PHASE 2 CONCEPTUAL DESIGN SERVICES FOR PERMANENT FLOOD STATIONS AND CANAL CLOSURES AT OUTFALLS

ALTERNATIVE CONSIDERATIONS REPORT

Prepared for

U.S. Army Corps of Engineers
New Orleans District
New Orleans, Louisiana

Prepared by

Black & Veatch
6601 College Boulevard
Overland Park, Kansas 66211

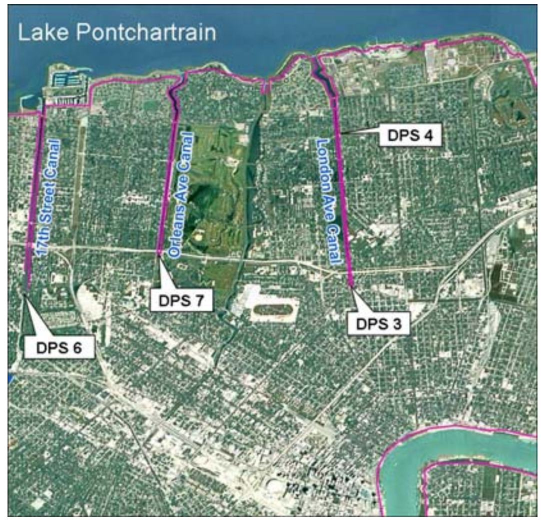
December 12, 2006

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1.0 EXECUTIVE SUMMARY

Subsequent to submission of the B&V report titled "Conceptual Design Report for Permanent Flood gates and Pump Stations" dated July 31, 2006, several potential cost reduction alternatives were identified. These alternatives represent changes to the currently conceived permanent pump station concept that if employed may provide benefit to the project in terms of reduced cost or improved schedule. The scope of this effort is to further develop those changes and determine the risk issues associated with their implementation. Then based on the results, provide a recommendation for implementation and inclusion into the Permanent Pump Station Program. The three identified alternatives to be considered included:



- Review of the DMJM report titled "Alternative Analysis of Interim Drainage Maintenance Opportunities for Orleans East Bank Project" dated 4 August 2006.
- Review of the Temporary Canal Closure Structure plans for the three canals.
- Develop a canal lining alternative as a single and complete parallel protection means.

1.1 ALTERNATIVE REPORT REVIEW

The DMJM report titled "Alternative Analysis of Interim Drainage Maintenance Opportunities for Orleans East Bank Project" dated 4 August 2006 was reviewed to identify cost effective alternate discharge locations and means for flows currently discharging or scheduled for discharge into the canals. The report review was to identify alternate discharge means for some of the flows in the 17th Street, Orleans, and London Avenue canals that if diverted could reduce flows and affect current permanent system strategies and result in a more cost effective overall solution.

The only alternative that clearly would provide a positive impact both from a cost standpoint and risk is implementation of project 10 in the London Avenue Canal. The cost savings are estimated to be approximately $14M and the design/construction duration is less than 1 year, which fits within the current permanent pump station implementation schedule. The only other project that showed promise was project 19 for London Avenue Canal. From a cost standpoint there was a marginal initial cost benefit, but the design/construction is expected to take 2 years and there would be substantial additional costs associated with operation of two additional pump stations.

1.2 EXISTING TEMPORARY CANAL CLOSURE REVIEW

Temporary canal closure structures were installed on 17th Street Canal, Orleans Avenue Canal, and London Avenue Canal to serve as an interim protection measure until a permanent solution could be installed. One structure per canal was installed and consists primarily of a gated section, pumping section, and closure supporting structure. These structures are substantially installed and some are operational. The substantial investment and the possibility that at least some portions of the structures may be salvaged for use in the permanent solution is the impetus for this evaluation. All information provided was reviewed to determine suitability and provide recommendations how it can be used in the permanent installation.

The use of the interim structures as a whole is not recommended due to concerns about operability and maintainability. Use of some components of the interim closure system in a new more permanent structure is possible. The electrical system (generator sets), controls, safe house, and fuel storage system are all adequate for reuse. The pumps have potential for reuse as the small/intermediate pumps for dry and normal rainfall flows in a permanent pump station. The gates have some potential for reuse, but modification of the existing gates for use as permanent gates may not be cost effective. The support structure appears to be adequate for its purpose but modification to address corrosion would have to be implemented.

1.3 CONCRETE LINED CANAL SECTION ANALYSIS

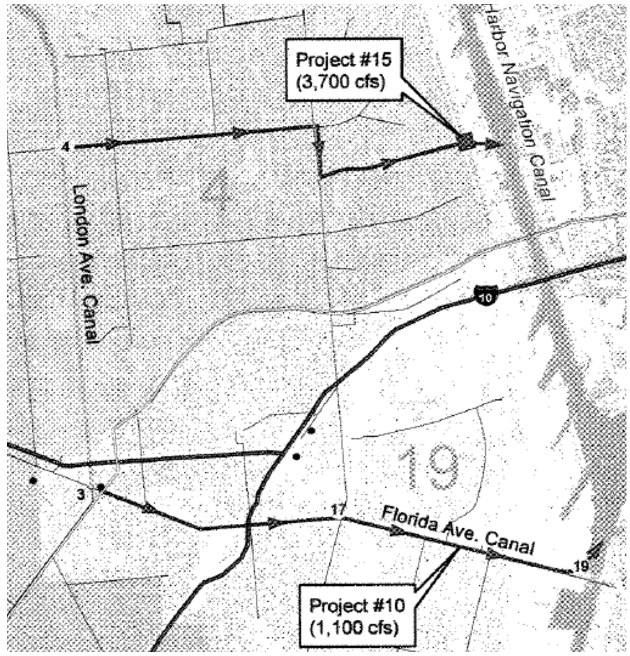
This is an extension of a concept presented in the Phase 1 B&V report titled "Conceptual Design Report for Permanent Flood Gates and Pump Stations" dated July 31, 2006. In the Phase 1 report, concrete lining the canal was presented as an Option 2 requirement because the depth of the canal and the stability of the soil did not allow use of an earthen bank similar to the one currently employed due to real estate acquisition/concerns. This revised lined section is basically the same canal lining except with the walls extended to the elevation of the top of the existing floodwalls. Configured this way, the canal lining serves as a single and complete method to satisfy the parallel protection required.

When properly constructed and maintained, floodwalls are an effective form of protection and should be considered a legitimate alternative. The estimated cost to implement this alternative is $578M. The real estate acquisition requirements are key to the feasibility of this alternative and without further study, the true extent of real estate acquisition required and the related difficulties are unclear. In addition, this alternative must be evaluated as part of the overall drainage solution to determine if it is cost effective. To implement this lining alternative into the overall drainage solution, modifications to existing pump stations may also be required to meet drainage flow rate requirements.

TASK C-1
ALTERNATIVE REPORT REVIEW

2.0 ALTERNATIVE REPORT REVIEW

DMJM Harris prepared a report on their findings that identified interim alternatives to the emergency temporary pumping at the temporary gate closures for each of the three Orleans Parish outfall canals discharging into Lake Pontchartrain. This report is titled “Alternative Analysis of Interim Drainage Maintenance Opportunities for Orleans East Bank Project” dated 4 August 2006. Canal maps extracted from the report are included in Appendix B. The reports objective was to identify water capacity means for minimizing the risk of interior flooding during hurricane gate closures, prior to construction and operation of a permanent system in 2010. The purpose for review of this document is to identify cost effective alternate discharge locations and means for flows currently discharging or scheduled for discharge into the canals in the future. Identification of alternate discharge means for some of the flows could affect current permanent system strategies and result in a more cost effective overall solution.



2.1 Screening

The Interim Drainage Maintenance Opportunities (IDMO) Alternative Analysis produced 20 projects for consideration. Many of these projects were eliminated based on evaluation factors (timing, capacity improvements, and construction impacts to system) and were not considered further in this evaluation. The following tables are excerpts from Table 1-1 of the DMJM Harris report and list the remaining projects that have been deemed suitable. The rationale behind further consideration was to screen the remaining projects so that cost and risk evaluations are performed on only appropriate projects.

17th Street Canal

Project	Description	CFS	Cost	Screening Rationale
1	Add pumping capacity at the lake on the west side of 17th Canal	3,300	$62.3M	Do Not Consider Further – duplication of permanent solution
11	Redirect flow at Monticello canal to the Mississippi River – Orleans Parish	1,600	$71.2M	Retain – potential possible impact for existing and future pump stations and canal features
16	Redirect flow from Hoey’s Basin to the Mississippi River – Jefferson Parish	2,400	$103.6M	Retain – potential possible impact for existing and future pump stations and canal

				features

Orleans Canal

Project	Description	CFS	Cost	Screening Rationale
3A	SELA – add conveyance capacity on Orleans Avenue from Olga Street to DPS7	1,000	$80.0M	Retain – although project is to de-bottle neck influent to DPS7 and will not serve to reduce Orleans Canal flows
3B	Add pumping capacity of 1,700 at the lake	1,700	$25.4M	Do Not Consider Further – duplication of permanent solution
19	Redirect flow from DPS2 to Bayou Saint John and pump to the lake	1,200	$29.7M	Retain – when implemented in conjunction with project 3A has potential possible impact

London Avenue Canal

Project	Description	CFS	Cost	Screening Rationale
4	Add pumping capacity at the lake	4,800	$70.4M	Do Not Consider Further – duplication of permanent solution
10	Divert flow from DPS3 via Florida Canal to DPS19	1,100	$3.5M	Retain – potential possible impact for existing and future pump stations and canal features
15	Redirect DPS4 to the Industrial Canal via Prentiss and Filmore	3,700	$81.7M	Retain – potential possible impact for future permanent pump station
19	Redirect flow from DPS2 to Bayou Saint John and pump to the lake	1,200	$29.7M	Retain – potential possible impact for existing and future pump stations and canal features

2.2 Cost Comparisons

Prior to cost comparison and grouping, costs are first validated to determine the applicability of using the costs interchangeably. This validation process is a comparison of per unit costs for various pump station sizes to ensure costs utilized in the comparisons are similar. Since the DMJM Harris report and the Black & Veatch report have pump station costing, projects in the each report are selected for comparison purposes. The following table compares the costs from Table 1-1 of the DMJM Harris report with the costs derived in the B&V report titled "Conceptual Design Report for Permanent Flood gates and Pump Stations" dated July 31, 2006. Cost estimates in both reports are comprised on Environmental, Right-of-Way Acquisition, Design, and Construction costs. The extent of construction is primarily the pump station itself and support structures in close proximity such as intake and discharge basins, stand-by power, and construction considerations such as geotechnical, structural, etc.

Cost Validation

DMJM Harris Report				
Project	Size (cfs)	Cost	Cost/cfs	Average Unit Cost
1	3,300	$62,300,000	$18,878	$15,785/cfs
3A	2,700	$39,700,000	$14,704	
3B	1,700	$25,400,000	$14,941	
4A	4,800	$70,400,000	$14,667	
4B	1,100	$17,300,000	$15,727	
Black & Veatch Report (Option 1 Pump Stations)				
Project	Size (cfs)	Cost	Cost/cfs	Average Unit Cost
17th Str	12,500	$197,804,992	$15,824	$16,379/cfs
Orleans	3,390	$65,808,512	$19,412	
London	8,980	$124,829,166	$13,901	

As can be seen from the average unit cost, the cost estimates for pump stations from the two reports compares favorably and therefore validates the use of report numbers interchangeably.

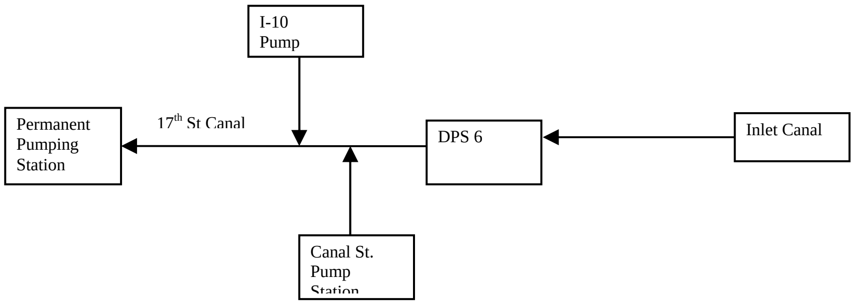
2.3 Evaluation

2.3.1 17th Street Canal

The 17th Street canal permanent pump station is required to pump a maximum of 12,500 cfs. Projects 11 and 16 from the DMJM Harris Report each have proposed flows diverted to the Mississippi River that would reduce flow (4,000 cfs) to the inlet of DPS6 and ultimately to the 17th Street Canal. Flow reduction in this canal may assist in resolving hydraulic problems more cost effectively than reconstruction of the problematic feature as identified in the Black & Veatch Report. Following is a listing of permanent pump station/canal components that may benefit from a flow reduction in the canal:

- Just north of DPS6, the Southern Railroad Bridge has been determined to be a hydraulic constriction, limiting the flow capacity of the canal and potentially causing the water level to exceed the canal safe water elevation at maximum flow and maximum lake level. Bridge replacement is the conservative remedy if the canal safe water level and/or the maximum flow and maximum lake level remain at the current criteria. Diversion of flow upstream (project 11 and 16) of the bridge may eliminate the need for bridge replacement.
- Diverting flow would also reduce or possibly eliminate the need to upgrade DPS6 to 11,480 cfs flow capability to support the future canal flowrates required. The chart below defines the future canal pumping capacities at various points along the canal:

17th Street Canal	**Capacity**
Existing DPS 6 capacity	9480 cfs
Future DPS 6 capacity increase	2000 cfs
Canal Street Pump Station	160 cfs
I-10 Pump Station	860 cfs
Permanent Pumping Station	**12500 cfs**



- Diverting flow from the 17th Street Canal would have the added benefit of reducing the required capacity of the permanent pump station at the lake front by a corresponding amount.

17th Street Canal Cost Evaluation

To determine what impact incorporation of projects 11 and 16 identified in the DMJM Report will have on the overall permanent pump station cost; a tabulation of costs is presented in the following table. Note that hydraulic model runs would have to be performed to determine if the reduced flow would eliminate the flow constriction at the Southern Railroad Bridge, but for the purposes of this evaluation, it is assumed the reduced flows would eliminate the affects of the constriction and therefore the bridge replacement cost. All costs are derived from the DMJM Harris and Black & Veatch Reports and are considered to be of Rough-Order-of-Magnitude accuracy and adequate for the purposes of this evaluation.

Cost Evaluation 2.3.1-1

Description	Savings	Added Cost	Remarks
Southern Railroad Bridge Replacement	$4M		Black & Veatch Report Bridge Back-up
Existing DPS6 Upgrade Not Required	$32.8M		2000 cfs addition not required @ $16,379/cfs
Permanent Pump Station Capacity Reduced to 8,500 cfs	$65.5M		4000 cfs addition not required @ $16,379/cfs
Project 11 – Redirect flow at Monticello Canal to the Mississippi River		$71.2M	Table 1-1 of DMJM Report
Project 16 – Redirect flow from Hoey's Basin to the Mississippi River		$103.6M	Table 1-1 of DMJM Report
Totals	$102.3M	$174.8M	Net Increase = $72.5M

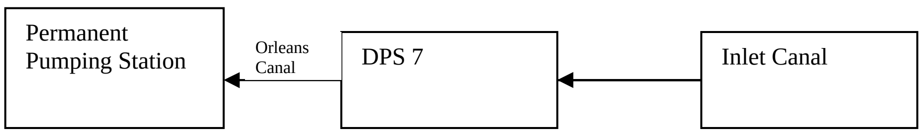
2.3.2 Orleans Canal

The Orleans canal permanent pump station is required to pump a maximum of 3,390 cfs. The DMJM Harris Report, Project 19, has proposed flows diverted to Bayou Saint John that would reduce flow (1,200 cfs) to the inlet of DPS7 and ultimately to the Orleans Canal. The canal had no problematic features that lend itself to a reduction of costs through flow redirects.

Therefore, there are no permanent pump station/canal components that may benefit from a flow reduction in the canal. The reduced flow requirements through the flow redirect in project 19 would have the following impact:

- Diverting flow from the Orleans Canal would have the benefit of reducing the required capacity of the permanent pump station at the lake front by a corresponding amount. The chart below defines the future canal pumping capacities at various points along the canal:

Orleans Avenue Canal	**Capacity**
Existing DPS 7 capacity	2690 cfs
Future DPS 7 capacity increase	700 cfs
Permanent Pumping Station	**3390 cfs**



Orleans Canal Cost Evaluation

To determine what impact incorporation of project 19 identified in the DMJM Report will have on the overall permanent pump station cost; a tabulation of costs is presented in the following table. Note that a SELA project to eliminate an existing conveyance problem to DPS7 is being considered. Apparently, without the construction of this SELA project, the future flow capacity for DPS7 cannot be achieved. This SELA project has not been included in this evaluation because it is assumed to be currently funded and will be constructed. All costs are derived from the DMJM Harris and Black & Veatch Reports and are considered to be of Rough-Order-of-Magnitude accuracy and adequate for the purposes of this evaluation.

