

Subject: Meeting on Stress Analyses for Underground Piping  
In Attendance: Bethesda, P-111 + 9:00 a.m. Jan. 20, 1981

	<u>ETEC</u>	<u>Bechtel</u>	<u>CPCo</u>	<u>NRC</u>	<u>William Lincoln Becke</u>
5:00	J. Brummer	A. Bees	Dennis Buback	H. Brummer	Mike Miller, Attorney
6:00	W. Chen	A. Pudel J. LeGoffe	G. Keeley G. Vover H. Slager	T. Cappucci D. Hood D. Gupta J. Kane	

A. Bees

GED recorded data. Bechtel developed profiles  
 techniques used - Probe Aqueducter - (similar to manometer)  
 Pipes > 20"  $\phi$  - surveying small man of device to keep on track  
 selected stations  
 Calibration accuracy - 1/4" Measurement accuracy may reach this 1/2" total  
 Limitation - To keep device @ invert elevation  
 Small pipes - TV camera  
 Some pipes (> 20") were surveyed from valve pit  
 "close proximity" - <sup>upper bound</sup> ten to 20 feet - may or may not be in same trench

T. Cappucci - Please provide drawing wh

- Variability of soil conditions & effect on selection of pipes to be surveyed  
 - Could be resolved by:
  1. ~~On plan view~~ On plan view which shows all pipes & conduits (Cut I  
 & non Cut I pipes) show

1/20/01

3+3

Plastic deformation would have been reached before reaching some of the computed stresses ( $> \sigma_{uc}$ )  
52.5 ksi

Elastic Stress 212.2 ksi

Young's Modulus  $27 \cdot 10^3$  ksi

will provide limits

Equivalent strain 0.073 in/in

Considering elastic-plastic state

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Topics where CPC has requested feedback from NRC staff

Curve smoothing - To be further evaluated by ETIC

3 Sc criteria

- Need for further profiling - Address variability of Hm conditions based on bearing information (either plan or profile presentation.)
- Use this presentation to decide on:
    1. Further need for profiling,
    2. Adequacy of proportioning
    3. max settlement (future)

## Discussion Topics - Pipe Stress Analysis

- NRC position on requiring additional profiling of buried pipes
- ~~Method of analysis - resolve differences~~
- ~~Dates of profiles where analysis was made~~
- \* Future monitoring - Necessity for shutting plant down
- Elevation <sup>monitoring</sup> intervals - Shorten up to 5' (max)  
Discuss add'l work
- Stresses @ bends
- Pipe connections @ building - analysis & modeling  
should allow for continuity between connections & areas of  
plant fill
- \* Pipes running thru fill to structure founded on till  
How many of this type
- Tech Spec - Need to establish the settlement limits  
(total & differential) for each component?
- \* - Extend profiles to areas <sup>at plant fill</sup> where no surcharge  
was placed

Tabulation of actual survey data (To avoid future scaling) <sup>Requested of G. Kurky</sup>

Explain rebound effect at 10" - CHBC - 27? (Request of Al Buss)

- \* Ask for plan w/ stationing that agrees with profile stationing

## DISCUSSION TOPICS

NRC-ETEC-BECHTEL  
MEETING JANUARY 20, 1981  
BETHESDA, MARYLAND

### A. Status Update

1. 50.54f Questions and Responses
2. Survey Data
  - a. 8-1HBC-81 Re-bedded Condition
  - b. Purpose of Re-bedding
3. Calculations
  - a. Results
  - b. Affect on Previous Information

### B. Method of Calculations

1. ETEC Telecon Questions of 1/14/81
  - a. Reason for Different Allowables
  - b. Basis for Allowables
  - c. Connection Detail 36" to 26" Service Water
  - d. Two Profiles of 26-OHBC-54
  - e. Reason for Change in Profiles Rev 2 to Rev 10
  - f. High Stress Levels
  - g. End Support Assumptions, Fixed or Hinged

TABLE 17-2

SETTLEMENT STRESSES OF PROFILED SYSTEMS

LOCATION OF AV. STRESS (STATION)	Line	Seismic Category I	Location Shown in Figure	Profile Shown in Figure	Stress (1) (ksi)	Code Allowable (2) (ksi)	DATE OF PROFILE DATA
<b>Service water lines</b>							
1+30	26"/36"-OHBC-16	Yes ✓	17-1	17-2	14.0	15.2	52.5
0+40	26"/36"-OHBC-18	Yes ✓	17-1	17-2	27.0	52.5	APRIL 79
1+00	26"-OHBC-54	Yes ✓	17-1 & 19-1	17-2 & 19-1	22.0	52.5	MAY/JUNE 79
0+67	26"-OHBC-55	Yes ✓	17-1 & 19-1	17-2 & 19-1	17.0	37.9	52.5
0+50	10"-OHBC-27	Yes ✓	19-1	19-1	21.2	15.3	45.0
0+10	8"-IHBC-81	Yes ✓	19-1	19-1	17.7	17.2	45.0
0+15	8"-IHBC-82	Yes ✓	19-1	19-1	11.3	14.3	45.0
0+25	8"-IHBC-311	Yes ✓	19-1	19-1	21.1	24.0	45.0
0+30	26"-1JBD-2	No ✓	19-1	19-1	11.0	13.1	47.1
0+08	26"-2JBD-1	No ✓	19-1	19-1	16.1	63.2	47.1
<b>Condensate water line</b>							
1+60	20"-IHCD-169	No ✓	17-1 & 19-1	17-2 & 19-1	22.0	187.0	47.7

- (1) Analytical values generated from settlement gage data. Rounding in excess of the accuracy of the gage was necessary in several zones. These zones will be subjected to further investigation.  
 (2) Equation 10a, ASME Section III, Division 1, Subsection NC

LOCATION OF AV. STRESS (STATION)	Line	Seismic Category I	Location Shown in Figure	Profile Shown in Figure	Stress (1) (ksi)	Code Allowable (2) (ksi)	DATE OF PROFILE DATA
<b>SERVICE WATER LINES</b>							
1+38	26"-OHBC-54	YES ✓	19-1	19-1	23.2	52.5	SEPT. 79
0+112	26"-OHBC-55	YES ✓	19-1	19-1	18.6	52.5	SEPT. 79

FOR INFORMATION ONLY

Revision 8) 4  
9/79 y/nl

8/7/79

K. V. SWANSON

DESP. NOTES = 255, 255, 245, 345, 330, 320, 315, 295, 295  
255, 240, 230, 210, 201, 170, 150, 130.

