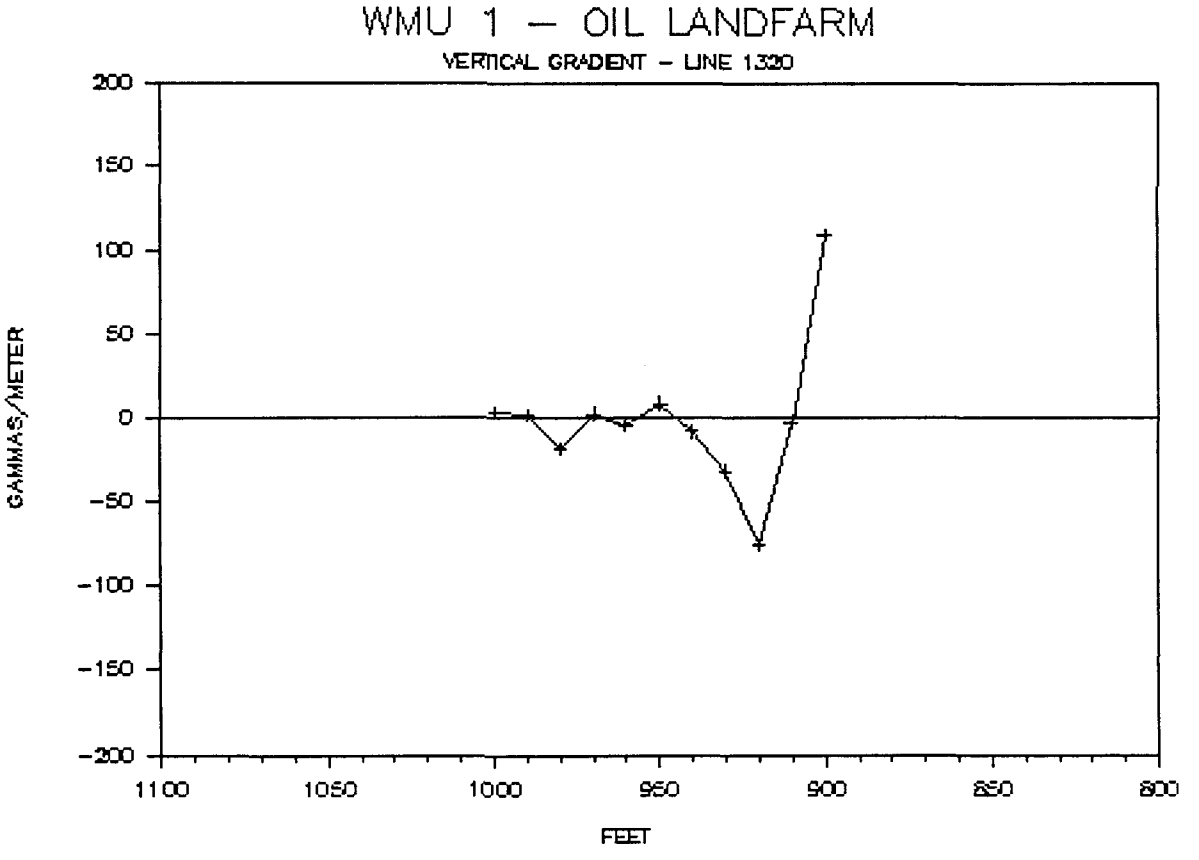

WMU 1 — OIL LANDFARM
TOTAL MAGNETIC FIELD – LINE 1280
GAMMAS (Thousands)
56
55.8
55.6
55.4
55.2
55
54.8
54.6
54.4
54.2
54
53.8
53.6
53.4
53.2
53
1100
1050
1000
950
900
850
800
FEET


WMU 1 — OIL LANDFARM
VERTICAL GRADIENT – LINE 1280
GAMMAS/METER
200
150
100
50
0
-50
-100
-150
-200
1100
1050
1000
950
900
850
800
FEET


WMU 1 — OIL LANDFARM
TOTAL MAGNETIC FIELD – LINE 1300
GAMMAS (Thousands)
56
55.8
55.6
55.4
55.2
55
54.8
54.6
54.4
54.2
54
53.8
53.6
53.4
53.2
53
1100
1050
1000
950
900
850
800
FEET

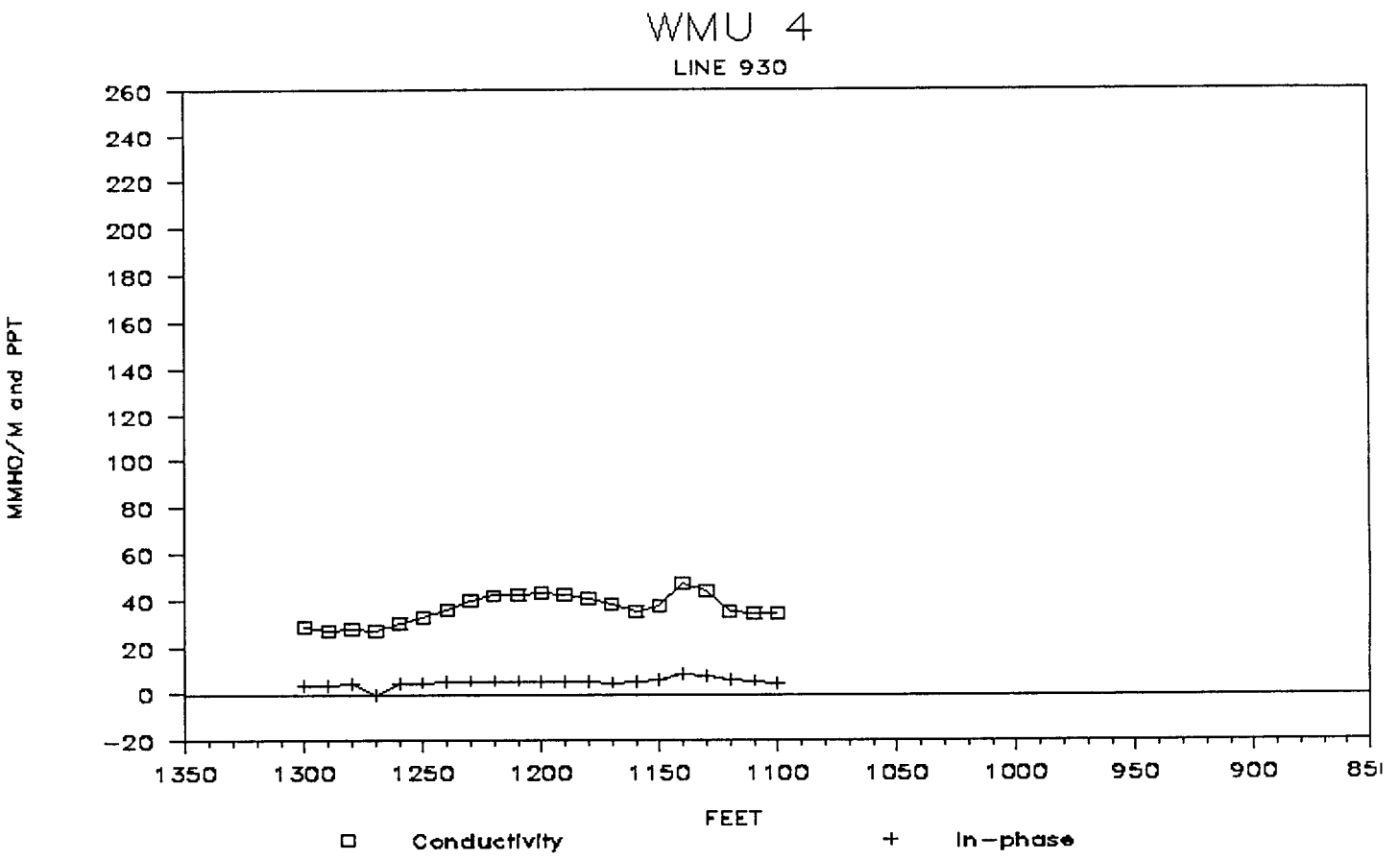

WMU 1 — OIL LANDFARM
VERTICAL GRADIENT – LINE 1300
GAMMAS/METER
200
150
100
50
0
-50
-100
-150
-200
1100
1050
1000
950
900
850
800
FEET

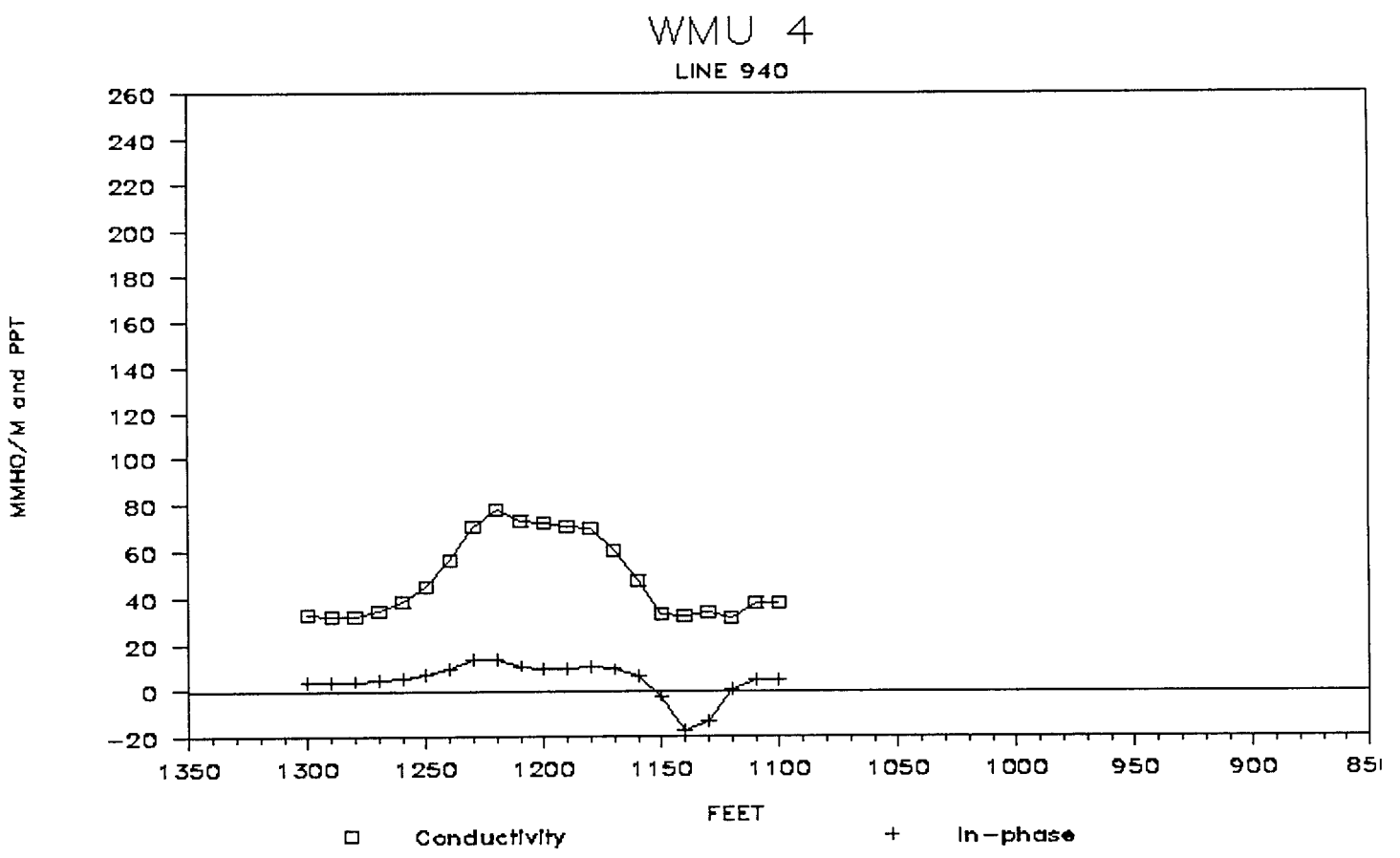

WMU 1 — OIL LANDFARM
TOTAL MAGNETIC FIELD - LINE 1320
GAMMAS (Thousands)
56
55.8
55.6
55.4
55.2
55
54.8
54.6
54.4
54.2
54
53.8
53.6
53.4
53.2
53
1100
1050
1000
950
900
850
800
FEET

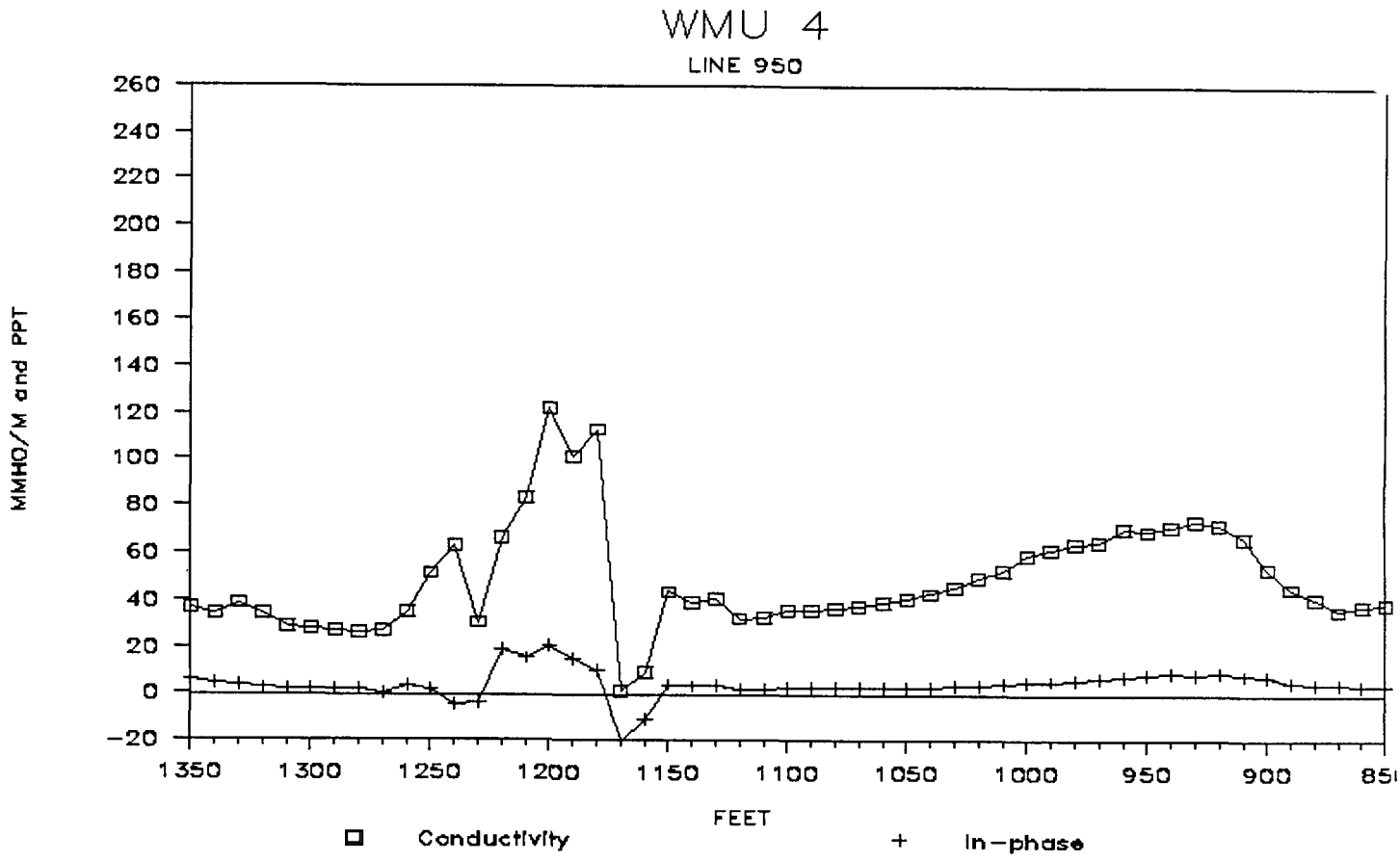

WMU 1 — OIL LANDFARM
VERTICAL GRADIENT - LINE 1320
GAMMAS/METER
200
150
100
50
0
-50
-100
-150
-200
1100
1050
1000
950
900
850
800
FEET

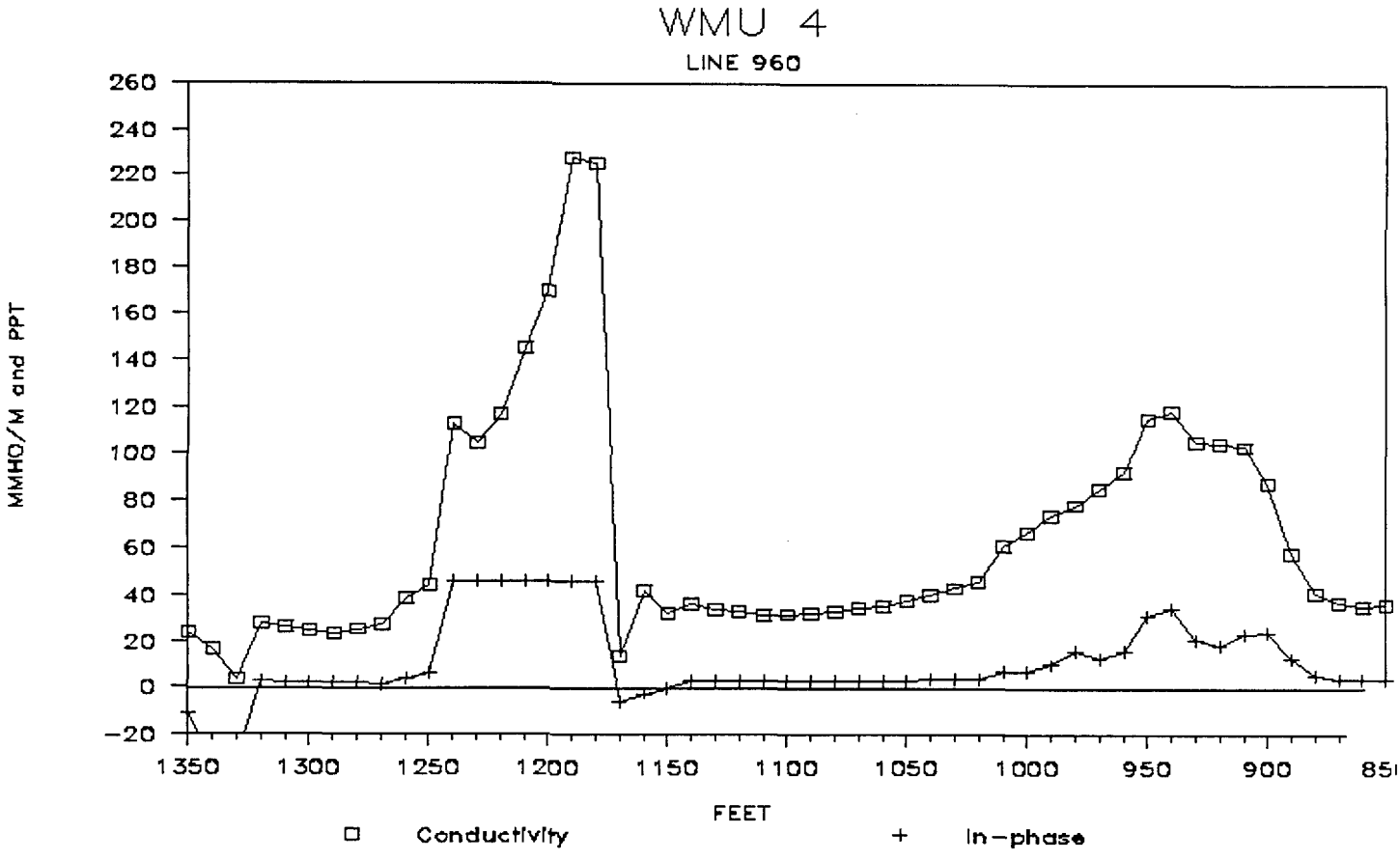
Attachment B

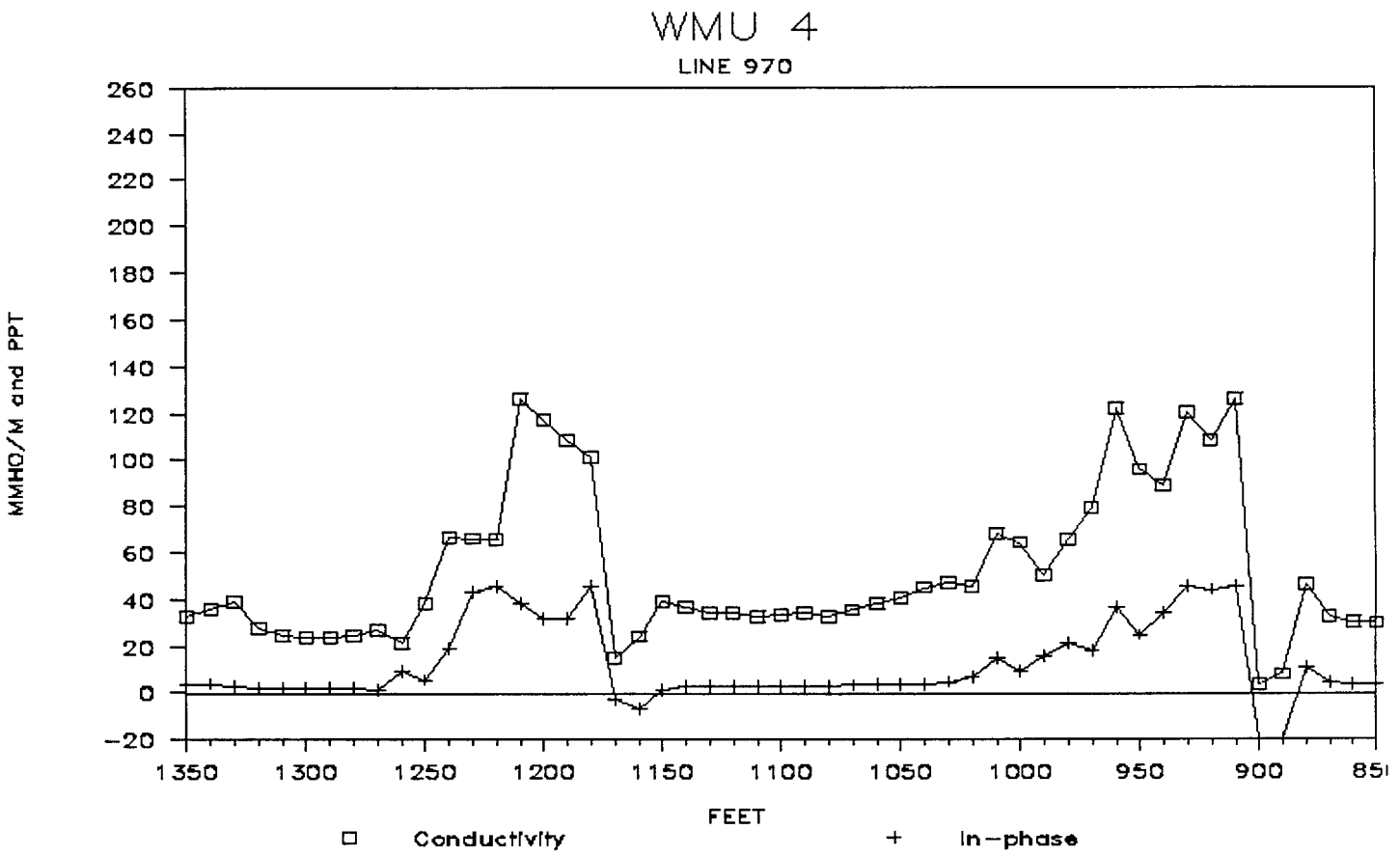
WMU 4 - CONTAMINATED BURIAL YARD GEOPHYSICAL DATA

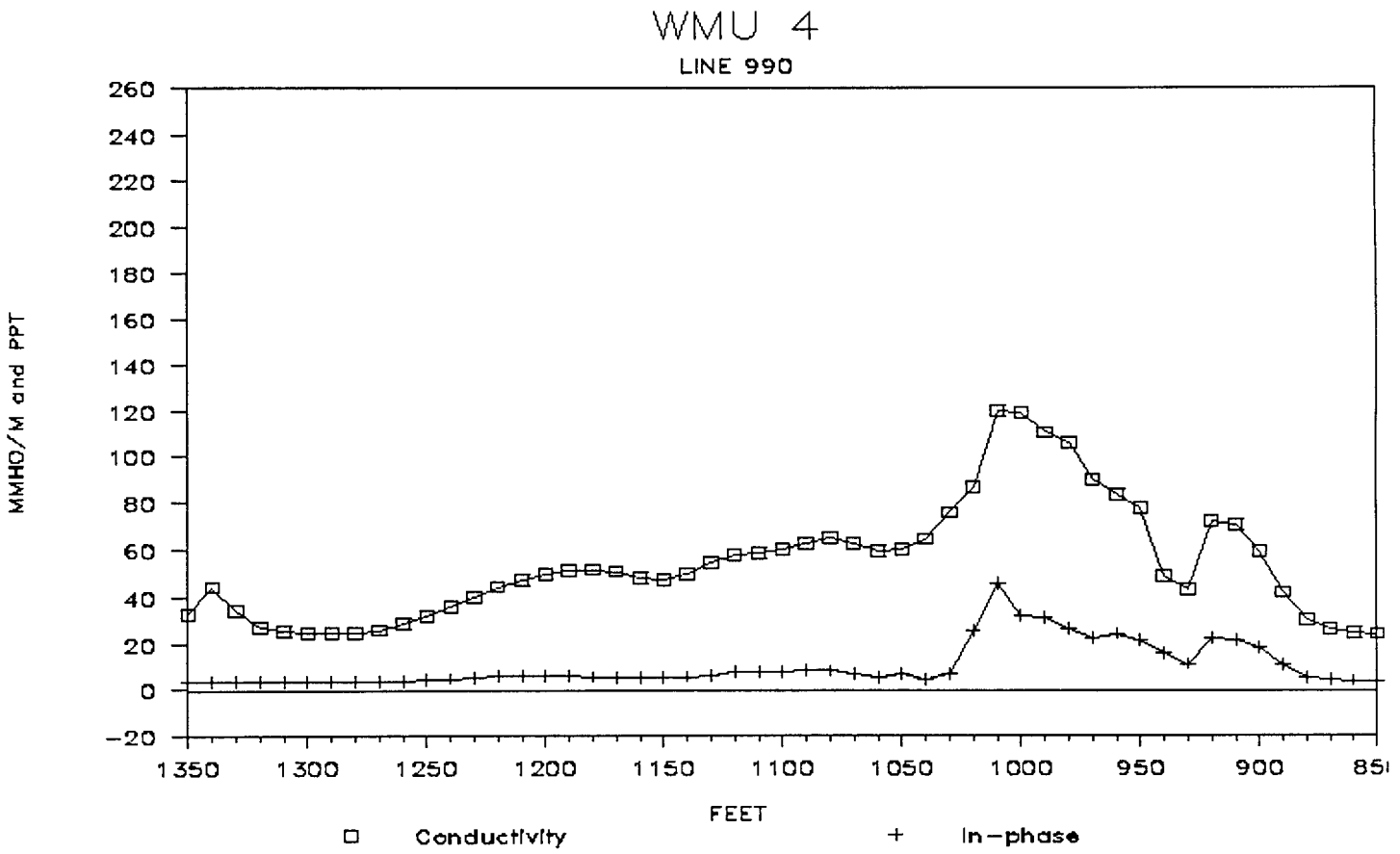

WMU 4
LINE 930
MMHO/M and PPT
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
1350
1300
1250
1200
1150
1100
1050
1000
950
900
FEET
Conductivity
In-phase

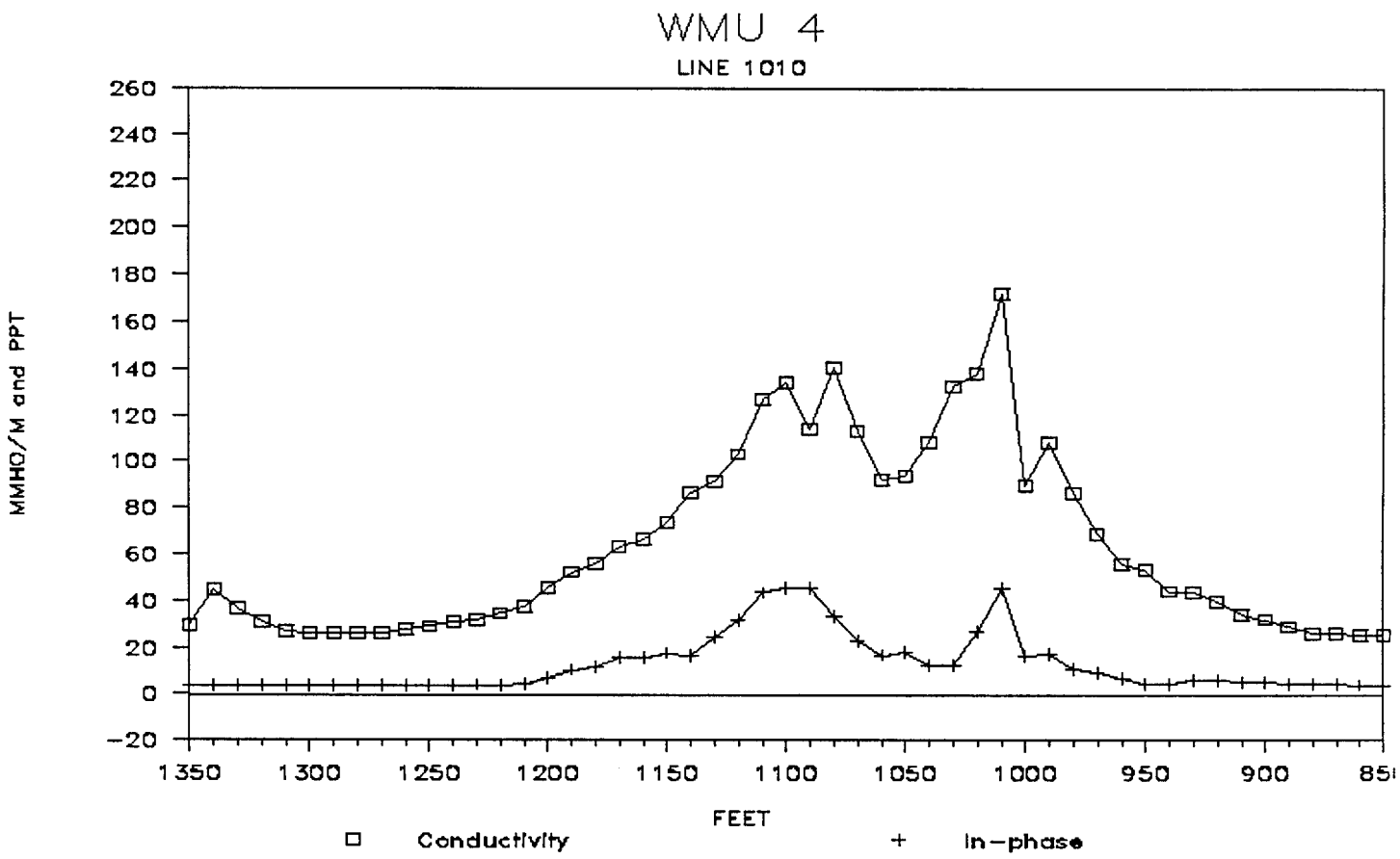

WMU 4
LINE 940
MMHO/M and PPT
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
1350
1300
1250
1200
1150
1100
1050
1000
950
900
FEET
Conductivity
In-phase


WMU 4
LINE 950
MMHO/M and PPT
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
1350
1300
1250
1200
1150
1100
1050
1000
950
900
FEET
Conductivity
In-phase


WMU 4
LINE 960
MMHO/M and PPT
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
1350
1300
1250
1200
1150
1100
1050
1000
950
900
FEET
Conductivity
In-phase


WMU 4
LINE 970
MMHO/M and PPT
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
1350
1300
1250
1200
1150
1100
1050
1000
950
900
FEET
Conductivity
In-phase


WMU 4
LINE 990
MMHO/M and PPT
260
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
1350
1300
1250
1200
1150
1100
1050
1000
950
900
FEET
Conductivity
In-phase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MMHO/M and PPT
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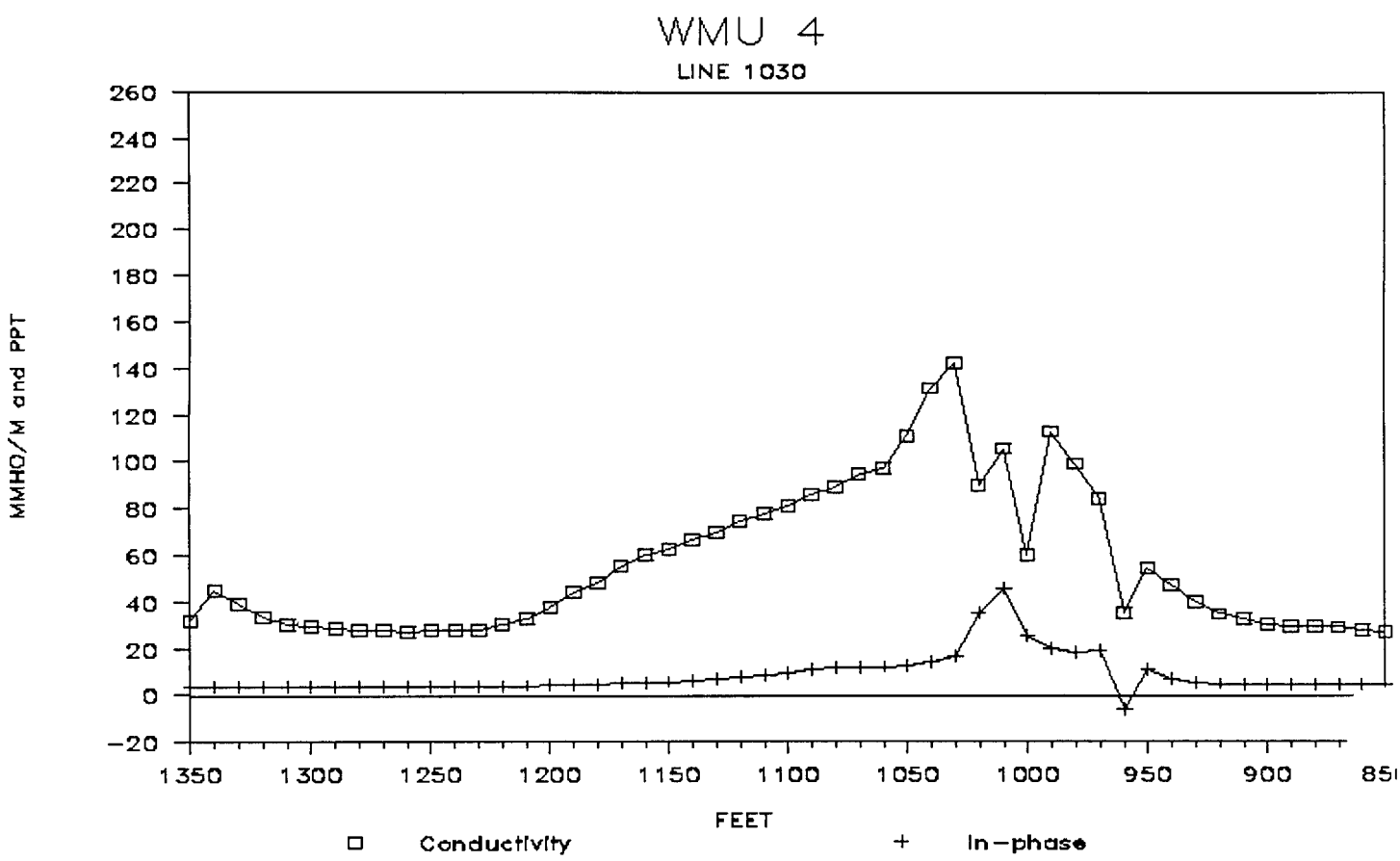
FEET
Conductivity
In-phase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LINE 1030
MMHO/M and PPT
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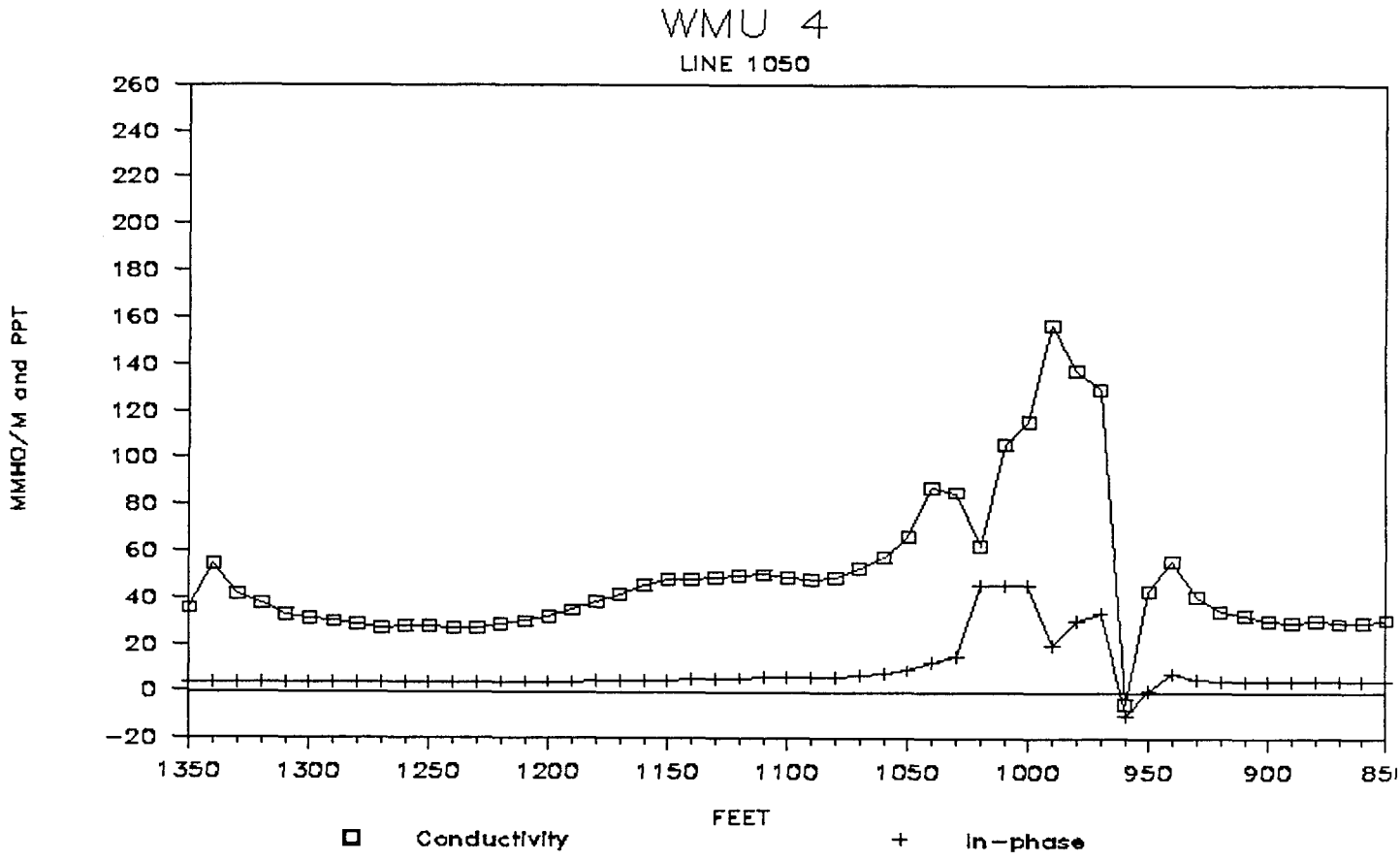
Conductivity
In-phase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LINE 1050
MMHO/M and PPT
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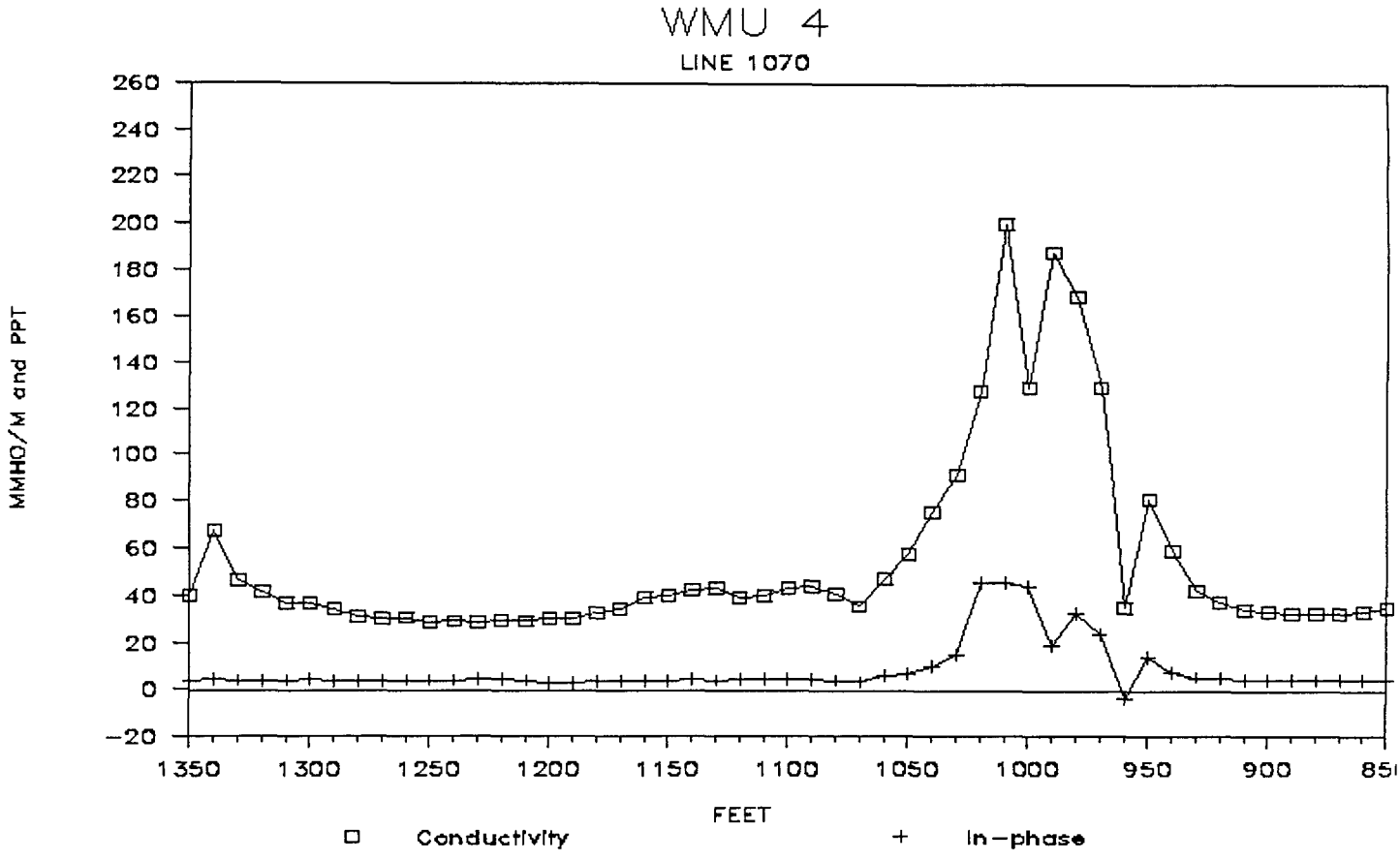
FEET
Conductivity
In-phase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LINE 1070
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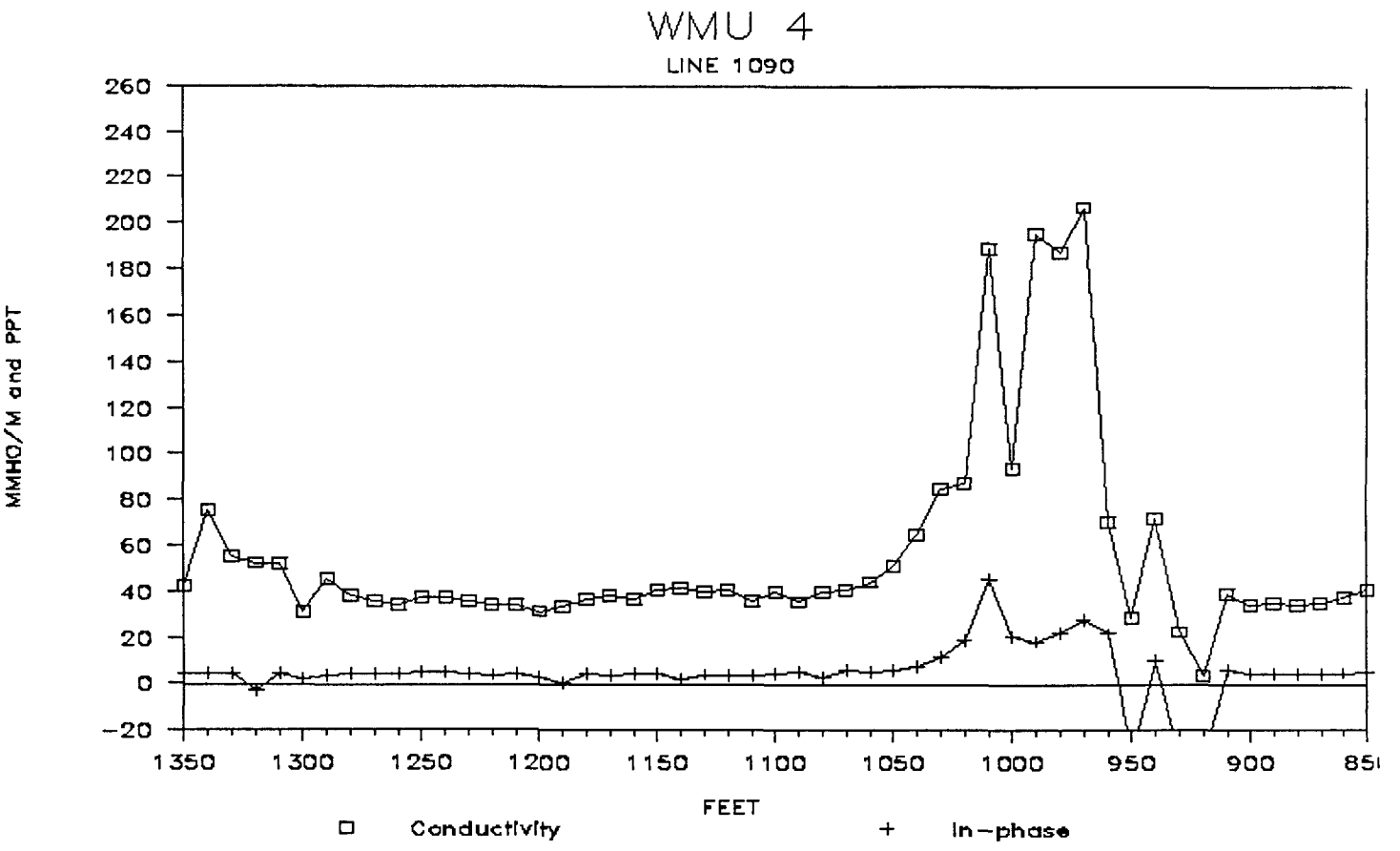
FEET
Conductivity
In-phase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LINE 1090
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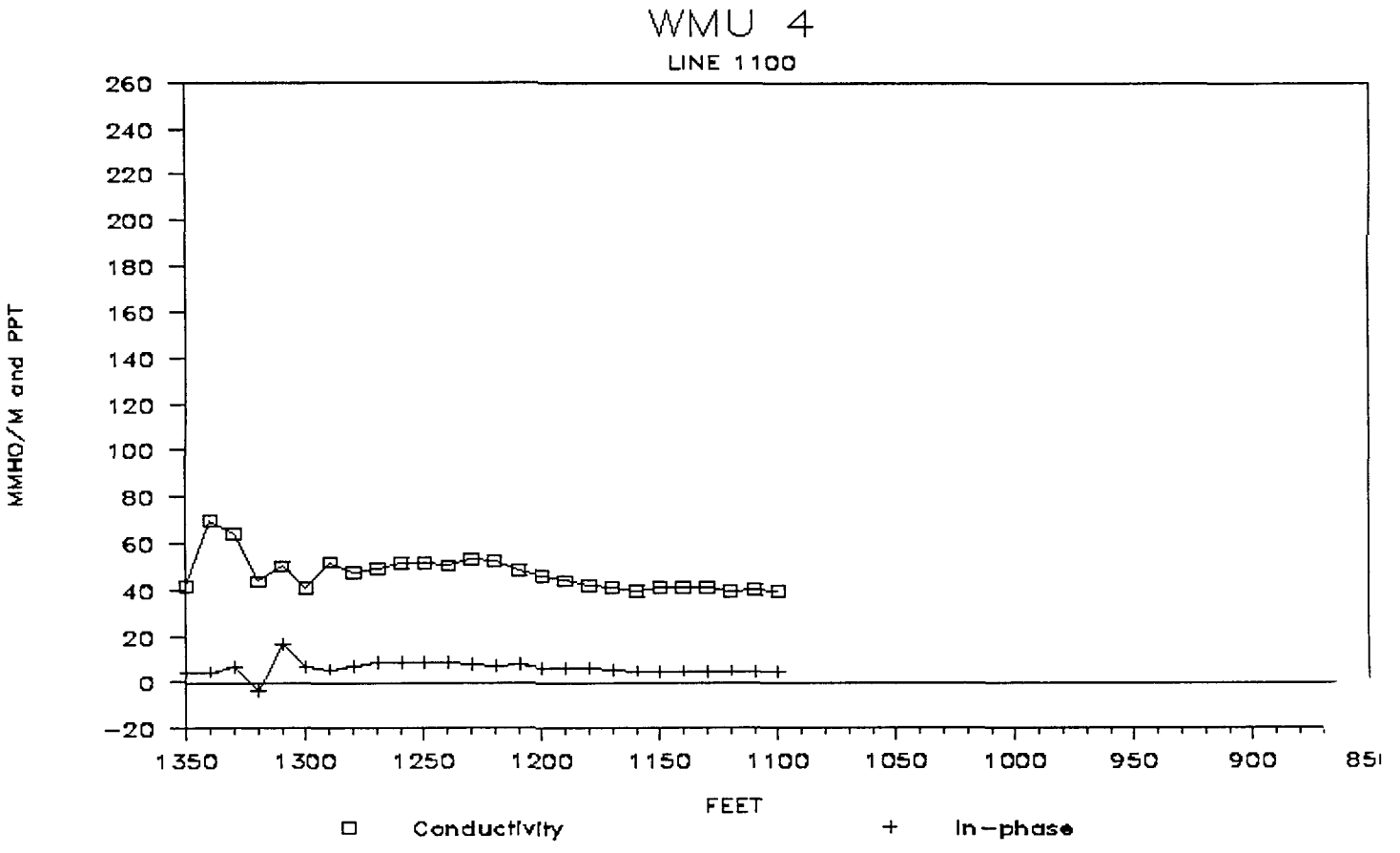
FEET
Conductivity
In-phase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LINE 1100
MMHO/M and PPT
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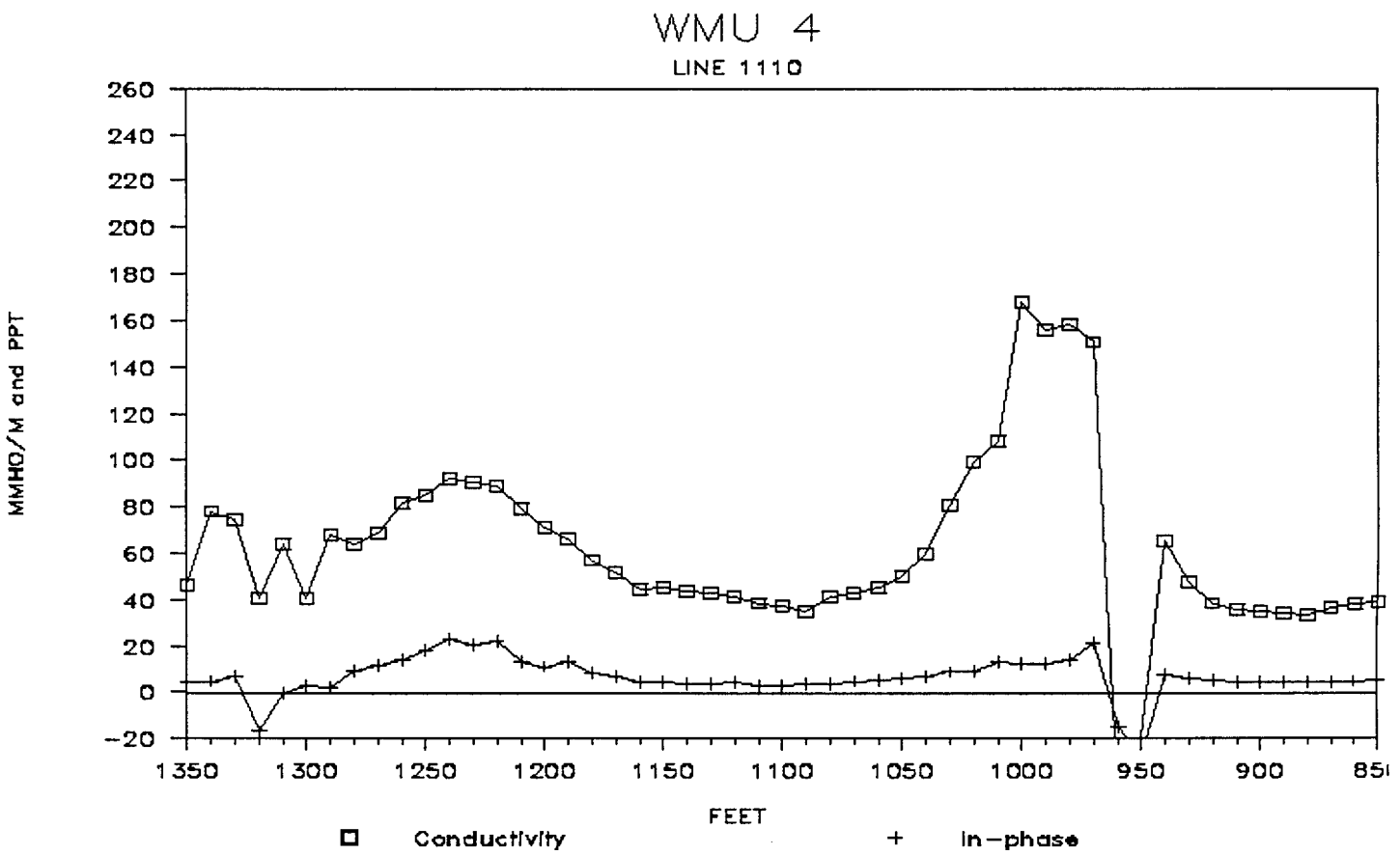
Conductivity
In-phase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LINE 1110
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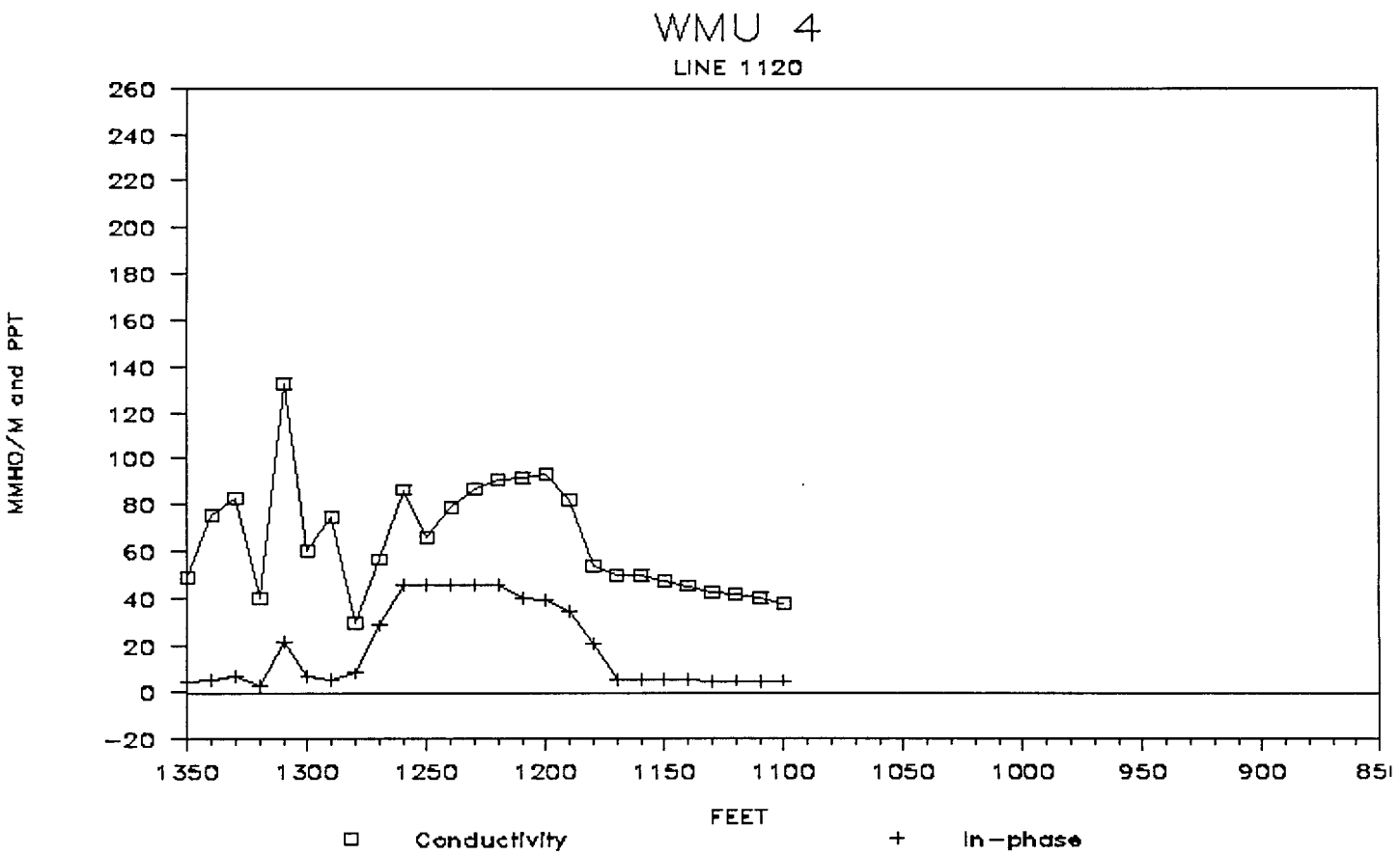
FEET
Conductivity
In-phase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LINE 1120
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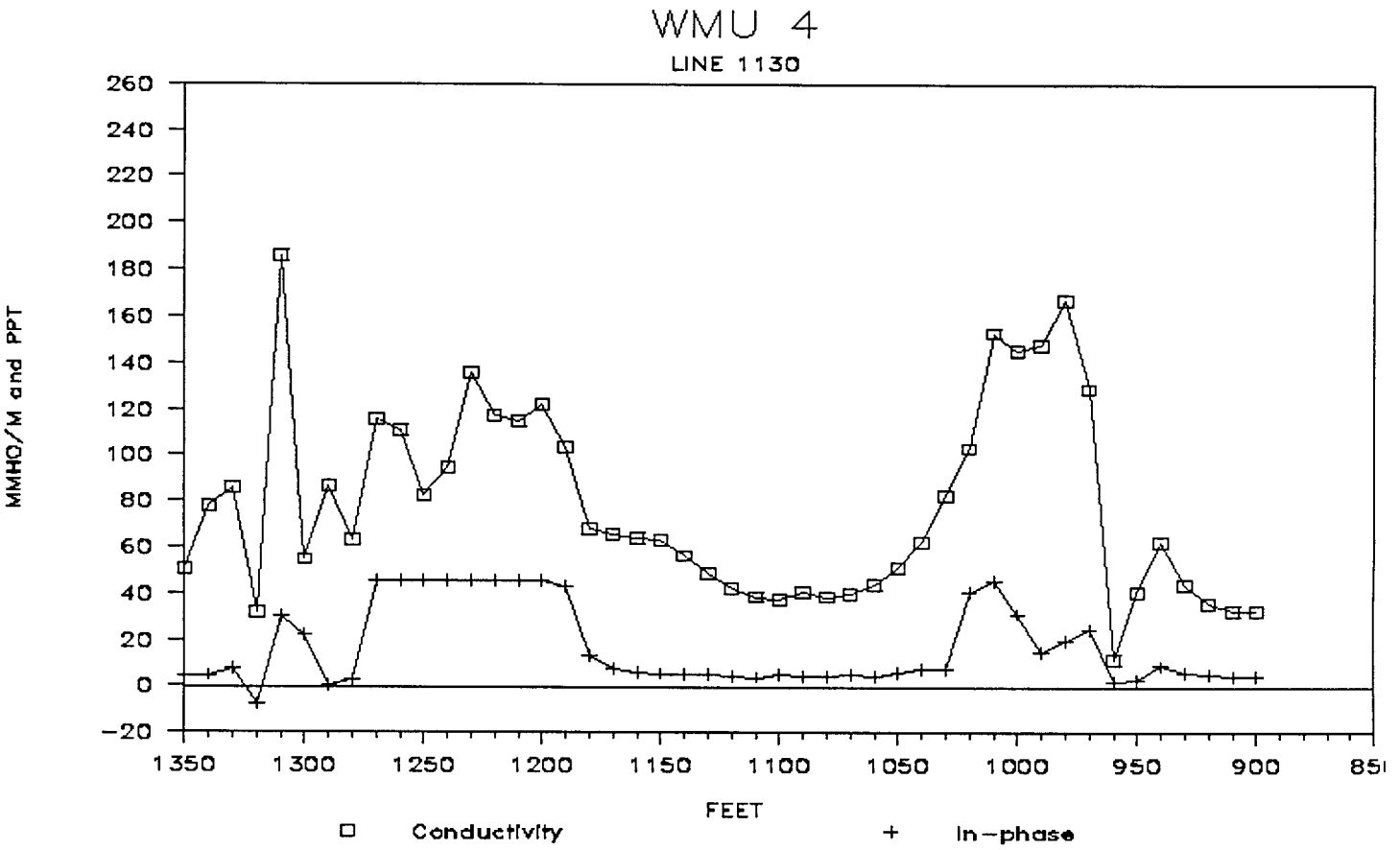
FEET
Conductivity
In-phase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LINE 1130
MMHO/M and PPT
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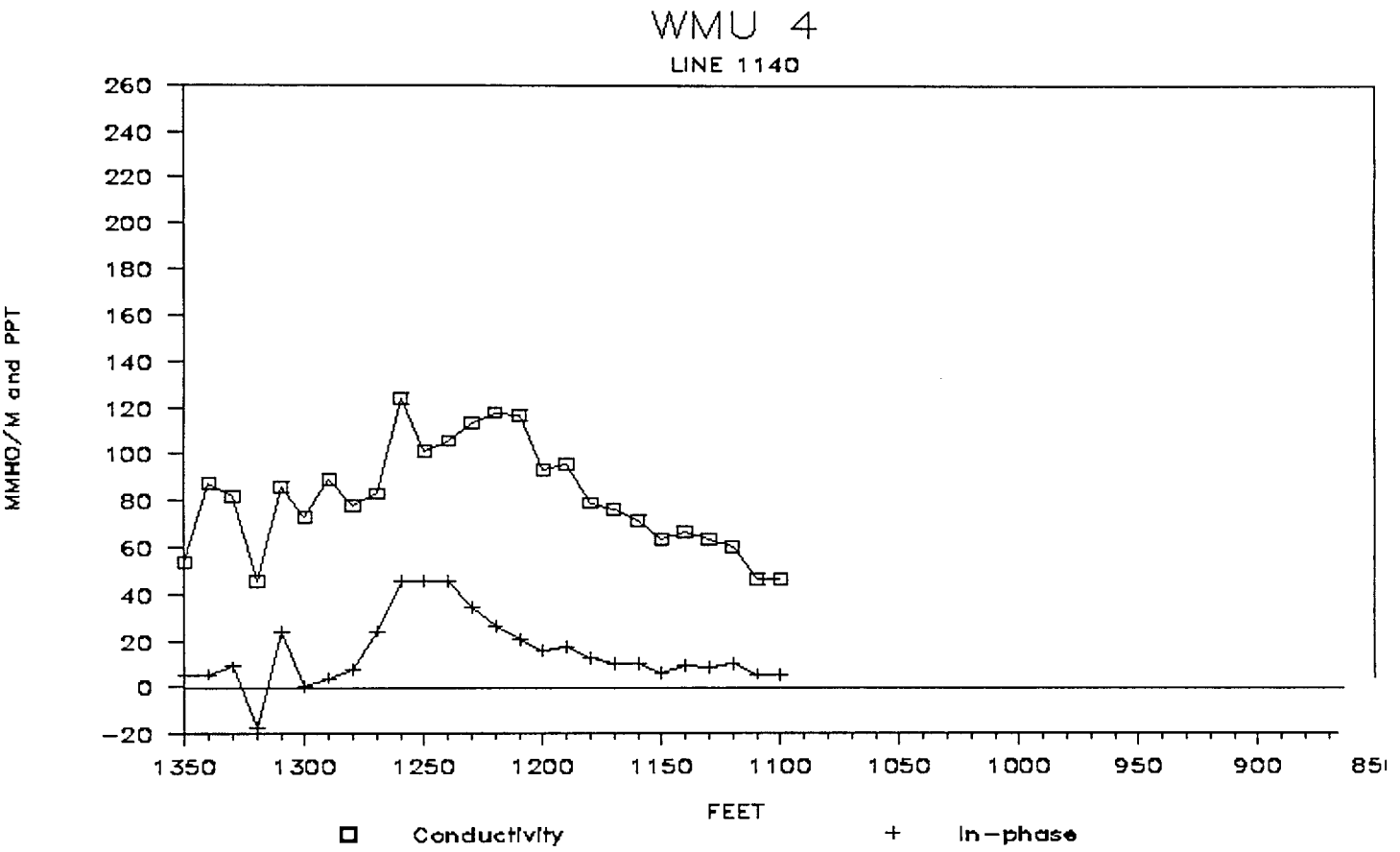
FEET
Conductivity
In-phase


WMU 4
LINE 1140
MMHO/M and PPT
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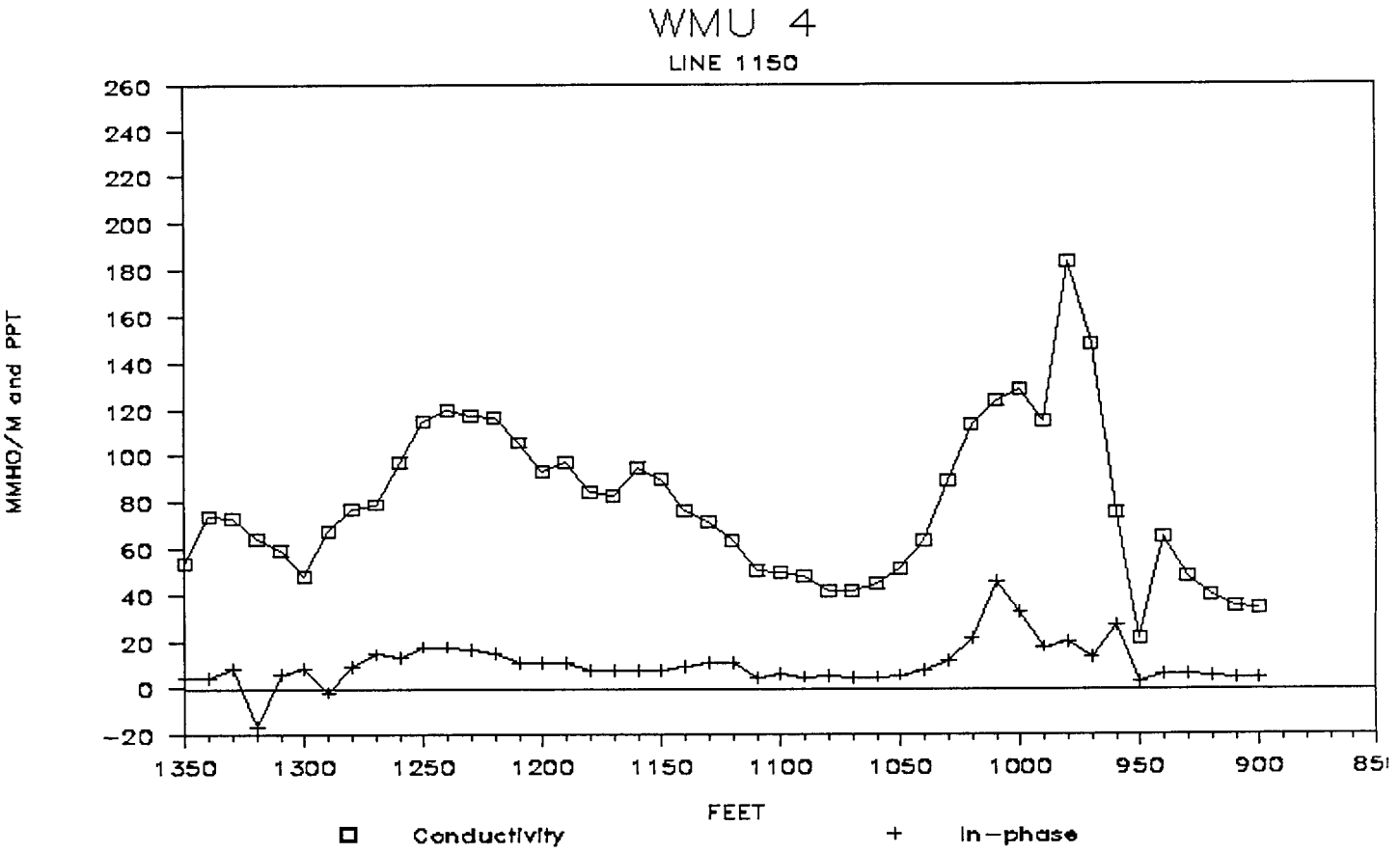
FEET
Conductivity
In-phase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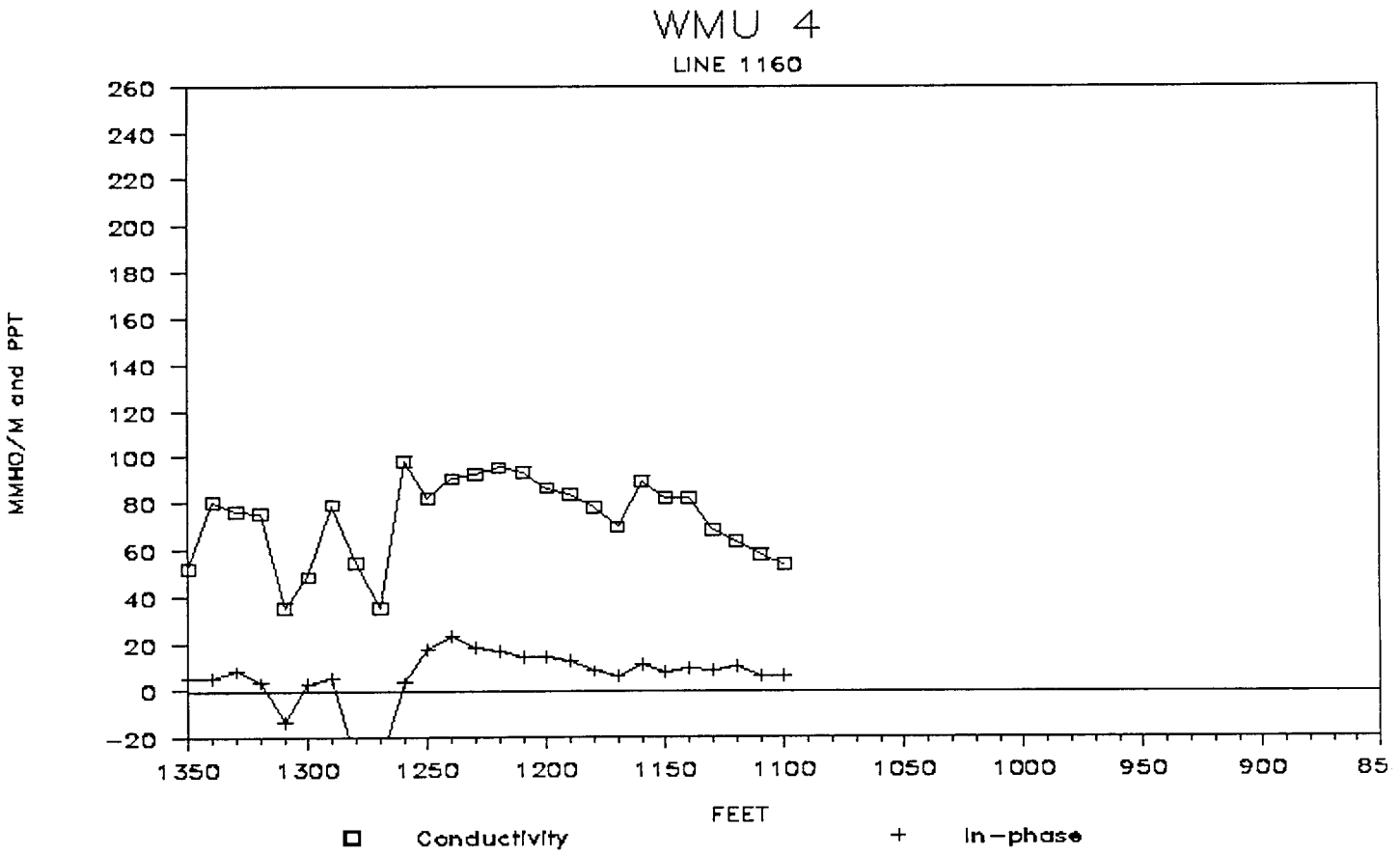
FEET
Conductivity
In-phase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LINE 1160
MMHO/M and PPT
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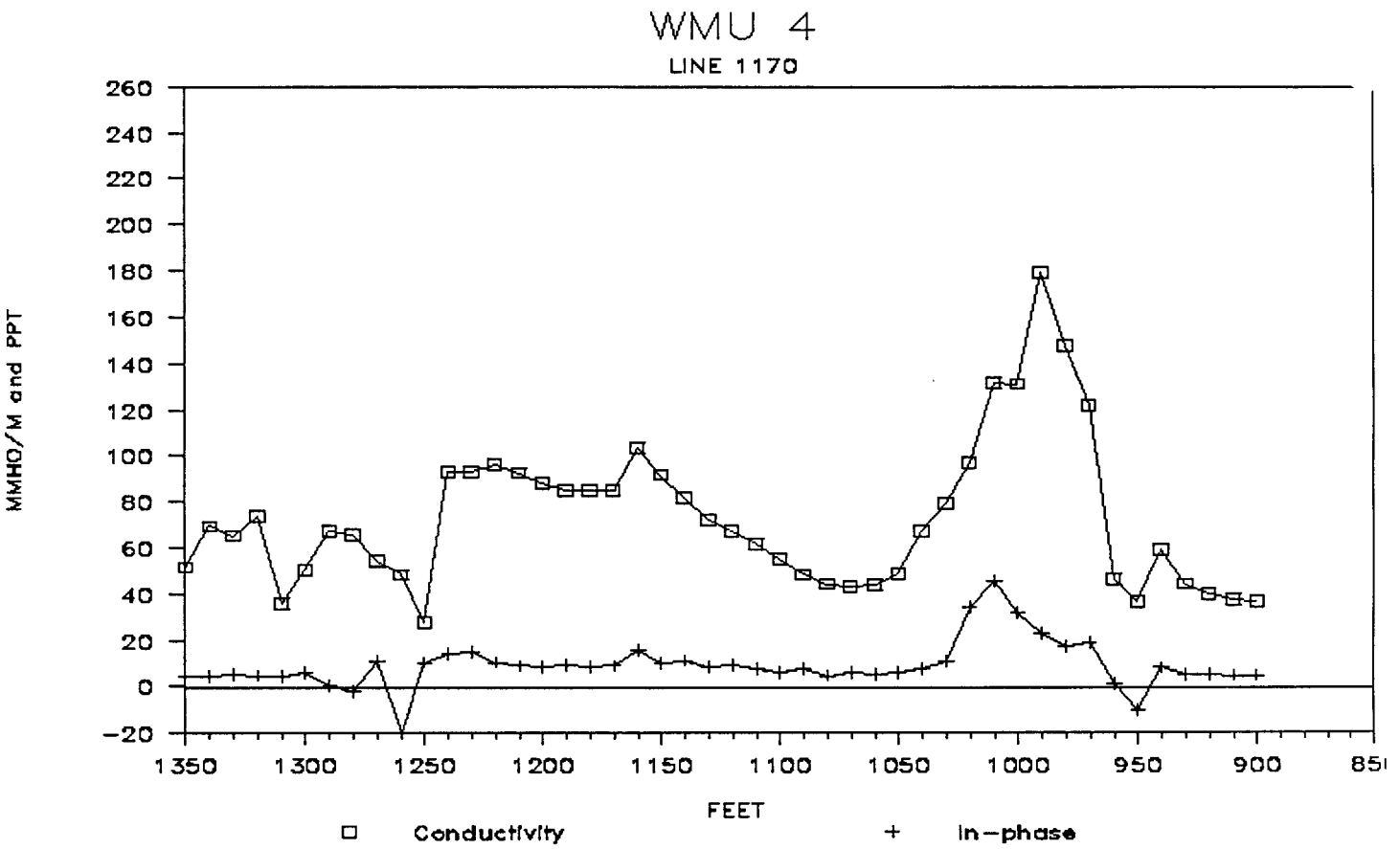
FEET
Conductivity
In-phase


WMU 4
LINE 1170
MMHO/M and PPT
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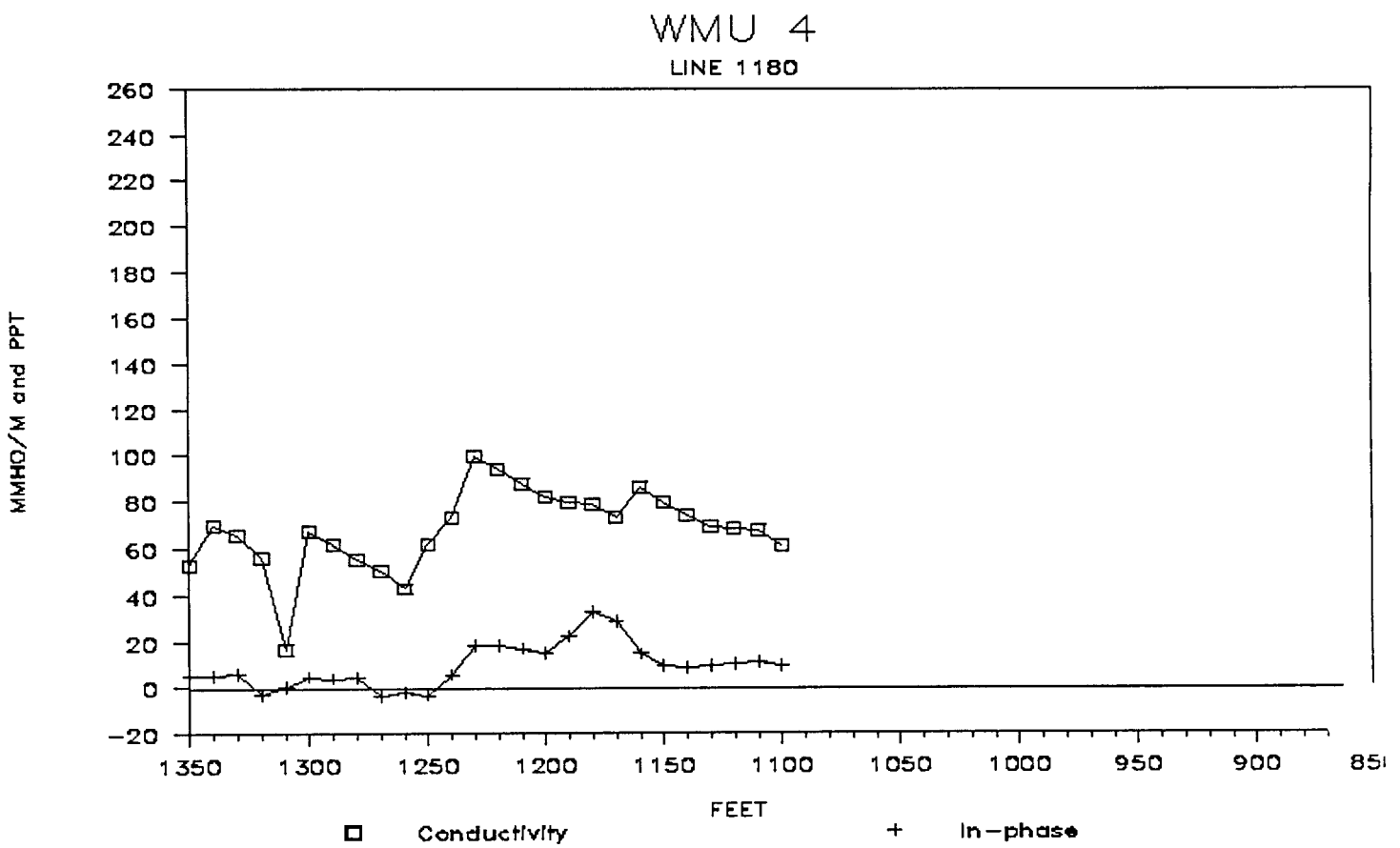
FEET
Conductivity
In-phase


WMU 4
LINE 1180
MMHO/M and PPT
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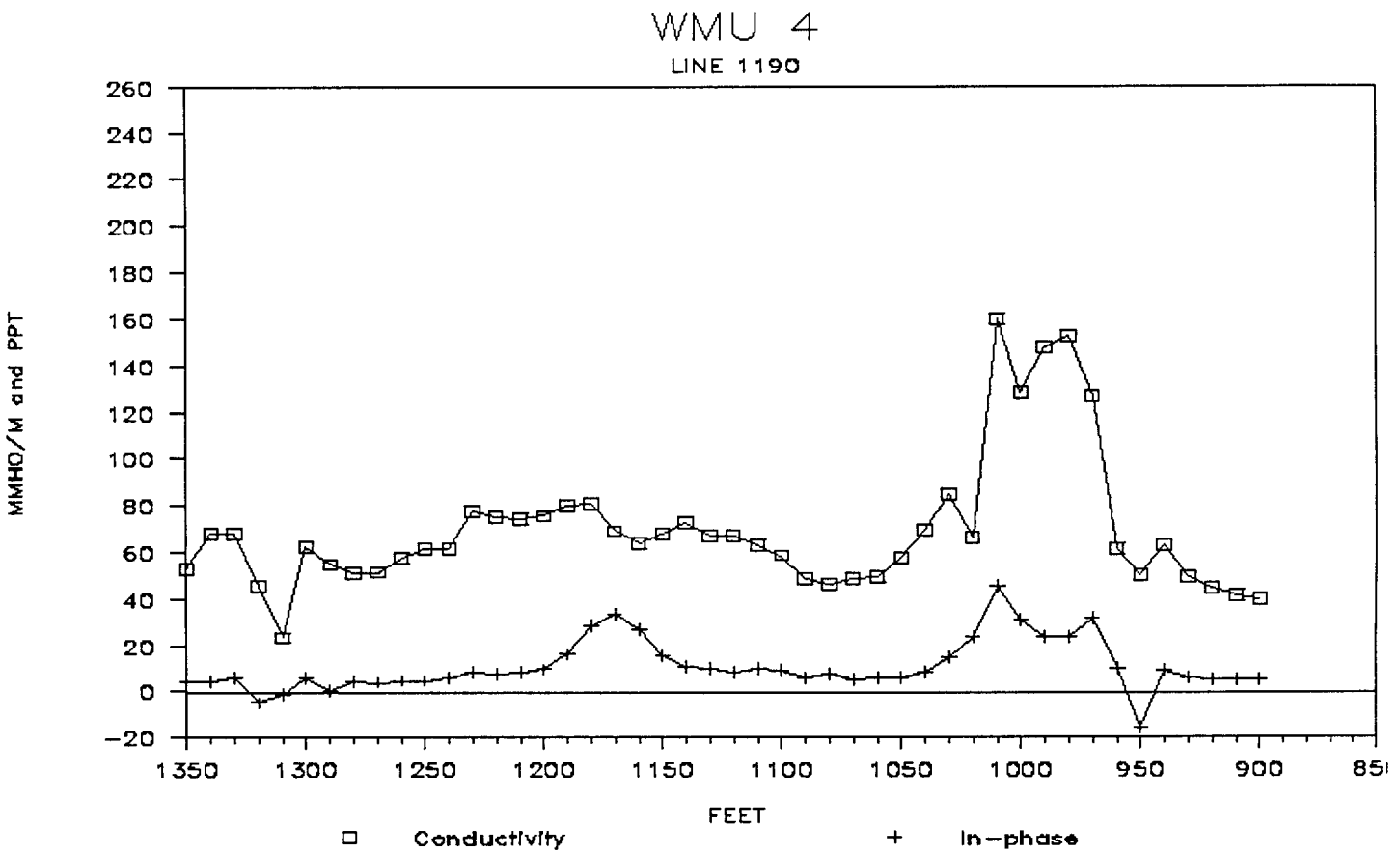
FEET
Conductivity
In-phase


WMU 4
LINE 1190
MMHO/M and PPT
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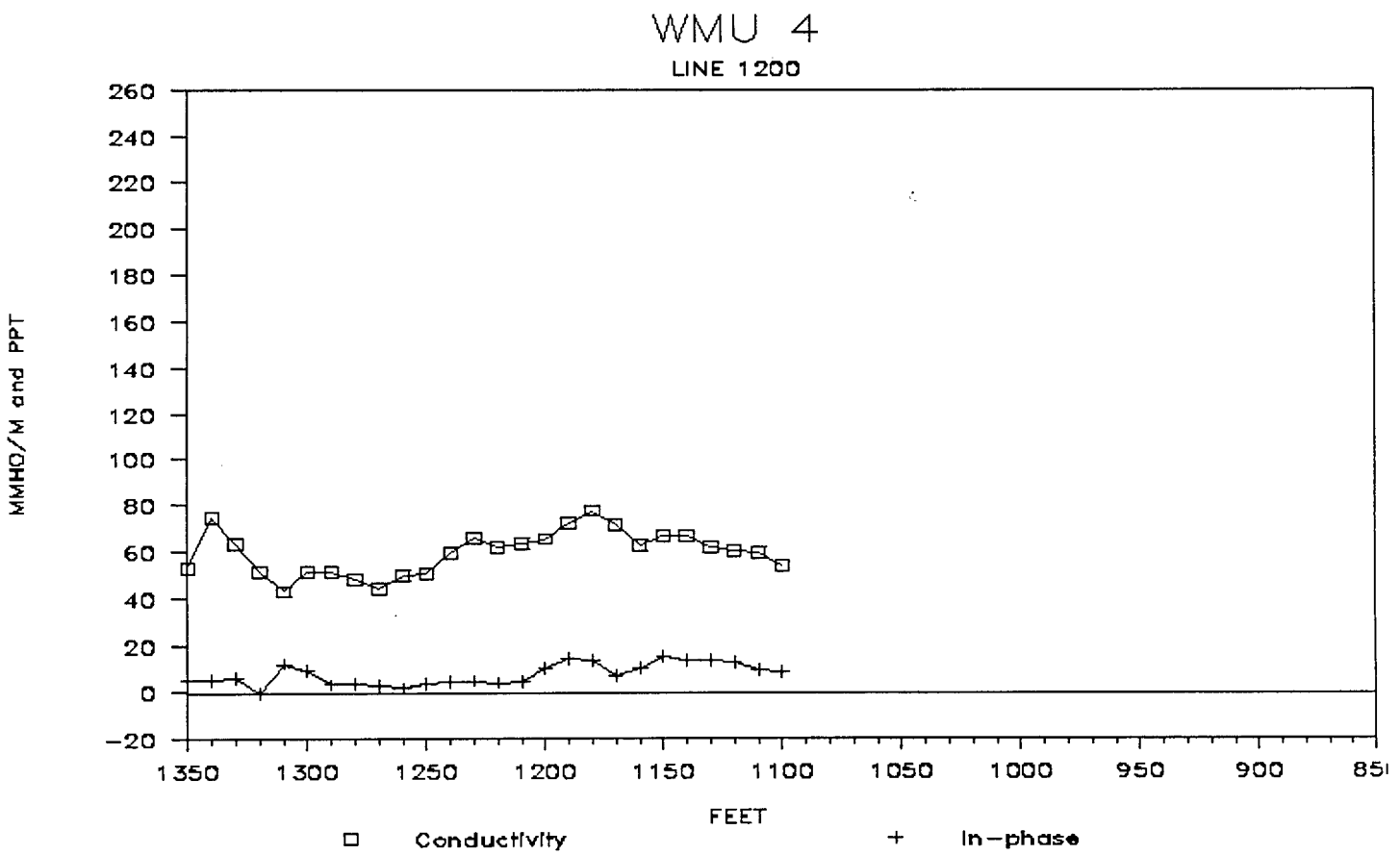
FEET
Conductivity
In-phase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LINE 1200
MMHO/M and PPT
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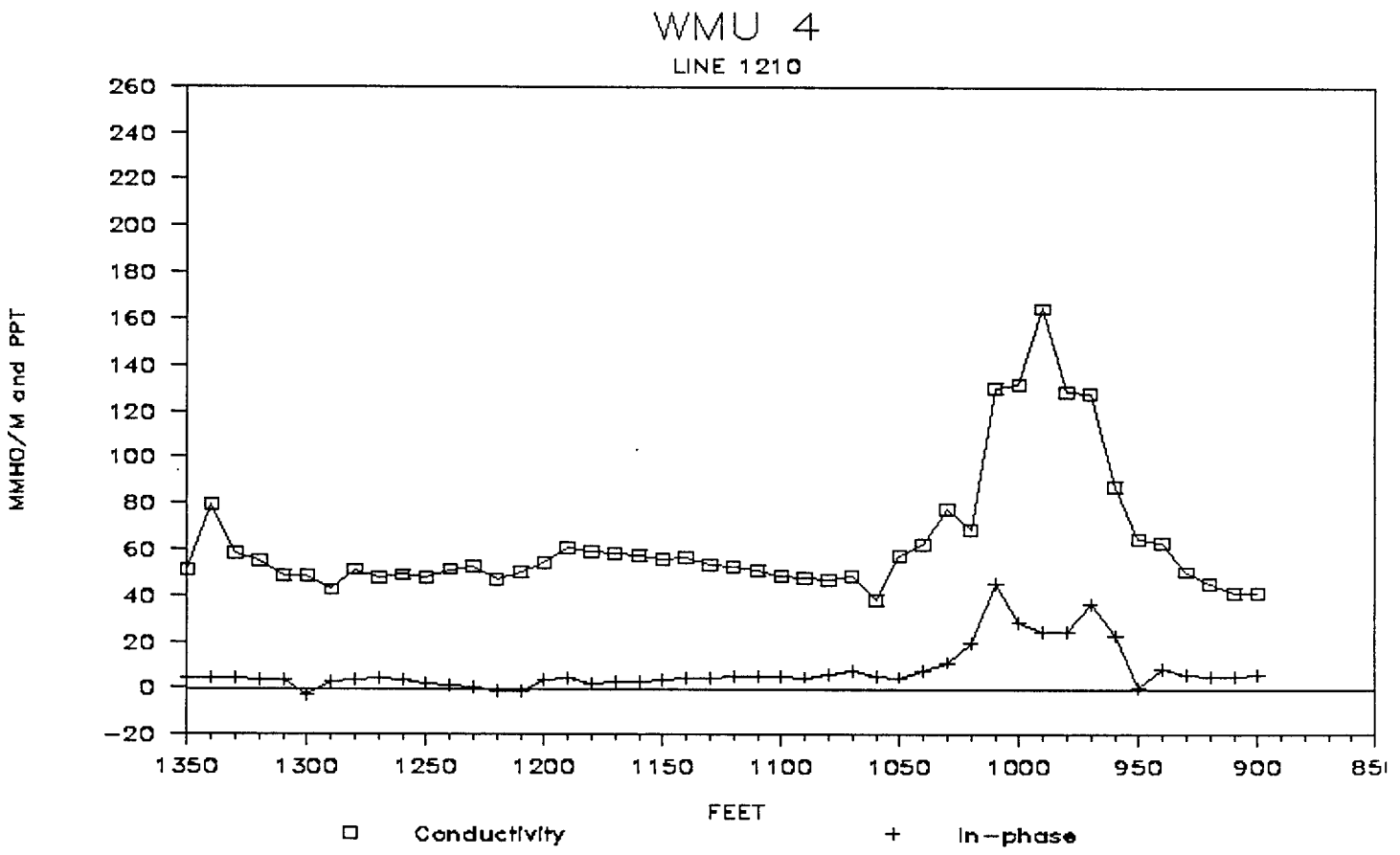
FEET
Conductivity
In-phase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LINE 1210
MMHO/M and PPT
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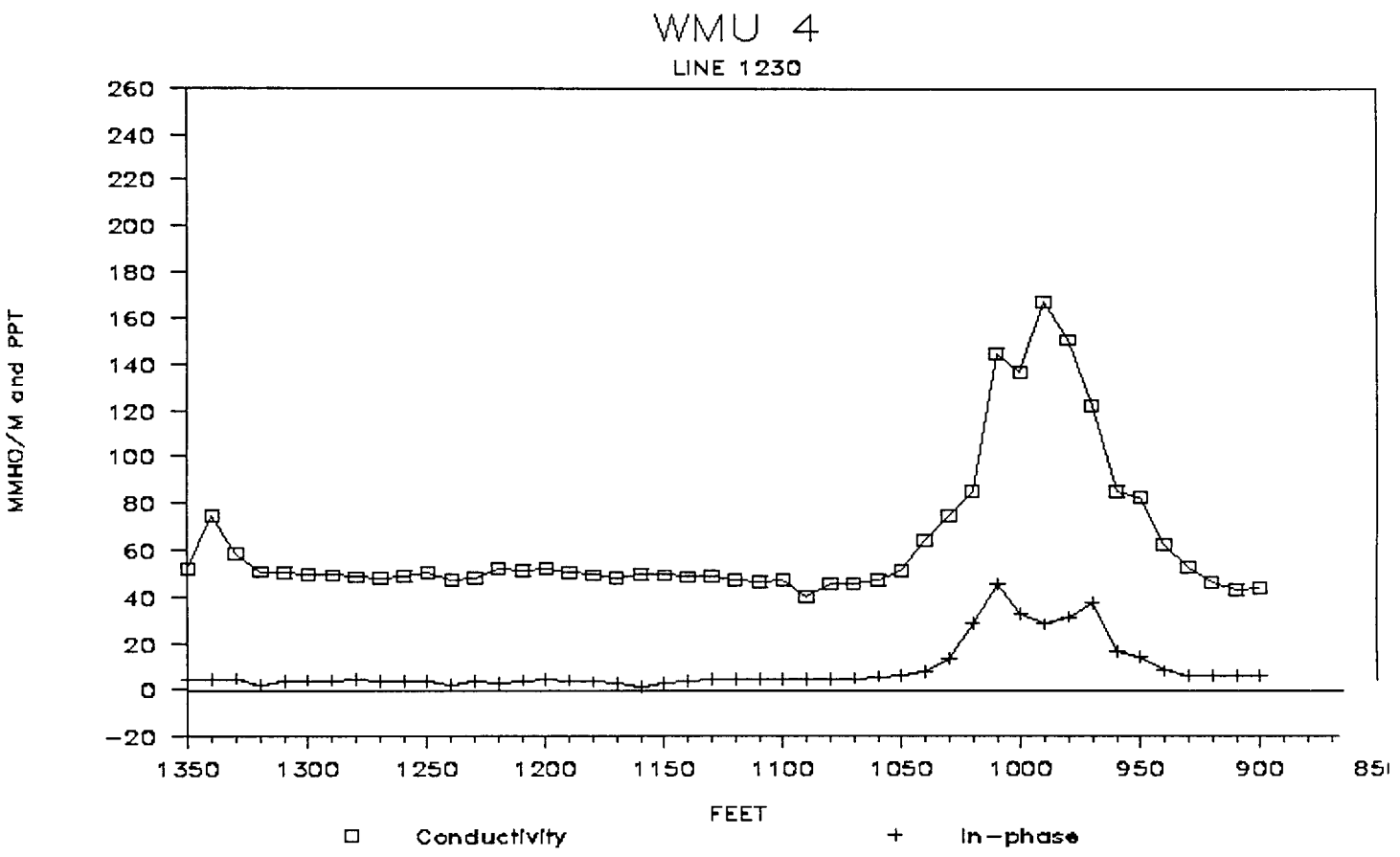
Conductivity
In-phase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LINE 1230
MMHO/M and PPT
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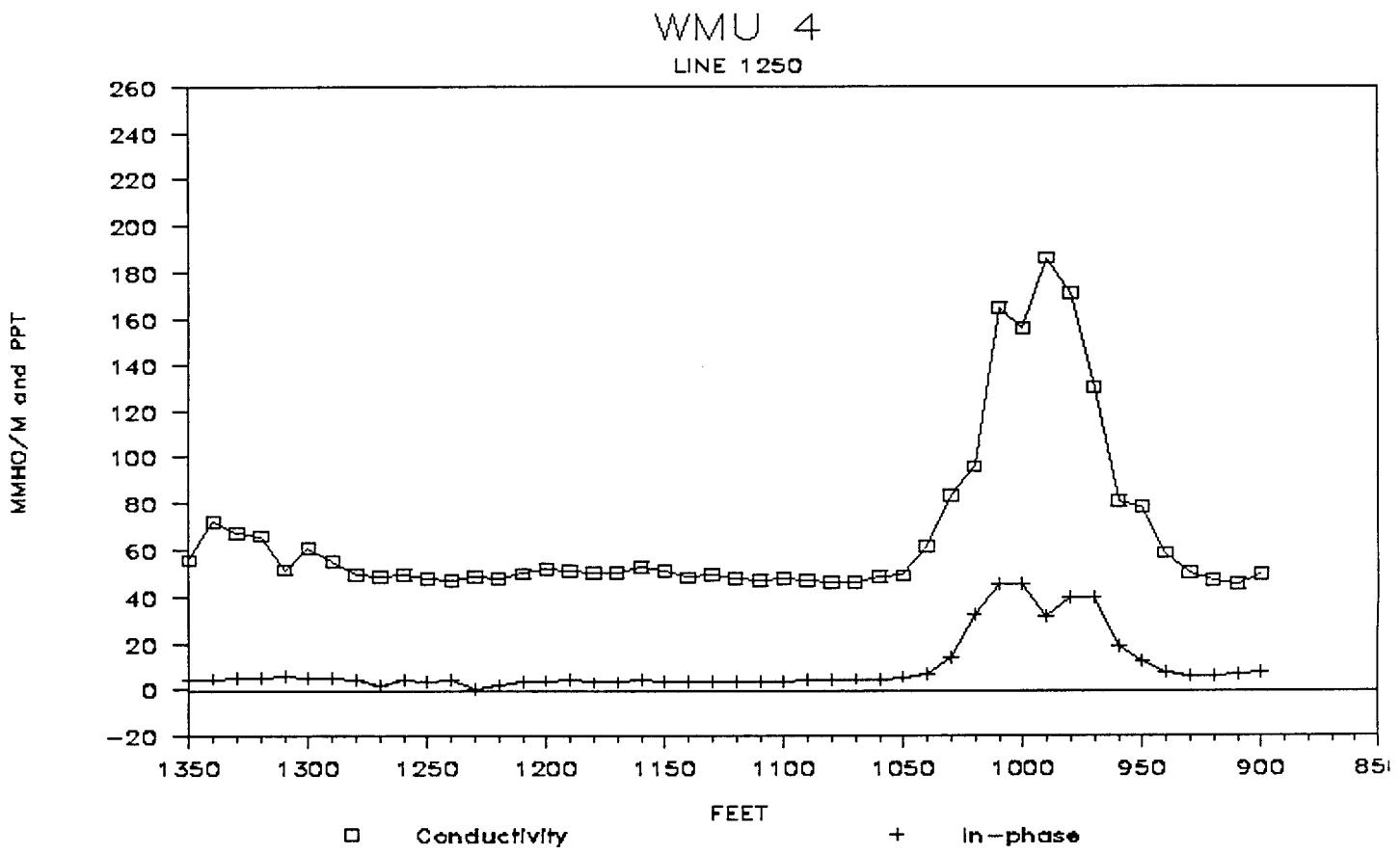
FEET
Conductivity
In-phase


WMU 4
LINE 1250
MMHO/M and PPT
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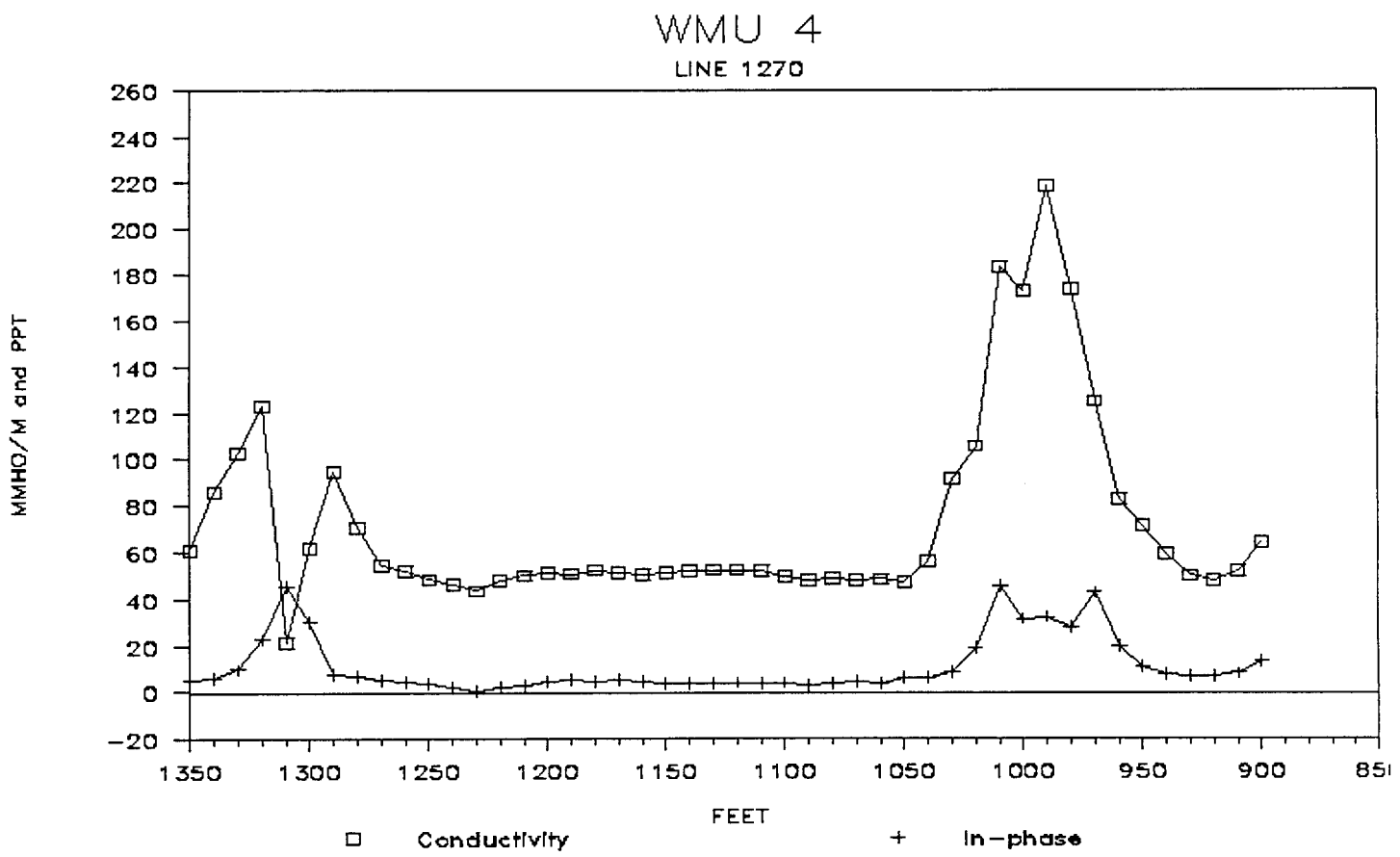
FEET
Conductivity
In-phase