Cost Evaluation 2.3.2-1

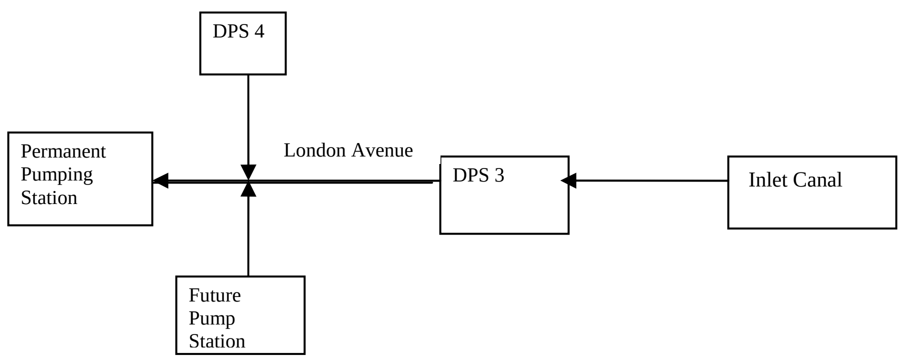
Description	Savings	Added Cost	Remarks
Permanent Pump Station Capacity Reduced to 2,190 cfs	$19.6M		1200 cfs addition not required @ $16,379/cfs
Project 19 – Redirect flow from DPS2 to Bayou Saint John and pump to the lake		$29.7M	Table 1-1 of DMJM Report
Totals	$19.6M	$29.7M	Net Inc = $10.1M

2.3.3 London Avenue Canal

The London Avenue canal permanent pump station is required to pump a maximum of 8,980 cfs. Project 10 from the DMJM Harris Report has proposed flow diverted to the Inner Harbor Navigational Canal that would reduce flow (1,100 cfs) to the inlet to DPS3 and ultimately to the London Avenue Canal. Project 15 from the DMJM Harris Report has proposed flow diverted to the Inner Harbor Navigational Canal (Industrial Canal) that would reduce flow (3,700 cfs) to the midpoint of the London Avenue Canal, essentially pumping DPS4 away from the London Avenue Canal instead of into it. Project 19 from the DMJM Harris Report has proposed flows diverted to Bayou Saint John that would reduce flow (1,200 cfs) to the inlet to DPS3 and ultimately to the London Avenue Canal. Flow reduction in this canal may assist in resolving hydraulic problems more cost effectively than reconstruction of the problematic feature as identified in the Black & Veatch Report. Following is a listing of permanent pump station/canal components that may benefit from a flow reduction in the canal:

- Just north of DPS3, the Gentilly Bridge has been determined to be a hydraulic constriction, limiting the flow capacity of the canal and causing the water level to exceed the safe water elevation at maximum flow and maximum lake level. Bridge replacement is the conservative remedy if the canal safe water level and/or the maximum flow and maximum lake level remain at the current criteria. Diversion of flow upstream (projects 10 and 19) of the bridge may eliminate the need for bridge replacement.
- Diverting flow from the inlet to DPS3 (projects 10 and 19) would reduce the load on the existing pump station. DPS3 currently has sufficient installed capacity to support the permanent canal solution, so diversion of flow from DPS3 inlet will not produce cost savings. The chart below defines the future canal pumping capacities at various points along the canal:

London Avenue Canal	Capacity
Existing DPS 3 capacity	4260 cfs
Existing DPS 4 capacity	3720 cfs
Future pumping station capacity, to be located on opposite side of canal from DPS 4	1000 cfs
Permanent Pumping Station	**8980 cfs**



- Diverting flow from the midpoint of the London Avenue Canal (project 15) would have the benefit of reducing the required capacity of the permanent pump station at the lake front by a corresponding amount.

London Avenue Canal Cost Evaluation

To determine what impact incorporation of projects 10, 15 and 19 identified in the DMJM Report will have on the overall permanent pump station cost; a tabulation of costs is presented in the following tables. Two cost evaluations are presented because two distinct impacts/benefits are recognized by implementation of the DMJM projects. Cost Evaluation 2.3.3-1 evaluates the feasibility of implementing projects 10 and 19, which have impacts along the length of the London Avenue Canal and may eliminate the need for the Gentilly Bridge replacement. Note that hydraulic model runs would have to be performed to determine if the reduced flow would eliminate the flow constriction at the Gentilly Bridge, so for the purposes of this evaluation it is assumed the reduced flows would not eliminate the affects of the constriction and therefore the bridge replacement cost. Cost Evaluation 2.3.3-2 evaluates the feasibility of implementation of project 10 which also has impacts along the length of the London Avenue Canal but does so without the addition of a pumping station. Cost Evaluation 2.3.3-3 evaluates the feasibility of implementation of project 15 which has impacts on only the north half of the London Avenue Canal. All costs are derived from the DMJM Harris and Black & Veatch Reports and are considered to be of Rough-Order-of-Magnitude accuracy and adequate for the purposes of this evaluation.

Cost Evaluation 2.3.3-1

Description	Savings	Added Cost	Remarks
Gentilly Bridge Replacement	$0M		Replacement still required
Existing DPS3 Capacity Reduced to 1,960 cfs	$0M		Pump Station currently has sufficient installed capacity
Permanent Pump Station Capacity Reduced to 6,680 cfs	$37.7M		2300 cfs capacity not required @ $16,379/cfs
Project 10 – Divert flow from DPS3 via Florida Canal to DPS19		$3.5M	Table 1-1 of DMJM Report
Project 19 – Redirect flow from DPS2 to Bayou Saint John and pump to the lake		$29.7M	Table 1-1 of DMJM Report
Totals	$37.7M	$33.3M	Net Decrease = $4.4M

Cost Evaluation 2.3.3-2

Description	Savings	Added Cost	Remarks
Gentilly Bridge Replacement	$0M		Replacement still required
Existing DPS3 Capacity Reduced to 3,160 cfs	$0M		Pump Station currently has sufficient installed capacity
Permanent Pump Station Capacity Reduced to 7,880 cfs	$18.0M		1100 cfs capacity not required @ $16,379/cfs
Project 10 – Divert flow from DPS3 via Florida Canal to DPS19		$3.5M	Table 1-1 of DMJM Report
Totals	$18.0M	$3.5M	Net Decrease = $14.5M

Cost Evaluation 2.3.3-3

Description	Savings	Added Cost	Remarks
Gentilly Bridge Replacement	$0M		Feature not affected
Existing DPS3 Capacity	$0M		Feature not affected
Permanent Pump Station Capacity Reduced to 5,280 cfs	$60.6M		3700 cfs capacity not required @ $16,379/cfs
Project 15 – Redirect DPS4 to the Inner Harbor Navigational Canal via Prentiss and Filmore		$81.7M	Table 1-1 of DMJM Report
Totals	$60.6M	$81.7M	Net Increase = $21.1M

2.4 Risk Issues & Impacts

The risk associated with this approach is presented in the following table. The risk factors are based on a three tier system (low, moderate, high). Low generally means that minimal negative impacts are expected to the permanent pump station implementation. An example of low risk is that the initial cost and potential cost growth is less than those anticipated in the current approach because of readily available materials, land already acquired, and construction methods are tried and true. Moderate means that impacts are possible but are expected to be equal to the permanent pump station implementation. An example of moderate risk is that the initial cost and potential cost growth are similar to the current approach and that some limiting factors may exist such as material/labor availability is questionable, some land acquisition is required, or construction methods are somewhat weather dependant or experimental. High means that impacts are expected to be greater than those anticipated for the permanent pump station implementation. An example of high risk is that the initial cost and potential cost growth exceed the current approach and that some limiting factors exist such as material/labor availability is long lead, major land acquisition is required, or construction methods are weather dependant and/or experimental.

Risk Factor	17th Street	Orleans	London Avenue		
	Proj 11 & 16	Proj 19	Proj. 10 & 19	Proj. 10	Proj 15
Design & Construction					
Cost/Cost Growth	High	High	Moderate	Low	High
Schedule	Moderate	Moderate	Moderate	Low	Moderate
Complexity	High	High	High	Low	High
Real Estate Acquire	Moderate	Moderate	Moderate	Low	Moderate
Environ (NEPA)	Moderate	Moderate	Moderate	High	High
Public Perception	Unknown	Unknown	Unknown	Unknown	Unknown
Operations & Maintenance					
Cost	High	High	High	Low	Moderate
Reliability/Maint.	High	High	High	Low	High
Complexity	Moderate	High	High	Low	Moderate
Security/Vulnerability	Moderate	Moderate	Moderate	Low	Moderate

2.5 Recommendations for Implementation

The only alternative that clearly would provide a positive impact both from a cost standpoint and risk is implementation of project 10. The cost savings are estimated to be approximately $14M and the design/construction duration is less than 1 year, which fits within the current permanent pump station implementation schedule. The only other project that showed promise was project 19 for London Avenue Canal. From a cost standpoint there was a marginal benefit, but the design/construction is expected to take 2 years and there would be substantial additional costs associated with operation of two additional pump stations.

TASK C-2
EXISTING TEMPORARY CANAL CLOSURE REVIEW

3.0 EXISTING TEMPORARY CANAL CLOSURE REVIEW

3.1 Description

Temporary canal closure structures were installed on 17th Street Canal, Orleans Avenue Canal, and London Avenue Canal to serve as an interim protection measure until a permanent solution could be installed. One structure per canal was installed and consists primarily of a gated section, pumping section, and closure supporting structure. These structures are substantially installed and some are operational. Plans used for the bidding process were provided for use in evaluating the structure and it components. Specifications were not provided for use in the evaluation. Visual inspection of the structure was possible only from a distance and factors in only to the extent of confirming features installed.

The substantial investment and the possibility that at least some portions of the structures may be salvaged for use in the permanent solution is the impetus for this evaluation. All information provided will be reviewed to determine suitability and provide recommendations how it can be used in the permanent installation.

3.2 Component Evaluation

The existing structures were evaluated for suitability with respect to applicability and serviceability. This engineering and design evaluation should not be construed as a comprehensive review and is only a high level evaluation to identify potential components that were constructed/installed equal to a permanent installation or can be easily converted to permanent installation quality.

3.2.1 Gates

Type - The needle gates installed in each of the structures are also known as vertical lift gates. These type gates are typically used as hurricane gates that are lowered to protect against tidal storm surges. This type gate is the most economical and should serve well in this application and in a permanent installation. This type gate is suitable for infrequent operation which is expected to be the case for these canals.

Capacity – The capacity of the gates to handle the maximum anticipated flow is checked to ensure that the structure in its present location is adequately sized. The cross-sectional flow areas of the gates are calculated assuming a +1' lake level which is considered the lowest lake condition that will be encountered and is therefore the worst case for the gate. Based on the water velocities in the table below, the capacity is considered adequate to pass the permanent flow capacities for each canal.

Parameter		Canal		
		17 Street	Orleans	London Ave
Low Lake Elevation		+1'	+1'	+1'
Gate Sill Elevation		-10'	-8'	-8'
Water Passage Height		11'	9'	9'
Gate Opening Width		10.25'	10.25'	10.25'
Number of Gates		11	5	13
Water Passage Width		112.75'	51.25'	133.25'
Water Passage Area		1240.25 sf	461.25 sf	1199.25 sf

Parameter		Canal		
		17 Street	Orleans	London Ave
Flowrate		12500 cfs	3390 cfs	8980 cfs
Water Velocity		10.08 ft/sec	7.35 ft/sec	7.49 ft/sec

End Supports – The end support type installed is generally not desirable for long term use under differential head. The structure side of the end supports consists of the flanges of vertical steel members. For many permanent installations, the gate guides are fabricated of concrete with metal embeds for bearing and sealing surfaces. Concrete is more durable for this purpose and would provide a longer term solution. The guide members appear to be adequately sized and are assumed to be sufficient to resist the design storm surge and differential head. The gate side of the end supports consists of a metal-to-metal bearing and sliding surface with a bearing bar. This type of bearing surface is generally used for only emergency gates and does not operate well against a differential head. While all components are relatively new, the gate lifting/lowering system may function adequately against a differential head, but as sliding components wear and corrode, operability under differential head may become an issue. Permanent gates if equipped with wheels or rollers, although also requiring maintenance, will last longer and be a more reliable installation. The fit of the gates within the guides exceeds what would be considered acceptable and has already resulted in a field modification to make more functional. The use of flanges of the vertical steel members as guides did not allow for any adjustment/alignment of the gate while installing. Typically guides are accomplished by leaving blockouts in the structural concrete and though use of embeds and double-nutted anchor bolts, adjusted to the proper fit.

Seals – J seals are used for water seals and are satisfactory for this purpose but not ideal. The J seals are pressure activated and the outboard installation location on the London Avenue and Orleans canal interim closure structure gates will not be as effective.

Material Selection & Corrosion Protection – Some materials used to fabricate the structure are not ideal for the application, but may have been used to satisfy the tight schedule. Corrosion of vertical lift gates is best controlled by application of protective coatings, but is also effectively controlled by proper selection of materials, cathodic protection, and proper design of materials. In cases of ponding water or a structure that has crevices such as that for the interim structures, corrosion protection is vital. The installed materials, although not the first choice are satisfactory for use in a temporary situation, but will prove to increase maintenance or require major repair during the expected life span of 50 years.

- Stainless steel is often used for embeds/wearing surfaces/seal plates/seal bolts and nuts for a permanent structure. There are no special materials for these components on the gates. An example is the needle trough embedded in the diaphragm seal cap. This submerged feature is fabricated of steel but not equipped with cathodic protection and will degrade and have maintenance issue over time. Stainless steel is often used for this feature.
- As used for the interim structures, carbon steel can be used throughout a gate and structure, but the steel type is important to long term durability. Materials of construction of the installed gate and coating system could not be determined. Generally, the gate body should be a welding quality structural steel, either carbon or high-strength low-alloy such as ASTM A36 or A572. A coating system is applied to the gates and the USACE field team verbally indicated it is a marine coating on Orleans and London Avenue and a coal

tar type coating on 17th Street which are acceptable types. Coating types of alkyd enamel, vinyl, and epoxy paint systems are most commonly employed. The conditions the coating was applied under are in question and extent of coverage are vital to the coating system providing protection. Because the coating integrity could not be confirmed visually or through records indicating application was in a controlled environment, the gates are not considered adequately protected by the coating. Note that a coating with holidays will not provide complete protection and can increase localized corrosion rate. With the extent of crevices on the gates and supporting structure, the potential is high that incomplete coating has been achieved. The structure has not been equipped with a passive or active cathodic protection system.

Weldments – The environmental conditions that the structure was welded under and the extent of quality control that was applied is unknown. These factors heavily determine the quality of the weldments and thus the long term functionality. There were no observed deficiencies.

Operating equipment – There are few operating parts with respect to the gates other than the gates themselves and the hoisting mechanisms. The gates, discussed in the paragraphs above, have seals that will wear at an accelerated rate because of the gate misalignment. The gates have a significant amount of lateral movement in all directions that will tend to increase abrasive wear to the seals. The hydraulic hoisting mechanisms appear to be suitable for the application and are of the quality that could be used for a permanent structure. The needle trough is not equipped with a means of clearing the trough of debris before lower the gates. Permanent systems often have a jetting system installed that is used for this purpose.

3.2.2 Pumping Equipment

Pump Type – The hydraulic driven pumps used for the interim control structures are a common pump type for use in this application. Hydraulic pumps were originally developed for use as a portable rental pump but over time have grown in size and acceptance for use as a permanently installed unit. The long term durability is not expected to be as long as the pump types Orleans Parish currently has installed and therefore is questionable if the pumps would be a legitimate long term solution for the pump station.

Pump Materials – The pump supplier MWI was contacted and indicated that materials of construction used for the pumps is not common. Generally the mix of materials was selected to satisfy schedule constraints and not necessarily for long term durability. The mix of materials will accelerate the rate of corrosion and could cause the units to be maintenance intensive.

Pump Capacity - These pumps are generally 250 cfs to 300 cfs in size and are suitable for the low flow conditions at permanent pumps station. The pumps are too small to satisfy the overall capacity requirement because the number of units would be unmanageable both from an installation standpoint and operations/maintenance standpoint.

Discharge and Hydraulic Piping – The piping has some inconsistencies from what would be expected for this installation. The discharge piping for at least 17th Street used spiral welded piping. This type piping should perform acceptably, but seamless would be preferred. The hydraulic piping is generally 3” diameter and utilizes socket weld fittings. This fitting type for 3” line size is unusual but dose not pose any operational or maintenance issues. The field staff indicated that the hydraulic piping wall thickness is sized for the rated pressure of 3500 psi and has little to no extra wall thickness for corrosion. The piping is not coated and could soon begin to reduce to the safety factor and eventually lead to failure. The adequacy of the wall thickness for the discharge piping was not determined but it is not coated and could pose problems as corrosion reduces the wall thickness.

Ancillary Equipment – The interim closure structure has ancillary equipment that supports the system function such as:

- The fuel storage equipment consists of a single wall saddled tank mounted in a concrete containment basin. There appeared to be no issues with the tankage other than the proximity to residential units for 17th Street. The components appear to be satisfactory for use in a permanent installation.
- No issues were identified with the hydraulic units that operate the pumps and the units that operate the gates.
- No issues were identified with the operations room/safe house. It appears to be adequate to serve the purpose for long term use.
- Electrical power is provided to the interim closure via underground ductbanks. The capacity of the power feed was not determined nor its adequacy to support operations.
- Electrical controls for the equipment was primarily provided with and dedicated to the mechanical equipment. This control equipment was sophisticated enough to maintain operation. Within/adjacent to the safe house were microwave towers, cameras and monitoring equipment installed allowing local and remote monitoring and control. This equipment appears to be the quality expected for this application, but the ability of the exterior equipment to sustain operations during a severe storm is unclear.

- The structures are burdened with a significant amount of add-on equipment that was not designed into the unit originally. This equipment consists primarily of added pumps on the service bridge, which is installed in a location and in such a way that long term operation is not recommended. The shear number of pumps and associated equipment will make the interim system difficult to maintain and operate. Additional pumping units are currently being considered for the inlet canal which will further increase the complexity and number of equipment to maintain and operate.

Orientation – The pumps are orientated in the canal perpendicular to the canal flow and have no flow straightening bays. Large pumps such as these are sensitive to flow variations and eddies which affect performance and longevity. Permanent pump stations are designed to protect the pumps with screens, have a designed bay geometry to smooth flow, and provide the proper wall and floor offsets to avoid eddies. The interim pump orientation and arrangement does not satisfy the typical criteria and likely will not produce the anticipated flow or service life expected of a permanent installation.

Support Structures – The structure used to support the pumps are fabricated largely of unprotected steel. Although these structures appear adequate to support the equipment and provide access for maintenance, will corrode over time and could fail to perform the intend function in the future.

Super Structures – A permanent pump station generally has pumps covered or enclosed to extend life, ease maintenance, and make more aesthetically pleasing. Although these pumps are designed to operate outdoors, this operating condition is normally not expected to last for more than a few years at most. Therefore, without covers, the pumps are expected to experience maintenance issues sooner than covered pumps would.

3.2.3 Closure Structure

Sheet Pile Cells/Floodwall Transitions – The sheet pile used for these purposes varies in size/thickness but is not considered a concern. The primary concern is the transitions from the structure to the floodwall. This transition appears to be a weak link in that it uses a variety of shapes together that may not provide the same level of protection confidence as the rest of the floodwall. These transitions may be more prone to failure due to the unusual combination.

Corrosion Protection – Many parts of the structure appears to be uncoated and is subject to corrosion attack. Permanent structures would be primarily concrete which is more capable of resisting corrosion and more suitable for long term use.