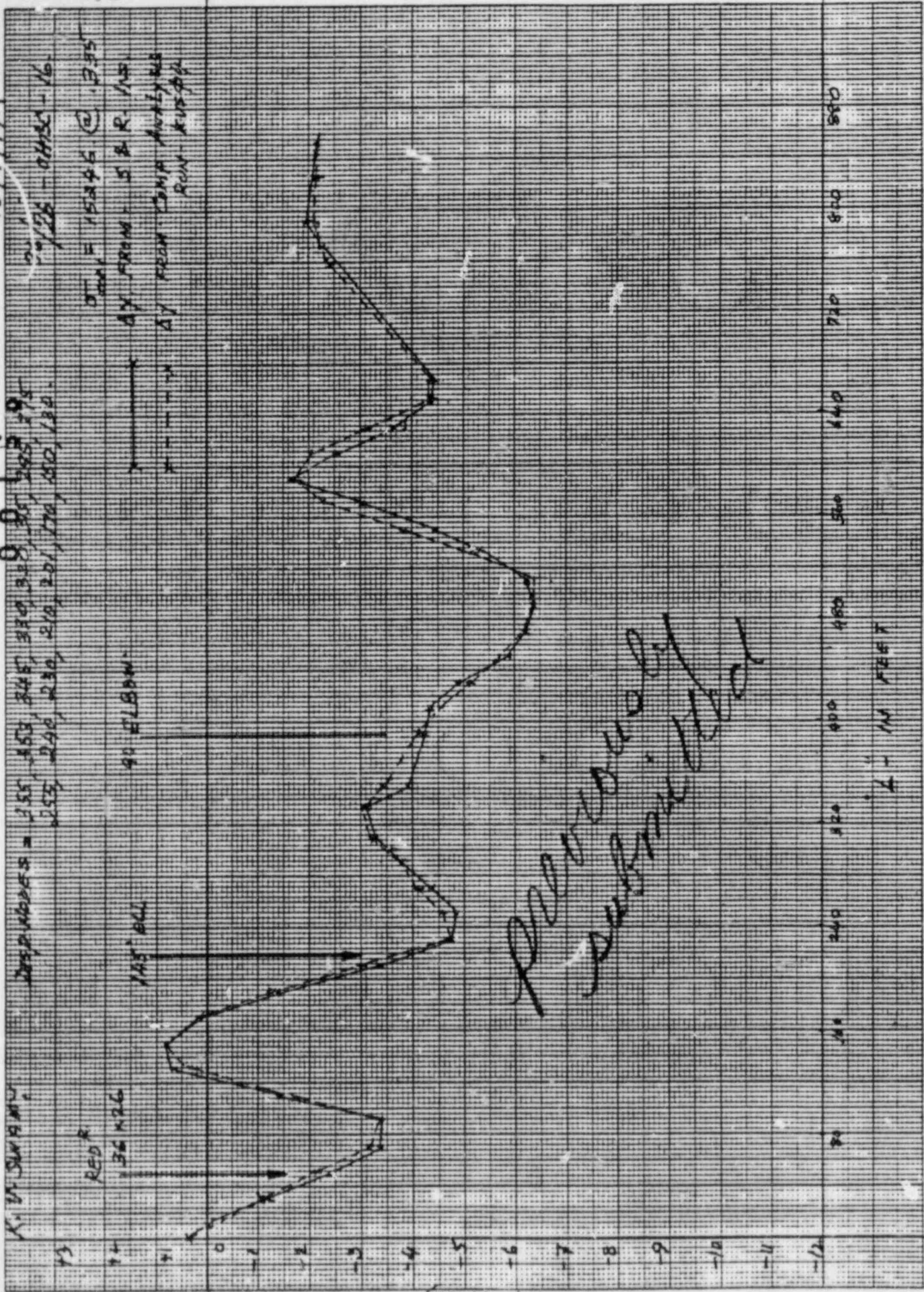
RED R  
36 X 26

145' BL

90' ELBOW

DATA F 15246 @ 3.95

BY FROM - S & R. MS  
BY FROM COMP ANALYSIS  
RUN - KUSOPK



Photocopy  
Submitted

00460129

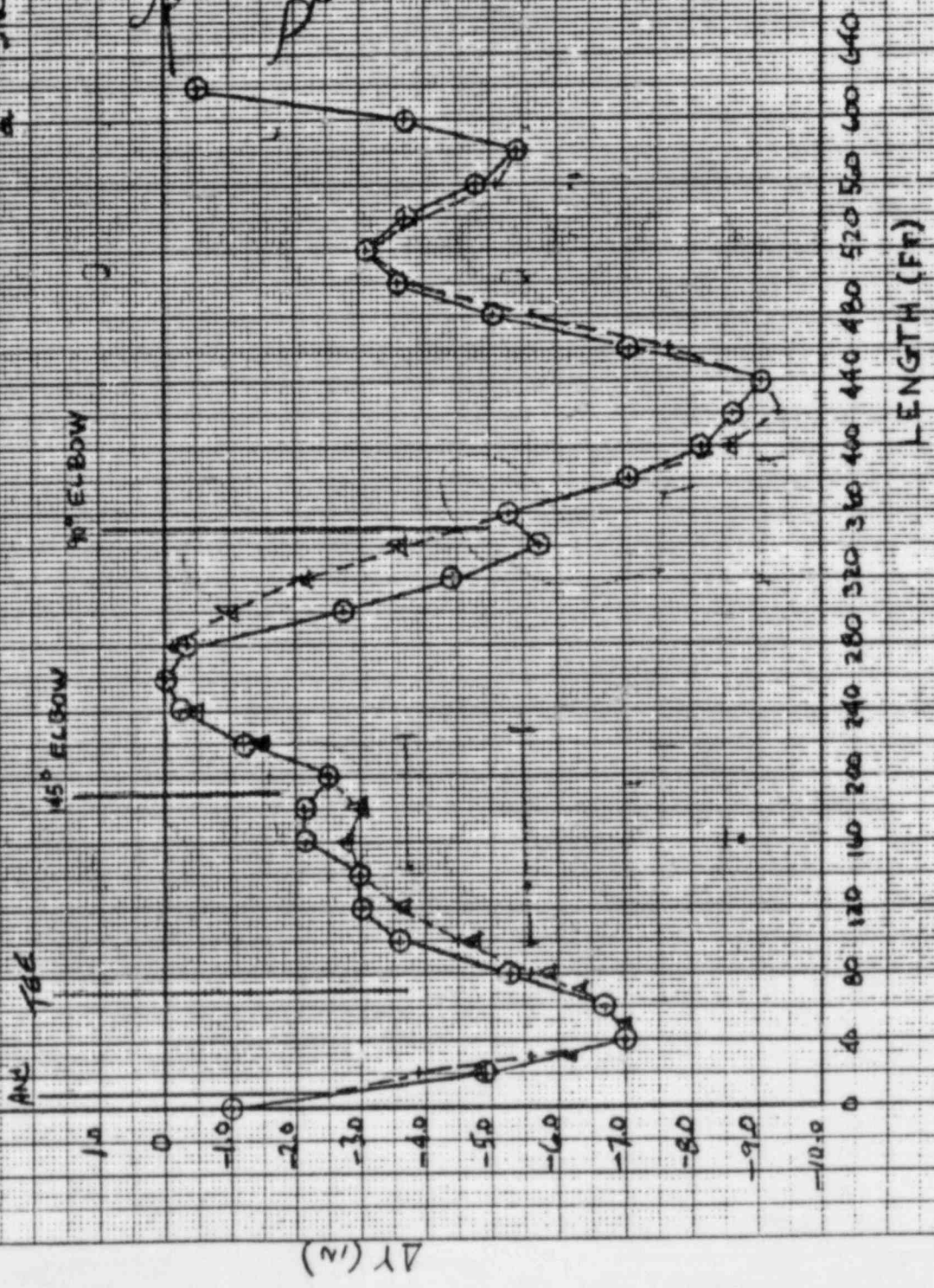
By: S. KANNAN (for S.W.A.C.O.R.)  
CHKD:

56/24-DHEC-19

FIELD DATA

JAC 14  $V = 62000$  AT ANC  
JAC 14  $V = 27000$  AT 50

*Records submitted*



461512  
00353

26-0446-55

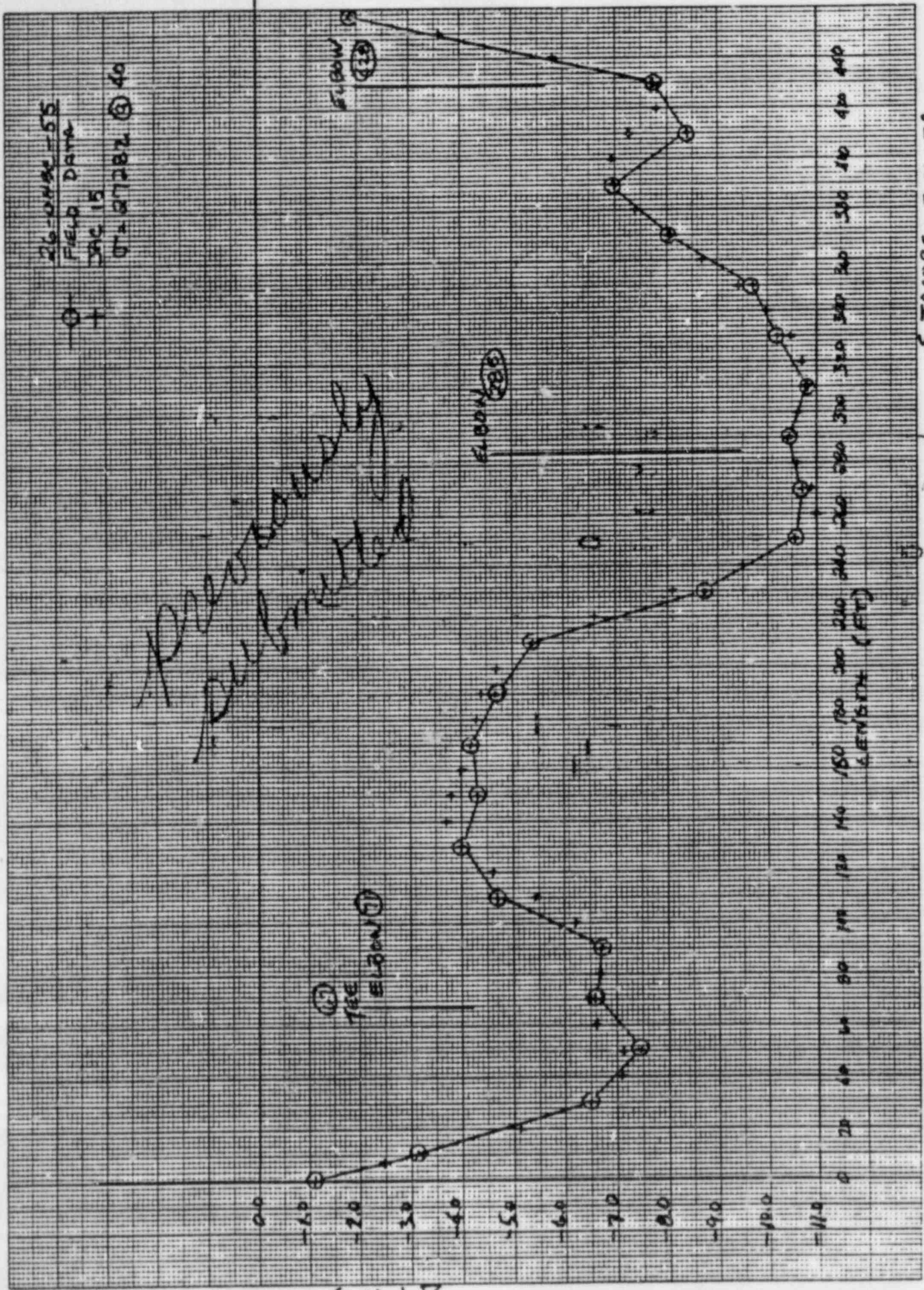
FIELD DATA

JAC 15

07-0728Z @ 40

+

*Estimated  
Submittals*





10-0113C-27

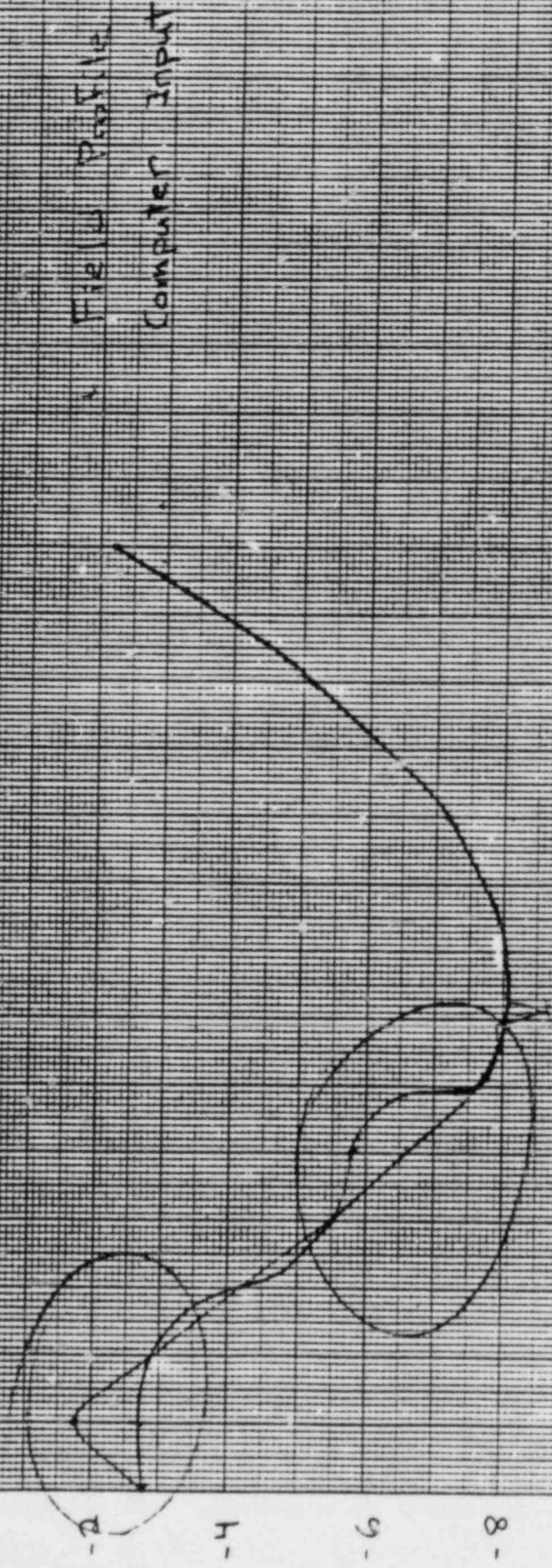
Pror. 1006

sweepnet (elbow)

Length along side  $Q$  in ft.

5 10 20 30 40 50 60 70

Displacement in.



8-1HBC-81

Prob. 1010

Length along pipe  $\xi$

140 ft.

