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

July 11, 1985

Docket No. 50-416

LICENSEE: Mississippi Power and Light Company

FACILITY: Grand Gulf Unit 1

SUBJECT: SUMMARY OF JUNE 19, 1985 MEETING REGARDING CONTAINMENT SUPPRESSION POOL SWELL THROUGH ENCROACHED AREAS

The purpose of the meeting was to discuss resolution of concerns regarding containment suppression pool swell through encroached areas. Enclosure 1 is a list of attendees. Enclosure 2 is a copy of slides and/or handouts prepared by an NRC consultant used in the meeting. Enclosure 3 is a copy of slides prepared by General Electric (GE) used in the meeting.

An NRC consultant presented a preliminary evaluation of encroached pool swell, which is not the NRC position at this time. This preliminary evaluation identified the existence of a water ligament near the containment wall where impact velocities can be greater than 50 ft./sec.

A GE representative made a presentation for the licensee regarding encroachment tests with blocked vents. These tests showed that blocking vents is a possible resolution to concerns regarding pool swell through encroached areas.

MP&L and the NRC staff agreed to have another meeting on this subject after further review of test data and the preliminary evaluation.

DESIGNATED ORIGINAL
Certified By Angela Hatton

Jon B. Hopkins
Jon B. Hopkins, Project Manager
Licensing Branch No. 4
Division of Licensing

Enclosures:
As stated

8507260662 850711
PDR ADOCK 05000416
P PDR

Enclosure 1

List of Attendees

6/19/85

NRC

J. Hopkins
J. Kudrick
F. Eltawila
B. Siegel
A. Sonin - consultant (MIT/BNL)
C. Economos - consultant (BNL)

MP&L

G. Smith
W. Mashburn

Bechtel

R. Pernisi
E. Fotopoulos
S. Sen

GE

J. Torbeck

Illinois Power Co.

J. Peterson

Gulf States Util.

L. England

Cleveland Electric Ill. Co.

R. Pender

Proposed resolution of HCU-level impact issue:

Unenrcoached pool region

- The existing LD is based on $1/\sqrt{3}$-scale expt's where stream *should* have been present and water velocities properly simulated. Also, measurements were made in the region where the stream was subsequently found.
- Hence, existing LD *should* be OK!

Encroached pool regions

- Stream velocities were lower than in unencroached pool, and widths no greater (of solid water-stream).
- Although "lips" made some of the impacting regions broader than in the unencroached pool, the $1/\sqrt{3}$-scale data shows that even *local* pressures in impacted region are below mean pressure specified in LD.
- Hence, existing clean-pool LD should *bound* encroached pool cases.

The 1/10-scale simulations raise two questions about the adequacy of the existing load definition:

1. In both the unencroached and the various encroached pools, a 4-5 foot wide stream of solid water rose along the containment wall and reached the hcu floor level with high velocity.
The existing LD recognizes only "froth" above 18-19 FT.

<u>Concern</u>: Impact loads at HCU floor level.

2. Velocities higher than 50 FT/s were observed in the solid water stream in the unencroached pool and some of the encroached pools.

<u>Concern</u>: impact/drag loads on structures below HCU floor in region traversed by water stream.

TABLE 1: POOL SWELL IN 1/10-SCALE SIMULATION OF UNENCROACHED POOL (FROM FIGS. 1-5)

Frame No.	time (sec), t		Z_o+	ΔZ_o	Δt	V
	1/10-scale	full scale	(ft) full scale	(ft)	(sec) full scale	(ft/sec) full scale
5	0.103	0.326	6.4			
			8.0	3.1	0.116	27
10	0.140	0.442	9.5			
			11.8	4.5	0.121	37
16	0.178	0.563	14.0			
			15.9	3.7	0.0758	49
20	0.202	0.638	17.2			
24	0.227	0.717	> 22			

+See Figs. 1-4 for definition of Z_o.

Table 2 Ceiling Impact Pressures: PSTF Data Vs. NUREG-0978 Specification

		1 Av. of tests 5801-5, 9 & 15 in PSTF (psi)	2 Col. 1 interpreted as full scale ceiling pressure at 26 ft. elevation (psi)	3 Col. 2 extrapolated to 20-ft. elevation (see text) (psi)
PSTF Data	Peak local ceiling pressure 0.9 ft. (full scale) from containment wall.[a]	4.5	7.8	11.1
PSTF Data	Peak local ceiling pressure anywhere on ceiling.[b]	7.2	12.5	17.9
PSTF Data	Peak average ceiling pressure (integrated pressure divided by area).[c]	2.8	4.8	6.9
NUREG specification	NUREG-0978 specification of peak average ceiling pressure.		8.8	19.4

(a),(b): See Fig. 4-64 of Refs. 5 and 6.
(c): See Table 4-3 of Ref. 5.

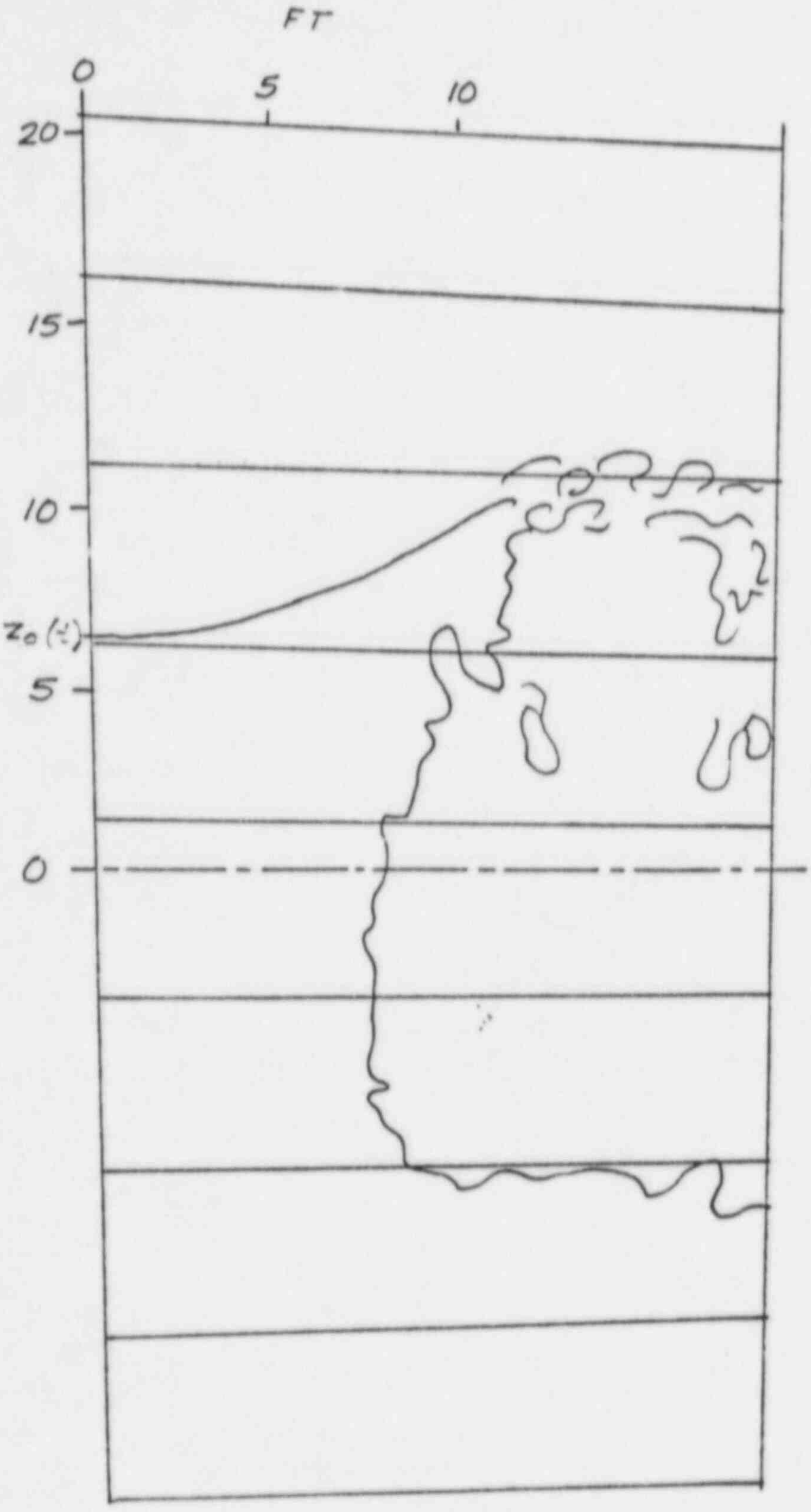


Fig. 1 : Frame No. 5, 1/10-scale unencroached pool simulation. t = 0.33 s (full scale) after "vent clearing".

