US Army Corps
of Engineers
New Orleans District

NEW ORLEANS TO VENICE, LOUISIANA

HURRICANE PROTECTION

REACH B-1 -TROPICAL BEND TO FORT JACKSON

EMPIRE FLOODGATE

PERIODIC INSPECTION REPORT NO. 6

30 JANUARY 1990

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EMPIRE FLOODGATE

PHOTO TAKEN 22 JULY 86

SUMMARY

The Empire Floodgate was inspected on 30 January 1990 by representatives of NOD, LMVD and the Plaquemines Parish Government and found to be stable and structurally sound. Minor discrepancies are noted within.

EMPIRE FLOODGATE

PERIODIC INSPECTION REPORT NO. 6

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SECTION I - INTRODUCTION

1-01 Authority. Authority is provided by ER 1110-2-100, subject, "Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures", dated 8 April 1988.

1-02. Purpose and Scope. The results and conclusions of the inspection and evaluation for assuring the structural integrity and operational adequacy of the structure are presented herein.

1-03. Datum. All elevations, except where otherwise indicated, are in feet and refer to the National Geodetic Vertical Datum (NGVD), formerly Mean Sea Level (m.s.l.)

1-04 Previous Inspections.

Report No.	Date of Inspection	Date Report Approved
1	4 Sep 1975	7 Apr 1976
2	4 Oct 1978	13 Aug 1979
3	29 Jul 1981	20 Oct 1982
4	31 Jan 1984	4 Jan 1985
5	29 Jan 1987	21 Sep 1987

SECTION II - PROJECT DESCRIPTION AND PURPOSE

2-01. General. The description of the structure, historical and other general background information, are included in report no. 1 which also contains selected construction drawings illustrating typical sections and details. This report is supplementary to previously numbered reports.

SECTION III - OPERATION AND MAINTENANCE DATA

3-01 Operation and Maintenance Problems. The following work was done at the structure since the last inspection:

a. May 1989. A jet suction dredge was used to clean the underwater concrete gate recesses. (See Appendix II).

b. June 1989. A broken chain was repaired.

c. August 1989. The transmitter of the synchronizer for the lift motors and a motor casing for ream drive were repaired.

3-02 Actions on Deficiencies from Last Inspection. The proposed remedial work included in the last inspection report will be accomplished by the Plaquemines Parish Commission Council when the structure is dewatered. Dewatering of the structure is past due by 3-1/2 years.

SECTION IV - REVIEW OF DESIGN AND ANALYSIS OF INSTRUMENTATION

4-01 Review of Design. A detailed comparison of the original design criteria to current design criteria was recorded in Periodic Inspection Report No. 1, dated 4 September 1975. A review of this comparison shows that the original design is equal to or is more conservative than current design criteria. The allowable working stresses for concrete and structural steel are in accordance with those recommended in "Working Stresses for Structural Design," EM 1110-1-2101, dated November 1963, through change 2 dated 17 January 1972, which is still current. The actual conditions experienced at the floodgate since design and construction have not exceeded the conditions investigated in the design review. There have been no appreciable change in design criteria, assumptions or function of this structure; therefore, a detailed design analysis is not required.

4-02 Analysis of Instrumentation Data. Settlement on the eastern side of the structure at 2+06E to 3+03E ranges from 0.6 feet near the monolith to 1 foot at the ends of the sheet pile wall more than on the western side at 2+06W to 3+03W. At Station 3+03E, the sheet piling has settled almost 2.0 feet since construction in 1976. The design grades for top of the sheet piling elevation and the levee heights at the base of the wall are 15.0 feet and 8.0 feet, respectively. The 8 Dec 88 readings for top of the sheet piling elevations and the levee heights at the base of the walk, were 2 to 3 feet below the design grades. (See plates I-2 thru I-7.)

SECTION V - INSPECTION

5-01 Inspection Team. The inspection of the structure was conducted on 30 January 1990 by the following personnel:

NEW ORLEANS DISTRICT

Johnny B. Drummond	Gen Engr Sec
Richard L. Tillman	Struc Des Sec
Jose A. Lizarribar	F&M Br (Materials)
Lawrence S. Dressler	F&M Br (Struc Foundations)
Deborah F. Garrett	H&H Br
E. Paul Mayeux, Jr.	Gen Engr Sec (Electrical)
Dennis C. Strecker	Gen Engr Sec (Mechanical)
Colette D. Duffour	O&R Div
Jerry A. Colletti	O&R Div

PLAQUEMINES PARISH GOVERNMENT

Henry Urban	Maintenance Foreman
Carroll Martin	Supt. of Heavy Equipment

STATE OF LOUISIANA

Connie L. Standige	LDOTD
A.V. Flotte	LDOTD

LOWER MISSISSIPPI VALLEY DIVISION

Frank N. Johnson	Tech Engr Br
Edwin L. Boren	Con-Ops Div
Roston C. Jarrell, Jr.	Con-Ops Div

5-02 Orientation. Prior to the inspection, the team members were given a brief orientation of the following features of the structure: structural, hydraulic and hydrology, foundations and materials, electrical, mechanical and operations.

5-03 Observations. The floodgate was not dewatered at the time of the inspection, therefore, the following observations were limited to those portions of the structure above the water surface.

a. Floodwall. Overall, the floodwall was in very good condition. There has been no further separation between the inverted T-wall monoliths and the steel sheet piling beyond what was reported in the previous periodic inspection reports. The L-type waterstops between the sheet piling and the monoliths is still intact and in good condition. A gap of approximately one-half inch was observed between the L-type waterstop that is attached to the sheet piling and the adjacent T-wall monolith on both, the east and west sides of the structure. (See Photo 1).

b. Gatebay Monolith. The gatebay concrete was in very good condition. No significant cracks, spalled concrete areas nor exposed reinforcing steel was observed. Minor spalls are noted in paragraphs d and h(3). Water was again observed flowing from a two-inch hole in the North wall of the counterweight recess shaft on the East half of the structure. However, the inspection team was informed that the hole was placed intentionally in order to drain water ponding in the shaft caused by the continual blockage of the original drain hole by silt. The original drain hole is at elevation -12.0, while the silt in the channel is only maintained to elevation -9.0. The protective wall armor, corner plates, and ladders on each of the channel walls contained a large amount of corrosion. (See Photo 2).

c. Flap Gate. The flap gate was raised to the closed position and then lowered again to the open position. The operation of the gate was satisfactory. The paint on both sides of the gate appeared to be in fairly good condition. The sacrificial anodes of the cathodic protection system, visible above the water surface, were partially eaten away. Soil deposits accumulating on the gate while in the opened position are still posing a problem. The damage to the skin plate and the top channel beam across the three central spans of the gate, as reported in previous periodic inspection reports, hasn't been repaired yet. It was obvious that further damage to the gate in the same vicinity has since occurred. (See Photo 2). The damage to the gate does not in any way adversely affect the operation of the floodgate. As stated in earlier reports, the damage to the gate is due to it being hit by passing vessels because of the inability of the gate to seat properly when in the fully opened position because of the silt buildup underneath it. Remedial repairs are planned as soon as funds are allocated for dewatering the structure.

d. Handrails. Overall, the handrails were in good condition. On the east half of the structure, the south handrail had apparently been hit and was bent slightly towards the north. The impact caused the concrete around the handrail anchor bolts to spall on the top of the south face of the structure. (See Photo 3). Even though the handrailing was bent, it was still securely attached. No exposed reinforcing bars were observed in the spalled areas. On the west half of the structure, adjacent to and on the north side of the channel ladders, the two-foot section of the handrailing did not have any anchor bolts and the railing was loose.

e. Approach Channels. The general condition of the timber guide walls, fenders and dolphins were excellent. Almost all the timber piles and vertical wales need to be capped. (See Photo 4).

f. Needles and Storage Rack. The timber blocking used to support the needle girders on the storage rack was badly rotted. Soil deposits were observed on the webs of the needle girders. Corrosion caused by the soil deposits was evident on the needle girders. The concrete needles appeared to be in good condition.

g. Walkway. The stair treads between the pump platform and the boat dock are serrated type, galvanized gratings. The bottom stair tread has rusted completely through and is loose.

h. Concrete.

(1) In general the structural integrity of the floodgate structure and T-walls appears to be good. The vertical alignment of the T-walls also appears to be good. The general appearance of the structure is fair.

(2) Some horizontal and vertical hairline cracks were observed throughout the structure, including T-walls. A few show light efflorescence deposits. These cracks are not new and have been noticed in previous inspections. These are probably shrinkage cracks that developed early after original concrete placements and are of no major significance at this time. No remedial action is required; they will be monitored in future inspections.

(3) Another spall was found at the expansion joint between survey reference markers RM-14 and RM-15. This joint is between T-wall monoliths T-1R and T-2R. The spall should be repaired with a low w/c ratio mortar when the expansion joints are refilled and sealed.

(4) The expansion joints filler material is either partially or completely missing from most of the expansion joints. The void left by the missing filler could allow foreign materials to lodge in the joint, possibly causing spalls and/or cracks during concrete thermal expansion. To avoid this possibility, all expansion joints (including horizontal, vertical and inclined surfaces) should be sealed with joint sealant. ACI 504R-77 provides guidance on joint sealants for concrete structures. Note that a specialized sealant might be needed for application on vertical and inclined surfaces. Backup material should be inserted in the joints to control the depth of penetration of the sealant.

i. Instrumentation.

(1) The survey data for T-wall monolith T-4R, shows differential settlement of 2.88 inches between reference markers RM-19 and RM-20. As shown on Plate I-4, this differential settlement has been increasing at a steady rate. This settlement has caused monolith T-4R to rotate away from monolith T-3R, increasing the distance between reference markers RM-18 and RM-19 by approximately 1 inch. As a result of the increasing distance between monoliths, the waterstop is being stretched. The present condition of the waterstop could not be assessed at this time. If the movement continues, the waterstop could tear apart. This situation is caused by the stresses induced into the foundation soils by the presence of the levee. Evaluation of the settlement reference marks suggests that this consolidation will continue to a decreasing degree in the future. No remedial action is recommended at this time. The settlement data will be monitored for further movement.

(2) Reference marks on the floodgate structure indicate that the structure settlements have stabilized.

j. Riprap Protection.