120

100

80

60

40

20

Displacements

3

8

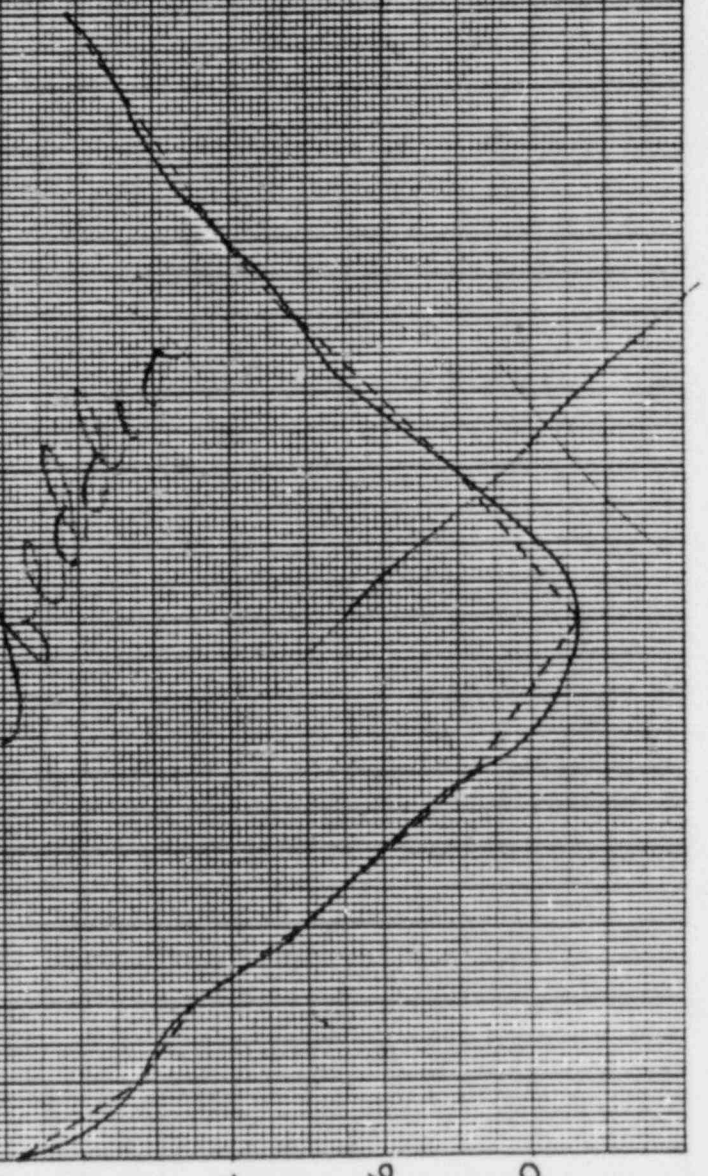
-12

-16

-20

Computer Analysis

Pipe Profile



B-2 H80 - BR

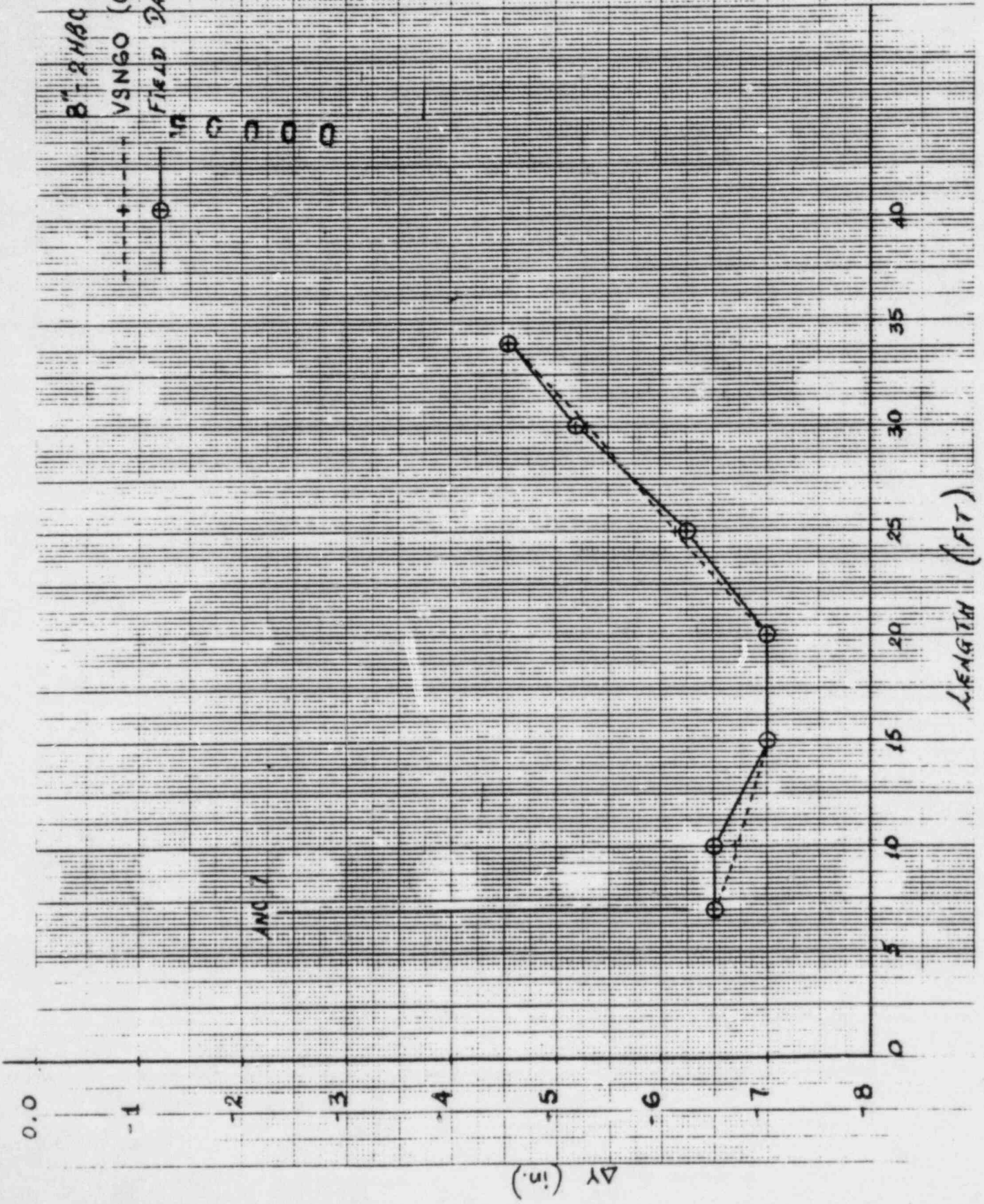
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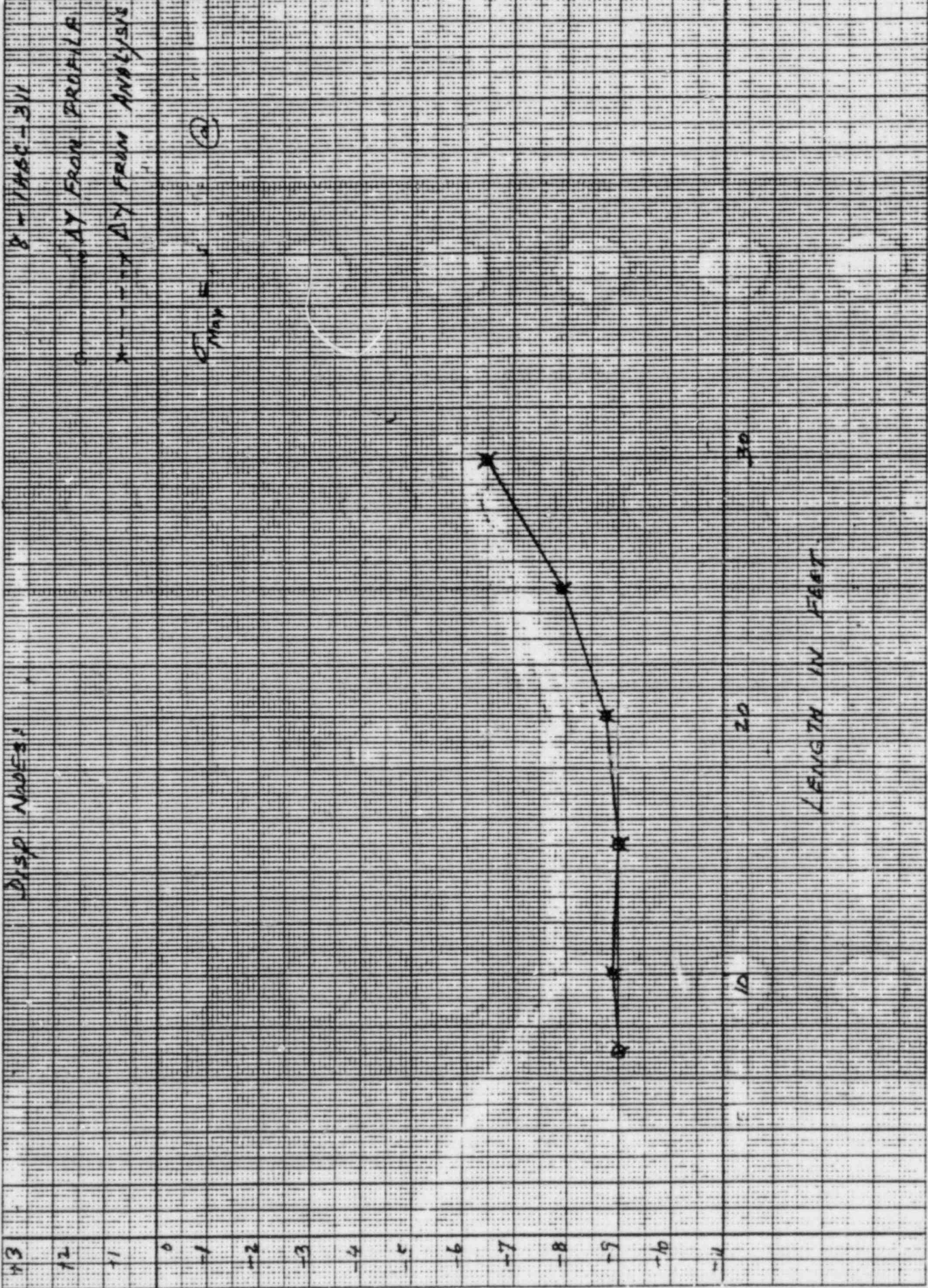
FIELD DATA

