

PROGRAM FOR THE NON DESTRUCTIVE EXAMINATION
OF CRACKS IN THE WATERFORD 3 BASEMAT

1. PURPOSE

The purpose of this program is to define the vertical extension of East-West cracks located at the top of the mat. The Program will attempt to define:

- A. crack depth
- B. crack length
- C. crack orientation
- D. proximity to or linkage with other cracks in the lower portion of the mat.
- E. estimate of crack width

2. DESCRIPTION

The Program will utilize the services of R.A. Muenow and Associates to perform a non destructive microseismic evaluation of the concrete using the pulse echo method. An evaluation of East-west oriented cracks located between column line R and about 6 feet south of column line P, including those beneath the reactor building will be accomplished. In addition, one crack, NE-SW trending, northeast of the reactor building and one crack, NW-SE trending, northwest of the reactor building will be examined and evaluated.

The elements of the program are as follows:

- A. A test grid system will be established by R.A. Muenow and Associates, utilizing areas of the basemat where no surface cracking appears. A construction joint will be tested to establish a baseline.
- B. A Pulse Echo evaluation of the concrete will be performed by R.A. Muenow and Associates, Inc. in accordance with the Test Method for Pulse Echo Method which includes:
 - 1) Each test point will be established by R.A. Muenow and Associates so that test data will reveal information relative to crack depth, length and orientation.

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- 2) Each test point will be accomplished with a 3 transducer array with test angles of 30°, 45° and 60°.
- 3) Each test point will also be accomplished with a 0° transducer for completeness of data collection.
- 4) The 30° transducer shall have a variability angle between 20° and 40°, for final detailing.
- 5) A minimum of one polaroid picture of the CRT display shall be furnished at each grid location where additional testing is performed.
- 6) Furnishing of calibration records for the equipment used in the testing. Calibrations shall be traceable to a National Bureau of Standards standard.

3. EVALUATION

A report on the results of the test data will be furnished by R.A. Muenow and Associates. The report will evaluate each crack tested for depth, length, orientation, width and proximity to or linkage with other cracks in the lower portion of the mat. The report results will be evaluated to determine the effect of the results on the design assumptions, and any corrective actions required.

Gambit newspaper of New Orleans published a story entitled "A Poor Foundation At Waterford III?" in December of 1983. The story concerned cracks in the basemat and quality assurance records deficiencies. Gambit implies that the Region IV finding that the basemat's construction was sound is in error because of problems identified during the records review performed by EBASCO's Quality Assurance Installations Review Group (QAIRG). Gambit states that the irregularities identified in the records review reflect construction deficiencies that are directly related to the cracks and associated water seepage in the foundation basemat. A series of nonconformance reports issued by QAIRG and a memorandum written in 1975 are used as the basis for the story which also relies on information provided to Gambit by George H. Hill, a former member of QAIRG. The memo dated December 12, 1975 was written by F. L. Phearson and describes poor concrete placement activities during the placement of concrete for the basemat. Gambit quotes Hill as stating that the memo describes a concrete placement in which "everything that could have been done wrong was done wrong." The subject of this description was concrete placement no. 499-802-2 in the common foundation mat. The entire mat was composed of 28 placements totaling 45,894 cubic yards. Placement no. 499-802-2 involved 1,639 cubic yards or 3.6 percent of the total and was the third placement in the series of 28.

On January 10, 1984, Region IV conducted an investigative interview with Hill who was Gambit's main source of information. Mr. Hill expressed concern with the Phearson memo because "that letter is on the placement that had the cracks in it." Mr. Hill further stated, "My point was, though, they never took that letter into consideration. They're assuming all of this time that this 12 foot of concrete was placed strictly in accordance with ACI."

The poor placement practices which occurred during placement no. 499-802-2 were addressed in Stop Work Order No. 1, issued by Louisiana Power & Light against J. A. Jones and EBASCO on December 16, 1975. The Stop Work Order was issued as a result of observations made by LP&L Quality Assurance Engineers Bennett P. Brown and Thomas Gennets and by EBASCO Quality Assurance Engineer J. Gutierrez. Their observations are documented on LP&L Site Surveillance Reports W3S75-63S, W3S75-64S and on EBASCO Quality Assurance Engineering Audit Report No. JG-75-12-2. The Stop Work Order was reviewed by NRC Inspectors and is addressed in NRC Inspection

Reports 75-10 and 76-01. It was determined that the concrete was not adversely affected by the observed practices to the extent that it was not structurally sound and consequently the disposition to use-as-is was not challenged.

Mr. Brown documented 13 observations which include and go beyond the items listed in the Pheanson memo. In a signed and sworn statement to the NRC, Mr. Brown states that most of the improper practices which he observed were subject to corrective actions at the time he pointed them out. He stated that the purpose of documenting the noted discrepancies was to prevent recurrence in future placements. It was his opinion that what he observed was not in any case of such a serious magnitude as to render the placement unsatisfactory and that because of the actions taken at the time of the placement, all concrete as placed satisfied the specification requirements.

Mr. Pheanson was employed by EBASCO as a Quality Control Engineer - Civil. The Pheanson memo is a handwritten document entitled "Afteraction Report" and is not a result of a required Quality Assurance Procedure. The memo is addressed to W. C. Griggs who at the time held the position of Senior Quality Control Supervisor. In a signed and sworn statement to the NRC, Mr. Griggs stated that he did not recall the memo nor any particulars regarding the placement referenced. He did express satisfaction that as result of his supervisory overview of the inspection process during the construction of the basemat, any problems encountered were addressed by the quality assurance program and that in his opinion the concrete in the basemat is satisfactory. A review of the documentation package for the placement in question indicates that four placement inspection reports were generated. Two reports were generated by EBASCO Quality Control and two by J. A. Jones Quality Control. Inspection findings include excess concrete on steel, improper vibrator usage, and spillage of dry concrete from disconnected pumping equipment into the placement. The reports also indicate that corrective measures were being taken at the time. The excess concrete was cleaned, the spillage was cleaned up and "vibrator operators required constant instructions in proper use of vibrators." The reports also document the inspectors findings that the placement and consolidation of the concrete was acceptable. These inspection reports corroborate the statement from Mr. Brown, the LP&L QA Engineer, concerning the connective actions taken at the time of the noted discrepancies.

In addition to reviewing the concrete placement documentation, all nonconformance reports generated on the foundation basemat were reviewed for the purpose of verifying that none of the noted discrepancies could lead to the generation of the concrete cracks. Two nonconformance reports were identified- (W3-39 and W3-93) which document problems encountered with basemat placements no. 10B and 19. Placement no. 10B was contaminated by a heavy rain and placement no. 19 developed a cold-joint due to poor stair-stepping technique. Both placements received extensive evaluation by coring and were later repaired by pressure grouting and/or dry-packing of areas removed. Region IV monitored the status of and observed repairs in progress as monitored in NRC inspection reports 76-05, 76-07, 76-08, 76-09, 76-10, 77-03, 77-04, 77-06, and 77-08.

Cracks in the basemat were identified in 1977 and again in 1983. The cracks were the subject of nonconformance reports no. W3-535 and W3-6143. NRC RIV observed the sealing of the cracks that occurred beneath the containment vessel as documented in NRC Report No. 77-07 and the matter was closed in Report No. 77-08. It is the opinion of NRC RIV that the 1983 cracks are similar to the earlier cracks that were identified in 1977. The original cracks were located in the center of the mat and were the result of mat flexure. The extent of cracking away from the center of the mat may not have been fully defined until 1983 because of: concern in 1977 only with stability of the containment, return to normal ground water pressure until July, 1979 and the minuteness of the crack width.

Based on Region IV's monitoring of concrete activities and its confidence level in the Quality Assurance program to identify and correct problems in the concrete placement area, it cannot support the argument that the cracks identified in 1983 result from localized porous zones due to unaddressed poor construction practices. The cracks result from flexure of the mat and occur in placements other than those which have been the subject of nonconformance reports or allegations.