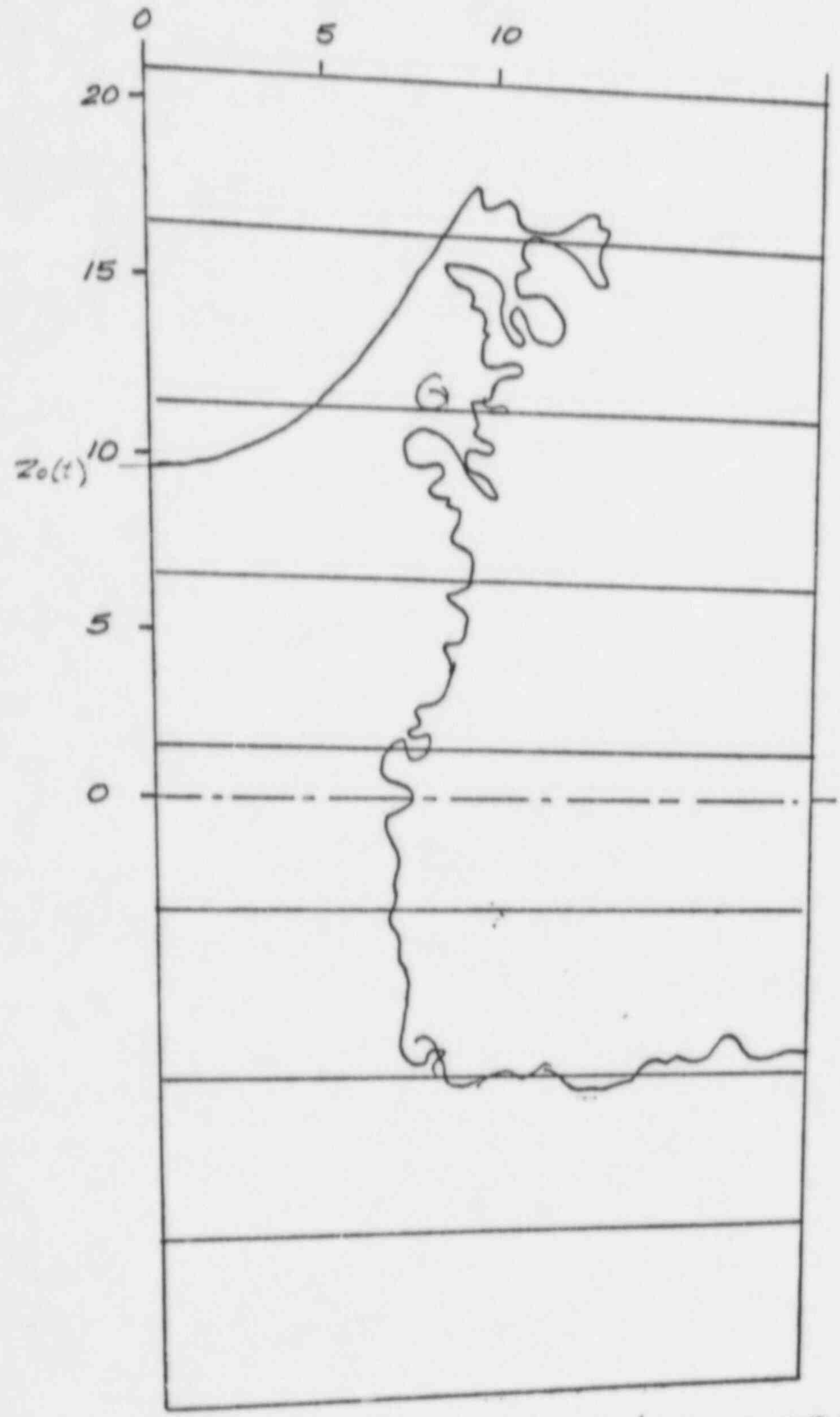


Fig. 2 : Frame No. 10, 1/10-scale unencroached pool simulation. t = 0.44 s (full scale) after "vent clearing".

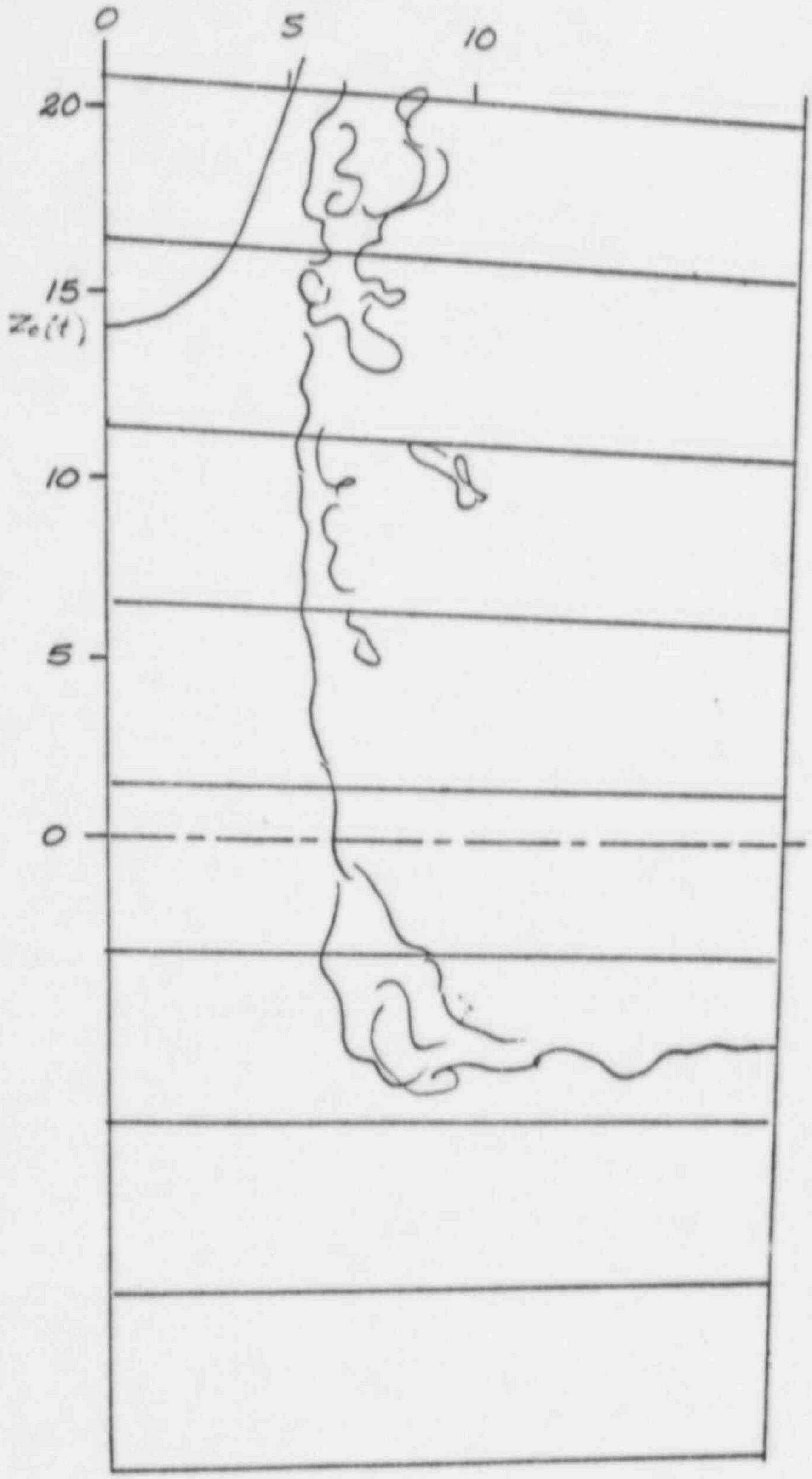


Fig 3: Frame No. 16, 1/10-scale unencroached pool simulation. $t = 0.56$ s (full scale) after "vent clearing".