3.3 Risk Issues

The risk of using the interim structure and equipment permanently is that many of the components were not intended or designed for permanent use in this application and may fail prematurely, will require substantial maintenance, or cause difficulties in operation. Considering the challenges identified in this report, as the system ages and the difficulties grow worse, the system could easily drift into disrepair and not be ready for use at the time it is called to work. A system like this is completely tested only when a storm event imposes the combination of flows, loads, and environmental conditions that challenge all aspects of the system simultaneously. The risk is that the system, although externally may appear to be adequate and it may pass some individual testing, may not function properly. Adding to the risk is the multiple additions of equipment for increased flow capacity that will make the system more complex than is prudent and will exacerbate the maintenance and operability problems expected in the future.

3.4 Recommendations

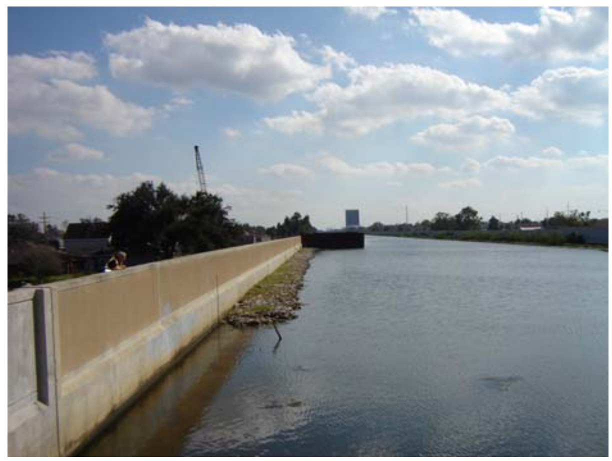
The use of the interim structures as a whole is not recommended due to the concerns about operability and maintainability. Use of some components of the interim closure system in a new more permanent structure is possible. The electrical system (generator sets), controls, safe house, and fuel storage system are all adequate for reuse. The pumps have potential for reuse as the small/intermediate pumps for dry and normal rainfall flows in a permanent pump station. The gates have some potential for reuse, but modification of the existing gates for use as permanent gates may not be cost effective. The overall structure appears to be adequate for its purpose but modification to address corrosion would have to be implemented.

TASK C-3
CONCRETE LINED CANAL SECTION ANALYSIS

4.0 CONCRETE LINED CANAL SECTION ANALYSIS

4.1 Description

The lined canal section alternative is an extension of a concept presented in the Phase 1 B&V report titled "Conceptual Design Report for Permanent Flood Gates and Pump Stations" dated July 31, 2006. In the Phase 1 report, concrete lining the canal was presented as an Option 2 requirement because the depth of the canal and the stability of the soil did not allow use of an earthen bank similar to the one currently employed due to real estate concerns. The canal lining was therefore primarily a means for the degraded canal to remain within the confines of the existing Right-of-Way. The lined section that is being considered in this analysis is basically the same canal lining except with the walls extended to the elevation of the top of the existing floodwalls. Configured this way, the canal lining serves as a single and complete method to satisfy the parallel protection required. Figure 1 – Canal Liner Box Concept included in Appendix C provide details of the construction methods and sequence that would be utilized. A second concept that was also considered included a canal lining along the contour of the canal and the existing floodwalls replaced with pile supported floodwalls. Figure 2 – Canal Liner Contour Concept included in Appendix C provide details of the construction methods and sequence that would be utilized. This contour method is a variation of Alternative 1 in the Post-Authorization Change Report (PACR) for New Orleans Area Hurricane Protection System. Alternative 1 is paragraph 4.1.1.4.1 titled Restoration of parallel protection along 17th Street, Orleans Avenue, and London Avenue Canals. These details serve as the basis for costing that will ultimately be compared against each other and with other permanent solutions to determine if this is a feasible solution from a cost standpoint.



4.2 Estimated Costs

4.2.1 Cost Basis

To qualify as a single and complete method to stabilize and secure the parallel protection, the approach must be designed to accommodate the highest water level expected and not rely on other system components to protect the surrounding neighborhoods from a storm surge. For the purposes of this analysis, the top of new floodwall will be equal to the existing floodwall top height of +14' NAVD88. Note that satisfying the parallel protection requirements for a storm surge and providing the means to keep the surrounding community from flooding during a storm rainfall event, although complimentary, are two different requirements. The parallel protection is a barrier between the surrounding community and Lake Pontchartrain that holds the lake back. In this case it also serves as a conduit for the pump station discharge water to exit the area. A complete drainage and protection solution for the area also includes other components such as new and/or modified pump stations. The scope of this analysis is to derive Rough-Order-of-Magnitude (ROM) costs for the parallel protection component only. Evaluation of inclusion of this concept into the overall solution will require it to be combined with pump station costs to arrive at a total solution cost which is outside the scope of this task. Costs for real estate acquisition, fronting protection at pump stations, and bridge floodproofing will be obtained from other sources.

The Canal Liner Box Concept illustrated in Figure 1 is a reinforced box culvert constructed in place via a multi-step construction sequence that allows the canal to remain in service throughout the implementation process. This concept involves the following sequence:

- Construct sheet pile box for wall installation. Sheet pile box will be enclosed on all sides serving as a cofferdam inside the canal to allow excavation and construction work inside the box and the canal to stay in service outside the box. Sheet pile on outboard wall will be reinforced with H piles and whalers to resist soil load from canal wall.
- Excavate soil from within cofferdam. Dispose of in local landfill – assume limited quantity is contaminated.
- Install reinforcing bar, forms, and pour concrete for footing and wall. Outboard sheet pile will serve as the form for the bottom part of the wall. Bond breaker will be applied to allow sheet pile removal.
- Install reinforcing bar, forms, and pour concrete for buttress inside cofferdam. Extend reinforcing bar to sheet pile wall for tie-in to tremie slab.
- Remove sheet pile box except outboard portion and move to next location for reuse. Outboard box will resist soil loading until box construction is complete.
- In the wet, excavate area between the two sheet pile boxes and prepare canal bottom for tremie concrete installation. Dispose of excavated material in local landfill.
- Tremie in concrete for liner floor. Finished floor elevation to be same as original canal floor elevation. Note that this is not a structural floor and will contain relief holes to equalize water pressure, so no differential pressure loading will be imparted to the floor.
- Dismantle outboard sheet pile wall and move to next location for reuse
- Demolish existing floodwalls

The Canal Liner Contour Concept illustrated in Figure 2 is a reinforced floodwall connected to a liner contoured to the bottom of the existing canal via a multi-step construction sequence that allows the canal to remain in service throughout the implementation process.

- Construct temporary sheet pile wall for floodwall installation. Temporary sheet pile wall will isolate section of existing floodwall serving as the temporary floodwall to allow excavation and construction work in area, allowing the canal to stay in service. Temporary sheet pile wall will be tied into floodwalls on both ends to maintain the integrity of the parallel protection system.
- Demolish existing floodwalls and excavate soil for the floodwall footing. Dispose of in local landfill – assume limited quantity is contaminated.
- Install battered piles and sheet pile cut-off wall beneath floodwall footing
- Install reinforcing bar, forms, and pour concrete for floodwall and footing
- Dismantle temporary sheet pile wall and move to next location for reuse
- Install temporary (breachable dams) at each end of area of work. Also install dry weather pump around work area to maintain canal flows. These dams will allow excavation and installation of canal bottom liner to be installed in the dry. Should a storm event occur,

the dams will be breached until the storm event has passed and the breachable dam restored, area pumped dry, and work resumed.

- Finished floor elevation to be same as original canal floor elevation. Note that this is not a structural floor and will contain relief holes to equalize water pressure, so no differential pressure loading will be imparted to the floor.

4.2.2 Cost Analysis

Lining Cost Estimates

Based on the cost basis indicated above and the markup factors below, the estimated costs for each of the two concepts were generated. See Appendix A for cost element detail.

- 15% for Design
- 5% for Subcontractor Margin
- 1% for Bond
- 20% for Construction Contingency
- Midpoint of Construction is Sept 2009
- 6% for Annual Escalation Rate

ROM Cost Estimate 4.2.2.1

Canal	Canal Length	Box Total Cost	Contour Total Cost
17th Street	13,500 ft	$170,602,707	$225,197,382
Orleans	11,100 ft	$95,008,632	Not Estimated
London Avenue	14,835 ft	$133,507,453	Not Estimated

Validation

Comparison of the estimated costs for similar features from this and previous reports will first be performed to validate the estimate. To do this, the costs generated for the Contour Concept in this report will be compared to the canal features presented in the PACR. The components in the two estimates are essentially the same with the exception of the canal lining. When the lining cost is removed from the Contour Concept, the remaining cost is only floodwall related cost. As can be seen in Table 4.2.2, the costs compare favorably with the floodwall cost in the PACR for the canals. Therefore, based on this comparison, it is reasonable to assume that the criteria and costing methods for the two estimates are similar and the numbers can be used interchangeably.

Validation Table 4.2.2.2

Item	Contour Concept (Note 1) 17th Street Floodwall Cost	Post Authorization (Note 2) 17th Street Floodwall Cost
Total Cost	$225,197,382	$189,000,000
Delete Contour Lining	$27,932,008	$0
Comparison Cost	$197,265,374	$189,000,000
% Difference	4.2%	

Note 1 – Items 8, 9, and 10 only from Contour Cost Estimate in Appendix A
Note 2 – 17th Street Canal Feature Cost from Table 1 of the PACR

Parallel Protection Costs
Parallel protection costs will only be developed using the Canal Liner Box Concept because it was the least cost of the two concepts. The Canal Liner Contour Concept was developed primarily for comparison purposes and is no longer needed. To get an accurate understanding of the implementation cost of the Canal Liner Box Concept alternative will involve combining cost elements from this document and the PACR. The cost estimates for the box lining is only one part of the elements that make up the total parallel protection solution. As can be seen in Table 1 of Alternative 1 (paragraph 4.1.1.4.1) in the PACR, restoring parallel protection for these canals includes several cost elements including:

- Replace Floodwalls
- Fronting Protection at DPS3 and DPS7
- Floodproof Robert E. Lee Boulevard Bridge over London Avenue Canal
- Real Estate Acquisitions

Therefore, the total parallel protection solution cost is a combination of cost elements from the PACR and this Phase 2 report and is presented in the table below.

Parallel Protection Solution Cost 4.2.2.3

Item	Cost ($)	Origin	Notes
17th Street Canal	170,602,707	Table 4.2.2.1	
Orleans Canal	95,008,632	Table 4.2.2.1	
London Avenue Canal	133,507,453	Table 4.2.2.1	
Fronting Protection @ DPS3 & DPS7	24,000,000	PACR	
Floodproof Robert E. Lee Boulevard Bridge	5,000,000	PACR	
Real Estate Acquisition	150,000,000	PACR	1
Total (rounded)	578,000,000		2

Note 1 – because the construction features are entirely within the canal, the real estate costs should be conservative. Substantial temporary easements will be required for construction equipment access and material delivery outside the floodwalls but the extent of real estate required is undetermined at this time.
Note 2 - this addresses only parallel protection and does provide for water removal from drainage areas.

4.3 Risk Issues

The risk associated with this approach is presented in the following table. The risk factors are based on a three tier system (low, moderate, high). Low risk generally means that minimal negative impacts are expected. Moderate risk means that impacts are possible but are expected to be equal to the permanent pump station implementation. High risk means that impacts are expected to be greater than those anticipated for the permanent pump station implementation.

Risk Evaluation 4.3.1

Risk Factor	Risk Rating	Remarks
Design & Construction		
Cost/Cost Growth	Moderate	Materials of construction ands skills of labor pool are normally not difficult to obtain but with the volume of work in the area, increases risk.

Risk Factor	Risk Rating	Remarks
Schedule	Moderate	Highly weather dependant construction but can be staged somewhat to occur during dry season.
Complexity	Low	Construction techniques and equipment are tried and true and should be little chance of unknowns.
Real Estate Acquisition	High	Somewhat undefined at this point, but judging from the PACR, is expected to be a problem.
Environmental (NEPA)	Low	Low profile, no noise generation, and within confines of existing structures. Possibility of hazardous waste disposal concerns.
Public Perception	Low	No more intrusive than current arrangement, but construction activities will be source of concern.
Operations & Maintenance		
Cost	Low	Virtually no cost here, very similar to existing system.
Reliability	Low	High reliability with no moving parts and materials of construction known to last decades.
Complexity	Low	Simplest form of parallel protection available.
Security/Vulnerability	Low	Unmanned with no separation means from the public, the construction is rugged and built to stand normal vandalism but not extreme terrorist threat.

4.4 Recommendations

This type of parallel protection has served the canals and the Orleans parish for many years and when installed correctly is highly reliable. Note the Katrina failure cause of the parallel protection on the three canals is not inherent to this proposed design. When constructed and maintained in good condition, it is an effective form of protection and should be considered a legitimate alternative. The real estate acquisition requirements are key to the feasibility of this alternative. It is unclear without further study to determine the true extent of real estate acquisition and the difficulties this may present. In addition, after real estate issues are resolved, this alternative must be evaluated as part of the overall drainage solution to determine if it is cost effective. To implement this lining alternative into the overall drainage solution, modifications to existing pump stations may also be required to meet drainage flow rate requirements.

Further study is recommended to resolve the following issues:

- Further refine real estate needs/cost for access along length of the canals for material laydown, batch plant, deliveries, construction equipment working space, etc. The use of the PACR real estate estimate should be conservative because the affected area is very similar to that for the Canal Liner Box Concept, but would be confirmed by additional study. Then based on real estate needs, determine the approximate cost and time required to secure.
- Evaluate modifications needed at existing pump stations to meet area drainage requirements and discharge into the canals at the anticipated high water level. Obtaining

the DPS capacity and head requirements would be required information prior to evaluating the modifications required.

Appendix A

CANAL LINING COST ESTIMATE

Black & Veatch

Project Name: New Orleans Canal Improvements — 14-Nov-06

ROM Cost Evaluation — G. Hicks

Project No. / Phase No.: 041669.03.10

Location: New Orleans, Louisiana

Summary ROM Cost Assessment for :

CANAL LINER "BOX" & CANAL LINER "CONTOUR" CONCEPTS

Item	LENGTH OF CANAL LF	ESTIMATED COSTS "BOX" TOTAL COST (See Note 1.)	"CONTOUR" TOTAL COST	"BOX" COST / L.F.	"CONTOUR" COST / L.F.	"BOX" ROM COST / L.F.	"CONTOUR" ROM COST / L.F.
a. 17 th Street	13500	$ 170,602,707	$ 225,197,382	$ 12,637	$ 16,681	$ 12,640	$ 16,680
b Orleans Avenue	11100	$ 95,008,632	X	$ 8,559	X	$ 8,600	X
c. London Avenue	14835	$ 133,507,453	X	$ 8,999	X	$ 9,000	X

NOTES:

1. Costs are "Costs to Owner", including overhead and profits .
2. Costs do not incl mob-demob costs
3. Costs are extrapolated from MEANS 2004 and adjusted to 2006 dollars or extracted from current B&V in-house Projects. Costs then escalated from Jan2007 by percent shown to Sept2009 mid-point date of construction. construction. Estimate allows for a 6% escalation, compounded annually for a 2.75 year period (33 months).
4. No cost adjustments made for tax on materials.
5. "X" denotes costs of "CONTOUR" concept for Orleans Ave and London Ave NOT developed.

Black & Veatch

Project Name: New Orleans Canal Improvements — 14-Nov-06

ROM Cost Evaluation — G. Hicks

Project No. / Phase No.: 041669.03.10

Location: New Orleans, Louisiana

Quantity Assessment of Work Items for :

17th STREET CANAL LINER BOX CONCEPT

ROM

Estimated Total Cost Comparative Summary:

Estmated length of Canal = 13500 LF

Item	UNIT	Est Cost / Unit (See Note 1.)	Quantities ALT 1	Quantities	Costs ALT 1	Costs
1. Install Sheet Pile Box w/ H-Piles (W/B & E/B)						
Purchase Sheet Pile Box PZ 27 Type Sheet Piles	TON	$ 925.00	275		$ 253,927.30	
Delivery of sheetpiles	LB	$ 0.03	549032		$ 16,470.96	
Purchase HP14 Piles	TON	$ 1,450.00	18.25		$ 26,462.50	
Delivery of sheetpiles	LB	$ 0.03	36500		$ 1,095.00	
Installation of Sheet Piles in Leap-Frog procedure (excludes material costs)	HRS	$ 575.00	15000		$ 8,625,000.00	
Removal of Sheet Piles in Leap-Frog procedure (excludes material costs)	HRS	$ 388.00	10210		$ 3,961,480.00	
Install H-Piles installed in Leap-Frog procedure for rigidity (use HP14x73 x 50-ft)	VLF	$ 8.51	67500		$ 574,425.00	
2. Excavate within Sheet Pile Box (W/B & E/B)						
Excavate soil within Sheet pile Box	CY	$ 7.50	304000		$ 2,280,000	
Flowable Fill "Mud Slab" at bottom of excavation	CY	$ 80.00	16000		$ 1,280,000	
3. Concrete Liner Wall (W/B) - (form & pour) (W/B & E/B)						
Concrete Formwork (material only, reusable; Floodside of Wall only)	SF	$ 1.00	3200		$ 3,200	
Install Stl framed Plywood Wall Formwork in Leap-Frog procedure, Floodside face; excl material	SF	$ 4.50	432000		$ 1,944,000	
Install Temporary bracing / whalers / shoring on Protected Side	LS	$ 50,000.00	1		$ 50,000	
Reinforcing Steel, #8<, detailed, milled,delivered, in-place	TON	$ 3,650.00	7850		$ 28,654,213	
Concrete in Footing / Buttress, 4000 psi ready-mix (incl material, tremie placement)	CY	$ 90.00	43350		$ 3,901,500	
Concrete Finishing of Footing, screed	SF	$ 0.35	378000		$ 132,300	
Concrete in Stem Wall, 4000psi ready mix, (incl material, pump placement)	CY	$ 100.00	64000		$ 6,400,000	
Finish of Walls, break ties and patch voids	SF	$ 0.75	900000		$ 675,000	
Install Aggregate Base (Assumed None Required)	CY	$ 16.75	-		-	
4. Concrete Buttresses (W/B & E/B)						
Quantities for concrete / formwork / rebar incl in Item 3 above.	-	-	-	-	-	
5. Earthwork (OUTSIDE of Sheet Pile Box); along length of Canal						
Dredge Canal (to bottom of Tremie Conc Floor slab)	CY	$ 10.00	473500		$ 4,735,000	
Excavate / Remove tops of Existing Levees; dozer / front end loader	CY	$ 2.50	190000		$ 475,000	
6. Tremie Concrete Floor						
Install Tremie Concrete Floor (at bottom of Canal; full width btwn Box Wall Fdns)	CY	$ 90.00	204000		$ 18,360,000	
7. Demolition and Disposal of Existing I-Walls						
Estimated volume of exist I-Wall for demolition	CY	$ 150.00	24000		$ 3,600,000	
Hauling of I-Wall debris, assume 1-way haul =10 miles, as waste-landfill	LCY	$ 19.00	31200		$ 592,800	

Project Name: **New Orleans Canal Improvements**

Estimated Total Cost Comparative Summary for:

17th STREET CANAL LINER BOX CONCEPT

Item	UNIT	Est Cost / Unit (See Note 1.)	Quantities ALT 1	Quantities	Costs ALT 1	Costs
		Estmated length of Canal =			13500	LF
8. Disposal of Excavated Materials						
Contaminated Excavation to Landfill,used for daily cover no fees, 1-way haul = 25 miles	CY	$ 30.00	96750		$ 2,902,500	
Contaminated Excavation for local re-use, 1-way haul = 5 miles	CY	$ 9.50	193500		$ 1,838,250	
Excavated Material for re-use as on-site fill, spread and compact	CY	$ 5.25	290250		$ 1,523,813	
Excavated Material to waste locally, no tip fees, 1-way haul = 5 miles	CY	$ 8.50	387000		$ 3,289,500	

	ALT 1	
Subtotals	$ 96,109,436	$ -
add 15% for Design contingency	$ 19,221,887	$ -
add 5% for margin for subcontractors	$ 4,805,472	$ -
add 1% for Bond Costs	$ 961,094	$ -
	$ 121,097,890	$ -
add 20% for Construction contingency	$ 24,219,578	$ -
Estimated Total Cost (2006) =	$ 145,317,468	$ -
Percent Escalation to Mid-Point of Const =	17.40%	
Escalation Cost =	25,285,239	
Est Total Cost to Mid-point of Const (01/ 2009) =	$ 170,602,707	
ESTIMATED COST PER L.F. =	$ 12,637	$ -
ROM COST PER L.F. =	$ 12,640	$ -

NOTES:

1. Costs are "Costs to Owner", including overhead and profits .
2. Costs do not incl mob-demob costs
3. Costs are extrapolated from MEANS 2004 and adjusted to 2006 dollars or extracted from current B&V in-house Projects. Costs then escalated from Jan2007 by percent shown to Sept2009 mid-point date of construction. construction. Estimate allows for a 6% escalation, compounded annually for a 2.75 year period (33 months).
4. No cost adjustments made for tax on materials.