(1) Placement of riprap on the existing breakwater and on the east and west sides of the north and south approach channels was scheduled to take place during the March 1988 dewatering of the structure. However, the dewatering has not occurred as of the recent inspection of 30 January 1990. The breakwater is an integral part of the design for the reduction of wave forces on the floodgate. The breakwater still appears to be losing stone. Restoration of the breakwater to its design elevation of 3.0 ft. NGVD and cross section is important to structural integrity in the event of a hurricane.

(2) The stone protection between the structure and the east and west levee was below the water surface line. The design elevation is 1.0 ft NGVD. The staff gages recorded readings of 0.7 ft NGVD. Close monitoring of these areas is advised in order to determine the impact, if any, on the levee system.

(3) The banklines on the east and west sides of the approach channels appear to be receding. Monitor these areas for possible impacts on the levee system.

(4) The staff gages near the boat dock and the timber fenders were very hard to read below the 2.5 ft line. They were covered with mud barnacles and algae. These gages should be cleaned or replaced.

k. Mechanical and Electrical.

(1) The emergency generator was manually started and reached rated voltage and frequency within a brief time.

(2) The floodgate was opened and closed from the master control station. Limit switches controlled gate stop functions as required. Gate operation was satisfactory. Utility power was used to close the floodgate and emergency generator power was used to open the floodgate.

(3) A visual inspection of the main switchboard, electric service and motor controls was made. All systems operated satisfactorily and no deficiencies were found in the electrical and mechanical operations.

1. Hoist Chains and Counterweight Chains. Several links in the splash zone were severely corroded. (See photo 5). In the past year some links in the hoist chain have broken while lifting the gate. Failure of these links was due to corrosion. The sections of hoist chains and counterweight chains in the splash zone should be replaced prior to dewatering the structure.

PHOTO 1 - One-half inch separation between L-Type waterstop and T-Wall monolith

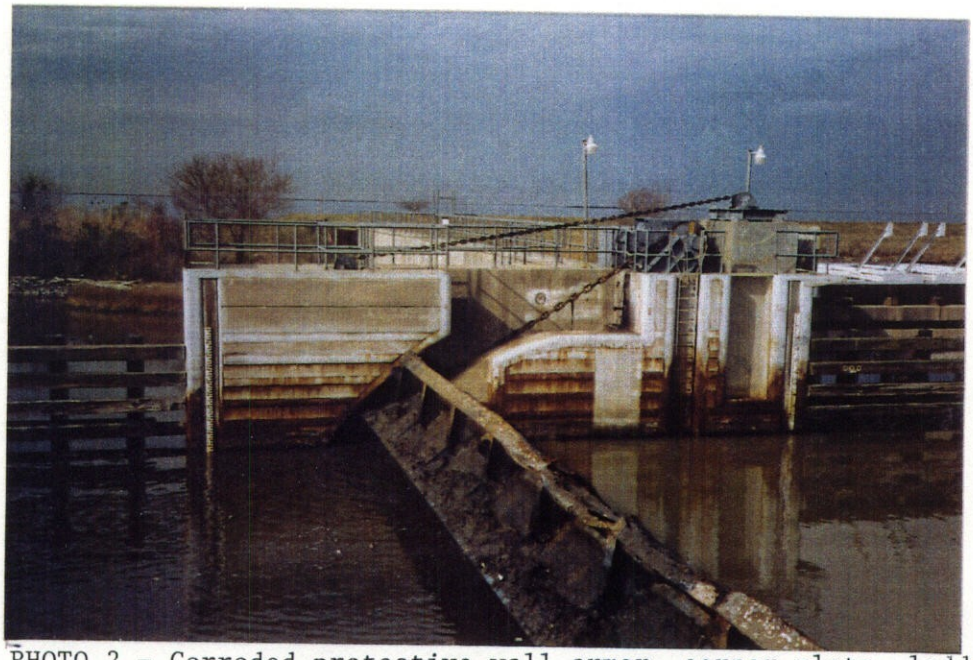


PHOTO 2 - Corroded protective wall armor, corner plate, ladder and damaged flap gate

PHOTO 3 - Damaged concrete and bent south handrail on the east half of structure

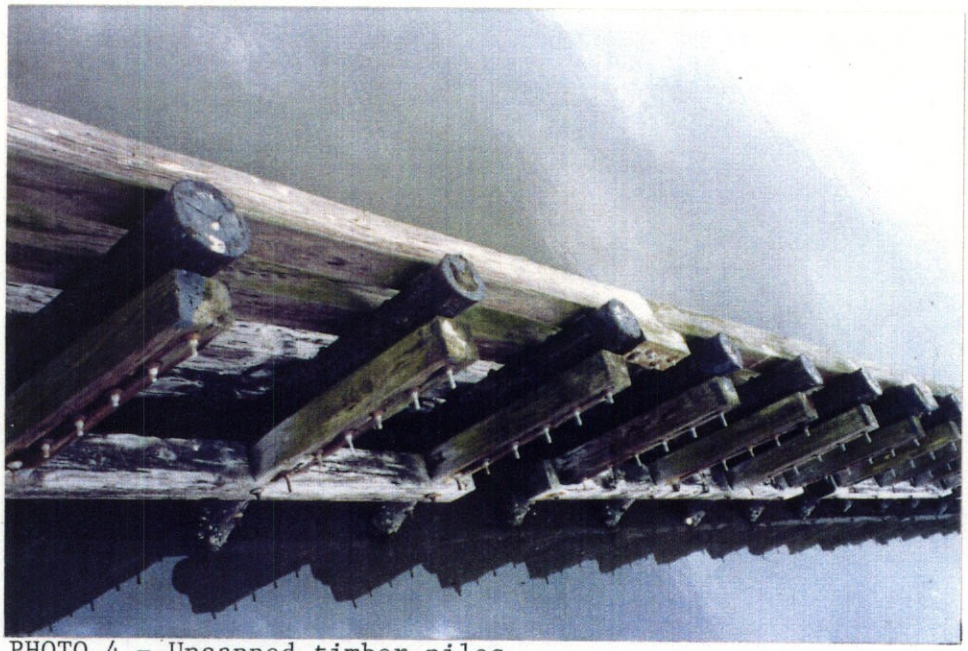


PHOTO 4 - Uncapped timber piles

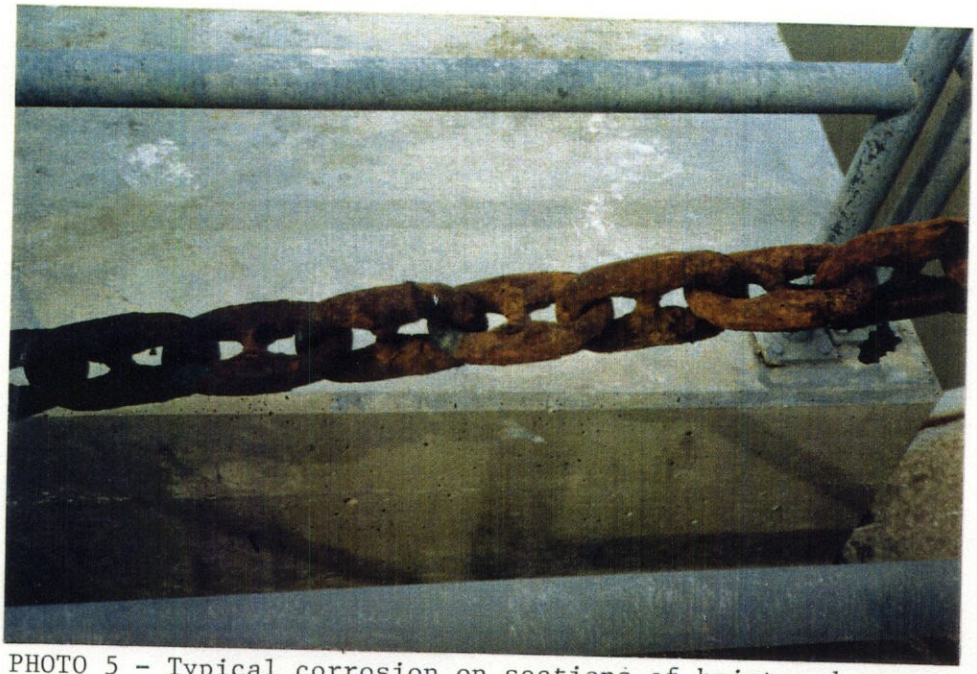


PHOTO 5 - Typical corrosion on sections of hoist and counter-weight chains in the splash zone

SECTION VI - CONCLUSION AND REMEDIAL ACTIONS

6-01 Conclusion. It is concluded that the Empire Floodgate is safe, stable and in satisfactory operating condition.

6-02 Proposed Remedial Actions.

a. The following remedial actions will be accomplished by the local interest (Plaquemines Government) during the dewatering of the structure, which is currently unscheduled due to a lack of funding.

(1) The damaged gate skin plate and channel beam will be repaired.

(2) A 24-inch layer of No. 2 riprap stone will be replaced at the breakwater dike and on the banks of the north and south approach channels.

(3) The corroded protective wall armors and ladders will be cleaned and painted.

(4) The cathodic protection anodes will be replaced.

(5) The parish is considering dredging the approaches of the structure to elevation -12.0 ft. NGVD during the same period as the dewatering operation in order to remove large silt deposits which prevent the gate from laying flat in the recess.

(6) Decayed timber blocking, used to support the needle girders on the storage rack, will be replaced.

(7) All expansion joints will be sealed with joint sealant.

b. The following remedial actions will be accomplished by the Plaquemines Parish Commission Council under their routine maintenance program.

(1) Damaged handrails and concrete spalls will be repaired.

(2) Staff gages will be cleaned or replaced.

(3) The rusted bottom stair tread of the walkway between the pump platform and the boat dock will be replaced.

(4) Soil and other debris will be removed from the surfaces of the steel needle girders and supports.

(5) Timber piles and vertical wales will be capped.

(6) The sections of corroded hoist chains and counterweight chains, in the splash zone, will be replaced.

6-03 Next Inspection. The next inspection of Empire Floodgate is scheduled for January 1993 or when the structure will be dewatered; whichever date is sooner.

