Consumer Exhibit # 9 (Kam)

SETTLEMENT UPDATE

FOR

MIDLAND PLANT UNITS 1 AND 2

CONSUMERS POWER COMPANY

DOCKET NUMBERS 50-329 AND 50-330

Report Date: September 14, 1980

Settlement Update

The information shown on Attachment 1 is the average observed settlement from September 1979 through August 1980 for the buildings shown. For more detailed information, Figures 1 through 28, which include a location plan for settlement markers, are attached. These readings in Figures 1 through 28 are updated for all structures through July 1980.

Settlement Due to Dewatering

Temporary dewatering to permit future underpinning construction activities was put into operation on August 10, 1980. This will aid in the design of the permanent dewatering system and also will provide data to substantiate predicted settlement due to dewatering. Readings at thirty points are taken twice weekly and at other points weekly if possible.

Readings as of August 31, 1980, show insignificant settlement.

Attachment 1

MIDLAND PROJECT

AVERAGE

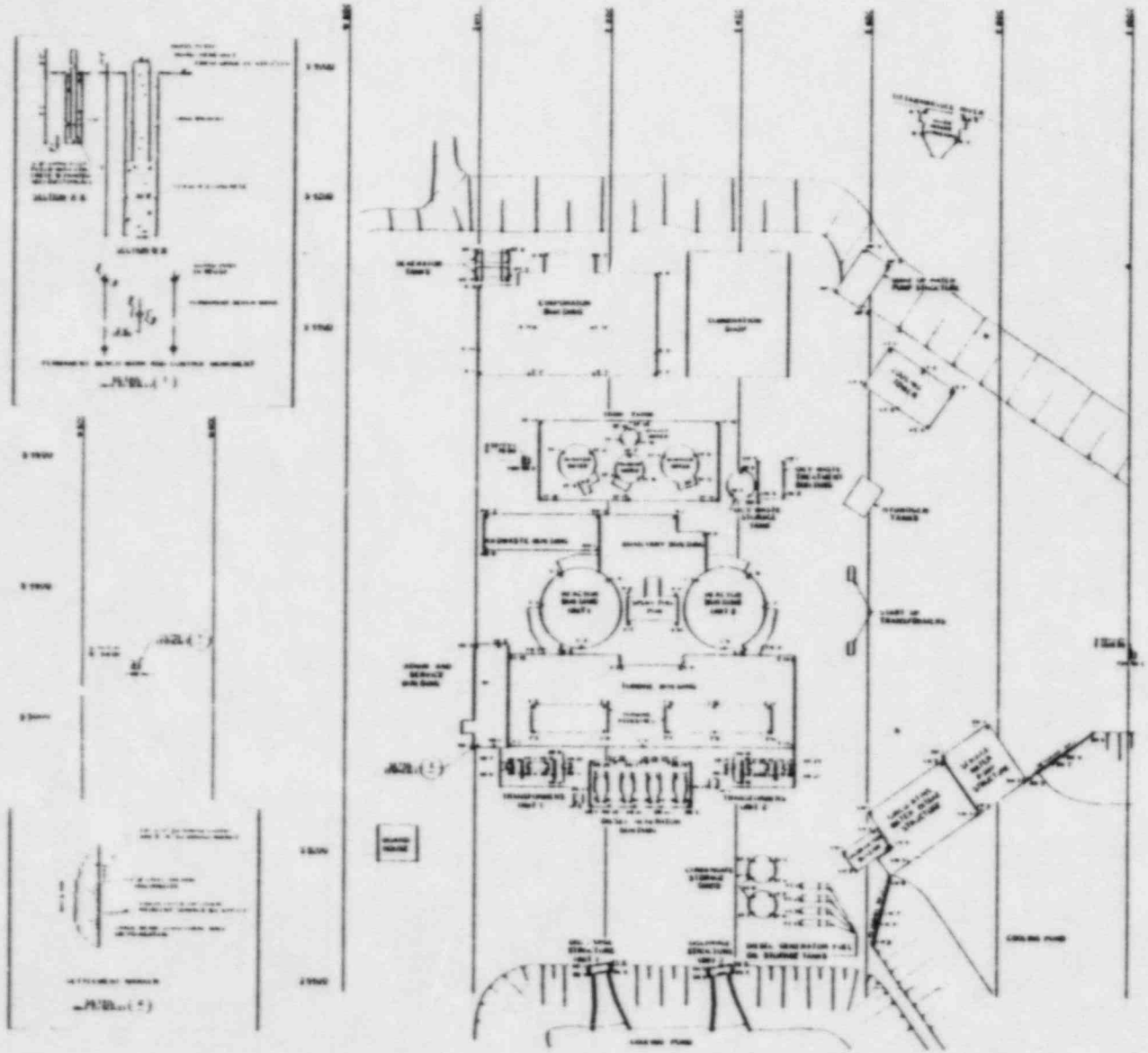
OBSERVED SETTLEMENTS (INCHES)

OF STRUCTURES

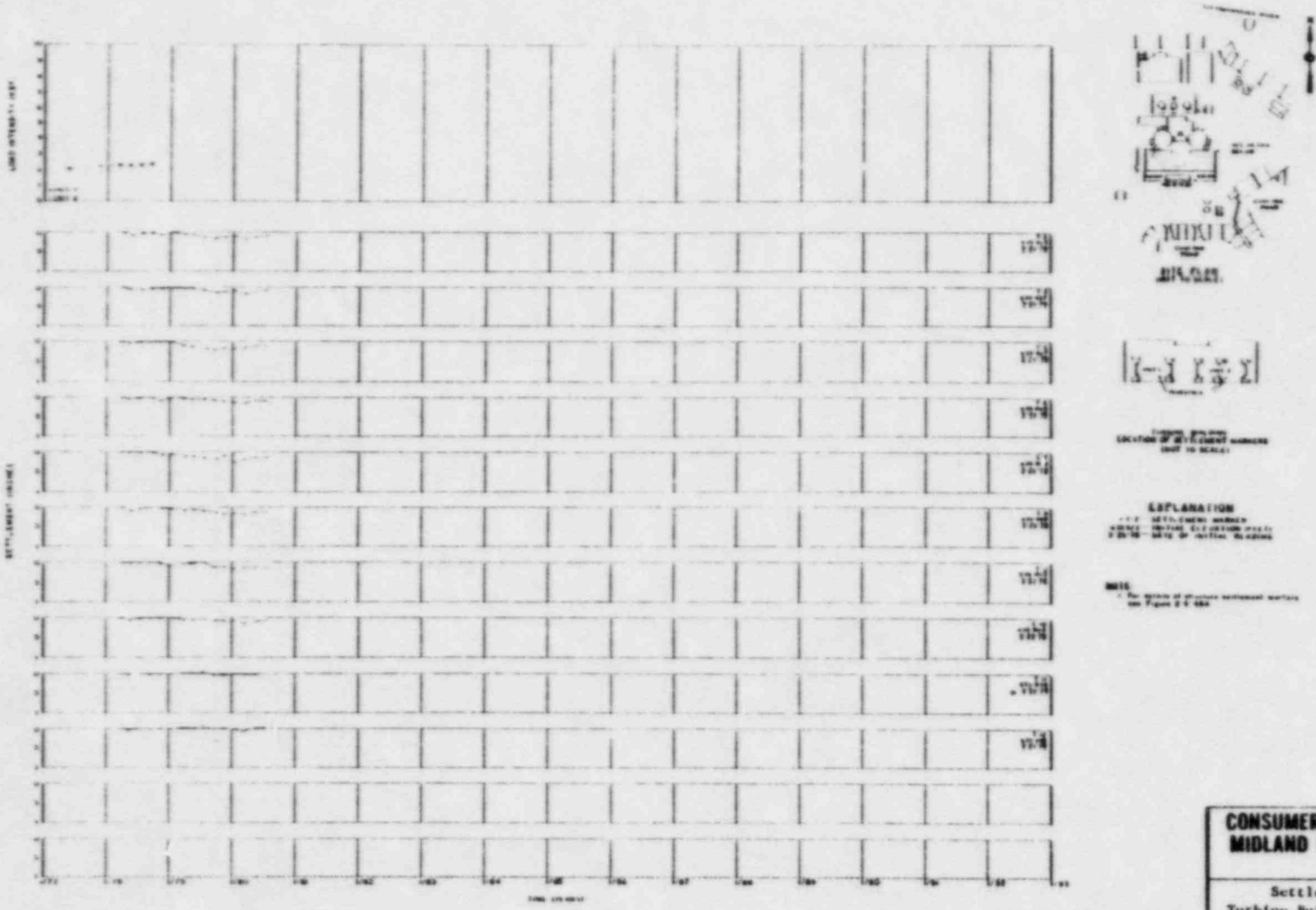
SEPTEMBER 1979 TO AUGUST 1980

1. Diesel generator building (0.0625)
2. Auxiliary building electrical penetration rooms (0.0625)
3. Feedwater isolation pits (0.080)
4. Service water structure (0.120)
5. Service water structure wing wall (0.010)
6. Diesel fuel oil storage tanks (0.010)
*7. Condensate storage tank (1.625 during load test; 0.060 last 90 days)
*8. Circulating water wing walls (0.040)
*9. Cooling pond dike (3 points: 1.875 - since 6/6/78: 0.010)

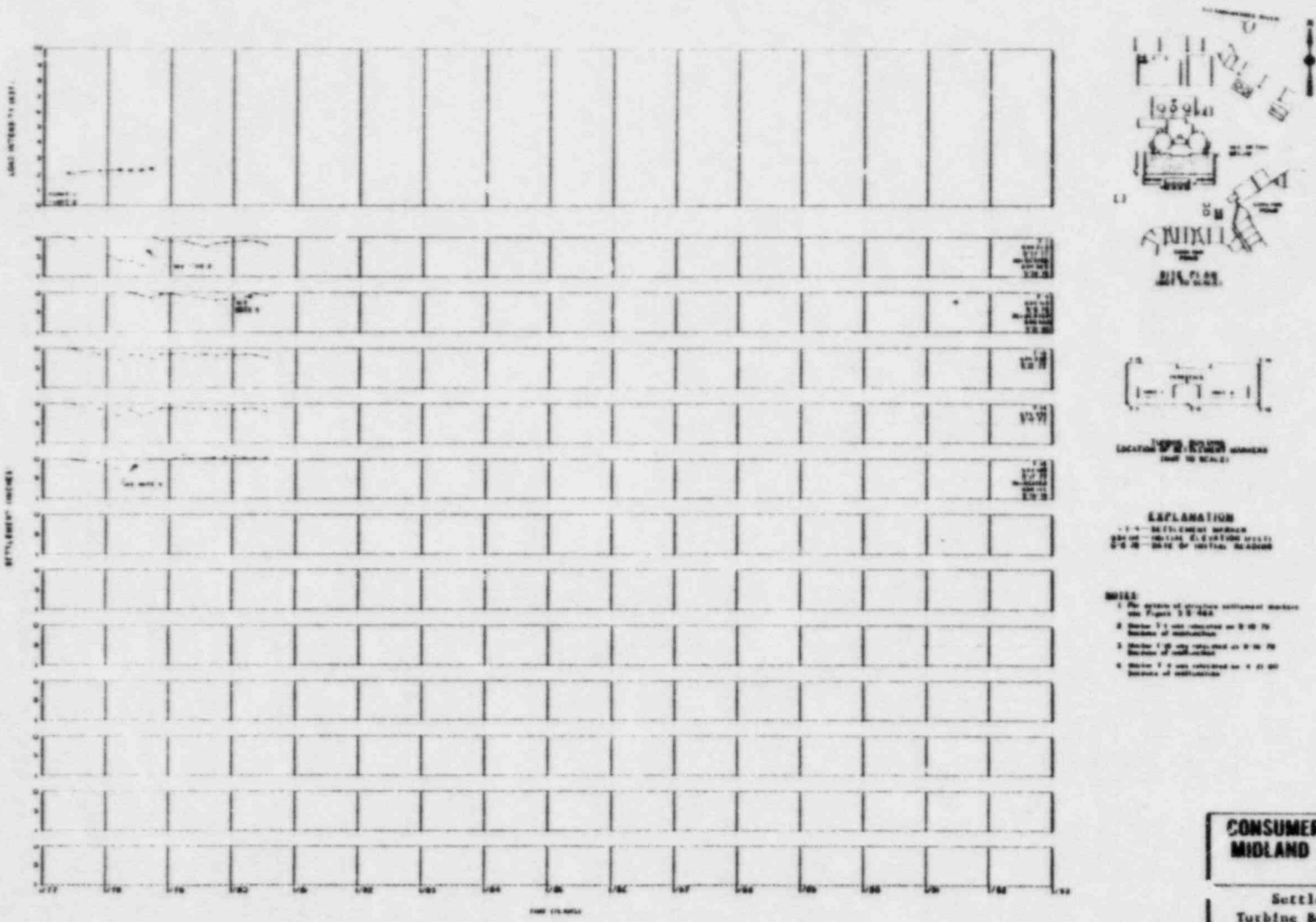
*Non-Category I



CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Location of Settlement Markers (SK-C-419, Rev 0)
Figure 1



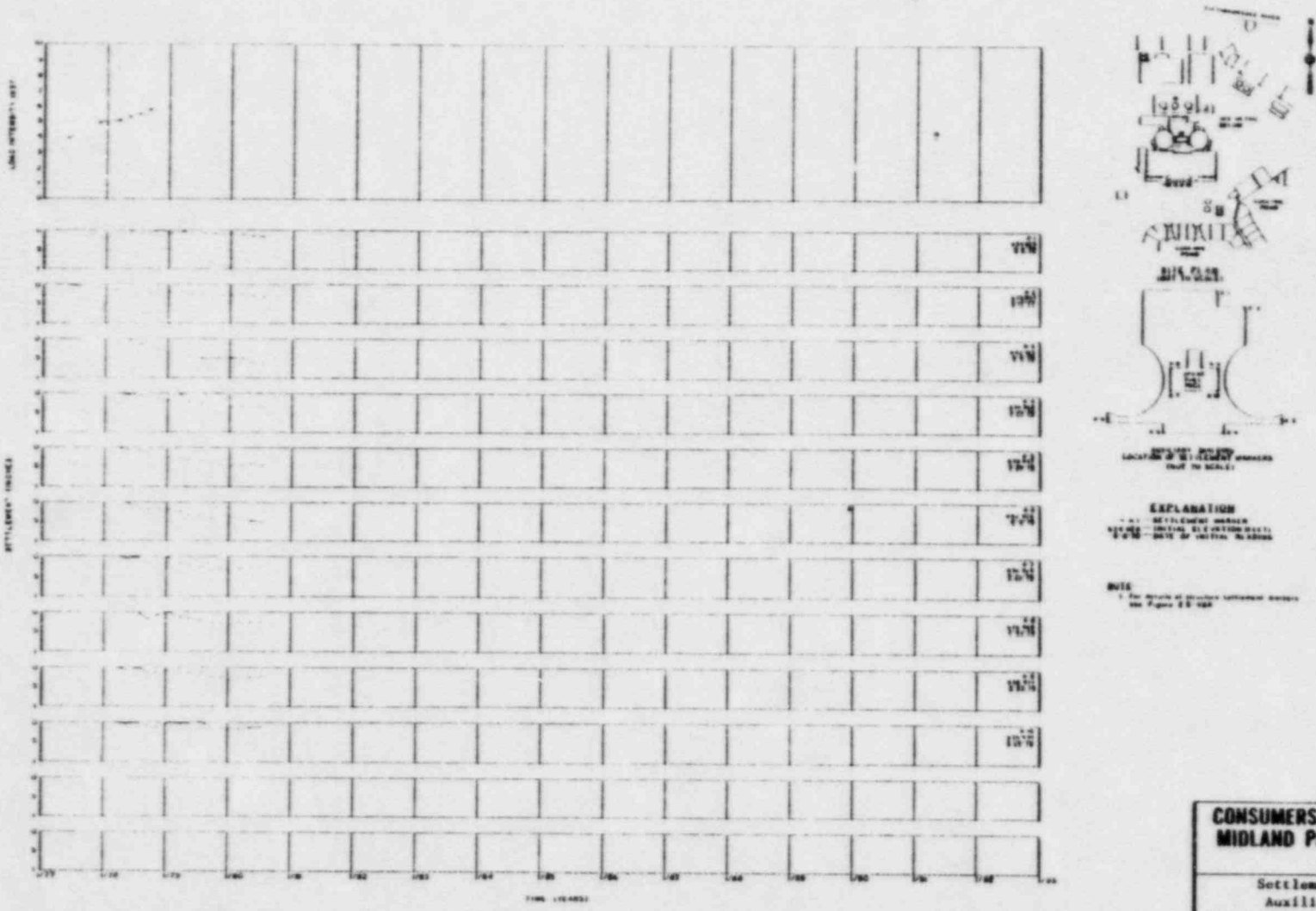
CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Turbine Building (Sh 1 of 2) (SK-G-415, Rev 1)
Figure 2



CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

Settlement vs. Time
Turbine Building (Sh 2 of 2)
(SK-G-416, Rev 1)

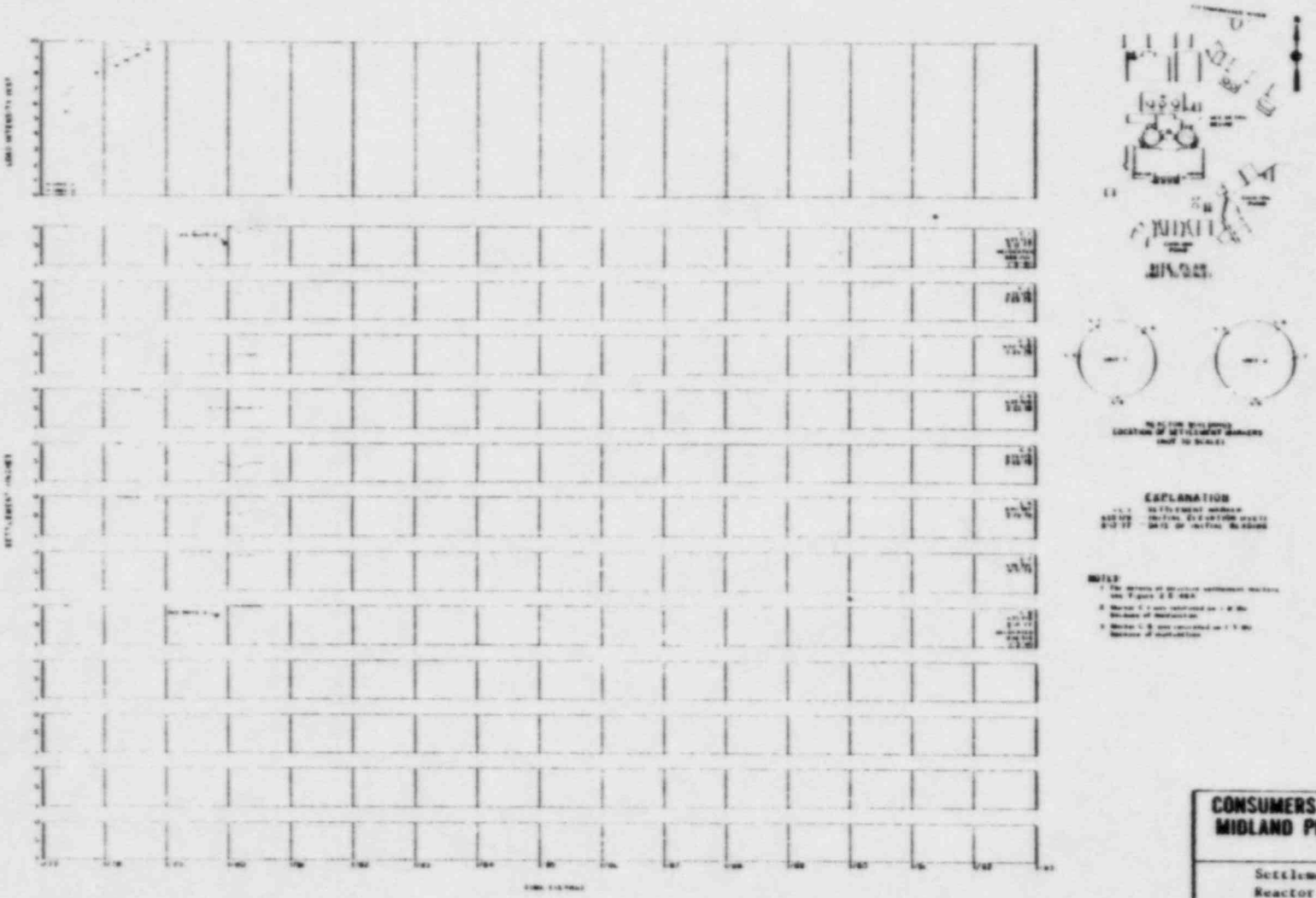
Figure 3



CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

Settlement vs. Time
Auxiliary Building
(SK-C-418, Rev 1)

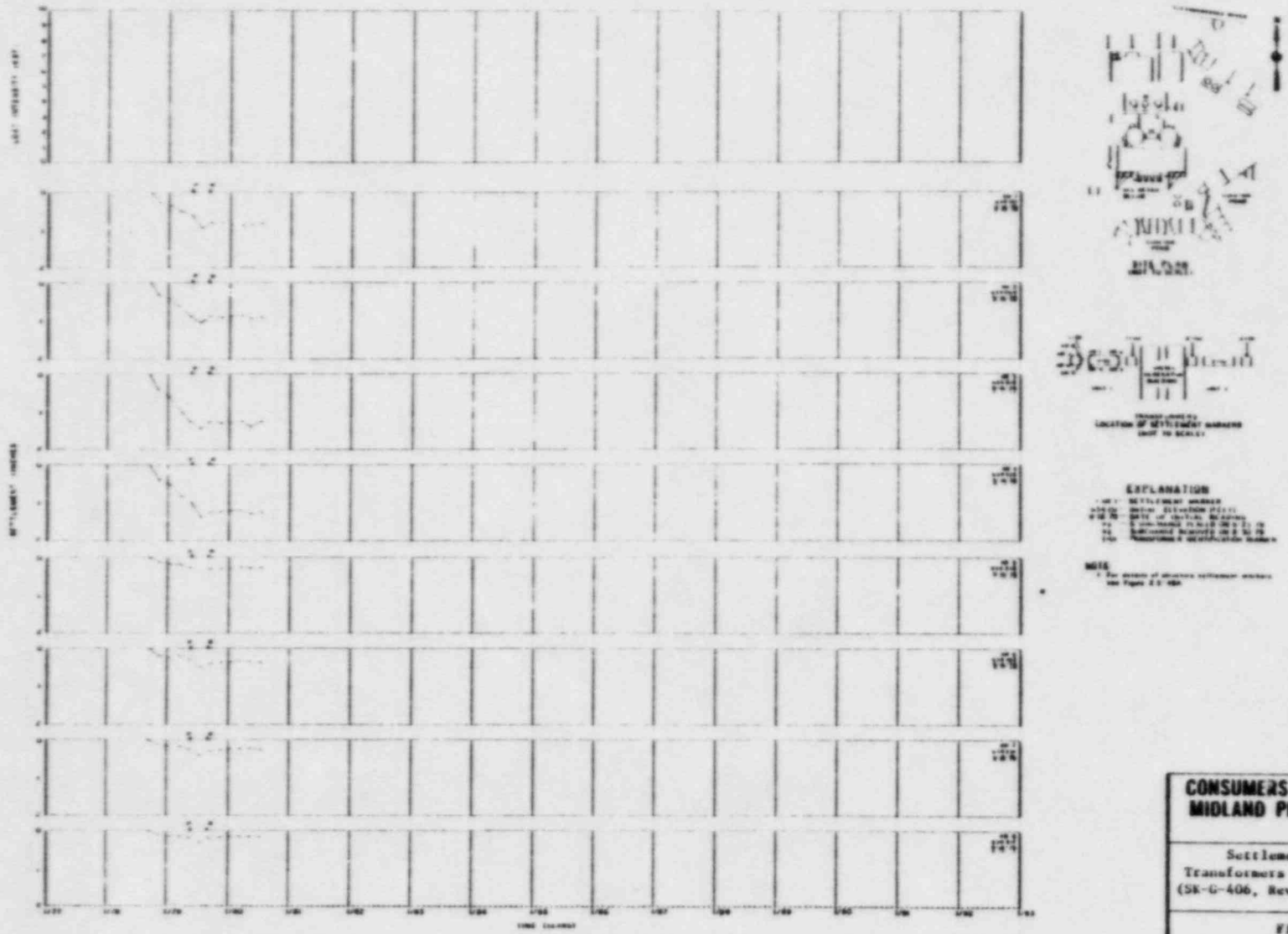
Figure 4



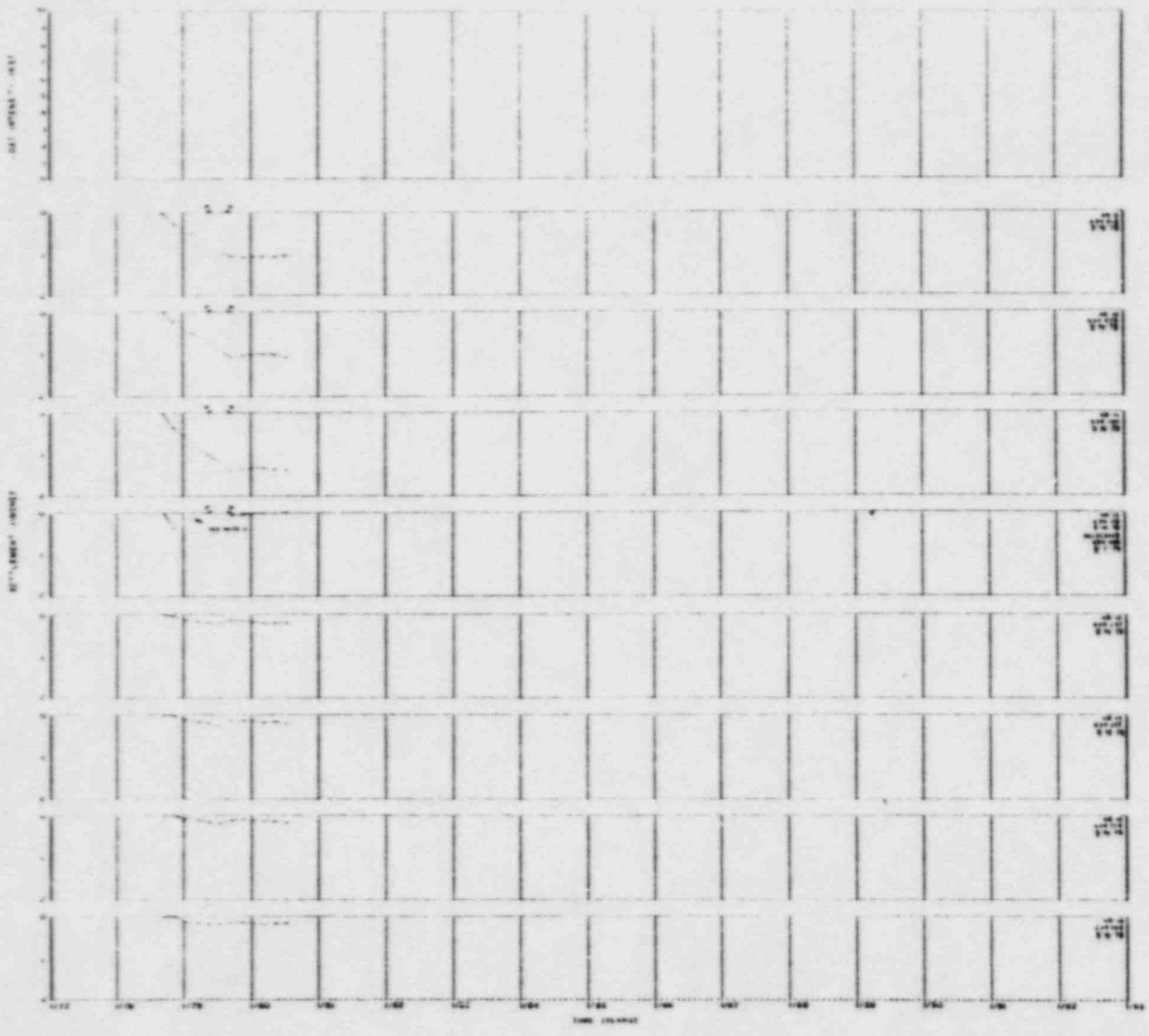
CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

