

ADD 6769

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June 10, 1988

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JN-0908

Mr. Frederick M. Chatry
Chief, Engineering Division
New Orleans District,
Corps of Engineers
P.O. Box 60267
New Orleans, LA 70160

RE: 17TH STREET CANAL PARALLEL FLOOD PROTECTION
PHASE IB - HAMMOND HIGHWAY TO PUMP STATION NO. 6
OLB PROJECT NO. 2043-2027

Dear Mr. Chatry:

You will find herewith for your review and comment, three sets of sketches and analyses for the pile-braced wall on the Orleans levee between Pump Station No. 6 and the railroad. In an effort to reduce the load on the pile-braced wall, we are proposing to degrade the crown of levee to elevation 31.5 SWB Datum. As such, in addition to the stability analyses for the levee and anchored wall, we are also submitting stability analyses for an I-Wall that is presently under contract to be installed in the crown of the Orleans levee.

We have taken the liberty to submit our proposed wall to Atlas Construction Company for a cost estimate. Atlas is the contractor presently mobilized at the job site to install the I-Wall in the crown of the levee, as well as, a similar pile-braced wall in the vicinity.

If you should have any questions regarding the attached analyses, please call.

Very truly yours,

MODJESKI AND MASTERS
Engineers


BARNEY T. MARTIN, JR.

BTM:jrb

Enclosures

cc: Mr. Ed Bailey
Mr. G. Joseph Sullivan
Mr. John Holtgreve
Mr. Larry Bodet

DISPOSITION FORM

REFERENCE OR OFFICE SYMBOL
CELMN-ED-55

SUBJECT Lake Pontchartrain La. & Vic
Hurricane Protection Project 17th St Canal
Parallel Flood Protection Press 13-dammond
HWY to Pump Sta No.6

TO C/Des Svcs Br

FROM C/Des Br

DATE

GMT1

25 June 58
Wortzel

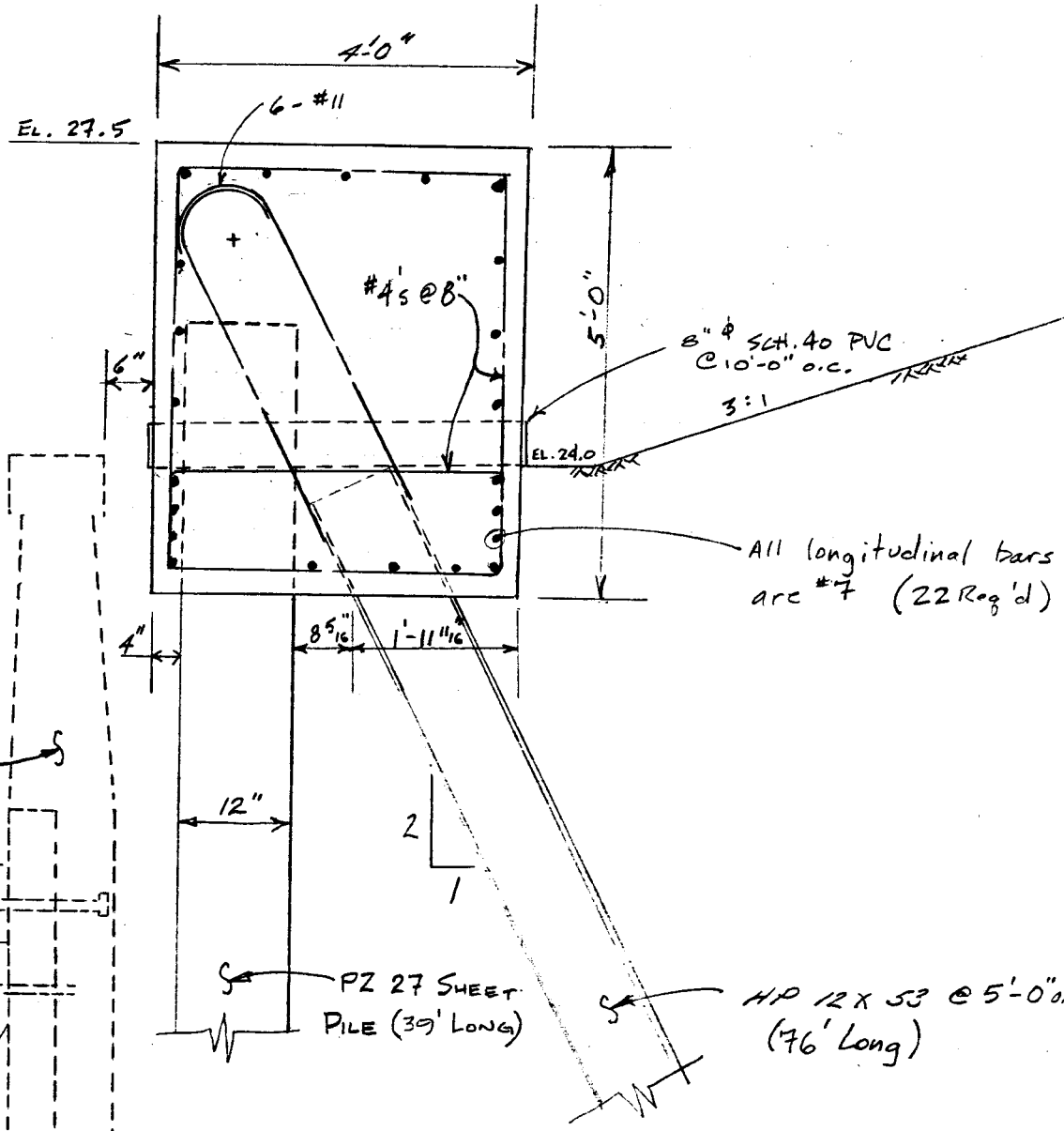
FOR INFORMATION PURPOSES ONLY. PLEASE RETURN TO CELMN-ED-55

1. Reference DF, CELMN-ED-56(1110-2-1150a), dated 17 June 58, subject as above.

2. The review of the subject pile-braced wall and i-wall designs have been completed. The pile-braced wall constructed with FZ-27 sections for the lockup wall is not acceptable. The design provided by Moultrie and Tarrant Engineers, exceeds the allowable bending stresses when the factor of safety equal to 1.20 is applied to the soil parameters. A replacement FZ-45 sections with coal tar epoxy coating in lieu of the FZ-27 section for the subject lockup wall. The i-wall design using FZ-27 sections is acceptable.