APPENDIX I - LMVD TRIP REPORT

CELMV-ED-TS

28 Feb 90

MEMORANDUM FOR RECORD

SUBJECT: Trip Report, Periodic Inspection No. 6, Empire Floodgate, New Orleans District

1. On 30 Jan 90, the undersigned participated in the sixth periodic inspection of the Empire Floodgate with representatives of the New Orleans District, the Plaquemines Parish Commission Council (local interest),and the Louisiana Department of Transportation and Development. Personnel participating in the inspection are listed in enclosure 1.

2. Purpose. This inspection was made in accordance with the provisions of ER 1110-2-100, Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures. The structure was not dewatered for the inspection.

3. Description of Project. The Empire Floodgate is part of the New Orleans to Venice, LA, Hurricane Protection levee system. It serves to provide protection for an area of about 365 acres inclosed by hurricane protection levees and Mississippi River Levees and allows water traffic to proceed normally along the waterway from Empire, LA, to the Gulf of Mexico.

4. Description of Structure. The Empire Floodgate structure consists of a reinforced concrete gate bay, supported on prestressed concrete piles, timber guide walls, pile supported inverted "T" type reinforced concrete floodwalls, and uncapped steel sheet piling connecting the "T" type floodwalls to the earthen levee on each side. The gate bay is 109 ft in length and has a channel width of 84 ft. The floodgate is a bottom hinged single-leaf flap gate, which in the open position, rests in a recess in the base slab of the structure.

5. Observations and Recommendations. In general the structure is in satisfactory condition, however, lack of funds for periodic maintenance from both Plaquemines Parish and the State of Louisiana has resulted in a three year delay in the initial dewatering of the structure. This has resulted in a backlog of maintenance items. The following are major items that should be corrected as soon as possible.

a. Bottom Hinged Flap Gate.

(1) Because of an accumulation of slit in the gate recesses, the gate does not rest properly on the sill. Consequently, the leading edge of the gate sets approximately 2 feet above the top of the end sill. As a result of this improper seating, the gate has been struck numerous times by marine traffic, causing extensive damage to the skin plate and interconnecting framing members (see photos, encl 2). This same type

damage (but to a lesser extent) was observed and noted in the CELMV trip report of 26 August 1981. The main plate girder does not appear to have suffered any damage and the members that are damaged do not affect the operation of the gate. It should be noted however, that once the protective skin plate and lighter framing members are crushed to the extent that they no longer offer protection to the main plate girder, then severe damage to the girder and gate hinges may occur, possibly rendering the gate inoperable. Remedial repairs are planned as soon as funds are allocated for dewatering the structure.

(2) As a result of a request by letter from Plaquemines Parish in 1988 for assistance in developing a method of cleaning the silt from underneath the floodgate, the New Orleans District designed and built a small 4 inch jet dredge that could be used to clean out the side recesses and other areas not easily accessible to conventional dredging methods. The small jet dredge was very successful in cleaning out the recesses, however, the remaining silt under the gate was not sufficiently cleaned out with the larger 10 inch dredge supplied by the Plaquemines Parish contractor. Consequently, enough silt remains underneath the gate to prevent the gate from seating perfectly level. Plaquemines Parish representatives at the inspection stated that when the next maintenance dredging is performed they will reassess their dredging procedure to insure that the entire silted area is properly cleaned out using both the 4 inch jet dredge and a larger dredge. A description and photographs of the small jet dredge was provided by NOD and is attached as encl 3.

b. Hoist Chains and Counterweight Chains. In the past year some links in the hoist chain have broken while lifting the gate (see photos at encl 2). The links that broke were located either in the splash zone or under water near the mudline. The links were severely corroded and had experienced considerable elongation prior to failure. The chain was repaired with special replacement links which are commonly used in anchor chain applications. The hoist chains and counterweight chains should be replaced when the structure is dewatered.

c. Embedded Metals. Wall armor and corner protection plates in the splash zone are severely corroded. These items will be sandblasted and painted when the structure is dewatered.

d. Needle Girder Storage Rack.

(1) The concrete storage rack for the needle girders, concrete needles, and related hardware is in satisfactory condition, however, the 12" x 12" treated timbers used as spacers between the stacked items on the rack are badly decayed. All of the timbers should be replaced when the structure is dewatered.

(2) The paint on the steel needle girders and steel needle girder supports is satisfactory at this time, however, an accumulation of soil and other debris has collected on the top surface of the steel members. This material should be removed as part of general maintenance and also to prevent moisture in the soil from corroding the steel.

e. Riprap. In general the riprap protection appeared satisfactory, however, one area that is deficient is the southeast leg of the breakwater dike (see encl 4). The top surface of the dike was visible above the water surface about 6 inches to one foot. The design elevevation of the top of the dike is 3.0 ft. NGVD (the Gulfside stage at the time of the inspection was 0.5 NGVD). Repair of this item can be performed at any time and does not have to wait for the dewatering of the structure.

f. Miscellaneous.

(1) Some of the stair treads and ladder rungs on the landside boat dock and the pumping station (adjacent to the main structure) are badly corroded and in some cases have rusted through. These items should be repaired.

(2) On the west gate monolith wall some bolts are missing from the handrailing base plates. These should be replaced.

6. Action. No action required by the Division Commander at this time. Those deficiencies requiring action will be corrected as described above. CELMN will prepare an inspection report in accordance with ER 1110-2-100. The report will be submitted to CELMV for approval. Copies of the approved report will be furnished to Plaquemines Parish and the State of Louisiana.

7. Next Inspection. The next periodic inspection of this structure will be in January of 1993.

Encl

FRANK N. JOHNSON

EDWIN L. BOREN

ROSTON C. JARRELL JR.

ROUTING:
CELMV-ED-TS
CELMV-ED-T
CELMV-ED-G
CELMV-ED-W
CELMV-CO
CELMV-ED-A
CELMV-ED
CELMV-ED-T/Files

CF w/encls 1 and 4
CELMN-ED-DG (Mr. Drummond)

List of Attendees
Periodic Inspection No. 6
Empire Floodgate
New Orleans District

Lower Mississippi Valley Division

Frank N. Johnson	CELMV-ED-TS
Edwin L. Boren	CELMV-CO-O
Roston C. Jarrell, Jr.	CELMV-CO-O

New Orleans District

Johnny Drummond	CELMN-ED-DG
Rick Tillman	CELMN-ED-DD
Dennis C. Strecker	CELMN-ED-DG
Larry Dressler	CELMN-ED-FS
Jose' A. Lizarribar	CELMN-ED-FM
Colette D. Duffour	CELMN-OD-R
Jerry A. Colletti	CELMN-OD-R
Deborah Garrett	CELMN-ED-HC
E. Paul Mayeux, Jr.	CELMN-ED-DG

Plaquemine Parish

Carrol J. Martin
Henry Urban
Tommy Hebert

State of Louisiana (LDOTD)

Connie L. Standige
A.V. Flotte

ENCL 1

APPENDIX II - JET SUCTION DREDGE REPORT

JET-SUCTION DREDGE

The New Orleans District designed and built a small jet dredge based on a letter request from Plaquemines Parish for a method of cleaning the silt from underneath Empire Floodgate . The jet dredge was designed for cleaning the side concrete recesses and areas around the hinges not easily cleaned by conventional dredge methods. Major silt removal is accomplished by either a bucket dredge or a much larger jet dredge.

The jet suction dredge consists of a dredge head with suction pipe, a suction pump, vertical support column with operating handle, and operating hoses. The dredge head, attached to one end of the suction pipe, has 9 guarded lancing jets across the front and on either side of a 24" X 12" grated suction opening. The lancing jets collectively provide 200 gpm @ 100 psi for breaking up compacted sediments. Attached to the opposite end of the suction pipe is the dredge pump. The dredge pump is a hydraulically driven trash pump capable of passing 3-3/4" solids. It has a rated capacity of 800 gpm @ 15' head and 400 gpm @ 38' head. The pump, Model No. TP-04 is manufactured by Stanley Hydraulic Tools. The suction pipe and the vertical column is constructed of 5" Sch.80 steel pipe. One end of the vertical column has a lifting eye while the other end has a yoke for supporting the suction pipe. Below the lifting eye are three 2" diameter pin holes for attaching the operating handle. The operating handle provides a means for sweeping the dredge head from side to side. Hoses provided with the dredge consist of a 3/4" diameter by 100' long 2500 psi hydraulic supply hose, a 1" diameter by 100' long hydraulic return hose, a 2" diameter by 90' long 150 psi water hose for the lancing jets and dredge discharge hoses. The assembled dredge weights approximately 1300 lbs.

Operation of the dredge requires a crane, a high pressure water pump and an hydraulic pump. The crane should have a minimum capacity of 3,000 lbs and a boom length of at least 40'. The high pressure pump for the lancing jets should have minimum capacity of 200 gpm @ 100 psi. The hydraulic pump should have a minimum rating of 16 gpm @ 2000psi.

