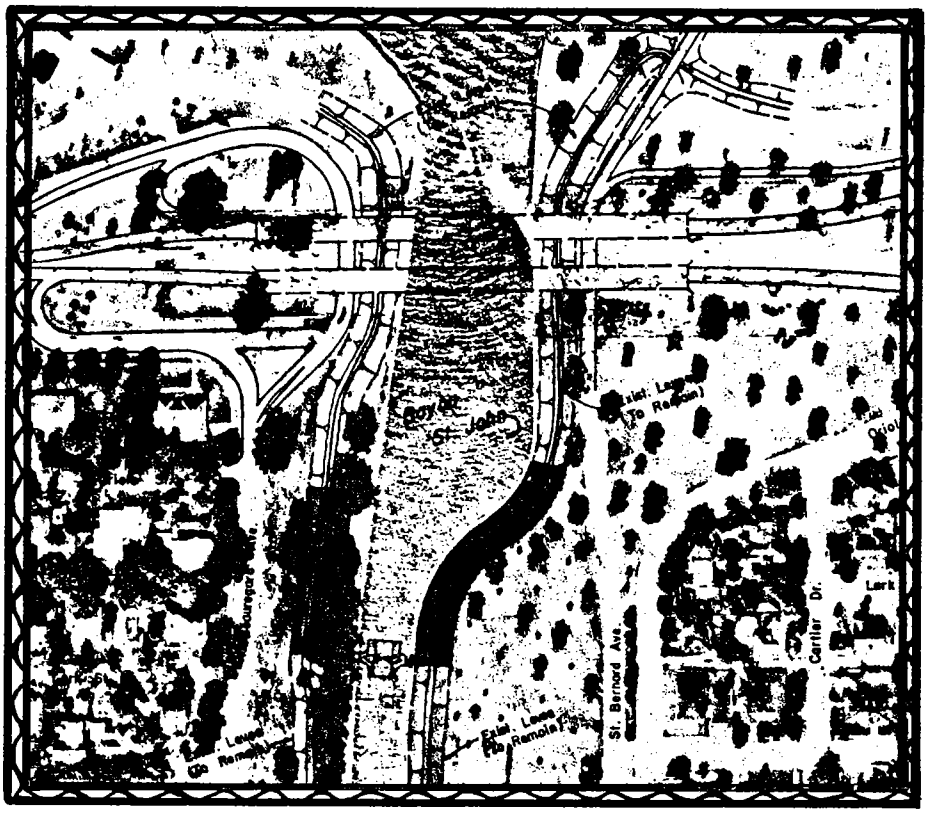
BAYOU ST. JOHN
GATE STRUCTURE STUDY



prepared for:

Board of Levee Commissioners

of the

Orleans Levee District

August, 1986

3012 26th ST. **Pepper and Associates, Inc.** Metairie, La.
Consulting Engineers

August 19, 1986

Mr. C. E. Bailey
Chief Engineer
The Board of Levee Commissioners
of the Orleans Levee District
Suite 202 - Administration Bldg.
New Orleans Lakefront Airport
New Orleans, Louisiana 70126

RE: Bayou St. John
Gate Structure Study

Dear Mr. Bailey:

In accordance with the authorization granted by the Orleans Levee Board during an Engineering Committee Meeting on August 6, 1986, we are submitting the Final Report comparing three (3) alternate gate structures providing flood protection closure across Bayou St. John, approximately 650 feet south of the centerline of Lakeshore Drive.

In addition, improvements to approximately 530 feet of existing levee along the banks of the bayou and the subsequent removal of the existing flow control structure in Bayou St. John at Robert E. Lee Boulevard, have been investigated.

These improvements comprise the second phase of the Orleans Levee Board's project to match the High Level Plan of Flood Protection for this area.

The following types of gate structures are evaluated:

1. Sector Gate
2. Miter Gate
3. Flap Gate

This report has incorporated the comments received from both Design Engineering, Inc., and your office concerning our previous draft submittal during our meeting of July 31, 1986. In addition, the analyses of the gate structures and levee system is based on the design parameters required by the U.S. Army Corps of Engineers and the Orleans Levee Board.

Very truly yours,

PEPPER & ASSOCIATES, INC.

Jerome Pepper
President

JP/ks
Enclosures

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APPENDIX

I. INTRODUCTION

The purpose of this study is to evaluate and compare three alternative gate structures providing flood protection closure across Bayou St. John, approximately 650 feet south of the centerline of Lakeshore Drive. This construction is to be performed in the second phase of the Orleans Levee Board's project to complete the High Level Plan of Flood Protection for this area. The following types of gate structure are reviewed:

1. Sector Gate
2. Miter Gate
3. Flap Gate

The Army Corps of Engineers' Design Criteria for both flood protection elevation and structural design are used in all analyses.

In addition to the gate structure, the proposed closure system will include improvements to approximately 280 feet of existing levee on the west bank and 250 feet on the east bank of Bayou St. John with 115 feet of reinforced concrete retaining wall to tie to the gate itself. This levee construction will match prior levee improvements extending approximately 370 feet south of the Lakeshore Drive centerline which, along with the new bridge crossing of Bayou St. John, are part of the Levee Board's phase one construction. The proposed improvements will basically consist of some minor reshaping of the existing levees and the embedment of a combination steel sheet pile, concrete cap floodwall effectively raising the system to the required flood protection elevations.

Finally, upon completion of the flood protection closure of Bayou St. John, the existing closure system between Lake Pontchartrain and the bayou at Robert E. Lee Blvd. will be removed. The finished gate structure will allow for adequate controlled flow of water between the lake and Bayou St. John.

The total estimated cost for each gate structure including the associated levee improvements and subsequent removal of the existing flow control structure at Robert E. Lee Blvd. is tabulated as a means of direct comparison.

II. AUTHORIZATION

On August 6, 1985, during an Engineering Committee Meeting of the Orleans Levee Board, Pepper and Associates, Inc., was authorized to prepare preliminary conceptual layouts, sketches and cost estimates for the three gate structure alternates, required levee improvements and subsequent removal of the existing flow control structure in Bayou St. John at Robert E. Lee Blvd. These improvements comprise Phase II of the Orleans Levee Board's plan to match the High Level Plan of Flood Protection for this area.

III. DESIGN PARAMETERS

The design parameters listed below were required by the U. S. Corps of Engineers and the Orleans Levee Board. Design of any of the gate structures and levees must conform to these parameters.

A. Differential Hydraulic Load

Bayou St. John at location of gate structure, 650 feet south of Lakeshore Drive Centerline.

1) Elev. = 11.5 N.G.V.D.: maximum stage for lakeside of gate
   Elev. = 0.5 N.G.V.D.: minimum stage for landside of gate
2) Elev. = -5.0 N.G.V.D.: minimum stage for lakeside of gate
   Elev. = 3.0 N.G.V.D.: maximum stage for landside of gate
3) Elev. = -8.0 N.G.V.D.: elevation on the top of foundation slab of gate structure

B. Flood Protection Elevation

1) Elev. = 16.5 N.G.V.D.: top of gate structure, 650 feet south of Lakeshore Dr. centerline

2) Levees along Bayou St. John must gradually decrease in elevation from 18.00 N.G.V.D. at the Lakeshore Dr. bridge crossing of Bayou St. John to elevation of 14.5 N.G.V.D. at a point 600 feet south of the bridge.

C. Wave Force on Gate Structure and Levee System

Design for force obtained from the one percent wave during the Standard Project Hurricane as provided by the U. S. Army Corps of Engineers. (See Appendix Sheets 1-3 for design values.)

D. Factors of Safety

1) Factor of safety of 2 applied to pile foundation for gate structure.

2) Factor of safety of 1.30 applied to slope stability of levee system along Bayou St. John.

3) A reduced factor of safety of 1.25 applied to steel sheet pile embedment depth in levee system along Bayou St. John because the dynamic wave force is included in analysis.

E. Soils Investigation

1) On September 23, 1985, Eustis Engineering Company presented an interim report containing slope stability analyses for the proposed levee improvements between the bridge at Lakeshore Drive and the proposed gate structure. In addition, the report provided bulkhead analyses for the steel sheet pile - concrete cap floodwall to be embedded in the levee crown. (See Appendix Sheets 4-8 for details.)

IV. GENERAL DESCRIPTION OF GATE STRUCTURES

In order to provide both increased flood protection and a controlled flow of water between Lake Pontchartrain and Bayou St. John,

the Orleans Levee Board decided to investigate the construction of a gate structure across the bayou. The structure would be located approximately 650 feet south of the centerline of Lakeshore Drive. (See Figure 1). The width of the bayou at this location is at a minimum (approximately 90 feet), thus reducing the cost of any gate structure necessary to span the cross section of the channel. Also, this site is located over 600 feet north of Historic Fort St. John and as such, will not disturb the integrity of this site.

Three alternative gate structures were evaluated to provide the desired flood protection and water flow control. (See Figure 2). Each alternate must meet the design criteria set forth by both the U. S. Army Corps of Engineers and the Orleans Levee Board previously detailed in this report while providing a 30 foot clear width opening for future vessel traffic and free flow of the bayou.

A. Sector Gates (Figures 3-6)

1) A sector gate is similar in shape to a tainter gate except oriented to rotate about a vertical axis and is supported at the top and bottom in a manner similar to a miter gate. Like miter gates, sector gates are used in pairs, meeting at the center of the opening when in the closed position and swinging into recesses in the gate walls for the open position. The trunnions are located in the gate walls, and the skin plates face in the direction of the flood side (Lake Pontachartrain).

a) Normally, sector gates are used in tidal reaches of rivers or canals where the lifts are low and where the gates may be subjected to reversal of heads. Since these gates can be opened and closed under head, they can be used to close off flow in an emergency. The gates swing apart and water flows into or out of the gate structure through the center opening between the gates. In some cases, flow is admitted through culverts to improve filling characteristics or where drift may not permit adequate flow between the gates.

b) The only disadvantages of the sector gates are high construction cost and larger wall recesses.

B. Miter Gates (Figures 9 and 10)

1) These gates are fairly simple in construction and operation and can be opened or closed more rapidly than any other type of gate. Maintenance costs generally are low. A disadvantage of this gate is that it cannot be used to close off flow in an emergency situation with an appreciable unbalanced head.

a) Miter gates fit into recesses in the wall in the open position. The bottom of the recess should extend below the gate bottom to preclude operating

difficulties from silt and debris collection. An air bubbler system may be provided to help clear debris from gate recesses.

b) Miter gates are framed either horizontally or vertically. The skin plate of a horizontally framed gate is supported by horizontal members which may be either straight girders acting as beams, or circular arches. Each such horizontal member is supported by the vertical quoin post at one end and the miter post at the other. All water load is transmitted through the girders and quoin blocking into the gate monoliths. A vertically framed gate resists the water pressure by a series of vertical girders more or less uniformly spaced throughout the length of the gate, and supported at top and bottom by horizontal girders transmitting the loads to miter and quoin at the top of the leaf, and directly to the sill at the bottom.

c) The relative costs of the two types of gates (horizontally and vertically framed) depend largely upon three main factors:

- Overall weight of the gate;
- Simplicity of design and ease of fabrication and erection;
- Cost of that part of the gate structure walls and sills influenced by the design of the gate.

d) The overturning moment carried to the lock wall by a horizontally framed gate is greater about all points below the sill than that caused by a vertically framed gate, unless the entire sill load is transmitted to the wall. Hence, the latter type requires less masonry in a thrust wall of gravity section, but the heavier sill necessary to support the bottom girder into which the verticals are framed may counterbalance this saving.

e) The miter gate will not support a one (1') foot high reversed head in which the landside head is much higher than the lakeside head. For this project, the U. S. Army Corps of Engineers requires the gate structure to support an eight (8') foot high reversed head. (See Differential Hydraulic Load, page 3.)

C. Flap Gates (Figures 11 and 12)

1) A flap gate has only one leaf oriented to rotate about a horizontal axis located at the bottom of the gate. When open, the gate lies parallel to the channel bottom in a recess in the foundation slab. When closing, the top of the gate is swung upward, rotating about hinges connected to the gate bottom.

a) Since the gate rests in a large rectangular recess below the channel elevation when open, silting will occur in the recess while the gate is closed, which causes a maintenance problem.

b) Operation of the flap gates is more complicated than both the miter and sector gates involving counter-weights to facilitate opening and closing movements.

c) The flap gate will not support a one (1') foot high reversed head in which the landside head is much higher than the lakeside head. For this project, the U. S. Army Corps of Engineers requires the gate structure to support an eight (8') foot high reversed head. (See Differential Hydraulic Load, page 3.)

d) A pump connected to a series of pipes will be required to clean any silting which might occur on the gate structure.

D. Basic Dimensions

1) Sector Gates. Sector gates are generally laid out with the frames forming an equilateral triangle. The normal layout is for sixty degrees (60°) or greater interior angles, formed by the frames and chord line behind the skin plates. One strut is parallel to the gate wall in

the closed position, thereby causing the other strut to form an angle equal to the interior angle, with the lock wall. The pintle is located so that the gate is completely in the recess in the open position.

2) Miter Gates. A miter gate is a three-hinged arch when the leaves are mitered. Gate geometry is a function of the angle the work line of the leaf makes with a line normal to the lock walls, with the gate in a mitered position. Past study and design has determined that for miter gates a slope of 1L on 3T gives the best results (L = Longitudinal, T = Transverse). In general, vertically framed gates have been used where the height to length ratio of the leaf was less than 0.5. The approximate ratio of height to length, where the weight of a vertically framed leaf is essentially the same as a horizontally framed leaf, is somewhere between 0.70 and 1.0. However, vertically framed gates are not recommended for new construction. Even with a slight increase in cost, the greater rigidity of the horizontally framed gates makes them more desirable.

3) Flap Gates. Gate geometry is a simple rectangle conforming to the height and width of the required channel opening.

V. EXISTING LEVEE IMPROVEMENTS

To match the U. S. Army Corps of Engineers' High Level Plan of Flood Protection, the existing levee system along Bayou St. John from approximately 370 feet south of the Lakeshore Dr. centerline to the proposed gate structure will be improved as part of Phase II of this project. (See Figure 13). Along with the gate structure and subsequent removal of the existing closure system for the bayou at Robert E. Lee Blvd., this levee construction comprises phase two of the Board's flood protection system for the area. Phase one consists of a bridge at Lakeshore Drive with associated roadway improvements together with levee improvements along the east and west banks of the bayou from just north of the bridge to the point matching phase two construction, 370 feet south of the Lakeshore Dr. centerline.

Approximately 280 feet of existing levee on the east bank and 250 feet on the west bank will be affected. In order to insure the proper factor of safety for slope stability and match the Corps of Engineers' design criteria as specified in Part II of this report, the existing alignment and elevation of the levee system will remain essentially the same. However, some reshaping will be required to provide a 10 foot crown width of constant elevation as shown in the cross section of Figure 14. The required flood protection along the bayou is to decrease gradually from an elevation of 18.0 N.G.V.D. at the Lakeshore Dr. bridge to an elevation of 14.5 N.G.V.D. at a point 600 feet south of the bridge. Steel sheet pile will be driven into the levee crown and will

extend above the crown to provide the required flood protection elevation. Based on the wave force criteria provided by the U. S. Army Corps of Engineers (see Appendix Sheets 1-3), a PZ-22 sheet pile section was selected which will be subject to a maximum deflection of 1.25 inches. In addition, a concrete cap will encase the exposed sheet pile wall.

Finally, at the location of the gate structure, a concrete retaining wall spanning approximately 115 feet will be constructed to tie the existing levee system to the proposed gate structure (See Figure 13). The wall will be 2 feet thick with a maximum height of 24'-6" as shown in Section B-B of Figure 4.

VI. REMOVAL OF EXISTING CLOSURE SYSTEM

After construction of the proposed sector gate is complete, the existing water flow control structure in Bayou St. John at Robert E. Lee Blvd. will be redundant. The basic structure is a 20 foot wide by 11' - 5½" long by 15 foot high concrete box culvert on the lake side which is adjoined to a 20 foot wide by 10' long by 7'-6" high concrete box culvert on the land side (See Figures 7 and 8). The two boxes are adjoined by a one foot thick concrete wall which spans the 20 foot wide opening and runs 15 feet high. The flow of water is regulated by three pipes which pass through the concrete wall allowing flow from the lake side box culvert to the land side box.

In order to permit free flow from the lake side of the structure to the land side, the one foot thick concrete wall will be broken out from the adjoining box culverts. In addition, the existing pipes and associated apparatus such as screens which lie inside the box will also be removed. Some additional shoring of the remaining open box sections may be necessary to assure a proper factor of safety against collapse.

Naturally, the cost for removal of the structure will not affect the selection of the alternate gates across the bayou. The cost of removal of the existing structure at Robert E. Lee Boulevard is included in all three alternates and the cost estimates in Section IX.

VII. DISCUSSION OF GATE SELECTION

The sector, miter and flap gate structures all allow for a 30'-0" clear width opening for future vessel traffic and free flow in Bayou St. John along with unlimited vertical clearance (See Figures 3, 9 and 11). In addition, the following items, common to each type of gate structure, are required along with the construction of each gate and its housing structure:

1) Flow Control Structure (See Figure 6).

2) Improvements to the existing levee system along both the east and west banks of Bayou St. John totalling approximately 530 feet. The existing levees will be reshaped to provide a 10 foot crown width and steel sheet pile will be driven, extending above the crown to provide the

required flood protection elevation. The exposed sheet pile will be encased in concrete (See Figures 13 and 14).