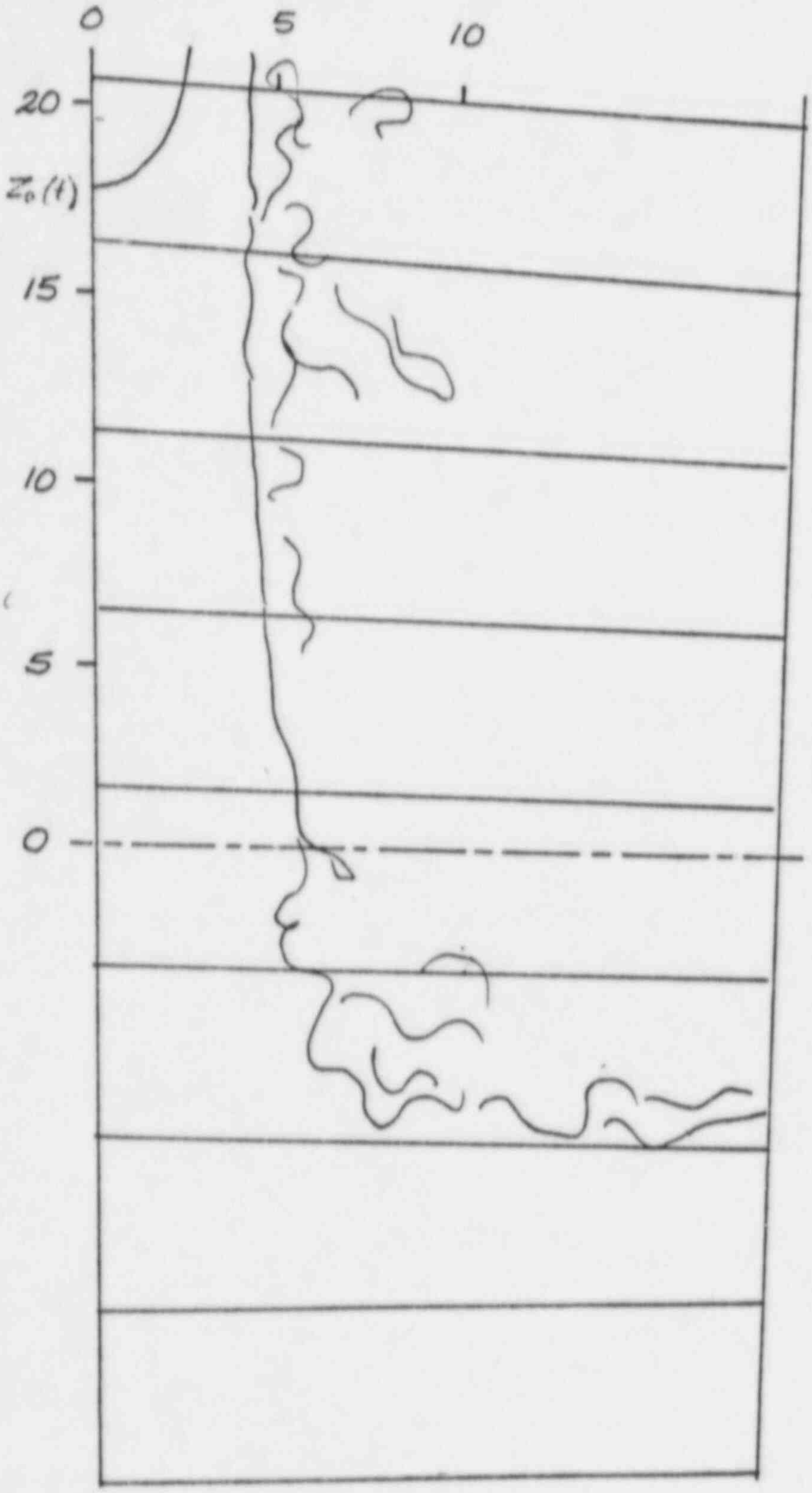


Fig. 4: Frame No. 20, 1/10-scale unencroached pool swell simulation. t = 0.64 s after "vent clearing".

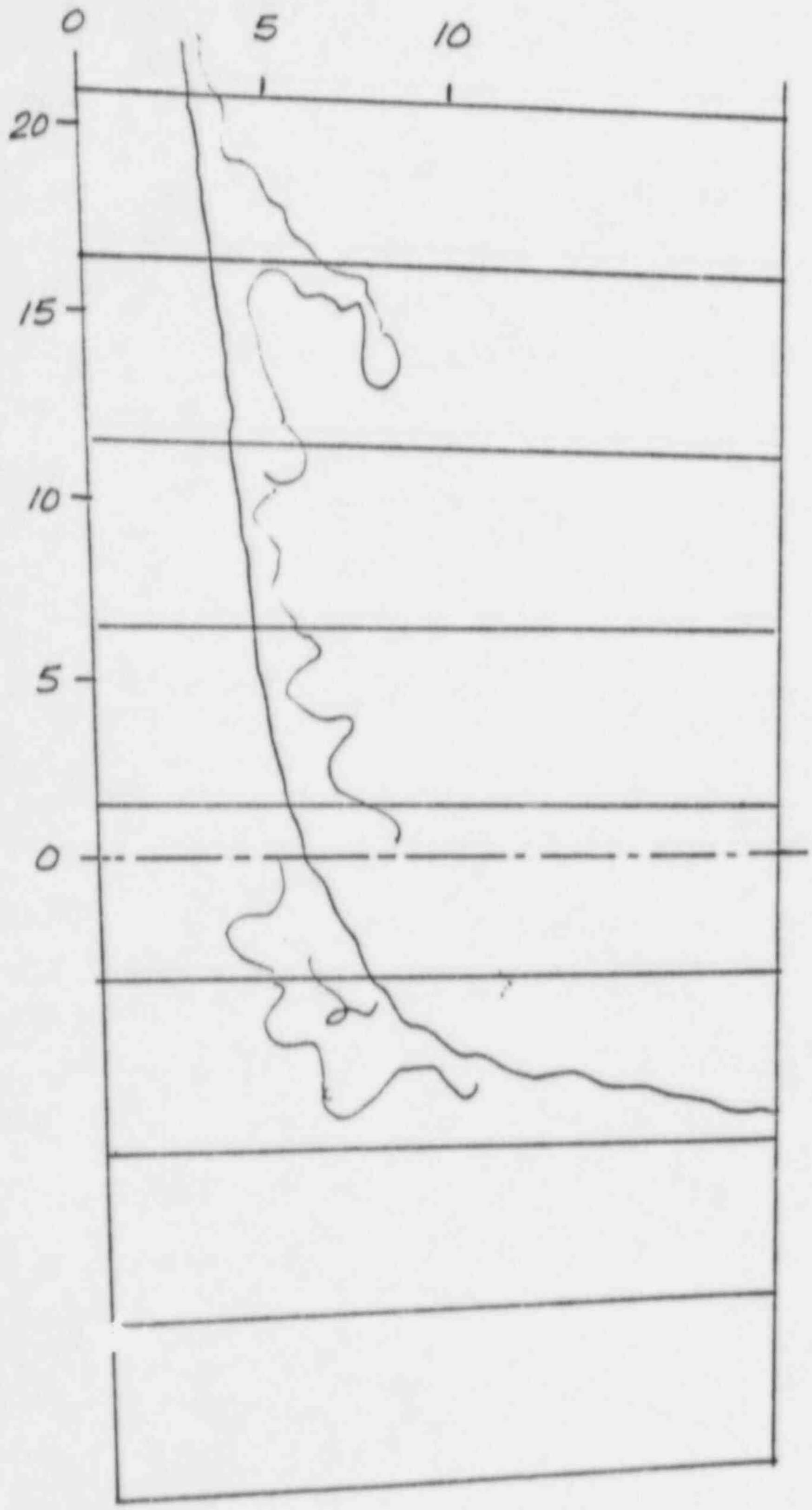


Fig. 5: Frame No. 24, 1/10-scale unencroached pool swell simulation. $t = 0.72$ s after "vent clearing"

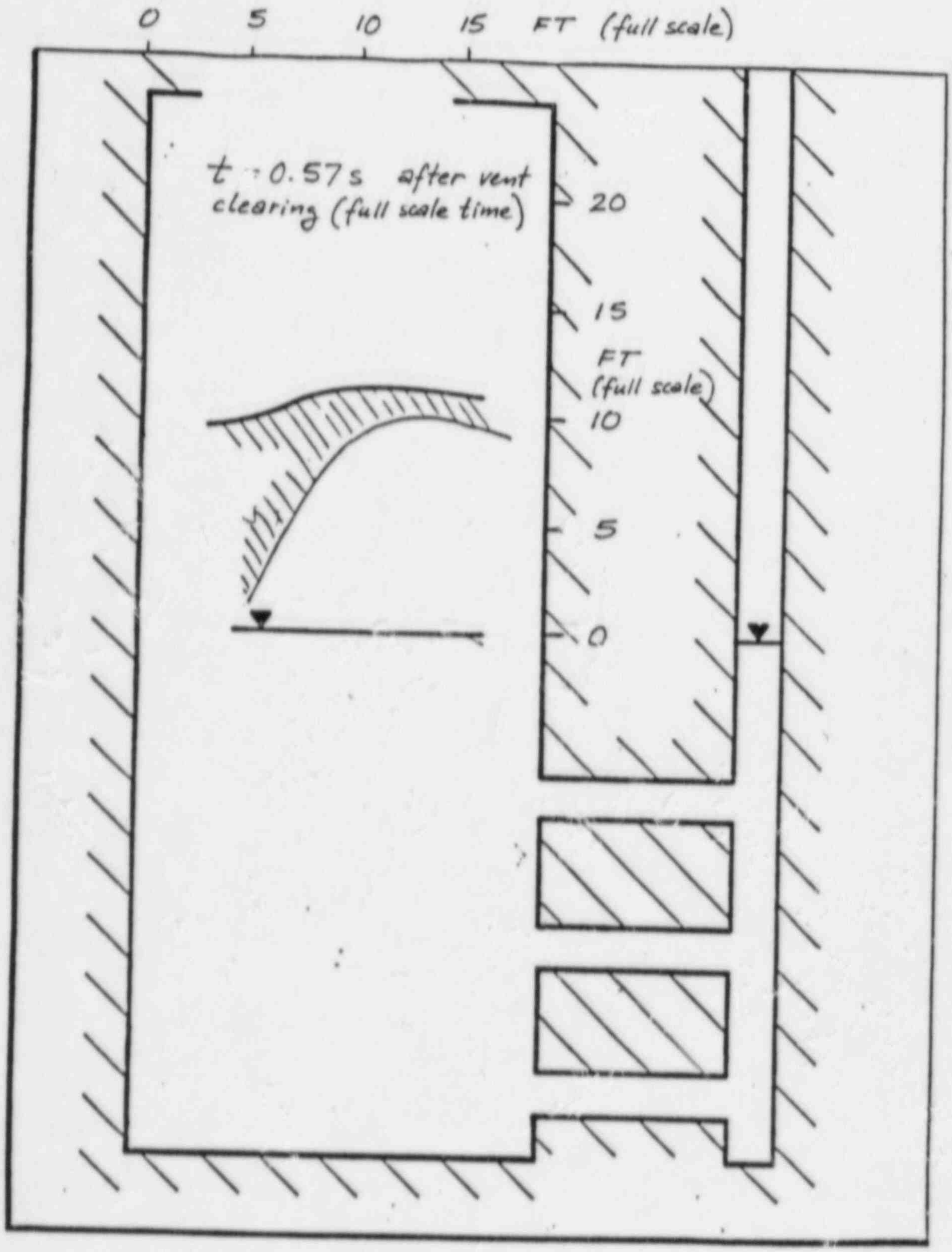


Fig. 6 Run 5801-9 water ligament 0.57s after vent clearing (full scale time). Distances are indicated in full scale feet. Data from NEDM-13407 P. 1/15 - scale Moody-scaled test.