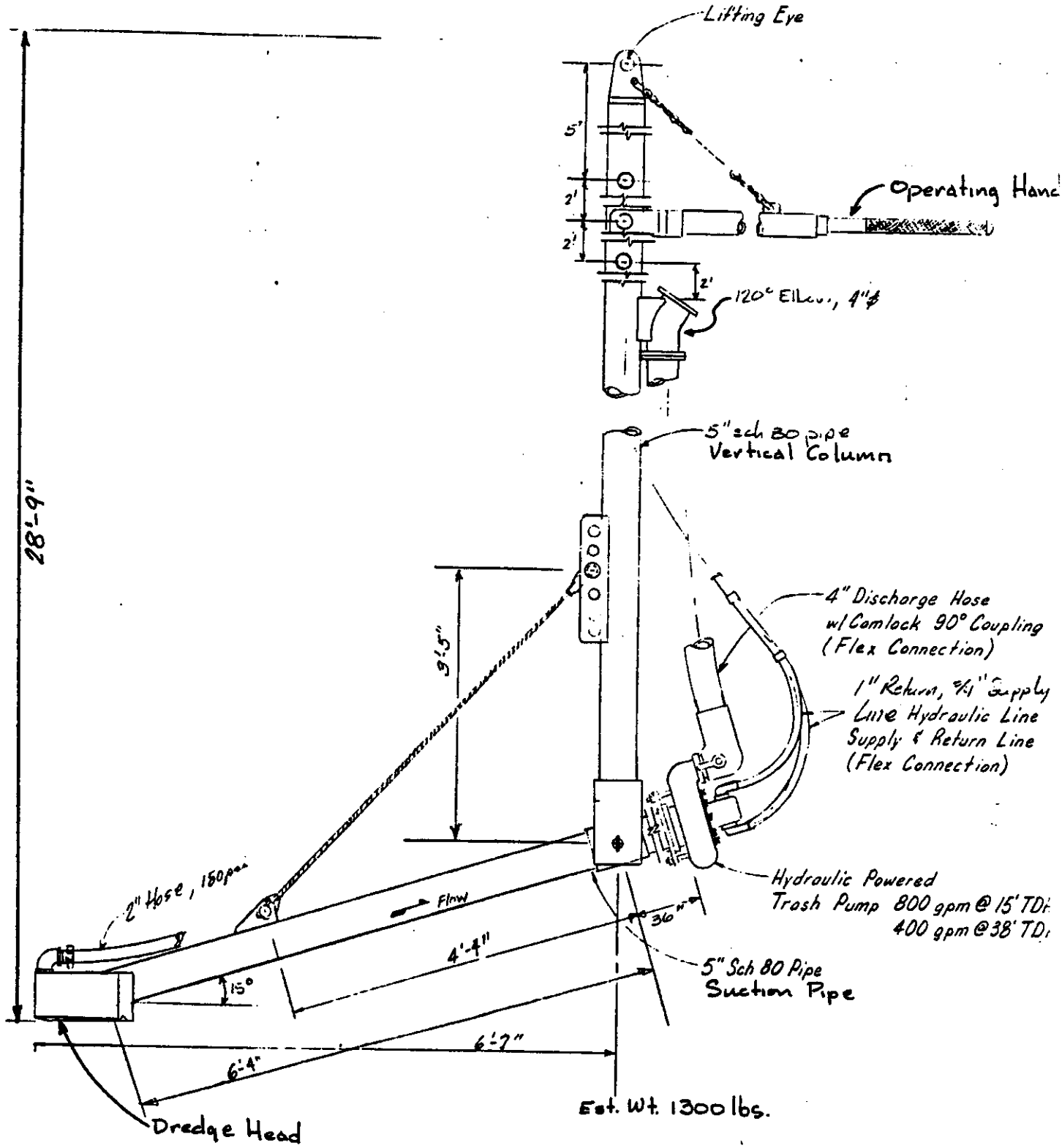
A sketch and photographs of the dredge is attached.

JET DREDGE WITH ACCUMULATED DEBRIS

JET DREDGE SHOWING THE ACTION OF THE LANCING JETS

DREDGE DISCHARGE

DREDGE OPERATING IN THE GATE RECESS



JET SUCTION DREDGE

INSTRUMENTATION PLATES

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I-4	Settlement and Reference Marks Differential Movement	H-4-27323
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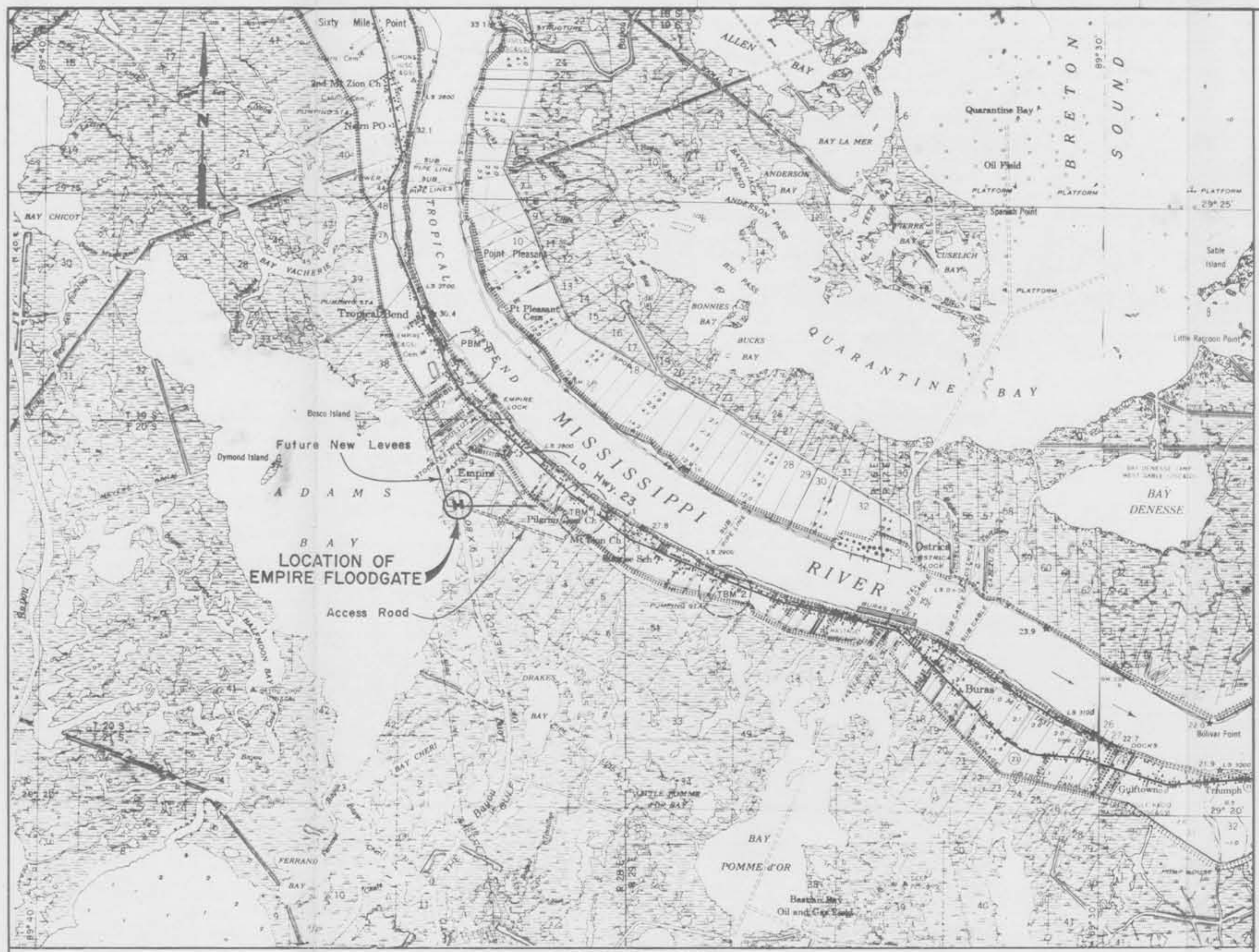
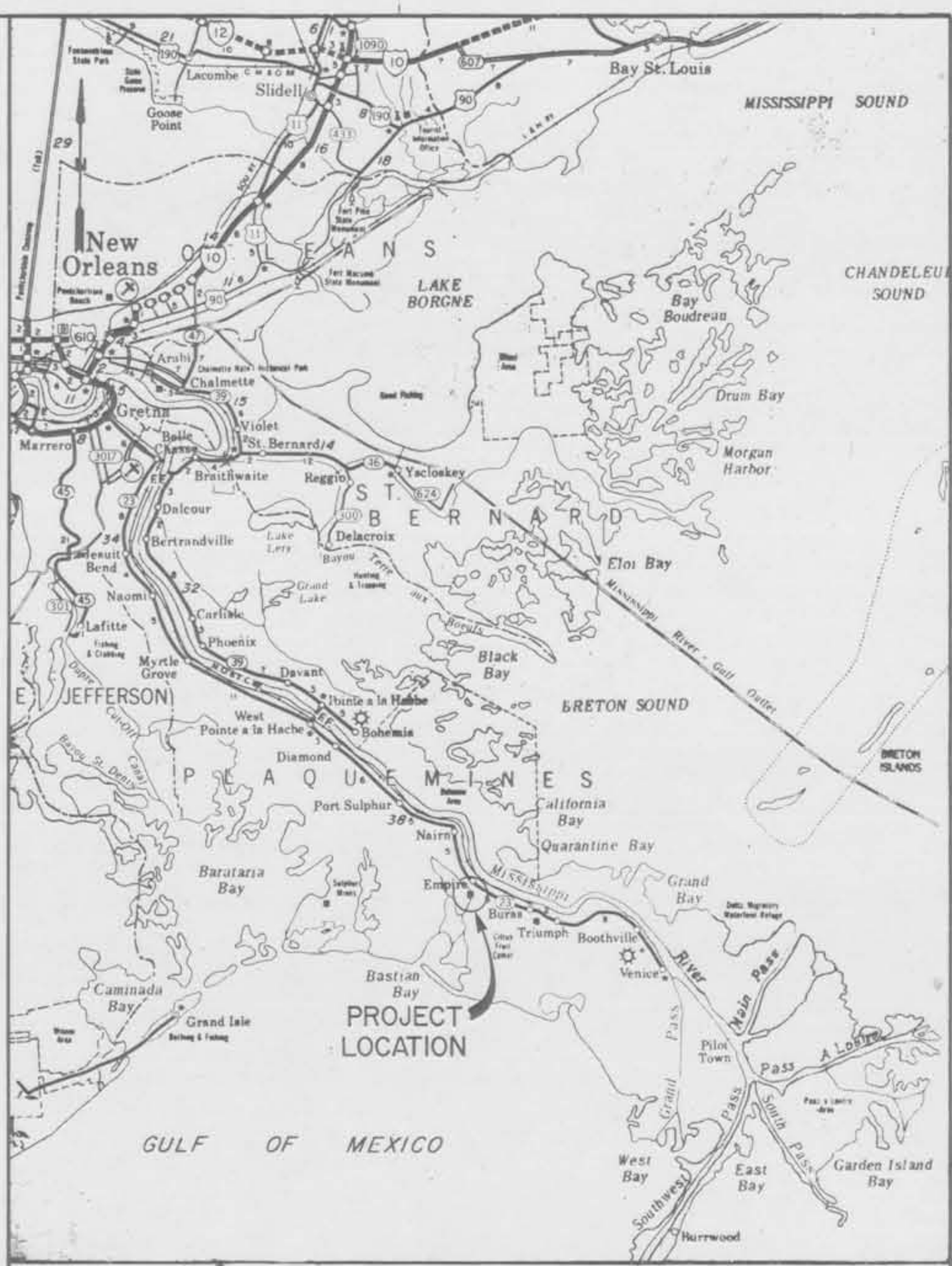
I-7	Settlement and Reference Marks Differential's Movement	H-4-27323