3) Concrete Flood Wall, on both sides of the gate structure, connecting the gate structure in the bayou to the levee system located along the east and west banks (See Figures 3, 9 and 11).

4) Removal of Existing Closure System for Bayou St. John at Robert E. Lee Blvd. (See Figures 7 and 8).

The decision regarding gate selection should consider the major characteristics of each gate which are summarized below.

A. Sector Gate. The overall height of the structure to house the gate measured from the top of slab foundation is 24'-6" which is comparable to the miter and flap gate alternates. However, the recesses necessary to house the gate in the open position require the structure to have a larger foundation than the other gate alternates (See Figure 3). As a result, the existing concrete bulkhead defining the westbank of the bayou must be set back 10 feet as shown.

The Sector Gate can be designed to be structurally stable under both a positive head differential of 11 feet on the Lakeside of the bayou and 8 feet on the landside, which is the required hydraulic loading to be resisted by the gate(see

differential hydraulic loading, Page 3). The positive head differential on the landside is termed a reversal of head. As a result, this gate can be used to close off flow in an emergency.

Also, the Sector Gate is comprised of a truss section oriented to rotate about a vertical axis and supported at the top and bottom. As a result, the gate is highly resistant to deflections since the hydraulic load is applied radially to the gate and distributed to both the top and bottom supports. Since deflections are not a problem with this gate, extensive maintenance to insure proper alignment of the interlocking gate components will not be necessary.

The total probable construction budget for this alternate is $4,985,134.00 and is detailed on Pages 19 and 20.

B. Miter Gate. The operation of this gate is fairly simple. Although silting can be a problem when the gate is open, the addition of a silting beam (See Sheet 9) will minimize the problem by allowing the gate to close approximately 2 feet above the channel bottom. The additional cost for the beam is only about $10,000. However, this gate may not be subjected to a head reversal of more than one foot occurring if the water level in the lake is significantly lowered during an emergency such as a hurricane. The anticipated maximum head reversal is eight feet which exceeds the structural capacity

of this gate (see differential hydraulic load - page 3 for design parameters).

In addition, the miter gate acts as a cantilever and is very susceptible to deflections which can result in misalignment of the gate components. A system of trunnions and tie rods forming part of the gate must be frequently adjusted to correct for the deflections requiring additional maintenance and operating costs.

The total probable construction budget for this alternate is $4,483,215.00 and is detailed on Pages 21 and 22.

C. Flap Gate. The flap gate is very susceptible to silting and will require a platform housing pumps to clean the structure (See Figures 11 and 12). Also, operation of the gates is more complicated than both the miter and sector gates. Finally, similar to the miter gate, the flap gate may not be subjected to a head reversal of more than one foot which may occur during an emergency. The anticipated maximum head reversal is eight feet which exceeds the structural capacity of this gate (see differential hydraulic load - page 3 for details).
The total probable construction budget for this alternate is $4,691,039.00 and is detailed on Pages 23 and 24.

D. Cost Summary

Gate	Total Probable Construction Budget
Sector Gate	$4,985,134.00
Miter Gate	$4,483,215.00
Flap Gate	$4,691,039.00

VIII. RECOMMENDATION

All three gate structures investigated, must be designed to provide two primary functions. One function, water flow control in Bayou St. John, is provided equally by the sector, miter and flap gates. Since the other primary function of the gate structure is to provide flood protection closure at Bayou St. John, the sector gate is the best alternative. The Corps of Engineers, during a meeting with our personnel on June 3, 1986, advised that the sector gate was the most dependable of the three alternates. This gate is highly resistant to damage due to deflection since the hydraulic load is applied radially to the gate and distributed to supports at both the bottom and top of the gate. Whereas, the miter gate is very susceptible to deflections which can result in misalignment between the interlocking gate components, requiring additional maintenance. In addition, the sector gate can be closed in emergency situations which create any appreciable unbalanced head. The miter gate can only support a large positive head differential on the lakeside but it cannot support more than a one foot head reversal in which the water level in the lake drops below the landside level. As indicated on Page 3 of this study, the differential

in elevation at the gate location could be as much as 8.0' under a reverse head condition which may occur during an emergency such as a hurricane.

Construction of the sector gate requires a larger volume of concrete and steel reinforcing in the housing structure along with a greater quantity of structural steel in the gate itself. As a result, this alternate is approximately $502,000.00 (11 percent) more expensive than the miter gate. However, the actual cost of the sector gate may be reduced if the final detailed analysis allows for a more economical gate and housing structure.

Similar to the miter gate, the flap gate cannot support more than a one foot high reversal of head during an emergency. Also, this gate structure is very uncommon with only one flap gate located in the entire State of Louisiana at Empire. Since the cost of the gate is approximately $208,000 (5 percent) more expensive than the miter gate, this alternate is not recommended.

CONSTRUCTION COST ESTIMATE

01-July-86

STUDY OF PROPOSED GATE STRUCTURE ACROSS BAYOU SAINT JOHN
APPROXIMATELY 650 FEET SOUTH OF LAKESHORE DRIVE
DESIGN ALTERNATE "A" : SECTOR GATE

ITEM NUMBER	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	MOBILIZATION AND DEMOBILIZATION	LUMP SUM	LUMP SUM	$250,000.00	$250,000.00
2	EXCAVATION (BAYOU ST. JOHN)	6,475	CU.YD.	$15.00	$97,125.00
3	EXCAVATION (LEVEE REMOVAL AND RETAINING WALL)	5,696	CU.YD.	$6.00	$34,176.00
4	SHELL	2,048	CU.YD.	$20.00	$40,960.00
5	LEVEE EMBANKMENT	5,696	CU.YD.	$10.00	$56,960.00
6	CLAY PLUG	100	CU.YD.	$15.00	$1,500.00
7	DEWATERING, SURFACE DRAINAGE AND PIEZOMETRIC HEAD CONTROL	LUMP SUM	LUMP SUM	$100,000.00	$100,000.00
8	RIP RAP	1,432	TONS	$30.00	$42,960.00
9	PRESTRESSED CONCRETE PILES (14" Sq.Dia.)	25,245	LIN.FT.	$20.00	$504,900.00
10	PILE LOADING TEST	2	EACH	$5,000.00	$10,000.00
11	STEEL SHEET PILE	17,230	SQ.FT.	$12.00	$206,760.00
12	CONCRETE IN SLAB	1021	CU.YD.	$300.00	$306,300.00
13	CONCRETE IN CAP (LEVEE & SHEET PILE WALL)	374	CU.YD.	$220.00	$82,280.00
14	CONCRETE IN GATE WALLS	800	CU.YD.	$400.00	$320,000.00
15	CONCRETE IN TEE WALLS	472	CU.YD.	$300.00	$141,600.00
16	CONCRETE IN SLUICE GATE STRUCTURE	60	CU.YD.	$400.00	$24,000.00
17	CONCRETE IN STABILIZATION SLAB	114	CU.YD.	$125.00	$14,250.00
18	DEFORMED REINFORCING STEEL	512,270	POUND	$0.60	$307,362.00
19	LADDER SAFETY DEVICE	100	LIN.FT.	$50.00	$5,000.00
20	PIPE HAND RAIL	6000	POUND	$2.00	$12,000.00
21	MISCELLANEOUS METAL WORK	20,000	POUND	$2.00	$40,000.00
22	SECTOR GATE	LUMP SUM	LUMP SUM	$580,000.00	$580,000.00

CONSTRUCTION COST ESTIMATE

01-July-86

STUDY OF PROPOSED GATE STRUCTURE ACROSS BAYOU SAINT JOHN
APPROXIMATELY 650 FEET SOUTH OF LAKESHORE DRIVE
DESIGN ALTERNATE "A" : SECTOR GATE

ITEM NUMBER	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
23	CONTROL HOUSE	1	EACH	$68,000.00	$68,000.00
24	GATE OPERATING MACHINERY	LUMP SUM	LUMP SUM	$250,000.00	$250,000.00
25	LIGHTING SYSTEM	LUMP SUM	LUMP SUM	$5,000.00	$5,000.00
26	CATHODIC PROTECTION (GATES)	LUMP SUM	LUMP SUM	$32,000.00	$32,000.00
27	NEEDLE DAM AND STORAGE RACK	LUMP SUM	LUMP SUM	$196,000.00	$196,000.00
28	TEMPORARY LEVEES AND COFFERDAM DURING CONSTRUCTION	LUMP SUM	LUMP SUM	$325,000.00	$325,000.00
29	ENVIRONMENT PROTECTION	LUMP SUM	LUMP SUM	$30,000.00	$30,000.00
30	REMOVAL OF STRUCTURE AT ROBERT E LEE BLVD.	LUMP SUM	LUMP SUM	$150,000.00	$150,000.00
31	LANDSCAPING	LUMP SUM	LUMP SUM	$10,000.00	$10,000.00
32	WATER STOPS, EXPANSION JOINT,ETC.	LUMP SUM	LUMP SUM	$27,000.00	$27,000.00
33	ELECTRICAL WORK	LUMP SUM	LUMP SUM	$20,000.00	$20,000.00
34	SLUICE GATES (INCLUDING MOTOR BRACKETS,ETC.)	LUMP SUM	LUMP SUM	$25,000.00	$25,000.00
	SUBTOTAL				$4,316,133.00
	CONTINGENCIES (10%)				$431,613.30
	SUBTOTAL				$4,747,746.30
	INFLATION (5%)				$237,387.32
	TOTAL COST				$4,985,133.62

CONSTRUCTION COST ESTIMATE

01-July-86

STUDY OF PROPOSED GATE STRUCTURE ACROSS BAYOU SAINT JOHN
APPROXIMATELY 650 FEET SOUTH OF LAKESHORE DRIVE
DESIGN ALTERNATE "B" : MITER GATE

ITEM NUMBER	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	MOBILIZATION AND DEMOBILIZATION	LUMP SUM	LUMP SUM	$250,000.00	$250,000.00
2	EXCAVATION (BAYOU ST. JOHN)	6,275	CU.YD.	$15.00	$94,125.00
3	EXCAVATION (LEVEE REMOVAL AND RETAINING WALL)	5,696	CU.YD.	$6.00	$34,176.00
4	SHELL	1,607	CU.YD.	$20.00	$32,140.00
5	LEVEE EMBANKMENT	5,696	CU.YD.	$10.00	$56,960.00
6	CLAY PLUG	100	CU.YD.	$15.00	$1,500.00
7	DEWATERING, SURFACE DRAINAGE AND PIEZOMETRIC HEAD CONTROL	LUMP SUM	LUMP SUM	$100,000.00	$100,000.00
8	RIP RAP	1,432	TONS	$30.00	$42,960.00
9	PRESTRESSED CONCRETE PILES (14" Sq.Dia.)	22,055	LIN.FT.	$20.00	$441,100.00
10	PILE LOADING TEST	2	EACH	$5,000.00	$10,000.00
11	STEEL SHEET PILE	17,230	SQ.FT.	$12.00	$206,760.00
12	CONCRETE IN SLAB	515	CU.YD.	$300.00	$154,500.00
13	CONCRETE IN CAP (LEVEE & SHEET PILE WALL)	350	CU.YD.	$220.00	$77,000.00
14	CONCRETE IN GATE WALLS	786	CU.YD.	$400.00	$314,400.00
15	CONCRETE IN TEE WALLS	530	CU.YD.	$300.00	$159,000.00
16	CONCRETE IN SLUICE GATE STRUCTURE	60	CU.YD.	$400.00	$24,000.00
17	CONCRETE IN STABILIZATION SLAB	54	CU.YD.	$125.00	$6,750.00
18	DEFORMED REINFORCING STEEL	347,000	POUND	$0.60	$208,200.00
19	LADDER SAFETY DEVICE	100	LIN.FT.	$50.00	$5,000.00
20	PIPE HAND RAIL	4000	POUND	$2.00	$8,000.00
21	MISCELLANEOUS METAL WORK	16,000	POUND	$2.00	$32,000.00
22	MITER GATE	LUMP SUM	LUMP SUM	$320,000.00	$320,000.00

CONSTRUCTION COST ESTIMATE

01-July-86

STUDY OF PROPOSED GATE STRUCTURE ACROSS BAYOU SAINT JOHN
APPROXIMATELY 650 FEET SOUTH OF LAKESHORE DRIVE
DESIGN ALTERNATE "B" : MITER GATE

ITEM NUMBER	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
23	CONTROL HOUSE	1	EACH	$68,000.00	$68,000.00
24	GATE OPERATING MACHINERY	LUMP SUM	LUMP SUM	$415,000.00	$415,000.00
25	LIGHTING SYSTEM	LUMP SUM	LUMP SUM	$5,000.00	$5,000.00
26	CATHODIC PROTECTION (GATES)	LUMP SUM	LUMP SUM	$32,000.00	$32,000.00
27	NEEDLE DAM AND STORAGE RACK	LUMP SUM	LUMP SUM	$196,000.00	$196,000.00
28	TEMPORARY LEVEES AND COFFERDAM DURING CONSTRUCTION	LUMP SUM	LUMP SUM	$325,000.00	$325,000.00
29	ENVIRONMENT PROTECTION	LUMP SUM	LUMP SUM	$30,000.00	$30,000.00
30	REMOVAL OF STRUCTURE AT ROBERT E LEE BLVD.	LUMP SUM	LUMP SUM	$150,000.00	$150,000.00
31	LANDSCAPING	LUMP SUM	LUMP SUM	$10,000.00	$10,000.00
32	WATER STOPS, EXPANSION JOINT,ETC.	LUMP SUM	LUMP SUM	$27,000.00	$27,000.00
33	ELECTRICAL WORK	LUMP SUM	LUMP SUM	$20,000.00	$20,000.00
34	SLUICE GATES (INCLUDING MOTOR BRACKETS,ETC.)	LUMP SUM	LUMP SUM	$25,000.00	$25,000.00
	SUBTOTAL				$3,881,571.00
	CONTINGENCIES (10%)				$388,157.10
	SUBTOTAL				$4,269,728.10
	INFLATION (5%)				$213,486.41
	TOTAL COST				$4,483,214.51

CONSTRUCTION COST ESTIMATE

01-July-86

STUDY OF PROPOSED GATE STRUCTURE ACROSS BAYOU SAINT JOHN
APPROXIMATELY 650 FEET SOUTH OF LAKESHORE DRIVE
DESIGN ALTERNATE "C" : FLAP GATE

ITEM NUMBER	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	MOBILIZATION AND DEMOBILIZATION	LUMP SUM	LUMP SUM	$250,000.00	$250,000.00
2	EXCAVATION (BAYOU ST. JOHN)	6,275	CU.YD.	$15.00	$94,125.00
3	EXCAVATION (LEVEE REMOVAL AND RETAINING WALL)	5,696	CU.YD.	$6.00	$34,176.00
4	SHELL	1,560	CU.YD.	$20.00	$31,200.00
5	LEVEE EMBANKMENT	5,696	CU.YD.	$10.00	$56,960.00
6	CLAY PLUG	100	CU.YD.	$15.00	$1,500.00
7	DEWATERING, SURFACE DRAINAGE AND PIEZOMETRIC HEAD CONTROL	LUMP SUM	LUMP SUM	$100,000.00	$100,000.00
8	RIP RAP	1,432	TONS	$30.00	$42,960.00
9	PRESTRESSED CONCRETE PILES (14" Sq.Dia.)	20,900	LIN.FT.	$20.00	$418,000.00
10	PILE LOADING TEST	2	EACH	$5,000.00	$10,000.00
11	STEEL SHEET PILE	17,230	SQ.FT.	$12.00	$206,760.00
12	CONCRETE IN SLAB	740	CU.YD.	$300.00	$222,000.00
13	CONCRETE IN CAP (LEVEE & SHEET PILE WALL)	350	CU.YD.	$220.00	$77,000.00
14	CONCRETE IN GATE WALLS	800	CU.YD.	$400.00	$320,000.00
15	CONCRETE IN TEE WALLS	530	CU.YD.	$300.00	$159,000.00
16	CONCRETE IN SLUICE GATE STRUCTURE	60	CU.YD.	$400.00	$24,000.00
17	CONCRETE IN STABILIZATION SLAB	45	CU.YD.	$125.00	$5,625.00
18	DEFORMED REINFORCING STEEL	402,000	POUND	$0.60	$241,200.00
19	LADDER SAFETY DEVICE	100	LIN.FT.	$50.00	$5,000.00
20	PIPE HAND RAIL	4000	POUND	$2.00	$8,000.00
21	MISCELLANEOUS METAL WORK	16,000	POUND	$2.00	$32,000.00
22	FLAP GATE	LUMP SUM	LUMP SUM	$218,000.00	$218,000.00

CONSTRUCTION COST ESTIMATE

01-July-86

STUDY OF PROPOSED GATE STRUCTURE ACROSS BAYOU SAINT JOHN
APPROXIMATELY 650 FEET SOUTH OF LAKESHORE DRIVE
DESIGN ALTERNATE "C" : FLAP GATE