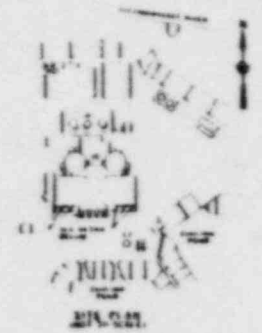
Settlement vs. Time
Reactor Buildings
(SK-C-414, Rev 1)

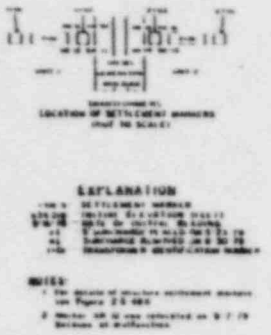
Figure 5



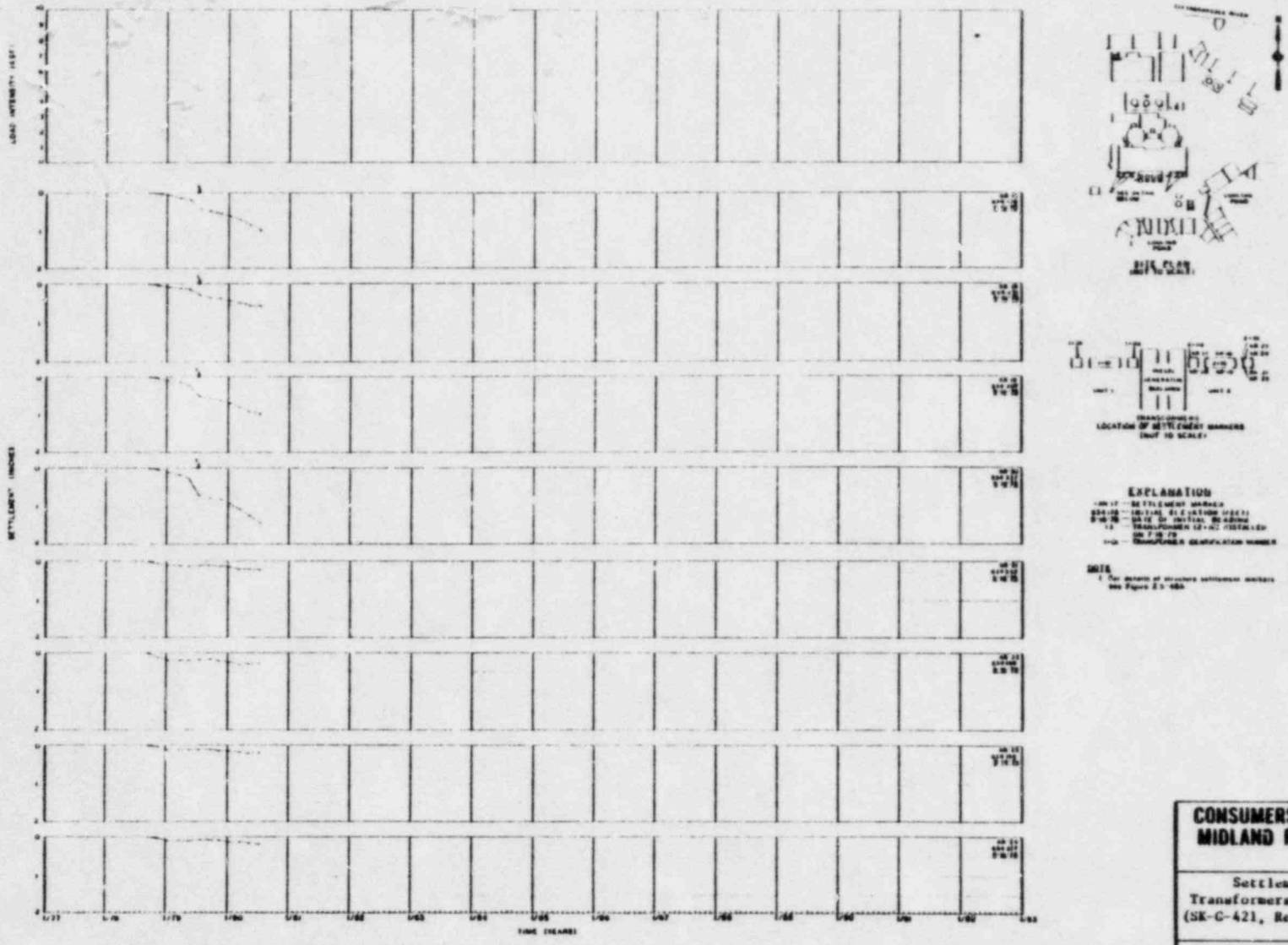
CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Transformers (Sh 1 of 3) Unit 1 (SK-C-406, Rev 1)
Figure 6



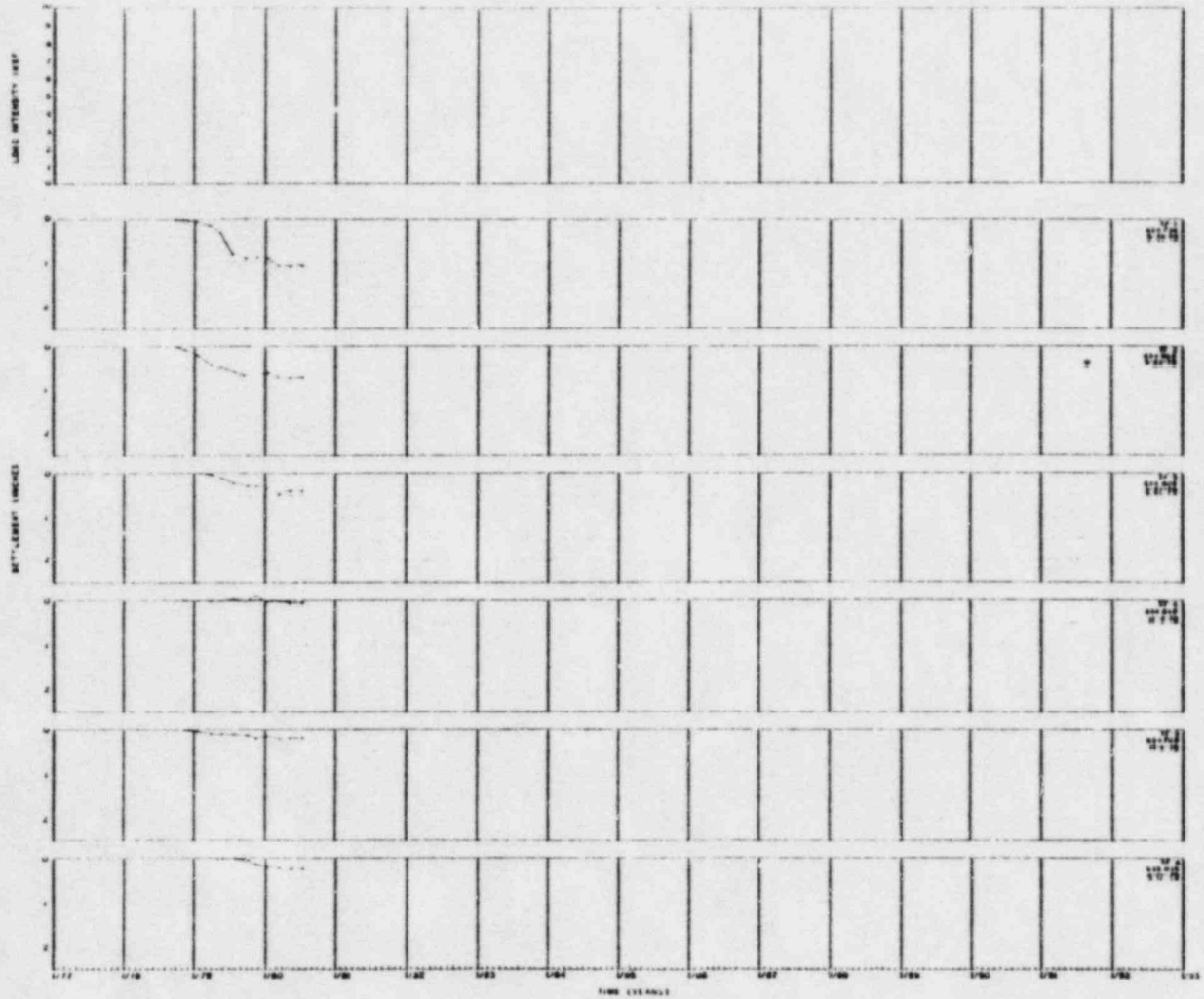


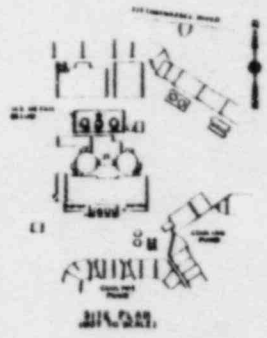


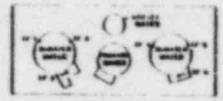
CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Transformers (Sh 2 of 3) Unit 1&2 (SK-G-407, Rev 1)
Figure 7

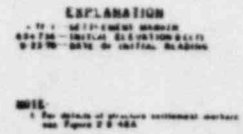


CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Transformers (Sh 3 of 3) Unit 3 (SK-C-421, Rev 1)
Figure 8

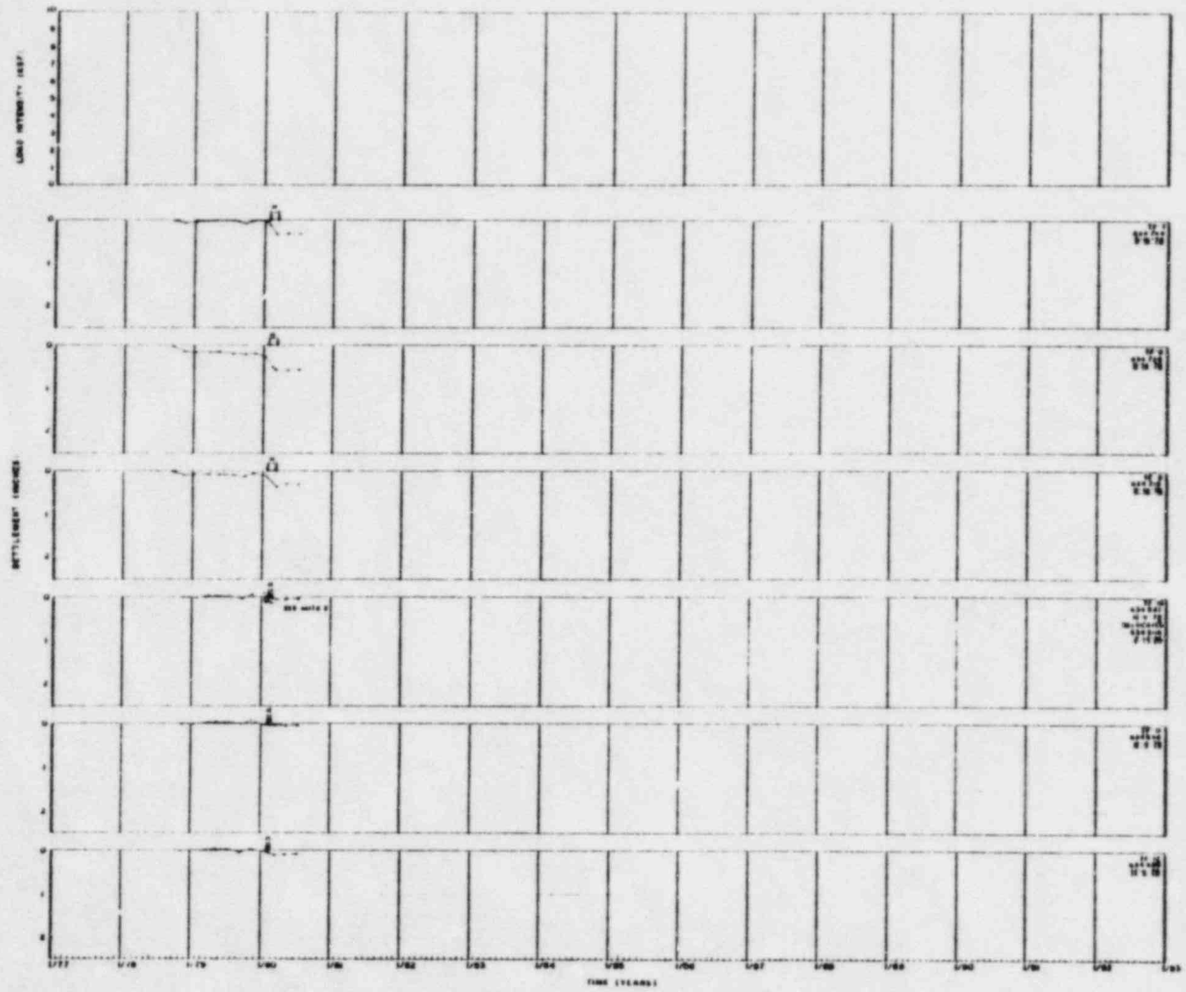


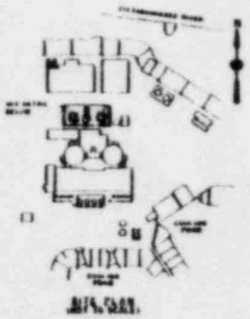






CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Tank Farm (Sh. 1 of 3) Borated Water Storage Tanks (SK-C-410, Rev 1)
Figure 9

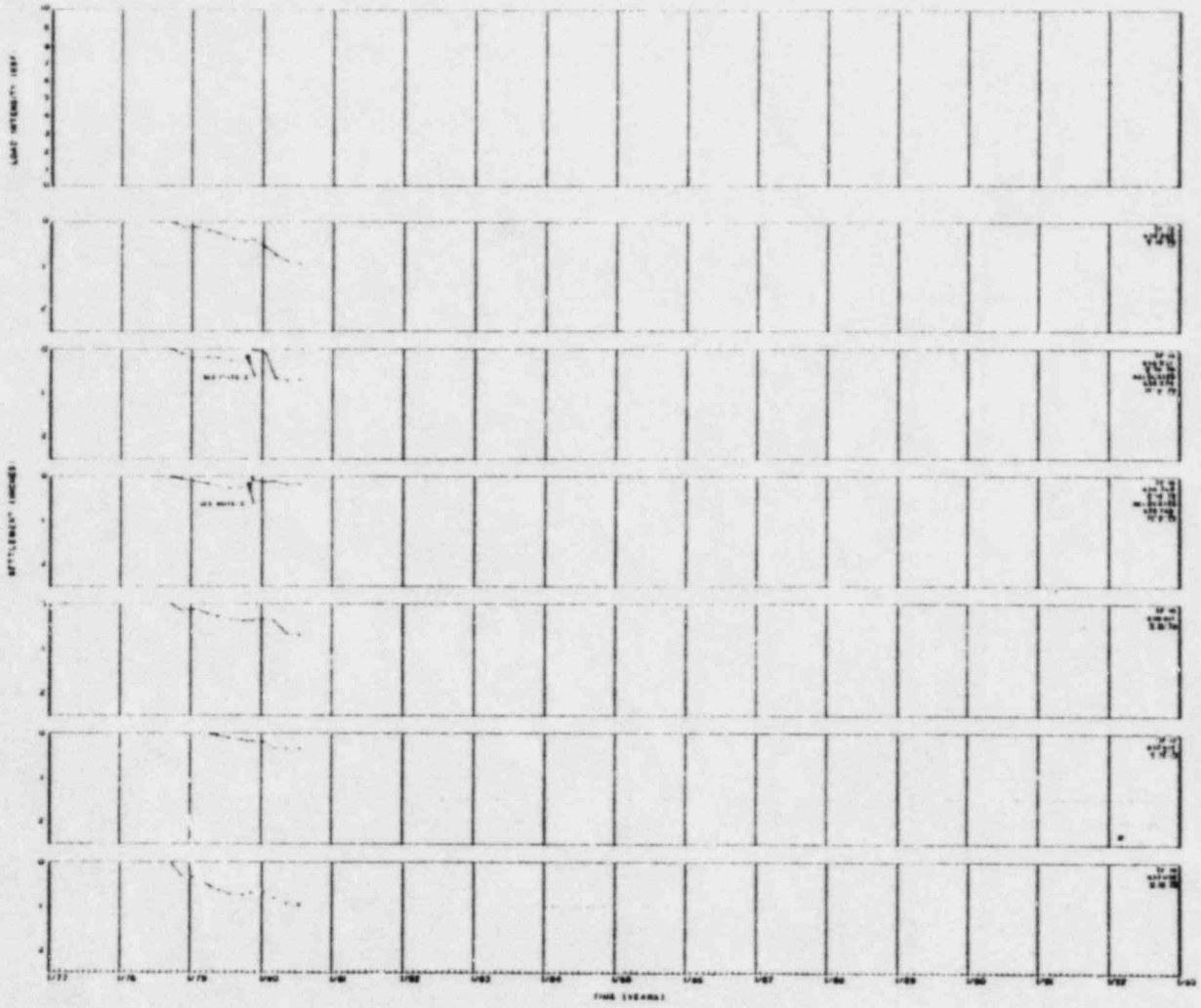


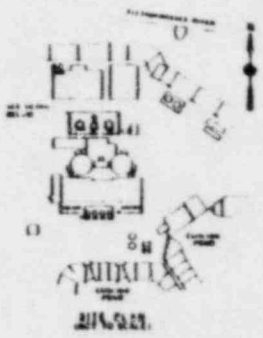


EXPLANATION

NOTES

CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Tank Farm (Sh 2 of 3) Primary & Utility Water Tanks (SK-G-411, Rev 1)
Figure 10

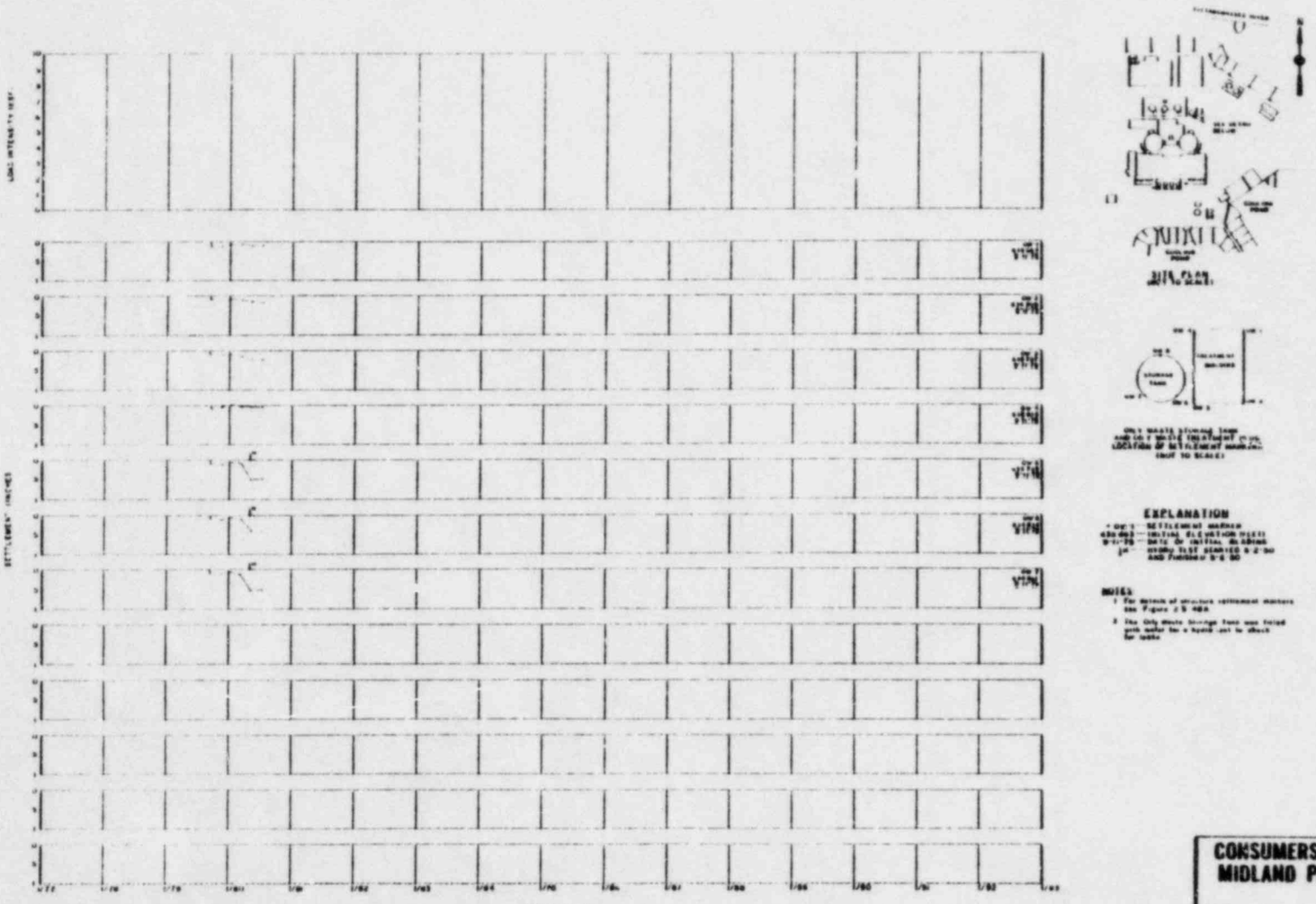




EXPLANATION

NOTES:

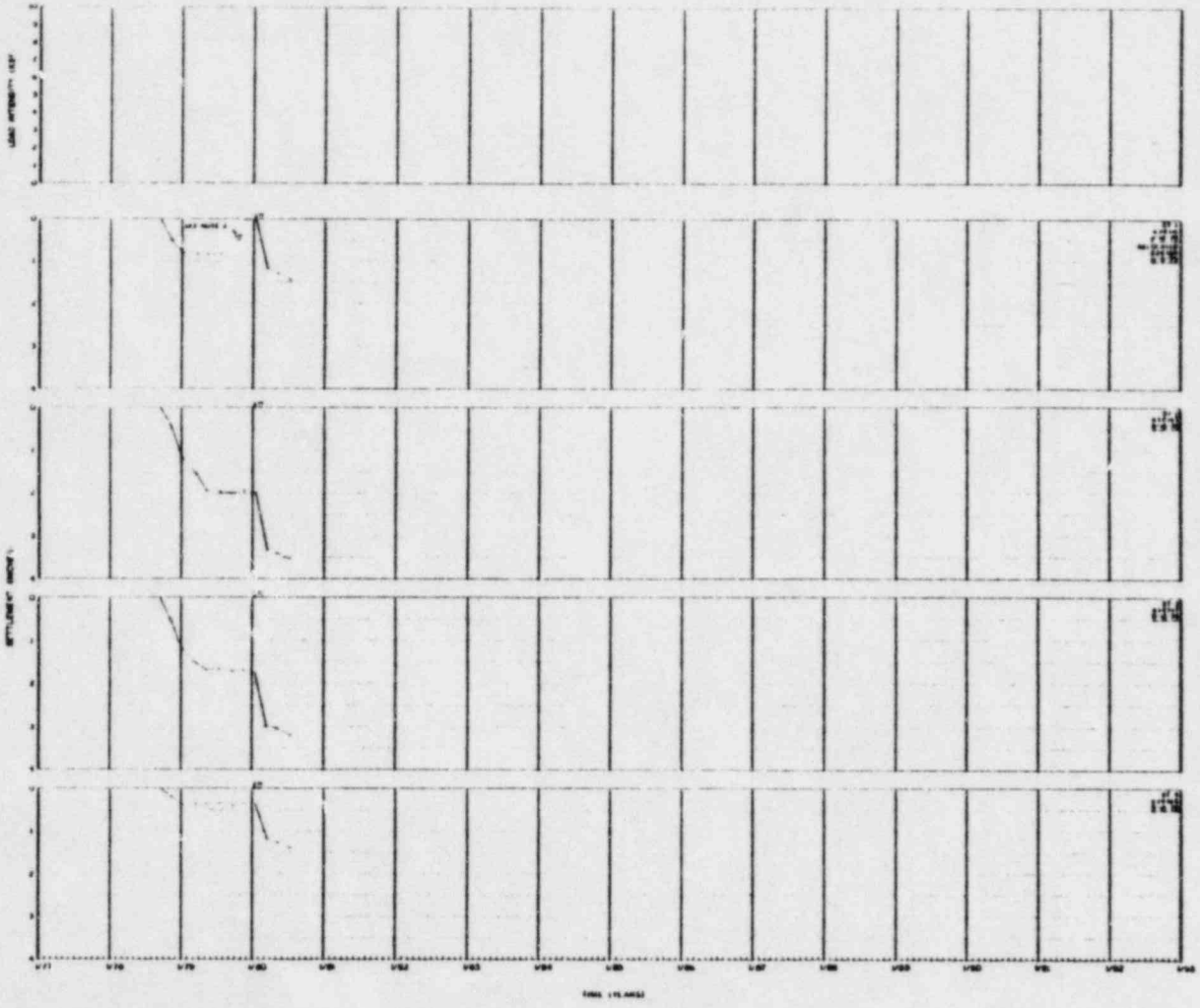
CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Tank Farm (Sh 3 of 3) Dike Wall (SK-C-420, Rev 1)
Figure 11

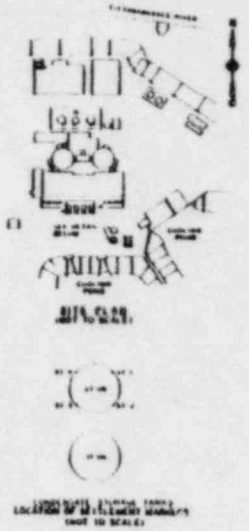


EXPLANATION

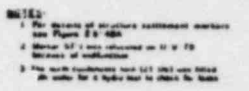
NOTES

CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Oily Waste Storage Tank & Oily Waste Treatment Building (SK-G-405, Rev 1)
Figure 12

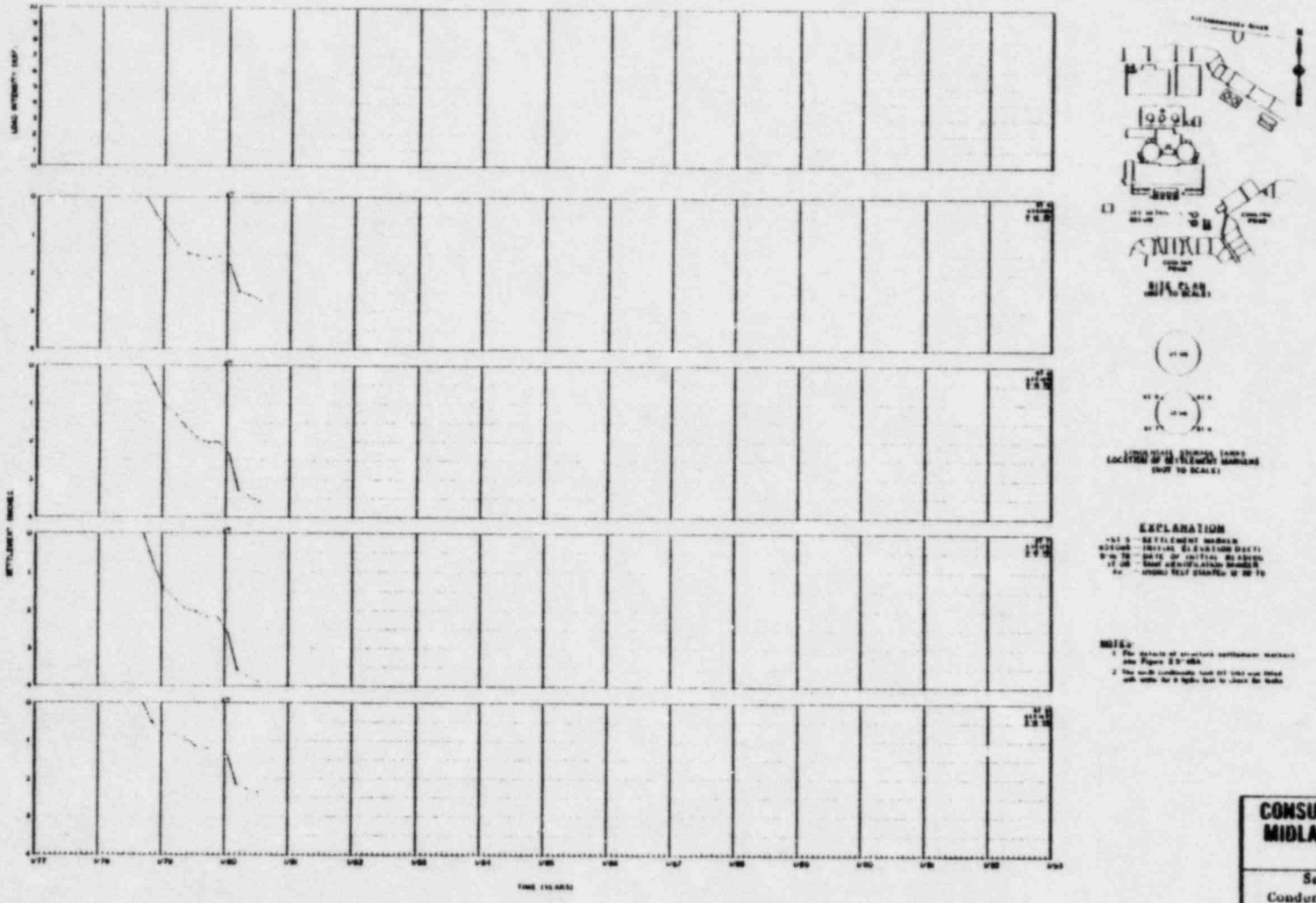




EXPLANATION



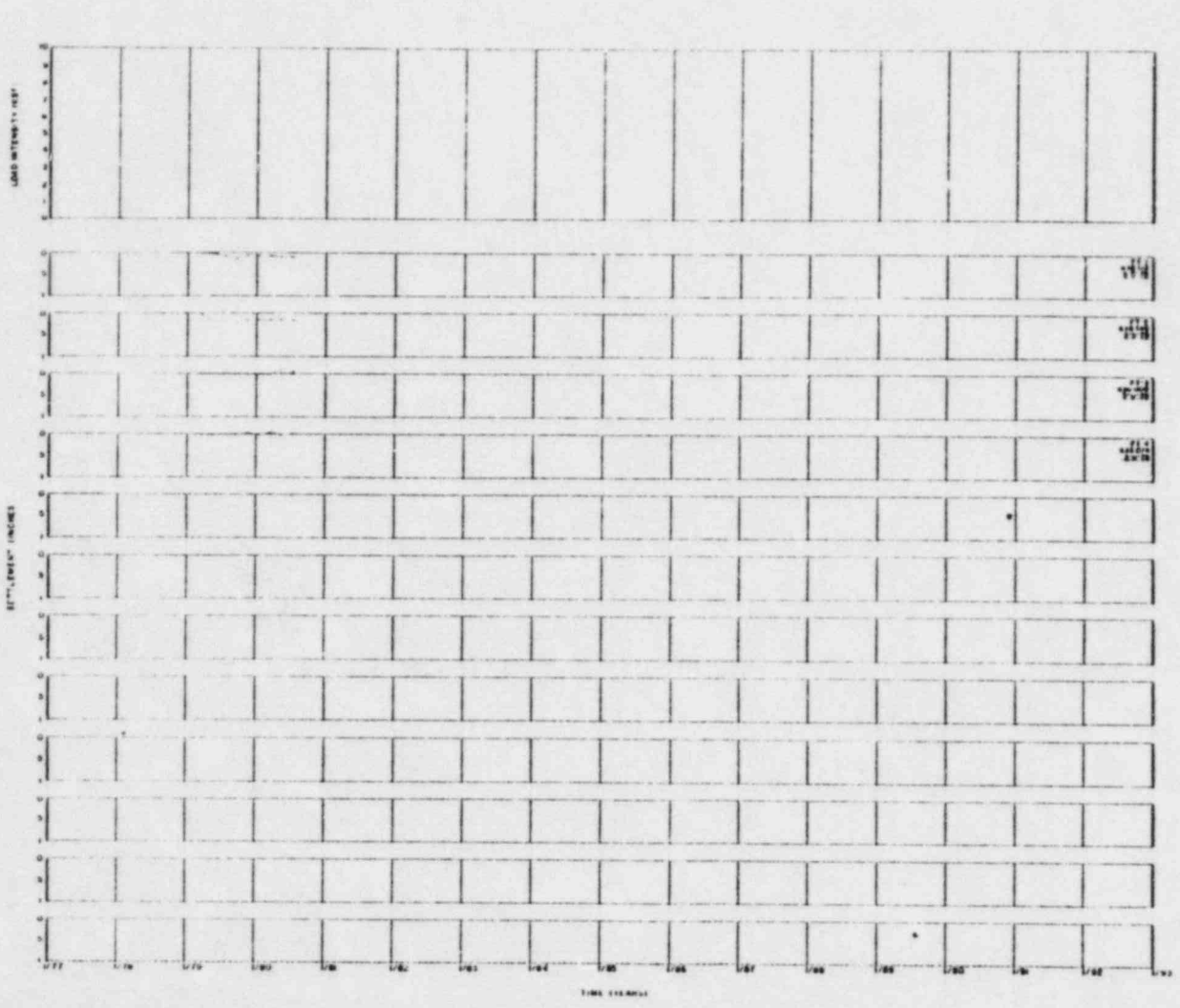
CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Condensate Storage Tanks (Sh 1 of 2) North Tank (SK-G-396, Rev 1)
Figure 13

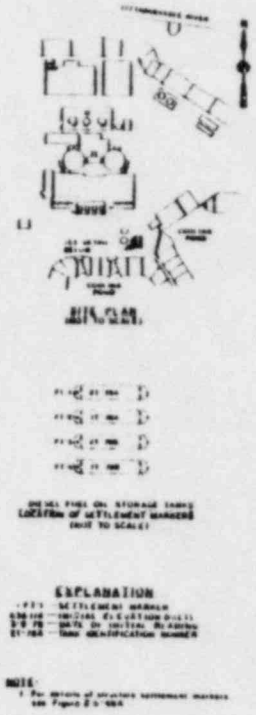


CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

Settlement vs. Time
Condensate Storage Tanks
(Sh 2 of 2) South Tank
(SK-G-422, Rev 1)

Figure 14

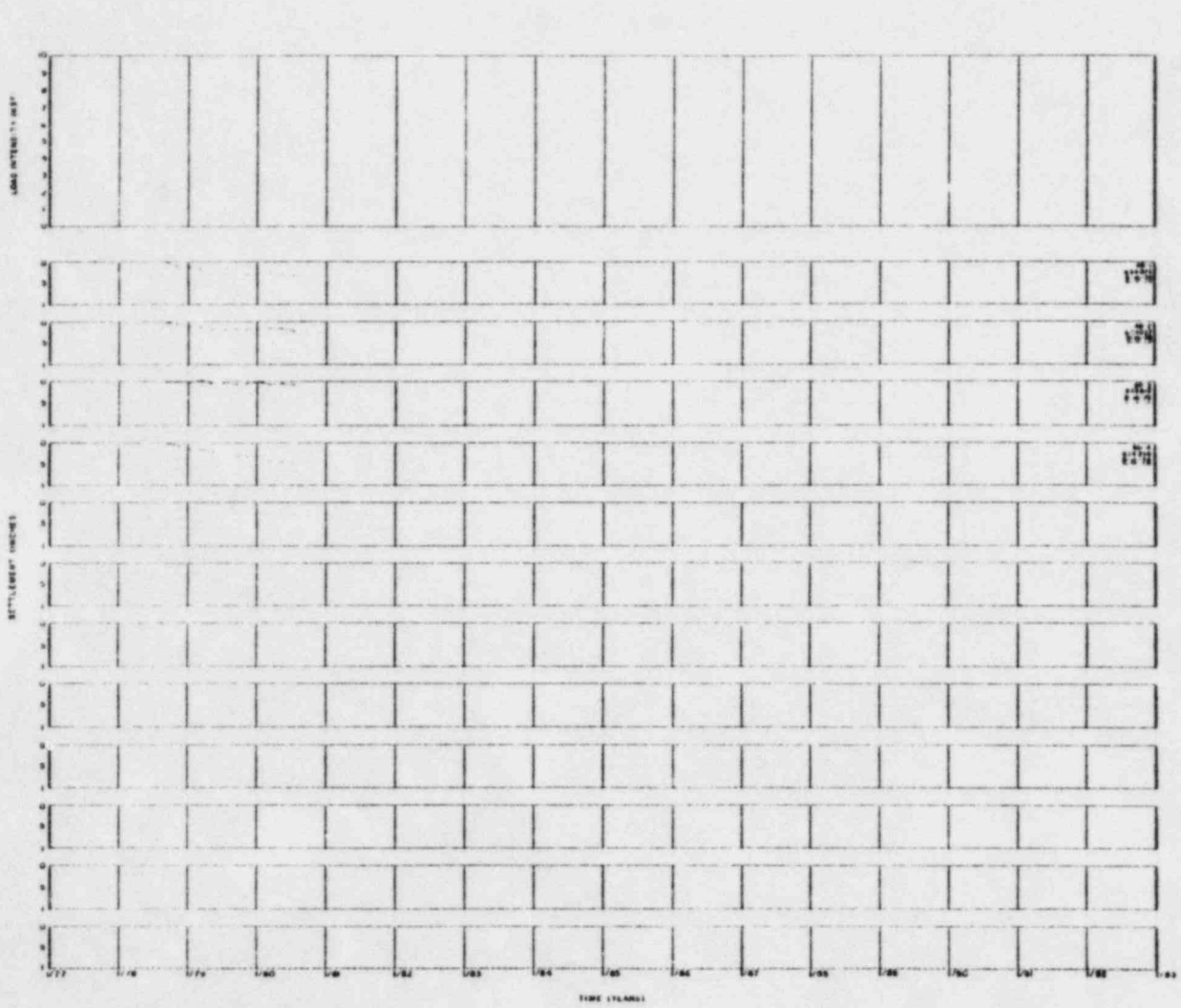


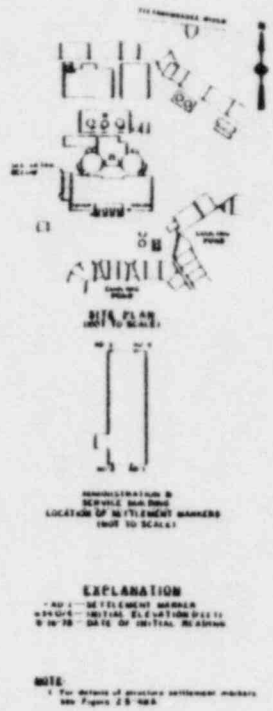


CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

Settlement vs. Time
Diesel Fuel Oil Storage Tanks
(SK-C-402, Rev 1)

Figure 15

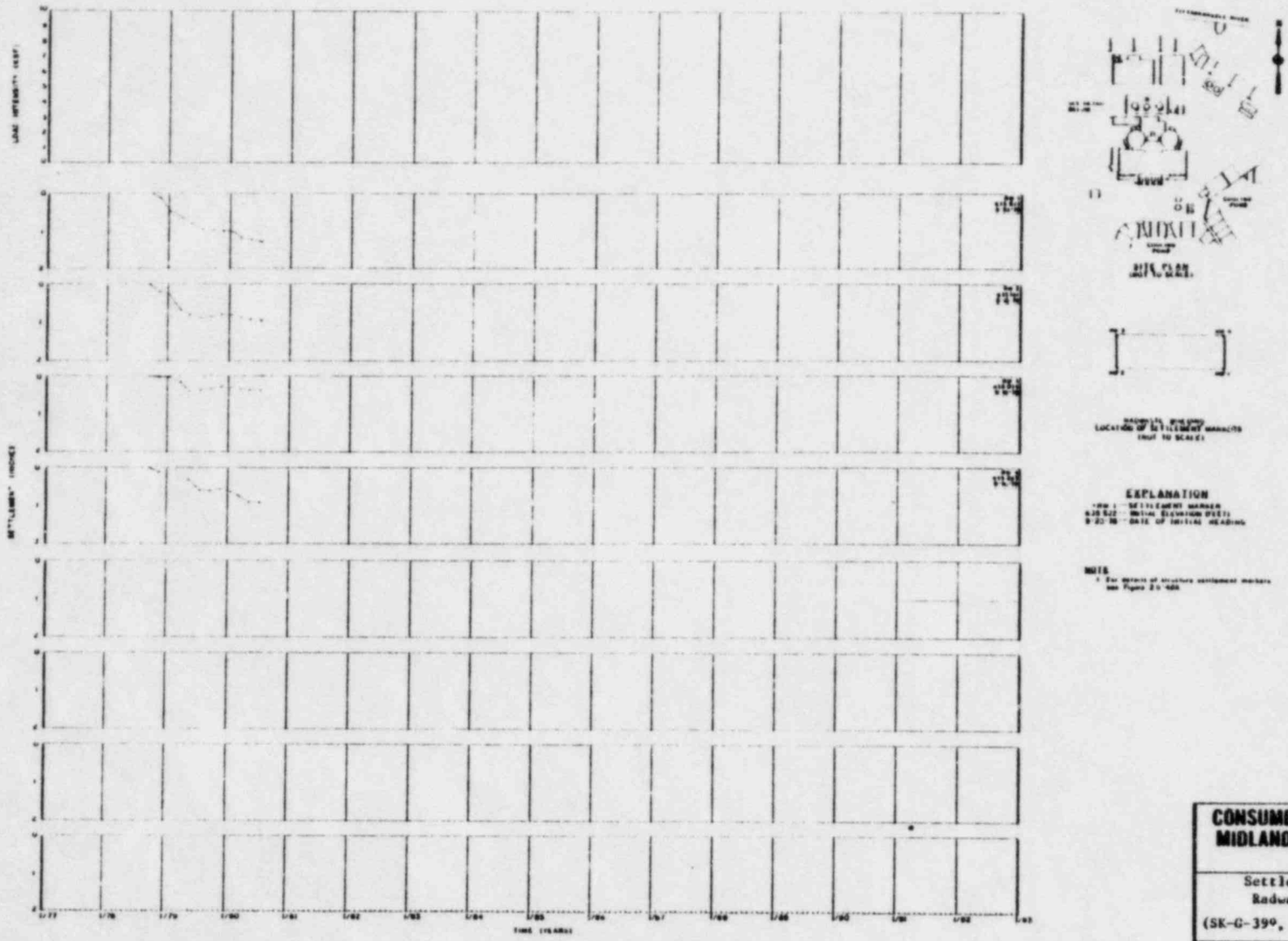




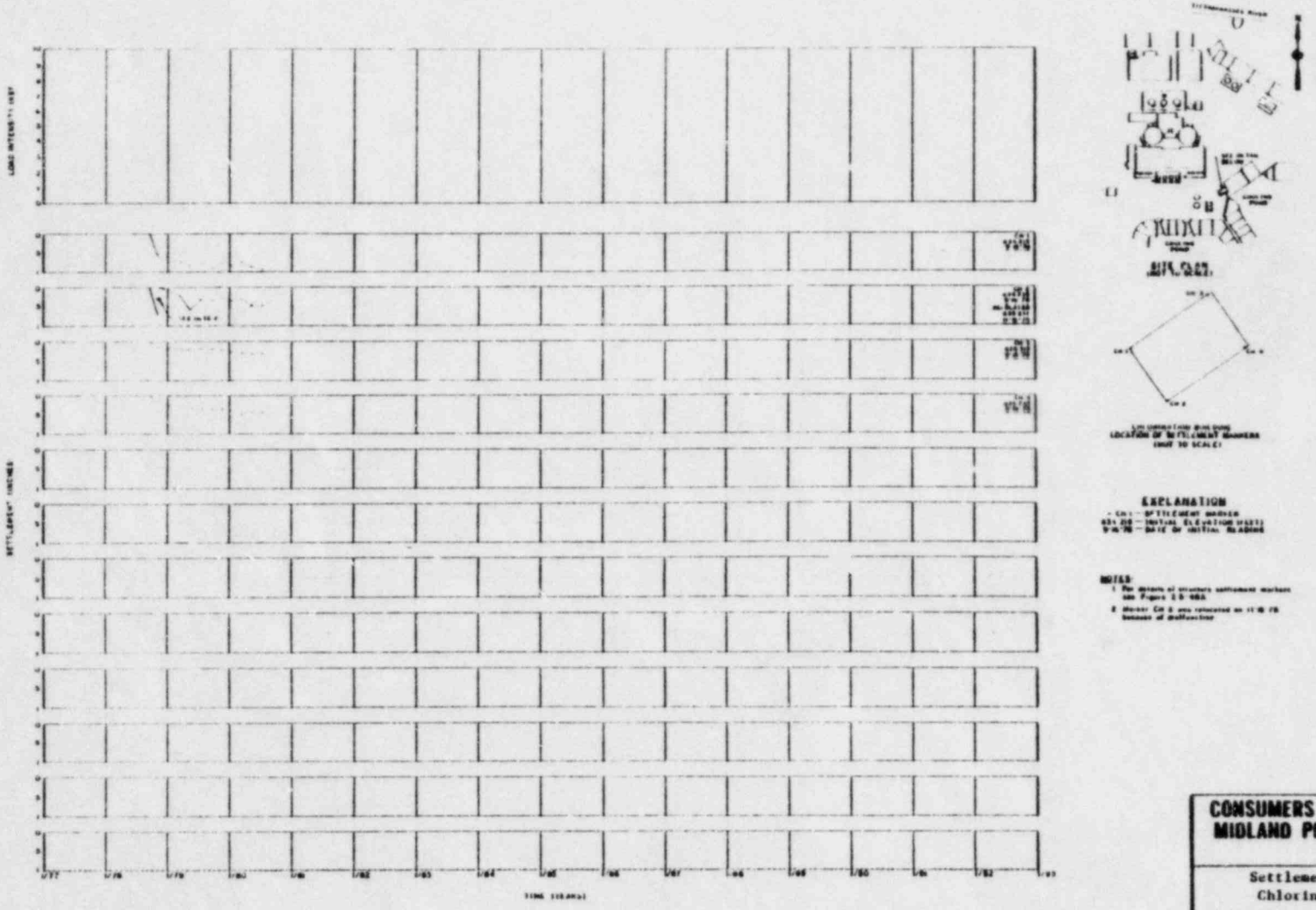
CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

Settlement vs. Time
Administration & Service Building
(SK-G-417, Rev 1)