LOCATION MAP

SCALE 1:31,680



VICINITY MAP

SCALE IN MILES

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12	PLAN OF GATE BAY MONOLITH	30	NEEDLES AND STORAGE RACK	45	PLAN - MACHINERY ARRANGEMENT		
13	SECTIONAL ELEVATION OF GATE BAY MONOLITH	31	MISCELLANEOUS EMBEDDED METALS	46	ELEVATION - MACHINERY ARRANGEMENT		
14	TRANSVERSE SECTION OF GATE BAY MONOLITH	32	MISCELLANEOUS EMBEDDED METALS	47	MACHINERY BASE		
15	GATE BAY WALL REINFORCEMENT PLAN AT EL. 15.0	33	EMBEDDED METAL - CORNER PROTECTION	48	MACHINERY HOUSING		
16	GATE BAY WALL REINFORCEMENT PLAN AND SECTIONS	34	LADDER AND STAFF GAGE DETAILS	49	MISCELLANEOUS DETAILS		
16A	GATE BAY WALL REINFORCEMENT PLAN AND SECTION	35	HANDRAILING LAYOUT - SECTIONS AND DETAILS	50	CHAIN AND SHAFT DETAILS		
17	GATE BAY WALL REINFORCEMENT SECTIONS			51	LOCKING DEVICE AND SHOCK ABSORBER DETAILS		
				52	ENGINE GENERATOR LAYOUT		

Note:
See dwg. 2 for tabulation of bench marks.

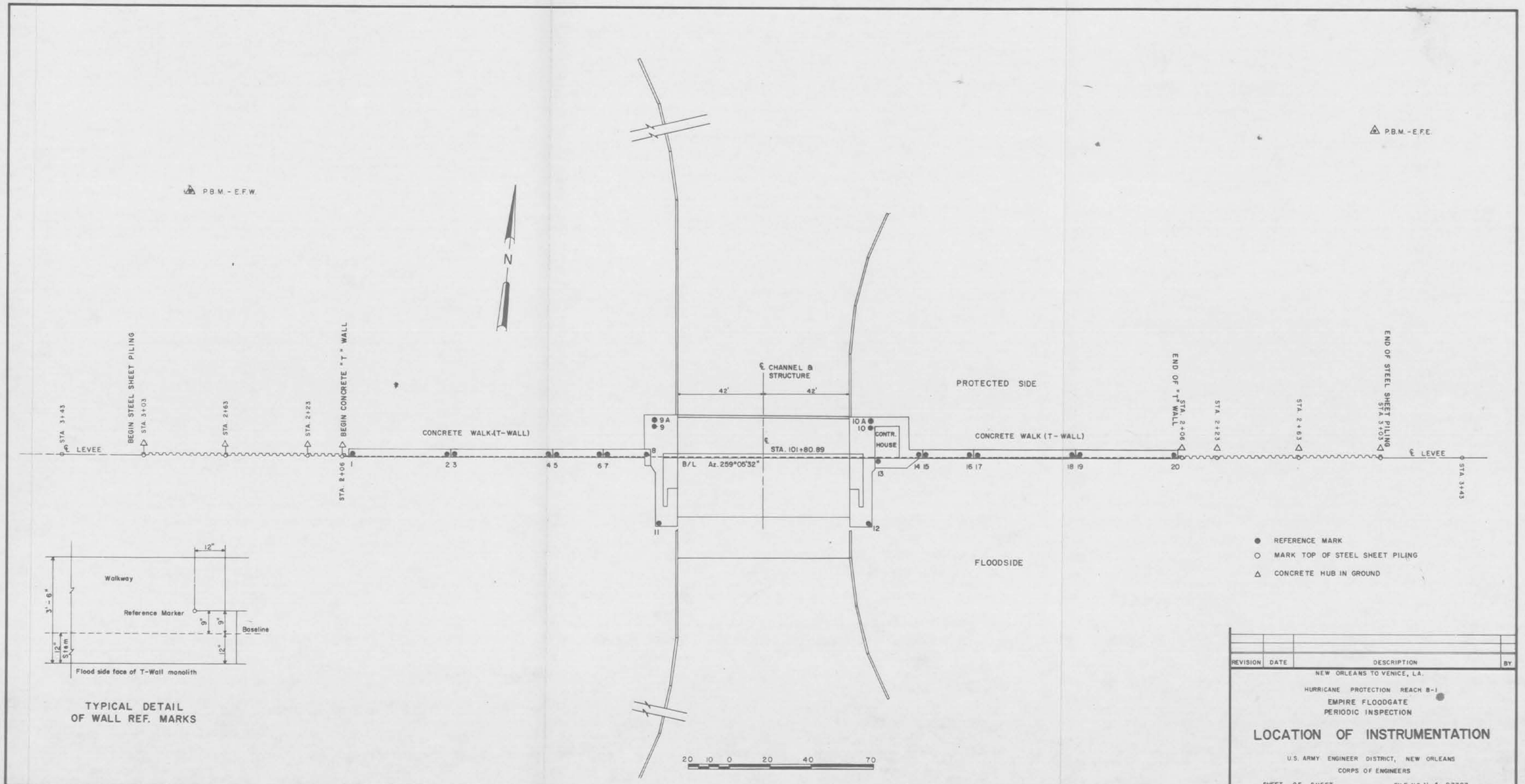
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
NEW ORLEANS, LA.

William E. Sommer
Jerome C. Baehr
William E. ... Jr. LTC
For
D.A.M. R.G.S. F.N.J.
Jed L. Henderson, Jr.

NEW ORLEANS TO VENICE, LOUISIANA
HURRICANE PROTECTION, REACH B-1
EMPIRE FLOODGATE
PLAQUEMINES PARISH, LA.
LOCATION MAP VICINITY
MAP AND INDEX

FEB 1973
DACW29-73-B-0111
H-4-26081
1 64

PLATE - 1



TYPICAL DETAIL
OF WALL REF. MARKS

REVISION	DATE	DESCRIPTION	BY

NEW ORLEANS TO VENICE, LA.

HURRICANE PROTECTION REACH B-1

EMPIRE FLOODGATE
PERIODIC INSPECTION

LOCATION OF INSTRUMENTATION

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

SHEET OF SHEET FILE NO. H-4-27323

PLATE I-1

Safety is a Part of Your Contract

SETTLEMENT REFERENCE MARK - SHEET PILING and LEVEE

REFERENCE MARK EAST or WEST		2+06E	2+06E	2+23E	2+23E	2+63E	2+63E	3+03E	3+03E	3+43E	E-W	2+06W	2+06W	2+23W	2+23W	2+63W	2+63W	3+03W	3+03W	3+43W
INITIAL DATE		12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75		12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75
ORIGINAL READINGS (FT)		14.13	7.65	13.89	8.13	13.78	7.96	13.76	14.45	14.11		13.87	7.11	13.38	7.56	13.03	7.80	12.65	13.91	11.69
DATE OF OBSERVATION	9 NOVEMBER 1984	13.21	6.29	12.75	②	12.32	6.22	12.07	11.88	12.03		13.37	②	12.78	②	12.26	②	11.71	12.42	10.11
	24 JULY 1986	13.11	6.17	12.62	②	12.16	5.96	11.92	11.61	11.86		13.35	②	12.75	②	12.22	②	11.64	12.15	②
	8 DECEMBER 1988	13.00	6.02	12.49	②	12.01	5.77	11.74	11.40	15.74		13.33	②	12.72	②	12.18	②	11.58	12.05	②

NOTE: FIRST STATIONINGS LISTED ARE ON STEEL SHEET PILINGS. ELEVATIONS FOR 3+43E & W ARE ON CONCRETE MONUMENTS

SETTLEMENT REFERENCE MARKS - STRUCTURE and T-WALL

PBM

NO. OF REFERENCE MARKS		RM 1	RM 2	RM 3	RM 4	RM 5	RM 6	RM 7	RM 8	RM 9	RM9A	RM10	RM10A	RM11	RM12	RM13	RM14	RM15	RM16	RM17	RM18	RM19	RM20	Temp.	Gage1	Gage2	Remarks	E.F.E.	E.F.W.
INITIAL DATE		12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	5-19-76	12-2-75	5-19-76	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75					12-2-75	
ORIGINAL READINGS (FT)		14.59	14.72	14.73	14.78	14.76	14.77	14.79	14.74	14.76	14.77	14.71	14.70	14.74	14.73	14.75	14.68	14.67	14.67	14.66	14.61	14.61	14.57					3.122	
DATE OF OBSERVATION	9 NOVEMBER 1984	14.18	14.38	14.39	14.44	14.42	14.42	14.42	14.36	14.39	14.38	14.30	14.30	14.37	14.33	14.34	14.27	14.26	14.25	14.24	14.14	14.13	13.93	70°	0.90	0.90		2.971	-
	24 JULY 1986	14.16	14.38	14.38	14.45	14.43	14.43	14.43	14.37	14.40	14.40	14.30	14.29	14.39	14.32	14.34	14.26	14.25	14.24	14.24	14.11	14.11	13.86	83°	1.20	1.20		2.971	4.200
	8 DECEMBER 1988	14.14	14.37	14.37	14.44	14.42	14.44	14.43	14.36	14.40	14.39	14.29	14.28	14.38	14.33	14.33	14.25	14.24	14.22	14.21	14.07	14.07	13.79	60°	0.00	0.00		2.971	4.217

DISTANCES TO REFERENCE MARKS

NO. OF REFERENCE MARKS		RM2 - RM3	RM4 - RM5	RM6 - RM7	RM9A-RM10A	RM11 - RM12	RM14 - RM15	RM16 - RM17	RM18 - RM19	Temp.	Remarks
INITIAL DATE		12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	12-2-75	54°	
ORIGINAL DISTANCE (IN)		24.313	24.500	23.750	105.83 ①	103.96 ①	24.000	24.094	24.313		
DATE OF OBSERVATION	9 NOVEMBER 1984	24.750	24.750	23.813	-	-	24.000	24.375	24.813	70°	
	24 JULY 1986	24.843	24.750	23.718	-	-	24.000	24.406	25.000	83°	
	8 DECEMBER 1988	24.875	24.906	23.781	-	-	24.156	24.53	25.219	70°	

NOTES:

THE DIFFERENTIAL GRAPHS (1975-DATE) ARE PLOTTED USING THE EQUATION (R-R)-.151' = DIFF. THE 0.151 IS CAUSED BY THE FOLLOWING BENCH MARK (N.G.V.D.) CORRECTIONS; PBM E.F.E. (1975-76) ELEV. 3.122' - (1979) ELEV. 2.971' = 0.151'

① APPEARS TO BE SURVEY ERROR.