ITEM NUMBER	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT
23	CONTROL HOUSE	1	EACH	$68,000.00	$68,000.00
24	GATE OPERATING MACHINERY	LUMP SUM	LUMP SUM	$415,000.00	$415,000.00
25	LIGHTING SYSTEM	LUMP SUM	LUMP SUM	$5,000.00	$5,000.00
26	CATHODIC PROTECTION (GATES)	LUMP SUM	LUMP SUM	$32,000.00	$32,000.00
27	NEEDLE DAM AND STORAGE RACK	LUMP SUM	LUMP SUM	$196,000.00	$196,000.00
28	TEMPORARY LEVEES AND COFFERDAM DURING CONSTRUCTION	LUMP SUM	LUMP SUM	$325,000.00	$325,000.00
29	ENVIRONMENT PROTECTION	LUMP SUM	LUMP SUM	$30,000.00	$30,000.00
30	REMOVAL OF STRUCTURE AT ROBERT E LEE BLVD.	LUMP SUM	LUMP SUM	$150,000.00	$150,000.00
31	LANDSCAPING	LUMP SUM	LUMP SUM	$10,000.00	$10,000.00
32	WATER STOPS, EXPANSION JOINT,ETC.	LUMP SUM	LUMP SUM	$27,000.00	$27,000.00
33	ELECTRICAL WORK	LUMP SUM	LUMP SUM	$20,000.00	$20,000.00
34	SLUICE GATES (INCLUDING MOTOR BRACKETS,ETC.)	LUMP SUM	LUMP SUM	$25,000.00	$25,000.00
35	COUNTERWEIGHT	2	EACH	$33,000.00	$66,000.00
36	PUMP PLATFORM	LUMP SUM	LUMP SUM	$60,000.00	$60,000.00
37	PUMPING UNIT	LUMP SUM	LUMP SUM	$75,000.00	$75,000.00
	SUBTOTAL				$4,061,506.00
	CONTINGENCIES (10%)				$406,150.60
	SUBTOTAL				$4,467,656.60
	INFLATION (5%)				$223,382.83
	TOTAL COST				$4,691,039.43

FIGURES

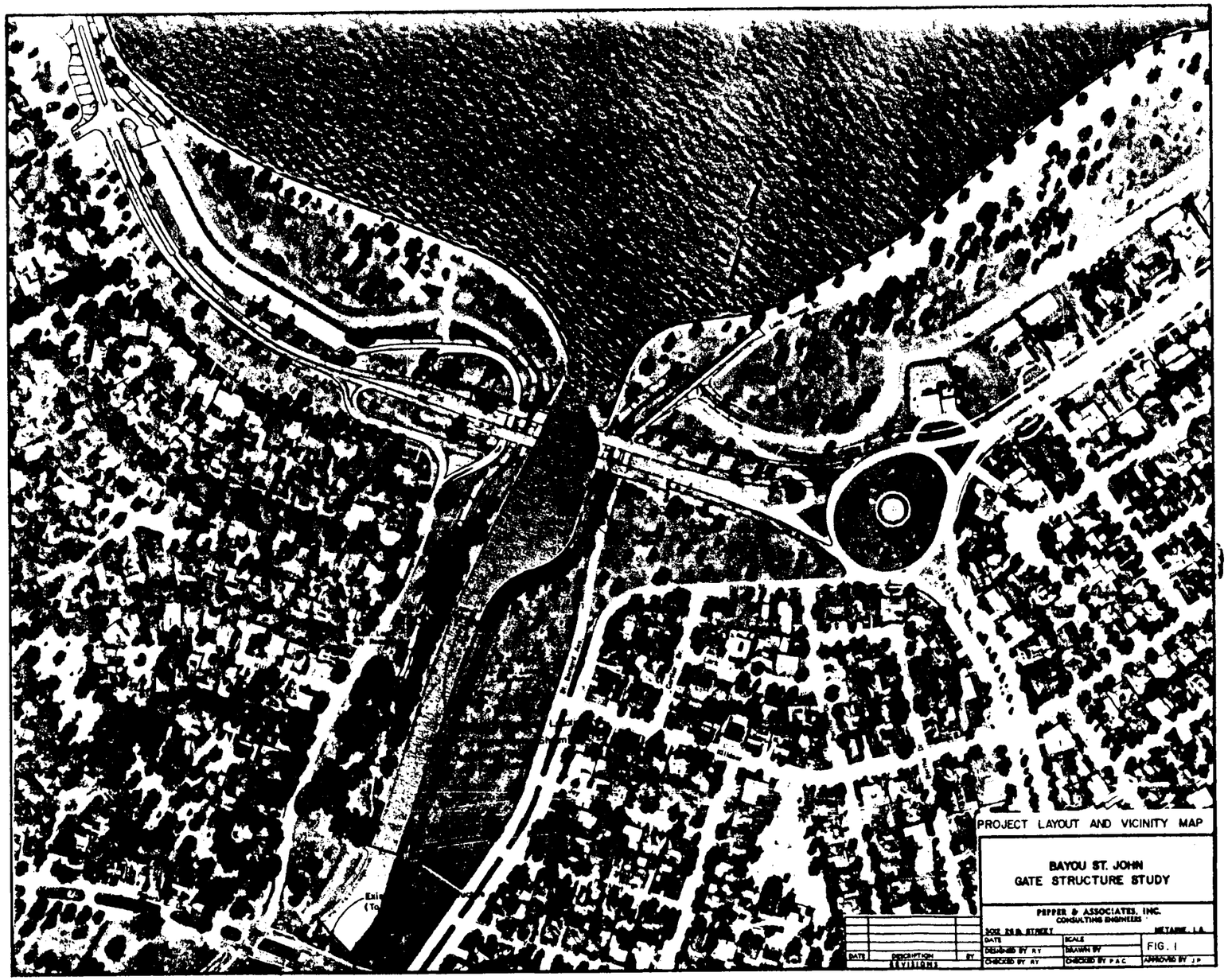
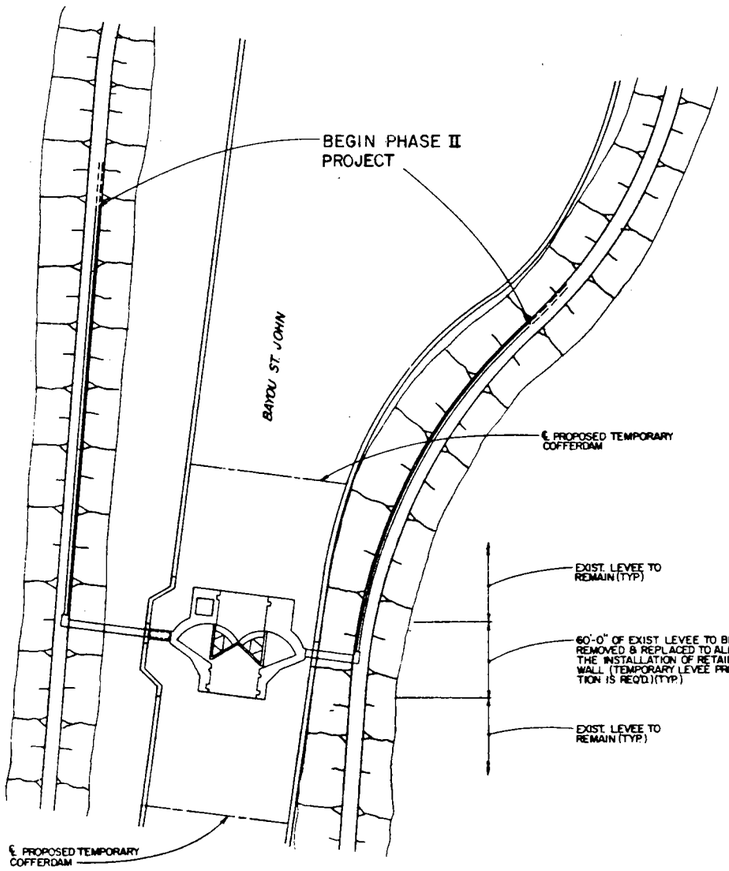
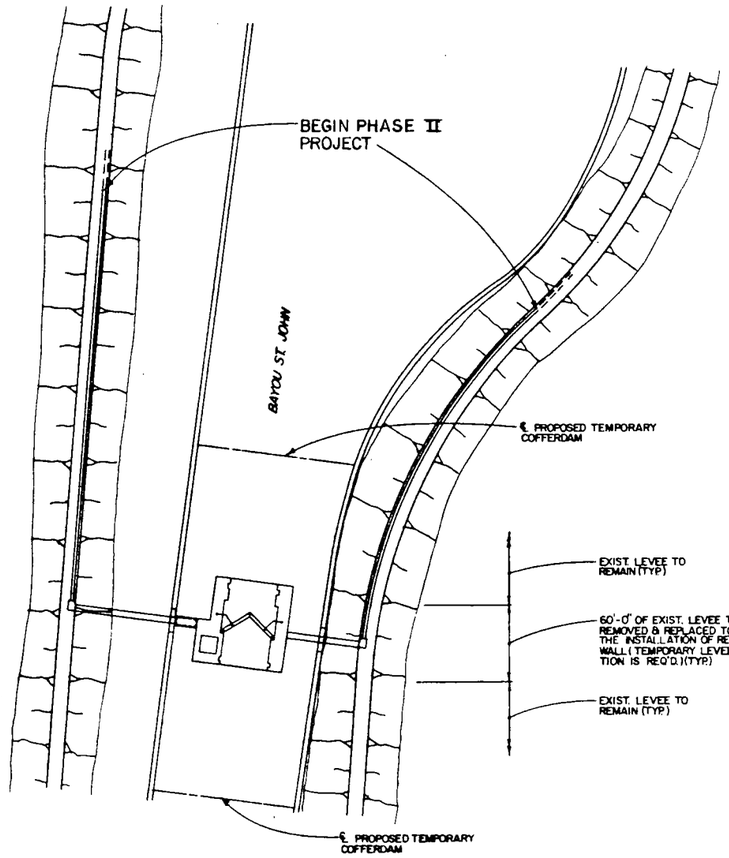

PROJECT LAYOUT AND VICINITY MAP
BAYOU ST. JOHN
GATE STRUCTURE STUDY
PEPPER & ASSOCIATES, INC.
CONSULTING ENGINEERS
3002 21st STREET
METAIRIE, LA.
DATE
SCALE
FIG. 1
DESIGNED BY RY
DRAWN BY
CHECKED BY RY
CHECKED BY P.A.C.
APPROVED BY J.P.
DATE
DESCRIPTION
BY
REVISIONS

Fig. 1



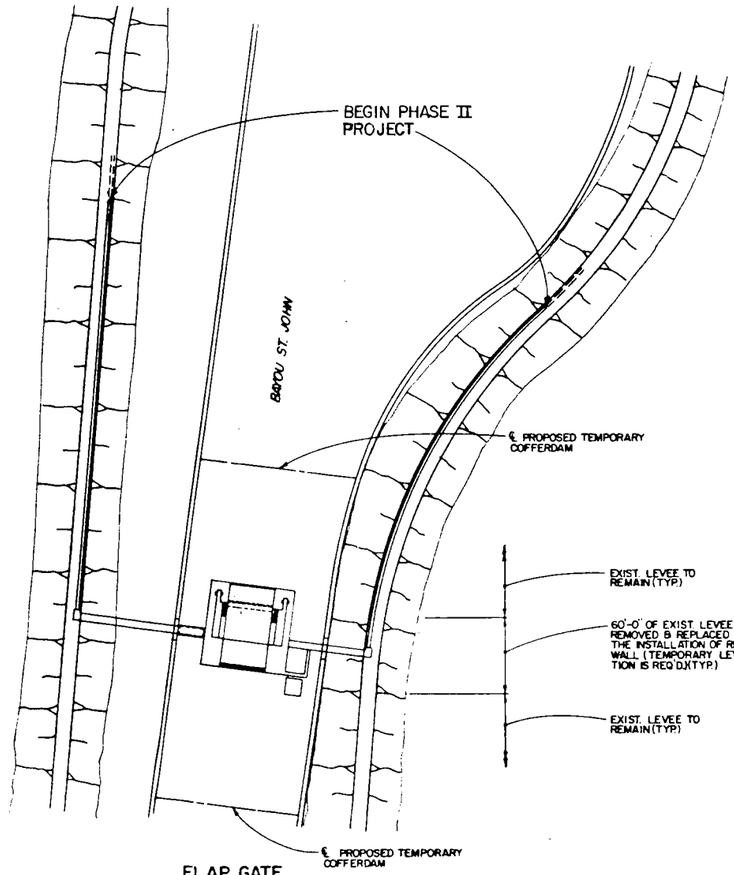
SECTOR GATE

(SEE SHEETS 3-6 FOR DETAILS)



MITER GATE

(SEE SHEETS 9 & 10 FOR DETAILS)



FLAP GATE

(SEE SHEETS 11 & 12 FOR DETAILS)

Fig. 2

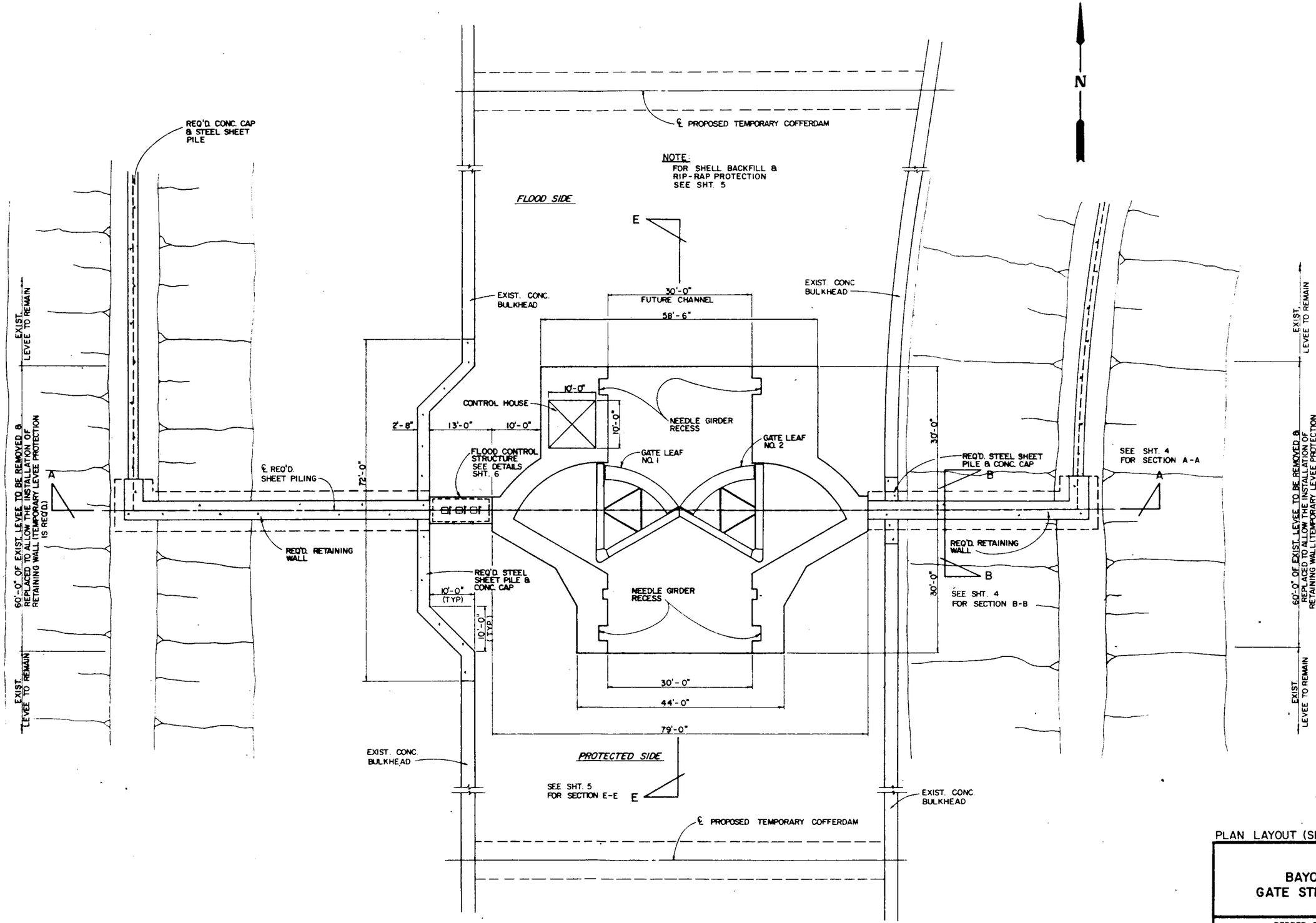
ALTERNATE GATE LAYOUTS

BAYOU ST. JOHN
GATE STRUCTURE STUDY

PEPPER & ASSOCIATES, INC.
CONSULTING ENGINEERS
3012 26th STREET METAIRIE, LA.

DATE	DESCRIPTION	BY
	REVISIONS	

DATE	SCALE 1"=60'-0"	FIG. 2
DESIGNED BY R.Y.	DRAWN BY B.B.H.	
CHECKED BY R.Y.	CHECKED BY P.A.C.	APPROVED BY J.P.