DANIEL H. MARSHALL
Chief, Design Branch

(SWB DATUM)

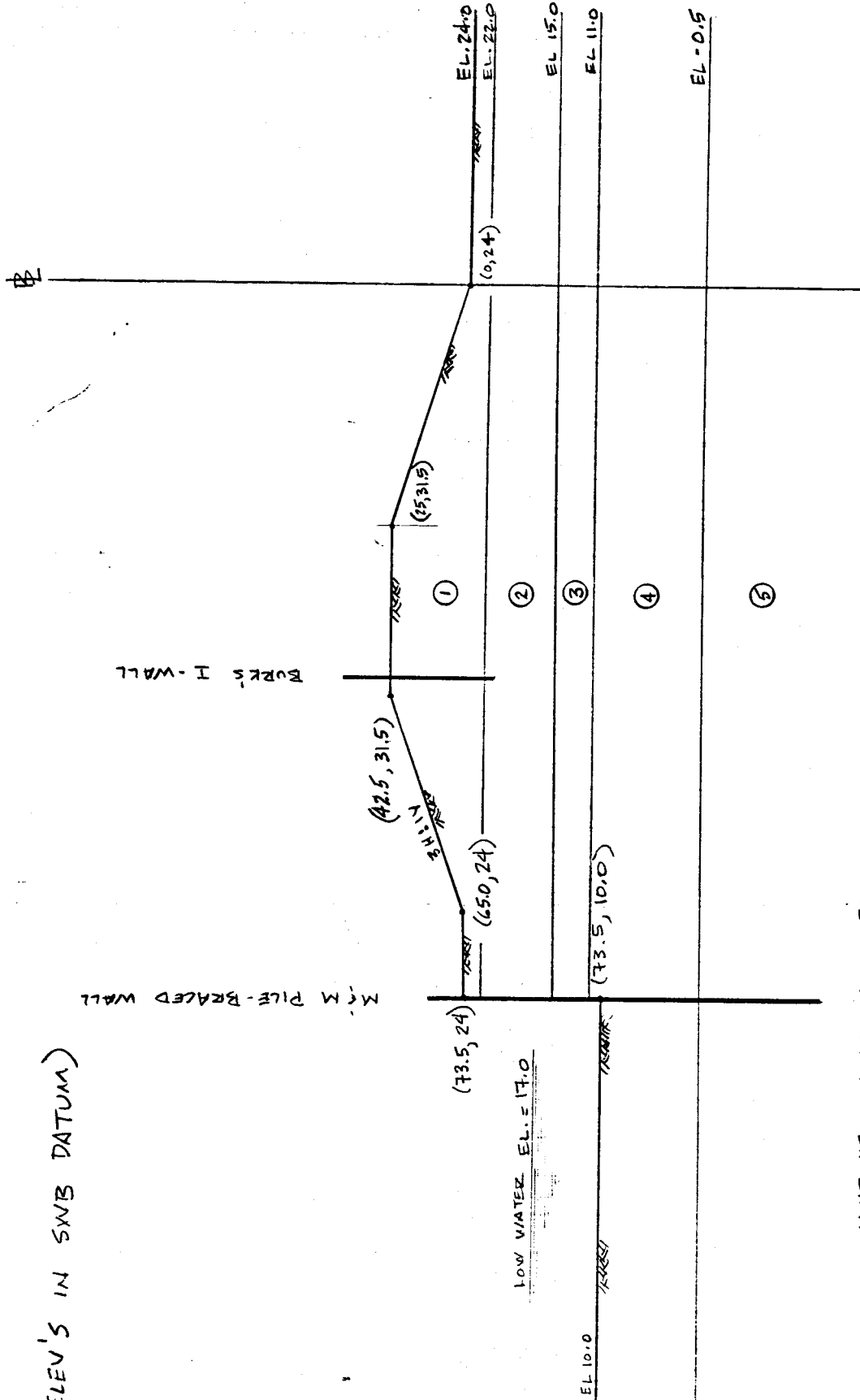


Existing wall and
bracing Pile to be
removed after
completion of new
wall

All longitudinal bars
are #7 (22 Req'd)

PZ 27 SHEET
PILE (39' LONG)

HP 12 X 53 @ 5'-0" o.c.
(76' Long)



(ELEV'S IN SWB DATUM)

STRATA NO.	UNIT WT. (PCF)	COHESION (PSF)	FRICTION ANGLE
1	114	700	23°
2	114	520	23°
3	114	720	23°
4	114	480	23°
5	120	0	30°

STABILITY ANALYSIS :

$$\Sigma R = R_A + R_B + R_P = 34,957 + 12,960 + 10,080 = 57,997$$

$$\Sigma D = D_A - D_P = 56,697 - 12,409 = 44,288$$

$$FS = \frac{\Sigma R}{\Sigma D} = \frac{57,997}{44,288} = 1.31$$

SHEET PILE FOR PILE BRACED WALL

FOR "S" CASE ANALYSIS WITH F.S. = 1.2, THE MINIMUM PENETRATION = EL - 9.0 (SWB DATUM)