17

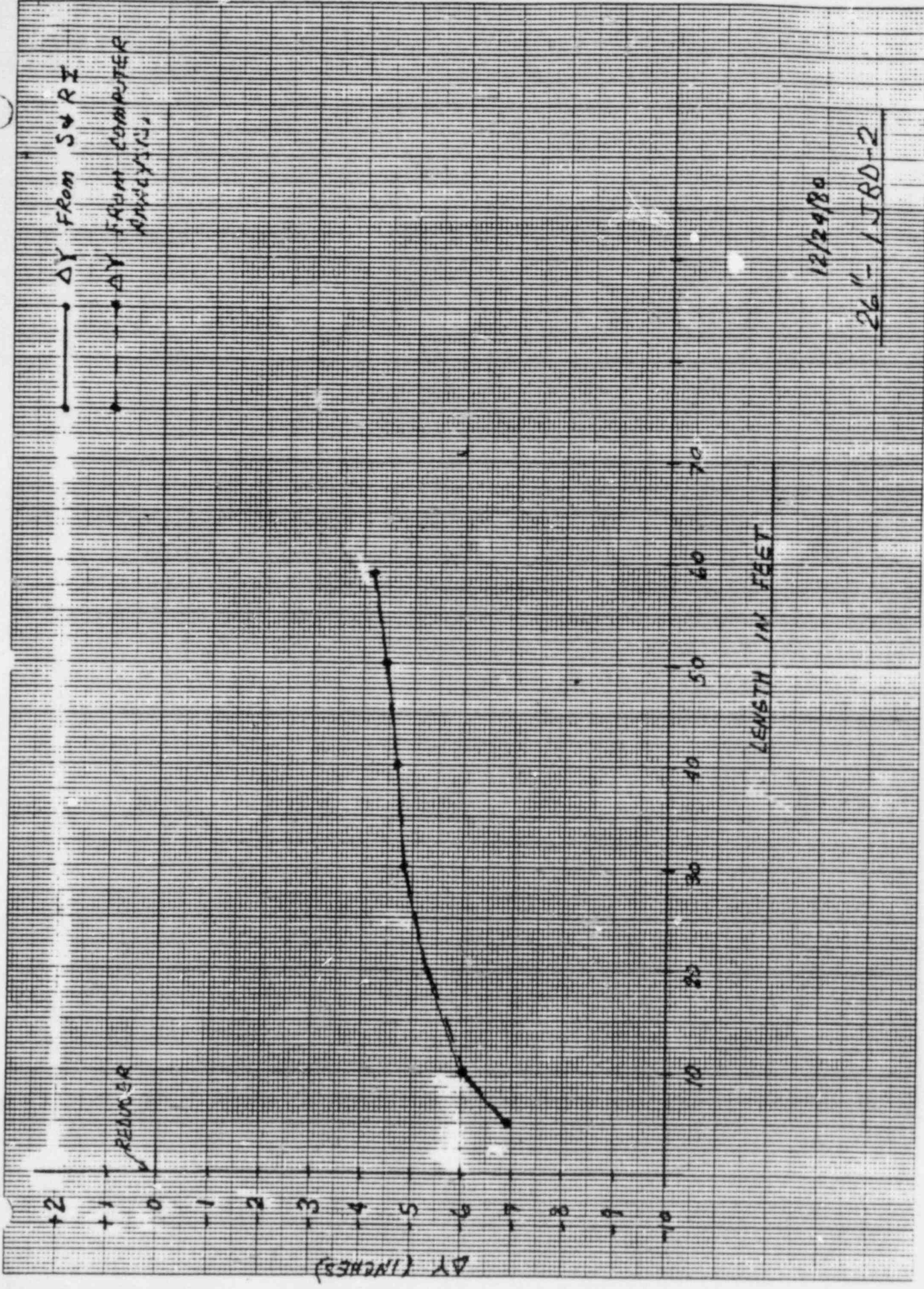
○ ○ ○ ○

ANG 1





00031



12/29/80  
26" - 1 J80-2

LINE NO.: 26-2JBD-1

□ - FIELD PROFILE  
○ - COMPUTER ANALYSIS

0.00

-1.00

-2.00

-3.00

-4.00