PLAN (SECTOR GATE)

SCALE: 1" = 10'-0"

Fig. 3

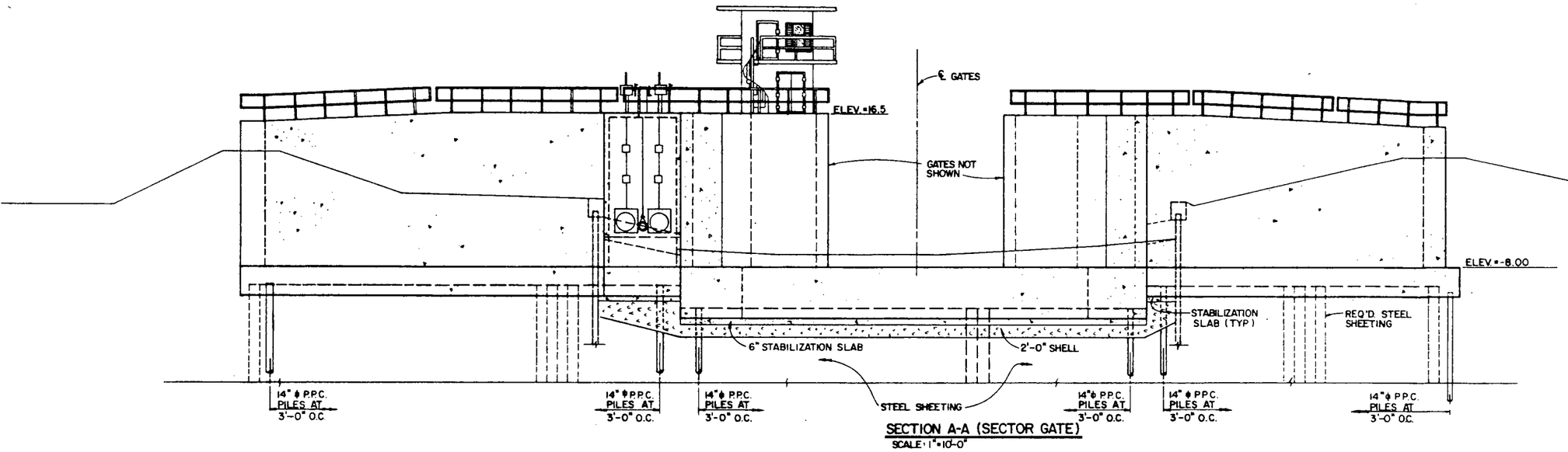
PLAN LAYOUT (SECTOR GATE)

BAYOU ST. JOHN GATE STRUCTURE STUDY

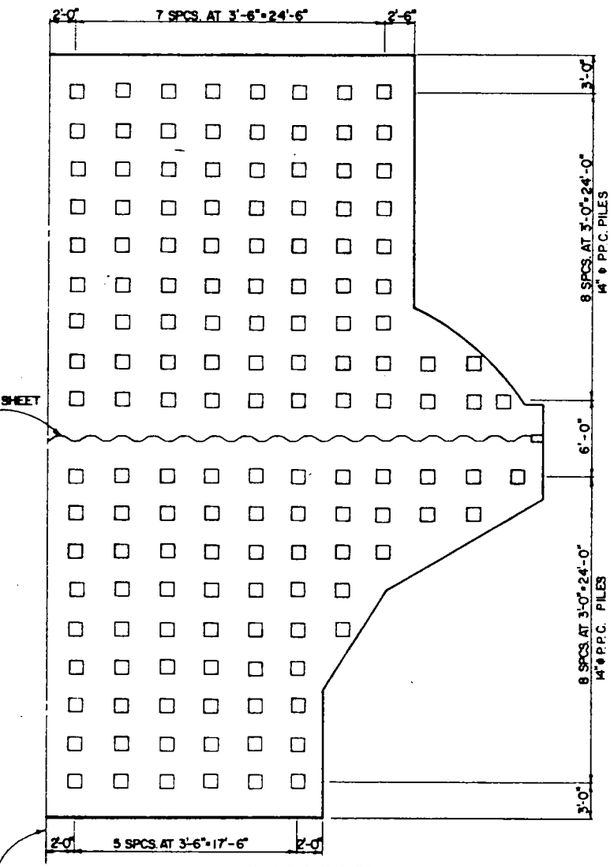
PEPPER & ASSOCIATES, INC.
CONSULTING ENGINEERS
3012 26th STREET METAIRIE, LA.

DATE	DESCRIPTION	BY
REVISIONS		

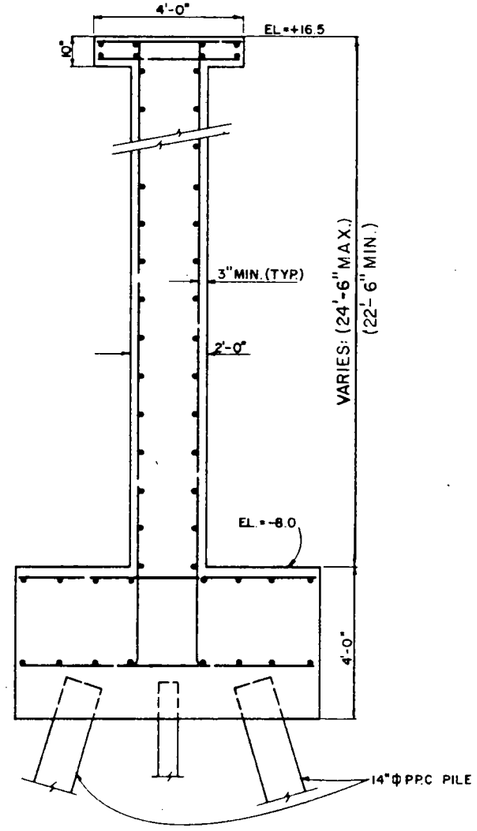
DATE		SCALE AS SHOWN	FIG. 3
DESIGNED BY RY		DRAWN BY PC	
CHECKED BY JP		CHECKED BY PC	APPROVED BY JP



SECTION A-A (SECTOR GATE)
SCALE: 1"=10'-0"



PILING LAYOUT
HALF PLAN
SCALE: 1"=6'-0"



SECTION B-B
SCALE: 1"=2'-0"

Fig. 4

STEEL NOTES:

1.) ALL STRUCTURAL STEEL SHALL BE ASTM A36-77 UNLESS OTHERWISE NOTED.

2.) TO PREVENT CORROSION BY MOISTURE BETWEEN STEEL SURFACES IN CONTACT, ALL SUCH CONTACTS SHALL BE SEALED WATERTIGHT BY RUNNING A CONTINUOUS 1/8" FILLET WELD ALONG ALL EDGES OF THE CONTACT.

3.) ERECTION BOLTS MAY BE LEFT IN PLACE PROVIDED THAT BOLT HEADS AND NUTS ARE SEAL WELDED TO PREVENT ENTRANCE OF MOISTURE. IF BOLTS ARE REMOVED, BOLT HOLES WILL BE PLUG WELDED.

4.) ERECTION BOLTS TO BE 3/4" DIAMETER UNLESS OTHERWISE NOTED.

5.) ALL WELDING SHALL BE ELECTRIC WELDING WORKMANSHIP AND TECHNIQUE, WHERE APPLICABLE SHALL CONFORM TO THE AMERICAN WELDING SOCIETY SPECIFICATIONS AWS D1.1-79, OR LATEST EDITION, STRUCTURAL WELDING CODE.

6.) SURFACE FINISHES SHALL CONFORM TO ANSI STANDARD B 26.1-1978 CODE FOR "SURFACE TEXTURE".

7.) TOLERANCES FOR MACHINE FURNISHED SURFACES SHOWN BY NON-DECIMAL DIMENSIONS SHALL BE WITHIN 1/64".

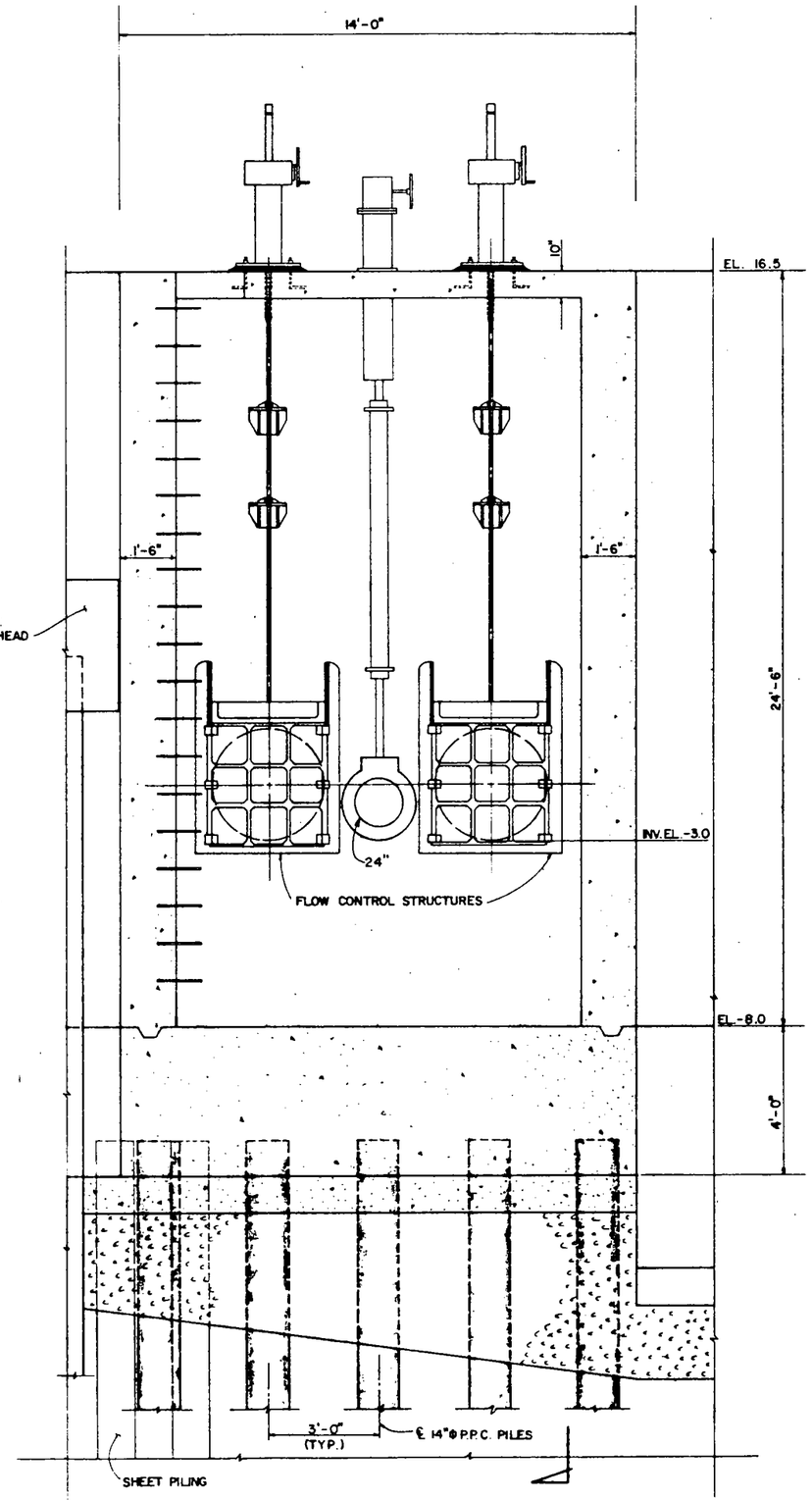
MISCELLANEOUS DETAILS (SECTOR GATE)

BAYOU ST. JOHN
GATE STRUCTURE STUDY

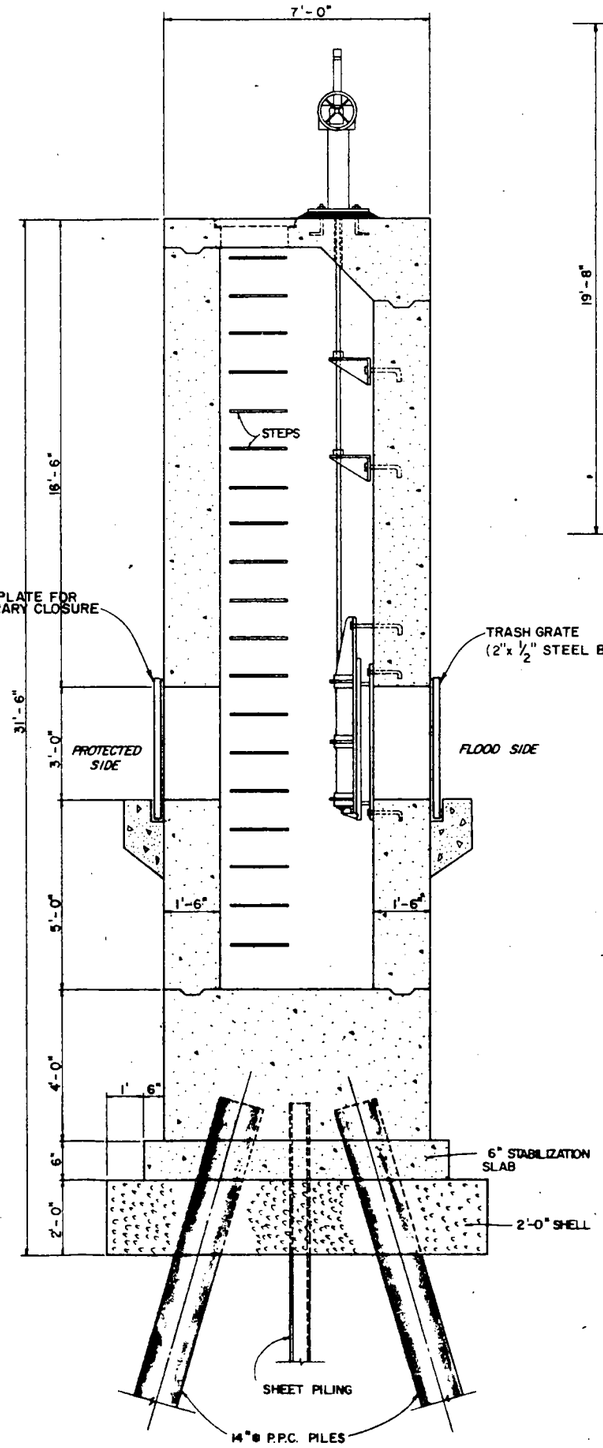
PEPPER & ASSOCIATES, INC.
CONSULTING ENGINEERS
3012 26th STREET METAIRIE, LA.

DATE	DESCRIPTION	BY
REVISIONS		

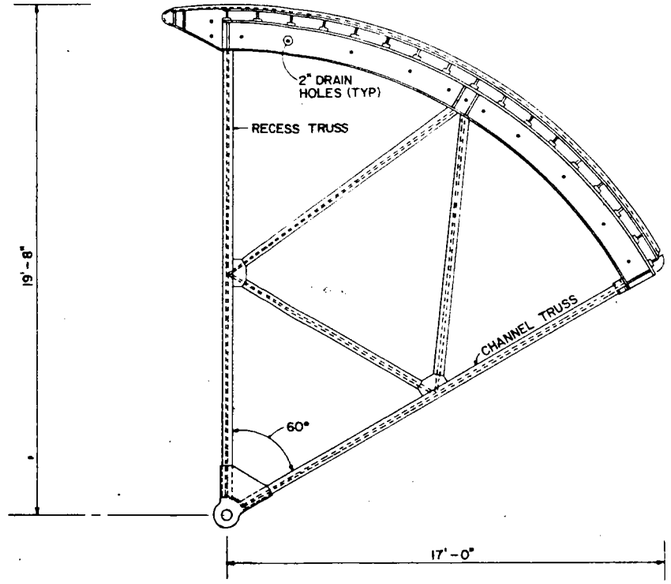
DATE	SCALE AS SHOWN	FIG. 4
DESIGNED BY R.Y.	DRAWN BY B.B.H.	
CHECKED BY R.Y.	CHECKED BY P.A.C.	APPROVED BY J.P.



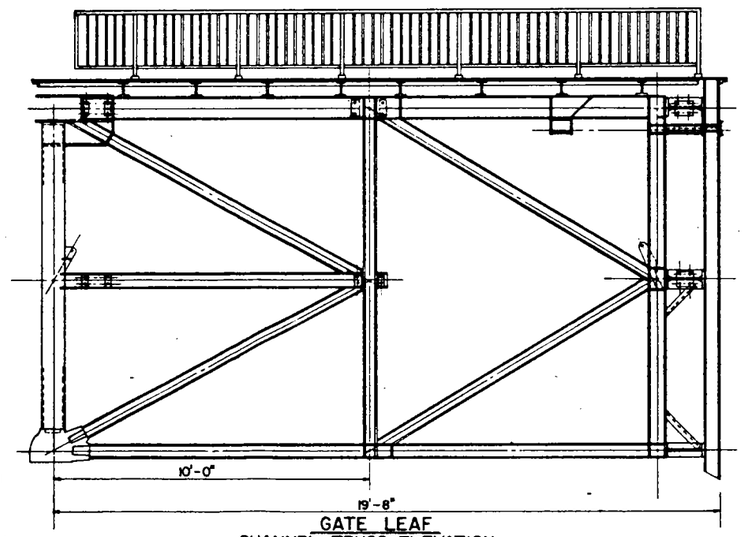
ELEVATION (FLOW CONTROL STRUCTURE)
N.T.S.



SECTION A-A
N.T.S.



PLAN (GATE LEAF)
N.T.S.



GATE LEAF
CHANNEL TRUSS ELEVATION
N.T.S.