WILL CARRY SHEET PILE DOWN TO ELEVATION -13.5
 (TO MATCH BURK'S WALL) AND THEREBY REDUCE
 THE ANCHOR FORCE AND BENDING MOMENT

FOR "S" CASE ANALYSIS WITH F.S. = 1.0 AND
 PENETRATION = EL - 13.5 :

ANCHOR FORCE = 4.50^{KLF}

MAXIMUM MOMENT = 40.2^{1-K/1} @ EL 13.2

REQUIRED SECTION MODULUS :

$$\frac{40.2^{1-K/1} \times 12^{1/4}}{0.45 \times 39^{KSI}} = 27.5 \frac{IN^3}{FT}$$

USE PZ 27 → S = 30.2 ^{IN³}/_{FT}

LENGTH = 25.5 + 13.5 = 39'

SHEET PILE FOR PILE - BRACED WALL

Anchor Elevation is 26.00

Anchor Force is -6655.80 (FOR MIN. PEN. = EL -9.0)

F.S. = 1.2 "S" CASE MINIMUM PENETRATION = -9.0

Elevation	Pressure	Shear Sum	Moment
26.01	0.00	0.00	0.00
26.00	0.00	0.00	0.00
25.01	0.40	-6655.60	-6589.14
24.01	0.80	-6655.00	-13244.45
24.00	0.80	-6654.99	-13311.00
24.00	0.80	-6654.99	-13311.00
23.00	88.81	-6610.19	-19943.59
22.00	177.05	-6477.26	-26487.31
22.00	177.05	-6477.26	-26487.31
21.00	265.29	-6256.09	-32853.99
20.00	353.54	-5946.67	-38955.37
19.00	441.78	-5549.01	-44703.21
18.00	530.02	-5063.11	-50009.27
17.00	618.26	-4488.97	-54785.32
16.00	644.00	-3857.84	-58958.73
15.00	669.74	-3200.97	-62488.14
15.00	669.74	-3200.97	-62488.14
14.00	695.48	-2518.36	-65347.81
13.00	721.23	-1810.01	-67511.99
12.00	746.97	-1075.91	-68954.95
11.00	790.02	-307.41	-69646.61
11.00	790.02	-307.41	-69646.61
10.00	826.50	500.85	-69552.06
9.00	773.55	1300.87	-68651.20
8.00	713.79	2044.54	-66978.49
7.00	654.04	2728.46	-64591.99
6.00	594.28	3352.62	-61551.46
5.00	534.53	3917.02	-57916.64
4.00	474.77	4421.67	-53747.29
3.00	415.02	4866.57	-49103.18
2.00	355.26	5251.71	-44044.04
1.00	295.51	5577.09	-38629.64
0.00	235.76	5842.73	-32919.73
-0.50	205.88	5953.14	-29970.77
-0.50	0.00	5953.14	-29970.77
-0.50	-258.89	5953.14	-29970.77
-1.50	-369.36	5639.01	-24174.69

SHEET PILE FOR PILE-
BRACED WALL

Modjeski & Masters
New Orleans, La. 70130
Program : CREWMOM
Version : PC081787

F.S. = 1.2 " S" CASE

Elevation	Pressure	Shear Sum	Moment
-2.50	-479.84	5214.41	-18747.98
-3.50	-590.31	4679.34	-13801.11
-4.50	-700.78	4033.79	-9444.55
-5.50	-811.26	3277.77	-5788.76
-6.50	-921.73	2411.28	-2944.24
-7.50	-1032.21	1434.31	-1021.45
-8.50	-1142.68	346.86	-130.87
-8.80	-1175.74	-0.90	-78.97

Location of Maximum Moments

Elevation	Moment
10.61	-69705.90
-8.80	-78.97

SHEET PILE FOR PILE -
BRACED WALL

Anchor Elevation is 26.00
 Anchor Force is -4498.68 (FOR PEN. = EL -13.5)

F.S. = 1.0 "S" CASE INTERMEDIATE PEN. = -13.5

Elevation	Pressure	Shear Sum	Moment
26.01	0.00	0.00	0.00
26.00	0.00	0.00	0.00
25.01	0.37	-4498.50	-4453.60
24.01	0.75	-4497.94	-8951.82
24.00	0.75	-4497.93	-8996.80
24.00	0.75	-4497.93	-8996.80
23.00	85.56	-4454.77	-13473.15
22.00	170.62	-4326.68	-17863.88
22.00	170.62	-4326.68	-17863.88
21.00	255.68	-4113.53	-22083.99
20.00	340.75	-3815.32	-26048.42
19.00	425.81	-3432.04	-29672.10
18.00	510.87	-2963.70	-32869.96
17.00	595.93	-2410.30	-35556.96
16.00	618.49	-1803.09	-37663.66
15.00	641.06	-1173.31	-39151.86
15.00	641.06	-1173.31	-39151.86
14.00	663.62	-520.97	-39999.00
13.00	686.18	153.93	-40183.51
12.00	708.74	851.39	-39680.86
11.00	733.67	1572.59	-38468.87
11.00	733.67	1572.59	-38468.87
10.00	763.05	2320.95	-36522.10
9.00	689.47	3047.21	-33838.02
8.00	608.59	3696.24	-30466.29
7.00	527.71	4264.39	-26485.98
6.00	446.83	4751.66	-21977.95
5.00	365.95	5158.05	-17023.10
4.00	285.07	5483.56	-11702.29
3.00	204.19	5728.19	-6096.41
2.00	123.31	5891.94	-286.35
1.00	42.43	5974.81	5647.03
0.48	0.00	5985.84	8756.80
0.00	-38.45	5976.61	11627.79
-0.50	-78.89	5947.28	14608.76
-0.50	-638.49	5947.28	14608.76
-1.50	-782.45	5236.81	20200.80