② CAP DESTROYED; SHOT NATURAL GROUND.

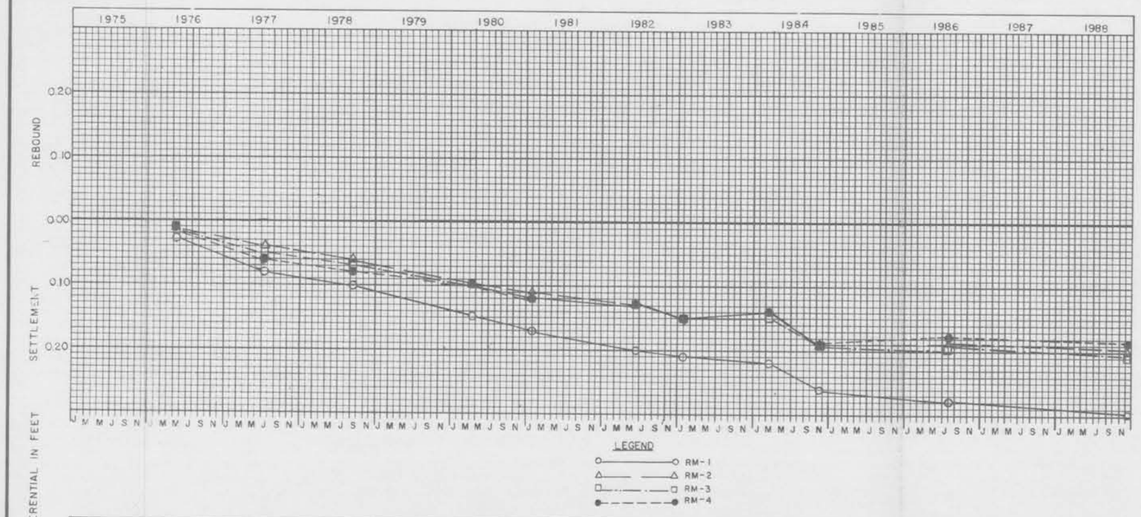
NEW ORLEANS TO VENICE, LA.
HURRICANE PROTECTION REACH B-1
PERIODIC INSPECTION
EMPIRE FLOODGATE

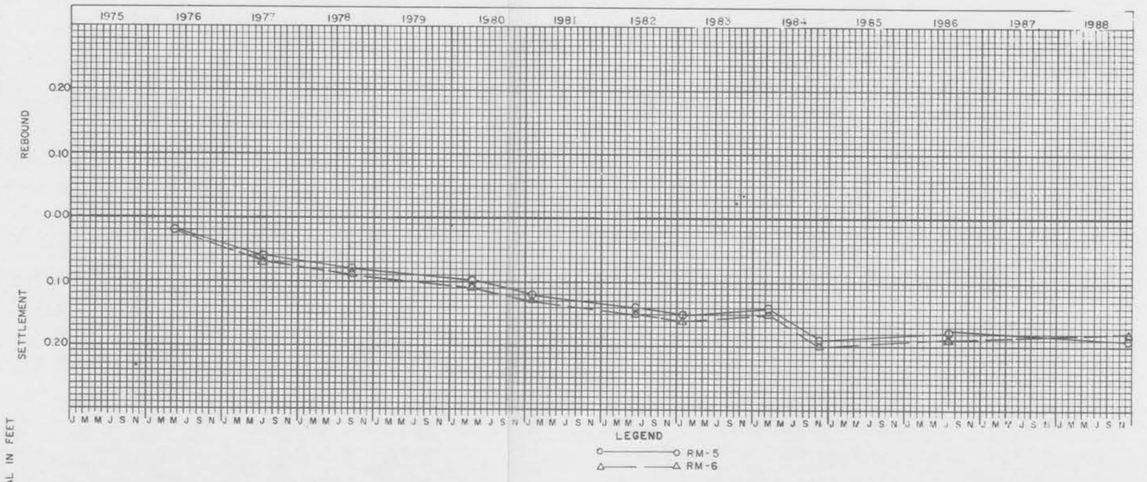
SETTLEMENT REFERENCE MARKS TABULATIONS

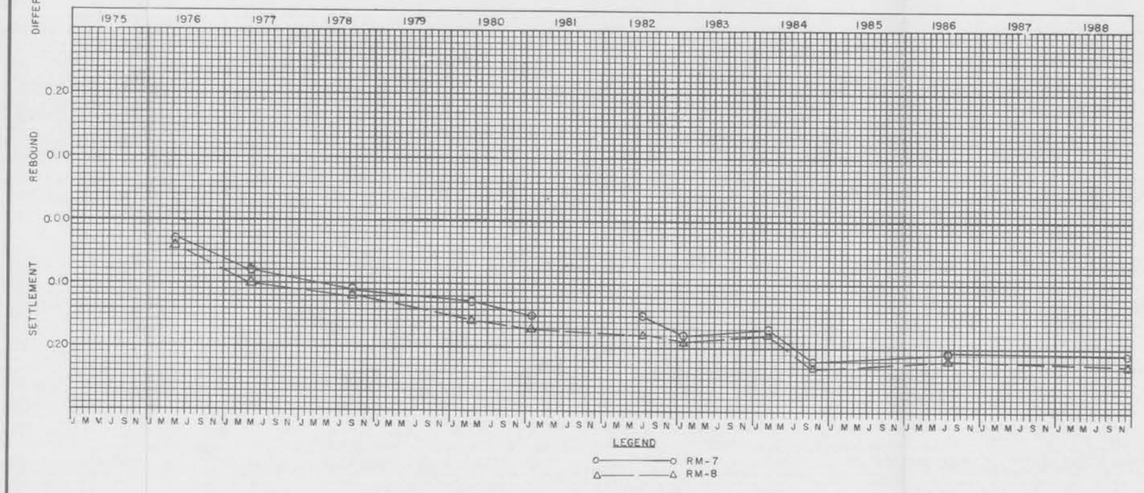
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

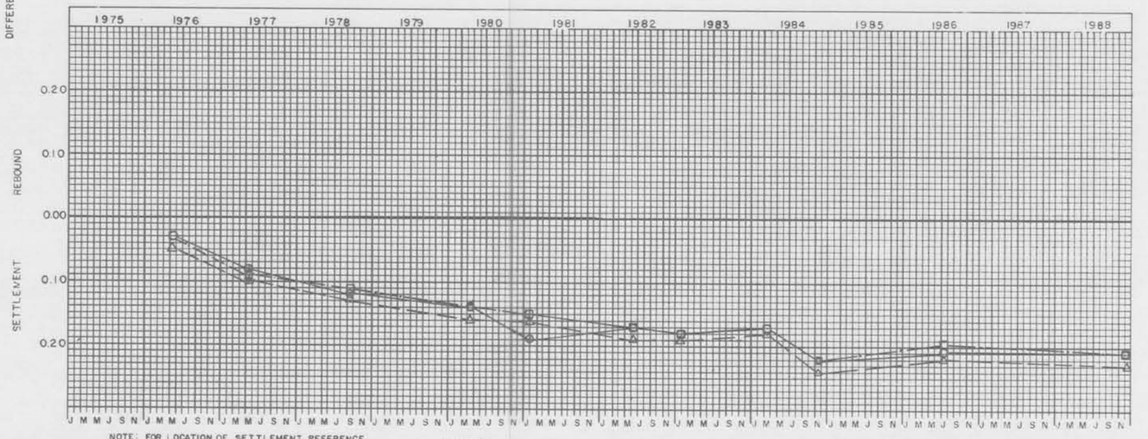
SHEET OF SHEET FILE NO.

PLATE I-2









NOTE: FOR LOCATION OF SETTLEMENT REFERENCE MARKS SEE PLATE.
FOR TABULATION OF ELEVATIONS SEE PLATE.

NOTE: ALL POINTS PLOTTED AFTER 1979 ARE USING THE EQUATION (R-R)-.151 = DIFF.; SEE TABULATION CHART FOR FURTHER INFORMATION.