NOTE

SEE SHT. 4 FOR STEEL NOTES

STRUCTURAL DETAILS (SECTOR GATE & FLOW CONTROL STRUCTURE)

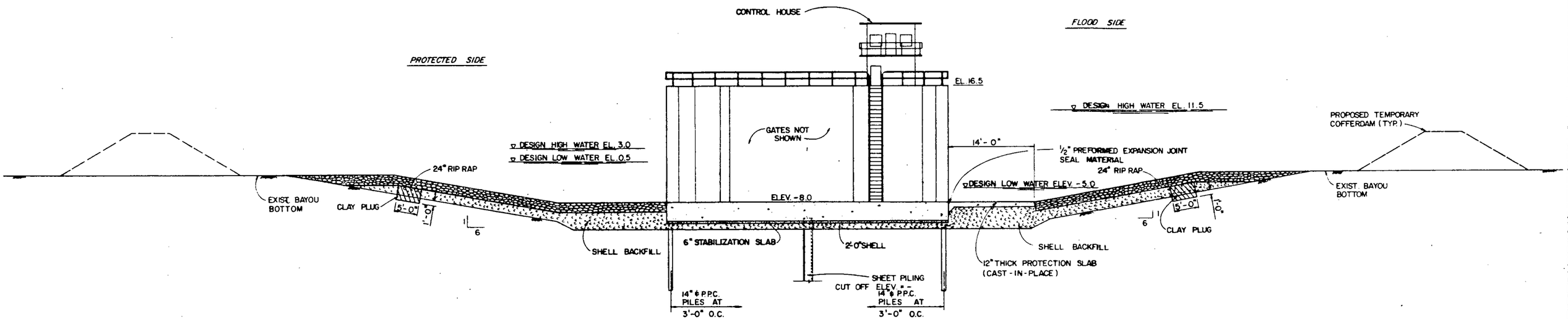
BAYOU ST. JOHN
GATE STRUCTURE STUDY

PEPPER & ASSOCIATES, INC.
CONSULTING ENGINEERS
3012 26th STREET METAIRIE, LA.

DATE	DESCRIPTION	BY
REVISIONS		

DATE	SCALE AS SHOWN	FIG. 6
DESIGNED BY R.Y.	DRAWN BY KAPER	
CHECKED BY J.P.	CHECKED BY PC	APPROVED BY JP

Fig. 6



SECTION E-E

CONCRETE NOTES:

1. ALL WALKWAY SURFACES SHALL BE GIVEN A BROOM FINISH. ALL OTHER UNFORMED SURFACES SHALL BE GIVEN A FLOAT FINISH, UNLESS OTHERWISE NOTED.
2. ALL INTERIOR AND EXTERIOR CONCRETE SURFACES OF CONTROL HOUSES WHICH ARE EXPOSED TO VIEW SHALL HAVE A CLASS "A" FINISH. ALL OTHER EXTERIOR FORMED SURFACES NOT COVERED BY BACKFILL SHALL BE CLASS "B" FINISH AND SURFACES COVERED BY BACKFILL SHALL BE CLASS "D" FINISH UNLESS OTHERWISE NOTED ON THE CONTRACT DRAWINGS.
3. CONSTRUCTION JOINTS SHALL BE PROVIDED WHERE SHOWN. WHERE NOT SHOWN, CONSTRUCTION JOINTS SHALL BE PLACED IN THE MIDDLE HALF OF BEAM OR SLAB SPANS OR AT LOCATIONS LEAST LIKELY TO IMPAIR THE INTEGRITY OF THE CONCRETE STRUCTURE. CONSTRUCTION JOINT LOCATIONS SHALL BE APPROVED BY THE ENGINEER.
4. PROVIDE 1" CHAMFER AT ALL EXPOSED CONCRETE CORNERS UNLESS OTHERWISE NOTED.
5. CLEAR COVER FOR ALL REINFORCEMENT IN THE GATE BAY MONOLITH EXCEPT AS OTHERWISE INDICATED OR AS SHOWN ON THE DRAWINGS SHALL BE AS FOLLOWS:
   a. UNFORMED SURFACES IN CONTACT WITH FOUNDATION - 6 INCHES.
   b. FORMED AND SCREEN SURFACES - 4 INCHES.

   CLEAR COVER FOR REINFORCEMENT IN ALL OTHER STRUCTURES EXCEPT GATE BAY MONOLITH SHALL BE AS INDICATED OR AS SHOWN ON THE DRAWINGS.
6. CLEAR DISTANCE BETWEEN ADJACENT LAYERS OR REINFORCEMENT SHALL BE 6 INCHES FOR THE GATE BAY MONOLITH AND 4 INCHES FOR ALL OTHER STRUCTURES, UNLESS OTHERWISE NOTED.
7. ALL BENDS OF REINFORCEMENT AND ALL BAR SPACERS AND SUPPORTS SHALL BE IN ACCORDANCE WITH THE AMERICAN CONCRETE INSTITUTE "MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES" IN EFFECT AT THE TIME OF FABRICATION.
8. TOP BARS ARE HORIZONTAL BARS AND BARS INCLINED LESS THAN 45 DEGREES WITH RESPECT TO A HORIZONTAL PLANE SO PLACED THAT MORE THAN 12 INCHES OF CONCRETE IS CAST IN THE MEMBER BELOW THE BAR. THE WORD "MEMBER" REFERS TO ANY REINFORCED CONCRETE ELEMENTS SUCH AS BEAMS, WALLS, FOOTINGS, SLABS, PIERS, ETC. OTHER BARS ARE ALL BARS EXCEPT TOP BARS.
9. REINFORCING BARS SHALL BE CONTINUOUS AT ALL CORNERS UNLESS OTHERWISE NOTED.
10. ALL REINFORCING EMBEDMENT SHALL BE MEASURED FROM FACE OF OPENINGS OR FROM INTERSECTION WITH REINFORCEMENT, WHICHEVER IS LARGER.
11. REINFORCEMENT WHERE NECESSARY TO AVOID OPENINGS, PIPES, EMBEDDED ITEMS AND OTHER OBSTRUCTIONS SHALL BE BENT OR SHIFTED AS DIRECTED BY THE ENGINEER.
12. REINFORCING BAR SPLICES SHALL BE PROVIDED WHERE SHOWN UNLESS APPROVED OTHERWISE BY THE ENGINEER. WHERE NOT SHOWN, SPLICES MAY BE PROVIDED SUBJECT TO APPROVAL BY THE ENGINEER.
13. REINFORCING BAR DESIGNATION NUMBERS CONFORM TO THE CURRENT NUMBERING SYSTEM OF THE CONCRETE REINFORCING STEEL INSTITUTE.

TYPICAL SECTION (SECTOR GATE)

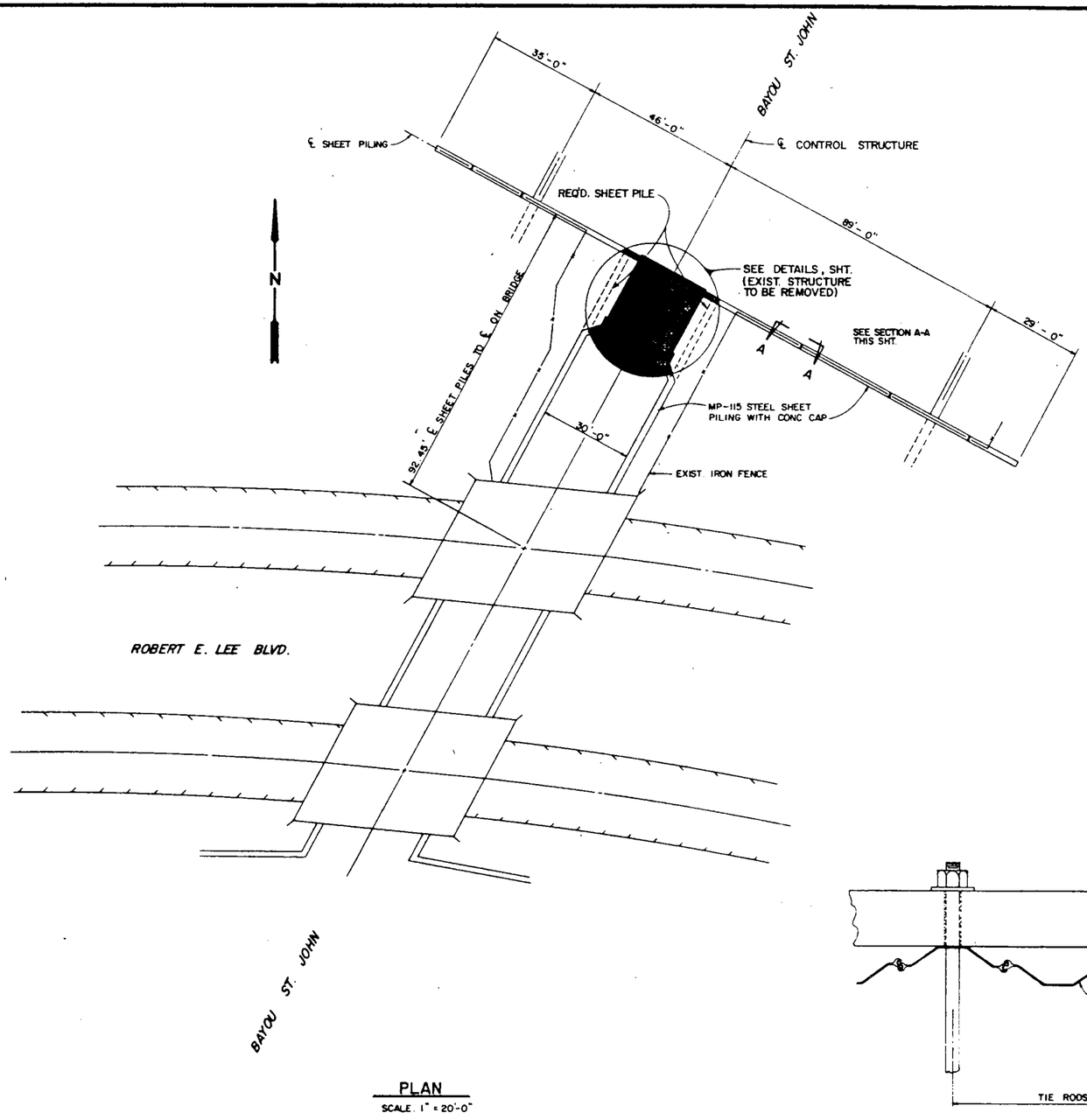
BAYOU ST. JOHN
GATE STRUCTURE STUDY

PEPPER & ASSOCIATES, INC.
CONSULTING ENGINEERS
3012 26th. STREET — METAIRIE, LA.

DATE	DESCRIPTION	BY
	REVISIONS	

DATE		SCALE 1"= 10'	FIG. 5
DESIGNED BY RY		DRAWN BY PAC	
CHECKED BY JP		CHECKED BY PC	APPROVED BY JP

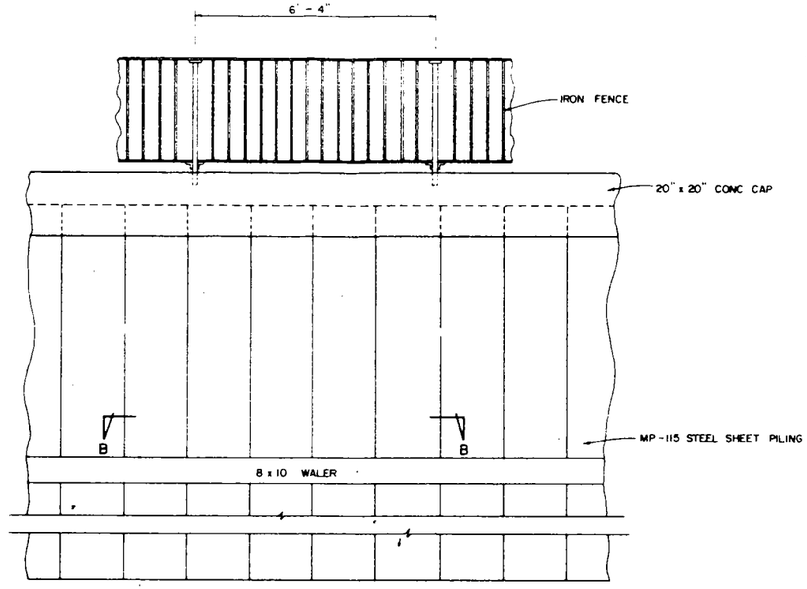
Fig. 5



PLAN

SCALE 1" = 20'-0"

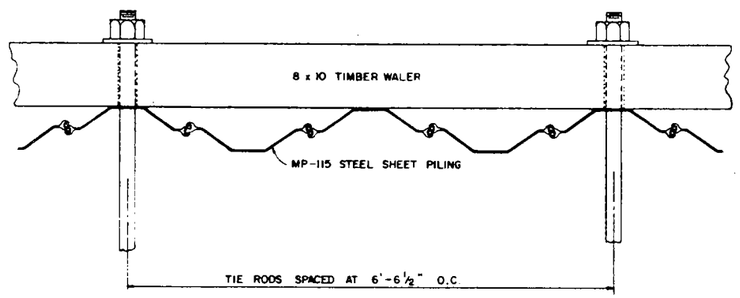
SEE SECTION B-B
THIS SHT.



SECTION A - A

(SHEET PILE AND FENCE ELEVATION)

SCALE 1/2" = 1'-0"



SECTION B - B

(EXISTING STEEL SHEET PILING AND TIE ROD DETAILS)

SCALE 1" = 1'-0"

Fig. 7

REMOVAL OF FLOW CONTROL
STRUCTURE AT ROBERT E. LEE

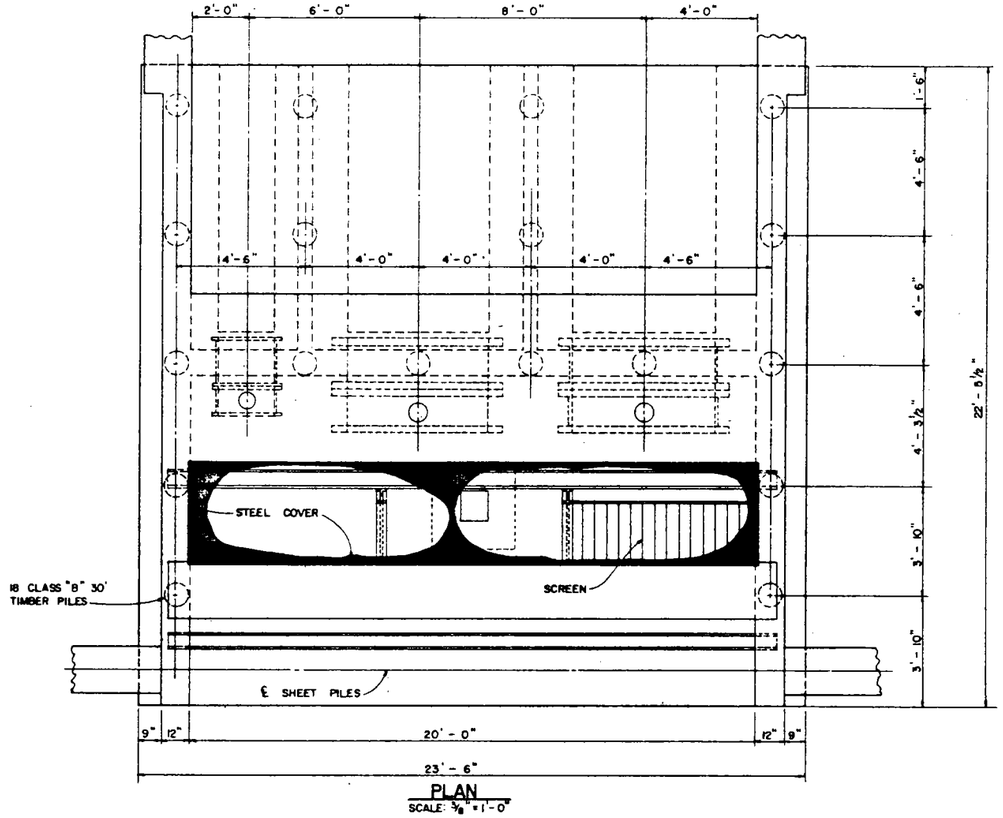
THE BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE DISTRICT

NEW VEHICULAR CROSSING
AND REALIGNMENT OF FLOOD PROTECTION LEVEE
AT LAKESHORE DRIVE AND BAYOU ST. JOHN

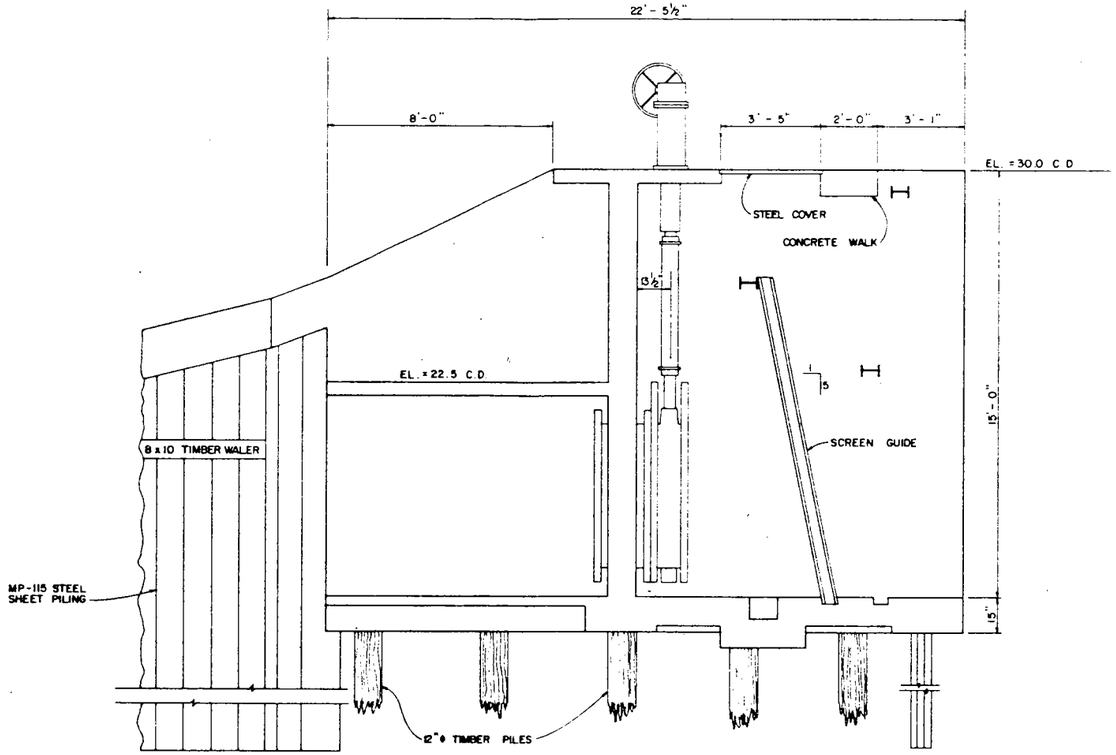
PEPPER & ASSOCIATES, INC.
CONSULTING ENGINEERS
3012 25th. STREET METAIRIE, LA.