-5.00

-6.00

0

5

10

15

20

25

30

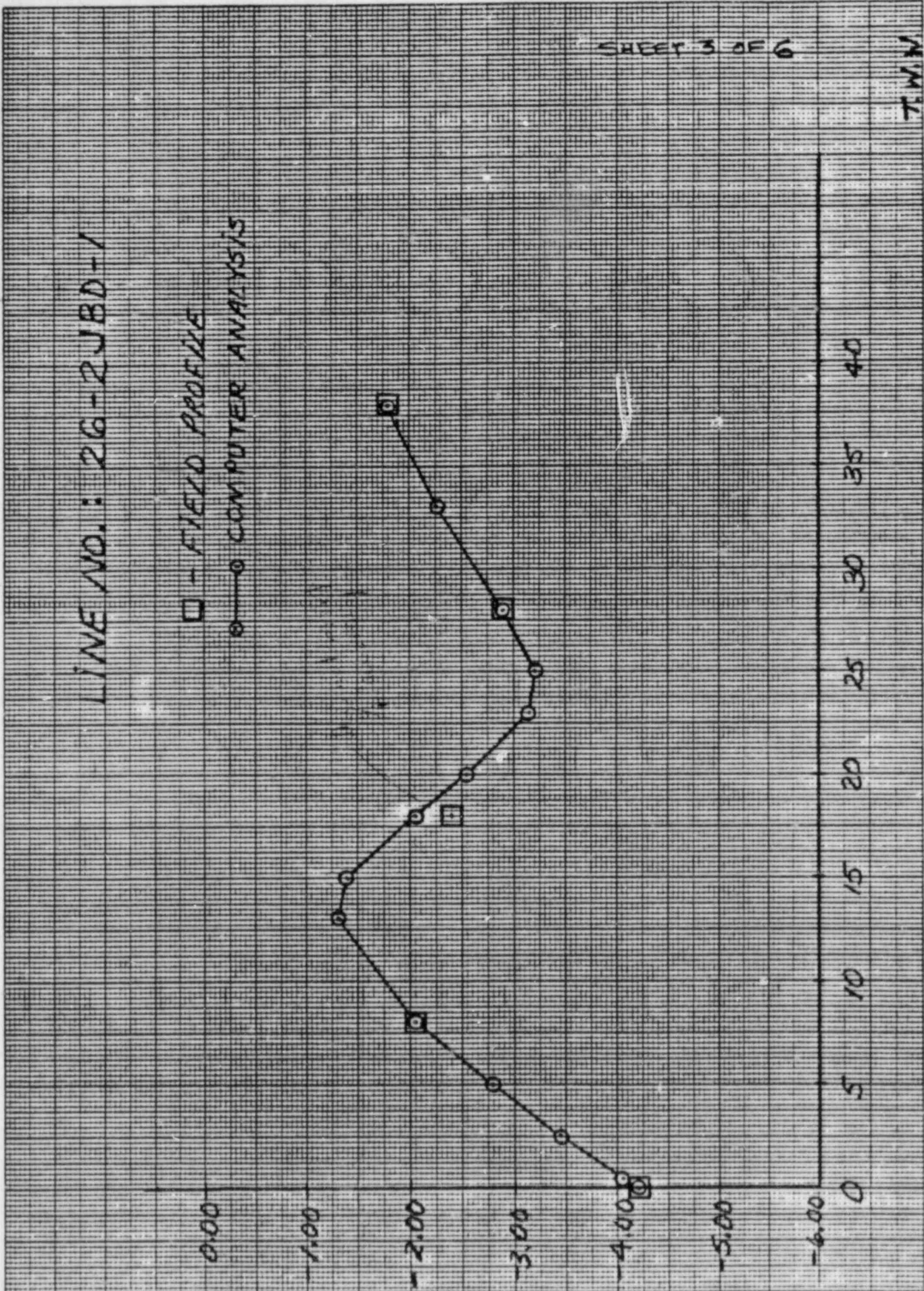
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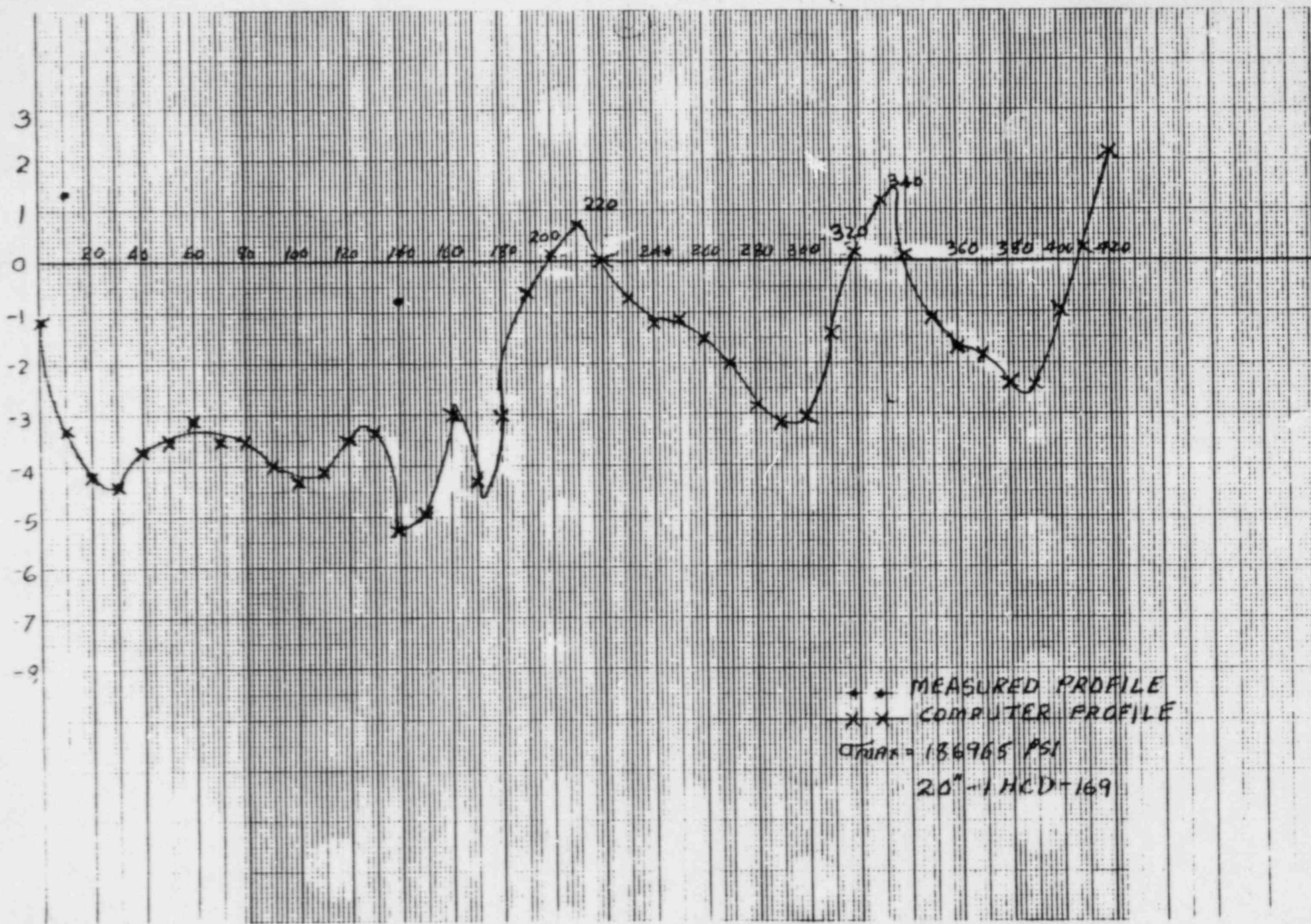
40

SHEET 3 OF 6

T.W.W.