WMU 4
LINE 1270
MMHO/M and PPT
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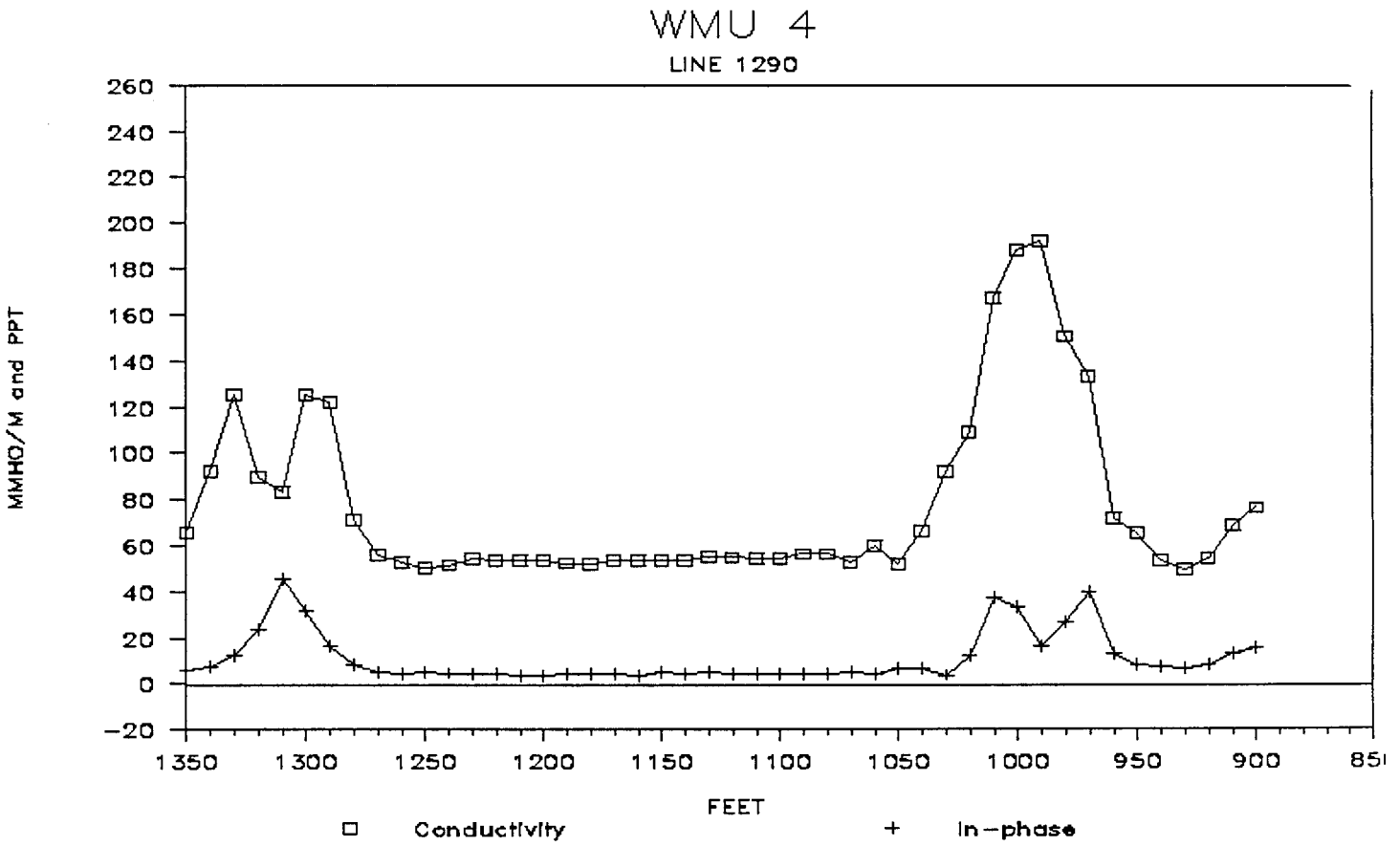
FEET
Conductivity
In-phase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LINE 1290
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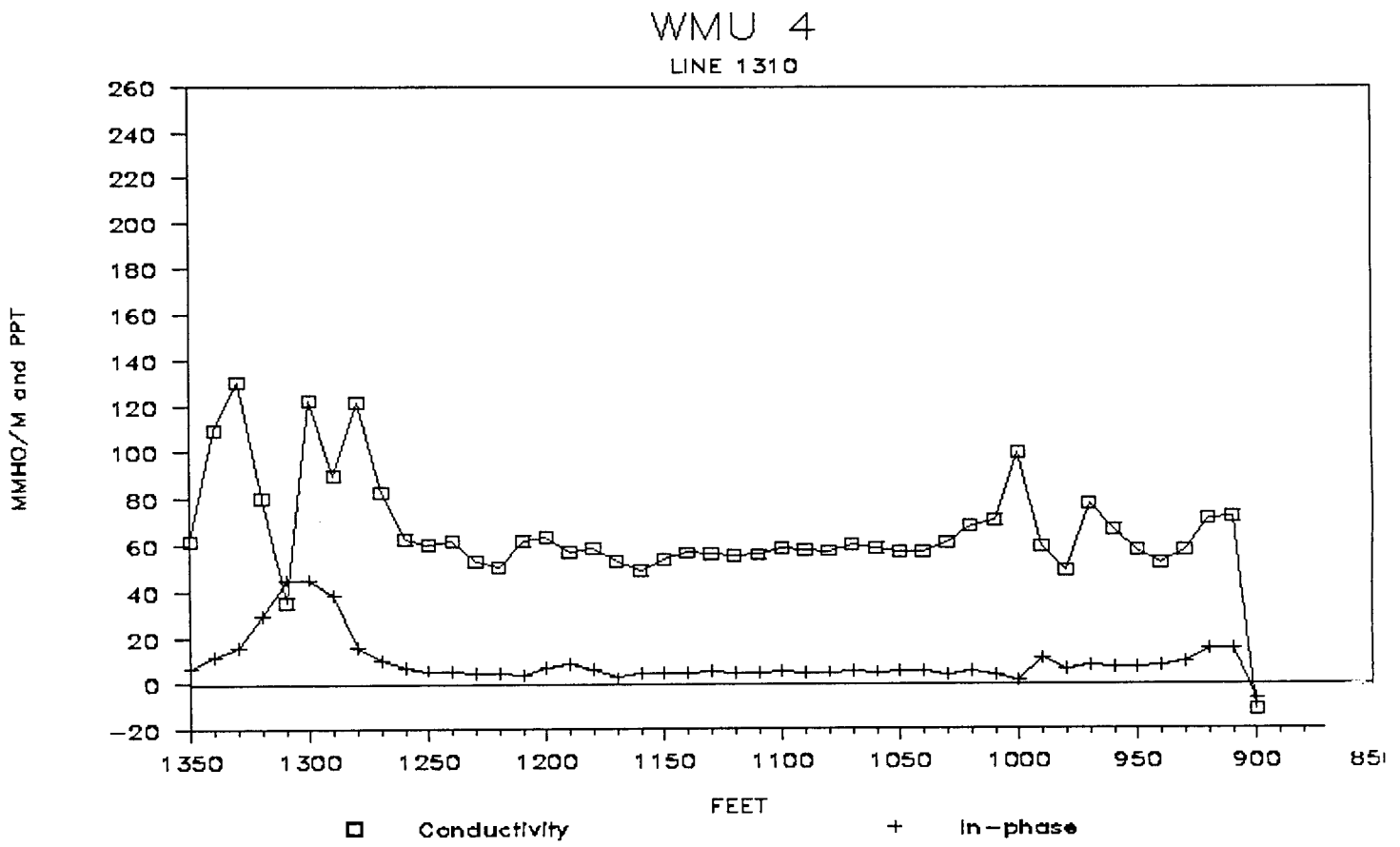
FEET
Conductivity
In-phase


WMU 4
LINE 1310
MMHO/M and PPT
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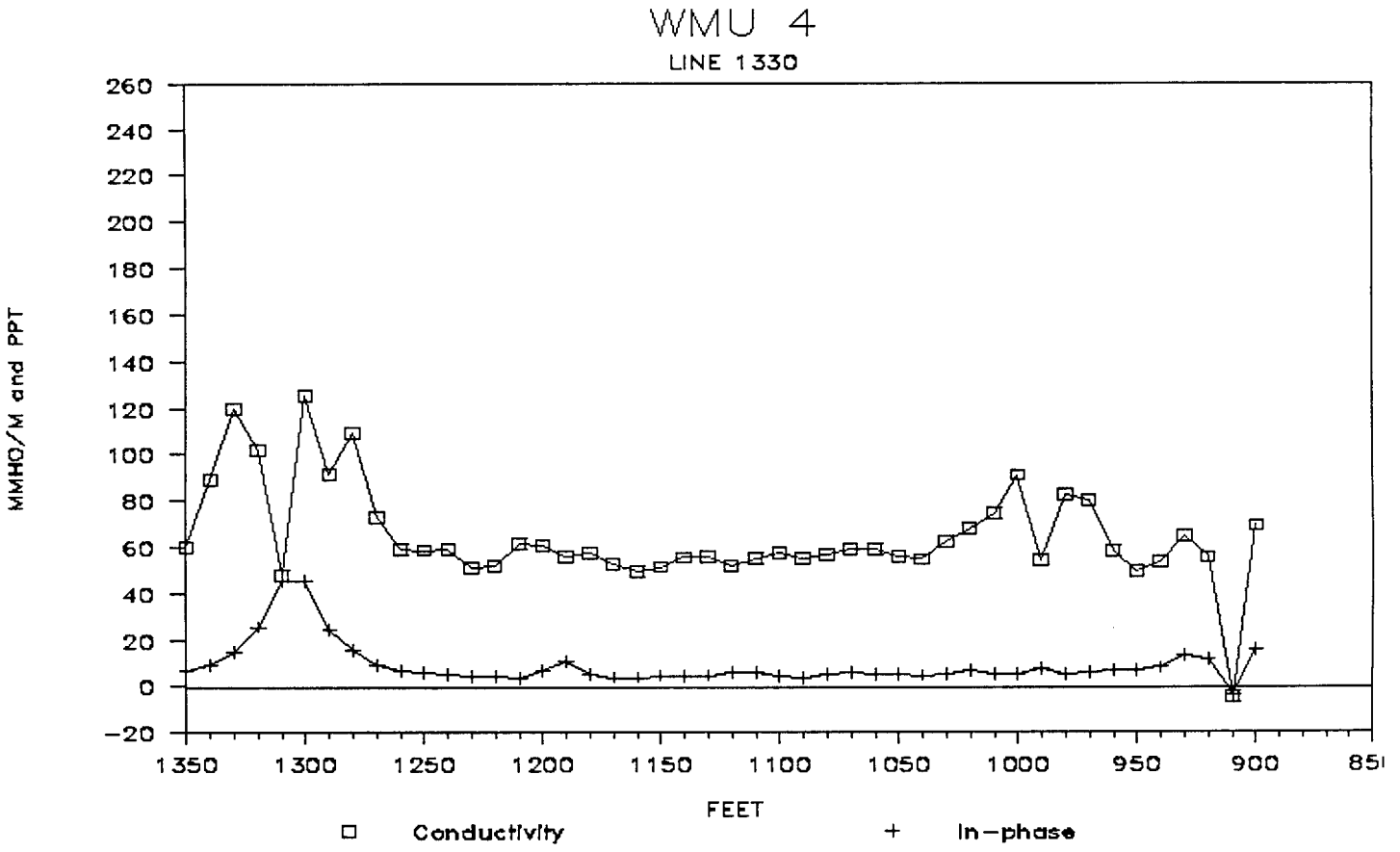
Conductivity
In-phase


WMU 4
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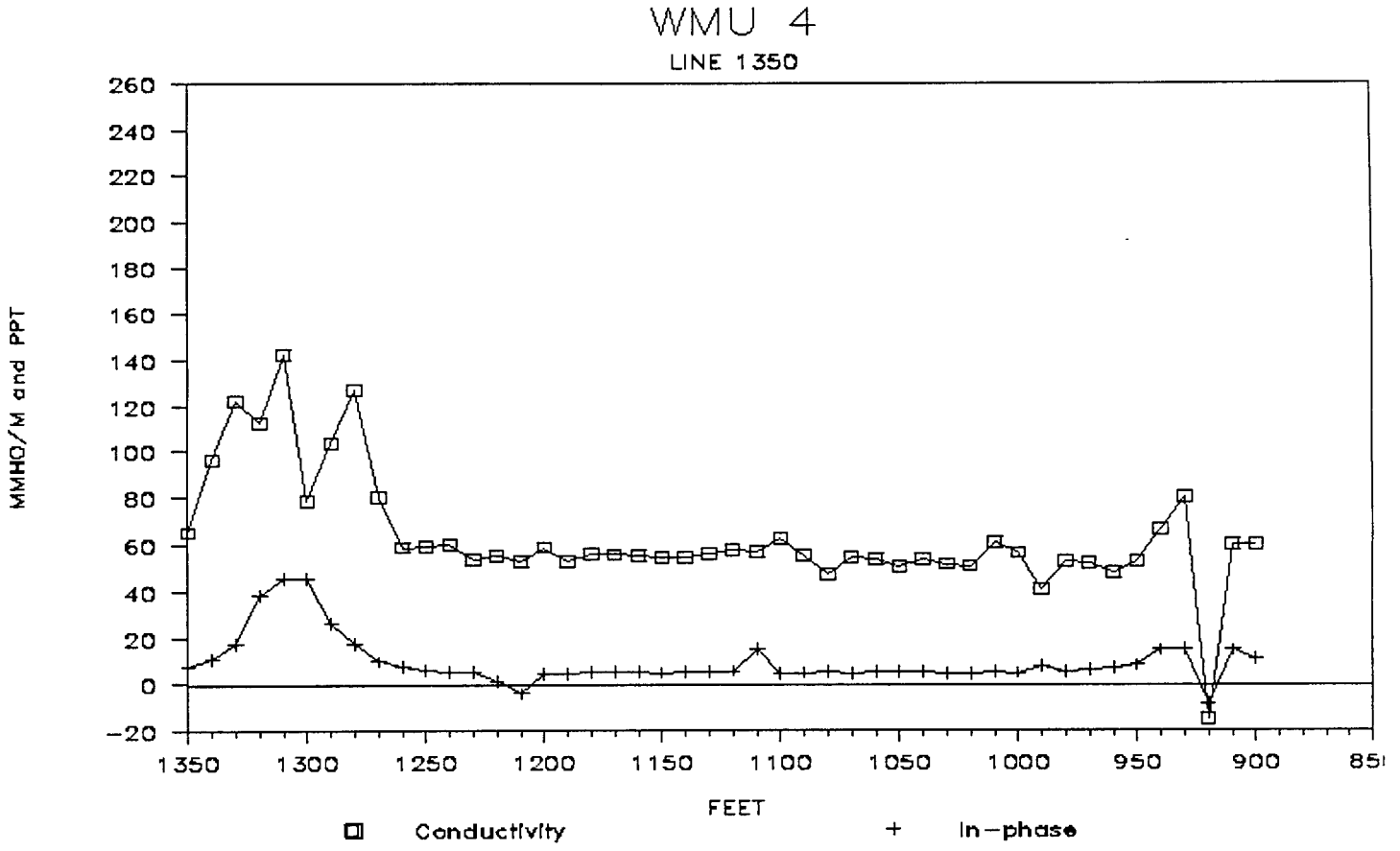
Conductivity
In-phase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LINE 1350
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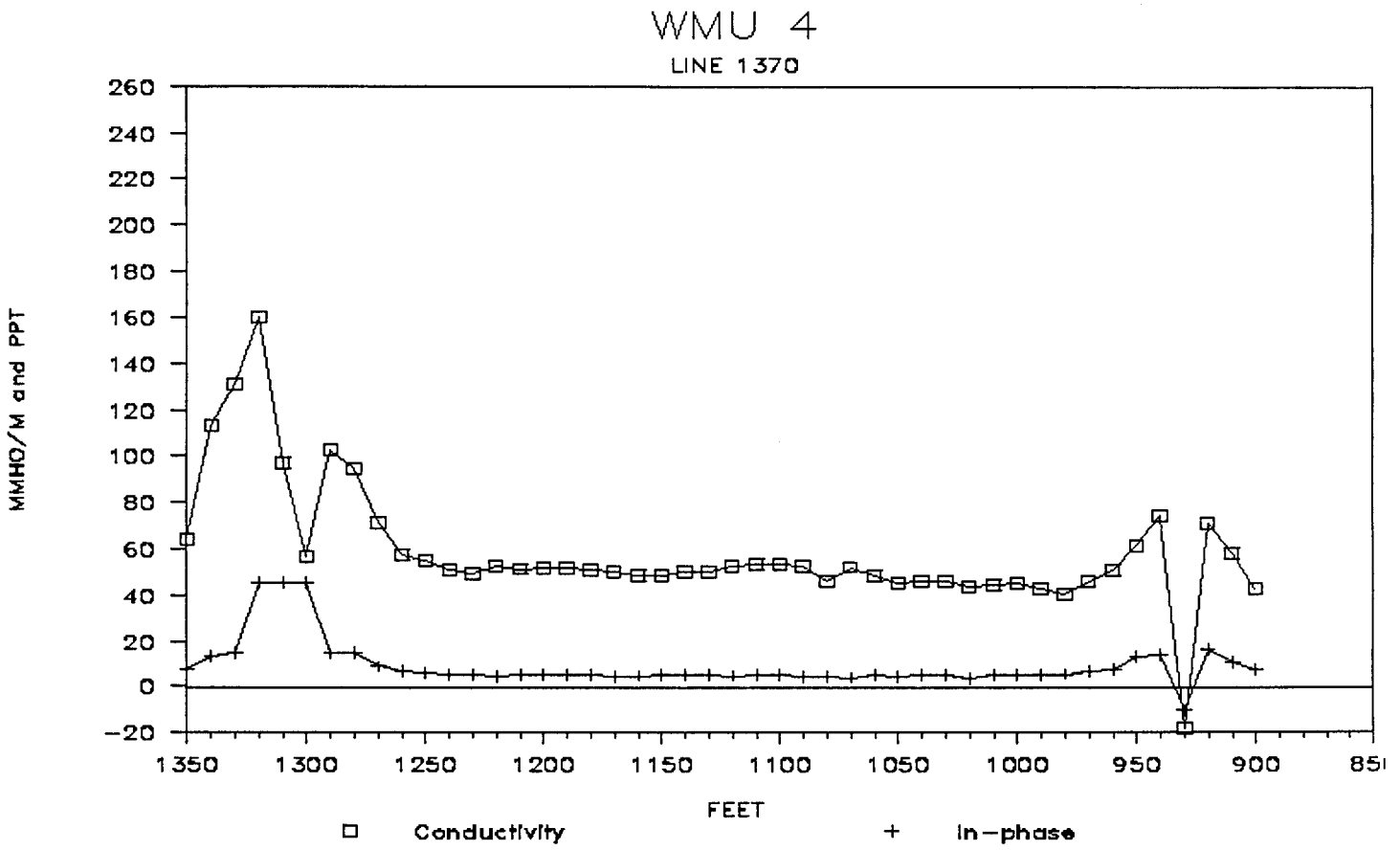
FEET
Conductivity
In-phase


WMU 4
LINE 1370
MMHO/M and PPT
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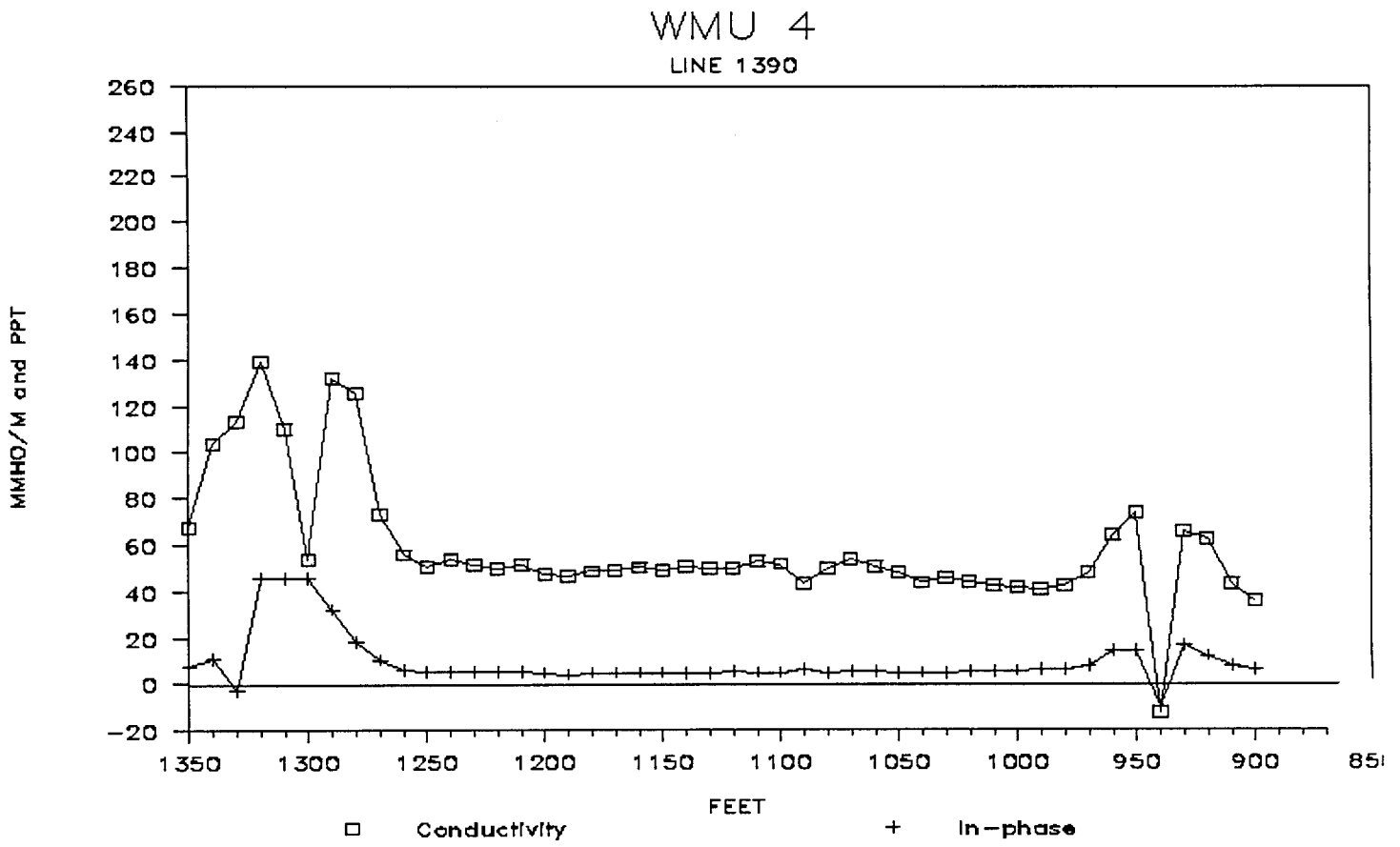
Conductivity
In-phase


WMU 4
LINE 1390
MMHO/M and PPT
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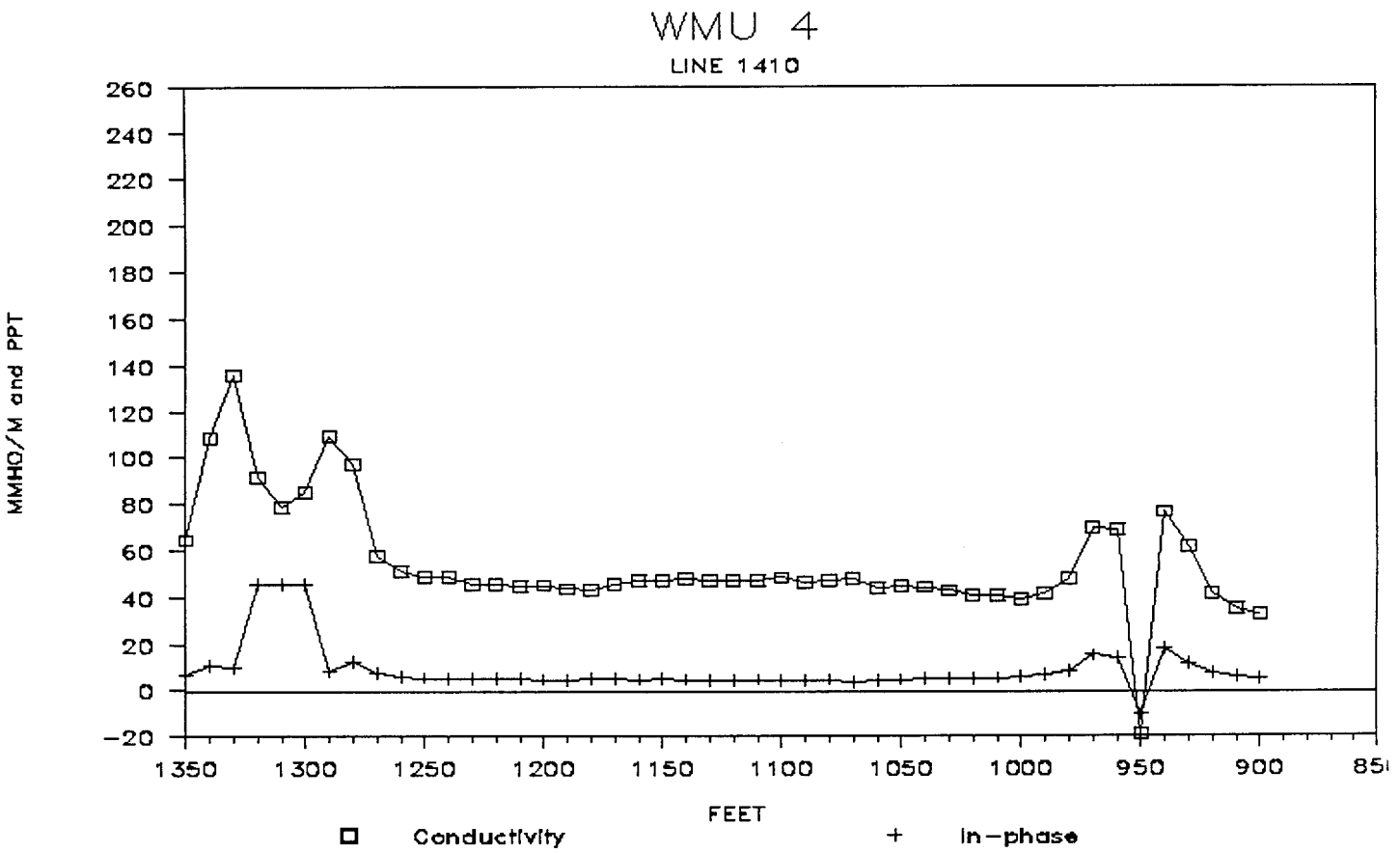
FEET
Conductivity
In-phase


WMU 4
LINE 1410
MMHO/M and PPT
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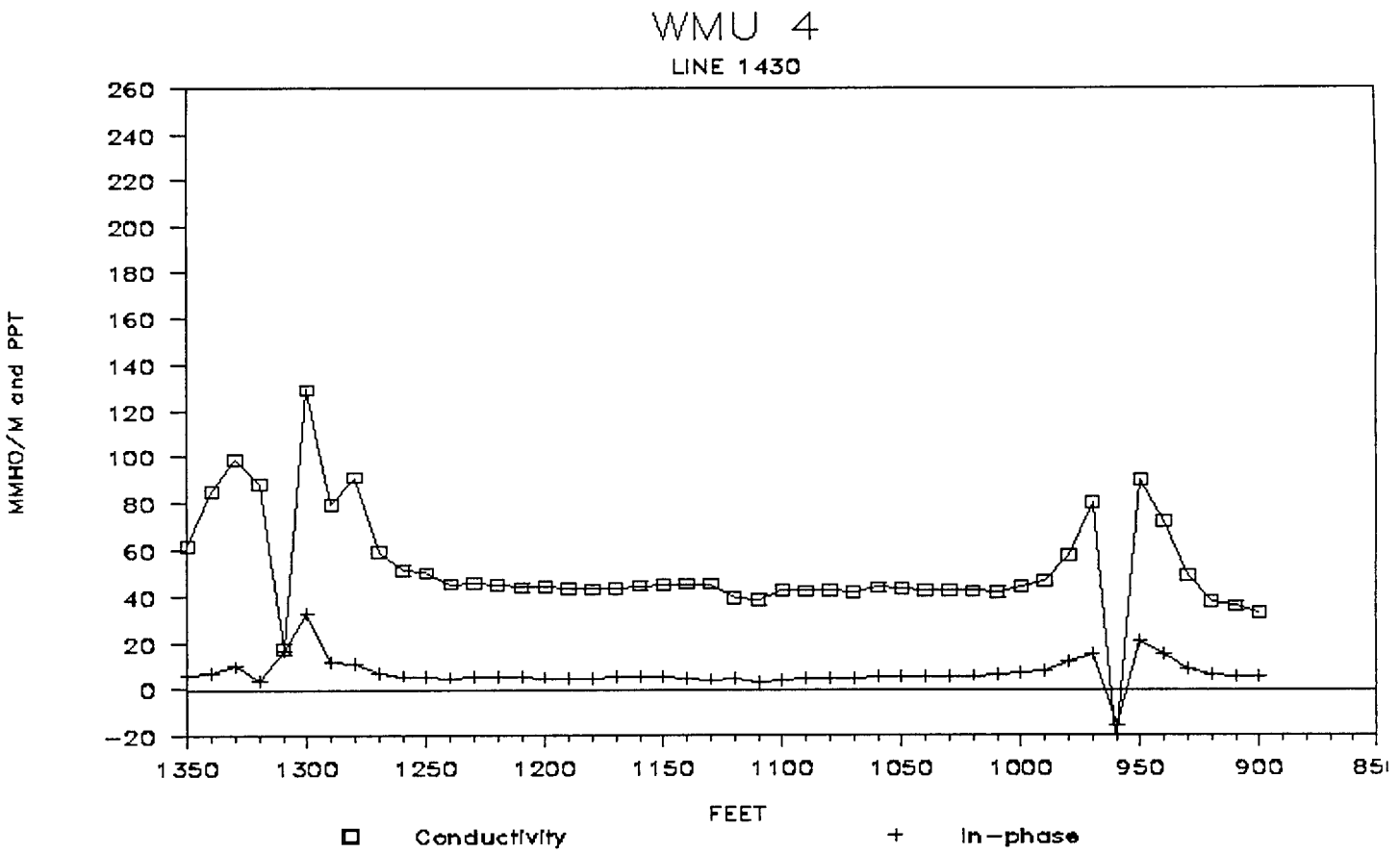
Conductivity
In-phase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LINE 1430
MMHO/M and PPT
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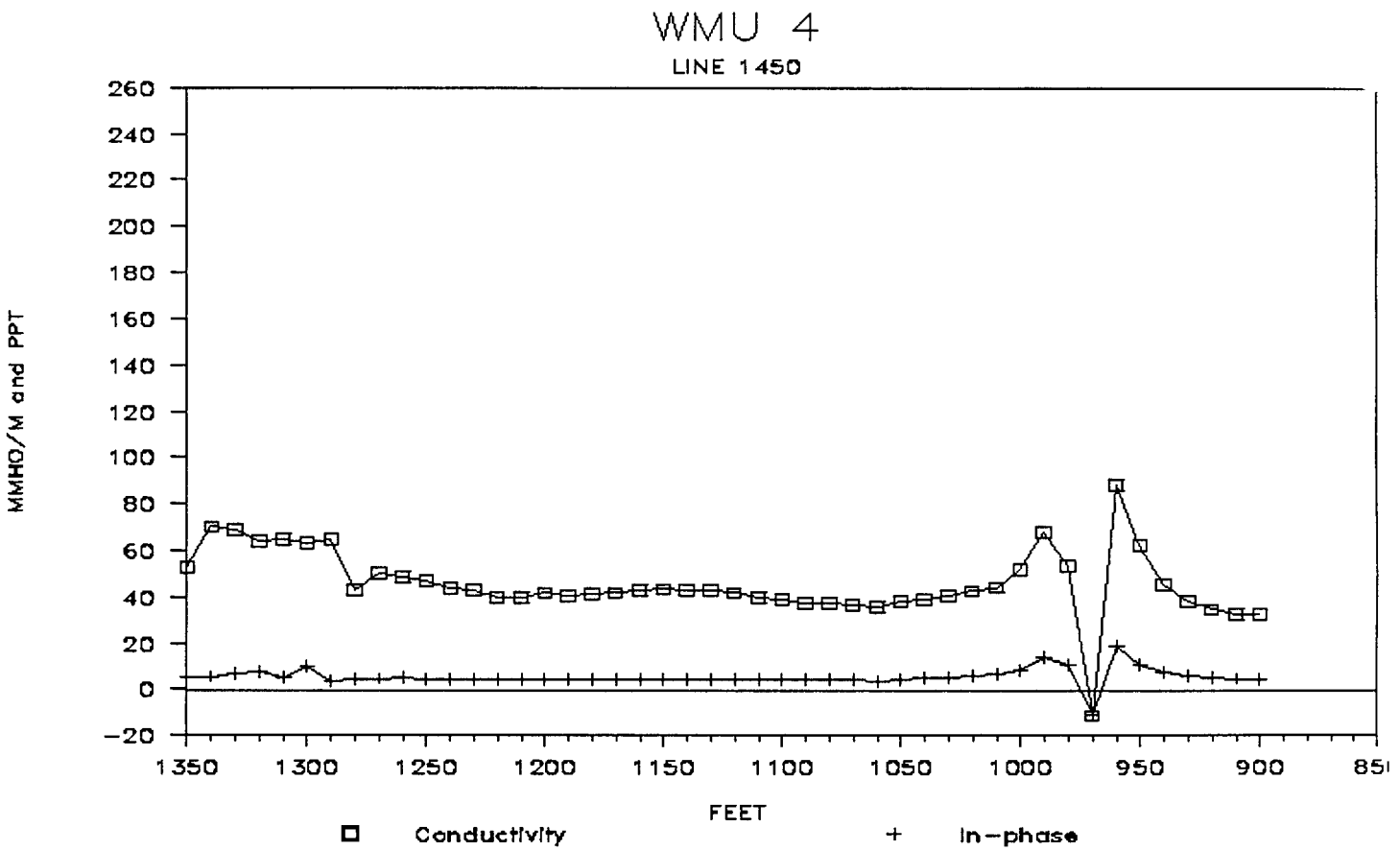
FEET
Conductivity
In-phase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LINE 1450
MMHO/M and PPT
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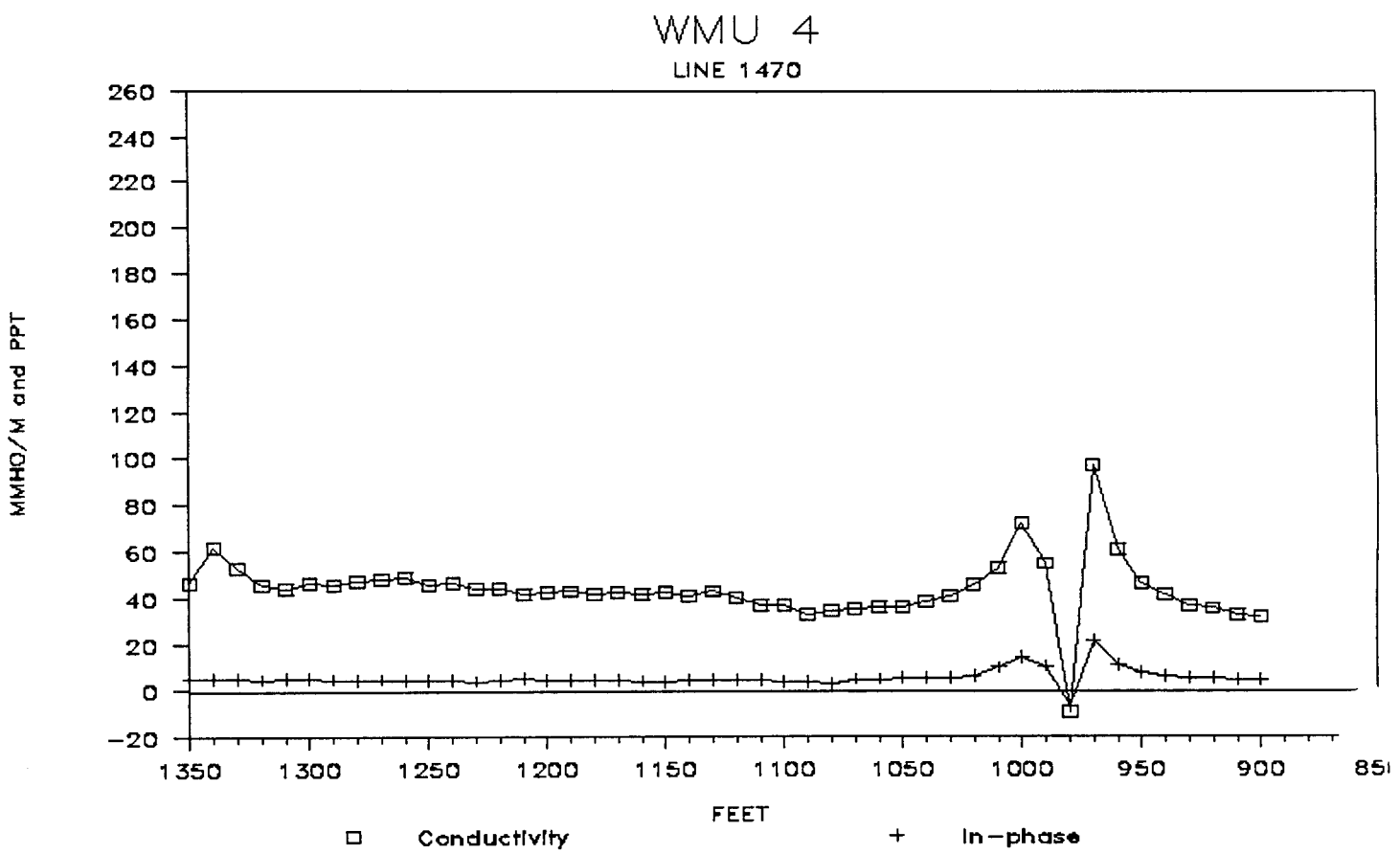
FEET
Conductivity
In-phase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LINE 1470
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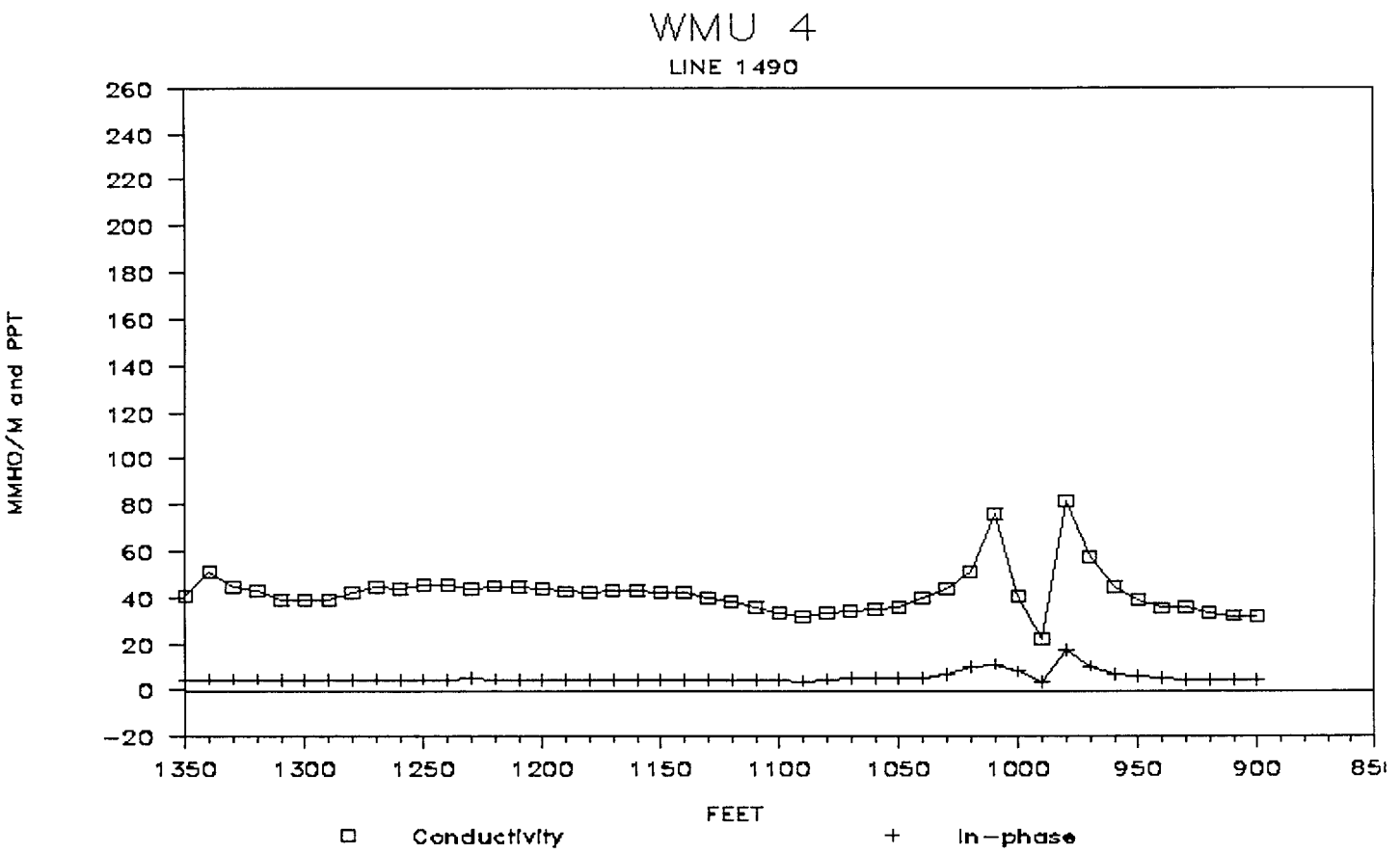
950
900
FEET
Conductivity
In-phase


WMU 4
LINE 1490
MMHO/M and PPT
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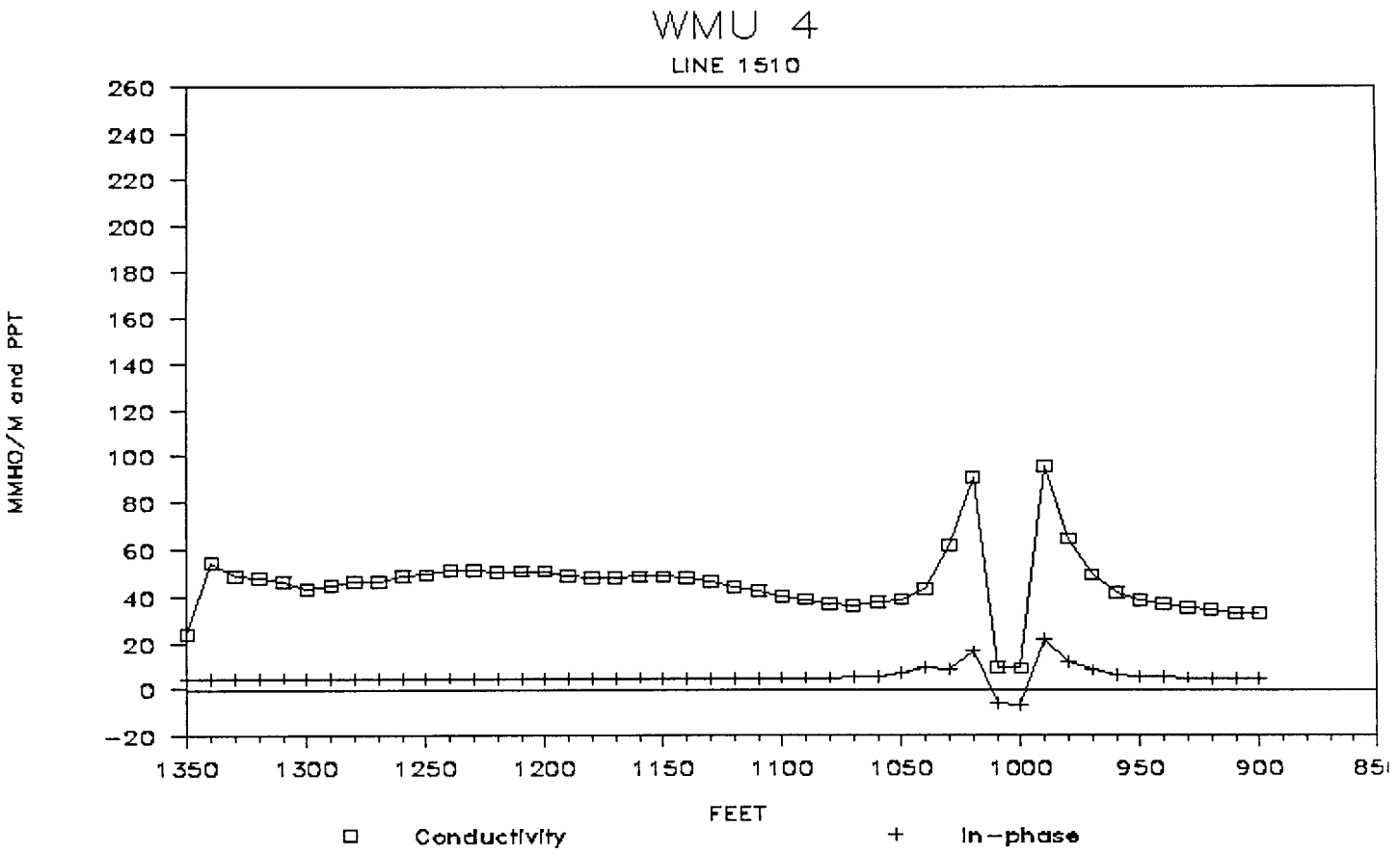
950
900
FEET
Conductivity
In-phase


WMU 4
LINE 1510
MMHO/M and PPT
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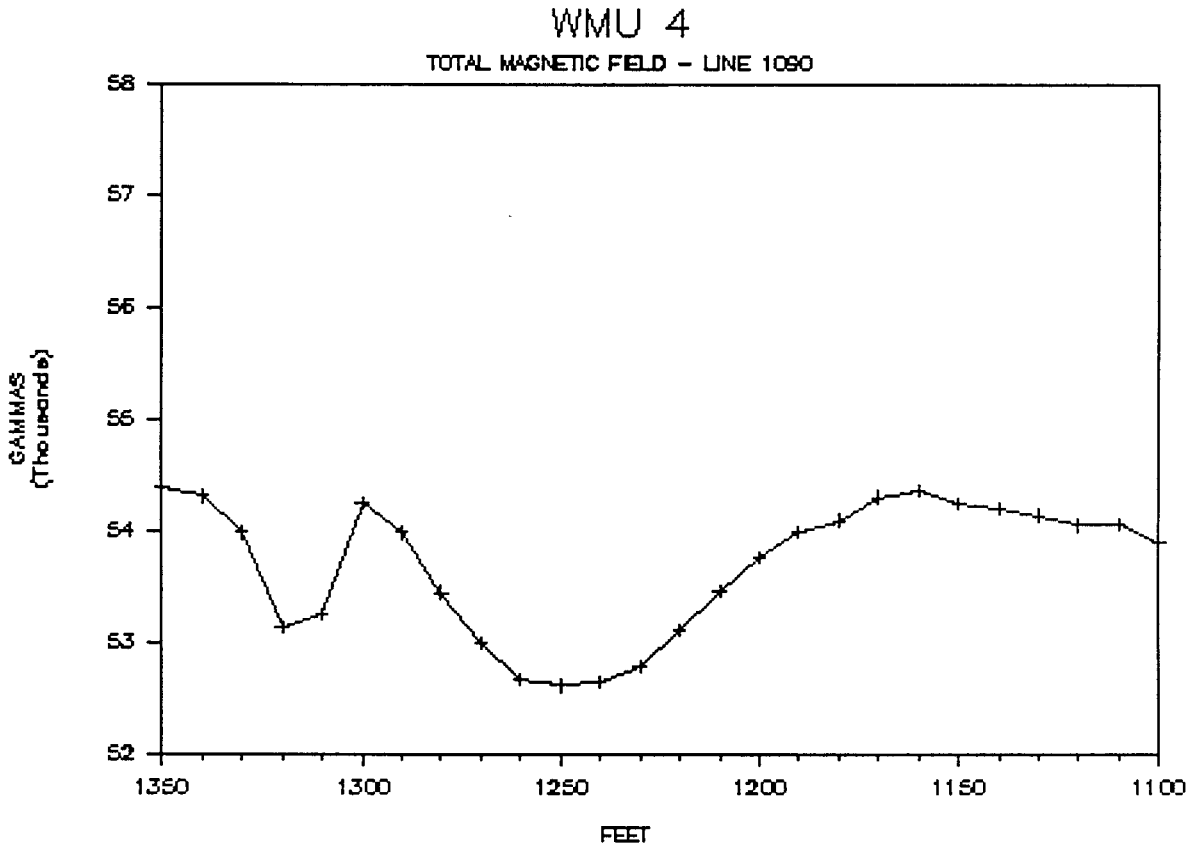
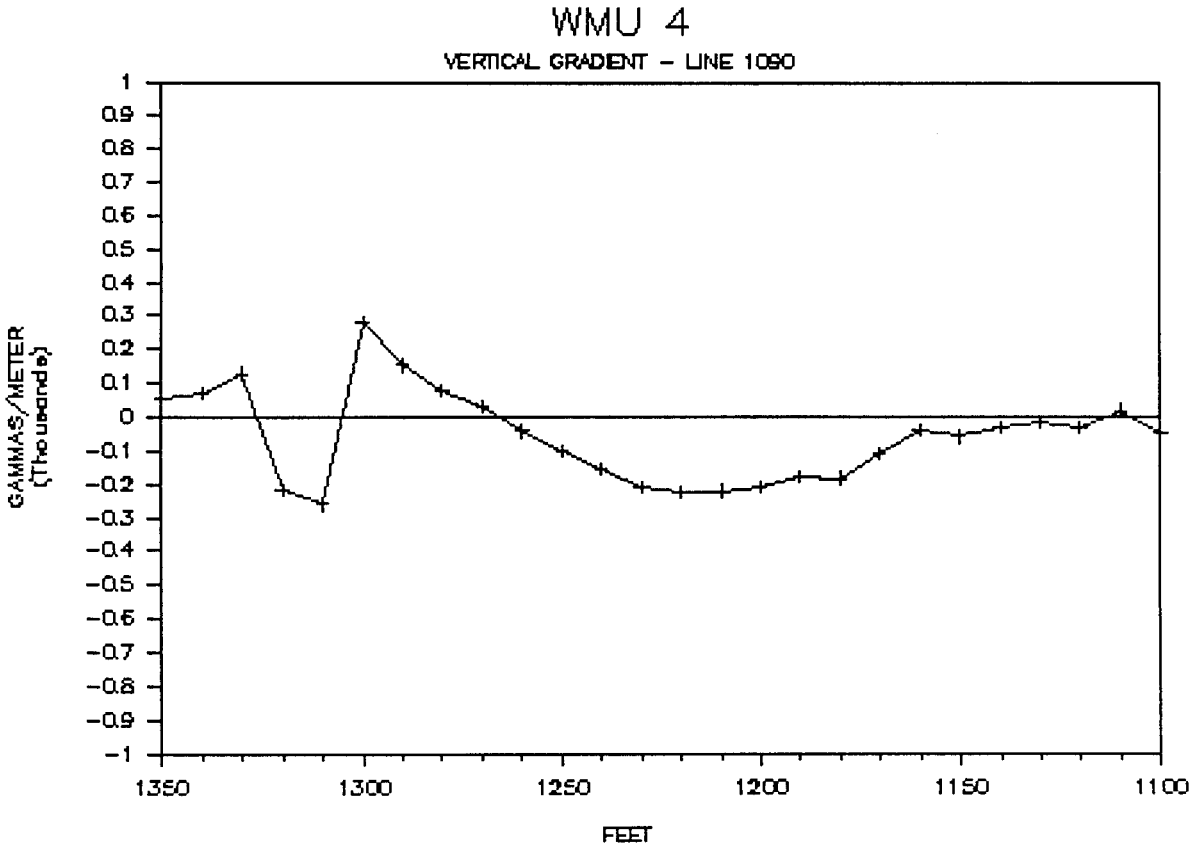
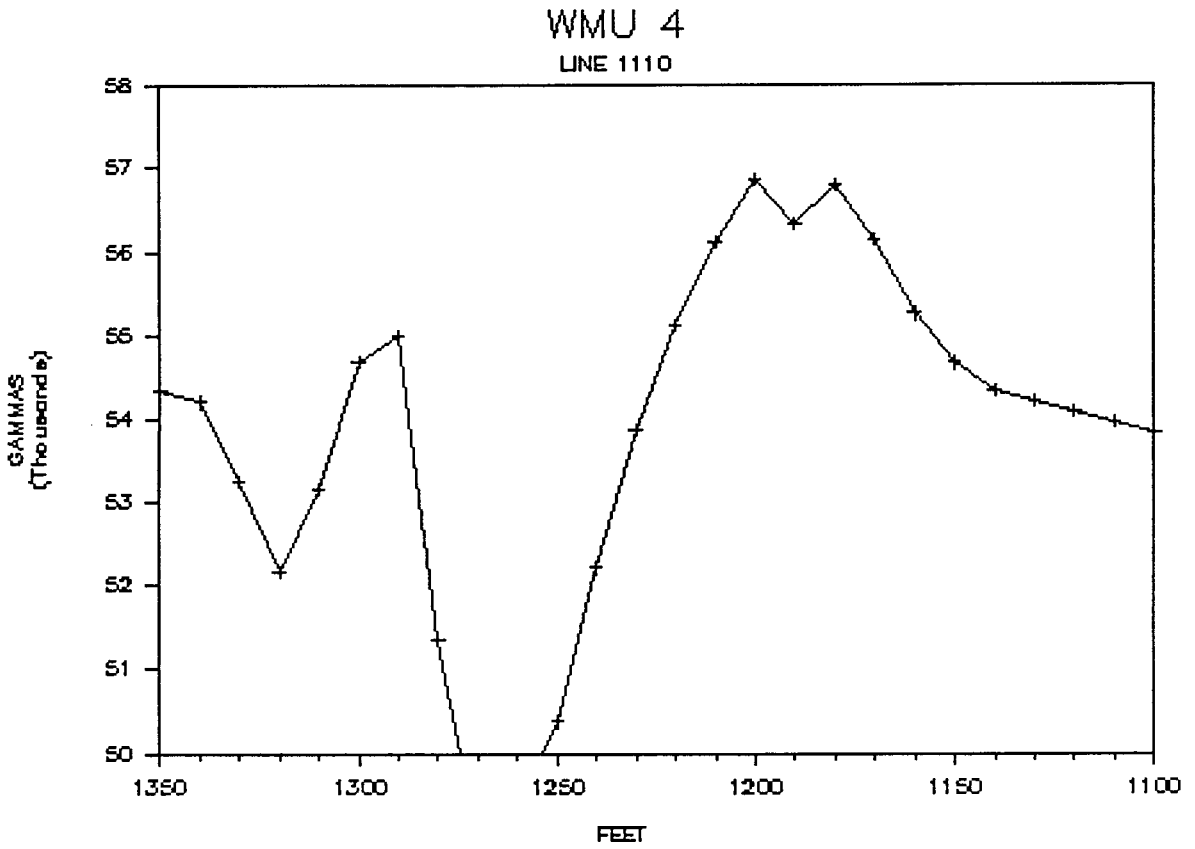
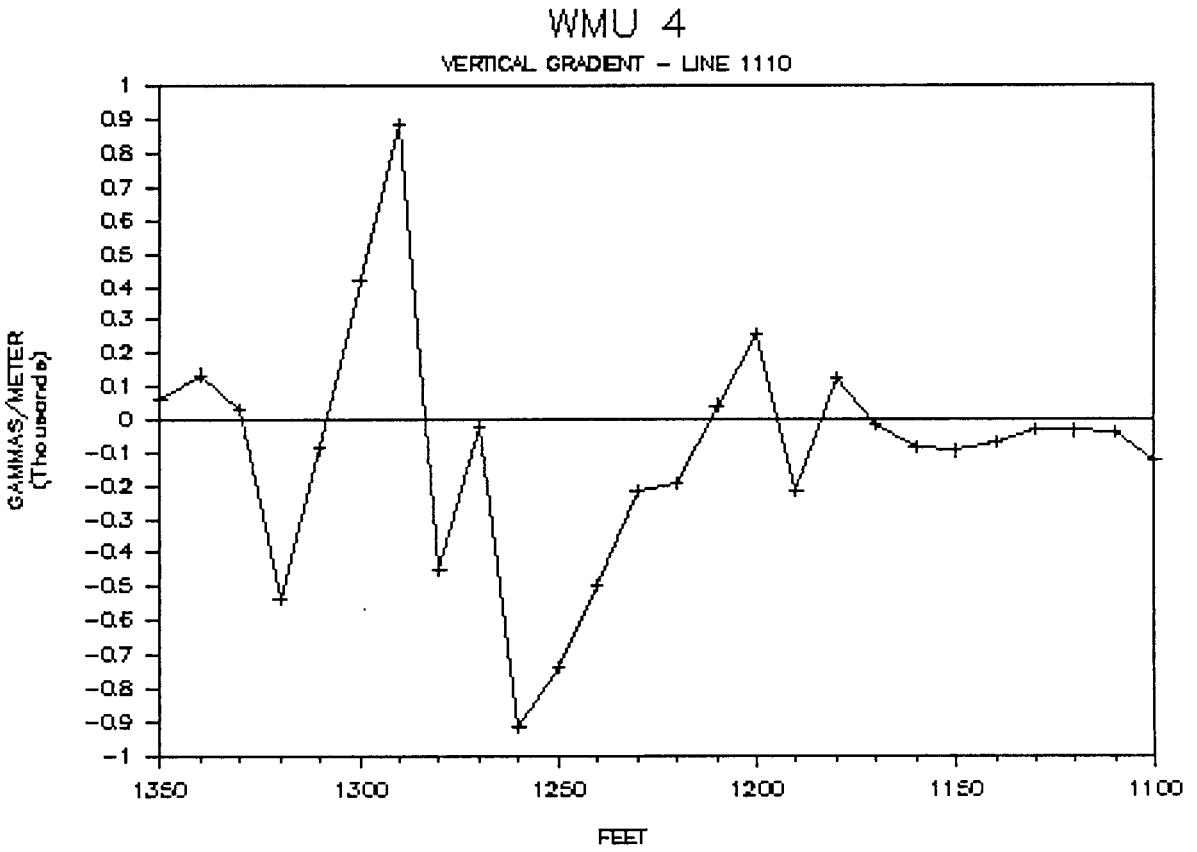
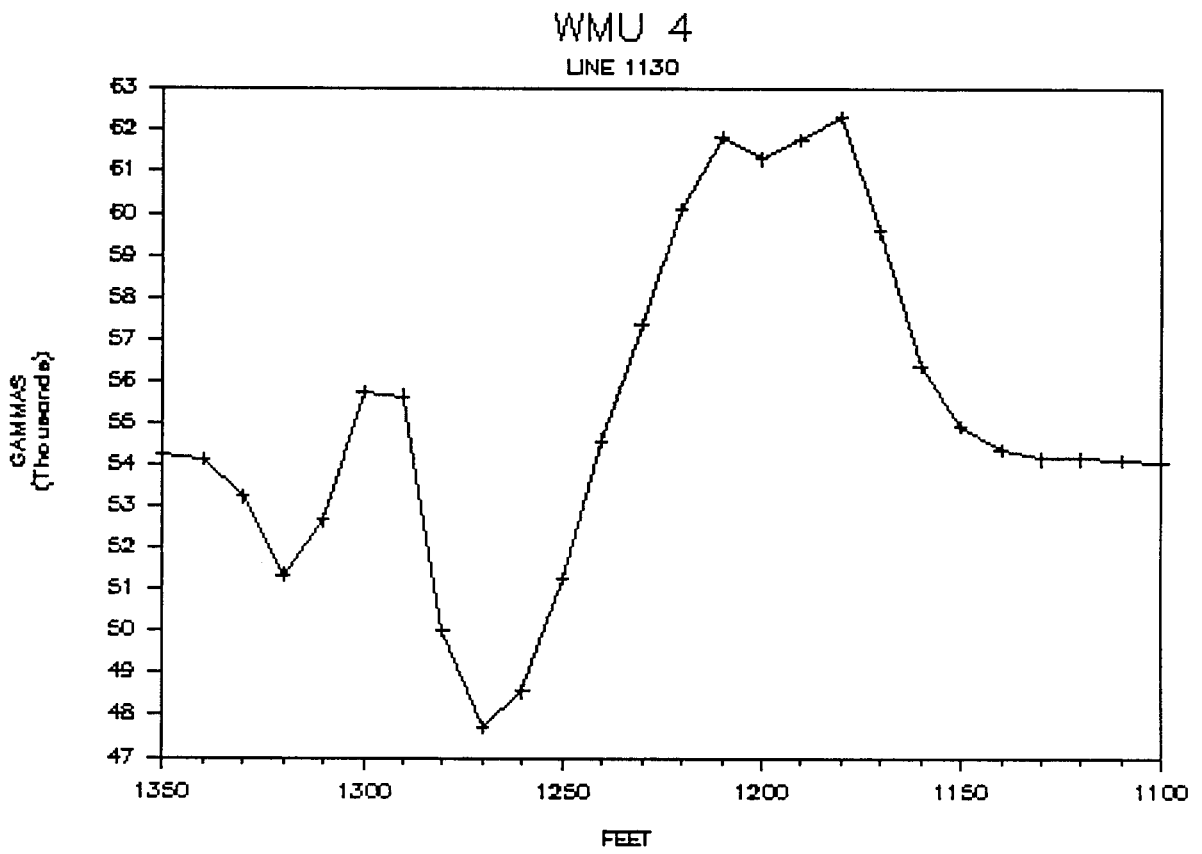
900
FEET
Conductivity
In-phase

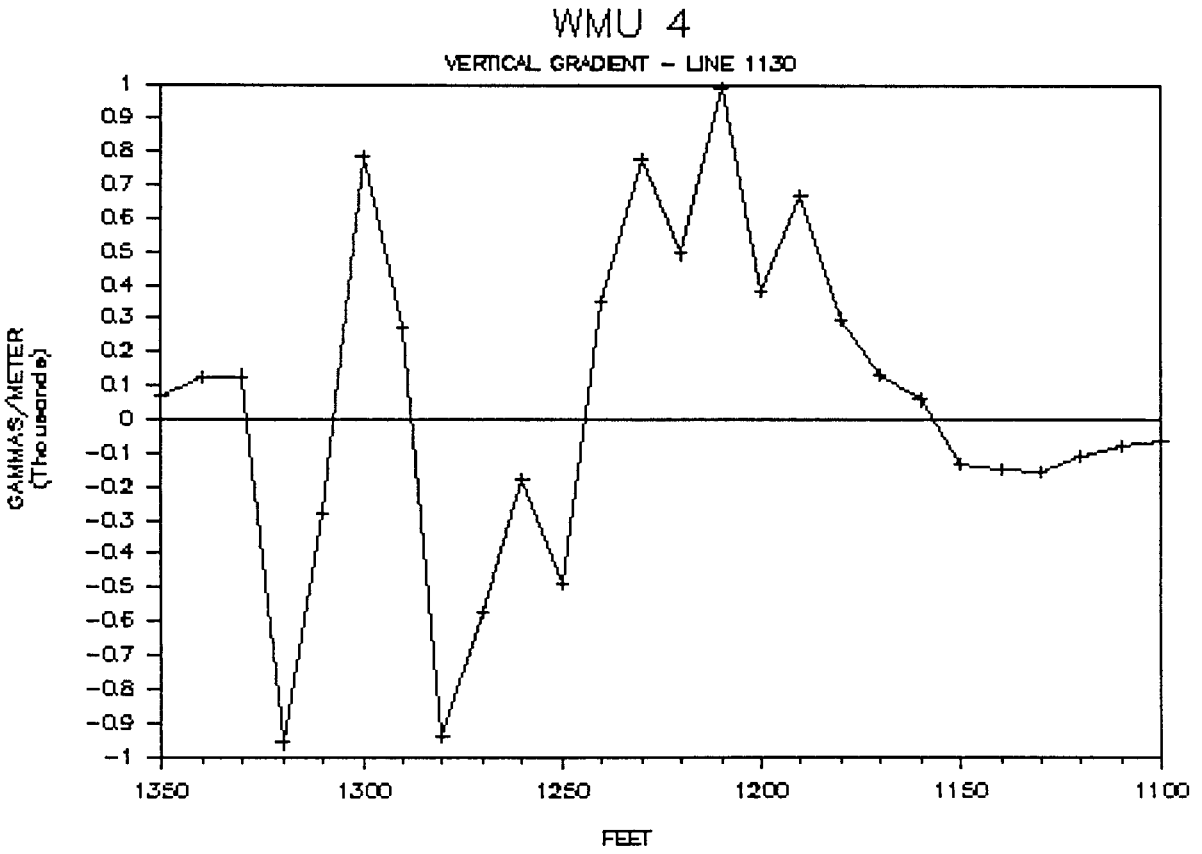

WMU 4
TOTAL MAGNETIC FIELD - LINE 1090
GAMMAS
(Thousands)
58
57
56
55
54
53
52
1350
1300
1250
1200
1150
1100
FEET

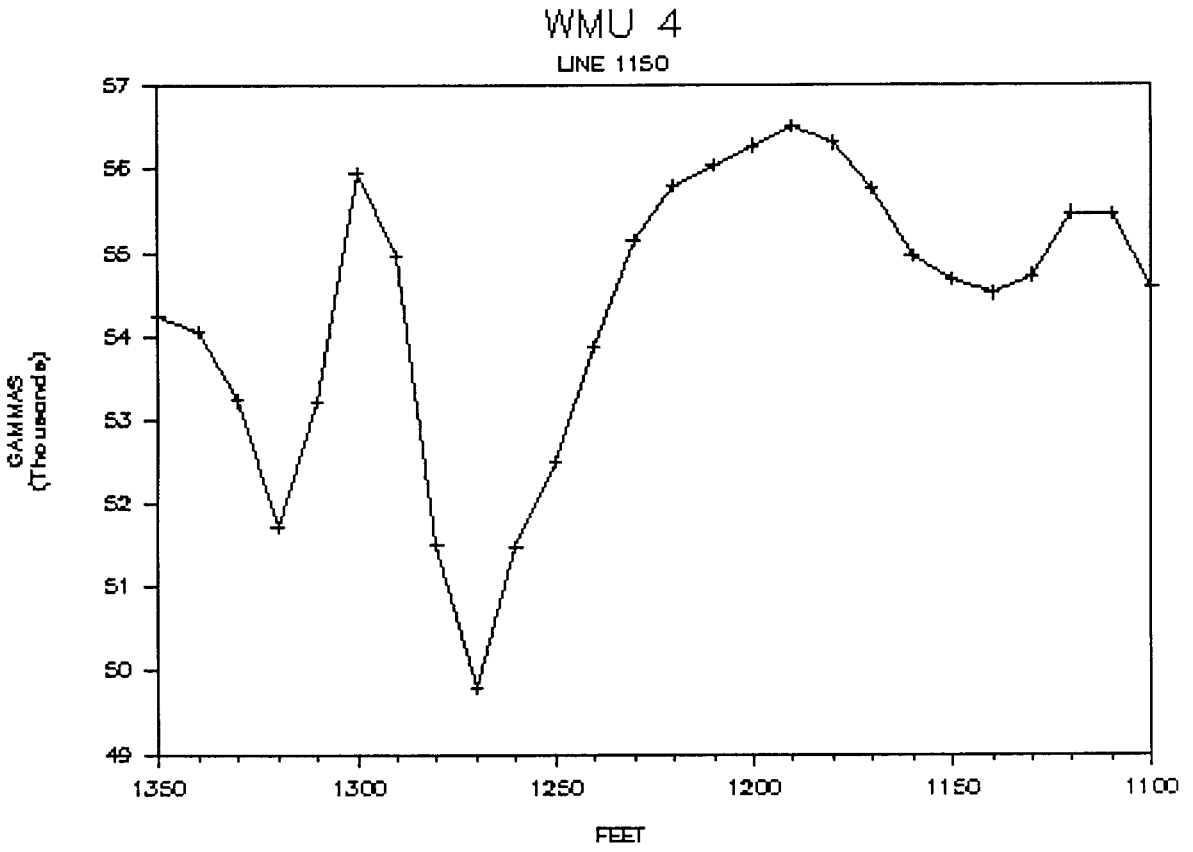

WMU 4
VERTICAL GRADIENT - LINE 1090
GAMMAS/METER
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1350
1300
1250
1200
1150
1100
FEET

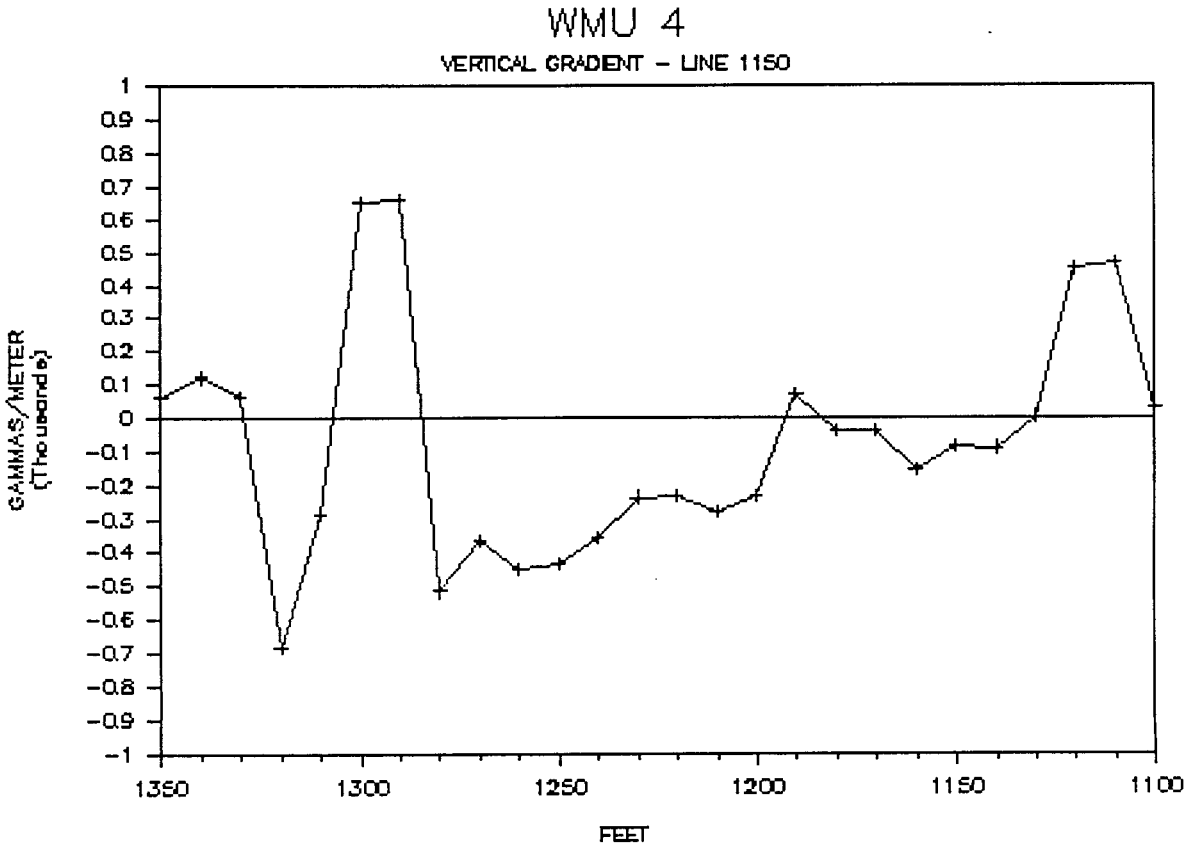

WMU 4
LINE 1110
GAMMAS
(Thousands)
58
57
56
55
54
53
52
51
50
1350
1300
1250
1200
1150
1100
FEET

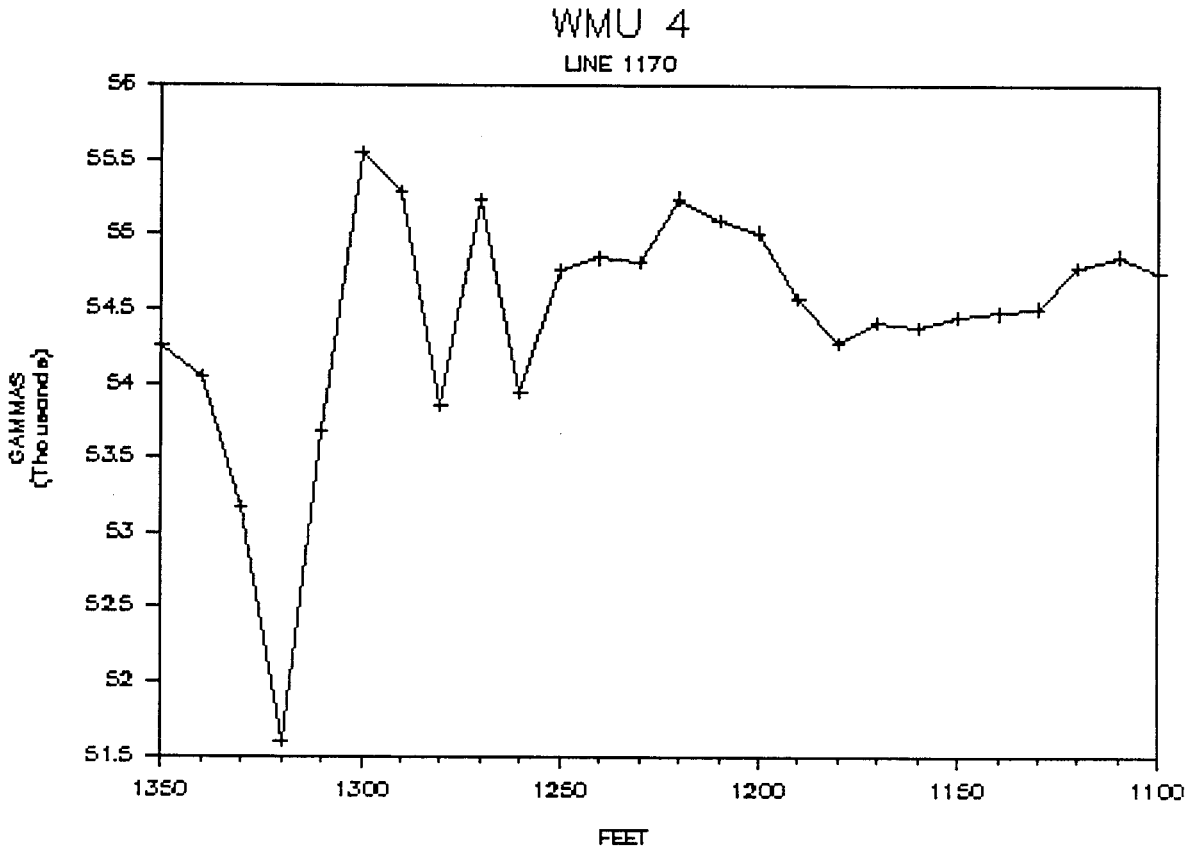

WMU 4
VERTICAL GRADIENT - LINE 1110
GAMMAS/METER
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1350
1300
1250
1200
1150
1100
FEET

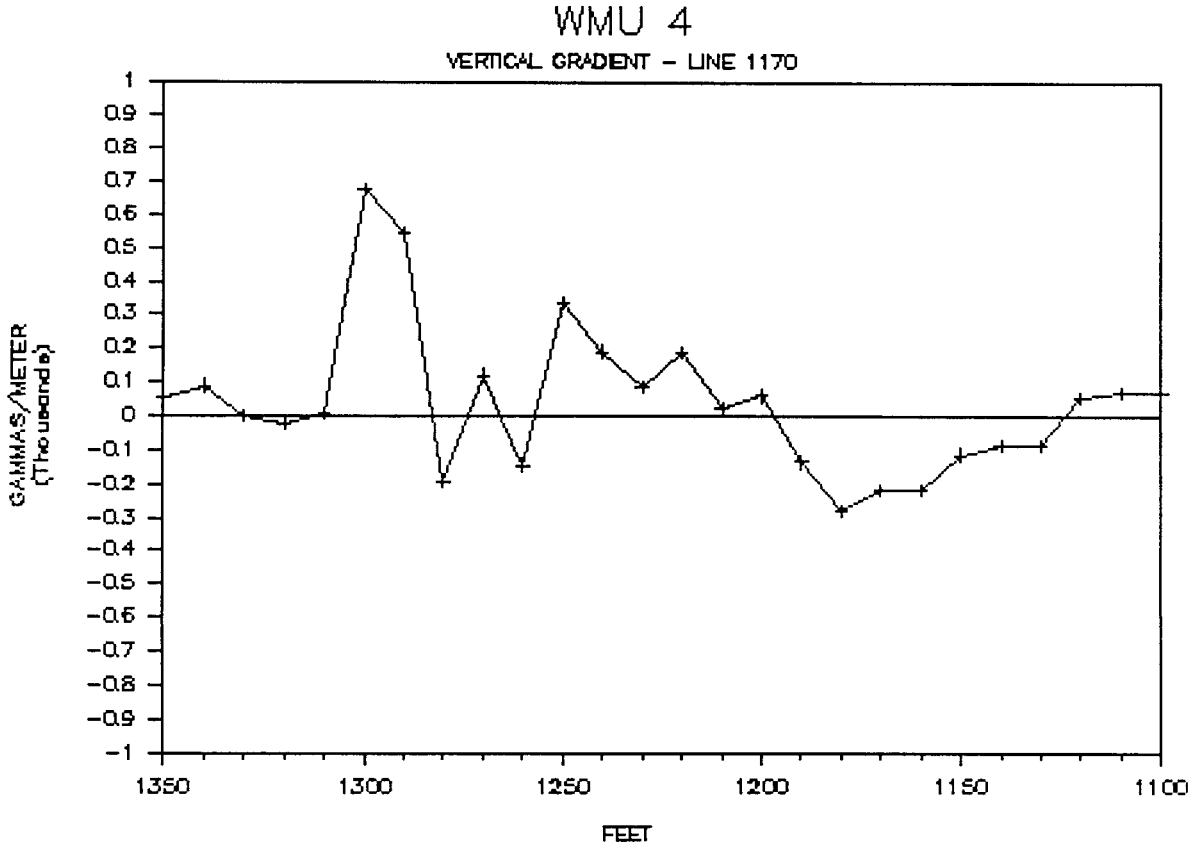

WMU 4
LINE 1130
GAMMAS
(Thousands)
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
47
1350
1300
1250
1200
1150
1100
FEET


WMU 4
VERTICAL GRADIENT - LINE 1130
GAMMAS/METER
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1350
1300
1250
1200
1150
1100
FEET


WMU 4
LINE 1150
GAMMAS
(Thousands)
57
56
55
54
53
52
51
50
49
1350
1300
1250
1200
1150
1100
FEET


WMU 4
VERTICAL GRADIENT – LINE 1150
GAMMAS/METER
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1350
1300
1250
1200
1150
1100
FEET


WMU 4
LINE 1170
GAMMAS
(Thousands)
56
55.5
55
54.5
54
53.5
53
52.5
52
51.5
1350
1300
1250
1200
1150
1100
FEET


WMU 4
VERTICAL GRADIENT - LINE 1170
GAMMAS/METER
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1350
1300
1250
1200
1150
1100
FEET

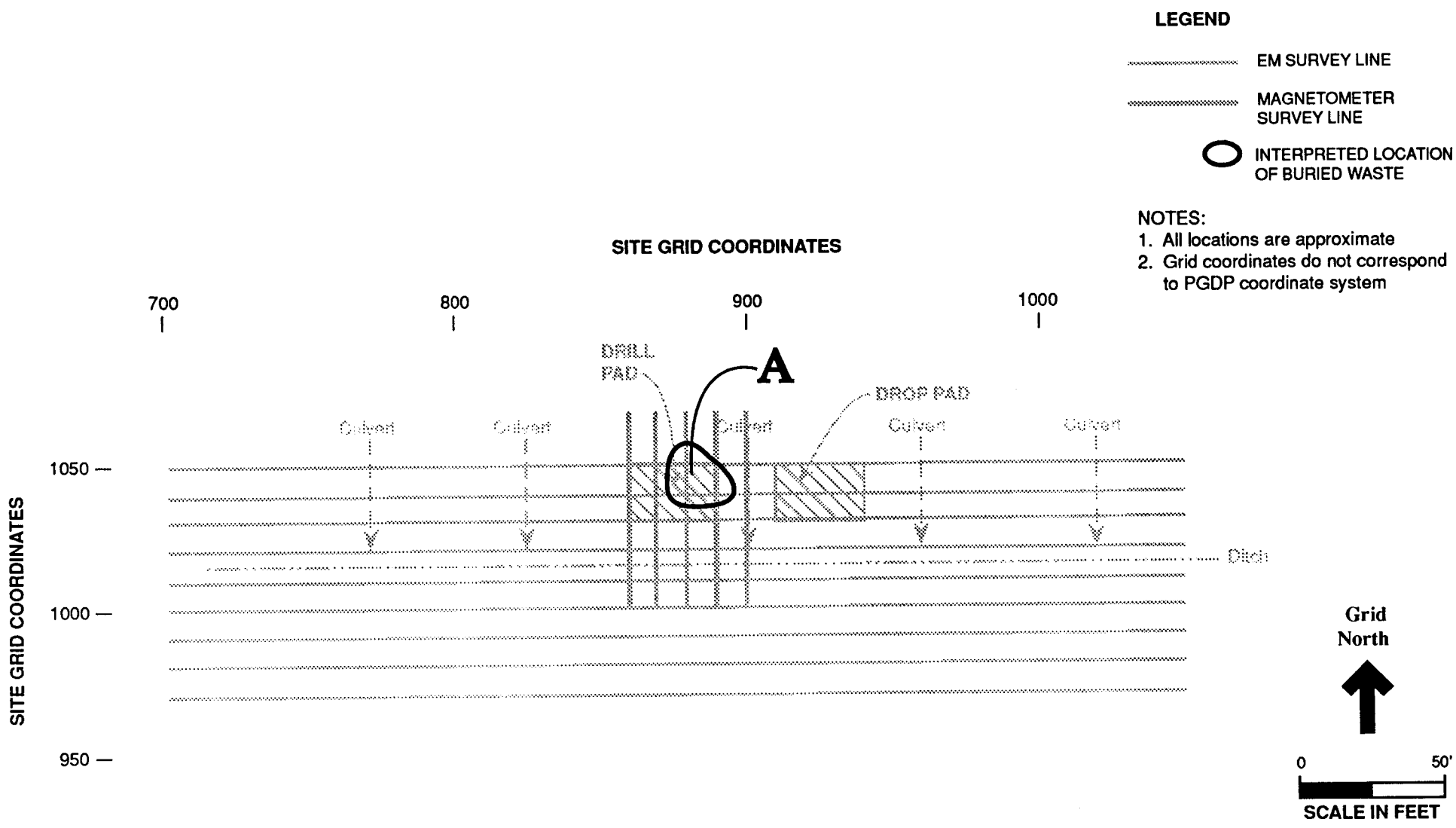


Figure 2-18
WMU-19: DROP TEST AREA RESULTS OF GEOPHYSICAL INVESTIGATION

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

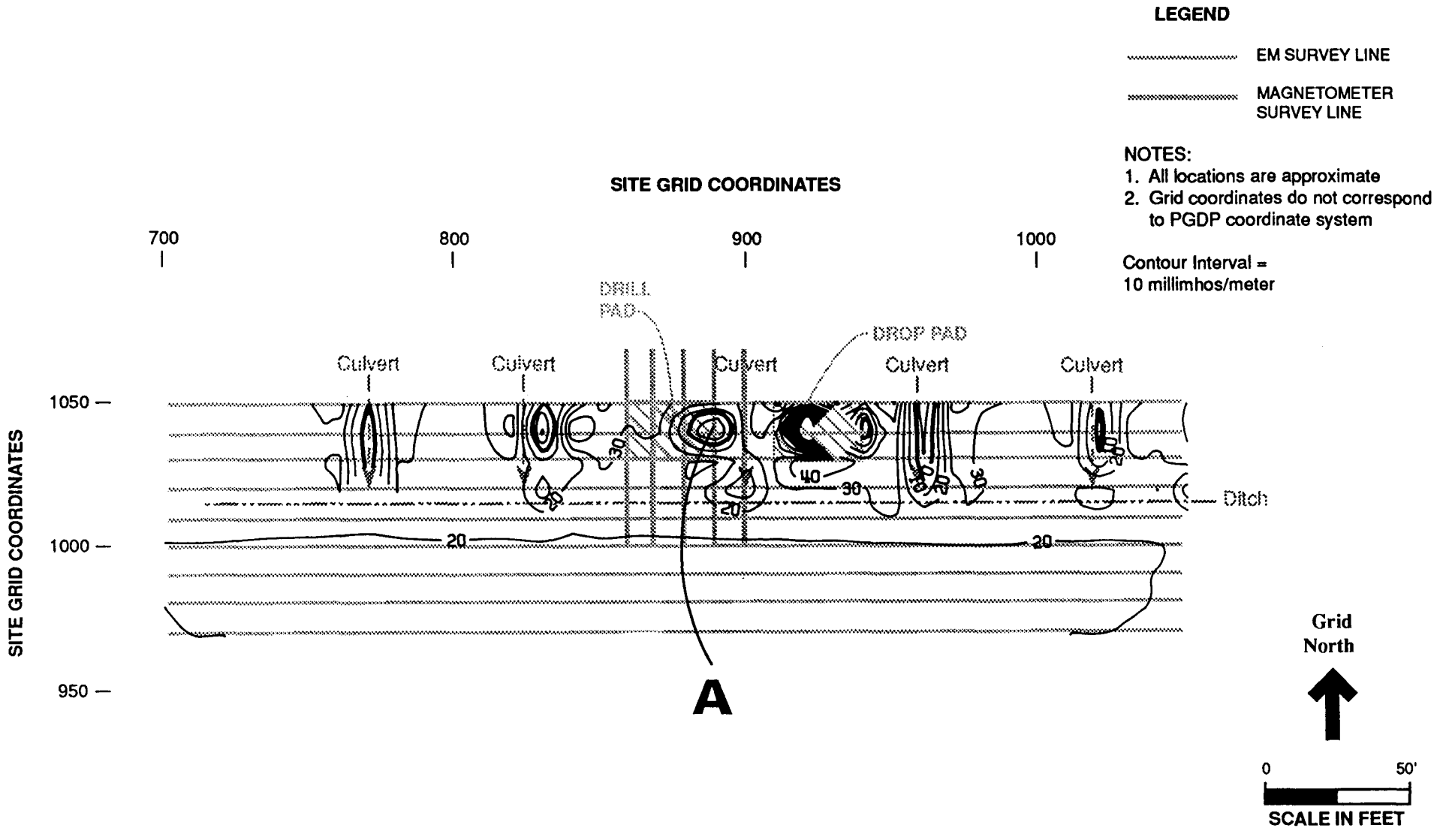


Figure 2-19
WMU-19: DROP TEST AREA
EM CONDUCTIVITY

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION

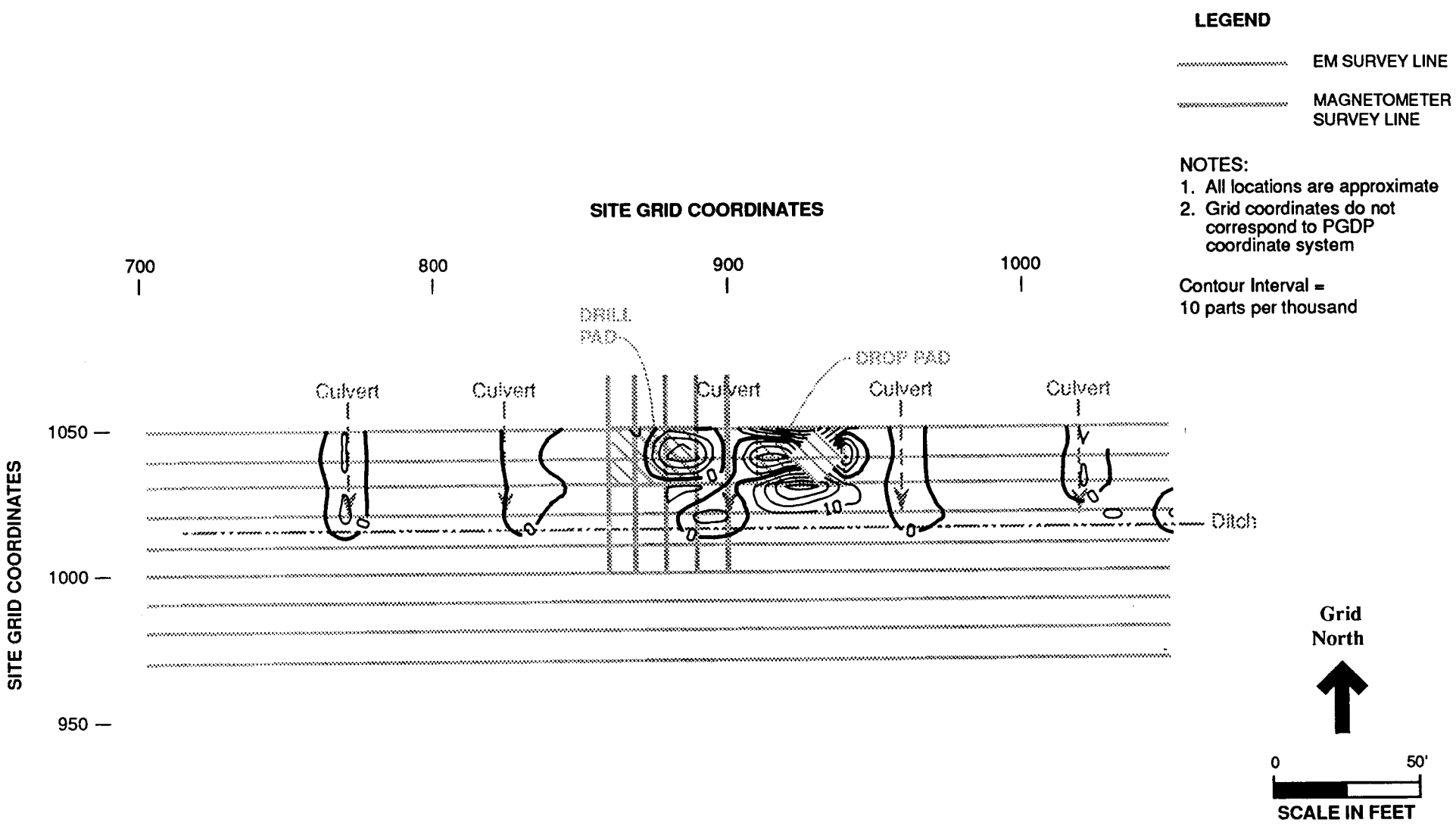
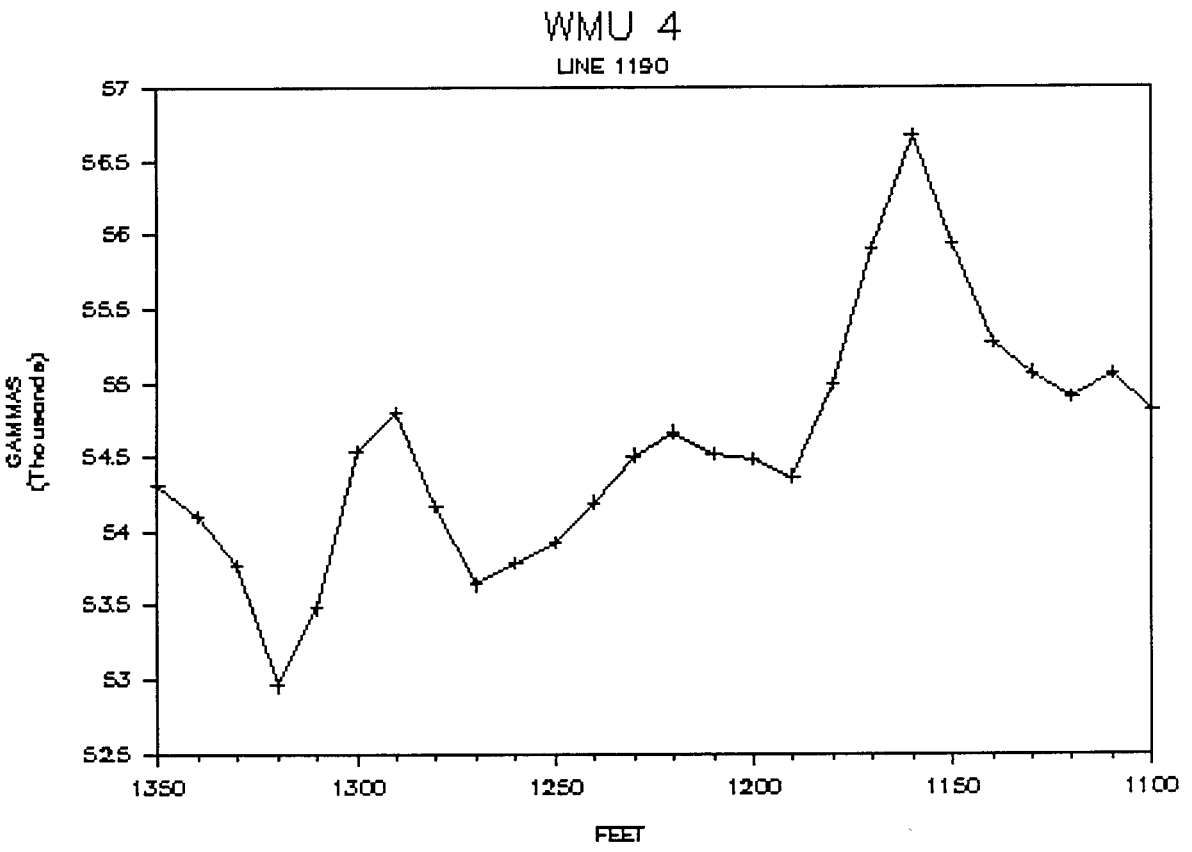
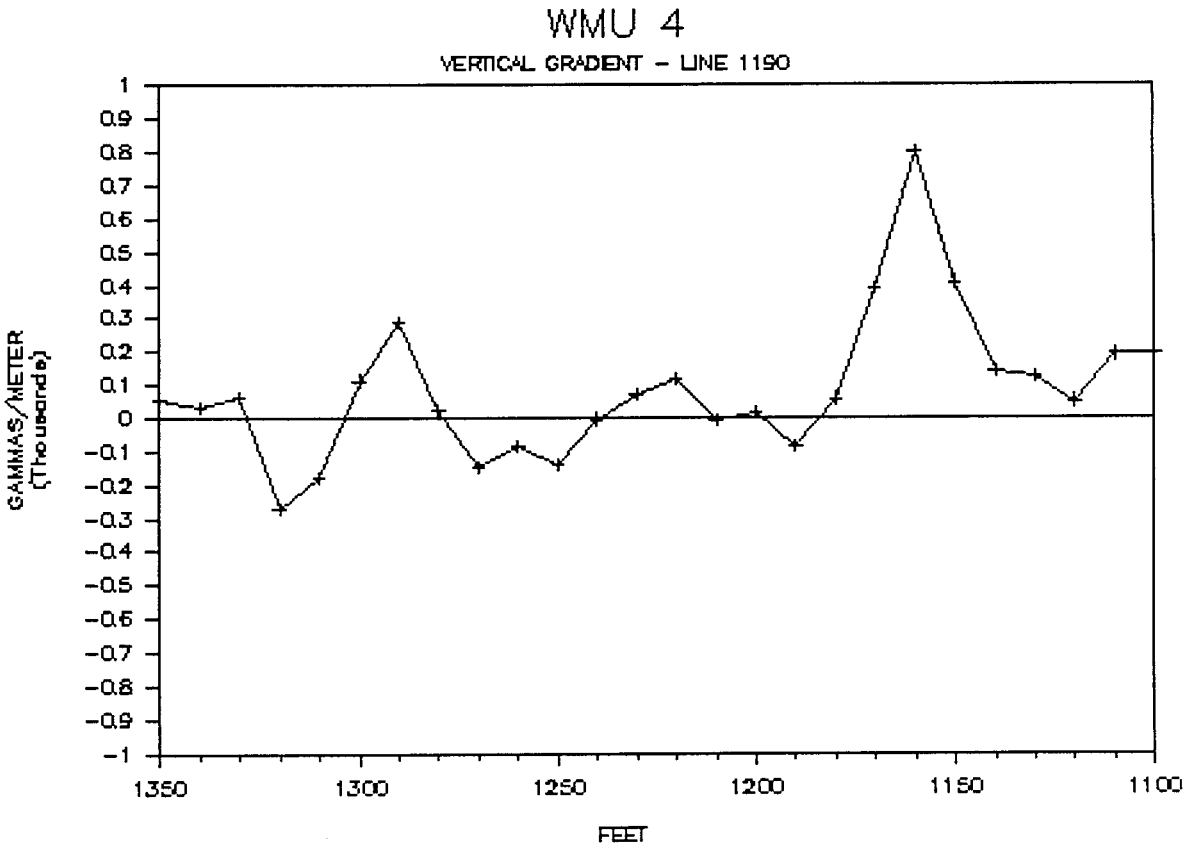
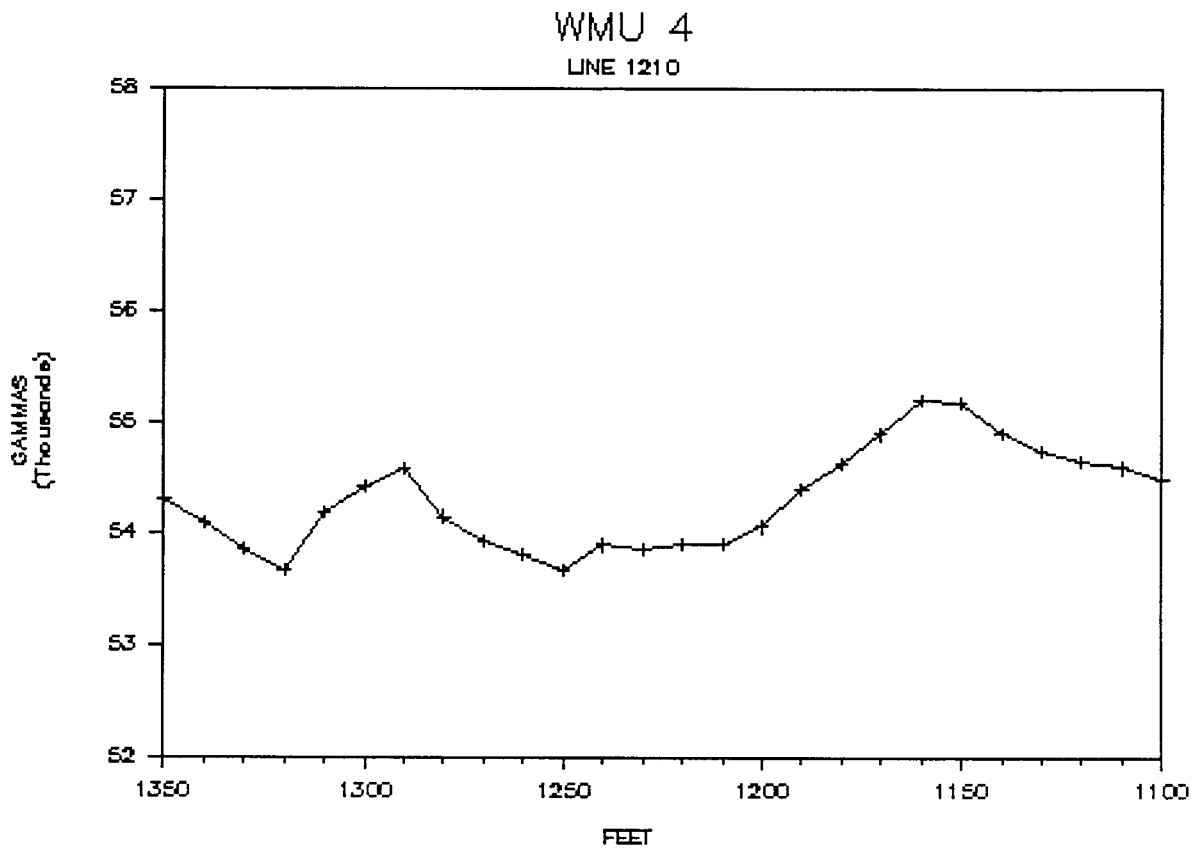


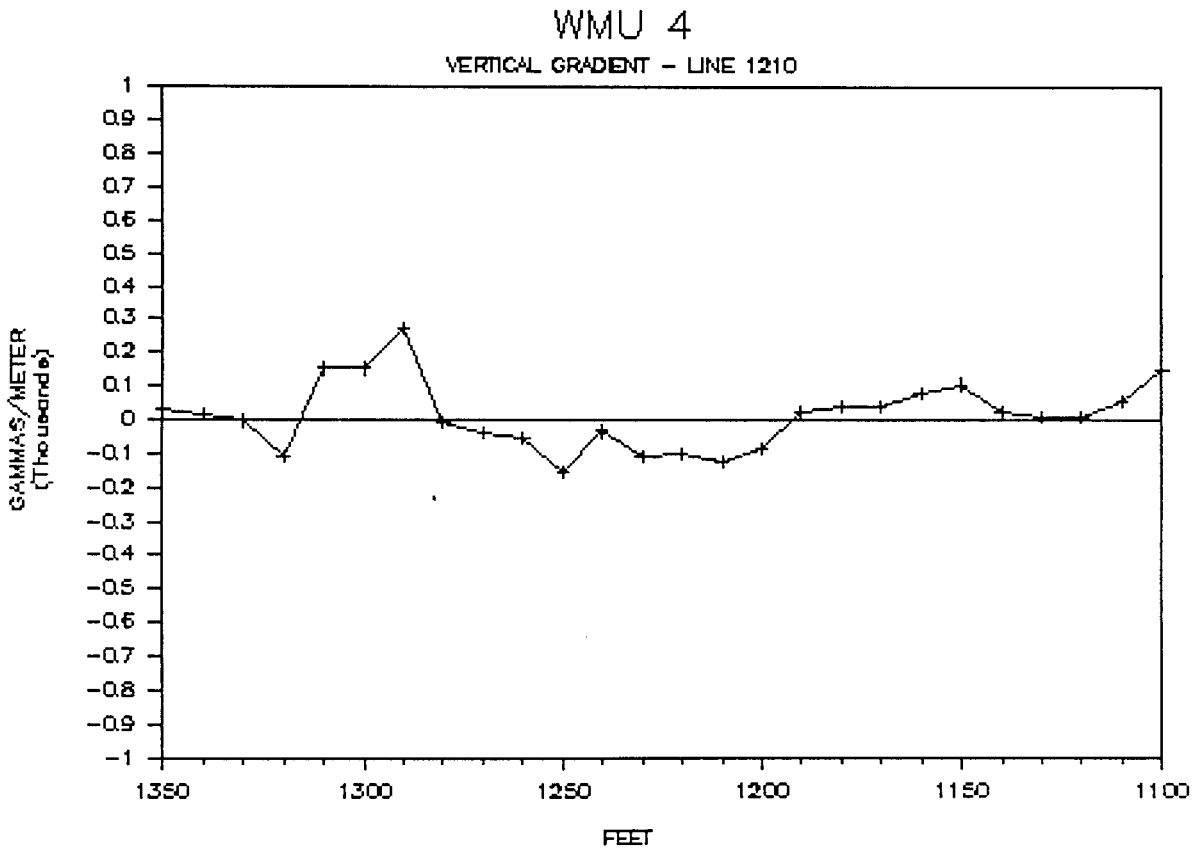
Figure 2-20
WMU-19: DROP TEST AREA
EM IN-PHASE DATA