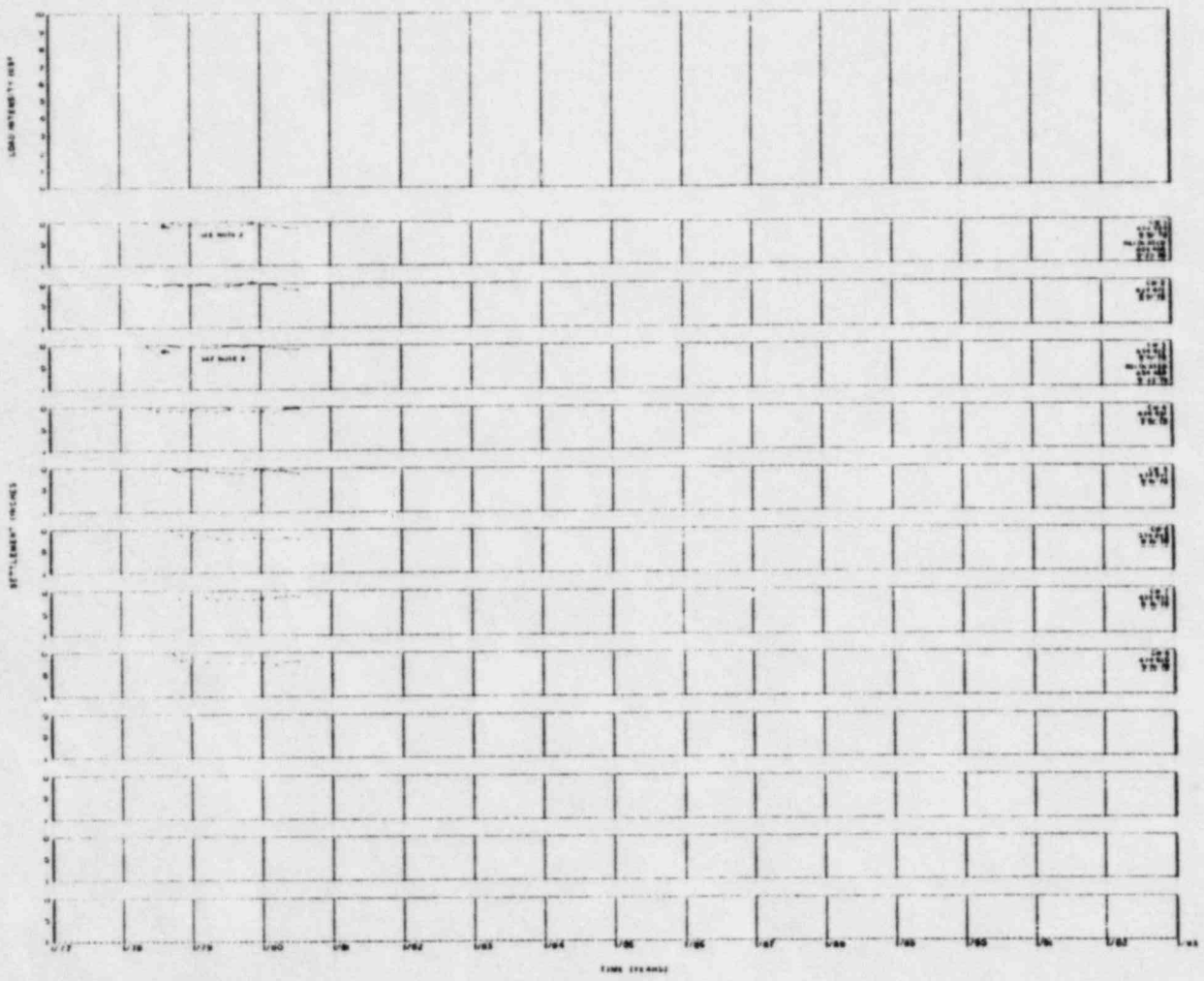
Figure 16



CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Radwaste Building (SK-G-399, Rev 1)
Figure 17



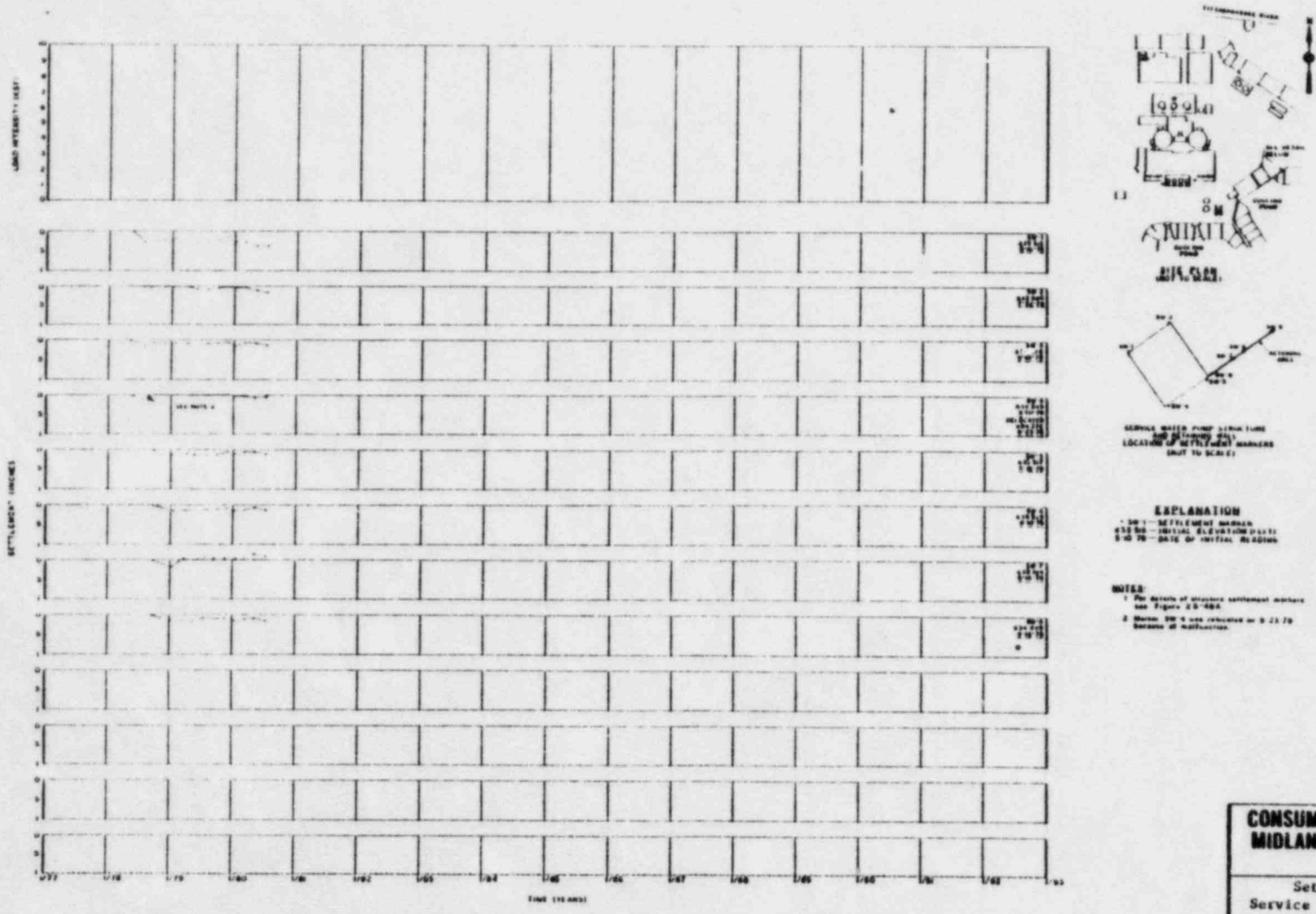
CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Chlorination Building (SK-G-397, Rev 1)
Figure 18



CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

Settlement vs. Time
Circulating Water Intake Structure
and Retaining Wall
(SK-C-409, Rev 1)

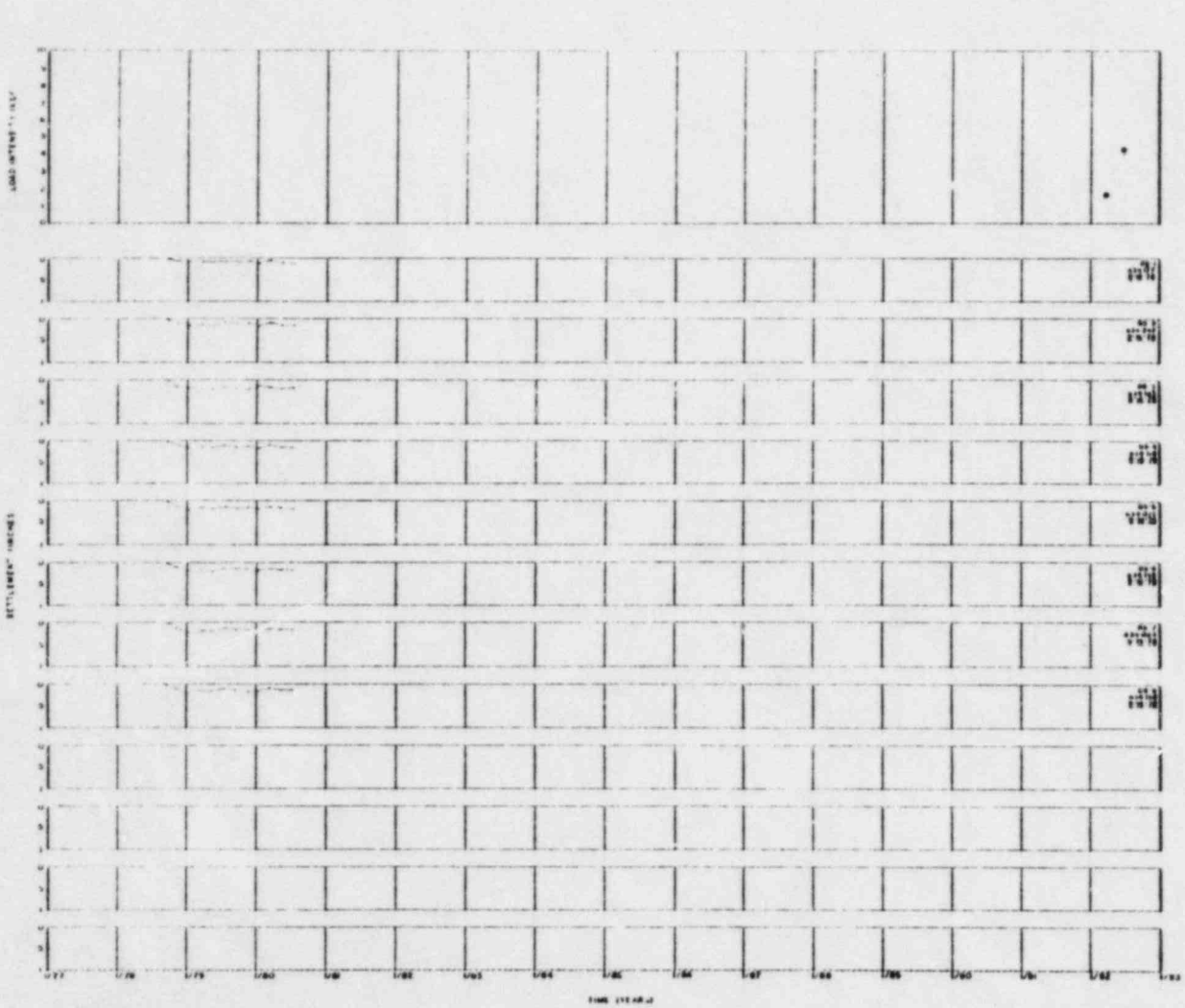
Figure 19

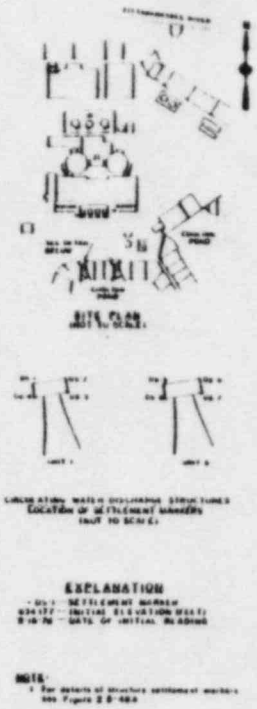


CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

Settlement vs. Time
Service Water Pump Structure
and Retaining Wall
(SK-C-413, Rev 1)

Figure 20

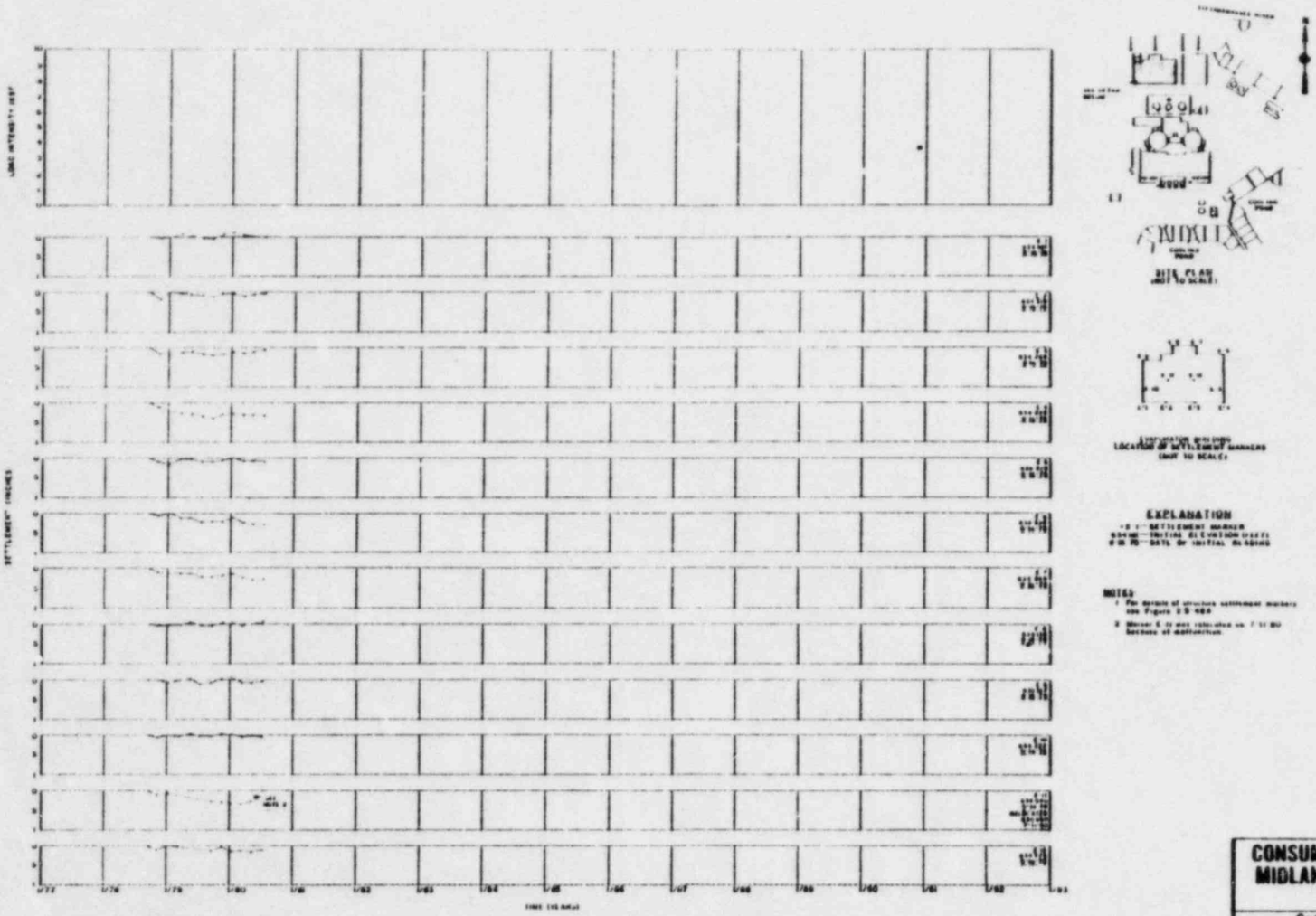




CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

Settlement vs. Time
Circulating Water Discharge
Structures
(SK-G-412, Rev 1)

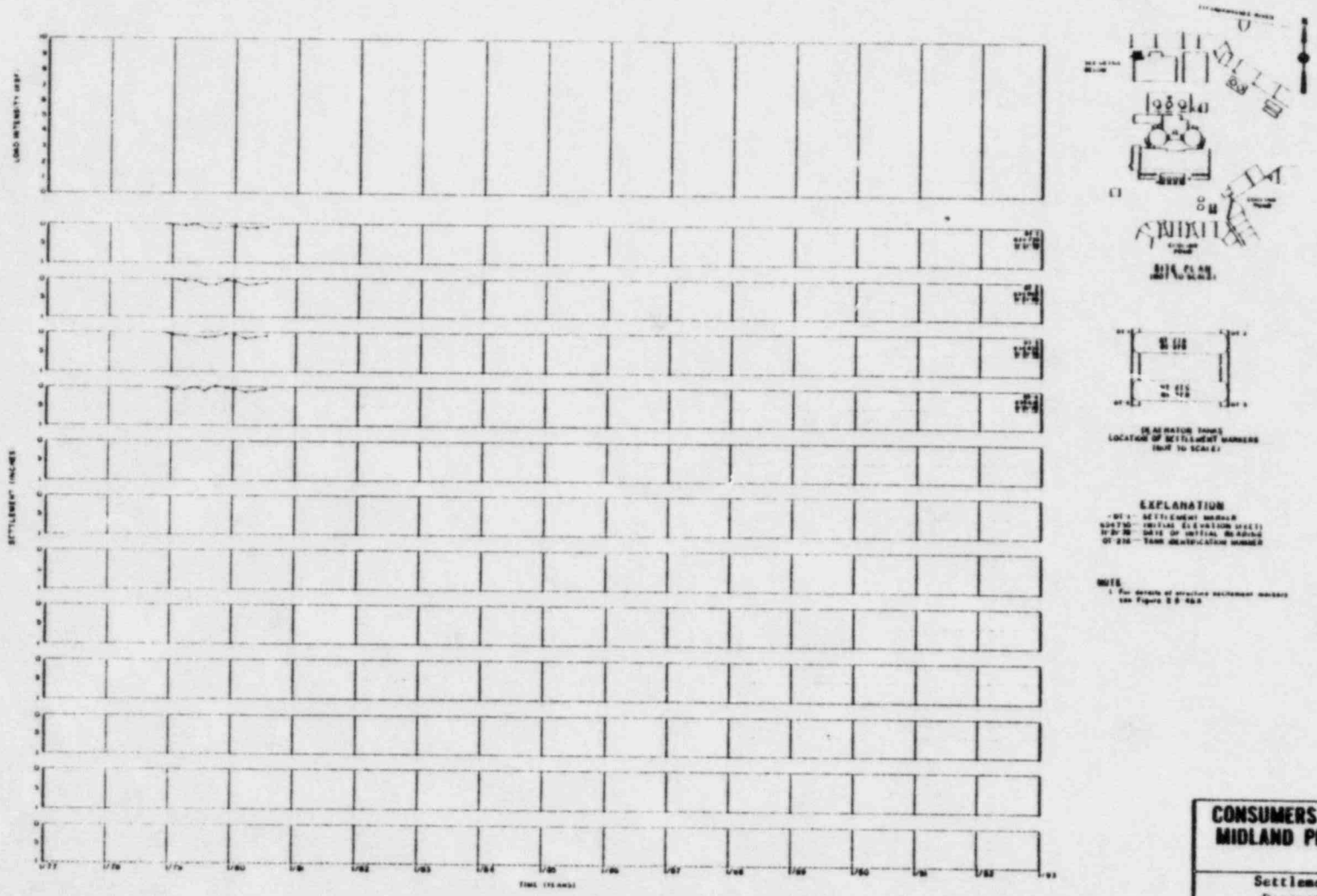
Figure 21



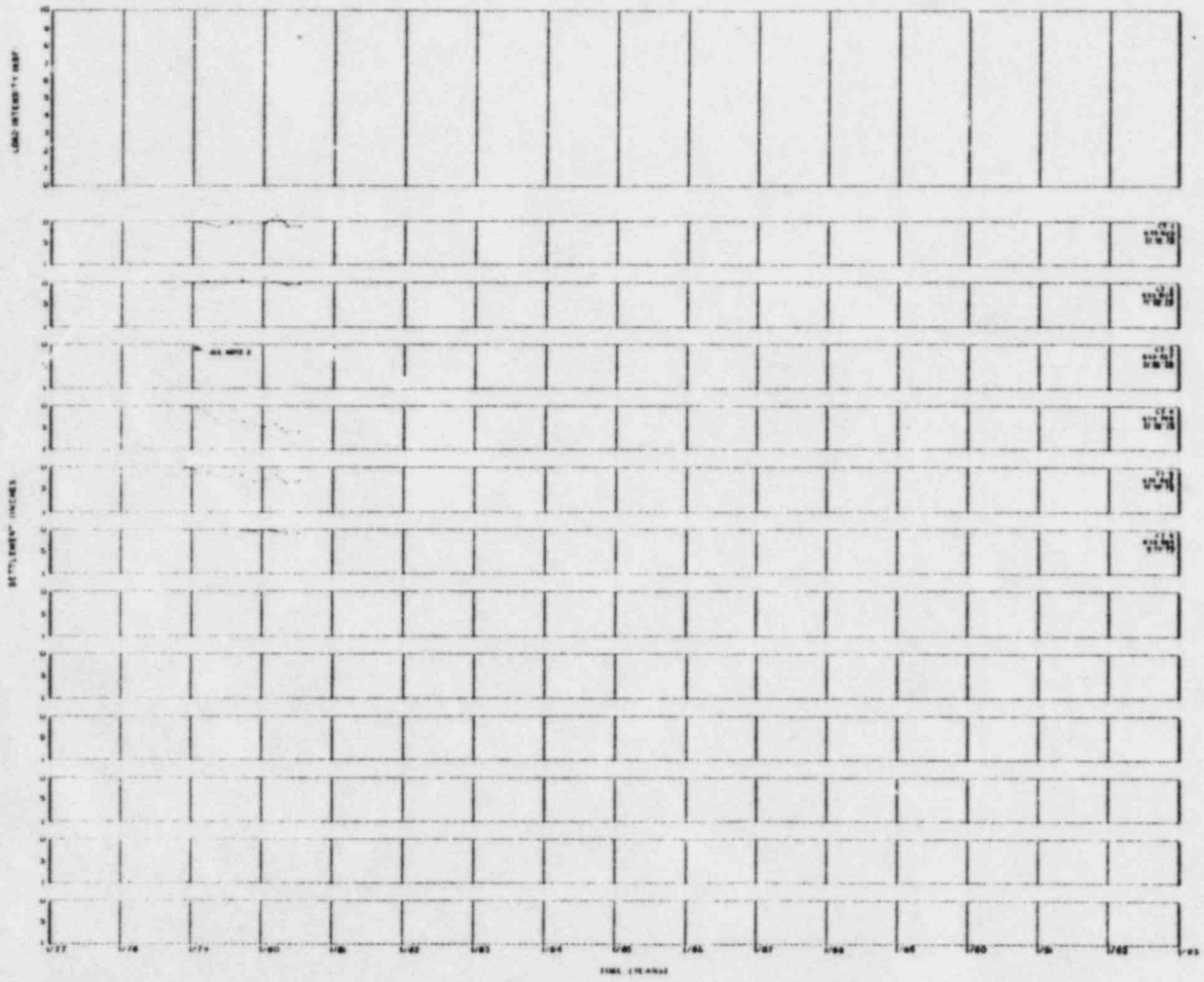
EXPLANATION

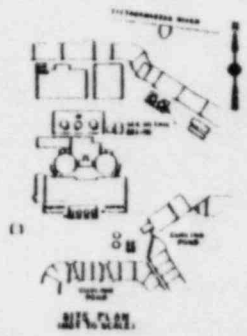
NOTES:

CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Evaporator Building (SK-G-408, Rev 1)
Figure 22



CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Deaerator Tanks (SK-C-404, Rev 1)
Figure 23