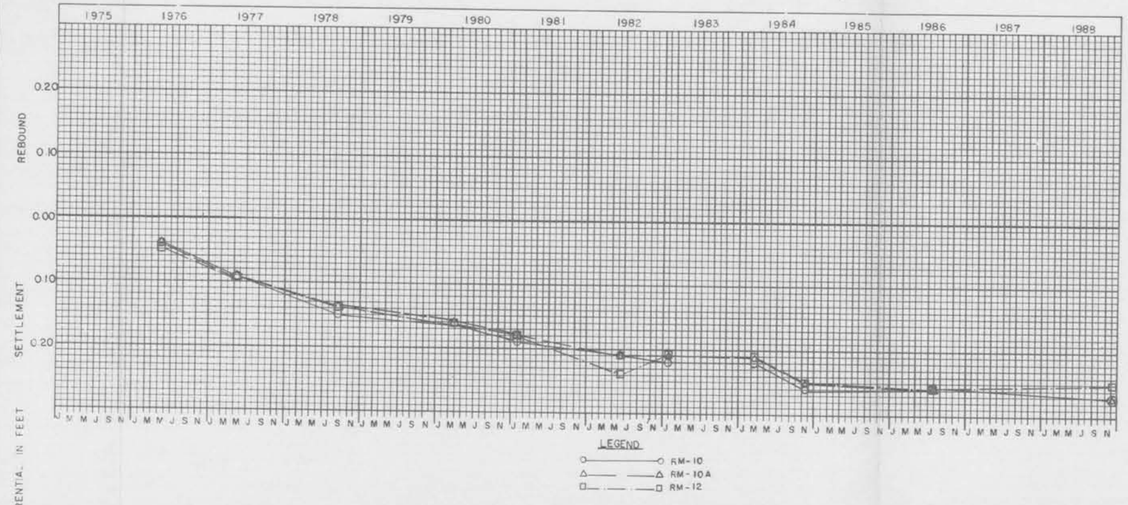
NEW ORLEANS TO VENICE, LA.
HURRICANE PROTECTION REACH B-1
PERIODIC INSPECTION
EMPIRE FLOODGATE

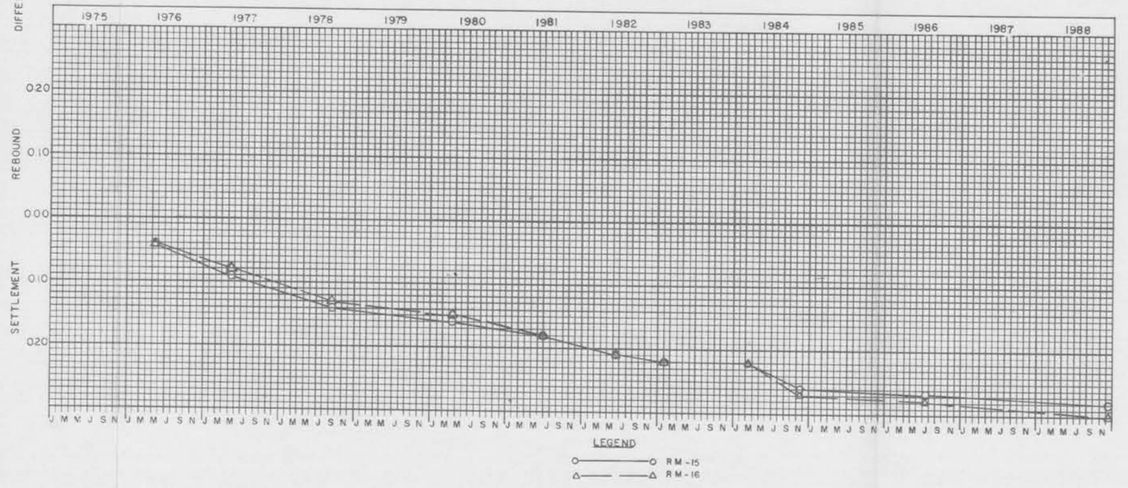
SETTLEMENT AND REFERENCE MARKS DIFFERENTIAL'S MOVEMENT

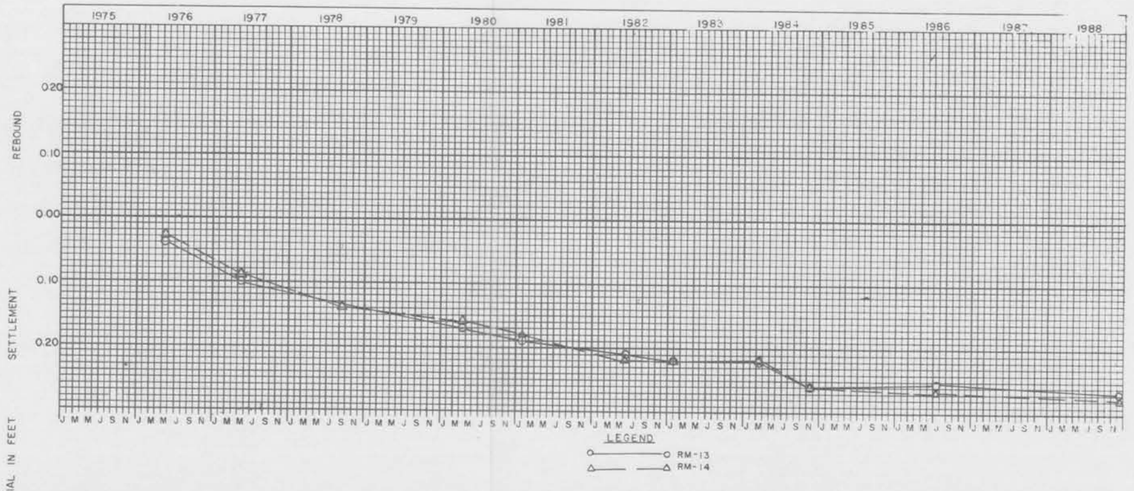
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

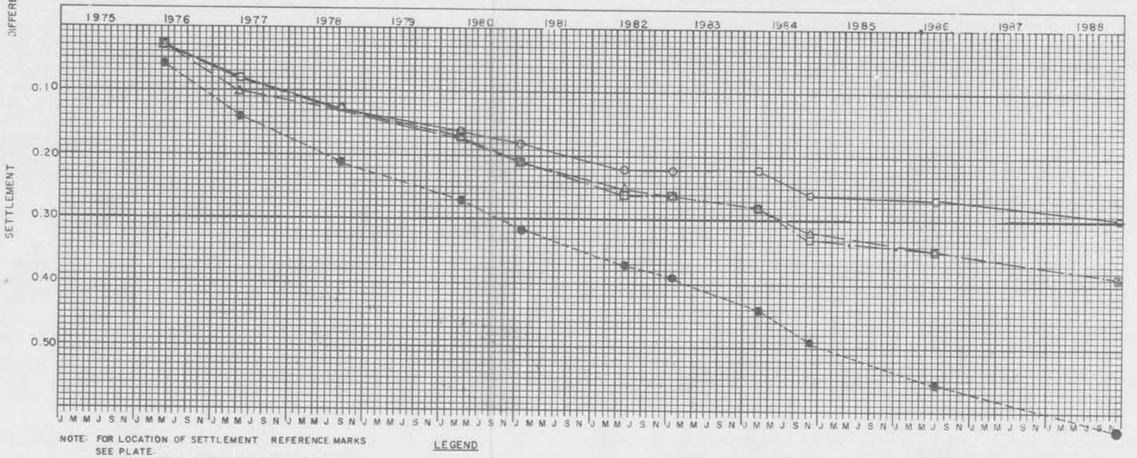
FILE NO H-4-27323

PLATE I-3









NOTE: FOR LOCATION OF SETTLEMENT REFERENCE MARKS SEE PLATE.
FOR TABULATION OF ELEVATIONS SEE PLATE.

NOTE: ALL POINTS PLOTTED AFTER 1979 ARE USING THE EQUATION (R-R)-.151 = DIFF.; SEE TABULATION CHART FOR FURTHER INFORMATION.

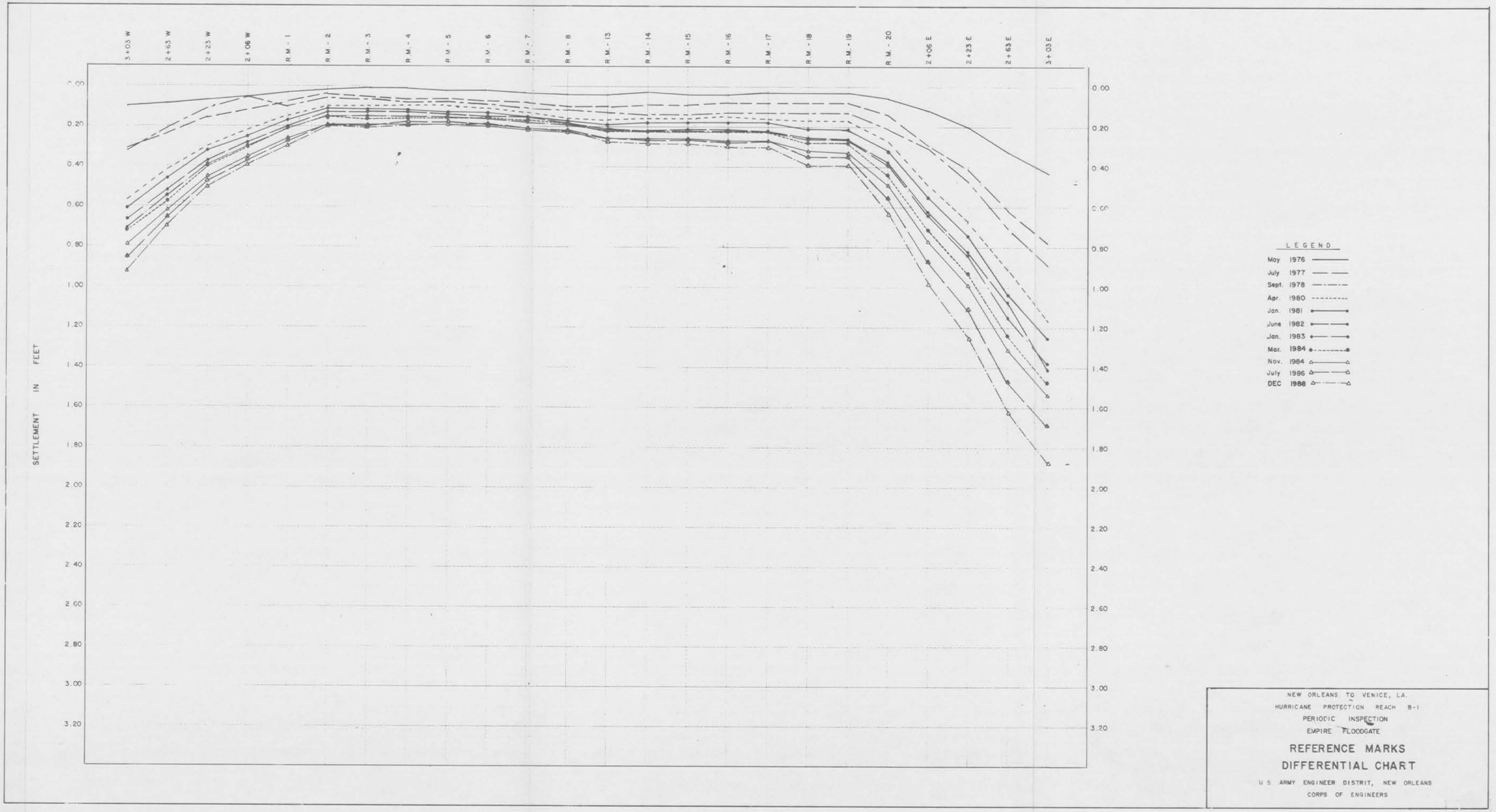
NEW ORLEANS TO VENICE, LA.
HURRICANE PROTECTION REACH B-1
PERIODIC INSPECTION
EMPIRE FLOODGATE