Black & Veatch

Project Name: **New Orleans Canal Improvements** — 14-Nov-06

ROM Cost Evaluation — G. Hicks

Project No. / Phase No.: **041669.03.10**

Location: **New Orleans, Louisiana**

Quantity Assessment of Work Items for :

17th STREET CANAL LINER BOX CONCEPT

ROM

Item No.	Description

1. Install Sheet Pile Box w/ H-Piles (W/B & E/B)

1 Unit Length of Temporary Sheet Pile Wall for use and end cut-offs

Length of Box (ft)		Width of Box (ft.)		Length of Canal (ft)	
100	LF	16	LF	13500	LF

2 Assume PZ 27 Type Sheet Piles

Height of Box VLF	LF along Length s LF	LF along Widths LF	AREA OF WALL SF	Sheet Pile PSF	TOTAL WT OF PILE TONS
40.0	200.0	32.0	9280	27	125
					125

3 Allowance for (2)- Sheet Pile Boxes for Leap-frog Construction — x 2 = **250**

4 Percentage allowance for loss due to diagonal anchors / misc.
(say 675 anch x 2 x 1.50 LF/Shtpile = 2025 HLF loss / 27000 x 100 = 7.5 % (Say 10% loss)

25	Extra allowance
275	Total Sheet Pile

6 Delivery of SheetPiles

Cost per LB	No. of LBS	Cost of Delivery
0.03	549032	$ 16,471

7 Installation of Sheet Piles (excludes material costs)
(allows for installation of approx (3) 40-ft sheets per hr)
3 x 40 x 41.25 PLF/2000 = 2.48 tons per hr.

Tons of Sheet Pile	Productivity (Tons / Hr)	No. Hrs Placement for (1) Sheet Pile Box	No. of Placements along reach of Wall	Total Hrs Placement Sheet Pile Box for Proj
275	2.48	110.6919355	135	14943.41129
			SAY	15000

8 Removal of Sheet Piles (excludes material costs)
(allows for removal of approx (4) 40-ft sheets per hr)
4 x 40 x 41.25 PLF/2000 = 3.30 tons per hr.

Tons of Sheet Pile	Productivity (Tons / Hr)	No. Hrs Removal for (1) Sheet Pile Box	No. of Box removal Sht Pile along reach of Wall	Total Hrs Removal of Sheet Pile Box for Proj
275	3.3	83.18666667	135	11230.2
			SAY	10210

9 Install H-Piles for rigidity (use HP14x73 x 50-ft)

AREA	H-Piles Spacing (ft)	Length of Box (ft)	Est Length of H-Piles VLF	Total Length of H-Piles/Box (VLF)	No. of Placements along reach of Wall	Total VLF of H-Pile Driven	Wt per LF of H-Pile LB	Total Tons of H-Piles
1	10	100	50.0	500	135	67500	73.0	18.25
				500		67500		18.25

2. Excavate within Sheet Pile Box (W/B & E/B)

1 Unit Length of Canal

Length of Canal (ft)	
13500	LF

2 Excavate soil within Sheet pile Box

AREA	Length of Canal (ft)	No. of Canal Sides (ea)	Exc Width (ft)	Exc Depth (ft)	VOL CY	
1	13500.0	2	16	19	304000	
					304000	EXCAV.

3 Mud Slab at bottom of excavation

AREA	Length of Canal (ft)	No. of Canal Sides (ea)	Width (ft)	Depth (ft)	VOL CY	
	13500.0	2	16	1	16000	
					16000	CY Mud Slab

3. Concrete Liner Wall (W/B) - (form & pour) (W/B & E/B)

1 Unit Length of Canal
(note: length of wall shown is nominal to allow for determination of cost / LF of wall section)

Length of Canal (ft)	Length of Reusable Formwork (ft)
13500	100

2 Concrete Formwork (Floodside of Wall only) (W/B & E/B)

	Footing / Buttress				Stem Wall				
	Reusable Length (ft)	Height of Footing (ft)	Width of Ftg. (ft)	**Area of Footing Formwork (SF)**	Hght of Wall F / S (ft)	Length of Wall (ft)		Area Reusable Wall Formwork (SF)	Area Formwork Installed (SF)
Wall / Ftgs	100	3	14	684	32	100.00		3200	432000
Buttress				376					
				1060				3200	432000

3 Assumed Sheetpile at Protectect Side of Wall to be use as formwork
(Assume PZ27 sheet piles);
Note: LF of Sheet Pile required is part of Item 1.3 above. Estimate assumes reuse of sheetpile)

Project Name: **New Orleans Canal Improvements**

Quantity Assessment of Work Items for :

3. Concrete Liner Wall (W/B) - (form & pour) (W/B & E/B) (Con't)

4 Cast-in-place Concrete (allows for both W/B & E/B)

	Footing / Buttress				Stem Wall					
Install Concrete Base Ftg and Wall	Height (ft)	Width (ft)	Length of Canal x 2 (ft)	**Total Ftg Vol (cy)**	Hght of Wall F / S (ft)	Width -top (ft)	Reach (Ft)	Vol Stem (cy)	No. of Stems EA	**TOTAL Stem Vol (cy)**
Wall / Ftg	3	14	27000	42000	32	2	13500	32000	2	64000
Buttress (at 20-ft spa. along length, BOTH SIDES ; say 1 CY per buttress)				**1350**						
				43350						**64000**

5 Concrete Reinforcement (allows for both W/B & E/B)

	Vol of Conc (Cy)	Vol of Concrete (CF)	Est. Wt. of Rebar (LBS/CF)	Total Wt of rebar (TONS)
FTG	43350	1170450.0	4.5	2634
Buttress	1350	36450.0	5.0	91
Stem Wall	64000	1728000.0	5.5	4752

	7477	Tons
add 5% allowance for lap and splices	**374**	Tons
	7850	Tons
SAY	**7850**	**Tons**

	Ftg / Walls	Buttresses	Totals	
6 Finish of footing surface, screed (allows for both W/B & E/B)	**378000**	**x**	**378000**	SF
Finish of Walls, break ties and patch voids (allows for both W/B & E/B)	**864000**	**36000**	**900000**	SF

7 Install Temporary bracing / whalers / shoring on Protected Side of new Concrete Wall sheetpile formwork — 1 LS

4. Concrete Buttresses (W/B & E/B)

1 Assume wall bracing with butresses at 20-ft o.c. along full length of wall.

2 quantities for concrete / formwork / reboar incl in Item 3 above.

5. Earthwork (OUTSIDE of Sheet Pile Box); along length of Canal

Addt'l Channel Excavation (Assume Dredging Excavation)

1 Unit Length of Canal — Length of Canal (ft): 13500 **LF**

2 Dredge Canal (to bottom of Tremie Conc Floor slab)

AREA	Length of Canal (ft)	Exc Width (ft)	Exc Depth (ft)	VOL CY	
1	13500.0	44	16	176000	
2	13500.0	30	2.5	37500	
3	13500.0	18	3	22500	
4	13500.0	50	19	237500	
				473500	**CHANNEL EXCAV.**

Excavate / Remove tops of Existing Levees (assume dozer / front end loader, 50' haul with loading)

1 Unit Length of Canal — Length of Canal (ft): 13500 **LF**

2 Determine volume of excavation removal required of levee caps each side of Canal (Spread & Compact following removal of sheetpile)

AREA	Length of Canal (ft)	Exc Width (ft)	Exc Depth (ft)	VOL CY	
E/B	13500	60	3	90000	
W/B	13500	50	4	100000	
				190000	**LEVEE EXCAV.**

6. Tremie Concrete Floor

1 Determine volume of Tremie Concrete required at bottom of Canal

AREA	Length of Canal (ft)	Width (ft)	Depth (ft)	VOL CY	
	13500	136	3	204000	
				204000	**TREMIE CONCRETE**

ROM

7. Demolition and Disposal of Existing I-Walls

I-Wall Demolition (Assume Dozer / Front End Loader / Hyd Backhoe type equipment)

1 Unit Length of Canal — Length of Canal (ft): 13500 **LF**

2 Estimated volume of exist I-Wall for demolition (along each side of Canal)

I-Wall No.	Length of Canal (ft)	Width (ft)	Depth (ft)	VOL CY	
E/B	13500.0	2.0	12	12000	
W/B	13500.0	2.0	12	12000	
				24000	**I-Wall Demo**
			1.3 Bulk	**7200**	
			TOTAL	**31200**	**LCY Hauling**

8. Disposal of Excavated Materials

	Percent for Disposal	Canal Excacation CY	Inside Liner Box Exc CY	Tops Levee Exc CY	TOTAL EXC. CY	VOL CY
1 Contaminated Excavation to Landfill, incl tip fees, 1-way haul = 25 miles	**10%**	473500	304000	190000	967500	**96750**
(allow 100 lbs/ cf = 1.35 tons / cy x $100 / ton tip fee =$135 + $20 / Cy Haul)						
2 Contaminated Excavation for local re-use, 1-way haul = 5 miles	**20%**	473500	304000	190000	967500	**193500**
3 Excavated Material for re-use as on-site fill, spread and compact	**30%**	473500	304000	190000	967500	**290250**
4 Excavated Material to waste locally, 1-way haul = 5 miles	**40%**	473500	304000	190000	967500	**387000**

Black & Veatch

Project Name: New Orleans Canal Improvements — 14-Nov-06

ROM Cost Evaluation — G. Hicks

Project No. / Phase No.: 041669.03.10

Location: New Orleans, Louisiana

Quantity Assessment of Work Items for :

ORLEANS AVENUE CANAL LINER BOX CONCEPT

ROM

Estimated Total Cost Comparative Summary:

Estmated length of Canal =	11100	LF

Item	UNIT	Est Cost / Unit (See Note 1.)	Quantities ALT 1	Quantities	Costs ALT 1	Costs
1. Install Sheet Pile Box w/ H-Piles (W/B & E/B)						
Purchase Sheet Pile Box PZ 27 Type Sheet Piles	TON	$ 925.00	206		$ 190,191.10	
Delivery of sheetpiles	LB	$ 0.03	411224		$ 12,336.72	
Purchase HP14 Piles	TON	$ 1,450.00	18.25		$ 26,462.50	
Delivery of sheetpiles	LB	$ 0.03	36500		$ 1,095.00	
Installation of Sheet Piles in Leap-Frog procedure (excludes material costs)	HRS	$ 575.00	9200		$ 5,290,000.00	
Removal of Sheet Piles in Leap-Frog procedure (excludes material costs)	HRS	$ 388.00	5600		$ 2,172,800.00	
Install H-Piles installed in Leap-Frog procedure for rigidity (use HP14x73 x 50-ft)	VLF	$ 8.51	55500		$ 472,305.00	
2. Excavate with Sheet Pile Box (W/B & E/B)						
Excavate soil within Sheet pile Box	CY	$ 7.50	105244		$ 789,333	
Flowable Fill "Mud Slab" at bottom of excavation	CY	$ 80.00	13156		$ 1,052,444	
3. Concrete Liner Wall (W/B) - (form & pour) (W/B & E/B)						
Concrete Formwork (material only, reusable; Floodside of Wall only)	SF	$ 1.00	2300		$ 2,300	
Install Stl framed Plywood Wall Formwork in Leap-Frog procedure, Floodside face; excl material	SF	$ 4.50	255300		$ 1,148,850	
Install Temporary bracing / whalers / shoring on Protected Side	LS	$ 42,000.00	1		$ 42,000	
Reinforcing Steel, #8<, detailed, milled,delivered, in-place	TON	$ 3,650.00	5300		$ 19,345,000	
Concrete in Footing / Buttress, 4000 psi ready-mix (incl material, tremie placement)	CY	$ 90.00	35643		$ 3,207,900	
Concrete Finishing of Footing, screed	SF	$ 0.35	310800		$ 108,780	
Concrete in Stem Wall, 4000psi ready mix, (incl material, pump placement)	CY	$ 100.00	37822		$ 3,782,222	
Finish of Walls, break ties and patch voids	SF	$ 0.75	291300		$ 218,475	
Install Aggregate Base (Assumed None Required)	CY	$ 16.75	-		-	
4. Concrete Buttresses (W/B & E/B)						
quantities for concrete / formwork / rebar incl in Item 3 above.	-	-	-	-	-	
5. Earthwork (OUTSIDE of Sheet Pile Box); along length of Canal						
Dredge Canal (to bottom of Tremie Conc Floor slab)	CY	$ 10.00	41728		$ 417,278	
Excavate / Remove tops of Existing Levees; dozer / front end loader	CY	$ 2.50	174722		$ 436,806	
6. Tremie Concrete Floor						
Install Tremie Concrete Floor (at bottom of Canal; full width btwn Box Wall Fdns)	CY	$ 90.00	75233		$ 6,771,000	
7. Demolition and Disposal of Existing I-Walls						
Estimated volume of exist I-Wall for demolition	CY	$ 150.00	27750		$ 4,162,500	
Hauling of I-Wall debris, assume 1-way haul =10 miles, as waste-landfill	LCY	$ 19.00	36075		$ 685,425	

Project Name: New Orleans Canal Improvements

Estimated Total Cost Comparative Summary for:

ORLEANS AVENUE CANAL LINER BOX CONCEPT

Item	UNIT	Est Cost / Unit (See Note 1.)	Quantities ALT 1	Quantities	Costs ALT 1	Costs
Estmated length of Canal =					11100	LF
8. Disposal of Excavated Materials						
Contaminated Excavation to Landfill,used for daily cover no fees, 1-way haul = 25 miles	CY	$ 30.00	32169		$ 965,083	
Contaminated Excavation for local re-use, 1-way haul = 5 miles	CY	$ 9.50	64339		$ 611,219	
Excavated Material for re-use as on-site fill, spread and compact	CY	$ 5.25	96508		$ 506,669	
Excavated Material to waste locally, no tip fees, 1-way haul = 5 miles	CY	$ 8.50	128678		$ 1,093,761	

	ALT 1	
Subtotals	$ 53,523,336	$ -
add 15% for Design contingency	$ 10,704,667	$ -
add 5% for margin for subcontractors	$ 2,676,167	$ -
add 1% for Bond Costs	$ 535,233	$ -
	$ 67,439,404	$ -
add 20% for Construction contingency	$ 13,487,881	$ -
Estimated Total Cost (2006) =	$ 80,927,284	$ -
Percent Escalation to Mid-Point of Const =	17.40%	
Escalation Cost =	14,081,347	
Est Total Cost to Mid-point of Const (01/ 2009) =	$ 95,008,632	
ESTIMATED COST PER L.F. =	$ 8,559	$ -
ROM COST PER L.F. =	$ 8,600	$ -

NOTES:

1. **Costs are "Costs to Owner", including overhead and profits .**
2. **Costs do not incl mob-demob costs**
3. **Costs are extrapolated from MEANS 2004 and adjusted to 2006 dollars or extracted from current B&V in-house Projects. Costs then escalated from Jan2007 by percent shown to Sept2009 mid-point date of construction. construction. Estimate allows for a 6% escalation, compounded annually for a 2.75 year period (33 months).**
4. **No cost adjustments made for tax on materials.**

Black & Veatch

Project Name:	**New Orleans Canal Improvements**	**14-Nov-06**
ROM Cost Evaluation		**G. Hicks**
Project No. / Phase No.:	**041669.03.10**	
Location:	**New Orleans, Louisiana**	**Page 1 of 3**

Quantity Assessment of Work Items for :

ORLEANS AVENUE CANAL LINER BOX CONCEPT

ROM

Item No. **Description**

1. Install Sheet Pile Box w/ H-Piles (W/B & E/B)

1 Unit Length of Temporary Sheet Pile Wall for use and end cut-offs

Length of Box (ft)		Width of Box (ft.)		Length of Canal (ft)	
100	LF	16	LF	11100	LF

2 Assume PZ 27 Type Sheet Piles

Height of Box VLF	LF along Length s LF	LF along Widths LF	AREA OF WALL SF	Sheet Pile PSF	TOTAL WT OF PILE TONS	
30.0	200.0	32.0	6960	27	94	
					94	
				x 2 =	187	
					19	Extra allowance
					206	Total Sheet Pile

3 Allowance for (2)- Sheet Pile Boxes for Leap-frog Construction

4 Percentage allowance for loss due to diagonal anchors / misc.
(say 675 anch x 2 x 1.50 LF/Shtpile = 2025 HLF loss / 27000 x 100 = 7.5 % (Say 10% loss)

6 Delivery of SheetPiles

Cost per LB	No. of LBS	Cost of Delivery
0.03	411224	$ 12,337

7 Installation of Sheet Piles (excludes material costs)
(allows for installation of approx (3) 40-ft sheets per hr)
3 x 40 x 41.25 PLF/2000 = 2.48 tons per hr.