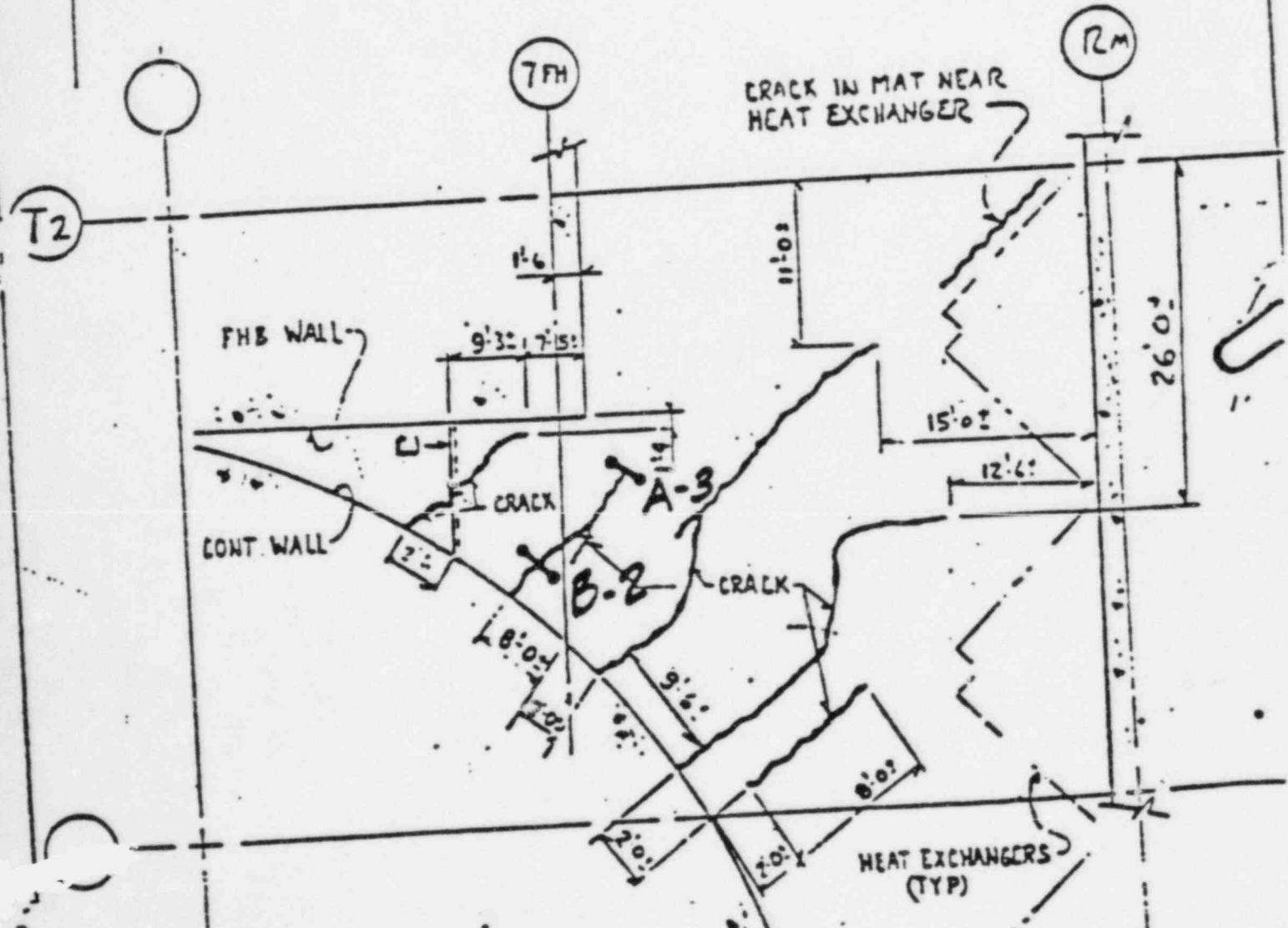
LEAD ENGINEERING ASSOCIATES • INC.
 UNDERKAMACK ROAD PARK RIDGE, N. J. 07655

PROJ. NO. _____
 C- _____
 SUBJ. SUBDIV. SHEET _____
 PREP. BY RRM DATE 9/1/83
 CHCKD. BY L&Z DATE 09/02/83

PROJECT _____
 CLIENT _____
 SUBJECT 32521/A - STAFF MAP

NOTES:

- 1 NO REPAIR.
- 2 NO FINISH
- 3 SOME EVIDENCE OF SEEPAGE
4. HAIRLINE CRACK

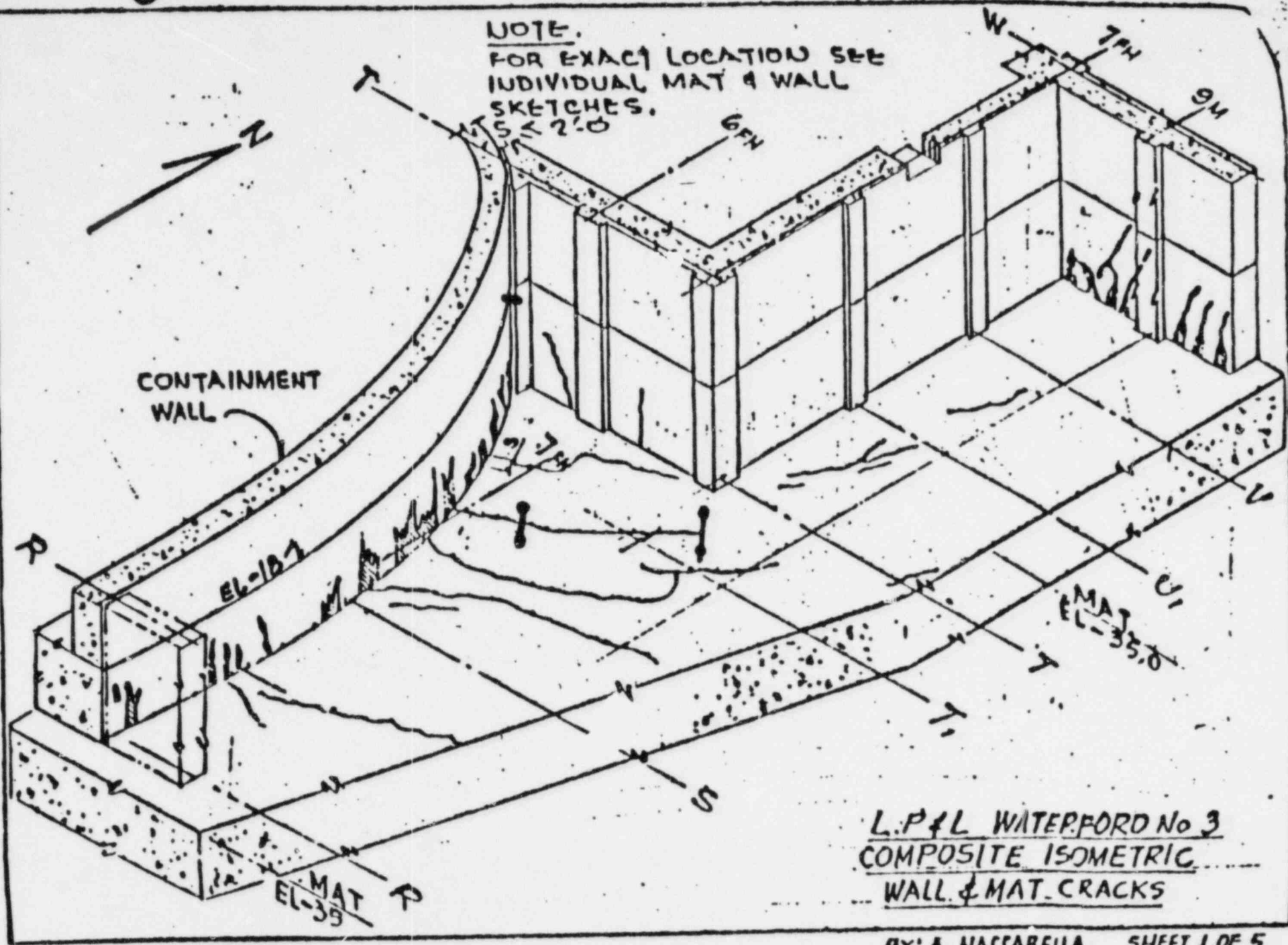


'PLAN AT EL - 34.75'