SETTLEMENT AND REFERENCE MARKS DIFFERENTIAL'S MOVEMENT

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

FILE NO H-4-27323

PLATE I-4



NEW ORLEANS TO VENICE, LA.
HURRICANE PROTECTION REACH B-1
PERIODIC INSPECTION
EMPIRE FLOODGATE

REFERENCE MARKS DIFFERENTIAL CHART

U.S. ARMY ENGINEER DISTRIT, NEW ORLEANS
CORPS OF ENGINEERS

PLATE 1-5

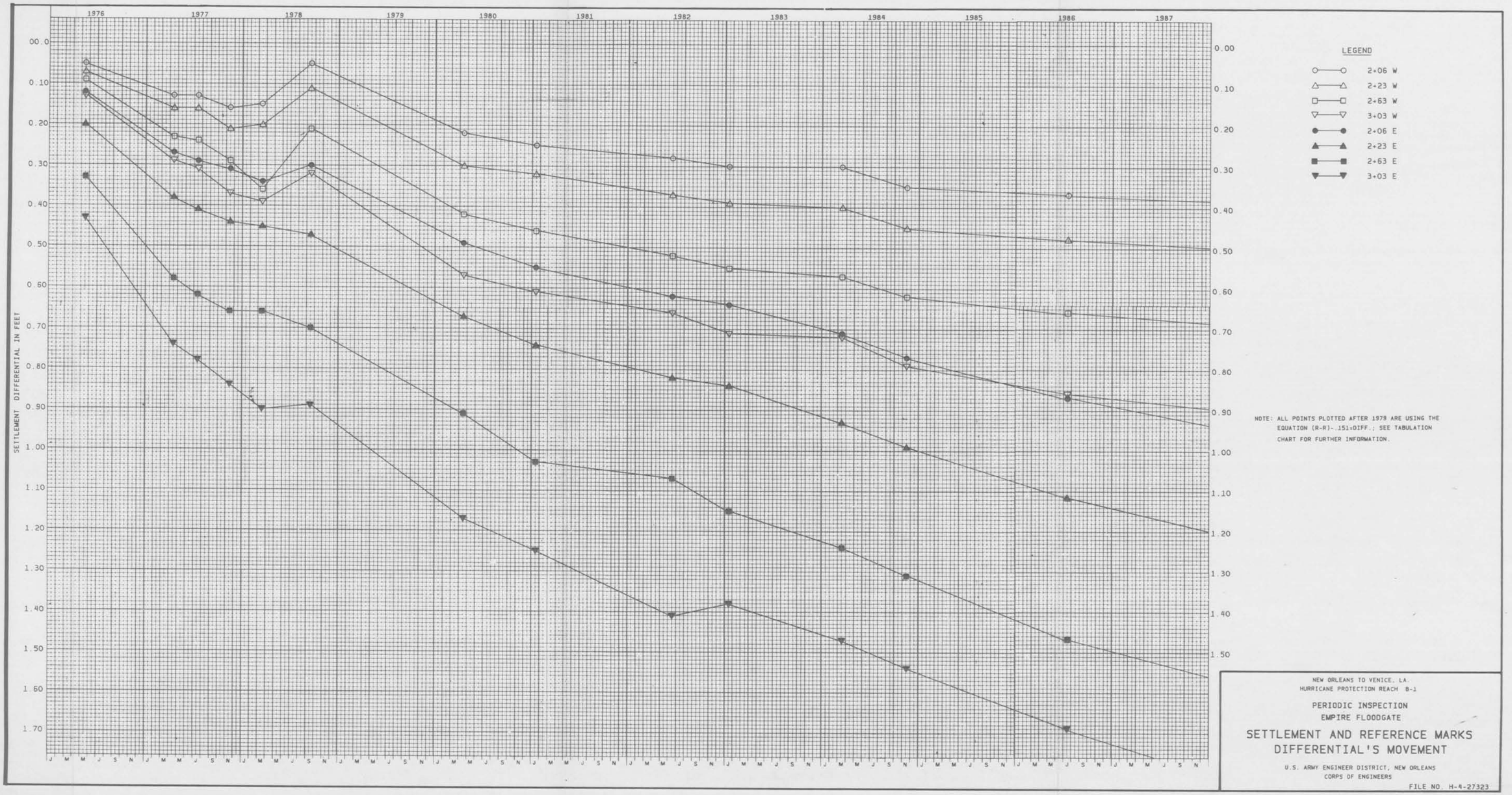

1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
SETTLEMENT DIFFERENTIAL IN FEET
00.0
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
1.10
1.20
1.30
1.40
1.50
LEGEND
2+06 W
2+23 W
2+63 W
3+03 W
2+06 E
2+23 E
2+63 E
3+03 E
NOTE: ALL POINTS PLOTTED AFTER 1979 ARE USING THE EQUATION (R-R)-.151+DIFF.; SEE TABULATION CHART FOR FURTHER INFORMATION.
NEW ORLEANS TO VENICE, LA.
HURRICANE PROTECTION REACH B-1
PERIODIC INSPECTION
EMPIRE FLOODGATE
SETTLEMENT AND REFERENCE MARKS
DIFFERENTIAL'S MOVEMENT
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS
FILE NO. H-4-27323

PLATE I-6

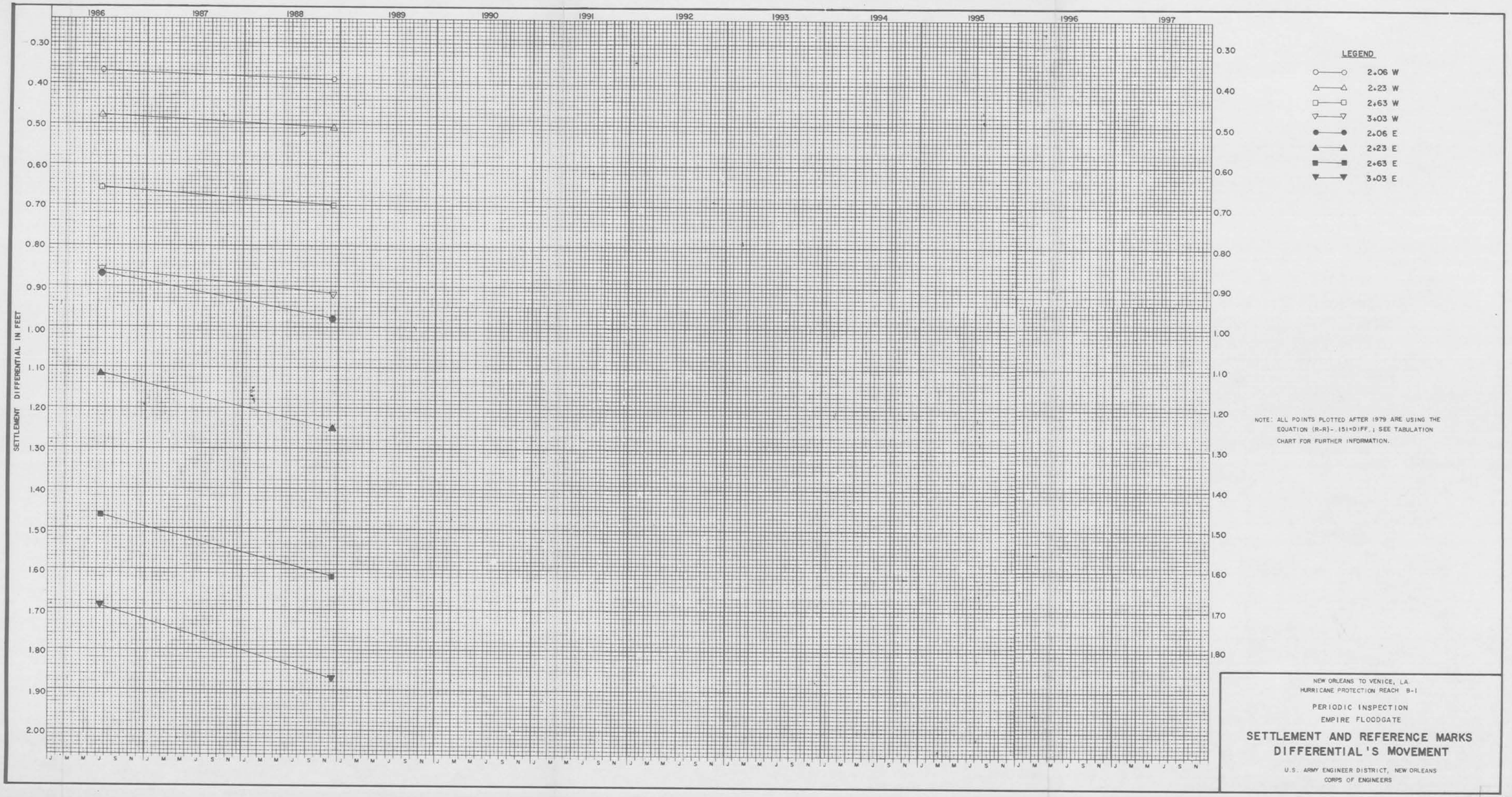

1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
SETTLEMENT DIFFERENTIAL IN FEET
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70
1.80
1.90
2.00
J M M J S N
LEGEND
2+06 W
2+23 W
2+63 W
3+03 W
2+06 E
2+23 E
2+63 E
3+03 E
NOTE: ALL POINTS PLOTTED AFTER 1979 ARE USING THE EQUATION (R-R)- 151=DIFF.; SEE TABULATION CHART FOR FURTHER INFORMATION.
NEW ORLEANS TO VENICE, LA.
HURRICANE PROTECTION REACH B-1
PERIODIC INSPECTION
EMPIRE FLOODGATE
SETTLEMENT AND REFERENCE MARKS
DIFFERENTIAL'S MOVEMENT
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CORPS OF ENGINEERS

PLATE I-7