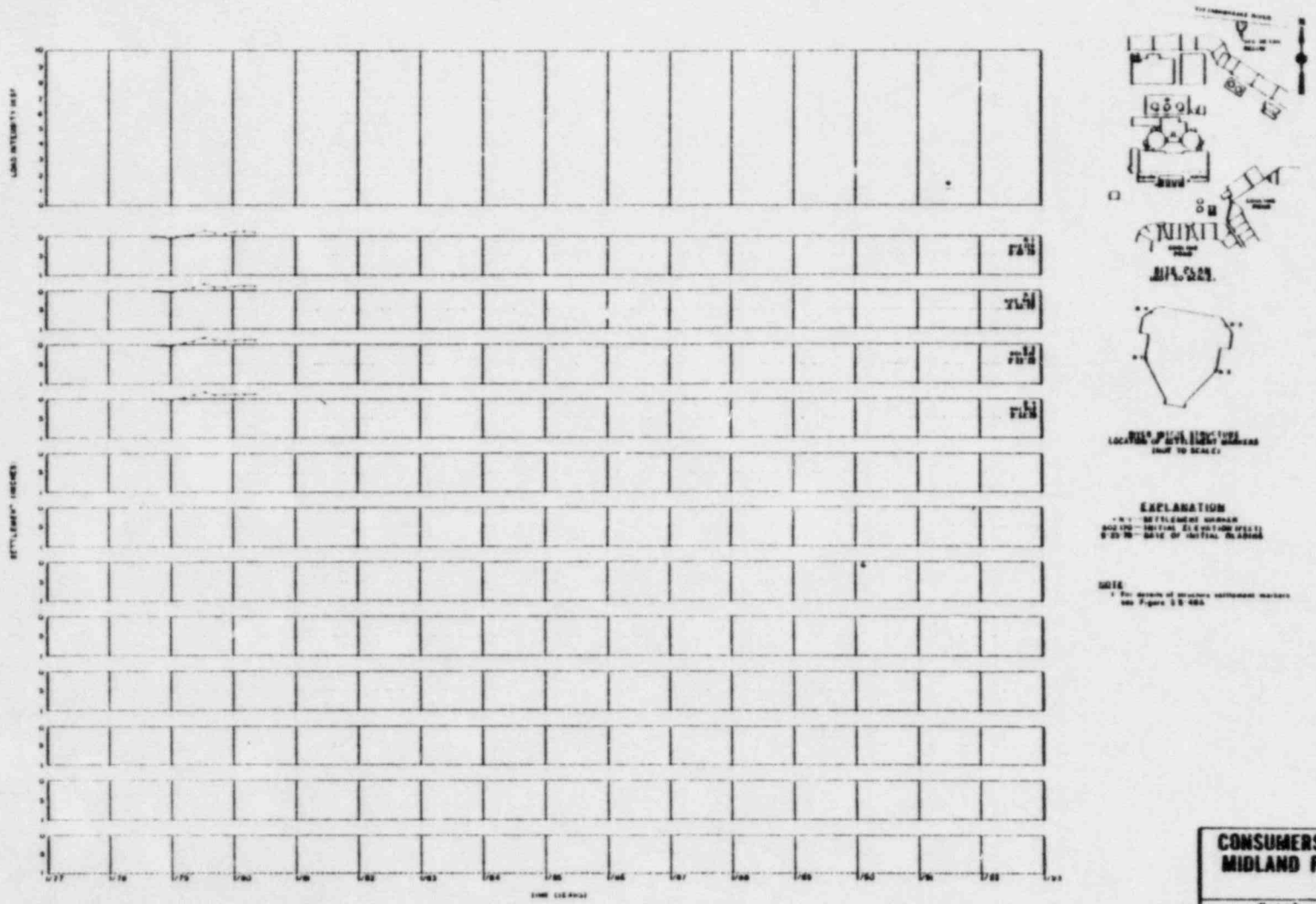




EXPLANATION

NOTE:

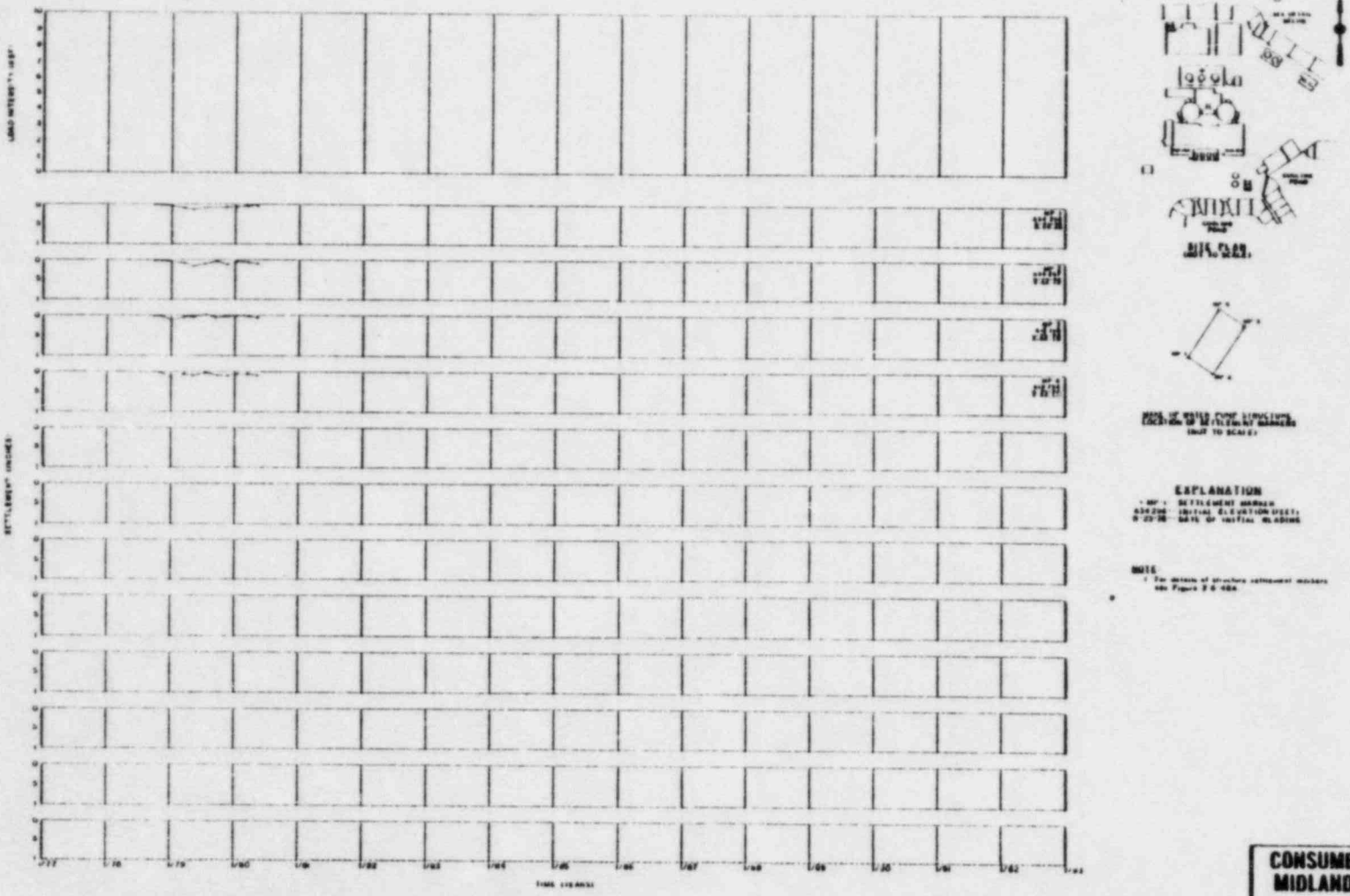
CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Cooling Tower (SK-C-401, Rev 1)
Figure 24



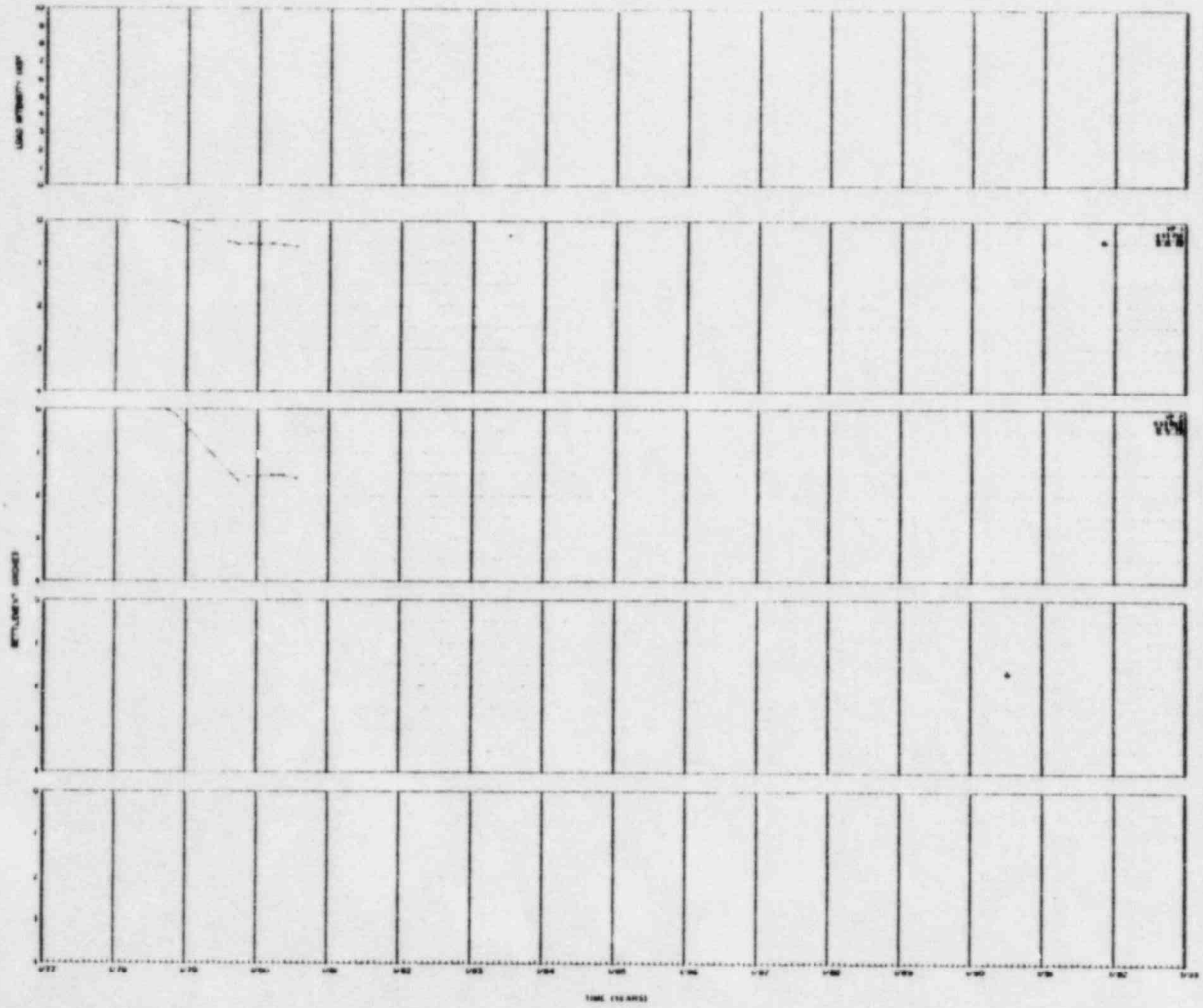
CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

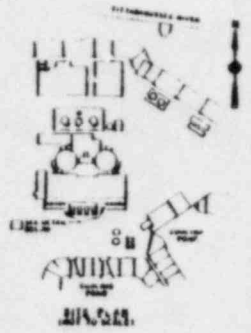
Settlement vs. Time
River Intake Structure
(SK-C-398, Rev 1)

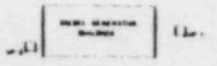
Figure 25



CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Makeup Water Pump Structure (SK-G-403, Rev 1)
Figure 26

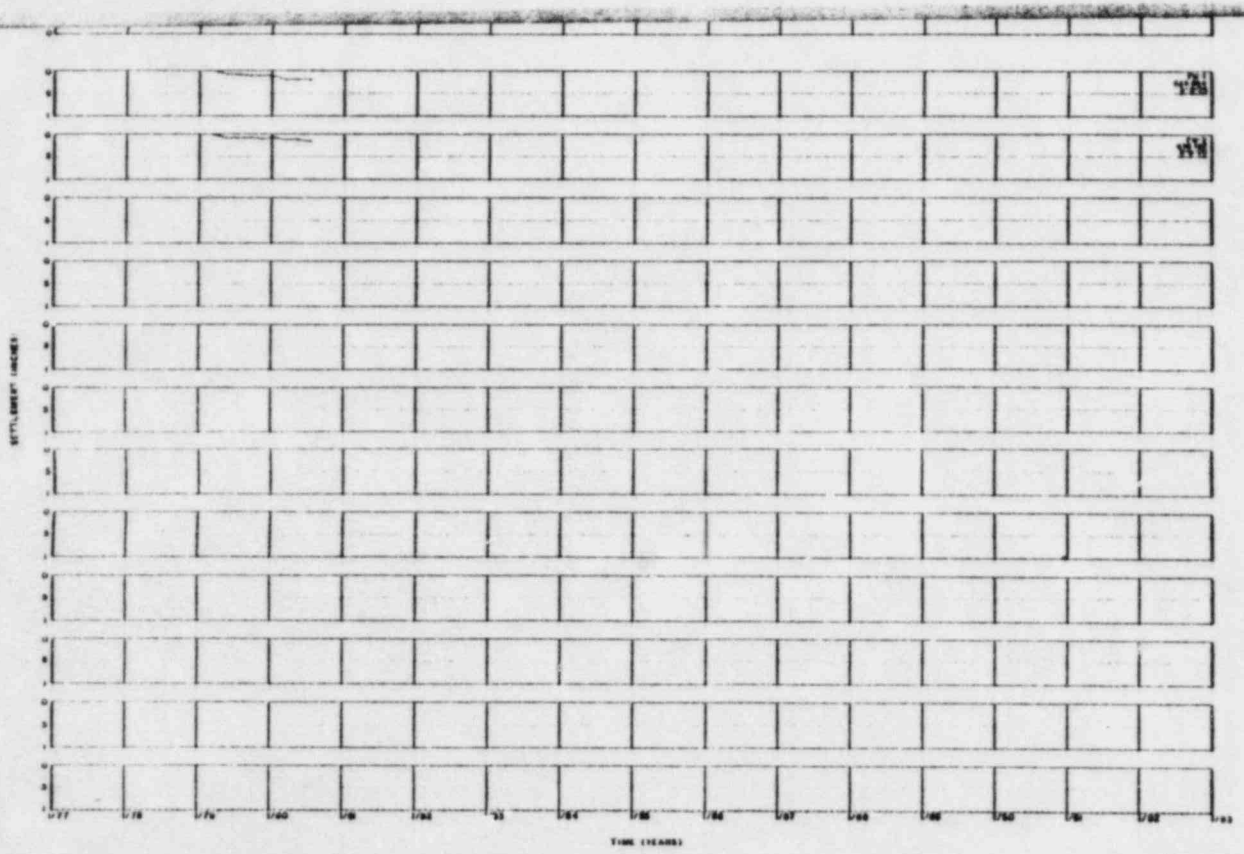


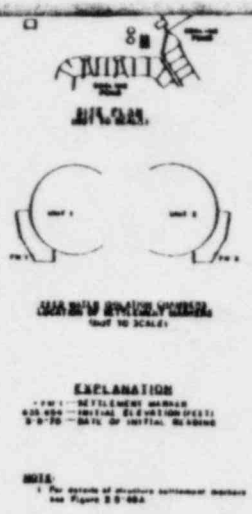




EXPLANATION

CONSUMERS POWER COMPANY MIDLAND PLANT UNITS 1 & 2
Settlement vs. Time Service Water Valve Pits (SK-G-400, Rev 1)
Figure 27





CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

Settlement vs Time
Feed Water Isolation Chambers
(SK-C-395, Rev 1)

Figure 28

Consumers Exhibit #10 (Kane)

TELEPHONE OR VERBAL CONVERSATION RECORD For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.	DATE 4 March 80

SUBJECT OF CONVERSATION

NRC

INCOMING CALL

PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
Paul Hadala	WES	8-542-3475
PERSON CALLED	**OFFICE**	**PHONE NUMBER AND EXTENSION**
NAbelring	NCEED-T	6793

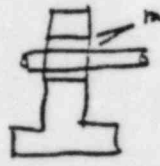
OUTGOING CALL

PERSON CALLING	OFFICE	PHONE NUMBER AND EXTENSION
PERSON CALLED	**ADDRESS**	**PHONE NUMBER AND EXTENSION**

SUMMARY OF CONVERSATION

Paul returned my earlier call. He indicated that a trip report will be forthcoming this week on the Midland trip. Basically it will ask several questions & identify problem areas as follows:

1) He wants to see jacking operation on service water bldg
2) We should ask applicant thru NRC to supply dynamic analysis of intake area under SSE loads.
3) We should look at the rattle space for the various pipe systems. Rattlespace is the areas between the large site pipe sleaves coming into buildings that allows settlement to occur w/o damaging the pipe



Paul also indicated that Tom Davisson, NRC consultant on Bailly is one of the best earthquake experts in the country & that he'll be on our side for Bailly. I called to ask him (Dr Hadala) to attend the 10 March 80 Mtg in Champaign-Urbana. He probably will & the situation will be discussed between he & Jim Simpson since they are together at a conference @ WES on another matter.

NAb 4 March 80

DA FORM APR 66 751 REPLACES EDITION OF 1 FEB 58 WHICH WILL BE USED.

COE SWT Testimony ... can be eliminated

DGB only COE-8, COE-13
SW Structure COE-16
Retaining Walls COE-14
Auxiliary Bldg COE 17 & 18

5/27/80
I-4

Consumers Exhibit # 11 (Kane)

NRC Position -- Diesel Generator Building

Vu No.1 CPCo Position No.1

1. Let's look at the preload program completed at Midland:
   Plan view of DGB - Start w/ Vu No 1. Stress need to consider time element
   - Outline of structure, 4 bays **Vu No.2**
   - Areal extent surcharge was placed
   - Extent of conduits & piping beneath DGB (service water, circulating water)
   - Location of sectional views A & B

   Sectional Views A & B **Vu No.3 & 4** Point out depth of fill (30' ±) Point out level to which we feel GWT rose during surcharging

2. Discuss uniqueness of preloading program completed at Midland
   - Placed after structure & conduits had been placed. Effects.
   (Show working drawings Fig.14 Settlement Data
   Note non-uniform, unusual settlement pattern
   Working Drawing Fig.60 - Surveyed Pipelines *Stress concern is for differential settlement & overstressing of conduits
   - Concern of overstressing pipes. Difficulties in monitoring & evaluating future settlement of safety related piping

3. CPCo Position No. 2 **Vu No.1** concerning stresses produced in fill under surcharge
   Vu No.5

4. Staff Position **Vu No.6** - Surcharge load apparently just meets DL+LL+ Effect of Dewatering. Does not allow for additional environmental loads. Normal practice in surcharge programs - Place a surcharge load that is 1.5 times final load to assure secondary consolidation is reached.

5. CPCo Position No.3 **Vu No.1** - Settlement Data **Vu No.7** Presented by Dr. Peck at Aug. 29, 1980 meeting
   - Shows decrease in rate of settlement after 100 days. Rebound.
   - Time period where surcharge was imposed in secondary consolidation was approximately 90 days.
   - Note that graph conveniently plots only settlement after surcharge was placed.

(1st 6. CPCo Position No.4 **Vu No.1** - Settlement & Piezometer Data
Show **Vu No.8**) Presented by Dr. Peck at Aug. 29, 1980 meeting
   - Cover info presented (Settlement - arithmetic scale, pond levels, PZ-30 behavior (particularly after removal) & surcharge load history
   - Show disagreement with previously submitted data (**Vu No.9**) at critical time of surcharge removal for PZ-30.
   - Show previously submitted Fig 27-5 (**Vu No.10**) where PZ-23 behavior at time of surcharge removal has been deleted & replaced w/ PZ-30 data but all other data (Settlement of DG-3, pond & surcharge) remains unchanged Show how PZ-23 supports our concern that secondary consolidation was not reached by observed behavior. Show other piezometers, PZ-36 **Vu No.11** and piezomter PZ-47 **Vu No.12**

7. CPCo Position No. 5 **Vu No.1** State of the art limitations
   - thin samples - True. However in some respect we have better control to duplicate long term field conditions which did not develop during surcharging period.
   - sample disturbance - Available methods for correction **Vu No.13**
   - problems in selecting representative samples - a problem that a geotechnical engineer faces in nearly every aspect of our work. Knowing the problem exists should not prevent us from facing it, using experience & best judgment.

Vu Ltr
3 of 4
9/27/80

8. CPCo Position No. 6 **Vu No. 14**
- Cite NRC experiences — Virgil C. Summer
- Fact that Midland design used the present state-of-the-art approach (undisturbed sampling & consolidation testing) to show that the foundation glacial materials were, in fact, preconsolidated under former glaciers. Here CPCo accepts the state-of-the-art because it does not cause them a problem
- Shows on **Vu No. 15** what we would expect (At depth testing & establishment of preconsolidation pressure.

9. CPCo Position No. 7 **Vu No. 14** Effect of temporary dewatering
-- Both NRC & COE anxiously await the details of the temporary dewatering now being conducted. The information that has been submitted to date, is conceptual and does not permit us to reach an agreement on the adequacy of the temporary dewatering scheme. We do not know their specific plans for monitoring of the water table for both drawdown, and for further settlement. The ~~data~~ results from the temporary dewatering could provide additional important settlement data but it highly unlikely the zone of dewatering influence will resolve all our concerns with the DGB and the additional borings and lab testing will still be required.

10. CPCo Position No. 8 **Vu No. 14** Future Monitoring
Because of the known settlement problem & concern — Midland during plant operation will be required to have strict tech. specs on settlement monitoring, ~~similar to~~ in much more detail than Zion.
There are some very serious concerns on the adequacy of monitoring settlement on buried safety related piping & conduits. the requested laboratory testing is viewed by both

J. Kane
4 of 4-
9/27/80

the COE & the NPC staff as a necessary approach to accurately predict the range of future settlements and satisfy ourselves that expected settlements will not exceed tolerable limits. Data and observations from the surcharge program pose questions as to its success because of the time it was imposed and the magnitude of the load. We view the additional testing as a reasonable way to resolve the concerns on the effectiveness of the preload program.

11. Summarize our concerns on the effectiveness of the Preload Program: we have concerns because
    a. Estimated settlement and piezometric levels made BEFORE the preloading were never reached. We are concerned that settlement is "tale" -
    b. Not following the usual practice of requiring a surcharge load equal to 1.5 times the final load to assure reaching secondary consolidation
    c. The behavior of certain piezometers after surcharge removal to cause concern that secondary consolidation was not reached

— Support for our position for testing * Vu No. 15 statement in Peck's testimony

12. CPCo Position No. 9, 10 & 11 — Bearing Capacity
Vu No. 14

List of Vugraphs for Diesel Generator Building

No.	Subject
1	CPCo Position List - DGB
2	Plan - DGB Area
3	Section A - DGB
4	Section B - DGB
5	CPCo graph of stress vs. depth
6	COE graph of stress
7	CPCo Measured & Predicted Settlement
8	CPCo Typical Settlement & Piezometer Data
9	PZ-30 Data (not yet made - Fig. 27-32)
10	Settlement & Piezometer Data (not yet made - Fig 27-5)
11	PZ-36
12	PZ-47
13	Consolidation Test Report
14	CPCo Position list (cont.)
15	Page from "Foundation Engineering" textbook

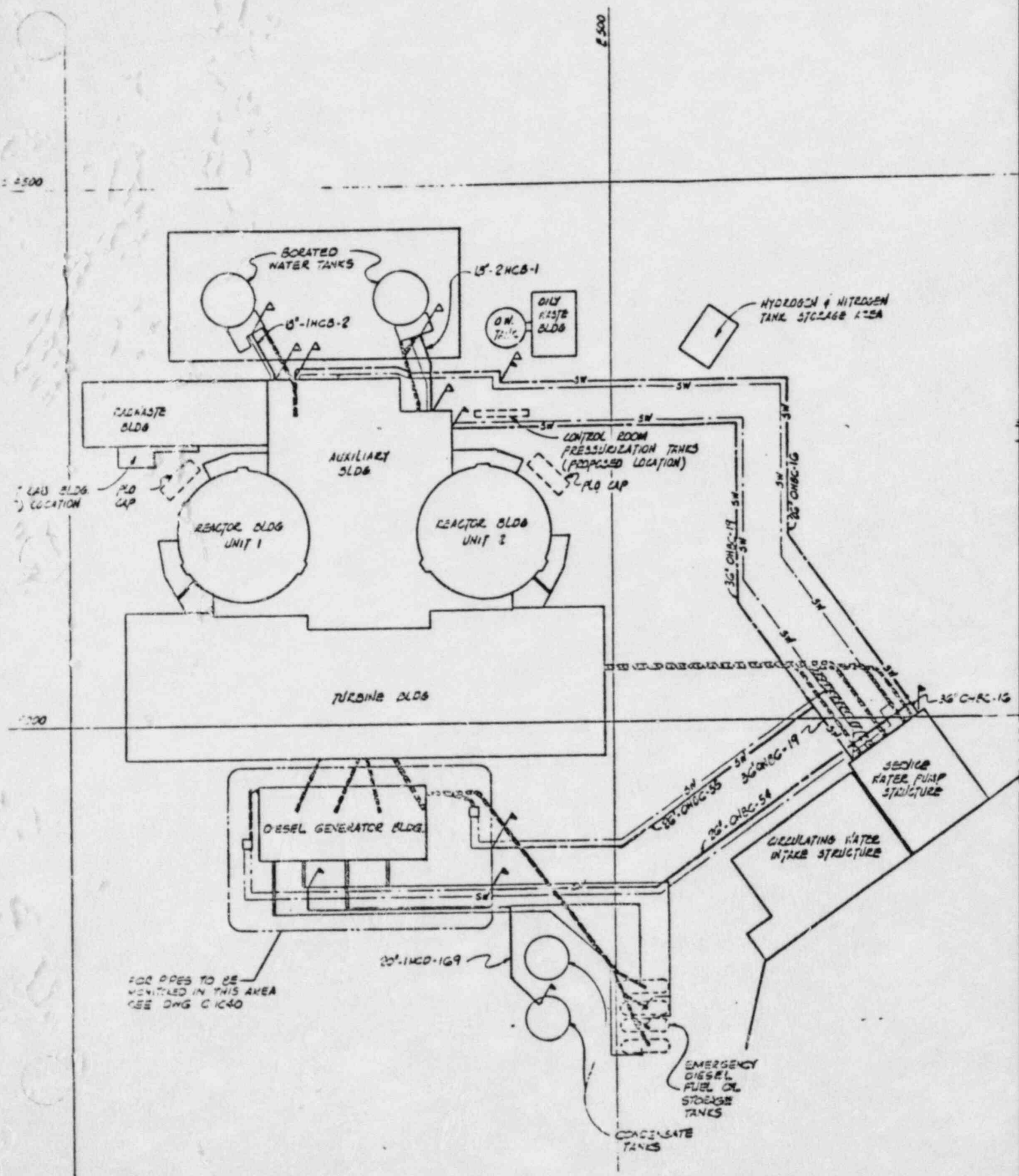
Consumers Exhibit # 12 (Kane)