Attachment NO 2 Date 1-82 B/33

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NOTE:
FOR EXACT LOCATION SEE
INDIVIDUAL MAT & WALL
SKETCHES.
S < 2'0



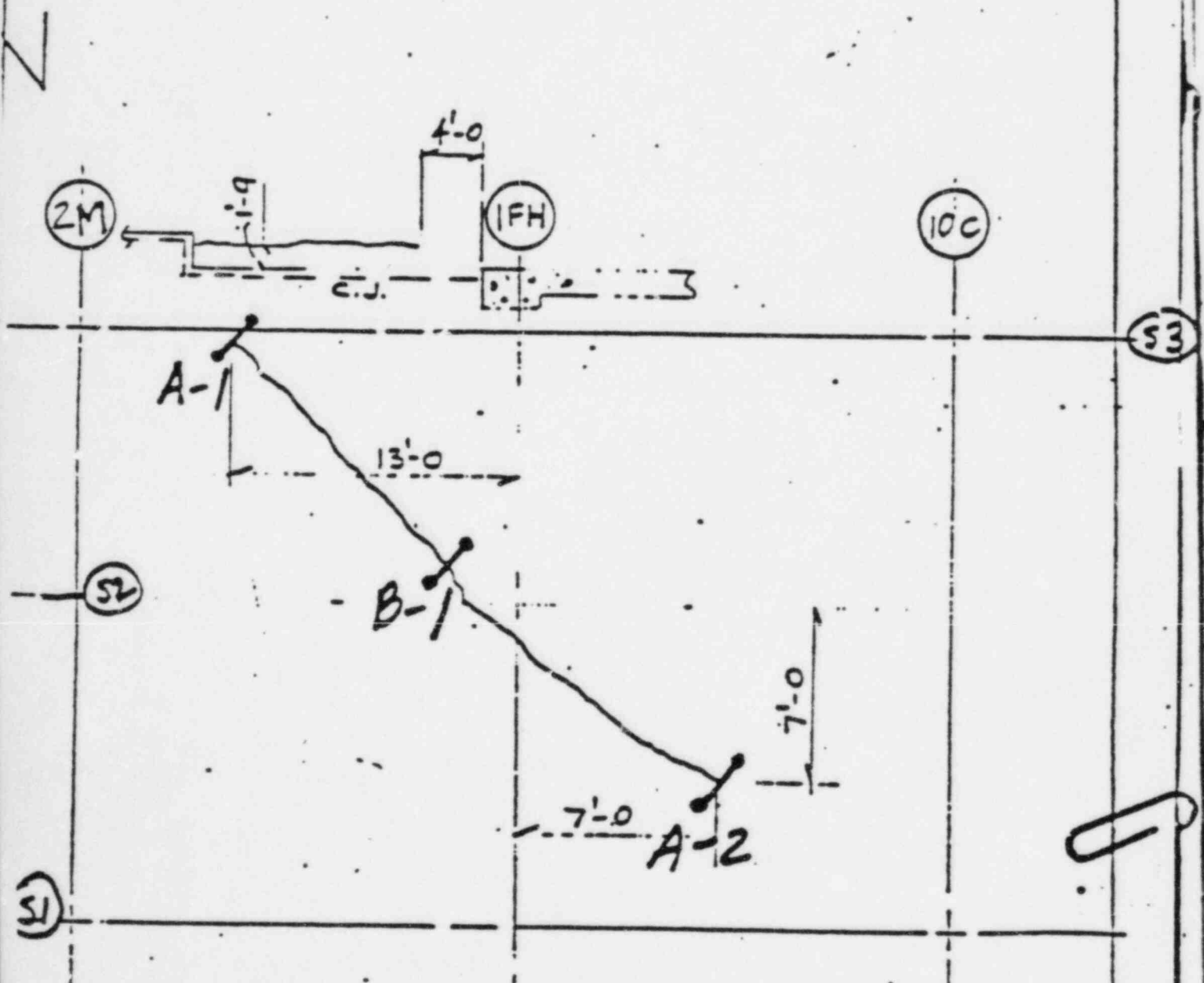
L.P&L WATERFORD No 3
COMPOSITE ISOMETRIC
WALL & MAT CRACKS

BY: A. NACCARELLA SHEET 1 OF 5

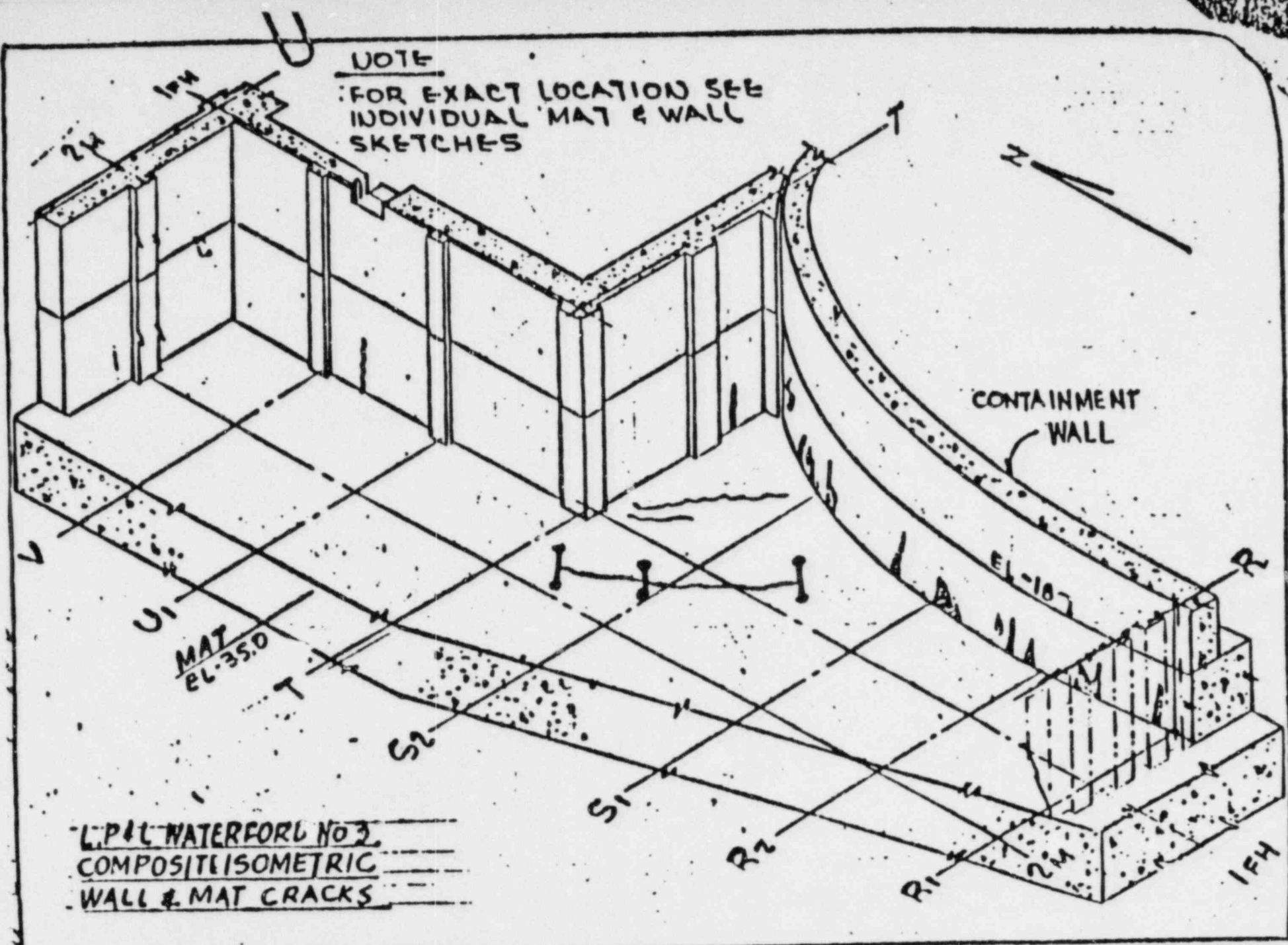
PROJ. NO.	
C-	
SUBJ.	SUBDIV. SHEET
PREP. BY	AK/GA DATE 9/1/83
CHKD. BY	LDL DATE 09/02/83