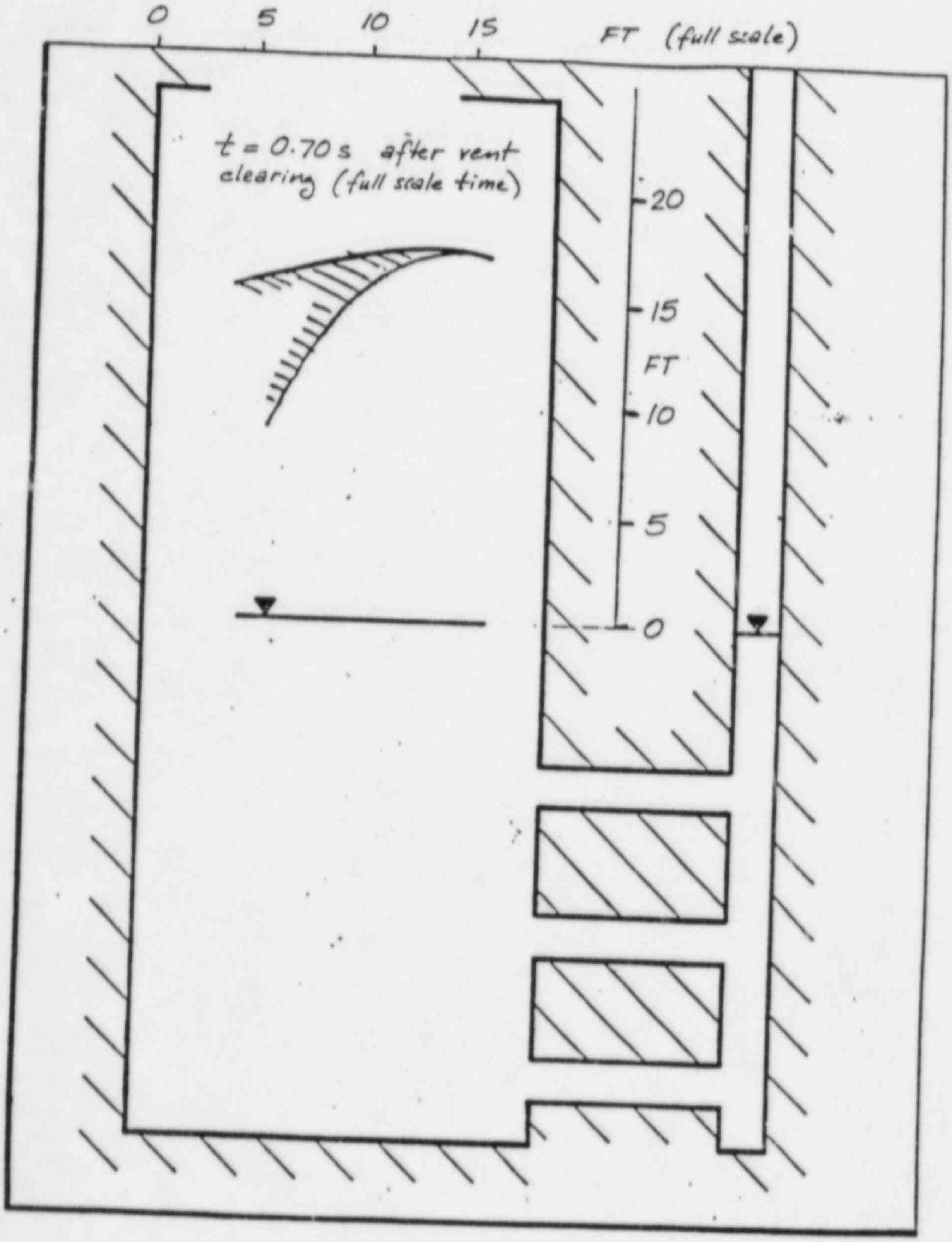


Fig. 7. Run 5801-9 water ligament 0.70 sec. after vent clearing (full scale time). Elevations are indicated in full scale feet. Data from NEDM-13407 P. $1/\sqrt{3}$-scale Moody-scaled test

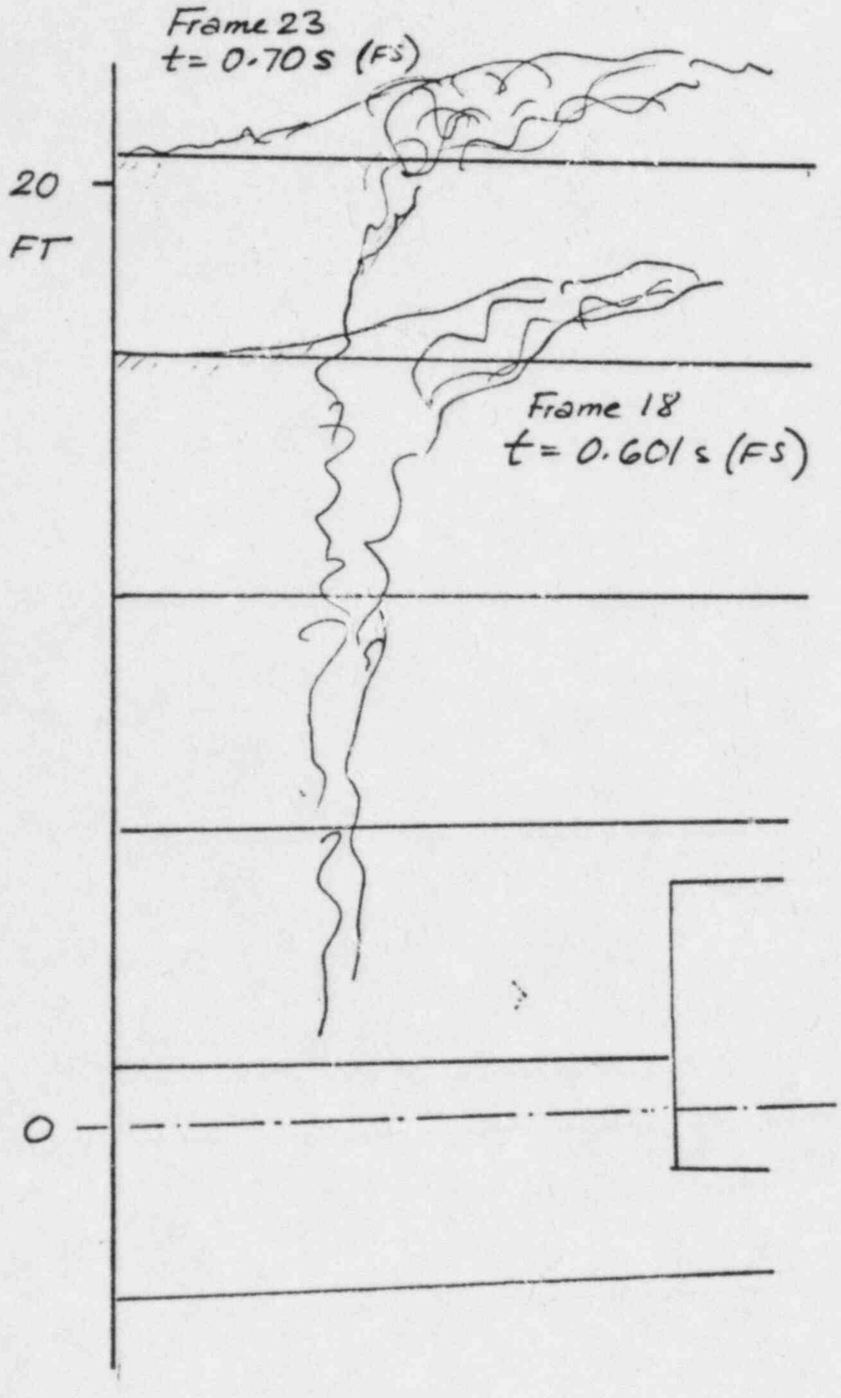


Fig. 8 : 1/10-scale simulation of Clinton's configuration 1 encroachment (Test F2R)