Tons of Sheet Pile	Productivity (Tons / Hr)	No. Hrs Placement for (1) Sheet Pile Box	No. of Placements along reach of Wall	Total Hrs Placement Sheet Pile Box for Proj
206	2.48	82.90806452	111	9202.795161
			SAY	9200

8 Removal of Sheet Piles (excludes material costs)
(allows for removal of approx (6) 30-ft sheets per hr)
6 x 30 x 41.25 PLF/2000 = 3.71 tons per hr.

Tons of Sheet Pile	Productivity (Tons / Hr)	No. Hrs Removal for (1) Sheet Pile Box	No. of Box removal Sht Pile along reach of Wall	Total Hrs Removal of Sheet Pile Box for Proj
206	3.71	55.42102426	111	6151.733693
			SAY	5600

9 Install H-Piles for rigidity (use HP14x73 x 50-ft)

AREA	H-Piles Spacing (ft)	Length of Box (ft)	Est Length of H-Piles VLF	Total Length of H-Piles/Box (VLF)	No. of Placements along reach of Wall	Total VLF of H-Pile Driven	Wt per LF of H-Pile LB	Total Tons of H-Piles
1	10	100	50.0	500	111	55500	73.0	18.25
				500		55500		18.25

2. Excavate with Sheet Pile Box (W/B & E/B)

1 Unit Length of Canal

Length of Canal (ft)	
11100	LF

2 Excavate soil within Sheet pile Box

AREA	Length of Canal (ft)	No. of Canal Sides (ea)	Exc Width (ft)	Exc Depth (ft)	VOL CY	
1	11100.0	2	16	8	105244	
					105244	EXCAV.

3 Mud Slab at bottom of excavation

AREA	Length of Canal (ft)	No. of Canal Sides (ea)	Width (ft)	Depth (ft)	VOL CY	
	11100.0	2	16	1	13156	
					13156	CY Mud Slab

3. Concrete Liner Wall (W/B) - (form & pour) (W/B & E/B)

1 Unit Length of Canal
(note: length of wall shown is nominal to allow for determination of cost / LF of wall section)

Length of Canal (ft)	Length of Reusable Formwork (ft)
11100	100

2 Concrete Formwork (Floodside of Wall only) (W/B & E/B)

	Footing / Buttress				Stem Wall				
	Reusable Length (ft)	Height of Footing (ft)	Width of Ftg. (ft)	**Area of Footing Formwork (SF)**	Hght of Wall F / S (ft)	Length of Wall (ft)		Area Reusable Wall Formwork (SF)	Area Formwork Installed (SF)
Wall / Ftgs	100	3	14	684	23	100.00		2300	255300
Buttress				376					
				1060				2300	255300

3 Sheetpile as Formwork for Protectect Side of Wall
(Assume PZ27 sheet piles);
Note: LF of Sheet Pile required is part of Item 1.3 above. Estimate assumes reuse of sheetpile, except at diagonal anchors)

Project Name: **New Orleans Canal Improvements**

Quantity Assessment of Work Items for : **Page 2 of 3**

3. Concrete Liner Wall (W/B) - (form & pour) (W/B & E/B) (Con't)

4 Cast-in-place Concrete (allows for both W/B & E/B)

	Footing / Buttress				Stem Wall					
Install Concrete Base Ftg and Wall	Height (ft)	Width (ft)	Length of Canal x 2 (ft)	**Total Ftg Vol (cy)**	Hght of Wall F / S (ft)	Width -top (ft)	Reach (Ft)	Vol Stem (cy)	No. of Stems EA	**TOTAL Stem Vol (cy)**
Wall / Ftg	3	14	22200	34533	23	2	11100	18911	2	37822
Buttress (at 20-ft spa. along length, BOTH SIDES ; say 1 CY per buttress)				**1110**						
				35643						**37822**

5 Concrete Reinforcement (allows for both W/B & E/B)

	Vol of Conc (Cy)	Vol of Concrete (CF)	Est. Wt. of Rebar (LBS/CF)	Total Wt of rebar (TONS)	
FTG	35643	962370.0	4.5	2165	
Buttress	1110	29970.0	5.0	75	
Stem Wall	37822	1021200.0	5.5	2808	
				5049	Tons
			add 5% allowance for lap and splices	**252**	Tons
				5301	Tons
			SAY	**5300**	**Tons**

	Ftg / Walls	Buttresses	Totals	
6 Finish of footing surface, screed (allows for both W/B & E/B)	**310800**	**x**	**310800**	SF
Finish of Walls, break ties and patch voids (allows for both W/B & E/B)	**255300**	**36000**	**291300**	SF

7 Install Temporary bracing / whalers / shoring on Protected Side of new Concrete Wall sheetpile formwork — 1 LS

4. Concrete Buttresses (W/B & E/B)

1 Assume wall bracing with butresses at 20-ft o.c. along full length of wall.

2 quantities for concrete / formwork / reboar incl in Item 3 above.

5. Earthwork (OUTSIDE of Sheet Pile Box); along length of Canal

Addt'l Channel Excavation (Assume Dredging Excavation)

1 Unit Length of Canal — Length of Canal (ft): **11100** **LF**

2 Dredge Canal (to bottom of Tremie Conc Floor slab)

AREA	Length of Canal (ft)	Exc Width (ft)	Exc Depth (ft)	VOL CY	
1	11100.0	58	3.5	41728	
				41728	**CHANNEL EXCAV.**

Excavate / Remove tops of Existing Levees (assume dozer / front end loader, 50' haul with loading)

1 Unit Length of Canal — Length of Canal (ft): **11100** **LF**

2 Determine volume of excavation removal required of levee caps each side of Canal (Spread & Compact following removal of sheetpile)

AREA	Length of Canal (ft)	Exc Width (ft)	Exc Depth (ft)	VOL CY	
E/B	11100	50	6.5	133611	
W/B	11100	25	4	41111	
				174722	**LEVEE EXCAV.**

6. Tremie Concrete Floor

1 Determine volume of Tremie Concrete required at bottom of Canal

AREA	Length of Canal (ft)	Width (ft)	Depth (ft)	VOL CY	
	11100	61	3	75233	
				75233	**TREMIE CONCRETE**

ROM

7. Demolition and Disposal of Existing I-Walls

I-Wall / T-Wall Demolition (Assume Dozer / Front End Loader / Hyd Backhoe type equipment)

1 Unit Length of Canal

Length of Canal (ft)	
11100	LF

2 Estimated volume of exist I-Wall for demolition (along each side of Canal)

I-Wall No.	Length of Canal (ft)	Width (ft)	Depth (ft)	VOL CY	
I- Wall	11100.0	1.5	15	9250	
T-Wall	11100.0	3.0	15	18500	
				27750	I-Wall Demo
			1.3 Bulk	8325	
			TOTAL	36075	LCY Hauling

8. Disposal of Excavated Materials

	Percent for Disposal	Canal Excacation CY	Inside Liner Box Exc CY	Tops Levee Exc CY	TOTAL EXC. CY	VOL CY
1 Contaminated Excavation to Landfill, incl tip fees, 1-way haul = 25 miles	10%	41728	105244	174722	321694	32169
(allow 100 lbs/ cf = 1.35 tons / cy x $100 / ton tip fee =$135 + $20 / Cy Haul)						
2 Contaminated Excavation for local re-use, 1-way haul = 5 miles	20%	41728	105244	174722	321694	64339
3 Excavated Material for re-use as on-site fill, spread and compact	30%	41728	105244	174722	321694	96508
4 Excavated Material to waste locally, 1-way haul = 5 miles	40%	41728	105244	174722	321694	128678

Black & Veatch

Project Name: New Orleans Canal Improvements — 14-Nov-06

ROM Cost Evaluation — G. Hicks

Project No. / Phase No.: 041669.03.10

Location: New Orleans, Louisiana

Quantity Assessment of Work Items for :

LONDON AVE CANAL LINER BOX CONCEPT

ROM

Estimated Total Cost Comparative Summary:

Estmated length of Canal = 14835 LF

Item	UNIT	Est Cost / Unit (See Note 1.)	Quantities ALT 1	Quantities	Costs ALT 1	Costs
1. Install Sheet Pile Box w/ H-Piles (W/B & E/B)						
Purchase Sheet Pile Box PZ 27 Type Sheet Piles	TON	$ 925.00	206		$ 190,191.10	
Delivery of sheetpiles	LB	$ 0.03	411224		$ 12,336.72	
Purchase HP14 Piles	TON	$ 1,450.00	18.25		$ 26,462.50	
Delivery of sheetpiles	LB	$ 0.03	36500		$ 1,095.00	
Installation of Sheet Piles in Leap-Frog procedure (excludes material costs)	HRS	$ 575.00	12350		$ 7,101,250.00	
Removal of Sheet Piles in Leap-Frog procedure (excludes material costs)	HRS	$ 388.00	7500		$ 2,910,000.00	
Install H-Piles installed in Leap-Frog procedure for rigidity (use HP14x73 x 50-ft)	VLF	$ 8.51	74500		$ 633,995.00	
2. Excavate with Sheet Pile Box (W/B & E/B)						
Excavate soil within Sheet pile Box	CY	$ 7.50	140658		$ 1,054,933	
Flowable Fill "Mud Slab" at bottom of excavation	CY	$ 80.00	17582		$ 1,406,578	
3. Concrete Liner Wall (W/B) - (form & pour) (W/B & E/B)						
Concrete Formwork (material only, reusable; Floodside of Wall only)	SF	$ 1.00	2300		$ 2,300	
Install Stl framed Plywood Wall Formwork in Leap-Frog procedure, Floodside face; excl material	SF	$ 4.50	342700		$ 1,542,150	
Install Temporary bracing / whalers / shoring on Protected Side	LS	$ 55,000.00	1		$ 55,000	
Reinforcing Steel, #8<, detailed, milled,delivered, in-place	TON	$ 3,650.00	7500		$ 27,375,000	
Concrete in Footing / Buttress, 4000 psi ready-mix (incl material, tremie placement)	CY	$ 90.00	54231		$ 4,880,760	
Concrete Finishing of Footing, screed	SF	$ 0.35	474720		$ 166,152	
Concrete in Stem Wall, 4000psi ready mix, (incl material, pump placement)	CY	$ 100.00	50549		$ 5,054,889	
Finish of Walls, break ties and patch voids	SF	$ 0.75	761000		$ 570,750	
Install Aggregate Base (Assumed None Required)	CY	$ 16.75	-		-	
4. Concrete Buttresses (W/B & E/B)						
quantities for concrete / formwork / rebar incl in Item 3 above.	-	-	-	-	-	
5. Earthwork (OUTSIDE of Sheet Pile Box); along length of Canal						
Dredge Canal (to bottom of Tremie Conc Floor slab)	CY	$ 10.00	163872		$ 1,638,718	
Excavate / Remove tops of Existing Levees; dozer / front end loader	CY	$ 2.50	39560		$ 98,900	
6. Tremie Concrete Floor						
Install Tremie Concrete Floor (at bottom of Canal; full width btwn Box Wall Fdns)	CY	$ 90.00	141757		$ 12,758,100	
7. Demolition and Disposal of Existing I-Walls						
Estimated volume of exist I-Wall for demolition	CY	$ 150.00	24725		$ 3,708,750	
Hauling of I-Wall debris, assume 1-way haul =10 miles, as waste-landfill	LCY	$ 19.00	32143		$ 610,708	

Project Name: New Orleans Canal Improvements

Estimated Total Cost Comparative Summary for:

LONDON AVE CANAL LINER BOX CONCEPT

Item	UNIT	Est Cost / Unit (See Note 1.)	Quantities ALT 1	Quantities	Costs ALT 1	Costs
		Estmated length of Canal =			14835	LF
8. Disposal of Excavated Materials						
Contaminated Excavation to Landfill,used for daily cover no fees, 1-way haul = 25 miles	CY	$ 30.00	34409		$ 1,032,269	
Contaminated Excavation for local re-use, 1-way haul = 5 miles	CY	$ 9.50	68818		$ 653,770	
Excavated Material for re-use as on-site fill, spread and compact	CY	$ 5.25	103227		$ 541,941	
Excavated Material to waste locally, no tip fees, 1-way haul = 5 miles	CY	$ 8.50	137636		$ 1,169,905	

	ALT 1	
Subtotals	$ 75,211,738	$ -
add 15% for Design contingency	$ 15,042,348	$ -
add 5% for margin for subcontractors	$ 3,760,587	$ -
add 1% for Bond Costs	$ 752,117	$ -
	$ 94,766,789	$ -
add 20% for Construction contingency	$ 18,953,358	$ -
Estimated Total Cost (2006) =	$ 113,720,147	$ -
Percent Escalation to Mid-Point of Const =	17.40%	
Escalation Cost =	19,787,306	
Est Total Cost to Mid-point of Const (01/ 2009) =	$ 133,507,453	
ESTIMATED COST PER L.F. =	$ 8,999	$ -
ROM COST PER L.F. =	**$ 9,000**	**$ -**

NOTES:

1. Costs are "Costs to Owner", including overhead and profits .
2. Costs do not incl mob-demob costs
3. Costs are extrapolated from MEANS 2004 and adjusted to 2006 dollars or extracted from current B&V in-house Projects. Costs then escalated from Jan2007 by percent shown to Sept2009 mid-point date of construction. construction. Estimate allows for a 6% escalation, compounded annually for a 2.75 year period (33 months).
4. No cost adjustments made for tax on materials.

Black & Veatch

Project Name: New Orleans Canal Improvements

ROM Cost Evaluation

Project No. / Phase No.: 041669.03.10

Location: New Orleans, Louisiana

Quantity Assessment of Work Items for :

LONDON AVE CANAL LINER BOX CONCEPT

ROM

Item No. **Description**

1. Install Sheet Pile Box w/ H-Piles (W/B & E/B)

1 Unit Length of Temporary Sheet Pile Wall for use and end cut-offs

Length of Box (ft)		Width of Box (ft.)		Length of Canal (ft)	
100	LF	16	LF	14835	LF

2 Assume PZ 27 Type Sheet Piles

Height of Box VLF	LF along Length s LF	LF along Widths LF	AREA OF WALL SF	Sheet Pile PSF	TOTAL WT OF PILE TONS
30.0	200.0	32.0	6960	27	94
					94
				x 2 =	187

3 Allowance for (2)- Sheet Pile Boxes for Leap-frog Construction

4 Percentage allowance for loss due to diagonal anchors / misc.
(say 675 anch x 2 x 1.50 LF/Shtpile = 2025 HLF loss / 27000 x 100 = 7.5 % (Say 10% loss)

19	Extra allowance
206	Total Sheet Pile

6 Delivery of SheetPiles

Cost per LB	No. of LBS	Cost of Delivery
0.03	411224	$ 12,337

7 Installation of Sheet Piles (excludes material costs)
(allows for installation of approx (3) 40-ft sheets per hr)
3 x 40 x 41.25 PLF/2000 = 2.48 tons per hr.

Tons of Sheet Pile	Productivity (Tons / Hr)	No. Hrs Placement for (1) Sheet Pile Box	No. of Placements along reach of Wall	Total Hrs Placement Sheet Pile Box for Proj
206	2.48	82.90806452	149	12353.30161
			SAY	12350

8 Removal of Sheet Piles (excludes material costs)
(allows for removal of approx (6) 30-ft sheets per hr)
6 x 30 x 41.25 PLF/2000 = 3.71 tons per hr.

Tons of Sheet Pile	Productivity (Tons / Hr)	No. Hrs Removal for (1) Sheet Pile Box	No. of Box removal Sht Pile along reach of Wall	Total Hrs Removal of Sheet Pile Box for Proj
206	3.71	55.42102426	149	8257.732615
			SAY	7500

9 Install H-Piles for rigidity (use HP14x73 x 50-ft)

AREA	H-Piles Spacing (ft)	Length of Box (ft)	Est Length of H-Piles VLF	Total Length of H-Piles/Box (VLF)	No. of Placements along reach of Wall	Total VLF of H-Pile Driven	Wt per LF of H-Pile LB	Total Tons of H-Piles
1	10	100	50.0	500	149	74500	73.0	18.25
				500		74500		18.25

2. Excavate with Sheet Pile Box (W/B & E/B)

1 Unit Length of Canal

Length of Canal (ft)	
14835	LF

2 Excavate soil within Sheet pile Box

AREA	Length of Canal (ft)	No. of Canal Sides (ea)	Exc Width (ft)	Exc Depth (ft)	VOL CY	
1	14835.0	2	16	8	140658	
					140658	EXCAV.