PROJECT: 111
 SUBJECT: 11111111 - C.I. A.C.I. V.A.P

- NOTES:
1. NO REPAIR
 2. NO FLOOR FINISH
 3. NO EVIDENCE OF SECPAGE
 4. HAIRLINE CRACK



Attachment No 3 SHt 1 of 2



NOTE
 FOR EXACT LOCATION SEE
 INDIVIDUAL MAT & WALL
 SKETCHES

CONTAINMENT
 WALL

MAT
 EL-350

EL-107

L.P.I.C. WATERFORD No 3
 COMPOSITE ISOMETRIC
 WALL & MAT CRACKS

BY: A. NACCARELLA SHEET 3 OF 5
 CHKD BY: G. N. DATE: 4/15/87

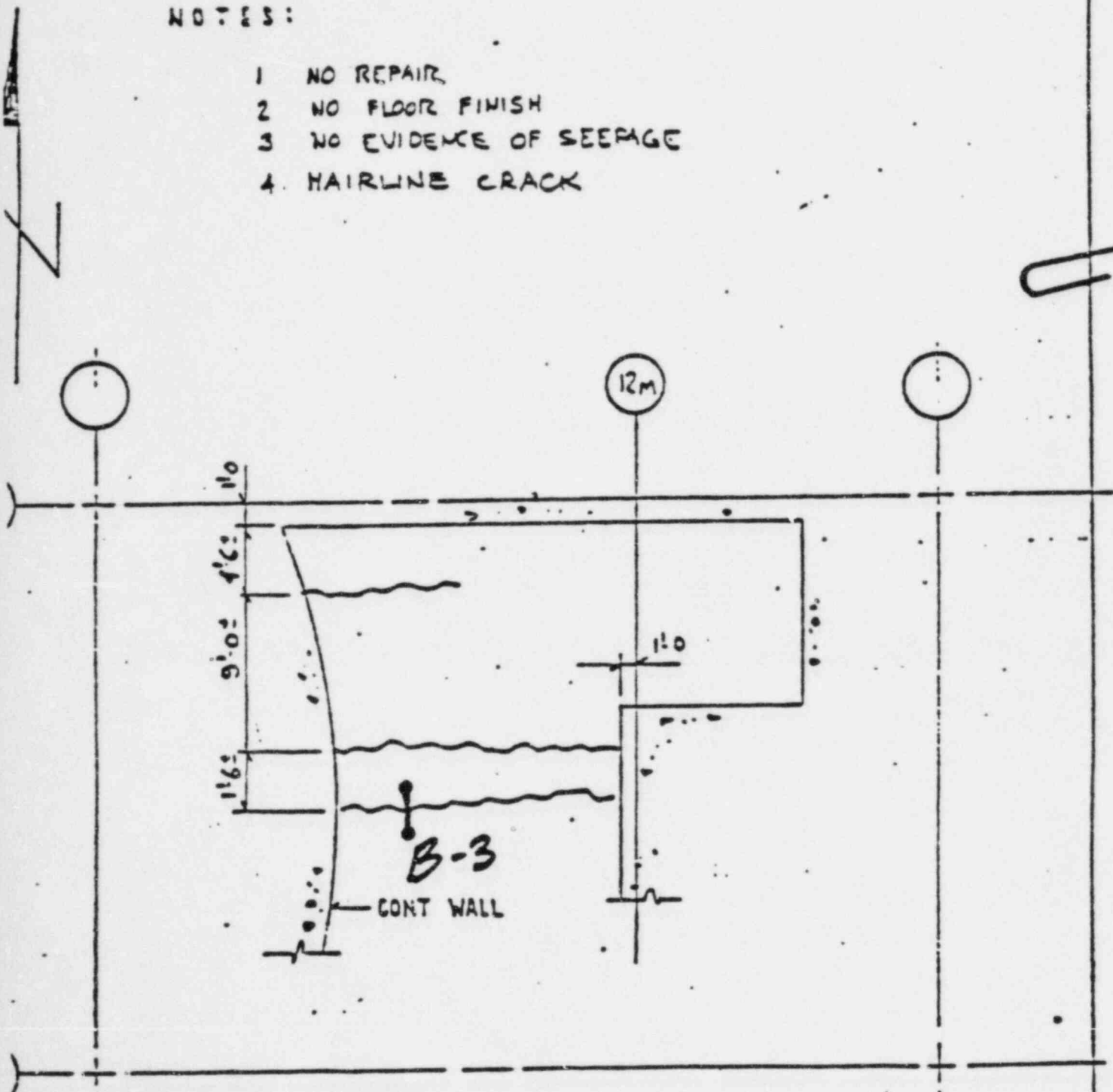
LEAD ENGINEERING ASSOCIATES • INC.
 WILSON ROAD, PARK RIDGE, N.J. 07656

PROJ. NO.		
C-	-	-
SUBJ.	SUBDIV.	SHEET
PREP. BY CAR/VW DATE 9/1/83		
CHCKD. BY ADB DATE 09/02/83		

PROJECT: _____
 DRAWING NO.: _____
 SUBJECT: BASELINE - CLASH. MAY

NOTES:

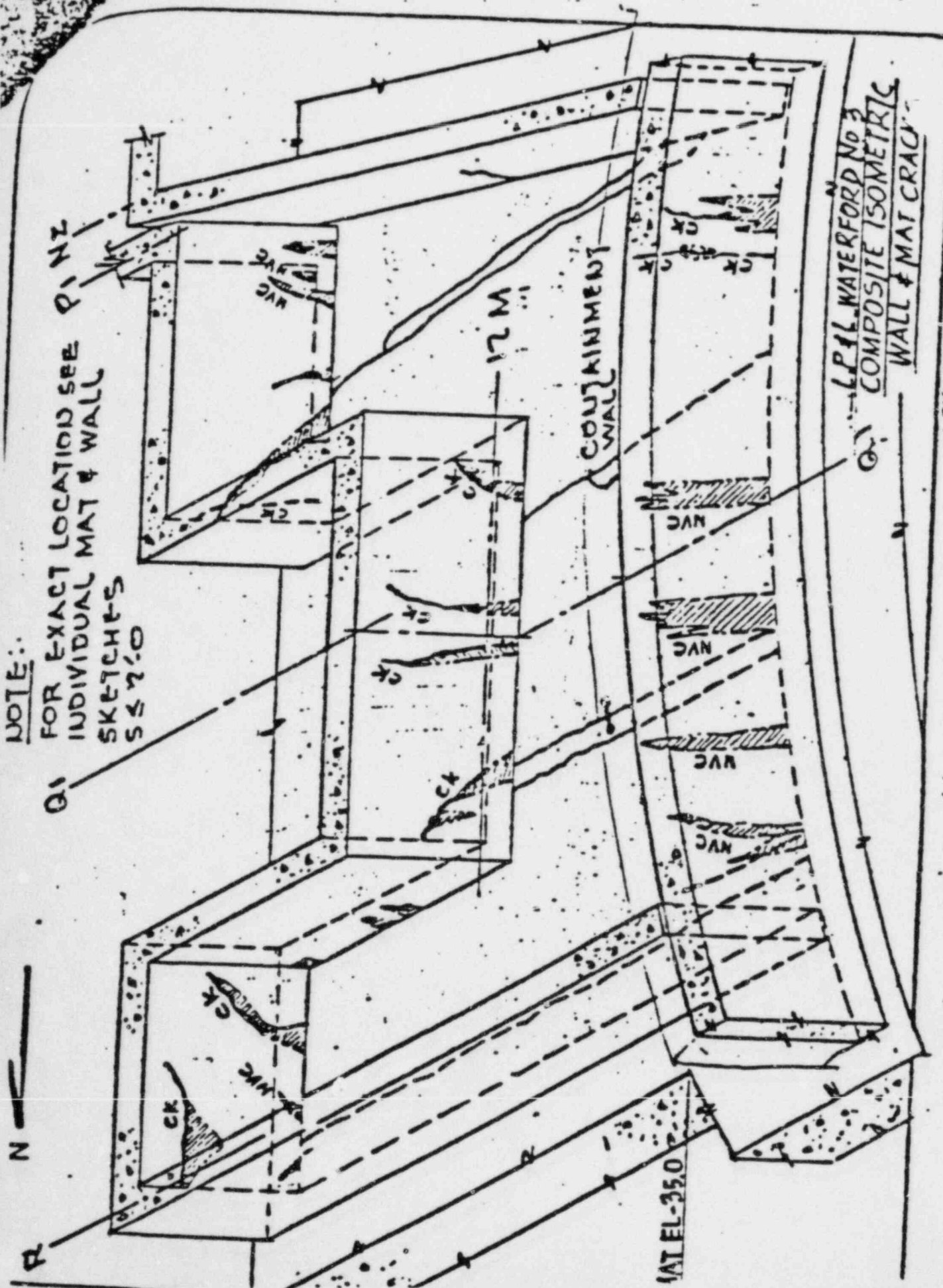
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2. NO FLOOR FINISH
3. NO EVIDENCE OF SEEPAGE
4. HAIRLINE CRACK



Attachment No. 4 Sht 1 of 2

NOTE:

FOR EXACT LOCATION SEE P. 1 NZ
INDIVIDUAL MAT & WALL
SKETCHES
S 27'0



LP14 WATERFORD No 3
COMPOSITE ISOMETRIC
WALL & MAT CRACK

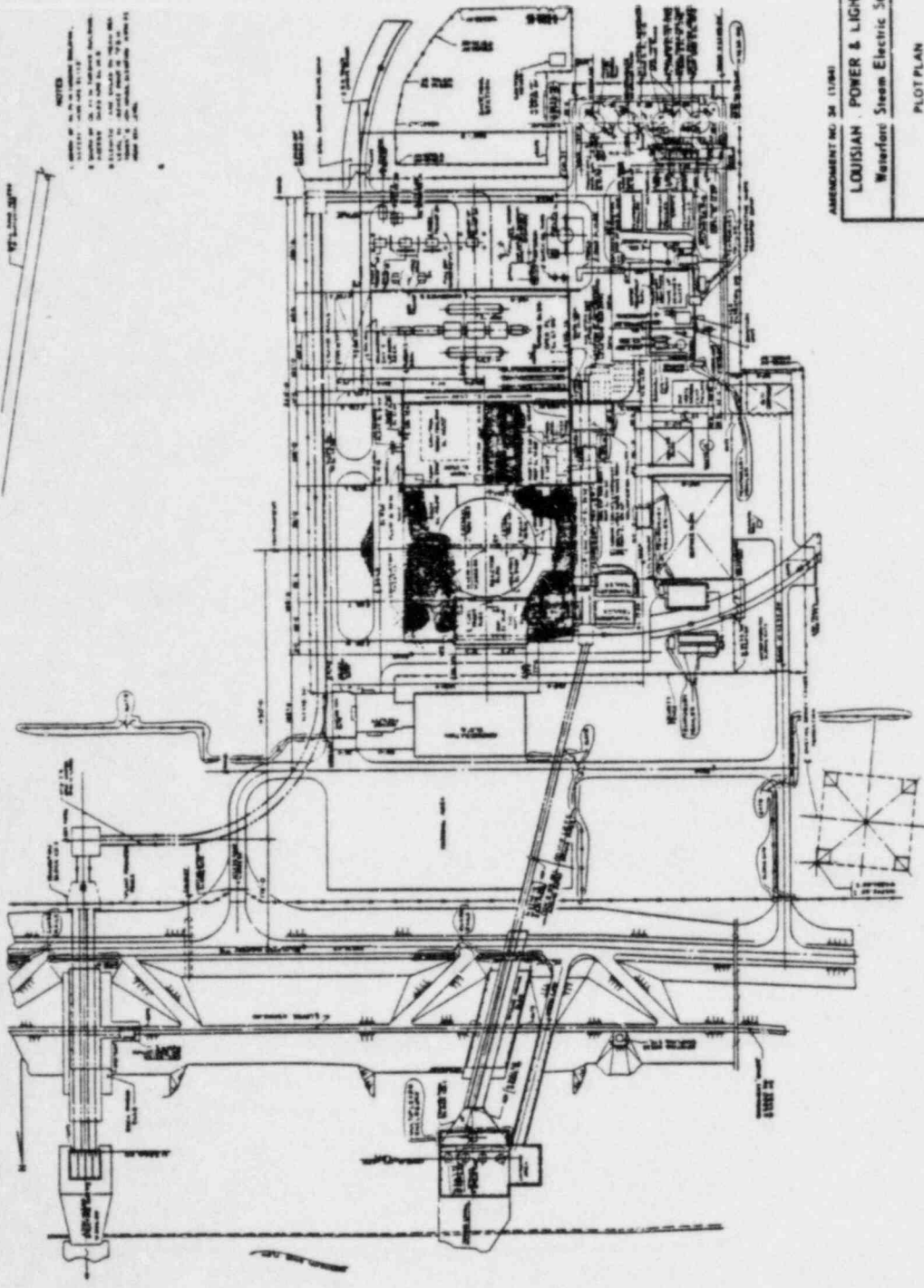
BY: A. NACCARELLA SHEET 2 OF 5
CHKD BY: G WU DATE: 4/17/04