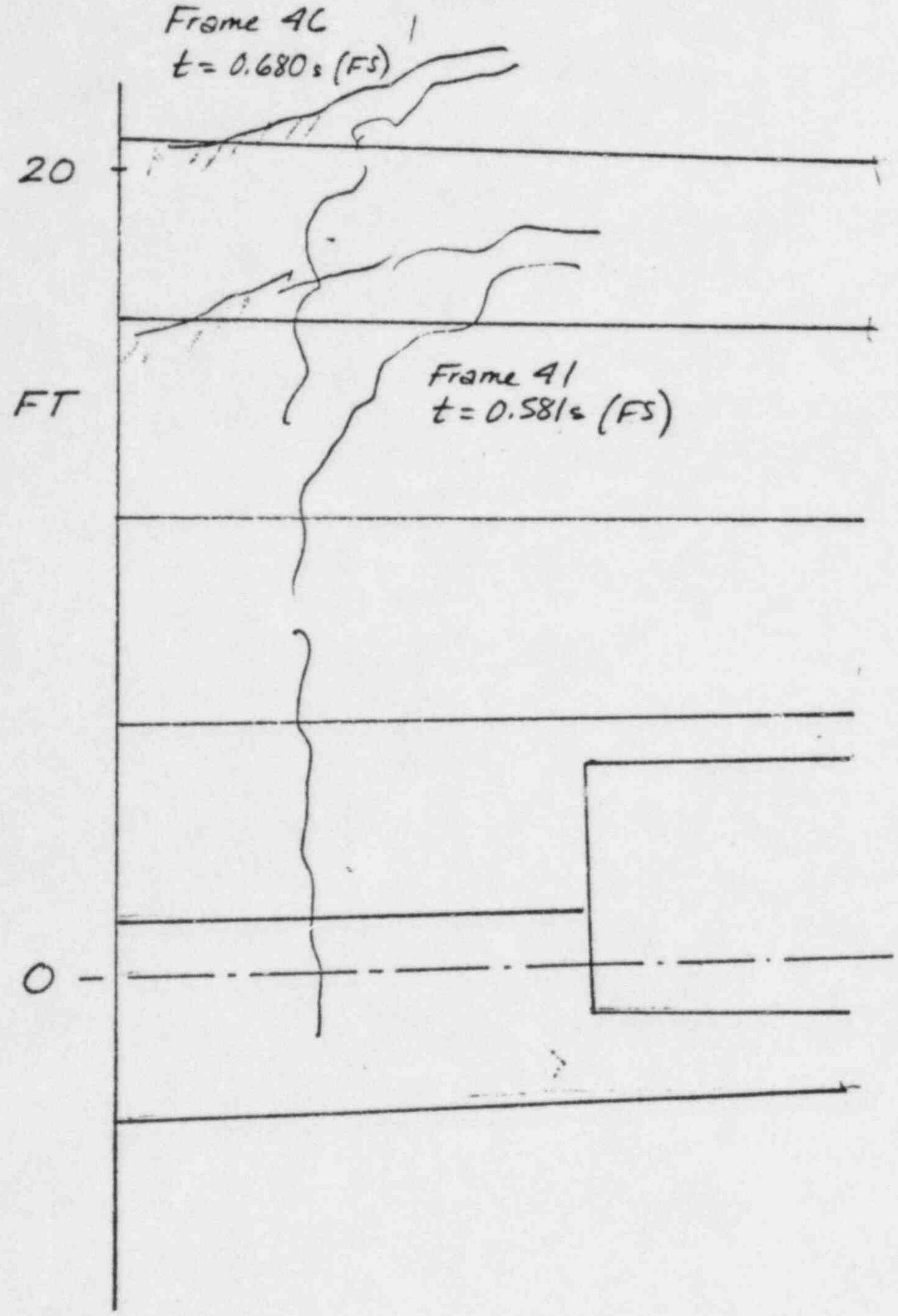


Fig. 9: 1/10 - scale simulation of Clinton's Configuration I encroachment (Test RO 5).

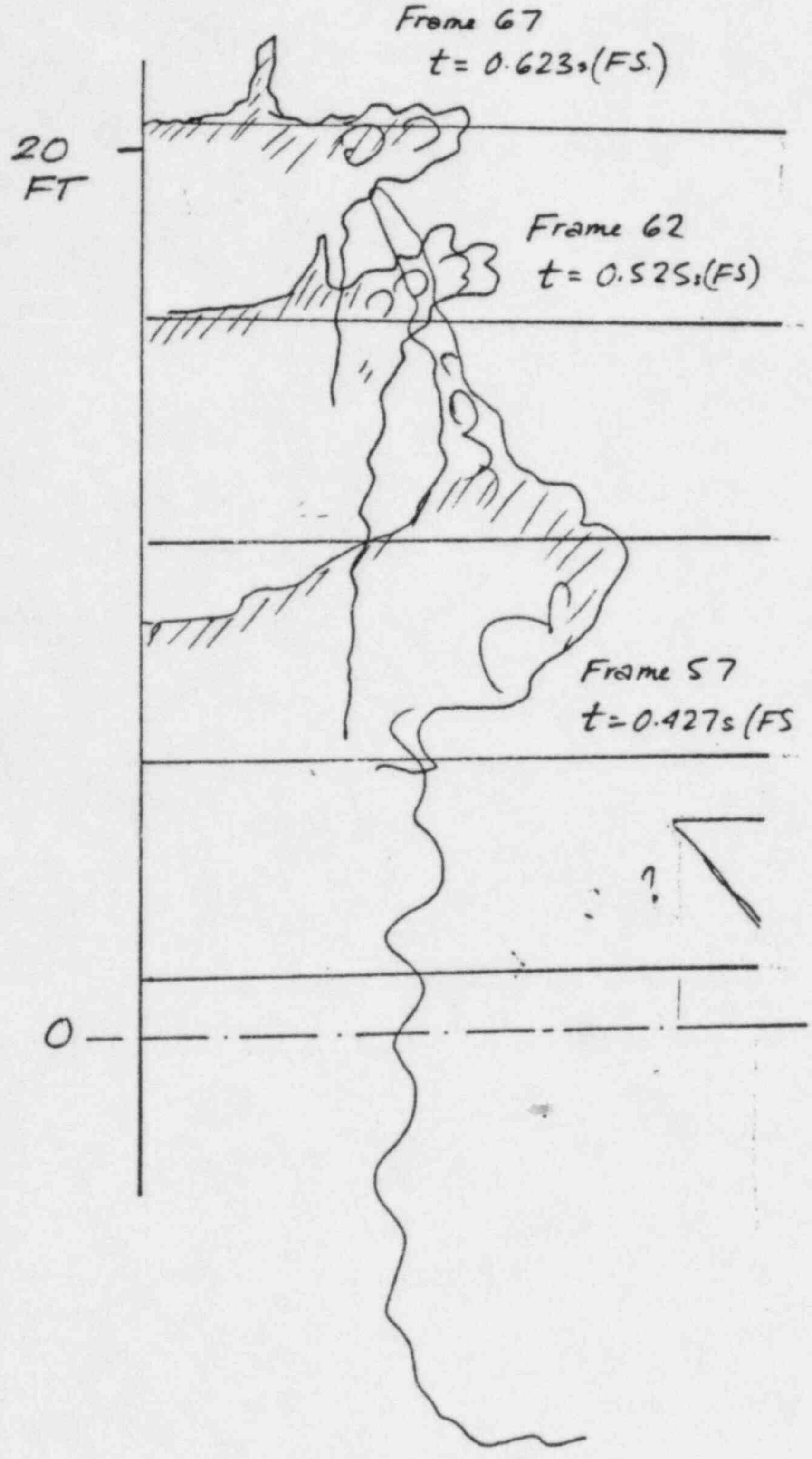


Fig. 10 = 1/10 - scale simulation of Clinton's Configuration 2 encroachment. Test F-5.