WATER





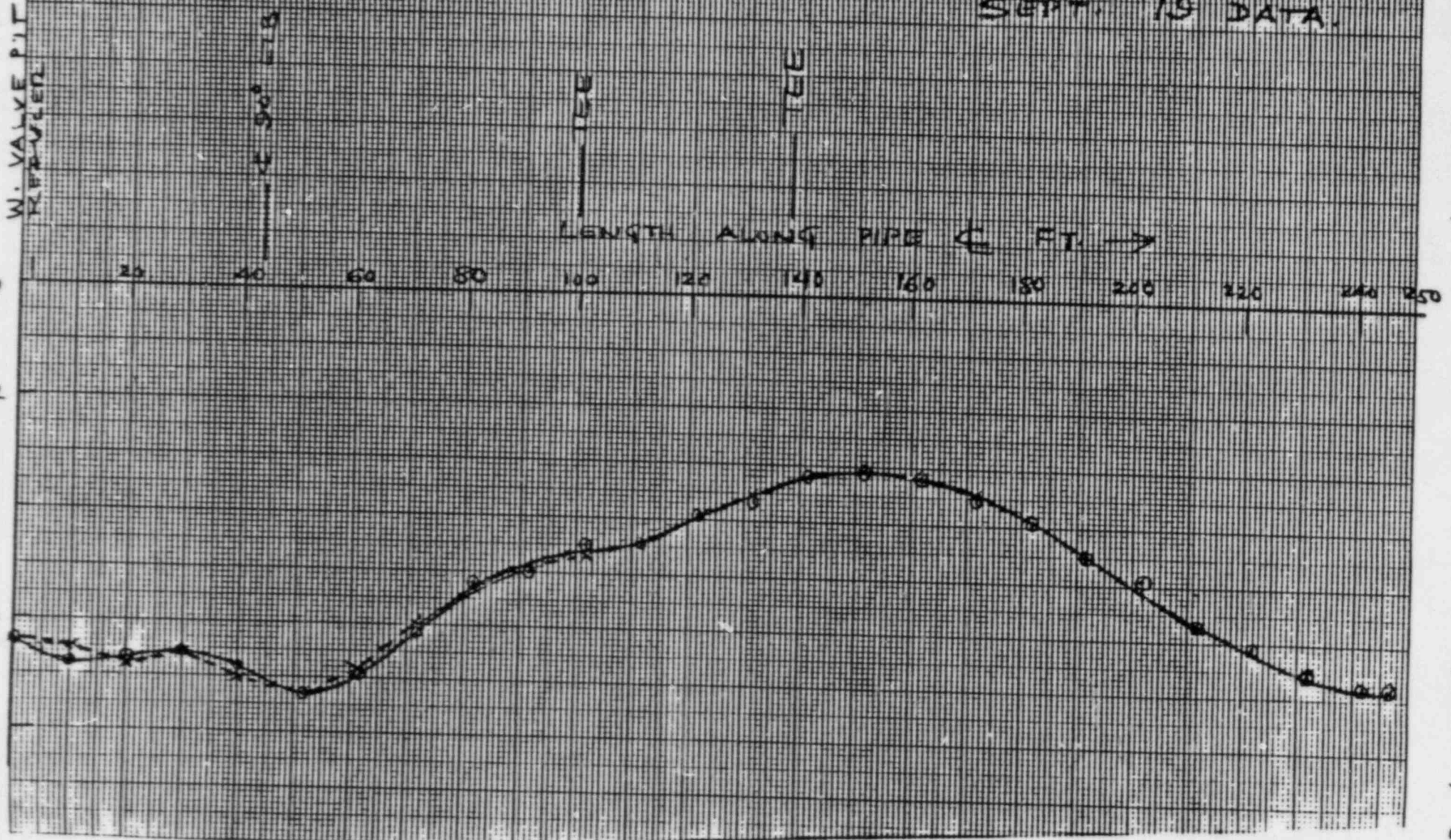
PAGE 7 OF 7  
1-7-11

Continued from - Ref. Cat. I

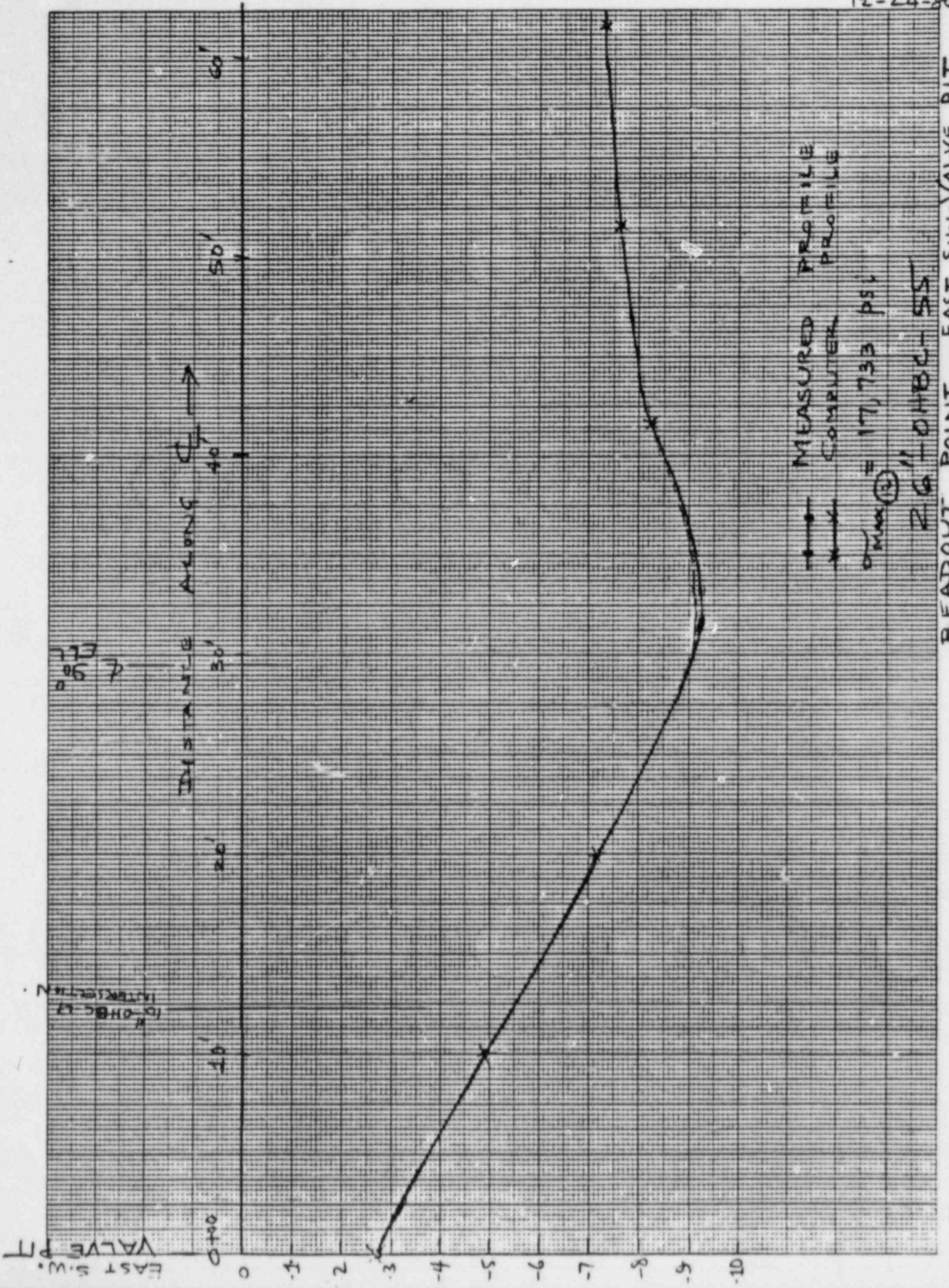
$\sigma_{MAX} = 23,153 \text{ PSI}$

○ - PROFILE  
X - - - COMPUTER

26-0450-54  
SEPT. 79 DATA.









UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

NOV 6 1980

MEMORANDUM FOR: F. J. Miraglia, Acting Chief, Licensing Branch #3, DL  
FROM: R. J. Bosnak, Chief, Mechanical Engineering Branch, DE  
SUBJECT: INTEROPERATORIES FOR UNDERGROUND PIPING IN THE RANDOM  
FILL AREA AT THE MIDLAND NUCLEAR PLANT

Please find enclosed pages 1 and 2 of the Enclosure to ETEC letter 80ETEC-DRF-4465 transmitting interoperatories for Consumer's Power Company. These questions are submitted in connection with the discovery period related to the upcoming hearings on the "Order Modifying Construction Permits CPPR-81 and 82". We will require a rapid response to these questions so that an evaluation can be made prior to the hearings.