SHEET PILE WALL FOR
PILE-SPACED WALL

Modjeski & Masters
New Orleans, La. 70130
Program : CREWMOM
Version : PC081787

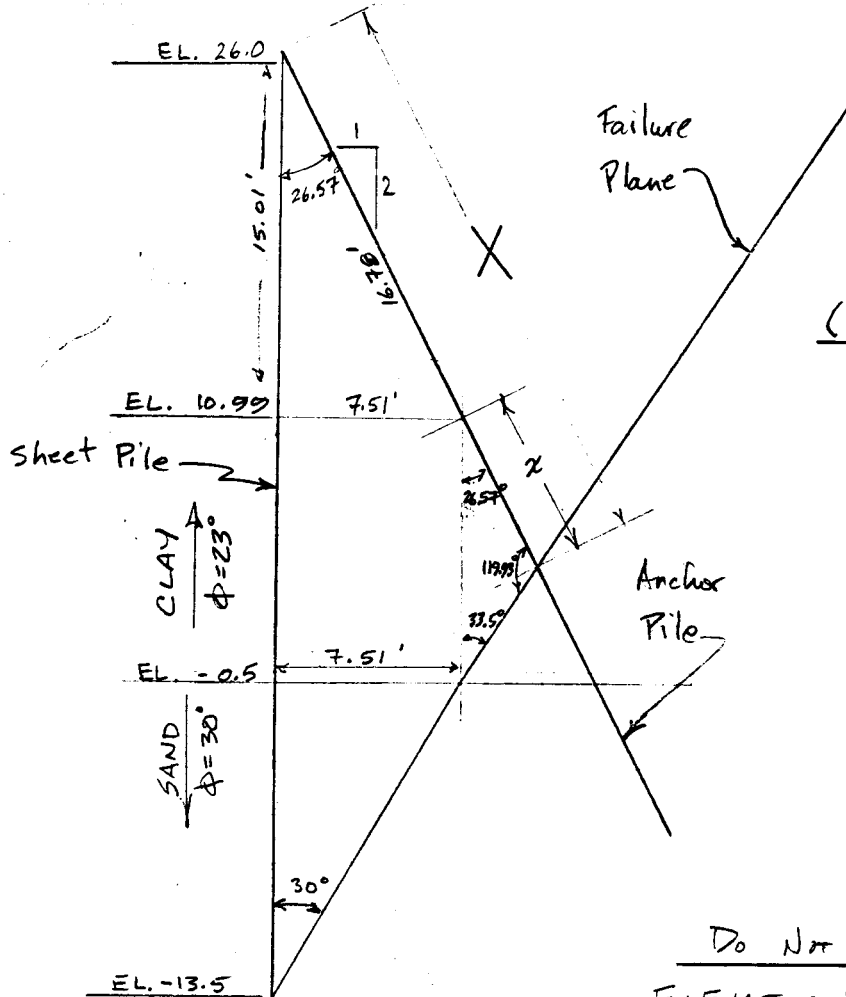
F.S. = 1.0 "S" CASE

Elevation	Pressure	Shear Sum	Moment
-2.50	-926.42	4382.37	25010.40
-3.50	-1070.39	3383.97	28893.57
-4.50	-1214.35	2241.60	31706.35
-5.50	-1358.32	955.26	33304.78
-6.50	-1502.28	-475.04	33552.75
-7.50	-1646.25	-2049.30	32290.58
-8.50	-1790.22	-3767.54	29382.16
-9.50	-1934.18	-5629.74	24683.52
-10.45	-2071.50	-7532.43	18431.49
-11.15	0.00	-8257.46	12905.03
-13.50	7021.97	-6.64	3194.71

Location of Maximum Moments

Elevation	Moment
13.23	-40200.84
-6.18	33629.02

FIND ELEV. OF INTERSECTION OF ANCHOR PILE AND FAILURE PLANE OF SHEET PILE



$$\frac{(10.99 + 0.5)}{\sin 119.93^\circ} = \frac{x}{\sin 33.5^\circ}$$

$$x = 7.32$$

$$X = 7.32 + 16.78 = 24.10'$$

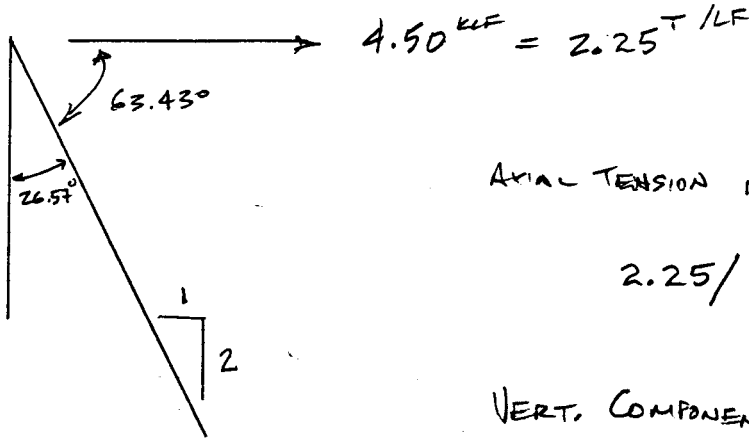
$$26 - 24.10 \cos 26.57^\circ = \underline{\underline{EL. 4.4}} \text{ @ INTERSECTION}$$