141 EL-35.0

B/34

NOTES

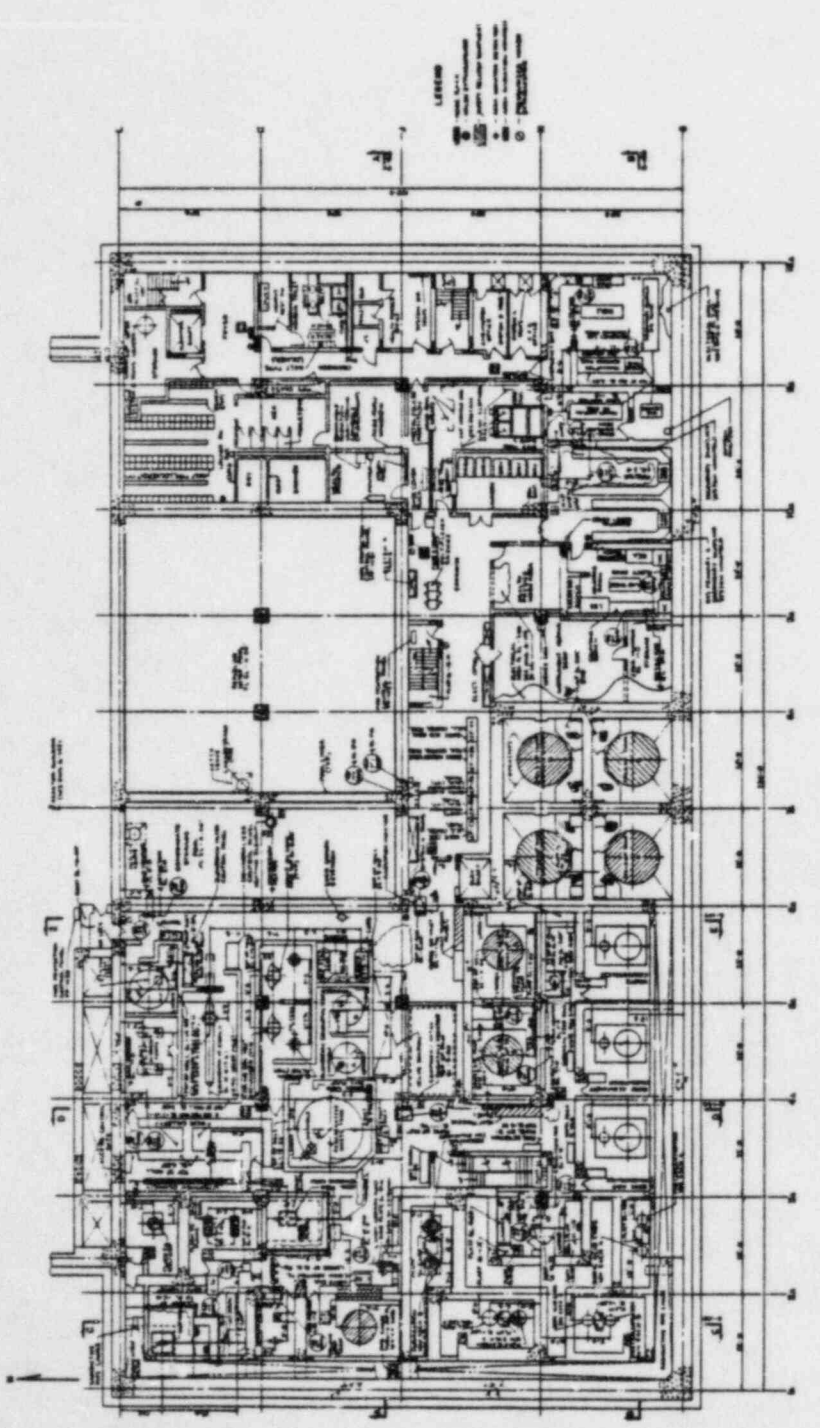
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AMENDMENT NO. 24 (11/64)
LOUISIAN POWER & LIGHT CO.
 Waterford Steam Electric Station

PLOT PLAN
 FIGURE 1.2.1

REF. ENG. LOU 1044-G-127 (REV. 13)

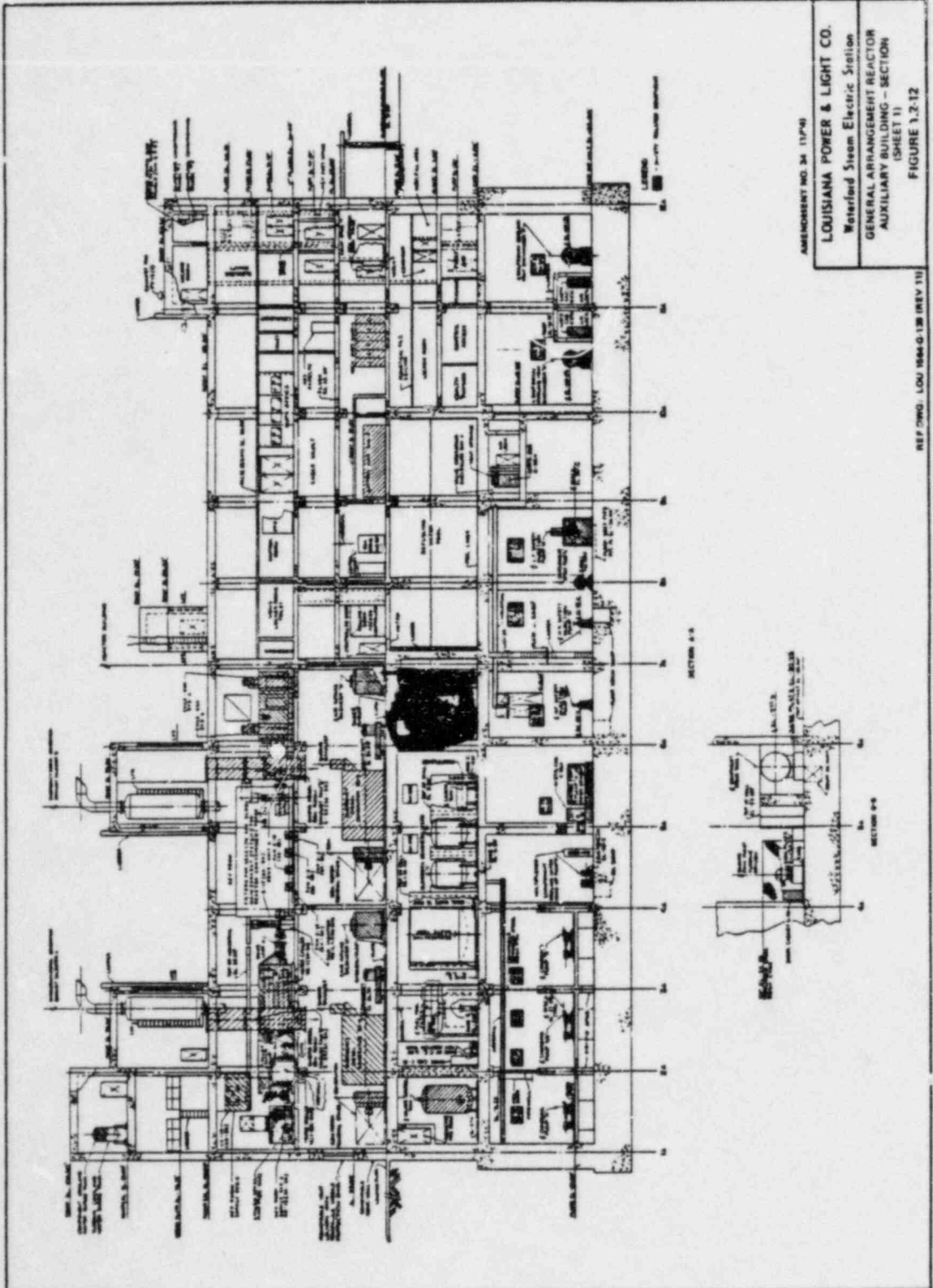


AMENDMENT NO. 21 11/64

LOUISIANA POWER & LIGHT CO.
 Waterford Steam Electric Station
 GENERAL ARRANGEMENT REACTOR
 AUXILIARY BUILDING
 PLAN EL - 4.00
 FIGURE 1.2.10

REF DWG. LOU 1564-G-136 (REV 13)