*F. Cherny for*  
R. J. Bosnak, Chief  
Mechanical Engineering Branch  
Division of Engineering

Enclosure: As stated

cc: J. P. Knight, DE  
H. L. Brammer, DE  
F. C. Cherny, DE  
D. Hood, DL  
W. Paton, ELD  
J. Kane, DE  
L. Heller, DE  
F. Rinaldi, DE  
R. Gonzales, DE

Contact: A. Cappucci, DE:MEB, x29476

~~8011240120~~ → 1 p. 1

QUESTIONS FOR CONSUMERS POWER COMPANY CONCERNING  
THE DEFORMATIONS OF BURIED PIPING DUE TO  
DIFFERENTIAL SOIL SETTLEMENT AT MIDLAND PLANT UNITS 1 AND 2

Reference Responses to the NRC 10 CFR 50.54(f) Request Regarding Plant Fill for Midland Plant Units 1 and 2, Consumers Power Company, Docket Numbers 50-329 and 50-330.

- 1) What were the criteria for determining which of the Category I buried lines were to be profiled and what was the justification for these criteria?
- 2) It appears that in some sections of the profiled lines the stresses are considerably higher than those listed in the reference. What is the method used to calculate the stresses in these lines due to the differential soil settlement?
- 3) There are sections of the profiled lines where the slope changes rather rapidly. This would indicate high local bearing loads. What are the magnitudes of these loads, type of load and their probable cause?
- 4) The sections of line where the slope changes rapidly could have high bearing loads and also high bending stresses. What assurance is there that local buckling will not occur in these areas?
- 5) What action is contemplated for buried pipes if the stresses due to the ground settlement are greater than the Code allowable for  $3 S_c$ ?
- 6) What assurance is there that the deformed lines do not induce high nozzle or component loads? Some of the profiled lines have considerable slope at attachment points to other pipes, tanks etc., and at building penetrations. If these lines were forced into position to make the final closure weld or the settlement occurred mainly after the final closure welds were made, high stresses could be induced into the piping, components, and supports.

- 7) Have methods for measuring in situ stresses in the deformed piping been investigated or tried? If not, why not? This may be the only method of determining the stresses in some areas where the final closure welds have been made before the major portion of the settlement occurred or where there is a concentrated load due to some unknown phenomenon.
- 8) If the stresses in the profiled lines exceed code allowables, how will this be related to the non-profiled lines?
- 9) Current profiles reflect present settlement only. How do you plan to account for the additional settlement that occurs over the life of the plant?
- 10) What are the criteria for the minimum rattle space of Category I piping at building penetrations and do all the Category I piping penetrations meet these criteria? If not, what corrective action is proposed?
- 11) Due to the slope of some of the lines at building penetrations it appears that there could be clearance on one side of the penetration and contact on the other. What assurance is there that there is sufficient clearance over the length of the penetration to accommodate the differential settlement between the pipe and the building and the expected seismic excitations?
- 12) The accuracy (and reliability) of the method used to profile the pipes should be clarified.



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20545

*Dinisch Gupta / Please plan to attend*

*Heller*

DEC 31 1980

*Kane*

*DFYI*

Docket Nos.: 50-329/330 OM, OL

MEMORANDUM FOR: F. Miraglia, Acting Chief, Licensing Branch No. 3, DL  
FROM: Darl Hood, Project Manager, Licensing Branch No. 3, DL  
SUBJECT: NOTICE OF MEETING - STRESS ANALYSES FOR UNDERGROUND  
PIPING - MIDLAND PLANT UNITS 1 & 2

Date & Time: 9:00 a.m.  
January 20, 1981  
Location: Room P-114  
Phillips Building  
Bethesda, Maryland

*2) Pls keep me posted on the results of this.*

Purpose: To resolve differences in bending stresses calculated by ETEC and Bechtel for underground pipes at Midland Plant, Units 1 & 2

*G.  
1/6*

Participants: <sup>1/</sup>

NRC

R. Bosnak, et.al.

Energy Technology Engineering Center

Consumers Power Company  
D. Budzik, et.al.

Bechtel  
L. Curtis, et.al.

*Darl Hood*  
Darl Hood, Project Manager  
Licensing Branch No. 3  
Division of Licensing

Enclosure:  
Agenda

cc: See next page.

<sup>1/</sup> Meetings between NRC technical staff and applicants for licenses are open for interested members of the public, petitioners, intervenors, or other parties to attend as observers pursuant to "Open Meeting and Statement of NRC Staff Policy", 43 FR 28058, 6/28/78.

*8101100292*

Enclosure

AGENDA

By letter of October 20, 1980, Mr. R. Tedesco noted that significant differences existed for the bending stresses in underground piping due to differential soil settlement as calculated by ETEC and by Bechtel for Midland Plant, Units 1 & 2. The letter requested details of the stress calculations and suggested a follow-up meeting to discuss these differences. The applicant replied by letter of November 14, 1980, providing the summary calculations and confirming the need for a follow-up meeting on these differences.

The agenda will consist of a review of the two summary calculations, one by ETEC and one by Bechtel, with emphasis on differences between the two.

2/22/82

1st  
J. Kern

### Briefing on Midland (E. Linn & L. Heller)

- Request to remove valve pit surcharge - Status
- At ASLB hearing - BWSI issues resolved except for Tech spec on monitoring (CL issue)
- Differences remain on whether: fill settlement was cause of BWSI problem
- Session on Underground Piping - Was report on status - Later session required HCEB issues - Provide soil profiles, develop settlement monitoring details, complete review of soil input in seismic analysis (Hickala)
- ASLB also wants NRC witness on corrosion of piping

Meetings this week - DCB, recharge test results, SW structure, unresolved

### Audit Issues

- Imp't. Milestones - Resolve outstanding issues on DCB & SW structure & Dewatering
- NRC Position on Phase III - Axial Bldg. - Mar. 8
  - Audit @ Ann Arbor on SW structure 11 Mar 15-14
  - Testimony De on DCB, SW & Perm Dewatering - Mar. 15
  - ASLB Hearing Mar 21 - Apr. 2, 1982

TABLE 17-2  
SETTLEMENT STRESSES OF PROFILED SYSTEMS

LOCATION OF MAX. STRESS (STATION)	Line	Beam Category	Location Shown in Figure	Profile Shown in Figure	Max Stress (ksi) (17)	Max Stress (ksi) (18)	Max Stress (ksi) (19)	Code Allowable (ksi) (20)	Corrected Allowable (ksi) (21)	DATE OF PROFILE DATA	
STA. 3+30	Service water lines 20°-0HBC-11	Yes	17-1	17-2	11.0	15.2	15.2	32.3		APRIL 79	
0+40		Yes	17-1	17-2	11.0	15.2	15.2	32.3		MARCH/JUNE 78	
0+50		Yes	17-1	17-2	11.0	15.2	15.2	32.3		APRIL 79	
0+28		Yes	17-1	17-2	11.0	15.2	15.2	32.3		APRIL 79	
0+70		Yes	17-1	17-2	11.0	15.2	15.2	32.3		JANUARY 79	
0+25		Yes	17-1	17-2	11.0	15.2	15.2	32.3		SEPT. 79	
0+20		Yes	17-1	17-2	11.0	15.2	15.2	32.3		SEPT. 79	
0+15		Yes	17-1	17-2	11.0	15.2	15.2	32.3		JANUARY 79	
		Condensate water line	No	17-1 & 18-1	17-2 & 18-1	11.0	29.0	29.0	47.1	50.4	APRIL 79
0+4.95		20°-1HCD-169	No	17-1 & 18-1	17-2 & 18-1	11.0	29.0	29.0	47.1	50.4	APRIL 79

(1) Analytical values generated from settlement gage data. Bounding in excess of the accuracy of the gage was necessary in several zones. These zones will be subjected to further investigation.

(2) Equation 18a, ASMS Section III, Division 1, Subsection MC

4 - June  
5 - April  
1 -  
1 -