DO NOT COUNT CAPACITY ABOVE ELEVATION 4.4

$$\text{SAND: } 45^\circ - \frac{\phi}{2} = 45^\circ - \frac{30^\circ}{2} = 30^\circ$$

$$\text{CLAY: } 45^\circ - \frac{\phi}{2} = 45^\circ - \frac{23^\circ}{2} = 33.5^\circ$$

ANCHORAGE PILE



AXIAL TENSION IN PILE :

$$2.25 / \cos 63.43 = 5.03 \text{ T/lf of wall}$$

$$\begin{aligned} \text{VERT. COMPONENT} &= 5.03 \sin 63.43 \\ &= 4.50 \text{ T/lf of wall} \end{aligned}$$

ASSUME 12" H-PILES

EUSTIS PILE CAPACITY CURVES BASED ON A GROUND SURFACE OF -12 NGVD = 10 SWB

REDUCE PILE CAPACITY:
 Perimeter of H-Pile

$$\begin{aligned} (10 - 4.4)(4)(480) &= 10,572 \text{ \#} = 5.38 \text{ T} \\ \text{N/FS} = 2 &\rightarrow 2.69 \text{ T} \end{aligned}$$

TRY 5'-0" SPACING : $4.50 \text{ T/lf} (5.0') = 22.50 \text{ T}$

FOR TENSION PILE : $(22.5 / 0.8) + 2.69 = 30.8 \text{ T}$

FOR 30.8^T CAPACITY, PILES FOUNDED @ -66 NGVD = -44 SWB

PILE LENGTH $(44 + 24) / \cos 26.57 = \underline{\underline{76'}}$



EUSTIS ENGINEERING

GEOTECHNICAL ENGINEERS

3011 28th Street • Metairie, Louisiana 70002 • 504-834-0157

29 May 1987

Modjeski and Masters
Consulting Engineers
Room 510
1055 St. Charles Avenue
New Orleans, Louisiana 70113

Attention Mr. Barney Martin

Gentlemen:

Geotechnical Analyses
Anchor Pile Capacities
Drainage Pump Station No. 6
Jefferson Parish, Louisiana

Geotechnical analyses have been made to determine the allowable pile load capacity of steel pipe and steel "H" anchor piles for support of a proposed new bulkhead along the east side of Drainage Pump Station No. 6. The computations were based on soil parameters furnished by the Corps of Engineers in a letter dated 19 August 1986 and the results of Boring 5 contained in Eustis Engineering's report entitled "Geotechnical Investigation, Sewerage and Water Board of New Orleans, Proposed Additions to Drainage Pump Station No. 6, New Orleans, Louisiana."

The computations were based on a pile embedment below the bottom of the intake basin at approximately el -12 NGVD and include a factor of safety of 2 against actual failure of the pile through the soil. The results are summarized and shown graphically in the form of pile capacity versus pile tip elevation curves on Enclosure 1. The values shown on Enclosure 1 are based on a soil-pile relationship. Therefore, the structural capacity of the piles and/or connections must be determined by others.

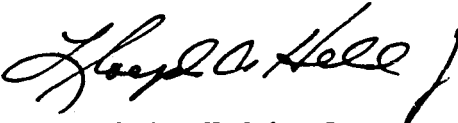
In order to facilitate driving, steel pipe piles should be driven open-end and should have a minimum wall thickness of at least 0.25 of an inch. Steel pipe and "H" piles should be driven using a steam or air hammer delivering at least 19,500 ft-lb of energy per blow to facilitate penetration of the sand strata above el -50 NGVD.

29 May 1987

All adjacent structures and facilities should be inspected prior to pile driving operations and vibrations transmitted to these structures should be closely monitored during all pile driving operations. If vibrations are measured at a level which is sufficient to cause damage to adjacent structures (particle velocity of 0.25 to 0.5 inches per second), all pile driving operations should cease immediately. Close field supervision should be maintained by experienced and qualified personnel during all pile driving to insure that proper procedures are followed, accurate records are kept and vibrations transmitted to adjacent structures are closely monitored. Eustis Engineering is available to monitor vibrations during pile driving and can provide consultations concerning the effect of vibrations on adjacent structures.