PADUCAH GASEOUS DIFFUSION PLANT
PADUCAH, KY
PHASE II SITE INVESTIGATION


WMU 4
LINE 1190
GAMMAS
(Thousands)
57
56.5
56
55.5
55
54.5
54
53.5
53
52.5
1350
1300
1250
1200
1150
1100
FEET

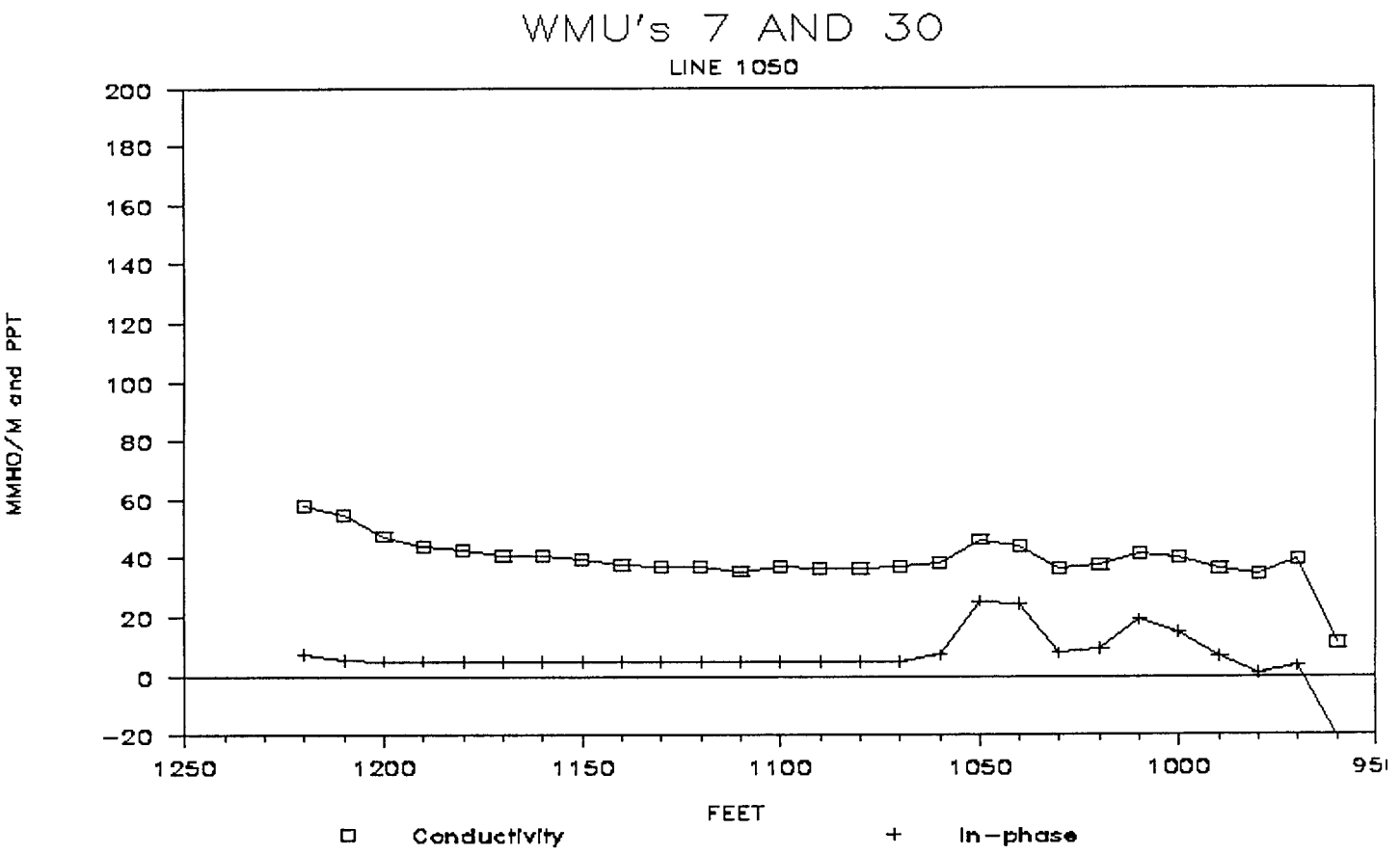

WMU 4
VERTICAL GRADIENT - LINE 1190
GAMMAS/METER
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1350
1300
1250
1200
1150
1100
FEET

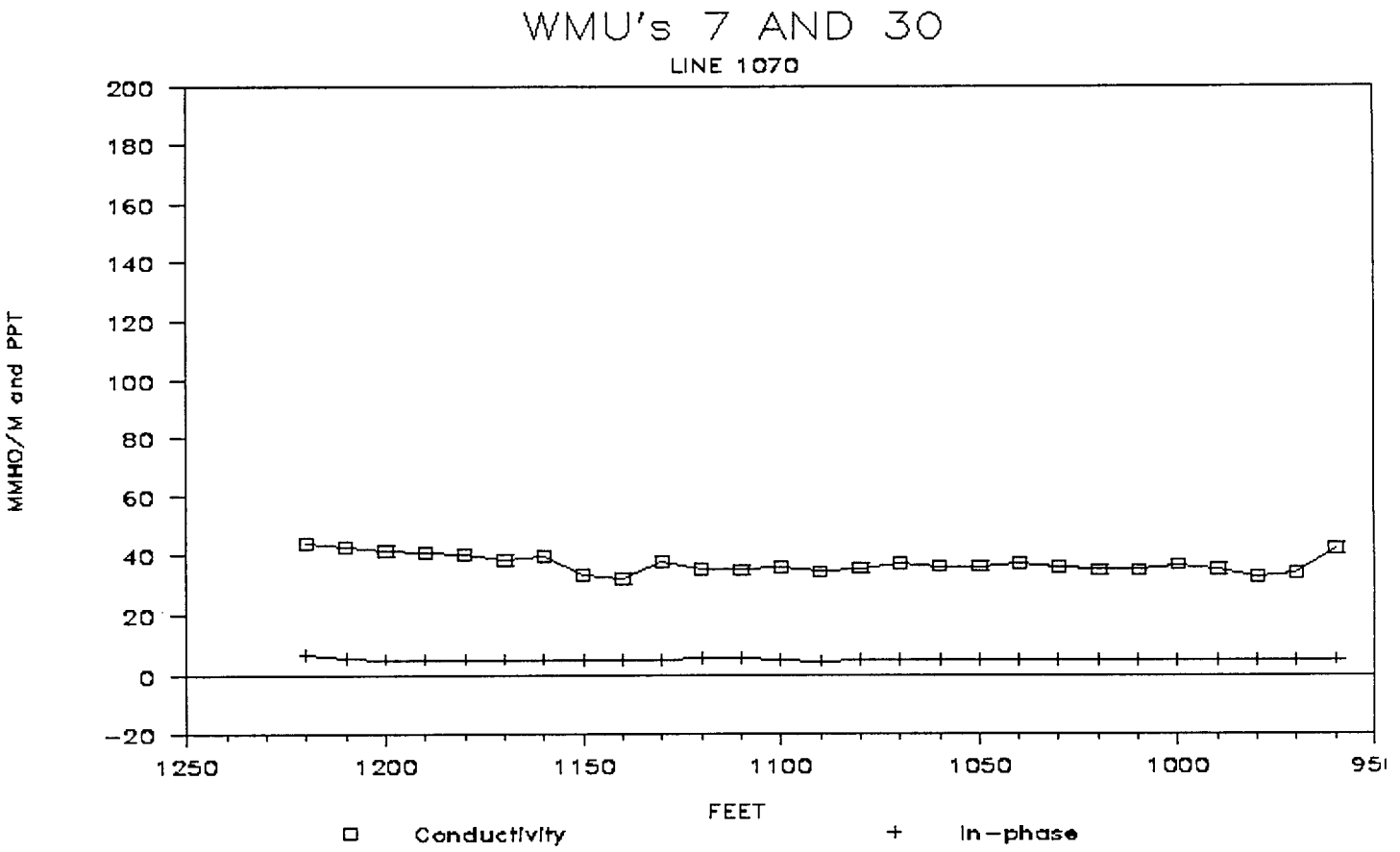

WMU 4
LINE 1210
GAMMAS
(Thousands)
58
57
56
55
54
53
52
1350
1300
1250
1200
1150
1100
FEET

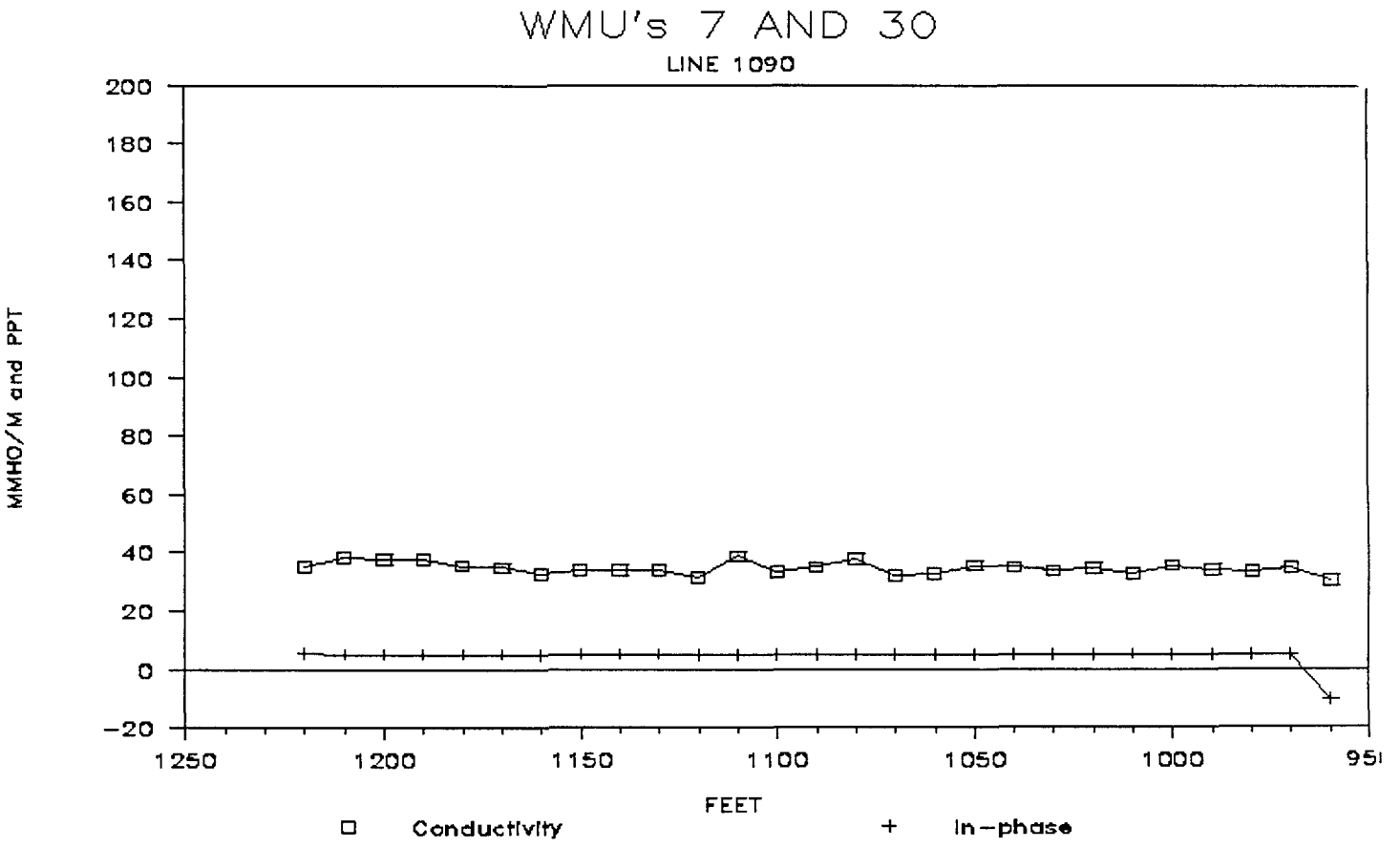

WMU 4
VERTICAL GRADIENT - LINE 1210
GAMMAS/METER
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1350
1300
1250
1200
1150
1100
FEET

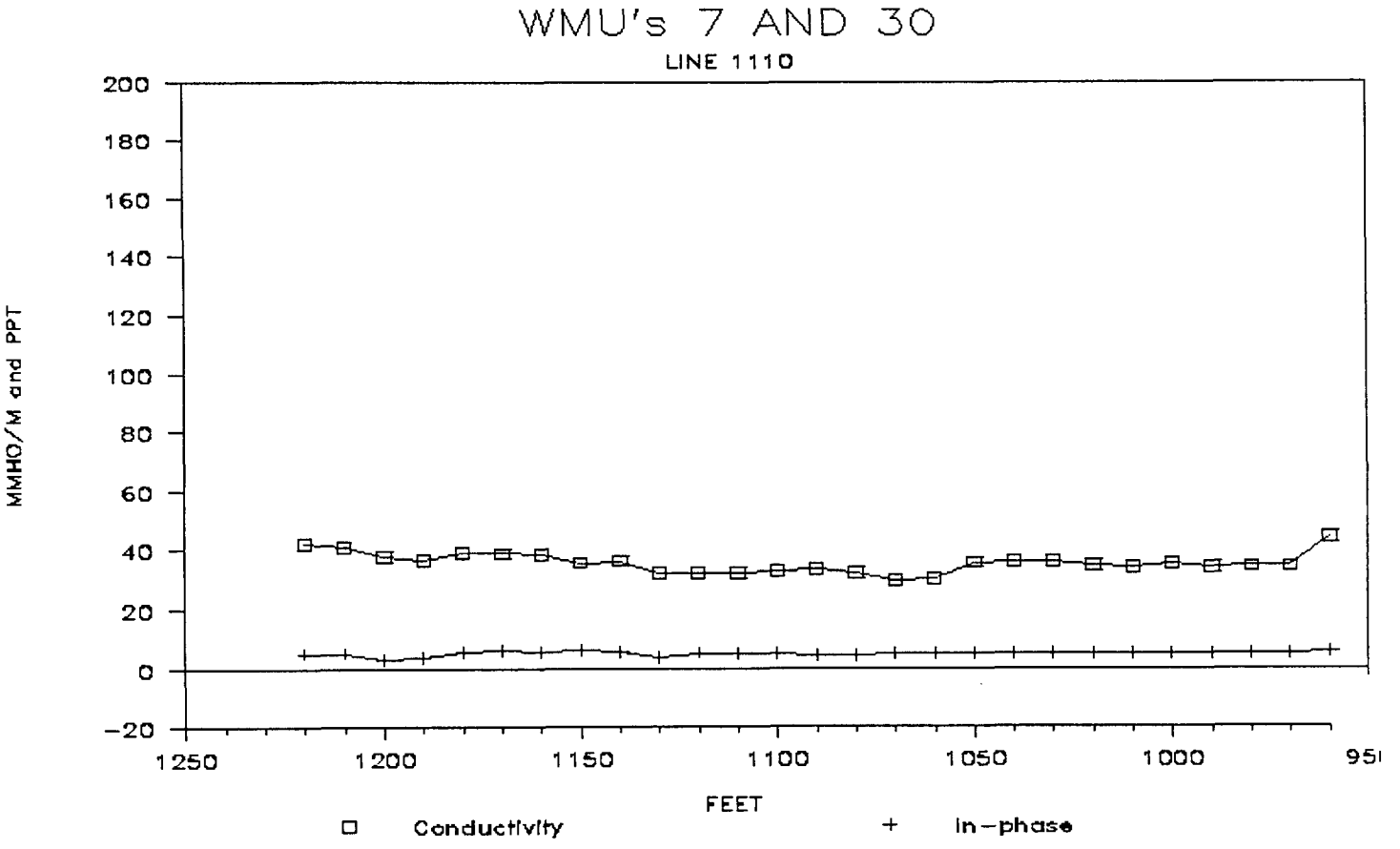
Attachment C

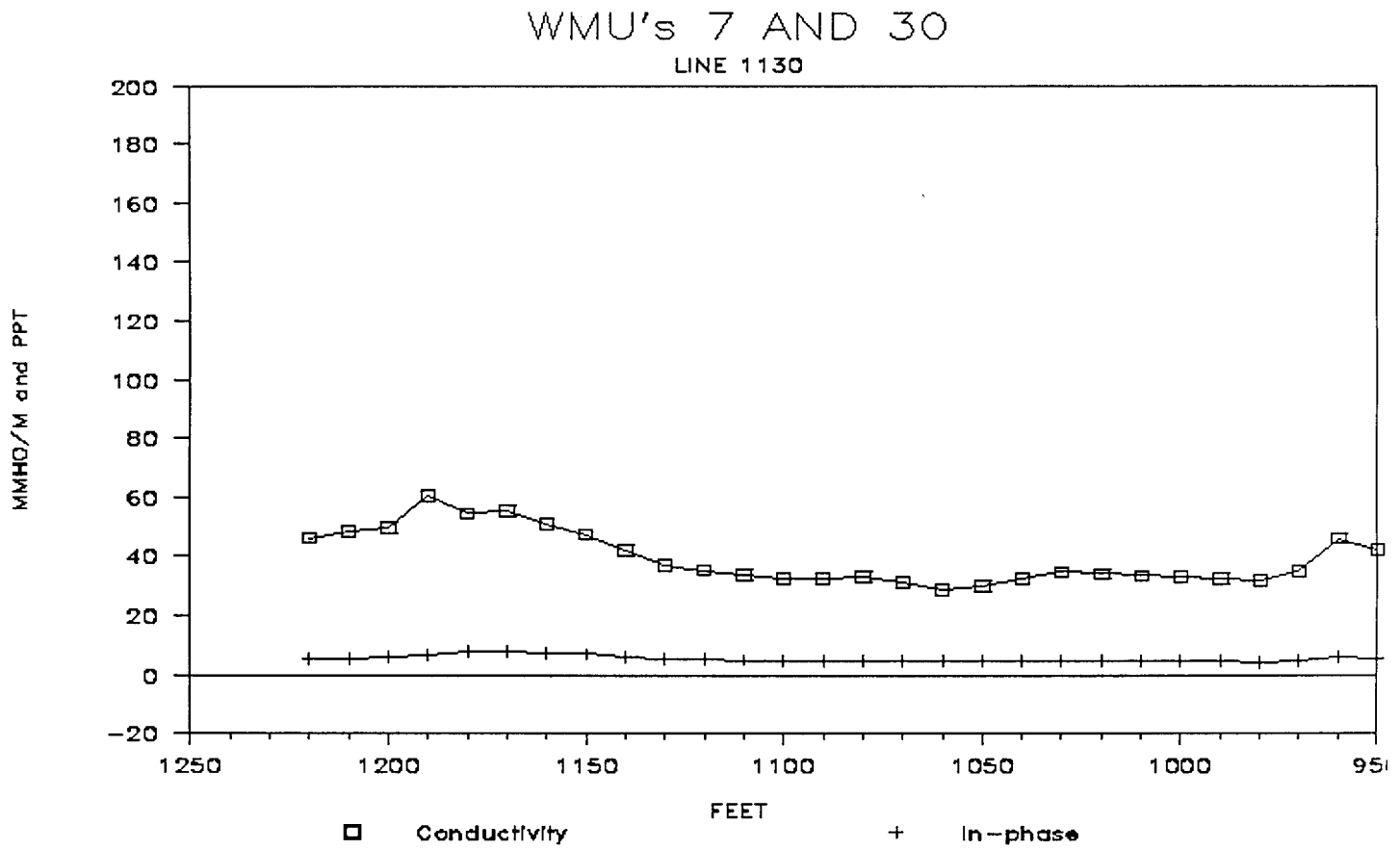
WMU 7 - BURIAL GROUND
WMU 30 - BURN AREA
GEOPHYSICAL DATA

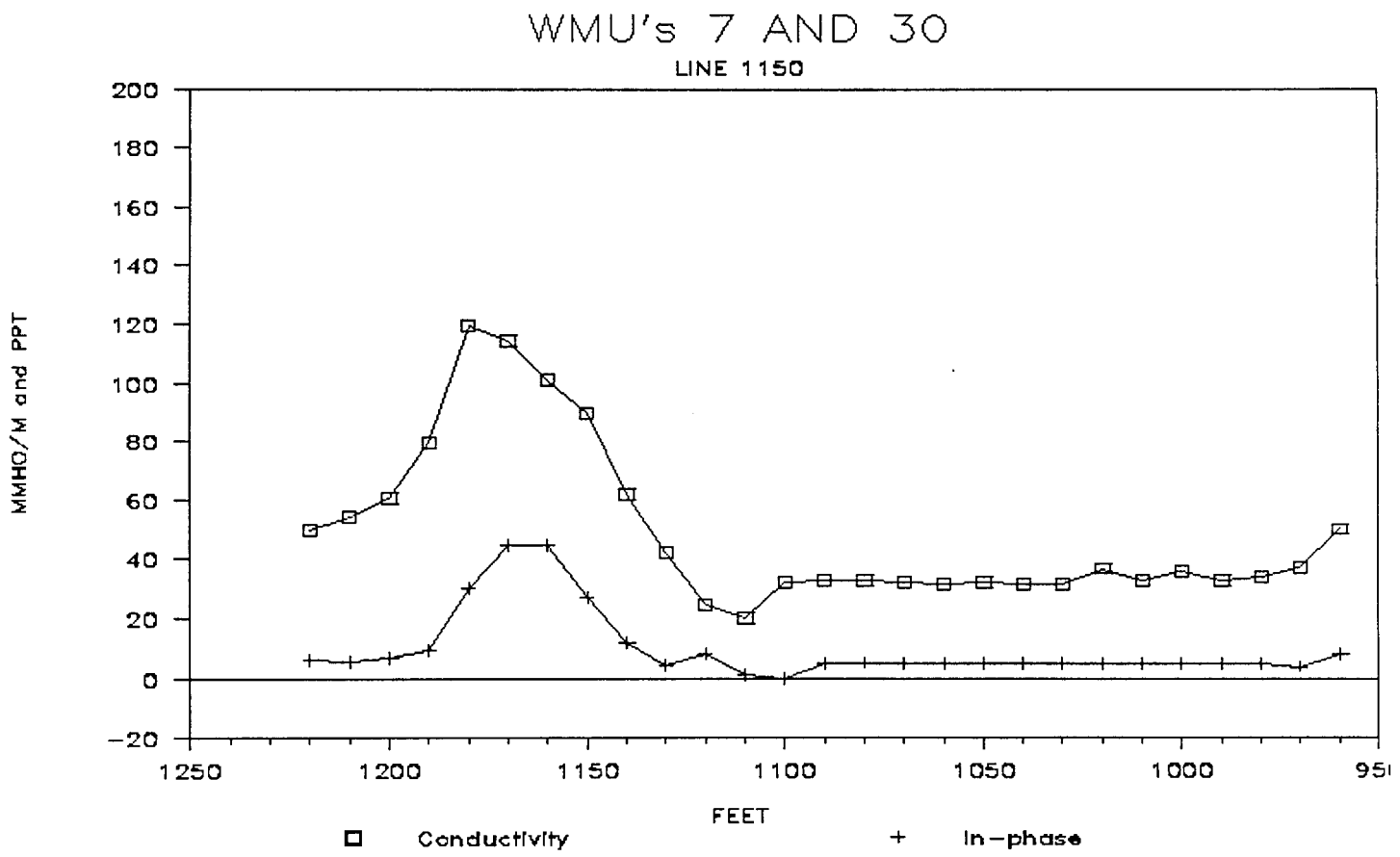

WMU's 7 AND 30
LINE 1050
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase

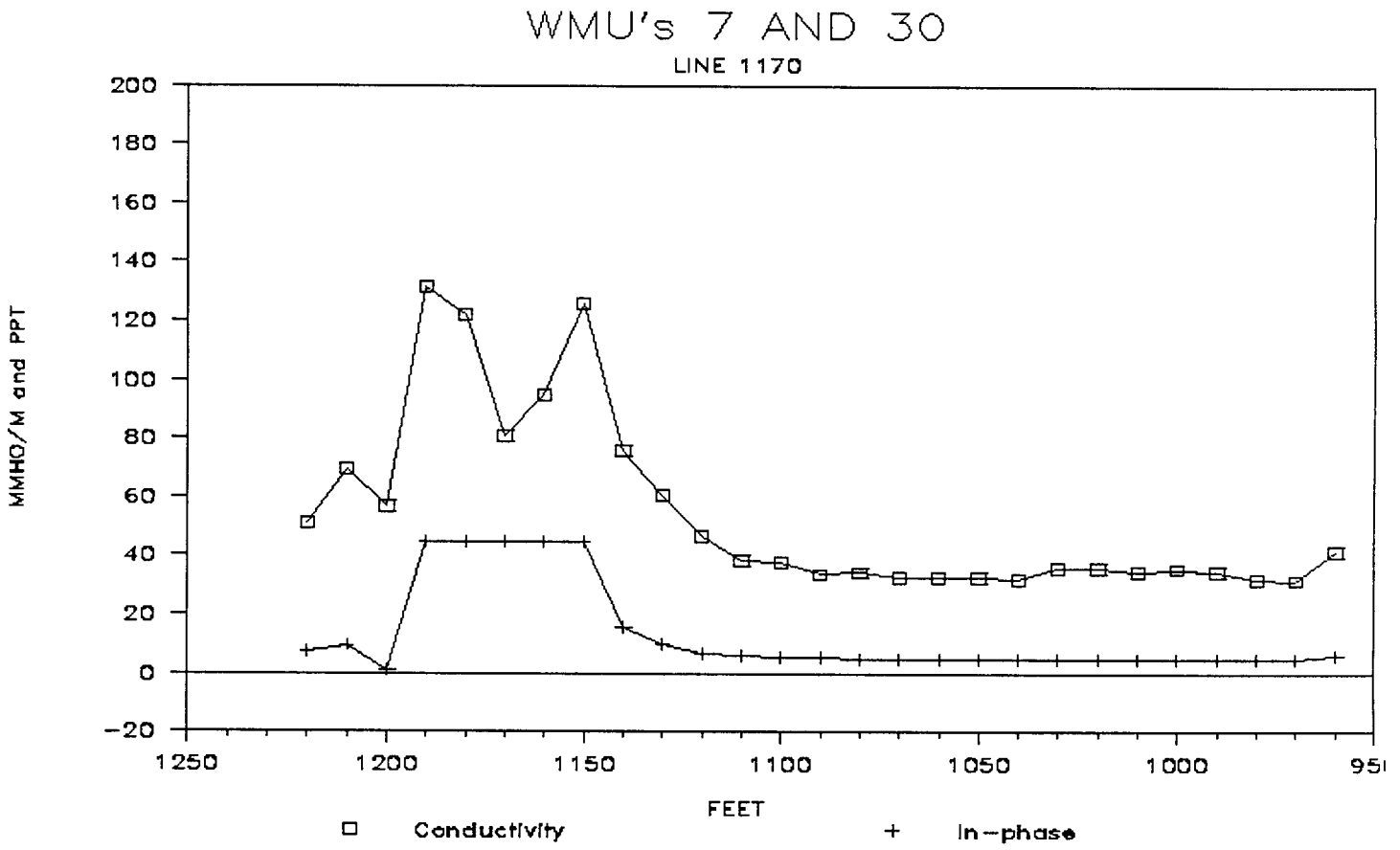

WMU's 7 AND 30
LINE 1070
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase

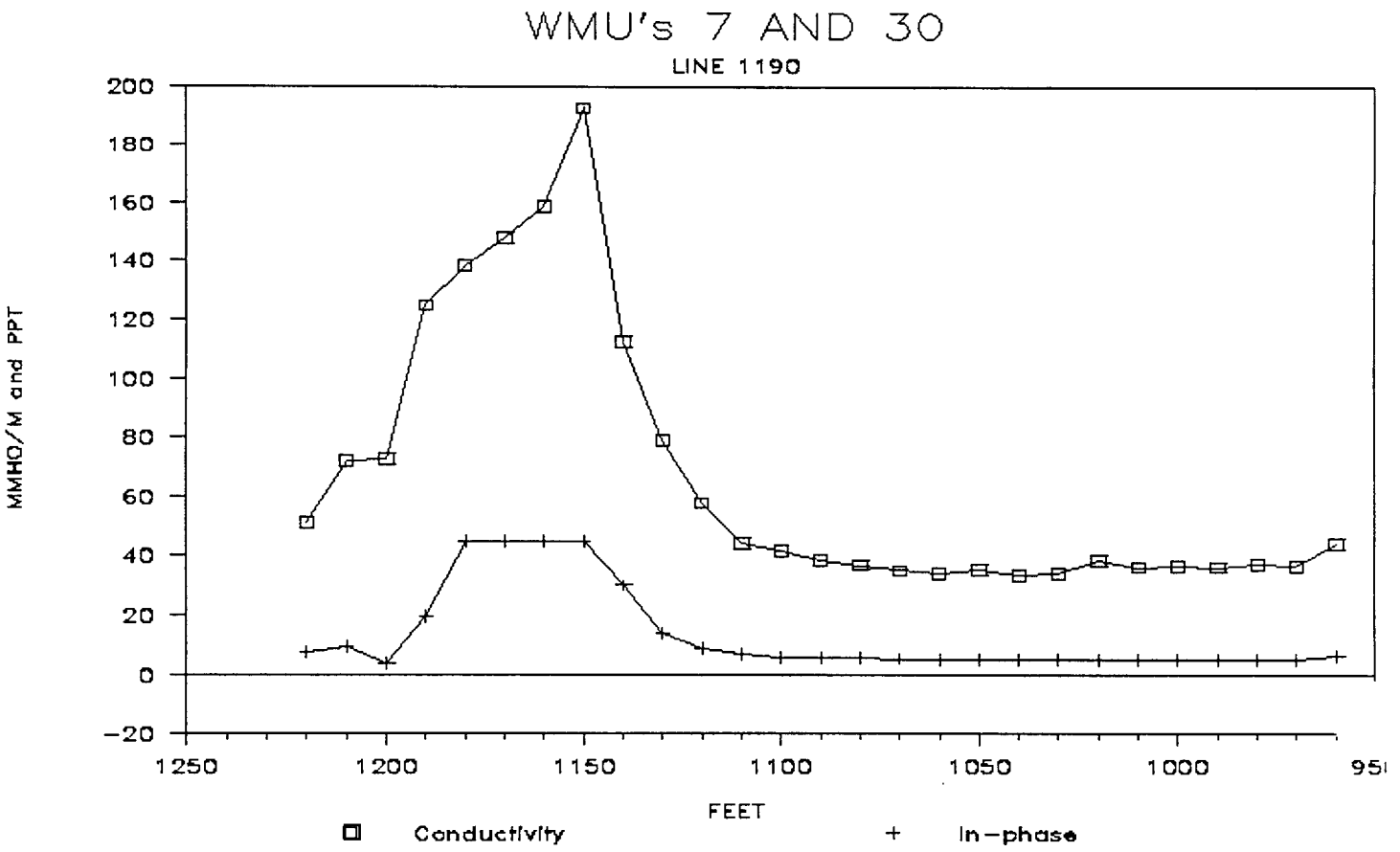

WMU's 7 AND 30
LINE 1090
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
951
FEET
Conductivity
In-phase

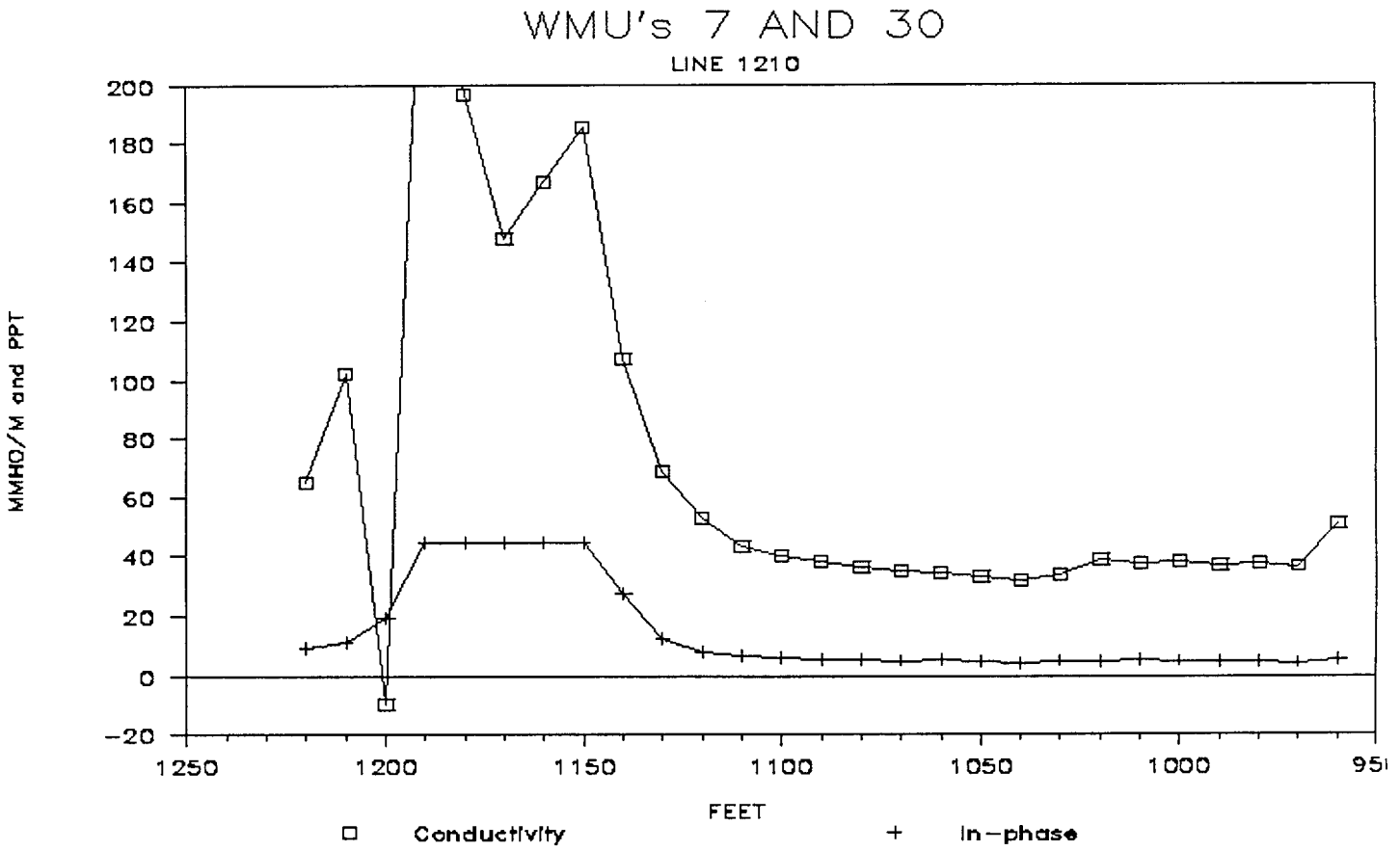

WMU's 7 AND 30
LINE 1110
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
951
FEET
Conductivity
In-phase

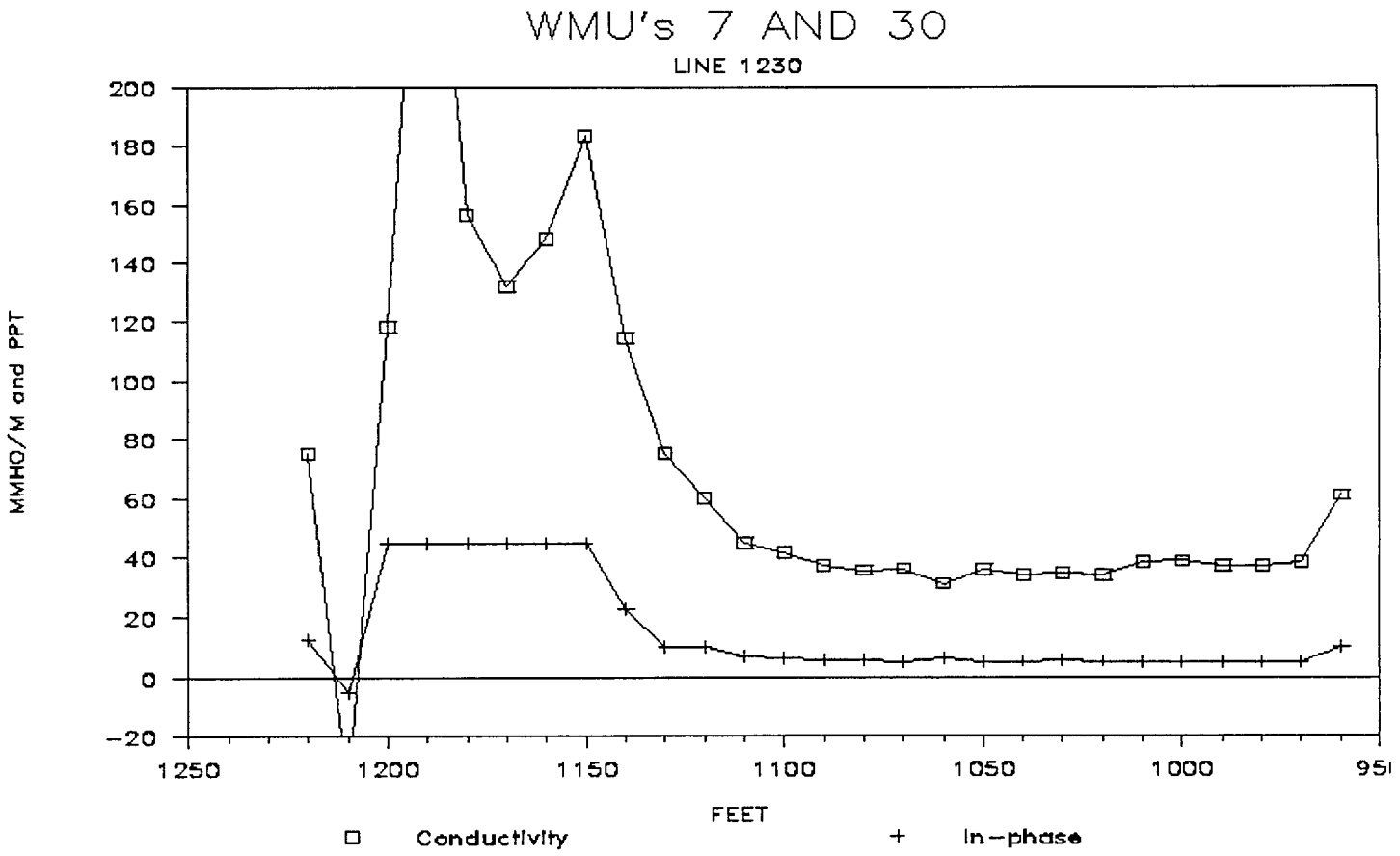

WMU's 7 AND 30
LINE 1130
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase

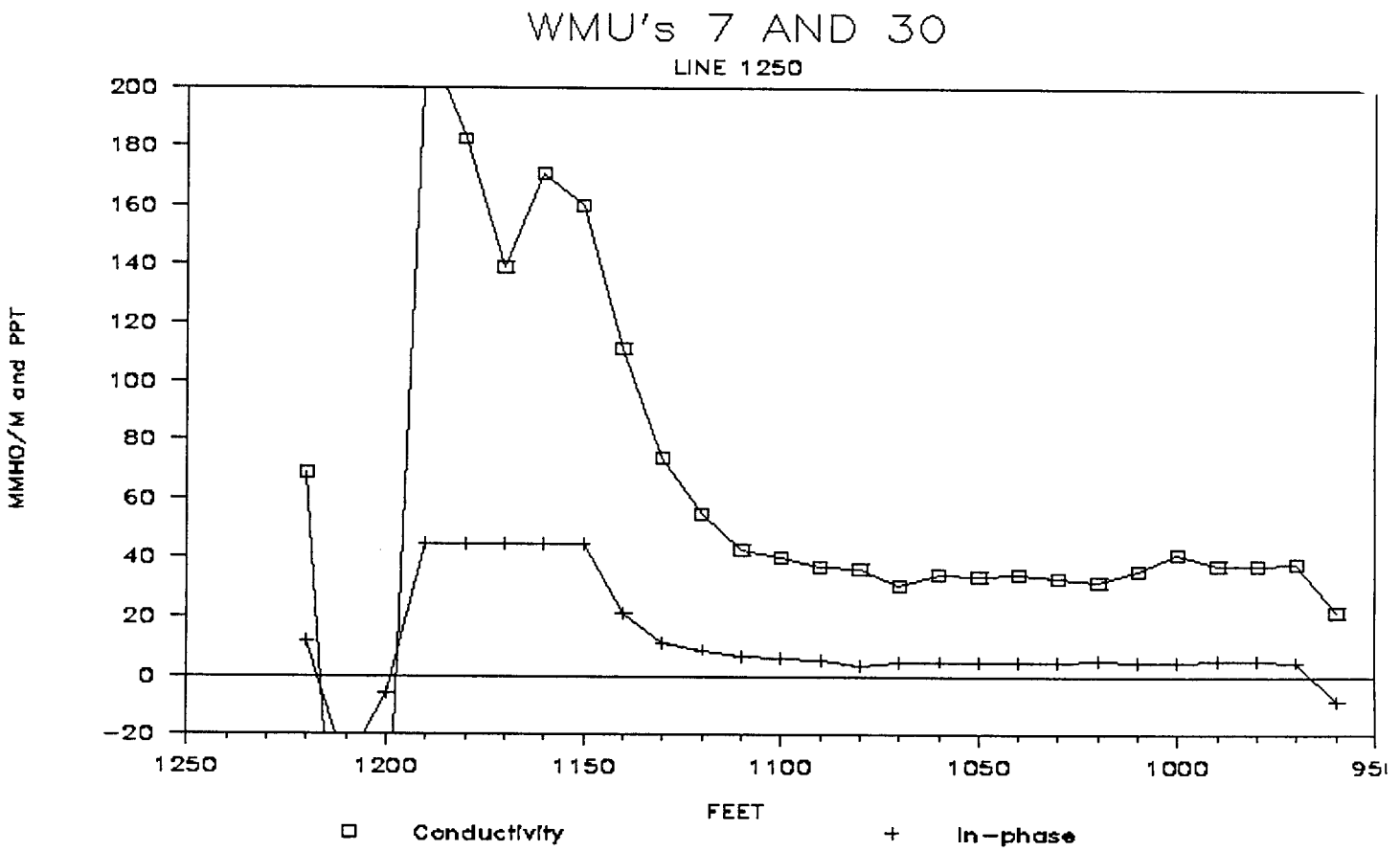

WMU's 7 AND 30
LINE 1150
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase

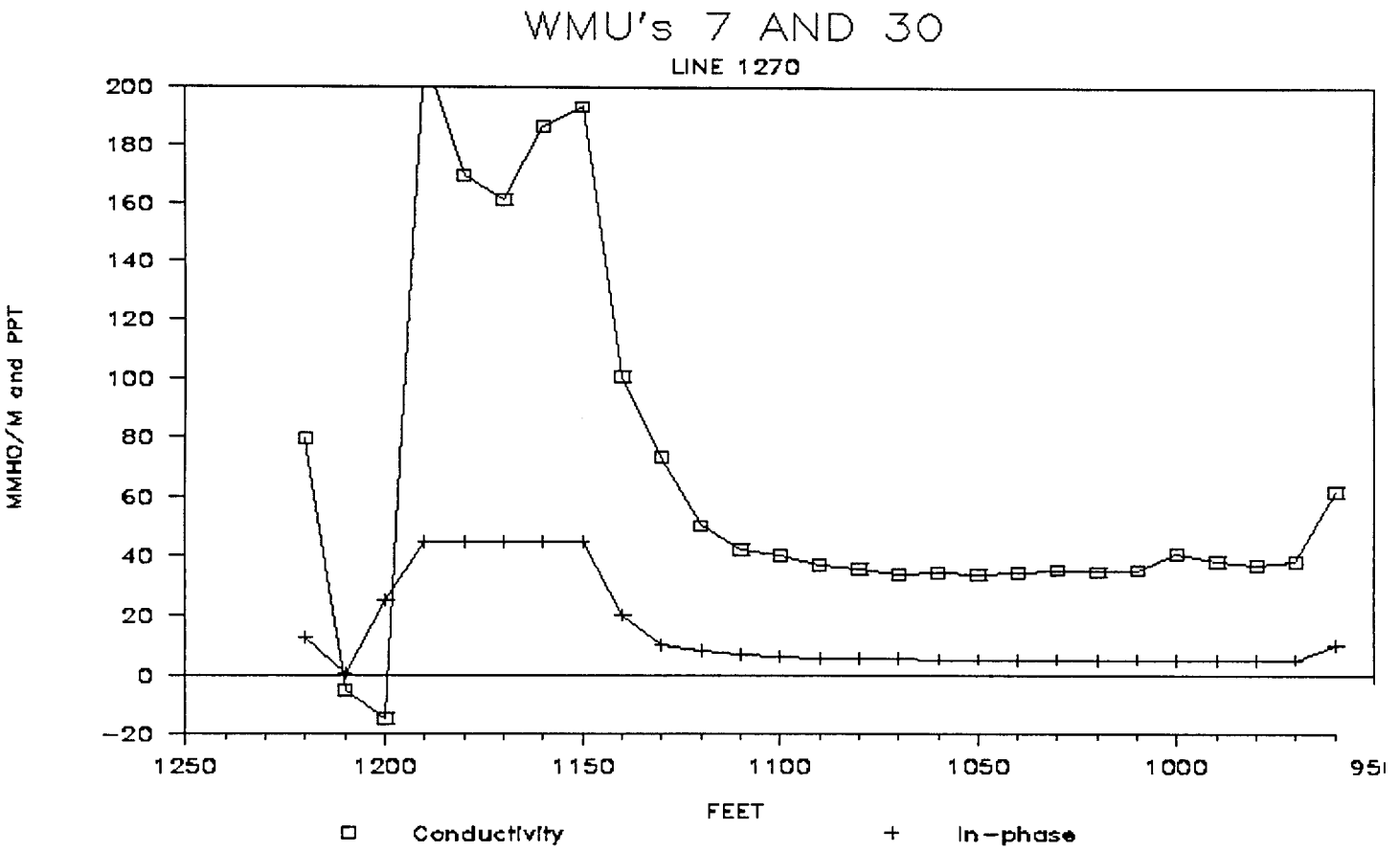

WMU's 7 AND 30
LINE 1170
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase

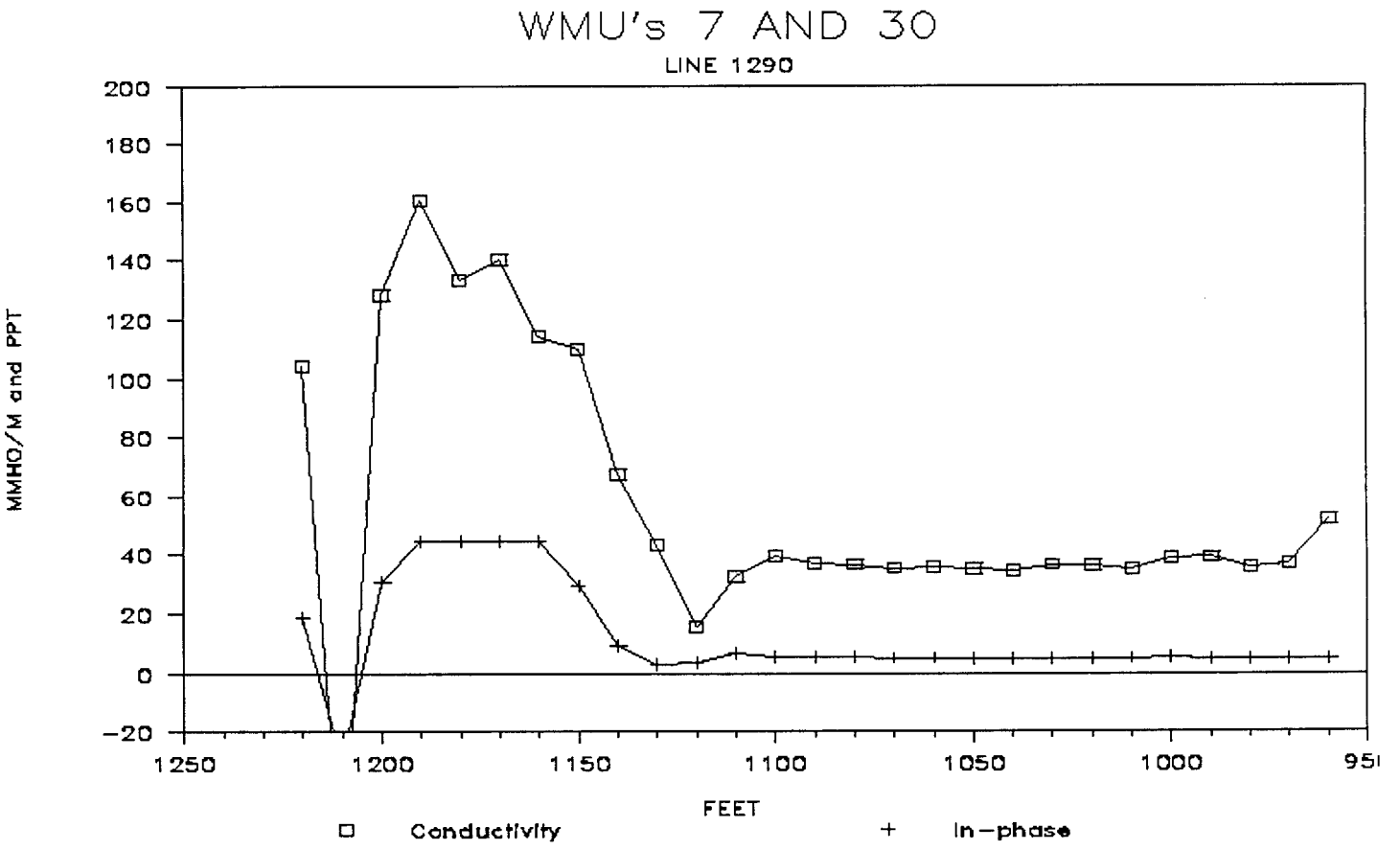

WMU's 7 AND 30
LINE 1190
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase

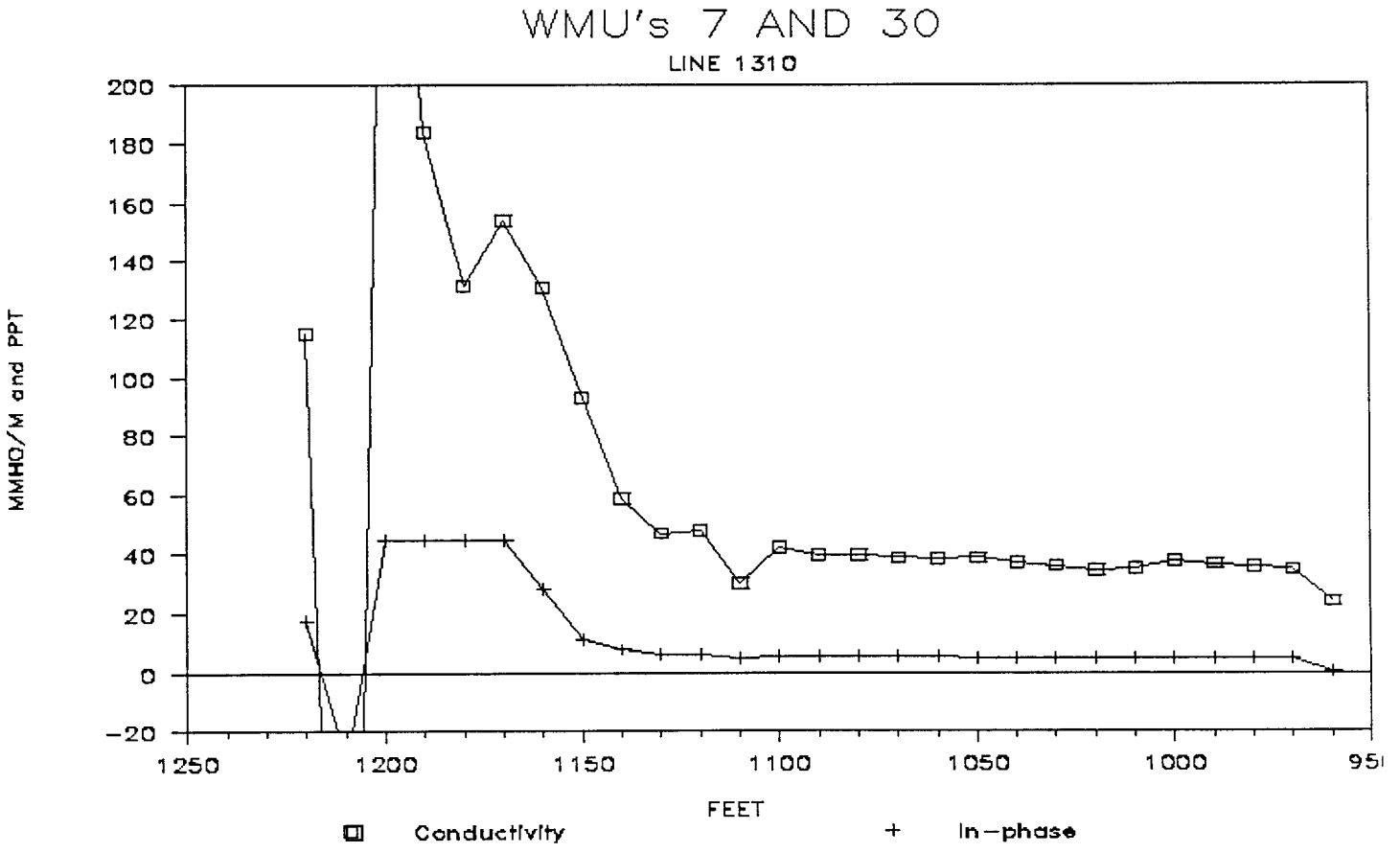

WMU's 7 AND 30
LINE 1210
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase

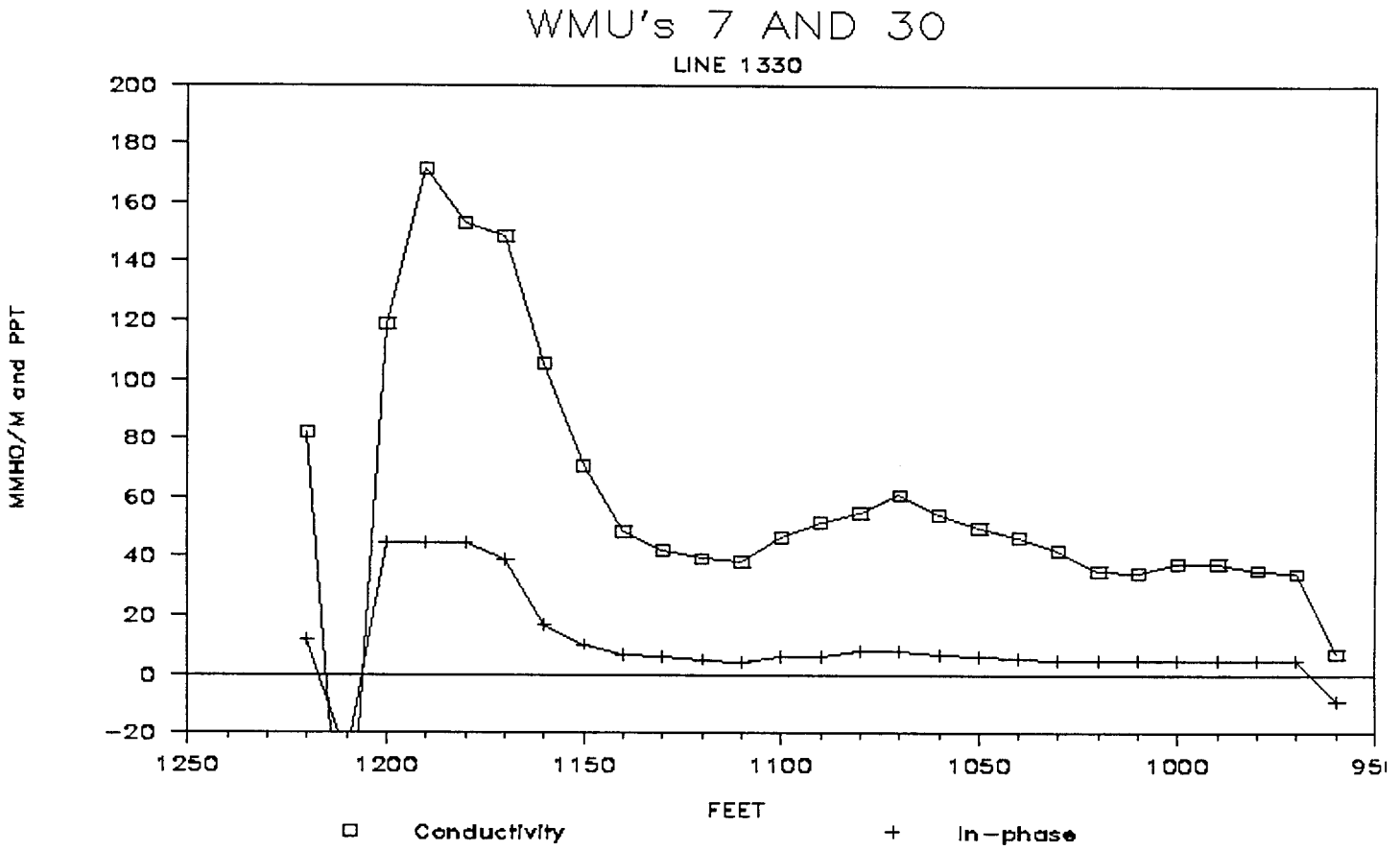

WMU's 7 AND 30
LINE 1230
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase

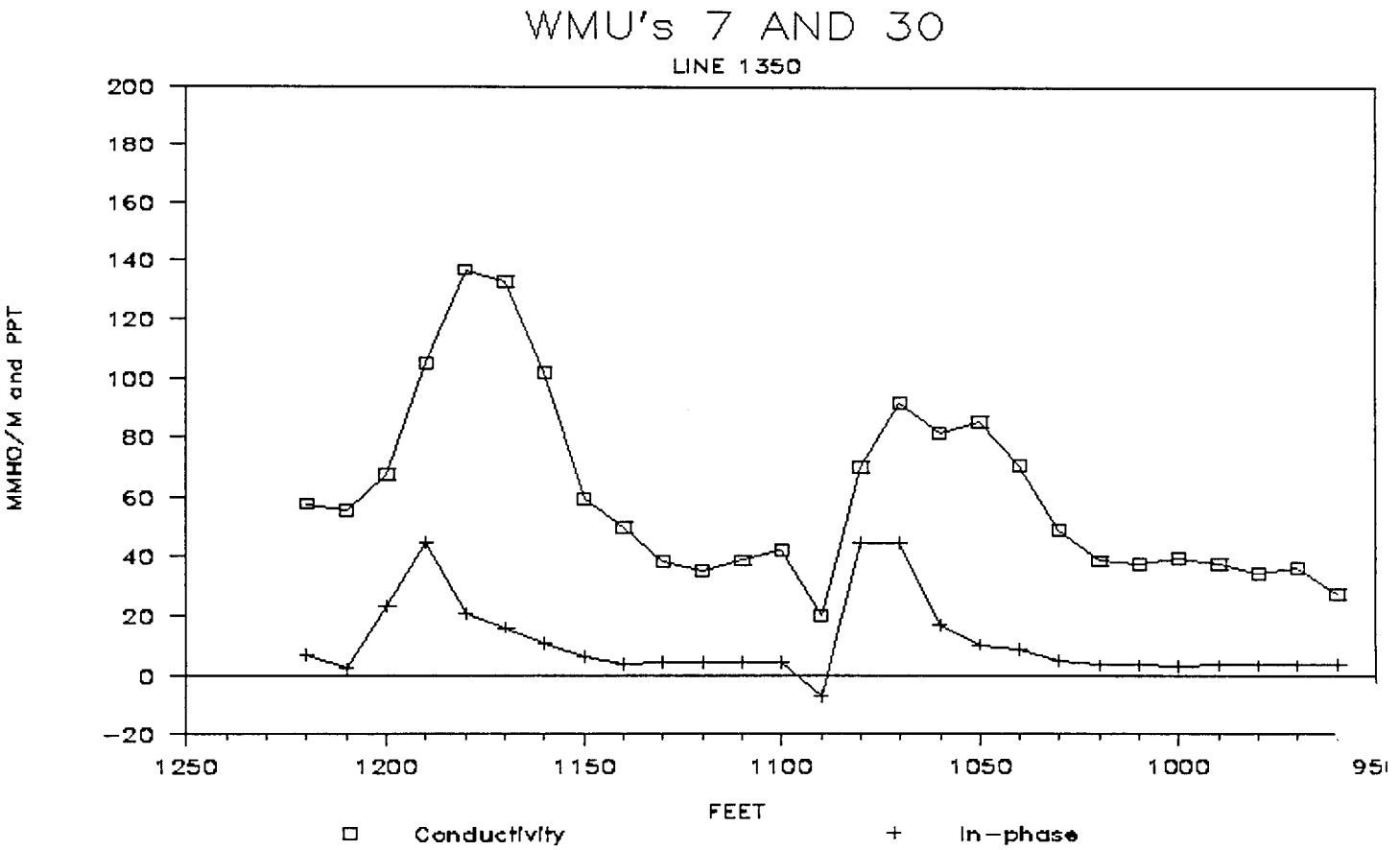

WMU's 7 AND 30
LINE 1250
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase

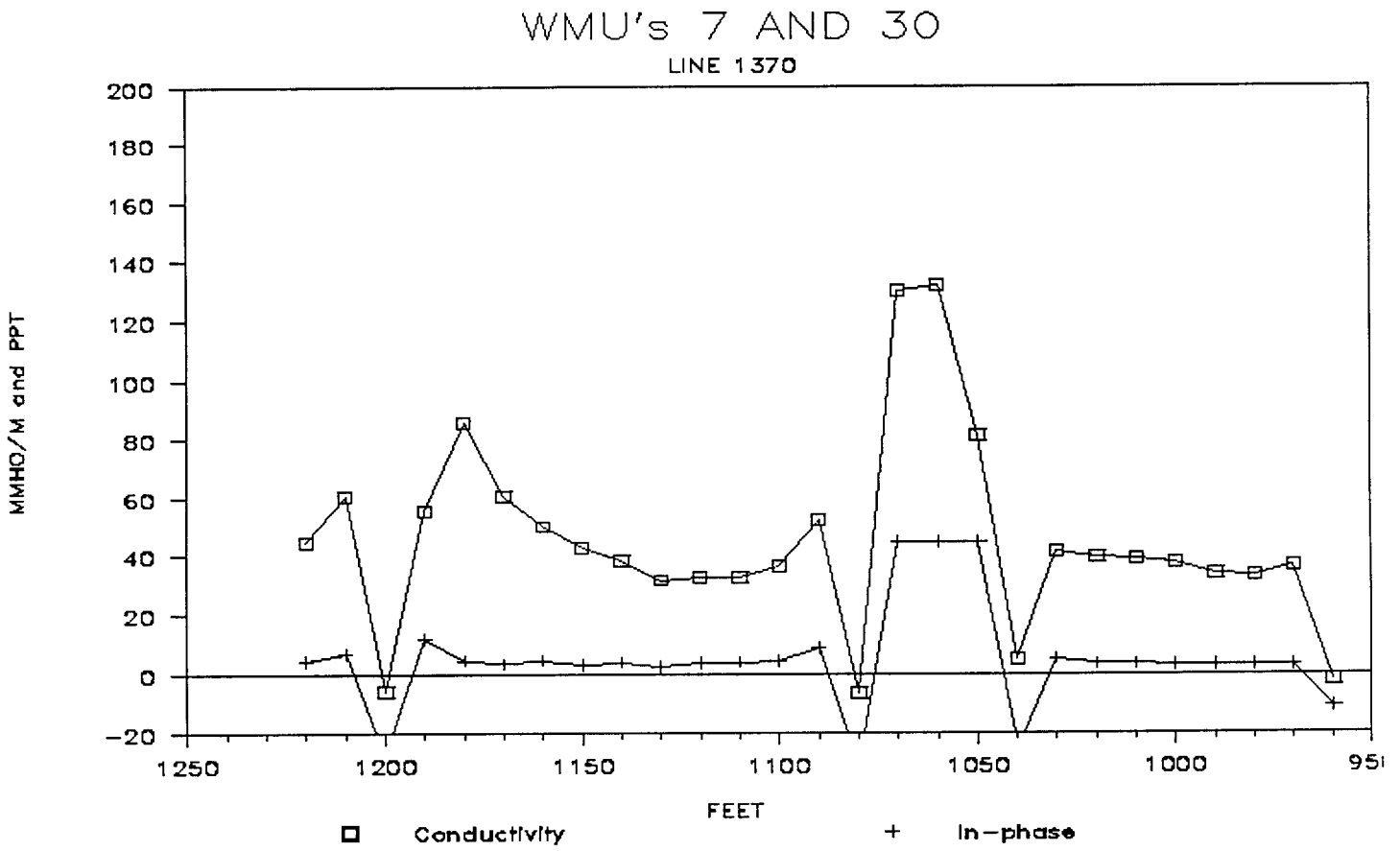

WMU's 7 AND 30
LINE 1270
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase

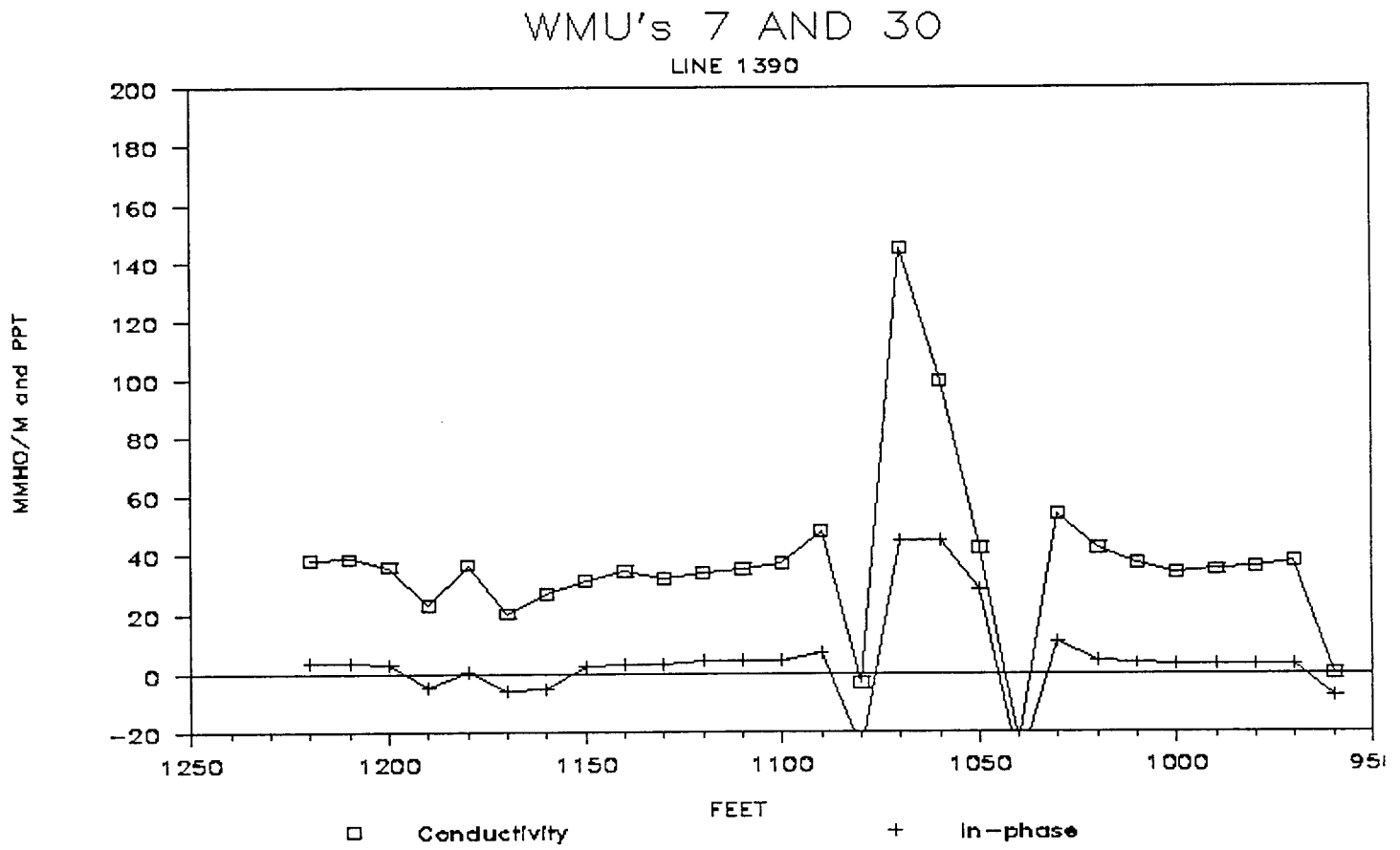

WMU's 7 AND 30
LINE 1290
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase

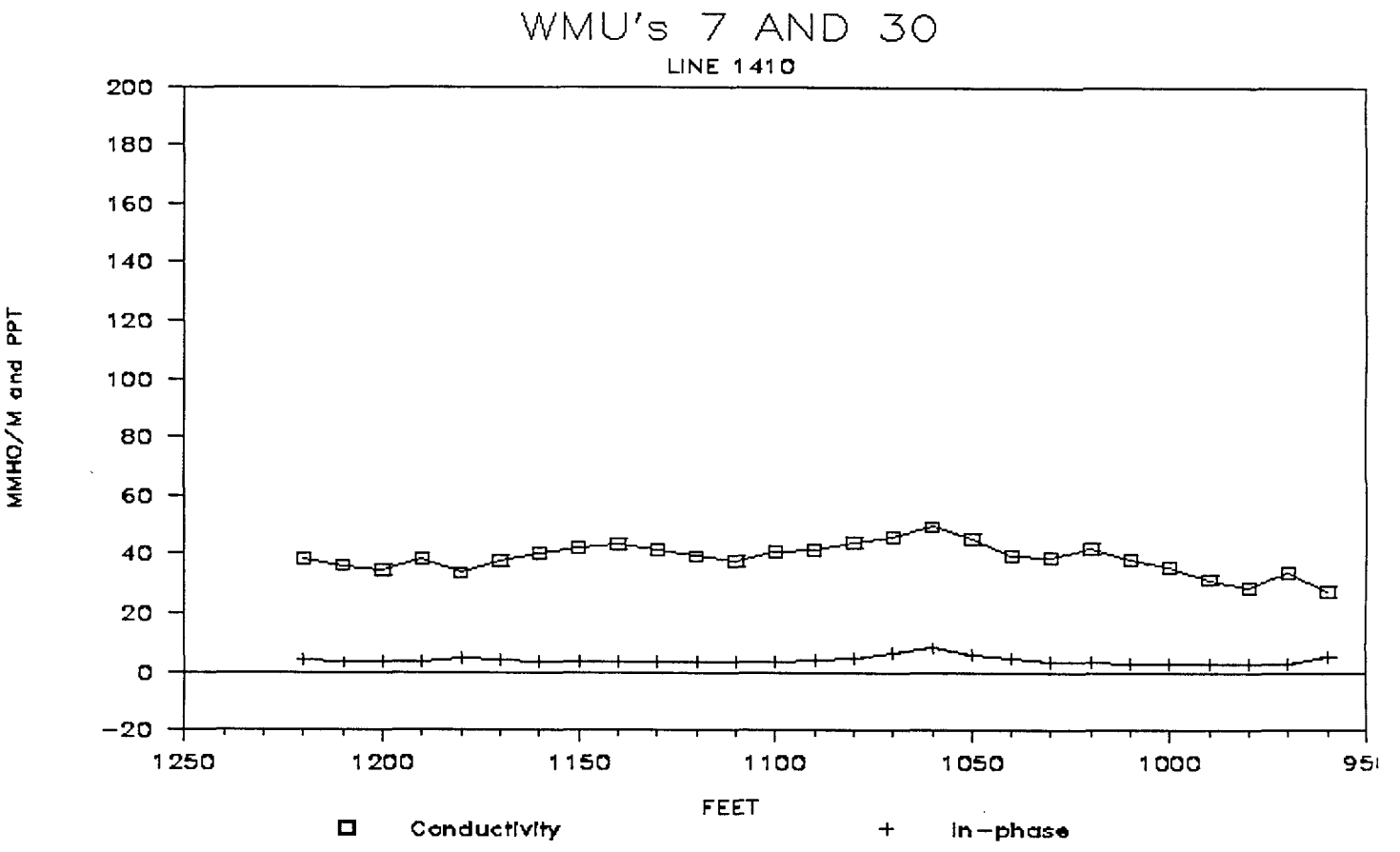

WMU's 7 AND 30
LINE 1310
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase

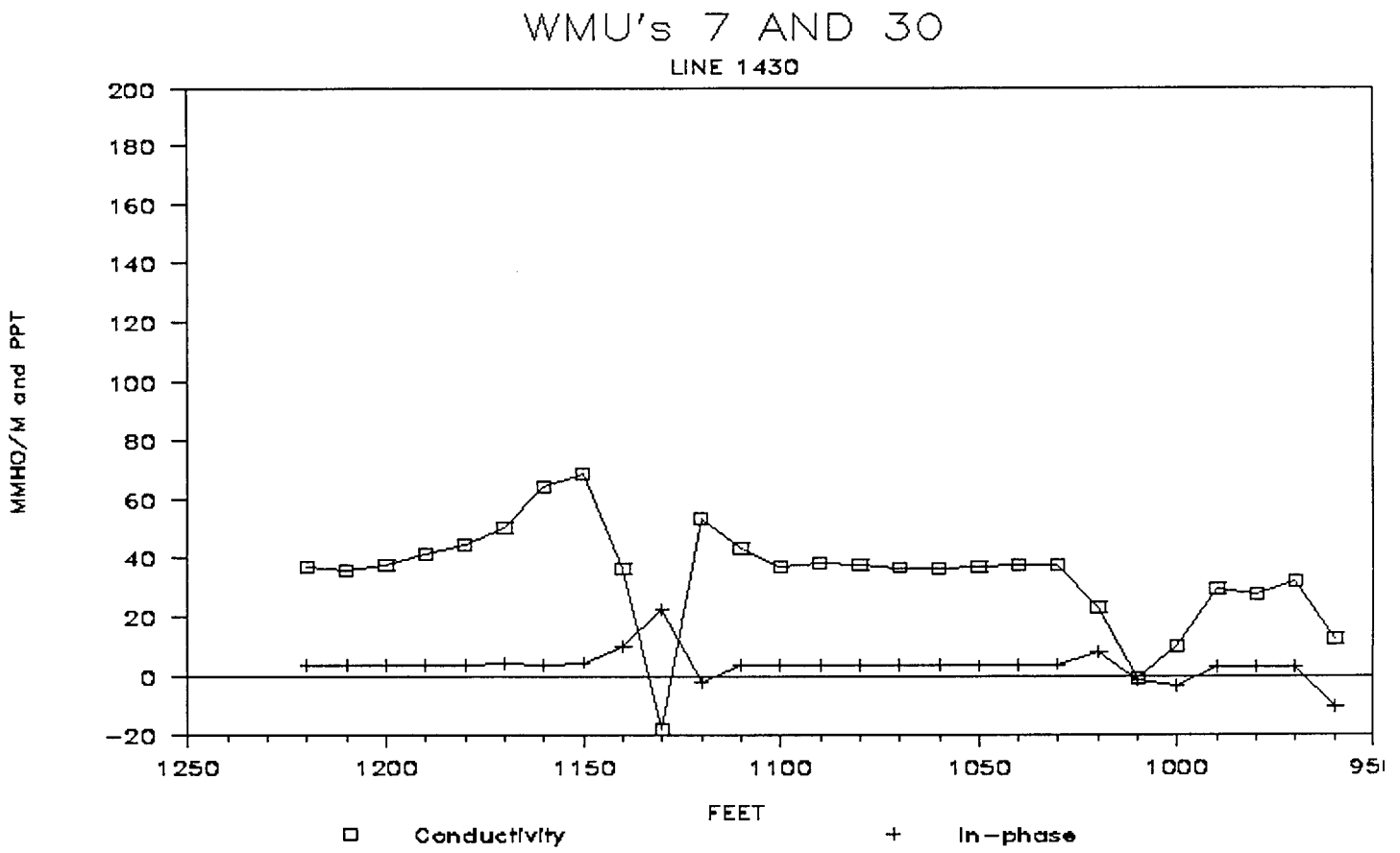

WMU's 7 AND 30
LINE 1330
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase


WMU's 7 AND 30
LINE 1350
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase


WMU's 7 AND 30
LINE 1370
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase


WMU's 7 AND 30
LINE 1390
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
In-phase


WMU's 7 AND 30
LINE 1410
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
1150
1100
1050
1000
FEET
Conductivity
+ In-phase