DATE	DESCRIPTION	BY
	REVISIONS	

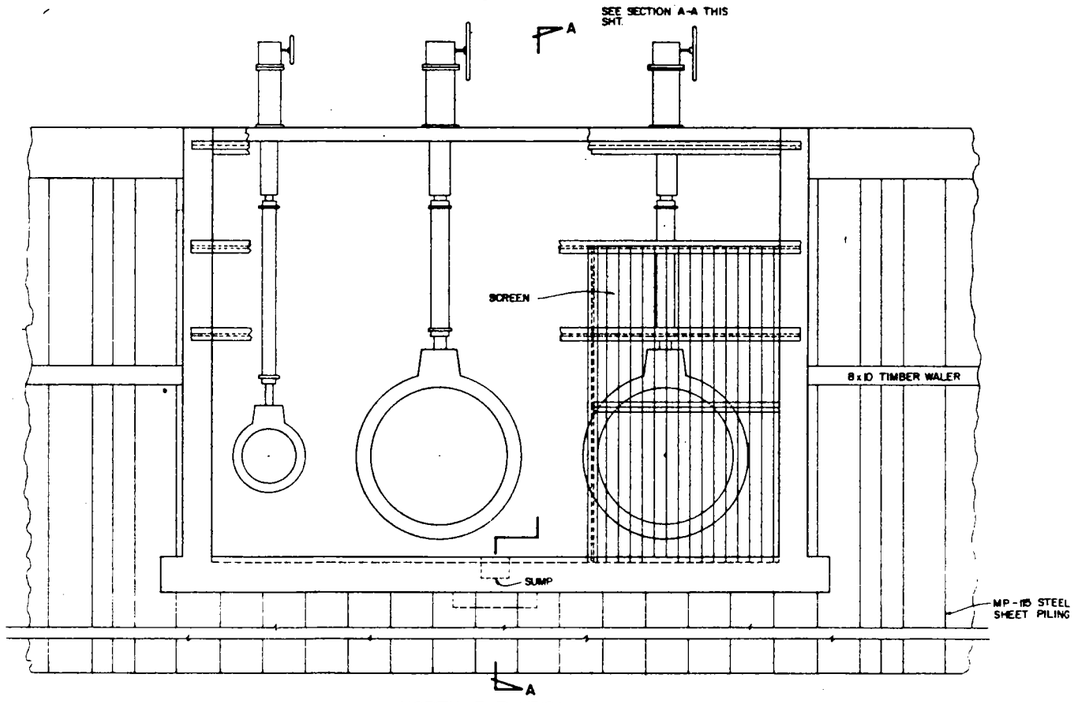
DATE		SCALE AS SHOWN	FIG. 7
DESIGNED BY RY		DRAWN BY PC	
CHECKED BY JP		CHECKED BY PC	APPROVED BY JP



PLAN
SCALE: $\frac{3}{8}$" = 1'-0"



SECTION A-A
SCALE $\frac{3}{8}$" = 1'-0"



NORTH ELEVATION
SCALE: $\frac{3}{8}$" = 1'-0"

Fig. 8

REMOVAL OF FLOW CONTROL STRUCTURE AT ROBERT E. LEE

THE BOARD OF LEVEE COMMISSIONERS
ORLEANS LEVEE DISTRICT

NEW VEHICULAR CROSSING
AND REALIGNMENT OF FLOOD PROTECTION LEVEE
AT LAKESHORE DRIVE AND BAYOU ST. JOHN

PEPPER & ASSOCIATES, INC.
CONSULTING ENGINEERS
3012 26th STREET METAIRIE, LA.

DATE	DESCRIPTION	BY
REVISIONS		

DATE		SCALE AS SHOWN	FIG. 8
DESIGNED BY S.P		DRAWN BY P.A.C	
CHECKED BY R.Y		CHECKED BY	APPROVED BY J.P.

EXIST. LEVEE TO REMAIN

60'-0" OF EXIST. LEVEE TO BE REMOVED & REPLACED TO ALLOW THE INSTALLATION OF RETAINING WALL (TEMPORARY LEVEE PROTECTION IS REQ'D.)

EXIST. LEVEE TO REMAIN

CONCRETE CAP

EXIST. CONC. BULKHEAD

℄ PROPOSE TEMPORARY COFFERDAM

FLOOD SIDE

47'-0"

8'-6" 30'-0" 8'-6"

NEEDLE RECESS

5'-0" 5'-0"

GATE LEAF #1

GATE LEAF #2

39'-0"

58'-0"

FLOW CONTROL STRUCTURES SEE DETAILS SHT 6

℄ REQ'D. SHEET PILING

6'-0"

REQ'D. RETAINING WALL

REQ'D. STEEL SHEET PILE & CONC. CAP

11'-0"

11'-0"

CONTROL ROOM

23'-0"

NEEDLE RECESS

54'-0"

PROTECTED SIDE

EXIST. CONC. BULKHEAD

℄ PROPOSED TEMPORARY COFFERDAM

EXIST. CONC. BULKHEAD

CONCRETE CAP

REQ'D. RETAINING WALL

B

REQ'D. STEEL SHEET PILE & CONC. CAP

A

SEE SECTION A-A THIS SHT.

B

SEE SHT. 4 FOR SECTION B-B

N

EXIST. LEVEE TO REMAIN

60'-0" OF EXIST. LEVEE TO BE REMOVED & REPLACED TO ALLOW THE INSTALLATION OF RETAINING WALL (TEMPORARY LEVEE PROTECTION IS REQ'D.)

EXIST. LEVEE TO REMAIN

PLAN (MITER GATE)

SCALE: 1"=10'-0"

MITER GATE

2'-0"

ELEV.-8.00

ELEV.-10.00

ALTERNATE SILTING BEAM DETAIL

℄ GATES

GATES NOT SHOWN

ELEV.=-8.0

6" STABILIZATION SLAB

2'-0" SHELL

REQ'D. STEEL SHEETING

14" ⌀ PILES AT 3'-0" O.C.

14" ⌀ PILES AT 3'-0" O.C.

14" ⌀ PILES AT 3'-0" O.C.

14" ⌀ PILES AT 3'-0" O.C.

SECTION A-A (MITER GATE)

SCALE: 1"=10'-0"

PLAN-PROFILE (MITER GATE)

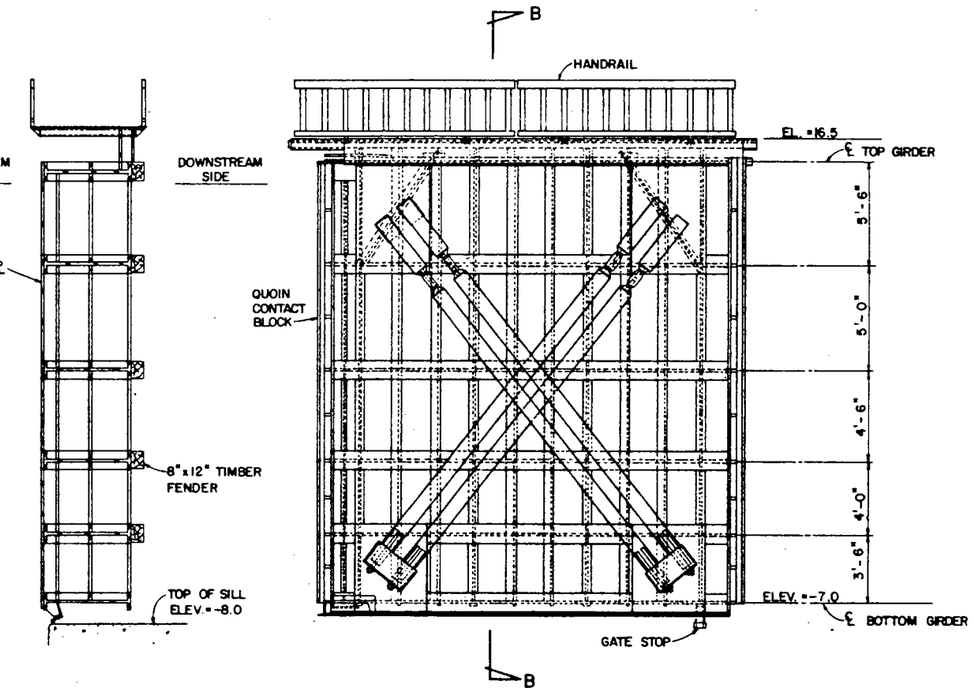
BAYOU ST. JOHN GATE STRUCTURE STUDY

PEPPER & ASSOCIATES, INC.
CONSULTING ENGINEERS
3012 26th STREET METAIRIE, LA.

DATE	DESCRIPTION	BY
REVISIONS		

DATE	SCALE AS SHOWN	FIG. 9
DESIGNED BY R.Y	DRAWN BY B.B.H.	
CHECKED BY J.P	CHECKED BY P.A.C	APPROVED BY J.P.

Fig. 9



SECTION B

SCALE 1/4"=1'

ELEVATION (MITER GATE)

SCALE: 1/4"=1'

STEEL NOTES:

1) ALL STRUCTURAL STEEL SHALL BE ASTM A36-77 UNLESS OTHERWISE NOTED.

2) TO PREVENT CORROSION BY MOISTURE BETWEEN STEEL SURFACES IN CONTACT, ALL SUCH CONTACTS SHALL BE SEALED WATERTIGHT BY RUNNING A CONTINUOUS 1/8" FILLET WELD ALONG ALL EDGES OF THE CONTACT.

3) ERECTION BOLTS MAY BE LEFT IN PLACE PROVIDED THAT BOLT HEADS AND NUTS ARE SEAL WELDED TO PREVENT ENTRANCE OF MOISTURE. IF BOLTS ARE REMOVED, BOLT HOLES WILL BE PLUG WELDED.

4) ERECTION BOLTS TO BE 3/4" DIAMETER UNLESS OTHERWISE NOTED.

5) ALL WELDING SHALL BE ELECTRIC WELDING. WORKMANSHIP AND TECHNIQUE, WHERE APPLICABLE SHALL CONFORM TO THE AMERICAN WELDING SOCIETY SPECIFICATIONS AWS D1.1-79, OR LATEST EDITION, STRUCTURAL WELDING CODE.

6) SURFACE FINISHES SHALL CONFORM TO ANSI STANDARD B 26.1-1978 CODE FOR "SURFACE TEXTURE".

7) TOLERANCES FOR MACHINE FURNISHED SURFACES SHOWN BY NON-DECIMAL DIMENSIONS SHALL BE WITHIN 1/64".

STRUCTURAL DETAILS (MITER GATE)

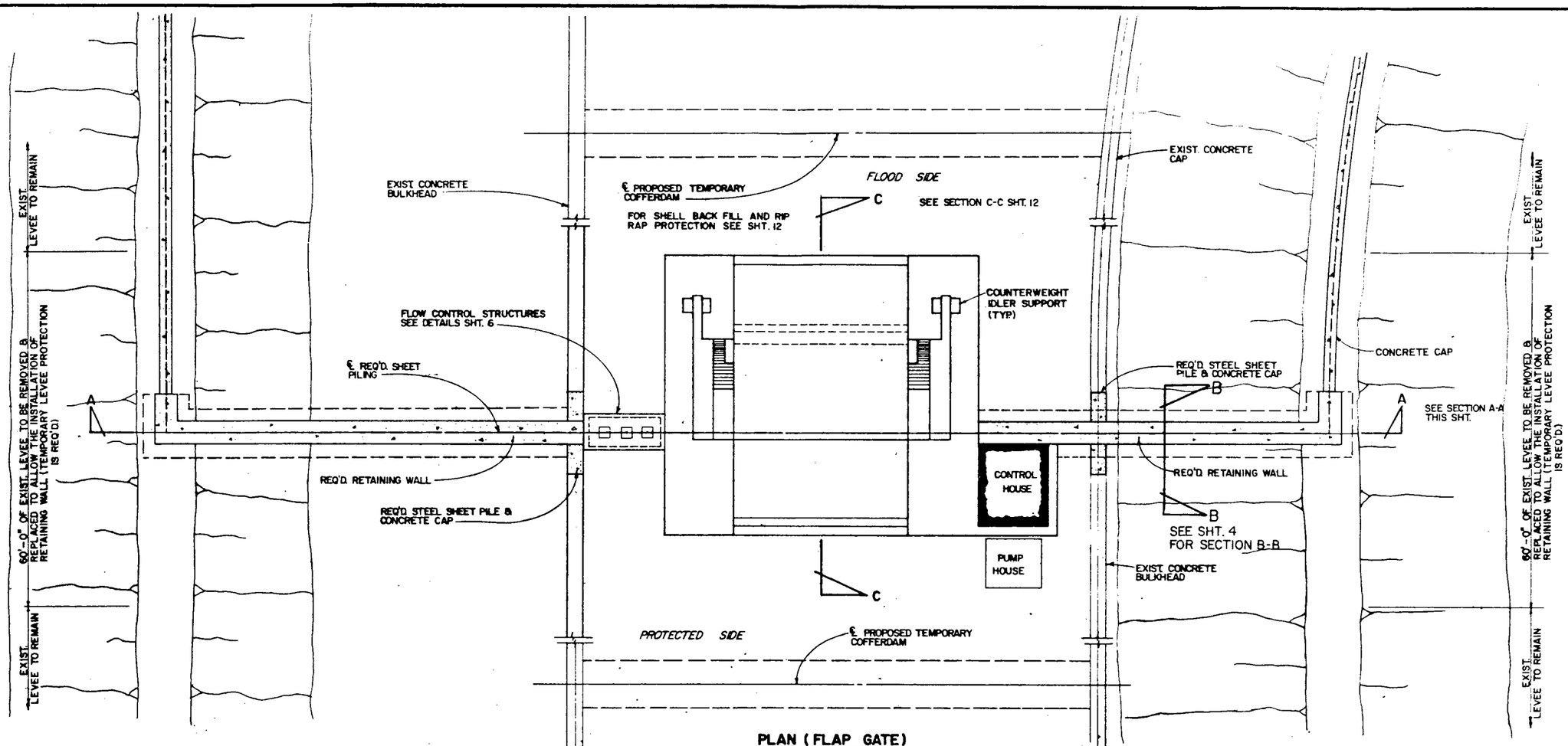
BAYOU ST. JOHN
GATE STRUCTURE STUDY

PEPPER & ASSOCIATES, INC.
CONSULTING ENGINEERS
3012 26th STREET METAIRIE, LA.

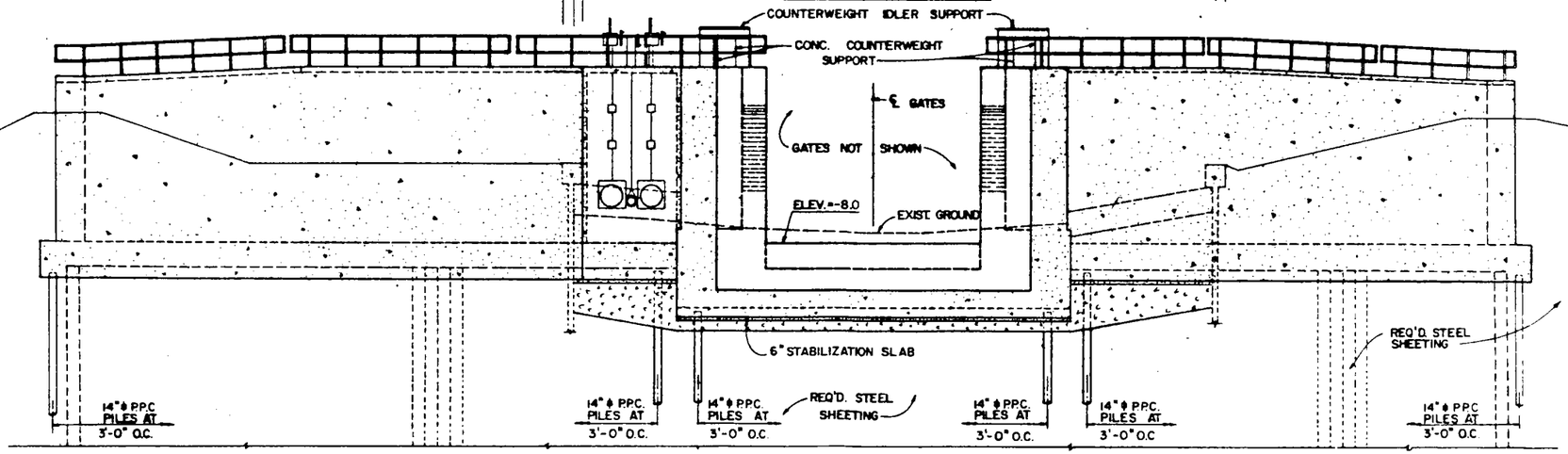
DATE	DESCRIPTION	BY
	REVISIONS	

DATE	SCALE AS SHOWN	FIG. 10
DESIGNED BY R.Y.	DRAWN BY P.C.	
CHECKED BY J.P.	CHECKED BY P.C.	APPROVED BY J.P.