Yours very truly,

EUSTIS ENGINEERING

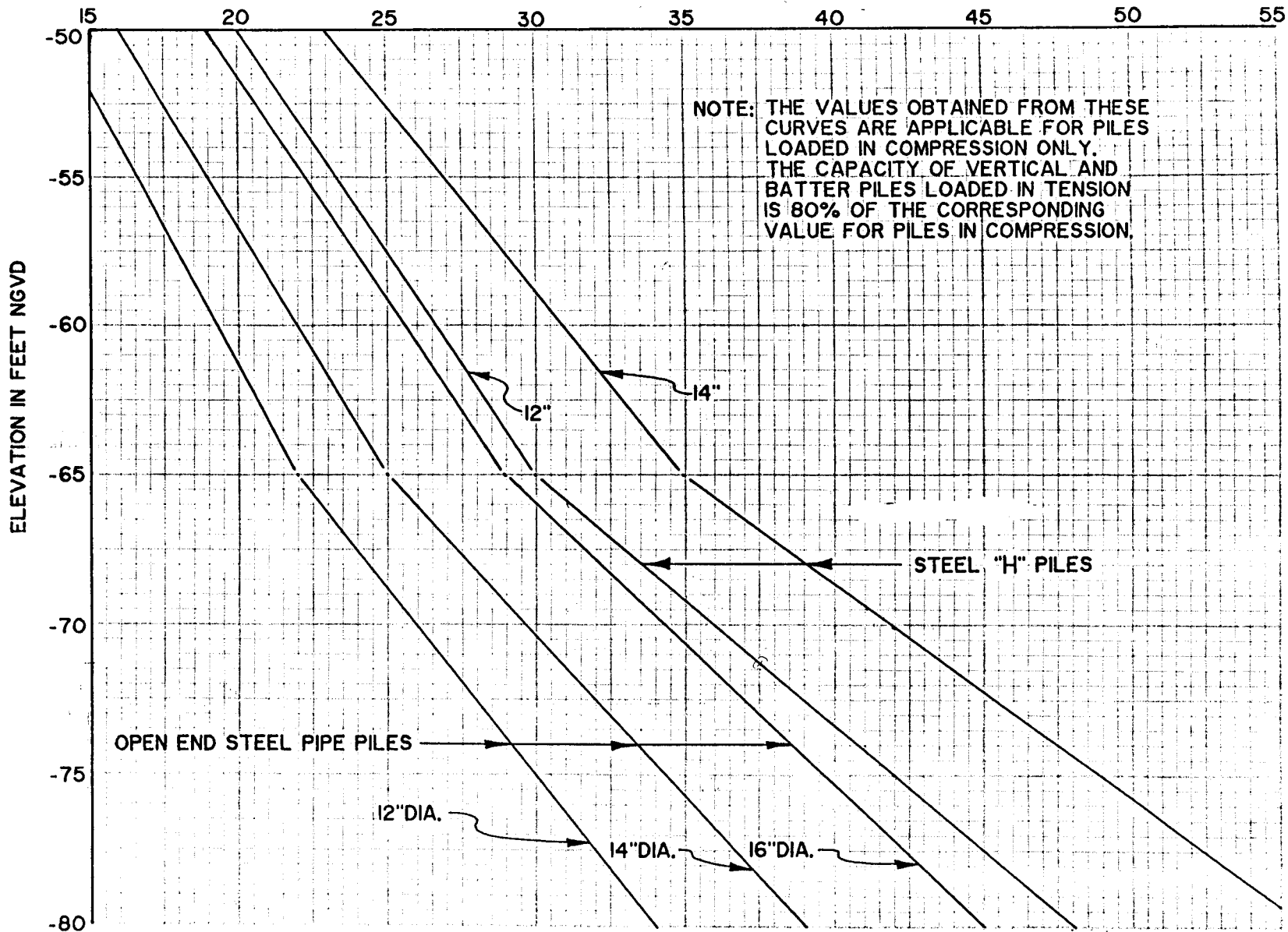


Lloyd A. Held, Jr.

L. J. Napolitano:bh

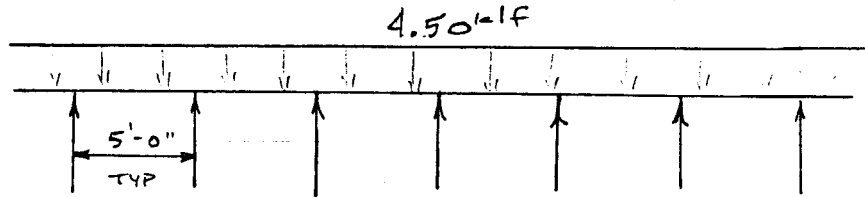
Enclosure 1

ALLOWABLE AXIAL CAPACITY OF VERTICAL PILE
OR VERTICAL COMPONENT OF BATTER PILE IN TONS
FACTOR OF SAFETY = 2.0



(ASSUME SAME DETAIL AS BURK & ASSOCIATES SINCE THIS IS AN EXTENSION OF THE SAME WALL)

CHECK FLEXURE IN CAP



$$\text{Max Moment} \approx \frac{1}{10} w l^2 = \frac{1}{10} (4.5) (5.0)^2 = \pm 11.25 \text{ k-ft}$$

$$d = 48" - 4" = 44"$$

$$A_s = \frac{M}{f_s j d} = \frac{11.25 \times 12}{20 \times 0.875 \times 44} = 0.18 \text{ in}^2 \quad \text{TOP AND BOTTOM (VERTICAL FACES)}$$

Flexural
 Min. Reinforcing (ACI 10.5.1 & 10.5.2) = $0.18 \times 1.333 = 0.23 \text{ T \& B}$
 $A_s \text{ Provided} = 4.8 \text{ in}^2 \text{ T \& B}$

Side Reinforcing (Horizontal Faces) Adequate (ACI 10.6.7 & 11.8.9)

CHECK SHEAR IN CAP

$$V = 0.6 w l = 0.6 (4.5) (5.0) = 13.5 \text{ k}$$

$$v_c = 13.5 \text{ k} / (60" \times 44") = 0.005 \text{ ksi} = 5 \text{ psi}$$

Min. Shear Reinforcing (ACI 11.8.8) $s \leq \frac{44}{5} = 8.8"$

Change Spacing of Stirrups to 8" o.c.

$$A_{s \text{ req'd}} = .0015 (60) (8) = 0.72 \text{ in}^2 / \text{ft}$$

$$A_{s \text{ provided}} = 3(0.2) \left(\frac{12}{8} \right) = 0.90 \text{ in}^2 / \text{ft}$$

ASSUME BULK DETAIL

CHECK PULL OUT OF PILE

6 - #11 BARS PER ANCHOR PILE

$$\text{TENSION IN PILE} = 5.03^{\text{T/LF}} \times 2^{\text{K/4}} \times 5' = 50.3^{\text{K/PILE}}$$

$$A_s = 6(1.56 \text{ in}^2) = 9.36 \text{ in}^2$$

$$f_s = 50.3^{\text{K/PILE}} \div 9.36 \text{ in}^2 / \text{PILE} = 5.4^{\text{KSI}}$$