J. Kane
9/27/80

CPCo Position - Diesel Generator Building

1. Full scale field test is the most reliable technique to predict settlement. The surcharge program allowed for direct measurements of settlement, therefore, no need to rely on sampling & lab testing. NRC Response
   Discuss importance of time element
2. Surcharge produced stresses in the fill in excess of stresses to prevail while DGB is operational.
3. Settlement data recorded during surcharge program showed:
   a. Eventual decrease in rate of settlement.
   b. Slight rebound after surcharge removal.
   c. Straight line behavior representative of secondary consolidation.
4. Piezometer data recorded during surcharging showed
   a. Rapid dissipation of pore water pressure, indicating rapid consolidation.
   b. Following surcharge removal, a slight drop in piezometric level occurred, and level eventually stabilized with groundwater table.
5. Recognized sampling & lab testing limitations.
   - thin (e.g. 3/4" thick) test samples
   - unavoidable sample disturbance
   - problems in selecting representative samples

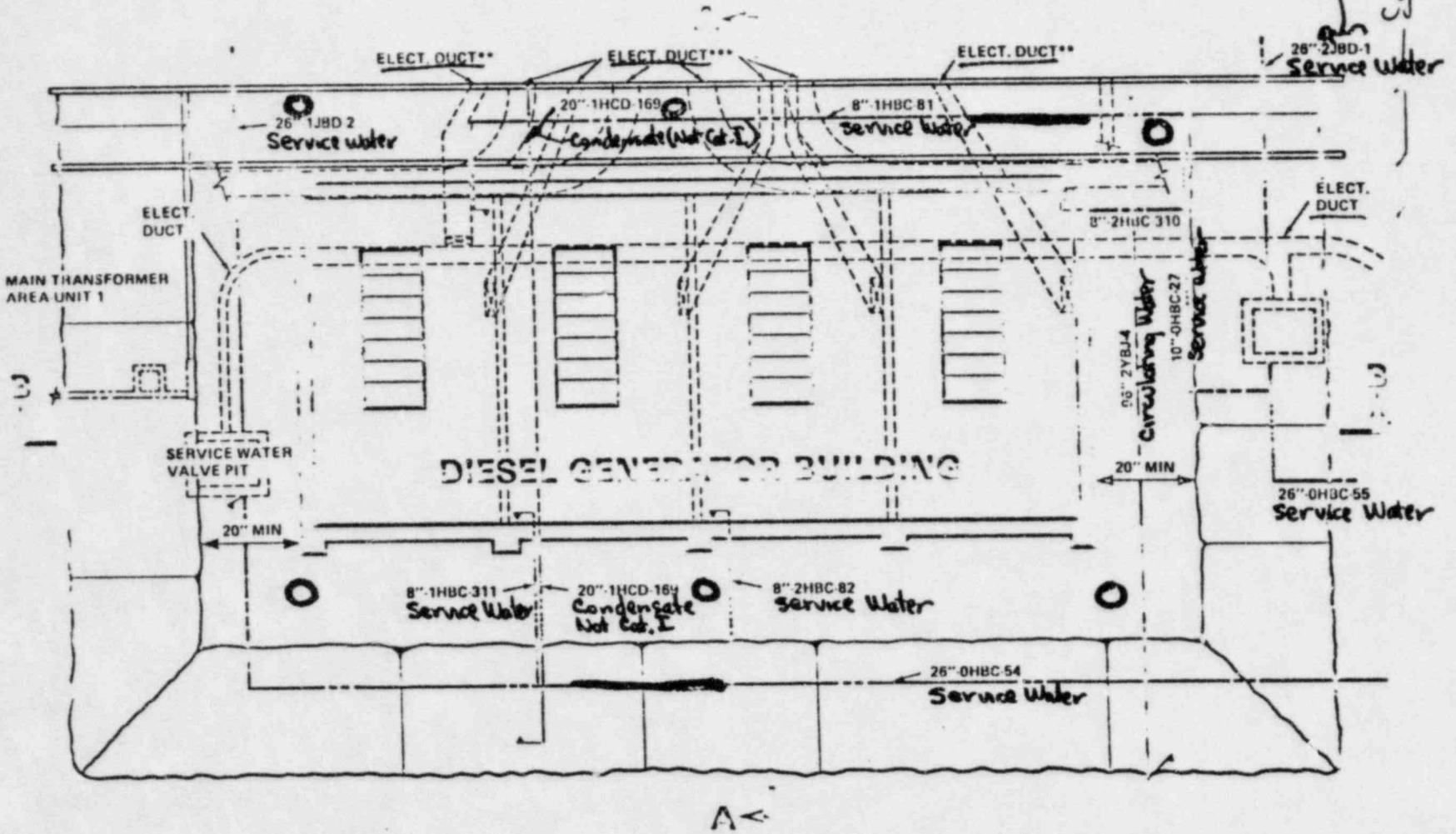
Vugraph 1


BORATED WATER TANKS
15"-2HCB-1
8"-1HCB-2
OILY WASTE BLDG
HYDROGEN & NITROGEN TANK STORAGE AREA
RADWASTE BLDG
AUXILIARY BLDG
CONTROL ROOM PRESSURIZATION TANKS (PROPOSED LOCATION)
PLO CAP
REACTOR BLDG UNIT 1
REACTOR BLDG UNIT 2
TURBINE BLDG
DIESEL GENERATOR BLDG
SERVICE WATER PUMP STRUCTURE
CIRCULATING WATER INTAKE STRUCTURE
EMERGENCY DIESEL FUEL OIL STORAGE TANKS
CONDENSATE TANKS
FOR PIPES TO BE INSTALLED IN THIS AREA SEE DWG C-1040
20"-1HCD-169
SW

Material
B = Carbon steel
C = Stainless steel

Pipe Size — Unit Designation — Service No
8" - 1 HBC - 81
Pressure rating — Material — Applicable code e.g ASME

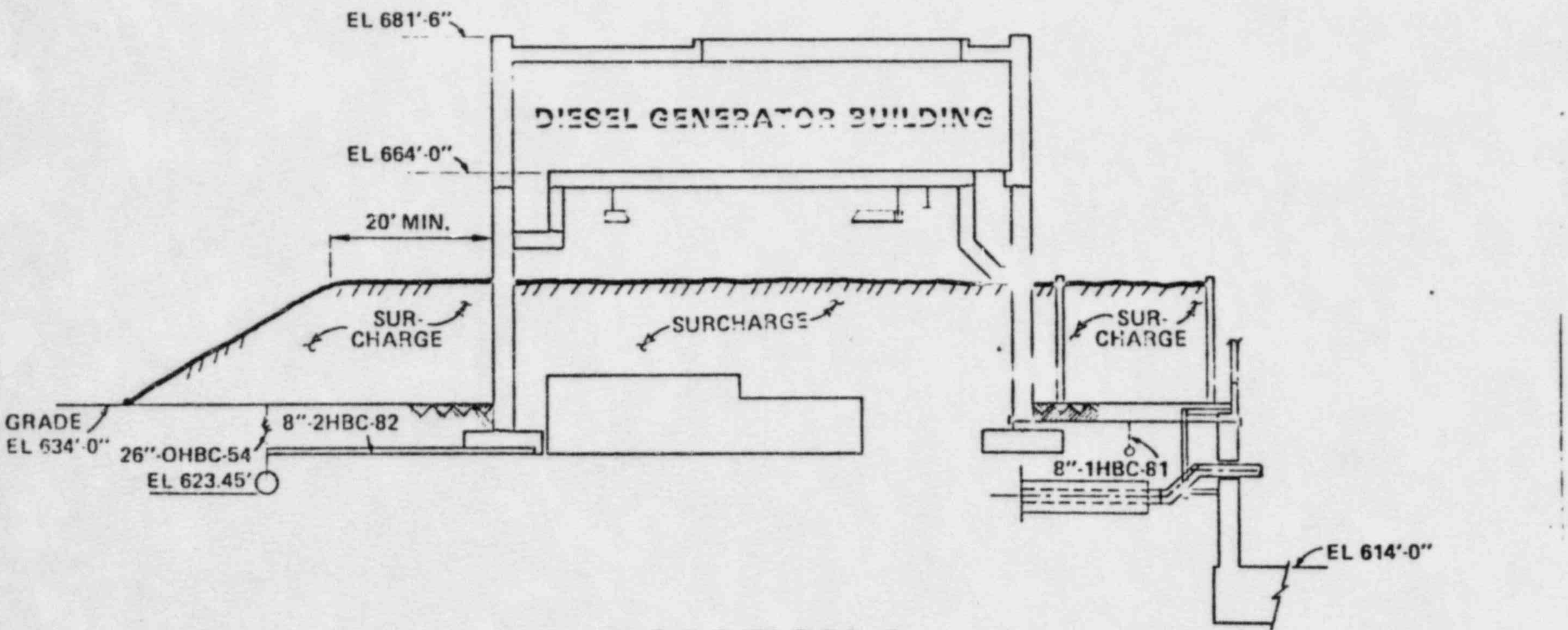
pipe class



O Proposed COE boring locations (Approximate)

Vugraph No 2

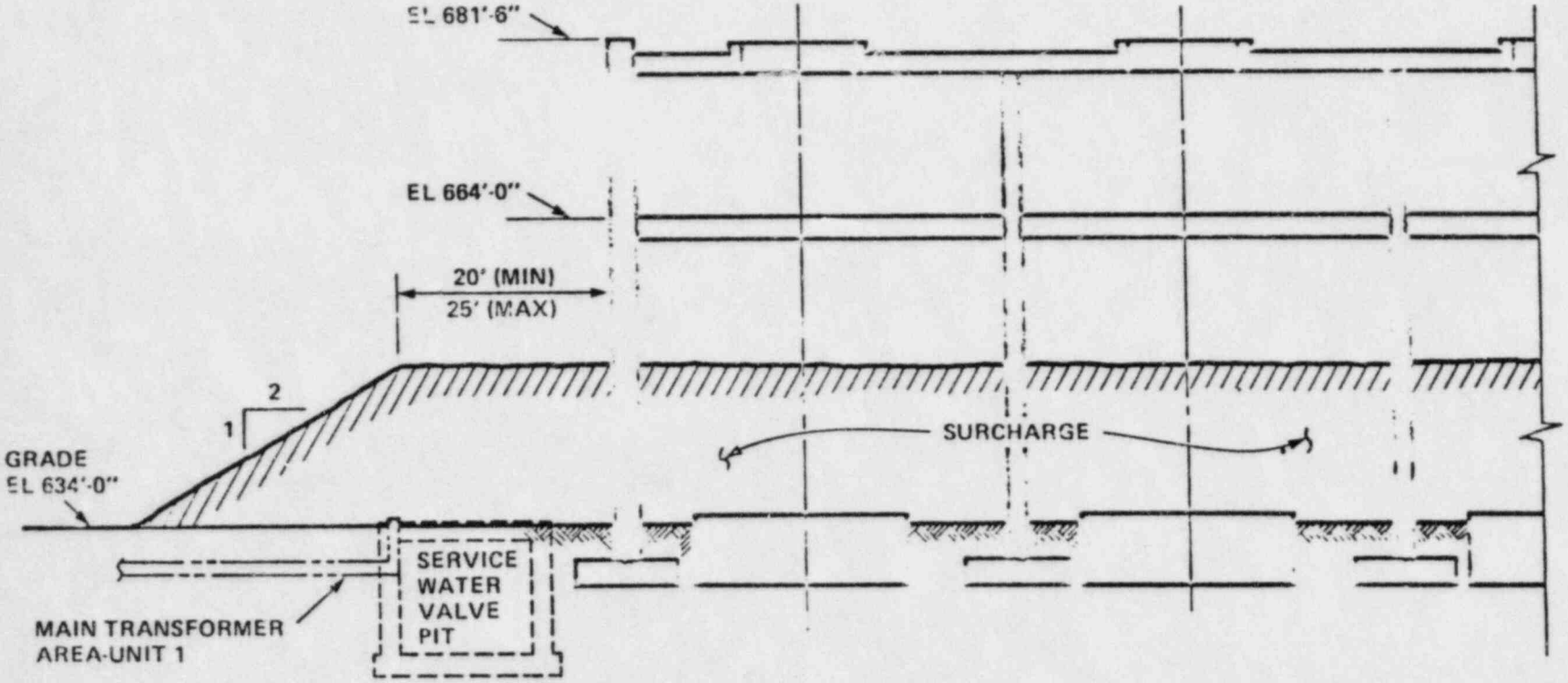
Vugraph 2



SECTION A

Vugraph 3

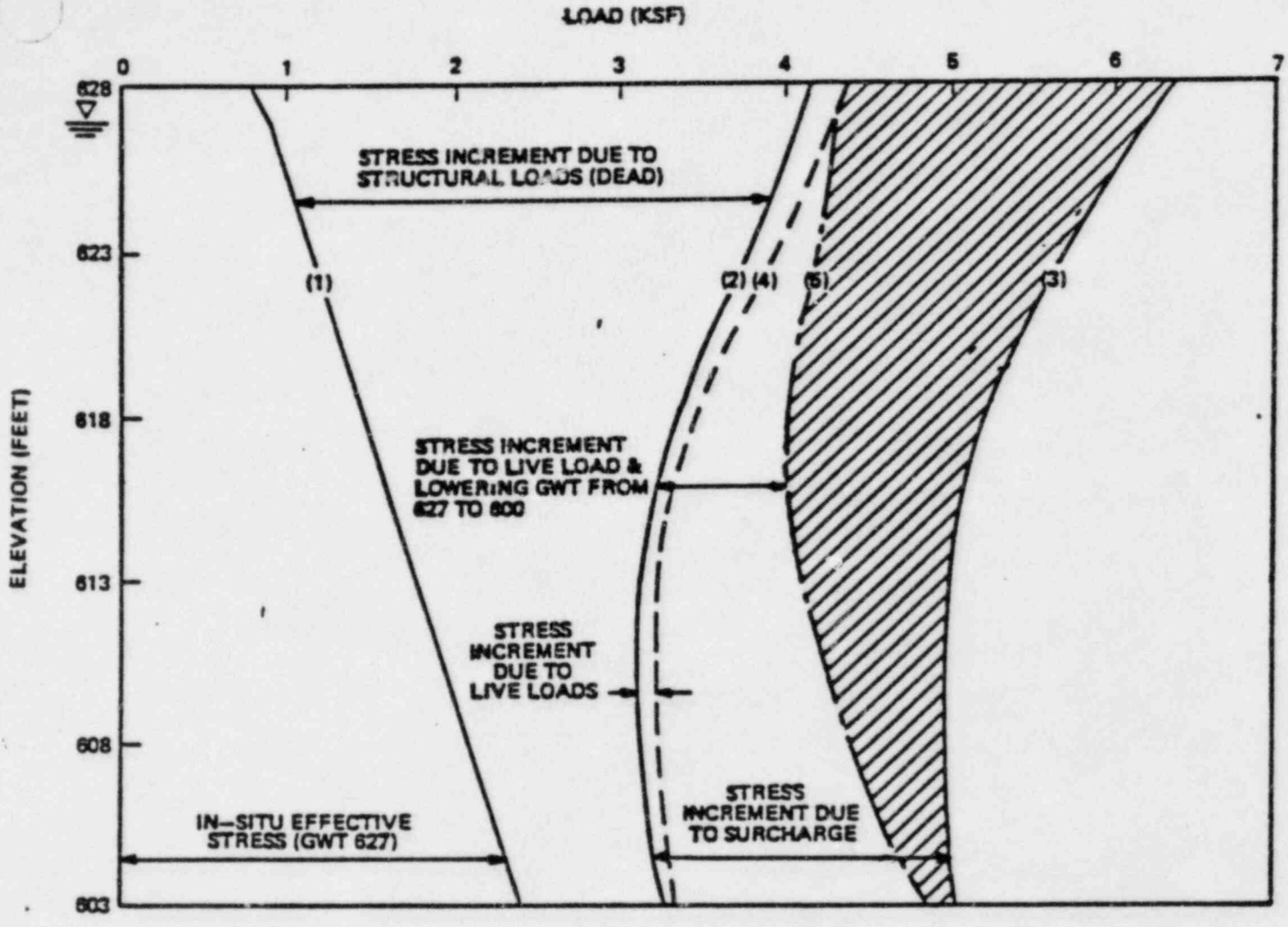
DIESEL GENERATOR BUILDING



SECTION B

Vugraph 4

Figure 2
(See Reference 1)



NOTES:

1. (1) In-situ effective overburden pressure GWT at 627.
2. (2) Total effective pressure due to in-situ effective overburden pressure and structural dead loads.
3. (3) Total effective pressure at the end of surcharge due to in-situ effective overburden pressure, structural dead loads, & surcharge loads.
4. (4) Total effective pressure due to in-situ effective overburden pressure, structural dead loads, & live loads.
5. (5) Total effective pressure during the life of plant operation due to in-situ effective overburden pressure, structural dead loads, dewatering loads, & live loads.

COMPARISON OF EFFECTIVE STRESS AT
1) END OF SURCHARGE AND 2) DURING
LIFE OF PLANT OPERATION

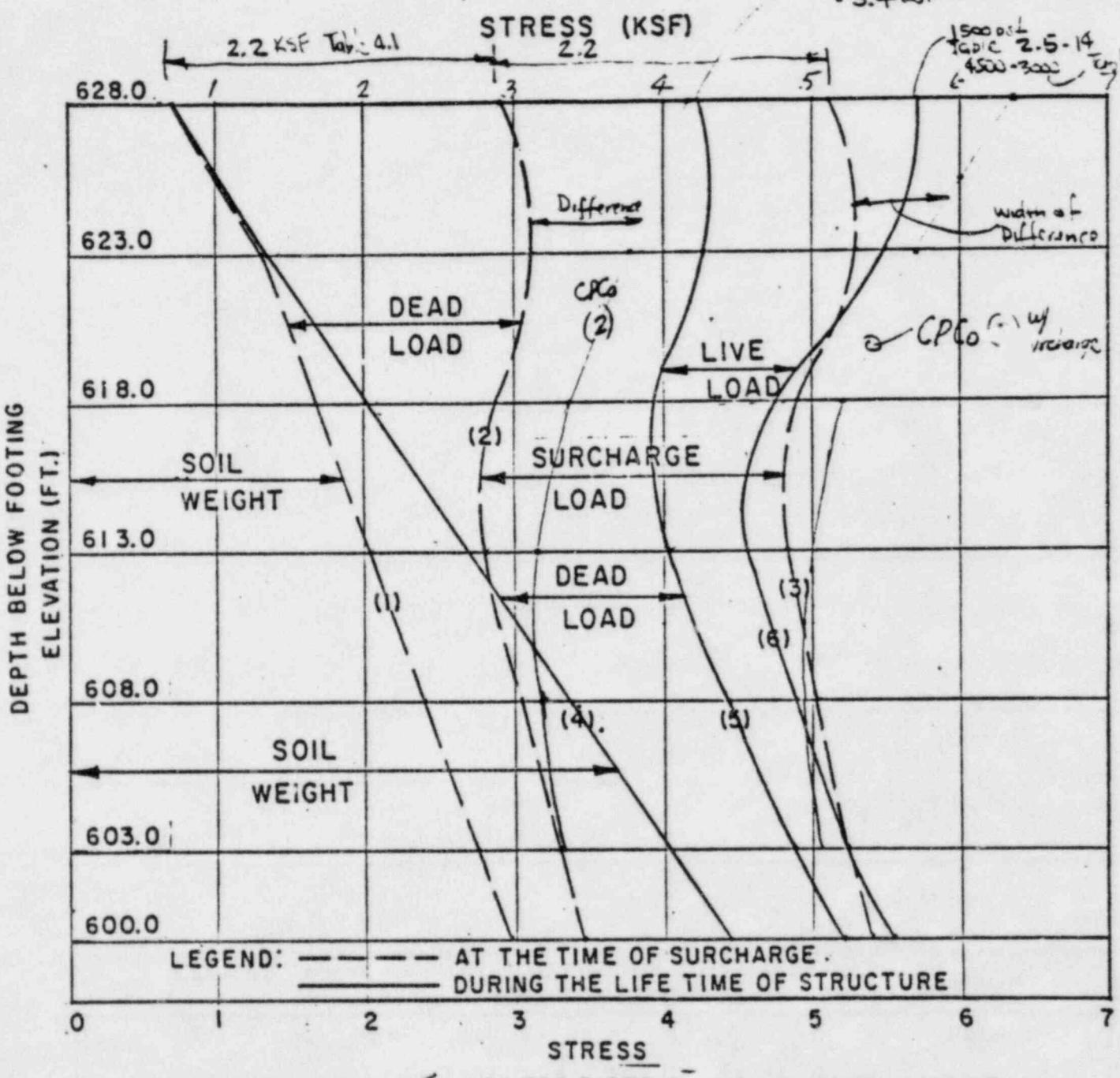
SOUTHWEST CORNER OF DIESEL GENERATOR BUILDING

Vugraph No.5

DIESEL GENERATOR BUILDING

MIDLAND 182

D.L = 3.5 ... by H. Singh
= 3.4 KSF



COMPARISON OF ~~TOTAL~~ STRESS DISTRIBUTION DURING LIFE OF PLANT OPERATION AND END OF THE SURCHARGE LOAD.

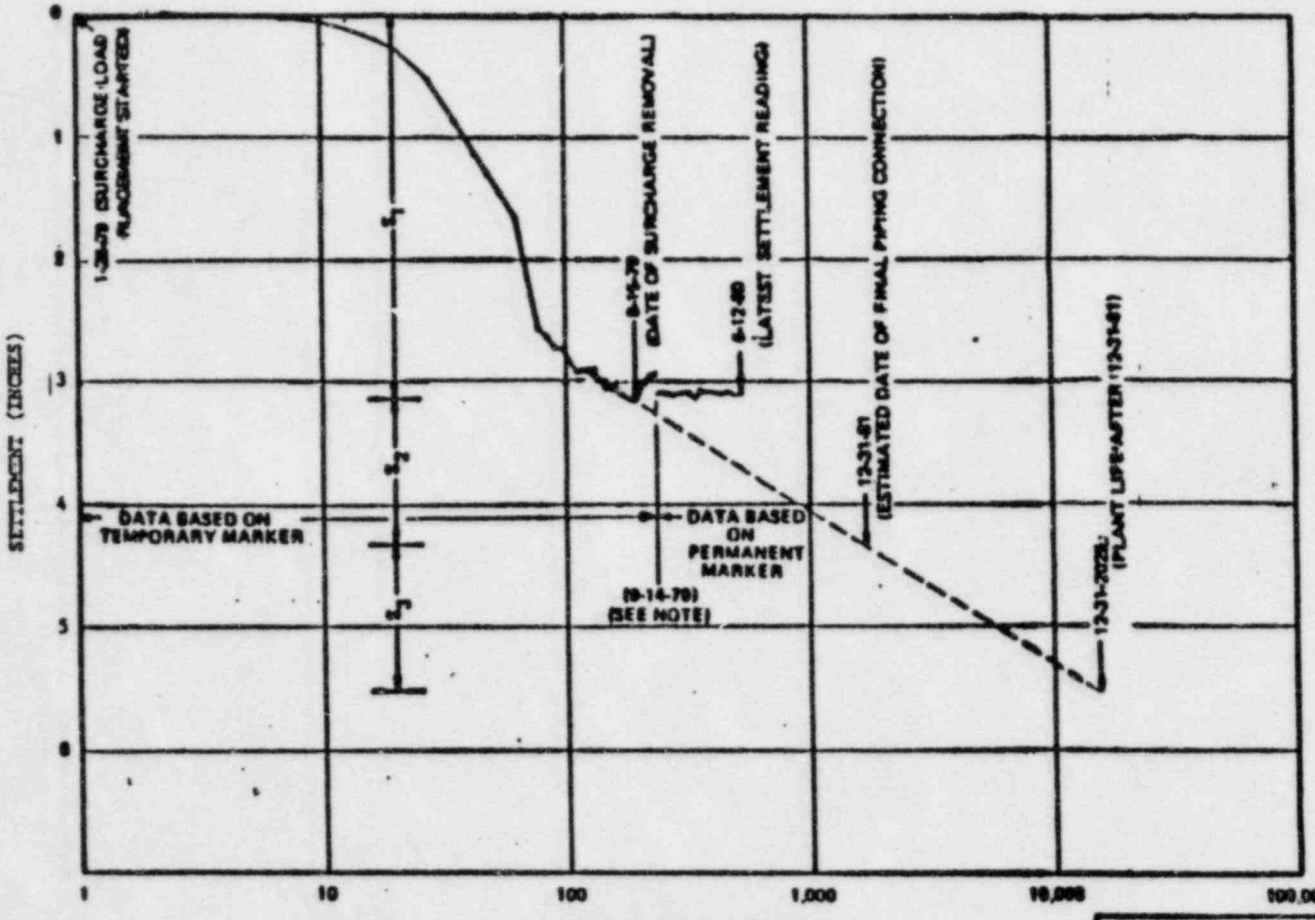
MIDDLE OF EAST WALL OF D.G. BUILDING

NOTE – EARTHQUAKE LOAD NOT INCLUDED

Vugraph No. 6

BY: H. N. SINGH & J. GRUNDSTROM – CHECKED BY: H.N. SINGH – 10 SEPT. 19

Figure 3
(See Reference 1)



LEGEND

—— MEASURED SETTLEMENT

--- PREDICTED SECONDARY COMPRESSION SETTLEMENT ASSUMING SURCHARGE REMAINS

NOTE:
The permanent marker could not be monitored from 3-22-79 to 9-14-79 due to surcharge. Temporary markers at elevation 664'-0"± were used during this period to estimate the settlement of the permanent markers. On 9-14-79 the settlement was again based directly upon the permanent markers.