Fig. 10



PLAN (FLAP GATE)



SECTION A-A

Fig. 11

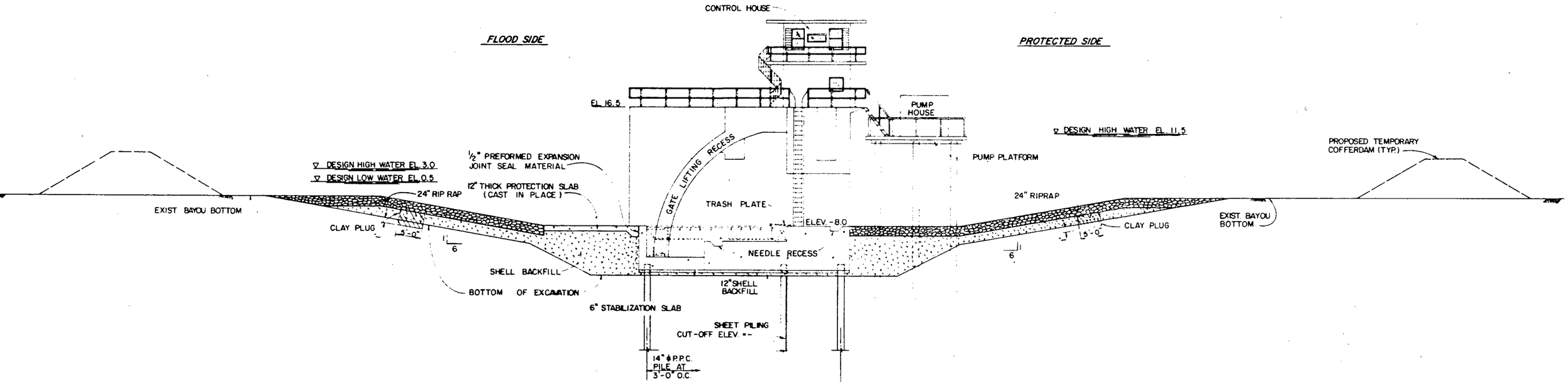
PLAN-PROFILE (FLAP GATE)

BAYOU ST. JOHN
GATE STRUCTURE STUDY

PEPPER & ASSOCIATES, INC.
CONSULTING ENGINEERS
3012 26th STREET — METAIRIE, LA.

DATE	DESCRIPTION	BY
REVISIONS		

DATE	SCALE 1" = 10'-0"	FIG. 11
DESIGNED BY R Y	DRAWN BY P C	
CHECKED BY J P	CHECKED BY P C	APPROVED BY J.P.



SECTION C-C
N.T.S.

CONCRETE NOTES:

1. ALL WALKWAY SURFACES SHALL BE GIVEN A BROOM FINISH. ALL OTHER UNFORMED SURFACES SHALL BE GIVEN A FLOAT FINISH, UNLESS OTHERWISE NOTED.
2. ALL INTERIOR AND EXTERIOR CONCRETE SURFACES OF CONTROL HOUSES WHICH ARE EXPOSED TO VIEW SHALL HAVE A CLASS "A" FINISH. ALL OTHER EXTERIOR FORMED SURFACES NOT COVERED BY BACKFILL SHALL BE CLASS "B" FINISH AND SURFACES COVERED BY BACKFILL SHALL BE CLASS "D" FINISH UNLESS OTHERWISE NOTED ON THE CONTRACT DRAWINGS.
3. CONSTRUCTION JOINTS SHALL BE PROVIDED WHERE SHOWN. WHERE NOT SHOWN, CONSTRUCTION JOINTS SHALL BE PLACED IN THE MIDDLE HALF OF BEAM OR SLAB SPANS OR AT LOCATIONS LEAST LIKELY TO IMPAIR THE INTEGRITY OF THE CONCRETE STRUCTURE. CONSTRUCTION JOINT LOCATIONS SHALL BE APPROVED BY THE ENGINEER.
4. PROVIDE 1" CHAMFER AT ALL EXPOSED CONCRETE CORNERS UNLESS OTHERWISE NOTED.
5. CLEAR COVER FOR ALL REINFORCEMENT IN THE GATE BAY MONOLITH EXCEPT AS OTHERWISE INDICATED OR AS SHOWN ON THE DRAWINGS SHALL BE AS FOLLOWS:
   a. UNFORMED SURFACES IN CONTACT WITH FOUNDATION – 6 INCHES.
   b. FORMED AND SCREEN SURFACES – 4 INCHES.

   CLEAR COVER FOR REINFORCEMENT IN ALL OTHER STRUCTURES EXCEPT GATE BAY MONOLITH SHALL BE AS INDICATED OR AS SHOWN ON THE DRAWINGS.
6. CLEAR DISTANCE BETWEEN ADJACENT LAYERS OR REINFORCEMENT SHALL BE 6 INCHES FOR THE GATE BAY MONOLITH AND 4 INCHES FOR ALL OTHER STRUCTURES, UNLESS OTHERWISE NOTED.
7. ALL BENDS OF REINFORCEMENT AND ALL BAR SPACERS AND SUPPORTS SHALL BE IN ACCORDANCE WITH THE AMERICAN CONCRETE INSTITUTE "MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES" IN EFFECT AT THE TIME OF FABRICATION.
8. TOP BARS ARE HORIZONTAL BARS AND BARS INCLINED LESS THAN 45 DEGREES WITH RESPECT TO A HORIZONTAL PLANE SO PLACED THAT MORE THAN 12 INCHES OF CONCRETE IS CAST IN THE MEMBER BELOW THE BAR. THE WORD "MEMBER" REFERS TO ANY REINFORCED CONCRETE ELEMENTS SUCH AS BEAMS, WALLS, FOOTINGS, SLABS, PIERS, ETC. OTHER BARS ARE ALL BARS EXCEPT TOP BARS.
9. REINFORCING BARS SHALL BE CONTINUOUS AT ALL CORNERS UNLESS OTHERWISE NOTED.
10. ALL REINFORCING EMBEDMENT SHALL BE MEASURED FROM FACE OF OPENINGS OR FROM INTERSECTION WITH REINFORCEMENT, WHICHEVER IS LARGER.
11. REINFORCEMENT WHERE NECESSARY TO AVOID OPENINGS, PIPES, EMBEDDED ITEMS AND OTHER OBSTRUCTIONS SHALL BE BENT OR SHIFTED AS DIRECTED BY THE ENGINEER.
12. REINFORCING BAR SPLICES SHALL BE PROVIDED WHERE SHOWN UNLESS APPROVED OTHERWISE BY THE ENGINEER. WHERE NOT SHOWN, SPLICES MAY BE PROVIDED SUBJECT TO APPROVAL BY THE ENGINEER.
13. REINFORCING BAR DESIGNATION NUMBERS CONFORM TO THE CURRENT NUMBERING SYSTEM OF THE CONCRETE REINFORCING STEEL INSTITUTE.

TYPICAL SECTION (FLAP GATE)

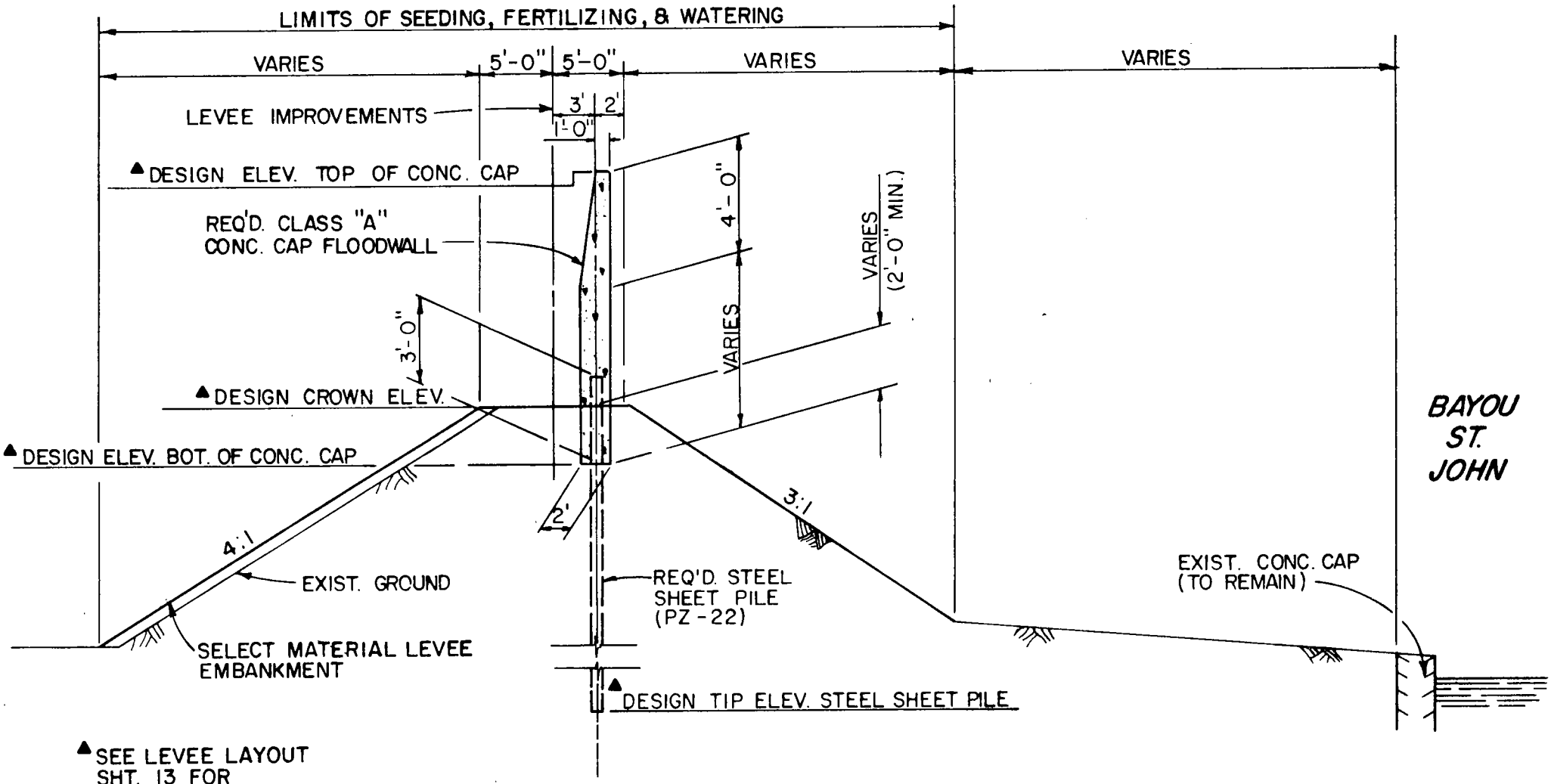
BAYOU ST. JOHN
GATE STRUCTURE STUDY

PEPPER & ASSOCIATES, INC.
CONSULTING ENGINEERS
3012 26th STREET — METAIRIE, LA.

DATE	DESCRIPTION	BY
	REVISIONS	

DATE	SCALE AS SHOWN	FIG. 12
DESIGNED BY R.Y.	DRAWN BY P.C.	
CHECKED BY J.P.	CHECKED BY P.C.	APPROVED BY J.P.

Fig. 12



▲SEE LEVEE LAYOUT SHT. 13 FOR ELEVATIONS

Fig. 14

TYPICAL SECTION
LEVEE IMPROVEMENTS
N.T.S.

LEVEE IMPROVEMENTS

BAYOU ST. JOHN
GATE STRUCTURE STUDY

PEPPER & ASSOCIATES, INC.
CONSULTING ENGINEERS

DATE	DESCRIPTION	BY
REVISIONS		

DATE | SCALE N.T.S. | SHT.
DESIGNED BY R.Y. | DRAWN BY S.A.M.
CHECKED BY R.Y. | CHECKED BY P.A.C. | APPROVED BY J.P.

APPENDIX

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
P.O. BOX 60267
NEW ORLEANS, LOUISIANA 70160

REPLY TO
ATTENTION OF:

March 10, 1986

Gate Study
4109-SA#4

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Reda Ker Cary
87

PHOTOCOPIES

PEPPER & ASSOCIATES, INC.
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Por
NEW ORLEANS, LA.

Coastal Engineering Section
Hydraulic & Hydrologic Branch

Mr. Jerome Pepper, President
Pepper and Associates, Incorporated
Consulting Engineers
3012 26th Street
Metairie, Louisiana 70002

Dear Mr. Pepper:

As requested in your letter of January 16, 1986, we have determined the following data on a proposed gate near the entrance to Bayou St. John.

If the gate structure is located adjacent to the centerline of Lakeshore Drive, the top elevation should be 20.5 ft NGVD. The largest force on the gate results from the one percent wave during the Standard Project Hurricane. The total force is approximately 33,000 lbs/linear foot of gate and is composed of a dynamic component resulting from a broken wave and a static component due to the water depth; a force diagram is enclosure 1. If the gate structure is located 650 feet south of the centerline of Lakeshore Drive, as is currently proposed, the top elevation should be 16.5 ft NGVD. The levees along the canal should gradually decrease in elevation from their height at the Lakeshore Drive Bridge to 14.5 ft NGVD at a point 600 feet landward of the bridge. The one percent wave force on the gate in this case is approximately 17,000 lbs/linear foot of gate and is a static force resulting from a standing wave at the gate; a force diagram is enclosure 2. Note that these forces are total forces on the gate, which include the water depth on the outside of the gate and assume no water on the inside of the gate. To determine the net force on the gate the static force resulting from the inside water level should be subtracted from the appropriate force given above.

The maximum and minimum stages we predict for the lakeside of the gate are 11.5 feet NGVD and -5 feet NGVD, respectively. The maximum and minimum stages landside of the gate will be a function of the nature and extent of control imposed by the levee board on water levels in Bayou St. John. Gate design should be based on analysis of a sufficient number of cases to achieve assurance that the gate will function under all reasonable configurations of water levels.

Any questions regarding this information can be directed to Jorge Romero, at 862-2645.