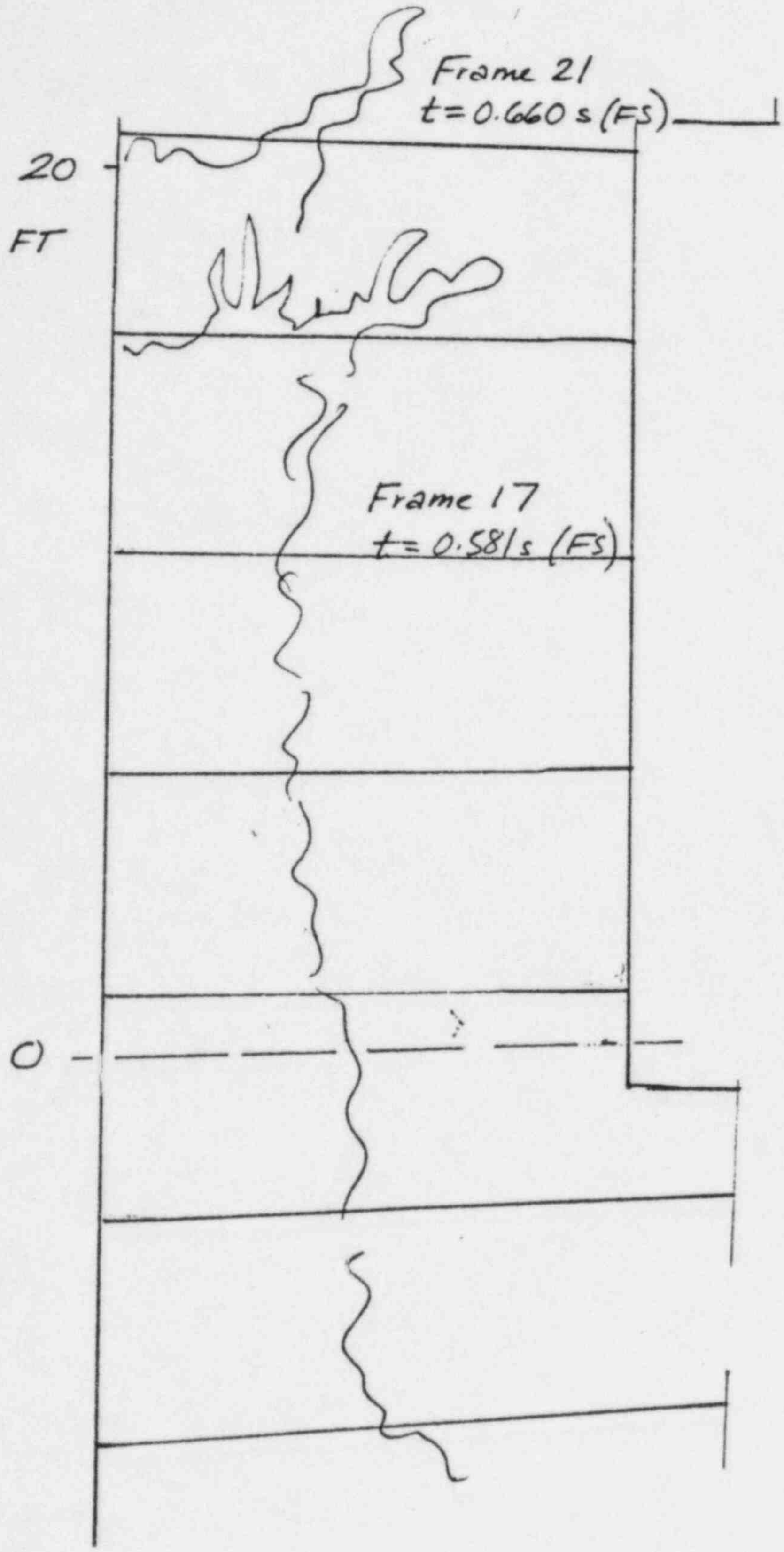


Fig. 11: 1/10-scale simulation of Perry encroachment

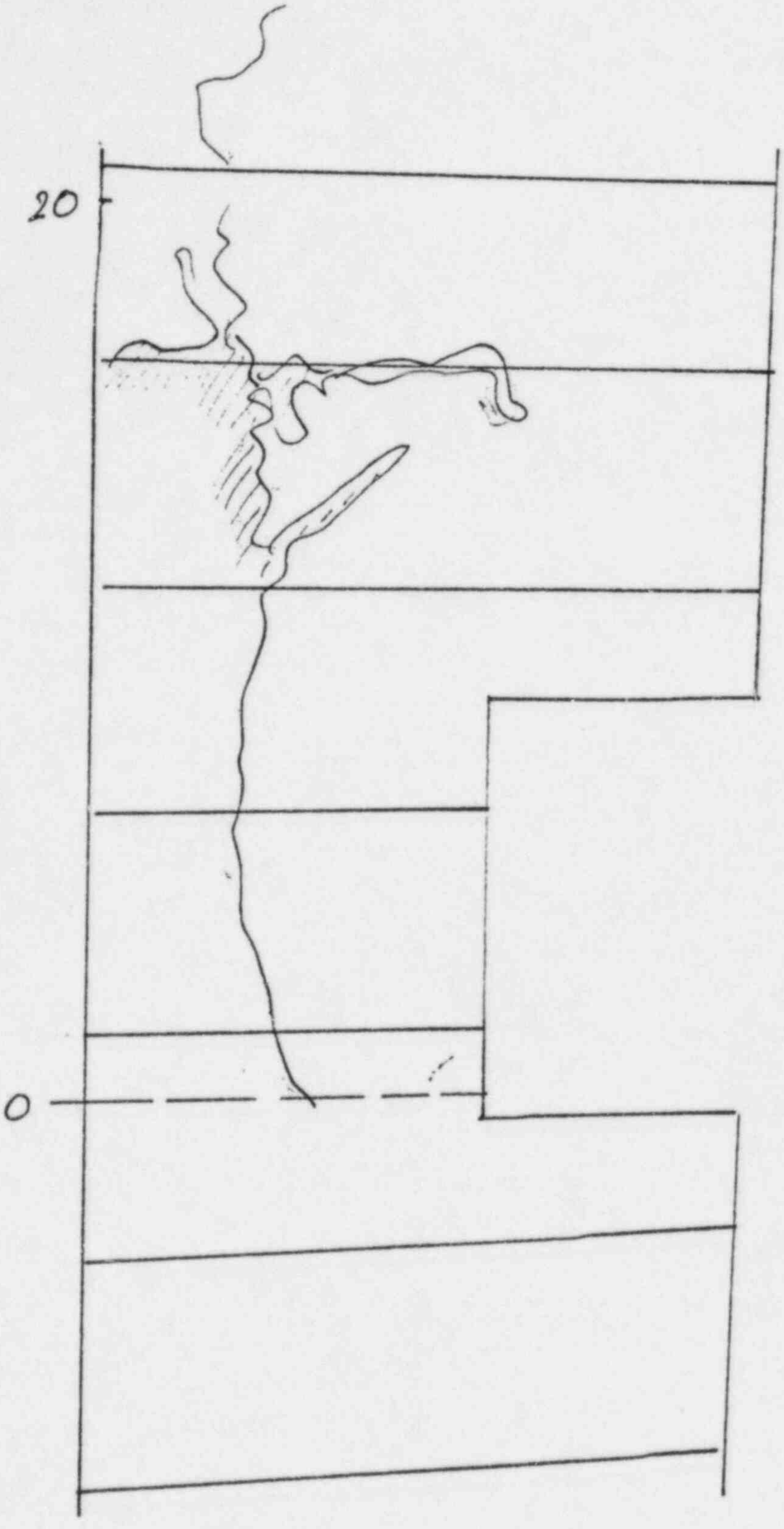


Fig. 12: 1/10-scale simulation of Grand Gulf encroachment, t = 0.64 s (full scale) after "vent clearing" (Frame 20).

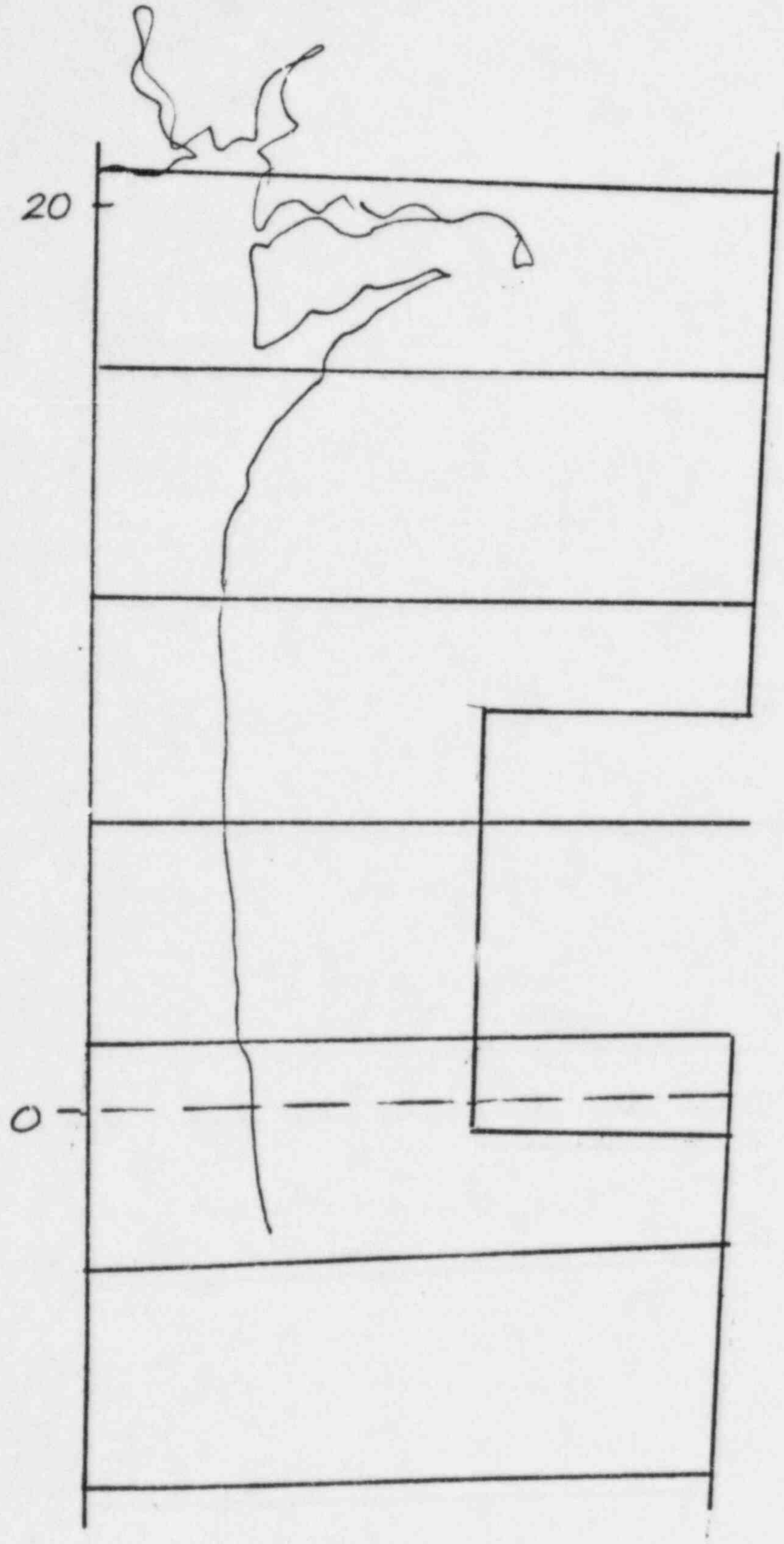


Fig. 13: 1/10 - scale simulation of Grand Gulf encroachment, t = 0.76 s (full scale) after "vent clearing" (Frame 26).