3 Mud Slab at bottom of excavation

AREA	Length of Canal (ft)	No. of Canal Sides (ea)	Width (ft)	Depth (ft)	VOL CY	
	14835.0	2	16	1	17582	
					17582	CY Mud Slab

3. Concrete Liner Wall (W/B) - (form & pour) (W/B & E/B)

1 Unit Length of Canal
(note: length of wall shown is nominal to allow for determination of cost / LF of wall section)

Length of Canal (ft)	Length of Reusable Formwork (ft)
14835	100

2 Concrete Formwork (Floodside of Wall only) (W/B & E/B)

	Footing / Buttress				Stem Wall				
	Reusable Length (ft)	Height of Footing (ft)	Width of Ftg. (ft)	**Area of Footing Formwork (SF)**	Hght of Wall F / S (ft)	Length of Wall (ft)		Area Reusable Wall Formwork (SF)	Area Formwork Installed (SF)
Wall / Ftgs	100	3	14	684	23	100.00		2300	342700
Buttress				376					
				1060				2300	342700

3 Assumed Sheetpile at Protectect Side of Wall to be use as formwork
(Assume PZ27 sheet piles);
Note: LF of Sheet Pile required is part of Item 1.3 above. Estimate assumes reuse of sheetpile)

Project Name: New Orleans Canal Improvements

Quantity Assessment of Work Items for :

3. Concrete Liner Wall (W/B) - (form & pour) (W/B & E/B) (Con't)

4 Cast-in-place Concrete (allows for both W/B & E/B)

	Footing				Stem Wall					
Install Concrete Base Ftg and Wall	Height (ft)	Width (ft)	Length of Canal x 2 (ft)	**Total Ftg Vol (cy)**	Hght of Wall F / S (ft)	Width -top (ft)	Reach (Ft)	Vol Stem (cy)	No. of Stems EA	**TOTAL Stem Vol (cy)**
Wall / Ftg	3	16	29670	52747	23	2	14835	25274	2	50549
Buttress (at 20-ft spa. along length, BOTH SIDES ; say 1 CY per buttress)				**1484**						
				54231						**50549**

5 Concrete Reinforcement (allows for both W/B & E/B)

	Vol of Conc (Cy)	Vol of Concrete (CF)	Est. Wt. of Rebar (LBS/CF)	Total Wt of rebar (TONS)	
FTG	54231	1464228.0	4.5	3295	
Buttress	1484	40068.0	5.0	100	
Stem Wall	50549	1364820.0	5.5	3753	
				7148	Tons
			add 5% allowance for lap and splices	**357**	Tons
				7505	Tons
			SAY	**7500**	**Tons**

	Ftg / Walls	Buttresses	Totals	
6 Finish of footing surface, screed (allows for both W/B & E/B)	**474720**	**x**	**474720**	SF
Finish of Walls, break ties and patch voids (allows for both W/B & E/B)	**682410**	**78590**	**761000**	SF

7 Install Temporary bracing / whalers / shoring on Protected Side of new Concrete Wall sheetpile formwork — 1 LS

4. Concrete Buttresses (W/B & E/B)

1 Assume wall bracing with butresses at 20-ft o.c. along full length of wall.

2 quantities for concrete / formwork / reboar incl in Item 3 above.

5. Earthwork (OUTSIDE of Sheet Pile Box); along length of Canal

Addt'l Channel Excavation (Assume Dredging Excavation)

1 Unit Length of Canal — Length of Canal (ft): **14835** **LF**

2 Dredge Canal (to bottom of Tremie Conc Floor slab)

AREA	Length of Canal (ft)	Exc Width (ft)	Exc Depth (ft)	VOL CY	
1	14835.0	13	2.5	8928	
2	14835.0	18	4.0	39560	
3	14835.0	84	3	115383	
				163872	**CHANNEL EXCAV.**

Excavate / Remove tops of Existing Levees (assume dozer / front end loader, 50' haul with loading)

1 Unit Length of Canal — Length of Canal (ft): **14835** **LF**

2 Determine volume of excavation removal required of levee caps each side of Canal (Spread & Compact following removal of sheetpile)

AREA	Length of Canal (ft)	Exc Width (ft)	Exc Depth (ft)	VOL CY	
E/B	14835	12	3	19780	
W/B	14835	12	3	19780	
				39560	**LEVEE EXCAV.**

6. Tremie Concrete Floor

1 Determine volume of Tremie Concrete required at bottom of Canal

AREA	Length of Canal (ft)	Width (ft)	Depth (ft)	VOL CY	
	14835	86	3	141757	
				141757	**TREMIE CONCRETE**

7. Demolition and Disposal of Existing I-Walls

I-Wall / T-Wall Demolition (Assume Dozer / Front End Loader / Hyd Backhoe type equipment)

	Length of Canal (ft)	
1 Unit Length of Canal	14835	LF

	I-Wall No.	Length of Canal (ft)	Width (ft)	Depth (ft)	VOL CY	
2 Estimated volume of exist I-Wall for demolition	I- Wall	14835.0	1.5	15	12363	
(along each side of Canal)	T-Wall	14835.0	1.5	15	12363	
					24725	**I-Wall Demo**
				1.3 Bulk	**7418**	
				TOTAL	**32143**	**LCY Hauling**

8. Disposal of Excavated Materials

	Percent for Disposal	Canal Excacation CY	Inside Liner Box Exc CY	Tops Levee Exc CY	TOTAL EXC. CY	VOL CY
1 Contaminated Excavation to Landfill, incl tip fees, 1-way haul = 25 miles	**10%**	163872	140658	39560	344090	**34409**
(allow 100 lbs/ cf = 1.35 tons / cy x $100 / ton tip fee =$135 + $20 / Cy Haul)						
2 Contaminated Excavation for local re-use, 1-way haul = 5 miles	**20%**	163872	140658	39560	344090	**68818**
3 Excavated Material for re-use as on-site fill, spread and compact	**30%**	163872	140658	39560	344090	**103227**
4 Excavated Material to waste locally, 1-way haul = 5 miles	**40%**	163872	140658	39560	344090	**137636**

Black & Veatch

Project Name: New Orleans Canal Improvements — 14-Nov-06

ROM Cost Evaluation — G. Hicks

Project No. / Phase No.: 041669.03.10

Location: New Orleans, Louisiana

Quantity Assessment of Work Items for :

17th STREET CANAL LINER CONTOUR CONCEPT

ROM

Estimated Total Cost Comparative Summary:

		Estmated length of Canal =	13500	LF		
		Est Cost / Unit	Quantities		Costs	
Item	UNIT	(See Note 1.)	ALT 1		ALT 1	
1. Demolition and Disposal of Existing I-Walls						
Estimated volume of exist I-Wall for demolition	CY	$ 150.00	24000		$ 3,600,000	
Hauling of I-Wall debris, assume 1-way haul =10 miles, as waste-landfill	LCY	$ 19.00	31200		$ 592,800	
2. Install Sheet Pile Box w/ H-Piles (W/B & E/B)						
Purchase Sheet Pile Box PZ 27 Type Sheet Piles	TON	$ 925.00	192		$ 177,443.86	
Delivery of sheetpiles	LB	$ 0.03	383662.4		$ 11,509.87	
Purchase HP14 Piles	TON	$ 1,450.00	18.25		$ 26,463	
Delivery of sheetpiles	LB	$ 0.03	36500		$ 1,095.00	
Installation of Sheet Piles in Leap-Frog procedure (excludes material costs)	HRS	$ 575.00	15000		$ 8,625,000.00	
Removal of Sheet Piles in Leap-Frog procedure (excludes material costs)	HRS	$ 388.00	10210		$ 3,961,480.00	
Install H-Piles installed in Leap-Frog procedure for rigidity (use HP14x73 x 50-ft)	VLF	$ 8.51	67500		$ 574,425.00	
3. Install temporary Sheet Pile across width of canal						
Purchase Sheet Pile Box PZ 27 Type Sheet Piles	TON	$ 925.00	238		$ 219,780.00	
Delivery of sheetpiles (incl in Item 2 above)	LB	-	-	-	-	-
Installation of Sheet Piles in Leap-Frog procedure (excludes material costs)	TON	$ 575.00	13000		$ 7,475,000.00	
Removal of Sheet Piles in Leap-Frog procedure (excludes material costs)	TON	$ 338.00	9720		$ 3,285,360.00	
4. Excavate within Sheet Pile Box (W/B & E/B)						
Excavate soil within Sheet pile Box	CY	$ 7.50	16000		$ 120,000	
Flowable Fill "Mud Slab" at bottom of excavation	CY	$ 80.00	16000		$ 1,280,000	
5. Reinforced Concrete Floodwalls (W/B & E/B)						
S.O.G. formwork	SF	$ 6.00	162120		$ 972,720	
Stem Wall Formwork,	SF	$ 6.00	486084		$ 2,916,506	
Reinforcing Steel in Wall / Ftg., #8<, detailed, milled,delivered, in-place	TON	$ 3,650.00	3182.42		$ 11,615,830	
Concrete in Footing, 4000 psi ready-mix (incl material, chute placement)	CY	$ 90.00	30000		$ 2,700,000	
Concrete Finishing of Footing, screed	SF	$ 0.35	270000		$ 94,500	
Concrete in Stem Wall, 4000psi ready mix, (incl material, pump placement)	CY	$ 100.00	20625		$ 2,062,500	
Finish of Walls, break ties and patch voids	SF	$ 0.75	486000		$ 364,500	
Install 4" Lean Concrete Stabilization Base below Conc Ftg, chute placement	CY	$ 75.00	3960		$ 297,000	

Project Name: New Orleans Canal Improvements

Estimated Total Cost Comparative Summary for:

17th STREET CANAL LINER BOX CONCEPT

Item	UNIT	Est Cost / Unit (See Note 1.)	Quantities ALT 1		Costs ALT 1	
Estmated length of Canal =					13500	LF
6. Pile support for T-Wall Concrete Base Slab						
Install PRECAST CONC PILES; prestressed, 75-80 Tons capacity, 95-ft length)	Ea	$ 4,275.00	6750		$ 28,856,250	
Estimated setup time between Pile locations	HR	$ 80.00	1688		$ 135,000	
7. Sheet Pile Cut-off Walls (Ctrd. on Ftg)						
Assume PZ 27 Type Sheet Piles, incl material, shipping, insallation	TONS	$ 2,000.00	15582.4		$ 31,164,750	
8. "Shotcrete" Sideslopes and Bottom of Canal						
Place 12" depth of "Shotcrete"; wet mix, placed at rate of 10 CY per hour, 3000 PSI	CY	$ 115.00	110000		$ 12,650,000	
9. Earthwork (OUTSIDE of Sheet Pile Box); along length of Canal						
Excavate / Remove tops of Existing Levees; dozer / front end loader	CY	$ 2.50	60000		$ 150,000	
Fill / Backfill at New Floodwalls	CY	$ 10.00	12500		$ 125,000	
Excavate Canal bot/side slopes (to bottom of "Shotcrete")	CY	$ 2.50	27500		$ 68,750	
Prepare and Roll Area of Fine Grading (Spread & Compact)	SY	$ 1.25	330000		$ 412,500	
10. Disposal of Excavated Materials						
Contaminated Excavation to Landfill, incl tip fees, 1-way haul = 25 miles	CY	$ 155.00	10350		$ 1,604,250	
Contaminated Excavation for local re-use, 1-way haul = 5 miles	CY	$ 9.50	20700		$ 196,650	
Excavated Material for re-use as on-site fill, spread and compact	CY	$ 5.25	31050		$ 163,013	
Excavated Material to waste locally, no tip fees, 1-way haul = 5 miles	CY	$ 8.50	41400		$ 351,900	
				Subtotals	$ 126,865,475	$ -
				add 15% for Design contingency	$ 25,373,095	$ -
				add 5% for margin for subcontractors	$ 6,343,274	$ -
				add 1% for Bond Costs	$ 1,268,655	$ -
					$ 159,850,498	$ -
				add 20% for Construction contingency	$ 31,970,100	$ -
				Estimated Total Cost (2006) =	$ 191,820,598	$ -
				Percent Escalation to Mid-Point of Const =	17.40%	
				Escalation Cost =	33,376,784	
				Est Total Cost to Mid-point of Const (01/ 2009) =	$ 225,197,382	
				ESTIMATED COST PER L.F. =	$ 16,681	$ -
				ROM COST PER L.F. =	**$ 16,680**	**$ -**

NOTES:

1. Costs are "Costs to Owner", including overhead and profits .
2. Costs do not incl mob-demob costs
3. Costs are extrapolated from MEANS 2004 and adjusted to 2006 dollars or extracted from current B&V in-house Projects. Costs then escalated from Jan2007 by percent shown to Sept2009 mid-point date of construction. construction. Estimate allows for a 6% escalation, compounded annually for a 2.75 year period (33 months).
4. No cost adjustments made for tax on materials.

Quantity Assessment of Work Items for :
17th STREET CANAL LINER CONTOUR CONCEPT
ROM

Item No. **Description**

1. Demolition and Disposal of Existing I-Walls

I-Wall Demolition (Assume Dozer / Front End Loader / Hyd Backhoe type equipment)

1 Unit Length of Canal — Length of Canal (ft): **13500** LF

2 Estimated volume of exist I-Wall for demolition (along each side of Canal)

I-Wall No.	Length of Canal (ft)	Width (ft)	Depth (ft)	VOL CY	
E/B	13500.0	2.0	12	12000	
W/B	13500.0	2.0	12	12000	
				24000	**I-Wall Demo**
			1.3 Bulk	**7200**	
			TOTAL	**31200**	**LCY Hauling**

2. Install Sheet Pile Box w/ H-Piles (W/B & E/B) + Cofferdam Across Canal

1 Unit Length of Temporary Sheet Pile Wall for use and end cut-offs

Length of Box (ft)		Box Width (ft.)		Length of Canal (ft)	
100	LF	16	LF	13500	LF

2 Assume PZ 27 Type Sheet Piles

Height of Box VLF	LF along Lengths LF	LF along Widths LF	AREA OF WALL SF	Sheet Pile PSF	Total Wt of Pile TONS	
28.0	200.0	32.0	6496	27	88	
					88	
				x 2 =	**174**	
					17	extra allowance
					192	Total Sheet Pile

3 Allowance for (2)- Sheet Pile Boxes for Leap-frog Construction
4 Percentage allowance for loss due to diagonal anchors / misc.
(say 675 anch x 2 x 1.50 LF/Shtpile = 2025 HLF loss / 27000 x 100 = 7.5 % (Say 10% loss)

6 Delivery of SheetPiles (incl BOX + Cofferdam Piles below)

Cost per LB	No. of LBS	Cost of Delivery
0.03	**858862**	**$ 25,766**

7 Installation of Sheet Piles (excludes material costs)
(allows for installation of approx (3) 40-ft sheets per hr)
3 x 40 x 41.25 PLF/2000 = 2.48 tons per hr.

Tons of Sheet Pile	Productivity (Tons / Hr)	No. Hrs Placement or (1) Sheet Pile Bo	No. of Placements along reach of Wall	Total Hrs Placement Sheet Pile Box for Proj
192	2.48	77.35129032	135	10442.42419
			SAY	**15000**

8 Removal of Sheet Piles (excludes material costs)
(allows for removal of approx (4) 40-ft sheets per hr)
4 x 40 x 41.25 PLF/2000 = 3.30 tons per hr.

Tons of Sheet Pile	Productivity (Tons / Hr)	No. Hrs Removal or (1) Sheet Pile Bo	No. of Box removal Sht Pile along reach of Wall	Total Hrs Removal of Sheet Pile Box for Proj
192	3.3	58.13066667	135	7847.64
			SAY	**10210**

9 Install H-Piles for rigidity (use HP14x73 x 50-ft)

AREA	H-Piles Spacing (ft)	Length of Box (ft)	Est Length of H-Piles VLF	Total Length of H-Piles/Box (VLF)	No. of Placements along reach of Wall	Total VLF of H-Pile Driven	Wt / LF of H-Pile LB	Total Tons of H-Piles
1	10	100	50.0	500	135	67500	73.0	18.25
				500		**67500**		**18.25**

3. Install Temporary Sheet Pile across Width of Canal

1 Install temporary type sheetpile cofferdam walls across width of canal
2 Assume PZ 27 Type Sheet Piles

Hght of CD Wall VLF	Length of CD Wall LF	AREA OF WALL SF	No. of Walls EA	Sheet Pile PSF	Total Wt of Pile TONS	
40.0	200.0	8000	2	27	216	
					22	extra allowance
					238	Total Sheet Pile

3 Installation of Sheet Piles (excludes material costs)
(allows for installation of approx (3) 40-ft sheets per hr)
3 x 40 x 41.25 PLF/2000 = 2.48 tons per hr.

Tons of Sheet Pile	Productivity (Tons / Hr)	No. Hrs Placement or (1) Sheet Pile Bo	No. of Placements along reach of Wall	Total Hrs Placement Sheet Pile Box for Proj
238	2.48	95.80645161	135	12933.87097
			SAY	**13000**

4 Removal of Sheet Piles (excludes material costs)
(allows for removal of approx (4) 40-ft sheets per hr)
4 x 40 x 41.25 PLF/2000 = 3.30 tons per hr.

Tons of Sheet Pile	Productivity (Tons / Hr)	No. Hrs Removal or (1) Sheet Pile Bo	No. of Box removal Sht Pile along reach of Wall	Total Hrs Removal of Sheet Pile Box for Proj
238	3.3	72	135	9720
			SAY	**9720**

ROM Cost Evaluation
Project No. / Phase No.: 041669.03.10
Location: New Orleans, Louisiana

Quantity Assessment of Work Items for :
17th STREET CANAL LINER CONTOUR CONCEPT
ROM

4. Excavate within Sheet Pile Box (W/B & E/B)

	Length of Canal (ft)	
1 Unit Length of Canal	13500	LF

	AREA	Length of Canal (ft)	No. of Canal Sides (ea)	Exc Width (ft)	Exc Depth (ft)	VOL CY	
2 Excavate soil within Sheet pile Box (note: substantial earthwork is allowed for in EARTHWORK)	1	13500.0	2	16	1	16000	
						16000	EXCAV.