WMU's 7 AND 30
LINE 1430
MMHO/M and PPT
200
180
160
140
120
100
80
60
40
20
0
-20
1250
1200
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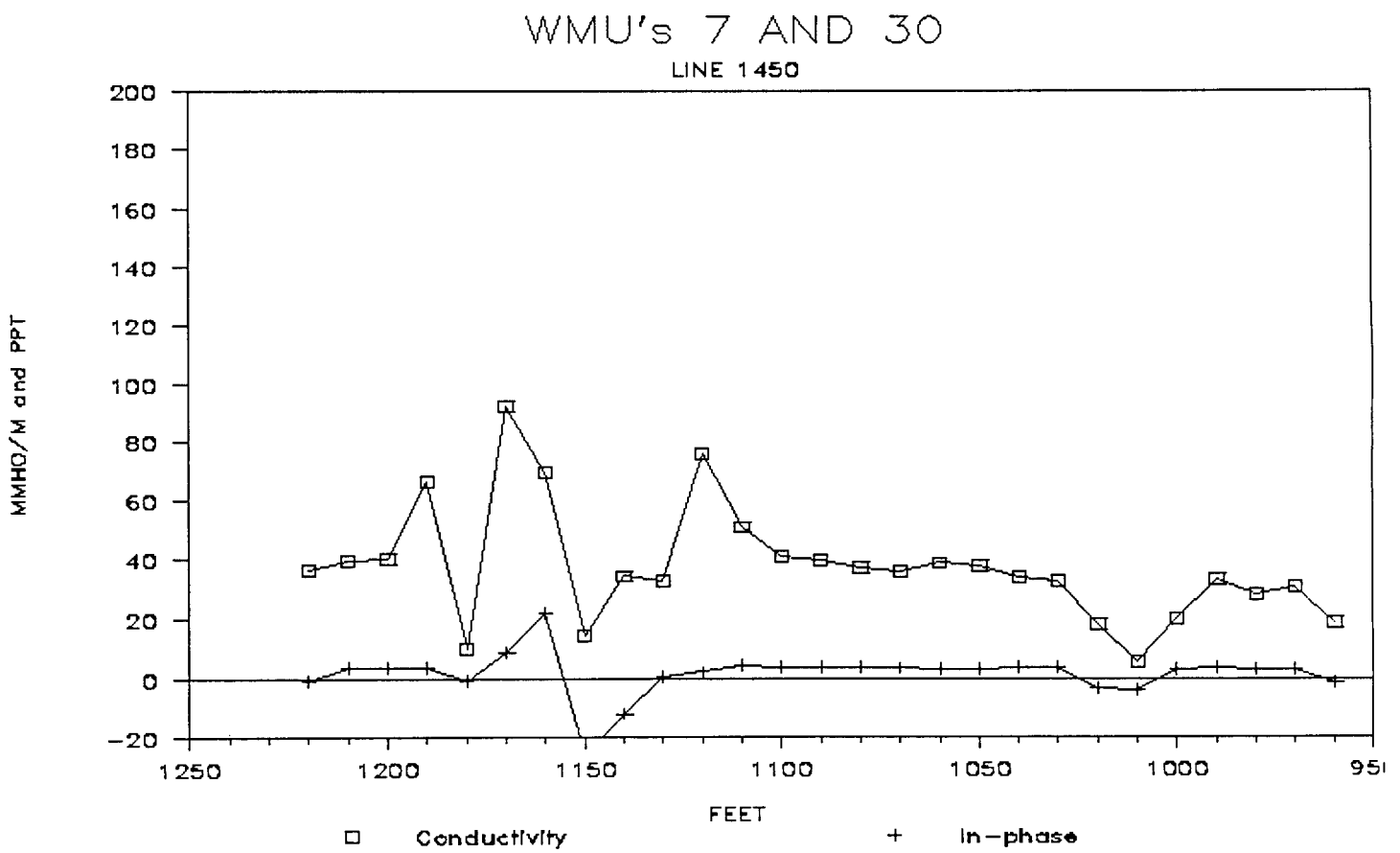
Conductivity
In-phase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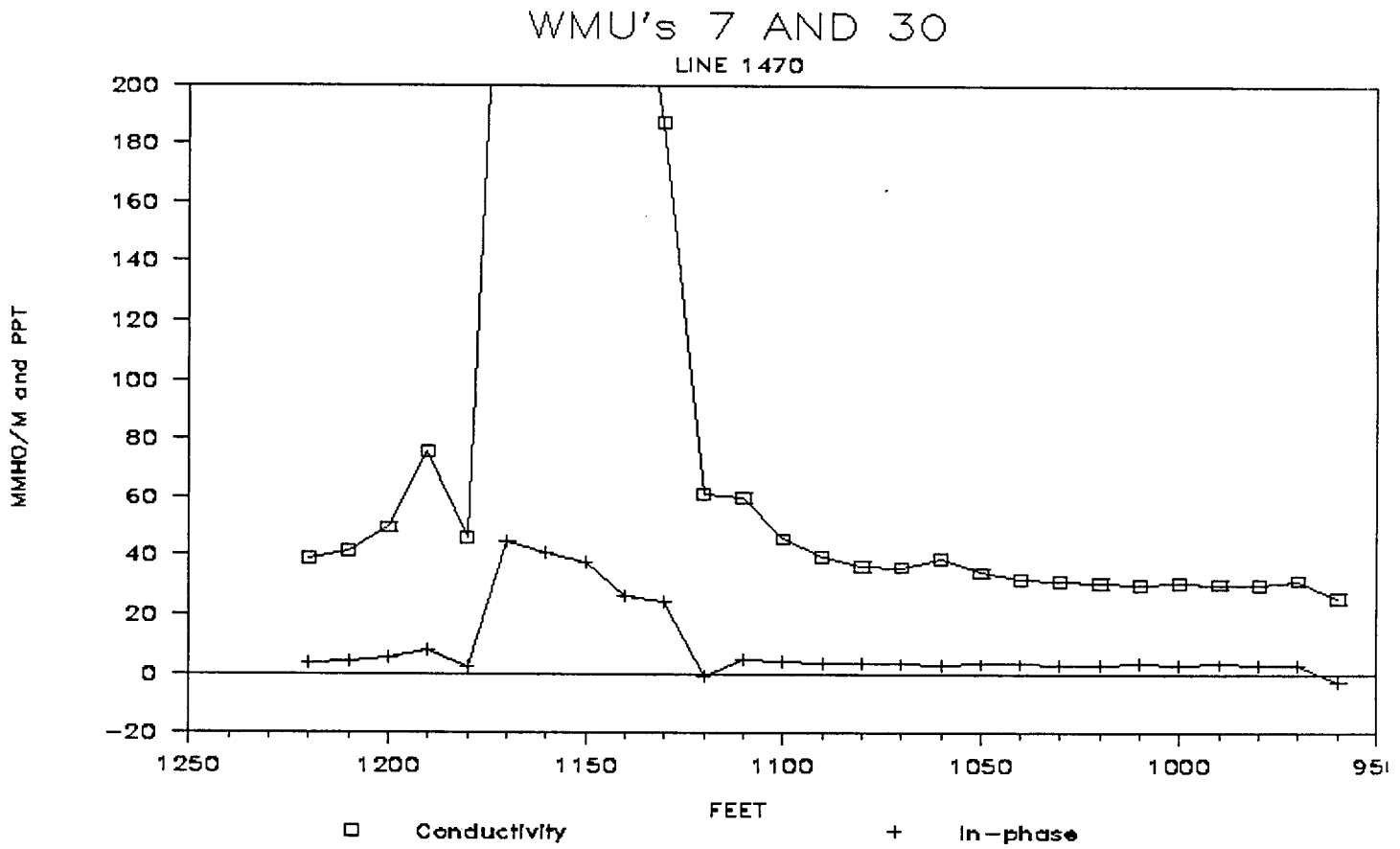
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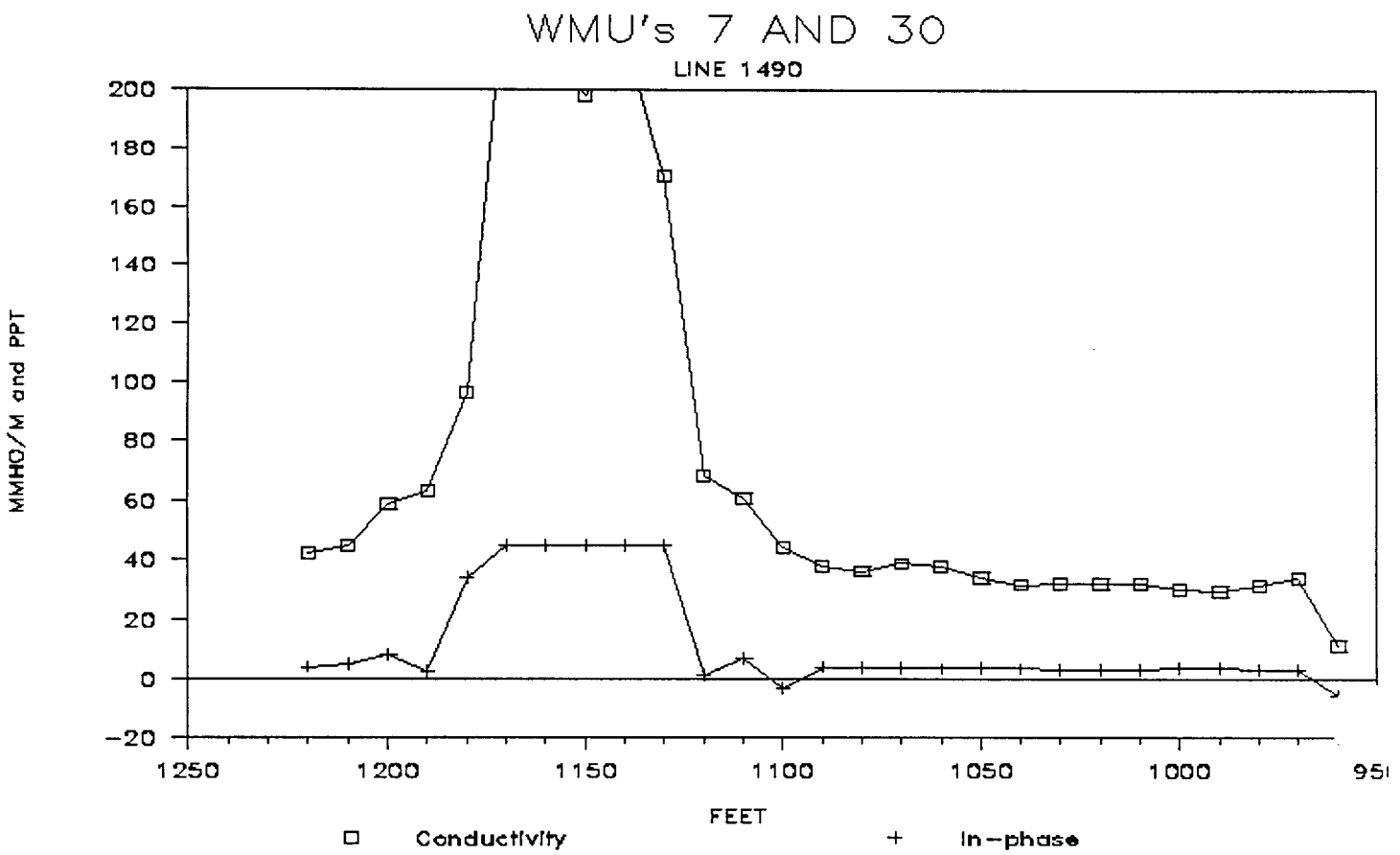
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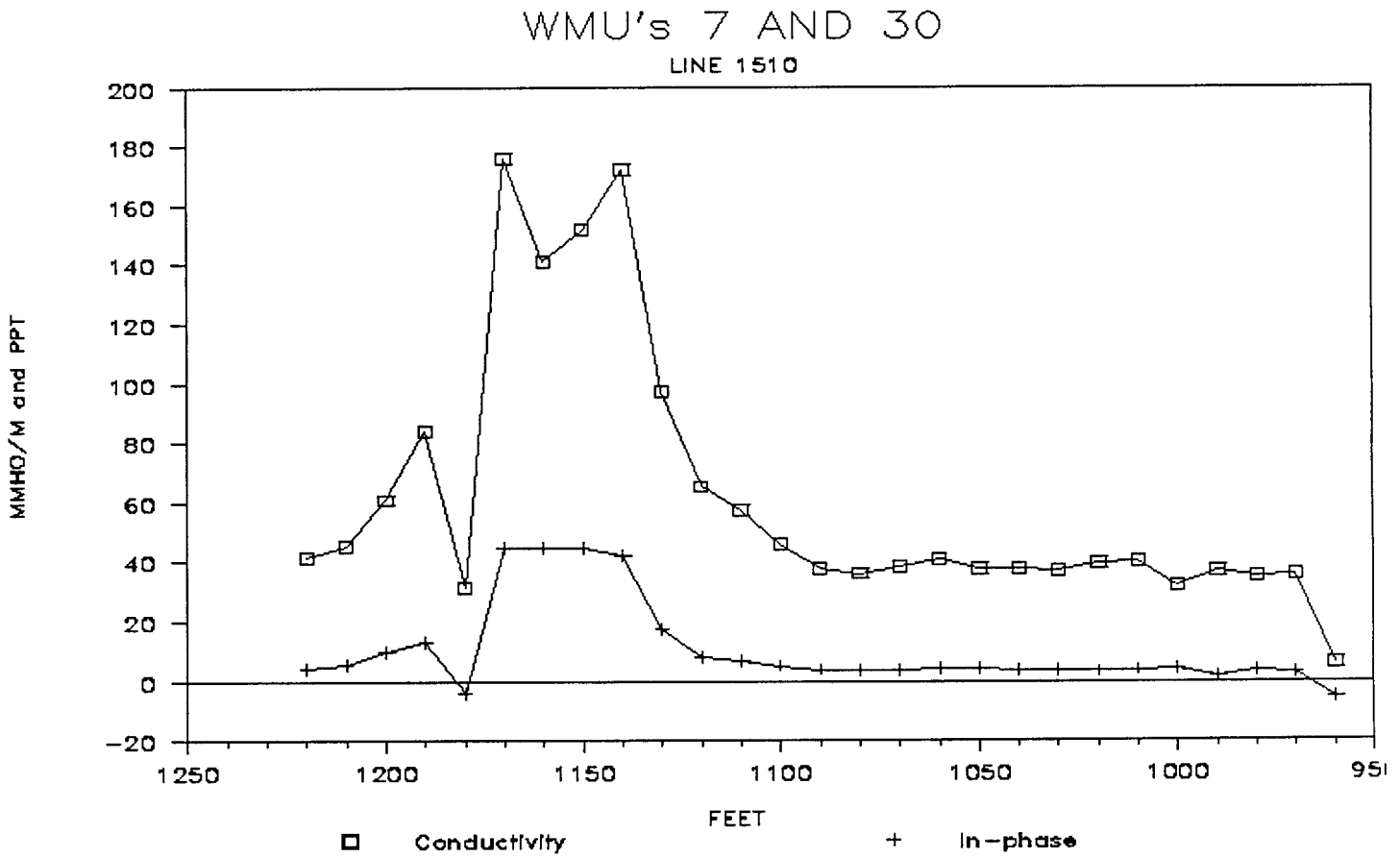
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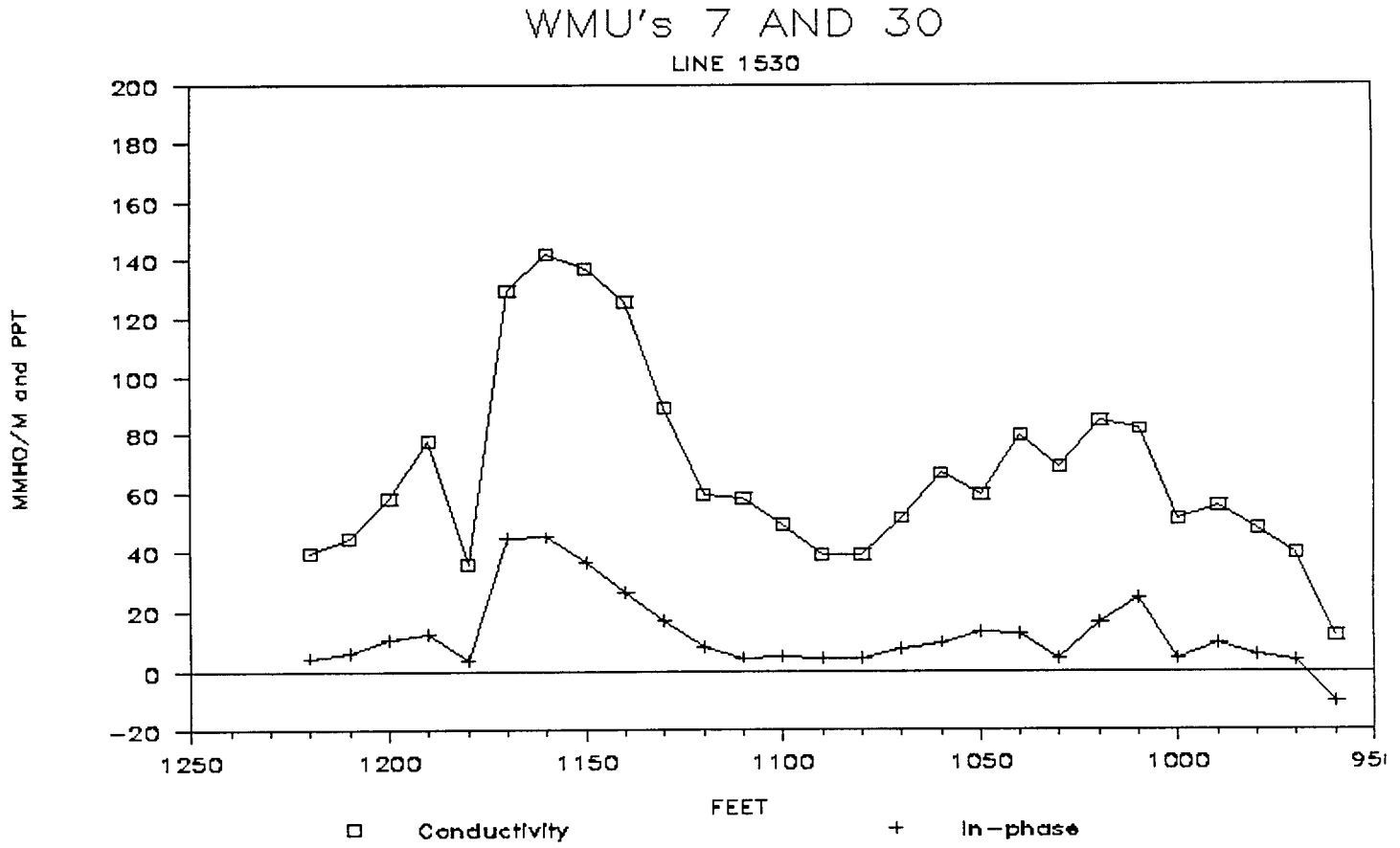
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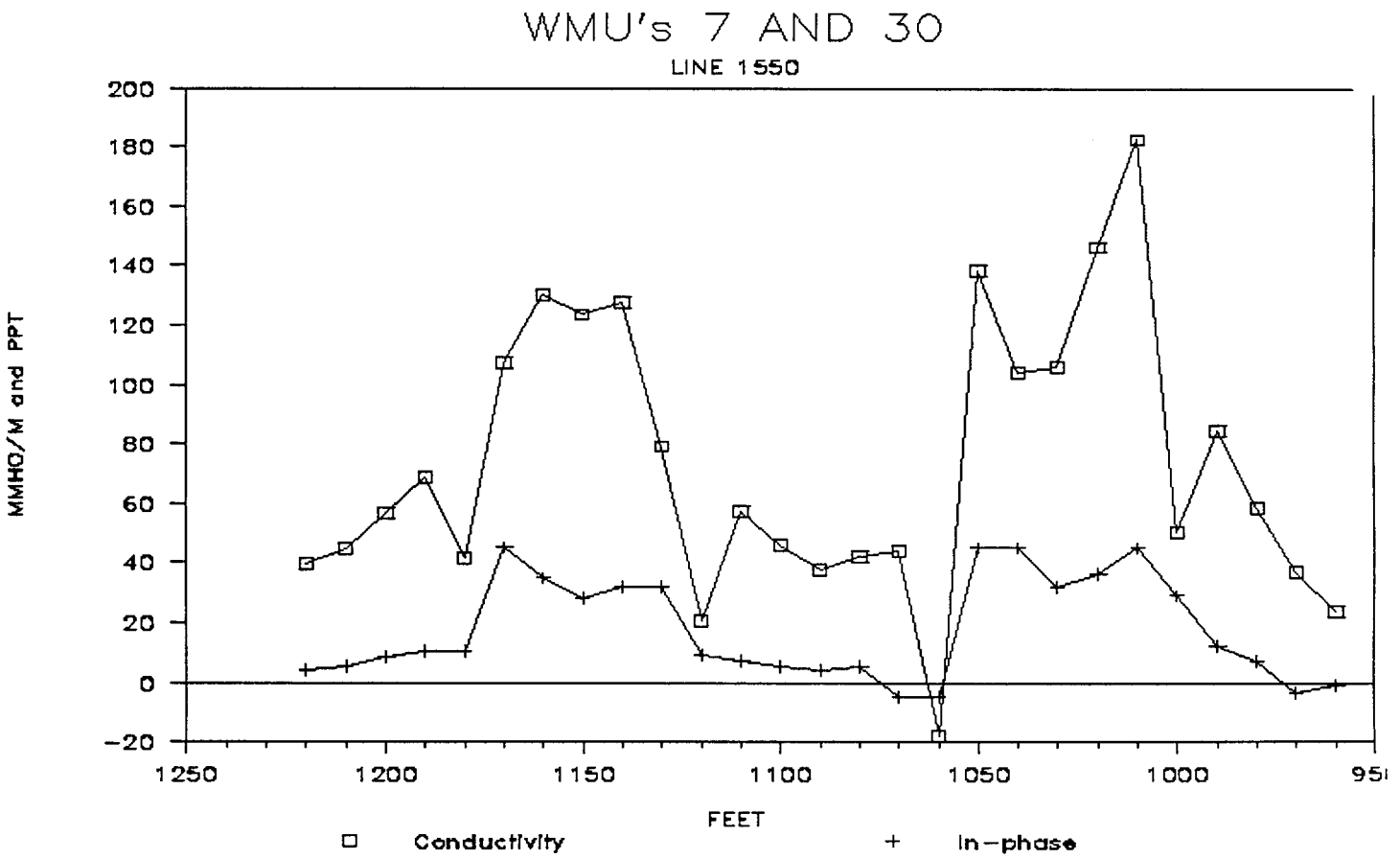
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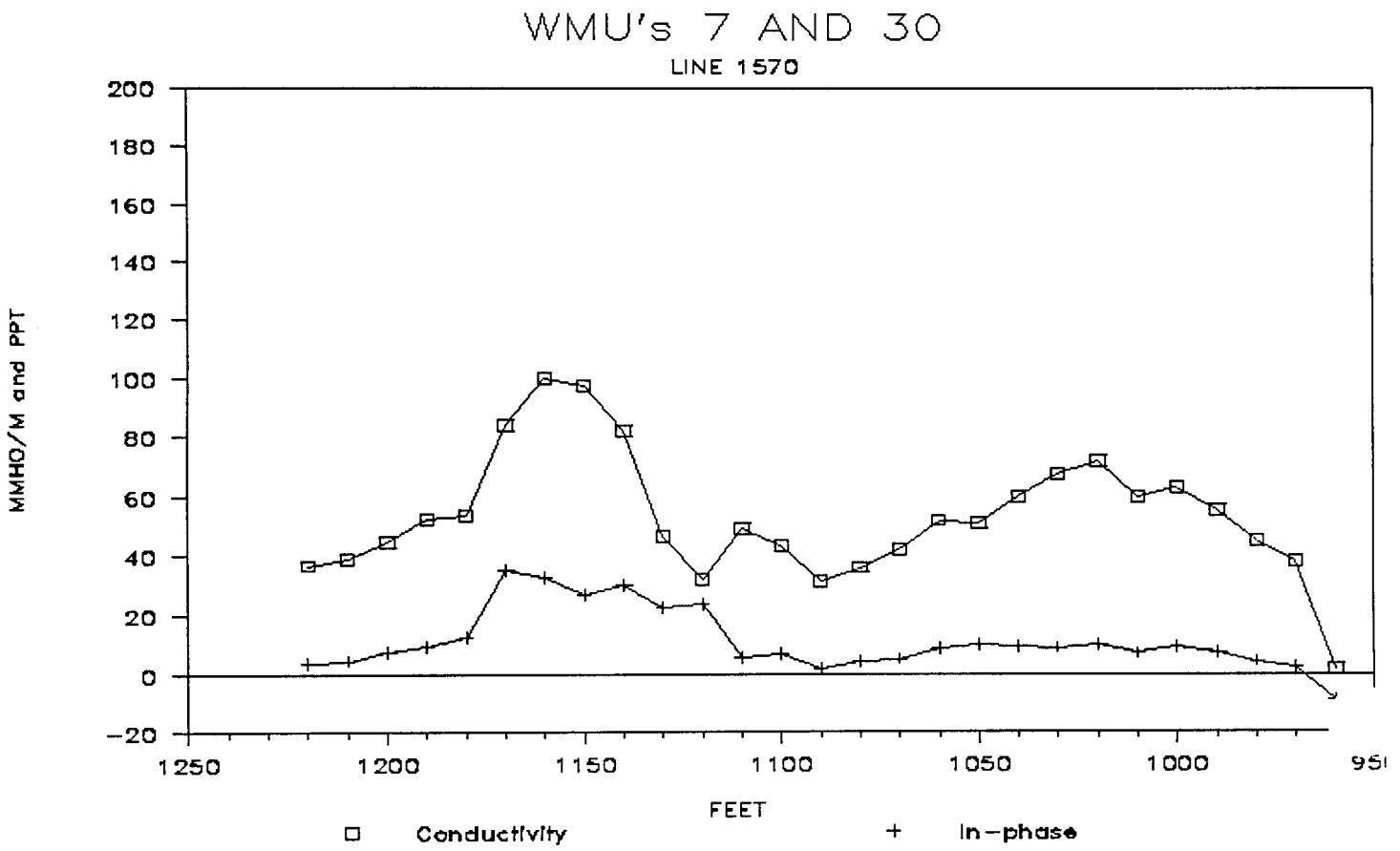
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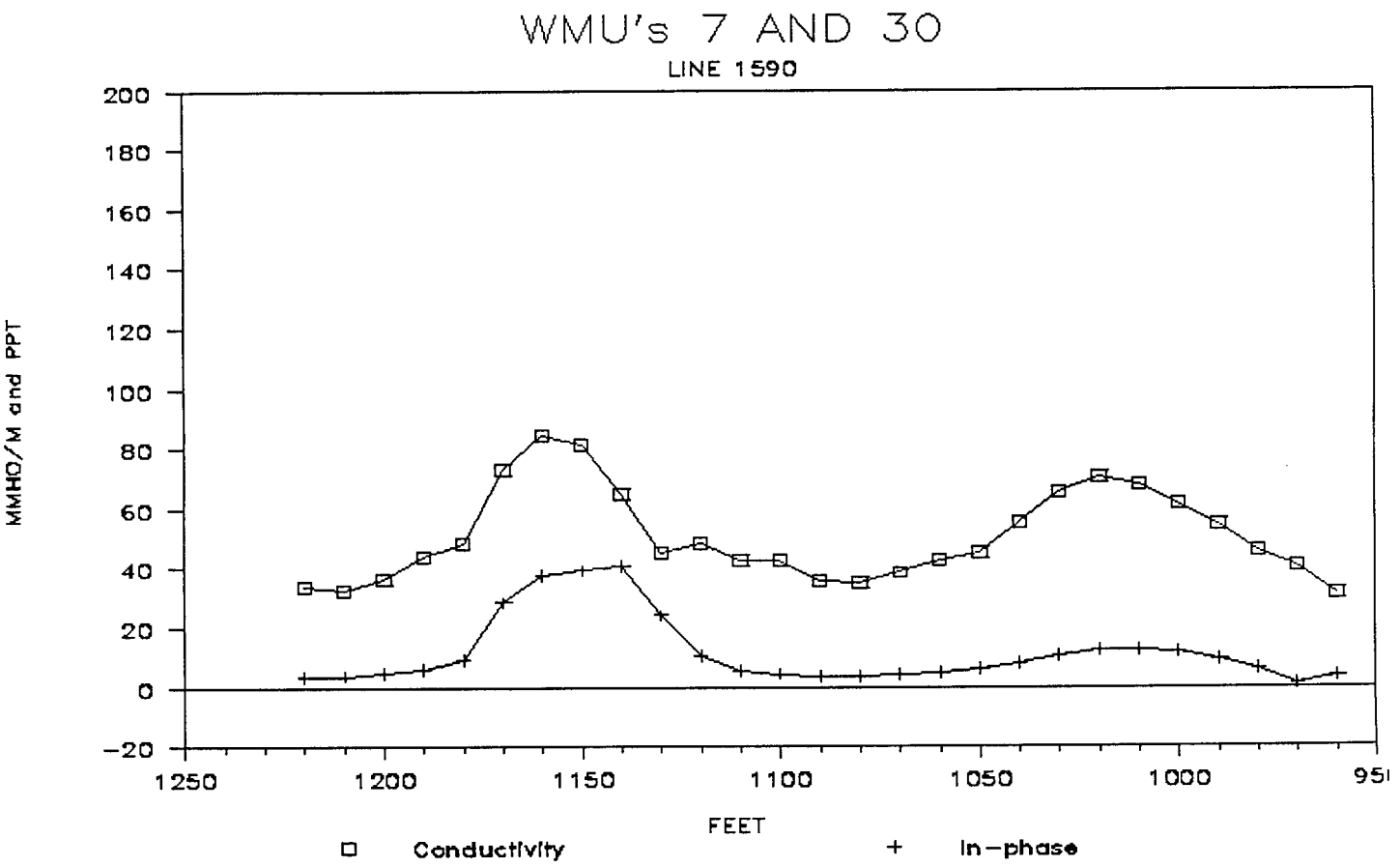
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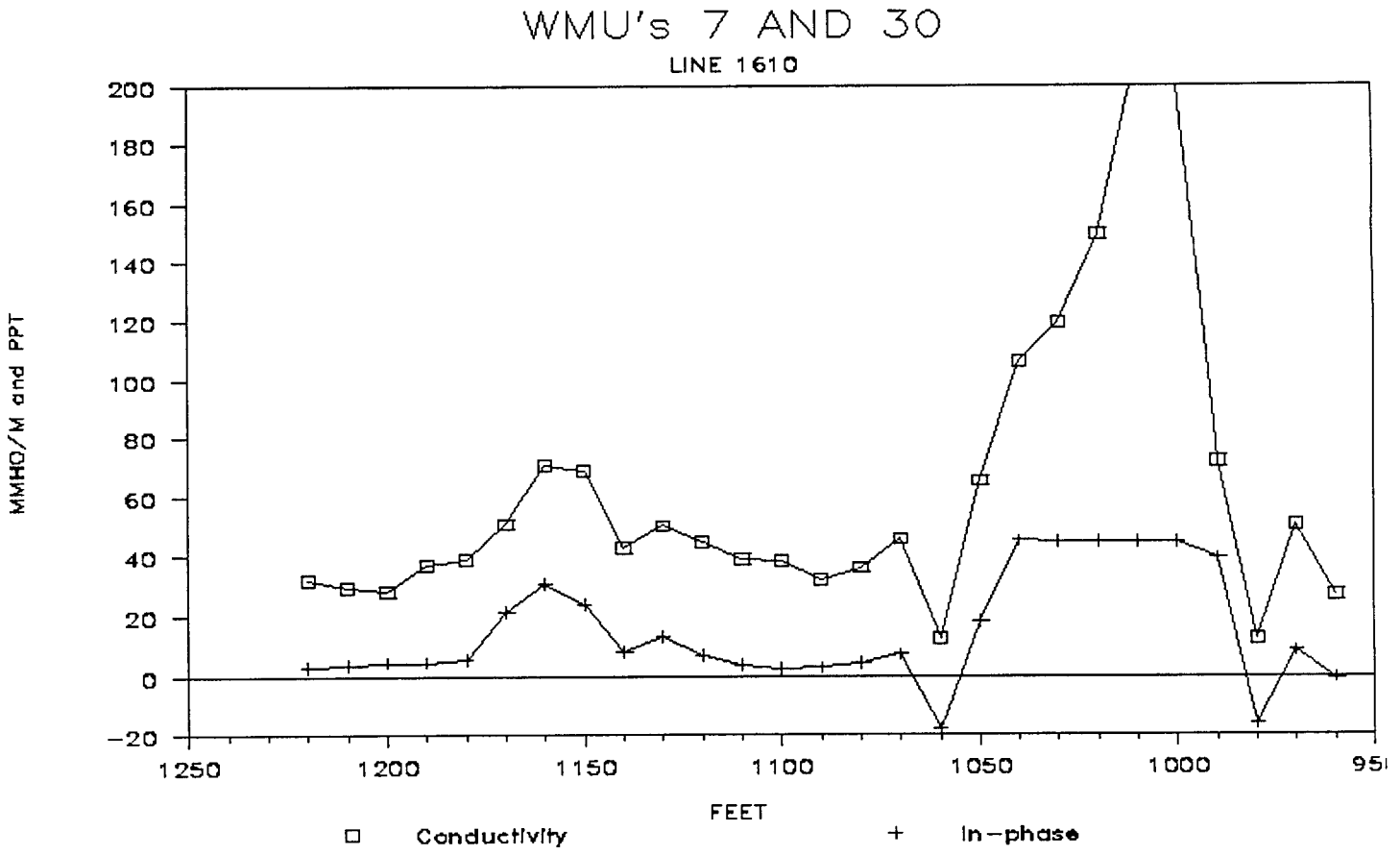
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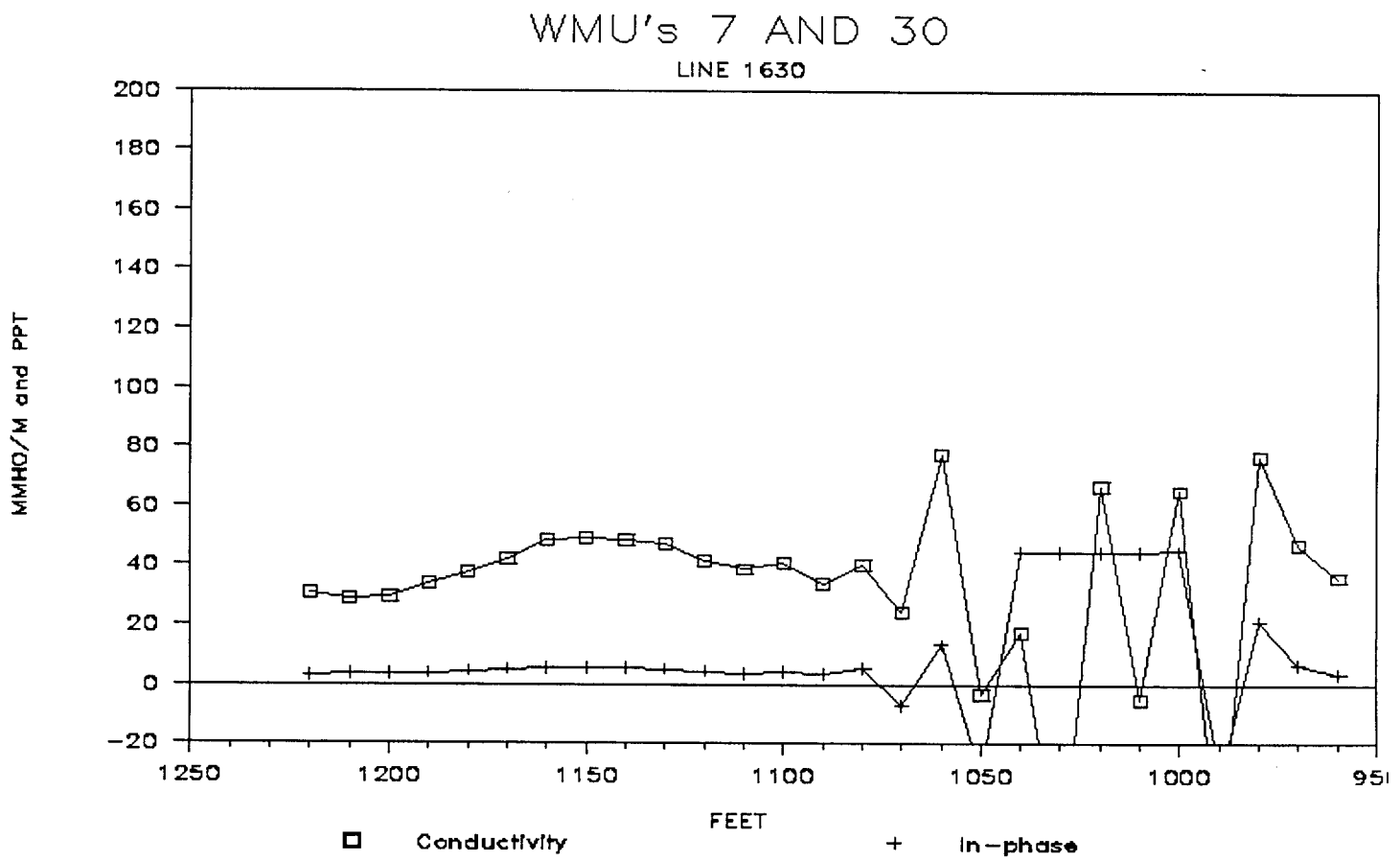
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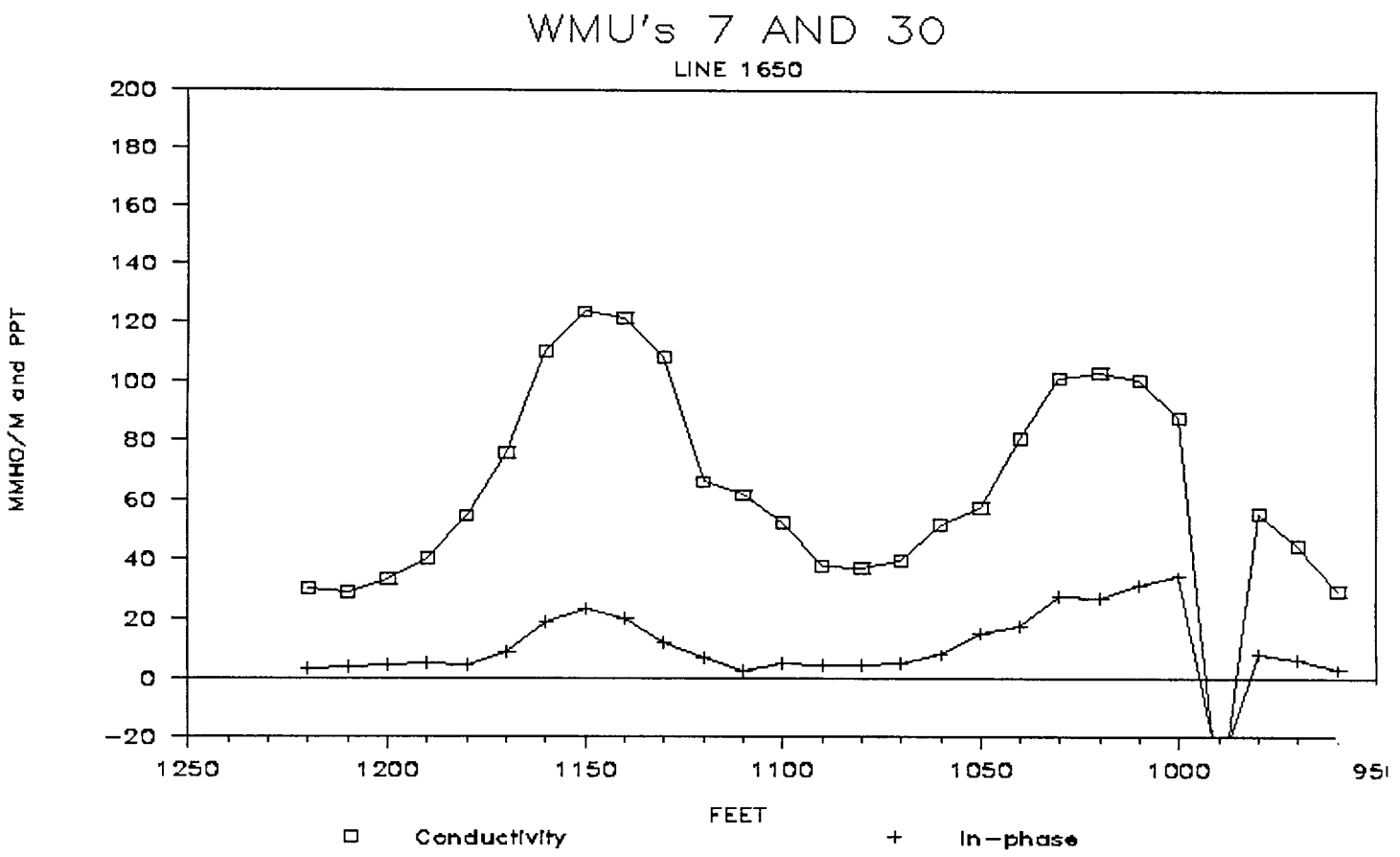
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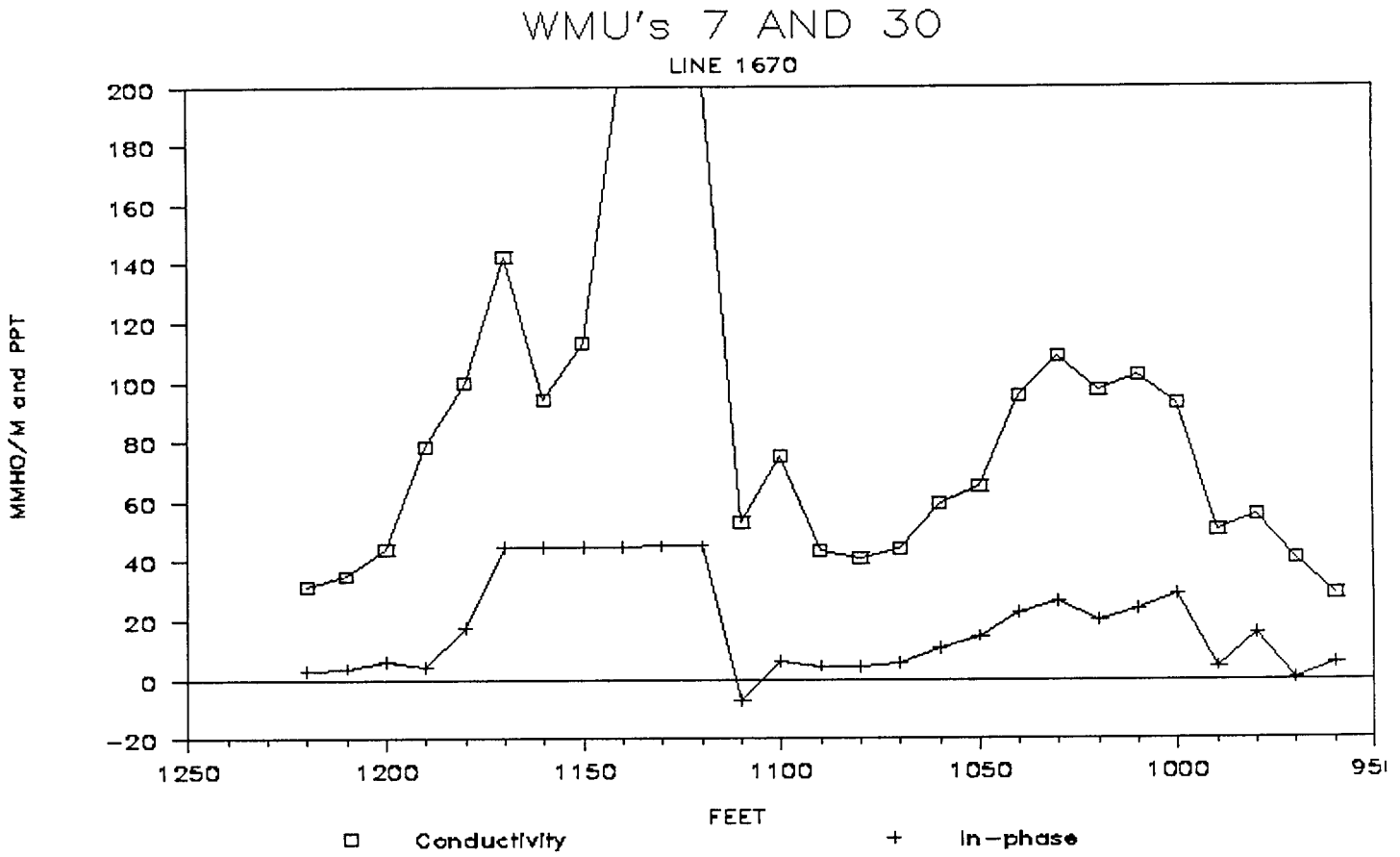
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Conductivity
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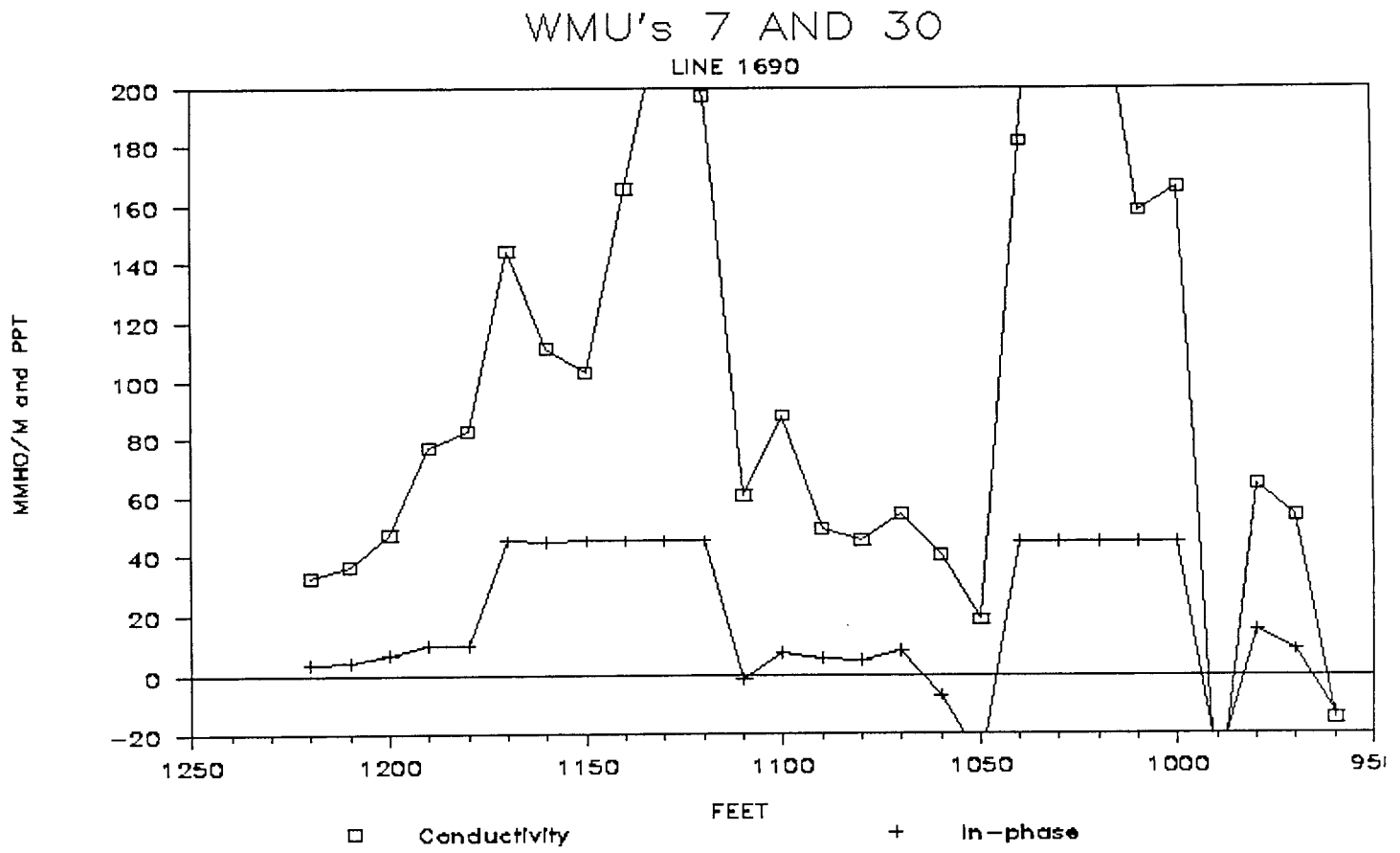
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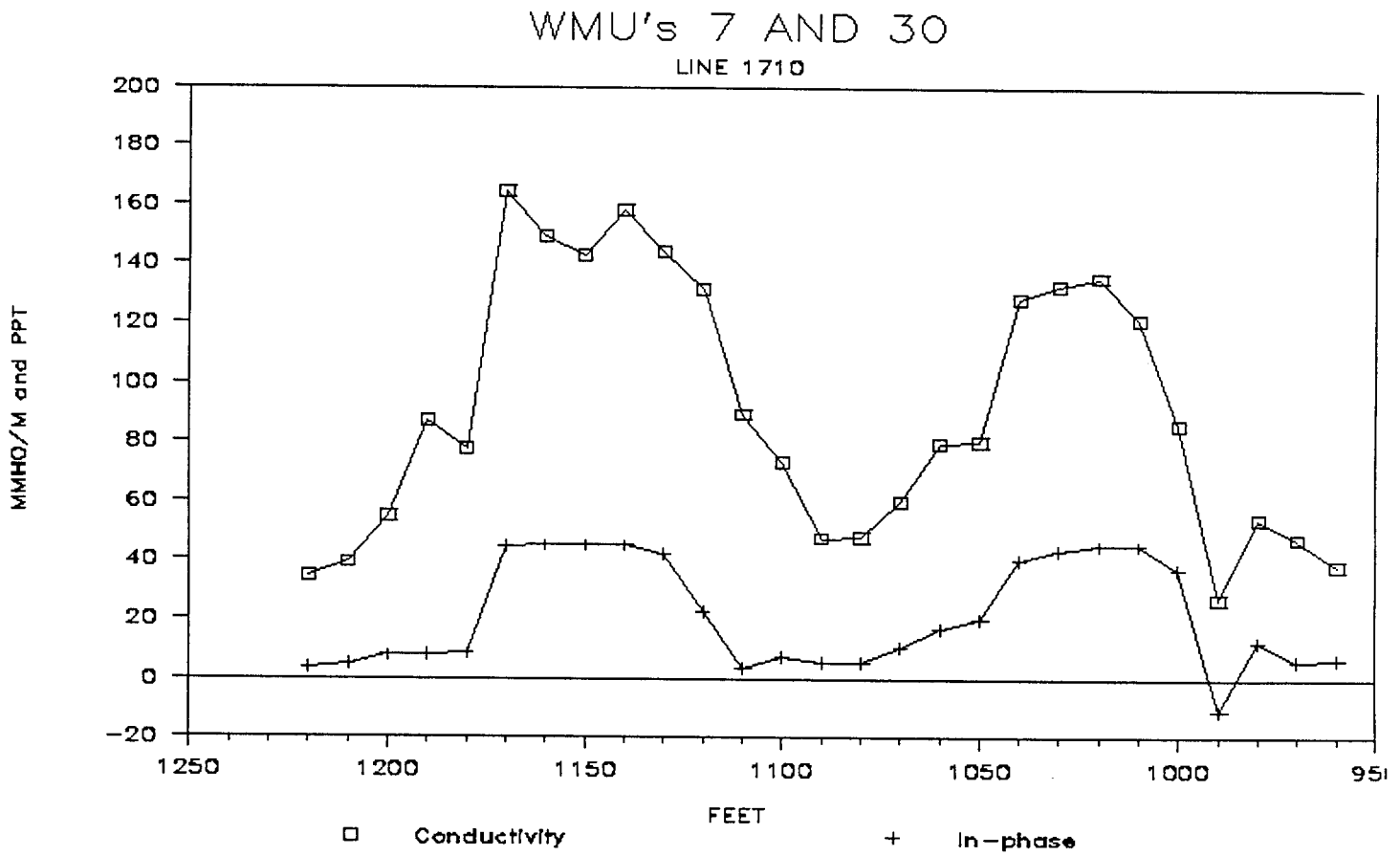
Conductivity
In-phase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MMHO/M and PPT
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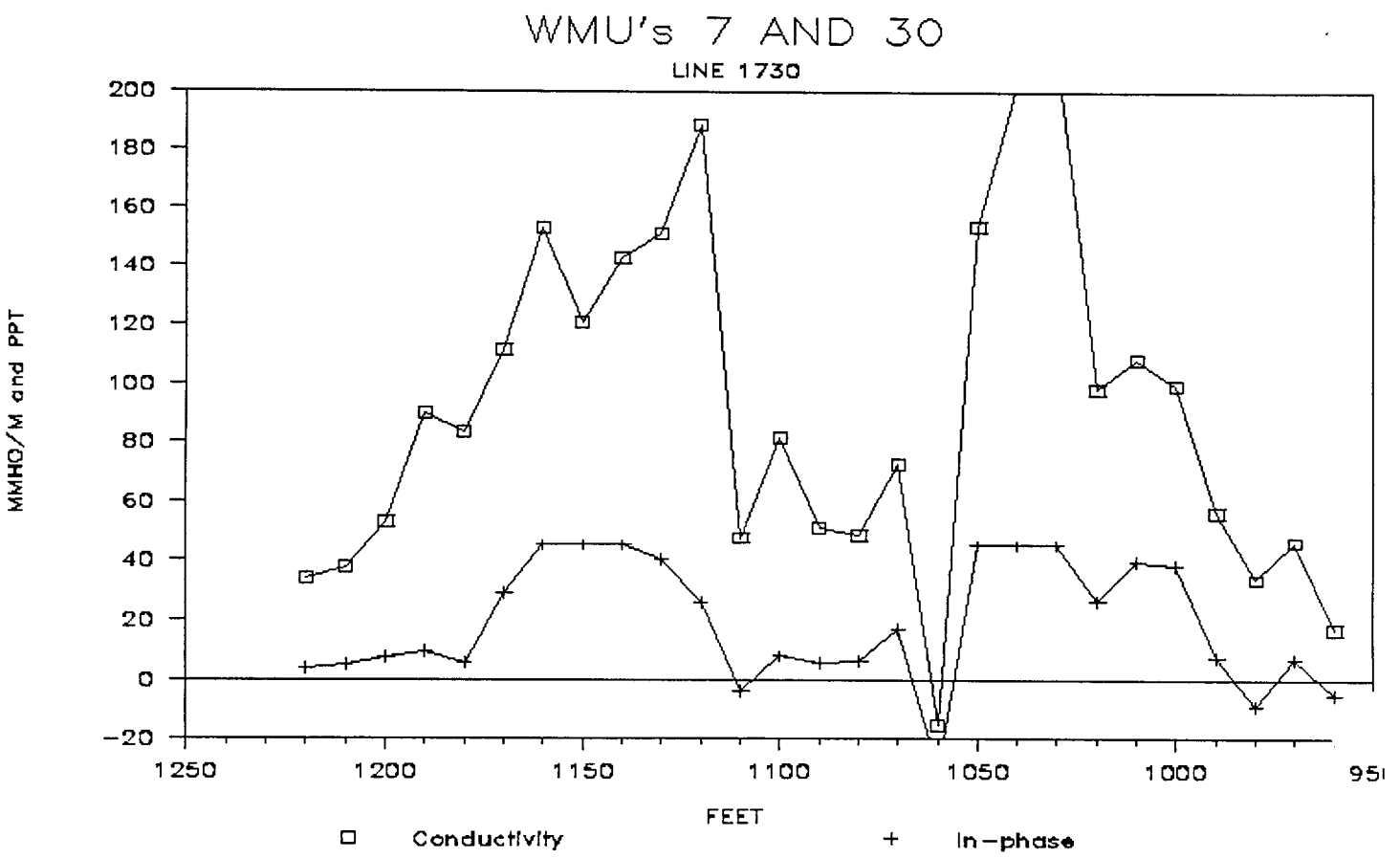
FEET
Conductivity
In-phase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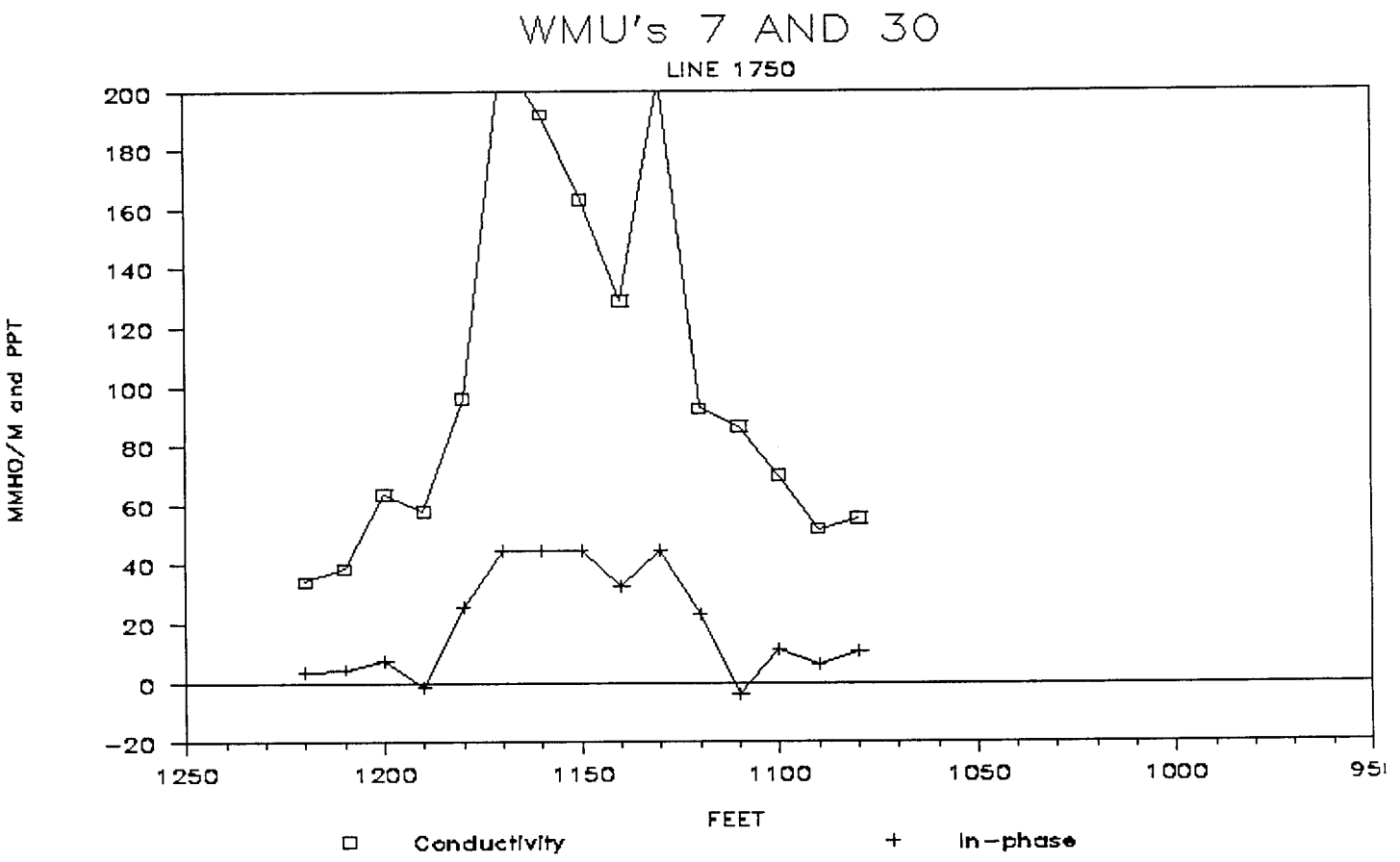
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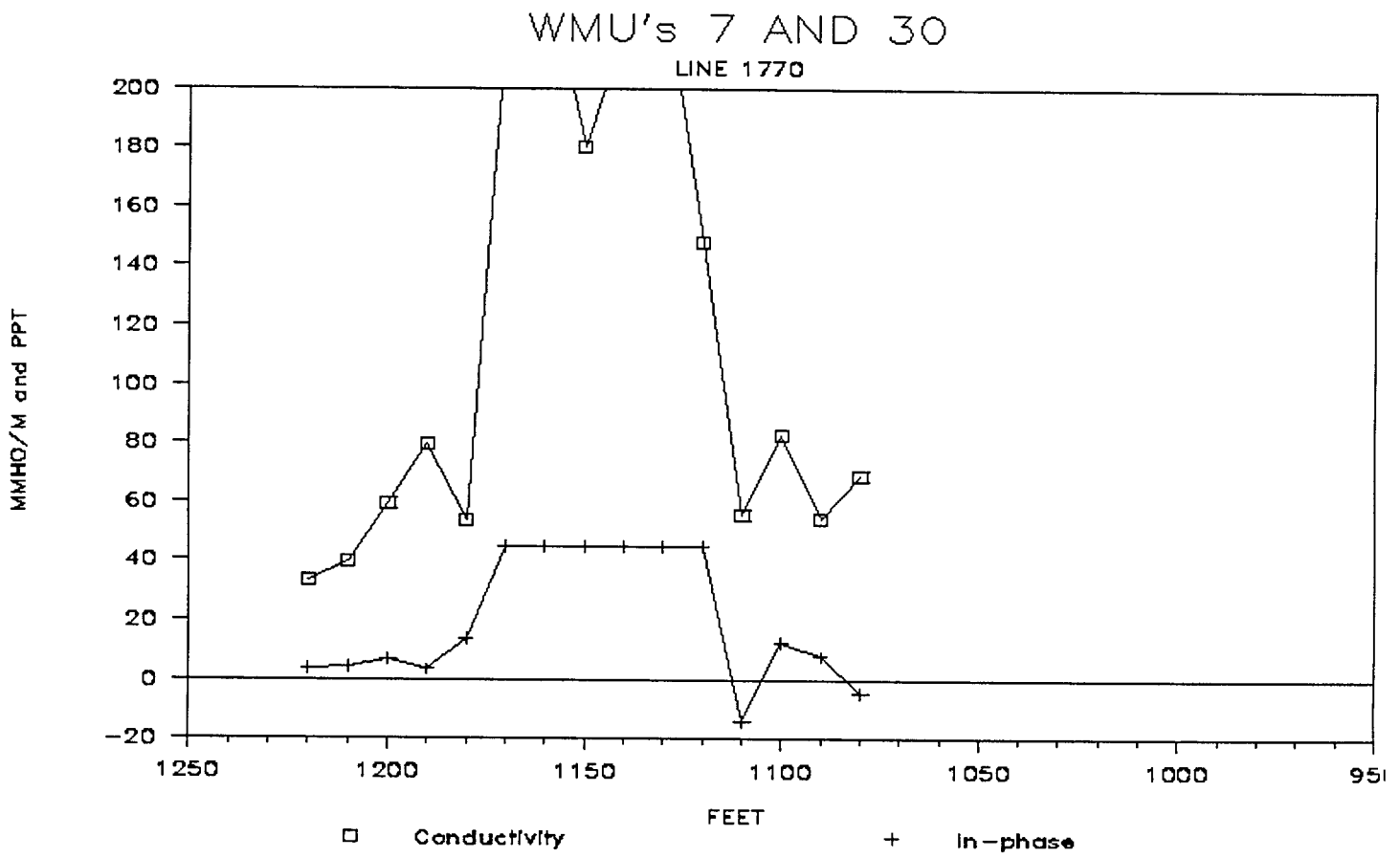
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Conductivity
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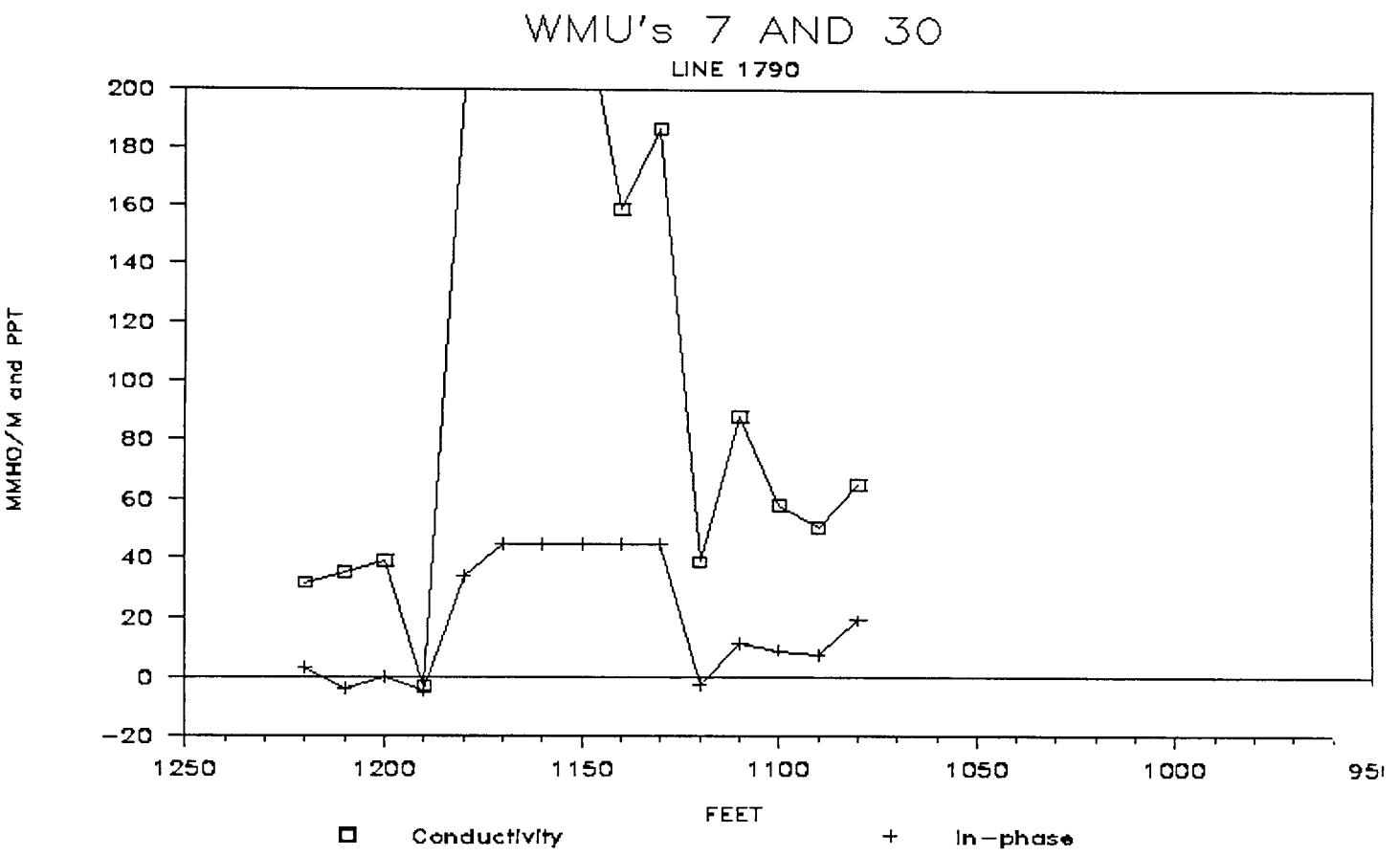
WMU's 7 AND 30
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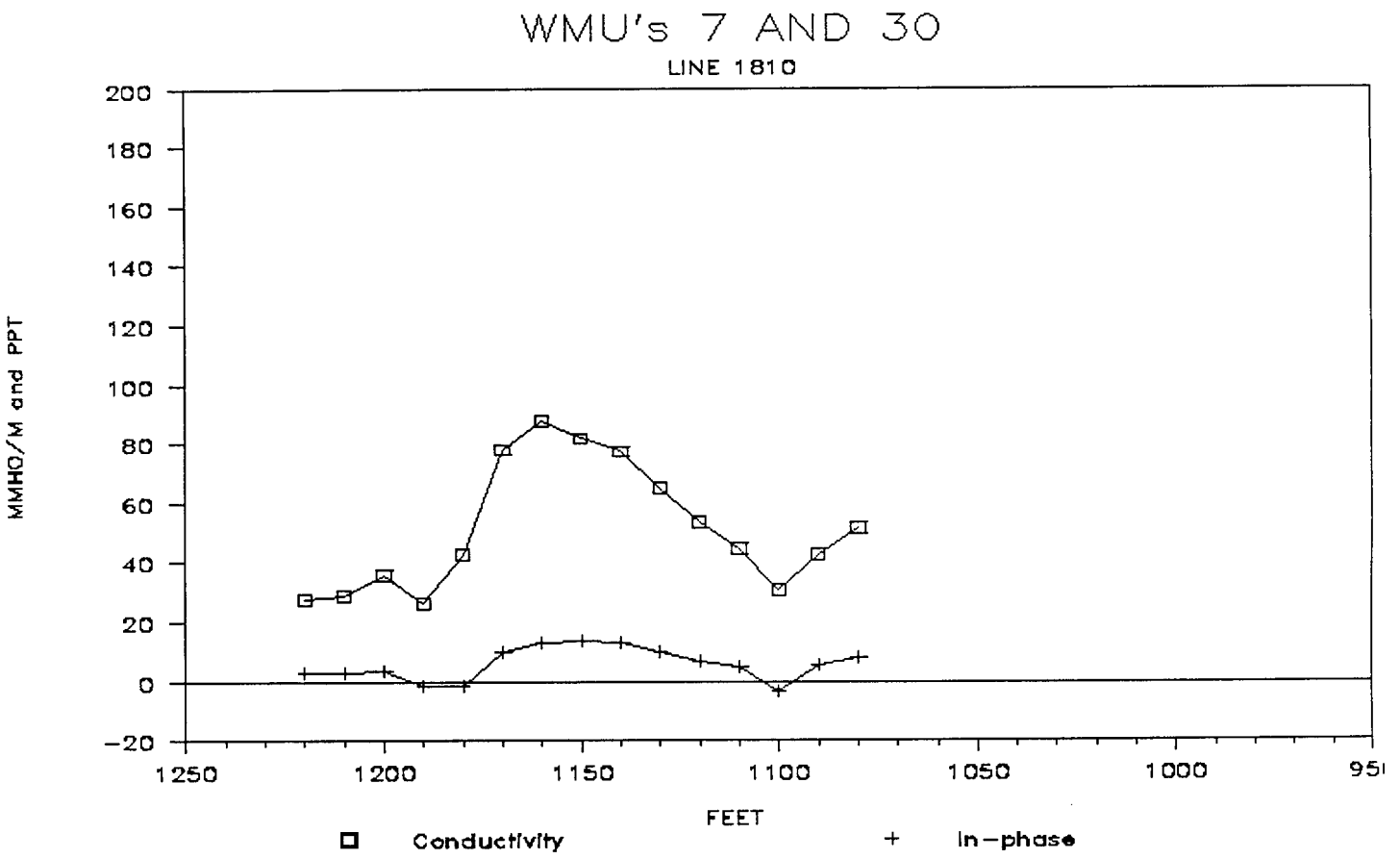
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LINE 1810
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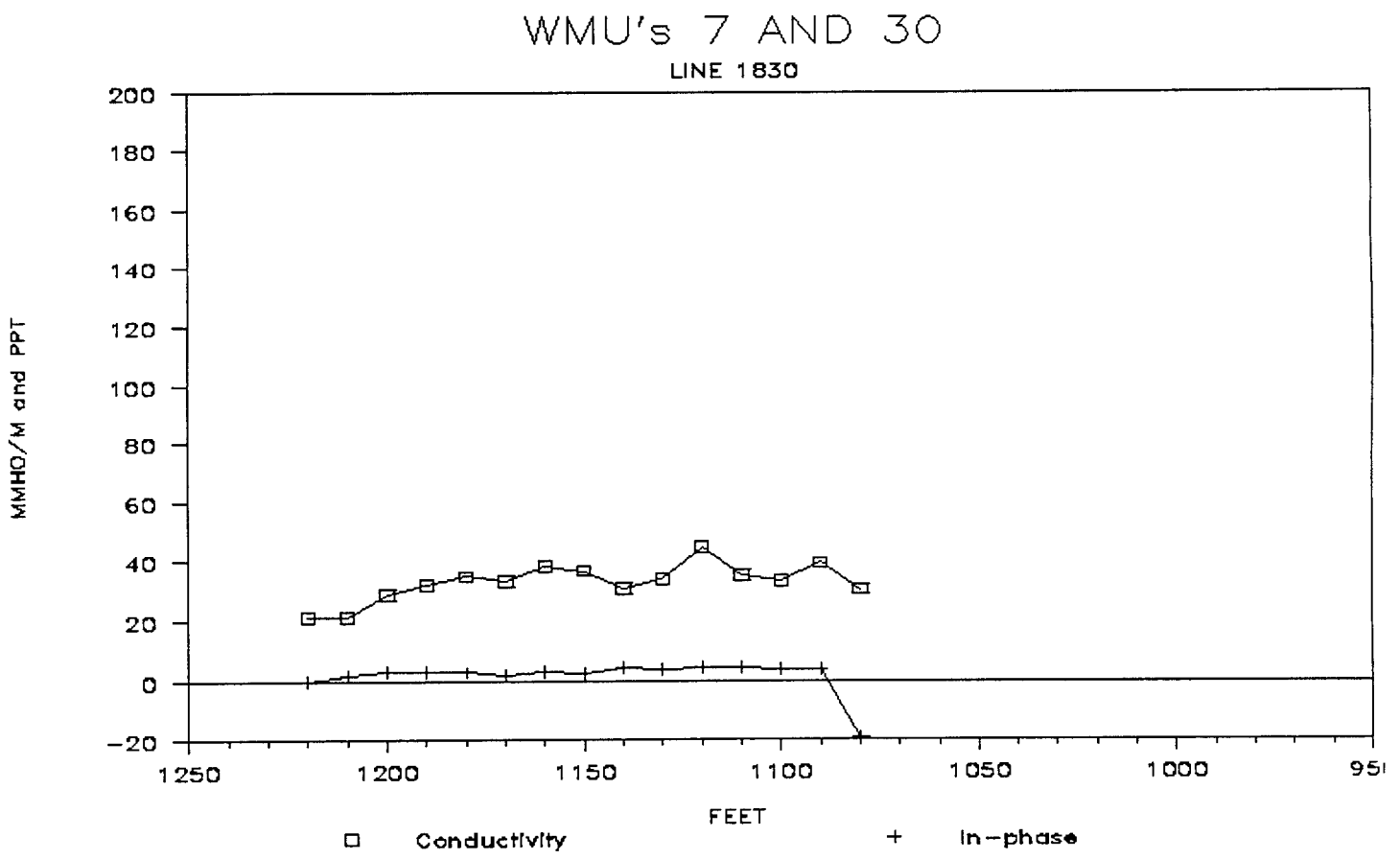
In-phase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LINE 1830
MMHO/M and PPT
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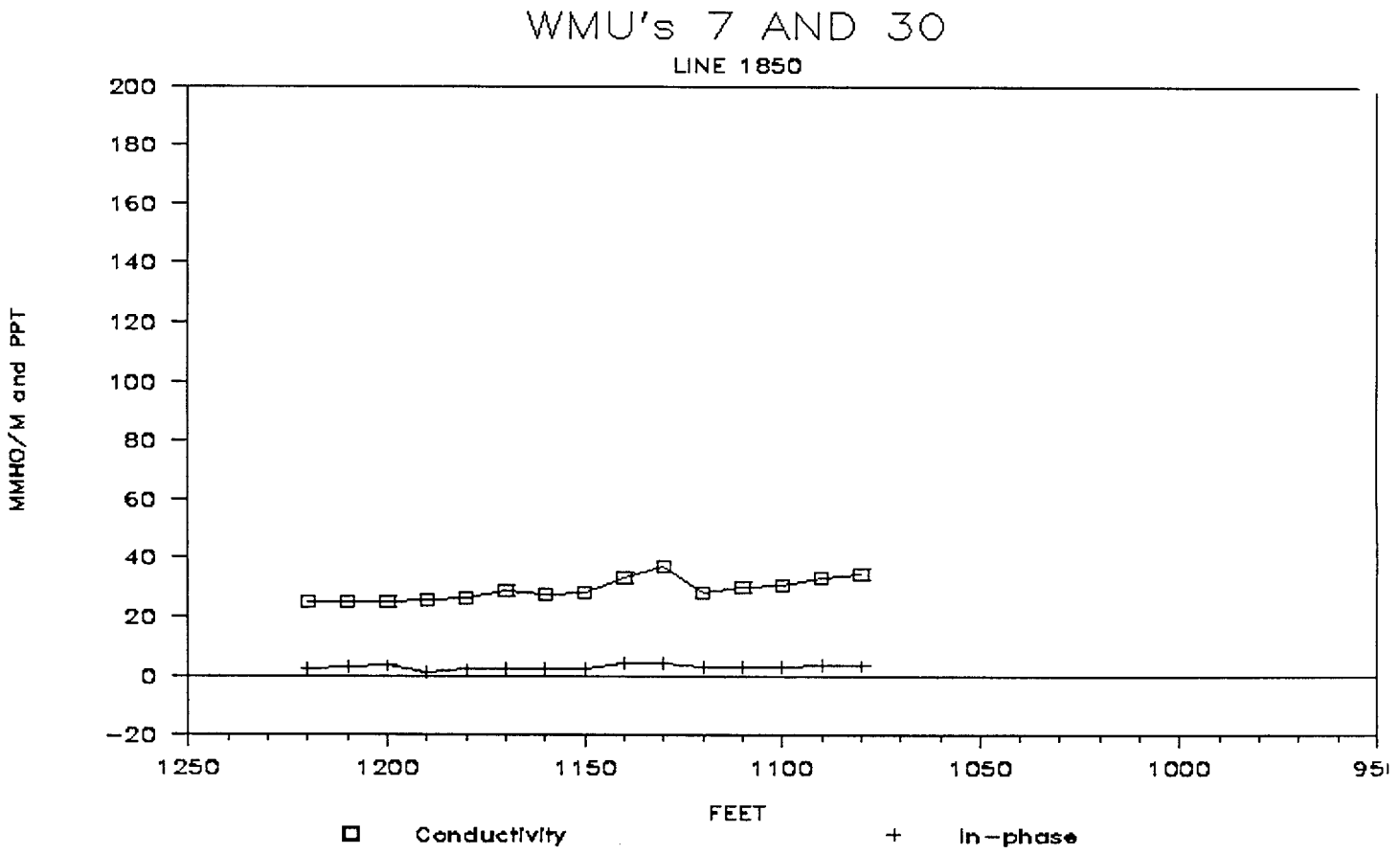
In-phase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MMHO/M and PPT
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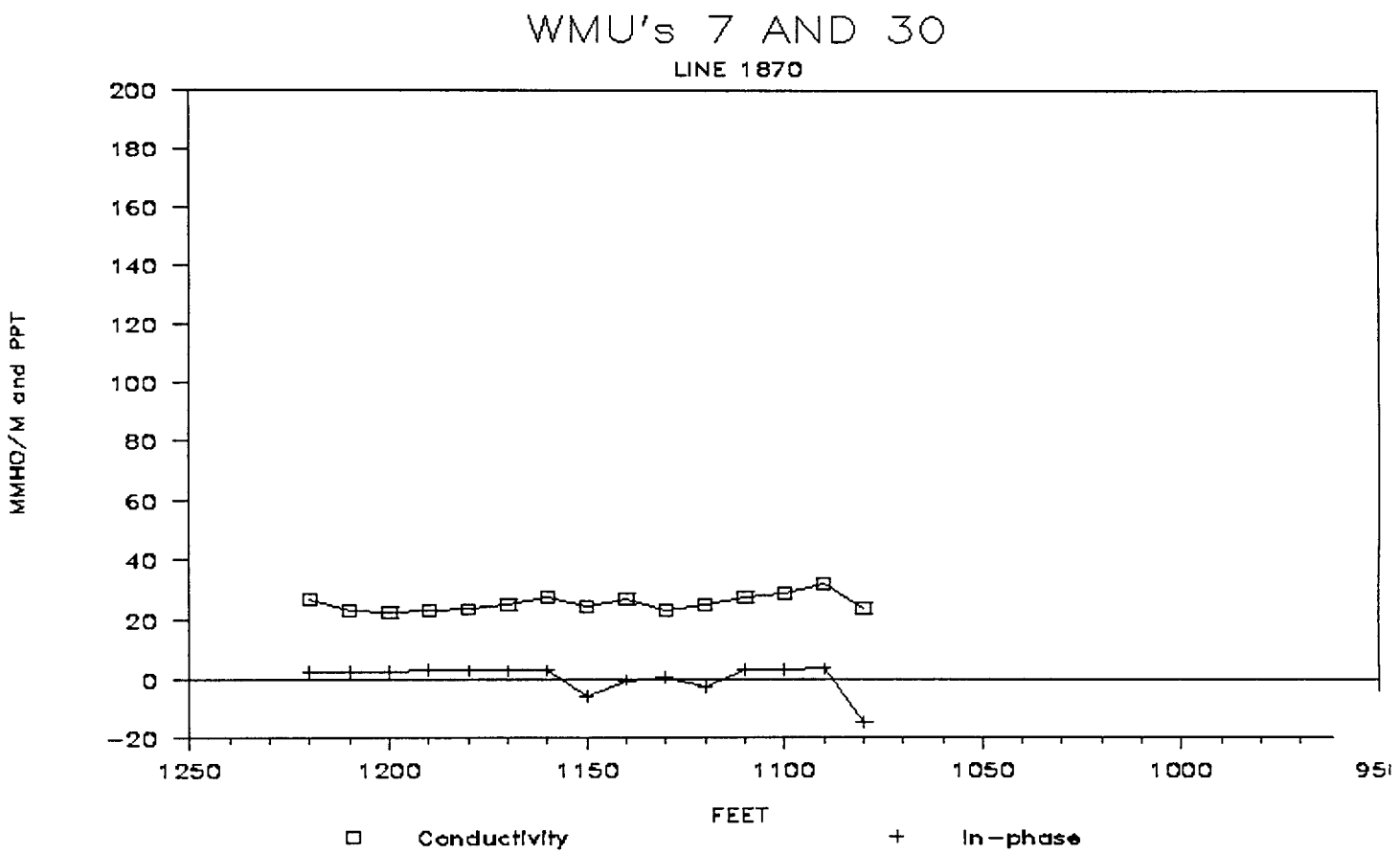
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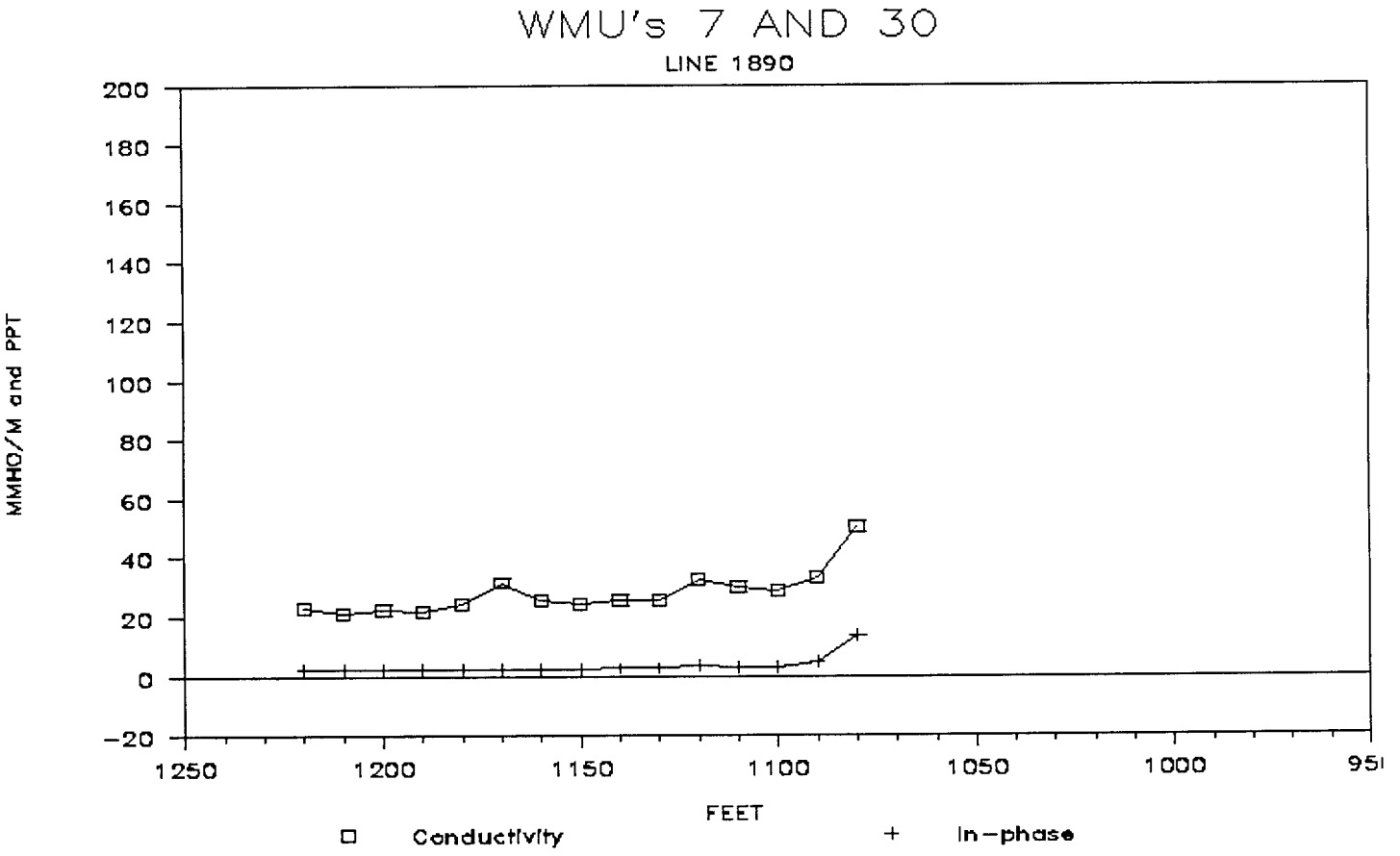
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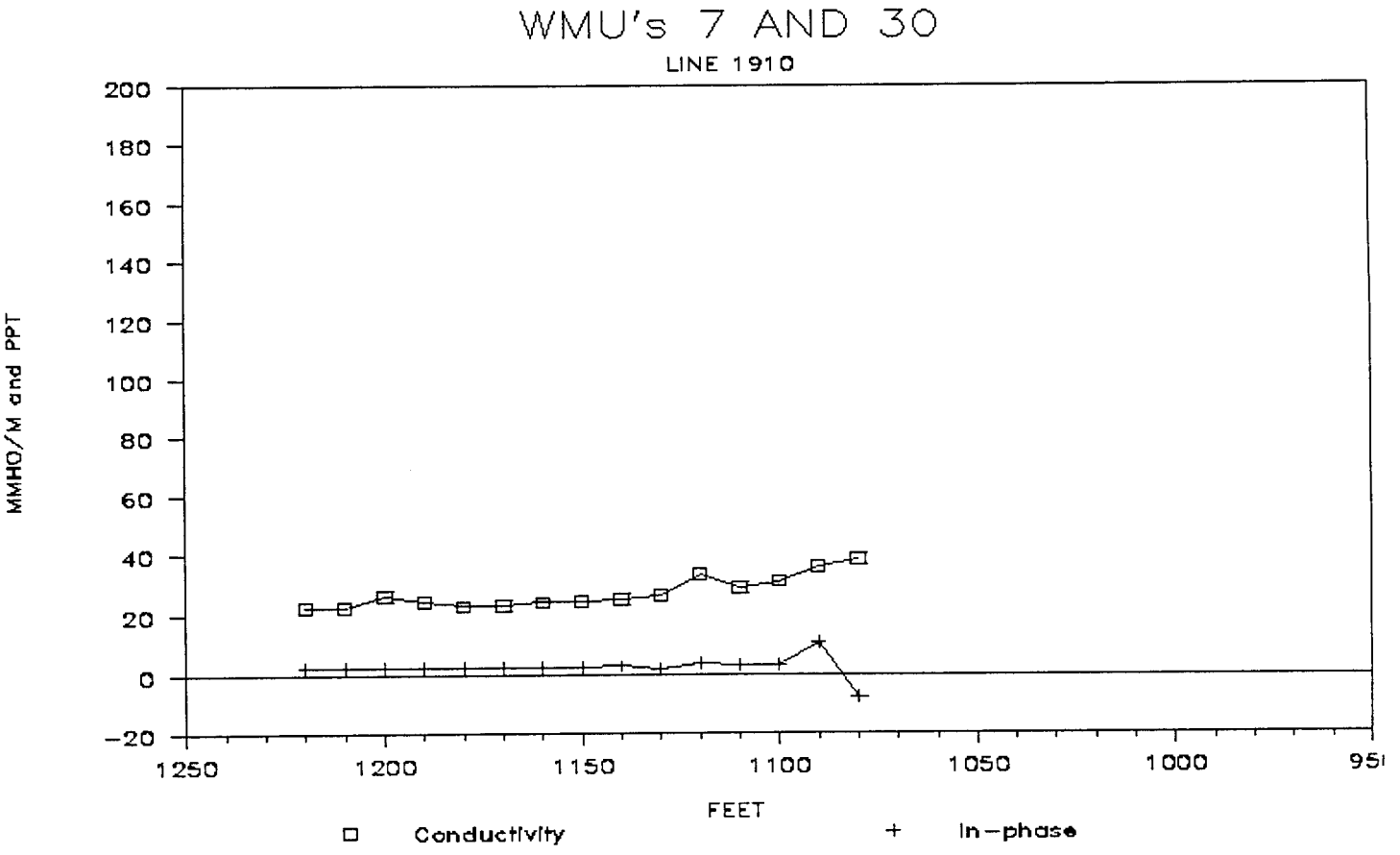
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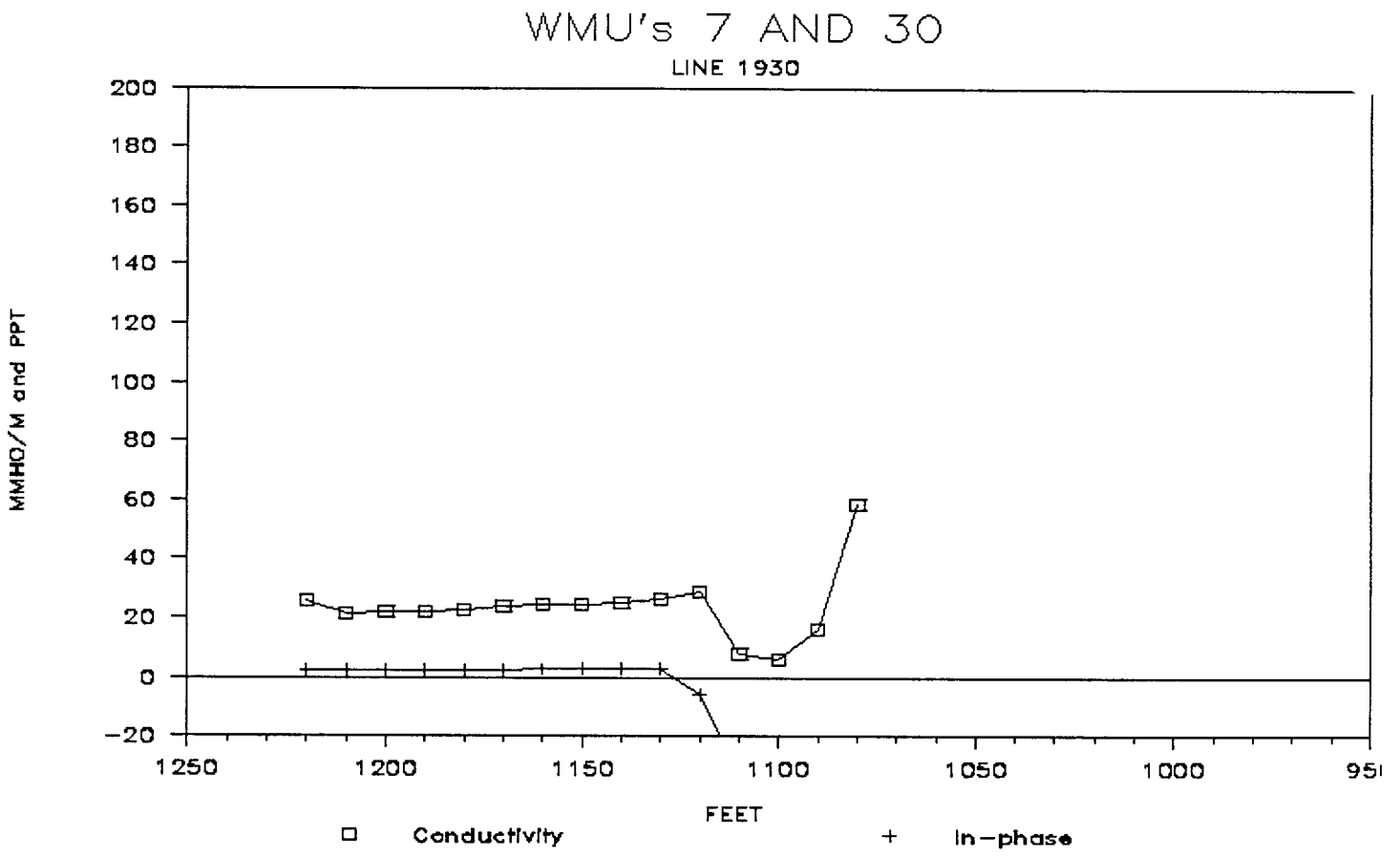
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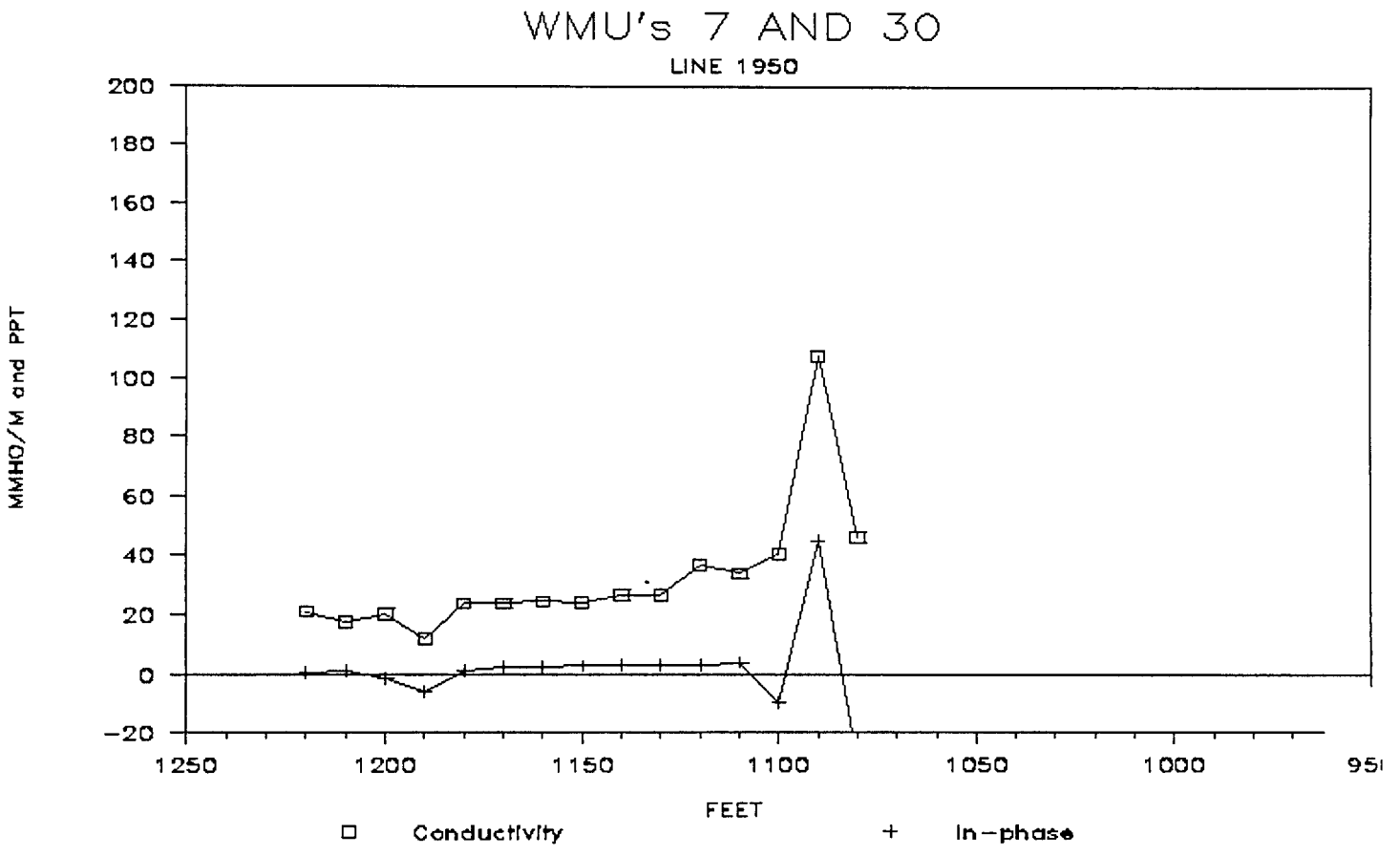
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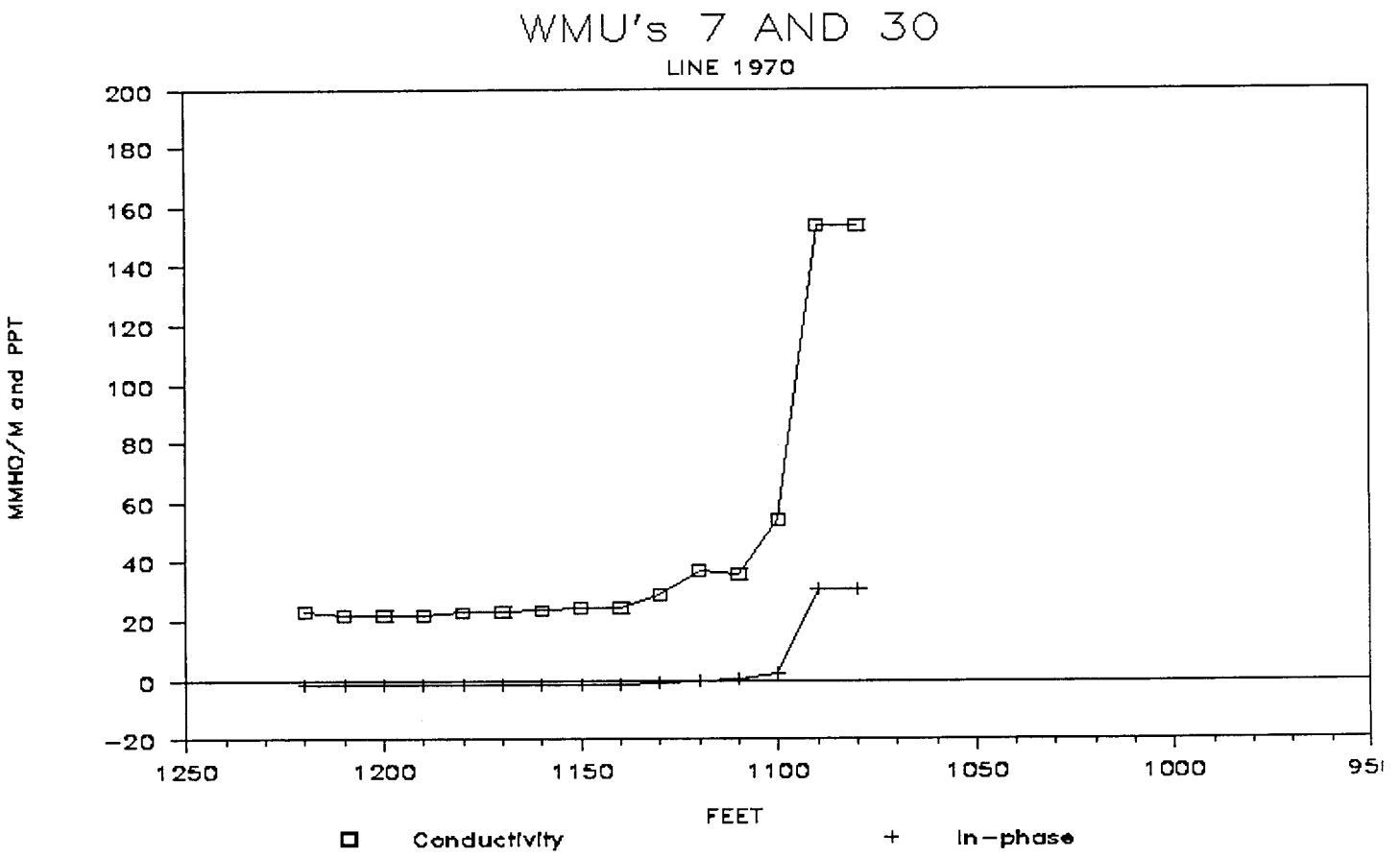
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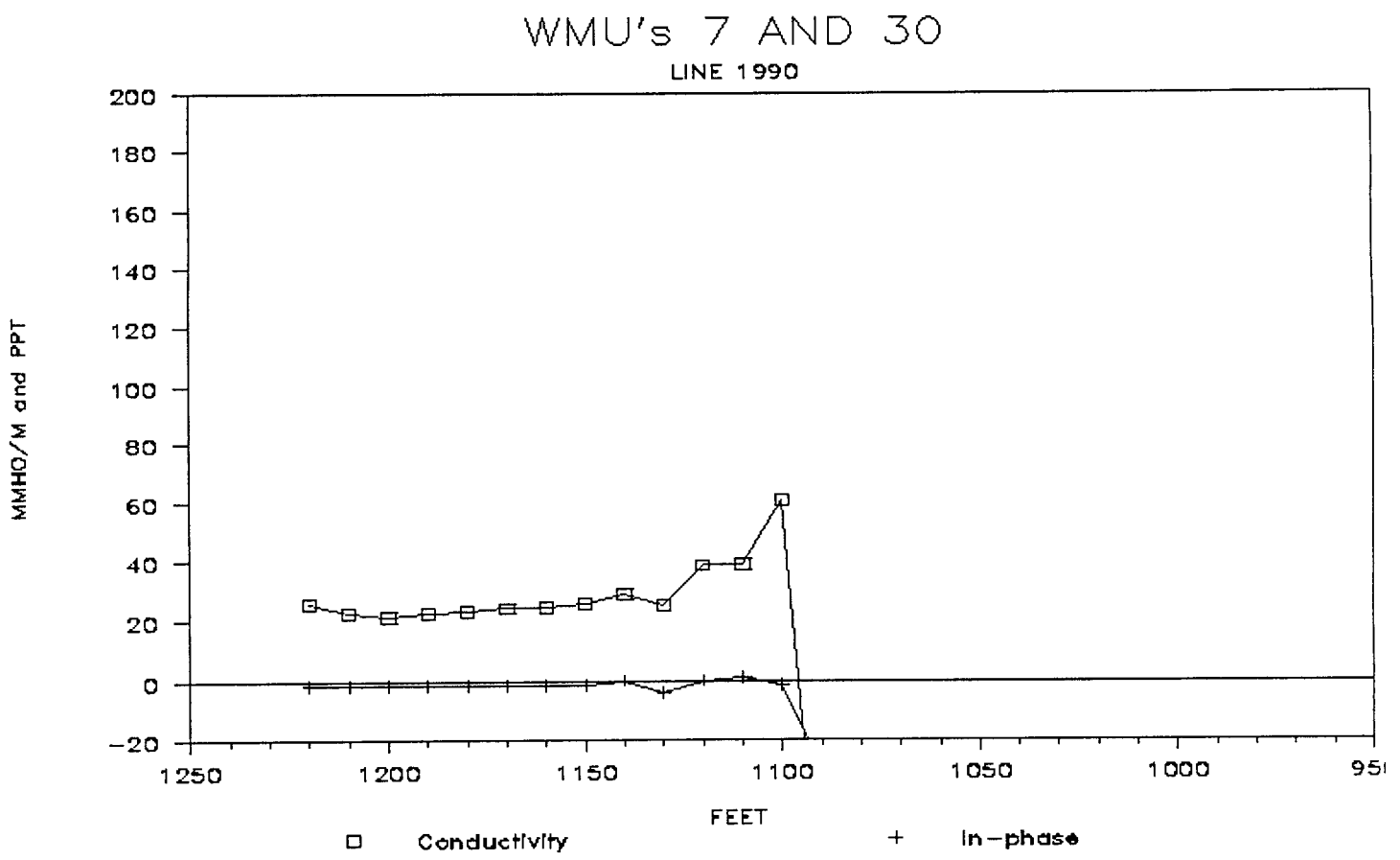
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MMHO/M and PPT
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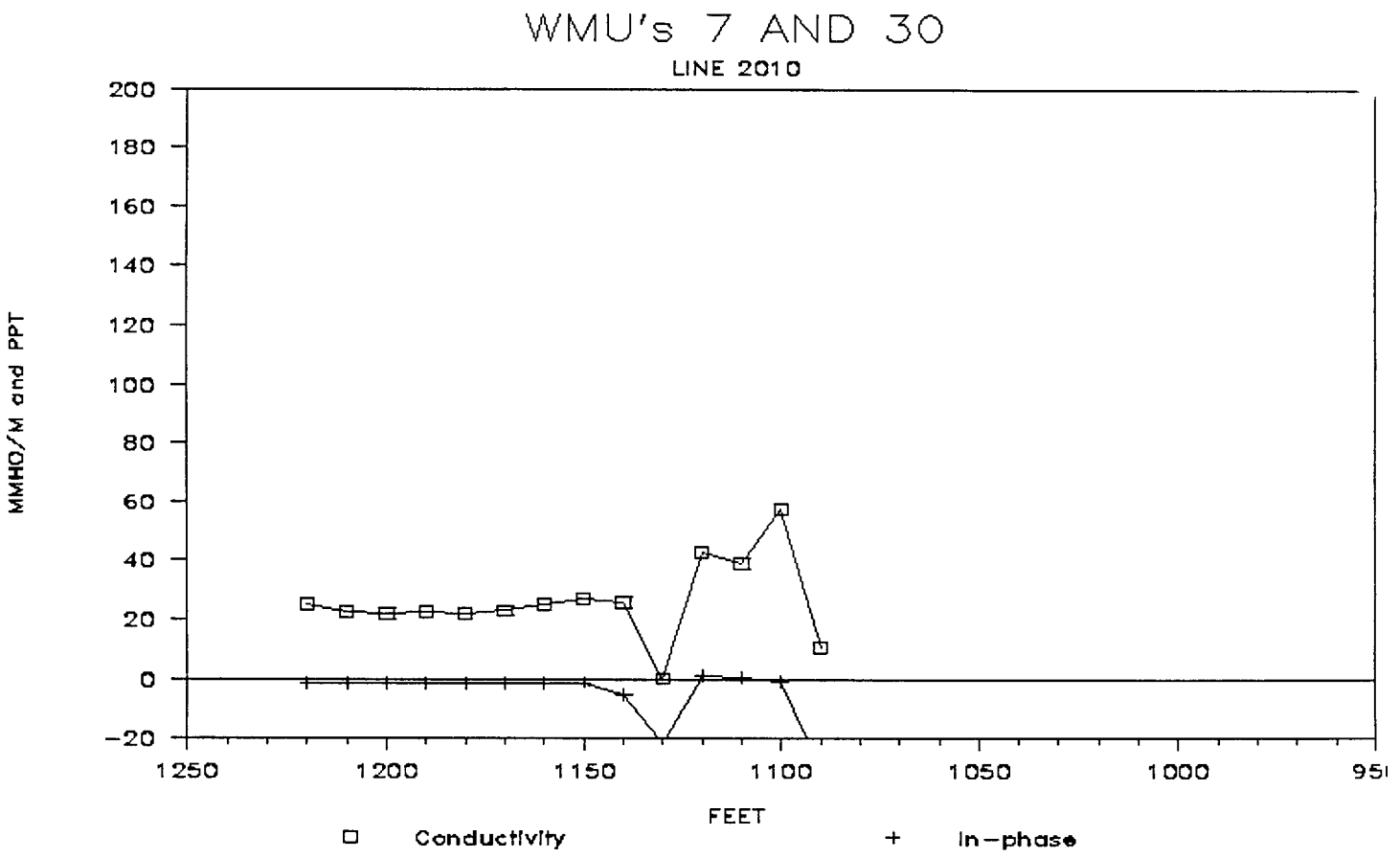
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MMHO/M and PPT
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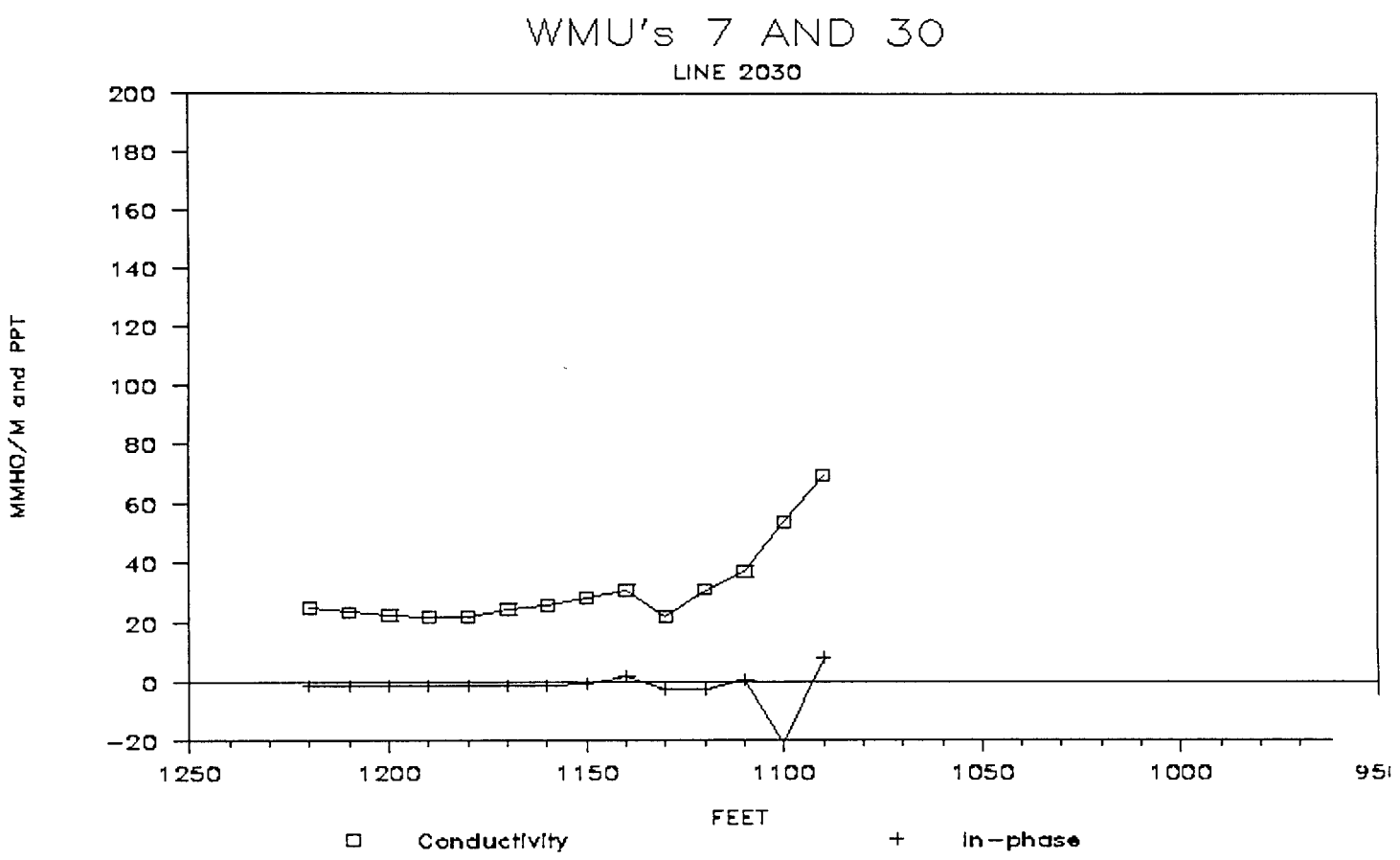
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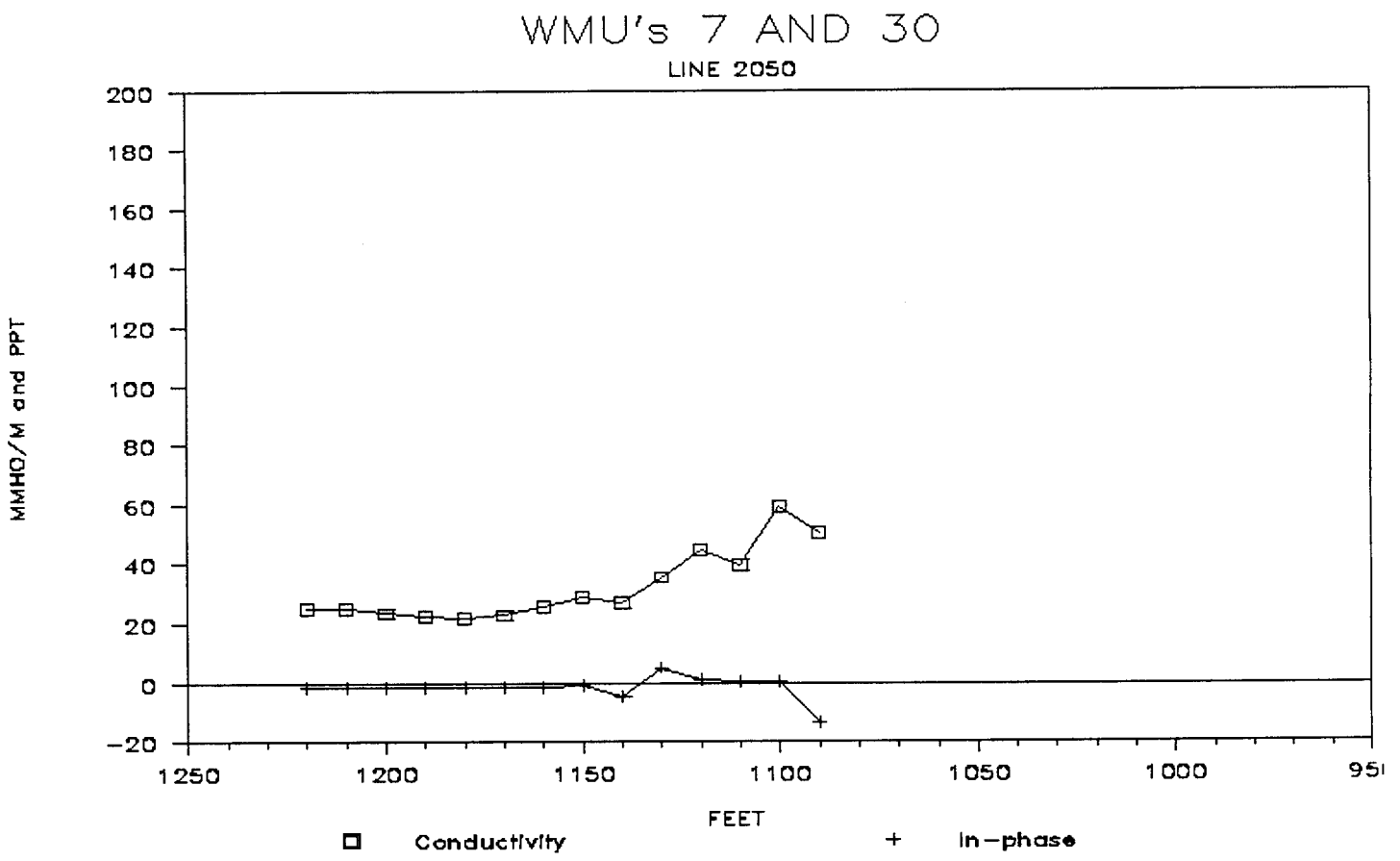
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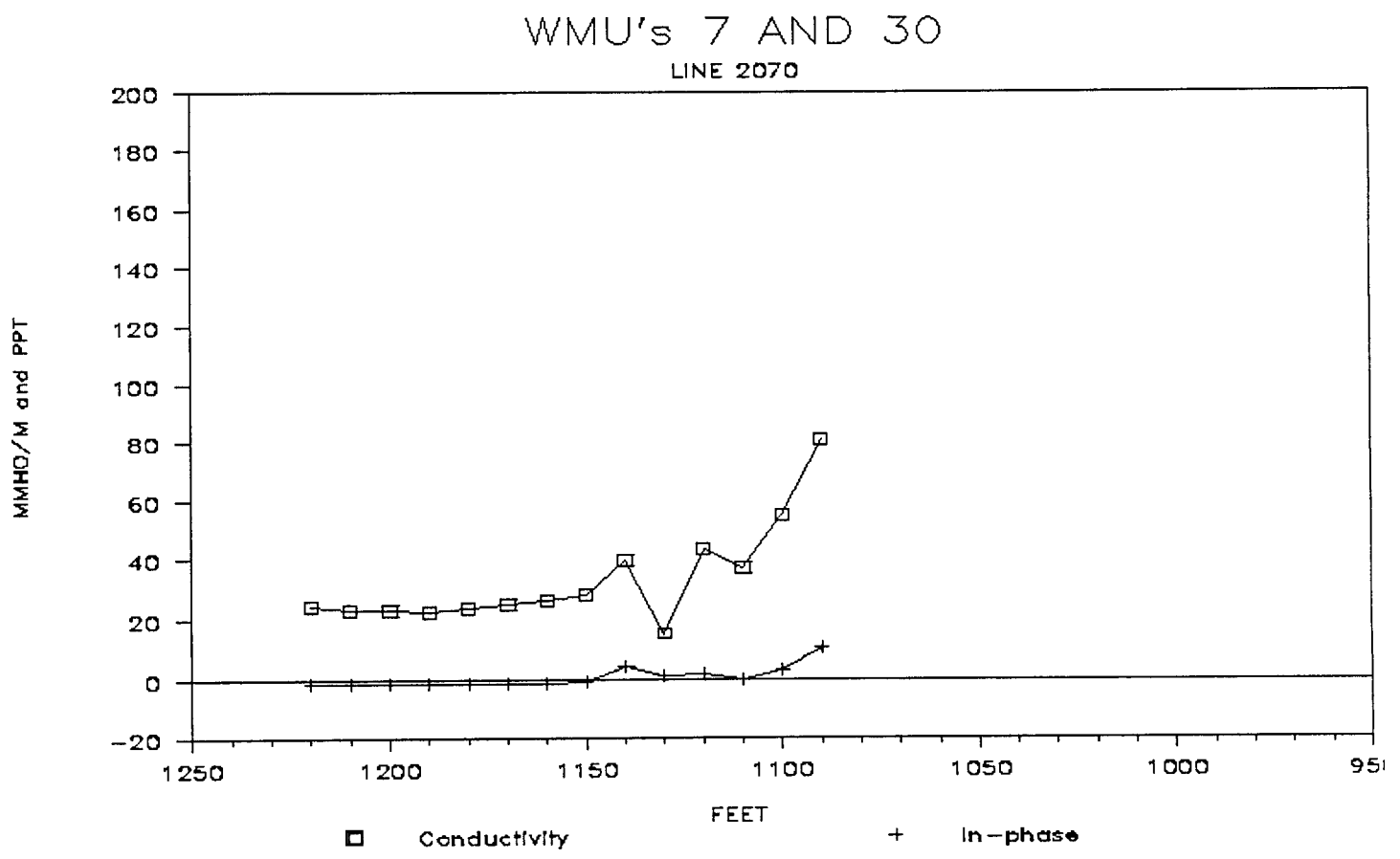
+ In-phase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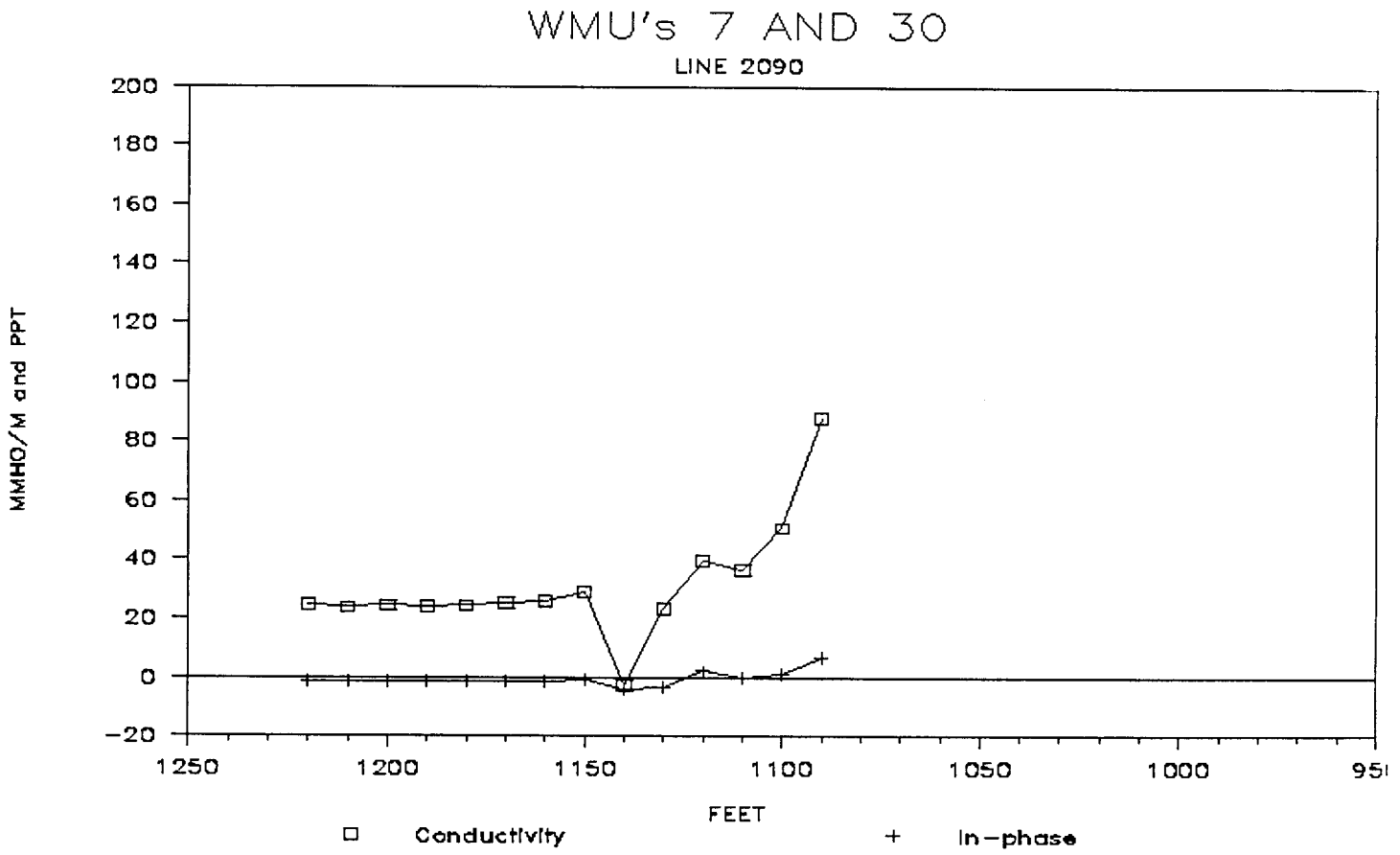
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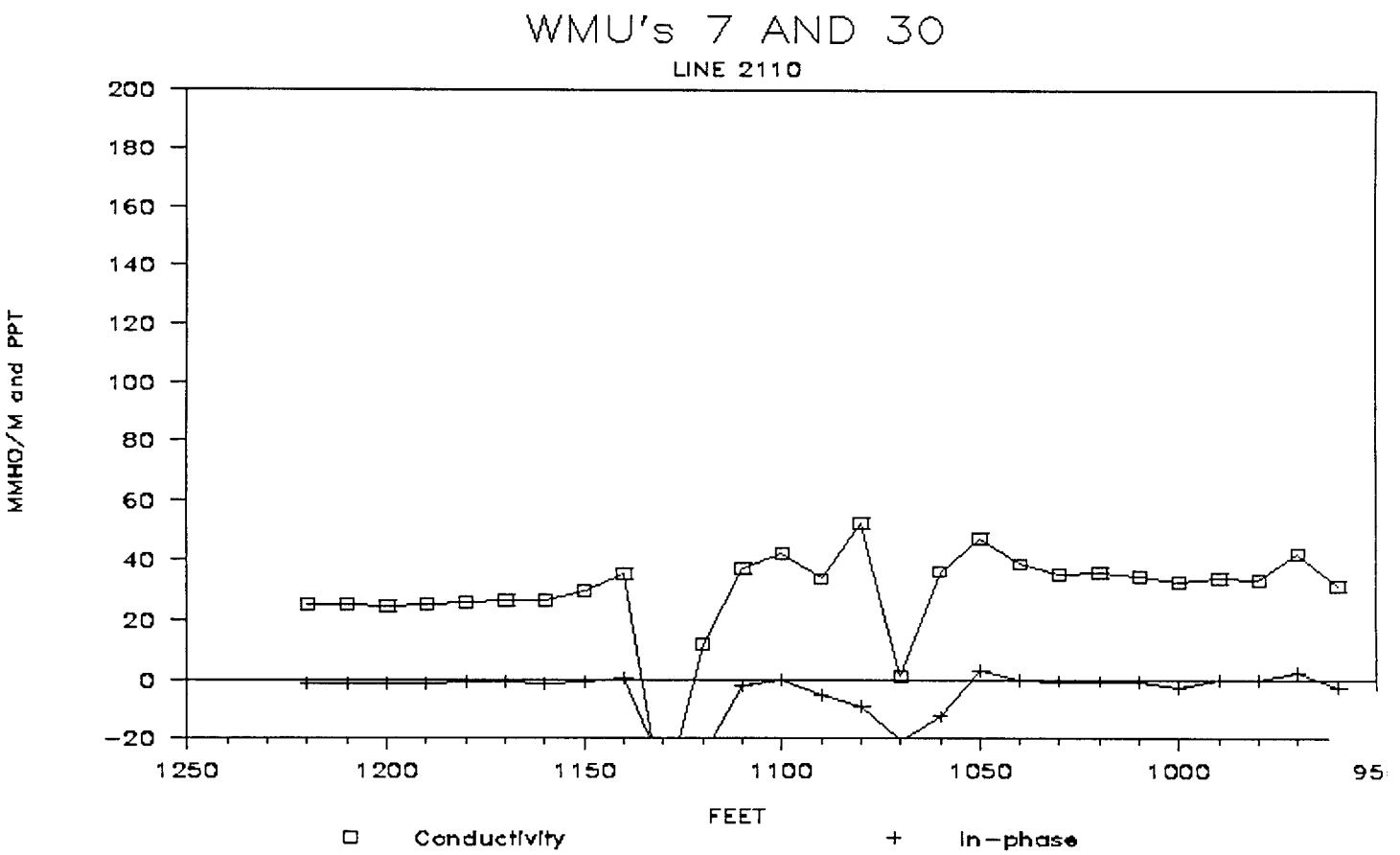
WMU's 7 AND 30
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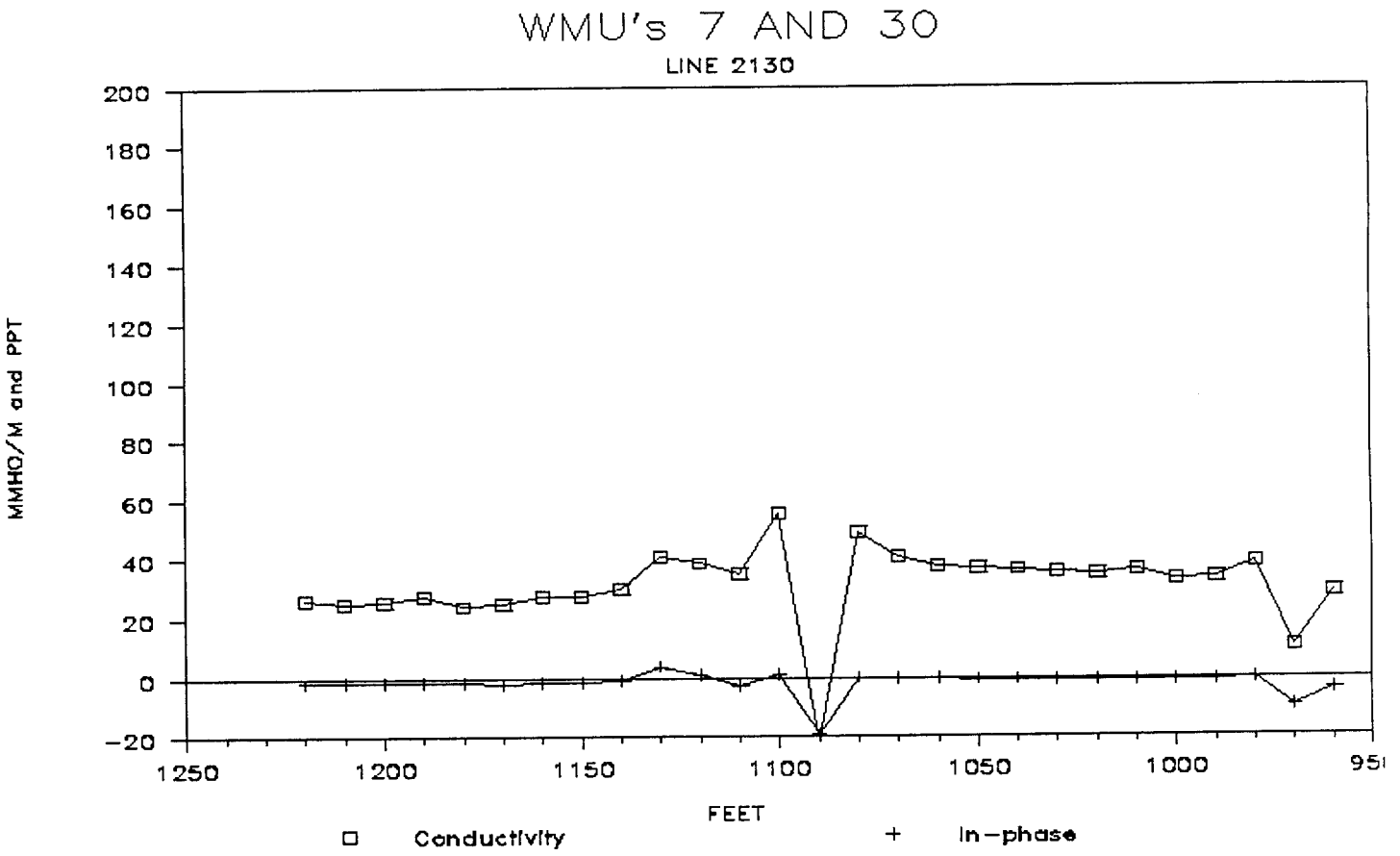
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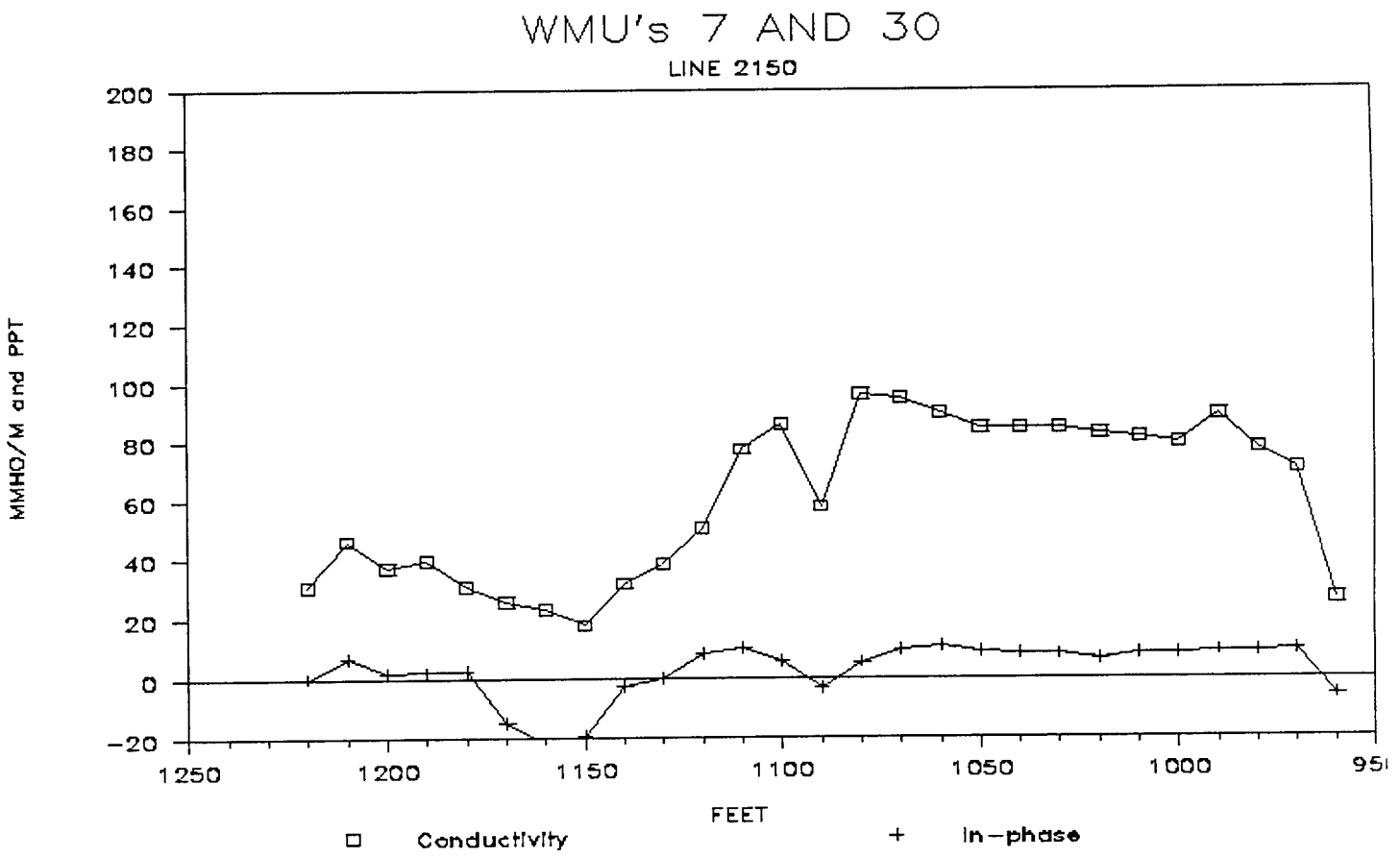
Conductivity
In-phase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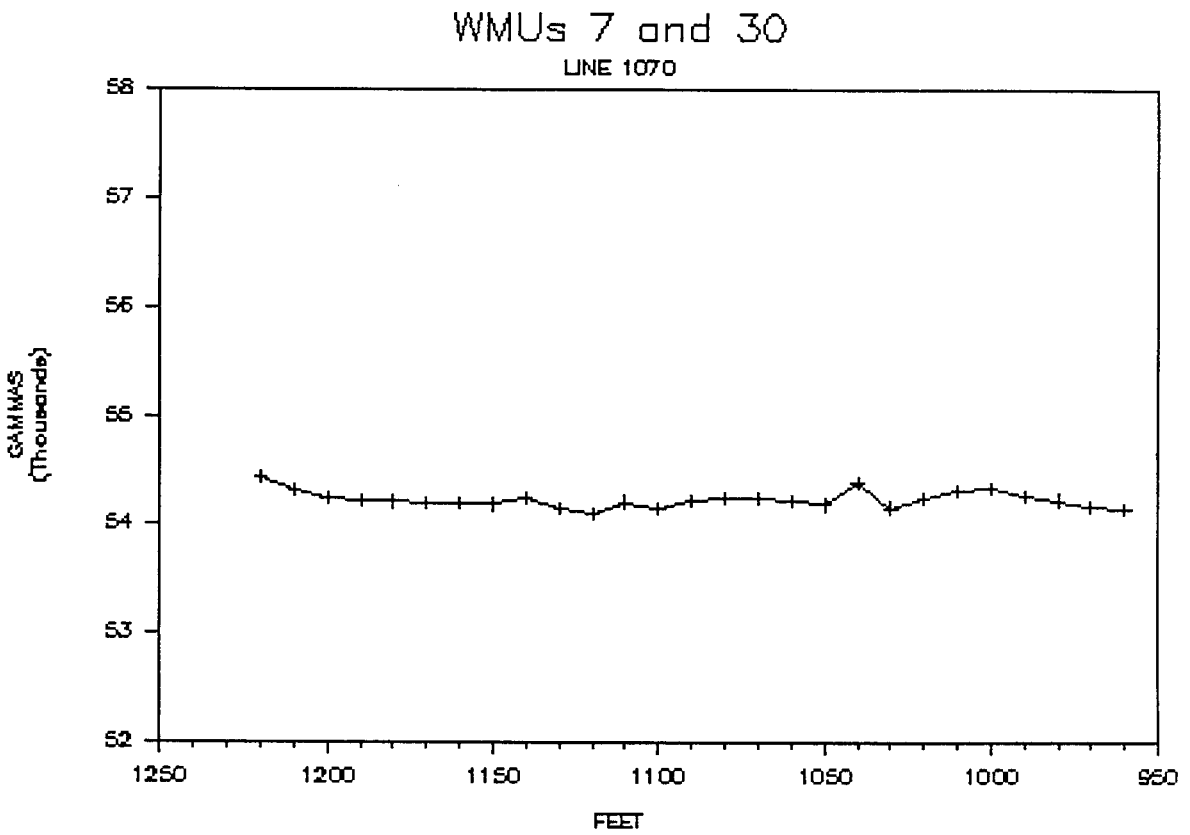
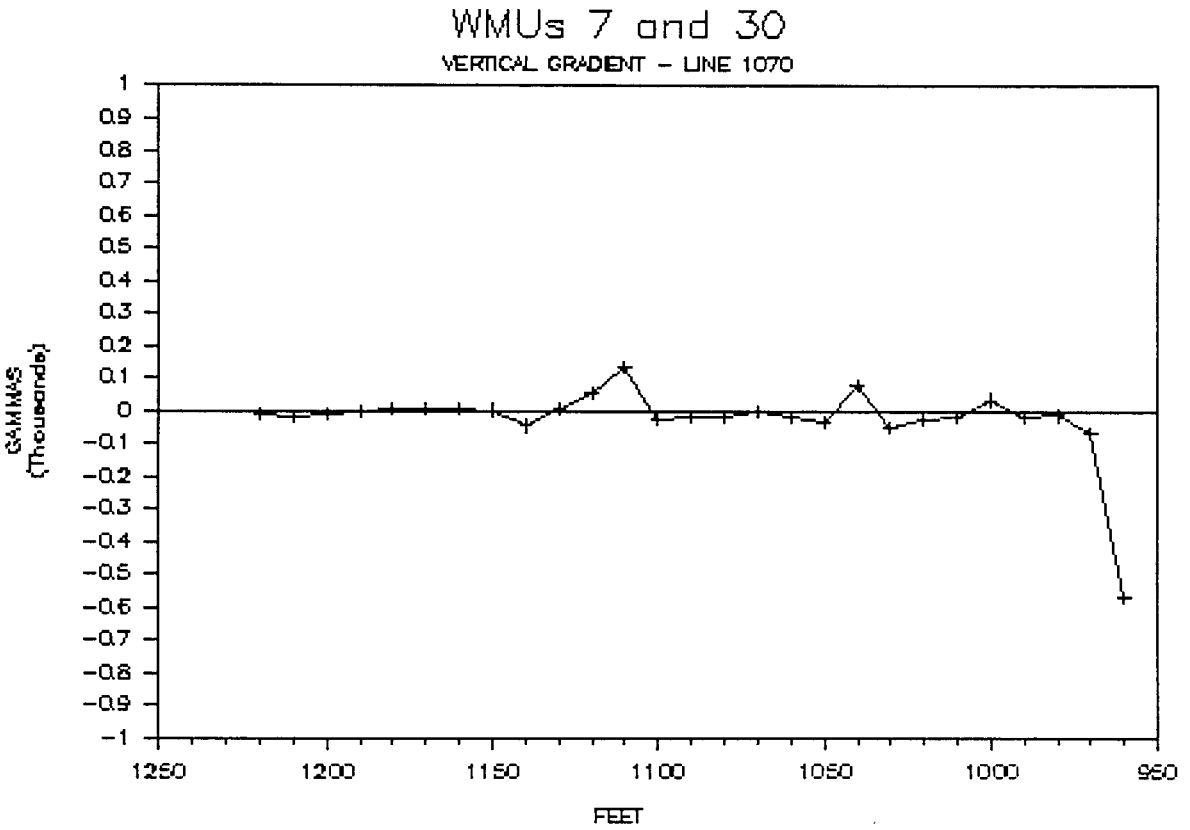
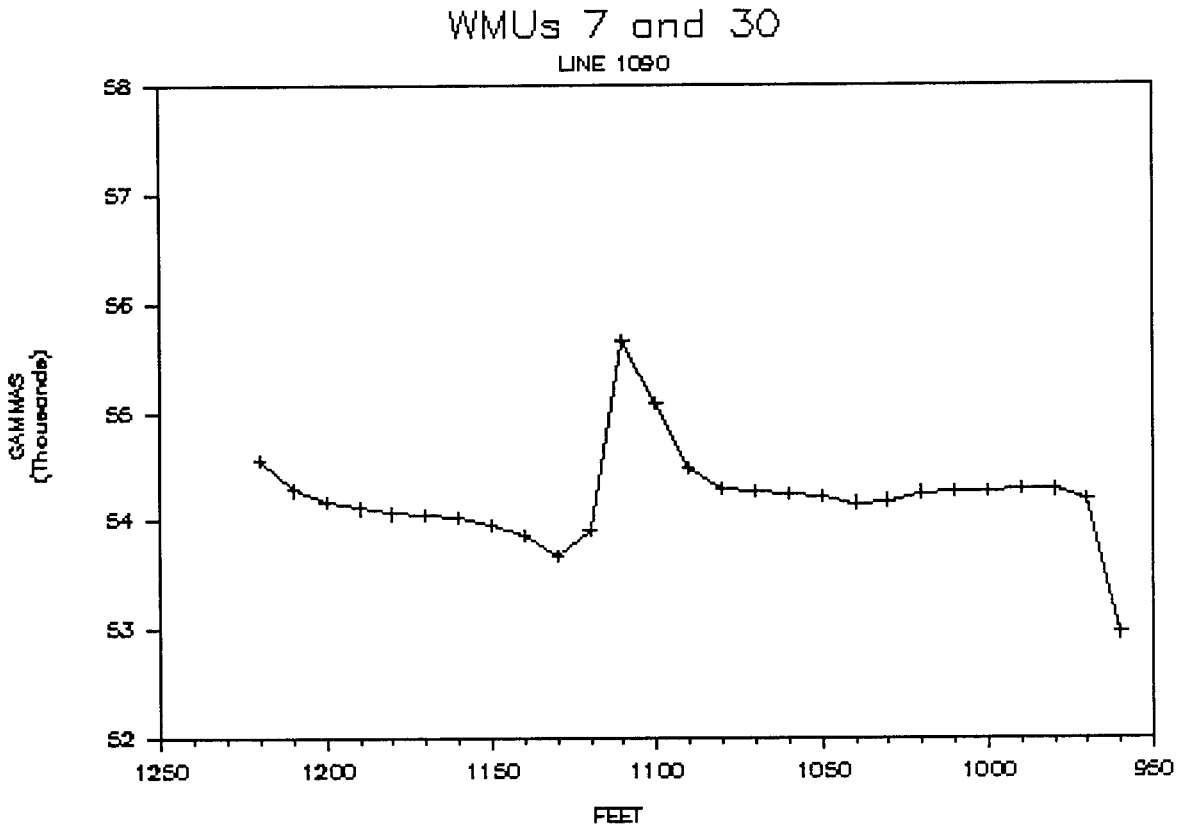
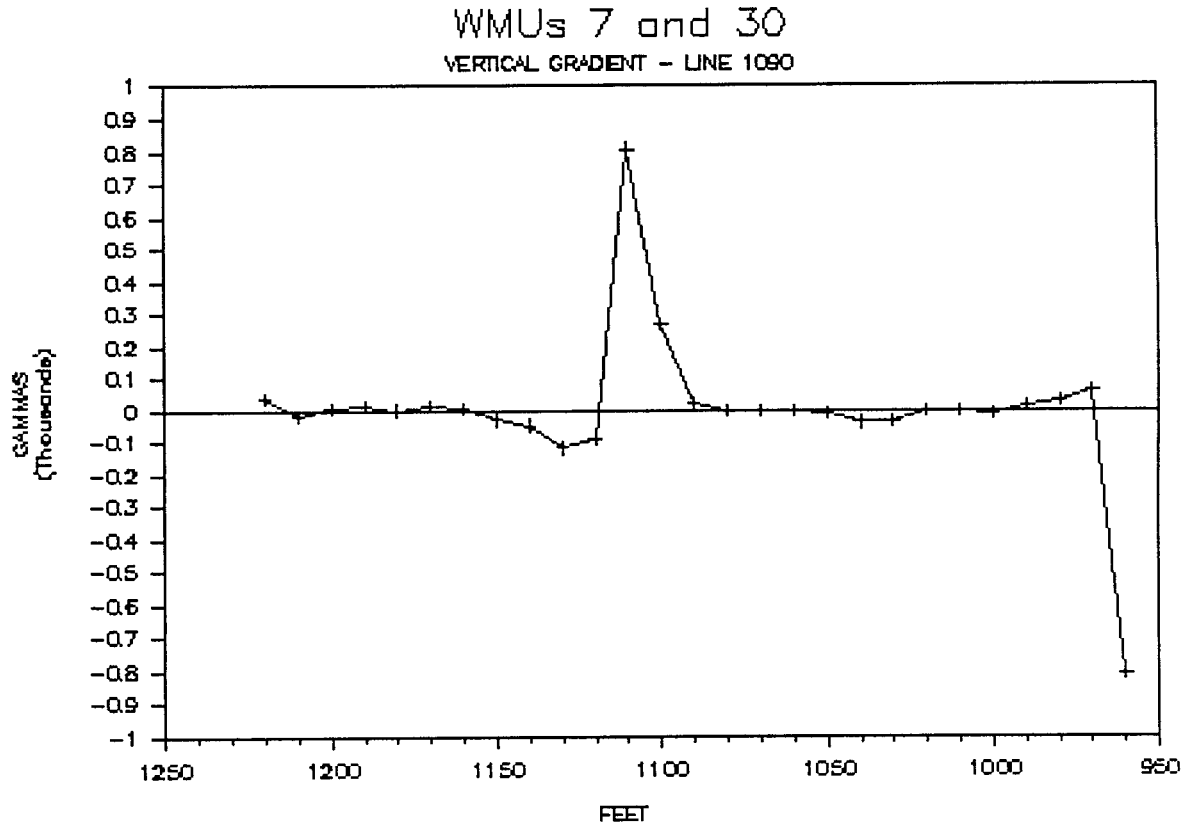
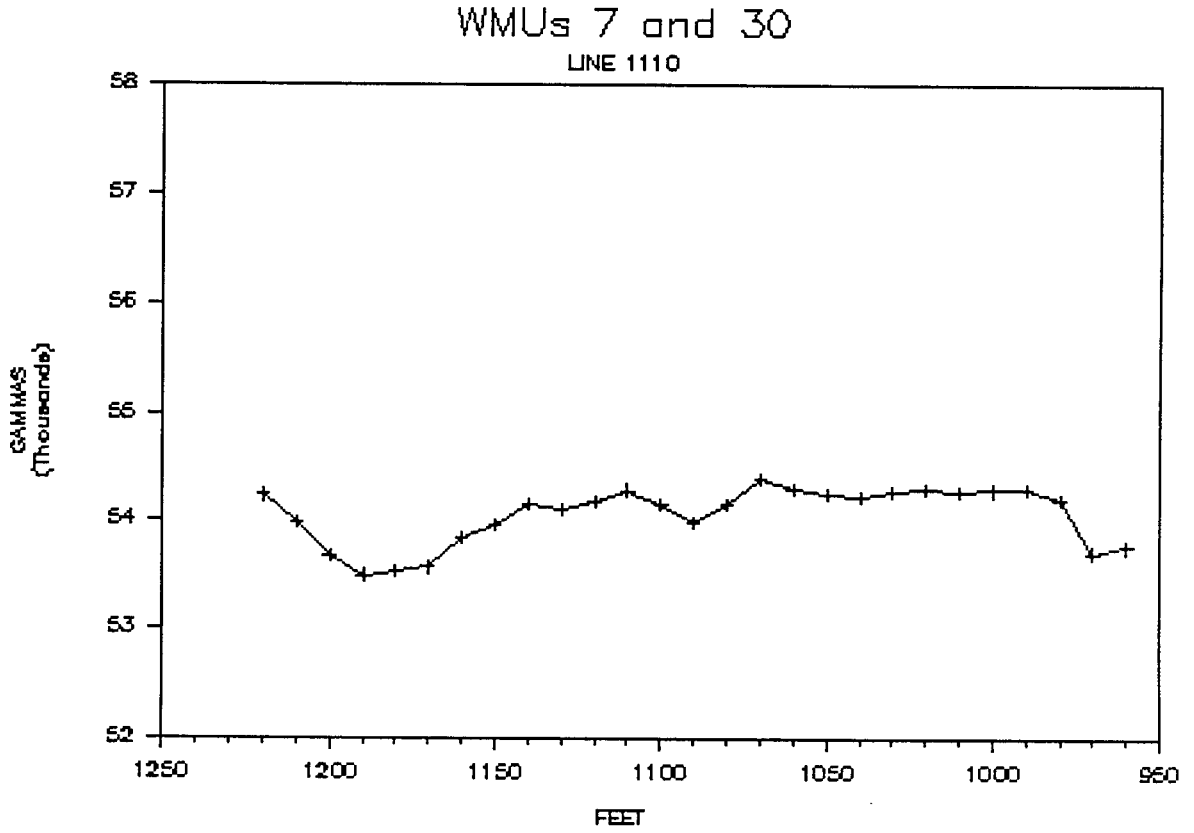
FEET
Conductivity
In-phase