BECHTEL ANN ARBOR		
MIDLAND POWER PLANT		
MEASURED AND PREDICTED SETTLEMENT VS LOG OF TIME (DG-3)		
JOB NO. 7220	DRAWING NO. FIGURE	REV.

Yugraph No. 1

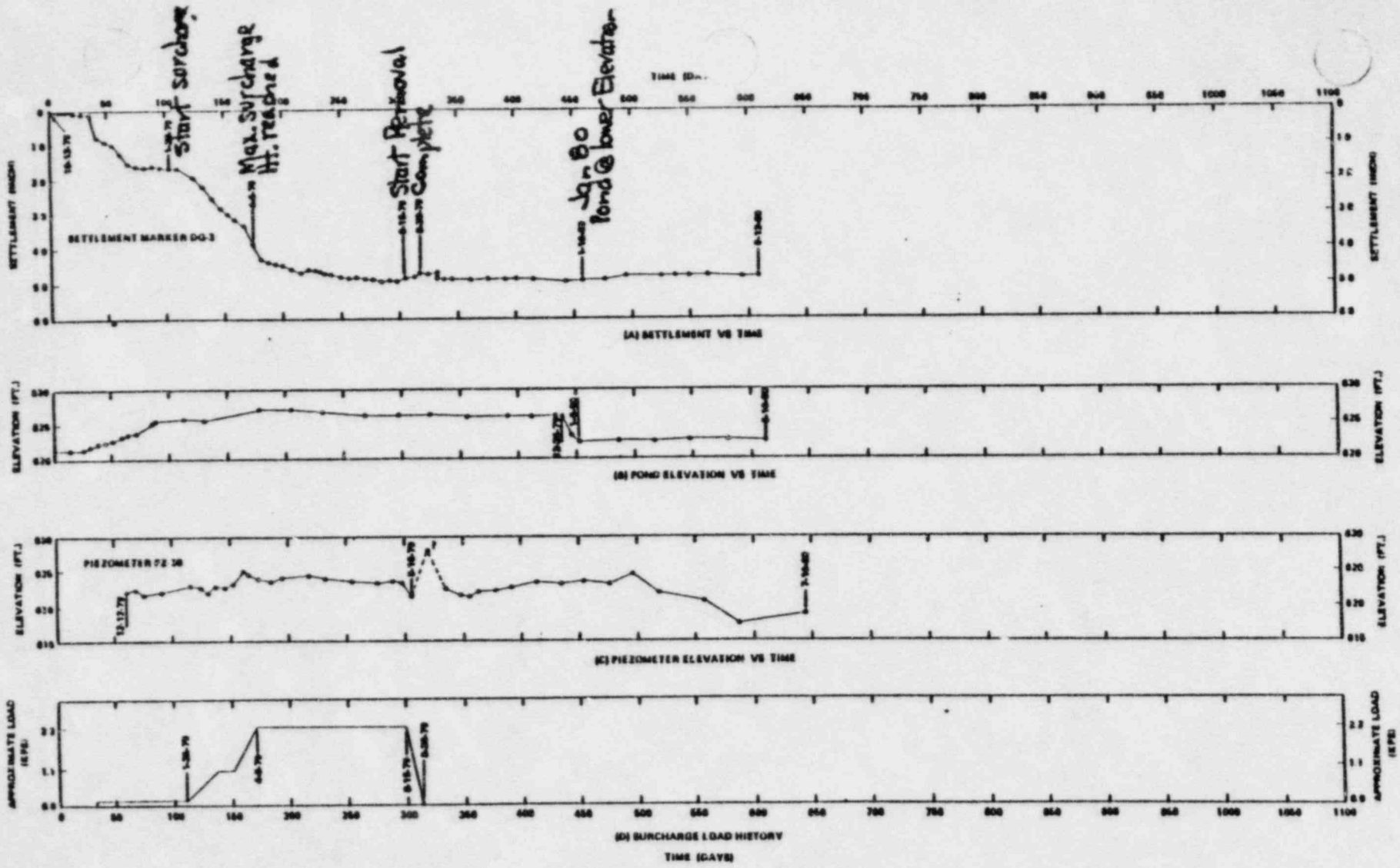
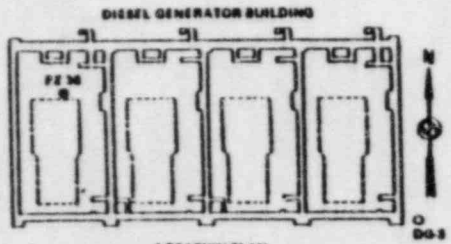


Figure 1
(See Reference 1)



NOTE:

On 10-13-78 the measured settlement at marker DG-3 was 2.982 inch.

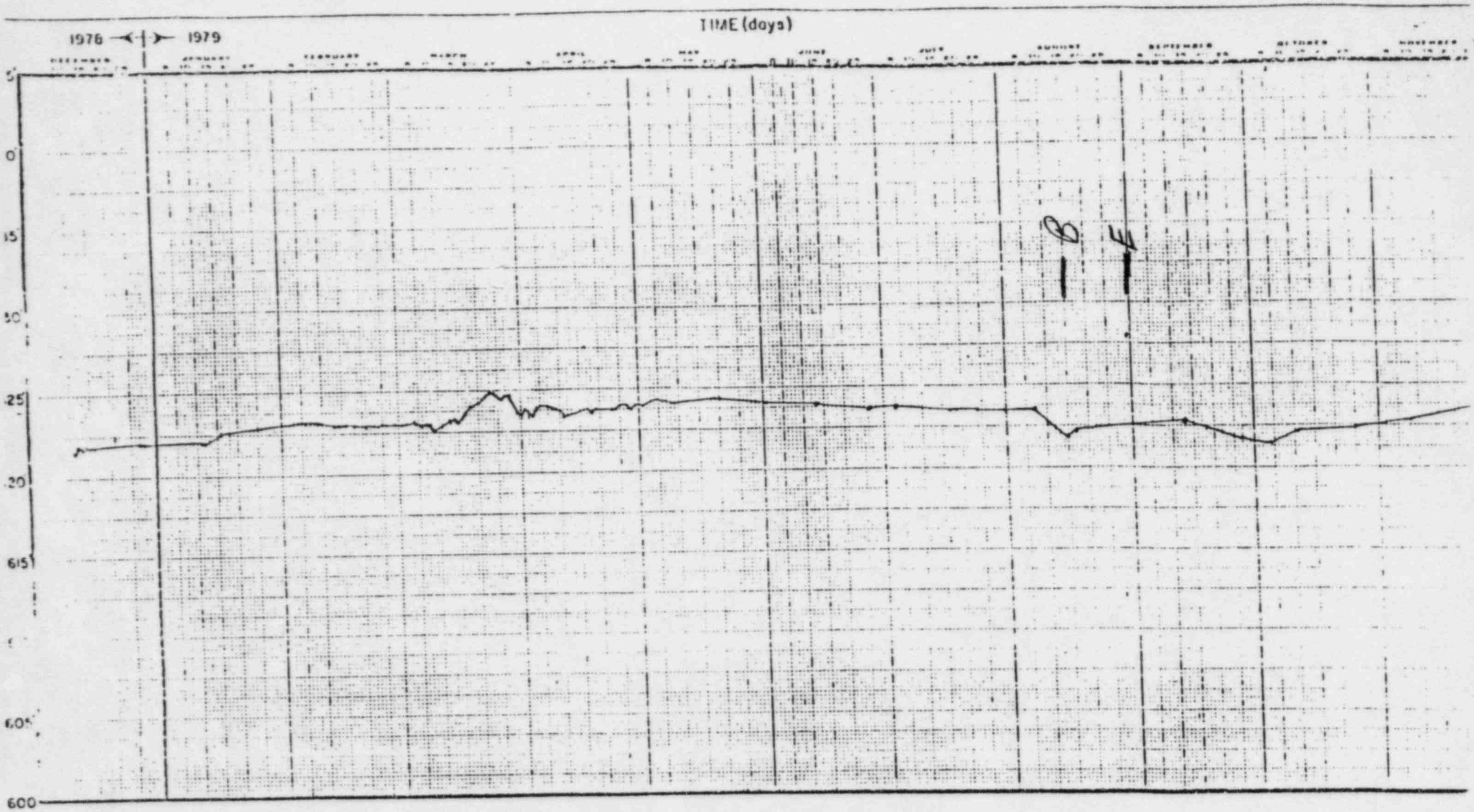
BECHTEL

MIDLAND POWER PLANT

DIESEL GENERATOR BUILDING
TYPICAL SETTLEMENT, LOOKING POND LEVEL
PIEZOMETER LEVEL AND SURCHARGE LOAD HISTORY

7220 FIGURE B7.9 A

Vugraph B



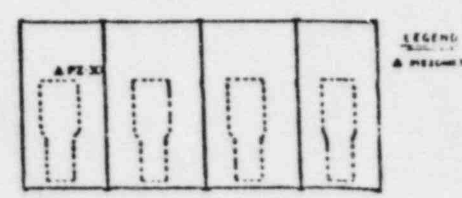
Reading may be less accurate than normal.
See Table 3.