	AREA	Length of Canal (ft)	No. of Canal Sides (ea)	Width (ft)	Depth (ft)	VOL CY	
3 Mud Slab at bottom of excavation		13500.0	2	16	1	16000	
						16000	CY Mud Slab

5. Reinforced Concrete Floodwalls (W/B & E/B)

	Length of Canal (ft)
1 Lengths of Flood Wall Types (note: length of wall shown is nominal to allow for determination of cost / LF of wall section)	13500.0

2 Formwork	Footing				Stem Wall				
	Length of Canal (ft)	Height of Footing (ft)	Width of Ftg. (ft)	**Area of Footing Formwork (SF)**	Hght of Stem (ft)	Thick. of Stem at top (ft)	Thick of Stem at Base	**Formwork Area for Stem (SF)**	
S.O.G.	13500	3	10	81060	9.0	2.25	3.00	243042	
Turndown Edge (N/A)	13500	0	0	0	0	0	0	0	
				81060				243042	
			x 2 =	162120	(W/B & E/B)		x 2 =	486084	(W/B & E/B)

3 Cast-in-place Concrete in Wall / Ftg.	Footing				Stem Wall					Total Volume of Concrete (CY)
	Height (ft)	Width (ft)	Reach of Wall (ft)	**Vol ftg (cy)**	Height (ft)	Width -top (ft)	Width - bot (ft)	Reach of Wall (ft)	**Vol Stem (cy)**	
S.O.G.	3	10	13500	15000	9	2.25	3.00	13500	10313	
Turndown Edge (N/A)	0	0	13500	0	0	0	0	0	0	
				15000					10313	25312
			x 2 =	30000	(W/B & E/B)			x 2 =	20625	50623
									(W/B & E/B)	(W/B & E/B)

4 Concrete Reinforcement (use 6.6 LBS / CF OF CONCRETE)	Vol of Conc (Cy)	Vol of Concrete (CF)	Wt. of Rebar (LBS/CF)	**Total Wt of rebar** (TONS)	**x 2** (TONS)	
S.O.G.	15000	405000.0	3.1897	645.91		
Stem Wall	10313	278437.5	6.79	945.3		
				1591.2	3182.4	(W/B & E/B)

	SF	(W/B & E/B) SF X 2
5 Finish of footing surface, screed	135000	270000
Finish of Walls, break ties and patch voids (incl turndn slab / stemwall)	243000	486000

6 4" Lean Concrete Stabilization Base below Conc Ftg, chute placement	Footing				(W/B & E/B)	
	Height (ft)	Width (ft)	Reach of Wall (ft)	**Vol ftg (cy)**	**x 2 (cy)**	
	0.33	12	13500	1980		
				1980	3960	(W/B & E/B)

6. Pile support for Concrete Base Slab

	Length of Canal (ft)		Pile Spa (FT)
1 Unit Length of Wall	13500	LF	8

	Piles along Width of Ftg Ea	Spaces along Length of Wall Ea	TOTAL PILES Ea	TOTAL PILES Ea x 2
2 Quantity of Piles (Nom.8-ft spacing, ea. way, SAY 95-FT LGTH Installation of 14-in Sq. PRECAST CONC PILES, 95-ft length)	2	1688	3375	6750
				(W/B & E/B)

	hr	total hrs	Ea x 2
3 Estimated setup time between Pile locations	0.25	844	1688
			(W/B & E/B)

Length of   Top Elev   Bot. Elev   Cut-off Length

Project Name: New Orleans Canal Improvements
ROM Cost Evaluation
Project No. / Phase No.: 041669.03.10

Location: New Orleans, Louisiana

Quantity Assessment of Work Items for :
17th STREET CANAL LINER CONTOUR CONCEPT
ROM

7. Sheet Pile Cut-off Walls (Ctrd. on Ftg)

	Canal (ft)		(ft.)	(ft.) (minus El)	(ft.)	
1 Unit Length of new Sheet Pile Cut-off Wall	13500	LF	2.75	40.00	42.75	LF

2 Assume PZ 27 Type Sheet Piles

	Height of Wall VLF	AREA OF WALL SF	PSF	TOTAL WT OF PILE TONS	Ea x 2
at centerline of Ftg	42.75	577125	27	7791.2	
				7791.2	**15582.4** (W/B & E/B)

8. "Shotcrete" Sideslopes and Bottom of Canal

	Length of Canal (ft)	Depth of Shotcrete VLF	E/B Slope VLF	Bot Canal width FT	W/B Slope VLF	Total Width LF	TOTAL AREA SF	TOTAL VOL CY
1 Place 12" depth of "Shotcrete"	13500	1	85	50	85	220	2970000	110000
							2970000	**110000**

9. Earthwork (OUTSIDE of Sheet Pile Box); along length of Canal

Excavate / Remove tops of Existing Levees (assume dozer / front end loader, 50' haul with loading)

	Length of Canal (ft)	
1 Unit Length of Canal	13500	LF

2 Determine volume of excavation removal required of levee caps each side of Canal (Spread & Compact following removal of sheetpile)

AREA	Length of Canal (ft)	Exc Width (ft)	Exc Depth (ft)	VOL CY	
E/B	13500	20	4	40000	
W/B	13500	20	2	20000	
				60000	**LEVEE EXCAV.**

Fill / Backfill at New Floodwalls

1 Determine Volume of Sloped Fill / Backfill required

AREA	Length of Canal (ft)	Nom Width (ft)	Nom Depth (ft)	VOL CY	
E/B	13500.0	25.0	1.0	6250	
W/B	13500.0	25.0	1.0	6250	
				12500	**CY SLOPED FILL / BACKFILL**

Addt'l Channel Excavation (Assume dozer/backhoe Excavation in dry)

	Length of Canal (ft)	
1 Unit Length of Canal	13500	LF

2 Excavate Canal bot/side slopes (to bottom of "Shotcrete") (assume minimum excavation performed)

Length of Canal (ft)	Total Width LF	Total Depth VLF	Total Exc Vol CY	
13500	220	0.25	27500	
			27500	**CHANNEL EXCAV.**

3 Prepare and Roll Area of Fine Grading (Spread & Compact) in Canal prior to placement of "Shotcrete" surfacing

	Length of Canal (ft)	Nom Width (ft)	Area of Grading SY	
	13500	220.0	330000	
			330000	**SY AREA**

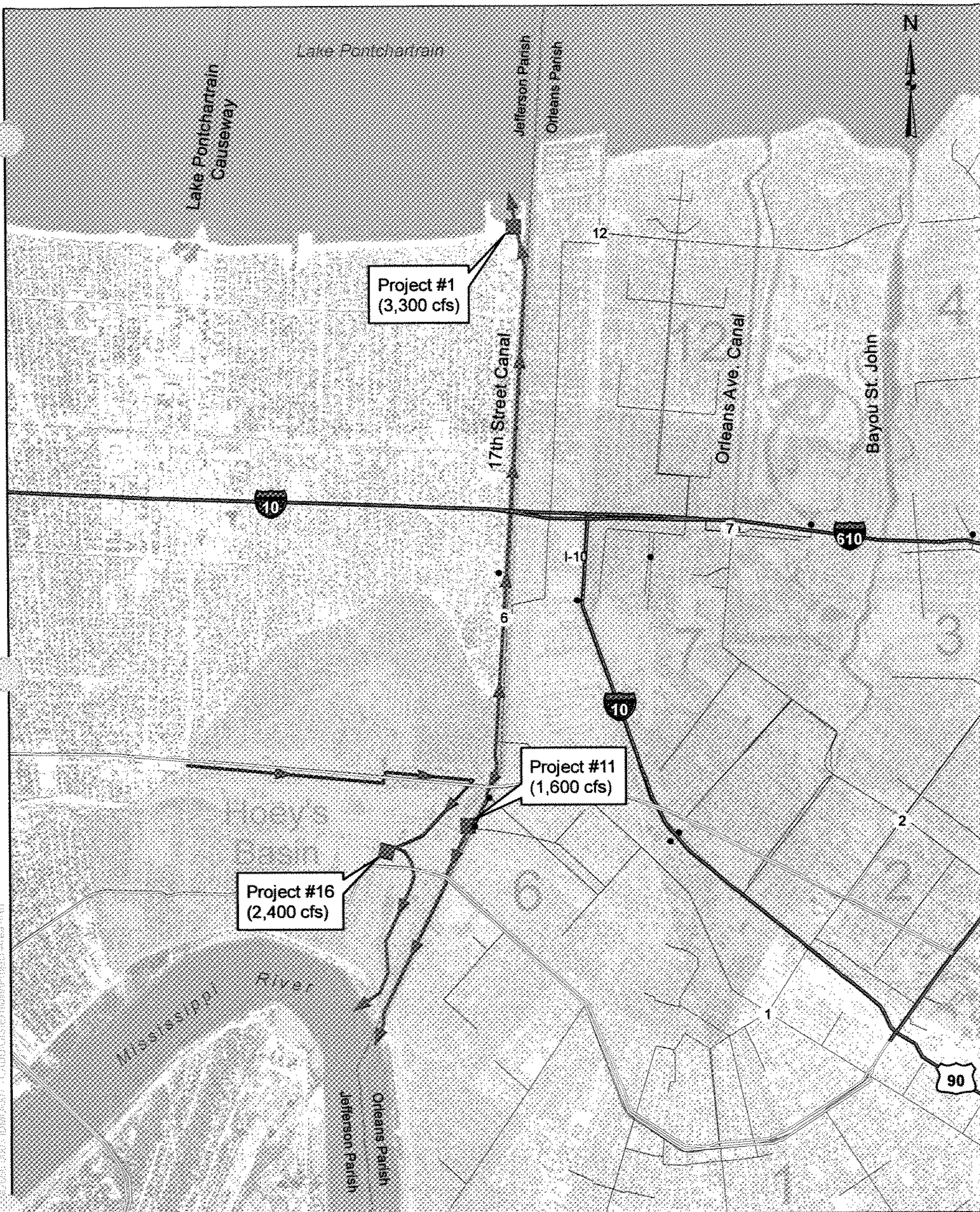
10. Disposal of Excavated Materials

	Percent for Disposal	Canal Excacation CY	Inside Liner Box Exc CY	Tops Levee Exc CY	TOTAL EXC. CY	VOL CY
1 Contaminated Excavation to Landfill, incl tip fees, 1-way haul = 25 miles	10%	27500	16000	60000	103500	**10350**
(allow 100 lbs/ cf = 1.35 tons / cy x $100 / ton tip fee =$135 + $20 / Cy Haul)						
2 Contaminated Excavation for local re-use, 1-way haul = 5 miles	20%	27500	16000	60000	103500	**20700**
3 Excavated Material for re-use as on-site fill, spread and compact	30%	27500	16000	60000	103500	**31050**
4 Excavated Material to waste locally, 1-way haul = 5 miles	40%	27500	16000	60000	103500	**41400**

Appendix B

CANAL MAPS

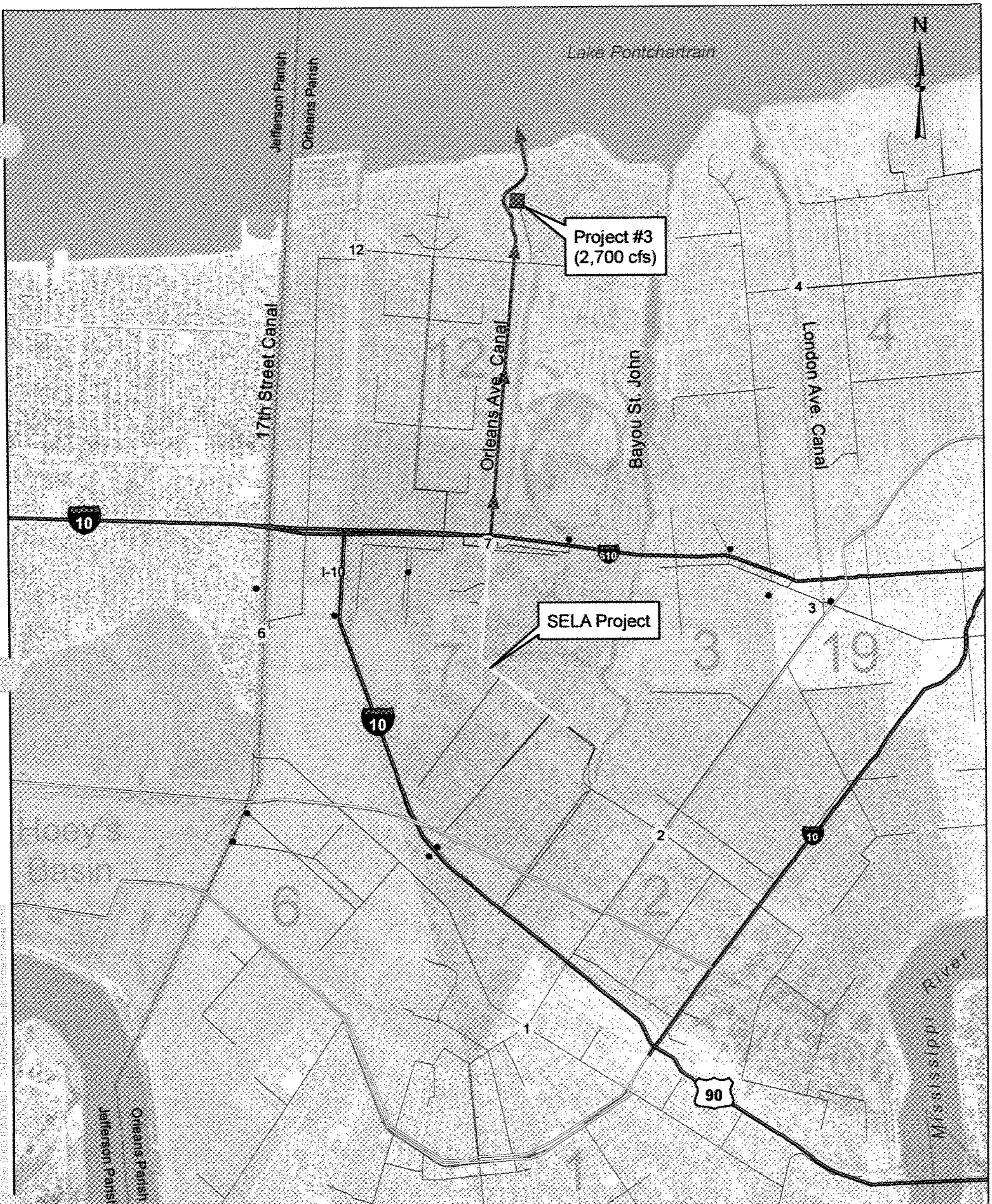
Selected maps extracted from DMJM report "Alternative Analysis of Interim Drainage Maintenance Opportunities for Orleans East Bank Project" date 4 August 2006.



Legend:

- Drainage Basins
- Conveyance System
- 5 Major Pump Stations
- • Minor Pump Stations
- New Pump Station

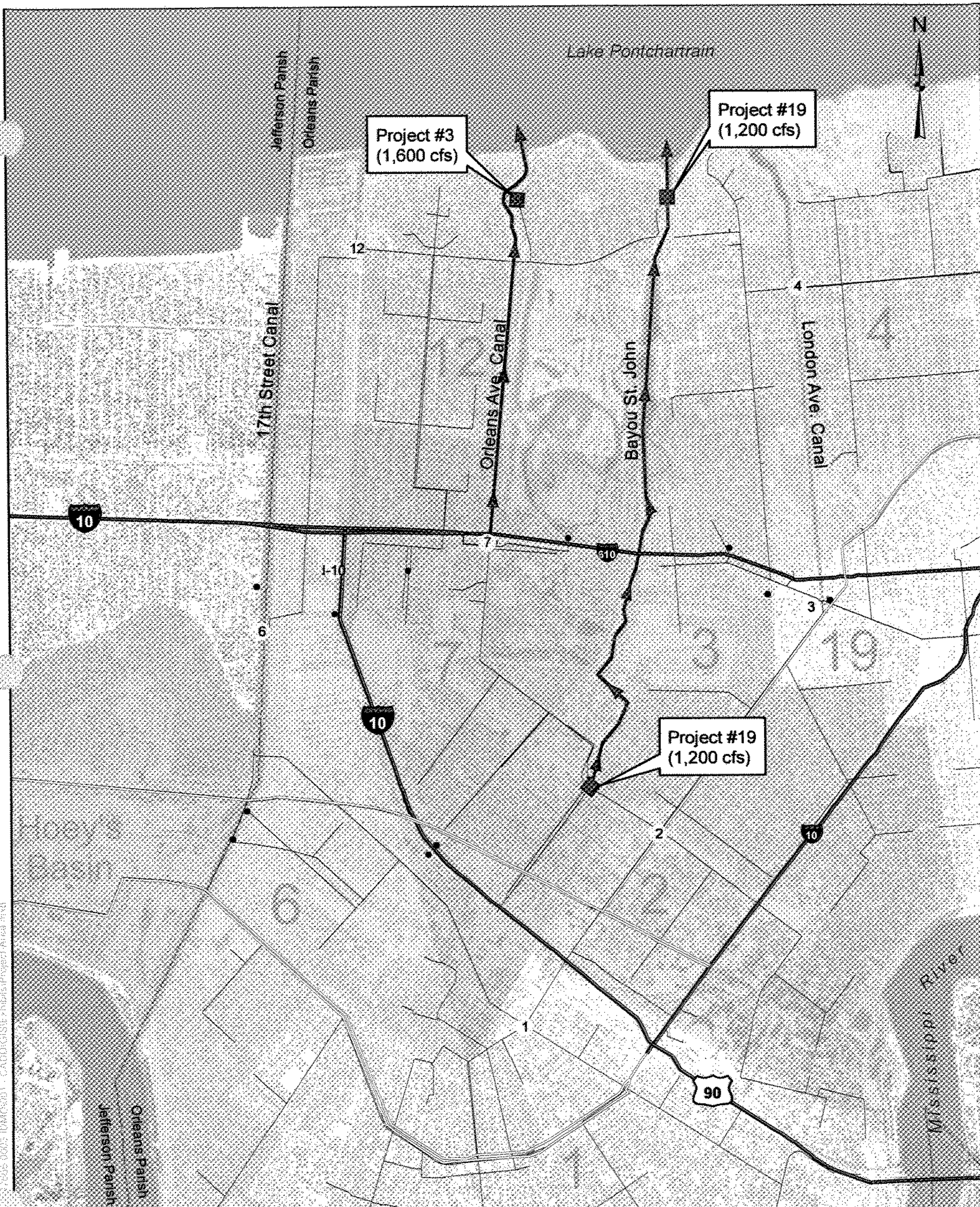
IDMO ALTERNATIVES ANALYSIS		
17TH STREET CANAL		
SCALE: 1"=4000'	ALTERNATIVE NO. 1	MAP 1-1
DATE: 08/04/06		



Legend:

Drainage Basins	5 Major Pump Stations
Conveyance System	• Minor Pump Stations
	New Pump Station