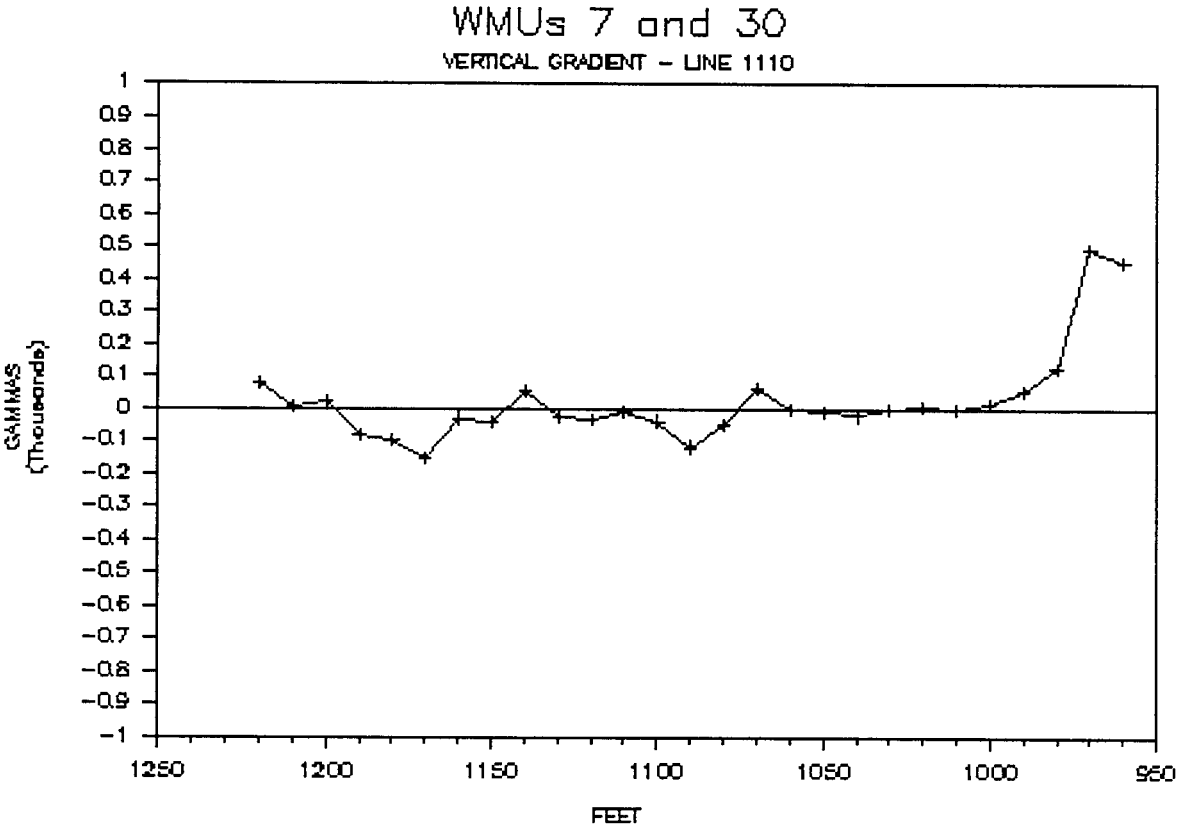

WMUs 7 and 30
LINE 1070
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

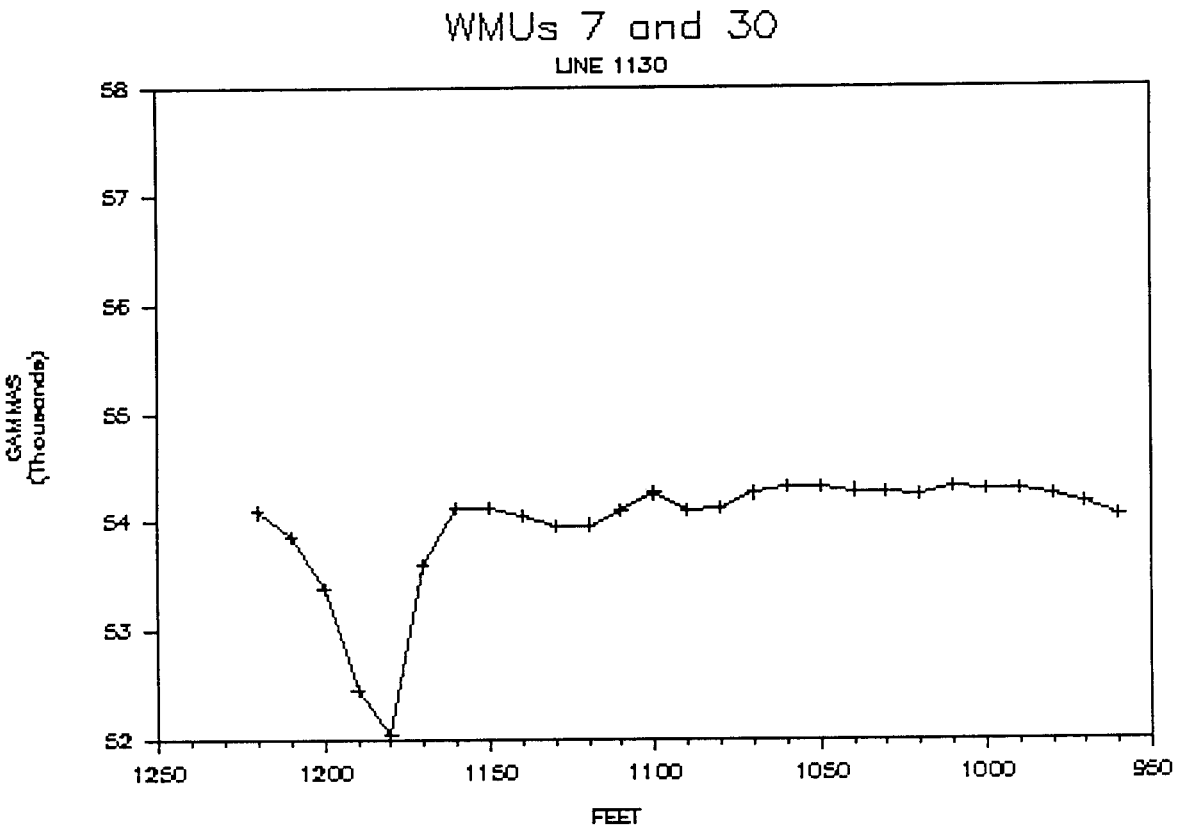

WMUs 7 and 30
VERTICAL GRADIENT – LINE 1070
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

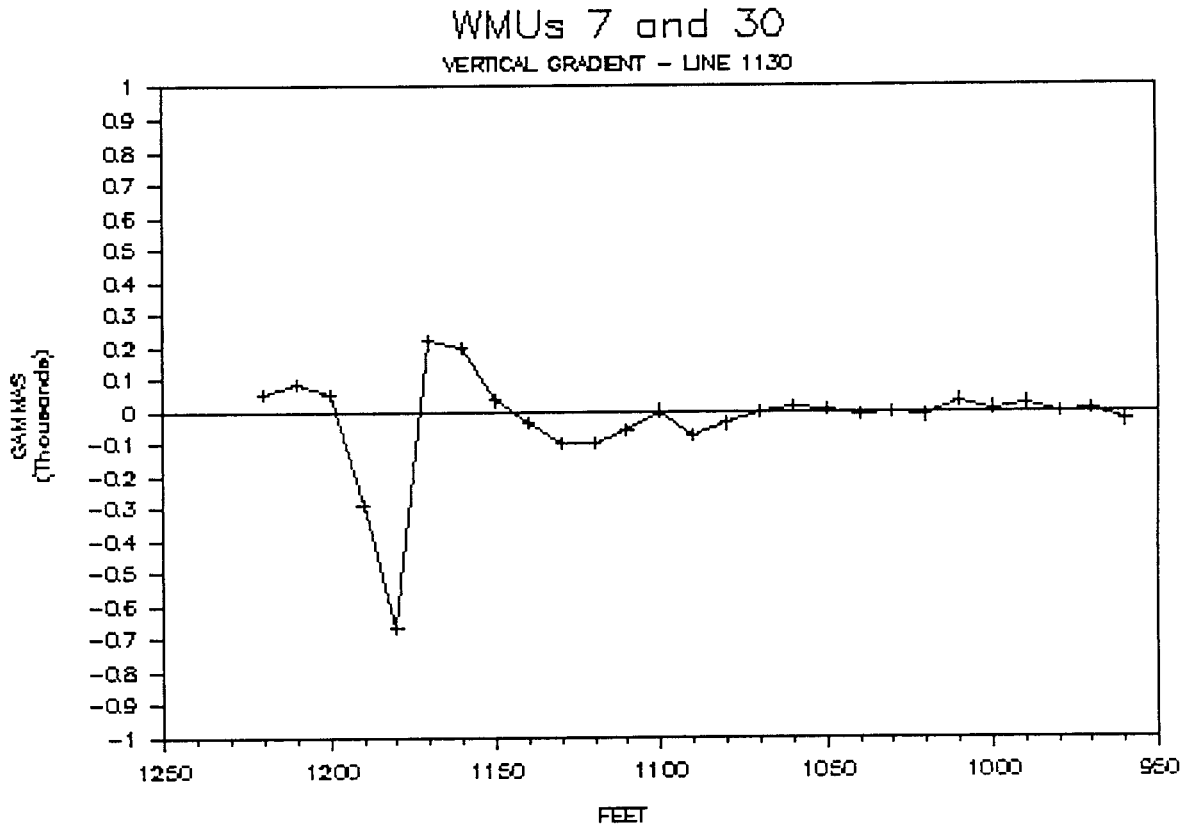

WMUs 7 and 30
LINE 1090
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

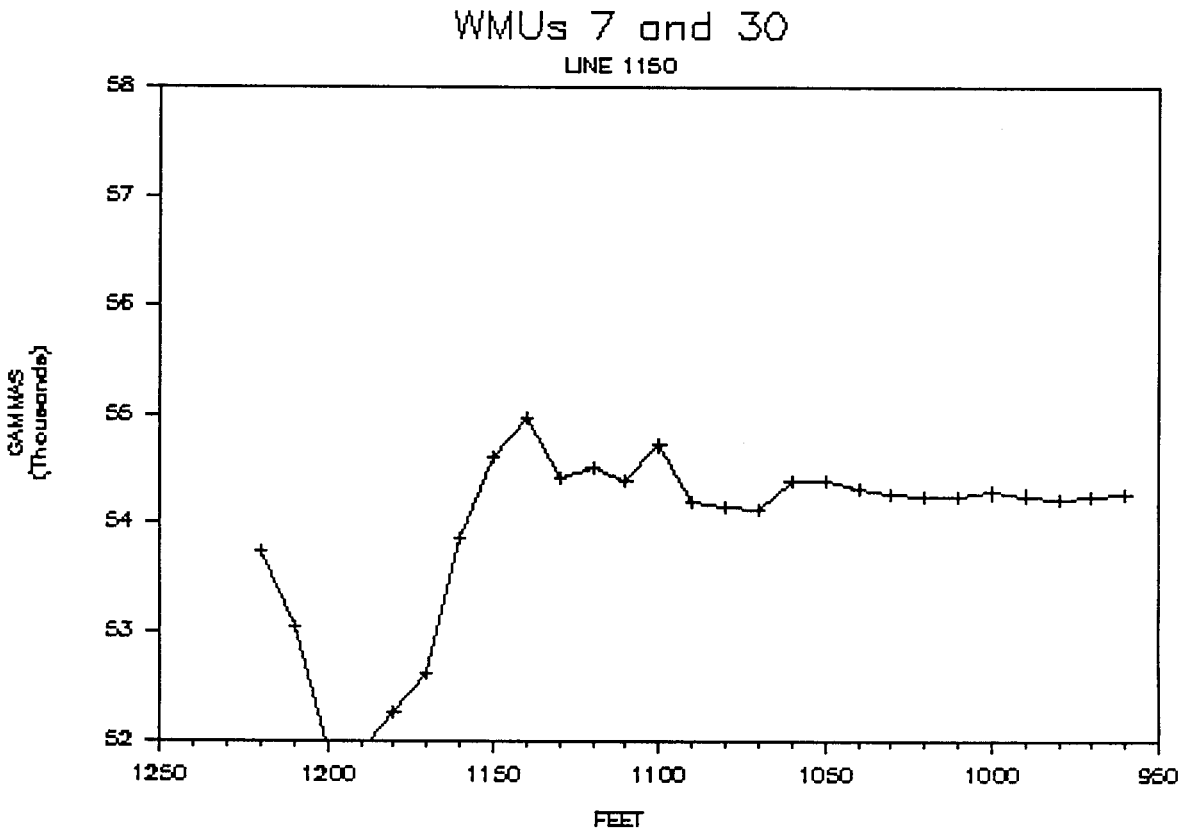

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1090
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

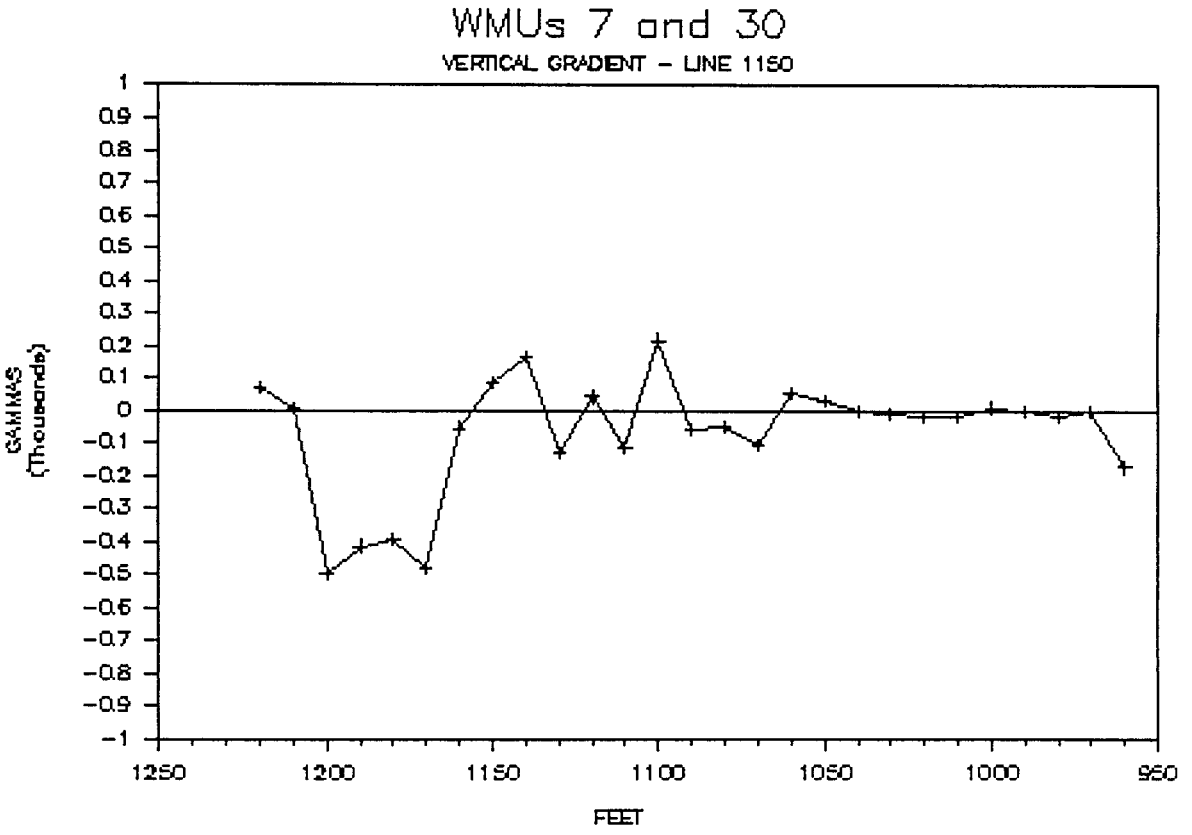

WMUs 7 and 30
LINE 1110
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

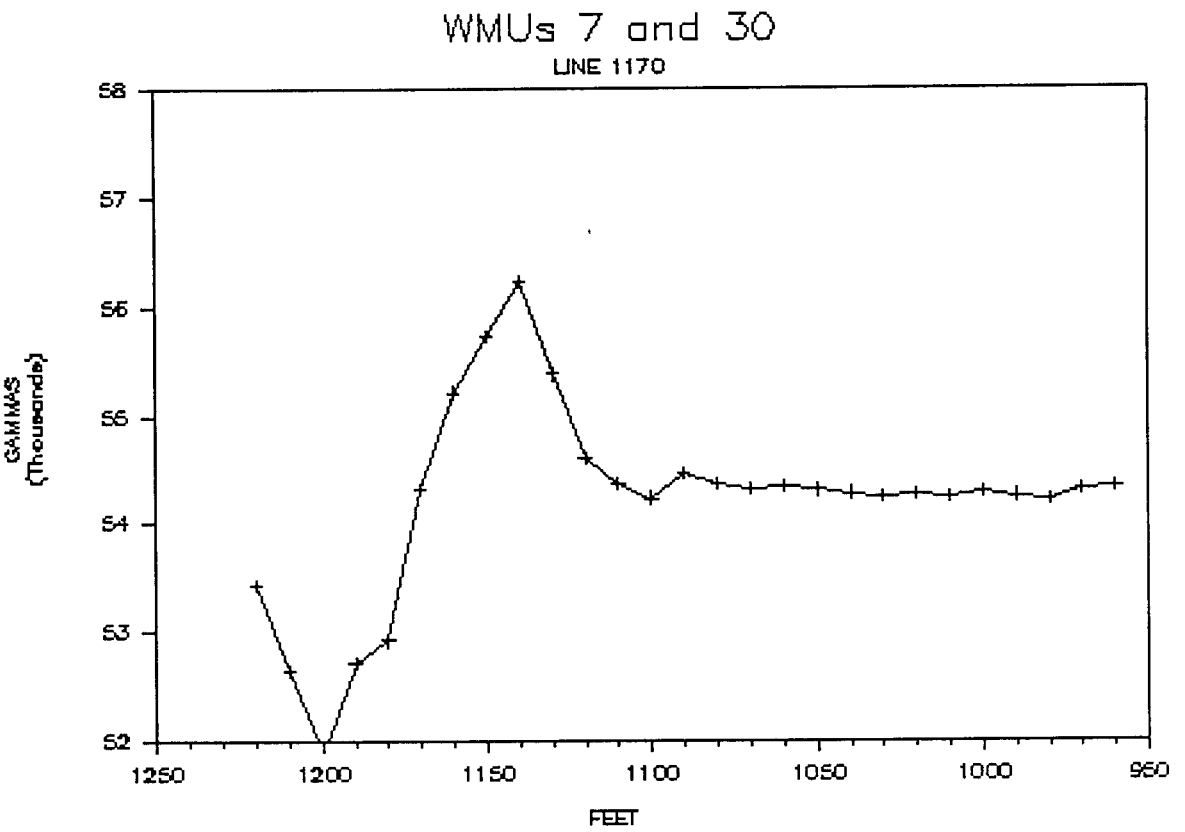

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1110
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

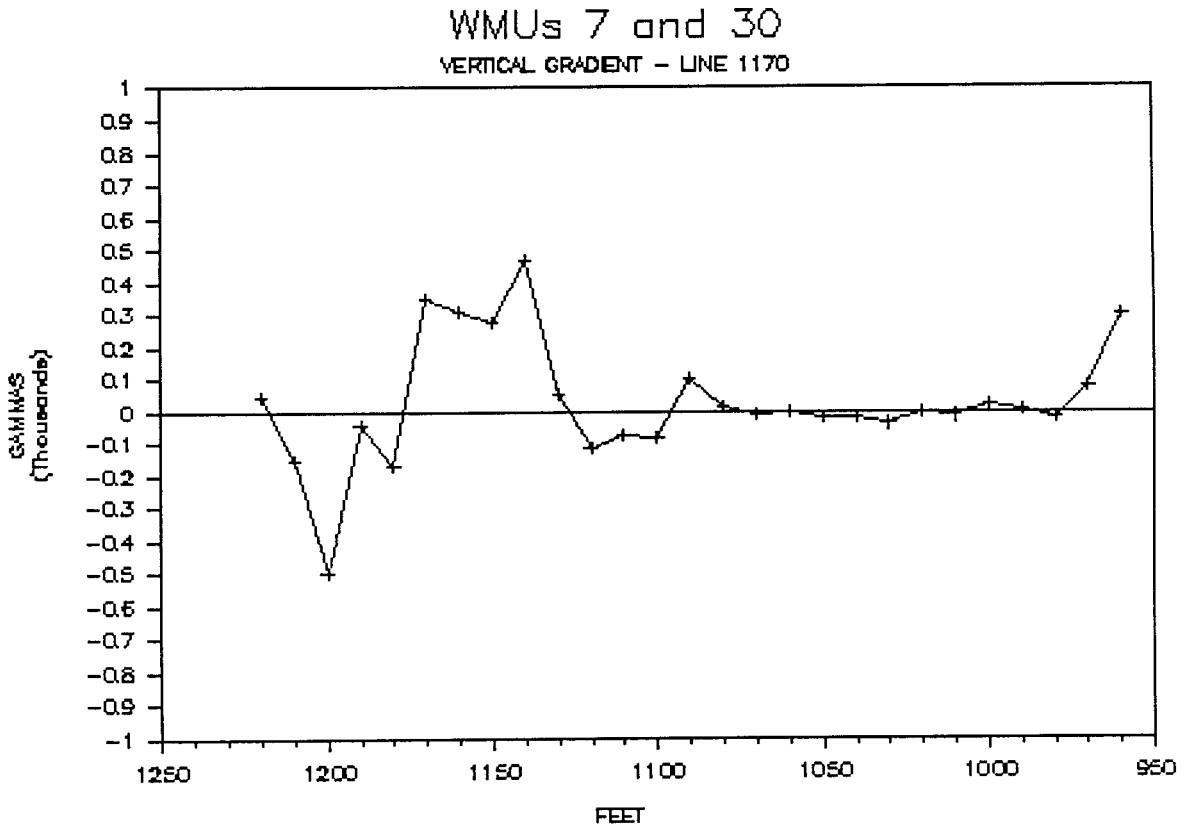

WMUs 7 and 30
LINE 1130
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

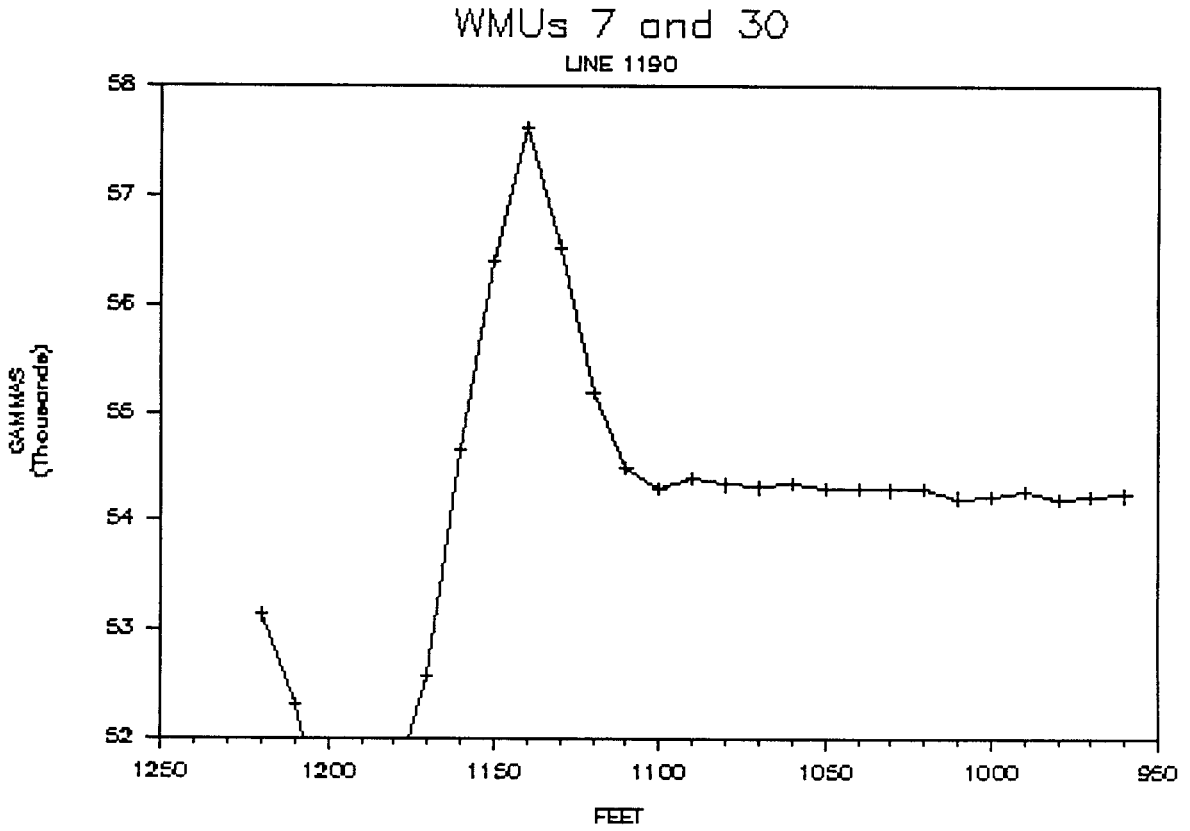

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1130
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

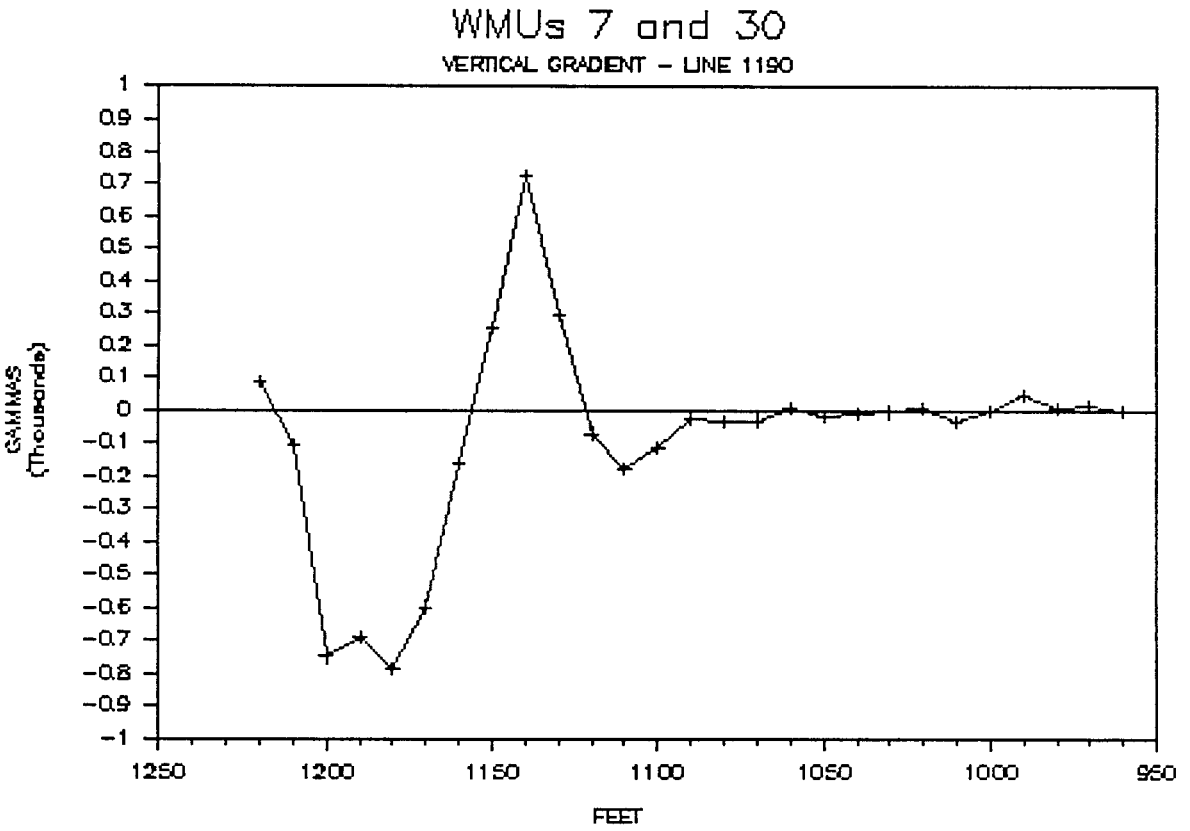

WMUs 7 and 30
LINE 1150
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

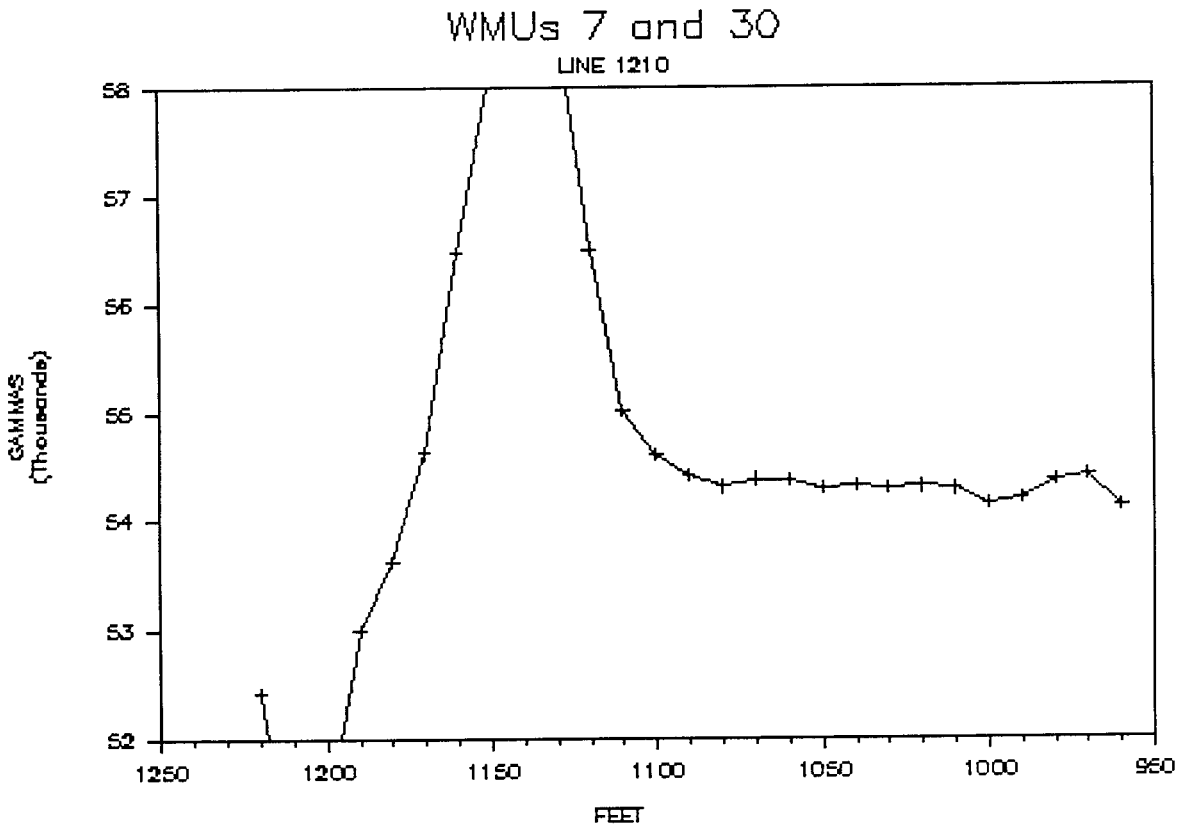

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1150
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

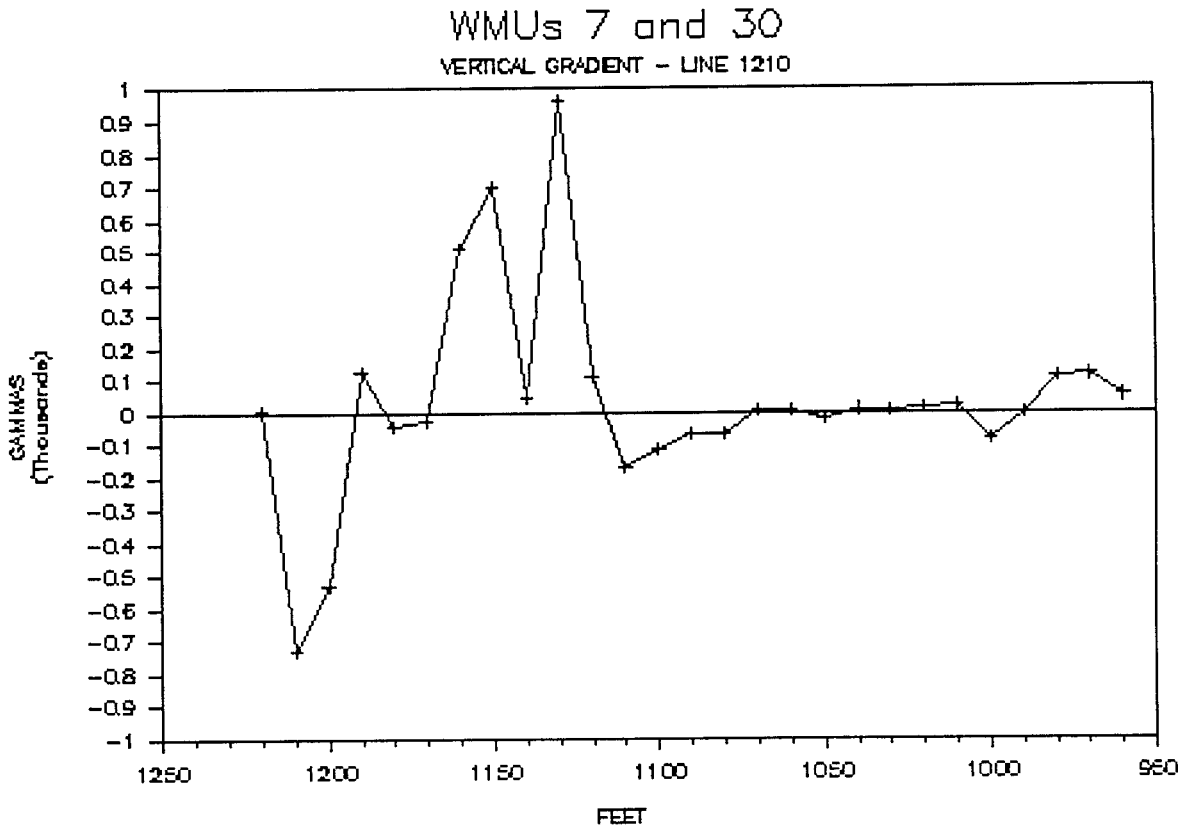

WMUs 7 and 30
LINE 1170
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
VERTICAL GRADIENT – LINE 1170
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
LINE 1190
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
VERTICAL GRADIENT - LINE 1190
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
LINE 1210
GAMMAS
(Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
VERTICAL GRADIENT - LINE 1210
GAMMAS
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
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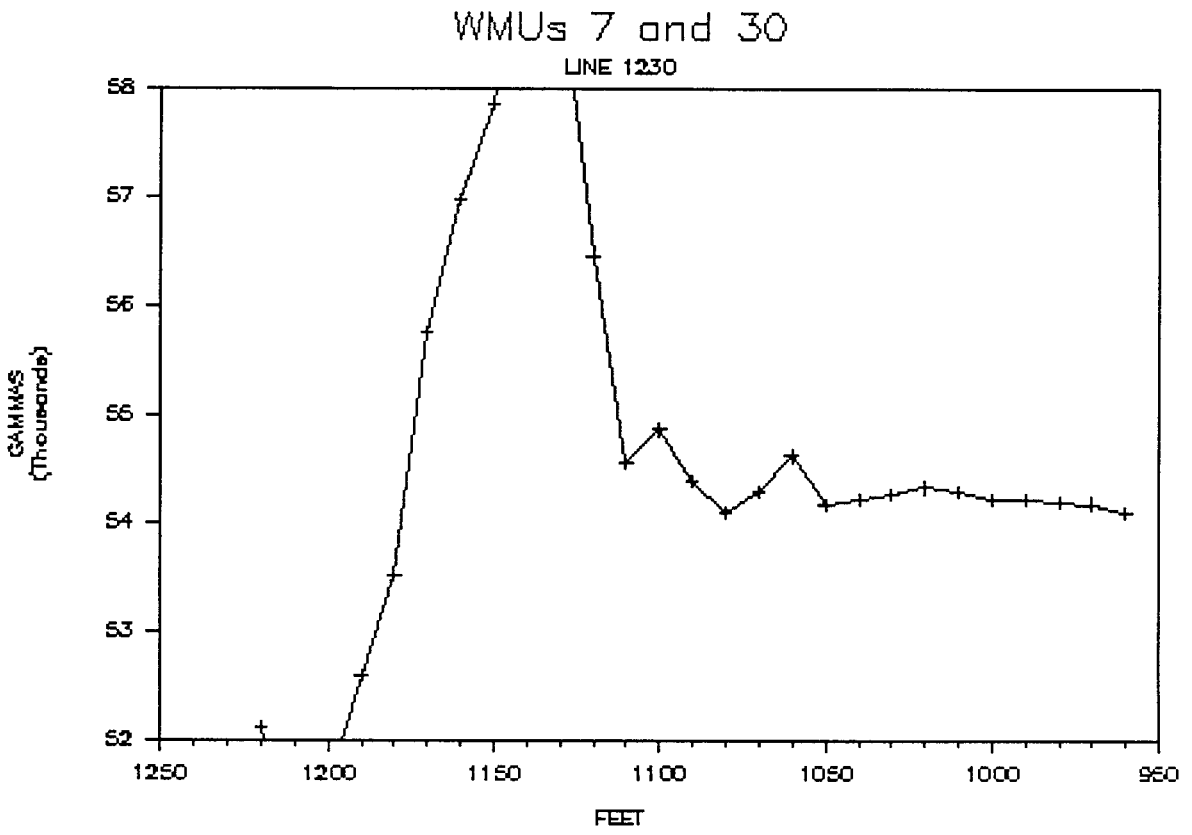
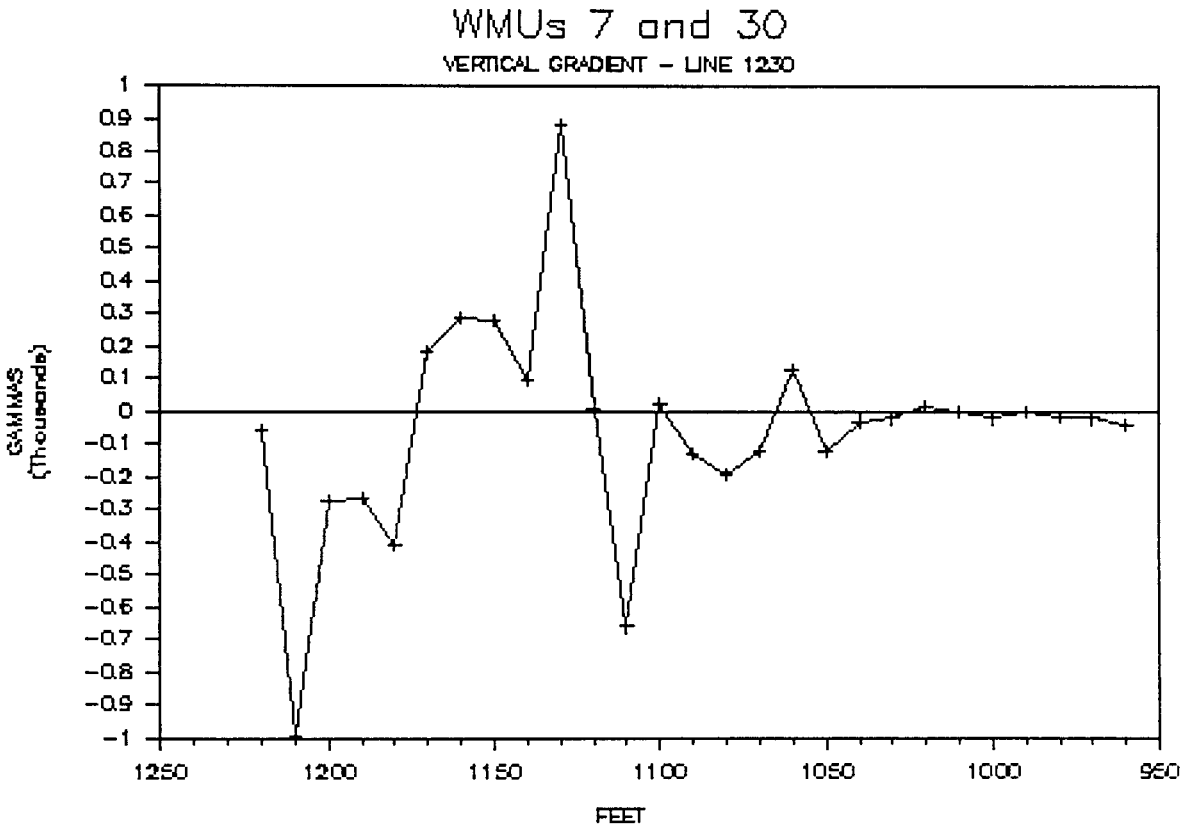
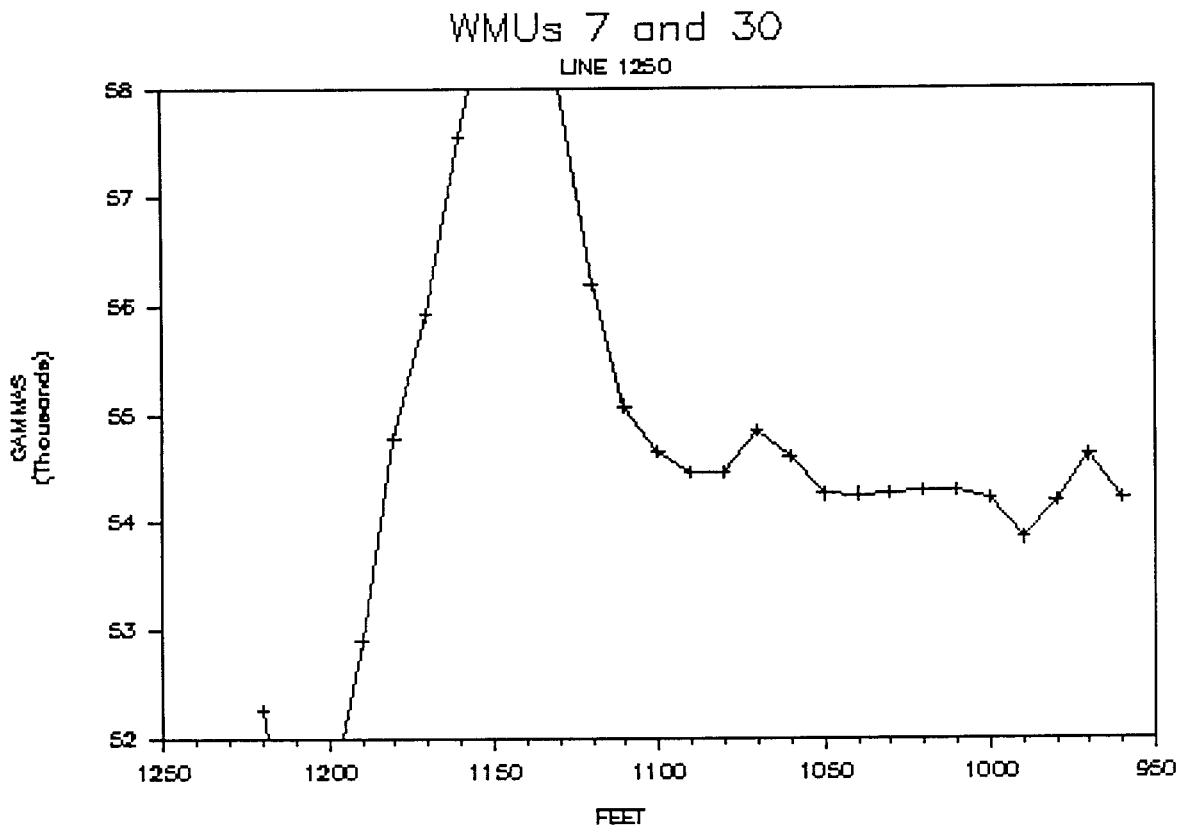
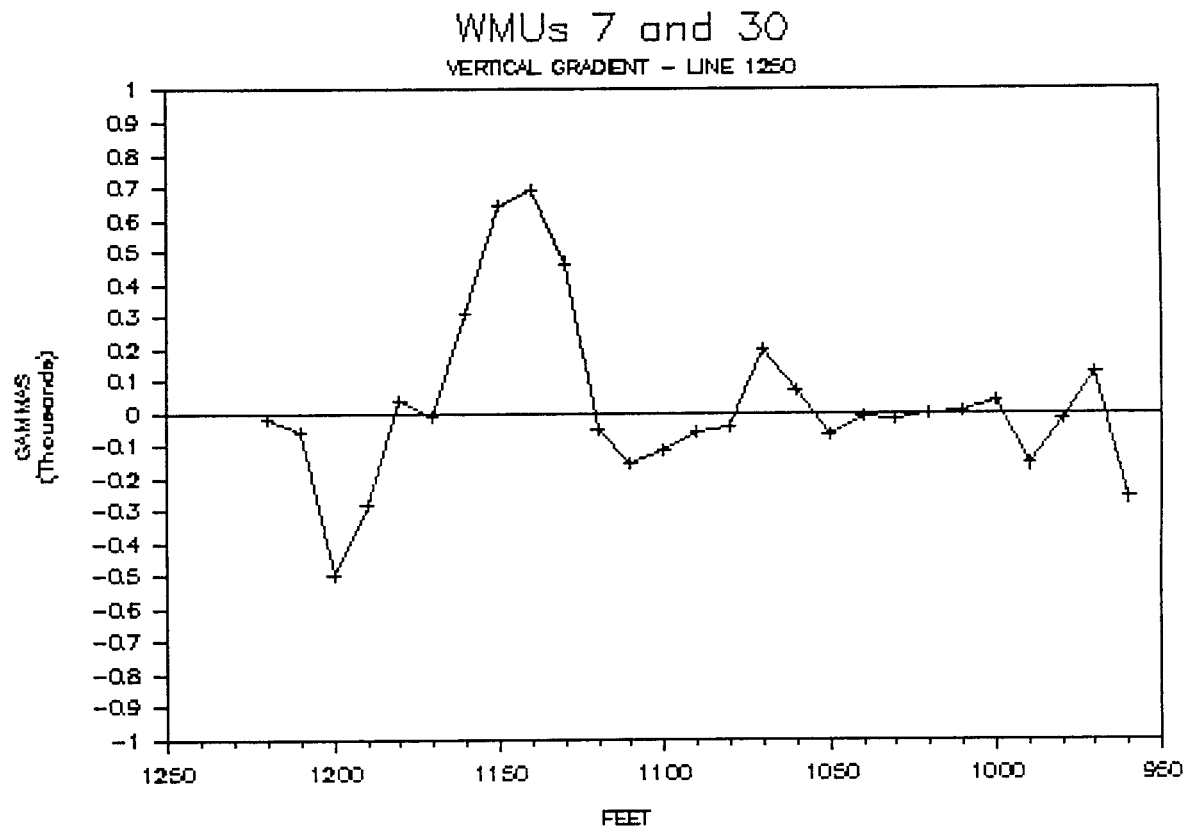
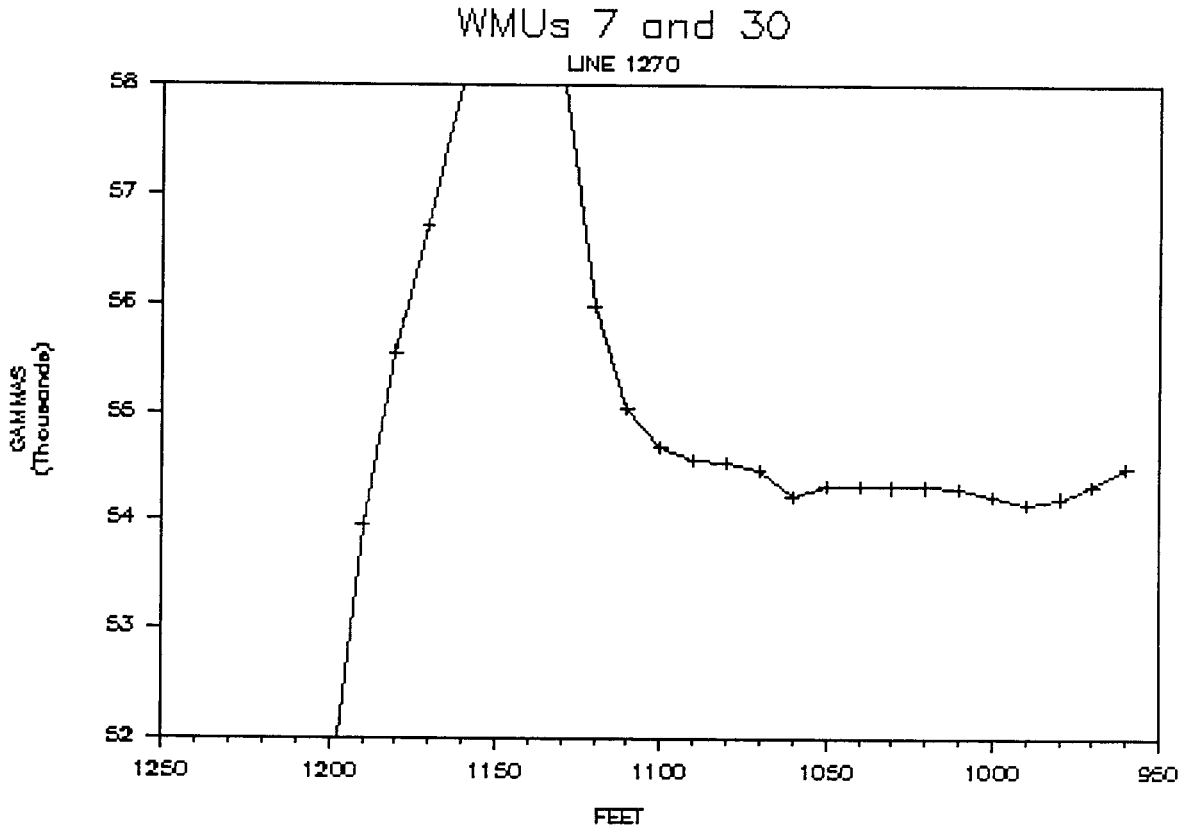
1200
1150
1100
1050
1000
950
FEET

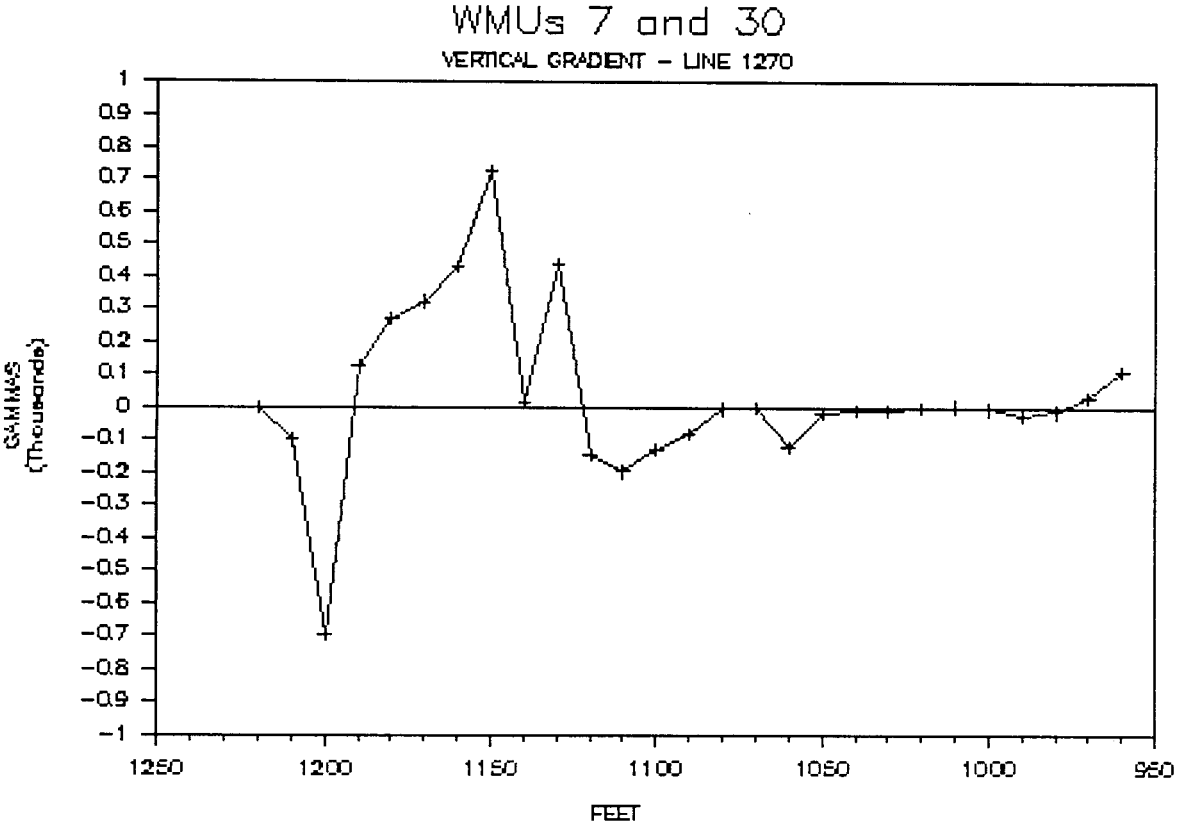

WMUs 7 and 30
LINE 1230
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

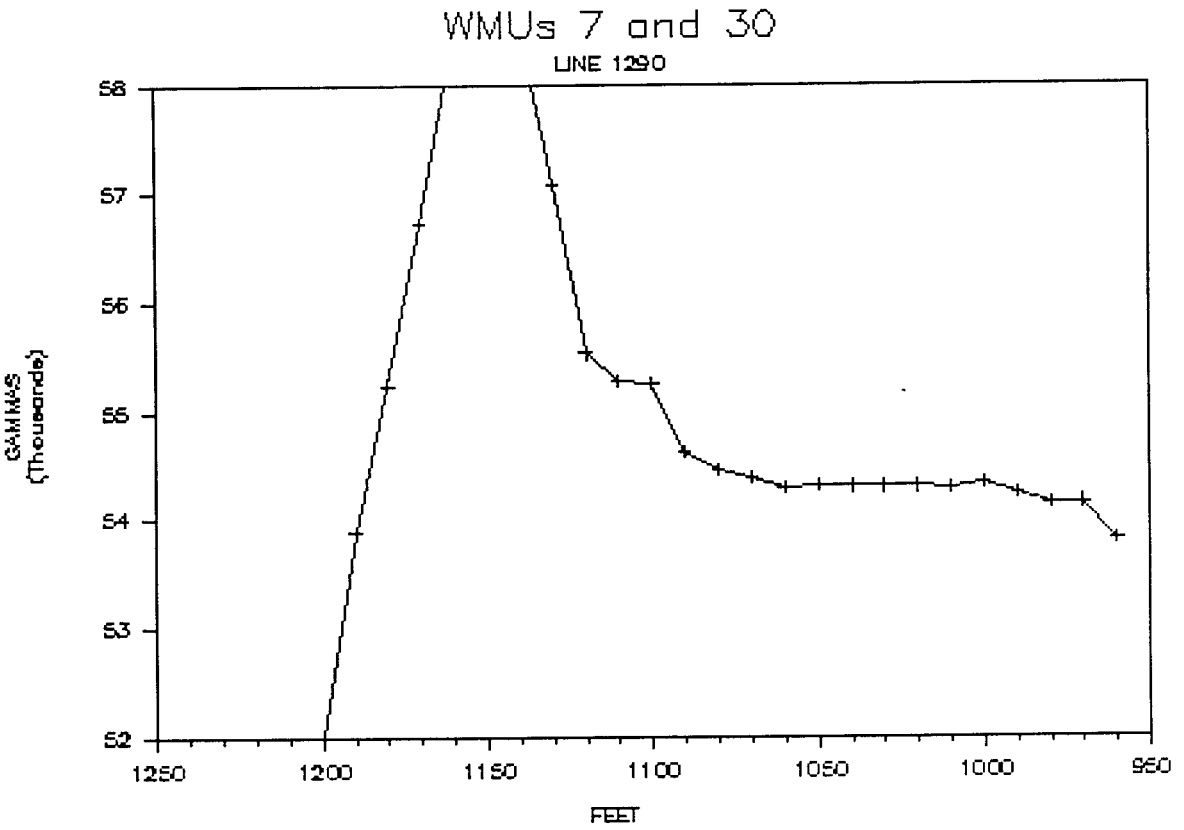

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1230
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

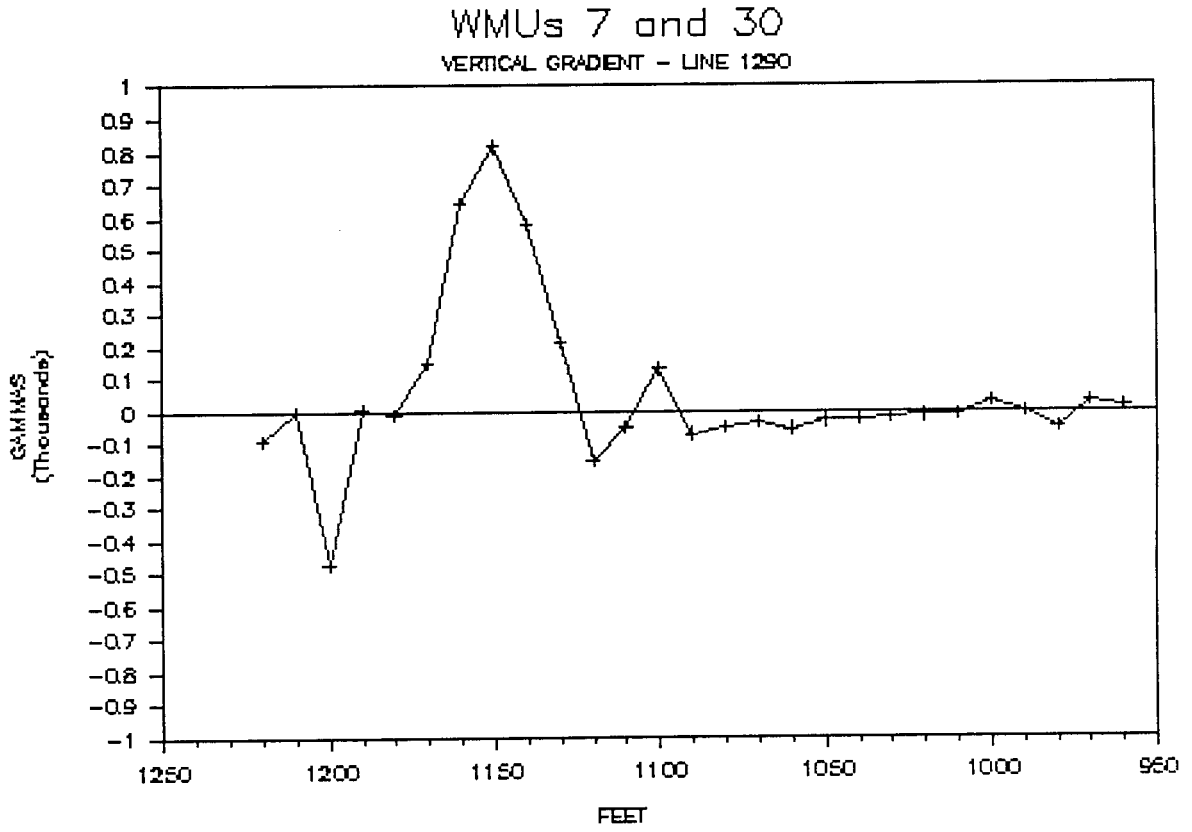

WMUs 7 and 30
LINE 1250
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

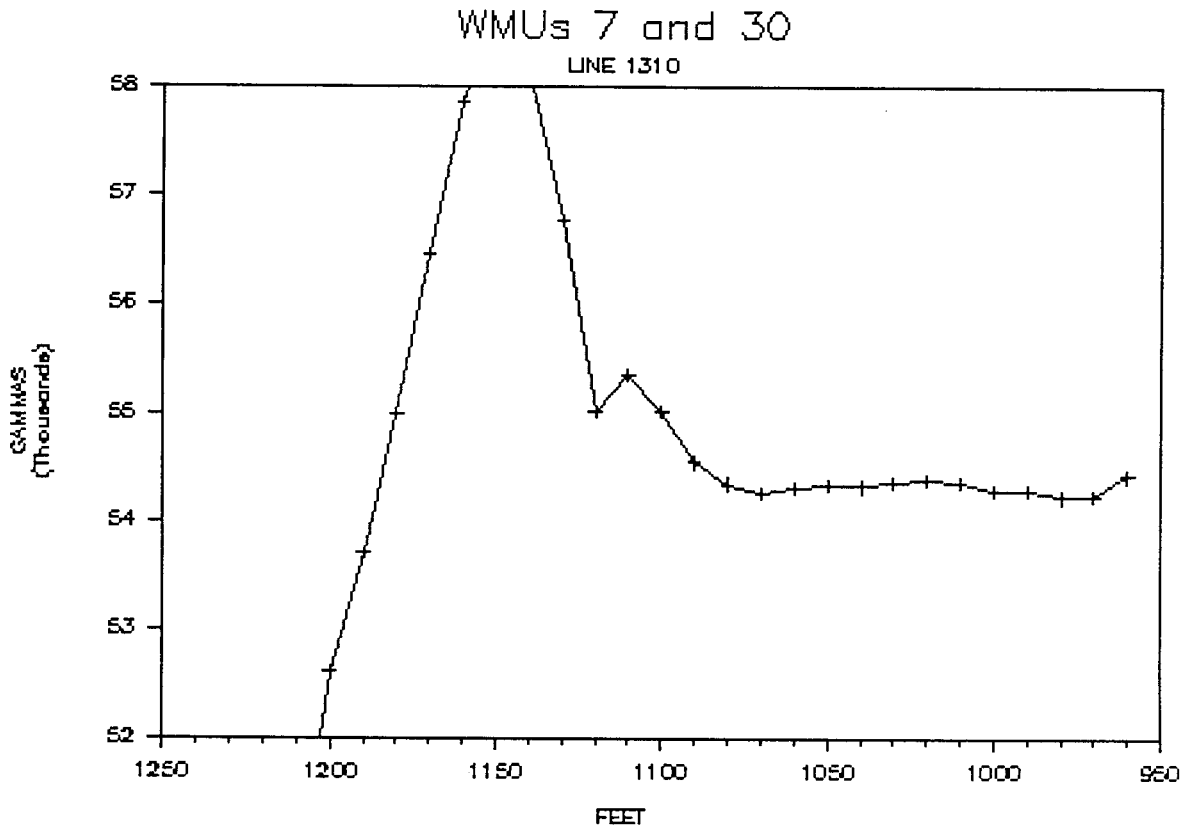

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1250
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

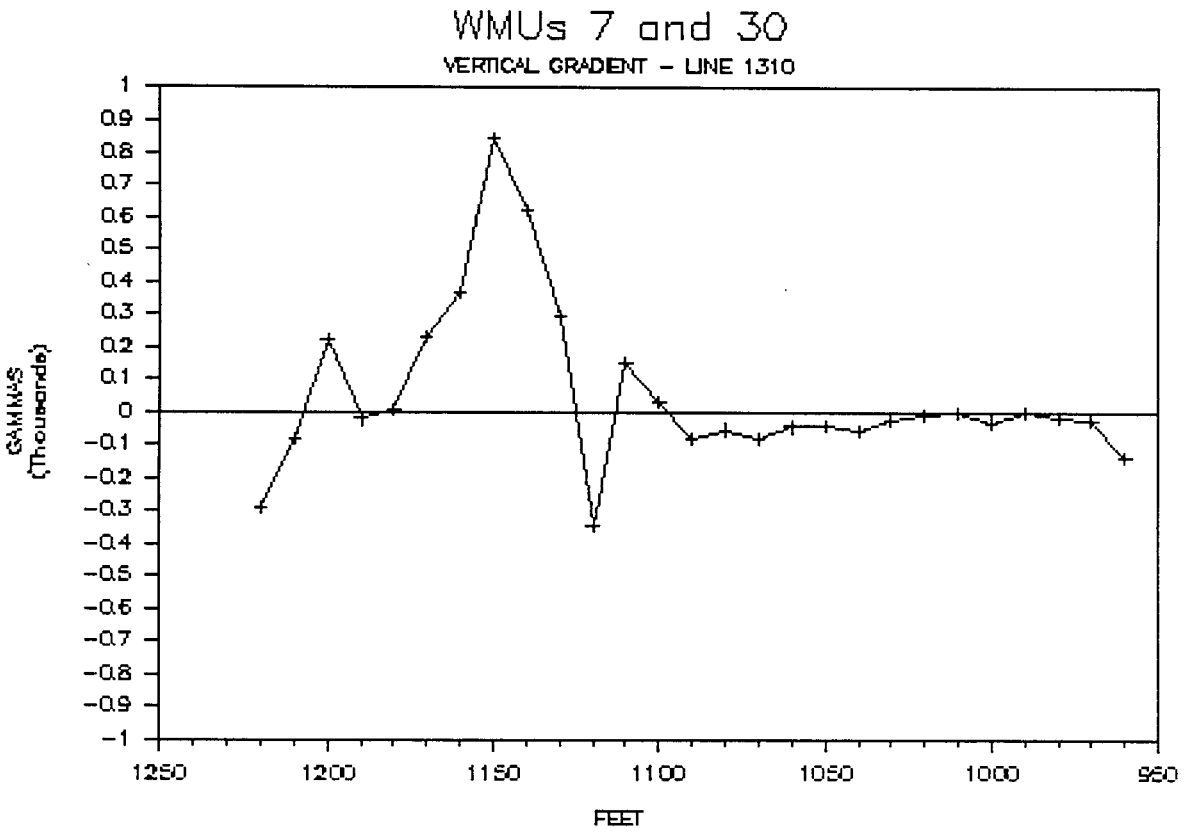

WMUs 7 and 30
LINE 1270
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

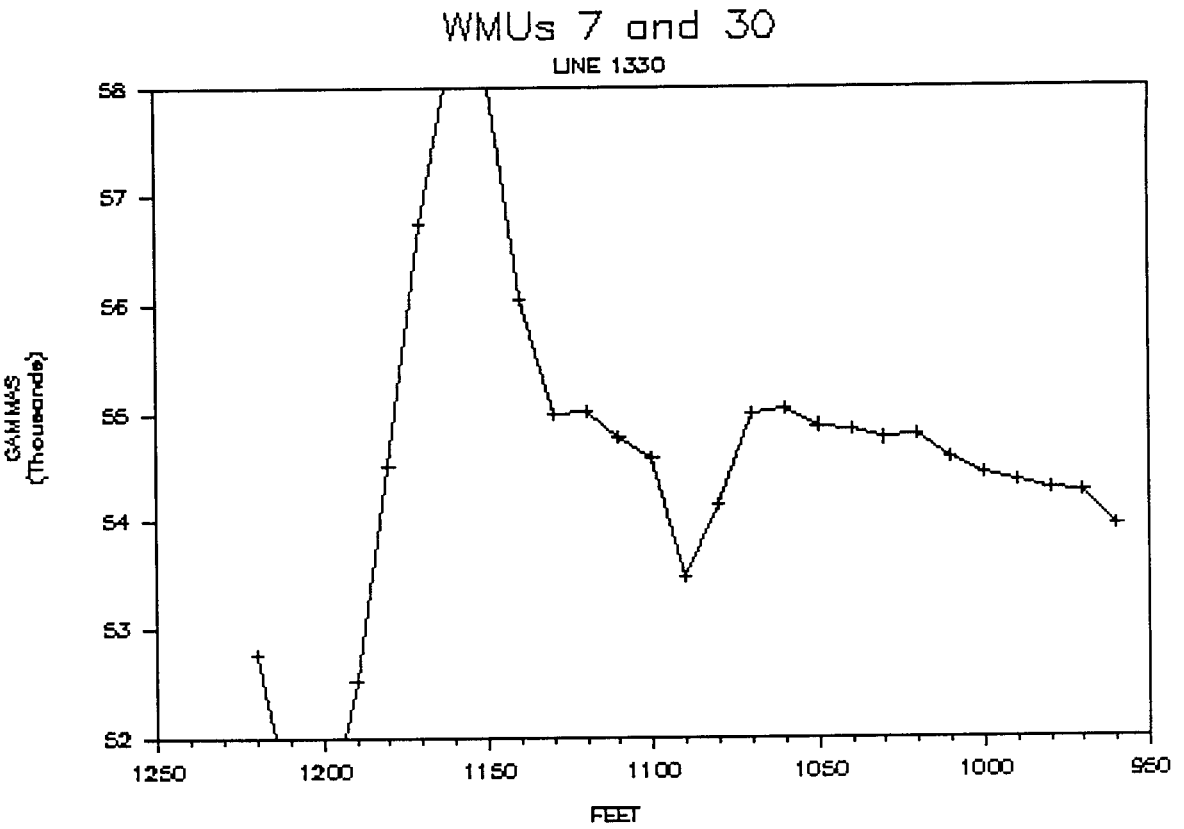

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1270
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

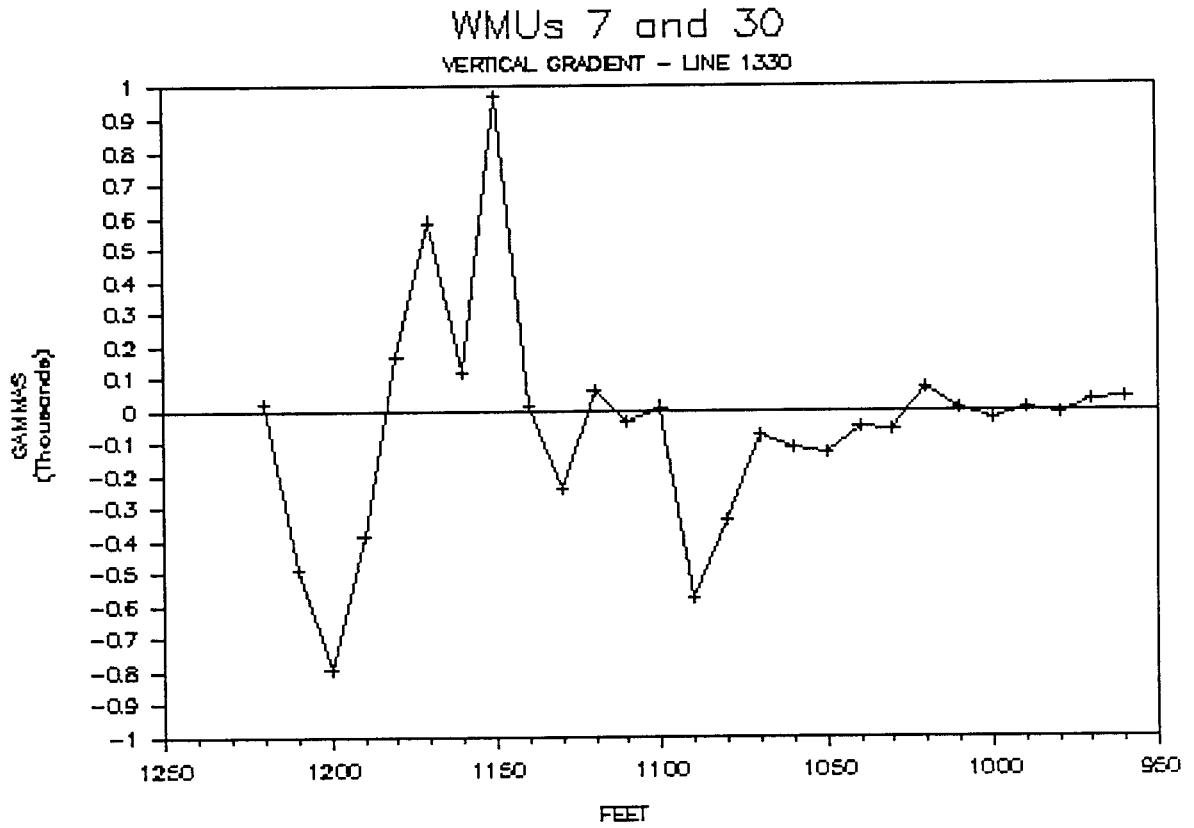

WMUs 7 and 30
LINE 1290
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

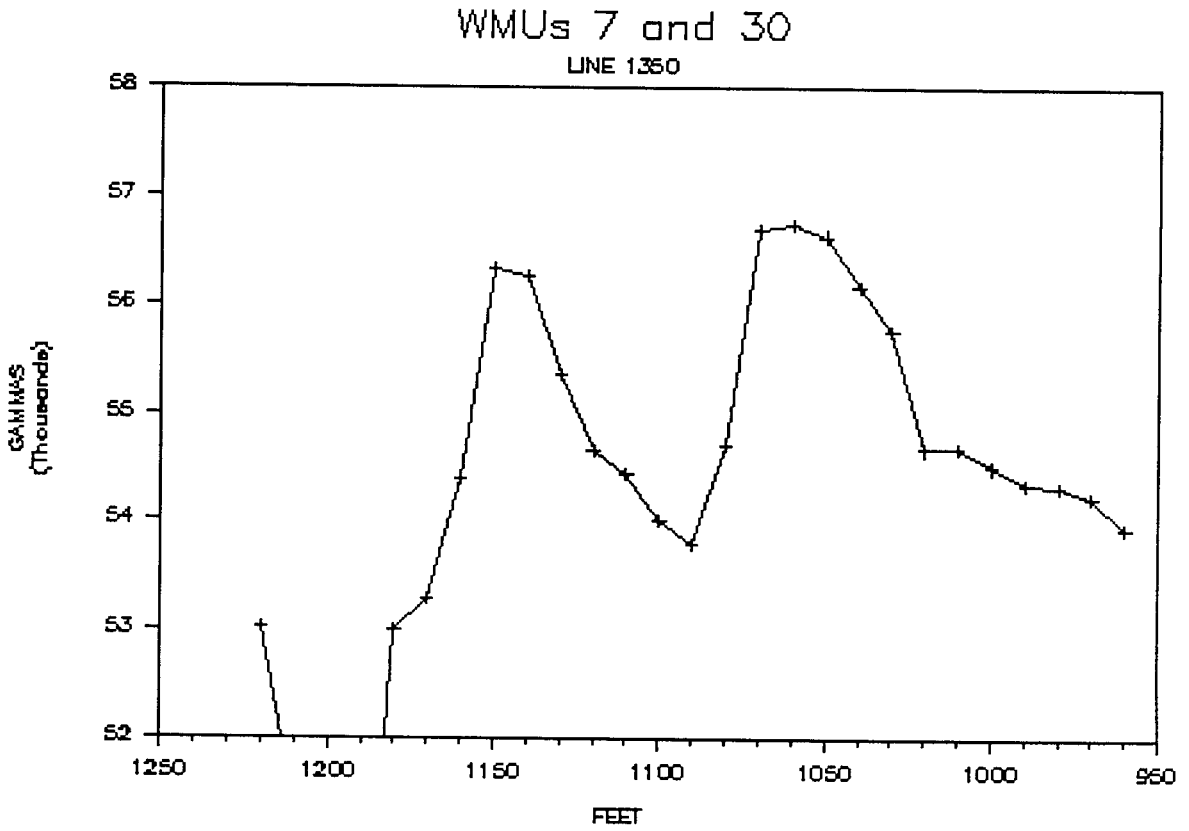

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1290
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

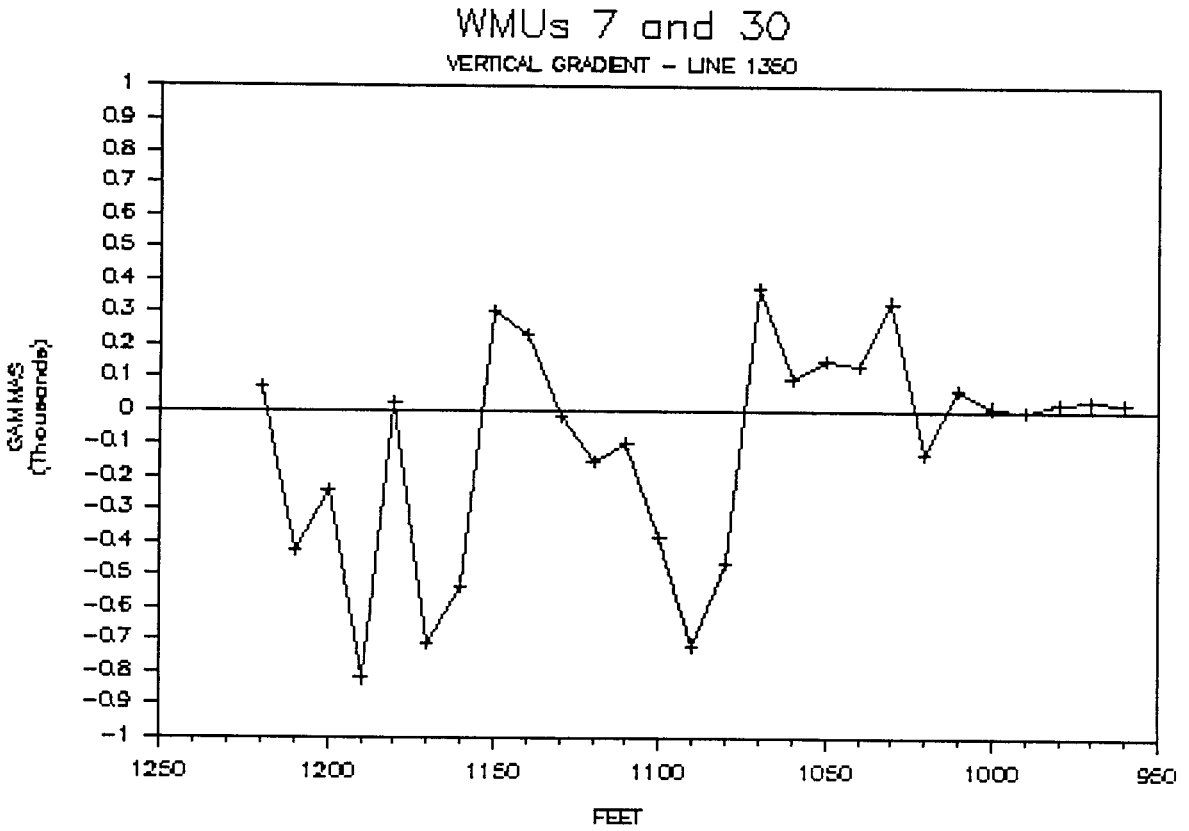

WMUs 7 and 30
LINE 1310
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

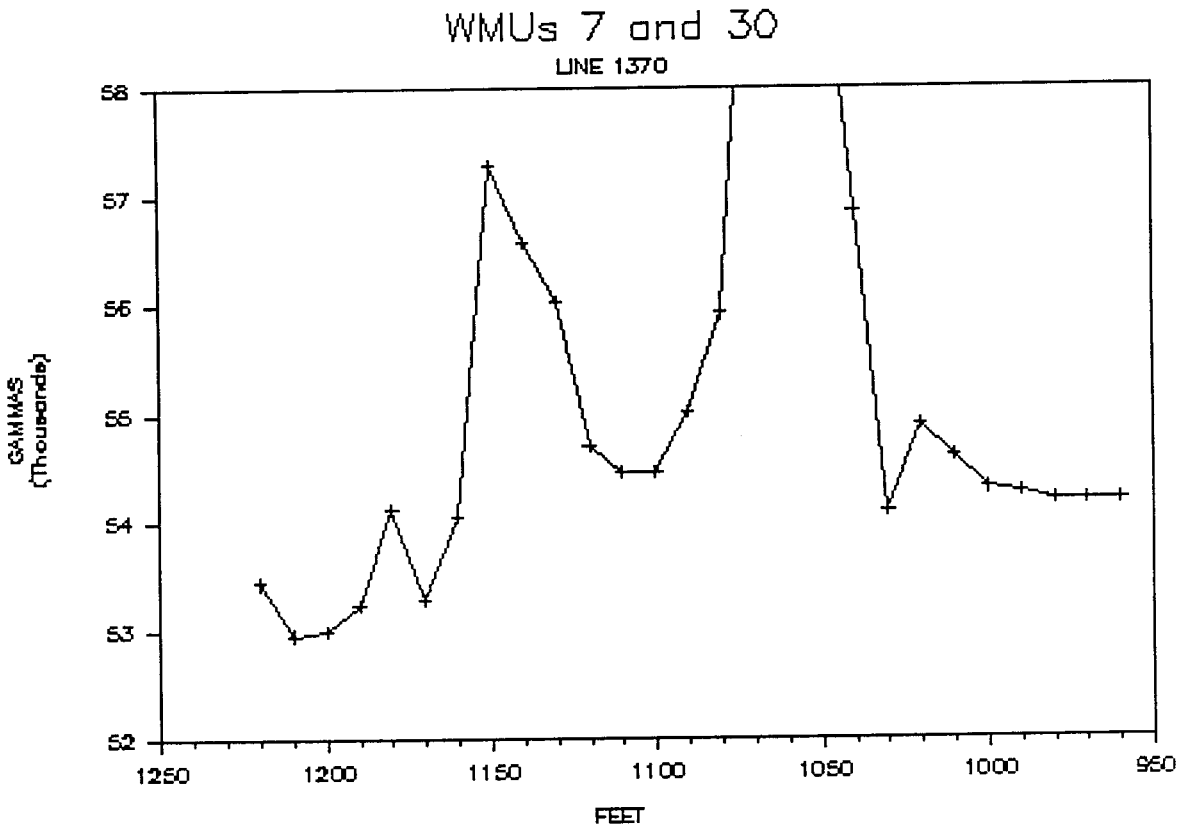

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1310
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