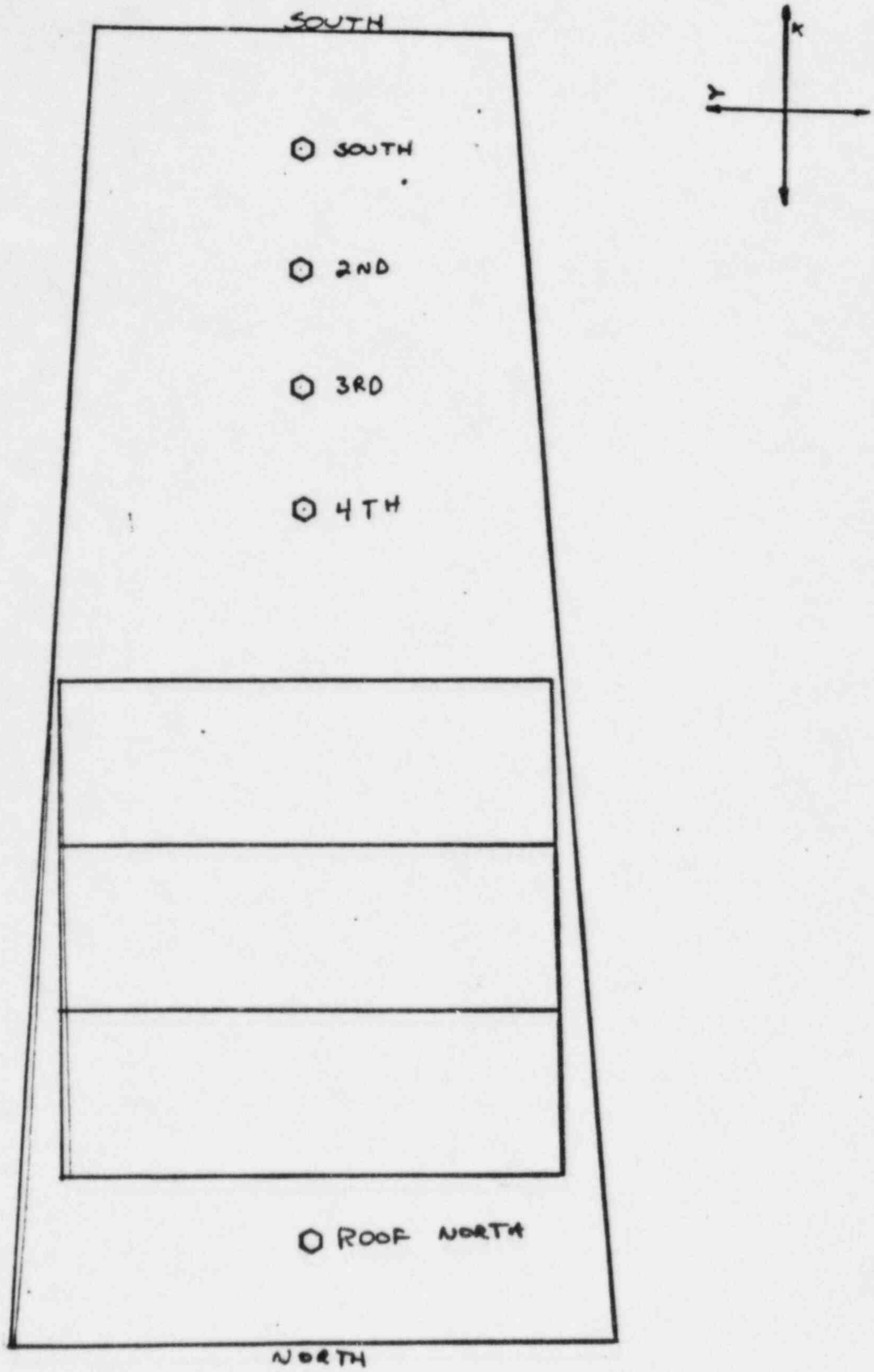


Figure 1 5801 [redacted], 5802 and 5803 TEST
IMPACT PRESSURE TRANSDUCER LOCATIONS

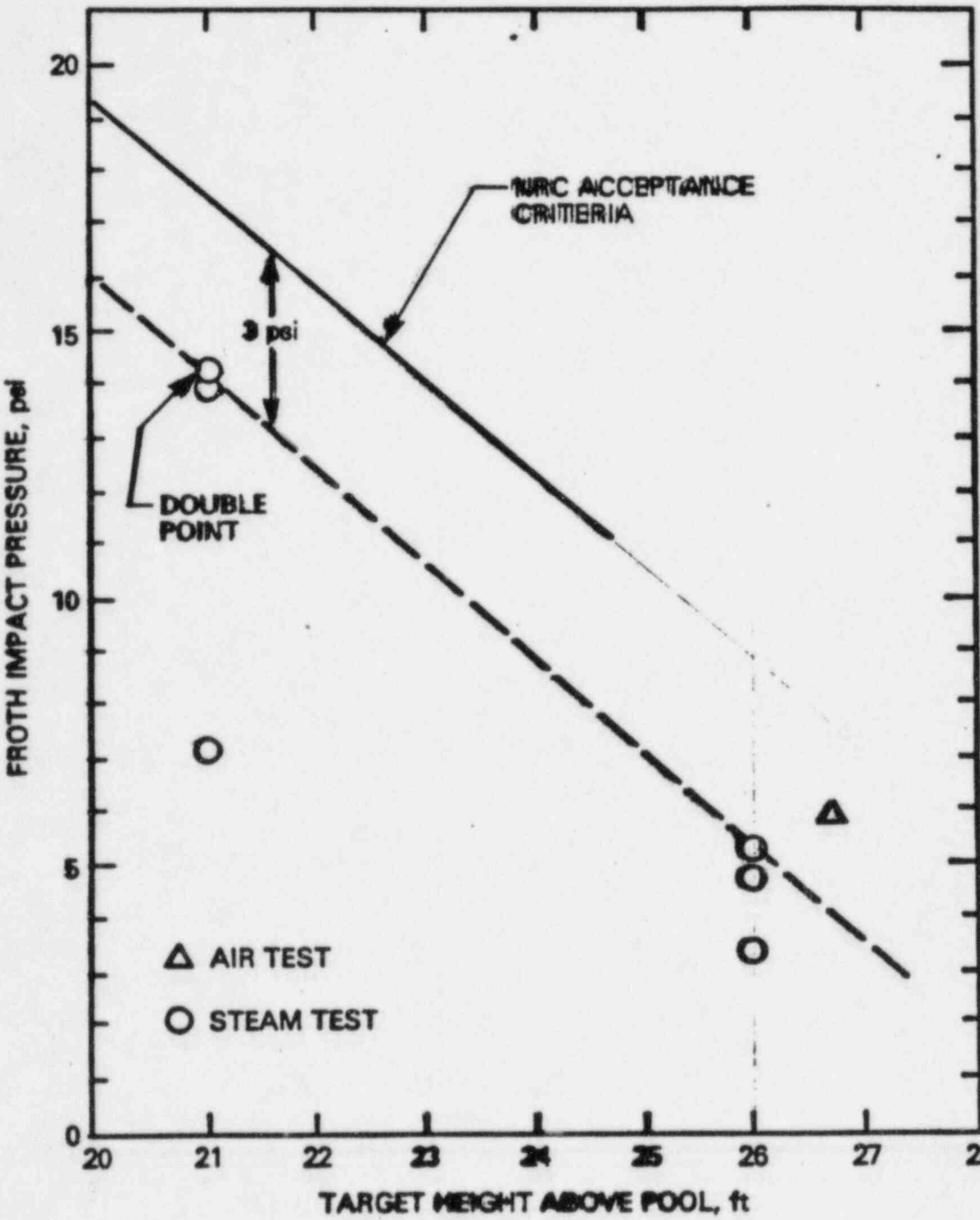


Figure 3-9 Froth Impact Measurements (from Figure 3-8) Scaled up to Full Size Using "Modified Froude Scaling"; Also Shown: NRC Acceptance Criteria

Water column velocities (full scale, FT/s) at c:a HCU floor level – from 1/10-scale tests:

	At contain't wall (≈ min. elevation)	At pt. of max. elevation	Average
PERRY	51	57	54
GRAND GULF	35	35	35
CLINTON I	47	47	47
CLINTON II	66	41	54
CLEAN POOL	57	66	60 (?)

Source: "Comparison of Velocities and thicknesses of Water Column at Containment Wall..."
GWS-06-145
Letter of 15 May 1985 from G.W. Smith.

NUREG 0978 : "50 FT/s."

Proposed resolution of issue relating to impact/drag loads on structures below HCU floor level.

Based on 1/10-scale data, examine regions where solid-water stream has $V > 50$ FT/s, and revise LD accordingly for structures (if any) in those regions.