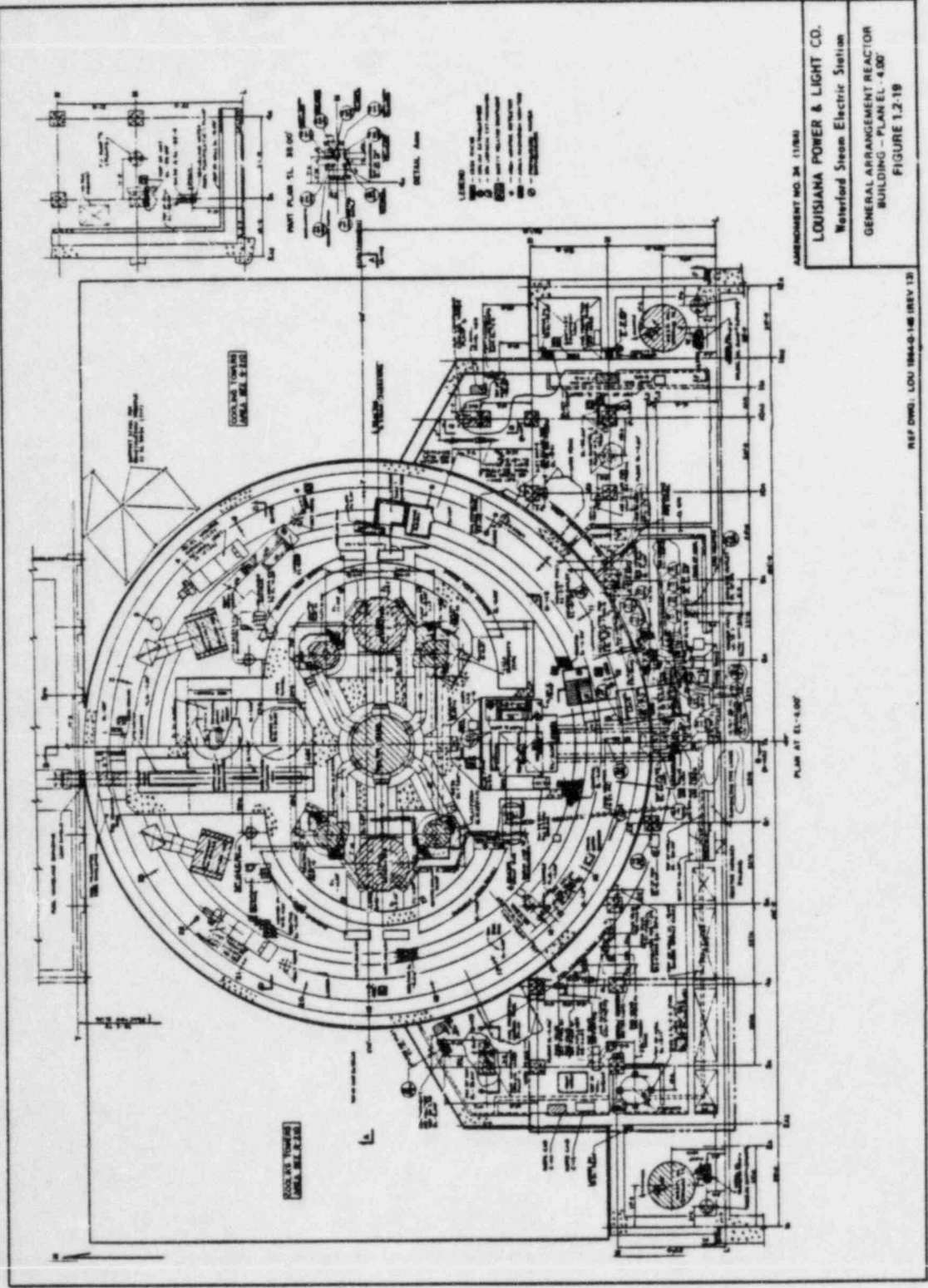
PLAN AT EL - 4.00'



AMENDMENT NO. 34 (11/79)
LOUISIANA POWER & LIGHT CO.
 Waterford Steam Electric Station
 GENERAL ARRANGEMENT REACTOR
 AUXILIARY BUILDING - SECTION
 (SHEET 1)

FIGURE 1.2-12

REF 0960, LOU 1884-G.12B (REV 11)



AMENDMENT NO. 24 (1/28/43)
LOUISIANA POWER & LIGHT CO.
 Waterford Steam Electric Station
 GENERAL ARRANGEMENT REACTOR
 BUILDING - PLAN EL. 4.00'
 FIGURE 1.2-19

REF DIMS. LOU 1844-G-148 (REV 12)

PLAN AT EL. 4.00'

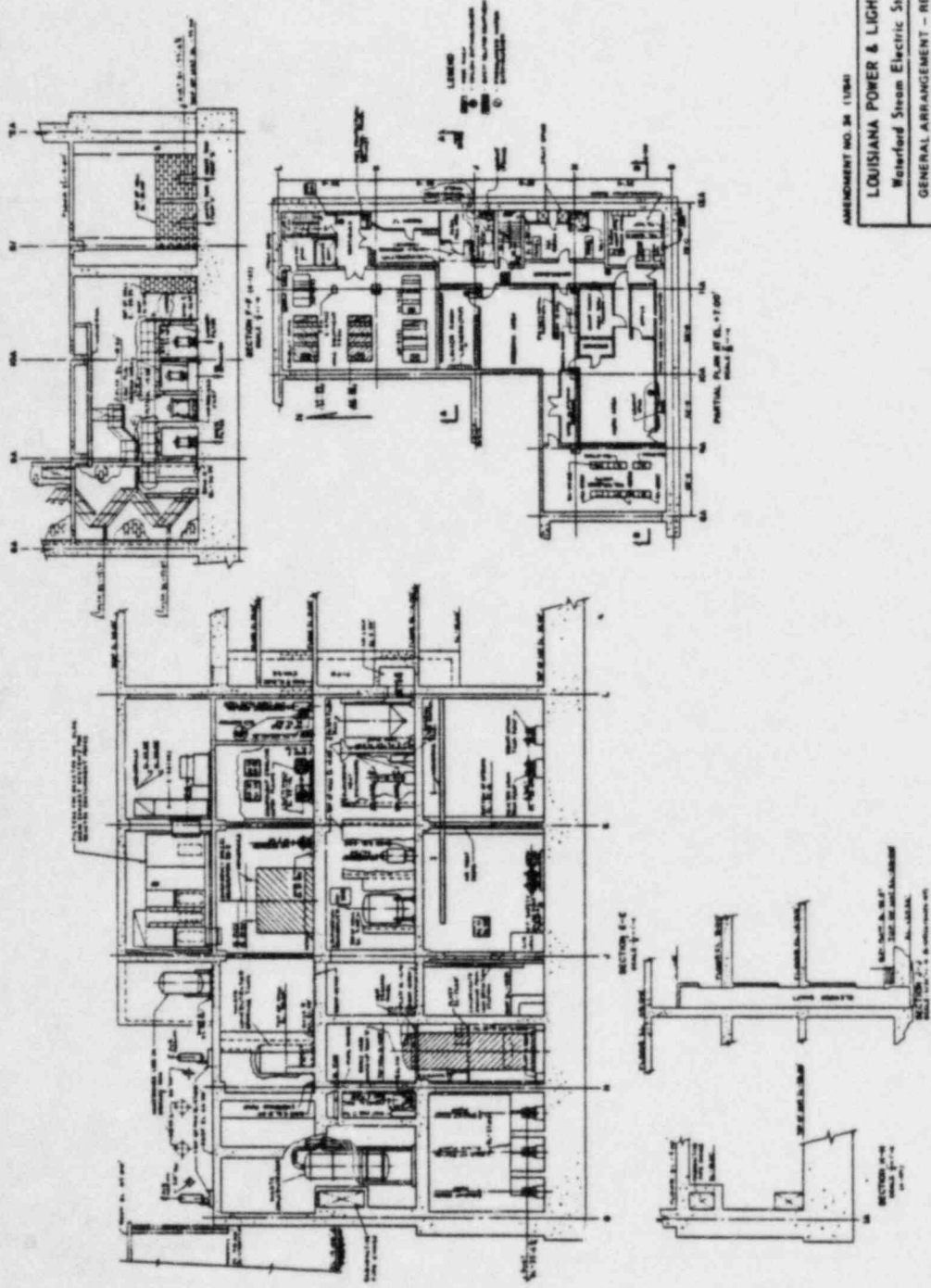
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COOLING TOWER
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COOLING TOWER
 AREA, SEE S. 102