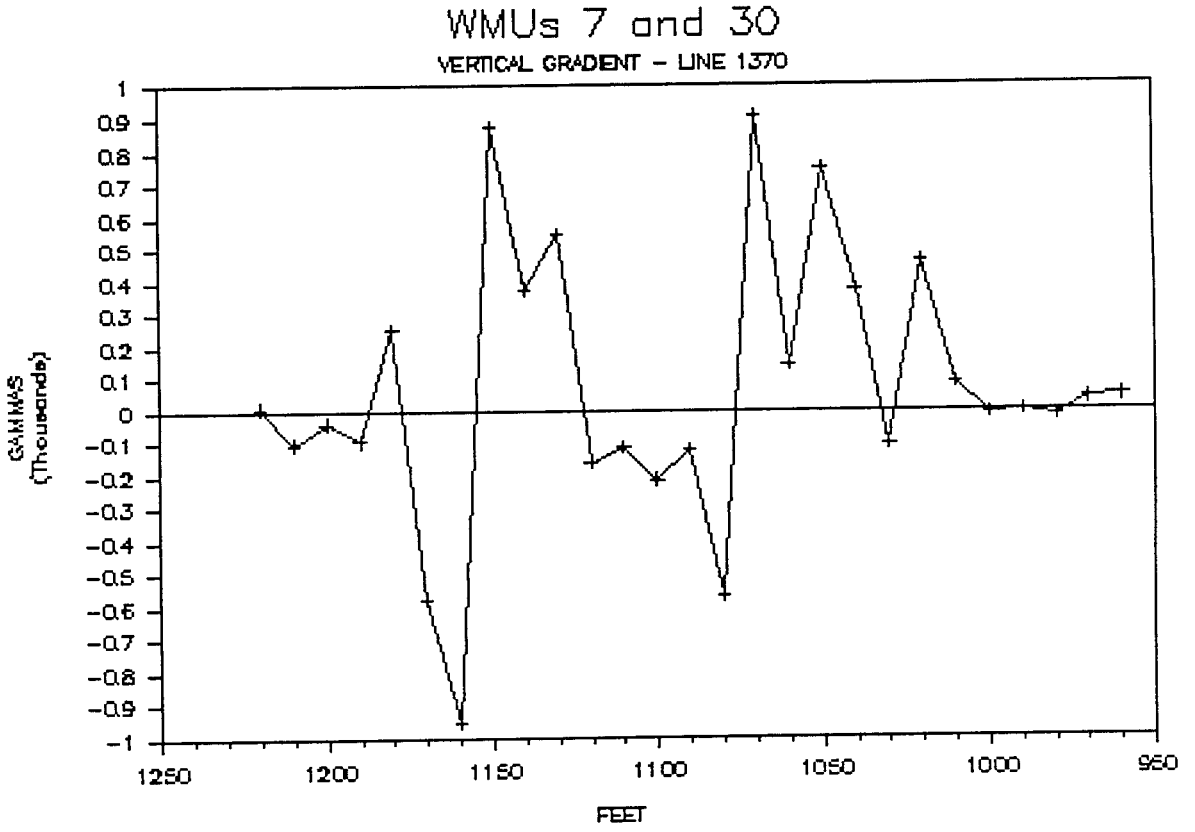

WMUs 7 and 30
LINE 1330
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

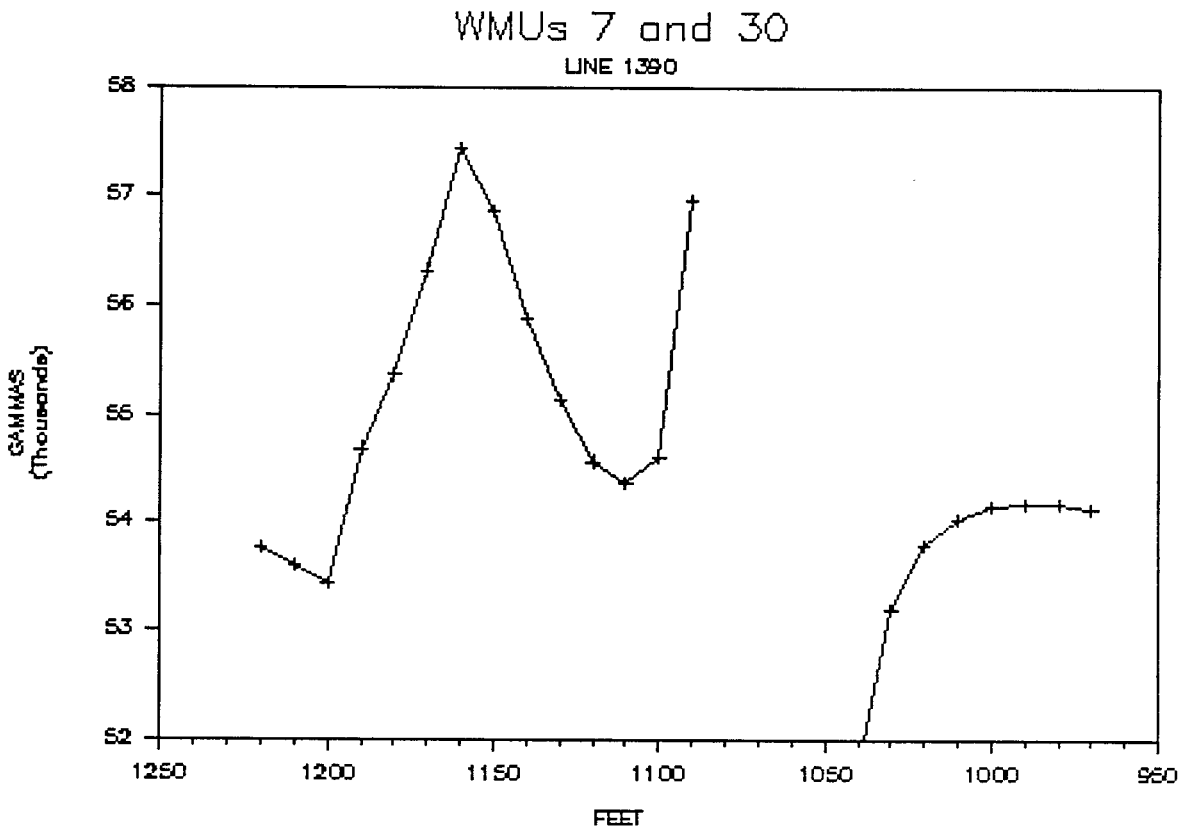

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1330
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

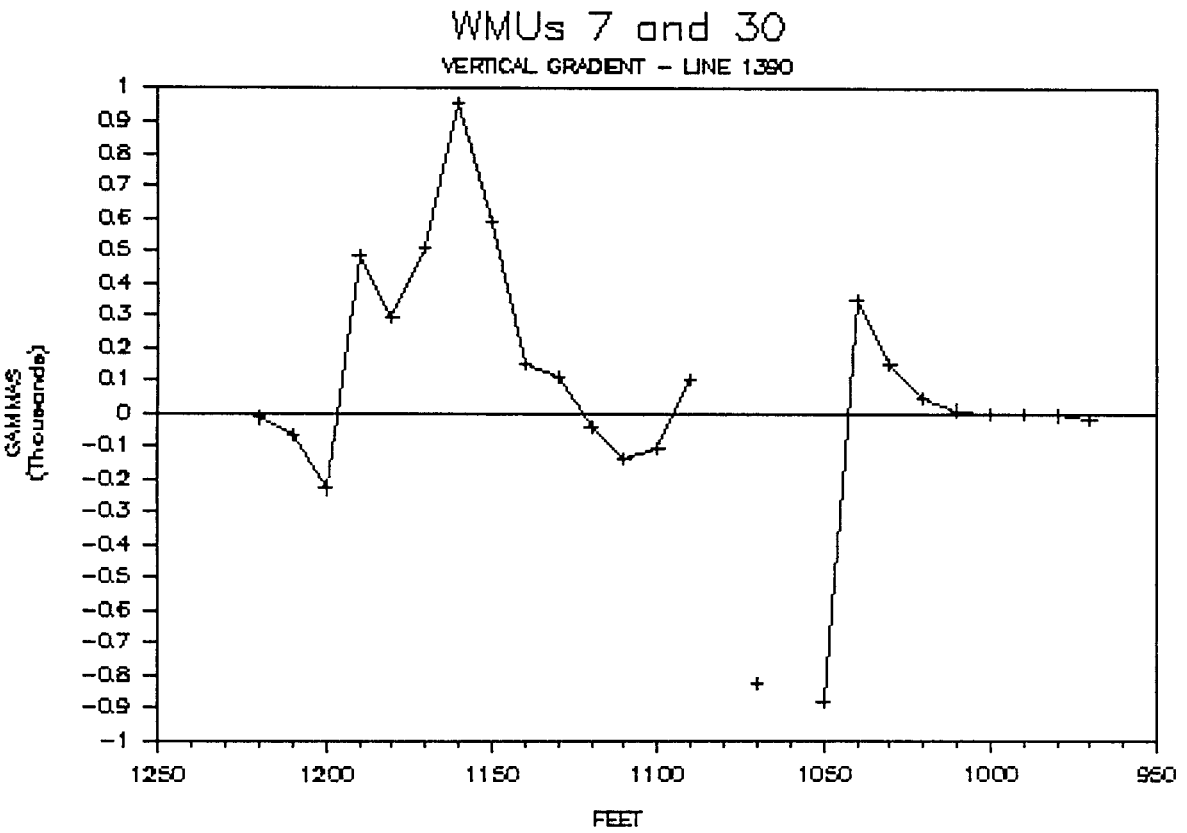

WMUs 7 and 30
LINE 1350
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

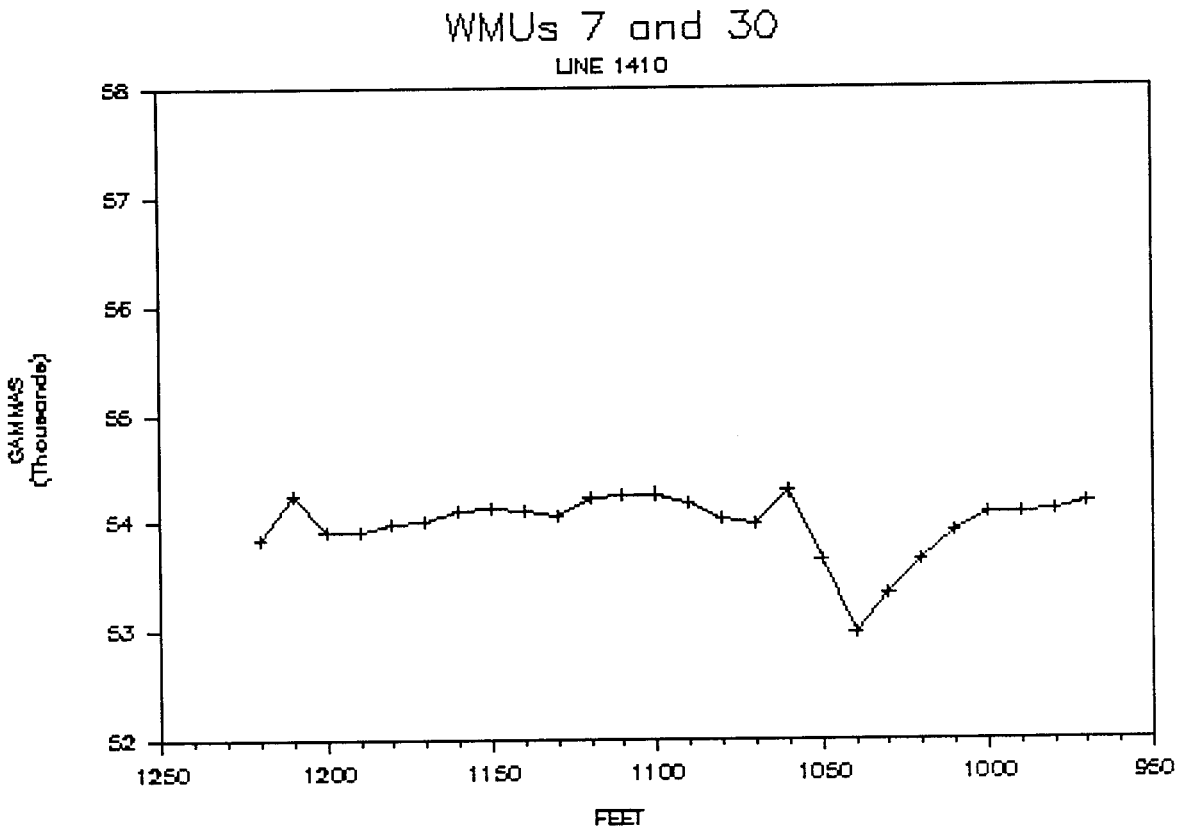

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1350
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

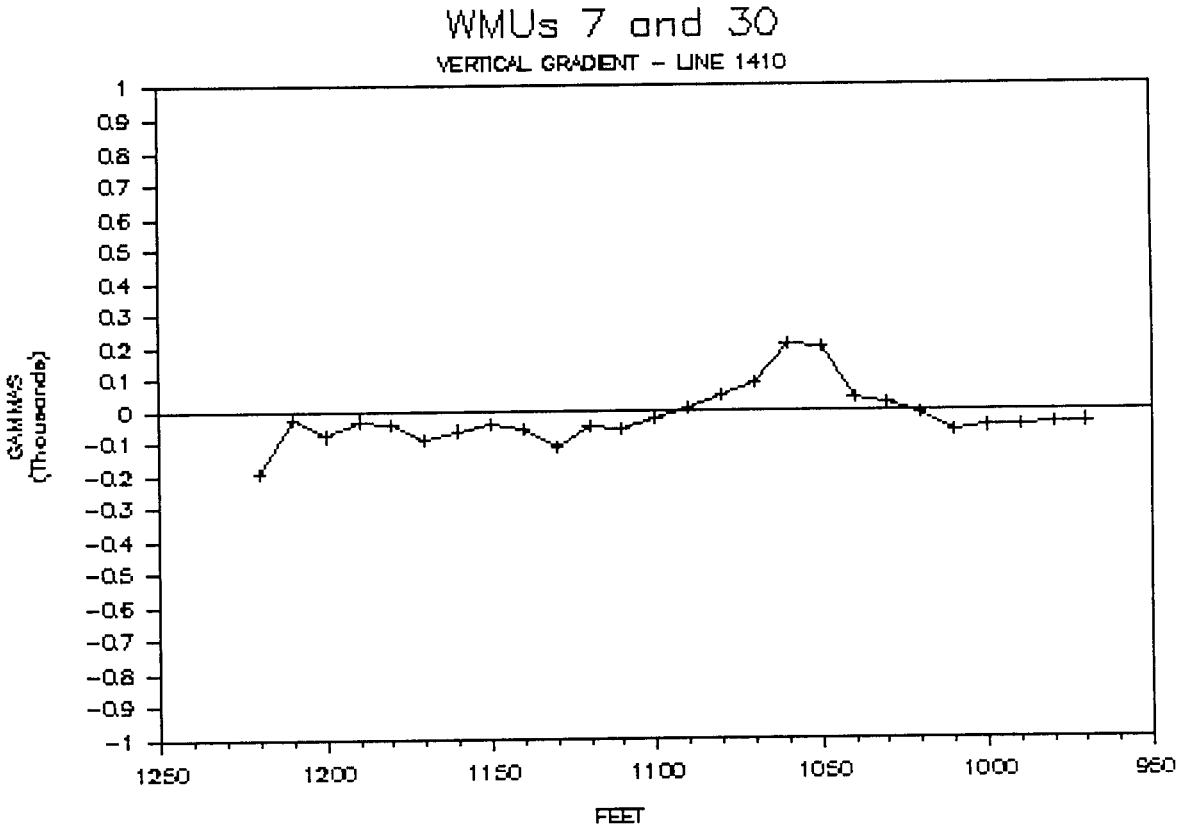

WMUs 7 and 30
LINE 1370
GAMMAS
(Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

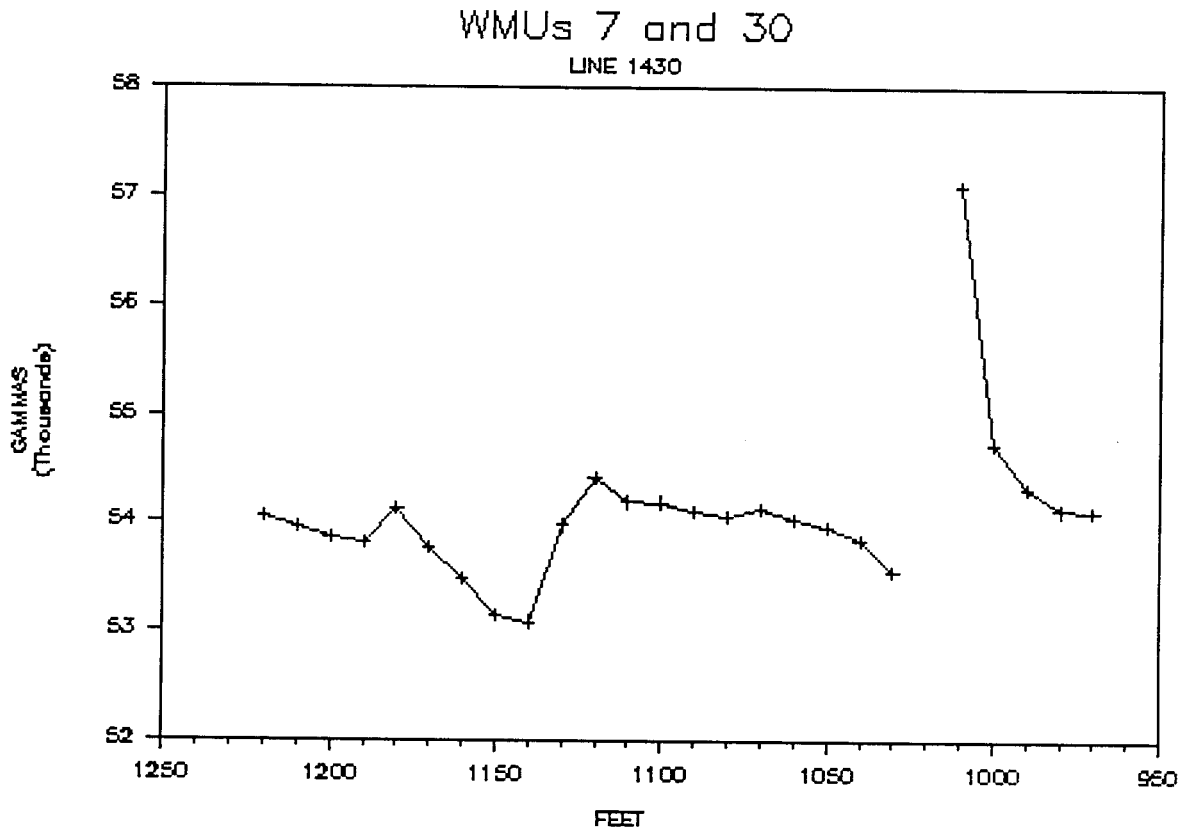

WMUs 7 and 30
VERTICAL GRADIENT – LINE 1370
GAMMAS
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

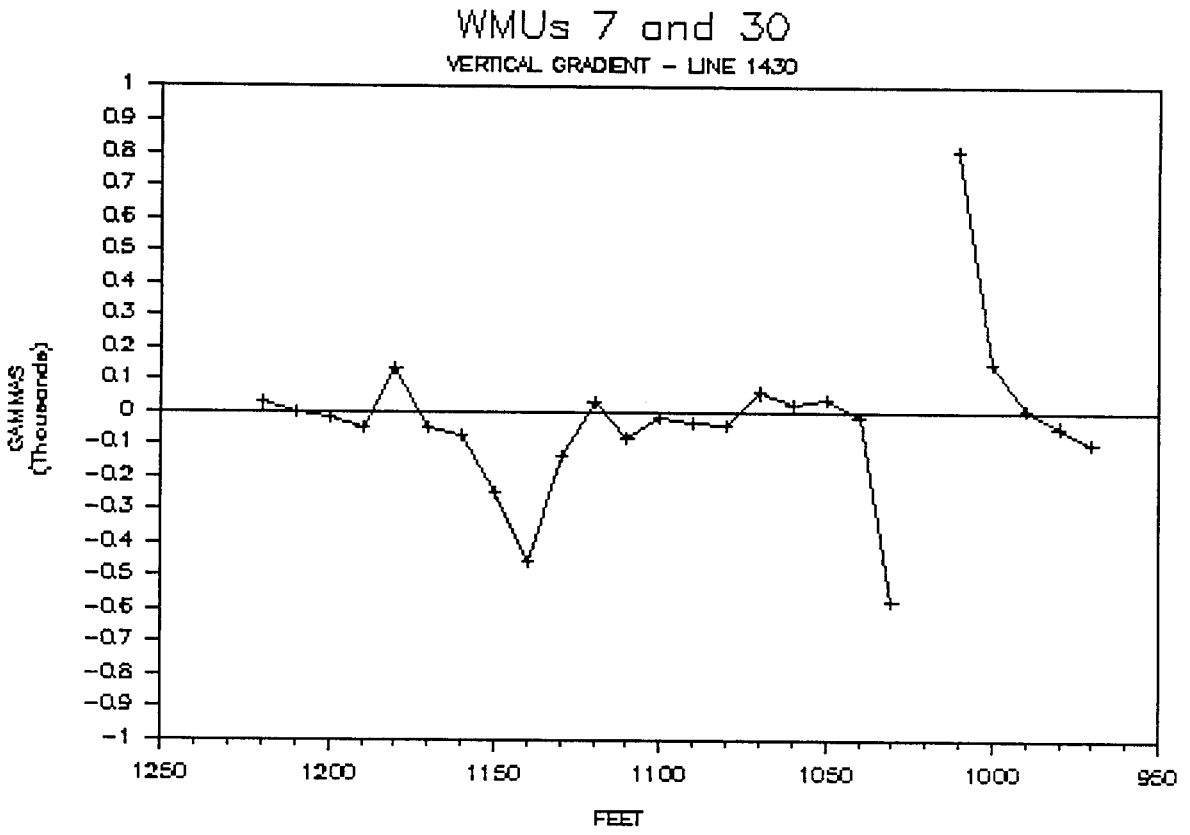

WMUs 7 and 30
LINE 1390
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
VERTICAL GRADIENT - LINE 1390
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
LINE 1410
GAMMAS
(Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
VERTICAL GRADIENT – LINE 1410
GAMMAS
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
LINE 1430
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
VERTICAL GRADIENT - LINE 1430
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
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1200
1150
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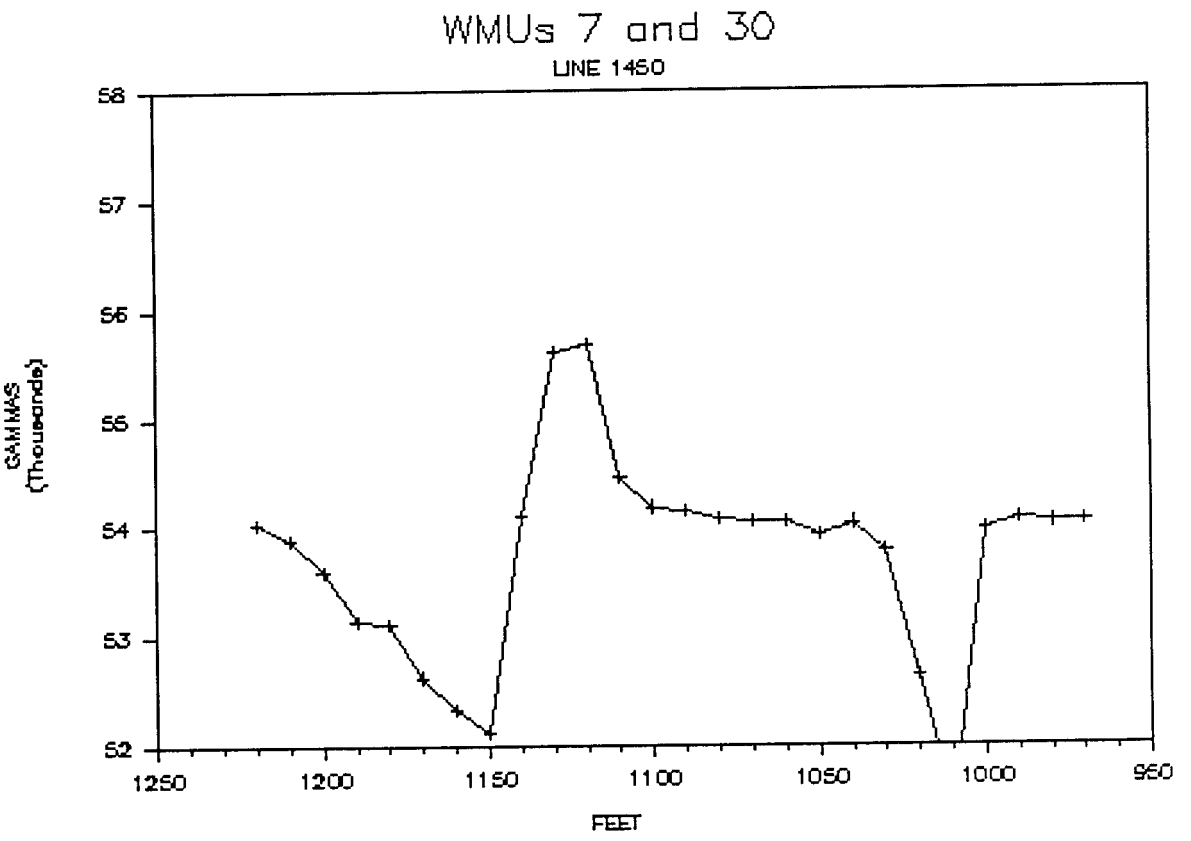
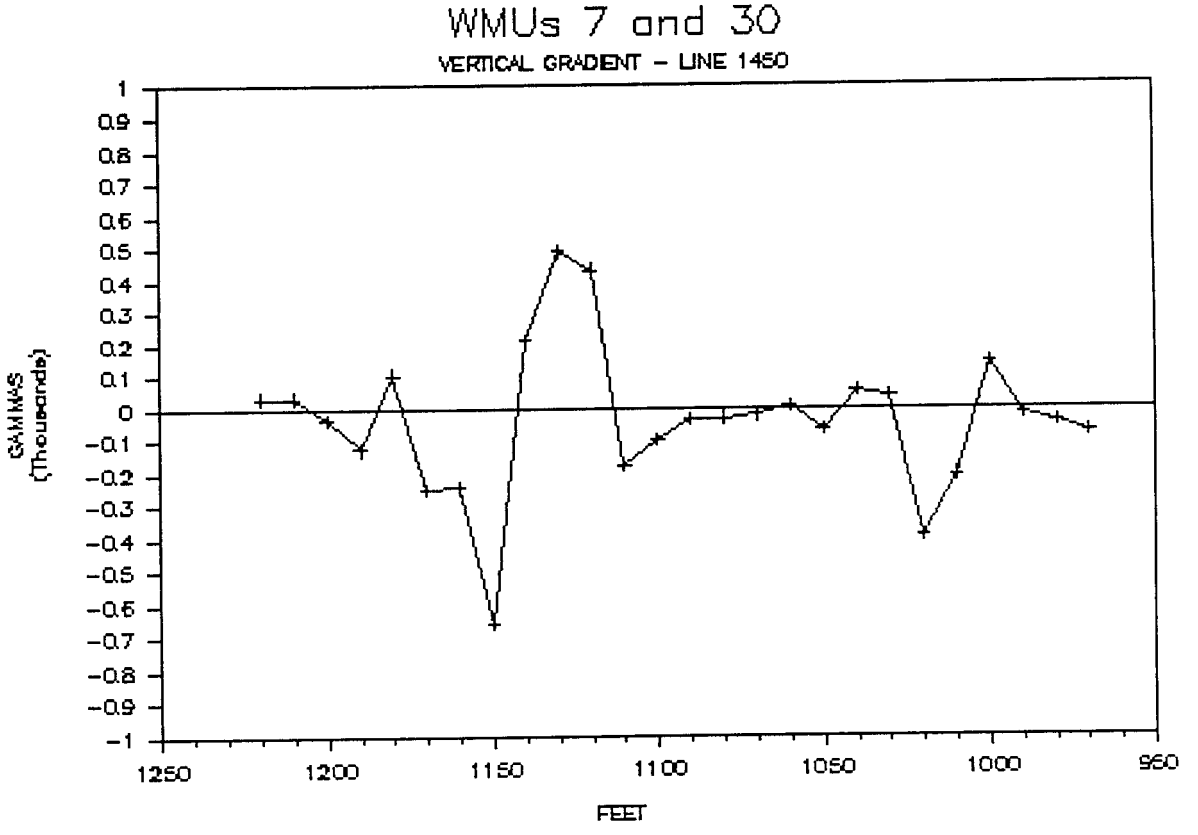
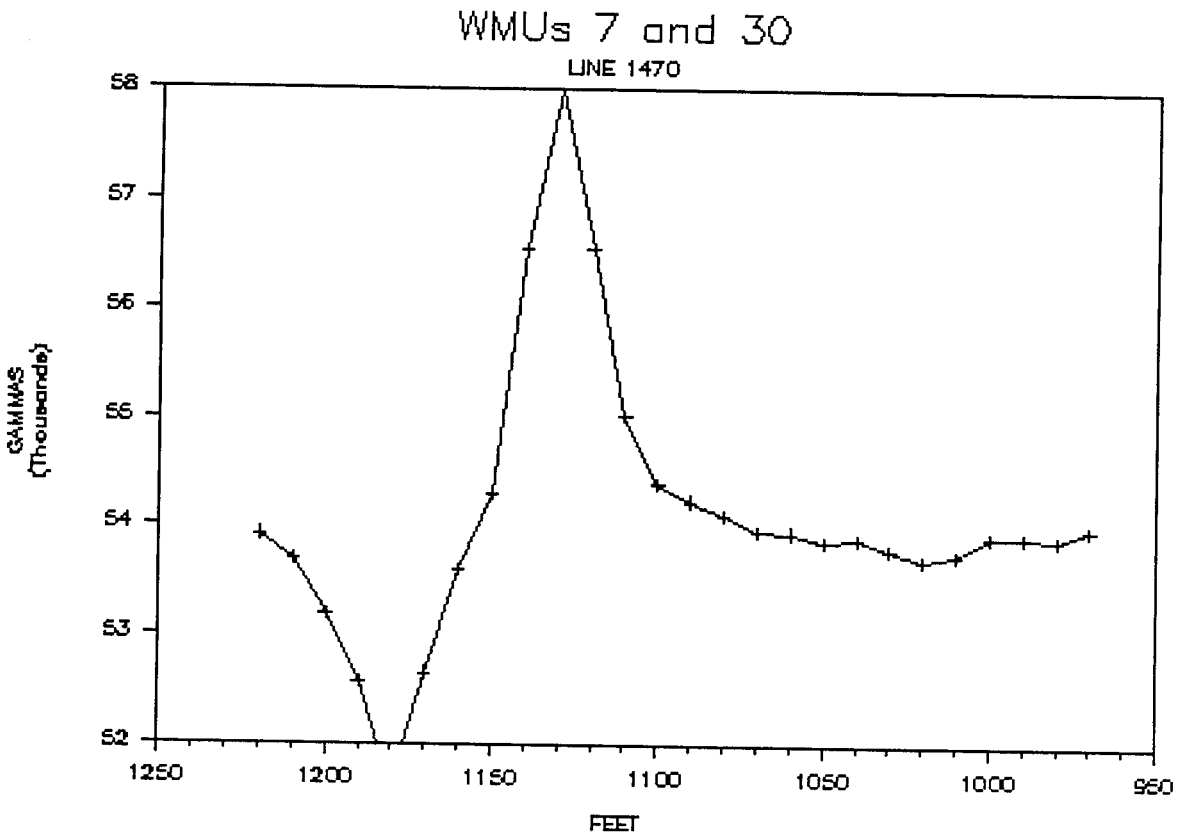
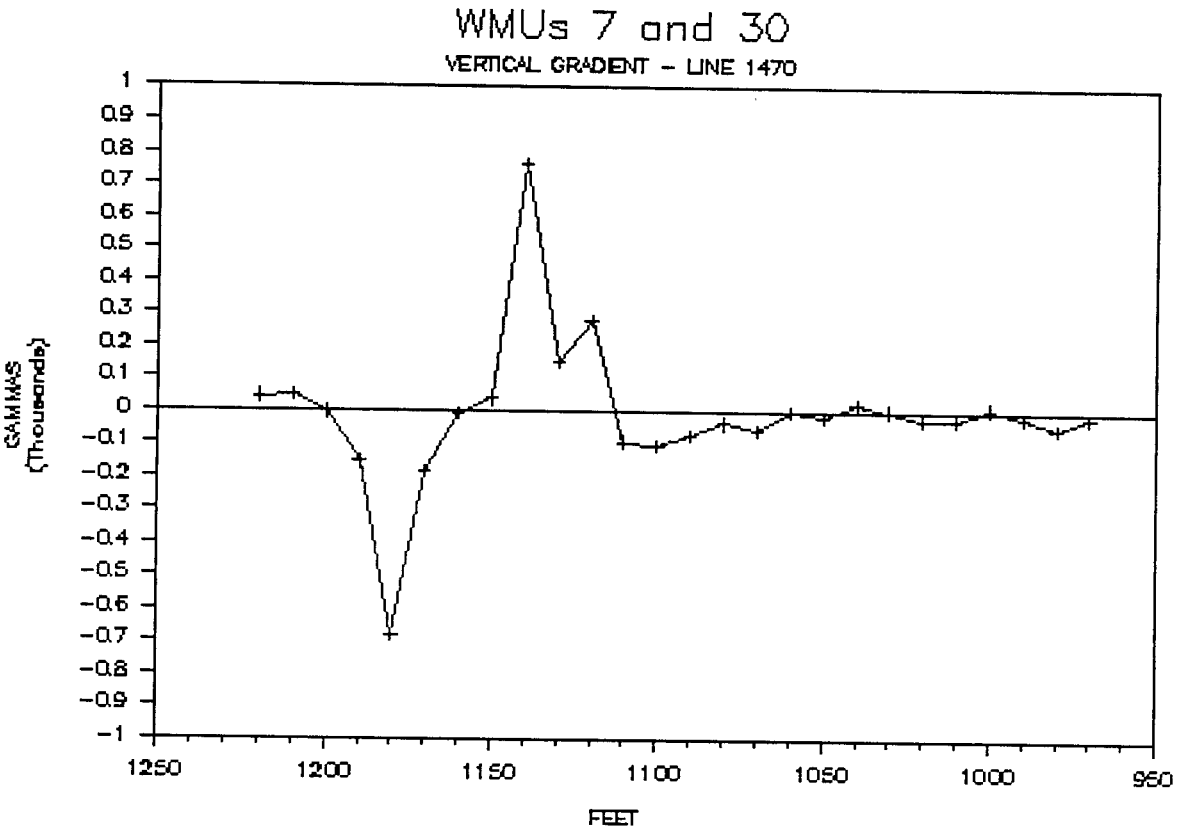
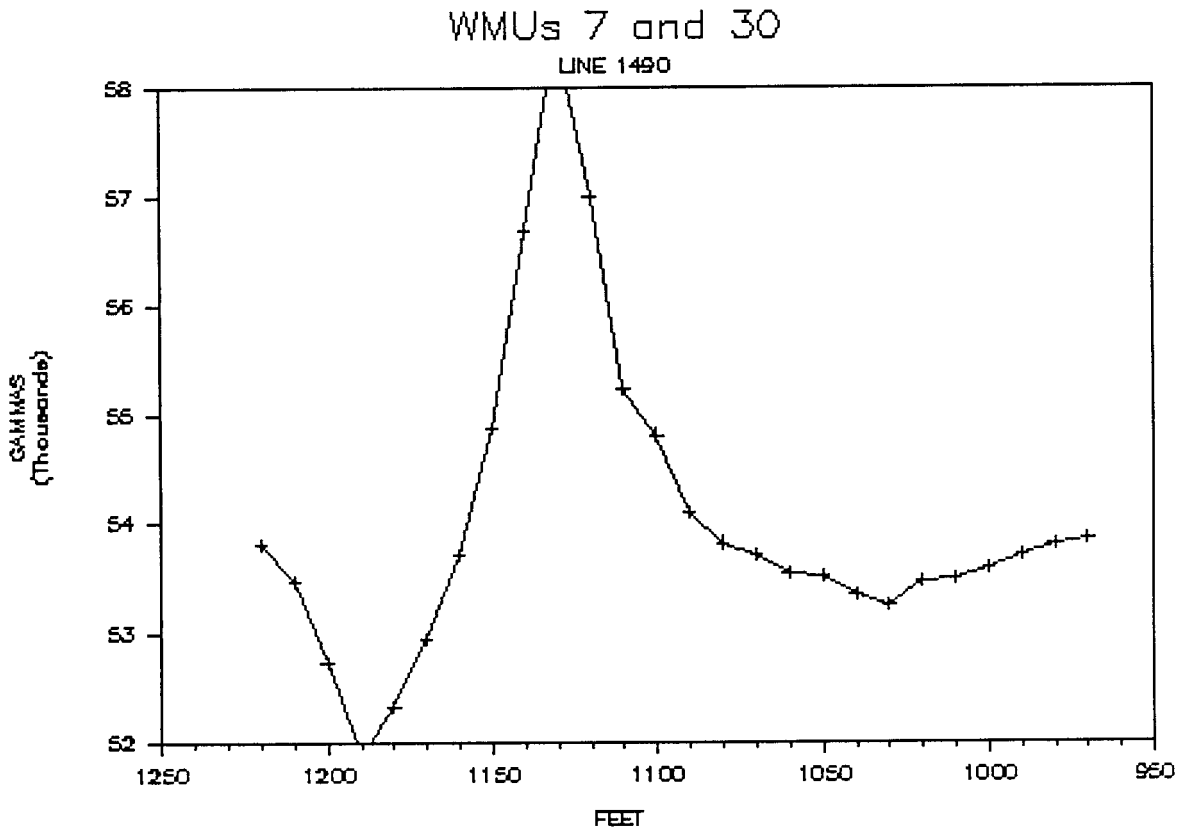
1050
1000
950
FEET

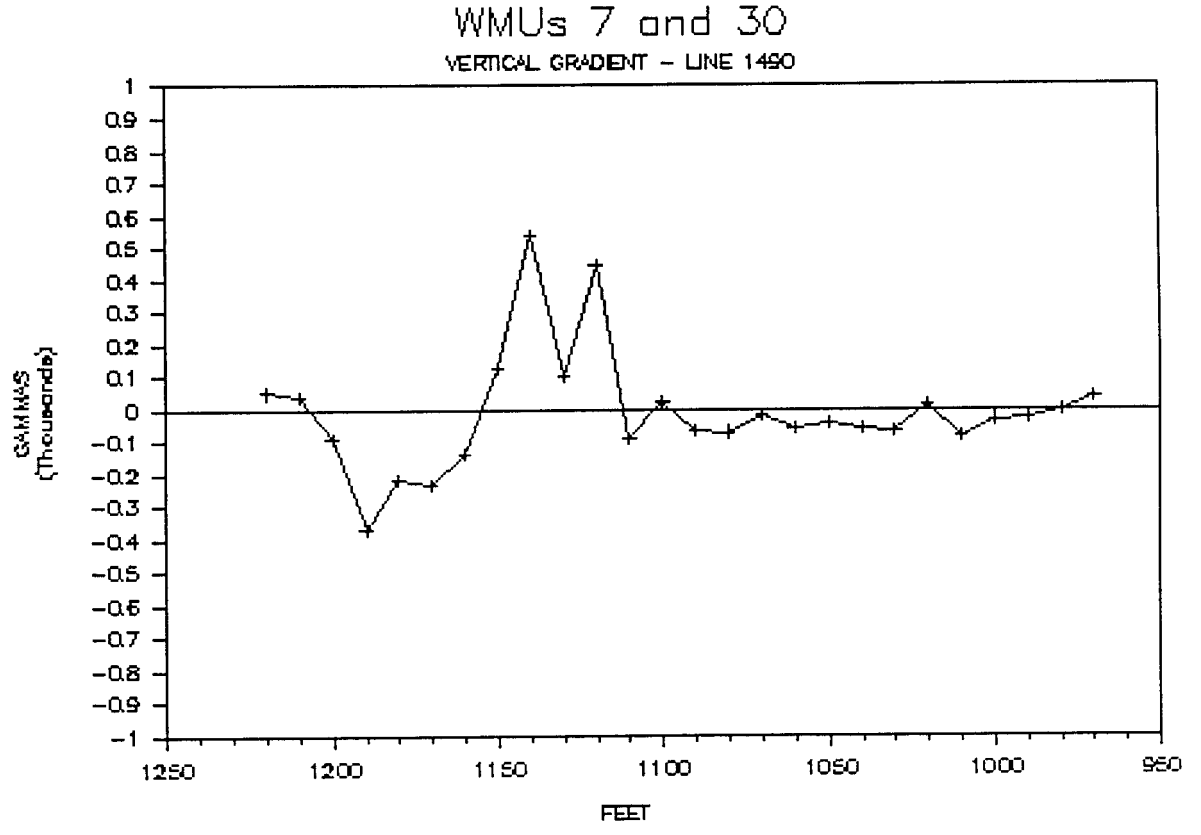

WMUs 7 and 30
LINE 1450
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

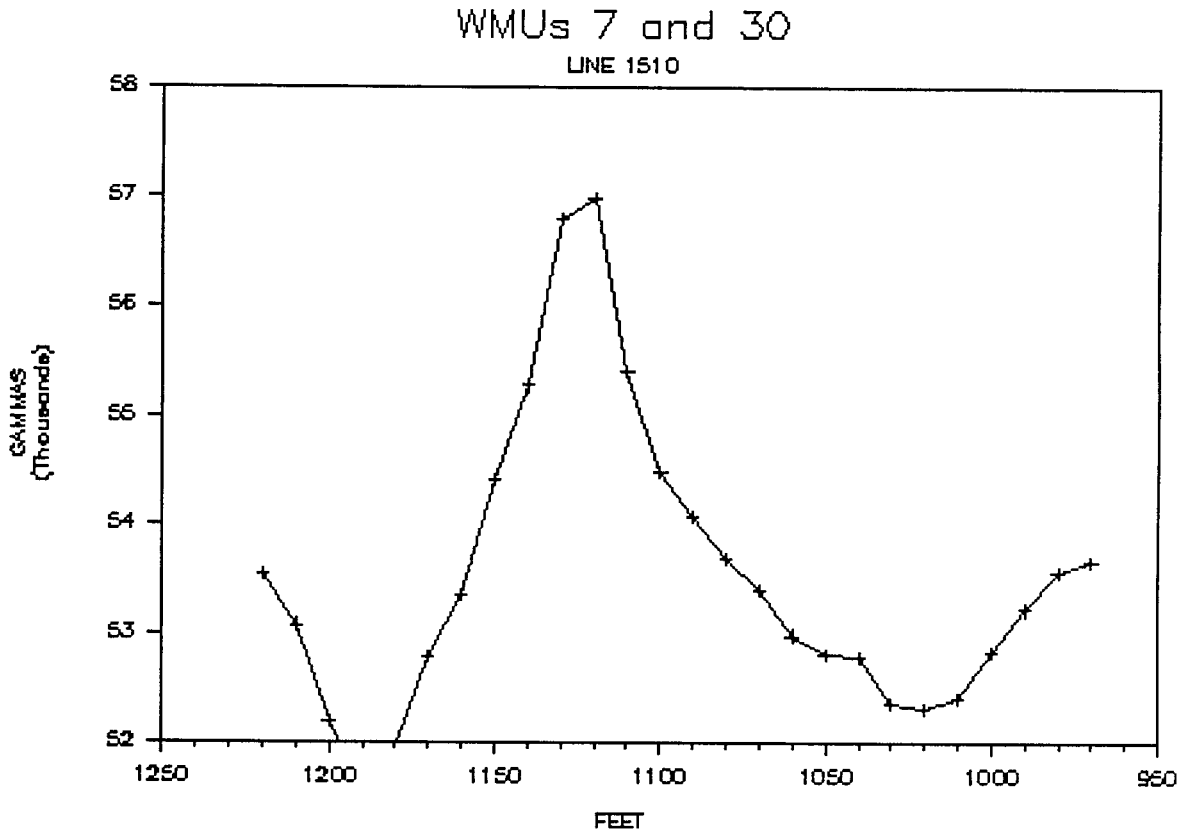

WMUs 7 and 30
VERTICAL GRADIENT – LINE 1450
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

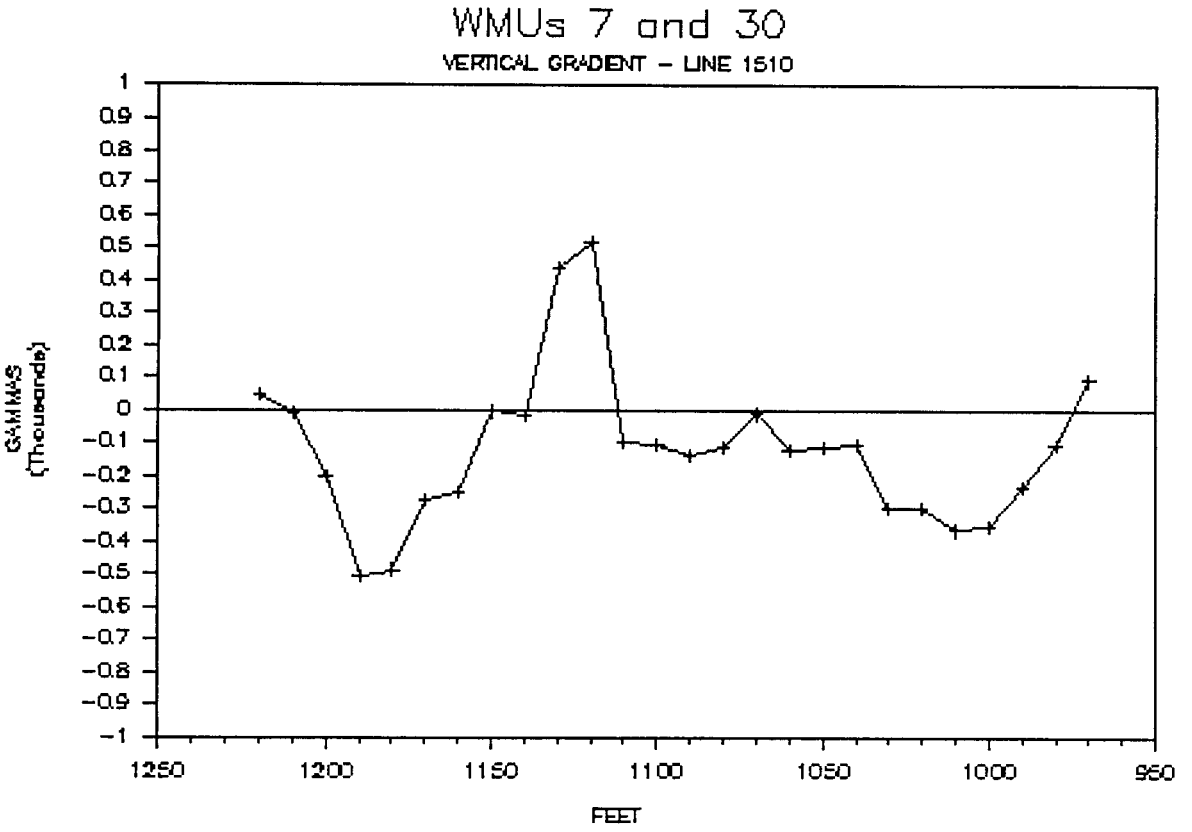

WMUs 7 and 30
LINE 1470
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
VERTICAL GRADIENT – LINE 1470
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
LINE 1490
GAMMAS
(Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
VERTICAL GRADIENT - LINE 1490
GAMMAS
(Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
LINE 1510
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
VERTICAL GRADIENT - LINE 1510
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
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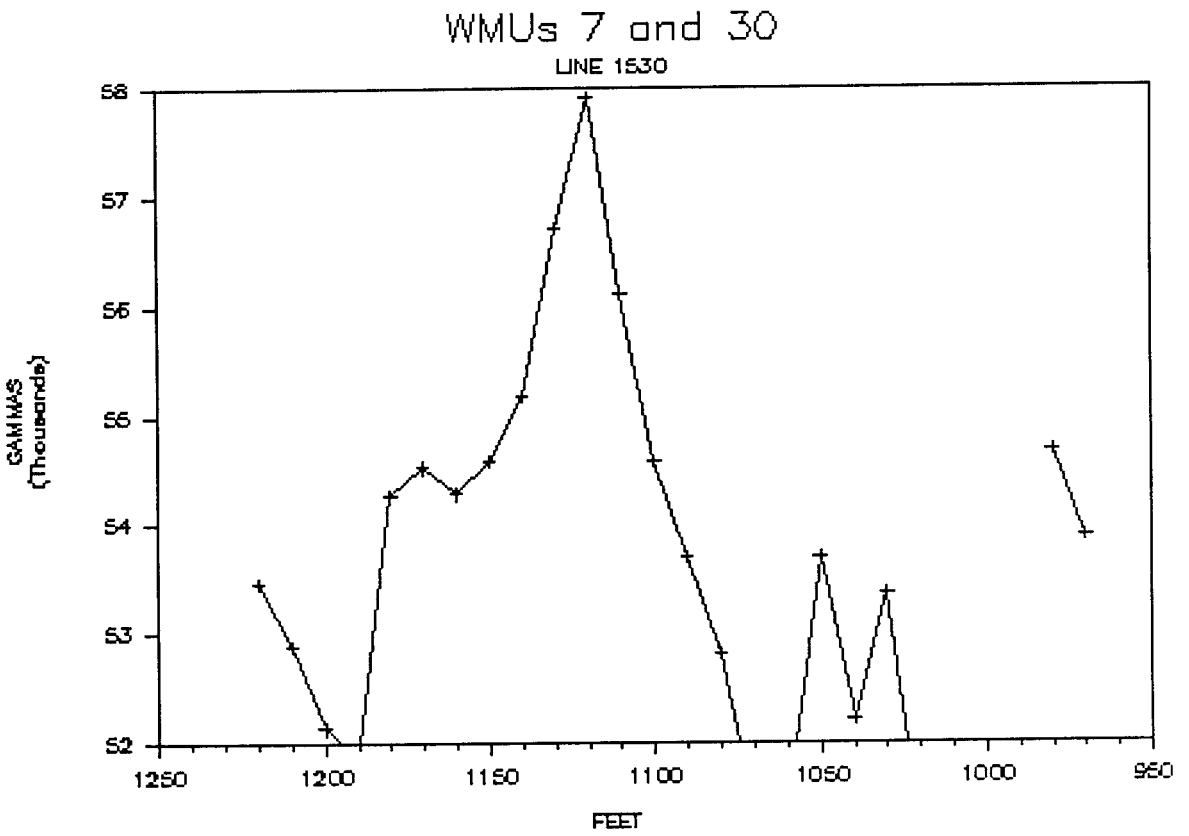
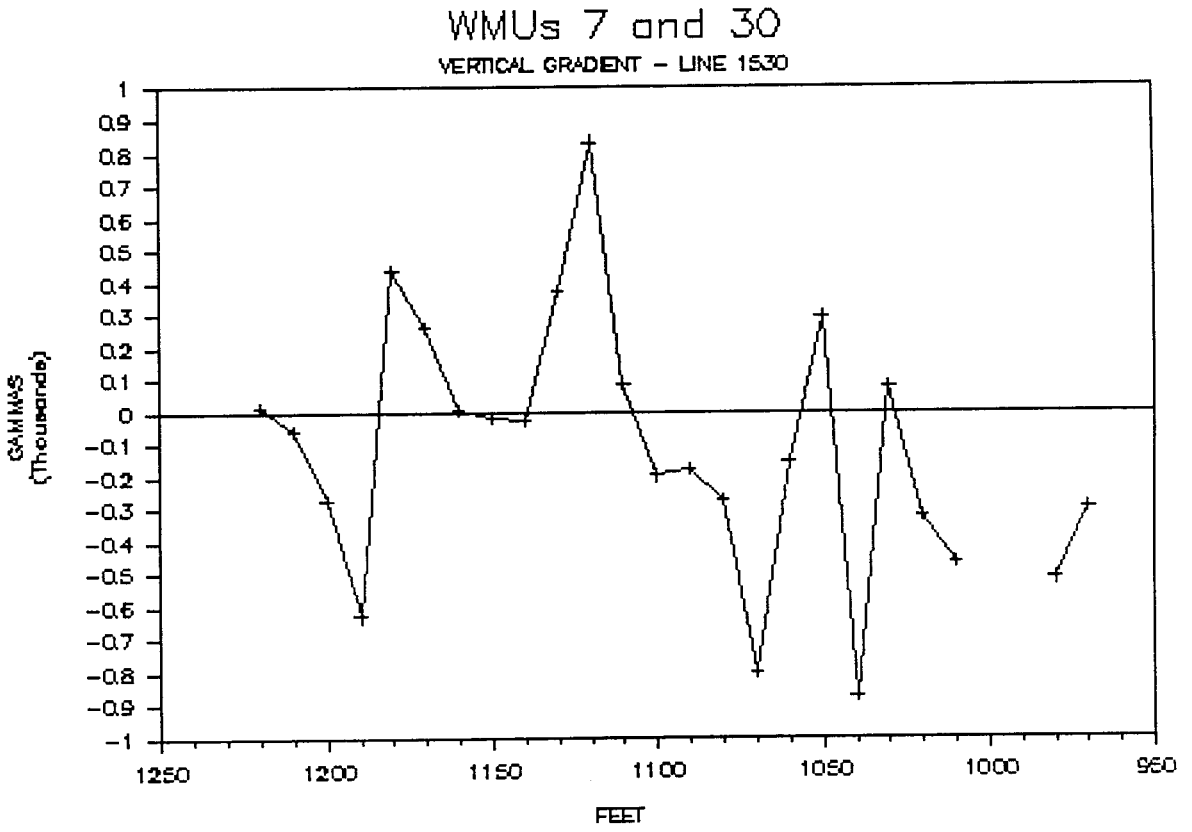
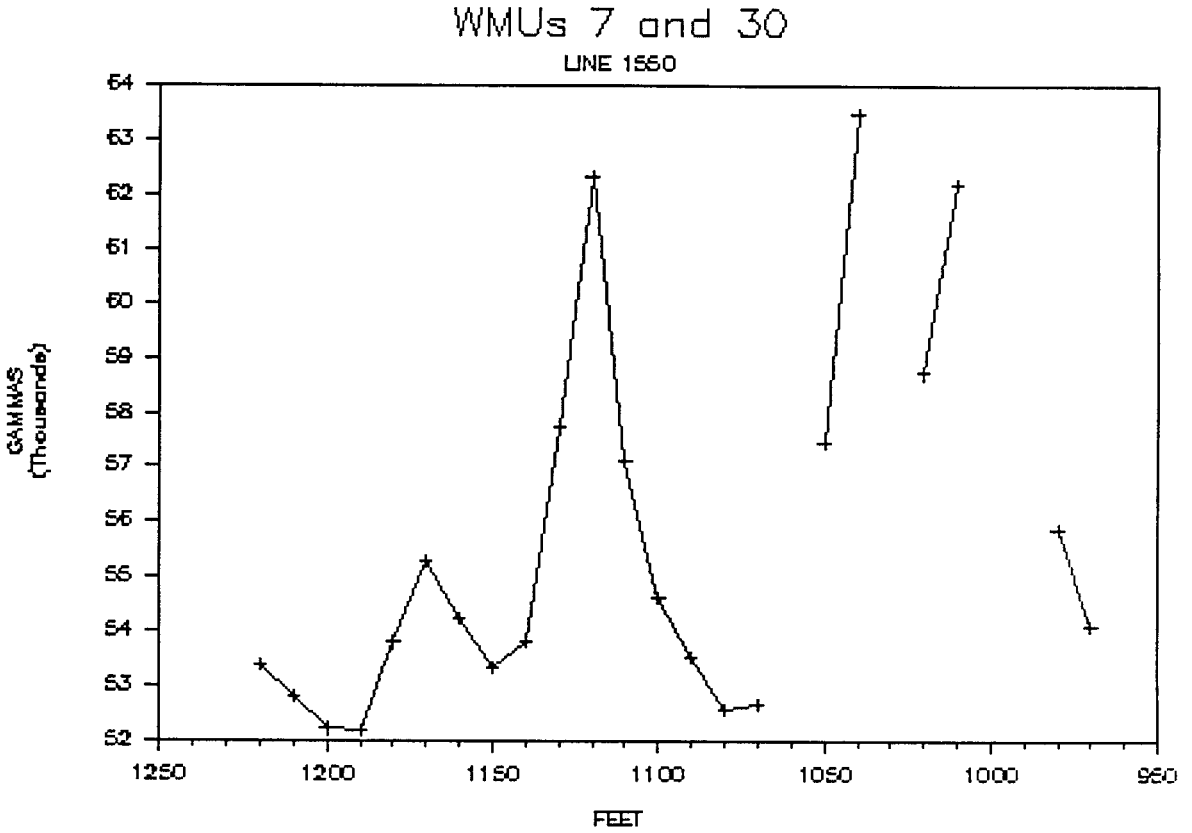
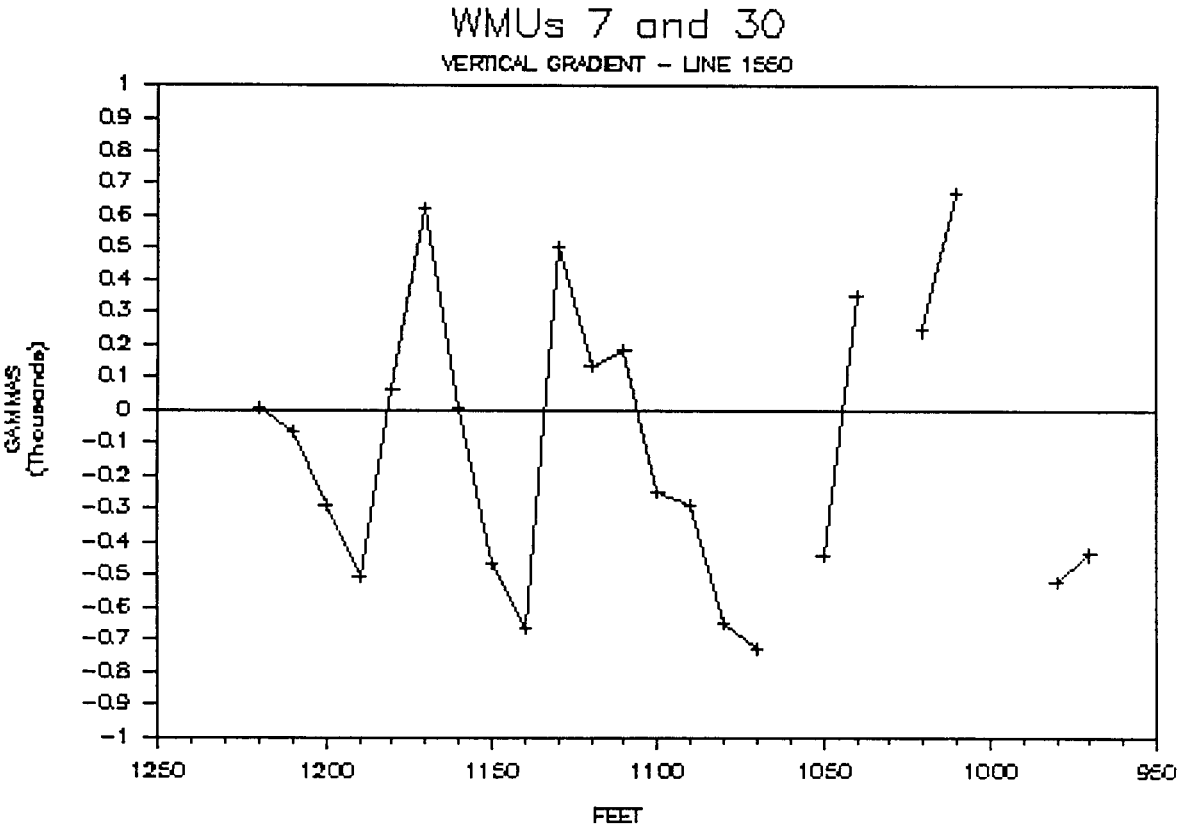
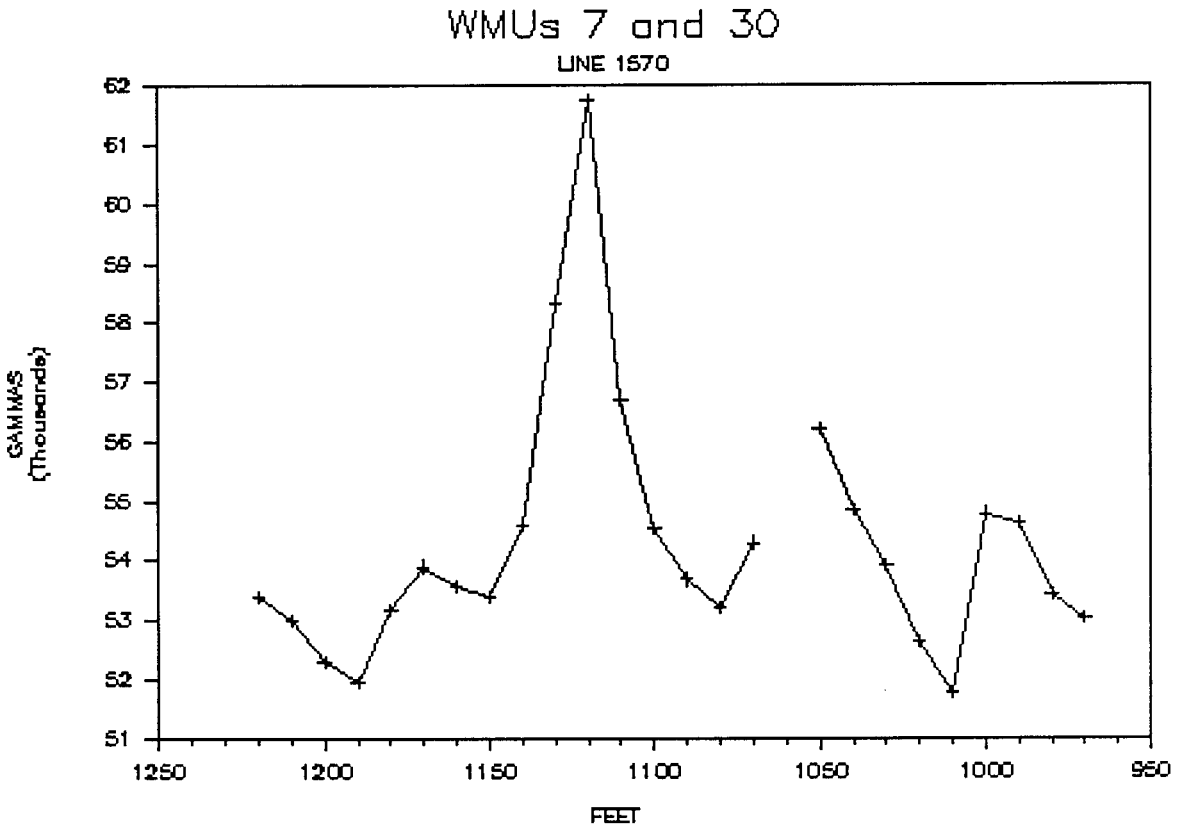
1200
1150
1100
1050
1000
950
FEET

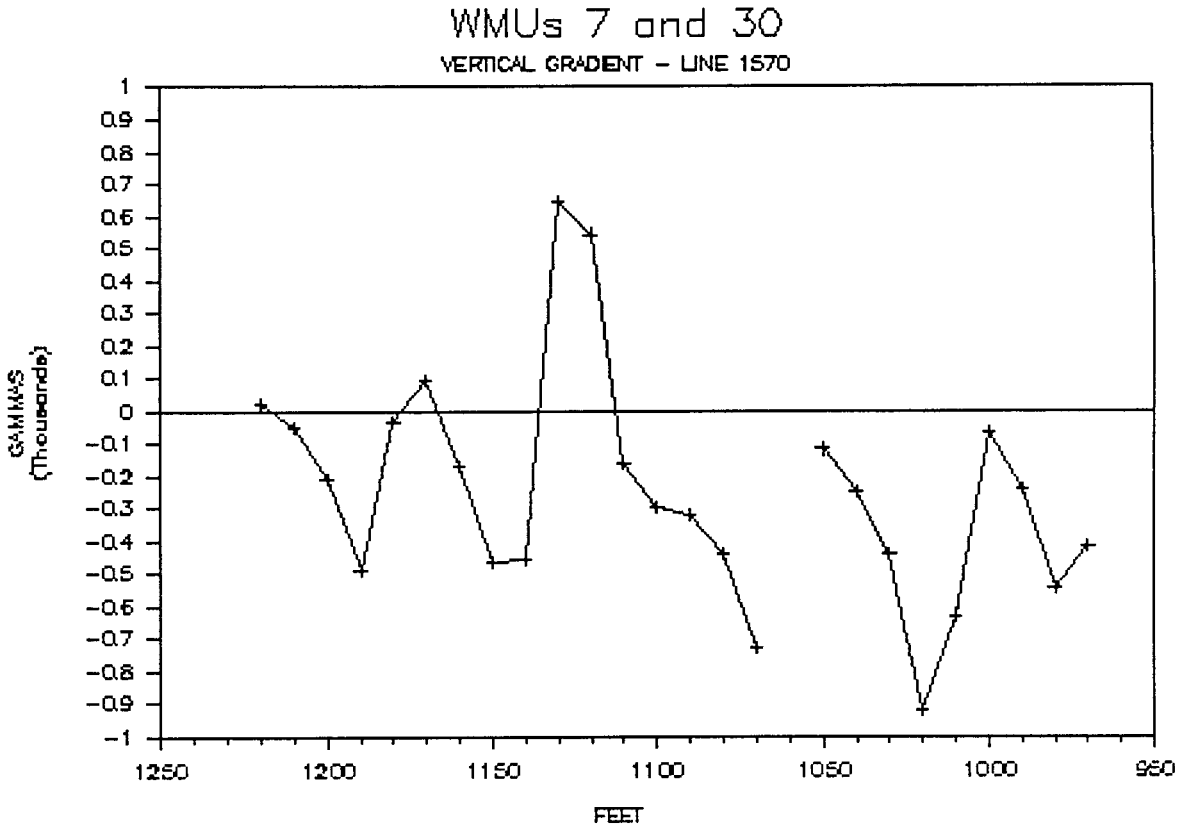

WMUs 7 and 30
LINE 1530
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

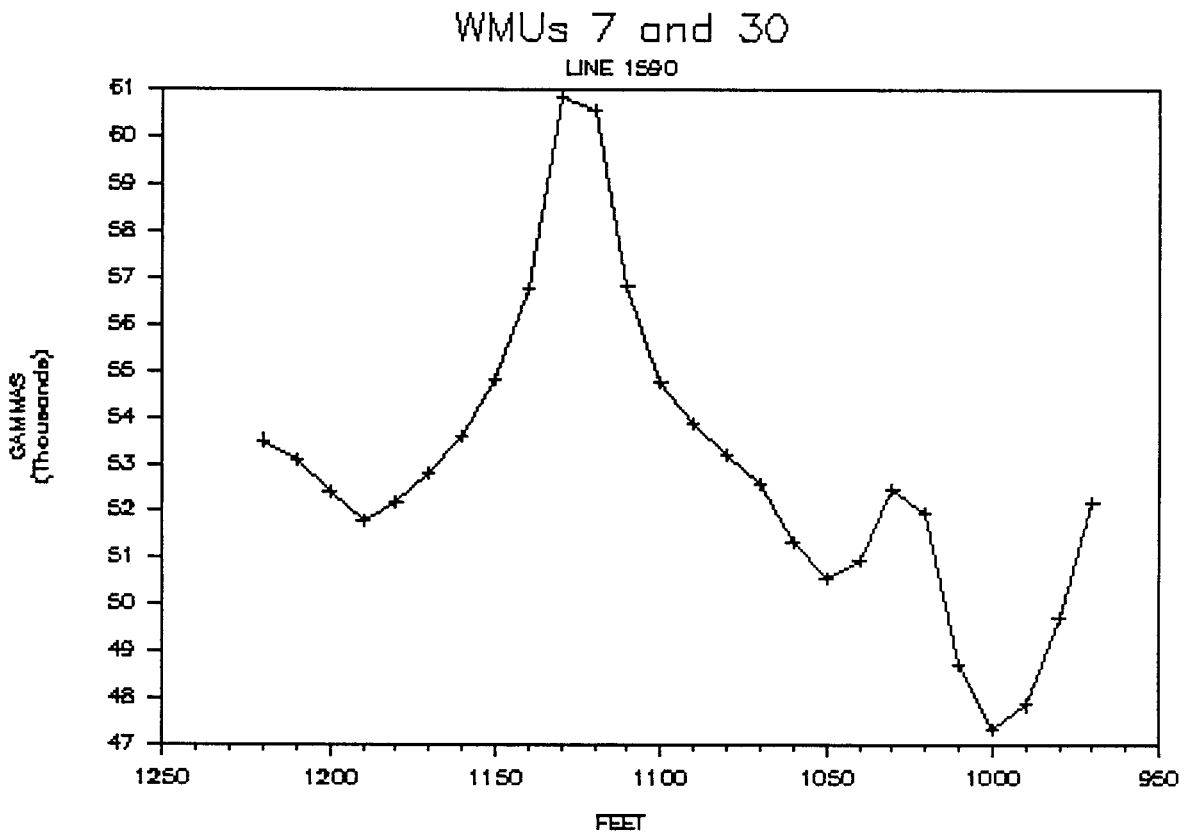

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1530
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

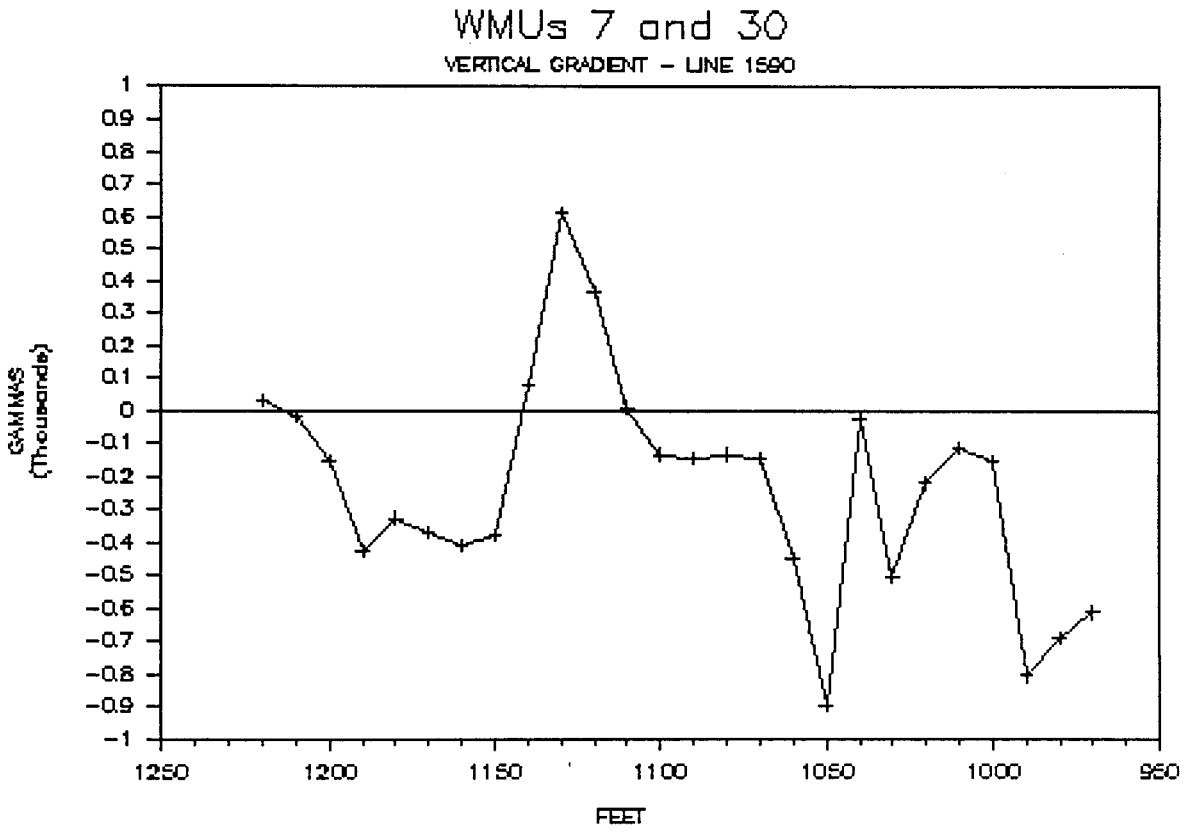

WMUs 7 and 30
LINE 1560
GAMMAS (Thousands)
64
63
62
61
60
59
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

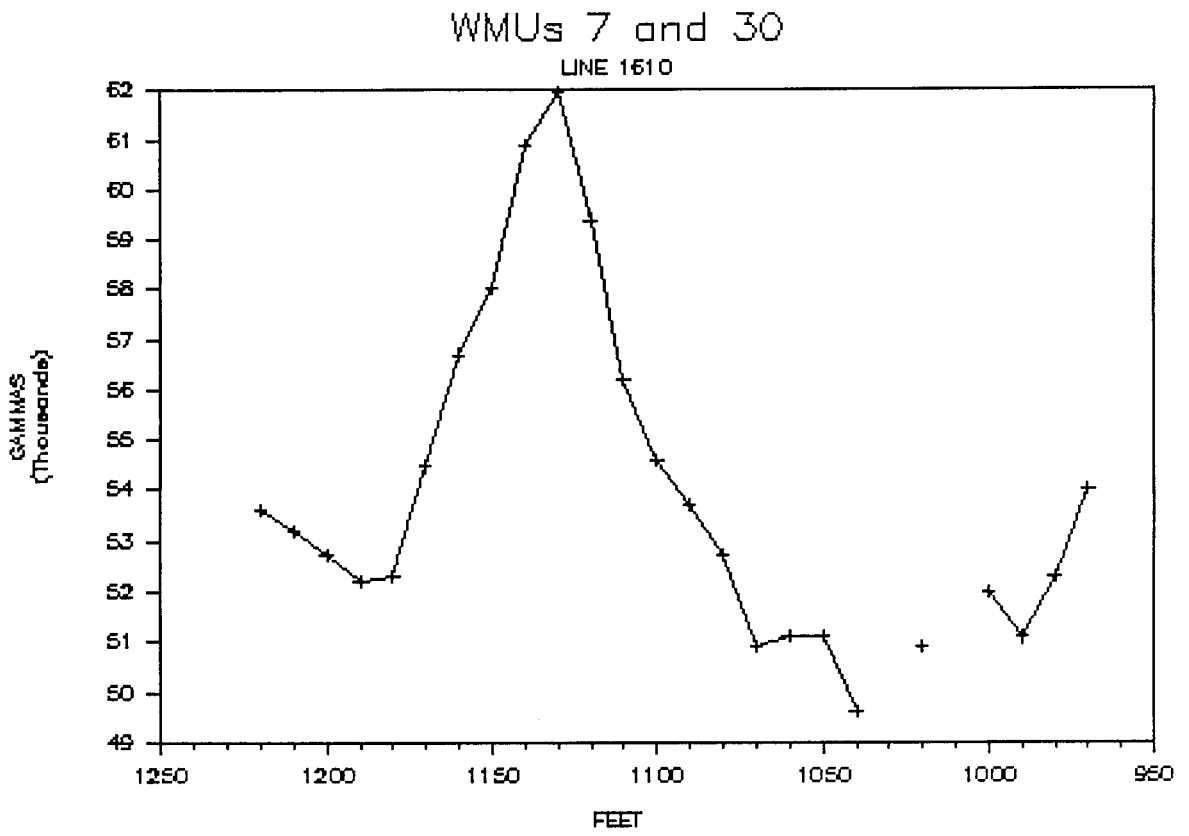

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1560
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

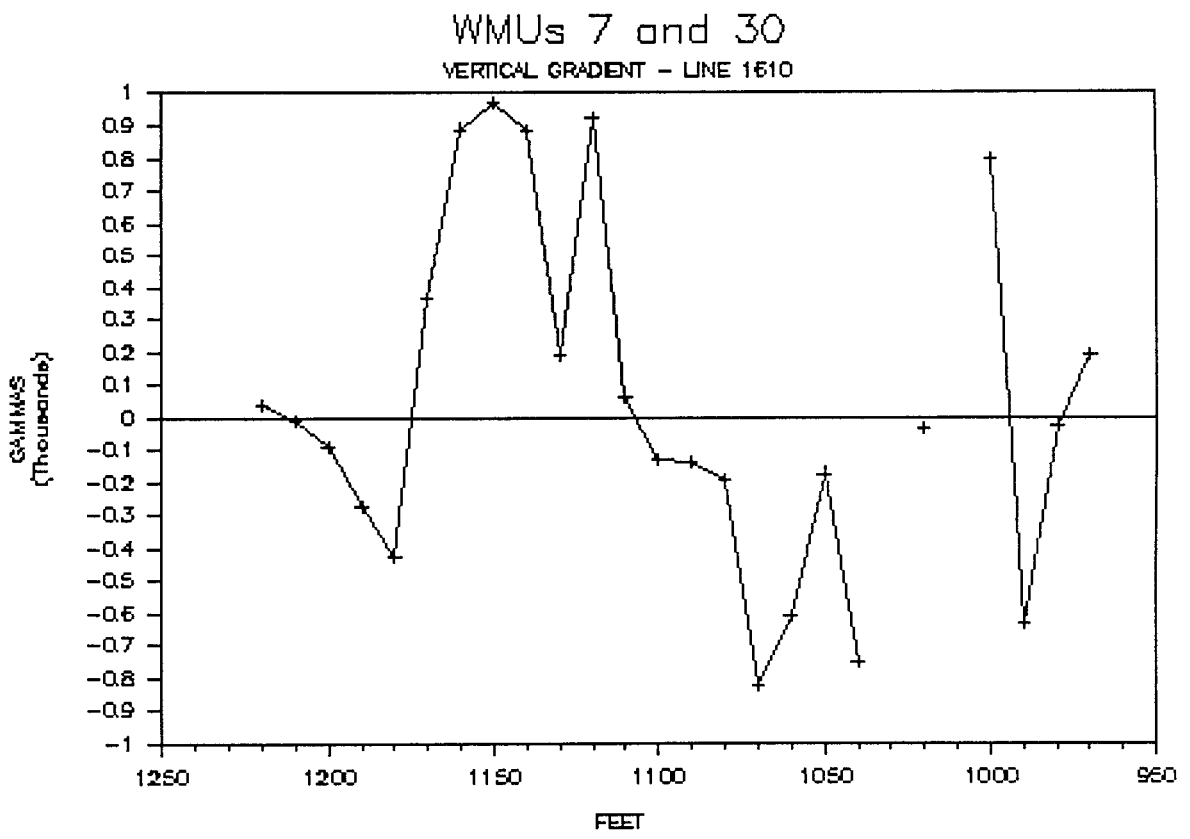

WMUs 7 and 30
LINE 1570
GAMMAS (Thousands)
62
61
60
59
58
57
56
55
54
53
52
51
1250
1200
1150
1100
1050
1000
950
FEET

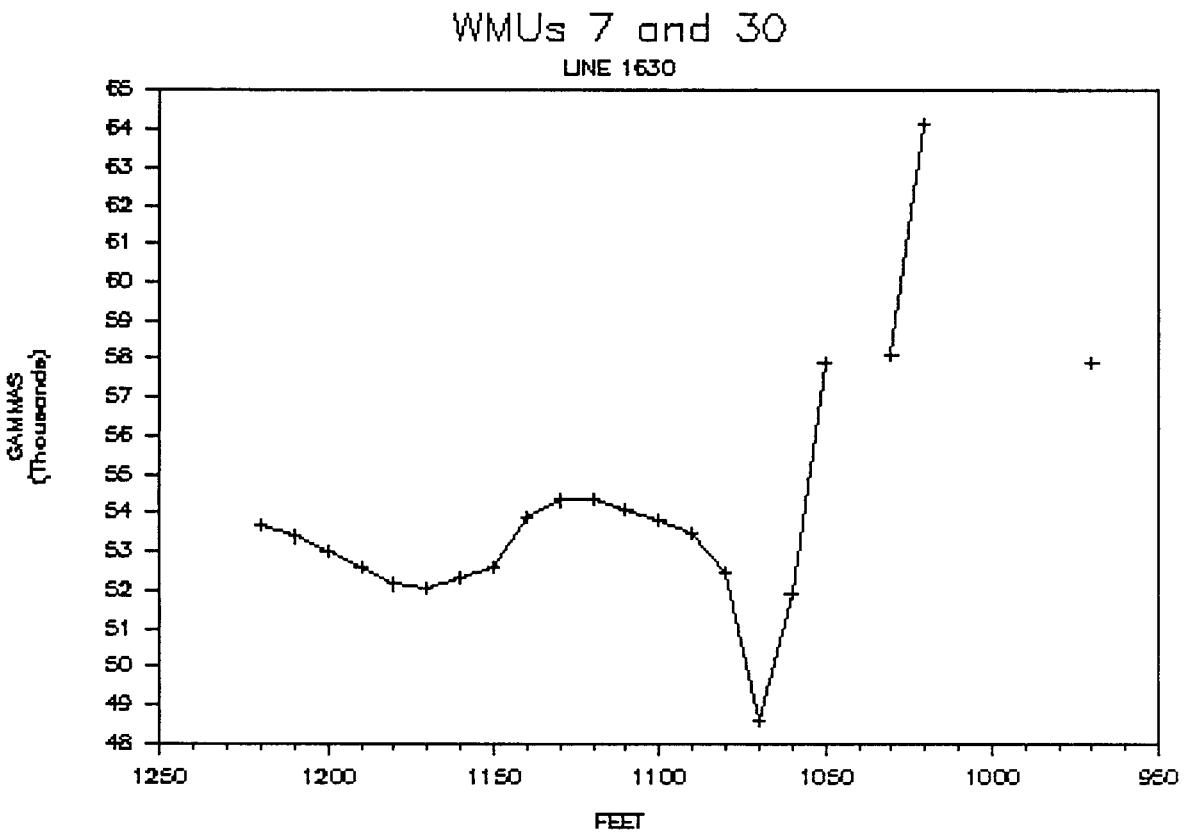

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1570
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

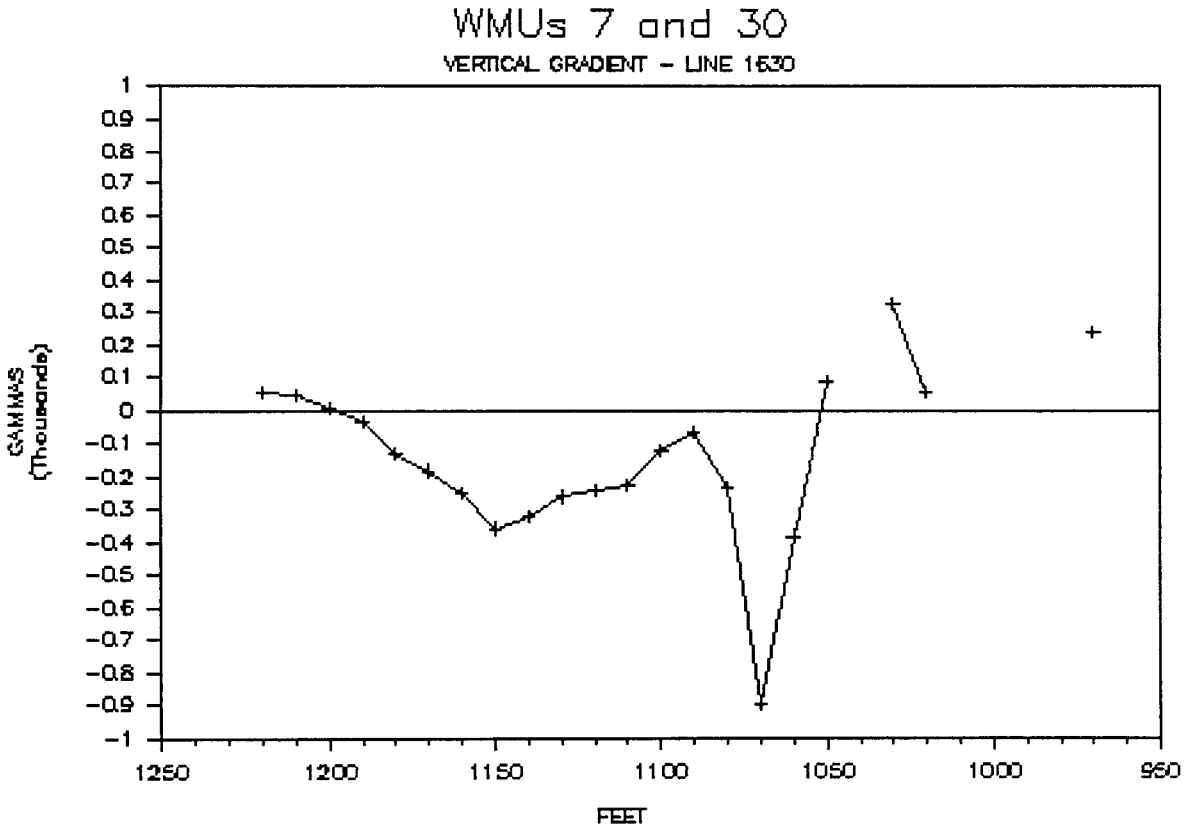

WMUs 7 and 30
LINE 1590
GAMMAS (Thousands)
61
60
59
58
57
56
55
54
53
52
51
50
49
48
47
1250
1200
1150
1100
1050
1000
950
FEET

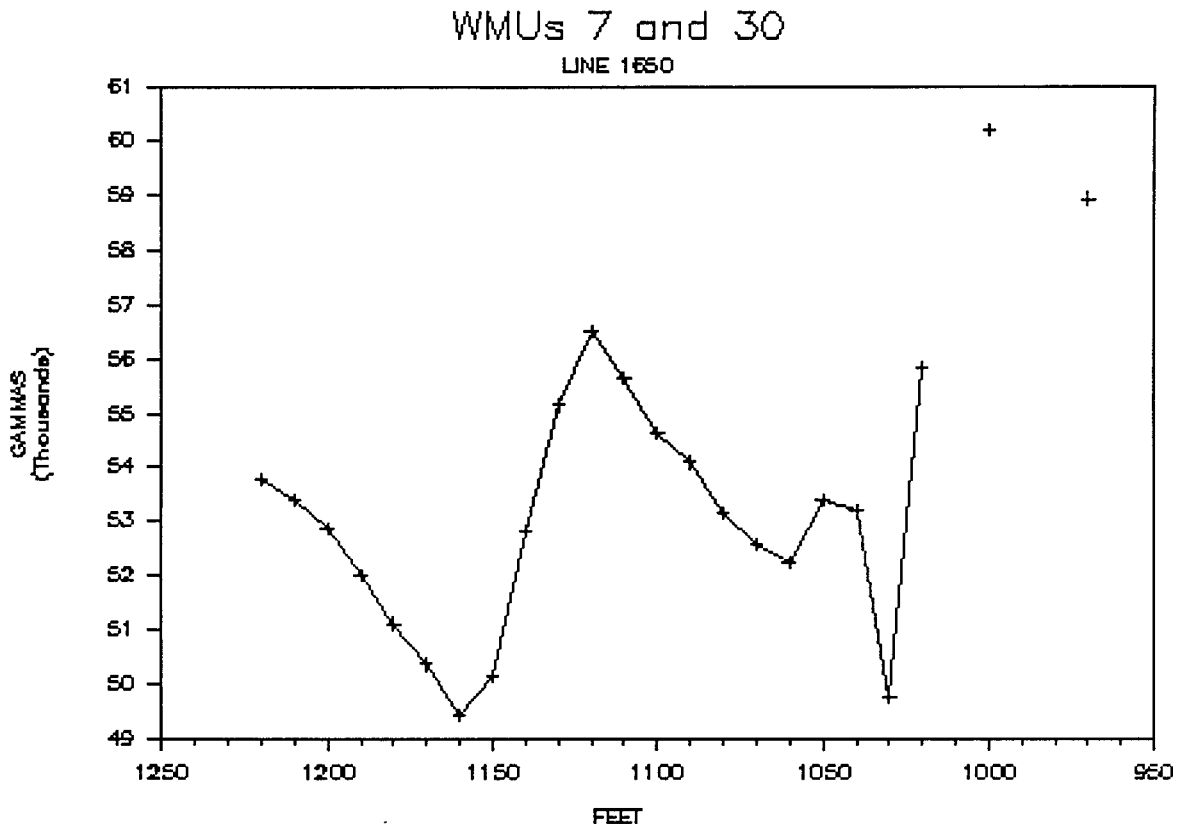

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1590
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

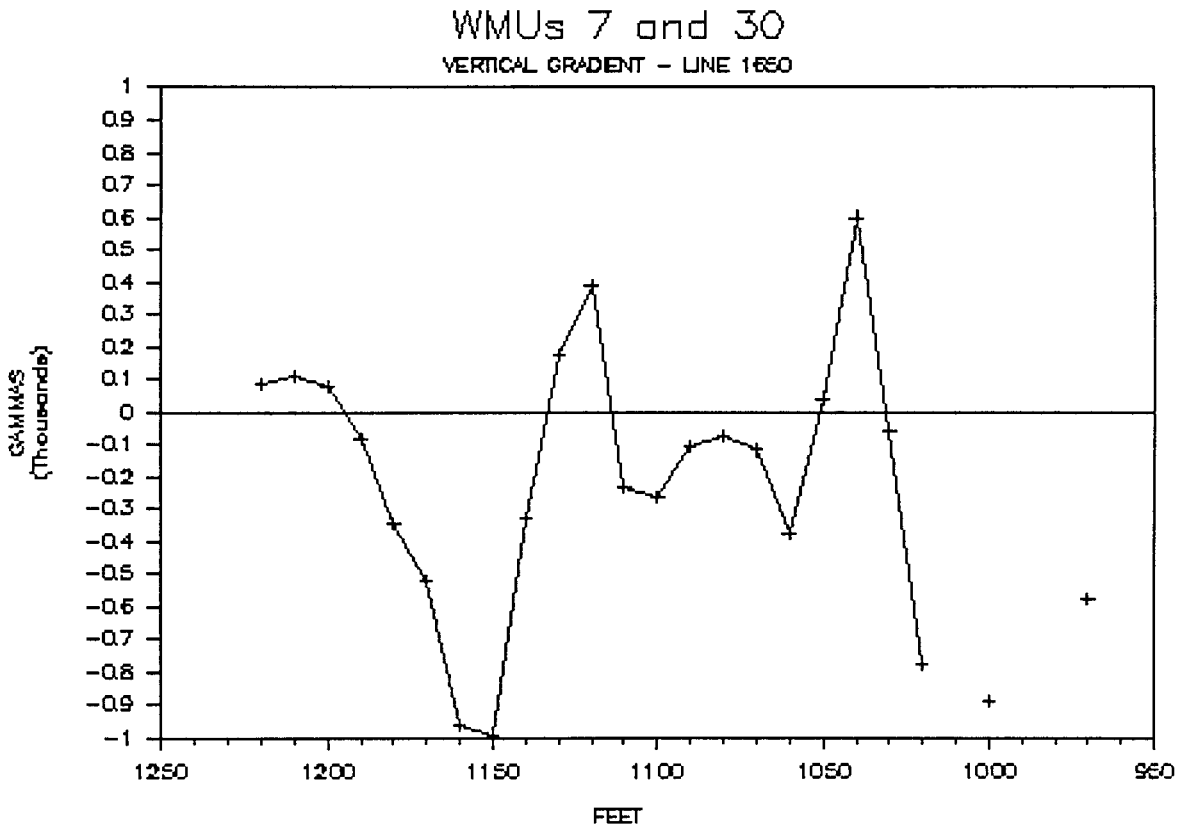

WMUs 7 and 30
LINE 1610
GAMMAS (Thousands)
62
61
60
59
58
57
56
55
54
53
52
51
50
49
1250
1200
1150
1100
1050
1000
950
FEET

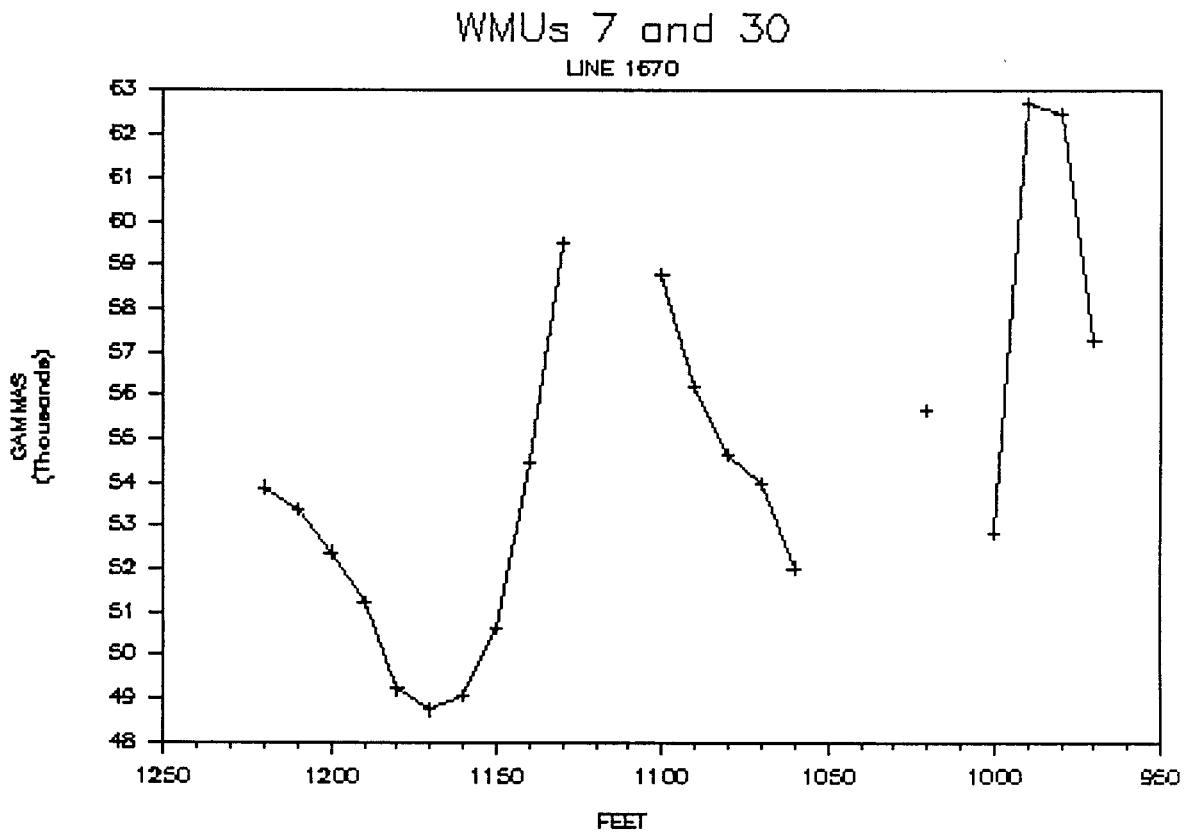

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1610
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

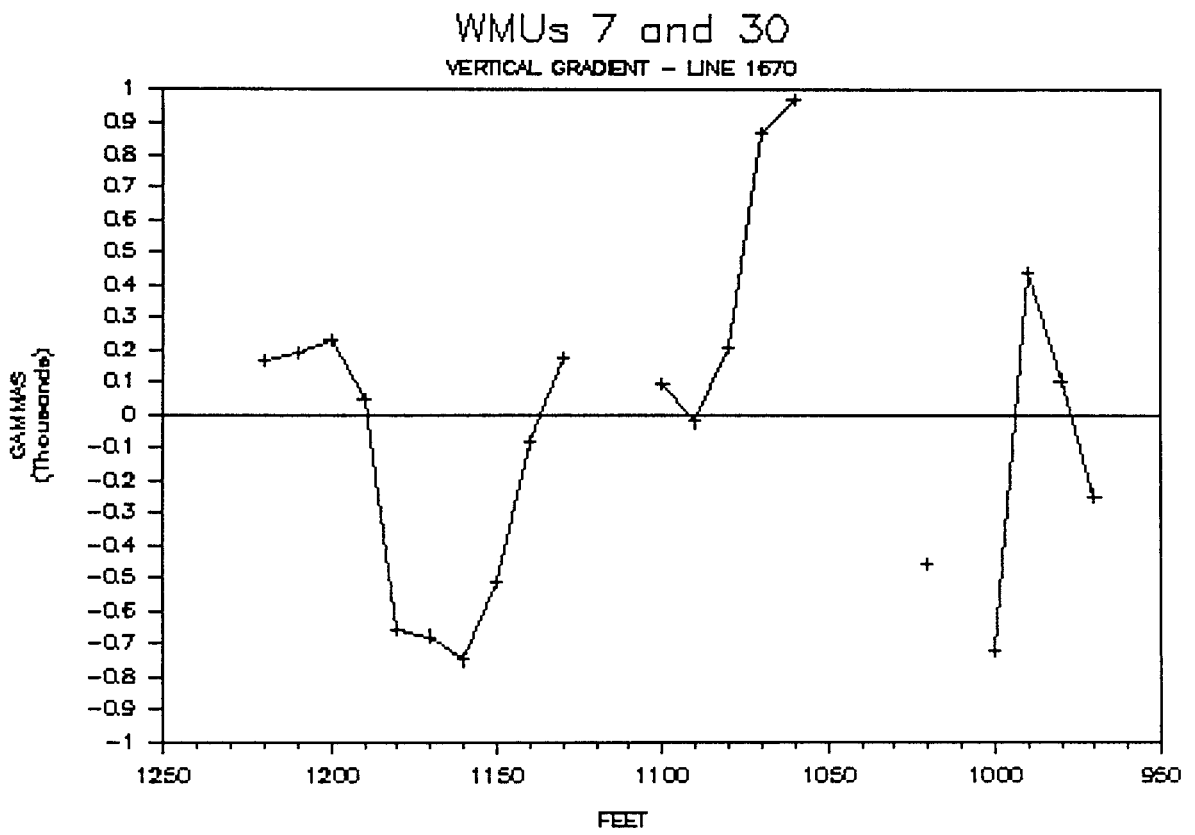

WMUs 7 and 30
LINE 1630
GAMMAS (Thousands)
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
1250
1200
1150
1100
1050
1000
950
FEET

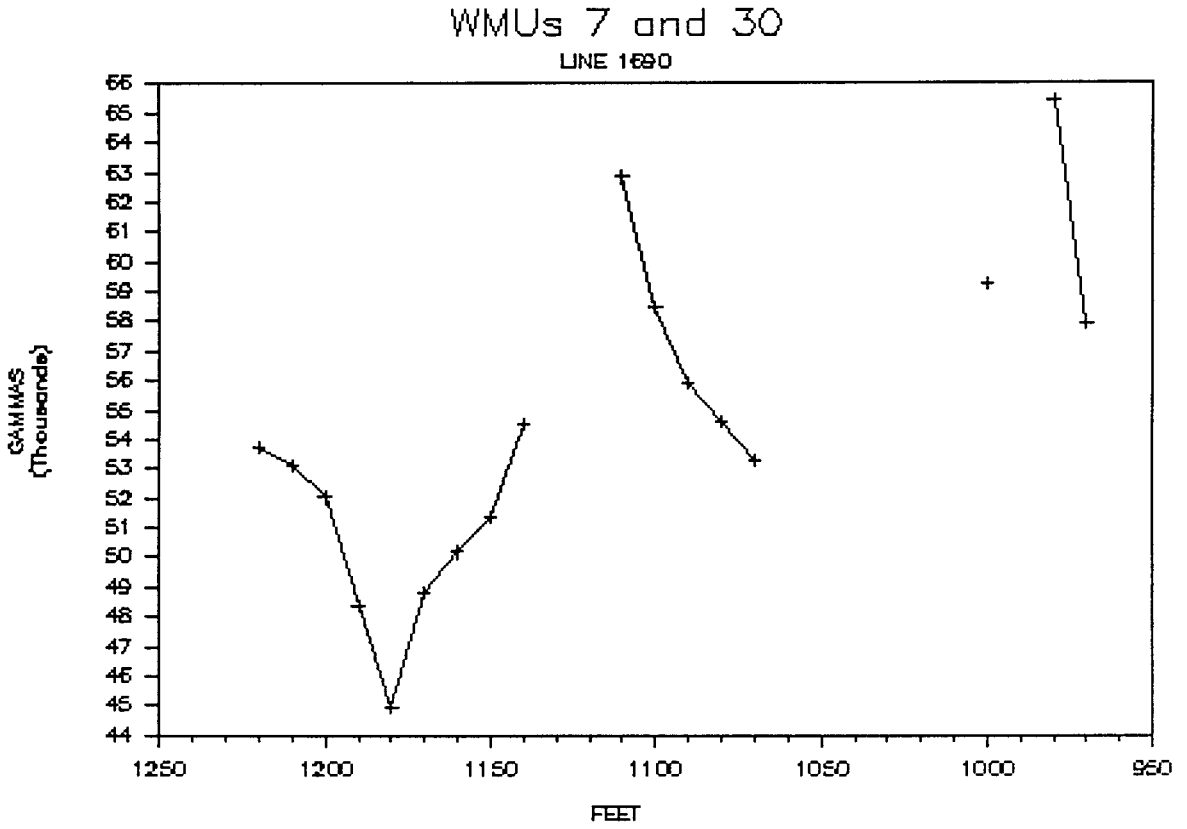

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1630
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

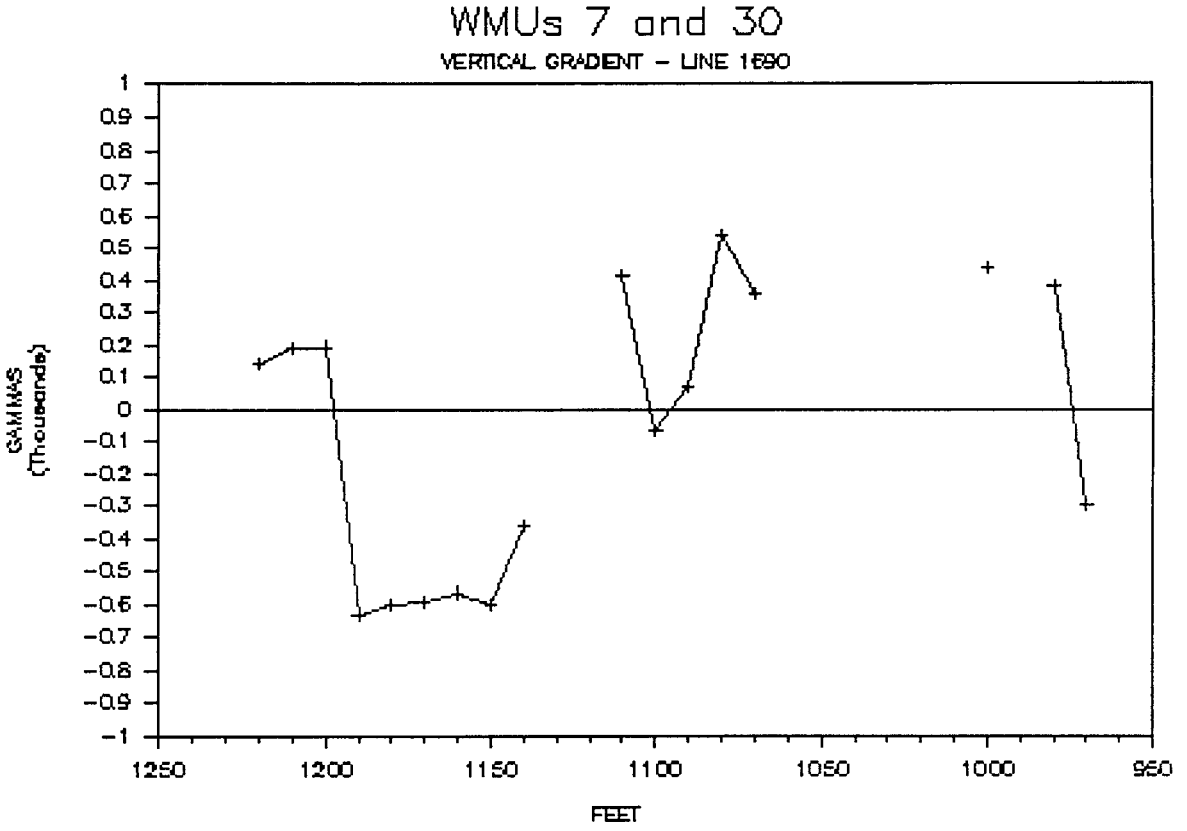

WMUs 7 and 30
LINE 1650
GAMMAS (Thousands)
61
60
59
58
57
56
55
54
53
52
51
50
49
1250
1200
1150
1100
1050
1000
950
FEET

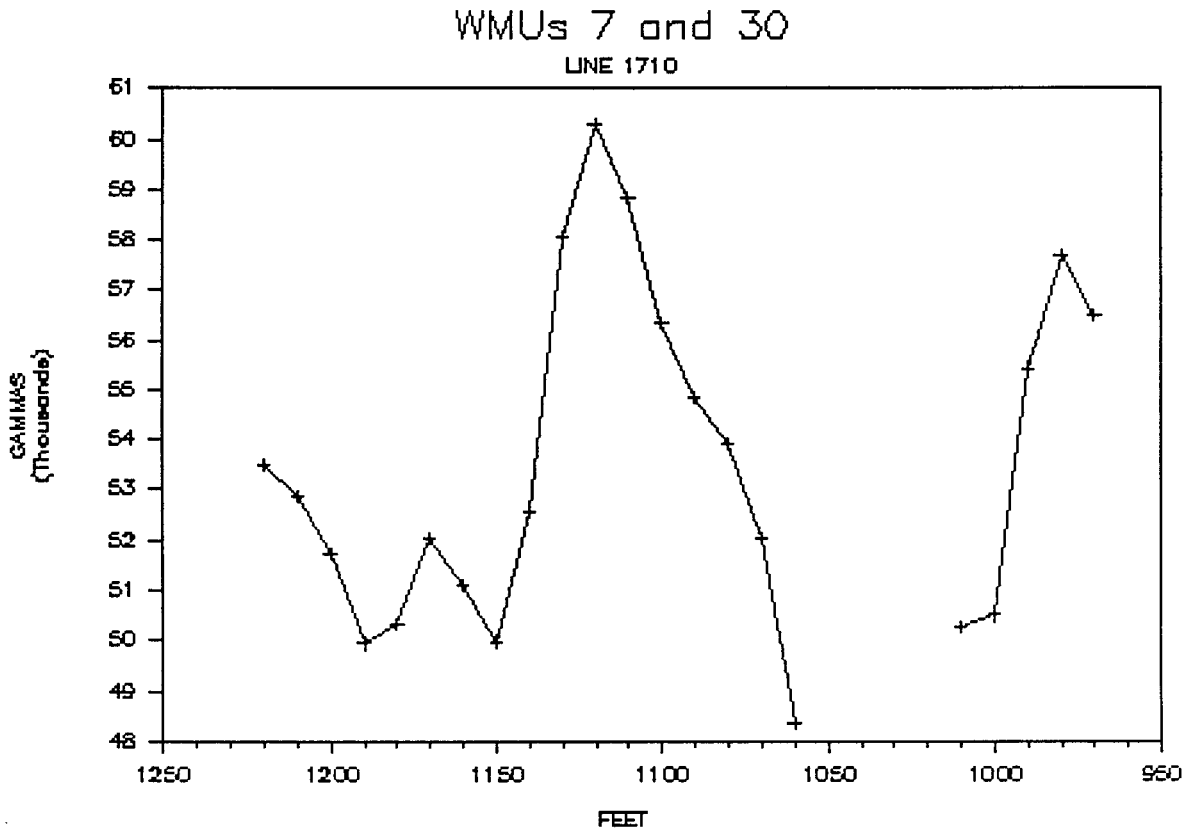

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1650
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