OK
Σ

CHECK DEVELOPMENT LENGTH

BASIC DEVELOPMENT LENGTH FOR A #11 = 68" ($f_y = 60, f'_c = 3.0$)

ACCORDING TO ACI 12.2.4 b CAN REDUCE LENGTH DUE TO "EXCESS" BARS AREA:

$$A_s \text{ REQ'D} = \frac{50.3^{\text{K}}}{24 \text{ KSI}} = 2.10 \text{ in}^2$$

$$A_s \text{ PROVIDED} = 9.36 \text{ in}^2$$

$$L_d = 68 \times \left(\frac{2.10}{9.36} \right) = 15.3"$$

BULK PROVIDES IN EXCESS OF 48"

OK
Σ

CHECK STABILITY OF I-WALL IF CROWN IS DEGRADED
TO ELEVATION 31.5 (SWB DATUM)

PENETRATION

FOR 3:1 PENETRATION TO HEAD RATIO, THE REQUIRED
 PENETRATION =

$$31.5 - 3(36.5 - 31.5) = \text{EL } 16.5$$

FOR "S" CASE ANALYSIS WITH F.S. = 1.5, THE REQUIRED
 PENETRATION = EL. 22.5 ← GOVERNS

THE FURNISHED PENETRATION = EL 21.5 GOOD

MOMENT

MAXIMUM MOMENT FOR "S" CASE ANALYSIS WITH
 F.S. = 1.0 IS 1.16^{1-K/1} AT EL. 28.3. THE
 REQUIRED SECTION MODULUS IS:

$$\frac{1.16^{1-K/1} \times 12^4}{0.45 \times 30 \text{ KSI}} = 0.8 \frac{\text{IN}^3}{\text{FT}} \text{ PZ 22 O.K.}$$

DEFLECTION

USING THE PRESSURE DIAGRAM FOR THE "S" CASE ANALYSIS
 WITH F.S. = 1.0, THE DEFLECTION OF PZ 22
 SHEET PILE IS 0.019" O.K.

I-WALL IN CROWN OF LEVEE

~~Anchor Elevation is 19.00~~
~~Anchor Force is 0.00~~

F.S. = 1.5 "S" CASE

Elevation	Pressure	Shear Sum	Moment
34.50	0.00	0.00	0.00
33.50	62.50	31.25	15.63
32.50	125.00	125.00	93.75
31.50	187.50	281.25	296.88
31.50	187.50	281.25	296.88
30.50	80.14	415.07	645.04
29.75	0.00	444.99	966.07
29.50	-27.21	441.54	1078.42
28.50	-136.68	359.60	1478.99
27.50	-249.96	166.28	1741.92
26.50	-363.25	-140.33	1761.76
25.75	-448.68	-446.49	1540.49
24.64	0.00	-695.09	907.98
22.78	750.25	-0.00	264.00
22.78	0.00	-0.00	264.00

Location of Maximum Moments

Elevation	Moment
26.91	1790.73

I - WALL IN CROWN OF LEVEE

~~Anchor Elevation is 19.00~~
~~Anchor Force is 0.00~~

F.S. = 1.0 " S " CASE

Elevation	Pressure	Shear Sum	Moment
34.50	0.00	0.00	0.00
33.50	62.50	31.25	15.63
32.50	125.00	125.00	93.75
31.50	187.50	281.25	296.88
31.50	187.50	281.25	296.88
30.50	12.34	381.17	628.09
30.43	0.00	381.61	654.96
29.50	-162.81	305.94	974.51
28.50	-337.97	55.54	1155.25
27.53	-511.18	-354.96	1016.02
26.63	0.00	-587.05	588.33
25.18	813.01	0.02	164.44
25.18	0.00	0.02	164.44

Location of Maximum Moments

Elevation	Moment
28.34	1159.63
25.18	164.44

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is TAGO.

REFERENCE OR OFFICE SYMBOL

CELMN-ED-SP
(110-2-1150a)

SUBJECT

Lake Pontchartrain La. & Vic Hurricane Protection
Project 17th St Canal Parallel Flood Protection
Phase IB - Hammond HWY to Pump Sta No. 6

TO

~~C/Des Br~~
C/F&M Br

FROM

C/Des Svcs Br

DATE

17 June 88
Stutts/saj/2614

CMT 1

1. Enclosed please find a June 10, 1988 letter from a Barney Martin of Odjeski and Masters Engineers concerning the subject flood protection.
2. It is requested that you review the stability analyses for both the pile-braced wall and I-wall designs attached to Mr. Martin's letter. Your comments are needed ASAP but should be provided NLT 27 June 88.
3. Should you have any questions concerning this request, please contact Mr. Stutts on ext. 2614.