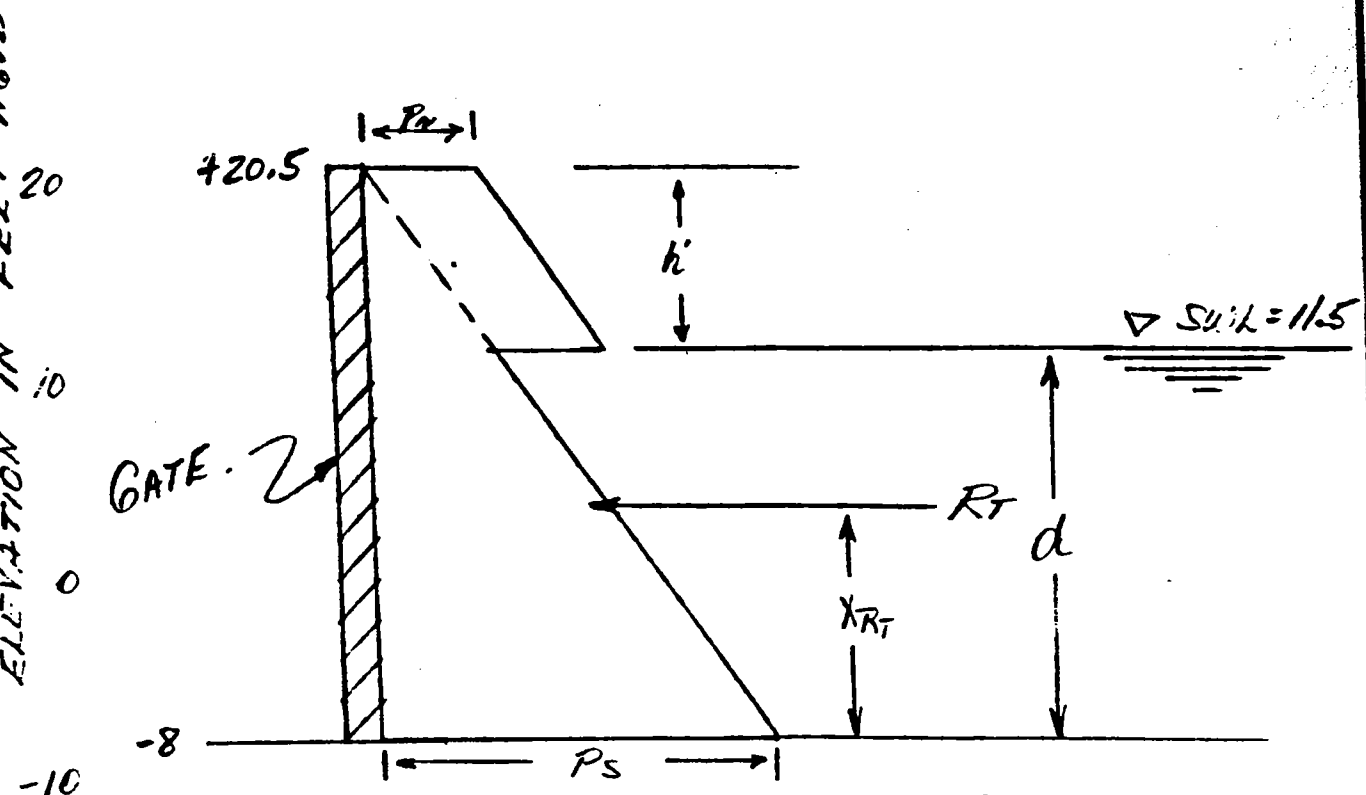
Sincerely,

FREDERIC M. CHATRY
Chief, Engineering Division

Enclosure

COMPUTATION SHEET

PROJECT LAKE PONTCHARTRAIN + VIC.	PAGE 1 OF 1	COMPUTED BY J.M.H	DATE 10 FEB 82
SUBJECT BAYOU ST. JOHN & LAKESHORE DR.		CHECKED BY	DATE



$H_1 = 14.2 \quad d_B = 17.3 \quad d = 11.5 - (-8) = 19.5$

$h' = 20.5 - 11.5 = 9.0 \quad h_c = .78 H_B = .78(14.2) = 11.1$

$p_s = w(d_s + h_c) = 64(19.5 + 11.1) = 1958 \ \#/ft^2$

$p_m = \frac{w d_B}{2} = \frac{64(17.3)}{2} = 554 \ \#/ft^2$

$R_S = \frac{p_s (d_s + h')}{2} = \frac{1958(19.5+9)}{2} = 27900 \ \#/ft$

$R_m = p_m h' = 554 \times 9 = 4986 \ \#/ft$

$R_T = R_S + R_m = 27900 + 4986 = 32,886 \ \#/ft$

$M_S = R_S \frac{(d_s + h')}{3} = 27900 \frac{(19.5+9)}{3} = 265,050 \ ft\#/ft$

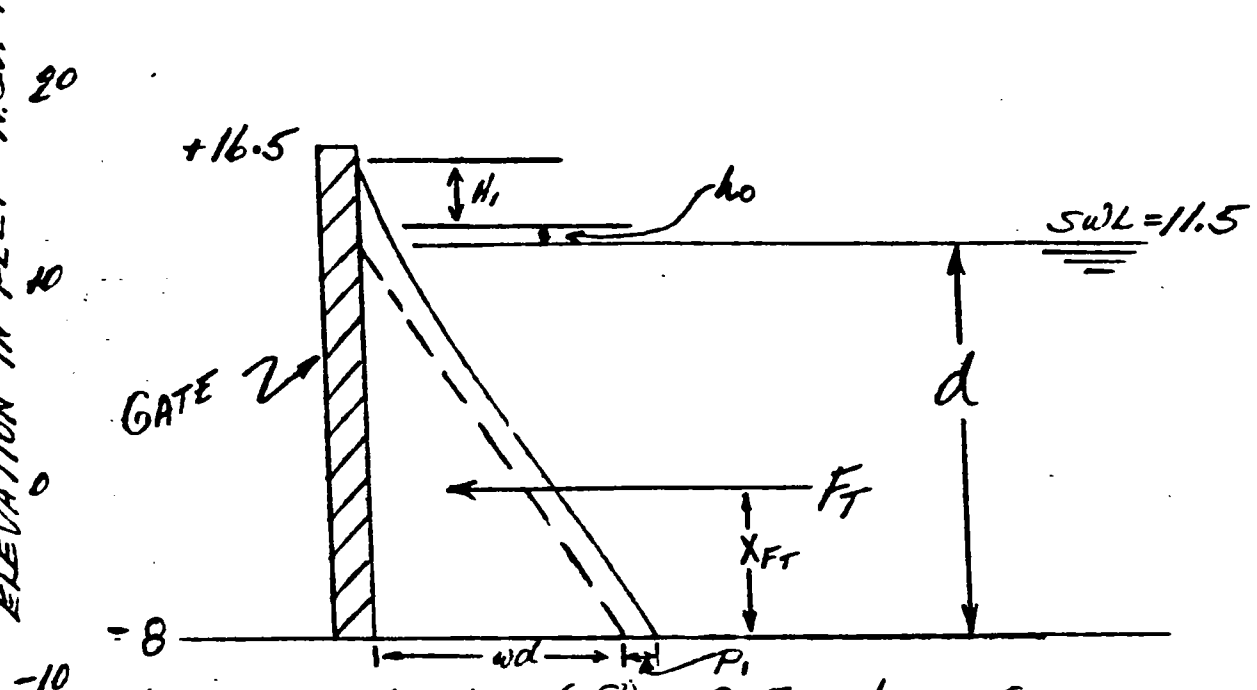
$M_{M} = R_m \left(d_s + \frac{h'}{2}\right) = 4986 \left(19.5 + \frac{9}{2}\right) = 119,660 \ ft\#/ft$

$M_T = M_S + M_M = 265,050 + 119660 = 384710 \ ft\#/ft$

$X_T = \frac{M_T}{R_T} = \frac{384710}{32886} = 11.7 \ ft \quad -8 = 3.7 \ FT. \ NGVD$

COMPUTATION SHEET

PROJECT LAKE PONTCHARTRAIN & VIC.	PAGE 1 OF 1	COMPUTED BY JMH	DATE 13 FEB 86
SUBJECT BAYOU ST. JOHN - 650' SOUTH OF & LAKESHORE DR.		CHECKED BY	DATE



$H_1 = 3.5 \quad d = 11.5 - (-8) = 19.5 \quad h_o = 0.9$

$\therefore y_c = d + h_o + H_1$

$= 19.5 + .9 + 3.5 = 23.9 \quad (= 23.9 - 8 = 15.9 \text{ FT. N.G.V.D.})$

$P_1 = w H_1 / \cosh(2\pi d/L) = 64 \times 3.5 / 1.36 = 165 \#/\text{ft}^2$

$F_{TOTAL} = \frac{wd^2}{2} + 0.2\, wd^2 = 0.7\, wd^2$

$= 0.7 \times 64 \times 19.5^2 = 17150 \#/\text{ft}$

$M_{TOTAL} = \frac{1}{6} wd^3 + 0.1\, wd^3 = 0.267\, wd^3$

$= 0.267 \times 64 \times 19.5^3 = 126700 \text{ ft} \#/\text{ft}$

$X_{FT} = \frac{M_T}{F_T} = \frac{126700}{17150} = 7.4 \text{ FT} - 8 = -0.6 \text{ FT N.G.V.D.}$

PARTNERS

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REG. C. E.

CHARLES A. BRAGG (1918-1979)
REG. C. E.

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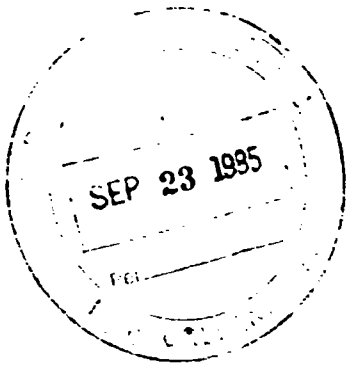
23 September 1985

4109-5A-4



Pepper and Associates
Consulting Engineers
3012 26th Street
Metairie, Louisiana 70002

Attention Mr. Jerome Pepper
President

Gentlemen:

Interim Report
Bayou St. John Bridge and Floodgate
New Orleans, Louisiana

In accordance with instructions received during a meeting on 20 August 1985 at the offices of Design Engineers Inc., this interim report contains the results of (1) supplementary analyses to the previous submitted draft report covering Scheme "A" and (2) analyses for a proposed Scheme "B" for the subject project.

Scheme "A"

Additional slope stability analyses were performed for the bridge approach embankments on the east and west sides of Bayou St. John. The computations were based on the following: a 2-ft high preload will be placed for a distance of 50 feet from the end of the embankment; initially no dredging will be permitted in the bayou during the preload operations; and a navigation channel may be dredged in the future to a bottom width of 30 feet at el -8 msl. The results of the computations indicate the minimum distance required between the bridge abutment and the existing bulkhead to provide a factor of safety of 1.3 during the 6-month preload period is 143 feet on the west side and 120 feet on the east side. After removal of the preload fill, a factor of safety of approximately 1.4 is indicated which will be reduced to 1.3 if a navigation channel is dredged at a future date.

Additional slope stability analyses were performed for the new levee embankments between the bridge and gate structure on the

east and west sides of the bayou. The computations were based on a crown elevation of 15 msl on the east side and 14.5 msl on the west side, and include consideration for possible future dredging of a navigation channel. The results of the computations indicate a minimum distance of 100 feet is required between the new floodwall and the existing bulkhead for a factor of safety of 1.3.

Additional bulkhead analyses were performed for the new floodwall to be embedded in the crown of the new levee embankment about 2 feet from the top of the slope on the bayou side. The computations were based on a top of wall elevation of 19 msl on the east side and 18.5 msl on the west side and include consideration of a dynamic wave force of 1665 plf at el 16.5 msl furnished by the Corps of Engineers. The results of the computations indicate a sheetpile penetration to el -1.0 msl and a maximum bending moment of 14.5 ft-kips per linear foot at approximately el 10.5 msl. A lateral pressure diagram is shown on Enclosure 1.

Settlement analyses were performed to determine the effect on the settlement of nearby residences due to weight imposed by the approach embankment on the west side. The computations were based on a maximum 7.1-ft height of embankment and a horizontal distance of 44 feet between the residence and toe of the embankment slope. The results of the computations indicate settlement of the residence should be very small and uniform and should occur gradually over a very long period of time. It is believed that vibrations due to the operation of construction equipment in the area may have a greater affect on adjacent residences than settlement due to the weight of fill. These vibrations should be monitored.

Scheme "B"

Furnished information indicates that Scheme "B" includes the construction of a longer bridge with a maximum 9 to 10-ft high approach embankment; raising the existing levee to el 12 msl; and installation of a sheetpile floodwall in the crown of the raised levee.

Considering a maximum 9 to 10-ft high approach embankment located approximately 250 feet from the existing bulkhead, slope stability analyses are not required. Based on previous analyses of the bridge approach embankments, a factor of safety in excess of 1.3 is indicated for the approach embankments of Scheme "B" including an additional height of fill for surcharging.

It is recommended that an additional 4 to 5 feet of surcharge fill be placed above the final design grade of the approach embankments on the east and west sides. the surcharge fill should extend at least 50 feet from the bridge abutment and

should be left in place for at least six months to reduce future settlement at the abutment and to reduce "drag" loads on piles supporting the abutment. Considering that the approach embankment will be located approximately 250 feet from the nearest residence, the effect of this fill material on the settlement of adjacent residences should be negligible. Vibrations due to the operation of construction equipment on the embankment may have a greater effect on adjacent residences and these vibrations should be monitored.

Slope stability analyses were performed for the existing levee between the bridge and gate structures on the east and west sides of the bayou raised, where required, to a crown elevation of 12 msl. The computations were based on a crown width of 10 feet at el 12 msl and included consideration for possible future dredging of a navigation channel. The results of the computations indicate that some reshaping will be necessary where the existing levee is at or near el 12 msl. Where the existing levee is at el 9.5 msl, a setback will be required to provide a minimum distance of 82 feet between the existing bulkhead and the new sheetpile floodwall. For the cross-section analyzed, a setback of 8 feet is required to provide the required distance of 82 feet. Typical cross-sections and computations are shown on the worksheets on Enclosures 2 and 3.

Bulkhead analyses were performed for the new floodwall to be embedded in the crown of the existing levee raised to el 12 msl. For conservative purposes, the computations were based on a top of wall elevation of 18 msl on both sides and included consideration of a dynamic wave force of 2497 pounds estimated from previous information furnished by the Corps of Engineers. The results of the computations indicate a sheetpile penetration of el -10 msl and a maximum bending moment of 31 ft-kips per linear foot at approximately el 6 msl. A lateral pressure diagram is shown on Enclosure 4.

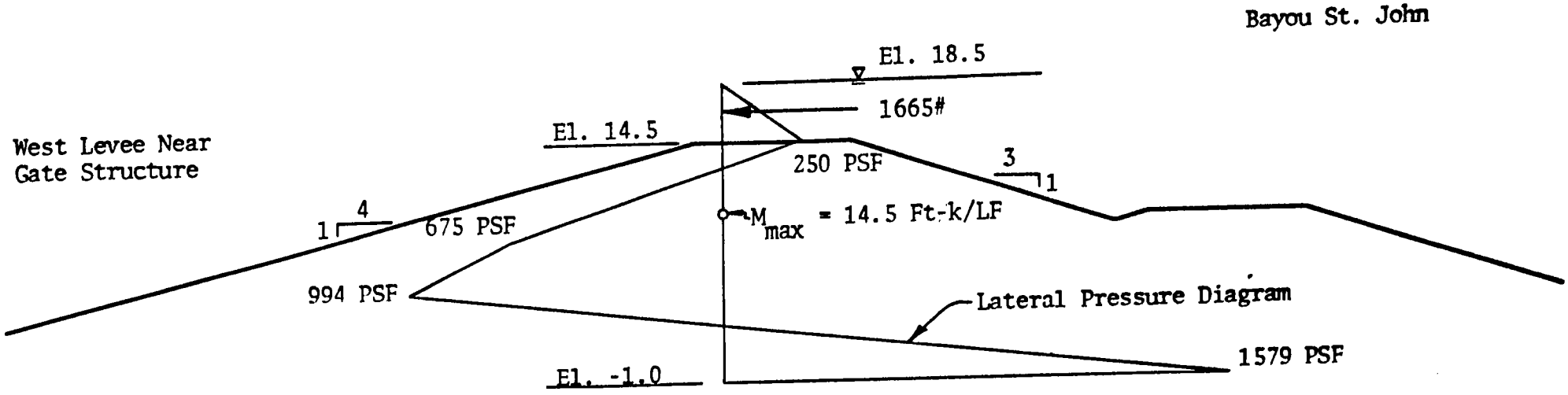
Yours very truly,

EUSTIS ENGINEERING COMPANY

By Lloyd A. Held, Jr.

L. J. Napolitano:bh

Enclosures 1 through 4

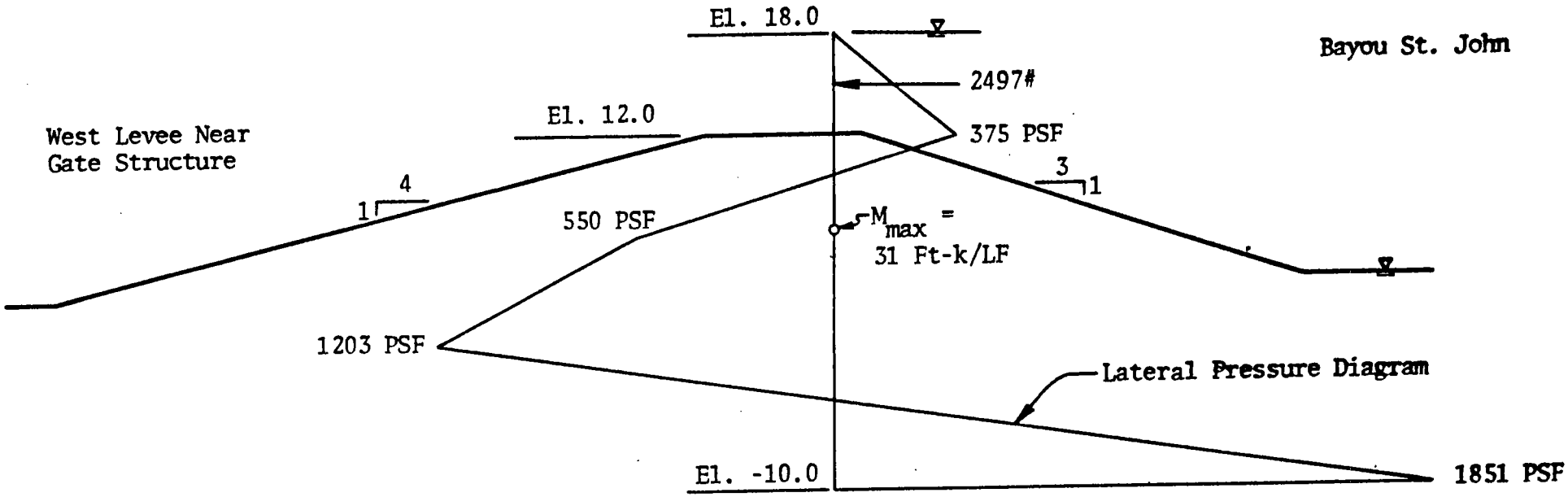


FLOODWALL ANALYSIS - SCHEME "A"

Interim Report
Bayou St. John Bridge and Floodgate
New Orleans, Louisiana

For: Pepper and Associates, Consulting Engineers, Metairie, Louisiana

Enc. 1



FLOODWALL ANALYSIS - SCHEME "B"

Interim Report
Bayou St. John Bridge and Floodgate
New Orleans, Louisiana

For: Pepper and Associates, Consulting Engineers, Metairie, Louisiana

Enc. 4