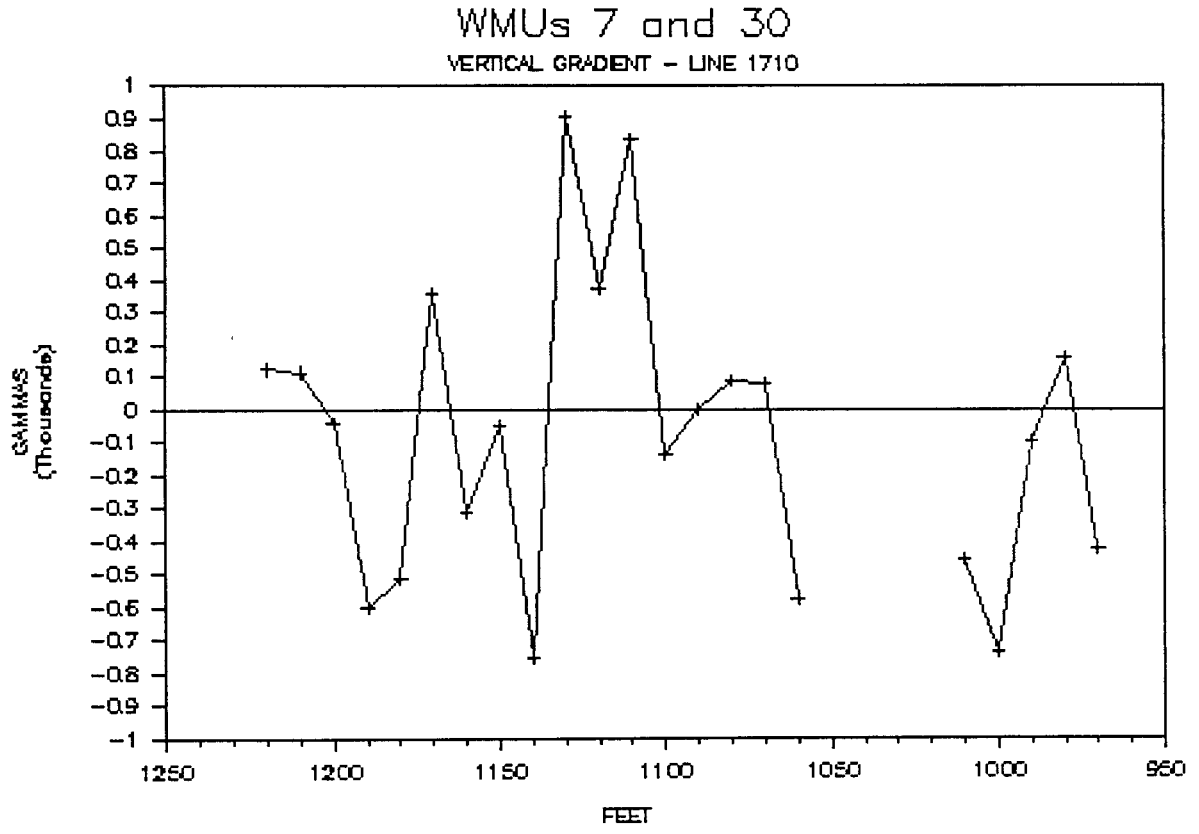

WMUs 7 and 30
LINE 1670
GAMMAS (Thousands)
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
1250
1200
1150
1100
1050
1000
950
FEET

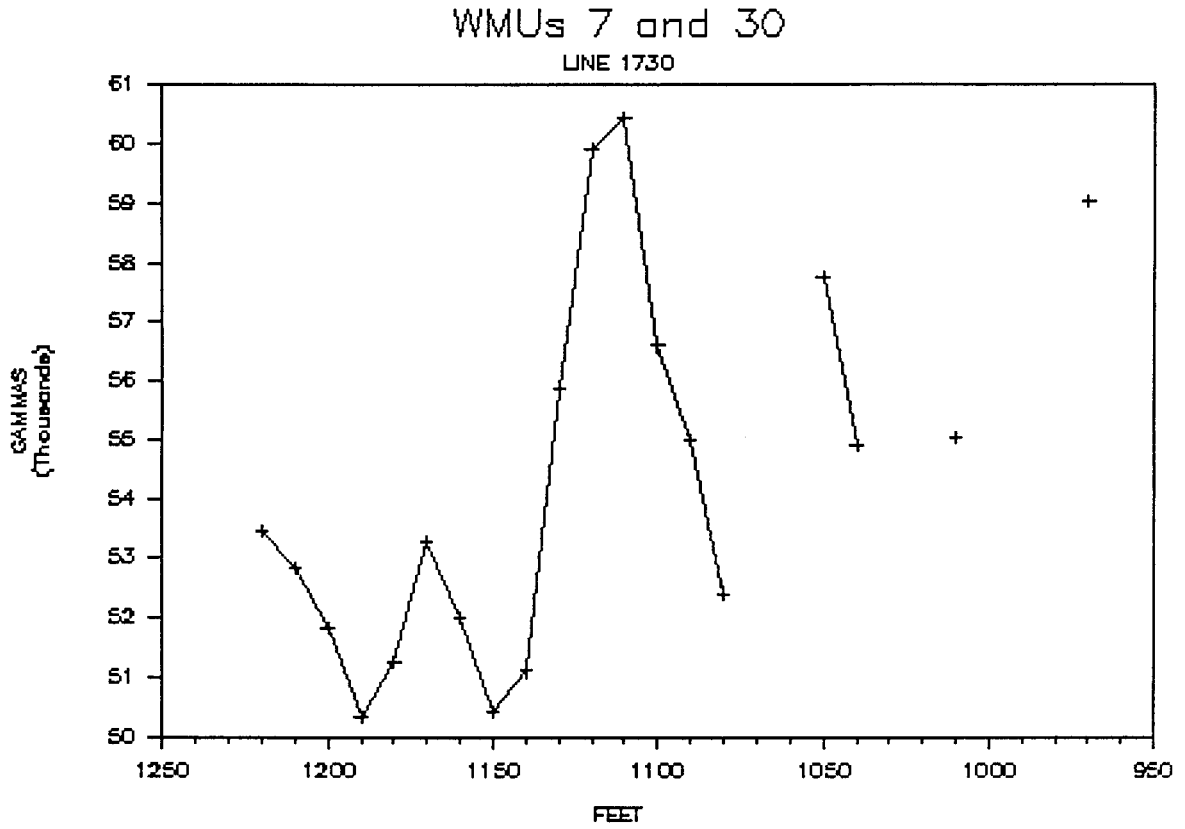

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1670
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

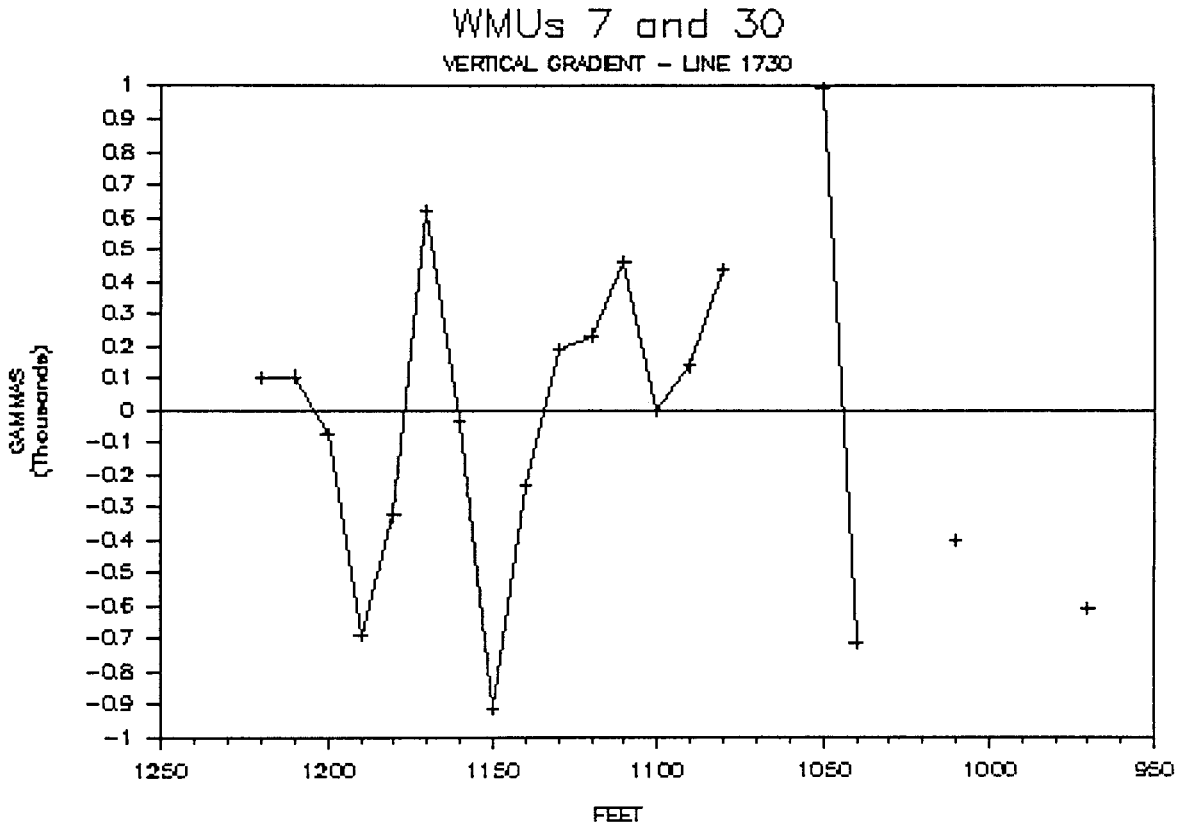

WMUs 7 and 30
LINE 1690
GAMMAS (Thousands)
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
47
46
45
44
1250
1200
1150
1100
1050
1000
950
FEET

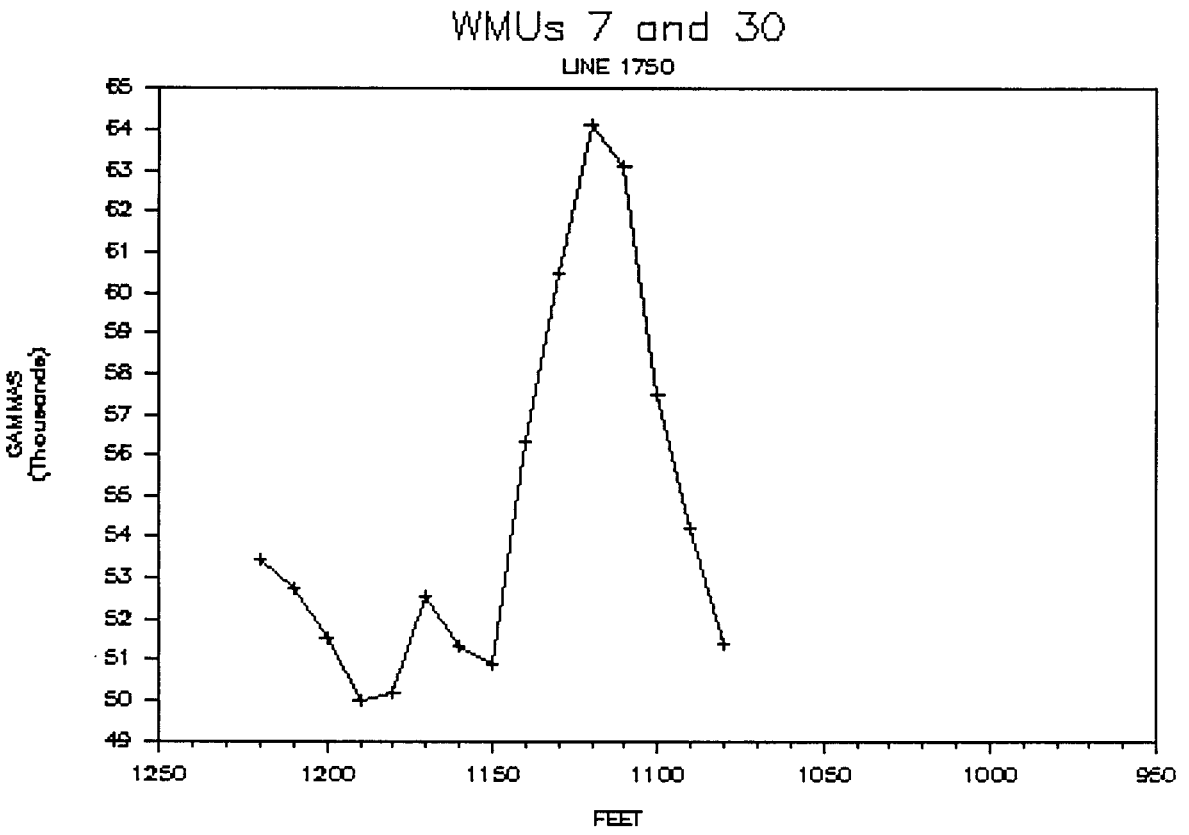

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1690
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

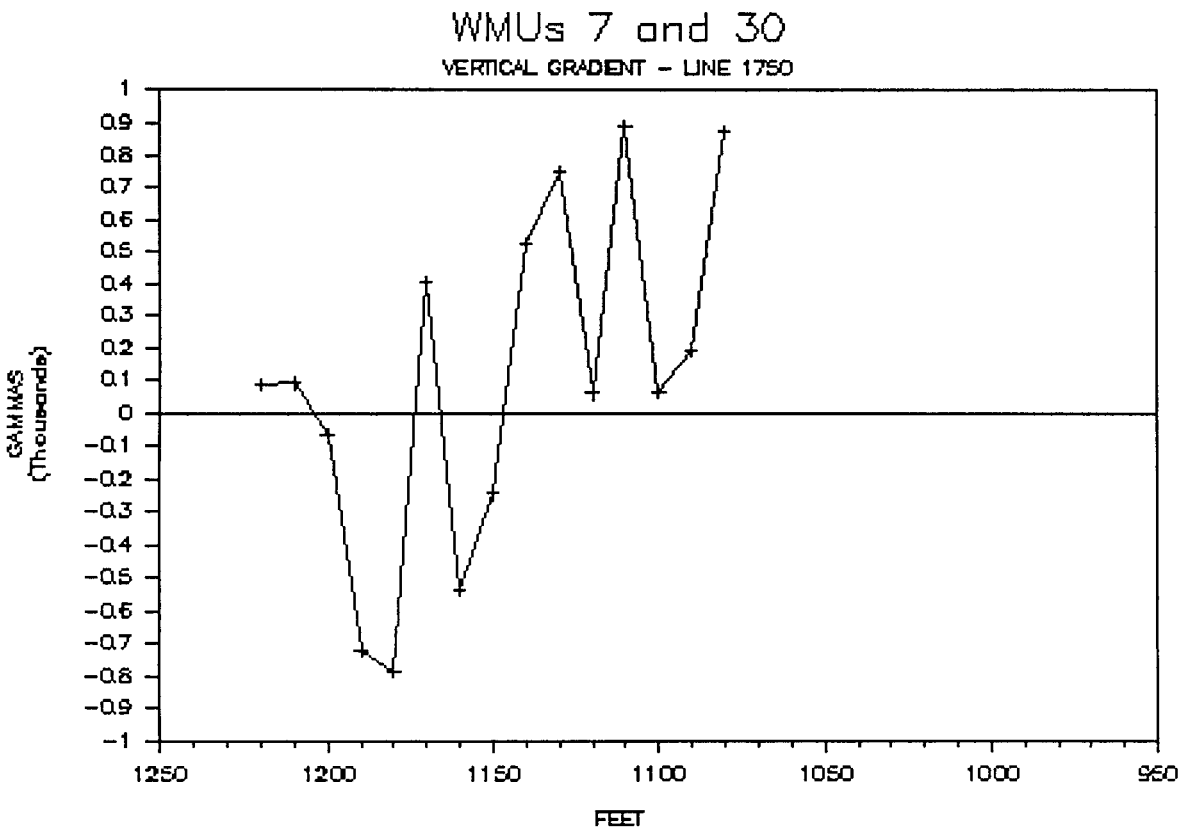

WMUs 7 and 30
LINE 1710
GAMMAS (Thousands)
61
60
59
58
57
56
55
54
53
52
51
50
49
48
1250
1200
1150
1100
1050
1000
950
FEET

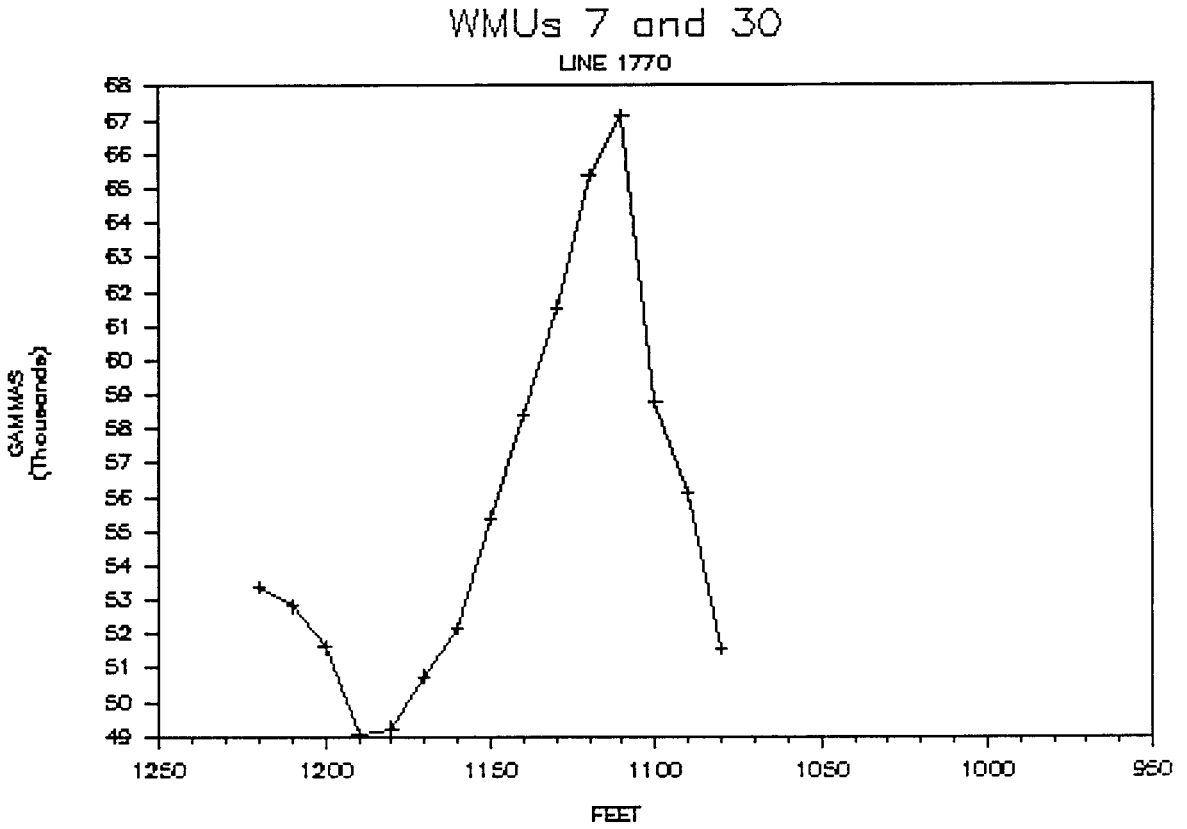

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1710
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

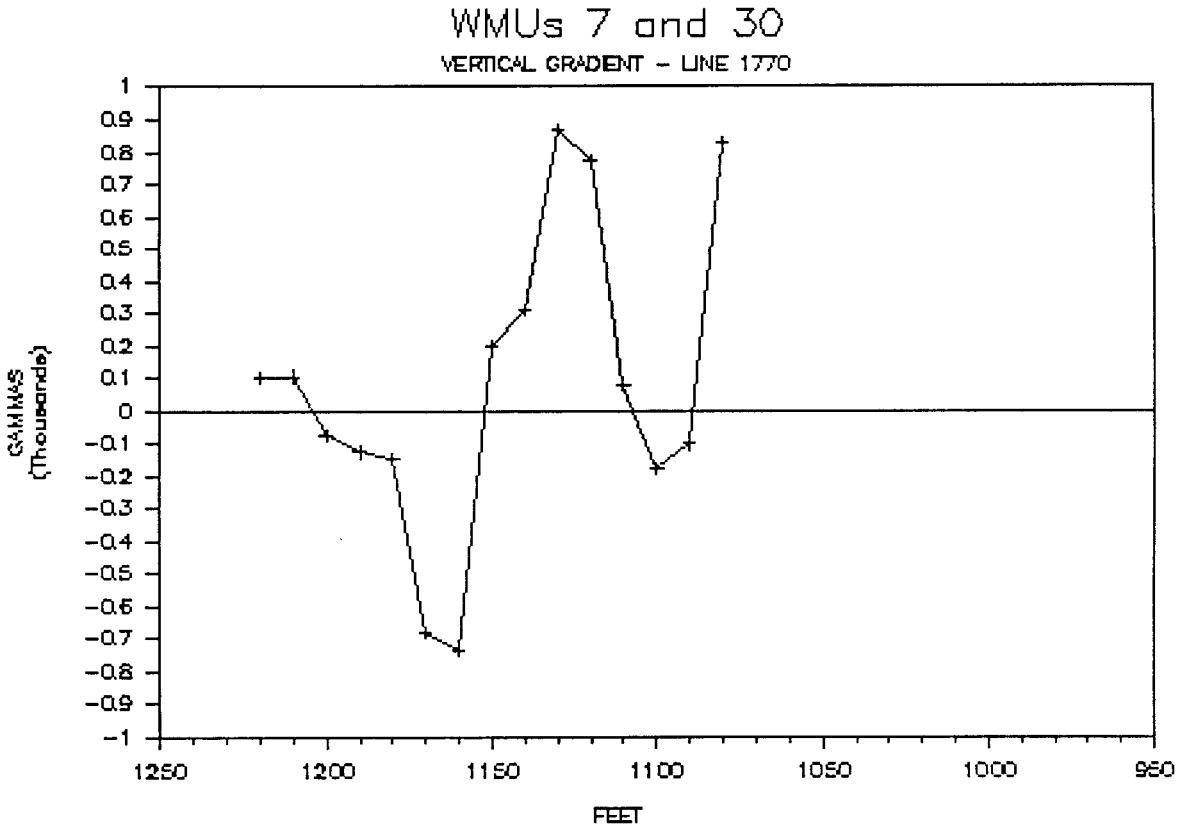

WMUs 7 and 30
LINE 1730
GAMMAS (Thousands)
61
60
59
58
57
56
55
54
53
52
51
50
1250
1200
1150
1100
1050
1000
950
FEET

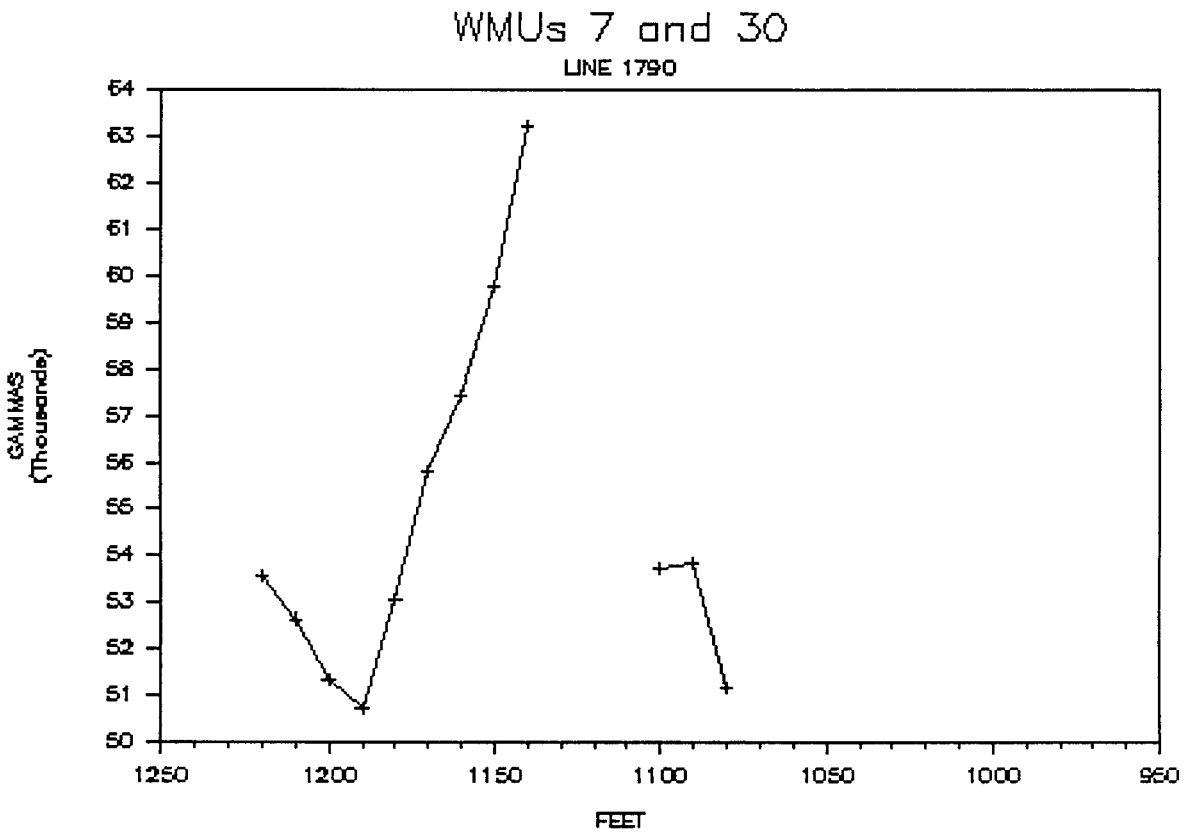

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1730
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

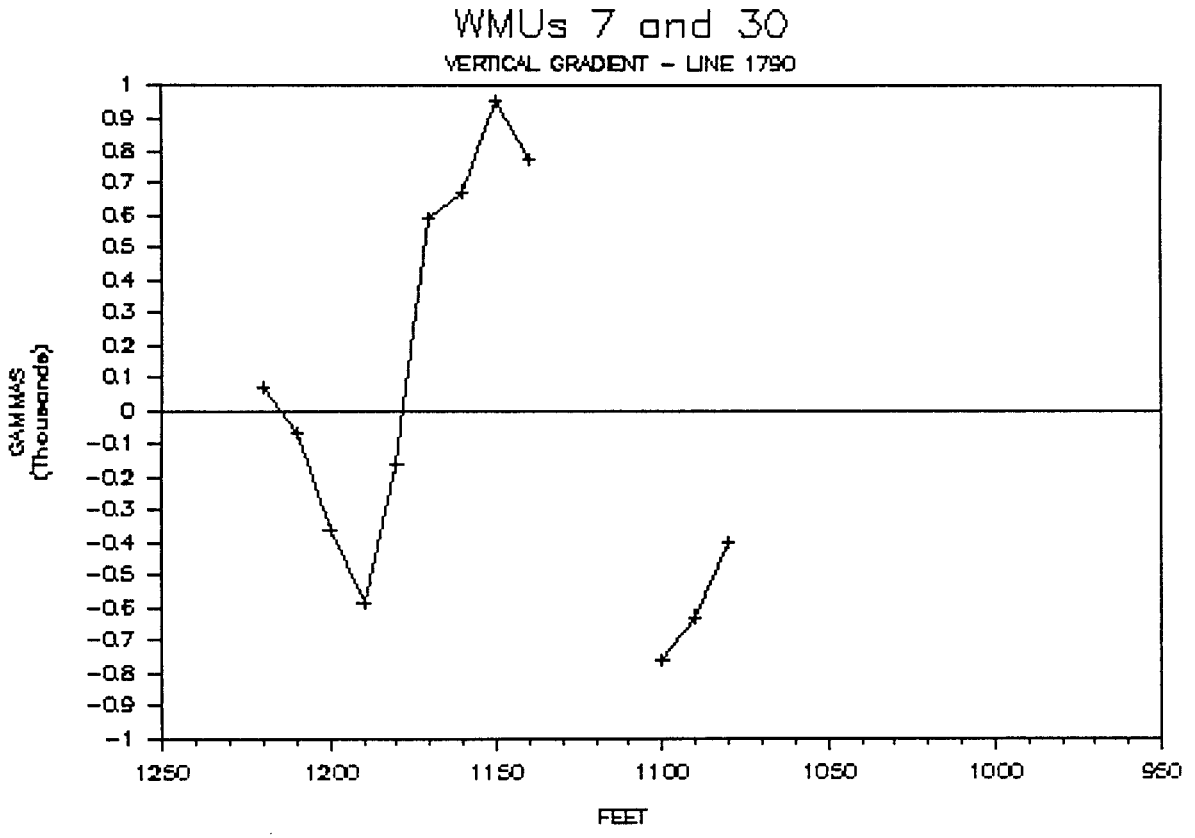

WMUs 7 and 30
LINE 1750
GAMMAS (Thousands)
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
1250
1200
1150
1100
1050
1000
950
FEET

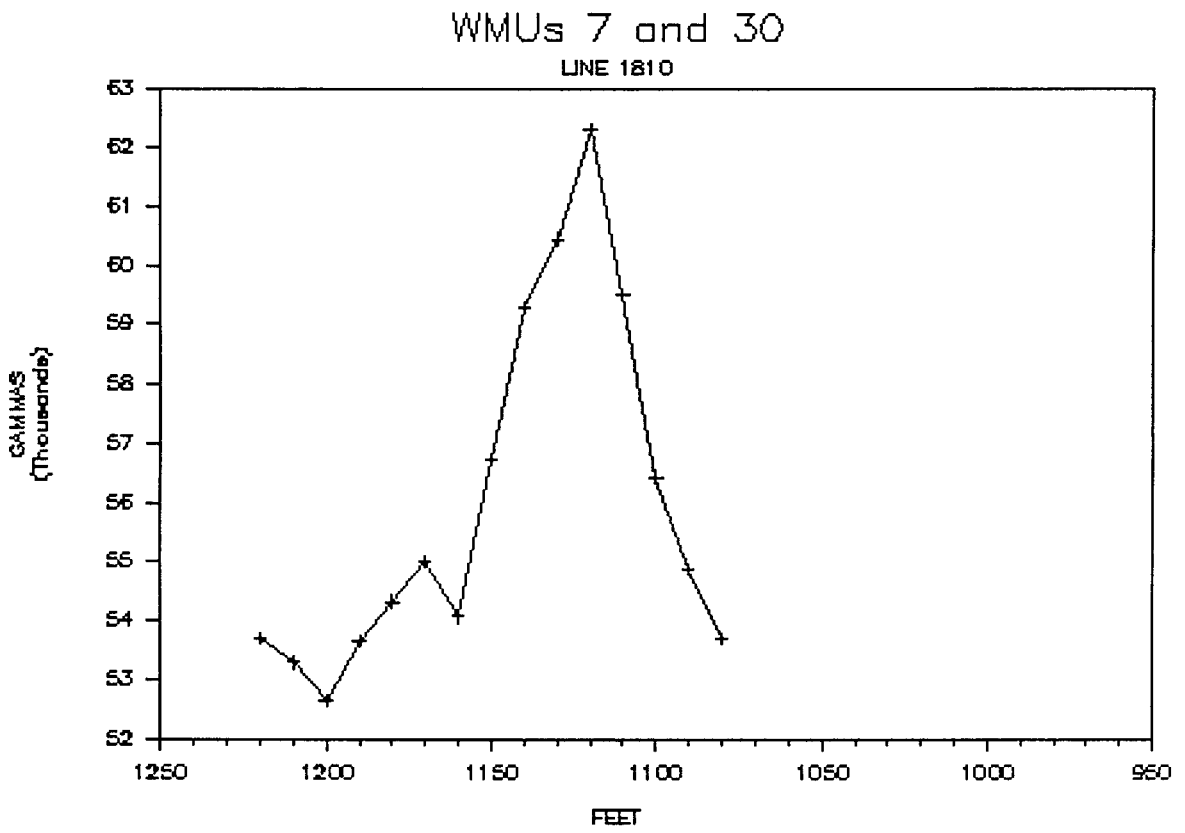

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1750
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

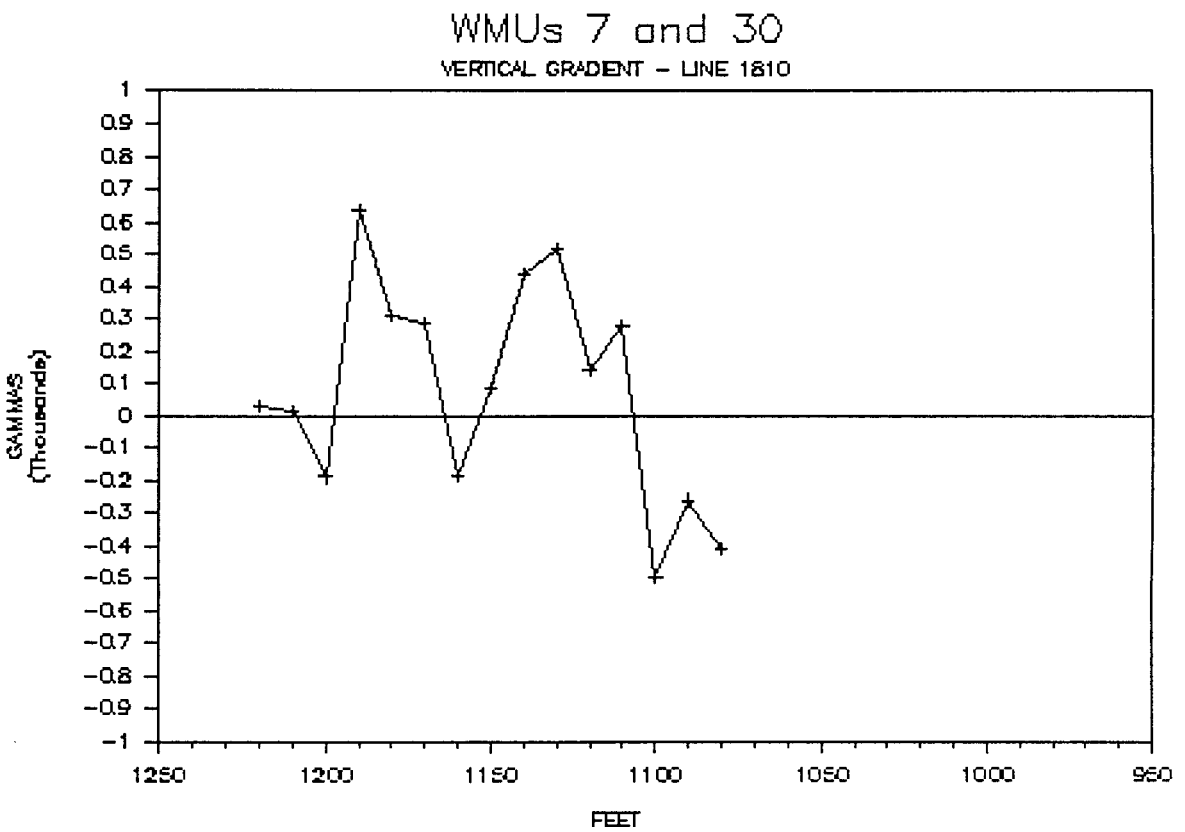

WMUs 7 and 30
LINE 1770
GAMMAS (Thousands)
68
67
66
65
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
49
1250
1200
1150
1100
1050
1000
950
FEET

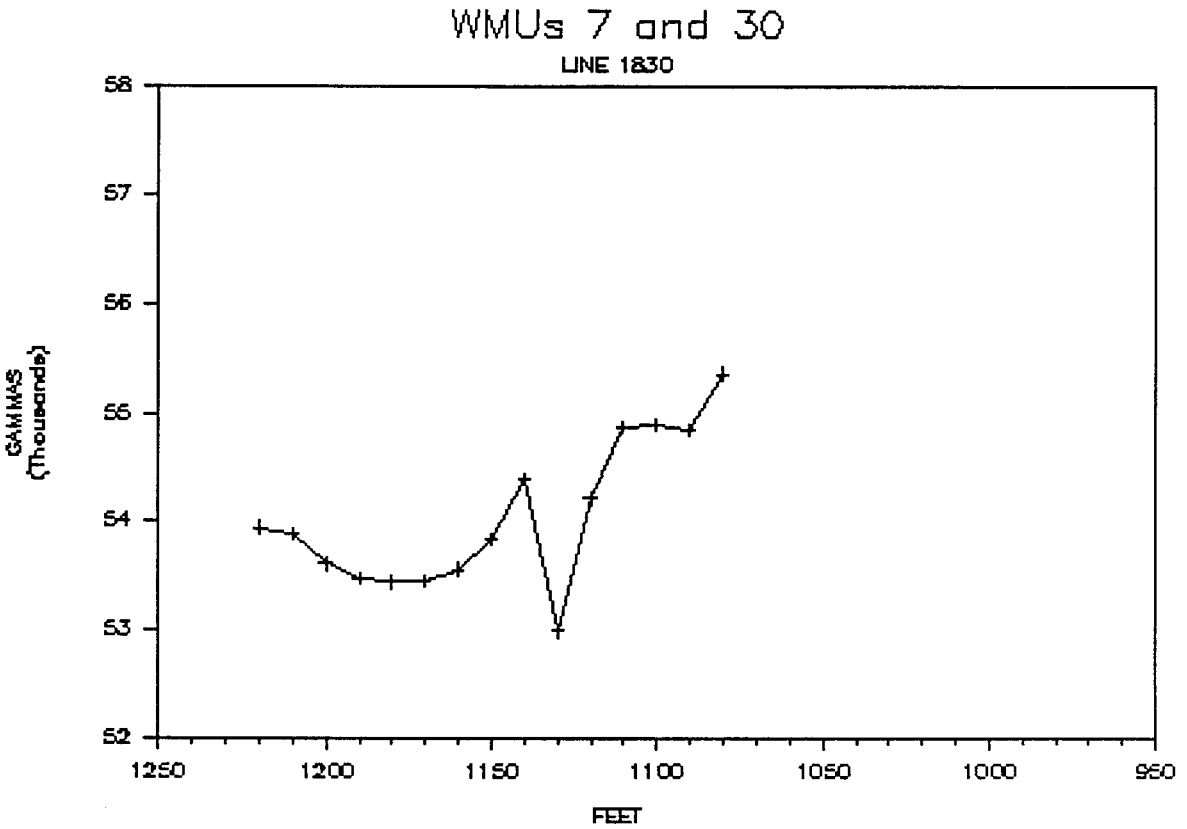

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1770
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

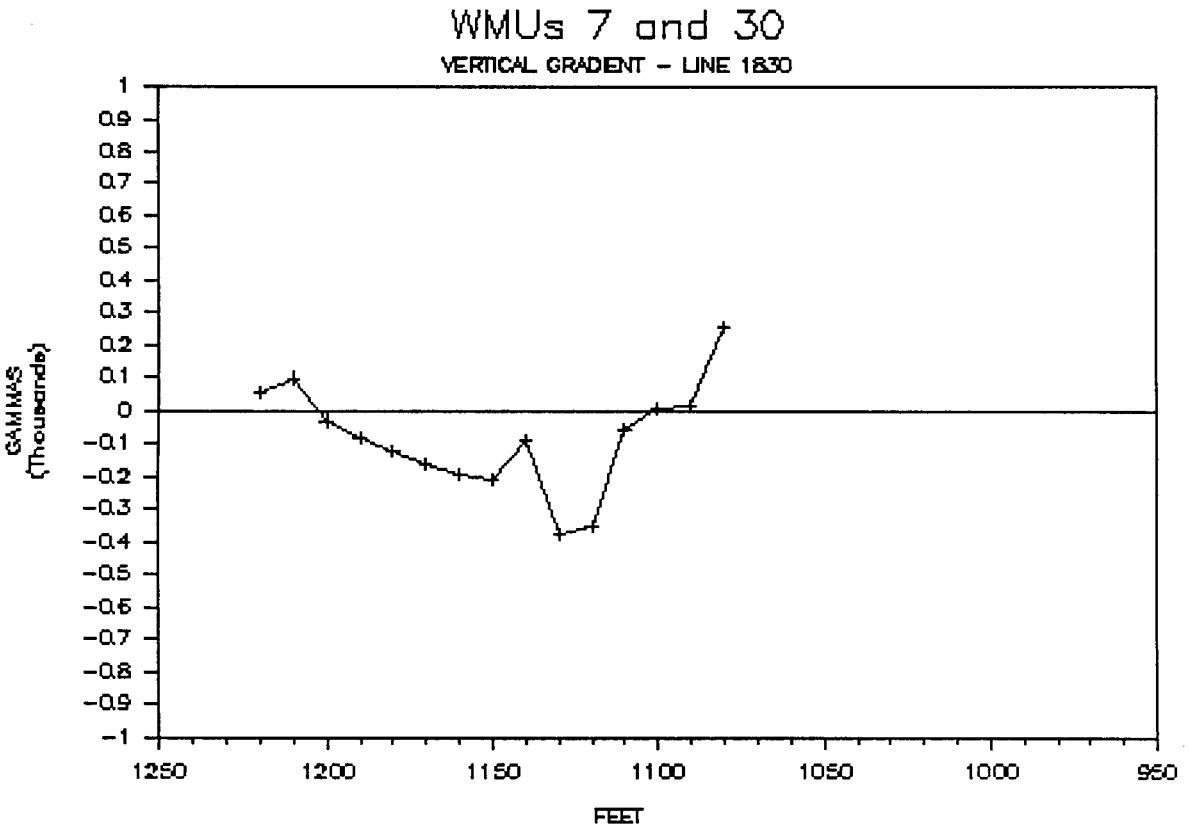

WMUs 7 and 30
LINE 1790
GAMMAS (Thousands)
64
63
62
61
60
59
58
57
56
55
54
53
52
51
50
1250
1200
1150
1100
1050
1000
950
FEET

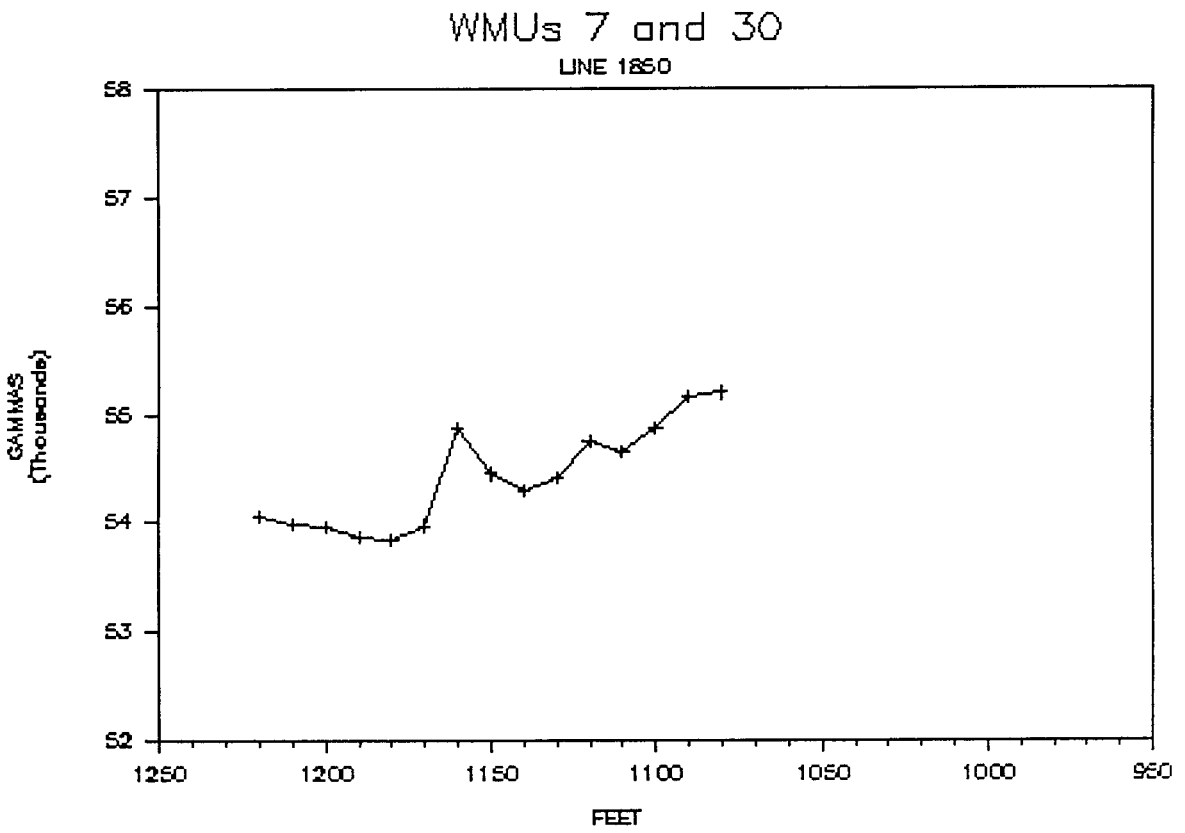

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1790
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

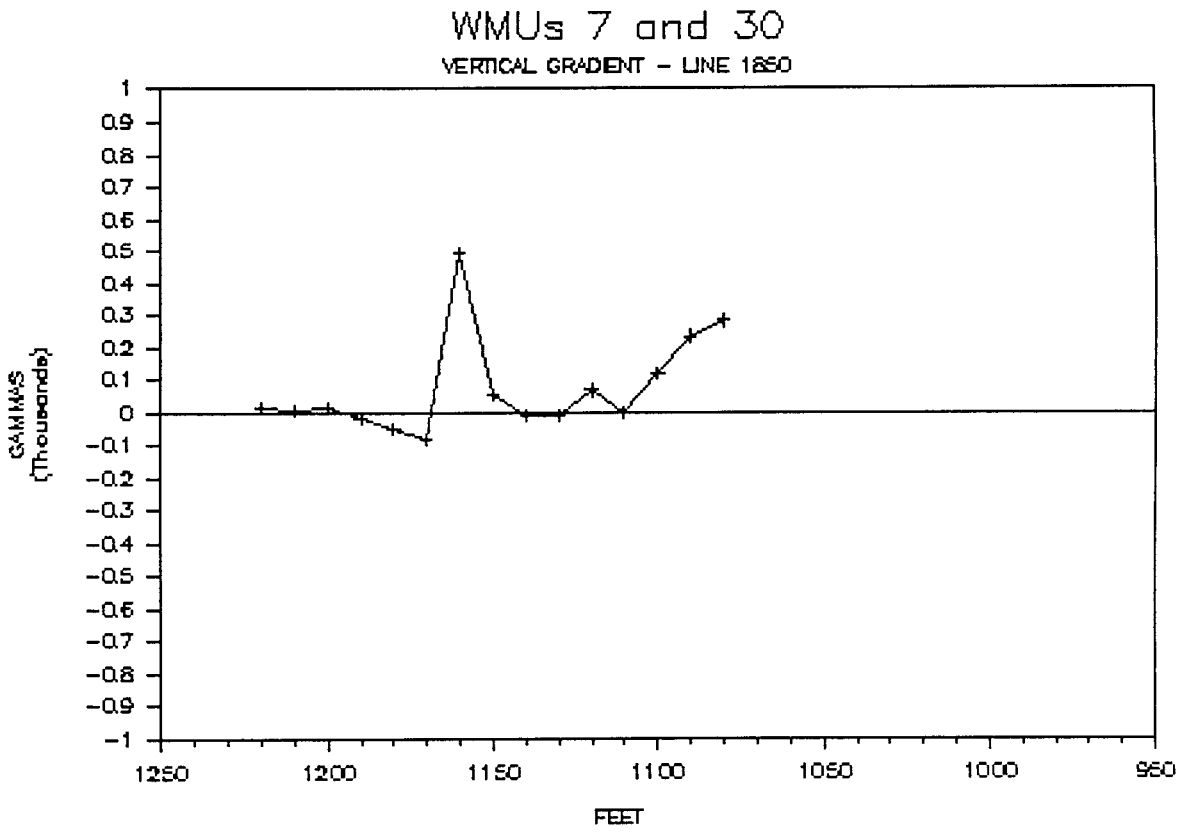

WMUs 7 and 30
LINE 1810
GAMMAS (Thousands)
63
62
61
60
59
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

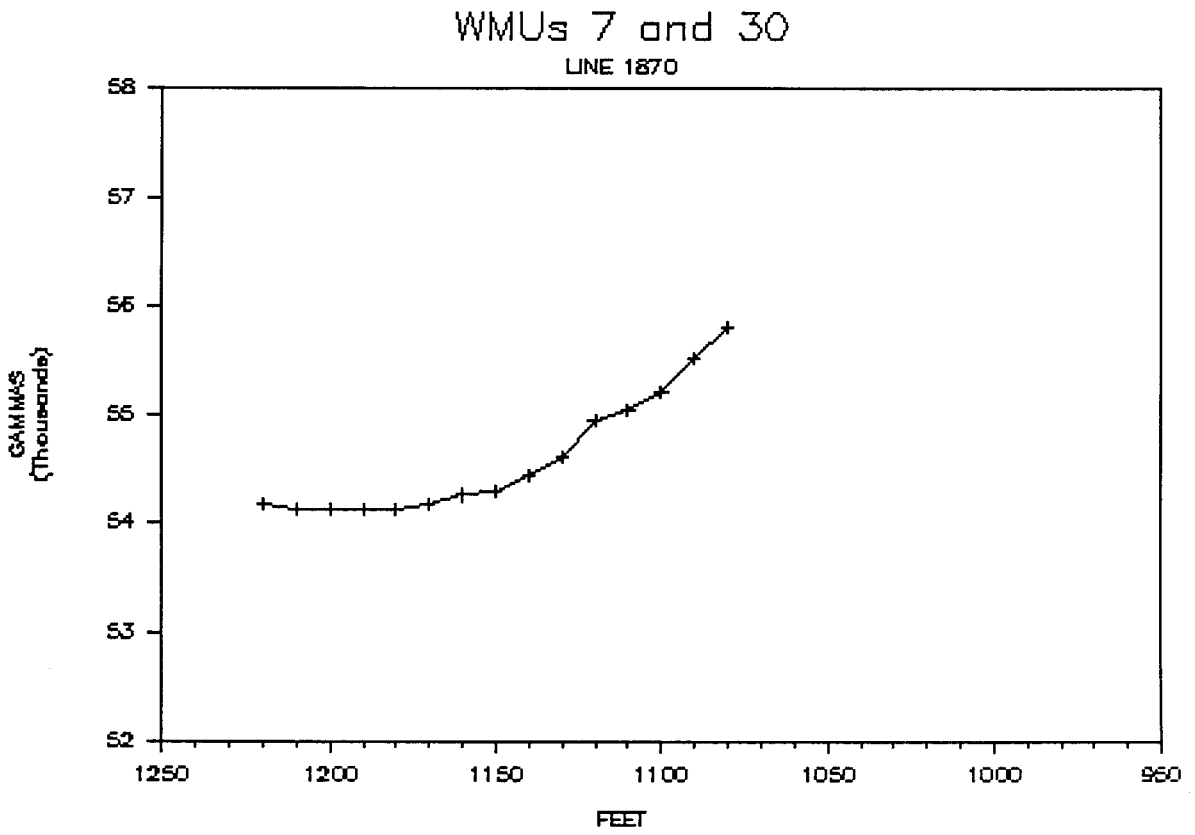

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1810
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

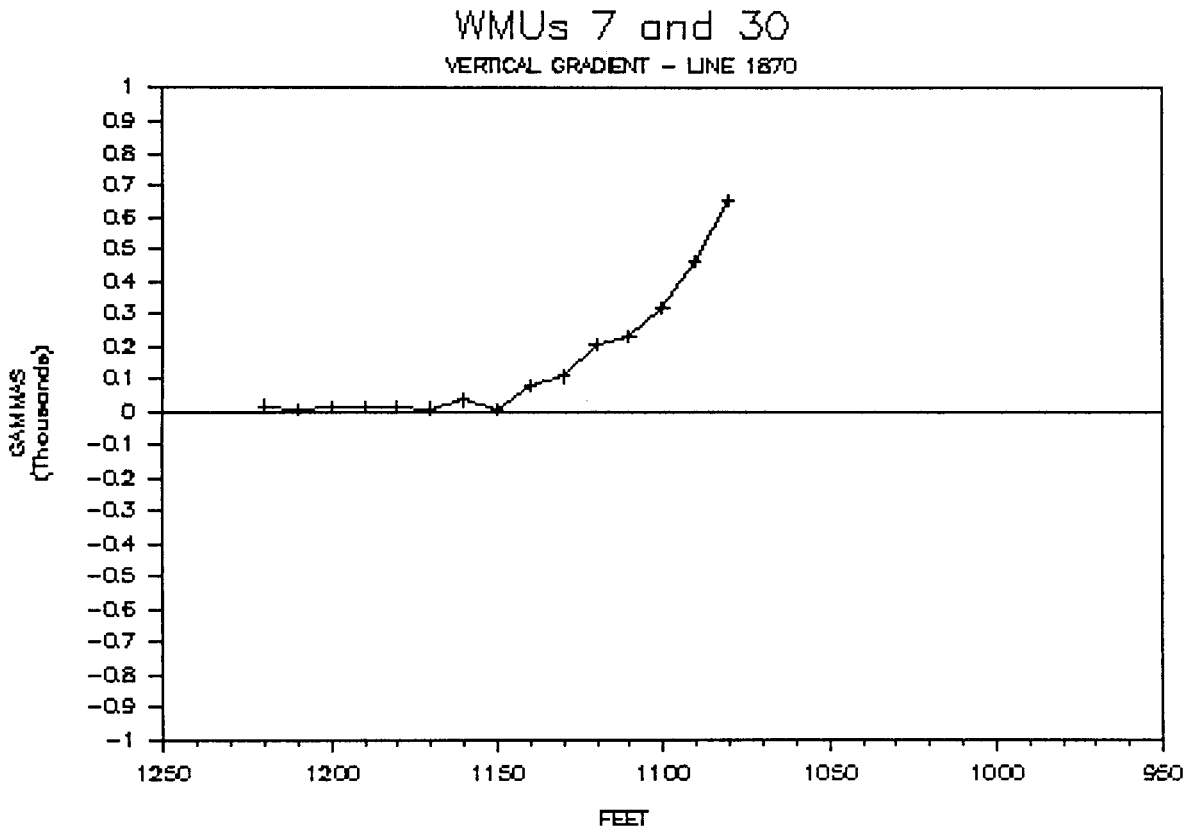

WMUs 7 and 30
LINE 1&30
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

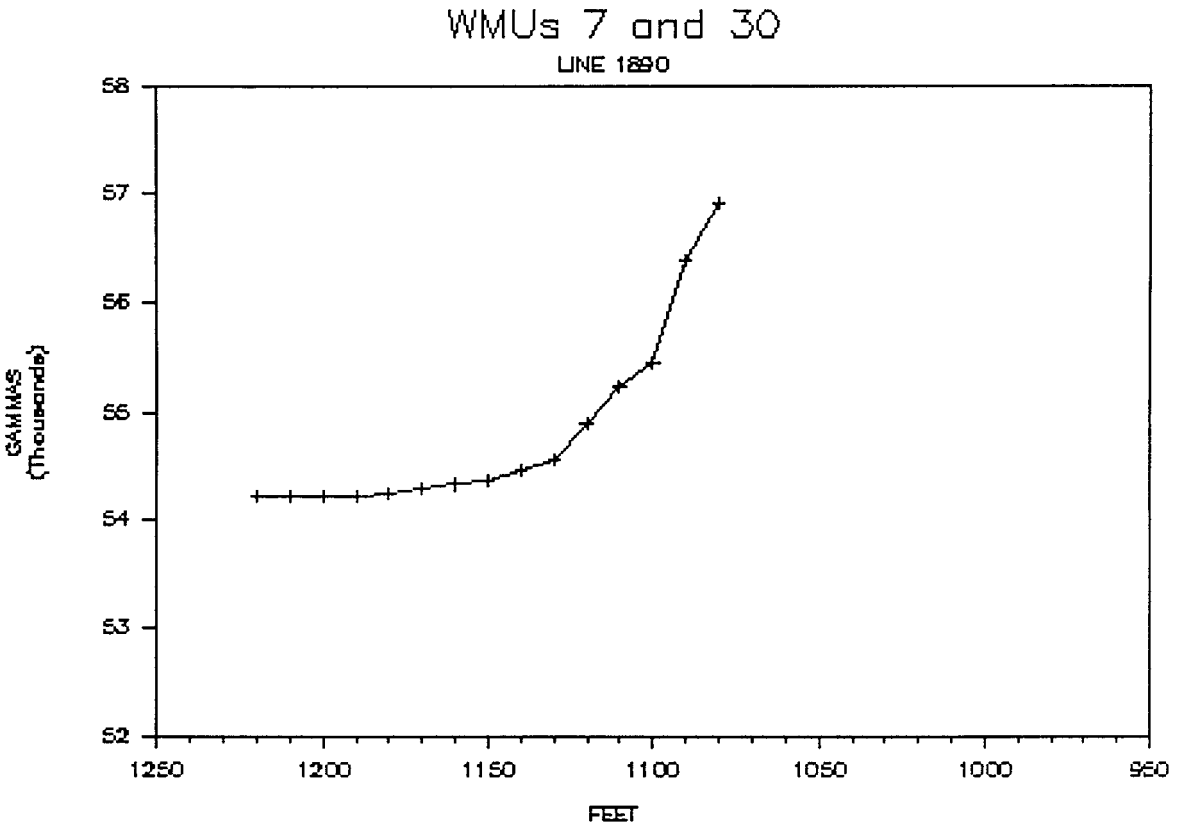

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1&30
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

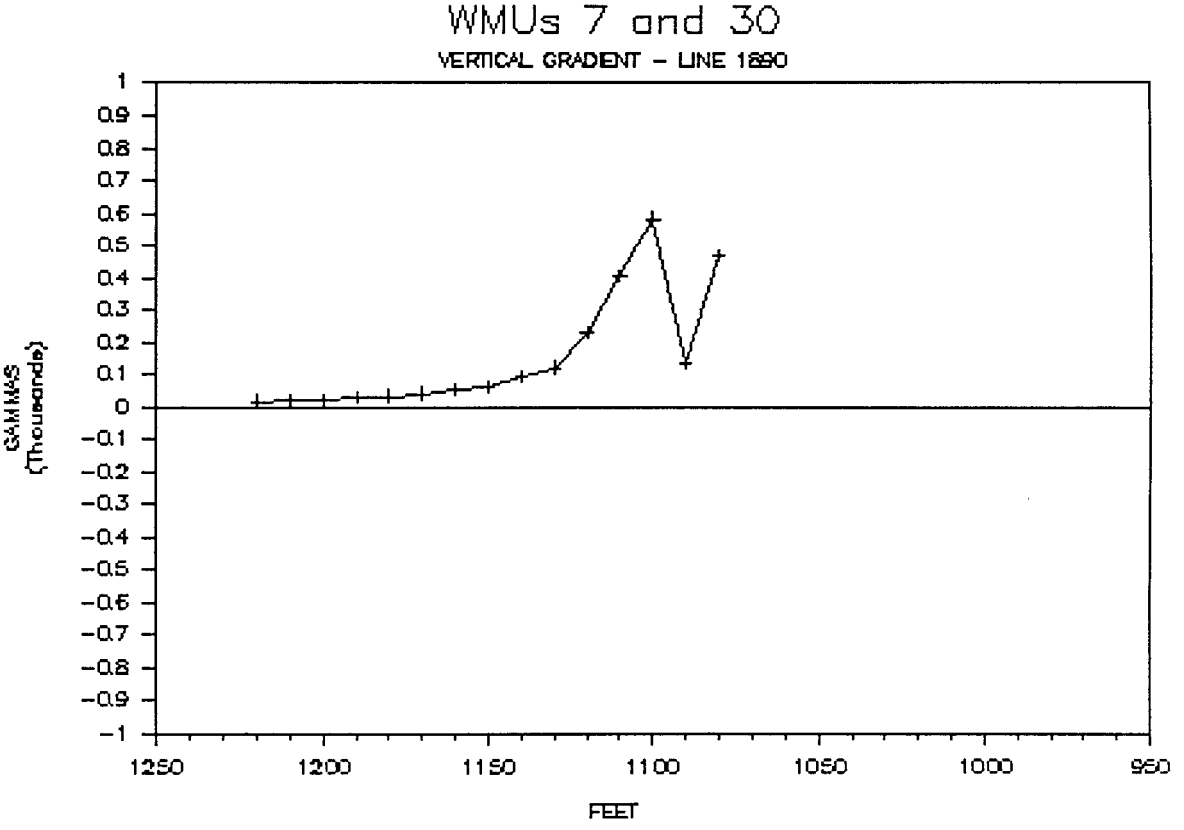

WMUs 7 and 30
LINE 1850
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

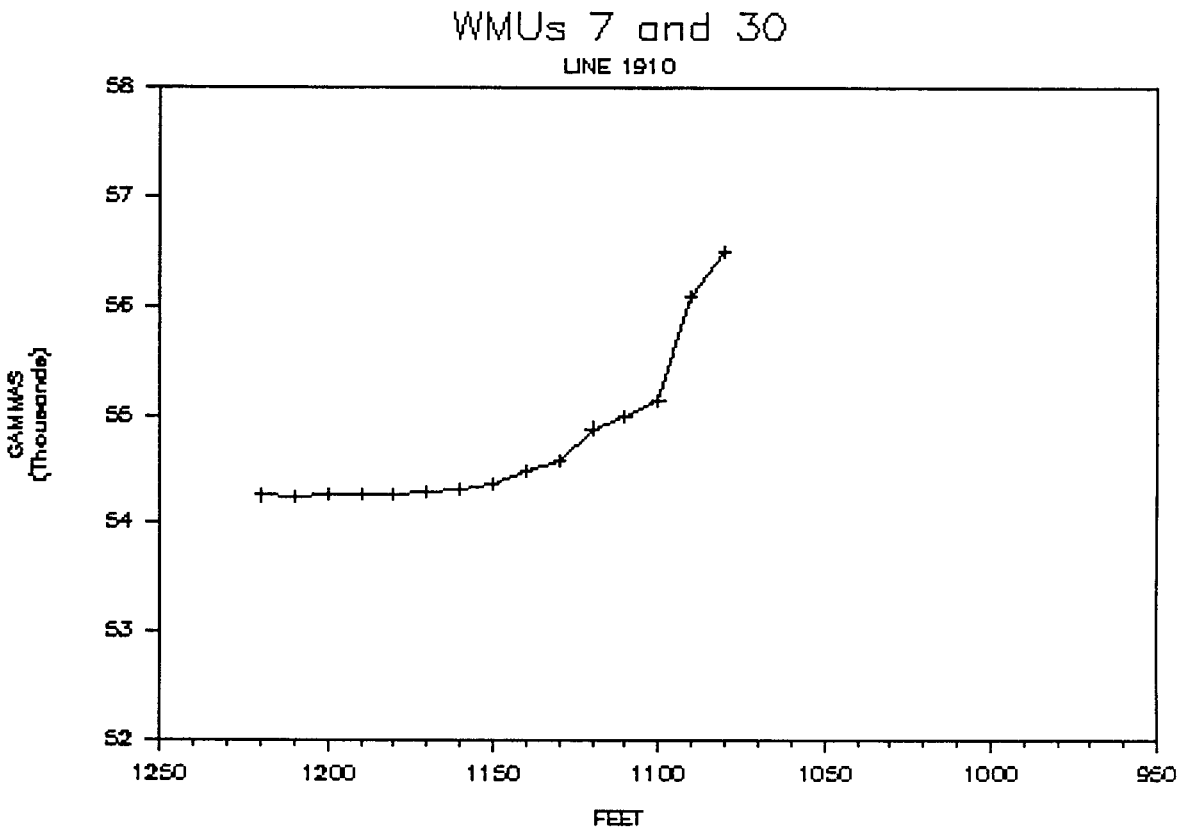

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1850
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

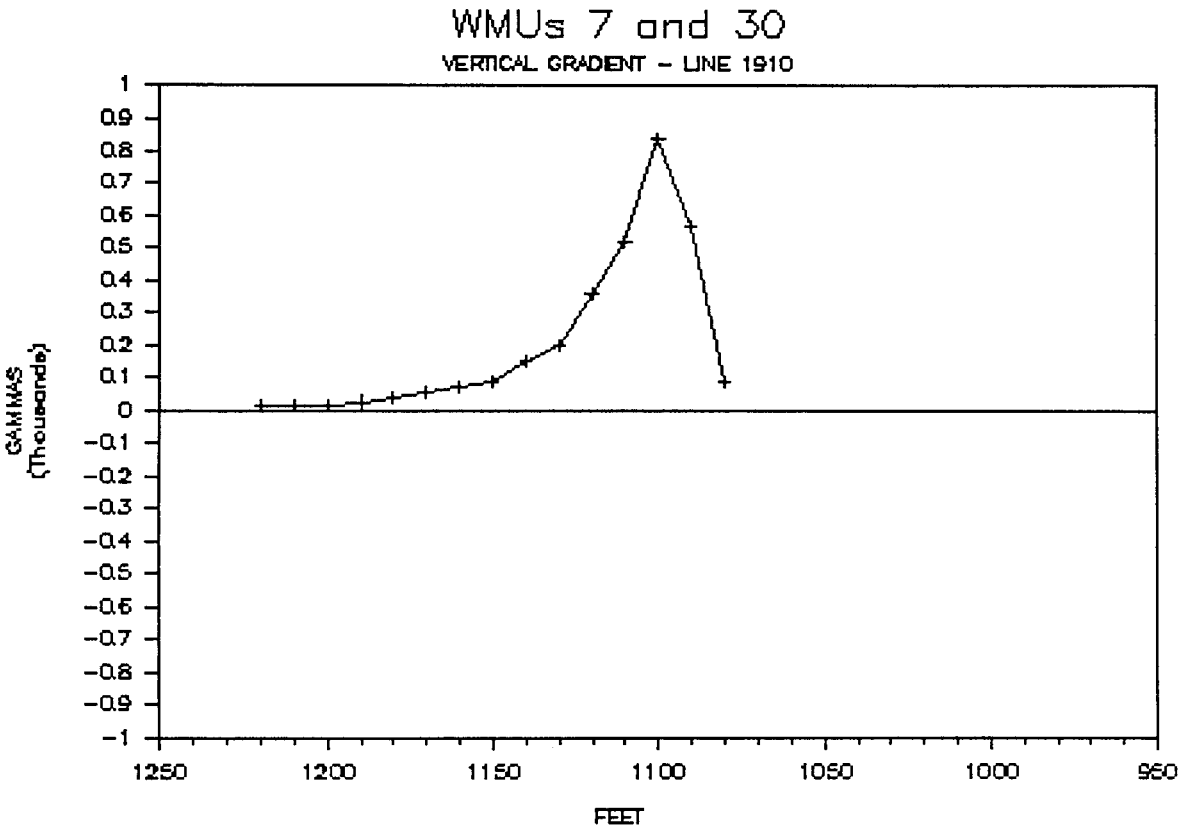

WMUs 7 and 30
LINE 1870
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

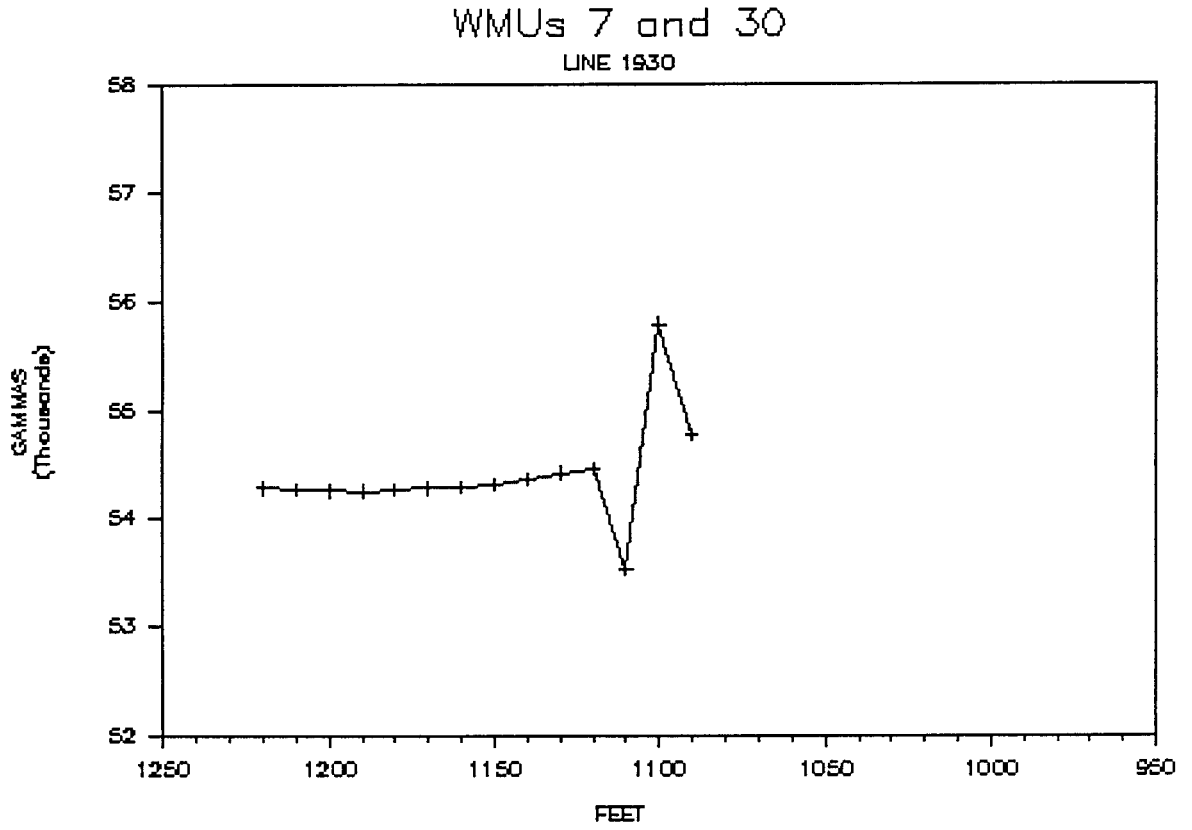

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1870
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

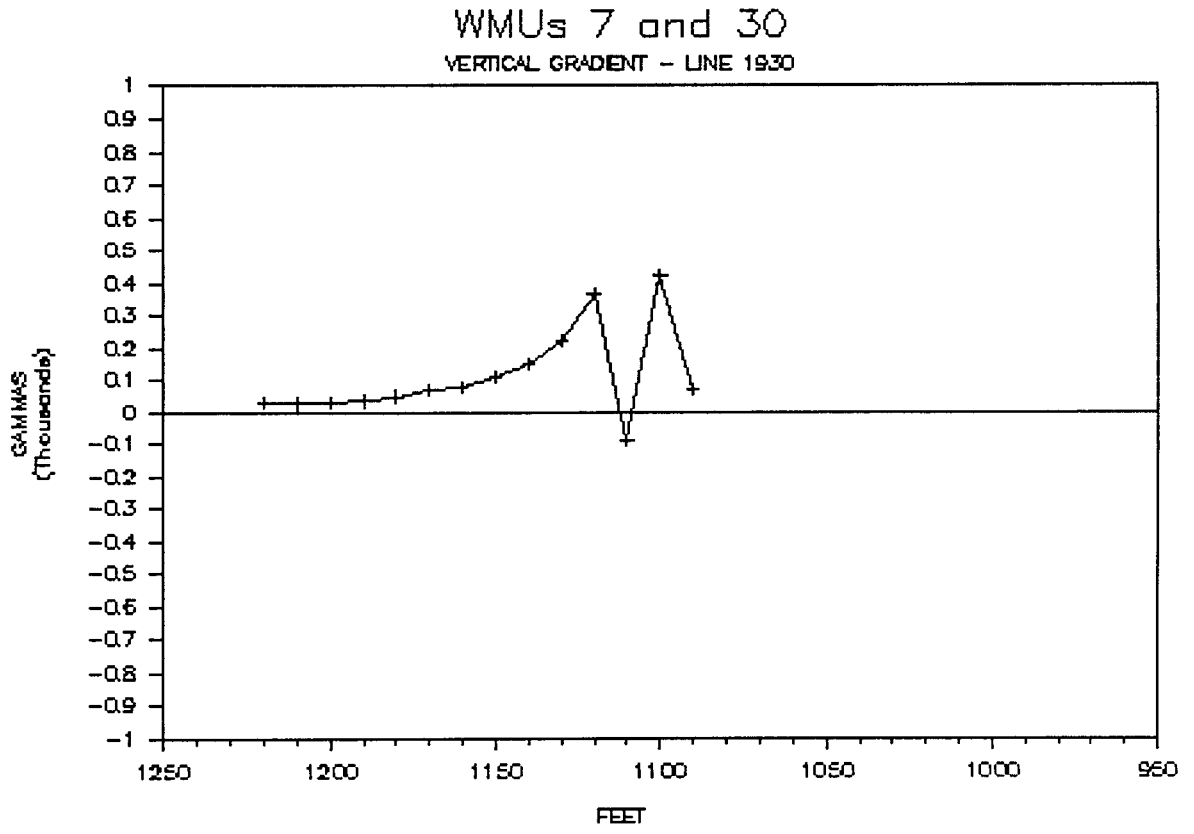

WMUs 7 and 30
LINE 1890
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

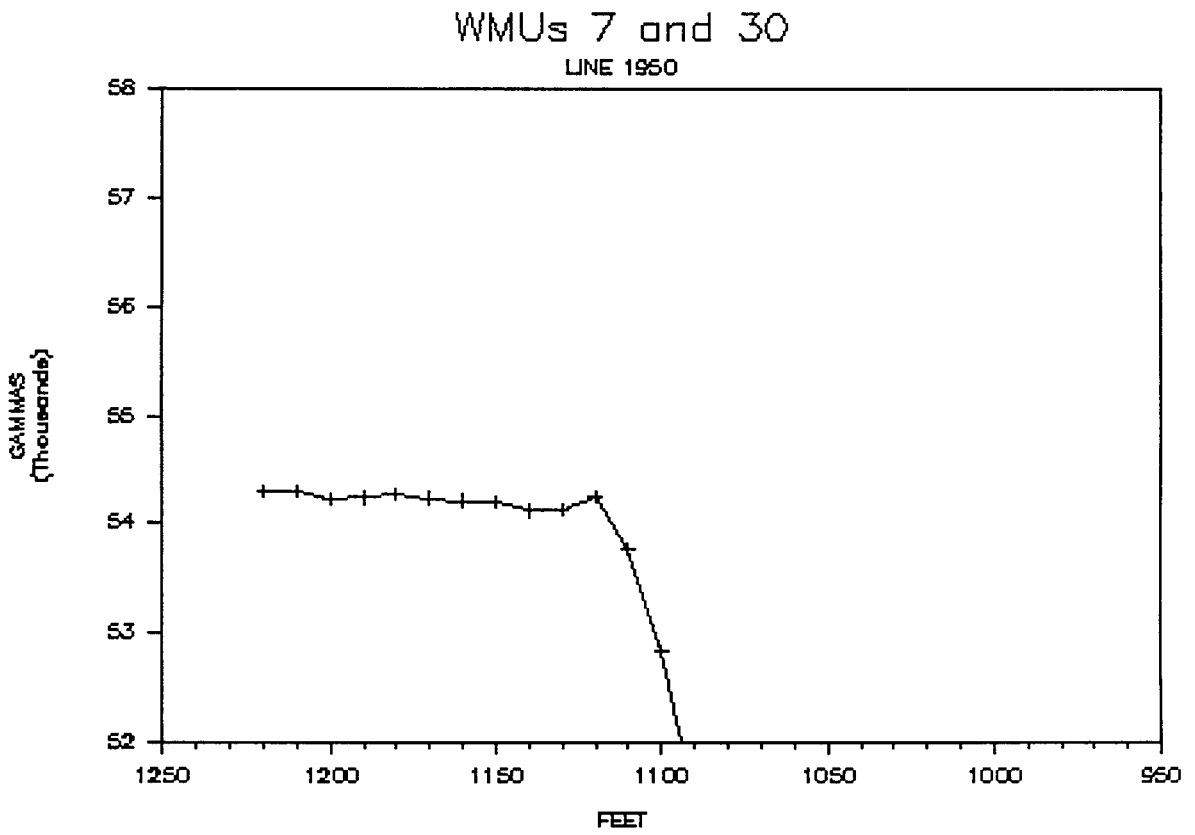

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1890
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

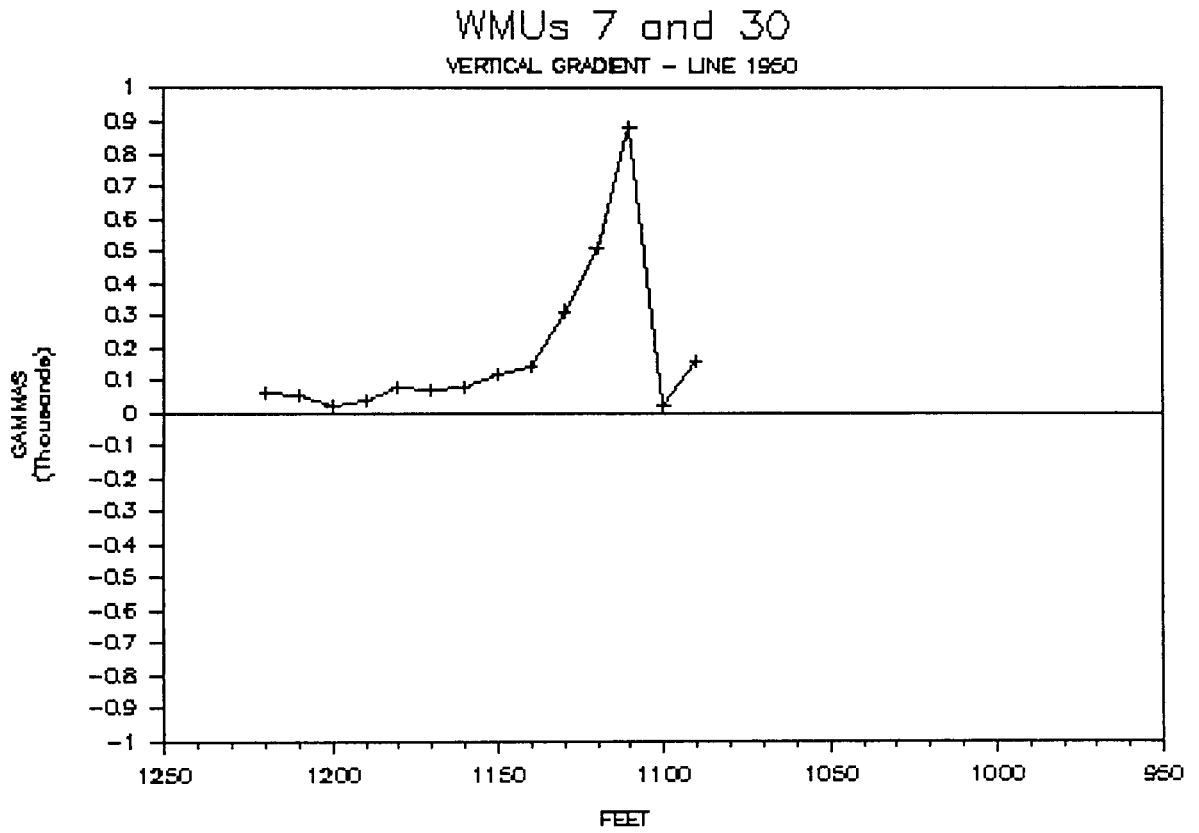

WMUs 7 and 30
LINE 1910
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

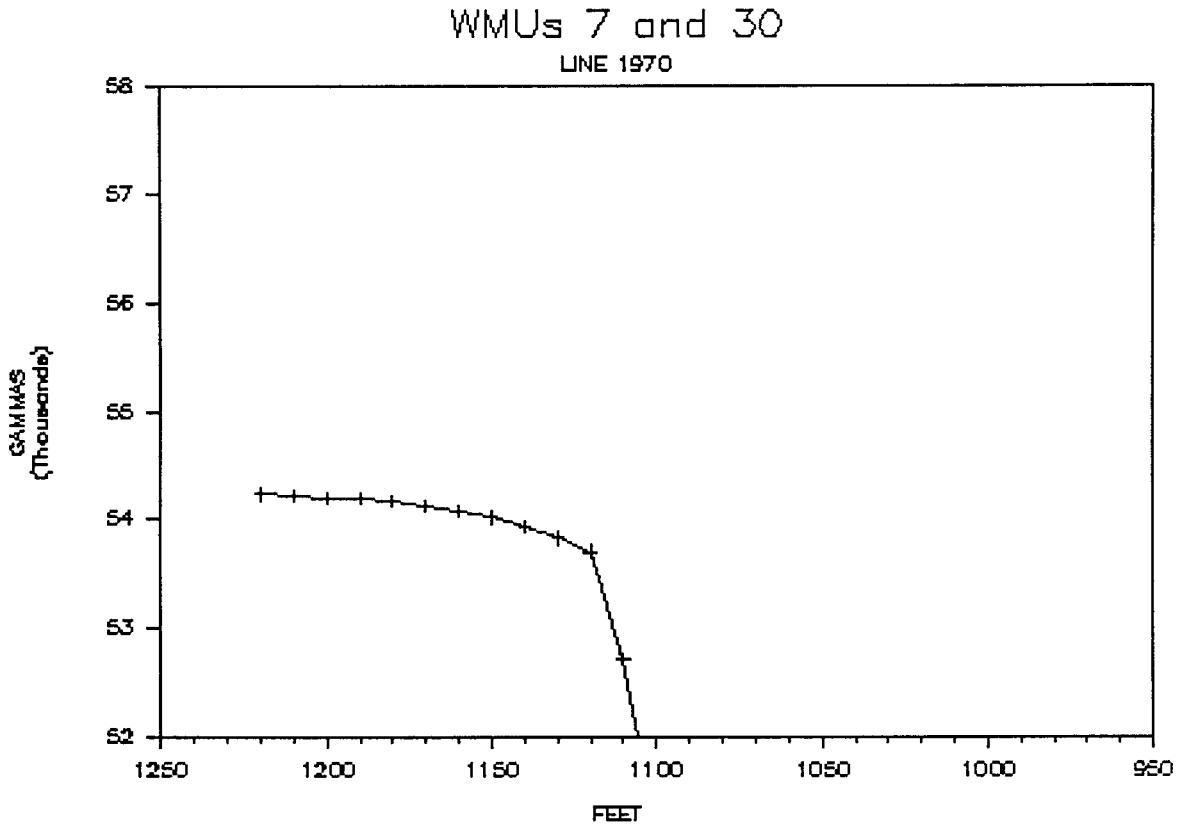

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1910
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

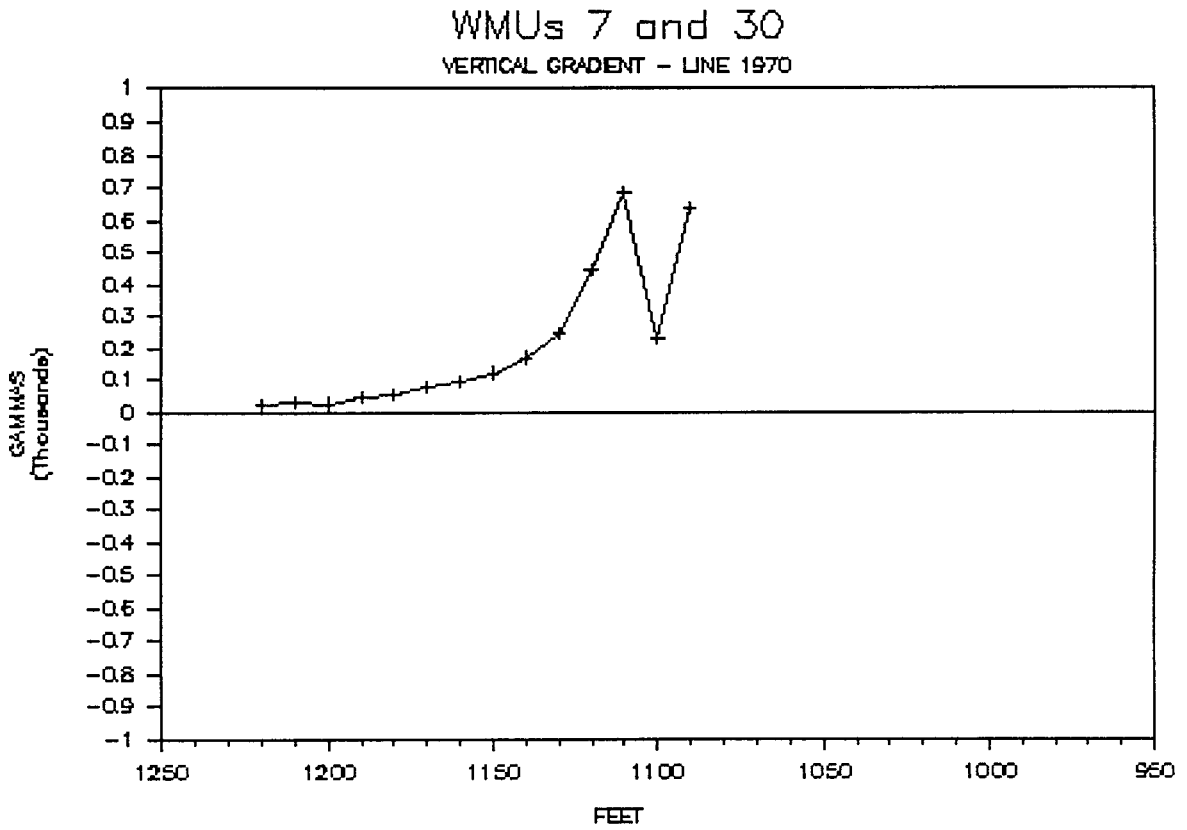

WMUs 7 and 30
LINE 1930
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

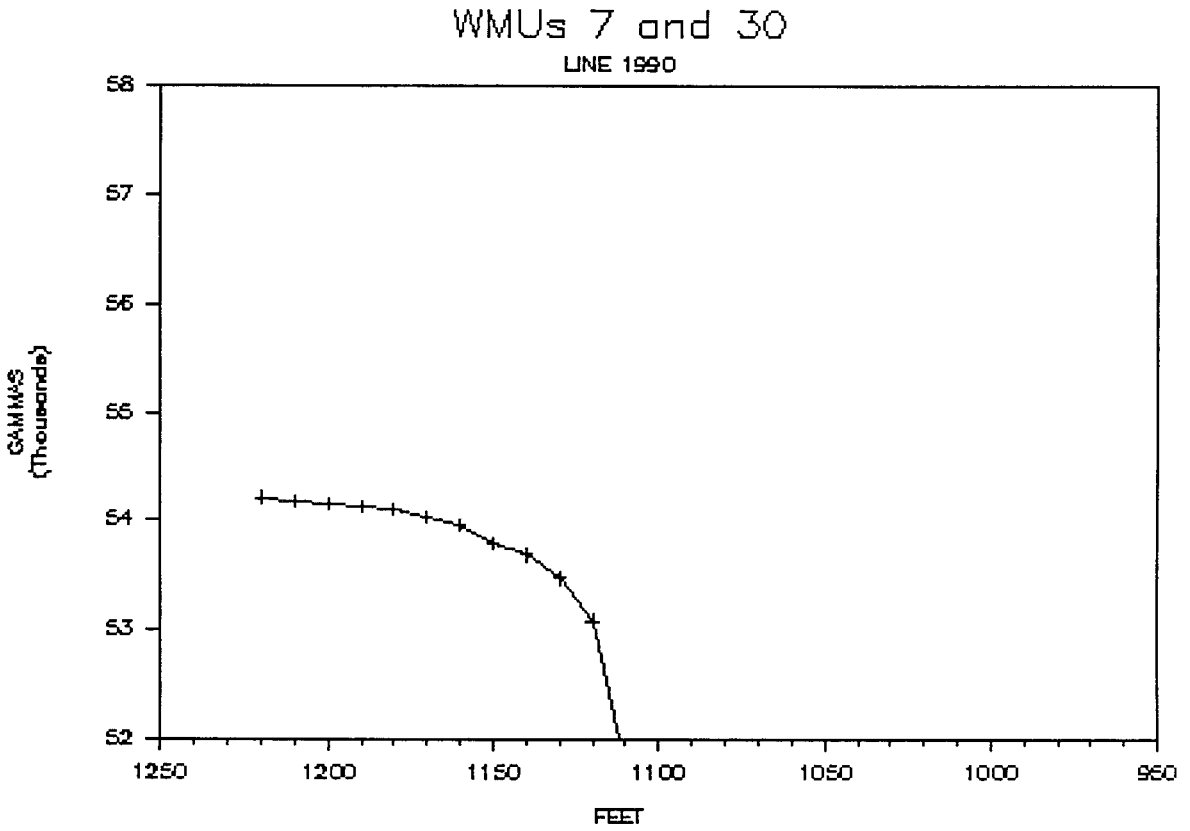

WMUs 7 and 30
VERTICAL GRADIENT – LINE 1930
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

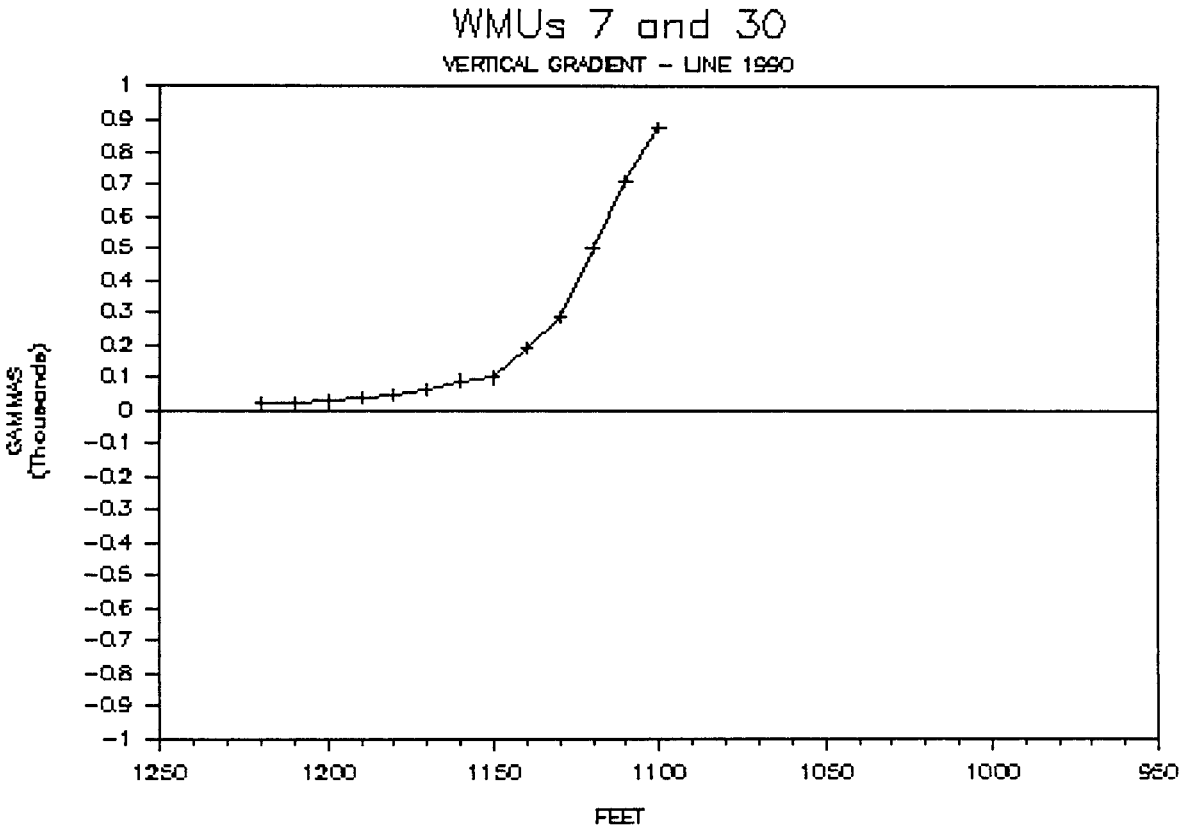

WMUs 7 and 30
LINE 1950
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

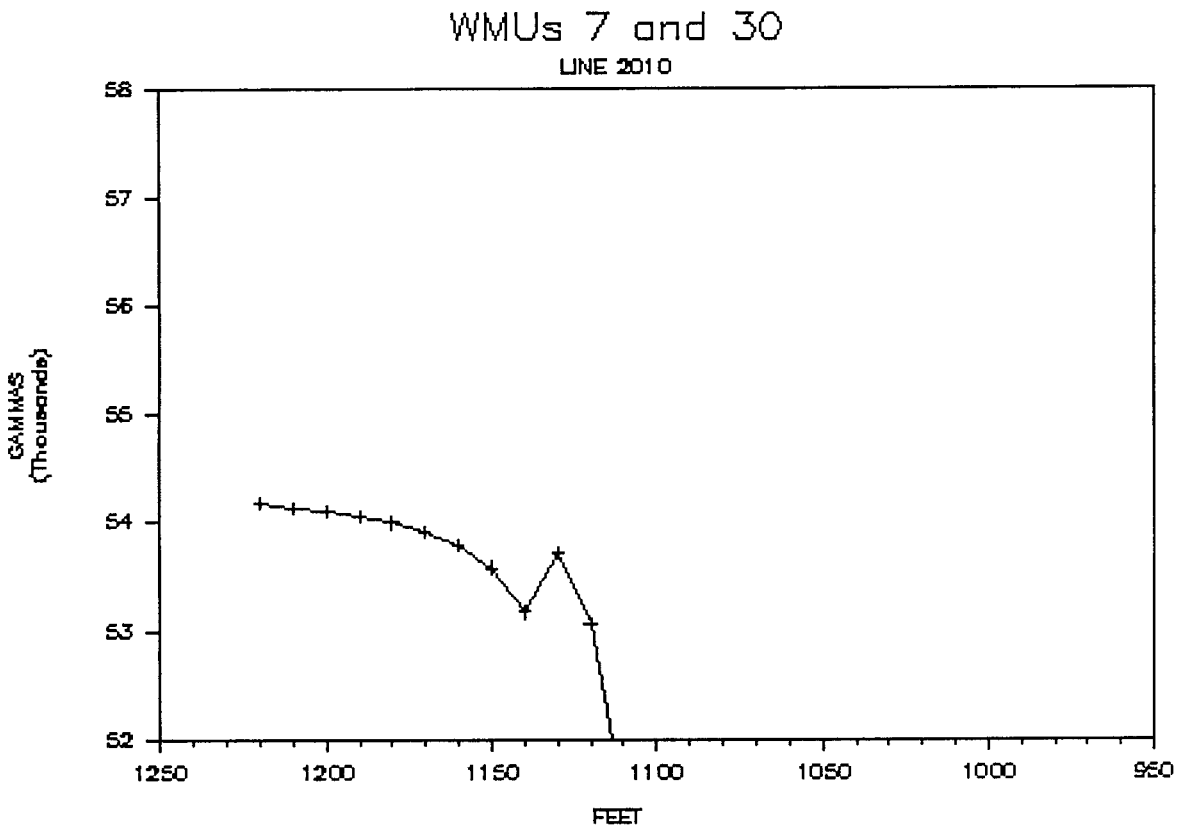

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1950
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

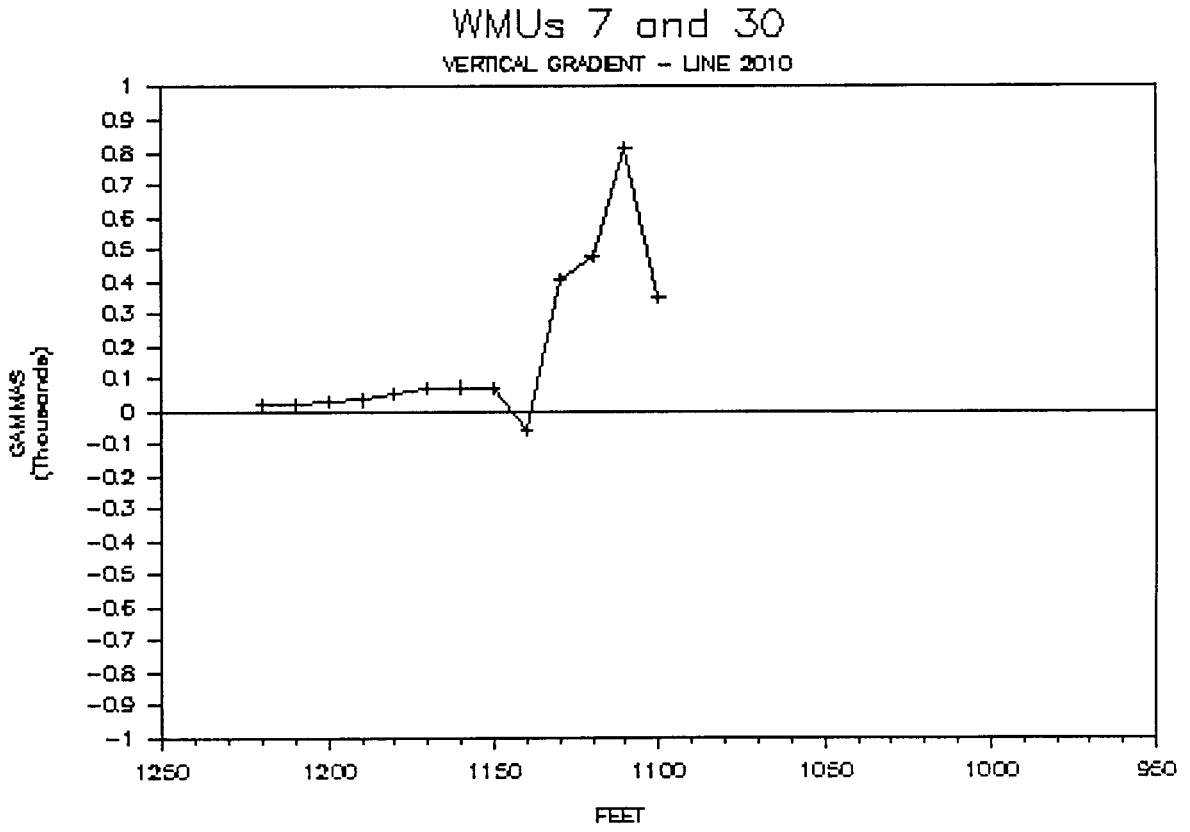

WMUs 7 and 30
LINE 1970
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

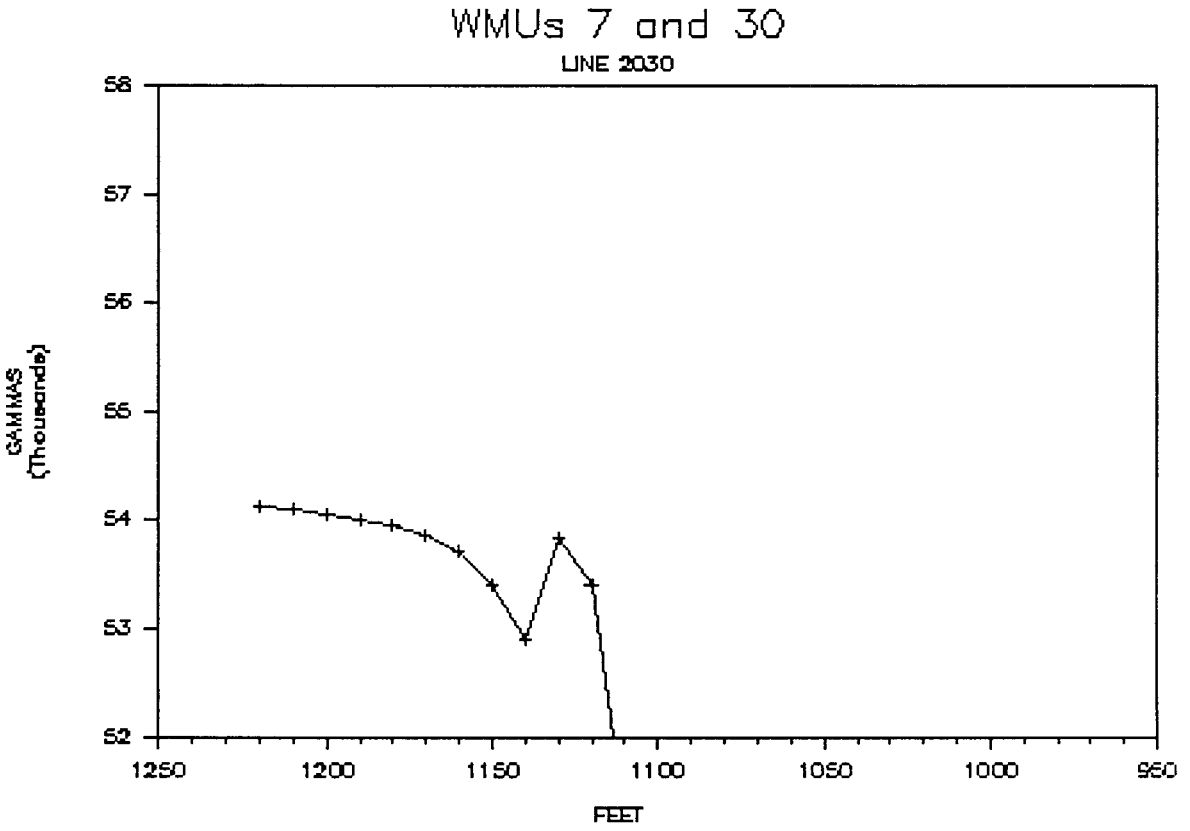

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1970
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