MIDLAND PLANT DIESEL GENERATOR BUILDING

—PIEZOMETRIC ELEVATION vs TIME—

PIEZOMETER No. 30

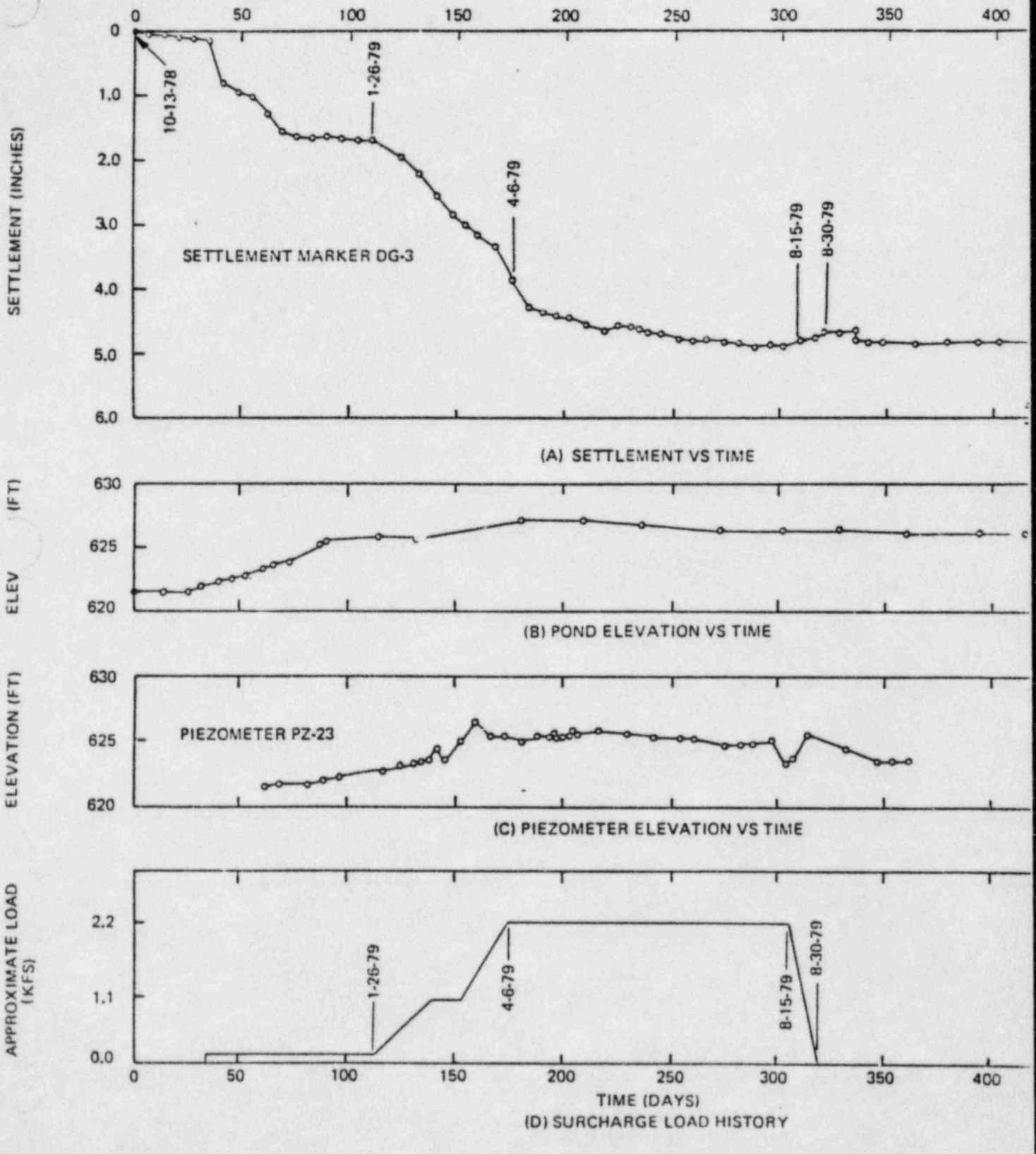
TIP ELEVATION (ft.) 602



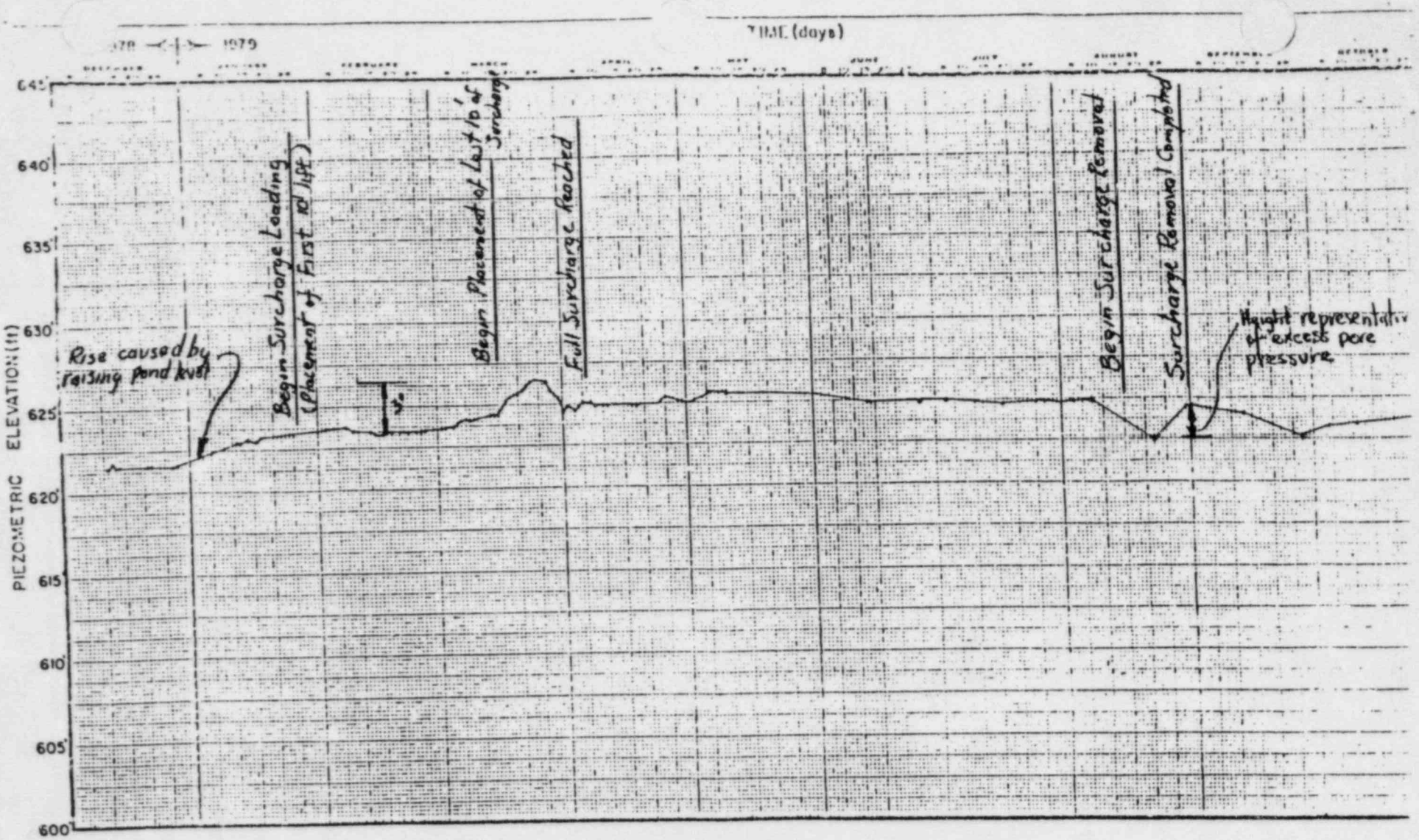
-LOCUS PLAN-

NOTE: PIEZOMETER ELEVATIONS ARE INITIAL ELEVATION OF CENTER OF OTTAWA SAND ZONE

Vuarapn No. 9



Vugraph No. 10

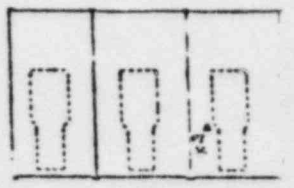


MIDLAND PLANT DIESEL GENERATOR BUILDING

—PIEZOMETRIC ELEVATION vs TIME—

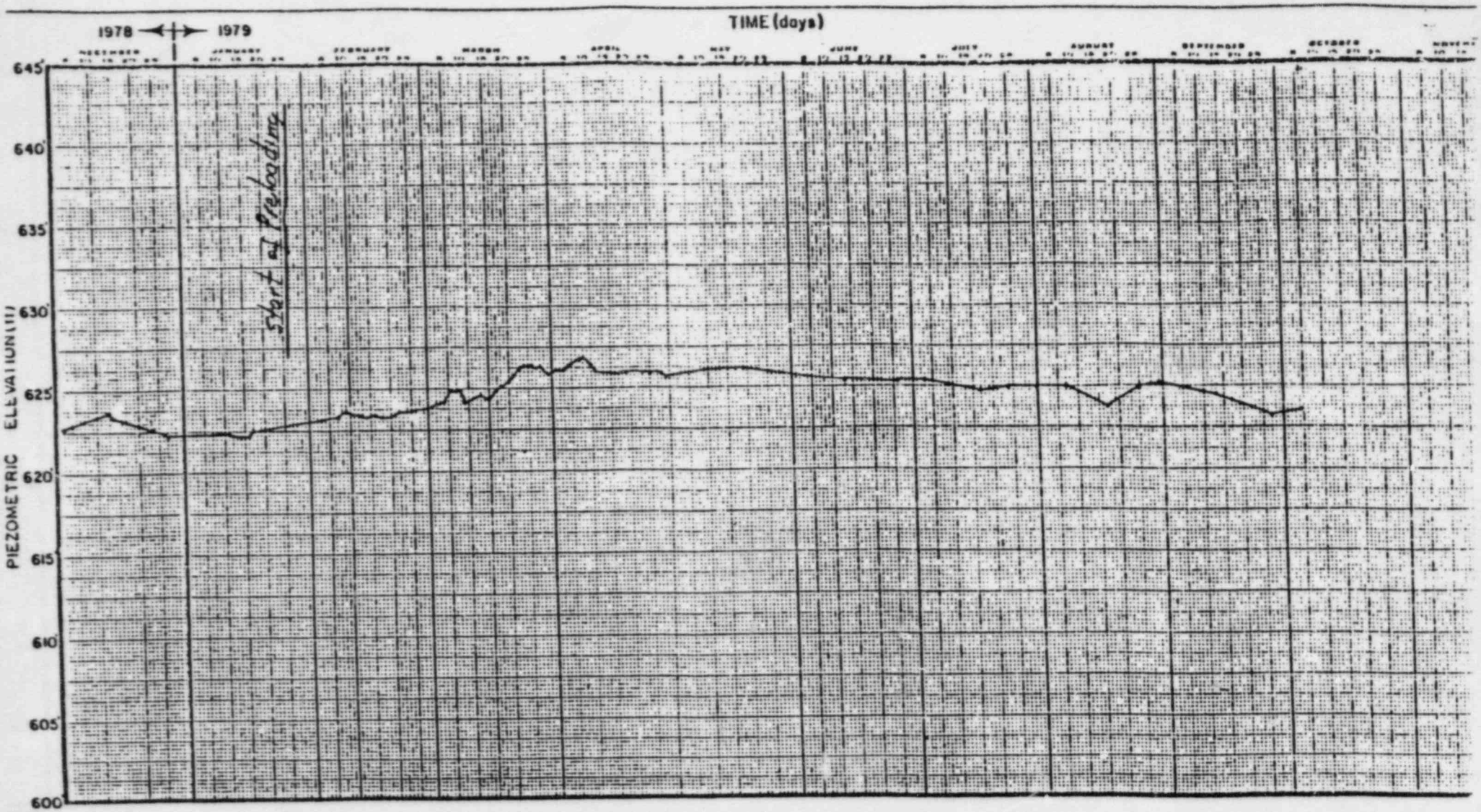
PIEZOMETER No. 36

TIP ELEVATION (ft) 603.2



—LOCUS PLAN—

NOTE: PIEZOMETER ELEVATIONS ARE INITIAL CENTER OF CYLINDER ELEVATION

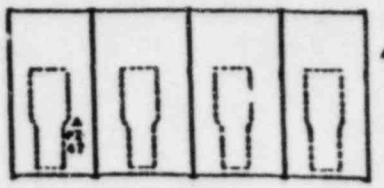


MIDLAND PLANT DIESEL GENERATOR BUILDING

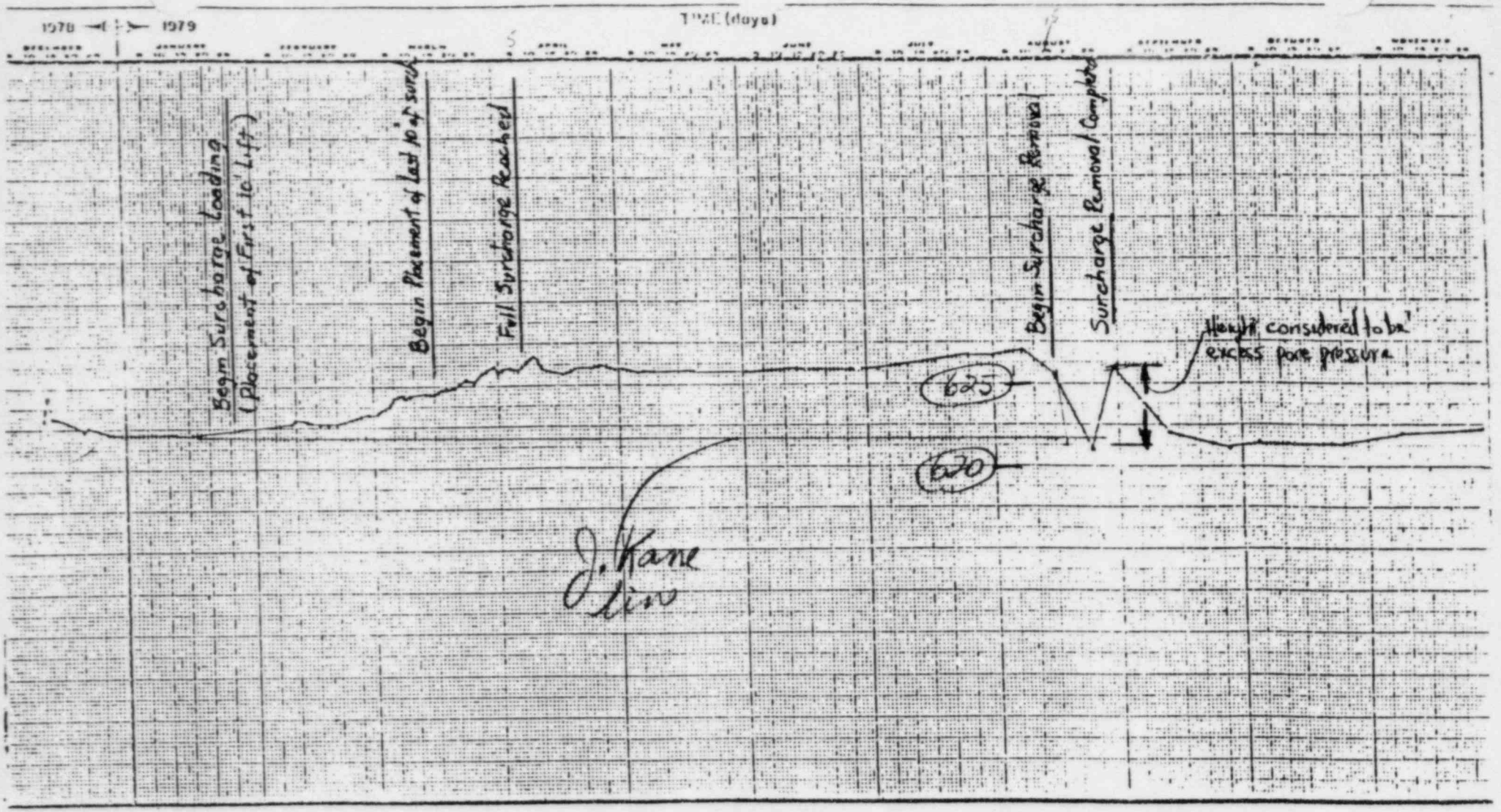
—PIEZOMETRIC ELEVATION vs TIME—

PIEZOMETER No. 47

TIP ELEVATION (ft.) 621



NOTE: PIEZOMETER ELEVATIONS ARE INITIAL ELEVATION OF CENTER OF STRAIN SAND ZONE



from Vol. 2 figure 27-42

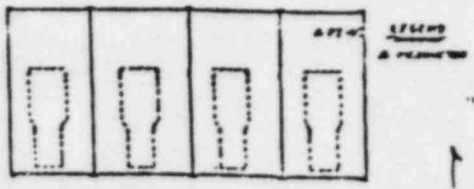
plot

MIDLAND PLANT DIESEL GENERATOR BUILDING

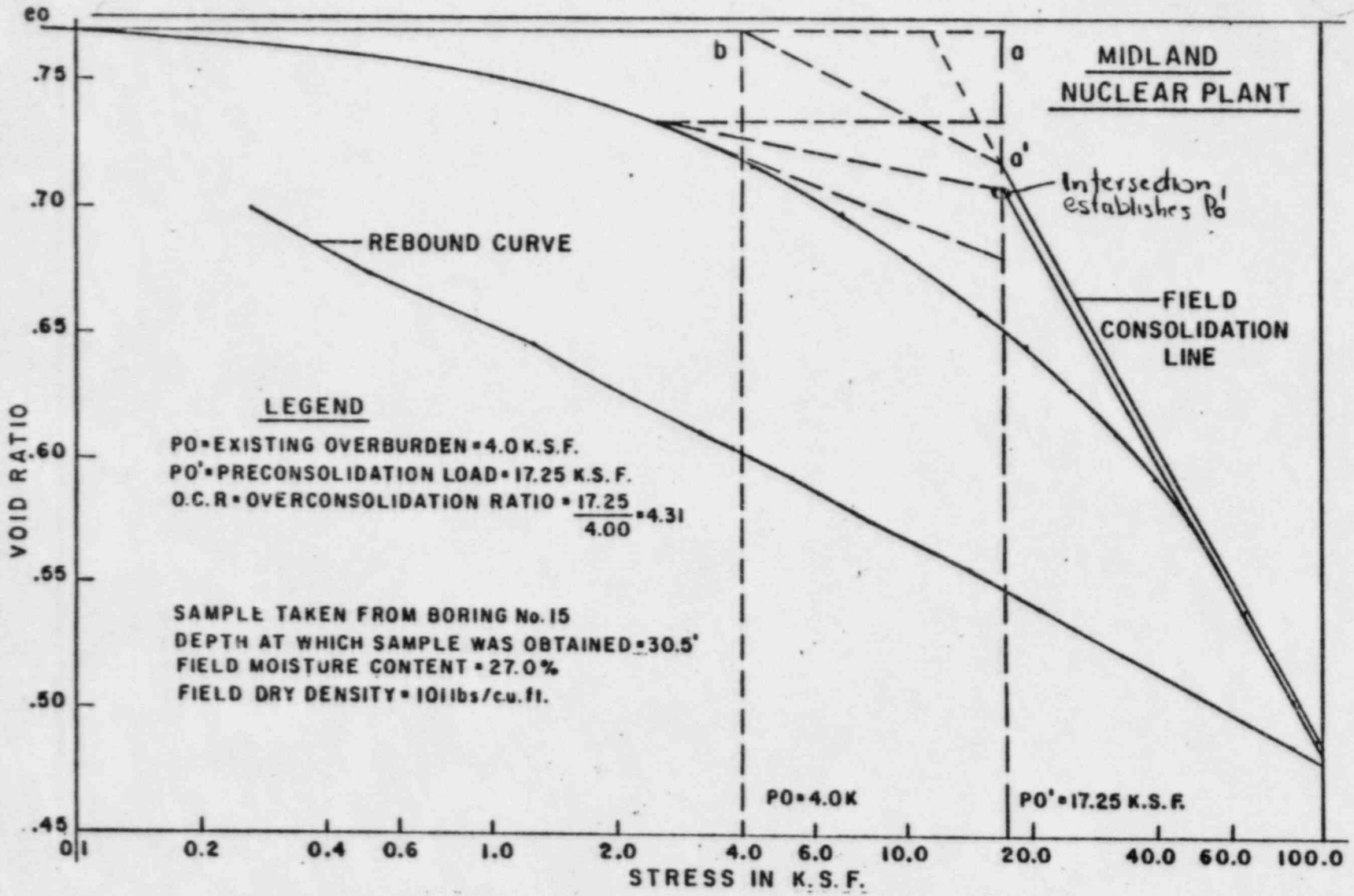
—PIEZOMETRIC ELEVATION vs TIME—

PIEZOMETER No. 40

TIP ELEVATION (ft.) 609.5



NOTE: PIEZOMETER ELEVATIONS ARE INITIAL ELEVATION OF CENTER OF OTTAWA SAND ZONE



GRAPHICAL METHOD FOR FIELD RELATION BETWEEN
VOID RATIO AND PRESSURE FOR PRECOMPRESSED CLAY

(Schmertmann 1953)

CPCo Position - DGB (cont.)

6. Other nuclear power plants (Kewanee-Quanicassee) have utilized evidence other than lab test results because of unrealistic settlement predictions based on lab data.

7. Temporary dewatering now being conducted will provide additional settlement data. Consider this future data to be more accurate in predicting settlement than COE-NRC requested sampling & testing.

8. Because settlement is a slow process - CPCo has the ability to directly measure settlement during plant operation & compare with predicted values. This monitoring can provide a positive & verifiable resolution of the safety question involved

Summary of COE-NRC Position on Additional Borings

— BEARING CAPACITY

9. Adopted reasonable soil parameters in design (e.g. unit weights, shear strength) Based on test results of samples as far as 500 ft away

10. Used state-of-the-art method for determining net ultimate bearing capacity

11. Bearing capacity analysis indicates ample margin of safety

Vugraph 14

dure. The field curve from which the settlements can be estimated should then be sketched by starting at point a and continuing parallel to the reloading curve $n'g$ to a point about halfway to p_0'. The curve should then be directed toward point f in such a manner as to follow the shape of K_0. This procedure does not eliminate the judgment of the interpreter, but it leads to reasonable results. The settlement corresponding to a pressure between the present overburden pressure and the preconsolidation pressure can be computed by means of eq. 3.3, but the value of Δe must be determined from the sketched field e-log p curve K (Fig. 3.6).

If we fail to recognize that the clay is preloaded and base a settlement computation on af, the computed settlement will be far too great. The change Δe_s in void ratio computed for an increase Δp in pressure is likely to be 4 to 10 times as great as the real change Δe_f, provided Δp is not greater than about half of $p_0' - p_0$. As Δp approaches $p_0' - f$, the error becomes smaller.

In connection with practical problems, the most important consideration is to be able to recognize whether or not a clay is preloaded. It almost certainly is if the water content is closer to the plastic limit than to the liquid limit. Moreover, by performing a consolidation test on a very carefully taken sample, one can often obtain the data required to make the decision. In Fig. 3.4 it may be noticed that the upward projection of the straight part of K_0 intersects the line $e = e_1$ at point b, which is located on the left of point a. This is always true of a normally loaded clay of ordinary sensitivity. On the other hand, in Fig. 3.6, which refers to a preloaded clay of ordinary sensitivity, b is located on the right side of a. Unfortunately, the influence of disturbance tends, by displacing b to the left, to destroy the evidence of preloading. Hence, if it is probable that a clay deposit may be preloaded and samples are to be obtained for consolidation tests, the best possible techniques for sampling should be used. An additional procedure for investigating the state of pre-

From "Foundation Engineering"
Ralph Peck
Walter Hanson
Thomas Thornburn
Second Edition 1973

Vugraph 15

Consumers Exhibit # 13 (Kane)

CPCo. Position - Cooling Pond Dike

1. Design & construction adequacy is NOT a subject of the Dec. 6, 1979 Order.

2. NOT safety related. NOT a Q-listed structure.
   - Is this saying that the cooling pond structure does not have to demonstrate adequate stability?
   - NRC SER @ CP stage concludes that cooling pond dikes had a design criteria that was adequate to assure slope stability during the design basis earthquake.

3. Dike is well constructed because:
   a. Accessible to heavy equipment for compacting
   b. Fill placed in thin (12" lifts) layers
   c. Fill conditioned for moisture
   d. Full time inspection during construction. Completed two walkdown inspections since construction completion.

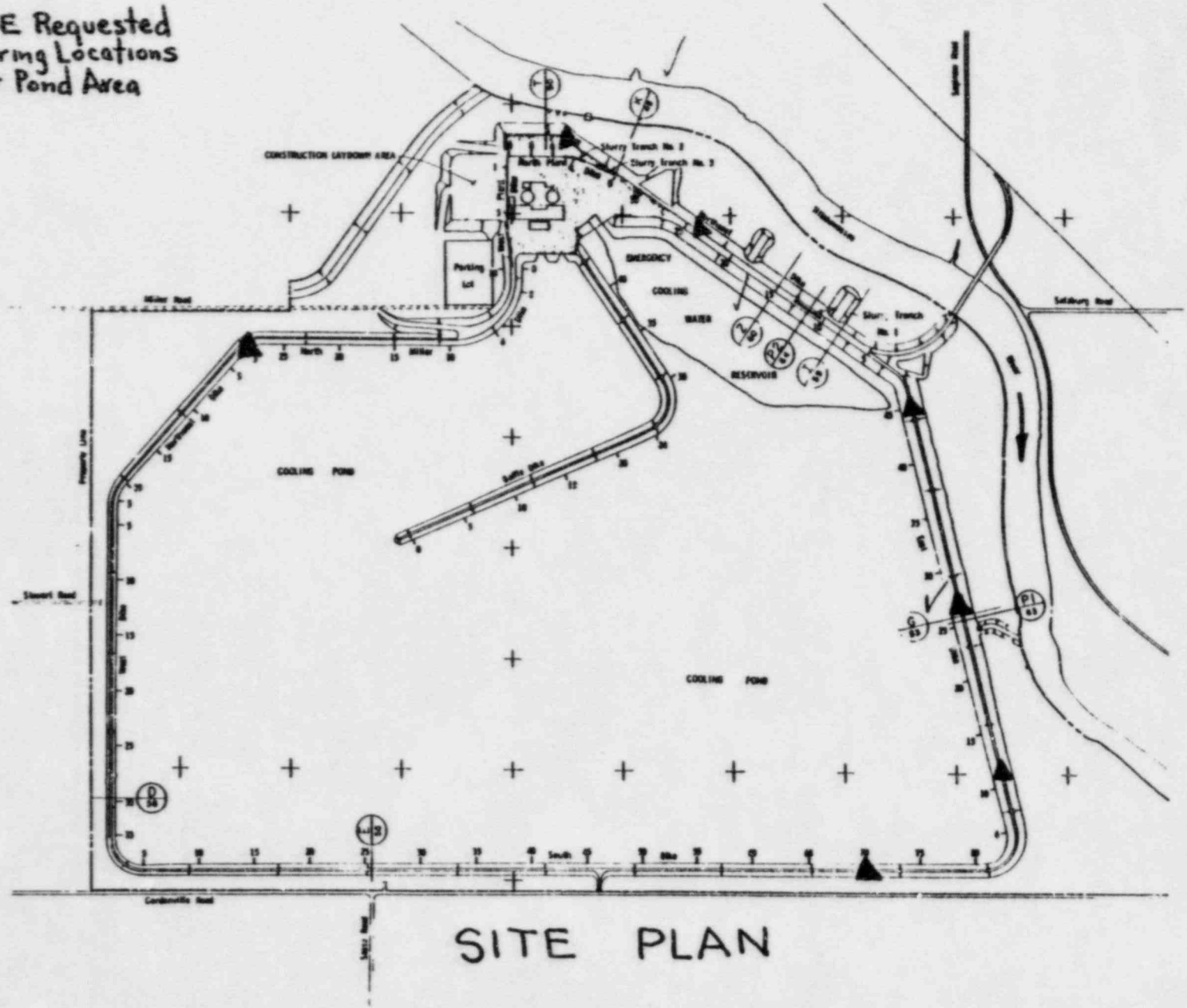
   - Similar statement has been made for Aux Bldg. & Sw Pumphouse but boring information

4. No significant settlement problem.
   - Settlement of dike can be an issue if concerned of cracking & loss of freeboard - but this is not the concern at Midland

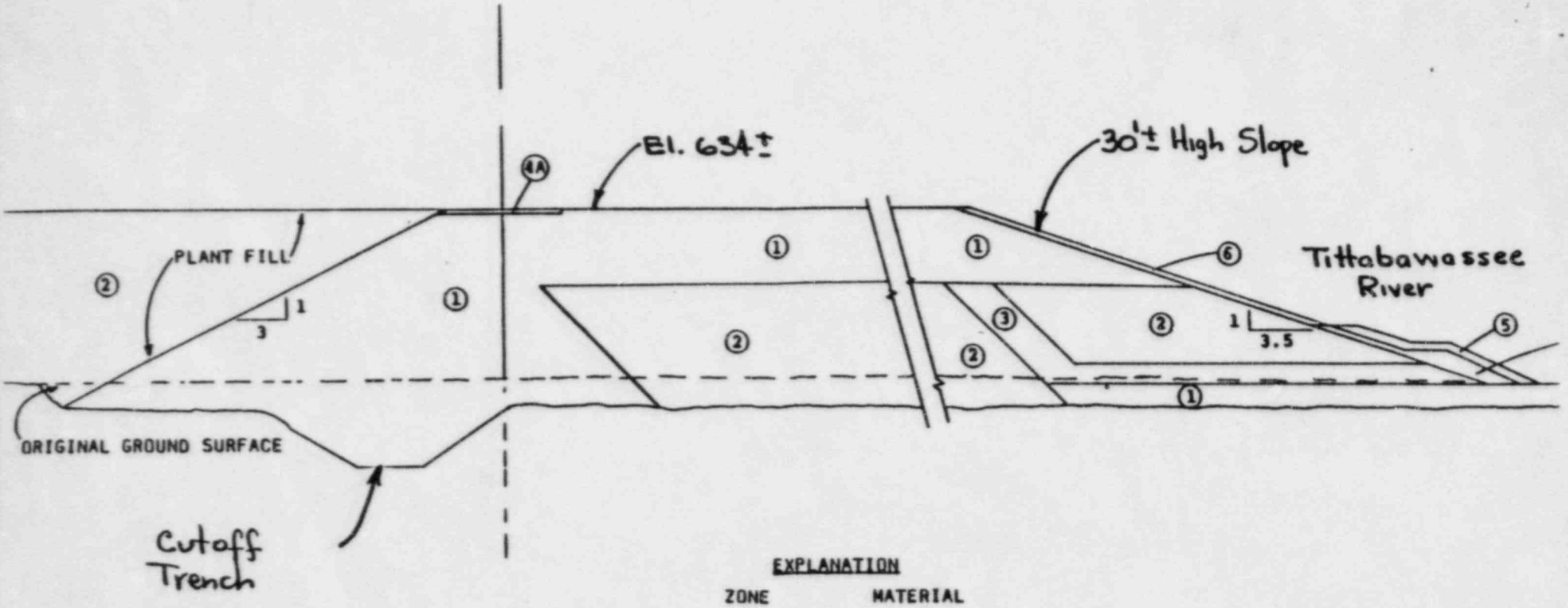
5. Borings (not yet furnished to NRC) w/ SPT completed for power poles & piezometer installations indicate stiff clay fill.

6. Possible damage to dike because of requested borings now that pond is filled.

▲ COE Requested Boring Locations for Pond Area



SITE PLAN



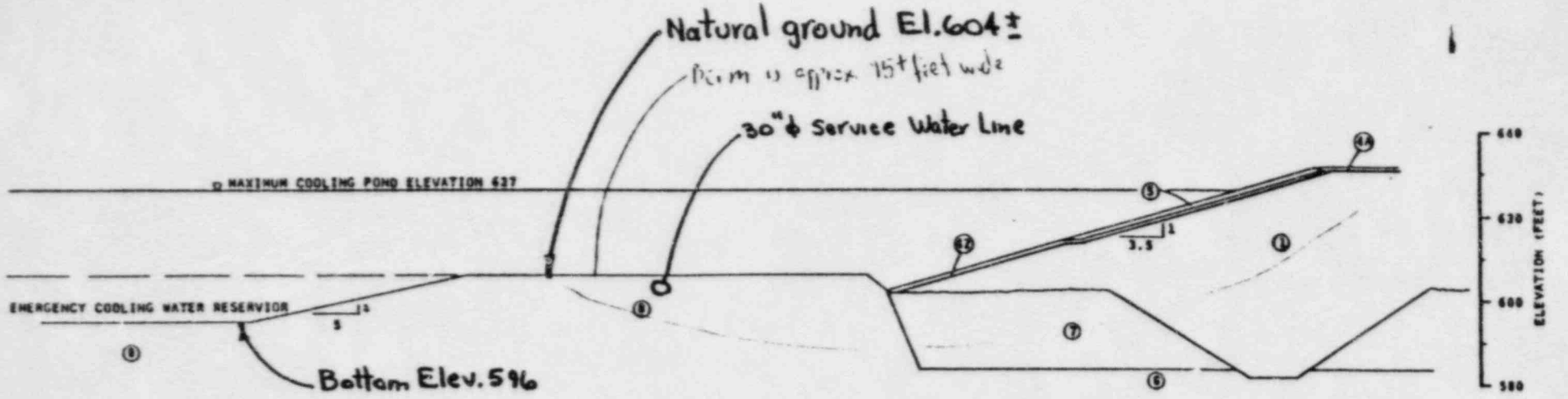
EXPLANATION

ZONE	MATERIAL
①	IMPERVIOUS FILL (>20% passing #200 sieve)
②	RANDOM FILL (all materials except organic)
③	SAND DRAIN
④ ④A	GRAVEL (crushed rock)
⑤	RIPRAP 18"
⑥	TOPSOIL & SEEDING

DIKE SECTION K

0 10 20 40

SCALE IN FEET

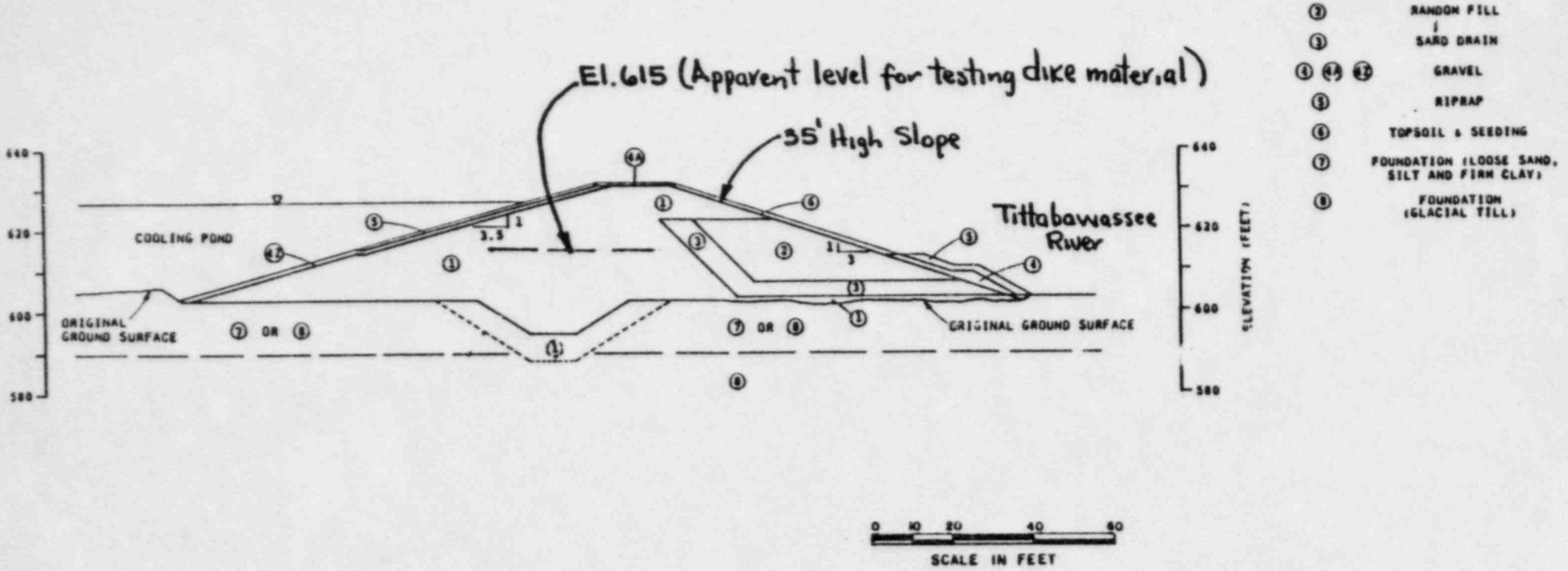


EXPLANATION

ZONE	MATERIAL	Adopted Shear Strengths
①	IMPERVIOUS FILL	$\phi = 29°$
④ ④A ④B	GRAVEL	$\phi = 37°$
⑤	RIPRAP	$\phi = 37°$
⑦	LOOSE SAND	$\phi = 32°$
⑧	FOUNDATION (GLACIAL TILL	$\phi = 37°$ or $c' = 7000$psf

0 10 20 40 60
SCALE IN FEET

DIKE SECTION Z



DIKE SECTION G
(Section of Max. Emb. Height)

Consumers Exhibit # 14 (Kane)

TELEPHONE OR VERBAL CONVERSATION RECORD

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

DATE: 6/25/80

SUBJECT OF CONVERSATION: Mid Land Nuclear Plant — Letter Report

INCOMING CALL

PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
Joe Kane	NRC Washington D.C.	8-492-6761
PERSON CALLED	**OFFICE**	**PHONE NUMBER AND EXTENSION**
H.N. Singh. Ron Ericson	Geotechnical Sec. C of E., Detroit.	226-6789

OUTGOING CALL

PERSON CALLING	OFFICE	PHONE NUMBER AND EXTENSION
PERSON CALLED	**ADDRESS**	**PHONE NUMBER AND EXTENSION**

SUMMARY OF CONVERSATION

Mr. Joe Kane of NRC called us, and conveyed his comments on the subject report forwarded to his office on 25th June Through tele copier. (Mailed to NRC on 20 JUNE 80 and not rec'd O/A 25 June) ltrs

Mr. Kane advised us that report is very comprehensive covering all the problem areas, and all the questions have been spelled out explicitly. Mr. Kane suggested some corrections in form of rephrasing some questions. These changes did not alter the intents of the questions. He further advised us to separate the questions pertaining to the Cooling Pond in two groups:

(a) questions on Emergency Cooling Pond (Cat. I. Struct)

(b) questions on operating Cooling Pond (non cat. I struct)

There have been some differences of opinions, Wheather or not we have authority to ask questions as to the stability of the diking system of the cooling pond, because the cooling pond dikes structure has not been classified as Cat. I. structure. Mr Kane advised us, that Safety of the diking System is very vital to the public health and Safety, and the environment, therefore its stability must be insured, and such we can ask questions on the diking Syste.

H. N. Singh

DA FORM 1 APR 66 751 REPLACES EDITION OF 1 FEB 58 WHICH WILL BE USED.

Consumers Exhibit #15 (Kane)

NCDED-G (24 Mar 80) 1st Ind
SUBJECT: Interagency Agreement No. NRC-03-79-167, Task No. 1, Midland Plant Units 1 and 2, Subtask No. 1 - Letter Report (INTERIM)

DA, North Central Division, Corps of Engineers, 536 South Clark Street, Chicago, Illinois 60605

11 APR 1980

TO: District Engineer, Detroit

1. The subject letter report is returned for revisions. See Inclosure 1, recommended changes.

2. Inclosure 2 is a suggested format for this report.

FOR THE DIVISION ENGINEER:

James M. Goodwin

ZANE M. GOODWIN, P.E.
Chief, Engineering Division

2 Incl
as