ENCLOSURE 3

GRAND GULF

PLANT UNIQUE

ENCROACHMENT TESTS

WITH BLOCKED VENTS

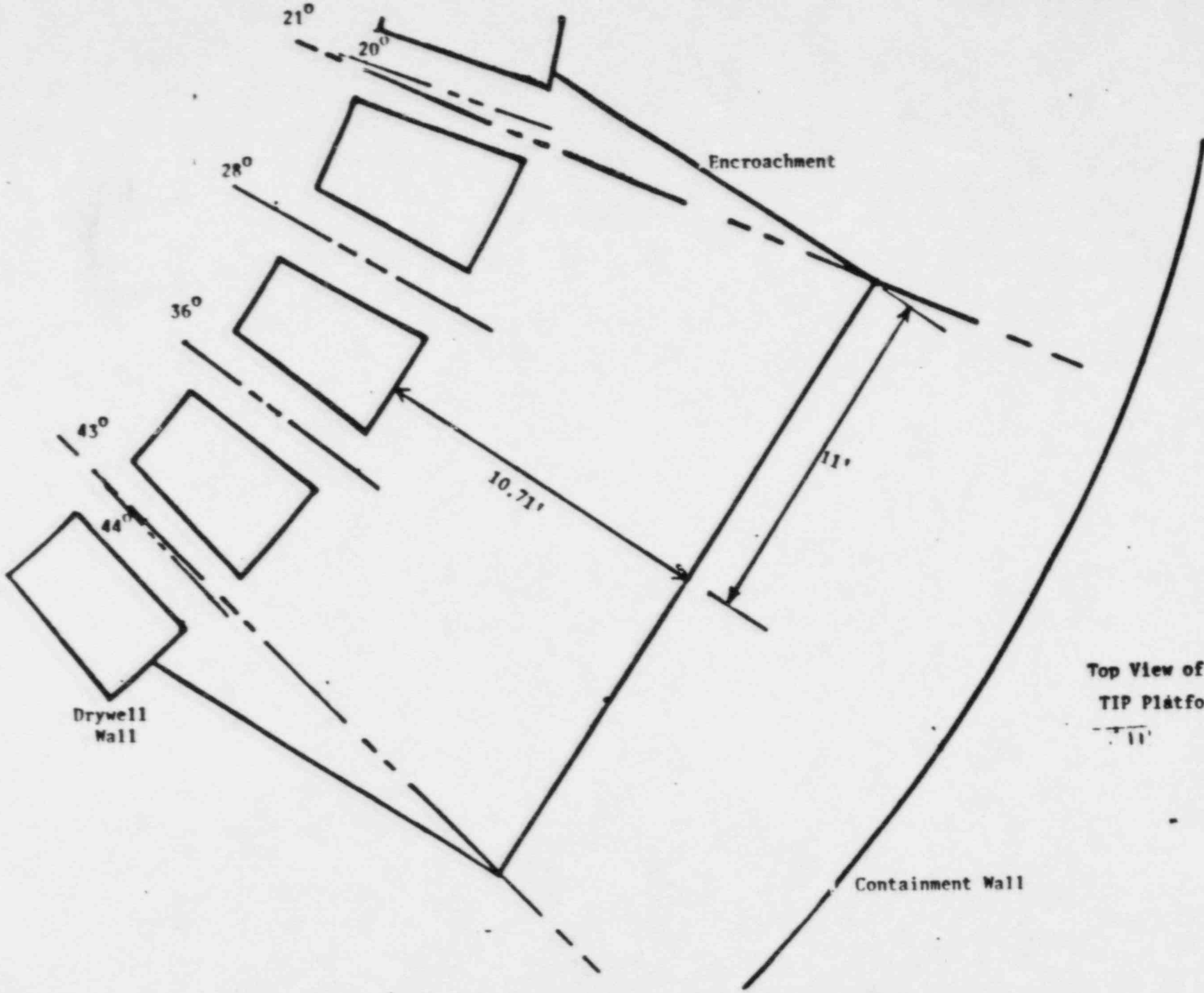
J.E. TORBECK
6/19/85

GRAND GULF ENCROACHMENT TESTS
WITH BLOCKED VENTS

SUMMARY DESCRIPTION

- o SAME HARDWARE AS GGNS PLANT UNIQUE TESTS
  - 1/10 SCALE RECTANGULAR TEST TANK
  - GGNS TIP PLATFORM
  - BLOCKED TOP VENT(S) UNDER ENCROACHMENT
- o TWO CONFIGURATIONS TESTED
  - ONE VENT BLOCKED
  - TWO VENTS BLOCKED
- o TEST MATRIX
  - THREE REPEAT TESTS WITH EACH CONFIGURATION
  - SAME BLOWDOWN CONDITIONS AS GGNS BASE TESTS

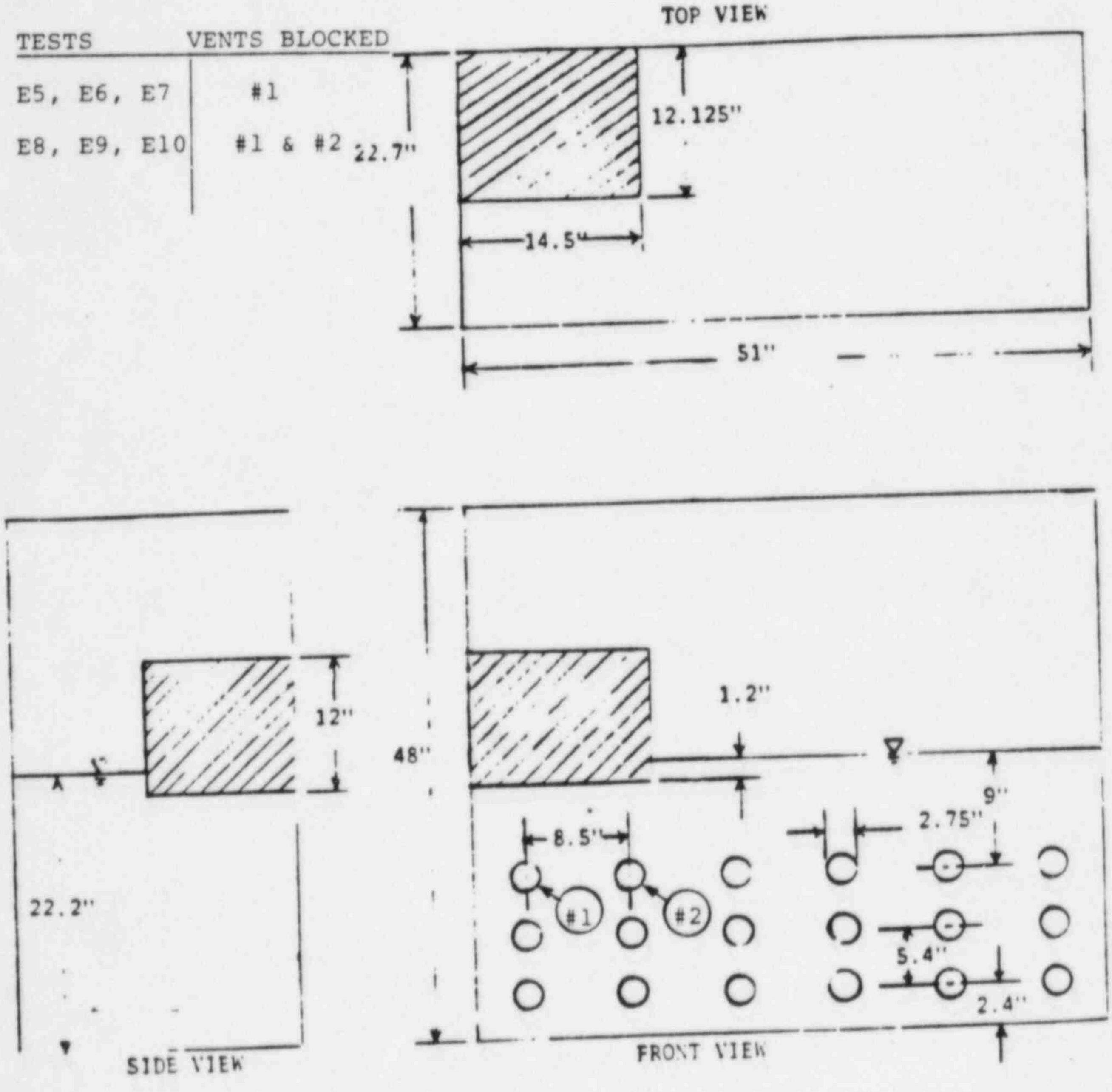
JET
6/19/85



Top View of Grand Gul
TIP Platform
11'

FIGURE I-1. TEST TANK AND SIMULATED GRAND GULF ENCROACHMENT

TESTS	VENTS BLOCKED
E5, E6, E7	#1
E8, E9, E10	#1 & #2



GRAND GULF ENCROACHMENT TESTS
WITH BLOCKED VENTS

CONCLUSIONS

- ONE VENT BLOCKED (EQUIVALENT TO TWO IN PLANT)
  - FROTH-LIKE IMPACT AT HCU FLOOR IN VICINITY OF ENCROACHMENT
  - NO EFFECT ON P_{DW}
  - CLEAN POOL RESPONSE UNCHANGED
- TWO VENTS BLOCKED (EQUIVALENT TO FOUR IN PLANT)
  - NEGLIGIBLE IMPACT AT HCU FLOOR IN VICINITY OF ENCROACHMENT
  - SMALL EFFECT ON P_{DW}
  - CLEAN POOL RESPONSE UNCHANGED

JET
6/19/85

EFFECT OF BLOCKED VENTS ON OTHER CONTAINMENT LOCA LOADS

DRYWELL PRESSURE

- o MINIMAL INCREASE IN PEAK DW GAGE PRESSURE FOR DBA
  - APPROXIMATELY 1% WITH FOUR VENTS BLOCKED
  - APPROXIMATELY 0.5% WITH TWO VENTS BLOCKED
  - ANALYTICAL PREDICTIONS CONSISTENT WITH 1/10 SCALE TEST DATA

POOL SWELL

- o NO INCREASE BECAUSE DW PRESSURE DOES NOT CHANGE
- o ASYMMETRIC LOAD BOUNDED BY 180° ASYMMETRIC POOL SWELL LOAD SPECIFIED IN MARK III CLR

CONDENSATION OSCILLATION AND CHUGGING

- o NO INCREASE IN LOADS AT UNBLOCKED VENTS
  - SLIGHT INCREASE IN VENT MASS FLUX
  - SLIGHT INCREASE IN LOCAL POOL TEMP
- o ASYMMETRIC LOAD BOUNDED BY POOL SWELL ASYMMETRIC LOAD

JET
6/19/85

MEETING SUMMARY DISTRIBUTION

Docket No(s): 50-416
NRC PDR
Local PDR
NSIC
PRC System
LB #4 r/f
Attorney, OELD
E. Adensam
Project Manager J. Hopkins
Licensing Assistant M. Duncan

NRC PARTICIPANTS

J. Hopkins
J. Kudrick
F. Eltawila
B. Siegel

bcc: Applicant & Service List