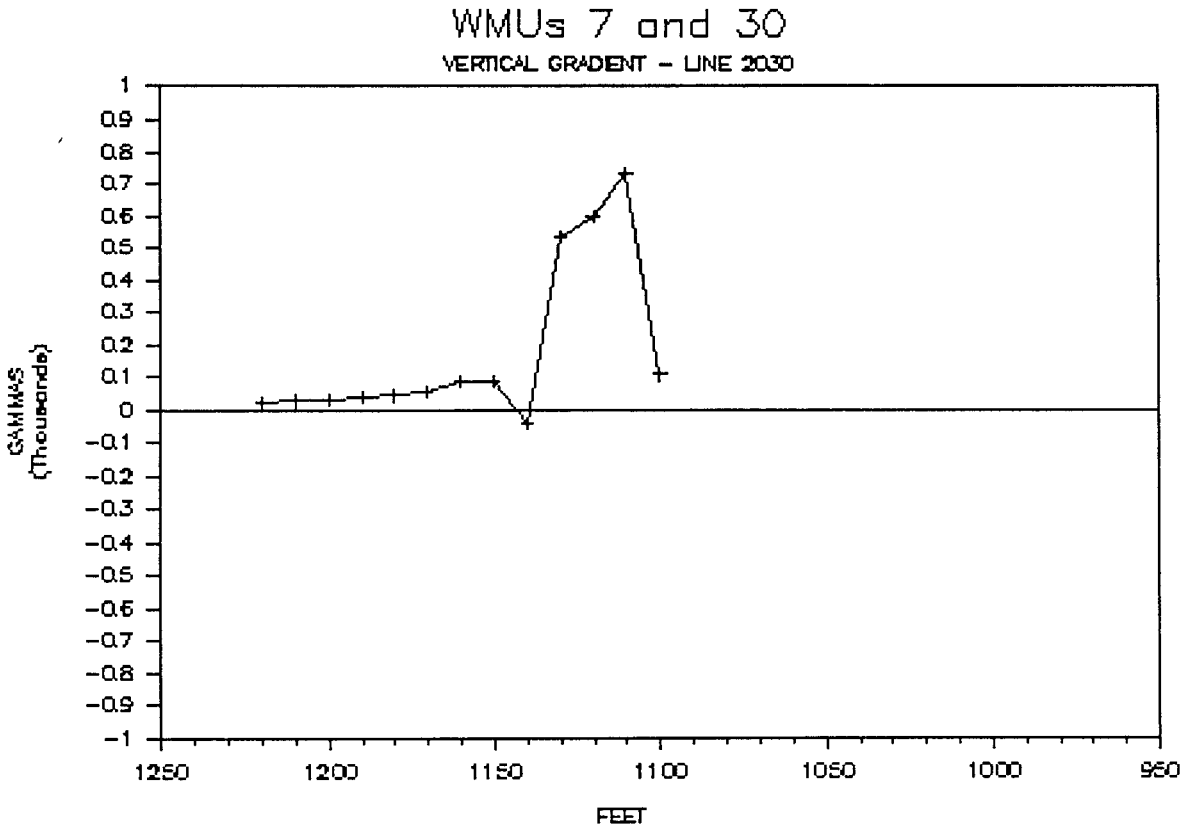

WMUs 7 and 30
LINE 1990
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

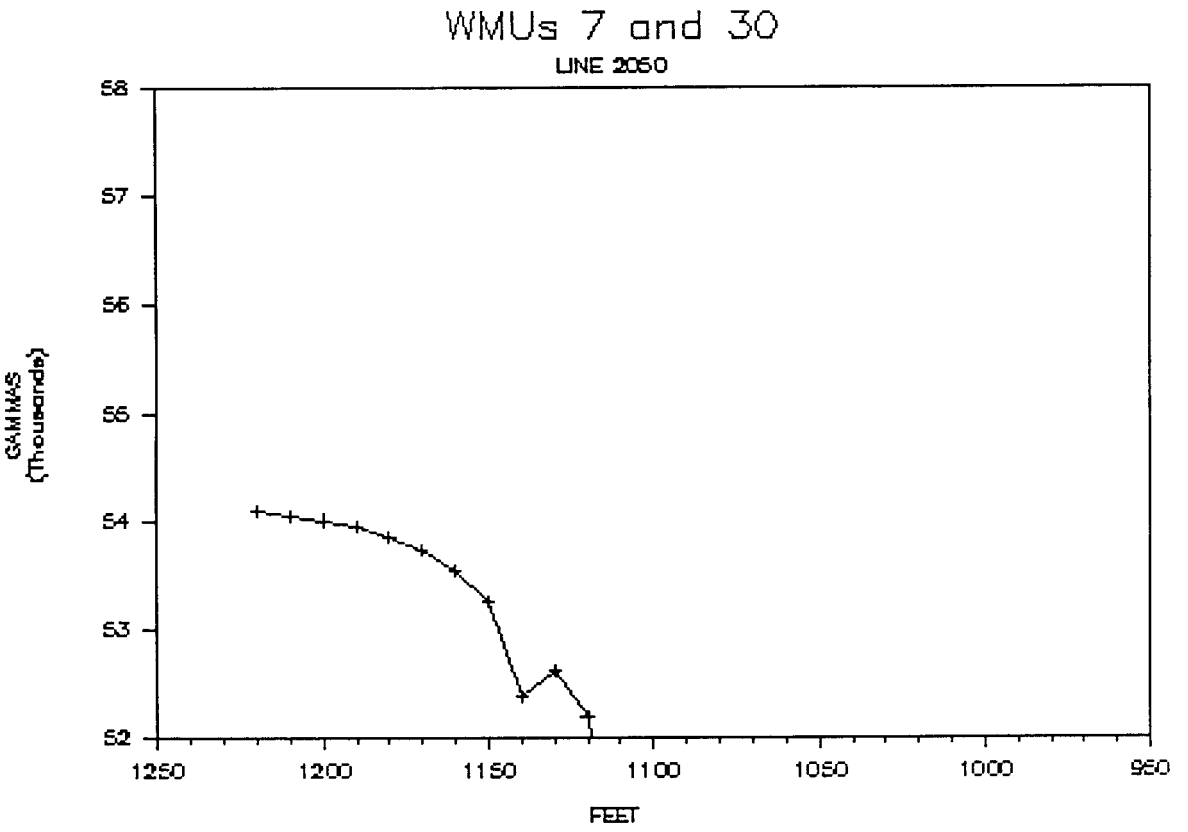

WMUs 7 and 30
VERTICAL GRADIENT - LINE 1990
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

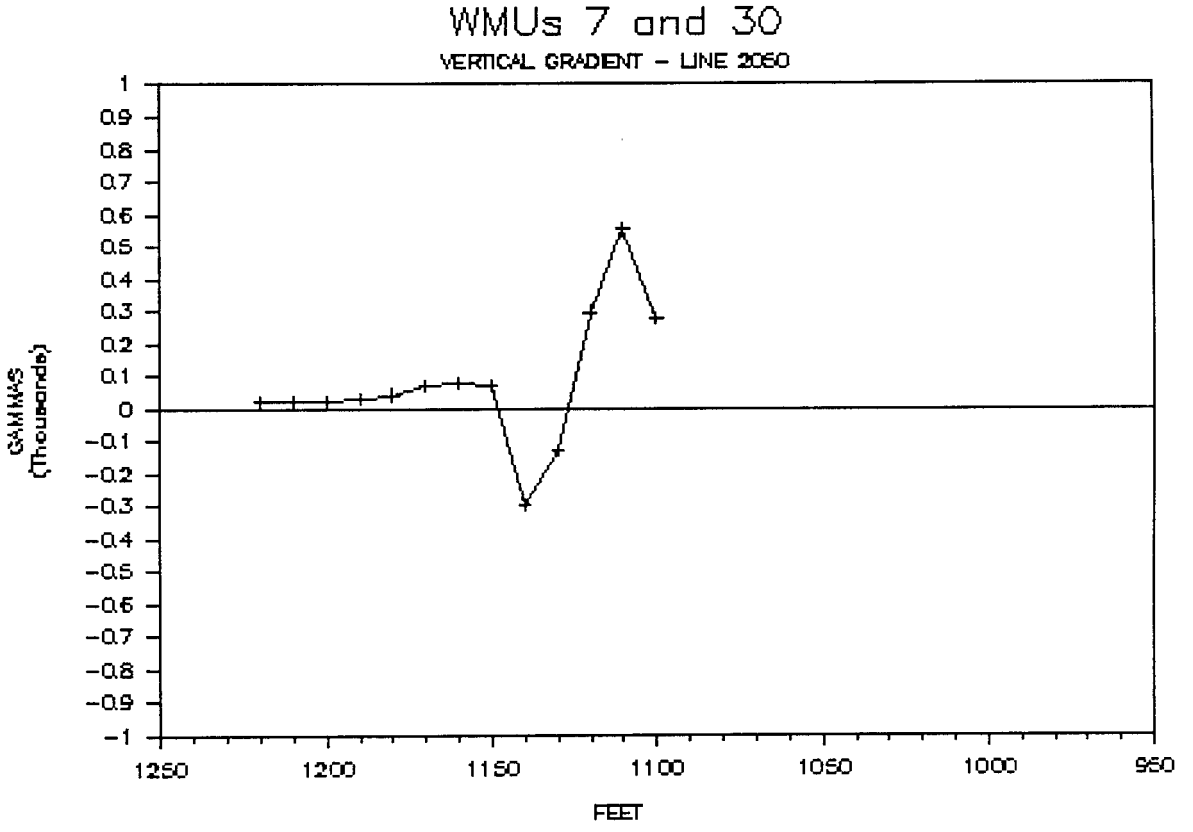

WMUs 7 and 30
LINE 2010
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

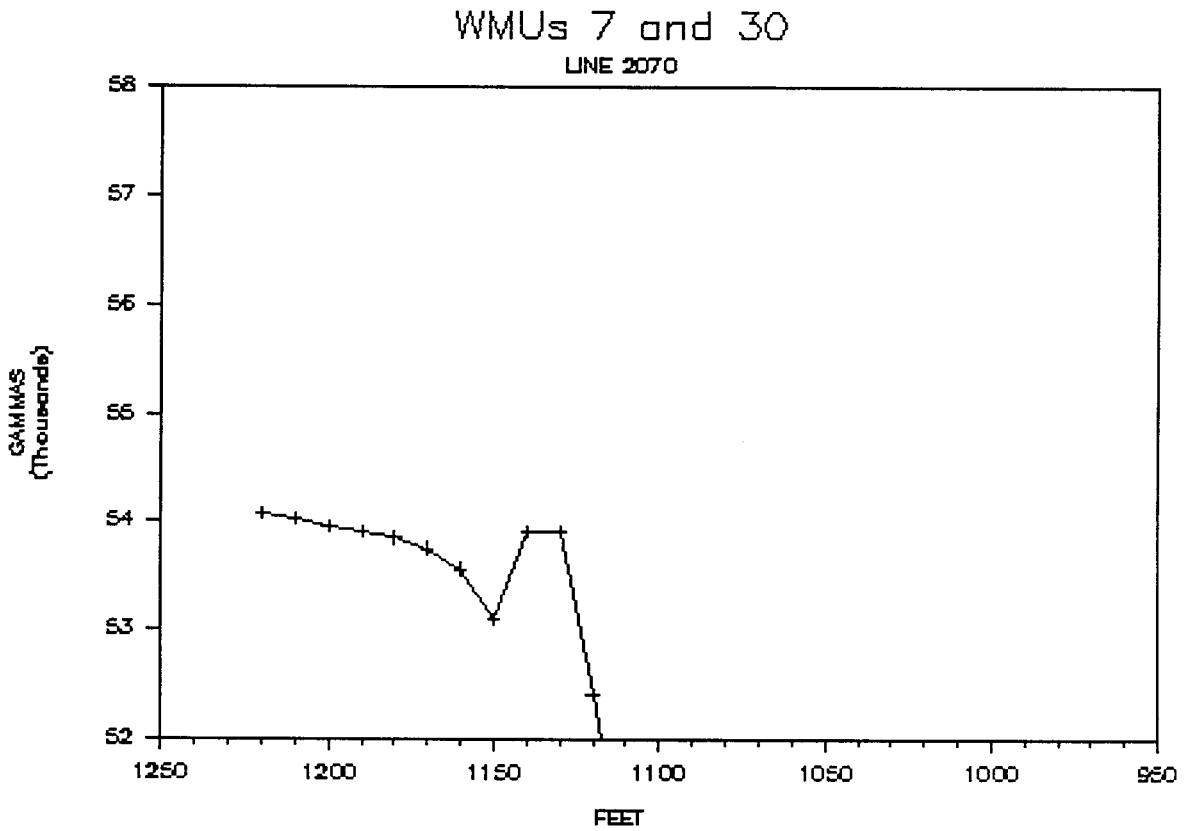

WMUs 7 and 30
VERTICAL GRADIENT - LINE 2010
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

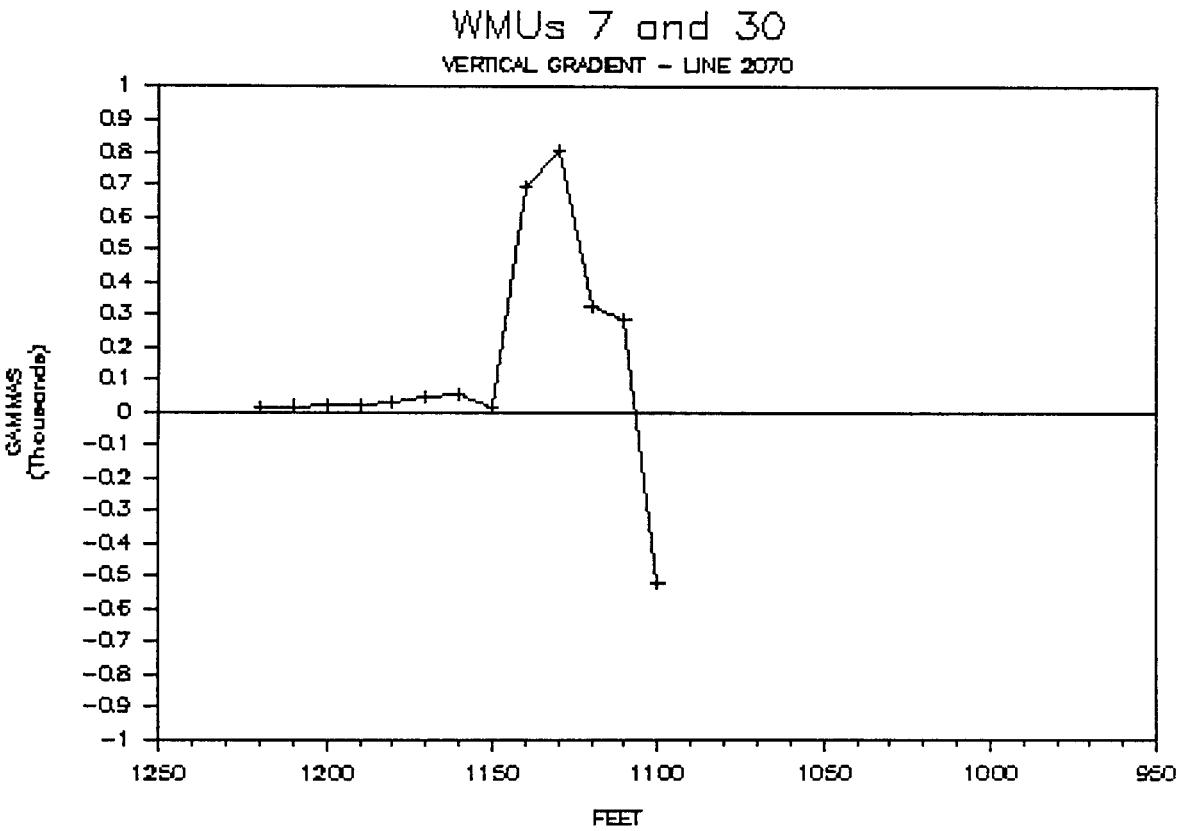

WMUs 7 and 30
LINE 2030
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

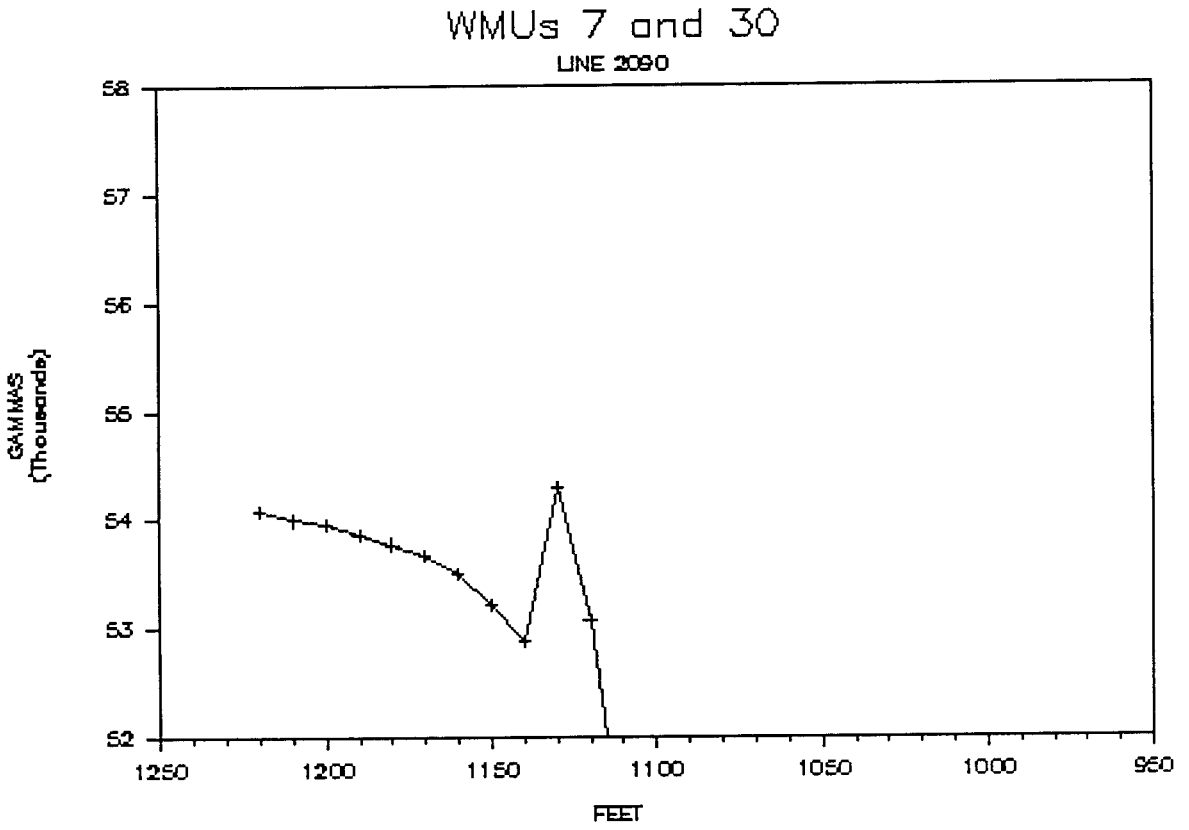

WMUs 7 and 30
VERTICAL GRADIENT - LINE 2030
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

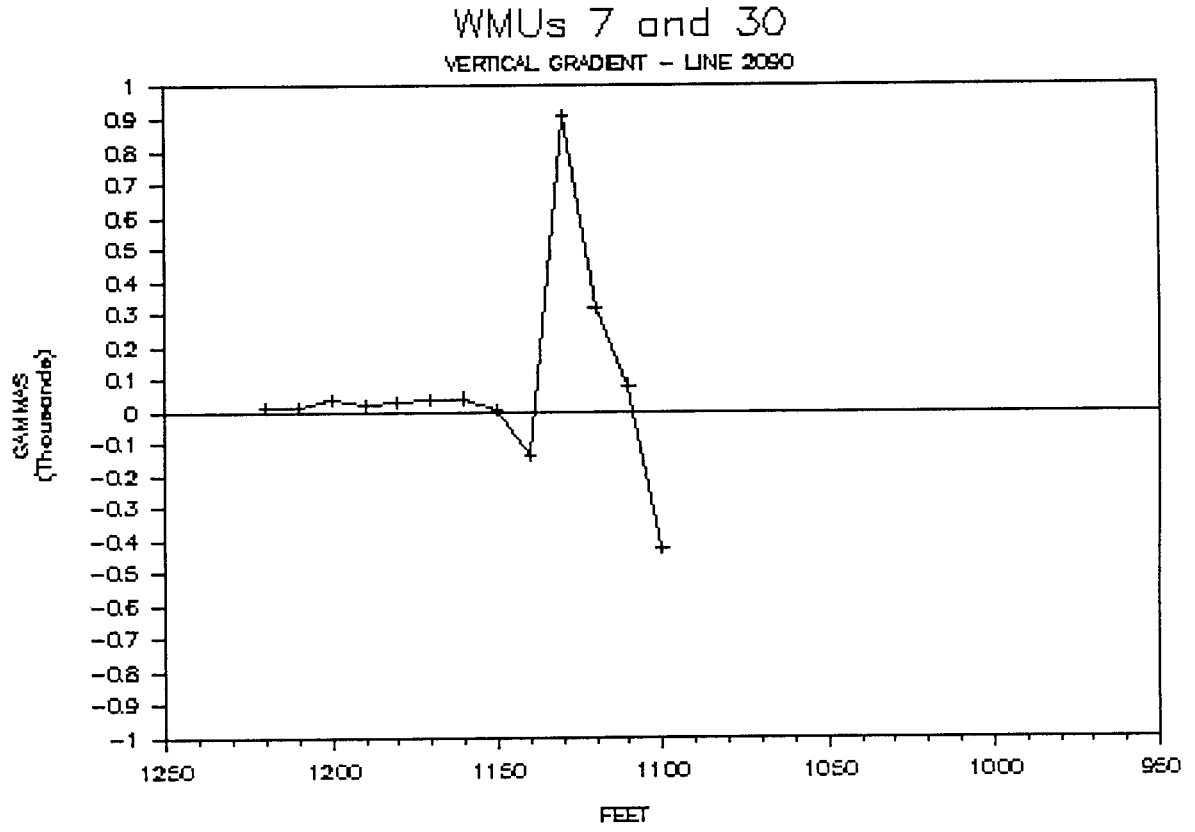

WMUs 7 and 30
LINE 2060
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

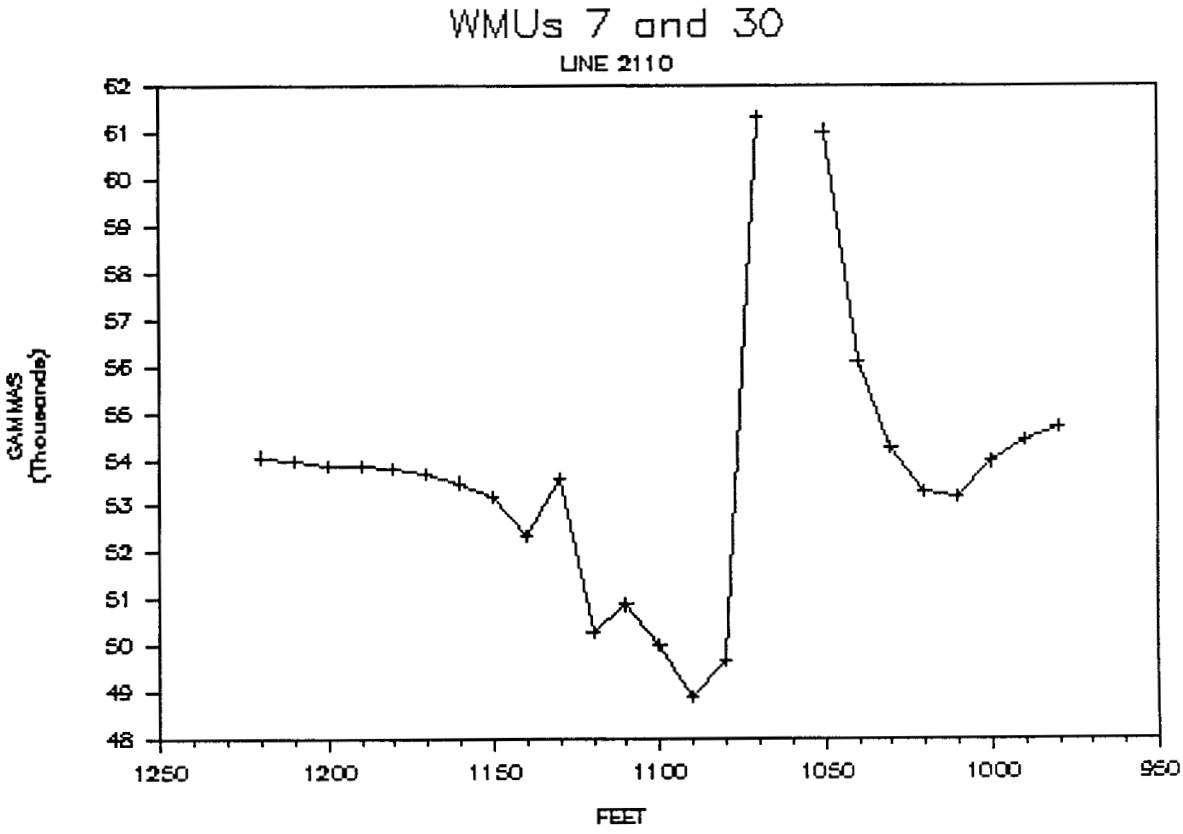

WMUs 7 and 30
VERTICAL GRADIENT - LINE 2060
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

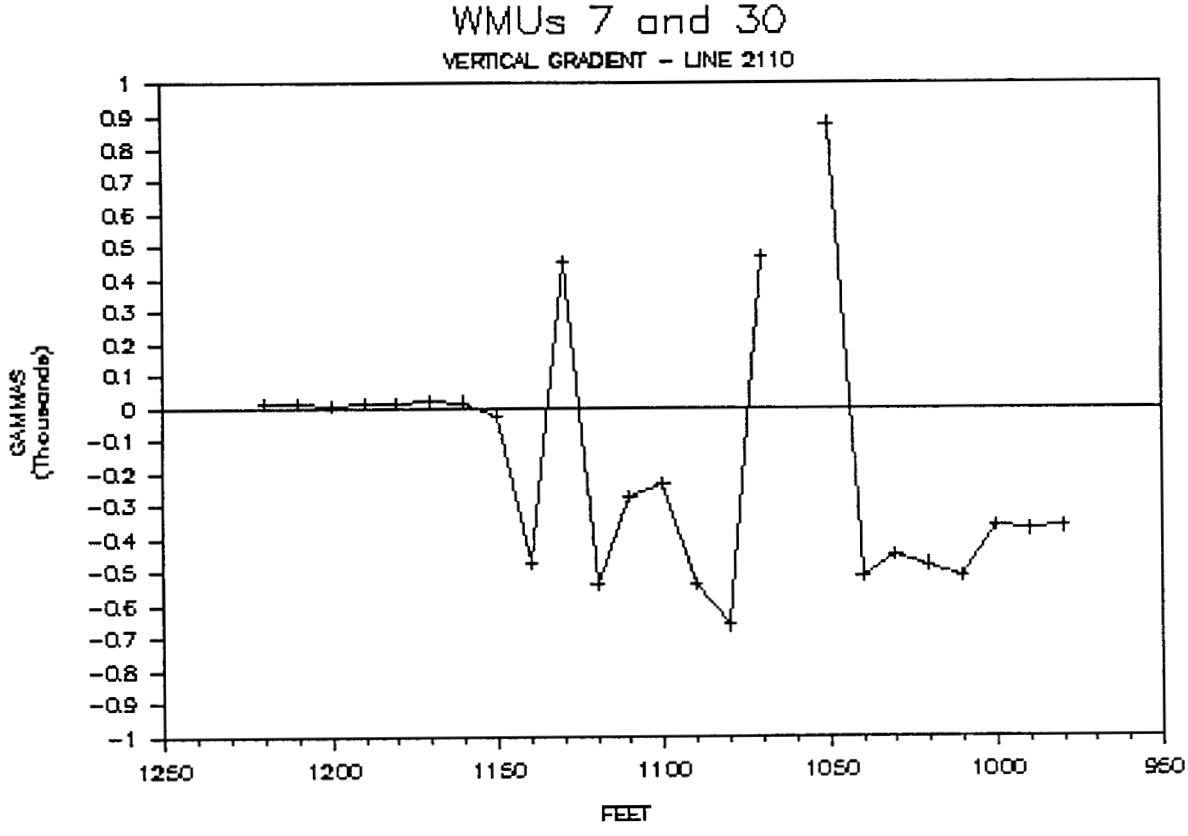

WMUs 7 and 30
LINE 2070
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

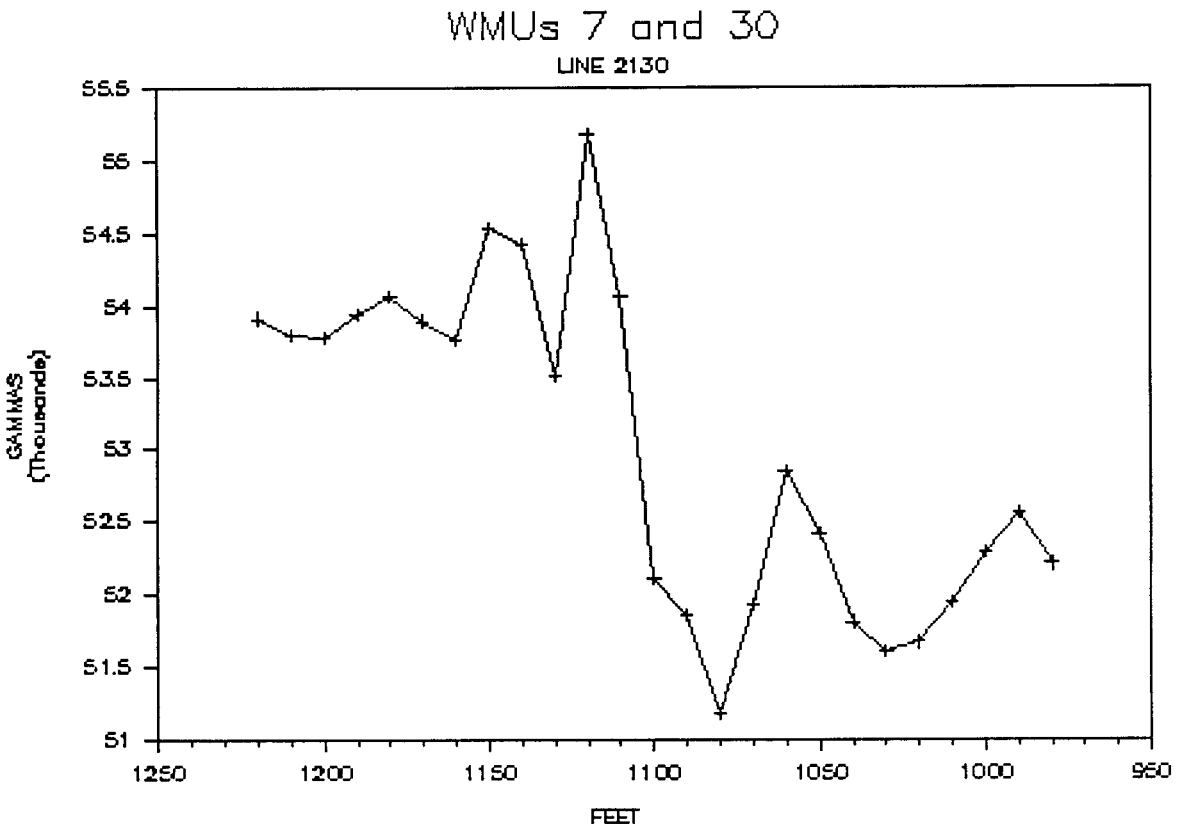

WMUs 7 and 30
VERTICAL GRADIENT - LINE 2070
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

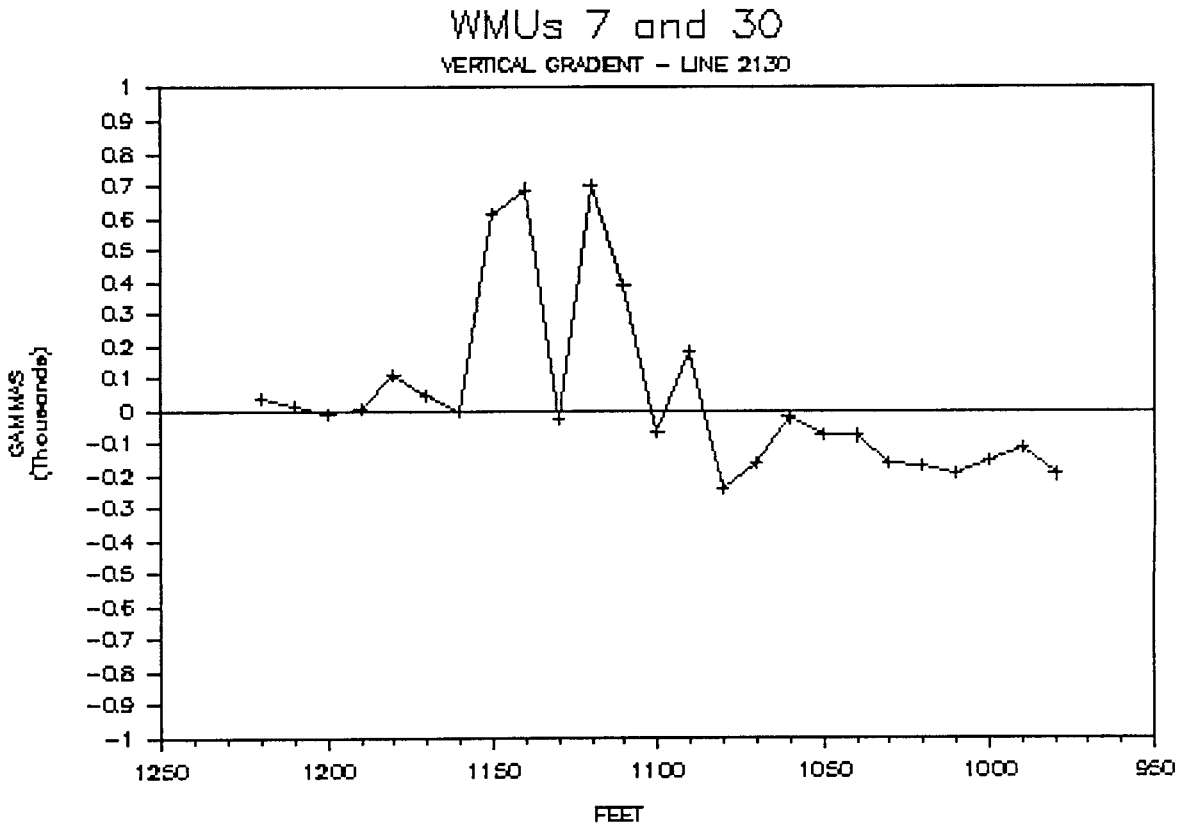

WMUs 7 and 30
LINE 2090
GAMMAS (Thousands)
58
57
56
55
54
53
52
1250
1200
1150
1100
1050
1000
950
FEET

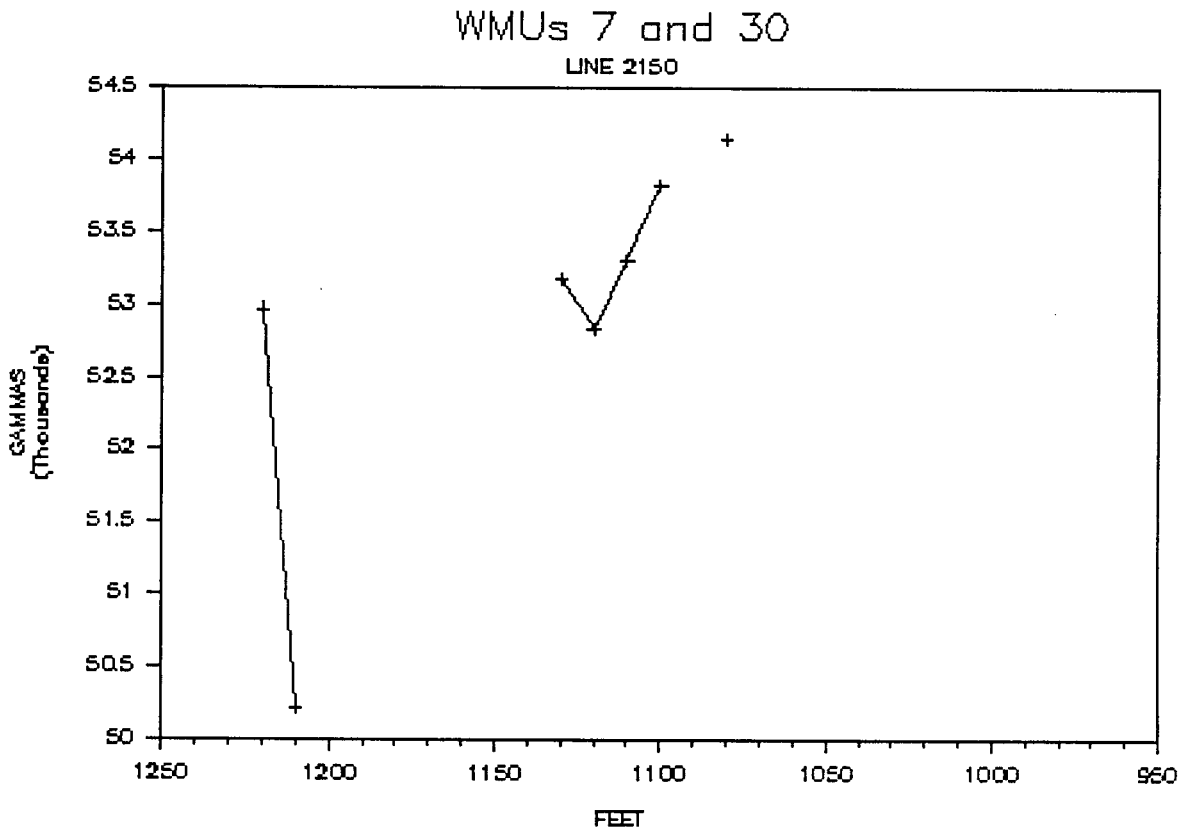

WMUs 7 and 30
VERTICAL GRADIENT – LINE 2090
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

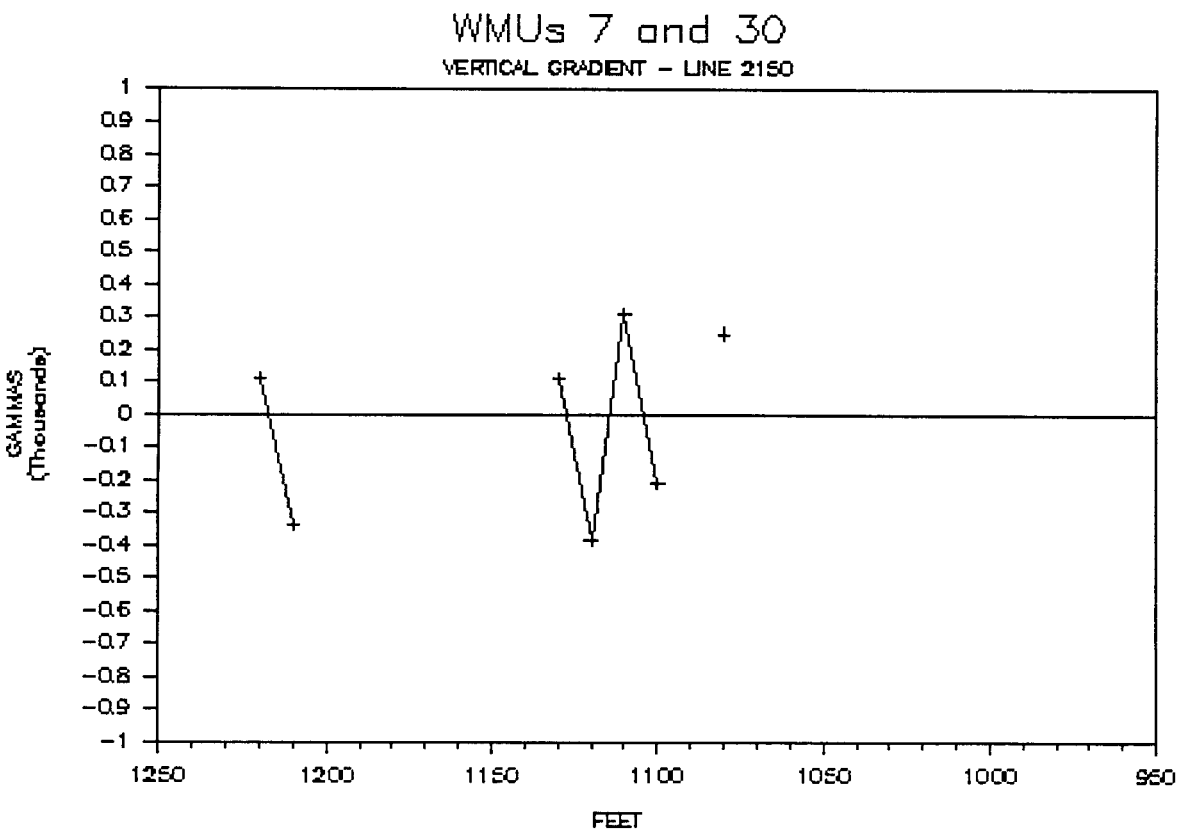

WMUs 7 and 30
LINE 2110
GAMMAS (Thousands)
62
61
60
59
58
57
56
55
54
53
52
51
50
49
48
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
VERTICAL GRADIENT - LINE 2110
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET


WMUs 7 and 30
LINE 2130
GAMMAS (Thousands)
55.5
55
54.5
54
53.5
53
52.5
52
51.5
51
1250
1200
1150
1100
1050
1000
950
FEET

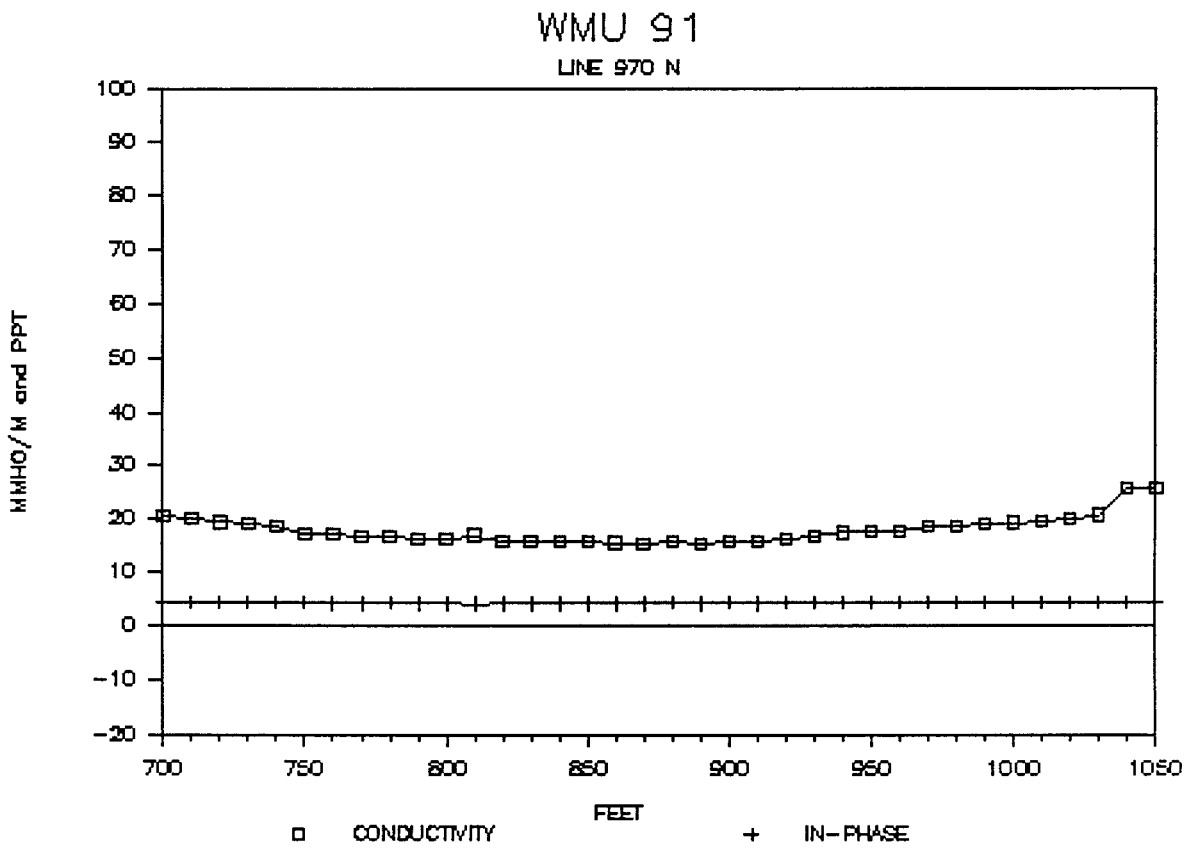

WMUs 7 and 30
VERTICAL GRADIENT - LINE 2130
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

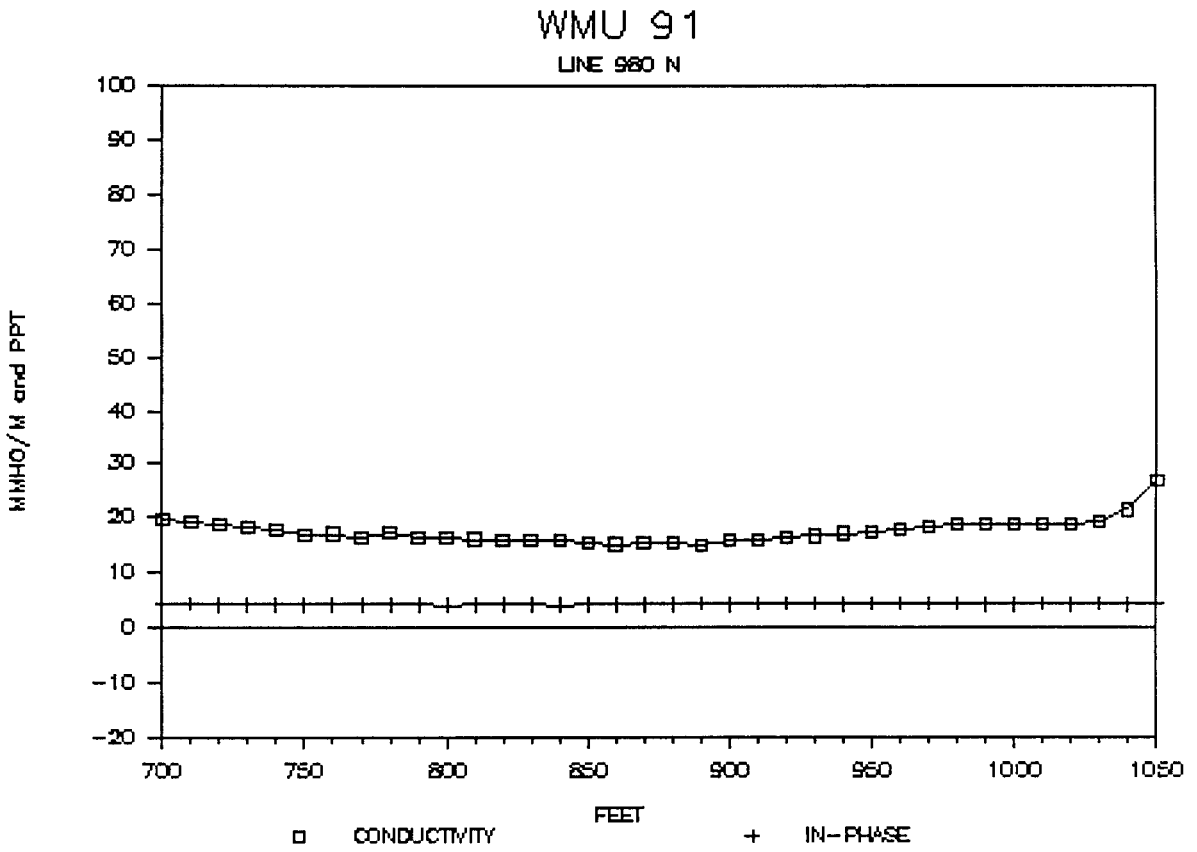

WMUs 7 and 30
LINE 2150
GAMMAS (Thousands)
54.5
54
53.5
53
52.5
52
51.5
51
50.5
50
1250
1200
1150
1100
1050
1000
950
FEET

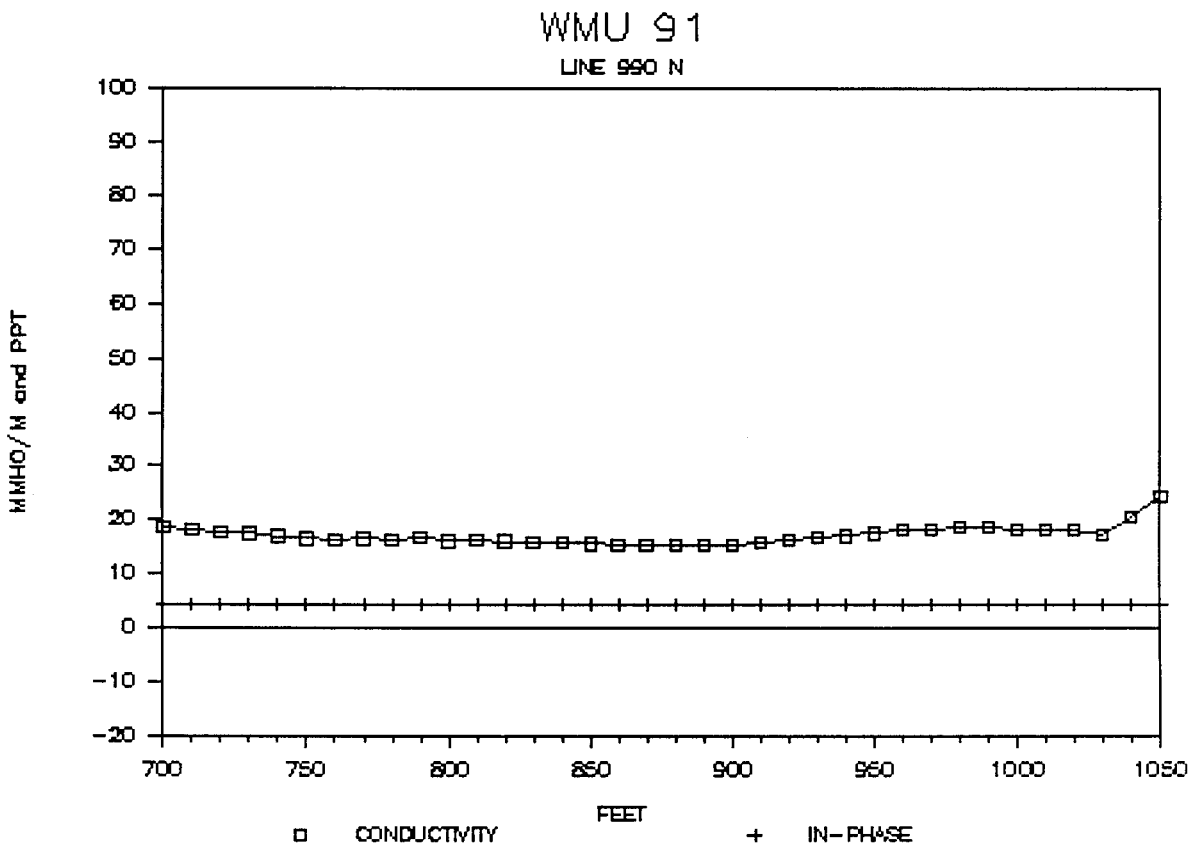

WMUs 7 and 30
VERTICAL GRADIENT - LINE 2150
GAMMAS (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1250
1200
1150
1100
1050
1000
950
FEET

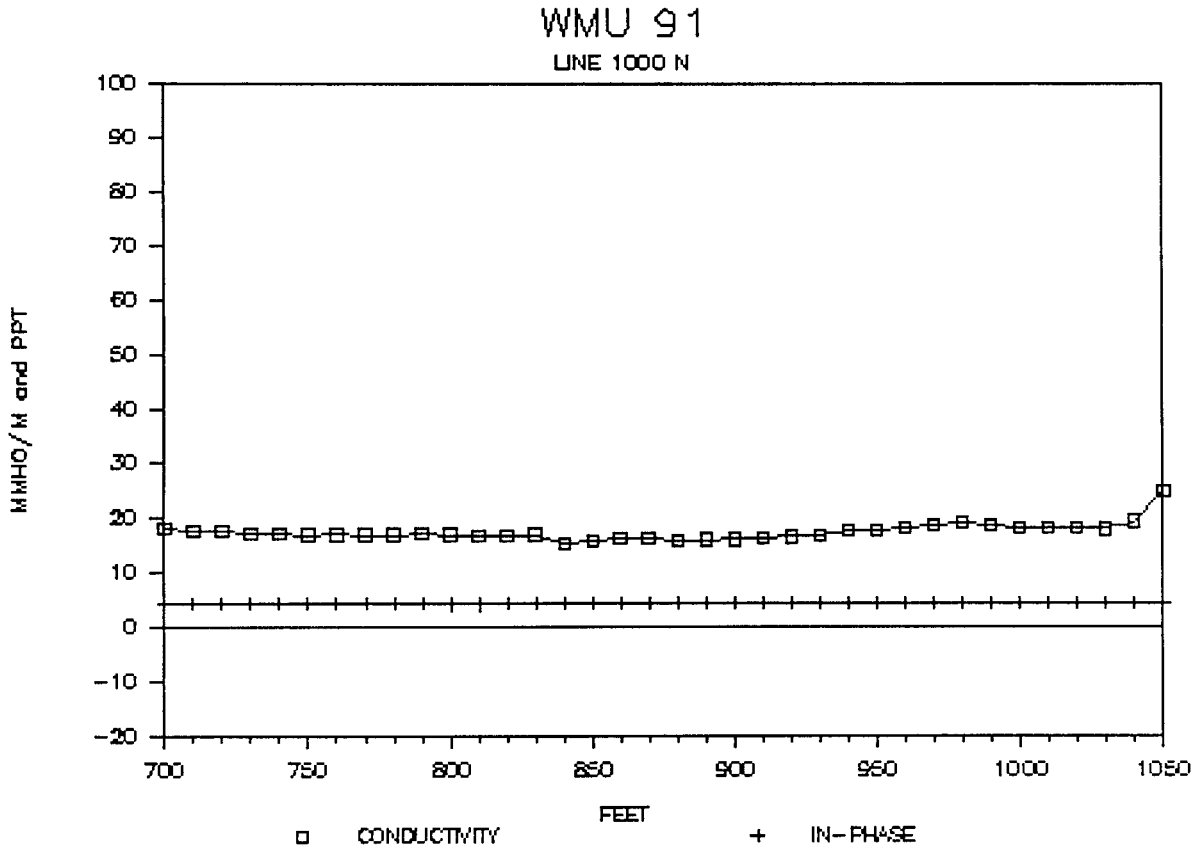
Attachment D

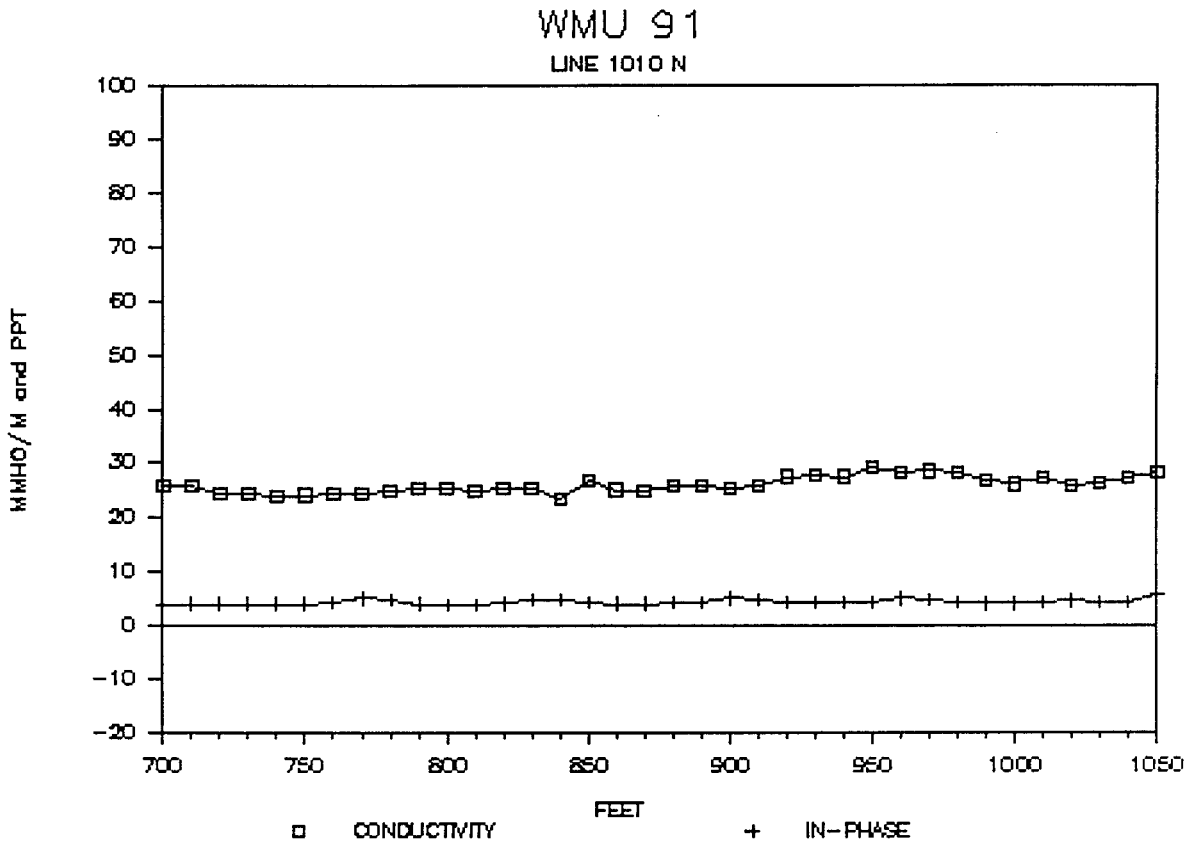
WMU 91 - DROP TEST AREA GEOPHYSICAL DATA

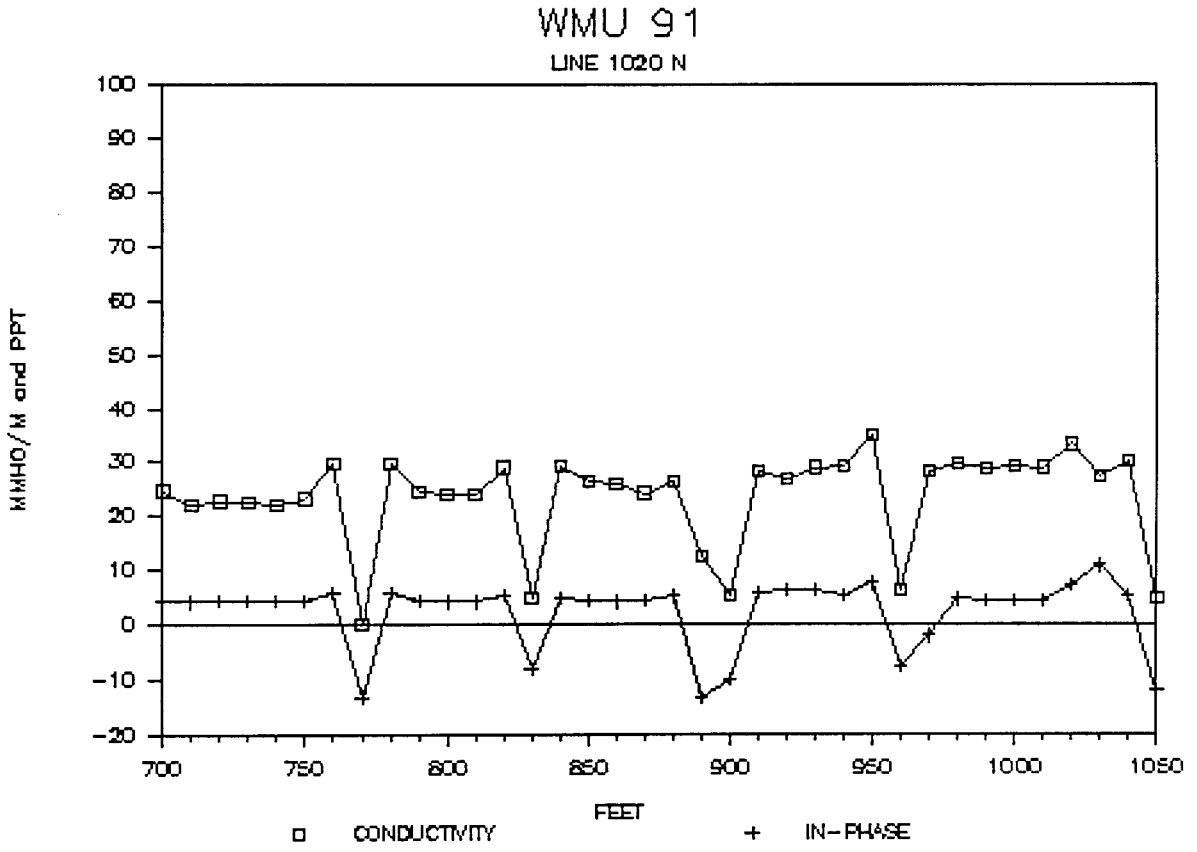

WMU 91
LINE 970 N
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
-20
700
750
800
850
900
950
1000
1050
FEET
CONDUCTIVITY
IN-PHASE

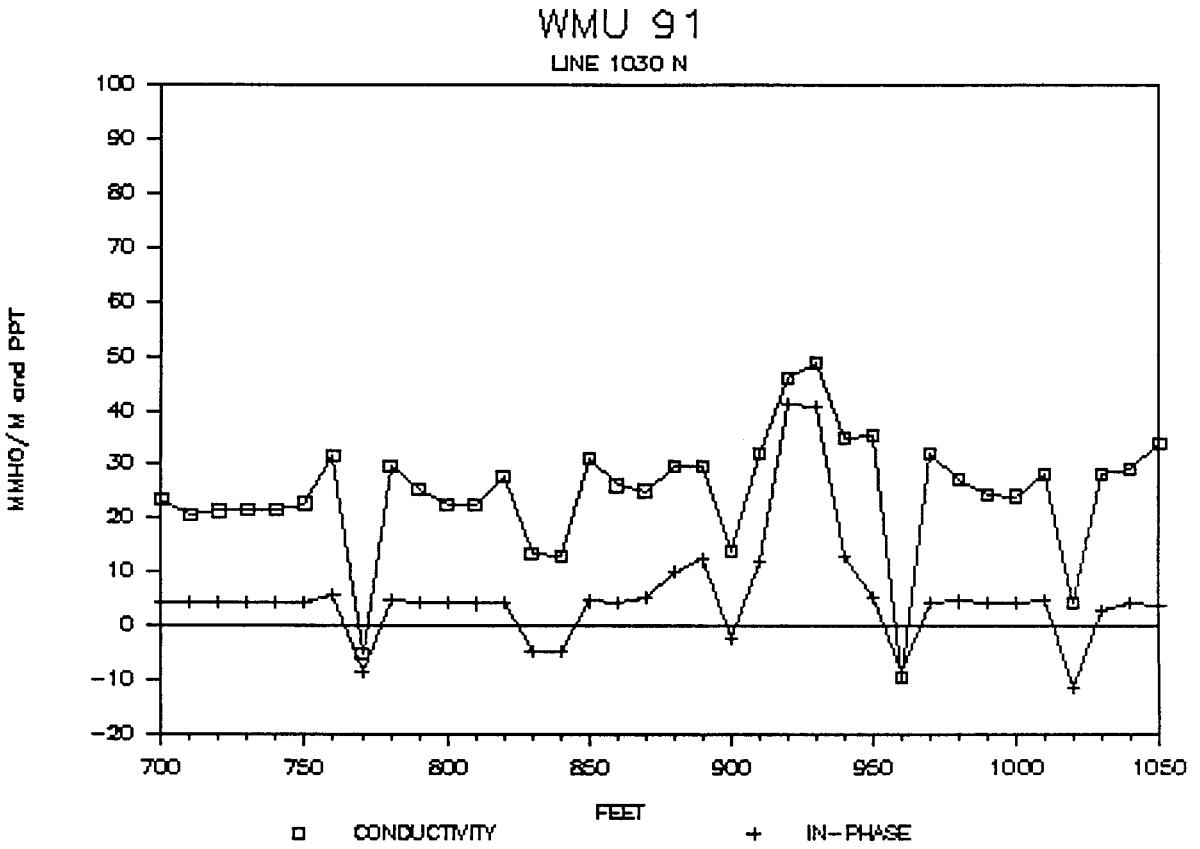

WMU 91
LINE 980 N
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
-20
700
750
800
850
900
950
1000
1050
FEET
CONDUCTIVITY
IN-PHASE

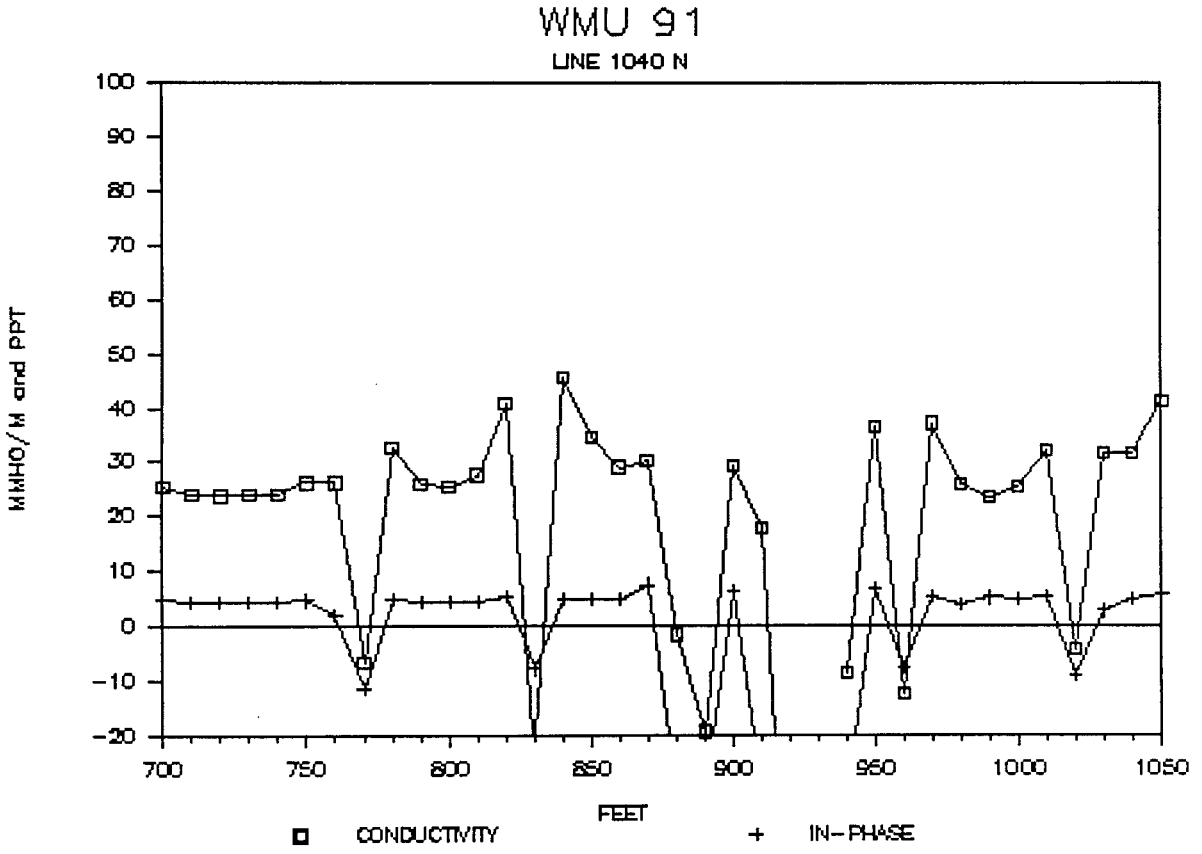

WMU 91
LINE 990 N
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
-20
700
750
800
850
900
950
1000
1050
FEET
CONDUCTIVITY
IN-PHASE

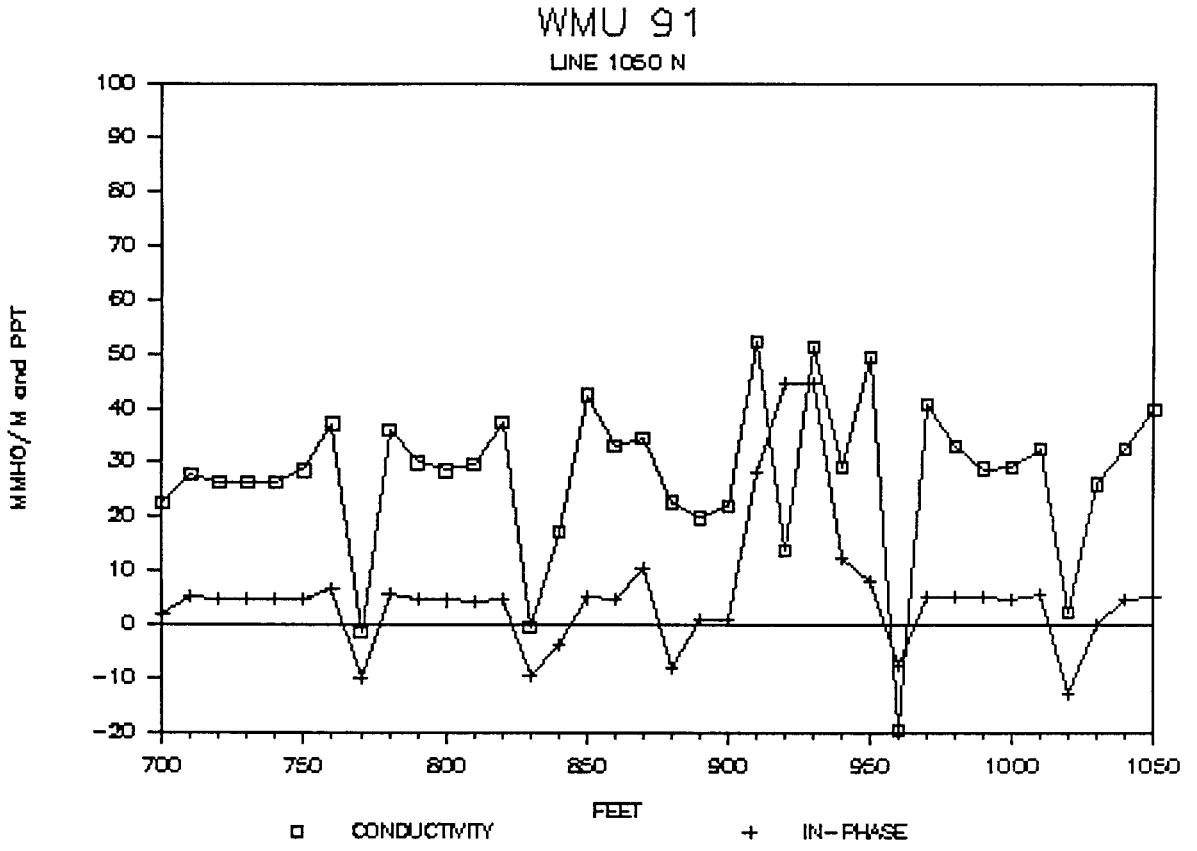

WMU 91
LINE 1000 N
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
-20
700
750
800
850
900
950
1000
1050
FEET
CONDUCTIVITY
IN-PHASE

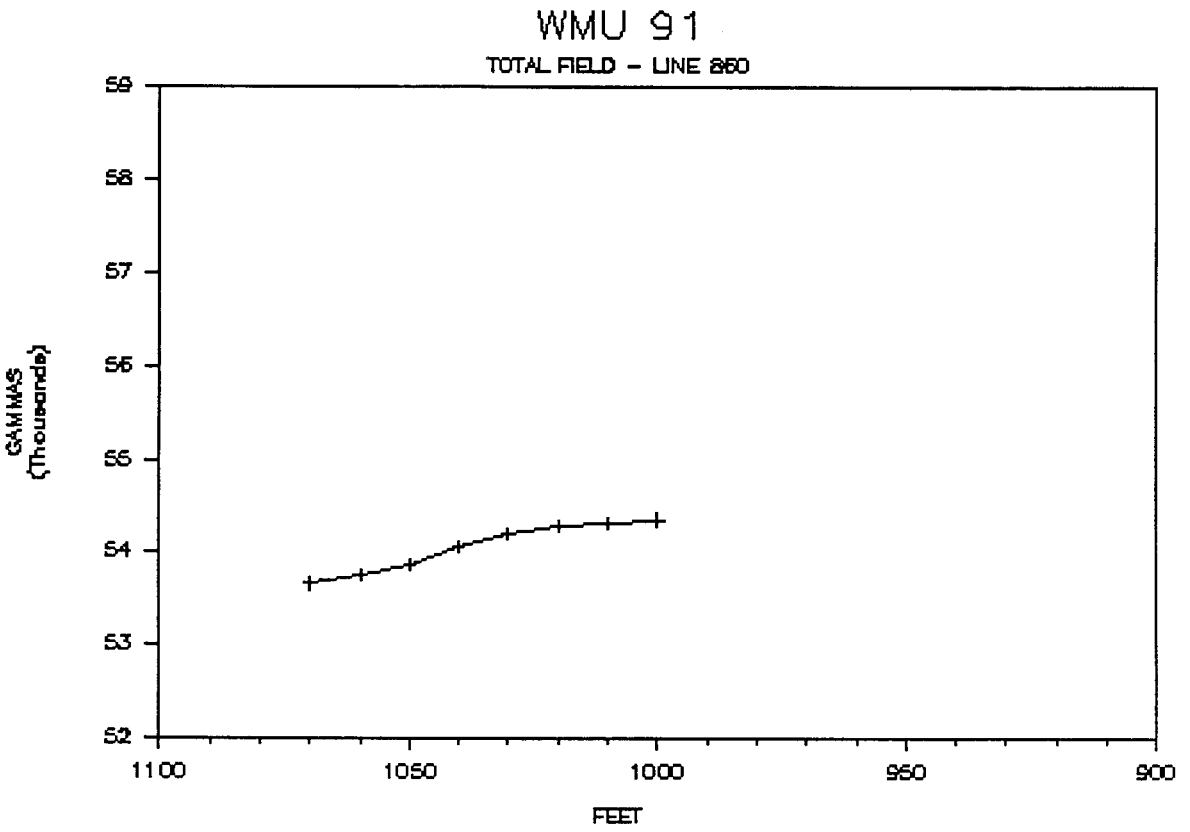

WMU 91
LINE 1010 N
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
-20
700
750
800
850
900
950
1000
1050
FEET
CONDUCTIVITY
IN-PHASE

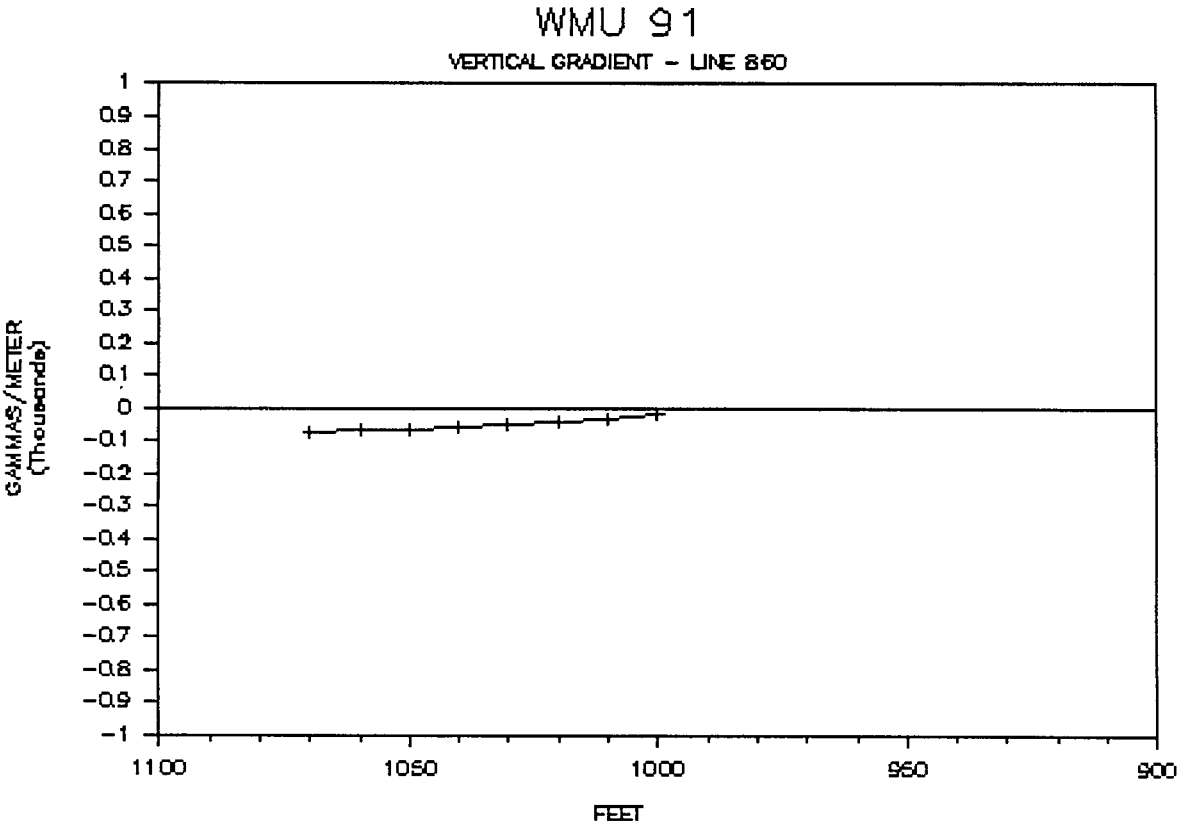

WMU 91
LINE 1020 N
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
-20
700
750
800
850
900
950
1000
1050
FEET
CONDUCTIVITY
IN-PHASE

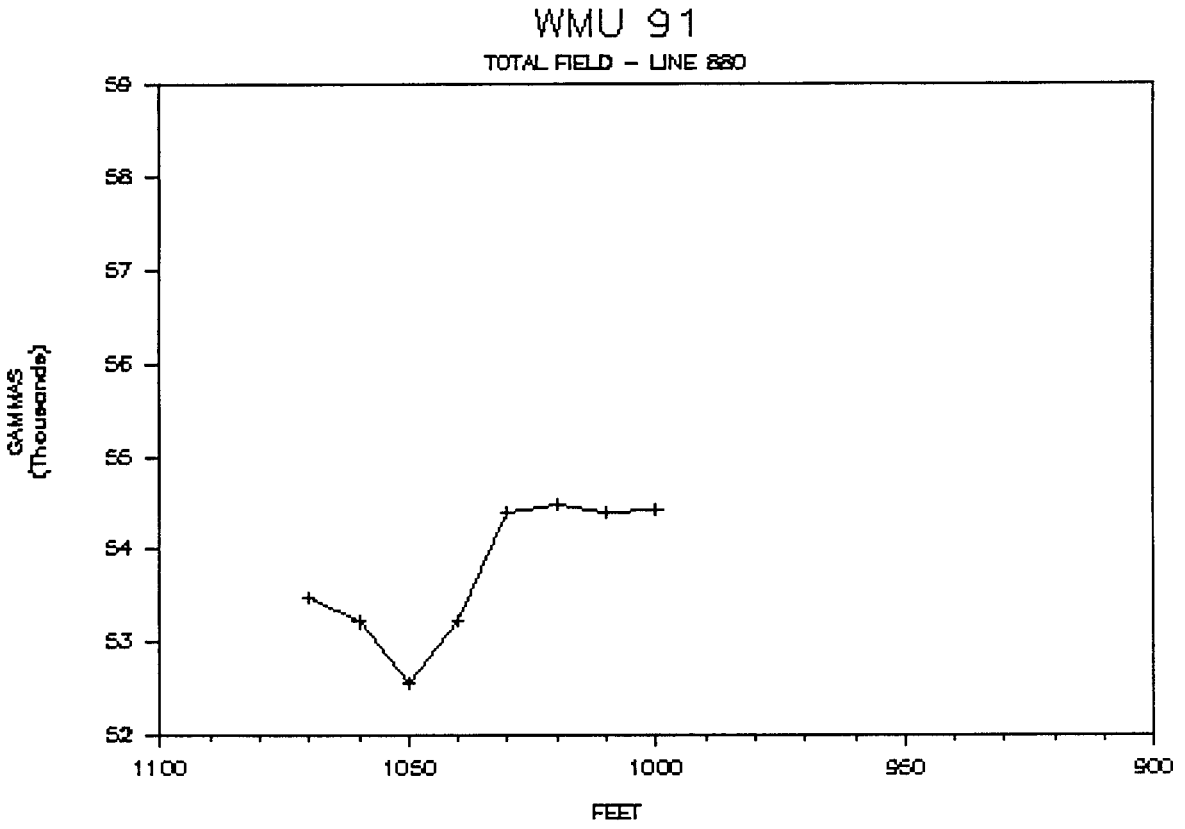

WMU 91
LINE 1030 N
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
-20
700
750
800
850
900
950
1000
1050
FEET
CONDUCTIVITY
IN-PHASE

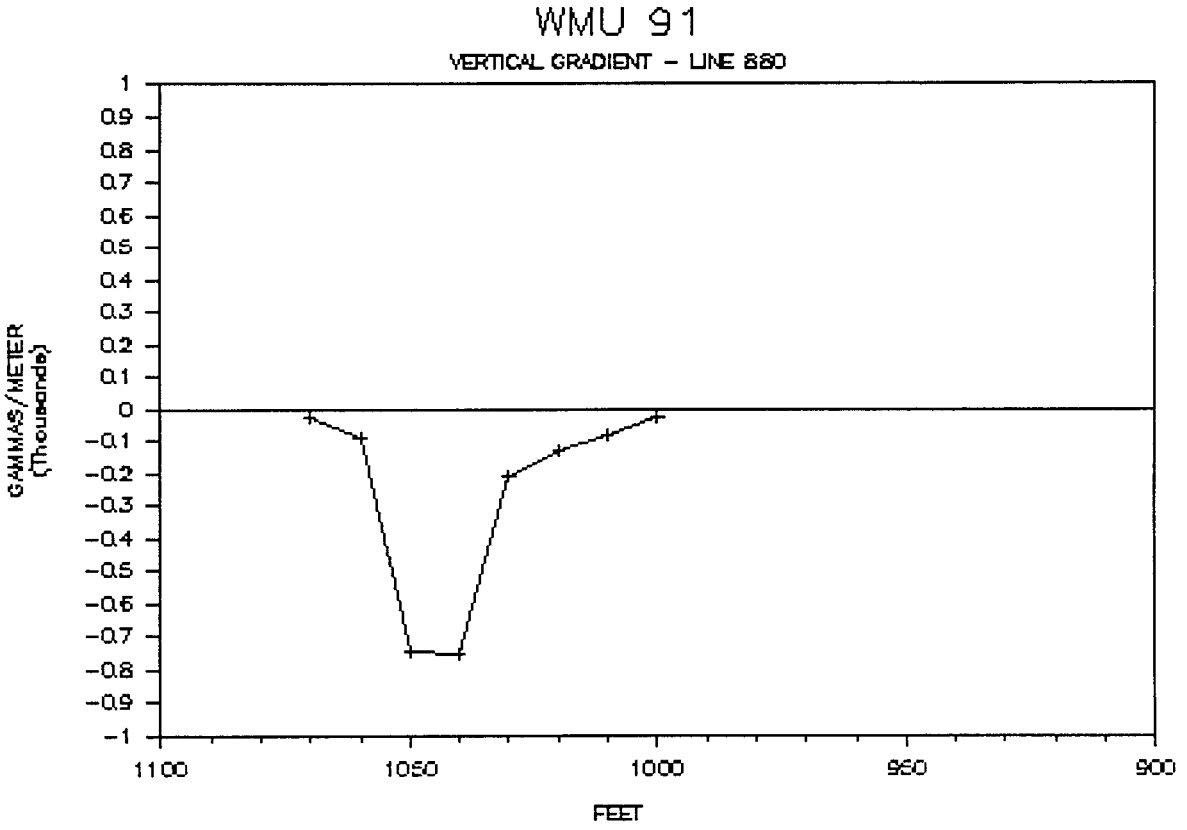

WMU 91
LINE 1040 N
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
-20
700
750
800
850
900
950
1000
1050
FEET
CONDUCTIVITY
IN-PHASE

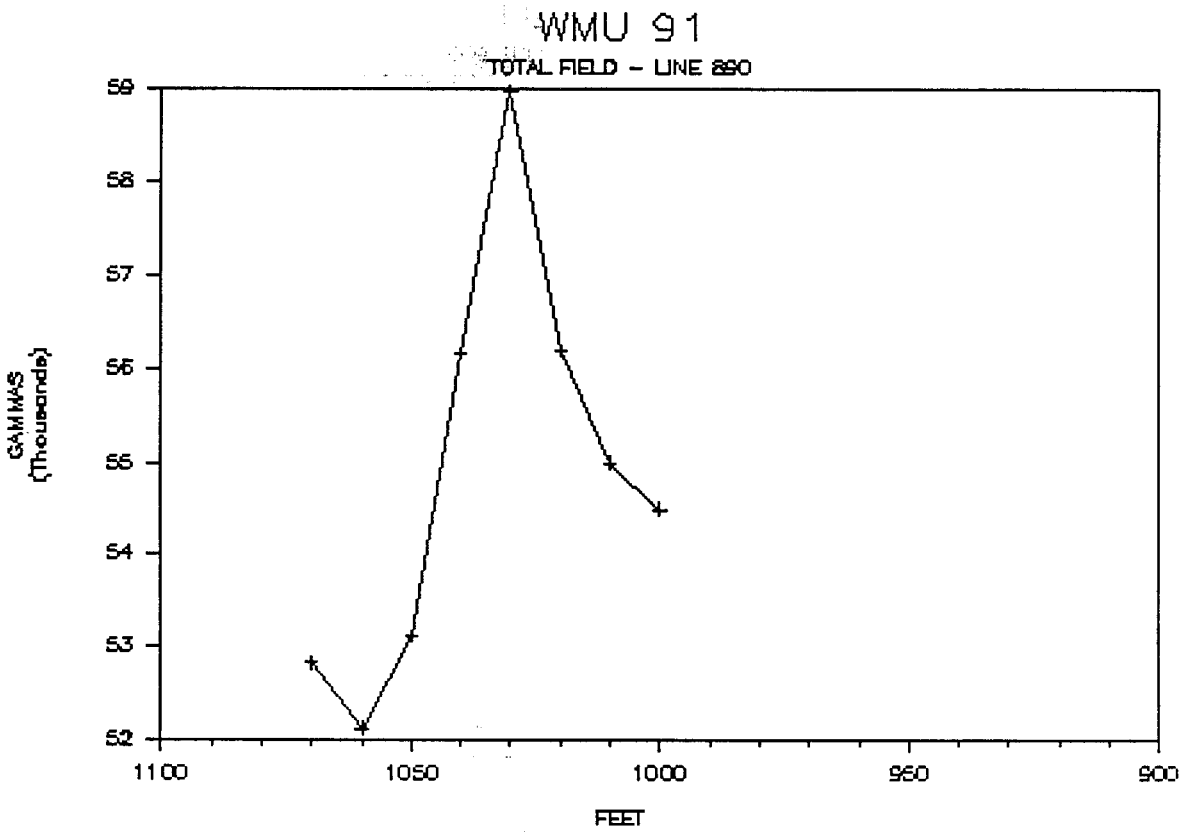

WMU 91
LINE 1050 N
MMHO/M and PPT
100
90
80
70
60
50
40
30
20
10
0
-10
-20
700
750
800
850
900
950
1000
1050
FEET
CONDUCTIVITY
IN-PHASE

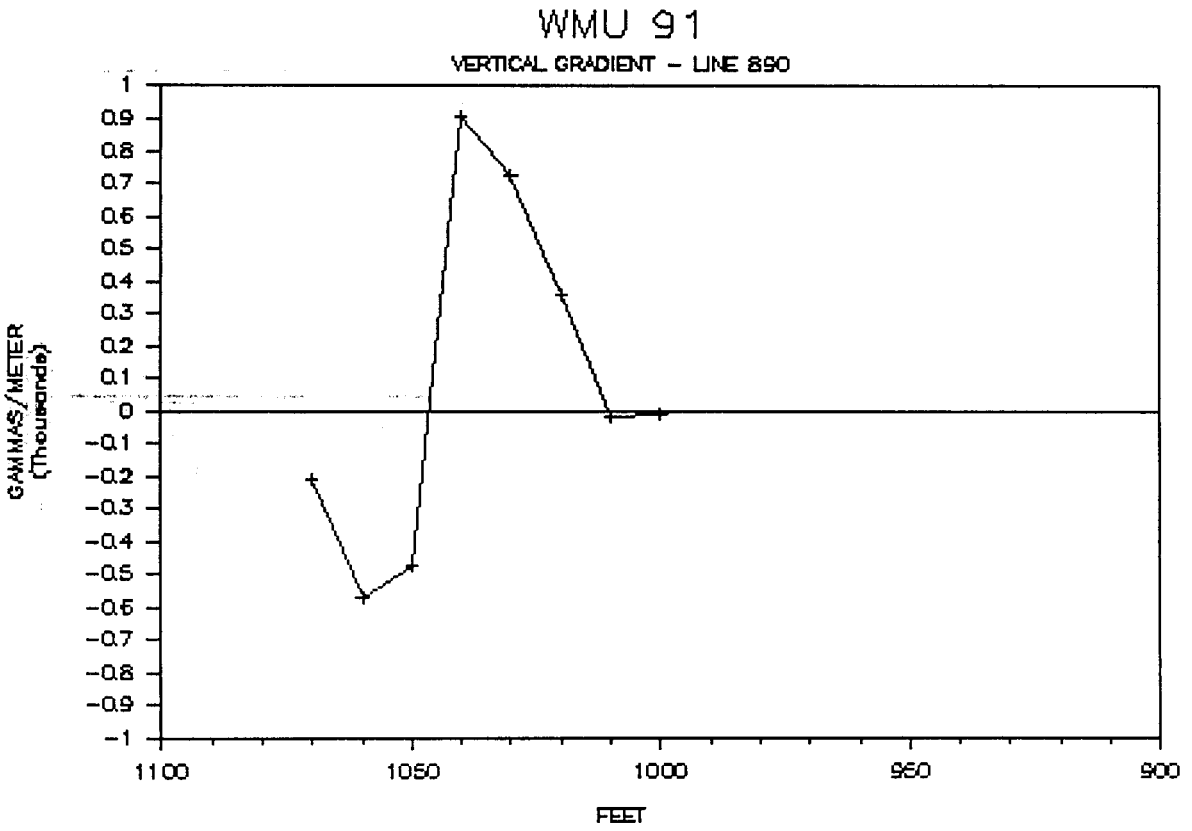

WMU 91
TOTAL FIELD - LINE 860
GAMMAS (Thousands)
59
58
57
56
55
54
53
52
1100
1050
1000
950
900
FEET

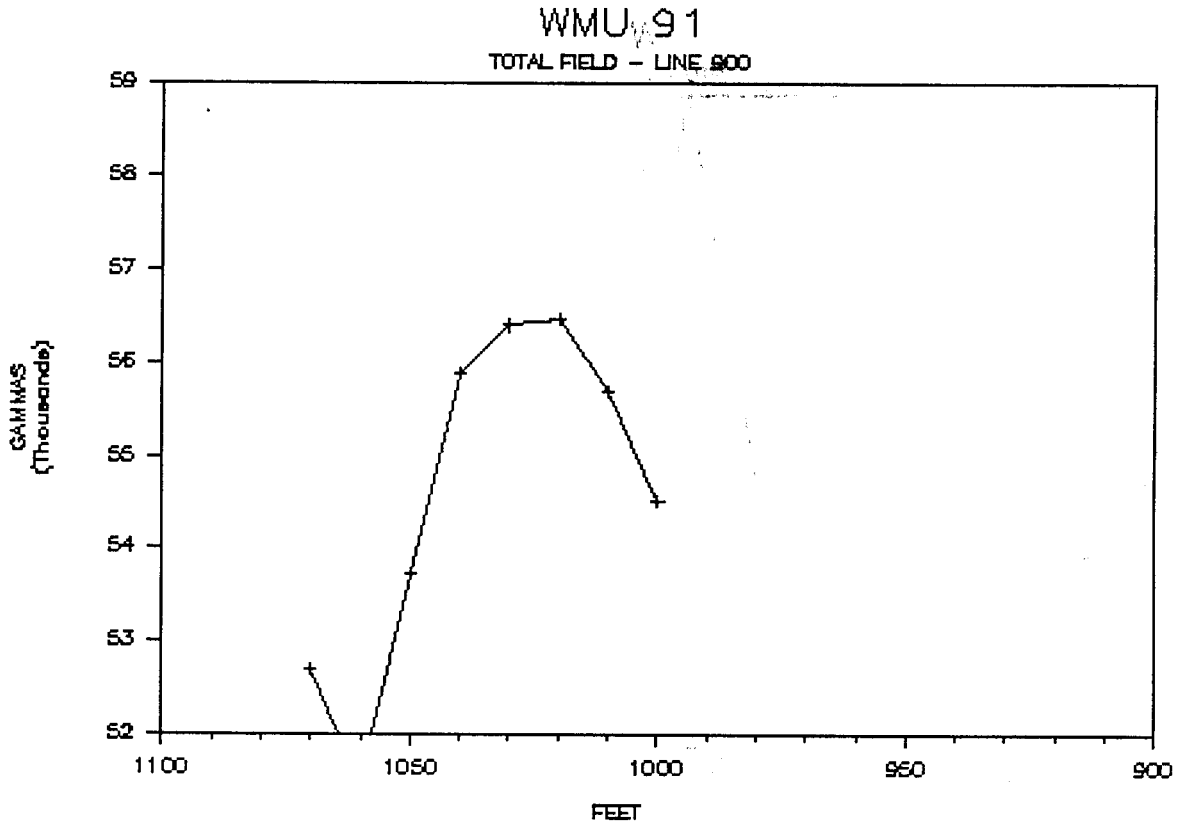

WMU 91
VERTICAL GRADIENT - LINE 860
GAMMAS/METER (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1100
1050
1000
950
900
FEET

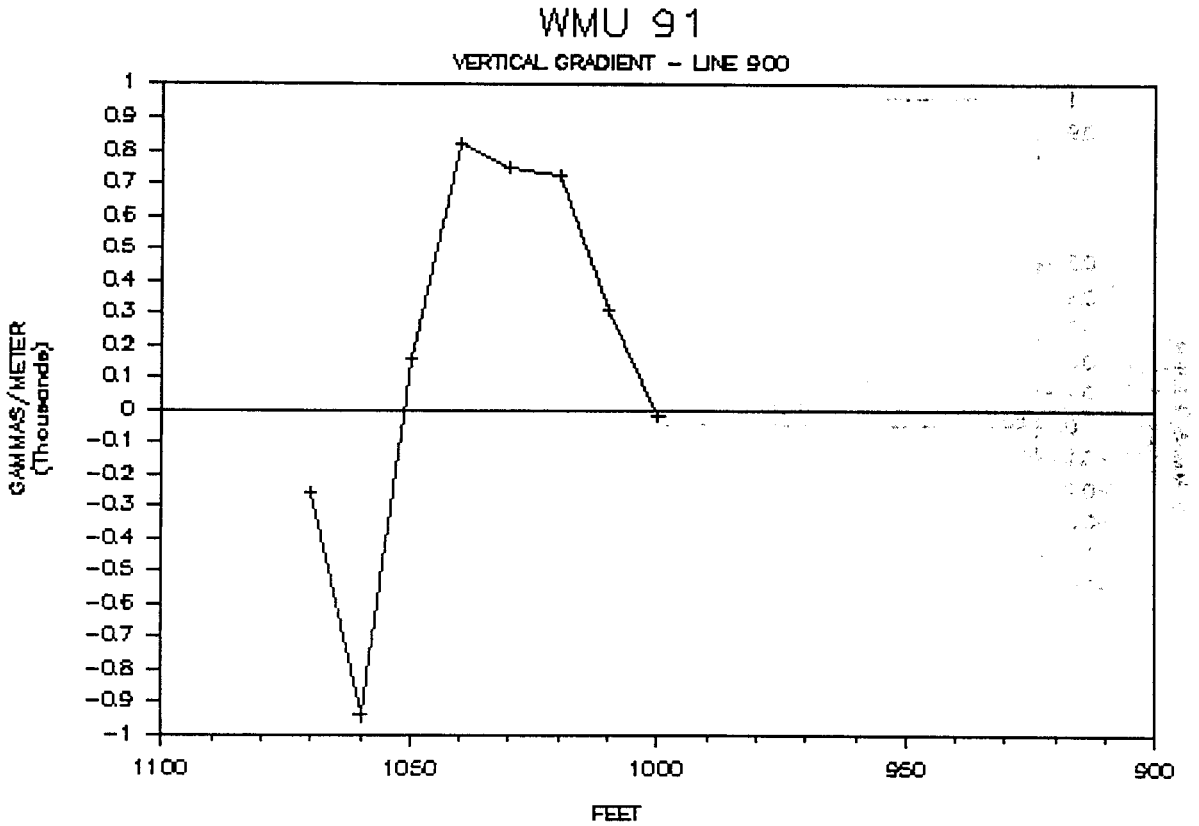

WMU 91
TOTAL FIELD - LINE 880
GAMMAS (Thousands)
59
58
57
56
55
54
53
52
1100
1050
1000
950
900
FEET

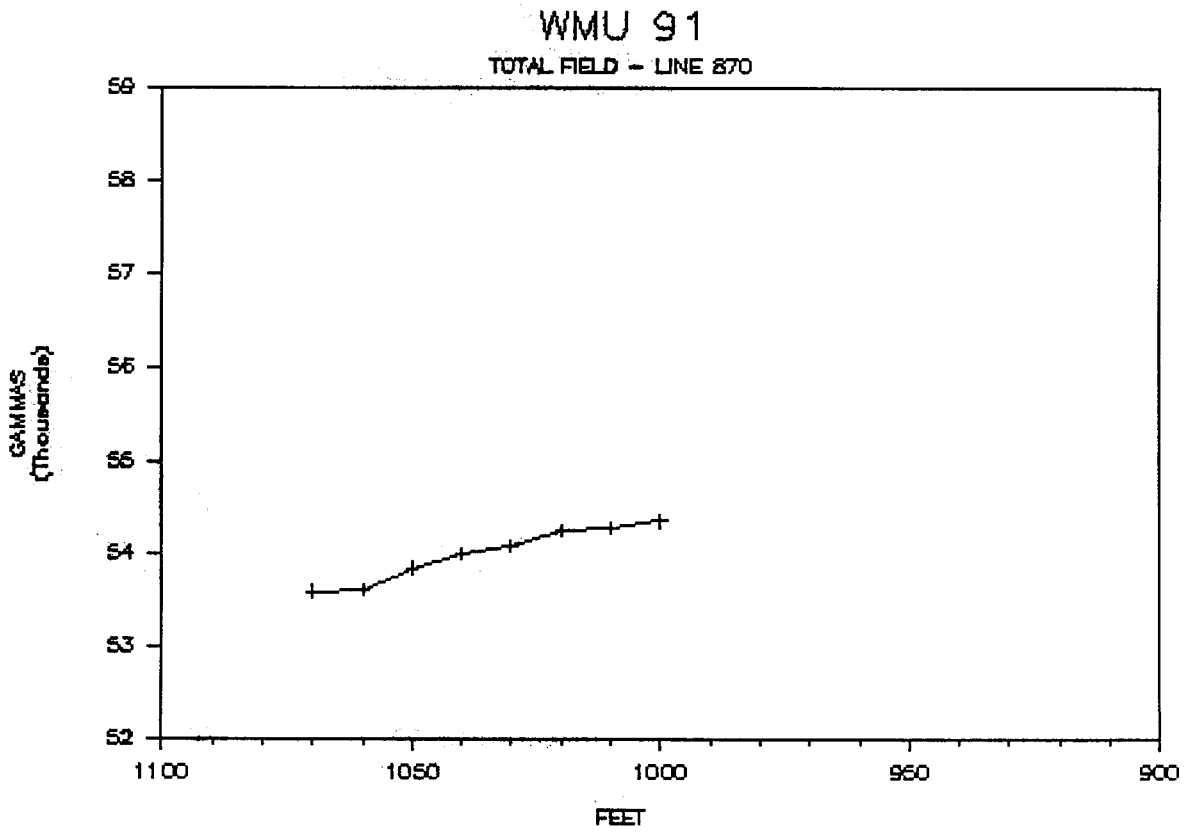

WMU 91
VERTICAL GRADIENT - LINE 880
GAMMAS/METER (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1100
1050
1000
950
900
FEET

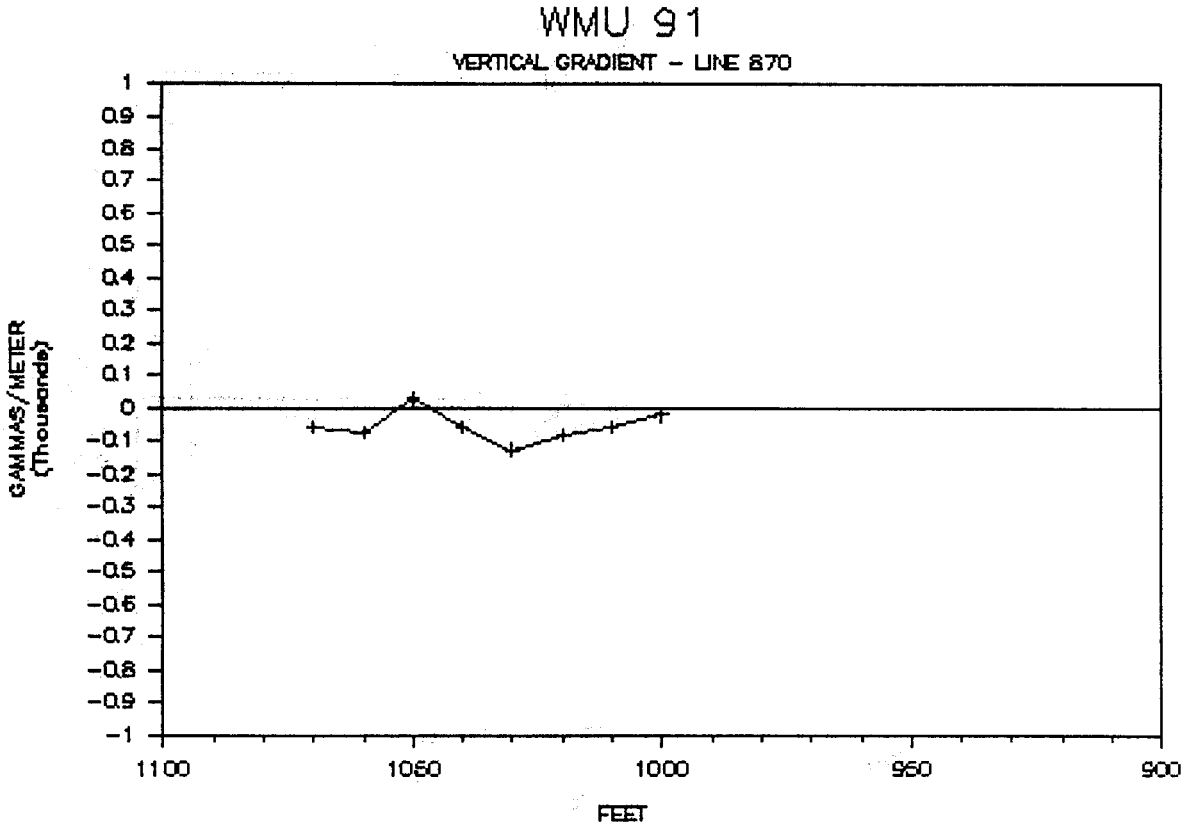

WMU 91
TOTAL FIELD - LINE 890
GAMMAS (Thousands)
59
58
57
56
55
54
53
52
1100
1050
1000
950
900
FEET


WMU 91
VERTICAL GRADIENT - LINE 890
GAMMAS/METER (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1100
1050
1000
950
900
FEET


WMU 91
TOTAL FIELD - LINE 900
GAMMAS (Thousands)
59
58
57
56
55
54
53
52
1100
1050
1000
950
900
FEET


WMU 91
VERTICAL GRADIENT - LINE 900
GAMMAS/METER (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1100
1050
1000
950
900
FEET


WMU 91
TOTAL FIELD - LINE 870
GAMMAS (Thousands)
59
58
57
56
55
54
53
52
1100
1050
1000
950
900
FEET


WMU 91
VERTICAL GRADIENT - LINE 870
GAMMAS/METER (Thousands)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
-0.8
-0.9
-1
1100
1050
1000
950
900
FEET