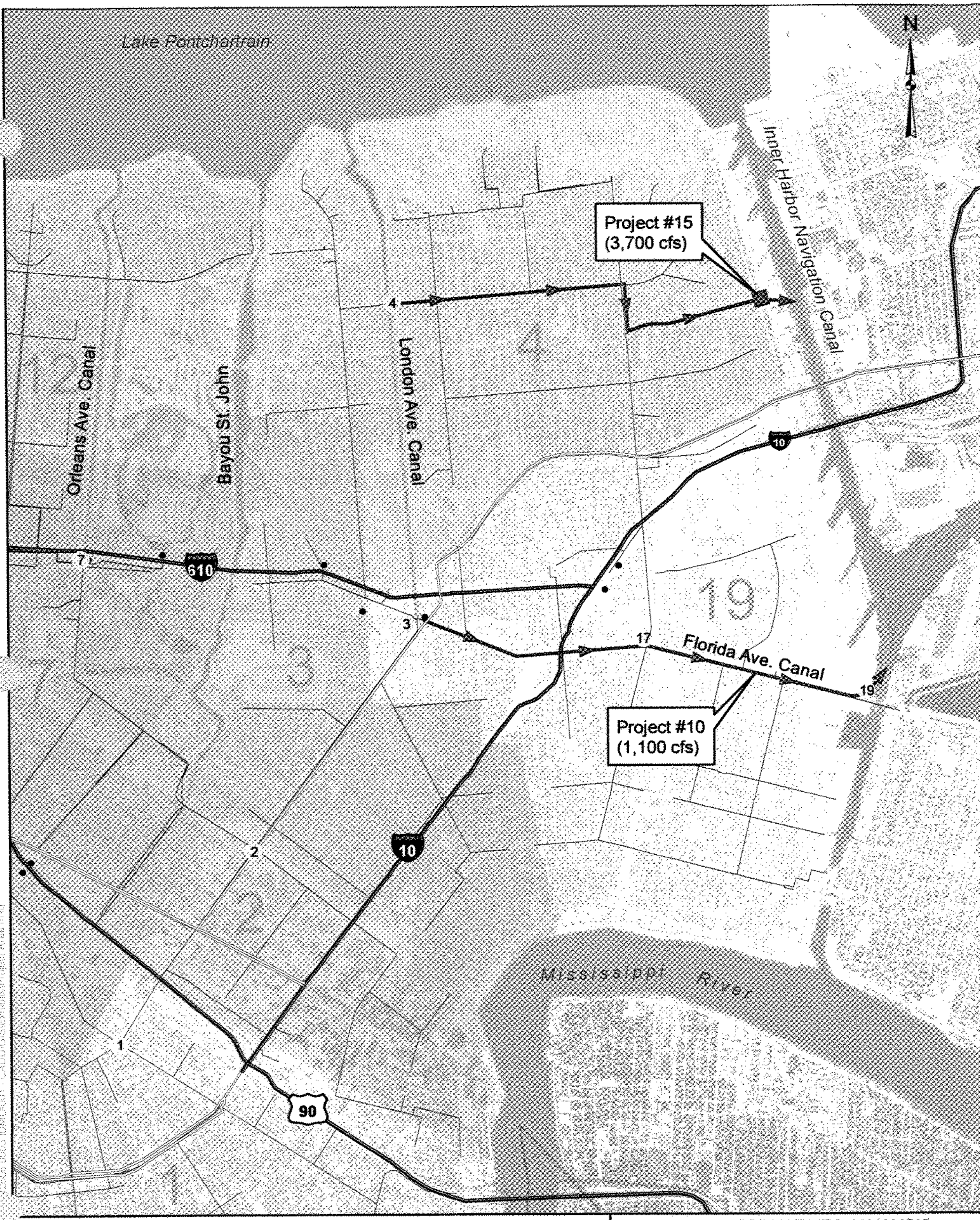
IDMO ALTERNATIVES ANALYSIS		
ORLEANS AVENUE CANAL		
SCALE: 1"=4000'	ALTERNATIVE NO. 1	MAP 1-2
DATE: 08/04/06		



Legend:

5	Drainage Basins	5	Major Pump Stations
	Conveyance System	•	Minor Pump Stations
		▩	New Pump Station

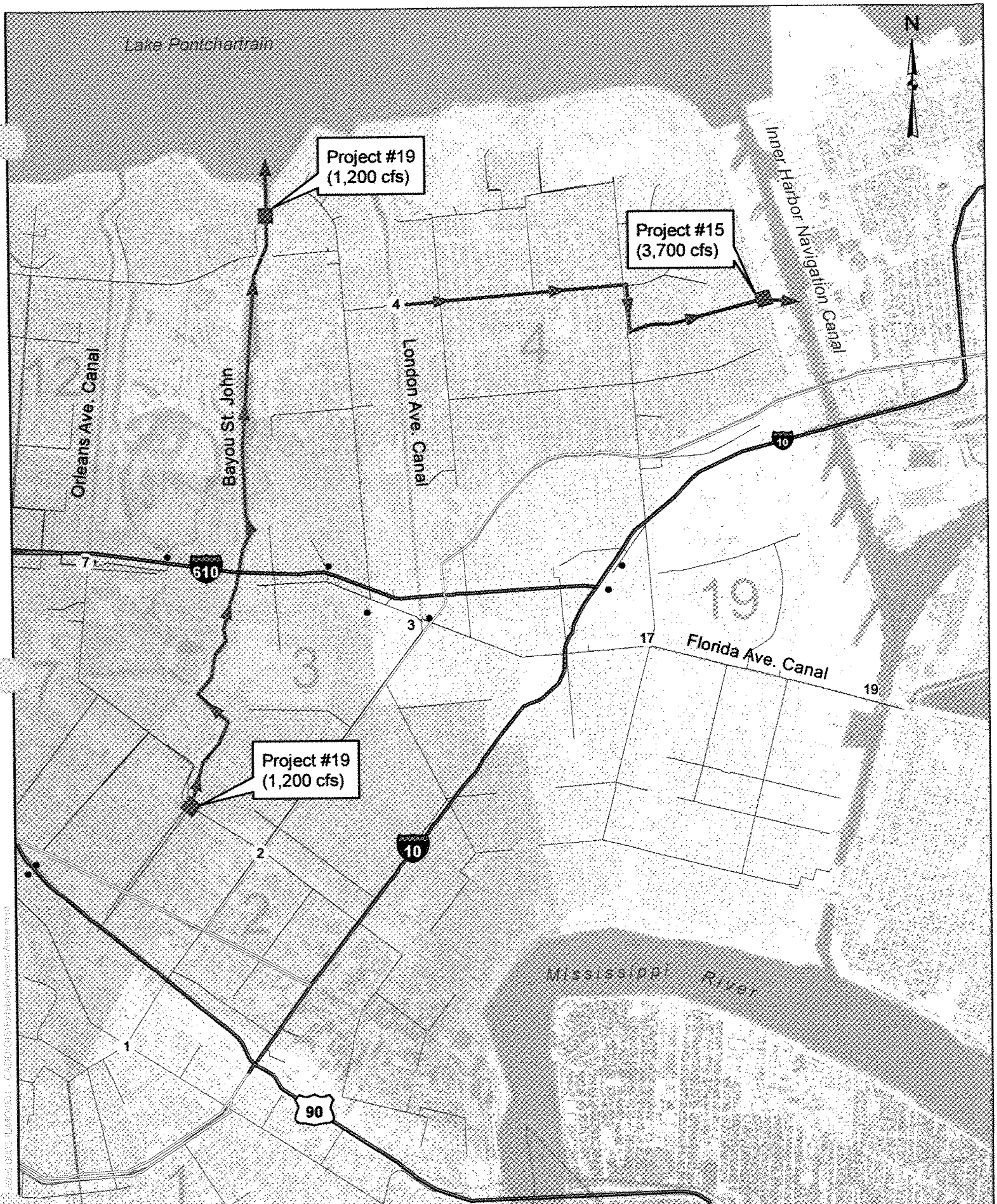
IDMO ALTERNATIVES ANALYSIS		
ORLEANS AVENUE CANAL		
SCALE: 1"=4000'	ALTERNATIVE NO. 2	MAP 1-3
DATE: 08/04/06		



Legend:

5	Drainage Basins
―	Conveyance System
5	Major Pump Stations
•	Minor Pump Stations
▩	New Pump Station

IDMO ALTERNATIVES ANALYSIS		
LONDON AVENUE CANAL		
SCALE: 1"=4000'	ALTERNATIVE NO. 1	MAP 1-4
DATE: 08/04/06		



Legend:

5	Drainage Basins	5	Major Pump Stations
	Conveyance System	•	Minor Pump Stations
		▩	New Pump Station

IDMO ALTERNATIVES ANALYSIS

LONDON AVENUE CANAL

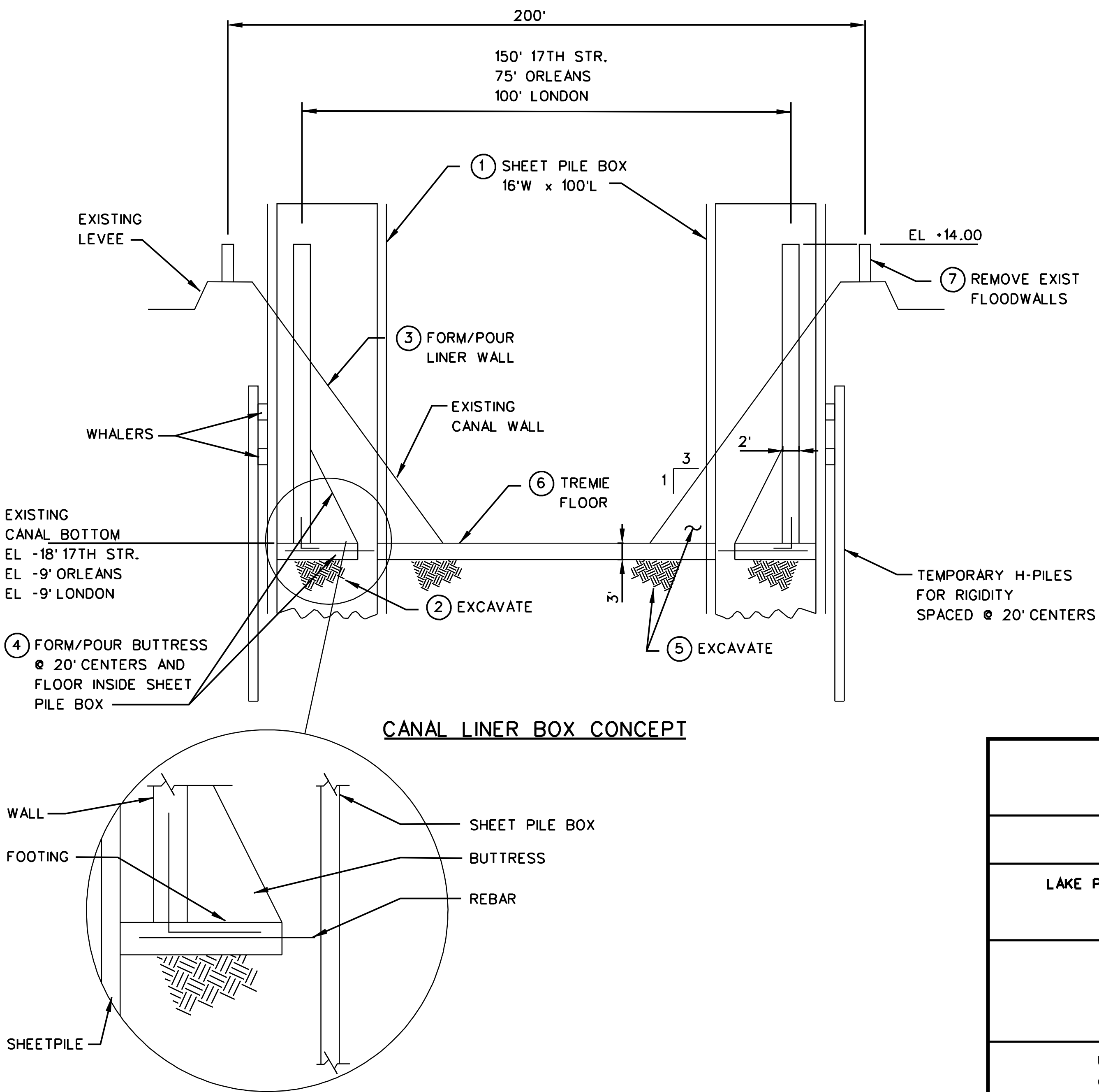
SCALE: 1"=4000'	ALTERNATIVE NO. 4	MAP 1-7
DATE: 08/04/06		

Appendix C

CANAL LINING DRAWINGS

pro03299 11/14/2006 1:31:48 PM
Z:\Projects\41669-New Orleans Phase 2\50.0 - Detailed Design\50.3 - Graphics\DGN\FIGURE 1.dgn

NOTES:
1. ELEVATIONS IN NAVD 88
2. (X) DENOTES CONSTRUCTION SEQUENCE



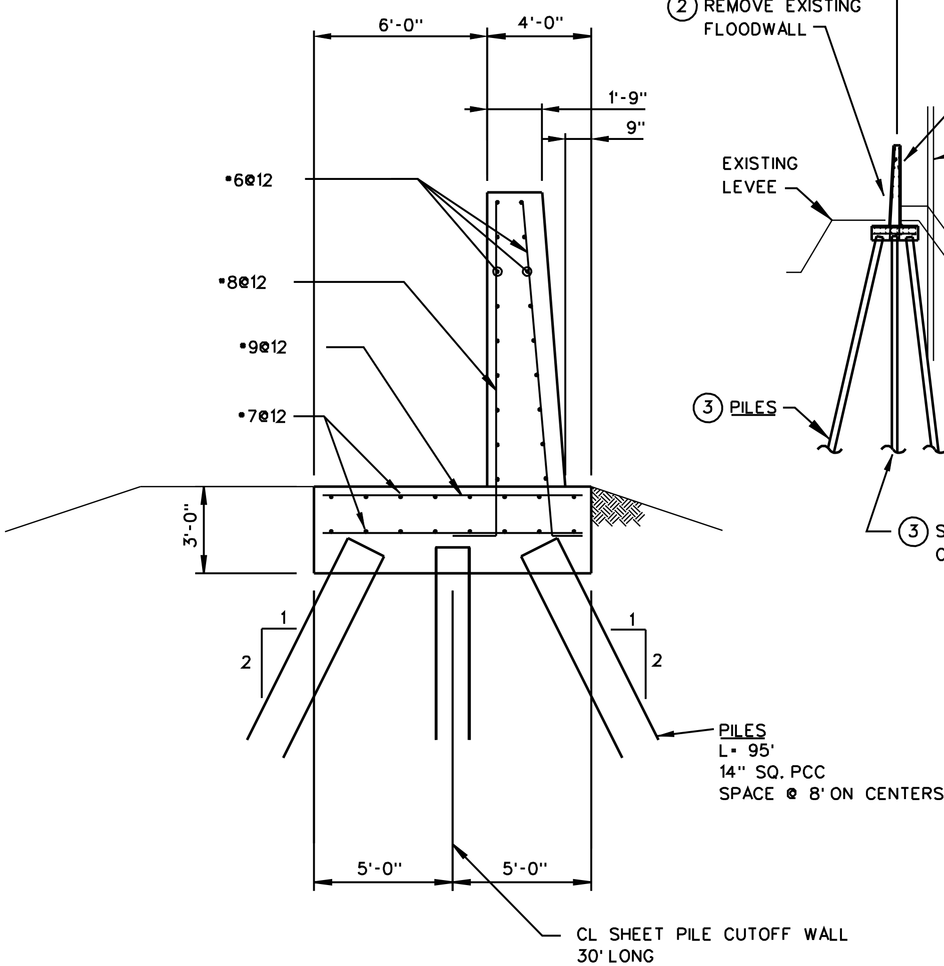
BLACK & VEATCH
building a world of difference™
ENERGY WATER INFORMATION GOVERNMENT

ALTERNATIVE CONSIDERATIONS
TASK C-3 CANAL LINING

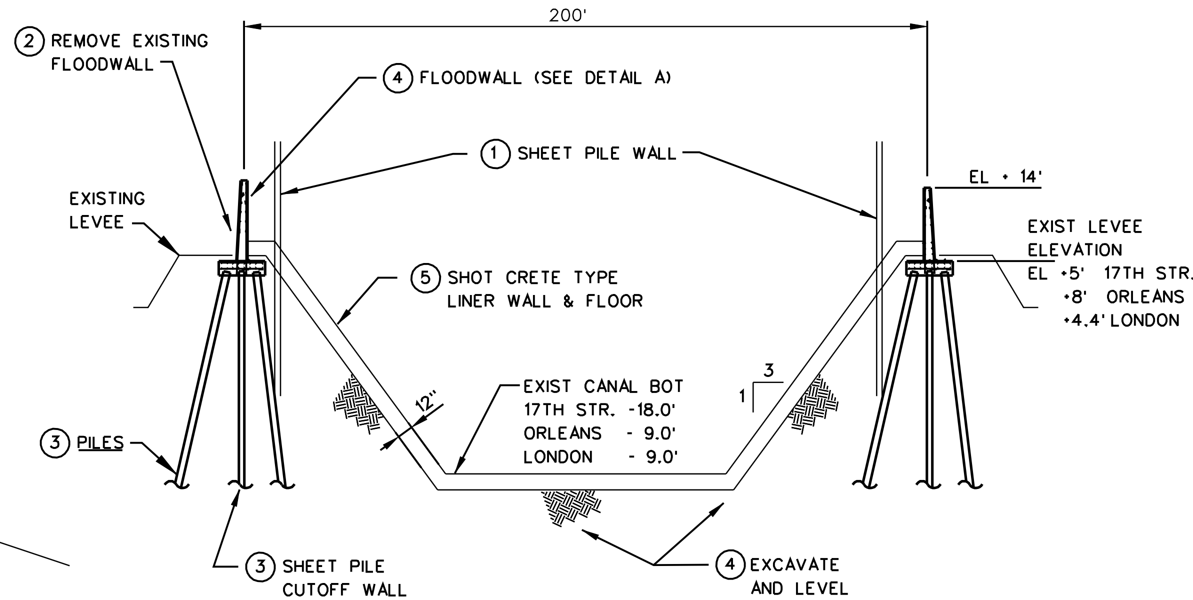
LAKE PONCHARTRAIN AND VICINITY, NEW ORLEANS, LOUISIANA
HURRICANE PROTECTION PROJECT
PHASE 2 PERMANENT PUMP STATIONS

FIGURE 1
CANAL LINER BOX CONCEPT

U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS 07-NOV-06



FLOODWALL
DETAIL A
NTS



CANAL LINER CONTOUR CONCEPT
NTS

NOTES:
1. ELEVATIONS IN NAVD 88
2. (X) DENOTES CONSTRUCTION SEQUENCE

BLACK & VEATCH
building a world of difference™
ENERGY WATER INFORMATION GOVERNMENT

ALTERNATIVE CONSIDERATIONS
TASK C-3 CANAL LINING

LAKE PONCHARTRAIN AND VICINITY, NEW ORLEANS, LOUISIANA
HURRICANE PROTECTION PROJECT
PHASE 2 PERMANENT PUMP STATIONS

FIGURE 2
CANAL LINER CONTOUR CONCEPT

U.S. ARMY ENGINEER DISTRICT NEW ORLEANS
CORPS OF ENGINEERS 07-NOV-06