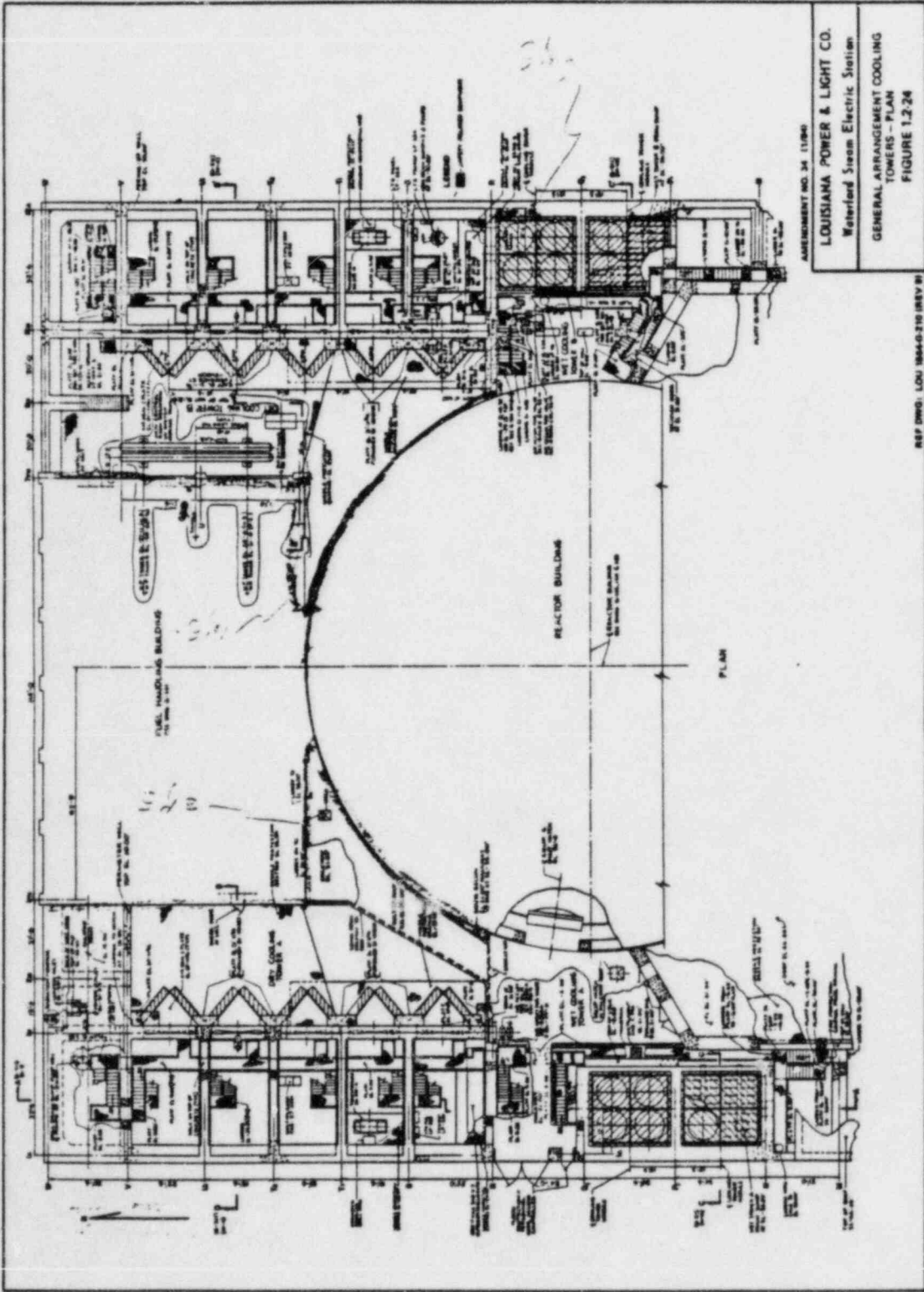
INLET PLUMB TO BE OUT

DETAIL Area



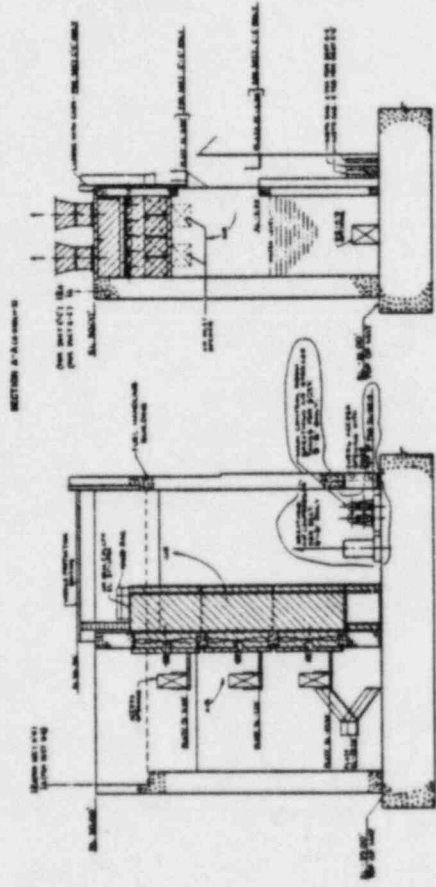
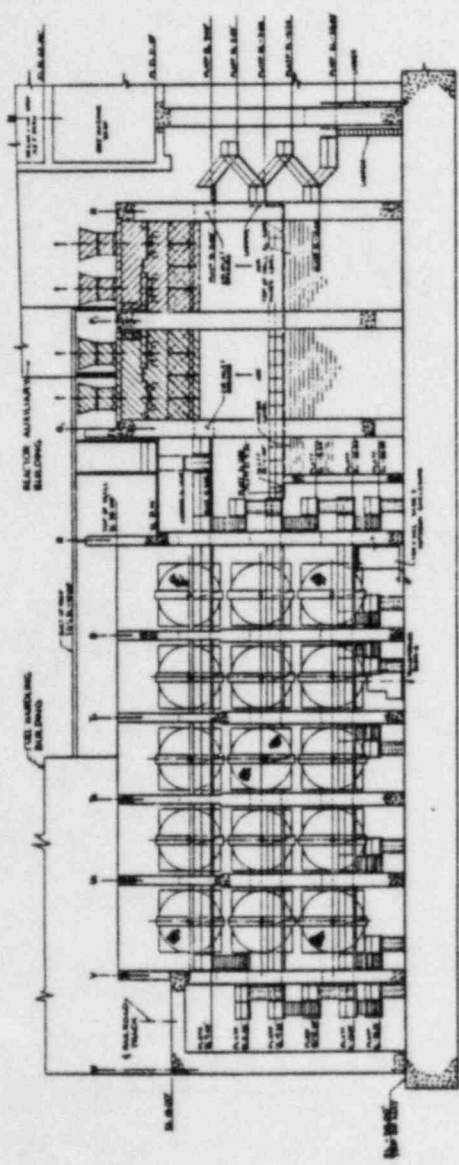
AMENDMENT NO. 34 (11/84)
LOUISIANA POWER & LIGHT CO.
 Waterford Steam Electric Station
 GENERAL ARRANGEMENT - REACTOR
 AUXILIARY BUILDING - PLANS AND
 SECTIONS (SHEET 4)
 FIGURE 1.2-23

REF. DWG: LOU 1944-S-148 (REV. 12)



AMENDMENT NO. 34 11/80
LOUISIANA POWER & LIGHT CO.
 Waterford Steam Electric Station
 GENERAL ARRANGEMENT COOLING
 TOWERS - PLAN
 FIGURE 1.2-24

REF DWG. LOU 1846-G-210 (REV 81)



LEGEND
 [Symbol] CONCRETE
 [Symbol] STEEL

AMENDMENT NO. 34 (11/84)
LOUISIANA POWER & LIGHT CO.
 Waterford Steam Electric Station
 GENERAL ARRANGEMENT COOLING
 TOWERS - SECTIONS
 FIGURE 1.2.25

SECTION C-C (SEE GENERAL ARRANGEMENT)
 SECTION C-C (SEE GENERAL ARRANGEMENT)
 AS SHOWN IN FIG. 1.2.25

SECTION B-B (SEE GENERAL ARRANGEMENT)
 SECTION B-B (SEE GENERAL ARRANGEMENT)
 AS SHOWN IN FIG. 1.2.25

REF DWG. LOU 9844-G-211 (REV. 6)