THOMAS E. HARRINGTON, JR.
Chief, Design Services Branch

Encl
as

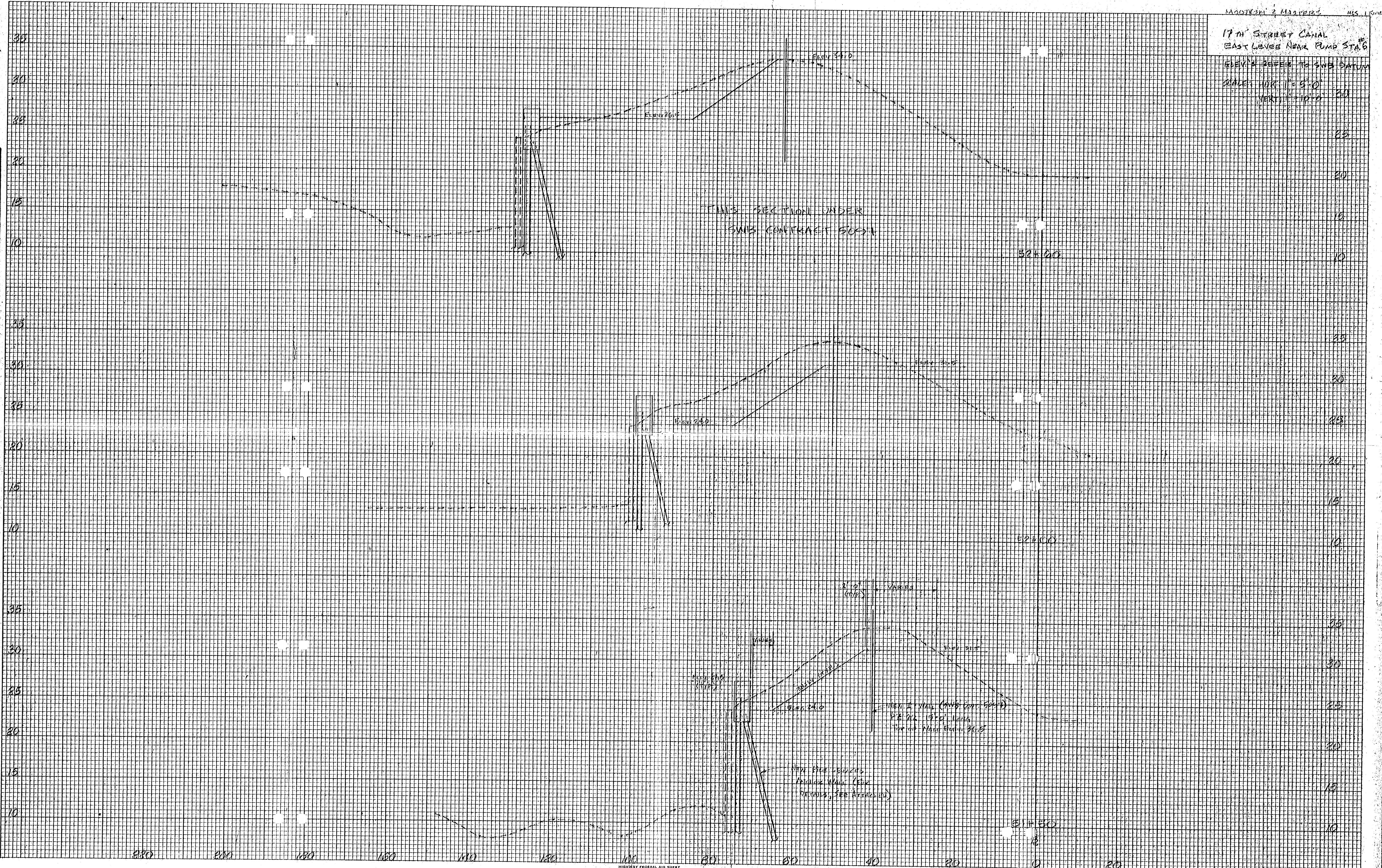
17th STREET CANAL
EAST LEVEE NEAR PUMP STATION

ELEVATIONS REFER TO SWB DATUM

SCALE: HORIZ. 1" = 5'-0"
VERT. 1" = 10'-0"

DATE	
BY	
SURVEYED	
FINAL SURVEY	
NOTE BOOK	
NO.	
AREAS CHECKED	

DATE	
BY	
SURVEYED	
ORIGINAL SURVEY	
NOTE BOOK	
NO.	
AREAS CHECKED	



INVERSE/AZ
FROM 151 TO 251, DIST = 218.5714 ✓
AZIMUTH = 274 31 26.0

I/A

INVERSE/AZ
FROM 418 TO 251, DIST = 1000.0078 ✓
AZIMUTH = 4 44 56.3

I/A

INVERSE/AZ
FROM 152 TO 252, DIST = 217.7857 ✓
AZIMUTH = 274 31 26.0

I/A

INVERSE/AZ
FROM 418 TO 252, DIST = 1200.0093 ✓
AZIMUTH = 4 44 56.3
<CR>

I/A

INVERSE/AZ
FROM 153 TO 253, DIST = 216.9999 ✓
AZIMUTH = 274 31 26.0

I/A

INVERSE/AZ
FROM 419 TO 253, DIST = ~~1400.0109~~ ✓
AZIMUTH = 4 44 56.3

I/A

INVERSE/AZ
FROM 154 TO 254, DIST = 219.5000 ✓
AZIMUTH = 273 56 26.0

I/A

INVERSE/AZ
FROM 419 TO 254, DIST = 109.5704 ✓
AZIMUTH = 2 30 30.5

I/A

INVERSE/AZ
FROM 155 TO 255, DIST = 224.5000 ✓
AZIMUTH = 273 56 26.0

I/A

<CR>

INVERSE/AZ
FROM 419 TO 255, DIST = 309.6329 ✓
AZIMUTH = 2 30 30.5

I/A

INVERSE/AZ
FROM 156 TO 256, DIST = 235.0000 ✓
AZIMUTH = 273 56 26.0

I/A

INVERSE/AZ
FROM 420 TO 256, DIST = 200.2754
AZIMUTH = 0 56 7.0

END

DO YOU HAVE MORE DATA TO RUN?

(0 NO, 1 YES)

=

0

END GOGO

A:\ (for help type HELP)>

A:\ (for help type HELP)>